FINAL REPORT
GEOTECHNICAL EXPLORATION REPORT
HAS-22-15.11
HARRISON COUNTY, OHIO
PID: 113440

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NEAS PROJECT 23-0011

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EXECUTIVE SUMMARY

The Ohio Department of Transportation has proposed a major rehabilitation project (HAS-22-15.11, PID 113440) along U.S. Route 22 (US 22) in Harrison County, Ohio. The project limits extend from the beginning of the 4-lane freeway/expressway at SLM 15.11 to SLM 18.75 (Cadiz Area). The scope of work also includes the replacement of abutments for three bridges—HAS-22-1753 Left, HAS-22-1753 Right, and HAS-250-1912—using drilled shaft foundations with rock sockets located behind the existing abutments.

National Engineering & Architectural Services, Inc. (NEAS) has been contracted to perform geotechnical engineering services for the project. The purpose of the geotechnical engineering services was to perform geotechnical explorations within the project limits to obtain information concerning the subsurface soil and groundwater conditions relevant to the design and construction of the project. The scope of work conducted by NEAS for the referenced project included reviewing published geotechnical data; performing 70 roadway and culvert borings during the initial exploration phase, along with 8 bridge borings and 1 culvert boring during additional exploration for the proposed construction; conducting laboratory testing of soil samples in accordance with SGE standards; and performing geotechnical engineering analyses to assess subgrade stabilization needs, establish pavement design parameters, design bridge foundations, and compile this geotechnical summary report based on the findings and recommendations.

The subgrade conditions in the project area are relatively consistent and are generally comprised of existing pavement sections underlain primarily by cohesive fine-grained soils, with minor amounts of non-cohesive coarse-grained soils and rock. The pavement sections range from 8 to 20 inches in thickness and are composed of asphalt, concrete, and granular base materials. Soils encountered within the project limits are typically classified as cohesive A-4a, A-4b, A-6a, A-6b and A-7-6 soil and non-cohesive A-1-a, A-1-b, A-2-4, A-3a and A-4a. Bedrock was encountered in 20 of the 70 roadway borings and was classified as severely weathered shale, highly weathered siltstone, or slightly weathered limestone.

Unstable and high moisture content soils were encountered in approximately 61% of the proposed subgrade surface. Of the 70 roadway borings completed, five (5) showed sulfate content greater than 3,000 ppm, though all remained below 5,000 ppm. Additionally, bedrock was encountered within 6 inches of the final subgrade elevation in two borings. NEAS recommends undercutting and replacing rock encountered within 6 inches of the bottom of subgrade with Item 204 embankment, then globally chemical stabilizing the entire project using cement to a depth of 14 inches. The limits of undercut and replacement (bedrock) include US-22 eastbound and westbound between Station 894+00 and Station 899+00, and US-22 eastbound only between Station 899+00 and Station 902+50. In these locations, the bedrock should be undercut and replaced with suitable material conforming to 204.02 Granular Material Type B, with the gradation of specified in CMS Item 703.17.

Stabilization limits should extend 18-inches beyond the edge of the proposed paved roadway, shoulder or median and it is recommended removing any topsoil, existing pavement materials or abandoned structure foundation materials. NEAS's opinion that the subgrade soils will provide adequate pavement support assuming it is designed and constructed in accordance with the recommendations provided within this report, as well as all applicable ODOT standards and specifications.

Drilled shafts will be used to support the substructures of the proposed HAS-22-17.53 L&R bridges over Columbus & Ohio River Railroad. Bedrock was encountered in all structural borings at the site, with elevations ranging from 1207.4 ft to 1224.2 ft, depending on location. Both abutments will be supported on a 3'-0" diameter drilled shaft with 3'-0" diameter rock socket. A drilled shaft foundation analysis was performed in accordance with the LRFD BDS. Estimated factored tip resistances range from 1,402 kips to 12,723 kips. Design based solely on end bearing is considered sufficient to support the drilled shaft loads at this site. Recommended rock socket lengths, based on rock description, laboratory testing, and rock integrity assessments for long-term performance, range from 12.0 ft to 23.0 ft. Notably, the factored unit tip resistances - calculated from rock laboratory test results – exceed the Strength I axial load. Bearing

capacity should not be a concern, particularly where the shaft extends deeper into higher-quality rock. Shafts subjected to horizontal loads and/or moments were also analyzed for maximum bending moment, maximum shear force and lateral deflection. The analyses of the laterally loaded shaft were conducted in LPILE for three loading conditions: factored loading for the Strength (I) Limit State, unfactored loading for the Service (I) Limit State, and fixed deflection at the beam seat equal to the thermal movement from the superstructure. The second fixity points were all located within the proposed shaft lengths. The axial condition governs the design. The average shear and moment demands in the shaft for the three loading cases are less than the shear and moment capacities, respectively.

Drilled shafts will be used to support the substructures of the proposed HAS-22-19.12 bridge over Columbus & Ohio River Railroad. At the project site, bedrock was encountered in both structural borings at elevations between 1205.8 ft and 1205.9 ft. Each abutment will be supported by 3'-0" diameter drilled shafts with 3'-0" diameter rock sockets. A drilled shaft foundation analysis was performed in accordance with the LRFD BDS. The estimated factored tip resistances range from 7,190 kips to 8,433 kips. Based on this analysis, end-bearing along is expected to provide sufficient capacity to support the drilled shaft loads at this location. Recommended rock socket lengths, based on rock description, laboratory testing, and rock integrity assessments for long-term performance, range from 13.2 ft to 18.9 ft. It is worth noting that the factored unit tip resistances—calculated from rock lab data—exceed the Strength I axial load demand. Bearing capacity is not expected to be an issue, especially where the shaft extends deeper into higher-quality rock. Shafts subjected to horizontal loads and/or moments were also analyzed for maximum bending moment, maximum shear force and lateral deflection. According to the instruction of ODOT, the overburden soils were ignored in the Lpile analyses due to the known eroding nature of the slopes. Based on our laterally loaded analyses, the second fixity points were all obtained within the proposed shaft lengths. The axial condition controls the design. The average shear and moment demand in shaft for three loading cases is less than the shear and moment capacity, respectively.

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1. INTRODUCTION

1.1. General

National Engineering & Architectural Services, Inc. (NEAS) is pleased to present the Subgrade Exploration Report to the Ohio Department of Transportation (ODOT) for the HAS-22-15.11 project (PID 113440), located along US 22 from the beginning of the 4-lane freeway/expressway at SLM 15.11 to SLM 18.91, including associated ramps in Harrison County, Ohio. The scope of work includes the replacement of abutments for three bridges—HAS-22-1753 Left, HAS-22-1753 Right, and HAS-250-1912—using drilled shaft foundations with rock sockets located behind the existing abutments.

The report presents a summary of the encountered surficial and subsurface conditions and our recommendations for bridge foundation design and construction, and subgrade stabilization and pavement design parameters for the planned improvements. Our recommendations are in accordance with Load and Resistance Factor Design (LRFD) method as set forth in AASHTO's Publication LRFD Bridge Design Specifications, 9th Edition (BDS) (AASHTO, 2020), ODOT's 2025 LRFD Bridge Design Manual (BDM) (ODOT, 2025), ODOT's 2025 Geotechnical Design Manual (GDM) (ODOT, 2025).

The exploration was conducted in general accordance with NEAS's original proposal to Arcadis U.S., Inc., dated April 20, 2023, and Modification # 1 dated February 14, 2025, as well as the provisions outlined in the ODOT's *Specifications for Geotechnical Explorations* (SGE) (ODOT, 2023).

The scope of work performed by NEAS as part of the referenced project included: 1) reviewing published geotechnical information; 2) performing 79 total test borings; 3) conducting laboratory testing of soil samples in accordance with the SGE; 4) performing geotechnical engineering analysis to assess subgrade stabilization requirements and recommended pavement design parameters; and 5) developing of this summary report.

2. GEOLOGY AND OBSERVATIONS OF THE PROJECT

2.1. Geology and Physiography

The project site is located within the Muskingum-Pittsburgh Plateau, part of the Allegheny (Kanawha) Plateaus (ODGS, 1998). This is a moderately to high relief, dissected plateau having broad major valleys that contain outwash terraces and tributaries with lacustrine terraces. Medium-grained bedrock sequences coarser than those in Marietta plateau but finer than those in Ironton plateau. Soils in this region are characteristically Mississippian and Pennsylvanian-age siltstone, shale, sandstone, economically important coals and claystones; Wisconsinan-age sand, gravel and lacustrine silt and silt-loam colluvium.

Based on the Quaternary geology map of Ohio, the geology at the project site is mapped as Colluvium derived from local bedrock in unglaciated areas that includes scattered areas of residuum, weathered material, landslides and bedrock outcrop (Pavey, et al 1999).

Based on the Bedrock Geologic Units Map of Ohio (USGS & ODGS, 2006), bedrock within the project area consists of shale, siltstone, and mudstone, of the Monongahela group and Conemaugh group formation. The Monongahela group formation is comprised of Pennsylvanian-age shale, black, red, gray and green to variegated red and yellow in color in the southern areas, clayey to sandy, nonbedded to thin bedded, locally calcareous. Sandstone, greenish-gray weathers to shades of yellow-brown in color, silty to locally conglomeratic, thin massive to cross bedded, locally calcareous. Limestone, gray in color, clayey to silty, thin to medium bedded (ODGS, 2003). The Conemaugh group formation is comprised of Pennsylvanian-

age. The shale in this formation is described as black, gray, green and red in color, clayey to silt, locally contains a marine fossil in lower half of unit, calcareous in part. The Siltstone in this formation is described as gray, green, and red in color, locally variegated, clayed to sandy, thin bedded to nonbedded. The mudstone in this formation is described as black, gray, green, red and yellow in color, variegated in part, clayey to silty, locally calcareous, commonly nonbedded. Sandstone is described as green-gray weathers to shades of yellow-brown, mostly very fine to medium grained, locally conglomeratic, thin to massive to cross bedded, locally calcareous (ODGS, 2003).

For the project limit started at SLM 15.11 and ends at SLM 18.75, the soils at the project site have been mapped using Web Soil Survey by the Natural Resources Conservation Service (USDA, 2015) as primarily mix of Morristown silty clay loam ,Morristown Channery silty clay loam, Guernsey silt loam, Lowell-silty clay loam followed by a local concentration of Gilpin-Lowell silt loam, Coshocton silt loam and Westmoreland-Dekalb complex. The Morristown series is comprised of both coarse- and fine-grained soils and classifies as A-2-4, A-6, and A-7-6 type soils according to the AASHTO method of soil classification. Similarly, the Morristown Channery series includes both coarse- and fine-grained soils and classifies as A-2-4, A-6, A-7-6 and A-8 type soils by the AASHTO method. On the other hand, the Guernsey series, consisting of fine-grained soils, is classified as A-4, A-6 and A-7-6 type soils. The Lowell series, also fine-grained, classifies as A-6 and A-7-6 type soils. The Gilpin-Lowell series, composed of fine-grained soils, classifies as A-4, A-6 and A-7-6 type soils. The Coshocton series, composed of fine-grained soils, classifies as A-6 and A-7-6 type soils. In contrast, Westmoreland-Dekalb is comprised of both coarse- and fine-grained soils and classifies as A-1, A-2, A-4, A-6, and A-7 type soils according to the AASHTO method of soil classification.

2.2. Hydrology/Hydrogeology

The project limits are not located within a designated flood hazard zone, based on available mapping from the Federal Emergency Management Agency's (FEMA) National Flood Hazard mapping program (FEMA, 2016).

2.3. Mining and Oil/Gas Production

According to ODNR's Mines of Ohio Locator, the project limit is located at coal mines sites which is listed as follows (ODNR [1], 2023).

- Historic surface Coal Mine with ID # 5895 located along the US 22 mainline.
- Inactive Coal Mine with ID # D0991 located approximately 300 ft south of US 22 EB.
- Active/Temporary inactive coal mine with ID # D-2277 located directly adjacent to the WB side of US 22.
- Abandoned underground coal mine with ID # HN-074 located beneath US 22, with an approximate coal elevation of 617 ft bgs.
- Inactive coal Mine with ID # D-1181 located along US 22.
- Inactive coal Mine with ID # D-0357 located approximately 250 ft south of US 22 EB.
- Coal Mine-AUM is partially known extent with ID # HN-057 located along the US 22 route.
- Inactive coal mine with ID # D-0901 located 0.22 miles north of US 22 WB.
- Inactive coal mine with ID # A-0816 located along US 22.
- Inactive coal mine with ID # C-0849 located approximately 110 ft south of US 22 EB.
- Historic Surface coal mine with ID # 3402 located along US 22.
- Inactive coal-surface mine with ID # D-1096 located approximately 150 ft south of US 22 EB.
- Inactive coal mine with ID # D-1082 located approximately 150 ft north of US 22 WB, near Bakers Ridge Road.

- Inactive coal mine with ID # D-1097 located approxiamtley 150 ft north of US 22 and 250 ft from Bakers Ridge Road , extending approximately 0.4 miles along US 22.
- Abandoned underground coal mine with ID # HN-068 located along US 22 at the intersection with the Upper Clearfork road.
- Inactive coal mine with ID # D-2195 located along US 22 WB.
- Oak Park oil and gas well ID# 34067209440000 located approximately 250 ft east of US-22 EB at coordinates 40.273067, -81.016349.
- Gammeter W F oil and gas well ID# 34067200810000 located at coordinates 40.285744, -81.001032.

2.4. Historical Records and Previous Phases of Project Exploration

The following report/plans were available for review and evaluation for this report:

- Project Boring Logs, soil profile and Investigation Sheets for HAS-22-14.68, dated November 27, 1959.
- Project Boring Logs, and Soil Profile Sheets for HAS-250-17.87, dated September 29, 1983.
- Project Boring Logs, and Soil Profile Sheets for HAS-22-15.09, dated October 22, 1958.

Historical soil borings associated with the above-referenced plans were reviewed, including two borings from the HAS-22-17.53 bridges and six borings from the HAS-22-19.12 bridge. These borings were specifically examined for bedrock information. Their data are summarized in Table 1 and provided in Appendix B. However, the top-of-rock elevations encountered in these historic borings were generally higher than those observed in the current project borings. As a result, none of the historic borings were used in our analysis.

Table 1: Historic Boring Infomation

Boring Number	Latitude	Longitude	Elevation (NGVD 29) (ft)	Elevation (NAVD 88) (ft)	Depth (ft)	Elevation of Top of Bedrock (NGVD 29) (ft)	Elevation of Top of Bedrock (NAVD 88) (ft)
HAS-22-17.53 L & R							
TH-001-0-58	40.284909	-80.999676	1237.7	1237.0	20.0	1232.9	1232.2
TH-008-0-58	40.285450	-80.999528	1215.4	1214.7	20.0	1211.7	1211.0
X-002-A-59	40.285157	-80.999698	1230.0	1229.3	38.0	1210.0	1209.3
HAS-22-19.12							
TH-001-0-59	40.283942	-80.999345	1233.0	1232.3	45.0	1217.0	1216.3
TH-002-0-59	40.283972	-80.999274	1233.0	1232.3	44.0	1223.0	1222.3
TH-003-0-59	40.283981	-80.999056	1241.6	1240.9	52.0	1236.6	1235.9
TH-004-0-59	40.283958	-80.998951	1241.5	1240.8	54.0	1234.8	1234.1
TH-005-0-59	40.284116	-80.999317	1233.0	1232.3	43.0	1220.0	1219.3
TH-006-0-59	40.284128	-80.999092	1241.6	1240.9	52.0	1230.1	1229.4

2.5. Field Reconnaissance

A field reconnaissance visit for the overall project area was conducted between July 26 and July 28, 2023, along US-22 and the associated ramps. Site conditions were noted and photographed during the visit. Photographs of notable geotechnical and drainage observations were taken and a summary of our observations by roadway segment are provided below.

2.5.1. Land Use and Cover

The land us near most of the project area includes: 1) commercial properties; 2) residential properties; 3) farmland; and 4) ODOT ROW.

2.5.1. US-22

In general, the pavement condition along the project section of the US-22 mainline was observed to be in good condition, with signs of weathering and surface wear. Moderate severity longitudinal and transverse cracking was common along this section, along with occasional moderate severity wheel track cracking, rutting, patching, and crack sealing deficiencies (Photograph 1). The roadway is level with the surrounding land in this area and slopes downward from both the north and south toward the lowest point. The roadway drains into ditches on both shoulders and basins in the median (Photograph 2 & 3). The area is highly vegetated, with signs of standing water observed, such as dense vegetation in the drainage ditches and cattails (Photograph 4 & 5). The area appeared to be stable, with no signs of instability.

Photograph 1: Overall Pavement Condition of US 22



Photograph 2: Drainage along US-22



Photograph 3: Drainage along US-22



Photograph 4: Standing Water along US-22



Photograph 5: Standing Water along US-22



2.5.2. US-22 EB to US-250 Ramp

In general, the pavement condition along this ramp was observed to be fair to good, showing some signs of weathering and surface wear. Light severity longitudinal and transverse cracking were common, along with block cracking and wheel path rutting (Photograph 6 & 7). The roadway is level with the surrounding land in this area and slopes downward from both the north and south toward the lowest point. The roadway drains to drainage basins located on both shoulders. The area is lightly vegetated, and no signs of standing water were observed.

Photograph 6: Overall Pavement Condition of US-22 EB to US-250 Ramp



Photograph 7: Overall Pavement Condition of US-22 EB to US-250 Ramp



2.5.3. US-22 WB to US-2 Ramp

In general, the pavement condition along this ramp was observed to be poor to fair, displaying signs of weathering and surface wear. Moderate to high severity longitudinal and transverse cracking was common, along with deficiencies in crack sealing and patching (Photograph 8). Additionally, raveling was observed on the shoulder, along with surface irregularities (Photograph 9). The roadway is level with the surrounding land, which is relatively flat. The roadway drains into drainage basins on both shoulders. The area is lightly vegetated, and no signs of standing water were observed.

Photograph 8: Overall Pavement Condition of US-22 WB to US-2 Ramp



Photograph 9: Overall Pavement Condition of US-22 WB to US-2 Ramp (Raveling)



2.5.4. US-250 NB To US-22 EB Ramp

In general, the pavement condition of this ramp was observed to be fair to good, with signs of weathering and surface wear. Light severity longitudinal and transverse cracking was common, along with deficiencies in patching and crack sealing (Photograph 10 & 11). The roadway is level with the surrounding land, which is relatively flat. The roadway drains into a drainage ditch past the eastern shoulder and drainage basins on the southern shoulder. The area is lightly vegetated, and no signs of standing water were observed.

Photograph 10: Overall Pavement Condition of US-250 NB to US-22 EB Ramp



Photograph 11: Overall Pavement Condition of US-250 NB to US-22 EB Ramp



2.5.5. US-9 to US-22 WB Ramp

In general, the pavement condition of this ramp was observed to be good, with some signs of weathering and surface wear. Light severity longitudinal and transverse cracking was common, along with deficiencies in crack sealing (Photograph 12). The roadway is level with the surrounding land, which is relatively flat. The roadway drains into a drainage ditch past the eastern shoulder and drainage basins on the southern shoulder. The area is lightly vegetated, and no signs of standing water were observed.

Photograph 12: Overall Pavement Condition of US-9 to US-22 WB Ramp



2.5.6. HAS-22-17.53 L Bridge over the Columbus & Ohio River Railroad (SFN: 3401170)

Overall, the bridge is in fair to good condition, though signs of wear and degradation were observed in both the superstructure and substructure. The monolithic concrete wearing surface exhibited medium-severity, frequent surface deterioration, along with low-severity, occasional longitudinal and transverse cracking (Photograph 13). The underside of the bridge was in good condition, with only occasional efflorescence noted.

The concrete gravity and pedestal substructures showed localized stress, including occasional spiderweb cracking (Photograph 14). Spread footers at each abutment were partially exposed and undercut due to erosion of surrounding soil and bedrock (Photographs 15–17). The exposed bedrock consists of interbedded shale and siltstone with siderite nodules and iron concretions, overlain by severely weathered yellowish-brown siltstone. Bedding is relatively flat-lying, with a gentle dip of 8° east. High-angle joint discontinuities were identified, striking N90°E/dipping 73°N and N55°E/dipping 68°NW (Photographs 18–19).

Additionally, water seepage was observed on the south side of the west abutment, approximately 15 feet above the railroad elevation (Photograph 20).

Photograph 13: Bridge Surface



Photograph 14: Substructure



Photograph 15: Abutment



Photograph 16: Abutment



Photograph 17: Abutment



Photograph 18: High-angle joint discontinuities



Photograph 19: High-angle joint discontinuities



Photograph 20: Water seepage



2.5.7. HAS-22-17.53 R Bridge over the Columbus & Ohio River Railroad (SFN: 3401146)

Overall, the bridge was observed to be in fair to good condition, though signs of wear and degradation were noted in both the superstructure and substructure. The monolithic concrete wearing surface exhibited medium-severity, frequent surface deterioration (Photograph 21). The underside of the bridge appeared to be in good condition, with only occasional efflorescence and minor corrosion observed on the steel stringer beams. The concrete pedestal substructures showed localized stress indicators, including occasional cracking and spalling (Photograph 22).

At the abutments, the spread footers were partially exposed and undercut due to erosion of the surrounding soil and bedrock (Photographs 23 and 24). The exposed bedrock consisted of highly weathered interbedded shale, siltstone, and coal overlain by highly weathered sandstone and severely weathered yellowish-brown siltstone. Bedding was generally flat lying, with a gentle dip of 4° to the east. High-angle joint discontinuities were identified, striking N85° and dipping 65° north, and N55°E and dipping 78° south (Photographs 25-27).

No other evidence of geotechnical instability was observed during the reconnaissance.

Photograph 21: Bridge Surface



Photograph 22: Concrete pedestal substructures



Photograph 23: Abutment



Photograph 24: Abutment



Photograph 25: High-angle joint discontinuities



Photograph 26: High-angle joint discontinuities observed at abutment



Photograph 27: High-angle joint discontinuities observed at abutment



2.5.8. HAS-22-19.12 Bridge Carrying US 22 East exit ramp to Cadiz Jewett Rd (SFN: 3401898)

Overall, the bridge was observed to be in fair to good condition, though signs of wear and degradation were present in both the superstructure and substructure. The monolithic concrete wearing surface exhibited medium-severity, frequent surface deterioration (Photograph 28).

The underside of the bridge appeared to be in good condition, with only occasional efflorescence noted. The concrete stub abutments displayed moderate spalling and occasional vertical cracking, indicative of localized wear (Photograph 29). At each abutment, the spread footers were partially exposed as a result of erosion of the surrounding soil and bedrock (Photograph 30).

Exposed bedrock consisted of a highly weathered anthracite coal seam overlain by severely to highly weathered interbedded shale and siltstone containing siderite nodules. Bedding was generally flat lying, with a gentle dip of 4°–11° east. High-angle joint discontinuities were identified, striking N80°W and dipping 62° south (Photograph 31). Within the project limits, rockfall hazards were observed due to undercutting of severely weathered shale (Photograph 32).

Photograph 28: Bridge Surface



Photograph 29: Concrete stub abutments



Photograph 30: Abutment



Photograph 31: High-angle joint discontinuities



Photograph 32: Rock hazards



3. GEOTECHNICAL EXPLORATION

3.1. Exploration Program

The subsurface exploration was conducted by NEAS between August 1, 2023, and September 17, 2023, including 70 boring drilled to depths ranging between 4.7 ft bgs and 51.5 ft bgs. A subsequent subsurface exploration for the bridge foundation replacements was performed by NEAS between March 12 and March 26, 2025, and included 8 additional borings drilled to depths ranging from 10.5 feet to 25.0 feet bgs. In addition, one culvert boring was completed on June 3, 2025, to a depth of 62.8 feet bgs. The boring locations were selected by NEAS in general accordance with the guidelines contained in the SGE with the intent to evaluate subgrade soil and groundwater conditions. Borings were located within the project area planned to be constructed that were not restricted by underground utilities or dictated terrain (i.e., steep embankment slopes). Boring information, including Latitude / Longitude and Elevation, is provided in Tables 2 and 3 below.

In the original subsurface exploration, borings were drilled using either CME 55T or CME 45B truck-mounted drilling rigs with 3.25-inch (inner diameter) or 4-inch hollow stem augers. Soil samples for subgrade borings were typically collected continuously to a depth of 7.5 feet, and then at 1.5-foot intervals to the end-of-boring (EOB) depth. Sampling was performed using an 18-inch split spoon sampler in accordance with AASHTO T-206, *Standard Method for Penetration Test and Split Barrel Sampling of Soils*. The soil samples obtained were visually classified in the field by NEAS representatives and preserved for further review by a geologist to determine the need for laboratory testing. Standard Penetration Tests (SPTs) were conducted using CME automatic hammers, which were calibrated on January 24, 2022, with measured energy efficiencies of 63.4% and 72.6%, as documented on the boring logs (Appendix B).

For the additional subsurface exploration, borings were drilled using a CME 55TB truck-mounted rig equipped with a 3.25-inch (inner diameter) hollow stem auger. Soil samples were typically recovered at 2.5-foot intervals to the top of bedrock, after which bedrock coring was performed using an NQ2 core bit. Sampling was conducted using an 18-inch split spoon sampler in accordance with AASHTO T-206. An exception was made for Borings B-140-0-23 and B-143-0-23, where augering extended through the top of rock before one split spoon sample was obtained to establish the top of rock. All collected samples were visually classified in the field by NEAS personnel and retained for geologist review and potential laboratory testing. Standard Penetration Tests (SPTs) were performed using a CME automatic hammer calibrated on July 30, 2024, with an energy efficiency of 89%, as noted on the boring logs (Appendix B).

Field boring logs were prepared by drilling personnel and included pavement description, lithological description, SPT results recorded as blows per 6-inch increment of penetration and estimated unconfined shear strength values on specimens exhibiting cohesion (using a hand-penetrometer). After completing the borings, the boreholes were backfilled with either auger cuttings, or a combination of these materials and patched accordingly with cold patch asphalt and/or cement when drilling through the roadway.

Table 2: Project Boring Information for Original Exploration

Boring Number	Latitude	Longitude	Elevation (ft)	Depth (ft)	Boring Number	Latitude	Longitude	Elevation (ft)	Depth (ft)
B-001-0-23	40.261068	-81.029352	1083.5	6.3	B-035-0-23	40.286528	-80.996300	1184.0	7.5
B-002-0-23	40.262033	-81.028574	1097.8	6.3	B-036-0-23	40.287252	-80.995144	1177.8	7.5
B-003-0-23	40.262776	-81.027507	1111.4	6.3	B-037-0-23	40.287570	-80.993798	1174.0	7.5
B-004-0-23	40.263782	-81.026955	1125.6	7.5	B-038-0-23	40.288204	-80.992646	1192.6	6.2
B-005-0-23	40.264444	-81.025917	1138.4	7.5	B-039-0-23	40.288450	-80.991231	1198.9	6.8
B-006-0-23	40.265524	-81.025267	1153.5	6.3	B-040-0-23	40.289136	-80.990118	1223.9	7.5
B-007-0-23	40.266257	-81.024274	1168.2	7.5	B-041-0-23	40.289401	-80.988735	1221.1	7.5
B-008-0-23	40.267197	-81.023665	1184.0	6.3	B-042-0-23	40.290100	-80.987569	1245.0	7.5
B-009-0-23	40.267889	-81.022504	1200.4	7.5	B-043-0-23	40.290495	-80.986297	1253.2	7.5
B-010-0-23	40.268927	-81.021973	1216.5	6.2	B-044-0-23	40.291310	-80.985355	1254.8	7.5
B-011-0-23	40.269647	-81.020879	1229.8	7.5	B-045-0-23	40.291951	-80.984145	1250.7	7.5
B-012-0-23	40.270634	-81.020319	1237.2	7.5	B-046-0-23	40.292965	-80.983610	1251.6	7.5
B-013-0-23	40.271446	-81.019249	1239.3	7.5	B-047-0-23	40.293829	-80.982676	1234.3	7.5
B-014-0-23	40.272375	-81.018653	1235.7	7.5	B-048-0-23	40.294891	-80.982417	1240.0	7.5
B-015-0-23	40.273114	-81.017522	1229.0	7.5	B-049-0-23	40.295846	-80.981617	1229.3	7.5
B-016-0-23	40.274110	-81.016951	1222.5	7.5	B-050-0-23	40.296844	-80.981077	1217.7	7.5
B-017-0-23	40.274755	-81.015876	1216.5	7.5	B-051-0-23	40.297597	-80.980076	1196.9	7.5
B-018-0-23	40.275742	-81.015260	1209.8	7.5	B-052-0-23	40.298160	-80.979375	1187.5	7.5
B-019-0-23	40.276579	-81.014273	1205.5	7.5	B-104-0-23	40.275379	-81.015074	1208.6	4.7
B-020-0-23	40.277576	-81.013638	1205.8	7.5	B-105-0-23	40.275555	-81.013896	1211.1	7.5
B-021-0-23	40.278295	-81.012471	1214.8	6.1	B-106-0-23	40.277163	-81.012870	1235.3	7.5
B-022-0-23	40.279409	-81.011691	1224.8	7.5	B-107-0-23	40.276038	-81.012593	1227.9	7.5
B-023-0-23	40.279788	-81.010591	1226.5	7.5	B-108-0-23	40.276036	-81.013962	1207.1	7.5
B-024-0-23	40.280639	-81.009515	1234.7	6.3	B-109-0-23	40.278605	-81.013232	1223.6	7.5
B-025-0-23	40.281020	-81.008280	1239.9	7.5	B-110-0-23	40.277835	-81.014212	1224.5	7.5
B-026-0-23	40.281731	-81.007245	1244.9	7.5	B-111-0-23	40.276817	-81.014740	1207.5	7.5
B-027-0-23	40.282087	-81.005857	1251.5	7.5	B-112-0-23	40.284059	-81.000113	1214.6	7.5
B-028-0-23	40.282855	-81.004853	1257.6	6.2	B-113-0-23	40.284062	-80.998851	1217.6	7.5
B-029-0-23	40.283209	-81.003489	1261.0	6.3	B-114-0-23	40.284633	-80.997739	1214.7	7.5
B-030-0-23	40.283996	-81.002433	1258.2	7.5	B-115-0-23	40.285724	-80.997539	1207.2	7.5
B-031-0-23	40.284395	-81.001160	1250.9	7.5	B-116-0-23	40.285411	-81.002019	1239.5	8.7
B-032-0-23	40.284943	-81.000564	1242.9	7.5	B-117-0-23	40.286466	-81.000345	1211.3	7.5
B-033-0-23	40.285274	-80.999015	1225.3	51.5	B-118-0-23	40.286148	-81.002021	1230.8	7.5
B-033-1-23	40.285546	-80.998835	1227.1	41.7	B-119-0-23	40.284836	-81.002214	1248.2	7.5
B-034-0-23	40.286239	-80.997678	1206.2	6.2	B-119-1-23	40.285386	-81.002230	1241.1	31.2

Notes: The as-drilled boring locations were surveyed post-drilling by Arcadis.

Table 3: Project Boring Information for Additional Exploration

Boring Number	Latitude	Longitude	Elevation (NAVD 88) (ft)	Boring Depth (ft)	Top of Rock Elevation (ft)	Top of Rock Depth (ft)	Substructure
B-033-2-23	40.285516	-80.998831	1223.2	62.8	1165.7	57.5	Culvert at Sta. 931+20.80
B-139-0-23	40.284959	-80.999687	1235.2	36.5	1224.2	11.0	HAS-22-17.53 R Rear Abutment
B-140-0-23	40.285188	-80.999752	1234.4	25.8	1209.4	25.0	HAS-22-17.53 L Rear Abutment
B-141-0-23	40.285277	-80.999831	1234.3	48.2	1211.3	23.0	HAS-22-17.53 L Rear Abutment
B-142-0-23	40.285106	-80.999376	1231.1	45.5	1212.6	18.5	HAS-22-17.53 R Forward Abutment
B-143-0-23	40.285223	-80.999409	1230.8	20.6	1210.8	20.0	HAS-22-17.53 R Forward Abutment
B-144-0-23	40.285450	-80.999474	1229.4	47.7	1207.4	22.0	HAS-22-17.53 L Forward Abutment
B-145-0-23	40.284087	-80.999409	1216.3	36.3	1205.8	10.5	HAS-22-19.12 Rear Abutment
B-146-0-23	40.283987	-80.999084	1217.9	40.1	1205.9	12.0	HAS-22-19.12 Forward Abutment

Notes:
1. The as-drilled boring location and corresponding ground surface elevation were surveyed in the field.

3.2. Laboratory Testing Program

The laboratory testing program consisted of classification testing, moisture content and sulfate content determinations. Data from the laboratory testing program were incorporated on the boring logs (Appendix B). Soil samples are retained at the laboratory until Stage 2 approval, after which they will be discarded.

3.2.1. Classification Testing

Representative soil samples were selected for index properties (Atterberg limits) and gradation testing for classification purposes. At each boring location, the upper two samples obtained below the proposed top of subgrade elevation were generally tested while additional samples in each boring were selected for testing with the intent of properly classifying the subsurface soil and groundwater conditions within the planned project limits. Soils not selected for testing were compared to laboratory tested samples and classified visually. Moisture content testing was conducted on all samples. The laboratory testing was performed in general accordance with applicable AASHTO specifications and ODOT Supplements.

Final classification of soil strata in accordance with AASHTO M-145 "Classification of Soils and Soil-Aggregate Mixtures for Highway Construction Purposes," as modified by ODOT "Classification of Soils" was made once laboratory test results became available. The results of the soil classification are presented on the boring logs in Appendix B.

3.2.2. Standard Penetration Test Results

Standard Penetration Tests (SPT) and split-barrel (commonly known as split-spoon) sampling of soils were performed at varying intervals (i.e., continuous, or 1.5-ft intervals) in the project borings performed. To account for the high efficiency (automatic) hammers used during SPT sampling, field SPT N-values were converted based on the calibrated efficiency (energy ratio) of the specific drill rig's hammer. Field N-values were converted to an equivalent rod energy of 60% (N_{60}) for use in analysis or for correlation purposes. The resulting N_{60} values are shown on the boring logs provided in Appendix B.

3.2.3. Sulfate testing

Sulfate testing was generally performed on one sample from each subgrade/roadway boring performed for pavement/subgrade design purposes. The selected samples were tested in accordance with ODOT Supplement 1122, "Determining Sulfate Content in Soils" dated July 17, 2015. In general, the upper most sample (within 3 ft of the proposed subgrade elevation) from each boring was tested when feasible. Testing results are presented on the boring logs and summarized in Table 4 below. Additionally, five of the 70 borings had sulfate content greater than 3,000 ppm; and these results are summarized in Table 5 below. The sulfate testing report is provided in Appendix C.

Table 4: Sulfate Content Summary

Boring ID	Sample	Depth (ft)	Dilution Ratio	Average Sulfate Content (ppm)	Boring ID	Sample	Depth (ft)	Dilution Ratio	Average Sulfate Content (ppm)
B-001-0-23	SS-1	1.5 - 3.0	20	593	B-035-0-23	SS-1	1.5 - 3.0	20	1,513
B-002-0-23	SS-1	1.5 - 3.0	20	920	B-036-0-23	SS-1	1.5 - 3.0	20	2,500
B-003-0-23	SS-1	1.5 - 3.0	20	880	B-037-0-23	SS-1	1.5 - 3.0	20	907
B-004-0-23	SS-1	1.5 - 3.0	20	320	B-038-0-23	SS-1	1.5 - 3.0	20	3,200
B-005-0-23	SS-1	1.5 - 3.0	20	873	B-039-0-23	SS-1	1.5 - 3.0	20	240
B-006-0-23	SS-1	1.5 - 3.0	20	640	B-040-0-23	SS-1	1.5 - 3.0	20	100
B-007-0-23	SS-1	1.5 - 3.0	20	540	B-041-0-23	SS-1	1.5 - 3.0	20	2,967
B-008-0-23	SS-1	1.5 - 3.0	20	840	B-042-0-23	SS-1	1.5 - 3.0	20	433
B-009-0-23	SS-1	1.5 - 3.0	20	600	B-043-0-23	SS-1	1.5 - 3.0	20	760
B-010-0-23	SS-1	1.5 - 3.0	20	100	B-044-0-23	SS-1	1.5 - 3.0	20	313
B-011-0-23	SS-1	1.5 - 3.0	20	640	B-045-0-23	SS-1	1.5 - 3.0	20	1,120
B-012-0-23	SS-1	1.5 - 3.0	20	3,500	B-046-0-23	SS-1	1.5 - 3.0	20	1,447
B-013-0-23	SS-1	1.5 - 3.0	20	687	B-047-0-23	SS-1	1.5 - 3.0	20	640
B-014-0-23	SS-1	1.5 - 3.0	20	1,500	B-048-0-23	SS-1	1.5 - 3.0	20	2,500
B-015-0-23	SS-1	1.5 - 3.0	20	180	B-049-0-23	SS-1	1.5 - 3.0	20	433
B-016-0-23	SS-1	1.5 - 3.0	20	340	B-050-0-23	SS-1	1.5 - 3.0	20	633
B-017-0-23	SS-1	1.5 - 3.0	20	800	B-051-0-23	SS-1	1.5 - 3.0	20	100
B-018-0-23	SS-1	1.5 - 3.0	20	180	B-052-0-23	SS-1	1.5 - 3.0	20	320
B-019-0-23	SS-1	1.5 - 3.0	20	3,067	B-105-0-23	SS-1	1.5 - 3.0	20	707
B-020-0-23	SS-1	1.5 - 3.0	20	1,800	B-106-0-23	SS-1	1.5 - 3.0	20	480
B-021-0-23	SS-1	1.5 - 3.0	20	720	B-107-0-23	SS-1	1.5 - 3.0	20	547
B-022-0-23	SS-1	1.5 - 3.0	20	820	B-108-0-23	SS-1	1.5 - 3.0	20	667
B-023-0-23	SS-1	1.5 - 3.0	20	1,220	B-109-0-23	SS-1	1.5 - 3.0	20	753
B-025-0-23	SS-1	1.5 - 3.0	20	833	B-110-0-23	SS-1	1.5 - 3.0	20	4,600
B-026-0-23	SS-1	1.5 - 3.0	20	600	B-111-0-23	SS-1	1.5 - 3.0	20	220
B-027-0-23	SS-1	1.5 - 3.0	20	987	B-112-0-23	SS-1	1.5 - 3.0	20	40
B-028-0-23	SS-1	1.5 - 3.0	20	260	B-113-0-23	SS-1	1.5 - 3.0	20	300
B-029-0-23	SS-1	1.5 - 3.0	20	520	B-114-0-23	SS-1	1.5 - 3.0	20	1,513
B-030-0-23	SS-1	1.5 - 3.0	20	867	B-115-0-23	SS-1	1.5 - 3.0	20	840
B-031-0-23	SS-1	1.5 - 3.0	20	433	B-116-0-23	SS-1	1.5 - 3.0	20	100
B-032-0-23	SS-1	1.5 - 3.0	20	720	B-117-0-23	SS-1	1.5 - 3.0	20	60
B-033-0-23	SS-1	1.5 - 3.0	20	2,500	B-118-0-23	SS-1	1.5 - 3.0	20	140
B-033-1-23	SS-1	1.5 - 3.0	20	360	B-119-0-23	SS-1	1.5 - 3.0	20	460
B-034-0-23	SS-1	1.5 - 3.0	20	3,600	B-119-1-23	SS-1	1.5 - 3.0	20	40

Table 5: High Sulfate Content Summary

Boring ID	Sample	Depth (ft)	Dilution Ratio	Average Sulfate Content (ppm)	Location
Sulfate Content > 3000 ppm					
B-012-0-23	SS-1	1.5 - 3.0	20	3,500	US-22
B-019-0-23	SS-1	1.5 - 3.0	20	3,067	US-22
B-034-0-23	SS-1	1.5 - 3.0	20	3,600	US-22
B-038-0-23	SS-1	1.5 - 3.0	20	3,200	US-22
B-110-0-23	SS-1	1.5 - 3.0	20	4,600	Ramp B

3.2.4. Unconfined Compressive Strength of Rock

Unconfined Compressive Strength of rock core samples was conducted in accordance with ASTM D7012 "Standard Test Methods for Compressive Strength and Elastic Moduli of Intact Rock Core Specimens under Varying Sates of Stress and Temperatures". The tests were performed on six rock core samples obtained during the exploration program. The results are summarized in Table 6 below and provided in Appendix C.

Table 6: Unconfined Compressive Strength of Rock Testing Summary

Boring ID	Depth (ft)	Elevation (ft)	Unconfined Compressive Strength (psi)	Stain at Failure (%)	Bedrock Type
B-139-0-23	14.2 - 14.6	1220.5 - 1220.9	4,367	1.3	Sandstone
B-141-0-23	30.2 - 30.6	1203.7 - 1204.1	426	5.2	Shale
B-142-0-23	23.0 - 23.4	1207.7 - 1208.1	6,584	1.2	Sandstone
B-144-0-23	27.4 - 27.7	1201.7 - 1202.0	677	1.0	Shale
B-145-0-23	17.3 - 17.6	1198.7 - 1199.0	2,555	2.4	Siltstone
B-146-0-23	15.5 - 15.9	1202.0 - 1202.4	5,279	3.0	Siltstone

3.3. Pavement Coring Exploration Program

The coring exploration program for this project was conducted by NEAS and included a total of six (6) pavement cores. Pavement cores were obtained at six project boring locations performed through the existing shoulder. Measurements, location information, photographs and other details of each core sample can be found in the Pavement Core Logs included within Appendix C. The approximate location for each core is depicted on the Boring Location Plan provided in Appendix A. A summary of these measurements is provided in Table 7 below.

Cores were drilled using a portable electric powered coring drill with a 4-inch (outer diameter) diamond tipped drill bit and utilizing water as the circulating fluid. Asphalt thicknesses were measured in the field after the cores were extracted and down-hole measurements were made. Each core sample was then photographed, logged, and stored for transportation to NEAS's laboratory. Following field documentation and photographs, the core holes were backfilled to existing grade with asphalt patch. Once in the laboratory the cores were: 1) remeasured for thickness verification and photographed; 2) checked for composition; and, 3) reviewed for individual layer identification and subsequent measurements.

Table 7: Pavement Core Summary

Boring ID	Proposed Alignment	Asphalt Thickness (in)	Concrete Thickness (in)	Brick Thickness (in)	Total Thickness (in)
X-002	US 22	3.50	9.00	-	12.50
X-005	US 22	4.00	9.50	-	13.50
X-009	US 22	2.75	10.00	-	12.75
X-010	US 22	3.75	9.50	-	13.25
X-012	US 22	3.75	8.50	-	12.25
X-013	US 22	3.75	8.75	-	12.50

4. FINDINGS

The subsurface conditions encountered during NEAS's explorations are described in the following subsections and/or on each boring log presented in Appendix B. The boring logs represent NEAS's interpretation of the subsurface conditions encountered at each boring location based on our site observations, field logs, visual review of the soil samples by NEAS's geologist, and laboratory test results. The lines designating the interfaces between various soil strata on the boring logs represent the approximate interface location; the actual transition between strata may be gradual and indistinct. The subsurface soil and groundwater characterizations included herein, including summary test data, are based on the subsurface findings from the geotechnical explorations performed by NEAS as part of the referenced project. It should be noted that, for the purposes of this report and our analysis, the term 'subgrade' has been assumed to represent soils and/or soil conditions from 1.5 ft below the boring ground surface to a depth of 7.5 ft.

4.1. Existing Pavement

The pavement section thicknesses in terms of asphalt, concrete and granular base were measured at representative project subgrade borings during the subsurface exploration for the project and are recorded on the test boring logs provided in Appendix B. A summary of these measurements is provided in Table 8 below.

Table 8: Measured Pavement Thickness at Boring Locations

Boring ID	Proposed Alignment	Asphalt Thickness (in)	Concrete Thickness (in)	Base Thickness (in)	Total Thickness (in)	Boring ID	Proposed Alignment	Asphalt Thickness (in)	Concrete Thickness (in)	Base Thickness (in)	Total Thickness (in)
B-001-0-23	US 22	6.0	10.0	-	16.0	B-035-0-23	US 22	6.0	7.0	-	13.0
B-002-0-23	US 22	11.0	-	-	11.0	B-036-0-23	US 22	4.0	9.5	-	13.5
B-003-0-23	US 22	12.0	-	-	12.0	B-037-0-23	US 22	4.0	9.0	-	13.0
B-004-0-23	US 22	6.0	8.0	-	14.0	B-038-0-23	US 22	12.0	-	-	12.0
B-005-0-23	US 22	3.0	9.0	-	12.0	B-039-0-23	US 22	11.0	-	-	11.0
B-006-0-23	US 22	6.0	8.0	-	14.0	B-040-0-23	US 22	10.5	-	-	10.5
B-007-0-23	US 22	5.0	8.0	-	13.0	B-041-0-23	US 22	4.0	9.0	-	13.0
B-008-0-23	US 22	12.0	-	-	12.0	B-042-0-23	US 22	4.0	9.0	-	13.0
B-009-0-23	US 22	5.0	9.0	-	14.0	B-043-0-23	US 22	4.0	9.0	-	13.0
B-010-0-23	US 22	12.0	-	-	12.0	B-044-0-23	US 22	4.0	9.0	-	13.0
B-011-0-23	US 22	11.5	-	-	11.5	B-045-0-23	US 22	10.0	-	-	10.0
B-012-0-23	US 22	6.0	7.0	-	13.0	B-046-0-23	US 22	4.0	9.0	-	13.0
B-013-0-23	US 22	5.0	8.0	-	13.0	B-047-0-23	US 22	4.0	8.0	-	12.0
B-014-0-23	US 22	12.0	-	-	12.0	B-048-0-23	US 22	4.0	8.0	-	12.0
B-015-0-23	US 22	4.0	9.5	-	13.5	B-049-0-23	US 22	4.0	9.0	-	13.0
B-016-0-23	US 22	6.5	7.0	-	13.5	B-050-0-23	US 22	4.5	8.5	-	13.0
B-017-0-23	US 22	4.0	9.0	-	13.0	B-051-0-23	US 22	12.5	-	-	12.5
B-018-0-23	US 22	10.0	-	-	10.0	B-052-0-23	US 22	6.0	7.0	-	13.0
B-019-0-23	US 22	3.5	8.5	-	12.0	B-104-0-23	Ramp C	8.0	10.0	-	18.0
B-020-0-23	US 22	12.0	-	-	12.0	B-105-0-23	Ramp C	7.0	10.0	-	17.0
B-021-0-23	US 22	12.0	-	-	12.0	B-106-0-23	Ramp C	4.0	6.0	-	10.0
B-022-0-23	US 22	11.0	-	-	11.0	B-107-0-23	Ramp D	12.0	-	-	12.0
B-023-0-23	US 22	5.5	7.0	-	12.5	B-108-0-23	Ramp D	13.0	-	-	13.0
B-024-0-23	US 22	7.0	7.0	-	14.0	B-109-0-23	Ramp A	14.0	-	-	14.0
B-025-0-23	US 22	6.0	7.0	-	13.0	B-110-0-23	Ramp B	12.0	-	-	12.0
B-026-0-23	US 22	11.0	-	-	11.0	B-111-0-23	Ramp B	10.0	-	-	10.0
B-027-0-23	US 22	5.0	8.0	-	13.0	B-112-0-23	Ramp G	9.0	-	-	9.0
B-028-0-23	US 22	11.5	-	-	11.5	B-113-0-23	Ramp G	8.0	9.0	-	17.0
B-029-0-23	US 22	3.0	10.0	-	13.0	B-114-0-23	Ramp G	10.5	-	-	10.5
B-030-0-23	US 22	6.0	8.0	-	14.0	B-115-0-23	Ramp H	10.0	-	-	10.0
B-031-0-23	US 22	4.0	9.0	-	13.0	B-116-0-23	RAMP E	9.0	-	-	9.0
B-032-0-23	US 22	8.5	-	-	8.5	B-117-0-23	RAMP E	9.0	-	-	9.0
B-033-0-23	US 22	8.0	5.0	-	13.0	B-118-0-23	RAMP F	9.0	-	-	9.0
B-033-1-23	US 22	7.0	6.0	-	13.0	B-119-0-23	RAMP F	12.0	-	-	12.0
B-034-0-23	US 22	10.5	-	-	10.5	B-119-1-23	RAMP F	10.0	-	-	10.0

4.2. Subgrade Conditions

The subgrade conditions in the project area are relatively consistent and are generally comprised of existing pavement sections underlain primarily by cohesive fine-grained soils, with minor amounts of non-cohesive coarse-grained soils and rock. The pavement sections range from 8 to 20 inches in thickness and are composed of asphalt, concrete, and granular base materials. Soils encountered within the project limits are typically classified as cohesive A-4a, A-4b, A-6a, A-6b and A-7-6 soil and non-cohesive A-1-a, A-1-b, A-2-4, A-3a and A-4a. Bedrock was encountered in 20 of the 70 borings and was classified as severely weathered shale, highly weathered siltstone, or slightly weathered limestone.

4.2.1. US-22 Mainline

This section starts approximately at SLM 15.11 and extends to SLM 18.91, consisting of 53 borings along the US-22 mainline, identified as B-001-0-23 to B-052-0-23.

Along US-22, eighty-three percent (83%) of the samples taken were classified as cohesive fine-grained soils and were comprised of: 1) Silt and Clay (A-6a, 42% of the samples); 2) Clay (A-7-6, 13% of the samples); 3) Sandy Silt (A-4a, 14% of the samples); 4) Silty Clay (A-6b, 12% of the samples); and, 5) Silt (A-4b, 2% of the samples). In terms of consistency of the cohesive soils, the description varies from soft to hard correlating to converted SPT-N values (N_{60}) ranging from 4 blows per foot (bpf) to refusal. Natural moisture contents ranged from 5 to 31 percent. Based on Atterberg limits test performed on representative samples of the cohesive soils, the liquid and plastic limit were estimated to range from 26 to 51 percent and from 18 to 27 percent, respectively.

Seven percent (7%) of the samples taken along the US-22 were classified as non-cohesive coarse-grained soils and were comprised of: 1) Gravel with sand and silt (A-2-4, 3% of the samples); 2) Gravel and/or stone fragments (A-1-a, 2% of the samples); 3) Gravel with Sand (A-1-b, 1% of the samples); and 4) Coarse and Fine Sand (A-3a, one sample). With respect to the relative density of the non-cohesive granular soils, the material description varies from loose to very dense correlating to N_{60} values ranging from 6 to 31 bpf. The natural moisture contents of granular soils ranged from 4 to 13 percent.

Rock was encountered along this section, primarily classified as shale, and in some areas as siltstone. The total percentage of rock within the total collected samples was ten percent (10%).

4.2.2. Ramp A

Ramp A specifically refers to the US-22 Westbound to US-250 Northbound ramp, which consists of 2 borings along the ramp, designated as B-022-0-23 and B-109-0-23.

Along Ramp A, sixty-three percent (63%) of the samples taken were classified as cohesive fine-grained soils and were comprised of: 1) Silt and Clay (A-6a, 38% of the samples); and 2) Clay (A-7-6, 25% of the samples. In terms of consistency of the cohesive soils, the description varies from very stiff to hard correlating to converted SPT-N values (N_{60}) ranging from 10 to 17 blows per foot (bpf). Natural moisture contents ranged from 14 to 17 percent. Based on Atterberg limits test performed on representative samples of the cohesive soils, the liquid and plastic limit were estimated to range from 33 to 42 percent and from 21 to 23 percent, respectively.

Thirteen percent (13%) of the samples taken along Ramp A were classified as non-cohesive coarse-grained soils and were comprised of non-cohesive sandy silt (A-4a, one sample). With respect to the relative density of the non-cohesive granular soils, the material can be described as a medium dense correlating to N_{60} value of 15 bpf. The natural moisture content of granular soils is 8 percent.

Rock was encountered along this section, primarily classified as shale, comprising a total percentage of twenty-five percent (25%) of the samples collected.

4.2.3. Ramp B

Ramp B specifically refers to the US-250 SB to US-22 WB ramp, which consists of 3 borings along the ramp, designated as B-018-0-23, B-110-0-23 and B-111-0-23.

Along Ramp B, sixty-seven percent (67%) of the samples taken were classified as cohesive fine-grained soils and were comprised of: 1) Clay (A-7-6, 42% of the samples); and, 2) Silt and Clay (A-6a, 25% of the samples). In terms of consistency of the cohesive soils, the description varies from very stiff to hard correlating to converted SPT-N values (N_{60}) ranging from 7 to 54 blows per foot (bpf). Natural moisture contents ranged from 13 to 20 percent. Based on Atterberg limits test performed on representative samples of the cohesive soils, the liquid and plastic limit were estimated to range from 38 to 44 percent and 24 to 26 percent, respectively.

Sixteen percent (16%) of the samples taken along Ramp B were classified as non-cohesive coarse-grained soils and were comprised of: 1) Stone Fragments (A-1-a. one sample); 2) Gravel with sand and silt (A-2-4, one sample). With respect to the relative density of the non-cohesive granular soils, the material can be described as loose correlating to N_{60} value ranging between 6 to 10 bpf. The natural moisture content of granular soils ranging between 7 and 11 percent.

Rock was encountered in this section, primarily classified as shale and coal, constituting a total percentage of twenty-five percent (17%) of the samples collected.

4.2.4. Ramp C

Ramp C specifically refers to the US-22 EB to US-250 NB ramp, which consists of 3 borings along the ramp, designated as B-017-0-23, B-104-0-23 and B-105-0-23.

Along Ramp C, fifty-four percent (54%) of the samples taken were classified as cohesive fine-grained soils and were comprised of: 1) Sandy Silt (A-4a, 18% of the samples); and 2) Silt and Clay (A-6a, 36% of the samples). In terms of consistency of the cohesive soils, the description varies from very stiff to hard correlating to converted SPT-N values (N_{60}) ranging from 7 to 38 blows per foot (bpf). Natural moisture contents ranged from 10 to 16 percent. Based on Atterberg limits test performed on representative samples of the cohesive soils, the liquid and plastic limit were estimated to range from 29 to 35 percent and from 20 to 22 percent, respectively.

Rock was encountered along this section, primarily classified as shale and siltstone, representing a total percentage of forty-five percent (45%) of the samples collected.

4.2.5. Ramp D

Ramp D refers to the US-250 SB to US-22 EB ramp, consisting of 3 borings along the ramp, designated as B-106-0-23 to B-108-0-23.

Along Ramp D, one hundred percent (100%) of the samples taken were classified as cohesive fine-grained soils and were comprised of: 1) Silt and Clay (A-6a, 42% of the samples); 2) Sandy Silt (A-4a, 33% of the samples); and 3) Clay (A-7-6, 25% of the samples). In terms of consistency of the cohesive soils, the description varies from very stiff to hard correlating to converted SPT-N values (N_{60}) ranging from 6 to 13 blows per foot (bpf). Natural moisture contents ranged from 10 to 25 percent. Based on Atterberg limits test performed on representative samples of the cohesive soils, the liquid and plastic limit were estimated to range from 32 to 44 percent and from 20 to 27 percent, respectively.

4.2.6. Ramp E

Ramp E refers to the US-22 WB to US-250 SB ramp. It comprises 4 borings along the ramp, designated as B-032-0-23, B-116-0-23 to B-118-0-23.

Along Ramp E, sixty-seven percent (67%) of the samples taken were classified as cohesive fine-grained soils and were comprised of: 1) Silt and Clay (A-6a, 33% of the samples); 2) Silty Clay (A-6b, 13% of the samples); 3) Clay (A-7-6, 13% of the samples; and 4) Sandy Silt (A-4a, one sample). In terms of consistency of the cohesive soils, the description varies from very stiff to hard correlating to converted SPT-N values (N_{60}) ranging from 6 to 23 blows per foot (bpf). Natural moisture contents ranged from 9 to 27 percent. Based on Atterberg limits test performed on representative samples of the cohesive soils, the liquid and plastic limit were estimated to range from 27 to 51 percent and 17 to 27 percent, respectively.

Twenty-seven percent (27%) of the samples taken along Ramp E were classified as non-cohesive coarse-grained soils and were comprised of: 1) Coarse and Fine Sand (A-3a, 27% of the samples). With respect to

the relative density of the non-cohesive granular soils, the material description varies from medium dense to very dense correlating to N_{60} values ranging from 22 to 58 bpf. The natural moisture content of granular soils ranged from 8 to 10 percent.

Rock was encountered along this section and primarily classified as limestone, constituting a total percentage of seven percent (7%) of the samples collected.

4.2.7. Ramp F

Ramp F refers to the US-250 SB to US-22 WB ramp, comprising 2 borings along the ramp identified as B-119-00-23 and B-119-1-23.

Along Ramp F, sixty-three percent (63%) of the samples taken were classified as cohesive fine-grained soils and were comprised of Silt and Clay (A-6a, 63% of the samples). In terms of consistency of the cohesive soils, the description varies from very stiff to hard correlating to converted SPT-N values (N_{60}) ranging from 7 to 23 blows per foot (bpf). Natural moisture contents ranged from 11 to 17 percent. Based on Atterberg limits test performed on representative samples of the cohesive soils, the liquid and plastic limit were estimated to range from 29 to 33 percent and 18 to 20 percent, respectively.

Thirty-eight percent (38%) of the samples taken along Ramp F were classified as non-cohesive coarse-grained soils and were comprised of: 1) Gravel with Sand (A-1-b, 25% of the samples); 3) Gravel with sand and silt (A-2-4, one sample). With respect to the relative density of the non-cohesive granular soils, the material description varies from medium dense to very dense correlating to N_{60} values ranging from 23 to 30 bpf. The natural moisture content of granular soils ranged from 8 to 12 percent.

4.2.8. Ramp G

Ramp G refers to the US-22 EB to US-250 NB ramp, consisting of 4 borings along the ramp identified as B-033-0-23 and B-112-0-23 to B-114-0-23.

Along Ramp G, eighty-eight percent (88%) of the samples taken were classified as cohesive fine-grained soils and were comprised of: 1) Sandy Silt (A-4a, 25% of the samples); 2) Silt and Clay (A-6a, 25% of the samples); 3) Silty Clay (A-6b, 25% of the samples); and 4) Silt (A-4b, 13% of the samples);. In terms of consistency of the cohesive soils, the description varies from very stiff to hard correlating to converted SPT-N values (N_{60}) ranging from 6 to 32 blows per foot (bpf). Natural moisture contents ranged from 9 to 20 percent. Based on Atterberg limits test performed on representative samples of the cohesive soils, the liquid and plastic limit were estimated to range from 25 to 40 percent and 18 to 23 percent, respectively.

Twelve percent (12%) of the samples taken along Ramp G were classified as non-cohesive coarse-grained soils and were comprised of non-cohesive sandy silt (A-4a, 12% of the samples). With respect to the relative density of the non-cohesive granular soils, the material can be described as dense correlating to N_{60} values ranging from 34 to 44 bpf. The natural moisture content of granular soils ranged from 9 to 10 percent.

4.2.9. Ramp H

Ramp H refers to the US-250 NB to US-22 EB ramp, consisting of one boring along the ramp designated as B-115-0-23.

Along Ramp H, one-hundred percent (100%) of the samples taken were classified as cohesive fine-grained soils and were comprised of Silt and Clay (A-6a, 100% of the samples). In terms of consistency of the cohesive soils, the description varies from very stiff to hard correlating to converted SPT-N values (N_{60}) ranging from 17 to 29 blows per foot (bpf). Natural moisture contents ranged from 11 to 13 percent. Based

on Atterberg limits test performed on representative samples of the cohesive soils, the liquid and plastic limit were estimated to range from 30 to 33 percent and from 19 to 21 percent, respectively.

4.2.10. Groundwater

Groundwater measurements were taken during the boring drilling procedures and/or immediately following the completion of each borehole. Groundwater was not encountered in project borings during drilling.

It should be noted that groundwater is affected by many hydrologic characteristics in the area and may vary from those measured at the time of the exploration.

4.2.11. Bedrock in Original Exploration

Bedrock was encountered in 20 out of the 70 roadway borings conducted for the project. A summary of the rock depths and elevations for each boring is provided in Table 9 below.

Table 9: Bedrock Summary for Original Exploration

Boring ID	Top of Rock Depth (ft)	Top of Rock Elevation (ft)
B-001-0-23	6.0	1078.8
B-009-0-23	4.0	1197.2
B-010-0-23	4.5	1212.5
B-011-0-23	6.0	1223.9
B-013-0-23	6.0	1234.0
B-017-0-23	4.5	1211.2
B-021-0-23	5.5	1209.9
B-024-0-23	1.2	1233.9
B-025-0-23	4.5	1236.0
B-028-0-23	5.5	1252.5
B-029-0-23	6.0	1255.6
B-033-0-23	25.5	1201.1
B-033-1-23	36.7	1190.4
B-034-0-23	6.0	1200.8
B-038-0-23	5.0	1188.1
B-104-0-23	1.5	1208.1
B-109-0-23	4.5	1219.8
B-111-0-23	4.5	1203.5
B-116-0-23	6.0	1234.2
B-119-1-23	31.0	1211.0

4.3. Subsurface Conditions

4.3.1. Overburden Soils

At the HAS-22-17.53 left bridge site, subsurface soils encountered immediately below the subgrade generally consisted of natural glacial till, comprising both cohesive fine-grained and non-cohesive coarse-grained layers. These glacial till soils extended to depths ranging from approximately 22.0 to 25.0 ft bgs, corresponding to elevations between 1207.4 to 1211.1 ft amsl.

The cohesive glacial till soils are classified on the boring logs as Sandy Silt (A-4a) and Silt and Clay (A-6a). At the rear abutment location, cohesive soils were encountered between elevations 1232.8 ft and 1229.6 ft, and again between 1224.6 ft and 1211.1 ft. At the forward abutment, cohesive soils were observed between elevations 1219.9 ft and 1209.9 ft. These soils exhibited very stiff to hard consistency, with Standard Penetration Test (SPT) N_{60} values ranging from 3 to 37 blows per foot (bpf), and estimated unconfined compressive strengths (based on hand penetrometer readings) ranging from approximately 2.25 to 4.50 tsf. Natural moisture contents varied between 8 and 32 percent.

The non-cohesive glacial till soils are classified as Gravel with Sand (A-1-b), Gravel with Sand and Silt (A-2-4), and Gravel and Stone Fragments with Sand, Silt, and Clay (A-2-6). At the rear abutment location, these granular materials were encountered between elevations 1229.6 ft and 1224.6 ft. At the forward abutment, they were encountered between elevations 1228.1 ft and 1219.9 ft, and again between 1209.9 ft and 1207.4 ft. These soils exhibited a relative density ranging from loose to very dense, as indicated by N_{60} values between 6 and 71 bpf. Natural moisture contents ranged from 6 to 15 percent.

At the HAS-22-17.53 right bridge site, the subsurface soils encountered immediately below the subgrade generally consisted of natural glacial till, comprising both cohesive fine-grained and non-cohesive coarse-grained layers. The glacial till soils extended to depths ranging from approximately 11.0 to 20.0 feet below ground surface (bgs), corresponding to elevations between 1210.7 ft and 1224.1 ft amsl.

The cohesive glacial till soils are classified on the boring logs as Sandy Silt (A-4a), Elastic Clay (A-7-5), and Clay (A-7-6). At the rear abutment location, cohesive soils were encountered between elevations 1233.8 ft and 1224.1 ft. No granular soils were observed at this location. At the forward abutment, cohesive soils were encountered between elevations 1219.0 ft and 1212.5 ft. These soils exhibited stiff to hard consistency, with Standard Penetration Test (SPT) N_{60} values ranging from 9 to 15 blows per foot (bpf), and estimated unconfined compressive strengths (based on hand penetrometer readings) ranging from approximately 1.50 to 4.50 tsf. Natural moisture contents ranged from 7 to 57 percent.

The non-cohesive glacial till soils are classified as Gravel with Sand and Silt (A-2-4) and Coarse and Fine Sand (A-3a). These granular materials were encountered at the forward abutment location between elevations 1229.7 ft and 1219.0 ft. They exhibited relative densities ranging from loose to medium dense, with N_{60} values between 9 and 18 bpf. Natural moisture contents for these soils ranged from 12 to 24 percent.

At the HAS-22-19.12 bridge site, subsurface soils encountered immediately below the subgrade generally consisted of natural glacial till, comprising both cohesive fine-grained and non-cohesive coarse-grained layers. The glacial till soils extended to depths ranging from approximately 10.5 to 12.0 feet below ground surface (bgs), corresponding to an elevation of about 1205.8 ft amsl.

The non-cohesive glacial till soils are classified on the boring logs as Gravel with Sand (A-1-b). These granular materials were encountered between elevations 1215.2 ft and 1209.3 ft at the rear abutment, and between 1216.7 ft and 1210.8 ft at the forward abutment. They exhibited relative densities ranging from loose to medium dense, with Standard Penetration Test (SPT) N_{60} values between 7 and 15 blows per foot (bpf). Natural moisture contents ranged from 4 to 9 percent.

The cohesive glacial till soils are classified as Sandy Silt (A-4a) and Silty Clay (A-6b). These cohesive soils were encountered between elevations 1209.3 ft and 1205.8 ft at the rear abutment, and between 1210.8 ft and 1205.8 ft at the forward abutment. They are described as having medium stiff to very stiff consistency, with N_{60} values between 6 and 7 bpf and estimated unconfined compressive strengths (based on hand penetrometer readings) ranging from approximately 1.00 to 2.50 tsf. Natural moisture contents ranged from 13 to 27 percent.

4.3.1. Bedrock in Bridge Exploration

Bedrock was encountered in all bridge borings. A summary of the bedrock characteristics—including rock type, depth, elevation, core recovery, and RQD—is presented in Table 10 below. Detailed rock core reports were presented in Appendix B.

Table 10: Bedrock Summary for Bridge Exploration

Boring ID	Bedrock Type	Bedrock Depth (ft)	Bedrock Elevation (ft)	Bedrock Recovery Avg (%)	Bedrock RQD Avg (%)
HAS-22-17.53 Left / Right Bridge					
B-139-0-23	Sandstone	11.0 - 17.0	1224.1 - 1218.1	100	42
	SiltStone	17.0 - 21.5	1218.1 - 1213.6	87	15
	Interbedded Shale and Siltstone	21.5 - 31.5	1213.6 - 1203.6	100	26
B-141-0-23	Sandstone	23.0 - 25.9	1211.1 - 1208.2	100	25
	Interbedded Shale and Siltstone	25.9 - 31.7	1208.2 - 1202.4	100	25
	Shale	31.7 - 39.9	1202.4 - 1194.2	97	9
	Coal	39.9 - 41.5	1194.2 - 1192.6	100	32
	Limestone	41.5 - 48.2	1192.6 - 1185.9	100	76
B-142-0-23	Sandstone	18.5 - 24.2	1212.5 - 1206.8	100	50
	Interbedded Shale and Siltstone	24.2 - 32.5	1206.8 - 1198.5	97	45
	Shale	32.5 - 37.2	1198.5 - 1193.8	100	13
	Coal	37.2 - 38.8	1193.8 - 1192.2	100	0
	Shale	38.8 - 40.5	1192.2 - 1190.5	100	0
	Limestone	40.5 - 45.5	1190.5 - 1185.5	100	77
B-144-0-23	SiltStone	22.0 - 22.7	1207.4 - 1206.7	-	-
	Interbedded Coal and Shale	22.7 - 29.2	1206.7 - 1200.2	58	33
	Limestone	29.2 - 32.7	1200.2 - 1196.7	100	61
	Sandstone	32.7 - 33.7	1196.7 - 1195.7	100	0
	Interbedded Shale and Siltstone	33.7 - 43.5	1195.7 - 1185.9	100	30
	Limestone	43.5 - 47.7	1185.9 - 1181.7	100	79
HAS-22-19.12 Bridge					
B-145-0-23	Shale	10.5 -11.3	1205.8 - 1205.0	-	-
	Interbedded Shale and Siltstone	11.3 - 19.9	1205.0 - 1196.4	100	56
	Coal	19.9 - 21.3	1196.4 - 1195.0	83	0
	Interbedded Limestone and Siltstone	21.3 - 36.3	1195.0 - 1180.0	98	67
B-146-0-23	Shale	12.0 - 15.1	1205.8 - 1202.7	-	-
	Interbedded Shale and Siltstone	15.1 - 19.2	1202.7 - 1198.6	94	89
	Interbedded Limestone and Siltstone	19.2 - 25.7	1198.6 - 1192.1	100	66
	Coal	25.7 - 27.9	1192.1 - 1189.9	87	0
	Interbedded Limestone and Siltstone	27.9 - 40.1	1189.9 - 1177.7	100	67

5. ANALYSES AND RECOMMENDATIONS

We understand that the overall project objective is a major rehabilitation of the US-22 with the associated ramps. For this purpose, a subgrade exploration and subsequent analysis was completed for the referenced project. The subgrade analysis was performed in accordance with ODOT's GDM criteria utilizing the ODOT provided subgrade analysis spreadsheet (GB1_ SubgradeAnalysis.xls, version 14.6 dated February 11, 2022). Input information for the spreadsheet was based on the soil characteristics gathered during NEAS's exploration (i.e., SPT results, laboratory test results, etc.).

5.1. Subgrade Analysis

A subgrade analysis was performed to identify the method, location, and dimensions (including depth) of required subgrade stabilization for the project. In addition to identifying stabilization recommendations, pavement design parameters are also determined to aid in pavement section design. The subsections below present the results of our subgrade analysis including pavement design parameters and unsuitable subgrade conditions identified within the project limits. Subgrade analysis spreadsheets are provided in Appendix D.

Again, it should be noted that for the purposes of this report and our analysis, the term 'proposed subgrade' has been assumed to represent soils and/or soil conditions extending to a depth of 7.5 ft below the bottom of proposed pavement section (i.e., top of subgrade).

5.1.1. Pavement Design Recommendations

It is our understanding that pavement analysis and design is to be performed to determine the proposed pavement section within the project limits to undergo the proposed improvements. A subgrade analysis was performed using the subgrade soil data obtained during our field exploration program to evaluate the soil characteristics to develop pavement parameters for use in pavement design. The subgrade analysis parameters recommended for use in pavement design are presented in Table 11 below. Provided in the table are ranges of maximum, minimum and average N_{60L} values for the indicated segments as well as the design CBR value recommended for use in pavement design.

Table 11: Pavement Design Parameters

Segment	Maximum N_{60L}	Minimum N_{60L}	Average N_{60L}	Average PI Values	Design CBR
US 22 Mainline	30	4	9	14	7
Ramp A	15	10	13	15	7
Ramp B	10	6	8	15	7
Ramp C	30	7	22	10	9
Ramp D	7	6	7	13	6
Ramp E	22	6	12	16	7
Ramp F	8	7	8	12	8
Ramp G	22	5	10	12	6
Ramp H	17	17	17	12	7
Entire Project	**30**	**4**	**9**	**13**	**7**

5.1.2. Unsuitable Soils

Per ODOT's GDM, the presence of select subgrade conditions are prohibited within the subgrade zone for new pavement construction. These prohibited subgrade conditions generally include the presence of rock, specific soil types, and soils with a liquid limit greater than 65 percent. With respect to the proposed improvement project these subgrade conditions are further discussed in the following subsections.

5.1.2.1. Rock

Rock was encountered at or close to subgrade elevation at couple boring locations performed within the project limits. Per ODOT's GDM, if rock is encountered within 6 inches of the bottom of the proposed asphalt or concrete pavement it is to be removed in accordance with 204.05 and replaced with Item 204.02 granular material type B with a gradation of 703.17. The summary of findings is summarized in Table 12 below.

5.1.2.2. Prohibited Soils

Prohibited soil types per the GDM include A-4b, A-2-5, A-5, A-7-5, A-8a, A-8b, and soils with liquid limits greater than 65. The prohibited soils A-4b were encountered on one boring B-021-0-23,within 3 feet of the subgrade. According to the ODOT GDM Section 610.1, "when A-4b soil is encountered in natural ground or an existing embankment within 3 feet of the subgrade, regardless of its consistency or moisture content, remove or chemically stabilize because of its susceptibility to frost heaving". In addition, ODOT GDM Section 610.1 stated that "When excavating and replacing, A-4b should be excavated to 36 inches below proposed subgrade and replaced with Item 204 Embankment, If the subgrade is going to be chemically stabilized to a depth of 14 inches, A-4b soil does not have to be removed". Since A-4b soils were encountered within the 3 feet of the subgrade, the soil needs to be either removed or chemically stabilized. The findings are summarized in Table 12 below.

Table 12: Rock and Prohibited Soils Summary

Boring ID	Prohibited Soil Type	Depth Below Subgrade (ft)
US-22 Mainline		
B-021-0-23	A-4b	2.7 - 4.2
B-024-0-23	Rock	0.0 - 2.1
Ramp C		
B-104-0-23	Rock	0.0 - 1.9

5.1.3. Unstable Soils

The GDM recommends subgrade stabilization for soils in which the N_{60} value of a particular soil sample (SS) at a referenced boring location is less than 12 bpf and in some cases less than 15 bpf (i.e., where moisture content is greater than optimum plus 3 percent). Based on the specific N_{60} value at the subject boring, *Figure B - Subgrade Stabilization* within the subgrade analysis recommends a depth of subgrade stabilization for ODOT standard stabilization methods. For the purposes of this report, the term 'weak soils' has been assumed to represent subgrade soils of these conditions. It should be noted that although a soil sample's N_{60} value may meet the criteria to be considered a weak soil, the depth in which the weak soil is encountered in relation to the proposed subgrade is considered when each individual subgrade boring is analyzed. For example, if the GDM recommends an excavate and replace of 12 inches within a weak soil underlying 18 inches of stable material, it would be unreasonable to recommend the removal of both the stable and unstable material for a total of 30 inches of excavate and replace.

Based on N_{60} values encountered within the project borings, our subgrade analysis indicated the possible need for 12 inches to 14 inches of chemical treatment or 12 inches to 24 inches excavate and replace with item 204 at different boring locations along the project limits. Information on the boring location where weak soils were encountered and determined to have a potential impact on subgrade performance is shown in Table 13 below.

Table 13: Unstable (Weak) Soils Location Summary

Boring ID	N_{60L}	Depth Below Subgrade (ft)	Boring ID	N_{60L}	Depth Below Subgrade (ft)
US-22 Mainline			**US-22 Mainline**		
B-001-0-23	4	0.0 - 1.2	B-047-0-23	10	0.9 - 2.4
B-002-0-23	5	0.2 - 1.7	B-048-0-23	8	0.0 - 1.4
B-003-0-23	8	0.4 - 1.9	B-049-0-23	7	0.0 - 1.5
B-004-0-23	11	0.0 - 1.0	B-050-0-23	5	0.0 - 1.5
B-004-0-23	11	1.0 - 2.5	B-051-0-23	11	0.0 - 1.5
B-005-0-23	6	0.0 - 1.5	B-052-0-23	6	0.0 - 1.5
B-008-0-23	13	0.0 - 1.3	**Ramp A**		
B-009-0-23	5	0.0 - 1.1	B-022-0-23	11	0.0 -1.7
B-010-0-23	7	0.0 - 1.2	B-022-0-23	10	1.7 - 3.2
B-011-0-23	6	0.1 - 1.6	**Ramp B**		
B-013-0-23	8	0.0 - 1.3	B-110-0-23	7	0.0 - 1.6
B-015-0-23	8	0.0 - 1.5	B-110-0-23	10	1.6 - 3.1
B-019-0-23	7	0.0 - 1.2	B-111-0-23	6	0.0 - 1.5
B-020-0-23	8	0.0 - 1.5	B-111-0-23	8	1.2 - 2.7
B-022-0-23	10	0.0 - 1.0	**Ramp C**		
B-025-0-23	8	0.0 - 1.3	B-105-0-23	10	0.0 - 0.9
B-026-0-23	8	0.7 - 2.2	**Ramp D**		
B-027-0-23	4	0.0 - 1.5	B-106-0-23	6	0.0 - 1.5
B-027-0-23	7	1.5 - 3.0	B-106-0-23	8	1.5 - 3.0
B-028-0-23	8	0.3 - 1.8	B-107-0-23	7	0.0 - 1.6
B-029-0-23	7	0.0 - 1.4	B-107-0-23	8	1.6 - 3.1
B-031-0-23	10	0.0 - 1.4	B-108-0-23	7	0.0 - 1.6
B-032-0-23	6	0.4 - 1.9	B-108-0-23	8	1.6 - 3.1
B-033-0-23	6	0.0 - 1.5	**Ramp E**		
B-034-0-23	10	0.0 - 1.5	B-032-0-23	6	0.0 - 1.4
B-035-0-23	8	0.1 - 1.6	B-032-0-23	7	1.4 - 2.9
B-036-0-23	10	0.0 - 1.4	B-116-0-23	10	0.4 - 1.9
B-037-0-23	6	0.0 - 1.1	B-116-0-23	7	1.9 - 3.4
B-038-0-23	6	0.1 - 1.6	**Ramp F**		
B-039-0-23	6	0.1 - 1.6	B-119-0-23	8	0.1 - 1.6
B-040-0-23	7	0.1 - 1.6	B-119-1-23	10	0.0 -1.3
B-041-0-23	8	0.0 - 1.5	B-119-1-23	7	1.3 - 2.8
B-042-0-23	6	0.1 - 1.6	**Ramp G**		
B-043-0-23	6	0.0 - 1.4	B-033-0-23	6	0.0 - 0.9
B-044-0-23	7	1.3 - 2.8	B-033-0-23	7	0.9- 2.4
B-045-0-23	10	0.0 - 1.5	B-112-0-23	7	0.6 - 2.1
B-046-0-23	5	1.4 - 2.9	B-113-0-23	5	0.0 - 1.2
B-047-0-23	7	0.0 - 0.9	B-113-0-23	6	1.2 - 2.7

5.1.3.1. High Moisture Content Soils

High moisture content soils are defined by the GDM as soils that exceed the estimated optimum moisture content (per *Figure A - Optimum Moisture Content* within the GDM) for a given classification by 3 percent or more. Per the GDM, soils determined to be above the identified moisture content levels are a likely indication of the presence of an unstable subgrade and may require some form of subgrade stabilization. Similar to our analysis of weak soils, although a soil sample's moisture content may meet the criteria to be considered high, the depth in which the high moisture soil is encountered in relation to the proposed subgrade is considered when each individual subgrade boring is analyzed for stabilization recommendations. Based on the subsurface exploration performed, high moisture content soils within the proposed subgrade of the project were encountered in borings as shown in Table 14 below.

Table 14: High Moisture Content Soils Summary

Boring ID	Sample ID	Soil Type	Moisture Content (%)	Optimum Moisture Content (%)	Moisture Above Optimum (%)	Depth Below Subgrade (ft)
US-22 Mainline						
B-001-0-23	SS-2	A-6a	21	14	7	1.2 - 2.7
B-002-0-23	SS-1	A-7-6	31	23	8	0.2 - 1.7
B-008-0-23	SS-1	A-6a	18	14	4	0.0 - 1.3
B-009-0-23	SS-2	A-6a	21	14	7	1.1 - 2.6
B-015-0-23	SS-2	A-6b	21	16	5	1.5 - 3.0
B-020-0-23	SS-2	A-6a	21	18	3	1.5 - 3.0
B-027-0-23	SS-2	A-4a	16	10	6	1.5 - 3.0
B-034-0-23	SS-2	A-6a	20	15	5	1.5 - 3.0
B-036-0-23	SS-1	A-6b	21	17	4	0.0 - 1.4
B-039-0-23	SS-2	A-4a	20	10	10	1.6 - 3.1
B-043-0-23	SS-2	A-6b	19	16	3	1.4 - 2.9
B-044-0-23	SS-1	A-4a	17	13	4	1.3 - 2.8
B-046-0-23	SS-1	A-6a	21	17	4	1.4 - 2.9
Ramp D						
B-106-0-23	SS-2	A-4a	14	10	4	1.5 - 3.0
Ramp F						
B-119-1-23	SS-2	A-6a	17	14	3	1.3 - 2.8

5.1.4. Stabilization Recommendations

Unsuitable soils were encountered within the 3 feet of the subgrade along the project portion as discussed in section 5.1.2.1 and 5.1.2.2 and summarized in Table 11. In addition, with respect to unstable and high moisture content soils, many borings performed along the project limits encountered soil with an N_{60} value below 12 bpf and moisture content greater than optimum plus 3 percent within 3 feet of subgrade as discussed in section 5.1.3.

According to ODOT GDM Section 605, "for all Interstates and other divided highways with four or more lanes more than 1-mile in project length, chemically stabilize the subgrade for the entire project (global stabilization)". Based on the roadway basemap, the proposed rehabilitation along US-22 and associated ramps exceeds 1 mile in length. However, eight (8) borings out of 140 encountered sulfate content greater than 3,000 ppm and one of them exceeded 5,000 ppm. NEAS recommends undercutting and replacing rock encountered within 6 inches of the bottom of subgrade with Item 204 embankment, then globally chemical stabilizing the entire project using cement to a depth of 14 inches. The limits of undercut and replacement (bedrock) include US-22 eastbound and westbound between Station 894+00 and Station 899+00, and US-22 eastbound only between Station 899+00 and Station 902+50. In these locations, the bedrock should be undercut and replaced with suitable material conforming to 204.02 Granular Material Type B, with the gradation of specified in CMS Item 703.17.

Stabilization limits should extend 18-inches beyond the edge of the proposed paved roadway, shoulder or median and it is recommended removing any topsoil, existing pavement materials or abandoned structure foundation materials. NEAS's opinion that the subgrade soils will provide adequate pavement support assuming it is designed and constructed in accordance with the recommendations provided within this report, as well as all applicable ODOT standards and specifications.

5.2. HAS-22-17.53 L/R Bridges Analysis

For analysis purposes, each boring log was reviewed, and a generalized material profile was developed for analysis. Utilizing the generalized soil profile, engineering properties for each soil strata were estimated based on their field (i.e., SPT N_{60} Values, hand penetrometer values, etc.) and laboratory (i.e., Atterberg Limits, grain size, etc.) test results using correlations provided in published engineering manuals, research reports and guidance documents. The developed soil profile and estimated engineering soil and rock

properties (with cited correlation/reference material) used in our evaluation is summarized per boring within Tables 15-18 below.

Table 15: B-139-0-24 Soil Profile

HAS-22-17.53 Right: Rear Abutment B-139-0-23							
Soil Description	**Unit Weight[1] (pcf)**	**Moist Unit Weight[1] (pcf)**	**Saturated Unit Weight[1] (pcf)**	**Undrained Shear Strength[2] (psf)**	**Effective Cohesion[3] (psf)**	**Effective Friction Angle[3] (degrees)**	**Setup Factor (f_{su})**
Sandy Silt (A-4a) Depth (1235.2 ft - 1224.2 ft)	110	110	120	1250	150	24	1.50
Notes: *1. Values interpreted from ODOT Geotechnical Design Manual (GDM) Section 405.* *2. Values calculated from Terzaghi and Peck (1967) if N160<52, else Stroud and Butler (1975) was used.* *3. Values interpreted from LRFD BDS Table 10.4.6.2.4-1 and ODOT GDM Table 400-3.*							

Table 16: B-141-0-24 Soil Profile

HAS-22-17.53 Left: Rear Abutment B-141-0-23							
Soil Description	**Unit Weight[1] (pcf)**	**Moist Unit Weight[1] (pcf)**	**Saturated Unit Weight[1] (pcf)**	**Undrained Shear Strength[2] (psf)**	**Effective Cohesion[3] (psf)**	**Effective Friction Angle[3] (degrees)**	**Setup Factor (f_{su})**
Sandy Silt (A-4a) Depth (1234.3 ft - 1229.8 ft)	110	110	120	1600	150	24	1.50
Gravel with Sand (A-1-b) Depth (1229.8 ft - 1227.3 ft)	112	112	122	-	-	34	1.00
Gravel with Sand, Silt and Clay (A-2-6 Depth (1227.3 ft - 1224.8 ft)	110	110	120	-	-	30	1.20
Silt and Clay (A-6a) Depth (1224.8 ft - 1219.8 ft)	105	105	115	800	75	21	1.50
Sandy Silt (A-4a) Depth (1219.8 ft - 1211.3 ft)	110	110	120	1500	150	24	1.50
Notes: *1. Values interpreted from ODOT Geotechnical Design Manual (GDM) Section 405.* *2. Values calculated from Terzaghi and Peck (1967) if N160<52, else Stroud and Butler (1975) was used.* *3. Values interpreted from LRFD BDS Table 10.4.6.2.4-1 and ODOT GDM Table 400-3.*							

Table 17: B-142-0-24 Soil Profile

HAS-22-17.53 Right: Forward Abutment B-142-0-23							
Soil Description	**Unit Weight[1] (pcf)**	**Moist Unit Weight[1] (pcf)**	**Saturated Unit Weight[1] (pcf)**	**Undrained Shear Strength[2] (psf)**	**Effective Cohesion[3] (psf)**	**Effective Friction Angle[3] (degrees)**	**Setup Factor (f_{su})**
Coarse and Fine Sand (A-3a) Depth (1231.1 ft - 1221.6 ft)	112	112	122	-	-	33	1.00
Gravel with Sand and Silt (A-2-4) Depth (1221.6 ft - 1219.1 ft)	115	115	125	-	-	34	1.20
Elastic Clay (A-7-5) Depth (1219.1 ft - 1216.6 ft)	102	102	112	500	50	19	1.75
Clay (A-7-6) Depth (1216.6 ft - 1212.6 ft)	112	112	122	1850	200	23	2.00
Notes: *1. Values interpreted from ODOT Geotechnical Design Manual (GDM) Section 405.* *2. Values calculated from Terzaghi and Peck (1967) if N160<52, else Stroud and Butler (1975) was used.* *3. Values interpreted from LRFD BDS Table 10.4.6.2.4-1 and ODOT GDM Table 400-3.*							

Table 18: B-144-0-24 Soil Profile

HAS-22-17.53 Left: Forward Abutment B-144-0-23							
Soil Description	**Unit Weight[1] (pcf)**	**Moist Unit Weight[1] (pcf)**	**Saturated Unit Weight[1] (pcf)**	**Undrained Shear Strength[2] (psf)**	**Effective Cohesion[3] (psf)**	**Effective Friction Angle[3] (degrees)**	**Setup Factor (f_{su})**
Gravel with Sand and Silt (A-2-4) Depth (1229.4 ft - 1219.9 ft)	112	112	122	-	-	34	1.20
Sandy Silt (A-4a) Depth (1219.9 ft - 1217.4 ft)	108	108	118	850	100	23	1.50
Silt and Clay (A-6a) Depth (1217.4 ft - 1209.9 ft)	112	112	122	2200	200	24	1.50
Gravel with Sand and Silt (A-2-4) Depth (1209.9 ft - 1207.4 ft)	130	130	140	-	-	40	1.20
Notes: *1. Values interpreted from ODOT Geotechnical Design Manual (GDM) Section 405.* *2. Values calculated from Terzaghi and Peck (1967) if N160<52, else Stroud and Butler (1975) was used.* *3. Values interpreted from LRFD BDS Table 10.4.6.2.4-1 and ODOT GDM Table 400-3.*							

Deep foundation elements subjected to horizontal loads and/or moments should be analyzed for maximum bending moment, maximum shear force and lateral deflection and should be checked whether the foundation element is structurally capable of resisting the lateral load. For the purpose of evaluating the shaft resistance in the lateral direction, drilled shaft has been analyzed by using the software entitled Lpile by Ensoft, Inc. The generalized soil/rock parameters, to be used to analyze the laterally loaded shaft by the p-y curve method for soil and rock strata are shown in Table 19 to Table 22, respectively.

Table 19: B-139-0-24 Lpile Parameters

Layer Number (No.)	Top Elev. (ft)	Bottom Elev. (ft)	Layer Depth (ft)	Soil/Rock Class	LPILE p-y Model	Soil Strain Parameter ε50	Soil Modulus Parameter p-y k (pci)	Rock RQD (%)	Rock Uniaxial Compressive Strength qu (psi)	Rock Strain Factor krm[1]	Rock Initial Modulus of Rock Mass (psi)[2]
B-139-0-23											
1	1235.2	1224.2	11	A-4a	Stiff Clay w/o Water	0.008	371	-	-	-	-
2	1224.2	1218.2	17	Interbedded Sandstone and Shale	Weak Rock	-	-	42	3,318	0.00005	300,000
3	1218.2	1213.7	21.5	SiltStone	Weak Rock	-	-	15	200	0.00050	18,000
4	1213.7	1203.7	31.5	Interbedded Shale and Siltstone	Weak Rock	-	-	26	1,102	0.00016	99,000

Note:
1. Values interpreted from LPILE Technical Manual.
2. Values interpreted from ODOT Geotechnical Design Manual (GDM) Section 406.

Table 20: B-141-0-24 Lpile Parameters

Layer Number (No.)	Top Elev. (ft)	Bottom Elev. (ft)	Layer Depth (ft)	Soil/Rock Class	LPILE p-y Model	Soil Strain Parameter ε50	Soil Modulus Parameter p-y k (pci)	Rock RQD (%)	Rock Uniaxial Compressive Strength qu (psi)	Rock Strain Factor krm[1]	Rock Initial Modulus of Rock Mass (psi)[2]
B-141-0-23											
1	1234.3	1229.8	4.5	A-4a	Stiff Clay w/o Water	0.0070	542	-	-	-	-
2	1229.8	1227.3	7	A-1-b	Sand (Reese)	-	140	-	-	-	-
3	1227.3	1224.8	9.5	A-2-6	Sand (Reese)	-	46	-	-	-	-
4	1224.8	1219.8	14.5	A-6a	Soft Clay	0.0109	147	-	-	-	-
5	1219.8	1211.3	23	A-4a	Stiff Clay w/o Water	0.0072	514	-	-	-	-
6	1211.3	1208.4	25.9	Sandstone	Weak Rock	-	-	25	7,500	0.00005	680,000
7	1208.4	1202.6	31.7	Interbedded Shale and Siltstone	Weak Rock	-	-	46	748	0.00025	67,000
8	1202.6	1194.4	39.9	Shale	Weak Rock	-	-	9	1,125	0.00016	100,000
9	1194.4	1192.8	41.5	Coal	Weak Rock	-	-	10	200	0.00050	18,000
10	1192.8	1186.1	48.2	Limestone	Weak Rock	-	-	76	10,000	0.00005	900,000

Note:
1. Values interpreted from LPILE Technical Manual.
2. Values interpreted from ODOT Geotechnical Design Manual (GDM) Section 406.

Table 21: B-142-0-24 Lpile Parameters

Layer Number (No.)	Top Elev. (ft)	Bottom Elev. (ft)	Layer Depth (ft)	Soil/Rock Class	LPILE p-y Model	Soil Strain Parameter ε50	Soil Modulus Parameter p-y k (pci)	Rock RQD (%)	Rock Uniaxial Compressive Strength qu (psi)	Rock Strain Factor krm[1]	Rock Initial Modulus of Rock Mass (psi)[2]
B-142-0-23											
1	1231.1	1221.6	9.5	A-3a	Sand (Reese)	-	108	-	-	-	-
2	1221.6	1219.1	12	A-2-4	Sand (Reese)	-	179	-	-	-	-
3	1219.1	1216.6	14.5	A-7-5	Soft Clay	0.0155	56	-	-	-	-
4	1216.6	1212.6	18.5	A-7-6	Stiff Clay w/o Water	0.0065	625	-	-	-	-
5	1212.6	1210.6	20.5	Sandstone	Weak Rock	-	-	0	1,500	0.00011	140,000
6	1210.6	1206.9	24.2	Sandstone	Weak Rock	-	-	50	6,584	0.00005	590,000
7	1206.9	1198.6	32.5	Interbedded Shale and Siltstone	Weak Rock	-	-	13	2,288	0.00006	210,000
8	1198.6	1193.9	37.2	Shale	Weak Rock	-	-	29	360	0.00050	32,000
9	1193.9	1192.3	38.8	Coal	Weak Rock	-	-	0	200	0.00050	18,000
10	1192.3	1190.6	40.5	Shale	Weak Rock	-	-	0	360	0.00050	32,000
11	1190.6	1185.6	45.5	Limestone	Weak Rock	-	-	77	10,000	0.00005	900,000

Note:
1. Values interpreted from LPILE Technical Manual.
2. Values interpreted from ODOT Geotechnical Design Manual (GDM) Section 406.

Table 22: B-144-0-24 Lpile Parameters

Layer Number (No.)	Top Elev. (ft)	Bottom Elev. (ft)	Layer Depth (ft)	Soil/Rock Class	LPILE p-y Model	Soil Strain Parameter ε50	Soil Modulus Parameter p-y k (pci)	Rock RQD (%)	Rock Uniaxial Compressive Strength qu (psi)	Rock Strain Factor krm[1]	Rock Initial Modulus of Rock Mass (psi)[2]
B-144-0-23											
1	1229.4	1219.9	9.5	A-2-4	Sand (Reese)	-	140	-	-	-	-
2	1219.9	1217.4	12	A-4a	Stiff Clay w/o Water	0.0104	170	-	-	-	-
3	1217.4	1209.9	19.5	A-6a	Stiff Clay w/o Water	0.0059	736	-	-	-	-
4	1209.9	1207.4	22	A-2-4	Sand (Reese)	-	798	-	-	-	-
5	1207.4	1206.7	22.7	Siltstone	Weak Rock	-	-	0	200	0.00050	18,000
6	1206.7	1200.2	29.2	Interbedded Coal and Shale	Weak Rock			10	391	0.00050	35,000
7	1200.2	1196.7	32.7	Limestone	Weak Rock	-	-	61	7,500	0.00005	680,000
8	1196.7	1195.7	33.7	Sandstone	Weak Rock	-	-	0	7,500	0.00005	680,000
9	1195.7	1185.9	43.5	Interbedded Shale and Siltstone	Weak Rock			30	1,395	0.00012	130,000
10	1185.9	1181.7	47.7	Limestone	Weak Rock	-	-	79	7,500	0.00005	680,000

Note:
1. *Values interpreted from LPILE Technical Manual.*
2. *Values interpreted from ODOT Geotechnical Design Manual (GDM) Section 406.*

5.2.1. Axially Loaded Shaft Analysis

Drilled shafts are proposed to support the substructures of the HAS-22-17.53 L&R bridges over the Columbus & Ohio River Railroad. At the project site, bedrock was encountered in all structural borings, with elevations ranging from 1207.4 ft to 1224.2 ft, depending on location. Both abutments will be supported by 3'-0" diameter drilled shafts with 3'-0" diameter rock sockets.

A drilled shaft foundation analysis was performed at the proposed bridge location in accordance with the LRFD BDS. Specifically, the procedures in Section 10.8.3.5.4 of the LRFD BDS were used to calculate the nominal and factored unit tip resistance (per LRFD BDS Section 10.8.3.5.4c) in rock for drilled shaft foundations at each substructure.

Design based solely on end-bearing should be sufficient to support the drilled shaft loads at the referenced bridge site. As no voids, karst features, or adverse jointing conditions were identified within the site bedrock, LRFD BDS Equation 10.8.3.5.4c-1 was utilized for calculating drilled shaft tip resistance. The tip resistance was determined based on: 1) bedrock properties obtained from lab testing, and 2) an assumed compressive strength of 4,000 pounds per square inch (psi) for the concrete used in shaft construction.

The nominal and factored unit tip resistances for a drilled shaft foundation socketed in rock are summarized in Table 23 below. In accordance with LRFD BDS Table 10.5.5.2.4-1, the nominal resistance was multiplied by a resistance factor of 0.50 to obtain the factored unit tip resistance. Drilled shaft tip resistance calculations for each substructure are provided in Appendix D.

Table 23: Rock Socket Resistance Summary - HAS-22-17.53 L/R Bridges

Substructure	Boring Used	Drilled Shaft Diameter (in)	Rock Socket Diameter (in)	Nominal Unit Tip Resistance (kips)	Factored Unit Tip Resistance (kips)
HAS-22-17.53 L Bridge					
Rear Abutment	B-140-0-23 & B-141-0-23	36	36	25,447	12,723
Forward Abutment	B-143-0-23 & B-144-0-23	36	36	3,550	1,775
HAS-22-17.53 R Bridge					
Rear Abutment	B-139-0-23 & B-140-0-23	36	36	2,804	1,402
Forward Abutment	B-142-0-23 & B-143-0-23	36	36	25,447	12,723

Notes:
1. *Compressive strength of rock exceeded the drilled shaft concrete compressive strength. Unit resistance limited based on 4,000 psi drilled shaft concrete.*

Since only tip resistance is considered in the rock socket design, ODOT's BDM plan note 606.8-1 should be revised as follows: "The maximum factored load at each substructure is fully supported by the drilled shafts in tip resistance, ignoring any contribution from side resistance."

At the proposed bridge site, the top of bedrock for each shaft was estimated based on conditions encountered in nearby borings. Recommended rock socket lengths—determined from rock descriptions, laboratory test results, and rock integrity assessments to ensure long-term performance—are provided in Table 24. The factored unit tip resistances, calculated from laboratory testing and summarized in Table 23, exceed the Strength I axial load demand. Therefore, bearing capacity is not expected to be a concern, especially where shafts are embedded deeper into higher-quality rock.

Table 24: Estimated Drilled Shaft Length Summary - HAS-22-17.53 L/R Bridges

Substructure	Boring Used	Shaft Diameter (ft)	Strength I Load per Shaft (kips)	Factored Tip Resistance (kips)	Bottom of Footing (ft)	Shaft Number (From South to North)	Estimated Top of Bedrock (ft)	Estimated Tip Elevation (ft)	Rock Socket Length (ft)	Total Shaft Length (ft)
HAS-22-17.53 Left Bridge										
Rear Abutment	B-140-0-23 & B-141-0-23	3	405.8	542.0	1220.7	1	1209.0	1186.8	22.2	33.9
						2	1209.7	1187.5	22.2	33.2
						3	1210.5	1188.3	22.2	32.4
						4	1211.3	1189.1	22.2	31.6
						5	1212.0	1189.8	22.2	30.9
Forward Abutment	B-143-0-23 & B-144-0-23	3	409.8	861.4	1216.6	1	1209.4	1196.2	13.2	20.4
						2	1208.8	1195.6	13.2	21.0
						3	1208.3	1195.1	13.2	21.5
						4	1207.7	1194.5	13.2	22.1
						5	1207.1	1193.9	13.2	22.7
HAS-22-17.53 Right Bridge										
Rear Abutment	B-139-0-23 & B-140-0-23	3	393.2	5556.3	1222.1	1	1225.5	1210.1	12.0	12.0
						2	1223.0	1210.1	12.0	12.0
						3	1220.5	1208.5	12.0	13.6
						4	1217.9	1205.9	12.0	16.2
						5	1215.4	1203.4	12.0	18.7
Forward Abutment	B-142-0-23 & B-143-0-23	3	405.1	8377.1	1217.9	1	1212.9	1189.9	23.0	28.0
						2	1212.3	1189.3	23.0	28.6
						3	1211.7	1188.7	23.0	29.2
						4	1211.1	1188.1	23.0	29.8
						5	1210.5	1187.5	23.0	30.4

5.2.2. Laterally Loaded Shaft Analysis

At each substructure location, since top of bedrock changes, Lpile analyses were performed on two shafts (shaft 1 and shaft 5, shaft number listed in Table 24) from each substructure with either highest or lowest top of bedrock. Based on the instruction of ODOT, starting the top of the p-y soil/bedrock model at the location where the ground surface is 4D from the edge of the drilled shaft, where D = drilled shaft diameter, and the overburden soils were ignored in the Lpile analyses due to the known eroding nature of the slopes.

The laterally loaded shaft analyses were run in Lpile for three loading conditions, factored loading for Strength (I) Limit State, unfactored loading for Service (I) Limit State and fixed deflection at the beam seat equal to the thermal movement from the superstructure. All the three loading cases were applied at the bearing seat, along with the distributed earth pressure and live load applied down to the proposed top of bedrock. The vertical and lateral loads were provided by the design team, which are attached in Appendix D. The unfactored loading condition is to determine drilled shaft head deflection; the factored loading condition is to determine the structural shear and moment on the drilled shaft. The LPILE analyses results for Strength I Limit State and Service I Limit State are summarized in Table 25, and the LPILE analyses results for thermal movement are summarized in Table 26. The Lpile analyses output can be found in Appendix D.

Table 25: Lpile analysis Summary – Strength I and Service I Limit State - HAS-22-17.53 L/R Bridges

Strength and Service Limit State - LPILE Analyses Summary									
Substructure	Boring Used	Shaft Number (From South to North)	Maximum Moment in Shaft - Strength Limit State (in-lbs)	Depth of Maximum Bending Moment below Shaft Head (ft)	Average Shear in Shaft - Strength Limit State(lbs)[1]	Depth of Maximum Average Shear Force below Shaft Head (ft)	Deflection at Bearing Level - Service Limit State (in)	First Fixity Point below Shaft Head (ft)	Second Fixity Point below Shaft Head (ft)
HAS-22-17.53 Left Bridge									
Rear Abutment	B-140-0-23 & B-141-0-23	1	5,972,026	12.0	-143,767	13.5	0.486	12.5	15.5
		5	4,919,806	9.5	-117,271	11.0	0.240	10.5	14.0
Forward Abutment	B-143-0-23 & B-144-0-23	1	4,286,941	7.9	-91,546	10.4	0.192	9.90	14.9
		5	5,256,418	10.3	-110,959	12.8	0.399	12.3	17.2
HAS-22-17.53 Right Bridge									
Rear Abutment	B-139-0-23 & B-140-0-23	1	2,724,583	4.4	-62,253	7.1	0.048	7.6	11.1
		5	3,530,360	6.7	-85,274	8.2	0.065	7.7	11.2
Forward Abutment	B-142-0-23 & B-143-0-23	1	3,165,070	5.3	-76,560	6.7	0.050	6.7	9.7
		5	3,892,533	7.4	-93,385	8.9	0.096	8.9	11.9
Notes: *1. Average shear in shaft was calculated in according to ODOT GDM Section 1501.7.9*									

Table 26: Lpile analysis Summary – Thermal Movement - HAS-22-17.53 L/R Bridges

Thermal Movement - LPILE Analyses Summary									
Substructure	Boring Used	Shaft Number (From South to North)	Maximum Moment in Shaft (in-lbs)	Depth of Maximum Bending Moment below Shaft Head (ft)	Average Shear in Shaft (lbs)[1]	Depth of Maximum Average Shear Force below Shaft Head (ft)	Deflection at Bearing Level (in)	First Fixity Point below Shaft Head (ft)	Second Fixity Point below Shaft Head (ft)
HAS-22-17.53 Left Bridge									
Rear Abutment	B-140-0-23 & B-141-0-23	1	4,578,627	12.0	-110,295	13.5	0.480	12.5	15.5
		5	5,179,761	9.5	-124,092	11.0	0.480	10.0	13.0
Forward Abutment	B-143-0-23 & B-144-0-23	1	4,801,409	7.9	-102,437	10.4	0.480	10.40	14.9
		5	4,341,549	10.3	-92,101	12.8	0.480	12.3	17.2
HAS-22-17.53 Right Bridge									
Rear Abutment	B-139-0-23 & B-140-0-23	1	5,919,722	4.9	-134,812	7.6	0.480	8.0	11.6
		5	6,320,499	6.7	-154,084	8.2	0.480	7.7	10.7
Forward Abutment	B-142-0-23 & B-143-0-23	1	6,894,078	5.3	-169,065	6.7	0.480	6.7	9.2
		5	5,689,188	7.4	-137,981	8.9	0.480	8.9	11.4
Notes: *1. Average shear in shaft was calculated in according to ODOT GDM Section 1501.7.9*									

As shown, the second fixity points all fall within the proposed shaft lengths listed in Table 24. The axial condition governs the design of drilled shaft lengths. The shear capacity was provided by the design team as 276,000 kips. As can be seen from Tables 25 and 26, the average shear in the shaft for three loading cases is less than the shear capacity. In terms of the moment check, the maximum moment demand from the three loading cases is summarized in Table 27, along with the moment capacity and utilization ratio. All the utilization ratios are less than 1, which indicates that the strength moment demand is less than the moment capacity.

Table 27: Moment Check - HAS-22-17.53 L/R Bridges

Location	Strength Moment Demand (lb-in)	Strength Moment Demand (k-ft)	Axial Demand (kips)	Moment Capacity (k-ft)	Utilization Ratio
HAS-22-17.53 Left Bridge					
Rear Abutment	5,972,026	497.7	366.4	997.1	0.50
Forward Abutment	5,256,418	438.0	381.7	1008.0	0.43
HAS-22-17.53 Right Bridge					
Rear Abutment	6,320,499	526.7	366.5	997.2	0.53
Forward Abutment	6,894,078	574.5	366.6	997.3	0.58

5.2.3. Global Stability

Global stability should not be a concern for substructures utilizing a drilled shaft rock socket system.

5.3. HAS-22-19.12 Bridge Analysis

For analysis purposes, each boring log was reviewed, and a generalized material profile was developed for analysis. Utilizing the generalized soil profile, engineering properties for each soil strata were estimated based on their field (i.e., SPT N_{60} Values, hand penetrometer values, etc.) and laboratory (i.e., Atterberg Limits, grain size, etc.) test results using correlations provided in published engineering manuals, research reports and guidance documents. The developed soil profile and estimated engineering soil and rock properties (with cited correlation/reference material) used in our evaluation is summarized per boring within Tables 28-29 below.

Table 28: B-145-0-24 Soil Profile

HAS-22-19.12: Forward Abutment B-145-0-23							
Soil Description	**Unit Weight[1] (pcf)**	**Moist Unit Weight[1] (pcf)**	**Saturated Unit Weight[1] (pcf)**	**Undrained Shear Strength[2] (psf)**	**Effective Cohesion[3] (psf)**	**Effective Friction Angle[3] (degrees)**	**Setup Factor (f_{su})**
Gravel with Sand (A-1-b) Depth (1216.3 ft - 1209.3 ft)	112	112	122	-	-	35	1.00
Sandy Silt (A-4a) Depth (1209.3 ft - 1205.8 ft)	105	105	115	750	75	22	1.50

Notes:
1. *Values interpreted from ODOT Geotechnical Design Manual (GDM) Section 405.*
2. *Values calculated from Terzaghi and Peck (1967) if N160<52, else Stroud and Butler (1975) was used.*
3. *Values interpreted from LRFD BDS Table 10.4.6.2.4-1 and ODOT GDM Table 400-3.*

Table 29: B-146-0-24 Soil Profile

HAS-22-19.12: Rear Abutment B-146-0-23							
Soil Description	**Unit Weight[1] (pcf)**	**Moist Unit Weight[1] (pcf)**	**Saturated Unit Weight[1] (pcf)**	**Undrained Shear Strength[2] (psf)**	**Effective Cohesion[3] (psf)**	**Effective Friction Angle[3] (degrees)**	**Setup Factor (f_{su})**
Gravel with Sand (A-1-b) Depth (1217.9 ft - 1210.9 ft)	110	110	120	-	-	34	1.00
Sandy Silt (A-4a) Depth (1210.9 ft - 1205.9 ft)	105	105	115	800	75	22	1.50

Notes:
1. *Values interpreted from ODOT Geotechnical Design Manual (GDM) Section 405.*
2. *Values calculated from Terzaghi and Peck (1967) if N160<52, else Stroud and Butler (1975) was used.*
3. *Values interpreted from LRFD BDS Table 10.4.6.2.4-1 and ODOT GDM Table 400-3.*

Deep foundation elements subjected to horizontal loads and/or moments should be analyzed for maximum bending moment, maximum shear force and lateral deflection and should be checked whether the foundation element is structurally capable of resisting the lateral load. For the purpose of evaluating the shaft resistance in the lateral direction, drilled shaft has been analyzed by using the software entitled Lpile by Ensoft, Inc. The generalized soil/rock parameters, to be used to analyze the laterally loaded shaft by the p-y curve method for soil and rock strata are shown in Table 30 to Table 31, respectively.

Table 30: B-145-0-24 Lpile Parameters

Layer Number (No.)	Top Elev. (ft)	Bottom Elev. (ft)	Layer Depth (ft)	Soil/Rock Class	LPILE p-y Model	Soil Strain Parameter ε50	Soil Modulus Parameter p-y k (pci)	Rock RQD (%)	Rock Uniaxial Compressive Strength qu (psi)	Rock Strain Factor krm[1]	Rock Initial Modulus of Rock Mass (psi)[2]
B-145-0-23											
1	1216.3	1209.3	7	A-1-b	Sand (Reese)	-	179	-	-	-	-
2	1209.3	1205.8	10.5	A-4a	Soft Clay	0.0115	125	-	-	-	-
3	1205.8	1205.0	11.3	Shale	Weak Rock	-	-	0	200	0.00050	18,000
4	1205.0	1196.4	19.9	Interbedded Shale and Siltstone	Weak Rock	-	-	56	1,354	0.00012	120,000
5	1196.4	1195.0	21.3	Coal	Weak Rock	-	-	0	200	0.00050	18,000
6	1195.0	1180.0	36.3	Interbedded limestone and siltstone	Weak Rock	-	-	67	6,628	0.00005	600,000

Note:
1. *Values interpreted from LPILE Technical Manual.*
2. *Values interpreted from ODOT Geotechnical Design Manual (GDM) Section 406.*

Table 31: B-146-0-24 Lpile Parameters

Layer Number (No.)	Top Elev. (ft)	Bottom Elev. (ft)	Layer Depth (ft)	Soil/Rock Class	LPILE p-y Model	Soil Strain Parameter ε50	Soil Modulus Parameter p-y k (pci)	Rock RQD (%)	Rock Uniaxial Compressive Strength qu (psi)	Rock Strain Factor krm[1]	Rock Initial Modulus of Rock Mass (psi)[2]
B-146-0-23											
1	1217.9	1210.9	7	A-1-b	Sand (Reese)	-	140	-	-	-	-
2	1210.9	1205.9	12	A-4a	Soft Clay	0.0109	147	-	-	-	-
3	1205.9	1202.8	15.1	Shale	Weak Rock	-	-	0	200	0.00050	18,000
4	1202.8	1198.7	19.2	Interbedded Shale and Siltstone	Weak Rock	-	-	89	2,247	0.00006	200,000
5	1198.7	1192.2	25.7	Interbedded limestone and siltstone	Weak Rock	-	-	66	6,894	0.00005	620,000
6	1192.2	1190.0	27.9	Coal	Weak Rock	-	-	0	200	0.00050	18,000
7	1190	1177.8	40.1	Interbedded Limestone and Siltstone	Weak Rock	-	-	67	5,651	0.00005	510,000

Note:
1. *Values interpreted from LPILE Technical Manual.*
2. *Values interpreted from ODOT Geotechnical Design Manual (GDM) Section 406.*

5.3.1. Axially Loaded Shaft Analysis

Shafts will be utilized to support the substructures of the proposed HAS-22-19.12 bridge over the Columbus & Ohio River Railroad. At the project site, bedrock was encountered in both structural borings, at an elevation of 1205.8 ft and 1205.9 ft at the rear and forward abutments, respectively. Both abutments are planned to be supported on 3'-0" diameter drilled shafts with 3'-0" diameter rock sockets.

Based on the email from Compass dated July 25, 2025, the Strength I axial loads are 367.2 kips and 361.7 kips for rear and forward abutment, respectively. A drilled shaft foundation analysis was performed at the proposed bridge location in accordance with the LRFD BDS. Specifically, the procedures in Section 10.8.3.5.4 of the LRFD BDS were used to calculate the nominal and factored unit tip resistance (per LRFD BDS Section 10.8.3.5.4c) in rock for drilled shaft foundations at each substructure.

Design based solely on end-bearing should be sufficient to support the drilled shaft loads at the referenced bridge site. As no voids, karst features, clay-filled seams, or adverse jointing conditions were identified within the site bedrock, LRFD BDS Equation 10.8.3.5.4c-1 was utilized for calculating drilled shaft tip resistance. The tip resistance was determined based on: 1) bedrock properties obtained from lab testing, and 2) an assumed compressive strength of 4,000 pounds per square inch (psi) for the concrete used in shaft construction.

The nominal and factored unit tip resistances for a drilled shaft foundation socketed in rock are summarized in Table 32 below. In accordance with LRFD BDS Table 10.5.5.2.4-1, the nominal resistance was multiplied by a resistance factor of 0.50 to obtain the factored unit tip resistance. Drilled shaft tip resistance calculations for each substructure are provided in Appendix D.

Table 32: Rock Socket Resistance Summary – HAS-22-19.12 Bridge

Substructure	Boring Used	Drilled Shaft Diameter (in)	Rock Socket Diameter (in)	Nominal Unit Tip Resistance (kips)	Factored Unit Tip Resistance (kips)
HAS-22-19.12 Bridge					
Rear Abutment	B-146-0-23	36	36	14,380	7,190
Forward Abutment	B-145-0-23	36	36	16,866	8,433

Notes:
1. *Compressive strength of rock exceeded the drilled shaft concrete compressive strength. Unit resistance limited based on 4,000 psi drilled shaft concrete.*

Since only tip resistance is utilized in the rock socket design, ODOT's BDM plan note 606.8-1 should be revised as follows: "The maximum factored load at each substructure is fully supported by the drilled shafts in tip resistance, ignoring any contribution from side resistance."

At the proposed bridge site, coal was encountered at both the rear and forward abutment locations. It is therefore recommended that each drilled shaft be socketed at least 3.0 feet below the bottom of the coal layer. The bottom of coal was observed at approximately elevations 1195.0 ft and 1190.0 ft at the rear and forward abutments, respectively. Accordingly, the recommended shaft tip elevations are 1192.0 ft and 1187.0 ft, respectively. The estimated shaft and socket lengths are summarized in Table 33 below. It should be noted that the factored unit tip resistances, calculated from rock laboratory testing and listed in Table 33, exceed the Strength I axial load. Bearing capacity is therefore not expected to be an issue, particularly where the shaft extends deeper into higher-quality rock. Final shaft lengths will be determined once the bottom of footing elevation is established.

Tabel 33: Estimated Drilled Shaft Length Summary – HAS-22-19.12 Bridge

Substructure	Boring Used	Shaft Diameter (ft)	Strength I Load per Shaft (kips)	Factored Tip Resistance (kips)	Bottom of Footing (ft)	Shaft Number (From South to North)	Estimated Top of Bedrock (ft)	Estimated Tip Elevation (ft)	Rock Socket Length (ft)	Total Shaft Length (ft)
HAS-22-19.12 Bridge										
Rear Abutment	B-146-0-23	3	367.2	3250.8	1206.1	-	1205.9	1187.0	18.9	19.1
Forward Abutment	B-145-0-23	3	361.7	6716.7	1205.2	-	1205.8	1192.0	13.2	13.2

5.3.2. Laterally Loaded Shaft Analysis

The laterally loaded shaft analyses were run in Lpile for three loading conditions, factored loading for Strength (I) Limit State, unfactored loading for Service (I) Limit State and fixed deflection at the beam seat equal to the thermal movement from the superstructure. All the three loading cases were applied at the bearing seat, along with the distributed earth pressure and live load applied down to the proposed top of bedrock. The vertical and lateral loads were provided by the design team, which are attached in Appendix D. Based on the instruction of ODOT, starting the top of the p-y soil/bedrock model at the location where the ground surface is 4D from the edge of the drilled shaft, where D = drilled shaft diameter, and the overburden soils were ignored in the Lpile analyses due to the known eroding nature of the slopes.

The unfactored loading condition is to determine drilled shaft head deflection; the factored loading condition is to determine the structural shear and moment on the drilled shaft. The LPILE analyses results for Strength I Limit State and Service I Limit State are summarized in Table 34, and the LPILE analyses results for thermal movement are summarized in Table 35. The Lpile analyses output can be found in Appendix D.

Table 34: Lpile analysis Summary – Strength I and Service I Limit State – HAS-22-19.12 Bridge

Strength and Service Limit State - LPILE Analyses Summary										
Substructure	Boring Used	Shaft Number (From South to North)	Maximum Moment in Shaft - Strength Limit State (in-lbs)	Depth of Maximum Bending Moment below Shaft Head (ft)	Average Shear in Shaft - Strength Limit State(lbs)[1]	Shear Capacity (lbs)[2]	Depth of Maximum Average Shear Force below Shaft Head (ft)	Deflection at Bearing Level - Service Limit State (in)	First Fixity Point below Shaft Head (ft)	Second Fixity Point below Shaft Head (ft)
HAS-22-19.12 Bridge										
Rear Abutment	B-146-0-23	-	2,388,437	2.7	-58,406	276,000	4.7	0.028	4.7	8.2
Forward Abutment	B-145-0-23	-	1,772,427	0.3	-41,557	276,000	2.3	0.007	1.8	5.7
Notes: *1. Average shear in shaft was calculated in according to ODOT GDM Section 1501.7.9*										

Table 35: Lpile analysis Summary – Thermal Movement – HAS-22-19.12 Bridge

Thermal Movement - LPILE Analyses Summary										
Substructure	Boring Used	Shaft Number (From South to North)	Maximum Moment in Shaft (in-lbs)	Depth of Maximum Bending Moment below Shaft Head (ft)	Average Shear in Shaft (lbs)[1]	Shear Capacity (lbs)[2]	Depth of Maximum Average Shear Force below Shaft Head (ft)	Deflection at Bearing Level (in)	First Fixity Point below Shaft Head (ft)	Second Fixity Point below Shaft Head (ft)
HAS-22-19.12 Bridge										
Rear Abutment	B-146-0-23	-	6,330,285	3.2	-157,473	276,000	5.2	0.380	4.7	8.2
Forward Abutment	B-145-0-23	-	10,052,690	0.3	-245,682	276,000	2.3	0.380	2.3	5.7
Notes: *1. Average shear in shaft was calculated in according to ODOT GDM Section 1501.7.9*										

As shown, the second fixity points all fall within the proposed shaft lengths listed in Table 33. The axial condition governs the design of drilled shaft lengths. The shear capacity was provided by the design team

as 276,000 kips. As can be seen from Tables 34-35, the average shear in the shaft for three loading cases is less than the shear capacity. In terms of the moment check, the maximum moment demand from the three loading cases is summarized in Table 36 below, along with the moment capacity and utilization ratio. All the utilization ratios are less than 1, which indicates that the strength moment demand is less than the moment capacity.

Table 36: Moment Check – HAS-22-19.12 Bridge

Location	Strength Moment Demand (lb-in)	Strength Moment Demand (k-ft)	Axial Demand (kips)	Moment Capacity (k-ft)	Utilization Ratio
HAS-22-19.12 Bridge					
Rear Abutment	6,330,285	527.5	325.1	967.7	0.55
Forward Abutment	10,052,690	837.7	326.8	969.0	0.86

5.3.3. Global Stability

Global stability should not be a concern for substructures utilizing a drilled shaft rock socket system.

6. QUALIFICATIONS

The investigation was performed in accordance with accepted geotechnical engineering practice for the purpose of characterizing the subsurface and groundwater within the project limits. This report has been prepared for Arcadis and their design consultants to be used solely in evaluating the roadway subgrade and pavement design parameter that will serve as the basis for development of design and construction of the roadway improvement project. The assessment of general site environmental conditions or the presence of pollutants in the soil, rock and groundwater of the site was beyond the scope of this geotechnical exploration. Our recommendations are based on the results of our field explorations, laboratory tests results from representative soil samples, and geotechnical engineering analyses. The results of the field explorations and laboratory tests, which form the basis of our recommendations, are presented in the appendices as noted. This report does not reflect any variations that may occur between the borings or elsewhere on the site, or variations whose nature and extent may not become evident until a later stage of construction. If any changes occur in the nature, design or location of the proposed roadway, the conclusions and recommendations contained in this report should not be considered valid until they are reviewed and have been modified or verified in writing by a geotechnical engineer.

It has been a pleasure to be of service to Arcadis in performing this geotechnical exploration for the HAS-22-15.11 project. Please call if there are any questions, or if we can be of further service.

Respectfully Submitted,

Chunmei (Melinda) He, Ph.D., P.E.
Project Manager

Zhao Mankoci, Ph.D., P.E.
Geotechnical Engineer

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APPENDIX A

BORING LOCATION PLAN

HAS-22-15.25

MODEL: Segment-1-100Scale_DT [Sheet]_1 PAPERSIZE: 34x22 (in.) DATE: 4/18/2023 TIME: 10:15:48 AM USER: dtarawneh
P:\OHDOT_v2\WorkSets\HAS-22-15.25_21.47 (113440)\400-Engineering\Geotechnical\Basemaps\HAS-22-15.25_21.47 (113440)_BI001.dgn



DESIGNER: DT
REVIEWER: XXX MM-DD-YY
PROJECT ID: 113440
SHEET: 1 TOTAL: 14
DESIGN AGENCY: NEAS National Engineering & Architectural Services Inc

BORING LOCATION PLAN
SLM 15.25 - SLM 18.91

HORIZONTAL SCALE IN FEET
0 200
100 400

HAS-22-15.25

MODEL: Segment-1-100Scale_DT [Sheet]_2 PAPERSIZE: 34x22 (in.) DATE: 4/18/2023 TIME: 10:16:29 AM USER: dtarawneh
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DESIGNER: DT
REVIEWER: XXX MM-DD-YY
PROJECT ID: 113440
SHEET: 2 TOTAL: 14
DESIGN AGENCY: NEAS National Engineering & Architectural Services Inc

BORING LOCATION PLAN
SLM 15.25 - SLM 18.91

HORIZONTAL SCALE IN FEET
0 200
100 400

HAS-22-15.25

MODEL: Segment-1-100Scale_DT [Sheet]_3 PAPERSIZE: 34x22 (in.) DATE: 4/18/2023 TIME: 10:17:09 AM USER: dtarawneh
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DESIGNER: DT
REVIEWER: XXX MM-DD-YY
PROJECT ID: 113440
SHEET 3 | TOTAL 14
DESIGN AGENCY: NEAS National Engineering & Architectural Services Inc.

BORING LOCATION PLAN
SLM 15.25 - SLM 18.91

HORIZONTAL SCALE IN FEET
0 200
100 400

HAS-22-15.25

MODEL: Segment-1-100Scale_DT [Sheet]_4 PAPERSIZE: 34x22 (in.) DATE: 4/20/2023 TIME: 2:52:32 PM USER: dtarawneh
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SHEET 4 TOTAL 14	PROJECT ID 113440	REVIEWER XXX MM-DD-YY	DESIGNER DT	DESIGN AGENCY NEAS National Engineering & Architectural Services Inc.

BORING LOCATION PLAN
SLM 15.25 - SLM 18.91

HORIZONTAL SCALE IN FEET
0 200
100 400

HAS-22-15.25

MODEL: Segment-1-100Scale_DT[Sheet]_5 PAPERSIZE: 34x22 (in.) DATE: 4/20/2023 TIME: 2:24:39 PM USER: dtarawneh
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BORING LOCATION PLAN
SLM 15.25 - SLM 25.21

HORIZONTAL SCALE IN FEET
0 200
100 400

DESIGNER	DT
REVIEWER	XXX MM-DD-YY
PROJECT ID	113440
SHEET	5
TOTAL	14

DESIGN AGENCY
NEAS National Engineering & Architectural Services Inc.

HAS-22-15.25

MODEL: Segment-1-100Scale_DT[Sheet]_6 PAPERSIZE: 34x22 (in.) DATE: 4/18/2023 TIME: 10:18:41 AM USER: dtarawneh
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SHEET 6 / TOTAL 14	PROJECT ID 113440	REVIEWER XXX MM-DD-YY	DESIGNER DT

DESIGN AGENCY: NEAS National Engineering & Architectural Services Inc.

BORING LOCATION PLAN
SLM 15.25 - SLM 18.91

HORIZONTAL SCALE IN FEET
0 200
100 400

HAS-22-15.25

MODEL: Segment-1-100Scale_DT[Sheet]_7 PAPERSIZE: 34x22 (in.) DATE: 4/18/2023 TIME: 10:19:10 AM USER: dtarawneh
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SHEET 7 | TOTAL 14
PROJECT ID 113440
REVIEWER XXX MM-DD-YY
DESIGNER DT
DESIGN AGENCY NEAS National Engineering & Architectural Services Inc.

BORING LOCATION PLAN
SLM 15.25 - SLM 18.91

HORIZONTAL SCALE IN FEET
0 200
100 400

HAS-22-1753 L/R

Proposed Boring Location
B-139 and B-144 should be drilled behind the expansion joints on the approach slab.

Legend

- OGE-R166-12372-002.TIF
- Proposed Boring

B-144-0-23

TH-008-0-58

B-141-0-23

B-143-0-23

B-140-0-23

B-142-0-23

B-139-0-23

TH-001-0-58

Google Earth

90 ft

N

HAS-250-1912

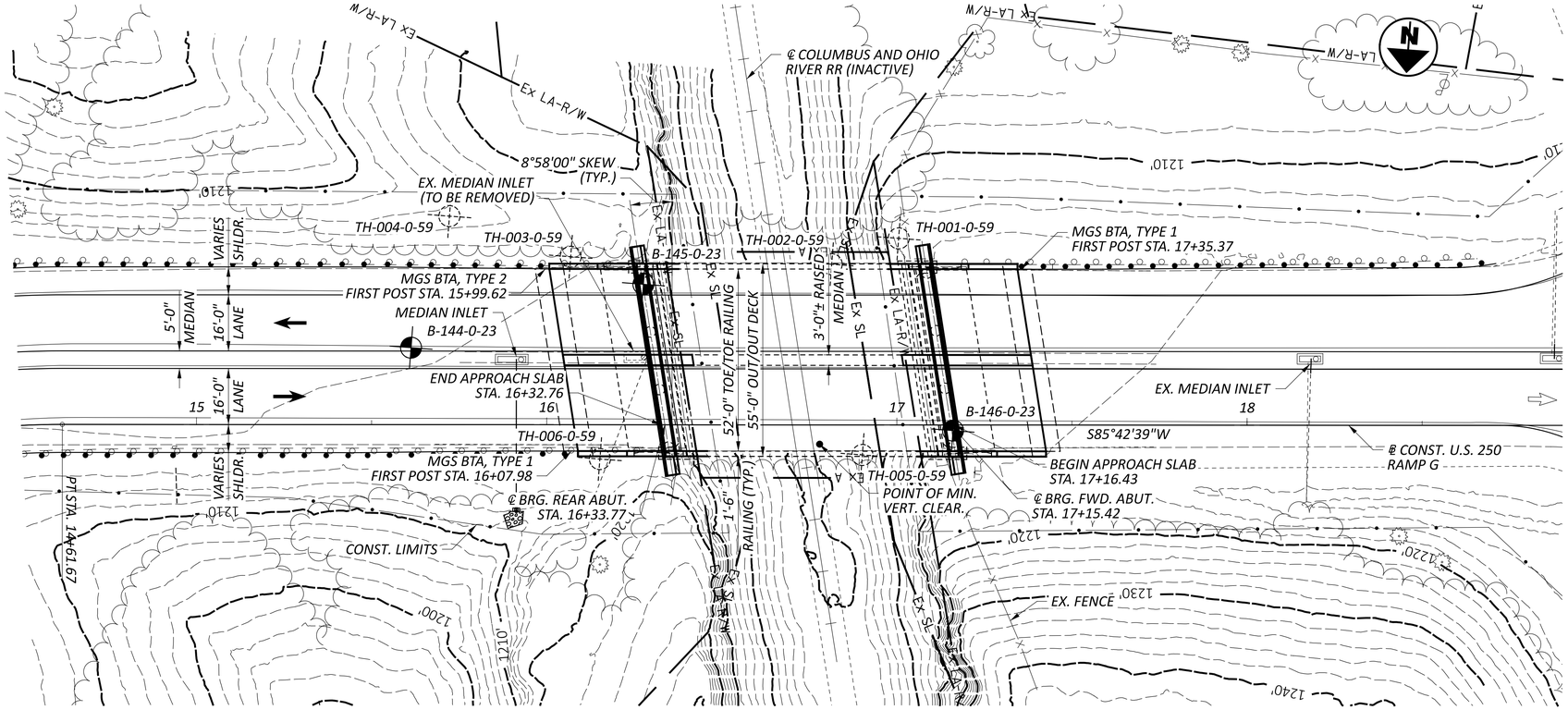
Proposed Boring Location
B-145 and B-146 should be drilled behind the expansion joints on the approach slab.

Legend

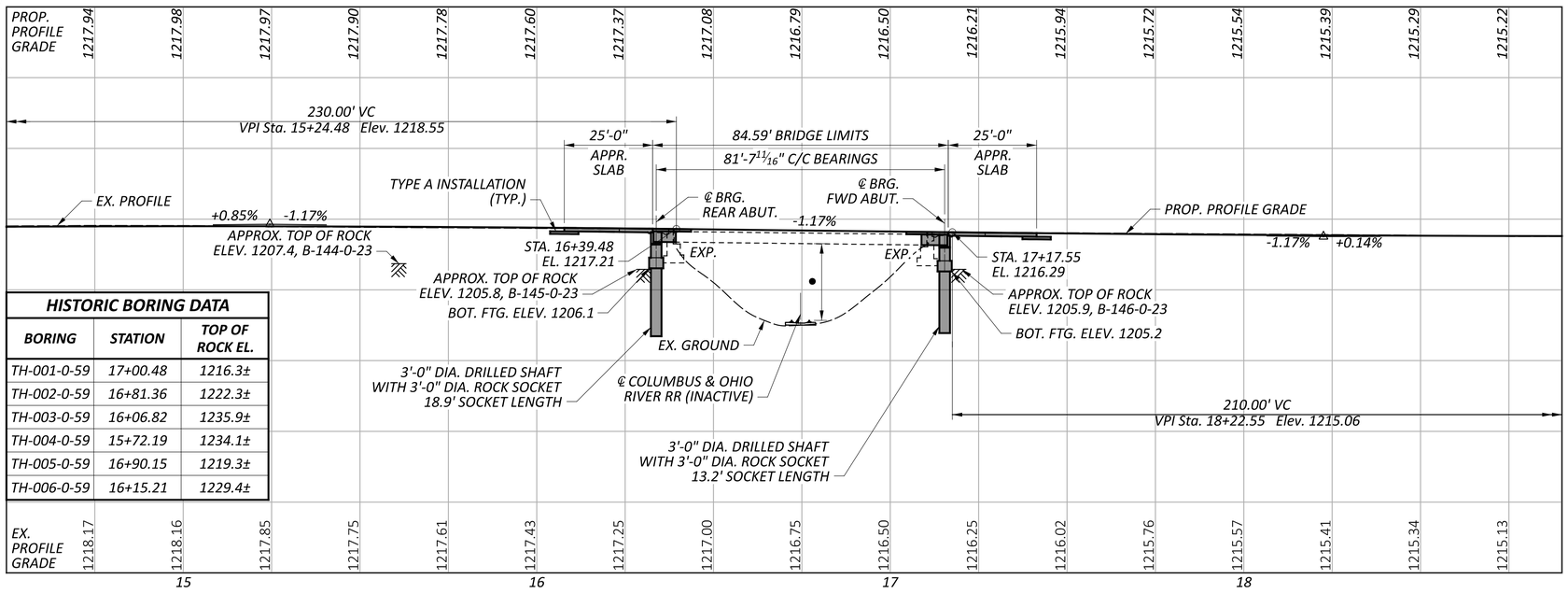
- OGE-R166-12372-002.TIF
- Proposed Boring

B-145-0-23
TH-005-0-59
TH-006-0-59
TH-002-0-59
B-146-0-23
TH-003-0-59
TH-004-0-59
TH-001-0-59

Google Earth
N
100 ft



PLAN



PROFILE ALONG ℄ CONST. U.S. 250 RAMP G

HISTORIC BORING DATA

BORING	STATION	TOP OF ROCK EL.
TH-001-0-59	17+00.48	1216.3±
TH-002-0-59	16+81.36	1222.3±
TH-003-0-59	16+06.82	1235.9±
TH-004-0-59	15+72.19	1234.1±
TH-005-0-59	16+90.15	1219.3±
TH-006-0-59	16+15.21	1229.4±

BENCHMARK DATA

BM #1 STA.	923+32.88,	ELEV.	1251.61,	OFFSET	7.65',	LT.
BM #2 STA.	933+61.49,	ELEV.	1212.53,	OFFSET	97.26',	RT.

FOR ADDITIONAL BENCHMARK INFORMATION. SEE ROADWAY PLAN SHEETS 2-3.

NOTES

EARTHWORK LIMITS SHOWN ARE APPROXIMATE. ACTUAL SLOPES SHALL CONFORM TO PLAN CROSS SECTIONS.

DESIGN TRAFFIC:

2024 ADT = 2,068 2024 ADTT = 289
2044 ADT = 2,523 2044 ADTT = 353
DIRECTIONAL DISTRIBUTION = 0.59

LEGEND

- HISTORIC BORING LOCATION
- BORING LOCATION
- 23'-0" REQUIRED MINIMUM VERTICAL CLEARANCE
  23'-0"± ACTUAL MINIMUM VERTICAL CLEARANCE

PROPOSED WORK:

1. REMOVE EXISTING APPROACH SLABS.
2. CONSTRUCT NEW ABUTMENTS ON DRILLED SHAFTS.
3. REMOVE EXISTING DECK ENDS AND END CROSS-FRAMES.
4. TEMPORARILY SUPPORT EXISTING BEAMS AND SPLICE NEW BEAM EXTENSIONS.
5. PLACE DECK ENDS, DIAPHRAGMS, AND APPROACH SLABS.
6. SEAL ENTIRE BRIDGE DECK WITH HIGH MOLECULAR WEIGHT METHACRYLATE.
7. REMOVE EXISTING SEALER AND RESEAL DECK EDGES.

EXISTING STRUCTURE

TYPE: SINGLE SPAN STEEL BEAM WITH COMPOSITE REINFORCED CONCRETE DECK SUPPORTED ON REINFORCED CONCRETE STUB ABUTMENTS

SPANS: 70'-0"± C/C BEARINGS

ROADWAY: 52'-0"± TOE/TOE RAILING

LOADING: HS20-44 CASE II & ALTERNATE MILITARY LOADING

SKEW: 8°58'00"± RIGHT FORWARD

WEARING SURFACE: 1"± MONOLITHIC CONCRETE

APPROACH SLABS: 15'-0"± LONG, (AS-1-81)

ALIGNMENT: TANGENT

CROWN: 0.016± FT/FT

STRUCTURE FILE NUMBER: 3401898

DATE BUILT: 1960 (MAJOR RECONSTRUCTION 1997)

DISPOSITION: ABUTMENT REPLACEMENT AND DECK SEALING

PROPOSED STRUCTURE

PROPOSED WORK: BUILD NEW SEMI-INTEGRAL ABUTMENTS ON DRILLED SHAFTS BEHIND EXISTING AND EXTEND BRIDGE.

TYPE: SINGLE SPAN STEEL BEAM WITH COMPOSITE REINFORCED CONCRETE DECK SUPPORTED ON REINFORCED CONCRETE SEMI-INTEGRAL ABUTMENTS ON DRILLED SHAFTS

SPANS: 81'-7 11/16" C/C BEARINGS

ROADWAY: 52'-0" TOE/TOE RAILING

LOADING: HL93 AND 0.000 KSF FUTURE WEARING SURFACE

SKEW: 8°58'00" RIGHT FORWARD

WEARING SURFACE: 1" MONOLITHIC CONCRETE

APPROACH SLABS: 15'-0" LONG (AS-1-15, AS-2-15 TYPE A)

ALIGNMENT: TANGENT

CROWN: 0.016 FT/FT± (MATCH EXISTING)

DECK AREA: 4602 SF

COORDINATES: LATITUDE 40°17'02.54" N
LONGITUDE 80°59'56.83" W

SITE PLAN
BRIDGE NO. HAS-00250-19.120
OVER COLUMBUS & OHIO RIVER RR SPUR

SFN 3401898

DESIGN AGENCY

COMPASS INFRASTRUCTURE GROUP

DESIGNER	CHECKER
CDH	CCJ

REVIEWER GLG 11/10/25

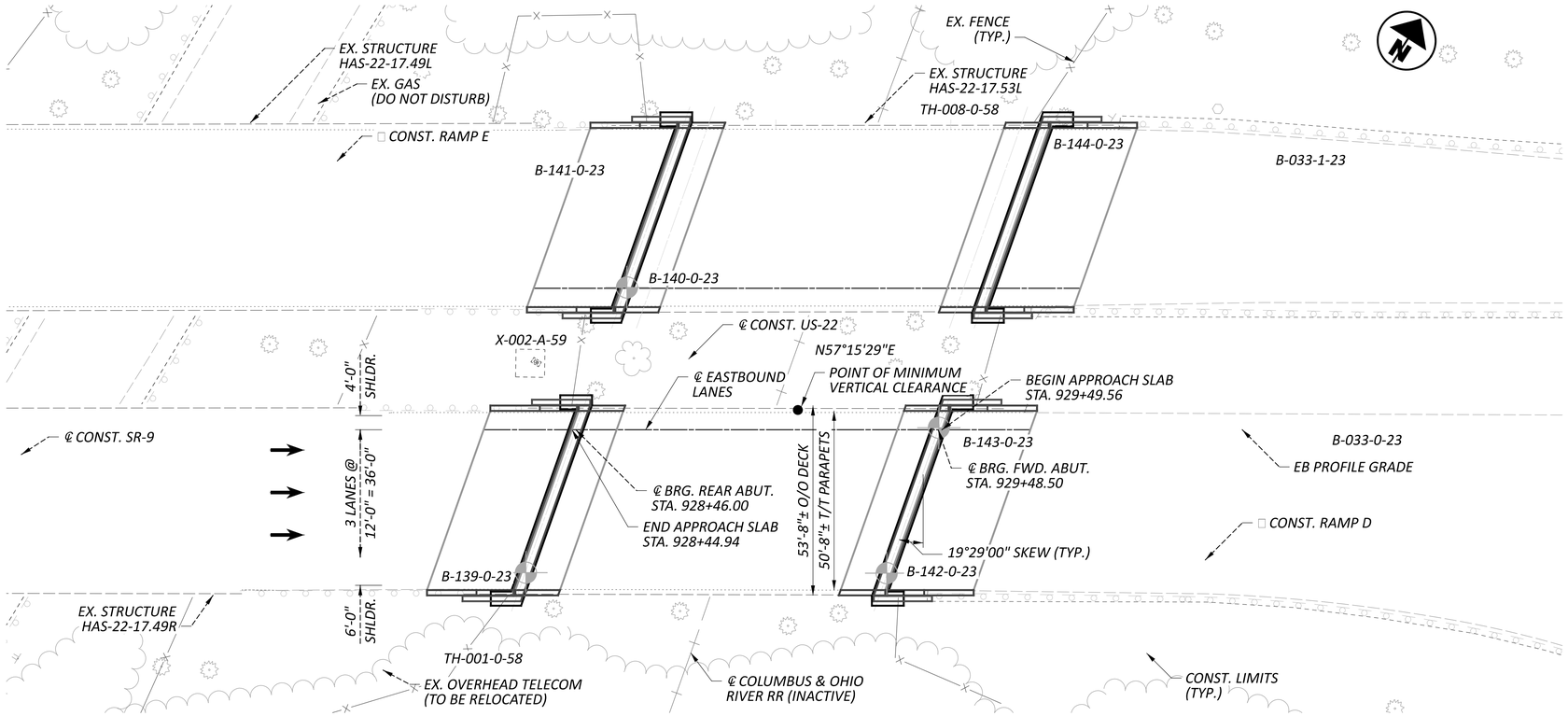
PROJECT ID 113440

SUBSET	TOTAL
1	24

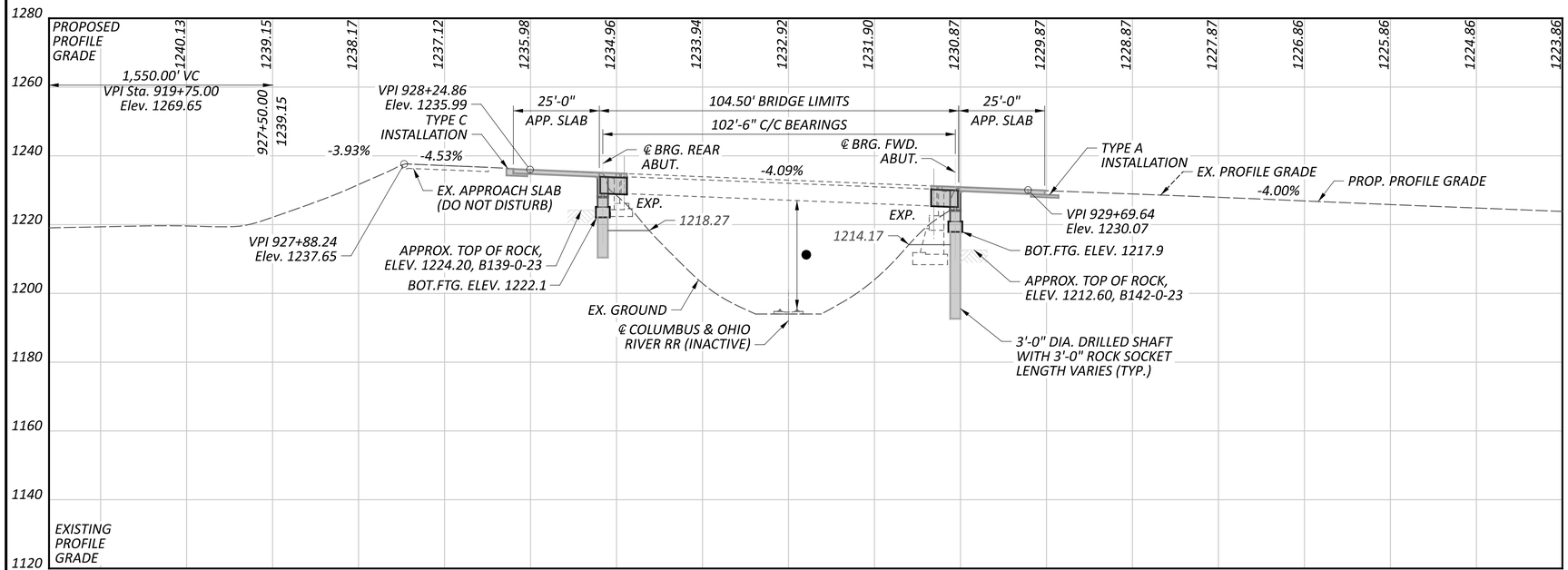
SHEET	TOTAL
P.624	736

HAS-022-15.11 PAVEMENT RECONSTRUCTION

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PLAN



PROFILE ALONG EB PROFILE GRADE LINE

BENCHMARK DATA

CP24	STA.	923+32.88,	ELEV.	1251.61,	OFFSET	7.65',	LT.
CP05	STA.	933+61.49,	ELEV.	1212.53,	OFFSET	97.26,	RT.

FOR ADDITIONAL BENCHMARK INFORMATION. SEE ROADWAY PLAN SHEETS 2-5.

DESIGN TRAFFIC:

2026 ADT = 3,723 2026 ADTT = 522
2046 ADT = 4,641 2046 ADTT = 650
DIRECTIONAL DISTRIBUTION = 1.0

LEGEND

PROJECT BORING LOCATION

HISTORIC BORING LOCATION

● 23'-0" REQUIRED MINIMUM VERTICAL CLEARANCE
30'-0"± ACTUAL MINIMUM VERTICAL CLEARANCE

PROPOSED WORK:

1. REMOVE EXISTING APPROACH SLABS.
2. CONSTRUCT NEW ABUTMENTS ON DRILLED SHAFTS.
3. REMOVE EXISTING DECK ENDS AND END CROSS-FRAMES.
4. TEMPORARILY SUPPORT EXISTING BEAMS AND SPLICE NEW BEAM EXTENSIONS.
5. PLACE DECK ENDS, DIAPHRAGMS, AND APPROACH SLABS.
6. SEAL ENTIRE BRIDGE DECK WITH EPOXY POLYMER OVERLAY.
7. REMOVE EXISTING SEALER AND RESEAL DECK EDGES.

EXISTING STRUCTURE

TYPE: SINGLE SPAN STEEL GIRDER WITH REINFORCED CONCRETE COMPOSITE DECK SUPPORTED ON REINFORCED CONCRETE STUB ABUTMENTS

SPANS: 90'-0"± C/C BEARINGS

ROADWAY: 50'-8"± TOE/TOE OF PARAPETS

LOADING: HS20-44 CASE II & ALTERNATE MILITARY LOADING & 0.06 KSF FWS

SKEW: 19°29'00"± LEFT FORWARD

WEARING SURFACE: 1"± MONOLITHIC CONCRETE

APPROACH SLABS: 25'-0"± LONG (AS-1-81)

ALIGNMENT: TANGENT

CROWN: 0.0156± FT/FT

STRUCTURE FILE NUMBER: 3401170

DATE BUILT: 1960 (MAJOR RECONSTRUCTION 2001)

DISPOSITION: ABUTMENT REPLACEMENT AND DECK SEALING

PROPOSED STRUCTURE

PROPOSED WORK: BUILD NEW SEMI-INTEGRAL ABUTMENTS ON DRILLED SHAFTS BEHIND EXISTING AND EXTEND BRIDGE.

TYPE: SINGLE SPAN STEEL GIRDER WITH REINFORCED CONCRETE COMPOSITE DECK SUPPORTED ON REINFORCED CONCRETE STUB SEMI-INTEGRAL ABUTMENTS

SPANS: 102'-6" C/C BEARINGS

ROADWAY: 50'-8" TOE/TOE OF PARAPETS

LOADING: HI-93 AND 0.000 KSF FUTURE WEARING SURFACE

SKEW: 19°29'00" LEFT FOWARD

WEARING SURFACE: 1" MONOLITHIC CONCRETE

APPROACH SLABS: 25'-0" LONG (AS-1-15, AS-2-15 TYPE C) REAR
25'-0" LONG (AS-1-15, AS-2-15 TYPE A) FORWARD

ALIGNMENT: TANGENT

CROWN: 0.0156 FT/FT± (MATCH EXISTING)

DECK AREA: 5,118 SF

COORDINATES: LATITUDE 40°17'05.99" N LONGITUDE 80°59'59.09" W

SITE PLAN
BRIDGE NO. HAS-22-17.530R
OVER COLUMBUS & OHIO RIVER RR SPUR

SFN 3401170

DESIGN AGENCY

COMPASS INFRASTRUCTURE GROUP

DESIGNER	CHECKER
CDH	CCJ

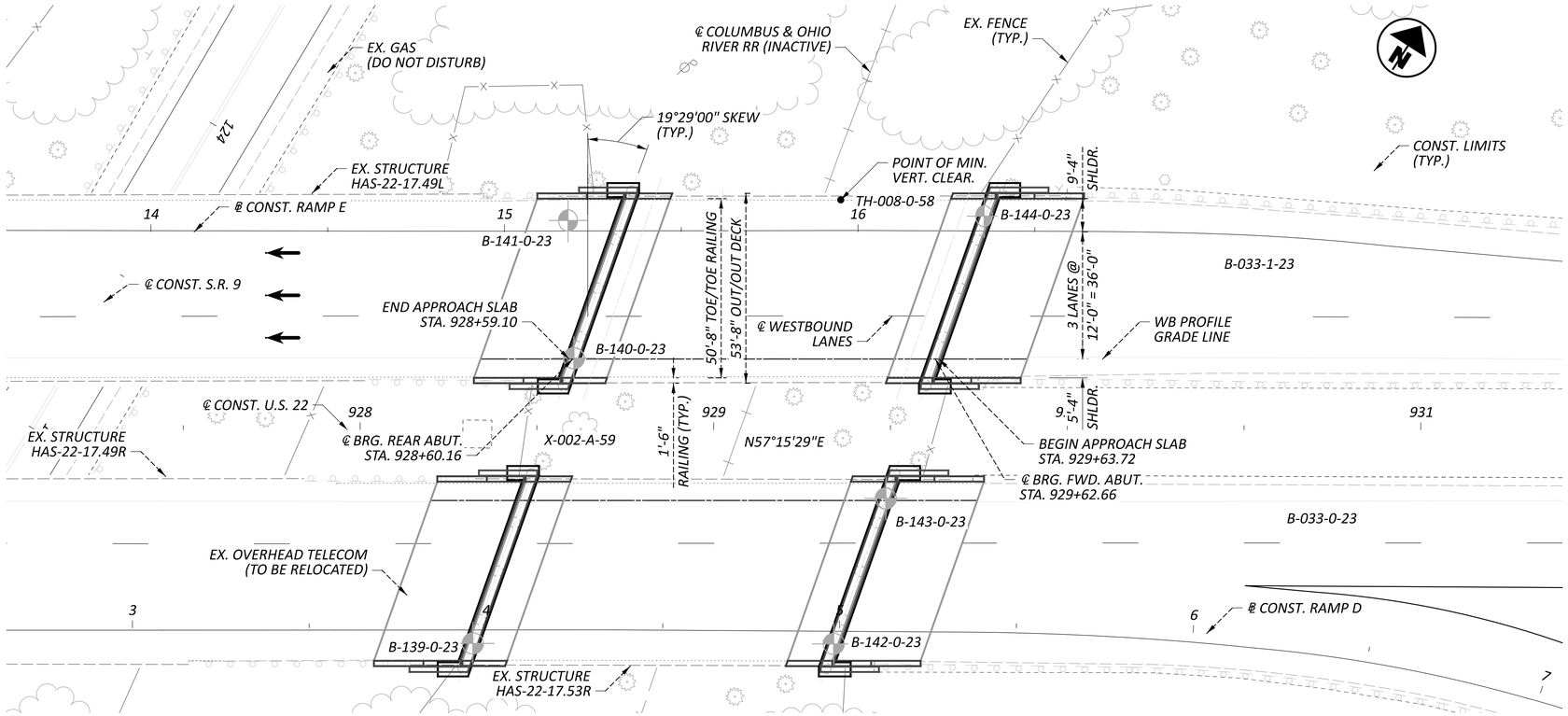
REVIEWER DEB 09/16/25

PROJECT ID 113440

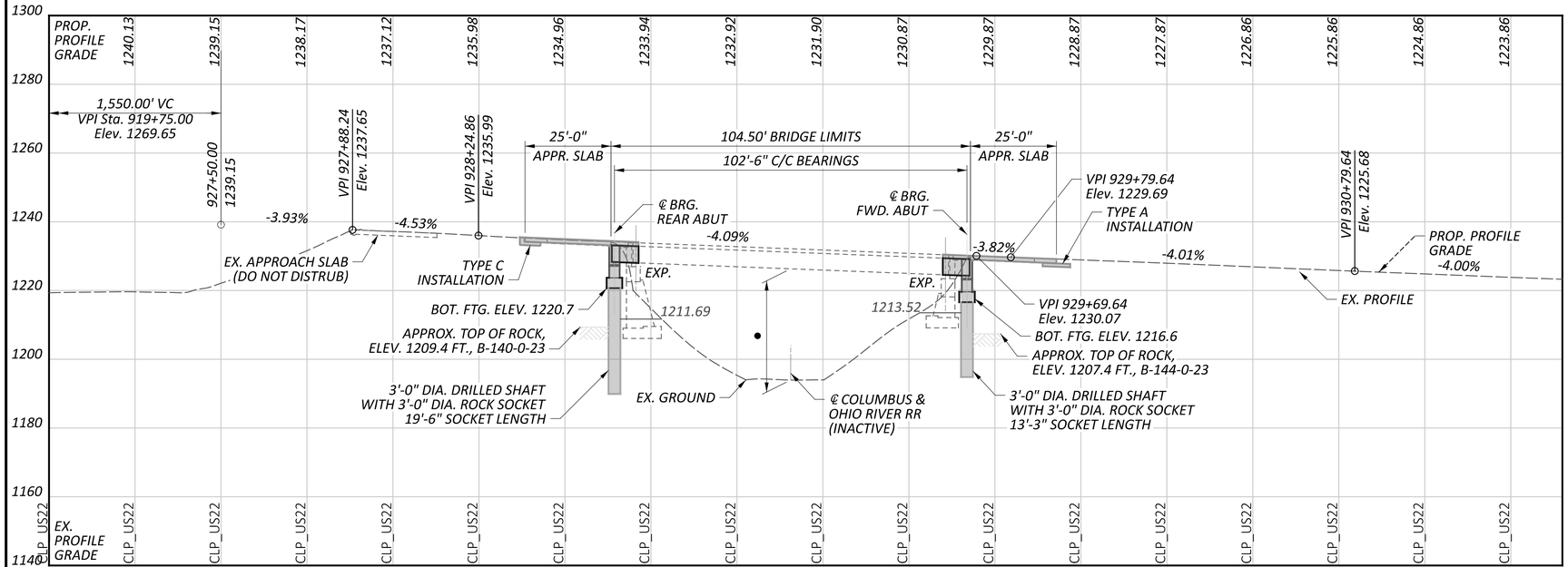
SUBSET	TOTAL
1	22

SHEET	TOTAL
P:0	0

HAS-022-15.25/21.47



PLAN



PROFILE ALONG WB PROFILE GRADE LINE

BENCHMARK DATA

BM #1 STA.	923+32.88,	ELEV.	1251.61,	OFFSET	7.65',	LT.
BM #2 STA.	933+61.49,	ELEV.	1212.53,	OFFSET	97.26',	RT.

FOR ADDITIONAL BENCHMARK INFORMATION. SEE ROADWAY PLAN SHEET X.

NOTES

EARTHWORK LIMITS SHOWN ARE APPROXIMATE. ACTUAL SLOPES SHALL CONFORM TO PLAN CROSS SECTIONS.

DESIGN TRAFFIC:

2026 ADT = 3,723 2026 ADTT = 522
2046 ADT = 4,641 2046 ADTT = 650
DIRECTIONAL DISTRIBUTION = 1.0

LEGEND

- HISTORIC BORING LOCATION
- PROJECT BORING LOCATION
- ● 23'-0" REQUIRED MINIMUM VERTICAL CLEARANCE
  30'-0"± ACTUAL MINIMUM VERTICAL CLEARANCE

PROPOSED WORK:

1. REMOVE EXISTING APPROACH SLABS.
2. CONSTRUCT NEW ABUTMENTS ON DRILLED SHAFTS.
3. REMOVE EXISTING DECK ENDS AND END CROSS-FRAMES.
4. TEMPORARILY SUPPORT EXISTING BEAMS AND SPLICE NEW BEAM EXTENSIONS.
5. PLACE DECK ENDS, DIAPHRAGMS, AND APPROACH SLABS.
6. SEAL ENTIRE BRIDGE DECK WITH EPOXY POLYMER OVERLAY.
7. REMOVE EXISTING SEALER AND RESEAL DECK EDGES.

EXISTING STRUCTURE

TYPE: SINGLE SPAN STEEL GIRDER WITH COMPOSITE REINFORCED CONCRETE DECK SUPPORTED ON REINFORCED CONCRETE STUB ABUTMENTS

SPANS: 90'-0"± C/C BEARINGS
ROADWAY: 50'-8"± TOE/TOE RAILING
LOADING: HS20-44 CASE II & ALTERNATE MILITARY LOADING
SKEW: 19°29'00"± LEFT FORWARD
WEARING SURFACE: 1"± MONOLITHIC CONCRETE
APPROACH SLABS: 25'-0"± LONG (AS-1-81)
ALIGNMENT: TANGENT
CROWN: 0.0156± FT/FT
STRUCTURE FILE NUMBER: 3401146
DATE BUILT: 1960 (MAJOR RECONSTRUCTION 2001)
DISPOSITION: ABUTMENT REPLACEMENT AND DECK SEALING

PROPOSED STRUCTURE

PROPOSED WORK: BUILD NEW SEMI-INTEGRAL ABUTMENTS ON DRILLED SHAFTS BEHIND EXISTING AND EXTEND BRIDGE.

TYPE: SINGLE SPAN STEEL GIRDER WITH COMPOSITE REINFORCED CONCRETE DECK SUPPORTED ON REINFORCED CONCRETE SEMI-INTEGRAL ABUTMENTS ON DRILLED SHAFTS

SPANS: 102'-6" C/C BEARINGS
ROADWAY: 50'-8" TOE/TOE RAILING
LOADING: HL93 AND 0.000 KSF FUTURE WEARING SURFACE
SKEW: 19°29'00" LEFT FORWARD
WEARING SURFACE: 1" MONOLITHIC CONCRETE
APPROACH SLABS: 25'-0" LONG (AS-1-15, AS-2-15 TYPE C) REAR
25'-0" LONG (AS-1-15, AS-2-15 TYPE A) FORWARD
ALIGNMENT: TANGENT
CROWN: 0.0156 FT/FT± (MATCH EXISTING)
DECK AREA: 5,615 SF
COORDINATES: LATITUDE 40°17'06.72" N LONGITUDE 80°59'58.33" W

SITE PLAN
BRIDGE NO. HAS-22-17.530L
OVER COLUMBUS & OHIO RIVER RR SPUR

SFN 3401146

DESIGN AGENCY
COMPASS INFRASTRUCTURE GROUP

DESIGNER	CHECKER
CDH	CCJ

REVIEWER DEB 09/16/25

PROJECT ID 113440

SUBSET	TOTAL
1	21

SHEET	TOTAL
P:0	0

HAS-022-15.25/21.47

APPENDIX B

BORING LOGS

PROJECT: HAS-22-15.25-21.47	DRILLING FIRM / OPERATOR: NEAS / JL	DRILL RIG: CME 45B	STATION / OFFSET: 806+29, 26' RT.	EXPLORATION ID B-001-0-23
TYPE: SUBGRADE	SAMPLING FIRM / LOGGER: NEAS / JL	HAMMER: CME AUTOMATIC	ALIGNMENT: CLP_US22	
PID: SFN:	DRILLING METHOD: 4.00" FA	CALIBRATION DATE: 1/24/22	ELEVATION: 1084.8 (MSL) EOB: 6.3 ft.	PAGE 1 OF 1
START: 8/15/23 END: 8/15/23	SAMPLING METHOD: SPT	ENERGY RATIO (%): 72.6	LAT / LONG: 40.261068, -81.029352	

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)	SO4 ppm	BACK FILL
6.0" ASPHALT AND 10.0" CONCRETE (DRILLERS DESCRIPTION)	1084.8																		
	1083.5	1																	
VERY STIFF, GRAY, **SILT AND CLAY**, SOME SAND, TRACE GRAVEL, DAMP		2	1 1 2	4	61	SS-1	4.00	4	12	13	38	33	35	23	12	19	A-6a (8)	-	
		3																	
	1080.3	4	1 2 4	7	50	SS-2	4.00	-	-	-	-	-	-	-	-	21	A-6a (V)	-	
HARD, GRAY, **SANDY SILT**, SOME STONE FRAGMENTS, LITTLE CLAY, RELIC ROCK, DAMP	1078.8	5	7 22 34	68	78	SS-3	4.50	21	12	13	38	16	31	21	10	11	A-4a (4)	-	
SHALE, GRAY, SEVERELY WEATHERED, VERY WEAK, FISSILE.	1078.5	TR EOB 6	50/3"	-	100	SS-4	-	-	-	-	-	-	-	-	-	-	Rock (V)	-	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING. HOLE DID NOT CAVE. BORING OFFSET 12.0' NORTH.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLACED 0.5 BAG ASPHALT PATCH; POURED 1 BAG HOLE PLUG; SHOVELED SOIL CUTTINGS

STANDARD ODOT LOG W/ SULFATES (8.5 X 11) - OH DOT.GDT - 10/18/24 12:22 - X:\1ACTIVE PROJECTS\ACTIVE SOIL PROJECTS\HAS-22-15.25-21.47\GINT FILES\HAS-22-15.25-21.47.GPJ

PROJECT: HAS-22-15.25-21.47	DRILLING FIRM / OPERATOR: NEAS / JL	DRILL RIG: CME 45B	STATION / OFFSET: 810+41, 27' LT.
TYPE: SUBGRADE	SAMPLING FIRM / LOGGER: NEAS / JL	HAMMER: CME AUTOMATIC	ALIGNMENT: CLP_US22
PID: SFN:	DRILLING METHOD: 4.00" FA	CALIBRATION DATE: 1/24/22	ELEVATION: 1098.2 (MSL) EOB: 6.3 ft.
START: 8/1/23 END: 8/1/23	SAMPLING METHOD: SPT	ENERGY RATIO (%): 72.6	LAT / LONG: 40.262033, -81.028574

EXPLORATION ID B-002-0-23

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)	SO4 ppm	BACK FILL
11.0" ASPHALT (DRILLERS DESCRIPTION)	1098.2 1097.3																		
VERY STIFF, BROWN, **CLAY**, SOME SILT, LITTLE SAND, TRACE GRAVEL, MOIST	1095.2	1	2 2 2	5	28	SS-1	3.25	2	2	11	29	56	49	26	23	31	A-7-6 (15)	920	
HARD, BROWNISH GRAY, **SILT AND CLAY**, SOME SAND, LITTLE GRAVEL, DAMP	1093.7	2 3	2 3 2	6	33	SS-2	4.25	13	14	11	33	29	38	23	15	12	A-6a (7)	-	
MEDIUM DENSE, GRAY, **GRAVEL AND STONE FRAGMENTS WITH SAND**, LITTLE SILT, TRACE CLAY, CONTAINS ASPHALT FRAGMENTS, DAMP	1092.2	4 5	4 8 15	28	50	SS-3	-	-	-	-	-	-	-	-	-	10	A-1-b (V)	-	
SILTSTONE, GRAY, HIGHLY WEATHERED, SLIGHTLY STRONG, (NO RECOVERY - DRILLERS DESCRIPTION).	1091.9	TR EOB 6	50/3"	-	0	SS-4	-	-	-	-	-	-	-	-	-	-		-	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING. HOLE DID NOT CAVE. DRILLED AS STAKED.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLACED 0.5 BAG ASPHALT PATCH; POURED 1 BAG HOLE PLUG; SHOVELED SOIL CUTTINGS

STANDARD ODOT LOG W/ SULFATES (8.5 X 11) - OH DOT.GDT - 10/18/24 12:22 - X:\1ACTIVE PROJECTS\ACTIVE SOIL PROJECTS\HAS-22-15.25-21.47\GINT FILES\HAS-22-15.25-21.47.GPJ

STANDARD ODOT LOG W/ SULFATES (8.5 X 11) - OH DOT.GDT - 10/18/24 12:22 - X:\1ACTIVE PROJECTS\ACTIVE SOIL PROJECTS\HAS-22-15.25-21.47\GINT FILES\HAS-22-15.25-21.47.GPJ

PROJECT: HAS-22-15.25-21.47
TYPE: SUBGRADE
PID: SFN:
START: 8/2/23 END: 8/2/23

DRILLING FIRM / OPERATOR: NEAS / JL
SAMPLING FIRM / LOGGER: NEAS / JL
DRILLING METHOD: 4.00" FA
SAMPLING METHOD: SPT

DRILL RIG: CME 45B
HAMMER: CME AUTOMATIC
CALIBRATION DATE: 1/24/22
ENERGY RATIO (%): 72.6

STATION / OFFSET: 814+37, 50' RT.
ALIGNMENT: CLP_US22
ELEVATION: 1111.9 (MSL) EOB: 6.3 ft.
LAT / LONG: 40.262776, -81.027507

EXPLORATION ID B-003-0-23

MATERIAL DESCRIPTION AND NOTES	ELEV. 1111.9	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
12.0" ASPHALT (DRILLERS DESCRIPTION)	1110.9																		
HARD, BROWN AND GRAY, **SILT AND CLAY**, SOME SAND, LITTLE GRAVEL, DAMP	1108.9	1	3 3 4	8	67	SS-1	4.25	11	13	14	40	22	34	21	13	18	A-6a (7)	880	
HARD, GRAY AND BROWN, **SANDY SILT**, SOME CLAY, TRACE STONE FRAGMENTS, DAMP	1107.4	2	3 4 14	22	56	SS-2	4.25	0	9	26	43	22	27	19	8	11	A-4a (6)	-	
HARD, BROWN, **SILT AND CLAY**, LITTLE SAND, TRACE TO LITTLE STONE FRAGMENTS, DAMP	1105.6	3	11 10 16	31	50	SS-3	4.50	1	10	17	30	42	29	18	11	12	A-6a (8)	-	
	EOB	4	50/3"	-	100	SS-4	4.50	-	-	-	-	-	-	-	-	11	A-6a (V)	-	
		5																	
		6																	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING. HOLE DID NOT CAVE. DRILLED AS STAKED.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLACED 0.5 BAG ASPHALT PATCH; POURED 1 BAG HOLE PLUG; SHOVELED SOIL CUTTINGS

PROJECT: HAS-22-15.25-21.47	DRILLING FIRM / OPERATOR: NEAS / JL	DRILL RIG: CME 55T	STATION / OFFSET: 818+22, 39' LT.
TYPE: SUBGRADE	SAMPLING FIRM / LOGGER: NEAS / JL	HAMMER: CME AUTOMATIC	ALIGNMENT: CLP_US22
PID: SFN:	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 1/24/22	ELEVATION: 1126.2 (MSL) EOB: 7.5 ft.
START: 9/7/23 END: 9/7/23	SAMPLING METHOD: SPT	ENERGY RATIO (%): 63.4	LAT / LONG: 40.263782, -81.026955

EXPLORATION ID B-004-0-23

MATERIAL DESCRIPTION AND NOTES	ELEV. 1126.2	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
6.0" ASPHALT AND 8.0" CONCRETE (DRILLERS DESCRIPTION)	1125.0																		
HARD, BROWN AND GRAY, **SILT AND CLAY**, SOME SAND, SOME GRAVEL, DAMP		1	3 4 6	11	33	SS-1	4.50	25	12	12	32	19	36	22	14	14	A-6a (5)	320	
		2	2 4 6	11	56	SS-2	4.50	31	17	16	22	14	36	23	13	11	A-6a (1)	-	
		3	3 5 7	13	61	SS-3	4.50	-	-	-	-	-	-	-	-	13	A-6a (V)	-	
		4																	
		5																	
		6																	
	1118.7	7 EOB	3 4 9	14	89	SS-4	4.50	-	-	-	-	-	-	-	-	16	A-6a (V)	-	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING. HOLE DID NOT CAVE. DRILLED AS STAKED.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLACED 0.5 BAG ASPHALT PATCH; SHOVELED SOIL CUTTINGS

STANDARD ODOT LOG W/ SULFATES (8.5 X 11) - OH DOT.GDT - 10/18/24 12:22 - X:\1\ACTIVE PROJECTS\ACTIVE SOIL PROJECTS\HAS-22-15.25-21.47\GINT FILES\HAS-22-15.25-21.47.GPJ

PROJECT: HAS-22-15.25-21.47	DRILLING FIRM / OPERATOR: NEAS / JL	DRILL RIG: CME 45B	STATION / OFFSET: 821+91, 24' RT.
TYPE: SUBGRADE	SAMPLING FIRM / LOGGER: NEAS / JL	HAMMER: CME AUTOMATIC	ALIGNMENT: CLP_US22
PID: SFN:	DRILLING METHOD: 4.00" FA	CALIBRATION DATE: 1/24/22	ELEVATION: 1138.7 (MSL) EOB: 7.5 ft.
START: 8/16/23 END: 8/16/23	SAMPLING METHOD: SPT	ENERGY RATIO (%): 72.6	LAT / LONG: 40.264444, -81.025917

EXPLORATION ID B-005-0-23

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)	SO4 ppm	BACK FILL
3.0" ASPHALT AND 9.0" CONCRETE (DRILLERS DESCRIPTION)	1138.7																		
	1137.7																		
VERY STIFF, BROWN, **SANDY SILT**, SOME GRAVEL, LITTLE CLAY, DAMP		1	2 2 3	6	67	SS-1	3.00	22	13	13	34	18	32	22	10	13	A-4a (3)	-	
	1135.7	2																	
VERY STIFF, BROWN AND GRAY, **SILT AND CLAY**, SOME GRAVEL, SOME SAND, DAMP		3	2 3 3	7	61	SS-2	2.75	26	11	11	28	24	33	21	12	14	A-6a (4)	-	
		4	3 4 6	12	72	SS-3	3.00	-	-	-	-	-	-	-	-	16	A-6a (V)	-	
		5	3 5 7	15	67	SS-4	3.00	-	-	-	-	-	-	-	-	14	A-6a (V)	-	
	1131.2	6																	
	EOB	7																	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING. HOLE DID NOT CAVE. DRILLED AS STAKED.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLACED 0.5 BAG ASPHALT PATCH; POURED 1 BAG HOLE PLUG; SHOVELED SOIL CUTTINGS

STANDARD ODOT LOG W/ SULFATES (8.5 X 11) - OH DOT.GDT - 10/18/24 12:22 - X:\1ACTIVE PROJECTS\ACTIVE SOIL PROJECTS\HAS-22-15.25-21.47\GINT FILES\HAS-22-15.25-21.47.GPJ

STANDARD ODOT LOG W/ SULFATES (8.5 X 11) - OH DOT.GDT - 10/18/24 12:22 - X:\1ACTIVE PROJECTS\ACTIVE SOIL PROJECTS\HAS-22-15.25-21.47\GINT FILES\HAS-22-15.25-21.47.GPJ

PROJECT: HAS-22-15.25-21.47	DRILLING FIRM / OPERATOR: NEAS / JL	DRILL RIG: CME 55T	STATION / OFFSET: 826+10, 21' LT.	EXPLORATION ID B-006-0-23
TYPE: SUBGRADE	SAMPLING FIRM / LOGGER: NEAS / JL	HAMMER: CME AUTOMATIC	ALIGNMENT: CLP_US22	
PID: SFN:	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 1/24/22	ELEVATION: 1153.9 (MSL) EOB: 6.3 ft.	PAGE 1 OF 1
START: 9/7/23 END: 9/7/23	SAMPLING METHOD: SPT	ENERGY RATIO (%): 63.4	LAT / LONG: 40.265524, -81.025267	

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)	SO4 ppm	BACK FILL
6.0" ASPHALT AND 8.0" CONCRETE (DRILLERS DESCRIPTION)	1153.9																		
	1152.7																		
MEDIUM DENSE, GRAY, **STONE FRAGMENTS**, LITTLE SAND, TRACE SILT, TRACE CLAY, CONCRETE FRAGMENTS, DAMP		1	7 5 6	12	6	SS-1	-	-	-	-	-	-	-	-	-	8	A-1-a (V)	-	
	1149.4	2	4 6 5	12	11	SS-2	-	-	-	-	-	-	-	-	-	7	A-1-a (V)	-	
HARD, BROWN, **SILT AND CLAY**, SOME SAND, SOME GRAVEL, DAMP	1147.9	3 4 5	3 5 7	13	39	SS-3	4.50	24	13	20	23	20	34	21	13	12	A-6a (2)	640	
VERY DENSE, GRAY, **STONE FRAGMENTS**, LITTLE SAND, TRACE SILT, TRACE CLAY, POSSIBLE COBBLE, DAMP	1147.6	EOB 6	50/4"	-	100	SS-4	-	-	-	-	-	-	-	-	-	4	A-1-a (V)	-	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING. HOLE DID NOT CAVE. DRILLED AS STAKED.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLACED 0.5 BAG ASPHALT PATCH; SHOVELED SOIL CUTTINGS

PROJECT: HAS-22-15.25-21.47	DRILLING FIRM / OPERATOR: NEAS / JL	DRILL RIG: CME 45B	STATION / OFFSET: 829+93, 34' RT.
TYPE: SUBGRADE	SAMPLING FIRM / LOGGER: NEAS / JL	HAMMER: CME AUTOMATIC	ALIGNMENT: CLP_US22
PID: SFN:	DRILLING METHOD: 4.00" FA	CALIBRATION DATE: 1/24/22	ELEVATION: 1169.5 (MSL) EOB: 7.5 ft.
START: 8/15/23 END: 8/15/23	SAMPLING METHOD: SPT	ENERGY RATIO (%): 72.6	LAT / LONG: 40.266257, -81.024274

EXPLORATION ID B-007-0-23

PAGE 1 OF 1

MATERIAL DESCRIPTION AND NOTES	ELEV. 1169.5	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
5.0" ASPHALT AND 8.0" CONCRETE (DRILLERS DESCRIPTION)	1168.4	1																	
VERY STIFF, BROWN AND ORANGISH BROWN, **SILT AND CLAY**, SOME SAND, TRACE GRAVEL, IRON STAINING, DAMP	1166.5	2	4 11 7	22	56	SS-1	3.50	5	10	18	39	28	32	20	12	15	A-6a (7)	-	
HARD, GRAY, **SANDY SILT**, LITTLE GRAVEL, LITTLE CLAY, DAMP		3	4 4 6	12	67	SS-2	4.25	19	11	13	40	17	29	20	9	11	A-4a (4)	-	
		4	4 6 5	13	56	SS-3	4.25	-	-	-	-	-	-	-	-	11	A-4a (V)	-	
		5																	
		6	4 7 6	16	67	SS-4	4.25	-	-	-	-	-	-	-	-	14	A-4a (V)	-	
	1162.0	7 EOB																	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING. HOLE DID NOT CAVE. DRILLED AS STAKED.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLACED 0.5 BAG ASPHALT PATCH; POURED 1 BAG HOLE PLUG; SHOVELED SOIL CUTTINGS

STANDARD ODOT LOG W/ SULFATES (8.5 X 11) - OH DOT.GDT - 10/18/24 12:22 - X:\1ACTIVE PROJECTS\ACTIVE SOIL PROJECTS\HAS-22-15.25-21.47\GINT FILES\HAS-22-15.25-21.47.GPJ

STANDARD ODOT LOG W/ SULFATES (8.5 X 11) - OH DOT.GDT - 10/18/24 12:22 - X:\1ACTIVE PROJECTS\ACTIVE SOIL PROJECTS\HAS-22-15.25-21.47\GINT FILES\HAS-22-15.25-21.47.GPJ

PROJECT: HAS-22-15.25-21.47	DRILLING FIRM / OPERATOR: NEAS / JL	DRILL RIG: CME 45B	STATION / OFFSET: 833+69, 48' LT.	EXPLORATION ID B-008-0-23
TYPE: SUBGRADE	SAMPLING FIRM / LOGGER: NEAS / JL	HAMMER: CME AUTOMATIC	ALIGNMENT: CLP_US22	
PID: SFN:	DRILLING METHOD: 4.00" FA	CALIBRATION DATE: 1/24/22	ELEVATION: 1184.5 (MSL) EOB: 6.3 ft.	PAGE 1 OF 1
START: 8/1/23 END: 8/1/23	SAMPLING METHOD: SPT	ENERGY RATIO (%): 72.6	LAT / LONG: 40.267197, -81.023665	

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)	SO4 ppm	BACK FILL
12.0" ASPHALT (DRILLERS DESCRIPTION)	1184.5																		
HARD, BROWN AND YELLOWISH BROWN, **SILT AND CLAY**, SOME SAND, TRACE GRAVEL, DAMP	1183.5	1	4 6 5	13	50	SS-1	4.25	3	13	17	37	30	33	19	14	18	A-6a (8)	840	
STIFF, YELLOWISH BROWN, **SANDY SILT**, LITTLE GRAVEL, TRACE CLAY, CONTAINS NO INTACT SOIL FOR HP READINGS, DAMP	1181.5	2	4 4 5	11	33	SS-2	-	16	18	11	49	6	28	21	7	12	A-4a (4)	-	
VERY STIFF TO HARD, GREENISH GRAY, **SILT**, SOME SAND, SOME GRAVEL, TRACE CLAY, CONTAINS NO INTACT SOIL FOR HP READINGS, DAMP	1180.0	3	4 8 15	28	50	SS-3	-	21	16	11	50	2	29	19	10	11	A-4b (3)	-	
	1178.2 EOB	4 5 6	50/3"	-	100	SS-4	-	-	-	-	-	-	-	-	-	10	A-4b (V)	-	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING. HOLE DID NOT CAVE. DRILLED AS STAKED.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLACED 0.5 BAG ASPHALT PATCH; POURED 1 BAG HOLE PLUG; SHOVELED SOIL CUTTINGS

PROJECT: HAS-22-15.25-21.47	DRILLING FIRM / OPERATOR: NEAS / JL	DRILL RIG: CME 45B	STATION / OFFSET: 837+69, 57' RT.
TYPE: SUBGRADE	SAMPLING FIRM / LOGGER: NEAS / JL	HAMMER: CME AUTOMATIC	ALIGNMENT: CLP_US22
PID: SFN:	DRILLING METHOD: 4.00" FA	CALIBRATION DATE: 1/24/22	ELEVATION: 1201.2 (MSL) EOB: 7.5 ft.
START: 8/15/23 END: 8/15/23	SAMPLING METHOD: SPT	ENERGY RATIO (%): 72.6	LAT / LONG: 40.267889, -81.022504

EXPLORATION ID B-009-0-23

PAGE 1 OF 1

MATERIAL DESCRIPTION AND NOTES	ELEV. 1201.2	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
5.0" ASPHALT AND 9.0" CONCRETE (DRILLERS DESCRIPTION)	1200.1																		
VERY STIFF, BROWN, **SILT AND CLAY**, SOME SAND, TRACE GRAVEL, SS-3 RELIC ROCK, DAMP		1	1 2 2	5	50	SS-1	3.25	7	13	16	41	23	33	22	11	18	A-6a (6)	-	
	1197.2	2 3 4 TR	12 18 36	65	67	SS-2	4.00	-	-	-	-	-	-	-	-	21	A-6a (V)	-	
SHALE, GRAY, SEVERELY WEATHERED, VERY WEAK, FISSILE.		5	15 23 39	75	61	SS-3	-	-	-	-	-	-	-	-	-	-	Rock (V)	-	
	1193.7	6 7 EOB	17 28 40	82	50	SS-4	-	-	-	-	-	-	-	-	-	-	Rock (V)	-	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING. HOLE DID NOT CAVE. DRILLED AS STAKED.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLACED 0.5 BAG ASPHALT PATCH; POURED 1 BAG HOLE PLUG; SHOVELED SOIL CUTTINGS

STANDARD ODOT LOG W/ SULFATES (8.5 X 11) - OH DOT.GDT - 10/18/24 12:22 - X:\1\ACTIVE PROJECTS\ACTIVE SOIL PROJECTS\HAS-22-15.25-21.47\GINT FILES\HAS-22-15.25-21.47.GPJ

STANDARD ODOT LOG W/ SULFATES (8.5 X 11) - OH DOT.GDT - 10/18/24 12:22 - X:\1ACTIVE PROJECTS\ACTIVE SOIL PROJECTS\HAS-22-15.25-21.47\GINT FILES\HAS-22-15.25-21.47.GPJ

PROJECT: HAS-22-15.25-21.47	DRILLING FIRM / OPERATOR: NEAS / JL	DRILL RIG: CME 45B	STATION / OFFSET: 841+56, 44' LT.	EXPLORATION ID B-010-0-23
TYPE: SUBGRADE	SAMPLING FIRM / LOGGER: NEAS / JL	HAMMER: CME AUTOMATIC	ALIGNMENT: CLP_US22	
PID: SFN:	DRILLING METHOD: 4.00" FA	CALIBRATION DATE: 1/24/22	ELEVATION: 1217.0 (MSL) EOB: 6.2 ft.	PAGE 1 OF 1
START: 8/1/23 END: 8/1/23	SAMPLING METHOD: SPT	ENERGY RATIO (%): 72.6	LAT / LONG: 40.268927, -81.021973	

MATERIAL DESCRIPTION AND NOTES	ELEV. 1217.0	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
12.0" ASPHALT (DRILLERS DESCRIPTION)	1216.0																		
MEDIUM STIFF, BROWN AND GRAY, **SANDY SILT**, SOME CLAY, TRACE GRAVEL, CONTAINS NO INTACT SOIL FOR HP READINGS, DAMP	1212.5	1 2 3 4	2 3 3	7	44	SS-1	-	9	8	28	32	23	27	19	8	13	A-4a (4)	100	
			3 3 2	6	17	SS-2	-	-	-	-	-	-	-	-	-	7	A-4a (V)	-	
SHALE, DARK GRAY, HIGHLY WEATHERED, VERY WEAK TO WEAK, FISSILE.	1210.8	TR	3 6 50/5"	-	59	SS-3	-	-	-	-	-	-	-	-	-	-	Rock (V)	-	
		EOB 5 6	50/2"	-	100	SS-4	-	-	-	-	-	-	-	-	-	-	Rock (V)	-	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING. HOLE DID NOT CAVE. DRILLED AS STAKED.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLACED 0.5 BAG ASPHALT PATCH; POURED 1 BAG HOLE PLUG; SHOVELED SOIL CUTTINGS

PROJECT: HAS-22-15.25-21.47	DRILLING FIRM / OPERATOR: NEAS / JL	DRILL RIG: CME 45B	STATION / OFFSET: 845+48, 51' RT.
TYPE: SUBGRADE	SAMPLING FIRM / LOGGER: NEAS / JL	HAMMER: CME AUTOMATIC	ALIGNMENT: CLP_US22
PID: SFN:	DRILLING METHOD: 4.00" FA	CALIBRATION DATE: 1/24/22	ELEVATION: 1229.9 (MSL) EOB: 7.5 ft.
START: 8/2/23 END: 8/2/23	SAMPLING METHOD: SPT	ENERGY RATIO (%): 72.6	LAT / LONG: 40.269647, -81.020879

EXPLORATION ID B-011-0-23

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)	SO4 ppm	BACK FILL
11.5" ASPHALT (DRILLERS DESCRIPTION)	1229.9 1228.9	1																	
HARD, GRAY AND BROWN, **SILT AND CLAY**, LITTLE TO SOME SAND, TRACE GRAVEL, DAMP		2 3	2 2 3	6	67	SS-1	4.50	5	8	19	39	29	31	20	11	15	A-6a (7)	640	
	1225.4	4	2 3 4	8	61	SS-2	4.50	4	6	6	57	27	32	21	11	7	A-6a (8)	-	
MEDIUM DENSE, GRAY, **STONE FRAGMENTS WITH SAND**, LITTLE SILT, TRACE CLAY, RELIC ROCK, DAMP	1223.9	5 TR 6	7 11 8	23	50	SS-3	-	-	-	-	-	-	-	-	-	6	A-1-b (V)	-	
SILTSTONE, GRAY, HIGHLY WEATHERED, VERY WEAK.	1222.4	7 EOB	10 12 15	33	56	SS-4	-	-	-	-	-	-	-	-	-	-	Rock (V)	-	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING. HOLE DID NOT CAVE. DRILLED AS STAKED.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLACED 0.5 BAG ASPHALT PATCH; POURED 1 BAG HOLE PLUG; SHOVELED SOIL CUTTINGS

STANDARD ODOT LOG W/ SULFATES (8.5 X 11) - OH DOT.GDT - 10/18/24 12:22 - X:\1ACTIVE PROJECTS\ACTIVE SOIL PROJECTS\HAS-22-15.25-21.47\GINT FILES\HAS-22-15.25-21.47.GPJ

PROJECT: HAS-22-15.25-21.47	DRILLING FIRM / OPERATOR: NEAS / JL	DRILL RIG: CME 45B	STATION / OFFSET: 849+30, 38' LT.
TYPE: SUBGRADE	SAMPLING FIRM / LOGGER: NEAS / JL	HAMMER: CME AUTOMATIC	ALIGNMENT: CLP_US22
PID: SFN:	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 1/24/22	ELEVATION: 1237.7 (MSL) EOB: 7.5 ft.
START: 9/7/23 END: 9/7/23	SAMPLING METHOD: SPT	ENERGY RATIO (%): 72.6	LAT / LONG: 40.270634, -81.020319

EXPLORATION ID B-012-0-23

PAGE 1 OF 1

MATERIAL DESCRIPTION AND NOTES	ELEV. 1237.7	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
6.0" ASPHALT AND 7.0" CONCRETE (DRILLERS DESCRIPTION)	1236.6																		
VERY STIFF, BROWN AND GRAY, **SILT AND CLAY**, SOME GRAVEL, SOME SAND, DAMP	1234.7	1–3	5 5 6	13	72	SS-1	4.00	29	14	9	25	23	34	21	13	14	A-6a (4)	3500	
MEDIUM DENSE, GRAY, **STONE FRAGMENTS WITH SAND AND SILT**, LITTLE CLAY, DAMP		3–5	5 5 7	15	67	SS-2	-	45	17	8	16	14	NP	NP	NP	9	A-2-4 (0)	-	
		5–6	6 9 10	23	78	SS-3	-	-	-	-	-	-	-	-	-	10	A-2-4 (V)	-	
	1230.2	6–7	13 9 11	24	50	SS-4	-	-	-	-	-	-	-	-	-	8	A-2-4 (V)	-	
		EOB																	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING. HOLE DID NOT CAVE. DRILLED AS STAKED.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLACED 0.5 BAG ASPHALT PATCH; SHOVELED SOIL CUTTINGS

STANDARD ODOT LOG W/ SULFATES (8.5 X 11) - OH DOT.GDT - 10/18/24 12:22 - X:\1ACTIVE PROJECTS\ACTIVE SOIL PROJECTS\HAS-22-15.25-21.47\GINT FILES\HAS-22-15.25-21.47.GPJ

PROJECT: HAS-22-15.25-21.47	DRILLING FIRM / OPERATOR: NEAS / JL	DRILL RIG: CME 45B	STATION / OFFSET: 853+47, 38' RT.
TYPE: SUBGRADE	SAMPLING FIRM / LOGGER: NEAS / JL	HAMMER: CME AUTOMATIC	ALIGNMENT: CLP_US22
PID: SFN:	DRILLING METHOD: 4.00" FA	CALIBRATION DATE: 1/24/22	ELEVATION: 1240.0 (MSL) EOB: 7.5 ft.
START: 8/15/23 END: 8/18/23	SAMPLING METHOD: SPT	ENERGY RATIO (%): 72.6	LAT / LONG: 40.271446, -81.019249

EXPLORATION ID B-013-0-23

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MATERIAL DESCRIPTION AND NOTES	ELEV. 1240.0	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
5.0" ASPHALT AND 8.0" CONCRETE (DRILLERS DESCRIPTION)	1238.9																		
VERY STIFF TO HARD, BROWN AND GRAY, **SANDY SILT**, LITTLE CLAY, LITTLE GRAVEL, DAMP	1237.0	1	1 3 4	8	67	SS-1	4.00	18	12	26	25	19	30	20	10	14	A-4a (2)	-	
HARD, BROWN AND GRAY, **SILT AND CLAY**, SOME SAND, TRACE GRAVEL, SS-3 RELIC ROCK, DAMP	1234.0	2 3 4 5	2 4 4	10	78	SS-2	4.50	-	-	-	-	-	-	-	-	16	A-6a (V)	-	
			3 14 24	46	50	SS-3	4.50	4	8	17	50	21	34	23	11	13	A-6a (8)	-	
SHALE, GRAY, SEVERELY WEATHERED, VERY WEAK, FISSILE.	1232.5	TR 6 7 EOB	3 16 27	52	61	SS-4	-	-	-	-	-	-	-	-	-	8	Rock (V)	-	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING. HOLE DID NOT CAVE. DRILLED AS STAKED.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLACED 0.5 BAG ASPHALT PATCH; POURED 1 BAG HOLE PLUG; SHOVELED SOIL CUTTINGS

STANDARD ODOT LOG W/ SULFATES (8.5 X 11) - OH DOT.GDT - 10/18/24 12:22 - X:\1ACTIVE PROJECTS\ACTIVE SOIL PROJECTS\HAS-22-15.25-21.47\GINT FILES\HAS-22-15.25-21.47.GPJ

PROJECT: HAS-22-15.25-21.47	DRILLING FIRM / OPERATOR: NEAS / JL	DRILL RIG: CME 45B	STATION / OFFSET: 857+18, 48' LT.
TYPE: SUBGRADE	SAMPLING FIRM / LOGGER: NEAS / JL	HAMMER: CME AUTOMATIC	ALIGNMENT: CLP_US22
PID: SFN:	DRILLING METHOD: 4.00" FA	CALIBRATION DATE: 1/24/22	ELEVATION: 1236.3 (MSL) EOB: 7.5 ft.
START: 8/1/23 END: 8/1/23	SAMPLING METHOD: SPT	ENERGY RATIO (%): 72.6	LAT / LONG: 40.272375, -81.018653

EXPLORATION ID B-014-0-23

PAGE 1 OF 1

MATERIAL DESCRIPTION AND NOTES	ELEV. 1236.3	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
12.0" ASPHALT (DRILLERS DESCRIPTION)	1235.3																		
VERY STIFF TO HARD, YELLOWISH BROWN AND GRAY, **SILTY CLAY**, TRACE TO LITTLE SAND, TRACE GRAVEL, DAMP		1																	
		2	4 6 5	13	67	SS-1	3.50	2	5	13	37	43	38	21	17	18	A-6b (11)	1500	
	1231.8	3	4 5 7	15	61	SS-2	4.50	2	5	3	48	42	38	22	16	14	A-6b (10)	-	
HARD, YELLOWISH BROWN AND GRAY, **SANDY SILT**, SOME CLAY, TRACE GRAVEL, DAMP	1230.3	4	4 4 4	10	39	SS-3	4.50	-	-	-	-	-	-	-	-	13	A-4a (V)	-	
VERY STIFF, YELLOWISH BROWN AND GRAY, **CLAY**, SOME SILT, LITTLE SAND, TRACE GRAVEL, DAMP	1228.8	5	4 5 4	11	44	SS-4	3.50	-	-	-	-	-	-	-	-	23	A-7-6 (V)	-	
		EOB 6 7																	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING. HOLE DID NOT CAVE. DRILLED AS STAKED.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLACED 0.5 BAG ASPHALT PATCH; POURED 1 BAG HOLE PLUG; SHOVELED SOIL CUTTINGS

STANDARD ODOT LOG W/ SULFATES (8.5 X 11) - OH DOT.GDT - 10/18/24 12:22 - X:\1\ACTIVE PROJECTS\ACTIVE SOIL PROJECTS\HAS-22-15.25-21.47\GINT FILES\HAS-22-15.25-21.47.GPJ

PROJECT: HAS-22-15.25-21.47	DRILLING FIRM / OPERATOR: NEAS / JL	DRILL RIG: CME 45B	STATION / OFFSET: 861+22, 39' RT.
TYPE: SUBGRADE	SAMPLING FIRM / LOGGER: NEAS / JL	HAMMER: CME AUTOMATIC	ALIGNMENT: CLP_US22
PID: SFN:	DRILLING METHOD: 4.00" FA	CALIBRATION DATE: 1/24/22	ELEVATION: 1229.7 (MSL) EOB: 7.5 ft.
START: 8/15/23 END: 8/15/23	SAMPLING METHOD: SPT	ENERGY RATIO (%): 72.6	LAT / LONG: 40.273114, -81.017522

EXPLORATION ID B-015-0-23

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)	SO4 ppm	BACK FILL
4.0" ASPHALT AND 9.5" CONCRETE (DRILLERS DESCRIPTION)	1229.7																		
	1228.6																		
LOOSE, BROWN, **GRAVEL WITH SAND AND SILT**, LITTLE CLAY, DAMP		1	2 3 4	8	72	SS-1	-	26	12	30	19	13	NP	NP	NP	12	A-2-4 (0)	-	
	1226.7	2																	
VERY STIFF TO HARD, YELLOWISH BROWN, **SILTY CLAY**, LITTLE SAND, TRACE GRAVEL, DAMP		3	3 3 4	8	67	SS-2	4.00	5	6	9	32	48	39	21	18	21	A-6b (11)	-	
		4	5 7 8	18	61	SS-3	4.50	-	-	-	-	-	-	-	-	18	A-6b (V)	-	
		5	6 7 11	22	72	SS-4	4.50	-	-	-	-	-	-	-	-	16	A-6b (V)	-	
	1222.2	6																	
		EOB 7																	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING. HOLE DID NOT CAVE. DRILLED AS STAKED.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLACED 0.5 BAG ASPHALT PATCH; POURED 1 BAG HOLE PLUG; SHOVELED SOIL CUTTINGS

STANDARD ODOT LOG W/ SULFATES (8.5 X 11) - OH DOT.GDT - 10/18/24 12:22 - X:\1ACTIVE PROJECTS\ACTIVE SOIL PROJECTS\HAS-22-15.25-21.47\GINT FILES\HAS-22-15.25-21.47.GPJ

PROJECT: HAS-22-15.25-21.47	DRILLING FIRM / OPERATOR: NEAS / JL	DRILL RIG: CME 55T	STATION / OFFSET: 865+08, 39' LT.	EXPLORATION ID B-016-0-23
TYPE: SUBGRADE	SAMPLING FIRM / LOGGER: NEAS / JL	HAMMER: CME AUTOMATIC	ALIGNMENT: CLP_US22	
PID: SFN:	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 1/24/22	ELEVATION: 1223.4 (MSL) EOB: 7.5 ft.	PAGE 1 OF 1
START: 9/7/23 END: 9/7/23	SAMPLING METHOD: SPT	ENERGY RATIO (%): 63.4	LAT / LONG: 40.274110, -81.016951	

MATERIAL DESCRIPTION AND NOTES	ELEV. 1223.4	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
6.0" ASPHALT AND 7.0" CONCRETE (DRILLERS DESCRIPTION)	1222.3																		
VERY STIFF, BROWN AND GRAY, **CLAY**, SOME SILT, LITTLE SAND, TRACE GRAVEL, DAMP SS-1 NO RECOVERY	1218.9	1	6 6 7	14	0	SS-1	-	-	-	-	-	-	-	-	-	-		-	
VERY STIFF, BROWN AND GRAY, **SILT AND CLAY**, SOME SAND, LITTLE GRAVEL, DAMP	1215.9	2 3 4 5	5 5 6	12	67	SS-2	4.00	5	8	10	32	45	41	21	20	18	A-7-6 (12)	-	
			5 7 8	16	89	SS-3	4.00	12	11	12	31	34	34	21	13	16	A-6a (7)	-	
		EOB 6 7	3 5 6	12	78	SS-4	4.00	-	-	-	-	-	-	-	-	18	A-6a (V)	-	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING. HOLE DID NOT CAVE. DRILLED AS STAKED.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLACED 0.5 BAG ASPHALT PATCH; SHOVELED SOIL CUTTINGS

STANDARD ODOT LOG W/ SULFATES (8.5 X 11) - OH DOT.GDT - 10/18/24 12:22 - X:\1ACTIVE PROJECTS\ACTIVE SOIL PROJECTS\HAS-22-15.25-21.47\GINT FILES\HAS-22-15.25-21.47.GPJ

PROJECT: HAS-22-15.25-21.47	DRILLING FIRM / OPERATOR: NEAS / JL	DRILL RIG: CME 45B	STATION / OFFSET: 868+75, 26' RT.
TYPE: SUBGRADE	SAMPLING FIRM / LOGGER: NEAS / JL	HAMMER: CME AUTOMATIC	ALIGNMENT: CLP_US22
PID: SFN:	DRILLING METHOD: 4.00" FA	CALIBRATION DATE: 1/24/22	ELEVATION: 1215.7 (MSL) EOB: 7.5 ft.
START: 8/16/23 END: 8/16/23	SAMPLING METHOD: SPT	ENERGY RATIO (%): 72.6	LAT / LONG: 40.274755, -81.015876

EXPLORATION ID B-017-0-23

PAGE 1 OF 1

MATERIAL DESCRIPTION AND NOTES	ELEV. 1215.7	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
4.0" ASPHALT AND 9.0" CONCRETE (DRILLERS DESCRIPTION)	1214.6																		
HARD, BROWN AND GRAY, **SANDY SILT**, LITTLE CLAY, TRACE STONE FRAGMENTS, RELIC ROCK, DAMP	1211.2	1 2 3 4 TR	5 12 17	35	61	SS-1	4.25	10	14	16	42	18	29	21	8	12	A-4a (5)	-	
			5 14 17	38	56	SS-2	4.50	5	20	12	45	18	30	22	8	10	A-4a (6)	-	
SHALE, BROWN AND GRAY, SEVERELY WEATHERED, VERY WEAK, FISSILE.		5	14 20 18	46	72	SS-3	-	-	-	-	-	-	-	-	-	9	Rock (V)	-	
	1208.2	6 7 EOB	15 19 20	47	61	SS-4	-	-	-	-	-	-	-	-	-	11	Rock (V)	-	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING. HOLE DID NOT CAVE. DRILLED AS STAKED.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLACED 0.5 BAG ASPHALT PATCH; POURED 1 BAG HOLE PLUG; SHOVELED SOIL CUTTINGS

STANDARD ODOT LOG W/ SULFATES (8.5 X 11) - OH DOT.GDT - 10/18/24 12:22 - X:\1\ACTIVE PROJECTS\ACTIVE SOIL PROJECTS\HAS-22-15.25-21.47\GINT FILES\HAS-22-15.25-21.47.GPJ

PROJECT: HAS-22-15.25-21.47	DRILLING FIRM / OPERATOR: NEAS / JL	DRILL RIG: CME 55T	STATION / OFFSET: 872+66, 50' LT.
TYPE: SUBGRADE	SAMPLING FIRM / LOGGER: NEAS / JL	HAMMER: CME AUTOMATIC	ALIGNMENT: CLP_US22
PID: SFN:	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 1/24/22	ELEVATION: 1210.5 (MSL) EOB: 7.5 ft.
START: 9/7/23 END: 9/7/23	SAMPLING METHOD: SPT	ENERGY RATIO (%): 63.4	LAT / LONG: 40.275742, -81.015260

EXPLORATION ID B-018-0-23

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MATERIAL DESCRIPTION AND NOTES	ELEV. 1210.5	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
10.0" ASPHALT (DRILLERS DESCRIPTION)	1209.7																		
LOOSE, BROWN, **STONE FRAGMENTS**, LITTLE SAND, TRACE SILT, TRACE CLAY, DAMP	1207.5		3 4 5	10	6	SS-1	-	-	-	-	-	-	-	-	-	7	A-1-a (V)	-	
HARD, BROWN AND DARK GRAY, **SILT AND CLAY**, LITTLE GRAVEL, LITTLE SAND, DAMP	1206.0		3 6 6	13	72	SS-2	4.50	19	7	5	40	29	38	26	12	13	A-6a (8)	-	
HARD, BROWN AND DARK GRAY, **CLAY**, SOME SILT, LITTLE SAND, LITTLE GRAVEL, RELIC ROCK STRUCTURE, DAMP	1203.0		6 17 34	54	78	SS-3	4.50	16	8	12	28	36	41	24	17	14	A-7-6 (9)	-	
		EOB	9 13 37	53	44	SS-4	4.50	-	-	-	-	-	-	-	-	15	A-7-6 (V)	-	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING. HOLE DID NOT CAVE. DRILLED AS STAKED.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLACED 0.5 BAG ASPHALT PATCH; SHOVELED SOIL CUTTINGS

STANDARD ODOT LOG W/ SULFATES (8.5 X 11) - OH DOT.GDT - 10/18/24 12:22 - X:\1ACTIVE PROJECTS\ACTIVE SOIL PROJECTS\HAS-22-15.25-21.47\GINT FILES\HAS-22-15.25-21.47.GPJ

PROJECT: HAS-22-15.25-21.47	DRILLING FIRM / OPERATOR: NEAS / JL	DRILL RIG: CME 45B	STATION / OFFSET: 876+76, 24' RT.
TYPE: SUBGRADE	SAMPLING FIRM / LOGGER: NEAS / JL	HAMMER: CME AUTOMATIC	ALIGNMENT: CLP_US22
PID: SFN:	DRILLING METHOD: 4.00" FA	CALIBRATION DATE: 1/24/22	ELEVATION: 1206.2 (MSL) EOB: 7.5 ft.
START: 8/16/23 END: 8/16/23	SAMPLING METHOD: SPT	ENERGY RATIO (%): 72.6	LAT / LONG: 40.276579, -81.014273

EXPLORATION ID B-019-0-23

PAGE 1 OF 1

MATERIAL DESCRIPTION AND NOTES	ELEV. 1206.2	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
3.5" ASPHALT AND 8.5" CONCRETE (DRILLERS DESCRIPTION)	1205.2																		
VERY STIFF, BROWNISH GRAY, **SILT AND CLAY**, SOME SAND, LITTLE TO SOME GRAVEL, DAMP		1																	
		2	3 3 3	7	78	SS-1	3.00	11	10	16	35	28	34	21	13	17	A-6a (7)	-	
		3	3 3 4	8	72	SS-2	3.50	22	12	10	29	27	38	24	14	17	A-6a (6)	-	
		4	3 4 5	11	56	SS-3	3.50	-	-	-	-	-	-	-	-	16	A-6a (V)	-	
		5	4 4 6	12	67	SS-4	3.25	-	-	-	-	-	-	-	-	17	A-6a (V)	-	
	1198.7	6 EOB																	
		7																	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING. HOLE DID NOT CAVE. DRILLED AS STAKED.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLACED 0.5 BAG ASPHALT PATCH; POURED 1 BAG HOLE PLUG; SHOVELED SOIL CUTTINGS

STANDARD ODOT LOG W/ SULFATES (8.5 X 11) - OH DOT.GDT - 10/18/24 12:22 - X:\1ACTIVE PROJECTS\ACTIVE SOIL PROJECTS\HAS-22-15.25-21.47\GINT FILES\HAS-22-15.25-21.47.GPJ

PROJECT: HAS-22-15.25-21.47	DRILLING FIRM / OPERATOR: NEAS / JL	DRILL RIG: CME 45B	STATION / OFFSET: 880+67, 48' LT.
TYPE: SUBGRADE	SAMPLING FIRM / LOGGER: NEAS / JL	HAMMER: CME AUTOMATIC	ALIGNMENT: CLP_US22
PID: SFN:	DRILLING METHOD: 4.00" FA	CALIBRATION DATE: 1/24/22	ELEVATION: 1210.3 (MSL) EOB: 7.5 ft.
START: 8/1/23 END: 8/1/23	SAMPLING METHOD: SPT	ENERGY RATIO (%): 72.6	LAT / LONG: 40.277576, -81.013638

EXPLORATION ID B-020-0-23

PAGE 1 OF 1

MATERIAL DESCRIPTION AND NOTES	ELEV. 1210.3	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
12.0" ASPHALT (DRILLERS DESCRIPTION)	1209.3																		
HARD, BROWN, **SILT AND CLAY**, LITTLE TO SOME SAND, TRACE TO LITTLE GRAVEL, CONTAINS COAL FRAGMENTS, DAMP		1	3 3 4	8	72	SS-1	4.00	11	16	8	42	23	35	23	12	13	A-6a (7)	1800	
		2	3 4 5	11	67	SS-2	4.25	13	6	9	35	37	38	23	15	21	A-6a (9)	-	
		3	3 5 5	12	44	SS-3	4.50	3	11	22	34	30	31	19	12	12	A-6a (7)	-	
		4	4 4 4	10	56	SS-4	4.50	-	-	-	-	-	-	-	-	14	A-6a (V)	-	
	1202.8	5 EOB																	
		6																	
		7																	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING. HOLE DID NOT CAVE. DRILLED AS STAKED.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLACED 0.5 BAG ASPHALT PATCH; POURED 1 BAG HOLE PLUG; SHOVELED SOIL CUTTINGS

STANDARD ODOT LOG W/ SULFATES (8.5 X 11) - OH DOT.GDT - 10/18/24 12:22 - X:\1\ACTIVE PROJECTS\ACTIVE SOIL PROJECTS\HAS-22-15.25-21.47\GINT FILES\HAS-22-15.25-21.47.GPJ

PROJECT: HAS-22-15.25-21.47	DRILLING FIRM / OPERATOR: NEAS / JL	DRILL RIG: CME 45B	STATION / OFFSET: 884+79, 51' RT.
TYPE: SUBGRADE	SAMPLING FIRM / LOGGER: NEAS / JL	HAMMER: CME AUTOMATIC	ALIGNMENT: CLP_US22
PID: SFN:	DRILLING METHOD: 4.00" FA	CALIBRATION DATE: 1/24/22	ELEVATION: 1215.4 (MSL) EOB: 6.1 ft.
START: 8/2/23 END: 8/2/23	SAMPLING METHOD: SPT	ENERGY RATIO (%): 72.6	LAT / LONG: 40.278295, -81.012471

EXPLORATION ID B-021-0-23

PAGE 1 OF 1

MATERIAL DESCRIPTION AND NOTES	ELEV. 1215.4	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
12.0" ASPHALT (DRILLERS DESCRIPTION)	1214.4																		
HARD, GRAY, **SANDY SILT**, SOME CLAY, TRACE GRAVEL, DAMP	1212.4	1	4 5 5	12	56	SS-1	4.50	10	10	11	44	25	30	20	10	11	A-4a (7)	720	
DENSE TO VERY DENSE, GRAY, **SILT**, LITTLE CLAY, LITTLE SAND, TRACE TO LITTLE STONE FRAGMENTS, RELIC ROCK, DAMP	1209.9	2 3 4 5	4 11 17	34	44	SS-2	4.50	9	6	7	58	20	30	21	9	7	A-4b (8)	-	
			10 18 50/3"	-	67	SS-3	4.50	-	-	-	-	-	-	-	-	5	A-4b (V)	-	
SILTSTONE, GRAY, HIGHLY WEATHERED, VERY WEAK.	1209.3	TR EOB 6	50/1"	-	100	SS-4	-	-	-	-	-	-	-	-	-	-	Rock (V)	-	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING. HOLE DID NOT CAVE. DRILLED AS STAKED.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLACED 0.5 BAG ASPHALT PATCH; POURED 1 BAG HOLE PLUG; SHOVELED SOIL CUTTINGS

STANDARD ODOT LOG W/ SULFATES (8.5 X 11) - OH DOT.GDT - 10/18/24 12:22 - X:\1ACTIVE PROJECTS\ACTIVE SOIL PROJECTS\HAS-22-15.25-21.47\GINT FILES\HAS-22-15.25-21.47.GPJ

PROJECT: HAS-22-15.25-21.47	DRILLING FIRM / OPERATOR: NEAS / JL	DRILL RIG: CME 45B	STATION / OFFSET: 889+27, 54' LT.	EXPLORATION ID B-022-0-23
TYPE: SUBGRADE	SAMPLING FIRM / LOGGER: NEAS / JL	HAMMER: CME AUTOMATIC	ALIGNMENT: CLP_US22	
PID: SFN:	DRILLING METHOD: 4.00" FA	CALIBRATION DATE: 1/24/22	ELEVATION: 1225.4 (MSL) EOB: 7.5 ft.	PAGE 1 OF 1
START: 8/1/23 END: 8/1/23	SAMPLING METHOD: SPT	ENERGY RATIO (%): 72.6	LAT / LONG: 40.279409, -81.011691	

MATERIAL DESCRIPTION AND NOTES	ELEV. 1225.4	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
11.0" ASPHALT (DRILLERS DESCRIPTION)	1224.5																		
VERY STIFF TO HARD, BROWN AND DARK GRAY, **CLAY**, "AND" SILT, LITTLE SAND, TRACE GRAVEL, DAMP	1220.9	1 2 3 4	3 4 5	11	67	SS-1	3.50	6	7	6	45	36	42	23	19	17	A-7-6 (12)	820	
			4 4 4	10	67	SS-2	4.25	-	-	-	-	-	-	-	-	17	A-7-6 (V)	-	
HARD, BROWN, **SILT AND CLAY**, SOME SAND, TRACE GRAVEL, DAMP	1217.9	5 6 7	6 6 7	16	56	SS-3	4.50	1	12	12	48	27	33	21	12	14	A-6a (9)	-	
		EOB	5 7 7	17	72	SS-4	4.50	-	-	-	-	-	-	-	-	15	A-6a (V)	-	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING. HOLE DID NOT CAVE. DRILLED AS STAKED.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLACED 0.5 BAG ASPHALT PATCH; POURED 1 BAG HOLE PLUG; SHOVELED SOIL CUTTINGS

STANDARD ODOT LOG W/ SULFATES (8.5 X 11) - OH DOT.GDT - 10/18/24 12:22 - X:\1\ACTIVE PROJECTS\ACTIVE SOIL PROJECTS\HAS-22-15.25-21.47\GINT FILES\HAS-22-15.25-21.47.GPJ

PROJECT: HAS-22-15.25-21.47	DRILLING FIRM / OPERATOR: NEAS / JL	DRILL RIG: CME 45B	STATION / OFFSET: 892+49, 41' RT.
TYPE: SUBGRADE	SAMPLING FIRM / LOGGER: NEAS / JL	HAMMER: CME AUTOMATIC	ALIGNMENT: CLP_US22
PID: SFN:	DRILLING METHOD: 4.00" FA	CALIBRATION DATE: 1/24/22	ELEVATION: 1227.1 (MSL) EOB: 7.5 ft.
START: 8/15/23 END: 8/15/23	SAMPLING METHOD: SPT	ENERGY RATIO (%): 72.6	LAT / LONG: 40.279788, -81.010591

EXPLORATION ID B-023-0-23

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MATERIAL DESCRIPTION AND NOTES	ELEV. 1227.1	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
5.5" ASPHALT AND 7.0" CONCRETE (DRILLERS DESCRIPTION)	1226.1																		
HARD, BROWN AND BLACK, **SILT AND CLAY**, SOME SAND, LITTLE GRAVEL, COAL FRAGMENTS, DAMP		1																	
		2	2 3 4	8	61	SS-1	4.25	12	14	11	32	31	40	25	15	19	A-6a (8)	-	
		3	3 3 4	8	56	SS-2	4.50	20	12	13	31	24	37	23	14	17	A-6a (6)	-	
		4	4 4 6	12	72	SS-3	4.50	-	-	-	-	-	-	-	-	15	A-6a (V)	-	
		5	5 6 7	16	78	SS-4	4.50	-	-	-	-	-	-	-	-	14	A-6a (V)	-	
	1219.6	EOB																	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING. HOLE DID NOT CAVE. DRILLED AS STAKED.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLACED 0.5 BAG ASPHALT PATCH; POURED 1 BAG HOLE PLUG; SHOVELED SOIL CUTTINGS

STANDARD ODOT LOG W/ SULFATES (8.5 X 11) - OH DOT.GDT - 10/18/24 12:22 - X:\1\ACTIVE PROJECTS\ACTIVE SOIL PROJECTS\HAS-22-15.25-21.47\GINT FILES\HAS-22-15.25-21.47.GPJ

PROJECT: HAS-22-15.25-21.47	DRILLING FIRM / OPERATOR: NEAS / JL	DRILL RIG: CME 55T	STATION / OFFSET: 896+72, 27' LT.
TYPE: SUBGRADE	SAMPLING FIRM / LOGGER: NEAS / JL	HAMMER: CME AUTOMATIC	ALIGNMENT: CLP_US22
PID: SFN:	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 1/24/22	ELEVATION: 1235.1 (MSL) EOB: 6.3 ft.
START: 9/7/23 END: 9/7/23	SAMPLING METHOD: SPT	ENERGY RATIO (%): 63.4	LAT / LONG: 40.280639, -81.009515

EXPLORATION ID B-024-0-23

PAGE 1 OF 1

MATERIAL DESCRIPTION AND NOTES	ELEV. 1235.1	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
7.0" ASPHALT AND 7.0" CONCRETE (DRILLERS DESCRIPTION)	1233.9	TR																	
SHALE, DARK GRAY, SEVERELY WEATHERED, VERY WEAK, FISSILE.		1	5 13 50/3"	-	47	SS-1	-	-	-	-	-	-	-	-	-	-	Rock (V)	-	
		2																	
		3	11 50/5"	-	73	SS-2	-	-	-	-	-	-	-	-	-	-	Rock (V)	-	
		4																	
		5	50/5"	-	100	SS-3	-	-	-	-	-	-	-	-	-	-	Rock (V)	-	
	1228.8	EOB 6	50/3"	-	100	SS-4	-	-	-	-	-	-	-	-	-	-	Rock (V)	-	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING. HOLE DID NOT CAVE. OFFSET 8' NORTH.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLACED 0.5 BAG ASPHALT PATCH; SHOVELED SOIL CUTTINGS

STANDARD ODOT LOG W/ SULFATES (8.5 X 11) - OH DOT.GDT - 10/18/24 12:22 - X:\1ACTIVE PROJECTS\ACTIVE SOIL PROJECTS\HAS-22-15.25-21.47\GINT FILES\HAS-22-15.25-21.47.GPJ

PROJECT: HAS-22-15.25-21.47	DRILLING FIRM / OPERATOR: NEAS / JL	DRILL RIG: CME 45B	STATION / OFFSET: 900+37, 39' RT.
TYPE: SUBGRADE	SAMPLING FIRM / LOGGER: NEAS / JL	HAMMER: CME AUTOMATIC	ALIGNMENT: CLP_US22
PID: SFN:	DRILLING METHOD: 4.00" FA	CALIBRATION DATE: 1/24/22	ELEVATION: 1240.5 (MSL) EOB: 7.5 ft.
START: 8/15/23 END: 8/15/23	SAMPLING METHOD: SPT	ENERGY RATIO (%): 72.6	LAT / LONG: 40.281020, -81.008280

EXPLORATION ID B-025-0-23

PAGE 1 OF 1

MATERIAL DESCRIPTION AND NOTES	ELEV. 1240.5	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
6.0" ASPHALT AND 7.0" CONCRETE (DRILLERS DESCRIPTION)	1239.4																		
VERY STIFF, BROWN AND DARK GRAY, **SILT AND CLAY**, SOME SAND, LITTLE GRAVEL, DAMP	1237.5		1 3 4	8	67	SS-1	4.00	13	11	16	29	31	35	21	14	18	A-6a (7)	-	
HARD, BROWN AND ORANGISH BROWN, **SANDY SILT**, LITTLE GRAVEL, LITTLE CLAY, IRON STAINING, RELIC ROCK, DAMP	1236.0	TR	3 6 14	24	56	SS-2	4.50	19	17	12	35	17	33	23	10	11	A-4a (3)	-	
SHALE, BROWN AND LIGHT BROWN, SEVERELY WEATHERED, VERY WEAK, FISSILE.			16 35 42	93	56	SS-3	-	-	-	-	-	-	-	-	-	10	Rock (V)	-	
	1233.0	EOB	18 37 42	96	61	SS-4	-	-	-	-	-	-	-	-	-	9	Rock (V)	-	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING. HOLE DID NOT CAVE. DRILLED AS STAKED.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLACED 0.5 BAG ASPHALT PATCH; POURED 1 BAG HOLE PLUG; SHOVELED SOIL CUTTINGS

STANDARD ODOT LOG W/ SULFATES (8.5 X 11) - OH DOT.GDT - 10/18/24 12:22 - X:\1 ACTIVE PROJECTS\ACTIVE SOIL PROJECTS\HAS-22-15.25-21.47\GINT FILES\HAS-22-15.25-21.47.GPJ

PROJECT: HAS-22-15.25-21.47	DRILLING FIRM / OPERATOR: NEAS / JL	DRILL RIG: CME 45B	STATION / OFFSET: 904+19, 49' LT.
TYPE: SUBGRADE	SAMPLING FIRM / LOGGER: NEAS / JL	HAMMER: CME AUTOMATIC	ALIGNMENT: CLP_US22
PID: SFN:	DRILLING METHOD: 4.00" FA	CALIBRATION DATE: 1/24/22	ELEVATION: 1245.4 (MSL) EOB: 7.5 ft.
START: 8/1/23 END: 8/1/23	SAMPLING METHOD: SPT	ENERGY RATIO (%): 72.6	LAT / LONG: 40.281731, -81.007245

EXPLORATION ID B-026-0-23

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)	SO4 ppm	BACK FILL
11.0" ASPHALT (DRILLERS DESCRIPTION)	1245.4 1244.5																		
MEDIUM STIFF TO HARD, GRAY, **SANDY SILT**, LITTLE TO SOME CLAY, TRACE TO LITTLE GRAVEL, SS-1 CONTAINS NO INTACT SOIL FOR HP READINGS, DAMP	1240.9	1 2 3 4	3 3 4	8	61	SS-1	-	14	14	31	22	19	27	19	8	7	A-4a (1)	600	
			3 4 6	12	67	SS-2	4.50	8	6	13	49	24	31	21	10	16	A-4a (8)	-	
LOOSE, GRAY, **COARSE AND FINE SAND**, LITTLE SILT, LITTLE GRAVEL, TRACE CLAY, DAMP	1239.4	5	3 3 4	8	44	SS-3	-	-	-	-	-	-	-	-	-	13	A-3a (V)	-	
HARD, GRAY, **SANDY SILT**, LITTLE CLAY, TRACE GRAVEL, DAMP	1237.9	6 7 EOB	3 4 5	11	56	SS-4	4.50	-	-	-	-	-	-	-	-	10	A-4a (V)	-	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING. HOLE DID NOT CAVE. DRILLED AS STAKED.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLACED 0.5 BAG ASPHALT PATCH; POURED 1 BAG HOLE PLUG; SHOVELED SOIL CUTTINGS

STANDARD ODOT LOG W/ SULFATES (8.5 X 11) - OH DOT.GDT - 10/18/24 12:22 - X:\1ACTIVE PROJECTS\ACTIVE SOIL PROJECTS\HAS-22-15.25-21.47\GINT FILES\HAS-22-15.25-21.47.GPJ

PROJECT: HAS-22-15.25-21.47	DRILLING FIRM / OPERATOR: NEAS / JL	DRILL RIG: CME 45B	STATION / OFFSET: 908+20, 38' RT.
TYPE: SUBGRADE	SAMPLING FIRM / LOGGER: NEAS / JL	HAMMER: CME AUTOMATIC	ALIGNMENT: CLP_US22
PID: SFN:	DRILLING METHOD: 4.00" FA	CALIBRATION DATE: 1/24/22	ELEVATION: 1252.3 (MSL) EOB: 7.5 ft.
START: 8/15/23 END: 8/15/23	SAMPLING METHOD: SPT	ENERGY RATIO (%): 72.6	LAT / LONG: 40.282087, -81.005857

EXPLORATION ID B-027-0-23

PAGE 1 OF 1

MATERIAL DESCRIPTION AND NOTES	ELEV. 1252.3	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
5.0" ASPHALT AND 8.0" CONCRETE (DRILLERS DESCRIPTION)	1251.2																		
SOFT TO HARD, BROWNISH GRAY AND DARK GRAY, **SANDY SILT**, SOME TO "AND" GRAVEL, LITTLE CLAY, SS-1 THROUGH SS-3 CONTAIN NO INTACT SOIL FOR HP READINGS, DAMP		1 2 3 4 5 6 7	1 1 2	4	72	SS-1	-	37	12	14	23	14	31	21	10	14	A-4a (0)	-	
			1 3 3	7	56	SS-2	-	-	-	-	-	-	-	-	-	16	A-4a (V)	-	
			4 4 5	11	61	SS-3	-	29	13	11	34	13	31	21	10	9	A-4a (2)	-	
			4 6 7	16	67	SS-4	4.25	-	-	-	-	-	-	-	-	18	A-4a (V)	-	
	1244.8	EOB																	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING. HOLE DID NOT CAVE. DRILLED AS STAKED.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLACED 0.5 BAG ASPHALT PATCH; POURED 1 BAG HOLE PLUG; SHOVELED SOIL CUTTINGS

STANDARD ODOT LOG W/ SULFATES (8.5 X 11) - OH DOT.GDT - 10/18/24 12:22 - X:\1ACTIVE PROJECTS\ACTIVE SOIL PROJECTS\HAS-22-15.25-21.47\GINT FILES\HAS-22-15.25-21.47.GPJ

STANDARD ODOT LOG W/ SULFATES (8.5 X 11) - OH DOT.GDT - 10/18/24 12:22 - X:\1ACTIVE PROJECTS\ACTIVE SOIL PROJECTS\HAS-22-15.25-21.47\GINT FILES\HAS-22-15.25-21.47.GPJ

PROJECT: HAS-22-15.25-21.47	DRILLING FIRM / OPERATOR: NEAS / JL	DRILL RIG: CME 45B	STATION / OFFSET: 912+02, 48' LT.
TYPE: SUBGRADE	SAMPLING FIRM / LOGGER: NEAS / JL	HAMMER: CME AUTOMATIC	ALIGNMENT: CLP_US22
PID: SFN:	DRILLING METHOD: 4.00" FA	CALIBRATION DATE: 1/24/22	ELEVATION: 1258.0 (MSL) EOB: 6.2 ft.
START: 8/1/23 END: 8/1/23	SAMPLING METHOD: SPT	ENERGY RATIO (%): 72.6	LAT / LONG: 40.282855, -81.004853

EXPLORATION ID B-028-0-23

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)	SO4 ppm	BACK FILL
11.5" ASPHALT (DRILLERS DESCRIPTION)	1258.0 1257.0																		
HARD, BROWN, **SILT AND CLAY**, LITTLE SAND, TRACE TO LITTLE GRAVEL AND STONE FRAGMENTS, DAMP		1 2 3 4 5	2 3 4 3 3 5	8	56	SS-1	4.25	3	3	11	54	29	32	21	11	16	A-6a (8)	260	
				10	67	SS-2	4.25	-	-	-	-	-	-	-	-	15	A-6a (V)	-	
	1252.5	TR	24 28 34	75	50	SS-3	4.25	-	-	-	-	-	-	-	-	8	A-6a (V)	-	
SILTSTONE, GRAY, HIGHLY WEATHERED, WEAK.	1251.8	EOB 6	50/2"	-	100	SS-4	-	-	-	-	-	-	-	-	-	5	Rock (V)	-	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING. HOLE DID NOT CAVE. DRILLED AS STAKED.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLACED 0.5 BAG ASPHALT PATCH; POURED 1 BAG HOLE PLUG; SHOVELED SOIL CUTTINGS

PROJECT: HAS-22-15.25-21.47	DRILLING FIRM / OPERATOR: NEAS / JL	DRILL RIG: CME 45B	STATION / OFFSET: 915+96, 40' RT.
TYPE: SUBGRADE	SAMPLING FIRM / LOGGER: NEAS / JL	HAMMER: CME AUTOMATIC	ALIGNMENT: CLP_US22
PID: SFN:	DRILLING METHOD: 4.00" FA	CALIBRATION DATE: 1/24/22	ELEVATION: 1261.6 (MSL) EOB: 6.3 ft.
START: 8/15/23 END: 8/15/23	SAMPLING METHOD: SPT	ENERGY RATIO (%): 72.6	LAT / LONG: 40.283209, -81.003489

EXPLORATION ID B-029-0-23

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)	SO4 ppm	BACK FILL
3.0" ASPHALT AND 10.0" CONCRETE (DRILLERS DESCRIPTION)	1261.6																		
	1260.5																		
STIFF, BROWN, **SILT AND CLAY**, LITTLE SAND, LITTLE GRAVEL, DAMP		1	1 3 3	7	22	SS-1	1.50	19	10	8	30	33	35	20	15	9	A-6a (8)	-	
	1258.6	2																	
STIFF TO VERY STIFF, BLUEISH GRAY, **SILT AND CLAY**, SOME SAND, LITTLE GRAVEL, CONTAINS NO INTACT SOIL FOR HP READINGS, RELIC ROCK, DAMP		3	3 5 6	13	56	SS-2	-	16	11	12	37	24	34	21	13	17	A-6a (6)	-	
		4	5 7 9	19	50	SS-3	-	-	-	-	-	-	-	-	-	14	A-6a (V)	-	
	1255.6	5																	
SHALE, BLUEISH GRAY, HIGHLY WEATHERED, WEAK.	1255.3	TR EOB 6	50/3"	-	100	SS-4	-	-	-	-	-	-	-	-	-	-	Rock (V)	-	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING. HOLE DID NOT CAVE. DRILLED AS STAKED.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLACED 0.5 BAG ASPHALT PATCH; POURED 1 BAG HOLE PLUG; SHOVELED SOIL CUTTINGS

STANDARD ODOT LOG W/ SULFATES (8.5 X 11) - OH DOT.GDT - 10/18/24 12:22 - X:\1ACTIVE PROJECTS\ACTIVE SOIL PROJECTS\HAS-22-15.25-21.47\GINT FILES\HAS-22-15.25-21.47.GPJ

PROJECT: HAS-22-15.25-21.47	DRILLING FIRM / OPERATOR: NEAS / JL	DRILL RIG: CME 55T	STATION / OFFSET: 919+95, 33' LT.
TYPE: SUBGRADE	SAMPLING FIRM / LOGGER: NEAS / JL	HAMMER: CME AUTOMATIC	ALIGNMENT: CLP_US22
PID: SFN:	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 1/24/22	ELEVATION: 1259.1 (MSL) EOB: 7.5 ft.
START: 9/7/23 END: 9/7/23	SAMPLING METHOD: SPT	ENERGY RATIO (%): 63.4	LAT / LONG: 40.283996, -81.002433

EXPLORATION ID B-030-0-23

PAGE 1 OF 1

MATERIAL DESCRIPTION AND NOTES	ELEV. 1259.1	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
6.0" ASPHALT AND 8.0" CONCRETE (DRILLERS DESCRIPTION)	1257.9																		
VERY STIFF TO HARD, BROWN AND GRAY, **SILT AND CLAY**, LITTLE TO SOME SAND, LITTLE TO SOME GRAVEL, DAMP		1	6 5 6	12	56	SS-1	4.00	21	13	11	38	17	35	23	12	13	A-6a (5)	867	
		2	3 4 4	8	67	SS-2	4.00	13	11	8	36	32	36	21	15	16	A-6a (9)	-	
		3	2 3 4	7	67	SS-3	4.25	-	-	-	-	-	-	-	-	21	A-6a (V)	-	
		4	3 3 4	7	72	SS-4	4.25	-	-	-	-	-	-	-	-	14	A-6a (V)	-	
	1251.6	5 EOB																	
		6																	
		7																	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING. HOLE DID NOT CAVE. DRILLED AS STAKED.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLACED 0.5 BAG ASPHALT PATCH; SHOVELED SOIL CUTTINGS

STANDARD ODOT LOG W/ SULFATES (8.5 X 11) - OH DOT.GDT - 10/18/24 12:22 - X:\1\ACTIVE PROJECTS\ACTIVE SOIL PROJECTS\HAS-22-15.25-21.47\GINT FILES\HAS-22-15.25-21.47.GPJ

PROJECT: HAS-22-15.25-21.47	DRILLING FIRM / OPERATOR: NEAS / JL	DRILL RIG: CME 45B	STATION / OFFSET: 923+74, 24' RT.
TYPE: SUBGRADE	SAMPLING FIRM / LOGGER: NEAS / JL	HAMMER: CME AUTOMATIC	ALIGNMENT: CLP_US22
PID: SFN:	DRILLING METHOD: 4.00" FA	CALIBRATION DATE: 1/24/22	ELEVATION: 1251.6 (MSL) EOB: 7.5 ft.
START: 8/15/23 END: 8/15/23	SAMPLING METHOD: SPT	ENERGY RATIO (%): 72.6	LAT / LONG: 40.284395, -81.001160

EXPLORATION ID B-031-0-23

PAGE 1 OF 1

MATERIAL DESCRIPTION AND NOTES	ELEV. 1251.6	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
4.0" ASPHALT AND 9.0" CONCRETE (DRILLERS DESCRIPTION)	1250.5																		
VERY STIFF TO HARD, BROWN AND GRAY, **SILT AND CLAY**, SOME SAND, TRACE GRAVEL, DAMP		1 2 3 4 5 6 7	3 3 5 4 3 5 4 7 8 5 7 9	10 10 18 19	56 61 72 78	SS-1 SS-2 SS-3 SS-4	2.50 4.50 4.50 4.50	10 6 - -	8 15 - -	13 12 - -	39 43 - -	30 24 - -	33 34 - -	22 21 - -	11 13 - -	18 16 18 19	A-6a (7) A-6a (8) A-6a (V) A-6a (V)	- - - -	
	1244.1	EOB																	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING. HOLE DID NOT CAVE. DRILLED AS STAKED.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLACED 0.5 BAG ASPHALT PATCH; POURED 1 BAG HOLE PLUG; SHOVELED SOIL CUTTINGS

STANDARD ODOT LOG W/ SULFATES (8.5 X 11) - OH DOT.GDT - 10/18/24 12:22 - X:\1ACTIVE PROJECTS\ACTIVE SOIL PROJECTS\HAS-22-15.25-21.47\GINT FILES\HAS-22-15.25-21.47.GPJ

PROJECT: HAS-22-15.25-21.47	DRILLING FIRM / OPERATOR: NEAS / JL	DRILL RIG: CME 45B	STATION / OFFSET: 926+17, 62' LT.
TYPE: SUBGRADE	SAMPLING FIRM / LOGGER: NEAS / JL	HAMMER: CME AUTOMATIC	ALIGNMENT: CLP_US22
PID: SFN:	DRILLING METHOD: 4.00" FA	CALIBRATION DATE: 1/24/22	ELEVATION: 1243.7 (MSL) EOB: 7.5 ft.
START: 8/2/23 END: 8/2/23	SAMPLING METHOD: SPT	ENERGY RATIO (%): 72.6	LAT / LONG: 40.284943, -81.000564

EXPLORATION ID B-032-0-23

PAGE 1 OF 1

MATERIAL DESCRIPTION AND NOTES	ELEV. 1243.7	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
8.5" ASPHALT (DRILLERS DESCRIPTION)	1243.0																		
VERY STIFF TO HARD, BROWN AND GRAY, **SILT AND CLAY**, SOME SAND, TRACE GRAVEL, DAMP	1239.2	1 2 3 4	2 2 3	6	56	SS-1	4.00	7	6	17	28	42	34	21	13	9	A-6a (8)	720	
			2 3 3	7	61	SS-2	4.25	-	-	-	-	-	-	-	-	14	A-6a (V)	-	
VERY STIFF, BROWN AND GRAY, **CLAY**, SOME SILT, TRACE SAND, TRACE GRAVEL, DAMP	1236.2	5 6 7 EOB	2 2 3	6	61	SS-3	4.00	1	2	8	29	60	51	27	24	20	A-7-6 (16)	-	
			2 3 3	7	67	SS-4	4.00	-	-	-	-	-	-	-	-	27	A-7-6 (V)	-	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING. HOLE DID NOT CAVE. DRILLED AS STAKED.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLACED 0.5 BAG ASPHALT PATCH; POURED 1 BAG HOLE PLUG; SHOVELED SOIL CUTTINGS

STANDARD ODOT LOG W/ SULFATES (8.5 X 11) - OH DOT.GDT - 10/18/24 12:23 - X:\1\ACTIVE PROJECTS\ACTIVE SOIL PROJECTS\HAS-22-15.25-21.47\GINT FILES\HAS-22-15.25-21.47.GPJ

STANDARD ODOT LOG W/ SULFATES (8.5 X 11) - OH DOT.GDT - 10/18/24 12:23 - X:\1ACTIVE PROJECTS\ACTIVE SOIL PROJECTS\HAS-22-15.25-21.47\GINT FILES\HAS-22-15.25-21.47.GPJ

PROJECT: HAS-22-15.25-21.47	DRILLING FIRM / OPERATOR: NEAS / CA	DRILL RIG: CME 55T	STATION / OFFSET: 930+56, 25' RT.	EXPLORATION ID B-033-0-23
TYPE: CULVERT	SAMPLING FIRM / LOGGER: NEAS / JL	HAMMER: CME AUTOMATIC	ALIGNMENT: CLP_US22	
PID: SFN:	DRILLING METHOD: 3.25" HSA / NQ2	CALIBRATION DATE: 1/24/22	ELEVATION: 1226.6 (MSL) EOB: 51.5 ft.	PAGE 1 OF 2
START: 8/31/23 END: 8/31/23	SAMPLING METHOD: SPT / NQ2	ENERGY RATIO (%): 63.4	LAT / LONG: 40.285274, -80.999015	

MATERIAL DESCRIPTION AND NOTES	ELEV. 1226.6	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
8.0" ASPHALT AND 5.0" CONCRETE (DRILLERS DESCRIPTION)	1225.5																		
HARD, BROWN AND GRAY, **SILTY CLAY**, SOME SAND, TRACE TO LITTLE GRAVEL, DAMP			2 3 3	6	22	SS-1	4.50	-	-	-	-	-	-	-	-	16	A-6b (V)	-	
			3 3 4	7	50	SS-2	4.25	4	10	14	36	36	40	22	18	15	A-6b (11)	2500	
			4 5 4	10	39	SS-3	4.25	18	11	14	26	31	39	22	17	14	A-6b (7)	-	
	1218.6		5 5 6	12	33	SS-4	4.25	-	-	-	-	-	-	-	-	15	A-6b (V)	-	
VERY STIFF TO HARD, GRAY AND BROWN, **SILT AND CLAY**, LITTLE TO SOME SAND, LITTLE TO SOME GRAVEL, DAMP			5 13 6	20	50	SS-5	3.00	27	10	10	25	28	35	21	14	14	A-6a (5)	-	
			2 4 5	10	78	SS-6	3.25	-	-	-	-	-	-	-	-	20	A-6a (V)	-	
			2 4 8	13	83	SS-7	3.25	-	-	-	-	-	-	-	-	19	A-6a (V)	-	
			4 8 11	20	89	SS-8	4.50	20	12	11	30	27	36	21	15	13	A-6a (6)	-	
	1206.1		5 8 12	21	78	SS-9	4.50	-	-	-	-	-	-	-	-	16	A-6a (V)	-	
VERY STIFF, BROWN AND GRAY, **SILTY CLAY**, SOME SAND, LITTLE GRAVEL, DAMP			8 5 8	14	72	SS-10	4.00	16	11	10	30	33	37	20	17	16	A-6b (8)	-	
			7 8 11	20	50	SS-11	4.00	-	-	-	-	-	-	-	-	15	A-6b (V)	-	
	1201.1	TR																	
SILTSTONE, GRAY, MODERATELY WEATHERED, SLIGHTLY STRONG.			49 50/1"	-	43	SS-12	-	-	-	-	-	-	-	-	-	5	Rock (V)	-	
			50/5"	-	80	SS-13	-	-	-	-	-	-	-	-	-	12	Rock (V)	-	

PID:	SFN:	PROJECT: HAS-22-15.25-21.47	STATION / OFFSET: 930+56, 25' RT.	START: 8/31/23	END: 8/31/23	PG 2 OF 2	B-033-0-23

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)	SO4 ppm	BACK FILL
SILTSTONE, GRAY, MODERATELY WEATHERED, SLIGHTLY STRONG. *(continued)* @31.0'; SS-14 CONTAINS NO RECOVERY	1196.6	31	50/2"	-	0	SS-14	-	-	-	-	-	-	-	-	-	-		-	
COAL, BLACK, HIGHLY WEATHERED, VERY WEAK, LAMINATED, BEDDING DISCONTINUITIES: LOW ANGLE, HIGHLY FRACTURED, NARROW, SLIGHTLY ROUGH, LAMINATED, POOR SURFACE CONDITION; RQD 0%, REC 100%.	1195.1	32																	
SHALE, GRAY AND DARK GRAY, HIGHLY WEATHERED, VERY WEAK, VERY THIN BEDDED, CORED THROUGH METAL WIRE; EVIDENCE OF MINE. CONTAINS 0.5" CLAY SEAMS, BEDDING DISCONTINUITIES: LOW ANGLE, FRACTURED, OPEN TO NARROW, SLIGHTLY ROUGH, BLOCKY/DISTURBED/SEAMY, VERY POOR SURFACE CONDITION; RQD 17%, REC 83%.	1192.8	33																	
DRILLER NOTED ~2.0' VOID FROM 36.9'-38.9'. POSSIBLE MINE SHAFT	1189.7	34																	
LIMESTONE, GRAY, MODERATELY WEATHERED, STRONG, THIN BEDDED, CONTAINS INTERBEDDED 0.25"-0.5" CLAY SEAMS, BEDDING DISCONTINUITIES: LOW ANGLE, JOINT DISCONTINUITIES: HIGH ANGLE FROM 38.9-39.4', 40.8-41.3', 45.9-46.4', AND 47.0-47.3', FRACTURED TO MODERATELY FRACTURED, OPEN TO NARROW, SLIGHTLY ROUGH, VERY BLOCKY, POOR SURFACE CONDITION; RQD 30%, REC 80%.	1187.7	35	14		72	NQ2-1											CORE		
		36																	
		37																	
		38																	
		39																	
		40																	
		41																	
		42																	
		43																	
		44																	
		45																	
		46																	
		47	30		77	NQ2-2											CORE		
		48																	
		49																	
		50																	
	1175.1	51 EOB																	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING. HOLE DID NOT CAVE. DRILLED AS STAKED.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLACED 0.5 BAG ASPHALT PATCH; POURED 3 BAG HOLE PLUG; SHOVELED SOIL CUTTINGS

STANDARD ODOT LOG W/ SULFATES (8.5 X 11) - OH DOT.GDT - 10/18/24 12:23 - X:\1ACTIVE PROJECTS\ACTIVE SOIL PROJECTS\HAS-22-15.25-21.47\GINT FILES\HAS-22-15.25-21.47.GPJ

STANDARD ODOT LOG W/ SULFATES (8.5 X 11) - OH DOT.GDT - 10/18/24 12:23 - X:\1ACTIVE PROJECTS\ACTIVE SOIL PROJECTS\HAS-22-15.25-21.47\GINT FILES\HAS-22-15.25-21.47.GPJ

PROJECT: HAS-22-15.25-21.47 | DRILLING FIRM / OPERATOR: NEAS / JL | DRILL RIG: CME 45B | STATION / OFFSET: 930+39, 52' LT. | EXPLORATION ID B-033-1-23

TYPE: CULVERT | SAMPLING FIRM / LOGGER: NEAS / JL | HAMMER: CME AUTOMATIC | ALIGNMENT: CLP_US22

PID: | SFN: | DRILLING METHOD: 3.25" HSA / NQ2 | CALIBRATION DATE: 1/24/22 | ELEVATION: 1227.1 (MSL) EOB: 41.7 ft. | PAGE 1 OF 2

START: 9/5/23 END: 9/5/23 | SAMPLING METHOD: SPT / NQ2 | ENERGY RATIO (%): 72.6 | COORD: 229074.6406 N, 2387246.2840 E

MATERIAL DESCRIPTION AND NOTES	ELEV. 1227.1	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
7.0" ASPHALT AND 6.0" CONCRETE (DRILLERS DESCRIPTION)	1226.0																		
HARD, BROWN, **SANDY SILT**, LITTLE CLAY, LITTLE GRAVEL, DAMP	1224.1	1	5 5 4	11	67	SS-1	4.50	12	15	19	40	14	30	22	8	11	A-4a (4)	360	
VERY STIFF TO HARD, BROWN AND GRAY, **SILTY CLAY**, LITTLE SAND, TRACE GRAVEL, DAMP	1219.1	2	3 4 4	10	72	SS-2	3.50	8	8	9	34	41	38	22	16	17	A-6b (10)	-	
		3	2 3 4	8	72	SS-3	4.50	-	-	-	-	-	-	-	-	16	A-6b (V)	-	
		4	2 4 4	10	78	SS-4	4.50	8	8	11	36	37	37	21	16	18	A-6b (10)	-	
		5																	
		6																	
		7																	
		8																	
VERY STIFF TO HARD, BROWN AND GRAY, **SILT AND CLAY**, SOME SAND, TRACE TO LITTLE GRAVEL, DAMP		9	2 3 6	11	83	SS-5	3.50	-	-	-	-	-	-	-	-	17	A-6a (V)	-	
		10																	
		11	2 3 5	10	72	SS-6	3.75	15	12	16	32	25	35	21	14	16	A-6a (6)	-	
		12																	
		13																	
		14	3 6 20	31	72	SS-7	3.75	-	-	-	-	-	-	-	-	15	A-6a (V)	-	
		15																	
		16																	
		17	4 9 16	30	61	SS-8	4.00	-	-	-	-	-	-	-	-	17	A-6a (V)	-	
		18																	
		19	4 6 11	21	78	SS-9	4.50	2	4	18	48	28	34	21	13	15	A-6a (9)	-	
		20																	
		21																	
		22	24 29 18	57	89	SS-10	4.50	-	-	-	-	-	-	-	-	10	A-6a (V)	-	
		23																	
		24	21 28 31	71	61	SS-11	4.50	-	-	-	-	-	-	-	-	10	A-6a (V)	-	
		25																	
		26																	
		27	5 16 12	34	72	SS-12	4.50	-	-	-	-	-	-	-	-	12	A-6a (V)	-	
		28																	
		29	14 14 16	36	61	SS-13	4.50	-	-	-	-	-	-	-	-	12	A-6a (V)	-	

PID:	SFN:	PROJECT: HAS-22-15.25-21.47	STATION / OFFSET: 930+39, 52' LT.	START: 9/5/23	END: 9/5/23	PG 2 OF 2	B-033-1-23

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)	SO4 ppm	BACK FILL
VERY STIFF TO HARD, BROWN AND GRAY, **SILT AND CLAY**, SOME SAND, TRACE TO LITTLE GRAVEL, DAMP *(continued)* SS-14 AND SS-15 CONTAIN RELIC SHALE ROCK STRUCTURE	1197.1	31	24 25 36	74	67	SS-14	4.50	-	-	-	-	-	-	-	-	10	A-6a (V)	-	
		32																	
		33																	
		34	22 27 36	76	67	SS-15	4.50	-	-	-	-	-	-	-	-	9	A-6a (V)	-	
	1192.1	TR 35																	
COAL, BLACK, SEVERELY WEATHERED, VERY WEAK.	1190.4	36	27 50/2"	-	75	SS-16	-	-	-	-	-	-	-	-	-	-	Rock (V)	-	
SHALE, DARK GRAY, MODERATELY WEATHERED, WEAK, LAMINATED, FISSILE, SILTY, BEDDING DISCONTINUITIES: LOW ANGLE, HIGHLY FRACTURED, OPEN, SLIGHTLY ROUGH, BLOCKY/DISTURBED/SEAMY, FAIR SURFACE CONDITION; RQD 0%, REC 100%.	1189.9	37																	
		38																	
		39	75		100	NQ2-1											CORE		
		40																	
LIMESTONE, GRAY, SLIGHTLY WEATHERED, STRONG, VERY FINE TO FINE GRAINED, THIN BEDDED, BEDDING DISCONTINUITIES: LOW ANGLE, JOINT DISCONTINUITIES: HIGH ANGLE FROM 40.7-41.2', FRACTURED TO MODERATELY FRACTURED, NARROW, SLIGHTLY TO VERY ROUGH, VERY BLOCKY, GOOD SURFACE CONDITION; RQD 83%, REC 100%.	1185.4	EOB 41																	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING. HOLE DID NOT CAVE. DRILLED AS STAKED.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLACED 0.5 BAG ASPHALT PATCH; POURED 3 BAG HOLE PLUG; SHOVELED SOIL CUTTINGS

STANDARD ODOT LOG W/ SULFATES (8.5 X 11) - OH DOT.GDT - 10/18/24 12:23 - X:\1ACTIVE PROJECTS\ACTIVE SOIL PROJECTS\HAS-22-15.25-21.47\GINT FILES\HAS-22-15.25-21.47.GPJ

PROJECT: HAS-22-15.25-21.47	DRILLING FIRM / OPERATOR: NEAS / JL	DRILL RIG: CME 45B	STATION / OFFSET: 935+52, 48' LT.	EXPLORATION ID B-034-0-23
TYPE: SUBGRADE	SAMPLING FIRM / LOGGER: NEAS / JL	HAMMER: CME AUTOMATIC	ALIGNMENT: CLP_US22	
PID: SFN:	DRILLING METHOD: 4.00" FA	CALIBRATION DATE: 1/24/22	ELEVATION: 1206.8 (MSL) EOB: 6.2 ft.	PAGE 1 OF 1
START: 8/2/23 END: 8/2/23	SAMPLING METHOD: SPT	ENERGY RATIO (%): 72.6	LAT / LONG: 40.286239, -80.997678	

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)	SO4 ppm	BACK FILL
10.5" ASPHALT (DRILLERS DESCRIPTION)	1206.8 1205.9																		
HARD, BROWN AND GRAY, **SILTY CLAY**, TRACE SAND, TRACE GRAVEL, DAMP	1203.8		2 3 5	10	67	SS-1	4.25	6	4	6	39	45	39	23	16	17	A-6b (10)	3600	
HARD, BROWN AND GRAY, **SILT AND CLAY**, LITTLE TO SOME SAND, TRACE TO LITTLE GRAVEL, DAMP	1200.8		3 3 4	8	56	SS-2	4.25	3	8	14	45	30	33	20	13	20	A-6a (9)	-	
			5 5 6	13	50	SS-3	4.50	17	6	7	35	35	36	22	14	14	A-6a (9)	-	
SILTSTONE, GRAY, MODERATELY WEATHERED, SLIGHTLY STRONG.	1200.6	TR EOB	50/2"	-	50	SS-4	-	-	-	-	-	-	-	-	-	-	Rock (V)	-	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING. HOLE DID NOT CAVE. DRILLED AS STAKED.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLACED 0.5 BAG ASPHALT PATCH; POURED 1 BAG HOLE PLUG; SHOVELED SOIL CUTTINGS

STANDARD ODOT LOG W/ SULFATES (8.5 X 11) - OH DOT.GDT - 10/18/24 12:23 - X:\1ACTIVE PROJECTS\ACTIVE SOIL PROJECTS\HAS-22-15.25-21.47\GINT FILES\HAS-22-15.25-21.47.GPJ

PROJECT: HAS-22-15.25-21.47	DRILLING FIRM / OPERATOR: NEAS / JL	DRILL RIG: CME 45B	STATION / OFFSET: 940+84, 42' RT.
TYPE: SUBGRADE	SAMPLING FIRM / LOGGER: NEAS / JL	HAMMER: CME AUTOMATIC	ALIGNMENT: CLP_US22
PID: SFN:	DRILLING METHOD: 4.00" FA	CALIBRATION DATE: 1/24/22	ELEVATION: 1185.5 (MSL) EOB: 7.5 ft.
START: 8/15/23 END: 8/15/23	SAMPLING METHOD: SPT	ENERGY RATIO (%): 72.6	LAT / LONG: 40.286528, -80.996300

EXPLORATION ID B-035-0-23

PAGE 1 OF 1

MATERIAL DESCRIPTION AND NOTES	ELEV. 1185.5	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
6.0" ASPHALT AND 7.0" CONCRETE (DRILLERS DESCRIPTION)	1184.4																		
VERY STIFF TO HARD, BROWN AND GRAY, **SILT AND CLAY**, LITTLE TO SOME SAND, TRACE TO LITTLE GRAVEL, DAMP		1	2 3 4	8	61	SS-1	4.25	13	10	18	32	27	34	20	14	15	A-6a (6)	-	
		2	3 4 5	11	72	SS-2	3.50	10	11	9	31	39	38	23	15	18	A-6a (9)	-	
	1179.5	3	7 9 11	24	50	SS-3	3.75	-	-	-	-	-	-	-	-	18	A-6a (V)	-	
DENSE, GRAY, **STONE FRAGMENTS WITH SAND**, LITTLE SILT, LITTLE CLAY, DAMP	1178.0	4	8 12 14	31	33	SS-4	-	-	-	-	-	-	-	-	-	9	A-1-b (V)	-	
EOB		5																	
		6																	
		7																	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING. HOLE DID NOT CAVE. BORING OFFSET 100' EAST.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLACED 0.5 BAG ASPHALT PATCH; POURED 1 BAG HOLE PLUG; SHOVELED SOIL CUTTINGS

STANDARD ODOT LOG W/ SULFATES (8.5 X 11) - OH DOT.GDT - 10/18/24 12:23 - X:\1\ACTIVE PROJECTS\ACTIVE SOIL PROJECTS\HAS-22-15.25-21.47\GINT FILES\HAS-22-15.25-21.47.GPJ

STANDARD ODOT LOG W/ SULFATES (8.5 X 11) - OH DOT.GDT - 10/18/24 12:23 - X:\1ACTIVE PROJECTS\ACTIVE SOIL PROJECTS\HAS-22-15.25-21.47\GINT FILES\HAS-22-15.25-21.47.GPJ

PROJECT: HAS-22-15.25-21.47
TYPE: SUBGRADE
PID: SFN:
START: 8/22/23 END: 8/22/23

DRILLING FIRM / OPERATOR: NEAS / JL
SAMPLING FIRM / LOGGER: NEAS / JL
DRILLING METHOD: 4.00" FA
SAMPLING METHOD: SPT

DRILL RIG: CME 45B
HAMMER: CME AUTOMATIC
CALIBRATION DATE: 1/24/22
ENERGY RATIO (%): 72.6

STATION / OFFSET: 943+47, 24' LT.
ALIGNMENT: CLP_US22
ELEVATION: 1178.3 (MSL) EOB: 7.5 ft.
LAT / LONG: 40.287252, -80.995144

EXPLORATION ID B-036-0-23

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)	SO4 ppm	BACK FILL
4.0" ASPHALT AND 9.5" CONCRETE (DRILLERS DESCRIPTION)	1178.3																		
HARD, BROWN AND GRAY, **SILTY CLAY**, LITTLE SAND, TRACE GRAVEL, DAMP	1177.2	1	3 3 5	10	44	SS-1	4.25	3	8	11	35	43	40	22	18	21	A-6b (11)	-	
VERY STIFF TO HARD, BROWN AND GRAY, **CLAY**, SOME SILT, LITTLE SAND, TRACE GRAVEL, DAMP	1175.3	2 3 4	4 3 5	10	44	SS-2	4.00	4	7	8	34	47	41	24	17	20	A-7-6 (11)	-	
		5 6	2 3 6	11	100	SS-3	4.25	-	-	-	-	-	-	-	-	20	A-7-6 (V)	-	
	1170.8	7 EOB	3 6 6	15	100	SS-4	3.75	-	-	-	-	-	-	-	-	22	A-7-6 (V)	-	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING. HOLE DID NOT CAVE. DRILLED AS STAKED.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLACED 0.5 BAG ASPHALT PATCH; POURED 1 BAG HOLE PLUG; SHOVELED SOIL CUTTINGS

PROJECT: HAS-22-15.25-21.47	DRILLING FIRM / OPERATOR: NEAS / JL	DRILL RIG: CME 45B	STATION / OFFSET: 947+36, 24' RT.
TYPE: SUBGRADE	SAMPLING FIRM / LOGGER: NEAS / JL	HAMMER: CME AUTOMATIC	ALIGNMENT: CLP_US22
PID: SFN:	DRILLING METHOD: 4.00" FA	CALIBRATION DATE: 1/24/22	ELEVATION: 1179.7 (MSL) EOB: 7.5 ft.
START: 8/16/23 END: 8/16/23	SAMPLING METHOD: SPT	ENERGY RATIO (%): 72.6	LAT / LONG: 40.287570, -80.993798

EXPLORATION ID B-037-0-23

PAGE 1 OF 1

MATERIAL DESCRIPTION AND NOTES	ELEV. 1179.7	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
4.0" ASPHALT AND 9.0" CONCRETE (DRILLERS DESCRIPTION)	1178.6																		
HARD, BROWN AND GRAY, **SILT AND CLAY**, LITTLE TO SOME SAND, TRACE GRAVEL, DAMP		1																	
		2	2 2 3	6	67	SS-1	4.50	10	16	18	36	20	32	21	11	16	A-6a (5)	-	
		3	2 3 3	7	72	SS-2	4.50	8	9	9	37	37	39	24	15	18	A-6a (10)	-	
		4																	
		5	2 5 6	13	56	SS-3	4.50	-	-	-	-	-	-	-	-	22	A-6a (V)	-	
		6																	
		7	3 6 9	18	61	SS-4	4.50	-	-	-	-	-	-	-	-	14	A-6a (V)	-	
	1172.2	EOB																	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING. HOLE DID NOT CAVE. DRILLED AS STAKED.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLACED 0.5 BAG ASPHALT PATCH; POURED 1 BAG HOLE PLUG; SHOVELED SOIL CUTTINGS

STANDARD ODOT LOG W/ SULFATES (8.5 X 11) - OH DOT.GDT - 10/18/24 12:23 - X:\1\ACTIVE PROJECTS\ACTIVE SOIL PROJECTS\HAS-22-15.25-21.47\GINT FILES\HAS-22-15.25-21.47.GPJ

PROJECT: HAS-22-15.25-21.47	DRILLING FIRM / OPERATOR: NEAS / JL	DRILL RIG: CME 45B	STATION / OFFSET: 951+26, 50' LT.
TYPE: SUBGRADE	SAMPLING FIRM / LOGGER: NEAS / JL	HAMMER: CME AUTOMATIC	ALIGNMENT: CLP_US22
PID: SFN:	DRILLING METHOD: 4.00" FA	CALIBRATION DATE: 1/24/22	ELEVATION: 1193.1 (MSL) EOB: 6.2 ft.
START: 8/2/23 END: 8/2/23	SAMPLING METHOD: SPT	ENERGY RATIO (%): 72.6	LAT / LONG: 40.288204, -80.992646

EXPLORATION ID B-038-0-23

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)	SO4 ppm	BACK FILL
	1193.1																		
12.0" ASPHALT (DRILLERS DESCRIPTION)	1192.1																		
VERY STIFF, BROWN AND GRAY, **CLAY**, SOME SILT, LITTLE SAND, TRACE GRAVEL, DAMP		1	2 2 3	6	67	SS-1	3.25	10	6	5	30	49	42	24	18	23	A-7-6 (12)	3200	
	1188.6	2	2 3 3	7	78	SS-2	4.00	-	-	-	-	-	-	-	-	16	A-7-6 (V)	-	
HARD, BROWN AND GRAY, **SANDY SILT**, SOME CLAY, LITTLE GRAVEL, DAMP	1188.1	3 TR	5 50/1"	-	71	SS-3	4.50	-	-	-	-	-	-	-	-	16	A-4a (V)	-	
SILTSTONE, GRAY, MODERATELY WEATHERED, SLIGHTLY STRONG.	1186.9	4 EOB	50/2"	-	100	SS-4	-	-	-	-	-	-	-	-	-	-	Rock (V)	-	
		5																	
		6																	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING. HOLE DID NOT CAVE. DRILLED AS STAKED.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLACED 0.5 BAG ASPHALT PATCH; POURED 1 BAG HOLE PLUG; SHOVELED SOIL CUTTINGS

STANDARD ODOT LOG W/ SULFATES (8.5 X 11) - OH DOT.GDT - 10/18/24 12:23 - X:\1ACTIVE PROJECTS\ACTIVE SOIL PROJECTS\HAS-22-15.25-21.47\GINT FILES\HAS-22-15.25-21.47.GPJ

PROJECT: HAS-22-15.25-21.47	DRILLING FIRM / OPERATOR: NEAS / JL	DRILL RIG: CME 45B	STATION / OFFSET: 955+18, 48' RT.	EXPLORATION ID B-039-0-23
TYPE: SUBGRADE	SAMPLING FIRM / LOGGER: NEAS / JL	HAMMER: CME AUTOMATIC	ALIGNMENT: CLP_US22	
PID: SFN:	DRILLING METHOD: 4.00" FA	CALIBRATION DATE: 1/24/22	ELEVATION: 1208.8 (MSL) EOB: 6.8 ft.	PAGE 1 OF 1
START: 8/2/23 END: 8/2/23	SAMPLING METHOD: SPT	ENERGY RATIO (%): 72.6	LAT / LONG: 40.288450, -80.991231	

MATERIAL DESCRIPTION AND NOTES	ELEV. 1208.8	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
11.0" ASPHALT (DRILLERS DESCRIPTION)	1207.9																		
HARD, BROWN, **SANDY SILT**, SOME CLAY, TRACE GRAVEL, DAMP		1	2 2 3	6	67	SS-1	4.25	2	7	15	47	29	31	21	10	16	A-4a (8)	240	
	1204.3	2	2 3 4	8	61	SS-2	4.25	-	-	-	-	-	-	-	-	20	A-4a (V)	-	
VERY STIFF, BROWN, **SILT AND CLAY**, LITTLE GRAVEL, TRACE SAND, DAMP	1202.8	3	7 11 18	35	56	SS-3	4.00	12	4	6	38	40	37	23	14	14	A-6a (10)	-	
VERY DENSE, BROWN AND GRAY, **GRAVEL WITH SAND AND SILT**, TRACE CLAY, DAMP	1202.0	4 5 6 EOB	19 50/3"	-	78	SS-4	-	-	-	-	-	-	-	-	-	8	A-2-4 (V)	-	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING. HOLE DID NOT CAVE. DRILLED AS STAKED.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLACED 0.5 BAG ASPHALT PATCH; POURED 1 BAG HOLE PLUG; SHOVELED SOIL CUTTINGS

STANDARD ODOT LOG W/ SULFATES (8.5 X 11) - OH DOT.GDT - 10/18/24 12:23 - X:\1\ACTIVE PROJECTS\ACTIVE SOIL PROJECTS\HAS-22-15.25-21.47\GINT FILES\HAS-22-15.25-21.47.GPJ

PROJECT: HAS-22-15.25-21.47	DRILLING FIRM / OPERATOR: NEAS / JL	DRILL RIG: CME 45B	STATION / OFFSET: 959+09, 49' LT.	EXPLORATION ID B-040-0-23
TYPE: SUBGRADE	SAMPLING FIRM / LOGGER: NEAS / JL	HAMMER: CME AUTOMATIC	ALIGNMENT: CLP_US22	
PID: SFN:	DRILLING METHOD: 4.00" FA	CALIBRATION DATE: 1/24/22	ELEVATION: 1224.2 (MSL) EOB: 7.5 ft.	PAGE 1 OF 1
START: 8/2/23 END: 8/2/23	SAMPLING METHOD: SPT	ENERGY RATIO (%): 72.6	LAT / LONG: 40.289136, -80.990118	

MATERIAL DESCRIPTION AND NOTES	ELEV. 1224.2	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
10.5" ASPHALT (DRILLERS DESCRIPTION)	1223.3																		
HARD, BROWN, **SANDY SILT**, SOME CLAY, TRACE GRAVEL, DAMP	1221.2		2 3 3	7	67	SS-1	4.50	9	12	18	36	25	29	19	10	13	A-4a (5)	100	
HARD, BROWN AND GRAY, **SILTY CLAY**, SOME GRAVEL, LITTLE SAND, DAMP	1219.7		3 3 3	7	56	SS-2	4.25	23	5	6	34	32	39	22	17	17	A-6b (9)	-	
HARD, GRAY, **SILT AND CLAY**, LITTLE SAND, TRACE GRAVEL, DAMP	1216.7	EOB	4 5 7	15	56	SS-3	4.50	6	7	11	40	36	35	22	13	14	A-6a (9)	-	
			5 5 8	16	44	SS-4	4.50	-	-	-	-	-	-	-	-	11	A-6a (V)	-	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING. HOLE DID NOT CAVE. DRILLED AS STAKED.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLACED 0.5 BAG ASPHALT PATCH; POURED 1 BAG HOLE PLUG; SHOVELED SOIL CUTTINGS

STANDARD ODOT LOG W/ SULFATES (8.5 X 11) - OH DOT.GDT - 10/18/24 12:23 - X:\1ACTIVE PROJECTS\ACTIVE SOIL PROJECTS\HAS-22-15.25-21.47\GINT FILES\HAS-22-15.25-21.47.GPJ

PROJECT: HAS-22-15.25-21.47	DRILLING FIRM / OPERATOR: NEAS / JL	DRILL RIG: CME 45B	STATION / OFFSET: 962+90, 40' RT.
TYPE: SUBGRADE	SAMPLING FIRM / LOGGER: NEAS / JL	HAMMER: CME AUTOMATIC	ALIGNMENT: CLP_US22
PID: SFN:	DRILLING METHOD: 4.00" FA	CALIBRATION DATE: 1/24/22	ELEVATION: 1235.6 (MSL) EOB: 7.5 ft.
START: 8/17/23 END: 8/17/23	SAMPLING METHOD: SPT	ENERGY RATIO (%): 72.6	LAT / LONG: 40.289401, -80.988735

EXPLORATION ID B-041-0-23

PAGE 1 OF 1

MATERIAL DESCRIPTION AND NOTES	ELEV. 1235.6	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
4.0" ASPHALT AND 9.0" CONCRETE (DRILLERS DESCRIPTION)	1234.5	1																	
HARD, BROWN AND GRAY, **SILT AND CLAY**, "AND" SAND, TRACE GRAVEL, DAMP	1232.6	2	3 3 4	8	61	SS-1	4.50	5	9	29	32	25	30	19	11	15	A-6a (5)	-	
HARD, BROWN AND GRAY, **SILTY CLAY**, LITTLE GRAVEL, LITTLE SAND, DAMP		3	3 4 6	12	56	SS-2	4.50	20	8	10	32	30	38	22	16	16	A-6b (8)	-	
		4	3 3 4	8	61	SS-3	4.50	-	-	-	-	-	-	-	-	18	A-6b (V)	-	
	1228.1	5	3 4 4	10	61	SS-4	4.50	-	-	-	-	-	-	-	-	20	A-6b (V)	-	
		EOB 6																	
		7																	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING. HOLE DID NOT CAVE. DRILLED AS STAKED.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLACED 0.5 BAG ASPHALT PATCH; POURED 1 BAG HOLE PLUG; SHOVELED SOIL CUTTINGS

STANDARD ODOT LOG W/ SULFATES (8.5 X 11) - OH DOT.GDT - 10/18/24 12:23 - X:\1\ACTIVE PROJECTS\ACTIVE SOIL PROJECTS\HAS-22-15.25-21.47\GINT FILES\HAS-22-15.25-21.47.GPJ

PROJECT: HAS-22-15.25-21.47	DRILLING FIRM / OPERATOR: NEAS / JL	DRILL RIG: CME 45B	STATION / OFFSET: 967+00, 24' LT.
TYPE: SUBGRADE	SAMPLING FIRM / LOGGER: NEAS / JL	HAMMER: CME AUTOMATIC	ALIGNMENT: CLP_US22
PID: SFN:	DRILLING METHOD: 4.00" FA	CALIBRATION DATE: 1/24/22	ELEVATION: 1246.5 (MSL) EOB: 7.5 ft.
START: 8/22/23 END: 8/22/23	SAMPLING METHOD: SPT	ENERGY RATIO (%): 72.6	LAT / LONG: 40.290100, -80.987569

EXPLORATION ID B-042-0-23

PAGE 1 OF 1

MATERIAL DESCRIPTION AND NOTES	ELEV. 1246.5	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
4.0" ASPHALT AND 9.0" CONCRETE (DRILLERS DESCRIPTION)	1245.4																		
VERY STIFF TO HARD, BROWN AND ORANGISH BROWN, **CLAY**, "AND" SILT, LITTLE SAND, TRACE GRAVEL, IRON STAINING, DAMP		1	2 2 3	6	78	SS-1	2.50	1	8	11	38	42	48	27	21	23	A-7-6 (14)	-	
		2	2 3 5	10	44	SS-2	4.00	2	8	12	40	38	44	25	19	19	A-7-6 (12)	-	
		3	4 5 6	13	39	SS-3	4.00	-	-	-	-	-	-	-	-	20	A-7-6 (V)	-	
		4	4 6 6	15	56	SS-4	4.25	-	-	-	-	-	-	-	-	20	A-7-6 (V)	-	
	1239.0	5 EOB																	
		6																	
		7																	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING. HOLE DID NOT CAVE. DRILLED AS STAKED.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLACED 0.5 BAG ASPHALT PATCH; POURED 1 BAG HOLE PLUG; SHOVELED SOIL CUTTINGS

STANDARD ODOT LOG W/ SULFATES (8.5 X 11) - OH DOT.GDT - 10/18/24 12:23 - X:\1\ACTIVE PROJECTS\ACTIVE SOIL PROJECTS\HAS-22-15.25-21.47\GINT FILES\HAS-22-15.25-21.47.GPJ

PROJECT: HAS-22-15.25-21.47	DRILLING FIRM / OPERATOR: NEAS / JL	DRILL RIG: CME 45B	STATION / OFFSET: 970+82, 25' RT.	EXPLORATION ID B-043-0-23
TYPE: SUBGRADE	SAMPLING FIRM / LOGGER: NEAS / JL	HAMMER: CME AUTOMATIC	ALIGNMENT: CLP_US22	
PID: SFN:	DRILLING METHOD: 4.00" FA	CALIBRATION DATE: 1/24/22	ELEVATION: 1254.0 (MSL) EOB: 7.5 ft.	PAGE 1 OF 1
START: 8/17/23 END: 8/17/23	SAMPLING METHOD: SPT	ENERGY RATIO (%): 72.6	LAT / LONG: 40.290495, -80.986297	

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)	SO4 ppm	BACK FILL
4.0" ASPHALT AND 9.0" CONCRETE (DRILLERS DESCRIPTION)	1254.0																		
VERY STIFF, BROWN AND ORANGISH BROWN, **CLAY**, SOME SILT, SOME SAND, TRACE GRAVEL, IRON STAINING, DAMP	1252.9	1	1 2 3	6	56	SS-1	3.50	4	11	14	34	37	45	24	21	21	A-7-6 (13)	-	
VERY STIFF TO HARD, BROWN AND ORANGISH BROWN, **SILTY CLAY**, SOME SAND, TRACE GRAVEL, IRON STAINING, DAMP	1251.0	2	2 3 5	10	61	SS-2	4.00	-	-	-	-	-	-	-	-	19	A-6b (V)	-	
		3	4 5 9	17	67	SS-3	4.50	3	11	15	29	42	39	21	18	17	A-6b (10)	-	
		4	5 6 13	23	61	SS-4	4.25	-	-	-	-	-	-	-	-	18	A-6b (V)	-	
	1246.5	5 EOB																	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING. HOLE DID NOT CAVE. DRILLED AS STAKED.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLACED 0.5 BAG ASPHALT PATCH; POURED 1 BAG HOLE PLUG; SHOVELED SOIL CUTTINGS

STANDARD ODOT LOG W/ SULFATES (8.5 X 11) - OH DOT.GDT - 10/18/24 12:23 - X:\1\ACTIVE PROJECTS\ACTIVE SOIL PROJECTS\HAS-22-15.25-21.47\GINT FILES\HAS-22-15.25-21.47.GPJ

PROJECT: HAS-22-15.25-21.47	DRILLING FIRM / OPERATOR: NEAS / JL	DRILL RIG: CME 45B	STATION / OFFSET: 974+82, 40' LT.
TYPE: SUBGRADE	SAMPLING FIRM / LOGGER: NEAS / JL	HAMMER: CME AUTOMATIC	ALIGNMENT: CLP_US22
PID: SFN:	DRILLING METHOD: 4.00" FA	CALIBRATION DATE: 1/24/22	ELEVATION: 1255.9 (MSL) EOB: 7.5 ft.
START: 8/18/23 END: 8/18/23	SAMPLING METHOD: SPT	ENERGY RATIO (%): 72.6	LAT / LONG: 40.291310, -80.985355

EXPLORATION ID B-044-0-23

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)	SO4 ppm	BACK FILL
	1255.9																		
4.0" ASPHALT AND 9.0" CONCRETE (DRILLERS DESCRIPTION)	1254.8																		
VERY STIFF, BROWN AND GRAY, **SANDY SILT**, LITTLE CLAY, TRACE GRAVEL, DAMP	1252.9	1	2 3 3	7	44	SS-1	4.00	5	12	30	33	20	26	18	8	17	A-4a (4)	-	
VERY STIFF, BROWN AND GRAY, **CLAY**, "AND" SILT, LITTLE SAND, TRACE GRAVEL, DAMP		2	2 3 4	8	50	SS-2	4.00	2	7	11	39	41	46	24	22	22	A-7-6 (14)	-	
		3	3 4 4	10	39	SS-3	3.50	-	-	-	-	-	-	-	-	20	A-7-6 (V)	-	
	1248.4	4	3 5 4	11	44	SS-4	3.75	-	-	-	-	-	-	-	-	21	A-7-6 (V)	-	
		EOB 5																	
		6																	
		7																	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING. HOLE DID NOT CAVE. DRILLED AS STAKED.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLACED 0.5 BAG ASPHALT PATCH; POURED 1 BAG HOLE PLUG; SHOVELED SOIL CUTTINGS

STANDARD ODOT LOG W/ SULFATES (8.5 X 11) - OH DOT.GDT - 10/18/24 12:23 - X:\1ACTIVE PROJECTS\ACTIVE SOIL PROJECTS\HAS-22-15.25-21.47\GINT FILES\HAS-22-15.25-21.47.GPJ

PROJECT: HAS-22-15.25-21.47	DRILLING FIRM / OPERATOR: NEAS / JL	DRILL RIG: CME 45B	STATION / OFFSET: 978+75, 48' RT.
TYPE: SUBGRADE	SAMPLING FIRM / LOGGER: NEAS / JL	HAMMER: CME AUTOMATIC	ALIGNMENT: CLP_US22
PID: SFN:	DRILLING METHOD: 4.00" FA	CALIBRATION DATE: 1/24/22	ELEVATION: 1258.4 (MSL) EOB: 7.5 ft.
START: 8/2/23 END: 8/2/23	SAMPLING METHOD: SPT	ENERGY RATIO (%): 72.6	LAT / LONG: 40.291951, -80.984145

EXPLORATION ID B-045-0-23

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MATERIAL DESCRIPTION AND NOTES	ELEV. 1258.4	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
10.0" ASPHALT (DRILLERS DESCRIPTION)	1257.6																		
VERY STIFF TO HARD, BROWN, **CLAY**, "AND" SILT, TRACE TO LITTLE SAND, TRACE TO LITTLE GRAVEL, DAMP		1	3 3 3	7	67	SS-1	4.50	11	6	6	38	39	41	25	16	15	A-7-6 (11)	1120	
		2	3 4 4	10	61	SS-2	3.50	4	4	3	48	41	44	25	19	20	A-7-6 (12)	-	
	1253.9	3																	
HARD, BROWN, **SILT AND CLAY**, LITTLE SAND, TRACE GRAVEL, DAMP		4	3 3 4	8	56	SS-3	4.50	8	8	5	40	39	37	22	15	16	A-6a (10)	-	
	1252.4	5																	
LOOSE, BROWN, **GRAVEL WITH SAND AND SILT**, LITTLE CLAY, DAMP		6	2 3 2	6	50	SS-4	-	-	-	-	-	-	-	-	-	8	A-2-4 (V)	-	
	1250.9	7 EOB																	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING. HOLE DID NOT CAVE. DRILLED AS STAKED.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLACED 0.5 BAG ASPHALT PATCH; POURED 1 BAG HOLE PLUG; SHOVELED SOIL CUTTINGS

STANDARD ODOT LOG W/ SULFATES (8.5 X 11) - OH DOT.GDT - 10/18/24 12:23 - X:\1\ACTIVE PROJECTS\ACTIVE SOIL PROJECTS\HAS-22-15.25-21.47\GINT FILES\HAS-22-15.25-21.47.GPJ

PROJECT: HAS-22-15.25-21.47	DRILLING FIRM / OPERATOR: NEAS / JL	DRILL RIG: CME 45B	STATION / OFFSET: 982+65, 40' LT.
TYPE: SUBGRADE	SAMPLING FIRM / LOGGER: NEAS / JL	HAMMER: CME AUTOMATIC	ALIGNMENT: CLP_US22
PID: SFN:	DRILLING METHOD: 4.00" FA	CALIBRATION DATE: 1/24/22	ELEVATION: 1252.6 (MSL) EOB: 7.5 ft.
START: 8/18/23 END: 8/18/23	SAMPLING METHOD: SPT	ENERGY RATIO (%): 72.6	LAT / LONG: 40.292965, -80.983610

EXPLORATION ID B-046-0-23

PAGE 1 OF 1

MATERIAL DESCRIPTION AND NOTES	ELEV. 1252.6	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
4.0" ASPHALT AND 9.0" CONCRETE (DRILLERS DESCRIPTION)	1251.5																		
STIFF TO VERY STIFF, BROWN, **SILT AND CLAY**, "AND" SAND, LITTLE GRAVEL, DAMP TO MOIST	1248.1	1 2 3 4 5 6 7	1 2 2 / 2 3	5	56	SS-1	2.25	12	17	24	26	21	35	22	13	21	A-6a (3)	-	
			2 2 3	6	61	SS-2	2.00	-	-	-	-	-	-	-	-	26	A-6a (V)	-	
STIFF TO VERY STIFF, BROWN, **CLAY**, SOME SILT, LITTLE SAND, TRACE GRAVEL, MOIST	1245.1		2 3 3	7	50	SS-3	2.00	3	7	13	31	46	49	23	26	29	A-7-6 (16)	-	
		EOB	3 4 4	10	44	SS-4	2.25	-	-	-	-	-	-	-	-	25	A-7-6 (V)	-	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING. HOLE DID NOT CAVE. DRILLED AS STAKED.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLACED 0.5 BAG ASPHALT PATCH; POURED 1 BAG HOLE PLUG; SHOVELED SOIL CUTTINGS

STANDARD ODOT LOG W/ SULFATES (8.5 X 11) - OH DOT.GDT - 10/18/24 12:23 - X:\1\ACTIVE PROJECTS\ACTIVE SOIL PROJECTS\HAS-22-15.25-21.47\GINT FILES\HAS-22-15.25-21.47.GPJ

PROJECT: HAS-22-15.25-21.47	DRILLING FIRM / OPERATOR: NEAS / JL	DRILL RIG: CME 45B	STATION / OFFSET: 986+53, 25' RT.
TYPE: SUBGRADE	SAMPLING FIRM / LOGGER: NEAS / JL	HAMMER: CME AUTOMATIC	ALIGNMENT: CLP_US22
PID: SFN:	DRILLING METHOD: 4.00" FA	CALIBRATION DATE: 1/24/22	ELEVATION: 1249.2 (MSL) EOB: 7.5 ft.
START: 8/17/23 END: 8/17/23	SAMPLING METHOD: SPT	ENERGY RATIO (%): 72.6	LAT / LONG: 40.293829, -80.982676

EXPLORATION ID B-047-0-23

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)	SO4 ppm	BACK FILL
4.0" ASPHALT AND 8.0" CONCRETE (DRILLERS DESCRIPTION)	1249.2																		
	1248.2																		
HARD, BROWN AND GRAY, **SILT AND CLAY**, SOME SAND, LITTLE GRAVEL, DAMP		1																	
		2	2 3 3	7	61	SS-1	4.25	12	16	11	36	25	36	23	13	17	A-6a (6)	-	
		3	3 4 4	10	56	SS-2	4.25	14	14	9	39	24	39	24	15	17	A-6a (8)	-	
		4																	
		5	3 6 8	17	56	SS-3	4.50	-	-	-	-	-	-	-	-	24	A-6a (V)	-	
		6																	
	1241.7	7	3 7 9	19	61	SS-4	4.50	-	-	-	-	-	-	-	-	24	A-6a (V)	-	
		EOB																	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING. HOLE DID NOT CAVE. DRILLED AS STAKED.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLACED 0.5 BAG ASPHALT PATCH; POURED 1 BAG HOLE PLUG; SHOVELED SOIL CUTTINGS

STANDARD ODOT LOG W/ SULFATES (8.5 X 11) - OH DOT.GDT - 10/18/24 12:23 - X:\1\ACTIVE PROJECTS\ACTIVE SOIL PROJECTS\HAS-22-15.25-21.47\GINT FILES\HAS-22-15.25-21.47.GPJ

PROJECT: HAS-22-15.25-21.47	DRILLING FIRM / OPERATOR: NEAS / JL	DRILL RIG: CME 45B	STATION / OFFSET: 990+48, 25' LT.
TYPE: SUBGRADE	SAMPLING FIRM / LOGGER: NEAS / JL	HAMMER: CME AUTOMATIC	ALIGNMENT: CLP_US22
PID: SFN:	DRILLING METHOD: 4.00" FA	CALIBRATION DATE: 1/24/22	ELEVATION: 1240.6 (MSL) EOB: 7.5 ft.
START: 8/22/23 END: 8/22/23	SAMPLING METHOD: SPT	ENERGY RATIO (%): 72.6	LAT / LONG: 40.294891, -80.982417

EXPLORATION ID B-048-0-23

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)	SO4 ppm	BACK FILL
4.0" ASPHALT AND 8.0" CONCRETE (DRILLERS DESCRIPTION)	1240.6																		
HARD, BROWN AND GRAY, **SILTY CLAY**, SOME SAND, TRACE GRAVEL, DAMP	1239.6	1																	
		2	2 3 4	8	67	SS-1	4.50	10	9	15	35	31	38	22	16	18	A-6b (9)	-	
		3	3 3 5	10	72	SS-2	4.50	3	10	14	41	32	40	23	17	17	A-6b (10)	-	
		4	3 5 6	13	28	SS-3	4.50	-	-	-	-	-	-	-	-	20	A-6b (V)	-	
		5	3 5 5	12	22	SS-4	4.50	-	-	-	-	-	-	-	-	12	A-6b (V)	-	
	1233.1	6																	
		EOB 7																	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING. HOLE DID NOT CAVE. DRILLED AS STAKED.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLACED 0.5 BAG ASPHALT PATCH; POURED 1 BAG HOLE PLUG; SHOVELED SOIL CUTTINGS

STANDARD ODOT LOG W/ SULFATES (8.5 X 11) - OH DOT.GDT - 10/18/24 12:23 - X:\1\ACTIVE PROJECTS\ACTIVE SOIL PROJECTS\HAS-22-15.25-21.47\GINT FILES\HAS-22-15.25-21.47.GPJ

PROJECT: HAS-22-15.25-21.47	DRILLING FIRM / OPERATOR: NEAS / JL	DRILL RIG: CME 45B	STATION / OFFSET: 994+55, 38' RT.
TYPE: SUBGRADE	SAMPLING FIRM / LOGGER: NEAS / JL	HAMMER: CME AUTOMATIC	ALIGNMENT: CLP_US22
PID: SFN:	DRILLING METHOD: 4.00" FA	CALIBRATION DATE: 1/24/22	ELEVATION: 1229.0 (MSL) EOB: 7.5 ft.
START: 8/17/23 END: 8/17/23	SAMPLING METHOD: SPT	ENERGY RATIO (%): 72.6	LAT / LONG: 40.295846, -80.981617

EXPLORATION ID B-049-0-23

PAGE 1 OF 1

MATERIAL DESCRIPTION AND NOTES	ELEV. 1229.0	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
4.0" ASPHALT AND 9.0" CONCRETE (DRILLERS DESCRIPTION)	1227.9																		
HARD, BROWN AND GRAY, **SILT AND CLAY**, SOME SAND, TRACE TO LITTLE GRAVEL, DAMP		1	1 2 4	7	50	SS-1	4.50	5	16	12	39	28	34	21	13	18	A-6a (8)	-	
		2	1 3 4	8	61	SS-2	4.50	11	13	11	42	23	36	22	14	17	A-6a (8)	-	
		3	3 3 5	10	56	SS-3	4.50	-	-	-	-	-	-	-	-	16	A-6a (V)	-	
		4	5 7 7	17	61	SS-4	4.50	-	-	-	-	-	-	-	-	15	A-6a (V)	-	
	1221.5	5																	
		EOB 6																	
		7																	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING. HOLE DID NOT CAVE. DRILLED AS STAKED.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLACED 0.5 BAG ASPHALT PATCH; POURED 1 BAG HOLE PLUG; SHOVELED SOIL CUTTINGS

STANDARD ODOT LOG W/ SULFATES (8.5 X 11) - OH DOT.GDT - 10/18/24 12:23 - X:\1\ACTIVE PROJECTS\ACTIVE SOIL PROJECTS\HAS-22-15.25-21.47\GINT FILES\HAS-22-15.25-21.47.GPJ

PROJECT: HAS-22-15.25-21.47	DRILLING FIRM / OPERATOR: NEAS / JL	DRILL RIG: CME 45B	STATION / OFFSET: 998+48, 18' LT.
TYPE: SUBGRADE	SAMPLING FIRM / LOGGER: NEAS / JL	HAMMER: CME AUTOMATIC	ALIGNMENT: CLP_US22
PID: SFN:	DRILLING METHOD: 4.00" FA	CALIBRATION DATE: 1/24/22	ELEVATION: 1217.9 (MSL) EOB: 7.5 ft.
START: 8/18/23 END: 8/18/23	SAMPLING METHOD: SPT	ENERGY RATIO (%): 72.6	LAT / LONG: 40.296844, -80.981077

EXPLORATION ID B-050-0-23

MATERIAL DESCRIPTION AND NOTES	ELEV. 1217.9	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
4.5" ASPHALT AND 8.5" CONCRETE (DRILLERS DESCRIPTION)	1216.8																		
VERY STIFF, BROWN, **SANDY SILT**, LITTLE CLAY, LITTLE GRAVEL, DAMP	1214.9	1 2 3 4 5 6 7	1 2 2	5	67	SS-1	4.00	15	16	21	30	18	29	20	9	14	A-4a (3)	-	
VERY STIFF TO HARD, BROWN AND GRAY, **SILT AND CLAY**, SOME SAND, TRACE GRAVEL, IRON STAINING, DAMP			2 2 3	6	61	SS-2	4.50	10	13	9	41	27	36	23	13	17	A-6a (8)	-	
			2 3 4	8	61	SS-3	4.00	-	-	-	-	-	-	-	-	19	A-6a (V)	-	
	1210.4	EOB	3 4 6	12	50	SS-4	4.25	-	-	-	-	-	-	-	-	16	A-6a (V)	-	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING. HOLE DID NOT CAVE. DRILLED AS STAKED.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLACED 0.5 BAG ASPHALT PATCH; POURED 1 BAG HOLE PLUG; SHOVELED SOIL CUTTINGS

STANDARD ODOT LOG W/ SULFATES (8.5 X 11) - OH DOT.GDT - 10/18/24 12:23 - X:\1ACTIVE PROJECTS\ACTIVE SOIL PROJECTS\HAS-22-15.25-21.47\GINT FILES\HAS-22-15.25-21.47.GPJ

STANDARD ODOT LOG W/ SULFATES (8.5 X 11) - OH DOT.GDT - 10/18/24 12:23 - X:\1\ACTIVE PROJECTS\ACTIVE SOIL PROJECTS\HAS-22-15.25-21.47\GINT FILES\HAS-22-15.25-21.47.GPJ

PROJECT: HAS-22-15.25-21.47
TYPE: SUBGRADE
PID: SFN:
START: 8/3/23 END: 8/3/23

DRILLING FIRM / OPERATOR: NEAS / JL
SAMPLING FIRM / LOGGER: NEAS / JL
DRILLING METHOD: 4.00" FA
SAMPLING METHOD: SPT

DRILL RIG: CME 45B
HAMMER: CME AUTOMATIC
CALIBRATION DATE: 1/24/22
ENERGY RATIO (%): 72.6

STATION / OFFSET: 1002+32, 45' RT.
ALIGNMENT: CLP_US22
ELEVATION: 1199.4 (MSL) EOB: 7.5 ft.
LAT / LONG: 40.297597, -80.980076

EXPLORATION ID B-051-0-23

MATERIAL DESCRIPTION AND NOTES	ELEV. 1199.4	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
12.5" ASPHALT (DRILLERS DESCRIPTION)	1198.4																		
VERY STIFF TO HARD, DARK GRAY, **SILT AND CLAY**, SOME TO "AND" SAND, TRACE TO LITTLE GRAVEL, DAMP		1	3 4 5	11	67	SS-1	4.25	1	12	29	33	25	32	20	12	14	A-6a (5)	100	
		2	3 4 5	11	56	SS-2	4.25	-	-	-	-	-	-	-	-	14	A-6a (V)	-	
		3	3 4 4	10	61	SS-3	3.00	17	10	18	29	26	33	22	11	19	A-6a (4)	-	
		4	3 5 5	12	61	SS-4	4.00	-	-	-	-	-	-	-	-	18	A-6a (V)	-	
	1191.9	5 EOB																	
		6																	
		7																	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING. HOLE DID NOT CAVE. DRILLED AS STAKED.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLACED 0.5 BAG ASPHALT PATCH; POURED 1 BAG HOLE PLUG; SHOVELED SOIL CUTTINGS

PROJECT: HAS-22-15.25-21.47	DRILLING FIRM / OPERATOR: NEAS / JL	DRILL RIG: CME 45B	STATION / OFFSET: 1005+26, 7' RT.
TYPE: SUBGRADE	SAMPLING FIRM / LOGGER: NEAS / JL	HAMMER: CME AUTOMATIC	ALIGNMENT: CLP_US22
PID: SFN:	DRILLING METHOD: 4.00" FA	CALIBRATION DATE: 1/24/22	ELEVATION: 1189.8 (MSL) EOB: 7.5 ft.
START: 8/18/23 END: 8/18/23	SAMPLING METHOD: SPT	ENERGY RATIO (%): 72.6	LAT / LONG: 40.298160, -80.979375

EXPLORATION ID B-052-0-23

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)	SO4 ppm	BACK FILL
6.0" ASPHALT AND 7.0" CONCRETE (DRILLERS DESCRIPTION)	1189.8 1188.7																		
LOOSE, BROWN, **SANDY SILT**, LITTLE CLAY, TRACE GRAVEL, DAMP	1186.8		3 2 3	6	39	SS-1	-	9	10	42	20	19	NP	NP	NP	13	A-4a (1)	-	
VERY STIFF, BROWN WITH ORANGISH BROWN AND DARK GRAY, **CLAY**, SOME SILT, LITTLE SAND, TRACE GRAVEL, CONTAINS COAL FRAGMENTS, DAMP TO MOIST			3 3 3	7	44	SS-2	3.00	5	5	8	29	53	44	23	21	21	A-7-6 (13)	-	
			3 4 5	11	61	SS-3	3.25	-	-	-	-	-	-	-	-	24	A-7-6 (V)	-	
	1182.3	EOB	4 4 7	13	56	SS-4	3.50	-	-	-	-	-	-	-	-	17	A-7-6 (V)	-	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING. HOLE DID NOT CAVE. DRILLED AS STAKED.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLACED 0.5 BAG ASPHALT PATCH; POURED 1 BAG HOLE PLUG; SHOVELED SOIL CUTTINGS

STANDARD ODOT LOG W/ SULFATES (8.5 X 11) - OH DOT.GDT - 10/18/24 12:23 - X:\1ACTIVE PROJECTS\ACTIVE SOIL PROJECTS\HAS-22-15.25-21.47\GINT FILES\HAS-22-15.25-21.47.GPJ

PROJECT: HAS-22-15.25-21.47	DRILLING FIRM / OPERATOR: NEAS / JL	DRILL RIG: CME 55T	STATION / OFFSET: 4+01, 4' LT.
TYPE: SUBGRADE	SAMPLING FIRM / LOGGER: NEAS / JL	HAMMER: CME AUTOMATIC	ALIGNMENT: RAMP C
PID: SFN:	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 1/24/22	ELEVATION: 1209.6 (MSL) EOB: 4.7 ft.
START: 9/7/23 END: 9/7/23	SAMPLING METHOD: SPT	ENERGY RATIO (%): 63.4	LAT / LONG: 40.275379, -81.015074

EXPLORATION ID B-104-0-23

PAGE 1 OF 1

MATERIAL DESCRIPTION AND NOTES	ELEV. 1209.6	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
8.0" ASPHALT AND 10.0" SAND (DRILLERS DESCRIPTION)	1208.1	TR																	
SHALE, BLACK, SEVERELY WEATHERED, VERY WEAK, FISSILE.	1206.1	1	6 17 37	57	89	SS-1	-	-	-	-	-	-	-	-	-	-	Rock (V)	-	
SILTSTONE, GRAY, HIGHLY WEATHERED, SLIGHTLY STRONG.	1204.9	2	6 50/5"	-	64	SS-2	-	-	-	-	-	-	-	-	-	-	Rock (V)	-	
		3	50/2"	-	100	SS-3	-	-	-	-	-	-	-	-	-	-	Rock (V)	-	
		4 EOB																	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING. HOLE DID NOT CAVE. DRILLED AS STAKED.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLACED 0.5 BAG ASPHALT PATCH; SHOVELED SOIL CUTTINGS

STANDARD ODOT LOG W/ SULFATES (8.5 X 11) - OH DOT.GDT - 10/18/24 12:24 - X:\1ACTIVE PROJECTS\ACTIVE SOIL PROJECTS\HAS-22-15.25-21.47\GINT FILES\HAS-22-15.25-21.47.GPJ

PROJECT: HAS-22-15.25-21.47	DRILLING FIRM / OPERATOR: NEAS / JL	DRILL RIG: CME 55T	STATION / OFFSET: 7+38, 15' LT.
TYPE: SUBGRADE	SAMPLING FIRM / LOGGER: NEAS / JL	HAMMER: CME AUTOMATIC	ALIGNMENT: RAMP C
PID: SFN:	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 1/24/22	ELEVATION: 1212.3 (MSL) EOB: 7.5 ft.
START: 9/7/23 END: 9/7/23	SAMPLING METHOD: SPT	ENERGY RATIO (%): 63.4	LAT / LONG: 40.275555, -81.013896

EXPLORATION ID B-105-0-23

PAGE 1 OF 1

MATERIAL DESCRIPTION AND NOTES	ELEV. 1212.3	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
7.0" ASPHALT AND 10.0" SAND (DRILLERS DESCRIPTION)	1210.9																		
VERY STIFF, BROWN AND DARK GRAY, **SILT AND CLAY**, SOME GRAVEL, LITTLE TO SOME SAND, DAMP		1 2 3 4 5 6 7	3 4 5	10	61	SS-1	3.25	27	18	15	25	15	32	20	12	12	A-6a (2)	-	
			3 5 6	12	56	SS-2	3.00	24	10	10	30	26	35	22	13	15	A-6a (5)	-	
			2 3 4	7	78	SS-3	2.50	-	-	-	-	-	-	-	-	16	A-6a (V)	-	
	1204.8	EOB	2 4 4	8	78	SS-4	2.75	-	-	-	-	-	-	-	-	13	A-6a (V)	-	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING. HOLE DID NOT CAVE. BORING OFFSET 5.0' WEST.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLACED 0.5 BAG ASPHALT PATCH; SHOVELED SOIL CUTTINGS

STANDARD ODOT LOG W/ SULFATES (8.5 X 11) - OH DOT.GDT - 10/18/24 12:24 - X:\1ACTIVE PROJECTS\ACTIVE SOIL PROJECTS\HAS-22-15.25-21.47\GINT FILES\HAS-22-15.25-21.47.GPJ

PROJECT: HAS-22-15.25-21.47	DRILLING FIRM / OPERATOR: NEAS / JL	DRILL RIG: CME 45B	STATION / OFFSET: 12+65, 150' RT.
TYPE: SUBGRADE	SAMPLING FIRM / LOGGER: NEAS / JL	HAMMER: CME AUTOMATIC	ALIGNMENT: RAMP D
PID: SFN:	DRILLING METHOD: 4.00" FA	CALIBRATION DATE: 1/24/22	ELEVATION: 1235.7 (MSL) EOB: 7.5 ft.
START: 8/9/23 END: 8/9/23	SAMPLING METHOD: SPT	ENERGY RATIO (%): 72.6	LAT / LONG: 40.277163, -81.012870

EXPLORATION ID B-106-0-23

PAGE 1 OF 1

MATERIAL DESCRIPTION AND NOTES	ELEV. 1235.7	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
4.0" ASPHALT AND 6.0" CONCRETE (DRILLERS DESCRIPTION)	1234.9																		
HARD, BROWN AND GRAY, **SANDY SILT**, SOME CLAY, TRACE GRAVEL, DAMP		1																	
		2	3 2 3	6	61	SS-1	4.50	0	11	22	35	32	32	22	10	10	A-4a (6)	480	
		3	3 3 4	8	67	SS-2	4.50	-	-	-	-	-	-	-	-	14	A-4a (V)	-	
		4	4 4 7	13	67	SS-3	4.50	-	-	-	-	-	-	-	-	14	A-4a (V)	-	
		5	4 5 6	13	56	SS-4	4.50	-	-	-	-	-	-	-	-	13	A-4a (V)	-	
	1228.2	6 EOB																	
		7																	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING. HOLE DID NOT CAVE. BORING OFFSET 12.0' WEST.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLACED 0.5 BAG ASPHALT PATCH; POURED 1 BAG HOLE PLUG; SHOVELED SOIL CUTTINGS

STANDARD ODOT LOG W/ SULFATES (8.5 X 11) - OH DOT.GDT - 10/18/24 12:24 - X:\1\ACTIVE PROJECTS\ACTIVE SOIL PROJECTS\HAS-22-15.25-21.47\GINT FILES\HAS-22-15.25-21.47.GPJ

PROJECT: HAS-22-15.25-21.47	DRILLING FIRM / OPERATOR: NEAS / JL	DRILL RIG: CME 45B	STATION / OFFSET: 2+39, 2' RT.
TYPE: SUBGRADE	SAMPLING FIRM / LOGGER: NEAS / JL	HAMMER: CME AUTOMATIC	ALIGNMENT: RAMP D
PID: SFN:	DRILLING METHOD: 4.00" FA	CALIBRATION DATE: 1/24/22	ELEVATION: 1228.2 (MSL) EOB: 7.5 ft.
START: 8/9/23 END: 8/9/23	SAMPLING METHOD: SPT	ENERGY RATIO (%): 72.6	LAT / LONG: 40.276038, -81.012593

EXPLORATION ID B-107-0-23

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)	SO4 ppm	BACK FILL
12.0" ASPHALT (DRILLERS DESCRIPTION)	1228.2 1227.2																		
HARD, BROWN AND GRAY, **SILT AND CLAY**, SOME SAND, LITTLE GRAVEL, DAMP	1225.2	1 2 3	2 3 3	7	56	SS-1	4.25	16	10	17	33	24	32	20	12	14	A-6a (5)	-	
VERY STIFF TO HARD, BROWN AND GRAY, **CLAY**, SOME SILT, SOME SAND, TRACE GRAVEL, DAMP		4 5	2 3 4	8	67	SS-2	3.75	8	12	12	30	38	44	27	17	25	A-7-6 (10)	-	
			2 3 3	7	67	SS-3	4.25	-	-	-	-	-	-	-	-	21	A-7-6 (V)	-	
	1220.7	6 7 EOB	3 3 3	7	61	SS-4	4.50	-	-	-	-	-	-	-	-	16	A-7-6 (V)	-	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING. HOLE DID NOT CAVE. DRILLED AS STAKED.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLACED 0.5 BAG ASPHALT PATCH; POURED 1 BAG HOLE PLUG; SHOVELED SOIL CUTTINGS

STANDARD ODOT LOG W/ SULFATES (8.5 X 11) - OH DOT.GDT - 10/18/24 12:24 - X:\1ACTIVE PROJECTS\ACTIVE SOIL PROJECTS\HAS-22-15.25-21.47\GINT FILES\HAS-22-15.25-21.47.GPJ

PROJECT: HAS-22-15.25-21.47	DRILLING FIRM / OPERATOR: NEAS / JL	DRILL RIG: CME 45B	STATION / OFFSET: 6+90, 2' RT.
TYPE: SUBGRADE	SAMPLING FIRM / LOGGER: NEAS / JL	HAMMER: CME AUTOMATIC	ALIGNMENT: RAMP D
PID: SFN:	DRILLING METHOD: 4.00" FA	CALIBRATION DATE: 1/24/22	ELEVATION: 1207.6 (MSL) EOB: 7.5 ft.
START: 8/9/23 END: 8/9/23	SAMPLING METHOD: SPT	ENERGY RATIO (%): 72.6	LAT / LONG: 40.276036, -81.013962

EXPLORATION ID B-108-0-23

PAGE 1 OF 1

MATERIAL DESCRIPTION AND NOTES	ELEV. 1207.6	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
13.0" ASPHALT (DRILLERS DESCRIPTION)	1206.5																		
VERY STIFF TO HARD, BROWN AND GRAY, **SILT AND CLAY**, LITTLE TO SOME SAND, LITTLE TO SOME GRAVEL, DAMP		1 2 3 4 5 6 7	2 2 4	7	67	SS-1	3.75	12	11	16	36	25	34	21	13	15	A-6a (6)	-	
			2 3 4	8	61	SS-2	4.25	22	11	9	35	23	35	23	12	14	A-6a (5)	-	
			2 3 5	10	67	SS-3	3.50	-	-	-	-	-	-	-	-	14	A-6a (V)	-	
	1200.1	EOB	3 3 5	10	56	SS-4	4.00	-	-	-	-	-	-	-	-	16	A-6a (V)	-	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING. HOLE DID NOT CAVE. DRILLED AS STAKED.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLACED 0.5 BAG ASPHALT PATCH; POURED 1 BAG HOLE PLUG; SHOVELED SOIL CUTTINGS

STANDARD ODOT LOG W/ SULFATES (8.5 X 11) - OH DOT.GDT - 10/18/24 12:24 - X:\1ACTIVE PROJECTS\ACTIVE SOIL PROJECTS\HAS-22-15.25-21.47\GINT FILES\HAS-22-15.25-21.47.GPJ

STANDARD ODOT LOG W/ SULFATES (8.5 X 11) - OH DOT.GDT - 10/18/24 12:24 - X:\1ACTIVE PROJECTS\ACTIVE SOIL PROJECTS\HAS-22-15.25-21.47\GINT FILES\HAS-22-15.25-21.47.GPJ

PROJECT: HAS-22-15.25-21.47
TYPE: SUBGRADE
PID: SFN:
START: 9/7/23 END: 9/7/23

DRILLING FIRM / OPERATOR: NEAS / JL
SAMPLING FIRM / LOGGER: NEAS / JL
DRILLING METHOD: 3.25" HSA
SAMPLING METHOD: SPT

DRILL RIG: CME 55T
HAMMER: CME AUTOMATIC
CALIBRATION DATE: 1/24/22
ENERGY RATIO (%): 63.4

STATION / OFFSET: 1+33, 2' RT.
ALIGNMENT: RAMP A
ELEVATION: 1224.3 (MSL) EOB: 7.5 ft.
LAT / LONG: 40.278605, -81.013232

EXPLORATION ID B-109-0-23

MATERIAL DESCRIPTION AND NOTES	ELEV. 1224.3	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
14.0" CONCRETE (DRILLERS DESCRIPTION)	1223.1	1																	
HARD, BROWN AND GRAY, **SILT AND CLAY**, SOME SAND, LITTLE GRAVEL, DAMP	1221.3	2	3 5 9	15	72	SS-1	4.50	14	16	11	37	22	36	23	13	14	A-6a (6)	-	
MEDIUM DENSE, GRAY, **SANDY SILT**, SOME STONE FRAGMENTS, LITTLE CLAY, DAMP	1219.8	3 4	3 4 10	15	83	SS-2	-	24	12	10	41	13	NP	NP	NP	8	A-4a (4)	-	
SHALE, GRAY, SEVERELY WEATHERED, VERY WEAK, FISSILE.		TR 5	7 12 24	38	50	SS-3	-	-	-	-	-	-	-	-	-	8	Rock (V)	-	
	1216.8	6 7 EOB	8 24 44	72	67	SS-4	-	-	-	-	-	-	-	-	-	7	Rock (V)	-	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING. HOLE DID NOT CAVE. DRILLED AS STAKED.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLACED 0.5 BAG ASPHALT PATCH; SHOVELED SOIL CUTTINGS

PROJECT: HAS-22-15.25-21.47	DRILLING FIRM / OPERATOR: NEAS / JL	DRILL RIG: CME 45B	STATION / OFFSET: 10+02, 9' LT.
TYPE: SUBGRADE	SAMPLING FIRM / LOGGER: NEAS / JL	HAMMER: CME AUTOMATIC	ALIGNMENT: RAMP B
PID: SFN:	DRILLING METHOD: 4.00" FA	CALIBRATION DATE: 1/24/22	ELEVATION: 1225.0 (MSL) EOB: 7.5 ft.
START: 8/2/23 END: 8/2/23	SAMPLING METHOD: SPT	ENERGY RATIO (%): 72.6	LAT / LONG: 40.277835, -81.014212

EXPLORATION ID B-110-0-23

PAGE 1 OF 1

MATERIAL DESCRIPTION AND NOTES	ELEV. 1225.0	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
12.0" ASPHALT (DRILLERS DESCRIPTION)	1224.0																		
HARD, BROWN, **SILT AND CLAY**, SOME SAND, TRACE GRAVEL, DAMP	1222.0	1 2 3	3 3 3	7	67	SS-1	4.50	2	10	13	45	30	38	24	14	20	A-6a (10)	4600	
HARD, BROWN, **CLAY**, "AND" SILT, TRACE SAND, TRACE GRAVEL, DAMP		4 5	3 4 4	10	56	SS-2	4.50	0	1	5	50	44	44	24	20	20	A-7-6 (13)	-	
		6	3 5 7	15	56	SS-3	4.25	-	-	-	-	-	-	-	-	20	A-7-6 (V)	-	
	1217.5	7 EOB	4 6 6	15	67	SS-4	4.25	-	-	-	-	-	-	-	-	22	A-7-6 (V)	-	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING. HOLE DID NOT CAVE. DRILLED AS STAKED.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLACED 0.5 BAG ASPHALT PATCH; POURED 1 BAG HOLE PLUG; SHOVELED SOIL CUTTINGS

STANDARD ODOT LOG W/ SULFATES (8.5 X 11) - OH DOT.GDT - 10/18/24 12:24 - X:\1ACTIVE PROJECTS\ACTIVE SOIL PROJECTS\HAS-22-15.25-21.47\GINT FILES\HAS-22-15.25-21.47.GPJ

PROJECT: HAS-22-15.25-21.47	DRILLING FIRM / OPERATOR: NEAS / JL	DRILL RIG: CME 55T	STATION / OFFSET: 6+04, 5' RT.
TYPE: SUBGRADE	SAMPLING FIRM / LOGGER: NEAS / JL	HAMMER: CME AUTOMATIC	ALIGNMENT: RAMP B
PID: SFN:	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 1/24/22	ELEVATION: 1208.0 (MSL) EOB: 7.5 ft.
START: 9/7/23 END: 9/7/23	SAMPLING METHOD: SPT	ENERGY RATIO (%): 63.4	LAT / LONG: 40.276817, -81.014740

EXPLORATION ID B-111-0-23

PAGE 1 OF 1

MATERIAL DESCRIPTION AND NOTES	ELEV. 1208.0	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
10.0" ASPHALT (DRILLERS DESCRIPTION)	1207.2																		
LOOSE, BROWN, **GRAVEL WITH SAND AND SILT**, LITTLE CLAY, DAMP	1205.0	1 2 3	2 3 3	6	50	SS-1	-	29	10	28	18	15	NP	NP	NP	11	A-2-4 (0)	-	
VERY STIFF, BROWN AND GRAY, **SILT AND CLAY**, LITTLE STONE FRAGMENTS, LITTLE SAND, DAMP	1203.5	4	3 4 4	8	72	SS-2	3.50	14	7	6	41	32	38	24	14	15	A-6a (9)	-	
SHALE, GRAY, SEVERELY WEATHERED, VERY WEAK, FISSILE.	1202.0	TR 5	6 12 22	36	61	SS-3	-	-	-	-	-	-	-	-	-	10	Rock (V)	-	
COAL, BLACK, SEVERELY WEATHERED, VERY WEAK.	1200.5	6 7 EOB	5 12 17	31	67	SS-4	-	-	-	-	-	-	-	-	-	9	Rock (V)	-	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING. HOLE DID NOT CAVE. DRILLED AS STAKED.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLACED 0.5 BAG ASPHALT PATCH; SHOVELED SOIL CUTTINGS

STANDARD ODOT LOG W/ SULFATES (8.5 X 11) - OH DOT.GDT - 10/18/24 12:24 - X:\1\ACTIVE PROJECTS\ACTIVE SOIL PROJECTS\HAS-22-15.25-21.47\GINT FILES\HAS-22-15.25-21.47.GPJ

PROJECT: HAS-22-15.25-21.47	DRILLING FIRM / OPERATOR: NEAS / JL	DRILL RIG: CME 55T	STATION / OFFSET: 19+13, 3' RT.
TYPE: SUBGRADE	SAMPLING FIRM / LOGGER: NEAS / JL	HAMMER: CME AUTOMATIC	ALIGNMENT: RAMP G
PID: SFN:	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 1/24/22	ELEVATION: 1214.6 (MSL) EOB: 7.5 ft.
START: 9/8/23 END: 9/8/23	SAMPLING METHOD: SPT	ENERGY RATIO (%): 63.4	LAT / LONG: 40.284059, -81.000113

EXPLORATION ID B-112-0-23

PAGE 1 OF 1

MATERIAL DESCRIPTION AND NOTES	ELEV. 1214.6	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
9.0" ASPHALT (DRILLERS DESCRIPTION)	1213.8																		
HARD, BROWN, **SANDY SILT**, LITTLE CLAY, LITTLE GRAVEL, DAMP	1210.1	1	3 4 3	7	67	SS-1	4.50	15	13	26	30	16	25	18	7	13	A-4a (2)	40	
		2	4 7 13	21	78	SS-2	4.50	-	-	-	-	-	-	-	-	14	A-4a (V)	-	
HARD, BROWN, **SILT**, SOME CLAY, TRACE SAND, TRACE GRAVEL, DAMP	1207.1	3	6 9 16	26	83	SS-3	4.50	4	3	7	59	27	33	23	10	12	A-4b (8)	-	
		4	6 13 17	32	78	SS-4	4.50	-	-	-	-	-	-	-	-	10	A-4b (V)	-	
		5																	
		6																	
		7 EOB																	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING. HOLE DID NOT CAVE. DRILLED AS STAKED.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLACED 0.5 BAG ASPHALT PATCH; POURED 1 BAG HOLE PLUG; SHOVELED SOIL CUTTINGS

STANDARD ODOT LOG W/ SULFATES (8.5 X 11) - OH DOT.GDT - 10/18/24 12:24 - X:\1\ACTIVE PROJECTS\ACTIVE SOIL PROJECTS\HAS-22-15.25-21.47\GINT FILES\HAS-22-15.25-21.47.GPJ

STANDARD ODOT LOG W/ SULFATES (8.5 X 11) - OH DOT.GDT - 10/18/24 12:24 - X:\1\ACTIVE PROJECTS\ACTIVE SOIL PROJECTS\HAS-22-15.25-21.47\GINT FILES\HAS-22-15.25-21.47.GPJ

PROJECT: HAS-22-15.25-21.47	DRILLING FIRM / OPERATOR: NEAS / JL	DRILL RIG: CME 45B	STATION / OFFSET: 15+61, 22' LT.	EXPLORATION ID B-113-0-23
TYPE: SUBGRADE	SAMPLING FIRM / LOGGER: NEAS / JL	HAMMER: CME AUTOMATIC	ALIGNMENT: RAMP G	
PID: SFN:	DRILLING METHOD: 4.00" FA	CALIBRATION DATE: 1/24/22	ELEVATION: 1218.2 (MSL) EOB: 7.5 ft.	PAGE 1 OF 1
START: 8/9/23 END: 8/9/23	SAMPLING METHOD: SPT	ENERGY RATIO (%): 72.6	LAT / LONG: 40.284062, -80.998851	

MATERIAL DESCRIPTION AND NOTES	ELEV. 1218.2	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
8.0" ASPHALT AND 9.0" CONCRETE (DRILLERS DESCRIPTION)	1216.8	1																	
HARD, BROWN, **SANDY SILT**, SOME CLAY, TRACE GRAVEL, DAMP	1215.2	2	5 2 2	5	67	SS-1	4.25	0	8	31	39	22	27	19	8	9	A-4a (5)	300	
VERY STIFF, BROWN, **SILT AND CLAY**, SOME SAND, TRACE GRAVEL, DAMP	1213.7	3 4	2 3 2	6	56	SS-2	4.00	0	5	17	47	31	32	21	11	17	A-6a (8)	-	
HARD, BROWN, **SANDY SILT**, LITTLE CLAY, LITTLE GRAVEL, DAMP	1212.2	5	3 4 5	11	56	SS-3	4.25	-	-	-	-	-	-	-	-	15	A-4a (V)	-	
VERY STIFF, BROWN, **SILT AND CLAY**, SOME SAND, TRACE GRAVEL, DAMP	1210.7	6 7 EOB	3 4 6	12	61	SS-4	3.75	-	-	-	-	-	-	-	-	20	A-6a (V)	-	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING. HOLE DID NOT CAVE. BORING OFFSET 5.0' NORTH.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLACED 0.5 BAG ASPHALT PATCH; POURED 1 BAG HOLE PLUG; SHOVELED SOIL CUTTINGS

PROJECT: HAS-22-15.25-21.47	DRILLING FIRM / OPERATOR: NEAS / JL	DRILL RIG: CME 45B	STATION / OFFSET: 11+57, 5' RT.	EXPLORATION ID B-114-0-23
TYPE: SUBGRADE	SAMPLING FIRM / LOGGER: NEAS / JL	HAMMER: CME AUTOMATIC	ALIGNMENT: RAMP G	
PID: SFN:	DRILLING METHOD: 4.00" FA	CALIBRATION DATE: 1/24/22	ELEVATION: 1215.1 (MSL) EOB: 7.5 ft.	PAGE 1 OF 1
START: 8/9/23 END: 8/9/23	SAMPLING METHOD: SPT	ENERGY RATIO (%): 72.6	LAT / LONG: 40.284633, -80.997739	

MATERIAL DESCRIPTION AND NOTES	ELEV. 1215.1	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
10.5" ASPHALT (DRILLERS DESCRIPTION)	1214.2																		
DENSE, BROWN AND GRAY, **SANDY SILT**, LITTLE CLAY, LITTLE GRAVEL, DAMP	1210.6	1 2 3 4	12 26 10	44	44	SS-1	-	13	14	16	37	20	NP	NP	NP	9	A-4a (4)	-	
			12 14 14	34	50	SS-2	-	-	-	-	-	-	-	-	-	10	A-4a (V)	-	
HARD, BROWN AND GRAY, **SILT AND CLAY**, SOME SAND, LITTLE GRAVEL, DAMP	1207.6	5 6 7	4 7 11	22	67	SS-3	4.25	13	14	14	29	30	32	20	12	14	A-6a (6)	-	
		EOB	5 9 12	25	56	SS-4	4.25	-	-	-	-	-	-	-	-	13	A-6a (V)	-	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING. HOLE DID NOT CAVE. DRILLED AS STAKED.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLACED 0.5 BAG ASPHALT PATCH; POURED 1 BAG HOLE PLUG; SHOVELED SOIL CUTTINGS

STANDARD ODOT LOG W/ SULFATES (8.5 X 11) - OH DOT.GDT - 10/18/24 12:24 - X:\1\ACTIVE PROJECTS\ACTIVE SOIL PROJECTS\HAS-22-15.25-21.47\GINT FILES\HAS-22-15.25-21.47.GPJ

PROJECT: HAS-22-15.25-21.47	DRILLING FIRM / OPERATOR: NEAS / JL	DRILL RIG: CME 45B	STATION / OFFSET: 3+75, 7' LT.
TYPE: SUBGRADE	SAMPLING FIRM / LOGGER: NEAS / JL	HAMMER: CME AUTOMATIC	ALIGNMENT: RAMP H
PID: SFN:	DRILLING METHOD: 4.00" FA	CALIBRATION DATE: 1/24/22	ELEVATION: 1207.6 (MSL) EOB: 7.5 ft.
START: 8/9/23 END: 8/9/23	SAMPLING METHOD: SPT	ENERGY RATIO (%): 72.6	LAT / LONG: 40.285724, -80.997539

EXPLORATION ID B-115-0-23

PAGE 1 OF 1

MATERIAL DESCRIPTION AND NOTES	ELEV. 1207.6	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
10.0" ASPHALT (DRILLERS DESCRIPTION)	1206.8																		
VERY STIFF TO HARD, BROWN AND GRAY, **SILT AND CLAY**, SOME TO "AND" SAND, TRACE GRAVEL, DAMP		1																	
		2	4 13 11	29	67	SS-1	4.50	6	9	22	31	32	33	21	12	12	A-6a (6)	840	
		3	5 9 11	24	56	SS-2	4.00	1	13	23	32	31	30	19	11	11	A-6a (6)	-	
		4	4 6 8	17	61	SS-3	4.00	-	-	-	-	-	-	-	-	13	A-6a (V)	-	
		5	5 7 9	19	67	SS-4	3.75	-	-	-	-	-	-	-	-	11	A-6a (V)	-	
	1200.1	6 EOB																	
		7																	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING. HOLE DID NOT CAVE. BORING OFFSET 12.0' WEST.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLACED 0.5 BAG ASPHALT PATCH; POURED 1 BAG HOLE PLUG; SHOVELED SOIL CUTTINGS

STANDARD ODOT LOG W/ SULFATES (8.5 X 11) - OH DOT.GDT - 10/18/24 12:24 - X:\1ACTIVE PROJECTS\ACTIVE SOIL PROJECTS\HAS-22-15.25-21.47\GINT FILES\HAS-22-15.25-21.47.GPJ

PROJECT: HAS-22-15.25-21.47	DRILLING FIRM / OPERATOR: NEAS / ASHBAUGH	DRILL RIG: CME 55T	STATION / OFFSET: 7+73, 3' LT.
TYPE: CULVERT	SAMPLING FIRM / LOGGER: NEAS / JL	HAMMER: CME AUTOMATIC	ALIGNMENT: RAMP E
PID: SFN:	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 1/24/22	ELEVATION: 1240.2 (MSL) EOB: 8.7 ft.
START: 9/6/23 END: 9/6/23	SAMPLING METHOD: SPT	ENERGY RATIO (%): 63.4	LAT / LONG: 40.285411, -81.002019

EXPLORATION ID B-116-0-23

PAGE 1 OF 1

MATERIAL DESCRIPTION AND NOTES	ELEV. 1240.2	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
9.0" ASPHALT (DRILLERS DESCRIPTION)	1239.4																		
HARD, BROWN AND GRAY, **SILTY CLAY**, LITTLE SAND, LITTLE GRAVEL, DAMP	1235.7	1	5 4 5	10	50	SS-1	4.50	18	9	9	30	34	38	21	17	15	A-6b (9)	100	
		2	3 3 4	7	61	SS-2	4.50	-	-	-	-	-	-	-	-	17	A-6b (V)	-	
HARD, BROWN AND GRAY, **SANDY SILT**, SOME CLAY, LITTLE GRAVEL, DAMP	1234.2	3	2 5 7	13	78	SS-3	4.50	17	10	14	30	29	27	17	10	14	A-4a (5)	-	
LIMESTONE, GRAY, SLIGHTLY WEATHERED, STRONG. @6.5'; AUGER REFUSAL		4 TR 5 6	50/2"	-	50	SS-4	-	-	-	-	-	-	-	-	-	2	Rock (V)	-	
@8.5'; AUGER REFUSAL. BORING TERMINATED PER ENGINEERS DECISION.	1231.5	7 8 EOB	50/2"	-	50	SS-5	-	-	-	-	-	-	-	-	-	1	Rock (V)	-	
AFTER EOB, DRILLERS OFFSET 10.0' SOUTH AND ENCOUNTERED AUGER REFUSAL AT 9.8'																			

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING. HOLE DID NOT CAVE. DRILLED AS STAKED.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLACED 0.5 BAG ASPHALT PATCH; POURED 1 BAG HOLE PLUG; SHOVELED SOIL CUTTINGS

STANDARD ODOT LOG W/ SULFATES (8.5 X 11) - OH DOT.GDT - 10/18/24 12:24 - X:\1ACTIVE PROJECTS\ACTIVE SOIL PROJECTS\HAS-22-15.25-21.47\GINT FILES\HAS-22-15.25-21.47.GPJ

PROJECT: HAS-22-15.25-21.47	DRILLING FIRM / OPERATOR: NEAS / JL	DRILL RIG: CME 55T	STATION / OFFSET: 0+32, 3' LT.
TYPE: SUBGRADE	SAMPLING FIRM / LOGGER: NEAS / JL	HAMMER: CME AUTOMATIC	ALIGNMENT: RAMP E
PID: SFN:	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 1/24/22	ELEVATION: 1211.3 (MSL) EOB: 7.5 ft.
START: 9/7/23 END: 9/7/23	SAMPLING METHOD: SPT	ENERGY RATIO (%): 63.4	LAT / LONG: 40.286466, -81.000345

EXPLORATION ID B-117-0-23

PAGE 1 OF 1

MATERIAL DESCRIPTION AND NOTES	ELEV. 1211.3	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
9.0" ASPHALT (DRILLERS DESCRIPTION)	1210.5																		
MEDIUM DENSE TO VERY DENSE, BROWN AND ORANGISH BROWN, **COARSE AND FINE SAND**, LITTLE SILT, TRACE TO LITTLE CLAY, TRACE GRAVEL, IRON STAINING, DAMP		1 2 3 4 5 6 7	6 10 11	22	44	SS-1	-	7	28	41	14	10	NP	NP	NP	10	A-3a (0)	60	
			9 15 19	36	83	SS-2	-	4	19	48	15	14	NP	NP	NP	10	A-3a (0)	-	
			11 21 34	58	78	SS-3	-	-	-	-	-	-	-	-	-	8	A-3a (V)	-	
	1203.8	EOB	13 16 29	48	33	SS-4	-	-	-	-	-	-	-	-	-	9	A-3a (V)	-	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING. HOLE DID NOT CAVE. DRILLED AS STAKED.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLACED 0.5 BAG ASPHALT PATCH; SHOVELED SOIL CUTTINGS

STANDARD ODOT LOG W/ SULFATES (8.5 X 11) - OH DOT.GDT - 10/18/24 12:24 - X:\1\ACTIVE PROJECTS\ACTIVE SOIL PROJECTS\HAS-22-15.25-21.47\GINT FILES\HAS-22-15.25-21.47.GPJ

PROJECT: HAS-22-15.25-21.47	DRILLING FIRM / OPERATOR: NEAS / JL	DRILL RIG: CME 55T	STATION / OFFSET: 5+14, 31' RT.
TYPE: SUBGRADE	SAMPLING FIRM / LOGGER: NEAS / JL	HAMMER: CME AUTOMATIC	ALIGNMENT: RAMP E
PID: SFN:	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 1/24/22	ELEVATION: 1230.9 (MSL) EOB: 7.5 ft.
START: 9/6/23 END: 9/6/23	SAMPLING METHOD: SPT	ENERGY RATIO (%): 63.4	LAT / LONG: 40.286148, -81.002021

EXPLORATION ID B-118-0-23

PAGE 1 OF 1

MATERIAL DESCRIPTION AND NOTES	ELEV. 1230.9	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
9.0" ASPHALT (DRILLERS DESCRIPTION)	1230.1																		
MEDIUM DENSE, BROWN, **SANDY SILT**, SOME GRAVEL, SOME CLAY, DAMP	1227.9	1 2 3	7 5 6	12	22	SS-1	-	35	12	10	22	21	NP	NP	NP	12	A-4a (2)	140	
HARD, BROWN AND GRAY, **SILT AND CLAY**, SOME GRAVEL, SOME SAND, DAMP		4 5	4 4 8	13	56	SS-2	4.50	23	10	11	31	25	33	19	14	12	A-6a (6)	-	
			5 13 9	23	72	SS-3	4.50	-	-	-	-	-	-	-	-	10	A-6a (V)	-	
	1223.4	6 7 EOB	4 7 9	17	83	SS-4	4.50	-	-	-	-	-	-	-	-	12	A-6a (V)	-	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING. HOLE DID NOT CAVE. DRILLED AS STAKED.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLACED 0.5 BAG ASPHALT PATCH; SHOVELED SOIL CUTTINGS

STANDARD ODOT LOG W/ SULFATES (8.5 X 11) - OH DOT.GDT - 10/18/24 12:24 - X:\1\ACTIVE PROJECTS\ACTIVE SOIL PROJECTS\HAS-22-15.25-21.47\GINT FILES\HAS-22-15.25-21.47.GPJ

PROJECT: HAS-22-15.25-21.47	DRILLING FIRM / OPERATOR: NEAS / JL	DRILL RIG: CME 45B	STATION / OFFSET: 6+29, 3' LT.
TYPE: SUBGRADE	SAMPLING FIRM / LOGGER: NEAS / JL	HAMMER: CME AUTOMATIC	ALIGNMENT: RAMP F
PID: SFN:	DRILLING METHOD: 4.00" FA	CALIBRATION DATE: 1/24/22	ELEVATION: 1249.0 (MSL) EOB: 7.5 ft.
START: 8/1/23 END: 8/1/23	SAMPLING METHOD: SPT	ENERGY RATIO (%): 72.6	LAT / LONG: 40.284836, -81.002214

EXPLORATION ID B-119-0-23

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)	SO4 ppm	BACK FILL
12.0" ASPHALT (DRILLERS DESCRIPTION)	1249.0																		
	1248.0																		
VERY STIFF TO HARD, BROWN AND GRAY, **SILT AND CLAY**, SOME SAND, LITTLE GRAVEL, DAMP		1 2 3 4 5 6 7	2 3 4	8	39	SS-1	4.50	19	9	20	26	26	29	18	11	11	A-6a (4)	460	
			3 4 6	12	44	SS-2	4.00	-	-	-	-	-	-	-	-	14	A-6a (V)	-	
			3 7 12	23	56	SS-3	4.00	-	-	-	-	-	-	-	-	17	A-6a (V)	-	
	1243.0																		
MEDIUM DENSE, BLUEISH GRAY, **STONE FRAGMENTS WITH SAND AND SILT**, SOME CLAY, DAMP	1241.5	EOB	5 9 16	30	50	SS-4	-	33	14	20	10	23	NP	NP	NP	10	A-2-4 (0)	-	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING. HOLE DID NOT CAVE. DRILLED AS STAKED.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLACED 0.5 BAG ASPHALT PATCH; POURED 1 BAG HOLE PLUG; SHOVELED SOIL CUTTINGS

STANDARD ODOT LOG W/ SULFATES (8.5 X 11) - OH DOT.GDT - 10/18/24 12:24 - X:\1\ACTIVE PROJECTS\ACTIVE SOIL PROJECTS\HAS-22-15.25-21.47\GINT FILES\HAS-22-15.25-21.47.GPJ

STANDARD ODOT LOG W/ SULFATES (8.5 X 11) - OH DOT.GDT - 10/18/24 12:24 - X:\1ACTIVE PROJECTS\ACTIVE SOIL PROJECTS\HAS-22-15.25-21.47\GINT FILES\HAS-22-15.25-21.47.GPJ

PROJECT: HAS-22-15.25-21.47	DRILLING FIRM / OPERATOR: NEAS / JL	DRILL RIG: CME 55T	STATION / OFFSET: 8+32, 4' LT.	EXPLORATION ID B-119-1-23	
TYPE: CULVERT	SAMPLING FIRM / LOGGER: NEAS / JL	HAMMER: CME AUTOMATIC	ALIGNMENT: RAMP F		
PID: SFN:	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 1/24/22	ELEVATION: 1242.0 (MSL) EOB: 31.2 ft.	PAGE 1 OF 2	
START: 9/6/23 END: 9/6/23	SAMPLING METHOD: SPT	ENERGY RATIO (%): 63.4	LAT / LONG: 40.285386, -81.002230		

MATERIAL DESCRIPTION AND NOTES	ELEV. 1242.0	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
10.0" ASPHALT (DRILLERS DESCRIPTION)	1241.2																		
HARD, BROWN, **SILT AND CLAY**, SOME SAND, LITTLE GRAVEL, DAMP	1237.5	1																	
		2	3 4 5	10	78	SS-1	4.25	13	10	12	35	30	33	20	13	14	A-6a (7)	40	
		3	2 3 4	7	56	SS-2	4.25	-	-	-	-	-	-	-	-	17	A-6a (V)	-	
MEDIUM DENSE TO VERY DENSE, GRAY AND GREEN, **STONE FRAGMENTS WITH SAND**, LITTLE CLAY, LITTLE SILT, DAMP TO MOIST		4																	
		5	5 13 11	25	78	SS-3	-	51	17	7	12	13	NP	NP	NP	8	A-1-b (0)	-	
		6	3 8 14	23	83	SS-4	-	-	-	-	-	-	-	-	-	12	A-1-b (V)	-	
		7																	
		8																	
		9	4 15 13	30	50	SS-5	-	-	-	-	-	-	-	-	-	13	A-1-b (V)	-	
		10																	
		11																	
		12	3 5 8	14	72	SS-6	-	-	-	-	-	-	-	-	-	13	A-1-b (V)	-	
		13																	
		14	5 50/5"	-	100	SS-7	-	-	-	-	-	-	-	-	-	19	A-1-b (V)	-	
	1226.5	15																	
HARD, BROWN AND GRAY, **SILT AND CLAY**, LITTLE SAND, TRACE GRAVEL, DAMP		16																	
		17	8 12 20	34	78	SS-8	4.50	3	4	12	38	43	33	19	14	17	A-6a (10)	-	
		18																	
		19	4 8 11	20	72	SS-9	4.50	-	-	-	-	-	-	-	-	16	A-6a (V)	-	
	1221.5	20																	
HARD, BROWN AND GRAY AND GREEN, **SANDY SILT**, SOME GRAVEL, SOME CLAY, CONTAINS INTERBEDDED SILT SEAMS, DAMP		21																	
		22	11 11 12	24	72	SS-10	4.50	29	12	7	27	25	26	18	8	10	A-4a (3)	-	
		23																	
		24	22 12 18	32	89	SS-11	4.50	-	-	-	-	-	-	-	-	18	A-4a (V)	-	
		25																	
		26																	
		27	5 6 10	17	78	SS-12	4.50	-	-	-	-	-	-	-	-	9	A-4a (V)	-	
		28																	
		29	7 3 4	7	83	SS-13	4.50	-	-	-	-	-	-	-	-	13	A-4a (V)	-	

PID:	SFN:	PROJECT: HAS-22-15.25-21.47	STATION / OFFSET: 8+32, 4' LT.	START: 9/6/23	END: 9/6/23	PG 2 OF 2	B-119-1-23

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)	SO4 ppm	BACK FILL
	1212.0																		
	1211.0																		
LIMESTONE, GRAY, SLIGHTLY WEATHERED, STRONG. @31.2'; AUGER REFUSAL. BORING TERMINATED PER ENGINEERS DECISION	1210.8	TR 31	60/2"	-	100	SS-14	-	-	-	-	-	-	-	-	-	4	Rock (V)	-	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING. HOLE DID NOT CAVE. DRILLED AS STAKED.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLACED 0.5 BAG ASPHALT PATCH; SHOVELED SOIL CUTTINGS

STANDARD ODOT LOG W/ SULFATES (8.5 X 11) - OH DOT.GDT - 10/18/24 12:24 - X:\1ACTIVE PROJECTS\ACTIVE SOIL PROJECTS\HAS-22-15.25-21.47\GINT FILES\HAS-22-15.25-21.47.GPJ

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 10/30/25 09:36 - X:\1ACTIVE PROJECTS\ACTIVE SOIL PROJECTS\HAS-22-15.11_(15.25-21.47-2025)\GINT FILES\HAS-22-15.25-21.47_2

PROJECT: HAS-22-15.11	DRILLING FIRM / OPERATOR: NEAS INC. / JL	DRILL RIG: CME 55TB	STATION / OFFSET: 931+42, 13' RT.	EXPLORATION ID B-033-2-23
TYPE: CULVERT	SAMPLING FIRM / LOGGER: NEAS INC. / JL	HAMMER: CME AUTOMATIC	ALIGNMENT: CLP_US22	
PID: 113440 SFN:	DRILLING METHOD: 3.25" HSA / NQ2	CALIBRATION DATE: 7/30/24	ELEVATION: 1223.2 (MSL) EOB: 62.8 ft.	PAGE 1 OF 3
START: 6/3/25 END: 6/4/25	SAMPLING METHOD: SPT / NQ2	ENERGY RATIO (%): 89	LAT / LONG: 40.285516, -80.998831	

MATERIAL DESCRIPTION AND NOTES	ELEV. 1223.2	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	BACK FILL
5.0" TOPSOIL (DRILLERS DESCRIPTION)	1222.8																	
HARD, BROWN AND BROWNISH GRAY, **SANDY SILT**, SOME CLAY, TRACE TO LITTLE GRAVEL, COAL FRAGMENTS, DAMP **(FILL)**			4 4 7	16	44	SS-1	4.50	5	15	17	40	23	32	22	10	15	A-4a (6)	
			3 13 8	31	50	SS-2	4.50	-	-	-	-	-	-	-	-	15	A-4a (V)	
	1213.7		9 12 8	30	39	SS-3	4.50	-	-	-	-	-	-	-	-	13	A-4a (V)	
VERY STIFF TO HARD, BROWN MOTTLED WITH GRAY AND ORANGISH BROWN, **CLAY**, SOME SILT, LITTLE SAND, TRACE GRAVEL, IRON STAINING, DAMP **(FILL)**			4 5 7	18	72	SS-4	4.50	-	-	-	-	-	-	-	-	18	A-7-6 (V)	
	1208.7		4 4 6	15	83	SS-5	3.00	9	7	7	34	43	42	24	18	19	A-7-6 (12)	
MEDIUM DENSE, BROWN AND GRAY, **STONE FRAGMENTS WITH SAND AND SILT**, TRACE CLAY, DAMP **(FILL)**	1206.2		4 7 9	24	61	SS-6	-	-	-	-	-	-	-	-	-	12	A-2-4 (V)	
HARD, GRAY, **SILT AND CLAY**, SOME SAND, TRACE GRAVEL, DAMP **(FILL)**	1203.7		5 6 9	22	56	SS-7	4.50	9	14	10	31	36	36	21	15	14	A-6a (8)	
VERY DENSE, GRAY, **STONE FRAGMENTS**, LITTLE SAND, TRACE SILT, TRACE CLAY, COBBLE, DAMP **(FILL)**	1201.2		18 24 30	80	22	SS-8	-	-	-	-	-	-	-	-	-	8	A-1-a (V)	
HARD, GRAY, **SILT AND CLAY**, SOME SAND, LITTLE GRAVEL, COAL FRAGMENTS, DAMP **(FILL)**	1198.7		5 5 6	16	39	SS-9	4.50	12	15	12	30	31	33	21	12	12	A-6a (6)	
MEDIUM DENSE, BROWN AND DARK GRAY, **STONE FRAGMENTS WITH SAND AND SILT**, TRACE CLAY, DAMP **(FILL)**	1196.2		4 4 8	18	22	SS-10	-	-	-	-	-	-	-	-	-	10	A-2-4 (V)	
HARD, GRAY AND BROWN, **SILT AND CLAY**, SOME SAND, LITTLE GRAVEL, DAMP **(FILL)**			7 7 7	21	72	SS-11	4.50	12	16	11	36	25	35	22	13	13	A-6a (6)	

PID: 113440	SFN:	PROJECT: HAS-22-15.11	STATION / OFFSET: 931+42, 13' RT.	START: 6/3/25	END: 6/4/25	PG 2 OF 3	B-033-2-23

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
HARD, GRAY AND BROWN, **SILT AND CLAY**, SOME SAND, LITTLE GRAVEL, DAMP *(continued)*	1193.2	31	4 5 7	18	67	SS-12	4.50	-	-	-	-	-	-	-	-	10	A-6a (V)	
MEDIUM DENSE TO DENSE, BROWN AND GRAY, **STONE FRAGMENTS WITH SAND AND SILT**, TRACE CLAY, DAMP **(FILL)**	1191.2	32 33 34	18 16 14	45	22	SS-13	-	-	-	-	-	-	-	-	-	11	A-2-4 (V)	
		35 36	9 8 9	25	61	SS-14	-	-	-	-	-	-	-	-	-	9	A-2-4 (V)	
	1183.7	37 38 39	14 7 14	31	56	SS-15	-	-	-	-	-	-	-	-	-	10	A-2-4 (V)	
MEDIUM DENSE, BLACK AND GRAY, **STONE FRAGMENTS**, LITTLE SAND, TRACE SILT, TRACE CLAY, COAL FRAGMENTS, DAMP **(FILL)**	1181.2	40 41	6 8 12	30	33	SS-16	-	-	-	-	-	-	-	-	-	9	A-1-a (V)	
MEDIUM DENSE, BLACK AND BROWN, **STONE FRAGMENTS WITH SAND AND SILT**, TRACE CLAY, COAL FRAGMENTS, DAMP **(FILL)**	1178.7	42 43 44	9 6 12	27	72	SS-17	-	-	-	-	-	-	-	-	-	12	A-2-4 (V)	
DENSE, GRAY, **STONE FRAGMENTS**, LITTLE SAND, TRACE SILT, TRACE CLAY, DAMP	1176.2	45 46 47	13 13 10	34	39	SS-18	-	-	-	-	-	-	-	-	-	5	A-1-a (V)	
MEDIUM DENSE, GRAY AND BROWN, **STONE FRAGMENTS WITH SAND AND SILT**, TRACE CLAY, DAMP	1173.7	48 49	8 7 8	22	44	SS-19	-	-	-	-	-	-	-	-	-	7	A-2-4 (V)	
MEDIUM DENSE, GRAY, **STONE FRAGMENTS**, LITTLE SAND, TRACE SILT, TRACE CLAY, WET	W 1173.7	50 51 52	31 11 9	30	39	SS-20	-	-	-	-	-	-	-	-	-	14	A-1-a (V)	
VERY STIFF, GRAY AND BROWN, **SILT AND CLAY**, SOME SAND, LITTLE GRAVEL, DAMP	1171.2	53 54	5 8 10	27	83	SS-21	2.50	17	19	12	33	19	34	23	11	17	A-6a (4)	
DENSE, GRAY, **STONE FRAGMENTS**, LITTLE SAND, TRACE SILT, TRACE CLAY, WET	1168.7	55 56 57	30 16 8	36	39	SS-22	-	-	-	-	-	-	-	-	-	18	A-1-a (V)	
SILTSTONE, GRAY, MODERATELY WEATHERED, SLIGHTLY STRONG.	1165.7 / 1165.4	TR 58	50/1"	-	100	SS-23	-	-	-	-	-	-	-	-	-	8	Rock (V)	
@59.9'; 1.0" CLAY SEAM @60.5'; 2.0" CLAY SEAM		59 60 61	63		94	NQ2-1											CORE	

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 10/30/25 09:36 - X:\1ACTIVE PROJECTS\ACTIVE SOIL PROJECTS\HAS-22-15.11_(15.25-21.47-2025)\GINT FILES\HAS-22-15.25-21.47_2

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 10/30/25 09:36 - X:\1ACTIVE PROJECTS\ACTIVE SOIL PROJECTS\HAS-22-15.11_(15.25-21.47-2025)\GINT FILES\HAS-22-15.25-21.47_2

PID: 113440	SFN:	PROJECT: HAS-22-15.11	STATION / OFFSET: 931+42, 13' RT.	START: 6/3/25	END: 6/4/25	PG 3 OF 3	B-033-2-23

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
SILTSTONE, GRAY AND DARK GRAY, SLIGHTLY WEATHERED, SLIGHTLY STRONG, THIN BEDDED, CALCAREOUS, CLAY SEAMS, BEDDING DISCONTINUITIES: LOW ANGLE, JOINT DISCONTINUITIES: HIGH ANGLE FROM 58.2'-59.5', FRACTURED TO MODERATELY FRACTURED, OPEN TO NARROW, SLIGHTLY ROUGH, BLOCKY/DISTURBED/SEAMY, FAIR TO GOOD SURFACE CONDITION; RQD 63%, REC 94%. *(continued)*	1161.0 1160.4	EOB																

NOTES: GROUNDWATER ENCOUNTERED AT 49.5' DURING DRILLING. HOLE DID NOT CAVE. BORING OFFSET 12.0' SOUTH.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: POURED 3 BAGS HOLE PLUG; SHOVELED SOIL CUTTINGS

PROJECT: HAS-22-15.11	DRILLING FIRM / OPERATOR: NEAS INC. / JL	DRILL RIG: CME 55TB	STATION / OFFSET: 928+32, 60' RT.	EXPLORATION ID B-139-0-23
TYPE: BRIDGE	SAMPLING FIRM / LOGGER: NEAS INC. / JL	HAMMER: CME AUTOMATIC	ALIGNMENT: CLP_US22	
PID: 113440 SFN:	DRILLING METHOD: 3.25" HSA / NQ2	CALIBRATION DATE: 7/30/24	ELEVATION: 1235.2 (MSL) EOB: 36.5 ft.	PAGE 1 OF 2
START: 3/25/25 END: 3/1/35	SAMPLING METHOD: SPT / NQ2	ENERGY RATIO (%): 89	LAT / LONG: 40.284959, -80.999687	

MATERIAL DESCRIPTION AND NOTES	ELEV. 1235.2	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	BACK FILL
16.0" CONCRETE (DRILLERS DESCRIPTION)	1233.9																	
VERY STIFF TO HARD, BROWN, **SANDY SILT**, LITTLE GRAVEL, LITTLE CLAY, DAMP			3 3 5	12	50	SS-1	4.50	18	14	28	27	13	22	17	5	12	A-4a (1)	
			3 3 4	10	61	SS-2	3.75	-	-	-	-	-	-	-	-	14	A-4a (V)	
			2 3 3	9	50	SS-3	4.50	-	-	-	-	-	-	-	-	17	A-4a (V)	
@10.0'; SS-4 CONTAINS NO INTACT SOIL FOR HP READINGS	1224.2	TR	10 39 50/5"	-	41	SS-4	-	-	-	-	-	-	-	-	-	7	A-4a (V)	
INTERBEDDED SANDSTONE (71%) AND SHALE (29%), BEDDING DISCONTINUITIES: LOW ANGLE, HIGHLY FRACTURED TO SLIGHTLY FRACTURED, NARROW, SLIGHTLY ROUGH, BLOCKY/DISTURBED/SEAMY, FAIR SURFACE CONDITION, RQD 42%, REC. 100%; **SANDSTONE**, GRAY, MODERATELY WEATHERED, MODERATELY STRONG, FINE TO MEDIUM GRAINED, LAMINATED TO THIN BEDDED; **SHALE**, DARK GRAY, MODERATELY WEATHERED, WEAK, FISSILE. @14.2'-14.6'; Qu = 4367 PSI @ 1.3% (SANDSTONE)	1218.2		30		94	NQ2-1											CORE	
SILTSTONE, YELLOWISH BROWN, SEVERELY WEATHERED, EXTREMELY WEAK, VERY THIN TO THIN BEDDED, SHEAR DISCONTINUITIES, BEDDING DISCONTINUITIES: LOW ANGLE, HIGHLY FRACTURED TO MODERATELY FRACTURED, OPEN TO NARROW, SLICKENSIDED TO SLIGHTLY ROUGH, BLOCKY/DISTURBED/SEAMY, POOR TO VERY POOR SURFACE CONDITION; RQD 15%, REC 87%.	1213.7																	
INTERBEDDED SHALE (56%) AND SILTSTONE (44%), BEDDING DISCONTINUITIES: LOW ANGLE, HIGHLY FRACTURED TO MODERATELY FRACTURED, OPEN TO NARROW, SLIGHTLY ROUGH, BLOCKY/DISTURBED/SEAMY, FAIR TO POOR SURFACE CONDITION, RQD 26%, REC. 100%; **SHALE**, DARK GRAY, MODERATELY WEATHERED, VERY WEAK, LAMINATED TO THIN BEDDED, FISSILE; **SILTSTONE**, GRAY, SLIGHTLY WEATHERED, SLIGHTLY TO MODERATELY STRONG.			26		100	NQ2-2											CORE	

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 8/18/25 15:35 - X:\1ACTIVE PROJECTS\ACTIVE SOIL PROJECTS\HAS-22-15.11_(15.25-21.47-2025)\GINT FILES\HAS-22-15.25-21.47_20

PID: 113440	SFN:	PROJECT: HAS-22-15.11	STATION / OFFSET: 928+32, 60' RT.	START: 3/25/25	END: 3/1/35	PG 2 OF 2	B-139-0-23

MATERIAL DESCRIPTION AND NOTES	ELEV. 1205.2	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	BACK FILL
	1203.7	31																
@31.5'-36.5'; NQ2-3 CONTAINS NO RECOVERY.		32 33 34	0		0	NQ2-3											CORE	
	1198.7	35 36 EOB																

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING. HOLE DID NOT CAVE. DRILLED AS STAKED.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: POURED 2.0 BAGS HOLE PLUG; PLACED 0.5 BAG QUICKCRETE; SHOVELED SOIL CUTTINGS

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 8/18/25 15:35 - X:\1ACTIVE PROJECTS\ACTIVE SOIL PROJECTS\HAS-22-15.11_(15.25-21.47-2025)\GINT FILES\HAS-22-15.25-21.47_20

PROJECT: HAS-22-15.11	DRILLING FIRM / OPERATOR: NEAS INC. / JL	DRILL RIG: CME 55TB	STATION / OFFSET: 928+60, 20' LT.	EXPLORATION ID B-140-0-23
TYPE: BRIDGE	SAMPLING FIRM / LOGGER: NEAS INC. / JL	HAMMER: CME AUTOMATIC	ALIGNMENT: CLP_US22	
PID: 113440 SFN:	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 7/30/24	ELEVATION: 1234.4 (MSL) EOB: 25.8 ft.	PAGE 1 OF 1
START: 3/20/25 END: 3/20/25	SAMPLING METHOD: SPT	ENERGY RATIO (%): 89	LAT / LONG: 40.285188, -80.999752	

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
16.0" CONCRETE (DRILLERS DESCRIPTION)	1234.4																	
	1233.1	1																
AUGERED TO 25.0' WITHOUT SAMPLING		2																
		3																
		4																
		5																
		6																
		7																
		8																
		9																
		10																
		11																
		12																
		13																
		14																
		15																
		16																
		17																
		18																
		19																
		20																
		21																
		22																
		23																
		24																
	1209.4	TR 25																
SANDSTONE, BROWNISH GRAY, MODERATELY WEATHERED, SLIGHTLY STRONG, FINE TO MEDIUM GRAINED.	1208.6	EOB	20 50/3"	-	44	SS-1	-	-	-	-	-	-	-	-	-	6	Rock (V)	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING. HOLE DID NOT CAVE. BORING OFFSET 2.0' NORTHWEST.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: POURED 1.0 BAG HOLE PLUG; PLACED 0.5 BAG QUICKCRETE; SHOVELED SOIL CUTTINGS

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 8/18/25 15:35 - X:\1ACTIVE PROJECTS\ACTIVE SOIL PROJECTS\HAS-22-15.11_(15.25-21.47-2025)\GINT FILES\HAS-22-15.25-21.47_20

PROJECT: HAS-22-15.11	DRILLING FIRM / OPERATOR: NEAS INC. / JL	DRILL RIG: CME 55TB	STATION / OFFSET: 928+59, 59' LT.	EXPLORATION ID B-141-0-23
TYPE: BRIDGE	SAMPLING FIRM / LOGGER: NEAS INC. / JL	HAMMER: CME AUTOMATIC	ALIGNMENT: CLP_US22	
PID: 113440 SFN:	DRILLING METHOD: 3.25" HSA / NQ2	CALIBRATION DATE: 7/30/24	ELEVATION: 1234.3 (MSL) EOB: 48.2 ft.	PAGE 1 OF 2
START: 3/17/25 END: 3/17/25	SAMPLING METHOD: SPT / NQ2	ENERGY RATIO (%): 89	LAT / LONG: 40.285277, -80.999831	

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
16.0" CONCRETE (DRILLERS DESCRIPTION)	1234.3																	
	1233.0	1																
VERY STIFF, BROWN, **SANDY SILT**, LITTLE CLAY, LITTLE GRAVEL, DAMP		2																
		3	3 3 6	13	39	SS-1	3.50	13	12	27	30	18	25	17	8	14	A-4a (3)	
	1229.8	4																
LOOSE, BROWN, **GRAVEL WITH SAND**, LITTLE SILT, TRACE CLAY, IRON STAINING, DAMP		5																
		6	4 3 4	10	33	SS-2	-	-	-	-	-	-	-	-	-	9	A-1-b (V)	
	1227.3	7																
LOOSE, BROWN, **GRAVEL WITH SAND, SILT, AND CLAY**, DAMP		8	3 2 2	6	28	SS-3	-	-	-	-	-	-	-	-	-	15	A-2-6 (V)	
	1224.8	9																
VERY STIFF, BROWN MOTTLED WITH ORANGISH BROWN, **SILT AND CLAY**, SOME SAND, LITTLE GRAVEL, IRON STAINING, DAMP		10																
		11	2 2 2	6	44	SS-4	2.50	14	10	16	38	22	32	20	12	17	A-6a (6)	
		12																
		13	3 3 2	7	56	SS-5	3.25	-	-	-	-	-	-	-	-	18	A-6a (V)	
	1219.8	14																
VERY STIFF TO HARD, BROWN AND ORANGISH BROWN BECOMING BROWN AND GRAY, **SANDY SILT**, LITTLE CLAY, TRACE GRAVEL AND STONE FRAGMENTS, IRON STAINING, DAMP		15																
		16	1 1 1	3	33	SS-6	3.75	1	14	27	38	20	29	22	7	17	A-4a (5)	
		17																
		18	0 0 2	3	33	SS-7	3.00	-	-	-	-	-	-	-	-	20	A-4a (V)	
		19																
		20																
		21	8 9 12	31	83	SS-8	4.50	-	-	-	-	-	-	-	-	21	A-4a (V)	
		22																
	1211.3	TR 23	48 50/2"	-	38	SS-9	-	-	-	-	-	-	-	-	-	8	A-4a (V)	
@22.5'; SS-9 CONTAINS NO INTACT SOIL FOR HP READINGS. RESIDUAL ROCK																		
SANDSTONE, GRAY AND BROWN, MODERATELY WEATHERED, STRONG, FINE TO MEDIUM GRAINED, LAMINATED TO THIN BEDDED, BEDDING DISCONTINUITIES: LOW ANGLE, HIGHLY FRACTURED TO MODERATELY FRACTURED, NARROW, SLIGHTLY ROUGH, BLOCKY/DISTURBED/SEAMY, FAIR SURFACE CONDITION; RQD 25%, REC 100%.	1208.4	24 25 26 27 28 29	33		98	NQ2-1											CORE	

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 8/18/25 15:35 - X:\1\ACTIVE PROJECTS\ACTIVE SOIL PROJECTS\HAS-22-15.11_(15.25-21.47-2025)\GINT FILES\HAS-22-15.25-21.47_20

PID: 113440	SFN:	PROJECT: HAS-22-15.11	STATION / OFFSET: 928+59, 59' LT.	START: 3/17/25	END: 3/17/25	PG 2 OF 2	B-141-0-23

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
INTERBEDDED SHALE (70%) AND SILTSTONE (30%), CONTAINS INTERBEDDED CLAY SEAMS, BEDDING DISCONTINUITIES: LOW ANGLE, HIGHLY FRACTURED TO MODERATELY FRACTURED, OPEN TO NARROW, SLIGHTLY ROUGH, BLOCKY/DISTURBED/SEAMY, FAIR TO POOR SURFACE CONDITION, RQD 46%, REC. 100%; **SHALE**, GRAY, HIGHLY WEATHERED, VERY WEAK, LAMINATED TO THIN BEDDED, FISSILE; **SILTSTONE**, GRAY, SLIGHTLY WEATHERED, SLIGHTLY STRONG. *(continued)* @30.2'-30.6'; Qu = 426 PSI @ 5.2% (SHALE)	1204.3	31																	
	1202.6	32																
		33																
		34																
		35																
		36																
		37																
SHALE, GRAY AND DARK GRAY, MODERATELY WEATHERED, WEAK TO SLIGHTLY STRONG, LAMINATED, FISSILE, CONTAINS A 1.0" CLAY SEAM AT 37.5', BEDDING DISCONTINUITIES: LOW ANGLE, HIGHLY FRACTURED TO MODERATELY FRACTURED, OPEN TO NARROW, SLIGHTLY ROUGH, LAMINATED, FAIR TO POOR SURFACE CONDITION; RQD 9%, REC 97%.		38	25		100	NQ2-2											CORE	
	1194.4	39																
		40																
C		41																
COAL, BLACK, HIGHLY WEATHERED, VERY WEAK, LAMINATED TO THIN BEDDED, FOSSILIFEROUS, BEDDING DISCONTINUITIES: LOW ANGLE, HIGHLY FRACTURED TO MODERATELY FRACTURED, NARROW, SLIGHTLY ROUGH TO VERY ROUGH, BLOCKY, FAIR TO POOR SURFACE CONDITION; RQD 32%, REC 100%.	1192.8	42																
		43																
LIMESTONE, GRAY AND LIGHT BROWN, SLIGHTLY WEATHERED, STRONG TO VERY STRONG, VERY FINE TO MEDIUM GRAINED, THIN TO THICK BEDDED, FOSSILIFEROUS, BEDDING DISCONTINUITIES: LOW ANGLE, FRACTURED TO SLIGHTLY FRACTURED, NARROW, SLIGHTLY ROUGH TO VERY ROUGH, BLOCKY, FAIR TO GOOD SURFACE CONDITION; RQD 76%, REC 100%.		44	75		100	NQ2-3											CORE	
		45																
		46																
		47																
	1186.1	EOB 48																

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING. HOLE DID NOT CAVE. DRILLED AS STAKED.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PUMPED 10.0 GAL. BENTONITE GROUT; POURED 1.0 BAG HOLE PLUG; PLACED 0.5 BAG QUICKCRETE; SHOVELED SOIL CUTTINGS

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 8/18/25 15:35 - X:\1ACTIVE PROJECTS\ACTIVE SOIL PROJECTS\HAS-22-15.11_(15.25-21.47-2025)\GINT FILES\HAS-22-15.25-21.47_20

PROJECT: HAS-22-15.11	DRILLING FIRM / OPERATOR: NEAS INC. / JL	DRILL RIG: CME 55TB	STATION / OFFSET: 929+34, 61' RT.	EXPLORATION ID B-142-0-23
TYPE: BRIDGE	SAMPLING FIRM / LOGGER: NEAS INC. / JL	HAMMER: CME AUTOMATIC	ALIGNMENT: CLP_US22	
PID: 113440 SFN:	DRILLING METHOD: 3.25" HSA / NQ2	CALIBRATION DATE: 7/30/24	ELEVATION: 1231.1 (MSL) EOB: 45.5 ft.	PAGE 1 OF 2
START: 3/26/25 END: 3/26/25	SAMPLING METHOD: SPT / NQ2	ENERGY RATIO (%): 89	LAT / LONG: 40.285106, -80.999376	

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
16.0" CONCRETE (DRILLERS DESCRIPTION)	1231.1																	
	1229.8	1																
LOOSE TO MEDIUM DENSE, BROWN, **COARSE AND FINE SAND**, SOME GRAVEL, LITTLE SILT, LITTLE CLAY, MOIST		2																
		3	4 4 4	12	56	SS-1	-	21	13	37	17	12	NP	NP	NP	12	A-3a (0)	
		4																
		5	3 6 5	16	67	SS-2	-	-	-	-	-	-	-	-	-	13	A-3a (V)	
		6																
		7																
		8	3 2 4	9	72	SS-3	-	-	-	-	-	-	-	-	-	15	A-3a (V)	
	1221.6	9																
MEDIUM DENSE, BROWN, **STONE FRAGMENTS WITH SAND AND SILT**, TRACE CLAY, WET		10																
		11	6 8 4	18	61	SS-4	-	-	-	-	-	-	-	-	-	24	A-2-4 (V)	
	1219.1	12																
STIFF, BROWN MOTTLED WITH ORANGISH BROWN, **ELASTIC CLAY**, LITTLE SILT, TRACE SAND, TRACE GRAVEL, MOIST		13	2 1 2	4	78	SS-5	1.50	1	7	3	17	72	65	31	34	57	A-7-5 (20)	
	1216.6	14																
HARD, BROWN, **CLAY**, "AND" SAND, LITTLE SILT, LITTLE STONE FRAGMENTS, RESIDUAL ROCK, MOIST TO DAMP		15																
		16	3 3 7	15	78	SS-6	4.50	16	17	20	18	29	48	28	20	36	A-7-6 (6)	
		17																
	1212.6	18	5 7 50/3"	-	47	SS-7	4.50	-	-	-	-	-	-	-	-	15	A-7-6 (V)	
SANDSTONE, GRAY, HIGHLY WEATHERED, SLIGHTLY STRONG TO MODERATELY STRONG, FINE TO MEDIUM GRAINED.		19																
	1210.6	20	50/5"	-	80	SS-8	-	-	-	-	-	-	-	-	-	5	Rock (V)	
SANDSTONE, GRAY, MODERATELY WEATHERED, MODERATELY STRONG, FINE TO MEDIUM GRAINED, VERY THIN TO THIN BEDDED, BEDDING DISCONTINUITIES: LOW ANGLE, JOINT DISCONTINUITIES: HIGH ANGLE FROM 20.7'-21.0', HIGHLY FRACTURED TO MODERATELY FRACTURED, NARROW, SLIGHTLY ROUGH TO VERY ROUGH, BLOCKY, FAIR SURFACE CONDITION; RQD 50%, REC 100%. @23.0'-23.4'; Qu = 6584 PSI @ 1.2%	1206.9	21																
		22																
		23																
		24																
		25	45		98	NQ2-1											CORE	
		26																
		27																
		28																
		29																

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STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 8/18/25 15:35 - X:\1ACTIVE PROJECTS\ACTIVE SOIL PROJECTS\HAS-22-15.11_(15.25-21.47-2025)\GINT FILES\HAS-22-15.25-21.47_20

PID: 113440	SFN:	PROJECT: HAS-22-15.11	STATION / OFFSET: 929+34, 61' RT.	START: 3/26/25	END: 3/26/25	PG 2 OF 2	B-142-0-23

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
INTERBEDDED SHALE (73%) AND SILTSTONE (27%), CONTAINS INTERBEDDED 0.5" CLAY SEAMS, BEDDING DISCONTINUITIES: LOW ANGLE, HIGHLY FRACTURED TO MODERATELY FRACTURED, OPEN TO NARROW, SLIGHTLY ROUGH, LAMINATED, FAIR TO POOR SURFACE CONDITION, RQD 45%, REC. 97%; **SHALE**, GRAY AND DARK GRAY, HIGHLY TO MODERATELY WEATHERED, VERY WEAK TO WEAK, LAMINATED, FISSILE; **SILTSTONE**, GRAY, SLIGHTLY WEATHERED, STRONG. *(continued)*	1201.1																		
	1198.6	31																
		32																
		33																
		34																
		35	17		100	NQ2-2											CORE	
		36																
		37																
SHALE, DARK GRAY, MODERATELY WEATHERED, VERY WEAK TO WEAK, LAMINATED, FISSILE, BEDDING DISCONTINUITIES: LOW ANGLE, HIGHLY FRACTURED TO MODERATELY FRACTURED, OPEN TO NARROW, SLIGHTLY ROUGH, LAMINATED, FAIR TO POOR SURFACE CONDITION; RQD 13%, REC 100%.	1193.9																	
	1192.3	38																
COAL, BLACK, HIGHLY WEATHERED, VERY WEAK, LAMINATED, FOSSILIFEROUS, BEDDING DISCONTINUITIES: LOW ANGLE, JOINT DISCONTINUITIES: HIGH ANGLE FROM 37.2'-38.0' AND 38.2'-38.7', HIGHLY FRACTURED TO MODERATELY FRACTURED, NARROW, SLIGHTLY ROUGH TO VERY ROUGH, VERY BLOCKY, FAIR TO POOR SURFACE CONDITION; RQD 0%, REC 100%.	1190.6	39																
		40																
		41																
		42																
		43	77		100	NQ2-3											CORE	
		44																
SHALE, DARK GRAY, MODERATELY WEATHERED, VERY WEAK TO WEAK, LAMINATED, FISSILE, BEDDING DISCONTINUITIES: LOW ANGLE, HIGHLY FRACTURED, OPEN TO NARROW, SLIGHTLY ROUGH, LAMINATED, FAIR TO POOR SURFACE CONDITION; RQD 0%, REC 100%.	1185.6	45 EOB																
LIMESTONE, GRAY, SLIGHTLY WEATHERED, STRONG TO VERY STRONG, VERY FINE TO MEDIUM GRAINED, THIN TO THICK BEDDED, FOSSILIFEROUS, CONTAINS 0.5" CLAY SEAM AT 43.2' AND A 1.0" CLAY SEAM AT 43.6', BEDDING DISCONTINUITIES: LOW ANGLE, FRACTURED TO SLIGHTLY FRACTURED, OPEN TO NARROW, SLIGHTLY ROUGH, INTACT, FAIR TO POOR SURFACE CONDITION; RQD 77%, REC 100%.																	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING. HOLE DID NOT CAVE. DRILLED AS STAKED.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: POURED 2.0 BAGS HOLE PLUG; PLACED 0.5 BAG QUICKCRETE; SHOVELED SOIL CUTTINGS

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 8/18/25 15:35 - X:\1ACTIVE PROJECTS\ACTIVE SOIL PROJECTS\HAS-22-15.11_(15.25-21.47-2025)\GINT FILES\HAS-22-15.25-21.47_20

PROJECT: HAS-22-15.11	DRILLING FIRM / OPERATOR: NEAS INC. / JL	DRILL RIG: CME 55TB	STATION / OFFSET: 929+49, 19' RT.	EXPLORATION ID B-143-0-23
TYPE: BRIDGE	SAMPLING FIRM / LOGGER: NEAS INC. / JL	HAMMER: CME AUTOMATIC	ALIGNMENT: CLP_US22	
PID: 113440 SFN:	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 7/30/24	ELEVATION: 1230.8 (MSL) EOB: 20.6 ft.	PAGE 1 OF 1
START: 3/24/25 END: 3/24/25	SAMPLING METHOD: SPT	ENERGY RATIO (%): 89	LAT / LONG: 40.285223, -80.999409	

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
15.0" CONCRETE (DRILLERS DESCRIPTION)	1230.8																	
	1229.5	1																
AUGERED TO 20.0' WITHOUT SAMPLING		2																
		3																
		4																
		5																
		6																
		7																
		8																
		9																
		10																
		11																
		12																
		13																
		14																
		15																
		16																
		17																
		18																
		19																
	1210.8																	
SANDSTONE, BROWNISH GRAY, MODERATELY WEATHERED, SLIGHTLY STRONG, FINE TO MEDIUM GRAINED.	1210.2	TR EOB 20	18 50/1"	-	57	SS-1	-	-	-	-	-	-	-	-	-	8	Rock (V)	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING. HOLE DID NOT CAVE. DRILLED AS STAKED.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: POURED 1.0 BAG HOLE PLUG; PLACED 0.5 BAG QUICKCRETE; SHOVELED SOIL CUTTINGS

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 8/18/25 15:35 - X:\1ACTIVE PROJECTS\ACTIVE SOIL PROJECTS\HAS-22-15.11_(15.25-21.47-2025)\GINT FILES\HAS-22-15.25-21.47_20

PROJECT: HAS-22-15.11	DRILLING FIRM / OPERATOR: NEAS INC. / JL	DRILL RIG: CME 55TB	STATION / OFFSET: 929+76, 60' LT.	EXPLORATION ID B-144-0-23
TYPE: BRIDGE	SAMPLING FIRM / LOGGER: NEAS INC. / JL	HAMMER: CME AUTOMATIC	ALIGNMENT: CLP_US22	
PID: 113440 SFN:	DRILLING METHOD: 3.25" HSA / NQ2	CALIBRATION DATE: 7/30/24	ELEVATION: 1229.4 (MSL) EOB: 47.7 ft.	PAGE 1 OF 2
START: 3/18/25 END: 3/18/25	SAMPLING METHOD: SPT / NQ2	ENERGY RATIO (%): 89	LAT / LONG: 40.285450, -80.999474	

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
15.0" CONCRETE (DRILLERS DESCRIPTION)	1229.4																	
LOOSE TO MEDIUM DENSE, BROWN, **GRAVEL WITH SAND AND SILT**, TRACE CLAY, DAMP TO MOIST	1228.1		4 5 4	13	28	SS-1	-	34	12	31	14	9	NP	NP	NP	10	A-2-4 (0)	
			4 4 5	13	50	SS-2	-	-	-	-	-	-	-	-	-	11	A-2-4 (V)	
	1219.9		3 3 3	9	67	SS-3	-	-	-	-	-	-	-	-	-	15	A-2-4 (V)	
VERY STIFF, BROWN, **SANDY SILT**, LITTLE GRAVEL, LITTLE CLAY, DAMP	1217.4		4 2 3	7	61	SS-4	4.00	20	12	29	23	16	25	17	8	14	A-4a (1)	
VERY STIFF, BROWN AND ORANGISH BROWN, **SILT AND CLAY**, SOME SAND, TRACE GRAVEL, MOIST TO DAMP			2 3 3	9	72	SS-5	2.25	4	11	15	37	33	35	20	15	24	A-6a (9)	
			2 2 3	7	67	SS-6	2.25	-	-	-	-	-	-	-	-	32	A-6a (V)	
	1209.9		0 2 23	37	33	SS-7	2.50	8	8	21	32	31	35	21	14	21	A-6a (7)	
VERY DENSE, LIGHT BROWN, **STONE FRAGMENTS WITH SAND AND SILT**, TRACE CLAY, RESIDUAL ROCK, DAMP	1207.4	TR	29 23 25	71	61	SS-8	-	-	-	-	-	-	-	-	-	6	A-2-4 (V)	
SILTSTONE, BROWN, SEVERELY WEATHERED, VERY WEAK.	1206.7		50/2"	-	100	SS-9	-	-	-	-	-	-	-	-	-	5	Rock (V)	
INTERBEDDED COAL (60%) AND SHALE (40%), BEDDING DISCONTINUITIES: LOW ANGLE, HIGHLY FRACTURED TO MODERATELY FRACTURED, OPEN TO NARROW, SLIGHTLY ROUGH, BLOCKY/DISTURBED/SEAMY, FAIR TO POOR SURFACE CONDITION, RQD 33%, REC. 58%; **COAL**, BLACK, HIGHLY TO MODERATELY WEATHERED, VERY WEAK, LAMINATED TO THIN BEDDED, FOSSILIFEROUS; **SHALE**, GRAY AND DARK GRAY, MODERATELY TO HIGHLY WEATHERED, VERY WEAK TO WEAK, FISSILE. @24.7'-26.7'; NO RECOVERY. POSSIBLE UNDERCLAY	1200.2		43		73	NQ2-1											CORE	

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 8/18/25 15:35 - X:\1ACTIVE PROJECTS\ACTIVE SOIL PROJECTS\HAS-22-15.11_(15.25-21.47-2025)\GINT FILES\HAS-22-15.25-21.47_20

PID: 113440	SFN:	PROJECT: HAS-22-15.11	STATION / OFFSET: 929+76, 60' LT.	START: 3/18/25	END: 3/18/25	PG 2 OF 2	B-144-0-23

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
@27.4'-27.7'; Qu = 677 PSI @ 1.0% (SHALE)	1199.4																	
LIMESTONE, BROWNISH GRAY AND ORANGISH BROWN, MODERATELY WEATHERED, STRONG, VERY FINE TO MEDIUM GRAINED, VERY THIN TO THIN BEDDED, BEDDING DISCONTINUITIES: LOW ANGLE, JOINT DISCONTINUITIES: HIGH ANGLE, HIGHLY FRACTURED TO MODERATELY FRACTURED, NARROW, SLIGHTLY ROUGH TO VERY ROUGH, VERY BLOCKY, GOOD SURFACE CONDITION; RQD 61%, REC 100%. *(continued)*	1196.7	31 32																
	1195.7	33																
SANDSTONE, GRAY AND ORANGISH BROWN, MODERATELY WEATHERED, STRONG, FINE TO MEDIUM GRAINED, LAMINATED, CONTAINS A 1.0" CLAY SEAM AT 33.4', BEDDING DISCONTINUITIES: LOW ANGLE, HIGHLY FRACTURED TO FRACTURED, OPEN TO NARROW, SLIGHTLY ROUGH TO VERY ROUGH, BLOCKY/DISTURBED/SEAMY, FAIR TO POOR SURFACE CONDITION; RQD 0%, REC 100%.		34 35 36 37 38	25		100	NQ2-2												CORE	
INTERBEDDED SHALE (76%) AND SILTSTONE (24%), BEDDING DISCONTINUITIES: LOW ANGLE, JOINT DISCONTINUITIES: HIGH ANGLE FROM 42.8'-43.5', HIGHLY FRACTURED TO FRACTURED, OPEN TO NARROW, SLIGHTLY ROUGH, BLOCKY/DISTURBED/SEAMY, FAIR TO POOR SURFACE CONDITION, RQD 30%, REC. 100%;	1185.9	39 40 41 42 43																
SHALE, GRAY AND DARK GRAY, SEVERELY TO MODERATELY WEATHERED, VERY WEAK TO SLIGHTLY STRONG, THINLY LAMINATED TO THIN BEDDED, FISSILE; **SILTSTONE**, GRAY, MODERATELY WEATHERED, SLIGHTLY TO MODERATELY STRONG.		44 45	75		100	NQ2-3												CORE	
LIMESTONE, GRAY AND ORANGISH BROWN, MODERATELY WEATHERED, STRONG, VERY FINE TO MEDIUM GRAINED, THIN TO THICK BEDDED, FOSSILIFEROUS, BEDDING DISCONTINUITIES: LOW ANGLE, JOINT DISCONTINUITIES: HIGH ANGLE FROM 45.0'-46.5', SHEAR DISCONTINUITIES, FRACTURED TO SLIGHTLY FRACTURED, OPEN TO NARROW, SLIGHTLY ROUGH TO SLICKENSIDED, BLOCKY, FAIR TO POOR SURFACE CONDITION; RQD 79%, REC 100%.	1181.7	46 47 EOB																

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING. HOLE DID NOT CAVE. DRILLED AS STAKED.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PUMPED 10.0 GAL. BENTONITE GROUT; POURED 1.0 BAG HOLE PLUG; PLACED 0.5 BAG QUICKCRETE; SHOVELED SOIL CUTTINGS

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 8/18/25 15:35 - X:\1ACTIVE PROJECTS\ACTIVE SOIL PROJECTS\HAS-22-15.11_(15.25-21.47-2025)\GINT FILES\HAS-22-15.25-21.47_20

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 9/2/25 09:14 - X:\1ACTIVE PROJECTS\HAS-22-15.11_(15.25-21.47-2025)\GINT FILES\HAS-22-15.25-21.47_

PROJECT: HAS-22-15.11	DRILLING FIRM / OPERATOR: NEAS INC. / JL	DRILL RIG: CME 55TB	STATION / OFFSET: 17+16, 2' RT.	EXPLORATION ID B-145-0-23
TYPE: BRIDGE	SAMPLING FIRM / LOGGER: NEAS INC. / JL	HAMMER: CME AUTOMATIC	ALIGNMENT: BLP_RG	
PID: 113440 SFN:	DRILLING METHOD: 3.25" HSA / NQ2	CALIBRATION DATE: 7/30/24	ELEVATION: 1216.3 (MSL) EOB: 36.3 ft.	PAGE 1 OF 2
START: 3/13/25 END: 3/13/25	SAMPLING METHOD: SPT / NQ2	ENERGY RATIO (%): 89	LAT / LONG: 40.283987, -80.999084	

MATERIAL DESCRIPTION AND NOTES	ELEV. 1216.3	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
13.0" CONCRETE (DRILLERS DESCRIPTION)	1215.2																	
MEDIUM DENSE, GRAY, **STONE FRAGMENTS WITH SAND**, LITTLE SILT, TRACE CLAY, DAMP **(FILL)**	1211.8		9 6 4	15	22	SS-1	-	-	-	-	-	-	-	-	-	4	A-1-b (V)	
LOOSE, BROWN AND ORANGISH BROWN, **GRAVEL WITH SAND**, LITTLE SILT, TRACE CLAY, DAMP **(FILL)**	1209.3		3 3 2	7	22	SS-2	-	-	-	-	-	-	-	-	-	9	A-1-b (V)	
VERY STIFF, GRAY AND ORANGISH BROWN, **SANDY SILT**, SOME GRAVEL, LITTLE CLAY, CONTAINS FABRIC MATERIAL, DAMP **(FILL)**	1205.8		2 2 2	6	33	SS-3	2.50	29	15	14	23	19	28	20	8	13	A-4a (1)	
SHALE, GRAY, HIGHLY WEATHERED, VERY WEAK, FISSILE.	1205.0	TR	14 48 50/3"	-	60	SS-4	-	-	-	-	-	-	-	-	-	9	Rock (V)	
INTERBEDDED SHALE (84%) AND SILTSTONE (16%), BEDDING DISCONTINUITIES: LOW ANGLE, HIGHLY FRACTURED TO MODERATELY FRACTURED, NARROW TO TIGHT, SLIGHTLY ROUGH, LAMINATED, FAIR TO GOOD SURFACE CONDITION, RQD 56%, REC. 100%; **SHALE**, GRAY AND DARK GRAY, SLIGHTLY TO MODERATELY WEATHERED, WEAK TO SLIGHTLY STRONG, LAMINATED, FISSILE; **SILTSTONE**, GRAY AND LIGHT GRAY, SLIGHTLY WEATHERED, SLIGHTLY STRONG, ARGILLACEOUS. @17.3'-17.6'; Qu = 2555 PSI @ 2.4% (SILTSTONE)	1196.4		48		98	NQ2-1											CORE	
COAL, BLACK, MODERATELY WEATHERED, VERY WEAK, THINLY LAMINATED, FOSSILIFEROUS, BEDDING DISCONTINUITIES: LOW ANGLE, HIGHLY FRACTURED TO FRACTURED, NARROW, SLIGHTLY ROUGH, BLOCKY/DISTURBED/SEAMY, FAIR SURFACE CONDITION; RQD 0%, REC 83%.	1195.0		77		98	NQ2-2											CORE	

PID: 113440	SFN:	PROJECT: HAS-22-15.11	STATION / OFFSET: 17+16, 2' RT.	START: 3/13/25	END: 3/13/25	PG 2 OF 2	B-145-0-23

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
INTERBEDDED LIMESTONE (62%) AND SILTSTONE (38%), BEDDING DISCONTINUITIES: LOW ANGLE, SHEAR DISCONTINUITIES, JOINT DISCONTINUITIES: HIGH ANGLE FROM 22.5'-22.9', 25.5'-25.8', 27.3'-27.4', 31.3'-31.4', 31.7'-32.7', AND 33.9'-34.1', FRACTURED TO SLIGHTLY FRACTURED, OPEN TO NARROW, SLIGHTLY ROUGH TO SLICKENSIDED, VERY BLOCKY, FAIR TO POOR SURFACE CONDITION, RQD 67%, REC. 98%; **LIMESTONE**, LIGHT BROWNISH GRAY AND GRAY, SLIGHTLY WEATHERED, STRONG TO VERY STRONG, VERY FINE TO MEDIUM GRAINED, VERY THIN TO THICK BEDDED, FOSSILIFEROUS; **SILTSTONE**, GRAY AND DARK GRAY, SLIGHTLY TO MODERATELY WEATHERED, WEAK TO SLIGHTLY STRONG. *(continued)*	1186.3	31																
		32																
		33																
		34	46		100	NQ2-3											CORE	
		35																
	1180.0	36 EOB																

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING. HOLE DID NOT CAVE. DRILLED AS STAKED.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLACED 0.5 BAG ASPHALT PATCH; POURED 2.0 BAGS HOLE PLUG; SHOVELED SOIL CUTTINGS

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 9/2/25 09:14 - X:\1ACTIVE PROJECTS\ACTIVE SOIL PROJECTS\HAS-22-15.11_(15.25-21.47-2025)\GINT FILES\HAS-22-15.25-21.47_

PROJECT: HAS-22-15.11	DRILLING FIRM / OPERATOR: NEAS INC. / JL	DRILL RIG: CME 55TB	STATION / OFFSET: 16+28, 40' LT.	EXPLORATION ID B-146-0-23
TYPE: BRIDGE	SAMPLING FIRM / LOGGER: NEAS INC. / JL	HAMMER: CME AUTOMATIC	ALIGNMENT: BLP_RG	
PID: 113440 SFN:	DRILLING METHOD: 3.25" HSA / NQ2	CALIBRATION DATE: 7/30/24	ELEVATION: 1217.9 (MSL) EOB: 40.1 ft.	PAGE 1 OF 2
START: 3/12/25 END: 3/12/25	SAMPLING METHOD: SPT / NQ2	ENERGY RATIO (%): 89	LAT / LONG: 40.284087, -80.999409	

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
13.0" CONCRETE (DRILLERS DESCRIPTION)	1217.9																	
LOOSE, GRAY, **GRAVEL AND STONE FRAGMENTS WITH SAND**, LITTLE SILT, TRACE CLAY, CONTAINS FABRIC MATERIAL, DAMP **(FILL)**	1216.8		4 2 3	7	28	SS-1	-	-	-	-	-	-	-	-	-	5	A-1-b (V)	
	1210.9		4 3 3	9	28	SS-2	-	-	-	-	-	-	-	-	-	4	A-1-b (V)	
MEDIUM STIFF TO STIFF, BROWN AND ORANGISH BROWN, **SILTY CLAY**, SOME SAND, TRACE GRAVEL, MOIST TO DAMP			2 2 2	6	39	SS-3	1.00	10	9	13	32	36	40	22	18	27	A-6b (10)	
	1205.9	TR	0 2 3	7	50	SS-4	1.25	-	-	-	-	-	-	-	-	18	A-6b (V)	
SHALE, DARK GRAY, HIGHLY WEATHERED, VERY WEAK, FISSILE.	1202.8		50/5"	-	80	SS-5	-	-	-	-	-	-	-	-	-	6	Rock (V)	
INTERBEDDED SHALE (73%) AND SILTSTONE (27%), BEDDING DISCONTINUITIES: LOW ANGLE, FRACTURED TO SLIGHTLY FRACTURED, NARROW, SLIGHTLY ROUGH, BLOCKY/DISTURBED/SEAMY, GOOD TO FAIR SURFACE CONDITION, RQD 89%, REC. 94%; **SHALE**, GRAY, SLIGHTLY WEATHERED, VERY WEAK TO SLIGHTLY STRONG, LAMINATED, FISSILE;			50/1"	-	100	SS-6	-	-	-	-	-	-	-	-	-	3	Rock (V)	
SILTSTONE, LIGHT GRAY AND GRAY, SLIGHTLY WEATHERED, WEAK TO MODERATELY STRONG. @15.5'-15.9'; Qu = 5279 PSI @ 3.0% (SILTSTONE)	1198.7		76		98	NQ2-1											CORE	
INTERBEDDED LIMESTONE (65%) AND SILTSTONE (35%), BEDDING DISCONTINUITIES: LOW ANGLE, JOINT DISCONTINUITIES: HIGH ANGLE FROM 21.2'-21.5' AND 23.5'-24.3', FRACTURED TO SLIGHTLY FRACTURED, NARROW, SLIGHTLY ROUGH, BLOCKY, GOOD TO FAIR SURFACE CONDITION, RQD 66%, REC. 100%; **LIMESTONE**, LIGHT BROWN AND GRAY, SLIGHTLY WEATHERED, STRONG TO VERY STRONG, VERY FINE TO MEDIUM GRAINED, LAMINATED TO MEDIUM BEDDED, FOSSILIFEROUS;	1192.2																	
SILTSTONE, GRAY, SLIGHTLY WEATHERED, WEAK TO SLIGHTLY STRONG.	1190.0																	
COAL, BLACK, MODERATELY TO HIGHLY WEATHERED, VERY WEAK, THINLY LAMINATED, FOSSILIFEROUS, BEDDING DISCONTINUITIES: LOW ANGLE, HIGHLY																		

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 9/2/25 16:48 - X:\1ACTIVE PROJECTS\ACTIVE SOIL PROJECTS\HAS-22-15.11_(15.25-21.47-2025)\GINT FILES\HAS-22-15.25-21.47_

PID: 113440	SFN:	PROJECT: HAS-22-15.11	STATION / OFFSET: 16+28, 40' LT.	START: 3/12/25	END: 3/12/25	PG 2 OF 2	B-146-0-23

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
FRACTURED TO FRACTURED, NARROW, SLIGHTLY ROUGH, DISINTIGRATED, FAIR SURFACE CONDITION; RQD 0%, REC 87%.	1187.9	31	54		98	NQ2-2											CORE	
INTERBEDDED LIMESTONE (51%) AND SILTSTONE (49%), BEDDING DISCONTINUITIES: LOW ANGLE, JOINT DISCONTINUITIES: HIGH ANGLE FROM 34.6'-35.8', SHEAR DISCONTINUITIES, HIGHLY FRACTURED TO SLIGHTLY FRACTURED, OPEN TO NARROW, SLIGHTLY ROUGH TO SLICKENSIDED, VERY BLOCKY, FAIR TO POOR SURFACE CONDITION, RQD 67%, REC. 100%; **LIMESTONE**, LIGHT BROWN AND GRAY, SLIGHTLY WEATHERED, STRONG TO VERY STRONG, VERY FINE TO MEDIUM GRAINED, VERY THIN TO MEDIUM BEDDED, FOSSILIFEROUS; **SILTSTONE**, GRAY, SLIGHTLY TO MODERATELY WEATHERED, WEAK TO SLIGHTLY STRONG, PYRITIC. *(continued)*		32 33 34 35 36 37 38 39	62		100	NQ2-3											CORE	
	1177.8	EOB 40																

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING. HOLE DID NOT CAVE. DRILLED AS STAKED.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLACED 0.5 BAG ASPHALT PATCH; POURED 2.0 BAGS HOLE PLUG; SHOVELED SOIL CUTTINGS

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 9/2/25 16:48 - X:\1ACTIVE PROJECTS\ACTIVE SOIL PROJECTS\HAS-22-15.11_(15.25-21.47-2025)\GINT FILES\HAS-22-15.25-21.47_

TH-001-0-58
C/L CONST. US-22
STA. 928+25, 77' RT.

STATE OF OHIO
DEPARTMENT OF HIGHWAYS
TESTING LABORATORY

LOG OF BORING

CO., RT. NO., SEC. HAS-22-15.09 BRIDGE NO. HAS-22-1758
REAR ABUTMENT OVER PENNA. RR (SPUR)

LOCATION: T.H. 1 STA. 928+37 OFFSET 80' RT. FED. NO.

ELEV.	DEPTH	NO. BLOWS	SAMPLE NO.	DESCRIPTION
1237.7	0			
	2			Brown silty clay, micaceous, plastic, soft.
	4			
1232.9				TOP OF BROKEN AND WEATHERED ROCK
	6			Sandstone, dark gray to gray, soft to firm, fine grained, fissile, argillaceous, very micaceous, broken, weathered; *
1230.8				
1230.1	8			Shale, brown, soft to firm, **
	10			Sandstone, medium hard, fine grained, argillaceous, ferruginous, very micaceous, broken; with frequent lateral and vertical gradations into shaly sandstone; 0.7' soft, light brown, very argillaceous, broken, shale stringer at approximate 1225.8' elevation. Core Loss 6%
	12			
1224.7				
	14			Shale, light br. & gr., soft to firm, micaceous, carbonaceous & fossiliferous, Loss 4%
1222.6	16			ferruginous in part, very siliceous, broken. Sandstone, dark to light gray, medium hard to firm, fine grained, argillaceous, very micaceous, somewhat carbonaceous, broken; with lateral & vertical gradations into shaly sandstone. Core Loss 0%
	18			
1218.8				
1217.7	20			Indurated clay, light yellowish brown, soft to medium hard, calcareous. ***
	22			BOTTOM OF BORING
	24			
	26			
	28			
	30			
	32			
	34			
	36			

*with frequent vertical gradations into shaly sandstone. Core Loss 15%

**slightly micaceous, very badly broken. Core Loss 10%

***very crumbly, broken, jointed. Core Loss 20%

JAC 9/21/58

TH-008-0-58
C/L CONST. US-22
STA. 929+64, 68' LT.

STATE OF OHIO
DEPARTMENT OF HIGHWAYS
TESTING LABORATORY

SHEET 4

LOG OF BORING

CO., RT. NO., SEC. HAS-22-15.09 BRIDGE NO. HAS-22-1758
FORWARD ABUTMENT OVER PENNA. RR (SPUR)

LOCATION: T.H. 8 STA. 929+76 OFFSET 66' LT. FED. NO.

ELEV.	DEPTH	NO. BLOWS	SAMPLE NO.	DESCRIPTION
1215.4	0			Brown, dense clay & sandstone.
	2			
1211.7	4			TOP OF BROKEN AND WEATHERED ROCK
	6			Sandstone, light brownish gray, medium hard, fine grained, ferruginous, very micaceous, somewhat argillaceous, broken, weathered. Core Loss 45%
1208.5	8			Shale, light greenish brown, firm to soft, siliceous, micaceous, ferruginous, broken; upper 0.3' soft, very ferruginous, plastic, crumbly clay; lower 0.9' badly broken, crumbly, soft, interbedded with soft clay seams. Core Loss 16%
	10			
1203.7	12			
	14			Shale, gray to light gray, medium hard to hard, siliceous, very micaceous, slightly carbonaceous, broken; with frequent lateral and vertical gradations into thin seams of very siliceous shale; lower 4.0' nonsiliceous, medium hard to firm. Core Loss 1%
	16			
	18			
1195.4	20			
	22			BOTTOM OF BORING
	24			
	26			
	28			
	30			
	32			
	34			
	36			

JAM
4/21/58

X-002-A-59
C/L CONST. US-22

STATE OF OHIO
DEPARTMENT OF HIGHWAYS
TESTING LABORATORY

SHEET 1 OF 1

LOG OF STRATIGRAPHIC ROCK SECTION

CO., RT. NO., SEC. HAS-22-14.68 BRIDGE NO. HAS-22-1758
OVER ELENA R.R. (CPUR)

LOCATION: T.H. ____ STA. 928+60 to 929+00 OFFSET ____ FED. NO. ____

ELEV.	DEPTH	NO. BLOWS	SAMPLE NO.	DESCRIPTION
1230.0	0			
	2			
	4			Soft Sandy Shale
	6			
1223.0	8			Shaly Sandstone
1220.0	10			
	12			
	14			
	16			Variegated Blue-Gray to Buff Indurated Clay
	18			
1210.0	20			
	22			Sandstone
1207.0	24			Clay Shale With Nodular Limestone
1204.0	26			
	28			
	30			
	32			Carbonaceous Shale
	34			
	36			

LOG (CONTINUED) SHEET 2

BRIDGE NO. HAS-22-1758 T.H.

ELEV.	DEPTH	NO. BLOWS	SAMPLE NO.	DESCRIPTION
1192.0	38			Carbonaceous Shale
				BOTTOM OF BORING
	40			
	42			
	44			
	46			
	48			
	50			
	52			
	54			
	56			
	58			
	60			
	62			
	64			
	66			
	68			
	70			
	72			
	74			
	76			
	78			
	80			
	82			

X-002-A-59
C/L CONST. US-22

TH-001-0-59
B/L CONST. RAMP G
STA. 17+01, 52' LT.

STATE OF OHIO
DEPARTMENT OF HIGHWAYS
TESTING LABORATORY

LOG OF BORING

CO., RT. NO., SEC. HAS-22- 14.68 BRIDGE NO. HAS-22-RAMP"G"
EAST ABUTMENT OVER PENNA. R.R.

LOCATION: T.H. 1 STA. 14+85 OFFSET 18' RT FED. NO.

ELEV.	DEPTH	NO. BLOWS	SAMPLE NO.	DESCRIPTION
1233.0	0			
	2			
	4			
1228.0	6	9/12	17810	Brown & Gray Sandy Gravelly Silt
	8			
1223.0	10			
	12	5/5	17811	Brown & Gray Clay
	14			
1218.0				
1217.0	16	27/29	17812	Brown Sandy Gravelly Clay
				TOP OF ROCK
1214.8	18			Shale, greenish gray, siliceous, micaceous, firm. Core Loss 5%.
	20			Sandstone, greenish gray, medium-grained, micaceous, firm, thin-bedded with shale seam at 19.2'. Core Loss 7%.
1212.0				
1210.4	22			Shale, brownish gray, siliceous, micaceous firm. No Core Loss.
	24			Shale, gray, siliceous to slightly siliceous, firm, fissile. Core Loss 6%.
	26			
1205.9				
1204.4	28			Shale, gray, siliceous, micaceous, firm. Core Loss 7%.
	30			
	32			Shale, dark-gray to gray, slightly siliceous to siliceous at top, hard, firm, fissile. Core Loss 3%.
1198.6	34			
1197.1	36			Coal, jointed. Core Loss 7%.

LOG OF BORING (CONTINUED) SHEET 3

BRIDGE NO. HAS-22-RAMP "G" T.H. 1

ELEV.	DEPTH	NO. BLOWS	SAMPLE NO.	DESCRIPTION
1195.2	38			Shale, dark-gray, firm, poorly fissile. Core Loss 11%.
1193.1	40			Limestone, gray to dark-gray, impure, hard, firm. Core Loss 5%.
1192.5				Shale, dark-gray, firm, fissile. No Core Loss
1191.9	42			Limestone, dark-gray, hard, firm. No Core Loss
				Shale, gray, calcareous, firm, poorly fissile, jointed 42.7-43.8'.
1189.5	44			No Core Loss.
1188.0				Limestone, gray, dense, hard, firm, medium-bedded. Core Loss 0%.
	46			BOTTOM OF BORING
	48			
	50			
	52			
	54			
	56			
	58			
	60			
	62			
	64			
	66			
	68			
	70			
	72			
	74			
	76			
	78			
	80			
	82			

TH-001-0-59
B/L CONST. RAMP G
STA. 17+01, 52' LT.

TH-002-0-59
B/L CONST. RAMP G
STA. 16+81, 42' LT.

STATE OF OHIO
DEPARTMENT OF HIGHWAYS
TESTING LABORATORY

LOG OF STRATIGRAPHIC ROCK SECTION

CO., RT. NO., SEC. HAS-22-11.68 EAST ABUTMENT BRIDGE NO. HAS-22-RAMP "G" OVER PENNA R.R.

LOCATION: T.H. ___ STA. 15+04 OFFSET 8' RT FED. NO. ___

ELEV.	DEPTH	NO. BLOWS	SAMPLE NO.	DESCRIPTION
1233.0	0			
	2			Covered Interval
	4			
	6			
	8			
1223.0	10			
	12			Shale, brown, very limey, sandy, firm.
	14			
	16			
	18			
	20			
1212.0	22			Sandstone, brown, very resistant, firm.
1210.0	24			Shale, dark gray to black, carbonaceous fissile, siliceous, firm.
	26			
	28			
	30			
	32			
	34			
1198.0	36			Coal

AW
5.14.59

LOG (CONTINUED) SHEET 9

BRIDGE NO. HAS-22-RAMP "G" T.H.

ELEV.	DEPTH	NO. BLOWS	SAMPLE NO.	DESCRIPTION
1196.0				Coal
	38			Shale, gray, fissile, carbonanceous with very minor limestone seams, firm.
1193.0	40			
				Limestone, gray, dense, hard.
1191.0	42			
				Shale, gray, fissile, firm.
1189.0	44			BOTTOM OF SECTION
	46			
	48			
	50			
	52			
	54			
	56			
	58			
	60			
	62			
	64			
	66			
	68			
	70			
	72			
	74			
	76			
	78			
	80			
	82			

TH-002-0-59
B/L CONST. RAMP G
STA. 16+81, 42' LT.

TH-003-0-59
B/L CONST. RAMP G
STA. 16+20, 43' LT.

STATE OF OHIO
DEPARTMENT OF HIGHWAYS
TESTING LABORATORY

LOG OF STRATIGRAPHIC ROCK SECTION

CO., RT. NO. SEC. HAS-22-14.68 BRIDGE NO. HAS-22-RAMP "G"
WEST ABUTMENT OVER PENNA R.R.

LOCATION: T.H. ___ STA. 15+65 OFFSET 8'RT FED. NO. ___

ELEV.	DEPTH	NO. BLOWS	SAMPLE NO.	DESCRIPTION
1241.6	0			
	2			Residual mantle
	4			
1236.6	6			Shale, brown argillaceous, soft.
1233.6	8			
	10			
	12			
	14			Shale, brown sandy fissile siliceous, firm.
	16			
	18			
1221.6	20			
1220.6				Sandstone, brown, shaly, argillaceous*
1219.6	22			Clay, shaly, brown soft.
	24			Limestone, gray impure, blocky, weathers to small fragments, very argillaceous, medium-firm.
	26			
	28			
1212.6				
1211.6	30			Limestone, gray becomes shaly and sandy**
				Sandstone, brown resistant, firm to hard
1209.6	32			
	34			Shale, gray fissile clay and partly carbonaceous siliceous in bottom 5', firm.
	36			

*firm.
**firm.

MW
5-14-59

LOG (CONTINUED) SHEET /3

BRIDGE NO. HAS-22-RAMP "G" T.H.

ELEV.	DEPTH	NO. BLOWS	SAMPLE NO.	DESCRIPTION
	38			
	40			Shale, gray fissile clay and partly carbonaceous siliceous in bottom 5', firm.
	42			
1197.6	44			
1196.1	46			Coal, very persistant
	48			Shale, dark gray, carbonaceous, with two 3" limestone stringers, firm.
1192.6	50			Limestone, gray, dense, hard.
1190.6				
1189.6	52			Shale, dark gray, fissile, firm.
				BOTTOM OF SECTION
	54			
	56			
	58			
	60			
	62			
	64			
	66			
	68			
	70			
	72			
	74			
	76			
	78			
	80			
	82			

TH-003-0-59
B/L CONST. RAMP G
STA. 16+20, 43' LT.

TH-004-0-59
B/L CONST. RAMP G
STA. 15+91, 53' LT.

STATE OF OHIO
DEPARTMENT OF HIGHWAYS
TESTING LABORATORY

SHEET #

LOG OF BORING

CO., RT. NO., SEC. HAS-22-14.68 WEST ABUTMENT — BRIDGE NO. HAS-22-RAMP "G" OVER PENNA. R.R.

LOCATION: T.H. 4 STA. 15+95 OFFSET 18'RT FED. NO.

ELEV.	DEPTH	NO. BLOWS	SAMPLE NO.	DESCRIPTION
1241.5	0			
	2			
	4			
1236.5				
	6	9/21	17809	Brown Sandy Silt
1234.8				TOP OF SOFT, WEATHERED ROCK
1233.0	8			Shale, brown, siliceous, moist, crumbly.*
				TOP OF FIRM ROCK
	10			Shale, brown, siliceous, medium-firm, generally jointed. Core Loss 9%.
	12			
1228.5				
	14			Shale, gray to dark-gray, siliceous, micaceous, contains carbonized plant remains, firm, grades to sandstone below 18.5. Core Loss 6%.
	16			
	18			
1222.9	20			Indurated clay, yellowish brown above 21.0', gray in remainder, calcareous, soft to firm, badly broken (probably by drill); with broken, thin layers (1-2") of limestone. Core Loss 59%.
	22			
	24			
1216.9				
	26			Limestone, gray, fine-grained, argillaceous, medium-firm, grades to dense calcareous shale, jointed at base.**
1214.5	28			Shale, greenish gray, siliceous, micaceous, firm, jointed in part. Core Loss 9%.
1212.3	30			Sandstone, gray and brown, medium-grained micaceous, firm, medium-firm. No Core Loss
1209.7	32			
	34			Shale, gray, siliceous, firm. No Core Loss
	36			

*No Core Loss
**Core Loss 9%.

AW
5-14-59

LOG OF BORING (CONTINUED) SHEET 5

BRIDGE NO. HAS-22-RAMP "G" T.H. 4

ELEV.	DEPTH	NO. BLOWS	SAMPLE NO.	DESCRIPTION
	38			See description on previous sheet.
1201.8	40			
	42			Shale, gray, slightly siliceous to siliceous, firm, fissile. Core Loss 2%.
	44			
1196.5				
1194.8	46			Coal. No Core Loss
	48			Shale, gray (black in top 0.3'), calcareous, dense, firm, with two layers of limestone between 48.2' and 49.0'.*
1191.9	50			Limestone, gray, fine-grained, dense, hard, firm, jointed. Core Loss 0%.
1188.2	52			
1187.5	54			Shale, gray, calcareous, firm, broken. Core Loss 29%.
				BOTTOM OF BORING
	56			
	58			
	60			
	62			
	64			
	66			
	68			
	70			
	72			
	74			
	76			
	78			
	80			
	82			

TH-004-0-59
B/L CONST. RAMP G
STA. 15+91, 53' LT.

TH-005-0-59
B/L CONST. RAMP G
STA. 16+90, 11' RT.

STATE OF OHIO
DEPARTMENT OF HIGHWAYS
TESTING LABORATORY

LOG OF STRATIGRAPHIC ROCK SECTION

CO.,RT.NO. SEC. HAS-22-14.68 BRIDGE NO. HAS-22-RAMP "G"
EAST ABUTMENT OVER PENNA R.R.

LOCATION: T.H.____ STA. 14+96 OFFSET 45'LT FED.NO.____

ELEV.	DEPTH	NO. BLOWS	SAMPLE NO.	DESCRIPTION
1233.0	0			
	2			Covered Interval
	4			
	6			
	8			
	10			
	12			
1220.0	14			Shale, brown, very limey,hard.
	16			
	18			
	20			
1212.0	22			Sandstone, brown, very prominent and resistant, firm.
1210.0	24			Shale, dark gray to black, carbonaceous, fissile, siliceous, firm.
	26			
	28			
	30			
	32			
	34			
1198.0	36			Coal

AW
5-14-59

LOG (CONTINUED) SHEET 7

BRIDGE NO. [redacted]-22-RAMP "G" T.H.

ELEV.	DEPTH	NO. BLOWS	SAMPLE NO.	DESCRIPTION
1196.0				Coal
	38			Shale, gray, fissile, carbonaceous, firm.
1193.0	40			
				Limestone, gray, dense, hard.
1191.0	42			
1190.0				Shale, gray, firm.
	44			BOTTOM OF SECTION
	46			
	48			
	50			
	52			
	54			
	56			
	58			
	60			
	62			
	64			
	66			
	68			
	70			
	72			
	74			
	76			
	78			
	80			
	82			

TH-005-0-59
B/L CONST. RAMP G
STA. 16+90, 11' RT.

TH-006-0-59
B/L CONST. RAMP G
STA. 16+27, 11' RT.

STATE OF OHIO
DEPARTMENT OF HIGHWAYS
TESTING LABORATORY

SHEET 10

LOG OF STRATIGRAPHIC ROCK SECTION

CO., RT. NO., SEC. HAS-22-14.68 WEST ABUTMENT — BRIDGE NO. HAS-22-RAMP "G" OVER PENNA R.R.

LOCATION: T.H. ____ STA. 15+58 ____ OFFSET 46'LT ____ FED. NO. ____

ELEV.	DEPTH	NO. BLOWS	SAMPLE NO.	DESCRIPTION
1241.6	0			
	2			Covered Interval
	4			
	6			
	8			
	10			
1230.1	12			
	14			Shale, brown sandy and siliceous, firm.
	16			
	18			
1222.6				
1221.6	20			Clay, shaly , brown, soft.
	22			Shale, brown, very limey, hard and firm.
1217.6	24			
	26			Limestone, gray, blocky, argillaceous, firm.
1214.1	28			
1212.6	30			Limestone, gray, shaly, firm.
	32			Sandstone, brown, resistant, firm.
1209.6	34			
	36			Shale, dark gray, carbonaceous, somewhat fissile, siliceous, firm.

AW
5-14-59

LOG (CONTINUED)

BRIDGE NO. HAS-22- RAMP "G" T.H.

ELEV.	DEPTH	NO. BLOWS	SAMPLE NO.	DESCRIPTION
	38			
	40			Shale, dark gray, carbonaceous, somewhat fissile, siliceous, firm.
	42			
1198.6	44			Coal
1196.6	46			Shale, gray, with several minor one-inch, two-inch spotty seams of limestone, firm.
1193.6	48			Limestone, gray, dense, hard.
1191.6	50			Shale, gray, firm.
1189.1	52			BOTTOM OF SECTION
	54			
	56			
	58			
	60			
	62			
	64			
	66			
	68			
	70			
	72			
	74			
	76			
	78			
	80			
	82			

TH-006-0-59
B/L CONST. RAMP G
STA. 16+27, 11' RT.

APPENDIX C

UNDISTURBED TEST DATA

SULFATE REPORT

OHIO DEPARTMENT OF TRANSPORTATION DETERMINING SULFATE CONTENT IN SOILS SUPPLEMENT 1122

Project C-R-S:	HAS-22-15.25/21.47
PID No:	23-0011
Report Date:	9/18/2023
Consultant:	NEAS Inc.
Technician:	L. Rosenbeck

Boring ID & Sample #	Station	Offset	Latitude & Longitude or State Plane Coordinates	Elevation	Soaking Time (hr)	Replicate Sample Readings						Sulfate Content (ppm)
						1		2		3		
						Dilution	Reading	Dilution	Reading	Dilution	Reading	
B-001-0-23 SS-1					16.7	20	29	20	30	20	30	**593**
B-002-0-23 SS-1					20.0	20	46	20	46	20	46	**920**
B-003-0-23 SS-1					20.0	20	44	20	44	20	44	**880**
B-004-0-23 SS-1					16.2	20	16	20	16	20	16	**320**
B-005-0-23 SS-1					16.4	20	44	20	42	20	45	**873**
B-006-0-23 SS-3					16.2	20	32	20	32	20	32	**640**
B-007-0-23 SS-1					16.6	20	26	20	28	20	27	**540**
B-008-0-23 SS-1					20.0	20	42	20	42	20	42	**840**
B-009-0-23 SS-1					16.5	20	29	20	31	20	30	**600**
B-010-0-23 SS-1					20.0	20	5	20	5	20	5	**100**
B-011-0-23 SS-1					20.0	20	32	20	32	20	32	**640**
B-012-0-23 SS-1					16.2	100	35	100	37	100	33	**3500**
B-013-0-23 SS-1					20.7	20	33	20	35	20	35	**687**
B-014-0-23 SS-1					20.0	20	75	20	75	20	75	**1500**
B-015-0-23 SS-1					17.8	20	9	20	9	20	9	**180**
B-016-0-23 SS-1					16.1	20	17	20	17	20	17	**340**
B-017-0-23 SS-1					16.3	20	41	20	39	20	40	**800**
B-018-0-23 SS-1					16.1	20	9	20	9	20	9	**180**

B-019-0-23 SS-1						20.1	100	33	100	29	100	30	**3067**
B-020-0-23 SS-1						20.0	20	90	20	90	20	90	**1800**
B-021-0-23 SS-1						20.0	20	36	20	36	20	36	**720**
B-022-0-23 SS-1						20.0	20	41	20	41	20	41	**820**
B-023-0-23 SS-1						17.8	20	61	20	61	20	61	**1220**
B-025-0-23 SS-1						16.3	20	42	20	41	20	42	**833**
B-026-0-23 SS-1						21.0	20	30	20	30	20	30	**600**
B-027-0-23 SS-1						20.1	20	48	20	51	20	49	**987**
B-028-0-23 SS-1						21.0	20	13	20	13	20	13	**260**
B-029-0-23 SS-1						16.6	20	26	20	26	20	26	**520**
B-030-0-23 SS-1						16.2	20	41	20	45	20	44	**867**
B-031-0-23 SS-1						16.6	20	22	20	22	20	21	**433**
B-032-0-23 SS-1						21.0	20	36	20	36	20	36	**720**
B-033-0-23 SS-2						16.2	100	24	100	26	100	25	**2500**
B-033-1-23 SS-1						16.2	20	18	20	18	20	18	**360**
B-034-0-23 SS-1						20.0	20	180	20	180	20	180	**3600**
B-035-0-23 SS-1						20.1	20	75	20	78	20	74	**1513**
B-036-0-23 SS-1						16.5	100	24	100	26	100	25	**2500**
B-037-0-23 SS-1						16.6	20	46	20	45	20	45	**907**
B-038-0-23 SS-1						20.0	20	160	20	160	20	160	**3200**
B-039-0-23 SS-1						20.0	20	12	20	12	20	12	**240**
B-040-0-23 SS-1						20.0	20	5	20	5	20	5	**100**
B-041-0-23 SS-1						16.6	100	34	100	25	100	30	**2967**
B-042-0-23 SS-1						16.6	20	21	20	22	20	22	**433**
B-043-0-23 SS-1						16.5	20	39	20	37	20	38	**760**
B-044-0-23 SS-1						16.6	20	16	20	16	20	15	**313**
B-045-0-23 SS-1						20.0	20	56	20	56	20	56	**1120**
B-046-0-23 SS-1						16.6	20	71	20	73	20	73	**1447**
B-047-0-23 SS-1						16.5	20	32	20	34	20	30	**640**
B-048-0-23 SS-1						16.5	100	25	100	26	100	24	**2500**
B-049-0-23 SS-1						20.1	20	22	20	22	20	21	**433**
B-050-0-23 SS-1						20.0	20	33	20	30	20	32	**633**

B-051-0-23 SS-1						21.0	20	5	20	5	20	5	**100**
B-052-0-23 SS-1						18.0	20	16	20	16	20	16	**320**
B-105-0-23 SS-1						16.1	20	36	20	34	20	36	**707**
B-106-0-23 SS-1						21.0	20	24	20	24	20	24	**480**
B-107-0-23 SS-1						20.7	20	29	20	27	20	26	**547**
B-108-0-23 SS-1						20.7	20	34	20	34	20	32	**667**
B-109-0-23 SS-1						16.1	20	38	20	37	20	38	**753**
B-110-0-23 SS-1						20.0	20	230	20	230	20	230	**4600**
B-111-0-23 SS-1						16.1	20	11	20	11	20	11	**220**
B-112-0-23 SS-1						16.4	20	2	20	2	20	2	**40**
B-113-0-23 SS-1						21.0	20	15	20	15	20	15	**300**
B-114-0-23 SS-1						20.7	20	74	20	78	20	75	**1513**
B-115-0-23 SS-1						21.0	20	42	20	42	20	42	**840**
B-116-0-23 SS-1						16.4	20	5	20	5	20	5	**100**
B-117-0-23 SS-1						16.2	20	3	20	3	20	3	**60**
B-118-0-23 SS-1						16.2	20	7	20	7	20	7	**140**
B-119-0-23 SS-1						21.0	20	23	20	23	20	23	**460**
B-119-1-23 SS-1						16.2	20	2	20	2	20	2	**40**

PAVEMENT CORE REPORT

Core Photo: X-002



Core Information				
Core Diameter (in):			**3.75**	
Core Total Length (in):			**12.5**	
Layers	Core Composition & Thickness (in)			Remarks/ Condition
	Asphalt	Concrete	Brick	
1	1.75			Good
2	1.75			Good
3		9		Good
4				
Rebar Encountered	N/A			

Pavement & Core Photo Log

National Engineering & Architectural Services Inc.

Roadway Project

HAS-22-15.25/21.47

NEAS Project No.:	23-0011
Date:	9/18/2023
Taken By:	LR
Scale:	N/A

Core Photo: X-005



Core Information				
Core Diameter (in):			**3.75**	
Core Total Length (in):			**13.5**	
Layers	Core Composition & Thickness (in)			Remarks/ Condition
	Asphalt	Concrete	Brick	
1	2			Good
2	2			Good
3		9.5		Good
4				
Rebar Encountered	N/A			

Pavement & Core Photo Log

National Engineering & Architectural Services Inc.

Roadway Project

HAS-22-15.25/21.47

NEAS Project No.:	23-0011
Date:	9/18/2023
Taken By:	LR
Scale:	N/A

Core Photo: X-009



Core Information				
Core Diameter (in):			**3.75**	
Core Total Length (in):			**12.75**	
Layers	Core Composition & Thickness (in)			Remarks/ Condition
	Asphalt	Concrete	Brick	
1	2.75			Good
2		10		Good
3				
4				
Rebar Encountered	N/A			

Pavement & Core Photo Log

National Engineering & Architectural Services Inc.

Roadway Project

HAS-22-15.25/21.47

NEAS Project No.:	23-0011
Date:	9/18/2023
Taken By:	LR
Scale:	N/A

Core Photo: X-010



Core Information				
Core Diameter (in):			**3.75**	
Core Total Length (in):			**13.25**	
Layers	Core Composition & Thickness (in)			Remarks/ Condition
	Asphalt	Concrete	Brick	
1	2.5			Good
2	1.25			Poor
3		9.5		Good
4				
Rebar Encountered	N/A			

Pavement & Core Photo Log

National Engineering & Architectural Services Inc.

Roadway Project

HAS-22-15.25/21.47

NEAS Project No.:	23-0011
Date:	9/18/2023
Taken By:	LR
Scale:	N/A

Core Photo: X-012



Core Information				
Core Diameter (in):			**3.75**	
Core Total Length (in):			**12.25**	
Layers	Core Composition & Thickness (in)			Remarks/ Condition
	Asphalt	Concrete	Brick	
1	2			Good
2	1.75			Good
3		8.5		Good
4				
Rebar Encountered	1/2" diameter rebar at 6.75" depth			

Pavement & Core Photo Log

National Engineering & Architectural Services Inc.

Roadway Project

HAS-22-15.25/21.47

NEAS Project No.:	23-0011
Date:	9/18/2023
Taken By:	LR
Scale:	N/A

Core Photo: X-013



Core Information				
Core Diameter (in):			**3.75**	
Core Total Length (in):			**12.5**	
Layers	Core Composition & Thickness (in)			Remarks/ Condition
	Asphalt	Concrete	Brick	
1	1.75			Good
2	2			Good
3		8.75		Fair
4				
Rebar Encountered	N/A			

Pavement & Core Photo Log

National Engineering & Architectural Services Inc.

Roadway Project

HAS-22-15.25/21.47

NEAS Project No.:	23-0011
Date:	9/18/2023
Taken By:	LR
Scale:	N/A

ROCK CORE REPORT

OHIO DEPARTMENT OF TRANSPORTATION
DIVISION OF ENGINEERING

Office of Geotechnical Engineering

B-033-0-23



Run #:	Depth		Recovery		RQD	
NQ2-1	31.5'	41.5'	86.5"	72%	17"	14%
HAS-22-15.25/21.47						

OHIO DEPARTMENT OF TRANSPORTATION
DIVISION OF ENGINEERING

Office of Geotechnical Engineering

B-033-0-23



Run #:	Depth		Recovery		RQD	
NQ2-2	41.5’	51.5’	92.5”	77%	36”	30%
HAS-22-15.25/21.47						

OHIO DEPARTMENT OF TRANSPORTATION
DIVISION OF ENGINEERING

Office of Geotechnical Engineering

B-033-1-23



Run #:	Depth		Recovery		RQD	
NQ2-1	36.7’	41.7’	60”	100%	45”	75%
HAS-22-15.25/21.47						

OHIO DEPARTMENT OF TRANSPORTATION
DIVISION OF ENGINEERING

Office of Geotechnical Engineering

B-065-0-23



Run #:	Depth		Recovery		RQD	
NQ2-1	32.0'	42.0'	33"	28%	0"	0%
HAS-22-15.25/21.47						

OHIO DEPARTMENT OF TRANSPORTATION
DIVISION OF ENGINEERING

Office of Geotechnical Engineering

B-065-0-23



Run #:	Depth		Recovery		RQD	
NQ2-2	42.0’	52.0’	81”	68%	34.5”	29%
HAS-22-15.25/21.47						

OHIO DEPARTMENT OF TRANSPORTATION
DIVISION OF ENGINEERING

Office of Geotechnical Engineering

B-065-1-23



Run #:	Depth		Recovery		RQD	
NQ2-1	29.5'	39.5'	81"	68%	18"	15%
HAS-22-15.25/21.47						

OHIO DEPARTMENT OF TRANSPORTATION
DIVISION OF ENGINEERING

Office of Geotechnical Engineering

B-065-1-23



Run #:	Depth		Recovery		RQD	
NQ2-2	39.5’	44.5’	60”	100%	0”	0%
HAS-22-15.25/21.47						

OHIO DEPARTMENT OF TRANSPORTATION
DIVISION OF ENGINEERING

Office of Geotechnical Engineering

B-139-0-23



Run #:	Depth		Recovery		RQD	
NQ2-1	11.5'	21.5'	113/120	94%	36/120	30%

HAS-22-15.11 PID 113440

OHIO DEPARTMENT OF TRANSPORTATION
DIVISION OF ENGINEERING

Office of Geotechnical Engineering

B-139-0-23



Run #:	Depth		Recovery		RQD	
NQ2-2	21.5'	31.5'	120/120	100%	31/120	26%
HAS-22-15.11 PID 113440						

OHIO DEPARTMENT OF TRANSPORTATION
DIVISION OF ENGINEERING

Office of Geotechnical Engineering

B-139-0-23



Run #:	Depth		Recovery		RQD	
NQ2-3	31.5'	36.5'	0/60	0%	0/60	0%
HAS-22-15.11 PID 113440						

OHIO DEPARTMENT OF TRANSPORTATION
DIVISION OF ENGINEERING

Office of Geotechnical Engineering

B-141-0-23



Run #:	Depth		Recovery		RQD	
NQ2-1	23.2'	33.2'	117/120	98%	40/120	33%
HAS-22-15.11 PID 113440						

OHIO DEPARTMENT OF TRANSPORTATION
DIVISION OF ENGINEERING

Office of Geotechnical Engineering

B-141-0-23



Run #:	Depth		Recovery		RQD	
NQ2-2	33.2'	43.2'	120/120	100%	30.5/120	25%
HAS-22-15.11 PID 113440						

OHIO DEPARTMENT OF TRANSPORTATION
DIVISION OF ENGINEERING

Office of Geotechnical Engineering

B-141-0-23



Run #:	Depth		Recovery		RQD	
NQ2-3	43.2'	48.2'	60/60	100%	45/60	75%
HAS-22-15.11 PID 113440						

OHIO DEPARTMENT OF TRANSPORTATION
DIVISION OF ENGINEERING

Office of Geotechnical Engineering

B-142-0-23



Run #:	Depth		Recovery		RQD	
NQ2-1	20.5'	30.5'	117/120	98%	53.5/120	45%
HAS-22-15.11 PID 113440						

OHIO DEPARTMENT OF TRANSPORTATION
DIVISION OF ENGINEERING

Office of Geotechnical Engineering

B-142-0-23



Run #:	Depth		Recovery		RQD	
NQ2-2	30.5'	40.5'	120/120	100%	20/120	17%
HAS-22-15.11 PID 113440						

OHIO DEPARTMENT OF TRANSPORTATION
DIVISION OF ENGINEERING

Office of Geotechnical Engineering

B-142-0-23



Run #:	Depth		Recovery		RQD	
NQ2-3	40.5'	45.5'	60/60	100%	46/60	77%
HAS-22-15.11 PID 113440						

OHIO DEPARTMENT OF TRANSPORTATION
DIVISION OF ENGINEERING

Office of Geotechnical Engineering

B-144-0-23



Run #:	Depth		Recovery		RQD	
NQ2-1	22.7’	32.7’	88/120	73%	51.5/120	43%
HAS-22-15.11 PID 113440						

OHIO DEPARTMENT OF TRANSPORTATION
DIVISION OF ENGINEERING

Office of Geotechnical Engineering

B-144-0-23



Run #:	Depth		Recovery		RQD	
NQ2-2	32.7'	42.7'	120/120	100%	30/120	25%
HAS-22-15.11 PID 113440						

OHIO DEPARTMENT OF TRANSPORTATION
DIVISION OF ENGINEERING

Office of Geotechnical Engineering

B-144-0-23



Run #:	Depth		Recovery		RQD	
NQ2-3	42.7'	47.7'	60/60	100%	45/60	75%
HAS-22-15.11 PID 113440						

OHIO DEPARTMENT OF TRANSPORTATION
DIVISION OF ENGINEERING

Office of Geotechnical Engineering

B-145-0-23



Run #:	Depth		Recovery		RQD	
NQ2-1	11.3'	21.3'	117/120	98%	57.5/120	48%
HAS-22-15.11 PID 113440						

OHIO DEPARTMENT OF TRANSPORTATION
DIVISION OF ENGINEERING

Office of Geotechnical Engineering

B-145-0-23



Run #:	Depth		Recovery		RQD	
NQ2-2	21.3'	31.3'	117/120	98%	92.5/120	77%
HAS-22-15.11 PID 113440						

OHIO DEPARTMENT OF TRANSPORTATION
DIVISION OF ENGINEERING

Office of Geotechnical Engineering

B-145-0-23



Run #:	Depth		Recovery		RQD	
NQ2-3	31.3'	36.3'	60/60	100%	27.5/60	46%
HAS-22-15.11 PID 113440						

OHIO DEPARTMENT OF TRANSPORTATION
DIVISION OF ENGINEERING

Office of Geotechnical Engineering

B-146-0-23



Run #:	Depth		Recovery		RQD	
NQ2-1	15.1'	25.1'	117/120	98%	91.5/120	76%
HAS-22-15.11 PID 113440						

OHIO DEPARTMENT OF TRANSPORTATION
DIVISION OF ENGINEERING

Office of Geotechnical Engineering

B-146-0-23



Run #:	Depth		Recovery		RQD	
NQ2-2	25.1'	35.1'	117/120	98%	65/120	54%
HAS-22-15.11 PID 113440						

OHIO DEPARTMENT OF TRANSPORTATION
DIVISION OF ENGINEERING

Office of Geotechnical Engineering

B-146-0-23



Run #:	Depth		Recovery		RQD	
NQ2-3	35.1'	40.1'	60/60	100%	37/60	62%
HAS-22-15.11 PID 113440						

ROCK UNCONFINED COMPRESSIVE STRENGTH REPORT

National Engineering & Architectural Services Inc.
5710 Westbourne Avenue
Columbus, OH 43213
614-892-0162

Unconfined Compressive Strength of Rock Core (ASTM D7012 Method C)

(Project: HAS-22-15.11, Boring Location: B-139-0-23, NQ2-1, Depth: 14.2-14.6 ft)

Tested Date: 4/16/2025

Specimen Properties

Average Dia., D_{avg} (in):	1.98
Average Height, H_{avg} (in):	4.46
Length to Diameter Ratio:	2.26
Area, A (in^2):	3.06
Volume, V (in^3):	13.66
Wet Mass of Specimen (lb):	1.2
Moisture Content (%):	2.0
Dry Mass of Specimen (lb):	1.2
Wet Unit Weight, γ (lb/ft^3):	148.7
Dry Unit Weight, γ_d (lb/ft^3):	145.8

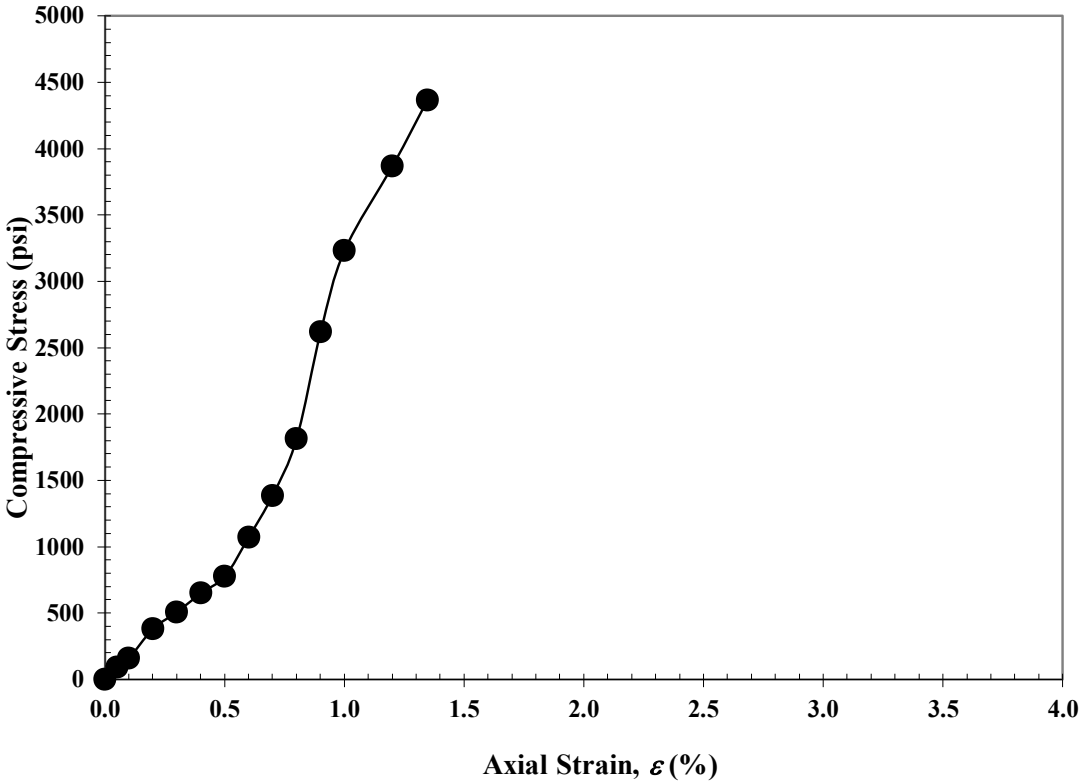
Final Specimen Figure



Results

Unconfined Compressive Strength (psi): **4367** **30** (MPa)

Strain (%): **1.3**



Notes: Sandstone, gray, moderately weathered, moderately strong, fine to medium grained.

Sample trimming procedure does not conform to ASTM D4543 and the results reported may differ from the results obtained from a test specimen that meets the requirements of Practice D4543.

National Engineering & Architectural Services Inc.
5710 Westbourne Avenue
Columbus, OH 43213
614-892-0162

Unconfined Compressive Strength of Rock Core (ASTM D7012 Method C)

(Project: HAS-22-15.11, Boring Location: B-141-0-23, NQ2-1, Depth: 30.2-30.6 ft)

Tested Date: 4/16/2025

Specimen Properties

Average Dia., D_{avg} (in):	1.97
Average Height, H_{avg} (in):	4.36
Length to Diameter Ratio:	2.21
Area, A (in^2):	3.06
Volume, V (in^3):	13.33
Wet Mass of Specimen (lb):	1.2
Moisture Content (%):	5.3
Dry Mass of Specimen (lb):	1.2
Wet Unit Weight, γ (lb/ft^3):	157.5
Dry Unit Weight, γ_d (lb/ft^3):	149.6

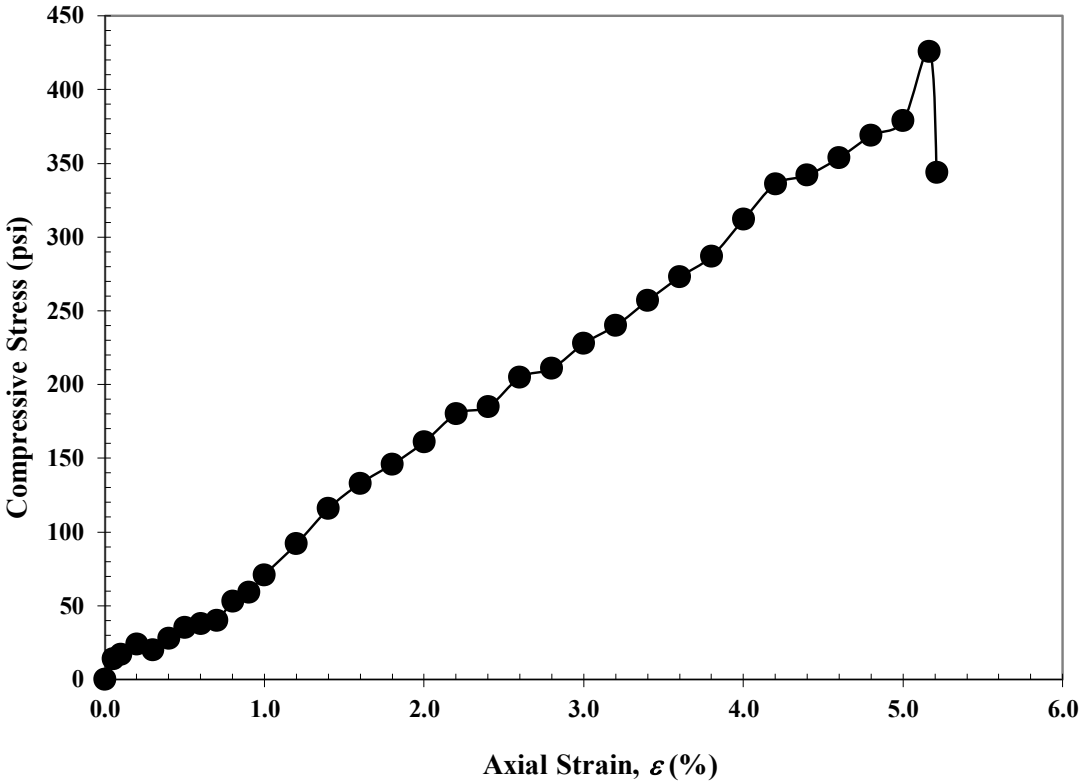
Final Specimen Figure



Results

Unconfined Compressive Strength (psi): **426** **3** (MPa)

Strain (%): **5.2**



Notes: Shale, gray, highly weathered, very weak, fissile.

Sample trimming procedure does not conform to ASTM D4543 and the results reported may differ from the results obtained from a test specimen that meets the requirements of Practice D4543.

National Engineering & Architectural Services Inc.
5710 Westbourne Avenue
Columbus, OH 43213
614-892-0162

Unconfined Compressive Strength of Rock Core (ASTM D7012 Method C)

(Project: HAS-22-15.11, Boring Location: B-142-0-23, NQ2-1, Depth: 23.0-23.4 ft)

Tested Date: 4/16/2025

Specimen Properties

Average Dia., D_{avg} (in):	1.98
Average Height, H_{avg} (in):	4.50
Length to Diameter Ratio:	2.28
Area, A (in^2):	3.07
Volume, V (in^3):	13.80
Wet Mass of Specimen (lb):	1.2
Moisture Content (%):	1.5
Dry Mass of Specimen (lb):	1.2
Wet Unit Weight, γ (lb/ft^3):	153.1
Dry Unit Weight, γ_d (lb/ft^3):	150.8

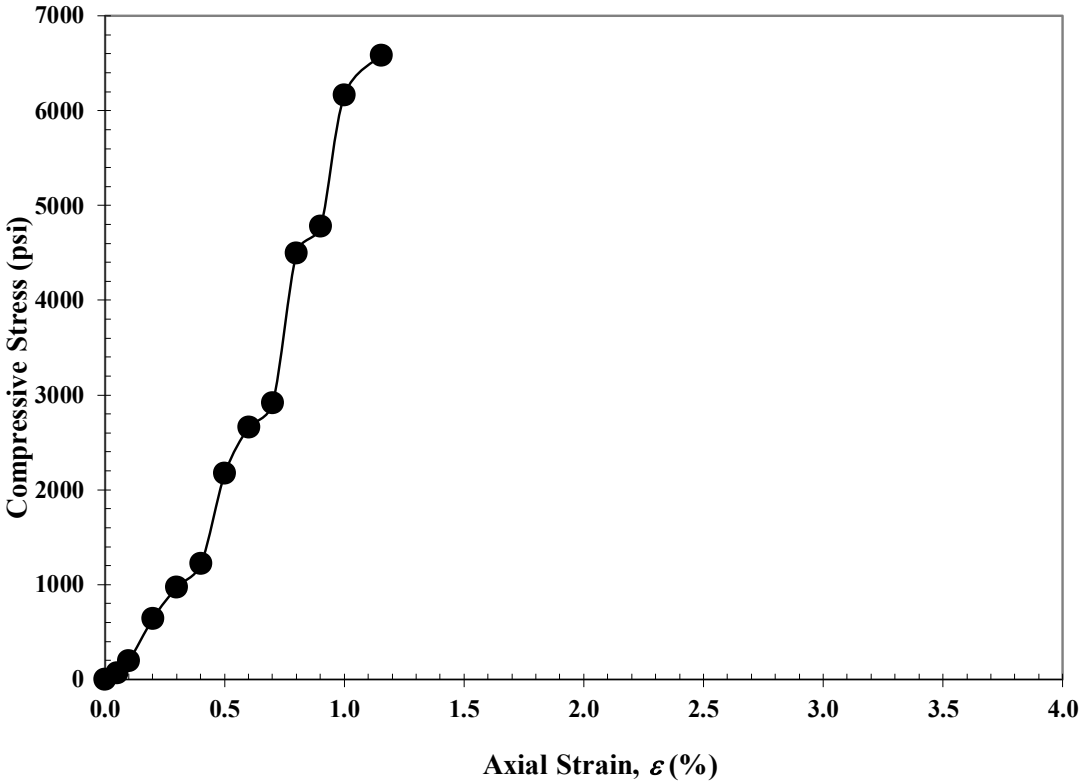
Final Specimen Figure



Results

Unconfined Compressive Strength (psi): **6584** **45** (MPa)

Strain (%): **1.2**



Notes: Sandstone, gray, moderately weathered, moderately strong, fine to medium grained.

Sample trimming procedure does not conform to ASTM D4543 and the results reported may differ from the results obtained from a test specimen that meets the requirements of Practice D4543.

National Engineering & Architectural Services Inc.
5710 Westbourne Avenue
Columbus, OH 43213
614-892-0162

Unconfined Compressive Strength of Rock Core (ASTM D7012 Method C)

(Project: HAS-22-15.11, Boring Location: B-144-0-23, NQ2-1, Depth: 27.4-27.7 ft)

Tested Date: 4/16/2025

Specimen Properties

Average Dia., D_{avg} (in):	1.95
Average Height, H_{avg} (in):	3.85
Length to Diameter Ratio:	1.97
Area, A (in^2):	2.99
Volume, V (in^3):	11.54
Wet Mass of Specimen (lb):	0.0
Moisture Content (%):	4.8
Dry Mass of Specimen (lb):	0.0
Wet Unit Weight, γ (lb/ft^3):	1.5
Dry Unit Weight, γ_d (lb/ft^3):	1.5

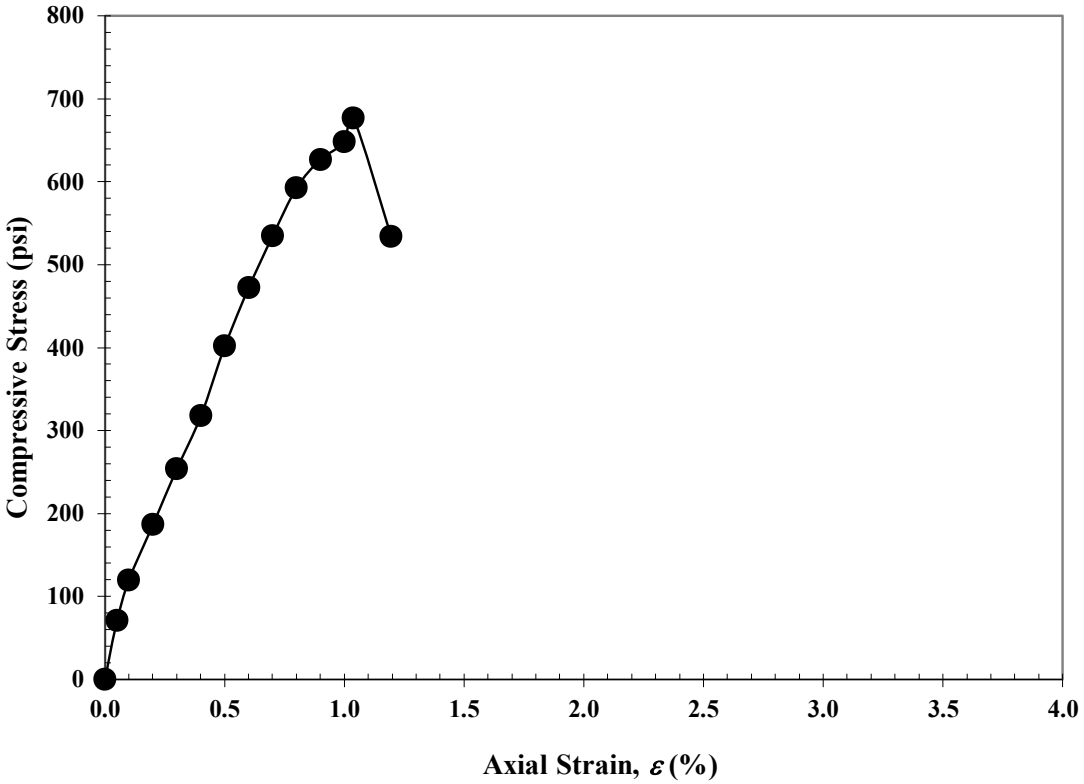
Final Specimen Figure



Results

Unconfined Compressive Strength (psi): **677** **5** (MPa)

Strain (%): **1.0**



Notes: Shale, gray, highly weathered, very weak, fissile.

Sample trimming procedure does not conform to ASTM D4543 and the results reported may differ from the results obtained from a test specimen that meets the requirements of Practice D4543.

National Engineering & Architectural Services Inc.
5710 Westbourne Avenue
Columbus, OH 43213
614-892-0162

Unconfined Compressive Strength of Rock Core (ASTM D7012 Method C)

(Project: HAS-22-15.11, Boring Location: B-145-0-23, NQ2-1, Depth: 17.3-17.6 ft)

Tested Date: 4/16/2025

Specimen Properties

Average Dia., D_{avg} (in):	1.97
Average Height, H_{avg} (in):	4.06
Length to Diameter Ratio:	2.06
Area, A (in^2):	3.05
Volume, V (in^3):	12.38
Wet Mass of Specimen (lb):	1.2
Moisture Content (%):	2.7
Dry Mass of Specimen (lb):	1.1
Wet Unit Weight, γ (lb/ft^3):	162.1
Dry Unit Weight, γ_d (lb/ft^3):	157.8

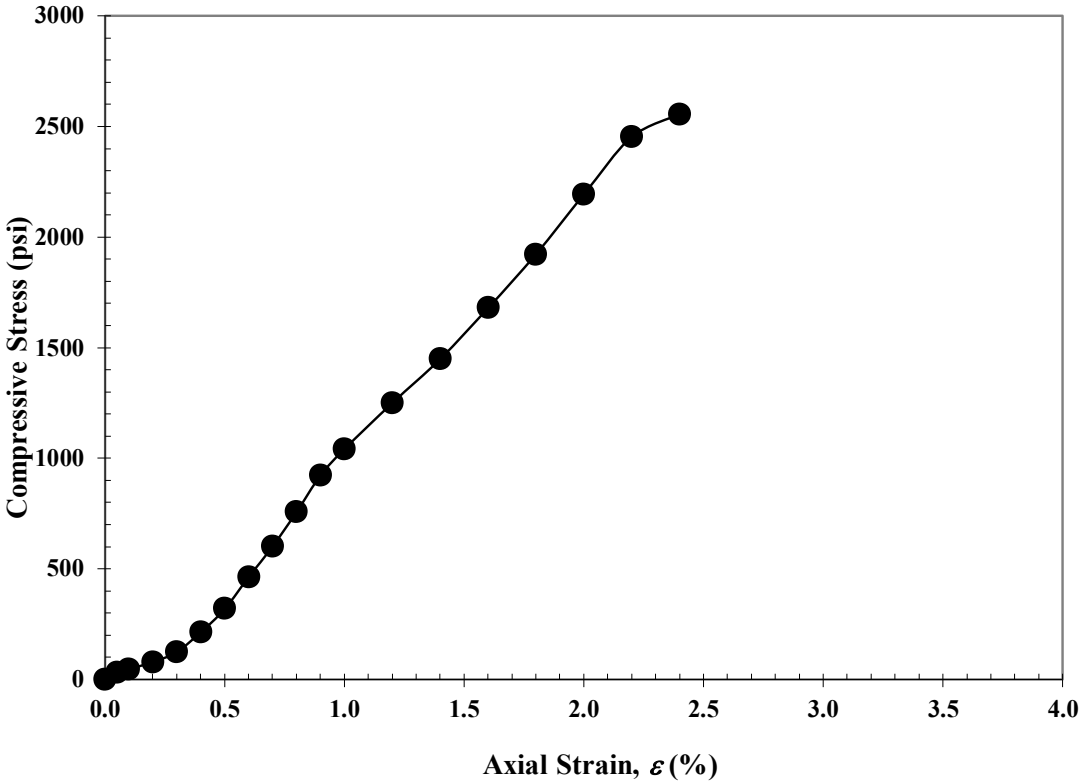
Final Specimen Figure



Results

Unconfined Compressive Strength (psi): **2555** **18** (MPa)

Strain (%): **2.4**



Notes: Siltstone, dark gray, slightly weathered, slightly strong, argillaceous.

Sample trimming procedure does not conform to ASTM D4543 and the results reported may differ from the results obtained from a test specimen that meets the requirements of Practice D4543.

National Engineering & Architectural Services Inc.
5710 Westbourne Avenue
Columbus, OH 43213
614-892-0162

Unconfined Compressive Strength of Rock Core (ASTM D7012 Method C)

(Project: HAS-22-15.11, Boring Location: B-146-0-23, NQ2-1, Depth: 15.5-15.9 ft)

Tested Date: 4/16/2025

Specimen Properties

Average Dia., D_{avg} (in):	1.97
Average Height, H_{avg} (in):	4.23
Length to Diameter Ratio:	2.14
Area, A (in^2):	3.06
Volume, V (in^3):	12.94
Wet Mass of Specimen (lb):	1.2
Moisture Content (%):	1.7
Dry Mass of Specimen (lb):	1.2
Wet Unit Weight, γ (lb/ft^3):	158.0
Dry Unit Weight, γ_d (lb/ft^3):	155.3

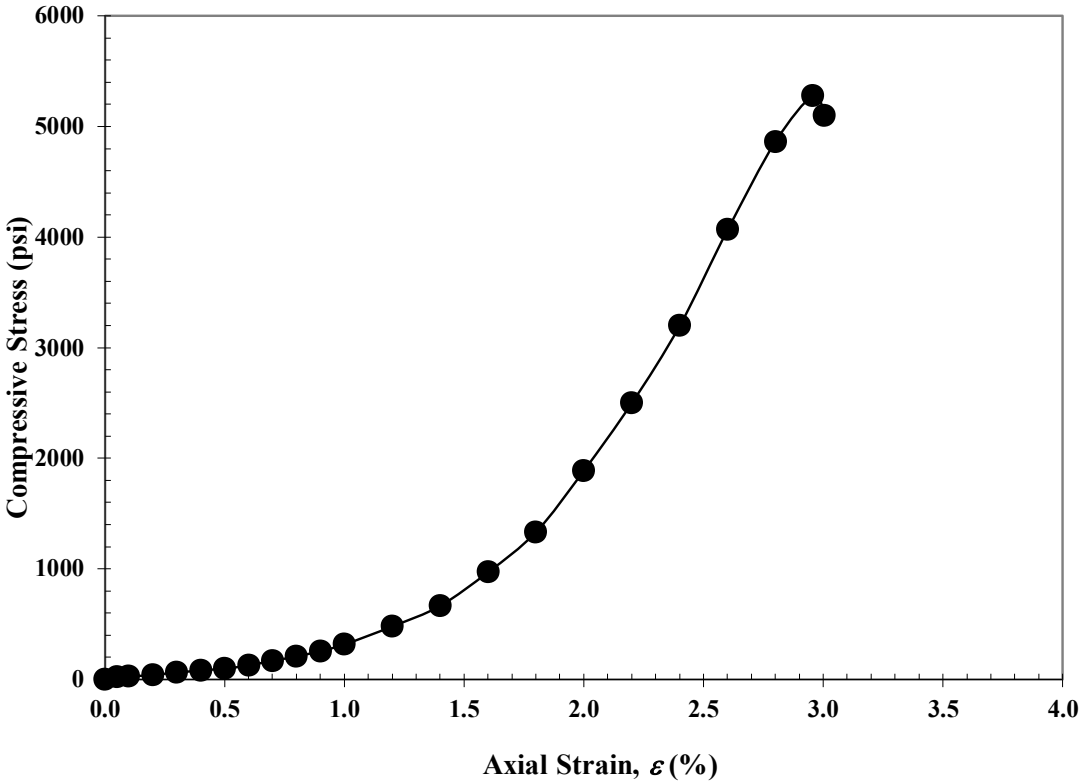
Final Specimen Figure



Results

Unconfined Compressive Strength (psi): **5279** **36** (MPa)

Strain (%): **3.0**



Notes: Siltstone, light gray and gray, slightly weathered, moderately strong.

Sample trimming procedure does not conform to ASTM D4543 and the results reported may differ from the results obtained from a test specimen that meets the requirements of Practice D4543.

APPENDIX D

CALCULATION

OHIO DEPARTMENT OF TRANSPORTATION

OFFICE OF GEOTECHNICAL ENGINEERING

PLAN SUBGRADES
Geotechnical Design Manual Section 600

Instructions: Enter data in the shaded cells only.
(Enter state route number, project description,county, consultant's name, prepared by name, and date prepared. This information will be transferred to all other sheets. The date prepared must be entered in the appropriate cell on this sheet to remove these instructions prior to printing.)

HAS-22-15.11
113440

Major Rhabilitation on US 22 from SLM 15.11 to SLM 18.91 - Entire Project

NEAS, Inc.

Prepared By: Derar M. Tarawneh
Date prepared: Tuesday, September 5, 2023

Chunmei (Melinda) He, Ph.D., P.E.
2800 Corporate Exchange Drive
Suite 240
Columbus, OH 43231
614.714.0299 Ext 111
che@neasinc.com

NO. OF BORINGS: 70

#	Boring ID	Alignment	Station	Offset	Dir	Drill Rig	ER	Boring EL.	Proposed Subgrade EL	Cut Fill
1	B-001-0-23	US 22	806+29	26	RT.	CME 45B	73	1084.8	1082.9	1.8 C
2	B-002-0-23	US 22	810+41	27	LT.	CME 45B	73	1098.2	1096.9	1.3 C
3	B-003-0-23	US 22	814+37	50	RT.	CME 45B	73	1111.9	1110.8	1.1 C
4	B-004-0-23	US 22	818+22	39	LT.	CME 55T	63	1126.2	1124.2	2.0 C
5	B-005-0-23	US 22	821+91	24	RT.	CME 45B	73	1138.7	1137.1	1.5 C
6	B-006-0-23	US 22	826+10	21	LT.	CME 55T	63	1153.9	1151.9	2.0 C
7	B-007-0-23	US 22	829+93	34	RT.	CME 45B	73	1169.5	1167.3	2.2 C
8	B-008-0-23	US 22	833+69	48	LT.	CME 45B	73	1184.5	1182.8	1.7 C
9	B-009-0-23	US 22	837+69	57	RT.	CME 45B	73	1201.2	1199.3	1.9 C
10	B-010-0-23	US 22	841+56	44	LT.	CME 45B	73	1217.0	1215.2	1.8 C
11	B-011-0-23	US 22	845+48	51	RT.	CME 45B	73	1229.9	1228.5	1.4 C
12	B-012-0-23	US 22	849+30	38	LT.	CME 45B	73	1237.7	1236.1	1.7 C
13	B-013-0-23	US 22	853+47	38	RT.	CME 45B	73	1240.0	1238.3	1.7 C
14	B-014-0-23	US 22	857+18	48	LT.	CME 45B	73	1236.3	1235.0	1.3 C
15	B-015-0-23	US 22	861+22	39	RT.	CME 45B	73	1229.7	1228.2	1.6 C
16	B-016-0-23	US 22	865+8	39	LT.	CME 55T	63	1223.4	1221.7	1.7 C
17	B-017-0-23	US 22	868+75	26	RT.	CME 45B	73	1215.7	1215.5	0.2 C
18	B-018-0-23	US 22	872+66	50	LT.	CME 55T	63	1210.5	1208.9	1.6 C
19	B-019-0-23	US 22	876+76	24	RT.	CME 45B	73	1206.2	1204.4	1.8 C
20	B-020-0-23	US 22	880+67	48	LT.	CME 45B	73	1210.3	1208.8	1.5 C
21	B-021-0-23	US 22	884+79	51	RT.	CME 45B	73	1215.4	1215.1	0.3 C
22	B-022-0-23	US 22	889+27	54	LT.	CME 45B	73	1225.4	1221.9	3.5 C
23	B-023-0-23	US 22	892+49	41	RT.	CME 45B	73	1227.1	1226.8	0.3 C
24	B-024-0-23	US 22	896+72	27	LT.	CME 55T	63	1235.1	1233.3	1.9 C
25	B-025-0-23	US 22	900+37	39	RT.	CME 45B	73	1240.5	1238.8	1.7 C
26	B-026-0-23	US 22	904+19	49	LT.	CME 45B	73	1245.4	1244.7	0.8 C
27	B-027-0-23	US 22	908+20	38	RT.	CME 45B	73	1252.3	1250.8	1.5 C
28	B-028-0-23	US 22	912+2	48	LT.	CME 45B	73	1258.0	1256.9	1.2 C
29	B-029-0-23	US 22	915+96	40	RT.	CME 45B	73	1261.6	1259.9	1.7 C
30	B-030-0-23	US 22	919+95	33	LT.	CME 55T	63	1259.1	1257.5	1.7 C
31	B-031-0-23	US 22	923+74	24	RT.	CME 45B	73	1251.6	1250.0	1.6 C
32	B-032-0-23	US 22	926+17	62	LT.	CME 45B	73	1243.7	1242.6	1.1 C
33	B-033-0-23	US 22	930+56	25	RT.	CME 55T	63	1226.6	1225.1	1.5 C
34	B-033-1-23	US 22	930+39	52	LT.	CME 45B	73	1227.1	1230.6	3.5 F
35	B-034-0-23	US 22	935+52	48	LT.	CME 45B	73	1206.8	1205.3	1.5 C
36	B-035-0-23	US 22	940+84	42	RT.	CME 45B	73	1185.5	1184.1	1.4 C
37	B-036-0-23	US 22	943+47	24	LT.	CME 45B	73	1178.3	1176.7	1.6 C
38	B-037-0-23	US 22	947+36	24	RT.	CME 45B	73	1179.7	1177.9	1.9 C
39	B-038-0-23	US 22	951+26	50	LT.	CME 45B	73	1193.1	1191.7	1.4 C
40	B-039-0-23	US 22	955+18	48	RT.	CME 45B	73	1208.8	1207.4	1.4 C
41	B-040-0-23	US 22	959+9	49	LT.	CME 45B	73	1224.2	1222.8	1.4 C
42	B-041-0-23	US 22	962+90	40	RT.	CME 45B	73	1235.6	1234.0	1.5 C
43	B-042-0-23	US 22	967+0	24	LT.	CME 45B	73	1246.5	1245.1	1.4 C
44	B-043-0-23	US 22	970+82	25	RT.	CME 45B	73	1254.0	1252.4	1.6 C
45	B-044-0-23	US 22	974+82	40	LT.	CME 45B	73	1255.9	1255.7	0.2 C

#	Boring ID	Alignment	Station	Offset	Dir	Drill Rig	ER	Boring EL.	Proposed Subgrade EL	Cut Fill
46	B-045-0-23	US 22	978+75	48	RT.	CME 45B	73	1258.4	1255.3	3.1 C
47	B-046-0-23	US 22	982+65	40	LT.	CME 45B	73	1252.6	1252.5	0.1 C
48	B-047-0-23	US 22	986+53	25	RT.	CME 45B	73	1249.2	1247.1	2.1 C
49	B-048-0-23	US 22	990+48	25	LT.	CME 45B	73	1240.6	1239.0	1.6 C
50	B-049-0-23	US 22	994+55	38	RT.	CME 45B	73	1229.0	1227.5	1.5 C
51	B-050-0-23	US 22	998+48	18	LT.	CME 45B	73	1217.9	1216.4	1.5 C
52	B-051-0-23	US 22	1002+32	45	RT.	CME 45B	73	1199.4	1197.9	1.5 C
53	B-052-0-23	US 22	1005+26	7	RT.	CME 45B	73	1189.8	1188.3	1.5 C
54	B-104-0-23	Ramp C	4+1	4	LT.	CME 55T	63	1209.6	1207.5	2.1 C
55	B-105-0-23	Ramp C	7+38	4	LT.	CME 55T	63	1212.3	1210.2	2.1 C
56	B-106-0-23	Ramp D	12+65	150	RT.	CME 45B	73	1235.7	1234.2	1.5 C
57	B-107-0-23	Ramp D	2+39	150	RT.	CME 45B	73	1228.2	1226.8	1.4 C
58	B-108-0-23	Ramp D	6+90	2	RT.	CME 45B	73	1207.6	1206.2	1.4 C
59	B-109-0-23	Ramp A	1+33	2	RT.	CME 55T	63	1224.3	1223.0	1.3 C
60	B-110-0-23	Ramp B	10+2	2	RT.	CME 45B	73	1225.0	1223.7	1.4 C
61	B-111-0-23	Ramp B	6+4	9	LT.	CME 55T	63	1208.0	1206.2	1.8 C
62	B-112-0-23	Ramp G	19+13	5	RT.	CME 55T	63	1214.6	1213.7	0.9 C
63	B-113-0-23	Ramp G	15+61	3	RT.	CME 45B	73	1218.2	1216.4	1.8 C
64	B-114-0-23	Ramp G	11+57	22	LT.	CME 45B	73	1215.1	1213.9	1.1 C
65	B-115-0-23	Ramp H	3+75	5	RT.	CME 45B	73	1207.6	1205.6	2.0 C
66	B-116-0-23	RAMP E	7+73	7	LT.	CME 55T	63	1240.2	1239.0	1.1 C
67	B-117-0-23	RAMP E	0+32	3	LT.	CME 55T	63	1211.3	1210.3	1.0 C
68	B-118-0-23	RAMP E	5+14	31	RT.	CME 55T	63	1230.9	1227.5	3.4 C
69	B-119-0-23	RAMP F	6+29	31	RT.	CME 45B	73	1249.0	1247.6	1.4 C
70	B-119-1-23	RAMP F	8+32	4	LT.	CME 55T	63	1242.0	1240.4	1.7 C

OHIO DEPARTMENT OF TRANSPORTATION

Subgrade Analysis

V. 14.6 2/11/2022

#	Boring	Sample	Sample Depth		Subgrade Depth		Standard Penetration		HP (tsf)	Physical Characteristics						Moisture		Ohio DOT		Sulfate Content (ppm)	Problem		Excavate and Replace (Item 204)		Recommendation (Enter depth in inches)
			From	To	From	To	N_{60}	N_{60L}		LL	PL	PI	% Silt	% Clay	P200	M_C	M_{OPT}	Class	GI		Unsuitable	Unstable	Unsuitable	Unstable	
1	B	SS-1	1.5	3.0	-0.3	1.2	4		4	35	23	12	38	33	71	19	18	A-6a	8	593		N_{60}		24"	
	001-0	SS-2	3.0	4.5	1.2	2.7	7		4							21	14	A-6a	10			N_{60} & Mc			
	23	SS-3	4.5	6.0	2.7	4.2	68		4.5	31	21	10	38	16	54	11	16	A-4a	4						
		SS-4	6.0	6.3	4.2	4.5		4									0	Rock	0						
2	B	SS-1	1.5	3.0	0.2	1.7	5		3.25	49	26	23	29	56	85	31	23	A-7-6	15	920		N_{60} & Mc		21"	
	002-0	SS-2	3.0	4.5	1.7	3.2	6		4.25	38	23	15	33	29	62	12	18	A-6a	7			N_{60}			
	23	SS-3	4.5	6.0	3.2	4.7	28									10	6	A-1-b	0						
		SS-4	6.0	6.3	4.7	5.0		5																	
3	B	SS-1	1.5	3.0	0.4	1.9	8		4.25	34	21	13	40	22	62	18	16	A-6a	7	880		N_{60}		12"	
	003-0	SS-2	3.0	4.5	1.9	3.4	22		4.25	27	19	8	43	22	65	11	14	A-4a	6						
	23	SS-3	4.5	6.0	3.4	4.9	31		4.5	29	18	11	30	42	72	12	14	A-6a	8						
		SS-4	6.0	6.3	4.9	5.2		8	4.5							11	14	A-6a	10						
4	B	SS-1	1.5	3.0	-0.5	1.0	11		4.5	36	22	14	32	19	51	14	17	A-6a	5	320		N_{60}		12"	
	004-0	SS-2	3.0	4.5	1.0	2.5	11		4.5	36	23	13	22	14	36	11	18	A-6a	1			N_{60}		12"	
	23	SS-3	4.5	6.0	2.5	4.0	13		4.5							13	14	A-6a	10						
		SS-4	6.0	7.5	4.0	5.5	14	11	4.5							16	14	A-6a	10						
5	B	SS-1	1.5	3.0	0.0	1.5	6		3	32	22	10	34	18	52	13	17	A-4a	3	873		N_{60}		18"	
	005-0	SS-2	3.0	4.5	1.5	3.0	7		2.75	33	21	12	28	24	52	14	16	A-6a	4			N_{60}			
	23	SS-3	4.5	6.0	3.0	4.5	12		3							16	14	A-6a	10						
		SS-4	6.0	7.5	4.5	6.0	15	6	3							14	14	A-6a	10						
6	B	SS-1	1.5	3.0	-0.5	1.0	12									8	6	A-1-a	0						
	006-0	SS-2	3.0	4.5	1.0	2.5	12									7	6	A-1-a	0						
	23	SS-3	4.5	6.0	2.5	4.0	13		4.5	34	21	13	23	20	43	12	16	A-6a	2	640					
		SS-4	6.0	6.3	4.0	4.3		12								4	6	A-1-a	0						
7	B	SS-1	1.5	3.0	-0.7	0.8	22		3.5	32	20	12	39	28	67	15	15	A-6a	7	540					
	007-0	SS-2	3.0	4.5	0.8	2.3	12		4.25	29	20	9	40	17	57	11	15	A-4a	4						
	23	SS-3	4.5	6.0	2.3	3.8	13		4.25							11	10	A-4a	8						
		SS-4	6.0	7.5	3.8	5.3	16	12	4.25							14	10	A-4a	8						
8	B	SS-1	1.5	3.0	-0.2	1.3	13		4.25	33	19	14	37	30	67	18	14	A-6a	8	840		N_{60} & Mc		12"	
	008-0	SS-2	3.0	4.5	1.3	2.8	11			28	21	7	49	6	55	12	16	A-4a	4			N_{60}			
	23	SS-3	4.5	6.0	2.8	4.3	28			29	19	10	50	2	52	11	14	A-4b	3						
		SS-4	6.0	6.3	4.3	4.6		11								10	10	A-4b	8						
9	B	SS-1	1.5	3.0	-0.4	1.1	5		3.25	33	22	11	41	23	64	18	17	A-6a	6	600		N_{60}		21"	
	009-0	SS-2	3.0	4.5	1.1	2.6	65		4							21	14	A-6a	10			Mc			
	23	SS-3	4.5	6.0	2.6	4.1	75										0	Rock	0						
		SS-4	6.0	7.5	4.1	5.6	82	5									0	Rock	0						

OHIO DEPARTMENT OF TRANSPORTATION

Subgrade Analysis

V. 14.6 2/11/2022

#	Boring	Sample	Sample Depth		Subgrade Depth		Standard Penetration		HP (tsf)	Physical Characteristics						Moisture		Ohio DOT		Sulfate Content (ppm)	Problem		Excavate and Replace (Item 204)		Recommendation (Enter depth in inches)
			From	To	From	To	N_{60}	N_{60L}		LL	PL	PI	% Silt	% Clay	P200	M_C	M_{OPT}	Class	GI		Unsuitable	Unstable	Unsuitable	Unstable	
10	B	SS-1	1.5	3.0	-0.3	1.2	7			27	19	8	32	23	55	13	14	A-4a	4	100		N_{60}		15"	
	010-0	SS-2	3.0	4.5	1.2	2.7	6									7	10	A-4a	8			N_{60}			
	23	SS-3	4.5	6.0	2.7	4.2											0	Rock	0						
		SS-4	6.0	6.2	4.2	4.4		6									0	Rock	0						
11	B	SS-1	1.5	3.0	0.1	1.6	6		4.5	31	20	11	39	29	68	15	15	A-6a	7	640		N_{60}		18"	
	011-0	SS-2	3.0	4.5	1.6	3.1	8		4.5	32	21	11	57	27	84	7	16	A-6a	8			N_{60}			
	23	SS-3	4.5	6.0	3.1	4.6	23									6	6	A-1-b	0						
		SS-4	6.0	7.5	4.6	6.1	33	6									0	Rock	0						
12	B	SS-1	1.5	3.0	-0.2	1.3	13		4	34	21	13	25	23	48	14	16	A-6a	4	3500					
	012-0	SS-2	3.0	4.5	1.3	2.8	15			NP	NP	NP				9	10	A-2-4	0						
	23	SS-3	4.5	6.0	2.8	4.3	23									10	10	A-2-4	0						
		SS-4	6.0	7.5	4.3	5.8	24	13								8	10	A-2-4	0						
13	B	SS-1	1.5	3.0	-0.2	1.3	8		4	30	20	10	25	19	44	14	15	A-4a	2	687		N_{60}		12"	
	013-0	SS-2	3.0	4.5	1.3	2.8	10		4.5							16	14	A-6a	10			N_{60}			
	23	SS-3	4.5	6.0	2.8	4.3	46		4.5	34	23	11	50	21	71	13	18	A-6a	8						
		SS-4	6.0	7.5	4.3	5.8	52	8								8	0	Rock	0						
14	B	SS-1	1.5	3.0	0.2	1.7	13		3.5	38	21	17	37	43	80	18	16	A-6b	11	1500					
	014-0	SS-2	3.0	4.5	1.7	3.2	15		4.5	38	22	16	48	42	90	14	17	A-6b	10						
	23	SS-3	4.5	6.0	3.2	4.7	10		4.5							13	10	A-4a	8						
		SS-4	6.0	7.5	4.7	6.2	11	10	3.5							23	18	A-7-6	16						
15	B	SS-1	1.5	3.0	-0.1	1.5	8			NP	NP	NP	19	13	32	12	10	A-2-4	0	180		N_{60}		12"	
	015-0	SS-2	3.0	4.5	1.5	3.0	8		4	39	21	18	32	48	80	21	16	A-6b	11			N_{60} & Mc			
	23	SS-3	4.5	6.0	3.0	4.5	18		4.5							18	16	A-6b	16						
		SS-4	6.0	7.5	4.5	6.0	22	8	4.5							16	16	A-6b	16						
16	B	SS-1	1.5	3.0	-0.2	1.3	14													340					
	016-0	SS-2	3.0	4.5	1.3	2.8	12		4	41	21	20	32	45	77	18	18	A-7-6	12						
	23	SS-3	4.5	6.0	2.8	4.3	16		4	34	21	13	31	34	65	16	16	A-6a	7						
		SS-4	6.0	7.5	4.3	5.8	12	12	4							18	14	A-6a	10						
17	B	SS-1	1.5	3.0	1.3	2.8	35		4.25	29	21	8	42	18	60	12	16	A-4a	5	800					
	017-0	SS-2	3.0	4.5	2.8	4.3	38		4.5	30	22	8	45	18	63	10	17	A-4a	6						
	23	SS-3	4.5	6.0	4.3	5.8	46									9	0	Rock	0						
		SS-4	6.0	7.5	5.8	7.3	47	30								11	0	Rock							
18	B	SS-1	1.5	3.0	-0.1	1.4	10									7	6	A-1-a	0	180					
	018-0	SS-2	3.0	4.5	1.4	2.9	13		4.5	38	26	12	40	29	69	13	21	A-6a	8						
	23	SS-3	4.5	6.0	2.9	4.4	54		4.5	41	24	17	28	36	64	14	21	A-7-6	9						
		SS-4	6.0	7.5	4.4	5.9	53	10	4.5							15	18	A-7-6	16						

OHIO DEPARTMENT OF TRANSPORTATION

Subgrade Analysis

V. 14.6 2/11/2022

#	Boring	Sample	Sample Depth		Subgrade Depth		Standard Penetration		HP (tsf)	Physical Characteristics						Moisture		Ohio DOT		Sulfate Content (ppm)	Problem		Excavate and Replace (Item 204)		Recommendation (Enter depth in inches)
			From	To	From	To	N_{60}	N_{60L}		LL	PL	PI	% Silt	% Clay	P200	M_C	M_{OPT}	Class	GI		Unsuitable	Unstable	Unsuitable	Unstable	
19	B	SS-1	1.5	3.0	-0.3	1.2	7		3	34	21	13	35	28	63	17	16	A-6a	7	3067		N_{60}		15"	
	019-0	SS-2	3.0	4.5	1.2	2.7	8		3.5	38	24	14	29	27	56	17	19	A-6a	6			N_{60}			
	23	SS-3	4.5	6.0	2.7	4.2	11		3.5							16	14	A-6a	10						
		SS-4	6.0	7.5	4.2	5.7	12	7	3.25							17	14	A-6a	10						
20	B	SS-1	1.5	3.0	0.0	1.5	8		4	35	23	12	42	23	65	13	18	A-6a	7	1800		N_{60}		12"	
	020-0	SS-2	3.0	4.5	1.5	3.0	11		4.25	38	23	15	35	37	72	21	18	A-6a	9			N_{60} & Mc			
	23	SS-3	4.5	6.0	3.0	4.5	12		4.5	31	19	12	34	30	64	12	14	A-6a	7						
		SS-4	6.0	7.5	4.5	6.0	10	8	4.5							14	14	A-6a	10						
21	B	SS-1	1.5	3.0	1.2	2.7	12		4.5	30	20	10	44	25	69	11	15	A-4a	7	720					
	021-0	SS-2	3.0	4.5	2.7	4.2	34		4.5	30	21	9	58	20	78	7	16	A-4b	8						
	23	SS-3	4.5	5.5	4.2	5.2	50		4.5							5	10	A-4b	8						
		SS-4	5.5	6.1	5.2	5.8	100	12									0	Rock							
22	B	SS-1	1.5	3.0	-2.0	-0.5	11		3.5	42	23	19	45	36	81	17	20	A-7-6	12	820					
	022-0	SS-2	3.0	4.5	-0.5	1.0	10		4.25							17	18	A-7-6	16			N_{60}		12"	
	23	SS-3	4.5	6.0	1.0	2.5	16		4.5	33	21	12	48	27	75	14	16	A-6a	9						
		SS-4	6.0	7.5	2.5	4.0	17	10	4.5							15	14	A-6a	10						
23	B	SS-1	1.5	3.0	1.2	2.7	8		4.25	40	25	15	32	31	63	19	20	A-6a	8	1220		N_{60}			
	023-0	SS-2	3.0	4.5	2.7	4.2	8		4.5	37	23	14	31	24	55	17	18	A-6a	6						
	23	SS-3	4.5	6.0	4.2	5.7	12		4.5							15	14	A-6a	10						
		SS-4	6.0	7.5	5.7	7.2	16	8	4.5							14	14	A-6a							
24	B	SS-1	1.5	2.5	-0.4	0.6	50										0	Rock	0		Rock				
	024-0	SS-2	3.0	4.0	1.1	2.1	50										0	Rock	0		Rock		25"		
	23	SS-3	4.5	5.0	2.6	3.1	100										0	Rock	0						
		SS-4	6.0	6.3	4.1	4.4	100	30									0	Rock	0						
25	B	SS-1	1.5	3.0	-0.2	1.3	8		4	35	21	14	29	31	60	18	16	A-6a	7	833		N_{60}		12"	
	025-0	SS-2	3.0	4.5	1.3	2.8	24		4.5	33	23	10	35	17	52	11	18	A-4a	3						
	23	SS-3	4.5	6.0	2.8	4.3	93									10	0	Rock	0						
		SS-4	6.0	7.5	4.3	5.8	96	8								9	0	Rock	0						
26	B	SS-1	1.5	3.0	0.7	2.2	8			27	19	8	22	19	41	7	14	A-4a	1	600		N_{60}		12"	
	026-0	SS-2	3.0	4.5	2.2	3.7	12		4.5	31	21	10	49	24	73	16	16	A-4a	8						
	23	SS-3	4.5	6.0	3.7	5.2	8									13	8	A-3a	0						
		SS-4	6.0	7.5	5.2	6.7	11	8	4.5							10	10	A-4a							
27	B	SS-1	1.5	3.0	0.0	1.5	4			31	21	10	23	14	37	14	16	A-4a	0	987		N_{60}		24"	
	027-0	SS-2	3.0	4.5	1.5	3.0	7									16	10	A-4a	8			N_{60} & Mc			
	23	SS-3	4.5	6.0	3.0	4.5	11			31	21	10	34	13	47	9	16	A-4a	2						
		SS-4	6.0	7.5	4.5	6.0	16	4	4.25							18	10	A-4a	8						

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Subgrade Analysis

V. 14.6 2/11/2022

#	Boring	Sample	Sample Depth		Subgrade Depth		Standard Penetration		HP (tsf)	Physical Characteristics						Moisture		Ohio DOT		Sulfate Content (ppm)	Problem		Excavate and Replace (Item 204)		Recommendation (Enter depth in inches)
			From	To	From	To	N_{60}	N_{60L}		LL	PL	PI	% Silt	% Clay	P200	M_C	M_{OPT}	Class	GI		Unsuitable	Unstable	Unsuitable	Unstable	
28	B	SS-1	1.5	3.0	0.3	1.8	8		4.25	32	21	11	54	29	83	16	16	A-6a	8	260		N_{60}		12"	
	028-0	SS-2	3.0	4.5	1.8	3.3	10		4.25							15	14	A-6a	10			N_{60}			
	23	SS-3	4.5	6.0	3.3	4.8	75		4.25							8	14	A-6a	10						
		SS-4	6.0	6.2	4.8	5.0	100	8								5	0	Rock	0						
29	B	SS-1	1.5	3.0	-0.2	1.4	7		1.5	35	20	15	30	33	63	9	15	A-6a	8	520		HP		15"	
	029-0	SS-2	3.0	4.5	1.4	2.9	13			34	21	13	37	24	61	17	16	A-6a	6						
	23	SS-3	4.5	6.0	2.9	4.4	19									14	14	A-6a	10						
		SS-4	6.0	6.3	4.4	4.7	100	7									0	Rock	0						
30	B	SS-1	1.5	3.0	-0.2	1.3	12		4	35	23	12	38	17	55	13	18	A-6a	5	867					
	030-0	SS-2	3.0	4.5	1.3	2.8	8		4	36	21	15	36	32	68	16	16	A-6a	9			N_{60}			
	23	SS-3	4.5	6.0	2.8	4.3	7		4.25							21	14	A-6a	10						
		SS-4	6.0	7.5	4.3	5.8	7	7	4.25							14	14	A-6a	10						
31	B	SS-1	1.5	3.0	-0.1	1.4	10		2.5	33	22	11	39	30	69	18	17	A-6a	7	433		N_{60}		12"	
	031-0	SS-2	3.0	4.5	1.4	2.9	10		4.5	34	21	13	43	24	67	16	16	A-6a	8			N_{60}			
	23	SS-3	4.5	6.0	2.9	4.4	18		4.5							18	14	A-6a	10						
		SS-4	6.0	7.5	4.4	5.9	19	10	4.5							19	14	A-6a	10						
32	B	SS-1	1.5	3.0	0.4	1.9	6		4	34	21	13	28	42	70	9	16	A-6a	8	720		N_{60}		18"	
	032-0	SS-2	3.0	4.5	1.9	3.4	7		4.25							14	14	A-6a	10			N_{60}			
	23	SS-3	4.5	6.0	3.4	4.9	6		4	51	27	24	29	60	89	20	24	A-7-6	16						
		SS-4	6.0	7.5	4.9	6.4	7	6	4							27	18	A-7-6	16						
33	B	SS-1	1.5	3.0	0.0	1.5	6		4.5							16	16	A-6b	16			N_{60}		18"	
	033-0	SS-2	3.0	4.5	1.5	3.0	7		4.25	40	22	18	36	36	72	15	17	A-6b	11	2500		N_{60}			
	23	SS-3	4.5	6.0	3.0	4.5	10		4.25	39	22	17	26	31	57	14	17	A-6b	7						
		SS-4	6.0	7.5	4.5	6.0	12	6	4.25							15	16	A-6b	16						
34	B	SS-1	1.5	3.0	5.0	6.6	11		4.5	30	22	8	40	14	54	11	17	A-4a		360					
	033-1	SS-2	3.0	4.5	6.6	8.1	10		3.5	38	22	16	34	41	75	17	17	A-6b							
	23	SS-3	4.5	6.0	8.1	9.6	8		4.5							16	16	A-6b							
		SS-4	6.0	7.5	9.6	11.1	10	11	4.5	37	21	16	36	37	73	18	16	A-6b							
35	B	SS-1	1.5	3.0	0.0	1.5	10		4.25	39	23	16	39	45	84	17	18	A-6b	10	3600		N_{60}		12"	
	034-0	SS-2	3.0	4.5	1.5	3.0	8		4.25	33	20	13	45	30	75	20	15	A-6a	9			N_{60} & Mc			
	23	SS-3	4.5	6.0	3.0	4.5	13		4.5	36	22	14	35	35	70	14	17	A-6a	9						
		SS-4	6.0	6.2	4.5	4.7	50	8									0	Rock	0						
36	B	SS-1	1.5	3.0	0.1	1.6	8		4.25	34	20	14	32	27	59	15	15	A-6a	6	1513		N_{60}		12"	
	035-0	SS-2	3.0	4.5	1.6	3.1	11		3.5	38	23	15	31	39	70	18	18	A-6a	9			N_{60}			
	23	SS-3	4.5	6.0	3.1	4.6	24		3.75							18	14	A-6a	10						
		SS-4	6.0	7.5	4.6	6.1	31	8								9	6	A-1-b	0						

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Subgrade Analysis

V. 14.6 2/11/2022

#	Boring	Sample	Sample Depth		Subgrade Depth		Standard Penetration		HP (tsf)	Physical Characteristics						Moisture		Ohio DOT		Sulfate Content (ppm)	Problem		Excavate and Replace (Item 204)		Recommendation (Enter depth in inches)
			From	To	From	To	N_{60}	N_{60L}		LL	PL	PI	% Silt	% Clay	P200	M_C	M_{OPT}	Class	GI		Unsuitable	Unstable	Unsuitable	Unstable	
37	B	SS-1	1.5	3.0	-0.1	1.4	10		4.25	40	22	18	35	43	78	21	17	A-6b	11	2500		N_{60} & Mc		**12"**	
	036-0	SS-2	3.0	4.5	1.4	2.9	10		4	41	24	17	34	47	81	20	21	A-7-6	11			N_{60}			
	23	SS-3	4.5	6.0	2.9	4.4	11		4.25							20	18	A-7-6	16						
		SS-4	6.0	7.5	4.4	5.9	15	10	3.75							22	18	A-7-6	16						
38	B	SS-1	1.5	3.0	-0.4	1.1	6		4.5	32	21	11	36	20	56	16	16	A-6a	5	907		N_{60}		**18"**	
	037-0	SS-2	3.0	4.5	1.1	2.6	7		4.5	39	24	15	37	37	74	18	19	A-6a	10			N_{60}			
	23	SS-3	4.5	6.0	2.6	4.1	13		4.5							22	14	A-6a	10						
		SS-4	6.0	7.5	4.1	5.6	18	6	4.5							14	14	A-6a	10						
39	B	SS-1	1.5	3.0	0.1	1.6	6		3.25	42	24	18	30	49	79	23	21	A-7-6	12	3200		N_{60}		**18"**	
	038-0	SS-2	3.0	4.5	1.6	3.1	7		4							16	18	A-7-6	16			N_{60}			
	23	SS-3	4.5	5.0	3.1	3.6	100		4.5							16	10	A-4a	8						
		SS-4	6.0	6.2	4.6	4.8	100	6									0	Rock	0						
40	B	SS-1	1.5	3.0	0.1	1.6	6		4.25	31	21	10	47	29	76	16	16	A-4a	8	240		N_{60}		**18"**	
	039-0	SS-2	3.0	4.5	1.6	3.1	8		4.25							20	10	A-4a	8			N_{60} & Mc			
	23	SS-3	4.5	6.0	3.1	4.6	35		4	37	23	14	38	40	78	14	18	A-6a	10						
		SS-4	6.0	6.8	4.6	5.4		6								8	10	A-2-4	0						
41	B	SS-1	1.5	3.0	0.1	1.6	7		4.5	29	19	10	36	25	61	13	14	A-4a	5	100		N_{60}		**15"**	
	040-0	SS-2	3.0	4.5	1.6	3.1	7		4.25	39	22	17	34	32	66	17	17	A-6b	9			N_{60}			
	23	SS-3	4.5	6.0	3.1	4.6	15		4.5	35	22	13	40	36	76	14	17	A-6a	9						
		SS-4	6.0	7.5	4.6	6.1	16	7	4.5							11	14	A-6a	10						
42	B	SS-1	1.5	3.0	0.0	1.5	8		4.5	30	19	11	32	25	57	15	14	A-6a	5	2967		N_{60}		**12"**	
	041-0	SS-2	3.0	4.5	1.5	3.0	12		4.5	38	22	16	32	30	62	16	17	A-6b	8						
	23	SS-3	4.5	6.0	3.0	4.5	8		4.5							18	16	A-6b	16						
		SS-4	6.0	7.5	4.5	6.0	10	8	4.5							20	16	A-6b	16						
43	B	SS-1	1.5	3.0	0.1	1.6	6		2.5	48	27	21	38	42	80	23	24	A-7-6	14	433		N_{60}		**18"**	
	042-0	SS-2	3.0	4.5	1.6	3.1	10		4	44	25	19	40	38	78	19	22	A-7-6	12			N_{60}			
	23	SS-3	4.5	6.0	3.1	4.6	13		4							20	18	A-7-6	16						
		SS-4	6.0	7.5	4.6	6.1	15	6	4.25							20	18	A-7-6	16						
44	B	SS-1	1.5	3.0	-0.1	1.4	6		3.5	45	24	21	34	37	71	21	21	A-7-6	13	760		N_{60}		**18"**	
	043-0	SS-2	3.0	4.5	1.4	2.9	10		4							19	16	A-6b	16			N_{60} & Mc			
	23	SS-3	4.5	6.0	2.9	4.4	17		4.5	39	21	18	29	42	71	17	16	A-6b	10						
		SS-4	6.0	7.5	4.4	5.9	23	6	4.25							18	16	A-6b	16						
45	B	SS-1	1.5	3.0	1.3	2.8	7		4	26	18	8	33	20	53	17	13	A-4a	4	313		N_{60} & Mc			
	044-0	SS-2	3.0	4.5	2.8	4.3	8		4	46	24	22	39	41	80	22	21	A-7-6	14						
	23	SS-3	4.5	6.0	4.3	5.8	10		3.5							20	18	A-7-6	16						
		SS-4	6.0	7.5	5.8	7.3	11	7	3.75							21	18	A-7-6							

OHIO DEPARTMENT OF TRANSPORTATION

Subgrade Analysis

V. 14.6 2/11/2022

#	Boring	Sample	Sample Depth		Subgrade Depth		Standard Penetration		HP (tsf)	Physical Characteristics						Moisture		Ohio DOT		Sulfate Content (ppm)	Problem		Excavate and Replace (Item 204)		Recommendation (Enter depth in inches)
			From	To	From	To	N_{60}	N_{60L}		LL	PL	PI	% Silt	% Clay	P200	M_C	M_{OPT}	Class	GI		Unsuitable	Unstable	Unsuitable	Unstable	
46	B	SS-1	1.5	3.0	-1.6	-0.1	7		4.5	41	25	16	38	39	77	15	22	A-7-6	11	1120					
	045-0	SS-2	3.0	4.5	-0.1	1.5	10		3.5	44	25	19	48	41	89	20	22	A-7-6	12			N_{60}			**12"**
	23	SS-3	4.5	6.0	1.5	3.0	8		4.5	37	22	15	40	39	79	16	17	A-6a	10			N_{60}			
		SS-4	6.0	7.5	3.0	4.5	6	6								8	10	A-2-4	0						
47	B	SS-1	1.5	3.0	1.4	2.9	5		2.25	35	22	13	26	21	47	21	17	A-6a	3	1447		N_{60} & Mc			
	046-0	SS-2	3.0	4.5	2.9	4.4	6		2							26	14	A-6a	10						
	23	SS-3	4.5	6.0	4.4	5.9	7		2	49	23	26	31	46	77	29	20	A-7-6	16						
		SS-4	6.0	7.5	5.9	7.4	10	5	2.25							25	18	A-7-6							
48	B	SS-1	1.5	3.0	-0.6	0.9	7		4.25	36	23	13	36	25	61	17	18	A-6a	6	640		N_{60}			**15"**
	047-0	SS-2	3.0	4.5	0.9	2.4	10		4.25	39	24	15	39	24	63	17	19	A-6a	8			N_{60}			**12"**
	23	SS-3	4.5	6.0	2.4	3.9	17		4.5							24	14	A-6a	10						
		SS-4	6.0	7.5	3.9	5.4	19	7	4.5							24	14	A-6a	10						
49	B	SS-1	1.5	3.0	-0.1	1.4	8		4.5	38	22	16	35	31	66	18	17	A-6b	9	2500		N_{60}			**12"**
	048-0	SS-2	3.0	4.5	1.4	2.9	10		4.5	40	23	17	41	32	73	17	18	A-6b	10			N_{60}			
	23	SS-3	4.5	6.0	2.9	4.4	13		4.5							20	16	A-6b	16						
		SS-4	6.0	7.5	4.4	5.9	12	8	4.5							12	16	A-6b	16						
50	B	SS-1	1.5	3.0	0.0	1.5	7		4.5	34	21	13	39	28	67	18	16	A-6a	8	433		N_{60}			**15"**
	049-0	SS-2	3.0	4.5	1.5	3.0	8		4.5	36	22	14	42	23	65	17	17	A-6a	8			N_{60}			
	23	SS-3	4.5	6.0	3.0	4.5	10		4.5							16	14	A-6a	10						
		SS-4	6.0	7.5	4.5	6.0	17	7	4.5							15	14	A-6a	10						
51	B	SS-1	1.5	3.0	0.0	1.5	5		4	29	20	9	30	18	48	14	15	A-4a	3	633		N_{60}			**21"**
	050-0	SS-2	3.0	4.5	1.5	3.0	6		4.5	36	23	13	41	27	68	17	18	A-6a	8			N_{60}			
	23	SS-3	4.5	6.0	3.0	4.5	8		4							19	14	A-6a	10						
		SS-4	6.0	7.5	4.5	6.0	12	5	4.25							16	14	A-6a	10						
52	B	SS-1	1.5	3.0	0.0	1.5	11		4.25	32	20	12	33	25	58	14	15	A-6a	5	100		N_{60}			**12"**
	051-0	SS-2	3.0	4.5	1.5	3.0	11		4.25							14	14	A-6a	10			N_{60}			
	23	SS-3	4.5	6.0	3.0	4.5	10		3	33	22	11	29	26	55	19	17	A-6a	4						
		SS-4	6.0	7.5	4.5	6.0	12	10	4							18	14	A-6a	10						
53	B	SS-1	1.5	3.0	0.0	1.5	6			NP	NP	NP	20	19	39	13	11	A-4a	1	320		N_{60}			**18"**
	052-0	SS-2	3.0	4.5	1.5	3.0	7		3	44	23	21	29	53	82	21	20	A-7-6	13			N_{60}			
	23	SS-3	4.5	6.0	3.0	4.5	11		3.25							24	18	A-7-6	16						
		SS-4	6.0	7.5	4.5	6.0	13	6	3.5							17	18	A-7-6	16						
54	B	SS-1	1.5	3.0	-0.6	0.9	57										0	Rock	0		Rock				
	104-0	SS-2	3.0	4.0	0.9	1.9	100										0	Rock	0		Rock		**23"**		
	23	SS-3	4.5	4.7	2.4	2.6	100										0	Rock	0						
								30																	

OHIO DEPARTMENT OF TRANSPORTATION

Subgrade Analysis

V. 14.6 2/11/2022

#	Boring	Sample	Sample Depth		Subgrade Depth		Standard Penetration		HP (tsf)	Physical Characteristics						Moisture		Ohio DOT		Sulfate Content (ppm)	Problem		Excavate and Replace (Item 204)		Recommendation (Enter depth in inches)
			From	To	From	To	N_{60}	N_{60L}		LL	PL	PI	% Silt	% Clay	P200	M_C	M_{OPT}	Class	GI		Unsuitable	Unstable	Unsuitable	Unstable	
55	B	SS-1	1.5	3.0	-0.6	0.9	10		3.25	32	20	12	25	15	40	12	15	A-6a	2	707		N_{60}		12"	
	105-0	SS-2	3.0	4.5	0.9	2.4	12		3	35	22	13	30	26	56	15	17	A-6a	5						
	23	SS-3	4.5	6.0	2.4	3.9	7		2.5							16	14	A-6a	10						
		SS-4	6.0	7.5	3.9	5.4	8	7	2.75							13	14	A-6a	10						
56	B	SS-1	1.5	3.0	0.0	1.5	6		4.5	32	22	10	35	32	67	10	17	A-4a	6	480		N_{60}		18"	
	106-0	SS-2	3.0	4.5	1.5	3.0	8		4.5							14	10	A-4a	8			N_{60} & Mc			
	23	SS-3	4.5	6.0	3.0	4.5	13		4.5							14	10	A-4a	8						
		SS-4	6.0	7.5	4.5	6.0	13	6	4.5							13	10	A-4a	8						
57	B	SS-1	1.5	3.0	0.1	1.6	7		4.25	32	20	12	33	24	57	14	15	A-6a	5	547		N_{60}		15"	
	107-0	SS-2	3.0	4.5	1.6	3.1	8		3.75	44	27	17	30	38	68	25	24	A-7-6	10			N_{60}			
	23	SS-3	4.5	6.0	3.1	4.6	7		4.25							21	18	A-7-6	16						
		SS-4	6.0	7.5	4.6	6.1	7	7	4.5							16	18	A-7-6	16						
58	B	SS-1	1.5	3.0	0.1	1.6	7		3.75	34	21	13	36	25	61	15	16	A-6a	6	667		N_{60}		15"	
	108-0	SS-2	3.0	4.5	1.6	3.1	8		4.25	35	23	12	35	23	58	14	18	A-6a	5			N_{60}			
	23	SS-3	4.5	6.0	3.1	4.6	10		3.5							14	14	A-6a	10						
		SS-4	6.0	7.5	4.6	6.1	10	7	4							16	14	A-6a	10						
59	B	SS-1	1.5	3.0	0.2	1.7	15		4.5	36	23	13	37	22	59	14	18	A-6a	6	753					
	109-0	SS-2	3.0	4.5	1.7	3.2	15			NP	NP	NP	41	13	54	8	11	A-4a	4						
	23	SS-3	4.5	6.0	3.2	4.7	38									8	0	Rock	0						
		SS-4	6.0	7.5	4.7	6.2	72	15								7	0	Rock	0						
60	B	SS-1	1.5	3.0	0.1	1.6	7		4.5	38	24	14	45	30	75	20	19	A-6a	10	4600		N_{60}		15"	
	110-0	SS-2	3.0	4.5	1.6	3.1	10		4.5	44	24	20	50	44	94	20	21	A-7-6	13			N_{60}			
	23	SS-3	4.5	6.0	3.1	4.6	15		4.25							20	18	A-7-6	16						
		SS-4	6.0	7.5	4.6	6.1	15	7	4.25							20	18	A-7-6	16						
61	B	SS-1	1.5	3.0	-0.3	1.2	6			NP	NP	NP	18	15	33	11	10	A-2-4	0	220		N_{60}		18"	
	111-0	SS-2	3.0	4.5	1.2	2.7	8		3.5	38	24	14	41	32	73	15	19	A-6a	9			N_{60}			
	23	SS-3	4.5	6.0	2.7	4.2	36									10	0	Rock	0						
		SS-4	6.0	7.5	4.2	5.7	31	6								9	0	Rock	0						
62	B	SS-1	1.5	3.0	0.6	2.1	7		4.5	25	18	7	30	16	46	13	13	A-4a	2	40		N_{60}		15"	
	112-0	SS-2	3.0	4.5	2.1	3.6	21		4.5							14	10	A-4a	8						
	23	SS-3	4.5	6.0	3.6	5.1	26		4.5	33	23	10	59	27	86	12	18	A-4b	8						
		SS-4	6.0	7.5	5.1	6.6	32	7	4.5							10	10	A-4b							
63	B	SS-1	1.5	3.0	-0.3	1.2	5		4.25	27	19	8	39	22	61	9	14	A-4a	5	300		N_{60}		21"	
	113-0	SS-2	3.0	4.5	1.2	2.7	6		4	32	21	11	47	31	78	17	16	A-6a	8			N_{60}			
	23	SS-3	4.5	6.0	2.7	4.2	11		4.25							15	10	A-4a	8						
		SS-4	6.0	7.5	4.2	5.7	12	5	3.75							20	14	A-6a	10						

OHIO DEPARTMENT OF TRANSPORTATION

Subgrade Analysis

V. 14.6 2/11/2022

#	Boring	Sample	Sample Depth		Subgrade Depth		Standard Penetration		HP (tsf)	Physical Characteristics						Moisture		Ohio DOT		Sulfate Content (ppm)	Problem		Excavate and Replace (Item 204)		Recommendation (Enter depth in inches)
			From	To	From	To	N_{60}	N_{60L}		LL	PL	PI	% Silt	% Clay	P200	M_C	M_{OPT}	Class	GI		Unsuitable	Unstable	Unsuitable	Unstable	
64	B	SS-1	1.5	3.0	0.4	1.9	44			NP	NP	NP	37	20	57	9	11	A-4a	4	1513					
	114-0	SS-2	3.0	4.5	1.9	3.4	34									10	10	A-4a	8						
	23	SS-3	4.5	6.0	3.4	4.9	22		4.25	32	20	12	29	30	59	14	15	A-6a	6						
		SS-4	6.0	7.5	4.9	6.4	25	22	4.25							13	14	A-6a	10						
65	B	SS-1	1.5	3.0	-0.5	1.0	29		4.5	33	21	12	31	32	63	12	16	A-6a	6	840					
	115-0	SS-2	3.0	4.5	1.0	2.5	24		4	30	19	11	32	31	63	11	14	A-6a	6						
	23	SS-3	4.5	6.0	2.5	4.0	17		4							13	14	A-6a	10						
		SS-4	6.0	7.5	4.0	5.5	19	17	3.75							11	14	A-6a	10						
66	B	SS-1	1.5	3.0	0.4	1.9	10		4.5	38	21	17	30	34	64	15	16	A-6b	9	100		N_{60}		**12"**	
	116-0	SS-2	3.0	4.5	1.9	3.4	7		4.5							17	16	A-6b	16			N_{60}			
	23	SS-3	4.5	6.0	3.4	4.9	13		4.5	27	17	10	30	29	59	14	12	A-4a	5						
		SS-4	6.0	6.3	4.9	5.2	100	7								2	0	Rock	0						
67	B	SS-1	1.5	3.0	0.5	2.0	22			NP	NP	NP	14	10	24	10	8	A-3a	0	60					
	117-0	SS-2	3.0	4.5	2.0	3.5	36			NP	NP	NP	15	14	29	10	8	A-3a	0						
	23	SS-3	4.5	6.0	3.5	5.0	58									8	8	A-3a	0						
		SS-4	6.0	7.5	5.0	6.5	48	22								9	8	A-3a	0						
68	B	SS-1	1.5	3.0	-1.9	-0.4	12			NP	NP	NP	22	21	43	12	11	A-4a	2	140					
	118-0	SS-2	3.0	4.5	-0.4	1.1	13		4.5	33	19	14	31	25	56	12	14	A-6a	6						
	23	SS-3	4.5	6.0	1.1	2.6	23		4.5							10	14	A-6a	10						
		SS-4	6.0	7.5	2.6	4.1	17	13	4.5							12	14	A-6a	10						
69	B	SS-1	1.5	3.0	0.1	1.6	8		4.5	29	18	11	26	26	52	11	14	A-6a	4	460		N_{60}		**12"**	
	119-0	SS-2	3.0	4.5	1.6	3.1	12		4							14	14	A-6a	10						
	23	SS-3	4.5	6.0	3.1	4.6	23		4							17	14	A-6a	10						
		SS-4	6.0	7.5	4.6	6.1	30	8		NP	NP	NP	10	23	33	10	10	A-2-4	0						
70	B	SS-1	1.5	3.0	-0.2	1.3	10		4.25	33	20	13	35	30	65	14	15	A-6a	7	40		N_{60}		**12"**	
	119-1	SS-2	3.0	4.5	1.3	2.8	7		4.25							17	14	A-6a	10			N_{60} & Mc			
	23	SS-3	4.5	6.0	2.8	4.3	25			NP	NP	NP	12	13	25	8	6	A-1-b	0						
		SS-4	6.0	7.5	4.3	5.8	23	7								12	6	A-1-b	0						

PID: 113440

County-Route-Section: HAS-22-15.11

No. of Borings: 70

Geotechnical Consultant: NEAS, Inc.

Prepared By: Derar M. Tarawneh

Date prepared: 9/5/2023

Chemical Stabilization Options		
320	Rubblize & Roll	No
206	Cement Stabilization	Option
	Lime Stabilization	No
206	Depth	14''

Excavate and Replace Stabilization Options	
Global Geotextile Average(N60L):	12''
Average(HP):	0''
Global Geogrid Average(N60L):	0''
Average(HP):	0''

Design CBR	7

% Samples within 6 feet of subgrade			
$N_{60} \leq 5$	3%	HP ≤ 0.5	0%
$N_{60} < 12$	47%	0.5 < HP ≤ 1	0%
$12 \leq N_{60} < 15$	14%	1 < HP ≤ 2	1%
$N_{60} \geq 20$	25%	HP > 2	74%
M+	5%		
Rock	6%		
Unsuitable	12%		

Excavate and Replace at Surface	
Average	0''
Maximum	0''
Minimum	0''

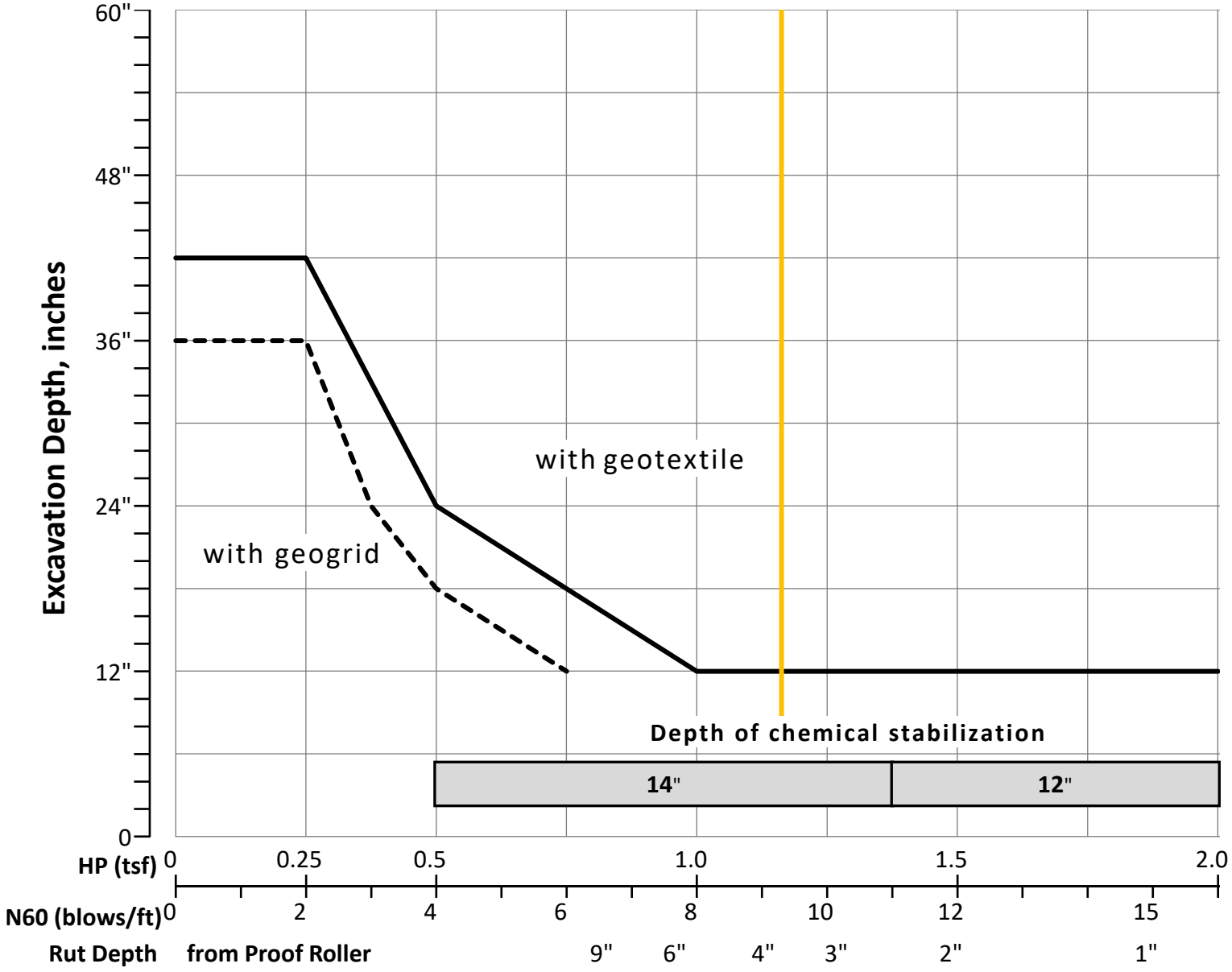
% Proposed Subgrade Surface	
Unstable & Unsuitable	63%
Unstable	61%
Unsuitable	3%

	N_{60}	N_{60L}	HP	LL	PL	PI	Silt	Clay	P 200	M_C	M_{OPT}	GI
Average	20	9	4.09	35	22	13	35	28	63	15	13	7
Maximum	100	30	4.50	51	27	26	59	60	94	31	24	16
Minimum	4	4	1.50	25	17	7	10	2	24	2	0	0

Classification Counts by Sample

ODOT Class	Rock	A-1-a	A-1-b	A-2-4	A-2-5	A-2-6	A-2-7	A-3	A-3a	A-4a	A-4b	A-5	A-6a	A-6b	A-7-5	A-7-6	A-8a	A-8b	Totals
Count	28	4	5	8	0	0	0	0	5	42	6	0	116	27	0	33	0	0	274
Percent	10%	1%	2%	3%	0%	0%	0%	0%	2%	15%	2%	0%	42%	10%	0%	12%	0%	0%	100%
% Rock|Granular|Cohesive	10%	23%									66%								100%
Surface Class Count	10	3	0	3	0	0	0	0	2	33	2	0	75	14	0	15	0	0	157
Surface Class Percent	6%	2%	0%	2%	0%	0%	0%	0%	1%	21%	1%	0%	48%	9%	0%	10%	0%	0%	100%

Fig. 600-1 – Subgrade Stabilization



OVERRIDE TABLE

Calculated Average	New Values	Check to Override
4.09	0.50	☐ HP
9.31	6.00	☐ N60L

Average HP
Average N_{60L}

US-22

OHIO DEPARTMENT OF TRANSPORTATION

OFFICE OF GEOTECHNICAL ENGINEERING

PLAN SUBGRADES
Geotechnical Design Manual Section 600

Instructions: Enter data in the shaded cells only.
(Enter state route number, project description,county, consultant's name, prepared by name, and date prepared. This information will be transferred to all other sheets. The date prepared must be entered in the appropriate cell on this sheet to remove these instructions prior to printing.)

HAS-22-15.11
113440

US 22 Mainline

NEAS, Inc.

Prepared By: Derar M. Tarawneh
Date prepared: Tuesday, September 19, 2023

Chunmei (Melinda) He, Ph.D., P.E.
2800 Corporate Exchange Drive
Suite 240
Columbus, OH 43231
614.714.0299 Ext 111
che@neasinc.com

NO. OF BORINGS: 53

#	Boring ID	Alignment	Station	Offset	Dir	Drill Rig	ER	Boring EL.	Proposed Subgrade EL	Cut Fill
1	B-001-0-23	US 22-Section 1	806+29	26	RT.	CME 45B	73	1084.8	1082.9	1.8 C
2	B-002-0-23	US 22-Section 1	810+41	27	LT.	CME 45B	73	1098.2	1096.9	1.3 C
3	B-003-0-23	US 22-Section 1	814+37	50	RT.	CME 45B	73	1111.9	1110.8	1.1 C
4	B-004-0-23	US 22-Section 1	818+22	39	LT.	CME 55T	63	1126.2	1124.2	2.0 C
5	B-005-0-23	US 22-Section 1	821+91	24	RT.	CME 45B	73	1138.7	1137.1	1.5 C
6	B-006-0-23	US 22-Section 1	826+10	21	LT.	CME 55T	63	1153.9	1151.9	2.0 C
7	B-007-0-23	US 22-Section 1	829+93	34	RT.	CME 45B	73	1169.5	1167.3	2.2 C
8	B-008-0-23	US 22-Section 1	833+69	48	LT.	CME 45B	73	1184.5	1182.8	1.7 C
9	B-009-0-23	US 22-Section 1	837+69	57	RT.	CME 45B	73	1201.2	1199.3	1.9 C
10	B-010-0-23	US 22-Section 1	841+56	44	LT.	CME 45B	73	1217.0	1215.2	1.8 C
11	B-011-0-23	US 22-Section 1	845+48	51	RT.	CME 45B	73	1229.9	1228.5	1.4 C
12	B-012-0-23	US 22-Section 1	849+30	38	LT.	CME 45B	73	1237.7	1236.1	1.7 C
13	B-013-0-23	US 22-Section 1	853+47	38	RT.	CME 45B	73	1240.0	1238.3	1.7 C
14	B-014-0-23	US 22-Section 1	857+18	48	LT.	CME 45B	73	1236.3	1235.0	1.3 C
15	B-015-0-23	US 22-Section 1	861+22	39	RT.	CME 45B	73	1229.7	1228.2	1.6 C
16	B-016-0-23	US 22-Section 1	865+8	39	LT.	CME 55T	63	1223.4	1221.7	1.7 C
17	B-017-0-23	US 22-Section 1	868+75	26	RT.	CME 45B	73	1215.7	1215.5	0.2 C
18	B-018-0-23	US 22-Section 1	872+66	50	LT.	CME 55T	63	1210.5	1208.9	1.6 C
19	B-019-0-23	US 22-Section 1	876+76	24	RT.	CME 45B	73	1206.2	1204.4	1.8 C
20	B-020-0-23	US 22-Section 1	880+67	48	LT.	CME 45B	73	1210.3	1208.8	1.5 C
21	B-021-0-23	US 22-Section 1	884+79	51	RT.	CME 45B	73	1215.4	1215.1	0.3 C
22	B-022-0-23	US 22-Section 1	889+27	54	LT.	CME 45B	73	1225.4	1221.9	3.5 C
23	B-023-0-23	US 22-Section 1	892+49	41	RT.	CME 45B	73	1227.1	1226.8	0.3 C
24	B-024-0-23	US 22-Section 1	896+72	27	LT.	CME 55T	63	1235.1	1233.3	1.9 C
25	B-025-0-23	US 22-Section 1	900+37	39	RT.	CME 45B	73	1240.5	1238.8	1.7 C
26	B-026-0-23	US 22-Section 1	904+19	49	LT.	CME 45B	73	1245.4	1244.7	0.8 C
27	B-027-0-23	US 22-Section 1	908+20	38	RT.	CME 45B	73	1252.3	1250.8	1.5 C
28	B-028-0-23	US 22-Section 1	912+2	48	LT.	CME 45B	73	1258.0	1256.9	1.2 C
29	B-029-0-23	US 22-Section 1	915+96	40	RT.	CME 45B	73	1261.6	1259.9	1.7 C
30	B-030-0-23	US 22-Section 1	919+95	33	LT.	CME 55T	63	1259.1	1257.5	1.7 C
31	B-031-0-23	US 22-Section 1	923+74	24	RT.	CME 45B	73	1251.6	1250.0	1.6 C
32	B-032-0-23	US 22-Section 1	926+17	62	LT.	CME 45B	73	1243.7	1242.6	1.1 C
33	B-033-0-23	US 22-Section 1	930+56	25	RT.	CME 55T	63	1226.6	1225.1	1.5 C
34	B-033-1-23	US 22-Section 1	930+39	52	LT.	CME 45B	73	1227.1	1230.6	3.5 F
35	B-034-0-23	US 22-Section 1	935+52	48	LT.	CME 45B	73	1206.8	1205.3	1.5 C
36	B-035-0-23	US 22-Section 1	940+84	42	RT.	CME 45B	73	1185.5	1184.1	1.4 C
37	B-036-0-23	US 22-Section 1	943+47	24	LT.	CME 45B	73	1178.3	1176.7	1.6 C
38	B-037-0-23	US 22-Section 1	947+36	24	RT.	CME 45B	73	1179.7	1177.9	1.9 C
39	B-038-0-23	US 22-Section 1	951+26	50	LT.	CME 45B	73	1193.1	1191.7	1.4 C
40	B-039-0-23	US 22-Section 1	955+18	48	RT.	CME 45B	73	1208.8	1207.4	1.4 C
41	B-040-0-23	US 22-Section 1	959+9	49	LT.	CME 45B	73	1224.2	1222.8	1.4 C
42	B-041-0-23	US 22-Section 1	962+90	40	RT.	CME 45B	73	1235.6	1234.0	1.5 C
43	B-042-0-23	US 22-Section 1	967+0	24	LT.	CME 45B	73	1246.5	1245.1	1.4 C
44	B-043-0-23	US 22-Section 1	970+82	25	RT.	CME 45B	73	1254.0	1252.4	1.6 C
45	B-044-0-23	US 22-Section 1	974+82	40	LT.	CME 45B	73	1255.9	1255.7	0.2 C

#	Boring ID	Alignment	Station	Offset	Dir	Drill Rig	ER	Boring EL.	Proposed Subgrade EL	Cut Fill
46	B-045-0-23	US 22-Section 1	978+75	48	RT.	CME 45B	73	1258.4	1255.3	3.1 C
47	B-046-0-23	US 22-Section 1	982+65	40	LT.	CME 45B	73	1252.6	1252.5	0.1 C
48	B-047-0-23	US 22-Section 1	986+53	25	RT.	CME 45B	73	1249.2	1247.1	2.1 C
49	B-048-0-23	US 22-Section 1	990+48	25	LT.	CME 45B	73	1240.6	1239.0	1.6 C
50	B-049-0-23	US 22-Section 1	994+55	38	RT.	CME 45B	73	1229.0	1227.5	1.5 C
51	B-050-0-23	US 22-Section 1	998+48	18	LT.	CME 45B	73	1217.9	1216.4	1.5 C
52	B-051-0-23	US 22-Section 1	1002+32	45	RT.	CME 45B	73	1199.4	1197.9	1.5 C
53	B-052-0-23	US 22-Section 1	1005+26	7	RT.	CME 45B	73	1189.8	1188.3	1.5 C

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Subgrade Analysis

V. 14.6 2/11/2022

#	Boring	Sample	Sample Depth		Subgrade Depth		Standard Penetration		HP (tsf)	Physical Characteristics						Moisture		Ohio DOT		Sulfate Content (ppm)	Problem		Excavate and Replace (Item 204)		Recommendation (Enter depth in inches)
			From	To	From	To	N_{60}	N_{60L}		LL	PL	PI	% Silt	% Clay	P200	M_C	M_{OPT}	Class	GI		Unsuitable	Unstable	Unsuitable	Unstable	
1	B	SS-1	1.5	3.0	-0.3	1.2	4		4	35	23	12	38	33	71	19	18	A-6a	8	593		N_{60}		24"	
	001-0	SS-2	3.0	4.5	1.2	2.7	7		4							21	14	A-6a	10			N_{60} & Mc			
	23	SS-3	4.5	6.0	2.7	4.2	68		4.5	31	21	10	38	16	54	11	16	A-4a	4						
		SS-4	6.0	6.3	4.2	4.5		4									0	Rock	0						
2	B	SS-1	1.5	3.0	0.2	1.7	5		3.25	49	26	23	29	56	85	31	23	A-7-6	15	920		N_{60} & Mc		21"	
	002-0	SS-2	3.0	4.5	1.7	3.2	6		4.25	38	23	15	33	29	62	12	18	A-6a	7			N_{60}			
	23	SS-3	4.5	6.0	3.2	4.7	28									10	6	A-1-b	0						
		SS-4	6.0	6.3	4.7	5.0		5																	
3	B	SS-1	1.5	3.0	0.4	1.9	8		4.25	34	21	13	40	22	62	18	16	A-6a	7	880		N_{60}		12"	
	003-0	SS-2	3.0	4.5	1.9	3.4	22		4.25	27	19	8	43	22	65	11	14	A-4a	6						
	23	SS-3	4.5	6.0	3.4	4.9	31		4.5	29	18	11	30	42	72	12	14	A-6a	8						
		SS-4	6.0	6.3	4.9	5.2		8	4.5							11	14	A-6a	10						
4	B	SS-1	1.5	3.0	-0.5	1.0	11		4.5	36	22	14	32	19	51	14	17	A-6a	5	320		N_{60}		12"	
	004-0	SS-2	3.0	4.5	1.0	2.5	11		4.5	36	23	13	22	14	36	11	18	A-6a	1			N_{60}		12"	
	23	SS-3	4.5	6.0	2.5	4.0	13		4.5							13	14	A-6a	10						
		SS-4	6.0	7.5	4.0	5.5	14	11	4.5							16	14	A-6a	10						
5	B	SS-1	1.5	3.0	0.0	1.5	6		3	32	22	10	34	18	52	13	17	A-4a	3	873		N_{60}		18"	
	005-0	SS-2	3.0	4.5	1.5	3.0	7		2.75	33	21	12	28	24	52	14	16	A-6a	4			N_{60}			
	23	SS-3	4.5	6.0	3.0	4.5	12		3							16	14	A-6a	10						
		SS-4	6.0	7.5	4.5	6.0	15	6	3							14	14	A-6a	10						
6	B	SS-1	1.5	3.0	-0.5	1.0	12									8	6	A-1-a	0						
	006-0	SS-2	3.0	4.5	1.0	2.5	12									7	6	A-1-a	0						
	23	SS-3	4.5	6.0	2.5	4.0	13		4.5	34	21	13	23	20	43	12	16	A-6a	2	640					
		SS-4	6.0	6.3	4.0	4.3		12								4	6	A-1-a	0						
7	B	SS-1	1.5	3.0	-0.7	0.8	22		3.5	32	20	12	39	28	67	15	15	A-6a	7	540					
	007-0	SS-2	3.0	4.5	0.8	2.3	12		4.25	29	20	9	40	17	57	11	15	A-4a	4						
	23	SS-3	4.5	6.0	2.3	3.8	13		4.25							11	10	A-4a	8						
		SS-4	6.0	7.5	3.8	5.3	16	12	4.25							14	10	A-4a	8						
8	B	SS-1	1.5	3.0	-0.2	1.3	13		4.25	33	19	14	37	30	67	18	14	A-6a	8	840		N_{60} & Mc		12"	
	008-0	SS-2	3.0	4.5	1.3	2.8	11			28	21	7	49	6	55	12	16	A-4a	4			N_{60}			
	23	SS-3	4.5	6.0	2.8	4.3	28			29	19	10	50	2	52	11	14	A-4b	3						
		SS-4	6.0	6.3	4.3	4.6		11								10	10	A-4b	8						
9	B	SS-1	1.5	3.0	-0.4	1.1	5		3.25	33	22	11	41	23	64	18	17	A-6a	6	600		N_{60}		21"	
	009-0	SS-2	3.0	4.5	1.1	2.6	65		4							21	14	A-6a	10			Mc			
	23	SS-3	4.5	6.0	2.6	4.1	75										0	Rock	0						
		SS-4	6.0	7.5	4.1	5.6	82	5									0	Rock	0						

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Subgrade Analysis

V. 14.6 2/11/2022

#	Boring	Sample	Sample Depth		Subgrade Depth		Standard Penetration		HP (tsf)	Physical Characteristics						Moisture		Ohio DOT		Sulfate Content (ppm)	Problem		Excavate and Replace (Item 204)		Recommendation (Enter depth in inches)
			From	To	From	To	N_{60}	N_{60L}		LL	PL	PI	% Silt	% Clay	P200	M_C	M_{OPT}	Class	GI		Unsuitable	Unstable	Unsuitable	Unstable	
10	B	SS-1	1.5	3.0	-0.3	1.2	7			27	19	8	32	23	55	13	14	A-4a	4	100		N_{60}		15"	
	010-0	SS-2	3.0	4.5	1.2	2.7	6									7	10	A-4a	8			N_{60}			
	23	SS-3	4.5	6.0	2.7	4.2											0	Rock	0						
		SS-4	6.0	6.2	4.2	4.4		6									0	Rock	0						
11	B	SS-1	1.5	3.0	0.1	1.6	6		4.5	31	20	11	39	29	68	15	15	A-6a	7	640		N_{60}		18"	
	011-0	SS-2	3.0	4.5	1.6	3.1	8		4.5	32	21	11	57	27	84	7	16	A-6a	8			N_{60}			
	23	SS-3	4.5	6.0	3.1	4.6	23									6	6	A-1-b	0						
		SS-4	6.0	7.5	4.6	6.1	33	6									0	Rock	0						
12	B	SS-1	1.5	3.0	-0.2	1.3	13		4	34	21	13	25	23	48	14	16	A-6a	4	3500					
	012-0	SS-2	3.0	4.5	1.3	2.8	15			NP	NP	NP				9	10	A-2-4	0						
	23	SS-3	4.5	6.0	2.8	4.3	23									10	10	A-2-4	0						
		SS-4	6.0	7.5	4.3	5.8	24	13								8	10	A-2-4	0						
13	B	SS-1	1.5	3.0	-0.2	1.3	8		4	30	20	10	25	19	44	14	15	A-4a	2	687		N_{60}		12"	
	013-0	SS-2	3.0	4.5	1.3	2.8	10		4.5							16	14	A-6a	10			N_{60}			
	23	SS-3	4.5	6.0	2.8	4.3	46		4.5	34	23	11	50	21	71	13	18	A-6a	8						
		SS-4	6.0	7.5	4.3	5.8	52	8								8	0	Rock	0						
14	B	SS-1	1.5	3.0	0.2	1.7	13		3.5	38	21	17	37	43	80	18	16	A-6b	11	1500					
	014-0	SS-2	3.0	4.5	1.7	3.2	15		4.5	38	22	16	48	42	90	14	17	A-6b	10						
	23	SS-3	4.5	6.0	3.2	4.7	10		4.5							13	10	A-4a	8						
		SS-4	6.0	7.5	4.7	6.2	11	10	3.5							23	18	A-7-6	16						
15	B	SS-1	1.5	3.0	-0.1	1.5	8			NP	NP	NP	19	13	32	12	10	A-2-4	0	180		N_{60}		12"	
	015-0	SS-2	3.0	4.5	1.5	3.0	8		4	39	21	18	32	48	80	21	16	A-6b	11			N_{60} & Mc			
	23	SS-3	4.5	6.0	3.0	4.5	18		4.5							18	16	A-6b	16						
		SS-4	6.0	7.5	4.5	6.0	22	8	4.5							16	16	A-6b	16						
16	B	SS-1	1.5	3.0	-0.2	1.3	14													340					
	016-0	SS-2	3.0	4.5	1.3	2.8	12		4	41	21	20	32	45	77	18	18	A-7-6	12						
	23	SS-3	4.5	6.0	2.8	4.3	16		4	34	21	13	31	34	65	16	16	A-6a	7						
		SS-4	6.0	7.5	4.3	5.8	12	12	4							18	14	A-6a	10						
17	B	SS-1	1.5	3.0	1.3	2.8	35		4.25	29	21	8	42	18	60	12	16	A-4a	5	800					
	017-0	SS-2	3.0	4.5	2.8	4.3	38		4.5	30	22	8	45	18	63	10	17	A-4a	6						
	23	SS-3	4.5	6.0	4.3	5.8	46									9	0	Rock	0						
		SS-4	6.0	7.5	5.8	7.3	47	30								11	0	Rock							
18	B	SS-1	1.5	3.0	-0.1	1.4	10									7	6	A-1-a	0	180					
	018-0	SS-2	3.0	4.5	1.4	2.9	13		4.5	38	26	12	40	29	69	13	21	A-6a	8						
	23	SS-3	4.5	6.0	2.9	4.4	54		4.5	41	24	17	28	36	64	14	21	A-7-6	9						
		SS-4	6.0	7.5	4.4	5.9	53	10	4.5							15	18	A-7-6	16						

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Subgrade Analysis

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#	Boring	Sample	Sample Depth		Subgrade Depth		Standard Penetration		HP (tsf)	Physical Characteristics						Moisture		Ohio DOT		Sulfate Content (ppm)	Problem		Excavate and Replace (Item 204)		Recommendation (Enter depth in inches)
			From	To	From	To	N_{60}	N_{60L}		LL	PL	PI	% Silt	% Clay	P200	M_C	M_{OPT}	Class	GI		Unsuitable	Unstable	Unsuitable	Unstable	
19	B	SS-1	1.5	3.0	-0.3	1.2	7		3	34	21	13	35	28	63	17	16	A-6a	7	3067		N_{60}		15"	
	019-0	SS-2	3.0	4.5	1.2	2.7	8		3.5	38	24	14	29	27	56	17	19	A-6a	6			N_{60}			
	23	SS-3	4.5	6.0	2.7	4.2	11		3.5							16	14	A-6a	10						
		SS-4	6.0	7.5	4.2	5.7	12	7	3.25							17	14	A-6a	10						
20	B	SS-1	1.5	3.0	0.0	1.5	8		4	35	23	12	42	23	65	13	18	A-6a	7	1800		N_{60}		12"	
	020-0	SS-2	3.0	4.5	1.5	3.0	11		4.25	38	23	15	35	37	72	21	18	A-6a	9			N_{60} & Mc			
	23	SS-3	4.5	6.0	3.0	4.5	12		4.5	31	19	12	34	30	64	12	14	A-6a	7						
		SS-4	6.0	7.5	4.5	6.0	10	8	4.5							14	14	A-6a	10						
21	B	SS-1	1.5	3.0	1.2	2.7	12		4.5	30	20	10	44	25	69	11	15	A-4a	7	720					
	021-0	SS-2	3.0	4.5	2.7	4.2	34		4.5	30	21	9	58	20	78	7	16	A-4b	8						
	23	SS-3	4.5	5.5	4.2	5.2	50		4.5							5	10	A-4b	8						
		SS-4	5.5	6.1	5.2	5.8	100	12									0	Rock							
22	B	SS-1	1.5	3.0	-2.0	-0.5	11		3.5	42	23	19	45	36	81	17	20	A-7-6	12	820					
	022-0	SS-2	3.0	4.5	-0.5	1.0	10		4.25							17	18	A-7-6	16			N_{60}		12"	
	23	SS-3	4.5	6.0	1.0	2.5	16		4.5	33	21	12	48	27	75	14	16	A-6a	9						
		SS-4	6.0	7.5	2.5	4.0	17	10	4.5							15	14	A-6a	10						
23	B	SS-1	1.5	3.0	1.2	2.7	8		4.25	40	25	15	32	31	63	19	20	A-6a	8	1220		N_{60}			
	023-0	SS-2	3.0	4.5	2.7	4.2	8		4.5	37	23	14	31	24	55	17	18	A-6a	6						
	23	SS-3	4.5	6.0	4.2	5.7	12		4.5							15	14	A-6a	10						
		SS-4	6.0	7.5	5.7	7.2	16	8	4.5							14	14	A-6a							
24	B	SS-1	1.5	2.5	-0.4	0.6	50										0	Rock	0		Rock				
	024-0	SS-2	3.0	4.0	1.1	2.1	50										0	Rock	0		Rock		25"		
	23	SS-3	4.5	5.0	2.6	3.1	100										0	Rock	0						
		SS-4	6.0	6.3	4.1	4.4	100	30									0	Rock	0						
25	B	SS-1	1.5	3.0	-0.2	1.3	8		4	35	21	14	29	31	60	18	16	A-6a	7	833		N_{60}		12"	
	025-0	SS-2	3.0	4.5	1.3	2.8	24		4.5	33	23	10	35	17	52	11	18	A-4a	3						
	23	SS-3	4.5	6.0	2.8	4.3	93									10	0	Rock	0						
		SS-4	6.0	7.5	4.3	5.8	96	8								9	0	Rock	0						
26	B	SS-1	1.5	3.0	0.7	2.2	8			27	19	8	22	19	41	7	14	A-4a	1	600		N_{60}		12"	
	026-0	SS-2	3.0	4.5	2.2	3.7	12		4.5	31	21	10	49	24	73	16	16	A-4a	8						
	23	SS-3	4.5	6.0	3.7	5.2	8									13	8	A-3a	0						
		SS-4	6.0	7.5	5.2	6.7	11	8	4.5							10	10	A-4a							
27	B	SS-1	1.5	3.0	0.0	1.5	4			31	21	10	23	14	37	14	16	A-4a	0	987		N_{60}		24"	
	027-0	SS-2	3.0	4.5	1.5	3.0	7									16	10	A-4a	8			N_{60} & Mc			
	23	SS-3	4.5	6.0	3.0	4.5	11			31	21	10	34	13	47	9	16	A-4a	2						
		SS-4	6.0	7.5	4.5	6.0	16	4	4.25							18	10	A-4a	8						

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Subgrade Analysis

V. 14.6 2/11/2022

#	Boring	Sample	Sample Depth		Subgrade Depth		Standard Penetration		HP (tsf)	Physical Characteristics						Moisture		Ohio DOT		Sulfate Content (ppm)	Problem		Excavate and Replace (Item 204)		Recommendation (Enter depth in inches)
			From	To	From	To	N_{60}	N_{60L}		LL	PL	PI	% Silt	% Clay	P200	M_C	M_{OPT}	Class	GI		Unsuitable	Unstable	Unsuitable	Unstable	
28	B	SS-1	1.5	3.0	0.3	1.8	8		4.25	32	21	11	54	29	83	16	16	A-6a	8	260		N_{60}		12"	
	028-0	SS-2	3.0	4.5	1.8	3.3	10		4.25							15	14	A-6a	10			N_{60}			
	23	SS-3	4.5	6.0	3.3	4.8	75		4.25							8	14	A-6a	10						
		SS-4	6.0	6.2	4.8	5.0	100	8								5	0	Rock	0						
29	B	SS-1	1.5	3.0	-0.2	1.4	7		1.5	35	20	15	30	33	63	9	15	A-6a	8	520		HP		15"	
	029-0	SS-2	3.0	4.5	1.4	2.9	13			34	21	13	37	24	61	17	16	A-6a	6						
	23	SS-3	4.5	6.0	2.9	4.4	19									14	14	A-6a	10						
		SS-4	6.0	6.3	4.4	4.7	100	7									0	Rock	0						
30	B	SS-1	1.5	3.0	-0.2	1.3	12		4	35	23	12	38	17	55	13	18	A-6a	5	867					
	030-0	SS-2	3.0	4.5	1.3	2.8	8		4	36	21	15	36	32	68	16	16	A-6a	9			N_{60}			
	23	SS-3	4.5	6.0	2.8	4.3	7		4.25							21	14	A-6a	10						
		SS-4	6.0	7.5	4.3	5.8	7	7	4.25							14	14	A-6a	10						
31	B	SS-1	1.5	3.0	-0.1	1.4	10		2.5	33	22	11	39	30	69	18	17	A-6a	7	433		N_{60}		12"	
	031-0	SS-2	3.0	4.5	1.4	2.9	10		4.5	34	21	13	43	24	67	16	16	A-6a	8			N_{60}			
	23	SS-3	4.5	6.0	2.9	4.4	18		4.5							18	14	A-6a	10						
		SS-4	6.0	7.5	4.4	5.9	19	10	4.5							19	14	A-6a	10						
32	B	SS-1	1.5	3.0	0.4	1.9	6		4	34	21	13	28	42	70	9	16	A-6a	8	720		N_{60}		18"	
	032-0	SS-2	3.0	4.5	1.9	3.4	7		4.25							14	14	A-6a	10			N_{60}			
	23	SS-3	4.5	6.0	3.4	4.9	6		4	51	27	24	29	60	89	20	24	A-7-6	16						
		SS-4	6.0	7.5	4.9	6.4	7	6	4							27	18	A-7-6	16						
33	B	SS-1	1.5	3.0	0.0	1.5	6		4.5							16	16	A-6b	16			N_{60}		18"	
	033-0	SS-2	3.0	4.5	1.5	3.0	7		4.25	40	22	18	36	36	72	15	17	A-6b	11	2500		N_{60}			
	23	SS-3	4.5	6.0	3.0	4.5	10		4.25	39	22	17	26	31	57	14	17	A-6b	7						
		SS-4	6.0	7.5	4.5	6.0	12	6	4.25							15	16	A-6b	16						
34	B	SS-1	1.5	3.0	5.0	6.6	11		4.5	30	22	8	40	14	54	11	17	A-4a		360					
	033-1	SS-2	3.0	4.5	6.6	8.1	10		3.5	38	22	16	34	41	75	17	17	A-6b							
	23	SS-3	4.5	6.0	8.1	9.6	8		4.5							16	16	A-6b							
		SS-4	6.0	7.5	9.6	11.1	10	11	4.5	37	21	16	36	37	73	18	16	A-6b							
35	B	SS-1	1.5	3.0	0.0	1.5	10		4.25	39	23	16	39	45	84	17	18	A-6b	10	3600		N_{60}		12"	
	034-0	SS-2	3.0	4.5	1.5	3.0	8		4.25	33	20	13	45	30	75	20	15	A-6a	9			N_{60} & Mc			
	23	SS-3	4.5	6.0	3.0	4.5	13		4.5	36	22	14	35	35	70	14	17	A-6a	9						
		SS-4	6.0	6.2	4.5	4.7	50	8									0	Rock	0						
36	B	SS-1	1.5	3.0	0.1	1.6	8		4.25	34	20	14	32	27	59	15	15	A-6a	6	1513		N_{60}		12"	
	035-0	SS-2	3.0	4.5	1.6	3.1	11		3.5	38	23	15	31	39	70	18	18	A-6a	9			N_{60}			
	23	SS-3	4.5	6.0	3.1	4.6	24		3.75							18	14	A-6a	10						
		SS-4	6.0	7.5	4.6	6.1	31	8								9	6	A-1-b	0						

OHIO DEPARTMENT OF TRANSPORTATION

Subgrade Analysis

V. 14.6 2/11/2022

#	Boring	Sample	Sample Depth		Subgrade Depth		Standard Penetration		HP (tsf)	Physical Characteristics						Moisture		Ohio DOT		Sulfate Content (ppm)	Problem		Excavate and Replace (Item 204)		Recommendation (Enter depth in inches)
			From	To	From	To	N_{60}	N_{60L}		LL	PL	PI	% Silt	% Clay	P200	M_C	M_{OPT}	Class	GI		Unsuitable	Unstable	Unsuitable	Unstable	
37	B	SS-1	1.5	3.0	-0.1	1.4	10		4.25	40	22	18	35	43	78	21	17	A-6b	11	2500		N_{60} & Mc		**12"**	
	036-0	SS-2	3.0	4.5	1.4	2.9	10		4	41	24	17	34	47	81	20	21	A-7-6	11			N_{60}			
	23	SS-3	4.5	6.0	2.9	4.4	11		4.25							20	18	A-7-6	16						
		SS-4	6.0	7.5	4.4	5.9	15	10	3.75							22	18	A-7-6	16						
38	B	SS-1	1.5	3.0	-0.4	1.1	6		4.5	32	21	11	36	20	56	16	16	A-6a	5	907		N_{60}		**18"**	
	037-0	SS-2	3.0	4.5	1.1	2.6	7		4.5	39	24	15	37	37	74	18	19	A-6a	10			N_{60}			
	23	SS-3	4.5	6.0	2.6	4.1	13		4.5							22	14	A-6a	10						
		SS-4	6.0	7.5	4.1	5.6	18	6	4.5							14	14	A-6a	10						
39	B	SS-1	1.5	3.0	0.1	1.6	6		3.25	42	24	18	30	49	79	23	21	A-7-6	12	3200		N_{60}		**18"**	
	038-0	SS-2	3.0	4.5	1.6	3.1	7		4							16	18	A-7-6	16			N_{60}			
	23	SS-3	4.5	5.0	3.1	3.6	100		4.5							16	10	A-4a	8						
		SS-4	6.0	6.2	4.6	4.8	100	6									0	Rock	0						
40	B	SS-1	1.5	3.0	0.1	1.6	6		4.25	31	21	10	47	29	76	16	16	A-4a	8	240		N_{60}		**18"**	
	039-0	SS-2	3.0	4.5	1.6	3.1	8		4.25							20	10	A-4a	8			N_{60} & Mc			
	23	SS-3	4.5	6.0	3.1	4.6	35		4	37	23	14	38	40	78	14	18	A-6a	10						
		SS-4	6.0	6.8	4.6	5.4		6								8	10	A-2-4	0						
41	B	SS-1	1.5	3.0	0.1	1.6	7		4.5	29	19	10	36	25	61	13	14	A-4a	5	100		N_{60}		**15"**	
	040-0	SS-2	3.0	4.5	1.6	3.1	7		4.25	39	22	17	34	32	66	17	17	A-6b	9			N_{60}			
	23	SS-3	4.5	6.0	3.1	4.6	15		4.5	35	22	13	40	36	76	14	17	A-6a	9						
		SS-4	6.0	7.5	4.6	6.1	16	7	4.5							11	14	A-6a	10						
42	B	SS-1	1.5	3.0	0.0	1.5	8		4.5	30	19	11	32	25	57	15	14	A-6a	5	2967		N_{60}		**12"**	
	041-0	SS-2	3.0	4.5	1.5	3.0	12		4.5	38	22	16	32	30	62	16	17	A-6b	8						
	23	SS-3	4.5	6.0	3.0	4.5	8		4.5							18	16	A-6b	16						
		SS-4	6.0	7.5	4.5	6.0	10	8	4.5							20	16	A-6b	16						
43	B	SS-1	1.5	3.0	0.1	1.6	6		2.5	48	27	21	38	42	80	23	24	A-7-6	14	433		N_{60}		**18"**	
	042-0	SS-2	3.0	4.5	1.6	3.1	10		4	44	25	19	40	38	78	19	22	A-7-6	12			N_{60}			
	23	SS-3	4.5	6.0	3.1	4.6	13		4							20	18	A-7-6	16						
		SS-4	6.0	7.5	4.6	6.1	15	6	4.25							20	18	A-7-6	16						
44	B	SS-1	1.5	3.0	-0.1	1.4	6		3.5	45	24	21	34	37	71	21	21	A-7-6	13	760		N_{60}		**18"**	
	043-0	SS-2	3.0	4.5	1.4	2.9	10		4							19	16	A-6b	16			N_{60} & Mc			
	23	SS-3	4.5	6.0	2.9	4.4	17		4.5	39	21	18	29	42	71	17	16	A-6b	10						
		SS-4	6.0	7.5	4.4	5.9	23	6	4.25							18	16	A-6b	16						
45	B	SS-1	1.5	3.0	1.3	2.8	7		4	26	18	8	33	20	53	17	13	A-4a	4	313		N_{60} & Mc			
	044-0	SS-2	3.0	4.5	2.8	4.3	8		4	46	24	22	39	41	80	22	21	A-7-6	14						
	23	SS-3	4.5	6.0	4.3	5.8	10		3.5							20	18	A-7-6	16						
		SS-4	6.0	7.5	5.8	7.3	11	7	3.75							21	18	A-7-6							

OHIO DEPARTMENT OF TRANSPORTATION

Subgrade Analysis

V. 14.6 2/11/2022

#	Boring	Sample	Sample Depth		Subgrade Depth		Standard Penetration		HP (tsf)	Physical Characteristics						Moisture		Ohio DOT		Sulfate Content (ppm)	Problem		Excavate and Replace (Item 204)		Recommendation (Enter depth in inches)
			From	To	From	To	N_{60}	N_{60L}		LL	PL	PI	% Silt	% Clay	P200	M_C	M_{OPT}	Class	GI		Unsuitable	Unstable	Unsuitable	Unstable	
46	B	SS-1	1.5	3.0	-1.6	-0.1	7		4.5	41	25	16	38	39	77	15	22	A-7-6	11	1120					
	045-0	SS-2	3.0	4.5	-0.1	1.5	10		3.5	44	25	19	48	41	89	20	22	A-7-6	12			N_{60}			**12"**
	23	SS-3	4.5	6.0	1.5	3.0	8		4.5	37	22	15	40	39	79	16	17	A-6a	10			N_{60}			
		SS-4	6.0	7.5	3.0	4.5	6	6								8	10	A-2-4	0						
47	B	SS-1	1.5	3.0	1.4	2.9	5		2.25	35	22	13	26	21	47	21	17	A-6a	3	1447		N_{60} & Mc			
	046-0	SS-2	3.0	4.5	2.9	4.4	6		2							26	14	A-6a	10						
	23	SS-3	4.5	6.0	4.4	5.9	7		2	49	23	26	31	46	77	29	20	A-7-6	16						
		SS-4	6.0	7.5	5.9	7.4	10	5	2.25							25	18	A-7-6							
48	B	SS-1	1.5	3.0	-0.6	0.9	7		4.25	36	23	13	36	25	61	17	18	A-6a	6	640		N_{60}			**15"**
	047-0	SS-2	3.0	4.5	0.9	2.4	10		4.25	39	24	15	39	24	63	17	19	A-6a	8			N_{60}			**12"**
	23	SS-3	4.5	6.0	2.4	3.9	17		4.5							24	14	A-6a	10						
		SS-4	6.0	7.5	3.9	5.4	19	7	4.5							24	14	A-6a	10						
49	B	SS-1	1.5	3.0	-0.1	1.4	8		4.5	38	22	16	35	31	66	18	17	A-6b	9	2500		N_{60}			**12"**
	048-0	SS-2	3.0	4.5	1.4	2.9	10		4.5	40	23	17	41	32	73	17	18	A-6b	10			N_{60}			
	23	SS-3	4.5	6.0	2.9	4.4	13		4.5							20	16	A-6b	16						
		SS-4	6.0	7.5	4.4	5.9	12	8	4.5							12	16	A-6b	16						
50	B	SS-1	1.5	3.0	0.0	1.5	7		4.5	34	21	13	39	28	67	18	16	A-6a	8	433		N_{60}			**15"**
	049-0	SS-2	3.0	4.5	1.5	3.0	8		4.5	36	22	14	42	23	65	17	17	A-6a	8			N_{60}			
	23	SS-3	4.5	6.0	3.0	4.5	10		4.5							16	14	A-6a	10						
		SS-4	6.0	7.5	4.5	6.0	17	7	4.5							15	14	A-6a	10						
51	B	SS-1	1.5	3.0	0.0	1.5	5		4	29	20	9	30	18	48	14	15	A-4a	3	633		N_{60}			**21"**
	050-0	SS-2	3.0	4.5	1.5	3.0	6		4.5	36	23	13	41	27	68	17	18	A-6a	8			N_{60}			
	23	SS-3	4.5	6.0	3.0	4.5	8		4							19	14	A-6a	10						
		SS-4	6.0	7.5	4.5	6.0	12	5	4.25							16	14	A-6a	10						
52	B	SS-1	1.5	3.0	0.0	1.5	11		4.25	32	20	12	33	25	58	14	15	A-6a	5	100		N_{60}			**12"**
	051-0	SS-2	3.0	4.5	1.5	3.0	11		4.25							14	14	A-6a	10			N_{60}			
	23	SS-3	4.5	6.0	3.0	4.5	10		3	33	22	11	29	26	55	19	17	A-6a	4						
		SS-4	6.0	7.5	4.5	6.0	12	10	4							18	14	A-6a	10						
53	B	SS-1	1.5	3.0	0.0	1.5	6			NP	NP	NP	20	19	39	13	11	A-4a	1	320		N_{60}			**18"**
	052-0	SS-2	3.0	4.5	1.5	3.0	7		3	44	23	21	29	53	82	21	20	A-7-6	13			N_{60}			
	23	SS-3	4.5	6.0	3.0	4.5	11		3.25							24	18	A-7-6	16						
		SS-4	6.0	7.5	4.5	6.0	13	6	3.5							17	18	A-7-6	16						

OHIO DEPARTMENT OF TRANSPORTATION

Subgrade Analysis

V. 14.6 2/11/2022

PID: 113440

County-Route-Section: HAS-22-15.11
No. of Borings: 53

Geotechnical Consultant: NEAS, Inc.
Prepared By: Derar M. Tarawneh
Date prepared: 9/19/2023

Chemical Stabilization Options		
320	Rubblize & Roll	No
206	Cement Stabilization	Option
	Lime Stabilization	No
206	Depth	14''

Excavate and Replace Stabilization Options	
Global Geotextile Average(N60L):	12''
Average(HP):	0''
Global Geogrid Average(N60L):	0''
Average(HP):	0''

Design CBR	7

% Samples within 6 feet of subgrade			
$N_{60} \leq 5$	3%	HP ≤ 0.5	0%
$N_{60} < 12$	50%	0.5 < HP ≤ 1	0%
$12 \leq N_{60} < 15$	16%	1 < HP ≤ 2	1%
$N_{60} \geq 20$	20%	HP > 2	75%
M+	6%		
Rock	5%		
Unsuitable	12%		

Excavate and Replace at Surface	
Average	0''
Maximum	0''
Minimum	0''

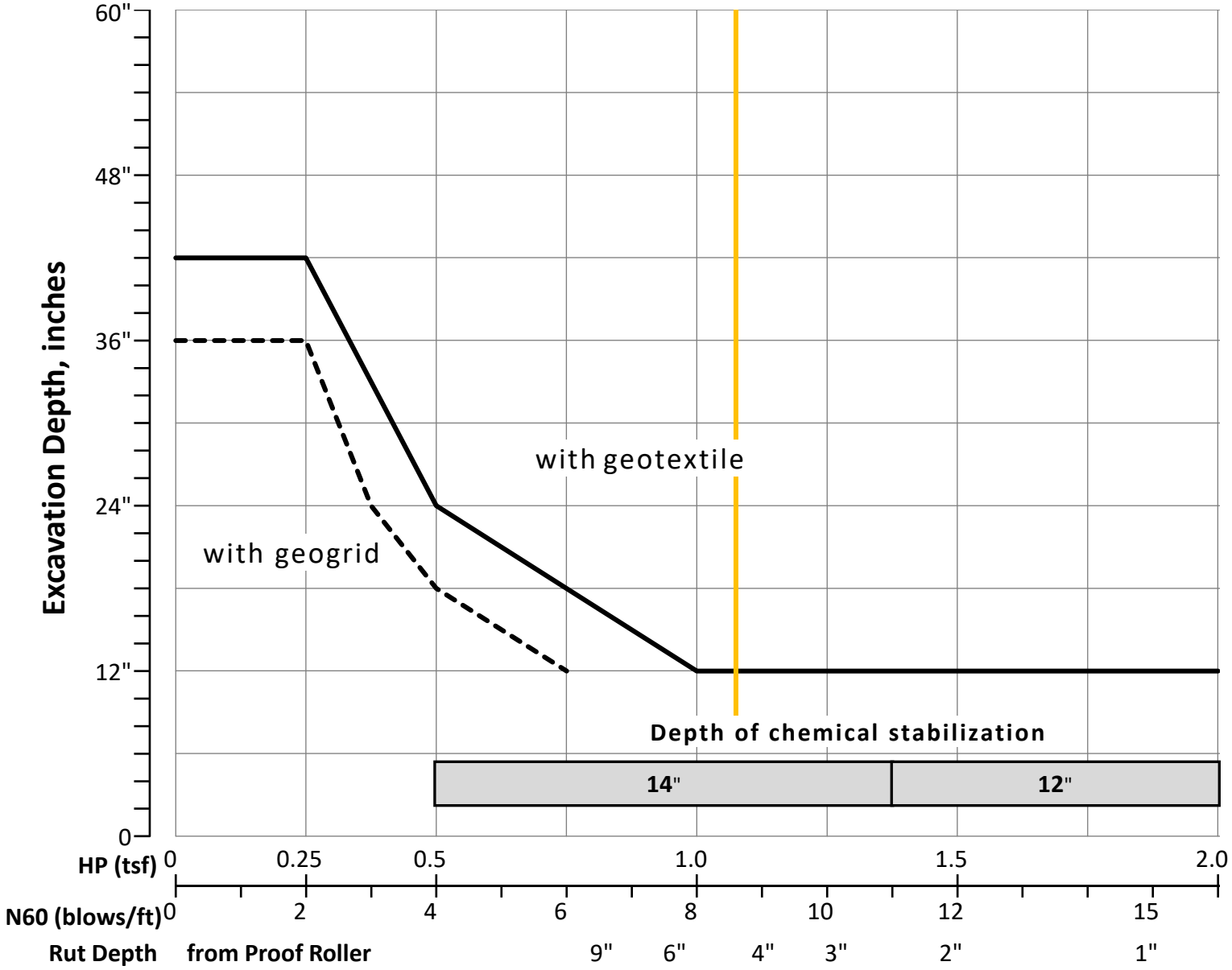
% Proposed Subgrade Surface	
Unstable & Unsuitable	67%
Unstable	66%
Unsuitable	2%

	N_{60}	N_{60L}	HP	LL	PL	PI	Silt	Clay	P 200	M_C	M_{OPT}	GI
Average	19	9	4.07	35	22	14	36	29	65	15	14	8
Maximum	100	30	4.50	51	27	26	58	60	90	31	24	16
Minimum	4	4	1.50	26	18	7	19	2	32	4	0	0

Classification Counts by Sample

ODOT Class	Rock	A-1-a	A-1-b	A-2-4	A-2-5	A-2-6	A-2-7	A-3	A-3a	A-4a	A-4b	A-5	A-6a	A-6b	A-7-5	A-7-6	A-8a	A-8b	Totals
Count	20	4	3	6	0	0	0	0	1	30	4	0	88	25	0	27	0	0	208
Percent	10%	2%	1%	3%	0%	0%	0%	0%	0%	14%	2%	0%	42%	12%	0%	13%	0%	0%	100%
% Rock|Granular|Cohesive	10%	21%									69%								100%
Surface Class Count	6	3	0	2	0	0	0	0	0	23	2	0	55	12	0	13	0	0	116
Surface Class Percent	5%	3%	0%	2%	0%	0%	0%	0%	0%	20%	2%	0%	47%	10%	0%	11%	0%	0%	100%

Fig. 600-1 – Subgrade Stabilization



OVERRIDE TABLE

Calculated Average	New Values	Check to Override
4.07	0.50	☐ HP
8.66	6.00	☐ N60L

Average HP
Average N_{60L}

RAMP A

OHIO DEPARTMENT OF TRANSPORTATION

OFFICE OF GEOTECHNICAL ENGINEERING

PLAN SUBGRADES
Geotechnical Design Manual Section 600

Instructions: Enter data in the shaded cells only.
(Enter state route number, project description,county, consultant's name, prepared by name, and date prepared. This information will be transferred to all other sheets. The date prepared must be entered in the appropriate cell on this sheet to remove these instructions prior to printing.)

HAS-22-15.11
113440

Ramp A

NEAS, Inc.

Prepared By: Derar M. Tarawneh
Date prepared: Tuesday, September 19, 2023

Chunmei (Melinda) He, Ph.D., P.E.
2800 Corporate Exchange Drive
Suite 240
Columbus, OH 43231
614.714.0299 Ext 111
che@neasinc.com

NO. OF BORINGS: 2

OHIO DEPARTMENT OF TRANSPORTATION

Subgrade Analysis

V. 14.6 2/11/2022

#	Boring ID	Alignment	Station	Offset	Dir	Drill Rig	ER	Boring EL.	Proposed Subgrade EL	Cut Fill
1	B-022-0-23	Ramp A	6+53	25	RT.	CME 45B	73	1225.4	1224.1	1.3 C
2	B-109-0-23	Ramp A	1+33	2	RT.	CME 55T	63	1224.3	1223.0	1.3 C

OHIO DEPARTMENT OF TRANSPORTATION

Subgrade Analysis

V. 14.6 2/11/2022

#	Boring	Sample	Sample Depth		Subgrade Depth		Standard Penetration		HP (tsf)	Physical Characteristics						Moisture		Ohio DOT		Sulfate Content (ppm)	Problem		Excavate and Replace (Item 204)		Recommendation (Enter depth in inches)
			From	To	From	To	N_{60}	N_{60L}		LL	PL	PI	% Silt	% Clay	P200	M_C	M_{OPT}	Class	GI		Unsuitable	Unstable	Unsuitable	Unstable	
1	B	SS-1	1.5	3.0	0.2	1.7	11		3.5	42	23	19	45	36	81	17	20	A-7-6	12	820		N_{60}		12"	
	022-0	SS-2	3.0	4.5	1.7	3.2	10		4.25							17	18	A-7-6	16			N_{60}			
	23	SS-3	4.5	6.0	3.2	4.7	16		4.5	33	21	12	48	27	75	14	16	A-6a	9						
		SS-4	6.0	7.5	4.7	6.2	17	10	4.5							15	14	A-6a	10						
2	B	SS-1	1.5	3.0	0.2	1.7	15		4.5	36	23	13	37	22	59	14	18	A-6a	6	753					
	109-0	SS-2	3.0	4.5	1.7	3.2	15			NP	NP	NP	41	13	54	8	11	A-4a	4						
	23	SS-3	4.5	6.0	3.2	4.7	38									8	0	Rock	0						
		SS-4	6.0	7.5	4.7	6.2	72	15								7	0	Rock	0						

OHIO DEPARTMENT OF TRANSPORTATION

Subgrade Analysis

V. 14.6 2/11/2022

PID: 113440

County-Route-Section: HAS-22-15.11
No. of Borings: 2

Geotechnical Consultant: NEAS, Inc.
Prepared By: Derar M. Tarawneh
Date prepared: 9/19/2023

Chemical Stabilization Options		
320	Rubblize & Roll	Option
206	Cement Stabilization	Option
	Lime Stabilization	No
206	Depth	12"

Excavate and Replace Stabilization Options	
Global Geotextile Average(N60L): Average(HP):	12" 0"
Global Geogrid Average(N60L): Average(HP):	0" 0"

Design CBR	7

% Samples within 6 feet of subgrade			
$N_{60} \leq 5$	0%	HP ≤ 0.5	0%
$N_{60} < 12$	25%	0.5 < HP ≤ 1	0%
$12 \leq N_{60} < 15$	0%	1 < HP ≤ 2	0%
$N_{60} \geq 20$	25%	HP > 2	63%
M+	0%		
Rock	0%		
Unsuitable	25%		

Excavate and Replace at Surface	
Average	0"
Maximum	0"
Minimum	0"

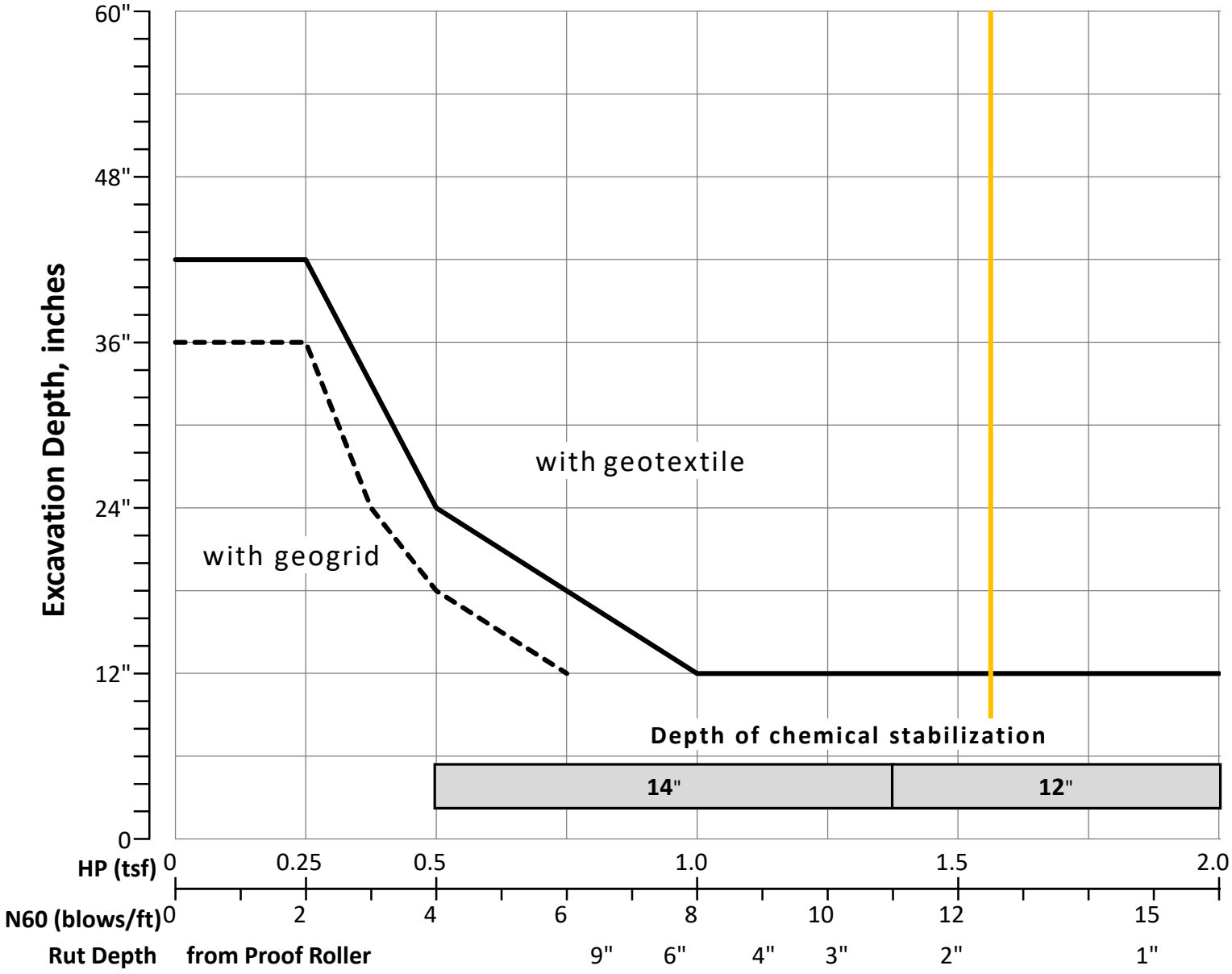
% Proposed Subgrade Surface	
Unstable & Unsuitable	50%
Unstable	50%
Unsuitable	0%

	N_{60}	N_{60L}	HP	LL	PL	PI	Silt	Clay	P 200	M_C	M_{OPT}	GI
Average	24	13	4.25	37	22	15	43	25	67	13	12	7
Maximum	72	15	4.50	42	23	19	48	36	81	17	20	16
Minimum	10	10	3.50	33	21	12	37	13	54	7	0	0

Classification Counts by Sample

ODOT Class	Rock	A-1-a	A-1-b	A-2-4	A-2-5	A-2-6	A-2-7	A-3	A-3a	A-4a	A-4b	A-5	A-6a	A-6b	A-7-5	A-7-6	A-8a	A-8b	Totals
Count	2	0	0	0	0	0	0	0	0	1	0	0	3	0	0	2	0	0	8
Percent	25%	0%	0%	0%	0%	0%	0%	0%	0%	13%	0%	0%	38%	0%	0%	25%	0%	0%	100%
% Rock|Granular|Cohesive	25%	13%									63%								100%
Surface Class Count	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	2	0	0	4
Surface Class Percent	0%	0%	0%	0%	0%	0%	0%	0%	0%	25%	0%	0%	25%	0%	0%	50%	0%	0%	100%

Fig. 600-1 – Subgrade Stabilization



OVERRIDE TABLE

Calculated Average	New Values	Check to Override
4.25	0.50	☐ HP
12.50	6.00	☐ N60L

Average HP
Average N_{60L}

RAMP B

OHIO DEPARTMENT OF TRANSPORTATION

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PLAN SUBGRADES
Geotechnical Design Manual Section 600

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113440

Ramp B

NEAS, Inc.

Prepared By: Derar M. Tarawneh
Date prepared: Tuesday, September 19, 2023

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2800 Corporate Exchange Drive
Suite 240
Columbus, OH 43231
614.714.0299 Ext 111
che@neasinc.com

NO. OF BORINGS: 3

#	Boring ID	Alignment	Station	Offset	Dir	Drill Rig	ER	Boring EL.	Proposed Subgrade EL	Cut Fill
1	B-018-0-23	Ramp B	1+91	6	RT.	CME 45B	73	1210.5	1209.0	1.5 C
2	B-111-0-23	Ramp B	6+4	9	LT.	CME 55T	63	1208.0	1206.2	1.8 C
3	B-110-0-23	Ramp B	10+2	2	RT.	CME 45B	73	1225.0	1223.7	1.4 C

OHIO DEPARTMENT OF TRANSPORTATION

Subgrade Analysis

V. 14.6 2/11/2022

#	Boring	Sample	Sample Depth		Subgrade Depth		Standard Penetration		HP (tsf)	Physical Characteristics						Moisture		Ohio DOT		Sulfate Content (ppm)	Problem		Excavate and Replace (Item 204)		Recommendation (Enter depth in inches)
			From	To	From	To	N_{60}	N_{60L}		LL	PL	PI	% Silt	% Clay	P200	M_C	M_{OPT}	Class	GI		Unsuitable	Unstable	Unsuitable	Unstable	
1	B	SS-1	1.5	3.0	0.0	1.5	10									7	6	A-1-a	0	180					
	018-0	SS-2	3.0	4.5	1.5	3.0	13		4.5	38	26	12	40	29	69	13	21	A-6a	8						
	23	SS-3	4.5	6.0	3.0	4.5	54		4.5	41	24	17	28	36	64	14	21	A-7-6	9						
		SS-4	6.0	7.5	4.5	6.0	53	10	4.5							15	18	A-7-6	16						
2	B	SS-1	1.5	3.0	-0.3	1.2	6			NP	NP	NP	18	15	33	11	10	A-2-4	0	220		N_{60}		**18"**	
	111-0	SS-2	3.0	4.5	1.2	2.7	8		3.5	38	24	14	41	32	73	15	19	A-6a	9			N_{60}			
	23	SS-3	4.5	6.0	2.7	4.2	36									10	0	Rock	0						
		SS-4	6.0	7.5	4.2	5.7	31	6								9	0	Rock	0						
3	B	SS-1	1.5	3.0	0.1	1.6	7		4.5	38	24	14	45	30	75	20	19	A-6a	10	4600		N_{60}		**15"**	
	110-0	SS-2	3.0	4.5	1.6	3.1	10		4.5	44	24	20	50	44	94	20	21	A-7-6	13			N_{60}			
	23	SS-3	4.5	6.0	3.1	4.6	15		4.25							20	18	A-7-6	16						
		SS-4	6.0	7.5	4.6	6.1	15	7	4.25							20	18	A-7-6	16						

OHIO DEPARTMENT OF TRANSPORTATION

Subgrade Analysis

V. 14.6 2/11/2022

PID: 113440

County-Route-Section: HAS-22-15.11
No. of Borings: 3

Geotechnical Consultant: NEAS, Inc.
Prepared By: Derar M. Tarawneh
Date prepared: 9/19/2023

Chemical Stabilization Options		
320	Rubblize & Roll	No
206	Cement Stabilization	Option
	Lime Stabilization	No
206	Depth	14"

Excavate and Replace Stabilization Options	
Global Geotextile Average(N60L):	15"
Average(HP):	0"
Global Geogrid Average(N60L):	0"
Average(HP):	0"

Design CBR	7

% Samples within 6 feet of subgrade			
$N_{60} \leq 5$	0%	HP ≤ 0.5	0%
$N_{60} < 12$	42%	0.5 < HP ≤ 1	0%
$12 \leq N_{60} < 15$	8%	1 < HP ≤ 2	0%
$N_{60} \geq 20$	33%	HP > 2	67%
M+	0%		
Rock	14%		
Unsuitable	17%		

Excavate and Replace at Surface	
Average	0"
Maximum	0"
Minimum	0"

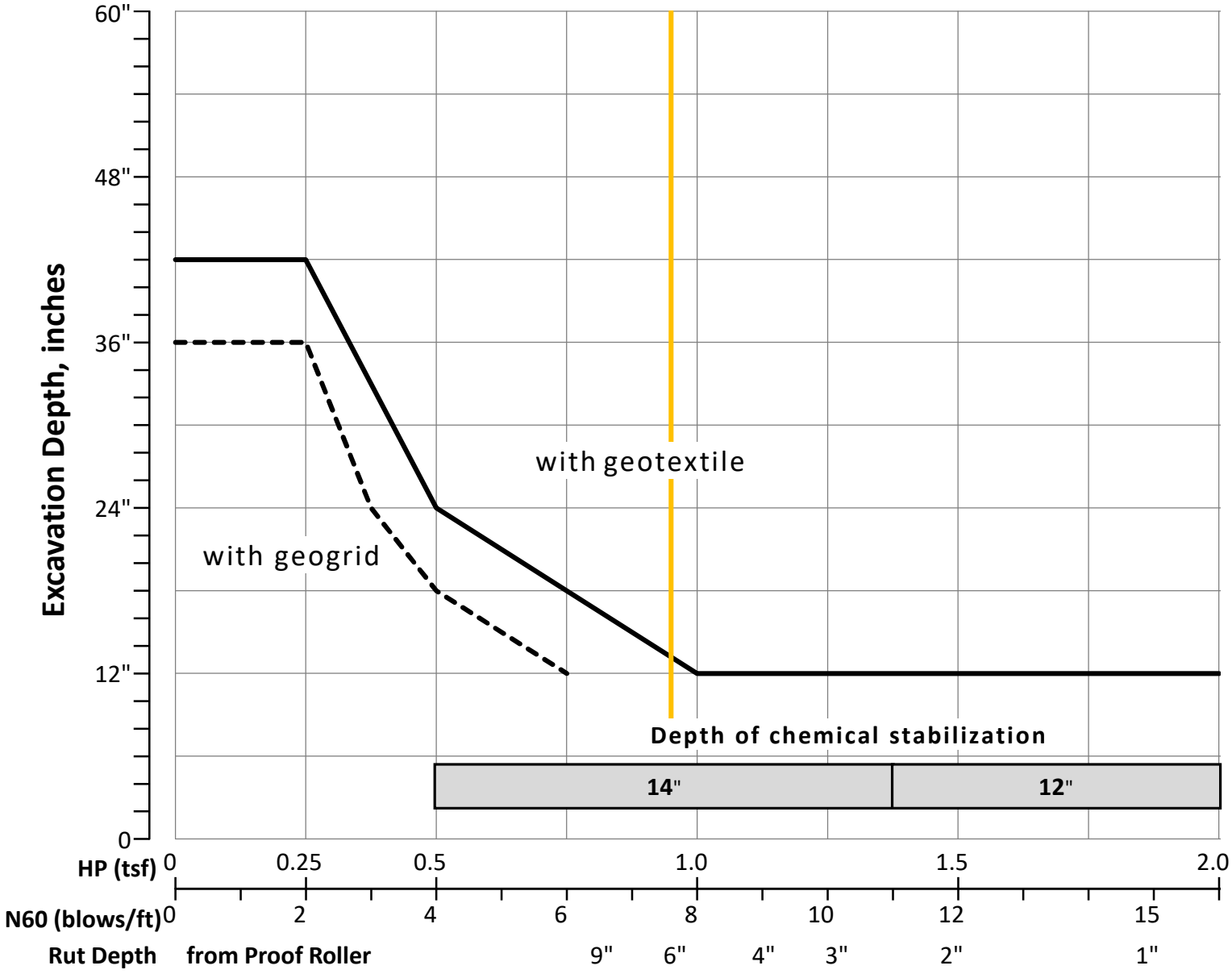
% Proposed Subgrade Surface	
Unstable & Unsuitable	57%
Unstable	57%
Unsuitable	0%

	N_{60}	N_{60L}	HP	LL	PL	PI	Silt	Clay	P 200	M_C	M_{OPT}	GI
Average	22	8	4.31	40	24	15	37	31	68	15	14	8
Maximum	54	10	4.50	44	26	20	50	44	94	20	21	16
Minimum	6	6	3.50	38	24	12	18	15	33	7	0	0

Classification Counts by Sample

ODOT Class	Rock	A-1-a	A-1-b	A-2-4	A-2-5	A-2-6	A-2-7	A-3	A-3a	A-4a	A-4b	A-5	A-6a	A-6b	A-7-5	A-7-6	A-8a	A-8b	Totals
Count	2	1	0	1	0	0	0	0	0	0	0	0	3	0	0	5	0	0	12
Percent	17%	8%	0%	8%	0%	0%	0%	0%	0%	0%	0%	0%	25%	0%	0%	42%	0%	0%	100%
% Rock|Granular|Cohesive	17%	17%									67%								100%
Surface Class Count	1	1	0	1	0	0	0	0	0	0	0	0	3	0	0	1	0	0	7
Surface Class Percent	14%	14%	0%	14%	0%	0%	0%	0%	0%	0%	0%	0%	43%	0%	0%	14%	0%	0%	100%

Fig. 600-1 – Subgrade Stabilization



OVERRIDE TABLE

Calculated Average	New Values	Check to Override
4.31	0.50	☐ HP
7.67	6.00	☐ N60L

Average HP
Average N_{60L}

RAMP C

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113440

Ramp C

NEAS, Inc.

Prepared By: Derar M. Tarawneh
Date prepared: Tuesday, September 19, 2023

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NO. OF BORINGS: 3

#	Boring ID	Alignment	Station	Offset	Dir	Drill Rig	ER	Boring EL.	Proposed Subgrade EL	Cut Fill
1	B-017-0-23	Ramp C	0+75	30	LT.	CME 45B	63	1215.7	1214.2	1.5 C
2	B-104-0-23	Ramp C	4+1	4	LT.	CME 55T	63	1209.6	1207.5	2.1 C
3	B-105-0-23	Ramp C	7+38	15	LT.	CME 55T	63	1212.3	1210.2	2.1 C

OHIO DEPARTMENT OF TRANSPORTATION

Subgrade Analysis

V. 14.6 2/11/2022

#	Boring	Sample	Sample Depth		Subgrade Depth		Standard Penetration		HP (tsf)	Physical Characteristics						Moisture		Ohio DOT		Sulfate Content (ppm)	Problem		Excavate and Replace (Item 204)		Recommendation (Enter depth in inches)
			From	To	From	To	N_{60}	N_{60L}		LL	PL	PI	% Silt	% Clay	P200	M_C	M_{OPT}	Class	GI		Unsuitable	Unstable	Unsuitable	Unstable	
1	B	SS-1	1.5	3.0	0.0	1.5	35		4.25	29	21	8	42	18	60	12	16	A-4a	5	800					
	017-0	SS-2	3.0	4.5	1.5	3.0	38		4.5	30	22	8	45	18	63	10	17	A-4a	6						
	23	SS-3	4.5	6.0	3.0	4.5	46									9	0	Rock	0						
		SS-4	6.0	7.5	4.5	6.0	47	30								11	0	Rock	0						
2	B	SS-1	1.5	3.0	-0.6	0.9	57										0	Rock	0		Rock				
	104-0	SS-2	3.0	4.0	0.9	1.9	100										0	Rock	0		Rock		**23"**		
	23	SS-3	4.5	4.7	2.4	2.6	100										0	Rock	0						
								30																	
3	B	SS-1	1.5	3.0	-0.6	0.9	10		3.25	32	20	12	25	15	40	12	15	A-6a	2	707		N_{60}		**12"**	
	105-0	SS-2	3.0	4.5	0.9	2.4	12		3	35	22	13	30	26	56	15	17	A-6a	5						
	23	SS-3	4.5	6.0	2.4	3.9	7		2.5							16	14	A-6a	10						
		SS-4	6.0	7.5	3.9	5.4	8	7	2.75							13	14	A-6a	10						

OHIO DEPARTMENT OF TRANSPORTATION

Subgrade Analysis

V. 14.6 2/11/2022

PID: 113440

County-Route-Section: HAS-22-15.11
No. of Borings: 3

Geotechnical Consultant: NEAS, Inc.
Prepared By: Derar M. Tarawneh
Date prepared: 9/19/2023

Chemical Stabilization Options		
320	Rubblize & Roll	Option
206	Cement Stabilization	Option
	Lime Stabilization	No
206	Depth	NA

Excavate and Replace Stabilization Options	
Global Geotextile Average(N60L): Average(HP):	0" 0"
Global Geogrid Average(N60L): Average(HP):	0" 0"

Design CBR	9

% Samples within 6 feet of subgrade			
$N_{60} \leq 5$	0%	HP ≤ 0.5	0%
$N_{60} < 12$	27%	0.5 < HP ≤ 1	0%
$12 \leq N_{60} < 15$	9%	1 < HP ≤ 2	0%
$N_{60} \geq 20$	64%	HP > 2	55%
M+	0%		
Rock	38%		
Unsuitable	45%		

Excavate and Replace at Surface	
Average	0"
Maximum	0"
Minimum	0"

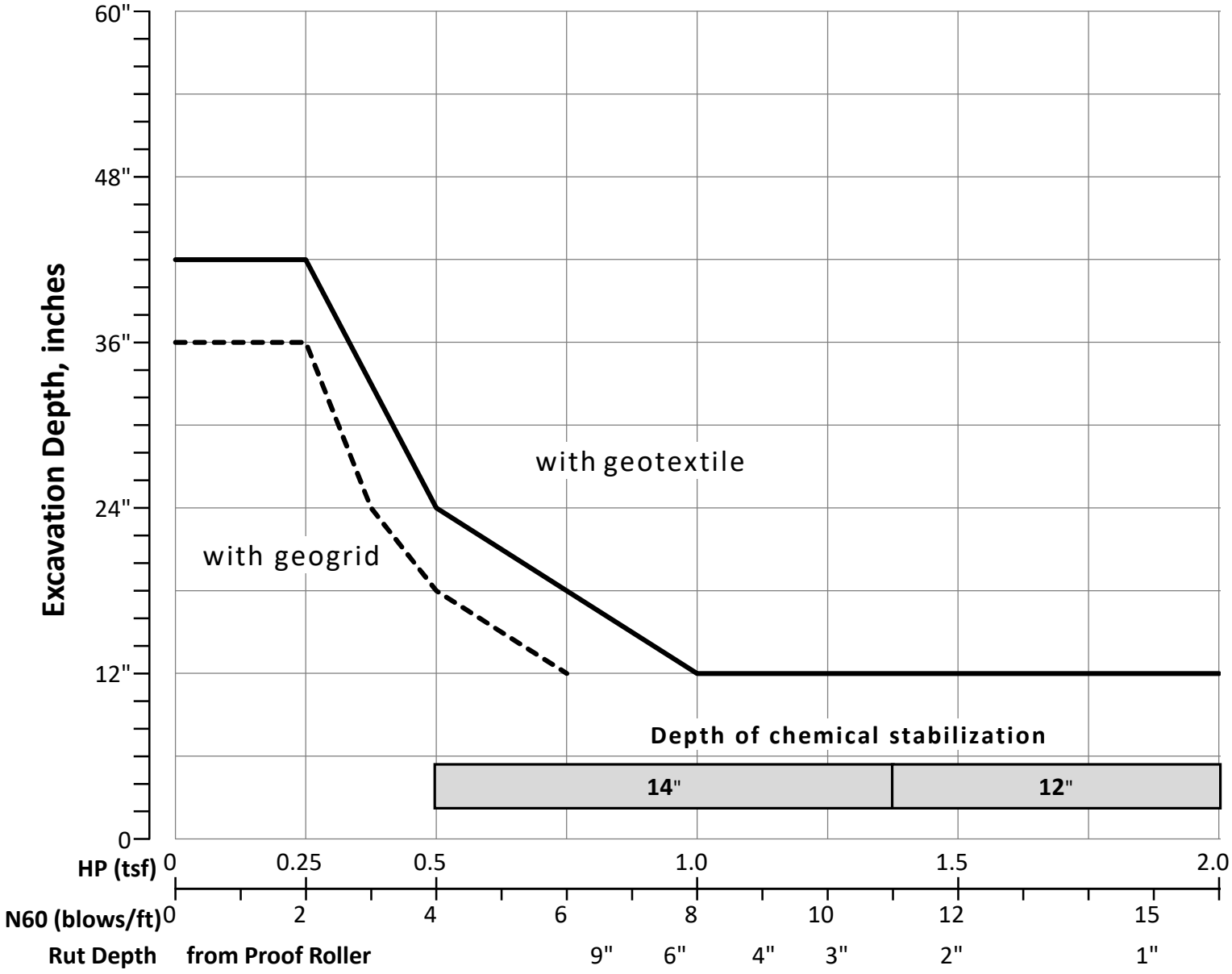
% Proposed Subgrade Surface	
Unstable & Unsuitable	38%
Unstable	13%
Unsuitable	25%

	N_{60}	N_{60L}	HP	LL	PL	PI	Silt	Clay	P 200	M_C	M_{OPT}	GI
Average	42	22	3.38	32	21	10	36	19	55	12	8	3
Maximum	100	30	4.50	35	22	13	45	26	63	16	17	10
Minimum	7	7	2.50	29	20	8	25	15	40	9	0	0

Classification Counts by Sample

ODOT Class	Rock	A-1-a	A-1-b	A-2-4	A-2-5	A-2-6	A-2-7	A-3	A-3a	A-4a	A-4b	A-5	A-6a	A-6b	A-7-5	A-7-6	A-8a	A-8b	Totals
Count	5	0	0	0	0	0	0	0	0	2	0	0	4	0	0	0	0	0	11
Percent	45%	0%	0%	0%	0%	0%	0%	0%	0%	18%	0%	0%	36%	0%	0%	0%	0%	0%	100%
% Rock|Granular|Cohesive	45%	18%									36%								100%
Surface Class Count	3	0	0	0	0	0	0	0	0	2	0	0	3	0	0	0	0	0	8
Surface Class Percent	38%	0%	0%	0%	0%	0%	0%	0%	0%	25%	0%	0%	38%	0%	0%	0%	0%	0%	100%

Fig. 600-1 – Subgrade Stabilization



OVERRIDE TABLE

Calculated Average	New Values	Check to Override
3.38	0.50	☐ HP
22.33	6.00	☐ N60L

Average HP

Average N_{60L}

RAMP D

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Geotechnical Design Manual Section 600

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113440

Ramp D

NEAS, Inc.

Prepared By:	**Derar M. Tarawneh**
Date prepared:	**Tuesday, September 19, 2023**

Chunmei (Melinda) He, Ph.D., P.E.
2800 Corporate Exchange Drive
Suite 240
Columbus, OH 43231
614.714.0299 Ext 111
che@neasinc.com

NO. OF BORINGS: 3

#	Boring ID	Alignment	Station	Offset	Dir	Drill Rig	ER	Boring EL.	Proposed Subgrade EL	Cut Fill
1	B-107-0-23	Ramp D	2+39	2	RT.	CME 45B	73	1228.2	1226.8	1.4 C
2	B-108-0-23	Ramp D	6+90	2	RT.	CME 45B	73	1207.6	1206.2	1.4 C
3	B-106-0-23	Ramp D	12+65	150	RT.	CME 45B	73	1235.7	1234.2	1.5 C

OHIO DEPARTMENT OF TRANSPORTATION

Subgrade Analysis

V. 14.6 2/11/2022

#	Boring	Sample	Sample Depth		Subgrade Depth		Standard Penetration		HP (tsf)	Physical Characteristics						Moisture		Ohio DOT		Sulfate Content (ppm)	Problem		Excavate and Replace (Item 204)		Recommendation (Enter depth in inches)
			From	To	From	To	N_{60}	N_{60L}		LL	PL	PI	% Silt	% Clay	P200	M_C	M_{OPT}	Class	GI		Unsuitable	Unstable	Unsuitable	Unstable	
1	B	SS-1	1.5	3.0	0.1	1.6	7		4.25	32	20	12	33	24	57	14	15	A-6a	5	547		N_{60}		15"	
	107-0	SS-2	3.0	4.5	1.6	3.1	8		3.75	44	27	17	30	38	68	25	24	A-7-6	10			N_{60}			
	23	SS-3	4.5	6.0	3.1	4.6	7		4.25							21	18	A-7-6	16						
		SS-4	6.0	7.5	4.6	6.1	7	7	4.5							16	18	A-7-6	16						
2	B	SS-1	1.5	3.0	0.1	1.6	7		3.75	34	21	13	36	25	61	15	16	A-6a	6	667		N_{60}		15"	
	108-0	SS-2	3.0	4.5	1.6	3.1	8		4.25	35	23	12	35	23	58	14	18	A-6a	5			N_{60}			
	23	SS-3	4.5	6.0	3.1	4.6	10		3.5							14	14	A-6a	10						
		SS-4	6.0	7.5	4.6	6.1	10	7	4							16	14	A-6a	10						
3	B	SS-1	1.5	3.0	0.0	1.5	6		4.5	32	22	10	35	32	67	10	17	A-4a	6	480		N_{60}		18"	
	106-0	SS-2	3.0	4.5	1.5	3.0	8		4.5							14	10	A-4a	8			N_{60} & Mc			
	23	SS-3	4.5	6.0	3.0	4.5	13		4.5							14	10	A-4a	8						
		SS-4	6.0	7.5	4.5	6.0	13	6	4.5							13	10	A-4a	8						

OHIO DEPARTMENT OF TRANSPORTATION

Subgrade Analysis

V. 14.6 2/11/2022

PID: 113440

County-Route-Section: HAS-22-15.11
No. of Borings: 3

Geotechnical Consultant: NEAS, Inc.
Prepared By: Derar M. Tarawneh
Date prepared: 9/19/2023

Chemical Stabilization Options		
320	Rubblize & Roll	No
206	Cement Stabilization	Option
	Lime Stabilization	No
206	Depth	14"

Excavate and Replace Stabilization Options	
Global Geotextile Average(N60L):	18"
Average(HP):	0"
Global Geogrid Average(N60L):	0"
Average(HP):	0"

Design CBR	6

% Samples within 6 feet of subgrade			
$N_{60} \leq 5$	0%	HP ≤ 0.5	0%
$N_{60} < 12$	83%	0.5 < HP ≤ 1	0%
$12 \leq N_{60} < 15$	17%	1 < HP ≤ 2	0%
$N_{60} \geq 20$	0%	HP > 2	100%
M+	8%		
Rock	0%		
Unsuitable	0%		

Excavate and Replace at Surface	
Average	0"
Maximum	0"
Minimum	0"

% Proposed Subgrade Surface	
Unstable & Unsuitable	100%
Unstable	100%
Unsuitable	0%

	N_{60}	N_{60L}	HP	LL	PL	PI	Silt	Clay	P 200	M_C	M_{OPT}	GI
Average	9	7	4.19	35	23	13	34	28	62	16	15	9
Maximum	13	7	4.50	44	27	17	36	38	68	25	24	16
Minimum	6	6	3.50	32	20	10	30	23	57	10	10	5

Classification Counts by Sample

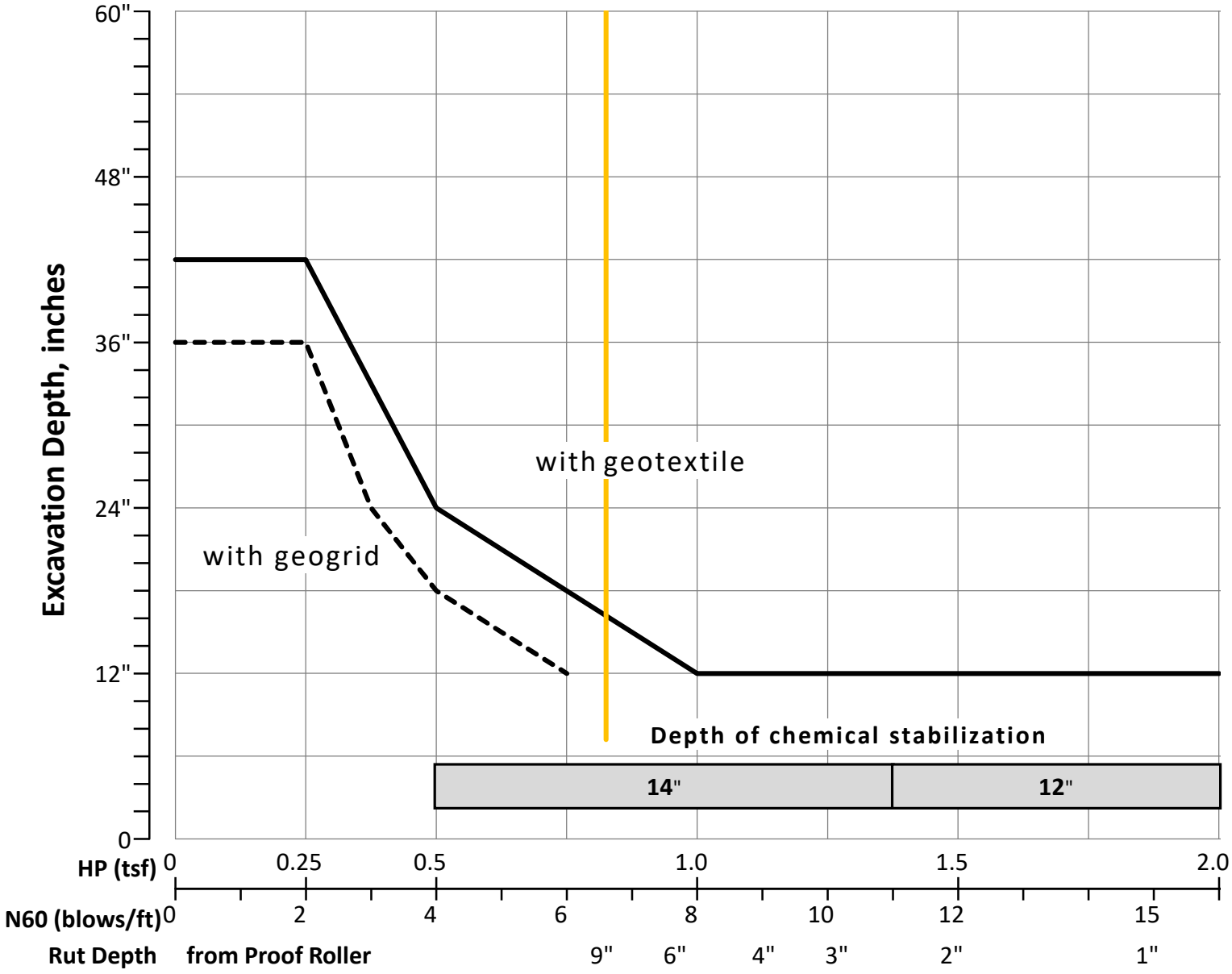
ODOT Class	Rock	A-1-a	A-1-b	A-2-4	A-2-5	A-2-6	A-2-7	A-3	A-3a	A-4a	A-4b	A-5	A-6a	A-6b	A-7-5	A-7-6	A-8a	A-8b	Totals
Count	0	0	0	0	0	0	0	0	0	4	0	0	5	0	0	3	0	0	12
Percent	0%	0%	0%	0%	0%	0%	0%	0%	0%	33%	0%	0%	42%	0%	0%	25%	0%	0%	100%
% Rock|Granular|Cohesive	0%	33%									67%								100%
Surface Class Count	0	0	0	0	0	0	0	0	0	2	0	0	3	0	0	1	0	0	6
Surface Class Percent	0%	0%	0%	0%	0%	0%	0%	0%	0%	33%	0%	0%	50%	0%	0%	17%	0%	0%	100%

OHIO DEPARTMENT OF TRANSPORTATION

Subgrade Analysis

V. 14.6 2/11/2022

Fig. 600-1 – Subgrade Stabilization



OVERRIDE TABLE

Calculated Average	New Values	Check to Override
4.19	0.50	☐ HP
6.67	6.00	☐ N60L

Average HP

Average N_{60L}

RAMP E

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Geotechnical Design Manual Section 600

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113440

Ramp E

NEAS, Inc.

Prepared By: Derar M. Tarawneh
Date prepared: Tuesday, September 19, 2023

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Columbus, OH 43231
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NO. OF BORINGS: 4

OHIO DEPARTMENT OF TRANSPORTATION

Subgrade Analysis

V. 14.6 2/11/2022

#	Boring ID	Alignment	Station	Offset	Dir	Drill Rig	ER	Boring EL.	Proposed Subgrade EL	Cut Fill
1	B-032-0-23	RAMP E	12+75	4	LT.	CME 45B	73	1243.7	1242.1	1.6 C
2	B-117-0-23	RAMP E	0+32	3	LT.	CME 55T	63	1211.3	1210.3	1.0 C
3	B-118-0-23	RAMP E	5+14	31	RT.	CME 55T	63	1230.9	1227.5	3.4 C
4	B-116-0-23	RAMP E	7+73	3	LT.	CME 55T	63	1240.2	1239.0	1.1 C

OHIO DEPARTMENT OF TRANSPORTATION

Subgrade Analysis

V. 14.6 2/11/2022

#	Boring	Sample	Sample Depth		Subgrade Depth		Standard Penetration		HP (tsf)	Physical Characteristics						Moisture		Ohio DOT		Sulfate Content (ppm)	Problem		Excavate and Replace (Item 204)		Recommendation (Enter depth in inches)
			From	To	From	To	N_{60}	N_{60L}		LL	PL	PI	% Silt	% Clay	P200	M_C	M_{OPT}	Class	GI		Unsuitable	Unstable	Unsuitable	Unstable	
1	B	SS-1	1.5	3.0	-0.1	1.4	6		4	34	21	13	28	42	70	9	16	A-6a	8	720		N_{60}		18"	
	032-0	SS-2	3.0	4.5	1.4	2.9	7		4.25							14	14	A-6a	10			N_{60}			
	23	SS-3	4.5	6.0	2.9	4.4	6		4	51	27	24	29	60	89	20	24	A-7-6	16						
		SS-4	6.0	7.5	4.4	5.9	7	6	4							27	18	A-7-6	16						
2	B	SS-1	1.5	3.0	0.5	2.0	22			NP	NP	NP	14	10	24	10	8	A-3a	0	60					
	117-0	SS-2	3.0	4.5	2.0	3.5	36			NP	NP	NP	15	14	29	10	8	A-3a	0						
	23	SS-3	4.5	6.0	3.5	5.0	58									8	8	A-3a	0						
		SS-4	6.0	7.5	5.0	6.5	48	22								9	8	A-3a	0						
3	B	SS-1	1.5	3.0	-1.9	-0.4	12			NP	NP	NP	22	21	43	12	11	A-4a	2	140					
	118-0	SS-2	3.0	4.5	-0.4	1.1	13		4.5	33	19	14	31	25	56	12	14	A-6a	6						
	23	SS-3	4.5	6.0	1.1	2.6	23		4.5							10	14	A-6a	10						
		SS-4	6.0	7.5	2.6	4.1	17	13	4.5							12	14	A-6a	10						
4	B	SS-1	1.5	3.0	0.4	1.9	10		4.5	38	21	17	30	34	64	15	16	A-6b	9	100		N_{60}		12"	
	116-0	SS-2	3.0	4.5	1.9	3.4	7		4.5							17	16	A-6b	16			N_{60}			
	23	SS-3	4.5	6.0	3.4	4.9	13		4.5	27	17	10	30	29	59	14	12	A-4a	5						
		SS-4	6.0	6.3	4.9	5.2	100	7								2	0	Rock	0						

OHIO DEPARTMENT OF TRANSPORTATION

Subgrade Analysis

V. 14.6 2/11/2022

PID: 113440

County-Route-Section: HAS-22-15.11
No. of Borings: 4

Geotechnical Consultant: NEAS, Inc.
Prepared By: Derar M. Tarawneh
Date prepared: 9/19/2023

Chemical Stabilization Options		
320	Rubblize & Roll	Option
206	Cement Stabilization	Option
	Lime Stabilization	No
206	Depth	12"

Excavate and Replace Stabilization Options	
Global Geotextile Average(N60L): Average(HP):	12" 0"
Global Geogrid Average(N60L): Average(HP):	0" 0"

Design CBR	7

% Samples within 6 feet of subgrade			
$N_{60} \leq 5$	0%	HP ≤ 0.5	0%
$N_{60} < 12$	40%	0.5 < HP ≤ 1	0%
$12 \leq N_{60} < 15$	13%	1 < HP ≤ 2	0%
$N_{60} \geq 20$	40%	HP > 2	67%
M+	0%		
Rock	0%		
Unsuitable	7%		

Excavate and Replace at Surface	
Average	0"
Maximum	0"
Minimum	0"

% Proposed Subgrade Surface	
Unstable & Unsuitable	40%
Unstable	40%
Unsuitable	0%

	N_{60}	N_{60L}	HP	LL	PL	PI	Silt	Clay	P 200	M_C	M_{OPT}	GI
Average	25	12	4.33	37	21	16	25	31	56	13	13	7
Maximum	100	22	4.50	51	27	24	31	60	89	27	24	16
Minimum	6	6	4.00	27	17	10	14	10	24	2	0	0

Classification Counts by Sample

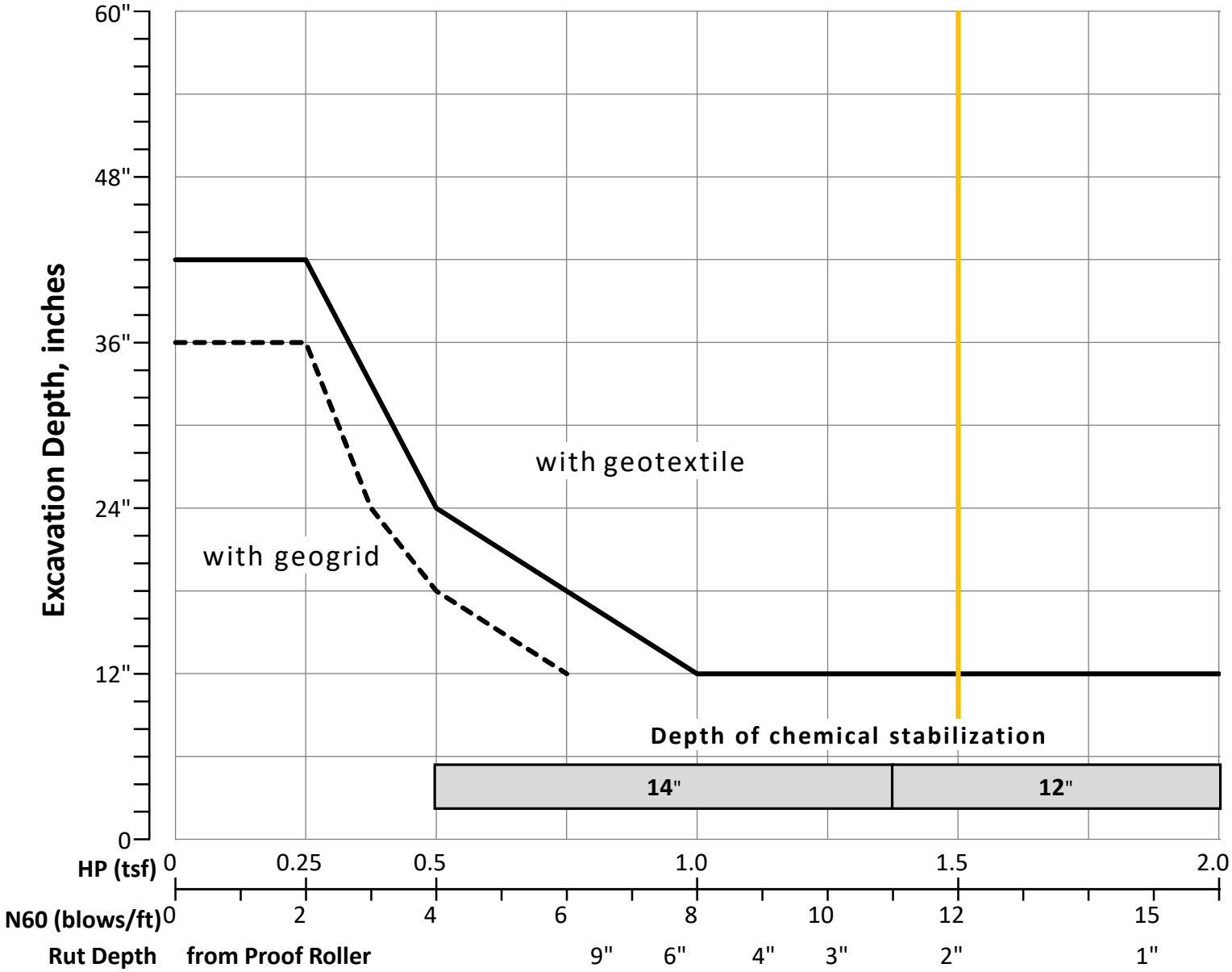
ODOT Class	Rock	A-1-a	A-1-b	A-2-4	A-2-5	A-2-6	A-2-7	A-3	A-3a	A-4a	A-4b	A-5	A-6a	A-6b	A-7-5	A-7-6	A-8a	A-8b	Totals
Count	1	0	0	0	0	0	0	0	4	1	0	0	5	2	0	2	0	0	15
Percent	7%	0%	0%	0%	0%	0%	0%	0%	27%	7%	0%	0%	33%	13%	0%	13%	0%	0%	100%
% Rock|Granular|Cohesive	7%	33%									60%								100%
Surface Class Count	0	0	0	0	0	0	0	0	2	1	0	0	5	2	0	0	0	0	10
Surface Class Percent	0%	0%	0%	0%	0%	0%	0%	0%	20%	10%	0%	0%	50%	20%	0%	0%	0%	0%	100%

OHIO DEPARTMENT OF TRANSPORTATION

Subgrade Analysis

V. 14.6 2/11/2022

Fig. 600-1 – Subgrade Stabilization



OVERRIDE TABLE

Calculated Average	New Values	Check to Override
4.33	0.50	☐ HP
12.00	6.00	☐ N60L

Average HP

Average N_{60L}

RAMP F

OHIO DEPARTMENT OF TRANSPORTATION

OFFICE OF GEOTECHNICAL ENGINEERING

PLAN SUBGRADES
Geotechnical Design Manual Section 600

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HAS-22-15.11
113440

Ramp F

NEAS, Inc.

Prepared By: Derar M. Tarawneh
Date prepared: Tuesday, September 19, 2023

Chunmei (Melinda) He, Ph.D., P.E.
2800 Corporate Exchange Drive
Suite 240
Columbus, OH 43231
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che@neasinc.com

NO. OF BORINGS: 2

OHIO DEPARTMENT OF TRANSPORTATION

Subgrade Analysis

V. 14.6 2/11/2022

#	Boring ID	Alignment	Station	Offset	Dir	Drill Rig	ER	Boring EL.	Proposed Subgrade EL	Cut Fill
1	B-119-0-23	RAMP F	6+29	3	LT.	CME 55T	63	1249.0	1247.6	1.4 C
2	B-119-1-23	RAMP F	8+32	4	LT.	CME 55T	63	1242.0	1240.4	1.7 C

OHIO DEPARTMENT OF TRANSPORTATION

Subgrade Analysis

V. 14.6 2/11/2022

#	Boring	Sample	Sample Depth		Subgrade Depth		Standard Penetration		HP (tsf)	Physical Characteristics						Moisture		Ohio DOT		Sulfate Content (ppm)	Problem		Excavate and Replace (Item 204)		Recommendation (Enter depth in inches)
			From	To	From	To	N_{60}	N_{60L}		LL	PL	PI	% Silt	% Clay	P200	M_C	M_{OPT}	Class	GI		Unsuitable	Unstable	Unsuitable	Unstable	
1	B	SS-1	1.5	3.0	0.1	1.6	8		4.5	29	18	11	26	26	52	11	14	A-6a	4	460		N_{60}		12"	
	119-0	SS-2	3.0	4.5	1.6	3.1	12		4							14	14	A-6a	10						
	23	SS-3	4.5	6.0	3.1	4.6	23		4							17	14	A-6a	10						
		SS-4	6.0	7.5	4.6	6.1	30	8		NP	NP	NP	10	23	33	10	10	A-2-4	0						
2	B	SS-1	1.5	3.0	-0.2	1.3	10		4.25	33	20	13	35	30	65	14	15	A-6a	7	40		N_{60}		12"	
	119-1	SS-2	3.0	4.5	1.3	2.8	7		4.25							17	14	A-6a	10			N_{60} & Mc			
	23	SS-3	4.5	6.0	2.8	4.3	25			NP	NP	NP	12	13	25	8	6	A-1-b	0						
		SS-4	6.0	7.5	4.3	5.8	23	7								12	6	A-1-b	0						

OHIO DEPARTMENT OF TRANSPORTATION

Subgrade Analysis

V. 14.6 2/11/2022

PID: 113440

County-Route-Section: HAS-22-15.11
No. of Borings: 2

Geotechnical Consultant: NEAS, Inc.
Prepared By: Derar M. Tarawneh
Date prepared: 9/19/2023

Chemical Stabilization Options		
320	Rubblize & Roll	No
206	Cement Stabilization	Option
	Lime Stabilization	No
206	Depth	14''

Excavate and Replace Stabilization Options	
Global Geotextile Average(N60L):	15''
Average(HP):	0''
Global Geogrid Average(N60L):	0''
Average(HP):	0''

Design CBR	8

% Samples within 6 feet of subgrade			
$N_{60} \leq 5$	0%	HP ≤ 0.5	0%
$N_{60} < 12$	38%	0.5 < HP ≤ 1	0%
$12 \leq N_{60} < 15$	13%	1 < HP ≤ 2	0%
$N_{60} \geq 20$	50%	HP > 2	63%
M+	13%		
Rock	0%		
Unsuitable	0%		

Excavate and Replace at Surface	
Average	0''
Maximum	0''
Minimum	0''

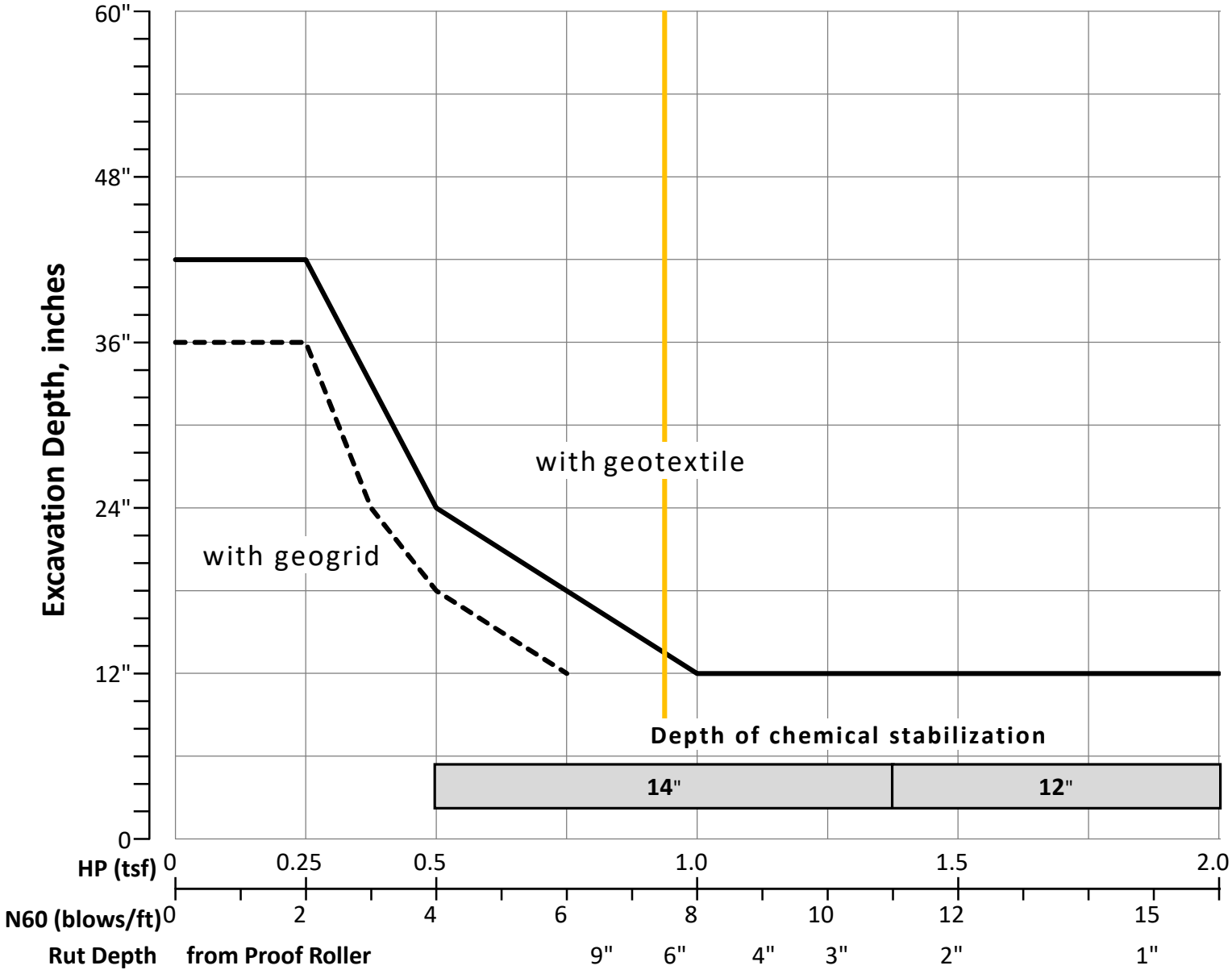
% Proposed Subgrade Surface	
Unstable & Unsuitable	75%
Unstable	75%
Unsuitable	0%

	N_{60}	N_{60L}	HP	LL	PL	PI	Silt	Clay	P 200	M_C	M_{OPT}	GI
Average	17	8	4.20	31	19	12	21	23	44	13	12	5
Maximum	30	8	4.50	33	20	13	35	30	65	17	15	10
Minimum	7	7	4.00	29	18	11	10	13	25	8	6	0

Classification Counts by Sample

ODOT Class	Rock	A-1-a	A-1-b	A-2-4	A-2-5	A-2-6	A-2-7	A-3	A-3a	A-4a	A-4b	A-5	A-6a	A-6b	A-7-5	A-7-6	A-8a	A-8b	Totals
Count	0	0	2	1	0	0	0	0	0	0	0	0	5	0	0	0	0	0	8
Percent	0%	0%	25%	13%	0%	0%	0%	0%	0%	0%	0%	0%	63%	0%	0%	0%	0%	0%	100%
% Rock|Granular|Cohesive	0%	38%									63%								100%
Surface Class Count	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	4
Surface Class Percent	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	100%	0%	0%	0%	0%	0%	100%

Fig. 600-1 – Subgrade Stabilization



OVERRIDE TABLE

Calculated Average	New Values	Check to Override
4.20	0.50	☐ HP
7.50	6.00	☐ N60L

Average HP

Average N_{60L}

RAMP G

OHIO DEPARTMENT OF TRANSPORTATION

OFFICE OF GEOTECHNICAL ENGINEERING

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HAS-22-15.11
113440

Ramp G

NEAS, Inc.

Prepared By: Derar M. Tarawneh
Date prepared: Tuesday, September 19, 2023

Chunmei (Melinda) He, Ph.D., P.E.
2800 Corporate Exchange Drive
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NO. OF BORINGS: 4

OHIO DEPARTMENT OF TRANSPORTATION

Subgrade Analysis

V. 14.6 2/11/2022

#	Boring ID	Alignment	Station	Offset	Dir	Drill Rig	ER	Boring EL.	Proposed Subgrade EL	Cut Fill
1	B-033-0-23	RAMP G	6+17	34	LT.	CME 55T	63	1226.6	1224.5	2.1 C
2	B-114-0-23	Ramp G	11+57	5	RT.	CME 45B	73	1215.1	1213.9	1.1 C
3	B-113-0-23	Ramp G	15+61	22	LT.	CME 45B	73	1218.2	1216.4	1.8 C
4	B-112-0-23	Ramp G	19+13	3	RT.	CME 55T	63	1214.6	1213.7	0.9 C

OHIO DEPARTMENT OF TRANSPORTATION

Subgrade Analysis

V. 14.6 2/11/2022

#	Boring	Sample	Sample Depth		Subgrade Depth		Standard Penetration		HP (tsf)	Physical Characteristics						Moisture		Ohio DOT		Sulfate Content (ppm)	Problem		Excavate and Replace (Item 204)		Recommendation (Enter depth in inches)
			From	To	From	To	N_{60}	N_{60L}		LL	PL	PI	% Silt	% Clay	P200	M_C	M_{OPT}	Class	GI		Unsuitable	Unstable	Unsuitable	Unstable	
1	B	SS-1	1.5	3.0	-0.6	0.9	6		4.5							16	16	A-6b	16			N_{60}		**18"**	
	033-0	SS-2	3.0	4.5	0.9	2.4	7		4.25	40	22	18	36	36	72	15	17	A-6b	11	2500		N_{60}		**15"**	
	23	SS-3	4.5	6.0	2.4	3.9	10		4.25	39	22	17	26	31	57	14	17	A-6b	7						
		SS-4	6.0	7.5	3.9	5.4	12	6	4.25							15	16	A-6b	16						
2	B	SS-1	1.5	3.0	0.4	1.9	44			NP	NP	NP	37	20	57	9	11	A-4a	4	1513					
	114-0	SS-2	3.0	4.5	1.9	3.4	34									10	10	A-4a	8						
	23	SS-3	4.5	6.0	3.4	4.9	22		4.25	32	20	12	29	30	59	14	15	A-6a	6						
		SS-4	6.0	7.5	4.9	6.4	25	22	4.25							13	14	A-6a	10						
3	B	SS-1	1.5	3.0	-0.3	1.2	5		4.25	27	19	8	39	22	61	9	14	A-4a	5	300		N_{60}		**21"**	
	113-0	SS-2	3.0	4.5	1.2	2.7	6		4	32	21	11	47	31	78	17	16	A-6a	8			N_{60}			
	23	SS-3	4.5	6.0	2.7	4.2	11		4.25							15	10	A-4a	8						
		SS-4	6.0	7.5	4.2	5.7	12	5	3.75							20	14	A-6a	10						
4	B	SS-1	1.5	3.0	0.6	2.1	7		4.5	25	18	7	30	16	46	13	13	A-4a	2	40		N_{60}		**15"**	
	112-0	SS-2	3.0	4.5	2.1	3.6	21		4.5							14	10	A-4a	8						
	23	SS-3	4.5	6.0	3.6	5.1	26		4.5	33	23	10	59	27	86	12	18	A-4b	8						
		SS-4	6.0	7.5	5.1	6.6	32	7	4.5							10	10	A-4b							

OHIO DEPARTMENT OF TRANSPORTATION

Subgrade Analysis

V. 14.6 2/11/2022

PID: 113440

County-Route-Section: HAS-22-15.11
No. of Borings: 4

Geotechnical Consultant: NEAS, Inc.
Prepared By: Derar M. Tarawneh
Date prepared: 9/19/2023

Chemical Stabilization Options		
320	Rubblize & Roll	No
206	Cement Stabilization	Option
	Lime Stabilization	No
206	Depth	14"

Excavate and Replace Stabilization Options	
Global Geotextile Average(N60L):	12"
Average(HP):	0"
Global Geogrid Average(N60L):	0"
Average(HP):	0"

Design CBR	6

% Samples within 6 feet of subgrade			
$N_{60} \leq 5$	6%	HP ≤ 0.5	0%
$N_{60} < 12$	44%	0.5 < HP ≤ 1	0%
$12 \leq N_{60} < 15$	13%	1 < HP ≤ 2	0%
$N_{60} \geq 20$	44%	HP > 2	88%
M+	0%		
Rock	0%		
Unsuitable	13%		

Excavate and Replace at Surface	
Average	0"
Maximum	0"
Minimum	0"

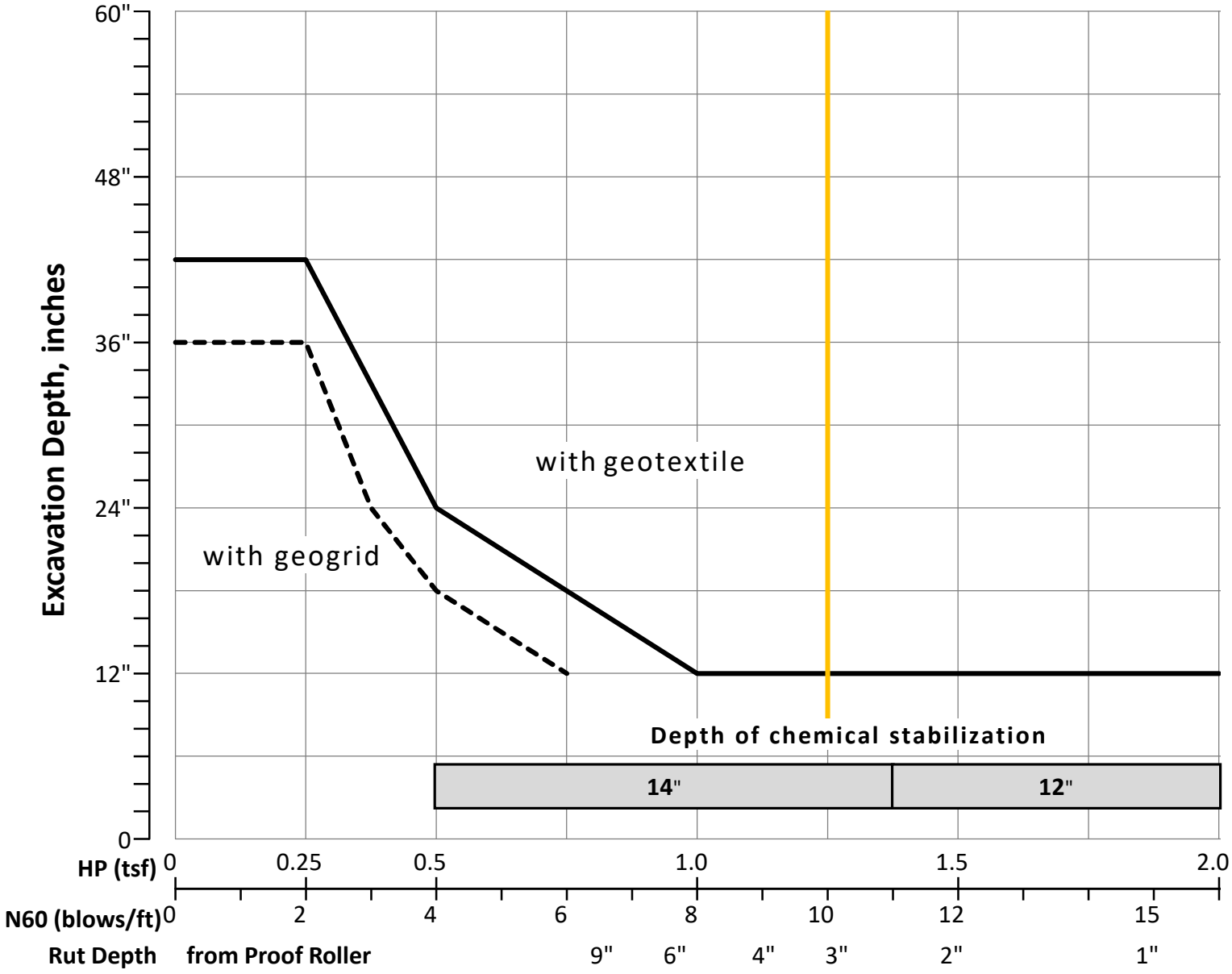
% Proposed Subgrade Surface	
Unstable & Unsuitable	50%
Unstable	50%
Unsuitable	0%

	N_{60}	N_{60L}	HP	LL	PL	PI	Silt	Clay	P 200	M_C	M_{OPT}	GI
Average	18	10	4.29	33	21	12	38	27	65	14	14	8
Maximum	44	22	4.50	40	23	18	59	36	86	20	18	16
Minimum	5	5	3.75	25	18	7	26	16	46	9	10	2

Classification Counts by Sample

ODOT Class	Rock	A-1-a	A-1-b	A-2-4	A-2-5	A-2-6	A-2-7	A-3	A-3a	A-4a	A-4b	A-5	A-6a	A-6b	A-7-5	A-7-6	A-8a	A-8b	Totals
Count	0	0	0	0	0	0	0	0	0	6	2	0	4	4	0	0	0	0	16
Percent	0%	0%	0%	0%	0%	0%	0%	0%	0%	38%	13%	0%	25%	25%	0%	0%	0%	0%	100%
% Rock|Granular|Cohesive	0%	38%									63%								100%
Surface Class Count	0	0	0	0	0	0	0	0	0	6	0	0	1	3	0	0	0	0	10
Surface Class Percent	0%	0%	0%	0%	0%	0%	0%	0%	0%	60%	0%	0%	10%	30%	0%	0%	0%	0%	100%

Fig. 600-1 – Subgrade Stabilization



OVERRIDE TABLE

Calculated Average	New Values	Check to Override
4.29	0.50	☐ HP
10.00	6.00	☐ N60L

Average HP
Average N_{60L}

RAMP H

OHIO DEPARTMENT OF TRANSPORTATION

OFFICE OF GEOTECHNICAL ENGINEERING

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Geotechnical Design Manual Section 600

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HAS-22-15.11
113440

Ramp H

NEAS, Inc.

Prepared By:	**Derar M. Tarawneh**
Date prepared:	**Tuesday, September 19, 2023**

Chunmei (Melinda) He, Ph.D., P.E.
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Suite 240
Columbus, OH 43231
614.714.0299 Ext 111
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NO. OF BORINGS: **1**

OHIO DEPARTMENT OF TRANSPORTATION

Subgrade Analysis

V. 14.6 2/11/2022

#	Boring ID	Alignment	Station	Offset	Dir	Drill Rig	ER	Boring EL.	Proposed Subgrade EL	Cut Fill
1	B-115-0-23	Ramp H	3+75	7	LT.	CME 45B	73	1207.6	1205.6	2.0 C

OHIO DEPARTMENT OF TRANSPORTATION

Subgrade Analysis

V. 14.6 2/11/2022

#	Boring	Sample	Sample Depth		Subgrade Depth		Standard Penetration		HP (tsf)	Physical Characteristics						Moisture		Ohio DOT		Sulfate Content (ppm)	Problem		Excavate and Replace (Item 204)		Recommendation (Enter depth in inches)
			From	To	From	To	N_{60}	N_{60L}		LL	PL	PI	% Silt	% Clay	P200	M_C	M_{OPT}	Class	GI		Unsuitable	Unstable	Unsuitable	Unstable	
1	B	SS-1	1.5	3.0	-0.5	1.0	29		4.5	33	21	12	31	32	63	12	16	A-6a	6	840					
	115-0	SS-2	3.0	4.5	1.0	2.5	24		4	30	19	11	32	31	63	11	14	A-6a	6						
	23	SS-3	4.5	6.0	2.5	4.0	17		4							13	14	A-6a	10						
		SS-4	6.0	7.5	4.0	5.5	19	17	3.75							11	14	A-6a	10						

OHIO DEPARTMENT OF TRANSPORTATION

Subgrade Analysis

V. 14.6 2/11/2022

PID: 113440

County-Route-Section: HAS-22-15.11
No. of Borings: 1

Geotechnical Consultant: NEAS, Inc.
Prepared By: Derar M. Tarawneh
Date prepared: 9/19/2023

Chemical Stabilization Options		
320	Rubblize & Roll	Option
206	Cement Stabilization	Option
	Lime Stabilization	No
206	Depth	NA

Excavate and Replace Stabilization Options	
Global Geotextile Average(N60L): Average(HP):	0" 0"
Global Geogrid Average(N60L): Average(HP):	0" 0"

Design CBR	7

% Samples within 6 feet of subgrade			
$N_{60} \leq 5$	0%	HP ≤ 0.5	0%
$N_{60} < 12$	0%	0.5 < HP ≤ 1	0%
$12 \leq N_{60} < 15$	0%	1 < HP ≤ 2	0%
$N_{60} \geq 20$	50%	HP > 2	100%
M+	0%		
Rock	0%		
Unsuitable	0%		

Excavate and Replace at Surface	
Average	0"
Maximum	0"
Minimum	0"

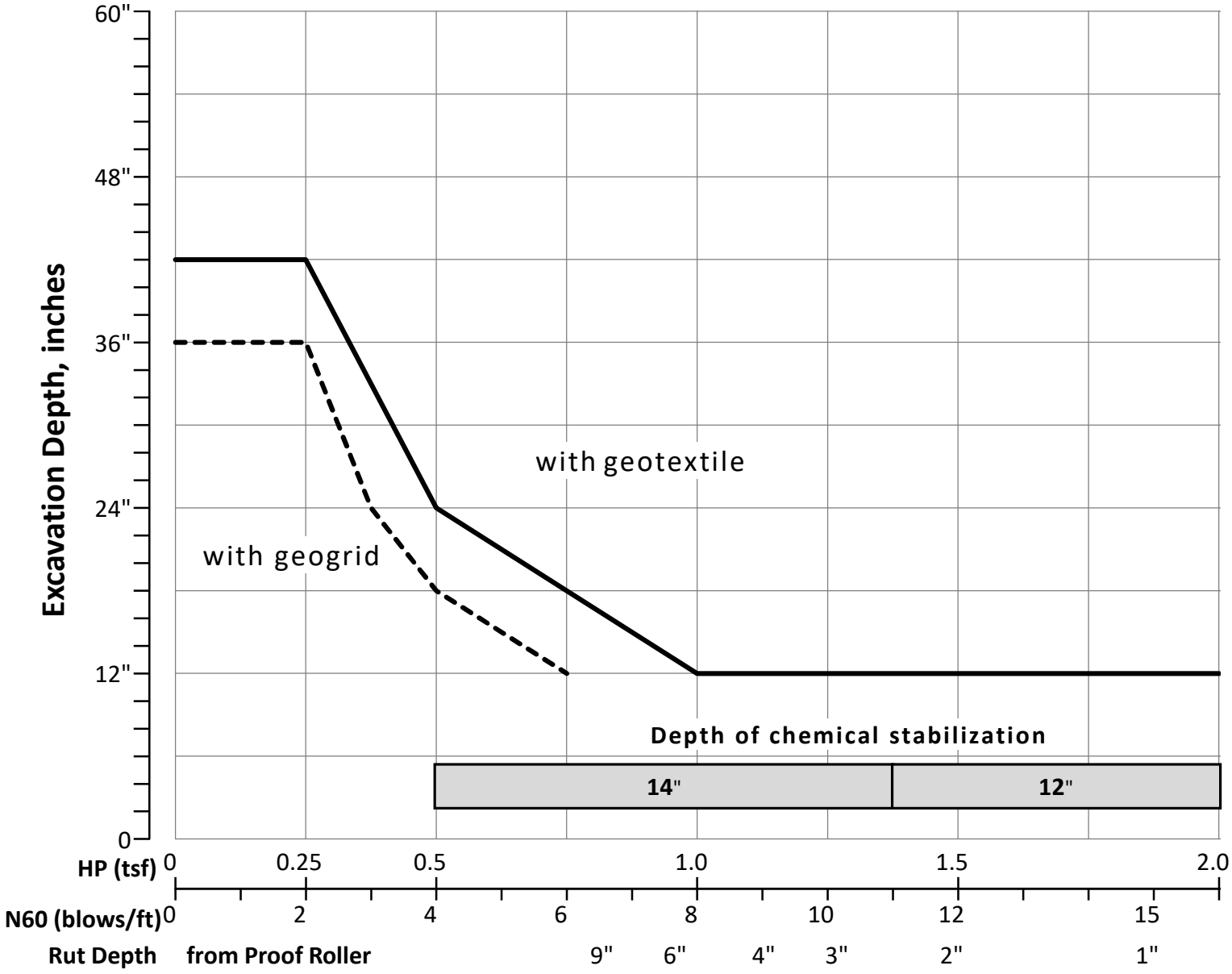
% Proposed Subgrade Surface	
Unstable & Unsuitable	0%
Unstable	0%
Unsuitable	0%

	N_{60}	N_{60L}	HP	LL	PL	PI	Silt	Clay	P 200	M_C	M_{OPT}	GI
Average	22	17	4.06	32	20	12	32	32	63	12	15	8
Maximum	29	17	4.50	33	21	12	32	32	63	13	16	10
Minimum	17	17	3.75	30	19	11	31	31	63	11	14	6

Classification Counts by Sample

ODOT Class	Rock	A-1-a	A-1-b	A-2-4	A-2-5	A-2-6	A-2-7	A-3	A-3a	A-4a	A-4b	A-5	A-6a	A-6b	A-7-5	A-7-6	A-8a	A-8b	Totals
Count	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	4
Percent	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	100%	0%	0%	0%	0%	0%	100%
% Rock|Granular|Cohesive	0%	0%									100%								100%
Surface Class Count	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	3
Surface Class Percent	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	100%	0%	0%	0%	0%	0%	100%

Fig. 600-1 – Subgrade Stabilization



OVERRIDE TABLE

Calculated Average	New Values	Check to Override
4.06	0.50	☐ HP
17.00	6.00	☐ N60L

Average HP
Average N_{60L}

HAS-22-17.53 L&R

Objective: **To estimate Drilled Shaft Tip Resistance in Rock. Assume rock below the base of shaft to a depth of 2D is intact or tightly jointed, and the socket length is 1.5D or longer (D is diameter of socket).**

Method: **In accordance with ODOT GDM, 2024, [Sect. 1306.4.2] and LRFD Bridge Design Specifications, 9th Ed., 2020, [Sect. 10.8.3.5.4 and 10.4.6.4].**

Givens:

Rock Parameters:

$q_u := 10000\ psi$ — Uniaxial Compressive Strength of Rock Core

Geometry:

$D := 3\ ft$ — Diameter of Drilled Shaft

$D_R := D = 3\ ft$ — Diameter of Rock Socket = Diameter of Drilled Shaft

Tip Resistance Calculation:

$q_p := 2.5 \cdot q_u$ $\quad q_p = 25000\ psi$ — Unfactored unit tip resistance, LRFD [Equ. 10.8.3.5.4c-1]

$q_b := \pi \cdot \left(\frac{D_R}{2}\right)^2 \cdot q_p$ $\quad q_b = 25446900.5\ lbf$ — Nominal Tip Resistance

$\phi_{st} := 0.50$ — Tip Resistance Factor in Rock LRFD [Sect. 10.5.5.2.4-1]

$q_{b_F} := \phi_{st} \cdot q_b$ $\quad q_{b_F} = 12723.5\ kip$ — Factored Tip Resistance

Created with PTC Mathcad Express. See www.mathcad.com for more information.

Objective: **To estimate Drilled Shaft Tip Resistance in Rock. Assume rock below the base of shaft to a depth of 2D is intact or tightly jointed, and the socket length is 1.5D or longer (D is diameter of socket).**

Method: **In accordance with ODOT GDM, 2024, [Sect. 1306.4.2] and LRFD Bridge Design Specifications, 9th Ed., 2020, [Sect. 10.8.3.5.4 and 10.4.6.4].**

Givens:

Rock Parameters:

$q_u := 1395\ psi$ — Uniaxial Compressive Strength of Rock Core

Geometry:

$D := 3\ ft$ — Diameter of Drilled Shaft

$D_R := D = 3\ ft$ — Diameter of Rock Socket = Diameter of Drilled Shaft

Tip Resistance Calculation:

$q_p := 2.5 \cdot q_u$ $\quad q_p = 3487.5\ psi$ — Unfactored unit tip resistance, LRFD [Equ. 10.8.3.5.4c-1]

$q_b := \pi \cdot \left(\frac{D_R}{2}\right)^2 \cdot q_p$ $\quad q_b = 3549842.6\ lbf$ — Nominal Tip Resistance

$\phi_{st} := 0.50$ — Tip Resistance Factor in Rock LRFD [Sect. 10.5.5.2.4-1]

$q_{b_F} := \phi_{st} \cdot q_b$ $\quad q_{b_F} = 1774.9\ kip$ — Factored Tip Resistance

Created with PTC Mathcad Express. See www.mathcad.com for more information.

Objective: **To estimate Drilled Shaft Tip Resistance in Rock. Assume rock below the base of shaft to a depth of 2D is intact or tightly jointed, and the socket length is 1.5D or longer (D is diameter of socket).**

Method: **In accordance with ODOT GDM, 2024, [Sect. 1306.4.2] and LRFD Bridge Design Specifications, 9th Ed., 2020, [Sect. 10.8.3.5.4 and 10.4.6.4].**

Givens:

Rock Parameters:

$q_u := 1102\ psi$ — Uniaxial Compressive Strength of Rock Core

Geometry:

$D := 3\ ft$ — Diameter of Drilled Shaft

$D_R := D = 3\ ft$ — Diameter of Rock Socket = Diameter of Drilled Shaft

Tip Resistance Calculation:

$q_p := 2.5 \cdot q_u$ $\quad q_p = 2755\ psi$ — Unfactored unit tip resistance, LRFD [Equ. 10.8.3.5.4c-1]

$q_b := \pi \cdot \left(\frac{D_R}{2}\right)^2 \cdot q_p$ $\quad q_b = 2804248.4\ lbf$ — Nominal Tip Resistance

$\phi_{st} := 0.50$ — Tip Resistance Factor in Rock LRFD [Sect. 10.5.5.2.4-1]

$q_{b_F} := \phi_{st} \cdot q_b$ $\quad q_{b_F} = 1402.1\ kip$ — Factored Tip Resistance

Created with PTC Mathcad Express. See www.mathcad.com for more information.

Objective: **To estimate Drilled Shaft Tip Resistance in Rock. Assume rock below the base of shaft to a depth of 2D is intact or tightly jointed, and the socket length is 1.5D or longer (D is diameter of socket).**

Method: **In accordance with ODOT GDM, 2024, [Sect. 1306.4.2] and LRFD Bridge Design Specifications, 9th Ed., 2020, [Sect. 10.8.3.5.4 and 10.4.6.4].**

Givens:

Rock Parameters:

$q_u := 10000\ psi$ — Uniaxial Compressive Strength of Rock Core

Geometry:

$D := 3\ ft$ — Diameter of Drilled Shaft

$D_R := D = 3\ ft$ — Diameter of Rock Socket = Diameter of Drilled Shaft

Tip Resistance Calculation:

$q_p := 2.5 \cdot q_u$ $\quad q_p = 25000\ psi$ — Unfactored unit tip resistance, LRFD [Equ. 10.8.3.5.4c-1]

$q_b := \pi \cdot \left(\frac{D_R}{2}\right)^2 \cdot q_p$ $\quad q_b = 25446900.5\ lbf$ — Nominal Tip Resistance

$\phi_{st} := 0.50$ — Tip Resistance Factor in Rock LRFD [Sect. 10.5.5.2.4-1]

$q_{b_F} := \phi_{st} \cdot q_b$ $\quad q_{b_F} = 12723.5\ kip$ — Factored Tip Resistance

Created with PTC Mathcad Express. See www.mathcad.com for more information.

HAS-22-17.53 L Bridge

COMPASS INFRASTRUCTURE GROUP

JOB:	10059	PID:	113340
CALCULATED BY:	CDH	DATE:	11/11/2025
CHECKED BY:	CCJ	DATE:	11/11/2025
PROJECT:	HAS-22 RR BRIDGES		
DESCRIPTION:	BEARING SEAT LOAD CALCULATION		

Bearing Level Loading Summary (No Abutment Self-Weight)						
Bridge Number	Substructure Location	Service		Thermal Movement (in)	Strength	
		Vertical (kips)	Lateral (kips)		Vertical (kips)	Lateral (kips)
HAS-22-17.53L	R.A.	212.15	15.82	0.48	295.89	19.12
	F.A.	218.60	15.82	0.48	304.02	19.12
HAS-22-17.53R	R.A.	212.15	15.82	0.48	295.89	19.12
	F.A.	212.15	15.82	0.48	295.89	19.12
HAS-250-19.12	R.A.	177.14	15.89	0.38	247.09	19.50
	F.A.	177.14	15.89	0.38	247.27	19.50

Note: Loading is given at the bearing seat level without consideration of the abutment stem/footing self-weight. Lateral Earth Pressure and Live Load Surcharge loads below the bearing seat level are excluded from the loads listed above.
All loads noted as excluded above should be included in the Lpile Model for complete analysis.

Bearing Level Loading Summary (Abutment Self-Weight Included)						
Bridge Number	Substructure Location	Service		Thermal Movement (in)	Strength	
		Vertical (kips)	Lateral (kips)		Vertical (kips)	Lateral (kips)
HAS-22-17.53L	R.A.	268.55	15.82	0.48	366.39	19.12
	F.A.	280.75	15.82	0.48	381.70	19.12
HAS-22-17.53R	R.A.	268.64	15.82	0.48	366.50	19.12
	F.A.	268.70	15.82	0.48	366.58	19.12
HAS-250-19.12	R.A.	239.53	15.89	0.38	325.07	19.50
	F.A.	240.79	15.89	0.38	326.83	19.50

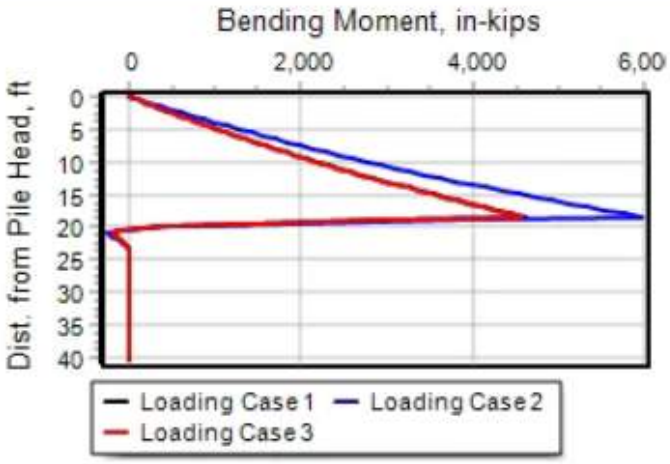
Note: Loading is given at the bearing seat level. Lateral Earth Pressure and Live Load Surcharge loads below the bearing seat level are excluded from the loads listed above.
All loads noted as excluded above should be included in the Lpile Model for complete analysis.

Distributed Lateral Loading Summary (lb/in)					
Bridge Number	Substructure Location	Service		Strength	
		Bearing Seat	Top of Rock	Bearing Seat	Top of Rock
HAS-22-17.53L	R.A.	24.6	73.4	39.0	112.2
	F.A.	27.3	72.2	43.1	110.4
HAS-22-17.53R	R.A.	24.6	59.7	39.0	91.6
	F.A.	24.6	61.6	39.0	94.5
HAS-250-19.12	R.A.	19.8	37.1	31.8	57.7
	F.A.	19.7	36.3	31.7	56.5

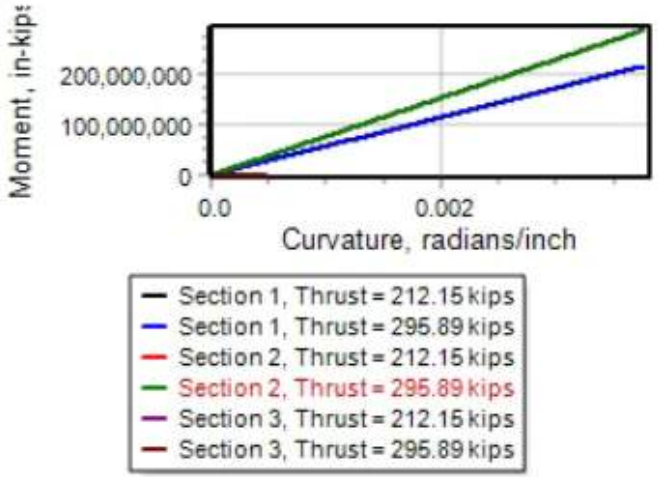
Note: Lateral Loads given are listed in lb/in per foot width along the vertical length of the abutment/shaft. Loads assume a trapezoidal distribution from the bearing seat level for EH and a uniform surcharge applied from the bearing seat level to the top of rock for LS. LS uses interpolated values based on abutment height.

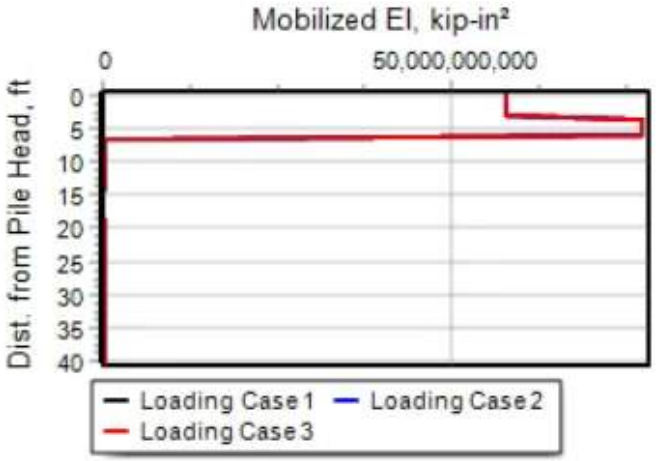
Results for HAS-22-17.53L RA Shaft 1 B-141.lp12d

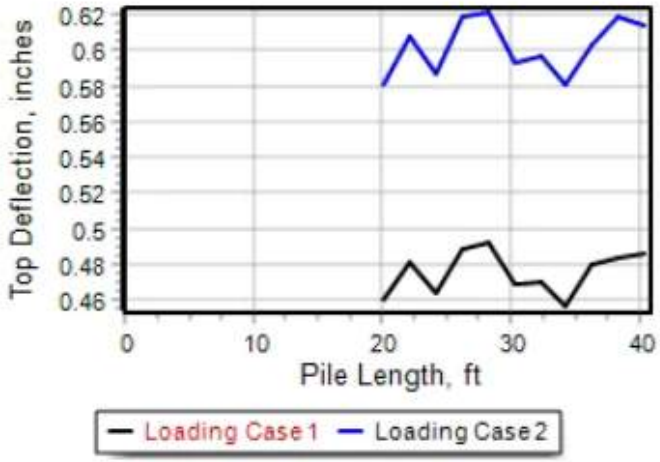












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LPile Version 2022-12.013

License ID : 500128183
License Type : (Single User License)

Analysis of Individual Piles and Drilled Shafts
Subjected to Lateral Loading Using the p-y Method
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This software is licensed for exclusive use by:
Barr Engineering Inc.
Columbus, OH, USA

==

This model was prepared by:
Zmankoci

Files Used for Analysis

Path to file locations:
\23-0011 113440 HAS-22-15.25\113440\geotechnical\bridges\XXX-YY-ZZ.ZZ (Crossing)\Analysis\Lpile\New folder\

Name of input data file:
HAS-22-17.53L RA Shaft 1 B-141.lp12d

Name of output report file:
HAS-22-17.53L RA Shaft 1 B-141.lp12o

Name of plot output file:
HAS-22-17.53L RA Shaft 1 B-141.lp12p

Name of runtime message file:
HAS-22-17.53L RA Shaft 1 B-141.lp12r

Date and Time of Analysis

Date: November 18, 2025 Time: 11:18:07

Problem Title

Project Name: HAS-22-17.53L

Job Number: 10059

Client: ODOT

Engineer: ZM

Description: HAS-22-17.53L Rear Abut B-141

```
--------------------------------------------------------------------------------
                         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                           =           81

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)
 - 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 = 40.363 ft
Depth of ground surface below top of pile = 18.1630 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	36.0000
2	3.463	36.0000
3	3.463	48.0000
4	6.463	48.0000
5	6.463	36.0000
6	40.363	36.0000

Input Structural Properties for Pile Sections:

Pile Section No. 1:

Section 1 is an elastic pile
Cross-sectional shape = rectangular
Length of section = 3.463000 ft
Width of top of section = 36.000000 in
Width of bottom of section = 36.000000 in
Top Section Depth = 175.000000 in
Bottom Section Depth = 175.000000 in

```
   Top Area                                          =        6300. sq. in
   Bottom Area                                       =        6300. sq. in
   Moment of Inertia at Top                          =    16078125. in^4
   Moment of Inertia at Bottom                       =    16078125. in^4
   Elastic Modulus                                   =     3604996. psi

Pile Section No. 2:

   Section 2 is an elastic pile
   Cross-sectional shape                             =     rectangular
   Length of section                                 =     3.000000 ft
   Width of top of section                           =    48.000000 in
   Width of bottom of section                        =    48.000000 in
   Top Section Depth                                 =   175.000000 in
   Bottom Section Depth                              =   175.000000 in
   Top Area                                          =        8400. sq. in
   Bottom Area                                       =        8400. sq. in
   Moment of Inertia at Top                          =    21437500. in^4
   Moment of Inertia at Bottom                       =    21437500. in^4
   Elastic Modulus                                   =     3604996. psi

Pile Section No. 3:

   Section 3 is a round drilled shaft, bored pile, or CIDH pile
   Length of section                                 =    33.900000 ft
   Shaft Diameter                                    =    36.000000 in



--------------------------------------------------------------------------------
                      Soil and Rock Layering Information
--------------------------------------------------------------------------------

The soil profile is modelled using 5 layers

Layer 1 is weak rock, p-y criteria by Reese, 1997

   Distance from top of pile to top of layer         =    18.163000 ft
```

Distance from top of pile to bottom of layer	=	21.063000 ft
Effective unit weight at top of layer	=	139.000000 pcf
Effective unit weight at bottom of layer	=	139.000000 pcf
Uniaxial compressive strength at top of layer	=	7500. psi
Uniaxial compressive strength at bottom of layer	=	7500. psi
Initial modulus of rock at top of layer	=	680000. psi
Initial modulus of rock at bottom of layer	=	680000. psi
RQD of rock at top of layer	=	25.000000 %
RQD of rock at bottom of layer	=	25.000000 %
k rm of rock at top of layer	=	0.0000500
k rm of rock at bottom of layer	=	0.0000500

Layer 2 is weak rock, p-y criteria by Reese, 1997

Distance from top of pile to top of layer	=	21.063000 ft
Distance from top of pile to bottom of layer	=	26.863000 ft
Effective unit weight at top of layer	=	139.000000 pcf
Effective unit weight at bottom of layer	=	139.000000 pcf
Uniaxial compressive strength at top of layer	=	748.000000 psi
Uniaxial compressive strength at bottom of layer	=	748.000000 psi
Initial modulus of rock at top of layer	=	67000. psi
Initial modulus of rock at bottom of layer	=	67000. psi
RQD of rock at top of layer	=	46.000000 %
RQD of rock at bottom of layer	=	46.000000 %
k rm of rock at top of layer	=	0.0002500
k rm of rock at bottom of layer	=	0.0002500

Layer 3 is weak rock, p-y criteria by Reese, 1997

Distance from top of pile to top of layer	=	26.863000 ft
Distance from top of pile to bottom of layer	=	35.063000 ft
Effective unit weight at top of layer	=	138.800000 pcf
Effective unit weight at bottom of layer	=	138.800000 pcf
Uniaxial compressive strength at top of layer	=	1125. psi
Uniaxial compressive strength at bottom of layer	=	1125. psi
Initial modulus of rock at top of layer	=	100000. psi

Initial modulus of rock at bottom of layer	=	100000.	psi
RQD of rock at top of layer	=	9.000000	%
RQD of rock at bottom of layer	=	9.000000	%
k rm of rock at top of layer	=	0.0001600	
k rm of rock at bottom of layer	=	0.0001600	

Layer 4 is weak rock, p-y criteria by Reese, 1997

Distance from top of pile to top of layer	=	35.063000	ft
Distance from top of pile to bottom of layer	=	36.663000	ft
Effective unit weight at top of layer	=	129.100000	pcf
Effective unit weight at bottom of layer	=	129.100000	pcf
Uniaxial compressive strength at top of layer	=	200.000000	psi
Uniaxial compressive strength at bottom of layer	=	200.000000	psi
Initial modulus of rock at top of layer	=	18000.	psi
Initial modulus of rock at bottom of layer	=	18000.	psi
RQD of rock at top of layer	=	10.000000	%
RQD of rock at bottom of layer	=	10.000000	%
k rm of rock at top of layer	=	0.0005000	
k rm of rock at bottom of layer	=	0.0005000	

Layer 5 is weak rock, p-y criteria by Reese, 1997

Distance from top of pile to top of layer	=	36.663000	ft
Distance from top of pile to bottom of layer	=	43.363000	ft
Effective unit weight at top of layer	=	150.400000	pcf
Effective unit weight at bottom of layer	=	150.400000	pcf
Uniaxial compressive strength at top of layer	=	10000.	psi
Uniaxial compressive strength at bottom of layer	=	10000.	psi
Initial modulus of rock at top of layer	=	900000.	psi
Initial modulus of rock at bottom of layer	=	900000.	psi
RQD of rock at top of layer	=	76.000000	%
RQD of rock at bottom of layer	=	76.000000	%
k rm of rock at top of layer	=	0.0000500	
k rm of rock at bottom of layer	=	0.0000500	

(Depth of the lowest soil layer extends 3.000 ft below the pile tip)

**** Warning - Possible Input Data Error ****

Values entered for effective unit weight of rock were outside the limits of
50 pcf to 150 pcf.

The maximum input value, in layer 4, for effective unit weight = 150.40 pcf

This data may be erroneous. Please check your data.

Summary of Input Soil Properties

Layer Num.	Soil Type Name (p-y Curve Type)	Layer Depth ft	Effective Unit Wt. pcf	Uniaxial qu psi	RQD %	E50 or krm	Rock Mass Modulus psi
1	Weak	18.1630	139.0000	7500.	25.0000	5.00E-05	680000.
	Rock	21.0630	139.0000	7500.	25.0000	5.00E-05	680000.
2	Weak	21.0630	139.0000	748.0000	46.0000	2.50E-04	67000.
	Rock	26.8630	139.0000	748.0000	46.0000	2.50E-04	67000.
3	Weak	26.8630	138.8000	1125.	9.0000	1.60E-04	100000.
	Rock	35.0630	138.8000	1125.	9.0000	1.60E-04	100000.
4	Weak	35.0630	129.1000	200.0000	10.0000	5.00E-04	18000.
	Rock	36.6630	129.1000	200.0000	10.0000	5.00E-04	18000.
5	Weak	36.6630	150.4000	10000.	76.0000	5.00E-05	900000.
	Rock	43.3630	150.4000	10000.	76.0000	5.00E-05	900000.

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	24.600
2	18.163	73.400

Distributed lateral load intensity for Load Case 2 defined using 2 points

Point No.	Depth X ft	Dist. Load lb/in
1	0.000	39.000
2	18.163	112.200

Distributed lateral load intensity for Load Case 3 defined using 2 points

Point No.	Depth X ft	Dist. Load lb/in
1	0.000	24.600
2	18.163	73.400

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 3

Load No.	Load Type	Condition 1	Condition 2	Axial Thrust Force, lbs	Compute Top y vs. Pile Length	Run Analysis
1	1	V = 15820. lbs	M = 0.0000 in-lbs	212150.	Yes	Yes
2	1	V = 19120. lbs	M = 0.0000 in-lbs	295890.	Yes	Yes
3	4	y = 0.480000 in	M = 0.0000 in-lbs	212150.	N.A.	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:

Moment-curvature properties were derived from elastic section properties

Pile Section No. 3:

Dimensions and Properties of Drilled Shaft (Bored Pile):

Length of Section	=	33.900000	ft
Shaft Diameter	=	36.000000	in
Concrete Cover Thickness (to edge of trans. reinf.)	=	3.000000	in
Number of Reinforcing Bars	=	10	bars
Yield Stress of Reinforcing Bars	=	60000.	psi
Modulus of Elasticity of Reinforcing Bars	=	29000000.	psi
Gross Area of Shaft	=	1018.	sq. in.
Total Area of Reinforcing Steel	=	10.000000	sq. in.
Area Ratio of Steel Reinforcement	=	0.98	percent
Edge-to-Edge Bar Spacing	=	7.407667	in
Maximum Concrete Aggregate Size	=	0.750000	in
Ratio of Bar Spacing to Aggregate Size	=	9.88	
Offset of Center of Rebar Cage from Center of Pile	=	0.0000	in
Transverse Reinforcement			
Type: Spiral			
Number of Transverse Reinf. (per spacing)	=	1	
Spacing of Transverse Reinf.	=	5.000000	in
Yield Stress of Transverse Reinf.	=	60000.	psi
Diameter of Transverse Reinf.	=	0.625000	in

Axial Structural Capacities:

Nom. Axial Structural Capacity = 0.85 Fc Ac + Fy As = 4026.778 kips
Tensile Load for Cracking of Concrete = -452.643 kips
Nominal Axial Tensile Capacity = -600.000 kips

Reinforcing Bar Dimensions and Positions Used in Computations:

Bar Number	Bar Diam. inches	Bar Area sq. in.	X inches	Y inches
1	1.128000	1.000000	13.811000	0.00000
2	1.128000	1.000000	11.173334	8.117902
3	1.128000	1.000000	4.267834	13.135042
4	1.128000	1.000000	-4.26783	13.135042
5	1.128000	1.000000	-11.17333	8.117902
6	1.128000	1.000000	-13.81100	0.00000
7	1.128000	1.000000	-11.17333	-8.11790
8	1.128000	1.000000	-4.26783	-13.13504
9	1.128000	1.000000	4.267834	-13.13504
10	1.128000	1.000000	11.173334	-8.11790

NOTE: The positions of the above rebars were computed by LPile

Minimum spacing between any two bars not equal to zero = 7.408 inches
between bars 5 and 6.

Ratio of bar spacing to maximum aggregate size = 9.88

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 = 2

Number	Axial Thrust Force kips
1	212.150
2	295.890

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 = 212.150 kips

Bending Curvature	Bending Moment	Bending Stiffness	Depth to N Axis	Max Comp Strain	Max Tens Strain	Max Conc Stress	Max Steel Stress	Run Msg
rad/in.	in-kip	kip-in2	in	in/in	in/in	ksi	ksi	

6.25000E-07	227.9555036	364728806.	93.2551693	0.00005828	0.00003578	0.2429131
1.6152124						
0.00000125	455.9077025	364726162.	55.6468591	0.00006956	0.00002456	0.2886513
1.8671236						
0.00000188	683.8488634	364719394.	43.1193201	0.00008085	0.00001335	0.3341747
2.1195005						
0.00000250	911.7734684	364709387.	36.8619742	0.00009215	0.00000215	0.3794820
2.3723431						
0.00000313	1140.	364687509.	33.1125893	0.0001035	-0.00000902	0.4245704
2.6256409						
0.00000375	1367.	364592768.	30.6162565	0.0001148	-0.00002019	0.4694250
2.8792929						
0.00000438	1594.	364397783.	28.8350253	0.0001262	-0.00003135	0.5140288
3.1331812						
0.00000500	1821.	364112796.	27.5002200	0.0001375	-0.00004250	0.5583710
3.3872318						
0.00000563	2046.	363754812.	26.4627501	0.0001489	-0.00005365	0.6024450
3.6413986						
0.00000625	2271.	363339324.	25.6332574	0.0001602	-0.00006479	0.6462468
3.8956529						
0.00000688	2495.	362878714.	24.9549300	0.0001716	-0.00007593	0.6897735
4.1499767						
0.00000750	2718.	362382343.	24.3899181	0.0001829	-0.00008708	0.7330235
4.4043572						
0.00000813	2940.	361857324.	23.9120344	0.0001943	-0.00009821	0.7759954
4.6587856						
0.00000875	2940.	336010372.	21.2352856	0.0001858	-0.000129	0.7432096
4.3379355 C						
0.00000938	2940.	313609681.	20.6675833	0.0001938	-0.000144	0.7731326
4.4934367 C						
0.00001000	2940.	294009076.	20.1551246	0.0002016	-0.000158	0.8023233
4.6443928 C						
0.00001063	2940.	276714424.	19.6915810	0.0002092	-0.000173	0.8309237
4.7918337 C						
0.00001125	2940.	261341400.	19.2692909	0.0002168	-0.000188	0.8589625
4.9359321 C						

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   0.00001188         2940.    247586590.    18.8819022     0.0002242     -0.000203     0.8864525
5.0767425 C
   0.00001250         2940.    235207260.    18.5255957     0.0002316     -0.000218     0.9134653
5.2147784 C
   0.00001313         2940.    224006915.    18.1965393     0.0002388     -0.000234     0.9400349
5.3502703 C
   0.00001375         2940.    213824782.    17.8913892     0.0002460     -0.000249     0.9661856
-5.569976 C
   0.00001438         2940.    204528053.    17.6080366     0.0002531     -0.000264     0.9919716
-5.941287 C
   0.00001500         2940.    196006050.    17.3443090     0.0002602     -0.000280     1.0174294
-6.314326 C
   0.00001563         2940.    188165808.    17.0985890     0.0002672     -0.000295     1.0426031
-6.688764 C
   0.00001625         2940.    180928662.    16.8662640     0.0002741     -0.000311     1.0673452
-7.065797 C
   0.00001688         2940.    174227600.    16.6490681     0.0002810     -0.000327     1.0918564
-7.443847 C
   0.00001750         2940.    168005186.    16.4445403     0.0002878     -0.000342     1.1160856
-7.823341 C
   0.00001813         2984.    164638024.    16.2509525     0.0002945     -0.000358     1.1400079
-8.204497 C
   0.00001875         3032.    161713430.    16.0688539     0.0003013     -0.000374     1.1637358
-8.586422 C
   0.00001938         3079.    158939946.    15.8953849     0.0003080     -0.000390     1.1871476
-8.970118 C
   0.00002000         3126.    156324498.    15.7316047     0.0003146     -0.000405     1.2103861
-9.354439 C
   0.00002063         3173.    153842793.    15.5757060     0.0003212     -0.000421     1.2333722
-9.740043 C
   0.00002125         3219.    151486489.    15.4270985     0.0003278     -0.000437     1.2561333
-10.126720 C
   0.00002188         3265.    149259806.    15.2869548     0.0003344     -0.000453     1.2787848
-10.513525 C
   0.00002250         3310.    147123264.    15.1511727     0.0003409     -0.000469     1.3010807
-10.902510 C
   0.00002313         3355.    145100712.    15.0227080     0.0003474     -0.000485     1.3232971
-11.291392 C
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   0.00002375         3400.    143173416.    14.9003389     0.0003539     -0.000501     1.3453392
-11.680967 C
   0.00002438         3445.    141323712.    14.7818674     0.0003603     -0.000517     1.3671046
-12.072105 C
   0.00002563         3533.    137886934.    14.5620591     0.0003732     -0.000549     1.4103550
-12.854481 C
   0.00002688         3621.    134721349.    14.3577000     0.0003859     -0.000582     1.4527805
-13.640855 C
   0.00002813         3707.    131821776.    14.1703925     0.0003985     -0.000614     1.4947565
-14.428086 C
   0.00002938         3793.    129136479.    13.9954824     0.0004111     -0.000646     1.5360373
-15.218336 C
   0.00003063         3879.    126661116.    13.8344698     0.0004237     -0.000679     1.5769366
-16.008925 C
   0.00003188         3964.    124349990.    13.6824160     0.0004361     -0.000711     1.6171108
-16.802904 C
   0.00003313         4048.    122209609.    13.5422254     0.0004486     -0.000744     1.6569908
-17.596513 C
   0.00003438         4132.    120204429.    13.4096541     0.0004610     -0.000777     1.6962493
-18.392688 C
   0.00003563         4215.    118329047.    13.2854181     0.0004733     -0.000809     1.7350661
-19.189863 C
   0.00003688         4299.    116577604.    13.1699520     0.0004856     -0.000842     1.7735932
-19.986671 C
   0.00003813         4381.    114924104.    13.0596821     0.0004979     -0.000875     1.8115062
-20.786100 C
   0.00003938         4464.    113367685.    12.9557557     0.0005101     -0.000907     1.8490130
-21.586282 C
   0.00004063         4546.    111904222.    12.8585340     0.0005224     -0.000940     1.8862343
-22.386098 C
   0.00004188         4628.    110523334.    12.7669698     0.0005346     -0.000973     1.9231114
-23.186099 C
   0.00004313         4710.    109207938.    12.6783401     0.0005468     -0.001006     1.9593546
-23.989062 C
   0.00004438         4791.    107964128.    12.5949862     0.0005589     -0.001039     1.9953163
-24.791662 C
   0.00004563         4872.    106786013.    12.5164754     0.0005711     -0.001071     2.0309959
-25.593897 C
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   0.00004688        4953.    105668326.    12.4424215     0.0005832     -0.001104     2.0663923
-26.395764 C
   0.00004813        5034.    104599478.    12.3706997     0.0005953     -0.001137     2.1012549
-27.199745 C
   0.00004938        5114.    103579448.    12.3020791     0.0006074     -0.001170     2.1357233
-28.004496 C
   0.00005063        5195.    102607621.    12.2370913     0.0006195     -0.001203     2.1699123
-28.808880 C
   0.00005188        5275.    101680501.    12.1754809     0.0006316     -0.001236     2.2038212
-29.612894 C
   0.00005313        5355.    100794923.    12.1170107     0.0006437     -0.001269     2.2374491
-30.416536 C
   0.00005438        5435.     99948012.    12.0614652     0.0006558     -0.001302     2.2707951
-31.219806 C
   0.00005563        5514.     99130658.    12.0066471     0.0006679     -0.001335     2.3035510
-32.025927 C
   0.00005688        5593.     98347149.    11.9544108     0.0006799     -0.001368     2.3360206
-32.831763 C
   0.00005813        5673.     97595466.    11.9046445     0.0006920     -0.001401     2.3682116
-33.637222 C
   0.00005938        5752.     96873591.    11.8572090     0.0007040     -0.001433     2.4001233
-34.442302 C
   0.00006063        5831.     96179670.    11.8119336     0.0007161     -0.001466     2.4317547
-35.247002 C
   0.00006188        5910.     95512001.    11.7687006     0.0007282     -0.001499     2.4631050
-36.051318 C
   0.00006313        5989.     94869015.    11.7273898     0.0007403     -0.001532     2.4941733
-36.855250 C
   0.00006438        6067.     94247967.    11.6874039     0.0007524     -0.001565     2.5248771
-37.659715 C
   0.00006563        6146.     93646088.    11.6480636     0.0007644     -0.001598     2.5551199
-38.465825 C
   0.00006688        6224.     93065082.    11.6104018     0.0007764     -0.001631     2.5850837
-39.271543 C
   0.00006813        6302.     92503791.    11.5743211     0.0007885     -0.001664     2.6147673
-40.076867 C
   0.00006938        6380.     91961141.    11.5397372     0.0008006     -0.001697     2.6441701
-40.881795 C
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   0.00007063        6458.     91436135.    11.5065716     0.0008127     -0.001730     2.6732909
-41.686325 C
   0.00007188        6535.     90927845.    11.4747513     0.0008247     -0.001763     2.7021290
-42.490454 C
   0.00007313        6613.     90435404.    11.4442327     0.0008369     -0.001796     2.7306834
-43.294180 C
   0.00007438        6691.     89958007.    11.4149069     0.0008490     -0.001829     2.7589532
-44.097502 C
   0.00007938        6999.     88181827.    11.3072667     0.0008975     -0.001960     2.8689252
-47.309803 C
   0.00008438        7306.     86589210.    11.2123237     0.0009460     -0.002091     2.9737861
-50.522241 C
   0.00008938        7611.     85154325.    11.1306931     0.0009948     -0.002223     3.0740333
-53.727767 C
   0.00009438        7914.     83851669.    11.0602835     0.0010438     -0.002354     3.1696012
-56.926211 C
   0.00009938        8214.     82660654.    10.9994697     0.0010931     -0.002484     3.2604205
-60.000000 CY
    0.0001044        8462.     81077530.    10.9246375     0.0011403     -0.002617     3.3424226
-60.000000 CY
    0.0001094        8622.     78825782.    10.8230452     0.0011838     -0.002754     3.4136567
-60.000000 CY
    0.0001144        8779.     76758545.    10.7318935     0.0012275     -0.002890     3.4810808
-60.000000 CY
    0.0001194        8936.     74854939.    10.6500142     0.0012713     -0.003026     3.5446680
-60.000000 CY
    0.0001244        9091.     73090925.    10.5740205     0.0013151     -0.003162     3.6039857
-60.000000 CY
    0.0001294        9244.     71447696.    10.5038328     0.0013589     -0.003299     3.6591496
-60.000000 CY
    0.0001344        9352.     69598541.    10.4209766     0.0014003     -0.003437     3.7074324
-60.000000 CY
    0.0001394        9414.     67547207.    10.3248424     0.0014390     -0.003578     3.7491897
-60.000000 CY
    0.0001444        9472.     65608880.    10.2336693     0.0014775     -0.003720     3.7874938
-60.000000 CY
    0.0001494        9528.     63788664.    10.1461895     0.0015156     -0.003862     3.8223061
-60.000000 CY
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    0.0001544        9584.     62082418.    10.0654353     0.0015539     -0.004004     3.8541338
-60.000000 CY
    0.0001594        9639.     60479335.     9.9907300     0.0015923     -0.004145     3.8829392
-60.000000 CY
    0.0001644        9693.     58969922.     9.9196628     0.0016305     -0.004287     3.9086834
-60.000000 CY
    0.0001694        9746.     57541410.     9.8541486     0.0016690     -0.004428     3.9310847
-60.000000 CY
    0.0001744        9798.     56189155.     9.7917527     0.0017074     -0.004570     3.9503172
-60.000000 CY
    0.0001794        9849.     54908787.     9.7330971     0.0017459     -0.004712     3.9664760
-60.000000 CY
    0.0001844        9900.     53694382.     9.6785609     0.0017845     -0.004853     3.9795192
-60.000000 CY
    0.0001894        9950.     52540644.     9.6278368     0.0018233     -0.004994     3.9894034
-60.000000 CY
    0.0001944        9999.     51442820.     9.5806481     0.0018622     -0.005135     3.9960841
-60.000000 CY
    0.0001994       10048.     50396360.     9.5365366     0.0019013     -0.005276     3.9995131
-60.000000 CY
    0.0002044       10095.     49394303.     9.4929916     0.0019401     -0.005417     3.9964108
-60.000000 CY
    0.0002094       10141.     48436650.     9.4524985     0.0019791     -0.005558     3.9995405
-60.000000 CY
    0.0002144       10187.     47520145.     9.4148867     0.0020183     -0.005699     3.9958315
-60.000000 CY
    0.0002194       10232.     46642003.     9.3799437     0.0020577     -0.005840     3.9992412
-60.000000 CY
    0.0002244       10276.     45799931.     9.3474847     0.0020973     -0.005980     3.9971355
-60.000000 CY
    0.0002294       10316.     44975600.     9.3151843     0.0021367     -0.006121     3.9983239
-60.000000 CY
    0.0002344       10351.     44166377.     9.2822771     0.0021755     -0.006262     3.9999589
-60.000000 CY
    0.0002394       10378.     43353626.     9.2462653     0.0022133     -0.006404     3.9958571
-60.000000 CY
    0.0002444       10396.     42539773.     9.2072543     0.0022500     -0.006547     3.9988404
-60.000000 CY
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    0.0002494        10409.     41740731.     9.1667954     0.0022860     -0.006692     3.9999793
-60.000000 CY
    0.0002544        10418.     40953686.     9.1235427     0.0023208     -0.006837     3.9946271
-60.000000 CY
    0.0002594        10426.     40195875.     9.0823761     0.0023557     -0.006982     3.9978145
-60.000000 CY
    0.0002644        10434.     39466015.     9.0430571     0.0023908     -0.007127     3.9995966
-60.000000 CY
    0.0002694        10442.     38762320.     9.0058951     0.0024260     -0.007272     3.9980123
-60.000000 CY
    0.0002744        10449.     38083014.     8.9706544     0.0024613     -0.007416     3.9949556
-60.000000 CY
    0.0003044        10489.     34460331.     8.7878711     0.0026748     -0.008283     3.9987552
-60.000000 CY
    0.0003344        10519.     31459915.     8.6361607     0.0028877     -0.009150     3.9994780
-60.000000 CY
    0.0003644        10545.     28941139.     8.5196288     0.0031043     -0.010013     3.9991133
-60.000000 CYT
    0.0003944        10567.     26794426.     8.4236884     0.0033221     -0.010875     3.9966096
-60.000000 CYT
    0.0004244        10585.     24942084.     8.3398606     0.0035392     -0.011738     3.9879578
-60.000000 CYT
    0.0004544        10601.     23329960.     8.2736862     0.0037594     -0.012598     3.9999293
-60.000000 CYT
    0.0004844        10601.     21885008.     8.2553526     0.0039987     -0.013439     3.9949553
-60.000000 CYT


Axial Thrust Force =    295.890 kips

    Bending       Bending       Bending      Depth to      Max Comp      Max Tens      Max Conc      Max
Steel  Run
   Curvature      Moment       Stiffness      N Axis        Strain        Strain        Stress        Stress
   Msg
    rad/in.       in-kip        kip-in2         in           in/in         in/in          ksi           ksi

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  6.25000E-07   225.7927934    361268469.   123.4548576    0.00007716    0.00005466     0.3200951
2.1625818
   0.00000125   451.5831204    361266496.    70.7468899    0.00008843    0.00004343     0.3653606
2.4144998
   0.00000188   677.3623026    361259895.    53.1862148    0.00009972    0.00003222     0.4104112
2.6668879
   0.00000250   903.1247683    361249907.    44.4123631     0.0001110    0.00002103     0.4552456
2.9197463
   0.00000313        1129.    361236782.    39.1532413     0.0001224    0.00000985     0.4998625
3.1730750
   0.00000375        1355.    361220595.    35.6514849     0.0001337   -0.00000131     0.5442608
3.4268740
   0.00000438        1580.    361189699.    33.1537808     0.0001450   -0.00001245     0.5884366
3.6811235
   0.00000500        1806.    361104678.    31.2829824     0.0001564   -0.00002359     0.6323764
3.9357325
   0.00000563        2030.    360948199.    29.8295664     0.0001678   -0.00003471     0.6760673
4.1906105
   0.00000625        2255.    360721907.    28.6679661     0.0001792   -0.00004583     0.7195001
4.4456939
   0.00000688        2478.    360433299.    27.7165094     0.0001906   -0.00005695     0.7626682
4.7009367
   0.00000750        2701.    360091206.    26.9269732     0.0002020   -0.00006805     0.8055671
4.9563067
   0.00000813        2923.    359703917.    26.2588515     0.0002134   -0.00007915     0.8481934
5.2117811
   0.00000875        3144.    359278644.    25.6861806     0.0002248   -0.00009025     0.8905447
5.4673434
   0.00000938        3364.    358821423.    25.1900476     0.0002362     -0.000101     0.9326193
5.7229817
   0.00001000        3364.    336395084.    23.1041703     0.0002310     -0.000129     0.9131738
5.4996094 C
   0.00001063        3364.    316607138.    22.5447011     0.0002395     -0.000143     0.9443334
5.6709870 C
   0.00001125        3364.    299017852.    22.0341597     0.0002479     -0.000157     0.9747761
5.8379696 C
   0.00001188        3364.    283280071.    21.5662631     0.0002561     -0.000171     1.0045899
6.0011875 C
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0.00001250	3364.	269116067.	21.1359243	0.0002642	-0.000186	1.0338316
6.1610347 C						
0.00001313	3364.	256301016.	20.7380740	0.0002722	-0.000200	1.0625275
6.3176714 C						
0.00001375	3364.	244650970.	20.3688620	0.0002801	-0.000215	1.0907058
6.4712766 C						
0.00001438	3364.	234013971.	20.0249514	0.0002879	-0.000230	1.1183968
6.6220495 C						
0.00001500	3364.	224263389.	19.7036901	0.0002956	-0.000244	1.1456327
6.7702108 C						
0.00001563	3364.	215292854.	19.4029014	0.0003032	-0.000259	1.1724483
6.9160050 C						
0.00001625	3378.	207898810.	19.1207970	0.0003107	-0.000274	1.1988806
7.0597018 C						
0.00001688	3436.	203629568.	18.8559097	0.0003182	-0.000289	1.2249695
7.2015987 C						
0.00001750	3493.	199582861.	18.6054868	0.0003256	-0.000304	1.2506622
7.3412344 C						
0.00001813	3548.	195750655.	18.3687106	0.0003329	-0.000320	1.2760057
7.4789660 C						
0.00001875	3603.	192137255.	18.1457912	0.0003402	-0.000335	1.3011058
7.6156490 C						
0.00001938	3656.	188693973.	17.9334511	0.0003475	-0.000350	1.3258349
-7.824974 C						
0.00002000	3709.	185435214.	17.7326370	0.0003547	-0.000365	1.3503284
-8.193871 C						
0.00002063	3761.	182336395.	17.5417087	0.0003618	-0.000381	1.3745479
-8.564128 C						
0.00002125	3812.	179385119.	17.3597775	0.0003689	-0.000396	1.3984938
-8.935762 C						
0.00002188	3863.	176574800.	17.1865166	0.0003760	-0.000412	1.4222017
-9.308490 C						
0.00002250	3913.	173893457.	17.0210625	0.0003830	-0.000427	1.4456623
-9.682405 C						
0.00002313	3962.	171328424.	16.8625950	0.0003899	-0.000443	1.4688631
-10.057632 C						
0.00002375	4011.	168887957.	16.7119182	0.0003969	-0.000458	1.4919137
-10.433241 C						

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   0.00002438        4059.    166534398.    16.5660026     0.0004038     -0.000474     1.5146183
-10.810938 C
   0.00002563        4155.    162141470.    16.2936982     0.0004175     -0.000505     1.5595621
-11.567693 C
   0.00002688        4249.    158100322.    16.0426675     0.0004311     -0.000536     1.6037385
-12.327605 C
   0.00002813        4341.    154353505.    15.8086724     0.0004446     -0.000568     1.6470294
-13.091815 C
   0.00002938        4433.    150896277.    15.5927082     0.0004580     -0.000599     1.6897395
-13.857699 C
   0.00003063        4523.    147678850.    15.3907080     0.0004713     -0.000631     1.7317181
-14.626675 C
   0.00003188        4612.    144684326.    15.2024306     0.0004846     -0.000663     1.7730727
-15.397841 C
   0.00003313        4700.    141889492.    15.0259400     0.0004977     -0.000695     1.8138319
-16.170995 C
   0.00003438        4788.    139274713.    14.8607886     0.0005108     -0.000727     1.8540069
-16.946089 C
   0.00003563        4874.    136819705.    14.7049433     0.0005239     -0.000759     1.8935827
-17.723318 C
   0.00003688        4961.    134522619.    14.5592902     0.0005369     -0.000791     1.9327631
-18.500805 C
   0.00003813        5046.    132345530.    14.4201043     0.0005498     -0.000823     1.9711910
-19.281985 C
   0.00003938        5131.    130303109.    14.2899936     0.0005627     -0.000855     2.0093010
-20.062752 C
   0.00004063        5215.    128371766.    14.1665377     0.0005755     -0.000887     2.0468870
-20.845110 C
   0.00004188        5299.    126538278.    14.0486255     0.0005883     -0.000919     2.0838902
-21.629688 C
   0.00004313        5382.    124807919.    13.9378745     0.0006011     -0.000951     2.1205803
-22.413859 C
   0.00004438        5466.    123166707.    13.8327852     0.0006138     -0.000984     2.1568421
-23.198771 C
   0.00004563        5548.    121597784.    13.7312625     0.0006265     -0.001016     2.1924654
-23.986586 C
   0.00004688        5630.    120109712.    13.6354503     0.0006392     -0.001048     2.2277802
-24.773998 C
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   0.00004813        5712.    118696175.    13.5449054     0.0006518     -0.001081     2.2627856
-25.561005 C
   0.00004938        5794.    117344021.    13.4577921     0.0006645     -0.001113     2.2972846
-26.349660 C
   0.00005063        5875.    116048229.    13.3737536     0.0006770     -0.001145     2.3312674
-27.140118 C
   0.00005188        5956.    114812390.    13.2940355     0.0006896     -0.001178     2.3649453
-27.930173 C
   0.00005313        6037.    113632257.    13.2183294     0.0007022     -0.001210     2.3983172
-28.719824 C
   0.00005438        6117.    112503976.    13.1463614     0.0007148     -0.001243     2.4313822
-29.509070 C
   0.00005563        6197.    111413701.    13.0756070     0.0007273     -0.001275     2.4638072
-30.301572 C
   0.00005688        6277.    110368099.    13.0079856     0.0007398     -0.001308     2.4958968
-31.094038 C
   0.00005813        6357.    109365279.    12.9435128     0.0007523     -0.001340     2.5276837
-31.886098 C
   0.00005938        6436.    108402529.    12.8819911     0.0007649     -0.001373     2.5591669
-32.677751 C
   0.00006063        6516.    107477352.    12.8232453     0.0007774     -0.001405     2.5903453
-33.468995 C
   0.00006188        6595.    106585542.    12.7666073     0.0007899     -0.001438     2.6211424
-34.260708 C
   0.00006313        6674.    105720878.    12.7108604     0.0008024     -0.001470     2.6513895
-35.054892 C
   0.00006438        6752.    104887835.    12.6574991     0.0008148     -0.001503     2.6813357
-35.848665 C
   0.00006563        6831.    104084606.    12.6063877     0.0008273     -0.001535     2.7109800
-36.642025 C
   0.00006688        6909.    103309510.    12.5574011     0.0008398     -0.001568     2.7403213
-37.434970 C
   0.00006813        6987.    102560986.    12.5104233     0.0008523     -0.001600     2.7693588
-38.227496 C
   0.00006938        7065.    101837590.    12.4653470     0.0008648     -0.001633     2.7980913
-39.019603 C
   0.00007063        7143.    101137973.    12.4220809     0.0008773     -0.001665     2.8265178
-39.811289 C
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   0.00007188         7220.    100455782.    12.3789436     0.0008897     -0.001698     2.8543810
-40.605825 C
   0.00007313         7298.     99794936.    12.3374020     0.0009022     -0.001730     2.8819291
-41.400107 C
   0.00007438         7375.     99154611.    12.2974548     0.0009146     -0.001763     2.9091746
-42.193961 C
   0.00007938         7682.     96778950.    12.1521243     0.0009646     -0.001893     3.0151098
-45.365052 C
   0.00008438         7987.     94656726.    12.0255138     0.0010147     -0.002023     3.1158848
-48.532510 C
   0.00008938         8289.     92740074.    11.9124562     0.0010647     -0.002153     3.2111206
-51.701533 C
   0.00009438         8589.     91004347.    11.8140847     0.0011150     -0.002283     3.3013836
-54.863146 C
   0.00009938         8886.     89421748.    11.7282588     0.0011655     -0.002412     3.3865995
-58.017161 C
    0.0001044         9180.     87954378.    11.6506457     0.0012160     -0.002541     3.4662742
-60.000000 CY
    0.0001094         9384.     85800606.    11.5481808     0.0012631     -0.002674     3.5353720
-60.000000 CY
    0.0001144         9541.     83421843.    11.4396312     0.0013084     -0.002809     3.5973697
-60.000000 CY
    0.0001194         9697.     81230817.    11.3419667     0.0013539     -0.002944     3.6551937
-60.000000 CY
    0.0001244         9850.     79194943.    11.2495142     0.0013992     -0.003078     3.7081633
-60.000000 CY
    0.0001294        10001.     77305964.    11.1658348     0.0014446     -0.003213     3.7569385
-60.000000 CY
    0.0001344        10151.     75543308.    11.0898380     0.0014902     -0.003347     3.8014419
-60.000000 CY
    0.0001394        10259.     73606225.    11.0036762     0.0015336     -0.003484     3.8396096
-60.000000 CY
    0.0001444        10321.     71489024.    10.9026681     0.0015741     -0.003623     3.8714236
-60.000000 CY
    0.0001494        10378.     69475705.    10.8063989     0.0016142     -0.003763     3.8995256
-60.000000 CY
    0.0001544        10434.     67587878.    10.7175204     0.0016545     -0.003903     3.9242726
-60.000000 CY
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    0.0001594       10489.     65813622.    10.6354135     0.0016950     -0.004042     3.9456180
-60.000000 CY
    0.0001644       10542.     64134489.    10.5556303     0.0017351     -0.004182     3.9632602
-60.000000 CY
    0.0001694       10594.     62548130.    10.4807597     0.0017752     -0.004322     3.9774653
-60.000000 CY
    0.0001744       10645.     61048330.    10.4102665     0.0018153     -0.004462     3.9882598
-60.000000 CY
    0.0001794       10696.     59627757.    10.3455446     0.0018557     -0.004602     3.9955935
-60.000000 CY
    0.0001844       10745.     58279864.    10.2853788     0.0018964     -0.004741     3.9994144
-60.000000 CY
    0.0001894       10794.     56995442.    10.2281739     0.0019370     -0.004881     3.9970351
-60.000000 CY
    0.0001944       10840.     55770067.    10.1742556     0.0019776     -0.005020     3.9997917
-60.000000 CY
    0.0001994       10886.     54601501.    10.1231235     0.0020183     -0.005159     3.9974730
-60.000000 CY
    0.0002044       10931.     53486159.    10.0755448     0.0020592     -0.005298     3.9998635
-60.000000 CY
    0.0002094       10975.     52419608.    10.0313940     0.0021003     -0.005437     3.9972164
-60.000000 CY
    0.0002144       11019.     51399270.     9.9902783     0.0021417     -0.005576     3.9997565
-60.000000 CY
    0.0002194       11061.     50421481.     9.9521062     0.0021832     -0.005714     3.9961638
-60.000000 CY
    0.0002244       11103.     49483900.     9.9165810     0.0022250     -0.005852     3.9993127
-60.000000 CY
    0.0002294       11144.     48582915.     9.8823074     0.0022668     -0.005991     3.9972109
-60.000000 CY
    0.0002344       11183.     47715784.     9.8493605     0.0023084     -0.006129     3.9980280
-60.000000 CY
    0.0002394       11221.     46876993.     9.8176662     0.0023501     -0.006267     3.9998847
-60.000000 CY
    0.0002444       11256.     46059903.     9.7866751     0.0023916     -0.006406     3.9950300
-60.000000 CY
    0.0002494       11283.     45245424.     9.7529083     0.0024321     -0.006545     3.9984053
-60.000000 CY
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    0.0002544        11306.     44446014.     9.7185154     0.0024721     -0.006685     3.9999015
-60.000000 CY
    0.0002594        11319.     43640540.     9.6798494     0.0025107     -0.006827     3.9945023
-60.000000 CY
    0.0002644        11330.     42857537.     9.6421489     0.0025491     -0.006968     3.9970850
-60.000000 CY
    0.0002694        11338.     42090633.     9.6039838     0.0025871     -0.007110     3.9992100
-60.000000 CY
    0.0002744        11346.     41350452.     9.5673334     0.0026250     -0.007252     3.9999954
-60.000000 CY
    0.0003044        11380.     37388565.     9.3667055     0.0028510     -0.008107     3.9934819
-60.000000 CY
    0.0003344        11408.     34118560.     9.2116385     0.0030801     -0.008957     3.9944808
-60.000000 CYT
    0.0003644        11430.     31368001.     9.0799576     0.0033085     -0.009809     3.9916365
-60.000000 CYT
    0.0003944        11447.     29026108.     8.9721368     0.0035384     -0.010659     3.9939045
-60.000000 CYT
    0.0004244        11462.     27009296.     8.8854430     0.0037708     -0.011507     3.9992875
-60.000000 CYT
    0.0004544        11462.     25226013.     8.9133442     0.0040500     -0.012307     3.9978007
60.0000000 CYT


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   Summary of Results for Nominal Moment Capacity for Section 3
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Moment values interpolated at maximum compressive strain = 0.003
or maximum developed moment if pile fails at smaller strains.

 Load           Axial Thrust        Nominal Mom. Cap.      Max. Comp.      Max. Tens.
  No.              kips                in-kip               Strain           Strain
 ----         ---------------     -----------------     ------------    ------------
   1              212.150             10532.895          0.00300000     -0.00959730
   2              295.890             11398.514          0.00300000     -0.00865979

Note that the values of moment capacity in the table above are not
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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	212.150000	10533.	137.897500	6846.	89062138.
2	0.65	295.890000	11399.	192.328500	7409.	98888514.
1	0.75	212.150000	10533.	159.112500	7900.	83911158.
2	0.75	295.890000	11399.	221.917500	8549.	91233835.
1	0.90	212.150000	10533.	190.935000	9480.	65371459.
2	0.90	295.890000	11399.	266.301000	10259.	73609913.

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	18.1630	0.00	N.A.	Yes	N.A.	N.A.
2	21.0630	2.9000	No	Yes	N.A.	N.A.
3	26.8630	8.7000	No	Yes	N.A.	N.A.
4	35.0630	16.9000	No	Yes	N.A.	N.A.
5	36.6630	18.5000	No	Yes	N.A.	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 = 15820.0 lbs
Applied moment at pile head = 0.0 in-lbs
Axial thrust load on pile head = 212150.0 lbs

Depth X	Deflect. y	Bending Moment	Shear Force	Slope S	Total Stress	Bending Stiffness	Soil Res. p	Soil Spr. Es*H	Distrib. Lat. Load
feet	inches	in-lbs	lbs	radians	psi*	lb-in^2	lb/inch	lb/inch	lb/inch
0.00	0.4863	-0.03617	15820.	-0.00267	33.6746	5.80E+13	0.00	0.00	24.9347
0.4983	0.4704	98426.	15972.	-0.00267	33.7848	5.80E+13	0.00	0.00	25.9388

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    0.9966     0.4544    197780.     16131.   -0.00267    33.8960   5.80E+13       0.00       0.00
27.2777
    1.4949     0.4385    298109.     16298.   -0.00267    34.0083   5.80E+13       0.00       0.00
28.6165
    1.9932     0.4226    399461.     16473.   -0.00267    34.1218   5.80E+13       0.00       0.00
29.9554
    2.4915     0.4066    501884.     16657.   -0.00267    34.2365   5.80E+13       0.00       0.00
31.2942
    2.9899     0.3907    605426.     16848.   -0.00267    34.3524   5.80E+13       0.00       0.00
32.6331
    3.4882     0.3747    710135.     17047.   -0.00267    26.0510   7.73E+13       0.00       0.00
33.9719
    3.9865     0.3588    816059.     17254.   -0.00267    26.1696   7.73E+13       0.00       0.00
35.3108
    4.4848     0.3429    923245.     17469.   -0.00267    26.2896   7.73E+13       0.00       0.00
36.6496
    4.9831     0.3269   1031741.     17692.   -0.00267    26.4110   7.73E+13       0.00       0.00
37.9885
    5.4814     0.3110   1141596.     17923.   -0.00266    26.5340   7.73E+13       0.00       0.00
39.3273
    5.9797     0.2951   1252857.     18163.   -0.00266    26.6586   7.73E+13       0.00       0.00
40.6662
    6.4780     0.2791   1365572.     18410.   -0.00265       0.00   3.65E+11       0.00       0.00
42.0050
    6.9763     0.2633   1479760.     18665.   -0.00263       0.00   3.64E+11       0.00       0.00
43.3438
    7.4746     0.2477   1595467.     18928.   -0.00261       0.00   3.64E+11       0.00       0.00
44.6827
    7.9729     0.2322   1712739.     19199.   -0.00258       0.00   3.64E+11       0.00       0.00
46.0215
    8.4712     0.2168   1831621.     19479.   -0.00255       0.00   3.64E+11       0.00       0.00
47.3604
    8.9696     0.2017   1952158.     19766.   -0.00252       0.00   3.64E+11       0.00       0.00
48.6992
    9.4679     0.1867   2074396.     20061.   -0.00248       0.00   3.64E+11       0.00       0.00
50.0381
    9.9662     0.1720   2198380.     20364.   -0.00245       0.00   3.63E+11       0.00       0.00
51.3769
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10.4645	0.1574	2324154.	20675.	-0.00241	0.00	3.63E+11	0.00	0.00	52.7158
10.9628	0.1431	2451766.	20995.	-0.00237	0.00	3.63E+11	0.00	0.00	54.0546
11.4611	0.1291	2581259.	21322.	-0.00233	0.00	3.63E+11	0.00	0.00	55.3935
11.9594	0.1152	2712678.	21657.	-0.00229	0.00	3.62E+11	0.00	0.00	56.7323
12.4577	0.1017	2846069.	22000.	-0.00224	0.00	3.62E+11	0.00	0.00	58.0712
12.9560	0.08843	2981478.	22352.	-0.00216	0.00	1.65E+11	0.00	0.00	59.4100
13.4543	0.07581	3118873.	22711.	-0.00205	0.00	1.57E+11	0.00	0.00	60.7488
13.9526	0.06391	3258290.	23078.	-0.00193	0.00	1.50E+11	0.00	0.00	62.0877
14.4510	0.05278	3399761.	23453.	-0.00179	0.00	1.43E+11	0.00	0.00	63.4265
14.9493	0.04250	3543320.	23837.	-0.00164	0.00	1.38E+11	0.00	0.00	64.7654
15.4476	0.03314	3689000.	24228.	-0.00148	0.00	1.32E+11	0.00	0.00	66.1042
15.9459	0.02478	3836832.	24627.	-0.00131	0.00	1.28E+11	0.00	0.00	67.4431
16.4442	0.01749	3986848.	25035.	-0.00112	0.00	1.24E+11	0.00	0.00	68.7819
16.9425	0.01135	4139078.	25450.	-9.23E-04	0.00	1.20E+11	0.00	0.00	70.1208
17.4408	0.00645	4293555.	25873.	-7.10E-04	0.00	1.17E+11	0.00	0.00	71.4596
17.9391	0.00286	4450308.	26293.	-4.83E-04	0.00	1.14E+11	0.00	0.00	69.0752
18.4374	6.70E-04	4609233.	-126325.	-2.42E-04	0.00	1.11E+11	-51114.	4.56E+08	0.00
18.9357	-3.11E-05	2940154.	-270649.	-6.83E-05	0.00	1.80E+11	2843.	5.46E+08	0.00
19.4340	-1.47E-04	1372602.	-215485.	-8.07E-06	0.00	3.65E+11	15608.	6.36E+08	0.00

19.9323	-1.28E-04	363103.	-122476.	6.17E-06	0.00	3.65E+11	15500.	7.26E+08	0.00
20.4307	-7.29E-05	-92158.	-46358.	8.39E-06	0.00	3.65E+11	9959.	8.16E+08	0.00
20.9290	-2.73E-05	-191328.	-4205.	6.06E-06	0.00	3.65E+11	4140.	9.06E+08	0.00
21.4273	-4.37E-07	-142463.	8194.	3.33E-06	0.00	3.65E+11	7.1762	9.82E+07	0.00
21.9256	1.25E-05	-93339.	7548.	1.39E-06	0.00	3.65E+11	-223.241	1.07E+08	0.00
22.4239	1.62E-05	-52195.	5940.	2.00E-07	0.00	3.65E+11	-314.545	1.16E+08	0.00
22.9222	1.49E-05	-22297.	4072.	-4.11E-07	0.00	3.65E+11	-310.192	1.25E+08	0.00
23.4205	1.13E-05	-3491.	2389.	-6.22E-07	0.00	3.65E+11	-252.927	1.34E+08	0.00
23.9188	7.42E-06	6272.	1103.	-5.99E-07	0.00	3.65E+11	-176.975	1.43E+08	0.00
24.4171	4.15E-06	9707.	260.1974	-4.68E-07	0.00	3.65E+11	-105.049	1.51E+08	0.00
24.9154	1.82E-06	9385.	-200.130	-3.12E-07	0.00	3.65E+11	-48.914	1.60E+08	0.00
25.4137	4.21E-07	7314.	-381.997	-1.75E-07	0.00	3.65E+11	-11.914	1.69E+08	0.00
25.9120	-2.65E-07	4817.	-393.993	-7.53E-08	0.00	3.65E+11	7.9015	1.78E+08	0.00
26.4104	-4.80E-07	2603.	-325.546	-1.45E-08	0.00	3.65E+11	14.9917	1.87E+08	0.00
26.9087	-4.39E-07	923.8714	-216.626	1.44E-08	0.00	3.65E+11	21.4382	2.92E+08	0.00
27.4070	-3.07E-07	11.7681	-106.606	2.21E-08	0.00	3.65E+11	15.3596	2.99E+08	0.00
27.9053	-1.75E-07	-351.126	-34.589	1.93E-08	0.00	3.65E+11	8.7273	2.99E+08	0.00
28.4036	-7.63E-08	-401.950	2.9142	1.31E-08	0.00	3.65E+11	3.8163	2.99E+08	0.00
28.9019	-1.75E-08	-316.307	16.9421	7.24E-09	0.00	3.65E+11	0.8755	2.99E+08	0.00

29.4002	1.03E-08	-199.351	18.0209	3.02E-09	0.00	3.65E+11	-0.515	2.99E+08	0.00
29.8985	1.86E-08	-100.796	13.7079	5.55E-10	0.00	3.65E+11	-0.928	2.99E+08	0.00
30.3968	1.69E-08	-35.414	8.4020	-5.61E-10	0.00	3.65E+11	-0.847	2.99E+08	0.00
30.8951	1.18E-08	-0.311	4.0996	-8.54E-10	0.00	3.65E+11	-0.592	2.99E+08	0.00
31.3934	6.72E-09	13.6167	1.3241	-7.45E-10	0.00	3.65E+11	-0.336	2.99E+08	0.00
31.8918	2.93E-09	15.5268	-0.119	-5.06E-10	0.00	3.65E+11	-0.147	2.99E+08	0.00
32.3901	6.69E-10	12.1907	-0.658	-2.79E-10	0.00	3.65E+11	-0.03344	2.99E+08	0.00
32.8884	-4.01E-10	7.6587	-0.698	-1.16E-10	0.00	3.65E+11	0.02007	2.99E+08	0.00
33.3867	-7.21E-10	3.8440	-0.530	-2.19E-11	0.00	3.65E+11	0.03604	2.99E+08	0.00
33.8850	-6.63E-10	1.3178	-0.323	2.04E-11	0.00	3.65E+11	0.03316	2.99E+08	0.00
34.3833	-4.77E-10	-0.02264	-0.153	3.10E-11	0.00	3.65E+11	0.02383	2.99E+08	0.00
34.8816	-2.92E-10	-0.511	-0.03803	2.67E-11	0.00	3.65E+11	0.01460	2.99E+08	0.00
35.3799	-1.58E-10	-0.477	0.00988	1.86E-11	0.00	3.65E+11	0.00142	5.38E+07	0.00
35.8782	-7.02E-11	-0.393	0.01601	1.14E-11	0.00	3.65E+11	6.31E-04	5.38E+07	0.00
36.3765	-2.11E-11	-0.286	0.01847	5.85E-12	0.00	3.65E+11	1.90E-04	5.38E+07	0.00
36.8748	0.00	-0.172	0.01924	2.10E-12	0.00	3.65E+11	7.00E-05	2.69E+09	0.00
37.3731	3.94E-12	-0.05587	0.01415	0.00	0.00	3.65E+11	-0.00177	2.69E+09	0.00
37.8715	2.56E-12	-0.00295	0.00541	0.00	0.00	3.65E+11	-0.00115	2.69E+09	0.00
38.3698	0.00	0.00878	7.64E-04	0.00	0.00	3.65E+11	-4.01E-04	2.69E+09	0.00

38.8681	0.00	0.00619	-5.43E-04	0.00	0.00	3.65E+11	-3.65E-05	2.69E+09	0.00
39.3664	0.00	0.00229	-4.88E-04	0.00	0.00	3.65E+11	5.46E-05	2.69E+09	0.00
39.8647	0.00	3.47E-04	-1.92E-04	0.00	0.00	3.65E+11	4.47E-05	2.69E+09	0.00
40.3630	0.00	0.00	0.00	0.00	0.00	3.65E+11	1.94E-05	1.35E+09	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. 1:

Pile-head deflection	=	0.48631726 inches
Computed slope at pile head	=	-0.0026655 radians
Maximum bending moment	=	4609233. inch-lbs
Maximum shear force	=	-270649. lbs
Depth of maximum bending moment	=	18.43741975 feet below pile head
Depth of maximum shear force	=	18.93572840 feet below pile head
Number of iterations	=	68
Number of zero deflection points	=	8
Pile deflection at ground	=	0.00187496 inches

Pile-head Deflection vs. Pile Length for Load Case 1

Boundary Condition Type 1, Shear and Moment

Shear = 15820. lbs

Moment = 0. in-lbs
Axial Load = 212150. lbs

Pile Length feet	Pile Head Deflection inches	Maximum Moment ln-lbs	Maximum Shear lbs
40.36300	0.48631726	4609233.	-270649.
38.34485	0.48390043	4616539.	-274739.
36.32670	0.47930083	4591899.	-270166.
34.30855	0.45657505	4531361.	-257368.
32.29040	0.47016913	4574014.	-260205.
30.27225	0.46858466	4565714.	-253921.
28.25410	0.49224665	4626086.	-264752.
26.23595	0.48835740	4617340.	-266080.
24.21780	0.46336434	4540751.	-258064.
22.19965	0.48085035	4584064.	-276477.
20.18150	0.45998987	4524142.	-272861.

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 = 19120.0 lbs
Applied moment at pile head = 0.0 in-lbs
Axial thrust load on pile head = 295890.0 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

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----
      0.00   0.6135   -0.00756   19120.   -0.00338   46.9667   5.80E+13   0.00   0.00
39.5021
    0.4983   0.5933   121022.   19361.   -0.00338   47.1022   5.80E+13   0.00   0.00
41.0083
    0.9966   0.5731   243511.   19612.   -0.00338   47.2393   5.80E+13   0.00   0.00
43.0165
    1.4949   0.5529   367538.   19875.   -0.00338   47.3781   5.80E+13   0.00   0.00
45.0248
    1.9932   0.5327   493175.   20150.   -0.00338   47.5188   5.80E+13   0.00   0.00
47.0331
    2.4915   0.5124   620493.   20438.   -0.00338   47.6613   5.80E+13   0.00   0.00
49.0413
    2.9899   0.4922   749565.   20737.   -0.00338   47.8058   5.80E+13   0.00   0.00
51.0496
    3.4882   0.4720   880462.   21048.   -0.00338   36.2107   7.73E+13   0.00   0.00
53.0579
    3.9865   0.4518   1013256.   21371.   -0.00338   36.3594   7.73E+13   0.00   0.00
55.0662
    4.4848   0.4315   1148019.   21707.   -0.00338   36.5102   7.73E+13   0.00   0.00
57.0744
    4.9831   0.4113   1284822.   22054.   -0.00338   36.6634   7.73E+13   0.00   0.00
59.0827
    5.4814   0.3911   1423738.   22413.   -0.00338   36.8189   7.73E+13   0.00   0.00
61.0910
    5.9797   0.3709   1564839.   22785.   -0.00338   36.9769   7.73E+13   0.00   0.00
63.0992
    6.4780   0.3507   1708195.   23168.   -0.00337   0.00   3.61E+11   0.00   0.00
65.1075
    6.9763   0.3306   1853829.   23563.   -0.00334   0.00   3.61E+11   0.00   0.00
67.1158
    7.4746   0.3107   2001809.   23971.   -0.00331   0.00   3.61E+11   0.00   0.00
69.1240
    7.9729   0.2911   2152202.   24390.   -0.00327   0.00   3.61E+11   0.00   0.00
71.1323
    8.4712   0.2716   2305075.   24821.   -0.00323   0.00   3.61E+11   0.00   0.00
73.1406

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    8.9696     0.2524   2460496.     25265.   -0.00319       0.00   3.60E+11       0.00       0.00
75.1488
    9.4679     0.2334   2618532.     25720.   -0.00315       0.00   3.60E+11       0.00       0.00
77.1571
    9.9662     0.2147   2779249.     26187.   -0.00311       0.00   3.60E+11       0.00       0.00
79.1654
   10.4645     0.1962   2942716.     26667.   -0.00306       0.00   3.60E+11       0.00       0.00
81.1737
   10.9628     0.1781   3108998.     27158.   -0.00301       0.00   3.59E+11       0.00       0.00
83.1819
   11.4611     0.1602   3278164.     27662.   -0.00296       0.00   3.59E+11       0.00       0.00
85.1902
   11.9594     0.1427   3450279.     28177.   -0.00288       0.00   2.03E+11       0.00       0.00
87.1985
   12.4577     0.1258   3625332.     28704.   -0.00277       0.00   1.91E+11       0.00       0.00
89.2067
   12.9560     0.1096   3803373.     29244.   -0.00265       0.00   1.80E+11       0.00       0.00
91.2150
   13.4543    0.09410   3984452.     29795.   -0.00252       0.00   1.70E+11       0.00       0.00
93.2233
   13.9526    0.07947   4168617.     30359.   -0.00237       0.00   1.62E+11       0.00       0.00
95.2315
   14.4510    0.06575   4355914.     30934.   -0.00221       0.00   1.54E+11       0.00       0.00
97.2398
   14.9493    0.05305   4546388.     31522.   -0.00203       0.00   1.47E+11       0.00       0.00
99.2481
   15.4476    0.04146   4740084.     32121.   -0.00184       0.00   1.41E+11       0.00       0.00
101.2563
   15.9459    0.03107   4937044.     32733.   -0.00163       0.00   1.35E+11       0.00       0.00
103.2646
   16.4442    0.02199   5137309.     33356.   -0.00140       0.00   1.30E+11       0.00       0.00
105.2729
   16.9425    0.01432   5340921.     33992.   -0.00116       0.00   1.26E+11       0.00       0.00
107.2812
   17.4408    0.00816   5547920.     34639.  -8.92E-04       0.00   1.22E+11       0.00       0.00
109.2894
   17.9391    0.00364   5758343.     35282.  -6.10E-04       0.00   1.18E+11       0.00       0.00
105.6063
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18.4374	8.71E-04	5972026.	-163000.	-3.08E-04	0.00	1.15E+11	-66424.	4.56E+08
0.00								
18.9357	-3.95E-05	3810050.	-350818.	-8.87E-05	0.00	1.79E+11	3605.	5.46E+08
0.00								
19.4340	-1.91E-04	1776760.	-279413.	-1.06E-05	0.00	3.61E+11	20277.	6.36E+08
0.00								
19.9323	-1.66E-04	468473.	-158603.	8.03E-06	0.00	3.61E+11	20129.	7.26E+08
0.00								
20.4307	-9.45E-05	-120063.	-59843.	1.09E-05	0.00	3.61E+11	12902.	8.16E+08
0.00								
20.9290	-3.52E-05	-247249.	-5325.	7.88E-06	0.00	3.61E+11	5332.	9.06E+08
0.00								
21.4273	-3.17E-07	-183777.	10632.	4.31E-06	0.00	3.61E+11	5.1979	9.82E+07
0.00								
21.9256	1.63E-05	-120113.	9772.	1.79E-06	0.00	3.61E+11	-292.725	1.07E+08
0.00								
22.4239	2.11E-05	-66913.	7672.	2.45E-07	0.00	3.61E+11	-409.617	1.16E+08
0.00								
22.9222	1.93E-05	-28358.	5244.	-5.43E-07	0.00	3.61E+11	-402.458	1.25E+08
0.00								
23.4205	1.46E-05	-4192.	3063.	-8.13E-07	0.00	3.61E+11	-327.077	1.34E+08
0.00								
23.9188	9.56E-06	8278.	1404.	-7.79E-07	0.00	3.61E+11	-227.999	1.43E+08
0.00								
24.4171	5.32E-06	12596.	319.3245	-6.06E-07	0.00	3.61E+11	-134.633	1.51E+08
0.00								
24.9154	2.32E-06	12099.	-268.827	-4.02E-07	0.00	3.61E+11	-62.083	1.60E+08
0.00								
25.4137	5.13E-07	9382.	-497.822	-2.24E-07	0.00	3.61E+11	-14.508	1.69E+08
0.00								
25.9120	-3.62E-07	6146.	-509.001	-9.54E-08	0.00	3.61E+11	10.7687	1.78E+08
0.00								
26.4104	-6.28E-07	3295.	-418.132	-1.72E-08	0.00	3.61E+11	19.6240	1.87E+08
0.00								
26.9087	-5.68E-07	1146.	-276.504	1.95E-08	0.00	3.61E+11	27.7456	2.92E+08
0.00								
27.4070	-3.94E-07	-11.503	-134.605	2.89E-08	0.00	3.61E+11	19.7143	2.99E+08
0.00								

27.9053	-2.22E-07	-463.993	-42.480	2.50E-08	0.00	3.61E+11	11.0982	2.99E+08	0.00
28.4036	-9.56E-08	-519.633	4.9881	1.68E-08	0.00	3.61E+11	4.7783	2.99E+08	0.00
28.9019	-2.06E-08	-404.399	22.3541	9.19E-09	0.00	3.61E+11	1.0300	2.99E+08	0.00
29.4002	1.43E-08	-252.324	23.2896	3.76E-09	0.00	3.61E+11	-0.717	2.99E+08	0.00
29.8985	2.43E-08	-125.882	17.5116	6.25E-10	0.00	3.61E+11	-1.215	2.99E+08	0.00
30.3968	2.18E-08	-42.897	10.6162	-7.72E-10	0.00	3.61E+11	-1.091	2.99E+08	0.00
30.8951	1.51E-08	1.0840	5.1005	-1.12E-09	0.00	3.61E+11	-0.754	2.99E+08	0.00
31.3934	8.45E-09	18.1062	1.5833	-9.59E-10	0.00	3.61E+11	-0.422	2.99E+08	0.00
31.8918	3.61E-09	20.0232	-0.219	-6.43E-10	0.00	3.61E+11	-0.181	2.99E+08	0.00
32.3901	7.53E-10	15.4855	-0.872	-3.50E-10	0.00	3.61E+11	-0.03767	2.99E+08	0.00
32.8884	-5.71E-10	9.6002	-0.899	-1.42E-10	0.00	3.61E+11	0.02853	2.99E+08	0.00
33.3867	-9.44E-10	4.7347	-0.673	-2.33E-11	0.00	3.61E+11	0.04721	2.99E+08	0.00
33.8850	-8.49E-10	1.5572	-0.404	2.88E-11	0.00	3.61E+11	0.04247	2.99E+08	0.00
34.3833	-6.00E-10	-0.102	-0.188	4.08E-11	0.00	3.61E+11	0.03002	2.99E+08	0.00
34.8816	-3.62E-10	-0.687	-0.04386	3.43E-11	0.00	3.61E+11	0.01808	2.99E+08	0.00
35.3799	-1.91E-10	-0.626	0.01531	2.34E-11	0.00	3.61E+11	0.00172	5.38E+07	0.00
35.8782	-8.17E-11	-0.504	0.02264	1.40E-11	0.00	3.61E+11	7.36E-04	5.38E+07	0.00
36.3765	-2.28E-11	-0.356	0.02545	6.92E-12	0.00	3.61E+11	2.05E-04	5.38E+07	0.00
36.8748	1.00E-12	-0.200	0.02472	2.32E-12	0.00	3.61E+11	-4.50E-04	2.69E+09	0.00

37.3731	4.97E-12	-0.06017	0.01668	0.00	0.00	3.61E+11	-0.00224	2.69E+09	0.00
37.8715	2.99E-12	-4.33E-04	0.00596	0.00	0.00	3.61E+11	-0.00135	2.69E+09	0.00
38.3698	0.00	0.01117	6.40E-04	0.00	0.00	3.61E+11	-4.35E-04	2.69E+09	0.00
38.8681	0.00	0.00722	-7.25E-04	0.00	0.00	3.61E+11	-2.13E-05	2.69E+09	0.00
39.3664	0.00	0.00250	-5.76E-04	0.00	0.00	3.61E+11	7.10E-05	2.69E+09	0.00
39.8647	0.00	3.25E-04	-2.09E-04	0.00	0.00	3.61E+11	5.18E-05	2.69E+09	0.00
40.3630	0.00	0.00	0.00	0.00	0.00	3.61E+11	1.82E-05	1.35E+09	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	=	0.61354838	inches
Computed slope at pile head	=	-0.0033822	radians
Maximum bending moment	=	5972026.	inch-lbs
Maximum shear force	=	-350818.	lbs
Depth of maximum bending moment	=	18.43741975	feet below pile head
Depth of maximum shear force	=	18.93572840	feet below pile head
Number of iterations	=	32	
Number of zero deflection points	=	8	
Pile deflection at ground	=	0.00239823	inches

Pile-head Deflection vs. Pile Length for Load Case 2

Boundary Condition Type 1, Shear and Moment

Shear = 19120. lbs
Moment = 0. in-lbs
Axial Load = 295890. lbs

Pile Length feet	Pile Head Deflection inches	Maximum Moment ln-lbs	Maximum Shear lbs
40.36300	0.61354838	5972026.	-350818.
38.34485	0.61813221	5983869.	-352673.
36.32670	0.60299030	5947617.	-346504.
34.30855	0.58012156	5865957.	-329863.
32.29040	0.59711504	5924435.	-333840.
30.27225	0.59348291	5912653.	-328986.
28.25410	0.62117676	5995181.	-343163.
26.23595	0.61910847	5983908.	-359323.
24.21780	0.58620010	5878409.	-349349.
22.19965	0.60710532	5937813.	-355451.
20.18150	0.58023719	5855304.	-352257.

Computed Values of Pile Loading and Deflection
for Lateral Loading for Load Case Number 3

Pile-head conditions are Displacement and Moment (Loading Type 4)
Displacement of pile head = 0.480000 inches
Moment at pile head = 0.0 in-lbs
Axial load at pile head = 212150.0 lbs

Depth	Deflect.	Bending	Shear	Slope	Total	Bending	Soil Res.	Soil Spr.	Distrib.

X	y	Moment	Force	S	Stress	Stiffness	p	Es*H	Lat. Load
feet	inches	in-lbs	lbs	radians	psi*	lb-in^2	lb/inch	lb/inch	lb/inch
0.00	0.4800	0.00	15688.	-0.00263	33.6746	5.80E+13	0.00	0.00	24.9347
0.4983	0.4643	97592.	15840.	-0.00263	33.7839	5.80E+13	0.00	0.00	25.9388
0.9966	0.4485	196112.	15999.	-0.00263	33.8942	5.80E+13	0.00	0.00	27.2777
1.4949	0.4328	295607.	16166.	-0.00263	34.0055	5.80E+13	0.00	0.00	28.6165
1.9932	0.4171	396125.	16341.	-0.00263	34.1181	5.80E+13	0.00	0.00	29.9554
2.4915	0.4013	497715.	16524.	-0.00263	34.2318	5.80E+13	0.00	0.00	31.2942
2.9899	0.3856	600423.	16715.	-0.00263	34.3468	5.80E+13	0.00	0.00	32.6331
3.4882	0.3698	704298.	16915.	-0.00263	26.0444	7.73E+13	0.00	0.00	33.9719
3.9865	0.3541	809388.	17122.	-0.00263	26.1621	7.73E+13	0.00	0.00	35.3108
4.4848	0.3384	915740.	17337.	-0.00263	26.2812	7.73E+13	0.00	0.00	36.6496
4.9831	0.3226	1023403.	17560.	-0.00263	26.4017	7.73E+13	0.00	0.00	37.9885
5.4814	0.3069	1132423.	17791.	-0.00263	26.5237	7.73E+13	0.00	0.00	39.3273
5.9797	0.2912	1242850.	18030.	-0.00263	26.6474	7.73E+13	0.00	0.00	40.6662
6.4780	0.2754	1354731.	18278.	-0.00262	0.00	3.65E+11	0.00	0.00	42.0050
6.9763	0.2598	1468086.	18533.	-0.00260	0.00	3.64E+11	0.00	0.00	43.3438
7.4746	0.2444	1582960.	18796.	-0.00257	0.00	3.64E+11	0.00	0.00	

44.6827								
7.9729	0.2291	1699399.	19067.	-0.00254	0.00	3.64E+11	0.00	0.00
46.0215								
8.4712	0.2139	1817448.	19346.	-0.00252	0.00	3.64E+11	0.00	0.00
47.3604								
8.9696	0.1990	1937152.	19633.	-0.00249	0.00	3.64E+11	0.00	0.00
48.6992								
9.4679	0.1842	2058558.	19929.	-0.00245	0.00	3.64E+11	0.00	0.00
50.0381								
9.9662	0.1697	2181710.	20232.	-0.00242	0.00	3.63E+11	0.00	0.00
51.3769								
10.4645	0.1553	2306653.	20543.	-0.00238	0.00	3.63E+11	0.00	0.00
52.7158								
10.9628	0.1412	2433433.	20862.	-0.00234	0.00	3.63E+11	0.00	0.00
54.0546								
11.4611	0.1273	2562095.	21190.	-0.00230	0.00	3.63E+11	0.00	0.00
55.3935								
11.9594	0.1137	2692684.	21525.	-0.00226	0.00	3.62E+11	0.00	0.00
56.7323								
12.4577	0.1003	2825246.	21868.	-0.00221	0.00	3.62E+11	0.00	0.00
58.0712								
12.9560	0.08724	2959824.	22219.	-0.00213	0.00	1.67E+11	0.00	0.00
59.4100								
13.4543	0.07479	3096392.	22579.	-0.00202	0.00	1.58E+11	0.00	0.00
60.7488								
13.9526	0.06304	3234984.	22946.	-0.00190	0.00	1.51E+11	0.00	0.00
62.0877								
14.4510	0.05206	3375633.	23321.	-0.00177	0.00	1.44E+11	0.00	0.00
63.4265								
14.9493	0.04192	3518372.	23704.	-0.00162	0.00	1.38E+11	0.00	0.00
64.7654								
15.4476	0.03268	3663234.	24096.	-0.00146	0.00	1.33E+11	0.00	0.00
66.1042								
15.9459	0.02443	3810252.	24495.	-0.00129	0.00	1.29E+11	0.00	0.00
67.4431								
16.4442	0.01724	3959456.	24902.	-0.00111	0.00	1.24E+11	0.00	0.00
68.7819								
16.9425	0.01118	4110879.	25318.	-9.11E-04	0.00	1.21E+11	0.00	0.00

70.1208
17.4408 0.00635 4264550. 25741. -7.00E-04 0.00 1.17E+11 0.00 0.00
71.4596
17.9391 0.00281 4420501. 26161. -4.76E-04 0.00 1.14E+11 0.00 0.00
69.0752
18.4374 6.58E-04 4578627. -123667. -2.37E-04 0.00 1.11E+11 -50181. 4.56E+08
0.00
18.9357 -2.45E-05 2942113. -267012. -6.70E-05 0.00 1.87E+11 2238. 5.46E+08
0.00
19.4340 -1.44E-04 1385492. -214652. -8.55E-06 0.00 3.65E+11 15275. 6.36E+08
0.00
19.9323 -1.27E-04 375019. -122967. 5.89E-06 0.00 3.65E+11 15391. 7.26E+08
0.00
20.4307 -7.31E-05 -85136. -47113. 8.27E-06 0.00 3.65E+11 9980. 8.16E+08
0.00
20.9290 -2.78E-05 -188443. -4659. 6.02E-06 0.00 3.65E+11 4219. 9.06E+08
0.00
21.4273 -1.05E-06 -140872. 8008. 3.32E-06 0.00 3.65E+11 17.2108 9.82E+07
0.00
21.9256 1.19E-05 -92683. 7421. 1.41E-06 0.00 3.65E+11 -213.543 1.07E+08
0.00
22.4239 1.58E-05 -52127. 5866. 2.23E-07 0.00 3.65E+11 -306.638 1.16E+08
0.00
22.9222 1.46E-05 -22535. 4038. -3.89E-07 0.00 3.65E+11 -304.610 1.25E+08
0.00
23.4205 1.12E-05 -3834. 2381. -6.05E-07 0.00 3.65E+11 -249.569 1.34E+08
0.00
23.9188 7.36E-06 5943. 1111. -5.88E-07 0.00 3.65E+11 -175.385 1.43E+08
0.00
24.4171 4.13E-06 9449. 273.2502 -4.62E-07 0.00 3.65E+11 -104.658 1.51E+08
0.00
24.9154 1.84E-06 9212. -186.750 -3.09E-07 0.00 3.65E+11 -49.196 1.60E+08
0.00
25.4137 4.41E-07 7216. -371.108 -1.74E-07 0.00 3.65E+11 -12.465 1.69E+08
0.00
25.9120 -2.47E-07 4774. -386.432 -7.58E-08 0.00 3.65E+11 7.3398 1.78E+08
0.00
26.4104 -4.66E-07 2595. -320.976 -1.54E-08 0.00 3.65E+11 14.5530 1.87E+08

0.00								
26.9087	-4.30E-07	935.6832	-214.603	1.36E-08	0.00	3.65E+11	21.0252	2.92E+08
0.00								
27.4070	-3.03E-07	28.2941	-106.420	2.15E-08	0.00	3.65E+11	15.1582	2.99E+08
0.00								
27.9053	-1.73E-07	-337.086	-35.188	1.90E-08	0.00	3.65E+11	8.6662	2.99E+08
0.00								
28.4036	-7.65E-08	-392.582	2.1634	1.30E-08	0.00	3.65E+11	3.8265	2.99E+08
0.00								
28.9019	-1.82E-08	-311.246	16.3287	7.20E-09	0.00	3.65E+11	0.9112	2.99E+08
0.00								
29.4002	9.57E-09	-197.319	17.6229	3.03E-09	0.00	3.65E+11	-0.478	2.99E+08
0.00								
29.8985	1.80E-08	-100.493	13.4996	5.89E-10	0.00	3.65E+11	-0.901	2.99E+08
0.00								
30.3968	1.66E-08	-35.874	8.3233	-5.29E-10	0.00	3.65E+11	-0.831	2.99E+08
0.00								
30.8951	1.17E-08	-0.950	4.0927	-8.31E-10	0.00	3.65E+11	-0.584	2.99E+08
0.00								
31.3934	6.67E-09	13.0748	1.3474	-7.31E-10	0.00	3.65E+11	-0.334	2.99E+08
0.00								
31.8918	2.94E-09	15.1657	-0.09032	-5.00E-10	0.00	3.65E+11	-0.147	2.99E+08
0.00								
32.3901	6.96E-10	11.9959	-0.634	-2.77E-10	0.00	3.65E+11	-0.03482	2.99E+08
0.00								
32.8884	-3.73E-10	7.5806	-0.683	-1.17E-10	0.00	3.65E+11	0.01866	2.99E+08
0.00								
33.3867	-7.00E-10	3.8325	-0.522	-2.32E-11	0.00	3.65E+11	0.03499	2.99E+08
0.00								
33.8850	-6.51E-10	1.3356	-0.320	1.92E-11	0.00	3.65E+11	0.03254	2.99E+08
0.00								
34.3833	-4.71E-10	0.00212	-0.153	3.01E-11	0.00	3.65E+11	0.02354	2.99E+08
0.00								
34.8816	-2.90E-10	-0.490	-0.03884	2.61E-11	0.00	3.65E+11	0.01452	2.99E+08
0.00								
35.3799	-1.58E-10	-0.462	0.00884	1.83E-11	0.00	3.65E+11	0.00142	5.38E+07
0.00								
35.8782	-7.13E-11	-0.384	0.01501	1.14E-11	0.00	3.65E+11	6.42E-04	5.38E+07

0.00									
36.3765	-2.20E-11	-0.283	0.01752	5.92E-12	0.00	3.65E+11	1.98E-04	5.38E+07	
0.00									
36.8748	0.00	-0.175	0.01881	2.17E-12	0.00	3.65E+11	2.32E-04	2.69E+09	
0.00									
37.3731	3.88E-12	-0.05801	0.01428	0.00	0.00	3.65E+11	-0.00175	2.69E+09	
0.00									
37.8715	2.59E-12	-0.00386	0.00557	0.00	0.00	3.65E+11	-0.00117	2.69E+09	
0.00									
38.3698	0.00	0.00860	8.45E-04	0.00	0.00	3.65E+11	-4.14E-04	2.69E+09	
0.00									
38.8681	0.00	0.00625	-5.22E-04	0.00	0.00	3.65E+11	-4.28E-05	2.69E+09	
0.00									
39.3664	0.00	0.00236	-4.91E-04	0.00	0.00	3.65E+11	5.32E-05	2.69E+09	
0.00									
39.8647	0.00	3.72E-04	-1.97E-04	0.00	0.00	3.65E+11	4.52E-05	2.69E+09	
0.00									
40.3630	0.00	0.00	0.00	0.00	0.00	3.65E+11	2.08E-05	1.35E+09	
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. 3:

Pile-head deflection	=	0.48000000	inches
Computed slope at pile head	=	-0.0026317	radians
Maximum bending moment	=	4578627.	inch-lbs
Maximum shear force	=	-267012.	lbs
Depth of maximum bending moment	=	18.43741975	feet below pile head
Depth of maximum shear force	=	18.93572840	feet below pile head
Number of iterations	=	21	
Number of zero deflection points	=	8	

Pile deflection at ground = 0.00184319 inches

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	15820.	M, in-lb	0.00	212150.	0.4863	-0.00267	-270649.	4609233.
2	V, lb	19120.	M, in-lb	0.00	295890.	0.6135	-0.00338	-350818.	5972026.
3	y, in	0.4800	M, in-lb	0.00	212150.	0.4800	-0.00263	-267012.	4578627.

Maximum pile-head deflection = 0.6135483831 inches
Maximum pile-head rotation = -0.0033822025 radians = -0.193786 deg.

Summary of Warning Messages

The following warning was reported 924 times

**** Warning ****

An unreasonable input value for unconfined compressive strength has been

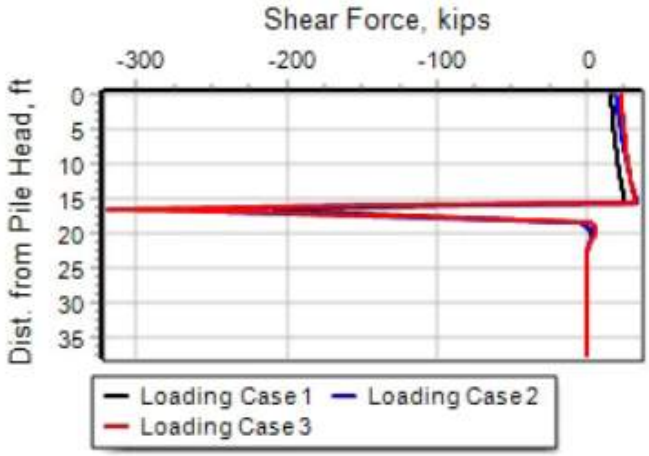
specified for a soil defined using the weak rock criteria. The input value is greater than 500 psi. Please check your input data for correctness.

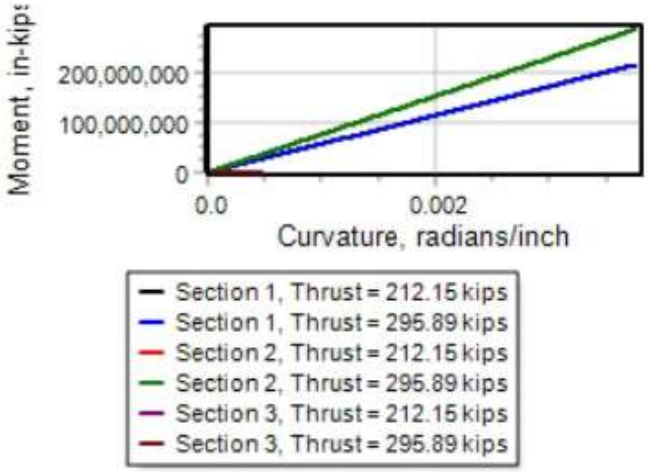
The analysis ended normally.

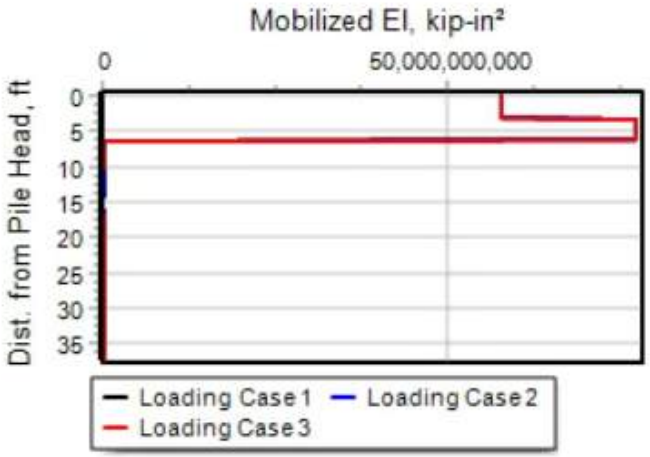
Results for HAS-22-17.53L RA Shaft 5 B-141.lp12d

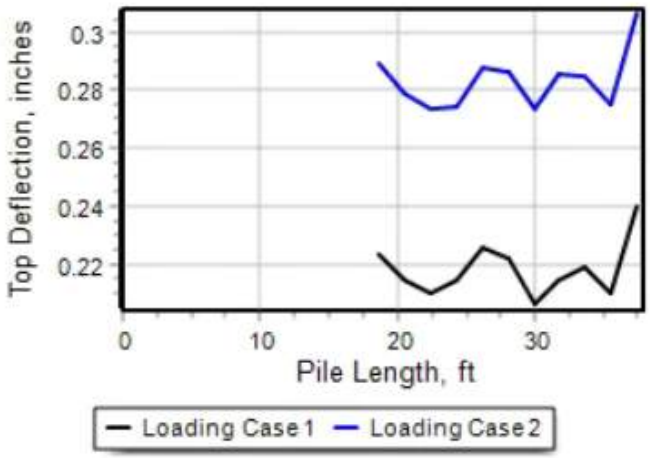












Show All Legends

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```
================================================================================

                            LPile Version 2022-12.013

                                License ID : 500128183
                          License Type : (Single User License)

                     Analysis of Individual Piles and Drilled Shafts
                   Subjected to Lateral Loading Using the p-y Method
                              © 1985-2024 by Ensoft, Inc.
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                                    Columbus, OH, USA

================================================================================


This model was prepared by:
Zmankoci




--------------------------------------------------------------------------------
                             Files Used for Analysis
--------------------------------------------------------------------------------

Path to file locations:
\23-0011 113440 HAS-22-15.25\113440\geotechnical\bridges\XXX-YY-ZZ.ZZ (Crossing)\Analysis\Lpile\New folder\

Name of input data file:
HAS-22-17.53L RA Shaft 5 B-141.lp12d

Name of output report file:
HAS-22-17.53L RA Shaft 5 B-141.lp12o
```

Name of plot output file:
HAS-22-17.53L RA Shaft 5 B-141.lp12p

Name of runtime message file:
HAS-22-17.53L RA Shaft 5 B-141.lp12r

Date and Time of Analysis

Date: November 18, 2025 Time: 11:20:02

Problem Title

Project Name: HAS-22-17.53L

Job Number: 10059

Client: ODOT

Engineer: ZM

Description: HAS-22-17.53L Rear Abut B-141

```
--------------------------------------------------------------------------------
                         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                          =           75

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)
 - 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 = 37.363 ft
Depth of ground surface below top of pile = 15.4730 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	36.0000
2	3.463	36.0000
3	3.463	48.0000
4	6.463	48.0000
5	6.463	36.0000
6	37.363	36.0000

Input Structural Properties for Pile Sections:

Pile Section No. 1:

Section 1 is an elastic pile
Cross-sectional shape = rectangular
Length of section = 3.463000 ft
Width of top of section = 36.000000 in
Width of bottom of section = 36.000000 in
Top Section Depth = 175.000000 in
Bottom Section Depth = 175.000000 in

```
   Top Area                                          =        6300. sq. in
   Bottom Area                                       =        6300. sq. in
   Moment of Inertia at Top                          =    16078125. in^4
   Moment of Inertia at Bottom                       =    16078125. in^4
   Elastic Modulus                                   =     3604996. psi

Pile Section No. 2:

   Section 2 is an elastic pile
   Cross-sectional shape                             =     rectangular
   Length of section                                 =     3.000000 ft
   Width of top of section                           =    48.000000 in
   Width of bottom of section                        =    48.000000 in
   Top Section Depth                                 =   175.000000 in
   Bottom Section Depth                              =   175.000000 in
   Top Area                                          =        8400. sq. in
   Bottom Area                                       =        8400. sq. in
   Moment of Inertia at Top                          =    21437500. in^4
   Moment of Inertia at Bottom                       =    21437500. in^4
   Elastic Modulus                                   =     3604996. psi

Pile Section No. 3:

   Section 3 is a round drilled shaft, bored pile, or CIDH pile
   Length of section                                 =    30.900000 ft
   Shaft Diameter                                    =    36.000000 in



--------------------------------------------------------------------------------
                       Soil and Rock Layering Information
--------------------------------------------------------------------------------

The soil profile is modelled using 5 layers

Layer 1 is weak rock, p-y criteria by Reese, 1997

   Distance from top of pile to top of layer         =    15.473000 ft
```

Distance from top of pile to bottom of layer	=	18.063000	ft
Effective unit weight at top of layer	=	139.000000	pcf
Effective unit weight at bottom of layer	=	139.000000	pcf
Uniaxial compressive strength at top of layer	=	7500.	psi
Uniaxial compressive strength at bottom of layer	=	7500.	psi
Initial modulus of rock at top of layer	=	680000.	psi
Initial modulus of rock at bottom of layer	=	680000.	psi
RQD of rock at top of layer	=	25.000000	%
RQD of rock at bottom of layer	=	25.000000	%
k rm of rock at top of layer	=	0.0000500	
k rm of rock at bottom of layer	=	0.0000500	

Layer 2 is weak rock, p-y criteria by Reese, 1997

Distance from top of pile to top of layer	=	18.063000	ft
Distance from top of pile to bottom of layer	=	23.863000	ft
Effective unit weight at top of layer	=	139.000000	pcf
Effective unit weight at bottom of layer	=	139.000000	pcf
Uniaxial compressive strength at top of layer	=	748.000000	psi
Uniaxial compressive strength at bottom of layer	=	748.000000	psi
Initial modulus of rock at top of layer	=	67000.	psi
Initial modulus of rock at bottom of layer	=	67000.	psi
RQD of rock at top of layer	=	46.000000	%
RQD of rock at bottom of layer	=	46.000000	%
k rm of rock at top of layer	=	0.0002500	
k rm of rock at bottom of layer	=	0.0002500	

Layer 3 is weak rock, p-y criteria by Reese, 1997

Distance from top of pile to top of layer	=	23.863000	ft
Distance from top of pile to bottom of layer	=	32.063000	ft
Effective unit weight at top of layer	=	138.800000	pcf
Effective unit weight at bottom of layer	=	138.800000	pcf
Uniaxial compressive strength at top of layer	=	1125.	psi
Uniaxial compressive strength at bottom of layer	=	1125.	psi
Initial modulus of rock at top of layer	=	100000.	psi

Initial modulus of rock at bottom of layer	=	100000.	psi
RQD of rock at top of layer	=	9.000000	%
RQD of rock at bottom of layer	=	9.000000	%
k rm of rock at top of layer	=	0.0001600	
k rm of rock at bottom of layer	=	0.0001600	

Layer 4 is weak rock, p-y criteria by Reese, 1997

Distance from top of pile to top of layer	=	32.063000	ft
Distance from top of pile to bottom of layer	=	33.663000	ft
Effective unit weight at top of layer	=	129.100000	pcf
Effective unit weight at bottom of layer	=	129.100000	pcf
Uniaxial compressive strength at top of layer	=	200.000000	psi
Uniaxial compressive strength at bottom of layer	=	200.000000	psi
Initial modulus of rock at top of layer	=	18000.	psi
Initial modulus of rock at bottom of layer	=	18000.	psi
RQD of rock at top of layer	=	10.000000	%
RQD of rock at bottom of layer	=	10.000000	%
k rm of rock at top of layer	=	0.0005000	
k rm of rock at bottom of layer	=	0.0005000	

Layer 5 is weak rock, p-y criteria by Reese, 1997

Distance from top of pile to top of layer	=	33.663000	ft
Distance from top of pile to bottom of layer	=	40.363000	ft
Effective unit weight at top of layer	=	150.400000	pcf
Effective unit weight at bottom of layer	=	150.400000	pcf
Uniaxial compressive strength at top of layer	=	10000.	psi
Uniaxial compressive strength at bottom of layer	=	10000.	psi
Initial modulus of rock at top of layer	=	900000.	psi
Initial modulus of rock at bottom of layer	=	900000.	psi
RQD of rock at top of layer	=	76.000000	%
RQD of rock at bottom of layer	=	76.000000	%
k rm of rock at top of layer	=	0.0000500	
k rm of rock at bottom of layer	=	0.0000500	

(Depth of the lowest soil layer extends 3.000 ft below the pile tip)

**** Warning - Possible Input Data Error ****

Values entered for effective unit weight of rock were outside the limits of
50 pcf to 150 pcf.

The maximum input value, in layer 4, for effective unit weight = 150.40 pcf

This data may be erroneous. Please check your data.

Summary of Input Soil Properties

Layer Num.	Soil Type Name (p-y Curve Type)	Layer Depth ft	Effective Unit Wt. pcf	Uniaxial qu psi	RQD %	E50 or krm	Rock Mass Modulus psi
1	Weak	15.4730	139.0000	7500.	25.0000	5.00E-05	680000.
	Rock	18.0630	139.0000	7500.	25.0000	5.00E-05	680000.
2	Weak	18.0630	139.0000	748.0000	46.0000	2.50E-04	67000.
	Rock	23.8630	139.0000	748.0000	46.0000	2.50E-04	67000.
3	Weak	23.8630	138.8000	1125.	9.0000	1.60E-04	100000.
	Rock	32.0630	138.8000	1125.	9.0000	1.60E-04	100000.
4	Weak	32.0630	129.1000	200.0000	10.0000	5.00E-04	18000.
	Rock	33.6630	129.1000	200.0000	10.0000	5.00E-04	18000.
5	Weak	33.6630	150.4000	10000.	76.0000	5.00E-05	900000.
	Rock	40.3630	150.4000	10000.	76.0000	5.00E-05	900000.

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	24.600
2	15.473	73.400

Distributed lateral load intensity for Load Case 2 defined using 2 points

Point No.	Depth X ft	Dist. Load lb/in
1	0.000	39.000
2	15.473	112.200

Distributed lateral load intensity for Load Case 3 defined using 2 points

Point No.	Depth X ft	Dist. Load lb/in
1	0.000	24.600
2	15.473	73.400

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 3

Load No.	Load Type	Condition 1	Condition 2	Axial Thrust Force, lbs	Compute Top y vs. Pile Length	Run Analysis
1	1	V = 15820. lbs	M = 0.0000 in-lbs	212150.	Yes	Yes
2	1	V = 19120. lbs	M = 0.0000 in-lbs	295890.	Yes	Yes
3	4	y = 0.480000 in	M = 0.0000 in-lbs	212150.	N.A.	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:

Moment-curvature properties were derived from elastic section properties

Pile Section No. 3:

Dimensions and Properties of Drilled Shaft (Bored Pile):

Length of Section	=	30.900000	ft
Shaft Diameter	=	36.000000	in
Concrete Cover Thickness (to edge of trans. reinf.)	=	3.000000	in
Number of Reinforcing Bars	=	10	bars
Yield Stress of Reinforcing Bars	=	60000.	psi
Modulus of Elasticity of Reinforcing Bars	=	29000000.	psi
Gross Area of Shaft	=	1018.	sq. in.
Total Area of Reinforcing Steel	=	10.000000	sq. in.
Area Ratio of Steel Reinforcement	=	0.98	percent
Edge-to-Edge Bar Spacing	=	7.407667	in
Maximum Concrete Aggregate Size	=	0.750000	in
Ratio of Bar Spacing to Aggregate Size	=	9.88	
Offset of Center of Rebar Cage from Center of Pile	=	0.0000	in
Transverse Reinforcement			
Type: Spiral			
Number of Transverse Reinf. (per spacing)	=	1	
Spacing of Transverse Reinf.	=	5.000000	in
Yield Stress of Transverse Reinf.	=	60000.	psi
Diameter of Transverse Reinf.	=	0.625000	in

Axial Structural Capacities:

Nom. Axial Structural Capacity = 0.85 Fc Ac + Fy As = 4026.778 kips
Tensile Load for Cracking of Concrete = -452.643 kips
Nominal Axial Tensile Capacity = -600.000 kips

Reinforcing Bar Dimensions and Positions Used in Computations:

Bar Number	Bar Diam. inches	Bar Area sq. in.	X inches	Y inches
1	1.128000	1.000000	13.811000	0.00000
2	1.128000	1.000000	11.173334	8.117902
3	1.128000	1.000000	4.267834	13.135042
4	1.128000	1.000000	-4.26783	13.135042
5	1.128000	1.000000	-11.17333	8.117902
6	1.128000	1.000000	-13.81100	0.00000
7	1.128000	1.000000	-11.17333	-8.11790
8	1.128000	1.000000	-4.26783	-13.13504
9	1.128000	1.000000	4.267834	-13.13504
10	1.128000	1.000000	11.173334	-8.11790

NOTE: The positions of the above rebars were computed by LPile

Minimum spacing between any two bars not equal to zero = 7.408 inches
between bars 5 and 6.

Ratio of bar spacing to maximum aggregate size = 9.88

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 = 2

Number	Axial Thrust Force kips
1	212.150
2	295.890

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 = 212.150 kips

Bending Curvature	Bending Moment	Bending Stiffness	Depth to N Axis	Max Comp Strain	Max Tens Strain	Max Conc Stress	Max Steel Stress	Run Msg
rad/in.	in-kip	kip-in2	in	in/in	in/in	ksi	ksi	

6.25000E-07	227.9555036	364728806.	93.2551693	0.00005828	0.00003578	0.2429131
1.6152124						
0.00000125	455.9077025	364726162.	55.6468591	0.00006956	0.00002456	0.2886513
1.8671236						
0.00000188	683.8488634	364719394.	43.1193201	0.00008085	0.00001335	0.3341747
2.1195005						
0.00000250	911.7734684	364709387.	36.8619742	0.00009215	0.00000215	0.3794820
2.3723431						
0.00000313	1140.	364687509.	33.1125893	0.0001035	-0.00000902	0.4245704
2.6256409						
0.00000375	1367.	364592768.	30.6162565	0.0001148	-0.00002019	0.4694250
2.8792929						
0.00000438	1594.	364397783.	28.8350253	0.0001262	-0.00003135	0.5140288
3.1331812						
0.00000500	1821.	364112796.	27.5002200	0.0001375	-0.00004250	0.5583710
3.3872318						
0.00000563	2046.	363754812.	26.4627501	0.0001489	-0.00005365	0.6024450
3.6413986						
0.00000625	2271.	363339324.	25.6332574	0.0001602	-0.00006479	0.6462468
3.8956529						
0.00000688	2495.	362878714.	24.9549300	0.0001716	-0.00007593	0.6897735
4.1499767						
0.00000750	2718.	362382343.	24.3899181	0.0001829	-0.00008708	0.7330235
4.4043572						
0.00000813	2940.	361857324.	23.9120344	0.0001943	-0.00009821	0.7759954
4.6587856						
0.00000875	2940.	336010372.	21.2352856	0.0001858	-0.000129	0.7432096
4.3379355 C						
0.00000938	2940.	313609681.	20.6675833	0.0001938	-0.000144	0.7731326
4.4934367 C						
0.00001000	2940.	294009076.	20.1551246	0.0002016	-0.000158	0.8023233
4.6443928 C						
0.00001063	2940.	276714424.	19.6915810	0.0002092	-0.000173	0.8309237
4.7918337 C						
0.00001125	2940.	261341400.	19.2692909	0.0002168	-0.000188	0.8589625
4.9359321 C						

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   0.00001188         2940.    247586590.    18.8819022     0.0002242     -0.000203     0.8864525
5.0767425 C
   0.00001250         2940.    235207260.    18.5255957     0.0002316     -0.000218     0.9134653
5.2147784 C
   0.00001313         2940.    224006915.    18.1965393     0.0002388     -0.000234     0.9400349
5.3502703 C
   0.00001375         2940.    213824782.    17.8913892     0.0002460     -0.000249     0.9661856
-5.569976 C
   0.00001438         2940.    204528053.    17.6080366     0.0002531     -0.000264     0.9919716
-5.941287 C
   0.00001500         2940.    196006050.    17.3443090     0.0002602     -0.000280     1.0174294
-6.314326 C
   0.00001563         2940.    188165808.    17.0985890     0.0002672     -0.000295     1.0426031
-6.688764 C
   0.00001625         2940.    180928662.    16.8662640     0.0002741     -0.000311     1.0673452
-7.065797 C
   0.00001688         2940.    174227600.    16.6490681     0.0002810     -0.000327     1.0918564
-7.443847 C
   0.00001750         2940.    168005186.    16.4445403     0.0002878     -0.000342     1.1160856
-7.823341 C
   0.00001813         2984.    164638024.    16.2509525     0.0002945     -0.000358     1.1400079
-8.204497 C
   0.00001875         3032.    161713430.    16.0688539     0.0003013     -0.000374     1.1637358
-8.586422 C
   0.00001938         3079.    158939946.    15.8953849     0.0003080     -0.000390     1.1871476
-8.970118 C
   0.00002000         3126.    156324498.    15.7316047     0.0003146     -0.000405     1.2103861
-9.354439 C
   0.00002063         3173.    153842793.    15.5757060     0.0003212     -0.000421     1.2333722
-9.740043 C
   0.00002125         3219.    151486489.    15.4270985     0.0003278     -0.000437     1.2561333
-10.126720 C
   0.00002188         3265.    149259806.    15.2869548     0.0003344     -0.000453     1.2787848
-10.513525 C
   0.00002250         3310.    147123264.    15.1511727     0.0003409     -0.000469     1.3010807
-10.902510 C
   0.00002313         3355.    145100712.    15.0227080     0.0003474     -0.000485     1.3232971
-11.291392 C
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-11.680967 C
   0.00002438         3445.    141323712.    14.7818674     0.0003603     -0.000517     1.3671046
-12.072105 C
   0.00002563         3533.    137886934.    14.5620591     0.0003732     -0.000549     1.4103550
-12.854481 C
   0.00002688         3621.    134721349.    14.3577000     0.0003859     -0.000582     1.4527805
-13.640855 C
   0.00002813         3707.    131821776.    14.1703925     0.0003985     -0.000614     1.4947565
-14.428086 C
   0.00002938         3793.    129136479.    13.9954824     0.0004111     -0.000646     1.5360373
-15.218336 C
   0.00003063         3879.    126661116.    13.8344698     0.0004237     -0.000679     1.5769366
-16.008925 C
   0.00003188         3964.    124349990.    13.6824160     0.0004361     -0.000711     1.6171108
-16.802904 C
   0.00003313         4048.    122209609.    13.5422254     0.0004486     -0.000744     1.6569908
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   0.00003438         4132.    120204429.    13.4096541     0.0004610     -0.000777     1.6962493
-18.392688 C
   0.00003563         4215.    118329047.    13.2854181     0.0004733     -0.000809     1.7350661
-19.189863 C
   0.00003688         4299.    116577604.    13.1699520     0.0004856     -0.000842     1.7735932
-19.986671 C
   0.00003813         4381.    114924104.    13.0596821     0.0004979     -0.000875     1.8115062
-20.786100 C
   0.00003938         4464.    113367685.    12.9557557     0.0005101     -0.000907     1.8490130
-21.586282 C
   0.00004063         4546.    111904222.    12.8585340     0.0005224     -0.000940     1.8862343
-22.386098 C
   0.00004188         4628.    110523334.    12.7669698     0.0005346     -0.000973     1.9231114
-23.186099 C
   0.00004313         4710.    109207938.    12.6783401     0.0005468     -0.001006     1.9593546
-23.989062 C
   0.00004438         4791.    107964128.    12.5949862     0.0005589     -0.001039     1.9953163
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   0.00004563         4872.    106786013.    12.5164754     0.0005711     -0.001071     2.0309959
-25.593897 C
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   0.00004688        4953.    105668326.    12.4424215     0.0005832     -0.001104     2.0663923
-26.395764 C
   0.00004813        5034.    104599478.    12.3706997     0.0005953     -0.001137     2.1012549
-27.199745 C
   0.00004938        5114.    103579448.    12.3020791     0.0006074     -0.001170     2.1357233
-28.004496 C
   0.00005063        5195.    102607621.    12.2370913     0.0006195     -0.001203     2.1699123
-28.808880 C
   0.00005188        5275.    101680501.    12.1754809     0.0006316     -0.001236     2.2038212
-29.612894 C
   0.00005313        5355.    100794923.    12.1170107     0.0006437     -0.001269     2.2374491
-30.416536 C
   0.00005438        5435.     99948012.    12.0614652     0.0006558     -0.001302     2.2707951
-31.219806 C
   0.00005563        5514.     99130658.    12.0066471     0.0006679     -0.001335     2.3035510
-32.025927 C
   0.00005688        5593.     98347149.    11.9544108     0.0006799     -0.001368     2.3360206
-32.831763 C
   0.00005813        5673.     97595466.    11.9046445     0.0006920     -0.001401     2.3682116
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   0.00005938        5752.     96873591.    11.8572090     0.0007040     -0.001433     2.4001233
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   0.00006063        5831.     96179670.    11.8119336     0.0007161     -0.001466     2.4317547
-35.247002 C
   0.00006188        5910.     95512001.    11.7687006     0.0007282     -0.001499     2.4631050
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-36.855250 C
   0.00006438        6067.     94247967.    11.6874039     0.0007524     -0.001565     2.5248771
-37.659715 C
   0.00006563        6146.     93646088.    11.6480636     0.0007644     -0.001598     2.5551199
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   0.00006688        6224.     93065082.    11.6104018     0.0007764     -0.001631     2.5850837
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   0.00006813        6302.     92503791.    11.5743211     0.0007885     -0.001664     2.6147673
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   0.00006938        6380.     91961141.    11.5397372     0.0008006     -0.001697     2.6441701
-40.881795 C
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   0.00007063        6458.     91436135.    11.5065716     0.0008127     -0.001730     2.6732909
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   0.00007188        6535.     90927845.    11.4747513     0.0008247     -0.001763     2.7021290
-42.490454 C
   0.00007313        6613.     90435404.    11.4442327     0.0008369     -0.001796     2.7306834
-43.294180 C
   0.00007438        6691.     89958007.    11.4149069     0.0008490     -0.001829     2.7589532
-44.097502 C
   0.00007938        6999.     88181827.    11.3072667     0.0008975     -0.001960     2.8689252
-47.309803 C
   0.00008438        7306.     86589210.    11.2123237     0.0009460     -0.002091     2.9737861
-50.522241 C
   0.00008938        7611.     85154325.    11.1306931     0.0009948     -0.002223     3.0740333
-53.727767 C
   0.00009438        7914.     83851669.    11.0602835     0.0010438     -0.002354     3.1696012
-56.926211 C
   0.00009938        8214.     82660654.    10.9994697     0.0010931     -0.002484     3.2604205
-60.000000 CY
    0.0001044        8462.     81077530.    10.9246375     0.0011403     -0.002617     3.3424226
-60.000000 CY
    0.0001094        8622.     78825782.    10.8230452     0.0011838     -0.002754     3.4136567
-60.000000 CY
    0.0001144        8779.     76758545.    10.7318935     0.0012275     -0.002890     3.4810808
-60.000000 CY
    0.0001194        8936.     74854939.    10.6500142     0.0012713     -0.003026     3.5446680
-60.000000 CY
    0.0001244        9091.     73090925.    10.5740205     0.0013151     -0.003162     3.6039857
-60.000000 CY
    0.0001294        9244.     71447696.    10.5038328     0.0013589     -0.003299     3.6591496
-60.000000 CY
    0.0001344        9352.     69598541.    10.4209766     0.0014003     -0.003437     3.7074324
-60.000000 CY
    0.0001394        9414.     67547207.    10.3248424     0.0014390     -0.003578     3.7491897
-60.000000 CY
    0.0001444        9472.     65608880.    10.2336693     0.0014775     -0.003720     3.7874938
-60.000000 CY
    0.0001494        9528.     63788664.    10.1461895     0.0015156     -0.003862     3.8223061
-60.000000 CY
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    0.0001544        9584.     62082418.    10.0654353     0.0015539     -0.004004     3.8541338
-60.000000 CY
    0.0001594        9639.     60479335.     9.9907300     0.0015923     -0.004145     3.8829392
-60.000000 CY
    0.0001644        9693.     58969922.     9.9196628     0.0016305     -0.004287     3.9086834
-60.000000 CY
    0.0001694        9746.     57541410.     9.8541486     0.0016690     -0.004428     3.9310847
-60.000000 CY
    0.0001744        9798.     56189155.     9.7917527     0.0017074     -0.004570     3.9503172
-60.000000 CY
    0.0001794        9849.     54908787.     9.7330971     0.0017459     -0.004712     3.9664760
-60.000000 CY
    0.0001844        9900.     53694382.     9.6785609     0.0017845     -0.004853     3.9795192
-60.000000 CY
    0.0001894        9950.     52540644.     9.6278368     0.0018233     -0.004994     3.9894034
-60.000000 CY
    0.0001944        9999.     51442820.     9.5806481     0.0018622     -0.005135     3.9960841
-60.000000 CY
    0.0001994       10048.     50396360.     9.5365366     0.0019013     -0.005276     3.9995131
-60.000000 CY
    0.0002044       10095.     49394303.     9.4929916     0.0019401     -0.005417     3.9964108
-60.000000 CY
    0.0002094       10141.     48436650.     9.4524985     0.0019791     -0.005558     3.9995405
-60.000000 CY
    0.0002144       10187.     47520145.     9.4148867     0.0020183     -0.005699     3.9958315
-60.000000 CY
    0.0002194       10232.     46642003.     9.3799437     0.0020577     -0.005840     3.9992412
-60.000000 CY
    0.0002244       10276.     45799931.     9.3474847     0.0020973     -0.005980     3.9971355
-60.000000 CY
    0.0002294       10316.     44975600.     9.3151843     0.0021367     -0.006121     3.9983239
-60.000000 CY
    0.0002344       10351.     44166377.     9.2822771     0.0021755     -0.006262     3.9999589
-60.000000 CY
    0.0002394       10378.     43353626.     9.2462653     0.0022133     -0.006404     3.9958571
-60.000000 CY
    0.0002444       10396.     42539773.     9.2072543     0.0022500     -0.006547     3.9988404
-60.000000 CY
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    0.0002494        10409.     41740731.     9.1667954     0.0022860     -0.006692     3.9999793
-60.000000 CY
    0.0002544        10418.     40953686.     9.1235427     0.0023208     -0.006837     3.9946271
-60.000000 CY
    0.0002594        10426.     40195875.     9.0823761     0.0023557     -0.006982     3.9978145
-60.000000 CY
    0.0002644        10434.     39466015.     9.0430571     0.0023908     -0.007127     3.9995966
-60.000000 CY
    0.0002694        10442.     38762320.     9.0058951     0.0024260     -0.007272     3.9980123
-60.000000 CY
    0.0002744        10449.     38083014.     8.9706544     0.0024613     -0.007416     3.9949556
-60.000000 CY
    0.0003044        10489.     34460331.     8.7878711     0.0026748     -0.008283     3.9987552
-60.000000 CY
    0.0003344        10519.     31459915.     8.6361607     0.0028877     -0.009150     3.9994780
-60.000000 CY
    0.0003644        10545.     28941139.     8.5196288     0.0031043     -0.010013     3.9991133
-60.000000 CYT
    0.0003944        10567.     26794426.     8.4236884     0.0033221     -0.010875     3.9966096
-60.000000 CYT
    0.0004244        10585.     24942084.     8.3398606     0.0035392     -0.011738     3.9879578
-60.000000 CYT
    0.0004544        10601.     23329960.     8.2736862     0.0037594     -0.012598     3.9999293
-60.000000 CYT
    0.0004844        10601.     21885008.     8.2553526     0.0039987     -0.013439     3.9949553
-60.000000 CYT


Axial Thrust Force =    295.890 kips

    Bending       Bending       Bending      Depth to      Max Comp      Max Tens      Max Conc      Max
Steel  Run
   Curvature      Moment       Stiffness      N Axis        Strain        Strain        Stress        Stress
   Msg
    rad/in.       in-kip        kip-in2         in           in/in         in/in          ksi           ksi

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  6.25000E-07   225.7927934    361268469.   123.4548576    0.00007716    0.00005466     0.3200951
2.1625818
   0.00000125   451.5831204    361266496.    70.7468899    0.00008843    0.00004343     0.3653606
2.4144998
   0.00000188   677.3623026    361259895.    53.1862148    0.00009972    0.00003222     0.4104112
2.6668879
   0.00000250   903.1247683    361249907.    44.4123631     0.0001110    0.00002103     0.4552456
2.9197463
   0.00000313        1129.    361236782.    39.1532413     0.0001224    0.00000985     0.4998625
3.1730750
   0.00000375        1355.    361220595.    35.6514849     0.0001337   -0.00000131     0.5442608
3.4268740
   0.00000438        1580.    361189699.    33.1537808     0.0001450   -0.00001245     0.5884366
3.6811235
   0.00000500        1806.    361104678.    31.2829824     0.0001564   -0.00002359     0.6323764
3.9357325
   0.00000563        2030.    360948199.    29.8295664     0.0001678   -0.00003471     0.6760673
4.1906105
   0.00000625        2255.    360721907.    28.6679661     0.0001792   -0.00004583     0.7195001
4.4456939
   0.00000688        2478.    360433299.    27.7165094     0.0001906   -0.00005695     0.7626682
4.7009367
   0.00000750        2701.    360091206.    26.9269732     0.0002020   -0.00006805     0.8055671
4.9563067
   0.00000813        2923.    359703917.    26.2588515     0.0002134   -0.00007915     0.8481934
5.2117811
   0.00000875        3144.    359278644.    25.6861806     0.0002248   -0.00009025     0.8905447
5.4673434
   0.00000938        3364.    358821423.    25.1900476     0.0002362     -0.000101     0.9326193
5.7229817
   0.00001000        3364.    336395084.    23.1041703     0.0002310     -0.000129     0.9131738
5.4996094 C
   0.00001063        3364.    316607138.    22.5447011     0.0002395     -0.000143     0.9443334
5.6709870 C
   0.00001125        3364.    299017852.    22.0341597     0.0002479     -0.000157     0.9747761
5.8379696 C
   0.00001188        3364.    283280071.    21.5662631     0.0002561     -0.000171     1.0045899
6.0011875 C
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0.00001250	3364.	269116067.	21.1359243	0.0002642	-0.000186	1.0338316
6.1610347 C						
0.00001313	3364.	256301016.	20.7380740	0.0002722	-0.000200	1.0625275
6.3176714 C						
0.00001375	3364.	244650970.	20.3688620	0.0002801	-0.000215	1.0907058
6.4712766 C						
0.00001438	3364.	234013971.	20.0249514	0.0002879	-0.000230	1.1183968
6.6220495 C						
0.00001500	3364.	224263389.	19.7036901	0.0002956	-0.000244	1.1456327
6.7702108 C						
0.00001563	3364.	215292854.	19.4029014	0.0003032	-0.000259	1.1724483
6.9160050 C						
0.00001625	3378.	207898810.	19.1207970	0.0003107	-0.000274	1.1988806
7.0597018 C						
0.00001688	3436.	203629568.	18.8559097	0.0003182	-0.000289	1.2249695
7.2015987 C						
0.00001750	3493.	199582861.	18.6054868	0.0003256	-0.000304	1.2506622
7.3412344 C						
0.00001813	3548.	195750655.	18.3687106	0.0003329	-0.000320	1.2760057
7.4789660 C						
0.00001875	3603.	192137255.	18.1457912	0.0003402	-0.000335	1.3011058
7.6156490 C						
0.00001938	3656.	188693973.	17.9334511	0.0003475	-0.000350	1.3258349
-7.824974 C						
0.00002000	3709.	185435214.	17.7326370	0.0003547	-0.000365	1.3503284
-8.193871 C						
0.00002063	3761.	182336395.	17.5417087	0.0003618	-0.000381	1.3745479
-8.564128 C						
0.00002125	3812.	179385119.	17.3597775	0.0003689	-0.000396	1.3984938
-8.935762 C						
0.00002188	3863.	176574800.	17.1865166	0.0003760	-0.000412	1.4222017
-9.308490 C						
0.00002250	3913.	173893457.	17.0210625	0.0003830	-0.000427	1.4456623
-9.682405 C						
0.00002313	3962.	171328424.	16.8625950	0.0003899	-0.000443	1.4688631
-10.057632 C						
0.00002375	4011.	168887957.	16.7119182	0.0003969	-0.000458	1.4919137
-10.433241 C						

```
   0.00002438        4059.    166534398.    16.5660026     0.0004038     -0.000474     1.5146183
-10.810938 C
   0.00002563        4155.    162141470.    16.2936982     0.0004175     -0.000505     1.5595621
-11.567693 C
   0.00002688        4249.    158100322.    16.0426675     0.0004311     -0.000536     1.6037385
-12.327605 C
   0.00002813        4341.    154353505.    15.8086724     0.0004446     -0.000568     1.6470294
-13.091815 C
   0.00002938        4433.    150896277.    15.5927082     0.0004580     -0.000599     1.6897395
-13.857699 C
   0.00003063        4523.    147678850.    15.3907080     0.0004713     -0.000631     1.7317181
-14.626675 C
   0.00003188        4612.    144684326.    15.2024306     0.0004846     -0.000663     1.7730727
-15.397841 C
   0.00003313        4700.    141889492.    15.0259400     0.0004977     -0.000695     1.8138319
-16.170995 C
   0.00003438        4788.    139274713.    14.8607886     0.0005108     -0.000727     1.8540069
-16.946089 C
   0.00003563        4874.    136819705.    14.7049433     0.0005239     -0.000759     1.8935827
-17.723318 C
   0.00003688        4961.    134522619.    14.5592902     0.0005369     -0.000791     1.9327631
-18.500805 C
   0.00003813        5046.    132345530.    14.4201043     0.0005498     -0.000823     1.9711910
-19.281985 C
   0.00003938        5131.    130303109.    14.2899936     0.0005627     -0.000855     2.0093010
-20.062752 C
   0.00004063        5215.    128371766.    14.1665377     0.0005755     -0.000887     2.0468870
-20.845110 C
   0.00004188        5299.    126538278.    14.0486255     0.0005883     -0.000919     2.0838902
-21.629688 C
   0.00004313        5382.    124807919.    13.9378745     0.0006011     -0.000951     2.1205803
-22.413859 C
   0.00004438        5466.    123166707.    13.8327852     0.0006138     -0.000984     2.1568421
-23.198771 C
   0.00004563        5548.    121597784.    13.7312625     0.0006265     -0.001016     2.1924654
-23.986586 C
   0.00004688        5630.    120109712.    13.6354503     0.0006392     -0.001048     2.2277802
-24.773998 C
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   0.00004813        5712.    118696175.    13.5449054     0.0006518     -0.001081     2.2627856
-25.561005 C
   0.00004938        5794.    117344021.    13.4577921     0.0006645     -0.001113     2.2972846
-26.349660 C
   0.00005063        5875.    116048229.    13.3737536     0.0006770     -0.001145     2.3312674
-27.140118 C
   0.00005188        5956.    114812390.    13.2940355     0.0006896     -0.001178     2.3649453
-27.930173 C
   0.00005313        6037.    113632257.    13.2183294     0.0007022     -0.001210     2.3983172
-28.719824 C
   0.00005438        6117.    112503976.    13.1463614     0.0007148     -0.001243     2.4313822
-29.509070 C
   0.00005563        6197.    111413701.    13.0756070     0.0007273     -0.001275     2.4638072
-30.301572 C
   0.00005688        6277.    110368099.    13.0079856     0.0007398     -0.001308     2.4958968
-31.094038 C
   0.00005813        6357.    109365279.    12.9435128     0.0007523     -0.001340     2.5276837
-31.886098 C
   0.00005938        6436.    108402529.    12.8819911     0.0007649     -0.001373     2.5591669
-32.677751 C
   0.00006063        6516.    107477352.    12.8232453     0.0007774     -0.001405     2.5903453
-33.468995 C
   0.00006188        6595.    106585542.    12.7666073     0.0007899     -0.001438     2.6211424
-34.260708 C
   0.00006313        6674.    105720878.    12.7108604     0.0008024     -0.001470     2.6513895
-35.054892 C
   0.00006438        6752.    104887835.    12.6574991     0.0008148     -0.001503     2.6813357
-35.848665 C
   0.00006563        6831.    104084606.    12.6063877     0.0008273     -0.001535     2.7109800
-36.642025 C
   0.00006688        6909.    103309510.    12.5574011     0.0008398     -0.001568     2.7403213
-37.434970 C
   0.00006813        6987.    102560986.    12.5104233     0.0008523     -0.001600     2.7693588
-38.227496 C
   0.00006938        7065.    101837590.    12.4653470     0.0008648     -0.001633     2.7980913
-39.019603 C
   0.00007063        7143.    101137973.    12.4220809     0.0008773     -0.001665     2.8265178
-39.811289 C
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   0.00007188         7220.    100455782.    12.3789436     0.0008897     -0.001698     2.8543810
-40.605825 C
   0.00007313         7298.     99794936.    12.3374020     0.0009022     -0.001730     2.8819291
-41.400107 C
   0.00007438         7375.     99154611.    12.2974548     0.0009146     -0.001763     2.9091746
-42.193961 C
   0.00007938         7682.     96778950.    12.1521243     0.0009646     -0.001893     3.0151098
-45.365052 C
   0.00008438         7987.     94656726.    12.0255138     0.0010147     -0.002023     3.1158848
-48.532510 C
   0.00008938         8289.     92740074.    11.9124562     0.0010647     -0.002153     3.2111206
-51.701533 C
   0.00009438         8589.     91004347.    11.8140847     0.0011150     -0.002283     3.3013836
-54.863146 C
   0.00009938         8886.     89421748.    11.7282588     0.0011655     -0.002412     3.3865995
-58.017161 C
    0.0001044         9180.     87954378.    11.6506457     0.0012160     -0.002541     3.4662742
-60.000000 CY
    0.0001094         9384.     85800606.    11.5481808     0.0012631     -0.002674     3.5353720
-60.000000 CY
    0.0001144         9541.     83421843.    11.4396312     0.0013084     -0.002809     3.5973697
-60.000000 CY
    0.0001194         9697.     81230817.    11.3419667     0.0013539     -0.002944     3.6551937
-60.000000 CY
    0.0001244         9850.     79194943.    11.2495142     0.0013992     -0.003078     3.7081633
-60.000000 CY
    0.0001294        10001.     77305964.    11.1658348     0.0014446     -0.003213     3.7569385
-60.000000 CY
    0.0001344        10151.     75543308.    11.0898380     0.0014902     -0.003347     3.8014419
-60.000000 CY
    0.0001394        10259.     73606225.    11.0036762     0.0015336     -0.003484     3.8396096
-60.000000 CY
    0.0001444        10321.     71489024.    10.9026681     0.0015741     -0.003623     3.8714236
-60.000000 CY
    0.0001494        10378.     69475705.    10.8063989     0.0016142     -0.003763     3.8995256
-60.000000 CY
    0.0001544        10434.     67587878.    10.7175204     0.0016545     -0.003903     3.9242726
-60.000000 CY
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    0.0001594       10489.     65813622.    10.6354135     0.0016950     -0.004042     3.9456180
-60.000000 CY
    0.0001644       10542.     64134489.    10.5556303     0.0017351     -0.004182     3.9632602
-60.000000 CY
    0.0001694       10594.     62548130.    10.4807597     0.0017752     -0.004322     3.9774653
-60.000000 CY
    0.0001744       10645.     61048330.    10.4102665     0.0018153     -0.004462     3.9882598
-60.000000 CY
    0.0001794       10696.     59627757.    10.3455446     0.0018557     -0.004602     3.9955935
-60.000000 CY
    0.0001844       10745.     58279864.    10.2853788     0.0018964     -0.004741     3.9994144
-60.000000 CY
    0.0001894       10794.     56995442.    10.2281739     0.0019370     -0.004881     3.9970351
-60.000000 CY
    0.0001944       10840.     55770067.    10.1742556     0.0019776     -0.005020     3.9997917
-60.000000 CY
    0.0001994       10886.     54601501.    10.1231235     0.0020183     -0.005159     3.9974730
-60.000000 CY
    0.0002044       10931.     53486159.    10.0755448     0.0020592     -0.005298     3.9998635
-60.000000 CY
    0.0002094       10975.     52419608.    10.0313940     0.0021003     -0.005437     3.9972164
-60.000000 CY
    0.0002144       11019.     51399270.     9.9902783     0.0021417     -0.005576     3.9997565
-60.000000 CY
    0.0002194       11061.     50421481.     9.9521062     0.0021832     -0.005714     3.9961638
-60.000000 CY
    0.0002244       11103.     49483900.     9.9165810     0.0022250     -0.005852     3.9993127
-60.000000 CY
    0.0002294       11144.     48582915.     9.8823074     0.0022668     -0.005991     3.9972109
-60.000000 CY
    0.0002344       11183.     47715784.     9.8493605     0.0023084     -0.006129     3.9980280
-60.000000 CY
    0.0002394       11221.     46876993.     9.8176662     0.0023501     -0.006267     3.9998847
-60.000000 CY
    0.0002444       11256.     46059903.     9.7866751     0.0023916     -0.006406     3.9950300
-60.000000 CY
    0.0002494       11283.     45245424.     9.7529083     0.0024321     -0.006545     3.9984053
-60.000000 CY
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    0.0002544        11306.     44446014.     9.7185154     0.0024721     -0.006685     3.9999015
-60.000000 CY
    0.0002594        11319.     43640540.     9.6798494     0.0025107     -0.006827     3.9945023
-60.000000 CY
    0.0002644        11330.     42857537.     9.6421489     0.0025491     -0.006968     3.9970850
-60.000000 CY
    0.0002694        11338.     42090633.     9.6039838     0.0025871     -0.007110     3.9992100
-60.000000 CY
    0.0002744        11346.     41350452.     9.5673334     0.0026250     -0.007252     3.9999954
-60.000000 CY
    0.0003044        11380.     37388565.     9.3667055     0.0028510     -0.008107     3.9934819
-60.000000 CY
    0.0003344        11408.     34118560.     9.2116385     0.0030801     -0.008957     3.9944808
-60.000000 CYT
    0.0003644        11430.     31368001.     9.0799576     0.0033085     -0.009809     3.9916365
-60.000000 CYT
    0.0003944        11447.     29026108.     8.9721368     0.0035384     -0.010659     3.9939045
-60.000000 CYT
    0.0004244        11462.     27009296.     8.8854430     0.0037708     -0.011507     3.9992875
-60.000000 CYT
    0.0004544        11462.     25226013.     8.9133442     0.0040500     -0.012307     3.9978007
60.0000000 CYT


--------------------------------------------------------------------------------
   Summary of Results for Nominal Moment Capacity for Section 3
--------------------------------------------------------------------------------

Moment values interpolated at maximum compressive strain = 0.003
or maximum developed moment if pile fails at smaller strains.

 Load           Axial Thrust        Nominal Mom. Cap.      Max. Comp.      Max. Tens.
  No.              kips                in-kip               Strain           Strain
 ----         ---------------     -----------------     ------------    ------------
   1              212.150             10532.895          0.00300000     -0.00959730
   2              295.890             11398.514          0.00300000     -0.00865979

Note that the values of moment capacity in the table above are not
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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	212.150000	10533.	137.897500	6846.	89062138.
2	0.65	295.890000	11399.	192.328500	7409.	98888514.
1	0.75	212.150000	10533.	159.112500	7900.	83911158.
2	0.75	295.890000	11399.	221.917500	8549.	91233835.
1	0.90	212.150000	10533.	190.935000	9480.	65371459.
2	0.90	295.890000	11399.	266.301000	10259.	73609913.

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	15.4730	0.00	N.A.	Yes	N.A.	N.A.
2	18.0630	2.5900	No	Yes	N.A.	N.A.
3	23.8630	8.3900	No	Yes	N.A.	N.A.
4	32.0630	16.5900	No	Yes	N.A.	N.A.
5	33.6630	18.1900	No	Yes	N.A.	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 = 15820.0 lbs
Applied moment at pile head = 0.0 in-lbs
Axial thrust load on pile head = 212150.0 lbs

Depth X	Deflect. y	Bending Moment	Shear Force	Slope S	Total Stress	Bending Stiffness	Soil Res. p	Soil Spr. Es*H	Distrib. Lat. Load
feet	inches	in-lbs	lbs	radians	psi*	lb-in^2	lb/inch	lb/inch	lb/inch
0.00	0.2402	0.02215	15820.	-0.00150	33.6746	5.80E+13	0.00	0.00	24.9928
0.4982	0.2312	96928.	15973.	-0.00150	33.7831	5.80E+13	0.00	0.00	26.1712

0.9963	0.2222	194790.	16134.	-0.00150	33.8927	5.80E+13	0.00	0.00
27.7424								
1.4945	0.2132	293645.	16305.	-0.00150	34.0033	5.80E+13	0.00	0.00
29.3135								
1.9927	0.2042	393547.	16485.	-0.00150	34.1152	5.80E+13	0.00	0.00
30.8847								
2.4909	0.1952	494552.	16674.	-0.00150	34.2283	5.80E+13	0.00	0.00
32.4559								
2.9890	0.1862	596717.	16873.	-0.00150	34.3426	5.80E+13	0.00	0.00
34.0271								
3.4872	0.1772	700099.	17081.	-0.00150	26.0397	7.73E+13	0.00	0.00
35.5983								
3.9854	0.1682	804752.	17298.	-0.00150	26.1569	7.73E+13	0.00	0.00
37.1694								
4.4836	0.1592	910734.	17525.	-0.00150	26.2755	7.73E+13	0.00	0.00
38.7406								
4.9817	0.1502	1018100.	17761.	-0.00150	26.3957	7.73E+13	0.00	0.00
40.3118								
5.4799	0.1413	1126907.	18007.	-0.00150	26.5176	7.73E+13	0.00	0.00
41.8830								
5.9781	0.1323	1237210.	18262.	-0.00150	26.6411	7.73E+13	0.00	0.00
43.4542								
6.4763	0.1233	1349066.	18527.	-0.00149	0.00	3.65E+11	0.00	0.00
45.0253								
6.9744	0.1144	1462503.	18801.	-0.00147	0.00	3.65E+11	0.00	0.00
46.5965								
7.4726	0.1057	1577575.	19084.	-0.00144	0.00	3.64E+11	0.00	0.00
48.1677								
7.9708	0.09715	1694336.	19376.	-0.00142	0.00	3.64E+11	0.00	0.00
49.7389								
8.4689	0.08876	1812839.	19678.	-0.00139	0.00	3.64E+11	0.00	0.00
51.3100								
8.9671	0.08054	1933137.	19990.	-0.00136	0.00	3.64E+11	0.00	0.00
52.8812								
9.4653	0.07252	2055286.	20311.	-0.00133	0.00	3.64E+11	0.00	0.00
54.4524								
9.9635	0.06470	2179337.	20641.	-0.00129	0.00	3.63E+11	0.00	0.00
56.0236								

10.4616	0.05709	2305346.	20981.	-0.00125	0.00	3.63E+11	0.00	0.00	57.5948
10.9598	0.04971	2433364.	21330.	-0.00121	0.00	3.63E+11	0.00	0.00	59.1659
11.4580	0.04257	2563446.	21688.	-0.00117	0.00	3.63E+11	0.00	0.00	60.7371
11.9562	0.03568	2695645.	22056.	-0.00113	0.00	3.62E+11	0.00	0.00	62.3083
12.4543	0.02905	2830014.	22433.	-0.00108	0.00	3.62E+11	0.00	0.00	63.8795
12.9525	0.02271	2966607.	22819.	-0.00101	0.00	1.66E+11	0.00	0.00	65.4507
13.4507	0.01700	3105404.	23215.	-8.95E-04	0.00	1.57E+11	0.00	0.00	67.0218
13.9489	0.01200	3246446.	23621.	-7.72E-04	0.00	1.50E+11	0.00	0.00	68.5930
14.4470	0.00778	3389776.	24036.	-6.37E-04	0.00	1.44E+11	0.00	0.00	70.1642
14.9452	0.00439	3535434.	24460.	-4.89E-04	0.00	1.38E+11	0.00	0.00	71.7354
15.4434	0.00192	3683461.	24796.	-3.30E-04	0.00	1.33E+11	0.00	0.00	40.8192
15.9415	4.49E-04	3832736.	-85274.	-1.57E-04	0.00	1.28E+11	-36865.	4.91E+08	0.00
16.4397	4.40E-05	2664314.	-208259.	-4.57E-05	0.00	3.62E+11	-4280.	5.81E+08	0.00
16.9379	-9.80E-05	1342873.	-188174.	-1.27E-05	0.00	3.65E+11	11000.	6.71E+08	0.00
17.4361	-1.08E-04	414508.	-114058.	1.66E-06	0.00	3.65E+11	13796.	7.61E+08	0.00
17.9342	-7.81E-05	-20829.	-39577.	4.89E-06	0.00	3.65E+11	11122.	8.51E+08	0.00
18.4324	-4.99E-05	-58698.	-4019.	4.24E-06	0.00	3.65E+11	774.2862	9.27E+07	0.00
18.9306	-2.75E-05	-68894.	-309.484	3.19E-06	0.00	3.65E+11	466.8304	1.02E+08	0.00
19.4288	-1.18E-05	-62406.	1736.	2.11E-06	0.00	3.65E+11	217.5227	1.10E+08	0.00

19.9269	-2.19E-06	-48143.	2517.	1.21E-06	0.00	3.65E+11	43.7141	1.19E+08	0.00
20.4251	2.67E-06	-32316.	2476.	5.49E-07	0.00	3.65E+11	-57.355	1.28E+08	0.00
20.9233	4.37E-06	-18539.	2005.	1.32E-07	0.00	3.65E+11	-100.250	1.37E+08	0.00
21.4215	4.25E-06	-8344.	1395.	-8.83E-08	0.00	3.65E+11	-103.835	1.46E+08	0.00
21.9196	3.32E-06	-1859.	827.9321	-1.72E-07	0.00	3.65E+11	-85.895	1.55E+08	0.00
22.4178	2.20E-06	1556.	391.2771	-1.74E-07	0.00	3.65E+11	-60.190	1.64E+08	0.00
22.9160	1.23E-06	2819.	105.0610	-1.39E-07	0.00	3.65E+11	-35.565	1.73E+08	0.00
23.4141	5.42E-07	2812.	-50.437	-9.24E-08	0.00	3.65E+11	-16.458	1.81E+08	0.00
23.9123	1.28E-07	2217.	-117.803	-5.11E-08	0.00	3.65E+11	-6.080	2.84E+08	0.00
24.4105	-6.92E-08	1404.	-125.696	-2.15E-08	0.00	3.65E+11	3.4395	2.97E+08	0.00
24.9087	-1.29E-07	713.7737	-96.168	-4.12E-09	0.00	3.65E+11	6.4392	2.99E+08	0.00
25.4068	-1.18E-07	253.9312	-59.218	3.81E-09	0.00	3.65E+11	5.9227	2.99E+08	0.00
25.9050	-8.32E-08	5.7465	-29.073	5.94E-09	0.00	3.65E+11	4.1622	2.99E+08	0.00
26.4032	-4.75E-08	-93.691	-9.538	5.22E-09	0.00	3.65E+11	2.3736	2.99E+08	0.00
26.9014	-2.09E-08	-108.300	0.6776	3.56E-09	0.00	3.65E+11	1.0440	2.99E+08	0.00
27.3995	-4.90E-09	-85.598	4.5300	1.97E-09	0.00	3.65E+11	0.2449	2.99E+08	0.00
27.8977	2.70E-09	-54.143	4.8592	8.27E-10	0.00	3.65E+11	-0.135	2.99E+08	0.00
28.3959	4.98E-09	-27.503	3.7113	1.57E-10	0.00	3.65E+11	-0.249	2.99E+08	0.00
28.8941	4.58E-09	-9.770	2.2822	-1.48E-10	0.00	3.65E+11	-0.229	2.99E+08	0.00

29.3922	3.21E-09	-0.217	1.1175	-2.30E-10	0.00	3.65E+11	-0.161	2.99E+08	0.00
29.8904	1.83E-09	3.5911	0.3635	-2.02E-10	0.00	3.65E+11	-0.09150	2.99E+08	0.00
30.3886	7.97E-10	4.1292	-0.02916	-1.39E-10	0.00	3.65E+11	-0.03986	2.99E+08	0.00
30.8867	1.69E-10	3.2428	-0.174	-7.85E-11	0.00	3.65E+11	-0.00844	2.99E+08	0.00
31.3849	-1.42E-10	2.0546	-0.178	-3.51E-11	0.00	3.65E+11	0.00708	2.99E+08	0.00
31.8831	-2.51E-10	1.1195	-0.119	-9.10E-12	0.00	3.65E+11	0.01255	2.99E+08	0.00
32.3813	-2.50E-10	0.6327	-0.07468	5.26E-12	0.00	3.65E+11	0.00225	5.38E+07	0.00
32.8794	-1.88E-10	0.2265	-0.06288	1.23E-11	0.00	3.65E+11	0.00169	5.38E+07	0.00
33.3776	-1.03E-10	-0.119	-0.05504	1.32E-11	0.00	3.65E+11	9.31E-04	5.38E+07	0.00
33.8758	-3.04E-11	-0.432	-0.01131	8.67E-12	0.00	3.65E+11	0.01370	2.69E+09	0.00
34.3740	0.00	-0.254	0.02934	3.05E-12	0.00	3.65E+11	-1.02E-04	2.69E+09	0.00
34.8721	5.97E-12	-0.08082	0.02101	0.00	0.00	3.65E+11	-0.00269	2.69E+09	0.00
35.3703	3.80E-12	-0.00326	0.00787	0.00	0.00	3.65E+11	-0.00171	2.69E+09	0.00
35.8685	1.30E-12	0.01324	0.00101	0.00	0.00	3.65E+11	-5.87E-04	2.69E+09	0.00
36.3667	0.00	0.00876	-8.95E-04	0.00	0.00	3.65E+11	-4.88E-05	2.69E+09	0.00
36.8648	0.00	0.00254	-7.33E-04	0.00	0.00	3.65E+11	1.03E-04	2.69E+09	0.00
37.3630	0.00	0.00	0.00	0.00	0.00	3.65E+11	1.42E-04	1.35E+09	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             =     0.24016308 inches
Computed slope at pile head      =     -0.0015043 radians
Maximum bending moment           =       3832736. inch-lbs
Maximum shear force              =       -208259. lbs
Depth of maximum bending moment  =    15.94154667 feet below pile head
Depth of maximum shear force     =    16.43972000 feet below pile head
Number of iterations             =            100
Number of zero deflection points =              7
Pile deflection at ground        =     0.00183597 inches
```

Pile-head Deflection vs. Pile Length for Load Case 1

Boundary Condition Type 1, Shear and Moment

```
Shear      =          15820. lbs
Moment     =              0. in-lbs
Axial Load =         212150. lbs
```

Pile Length feet	Pile Head Deflection inches	Maximum Moment ln-lbs	Maximum Shear lbs
37.36300	0.24016308	3832736.	-208259.
35.49485	0.21060710	3729746.	-192901.
33.62670	0.21925767	3754075.	-195960.
31.75855	0.21453653	3745574.	-201126.

29.89040	0.20656740	3706465.	-200601.
28.02225	0.22244307	3754613.	-209784.
26.15410	0.22580459	3755290.	-213828.
24.28595	0.21485975	3708217.	-208878.
22.41780	0.21049342	3707293.	-207176.
20.54965	0.21509848	3730680.	-208312.
18.68150	0.22355895	3754740.	-212362.

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 = 19120.0 lbs
Applied moment at pile head = 0.0 in-lbs
Axial thrust load on pile head = 295890.0 lbs

Depth	Deflect.	Bending	Shear	Slope	Total	Bending	Soil Res.	Soil Spr.	Distrib.
X	y	Moment	Force	S	Stress	Stiffness	p	Es*H	Lat. Load
feet	inches	in-lbs	lbs	radians	psi*	lb-in^2	lb/inch	lb/inch	lb/inch
0.00	0.3064	0.07491	19120.	-0.00193	46.9667	5.80E+13	0.00	0.00	39.5892
0.4982	0.2948	118425.	19362.	-0.00193	47.0992	5.80E+13	0.00	0.00	41.3568
0.9963	0.2833	238327.	19616.	-0.00193	47.2335	5.80E+13	0.00	0.00	43.7135
1.4945	0.2717	359792.	19885.	-0.00193	47.3695	5.80E+13	0.00	0.00	46.0703
1.9927	0.2602	482903.	20167.	-0.00193	47.5073	5.80E+13	0.00	0.00	48.4271

2.4909	0.2487	607745.	20464.	-0.00193	47.6471	5.80E+13	0.00	0.00
50.7838								
2.9890	0.2371	734402.	20774.	-0.00193	47.7889	5.80E+13	0.00	0.00
53.1406								
3.4872	0.2256	862957.	21099.	-0.00193	36.1911	7.73E+13	0.00	0.00
55.4974								
3.9854	0.2140	993496.	21438.	-0.00193	36.3373	7.73E+13	0.00	0.00
57.8542								
4.4836	0.2025	1126102.	21791.	-0.00193	36.4857	7.73E+13	0.00	0.00
60.2109								
4.9817	0.1909	1260860.	22158.	-0.00193	36.6366	7.73E+13	0.00	0.00
62.5677								
5.4799	0.1794	1397853.	22539.	-0.00193	36.7899	7.73E+13	0.00	0.00
64.9245								
5.9781	0.1679	1537167.	22934.	-0.00193	36.9459	7.73E+13	0.00	0.00
67.2812								
6.4763	0.1563	1678885.	23343.	-0.00192	0.00	3.61E+11	0.00	0.00
69.6380								
6.9744	0.1449	1823042.	23767.	-0.00189	0.00	3.61E+11	0.00	0.00
71.9948								
7.4726	0.1337	1969719.	24204.	-0.00186	0.00	3.61E+11	0.00	0.00
74.3515								
7.9708	0.1227	2118995.	24655.	-0.00182	0.00	3.61E+11	0.00	0.00
76.7083								
8.4689	0.1120	2270951.	25121.	-0.00179	0.00	3.61E+11	0.00	0.00
79.0651								
8.9671	0.1014	2425666.	25601.	-0.00175	0.00	3.60E+11	0.00	0.00
81.4218								
9.4653	0.09106	2583219.	26095.	-0.00171	0.00	3.60E+11	0.00	0.00
83.7786								
9.9635	0.08099	2743691.	26602.	-0.00166	0.00	3.60E+11	0.00	0.00
86.1354								
10.4616	0.07120	2907160.	27124.	-0.00161	0.00	3.60E+11	0.00	0.00
88.4922								
10.9598	0.06169	3073706.	27660.	-0.00156	0.00	3.59E+11	0.00	0.00
90.8489								
11.4580	0.05249	3243408.	28211.	-0.00151	0.00	3.59E+11	0.00	0.00
93.2057								

11.9562	0.04361	3416346.	28775.	-0.00144	0.00	2.05E+11	0.00	0.00	95.5625
12.4543	0.03533	3592523.	29353.	-0.00133	0.00	1.93E+11	0.00	0.00	97.9192
12.9525	0.02771	3772003.	29946.	-0.00121	0.00	1.82E+11	0.00	0.00	100.2760
13.4507	0.02084	3954846.	30552.	-0.00108	0.00	1.72E+11	0.00	0.00	102.6328
13.9489	0.01478	4141113.	31173.	-9.36E-04	0.00	1.63E+11	0.00	0.00	104.9895
14.4470	0.00964	4330864.	31807.	-7.77E-04	0.00	1.55E+11	0.00	0.00	107.3463
14.9452	0.00550	4524155.	32456.	-6.01E-04	0.00	1.48E+11	0.00	0.00	109.7031
15.4434	0.00245	4721042.	32971.	-4.10E-04	0.00	1.41E+11	0.00	0.00	62.4038
15.9415	5.97E-04	4919806.	-113531.	-2.02E-04	0.00	1.36E+11	-49075.	4.91E+08	0.00
16.4397	4.11E-05	3364361.	-272160.	-6.09E-05	0.00	3.13E+11	-3995.	5.81E+08	0.00
16.9379	-1.31E-04	1666037.	-240003.	-1.51E-05	0.00	3.61E+11	14753.	6.71E+08	0.00
17.4361	-1.39E-04	494895.	-142990.	2.82E-06	0.00	3.61E+11	17703.	7.61E+08	0.00
17.9342	-9.77E-05	-43586.	-48487.	6.55E-06	0.00	3.61E+11	13913.	8.51E+08	0.00
18.4324	-6.07E-05	-84842.	-4085.	5.49E-06	0.00	3.61E+11	941.7062	9.27E+07	0.00
18.9306	-3.21E-05	-92441.	360.4301	4.02E-06	0.00	3.61E+11	545.3851	1.02E+08	0.00
19.4288	-1.26E-05	-80546.	2687.	2.59E-06	0.00	3.61E+11	233.1429	1.10E+08	0.00
19.9269	-1.11E-06	-60318.	3451.	1.43E-06	0.00	3.61E+11	22.1872	1.19E+08	0.00
20.4251	4.43E-06	-39295.	3233.	6.01E-07	0.00	3.61E+11	-94.937	1.28E+08	0.00
20.9233	6.08E-06	-21663.	2533.	9.70E-08	0.00	3.61E+11	-139.363	1.37E+08	0.00

21.4215	5.59E-06	-9011.	1709.	-1.57E-07	0.00	3.61E+11	-136.370	1.46E+08
0.00								
21.9196	4.20E-06	-1233.	975.7847	-2.42E-07	0.00	3.61E+11	-108.834	1.55E+08
0.00								
22.4178	2.70E-06	2656.	429.7270	-2.30E-07	0.00	3.61E+11	-73.853	1.64E+08
0.00								
22.9160	1.45E-06	3906.	83.4666	-1.76E-07	0.00	3.61E+11	-41.990	1.73E+08
0.00								
23.4141	5.99E-07	3655.	-96.342	-1.13E-07	0.00	3.61E+11	-18.166	1.81E+08
0.00								
23.9123	1.04E-07	2754.	-165.402	-6.00E-08	0.00	3.61E+11	-4.938	2.84E+08
0.00								
24.4105	-1.18E-07	1677.	-162.589	-2.33E-08	0.00	3.61E+11	5.8797	2.97E+08
0.00								
24.9087	-1.75E-07	810.3850	-118.930	-2.71E-09	0.00	3.61E+11	8.7266	2.99E+08
0.00								
25.4068	-1.51E-07	255.3389	-70.331	6.11E-09	0.00	3.61E+11	7.5324	2.99E+08
0.00								
25.9050	-1.02E-07	-30.525	-32.646	7.97E-09	0.00	3.61E+11	5.0753	2.99E+08
0.00								
26.4032	-5.54E-08	-135.009	-9.198	6.60E-09	0.00	3.61E+11	2.7692	2.99E+08
0.00								
26.9014	-2.26E-08	-140.527	2.4587	4.32E-09	0.00	3.61E+11	1.1308	2.99E+08
0.00								
27.3995	-3.75E-09	-105.628	6.3991	2.28E-09	0.00	3.61E+11	0.1875	2.99E+08
0.00								
27.8977	4.67E-09	-64.026	6.2620	8.78E-10	0.00	3.61E+11	-0.233	2.99E+08
0.00								
28.3959	6.75E-09	-30.762	4.5555	9.40E-11	0.00	3.61E+11	-0.338	2.99E+08
0.00								
28.8941	5.79E-09	-9.561	2.6810	-2.40E-10	0.00	3.61E+11	-0.290	2.99E+08
0.00								
29.3922	3.89E-09	1.2927	1.2346	-3.08E-10	0.00	3.61E+11	-0.194	2.99E+08
0.00								
29.8904	2.11E-09	5.2018	0.3386	-2.54E-10	0.00	3.61E+11	-0.105	2.99E+08
0.00								
30.3886	8.46E-10	5.3424	-0.103	-1.67E-10	0.00	3.61E+11	-0.04230	2.99E+08
0.00								

30.8867	1.12E-10	3.9710	-0.246	-9.00E-11	0.00	3.61E+11	-0.00559	2.99E+08	0.00
31.3849	-2.30E-10	2.3997	-0.229	-3.73E-11	0.00	3.61E+11	0.01149	2.99E+08	0.00
31.8831	-3.34E-10	1.2389	-0.144	-7.16E-12	0.00	3.61E+11	0.01669	2.99E+08	0.00
32.3813	-3.15E-10	0.6745	-0.08593	8.67E-12	0.00	3.61E+11	0.00284	5.38E+07	0.00
32.8794	-2.30E-10	0.2115	-0.07125	1.60E-11	0.00	3.61E+11	0.00207	5.38E+07	0.00
33.3776	-1.24E-10	-0.177	-0.06172	1.63E-11	0.00	3.61E+11	0.00112	5.38E+07	0.00
33.8758	-3.56E-11	-0.526	-0.01051	1.05E-11	0.00	3.61E+11	0.01602	2.69E+09	0.00
34.3740	0.00	-0.303	0.03620	3.59E-12	0.00	3.61E+11	-3.90E-04	2.69E+09	0.00
34.8721	7.34E-12	-0.09370	0.02517	0.00	0.00	3.61E+11	-0.00330	2.69E+09	0.00
35.3703	4.54E-12	-0.00225	0.00920	0.00	0.00	3.61E+11	-0.00204	2.69E+09	0.00
35.8685	1.51E-12	0.01627	0.00106	0.00	0.00	3.61E+11	-6.81E-04	2.69E+09	0.00
36.3667	0.00	0.01043	-0.00111	0.00	0.00	3.61E+11	-4.55E-05	2.69E+09	0.00
36.8648	0.00	0.00296	-8.72E-04	0.00	0.00	3.61E+11	1.26E-04	2.69E+09	0.00
37.3630	0.00	0.00	0.00	0.00	0.00	3.61E+11	1.66E-04	1.35E+09	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             =     0.30638480 inches
Computed slope at pile head      =     -0.0019314 radians
Maximum bending moment           =       4919806. inch-lbs
Maximum shear force              =       -272160. lbs
Depth of maximum bending moment  =    15.94154667 feet below pile head
Depth of maximum shear force     =    16.43972000 feet below pile head
Number of iterations             =             46
Number of zero deflection points =              7
Pile deflection at ground        =     0.00234008 inches
```

Pile-head Deflection vs. Pile Length for Load Case 2

Boundary Condition Type 1, Shear and Moment

```
Shear      =          19120. lbs
Moment     =              0. in-lbs
Axial Load =         295890. lbs
```

Pile Length feet	Pile Head Deflection inches	Maximum Moment ln-lbs	Maximum Shear lbs
37.36300	0.30638480	4919806.	-272160.
35.49485	0.27542347	4781950.	-261916.
33.62670	0.28487688	4814701.	-269156.
31.75855	0.28528969	4804831.	-265501.
29.89040	0.27379479	4751608.	-257820.
28.02225	0.28648379	4814988.	-269222.
26.15410	0.28787605	4815345.	-274147.
24.28595	0.27437188	4751787.	-267441.
22.41780	0.27389119	4751648.	-265236.
20.54965	0.27904017	4783000.	-268690.

```
   18.68150    0.28921407      4815605.      -275781.


--------------------------------------------------------------------------------
                 Computed Values of Pile Loading and Deflection
                   for Lateral Loading for Load Case Number 3
--------------------------------------------------------------------------------

Pile-head conditions are Displacement and Moment (Loading Type 4)
Displacement of pile head                              =     0.480000 inches
Moment at pile head                                    =          0.0 in-lbs
Axial load at pile head                                =     212150.0 lbs

   Depth    Deflect.    Bending     Shear      Slope      Total     Bending   Soil Res.  Soil Spr.  Distrib.

     X          y       Moment      Force        S       Stress    Stiffness      p        Es*H     Lat.
Load
   feet      inches     in-lbs       lbs      radians     psi*      lb-in^2    lb/inch    lb/inch    lb/inch

---------- ---------- ---------- ---------- ---------- ---------- ---------- ---------- ----------
----------
      0.00     0.4800       0.00     22596.   -0.00304    33.6746   5.80E+13       0.00       0.00
24.9928
    0.4982     0.4618     139386.     22749.   -0.00304    33.8307   5.80E+13       0.00       0.00
26.1712
    0.9963     0.4436     279708.     22910.   -0.00304    33.9877   5.80E+13       0.00       0.00
27.7424
    1.4945     0.4254     421021.     23080.   -0.00304    34.1460   5.80E+13       0.00       0.00
29.3135
    1.9927     0.4072     563382.     23260.   -0.00304    34.3053   5.80E+13       0.00       0.00
30.8847
    2.4909     0.3890     706846.     23450.   -0.00304    34.4659   5.80E+13       0.00       0.00
32.4559
    2.9890     0.3708     851470.     23648.   -0.00304    34.6279   5.80E+13       0.00       0.00
34.0271
    3.4872     0.3526     997311.     23857.   -0.00304    26.3725   7.73E+13       0.00       0.00
35.5983
    3.9854     0.3344    1144423.     24074.   -0.00304    26.5372   7.73E+13       0.00       0.00
```

37.1694								
4.4836	0.3163	1292863.	24301.	-0.00304	26.7034	7.73E+13	0.00	0.00
38.7406								
4.9817	0.2981	1442688.	24537.	-0.00304	26.8711	7.73E+13	0.00	0.00
40.3118								
5.4799	0.2799	1593953.	24783.	-0.00304	27.0404	7.73E+13	0.00	0.00
41.8830								
5.9781	0.2617	1746715.	25038.	-0.00304	27.2115	7.73E+13	0.00	0.00
43.4542								
6.4763	0.2435	1901030.	25302.	-0.00303	0.00	3.64E+11	0.00	0.00
45.0253								
6.9744	0.2255	2056914.	25576.	-0.00299	0.00	3.64E+11	0.00	0.00
46.5965								
7.4726	0.2077	2214420.	25860.	-0.00296	0.00	3.63E+11	0.00	0.00
48.1677								
7.9708	0.1901	2373602.	26152.	-0.00292	0.00	3.63E+11	0.00	0.00
49.7389								
8.4689	0.1728	2534512.	26454.	-0.00288	0.00	3.63E+11	0.00	0.00
51.3100								
8.9671	0.1557	2697202.	26766.	-0.00284	0.00	3.62E+11	0.00	0.00
52.8812								
9.4653	0.1388	2861726.	27087.	-0.00279	0.00	3.62E+11	0.00	0.00
54.4524								
9.9635	0.1223	3028136.	27417.	-0.00271	0.00	1.62E+11	0.00	0.00
56.0236								
10.4616	0.1064	3196406.	27756.	-0.00259	0.00	1.53E+11	0.00	0.00
57.5948								
10.9598	0.09125	3366576.	28105.	-0.00246	0.00	1.45E+11	0.00	0.00
59.1659								
11.4580	0.07694	3538684.	28464.	-0.00232	0.00	1.38E+11	0.00	0.00
60.7371								
11.9562	0.06356	3712767.	28832.	-0.00215	0.00	1.32E+11	0.00	0.00
62.3083								
12.4543	0.05118	3888863.	29209.	-0.00198	0.00	1.26E+11	0.00	0.00
63.8795								
12.9525	0.03991	4067009.	29595.	-0.00179	0.00	1.22E+11	0.00	0.00
65.4507								
13.4507	0.02982	4247241.	29991.	-0.00158	0.00	1.18E+11	0.00	0.00

67.0218
13.9489 0.02103 4429595. 30397. -0.00135 0.00 1.14E+11 0.00 0.00
68.5930
14.4470 0.01363 4614105. 30811. -0.00111 0.00 1.11E+11 0.00 0.00
70.1642
14.9452 0.00771 4800806. 31236. -8.56E-04 0.00 1.08E+11 0.00 0.00
71.7354
15.4434 0.00339 4989734. 31572. -5.82E-04 0.00 1.05E+11 0.00 0.00
40.8192
15.9415 7.57E-04 5179761. -154111. -2.89E-04 0.00 1.03E+11 -62162. 4.91E+08
0.00
16.4397 -7.13E-05 3147893. -319185. -7.79E-05 0.00 1.55E+11 6936. 5.81E+08
0.00
16.9379 -1.74E-04 1363733. -239978. -6.03E-06 0.00 3.65E+11 19564. 6.71E+08
0.00
17.4361 -1.43E-04 278694. -126893. 7.43E-06 0.00 3.65E+11 18270. 7.61E+08
0.00
17.9342 -8.54E-05 -153434. -35932. 8.46E-06 0.00 3.65E+11 12162. 8.51E+08
0.00
18.4324 -4.24E-05 -150933. 2385. 5.96E-06 0.00 3.65E+11 657.3605 9.27E+07
0.00
18.9306 -1.41E-05 -124936. 5067. 3.70E-06 0.00 3.65E+11 240.1054 1.02E+08
0.00
19.4288 1.88E-06 -90356. 5681. 1.94E-06 0.00 3.65E+11 -34.743 1.10E+08
0.00
19.9269 9.03E-06 -57016. 5038. 7.29E-07 0.00 3.65E+11 -180.344 1.19E+08
0.00
20.4251 1.06E-05 -30120. 3820. 1.53E-08 0.00 3.65E+11 -227.357 1.28E+08
0.00
20.9233 9.22E-06 -11348. 2508. -3.25E-07 0.00 3.65E+11 -211.349 1.37E+08
0.00
21.4215 6.72E-06 -129.146 1386. -4.19E-07 0.00 3.65E+11 -164.089 1.46E+08
0.00
21.9196 4.21E-06 5226. 569.5609 -3.77E-07 0.00 3.65E+11 -109.096 1.55E+08
0.00
22.4178 2.22E-06 6682. 62.0950 -2.79E-07 0.00 3.65E+11 -60.680 1.64E+08
0.00
22.9160 8.74E-07 5969. -194.712 -1.76E-07 0.00 3.65E+11 -25.236 1.73E+08

0.00								
23.4141	1.17E-07	4354.	-280.787	-9.09E-08	0.00	3.65E+11	-3.560	1.81E+08
0.00								
23.9123	-2.13E-07	2612.	-261.172	-3.39E-08	0.00	3.65E+11	10.1227	2.84E+08
0.00								
24.4105	-2.88E-07	1231.	-188.179	-2.37E-09	0.00	3.65E+11	14.2974	2.97E+08
0.00								
24.9087	-2.41E-07	362.0020	-109.373	1.07E-08	0.00	3.65E+11	12.0676	2.99E+08
0.00								
25.4068	-1.60E-07	-76.222	-49.436	1.30E-08	0.00	3.65E+11	7.9845	2.99E+08
0.00								
25.9050	-8.55E-08	-229.100	-12.793	1.05E-08	0.00	3.65E+11	4.2747	2.99E+08
0.00								
26.4032	-3.37E-08	-229.204	5.0280	6.78E-09	0.00	3.65E+11	1.6874	2.99E+08
0.00								
26.9014	-4.46E-09	-169.001	10.7382	3.51E-09	0.00	3.65E+11	0.2230	2.99E+08
0.00								
27.3995	8.27E-09	-100.826	10.1688	1.30E-09	0.00	3.65E+11	-0.413	2.99E+08
0.00								
27.8977	1.11E-08	-47.425	7.2710	8.81E-11	0.00	3.65E+11	-0.556	2.99E+08
0.00								
28.3959	9.32E-09	-13.893	4.2158	-4.14E-10	0.00	3.65E+11	-0.466	2.99E+08
0.00								
28.8941	6.16E-09	2.9812	1.9012	-5.04E-10	0.00	3.65E+11	-0.308	2.99E+08
0.00								
29.3922	3.30E-09	8.8398	0.4870	-4.07E-10	0.00	3.65E+11	-0.165	2.99E+08
0.00								
29.8904	1.30E-09	8.8045	-0.200	-2.62E-10	0.00	3.65E+11	-0.06492	2.99E+08
0.00								
30.3886	1.61E-10	6.4487	-0.418	-1.37E-10	0.00	3.65E+11	-0.00806	2.99E+08
0.00								
30.8867	-3.44E-10	3.8046	-0.391	-5.34E-11	0.00	3.65E+11	0.01721	2.99E+08
0.00								
31.3849	-4.77E-10	1.7753	-0.268	-7.63E-12	0.00	3.65E+11	0.02383	2.99E+08
0.00								
31.8831	-4.35E-10	0.5978	-0.132	1.18E-11	0.00	3.65E+11	0.02177	2.99E+08
0.00								
32.3813	-3.35E-10	0.1981	-0.05783	1.83E-11	0.00	3.65E+11	0.00302	5.38E+07

0.00									
	32.8794	-2.16E-10	-0.09369	-0.04299	1.92E-11	0.00	3.65E+11	0.00194	5.38E+07
0.00									
	33.3776	-1.06E-10	-0.316	-0.03433	1.58E-11	0.00	3.65E+11	9.53E-04	5.38E+07
0.00									
	33.8758	-2.67E-11	-0.504	0.00440	9.12E-12	0.00	3.65E+11	0.01201	2.69E+09
0.00									
	34.3740	3.12E-12	-0.263	0.03609	2.83E-12	0.00	3.65E+11	-0.00140	2.69E+09
0.00									
	34.8721	7.11E-12	-0.07271	0.02234	0.00	0.00	3.65E+11	-0.00320	2.69E+09
0.00									
	35.3703	3.97E-12	0.00367	0.00743	0.00	0.00	3.65E+11	-0.00179	2.69E+09
0.00									
	35.8685	1.20E-12	0.01614	4.75E-04	0.00	0.00	3.65E+11	-5.39E-04	2.69E+09
0.00									
	36.3667	0.00	0.00935	-0.00114	0.00	0.00	3.65E+11	-2.08E-06	2.69E+09
0.00									
	36.8648	0.00	0.00248	-7.82E-04	0.00	0.00	3.65E+11	1.23E-04	2.69E+09
0.00									
	37.3630	0.00	0.00	0.00	0.00	0.00	3.65E+11	1.39E-04	1.35E+09
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. 3:

Pile-head deflection	=	0.48000000 inches
Computed slope at pile head	=	-0.0030437 radians
Maximum bending moment	=	5179761. inch-lbs
Maximum shear force	=	-319185. lbs
Depth of maximum bending moment	=	15.94154667 feet below pile head
Depth of maximum shear force	=	16.43972000 feet below pile head

```
Number of iterations             =             30
Number of zero deflection points =              7
Pile deflection at ground        =     0.00322920 inches
```

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	15820.	M, in-lb	0.00	212150.	0.2402	-0.00150	-208259.	3832736.
2	V, lb	19120.	M, in-lb	0.00	295890.	0.3064	-0.00193	-272160.	4919806.
3	y, in	0.4800	M, in-lb	0.00	212150.	0.4800	-0.00304	-319185.	5179761.

Maximum pile-head deflection = 0.4800000000 inches
Maximum pile-head rotation   = -0.0030436768 radians = -0.174390 deg.

Summary of Warning Messages

The following warning was reported 1271 times

**** Warning ****

An unreasonable input value for unconfined compressive strength has been specified for a soil defined using the weak rock criteria. The input value is greater than 500 psi. Please check your input data for correctness.

The analysis ended normally.

HAS-22-17.53L RA B-141 Shaft 1 Strength Limit		
Depth (ft)	Shear Force from Lpile(lb)	Average Shear (lb) based on ODOT GDM 1501.7.9
0	19120	19120
0.4983	19361	19240.5
0.9966	19612	19623.6
1.4949	19875	19899
1.9932	20150	20174.42857
2.4915	20438	20461.57143
2.9899	20737	20760.85714
3.4882	21048	21072.14286
3.9865	21371	21395.42857
4.4848	21707	21730.71429
4.9831	22054	22078
5.4814	22413	22437.28571
5.9797	22785	22808.71429
6.478	23168	23192
6.9763	23563	23587.28571
7.4746	23971	23994.71429
7.9729	24390	24414
8.4712	24821	24845.28571
8.9696	25265	25288.71429
9.4679	25720	25744
9.9662	26187	26211.42857
10.4645	26667	26690.8571
10.9628	27158	27182.1429
11.4611	27662	27685.5714
11.9594	28177	28201.0000
12.4577	28704	28728.4286
12.956	29244	29267.8571
13.4543	29795	29819.2857
13.9526	30359	30382.7143
14.451	30934	30958.2857
14.9493	31522	31545.7143
15.4476	32121	32145.2857
15.9459	32733	32756.7143
16.4442	33356	33377.8571
16.9425	33992	5589.0000
17.4408	34639	-49116.5714
17.9391	35282	-93708.8571
18.4374	-163000	-121131.5714
18.9357	-350818	-134536.5714
19.434	-279413	-140245.7143
19.9323	-158603	-143767.1429
20.4307	-59843	-119085.4286
20.929	-5325	-67872.5714
21.4273	10632	-27207.2857
21.9256	9772	-4112.1429
22.4239	7672	4637.4286
22.9222	5244	5443.7606
23.4205	3063	3886.4996
23.9188	1404	2419.3822
24.4171	319.3245	1250.6678
24.9154	-268.827	441.7918
25.4137	-497.822	-35.2802
25.912	-509.001	-255.0809
26.4104	-418.132	-306.7673
26.9087	-276.504	-267.6508
27.407	-134.605	-193.3400
27.9053	-42.48	-117.2985
28.4036	4.9881	-55.0637
28.9019	22.3541	-14.0465
29.4002	23.2896	5.9114
29.8985	17.5116	12.2062
30.3968	10.6162	11.4623
30.8951	5.1005	8.1443
31.3934	1.5833	4.69E+00
31.8918	-2.19E-01	2.09E+00
32.3901	-0.872	5.17E-01
32.8884	-8.99E-01	-2.39E-01
33.3867	-6.73E-01	-4.71E-01
33.885	-4.04E-01	-4.38E-01
34.3833	-1.88E-01	-3.10E-01
34.8816	-4.39E-02	-1.78E-01
35.3799	1.53E-02	-7.82E-02
35.8782	2.26E-02	-1.82E-02
36.3765	2.55E-02	9.56E-03
36.8748	2.47E-02	1.59E-02
37.3731	1.67E-02	1.36E-02
37.8715	5.96E-03	1.03E-02
38.3698	6.40E-04	6.64E-03
38.8681	-7.25E-04	3.11E-03
39.3664	-5.76E-04	8.48E-04
39.8647	-2.09E-04	-1.74E-04
40.363	0.00E+00	-3.78E-04

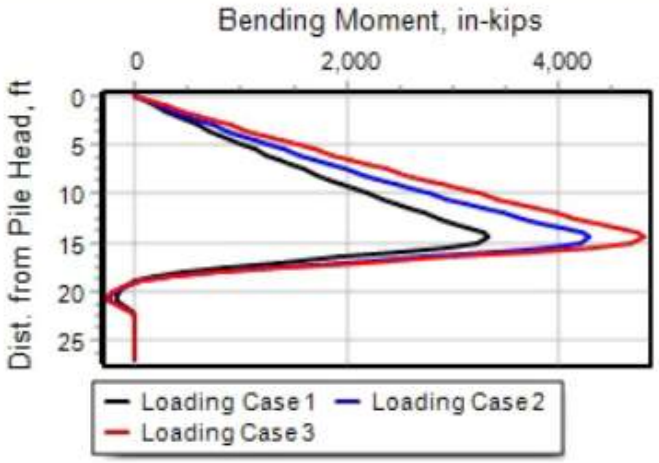
HAS-22-17.53L RA B-141 Shaft 1 Thermal Movement		
Depth (ft)	Shear Force from Lpile(lb)	Average Shear (lb) based on ODOT GDM 1501.7.9
0	15688	15688
0.4983	15840	15764
0.9966	15999	16006.8
1.4949	16166	16181.85714
1.9932	16341	16357.14286
2.4915	16524	16540.28571
2.9899	16715	16731.42857
3.4882	16915	16930.57143
3.9865	17122	17137.71429
4.4848	17337	17352.85714
4.9831	17560	17576.14286
5.4814	17791	17807.28571
5.9797	18030	18046.42857
6.478	18278	18293.57143
6.9763	18533	18548.71429
7.4746	18796	18811.85714
7.9729	19067	19083.14286
8.4712	19346	19362.28571
8.9696	19633	19649.42857
9.4679	19929	19944.57143
9.9662	20232	20247.85714
10.4645	20543	20559.1429
10.9628	20862	20878.4286
11.4611	21190	21205.5714
11.9594	21525	21540.8571
12.4577	21868	21884.1429
12.956	22219	22235.4286
13.4543	22579	22594.5714
13.9526	22946	22961.8571
14.451	23321	23337.1429
14.9493	23704	23720.4286
15.4476	24096	24111.7143
15.9459	24495	24511.0000
16.4442	24902	24916.7143
16.9425	25318	3863.7143
17.4408	25741	-37723.1429
17.9391	26161	-71887.0000
18.4374	-123667	-93011.1429
18.9357	-267012	-103358.4286
19.434	-214652	-107701.2857
19.9323	-122967	-110294.5714
20.4307	-47113	-91567.7143
20.929	-4659	-52585.1429
21.4273	8008	-21343.7143
21.9256	7421	-3436.8571
22.4239	5866	3452.2857
22.9222	4038	4156.8929
23.4205	2381	2986.2143
23.9188	1111	1873.0560
24.4171	273.2502	979.8515
24.9154	-186.75	357.1406
25.4137	-371.108	-13.6598
25.912	-386.432	-187.5770
26.4104	-320.976	-231.6396
26.9087	-214.603	-204.6519
27.407	-106.42	-149.3038
27.9053	-35.188	-91.5817
28.4036	2.1634	-43.7995
28.9019	16.3287	-11.9529
29.4002	17.6229	3.8347
29.8985	13.4996	9.0540
30.3968	8.3233	8.7320
30.8951	4.0927	6.3088
31.3934	1.3474	3.69E+00
31.8918	-9.03E-02	1.69E+00
32.3901	-0.634	4.56E-01
32.8884	-6.83E-01	-1.51E-01
33.3867	-5.22E-01	-3.49E-01
33.885	-3.20E-01	-3.35E-01
34.3833	-1.53E-01	-2.42E-01
34.8816	-3.88E-02	-1.42E-01
35.3799	8.84E-03	-6.45E-02
35.8782	1.50E-02	-1.68E-02
36.3765	1.75E-02	5.88E-03
36.8748	1.88E-02	1.16E-02
37.3731	1.43E-02	1.02E-02
37.8715	5.57E-03	8.00E-03
38.3698	8.45E-04	5.47E-03
38.8681	-5.22E-04	2.78E-03
39.3664	-4.91E-04	8.68E-04
39.8647	-1.97E-04	-7.30E-05
40.363	0.00E+00	-3.03E-04

HAS-22-17.53L RA B-141 Shaft 5 Strength Limit		
Depth (ft)	Shear Force from Lpile(lb)	Average Shear (lb) based on ODOT GDM 1501.7.9
0	19120	19120
0.4982	19362	19241
0.9963	19616	19630
1.4945	19885	19912.57143
1.9927	20167	20195.28571
2.4909	20464	20491.85714
2.989	20774	20802.57143
3.4872	21099	21127.28571
3.9854	21438	21466.14286
4.4836	21791	21819
4.9817	22158	22186
5.4799	22539	22567.14286
5.9781	22934	22962.28571
6.4763	23343	23371.42857
6.9744	23767	23794.71429
7.4726	24204	24232.14286
7.9708	24655	24683.71429
8.4689	25121	25149.28571
8.9671	25601	25628.85714
9.4653	26095	26122.57143
9.9635	26602	26630.57143
10.4616	27124	27152.5714
10.9598	27660	27688.5714
11.458	28211	28238.7143
11.9562	28775	28803.0000
12.4543	29353	29381.4286
12.9525	29946	29973.8571
13.4507	30552	30580.2857
13.9489	31173	31179.7143
14.447	31807	10767.7143
14.9452	32456	-32390.2857
15.4434	32971	-71041.0000
15.9415	-113531	-95921.4286
16.4397	-272160	-107392.0000
16.9379	-240003	-112612.1429
17.4361	-142990	-117270.7957
17.9342	-48487	-100668.2243
18.4324	-4085	-61295.2243
18.9306	360.4301	-26547.2243
19.4288	2687	-5758.2243
19.9269	3451	1412.6329
20.4251	3233	2135.6021
20.9233	2533	2145.5017
21.4215	1709	1773.5683
21.9196	975.7847	1266.8052
22.4178	429.727	781.3192
22.916	83.4666	396.2350
23.4141	-96.342	135.1022
23.9123	-165.402	-14.3429
24.4105	-162.589	-80.3962
24.9087	-118.93	-93.6340
25.4068	-70.331	-79.5196
25.905	-32.646	-54.9766
26.4032	-9.198	-30.8550
26.9014	2.4587	-13.2142
27.3995	6.3991	-2.7840
27.8977	6.262	2.0561
28.3959	4.5555	3.4185
28.8941	2.681	3.0525
29.3922	1.2346	2.1032
29.8904	0.3386	1.1760
30.3886	-0.103	0.5046
30.8867	-0.246	0.1093
31.3849	-0.229	-0.0772
31.8831	-0.144	-0.1344
32.3813	-0.08593	-0.1212
32.8794	-0.07125	-0.0809
33.3776	-0.06172	-0.0446
33.8758	-0.01051	-0.0227
34.374	0.0362	-0.0103
34.8721	0.02517	-0.0002
35.3703	0.0092	0.0084
35.8685	0.00106	0.0099
36.3667	-0.00111	0.0056
36.8648	-0.000872	0.0017
37.363	0	-0.0002

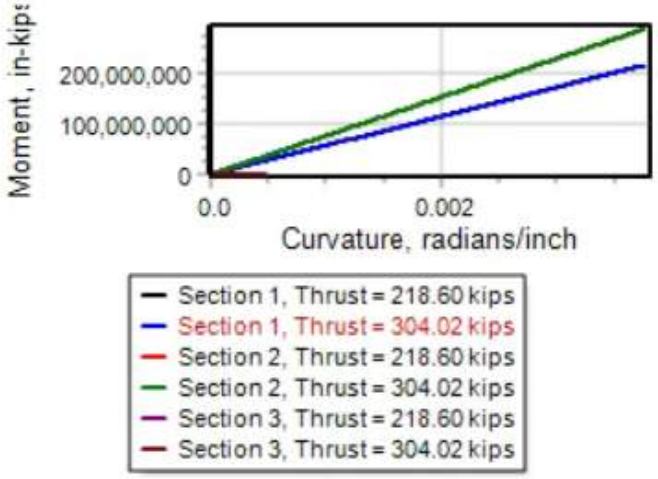
HAS-22-17.53L RA B-141 Shaft 5 Thermal Movement		
Depth (ft)	Shear Force from Lpile(lb)	Average Shear (lb) based on ODOT GDM 1501.7.9
0	22596	22596
0.4982	22749	22672.5
0.9963	22910	22919
1.4945	23080	23099
1.9927	23260	23279.14286
2.4909	23450	23468.42857
2.989	23648	23667.14286
3.4872	23857	23875.28571
3.9854	24074	24092.85714
4.4836	24301	24319.71429
4.9817	24537	24556
5.4799	24783	24801.57143
5.9781	25038	25056.71429
6.4763	25302	25321.14286
6.9744	25576	25595
7.4726	25860	25878.28571
7.9708	26152	26171
8.4689	26454	26473.14286
8.9671	26766	26784.57143
9.4653	27087	27105.28571
9.9635	27417	27435.57143
10.4616	27756	27775.2857
10.9598	28105	28124.2857
11.458	28464	28482.5714
11.9562	28832	28850.2857
12.4543	29209	29227.5714
12.9525	29595	29614.1429
13.4507	29991	30010.1429
13.9489	30397	30401.5714
14.447	30811	4213.0000
14.9452	31236	-45612.7143
15.4434	31572	-84179.7143
15.9415	-154111	-106649.7143
16.4397	-319185	-116184.4286
16.9379	-239978	-120306.0000
17.4361	-126893	-124092.4286
17.9342	-35932	-101265.0000
18.4324	2385	-54947.4286
18.9306	5067	-20119.1429
19.4288	5681	-1633.2857
19.9269	5038	3697.8571
20.4251	3820	3438.5087
20.9233	2508	2723.5223
21.4215	1386	1884.1348
21.9196	569.5609	1124.3081
22.4178	62.095	541.2836
22.916	-194.712	156.1151
23.4141	-280.787	-57.5096
23.9123	-261.172	-145.9377
24.4105	-188.179	-156.6360
24.9087	-109.373	-128.1017
25.4068	-49.436	-86.4553
25.905	-12.793	-47.6923
26.4032	5.028	-19.7709
26.9014	10.7382	-3.5439
27.3995	10.1688	3.7900
27.8977	7.271	5.6871
28.3959	4.2158	4.9403
28.8941	1.9012	3.3465
29.3922	0.487	1.8380
29.8904	-0.2	0.7610
30.3886	-0.418	0.1399
30.8867	-0.391	-0.1400
31.3849	-0.268	-0.2157
31.8831	-0.132	-0.1920
32.3813	-0.05783	-0.1317
32.8794	-0.04299	-0.0707
33.3776	-0.03433	-0.0292
33.8758	0.0044	-0.0093
34.374	0.03609	-0.0009
34.8721	0.02234	0.0050
35.3703	0.00743	0.0098
35.8685	0.000475	0.0092
36.3667	-0.00114	0.0047
36.8648	-0.000782	0.0012
37.363	0	-0.0004

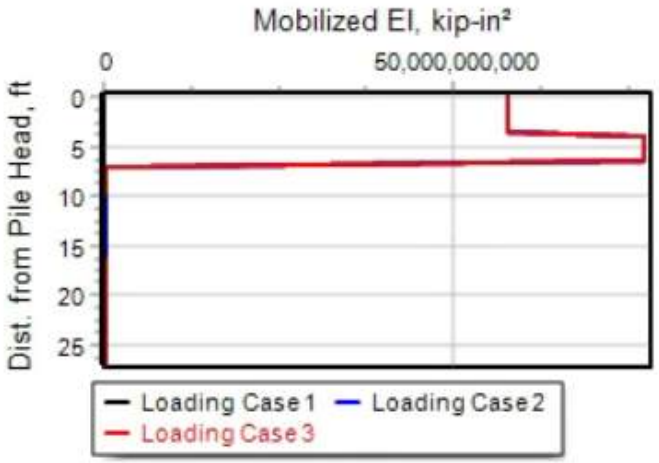
Results for HAS-22-17.53L FA Shaft 1 B-144.lp12d

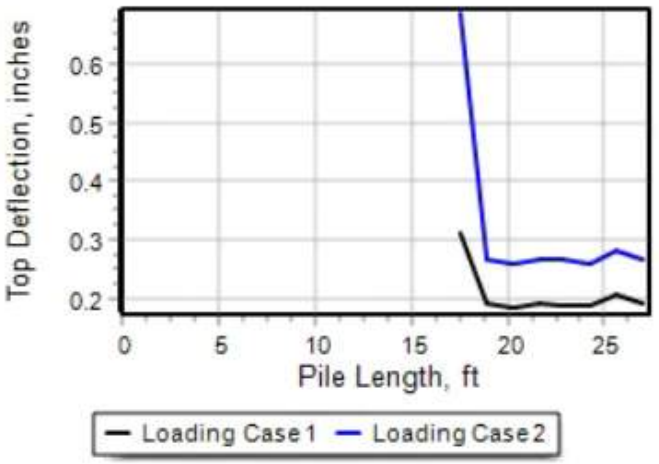












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LPile Version 2022-12.013

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License Type : (Single User License)

Analysis of Individual Piles and Drilled Shafts
Subjected to Lateral Loading Using the p-y Method
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Columbus, OH, USA

==========

This model was prepared by:
Zmankoci

Files Used for Analysis

Path to file locations:
\23-0011 113440 HAS-22-15.25\113440\geotechnical\bridges\XXX-YY-ZZ.ZZ (Crossing)\Analysis\Lpile\New folder\

Name of input data file:
HAS-22-17.53L FA Shaft 1 B-144.lp12d

Name of output report file:
HAS-22-17.53L FA Shaft 1 B-144.lp12o

Name of plot output file:
HAS-22-17.53L FA Shaft 1 B-144.lp12p

Name of runtime message file:
HAS-22-17.53L FA Shaft 1 B-144.lp12r

Date and Time of Analysis

Date: November 18, 2025 Time: 11:21:34

Problem Title

Project Name: HAS-22-17.53L

Job Number: 10059

Client: ODOT

Engineer: ZM

Description: HAS-22-17.53L over Colubmus & Ohio River RR Spur

```
--------------------------------------------------------------------------------
                         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                           =           54

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)
 - 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 = 27.000 ft
Depth of ground surface below top of pile = 13.8000 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	36.0000
2	3.600	36.0000
3	3.600	48.0000
4	6.600	48.0000
5	6.600	36.0000
6	27.000	36.0000

Input Structural Properties for Pile Sections:

Pile Section No. 1:

Section 1 is an elastic pile
Cross-sectional shape = rectangular
Length of section = 3.600000 ft
Width of top of section = 36.000000 in
Width of bottom of section = 36.000000 in
Top Section Depth = 175.000000 in
Bottom Section Depth = 175.000000 in

```
   Top Area                                          =        6300. sq. in
   Bottom Area                                       =        6300. sq. in
   Moment of Inertia at Top                          =    16078125. in^4
   Moment of Inertia at Bottom                       =    16078125. in^4
   Elastic Modulus                                   =     3604996. psi

Pile Section No. 2:

   Section 2 is an elastic pile
   Cross-sectional shape                             =     rectangular
   Length of section                                 =     3.000000 ft
   Width of top of section                           =    48.000000 in
   Width of bottom of section                        =    48.000000 in
   Top Section Depth                                 =   175.000000 in
   Bottom Section Depth                              =   175.000000 in
   Top Area                                          =        8400. sq. in
   Bottom Area                                       =        8400. sq. in
   Moment of Inertia at Top                          =    21437500. in^4
   Moment of Inertia at Bottom                       =    21437500. in^4
   Elastic Modulus                                   =     3604996. psi

Pile Section No. 3:

   Section 3 is a round drilled shaft, bored pile, or CIDH pile
   Length of section                                 =    20.400000 ft
   Shaft Diameter                                    =    36.000000 in



--------------------------------------------------------------------------------
                       Soil and Rock Layering Information
--------------------------------------------------------------------------------

The soil profile is modelled using 6 layers

Layer 1 is weak rock, p-y criteria by Reese, 1997

   Distance from top of pile to top of layer         =    13.800000 ft
```

Distance from top of pile to bottom of layer	=	14.500000	ft
Effective unit weight at top of layer	=	139.000000	pcf
Effective unit weight at bottom of layer	=	139.000000	pcf
Uniaxial compressive strength at top of layer	=	200.000000	psi
Uniaxial compressive strength at bottom of layer	=	200.000000	psi
Initial modulus of rock at top of layer	=	18000.	psi
Initial modulus of rock at bottom of layer	=	18000.	psi
RQD of rock at top of layer	=	0.0000	%
RQD of rock at bottom of layer	=	0.0000	%
k rm of rock at top of layer	=	0.0005000	
k rm of rock at bottom of layer	=	0.0005000	

Layer 2 is weak rock, p-y criteria by Reese, 1997

Distance from top of pile to top of layer	=	14.500000	ft
Distance from top of pile to bottom of layer	=	21.000000	ft
Effective unit weight at top of layer	=	139.000000	pcf
Effective unit weight at bottom of layer	=	139.000000	pcf
Uniaxial compressive strength at top of layer	=	391.000000	psi
Uniaxial compressive strength at bottom of layer	=	391.000000	psi
Initial modulus of rock at top of layer	=	35000.	psi
Initial modulus of rock at bottom of layer	=	35000.	psi
RQD of rock at top of layer	=	33.000000	%
RQD of rock at bottom of layer	=	33.000000	%
k rm of rock at top of layer	=	0.0005000	
k rm of rock at bottom of layer	=	0.0005000	

Layer 3 is weak rock, p-y criteria by Reese, 1997

Distance from top of pile to top of layer	=	21.000000	ft
Distance from top of pile to bottom of layer	=	24.500000	ft
Effective unit weight at top of layer	=	147.000000	pcf
Effective unit weight at bottom of layer	=	147.000000	pcf
Uniaxial compressive strength at top of layer	=	7500.	psi
Uniaxial compressive strength at bottom of layer	=	7500.	psi
Initial modulus of rock at top of layer	=	680000.	psi

Initial modulus of rock at bottom of layer	=	680000.	psi
RQD of rock at top of layer	=	61.000000	%
RQD of rock at bottom of layer	=	61.000000	%
k rm of rock at top of layer	=	0.0000500	
k rm of rock at bottom of layer	=	0.0000500	

Layer 4 is weak rock, p-y criteria by Reese, 1997

Distance from top of pile to top of layer	=	24.500000	ft
Distance from top of pile to bottom of layer	=	25.500000	ft
Effective unit weight at top of layer	=	150.000000	pcf
Effective unit weight at bottom of layer	=	150.000000	pcf
Uniaxial compressive strength at top of layer	=	7500.	psi
Uniaxial compressive strength at bottom of layer	=	7500.	psi
Initial modulus of rock at top of layer	=	680000.	psi
Initial modulus of rock at bottom of layer	=	680000.	psi
RQD of rock at top of layer	=	0.0000	%
RQD of rock at bottom of layer	=	0.0000	%
k rm of rock at top of layer	=	0.0000500	
k rm of rock at bottom of layer	=	0.0000500	

Layer 5 is weak rock, p-y criteria by Reese, 1997

Distance from top of pile to top of layer	=	25.500000	ft
Distance from top of pile to bottom of layer	=	35.300000	ft
Effective unit weight at top of layer	=	146.000000	pcf
Effective unit weight at bottom of layer	=	146.000000	pcf
Uniaxial compressive strength at top of layer	=	1395.	psi
Uniaxial compressive strength at bottom of layer	=	1395.	psi
Initial modulus of rock at top of layer	=	130000.	psi
Initial modulus of rock at bottom of layer	=	130000.	psi
RQD of rock at top of layer	=	30.000000	%
RQD of rock at bottom of layer	=	30.000000	%
k rm of rock at top of layer	=	0.0001200	
k rm of rock at bottom of layer	=	0.0001200	

Layer 6 is weak rock, p-y criteria by Reese, 1997

Distance from top of pile to top of layer	=	35.300000 ft
Distance from top of pile to bottom of layer	=	39.500000 ft
Effective unit weight at top of layer	=	148.000000 pcf
Effective unit weight at bottom of layer	=	148.000000 pcf
Uniaxial compressive strength at top of layer	=	7500. psi
Uniaxial compressive strength at bottom of layer	=	7500. psi
Initial modulus of rock at top of layer	=	680000. psi
Initial modulus of rock at bottom of layer	=	680000. psi
RQD of rock at top of layer	=	79.000000 %
RQD of rock at bottom of layer	=	79.000000 %
k rm of rock at top of layer	=	0.0000500
k rm of rock at bottom of layer	=	0.0000500

(Depth of the lowest soil layer extends 12.500 ft below the pile tip)

**** Warning - Possible Input Data Error ****

Values entered for effective unit weight of rock were outside the limits of
50 pcf to 150 pcf.

The maximum input value, in layer 6, for effective unit weight = 150.00 pcf

This data may be erroneous. Please check your data.

Summary of Input Soil Properties

Layer Num.	Soil Type Name (p-y Curve Type)	Layer Depth ft	Effective Unit Wt. pcf	Uniaxial qu psi	RQD %	E50 or krm	Rock Mass Modulus psi

1	Weak	13.8000	139.0000	200.0000	0.00	5.00E-04	18000.
	Rock	14.5000	139.0000	200.0000	0.00	5.00E-04	18000.
2	Weak	14.5000	139.0000	391.0000	33.0000	5.00E-04	35000.
	Rock	21.0000	139.0000	391.0000	33.0000	5.00E-04	35000.
3	Weak	21.0000	147.0000	7500.	61.0000	5.00E-05	680000.
	Rock	24.5000	147.0000	7500.	61.0000	5.00E-05	680000.
4	Weak	24.5000	150.0000	7500.	0.00	5.00E-05	680000.
	Rock	25.5000	150.0000	7500.	0.00	5.00E-05	680000.
5	Weak	25.5000	146.0000	1395.	30.0000	1.20E-04	130000.
	Rock	35.3000	146.0000	1395.	30.0000	1.20E-04	130000.
6	Weak	35.3000	148.0000	7500.	79.0000	5.00E-05	680000.
	Rock	39.5000	148.0000	7500.	79.0000	5.00E-05	680000.

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	27.300
2	13.800	72.200

Distributed lateral load intensity for Load Case 2 defined using 2 points

Point No.	Depth X ft	Dist. Load lb/in
1	0.000	43.100
2	13.800	110.400

Distributed lateral load intensity for Load Case 3 defined using 2 points

Point No.	Depth X ft	Dist. Load lb/in
1	0.000	27.300
2	13.800	72.200

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 3

Load No.	Load Type	Condition 1	Condition 2	Axial Thrust Force, lbs	Compute Top y vs. Pile Length	Run Analysis
1	1	V = 15820. lbs	M = 0.0000 in-lbs	218600.	Yes	Yes
2	1	V = 19120. lbs	M = 0.0000 in-lbs	304020.	Yes	Yes
3	4	y = 0.480000 in	M = 0.0000 in-lbs	218600.	N.A.	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:

Moment-curvature properties were derived from elastic section properties

Pile Section No. 3:

Dimensions and Properties of Drilled Shaft (Bored Pile):

Length of Section	=	20.400000 ft
Shaft Diameter	=	36.000000 in
Concrete Cover Thickness (to edge of trans. reinf.)	=	3.000000 in
Number of Reinforcing Bars	=	10 bars

Yield Stress of Reinforcing Bars	=	60000.	psi
Modulus of Elasticity of Reinforcing Bars	=	29000000.	psi
Gross Area of Shaft	=	1018.	sq. in.
Total Area of Reinforcing Steel	=	10.000000	sq. in.
Area Ratio of Steel Reinforcement	=	0.98	percent
Edge-to-Edge Bar Spacing	=	7.407667	in
Maximum Concrete Aggregate Size	=	0.750000	in
Ratio of Bar Spacing to Aggregate Size	=	9.88	
Offset of Center of Rebar Cage from Center of Pile	=	0.0000	in
Transverse Reinforcement			
Type: Spiral			
Number of Transverse Reinf. (per spacing)	=	1	
Spacing of Transverse Reinf.	=	5.000000	in
Yield Stress of Transverse Reinf.	=	60000.	psi
Diameter of Transverse Reinf.	=	0.625000	in

Axial Structural Capacities:

Nom. Axial Structural Capacity = 0.85 Fc Ac + Fy As	=	4026.778	kips
Tensile Load for Cracking of Concrete	=	-452.643	kips
Nominal Axial Tensile Capacity	=	-600.000	kips

Reinforcing Bar Dimensions and Positions Used in Computations:

Bar Number	Bar Diam. inches	Bar Area sq. in.	X inches	Y inches
1	1.128000	1.000000	13.811000	0.00000
2	1.128000	1.000000	11.173334	8.117902
3	1.128000	1.000000	4.267834	13.135042
4	1.128000	1.000000	-4.26783	13.135042
5	1.128000	1.000000	-11.17333	8.117902
6	1.128000	1.000000	-13.81100	0.00000
7	1.128000	1.000000	-11.17333	-8.11790
8	1.128000	1.000000	-4.26783	-13.13504
9	1.128000	1.000000	4.267834	-13.13504

10	1.128000	1.000000	11.173334	-8.11790

NOTE: The positions of the above rebars were computed by LPile

Minimum spacing between any two bars not equal to zero = 7.408 inches
between bars 5 and 6.

Ratio of bar spacing to maximum aggregate size = 9.88

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 = 2

Number	Axial Thrust Force kips
1	218.600
2	304.020

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 = 218.600 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	227.7896610	364463458.	95.5709666	0.00005973	0.00003723	0.2488600	1.6571863	
0.00000125	455.5760814	364460865.	56.8047719	0.00007101	0.00002601	0.2945620	1.9090980	
0.00000188	683.3514559	364454110.	43.8912777	0.00008230	0.00001480	0.3400491	2.1614757	
0.00000250	911.1102621	364444105.	37.4409590	0.00009360	0.00000360	0.3853201	2.4143195	
0.00000313	1139.	364426195.	33.5758474	0.0001049	-0.00000758	0.4303730	2.6676237	
0.00000375	1366.	364346828.	31.0025546	0.0001163	-0.00001874	0.4751948	2.9213028	
0.00000438	1593.	364170613.	29.1664909	0.0001276	-0.00002990	0.5197681	3.1752361	
0.00000500	1820.	363903991.	27.7906515	0.0001390	-0.00004105	0.5640815	3.4293444	
0.00000563	2045.	363562658.	26.7213241	0.0001503	-0.00005219	0.6081279	3.6835784	

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   0.00000625        2270.    363161815.    25.8663826     0.0001617   -0.00006334     0.6519027
3.9379068
   0.00000688        2494.    362713990.    25.1672595     0.0001730   -0.00007448     0.6954032
4.1923099
   0.00000750        2717.    362228808.    24.5849375     0.0001844   -0.00008561     0.7386273
4.4467739
   0.00000813        2939.    361713588.    24.0924206     0.0001958   -0.00009675     0.7815736
4.7012891
   0.00000875        2939.    335876904.    21.4968641     0.0001881     -0.000127     0.7519631
4.4043136 C
   0.00000938        2939.    313485110.    20.9186374     0.0001961     -0.000141     0.7820928
4.5616972 C
   0.00001000        2939.    293892291.    20.3984322     0.0002040     -0.000156     0.8115434
4.7149556 C
   0.00001063        2939.    276604509.    19.9266658     0.0002117     -0.000171     0.8403456
4.8642664 C
   0.00001125        2939.    261237592.    19.4961769     0.0002193     -0.000186     0.8685483
5.0099547 C
   0.00001188        2939.    247488245.    19.1020827     0.0002268     -0.000201     0.8962285
5.1525679 C
   0.00001250        2939.    235113832.    18.7395181     0.0002342     -0.000216     0.9234195
5.2923251 C
   0.00001313        2939.    223917936.    18.4046786     0.0002416     -0.000231     0.9501602
5.4294933 C
   0.00001375        2939.    213739848.    18.0946100     0.0002488     -0.000246     0.9764968
5.5644008 C
   0.00001438        2939.    204446811.    17.8069311     0.0002560     -0.000262     1.0024778
-5.858373 C
   0.00001500        2939.    195928194.    17.5377483     0.0002631     -0.000277     1.0280464
-6.230179 C
   0.00001563        2939.    188091066.    17.2862236     0.0002701     -0.000292     1.0532850
-6.603743 C
   0.00001625        2939.    180856794.    17.0513360     0.0002771     -0.000308     1.0782564
-6.978582 C
   0.00001688        2939.    174158394.    16.8296806     0.0002840     -0.000323     1.1028677
-7.355461 C
   0.00001750        2981.    170356574.    16.6210458     0.0002909     -0.000339     1.1271982
-7.733766 C
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   0.00001813        3030.    167191398.    16.4248266     0.0002977     -0.000355     1.1512982
-8.113107 C
   0.00001875        3079.    164192830.    16.2381740     0.0003045     -0.000371     1.1750620
-8.494358 C
   0.00001938        3127.    161372879.    16.0626308     0.0003112     -0.000386     1.1986623
-8.876132 C
   0.00002000        3174.    158691576.    15.8949165     0.0003179     -0.000402     1.2219389
-9.259748 C
   0.00002063        3221.    156159224.    15.7363631     0.0003246     -0.000418     1.2450513
-9.643919 C
   0.00002125        3267.    153753771.    15.5853511     0.0003312     -0.000434     1.2679265
-10.029252 C
   0.00002188        3313.    151463973.    15.4409485     0.0003378     -0.000450     1.2905628
-10.415778 C
   0.00002250        3359.    149299778.    15.3047930     0.0003444     -0.000466     1.3131177
-10.802199 C
   0.00002313        3404.    147218096.    15.1726735     0.0003509     -0.000482     1.3353013
-11.190938 C
   0.00002375        3450.    145243274.    15.0472406     0.0003574     -0.000498     1.3573942
-11.579669 C
   0.00002438        3495.    143365446.    14.9283471     0.0003639     -0.000514     1.3793788
-11.968537 C
   0.00002563        3583.    139830436.    14.7021746     0.0003767     -0.000546     1.4225869
-12.750409 C
   0.00002688        3671.    136599629.    14.4949714     0.0003896     -0.000578     1.4652511
-13.533869 C
   0.00002813        3758.    133624877.    14.3032305     0.0004023     -0.000610     1.5072808
-14.319740 C
   0.00002938        3845.    130878374.    14.1253453     0.0004149     -0.000643     1.5487190
-15.107709 C
   0.00003063        3930.    128334877.    13.9599821     0.0004275     -0.000675     1.5896082
-15.897454 C
   0.00003188        4015.    125976076.    13.8062956     0.0004401     -0.000707     1.6300192
-16.688392 C
   0.00003313        4100.    123772332.    13.6615739     0.0004525     -0.000740     1.6698059
-17.481863 C
   0.00003438        4184.    121725300.    13.5277526     0.0004650     -0.000772     1.7092972
-18.274960 C
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   0.00003563        4268.    119799900.    13.4004229     0.0004774     -0.000805     1.7481225
-19.071049 C
   0.00003688        4351.    117996824.    13.2811962     0.0004897     -0.000838     1.7865544
-19.867706 C
   0.00003813        4434.    116308859.    13.1701259     0.0005021     -0.000870     1.8246954
-20.663992 C
   0.00003938        4517.    114712014.    13.0638562     0.0005144     -0.000903     1.8622305
-21.462846 C
   0.00004063        4599.    113205583.    12.9634498     0.0005266     -0.000936     1.8993544
-22.262496 C
   0.00004188        4681.    111786329.    12.8693400     0.0005389     -0.000969     1.9361919
-23.061779 C
   0.00004313        4763.    110446652.    12.7809855     0.0005512     -0.001001     1.9727418
-23.860693 C
   0.00004438        4844.    109166644.    12.6949173     0.0005633     -0.001034     2.0086084
-24.663065 C
   0.00004563        4925.    107954153.    12.6138084     0.0005755     -0.001067     2.0441877
-25.465115 C
   0.00004688        5006.    106803917.    12.5372959     0.0005877     -0.001100     2.0794837
-26.266797 C
   0.00004813        5087.    105711075.    12.4650227     0.0005999     -0.001133     2.1144954
-27.068109 C
   0.00004938        5168.    104667903.    12.3957983     0.0006120     -0.001165     2.1490973
-27.870304 C
   0.00005063        5248.    103667901.    12.3286361     0.0006241     -0.001198     2.1831831
-28.674482 C
   0.00005188        5328.    102713959.    12.2649573     0.0006362     -0.001231     2.2169884
-29.478290 C
   0.00005313        5408.    101802815.    12.2045171     0.0006484     -0.001264     2.2505123
-30.281724 C
   0.00005438        5488.    100931507.    12.1470930     0.0006605     -0.001297     2.2837539
-31.084784 C
   0.00005563        5568.    100097340.    12.0924829     0.0006726     -0.001330     2.3167125
-31.887468 C
   0.00005688        5647.     99295408.    12.0397467     0.0006848     -0.001363     2.3492689
-32.691030 C
   0.00005813        5727.     98522174.    11.9882768     0.0006968     -0.001396     2.3813525
-33.496258 C
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   0.00005938        5806.     97779648.    11.9392009     0.0007089     -0.001429     2.4131562
-34.301104 C
   0.00006063        5885.     97065923.    11.8923659     0.0007210     -0.001462     2.4446794
-35.105569 C
   0.00006188        5963.     96379244.    11.8476542     0.0007331     -0.001494     2.4759209
-35.909649 C
   0.00006313        6042.     95717995.    11.8049104     0.0007452     -0.001527     2.5068800
-36.713342 C
   0.00006438        6121.     95080687.    11.7640344     0.0007573     -0.001560     2.5375558
-37.516648 C
   0.00006563        6199.     94465942.    11.7249205     0.0007694     -0.001593     2.5679473
-38.319563 C
   0.00006688        6278.     93871163.    11.6869649     0.0007816     -0.001626     2.5979676
-39.123080 C
   0.00006813        6356.     93294047.    11.6496083     0.0007936     -0.001659     2.6275380
-39.928137 C
   0.00006938        6434.     92736137.    11.6138019     0.0008057     -0.001692     2.6568269
-40.732797 C
   0.00007063        6511.     92196406.    11.5794581     0.0008178     -0.001725     2.6858334
-41.537056 C
   0.00007188        6589.     91673897.    11.5465015     0.0008299     -0.001758     2.7145567
-42.340913 C
   0.00007313        6667.     91167718.    11.5148621     0.0008420     -0.001790     2.7429958
-43.144365 C
   0.00007438        6744.     90677039.    11.4844962     0.0008542     -0.001823     2.7711498
-43.947410 C
   0.00007938        7053.     88854524.    11.3743139     0.0009028     -0.001955     2.8808951
-47.155476 C
   0.00008438        7359.     87221151.    11.2773088     0.0009515     -0.002086     2.9855301
-50.363244 C
   0.00008938        7664.     85747422.    11.1925216     0.0010003     -0.002217     3.0852786
-53.567464 C
   0.00009438        7966.     84409953.    11.1193494     0.0010494     -0.002348     3.1803378
-56.764561 C
   0.00009938        8267.     83187745.    11.0560554     0.0010987     -0.002479     3.2706394
-59.954351 C
    0.0001044        8521.     81642093.    10.9839576     0.0011465     -0.002611     3.3530314
-60.000000 CY
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    0.0001094        8681.     79372865.    10.8806662     0.0011901     -0.002747     3.4238502
-60.000000 CY
    0.0001144        8839.     77279520.    10.7873949     0.0012338     -0.002884     3.4907322
-60.000000 CY
    0.0001194        8995.     75351950.    10.7035597     0.0012777     -0.003020     3.5537680
-60.000000 CY
    0.0001244        9150.     73569969.    10.6280792     0.0013219     -0.003156     3.6129061
-60.000000 CY
    0.0001294        9303.     71907555.    10.5566155     0.0013658     -0.003292     3.6675558
-60.000000 CY
    0.0001344        9417.     70077677.    10.4744883     0.0014075     -0.003430     3.7156210
-60.000000 CY
    0.0001394        9481.     68022886.    10.3776263     0.0014464     -0.003571     3.7569452
-60.000000 CY
    0.0001444        9539.     66069800.    10.2863341     0.0014851     -0.003712     3.7948608
-60.000000 CY
    0.0001494        9595.     64235984.    10.1988387     0.0015235     -0.003854     3.8292653
-60.000000 CY
    0.0001544        9651.     62513919.    10.1166515     0.0015618     -0.003996     3.8604668
-60.000000 CY
    0.0001594        9705.     60895989.    10.0403646     0.0016002     -0.004137     3.8886368
-60.000000 CY
    0.0001644        9759.     59372610.     9.9684230     0.0016386     -0.004279     3.9137359
-60.000000 CY
    0.0001694        9813.     57935337.     9.9030264     0.0016773     -0.004420     3.9357243
-60.000000 CY
    0.0001744        9865.     56571036.     9.8405657     0.0017159     -0.004562     3.9542919
-60.000000 CY
    0.0001794        9916.     55278781.     9.7812665     0.0017545     -0.004703     3.9697468
-60.000000 CY
    0.0001844        9966.     54053116.     9.7257368     0.0017932     -0.004844     3.9820737
-60.000000 CY
    0.0001894       10016.     52888686.     9.6740812     0.0018320     -0.004985     3.9912288
-60.000000 CY
    0.0001944       10065.     51780695.     9.6260188     0.0018711     -0.005126     3.9971669
-60.000000 CY
    0.0001994       10113.     50724821.     9.5812987     0.0019103     -0.005267     3.9998412
-60.000000 CY
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    0.0002044       10161.     49716656.     9.5397776     0.0019497     -0.005408     3.9975228
-60.000000 CY
    0.0002094       10207.     48750143.     9.4985218     0.0019888     -0.005549     3.9998741
-60.000000 CY
    0.0002144       10252.     47824884.     9.4602523     0.0020280     -0.005689     3.9970567
-60.000000 CY
    0.0002194       10297.     46938705.     9.4246290     0.0020675     -0.005830     3.9997058
-60.000000 CY
    0.0002244       10341.     46088578.     9.3916003     0.0021072     -0.005970     3.9957144
-60.000000 CY
    0.0002294       10382.     45260298.     9.3591408     0.0021468     -0.006111     3.9990849
-60.000000 CY
    0.0002344       10419.     44453954.     9.3271992     0.0021861     -0.006251     3.9985957
-60.000000 CY
    0.0002394       10445.     43634189.     9.2906258     0.0022239     -0.006394     3.9971786
-60.000000 CY
    0.0002444       10465.     42823968.     9.2525827     0.0022611     -0.006536     3.9995019
-60.000000 CY
    0.0002494       10479.     42019515.     9.2125518     0.0022974     -0.006680     3.9977651
-60.000000 CY
    0.0002544       10489.     41233030.     9.1722479     0.0023332     -0.006824     3.9963803
-60.000000 CY
    0.0002594       10497.     40469295.     9.1303723     0.0023682     -0.006969     3.9988743
-60.000000 CY
    0.0002644       10505.     39733728.     9.0903766     0.0024033     -0.007114     3.9999535
-60.000000 CY
    0.0002694       10512.     39024129.     9.0527336     0.0024386     -0.007259     3.9940581
-60.000000 CY
    0.0002744       10519.     38339593.     9.0168271     0.0024740     -0.007404     3.9966832
-60.000000 CY
    0.0003044       10559.     34691301.     8.8337318     0.0026888     -0.008269     3.9995822
-60.000000 CY
    0.0003344       10589.     31668984.     8.6813284     0.0029028     -0.009135     3.9999504
-60.000000 CY
    0.0003644       10615.     29131161.     8.5618010     0.0031197     -0.009998     3.9998182
-60.000000 CYT
    0.0003944       10636.     26970343.     8.4679401     0.0033395     -0.010858     3.9984221
-60.000000 CYT
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    0.0004244        10654.     25104664.     8.3843538     0.0035581     -0.011719     3.9918639
-60.000000 CYT
    0.0004544        10669.     23480757.     8.3155271     0.0037784     -0.012579     3.9965436
-60.000000 CYT
    0.0004844        10669.     22026465.     8.2959480     0.0040183     -0.013419     3.9974800
-60.000000 CYT


Axial Thrust Force =    304.020 kips

    Bending       Bending       Bending      Depth to      Max Comp      Max Tens      Max Conc      Max
Steel  Run
   Curvature      Moment       Stiffness      N Axis        Strain        Strain        Stress        Stress
   Msg
    rad/in.       in-kip        kip-in2         in           in/in         in/in          ksi           ksi

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  6.25000E-07   225.5817071    360930731.   126.4024266    0.00007900    0.00005650     0.3275854
2.2160065
   0.00000125   451.1610297    360928824.    72.2206929    0.00009028    0.00004528     0.3728048
2.4679251
   0.00000188   676.7291968    360922238.    54.1687705     0.0001016    0.00003407     0.4178092
2.7203144
   0.00000250   902.2806318    360912253.    45.1493014     0.0001129    0.00002287     0.4625974
2.9731744
   0.00000313         1128.    360899122.    39.7428141     0.0001242    0.00001170     0.5071682
3.2265050
   0.00000375         1353.    360882932.    36.1428181     0.0001355   5.35568E-07     0.5515203
3.4803065
   0.00000438         1579.    360856958.    33.5750134     0.0001469   -0.00001061     0.5956510
3.7345673
   0.00000500         1804.    360784912.    31.6517806     0.0001583   -0.00002174     0.6395485
3.9892082
   0.00000563         2029.    360644697.    30.1576897     0.0001696   -0.00003286     0.6831992
4.2441356
   0.00000625         2253.    360435410.    28.9636283     0.0001810   -0.00004398     0.7265937
4.4992826
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   0.00000688         2476.    360163277.    27.9850508     0.0001924   -0.00005510     0.7697249
4.7546005
   0.00000750         2699.    359836604.    27.1737570     0.0002038   -0.00006620     0.8125878
5.0100547
   0.00000813         2921.    359463467.    26.4872123     0.0002152   -0.00007729     0.8551789
5.2656205
   0.00000875         3142.    359051057.    25.8987310     0.0002266   -0.00008839     0.8974956
5.5212799
   0.00000938         3362.    358605501.    25.3888102     0.0002380   -0.00009948     0.9395360
5.7770203
   0.00001000         3362.    336192657.    23.3702584     0.0002337     -0.000126     0.9230796
5.5767750 C
   0.00001063         3362.    316416619.    22.8022794     0.0002423     -0.000140     0.9544650
5.7503149 C
   0.00001125         3362.    298837918.    22.2837394     0.0002507     -0.000154     0.9851233
5.9193950 C
   0.00001188         3362.    283109606.    21.8093006     0.0002590     -0.000169     1.0151735
6.0848891 C
   0.00001250         3362.    268954126.    21.3719839     0.0002671     -0.000183     1.0445970
6.2465942 C
   0.00001313         3362.    256146787.    20.9675067     0.0002752     -0.000197     1.0734581
6.4049698 C
   0.00001375         3362.    244503751.    20.5923783     0.0002831     -0.000212     1.1018101
6.5603925 C
   0.00001438         3362.    233873153.    20.2432972     0.0002910     -0.000227     1.1296836
6.7130661 C
   0.00001500         3362.    224128438.    19.9175037     0.0002988     -0.000241     1.1571112
6.8632165 C
   0.00001563         3367.    215477826.    19.6127574     0.0003064     -0.000256     1.1841282
7.0110933 C
   0.00001625         3427.    210878244.    19.3257163     0.0003140     -0.000271     1.2106866
7.1562712 C
   0.00001688         3485.    206536551.    19.0557370     0.0003216     -0.000286     1.2368689
7.2993899 C
   0.00001750         3543.    202440437.    18.8017274     0.0003290     -0.000301     1.2627243
7.4408270 C
   0.00001813         3599.    198567821.    18.5621514     0.0003364     -0.000316     1.2882630
7.5806432 C
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0.00001875	3654.	194876493.	18.3341165	0.0003438	-0.000331	1.3133933 7.7180509 C
0.00001938	3708.	191392742.	18.1191984	0.0003511	-0.000346	1.3382996 7.8545621 C
0.00002000	3761.	188074835.	17.9146205	0.0003583	-0.000362	1.3628783 -8.088309 C
0.00002063	3814.	184923486.	17.7204191	0.0003655	-0.000377	1.3871975 -8.457237 C
0.00002125	3866.	181925843.	17.5357490	0.0003726	-0.000392	1.4112681 -8.827320 C
0.00002188	3917.	179064725.	17.3593766	0.0003797	-0.000408	1.4350598 -9.198833 C
0.00002250	3968.	176336782.	17.1912054	0.0003868	-0.000423	1.4586203 -9.571388 C
0.00002313	4018.	173732238.	17.0305390	0.0003938	-0.000439	1.4819486 -9.945006 C
0.00002375	4067.	171234742.	16.8762429	0.0004008	-0.000454	1.5050036 -10.320060 C
0.00002438	4116.	168860385.	16.7297725	0.0004078	-0.000470	1.5279450 -10.695179 C
0.00002563	4212.	164375016.	16.4519370	0.0004216	-0.000501	1.5729759 -11.450107 C
0.00002688	4307.	160246672.	16.1955909	0.0004353	-0.000532	1.6172097 -12.208428 C
0.00002813	4400.	156442756.	15.9591465	0.0004489	-0.000564	1.6607701 -12.969134 C
0.00002938	4492.	152911043.	15.7387032	0.0004623	-0.000595	1.7035485 -13.733270 C
0.00003063	4582.	149628781.	15.5332962	0.0004757	-0.000627	1.7456305 -14.500154 C
0.00003188	4672.	146579266.	15.3421495	0.0004890	-0.000658	1.7871582 -15.268555 C
0.00003313	4761.	143720548.	15.1621297	0.0005022	-0.000690	1.8279297 -16.040392 C
0.00003438	4849.	141055215.	14.9940736	0.0005154	-0.000722	1.8682428 -16.812971 C
0.00003563	4936.	138547915.	14.8355660	0.0005285	-0.000754	1.9078803 -17.588368 C

0.00003688	5022.	136194265.	14.6863983	0.0005416	-0.000786	1.9470143
-18.365021 C						
0.00003813	5108.	133983638.	14.5463529	0.0005546	-0.000818	1.9857033
-19.142401 C						
0.00003938	5193.	131886856.	14.4123824	0.0005675	-0.000850	2.0236935
-19.922998 C						
0.00004063	5278.	129915628.	14.2870094	0.0005804	-0.000882	2.0613644
-20.703180 C						
0.00004188	5362.	128047860.	14.1677953	0.0005933	-0.000914	2.0985105
-21.484971 C						
0.00004313	5445.	126271622.	14.0537386	0.0006061	-0.000946	2.1350783
-22.268956 C						
0.00004438	5529.	124592357.	13.9464265	0.0006189	-0.000979	2.1713315
-23.052530 C						
0.00004563	5612.	122999168.	13.8448039	0.0006317	-0.001011	2.2072045
-23.836355 C						
0.00004688	5694.	121471791.	13.7461145	0.0006443	-0.001043	2.2423941
-24.623563 C						
0.00004813	5776.	120020985.	13.6528425	0.0006570	-0.001075	2.2772740
-25.410364 C						
0.00004938	5858.	118640917.	13.5645781	0.0006698	-0.001108	2.3118430
-26.196758 C						
0.00005063	5939.	117322865.	13.4802775	0.0006824	-0.001140	2.3460073
-26.983729 C						
0.00005188	6020.	116054566.	13.3981401	0.0006950	-0.001172	2.3795564
-27.773558 C						
0.00005313	6101.	114843494.	13.3201340	0.0007076	-0.001205	2.4127991
-28.562981 C						
0.00005438	6182.	113685690.	13.2459713	0.0007202	-0.001237	2.4457345
-29.351997 C						
0.00005563	6262.	112577549.	13.1753956	0.0007329	-0.001270	2.4783614
-30.140603 C						
0.00005688	6342.	111510525.	13.1070018	0.0007455	-0.001302	2.5105071
-30.930725 C						
0.00005813	6422.	110481565.	13.0405503	0.0007580	-0.001335	2.5421607
-31.722532 C						
0.00005938	6501.	109493767.	12.9771342	0.0007705	-0.001367	2.5735102
-32.513930 C						

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   0.00006063        6581.    108544574.    12.9165669     0.0007831     -0.001399     2.6045544
-33.304916 C
   0.00006188        6660.    107631632.    12.8586824     0.0007956     -0.001432     2.6352924
-34.095490 C
   0.00006313        6739.    106752779.    12.8033133     0.0008082     -0.001464     2.6657231
-34.885648 C
   0.00006438        6817.    105901649.    12.7491816     0.0008207     -0.001497     2.6956687
-35.677508 C
   0.00006563        6896.    105077689.    12.6964746     0.0008332     -0.001529     2.7251741
-36.470582 C
   0.00006688        6974.    104282628.    12.6459532     0.0008457     -0.001562     2.7543761
-37.263238 C
   0.00006813        7052.    103514867.    12.5974982     0.0008582     -0.001594     2.7832736
-38.055474 C
   0.00006938        7130.    102772919.    12.5509989     0.0008707     -0.001627     2.8118656
-38.847287 C
   0.00007063        7208.    102055405.    12.5063525     0.0008833     -0.001659     2.8401511
-39.638677 C
   0.00007188        7285.    101361036.    12.4634710     0.0008958     -0.001692     2.8681289
-40.429640 C
   0.00007313        7363.    100688618.    12.4222520     0.0009084     -0.001724     2.8957982
-41.220175 C
   0.00007438        7440.    100032265.    12.3811191     0.0009208     -0.001757     2.9229125
-42.013510 C
   0.00007938        7747.     97596391.    12.2310996     0.0009708     -0.001887     3.0282576
-45.183267 C
   0.00008438        8051.     95424568.    12.1017498     0.0010211     -0.002016     3.1286657
-48.345946 C
   0.00008938        8353.     93464573.    11.9866907     0.0010713     -0.002146     3.2235672
-51.509131 C
   0.00009438        8653.     91685988.    11.8849713     0.0011216     -0.002276     3.3131904
-54.669146 C
   0.00009938        8950.     90064736.    11.7961411     0.0011722     -0.002405     3.3977534
-57.821508 C
    0.0001044        9245.     88576178.    11.7183687     0.0012231     -0.002534     3.4771687
-60.000000 CY
    0.0001094        9457.     86465372.    11.6171859     0.0012706     -0.002667     3.5462182
-60.000000 CY
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    0.0001144         9614.     84055093.    11.5060988     0.0013160     -0.002801     3.6075334
-60.000000 CY
    0.0001194         9769.     81834590.    11.4057088     0.0013616     -0.002936     3.6646593
-60.000000 CY
    0.0001244         9922.     79778790.    11.3146494     0.0014073     -0.003070     3.7173697
-60.000000 CY
    0.0001294        10074.     77864410.    11.2289319     0.0014527     -0.003205     3.7653976
-60.000000 CY
    0.0001344        10223.     76078940.    11.1511073     0.0014984     -0.003339     3.8091448
-60.000000 CY
    0.0001394        10337.     74163498.    11.0657433     0.0015423     -0.003475     3.8468705
-60.000000 CY
    0.0001444        10402.     72051356.    10.9675366     0.0015834     -0.003614     3.8784460
-60.000000 CY
    0.0001494        10459.     70017250.    10.8694471     0.0016236     -0.003754     3.9057561
-60.000000 CY
    0.0001544        10514.     68109949.    10.7788844     0.0016640     -0.003894     3.9296991
-60.000000 CY
    0.0001594        10569.     66317405.    10.6951983     0.0017045     -0.004033     3.9502277
-60.000000 CY
    0.0001644        10623.     64628744.    10.6171133     0.0017452     -0.004172     3.9672844
-60.000000 CY
    0.0001694        10675.     63025955.    10.5413013     0.0017854     -0.004312     3.9806112
-60.000000 CY
    0.0001744        10726.     61510646.    10.4704808     0.0018258     -0.004452     3.9905119
-60.000000 CY
    0.0001794        10776.     60075384.    10.4035735     0.0018661     -0.004591     3.9969352
-60.000000 CY
    0.0001844        10825.     58713564.    10.3422500     0.0019069     -0.004731     3.9998284
-60.000000 CY
    0.0001894        10874.     57418695.    10.2869107     0.0019481     -0.004869     3.9981606
-60.000000 CY
    0.0001944        10921.     56183417.    10.2311122     0.0019887     -0.005009     3.9999941
-60.000000 CY
    0.0001994        10966.     55002459.    10.1803352     0.0020297     -0.005148     3.9985442
-60.000000 CY
    0.0002044        11011.     53875693.    10.1318873     0.0020707     -0.005287     3.9998445
-60.000000 CY
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    0.0002094       11055.     52797875.    10.0869023     0.0021119     -0.005426     3.9983648
-60.000000 CY
    0.0002144       11098.     51767257.    10.0449090     0.0021534     -0.005564     3.9999898
-60.000000 CY
    0.0002194       11140.     50779161.    10.0055552     0.0021950     -0.005703     3.9975597
-60.000000 CY
    0.0002244       11181.     49832285.     9.9696816     0.0022369     -0.005841     3.9998155
-60.000000 CY
    0.0002294       11222.     48923030.     9.9359347     0.0022791     -0.005978     3.9957657
-60.000000 CY
    0.0002344       11262.     48049619.     9.9045539     0.0023214     -0.006116     3.9990577
-60.000000 CY
    0.0002394       11300.     47206831.     9.8731271     0.0023634     -0.006254     3.9990135
-60.000000 CY
    0.0002444       11334.     46381462.     9.8415259     0.0024050     -0.006392     3.9968319
-60.000000 CY
    0.0002494       11364.     45571589.     9.8090981     0.0024461     -0.006531     3.9993707
-60.000000 CY
    0.0002544       11387.     44764655.     9.7739899     0.0024863     -0.006671     3.9985107
-60.000000 CY
    0.0002594       11403.     43964018.     9.7368928     0.0025255     -0.006812     3.9958086
-60.000000 CY
    0.0002644       11414.     43174218.     9.6983670     0.0025640     -0.006953     3.9985374
-60.000000 CY
    0.0002694       11423.     42404679.     9.6601156     0.0026022     -0.007095     3.9998542
-60.000000 CY
    0.0002744       11430.     41657646.     9.6229370     0.0026403     -0.007237     3.9958540
-60.000000 CY
    0.0003044       11465.     37666731.     9.4235716     0.0028683     -0.008089     3.9960954
-60.000000 CY
    0.0003344       11492.     34369008.     9.2646396     0.0030979     -0.008940     3.9969199
-60.000000 CYT
    0.0003644       11514.     31599347.     9.1359784     0.0033289     -0.009789     3.9951256
-60.000000 CYT
    0.0003944       11531.     29237966.     9.0254008     0.0035594     -0.010638     3.9884137
-60.000000 CYT
    0.0004244       11545.     27205023.     8.9358480     0.0037922     -0.011485     3.9999846
-60.000000 CYT
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    0.0004544        11545.     25408818.     8.9639973     0.0040730     -0.012284     3.9994797
60.0000000 CYT


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   Summary of Results for Nominal Moment Capacity for Section 3
--------------------------------------------------------------------------------

Moment values interpolated at maximum compressive strain = 0.003
or maximum developed moment if pile fails at smaller strains.

 Load           Axial Thrust        Nominal Mom. Cap.      Max. Comp.      Max. Tens.
  No.              kips                in-kip               Strain           Strain
 ----         ----------------     ------------------     ------------    ------------
   1               218.600            10600.675           0.00300000     -0.00952142
   2               304.020            11480.488           0.00300000     -0.00857709

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     Resist.       Nominal        Nominal     Ult. (Fac)    Ult. (Fac)   Bend. Stiff.
Load      Factor      Ax. Thrust    Moment Cap    Ax. Thrust    Moment Cap    at Ult Mom
 No.                     kips         in-kips        kips          in-kips      kip-in^2
-----  ------------   ------------  ------------  ------------  ------------  ------------
   1       0.65         218.600000        10601.    142.090000         6890.     89813170.
   2       0.65         304.020000        11480.    197.613000         7462.     99854287.
```

1	0.75	218.600000	10601.	163.950000	7951.	84479290.
2	0.75	304.020000	11480.	228.015000	8610.	91938396.
1	0.90	218.600000	10601.	196.740000	9541.	66011934.
2	0.90	304.020000	11480.	273.618000	10332.	74232706.

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	13.8000	0.00	N.A.	Yes	N.A.	N.A.
2	14.5000	0.7000	No	Yes	N.A.	N.A.
3	21.0000	7.2000	No	Yes	N.A.	N.A.
4	24.5000	10.7000	No	Yes	N.A.	N.A.
5	25.5000	11.7000	No	Yes	N.A.	N.A.
6	35.3000	21.5000	No	Yes	N.A.	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 = 15820.0 lbs
Applied moment at pile head = 0.0 in-lbs
Axial thrust load on pile head = 218600.0 lbs

Depth X	Deflect. y	Bending Moment	Shear Force	Slope S	Total Stress	Bending Stiffness	Soil Res. p	Soil Spr. Es*H	Distrib. Lat. Load
feet	inches	in-lbs	lbs	radians	psi*	lb-in^2	lb/inch	lb/inch	lb/inch
0.00	0.1923	-0.02820	15820.	-0.00123	34.6984	5.80E+13	0.00	0.00	27.7067
0.5000	0.1848	97038.	15990.	-0.00123	34.8071	5.80E+13	0.00	0.00	28.9268
1.0000	0.1774	195118.	16168.	-0.00123	34.9169	5.80E+13	0.00	0.00	30.5536
1.5000	0.1700	294298.	16357.	-0.00123	35.0279	5.80E+13	0.00	0.00	32.1804
2.0000	0.1626	394636.	16555.	-0.00123	35.1402	5.80E+13	0.00	0.00	33.8072
2.5000	0.1552	496191.	16762.	-0.00123	35.2539	5.80E+13	0.00	0.00	35.4341
3.0000	0.1478	599022.	16980.	-0.00123	35.3690	5.80E+13	0.00	0.00	37.0609
3.5000	0.1404	703186.	17207.	-0.00123	35.4857	5.80E+13	0.00	0.00	38.6877
4.0000	0.1330	808744.	17444.	-0.00123	26.9292	7.73E+13	0.00	0.00	40.3145
4.5000	0.1256	915753.	17691.	-0.00123	27.0490	7.73E+13	0.00	0.00	41.9413
5.0000	0.1182	1024271.	17947.	-0.00123	27.1705	7.73E+13	0.00	0.00	43.5681
5.5000	0.1108	1134358.	18214.	-0.00123	27.2938	7.73E+13	0.00	0.00	

45.1949
6.0000 0.1034 1246072. 18490. -0.00123 27.4188 7.73E+13 0.00 0.00
46.8217
6.5000 0.09596 1359471. 18775. -0.00123 27.5458 7.73E+13 0.00 0.00
48.4486
7.0000 0.08855 1474614. 19071. -0.00122 0.00 3.64E+11 0.00 0.00
50.0754
7.5000 0.08129 1591528. 19376. -0.00120 0.00 3.64E+11 0.00 0.00
51.7022
8.0000 0.07419 1710269. 19691. -0.00117 0.00 3.64E+11 0.00 0.00
53.3290
8.5000 0.06726 1830893. 20016. -0.00114 0.00 3.64E+11 0.00 0.00
54.9558
9.0000 0.06051 1953455. 20351. -0.00111 0.00 3.64E+11 0.00 0.00
56.5826
9.5000 0.05395 2078013. 20695. -0.00108 0.00 3.63E+11 0.00 0.00
58.2094
10.0000 0.04760 2204620. 21049. -0.00104 0.00 3.63E+11 0.00 0.00
59.8362
10.5000 0.04147 2333335. 21413. -0.00100 0.00 3.63E+11 0.00 0.00
61.4630
11.0000 0.03556 2464211. 21787. -9.63E-04 0.00 3.63E+11 0.00 0.00
63.0899
11.5000 0.02991 2597305. 22170. -9.21E-04 0.00 3.62E+11 0.00 0.00
64.7167
12.0000 0.02451 2732672. 22564. -8.77E-04 0.00 3.62E+11 0.00 0.00
66.3435
12.5000 0.01938 2870369. 22966. -8.31E-04 0.00 3.62E+11 0.00 0.00
67.9703
13.0000 0.01454 3010450. 23379. -7.53E-04 0.00 1.68E+11 0.00 0.00
69.5971
13.5000 0.01034 3152896. 23802. -6.41E-04 0.00 1.60E+11 0.00 0.00
71.2239
14.0000 0.00685 3297750. 14762. -5.17E-04 0.00 1.52E+11 -3092. 2708582.
7.2119
14.5000 0.00414 3331398. -5926. -3.85E-04 0.00 1.51E+11 -3812. 5525606.
0.00
15.0000 0.00223 3227643. -32600. -2.57E-04 0.00 1.56E+11 -5079. 1.37E+07

0.00
15.5000 0.00106 2940876. -62384. -1.52E-04 0.00 2.06E+11 -4849. 2.75E+07
0.00
16.0000 4.05E-04 2479439. -85351. -8.85E-05 0.00 3.63E+11 -2807. 4.15E+07
0.00
16.5000 -2.39E-06 1916902. -93716. -5.22E-05 0.00 3.64E+11 18.4119 4.62E+07
0.00
17.0000 -2.21E-04 1354987. -88051. -2.52E-05 0.00 3.64E+11 1870. 5.09E+07
0.00
17.5000 -3.05E-04 860353. -73978. -6.96E-06 0.00 3.64E+11 2821. 5.55E+07
0.00
18.0000 -3.04E-04 467266. -56361. 3.96E-06 0.00 3.64E+11 3051. 6.02E+07
0.00
18.5000 -2.57E-04 184012. -38864. 9.33E-06 0.00 3.64E+11 2781. 6.49E+07
0.00
19.0000 -1.92E-04 871.8209 -23839. 1.08E-05 0.00 3.64E+11 2227. 6.95E+07
0.00
19.5000 -1.27E-04 -102084. -12443. 1.00E-05 0.00 3.64E+11 1571. 7.42E+07
0.00
20.0000 -7.20E-05 -148467. -4888. 7.95E-06 0.00 3.64E+11 946.6918 7.89E+07
0.00
20.5000 -3.16E-05 -160765. -726.757 5.41E-06 0.00 3.64E+11 440.5192 8.35E+07
0.00
21.0000 -7.14E-06 -157202. 6713. 2.79E-06 0.00 3.64E+11 2039. 1.71E+09
0.00
21.5000 1.83E-06 -80221. 11177. 8.35E-07 0.00 3.64E+11 -551.237 1.80E+09
0.00
22.0000 2.88E-06 -23083. 6792. -1.51E-08 0.00 3.64E+11 -910.419 1.89E+09
0.00
22.5000 1.65E-06 1280. 2420. -1.95E-07 0.00 3.64E+11 -546.784 1.99E+09
0.00
23.0000 5.48E-07 5960. 220.5764 -1.35E-07 0.00 3.64E+11 -186.416 2.04E+09
0.00
23.5000 3.30E-08 3928. -372.310 -5.36E-08 0.00 3.64E+11 -11.213 2.04E+09
0.00
24.0000 -9.44E-08 1492. -309.703 -8.94E-09 0.00 3.64E+11 32.0820 2.04E+09
0.00
24.5000 -7.43E-08 211.3192 -137.653 5.08E-09 0.00 3.64E+11 25.2680 2.04E+09

```
0.00
   25.0000  -3.34E-08   -159.784    -27.777   5.50E-09       0.00   3.64E+11    11.3572   2.04E+09
0.00
   25.5000  -8.27E-09   -122.023     7.9075   3.18E-09       0.00   3.64E+11     0.5377   3.90E+08
0.00
   26.0000   4.81E-09    -64.902     8.5834   1.65E-09       0.00   3.64E+11     -0.312   3.90E+08
0.00
   26.5000   1.15E-08    -19.026     5.4087   9.55E-10       0.00   3.64E+11     -0.746   3.90E+08
0.00
   27.0000   1.63E-08       0.00       0.00   7.98E-10       0.00   3.64E+11     -1.057   1.95E+08
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. 1:

Pile-head deflection             =     0.19225816 inches
Computed slope at pile head      =     -0.0012349 radians
Maximum bending moment           =       3331398. inch-lbs
Maximum shear force              =        -93716. lbs
Depth of maximum bending moment  =    14.50000000 feet below pile head
Depth of maximum shear force     =    16.50000000 feet below pile head
Number of iterations             =            223
Number of zero deflection points =              4
Pile deflection at ground        =     0.00824398 inches



--------------------------------------------------------------------------------
            Pile-head Deflection vs. Pile Length for Load Case 1
--------------------------------------------------------------------------------
```

Boundary Condition Type 1, Shear and Moment

Shear = 15820. lbs
Moment = 0. in-lbs
Axial Load = 218600. lbs

Pile Length feet	Pile Head Deflection inches	Maximum Moment ln-lbs	Maximum Shear lbs
27.00000	0.19225816	3331398.	-93716.
25.65000	0.20724932	3401704.	-96720.
24.30000	0.19031512	3324572.	-93860.
22.95000	0.19020286	3346624.	-95371.
21.60000	0.19315964	3343168.	-94613.
20.25000	0.18608522	3308773.	-93125.
18.90000	0.19533639	3344541.	-101582.
17.55000	0.31262726	3344084.	-150349.
16.20000	-27.3086708	-2216728.	198727.

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 = 19120.0 lbs
Applied moment at pile head = 0.0 in-lbs
Axial thrust load on pile head = 304020.0 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	0.2667	-0.00375	19120.	-0.00170	48.2571	5.80E+13	0.00	0.00	43.7096
0.5000	0.2565	118609.	19388.	-0.00170	48.3899	5.80E+13	0.00	0.00	45.5384
1.0000	0.2463	238858.	19668.	-0.00170	48.5246	5.80E+13	0.00	0.00	47.9768
1.5000	0.2361	360834.	19963.	-0.00170	48.6611	5.80E+13	0.00	0.00	50.4152
2.0000	0.2259	484625.	20273.	-0.00170	48.7997	5.80E+13	0.00	0.00	52.8536
2.5000	0.2157	610318.	20598.	-0.00170	48.9404	5.80E+13	0.00	0.00	55.2920
3.0000	0.2055	738002.	20937.	-0.00170	49.0834	5.80E+13	0.00	0.00	57.7304
3.5000	0.1953	867764.	21290.	-0.00170	49.2286	5.80E+13	0.00	0.00	60.1688
4.0000	0.1851	999692.	21659.	-0.00170	37.3120	7.73E+13	0.00	0.00	62.6072
4.5000	0.1748	1133874.	22042.	-0.00170	37.4623	7.73E+13	0.00	0.00	65.0457
5.0000	0.1646	1270397.	22439.	-0.00170	37.6151	7.73E+13	0.00	0.00	67.4841
5.5000	0.1544	1409349.	22852.	-0.00170	37.7707	7.73E+13	0.00	0.00	69.9225
6.0000	0.1442	1550819.	23278.	-0.00170	37.9291	7.73E+13	0.00	0.00	72.3609
6.5000	0.1340	1694893.	23720.	-0.00170	38.0903	7.73E+13	0.00	0.00	74.7993
7.0000	0.1238	1841659.	24176.	-0.00168	0.00	3.61E+11	0.00	0.00	77.2377
7.5000	0.1138	1991151.	24647.	-0.00165	0.00	3.61E+11	0.00	0.00	79.6761
8.0000	0.1040	2143450.	25132.	-0.00162	0.00	3.61E+11	0.00	0.00	82.1145
8.5000	0.09441	2298640.	25632.	-0.00158	0.00	3.60E+11	0.00	0.00	

84.5529
9.0000 0.08503 2456805. 26147. -0.00154 0.00 3.60E+11 0.00 0.00
86.9913
9.5000 0.07591 2618026. 26676. -0.00150 0.00 3.60E+11 0.00 0.00
89.4297
10.0000 0.06704 2782388. 27220. -0.00145 0.00 3.60E+11 0.00 0.00
91.8681
10.5000 0.05845 2949972. 27778. -0.00141 0.00 3.59E+11 0.00 0.00
94.3065
11.0000 0.05016 3120861. 28352. -0.00136 0.00 3.59E+11 0.00 0.00
96.7449
11.5000 0.04218 3295137. 28939. -0.00130 0.00 3.59E+11 0.00 0.00
99.1833
12.0000 0.03453 3472884. 29542. -0.00122 0.00 2.07E+11 0.00 0.00
101.6217
12.5000 0.02749 3654106. 30159. -0.00112 0.00 1.95E+11 0.00 0.00
104.0601
13.0000 0.02112 3838869. 30791. -9.99E-04 0.00 1.83E+11 0.00 0.00
106.4986
13.5000 0.01550 4027237. 31437. -8.66E-04 0.00 1.73E+11 0.00 0.00
108.9370
14.0000 0.01072 4219272. 21423. -7.20E-04 0.00 1.64E+11 -3458. 1935534.
11.0278
14.5000 0.00686 4286941. -1894. -5.63E-04 0.00 1.61E+11 -4326. 3780967.
0.00
15.0000 0.00397 4198595. -32477. -4.06E-04 0.00 1.65E+11 -5869. 8874118.
0.00
15.5000 0.00199 3898703. -67109. -2.65E-04 0.00 1.80E+11 -5676. 1.71E+07
0.00
16.0000 7.87E-04 3394252. -99398. -1.52E-04 0.00 2.13E+11 -5087. 3.88E+07
0.00
16.5000 1.58E-04 2706488. -118314. -8.22E-05 0.00 3.60E+11 -1218. 4.62E+07
0.00
17.0000 -1.99E-04 1974780. -116900. -4.32E-05 0.00 3.61E+11 1690. 5.09E+07
0.00
17.5000 -3.60E-04 1303848. -101840. -1.59E-05 0.00 3.61E+11 3330. 5.55E+07
0.00
18.0000 -3.90E-04 752758. -80106. 1.19E-06 0.00 3.61E+11 3915. 6.02E+07

0.00
18.5000 -3.45E-04 342578. -57156. 1.03E-05 0.00 3.61E+11 3735. 6.49E+07
0.00
19.0000 -2.67E-04 66849. -36681. 1.37E-05 0.00 3.61E+11 3090. 6.95E+07
0.00
19.5000 -1.81E-04 -97648. -20693. 1.34E-05 0.00 3.61E+11 2239. 7.42E+07
0.00
20.0000 -1.05E-04 -181521. -9823. 1.11E-05 0.00 3.61E+11 1384. 7.89E+07
0.00
20.5000 -4.76E-05 -215563. -3682. 7.82E-06 0.00 3.61E+11 662.8368 8.35E+07
0.00
21.0000 -1.14E-05 -225736. 8095. 4.15E-06 0.00 3.61E+11 3263. 1.71E+09
0.00
21.5000 2.25E-06 -118443. 15856. 1.29E-06 0.00 3.61E+11 -675.483 1.80E+09
0.00
22.0000 4.10E-06 -35464. 9942. 1.47E-08 0.00 3.61E+11 -1296. 1.89E+09
0.00
22.5000 2.42E-06 866.5170 3650. -2.73E-07 0.00 3.61E+11 -801.626 1.99E+09
0.00
23.0000 8.28E-07 8339. 400.6480 -1.96E-07 0.00 3.61E+11 -281.558 2.04E+09
0.00
23.5000 6.57E-08 5675. -510.990 -7.99E-08 0.00 3.61E+11 -22.321 2.04E+09
0.00
24.0000 -1.31E-07 2207. -444.563 -1.44E-08 0.00 3.61E+11 44.4632 2.04E+09
0.00
24.5000 -1.07E-07 340.3037 -202.001 6.79E-09 0.00 3.61E+11 36.3910 2.04E+09
0.00
25.0000 -4.93E-08 -216.680 -42.493 7.81E-09 0.00 3.61E+11 16.7783 2.04E+09
0.00
25.5000 -1.33E-08 -169.637 10.4311 4.60E-09 0.00 3.61E+11 0.8629 3.90E+08
0.00
26.0000 5.88E-09 -91.524 11.8739 2.43E-09 0.00 3.61E+11 -0.382 3.90E+08
0.00
26.5000 1.59E-08 -27.159 7.6274 1.44E-09 0.00 3.61E+11 -1.034 3.90E+08
0.00
27.0000 2.32E-08 0.00 0.00 1.22E-09 0.00 3.61E+11 -1.509 1.95E+08
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             =     0.26668987 inches
Computed slope at pile head      =     -0.0017009 radians
Maximum bending moment           =       4286941. inch-lbs
Maximum shear force              =       -118314. lbs
Depth of maximum bending moment  =    14.50000000 feet below pile head
Depth of maximum shear force     =    16.50000000 feet below pile head
Number of iterations             =             51
Number of zero deflection points =              4
Pile deflection at ground        =     0.01263122 inches
```

Pile-head Deflection vs. Pile Length for Load Case 2

Boundary Condition Type 1, Shear and Moment

```
Shear      =          19120. lbs
Moment     =              0. in-lbs
Axial Load =         304020. lbs
```

Pile Length feet	Pile Head Deflection inches	Maximum Moment ln-lbs	Maximum Shear lbs
27.00000	0.26668987	4286941.	-118314.

25.65000	0.28101927	4380030.	-122668.
24.30000	0.26220828	4272880.	-119320.
22.95000	0.26790414	4302234.	-119931.
21.60000	0.26846896	4293464.	-121038.
20.25000	0.25865935	4252288.	-117739.
18.90000	0.26962949	4299859.	-134903.
17.55000	0.68435002	4364158.	-197629.
16.20000	-22.7586313	-2199114.	202613.

Computed Values of Pile Loading and Deflection
for Lateral Loading for Load Case Number 3

Pile-head conditions are Displacement and Moment (Loading Type 4)
Displacement of pile head = 0.480000 inches
Moment at pile head = 0.0 in-lbs
Axial load at pile head = 218600.0 lbs

Depth	Deflect.	Bending	Shear	Slope	Total	Bending	Soil Res.	Soil Spr.	Distrib.
X	y	Moment	Force	S	Stress	Stiffness	p	Es*H	Lat. Load
feet	inches	in-lbs	lbs	radians	psi*	lb-in^2	lb/inch	lb/inch	lb/inch
0.00	0.4800	0.00	24084.	-0.00309	34.6984	5.80E+13	0.00	0.00	27.7067
0.5000	0.4615	149053.	24254.	-0.00309	34.8653	5.80E+13	0.00	0.00	28.9268
1.0000	0.4430	299148.	24433.	-0.00309	35.0333	5.80E+13	0.00	0.00	30.5536
1.5000	0.4244	450343.	24621.	-0.00309	35.2026	5.80E+13	0.00	0.00	32.1804
2.0000	0.4059	602696.	24819.	-0.00309	35.3732	5.80E+13	0.00	0.00	33.8072

2.5000	0.3874	756266.	25026.	-0.00309	35.5451	5.80E+13	0.00	0.00
35.4341								
3.0000	0.3689	911112.	25244.	-0.00309	35.7184	5.80E+13	0.00	0.00
37.0609								
3.5000	0.3503	1067292.	25471.	-0.00309	35.8933	5.80E+13	0.00	0.00
38.6877								
4.0000	0.3318	1224864.	25708.	-0.00309	27.3951	7.73E+13	0.00	0.00
40.3145								
4.5000	0.3133	1383887.	25955.	-0.00309	27.5731	7.73E+13	0.00	0.00
41.9413								
5.0000	0.2948	1544421.	26211.	-0.00309	27.7528	7.73E+13	0.00	0.00
43.5681								
5.5000	0.2762	1706522.	26478.	-0.00309	27.9343	7.73E+13	0.00	0.00
45.1949								
6.0000	0.2577	1870251.	26754.	-0.00309	28.1176	7.73E+13	0.00	0.00
46.8217								
6.5000	0.2392	2035665.	27040.	-0.00309	28.3028	7.73E+13	0.00	0.00
48.4486								
7.0000	0.2207	2202822.	27335.	-0.00307	0.00	3.63E+11	0.00	0.00
50.0754								
7.5000	0.2024	2371735.	27641.	-0.00303	0.00	3.63E+11	0.00	0.00
51.7022								
8.0000	0.1843	2542458.	27956.	-0.00299	0.00	3.63E+11	0.00	0.00
53.3290								
8.5000	0.1665	2715045.	28280.	-0.00295	0.00	3.62E+11	0.00	0.00
54.9558								
9.0000	0.1490	2889552.	28615.	-0.00290	0.00	3.62E+11	0.00	0.00
56.5826								
9.5000	0.1317	3066032.	28959.	-0.00282	0.00	1.65E+11	0.00	0.00
58.2094								
10.0000	0.1151	3244462.	29314.	-0.00270	0.00	1.55E+11	0.00	0.00
59.8362								
10.5000	0.09931	3424882.	29678.	-0.00257	0.00	1.46E+11	0.00	0.00
61.4630								
11.0000	0.08432	3607329.	30051.	-0.00242	0.00	1.39E+11	0.00	0.00
63.0899								
11.5000	0.07027	3791844.	30435.	-0.00226	0.00	1.33E+11	0.00	0.00
64.7167								

12.0000	0.05724	3978463.	30828.	-0.00208	0.00	1.27E+11	0.00	0.00	66.3435
12.5000	0.04535	4167224.	31231.	-0.00188	0.00	1.22E+11	0.00	0.00	67.9703
13.0000	0.03468	4358164.	31643.	-0.00167	0.00	1.18E+11	0.00	0.00	69.5971
13.5000	0.02535	4551317.	32066.	-0.00144	0.00	1.14E+11	0.00	0.00	71.2239
14.0000	0.01745	4746721.	20581.	-0.00119	0.00	1.11E+11	-3907.	1343305.	7.2119
14.5000	0.01109	4801409.	-5753.	-9.28E-04	0.00	1.10E+11	-4879.	2638431.	0.00
15.0000	0.00631	4680120.	-40171.	-6.71E-04	0.00	1.12E+11	-6594.	6266209.	0.00
15.5000	0.00304	4321120.	-78900.	-4.36E-04	0.00	1.19E+11	-6316.	1.25E+07	0.00
16.0000	0.00108	3734469.	-114373.	-2.44E-04	0.00	1.34E+11	-5509.	3.07E+07	0.00
16.5000	1.16E-04	2949284.	-133583.	-1.11E-04	0.00	1.80E+11	-894.561	4.62E+07	0.00
17.0000	-2.55E-04	2131766.	-129782.	-4.43E-05	0.00	3.63E+11	2161.	5.09E+07	0.00
17.5000	-4.15E-04	1392015.	-111777.	-1.52E-05	0.00	3.64E+11	3840.	5.55E+07	0.00
18.0000	-4.37E-04	790483.	-87093.	2.77E-06	0.00	3.64E+11	4388.	6.02E+07	0.00
18.5000	-3.82E-04	346890.	-61552.	1.21E-05	0.00	3.64E+11	4126.	6.49E+07	0.00
19.0000	-2.92E-04	51822.	-39034.	1.54E-05	0.00	3.64E+11	3380.	6.95E+07	0.00
19.5000	-1.97E-04	-121557.	-21598.	1.48E-05	0.00	3.64E+11	2432.	7.42E+07	0.00
20.0000	-1.14E-04	-207397.	-9825.	1.21E-05	0.00	3.64E+11	1493.	7.89E+07	0.00
20.5000	-5.10E-05	-239493.	-3217.	8.46E-06	0.00	3.64E+11	709.9284	8.35E+07	0.00
21.0000	-1.21E-05	-246027.	9260.	4.46E-06	0.00	3.64E+11	3449.	1.71E+09	0.00

21.5000	2.54E-06	-128389.	17318.	1.38E-06	0.00	3.64E+11	-763.114	1.80E+09	0.00
22.0000	4.47E-06	-38219.	10793.	7.53E-09	0.00	3.64E+11	-1412.	1.89E+09	0.00
22.5000	2.63E-06	1124.	3948.	-2.98E-07	0.00	3.64E+11	-869.709	1.99E+09	0.00
23.0000	8.97E-07	9157.	424.2563	-2.13E-07	0.00	3.64E+11	-304.868	2.04E+09	0.00
23.5000	6.98E-08	6215.	-561.557	-8.66E-08	0.00	3.64E+11	-23.737	2.04E+09	0.00
24.0000	-1.43E-07	2419.	-486.797	-1.56E-08	0.00	3.64E+11	48.6569	2.04E+09	0.00
24.5000	-1.17E-07	373.9451	-221.382	7.41E-09	0.00	3.64E+11	39.8148	2.04E+09	0.00
25.0000	-5.42E-08	-237.693	-46.695	8.53E-09	0.00	3.64E+11	18.4142	2.04E+09	0.00
25.5000	-1.47E-08	-186.414	11.4134	5.04E-09	0.00	3.64E+11	0.9552	3.90E+08	0.00
26.0000	6.36E-09	-100.746	13.0394	2.68E-09	0.00	3.64E+11	-0.413	3.90E+08	0.00
26.5000	1.75E-08	-29.949	8.3958	1.60E-09	0.00	3.64E+11	-1.135	3.90E+08	0.00
27.0000	2.56E-08	0.00	0.00	1.36E-09	0.00	3.64E+11	-1.664	1.95E+08	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. 3:

Pile-head deflection = 0.48000000 inches
Computed slope at pile head = -0.0030874 radians
Maximum bending moment = 4801409. inch-lbs

```
Maximum shear force              =       -133583. lbs
Depth of maximum bending moment  =    14.50000000 feet below pile head
Depth of maximum shear force     =    16.50000000 feet below pile head
Number of iterations             =             49
Number of zero deflection points =              4
Pile deflection at ground        =     0.02060860 inches
```

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	15820.	M, in-lb	0.00	218600.	0.1923	-0.00123	-93716.	3331398.
2	V, lb	19120.	M, in-lb	0.00	304020.	0.2667	-0.00170	-118314.	4286941.
3	y, in	0.4800	M, in-lb	0.00	218600.	0.4800	-0.00309	-133583.	4801409.

Maximum pile-head deflection = 0.4800000000 inches
Maximum pile-head rotation   = -0.0030874361 radians = -0.176897 deg.

Summary of Warning Messages

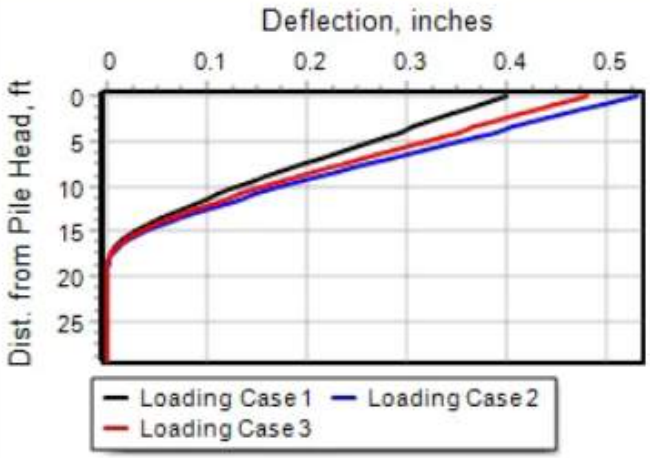
The following warning was reported 500 times

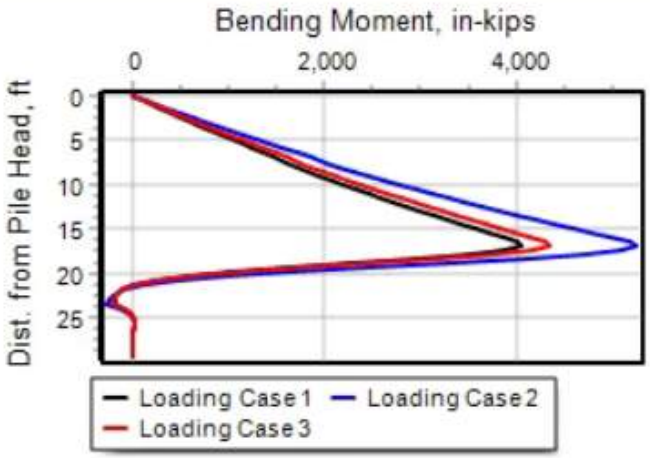
**** Warning ****

An unreasonable input value for unconfined compressive strength has been specified for a soil defined using the weak rock criteria. The input value is greater than 500 psi. Please check your input data for correctness.

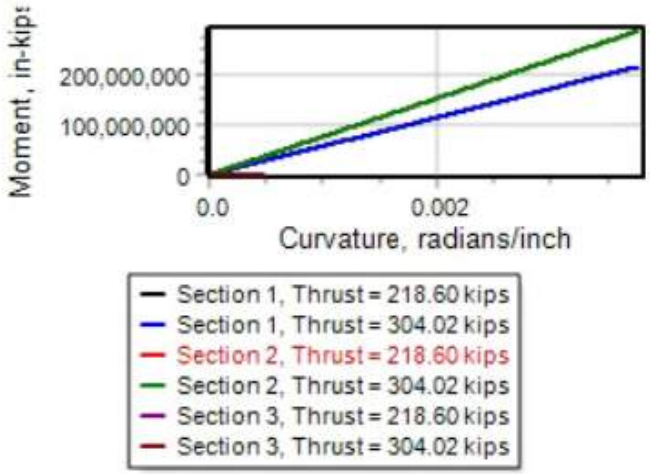
The analysis ended normally.

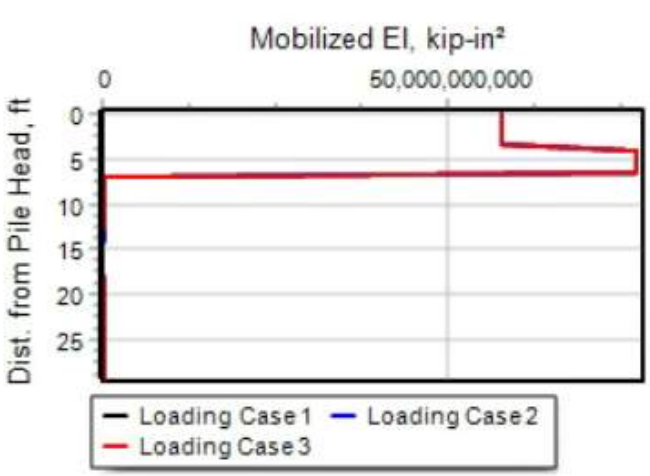
Results for HAS-22-17.53L FA Shaft 5 B-144.lp12d

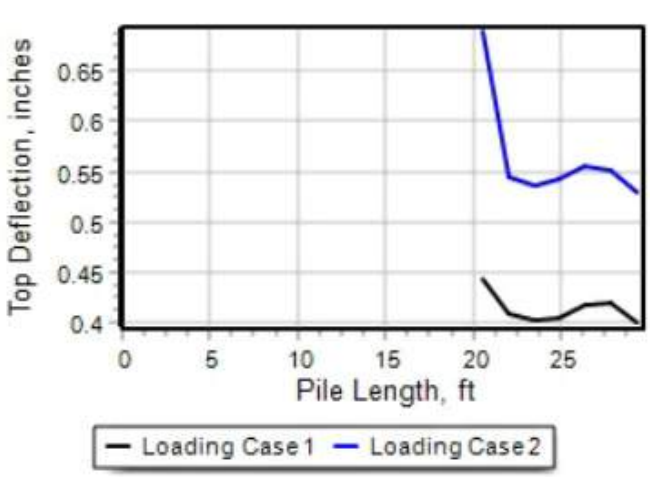












Show All Legends

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LPile Version 2022-12.013

License ID : 500128183
License Type : (Single User License)

Analysis of Individual Piles and Drilled Shafts
Subjected to Lateral Loading Using the p-y Method
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Barr Engineering Inc.
Columbus, OH, USA

==========

This model was prepared by:
Zmankoci

Files Used for Analysis

Path to file locations:
\23-0011 113440 HAS-22-15.25\113440\geotechnical\bridges\XXX-YY-ZZ.ZZ (Crossing)\Analysis\Lpile\New folder\

Name of input data file:
HAS-22-17.53L FA Shaft 5 B-144.lp12d

Name of output report file:
HAS-22-17.53L FA Shaft 5 B-144.lp12o

Name of plot output file:
HAS-22-17.53L FA Shaft 5 B-144.lp12p

Name of runtime message file:
HAS-22-17.53L FA Shaft 5 B-144.lp12r

Date and Time of Analysis

Date: November 18, 2025 Time: 11:23:14

Problem Title

Project Name: HAS-22-17.53L

Job Number: 10059

Client: ODOT

Engineer: ZM

Description: HAS-22-17.53L over Colubmus & Ohio River RR Spur

```
--------------------------------------------------------------------------------
                         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                           =           59

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)
 - 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 = 29.300 ft
Depth of ground surface below top of pile = 16.1000 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	36.0000
2	3.600	36.0000
3	3.600	48.0000
4	6.600	48.0000
5	6.600	36.0000
6	29.300	36.0000

Input Structural Properties for Pile Sections:

Pile Section No. 1:

Section 1 is an elastic pile
Cross-sectional shape = rectangular
Length of section = 3.600000 ft
Width of top of section = 36.000000 in
Width of bottom of section = 36.000000 in
Top Section Depth = 175.000000 in
Bottom Section Depth = 175.000000 in

```
   Top Area                                          =        6300. sq. in
   Bottom Area                                       =        6300. sq. in
   Moment of Inertia at Top                          =    16078125. in^4
   Moment of Inertia at Bottom                       =    16078125. in^4
   Elastic Modulus                                   =     3604996. psi

Pile Section No. 2:

   Section 2 is an elastic pile
   Cross-sectional shape                             =     rectangular
   Length of section                                 =     3.000000 ft
   Width of top of section                           =    48.000000 in
   Width of bottom of section                        =    48.000000 in
   Top Section Depth                                 =   175.000000 in
   Bottom Section Depth                              =   175.000000 in
   Top Area                                          =        8400. sq. in
   Bottom Area                                       =        8400. sq. in
   Moment of Inertia at Top                          =    21437500. in^4
   Moment of Inertia at Bottom                       =    21437500. in^4
   Elastic Modulus                                   =     3604996. psi

Pile Section No. 3:

   Section 3 is a round drilled shaft, bored pile, or CIDH pile
   Length of section                                 =    22.700000 ft
   Shaft Diameter                                    =    36.000000 in



--------------------------------------------------------------------------------
                       Soil and Rock Layering Information
--------------------------------------------------------------------------------

The soil profile is modelled using 6 layers

Layer 1 is weak rock, p-y criteria by Reese, 1997

   Distance from top of pile to top of layer         =    16.100000 ft
```

Distance from top of pile to bottom of layer	=	16.800000	ft
Effective unit weight at top of layer	=	139.000000	pcf
Effective unit weight at bottom of layer	=	139.000000	pcf
Uniaxial compressive strength at top of layer	=	200.000000	psi
Uniaxial compressive strength at bottom of layer	=	200.000000	psi
Initial modulus of rock at top of layer	=	18000.	psi
Initial modulus of rock at bottom of layer	=	18000.	psi
RQD of rock at top of layer	=	0.0000	%
RQD of rock at bottom of layer	=	0.0000	%
k rm of rock at top of layer	=	0.0005000	
k rm of rock at bottom of layer	=	0.0005000	

Layer 2 is weak rock, p-y criteria by Reese, 1997

Distance from top of pile to top of layer	=	16.800000	ft
Distance from top of pile to bottom of layer	=	23.300000	ft
Effective unit weight at top of layer	=	139.000000	pcf
Effective unit weight at bottom of layer	=	139.000000	pcf
Uniaxial compressive strength at top of layer	=	391.000000	psi
Uniaxial compressive strength at bottom of layer	=	391.000000	psi
Initial modulus of rock at top of layer	=	35000.	psi
Initial modulus of rock at bottom of layer	=	35000.	psi
RQD of rock at top of layer	=	33.000000	%
RQD of rock at bottom of layer	=	33.000000	%
k rm of rock at top of layer	=	0.0005000	
k rm of rock at bottom of layer	=	0.0005000	

Layer 3 is weak rock, p-y criteria by Reese, 1997

Distance from top of pile to top of layer	=	23.300000	ft
Distance from top of pile to bottom of layer	=	26.800000	ft
Effective unit weight at top of layer	=	147.000000	pcf
Effective unit weight at bottom of layer	=	147.000000	pcf
Uniaxial compressive strength at top of layer	=	7500.	psi
Uniaxial compressive strength at bottom of layer	=	7500.	psi
Initial modulus of rock at top of layer	=	680000.	psi

Initial modulus of rock at bottom of layer	=	680000.	psi
RQD of rock at top of layer	=	61.000000	%
RQD of rock at bottom of layer	=	61.000000	%
k rm of rock at top of layer	=	0.0000500	
k rm of rock at bottom of layer	=	0.0000500	

Layer 4 is weak rock, p-y criteria by Reese, 1997

Distance from top of pile to top of layer	=	26.800000	ft
Distance from top of pile to bottom of layer	=	27.800000	ft
Effective unit weight at top of layer	=	150.000000	pcf
Effective unit weight at bottom of layer	=	150.000000	pcf
Uniaxial compressive strength at top of layer	=	7500.	psi
Uniaxial compressive strength at bottom of layer	=	7500.	psi
Initial modulus of rock at top of layer	=	680000.	psi
Initial modulus of rock at bottom of layer	=	680000.	psi
RQD of rock at top of layer	=	0.0000	%
RQD of rock at bottom of layer	=	0.0000	%
k rm of rock at top of layer	=	0.0000500	
k rm of rock at bottom of layer	=	0.0000500	

Layer 5 is weak rock, p-y criteria by Reese, 1997

Distance from top of pile to top of layer	=	27.800000	ft
Distance from top of pile to bottom of layer	=	37.600000	ft
Effective unit weight at top of layer	=	146.000000	pcf
Effective unit weight at bottom of layer	=	146.000000	pcf
Uniaxial compressive strength at top of layer	=	1395.	psi
Uniaxial compressive strength at bottom of layer	=	1395.	psi
Initial modulus of rock at top of layer	=	130000.	psi
Initial modulus of rock at bottom of layer	=	130000.	psi
RQD of rock at top of layer	=	30.000000	%
RQD of rock at bottom of layer	=	30.000000	%
k rm of rock at top of layer	=	0.0001200	
k rm of rock at bottom of layer	=	0.0001200	

Layer 6 is weak rock, p-y criteria by Reese, 1997

Distance from top of pile to top of layer	=	37.600000 ft
Distance from top of pile to bottom of layer	=	41.800000 ft
Effective unit weight at top of layer	=	148.000000 pcf
Effective unit weight at bottom of layer	=	148.000000 pcf
Uniaxial compressive strength at top of layer	=	7500. psi
Uniaxial compressive strength at bottom of layer	=	7500. psi
Initial modulus of rock at top of layer	=	680000. psi
Initial modulus of rock at bottom of layer	=	680000. psi
RQD of rock at top of layer	=	79.000000 %
RQD of rock at bottom of layer	=	79.000000 %
k rm of rock at top of layer	=	0.0000500
k rm of rock at bottom of layer	=	0.0000500

(Depth of the lowest soil layer extends 12.500 ft below the pile tip)

**** Warning - Possible Input Data Error ****

Values entered for effective unit weight of rock were outside the limits of
50 pcf to 150 pcf.

The maximum input value, in layer 6, for effective unit weight = 150.00 pcf

This data may be erroneous. Please check your data.

Summary of Input Soil Properties

Layer Num.	Soil Type Name (p-y Curve Type)	Layer Depth ft	Effective Unit Wt. pcf	Uniaxial qu psi	RQD %	E50 or krm	Rock Mass Modulus psi

1	Weak	16.1000	139.0000	200.0000	0.00	5.00E-04	18000.
	Rock	16.8000	139.0000	200.0000	0.00	5.00E-04	18000.
2	Weak	16.8000	139.0000	391.0000	33.0000	5.00E-04	35000.
	Rock	23.3000	139.0000	391.0000	33.0000	5.00E-04	35000.
3	Weak	23.3000	147.0000	7500.	61.0000	5.00E-05	680000.
	Rock	26.8000	147.0000	7500.	61.0000	5.00E-05	680000.
4	Weak	26.8000	150.0000	7500.	0.00	5.00E-05	680000.
	Rock	27.8000	150.0000	7500.	0.00	5.00E-05	680000.
5	Weak	27.8000	146.0000	1395.	30.0000	1.20E-04	130000.
	Rock	37.6000	146.0000	1395.	30.0000	1.20E-04	130000.
6	Weak	37.6000	148.0000	7500.	79.0000	5.00E-05	680000.
	Rock	41.8000	148.0000	7500.	79.0000	5.00E-05	680000.

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	27.300
2	16.100	72.200

Distributed lateral load intensity for Load Case 2 defined using 2 points

Point No.	Depth X ft	Dist. Load lb/in
1	0.000	43.100
2	16.100	110.400

Distributed lateral load intensity for Load Case 3 defined using 2 points

Point No.	Depth X ft	Dist. Load lb/in
1	0.000	27.300
2	16.100	72.200

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 3

Load No.	Load Type	Condition 1	Condition 2	Axial Thrust Force, lbs	Compute Top y vs. Pile Length	Run Analysis
1	1	V = 15820. lbs	M = 0.0000 in-lbs	218600.	Yes	Yes
2	1	V = 19120. lbs	M = 0.0000 in-lbs	304020.	Yes	Yes
3	4	y = 0.480000 in	M = 0.0000 in-lbs	218600.	N.A.	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:

Moment-curvature properties were derived from elastic section properties

Pile Section No. 3:

Dimensions and Properties of Drilled Shaft (Bored Pile):

Length of Section	=	22.700000 ft
Shaft Diameter	=	36.000000 in
Concrete Cover Thickness (to edge of trans. reinf.)	=	3.000000 in
Number of Reinforcing Bars	=	10 bars

Yield Stress of Reinforcing Bars	=	60000.	psi
Modulus of Elasticity of Reinforcing Bars	=	29000000.	psi
Gross Area of Shaft	=	1018.	sq. in.
Total Area of Reinforcing Steel	=	10.000000	sq. in.
Area Ratio of Steel Reinforcement	=	0.98	percent
Edge-to-Edge Bar Spacing	=	7.407667	in
Maximum Concrete Aggregate Size	=	0.750000	in
Ratio of Bar Spacing to Aggregate Size	=	9.88	
Offset of Center of Rebar Cage from Center of Pile	=	0.0000	in
Transverse Reinforcement			
Type: Spiral			
Number of Transverse Reinf. (per spacing)	=	1	
Spacing of Transverse Reinf.	=	5.000000	in
Yield Stress of Transverse Reinf.	=	60000.	psi
Diameter of Transverse Reinf.	=	0.625000	in

Axial Structural Capacities:

Nom. Axial Structural Capacity = 0.85 Fc Ac + Fy As	=	4026.778	kips
Tensile Load for Cracking of Concrete	=	-452.643	kips
Nominal Axial Tensile Capacity	=	-600.000	kips

Reinforcing Bar Dimensions and Positions Used in Computations:

Bar Number	Bar Diam. inches	Bar Area sq. in.	X inches	Y inches
1	1.128000	1.000000	13.811000	0.00000
2	1.128000	1.000000	11.173334	8.117902
3	1.128000	1.000000	4.267834	13.135042
4	1.128000	1.000000	-4.26783	13.135042
5	1.128000	1.000000	-11.17333	8.117902
6	1.128000	1.000000	-13.81100	0.00000
7	1.128000	1.000000	-11.17333	-8.11790
8	1.128000	1.000000	-4.26783	-13.13504
9	1.128000	1.000000	4.267834	-13.13504

10	1.128000	1.000000	11.173334	-8.11790

NOTE: The positions of the above rebars were computed by LPile

Minimum spacing between any two bars not equal to zero = 7.408 inches
between bars 5 and 6.

Ratio of bar spacing to maximum aggregate size = 9.88

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 = 2

Number	Axial Thrust Force kips
1	218.600
2	304.020

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 = 218.600 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	227.7896610	364463458.	95.5709666	0.00005973	0.00003723	0.2488600	1.6571863	
0.00000125	455.5760814	364460865.	56.8047719	0.00007101	0.00002601	0.2945620	1.9090980	
0.00000188	683.3514559	364454110.	43.8912777	0.00008230	0.00001480	0.3400491	2.1614757	
0.00000250	911.1102621	364444105.	37.4409590	0.00009360	0.00000360	0.3853201	2.4143195	
0.00000313	1139.	364426195.	33.5758474	0.0001049	-0.00000758	0.4303730	2.6676237	
0.00000375	1366.	364346828.	31.0025546	0.0001163	-0.00001874	0.4751948	2.9213028	
0.00000438	1593.	364170613.	29.1664909	0.0001276	-0.00002990	0.5197681	3.1752361	
0.00000500	1820.	363903991.	27.7906515	0.0001390	-0.00004105	0.5640815	3.4293444	
0.00000563	2045.	363562658.	26.7213241	0.0001503	-0.00005219	0.6081279	3.6835784	

```
   0.00000625        2270.    363161815.    25.8663826     0.0001617   -0.00006334     0.6519027
3.9379068
   0.00000688        2494.    362713990.    25.1672595     0.0001730   -0.00007448     0.6954032
4.1923099
   0.00000750        2717.    362228808.    24.5849375     0.0001844   -0.00008561     0.7386273
4.4467739
   0.00000813        2939.    361713588.    24.0924206     0.0001958   -0.00009675     0.7815736
4.7012891
   0.00000875        2939.    335876904.    21.4968641     0.0001881     -0.000127     0.7519631
4.4043136 C
   0.00000938        2939.    313485110.    20.9186374     0.0001961     -0.000141     0.7820928
4.5616972 C
   0.00001000        2939.    293892291.    20.3984322     0.0002040     -0.000156     0.8115434
4.7149556 C
   0.00001063        2939.    276604509.    19.9266658     0.0002117     -0.000171     0.8403456
4.8642664 C
   0.00001125        2939.    261237592.    19.4961769     0.0002193     -0.000186     0.8685483
5.0099547 C
   0.00001188        2939.    247488245.    19.1020827     0.0002268     -0.000201     0.8962285
5.1525679 C
   0.00001250        2939.    235113832.    18.7395181     0.0002342     -0.000216     0.9234195
5.2923251 C
   0.00001313        2939.    223917936.    18.4046786     0.0002416     -0.000231     0.9501602
5.4294933 C
   0.00001375        2939.    213739848.    18.0946100     0.0002488     -0.000246     0.9764968
5.5644008 C
   0.00001438        2939.    204446811.    17.8069311     0.0002560     -0.000262     1.0024778
-5.858373 C
   0.00001500        2939.    195928194.    17.5377483     0.0002631     -0.000277     1.0280464
-6.230179 C
   0.00001563        2939.    188091066.    17.2862236     0.0002701     -0.000292     1.0532850
-6.603743 C
   0.00001625        2939.    180856794.    17.0513360     0.0002771     -0.000308     1.0782564
-6.978582 C
   0.00001688        2939.    174158394.    16.8296806     0.0002840     -0.000323     1.1028677
-7.355461 C
   0.00001750        2981.    170356574.    16.6210458     0.0002909     -0.000339     1.1271982
-7.733766 C
```

```
   0.00001813        3030.    167191398.    16.4248266     0.0002977     -0.000355     1.1512982
-8.113107 C
   0.00001875        3079.    164192830.    16.2381740     0.0003045     -0.000371     1.1750620
-8.494358 C
   0.00001938        3127.    161372879.    16.0626308     0.0003112     -0.000386     1.1986623
-8.876132 C
   0.00002000        3174.    158691576.    15.8949165     0.0003179     -0.000402     1.2219389
-9.259748 C
   0.00002063        3221.    156159224.    15.7363631     0.0003246     -0.000418     1.2450513
-9.643919 C
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   0.00002250        3359.    149299778.    15.3047930     0.0003444     -0.000466     1.3131177
-10.802199 C
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   0.00002375        3450.    145243274.    15.0472406     0.0003574     -0.000498     1.3573942
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-11.968537 C
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   0.00002688        3671.    136599629.    14.4949714     0.0003896     -0.000578     1.4652511
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   0.00002813        3758.    133624877.    14.3032305     0.0004023     -0.000610     1.5072808
-14.319740 C
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-60.000000 CYT
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    0.0004844        10669.     22026465.     8.2959480     0.0040183     -0.013419     3.9974800
-60.000000 CYT


Axial Thrust Force =    304.020 kips

    Bending       Bending       Bending      Depth to      Max Comp      Max Tens      Max Conc      Max
Steel  Run
   Curvature      Moment       Stiffness      N Axis        Strain        Strain        Stress        Stress
   Msg
    rad/in.       in-kip        kip-in2         in           in/in         in/in          ksi           ksi

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  6.25000E-07   225.5817071    360930731.   126.4024266    0.00007900    0.00005650     0.3275854
2.2160065
   0.00000125   451.1610297    360928824.    72.2206929    0.00009028    0.00004528     0.3728048
2.4679251
   0.00000188   676.7291968    360922238.    54.1687705     0.0001016    0.00003407     0.4178092
2.7203144
   0.00000250   902.2806318    360912253.    45.1493014     0.0001129    0.00002287     0.4625974
2.9731744
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3.2265050
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3.4803065
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3.7345673
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3.9892082
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5.9193950 C
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6.2465942 C
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7.5806432 C
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0.00002000	3761.	188074835.	17.9146205	0.0003583	-0.000362	1.3628783 -8.088309 C
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   0.00006188        6660.    107631632.    12.8586824     0.0007956     -0.001432     2.6352924
-34.095490 C
   0.00006313        6739.    106752779.    12.8033133     0.0008082     -0.001464     2.6657231
-34.885648 C
   0.00006438        6817.    105901649.    12.7491816     0.0008207     -0.001497     2.6956687
-35.677508 C
   0.00006563        6896.    105077689.    12.6964746     0.0008332     -0.001529     2.7251741
-36.470582 C
   0.00006688        6974.    104282628.    12.6459532     0.0008457     -0.001562     2.7543761
-37.263238 C
   0.00006813        7052.    103514867.    12.5974982     0.0008582     -0.001594     2.7832736
-38.055474 C
   0.00006938        7130.    102772919.    12.5509989     0.0008707     -0.001627     2.8118656
-38.847287 C
   0.00007063        7208.    102055405.    12.5063525     0.0008833     -0.001659     2.8401511
-39.638677 C
   0.00007188        7285.    101361036.    12.4634710     0.0008958     -0.001692     2.8681289
-40.429640 C
   0.00007313        7363.    100688618.    12.4222520     0.0009084     -0.001724     2.8957982
-41.220175 C
   0.00007438        7440.    100032265.    12.3811191     0.0009208     -0.001757     2.9229125
-42.013510 C
   0.00007938        7747.     97596391.    12.2310996     0.0009708     -0.001887     3.0282576
-45.183267 C
   0.00008438        8051.     95424568.    12.1017498     0.0010211     -0.002016     3.1286657
-48.345946 C
   0.00008938        8353.     93464573.    11.9866907     0.0010713     -0.002146     3.2235672
-51.509131 C
   0.00009438        8653.     91685988.    11.8849713     0.0011216     -0.002276     3.3131904
-54.669146 C
   0.00009938        8950.     90064736.    11.7961411     0.0011722     -0.002405     3.3977534
-57.821508 C
    0.0001044        9245.     88576178.    11.7183687     0.0012231     -0.002534     3.4771687
-60.000000 CY
    0.0001094        9457.     86465372.    11.6171859     0.0012706     -0.002667     3.5462182
-60.000000 CY
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    0.0001144         9614.     84055093.    11.5060988     0.0013160     -0.002801     3.6075334
-60.000000 CY
    0.0001194         9769.     81834590.    11.4057088     0.0013616     -0.002936     3.6646593
-60.000000 CY
    0.0001244         9922.     79778790.    11.3146494     0.0014073     -0.003070     3.7173697
-60.000000 CY
    0.0001294        10074.     77864410.    11.2289319     0.0014527     -0.003205     3.7653976
-60.000000 CY
    0.0001344        10223.     76078940.    11.1511073     0.0014984     -0.003339     3.8091448
-60.000000 CY
    0.0001394        10337.     74163498.    11.0657433     0.0015423     -0.003475     3.8468705
-60.000000 CY
    0.0001444        10402.     72051356.    10.9675366     0.0015834     -0.003614     3.8784460
-60.000000 CY
    0.0001494        10459.     70017250.    10.8694471     0.0016236     -0.003754     3.9057561
-60.000000 CY
    0.0001544        10514.     68109949.    10.7788844     0.0016640     -0.003894     3.9296991
-60.000000 CY
    0.0001594        10569.     66317405.    10.6951983     0.0017045     -0.004033     3.9502277
-60.000000 CY
    0.0001644        10623.     64628744.    10.6171133     0.0017452     -0.004172     3.9672844
-60.000000 CY
    0.0001694        10675.     63025955.    10.5413013     0.0017854     -0.004312     3.9806112
-60.000000 CY
    0.0001744        10726.     61510646.    10.4704808     0.0018258     -0.004452     3.9905119
-60.000000 CY
    0.0001794        10776.     60075384.    10.4035735     0.0018661     -0.004591     3.9969352
-60.000000 CY
    0.0001844        10825.     58713564.    10.3422500     0.0019069     -0.004731     3.9998284
-60.000000 CY
    0.0001894        10874.     57418695.    10.2869107     0.0019481     -0.004869     3.9981606
-60.000000 CY
    0.0001944        10921.     56183417.    10.2311122     0.0019887     -0.005009     3.9999941
-60.000000 CY
    0.0001994        10966.     55002459.    10.1803352     0.0020297     -0.005148     3.9985442
-60.000000 CY
    0.0002044        11011.     53875693.    10.1318873     0.0020707     -0.005287     3.9998445
-60.000000 CY
```

```
    0.0002094       11055.     52797875.    10.0869023     0.0021119     -0.005426     3.9983648
-60.000000 CY
    0.0002144       11098.     51767257.    10.0449090     0.0021534     -0.005564     3.9999898
-60.000000 CY
    0.0002194       11140.     50779161.    10.0055552     0.0021950     -0.005703     3.9975597
-60.000000 CY
    0.0002244       11181.     49832285.     9.9696816     0.0022369     -0.005841     3.9998155
-60.000000 CY
    0.0002294       11222.     48923030.     9.9359347     0.0022791     -0.005978     3.9957657
-60.000000 CY
    0.0002344       11262.     48049619.     9.9045539     0.0023214     -0.006116     3.9990577
-60.000000 CY
    0.0002394       11300.     47206831.     9.8731271     0.0023634     -0.006254     3.9990135
-60.000000 CY
    0.0002444       11334.     46381462.     9.8415259     0.0024050     -0.006392     3.9968319
-60.000000 CY
    0.0002494       11364.     45571589.     9.8090981     0.0024461     -0.006531     3.9993707
-60.000000 CY
    0.0002544       11387.     44764655.     9.7739899     0.0024863     -0.006671     3.9985107
-60.000000 CY
    0.0002594       11403.     43964018.     9.7368928     0.0025255     -0.006812     3.9958086
-60.000000 CY
    0.0002644       11414.     43174218.     9.6983670     0.0025640     -0.006953     3.9985374
-60.000000 CY
    0.0002694       11423.     42404679.     9.6601156     0.0026022     -0.007095     3.9998542
-60.000000 CY
    0.0002744       11430.     41657646.     9.6229370     0.0026403     -0.007237     3.9958540
-60.000000 CY
    0.0003044       11465.     37666731.     9.4235716     0.0028683     -0.008089     3.9960954
-60.000000 CY
    0.0003344       11492.     34369008.     9.2646396     0.0030979     -0.008940     3.9969199
-60.000000 CYT
    0.0003644       11514.     31599347.     9.1359784     0.0033289     -0.009789     3.9951256
-60.000000 CYT
    0.0003944       11531.     29237966.     9.0254008     0.0035594     -0.010638     3.9884137
-60.000000 CYT
    0.0004244       11545.     27205023.     8.9358480     0.0037922     -0.011485     3.9999846
-60.000000 CYT
```

```
    0.0004544        11545.     25408818.     8.9639973     0.0040730     -0.012284     3.9994797
60.0000000 CYT


--------------------------------------------------------------------------------
   Summary of Results for Nominal Moment Capacity for Section 3
--------------------------------------------------------------------------------

Moment values interpolated at maximum compressive strain = 0.003
or maximum developed moment if pile fails at smaller strains.

 Load           Axial Thrust        Nominal Mom. Cap.      Max. Comp.      Max. Tens.
  No.              kips                in-kip               Strain           Strain
 ----         ----------------     ------------------     ------------    ------------
   1               218.600            10600.675           0.00300000     -0.00952142
   2               304.020            11480.488           0.00300000     -0.00857709

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     Resist.       Nominal        Nominal     Ult. (Fac)    Ult. (Fac)   Bend. Stiff.
Load      Factor      Ax. Thrust    Moment Cap    Ax. Thrust    Moment Cap    at Ult Mom
 No.                     kips         in-kips        kips          in-kips      kip-in^2
-----  ------------   ------------  ------------  ------------  ------------  ------------
   1       0.65         218.600000        10601.    142.090000         6890.     89813170.
   2       0.65         304.020000        11480.    197.613000         7462.     99854287.
```

1	0.75	218.600000	10601.	163.950000	7951.	84479290.
2	0.75	304.020000	11480.	228.015000	8610.	91938396.
1	0.90	218.600000	10601.	196.740000	9541.	66011934.
2	0.90	304.020000	11480.	273.618000	10332.	74232706.

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	16.1000	0.00	N.A.	Yes	N.A.	N.A.
2	16.8000	0.7000	No	Yes	N.A.	N.A.
3	23.3000	7.2000	No	Yes	N.A.	N.A.
4	26.8000	10.7000	No	Yes	N.A.	N.A.
5	27.8000	11.7000	No	Yes	N.A.	N.A.
6	37.6000	21.5000	No	Yes	N.A.	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 = 15820.0 lbs
Applied moment at pile head = 0.0 in-lbs
Axial thrust load on pile head = 218600.0 lbs

Depth X	Deflect. y	Bending Moment	Shear Force	Slope S	Total Stress	Bending Stiffness	Soil Res. p	Soil Spr. Es*H	Distrib. Lat. Load
feet	inches	in-lbs	lbs	radians	psi*	lb-in^2	lb/inch	lb/inch	lb/inch
0.00	0.3994	-0.00670	15820.	-0.00226	34.6984	5.80E+13	0.00	0.00	27.6462
0.4966	0.3860	97705.	15988.	-0.00226	34.8078	5.80E+13	0.00	0.00	28.6850
0.9932	0.3725	196429.	16163.	-0.00226	34.9183	5.80E+13	0.00	0.00	30.0699
1.4898	0.3591	296220.	16346.	-0.00225	35.0300	5.80E+13	0.00	0.00	31.4549
1.9864	0.3457	397129.	16538.	-0.00225	35.1430	5.80E+13	0.00	0.00	32.8398
2.4831	0.3322	499204.	16738.	-0.00225	35.2573	5.80E+13	0.00	0.00	34.2248
2.9797	0.3188	602494.	16946.	-0.00225	35.3729	5.80E+13	0.00	0.00	35.6097
3.4763	0.3054	707049.	17162.	-0.00225	35.4900	5.80E+13	0.00	0.00	36.9947
3.9729	0.2919	812917.	17387.	-0.00225	26.9339	7.73E+13	0.00	0.00	38.3797
4.4695	0.2785	920148.	17619.	-0.00225	27.0539	7.73E+13	0.00	0.00	39.7646
4.9661	0.2650	1028792.	17861.	-0.00225	27.1756	7.73E+13	0.00	0.00	41.1496
5.4627	0.2516	1138897.	18110.	-0.00225	27.2988	7.73E+13	0.00	0.00	

42.5345								
5.9593	0.2382	1250512.	18368.	-0.00225	27.4238	7.73E+13	0.00	0.00
43.9195								
6.4559	0.2247	1363687.	18633.	-0.00225	27.5505	7.73E+13	0.00	0.00
45.3044								
6.9525	0.2113	1478470.	18908.	-0.00224	0.00	3.64E+11	0.00	0.00
46.6894								
7.4492	0.1980	1594880.	19190.	-0.00222	0.00	3.64E+11	0.00	0.00
48.0743								
7.9458	0.1849	1712964.	19480.	-0.00219	0.00	3.64E+11	0.00	0.00
49.4593								
8.4424	0.1719	1832767.	19779.	-0.00216	0.00	3.64E+11	0.00	0.00
50.8443								
8.9390	0.1591	1954337.	20086.	-0.00213	0.00	3.64E+11	0.00	0.00
52.2292								
9.4356	0.1465	2077720.	20402.	-0.00210	0.00	3.63E+11	0.00	0.00
53.6142								
9.9322	0.1341	2202963.	20726.	-0.00206	0.00	3.63E+11	0.00	0.00
54.9991								
10.4288	0.1220	2330112.	21057.	-0.00202	0.00	3.63E+11	0.00	0.00
56.3841								
10.9254	0.1100	2459213.	21398.	-0.00199	0.00	3.63E+11	0.00	0.00
57.7690								
11.4220	0.09830	2590314.	21746.	-0.00194	0.00	3.62E+11	0.00	0.00
59.1540								
11.9186	0.08684	2723459.	22103.	-0.00190	0.00	3.62E+11	0.00	0.00
60.5390								
12.4153	0.07565	2858696.	22467.	-0.00185	0.00	3.62E+11	0.00	0.00
61.9239								
12.9119	0.06474	2996072.	22841.	-0.00178	0.00	1.69E+11	0.00	0.00
63.3089								
13.4085	0.05446	3135558.	23222.	-0.00167	0.00	1.61E+11	0.00	0.00
64.6938								
13.9051	0.04487	3277190.	23612.	-0.00155	0.00	1.53E+11	0.00	0.00
66.0788								
14.4017	0.03604	3421003.	24010.	-0.00141	0.00	1.46E+11	0.00	0.00
67.4637								
14.8983	0.02804	3567030.	24416.	-0.00127	0.00	1.40E+11	0.00	0.00

68.8487
15.3949 0.02095 3715306. 24830. -0.00111 0.00 1.35E+11 0.00 0.00
70.2336
15.8915 0.01482 3865862. 25236. -9.39E-04 0.00 1.30E+11 0.00 0.00
65.8234
16.3881 0.00976 4018525. 14989. -7.55E-04 0.00 1.26E+11 -3505. 2140335.
0.00
16.8847 0.00583 4046476. -12311. -5.64E-04 0.00 1.25E+11 -5657. 5787573.
0.00
17.3814 0.00304 3873264. -45927. -3.78E-04 0.00 1.30E+11 -5625. 1.10E+07
0.00
17.8780 0.00131 3500071. -78246. -2.17E-04 0.00 1.43E+11 -5222. 2.37E+07
0.00
18.3746 4.56E-04 2941239. -103374. -1.12E-04 0.00 2.72E+11 -3211. 4.19E+07
0.00
18.8712 -1.75E-05 2268286. -112536. -6.09E-05 0.00 3.63E+11 136.3131 4.65E+07
0.00
19.3678 -2.69E-04 1600125. -105241. -2.92E-05 0.00 3.64E+11 2312. 5.12E+07
0.00
19.8644 -3.65E-04 1014026. -88174. -7.79E-06 0.00 3.64E+11 3416. 5.58E+07
0.00
20.3610 -3.62E-04 549226. -67066. 4.99E-06 0.00 3.64E+11 3668. 6.04E+07
0.00
20.8576 -3.06E-04 214679. -46209. 1.12E-05 0.00 3.64E+11 3332. 6.50E+07
0.00
21.3542 -2.28E-04 -1549. -28343. 1.30E-05 0.00 3.64E+11 2664. 6.96E+07
0.00
21.8508 -1.51E-04 -123168. -14808. 1.20E-05 0.00 3.64E+11 1879. 7.42E+07
0.00
22.3475 -8.57E-05 -178068. -5836. 9.50E-06 0.00 3.64E+11 1132. 7.88E+07
0.00
22.8441 -3.77E-05 -192749. -888.277 6.47E-06 0.00 3.64E+11 528.0783 8.34E+07
0.00
23.3407 -8.60E-06 -188672. 8037. 3.35E-06 0.00 3.64E+11 2467. 1.71E+09
0.00
23.8373 2.16E-06 -96962. 13451. 1.01E-06 0.00 3.64E+11 -650.571 1.80E+09
0.00
24.3339 3.47E-06 -28354. 8241. -1.20E-08 0.00 3.64E+11 -1098. 1.89E+09

0.00								
24.8305	2.01E-06	1261.	2980.	-2.33E-07	0.00	3.64E+11	-667.806	1.98E+09
0.00								
25.3271	6.82E-07	7161.	298.6825	-1.65E-07	0.00	3.64E+11	-231.984	2.03E+09
0.00								
25.8237	5.00E-08	4822.	-443.243	-6.67E-08	0.00	3.64E+11	-17.012	2.03E+09
0.00								
26.3203	-1.12E-07	1878.	-380.058	-1.19E-08	0.00	3.64E+11	38.2176	2.03E+09
0.00								
26.8169	-9.18E-08	291.9541	-173.151	5.84E-09	0.00	3.64E+11	31.2223	2.03E+09
0.00								
27.3136	-4.28E-08	-185.512	-36.751	6.71E-09	0.00	3.64E+11	14.5546	2.03E+09
0.00								
27.8102	-1.19E-08	-146.091	8.9135	4.00E-09	0.00	3.64E+11	0.7710	3.87E+08
0.00								
28.3068	4.85E-09	-79.286	10.2714	2.16E-09	0.00	3.64E+11	-0.315	3.87E+08
0.00								
28.8034	1.38E-08	-23.675	6.6526	1.31E-09	0.00	3.64E+11	-0.899	3.87E+08
0.00								
29.3000	2.05E-08	0.00	0.00	1.12E-09	0.00	3.64E+11	-1.333	1.94E+08
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	=	0.39941931 inches
Computed slope at pile head	=	-0.0022550 radians
Maximum bending moment	=	4046476. inch-lbs
Maximum shear force	=	-112536. lbs
Depth of maximum bending moment	=	16.88474576 feet below pile head
Depth of maximum shear force	=	18.87118644 feet below pile head

```
Number of iterations             =           117
Number of zero deflection points =             4
Pile deflection at ground        =     0.01269764 inches
```

Pile-head Deflection vs. Pile Length for Load Case 1

Boundary Condition Type 1, Shear and Moment

```
Shear      =          15820. lbs
Moment     =              0. in-lbs
Axial Load =         218600. lbs
```

Pile Length feet	Pile Head Deflection inches	Maximum Moment ln-lbs	Maximum Shear lbs
29.30000	0.39941931	4046476.	-112536.
27.83500	0.41983629	4086066.	-114893.
26.37000	0.41625630	4097009.	-114756.
24.90500	0.40466158	4078912.	-114389.
23.44000	0.40127964	4030900.	-112442.
21.97500	0.40891002	4062410.	-115547.
20.51000	0.44351351	4050603.	-154117.

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                          =      19120.0 lbs
```

Applied moment at pile head = 0.0 in-lbs
Axial thrust load on pile head = 304020.0 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	0.5295	0.07320	19120.	-0.00298	48.2571	5.80E+13	0.00	0.00	43.6190
0.4966	0.5117	120116.	19385.	-0.00298	48.3916	5.80E+13	0.00	0.00	45.1759
0.9932	0.4939	241836.	19660.	-0.00298	48.5279	5.80E+13	0.00	0.00	47.2518
1.4898	0.4762	365235.	19948.	-0.00298	48.6660	5.80E+13	0.00	0.00	49.3277
1.9864	0.4584	490385.	20248.	-0.00298	48.8061	5.80E+13	0.00	0.00	51.4036
2.4831	0.4407	617361.	20560.	-0.00298	48.9483	5.80E+13	0.00	0.00	53.4795
2.9797	0.4229	746235.	20885.	-0.00298	49.0926	5.80E+13	0.00	0.00	55.5554
3.4763	0.4051	877083.	21223.	-0.00298	49.2391	5.80E+13	0.00	0.00	57.6312
3.9729	0.3874	1009977.	21572.	-0.00298	37.3236	7.73E+13	0.00	0.00	59.7071
4.4695	0.3696	1144991.	21934.	-0.00298	37.4747	7.73E+13	0.00	0.00	61.7830
4.9661	0.3519	1282199.	22309.	-0.00298	37.6283	7.73E+13	0.00	0.00	63.8589
5.4627	0.3341	1421675.	22695.	-0.00298	37.7845	7.73E+13	0.00	0.00	65.9348
5.9593	0.3164	1563493.	23094.	-0.00298	37.9432	7.73E+13	0.00	0.00	68.0107
6.4559	0.2986	1707725.	23506.	-0.00298	38.1047	7.73E+13	0.00	0.00	

70.0866
6.9525 0.2809 1854446. 23930. -0.00296 0.00 3.61E+11 0.00 0.00
72.1625
7.4492 0.2633 2003675. 24366. -0.00293 0.00 3.61E+11 0.00 0.00
74.2384
7.9458 0.2459 2155480. 24815. -0.00290 0.00 3.61E+11 0.00 0.00
76.3143
8.4424 0.2287 2309930. 25276. -0.00286 0.00 3.60E+11 0.00 0.00
78.3902
8.9390 0.2118 2467096. 25749. -0.00282 0.00 3.60E+11 0.00 0.00
80.4661
9.4356 0.1951 2627045. 26235. -0.00278 0.00 3.60E+11 0.00 0.00
82.5420
9.9322 0.1787 2789846. 26733. -0.00273 0.00 3.60E+11 0.00 0.00
84.6178
10.4288 0.1625 2955569. 27243. -0.00269 0.00 3.59E+11 0.00 0.00
86.6937
10.9254 0.1467 3124282. 27766. -0.00264 0.00 3.59E+11 0.00 0.00
88.7696
11.4220 0.1311 3296053. 28301. -0.00258 0.00 3.59E+11 0.00 0.00
90.8455
11.9186 0.1159 3470952. 28849. -0.00251 0.00 2.08E+11 0.00 0.00
92.9214
12.4153 0.1013 3648970. 29409. -0.00240 0.00 1.95E+11 0.00 0.00
94.9973
12.9119 0.08728 3830160. 29981. -0.00228 0.00 1.84E+11 0.00 0.00
97.0732
13.4085 0.07405 4014572. 30566. -0.00215 0.00 1.74E+11 0.00 0.00
99.1491
13.9051 0.06164 4202256. 31163. -0.00201 0.00 1.65E+11 0.00 0.00
101.2250
14.4017 0.05013 4393260. 31772. -0.00185 0.00 1.57E+11 0.00 0.00
103.3009
14.8983 0.03962 4587630. 32394. -0.00167 0.00 1.49E+11 0.00 0.00
105.3768
15.3949 0.03020 4785411. 33028. -0.00148 0.00 1.43E+11 0.00 0.00
107.4527
15.8915 0.02197 4986646. 33648. -0.00127 0.00 1.37E+11 0.00 0.00

100.6673
16.3881 0.01503 5191064. 22316. -0.00105 0.00 1.32E+11 -3904. 1548208.
0.00
16.8847 0.00948 5256418. -8355. -8.10E-04 0.00 1.30E+11 -6390. 4015331.
0.00
17.3814 0.00537 5094413. -46714. -5.77E-04 0.00 1.34E+11 -6484. 7192939.
0.00
17.8780 0.00261 4701739. -84497. -3.68E-04 0.00 1.46E+11 -6196. 1.42E+07
0.00
18.3746 9.89E-04 4088659. -119286. -2.00E-04 0.00 1.70E+11 -5479. 3.30E+07
0.00
18.8712 2.24E-04 3280739. -140832. -1.01E-04 0.00 3.59E+11 -1752. 4.65E+07
0.00
19.3678 -2.16E-04 2410495. -140539. -5.39E-05 0.00 3.60E+11 1850. 5.12E+07
0.00
19.8644 -4.18E-04 1605894. -123377. -2.07E-05 0.00 3.61E+11 3909. 5.58E+07
0.00
20.3610 -4.62E-04 940082. -97783. 3.40E-07 0.00 3.61E+11 4680. 6.04E+07
0.00
20.8576 -4.14E-04 440449. -70397. 1.17E-05 0.00 3.61E+11 4511. 6.50E+07
0.00
21.3542 -3.22E-04 101001. -45749. 1.62E-05 0.00 3.61E+11 3761. 6.96E+07
0.00
21.8508 -2.21E-04 -104879. -26360. 1.62E-05 0.00 3.61E+11 2746. 7.42E+07
0.00
22.3475 -1.29E-04 -213232. -13080. 1.35E-05 0.00 3.61E+11 1711. 7.88E+07
0.00
22.8441 -5.92E-05 -260826. -5516. 9.64E-06 0.00 3.61E+11 827.7688 8.34E+07
0.00
23.3407 -1.46E-05 -279016. 9409. 5.18E-06 0.00 3.61E+11 4181. 1.71E+09
0.00
23.8373 2.56E-06 -148700. 19570. 1.65E-06 0.00 3.61E+11 -771.390 1.80E+09
0.00
24.3339 5.06E-06 -45775. 12496. 4.20E-08 0.00 3.61E+11 -1603. 1.89E+09
0.00
24.8305 3.06E-06 236.0095 4699. -3.34E-07 0.00 3.61E+11 -1014. 1.98E+09
0.00
25.3271 1.08E-06 10227. 584.2883 -2.48E-07 0.00 3.61E+11 -366.515 2.03E+09

0.00								
25.8237	1.06E-07	7201.	-615.002	-1.04E-07	0.00	3.61E+11	-35.977	2.03E+09
0.00								
26.3203	-1.58E-07	2897.	-562.300	-2.03E-08	0.00	3.61E+11	53.6642	2.03E+09
0.00								
26.8169	-1.36E-07	499.0476	-264.184	7.71E-09	0.00	3.61E+11	46.3863	2.03E+09
0.00								
27.3136	-6.59E-08	-251.658	-59.184	9.75E-09	0.00	3.61E+11	22.4133	2.03E+09
0.00								
27.8102	-2.02E-08	-206.383	11.5071	5.97E-09	0.00	3.61E+11	1.3113	3.87E+08
0.00								
28.3068	5.27E-09	-114.531	14.3945	3.32E-09	0.00	3.61E+11	-0.342	3.87E+08
0.00								
28.8034	1.94E-08	-34.832	9.6100	2.09E-09	0.00	3.61E+11	-1.263	3.87E+08
0.00								
29.3000	3.02E-08	0.00	0.00	1.80E-09	0.00	3.61E+11	-1.962	1.94E+08
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	=	0.52945627 inches
Computed slope at pile head	=	-0.0029801 radians
Maximum bending moment	=	5256418. inch-lbs
Maximum shear force	=	-140832. lbs
Depth of maximum bending moment	=	16.88474576 feet below pile head
Depth of maximum shear force	=	18.87118644 feet below pile head
Number of iterations	=	27
Number of zero deflection points	=	4
Pile deflection at ground	=	0.01905340 inches

Pile-head Deflection vs. Pile Length for Load Case 2

Boundary Condition Type 1, Shear and Moment

Shear = 19120. lbs
Moment = 0. in-lbs
Axial Load = 304020. lbs

Pile Length feet	Pile Head Deflection inches	Maximum Moment ln-lbs	Maximum Shear lbs
29.30000	0.52945627	5256418.	-140832.
27.83500	0.55171885	5309271.	-145101.
26.37000	0.55495985	5322901.	-147195.
24.90500	0.54186624	5294727.	-146016.
23.44000	0.53547518	5227107.	-144930.
21.97500	0.54486510	5267911.	-148135.
20.51000	0.68991147	5273065.	-203691.
19.04500	-32.9134394	-4153344.	289122.
17.58000	-19.2530111	-764404.	95019.

Computed Values of Pile Loading and Deflection
for Lateral Loading for Load Case Number 3

Pile-head conditions are Displacement and Moment (Loading Type 4)
Displacement of pile head = 0.480000 inches
Moment at pile head = 0.0 in-lbs
Axial load at pile head = 218600.0 lbs

Depth X	Deflect. y	Bending Moment	Shear Force	Slope S	Total Stress	Bending Stiffness	Soil Res. p	Soil Spr. Es*H	Distrib. Lat. Load
feet	inches	in-lbs	lbs	radians	psi*	lb-in^2	lb/inch	lb/inch	lb/inch
0.00	0.4800	0.00	17225.	-0.00271	34.6984	5.80E+13	0.00	0.00	27.6462
0.4966	0.4638	106673.	17393.	-0.00271	34.8178	5.80E+13	0.00	0.00	28.6850
0.9932	0.4477	214364.	17568.	-0.00271	34.9384	5.80E+13	0.00	0.00	30.0699
1.4898	0.4315	323124.	17751.	-0.00271	35.0602	5.80E+13	0.00	0.00	31.4549
1.9864	0.4153	433000.	17943.	-0.00271	35.1832	5.80E+13	0.00	0.00	32.8398
2.4831	0.3992	544043.	18143.	-0.00271	35.3075	5.80E+13	0.00	0.00	34.2248
2.9797	0.3830	656301.	18351.	-0.00271	35.4332	5.80E+13	0.00	0.00	35.6097
3.4763	0.3669	769824.	18567.	-0.00271	35.5603	5.80E+13	0.00	0.00	36.9947
3.9729	0.3507	884660.	18792.	-0.00271	27.0142	7.73E+13	0.00	0.00	38.3797
4.4695	0.3345	1000859.	19024.	-0.00271	27.1443	7.73E+13	0.00	0.00	39.7646
4.9661	0.3184	1118471.	19265.	-0.00271	27.2760	7.73E+13	0.00	0.00	41.1496
5.4627	0.3022	1237543.	19515.	-0.00271	27.4093	7.73E+13	0.00	0.00	42.5345
5.9593	0.2861	1358126.	19772.	-0.00271	27.5443	7.73E+13	0.00	0.00	43.9195
6.4559	0.2699	1480269.	20038.	-0.00271	27.6810	7.73E+13	0.00	0.00	45.3044
6.9525	0.2537	1604020.	20312.	-0.00270	0.00	3.64E+11	0.00	0.00	46.6894

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    7.4492     0.2377   1729395.     20595.   -0.00267       0.00   3.64E+11       0.00       0.00
48.0743
    7.9458     0.2219   1856441.     20885.   -0.00264       0.00   3.64E+11       0.00       0.00
49.4593
    8.4424     0.2062   1985203.     21184.   -0.00261       0.00   3.64E+11       0.00       0.00
50.8443
    8.9390     0.1908   2115729.     21491.   -0.00258       0.00   3.63E+11       0.00       0.00
52.2292
    9.4356     0.1755   2248065.     21807.   -0.00254       0.00   3.63E+11       0.00       0.00
53.6142
    9.9322     0.1605   2382256.     22130.   -0.00250       0.00   3.63E+11       0.00       0.00
54.9991
   10.4288     0.1457   2518350.     22462.   -0.00246       0.00   3.63E+11       0.00       0.00
56.3841
   10.9254     0.1312   2656392.     22802.   -0.00242       0.00   3.62E+11       0.00       0.00
57.7690
   11.4220     0.1169   2796429.     23151.   -0.00238       0.00   3.62E+11       0.00       0.00
59.1540
   11.9186     0.1028   2938506.     23507.   -0.00230       0.00   1.78E+11       0.00       0.00
60.5390
   12.4153    0.08941   3082606.     23872.   -0.00220       0.00   1.64E+11       0.00       0.00
61.9239
   12.9119    0.07664   3228759.     24245.   -0.00208       0.00   1.56E+11       0.00       0.00
63.3089
   13.4085    0.06462   3376999.     24627.   -0.00195       0.00   1.48E+11       0.00       0.00
64.6938
   13.9051    0.05340   3527360.     25017.   -0.00181       0.00   1.42E+11       0.00       0.00
66.0788
   14.4017    0.04306   3679875.     25414.   -0.00165       0.00   1.36E+11       0.00       0.00
67.4637
   14.8983    0.03368   3834576.     25821.   -0.00149       0.00   1.31E+11       0.00       0.00
68.8487
   15.3949    0.02534   3991496.     26235.   -0.00131       0.00   1.27E+11       0.00       0.00
70.2336
   15.8915    0.01811   4150665.     26640.   -0.00111       0.00   1.23E+11       0.00       0.00
65.8234
   16.3881    0.01209   4311908.     15818.  -9.02E-04       0.00   1.19E+11     -3698.   1822033.
0.00
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16.8847	0.00736	4341549.	-13073.	-6.84E-04	0.00	1.18E+11	-5999.	4854357.
0.00								
17.3814	0.00394	4157874.	-48825.	-4.74E-04	0.00	1.22E+11	-6000.	9079229.
0.00								
17.8780	0.00172	3760854.	-83343.	-2.88E-04	0.00	1.34E+11	-5585.	1.94E+07
0.00								
18.3746	5.00E-04	3165290.	-110479.	-1.45E-04	0.00	1.59E+11	-3522.	4.19E+07
0.00								
18.8712	-1.22E-05	2444475.	-120690.	-6.60E-05	0.00	3.63E+11	95.3808	4.65E+07
0.00								
19.3678	-2.86E-04	1726996.	-113101.	-3.17E-05	0.00	3.64E+11	2452.	5.12E+07
0.00								
19.8644	-3.91E-04	1096544.	-94909.	-8.64E-06	0.00	3.64E+11	3654.	5.58E+07
0.00								
20.3610	-3.89E-04	595827.	-72295.	5.20E-06	0.00	3.64E+11	3936.	6.04E+07
0.00								
20.8576	-3.29E-04	234872.	-49894.	1.20E-05	0.00	3.64E+11	3582.	6.50E+07
0.00								
21.3542	-2.46E-04	1122.	-30675.	1.39E-05	0.00	3.64E+11	2868.	6.96E+07
0.00								
21.8508	-1.63E-04	-130764.	-16094.	1.29E-05	0.00	3.64E+11	2025.	7.42E+07
0.00								
22.3475	-9.25E-05	-190725.	-6417.	1.02E-05	0.00	3.64E+11	1222.	7.88E+07
0.00								
22.8441	-4.08E-05	-207274.	-1074.	6.98E-06	0.00	3.64E+11	570.8536	8.34E+07
0.00								
23.3407	-9.33E-06	-203545.	8602.	3.62E-06	0.00	3.64E+11	2676.	1.71E+09
0.00								
23.8373	2.31E-06	-104764.	14502.	1.10E-06	0.00	3.64E+11	-696.249	1.80E+09
0.00								
24.3339	3.74E-06	-30707.	8900.	-1.12E-08	0.00	3.64E+11	-1184.	1.89E+09
0.00								
24.8305	2.17E-06	1311.	3224.	-2.52E-07	0.00	3.64E+11	-721.227	1.98E+09
0.00								
25.3271	7.38E-07	7715.	326.7407	-1.78E-07	0.00	3.64E+11	-251.014	2.03E+09
0.00								
25.8237	5.50E-08	5205.	-476.945	-7.21E-08	0.00	3.64E+11	-18.710	2.03E+09
0.00								

26.3203	-1.21E-07	2031.	-410.118	-1.29E-08	0.00	3.64E+11	41.1375	2.03E+09
0.00								
26.8169	-9.91E-08	317.4789	-187.136	6.27E-09	0.00	3.64E+11	33.6970	2.03E+09
0.00								
27.3136	-4.63E-08	-199.388	-39.835	7.23E-09	0.00	3.64E+11	15.7385	2.03E+09
0.00								
27.8102	-1.29E-08	-157.323	9.5582	4.32E-09	0.00	3.64E+11	0.8384	3.87E+08
0.00								
28.3068	5.16E-09	-85.478	11.0566	2.33E-09	0.00	3.64E+11	-0.336	3.87E+08
0.00								
28.8034	1.49E-08	-25.549	7.1721	1.42E-09	0.00	3.64E+11	-0.968	3.87E+08
0.00								
29.3000	2.21E-08	0.00	0.00	1.22E-09	0.00	3.64E+11	-1.439	1.94E+08
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. 3:

Pile-head deflection	=	0.48000000	inches
Computed slope at pile head	=	-0.0027124	radians
Maximum bending moment	=	4341549.	inch-lbs
Maximum shear force	=	-120690.	lbs
Depth of maximum bending moment	=	16.88474576	feet below pile head
Depth of maximum shear force	=	18.87118644	feet below pile head
Number of iterations	=	19	
Number of zero deflection points	=	4	
Pile deflection at ground	=	0.01558652	inches

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	15820.	M, in-lb	0.00	218600.	0.3994	-0.00226	-112536.	4046476.
2	V, lb	19120.	M, in-lb	0.00	304020.	0.5295	-0.00298	-140832.	5256418.
3	y, in	0.4800	M, in-lb	0.00	218600.	0.4800	-0.00271	-120690.	4341549.

Maximum pile-head deflection = 0.5294562739 inches
Maximum pile-head rotation = -0.0029801390 radians = -0.170749 deg.

Summary of Warning Messages

The following warning was reported 260 times

**** Warning ****

An unreasonable input value for unconfined compressive strength has been specified for a soil defined using the weak rock criteria. The input value is greater than 500 psi. Please check your input data for correctness.

The analysis ended normally.

HAS-22-17.53L FA B-144 Shaft 1 Strength Limit		
Depth (ft)	Shear Force from Lpile(lb)	Average Shear (lb) based on ODOT GDM 1501.7.9
0	19120	19120
0.5	19388	19254
1	19668	19682.4
1.5	19963	19992.42857
2	20273	20302.42857
2.5	20598	20626.85714
3	20937	20966
3.5	21290	21319.71429
4	21659	21688.14286
4.5	22042	22071
5	22439	22468.57143
5.5	22852	22880.85714
6	23278	23307.71429
6.5	23720	23749.14286
7	24176	24205.28571
7.5	24647	24676
8	25132	25161.42857
8.5	25632	25661.42857
9	26147	26176
9.5	26676	26705.28571
10	27220	27249.14286
10.5	27778	27807.7143
11	28352	28380.8571
11.5	28939	28968.7143
12	29542	29571.1429
12.5	30159	28663.2857
13	30791	24342.4286
13.5	31437	15568.7143
14	21423	1761.4286
14.5	-1894	-16746.7143
15	-32477	-38047.4286
15.5	-67109	-59238.4286
16	-99398	-76847.4286
16.5	-118314	-88020.5714
17	-116900	-91546.1429
17.5	-101840	-87199.2857
18	-80106	-75955.7143
18.5	-57156	-60457.0000
19	-36681	-44283.0000
19.5	-20693	-28578.0000
20	-9823	-14869.1429
20.5	-3682	-5283.7143
21	8095	477.8571
21.5	15856	3491.2354
22	9942	4821.5226
22.5	3650	5284.0136
23	400.648	4098.7277
23.5	-510.99	1827.5144
24	-444.563	408.7189
24.5	-202.001	-111.0134
25	-42.493	-167.1592
25.5	10.4311	-94.1607
26	11.8739	-35.7603
26.5	7.6274	-2.5121
27	0	7.4831

HAS-22-17.53L FA B-144 Shaft 1 Thermal Movement		
Depth (ft)	Shear Force from Lpile(lb)	Average Shear (lb) based on ODOT GDM 1501.7.9
0	24084	24084
0.5	24254	24169
1	24433	24442.2
1.5	24621	24640.14286
2	24819	24838.28571
2.5	25026	25046
3	25244	25263.42857
3.5	25471	25490.57143
4	25708	25727.57143
4.5	25955	25974.42857
5	26211	26231
5.5	26478	26497.28571
6	26754	26773.42857
6.5	27040	27059.28571
7	27335	27354.85714
7.5	27641	27660.14286
8	27956	27975.14286
8.5	28280	28300
9	28615	28634.71429
9.5	28959	28979
10	29314	29333.14286
10.5	29678	29697.1429
11	30051	30070.8571
11.5	30435	30454.2857
12	30828	30847.4286
12.5	31231	29547.8571
13	31643	24433.0000
13.5	32066	14346.4286
14	20581	-1329.0000
14.5	-5753	-22129.5714
15	-40171	-45733.2857
15.5	-78900	-68854.4286
16	-114373	-87762.7143
16.5	-133583	-99382.7143
17	-129782	-102437.1429
17.5	-111777	-96742.0000
18	-87093	-83488.4286
18.5	-61552	-65808.7143
19	-39034	-47728.0000
19.5	-21598	-30437.0000
20	-9825	-15521.1429
20.5	-3217	-5186.1429
21	9260	954.1429
21.5	17318	4100.1795
22	10793	5423.5285
22.5	3948	5813.5575
23	424.2563	4459.0743
23.5	-561.557	1978.4036
24	-486.797	438.1770
24.5	-221.382	-123.9603
25	-46.695	-183.3689
25.5	11.4134	-103.1465
26	13.0394	-39.2047
26.5	8.3958	-2.7693
27	0	8.2122

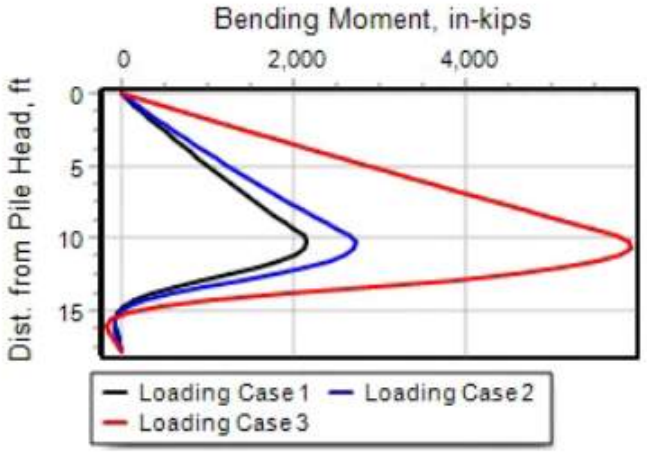
HAS-22-17.53L FA B-144 Shaft 5 Strength Limit		
Depth (ft)	Shear Force from Lpile(lb)	Average Shear (lb) based on ODOT GDM 1501.7.9
0	19120	19120
0.4966	19385	19252.5
0.9932	19660	19672.2
1.4898	19948	19972.28571
1.9864	20248	20272.71429
2.4831	20560	20585.14286
2.9797	20885	20910
3.4763	21223	21247.28571
3.9729	21572	21596.85714
4.4695	21934	21958.85714
4.9661	22309	22333.28571
5.4627	22695	22720
5.9593	23094	23119.14286
6.4559	23506	23530.71429
6.9525	23930	23954.57143
7.4492	24366	24390.85714
7.9458	24815	24839.57143
8.4424	25276	25300.57143
8.939	25749	25773.85714
9.4356	26235	26259.57143
9.9322	26733	26757.57143
10.4288	27243	27268.0000
10.9254	27766	27790.8571
11.422	28301	28326.0000
11.9186	28849	28873.5714
12.4153	29409	29433.5714
12.9119	29981	30005.8571
13.4085	30566	30590.5714
13.9051	31163	31187.5714
14.4017	31772	31793.1429
14.8983	32394	30698.1429
15.3949	33028	25138.0000
15.8915	33648	14012.7143
16.3881	22316	-2597.1429
16.8847	-8355	-24265.7143
17.3814	-46714	-49102.8571
17.878	-84497	-73986.7143
18.3746	-119286	-94800.0000
18.8712	-140832	-107575.4286
19.3678	-140539	-110958.7143
19.8644	-123377	-105423.2857
20.361	-97783	-92148.1429
20.8576	-70397	-73897.8571
21.3542	-45749	-54608.8571
21.8508	-26360	-35639.4286
22.3475	-13080	-18874.7143
22.8441	-5516	-7032.8571
23.3407	9409	174.0000
23.8373	19570	4023.1840
24.3339	12496	5803.8980
24.8305	4699	6511.5695
25.3271	584.2883	5129.6860
25.8237	-615.002	2325.5169
26.3203	-562.3	542.0179
26.8169	-264.184	-127.2114
27.3136	-59.184	-209.3083
27.8102	11.5071	-121.4509
28.3068	14.3945	-47.9761
28.8034	9.61	-4.7345
29.3	0	8.8779

HAS-22-17.53L FA B-144 Shaft 5 Thermal Movement		
Depth (ft)	Shear Force from Lpile(lb)	Average Shear (lb) based on ODOT GDM 1501.7.9
0	17225	17225
0.4966	17393	17309
0.9932	17568	17576
1.4898	17751	17767.71429
1.9864	17943	17959.42857
2.4831	18143	18159.28571
2.9797	18351	18367.28571
3.4763	18567	18583.57143
3.9729	18792	18808.14286
4.4695	19024	19040.85714
4.9661	19265	19281.85714
5.4627	19515	19531.14286
5.9593	19772	19788.71429
6.4559	20038	20054.57143
6.9525	20312	20328.71429
7.4492	20595	20611
7.9458	20885	20901.71429
8.4424	21184	21200.57143
8.939	21491	21507.71429
9.4356	21807	21823
9.9322	22130	22146.71429
10.4288	22462	22478.5714
10.9254	22802	22818.7143
11.422	23151	23167.0000
11.9186	23507	23523.7143
12.4153	23872	23888.7143
12.9119	24245	24261.8571
13.4085	24627	24643.2857
13.9051	25017	25033.0000
14.4017	25414	25428.4286
14.8983	25821	24224.5714
15.3949	26235	18838.8571
15.8915	26640	8290.0000
16.3881	15818	-7246.7143
16.8847	-13073	-26718.1429
17.3814	-48825	-47707.4286
17.878	-83343	-67670.4286
18.3746	-110479	-83488.5714
18.8712	-120690	-91948.8571
19.3678	-113101	-92101.5714
19.8644	-94909	-84577.5714
20.361	-72295	-71094.0000
20.8576	-49894	-54769.2857
21.3542	-30675	-38765.4286
21.8508	-16094	-23978.1429
22.3475	-6417	-11578.5714
22.8441	-1074	-3179.4286
23.3407	8602	1663.2857
23.8373	14502	4009.1058
24.3339	8900	4857.6851
24.8305	3224	4952.5254
25.3271	326.7407	3696.9345
25.8237	-476.945	1619.5295
26.3203	-410.118	349.4664
26.8169	-187.136	-109.5255
27.3136	-39.835	-155.1782
27.8102	9.5582	-87.0432
28.3068	11.0566	-33.1974
28.8034	7.1721	-2.4096
29.3	0	6.9467

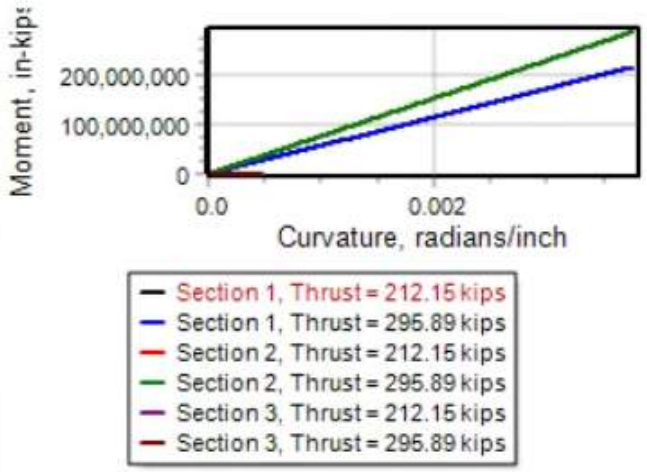
HAS-22-17.53 R Bridge

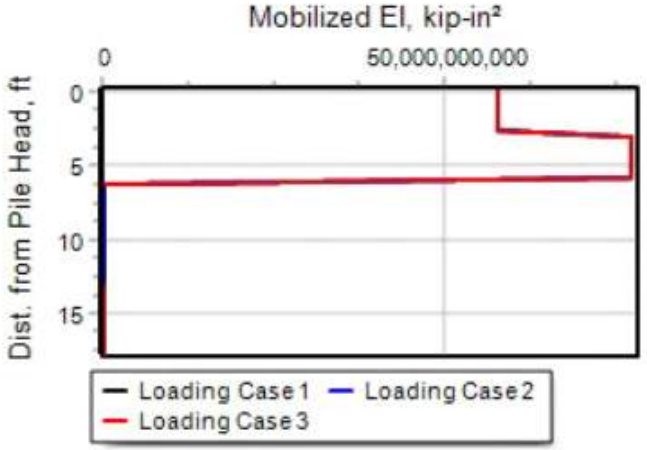
Results for HAS-22-17.53R RA Shaft 1 B-139.lp12d

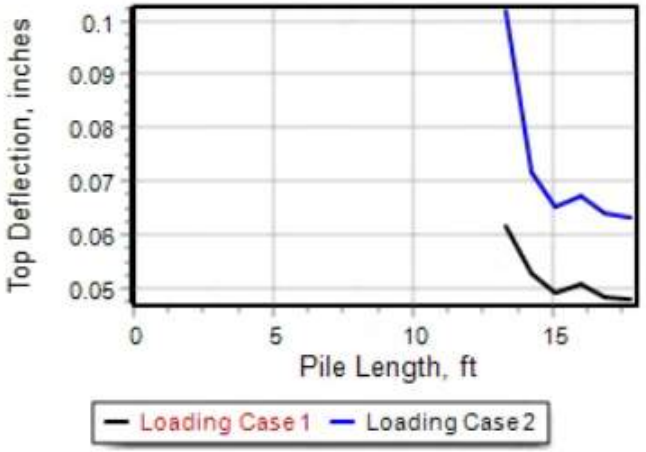












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LPile Version 2022-12.013

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Analysis of Individual Piles and Drilled Shafts
Subjected to Lateral Loading Using the p-y Method
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Columbus, OH, USA

==

This model was prepared by:
Zmankoci

Files Used for Analysis

Path to file locations:
\23-0011 113440 HAS-22-15.25\113440\geotechnical\bridges\XXX-YY-ZZ.ZZ (Crossing)\Analysis\Lpile\New folder\

Name of input data file:
HAS-22-17.53R RA Shaft 1 B-139.lp12d

Name of output report file:
HAS-22-17.53R RA Shaft 1 B-139.lp12o

Name of plot output file:
HAS-22-17.53R RA Shaft 1 B-139.lp12p

Name of runtime message file:
HAS-22-17.53R RA Shaft 1 B-139.lp12r

Date and Time of Analysis

Date: November 17, 2025 Time: 14:00:33

Problem Title

Project Name: HAS-22-17.53R

Job Number: 10059

Client: ODOT

Engineer: ZM

Description: HAS-22-17.53R Rear Abutment

```
--------------------------------------------------------------------------------
                         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                           =           40

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)
 - 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 = 17.800 ft
Depth of ground surface below top of pile = 9.6300 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	36.0000
2	2.800	36.0000
3	2.800	48.0000
4	5.800	48.0000
5	5.800	36.0000
6	17.800	36.0000

Input Structural Properties for Pile Sections:

Pile Section No. 1:

Section 1 is an elastic pile
Cross-sectional shape = rectangular
Length of section = 2.800000 ft
Width of top of section = 36.000000 in
Width of bottom of section = 36.000000 in
Top Section Depth = 175.000000 in
Bottom Section Depth = 175.000000 in

```
   Top Area                                          =        6300. sq. in
   Bottom Area                                       =        6300. sq. in
   Moment of Inertia at Top                          =    16078125. in^4
   Moment of Inertia at Bottom                       =    16078125. in^4
   Elastic Modulus                                   =     3604996. psi

Pile Section No. 2:

   Section 2 is an elastic pile
   Cross-sectional shape                             =     rectangular
   Length of section                                 =     3.000000 ft
   Width of top of section                           =    48.000000 in
   Width of bottom of section                        =    48.000000 in
   Top Section Depth                                 =   175.000000 in
   Bottom Section Depth                              =   175.000000 in
   Top Area                                          =        8400. sq. in
   Bottom Area                                       =        8400. sq. in
   Moment of Inertia at Top                          =    21437500. in^4
   Moment of Inertia at Bottom                       =    21437500. in^4
   Elastic Modulus                                   =     3604996. psi

Pile Section No. 3:

   Section 3 is a round drilled shaft, bored pile, or CIDH pile
   Length of section                                 =    12.000000 ft
   Shaft Diameter                                    =    36.000000 in



--------------------------------------------------------------------------------
                       Soil and Rock Layering Information
--------------------------------------------------------------------------------

The soil profile is modelled using 2 layers

Layer 1 is weak rock, p-y criteria by Reese, 1997

   Distance from top of pile to top of layer         =     9.630000 ft
```

```
   Distance from top of pile to bottom of layer        =    12.900000 ft
   Effective unit weight at top of layer               =   139.000000 pcf
   Effective unit weight at bottom of layer            =   139.000000 pcf
   Uniaxial compressive strength at top of layer       =   200.000000 psi
   Uniaxial compressive strength at bottom of layer    =   200.000000 psi
   Initial modulus of rock at top of layer             =       18000. psi
   Initial modulus of rock at bottom of layer          =       18000. psi
   RQD of rock at top of layer                         =    15.000000 %
   RQD of rock at bottom of layer                      =    15.000000 %
   k rm of rock at top of layer                        =    0.0005000
   k rm of rock at bottom of layer                     =    0.0005000


Layer 2 is weak rock, p-y criteria by Reese, 1997

   Distance from top of pile to top of layer           =    12.900000 ft
   Distance from top of pile to bottom of layer        =    22.900000 ft
   Effective unit weight at top of layer               =   143.500000 pcf
   Effective unit weight at bottom of layer            =   143.500000 pcf
   Uniaxial compressive strength at top of layer       =        1102. psi
   Uniaxial compressive strength at bottom of layer    =        1102. psi
   Initial modulus of rock at top of layer             =       99000. psi
   Initial modulus of rock at bottom of layer          =       99000. psi
   RQD of rock at top of layer                         =    26.000000 %
   RQD of rock at bottom of layer                      =    26.000000 %
   k rm of rock at top of layer                        =    0.0001600
   k rm of rock at bottom of layer                     =    0.0001600


 (Depth of the lowest soil layer extends 5.100 ft below the pile tip)



--------------------------------------------------------------------------------
                        Summary of Input Soil Properties
--------------------------------------------------------------------------------

Layer         Soil Type          Layer      Effective    Uniaxial                    E50       Rock Mass
```

Num.	Name (p-y Curve Type)	Depth ft	Unit Wt. pcf	qu psi	RQD %	or krm	Modulus psi
1	Weak	9.6300	139.0000	200.0000	15.0000	5.00E-04	18000.
	Rock	12.9000	139.0000	200.0000	15.0000	5.00E-04	18000.
2	Weak	12.9000	143.5000	1102.	26.0000	1.60E-04	99000.
	Rock	22.9000	143.5000	1102.	26.0000	1.60E-04	99000.

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	24.600
2	9.630	59.700

Distributed lateral load intensity for Load Case 2 defined using 2 points

Point No.	Depth X ft	Dist. Load lb/in
1	0.000	39.000
2	9.630	91.600

Distributed lateral load intensity for Load Case 3 defined using 2 points

Point No.	Depth X ft	Dist. Load lb/in
1	0.000	24.600
2	9.630	59.700

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 3

Load No.	Load Type	Condition 1	Condition 2	Axial Thrust Force, lbs	Compute Top y vs. Pile Length	Run Analysis
1	1	V = 15820. lbs	M = 0.0000 in-lbs	212150.	Yes	Yes
2	1	V = 19120. lbs	M = 0.0000 in-lbs	295890.	Yes	Yes
3	4	y = 0.480000 in	M = 0.0000 in-lbs	212150.	N.A.	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:

Moment-curvature properties were derived from elastic section properties

Pile Section No. 3:

Dimensions and Properties of Drilled Shaft (Bored Pile):

Length of Section	=	12.000000	ft
Shaft Diameter	=	36.000000	in
Concrete Cover Thickness (to edge of trans. reinf.)	=	3.000000	in
Number of Reinforcing Bars	=	10	bars
Yield Stress of Reinforcing Bars	=	60000.	psi
Modulus of Elasticity of Reinforcing Bars	=	29000000.	psi
Gross Area of Shaft	=	1018.	sq. in.
Total Area of Reinforcing Steel	=	10.000000	sq. in.
Area Ratio of Steel Reinforcement	=	0.98	percent
Edge-to-Edge Bar Spacing	=	7.407667	in

Maximum Concrete Aggregate Size = 0.750000 in
Ratio of Bar Spacing to Aggregate Size = 9.88
Offset of Center of Rebar Cage from Center of Pile = 0.0000 in
Transverse Reinforcement
Type: Spiral
Number of Transverse Reinf. (per spacing) = 1
Spacing of Transverse Reinf. = 5.000000 in
Yield Stress of Transverse Reinf. = 60000. psi
Diameter of Transverse Reinf. = 0.625000 in

Axial Structural Capacities:

Nom. Axial Structural Capacity = 0.85 Fc Ac + Fy As = 4026.778 kips
Tensile Load for Cracking of Concrete = -452.643 kips
Nominal Axial Tensile Capacity = -600.000 kips

Reinforcing Bar Dimensions and Positions Used in Computations:

Bar Number	Bar Diam. inches	Bar Area sq. in.	X inches	Y inches
1	1.128000	1.000000	13.811000	0.00000
2	1.128000	1.000000	11.173334	8.117902
3	1.128000	1.000000	4.267834	13.135042
4	1.128000	1.000000	-4.26783	13.135042
5	1.128000	1.000000	-11.17333	8.117902
6	1.128000	1.000000	-13.81100	0.00000
7	1.128000	1.000000	-11.17333	-8.11790
8	1.128000	1.000000	-4.26783	-13.13504
9	1.128000	1.000000	4.267834	-13.13504
10	1.128000	1.000000	11.173334	-8.11790

NOTE: The positions of the above rebars were computed by LPile

Minimum spacing between any two bars not equal to zero = 7.408 inches

between bars 5 and 6.

Ratio of bar spacing to maximum aggregate size = 9.88

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 = 2

Number	Axial Thrust Force kips
1	212.150
2	295.890

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 = 212.150 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	227.9555036	364728806.	93.2551693	0.00005828	0.00003578	0.2429131	1.6152124	
0.00000125	455.9077025	364726162.	55.6468591	0.00006956	0.00002456	0.2886513	1.8671236	
0.00000188	683.8488634	364719394.	43.1193201	0.00008085	0.00001335	0.3341747	2.1195005	
0.00000250	911.7734684	364709387.	36.8619742	0.00009215	0.00000215	0.3794820	2.3723431	
0.00000313	1140.	364687509.	33.1125893	0.0001035	-0.00000902	0.4245704	2.6256409	
0.00000375	1367.	364592768.	30.6162565	0.0001148	-0.00002019	0.4694250	2.8792929	
0.00000438	1594.	364397783.	28.8350253	0.0001262	-0.00003135	0.5140288	3.1331812	
0.00000500	1821.	364112796.	27.5002200	0.0001375	-0.00004250	0.5583710	3.3872318	
0.00000563	2046.	363754812.	26.4627501	0.0001489	-0.00005365	0.6024450	3.6413986	
0.00000625	2271.	363339324.	25.6332574	0.0001602	-0.00006479	0.6462468	3.8956529	
0.00000688	2495.	362878714.	24.9549300	0.0001716	-0.00007593	0.6897735	4.1499767	
0.00000750	2718.	362382343.	24.3899181	0.0001829	-0.00008708	0.7330235	4.4043572	

```
   0.00000813        2940.    361857324.    23.9120344     0.0001943   -0.00009821     0.7759954
4.6587856
   0.00000875        2940.    336010372.    21.2352856     0.0001858     -0.000129     0.7432096
4.3379355 C
   0.00000938        2940.    313609681.    20.6675833     0.0001938     -0.000144     0.7731326
4.4934367 C
   0.00001000        2940.    294009076.    20.1551246     0.0002016     -0.000158     0.8023233
4.6443928 C
   0.00001063        2940.    276714424.    19.6915810     0.0002092     -0.000173     0.8309237
4.7918337 C
   0.00001125        2940.    261341400.    19.2692909     0.0002168     -0.000188     0.8589625
4.9359321 C
   0.00001188        2940.    247586590.    18.8819022     0.0002242     -0.000203     0.8864525
5.0767425 C
   0.00001250        2940.    235207260.    18.5255957     0.0002316     -0.000218     0.9134653
5.2147784 C
   0.00001313        2940.    224006915.    18.1965393     0.0002388     -0.000234     0.9400349
5.3502703 C
   0.00001375        2940.    213824782.    17.8913892     0.0002460     -0.000249     0.9661856
-5.569976 C
   0.00001438        2940.    204528053.    17.6080366     0.0002531     -0.000264     0.9919716
-5.941287 C
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-7.823341 C
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-8.586422 C
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-12.854481 C
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-14.428086 C
   0.00002938         3793.    129136479.    13.9954824     0.0004111     -0.000646     1.5360373
-15.218336 C
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    0.0004544       10601.     23329960.     8.2736862     0.0037594     -0.012598     3.9999293
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    0.0004844       10601.     21885008.     8.2553526     0.0039987     -0.013439     3.9949553
-60.000000 CYT
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Axial Thrust Force = 295.890 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	225.7927934	361268469.	123.4548576	0.00007716	0.00005466	0.3200951	2.1625818	
0.00000125	451.5831204	361266496.	70.7468899	0.00008843	0.00004343	0.3653606	2.4144998	
0.00000188	677.3623026	361259895.	53.1862148	0.00009972	0.00003222	0.4104112	2.6668879	
0.00000250	903.1247683	361249907.	44.4123631	0.0001110	0.00002103	0.4552456	2.9197463	
0.00000313	1129.	361236782.	39.1532413	0.0001224	0.00000985	0.4998625	3.1730750	
0.00000375	1355.	361220595.	35.6514849	0.0001337	-0.00000131	0.5442608	3.4268740	
0.00000438	1580.	361189699.	33.1537808	0.0001450	-0.00001245	0.5884366	3.6811235	
0.00000500	1806.	361104678.	31.2829824	0.0001564	-0.00002359	0.6323764	3.9357325	
0.00000563	2030.	360948199.	29.8295664	0.0001678	-0.00003471	0.6760673	4.1906105	
0.00000625	2255.	360721907.	28.6679661	0.0001792	-0.00004583	0.7195001	4.4456939	
0.00000688	2478.	360433299.	27.7165094	0.0001906	-0.00005695	0.7626682	4.7009367	
0.00000750	2701.	360091206.	26.9269732	0.0002020	-0.00006805	0.8055671	4.9563067	
0.00000813	2923.	359703917.	26.2588515	0.0002134	-0.00007915	0.8481934	5.2117811	

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5.4996094 C
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5.6709870 C
   0.00001125        3364.    299017852.    22.0341597     0.0002479     -0.000157     0.9747761
5.8379696 C
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6.0011875 C
   0.00001250        3364.    269116067.    21.1359243     0.0002642     -0.000186     1.0338316
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6.7702108 C
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7.2015987 C
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   0.00004938        5794.    117344021.    13.4577921     0.0006645     -0.001113     2.2972846
-26.349660 C
   0.00005063        5875.    116048229.    13.3737536     0.0006770     -0.001145     2.3312674
-27.140118 C
   0.00005188        5956.    114812390.    13.2940355     0.0006896     -0.001178     2.3649453
-27.930173 C
   0.00005313        6037.    113632257.    13.2183294     0.0007022     -0.001210     2.3983172
-28.719824 C
   0.00005438        6117.    112503976.    13.1463614     0.0007148     -0.001243     2.4313822
-29.509070 C
   0.00005563        6197.    111413701.    13.0756070     0.0007273     -0.001275     2.4638072
-30.301572 C
   0.00005688        6277.    110368099.    13.0079856     0.0007398     -0.001308     2.4958968
-31.094038 C
   0.00005813        6357.    109365279.    12.9435128     0.0007523     -0.001340     2.5276837
-31.886098 C
   0.00005938        6436.    108402529.    12.8819911     0.0007649     -0.001373     2.5591669
-32.677751 C
   0.00006063        6516.    107477352.    12.8232453     0.0007774     -0.001405     2.5903453
-33.468995 C
   0.00006188        6595.    106585542.    12.7666073     0.0007899     -0.001438     2.6211424
-34.260708 C
   0.00006313        6674.    105720878.    12.7108604     0.0008024     -0.001470     2.6513895
-35.054892 C
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   0.00006438        6752.    104887835.    12.6574991     0.0008148     -0.001503     2.6813357
-35.848665 C
   0.00006563        6831.    104084606.    12.6063877     0.0008273     -0.001535     2.7109800
-36.642025 C
   0.00006688        6909.    103309510.    12.5574011     0.0008398     -0.001568     2.7403213
-37.434970 C
   0.00006813        6987.    102560986.    12.5104233     0.0008523     -0.001600     2.7693588
-38.227496 C
   0.00006938        7065.    101837590.    12.4653470     0.0008648     -0.001633     2.7980913
-39.019603 C
   0.00007063        7143.    101137973.    12.4220809     0.0008773     -0.001665     2.8265178
-39.811289 C
   0.00007188        7220.    100455782.    12.3789436     0.0008897     -0.001698     2.8543810
-40.605825 C
   0.00007313        7298.     99794936.    12.3374020     0.0009022     -0.001730     2.8819291
-41.400107 C
   0.00007438        7375.     99154611.    12.2974548     0.0009146     -0.001763     2.9091746
-42.193961 C
   0.00007938        7682.     96778950.    12.1521243     0.0009646     -0.001893     3.0151098
-45.365052 C
   0.00008438        7987.     94656726.    12.0255138     0.0010147     -0.002023     3.1158848
-48.532510 C
   0.00008938        8289.     92740074.    11.9124562     0.0010647     -0.002153     3.2111206
-51.701533 C
   0.00009438        8589.     91004347.    11.8140847     0.0011150     -0.002283     3.3013836
-54.863146 C
   0.00009938        8886.     89421748.    11.7282588     0.0011655     -0.002412     3.3865995
-58.017161 C
    0.0001044        9180.     87954378.    11.6506457     0.0012160     -0.002541     3.4662742
-60.000000 CY
    0.0001094        9384.     85800606.    11.5481808     0.0012631     -0.002674     3.5353720
-60.000000 CY
    0.0001144        9541.     83421843.    11.4396312     0.0013084     -0.002809     3.5973697
-60.000000 CY
    0.0001194        9697.     81230817.    11.3419667     0.0013539     -0.002944     3.6551937
-60.000000 CY
    0.0001244        9850.     79194943.    11.2495142     0.0013992     -0.003078     3.7081633
-60.000000 CY
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    0.0001294       10001.     77305964.    11.1658348     0.0014446     -0.003213     3.7569385
-60.000000 CY
    0.0001344       10151.     75543308.    11.0898380     0.0014902     -0.003347     3.8014419
-60.000000 CY
    0.0001394       10259.     73606225.    11.0036762     0.0015336     -0.003484     3.8396096
-60.000000 CY
    0.0001444       10321.     71489024.    10.9026681     0.0015741     -0.003623     3.8714236
-60.000000 CY
    0.0001494       10378.     69475705.    10.8063989     0.0016142     -0.003763     3.8995256
-60.000000 CY
    0.0001544       10434.     67587878.    10.7175204     0.0016545     -0.003903     3.9242726
-60.000000 CY
    0.0001594       10489.     65813622.    10.6354135     0.0016950     -0.004042     3.9456180
-60.000000 CY
    0.0001644       10542.     64134489.    10.5556303     0.0017351     -0.004182     3.9632602
-60.000000 CY
    0.0001694       10594.     62548130.    10.4807597     0.0017752     -0.004322     3.9774653
-60.000000 CY
    0.0001744       10645.     61048330.    10.4102665     0.0018153     -0.004462     3.9882598
-60.000000 CY
    0.0001794       10696.     59627757.    10.3455446     0.0018557     -0.004602     3.9955935
-60.000000 CY
    0.0001844       10745.     58279864.    10.2853788     0.0018964     -0.004741     3.9994144
-60.000000 CY
    0.0001894       10794.     56995442.    10.2281739     0.0019370     -0.004881     3.9970351
-60.000000 CY
    0.0001944       10840.     55770067.    10.1742556     0.0019776     -0.005020     3.9997917
-60.000000 CY
    0.0001994       10886.     54601501.    10.1231235     0.0020183     -0.005159     3.9974730
-60.000000 CY
    0.0002044       10931.     53486159.    10.0755448     0.0020592     -0.005298     3.9998635
-60.000000 CY
    0.0002094       10975.     52419608.    10.0313940     0.0021003     -0.005437     3.9972164
-60.000000 CY
    0.0002144       11019.     51399270.     9.9902783     0.0021417     -0.005576     3.9997565
-60.000000 CY
    0.0002194       11061.     50421481.     9.9521062     0.0021832     -0.005714     3.9961638
-60.000000 CY
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    0.0002244       11103.     49483900.     9.9165810     0.0022250     -0.005852     3.9993127
-60.000000 CY
    0.0002294       11144.     48582915.     9.8823074     0.0022668     -0.005991     3.9972109
-60.000000 CY
    0.0002344       11183.     47715784.     9.8493605     0.0023084     -0.006129     3.9980280
-60.000000 CY
    0.0002394       11221.     46876993.     9.8176662     0.0023501     -0.006267     3.9998847
-60.000000 CY
    0.0002444       11256.     46059903.     9.7866751     0.0023916     -0.006406     3.9950300
-60.000000 CY
    0.0002494       11283.     45245424.     9.7529083     0.0024321     -0.006545     3.9984053
-60.000000 CY
    0.0002544       11306.     44446014.     9.7185154     0.0024721     -0.006685     3.9999015
-60.000000 CY
    0.0002594       11319.     43640540.     9.6798494     0.0025107     -0.006827     3.9945023
-60.000000 CY
    0.0002644       11330.     42857537.     9.6421489     0.0025491     -0.006968     3.9970850
-60.000000 CY
    0.0002694       11338.     42090633.     9.6039838     0.0025871     -0.007110     3.9992100
-60.000000 CY
    0.0002744       11346.     41350452.     9.5673334     0.0026250     -0.007252     3.9999954
-60.000000 CY
    0.0003044       11380.     37388565.     9.3667055     0.0028510     -0.008107     3.9934819
-60.000000 CY
    0.0003344       11408.     34118560.     9.2116385     0.0030801     -0.008957     3.9944808
-60.000000 CYT
    0.0003644       11430.     31368001.     9.0799576     0.0033085     -0.009809     3.9916365
-60.000000 CYT
    0.0003944       11447.     29026108.     8.9721368     0.0035384     -0.010659     3.9939045
-60.000000 CYT
    0.0004244       11462.     27009296.     8.8854430     0.0037708     -0.011507     3.9992875
-60.000000 CYT
    0.0004544       11462.     25226013.     8.9133442     0.0040500     -0.012307     3.9978007
60.0000000 CYT


-------------------------------------------------------------------------------
   Summary of Results for Nominal Moment Capacity for Section 3
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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	212.150	10532.895	0.00300000	-0.00959730
2	295.890	11398.514	0.00300000	-0.00865979

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	212.150000	10533.	137.897500	6846.	89062138.
2	0.65	295.890000	11399.	192.328500	7409.	98888514.
1	0.75	212.150000	10533.	159.112500	7900.	83911158.
2	0.75	295.890000	11399.	221.917500	8549.	91233835.
1	0.90	212.150000	10533.	190.935000	9480.	65371459.
2	0.90	295.890000	11399.	266.301000	10259.	73609913.

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	9.6300	0.00	N.A.	Yes	N.A.	N.A.
2	12.9000	3.2700	No	Yes	N.A.	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 = 15820.0 lbs
Applied moment at pile head = 0.0 in-lbs
Axial thrust load on pile head = 212150.0 lbs

Depth X	Deflect. y	Bending Moment	Shear Force	Slope S	Total Stress	Bending Stiffness	Soil Res. p	Soil Spr. Es*H	Distrib. Lat.

Load feet	inches	in-lbs	lbs	radians	psi*	lb-in^2	lb/inch	lb/inch	lb/inch
0.00	0.04787	-0.00189	15820.	-4.12E-04	33.6746	5.80E+13	0.00	0.00	25.0055
0.4450	0.04567	85302.	15957.	-4.12E-04	33.7701	5.80E+13	0.00	0.00	26.2220
0.8900	0.04347	171352.	16101.	-4.12E-04	33.8664	5.80E+13	0.00	0.00	27.8439
1.3350	0.04127	258196.	16254.	-4.12E-04	33.9637	5.80E+13	0.00	0.00	29.4659
1.7800	0.03907	345880.	16416.	-4.12E-04	34.0618	5.80E+13	0.00	0.00	31.0879
2.2250	0.03687	434451.	16586.	-4.12E-04	34.1610	5.80E+13	0.00	0.00	32.7098
2.6700	0.03467	523954.	16765.	-4.12E-04	34.2612	5.80E+13	0.00	0.00	34.3318
3.1150	0.03247	614436.	16953.	-4.12E-04	25.9438	7.73E+13	0.00	0.00	35.9537
3.5600	0.03027	705944.	17149.	-4.12E-04	26.0463	7.73E+13	0.00	0.00	37.5757
4.0050	0.02807	798523.	17354.	-4.12E-04	26.1499	7.73E+13	0.00	0.00	39.1977
4.4500	0.02587	892219.	17568.	-4.12E-04	26.2548	7.73E+13	0.00	0.00	40.8196
4.8950	0.02367	987080.	17790.	-4.12E-04	26.3610	7.73E+13	0.00	0.00	42.4416
5.3400	0.02147	1083150.	18021.	-4.12E-04	26.4686	7.73E+13	0.00	0.00	44.0636
5.7850	0.01928	1180477.	18261.	-4.12E-04	26.5775	7.73E+13	0.00	0.00	45.6855
6.2300	0.01708	1279107.	18509.	-4.02E-04	0.00	3.65E+11	0.00	0.00	47.3075
6.6750	0.01498	1379064.	18766.	-3.83E-04	0.00	3.65E+11	0.00	0.00	48.9294
7.1200	0.01299	1480394.	19032.	-3.62E-04	0.00	3.64E+11	0.00	0.00	

50.5514
7.5650 0.01112 1583141. 19306. -3.39E-04 0.00 3.64E+11 0.00 0.00
52.1734
8.0100 0.00937 1687349. 19589. -3.15E-04 0.00 3.64E+11 0.00 0.00
53.7953
8.4550 0.00775 1793064. 19880. -2.90E-04 0.00 3.64E+11 0.00 0.00
55.4173
8.9000 0.00627 1900328. 20181. -2.63E-04 0.00 3.64E+11 0.00 0.00
57.0393
9.3450 0.00494 2009188. 20490. -2.34E-04 0.00 3.64E+11 0.00 0.00
58.6612
9.7900 0.00377 2119687. 14377. -2.04E-04 0.00 3.64E+11 -2356. 3335978.
8.3688
10.2350 0.00277 2163195. 1159. -1.72E-04 0.00 3.64E+11 -2602. 5022028.
0.00
10.6800 0.00193 2132460. -13169. -1.41E-04 0.00 3.64E+11 -2764. 7640518.
0.00
11.1250 0.00126 2022870. -28112. -1.10E-04 0.00 3.64E+11 -2833. 1.20E+07
0.00
11.5700 7.54E-04 1832476. -42427. -8.20E-05 0.00 3.64E+11 -2529. 1.79E+07
0.00
12.0150 3.89E-04 1569939. -53025. -5.70E-05 0.00 3.64E+11 -1441. 1.98E+07
0.00
12.4600 1.45E-04 1266297. -58450. -3.62E-05 0.00 3.65E+11 -591.143 2.17E+07
0.00
12.9050 1.43E-06 945777. -60121. -2.00E-05 0.00 3.65E+11 -34.761 1.30E+08
0.00
13.3500 -6.87E-05 624250. -55399. -8.55E-06 0.00 3.65E+11 1803. 1.40E+08
0.00
13.7950 -8.99E-05 354134. -43807. -1.39E-06 0.00 3.65E+11 2538. 1.51E+08
0.00
14.2400 -8.35E-05 156391. -30300. 2.35E-06 0.00 3.65E+11 2521. 1.61E+08
0.00
14.6850 -6.49E-05 30522. -18003. 3.71E-06 0.00 3.65E+11 2085. 1.72E+08
0.00
15.1300 -4.38E-05 -35893. -8445. 3.68E-06 0.00 3.65E+11 1495. 1.82E+08
0.00
15.5750 -2.56E-05 -59678. -1987. 2.98E-06 0.00 3.65E+11 923.7488 1.93E+08

```
0.00
   16.0200  -1.21E-05    -57121.      1704.   2.12E-06       0.00   3.65E+11   458.5763   2.03E+08
0.00
   16.4650  -2.97E-06    -41486.      3245.   1.40E-06       0.00   3.65E+11   118.8390   2.13E+08
0.00
   16.9100   2.87E-06    -22462.      3241.   9.30E-07       0.00   3.65E+11   -120.487   2.24E+08
0.00
   17.3550   6.96E-06     -6874.      2103.   7.16E-07       0.00   3.65E+11   -305.628   2.34E+08
0.00
   17.8000   1.05E-05       0.00       0.00   6.65E-07       0.00   3.65E+11   -482.148   1.22E+08
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. 1:

Pile-head deflection             =     0.04787299 inches
Computed slope at pile head      =     -0.0004121 radians
Maximum bending moment           =       2163195. inch-lbs
Maximum shear force              =        -60121. lbs
Depth of maximum bending moment  =    10.23500000 feet below pile head
Depth of maximum shear force     =    12.90500000 feet below pile head
Number of iterations             =              9
Number of zero deflection points =              2
Pile deflection at ground        =     0.00419308 inches



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            Pile-head Deflection vs. Pile Length for Load Case 1
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Boundary Condition Type 1, Shear and Moment

Shear = 15820. lbs
Moment = 0. in-lbs
Axial Load = 212150. lbs

Pile Length feet	Pile Head Deflection inches	Maximum Moment ln-lbs	Maximum Shear lbs
17.80000	0.04787299	2163195.	-60121.
16.91000	0.04814026	2149160.	-59786.
16.02000	0.05081783	2215706.	-61956.
15.13000	0.04911626	2175390.	-61720.
14.24000	0.05262813	2205243.	-75113.
13.35000	0.06166739	2134817.	-94049.

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 = 19120.0 lbs
Applied moment at pile head = 0.0 in-lbs
Axial thrust load on pile head = 295890.0 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    0.06338   -0.00104     19120.  -5.39E-04    46.9667   5.80E+13       0.00       0.00
39.6077
    0.4450    0.06050    103518.     19336.  -5.39E-04    47.0826   5.80E+13       0.00       0.00
41.4306
    0.8900    0.05762    208216.     19564.  -5.39E-04    47.1998   5.80E+13       0.00       0.00
43.8613
    1.3350    0.05475    314166.     19805.  -5.39E-04    47.3184   5.80E+13       0.00       0.00
46.2919
    1.7800    0.05187    421436.     20058.  -5.39E-04    47.4385   5.80E+13       0.00       0.00
48.7225
    2.2250    0.04899    530095.     20325.  -5.39E-04    47.5601   5.80E+13       0.00       0.00
51.1532
    2.6700    0.04611    640212.     20605.  -5.39E-04    47.6834   5.80E+13       0.00       0.00
53.5838
    3.1150    0.04323    751858.     20897.  -5.39E-04    36.0667   7.73E+13       0.00       0.00
56.0144
    3.5600    0.04035    865100.     21203.  -5.39E-04    36.1935   7.73E+13       0.00       0.00
58.4451
    4.0050    0.03747    980009.     21522.  -5.39E-04    36.3222   7.73E+13       0.00       0.00
60.8757
    4.4500    0.03460   1096654.     21853.  -5.39E-04    36.4527   7.73E+13       0.00       0.00
63.3063
    4.8950    0.03172   1215104.     22198.  -5.39E-04    36.5853   7.73E+13       0.00       0.00
65.7370
    5.3400    0.02884   1335429.     22555.  -5.39E-04    36.7201   7.73E+13       0.00       0.00
68.1676
    5.7850    0.02597   1457697.     22926.  -5.39E-04    36.8569   7.73E+13       0.00       0.00
70.5982
    6.2300    0.02309   1581978.     23309.  -5.27E-04       0.00   3.61E+11       0.00       0.00
73.0289
    6.6750    0.02034   1708304.     23706.  -5.02E-04       0.00   3.61E+11       0.00       0.00
75.4595
    7.1200    0.01772   1836743.     24115.  -4.76E-04       0.00   3.61E+11       0.00       0.00
77.8901
    7.5650    0.01525   1967359.     24538.  -4.48E-04       0.00   3.61E+11       0.00       0.00
80.3208
    8.0100    0.01294   2100220.     24973.  -4.18E-04       0.00   3.61E+11       0.00       0.00
82.7514
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    8.4550    0.01079   2235392.     25421.  -3.86E-04       0.00   3.61E+11       0.00       0.00
85.1820
    8.9000    0.00882   2372940.     25883.  -3.52E-04       0.00   3.61E+11       0.00       0.00
87.6127
    9.3450    0.00703   2512932.     26357.  -3.16E-04       0.00   3.60E+11       0.00       0.00
90.0433
    9.7900    0.00545   2655432.     19736.  -2.77E-04       0.00   3.60E+11     -2583.   2532815.
12.8412
   10.2350    0.00407   2724583.      5222.  -2.37E-04       0.00   3.60E+11     -2866.   3760183.
0.00
   10.6800    0.00291   2711956.    -10604.  -1.97E-04       0.00   3.60E+11     -3062.   5619715.
0.00
   11.1250    0.00196   2611955.    -27223.  -1.58E-04       0.00   3.60E+11     -3162.   8597816.
0.00
   11.5700    0.00123   2421715.    -44089.  -1.20E-04       0.00   3.61E+11     -3155.   1.37E+07
0.00
   12.0150   6.78E-04   2141462.    -59229.  -8.66E-05       0.00   3.61E+11     -2516.   1.98E+07
0.00
   12.4600   3.01E-04   1789420.    -69209.  -5.75E-05       0.00   3.61E+11     -1222.   2.17E+07
0.00
   12.9050   6.42E-05   1402492.    -76637.  -3.39E-05       0.00   3.61E+11     -1560.   1.30E+08
0.00
   13.3500  -6.16E-05    971047.    -76481.  -1.64E-05       0.00   3.61E+11      1618.   1.40E+08
0.00
   13.7950  -1.11E-04    585728.    -63814.  -4.87E-06       0.00   3.61E+11      3126.   1.51E+08
0.00
   14.2400  -1.14E-04    289528.    -46310.   1.60E-06       0.00   3.61E+11      3430.   1.61E+08
0.00
   14.6850  -9.37E-05     91130.    -29113.   4.41E-06       0.00   3.61E+11      3011.   1.72E+08
0.00
   15.1300  -6.65E-05    -21407.    -15016.   4.93E-06       0.00   3.61E+11      2269.   1.82E+08
0.00
   15.5750  -4.11E-05    -69252.     -5004.   4.26E-06       0.00   3.61E+11      1481.   1.93E+08
0.00
   16.0200  -2.11E-05    -74865.      1089.   3.19E-06       0.00   3.61E+11   801.2531   2.03E+08
0.00
   16.4650  -6.99E-06    -57629.      3975.   2.21E-06       0.00   3.61E+11   279.5087   2.13E+08
0.00
```

```
   16.9100   2.54E-06    -32421.      4436.   1.55E-06       0.00   3.61E+11   -106.652   2.24E+08
0.00
   17.3550   9.52E-06    -10253.      3036.   1.23E-06       0.00   3.61E+11   -417.839   2.34E+08
0.00
   17.8000   1.57E-05       0.00       0.00   1.15E-06       0.00   3.61E+11   -719.243   1.22E+08
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             =     0.06338380 inches
Computed slope at pile head      =     -0.0005392 radians
Maximum bending moment           =       2724583. inch-lbs
Maximum shear force              =        -76637. lbs
Depth of maximum bending moment  =    10.23500000 feet below pile head
Depth of maximum shear force     =    12.90500000 feet below pile head
Number of iterations             =             10
Number of zero deflection points =              2
Pile deflection at ground        =     0.00601583 inches



--------------------------------------------------------------------------------
            Pile-head Deflection vs. Pile Length for Load Case 2
--------------------------------------------------------------------------------

Boundary Condition Type 1, Shear and Moment

Shear      =          19120. lbs
Moment     =              0. in-lbs
Axial Load =         295890. lbs
```

Pile Length feet	Pile Head Deflection inches	Maximum Moment ln-lbs	Maximum Shear lbs
17.80000	0.06338380	2724583.	-76637.
16.91000	0.06379983	2704859.	-75078.
16.02000	0.06723003	2790978.	-78422.
15.13000	0.06521552	2743783.	-78724.
14.24000	0.07177262	2777232.	-103091.
13.35000	0.10188550	2684546.	-125192.

Computed Values of Pile Loading and Deflection
for Lateral Loading for Load Case Number 3

Pile-head conditions are Displacement and Moment (Loading Type 4)
Displacement of pile head = 0.480000 inches
Moment at pile head = 0.0 in-lbs
Axial load at pile head = 212150.0 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	0.4800	0.00	46004.	-0.00406	33.6746	5.80E+13	0.00	0.00	25.0055
0.4450	0.4583	250614.	46141.	-0.00406	33.9552	5.80E+13	0.00	0.00	26.2220
0.8900	0.4367	501976.	46286.	-0.00406	34.2366	5.80E+13	0.00	0.00	27.8439

1.3350	0.4150	754132.	46439.	-0.00406	34.5189	5.80E+13	0.00	0.00
29.4659								
1.7800	0.3934	1007128.	46600.	-0.00405	34.8021	5.80E+13	0.00	0.00
31.0879								
2.2250	0.3717	1261011.	46771.	-0.00405	35.0863	5.80E+13	0.00	0.00
32.7098								
2.6700	0.3501	1515826.	46950.	-0.00405	35.3716	5.80E+13	0.00	0.00
34.3318								
3.1150	0.3284	1771620.	47137.	-0.00405	27.2393	7.73E+13	0.00	0.00
35.9537								
3.5600	0.3068	2028439.	47334.	-0.00405	27.5269	7.73E+13	0.00	0.00
37.5757								
4.0050	0.2851	2286329.	47539.	-0.00405	27.8156	7.73E+13	0.00	0.00
39.1977								
4.4500	0.2635	2545337.	47752.	-0.00405	28.1055	7.73E+13	0.00	0.00
40.8196								
4.8950	0.2418	2805509.	47975.	-0.00405	28.3968	7.73E+13	0.00	0.00
42.4416								
5.3400	0.2202	3066891.	48206.	-0.00405	28.6894	7.73E+13	0.00	0.00
44.0636								
5.7850	0.1985	3329529.	48445.	-0.00405	28.9835	7.73E+13	0.00	0.00
45.6855								
6.2300	0.1769	3593469.	48693.	-0.00398	0.00	1.36E+11	0.00	0.00
47.3075								
6.6750	0.1560	3858598.	48950.	-0.00383	0.00	1.27E+11	0.00	0.00
48.9294								
7.1200	0.1360	4124939.	49216.	-0.00366	0.00	1.20E+11	0.00	0.00
50.5514								
7.5650	0.1169	4392514.	49490.	-0.00346	0.00	1.15E+11	0.00	0.00
52.1734								
8.0100	0.09897	4661346.	49773.	-0.00325	0.00	1.10E+11	0.00	0.00
53.7953								
8.4550	0.08222	4931454.	50065.	-0.00301	0.00	1.06E+11	0.00	0.00
55.4173								
8.9000	0.06680	5202862.	50365.	-0.00275	0.00	1.03E+11	0.00	0.00
57.0393								
9.3450	0.05283	5475589.	50674.	-0.00247	0.00	9.95E+10	0.00	0.00
58.6612								

9.7900	0.04043	5749656.	39470.	-0.00216	0.00	9.69E+10	-4263.	563099.	8.3688
10.2350	0.02972	5902035.	15533.	-0.00184	0.00	9.56E+10	-4710.	846406.	0.00
10.6800	0.02077	5919722.	-10405.	-0.00151	0.00	9.54E+10	-5004.	1286759.	0.00
11.1250	0.01359	5794332.	-37459.	-0.00118	0.00	9.65E+10	-5128.	2015517.	0.00
11.5700	0.00812	5522344.	-64663.	-8.75E-04	0.00	9.90E+10	-5061.	3328687.	0.00
12.0150	0.00424	5105715.	-90913.	-5.95E-04	0.00	1.04E+11	-4771.	6009571.	0.00
12.4600	0.00176	4552738.	-114891.	-3.55E-04	0.00	1.12E+11	-4209.	1.27E+07	0.00
12.9050	4.51E-04	3879487.	-155422.	-1.64E-04	0.00	1.27E+11	-10971.	1.30E+08	0.00
13.3500	1.06E-05	2893202.	-185462.	-6.12E-05	0.00	3.62E+11	-279.640	1.40E+08	0.00
13.7950	-2.02E-04	1898895.	-170979.	-2.59E-05	0.00	3.64E+11	5704.	1.51E+08	0.00
14.2400	-2.66E-04	1067208.	-134309.	-4.16E-06	0.00	3.65E+11	8030.	1.61E+08	0.00
14.6850	-2.47E-04	464489.	-91709.	7.05E-06	0.00	3.65E+11	7925.	1.72E+08	0.00
15.1300	-1.91E-04	87742.	-53182.	1.11E-05	0.00	3.65E+11	6505.	1.82E+08	0.00
15.5750	-1.28E-04	-103519.	-23482.	1.10E-05	0.00	3.65E+11	4619.	1.93E+08	0.00
16.0200	-7.35E-05	-163069.	-3687.	9.02E-06	0.00	3.65E+11	2795.	2.03E+08	0.00
16.4650	-3.17E-05	-142911.	7161.	6.78E-06	0.00	3.65E+11	1268.	2.13E+08	0.00
16.9100	-1.06E-06	-86606.	10664.	5.10E-06	0.00	3.65E+11	44.5847	2.24E+08	0.00
17.3550	2.28E-05	-29029.	8110.	4.26E-06	0.00	3.65E+11	-1001.	2.34E+08	0.00
17.8000	4.44E-05	0.00	0.00	4.05E-06	0.00	3.65E+11	-2036.	1.22E+08	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. 3:

```
Pile-head deflection             =     0.48000000 inches
Computed slope at pile head      =     -0.0040551 radians
Maximum bending moment           =       5919722. inch-lbs
Maximum shear force              =       -185462. lbs
Depth of maximum bending moment  =    10.68000000 feet below pile head
Depth of maximum shear force     =    13.35000000 feet below pile head
Number of iterations             =             12
Number of zero deflection points =              2
Pile deflection at ground        =     0.04488817 inches
```

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	15820.	M, in-lb	0.00	212150.	0.04787	-4.12E-04	-60121.	2163195.
2	V, lb	19120.	M, in-lb	0.00	295890.	0.06338	-5.39E-04	-76637.	2724583.
3	y, in	0.4800	M, in-lb	0.00	212150.	0.4800	-0.00406	-185462.	5919722.

Maximum pile-head deflection = 0.4800000000 inches
Maximum pile-head rotation = -0.0040551353 radians = -0.232342 deg.

Summary of Warning Messages

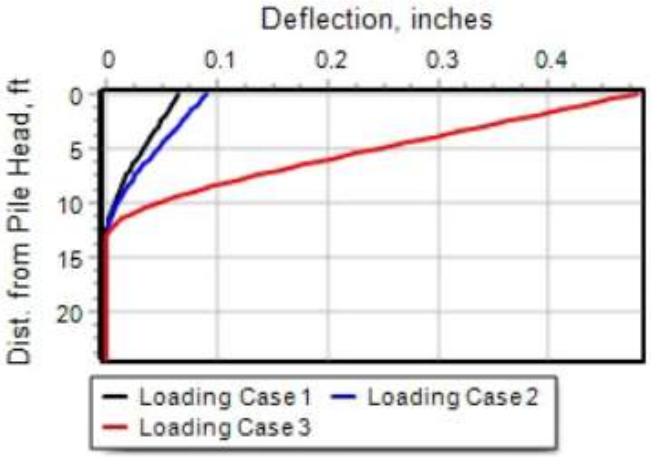
The following warning was reported 156 times

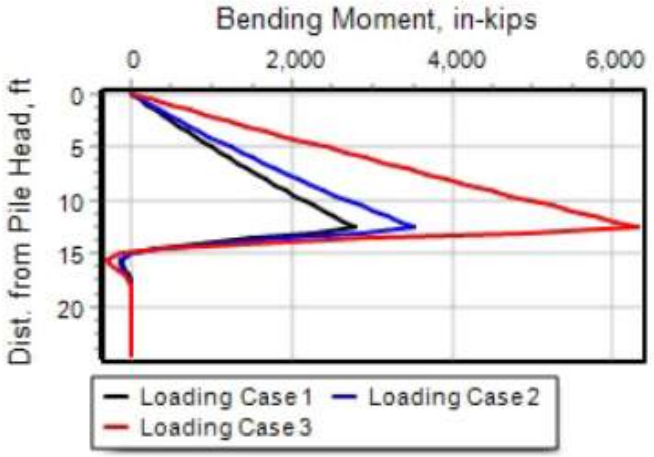
**** Warning ****

An unreasonable input value for unconfined compressive strength has been specified for a soil defined using the weak rock criteria. The input value is greater than 500 psi. Please check your input data for correctness.

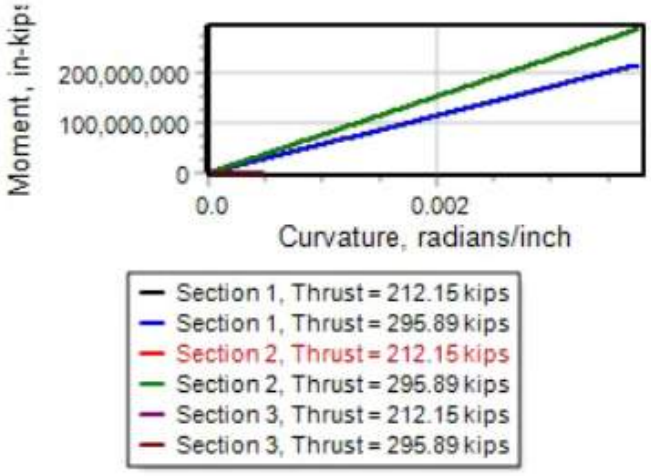
The analysis ended normally.

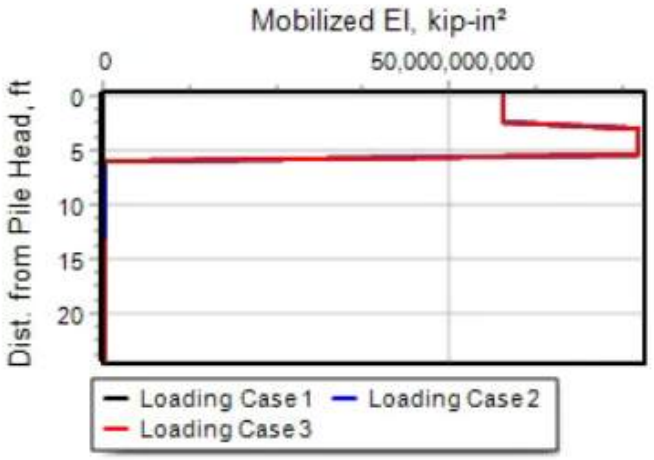
Results for HAS-22-17.53R RA Shaft 5 B-139.lp12d

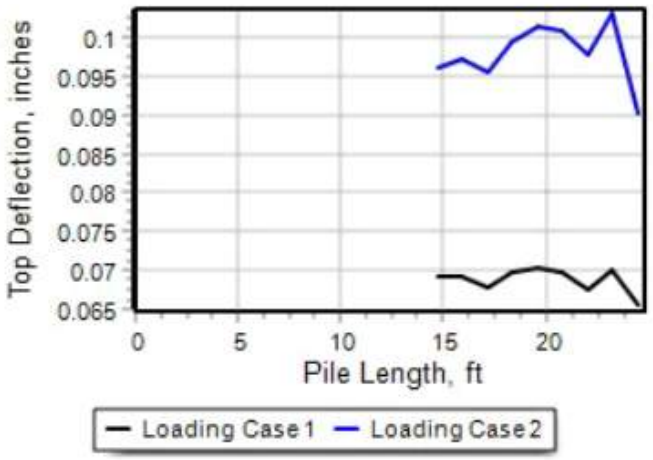












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LPile Version 2022-12.013

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Analysis of Individual Piles and Drilled Shafts
Subjected to Lateral Loading Using the p-y Method
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Columbus, OH, USA

This model was prepared by:
Zmankoci

Files Used for Analysis

Path to file locations:
\23-0011 113440 HAS-22-15.25\113440\geotechnical\bridges\XXX-YY-ZZ.ZZ (Crossing)\Analysis\Lpile\New folder\

Name of input data file:
HAS-22-17.53R RA Shaft 5 B-139.lp12d

Name of output report file:
HAS-22-17.53R RA Shaft 5 B-139.lp12o

Name of plot output file:
HAS-22-17.53R RA Shaft 5 B-139.lp12p

Name of runtime message file:
HAS-22-17.53R RA Shaft 5 B-139.lp12r

Date and Time of Analysis

Date: November 18, 2025 Time: 11:25:13

Problem Title

Project Name: HAS-22-17.53R

Job Number: 10059

Client: ODOT

Engineer: ZM

Description: HAS-22-17.53R Rear Abutment

```
--------------------------------------------------------------------------------
                         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                           =           49

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)
 - 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 = 24.500 ft
Depth of ground surface below top of pile = 12.5000 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	36.0000
2	2.800	36.0000
3	2.800	48.0000
4	5.800	48.0000
5	5.800	36.0000
6	24.500	36.0000

Input Structural Properties for Pile Sections:

Pile Section No. 1:

Section 1 is an elastic pile
Cross-sectional shape = rectangular
Length of section = 2.800000 ft
Width of top of section = 36.000000 in
Width of bottom of section = 36.000000 in
Top Section Depth = 175.000000 in
Bottom Section Depth = 175.000000 in

```
   Top Area                                          =        6300. sq. in
   Bottom Area                                       =        6300. sq. in
   Moment of Inertia at Top                          =    16078125. in^4
   Moment of Inertia at Bottom                       =    16078125. in^4
   Elastic Modulus                                   =     3604996. psi

Pile Section No. 2:

   Section 2 is an elastic pile
   Cross-sectional shape                             =     rectangular
   Length of section                                 =     3.000000 ft
   Width of top of section                           =    48.000000 in
   Width of bottom of section                        =    48.000000 in
   Top Section Depth                                 =   175.000000 in
   Bottom Section Depth                              =   175.000000 in
   Top Area                                          =        8400. sq. in
   Bottom Area                                       =        8400. sq. in
   Moment of Inertia at Top                          =    21437500. in^4
   Moment of Inertia at Bottom                       =    21437500. in^4
   Elastic Modulus                                   =     3604996. psi

Pile Section No. 3:

   Section 3 is a round drilled shaft, bored pile, or CIDH pile
   Length of section                                 =    18.700000 ft
   Shaft Diameter                                    =    36.000000 in



--------------------------------------------------------------------------------
                       Soil and Rock Layering Information
--------------------------------------------------------------------------------

The soil profile is modelled using 3 layers

Layer 1 is weak rock, p-y criteria by Reese, 1997

   Distance from top of pile to top of layer         =    12.500000 ft
```

Distance from top of pile to bottom of layer	=	18.500000	ft
Effective unit weight at top of layer	=	139.000000	pcf
Effective unit weight at bottom of layer	=	139.000000	pcf
Uniaxial compressive strength at top of layer	=	3318.	psi
Uniaxial compressive strength at bottom of layer	=	3318.	psi
Initial modulus of rock at top of layer	=	300000.	psi
Initial modulus of rock at bottom of layer	=	300000.	psi
RQD of rock at top of layer	=	42.000000	%
RQD of rock at bottom of layer	=	42.000000	%
k rm of rock at top of layer	=	0.0000500	
k rm of rock at bottom of layer	=	0.0000500	

Layer 2 is weak rock, p-y criteria by Reese, 1997

Distance from top of pile to top of layer	=	18.500000	ft
Distance from top of pile to bottom of layer	=	23.000000	ft
Effective unit weight at top of layer	=	139.000000	pcf
Effective unit weight at bottom of layer	=	139.000000	pcf
Uniaxial compressive strength at top of layer	=	200.000000	psi
Uniaxial compressive strength at bottom of layer	=	200.000000	psi
Initial modulus of rock at top of layer	=	18000.	psi
Initial modulus of rock at bottom of layer	=	18000.	psi
RQD of rock at top of layer	=	15.000000	%
RQD of rock at bottom of layer	=	15.000000	%
k rm of rock at top of layer	=	0.0005000	
k rm of rock at bottom of layer	=	0.0005000	

Layer 3 is weak rock, p-y criteria by Reese, 1997

Distance from top of pile to top of layer	=	23.000000	ft
Distance from top of pile to bottom of layer	=	33.000000	ft
Effective unit weight at top of layer	=	143.500000	pcf
Effective unit weight at bottom of layer	=	143.500000	pcf
Uniaxial compressive strength at top of layer	=	1102.	psi
Uniaxial compressive strength at bottom of layer	=	1102.	psi
Initial modulus of rock at top of layer	=	99000.	psi

Initial modulus of rock at bottom of layer = 99000. psi
RQD of rock at top of layer = 26.000000 %
RQD of rock at bottom of layer = 26.000000 %
k rm of rock at top of layer = 0.0001600
k rm of rock at bottom of layer = 0.0001600

(Depth of the lowest soil layer extends 8.500 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	Uniaxial qu psi	RQD %	E50 or krm	Rock Mass Modulus psi
1	Weak	12.5000	139.0000	3318.	42.0000	5.00E-05	300000.
	Rock	18.5000	139.0000	3318.	42.0000	5.00E-05	300000.
2	Weak	18.5000	139.0000	200.0000	15.0000	5.00E-04	18000.
	Rock	23.0000	139.0000	200.0000	15.0000	5.00E-04	18000.
3	Weak	23.0000	143.5000	1102.	26.0000	1.60E-04	99000.
	Rock	33.0000	143.5000	1102.	26.0000	1.60E-04	99000.

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	24.600
2	12.500	59.700

Distributed lateral load intensity for Load Case 2 defined using 2 points

Point No.	Depth X ft	Dist. Load lb/in
1	0.000	39.000
2	12.500	91.600

Distributed lateral load intensity for Load Case 3 defined using 2 points

Point No.	Depth X ft	Dist. Load lb/in
1	0.000	24.600
2	12.500	59.700

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 3

Load	Load	Condition	Condition	Axial Thrust	Compute Top y	Run

Analysis

No.	Type	1		2		Force, lbs	vs. Pile Length	
1	1	V =	15820. lbs	M =	0.0000 in-lbs	212150.	Yes	Yes
2	1	V =	19120. lbs	M =	0.0000 in-lbs	295890.	Yes	Yes
3	4	y =	0.480000 in	M =	0.0000 in-lbs	212150.	N.A.	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:

Moment-curvature properties were derived from elastic section properties

Pile Section No. 3:

Dimensions and Properties of Drilled Shaft (Bored Pile):

Length of Section	=	18.700000	ft
Shaft Diameter	=	36.000000	in
Concrete Cover Thickness (to edge of trans. reinf.)	=	3.000000	in
Number of Reinforcing Bars	=	10	bars
Yield Stress of Reinforcing Bars	=	60000.	psi
Modulus of Elasticity of Reinforcing Bars	=	29000000.	psi
Gross Area of Shaft	=	1018.	sq. in.
Total Area of Reinforcing Steel	=	10.000000	sq. in.
Area Ratio of Steel Reinforcement	=	0.98	percent
Edge-to-Edge Bar Spacing	=	7.407667	in
Maximum Concrete Aggregate Size	=	0.750000	in
Ratio of Bar Spacing to Aggregate Size	=	9.88	
Offset of Center of Rebar Cage from Center of Pile	=	0.0000	in
Transverse Reinforcement			
Type: Spiral			
Number of Transverse Reinf. (per spacing)	=	1	
Spacing of Transverse Reinf.	=	5.000000	in
Yield Stress of Transverse Reinf.	=	60000.	psi
Diameter of Transverse Reinf.	=	0.625000	in

Axial Structural Capacities:

Nom. Axial Structural Capacity = 0.85 Fc Ac + Fy As	=	4026.778	kips
Tensile Load for Cracking of Concrete	=	-452.643	kips
Nominal Axial Tensile Capacity	=	-600.000	kips

Reinforcing Bar Dimensions and Positions Used in Computations:

Bar Number	Bar Diam. inches	Bar Area sq. in.	X inches	Y inches
1	1.128000	1.000000	13.811000	0.00000
2	1.128000	1.000000	11.173334	8.117902
3	1.128000	1.000000	4.267834	13.135042
4	1.128000	1.000000	-4.26783	13.135042
5	1.128000	1.000000	-11.17333	8.117902
6	1.128000	1.000000	-13.81100	0.00000
7	1.128000	1.000000	-11.17333	-8.11790
8	1.128000	1.000000	-4.26783	-13.13504
9	1.128000	1.000000	4.267834	-13.13504
10	1.128000	1.000000	11.173334	-8.11790

NOTE: The positions of the above rebars were computed by LPile

Minimum spacing between any two bars not equal to zero = 7.408 inches
between bars 5 and 6.

Ratio of bar spacing to maximum aggregate size = 9.88

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 = 2

Number	Axial Thrust Force kips

| ------ | ------------------ |
| 1 | 212.150 |
| 2 | 295.890 |

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 = 212.150 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	227.9555036	364728806.	93.2551693	0.00005828	0.00003578	0.2429131	1.6152124	
0.00000125	455.9077025	364726162.	55.6468591	0.00006956	0.00002456	0.2886513	1.8671236	
0.00000188	683.8488634	364719394.	43.1193201	0.00008085	0.00001335	0.3341747	2.1195005	

```
   0.00000250   911.7734684    364709387.    36.8619742    0.00009215    0.00000215     0.3794820
2.3723431
   0.00000313        1140.    364687509.    33.1125893     0.0001035   -0.00000902     0.4245704
2.6256409
   0.00000375        1367.    364592768.    30.6162565     0.0001148   -0.00002019     0.4694250
2.8792929
   0.00000438        1594.    364397783.    28.8350253     0.0001262   -0.00003135     0.5140288
3.1331812
   0.00000500        1821.    364112796.    27.5002200     0.0001375   -0.00004250     0.5583710
3.3872318
   0.00000563        2046.    363754812.    26.4627501     0.0001489   -0.00005365     0.6024450
3.6413986
   0.00000625        2271.    363339324.    25.6332574     0.0001602   -0.00006479     0.6462468
3.8956529
   0.00000688        2495.    362878714.    24.9549300     0.0001716   -0.00007593     0.6897735
4.1499767
   0.00000750        2718.    362382343.    24.3899181     0.0001829   -0.00008708     0.7330235
4.4043572
   0.00000813        2940.    361857324.    23.9120344     0.0001943   -0.00009821     0.7759954
4.6587856
   0.00000875        2940.    336010372.    21.2352856     0.0001858     -0.000129     0.7432096
4.3379355 C
   0.00000938        2940.    313609681.    20.6675833     0.0001938     -0.000144     0.7731326
4.4934367 C
   0.00001000        2940.    294009076.    20.1551246     0.0002016     -0.000158     0.8023233
4.6443928 C
   0.00001063        2940.    276714424.    19.6915810     0.0002092     -0.000173     0.8309237
4.7918337 C
   0.00001125        2940.    261341400.    19.2692909     0.0002168     -0.000188     0.8589625
4.9359321 C
   0.00001188        2940.    247586590.    18.8819022     0.0002242     -0.000203     0.8864525
5.0767425 C
   0.00001250        2940.    235207260.    18.5255957     0.0002316     -0.000218     0.9134653
5.2147784 C
   0.00001313        2940.    224006915.    18.1965393     0.0002388     -0.000234     0.9400349
5.3502703 C
   0.00001375        2940.    213824782.    17.8913892     0.0002460     -0.000249     0.9661856
-5.569976 C
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   0.00001438        2940.    204528053.    17.6080366     0.0002531     -0.000264     0.9919716
-5.941287 C
   0.00001500        2940.    196006050.    17.3443090     0.0002602     -0.000280     1.0174294
-6.314326 C
   0.00001563        2940.    188165808.    17.0985890     0.0002672     -0.000295     1.0426031
-6.688764 C
   0.00001625        2940.    180928662.    16.8662640     0.0002741     -0.000311     1.0673452
-7.065797 C
   0.00001688        2940.    174227600.    16.6490681     0.0002810     -0.000327     1.0918564
-7.443847 C
   0.00001750        2940.    168005186.    16.4445403     0.0002878     -0.000342     1.1160856
-7.823341 C
   0.00001813        2984.    164638024.    16.2509525     0.0002945     -0.000358     1.1400079
-8.204497 C
   0.00001875        3032.    161713430.    16.0688539     0.0003013     -0.000374     1.1637358
-8.586422 C
   0.00001938        3079.    158939946.    15.8953849     0.0003080     -0.000390     1.1871476
-8.970118 C
   0.00002000        3126.    156324498.    15.7316047     0.0003146     -0.000405     1.2103861
-9.354439 C
   0.00002063        3173.    153842793.    15.5757060     0.0003212     -0.000421     1.2333722
-9.740043 C
   0.00002125        3219.    151486489.    15.4270985     0.0003278     -0.000437     1.2561333
-10.126720 C
   0.00002188        3265.    149259806.    15.2869548     0.0003344     -0.000453     1.2787848
-10.513525 C
   0.00002250        3310.    147123264.    15.1511727     0.0003409     -0.000469     1.3010807
-10.902510 C
   0.00002313        3355.    145100712.    15.0227080     0.0003474     -0.000485     1.3232971
-11.291392 C
   0.00002375        3400.    143173416.    14.9003389     0.0003539     -0.000501     1.3453392
-11.680967 C
   0.00002438        3445.    141323712.    14.7818674     0.0003603     -0.000517     1.3671046
-12.072105 C
   0.00002563        3533.    137886934.    14.5620591     0.0003732     -0.000549     1.4103550
-12.854481 C
   0.00002688        3621.    134721349.    14.3577000     0.0003859     -0.000582     1.4527805
-13.640855 C
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   0.00002813        3707.    131821776.    14.1703925     0.0003985     -0.000614     1.4947565
-14.428086 C
   0.00002938        3793.    129136479.    13.9954824     0.0004111     -0.000646     1.5360373
-15.218336 C
   0.00003063        3879.    126661116.    13.8344698     0.0004237     -0.000679     1.5769366
-16.008925 C
   0.00003188        3964.    124349990.    13.6824160     0.0004361     -0.000711     1.6171108
-16.802904 C
   0.00003313        4048.    122209609.    13.5422254     0.0004486     -0.000744     1.6569908
-17.596513 C
   0.00003438        4132.    120204429.    13.4096541     0.0004610     -0.000777     1.6962493
-18.392688 C
   0.00003563        4215.    118329047.    13.2854181     0.0004733     -0.000809     1.7350661
-19.189863 C
   0.00003688        4299.    116577604.    13.1699520     0.0004856     -0.000842     1.7735932
-19.986671 C
   0.00003813        4381.    114924104.    13.0596821     0.0004979     -0.000875     1.8115062
-20.786100 C
   0.00003938        4464.    113367685.    12.9557557     0.0005101     -0.000907     1.8490130
-21.586282 C
   0.00004063        4546.    111904222.    12.8585340     0.0005224     -0.000940     1.8862343
-22.386098 C
   0.00004188        4628.    110523334.    12.7669698     0.0005346     -0.000973     1.9231114
-23.186099 C
   0.00004313        4710.    109207938.    12.6783401     0.0005468     -0.001006     1.9593546
-23.989062 C
   0.00004438        4791.    107964128.    12.5949862     0.0005589     -0.001039     1.9953163
-24.791662 C
   0.00004563        4872.    106786013.    12.5164754     0.0005711     -0.001071     2.0309959
-25.593897 C
   0.00004688        4953.    105668326.    12.4424215     0.0005832     -0.001104     2.0663923
-26.395764 C
   0.00004813        5034.    104599478.    12.3706997     0.0005953     -0.001137     2.1012549
-27.199745 C
   0.00004938        5114.    103579448.    12.3020791     0.0006074     -0.001170     2.1357233
-28.004496 C
   0.00005063        5195.    102607621.    12.2370913     0.0006195     -0.001203     2.1699123
-28.808880 C
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0.00005188	5275.	101680501.	12.1754809	0.0006316	-0.001236	2.2038212
-29.612894 C						
0.00005313	5355.	100794923.	12.1170107	0.0006437	-0.001269	2.2374491
-30.416536 C						
0.00005438	5435.	99948012.	12.0614652	0.0006558	-0.001302	2.2707951
-31.219806 C						
0.00005563	5514.	99130658.	12.0066471	0.0006679	-0.001335	2.3035510
-32.025927 C						
0.00005688	5593.	98347149.	11.9544108	0.0006799	-0.001368	2.3360206
-32.831763 C						
0.00005813	5673.	97595466.	11.9046445	0.0006920	-0.001401	2.3682116
-33.637222 C						
0.00005938	5752.	96873591.	11.8572090	0.0007040	-0.001433	2.4001233
-34.442302 C						
0.00006063	5831.	96179670.	11.8119336	0.0007161	-0.001466	2.4317547
-35.247002 C						
0.00006188	5910.	95512001.	11.7687006	0.0007282	-0.001499	2.4631050
-36.051318 C						
0.00006313	5989.	94869015.	11.7273898	0.0007403	-0.001532	2.4941733
-36.855250 C						
0.00006438	6067.	94247967.	11.6874039	0.0007524	-0.001565	2.5248771
-37.659715 C						
0.00006563	6146.	93646088.	11.6480636	0.0007644	-0.001598	2.5551199
-38.465825 C						
0.00006688	6224.	93065082.	11.6104018	0.0007764	-0.001631	2.5850837
-39.271543 C						
0.00006813	6302.	92503791.	11.5743211	0.0007885	-0.001664	2.6147673
-40.076867 C						
0.00006938	6380.	91961141.	11.5397372	0.0008006	-0.001697	2.6441701
-40.881795 C						
0.00007063	6458.	91436135.	11.5065716	0.0008127	-0.001730	2.6732909
-41.686325 C						
0.00007188	6535.	90927845.	11.4747513	0.0008247	-0.001763	2.7021290
-42.490454 C						
0.00007313	6613.	90435404.	11.4442327	0.0008369	-0.001796	2.7306834
-43.294180 C						
0.00007438	6691.	89958007.	11.4149069	0.0008490	-0.001829	2.7589532
-44.097502 C						

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   0.00007938         6999.     88181827.    11.3072667     0.0008975     -0.001960     2.8689252
-47.309803 C
   0.00008438         7306.     86589210.    11.2123237     0.0009460     -0.002091     2.9737861
-50.522241 C
   0.00008938         7611.     85154325.    11.1306931     0.0009948     -0.002223     3.0740333
-53.727767 C
   0.00009438         7914.     83851669.    11.0602835     0.0010438     -0.002354     3.1696012
-56.926211 C
   0.00009938         8214.     82660654.    10.9994697     0.0010931     -0.002484     3.2604205
-60.000000 CY
    0.0001044         8462.     81077530.    10.9246375     0.0011403     -0.002617     3.3424226
-60.000000 CY
    0.0001094         8622.     78825782.    10.8230452     0.0011838     -0.002754     3.4136567
-60.000000 CY
    0.0001144         8779.     76758545.    10.7318935     0.0012275     -0.002890     3.4810808
-60.000000 CY
    0.0001194         8936.     74854939.    10.6500142     0.0012713     -0.003026     3.5446680
-60.000000 CY
    0.0001244         9091.     73090925.    10.5740205     0.0013151     -0.003162     3.6039857
-60.000000 CY
    0.0001294         9244.     71447696.    10.5038328     0.0013589     -0.003299     3.6591496
-60.000000 CY
    0.0001344         9352.     69598541.    10.4209766     0.0014003     -0.003437     3.7074324
-60.000000 CY
    0.0001394         9414.     67547207.    10.3248424     0.0014390     -0.003578     3.7491897
-60.000000 CY
    0.0001444         9472.     65608880.    10.2336693     0.0014775     -0.003720     3.7874938
-60.000000 CY
    0.0001494         9528.     63788664.    10.1461895     0.0015156     -0.003862     3.8223061
-60.000000 CY
    0.0001544         9584.     62082418.    10.0654353     0.0015539     -0.004004     3.8541338
-60.000000 CY
    0.0001594         9639.     60479335.     9.9907300     0.0015923     -0.004145     3.8829392
-60.000000 CY
    0.0001644         9693.     58969922.     9.9196628     0.0016305     -0.004287     3.9086834
-60.000000 CY
    0.0001694         9746.     57541410.     9.8541486     0.0016690     -0.004428     3.9310847
-60.000000 CY
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    0.0001744         9798.     56189155.     9.7917527     0.0017074     -0.004570     3.9503172
-60.000000 CY
    0.0001794         9849.     54908787.     9.7330971     0.0017459     -0.004712     3.9664760
-60.000000 CY
    0.0001844         9900.     53694382.     9.6785609     0.0017845     -0.004853     3.9795192
-60.000000 CY
    0.0001894         9950.     52540644.     9.6278368     0.0018233     -0.004994     3.9894034
-60.000000 CY
    0.0001944         9999.     51442820.     9.5806481     0.0018622     -0.005135     3.9960841
-60.000000 CY
    0.0001994        10048.     50396360.     9.5365366     0.0019013     -0.005276     3.9995131
-60.000000 CY
    0.0002044        10095.     49394303.     9.4929916     0.0019401     -0.005417     3.9964108
-60.000000 CY
    0.0002094        10141.     48436650.     9.4524985     0.0019791     -0.005558     3.9995405
-60.000000 CY
    0.0002144        10187.     47520145.     9.4148867     0.0020183     -0.005699     3.9958315
-60.000000 CY
    0.0002194        10232.     46642003.     9.3799437     0.0020577     -0.005840     3.9992412
-60.000000 CY
    0.0002244        10276.     45799931.     9.3474847     0.0020973     -0.005980     3.9971355
-60.000000 CY
    0.0002294        10316.     44975600.     9.3151843     0.0021367     -0.006121     3.9983239
-60.000000 CY
    0.0002344        10351.     44166377.     9.2822771     0.0021755     -0.006262     3.9999589
-60.000000 CY
    0.0002394        10378.     43353626.     9.2462653     0.0022133     -0.006404     3.9958571
-60.000000 CY
    0.0002444        10396.     42539773.     9.2072543     0.0022500     -0.006547     3.9988404
-60.000000 CY
    0.0002494        10409.     41740731.     9.1667954     0.0022860     -0.006692     3.9999793
-60.000000 CY
    0.0002544        10418.     40953686.     9.1235427     0.0023208     -0.006837     3.9946271
-60.000000 CY
    0.0002594        10426.     40195875.     9.0823761     0.0023557     -0.006982     3.9978145
-60.000000 CY
    0.0002644        10434.     39466015.     9.0430571     0.0023908     -0.007127     3.9995966
-60.000000 CY
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    0.0002694        10442.     38762320.     9.0058951     0.0024260     -0.007272     3.9980123
-60.000000 CY
    0.0002744        10449.     38083014.     8.9706544     0.0024613     -0.007416     3.9949556
-60.000000 CY
    0.0003044        10489.     34460331.     8.7878711     0.0026748     -0.008283     3.9987552
-60.000000 CY
    0.0003344        10519.     31459915.     8.6361607     0.0028877     -0.009150     3.9994780
-60.000000 CY
    0.0003644        10545.     28941139.     8.5196288     0.0031043     -0.010013     3.9991133
-60.000000 CYT
    0.0003944        10567.     26794426.     8.4236884     0.0033221     -0.010875     3.9966096
-60.000000 CYT
    0.0004244        10585.     24942084.     8.3398606     0.0035392     -0.011738     3.9879578
-60.000000 CYT
    0.0004544        10601.     23329960.     8.2736862     0.0037594     -0.012598     3.9999293
-60.000000 CYT
    0.0004844        10601.     21885008.     8.2553526     0.0039987     -0.013439     3.9949553
-60.000000 CYT


Axial Thrust Force =    295.890 kips

    Bending       Bending       Bending      Depth to      Max Comp      Max Tens      Max Conc      Max
Steel  Run
   Curvature      Moment       Stiffness      N Axis        Strain        Strain        Stress        Stress
   Msg
    rad/in.       in-kip        kip-in2         in           in/in         in/in          ksi           ksi

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  6.25000E-07   225.7927934    361268469.   123.4548576    0.00007716    0.00005466     0.3200951
2.1625818
   0.00000125   451.5831204    361266496.    70.7468899    0.00008843    0.00004343     0.3653606
2.4144998
   0.00000188   677.3623026    361259895.    53.1862148    0.00009972    0.00003222     0.4104112
2.6668879
   0.00000250   903.1247683    361249907.    44.4123631     0.0001110    0.00002103     0.4552456
2.9197463
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   0.00000313        1129.    361236782.    39.1532413     0.0001224    0.00000985     0.4998625
3.1730750
   0.00000375        1355.    361220595.    35.6514849     0.0001337   -0.00000131     0.5442608
3.4268740
   0.00000438        1580.    361189699.    33.1537808     0.0001450   -0.00001245     0.5884366
3.6811235
   0.00000500        1806.    361104678.    31.2829824     0.0001564   -0.00002359     0.6323764
3.9357325
   0.00000563        2030.    360948199.    29.8295664     0.0001678   -0.00003471     0.6760673
4.1906105
   0.00000625        2255.    360721907.    28.6679661     0.0001792   -0.00004583     0.7195001
4.4456939
   0.00000688        2478.    360433299.    27.7165094     0.0001906   -0.00005695     0.7626682
4.7009367
   0.00000750        2701.    360091206.    26.9269732     0.0002020   -0.00006805     0.8055671
4.9563067
   0.00000813        2923.    359703917.    26.2588515     0.0002134   -0.00007915     0.8481934
5.2117811
   0.00000875        3144.    359278644.    25.6861806     0.0002248   -0.00009025     0.8905447
5.4673434
   0.00000938        3364.    358821423.    25.1900476     0.0002362     -0.000101     0.9326193
5.7229817
   0.00001000        3364.    336395084.    23.1041703     0.0002310     -0.000129     0.9131738
5.4996094 C
   0.00001063        3364.    316607138.    22.5447011     0.0002395     -0.000143     0.9443334
5.6709870 C
   0.00001125        3364.    299017852.    22.0341597     0.0002479     -0.000157     0.9747761
5.8379696 C
   0.00001188        3364.    283280071.    21.5662631     0.0002561     -0.000171     1.0045899
6.0011875 C
   0.00001250        3364.    269116067.    21.1359243     0.0002642     -0.000186     1.0338316
6.1610347 C
   0.00001313        3364.    256301016.    20.7380740     0.0002722     -0.000200     1.0625275
6.3176714 C
   0.00001375        3364.    244650970.    20.3688620     0.0002801     -0.000215     1.0907058
6.4712766 C
   0.00001438        3364.    234013971.    20.0249514     0.0002879     -0.000230     1.1183968
6.6220495 C
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0.00001500	3364.	224263389.	19.7036901	0.0002956	-0.000244	1.1456327 6.7702108 C
0.00001563	3364.	215292854.	19.4029014	0.0003032	-0.000259	1.1724483 6.9160050 C
0.00001625	3378.	207898810.	19.1207970	0.0003107	-0.000274	1.1988806 7.0597018 C
0.00001688	3436.	203629568.	18.8559097	0.0003182	-0.000289	1.2249695 7.2015987 C
0.00001750	3493.	199582861.	18.6054868	0.0003256	-0.000304	1.2506622 7.3412344 C
0.00001813	3548.	195750655.	18.3687106	0.0003329	-0.000320	1.2760057 7.4789660 C
0.00001875	3603.	192137255.	18.1457912	0.0003402	-0.000335	1.3011058 7.6156490 C
0.00001938	3656.	188693973.	17.9334511	0.0003475	-0.000350	1.3258349 -7.824974 C
0.00002000	3709.	185435214.	17.7326370	0.0003547	-0.000365	1.3503284 -8.193871 C
0.00002063	3761.	182336395.	17.5417087	0.0003618	-0.000381	1.3745479 -8.564128 C
0.00002125	3812.	179385119.	17.3597775	0.0003689	-0.000396	1.3984938 -8.935762 C
0.00002188	3863.	176574800.	17.1865166	0.0003760	-0.000412	1.4222017 -9.308490 C
0.00002250	3913.	173893457.	17.0210625	0.0003830	-0.000427	1.4456623 -9.682405 C
0.00002313	3962.	171328424.	16.8625950	0.0003899	-0.000443	1.4688631 -10.057632 C
0.00002375	4011.	168887957.	16.7119182	0.0003969	-0.000458	1.4919137 -10.433241 C
0.00002438	4059.	166534398.	16.5660026	0.0004038	-0.000474	1.5146183 -10.810938 C
0.00002563	4155.	162141470.	16.2936982	0.0004175	-0.000505	1.5595621 -11.567693 C
0.00002688	4249.	158100322.	16.0426675	0.0004311	-0.000536	1.6037385 -12.327605 C
0.00002813	4341.	154353505.	15.8086724	0.0004446	-0.000568	1.6470294 -13.091815 C

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   0.00002938        4433.    150896277.    15.5927082     0.0004580     -0.000599     1.6897395
-13.857699 C
   0.00003063        4523.    147678850.    15.3907080     0.0004713     -0.000631     1.7317181
-14.626675 C
   0.00003188        4612.    144684326.    15.2024306     0.0004846     -0.000663     1.7730727
-15.397841 C
   0.00003313        4700.    141889492.    15.0259400     0.0004977     -0.000695     1.8138319
-16.170995 C
   0.00003438        4788.    139274713.    14.8607886     0.0005108     -0.000727     1.8540069
-16.946089 C
   0.00003563        4874.    136819705.    14.7049433     0.0005239     -0.000759     1.8935827
-17.723318 C
   0.00003688        4961.    134522619.    14.5592902     0.0005369     -0.000791     1.9327631
-18.500805 C
   0.00003813        5046.    132345530.    14.4201043     0.0005498     -0.000823     1.9711910
-19.281985 C
   0.00003938        5131.    130303109.    14.2899936     0.0005627     -0.000855     2.0093010
-20.062752 C
   0.00004063        5215.    128371766.    14.1665377     0.0005755     -0.000887     2.0468870
-20.845110 C
   0.00004188        5299.    126538278.    14.0486255     0.0005883     -0.000919     2.0838902
-21.629688 C
   0.00004313        5382.    124807919.    13.9378745     0.0006011     -0.000951     2.1205803
-22.413859 C
   0.00004438        5466.    123166707.    13.8327852     0.0006138     -0.000984     2.1568421
-23.198771 C
   0.00004563        5548.    121597784.    13.7312625     0.0006265     -0.001016     2.1924654
-23.986586 C
   0.00004688        5630.    120109712.    13.6354503     0.0006392     -0.001048     2.2277802
-24.773998 C
   0.00004813        5712.    118696175.    13.5449054     0.0006518     -0.001081     2.2627856
-25.561005 C
   0.00004938        5794.    117344021.    13.4577921     0.0006645     -0.001113     2.2972846
-26.349660 C
   0.00005063        5875.    116048229.    13.3737536     0.0006770     -0.001145     2.3312674
-27.140118 C
   0.00005188        5956.    114812390.    13.2940355     0.0006896     -0.001178     2.3649453
-27.930173 C
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   0.00005313        6037.    113632257.    13.2183294     0.0007022     -0.001210     2.3983172
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   0.00005438        6117.    112503976.    13.1463614     0.0007148     -0.001243     2.4313822
-29.509070 C
   0.00005563        6197.    111413701.    13.0756070     0.0007273     -0.001275     2.4638072
-30.301572 C
   0.00005688        6277.    110368099.    13.0079856     0.0007398     -0.001308     2.4958968
-31.094038 C
   0.00005813        6357.    109365279.    12.9435128     0.0007523     -0.001340     2.5276837
-31.886098 C
   0.00005938        6436.    108402529.    12.8819911     0.0007649     -0.001373     2.5591669
-32.677751 C
   0.00006063        6516.    107477352.    12.8232453     0.0007774     -0.001405     2.5903453
-33.468995 C
   0.00006188        6595.    106585542.    12.7666073     0.0007899     -0.001438     2.6211424
-34.260708 C
   0.00006313        6674.    105720878.    12.7108604     0.0008024     -0.001470     2.6513895
-35.054892 C
   0.00006438        6752.    104887835.    12.6574991     0.0008148     -0.001503     2.6813357
-35.848665 C
   0.00006563        6831.    104084606.    12.6063877     0.0008273     -0.001535     2.7109800
-36.642025 C
   0.00006688        6909.    103309510.    12.5574011     0.0008398     -0.001568     2.7403213
-37.434970 C
   0.00006813        6987.    102560986.    12.5104233     0.0008523     -0.001600     2.7693588
-38.227496 C
   0.00006938        7065.    101837590.    12.4653470     0.0008648     -0.001633     2.7980913
-39.019603 C
   0.00007063        7143.    101137973.    12.4220809     0.0008773     -0.001665     2.8265178
-39.811289 C
   0.00007188        7220.    100455782.    12.3789436     0.0008897     -0.001698     2.8543810
-40.605825 C
   0.00007313        7298.     99794936.    12.3374020     0.0009022     -0.001730     2.8819291
-41.400107 C
   0.00007438        7375.     99154611.    12.2974548     0.0009146     -0.001763     2.9091746
-42.193961 C
   0.00007938        7682.     96778950.    12.1521243     0.0009646     -0.001893     3.0151098
-45.365052 C
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   0.00008438         7987.     94656726.    12.0255138     0.0010147     -0.002023     3.1158848
-48.532510 C
   0.00008938         8289.     92740074.    11.9124562     0.0010647     -0.002153     3.2111206
-51.701533 C
   0.00009438         8589.     91004347.    11.8140847     0.0011150     -0.002283     3.3013836
-54.863146 C
   0.00009938         8886.     89421748.    11.7282588     0.0011655     -0.002412     3.3865995
-58.017161 C
    0.0001044         9180.     87954378.    11.6506457     0.0012160     -0.002541     3.4662742
-60.000000 CY
    0.0001094         9384.     85800606.    11.5481808     0.0012631     -0.002674     3.5353720
-60.000000 CY
    0.0001144         9541.     83421843.    11.4396312     0.0013084     -0.002809     3.5973697
-60.000000 CY
    0.0001194         9697.     81230817.    11.3419667     0.0013539     -0.002944     3.6551937
-60.000000 CY
    0.0001244         9850.     79194943.    11.2495142     0.0013992     -0.003078     3.7081633
-60.000000 CY
    0.0001294        10001.     77305964.    11.1658348     0.0014446     -0.003213     3.7569385
-60.000000 CY
    0.0001344        10151.     75543308.    11.0898380     0.0014902     -0.003347     3.8014419
-60.000000 CY
    0.0001394        10259.     73606225.    11.0036762     0.0015336     -0.003484     3.8396096
-60.000000 CY
    0.0001444        10321.     71489024.    10.9026681     0.0015741     -0.003623     3.8714236
-60.000000 CY
    0.0001494        10378.     69475705.    10.8063989     0.0016142     -0.003763     3.8995256
-60.000000 CY
    0.0001544        10434.     67587878.    10.7175204     0.0016545     -0.003903     3.9242726
-60.000000 CY
    0.0001594        10489.     65813622.    10.6354135     0.0016950     -0.004042     3.9456180
-60.000000 CY
    0.0001644        10542.     64134489.    10.5556303     0.0017351     -0.004182     3.9632602
-60.000000 CY
    0.0001694        10594.     62548130.    10.4807597     0.0017752     -0.004322     3.9774653
-60.000000 CY
    0.0001744        10645.     61048330.    10.4102665     0.0018153     -0.004462     3.9882598
-60.000000 CY
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    0.0001794       10696.     59627757.    10.3455446     0.0018557     -0.004602     3.9955935
-60.000000 CY
    0.0001844       10745.     58279864.    10.2853788     0.0018964     -0.004741     3.9994144
-60.000000 CY
    0.0001894       10794.     56995442.    10.2281739     0.0019370     -0.004881     3.9970351
-60.000000 CY
    0.0001944       10840.     55770067.    10.1742556     0.0019776     -0.005020     3.9997917
-60.000000 CY
    0.0001994       10886.     54601501.    10.1231235     0.0020183     -0.005159     3.9974730
-60.000000 CY
    0.0002044       10931.     53486159.    10.0755448     0.0020592     -0.005298     3.9998635
-60.000000 CY
    0.0002094       10975.     52419608.    10.0313940     0.0021003     -0.005437     3.9972164
-60.000000 CY
    0.0002144       11019.     51399270.     9.9902783     0.0021417     -0.005576     3.9997565
-60.000000 CY
    0.0002194       11061.     50421481.     9.9521062     0.0021832     -0.005714     3.9961638
-60.000000 CY
    0.0002244       11103.     49483900.     9.9165810     0.0022250     -0.005852     3.9993127
-60.000000 CY
    0.0002294       11144.     48582915.     9.8823074     0.0022668     -0.005991     3.9972109
-60.000000 CY
    0.0002344       11183.     47715784.     9.8493605     0.0023084     -0.006129     3.9980280
-60.000000 CY
    0.0002394       11221.     46876993.     9.8176662     0.0023501     -0.006267     3.9998847
-60.000000 CY
    0.0002444       11256.     46059903.     9.7866751     0.0023916     -0.006406     3.9950300
-60.000000 CY
    0.0002494       11283.     45245424.     9.7529083     0.0024321     -0.006545     3.9984053
-60.000000 CY
    0.0002544       11306.     44446014.     9.7185154     0.0024721     -0.006685     3.9999015
-60.000000 CY
    0.0002594       11319.     43640540.     9.6798494     0.0025107     -0.006827     3.9945023
-60.000000 CY
    0.0002644       11330.     42857537.     9.6421489     0.0025491     -0.006968     3.9970850
-60.000000 CY
    0.0002694       11338.     42090633.     9.6039838     0.0025871     -0.007110     3.9992100
-60.000000 CY
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    0.0002744        11346.     41350452.     9.5673334     0.0026250     -0.007252     3.9999954
-60.000000 CY
    0.0003044        11380.     37388565.     9.3667055     0.0028510     -0.008107     3.9934819
-60.000000 CY
    0.0003344        11408.     34118560.     9.2116385     0.0030801     -0.008957     3.9944808
-60.000000 CYT
    0.0003644        11430.     31368001.     9.0799576     0.0033085     -0.009809     3.9916365
-60.000000 CYT
    0.0003944        11447.     29026108.     8.9721368     0.0035384     -0.010659     3.9939045
-60.000000 CYT
    0.0004244        11462.     27009296.     8.8854430     0.0037708     -0.011507     3.9992875
-60.000000 CYT
    0.0004544        11462.     25226013.     8.9133442     0.0040500     -0.012307     3.9978007
60.0000000 CYT


--------------------------------------------------------------------------------
   Summary of Results for Nominal Moment Capacity for Section 3
--------------------------------------------------------------------------------

Moment values interpolated at maximum compressive strain = 0.003
or maximum developed moment if pile fails at smaller strains.

 Load           Axial Thrust        Nominal Mom. Cap.      Max. Comp.      Max. Tens.
  No.              kips                in-kip               Strain           Strain
 ----         ----------------     ------------------     ------------    ------------
   1              212.150             10532.895          0.00300000     -0.00959730
   2              295.890             11398.514          0.00300000     -0.00865979

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.
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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	212.150000	10533.	137.897500	6846.	89062138.
2	0.65	295.890000	11399.	192.328500	7409.	98888514.
1	0.75	212.150000	10533.	159.112500	7900.	83911158.
2	0.75	295.890000	11399.	221.917500	8549.	91233835.
1	0.90	212.150000	10533.	190.935000	9480.	65371459.
2	0.90	295.890000	11399.	266.301000	10259.	73609913.

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	12.5000	0.00	N.A.	Yes	N.A.	N.A.
2	18.5000	6.0000	No	Yes	N.A.	N.A.
3	23.0000	10.5000	No	Yes	N.A.	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 = 15820.0 lbs
Applied moment at pile head = 0.0 in-lbs
Axial thrust load on pile head = 212150.0 lbs

Depth X	Deflect. y	Bending Moment	Shear Force	Slope S	Total Stress	Bending Stiffness	Soil Res. p	Soil Spr. Es*H	Distrib. Lat. Load
feet	inches	in-lbs	lbs	radians	psi*	lb-in^2	lb/inch	lb/inch	lb/inch
0.00	0.06542	0.00644	15820.	-5.34E-04	33.6746	5.80E+13	0.00	0.00	24.9510
0.5000	0.06222	96048.	15973.	-5.34E-04	33.7821	5.80E+13	0.00	0.00	26.0040
1.0000	0.05902	193033.	16133.	-5.34E-04	33.8907	5.80E+13	0.00	0.00	27.4080
1.5000	0.05582	291004.	16302.	-5.33E-04	34.0004	5.80E+13	0.00	0.00	28.8120
2.0000	0.05262	390012.	16479.	-5.33E-04	34.1112	5.80E+13	0.00	0.00	30.2160
2.5000	0.04942	490108.	16664.	-5.33E-04	34.2233	5.80E+13	0.00	0.00	31.6200
3.0000	0.04622	591342.	16858.	-5.33E-04	25.9180	7.73E+13	0.00	0.00	33.0240

3.5000	0.04302	693765.	17061.	-5.33E-04	26.0326	7.73E+13	0.00	0.00
34.4280								
4.0000	0.03982	797427.	17271.	-5.33E-04	26.1487	7.73E+13	0.00	0.00
35.8320								
4.5000	0.03662	902380.	17491.	-5.33E-04	26.2662	7.73E+13	0.00	0.00
37.2360								
5.0000	0.03342	1008672.	17718.	-5.33E-04	26.3852	7.73E+13	0.00	0.00
38.6400								
5.5000	0.03022	1116356.	17954.	-5.33E-04	26.5058	7.73E+13	0.00	0.00
40.0440								
6.0000	0.02702	1225481.	18199.	-5.23E-04	0.00	3.65E+11	0.00	0.00
41.4480								
6.5000	0.02395	1336072.	18452.	-5.02E-04	0.00	3.65E+11	0.00	0.00
42.8520								
7.0000	0.02100	1448179.	18713.	-4.79E-04	0.00	3.65E+11	0.00	0.00
44.2560								
7.5000	0.01820	1561848.	18983.	-4.54E-04	0.00	3.64E+11	0.00	0.00
45.6600								
8.0000	0.01555	1677128.	19261.	-4.27E-04	0.00	3.64E+11	0.00	0.00
47.0640								
8.5000	0.01307	1794067.	19548.	-3.99E-04	0.00	3.64E+11	0.00	0.00
48.4680								
9.0000	0.01077	1912713.	19843.	-3.68E-04	0.00	3.64E+11	0.00	0.00
49.8720								
9.5000	0.00865	2033115.	20146.	-3.36E-04	0.00	3.64E+11	0.00	0.00
51.2760								
10.0000	0.00674	2155320.	20458.	-3.01E-04	0.00	3.64E+11	0.00	0.00
52.6800								
10.5000	0.00504	2279376.	20778.	-2.65E-04	0.00	3.63E+11	0.00	0.00
54.0840								
11.0000	0.00356	2405332.	21107.	-2.26E-04	0.00	3.63E+11	0.00	0.00
55.4880								
11.5000	0.00233	2533234.	21444.	-1.85E-04	0.00	3.63E+11	0.00	0.00
56.8920								
12.0000	0.00134	2663131.	21790.	-1.42E-04	0.00	3.62E+11	0.00	0.00
58.2960								
12.5000	6.20E-04	2795070.	-33706.	-9.69E-05	0.00	3.62E+11	-18586.	1.80E+08
29.6745								

13.0000	1.77E-04	2258910.	-108832.	-5.51E-05	0.00	3.63E+11	-6485.	2.20E+08	0.00
13.5000	-4.20E-05	1489232.	-122828.	-2.42E-05	0.00	3.64E+11	1820.	2.60E+08	0.00
14.0000	-1.14E-04	785039.	-100302.	-5.51E-06	0.00	3.65E+11	5689.	3.00E+08	0.00
14.5000	-1.08E-04	285626.	-64864.	3.30E-06	0.00	3.65E+11	6124.	3.40E+08	0.00
15.0000	-7.42E-05	6659.	-32403.	5.71E-06	0.00	3.65E+11	4697.	3.80E+08	0.00
15.5000	-3.96E-05	-103221.	-9996.	4.91E-06	0.00	3.65E+11	2772.	4.20E+08	0.00
16.0000	-1.52E-05	-113307.	1822.	3.13E-06	0.00	3.65E+11	1167.	4.60E+08	0.00
16.5000	-2.04E-06	-81362.	5834.	1.53E-06	0.00	3.65E+11	169.8819	5.00E+08	0.00
17.0000	3.12E-06	-43300.	5502.	5.04E-07	0.00	3.65E+11	-280.759	5.40E+08	0.00
17.5000	4.00E-06	-15345.	3498.	2.12E-08	0.00	3.65E+11	-387.031	5.80E+08	0.00
18.0000	3.37E-06	-1322.	1291.	-1.16E-07	0.00	3.65E+11	-348.585	6.20E+08	0.00
18.5000	2.61E-06	151.4352	193.8505	-1.26E-07	0.00	3.65E+11	-17.243	3.96E+07	0.00
19.0000	1.87E-06	1004.	102.9233	-1.16E-07	0.00	3.65E+11	-13.066	4.20E+07	0.00
19.5000	1.22E-06	1387.	36.6444	-9.64E-08	0.00	3.65E+11	-9.027	4.44E+07	0.00
20.0000	7.10E-07	1444.	-7.048	-7.31E-08	0.00	3.65E+11	-5.537	4.68E+07	0.00
20.5000	3.43E-07	1302.	-32.087	-5.05E-08	0.00	3.65E+11	-2.809	4.92E+07	0.00
21.0000	1.04E-07	1059.	-43.191	-3.11E-08	0.00	3.65E+11	-0.892	5.16E+07	0.00
21.5000	-3.05E-08	784.2137	-45.045	-1.59E-08	0.00	3.65E+11	0.2742	5.40E+07	0.00
22.0000	-8.73E-08	518.8893	-41.866	-5.20E-09	0.00	3.65E+11	0.7856	5.40E+07	0.00

22.5000	-9.29E-08	281.8372	-37.000	1.38E-09	0.00	3.65E+11	0.8361	5.40E+07	0.00
23.0000	-7.07E-08	74.8805	-23.993	4.32E-09	0.00	3.65E+11	3.4995	2.97E+08	0.00
23.5000	-4.11E-08	-6.095	-7.392	4.88E-09	0.00	3.65E+11	2.0344	2.97E+08	0.00
24.0000	-1.21E-08	-13.831	0.5089	4.72E-09	0.00	3.65E+11	0.5991	2.97E+08	0.00
24.5000	1.55E-08	0.00	0.00	4.61E-09	0.00	3.65E+11	-0.769	1.48E+08	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. 1:

```
Pile-head deflection             =     0.06542306 inches
Computed slope at pile head      =     -0.0005335 radians
Maximum bending moment           =       2795070. inch-lbs
Maximum shear force              =       -122828. lbs
Depth of maximum bending moment  =    12.50000000 feet below pile head
Depth of maximum shear force     =    13.50000000 feet below pile head
Number of iterations             =              6
Number of zero deflection points =              4
Pile deflection at ground        =     0.00061955 inches
```

Pile-head Deflection vs. Pile Length for Load Case 1

Boundary Condition Type 1, Shear and Moment

```
Shear      =          15820. lbs
Moment     =              0. in-lbs
Axial Load =         212150. lbs
```

Pile Length feet	Pile Head Deflection inches	Maximum Moment ln-lbs	Maximum Shear lbs
24.50000	0.06542306	2795070.	-122828.
23.27500	0.06993569	2882490.	-130484.
22.05000	0.06745463	2822122.	-127018.
20.82500	0.06956382	2862521.	-130714.
19.60000	0.07029896	2875876.	-131746.
18.37500	0.06962097	2862472.	-129690.
17.15000	0.06758240	2822156.	-127694.
15.92500	0.06912915	2842469.	-129833.
14.70000	0.06913492	2822465.	-156586.

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                              =      19120.0 lbs
Applied moment at pile head                           =          0.0 in-lbs
Axial thrust load on pile head                        =     295890.0 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	0.09014	0.00228	19120.	-7.23E-04	46.9667	5.80E+13	0.00	0.00	39.5260
0.5000	0.08580	116716.	19362.	-7.23E-04	47.0973	5.80E+13	0.00	0.00	41.1040
1.0000	0.08146	234911.	19615.	-7.23E-04	47.2297	5.80E+13	0.00	0.00	43.2080
1.5000	0.07712	354662.	19880.	-7.23E-04	47.3637	5.80E+13	0.00	0.00	45.3120
2.0000	0.07278	476044.	20159.	-7.23E-04	47.4996	5.80E+13	0.00	0.00	47.4160
2.5000	0.06844	599133.	20449.	-7.23E-04	47.6374	5.80E+13	0.00	0.00	49.5200
3.0000	0.06410	724004.	20753.	-7.23E-04	36.0355	7.73E+13	0.00	0.00	51.6240
3.5000	0.05977	850734.	21069.	-7.23E-04	36.1774	7.73E+13	0.00	0.00	53.7280
4.0000	0.05543	979398.	21398.	-7.23E-04	36.3215	7.73E+13	0.00	0.00	55.8320
4.5000	0.05109	1110072.	21739.	-7.23E-04	36.4678	7.73E+13	0.00	0.00	57.9360
5.0000	0.04675	1242831.	22093.	-7.23E-04	36.6164	7.73E+13	0.00	0.00	60.0400
5.5000	0.04242	1377752.	22459.	-7.23E-04	36.7674	7.73E+13	0.00	0.00	62.1440
6.0000	0.03808	1514909.	22839.	-7.10E-04	0.00	3.61E+11	0.00	0.00	64.2480
6.5000	0.03390	1654335.	23230.	-6.84E-04	0.00	3.61E+11	0.00	0.00	66.3520
7.0000	0.02987	1796101.	23635.	-6.55E-04	0.00	3.61E+11	0.00	0.00	68.4560
7.5000	0.02603	1940278.	24052.	-6.24E-04	0.00	3.61E+11	0.00	0.00	70.5600
8.0000	0.02239	2086938.	24481.	-5.91E-04	0.00	3.61E+11	0.00	0.00	72.6640
8.5000	0.01895	2236152.	24924.	-5.55E-04	0.00	3.61E+11	0.00	0.00	74.7680

9.0000	0.01573	2387992.	25379.	-5.16E-04	0.00	3.61E+11	0.00	0.00	76.8720
9.5000	0.01275	2542529.	25846.	-4.75E-04	0.00	3.60E+11	0.00	0.00	78.9760
10.0000	0.01003	2699834.	26326.	-4.31E-04	0.00	3.60E+11	0.00	0.00	81.0800
10.5000	0.00757	2859978.	26819.	-3.85E-04	0.00	3.60E+11	0.00	0.00	83.1840
11.0000	0.00541	3023031.	27325.	-3.36E-04	0.00	3.60E+11	0.00	0.00	85.2880
11.5000	0.00354	3189066.	27843.	-2.84E-04	0.00	3.59E+11	0.00	0.00	87.3920
12.0000	0.00200	3358152.	28373.	-2.29E-04	0.00	3.59E+11	0.00	0.00	89.4960
12.5000	7.88E-04	3530360.	-42160.	-1.48E-04	0.00	1.97E+11	-23646.	1.80E+08	45.5370
13.0000	2.25E-04	2852756.	-137666.	-7.02E-05	0.00	3.60E+11	-8235.	2.20E+08	0.00
13.5000	-5.36E-05	1878619.	-155399.	-3.08E-05	0.00	3.61E+11	2324.	2.60E+08	0.00
14.0000	-1.45E-04	988080.	-126751.	-6.94E-06	0.00	3.61E+11	7226.	3.00E+08	0.00
14.5000	-1.37E-04	357633.	-81795.	4.23E-06	0.00	3.61E+11	7760.	3.40E+08	0.00
15.0000	-9.37E-05	6520.	-40710.	7.26E-06	0.00	3.61E+11	5935.	3.80E+08	0.00
15.5000	-4.99E-05	-130918.	-12435.	6.22E-06	0.00	3.61E+11	3490.	4.20E+08	0.00
16.0000	-1.90E-05	-142728.	2410.	3.95E-06	0.00	3.61E+11	1459.	4.60E+08	0.00
16.5000	-2.43E-06	-102009.	7395.	1.92E-06	0.00	3.61E+11	202.7175	5.00E+08	0.00
17.0000	4.00E-06	-53990.	6923.	6.24E-07	0.00	3.61E+11	-360.004	5.40E+08	0.00
17.5000	5.05E-06	-18930.	4378.	1.82E-08	0.00	3.61E+11	-488.420	5.80E+08	0.00
18.0000	4.22E-06	-1452.	1605.	-1.51E-07	0.00	3.61E+11	-435.947	6.20E+08	0.00

18.5000	3.24E-06	331.7351	233.1012	-1.60E-07	0.00	3.61E+11	-21.386	3.96E+07	0.00
19.0000	2.29E-06	1346.	120.7487	-1.46E-07	0.00	3.61E+11	-16.064	4.20E+07	0.00
19.5000	1.48E-06	1781.	39.6195	-1.20E-07	0.00	3.61E+11	-10.979	4.44E+07	0.00
20.0000	8.50E-07	1822.	-13.201	-9.05E-08	0.00	3.61E+11	-6.628	4.68E+07	0.00
20.5000	3.97E-07	1623.	-42.862	-6.19E-08	0.00	3.61E+11	-3.259	4.92E+07	0.00
21.0000	1.07E-07	1307.	-55.396	-3.76E-08	0.00	3.61E+11	-0.919	5.16E+07	0.00
21.5000	-5.34E-08	958.5320	-56.711	-1.88E-08	0.00	3.61E+11	0.4809	5.40E+07	0.00
22.0000	-1.18E-07	626.9435	-52.076	-5.59E-09	0.00	3.61E+11	1.0639	5.40E+07	0.00
22.5000	-1.21E-07	333.6361	-45.631	2.39E-09	0.00	3.61E+11	1.0846	5.40E+07	0.00
23.0000	-8.96E-08	79.3648	-29.076	5.82E-09	0.00	3.61E+11	4.4337	2.97E+08	0.00
23.5000	-5.07E-08	-15.297	-8.243	6.35E-09	0.00	3.61E+11	2.5105	2.97E+08	0.00
24.0000	-1.34E-08	-19.579	1.2765	6.06E-09	0.00	3.61E+11	0.6628	2.97E+08	0.00
24.5000	2.20E-08	0.00	0.00	5.90E-09	0.00	3.61E+11	-1.088	1.48E+08	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 = 0.09014300 inches

```
Computed slope at pile head      =     -0.0007233 radians
Maximum bending moment           =       3530360. inch-lbs
Maximum shear force              =       -155399. lbs
Depth of maximum bending moment  =    12.50000000 feet below pile head
Depth of maximum shear force     =    13.50000000 feet below pile head
Number of iterations             =             20
Number of zero deflection points =              4
Pile deflection at ground        =     0.00078820 inches
```

Pile-head Deflection vs. Pile Length for Load Case 2

Boundary Condition Type 1, Shear and Moment

```
Shear      =          19120. lbs
Moment     =              0. in-lbs
Axial Load =         295890. lbs
```

Pile Length feet	Pile Head Deflection inches	Maximum Moment ln-lbs	Maximum Shear lbs
24.50000	0.09014300	3530360.	-155399.
23.27500	0.10318900	3647153.	-165381.
22.05000	0.09795385	3567445.	-160863.
20.82500	0.10086263	3620497.	-165648.
19.60000	0.10139089	3637870.	-166991.
18.37500	0.09955721	3620016.	-164354.
17.15000	0.09554029	3566738.	-161689.
15.92500	0.09733270	3593378.	-164455.
14.70000	0.09617076	3566886.	-198030.

Computed Values of Pile Loading and Deflection
for Lateral Loading for Load Case Number 3

Pile-head conditions are Displacement and Moment (Loading Type 4)
Displacement of pile head = 0.480000 inches
Moment at pile head = 0.0 in-lbs
Axial load at pile head = 212150.0 lbs

Depth X	Deflect. y	Bending Moment	Shear Force	Slope S	Total Stress	Bending Stiffness	Soil Res. p	Soil Spr. Es*H	Distrib. Lat. Load
feet	inches	in-lbs	lbs	radians	psi*	lb-in^2	lb/inch	lb/inch	lb/inch
0.00	0.4800	0.00	38739.	-0.00386	33.6746	5.80E+13	0.00	0.00	24.9510
0.5000	0.4568	237805.	38892.	-0.00386	33.9408	5.80E+13	0.00	0.00	26.0040
1.0000	0.4336	476546.	39052.	-0.00386	34.2081	5.80E+13	0.00	0.00	27.4080
1.5000	0.4104	716273.	39221.	-0.00386	34.4765	5.80E+13	0.00	0.00	28.8120
2.0000	0.3872	957038.	39398.	-0.00386	34.7460	5.80E+13	0.00	0.00	30.2160
2.5000	0.3641	1198891.	39584.	-0.00386	35.0168	5.80E+13	0.00	0.00	31.6200
3.0000	0.3409	1441881.	39778.	-0.00386	26.8702	7.73E+13	0.00	0.00	33.0240
3.5000	0.3177	1686060.	39980.	-0.00386	27.1436	7.73E+13	0.00	0.00	34.4280
4.0000	0.2945	1931479.	40191.	-0.00386	27.4183	7.73E+13	0.00	0.00	35.8320
4.5000	0.2713	2178187.	40410.	-0.00386	27.6945	7.73E+13	0.00	0.00	37.2360
5.0000	0.2481	2426236.	40638.	-0.00386	27.9722	7.73E+13	0.00	0.00	

38.6400
5.5000 0.2250 2675675. 40874. -0.00386 28.2515 7.73E+13 0.00 0.00
40.0440
6.0000 0.2018 2926556. 41118. -0.00383 0.00 2.53E+11 0.00 0.00
41.4480
6.5000 0.1790 3178840. 41371. -0.00373 0.00 1.54E+11 0.00 0.00
42.8520
7.0000 0.1570 3432509. 41632. -0.00360 0.00 1.42E+11 0.00 0.00
44.2560
7.5000 0.1358 3687587. 41902. -0.00344 0.00 1.32E+11 0.00 0.00
45.6600
8.0000 0.1157 3944096. 42180. -0.00326 0.00 1.25E+11 0.00 0.00
47.0640
8.5000 0.09669 4202057. 42467. -0.00306 0.00 1.19E+11 0.00 0.00
48.4680
9.0000 0.07896 4461493. 42762. -0.00284 0.00 1.13E+11 0.00 0.00
49.8720
9.5000 0.06264 4722424. 43065. -0.00259 0.00 1.09E+11 0.00 0.00
51.2760
10.0000 0.04788 4984870. 43377. -0.00232 0.00 1.05E+11 0.00 0.00
52.6800
10.5000 0.03483 5248851. 43698. -0.00202 0.00 1.02E+11 0.00 0.00
54.0840
11.0000 0.02363 5514386. 44026. -0.00170 0.00 9.91E+10 0.00 0.00
55.4880
11.5000 0.01443 5781493. 44363. -0.00135 0.00 9.66E+10 0.00 0.00
56.8920
12.0000 0.00739 6050192. 44709. -9.81E-04 0.00 9.44E+10 0.00 0.00
58.2960
12.5000 0.00266 6320499. -97228. -5.84E-04 0.00 9.24E+10 -47400. 1.07E+08
29.6745
13.0000 3.85E-04 4884941. -281685. -2.41E-04 0.00 1.07E+11 -14115. 2.20E+08
0.00
13.5000 -2.37E-04 2940898. -293195. -5.80E-05 0.00 1.93E+11 10278. 2.60E+08
0.00
14.0000 -3.11E-04 1366752. -215681. -1.09E-06 0.00 3.65E+11 15560. 3.00E+08
0.00
14.5000 -2.50E-04 352723. -126462. 1.31E-05 0.00 3.65E+11 14180. 3.40E+08

0.00								
15.0000	-1.54E-04	-150820.	-54570.	1.47E-05	0.00	3.65E+11	9784.	3.80E+08
0.00								
15.5000	-7.36E-05	-302152.	-9764.	1.10E-05	0.00	3.65E+11	5152.	4.20E+08
0.00								
16.0000	-2.25E-05	-268012.	10877.	6.30E-06	0.00	3.65E+11	1728.	4.60E+08
0.00								
16.5000	2.06E-06	-171649.	15547.	2.69E-06	0.00	3.65E+11	-171.561	5.00E+08
0.00								
17.0000	9.72E-06	-81458.	12408.	6.06E-07	0.00	3.65E+11	-874.602	5.40E+08
0.00								
17.5000	9.34E-06	-22751.	7077.	-2.51E-07	0.00	3.65E+11	-902.548	5.80E+08
0.00								
18.0000	6.71E-06	3465.	2289.	-4.09E-07	0.00	3.65E+11	-693.367	6.20E+08
0.00								
18.5000	4.43E-06	4719.	121.3642	-3.42E-07	0.00	3.65E+11	-29.207	3.96E+07
0.00								
19.0000	2.61E-06	4922.	-20.990	-2.63E-07	0.00	3.65E+11	-18.245	4.20E+07
0.00								
19.5000	1.27E-06	4468.	-103.990	-1.85E-07	0.00	3.65E+11	-9.422	4.44E+07
0.00								
20.0000	3.81E-07	3675.	-141.175	-1.18E-07	0.00	3.65E+11	-2.973	4.68E+07
0.00								
20.5000	-1.48E-07	2774.	-146.446	-6.54E-08	0.00	3.65E+11	1.2159	4.92E+07
0.00								
21.0000	-4.04E-07	1917.	-132.378	-2.68E-08	0.00	3.65E+11	3.4734	5.16E+07
0.00								
21.5000	-4.70E-07	1186.	-109.261	-1.31E-09	0.00	3.65E+11	4.2321	5.40E+07
0.00								
22.0000	-4.20E-07	606.2526	-85.237	1.34E-08	0.00	3.65E+11	3.7760	5.40E+07
0.00								
22.5000	-3.09E-07	162.7772	-65.564	1.98E-08	0.00	3.65E+11	2.7814	5.40E+07
0.00								
23.0000	-1.82E-07	-180.572	-30.125	1.96E-08	0.00	3.65E+11	9.0318	2.97E+08
0.00								
23.5000	-7.37E-08	-198.772	7.9152	1.65E-08	0.00	3.65E+11	3.6482	2.97E+08
0.00								
24.0000	1.54E-08	-85.631	16.5673	1.42E-08	0.00	3.65E+11	-0.764	2.97E+08

```
0.00
   24.5000   9.61E-08       0.00       0.00   1.34E-08       0.00   3.65E+11     -4.758   1.48E+08
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. 3:

Pile-head deflection             =     0.48000000 inches
Computed slope at pile head      =     -0.0038647 radians
Maximum bending moment           =       6320499. inch-lbs
Maximum shear force              =       -293195. lbs
Depth of maximum bending moment  =    12.50000000 feet below pile head
Depth of maximum shear force     =    13.50000000 feet below pile head
Number of iterations             =             75
Number of zero deflection points =              4
Pile deflection at ground        =     0.00265666 inches


--------------------------------------------------------------------------------
            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	15820.	M, in-lb	0.00	212150.	0.06542	-5.34E-04	-122828.	2795070.
2	V, lb	19120.	M, in-lb	0.00	295890.	0.09014	-7.23E-04	-155399.	3530360.
3	y, in	0.4800	M, in-lb	0.00	212150.	0.4800	-0.00386	-293195.	6320499.

Maximum pile-head deflection = 0.4800000000 inches
Maximum pile-head rotation = -0.0038647180 radians = -0.221432 deg.

Summary of Warning Messages

The following warning was reported 1139 times

**** Warning ****

An unreasonable input value for unconfined compressive strength has been specified for a soil defined using the weak rock criteria. The input value is greater than 500 psi. Please check your input data for correctness.

The analysis ended normally.

HAS-22-17.53R RA B-139 Shaft 1 Limit State		
Depth (ft)	Shear Force from Lpile(lb)	Average Shear (lb) based on ODOT GDM
0	19120	19120
0.445	19336	19228
0.89	19564	19576.6
1.335	19805	19830.42857
1.78	20058	20084.28571
2.225	20325	20351
2.67	20605	20630.71429
3.115	20897	20923.28571
3.56	21203	21229
4.005	21522	21547.57143
4.45	21853	21879.14286
4.895	22198	22223.71429
5.34	22555	22581.28571
5.785	22926	22951.71429
6.23	23309	23335.28571
6.675	23706	23731.71429
7.12	24115	24141.14286
7.565	24538	24563.57143
8.01	24973	24999
8.455	25421	24431.85714
8.9	25883	21732.85714
9.345	26357	16712.5714
9.79	19736	9256.0000
10.235	5222	-674.0000
10.68	-10604	-12832.8571
11.125	-27223	-26485.1429
11.57	-44089	-40252.7143
12.015	-59229	-51924.5714
12.46	-69209	-59526.0000
12.905	-76637	-62252.7143
13.35	-76481	-60113.2857
13.795	-63814	-53797.1429
14.24	-46310	-44625.0000
14.685	-29113	-33521.2857
15.13	-15016	-22027.5714
15.575	-5004	-12277.5714
16.02	1089	-5228.1429
16.465	3975	-1069.1429
16.91	4436	1255.3333
17.355	3036	2507.2000
17.8	0	2861.7500

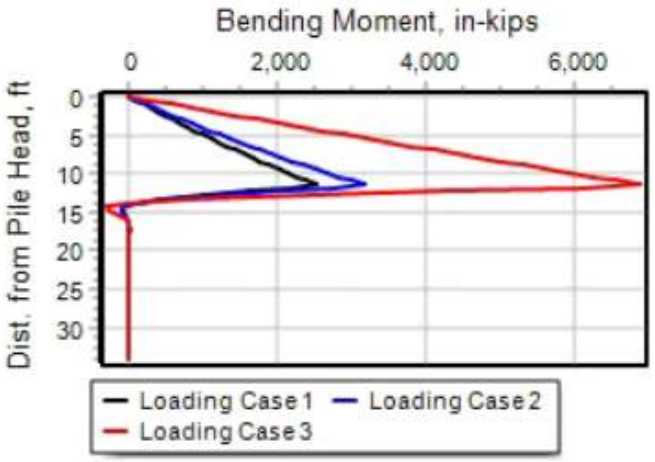
HAS-22-17.53R RA B-139 Shaft 1 Thermal Movement		
Depth (ft)	Shear Force from Lpile(lb)	Average Shear (lb) based on ODOT GDM 1501.7.9
0	46004	46004
0.445	46141	46072.5
0.89	46286	46294
1.335	46439	46455.85714
1.78	46600	46617.71429
2.225	46771	46788.14286
2.67	46950	46967.14286
3.115	47137	47154.71429
3.56	47334	47351.14286
4.005	47539	47556.14286
4.45	47752	47769.71429
4.895	47975	47992
5.34	48206	48222.85714
5.785	48445	48462.42857
6.23	48693	48710.71429
6.675	48950	48967.57143
7.12	49216	49233.14286
7.565	49490	49507.42857
8.01	49773	49790.42857
8.455	50065	48436.14286
8.9	50365	43624.28571
9.345	50674	35067.8571
9.79	39470	22606.1429
10.235	15533	6216.4286
10.68	-10405	-13966.1429
11.125	-37459	-37618.2857
11.57	-64663	-65460.0000
12.015	-90913	-94173.5714
12.46	-114891	-117112.7143
12.905	-155422	-130948.4286
13.35	-185462	-134812.1429
13.795	-170979	-129422.0000
14.24	-134309	-116363.5714
14.685	-91709	-94687.1429
15.13	-53182	-67169.5714
15.575	-23482	-41220.5714
16.02	-3687	-20875.0000
16.465	7161	-7773.7143
16.91	10664	-205.6667
17.355	8110	4449.6000
17.8	0	6483.7500

HAS-22-17.53R RA B-139 Shaft 5 Limit State		
Depth (ft)	Shear Force from Lpile(lb)	Average Shear (lb) based on ODOT GDM
0	19120	19120
0.5	19362	19241
1	19615	19627.2
1.5	19880	19905.42857
2	20159	20183.85714
2.5	20449	20474.71429
3	20753	20778.14286
3.5	21069	21094.28571
4	21398	21422.85714
4.5	21739	21764.28571
5	22093	22118.14286
5.5	22459	22484.71429
6	22839	22863.85714
6.5	23230	23255.57143
7	23635	23660
7.5	24052	24077.14286
8	24481	24506.71429
8.5	24924	24949
9	25379	25403.85714
9.5	25846	25871.42857
10	26326	26351.71429
10.5	26819	26844.4286
11	27325	17196.0000
11.5	27843	-6162.8571
12	28373	-32123.5714
12.5	-42160	-54062.1429
13	-137666	-69650.7143
13.5	-155399	-79444.0000
14	-126751	-85273.7143
14.5	-81795	-78906.5714
15	-40710	-58183.5714
15.5	-12435	-34994.7143
16	2410	-16262.0000
16.5	7395	-4347.7143
17	6923	1501.3002
17.5	4378	3294.9786
18	1605	2956.3528
18.5	233.1012	1898.0383
19	120.7487	902.9152
19.5	39.6195	269.5729
20	-13.201	32.1856
20.5	-42.862	-8.5540
21	-55.396	-32.3225
21.5	-56.711	-42.1361
22	-52.076	-41.4279
22.5	-45.631	-35.1224
23	-29.076	-27.2086
23.5	-8.243	-22.2916
24	1.2765	-16.3347
24.5	0	-9.0106

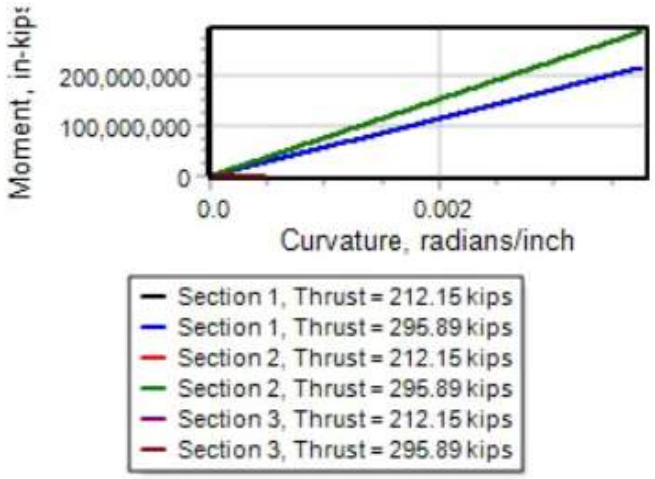
HAS-22-17.53R RA B-139 Shaft 5 Thermal Movement		
Depth (ft)	Shear Force from Lpile(lb)	Average Shear (lb) based on ODOT GDM 1501.7.9
0	38739	38739
0.5	38892	38815.5
1	39052	39060.4
1.5	39221	39237.71429
2	39398	39415
2.5	39584	39600.57143
3	39778	39794.57143
3.5	39980	39997
4	40191	40207.85714
4.5	40410	40427
5	40638	40654.57143
5.5	40874	40890.57143
6	41118	41135
6.5	41371	41387.85714
7	41632	41649.14286
7.5	41902	41918.85714
8	42180	42197
8.5	42467	42483.57143
9	42762	42778.71429
9.5	43065	43082.14286
10	43377	43394
10.5	43698	43714.2857
11	44026	23715.7143
11.5	44363	-22677.1429
12	44709	-70758.8571
12.5	-97228	-107813.0000
13	-281685	-132168.4286
13.5	-293195	-146301.7143
14	-215681	-154083.5714
14.5	-126462	-138640.0000
15	-54570	-96178.2857
15.5	-9764	-52520.7143
16	10877	-20698.1429
16.5	15547	-2305.1429
17	12408	5507.9092
17.5	7077	6899.7677
18	2289	5331.0549
18.5	121.3642	3089.8870
19	-20.99	1296.3947
19.5	-103.99	266.4836
20	-141.175	-76.1251
20.5	-146.446	-105.6396
21	-132.378	-112.0073
21.5	-109.261	-101.4551
22	-85.237	-80.1565
22.5	-65.564	-56.8689
23	-30.125	-37.9578
23.5	7.9152	-26.0739
24	16.5673	-14.2413
24.5	0	-1.4106

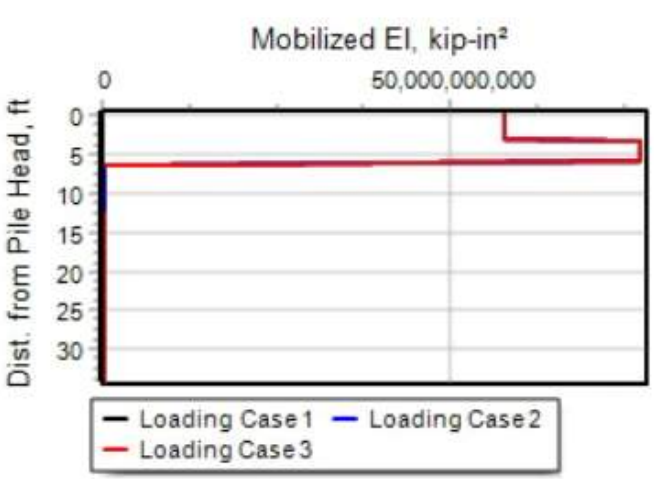
Results for HAS-22-17.53R FA Shaft 1 B-142.lp12d

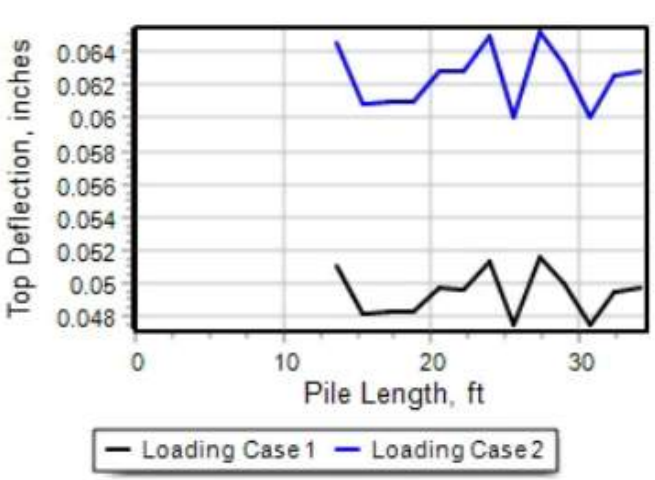












Show All Legends

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LPile Version 2022-12.013

License ID : 500128183
License Type : (Single User License)

Analysis of Individual Piles and Drilled Shafts
Subjected to Lateral Loading Using the p-y Method
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Barr Engineering Inc.
Columbus, OH, USA

==========

This model was prepared by:
Zmankoci

Files Used for Analysis

Path to file locations:
\23-0011 113440 HAS-22-15.25\113440\geotechnical\bridges\XXX-YY-ZZ.ZZ (Crossing)\Analysis\Lpile\New folder\

Name of input data file:
HAS-22-17.53R FA Shaft 1 B-142.lp12d

Name of output report file:
HAS-22-17.53R FA Shaft 1 B-142.lp12o

Name of plot output file:
HAS-22-17.53R FA Shaft 1 B-142.lp12p

Name of runtime message file:
HAS-22-17.53R FA Shaft 1 B-142.lp12r

Date and Time of Analysis

Date: November 18, 2025 Time: 11:26:32

Problem Title

Project Name: HAS-22-17.53R

Job Number: 10059

Client: ODOT

Engineer: ZM

Description: HAS-22-17.53R Forw Abutment

```
--------------------------------------------------------------------------------
                         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                           =           69

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)
 - 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 = 34.100 ft
Depth of ground surface below top of pile = 11.1000 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	36.0000
2	3.100	36.0000
3	3.100	48.0000
4	6.100	48.0000
5	6.100	36.0000
6	34.100	36.0000

Input Structural Properties for Pile Sections:

Pile Section No. 1:

Section 1 is an elastic pile
Cross-sectional shape = rectangular
Length of section = 3.100000 ft
Width of top of section = 36.000000 in
Width of bottom of section = 36.000000 in
Top Section Depth = 175.000000 in
Bottom Section Depth = 175.000000 in

```
   Top Area                                          =        6300. sq. in
   Bottom Area                                       =        6300. sq. in
   Moment of Inertia at Top                          =    16078125. in^4
   Moment of Inertia at Bottom                       =    16078125. in^4
   Elastic Modulus                                   =     3604996. psi

Pile Section No. 2:

   Section 2 is an elastic pile
   Cross-sectional shape                             =     rectangular
   Length of section                                 =     3.000000 ft
   Width of top of section                           =    48.000000 in
   Width of bottom of section                        =    48.000000 in
   Top Section Depth                                 =   175.000000 in
   Bottom Section Depth                              =   175.000000 in
   Top Area                                          =        8400. sq. in
   Bottom Area                                       =        8400. sq. in
   Moment of Inertia at Top                          =    21437500. in^4
   Moment of Inertia at Bottom                       =    21437500. in^4
   Elastic Modulus                                   =     3604996. psi

Pile Section No. 3:

   Section 3 is a round drilled shaft, bored pile, or CIDH pile
   Length of section                                 =    28.000000 ft
   Shaft Diameter                                    =    36.000000 in



--------------------------------------------------------------------------------
                       Soil and Rock Layering Information
--------------------------------------------------------------------------------

The soil profile is modelled using 7 layers

Layer 1 is weak rock, p-y criteria by Reese, 1997

   Distance from top of pile to top of layer         =    11.100000 ft
```

Distance from top of pile to bottom of layer	=	13.100000	ft
Effective unit weight at top of layer	=	139.000000	pcf
Effective unit weight at bottom of layer	=	139.000000	pcf
Uniaxial compressive strength at top of layer	=	1500.	psi
Uniaxial compressive strength at bottom of layer	=	1500.	psi
Initial modulus of rock at top of layer	=	140000.	psi
Initial modulus of rock at bottom of layer	=	140000.	psi
RQD of rock at top of layer	=	0.0000	%
RQD of rock at bottom of layer	=	0.0000	%
k rm of rock at top of layer	=	0.0001100	
k rm of rock at bottom of layer	=	0.0001100	

Layer 2 is weak rock, p-y criteria by Reese, 1997

Distance from top of pile to top of layer	=	13.100000	ft
Distance from top of pile to bottom of layer	=	16.800000	ft
Effective unit weight at top of layer	=	139.000000	pcf
Effective unit weight at bottom of layer	=	139.000000	pcf
Uniaxial compressive strength at top of layer	=	6584.	psi
Uniaxial compressive strength at bottom of layer	=	6584.	psi
Initial modulus of rock at top of layer	=	590000.	psi
Initial modulus of rock at bottom of layer	=	590000.	psi
RQD of rock at top of layer	=	50.000000	%
RQD of rock at bottom of layer	=	50.000000	%
k rm of rock at top of layer	=	0.0000500	
k rm of rock at bottom of layer	=	0.0000500	

Layer 3 is weak rock, p-y criteria by Reese, 1997

Distance from top of pile to top of layer	=	16.800000	ft
Distance from top of pile to bottom of layer	=	25.100000	ft
Effective unit weight at top of layer	=	146.000000	pcf
Effective unit weight at bottom of layer	=	146.000000	pcf
Uniaxial compressive strength at top of layer	=	2288.	psi
Uniaxial compressive strength at bottom of layer	=	2288.	psi
Initial modulus of rock at top of layer	=	210000.	psi

Initial modulus of rock at bottom of layer	=	210000.	psi
RQD of rock at top of layer	=	13.000000	%
RQD of rock at bottom of layer	=	13.000000	%
k rm of rock at top of layer	=	0.0000600	
k rm of rock at bottom of layer	=	0.0000600	

Layer 4 is weak rock, p-y criteria by Reese, 1997

Distance from top of pile to top of layer	=	25.100000	ft
Distance from top of pile to bottom of layer	=	29.800000	ft
Effective unit weight at top of layer	=	136.000000	pcf
Effective unit weight at bottom of layer	=	136.000000	pcf
Uniaxial compressive strength at top of layer	=	360.000000	psi
Uniaxial compressive strength at bottom of layer	=	360.000000	psi
Initial modulus of rock at top of layer	=	32000.	psi
Initial modulus of rock at bottom of layer	=	32000.	psi
RQD of rock at top of layer	=	29.000000	%
RQD of rock at bottom of layer	=	29.000000	%
k rm of rock at top of layer	=	0.0005000	
k rm of rock at bottom of layer	=	0.0005000	

Layer 5 is weak rock, p-y criteria by Reese, 1997

Distance from top of pile to top of layer	=	29.800000	ft
Distance from top of pile to bottom of layer	=	31.400000	ft
Effective unit weight at top of layer	=	127.000000	pcf
Effective unit weight at bottom of layer	=	127.000000	pcf
Uniaxial compressive strength at top of layer	=	200.000000	psi
Uniaxial compressive strength at bottom of layer	=	200.000000	psi
Initial modulus of rock at top of layer	=	18000.	psi
Initial modulus of rock at bottom of layer	=	18000.	psi
RQD of rock at top of layer	=	0.0000	%
RQD of rock at bottom of layer	=	0.0000	%
k rm of rock at top of layer	=	0.0005000	
k rm of rock at bottom of layer	=	0.0005000	

Layer 6 is weak rock, p-y criteria by Reese, 1997

Distance from top of pile to top of layer	=	31.400000	ft
Distance from top of pile to bottom of layer	=	33.100000	ft
Effective unit weight at top of layer	=	131.000000	pcf
Effective unit weight at bottom of layer	=	131.000000	pcf
Uniaxial compressive strength at top of layer	=	360.000000	psi
Uniaxial compressive strength at bottom of layer	=	360.000000	psi
Initial modulus of rock at top of layer	=	32000.	psi
Initial modulus of rock at bottom of layer	=	32000.	psi
RQD of rock at top of layer	=	0.0000	%
RQD of rock at bottom of layer	=	0.0000	%
k rm of rock at top of layer	=	0.0005000	
k rm of rock at bottom of layer	=	0.0005000	

Layer 7 is weak rock, p-y criteria by Reese, 1997

Distance from top of pile to top of layer	=	33.100000	ft
Distance from top of pile to bottom of layer	=	38.100000	ft
Effective unit weight at top of layer	=	150.000000	pcf
Effective unit weight at bottom of layer	=	150.000000	pcf
Uniaxial compressive strength at top of layer	=	10000.	psi
Uniaxial compressive strength at bottom of layer	=	10000.	psi
Initial modulus of rock at top of layer	=	900000.	psi
Initial modulus of rock at bottom of layer	=	900000.	psi
RQD of rock at top of layer	=	77.000000	%
RQD of rock at bottom of layer	=	77.000000	%
k rm of rock at top of layer	=	0.0000500	
k rm of rock at bottom of layer	=	0.0000500	

(Depth of the lowest soil layer extends 4.000 ft below the pile tip)

**** Warning - Possible Input Data Error ****

Values entered for effective unit weight of rock were outside the limits of
50 pcf to 150 pcf.

The maximum input value, in layer 6, for effective unit weight = 150.00 pcf

This data may be erroneous. Please check your data.

Summary of Input Soil Properties

Layer Num.	Soil Type Name (p-y Curve Type)	Layer Depth ft	Effective Unit Wt. pcf	Uniaxial qu psi	RQD %	E50 or krm	Rock Mass Modulus psi
1	Weak	11.1000	139.0000	1500.	0.00	1.10E-04	140000.
	Rock	13.1000	139.0000	1500.	0.00	1.10E-04	140000.
2	Weak	13.1000	139.0000	6584.	50.0000	5.00E-05	590000.
	Rock	16.8000	139.0000	6584.	50.0000	5.00E-05	590000.
3	Weak	16.8000	146.0000	2288.	13.0000	6.00E-05	210000.
	Rock	25.1000	146.0000	2288.	13.0000	6.00E-05	210000.
4	Weak	25.1000	136.0000	360.0000	29.0000	5.00E-04	32000.
	Rock	29.8000	136.0000	360.0000	29.0000	5.00E-04	32000.
5	Weak	29.8000	127.0000	200.0000	0.00	5.00E-04	18000.
	Rock	31.4000	127.0000	200.0000	0.00	5.00E-04	18000.
6	Weak	31.4000	131.0000	360.0000	0.00	5.00E-04	32000.
	Rock	33.1000	131.0000	360.0000	0.00	5.00E-04	32000.
7	Weak	33.1000	150.0000	10000.	77.0000	5.00E-05	900000.
	Rock	38.1000	150.0000	10000.	77.0000	5.00E-05	900000.

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	24.600
2	11.100	61.600

Distributed lateral load intensity for Load Case 2 defined using 2 points

Point No.	Depth X ft	Dist. Load lb/in
1	0.000	39.000
2	11.100	94.500

Distributed lateral load intensity for Load Case 3 defined using 2 points

Point No.	Depth X ft	Dist. Load lb/in
1	0.000	24.600
2	11.100	61.600

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 3

Load No.	Load Type	Condition 1	Condition 2	Axial Thrust Force, lbs	Compute Top y vs. Pile Length	Run Analysis
1	1	V = 15820. lbs	M = 0.0000 in-lbs	212150.	Yes	Yes
2	1	V = 19120. lbs	M = 0.0000 in-lbs	295890.	Yes	Yes
3	4	y = 0.480000 in	M = 0.0000 in-lbs	212150.	N.A.	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:

Moment-curvature properties were derived from elastic section properties

Pile Section No. 3:

Dimensions and Properties of Drilled Shaft (Bored Pile):

Length of Section	=	28.000000	ft
Shaft Diameter	=	36.000000	in
Concrete Cover Thickness (to edge of trans. reinf.)	=	3.000000	in
Number of Reinforcing Bars	=	10	bars
Yield Stress of Reinforcing Bars	=	60000.	psi
Modulus of Elasticity of Reinforcing Bars	=	29000000.	psi
Gross Area of Shaft	=	1018.	sq. in.
Total Area of Reinforcing Steel	=	10.000000	sq. in.
Area Ratio of Steel Reinforcement	=	0.98	percent
Edge-to-Edge Bar Spacing	=	7.407667	in
Maximum Concrete Aggregate Size	=	0.750000	in
Ratio of Bar Spacing to Aggregate Size	=	9.88	
Offset of Center of Rebar Cage from Center of Pile	=	0.0000	in
Transverse Reinforcement			
Type: Spiral			
Number of Transverse Reinf. (per spacing)	=	1	
Spacing of Transverse Reinf.	=	5.000000	in
Yield Stress of Transverse Reinf.	=	60000.	psi
Diameter of Transverse Reinf.	=	0.625000	in

Axial Structural Capacities:

Nom. Axial Structural Capacity = 0.85 Fc Ac + Fy As	=	4026.778	kips

Tensile Load for Cracking of Concrete = -452.643 kips
Nominal Axial Tensile Capacity = -600.000 kips

Reinforcing Bar Dimensions and Positions Used in Computations:

Bar Number	Bar Diam. inches	Bar Area sq. in.	X inches	Y inches
1	1.128000	1.000000	13.811000	0.00000
2	1.128000	1.000000	11.173334	8.117902
3	1.128000	1.000000	4.267834	13.135042
4	1.128000	1.000000	-4.26783	13.135042
5	1.128000	1.000000	-11.17333	8.117902
6	1.128000	1.000000	-13.81100	0.00000
7	1.128000	1.000000	-11.17333	-8.11790
8	1.128000	1.000000	-4.26783	-13.13504
9	1.128000	1.000000	4.267834	-13.13504
10	1.128000	1.000000	11.173334	-8.11790

NOTE: The positions of the above rebars were computed by LPile

Minimum spacing between any two bars not equal to zero = 7.408 inches
between bars 5 and 6.

Ratio of bar spacing to maximum aggregate size = 9.88

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 = 2

Number	Axial Thrust Force kips
1	212.150
2	295.890

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 = 212.150 kips

Bending Curvature	Bending Moment	Bending Stiffness	Depth to N Axis	Max Comp Strain	Max Tens Strain	Max Conc Stress	Max Steel Stress	Run Msg
rad/in.	in-kip	kip-in2	in	in/in	in/in	ksi	ksi	

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  6.25000E-07   227.9555036    364728806.    93.2551693    0.00005828    0.00003578     0.2429131
1.6152124
   0.00000125   455.9077025    364726162.    55.6468591    0.00006956    0.00002456     0.2886513
1.8671236
   0.00000188   683.8488634    364719394.    43.1193201    0.00008085    0.00001335     0.3341747
2.1195005
   0.00000250   911.7734684    364709387.    36.8619742    0.00009215    0.00000215     0.3794820
2.3723431
   0.00000313        1140.    364687509.    33.1125893     0.0001035   -0.00000902     0.4245704
2.6256409
   0.00000375        1367.    364592768.    30.6162565     0.0001148   -0.00002019     0.4694250
2.8792929
   0.00000438        1594.    364397783.    28.8350253     0.0001262   -0.00003135     0.5140288
3.1331812
   0.00000500        1821.    364112796.    27.5002200     0.0001375   -0.00004250     0.5583710
3.3872318
   0.00000563        2046.    363754812.    26.4627501     0.0001489   -0.00005365     0.6024450
3.6413986
   0.00000625        2271.    363339324.    25.6332574     0.0001602   -0.00006479     0.6462468
3.8956529
   0.00000688        2495.    362878714.    24.9549300     0.0001716   -0.00007593     0.6897735
4.1499767
   0.00000750        2718.    362382343.    24.3899181     0.0001829   -0.00008708     0.7330235
4.4043572
   0.00000813        2940.    361857324.    23.9120344     0.0001943   -0.00009821     0.7759954
4.6587856
   0.00000875        2940.    336010372.    21.2352856     0.0001858     -0.000129     0.7432096
4.3379355 C
   0.00000938        2940.    313609681.    20.6675833     0.0001938     -0.000144     0.7731326
4.4934367 C
   0.00001000        2940.    294009076.    20.1551246     0.0002016     -0.000158     0.8023233
4.6443928 C
   0.00001063        2940.    276714424.    19.6915810     0.0002092     -0.000173     0.8309237
4.7918337 C
   0.00001125        2940.    261341400.    19.2692909     0.0002168     -0.000188     0.8589625
4.9359321 C
   0.00001188        2940.    247586590.    18.8819022     0.0002242     -0.000203     0.8864525
5.0767425 C
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   0.00001250        2940.    235207260.    18.5255957     0.0002316     -0.000218     0.9134653
5.2147784 C
   0.00001313        2940.    224006915.    18.1965393     0.0002388     -0.000234     0.9400349
5.3502703 C
   0.00001375        2940.    213824782.    17.8913892     0.0002460     -0.000249     0.9661856
-5.569976 C
   0.00001438        2940.    204528053.    17.6080366     0.0002531     -0.000264     0.9919716
-5.941287 C
   0.00001500        2940.    196006050.    17.3443090     0.0002602     -0.000280     1.0174294
-6.314326 C
   0.00001563        2940.    188165808.    17.0985890     0.0002672     -0.000295     1.0426031
-6.688764 C
   0.00001625        2940.    180928662.    16.8662640     0.0002741     -0.000311     1.0673452
-7.065797 C
   0.00001688        2940.    174227600.    16.6490681     0.0002810     -0.000327     1.0918564
-7.443847 C
   0.00001750        2940.    168005186.    16.4445403     0.0002878     -0.000342     1.1160856
-7.823341 C
   0.00001813        2984.    164638024.    16.2509525     0.0002945     -0.000358     1.1400079
-8.204497 C
   0.00001875        3032.    161713430.    16.0688539     0.0003013     -0.000374     1.1637358
-8.586422 C
   0.00001938        3079.    158939946.    15.8953849     0.0003080     -0.000390     1.1871476
-8.970118 C
   0.00002000        3126.    156324498.    15.7316047     0.0003146     -0.000405     1.2103861
-9.354439 C
   0.00002063        3173.    153842793.    15.5757060     0.0003212     -0.000421     1.2333722
-9.740043 C
   0.00002125        3219.    151486489.    15.4270985     0.0003278     -0.000437     1.2561333
-10.126720 C
   0.00002188        3265.    149259806.    15.2869548     0.0003344     -0.000453     1.2787848
-10.513525 C
   0.00002250        3310.    147123264.    15.1511727     0.0003409     -0.000469     1.3010807
-10.902510 C
   0.00002313        3355.    145100712.    15.0227080     0.0003474     -0.000485     1.3232971
-11.291392 C
   0.00002375        3400.    143173416.    14.9003389     0.0003539     -0.000501     1.3453392
-11.680967 C
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   0.00002438         3445.    141323712.    14.7818674     0.0003603     -0.000517     1.3671046
-12.072105 C
   0.00002563         3533.    137886934.    14.5620591     0.0003732     -0.000549     1.4103550
-12.854481 C
   0.00002688         3621.    134721349.    14.3577000     0.0003859     -0.000582     1.4527805
-13.640855 C
   0.00002813         3707.    131821776.    14.1703925     0.0003985     -0.000614     1.4947565
-14.428086 C
   0.00002938         3793.    129136479.    13.9954824     0.0004111     -0.000646     1.5360373
-15.218336 C
   0.00003063         3879.    126661116.    13.8344698     0.0004237     -0.000679     1.5769366
-16.008925 C
   0.00003188         3964.    124349990.    13.6824160     0.0004361     -0.000711     1.6171108
-16.802904 C
   0.00003313         4048.    122209609.    13.5422254     0.0004486     -0.000744     1.6569908
-17.596513 C
   0.00003438         4132.    120204429.    13.4096541     0.0004610     -0.000777     1.6962493
-18.392688 C
   0.00003563         4215.    118329047.    13.2854181     0.0004733     -0.000809     1.7350661
-19.189863 C
   0.00003688         4299.    116577604.    13.1699520     0.0004856     -0.000842     1.7735932
-19.986671 C
   0.00003813         4381.    114924104.    13.0596821     0.0004979     -0.000875     1.8115062
-20.786100 C
   0.00003938         4464.    113367685.    12.9557557     0.0005101     -0.000907     1.8490130
-21.586282 C
   0.00004063         4546.    111904222.    12.8585340     0.0005224     -0.000940     1.8862343
-22.386098 C
   0.00004188         4628.    110523334.    12.7669698     0.0005346     -0.000973     1.9231114
-23.186099 C
   0.00004313         4710.    109207938.    12.6783401     0.0005468     -0.001006     1.9593546
-23.989062 C
   0.00004438         4791.    107964128.    12.5949862     0.0005589     -0.001039     1.9953163
-24.791662 C
   0.00004563         4872.    106786013.    12.5164754     0.0005711     -0.001071     2.0309959
-25.593897 C
   0.00004688         4953.    105668326.    12.4424215     0.0005832     -0.001104     2.0663923
-26.395764 C
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   0.00004813        5034.    104599478.    12.3706997     0.0005953     -0.001137     2.1012549
-27.199745 C
   0.00004938        5114.    103579448.    12.3020791     0.0006074     -0.001170     2.1357233
-28.004496 C
   0.00005063        5195.    102607621.    12.2370913     0.0006195     -0.001203     2.1699123
-28.808880 C
   0.00005188        5275.    101680501.    12.1754809     0.0006316     -0.001236     2.2038212
-29.612894 C
   0.00005313        5355.    100794923.    12.1170107     0.0006437     -0.001269     2.2374491
-30.416536 C
   0.00005438        5435.     99948012.    12.0614652     0.0006558     -0.001302     2.2707951
-31.219806 C
   0.00005563        5514.     99130658.    12.0066471     0.0006679     -0.001335     2.3035510
-32.025927 C
   0.00005688        5593.     98347149.    11.9544108     0.0006799     -0.001368     2.3360206
-32.831763 C
   0.00005813        5673.     97595466.    11.9046445     0.0006920     -0.001401     2.3682116
-33.637222 C
   0.00005938        5752.     96873591.    11.8572090     0.0007040     -0.001433     2.4001233
-34.442302 C
   0.00006063        5831.     96179670.    11.8119336     0.0007161     -0.001466     2.4317547
-35.247002 C
   0.00006188        5910.     95512001.    11.7687006     0.0007282     -0.001499     2.4631050
-36.051318 C
   0.00006313        5989.     94869015.    11.7273898     0.0007403     -0.001532     2.4941733
-36.855250 C
   0.00006438        6067.     94247967.    11.6874039     0.0007524     -0.001565     2.5248771
-37.659715 C
   0.00006563        6146.     93646088.    11.6480636     0.0007644     -0.001598     2.5551199
-38.465825 C
   0.00006688        6224.     93065082.    11.6104018     0.0007764     -0.001631     2.5850837
-39.271543 C
   0.00006813        6302.     92503791.    11.5743211     0.0007885     -0.001664     2.6147673
-40.076867 C
   0.00006938        6380.     91961141.    11.5397372     0.0008006     -0.001697     2.6441701
-40.881795 C
   0.00007063        6458.     91436135.    11.5065716     0.0008127     -0.001730     2.6732909
-41.686325 C
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   0.00007188        6535.     90927845.    11.4747513     0.0008247     -0.001763     2.7021290
-42.490454 C
   0.00007313        6613.     90435404.    11.4442327     0.0008369     -0.001796     2.7306834
-43.294180 C
   0.00007438        6691.     89958007.    11.4149069     0.0008490     -0.001829     2.7589532
-44.097502 C
   0.00007938        6999.     88181827.    11.3072667     0.0008975     -0.001960     2.8689252
-47.309803 C
   0.00008438        7306.     86589210.    11.2123237     0.0009460     -0.002091     2.9737861
-50.522241 C
   0.00008938        7611.     85154325.    11.1306931     0.0009948     -0.002223     3.0740333
-53.727767 C
   0.00009438        7914.     83851669.    11.0602835     0.0010438     -0.002354     3.1696012
-56.926211 C
   0.00009938        8214.     82660654.    10.9994697     0.0010931     -0.002484     3.2604205
-60.000000 CY
    0.0001044        8462.     81077530.    10.9246375     0.0011403     -0.002617     3.3424226
-60.000000 CY
    0.0001094        8622.     78825782.    10.8230452     0.0011838     -0.002754     3.4136567
-60.000000 CY
    0.0001144        8779.     76758545.    10.7318935     0.0012275     -0.002890     3.4810808
-60.000000 CY
    0.0001194        8936.     74854939.    10.6500142     0.0012713     -0.003026     3.5446680
-60.000000 CY
    0.0001244        9091.     73090925.    10.5740205     0.0013151     -0.003162     3.6039857
-60.000000 CY
    0.0001294        9244.     71447696.    10.5038328     0.0013589     -0.003299     3.6591496
-60.000000 CY
    0.0001344        9352.     69598541.    10.4209766     0.0014003     -0.003437     3.7074324
-60.000000 CY
    0.0001394        9414.     67547207.    10.3248424     0.0014390     -0.003578     3.7491897
-60.000000 CY
    0.0001444        9472.     65608880.    10.2336693     0.0014775     -0.003720     3.7874938
-60.000000 CY
    0.0001494        9528.     63788664.    10.1461895     0.0015156     -0.003862     3.8223061
-60.000000 CY
    0.0001544        9584.     62082418.    10.0654353     0.0015539     -0.004004     3.8541338
-60.000000 CY
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    0.0001594         9639.     60479335.     9.9907300     0.0015923     -0.004145     3.8829392
-60.000000 CY
    0.0001644         9693.     58969922.     9.9196628     0.0016305     -0.004287     3.9086834
-60.000000 CY
    0.0001694         9746.     57541410.     9.8541486     0.0016690     -0.004428     3.9310847
-60.000000 CY
    0.0001744         9798.     56189155.     9.7917527     0.0017074     -0.004570     3.9503172
-60.000000 CY
    0.0001794         9849.     54908787.     9.7330971     0.0017459     -0.004712     3.9664760
-60.000000 CY
    0.0001844         9900.     53694382.     9.6785609     0.0017845     -0.004853     3.9795192
-60.000000 CY
    0.0001894         9950.     52540644.     9.6278368     0.0018233     -0.004994     3.9894034
-60.000000 CY
    0.0001944         9999.     51442820.     9.5806481     0.0018622     -0.005135     3.9960841
-60.000000 CY
    0.0001994        10048.     50396360.     9.5365366     0.0019013     -0.005276     3.9995131
-60.000000 CY
    0.0002044        10095.     49394303.     9.4929916     0.0019401     -0.005417     3.9964108
-60.000000 CY
    0.0002094        10141.     48436650.     9.4524985     0.0019791     -0.005558     3.9995405
-60.000000 CY
    0.0002144        10187.     47520145.     9.4148867     0.0020183     -0.005699     3.9958315
-60.000000 CY
    0.0002194        10232.     46642003.     9.3799437     0.0020577     -0.005840     3.9992412
-60.000000 CY
    0.0002244        10276.     45799931.     9.3474847     0.0020973     -0.005980     3.9971355
-60.000000 CY
    0.0002294        10316.     44975600.     9.3151843     0.0021367     -0.006121     3.9983239
-60.000000 CY
    0.0002344        10351.     44166377.     9.2822771     0.0021755     -0.006262     3.9999589
-60.000000 CY
    0.0002394        10378.     43353626.     9.2462653     0.0022133     -0.006404     3.9958571
-60.000000 CY
    0.0002444        10396.     42539773.     9.2072543     0.0022500     -0.006547     3.9988404
-60.000000 CY
    0.0002494        10409.     41740731.     9.1667954     0.0022860     -0.006692     3.9999793
-60.000000 CY
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    0.0002544        10418.     40953686.     9.1235427     0.0023208     -0.006837     3.9946271
-60.000000 CY
    0.0002594        10426.     40195875.     9.0823761     0.0023557     -0.006982     3.9978145
-60.000000 CY
    0.0002644        10434.     39466015.     9.0430571     0.0023908     -0.007127     3.9995966
-60.000000 CY
    0.0002694        10442.     38762320.     9.0058951     0.0024260     -0.007272     3.9980123
-60.000000 CY
    0.0002744        10449.     38083014.     8.9706544     0.0024613     -0.007416     3.9949556
-60.000000 CY
    0.0003044        10489.     34460331.     8.7878711     0.0026748     -0.008283     3.9987552
-60.000000 CY
    0.0003344        10519.     31459915.     8.6361607     0.0028877     -0.009150     3.9994780
-60.000000 CY
    0.0003644        10545.     28941139.     8.5196288     0.0031043     -0.010013     3.9991133
-60.000000 CYT
    0.0003944        10567.     26794426.     8.4236884     0.0033221     -0.010875     3.9966096
-60.000000 CYT
    0.0004244        10585.     24942084.     8.3398606     0.0035392     -0.011738     3.9879578
-60.000000 CYT
    0.0004544        10601.     23329960.     8.2736862     0.0037594     -0.012598     3.9999293
-60.000000 CYT
    0.0004844        10601.     21885008.     8.2553526     0.0039987     -0.013439     3.9949553
-60.000000 CYT


Axial Thrust Force =    295.890 kips

    Bending       Bending       Bending      Depth to      Max Comp      Max Tens      Max Conc      Max
Steel  Run
   Curvature      Moment       Stiffness      N Axis        Strain        Strain        Stress        Stress
   Msg
    rad/in.       in-kip        kip-in2         in           in/in         in/in          ksi           ksi

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  6.25000E-07   225.7927934    361268469.   123.4548576    0.00007716    0.00005466     0.3200951
2.1625818
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   0.00000125   451.5831204    361266496.    70.7468899    0.00008843    0.00004343     0.3653606
2.4144998
   0.00000188   677.3623026    361259895.    53.1862148    0.00009972    0.00003222     0.4104112
2.6668879
   0.00000250   903.1247683    361249907.    44.4123631     0.0001110    0.00002103     0.4552456
2.9197463
   0.00000313        1129.    361236782.    39.1532413     0.0001224    0.00000985     0.4998625
3.1730750
   0.00000375        1355.    361220595.    35.6514849     0.0001337   -0.00000131     0.5442608
3.4268740
   0.00000438        1580.    361189699.    33.1537808     0.0001450   -0.00001245     0.5884366
3.6811235
   0.00000500        1806.    361104678.    31.2829824     0.0001564   -0.00002359     0.6323764
3.9357325
   0.00000563        2030.    360948199.    29.8295664     0.0001678   -0.00003471     0.6760673
4.1906105
   0.00000625        2255.    360721907.    28.6679661     0.0001792   -0.00004583     0.7195001
4.4456939
   0.00000688        2478.    360433299.    27.7165094     0.0001906   -0.00005695     0.7626682
4.7009367
   0.00000750        2701.    360091206.    26.9269732     0.0002020   -0.00006805     0.8055671
4.9563067
   0.00000813        2923.    359703917.    26.2588515     0.0002134   -0.00007915     0.8481934
5.2117811
   0.00000875        3144.    359278644.    25.6861806     0.0002248   -0.00009025     0.8905447
5.4673434
   0.00000938        3364.    358821423.    25.1900476     0.0002362     -0.000101     0.9326193
5.7229817
   0.00001000        3364.    336395084.    23.1041703     0.0002310     -0.000129     0.9131738
5.4996094 C
   0.00001063        3364.    316607138.    22.5447011     0.0002395     -0.000143     0.9443334
5.6709870 C
   0.00001125        3364.    299017852.    22.0341597     0.0002479     -0.000157     0.9747761
5.8379696 C
   0.00001188        3364.    283280071.    21.5662631     0.0002561     -0.000171     1.0045899
6.0011875 C
   0.00001250        3364.    269116067.    21.1359243     0.0002642     -0.000186     1.0338316
6.1610347 C
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   0.00001313        3364.    256301016.    20.7380740    0.0002722    -0.000200    1.0625275
6.3176714 C
   0.00001375        3364.    244650970.    20.3688620    0.0002801    -0.000215    1.0907058
6.4712766 C
   0.00001438        3364.    234013971.    20.0249514    0.0002879    -0.000230    1.1183968
6.6220495 C
   0.00001500        3364.    224263389.    19.7036901    0.0002956    -0.000244    1.1456327
6.7702108 C
   0.00001563        3364.    215292854.    19.4029014    0.0003032    -0.000259    1.1724483
6.9160050 C
   0.00001625        3378.    207898810.    19.1207970    0.0003107    -0.000274    1.1988806
7.0597018 C
   0.00001688        3436.    203629568.    18.8559097    0.0003182    -0.000289    1.2249695
7.2015987 C
   0.00001750        3493.    199582861.    18.6054868    0.0003256    -0.000304    1.2506622
7.3412344 C
   0.00001813        3548.    195750655.    18.3687106    0.0003329    -0.000320    1.2760057
7.4789660 C
   0.00001875        3603.    192137255.    18.1457912    0.0003402    -0.000335    1.3011058
7.6156490 C
   0.00001938        3656.    188693973.    17.9334511    0.0003475    -0.000350    1.3258349
-7.824974 C
   0.00002000        3709.    185435214.    17.7326370    0.0003547    -0.000365    1.3503284
-8.193871 C
   0.00002063        3761.    182336395.    17.5417087    0.0003618    -0.000381    1.3745479
-8.564128 C
   0.00002125        3812.    179385119.    17.3597775    0.0003689    -0.000396    1.3984938
-8.935762 C
   0.00002188        3863.    176574800.    17.1865166    0.0003760    -0.000412    1.4222017
-9.308490 C
   0.00002250        3913.    173893457.    17.0210625    0.0003830    -0.000427    1.4456623
-9.682405 C
   0.00002313        3962.    171328424.    16.8625950    0.0003899    -0.000443    1.4688631
-10.057632 C
   0.00002375        4011.    168887957.    16.7119182    0.0003969    -0.000458    1.4919137
-10.433241 C
   0.00002438        4059.    166534398.    16.5660026    0.0004038    -0.000474    1.5146183
-10.810938 C
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   0.00002563        4155.    162141470.    16.2936982     0.0004175     -0.000505     1.5595621
-11.567693 C
   0.00002688        4249.    158100322.    16.0426675     0.0004311     -0.000536     1.6037385
-12.327605 C
   0.00002813        4341.    154353505.    15.8086724     0.0004446     -0.000568     1.6470294
-13.091815 C
   0.00002938        4433.    150896277.    15.5927082     0.0004580     -0.000599     1.6897395
-13.857699 C
   0.00003063        4523.    147678850.    15.3907080     0.0004713     -0.000631     1.7317181
-14.626675 C
   0.00003188        4612.    144684326.    15.2024306     0.0004846     -0.000663     1.7730727
-15.397841 C
   0.00003313        4700.    141889492.    15.0259400     0.0004977     -0.000695     1.8138319
-16.170995 C
   0.00003438        4788.    139274713.    14.8607886     0.0005108     -0.000727     1.8540069
-16.946089 C
   0.00003563        4874.    136819705.    14.7049433     0.0005239     -0.000759     1.8935827
-17.723318 C
   0.00003688        4961.    134522619.    14.5592902     0.0005369     -0.000791     1.9327631
-18.500805 C
   0.00003813        5046.    132345530.    14.4201043     0.0005498     -0.000823     1.9711910
-19.281985 C
   0.00003938        5131.    130303109.    14.2899936     0.0005627     -0.000855     2.0093010
-20.062752 C
   0.00004063        5215.    128371766.    14.1665377     0.0005755     -0.000887     2.0468870
-20.845110 C
   0.00004188        5299.    126538278.    14.0486255     0.0005883     -0.000919     2.0838902
-21.629688 C
   0.00004313        5382.    124807919.    13.9378745     0.0006011     -0.000951     2.1205803
-22.413859 C
   0.00004438        5466.    123166707.    13.8327852     0.0006138     -0.000984     2.1568421
-23.198771 C
   0.00004563        5548.    121597784.    13.7312625     0.0006265     -0.001016     2.1924654
-23.986586 C
   0.00004688        5630.    120109712.    13.6354503     0.0006392     -0.001048     2.2277802
-24.773998 C
   0.00004813        5712.    118696175.    13.5449054     0.0006518     -0.001081     2.2627856
-25.561005 C
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   0.00004938        5794.    117344021.    13.4577921     0.0006645     -0.001113     2.2972846
-26.349660 C
   0.00005063        5875.    116048229.    13.3737536     0.0006770     -0.001145     2.3312674
-27.140118 C
   0.00005188        5956.    114812390.    13.2940355     0.0006896     -0.001178     2.3649453
-27.930173 C
   0.00005313        6037.    113632257.    13.2183294     0.0007022     -0.001210     2.3983172
-28.719824 C
   0.00005438        6117.    112503976.    13.1463614     0.0007148     -0.001243     2.4313822
-29.509070 C
   0.00005563        6197.    111413701.    13.0756070     0.0007273     -0.001275     2.4638072
-30.301572 C
   0.00005688        6277.    110368099.    13.0079856     0.0007398     -0.001308     2.4958968
-31.094038 C
   0.00005813        6357.    109365279.    12.9435128     0.0007523     -0.001340     2.5276837
-31.886098 C
   0.00005938        6436.    108402529.    12.8819911     0.0007649     -0.001373     2.5591669
-32.677751 C
   0.00006063        6516.    107477352.    12.8232453     0.0007774     -0.001405     2.5903453
-33.468995 C
   0.00006188        6595.    106585542.    12.7666073     0.0007899     -0.001438     2.6211424
-34.260708 C
   0.00006313        6674.    105720878.    12.7108604     0.0008024     -0.001470     2.6513895
-35.054892 C
   0.00006438        6752.    104887835.    12.6574991     0.0008148     -0.001503     2.6813357
-35.848665 C
   0.00006563        6831.    104084606.    12.6063877     0.0008273     -0.001535     2.7109800
-36.642025 C
   0.00006688        6909.    103309510.    12.5574011     0.0008398     -0.001568     2.7403213
-37.434970 C
   0.00006813        6987.    102560986.    12.5104233     0.0008523     -0.001600     2.7693588
-38.227496 C
   0.00006938        7065.    101837590.    12.4653470     0.0008648     -0.001633     2.7980913
-39.019603 C
   0.00007063        7143.    101137973.    12.4220809     0.0008773     -0.001665     2.8265178
-39.811289 C
   0.00007188        7220.    100455782.    12.3789436     0.0008897     -0.001698     2.8543810
-40.605825 C
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   0.00007313         7298.     99794936.    12.3374020     0.0009022     -0.001730     2.8819291
-41.400107 C
   0.00007438         7375.     99154611.    12.2974548     0.0009146     -0.001763     2.9091746
-42.193961 C
   0.00007938         7682.     96778950.    12.1521243     0.0009646     -0.001893     3.0151098
-45.365052 C
   0.00008438         7987.     94656726.    12.0255138     0.0010147     -0.002023     3.1158848
-48.532510 C
   0.00008938         8289.     92740074.    11.9124562     0.0010647     -0.002153     3.2111206
-51.701533 C
   0.00009438         8589.     91004347.    11.8140847     0.0011150     -0.002283     3.3013836
-54.863146 C
   0.00009938         8886.     89421748.    11.7282588     0.0011655     -0.002412     3.3865995
-58.017161 C
    0.0001044         9180.     87954378.    11.6506457     0.0012160     -0.002541     3.4662742
-60.000000 CY
    0.0001094         9384.     85800606.    11.5481808     0.0012631     -0.002674     3.5353720
-60.000000 CY
    0.0001144         9541.     83421843.    11.4396312     0.0013084     -0.002809     3.5973697
-60.000000 CY
    0.0001194         9697.     81230817.    11.3419667     0.0013539     -0.002944     3.6551937
-60.000000 CY
    0.0001244         9850.     79194943.    11.2495142     0.0013992     -0.003078     3.7081633
-60.000000 CY
    0.0001294        10001.     77305964.    11.1658348     0.0014446     -0.003213     3.7569385
-60.000000 CY
    0.0001344        10151.     75543308.    11.0898380     0.0014902     -0.003347     3.8014419
-60.000000 CY
    0.0001394        10259.     73606225.    11.0036762     0.0015336     -0.003484     3.8396096
-60.000000 CY
    0.0001444        10321.     71489024.    10.9026681     0.0015741     -0.003623     3.8714236
-60.000000 CY
    0.0001494        10378.     69475705.    10.8063989     0.0016142     -0.003763     3.8995256
-60.000000 CY
    0.0001544        10434.     67587878.    10.7175204     0.0016545     -0.003903     3.9242726
-60.000000 CY
    0.0001594        10489.     65813622.    10.6354135     0.0016950     -0.004042     3.9456180
-60.000000 CY
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    0.0001644       10542.     64134489.    10.5556303     0.0017351     -0.004182     3.9632602
-60.000000 CY
    0.0001694       10594.     62548130.    10.4807597     0.0017752     -0.004322     3.9774653
-60.000000 CY
    0.0001744       10645.     61048330.    10.4102665     0.0018153     -0.004462     3.9882598
-60.000000 CY
    0.0001794       10696.     59627757.    10.3455446     0.0018557     -0.004602     3.9955935
-60.000000 CY
    0.0001844       10745.     58279864.    10.2853788     0.0018964     -0.004741     3.9994144
-60.000000 CY
    0.0001894       10794.     56995442.    10.2281739     0.0019370     -0.004881     3.9970351
-60.000000 CY
    0.0001944       10840.     55770067.    10.1742556     0.0019776     -0.005020     3.9997917
-60.000000 CY
    0.0001994       10886.     54601501.    10.1231235     0.0020183     -0.005159     3.9974730
-60.000000 CY
    0.0002044       10931.     53486159.    10.0755448     0.0020592     -0.005298     3.9998635
-60.000000 CY
    0.0002094       10975.     52419608.    10.0313940     0.0021003     -0.005437     3.9972164
-60.000000 CY
    0.0002144       11019.     51399270.     9.9902783     0.0021417     -0.005576     3.9997565
-60.000000 CY
    0.0002194       11061.     50421481.     9.9521062     0.0021832     -0.005714     3.9961638
-60.000000 CY
    0.0002244       11103.     49483900.     9.9165810     0.0022250     -0.005852     3.9993127
-60.000000 CY
    0.0002294       11144.     48582915.     9.8823074     0.0022668     -0.005991     3.9972109
-60.000000 CY
    0.0002344       11183.     47715784.     9.8493605     0.0023084     -0.006129     3.9980280
-60.000000 CY
    0.0002394       11221.     46876993.     9.8176662     0.0023501     -0.006267     3.9998847
-60.000000 CY
    0.0002444       11256.     46059903.     9.7866751     0.0023916     -0.006406     3.9950300
-60.000000 CY
    0.0002494       11283.     45245424.     9.7529083     0.0024321     -0.006545     3.9984053
-60.000000 CY
    0.0002544       11306.     44446014.     9.7185154     0.0024721     -0.006685     3.9999015
-60.000000 CY
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    0.0002594        11319.     43640540.     9.6798494     0.0025107     -0.006827     3.9945023
-60.000000 CY
    0.0002644        11330.     42857537.     9.6421489     0.0025491     -0.006968     3.9970850
-60.000000 CY
    0.0002694        11338.     42090633.     9.6039838     0.0025871     -0.007110     3.9992100
-60.000000 CY
    0.0002744        11346.     41350452.     9.5673334     0.0026250     -0.007252     3.9999954
-60.000000 CY
    0.0003044        11380.     37388565.     9.3667055     0.0028510     -0.008107     3.9934819
-60.000000 CY
    0.0003344        11408.     34118560.     9.2116385     0.0030801     -0.008957     3.9944808
-60.000000 CYT
    0.0003644        11430.     31368001.     9.0799576     0.0033085     -0.009809     3.9916365
-60.000000 CYT
    0.0003944        11447.     29026108.     8.9721368     0.0035384     -0.010659     3.9939045
-60.000000 CYT
    0.0004244        11462.     27009296.     8.8854430     0.0037708     -0.011507     3.9992875
-60.000000 CYT
    0.0004544        11462.     25226013.     8.9133442     0.0040500     -0.012307     3.9978007
60.0000000 CYT


--------------------------------------------------------------------------------
   Summary of Results for Nominal Moment Capacity for Section 3
--------------------------------------------------------------------------------

Moment values interpolated at maximum compressive strain = 0.003
or maximum developed moment if pile fails at smaller strains.

 Load           Axial Thrust        Nominal Mom. Cap.      Max. Comp.      Max. Tens.
  No.              kips                in-kip               Strain          Strain
 ----         ----------------     ------------------     ------------    ------------
   1              212.150             10532.895          0.00300000     -0.00959730
   2              295.890             11398.514          0.00300000     -0.00865979

Note that the values of moment capacity in the table above are not
factored by a strength reduction factor (phi-factor).
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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	212.150000	10533.	137.897500	6846.	89062138.
2	0.65	295.890000	11399.	192.328500	7409.	98888514.
1	0.75	212.150000	10533.	159.112500	7900.	83911158.
2	0.75	295.890000	11399.	221.917500	8549.	91233835.
1	0.90	212.150000	10533.	190.935000	9480.	65371459.
2	0.90	295.890000	11399.	266.301000	10259.	73609913.

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	11.1000	0.00	N.A.	Yes	N.A.	N.A.
2	13.1000	2.0000	No	Yes	N.A.	N.A.

3	16.8000	5.7000	No	Yes	N.A.	N.A.
4	25.1000	14.0000	No	Yes	N.A.	N.A.
5	29.8000	18.7000	No	Yes	N.A.	N.A.
6	31.4000	20.3000	No	Yes	N.A.	N.A.
7	33.1000	22.0000	No	Yes	N.A.	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 = 15820.0 lbs
Applied moment at pile head = 0.0 in-lbs
Axial thrust load on pile head = 212150.0 lbs

Depth X	Deflect. y	Bending Moment	Shear Force	Slope S	Total Stress	Bending Stiffness	Soil Res. p	Soil Spr. Es*H	Distrib. Lat. Load
feet	inches	in-lbs	lbs	radians	psi*	lb-in^2	lb/inch	lb/inch	lb/inch
0.00	0.04974	-0.00138	15820.	-4.24E-04	33.6746	5.80E+13	0.00	0.00	25.0118
0.4942	0.04723	94792.	15972.	-4.24E-04	33.7807	5.80E+13	0.00	0.00	26.2473

0.9884	0.04471	190508.	16133.	-4.24E-04	33.8879	5.80E+13	0.00	0.00
27.8947								
1.4826	0.04220	287205.	16303.	-4.24E-04	33.9961	5.80E+13	0.00	0.00
29.5420								
1.9768	0.03969	384940.	16483.	-4.24E-04	34.1056	5.80E+13	0.00	0.00
31.1894								
2.4710	0.03717	483773.	16673.	-4.24E-04	34.2162	5.80E+13	0.00	0.00
32.8367								
2.9652	0.03466	583760.	16872.	-4.24E-04	34.3281	5.80E+13	0.00	0.00
34.4841								
3.4594	0.03215	684960.	17082.	-4.24E-04	26.0228	7.73E+13	0.00	0.00
36.1314								
3.9536	0.02964	787431.	17301.	-4.23E-04	26.1375	7.73E+13	0.00	0.00
37.7787								
4.4478	0.02713	891230.	17530.	-4.23E-04	26.2537	7.73E+13	0.00	0.00
39.4261								
4.9420	0.02462	996416.	17769.	-4.23E-04	26.3715	7.73E+13	0.00	0.00
41.0734								
5.4362	0.02211	1103046.	18017.	-4.23E-04	26.4908	7.73E+13	0.00	0.00
42.7208								
5.9304	0.01960	1211179.	18275.	-4.23E-04	26.6119	7.73E+13	0.00	0.00
44.3681								
6.4246	0.01709	1320872.	18543.	-4.12E-04	0.00	3.65E+11	0.00	0.00
46.0155								
6.9188	0.01470	1432156.	18821.	-3.90E-04	0.00	3.65E+11	0.00	0.00
47.6628								
7.4130	0.01246	1545087.	19109.	-3.66E-04	0.00	3.64E+11	0.00	0.00
49.3101								
7.9072	0.01037	1659721.	19406.	-3.40E-04	0.00	3.64E+11	0.00	0.00
50.9575								
8.4014	0.00843	1776113.	19713.	-3.12E-04	0.00	3.64E+11	0.00	0.00
52.6048								
8.8957	0.00667	1894319.	20030.	-2.82E-04	0.00	3.64E+11	0.00	0.00
54.2522								
9.3899	0.00509	2014394.	20356.	-2.50E-04	0.00	3.64E+11	0.00	0.00
55.8995								
9.8841	0.00370	2136394.	20693.	-2.16E-04	0.00	3.64E+11	0.00	0.00
57.5469								

10.3783	0.00253	2260374.	21039.	-1.80E-04	0.00	3.63E+11	0.00	0.00	59.1942
10.8725	0.00157	2386389.	21388.	-1.42E-04	0.00	3.63E+11	0.00	0.00	58.4015
11.3667	8.37E-04	2514409.	-17313.	-1.02E-04	0.00	3.63E+11	-13110.	9.29E+07	0.00
11.8609	3.52E-04	2181302.	-75764.	-6.39E-05	0.00	3.63E+11	-6602.	1.11E+08	0.00
12.3551	7.87E-05	1615942.	-100432.	-3.30E-05	0.00	3.64E+11	-1717.	1.29E+08	0.00
12.8493	-3.90E-05	990178.	-102641.	-1.18E-05	0.00	3.65E+11	971.4065	1.48E+08	0.00
13.3435	-6.13E-05	398559.	-78346.	-5.12E-07	0.00	3.65E+11	7222.	6.99E+08	0.00
13.8377	-4.51E-05	60926.	-39436.	3.22E-06	0.00	3.65E+11	5900.	7.76E+08	0.00
14.3319	-2.31E-05	-69196.	-12112.	3.16E-06	0.00	3.65E+11	3315.	8.52E+08	0.00
14.8261	-7.68E-06	-82735.	1286.	1.92E-06	0.00	3.65E+11	1203.	9.29E+08	0.00
15.3203	-2.77E-07	-53948.	4994.	8.10E-07	0.00	3.65E+11	46.9691	1.01E+09	0.00
15.8145	1.92E-06	-23508.	4091.	1.80E-07	0.00	3.65E+11	-351.310	1.08E+09	0.00
16.3087	1.86E-06	-5423.	1972.	-5.53E-08	0.00	3.65E+11	-363.271	1.16E+09	0.00
16.8029	1.27E-06	-113.845	616.0544	-1.00E-07	0.00	3.65E+11	-94.132	4.40E+08	0.00
17.2971	6.68E-07	1884.	180.7754	-8.59E-08	0.00	3.65E+11	-52.663	4.68E+08	0.00
17.7913	2.50E-07	2031.	-37.122	-5.41E-08	0.00	3.65E+11	-20.822	4.95E+08	0.00
18.2855	2.68E-08	1444.	-105.868	-2.58E-08	0.00	3.65E+11	-2.363	5.22E+08	0.00
18.7797	-5.66E-08	774.9016	-97.326	-7.76E-09	0.00	3.65E+11	5.2435	5.50E+08	0.00
19.2739	-6.53E-08	289.9264	-62.951	8.93E-10	0.00	3.65E+11	6.3493	5.77E+08	0.00

19.7681	-4.60E-08	28.2502	-30.228	3.48E-09	0.00	3.65E+11	4.6863	6.04E+08	0.00
20.2623	-2.40E-08	-68.608	-8.862	3.15E-09	0.00	3.65E+11	2.5191	6.23E+08	0.00
20.7565	-8.61E-09	-76.870	1.2879	1.97E-09	0.00	3.65E+11	0.9040	6.23E+08	0.00
21.2507	-6.40E-10	-53.338	4.1677	9.10E-10	0.00	3.65E+11	0.06722	6.23E+08	0.00
21.7449	2.19E-09	-27.440	3.6865	2.53E-10	0.00	3.65E+11	-0.230	6.23E+08	0.00
22.2391	2.37E-09	-9.613	2.2695	-4.78E-11	0.00	3.65E+11	-0.248	6.23E+08	0.00
22.7333	1.62E-09	-0.522	1.0289	-1.30E-10	0.00	3.65E+11	-0.170	6.23E+08	0.00
23.2275	8.21E-10	2.5916	0.2692	-1.13E-10	0.00	3.65E+11	-0.08625	6.23E+08	0.00
23.7217	2.74E-10	2.6716	-0.07185	-7.06E-11	0.00	3.65E+11	-0.02877	6.23E+08	0.00
24.2159	-1.58E-11	1.7396	-0.152	-3.47E-11	0.00	3.65E+11	0.00165	6.23E+08	0.00
24.7101	-1.38E-10	0.8658	-0.104	-1.35E-11	0.00	3.65E+11	0.01447	6.23E+08	0.00
25.2043	-1.76E-10	0.5007	-0.05320	-2.43E-12	0.00	3.65E+11	0.00282	9.49E+07	0.00
25.6986	-1.67E-10	0.2348	-0.03693	3.55E-12	0.00	3.65E+11	0.00267	9.49E+07	0.00
26.1928	-1.34E-10	0.06262	-0.02266	5.97E-12	0.00	3.65E+11	0.00215	9.49E+07	0.00
26.6870	-9.58E-11	-0.03404	-0.01175	6.20E-12	0.00	3.65E+11	0.00153	9.49E+07	0.00
27.1812	-6.06E-11	-0.07681	-0.00433	5.30E-12	0.00	3.65E+11	9.70E-04	9.49E+07	0.00
27.6754	-3.29E-11	-0.08546	1.03E-04	3.98E-12	0.00	3.65E+11	5.26E-04	9.49E+07	0.00
28.1696	-1.34E-11	-0.07560	0.00230	2.67E-12	0.00	3.65E+11	2.15E-04	9.49E+07	0.00
28.6638	-1.21E-12	-0.05819	0.00299	1.58E-12	0.00	3.65E+11	1.93E-05	9.49E+07	0.00

29.1580	5.38E-12	-0.04010	0.00280	0.00	0.00	3.65E+11	-8.61E-05	9.49E+07	0.00
29.6522	8.10E-12	-0.02504	0.00216	0.00	0.00	3.65E+11	-1.30E-04	9.49E+07	0.00
30.1464	8.41E-12	-0.01454	0.00155	0.00	0.00	3.65E+11	-7.57E-05	5.34E+07	0.00
30.6406	7.31E-12	-0.00670	0.00113	0.00	0.00	3.65E+11	-6.58E-05	5.34E+07	0.00
31.1348	5.57E-12	-0.00117	7.83E-04	0.00	0.00	3.65E+11	-5.01E-05	5.34E+07	0.00
31.6290	3.72E-12	0.00260	4.58E-04	0.00	0.00	3.65E+11	-5.95E-05	9.49E+07	0.00
32.1232	2.12E-12	0.00427	1.81E-04	0.00	0.00	3.65E+11	-3.39E-05	9.49E+07	0.00
32.6174	0.00	0.00475	3.72E-05	0.00	0.00	3.65E+11	-1.48E-05	9.49E+07	0.00
33.1116	0.00	0.00471	-2.61E-04	0.00	0.00	3.65E+11	-8.58E-05	2.67E+09	0.00
33.6058	0.00	0.00165	-3.97E-04	0.00	0.00	3.65E+11	3.99E-05	2.67E+09	0.00
34.1000	0.00	0.00	0.00	0.00	0.00	3.65E+11	9.40E-05	1.33E+09	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 = 0.04973836 inches
Computed slope at pile head = -0.0004238 radians
Maximum bending moment = 2514409. inch-lbs
Maximum shear force = -102641. lbs
Depth of maximum bending moment = 11.36666667 feet below pile head

Depth of maximum shear force = 12.84927536 feet below pile head
Number of iterations = 6
Number of zero deflection points = 7
Pile deflection at ground = 0.00123029 inches

Pile-head Deflection vs. Pile Length for Load Case 1

Boundary Condition Type 1, Shear and Moment

Shear = 15820. lbs
Moment = 0. in-lbs
Axial Load = 212150. lbs

Pile Length feet	Pile Head Deflection inches	Maximum Moment ln-lbs	Maximum Shear lbs
34.10000	0.04973836	2514409.	-102641.
32.39500	0.04951818	2488683.	-103513.
30.69000	0.04754013	2449781.	-97550.
28.98500	0.05004002	2507998.	-102599.
27.28000	0.05155680	2540153.	-105945.
25.57500	0.04752905	2449784.	-97758.
23.87000	0.05135147	2527323.	-109050.
22.16500	0.04967718	2482299.	-104121.
20.46000	0.04973313	2488689.	-102698.
18.75500	0.04827164	2456345.	-100479.
17.05000	0.04829776	2449950.	-99404.
15.34500	0.04819321	2449926.	-102316.
13.64000	0.05109323	2488887.	-122136.

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 = 19120.0 lbs
Applied moment at pile head = 0.0 in-lbs
Axial thrust load on pile head = 295890.0 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	0.06288	-0.00174	19120.	-5.35E-04	46.9667	5.80E+13	0.00	0.00	39.6178
0.4942	0.05970	115026.	19360.	-5.35E-04	47.0954	5.80E+13	0.00	0.00	41.4710
0.9884	0.05653	231510.	19614.	-5.35E-04	47.2258	5.80E+13	0.00	0.00	43.9420
1.4826	0.05335	349539.	19882.	-5.35E-04	47.3580	5.80E+13	0.00	0.00	46.4130
1.9768	0.05018	469201.	20164.	-5.35E-04	47.4920	5.80E+13	0.00	0.00	48.8841
2.4710	0.04701	590582.	20461.	-5.35E-04	47.6278	5.80E+13	0.00	0.00	51.3551
2.9652	0.04384	713769.	20773.	-5.35E-04	47.7658	5.80E+13	0.00	0.00	53.8261
3.4594	0.04066	838849.	21100.	-5.35E-04	36.1641	7.73E+13	0.00	0.00	56.2971
3.9536	0.03749	965909.	21441.	-5.35E-04	36.3064	7.73E+13	0.00	0.00	58.7681
4.4478	0.03432	1095036.	21797.	-5.35E-04	36.4509	7.73E+13	0.00	0.00	61.2391

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    4.9420    0.03115   1226316.     22167.  -5.35E-04    36.5979   7.73E+13       0.00       0.00
63.7101
    5.4362    0.02798   1359837.     22553.  -5.35E-04    36.7474   7.73E+13       0.00       0.00
66.1812
    5.9304    0.02481   1495685.     22952.  -5.34E-04    36.8995   7.73E+13       0.00       0.00
68.6522
    6.4246    0.02164   1633947.     23367.  -5.21E-04       0.00   3.61E+11       0.00       0.00
71.1232
    6.9188    0.01863   1774664.     23796.  -4.93E-04       0.00   3.61E+11       0.00       0.00
73.5942
    7.4130    0.01579   1917918.     24240.  -4.63E-04       0.00   3.61E+11       0.00       0.00
76.0652
    7.9072    0.01314   2063792.     24698.  -4.30E-04       0.00   3.61E+11       0.00       0.00
78.5362
    8.4014    0.01070   2212369.     25171.  -3.95E-04       0.00   3.61E+11       0.00       0.00
81.0072
    8.8957    0.00846   2363730.     25659.  -3.57E-04       0.00   3.61E+11       0.00       0.00
83.4783
    9.3899    0.00646   2517960.     26161.  -3.17E-04       0.00   3.60E+11       0.00       0.00
85.9493
    9.8841    0.00470   2675139.     26678.  -2.74E-04       0.00   3.60E+11       0.00       0.00
88.4203
   10.3783    0.00321   2835351.     27210.  -2.29E-04       0.00   3.60E+11       0.00       0.00
90.8913
   10.8725    0.00199   2998678.     27745.  -1.81E-04       0.00   3.60E+11       0.00       0.00
89.6192
   11.3667    0.00106   3165070.    -21302.  -1.30E-04       0.00   3.59E+11    -16631.   9.29E+07
0.00
   11.8609   4.47E-04   2746474.    -95420.  -8.12E-05       0.00   3.60E+11     -8365.   1.11E+08
0.00
   12.3551   9.93E-05   2033592.   -126649.  -4.18E-05       0.00   3.61E+11     -2166.   1.29E+08
0.00
   12.8493  -4.97E-05   1244459.   -129405.  -1.49E-05       0.00   3.61E+11      1237.   1.48E+08
0.00
   13.3435  -7.76E-05    498792.    -98631.  -6.06E-07       0.00   3.61E+11      9141.   6.99E+08
0.00
   13.8377  -5.69E-05     74614.    -49459.   4.10E-06       0.00   3.61E+11      7442.   7.76E+08
0.00
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14.3319	-2.90E-05	-87843.	-15052.	3.99E-06	0.00	3.61E+11	4162.	8.52E+08
0.00								
14.8261	-9.56E-06	-103932.	1728.	2.42E-06	0.00	3.61E+11	1497.	9.29E+08
0.00								
15.3203	-2.78E-07	-67353.	6308.	1.01E-06	0.00	3.61E+11	47.2007	1.01E+09
0.00								
15.8145	2.44E-06	-29112.	5126.	2.20E-07	0.00	3.61E+11	-446.041	1.08E+09
0.00								
16.3087	2.33E-06	-6557.	2453.	-7.30E-08	0.00	3.61E+11	-455.492	1.16E+09
0.00								
16.8029	1.58E-06	-22.320	754.8327	-1.27E-07	0.00	3.61E+11	-117.056	4.40E+08
0.00								
17.2971	8.23E-07	2396.	215.3545	-1.07E-07	0.00	3.61E+11	-64.880	4.68E+08
0.00								
17.7913	3.02E-07	2532.	-51.789	-6.70E-08	0.00	3.61E+11	-25.213	4.95E+08
0.00								
18.2855	2.78E-08	1782.	-133.819	-3.16E-08	0.00	3.61E+11	-2.451	5.22E+08
0.00								
18.7797	-7.30E-08	945.2511	-121.034	-9.24E-09	0.00	3.61E+11	6.7630	5.50E+08
0.00								
19.2739	-8.18E-08	346.3956	-77.393	1.36E-09	0.00	3.61E+11	7.9546	5.77E+08
0.00								
19.7681	-5.68E-08	27.2937	-36.635	4.43E-09	0.00	3.61E+11	5.7909	6.04E+08
0.00								
20.2623	-2.92E-08	-88.142	-10.361	3.93E-09	0.00	3.61E+11	3.0699	6.23E+08
0.00								
20.7565	-1.02E-08	-95.607	1.9264	2.42E-09	0.00	3.61E+11	1.0738	6.23E+08
0.00								
21.2507	-5.24E-10	-65.302	5.2739	1.10E-09	0.00	3.61E+11	0.05507	6.23E+08
0.00								
21.7449	2.82E-09	-33.058	4.5588	2.93E-10	0.00	3.61E+11	-0.296	6.23E+08
0.00								
22.2391	2.95E-09	-11.231	2.7627	-7.07E-11	0.00	3.61E+11	-0.310	6.23E+08
0.00								
22.7333	1.98E-09	-0.290	1.2277	-1.65E-10	0.00	3.61E+11	-0.208	6.23E+08
0.00								
23.2275	9.87E-10	3.3313	0.3032	-1.40E-10	0.00	3.61E+11	-0.104	6.23E+08
0.00								

23.7217	3.17E-10	3.3064	-0.103	-8.59E-11	0.00	3.61E+11	-0.03331	6.23E+08	0.00
24.2159	-3.10E-11	2.1099	-0.192	-4.14E-11	0.00	3.61E+11	0.00326	6.23E+08	0.00
24.7101	-1.74E-10	1.0279	-0.128	-1.57E-11	0.00	3.61E+11	0.01826	6.23E+08	0.00
25.2043	-2.17E-10	0.5881	-0.06387	-2.39E-12	0.00	3.61E+11	0.00347	9.49E+07	0.00
25.6986	-2.02E-10	0.2703	-0.04399	4.65E-12	0.00	3.61E+11	0.00324	9.49E+07	0.00
26.1928	-1.62E-10	0.06632	-0.02673	7.42E-12	0.00	3.61E+11	0.00258	9.49E+07	0.00
26.6870	-1.14E-10	-0.04678	-0.01364	7.58E-12	0.00	3.61E+11	0.00183	9.49E+07	0.00
27.1812	-7.17E-11	-0.09555	-0.00482	6.41E-12	0.00	3.61E+11	0.00115	9.49E+07	0.00
27.6754	-3.83E-11	-0.104	3.97E-04	4.77E-12	0.00	3.61E+11	6.13E-04	9.49E+07	0.00
28.1696	-1.51E-11	-0.09086	0.00293	3.17E-12	0.00	3.61E+11	2.41E-04	9.49E+07	0.00
28.6638	0.00	-0.06925	0.00368	1.86E-12	0.00	3.61E+11	1.10E-05	9.49E+07	0.00
29.1580	6.96E-12	-0.04725	0.00338	0.00	0.00	3.61E+11	-1.11E-04	9.49E+07	0.00
29.6522	1.00E-11	-0.02916	0.00258	0.00	0.00	3.61E+11	-1.60E-04	9.49E+07	0.00
30.1464	1.02E-11	-0.01669	0.00183	0.00	0.00	3.61E+11	-9.19E-05	5.34E+07	0.00
30.6406	8.79E-12	-0.00746	0.00132	0.00	0.00	3.61E+11	-7.91E-05	5.34E+07	0.00
31.1348	6.65E-12	-0.00101	9.10E-04	0.00	0.00	3.61E+11	-5.98E-05	5.34E+07	0.00
31.6290	4.41E-12	0.00333	5.23E-04	0.00	0.00	3.61E+11	-7.05E-05	9.49E+07	0.00
32.1232	2.49E-12	0.00520	1.96E-04	0.00	0.00	3.61E+11	-3.98E-05	9.49E+07	0.00
32.6174	1.08E-12	0.00566	2.68E-05	0.00	0.00	3.61E+11	-1.73E-05	9.49E+07	0.00

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   33.1116       0.00    0.00551  -3.15E-04       0.00       0.00   3.61E+11  -9.81E-05   2.67E+09
0.00
   33.6058       0.00    0.00192  -4.65E-04       0.00       0.00   3.61E+11   4.76E-05   2.67E+09
0.00
   34.1000       0.00       0.00       0.00       0.00       0.00   3.61E+11   1.09E-04   1.33E+09
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             =     0.06287516 inches
Computed slope at pile head      =     -0.0005351 radians
Maximum bending moment           =       3165070. inch-lbs
Maximum shear force              =       -129405. lbs
Depth of maximum bending moment  =    11.36666667 feet below pile head
Depth of maximum shear force     =    12.84927536 feet below pile head
Number of iterations             =              6
Number of zero deflection points =              7
Pile deflection at ground        =     0.00156135 inches



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            Pile-head Deflection vs. Pile Length for Load Case 2
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Boundary Condition Type 1, Shear and Moment

Shear      =          19120. lbs
Moment     =              0. in-lbs
Axial Load =         295890. lbs
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Pile Length feet	Pile Head Deflection inches	Maximum Moment ln-lbs	Maximum Shear lbs
34.10000	0.06287516	3165070.	-129405.
32.39500	0.06256835	3131592.	-130489.
30.69000	0.06005305	3080822.	-122899.
28.98500	0.06325329	3156748.	-129377.
27.28000	0.06519374	3198648.	-133669.
25.57500	0.06004752	3080827.	-123164.
23.87000	0.06492465	3181955.	-137582.
22.16500	0.06277656	3123306.	-131287.
20.46000	0.06285920	3131612.	-129480.
18.75500	0.06099538	3089426.	-126645.
17.05000	0.06102382	3081116.	-125271.
15.34500	0.06089480	3081075.	-128974.
13.64000	0.06457115	3131972.	-153855.

Computed Values of Pile Loading and Deflection
for Lateral Loading for Load Case Number 3

Pile-head conditions are Displacement and Moment (Loading Type 4)
Displacement of pile head = 0.480000 inches
Moment at pile head = 0.0 in-lbs
Axial load at pile head = 212150.0 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

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      0.00     0.4800       0.00     47267.   -0.00410    33.6746   5.80E+13       0.00       0.00
25.0118
    0.4942     0.4557     285908.     47419.   -0.00410    33.9947   5.80E+13       0.00       0.00
26.2473
    0.9884     0.4314     572738.     47579.   -0.00410    34.3158   5.80E+13       0.00       0.00
27.8947
    1.4826     0.4071     860550.     47750.   -0.00410    34.6380   5.80E+13       0.00       0.00
29.5420
    1.9768     0.3828    1149400.     47930.   -0.00410    34.9614   5.80E+13       0.00       0.00
31.1894
    2.4710     0.3585    1439348.     48119.   -0.00410    35.2860   5.80E+13       0.00       0.00
32.8367
    2.9652     0.3342    1730450.     48319.   -0.00410    35.6119   5.80E+13       0.00       0.00
34.4841
    3.4594     0.3099    2022764.     48528.   -0.00410    27.5205   7.73E+13       0.00       0.00
36.1314
    3.9536     0.2856    2316349.     48748.   -0.00410    27.8492   7.73E+13       0.00       0.00
37.7787
    4.4478     0.2613    2611263.     48977.   -0.00410    28.1793   7.73E+13       0.00       0.00
39.4261
    4.9420     0.2370    2907563.     49215.   -0.00410    28.5111   7.73E+13       0.00       0.00
41.0734
    5.4362     0.2127    3205307.     49464.   -0.00410    28.8444   7.73E+13       0.00       0.00
42.7208
    5.9304     0.1884    3504553.     49722.   -0.00410    29.1794   7.73E+13       0.00       0.00
44.3681
    6.4246     0.1641    3805360.     49990.   -0.00401       0.00   1.29E+11       0.00       0.00
46.0155
    6.9188     0.1409    4107564.     50268.   -0.00382       0.00   1.21E+11       0.00       0.00
47.6628
    7.4130     0.1188    4411191.     50555.   -0.00360       0.00   1.14E+11       0.00       0.00
49.3101
    7.9072    0.09812    4716265.     50853.   -0.00336       0.00   1.09E+11       0.00       0.00
50.9575
    8.4014    0.07894    5022808.     51160.   -0.00309       0.00   1.05E+11       0.00       0.00
52.6048
    8.8957    0.06145    5330843.     51477.   -0.00279       0.00   1.01E+11       0.00       0.00
```

54.2522
9.3899 0.04581 5640393. 51803. -0.00247 0.00 9.79E+10 0.00 0.00
55.8995
9.8841 0.03220 5951479. 52140. -0.00211 0.00 9.52E+10 0.00 0.00
57.5469
10.3783 0.02078 6264122. 52486. -0.00172 0.00 9.28E+10 0.00 0.00
59.1942
10.8725 0.01175 6578344. 52834. -0.00131 0.00 9.07E+10 0.00 0.00
58.4015
11.3667 0.00526 6894078. -43623. -8.63E-04 0.00 8.88E+10 -32588. 3.67E+07
0.00
11.8609 0.00151 6063106. -224061. -4.42E-04 0.00 9.43E+10 -28263. 1.11E+08
0.00
12.3551 1.70E-05 4237635. -308965. -1.45E-04 0.00 1.18E+11 -370.148 1.29E+08
0.00
12.8493 -2.09E-04 2398877. -294608. -1.86E-05 0.00 3.63E+11 5212. 1.48E+08
0.00
13.3435 -2.03E-04 743374. -208058. 7.05E-06 0.00 3.65E+11 23977. 6.99E+08
0.00
13.8377 -1.26E-04 -68886. -88159. 1.25E-05 0.00 3.65E+11 16459. 7.76E+08
0.00
14.3319 -5.48E-05 -302297. -15981. 9.51E-06 0.00 3.65E+11 7883. 8.52E+08
0.00
14.8261 -1.30E-05 -258455. 13429. 4.96E-06 0.00 3.65E+11 2035. 9.29E+08
0.00
15.3203 3.94E-06 -143030. 17480. 1.69E-06 0.00 3.65E+11 -668.934 1.01E+09
0.00
15.8145 7.08E-06 -51129. 11662. 1.13E-07 0.00 3.65E+11 -1293. 1.08E+09
0.00
16.3087 5.29E-06 -4704. 4761. -3.40E-07 0.00 3.65E+11 -1034. 1.16E+09
0.00
16.8029 3.04E-06 5346. 1025. -3.35E-07 0.00 3.65E+11 -225.807 4.40E+08
0.00
17.2971 1.31E-06 7454. 48.7806 -2.31E-07 0.00 3.65E+11 -103.409 4.68E+08
0.00
17.7913 3.00E-07 5925. -332.077 -1.22E-07 0.00 3.65E+11 -25.032 4.95E+08
0.00
18.2855 -1.40E-07 3516. -369.652 -4.57E-08 0.00 3.65E+11 12.3604 5.22E+08

0.00
18.7797 -2.42E-07 1541. -266.592 -4.55E-09 0.00 3.65E+11 22.3959 5.50E+08
0.00
19.2739 -1.94E-07 353.7748 -144.113 1.09E-08 0.00 3.65E+11 18.9094 5.77E+08
0.00
19.7681 -1.13E-07 -168.375 -53.912 1.24E-08 0.00 3.65E+11 11.5103 6.04E+08
0.00
20.2623 -4.78E-08 -285.704 -4.905 8.67E-09 0.00 3.65E+11 5.0172 6.23E+08
0.00
20.7565 -1.02E-08 -226.571 13.1363 4.50E-09 0.00 3.65E+11 1.0670 6.23E+08
0.00
21.2507 5.61E-09 -129.908 14.5530 1.60E-09 0.00 3.65E+11 -0.589 6.23E+08
0.00
21.7449 8.86E-09 -53.964 10.0481 1.09E-10 0.00 3.65E+11 -0.930 6.23E+08
0.00
22.2391 6.90E-09 -10.730 5.1416 -4.17E-10 0.00 3.65E+11 -0.725 6.23E+08
0.00
22.7333 3.91E-09 7.0210 1.7759 -4.47E-10 0.00 3.65E+11 -0.410 6.23E+08
0.00
23.2275 1.59E-09 10.3356 0.06239 -3.06E-10 0.00 3.65E+11 -0.167 6.23E+08
0.00
23.7217 2.76E-10 7.7618 -0.520 -1.59E-10 0.00 3.65E+11 -0.02902 6.23E+08
0.00
24.2159 -2.93E-10 4.1671 -0.515 -6.22E-11 0.00 3.65E+11 0.03078 6.23E+08
0.00
24.7101 -4.61E-10 1.6550 -0.280 -1.48E-11 0.00 3.65E+11 0.04840 6.23E+08
0.00
25.2043 -4.69E-10 0.8450 -0.114 5.49E-12 0.00 3.65E+11 0.00751 9.49E+07
0.00
25.6986 -3.96E-10 0.2990 -0.07329 1.48E-11 0.00 3.65E+11 0.00633 9.49E+07
0.00
26.1928 -2.94E-10 -0.02433 -0.04058 1.70E-11 0.00 3.65E+11 0.00470 9.49E+07
0.00
26.6870 -1.94E-10 -0.182 -0.01744 1.53E-11 0.00 3.65E+11 0.00310 9.49E+07
0.00
27.1812 -1.12E-10 -0.231 -0.00294 1.20E-11 0.00 3.65E+11 0.00179 9.49E+07
0.00
27.6754 -5.18E-11 -0.217 0.00481 8.33E-12 0.00 3.65E+11 8.29E-04 9.49E+07

0.00								
28.1696	-1.29E-11	-0.174	0.00788	5.15E-12	0.00	3.65E+11	2.06E-04	9.49E+07
0.00								
28.6638	9.27E-12	-0.124	0.00805	2.73E-12	0.00	3.65E+11	-1.48E-04	9.49E+07
0.00								
29.1580	1.95E-11	-0.07870	0.00669	1.08E-12	0.00	3.65E+11	-3.12E-04	9.49E+07
0.00								
29.6522	2.21E-11	-0.04451	0.00472	0.00	0.00	3.65E+11	-3.53E-04	9.49E+07
0.00								
30.1464	2.04E-11	-0.02274	0.00312	0.00	0.00	3.65E+11	-1.84E-04	5.34E+07
0.00								
30.6406	1.65E-11	-0.00744	0.00214	0.00	0.00	3.65E+11	-1.49E-04	5.34E+07
0.00								
31.1348	1.19E-11	0.00263	0.00138	0.00	0.00	3.65E+11	-1.08E-04	5.34E+07
0.00								
31.6290	7.61E-12	0.00892	6.99E-04	0.00	0.00	3.65E+11	-1.22E-04	9.49E+07
0.00								
32.1232	4.13E-12	0.01092	1.42E-04	0.00	0.00	3.65E+11	-6.61E-05	9.49E+07
0.00								
32.6174	1.71E-12	0.01060	-1.36E-04	0.00	0.00	3.65E+11	-2.74E-05	9.49E+07
0.00								
33.1116	0.00	0.00931	-6.30E-04	0.00	0.00	3.65E+11	-1.39E-04	2.67E+09
0.00								
33.6058	0.00	0.00313	-7.85E-04	0.00	0.00	3.65E+11	8.70E-05	2.67E+09
0.00								
34.1000	0.00	0.00	0.00	0.00	0.00	3.65E+11	1.78E-04	1.33E+09
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. 3:

```
Pile-head deflection             =     0.48000000 inches
Computed slope at pile head      =     -0.0040979 radians
Maximum bending moment           =       6894078. inch-lbs
Maximum shear force              =       -308965. lbs
Depth of maximum bending moment  =    11.36666667 feet below pile head
Depth of maximum shear force     =    12.35507246 feet below pile head
Number of iterations             =             11
Number of zero deflection points =              7
Pile deflection at ground        =     0.00876156 inches
```

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	15820.	M, in-lb	0.00	212150.	0.04974	-4.24E-04	-102641.	2514409.
2	V, lb	19120.	M, in-lb	0.00	295890.	0.06288	-5.35E-04	-129405.	3165070.
3	y, in	0.4800	M, in-lb	0.00	212150.	0.4800	-0.00410	-308965.	6894078.

Maximum pile-head deflection = 0.4800000000 inches
Maximum pile-head rotation   = -0.0040979151 radians = -0.234793 deg.

Summary of Warning Messages

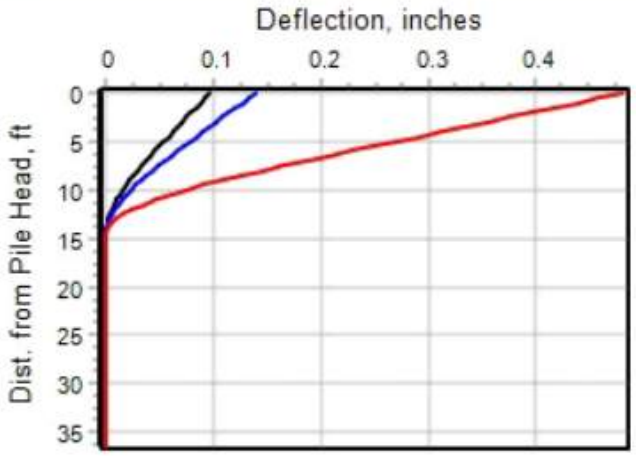
The following warning was reported 372 times

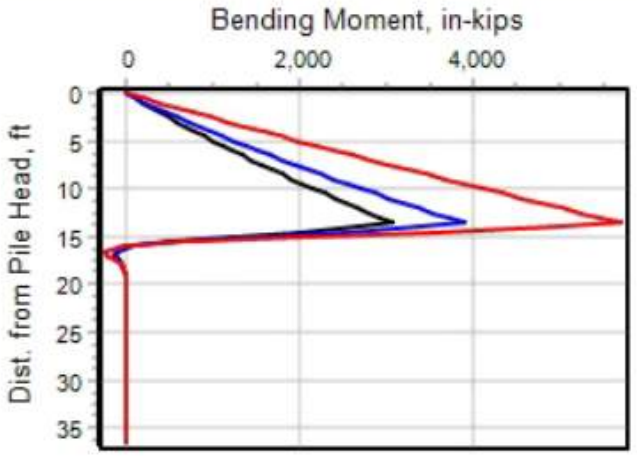
**** Warning ****

An unreasonable input value for unconfined compressive strength has been specified for a soil defined using the weak rock criteria. The input value is greater than 500 psi. Please check your input data for correctness.

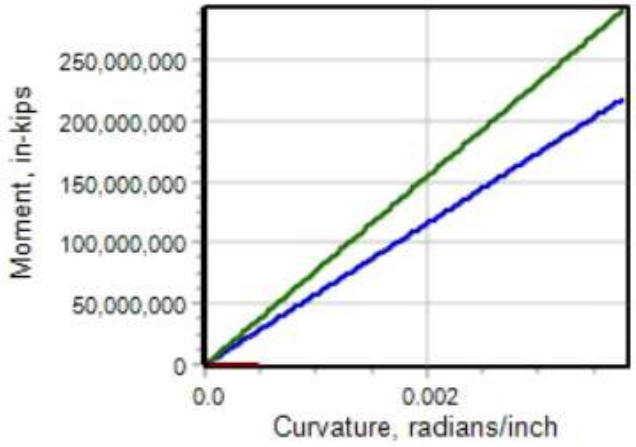
The analysis ended normally.

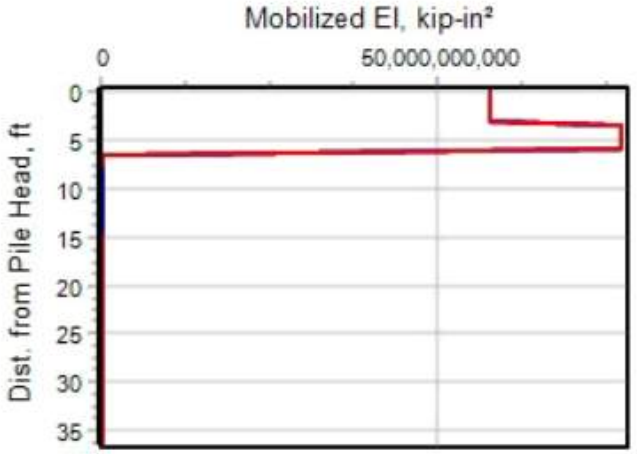
Results for HAS-22-17.53R FA Shaft 5 B-142.lp12d

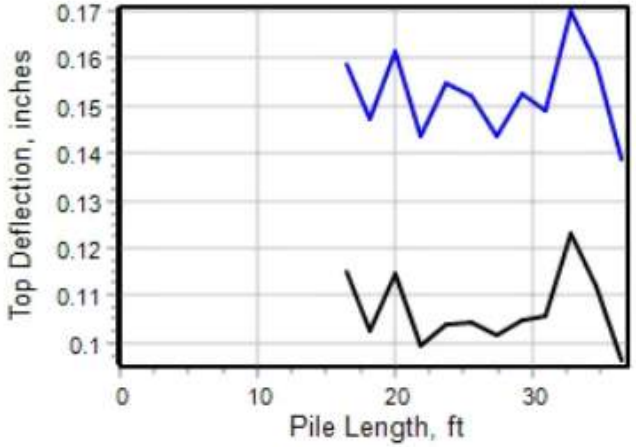












Show All Legends

Print

Close

```
================================================================================

                            LPile Version 2022-12.013

                                License ID : 500128183
                          License Type : (Single User License)

                     Analysis of Individual Piles and Drilled Shafts
                    Subjected to Lateral Loading Using the p-y Method
                              © 1985-2024 by Ensoft, Inc.
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                                  Barr Engineering Inc.
                                    Columbus, OH, USA

================================================================================


This model was prepared by:
Zmankoci




--------------------------------------------------------------------------------
                             Files Used for Analysis
--------------------------------------------------------------------------------

Path to file locations:
\23-0011 113440 HAS-22-15.25\113440\geotechnical\bridges\XXX-YY-ZZ.ZZ (Crossing)\Analysis\Lpile\New folder\

Name of input data file:
HAS-22-17.53R FA Shaft 5 B-142.lp12d

Name of output report file:
HAS-22-17.53R FA Shaft 5 B-142.lp12o
```

Name of plot output file:
HAS-22-17.53R FA Shaft 5 B-142.lp12p

Name of runtime message file:
HAS-22-17.53R FA Shaft 5 B-142.lp12r

Date and Time of Analysis

Date: November 18, 2025 Time: 11:28:05

Problem Title

Project Name: HAS-22-17.53R

Job Number: 10059

Client: ODOT

Engineer: ZM

Description: HAS-22-17.53R Forw Abutment

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 = 73

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)
 - 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 = 36.500 ft
Depth of ground surface below top of pile = 13.5000 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	36.0000
2	3.100	36.0000
3	3.100	48.0000
4	6.100	48.0000
5	6.100	36.0000
6	36.500	36.0000

Input Structural Properties for Pile Sections:

Pile Section No. 1:

Section 1 is an elastic pile
Cross-sectional shape = rectangular
Length of section = 3.100000 ft
Width of top of section = 36.000000 in
Width of bottom of section = 36.000000 in
Top Section Depth = 175.000000 in
Bottom Section Depth = 175.000000 in

```
   Top Area                                          =        6300. sq. in
   Bottom Area                                       =        6300. sq. in
   Moment of Inertia at Top                          =    16078125. in^4
   Moment of Inertia at Bottom                       =    16078125. in^4
   Elastic Modulus                                   =     3604996. psi

Pile Section No. 2:

   Section 2 is an elastic pile
   Cross-sectional shape                             =     rectangular
   Length of section                                 =     3.000000 ft
   Width of top of section                           =    48.000000 in
   Width of bottom of section                        =    48.000000 in
   Top Section Depth                                 =   175.000000 in
   Bottom Section Depth                              =   175.000000 in
   Top Area                                          =        8400. sq. in
   Bottom Area                                       =        8400. sq. in
   Moment of Inertia at Top                          =    21437500. in^4
   Moment of Inertia at Bottom                       =    21437500. in^4
   Elastic Modulus                                   =     3604996. psi

Pile Section No. 3:

   Section 3 is a round drilled shaft, bored pile, or CIDH pile
   Length of section                                 =    30.400000 ft
   Shaft Diameter                                    =    36.000000 in



--------------------------------------------------------------------------------
                       Soil and Rock Layering Information
--------------------------------------------------------------------------------

The soil profile is modelled using 7 layers

Layer 1 is weak rock, p-y criteria by Reese, 1997

   Distance from top of pile to top of layer         =    13.500000 ft
```

Distance from top of pile to bottom of layer	=	15.500000	ft
Effective unit weight at top of layer	=	139.000000	pcf
Effective unit weight at bottom of layer	=	139.000000	pcf
Uniaxial compressive strength at top of layer	=	1500.	psi
Uniaxial compressive strength at bottom of layer	=	1500.	psi
Initial modulus of rock at top of layer	=	140000.	psi
Initial modulus of rock at bottom of layer	=	140000.	psi
RQD of rock at top of layer	=	0.0000	%
RQD of rock at bottom of layer	=	0.0000	%
k rm of rock at top of layer	=	0.0001100	
k rm of rock at bottom of layer	=	0.0001100	

Layer 2 is weak rock, p-y criteria by Reese, 1997

Distance from top of pile to top of layer	=	15.500000	ft
Distance from top of pile to bottom of layer	=	19.200000	ft
Effective unit weight at top of layer	=	139.000000	pcf
Effective unit weight at bottom of layer	=	139.000000	pcf
Uniaxial compressive strength at top of layer	=	6584.	psi
Uniaxial compressive strength at bottom of layer	=	6584.	psi
Initial modulus of rock at top of layer	=	590000.	psi
Initial modulus of rock at bottom of layer	=	590000.	psi
RQD of rock at top of layer	=	50.000000	%
RQD of rock at bottom of layer	=	50.000000	%
k rm of rock at top of layer	=	0.0000500	
k rm of rock at bottom of layer	=	0.0000500	

Layer 3 is weak rock, p-y criteria by Reese, 1997

Distance from top of pile to top of layer	=	19.200000	ft
Distance from top of pile to bottom of layer	=	27.500000	ft
Effective unit weight at top of layer	=	146.000000	pcf
Effective unit weight at bottom of layer	=	146.000000	pcf
Uniaxial compressive strength at top of layer	=	2288.	psi
Uniaxial compressive strength at bottom of layer	=	2288.	psi
Initial modulus of rock at top of layer	=	210000.	psi

Initial modulus of rock at bottom of layer	=	210000.	psi
RQD of rock at top of layer	=	13.000000	%
RQD of rock at bottom of layer	=	13.000000	%
k rm of rock at top of layer	=	0.0000600	
k rm of rock at bottom of layer	=	0.0000600	

Layer 4 is weak rock, p-y criteria by Reese, 1997

Distance from top of pile to top of layer	=	27.500000	ft
Distance from top of pile to bottom of layer	=	32.200000	ft
Effective unit weight at top of layer	=	136.000000	pcf
Effective unit weight at bottom of layer	=	136.000000	pcf
Uniaxial compressive strength at top of layer	=	360.000000	psi
Uniaxial compressive strength at bottom of layer	=	360.000000	psi
Initial modulus of rock at top of layer	=	32000.	psi
Initial modulus of rock at bottom of layer	=	32000.	psi
RQD of rock at top of layer	=	29.000000	%
RQD of rock at bottom of layer	=	29.000000	%
k rm of rock at top of layer	=	0.0005000	
k rm of rock at bottom of layer	=	0.0005000	

Layer 5 is weak rock, p-y criteria by Reese, 1997

Distance from top of pile to top of layer	=	32.200000	ft
Distance from top of pile to bottom of layer	=	33.800000	ft
Effective unit weight at top of layer	=	127.000000	pcf
Effective unit weight at bottom of layer	=	127.000000	pcf
Uniaxial compressive strength at top of layer	=	200.000000	psi
Uniaxial compressive strength at bottom of layer	=	200.000000	psi
Initial modulus of rock at top of layer	=	18000.	psi
Initial modulus of rock at bottom of layer	=	18000.	psi
RQD of rock at top of layer	=	0.0000	%
RQD of rock at bottom of layer	=	0.0000	%
k rm of rock at top of layer	=	0.0005000	
k rm of rock at bottom of layer	=	0.0005000	

Layer 6 is weak rock, p-y criteria by Reese, 1997

Distance from top of pile to top of layer	=	33.800000	ft
Distance from top of pile to bottom of layer	=	35.500000	ft
Effective unit weight at top of layer	=	131.000000	pcf
Effective unit weight at bottom of layer	=	131.000000	pcf
Uniaxial compressive strength at top of layer	=	360.000000	psi
Uniaxial compressive strength at bottom of layer	=	360.000000	psi
Initial modulus of rock at top of layer	=	32000.	psi
Initial modulus of rock at bottom of layer	=	32000.	psi
RQD of rock at top of layer	=	0.0000	%
RQD of rock at bottom of layer	=	0.0000	%
k rm of rock at top of layer	=	0.0005000	
k rm of rock at bottom of layer	=	0.0005000	

Layer 7 is weak rock, p-y criteria by Reese, 1997

Distance from top of pile to top of layer	=	35.500000	ft
Distance from top of pile to bottom of layer	=	40.500000	ft
Effective unit weight at top of layer	=	150.000000	pcf
Effective unit weight at bottom of layer	=	150.000000	pcf
Uniaxial compressive strength at top of layer	=	10000.	psi
Uniaxial compressive strength at bottom of layer	=	10000.	psi
Initial modulus of rock at top of layer	=	900000.	psi
Initial modulus of rock at bottom of layer	=	900000.	psi
RQD of rock at top of layer	=	77.000000	%
RQD of rock at bottom of layer	=	77.000000	%
k rm of rock at top of layer	=	0.0000500	
k rm of rock at bottom of layer	=	0.0000500	

(Depth of the lowest soil layer extends 4.000 ft below the pile tip)

**** Warning - Possible Input Data Error ****

Values entered for effective unit weight of rock were outside the limits of
50 pcf to 150 pcf.

The maximum input value, in layer 6, for effective unit weight = 150.00 pcf

This data may be erroneous. Please check your data.

Summary of Input Soil Properties

Layer Num.	Soil Type Name (p-y Curve Type)	Layer Depth ft	Effective Unit Wt. pcf	Uniaxial qu psi	RQD %	E50 or krm	Rock Mass Modulus psi
1	Weak	13.5000	139.0000	1500.	0.00	1.10E-04	140000.
	Rock	15.5000	139.0000	1500.	0.00	1.10E-04	140000.
2	Weak	15.5000	139.0000	6584.	50.0000	5.00E-05	590000.
	Rock	19.2000	139.0000	6584.	50.0000	5.00E-05	590000.
3	Weak	19.2000	146.0000	2288.	13.0000	6.00E-05	210000.
	Rock	27.5000	146.0000	2288.	13.0000	6.00E-05	210000.
4	Weak	27.5000	136.0000	360.0000	29.0000	5.00E-04	32000.
	Rock	32.2000	136.0000	360.0000	29.0000	5.00E-04	32000.
5	Weak	32.2000	127.0000	200.0000	0.00	5.00E-04	18000.
	Rock	33.8000	127.0000	200.0000	0.00	5.00E-04	18000.
6	Weak	33.8000	131.0000	360.0000	0.00	5.00E-04	32000.
	Rock	35.5000	131.0000	360.0000	0.00	5.00E-04	32000.
7	Weak	35.5000	150.0000	10000.	77.0000	5.00E-05	900000.
	Rock	40.5000	150.0000	10000.	77.0000	5.00E-05	900000.

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	24.600
2	13.500	61.600

Distributed lateral load intensity for Load Case 2 defined using 2 points

Point No.	Depth X ft	Dist. Load lb/in
1	0.000	39.000
2	13.500	94.500

Distributed lateral load intensity for Load Case 3 defined using 2 points

Point No.	Depth X ft	Dist. Load lb/in
1	0.000	24.600
2	13.500	61.600

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 3

Load No.	Load Type	Condition 1	Condition 2	Axial Thrust Force, lbs	Compute Top y vs. Pile Length	Run Analysis
1	1	V = 15820. lbs	M = 0.0000 in-lbs	212150.	Yes	Yes
2	1	V = 19120. lbs	M = 0.0000 in-lbs	295890.	Yes	Yes
3	4	y = 0.480000 in	M = 0.0000 in-lbs	212150.	N.A.	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:

Moment-curvature properties were derived from elastic section properties

Pile Section No. 3:

Dimensions and Properties of Drilled Shaft (Bored Pile):

Length of Section	=	30.400000	ft
Shaft Diameter	=	36.000000	in
Concrete Cover Thickness (to edge of trans. reinf.)	=	3.000000	in
Number of Reinforcing Bars	=	10	bars
Yield Stress of Reinforcing Bars	=	60000.	psi
Modulus of Elasticity of Reinforcing Bars	=	29000000.	psi
Gross Area of Shaft	=	1018.	sq. in.
Total Area of Reinforcing Steel	=	10.000000	sq. in.
Area Ratio of Steel Reinforcement	=	0.98	percent
Edge-to-Edge Bar Spacing	=	7.407667	in
Maximum Concrete Aggregate Size	=	0.750000	in
Ratio of Bar Spacing to Aggregate Size	=	9.88	
Offset of Center of Rebar Cage from Center of Pile	=	0.0000	in
Transverse Reinforcement			
Type: Spiral			
Number of Transverse Reinf. (per spacing)	=	1	
Spacing of Transverse Reinf.	=	5.000000	in
Yield Stress of Transverse Reinf.	=	60000.	psi
Diameter of Transverse Reinf.	=	0.625000	in

Axial Structural Capacities:

Nom. Axial Structural Capacity = 0.85 Fc Ac + Fy As	=	4026.778	kips

Tensile Load for Cracking of Concrete = -452.643 kips
Nominal Axial Tensile Capacity = -600.000 kips

Reinforcing Bar Dimensions and Positions Used in Computations:

Bar Number	Bar Diam. inches	Bar Area sq. in.	X inches	Y inches
1	1.128000	1.000000	13.811000	0.00000
2	1.128000	1.000000	11.173334	8.117902
3	1.128000	1.000000	4.267834	13.135042
4	1.128000	1.000000	-4.26783	13.135042
5	1.128000	1.000000	-11.17333	8.117902
6	1.128000	1.000000	-13.81100	0.00000
7	1.128000	1.000000	-11.17333	-8.11790
8	1.128000	1.000000	-4.26783	-13.13504
9	1.128000	1.000000	4.267834	-13.13504
10	1.128000	1.000000	11.173334	-8.11790

NOTE: The positions of the above rebars were computed by LPile

Minimum spacing between any two bars not equal to zero = 7.408 inches
between bars 5 and 6.

Ratio of bar spacing to maximum aggregate size = 9.88

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 = 2

Number	Axial Thrust Force kips
1	212.150
2	295.890

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 = 212.150 kips

Bending Curvature	Bending Moment	Bending Stiffness	Depth to N Axis	Max Comp Strain	Max Tens Strain	Max Conc Stress	Max Steel Stress	Run Msg
rad/in.	in-kip	kip-in2	in	in/in	in/in	ksi	ksi	

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  6.25000E-07   227.9555036    364728806.    93.2551693    0.00005828    0.00003578     0.2429131
1.6152124
   0.00000125   455.9077025    364726162.    55.6468591    0.00006956    0.00002456     0.2886513
1.8671236
   0.00000188   683.8488634    364719394.    43.1193201    0.00008085    0.00001335     0.3341747
2.1195005
   0.00000250   911.7734684    364709387.    36.8619742    0.00009215    0.00000215     0.3794820
2.3723431
   0.00000313        1140.    364687509.    33.1125893     0.0001035   -0.00000902     0.4245704
2.6256409
   0.00000375        1367.    364592768.    30.6162565     0.0001148   -0.00002019     0.4694250
2.8792929
   0.00000438        1594.    364397783.    28.8350253     0.0001262   -0.00003135     0.5140288
3.1331812
   0.00000500        1821.    364112796.    27.5002200     0.0001375   -0.00004250     0.5583710
3.3872318
   0.00000563        2046.    363754812.    26.4627501     0.0001489   -0.00005365     0.6024450
3.6413986
   0.00000625        2271.    363339324.    25.6332574     0.0001602   -0.00006479     0.6462468
3.8956529
   0.00000688        2495.    362878714.    24.9549300     0.0001716   -0.00007593     0.6897735
4.1499767
   0.00000750        2718.    362382343.    24.3899181     0.0001829   -0.00008708     0.7330235
4.4043572
   0.00000813        2940.    361857324.    23.9120344     0.0001943   -0.00009821     0.7759954
4.6587856
   0.00000875        2940.    336010372.    21.2352856     0.0001858     -0.000129     0.7432096
4.3379355 C
   0.00000938        2940.    313609681.    20.6675833     0.0001938     -0.000144     0.7731326
4.4934367 C
   0.00001000        2940.    294009076.    20.1551246     0.0002016     -0.000158     0.8023233
4.6443928 C
   0.00001063        2940.    276714424.    19.6915810     0.0002092     -0.000173     0.8309237
4.7918337 C
   0.00001125        2940.    261341400.    19.2692909     0.0002168     -0.000188     0.8589625
4.9359321 C
   0.00001188        2940.    247586590.    18.8819022     0.0002242     -0.000203     0.8864525
5.0767425 C
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   0.00001250        2940.    235207260.    18.5255957     0.0002316     -0.000218     0.9134653
5.2147784 C
   0.00001313        2940.    224006915.    18.1965393     0.0002388     -0.000234     0.9400349
5.3502703 C
   0.00001375        2940.    213824782.    17.8913892     0.0002460     -0.000249     0.9661856
-5.569976 C
   0.00001438        2940.    204528053.    17.6080366     0.0002531     -0.000264     0.9919716
-5.941287 C
   0.00001500        2940.    196006050.    17.3443090     0.0002602     -0.000280     1.0174294
-6.314326 C
   0.00001563        2940.    188165808.    17.0985890     0.0002672     -0.000295     1.0426031
-6.688764 C
   0.00001625        2940.    180928662.    16.8662640     0.0002741     -0.000311     1.0673452
-7.065797 C
   0.00001688        2940.    174227600.    16.6490681     0.0002810     -0.000327     1.0918564
-7.443847 C
   0.00001750        2940.    168005186.    16.4445403     0.0002878     -0.000342     1.1160856
-7.823341 C
   0.00001813        2984.    164638024.    16.2509525     0.0002945     -0.000358     1.1400079
-8.204497 C
   0.00001875        3032.    161713430.    16.0688539     0.0003013     -0.000374     1.1637358
-8.586422 C
   0.00001938        3079.    158939946.    15.8953849     0.0003080     -0.000390     1.1871476
-8.970118 C
   0.00002000        3126.    156324498.    15.7316047     0.0003146     -0.000405     1.2103861
-9.354439 C
   0.00002063        3173.    153842793.    15.5757060     0.0003212     -0.000421     1.2333722
-9.740043 C
   0.00002125        3219.    151486489.    15.4270985     0.0003278     -0.000437     1.2561333
-10.126720 C
   0.00002188        3265.    149259806.    15.2869548     0.0003344     -0.000453     1.2787848
-10.513525 C
   0.00002250        3310.    147123264.    15.1511727     0.0003409     -0.000469     1.3010807
-10.902510 C
   0.00002313        3355.    145100712.    15.0227080     0.0003474     -0.000485     1.3232971
-11.291392 C
   0.00002375        3400.    143173416.    14.9003389     0.0003539     -0.000501     1.3453392
-11.680967 C
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   0.00002438         3445.    141323712.    14.7818674     0.0003603     -0.000517     1.3671046
-12.072105 C
   0.00002563         3533.    137886934.    14.5620591     0.0003732     -0.000549     1.4103550
-12.854481 C
   0.00002688         3621.    134721349.    14.3577000     0.0003859     -0.000582     1.4527805
-13.640855 C
   0.00002813         3707.    131821776.    14.1703925     0.0003985     -0.000614     1.4947565
-14.428086 C
   0.00002938         3793.    129136479.    13.9954824     0.0004111     -0.000646     1.5360373
-15.218336 C
   0.00003063         3879.    126661116.    13.8344698     0.0004237     -0.000679     1.5769366
-16.008925 C
   0.00003188         3964.    124349990.    13.6824160     0.0004361     -0.000711     1.6171108
-16.802904 C
   0.00003313         4048.    122209609.    13.5422254     0.0004486     -0.000744     1.6569908
-17.596513 C
   0.00003438         4132.    120204429.    13.4096541     0.0004610     -0.000777     1.6962493
-18.392688 C
   0.00003563         4215.    118329047.    13.2854181     0.0004733     -0.000809     1.7350661
-19.189863 C
   0.00003688         4299.    116577604.    13.1699520     0.0004856     -0.000842     1.7735932
-19.986671 C
   0.00003813         4381.    114924104.    13.0596821     0.0004979     -0.000875     1.8115062
-20.786100 C
   0.00003938         4464.    113367685.    12.9557557     0.0005101     -0.000907     1.8490130
-21.586282 C
   0.00004063         4546.    111904222.    12.8585340     0.0005224     -0.000940     1.8862343
-22.386098 C
   0.00004188         4628.    110523334.    12.7669698     0.0005346     -0.000973     1.9231114
-23.186099 C
   0.00004313         4710.    109207938.    12.6783401     0.0005468     -0.001006     1.9593546
-23.989062 C
   0.00004438         4791.    107964128.    12.5949862     0.0005589     -0.001039     1.9953163
-24.791662 C
   0.00004563         4872.    106786013.    12.5164754     0.0005711     -0.001071     2.0309959
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   0.00004688         4953.    105668326.    12.4424215     0.0005832     -0.001104     2.0663923
-26.395764 C
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   0.00004813        5034.    104599478.    12.3706997     0.0005953     -0.001137     2.1012549
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   0.00004938        5114.    103579448.    12.3020791     0.0006074     -0.001170     2.1357233
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   0.00005063        5195.    102607621.    12.2370913     0.0006195     -0.001203     2.1699123
-28.808880 C
   0.00005188        5275.    101680501.    12.1754809     0.0006316     -0.001236     2.2038212
-29.612894 C
   0.00005313        5355.    100794923.    12.1170107     0.0006437     -0.001269     2.2374491
-30.416536 C
   0.00005438        5435.     99948012.    12.0614652     0.0006558     -0.001302     2.2707951
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   0.00005563        5514.     99130658.    12.0066471     0.0006679     -0.001335     2.3035510
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   0.00005688        5593.     98347149.    11.9544108     0.0006799     -0.001368     2.3360206
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   0.00005813        5673.     97595466.    11.9046445     0.0006920     -0.001401     2.3682116
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   0.00005938        5752.     96873591.    11.8572090     0.0007040     -0.001433     2.4001233
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   0.00006063        5831.     96179670.    11.8119336     0.0007161     -0.001466     2.4317547
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   0.00006188        5910.     95512001.    11.7687006     0.0007282     -0.001499     2.4631050
-36.051318 C
   0.00006313        5989.     94869015.    11.7273898     0.0007403     -0.001532     2.4941733
-36.855250 C
   0.00006438        6067.     94247967.    11.6874039     0.0007524     -0.001565     2.5248771
-37.659715 C
   0.00006563        6146.     93646088.    11.6480636     0.0007644     -0.001598     2.5551199
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   0.00006688        6224.     93065082.    11.6104018     0.0007764     -0.001631     2.5850837
-39.271543 C
   0.00006813        6302.     92503791.    11.5743211     0.0007885     -0.001664     2.6147673
-40.076867 C
   0.00006938        6380.     91961141.    11.5397372     0.0008006     -0.001697     2.6441701
-40.881795 C
   0.00007063        6458.     91436135.    11.5065716     0.0008127     -0.001730     2.6732909
-41.686325 C
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   0.00007188        6535.     90927845.    11.4747513     0.0008247     -0.001763     2.7021290
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   0.00007313        6613.     90435404.    11.4442327     0.0008369     -0.001796     2.7306834
-43.294180 C
   0.00007438        6691.     89958007.    11.4149069     0.0008490     -0.001829     2.7589532
-44.097502 C
   0.00007938        6999.     88181827.    11.3072667     0.0008975     -0.001960     2.8689252
-47.309803 C
   0.00008438        7306.     86589210.    11.2123237     0.0009460     -0.002091     2.9737861
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   0.00008938        7611.     85154325.    11.1306931     0.0009948     -0.002223     3.0740333
-53.727767 C
   0.00009438        7914.     83851669.    11.0602835     0.0010438     -0.002354     3.1696012
-56.926211 C
   0.00009938        8214.     82660654.    10.9994697     0.0010931     -0.002484     3.2604205
-60.000000 CY
    0.0001044        8462.     81077530.    10.9246375     0.0011403     -0.002617     3.3424226
-60.000000 CY
    0.0001094        8622.     78825782.    10.8230452     0.0011838     -0.002754     3.4136567
-60.000000 CY
    0.0001144        8779.     76758545.    10.7318935     0.0012275     -0.002890     3.4810808
-60.000000 CY
    0.0001194        8936.     74854939.    10.6500142     0.0012713     -0.003026     3.5446680
-60.000000 CY
    0.0001244        9091.     73090925.    10.5740205     0.0013151     -0.003162     3.6039857
-60.000000 CY
    0.0001294        9244.     71447696.    10.5038328     0.0013589     -0.003299     3.6591496
-60.000000 CY
    0.0001344        9352.     69598541.    10.4209766     0.0014003     -0.003437     3.7074324
-60.000000 CY
    0.0001394        9414.     67547207.    10.3248424     0.0014390     -0.003578     3.7491897
-60.000000 CY
    0.0001444        9472.     65608880.    10.2336693     0.0014775     -0.003720     3.7874938
-60.000000 CY
    0.0001494        9528.     63788664.    10.1461895     0.0015156     -0.003862     3.8223061
-60.000000 CY
    0.0001544        9584.     62082418.    10.0654353     0.0015539     -0.004004     3.8541338
-60.000000 CY
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    0.0001594         9639.     60479335.     9.9907300     0.0015923     -0.004145     3.8829392
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    0.0001644         9693.     58969922.     9.9196628     0.0016305     -0.004287     3.9086834
-60.000000 CY
    0.0001694         9746.     57541410.     9.8541486     0.0016690     -0.004428     3.9310847
-60.000000 CY
    0.0001744         9798.     56189155.     9.7917527     0.0017074     -0.004570     3.9503172
-60.000000 CY
    0.0001794         9849.     54908787.     9.7330971     0.0017459     -0.004712     3.9664760
-60.000000 CY
    0.0001844         9900.     53694382.     9.6785609     0.0017845     -0.004853     3.9795192
-60.000000 CY
    0.0001894         9950.     52540644.     9.6278368     0.0018233     -0.004994     3.9894034
-60.000000 CY
    0.0001944         9999.     51442820.     9.5806481     0.0018622     -0.005135     3.9960841
-60.000000 CY
    0.0001994        10048.     50396360.     9.5365366     0.0019013     -0.005276     3.9995131
-60.000000 CY
    0.0002044        10095.     49394303.     9.4929916     0.0019401     -0.005417     3.9964108
-60.000000 CY
    0.0002094        10141.     48436650.     9.4524985     0.0019791     -0.005558     3.9995405
-60.000000 CY
    0.0002144        10187.     47520145.     9.4148867     0.0020183     -0.005699     3.9958315
-60.000000 CY
    0.0002194        10232.     46642003.     9.3799437     0.0020577     -0.005840     3.9992412
-60.000000 CY
    0.0002244        10276.     45799931.     9.3474847     0.0020973     -0.005980     3.9971355
-60.000000 CY
    0.0002294        10316.     44975600.     9.3151843     0.0021367     -0.006121     3.9983239
-60.000000 CY
    0.0002344        10351.     44166377.     9.2822771     0.0021755     -0.006262     3.9999589
-60.000000 CY
    0.0002394        10378.     43353626.     9.2462653     0.0022133     -0.006404     3.9958571
-60.000000 CY
    0.0002444        10396.     42539773.     9.2072543     0.0022500     -0.006547     3.9988404
-60.000000 CY
    0.0002494        10409.     41740731.     9.1667954     0.0022860     -0.006692     3.9999793
-60.000000 CY
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    0.0002544        10418.     40953686.     9.1235427     0.0023208     -0.006837     3.9946271
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    0.0002594        10426.     40195875.     9.0823761     0.0023557     -0.006982     3.9978145
-60.000000 CY
    0.0002644        10434.     39466015.     9.0430571     0.0023908     -0.007127     3.9995966
-60.000000 CY
    0.0002694        10442.     38762320.     9.0058951     0.0024260     -0.007272     3.9980123
-60.000000 CY
    0.0002744        10449.     38083014.     8.9706544     0.0024613     -0.007416     3.9949556
-60.000000 CY
    0.0003044        10489.     34460331.     8.7878711     0.0026748     -0.008283     3.9987552
-60.000000 CY
    0.0003344        10519.     31459915.     8.6361607     0.0028877     -0.009150     3.9994780
-60.000000 CY
    0.0003644        10545.     28941139.     8.5196288     0.0031043     -0.010013     3.9991133
-60.000000 CYT
    0.0003944        10567.     26794426.     8.4236884     0.0033221     -0.010875     3.9966096
-60.000000 CYT
    0.0004244        10585.     24942084.     8.3398606     0.0035392     -0.011738     3.9879578
-60.000000 CYT
    0.0004544        10601.     23329960.     8.2736862     0.0037594     -0.012598     3.9999293
-60.000000 CYT
    0.0004844        10601.     21885008.     8.2553526     0.0039987     -0.013439     3.9949553
-60.000000 CYT


Axial Thrust Force =    295.890 kips

    Bending       Bending       Bending      Depth to      Max Comp      Max Tens      Max Conc      Max
Steel  Run
   Curvature      Moment       Stiffness      N Axis        Strain        Strain        Stress        Stress
   Msg
    rad/in.       in-kip        kip-in2         in           in/in         in/in          ksi           ksi

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  6.25000E-07   225.7927934    361268469.   123.4548576    0.00007716    0.00005466     0.3200951
2.1625818
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   0.00000125   451.5831204    361266496.    70.7468899    0.00008843    0.00004343     0.3653606
2.4144998
   0.00000188   677.3623026    361259895.    53.1862148    0.00009972    0.00003222     0.4104112
2.6668879
   0.00000250   903.1247683    361249907.    44.4123631     0.0001110    0.00002103     0.4552456
2.9197463
   0.00000313        1129.    361236782.    39.1532413     0.0001224    0.00000985     0.4998625
3.1730750
   0.00000375        1355.    361220595.    35.6514849     0.0001337   -0.00000131     0.5442608
3.4268740
   0.00000438        1580.    361189699.    33.1537808     0.0001450   -0.00001245     0.5884366
3.6811235
   0.00000500        1806.    361104678.    31.2829824     0.0001564   -0.00002359     0.6323764
3.9357325
   0.00000563        2030.    360948199.    29.8295664     0.0001678   -0.00003471     0.6760673
4.1906105
   0.00000625        2255.    360721907.    28.6679661     0.0001792   -0.00004583     0.7195001
4.4456939
   0.00000688        2478.    360433299.    27.7165094     0.0001906   -0.00005695     0.7626682
4.7009367
   0.00000750        2701.    360091206.    26.9269732     0.0002020   -0.00006805     0.8055671
4.9563067
   0.00000813        2923.    359703917.    26.2588515     0.0002134   -0.00007915     0.8481934
5.2117811
   0.00000875        3144.    359278644.    25.6861806     0.0002248   -0.00009025     0.8905447
5.4673434
   0.00000938        3364.    358821423.    25.1900476     0.0002362     -0.000101     0.9326193
5.7229817
   0.00001000        3364.    336395084.    23.1041703     0.0002310     -0.000129     0.9131738
5.4996094 C
   0.00001063        3364.    316607138.    22.5447011     0.0002395     -0.000143     0.9443334
5.6709870 C
   0.00001125        3364.    299017852.    22.0341597     0.0002479     -0.000157     0.9747761
5.8379696 C
   0.00001188        3364.    283280071.    21.5662631     0.0002561     -0.000171     1.0045899
6.0011875 C
   0.00001250        3364.    269116067.    21.1359243     0.0002642     -0.000186     1.0338316
6.1610347 C
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   0.00001313        3364.    256301016.    20.7380740    0.0002722    -0.000200    1.0625275
6.3176714 C
   0.00001375        3364.    244650970.    20.3688620    0.0002801    -0.000215    1.0907058
6.4712766 C
   0.00001438        3364.    234013971.    20.0249514    0.0002879    -0.000230    1.1183968
6.6220495 C
   0.00001500        3364.    224263389.    19.7036901    0.0002956    -0.000244    1.1456327
6.7702108 C
   0.00001563        3364.    215292854.    19.4029014    0.0003032    -0.000259    1.1724483
6.9160050 C
   0.00001625        3378.    207898810.    19.1207970    0.0003107    -0.000274    1.1988806
7.0597018 C
   0.00001688        3436.    203629568.    18.8559097    0.0003182    -0.000289    1.2249695
7.2015987 C
   0.00001750        3493.    199582861.    18.6054868    0.0003256    -0.000304    1.2506622
7.3412344 C
   0.00001813        3548.    195750655.    18.3687106    0.0003329    -0.000320    1.2760057
7.4789660 C
   0.00001875        3603.    192137255.    18.1457912    0.0003402    -0.000335    1.3011058
7.6156490 C
   0.00001938        3656.    188693973.    17.9334511    0.0003475    -0.000350    1.3258349
-7.824974 C
   0.00002000        3709.    185435214.    17.7326370    0.0003547    -0.000365    1.3503284
-8.193871 C
   0.00002063        3761.    182336395.    17.5417087    0.0003618    -0.000381    1.3745479
-8.564128 C
   0.00002125        3812.    179385119.    17.3597775    0.0003689    -0.000396    1.3984938
-8.935762 C
   0.00002188        3863.    176574800.    17.1865166    0.0003760    -0.000412    1.4222017
-9.308490 C
   0.00002250        3913.    173893457.    17.0210625    0.0003830    -0.000427    1.4456623
-9.682405 C
   0.00002313        3962.    171328424.    16.8625950    0.0003899    -0.000443    1.4688631
-10.057632 C
   0.00002375        4011.    168887957.    16.7119182    0.0003969    -0.000458    1.4919137
-10.433241 C
   0.00002438        4059.    166534398.    16.5660026    0.0004038    -0.000474    1.5146183
-10.810938 C
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   0.00002563        4155.    162141470.    16.2936982     0.0004175     -0.000505     1.5595621
-11.567693 C
   0.00002688        4249.    158100322.    16.0426675     0.0004311     -0.000536     1.6037385
-12.327605 C
   0.00002813        4341.    154353505.    15.8086724     0.0004446     -0.000568     1.6470294
-13.091815 C
   0.00002938        4433.    150896277.    15.5927082     0.0004580     -0.000599     1.6897395
-13.857699 C
   0.00003063        4523.    147678850.    15.3907080     0.0004713     -0.000631     1.7317181
-14.626675 C
   0.00003188        4612.    144684326.    15.2024306     0.0004846     -0.000663     1.7730727
-15.397841 C
   0.00003313        4700.    141889492.    15.0259400     0.0004977     -0.000695     1.8138319
-16.170995 C
   0.00003438        4788.    139274713.    14.8607886     0.0005108     -0.000727     1.8540069
-16.946089 C
   0.00003563        4874.    136819705.    14.7049433     0.0005239     -0.000759     1.8935827
-17.723318 C
   0.00003688        4961.    134522619.    14.5592902     0.0005369     -0.000791     1.9327631
-18.500805 C
   0.00003813        5046.    132345530.    14.4201043     0.0005498     -0.000823     1.9711910
-19.281985 C
   0.00003938        5131.    130303109.    14.2899936     0.0005627     -0.000855     2.0093010
-20.062752 C
   0.00004063        5215.    128371766.    14.1665377     0.0005755     -0.000887     2.0468870
-20.845110 C
   0.00004188        5299.    126538278.    14.0486255     0.0005883     -0.000919     2.0838902
-21.629688 C
   0.00004313        5382.    124807919.    13.9378745     0.0006011     -0.000951     2.1205803
-22.413859 C
   0.00004438        5466.    123166707.    13.8327852     0.0006138     -0.000984     2.1568421
-23.198771 C
   0.00004563        5548.    121597784.    13.7312625     0.0006265     -0.001016     2.1924654
-23.986586 C
   0.00004688        5630.    120109712.    13.6354503     0.0006392     -0.001048     2.2277802
-24.773998 C
   0.00004813        5712.    118696175.    13.5449054     0.0006518     -0.001081     2.2627856
-25.561005 C
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   0.00004938        5794.    117344021.    13.4577921     0.0006645     -0.001113     2.2972846
-26.349660 C
   0.00005063        5875.    116048229.    13.3737536     0.0006770     -0.001145     2.3312674
-27.140118 C
   0.00005188        5956.    114812390.    13.2940355     0.0006896     -0.001178     2.3649453
-27.930173 C
   0.00005313        6037.    113632257.    13.2183294     0.0007022     -0.001210     2.3983172
-28.719824 C
   0.00005438        6117.    112503976.    13.1463614     0.0007148     -0.001243     2.4313822
-29.509070 C
   0.00005563        6197.    111413701.    13.0756070     0.0007273     -0.001275     2.4638072
-30.301572 C
   0.00005688        6277.    110368099.    13.0079856     0.0007398     -0.001308     2.4958968
-31.094038 C
   0.00005813        6357.    109365279.    12.9435128     0.0007523     -0.001340     2.5276837
-31.886098 C
   0.00005938        6436.    108402529.    12.8819911     0.0007649     -0.001373     2.5591669
-32.677751 C
   0.00006063        6516.    107477352.    12.8232453     0.0007774     -0.001405     2.5903453
-33.468995 C
   0.00006188        6595.    106585542.    12.7666073     0.0007899     -0.001438     2.6211424
-34.260708 C
   0.00006313        6674.    105720878.    12.7108604     0.0008024     -0.001470     2.6513895
-35.054892 C
   0.00006438        6752.    104887835.    12.6574991     0.0008148     -0.001503     2.6813357
-35.848665 C
   0.00006563        6831.    104084606.    12.6063877     0.0008273     -0.001535     2.7109800
-36.642025 C
   0.00006688        6909.    103309510.    12.5574011     0.0008398     -0.001568     2.7403213
-37.434970 C
   0.00006813        6987.    102560986.    12.5104233     0.0008523     -0.001600     2.7693588
-38.227496 C
   0.00006938        7065.    101837590.    12.4653470     0.0008648     -0.001633     2.7980913
-39.019603 C
   0.00007063        7143.    101137973.    12.4220809     0.0008773     -0.001665     2.8265178
-39.811289 C
   0.00007188        7220.    100455782.    12.3789436     0.0008897     -0.001698     2.8543810
-40.605825 C
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   0.00007313         7298.     99794936.    12.3374020     0.0009022     -0.001730     2.8819291
-41.400107 C
   0.00007438         7375.     99154611.    12.2974548     0.0009146     -0.001763     2.9091746
-42.193961 C
   0.00007938         7682.     96778950.    12.1521243     0.0009646     -0.001893     3.0151098
-45.365052 C
   0.00008438         7987.     94656726.    12.0255138     0.0010147     -0.002023     3.1158848
-48.532510 C
   0.00008938         8289.     92740074.    11.9124562     0.0010647     -0.002153     3.2111206
-51.701533 C
   0.00009438         8589.     91004347.    11.8140847     0.0011150     -0.002283     3.3013836
-54.863146 C
   0.00009938         8886.     89421748.    11.7282588     0.0011655     -0.002412     3.3865995
-58.017161 C
    0.0001044         9180.     87954378.    11.6506457     0.0012160     -0.002541     3.4662742
-60.000000 CY
    0.0001094         9384.     85800606.    11.5481808     0.0012631     -0.002674     3.5353720
-60.000000 CY
    0.0001144         9541.     83421843.    11.4396312     0.0013084     -0.002809     3.5973697
-60.000000 CY
    0.0001194         9697.     81230817.    11.3419667     0.0013539     -0.002944     3.6551937
-60.000000 CY
    0.0001244         9850.     79194943.    11.2495142     0.0013992     -0.003078     3.7081633
-60.000000 CY
    0.0001294        10001.     77305964.    11.1658348     0.0014446     -0.003213     3.7569385
-60.000000 CY
    0.0001344        10151.     75543308.    11.0898380     0.0014902     -0.003347     3.8014419
-60.000000 CY
    0.0001394        10259.     73606225.    11.0036762     0.0015336     -0.003484     3.8396096
-60.000000 CY
    0.0001444        10321.     71489024.    10.9026681     0.0015741     -0.003623     3.8714236
-60.000000 CY
    0.0001494        10378.     69475705.    10.8063989     0.0016142     -0.003763     3.8995256
-60.000000 CY
    0.0001544        10434.     67587878.    10.7175204     0.0016545     -0.003903     3.9242726
-60.000000 CY
    0.0001594        10489.     65813622.    10.6354135     0.0016950     -0.004042     3.9456180
-60.000000 CY
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    0.0001644       10542.     64134489.    10.5556303     0.0017351     -0.004182     3.9632602
-60.000000 CY
    0.0001694       10594.     62548130.    10.4807597     0.0017752     -0.004322     3.9774653
-60.000000 CY
    0.0001744       10645.     61048330.    10.4102665     0.0018153     -0.004462     3.9882598
-60.000000 CY
    0.0001794       10696.     59627757.    10.3455446     0.0018557     -0.004602     3.9955935
-60.000000 CY
    0.0001844       10745.     58279864.    10.2853788     0.0018964     -0.004741     3.9994144
-60.000000 CY
    0.0001894       10794.     56995442.    10.2281739     0.0019370     -0.004881     3.9970351
-60.000000 CY
    0.0001944       10840.     55770067.    10.1742556     0.0019776     -0.005020     3.9997917
-60.000000 CY
    0.0001994       10886.     54601501.    10.1231235     0.0020183     -0.005159     3.9974730
-60.000000 CY
    0.0002044       10931.     53486159.    10.0755448     0.0020592     -0.005298     3.9998635
-60.000000 CY
    0.0002094       10975.     52419608.    10.0313940     0.0021003     -0.005437     3.9972164
-60.000000 CY
    0.0002144       11019.     51399270.     9.9902783     0.0021417     -0.005576     3.9997565
-60.000000 CY
    0.0002194       11061.     50421481.     9.9521062     0.0021832     -0.005714     3.9961638
-60.000000 CY
    0.0002244       11103.     49483900.     9.9165810     0.0022250     -0.005852     3.9993127
-60.000000 CY
    0.0002294       11144.     48582915.     9.8823074     0.0022668     -0.005991     3.9972109
-60.000000 CY
    0.0002344       11183.     47715784.     9.8493605     0.0023084     -0.006129     3.9980280
-60.000000 CY
    0.0002394       11221.     46876993.     9.8176662     0.0023501     -0.006267     3.9998847
-60.000000 CY
    0.0002444       11256.     46059903.     9.7866751     0.0023916     -0.006406     3.9950300
-60.000000 CY
    0.0002494       11283.     45245424.     9.7529083     0.0024321     -0.006545     3.9984053
-60.000000 CY
    0.0002544       11306.     44446014.     9.7185154     0.0024721     -0.006685     3.9999015
-60.000000 CY
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    0.0002594        11319.     43640540.     9.6798494     0.0025107     -0.006827     3.9945023
-60.000000 CY
    0.0002644        11330.     42857537.     9.6421489     0.0025491     -0.006968     3.9970850
-60.000000 CY
    0.0002694        11338.     42090633.     9.6039838     0.0025871     -0.007110     3.9992100
-60.000000 CY
    0.0002744        11346.     41350452.     9.5673334     0.0026250     -0.007252     3.9999954
-60.000000 CY
    0.0003044        11380.     37388565.     9.3667055     0.0028510     -0.008107     3.9934819
-60.000000 CY
    0.0003344        11408.     34118560.     9.2116385     0.0030801     -0.008957     3.9944808
-60.000000 CYT
    0.0003644        11430.     31368001.     9.0799576     0.0033085     -0.009809     3.9916365
-60.000000 CYT
    0.0003944        11447.     29026108.     8.9721368     0.0035384     -0.010659     3.9939045
-60.000000 CYT
    0.0004244        11462.     27009296.     8.8854430     0.0037708     -0.011507     3.9992875
-60.000000 CYT
    0.0004544        11462.     25226013.     8.9133442     0.0040500     -0.012307     3.9978007
60.0000000 CYT


--------------------------------------------------------------------------------
   Summary of Results for Nominal Moment Capacity for Section 3
--------------------------------------------------------------------------------

Moment values interpolated at maximum compressive strain = 0.003
or maximum developed moment if pile fails at smaller strains.

 Load           Axial Thrust        Nominal Mom. Cap.      Max. Comp.      Max. Tens.
  No.              kips                in-kip               Strain          Strain
 ----         ----------------     ------------------     ------------    ------------
   1              212.150             10532.895          0.00300000     -0.00959730
   2              295.890             11398.514          0.00300000     -0.00865979

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	212.150000	10533.	137.897500	6846.	89062138.
2	0.65	295.890000	11399.	192.328500	7409.	98888514.
1	0.75	212.150000	10533.	159.112500	7900.	83911158.
2	0.75	295.890000	11399.	221.917500	8549.	91233835.
1	0.90	212.150000	10533.	190.935000	9480.	65371459.
2	0.90	295.890000	11399.	266.301000	10259.	73609913.

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	13.5000	0.00	N.A.	Yes	N.A.	N.A.
2	15.5000	2.0000	No	Yes	N.A.	N.A.

3	19.2000	5.7000	No	Yes	N.A.	N.A.
4	27.5000	14.0000	No	Yes	N.A.	N.A.
5	32.2000	18.7000	No	Yes	N.A.	N.A.
6	33.8000	20.3000	No	Yes	N.A.	N.A.
7	35.5000	22.0000	No	Yes	N.A.	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 = 15820.0 lbs
Applied moment at pile head = 0.0 in-lbs
Axial thrust load on pile head = 212150.0 lbs

Depth X	Deflect. y	Bending Moment	Shear Force	Slope S	Total Stress	Bending Stiffness	Soil Res. p	Soil Spr. Es*H	Distrib. Lat. Load
feet	inches	in-lbs	lbs	radians	psi*	lb-in^2	lb/inch	lb/inch	lb/inch
0.00	0.09623	-0.00699	15820.	-7.06E-04	33.6746	5.80E+13	0.00	0.00	24.9426
0.5000	0.09200	96268.	15973.	-7.06E-04	33.7824	5.80E+13	0.00	0.00	25.9704

1.0000	0.08776	193471.	16133.	-7.06E-04	33.8912	5.80E+13	0.00	0.00
27.3407								
1.5000	0.08352	291658.	16301.	-7.06E-04	34.0011	5.80E+13	0.00	0.00
28.7111								
2.0000	0.07928	390879.	16477.	-7.06E-04	34.1122	5.80E+13	0.00	0.00
30.0815								
2.5000	0.07504	491183.	16662.	-7.06E-04	34.2245	5.80E+13	0.00	0.00
31.4519								
3.0000	0.07081	592618.	16855.	-7.06E-04	34.3381	5.80E+13	0.00	0.00
32.8222								
3.5000	0.06657	695236.	17056.	-7.06E-04	26.0343	7.73E+13	0.00	0.00
34.1926								
4.0000	0.06233	799084.	17265.	-7.06E-04	26.1506	7.73E+13	0.00	0.00
35.5630								
4.5000	0.05810	904212.	17482.	-7.06E-04	26.2682	7.73E+13	0.00	0.00
36.9333								
5.0000	0.05386	1010670.	17708.	-7.06E-04	26.3874	7.73E+13	0.00	0.00
38.3037								
5.5000	0.04963	1118507.	17942.	-7.06E-04	26.5082	7.73E+13	0.00	0.00
39.6741								
6.0000	0.04539	1227772.	18184.	-7.06E-04	26.6305	7.73E+13	0.00	0.00
41.0444								
6.5000	0.04116	1338515.	18435.	-6.95E-04	0.00	3.65E+11	0.00	0.00
42.4148								
7.0000	0.03706	1450756.	18693.	-6.72E-04	0.00	3.65E+11	0.00	0.00
43.7852								
7.5000	0.03310	1564543.	18960.	-6.47E-04	0.00	3.64E+11	0.00	0.00
45.1556								
8.0000	0.02930	1679923.	19235.	-6.20E-04	0.00	3.64E+11	0.00	0.00
46.5259								
8.5000	0.02566	1796943.	19518.	-5.92E-04	0.00	3.64E+11	0.00	0.00
47.8963								
9.0000	0.02220	1915649.	19810.	-5.61E-04	0.00	3.64E+11	0.00	0.00
49.2667								
9.5000	0.01893	2036089.	20110.	-5.28E-04	0.00	3.64E+11	0.00	0.00
50.6370								
10.0000	0.01586	2158308.	20417.	-4.94E-04	0.00	3.64E+11	0.00	0.00
52.0074								

10.5000	0.01300	2282355.	20734.	-4.57E-04	0.00	3.63E+11	0.00	0.00	53.3778
11.0000	0.01037	2408276.	21058.	-4.18E-04	0.00	3.63E+11	0.00	0.00	54.7481
11.5000	0.00798	2536116.	21391.	-3.77E-04	0.00	3.63E+11	0.00	0.00	56.1185
12.0000	0.00584	2665924.	21731.	-3.34E-04	0.00	3.62E+11	0.00	0.00	57.4889
12.5000	0.00397	2797745.	22080.	-2.89E-04	0.00	3.62E+11	0.00	0.00	58.8593
13.0000	0.00237	2931626.	22438.	-2.42E-04	0.00	3.62E+11	0.00	0.00	60.2296
13.5000	0.00107	3067613.	-22140.	-1.60E-04	0.00	1.60E+11	-14950.	8.40E+07	30.6287
14.0000	4.55E-04	2666348.	-90255.	-8.01E-05	0.00	3.62E+11	-7785.	1.03E+08	0.00
14.5000	1.07E-04	1984752.	-120098.	-4.16E-05	0.00	3.64E+11	-2162.	1.21E+08	0.00
15.0000	-4.48E-05	1225283.	-123448.	-1.52E-05	0.00	3.65E+11	1045.	1.40E+08	0.00
15.5000	-7.55E-05	503411.	-95063.	-9.82E-07	0.00	3.65E+11	8417.	6.69E+08	0.00
16.0000	-5.66E-05	84535.	-48674.	3.85E-06	0.00	3.65E+11	7046.	7.47E+08	0.00
16.5000	-2.93E-05	-80682.	-15446.	3.89E-06	0.00	3.65E+11	4030.	8.26E+08	0.00
17.0000	-9.94E-06	-100824.	1139.	2.39E-06	0.00	3.65E+11	1498.	9.05E+08	0.00
17.5000	-5.55E-07	-67022.	5907.	1.01E-06	0.00	3.65E+11	90.9055	9.83E+08	0.00
18.0000	2.21E-06	-29946.	5004.	2.15E-07	0.00	3.65E+11	-391.700	1.06E+09	0.00
18.5000	2.02E-06	-6971.	2674.	-8.87E-08	0.00	3.65E+11	-384.954	1.14E+09	0.00
19.0000	1.15E-06	2146.	819.1300	-1.28E-07	0.00	3.65E+11	-233.450	1.22E+09	0.00
19.5000	4.84E-07	2859.	6.8725	-8.72E-08	0.00	3.65E+11	-37.302	4.62E+08	0.00

20.0000	1.02E-07	2229.	-130.112	-4.53E-08	0.00	3.65E+11	-8.359	4.90E+08	0.00
20.5000	-5.97E-08	1298.	-139.720	-1.63E-08	0.00	3.65E+11	5.1564	5.18E+08	0.00
21.0000	-9.37E-08	552.4001	-98.670	-1.12E-09	0.00	3.65E+11	8.5268	5.46E+08	0.00
21.5000	-7.32E-08	113.8558	-52.095	4.36E-09	0.00	3.65E+11	6.9982	5.74E+08	0.00
22.0000	-4.14E-08	-72.757	-18.650	4.70E-09	0.00	3.65E+11	4.1502	6.02E+08	0.00
22.5000	-1.68E-08	-109.958	-0.920	3.20E-09	0.00	3.65E+11	1.7597	6.30E+08	0.00
23.0000	-3.01E-09	-83.810	5.3056	1.60E-09	0.00	3.65E+11	0.3157	6.30E+08	0.00
23.5000	2.47E-09	-46.296	5.4733	5.33E-10	0.00	3.65E+11	-0.260	6.30E+08	0.00
24.0000	3.38E-09	-18.132	3.6279	2.63E-12	0.00	3.65E+11	-0.355	6.30E+08	0.00
24.5000	2.51E-09	-2.762	1.7725	-1.69E-10	0.00	3.65E+11	-0.263	6.30E+08	0.00
25.0000	1.35E-09	3.1386	0.5569	-1.66E-10	0.00	3.65E+11	-0.142	6.30E+08	0.00
25.5000	5.12E-10	3.9216	-0.03077	-1.08E-10	0.00	3.65E+11	-0.05375	6.30E+08	0.00
26.0000	5.71E-11	2.7696	-0.210	-5.30E-11	0.00	3.65E+11	-0.00599	6.30E+08	0.00
26.5000	-1.24E-10	1.4019	-0.189	-1.87E-11	0.00	3.65E+11	0.01306	6.30E+08	0.00
27.0000	-1.67E-10	0.5044	-0.09685	-3.03E-12	0.00	3.65E+11	0.01758	6.30E+08	0.00
27.5000	-1.61E-10	0.2397	-0.03639	3.09E-12	0.00	3.65E+11	0.00257	9.60E+07	0.00
28.0000	-1.30E-10	0.06763	-0.02242	5.62E-12	0.00	3.65E+11	0.00209	9.60E+07	0.00
28.5000	-9.33E-11	-0.02938	-0.01169	5.93E-12	0.00	3.65E+11	0.00149	9.60E+07	0.00
29.0000	-5.91E-11	-0.07265	-0.00437	5.10E-12	0.00	3.65E+11	9.46E-04	9.60E+07	0.00

29.5000	-3.21E-11	-0.08187	7.48E-06	3.82E-12	0.00	3.65E+11	5.14E-04	9.60E+07	0.00
30.0000	-1.32E-11	-0.07257	0.00219	2.55E-12	0.00	3.65E+11	2.12E-04	9.60E+07	0.00
30.5000	-1.50E-12	-0.05565	0.00289	1.50E-12	0.00	3.65E+11	2.39E-05	9.60E+07	0.00
31.0000	4.75E-12	-0.03786	0.00274	0.00	0.00	3.65E+11	-7.60E-05	9.60E+07	0.00
31.5000	7.26E-12	-0.02281	0.00216	0.00	0.00	3.65E+11	-1.16E-04	9.60E+07	0.00
32.0000	7.52E-12	-0.01194	0.00145	0.00	0.00	3.65E+11	-1.20E-04	9.60E+07	0.00
32.5000	6.60E-12	-0.00540	9.12E-04	0.00	0.00	3.65E+11	-5.94E-05	5.40E+07	0.00
33.0000	5.15E-12	-0.00100	5.94E-04	0.00	0.00	3.65E+11	-4.63E-05	5.40E+07	0.00
33.5000	3.59E-12	0.00173	3.58E-04	0.00	0.00	3.65E+11	-3.23E-05	5.40E+07	0.00
34.0000	2.21E-12	0.00330	1.55E-04	0.00	0.00	3.65E+11	-3.54E-05	9.60E+07	0.00
34.5000	1.15E-12	0.00359	-6.22E-06	0.00	0.00	3.65E+11	-1.85E-05	9.60E+07	0.00
35.0000	0.00	0.00322	-8.34E-05	0.00	0.00	3.65E+11	-7.25E-06	9.60E+07	0.00
35.5000	0.00	0.00259	-1.99E-04	0.00	0.00	3.65E+11	-3.14E-05	2.70E+09	0.00
36.0000	0.00	8.32E-04	-2.16E-04	0.00	0.00	3.65E+11	2.59E-05	2.70E+09	0.00
36.5000	0.00	0.00	0.00	0.00	0.00	3.65E+11	4.62E-05	1.35E+09	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             =     0.09623312 inches
Computed slope at pile head      =     -0.0007063 radians
Maximum bending moment           =       3067613. inch-lbs
Maximum shear force              =       -123448. lbs
Depth of maximum bending moment  =    13.50000000 feet below pile head
Depth of maximum shear force     =    15.00000000 feet below pile head
Number of iterations             =             27
Number of zero deflection points =              7
Pile deflection at ground        =     0.00106787 inches
```

Pile-head Deflection vs. Pile Length for Load Case 1

Boundary Condition Type 1, Shear and Moment

```
Shear      =          15820. lbs
Moment     =              0. in-lbs
Axial Load =         212150. lbs
```

Pile Length feet	Pile Head Deflection inches	Maximum Moment ln-lbs	Maximum Shear lbs
36.50000	0.09623312	3067613.	-123448.
34.67500	0.11198742	3146391.	-130544.
32.85000	0.12324741	3196494.	-136102.
31.02500	0.10548314	3096992.	-125338.
29.20000	0.10453733	3096792.	-126924.
27.37500	0.10157794	3068756.	-121242.
25.55000	0.10436115	3110496.	-127299.
23.72500	0.10382737	3110382.	-130093.

21.90000	0.09933857	3068281.	-124995.
20.07500	0.11440288	3139877.	-132606.
18.25000	0.10246049	3068928.	-127041.
16.42500	0.11480282	3133113.	-140978.

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 = 19120.0 lbs
Applied moment at pile head = 0.0 in-lbs
Axial thrust load on pile head = 295890.0 lbs

Depth	Deflect.	Bending	Shear	Slope	Total	Bending	Soil Res.	Soil Spr.	Distrib.
X	y	Moment	Force	S	Stress	Stiffness	p	Es*H	Lat. Load
feet	inches	in-lbs	lbs	radians	psi*	lb-in^2	lb/inch	lb/inch	lb/inch
0.00	0.1388	0.00545	19120.	-0.00100	46.9667	5.80E+13	0.00	0.00	39.5139
0.5000	0.1328	117215.	19362.	-0.00100	47.0979	5.80E+13	0.00	0.00	41.0556
1.0000	0.1268	235907.	19614.	-0.00100	47.2308	5.80E+13	0.00	0.00	43.1111
1.5000	0.1207	356152.	19879.	-0.00100	47.3654	5.80E+13	0.00	0.00	45.1667
2.0000	0.1147	478023.	20156.	-0.00100	47.5018	5.80E+13	0.00	0.00	47.2222
2.5000	0.1087	601593.	20446.	-0.00100	47.6402	5.80E+13	0.00	0.00	49.2778
3.0000	0.1027	726938.	20748.	-0.00100	47.7805	5.80E+13	0.00	0.00	

51.3333
3.5000 0.09664 854130. 21062. -0.00100 36.1812 7.73E+13 0.00 0.00
53.3889
4.0000 0.09061 983244. 21388. -0.00100 36.3258 7.73E+13 0.00 0.00
55.4444
4.5000 0.08459 1114354. 21727. -0.00100 36.4726 7.73E+13 0.00 0.00
57.5000
5.0000 0.07856 1247534. 22078. -0.00100 36.6217 7.73E+13 0.00 0.00
59.5556
5.5000 0.07254 1382858. 22442. -0.00100 36.7732 7.73E+13 0.00 0.00
61.6111
6.0000 0.06651 1520399. 22818. -0.00100 36.9271 7.73E+13 0.00 0.00
63.6667
6.5000 0.06049 1660232. 23206. -9.90E-04 0.00 3.61E+11 0.00 0.00
65.7222
7.0000 0.05463 1802383. 23606. -9.61E-04 0.00 3.61E+11 0.00 0.00
67.7778
7.5000 0.04896 1946920. 24019. -9.30E-04 0.00 3.61E+11 0.00 0.00
69.8333
8.0000 0.04347 2093913. 24444. -8.96E-04 0.00 3.61E+11 0.00 0.00
71.8889
8.5000 0.03820 2243433. 24882. -8.60E-04 0.00 3.61E+11 0.00 0.00
73.9444
9.0000 0.03315 2395549. 25332. -8.22E-04 0.00 3.61E+11 0.00 0.00
76.0000
9.5000 0.02834 2550330. 25794. -7.81E-04 0.00 3.60E+11 0.00 0.00
78.0556
10.0000 0.02378 2707845. 26268. -7.37E-04 0.00 3.60E+11 0.00 0.00
80.1111
10.5000 0.01950 2868165. 26755. -6.90E-04 0.00 3.60E+11 0.00 0.00
82.1667
11.0000 0.01550 3031357. 27254. -6.41E-04 0.00 3.59E+11 0.00 0.00
84.2222
11.5000 0.01180 3197492. 27766. -5.89E-04 0.00 3.59E+11 0.00 0.00
86.2778
12.0000 0.00843 3366638. 28290. -5.32E-04 0.00 3.36E+11 0.00 0.00
88.3333
12.5000 0.00541 3538857. 28826. -4.48E-04 0.00 1.96E+11 0.00 0.00

90.3889
13.0000 0.00305 3714138. 29374. -3.34E-04 0.00 1.85E+11 0.00 0.00
92.4444
13.5000 0.00140 3892533. -29159. -2.07E-04 0.00 1.75E+11 -19651. 8.40E+07
46.9931
14.0000 5.61E-04 3364963. -116792. -1.07E-04 0.00 2.98E+11 -9607. 1.03E+08
0.00
14.5000 1.25E-04 2491406. -153210. -5.20E-05 0.00 3.60E+11 -2532. 1.21E+08
0.00
15.0000 -6.22E-05 1526633. -156449. -1.86E-05 0.00 3.61E+11 1452. 1.40E+08
0.00
15.5000 -9.75E-05 614082. -119502. -7.77E-07 0.00 3.61E+11 10864. 6.69E+08
0.00
16.0000 -7.16E-05 92615. -60174. 5.09E-06 0.00 3.61E+11 8912. 7.47E+08
0.00
16.5000 -3.64E-05 -108024. -18410. 4.96E-06 0.00 3.61E+11 5009. 8.26E+08
0.00
17.0000 -1.20E-05 -128321. 2042. 3.00E-06 0.00 3.61E+11 1808. 9.05E+08
0.00
17.5000 -3.80E-07 -83529. 7653. 1.24E-06 0.00 3.61E+11 62.3091 9.83E+08
0.00
18.0000 2.91E-06 -36491. 6296. 2.45E-07 0.00 3.61E+11 -514.490 1.06E+09
0.00
18.5000 2.56E-06 -7973. 3294. -1.24E-07 0.00 3.61E+11 -486.190 1.14E+09
0.00
19.0000 1.41E-06 3042. 973.9456 -1.65E-07 0.00 3.61E+11 -287.267 1.22E+09
0.00
19.5000 5.73E-07 3715. -20.180 -1.09E-07 0.00 3.61E+11 -44.108 4.62E+08
0.00
20.0000 1.02E-07 2800. -177.562 -5.52E-08 0.00 3.61E+11 -8.353 4.90E+08
0.00
20.5000 -8.93E-08 1584. -179.500 -1.88E-08 0.00 3.61E+11 7.7066 5.18E+08
0.00
21.0000 -1.23E-07 646.0141 -122.818 -2.47E-10 0.00 3.61E+11 11.1872 5.46E+08
0.00
21.5000 -9.22E-08 110.4633 -62.787 6.03E-09 0.00 3.61E+11 8.8235 5.74E+08
0.00
22.0000 -5.05E-08 -107.446 -21.110 6.06E-09 0.00 3.61E+11 5.0688 6.02E+08

0.00
22.5000 -1.95E-08 -142.875 0.2437 3.98E-09 0.00 3.61E+11 2.0490 6.30E+08
0.00
23.0000 -2.75E-09 -104.535 7.2560 1.93E-09 0.00 3.61E+11 0.2884 6.30E+08
0.00
23.5000 3.60E-09 -55.810 6.9858 5.95E-10 0.00 3.61E+11 -0.378 6.30E+08
0.00
24.0000 4.39E-09 -20.708 4.4663 -4.04E-11 0.00 3.61E+11 -0.461 6.30E+08
0.00
24.5000 3.12E-09 -2.214 2.0995 -2.31E-10 0.00 3.61E+11 -0.328 6.30E+08
0.00
25.0000 1.63E-09 4.4866 0.6047 -2.12E-10 0.00 3.61E+11 -0.171 6.30E+08
0.00
25.5000 5.78E-10 5.0428 -0.08942 -1.33E-10 0.00 3.61E+11 -0.06069 6.30E+08
0.00
26.0000 3.30E-11 3.4140 -0.282 -6.25E-11 0.00 3.61E+11 -0.00347 6.30E+08
0.00
26.5000 -1.72E-10 1.6604 -0.238 -2.03E-11 0.00 3.61E+11 0.01803 6.30E+08
0.00
27.0000 -2.11E-10 0.5559 -0.118 -1.93E-12 0.00 3.61E+11 0.02216 6.30E+08
0.00
27.5000 -1.95E-10 0.2491 -0.04178 4.75E-12 0.00 3.61E+11 0.00312 9.60E+07
0.00
28.0000 -1.54E-10 0.05451 -0.02503 7.27E-12 0.00 3.61E+11 0.00246 9.60E+07
0.00
28.5000 -1.08E-10 -0.05135 -0.01247 7.30E-12 0.00 3.61E+11 0.00172 9.60E+07
0.00
29.0000 -6.64E-11 -0.09520 -0.00412 6.08E-12 0.00 3.61E+11 0.00106 9.60E+07
0.00
29.5000 -3.47E-11 -0.101 7.33E-04 4.45E-12 0.00 3.61E+11 5.55E-04 9.60E+07
0.00
30.0000 -1.30E-11 -0.08642 0.00302 2.90E-12 0.00 3.61E+11 2.07E-04 9.60E+07
0.00
30.5000 0.00 -0.06457 0.00363 1.65E-12 0.00 3.61E+11 -2.22E-06 9.60E+07
0.00
31.0000 6.80E-12 -0.04281 0.00330 0.00 0.00 3.61E+11 -1.09E-04 9.60E+07
0.00
31.5000 9.19E-12 -0.02496 0.00253 0.00 0.00 3.61E+11 -1.47E-04 9.60E+07

0.00								
32.0000	9.10E-12	-0.01241	0.00166	0.00	0.00	3.61E+11	-1.46E-04	9.60E+07
0.00								
32.5000	7.77E-12	-0.00510	0.00101	0.00	0.00	3.61E+11	-6.99E-05	5.40E+07
0.00								
33.0000	5.94E-12	-3.04E-04	6.39E-04	0.00	0.00	3.61E+11	-5.34E-05	5.40E+07
0.00								
33.5000	4.07E-12	0.00257	3.68E-04	0.00	0.00	3.61E+11	-3.66E-05	5.40E+07
0.00								
34.0000	2.46E-12	0.00412	1.41E-04	0.00	0.00	3.61E+11	-3.93E-05	9.60E+07
0.00								
34.5000	1.25E-12	0.00426	-3.73E-05	0.00	0.00	3.61E+11	-2.01E-05	9.60E+07
0.00								
35.0000	0.00	0.00367	-1.20E-04	0.00	0.00	3.61E+11	-7.64E-06	9.60E+07
0.00								
35.5000	0.00	0.00281	-2.33E-04	0.00	0.00	3.61E+11	-2.98E-05	2.70E+09
0.00								
36.0000	0.00	8.79E-04	-2.34E-04	0.00	0.00	3.61E+11	2.92E-05	2.70E+09
0.00								
36.5000	0.00	0.00	0.00	0.00	0.00	3.61E+11	4.88E-05	1.35E+09
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	=	0.13882496 inches
Computed slope at pile head	=	-0.0010046 radians
Maximum bending moment	=	3892533. inch-lbs
Maximum shear force	=	-156449. lbs
Depth of maximum bending moment	=	13.50000000 feet below pile head
Depth of maximum shear force	=	15.00000000 feet below pile head

Number of iterations = 98
Number of zero deflection points = 7
Pile deflection at ground = 0.00140361 inches

Pile-head Deflection vs. Pile Length for Load Case 2

Boundary Condition Type 1, Shear and Moment

Shear = 19120. lbs
Moment = 0. in-lbs
Axial Load = 295890. lbs

Pile Length feet	Pile Head Deflection inches	Maximum Moment ln-lbs	Maximum Shear lbs
36.50000	0.13882496	3892533.	-156449.
34.67500	0.15889937	3997517.	-164832.
32.85000	0.17004213	4063411.	-172457.
31.02500	0.14923744	3931590.	-158900.
29.20000	0.15246566	3932544.	-161478.
27.37500	0.14354574	3893912.	-154247.
25.55000	0.15217525	3950510.	-161310.
23.72500	0.15483003	3951294.	-165366.
21.90000	0.14355480	3893916.	-158750.
20.07500	0.16143996	3988993.	-169133.
18.25000	0.14705994	3894920.	-161966.
16.42500	0.15882404	3979225.	-179715.

Computed Values of Pile Loading and Deflection
for Lateral Loading for Load Case Number 3

Pile-head conditions are Displacement and Moment (Loading Type 4)
Displacement of pile head = 0.480000 inches
Moment at pile head = 0.0 in-lbs
Axial load at pile head = 212150.0 lbs

Depth X	Deflect. y	Bending Moment	Shear Force	Slope S	Total Stress	Bending Stiffness	Soil Res. p	Soil Spr. Es*H	Distrib. Lat. Load
feet	inches	in-lbs	lbs	radians	psi*	lb-in^2	lb/inch	lb/inch	lb/inch
0.00	0.4800	0.00	31504.	-0.00351	33.6746	5.80E+13	0.00	0.00	24.9426
0.5000	0.4590	193934.	31657.	-0.00351	33.8917	5.80E+13	0.00	0.00	25.9704
1.0000	0.4379	388802.	31816.	-0.00351	34.1099	5.80E+13	0.00	0.00	27.3407
1.5000	0.4169	584655.	31985.	-0.00351	34.3291	5.80E+13	0.00	0.00	28.7111
2.0000	0.3959	781541.	32161.	-0.00351	34.5496	5.80E+13	0.00	0.00	30.0815
2.5000	0.3748	979510.	32346.	-0.00351	34.7712	5.80E+13	0.00	0.00	31.4519
3.0000	0.3538	1178611.	32538.	-0.00351	34.9941	5.80E+13	0.00	0.00	32.8222
3.5000	0.3328	1378894.	32739.	-0.00350	26.7997	7.73E+13	0.00	0.00	34.1926
4.0000	0.3118	1580407.	32949.	-0.00350	27.0253	7.73E+13	0.00	0.00	35.5630
4.5000	0.2907	1783200.	33166.	-0.00350	27.2523	7.73E+13	0.00	0.00	36.9333
5.0000	0.2697	1987323.	33392.	-0.00350	27.4808	7.73E+13	0.00	0.00	38.3037
5.5000	0.2487	2192825.	33626.	-0.00350	27.7109	7.73E+13	0.00	0.00	

39.6741
6.0000 0.2276 2399755. 33868. -0.00350 27.9426 7.73E+13 0.00 0.00
41.0444
6.5000 0.2066 2608162. 34118. -0.00348 0.00 3.63E+11 0.00 0.00
42.4148
7.0000 0.1859 2818041. 34377. -0.00344 0.00 3.62E+11 0.00 0.00
43.7852
7.5000 0.1654 3029437. 34644. -0.00336 0.00 1.62E+11 0.00 0.00
45.1556
8.0000 0.1456 3242315. 34919. -0.00324 0.00 1.50E+11 0.00 0.00
46.5259
8.5000 0.1265 3456704. 35202. -0.00310 0.00 1.41E+11 0.00 0.00
47.8963
9.0000 0.1084 3672630. 35494. -0.00294 0.00 1.33E+11 0.00 0.00
49.2667
9.5000 0.09121 3890118. 35793. -0.00277 0.00 1.26E+11 0.00 0.00
50.6370
10.0000 0.07516 4109194. 36101. -0.00257 0.00 1.21E+11 0.00 0.00
52.0074
10.5000 0.06034 4329883. 36417. -0.00236 0.00 1.16E+11 0.00 0.00
53.3778
11.0000 0.04686 4552208. 36742. -0.00212 0.00 1.12E+11 0.00 0.00
54.7481
11.5000 0.03485 4776192. 37074. -0.00187 0.00 1.08E+11 0.00 0.00
56.1185
12.0000 0.02442 5001860. 37415. -0.00159 0.00 1.05E+11 0.00 0.00
57.4889
12.5000 0.01571 5229234. 37764. -0.00130 0.00 1.02E+11 0.00 0.00
58.8593
13.0000 0.00885 5458336. 38122. -9.80E-04 0.00 9.97E+10 0.00 0.00
60.2296
13.5000 0.00395 5689188. -42552. -6.41E-04 0.00 9.74E+10 -26982. 4.10E+07
30.6287
14.0000 0.00115 4949348. -182651. -3.25E-04 0.00 1.06E+11 -19749. 1.03E+08
0.00
14.5000 4.47E-05 3498205. -244610. -1.10E-04 0.00 1.39E+11 -904.509 1.21E+08
0.00
15.0000 -1.60E-04 2014308. -236115. -1.75E-05 0.00 3.64E+11 3736. 1.40E+08

0.00								
15.5000	-1.66E-04	664868.	-169528.	4.55E-06	0.00	3.65E+11	18460.	6.69E+08
0.00								
16.0000	-1.06E-04	-20038.	-74714.	9.85E-06	0.00	3.65E+11	13145.	7.47E+08
0.00								
16.5000	-4.74E-05	-231726.	-15700.	7.78E-06	0.00	3.65E+11	6526.	8.26E+08
0.00								
17.0000	-1.22E-05	-208463.	9375.	4.16E-06	0.00	3.65E+11	1832.	9.05E+08
0.00								
17.5000	2.53E-06	-119239.	13628.	1.47E-06	0.00	3.65E+11	-414.378	9.83E+08
0.00								
18.0000	5.44E-06	-44930.	9497.	1.15E-07	0.00	3.65E+11	-962.645	1.06E+09
0.00								
18.5000	3.91E-06	-5275.	4377.	-2.97E-07	0.00	3.65E+11	-744.139	1.14E+09
0.00								
19.0000	1.87E-06	7591.	1005.	-2.78E-07	0.00	3.65E+11	-379.856	1.22E+09
0.00								
19.5000	5.73E-07	6782.	-267.331	-1.60E-07	0.00	3.65E+11	-44.151	4.62E+08
0.00								
20.0000	-5.29E-08	4384.	-386.812	-6.83E-08	0.00	3.65E+11	4.3241	4.90E+08
0.00								
20.5000	-2.47E-07	2141.	-309.972	-1.47E-08	0.00	3.65E+11	21.2893	5.18E+08
0.00								
21.0000	-2.29E-07	664.1289	-183.603	8.40E-09	0.00	3.65E+11	20.8336	5.46E+08
0.00								
21.5000	-1.46E-07	-62.501	-79.276	1.34E-08	0.00	3.65E+11	13.9420	5.74E+08
0.00								
22.0000	-6.87E-08	-287.218	-16.772	1.05E-08	0.00	3.65E+11	6.8928	6.02E+08
0.00								
22.5000	-2.00E-08	-263.789	10.2103	5.94E-09	0.00	3.65E+11	2.1012	6.30E+08
0.00								
23.0000	2.64E-09	-164.710	15.6830	2.42E-09	0.00	3.65E+11	-0.277	6.30E+08
0.00								
23.5000	9.03E-09	-75.600	12.0072	4.44E-10	0.00	3.65E+11	-0.948	6.30E+08
0.00								
24.0000	7.96E-09	-20.625	6.6545	-3.48E-10	0.00	3.65E+11	-0.836	6.30E+08
0.00								
24.5000	4.86E-09	4.2554	2.6167	-4.82E-10	0.00	3.65E+11	-0.510	6.30E+08

0.00									
	25.0000	2.17E-09	10.7772	0.4028	-3.59E-10	0.00	3.65E+11	-0.228	6.30E+08
0.00									
	25.5000	5.50E-10	9.0898	-0.455	-1.95E-10	0.00	3.65E+11	-0.05780	6.30E+08
0.00									
	26.0000	-1.74E-10	5.3214	-0.573	-7.69E-11	0.00	3.65E+11	0.01822	6.30E+08
0.00									
	26.5000	-3.72E-10	2.2090	-0.401	-1.50E-11	0.00	3.65E+11	0.03909	6.30E+08
0.00									
	27.0000	-3.53E-10	0.5038	-0.173	7.35E-12	0.00	3.65E+11	0.03707	6.30E+08
0.00									
	27.5000	-2.84E-10	0.1333	-0.04811	1.26E-11	0.00	3.65E+11	0.00455	9.60E+07
0.00									
	28.0000	-2.02E-10	-0.07356	-0.02478	1.31E-11	0.00	3.65E+11	0.00323	9.60E+07
0.00									
	28.5000	-1.27E-10	-0.164	-0.00899	1.11E-11	0.00	3.65E+11	0.00203	9.60E+07
0.00									
	29.0000	-6.84E-11	-0.181	3.94E-04	8.29E-12	0.00	3.65E+11	0.00109	9.60E+07
0.00									
	29.5000	-2.76E-11	-0.159	0.00500	5.48E-12	0.00	3.65E+11	4.42E-04	9.60E+07
0.00									
	30.0000	-2.59E-12	-0.121	0.00645	3.17E-12	0.00	3.65E+11	4.15E-05	9.60E+07
0.00									
	30.5000	1.05E-11	-0.08197	0.00608	1.50E-12	0.00	3.65E+11	-1.67E-04	9.60E+07
0.00									
	31.0000	1.54E-11	-0.04852	0.00483	0.00	0.00	3.65E+11	-2.47E-04	9.60E+07
0.00									
	31.5000	1.56E-11	-0.02396	0.00335	0.00	0.00	3.65E+11	-2.49E-04	9.60E+07
0.00									
	32.0000	1.34E-11	-0.00837	0.00196	0.00	0.00	3.65E+11	-2.14E-04	9.60E+07
0.00									
	32.5000	1.04E-11	-4.93E-04	0.00103	0.00	0.00	3.65E+11	-9.34E-05	5.40E+07
0.00									
	33.0000	7.30E-12	0.00402	5.55E-04	0.00	0.00	3.65E+11	-6.57E-05	5.40E+07
0.00									
	33.5000	4.63E-12	0.00617	2.33E-04	0.00	0.00	3.65E+11	-4.17E-05	5.40E+07
0.00									
	34.0000	2.57E-12	0.00681	-1.59E-05	0.00	0.00	3.65E+11	-4.11E-05	9.60E+07

```
0.00
   34.5000   1.18E-12    0.00598  -1.96E-04       0.00       0.00   3.65E+11  -1.88E-05   9.60E+07
0.00
   35.0000       0.00    0.00446  -2.70E-04       0.00       0.00   3.65E+11  -6.02E-06   9.60E+07
0.00
   35.5000       0.00    0.00273  -3.09E-04       0.00       0.00   3.65E+11  -6.94E-06   2.70E+09
0.00
   36.0000       0.00   7.52E-04  -2.28E-04       0.00       0.00   3.65E+11   3.41E-05   2.70E+09
0.00
   36.5000       0.00       0.00       0.00       0.00       0.00   3.65E+11   4.18E-05   1.35E+09
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. 3:

Pile-head deflection             =     0.48000000 inches
Computed slope at pile head      =     -0.0035054 radians
Maximum bending moment           =       5689188. inch-lbs
Maximum shear force              =       -244610. lbs
Depth of maximum bending moment  =    13.50000000 feet below pile head
Depth of maximum shear force     =    14.50000000 feet below pile head
Number of iterations             =             22
Number of zero deflection points =              7
Pile deflection at ground        =     0.00394888 inches


--------------------------------------------------------------------------------
            Summary of Pile-head Responses for Conventional Analyses
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Definitions of Pile-head Loading Conditions:
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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	15820.	M, in-lb	0.00	212150.	0.09623	-7.06E-04	-123448.	3067613.
2	V, lb	19120.	M, in-lb	0.00	295890.	0.1388	-0.00100	-156449.	3892533.
3	y, in	0.4800	M, in-lb	0.00	212150.	0.4800	-0.00351	-244610.	5689188.

Maximum pile-head deflection = 0.4800000000 inches
Maximum pile-head rotation = -0.0035053720 radians = -0.200843 deg.

Summary of Warning Messages

The following warning was reported 666 times

**** Warning ****

An unreasonable input value for unconfined compressive strength has been
specified for a soil defined using the weak rock criteria. The input value
is greater than 500 psi. Please check your input data for correctness.

The analysis ended normally.

HAS-22-17.53R FA B-142 Shaft 1 Strength Limit		
Depth (ft)	Shear Force from Lpile(lb)	Average Shear (lb) based on ODOT GDM
0	19120	19120
0.4942	19360	19240
0.9884	19614	19628
1.4826	19882	19910.57143
1.9768	20164	20193.42857
2.471	20461	20490.71429
2.9652	20773	20802.57143
3.4594	21100	21129
3.9536	21441	21470.28571
4.4478	21797	21826.14286
4.942	22167	22196.71429
5.4362	22553	22581.85714
5.9304	22952	22981.71429
6.4246	23367	23396.14286
6.9188	23796	23825.28571
7.413	24240	24269
7.9072	24698	24727.42857
8.4014	25171	25200.42857
8.8957	25659	25688.14286
9.3899	26161	26188.85714
9.8841	26678	19617.42857
10.3783	27210	2390.1429
10.8725	27745	-19368.1429
11.3667	-21302	-41591.8571
11.8609	-95420	-59493.1429
12.3551	-126649	-70445.8571
12.8493	-129405	-76559.7143
13.3435	-98631	-73269.7143
13.8377	-49459	-58737.1429
14.3319	-15052	-39912.1429
14.8261	1728	-21075.2857
15.3203	6308	-6877.3096
15.8145	5126	219.0267
16.3087	2453	2361.9140
16.8029	754.8327	2095.9399
17.2971	215.3545	1177.5065
17.7913	-51.789	434.1646
18.2855	-133.819	78.5025
18.7797	-121.034	-30.8109
19.2739	-77.393	-61.3007
19.7681	-36.635	-53.1488
20.2623	-10.361	-33.3806
20.7565	1.9264	-15.6953
21.2507	5.2739	-4.4638
21.7449	4.5588	0.8131
22.2391	2.7627	2.2785
22.7333	1.2277	1.9759
23.2275	0.3032	1.2042
23.7217	-0.103	0.5438
24.2159	-0.192	0.1429
24.7101	-0.128	-0.0363
25.2043	-0.06387	-0.0816
25.6986	-0.04399	-0.0676
26.1928	-0.02673	-0.0401
26.687	-0.01364	-0.0214
27.1812	-0.00482	-0.0117
27.6754	0.000397	-0.0050
28.1696	0.00293	-0.0008
28.6638	0.00368	0.0014
29.158	0.00338	0.0023
29.6522	0.00258	0.0024
30.1464	0.00183	0.0020
30.6406	0.00132	0.0015
31.1348	0.00091	0.0011
31.629	0.000523	0.0006
32.1232	0.000196	0.0003
32.6174	0.0000268	0.0001
33.1116	-0.000315	0.0000
33.6058	-0.000465	-0.0001
34.1	0	-0.0002

HAS-22-17.53R FA B-142 Shaft 1 Thermal Movement		
Depth (ft)	Shear Force from Lpile(lb)	Average Shear (lb) based on ODOT GDM 1501.7.9
0	47267	47267
0.4942	47419	47343
0.9884	47579	47589
1.4826	47750	47769
1.9768	47930	47949.14286
2.471	48119	48139
2.9652	48319	48338.71429
3.4594	48528	48548
3.9536	48748	48767.14286
4.4478	48977	48996.14286
4.942	49215	49234.85714
5.4362	49464	49483.42857
5.9304	49722	49741.57143
6.4246	49990	50009.57143
6.9188	50268	50287.42857
7.413	50555	50575
7.9072	50853	50872.28571
8.4014	51160	51179.42857
8.8957	51477	51496.28571
9.3899	51803	51821.85714
9.8841	52140	38325.28571
10.3783	52486	-992.0000
10.8725	52834	-52483.7143
11.3667	-43623	-101971.0000
11.8609	-224061	-139142.1429
12.3551	-308965	-159234.2857
12.8493	-294608	-169065.0000
13.3435	-208058	-160914.7143
13.8377	-88159	-126408.8571
14.3319	-15981	-80605.0000
14.8261	13429	-37838.0000
15.3203	17480	-7969.0000
15.8145	11662	4632.1115
16.3087	4761	6867.6719
16.8029	1025	4896.4359
17.2971	48.7806	2361.2085
17.7913	-332.077	674.6209
18.2855	-369.652	-13.2236
18.7797	-266.592	-160.3529
19.2739	-144.113	-165.4450
19.7681	-53.912	-115.9264
20.2623	-4.905	-61.6835
20.7565	13.1363	-22.8644
21.2507	14.553	-2.0232
21.7449	10.0481	5.6875
22.2391	5.1416	6.3139
22.7333	1.7759	4.3637
23.2275	0.06239	2.2447
23.7217	-0.52	0.7930
24.2159	-0.515	0.0480
24.7101	-0.28	-0.2115
25.2043	-0.114	-0.2229
25.6986	-0.07329	-0.1490
26.1928	-0.04058	-0.0748
26.687	-0.01744	-0.0337
27.1812	-0.00294	-0.0162
27.6754	0.00481	-0.0048
28.1696	0.00788	0.0017
28.6638	0.00805	0.0046
29.158	0.00669	0.0053
29.6522	0.00472	0.0049
30.1464	0.00312	0.0038
30.6406	0.00214	0.0027
31.1348	0.00138	0.0017
31.629	0.000699	0.0010
32.1232	0.000142	0.0004
32.6174	-0.000136	0.0001
33.1116	-0.00063	-0.0001
33.6058	-0.000785	-0.0003
34.1	0	-0.0004

HAS-22-17.53R FA B-142 Shaft 5 Strength Limit		
Depth (ft)	Shear Force from Lpile(lb)	Average Shear (lb) based on ODOT GDM 1501.7.9
0	19120	19120
0.5	19362	19241
1	19614	19626.2
1.5	19879	19903.57143
2	20156	20181
2.5	20446	20470.42857
3	20748	20772.28571
3.5	21062	21086.42857
4	21388	21413
4.5	21727	21751.85714
5	22078	22103
5.5	22442	22466.42857
6	22818	22842.28571
6.5	23206	23230.42857
7	23606	23631
7.5	24019	24043.85714
8	24444	24469
8.5	24882	24906.42857
9	25332	25356.28571
9.5	25794	25818.42857
10	26268	26293
10.5	26755	26779.8571
11	27254	27279.0000
11.5	27766	27790.4286
12	28290	19872.2857
12.5	28826	-634.4286
13	29374	-26415.0000
13.5	-29159	-52731.4286
14	-116792	-73844.5714
14.5	-153210	-86558.8571
15	-156449	-93385.1429
15.5	-119502	-88927.8571
16	-60174	-71150.0000
16.5	-18410	-48363.4286
17	2042	-25543.0000
17.5	7653	-8332.1506
18	6296	261.2522
18.5	3294	2865.8862
19	973.9456	2548.5291
19.5	-20.18	1437.6979
20	-177.562	529.2998
20.5	-179.5	55.7127
21	-122.818	-83.3876
21.5	-62.787	-79.4682
22	-21.11	-53.1042
22.5	0.2437	-26.8233
23	7.256	-8.9780
23.5	6.9858	0.0780
24	4.4663	3.0809
24.5	2.0995	3.0058
25	0.6047	1.9353
25.5	-0.08942	0.9204
26	-0.282	0.2764
26.5	-0.238	-0.0271
27	-0.118	-0.1152
27.5	-0.04178	-0.1031
28	-0.02503	-0.0627
28.5	-0.01247	-0.0282
29	-0.00412	-0.0109
29.5	0.000733	-0.0044
30	0.00302	-0.0005
30.5	0.00363	0.0015
31	0.0033	0.0023
31.5	0.00253	0.0023
32	0.00166	0.0019
32.5	0.00101	0.0014
33	0.000639	0.0009
33.5	0.000368	0.0005
34	0.000141	0.0003
34.5	-0.0000373	0.0001
35	-0.00012	0.0000
35.5	-0.000233	-0.0001
36	-0.000234	-0.0001
36.5	0	-0.0001

HAS-22-17.53R FA B-142 Shaft 5 Thermal Movement		
Depth (ft)	Shear Force from Lpile(lb)	Average Shear (lb) based on ODOT GDM 1501.7.9
0	31504	31504
0.5	31657	31580.5
1	31816	31824.6
1.5	31985	32001
2	32161	32177.42857
2.5	32346	32362
3	32538	32554.85714
3.5	32739	32755.85714
4	32949	32965.14286
4.5	33166	33182.57143
5	33392	33408.28571
5.5	33626	33642.28571
6	33868	33884.42857
6.5	34118	34134.85714
7	34377	34393.42857
7.5	34644	34660.28571
8	34919	34935.28571
8.5	35202	35218.57143
9	35494	35510
9.5	35793	35809.71429
10	36101	36117.57143
10.5	36417	36433.7143
11	36742	36758.0000
11.5	37074	37090.7143
12	37415	25854.5714
12.5	37764	-5440.8571
13	38122	-45634.0000
13.5	-42552	-84661.0000
14	-182651	-114224.2857
14.5	-244610	-130292.5714
15	-236115	-137981.4286
15.5	-169528	-130563.2857
16	-74714	-102523.4286
16.5	-15700	-66222.4286
17	9375	-31866.4286
17.5	13628	-7504.5714
18	9497	3130.6670
18.5	4377	5318.2653
19	1005	3934.6979
19.5	-267.331	1961.6117
20	-386.812	593.5723
20.5	-309.972	-34.1094
21	-183.603	-176.2222
21.5	-79.276	-135.7917
22	-16.772	-78.8175
22.5	10.2103	-33.5851
23	15.683	-6.9823
23.5	12.0072	4.4004
24	6.6545	6.7314
24.5	2.6167	5.1909
25	0.4028	2.8932
25.5	-0.455	1.1531
26	-0.573	0.1956
26.5	-0.401	-0.1817
27	-0.173	-0.2406
27.5	-0.04811	-0.1755
28	-0.02478	-0.0929
28.5	-0.00899	-0.0347
29	0.000394	-0.0091
29.5	0.005	-0.0016
30	0.00645	0.0024
30.5	0.00608	0.0040
31	0.00483	0.0041
31.5	0.00335	0.0035
32	0.00196	0.0026
32.5	0.00103	0.0017
33	0.000555	0.0010
33.5	0.000233	0.0005
34	-0.0000159	0.0001
34.5	-0.000196	0.0000
35	-0.00027	-0.0001
35.5	-0.000309	-0.0002
36	-0.000228	-0.0002
36.5	0	-0.0002

HAS-22-19.12

Objective: **To estimate Drilled Shaft Tip Resistance in Rock. Assume rock below the base of shaft to a depth of 2D is intact or tightly jointed, and the socket length is 1.5D or longer (D is diameter of socket).**

Method: **In accordance with ODOT GDM, 2024, [Sect. 1306.4.2] and LRFD Bridge Design Specifications, 9th Ed., 2020, [Sect. 10.8.3.5.4 and 10.4.6.4].**

Givens:

Rock Parameters:

$q_u := 5651\ psi$ — Uniaxial Compressive Strength of Rock Core

Geometry:

$D := 3\ ft$ — Diameter of Drilled Shaft

$D_R := D = 3\ ft$ — Diameter of Rock Socket = Diameter of Drilled Shaft

Tip Resistance Calculation:

$q_p := 2.5 \cdot q_u$ $\quad q_p = 14127.5\ psi$ — Unfactored unit tip resistance, LRFD [Equ. 10.8.3.5.4c-1]

$q_b := \pi \cdot \left(\frac{D_R}{2}\right)^2 \cdot q_p$ $\quad q_b = 14380043.5\ lbf$ — Nominal Tip Resistance

$\phi_{st} := 0.50$ — Tip Resistance Factor in Rock LRFD [Sect. 10.5.5.2.4-1]

$q_{b_F} := \phi_{st} \cdot q_b$ $\quad q_{b_F} = 7190\ kip$ — Factored Tip Resistance

Created with PTC Mathcad Express. See www.mathcad.com for more information.

Objective: **To estimate Drilled Shaft Tip Resistance in Rock. Assume rock below the base of shaft to a depth of 2D is intact or tightly jointed, and the socket length is 1.5D or longer (D is diameter of socket).**

Method: **In accordance with ODOT GDM, 2024, [Sect. 1306.4.2] and LRFD Bridge Design Specifications, 9th Ed., 2020, [Sect. 10.8.3.5.4 and 10.4.6.4].**

Givens:

Rock Parameters:

$q_u := 6628\ psi$ — Uniaxial Compressive Strength of Rock Core

Geometry:

$D := 3\ ft$ — Diameter of Drilled Shaft

$D_R := D = 3\ ft$ — Diameter of Rock Socket = Diameter of Drilled Shaft

Tip Resistance Calculation:

$q_p := 2.5 \cdot q_u$ $\quad q_p = 16570\ psi$ — Unfactored unit tip resistance, LRFD [Equ. 10.8.3.5.4c-1]

$q_b := \pi \cdot \left(\frac{D_R}{2}\right)^2 \cdot q_p$ $\quad q_b = 16866205.6\ lbf$ — Nominal Tip Resistance

$\phi_{st} := 0.50$ — Tip Resistance Factor in Rock LRFD [Sect. 10.5.5.2.4-1]

$q_{b_F} := \phi_{st} \cdot q_b$ $\quad q_{b_F} = 8433.1\ kip$ — Factored Tip Resistance

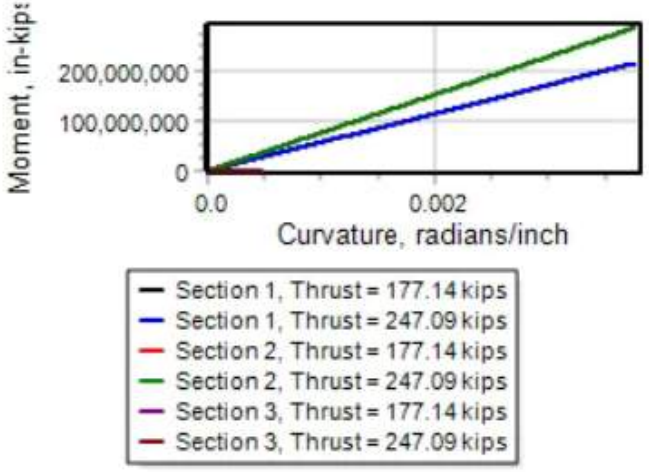
Created with PTC Mathcad Express. See www.mathcad.com for more information.

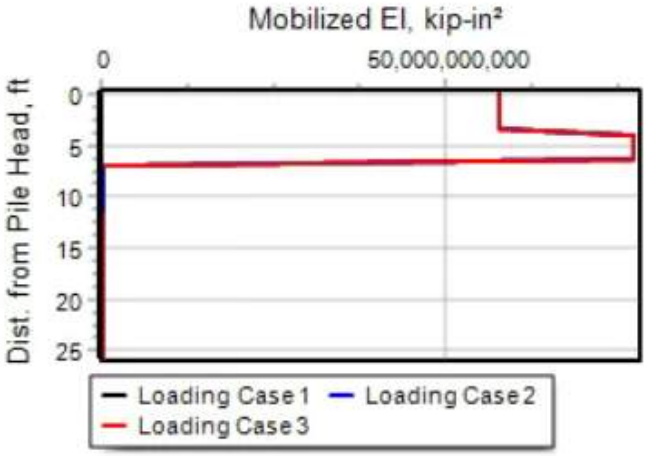
Results for HAS-22-19.12 RA B-146.lp12d

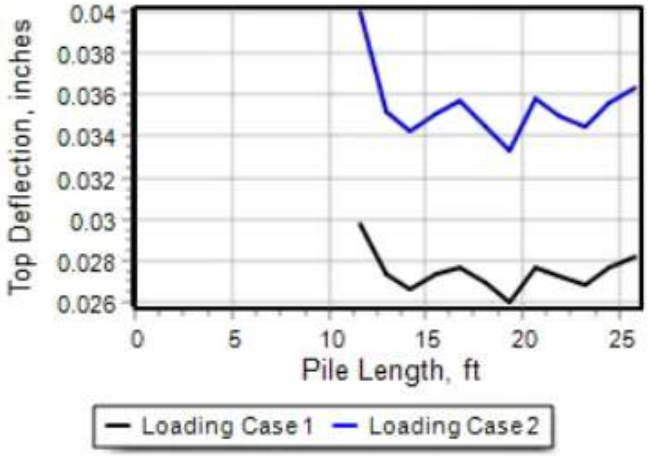












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LPile Version 2022-12.013

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License Type : (Single User License)

Analysis of Individual Piles and Drilled Shafts
Subjected to Lateral Loading Using the p-y Method
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Columbus, OH, USA

==

This model was prepared by:
Zmankoci

Files Used for Analysis

Path to file locations:
\23-0011 113440 HAS-22-15.25\113440\geotechnical\bridges\XXX-YY-ZZ.ZZ (Crossing)\Analysis\Lpile\New folder\

Name of input data file:
HAS-22-19.12 RA B-146.lp12d

Name of output report file:
HAS-22-19.12 RA B-146.lp12o

Name of plot output file:
HAS-22-19.12 RA B-146.lp12p

Name of runtime message file:
HAS-22-19.12 RA B-146.lp12r

Date and Time of Analysis

Date: November 18, 2025 Time: 11:29:17

Problem Title

Project Name: HAS-22-19.12

Job Number: 10059

Client: ODOT

Engineer: ZM

Description: HAS-22-19.12 Rear Abut

```
--------------------------------------------------------------------------------
                         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                           =           52

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)
 - 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 = 25.800 ft
Depth of ground surface below top of pile = 8.6900 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	36.0000
2	3.700	36.0000
3	3.700	48.0000
4	6.700	48.0000
5	6.700	36.0000
6	25.800	36.0000

Input Structural Properties for Pile Sections:

Pile Section No. 1:

Section 1 is an elastic pile
Cross-sectional shape = rectangular
Length of section = 3.700000 ft
Width of top of section = 36.000000 in
Width of bottom of section = 36.000000 in
Top Section Depth = 175.000000 in
Bottom Section Depth = 175.000000 in

```
   Top Area                                          =        6300. sq. in
   Bottom Area                                       =        6300. sq. in
   Moment of Inertia at Top                          =    16078125. in^4
   Moment of Inertia at Bottom                       =    16078125. in^4
   Elastic Modulus                                   =     3604996. psi

Pile Section No. 2:

   Section 2 is an elastic pile
   Cross-sectional shape                             =     rectangular
   Length of section                                 =     3.000000 ft
   Width of top of section                           =    48.000000 in
   Width of bottom of section                        =    48.000000 in
   Top Section Depth                                 =   175.000000 in
   Bottom Section Depth                              =   175.000000 in
   Top Area                                          =        8400. sq. in
   Bottom Area                                       =        8400. sq. in
   Moment of Inertia at Top                          =    21437500. in^4
   Moment of Inertia at Bottom                       =    21437500. in^4
   Elastic Modulus                                   =     3604996. psi

Pile Section No. 3:

   Section 3 is a round drilled shaft, bored pile, or CIDH pile
   Length of section                                 =    19.100000 ft
   Shaft Diameter                                    =    36.000000 in



--------------------------------------------------------------------------------
                       Soil and Rock Layering Information
--------------------------------------------------------------------------------

The soil profile is modelled using 5 layers

Layer 1 is weak rock, p-y criteria by Reese, 1997

   Distance from top of pile to top of layer         =     8.690000 ft
```

Distance from top of pile to bottom of layer	=	10.000000	ft
Effective unit weight at top of layer	=	139.000000	pcf
Effective unit weight at bottom of layer	=	139.000000	pcf
Uniaxial compressive strength at top of layer	=	200.000000	psi
Uniaxial compressive strength at bottom of layer	=	200.000000	psi
Initial modulus of rock at top of layer	=	18000.	psi
Initial modulus of rock at bottom of layer	=	18000.	psi
RQD of rock at top of layer	=	0.0000	%
RQD of rock at bottom of layer	=	0.0000	%
k rm of rock at top of layer	=	0.0005000	
k rm of rock at bottom of layer	=	0.0005000	

Layer 2 is weak rock, p-y criteria by Reese, 1997

Distance from top of pile to top of layer	=	10.000000	ft
Distance from top of pile to bottom of layer	=	14.100000	ft
Effective unit weight at top of layer	=	139.000000	pcf
Effective unit weight at bottom of layer	=	139.000000	pcf
Uniaxial compressive strength at top of layer	=	2247.	psi
Uniaxial compressive strength at bottom of layer	=	2247.	psi
Initial modulus of rock at top of layer	=	200000.	psi
Initial modulus of rock at bottom of layer	=	200000.	psi
RQD of rock at top of layer	=	89.000000	%
RQD of rock at bottom of layer	=	89.000000	%
k rm of rock at top of layer	=	0.0000600	
k rm of rock at bottom of layer	=	0.0000600	

Layer 3 is weak rock, p-y criteria by Reese, 1997

Distance from top of pile to top of layer	=	14.100000	ft
Distance from top of pile to bottom of layer	=	20.600000	ft
Effective unit weight at top of layer	=	147.000000	pcf
Effective unit weight at bottom of layer	=	147.000000	pcf
Uniaxial compressive strength at top of layer	=	6894.	psi
Uniaxial compressive strength at bottom of layer	=	6894.	psi
Initial modulus of rock at top of layer	=	620000.	psi

Initial modulus of rock at bottom of layer	=	620000.	psi
RQD of rock at top of layer	=	66.000000	%
RQD of rock at bottom of layer	=	66.000000	%
k rm of rock at top of layer	=	0.0000500	
k rm of rock at bottom of layer	=	0.0000500	

Layer 4 is weak rock, p-y criteria by Reese, 1997

Distance from top of pile to top of layer	=	20.600000	ft
Distance from top of pile to bottom of layer	=	22.800000	ft
Effective unit weight at top of layer	=	127.000000	pcf
Effective unit weight at bottom of layer	=	127.000000	pcf
Uniaxial compressive strength at top of layer	=	200.000000	psi
Uniaxial compressive strength at bottom of layer	=	200.000000	psi
Initial modulus of rock at top of layer	=	18000.	psi
Initial modulus of rock at bottom of layer	=	18000.	psi
RQD of rock at top of layer	=	0.0000	%
RQD of rock at bottom of layer	=	0.0000	%
k rm of rock at top of layer	=	0.0005000	
k rm of rock at bottom of layer	=	0.0005000	

Layer 5 is weak rock, p-y criteria by Reese, 1997

Distance from top of pile to top of layer	=	22.800000	ft
Distance from top of pile to bottom of layer	=	35.000000	ft
Effective unit weight at top of layer	=	145.000000	pcf
Effective unit weight at bottom of layer	=	145.000000	pcf
Uniaxial compressive strength at top of layer	=	5651.	psi
Uniaxial compressive strength at bottom of layer	=	5651.	psi
Initial modulus of rock at top of layer	=	510000.	psi
Initial modulus of rock at bottom of layer	=	510000.	psi
RQD of rock at top of layer	=	67.000000	%
RQD of rock at bottom of layer	=	67.000000	%
k rm of rock at top of layer	=	0.0000500	
k rm of rock at bottom of layer	=	0.0000500	

(Depth of the lowest soil layer extends 9.200 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	Uniaxial qu psi	RQD %	E50 or krm	Rock Mass Modulus psi
1	Weak	8.6900	139.0000	200.0000	0.00	5.00E-04	18000.
	Rock	10.0000	139.0000	200.0000	0.00	5.00E-04	18000.
2	Weak	10.0000	139.0000	2247.	89.0000	6.00E-05	200000.
	Rock	14.1000	139.0000	2247.	89.0000	6.00E-05	200000.
3	Weak	14.1000	147.0000	6894.	66.0000	5.00E-05	620000.
	Rock	20.6000	147.0000	6894.	66.0000	5.00E-05	620000.
4	Weak	20.6000	127.0000	200.0000	0.00	5.00E-04	18000.
	Rock	22.8000	127.0000	200.0000	0.00	5.00E-04	18000.
5	Weak	22.8000	145.0000	5651.	67.0000	5.00E-05	510000.
	Rock	35.0000	145.0000	5651.	67.0000	5.00E-05	510000.

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	19.800
2	8.690	37.100

Distributed lateral load intensity for Load Case 2 defined using 2 points

Point No.	Depth X ft	Dist. Load lb/in
1	0.000	31.800
2	8.690	57.700

Distributed lateral load intensity for Load Case 3 defined using 2 points

Point No.	Depth X ft	Dist. Load lb/in
1	0.000	19.800
2	8.690	37.100

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 3

Load No.	Load Type	Condition 1	Condition 2	Axial Thrust Force, lbs	Compute Top y vs. Pile Length	Run Analysis

1	1	V = 15890. lbs	M = 0.0000 in-lbs	177140.	Yes
Yes					
2	1	V = 19500. lbs	M = 0.0000 in-lbs	247090.	Yes
Yes					
3	4	y = 0.380000 in	M = 0.0000 in-lbs	177140.	N.A.
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:

Moment-curvature properties were derived from elastic section properties

Pile Section No. 3:

Dimensions and Properties of Drilled Shaft (Bored Pile):

Length of Section	=	19.100000	ft
Shaft Diameter	=	36.000000	in
Concrete Cover Thickness (to edge of trans. reinf.)	=	3.000000	in
Number of Reinforcing Bars	=	10	bars
Yield Stress of Reinforcing Bars	=	60000.	psi
Modulus of Elasticity of Reinforcing Bars	=	29000000.	psi
Gross Area of Shaft	=	1018.	sq. in.
Total Area of Reinforcing Steel	=	10.000000	sq. in.
Area Ratio of Steel Reinforcement	=	0.98	percent
Edge-to-Edge Bar Spacing	=	7.407667	in
Maximum Concrete Aggregate Size	=	0.750000	in
Ratio of Bar Spacing to Aggregate Size	=	9.88	
Offset of Center of Rebar Cage from Center of Pile	=	0.0000	in
Transverse Reinforcement			
Type: Spiral			
Number of Transverse Reinf. (per spacing)	=	1	
Spacing of Transverse Reinf.	=	5.000000	in
Yield Stress of Transverse Reinf.	=	60000.	psi
Diameter of Transverse Reinf.	=	0.625000	in

Axial Structural Capacities:

Nom. Axial Structural Capacity = 0.85 Fc Ac + Fy As	=	4026.778	kips
Tensile Load for Cracking of Concrete	=	-452.643	kips
Nominal Axial Tensile Capacity	=	-600.000	kips

Reinforcing Bar Dimensions and Positions Used in Computations:

Bar Number	Bar Diam. inches	Bar Area sq. in.	X inches	Y inches

1	1.128000	1.000000	13.811000	0.00000
2	1.128000	1.000000	11.173334	8.117902
3	1.128000	1.000000	4.267834	13.135042
4	1.128000	1.000000	-4.26783	13.135042
5	1.128000	1.000000	-11.17333	8.117902
6	1.128000	1.000000	-13.81100	0.00000
7	1.128000	1.000000	-11.17333	-8.11790
8	1.128000	1.000000	-4.26783	-13.13504
9	1.128000	1.000000	4.267834	-13.13504
10	1.128000	1.000000	11.173334	-8.11790

NOTE: The positions of the above rebars were computed by LPile

Minimum spacing between any two bars not equal to zero = 7.408 inches
between bars 5 and 6.

Ratio of bar spacing to maximum aggregate size = 9.88

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 = 2

Number	Axial Thrust Force kips
1	177.140

2 247.090

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 = 177.140 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	228.8535619	366165699.	80.7148430	0.00005045	0.00002795	0.2106281	1.3879190	
0.00000125	457.7034710	366162777.	49.3766194	0.00006172	0.00001672	0.2565627	1.6398275	
0.00000188	686.5423860	366155939.	38.9390753	0.00007301	0.00000551	0.3022824	1.8921997	
0.00000250	915.3570327	366142813.	33.7266609	0.00008432	-0.00000568	0.3477856	2.1450329	

```
   0.00000313        1144.    366059273.    30.6033743    0.00009564   -0.00001686     0.3930595
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-60.000000 CYT


Axial Thrust Force =    247.090 kips

    Bending       Bending       Bending      Depth to      Max Comp      Max Tens      Max Conc      Max
Steel  Run
   Curvature      Moment       Stiffness      N Axis        Strain        Strain        Stress        Stress
   Msg
    rad/in.       in-kip        kip-in2         in           in/in         in/in          ksi           ksi

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   0.00002813        3979.    141462860.    14.8768470     0.0004184     -0.000594     1.5610022
-13.851884 C
   0.00002938        4067.    138435388.    14.6836938     0.0004313     -0.000626     1.6028713
-14.632066 C
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   0.00003063        4154.    135633310.    14.5044773     0.0004442     -0.000658     1.6441953
-15.413874 C
   0.00003188        4240.    133024303.    14.3367663     0.0004570     -0.000691     1.6848978
-16.198039 C
   0.00003313        4326.    130599808.    14.1808866     0.0004697     -0.000723     1.7251602
-16.982978 C
   0.00003438        4411.    128323967.    14.0332969     0.0004824     -0.000755     1.7647330
-17.770995 C
   0.00003563        4496.    126204192.    13.8964223     0.0004951     -0.000787     1.8040008
-18.558622 C
   0.00003688        4580.    124205964.    13.7661730     0.0005076     -0.000820     1.8426160
-19.349085 C
   0.00003813        4664.    122328471.    13.6436845     0.0005202     -0.000852     1.8807966
-20.140414 C
   0.00003938        4747.    120566980.    13.5293093     0.0005327     -0.000885     1.9186768
-20.931358 C
   0.00004063        4830.    118896044.    13.4196307     0.0005452     -0.000917     1.9559273
-21.725059 C
   0.00004188        4913.    117316710.    13.3158683     0.0005576     -0.000950     1.9927619
-22.519527 C
   0.00004313        4995.    115826086.    13.2184293     0.0005700     -0.000982     2.0293006
-23.313615 C
   0.00004438        5077.    114414366.    13.1263058     0.0005825     -0.001015     2.0654812
-24.107924 C
   0.00004563        5159.    113064512.    13.0368904     0.0005948     -0.001048     2.1010150
-24.905325 C
   0.00004688        5240.    111784098.    12.9525229     0.0006071     -0.001080     2.1362572
-25.702348 C
   0.00004813        5321.    110567710.    12.8728106     0.0006195     -0.001113     2.1712069
-26.498991 C
   0.00004938        5402.    109410469.    12.7974066     0.0006319     -0.001146     2.2058632
-27.295251 C
   0.00005063        5483.    108299534.    12.7239932     0.0006442     -0.001178     2.2399419
-28.094049 C
   0.00005188        5563.    107237284.    12.6537617     0.0006564     -0.001211     2.2736424
-28.893382 C
   0.00005313        5643.    106222816.    12.5870834     0.0006687     -0.001244     2.3070535
-29.692333 C
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   0.00005438        5723.    105252824.    12.5237143     0.0006810     -0.001277     2.3401743
-30.490900 C
   0.00005563        5803.    104324299.    12.4634323     0.0006933     -0.001309     2.3730040
-31.289080 C
   0.00005688        5883.    103432555.    12.4055076     0.0007056     -0.001342     2.4054601
-32.087753 C
   0.00005813        5962.    102571389.    12.3487108     0.0007178     -0.001375     2.4373801
-32.888716 C
   0.00005938        6041.    101744537.    12.2945312     0.0007300     -0.001408     2.4690126
-33.689289 C
   0.00006063        6120.    100949869.    12.2428080     0.0007422     -0.001440     2.5003565
-34.489472 C
   0.00006188        6199.    100185422.    12.1933931     0.0007545     -0.001473     2.5314111
-35.289262 C
   0.00006313        6278.     99449393.    12.1461506     0.0007667     -0.001506     2.5621754
-36.088657 C
   0.00006438        6356.     98740117.    12.1009550     0.0007790     -0.001539     2.5926484
-36.887656 C
   0.00006563        6435.     98055778.    12.0576054     0.0007913     -0.001571     2.6228142
-37.686432 C
   0.00006688        6513.     97390555.    12.0144953     0.0008035     -0.001604     2.6524283
-38.487857 C
   0.00006813        6591.     96748050.    11.9731774     0.0008157     -0.001637     2.6817544
-39.288879 C
   0.00006938        6669.     96127028.    11.9335637     0.0008279     -0.001670     2.7107914
-40.089497 C
   0.00007063        6747.     95526339.    11.8955392     0.0008401     -0.001702     2.7395384
-40.889707 C
   0.00007188        6824.     94944914.    11.8590334     0.0008524     -0.001735     2.7679945
-41.689509 C
   0.00007313        6902.     94381756.    11.8239693     0.0008646     -0.001768     2.7961588
-42.488900 C
   0.00007438        6979.     93835937.    11.7902754     0.0008769     -0.001801     2.8240301
-43.287878 C
   0.00007938        7287.     91806348.    11.6665720     0.0009260     -0.001931     2.9323315
-46.482723 C
   0.00008438        7593.     89987013.    11.5570214     0.0009751     -0.002062     3.0353103
-49.678848 C
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   0.00008938         7896.     88349719.    11.4624254     0.0010245     -0.002193     3.1335457
-52.867953 C
   0.00009438         8198.     86865072.    11.3804782     0.0010740     -0.002323     3.2269695
-56.049869 C
   0.00009938         8497.     85507368.    11.3079609     0.0011237     -0.002454     3.3152697
-59.228408 C
    0.0001044         8773.     84052266.    11.2347403     0.0011726     -0.002585     3.3969041
-60.000000 CY
    0.0001094         8943.     81766561.    11.1302385     0.0012174     -0.002720     3.4669479
-60.000000 CY
    0.0001144         9101.     79569012.    11.0322821     0.0012618     -0.002856     3.5322381
-60.000000 CY
    0.0001194         9257.     77541412.    10.9423907     0.0013062     -0.002991     3.5932437
-60.000000 CY
    0.0001244         9410.     75661960.    10.8589911     0.0013506     -0.003127     3.6498686
-60.000000 CY
    0.0001294         9563.     73917797.    10.7836201     0.0013951     -0.003262     3.7024916
-60.000000 CY
    0.0001344         9699.     72175604.    10.7084763     0.0014390     -0.003399     3.7500668
-60.000000 CY
    0.0001394         9773.     70119797.    10.6138544     0.0014793     -0.003538     3.7901424
-60.000000 CY
    0.0001444         9830.     68087794.    10.5154897     0.0015182     -0.003679     3.8254110
-60.000000 CY
    0.0001494         9887.     66187347.    10.4248932     0.0015572     -0.003820     3.8575687
-60.000000 CY
    0.0001544         9943.     64405648.    10.3411927     0.0015964     -0.003961     3.8865757
-60.000000 CY
    0.0001594         9998.     62731413.    10.2638419     0.0016358     -0.004102     3.9123903
-60.000000 CY
    0.0001644        10051.     61146806.    10.1881544     0.0016747     -0.004243     3.9346062
-60.000000 CY
    0.0001694        10103.     59651388.    10.1177396     0.0017137     -0.004384     3.9536418
-60.000000 CY
    0.0001744        10155.     58237816.    10.0523754     0.0017529     -0.004525     3.9694765
-60.000000 CY
    0.0001794        10206.     56899158.     9.9897419     0.0017919     -0.004666     3.9820656
-60.000000 CY
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    0.0001844       10257.     55629253.     9.9352369     0.0018318     -0.004806     3.9913633
-60.000000 CY
    0.0001894       10306.     54420937.     9.8816783     0.0018713     -0.004946     3.9972990
-60.000000 CY
    0.0001944       10354.     53268008.     9.8286951     0.0019105     -0.005087     3.9998736
-60.000000 CY
    0.0001994       10401.     52168803.     9.7814849     0.0019502     -0.005227     3.9978482
-60.000000 CY
    0.0002044       10448.     51119797.     9.7365707     0.0019899     -0.005368     3.9999492
-60.000000 CY
    0.0002094       10493.     50116582.     9.6949242     0.0020299     -0.005508     3.9977402
-60.000000 CY
    0.0002144       10538.     49156916.     9.6561410     0.0020700     -0.005647     3.9999054
-60.000000 CY
    0.0002194       10582.     48236958.     9.6190434     0.0021102     -0.005787     3.9969308
-60.000000 CY
    0.0002244       10625.     47354956.     9.5867576     0.0021510     -0.005926     3.9996376
-60.000000 CY
    0.0002294       10668.     46508033.     9.5557003     0.0021918     -0.006066     3.9951007
-60.000000 CY
    0.0002344       10706.     45679168.     9.5237596     0.0022321     -0.006205     3.9987137
-60.000000 CY
    0.0002394       10741.     44869005.     9.4906754     0.0022718     -0.006346     3.9999944
-60.000000 CY
    0.0002444       10765.     44051478.     9.4535449     0.0023102     -0.006487     3.9959705
-60.000000 CY
    0.0002494       10783.     43241391.     9.4147167     0.0023478     -0.006630     3.9988331
-60.000000 CY
    0.0002544       10796.     42440095.     9.3740563     0.0023845     -0.006773     3.9999672
-60.000000 CY
    0.0002594       10805.     41657207.     9.3336159     0.0024209     -0.006917     3.9941270
-60.000000 CY
    0.0002644       10813.     40899694.     9.2947016     0.0024573     -0.007060     3.9974513
-60.000000 CY
    0.0002694       10821.     40169609.     9.2575973     0.0024938     -0.007204     3.9994134
-60.000000 CY
    0.0002744       10828.     39465371.     9.2222192     0.0025303     -0.007347     3.9993595
-60.000000 CY
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    0.0003044        10865.     35696448.     9.0292756     0.0027483     -0.008209     3.9945896
-60.000000 CY
    0.0003344        10895.     32583428.     8.8787413     0.0029688     -0.009069     3.9958163
-60.000000 CY
    0.0003644        10919.     29966369.     8.7550340     0.0031901     -0.009927     3.9939280
-60.000000 CYT
    0.0003944        10938.     27735769.     8.6515164     0.0034119     -0.010786     3.9890469
-60.000000 CYT
    0.0004244        10955.     25814598.     8.5683847     0.0036362     -0.011641     3.9999453
-60.000000 CYT
    0.0004544        10969.     24141869.     8.5014563     0.0038628     -0.012495     3.9947920
-60.000000 CYT


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   Summary of Results for Nominal Moment Capacity for Section 3
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Moment values interpolated at maximum compressive strain = 0.003
or maximum developed moment if pile fails at smaller strains.

 Load           Axial Thrust        Nominal Mom. Cap.      Max. Comp.      Max. Tens.
  No.              kips                in-kip               Strain           Strain
 ----         ----------------     ------------------     ------------    ------------
   1              177.140             10162.078           0.00300000     -0.01003034
   2              247.090             10898.452           0.00300000     -0.00918963

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
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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	177.140000	10162.	115.141000	6605.	84998679.
2	0.65	247.090000	10898.	160.608500	7084.	93144569.
1	0.75	177.140000	10162.	132.855000	7622.	80807819.
2	0.75	247.090000	10898.	185.317500	8174.	86983457.
1	0.90	177.140000	10162.	159.426000	9146.	61912053.
2	0.90	247.090000	10898.	222.381000	9809.	68853623.

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	8.6900	0.00	N.A.	Yes	N.A.	N.A.
2	10.0000	1.3100	No	Yes	N.A.	N.A.
3	14.1000	5.4100	No	Yes	N.A.	N.A.
4	20.6000	11.9100	No	Yes	N.A.	N.A.
5	22.8000	14.1100	No	Yes	N.A.	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 = 15890.0 lbs
Applied moment at pile head = 0.0 in-lbs
Axial thrust load on pile head = 177140.0 lbs

Depth X	Deflect. y	Bending Moment	Shear Force	Slope S	Total Stress	Bending Stiffness	Soil Res. p	Soil Spr. Es*H	Distrib. Lat. Load
feet	inches	in-lbs	lbs	radians	psi*	lb-in^2	lb/inch	lb/inch	lb/inch
0.00	0.02821	2.84E-05	15890.	-2.59E-04	28.1175	5.80E+13	0.00	0.00	20.0469
0.4962	0.02666	95235.	16012.	-2.59E-04	28.2241	5.80E+13	0.00	0.00	20.7877
0.9923	0.02512	191207.	16138.	-2.59E-04	28.3315	5.80E+13	0.00	0.00	21.7755
1.4885	0.02358	287951.	16271.	-2.59E-04	28.4398	5.80E+13	0.00	0.00	22.7632
1.9846	0.02203	385502.	16409.	-2.59E-04	28.5490	5.80E+13	0.00	0.00	23.7510
2.4808	0.02049	483895.	16554.	-2.59E-04	28.6592	5.80E+13	0.00	0.00	24.7387
2.9769	0.01895	583165.	16704.	-2.59E-04	28.7703	5.80E+13	0.00	0.00	25.7264

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    3.4731    0.01741    683346.     16860.  -2.59E-04    28.8825   5.80E+13       0.00       0.00
26.7142
    3.9692    0.01587    784475.     17022.  -2.59E-04    21.9663   7.73E+13       0.00       0.00
27.7019
    4.4654    0.01433    886585.     17190.  -2.59E-04    22.0807   7.73E+13       0.00       0.00
28.6897
    4.9615    0.01279    989712.     17364.  -2.59E-04    22.1961   7.73E+13       0.00       0.00
29.6774
    5.4577    0.01125   1093892.     17543.  -2.59E-04    22.3127   7.73E+13       0.00       0.00
30.6651
    5.9538    0.00971   1199158.     17729.  -2.59E-04    22.4306   7.73E+13       0.00       0.00
31.6529
    6.4500    0.00817   1305546.     17920.  -2.58E-04    22.5497   7.73E+13       0.00       0.00
32.6406
    6.9462    0.00663   1413091.     18117.  -2.47E-04       0.00   3.66E+11       0.00       0.00
33.6284
    7.4423    0.00523   1521804.     18321.  -2.23E-04       0.00   3.66E+11       0.00       0.00
34.6161
    7.9385    0.00397   1631718.     18530.  -1.97E-04       0.00   3.65E+11       0.00       0.00
35.6038
    8.4346    0.00288   1742866.     18745.  -1.70E-04       0.00   3.65E+11       0.00       0.00
36.5916
    8.9308    0.00195   1855281.     12014.  -1.40E-04       0.00   3.65E+11      -2298.   7008816.
0.5463
    9.4269    0.00121   1886215.     -2154.  -1.10E-04       0.00   3.65E+11      -2462.   1.22E+07
0.00
    9.9231   6.43E-04   1829859.    -14814.  -7.97E-05       0.00   3.65E+11      -1791.   1.66E+07
0.00
   10.4192   2.57E-04   1709983.    -47228.  -5.08E-05       0.00   3.65E+11      -9098.   2.11E+08
0.00
   10.9154   3.76E-05   1267586.    -78760.  -2.66E-05       0.00   3.66E+11      -1495.   2.37E+08
0.00
   11.4115  -5.93E-05    772188.    -75411.  -9.99E-06       0.00   3.66E+11       2619.   2.63E+08
0.00
   11.9077  -8.14E-05    369632.    -55842.  -7.04E-07       0.00   3.66E+11       3954.   2.89E+08
0.00
   12.4038  -6.77E-05    107241.    -33392.   3.17E-06       0.00   3.66E+11       3587.   3.16E+08
0.00
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12.9000	-4.36E-05	-28000.	-15264.	3.82E-06	0.00	3.66E+11	2503.	3.42E+08	0.00
13.3962	-2.22E-05	-74526.	-3725.	2.98E-06	0.00	3.66E+11	1374.	3.68E+08	0.00
13.8923	-8.06E-06	-72361.	1953.	1.79E-06	0.00	3.66E+11	533.8728	3.94E+08	0.00
14.3885	-9.10E-07	-51270.	4136.	7.84E-07	0.00	3.66E+11	199.3314	1.30E+09	0.00
14.8846	1.28E-06	-23113.	3846.	1.79E-07	0.00	3.66E+11	-296.853	1.39E+09	0.00
15.3808	1.22E-06	-5478.	2064.	-5.32E-08	0.00	3.66E+11	-301.550	1.47E+09	0.00
15.8769	6.42E-07	1468.	669.6273	-8.58E-08	0.00	3.66E+11	-166.935	1.55E+09	0.00
16.3731	2.02E-07	2496.	8.0318	-5.36E-08	0.00	3.66E+11	-55.306	1.63E+09	0.00
16.8692	3.82E-09	1564.	-159.878	-2.06E-08	0.00	3.66E+11	-1.098	1.71E+09	0.00
17.3654	-4.30E-08	592.4824	-124.581	-3.05E-09	0.00	3.66E+11	12.9545	1.79E+09	0.00
17.8615	-3.25E-08	80.3543	-56.003	2.42E-09	0.00	3.66E+11	10.0819	1.85E+09	0.00
18.3577	-1.42E-08	-74.390	-12.854	2.47E-09	0.00	3.66E+11	4.4128	1.85E+09	0.00
18.8538	-3.15E-09	-72.708	3.1889	1.27E-09	0.00	3.66E+11	0.9762	1.85E+09	0.00
19.3500	8.98E-10	-36.420	5.2664	3.84E-10	0.00	3.66E+11	-0.278	1.85E+09	0.00
19.8462	1.42E-09	-9.998	3.1284	6.23E-12	0.00	3.66E+11	-0.440	1.85E+09	0.00
20.3423	9.72E-10	0.8318	0.9220	-6.83E-11	0.00	3.66E+11	-0.301	1.85E+09	0.00
20.8385	6.06E-10	0.9808	0.00879	-5.36E-11	0.00	3.66E+11	-0.00545	5.36E+07	0.00
21.3346	3.34E-10	0.9366	-0.01639	-3.80E-11	0.00	3.66E+11	-0.00301	5.36E+07	0.00
21.8308	1.53E-10	0.7858	-0.02945	-2.40E-11	0.00	3.66E+11	-0.00138	5.36E+07	0.00

22.3269	4.88E-11	0.5859	-0.03487	-1.28E-11	0.00	3.66E+11	-4.39E-04	5.36E+07	0.00
22.8231	0.00	0.3705	-0.03684	-5.04E-12	0.00	3.66E+11	-2.21E-04	1.52E+09	0.00
23.3192	-1.12E-11	0.1473	-0.02899	0.00	0.00	3.66E+11	0.00286	1.52E+09	0.00
23.8154	-9.01E-12	0.02531	-0.01365	0.00	0.00	3.66E+11	0.00230	1.52E+09	0.00
24.3115	-4.37E-12	-0.01520	-0.00348	0.00	0.00	3.66E+11	0.00111	1.52E+09	0.00
24.8077	-1.20E-12	-0.01618	7.48E-04	0.00	0.00	3.66E+11	3.07E-04	1.52E+09	0.00
25.3038	0.00	-0.00629	0.00136	0.00	0.00	3.66E+11	-1.02E-04	1.52E+09	0.00
25.8000	1.39E-12	0.00	0.00	0.00	0.00	3.66E+11	-3.55E-04	7.59E+08	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. 1:

Pile-head deflection	=	0.02820590	inches
Computed slope at pile head	=	-0.0002591	radians
Maximum bending moment	=	1886215.	inch-lbs
Maximum shear force	=	-78760.	lbs
Depth of maximum bending moment	=	9.42692308	feet below pile head
Depth of maximum shear force	=	10.91538462	feet below pile head
Number of iterations	=	6	
Number of zero deflection points	=	6	
Pile deflection at ground	=	0.00240189	inches

Pile-head Deflection vs. Pile Length for Load Case 1

Boundary Condition Type 1, Shear and Moment

Shear = 15890. lbs
Moment = 0. in-lbs
Axial Load = 177140. lbs

Pile Length feet	Pile Head Deflection inches	Maximum Moment ln-lbs	Maximum Shear lbs
25.80000	0.02820590	1886215.	-78760.
24.51000	0.02765348	1893852.	-78775.
23.22000	0.02682740	1891246.	-80798.
21.93000	0.02727619	1878123.	-82006.
20.64000	0.02773810	1851234.	-78461.
19.35000	0.02602962	1895293.	-84391.
18.06000	0.02697117	1916747.	-85447.
16.77000	0.02768986	1851765.	-79160.
15.48000	0.02736173	1902789.	-84622.
14.19000	0.02669833	1864246.	-82253.
12.90000	0.02742475	1906139.	-86554.
11.61000	0.02981943	1856487.	-124671.
10.32000	-20.2607403	-1293296.	161099.

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 = 19500.0 lbs
Applied moment at pile head = 0.0 in-lbs
Axial thrust load on pile head = 247090.0 lbs

Depth X	Deflect. y	Bending Moment	Shear Force	Slope S	Total Stress	Bending Stiffness	Soil Res. p	Soil Spr. Es*H	Distrib. Lat. Load
feet	inches	in-lbs	lbs	radians	psi*	lb-in^2	lb/inch	lb/inch	lb/inch
0.00	0.03635	-4.54E-05	19500.	-3.33E-04	39.2206	5.80E+13	0.00	0.00	32.1697
0.4962	0.03437	117160.	19695.	-3.33E-04	39.3518	5.80E+13	0.00	0.00	33.2788
0.9923	0.03238	235500.	19897.	-3.33E-04	39.4843	5.80E+13	0.00	0.00	34.7575
1.4885	0.03040	355071.	20109.	-3.33E-04	39.6181	5.80E+13	0.00	0.00	36.2363
1.9846	0.02842	475928.	20329.	-3.33E-04	39.7535	5.80E+13	0.00	0.00	37.7150
2.4808	0.02644	598121.	20558.	-3.33E-04	39.8903	5.80E+13	0.00	0.00	39.1938
2.9769	0.02446	721703.	20796.	-3.33E-04	40.0286	5.80E+13	0.00	0.00	40.6725
3.4731	0.02248	846727.	21042.	-3.33E-04	40.1686	5.80E+13	0.00	0.00	42.1513
3.9692	0.02050	973245.	21297.	-3.33E-04	30.5051	7.73E+13	0.00	0.00	43.6300
4.4654	0.01852	1101309.	21562.	-3.32E-04	30.6484	7.73E+13	0.00	0.00	45.1088
4.9615	0.01654	1230973.	21835.	-3.32E-04	30.7936	7.73E+13	0.00	0.00	46.5876
5.4577	0.01456	1362287.	22116.	-3.32E-04	30.9406	7.73E+13	0.00	0.00	48.0663
5.9538	0.01258	1495306.	22407.	-3.32E-04	31.0895	7.73E+13	0.00	0.00	49.5451

```
    6.4500    0.01060   1630080.     22706.  -3.32E-04    31.2404   7.73E+13       0.00       0.00
51.0238
    6.9462    0.00863   1766664.     23015.  -3.18E-04       0.00   3.63E+11       0.00       0.00
52.5026
    7.4423    0.00682   1905065.     23332.  -2.87E-04       0.00   3.63E+11       0.00       0.00
53.9813
    7.9385    0.00520   2045334.     23657.  -2.55E-04       0.00   3.63E+11       0.00       0.00
55.4601
    8.4346    0.00379   2187520.     23992.  -2.20E-04       0.00   3.62E+11       0.00       0.00
56.9388
    8.9308    0.00258   2331671.     16828.  -1.83E-04       0.00   3.62E+11      -2464.   5684057.
0.8497
    9.4269    0.00161   2388437.      1623.  -1.44E-04       0.00   3.62E+11      -2644.   9805720.
0.00
    9.9231   8.63E-04   2351417.    -13410.  -1.05E-04       0.00   3.62E+11      -2406.   1.66E+07
0.00
   10.4192   3.51E-04   2229069.    -57562.  -6.77E-05       0.00   3.62E+11     -12426.   2.11E+08
0.00
   10.9154   5.74E-05   1666191.   -101346.  -3.57E-05       0.00   3.63E+11      -2282.   2.37E+08
0.00
   11.4115  -7.39E-05   1022375.    -98420.  -1.37E-05       0.00   3.63E+11       3265.   2.63E+08
0.00
   11.9077  -1.05E-04    494270.    -73457.  -1.24E-06       0.00   3.63E+11       5121.   2.89E+08
0.00
   12.4038  -8.86E-05    147676.    -44228.   4.02E-06       0.00   3.63E+11       4698.   3.16E+08
0.00
   12.9000  -5.75E-05    -32398.    -20422.   4.97E-06       0.00   3.63E+11       3299.   3.42E+08
0.00
   13.3962  -2.95E-05    -95517.     -5177.   3.92E-06       0.00   3.63E+11       1822.   3.68E+08
0.00
   13.8923  -1.08E-05    -94061.      2372.   2.37E-06       0.00   3.63E+11   714.3791   3.94E+08
0.00
   14.3885  -1.29E-06    -67279.      5337.   1.04E-06       0.00   3.63E+11   281.6985   1.30E+09
0.00
   14.8846   1.65E-06    -30509.      5035.   2.43E-07       0.00   3.63E+11   -383.289   1.39E+09
0.00
   15.3808   1.60E-06     -7326.      2718.  -6.74E-08       0.00   3.63E+11   -395.052   1.47E+09
0.00
```

15.8769	8.45E-07	1853.	887.6199	-1.12E-07	0.00	3.63E+11	-219.730	1.55E+09	0.00
16.3731	2.67E-07	3244.	15.6968	-7.04E-08	0.00	3.63E+11	-73.164	1.63E+09	0.00
16.8692	6.13E-09	2040.	-207.350	-2.71E-08	0.00	3.63E+11	-1.761	1.71E+09	0.00
17.3654	-5.60E-08	774.6911	-162.448	-4.08E-09	0.00	3.63E+11	16.8447	1.79E+09	0.00
17.8615	-4.24E-08	106.0568	-73.136	3.14E-09	0.00	3.63E+11	13.1568	1.85E+09	0.00
18.3577	-1.86E-08	-96.195	-16.821	3.22E-09	0.00	3.63E+11	5.7603	1.85E+09	0.00
18.8538	-4.11E-09	-94.253	4.1182	1.66E-09	0.00	3.63E+11	1.2736	1.85E+09	0.00
19.3500	1.17E-09	-47.162	6.8315	5.00E-10	0.00	3.63E+11	-0.362	1.85E+09	0.00
19.8462	1.84E-09	-12.907	4.0530	7.54E-12	0.00	3.63E+11	-0.571	1.85E+09	0.00
20.3423	1.26E-09	1.1000	1.1917	-8.92E-11	0.00	3.63E+11	-0.390	1.85E+09	0.00
20.8385	7.80E-10	1.2839	0.00994	-6.97E-11	0.00	3.63E+11	-0.00702	5.36E+07	0.00
21.3346	4.28E-10	1.2187	-0.02244	-4.92E-11	0.00	3.63E+11	-0.00385	5.36E+07	0.00
21.8308	1.95E-10	1.0168	-0.03913	-3.08E-11	0.00	3.63E+11	-0.00175	5.36E+07	0.00
22.3269	6.09E-11	0.7528	-0.04599	-1.63E-11	0.00	3.63E+11	-5.48E-04	5.36E+07	0.00
22.8231	0.00	0.4693	-0.04780	-6.34E-12	0.00	3.63E+11	-6.13E-05	1.52E+09	0.00
23.3192	-1.46E-11	0.1836	-0.03691	0.00	0.00	3.63E+11	0.00372	1.52E+09	0.00
23.8154	-1.15E-11	0.02977	-0.01712	0.00	0.00	3.63E+11	0.00293	1.52E+09	0.00
24.3115	-5.49E-12	-0.02028	-0.00424	0.00	0.00	3.63E+11	0.00140	1.52E+09	0.00
24.8077	-1.46E-12	-0.02073	0.00104	0.00	0.00	3.63E+11	3.73E-04	1.52E+09	0.00

```
   25.3038       0.00   -0.00795    0.00174       0.00       0.00   3.63E+11  -1.36E-04   1.52E+09
0.00
   25.8000   1.76E-12       0.00       0.00       0.00       0.00   3.63E+11  -4.48E-04   7.59E+08
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             =     0.03634854 inches
Computed slope at pile head      =     -0.0003329 radians
Maximum bending moment           =       2388437. inch-lbs
Maximum shear force              =       -101346. lbs
Depth of maximum bending moment  =     9.42692308 feet below pile head
Depth of maximum shear force     =    10.91538462 feet below pile head
Number of iterations             =              6
Number of zero deflection points =              6
Pile deflection at ground        =     0.00316573 inches



--------------------------------------------------------------------------------
            Pile-head Deflection vs. Pile Length for Load Case 2
--------------------------------------------------------------------------------

Boundary Condition Type 1, Shear and Moment

Shear      =          19500. lbs
Moment     =              0. in-lbs
Axial Load =         247090. lbs
```

Pile Length feet	Pile Head Deflection inches	Maximum Moment ln-lbs	Maximum Shear lbs
25.80000	0.03634854	2388437.	-101346.
24.51000	0.03559599	2396592.	-101954.
23.22000	0.03448574	2391392.	-104490.
21.93000	0.03497315	2372682.	-105550.
20.64000	0.03583671	2342694.	-102315.
19.35000	0.03331815	2404147.	-107899.
18.06000	0.03448031	2433861.	-108961.
16.77000	0.03575035	2347735.	-102502.
15.48000	0.03507082	2410979.	-108780.
14.19000	0.03430586	2360316.	-106007.
12.90000	0.03518495	2414784.	-111143.
11.61000	0.03999031	2351800.	-165864.
10.32000	-16.6949237	-1297545.	166409.

Computed Values of Pile Loading and Deflection
for Lateral Loading for Load Case Number 3

Pile-head conditions are Displacement and Moment (Loading Type 4)
Displacement of pile head = 0.380000 inches
Moment at pile head = 0.0 in-lbs
Axial load at pile head = 177140.0 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	0.3800	0.00	55085.	-0.00348	28.1175	5.80E+13	0.00	0.00	

20.0469
0.4962 0.3593 331990. 55206. -0.00348 28.4891 5.80E+13 0.00 0.00
20.7877
0.9923 0.3386 664717. 55333. -0.00348 28.8616 5.80E+13 0.00 0.00
21.7755
1.4885 0.3178 998215. 55465. -0.00348 29.2350 5.80E+13 0.00 0.00
22.7632
1.9846 0.2971 1332521. 55604. -0.00348 29.6093 5.80E+13 0.00 0.00
23.7510
2.4808 0.2764 1667668. 55748. -0.00348 29.9845 5.80E+13 0.00 0.00
24.7387
2.9769 0.2557 2003692. 55898. -0.00348 30.3607 5.80E+13 0.00 0.00
25.7264
3.4731 0.2350 2340628. 56055. -0.00348 30.7379 5.80E+13 0.00 0.00
26.7142
3.9692 0.2143 2678510. 56217. -0.00348 24.0868 7.73E+13 0.00 0.00
27.7019
4.4654 0.1936 3017374. 56384. -0.00348 24.4661 7.73E+13 0.00 0.00
28.6897
4.9615 0.1729 3357255. 56558. -0.00348 24.8467 7.73E+13 0.00 0.00
29.6774
5.4577 0.1521 3698188. 56738. -0.00348 25.2283 7.73E+13 0.00 0.00
30.6651
5.9538 0.1314 4040207. 56923. -0.00348 25.6112 7.73E+13 0.00 0.00
31.6529
6.4500 0.1107 4383348. 57115. -0.00348 25.9954 7.73E+13 0.00 0.00
32.6406
6.9462 0.09003 4727646. 57312. -0.00333 0.00 9.86E+10 0.00 0.00
33.6284
7.4423 0.07103 5072835. 57515. -0.00303 0.00 9.51E+10 0.00 0.00
34.6161
7.9385 0.05392 5418916. 57724. -0.00270 0.00 9.22E+10 0.00 0.00
35.6038
8.4346 0.03889 5765890. 57939. -0.00233 0.00 8.97E+10 0.00 0.00
36.5916
8.9308 0.02614 6113757. 44961. -0.00193 0.00 8.76E+10 -4397. 1001403.
0.5463
9.4269 0.01587 6305351. 17917. -0.00151 0.00 8.65E+10 -4689. 1759475.

0.00									
	9.9231	0.00817	6330285.	-9903.	-0.00107	0.00	8.64E+10	-4657.	3391704.
0.00									
	10.4192	0.00308	6189691.	-120469.	-6.44E-04	0.00	8.71E+10	-32484.	6.28E+07
0.00									
	10.9154	5.06E-04	4897138.	-277082.	-2.82E-04	0.00	9.69E+10	-20125.	2.37E+08
0.00									
	11.4115	-2.77E-04	2890876.	-300509.	-7.07E-05	0.00	1.41E+11	12255.	2.63E+08
0.00									
	11.9077	-3.36E-04	1318918.	-215391.	8.51E-07	0.00	3.66E+11	16337.	2.89E+08
0.00									
	12.4038	-2.67E-04	326065.	-124590.	1.42E-05	0.00	3.66E+11	14164.	3.16E+08
0.00									
	12.9000	-1.67E-04	-164697.	-53934.	1.55E-05	0.00	3.66E+11	9570.	3.42E+08
0.00									
	13.3962	-8.21E-05	-316202.	-10334.	1.16E-05	0.00	3.66E+11	5076.	3.68E+08
0.00									
	13.8923	-2.81E-05	-287776.	10321.	6.72E-06	0.00	3.66E+11	1863.	3.94E+08
0.00									
	14.3885	-2.01E-06	-193311.	17180.	2.81E-06	0.00	3.66E+11	441.1067	1.30E+09
0.00									
	14.8846	5.38E-06	-83207.	14767.	5.65E-07	0.00	3.66E+11	-1252.	1.39E+09
0.00									
	15.3808	4.72E-06	-17471.	7581.	-2.53E-07	0.00	3.66E+11	-1162.	1.47E+09
0.00									
	15.8769	2.36E-06	7071.	2292.	-3.38E-07	0.00	3.66E+11	-614.581	1.55E+09
0.00									
	16.3731	6.94E-07	9828.	-103.024	-2.00E-07	0.00	3.66E+11	-190.093	1.63E+09
0.00									
	16.8692	-2.30E-08	5845.	-649.226	-7.30E-08	0.00	3.66E+11	6.6140	1.71E+09
0.00									
	17.3654	-1.75E-07	2097.	-472.990	-8.42E-09	0.00	3.66E+11	52.5865	1.79E+09
0.00									
	17.8615	-1.23E-07	212.8322	-202.626	1.04E-08	0.00	3.66E+11	38.2335	1.85E+09
0.00									
	18.3577	-5.14E-08	-315.927	-41.383	9.52E-09	0.00	3.66E+11	15.9308	1.85E+09
0.00									
	18.8538	-1.00E-08	-279.961	15.2982	4.67E-09	0.00	3.66E+11	3.1093	1.85E+09

0.00								
19.3500	4.23E-09	-133.770	20.6540	1.31E-09	0.00	3.66E+11	-1.310	1.85E+09
0.00								
19.8462	5.53E-09	-34.023	11.6473	-5.72E-11	0.00	3.66E+11	-1.715	1.85E+09
0.00								
20.3423	3.55E-09	4.9227	3.2690	-2.94E-10	0.00	3.66E+11	-1.099	1.85E+09
0.00								
20.8385	2.04E-09	4.9037	-0.05776	-2.14E-10	0.00	3.66E+11	-0.01832	5.36E+07
0.00								
21.3346	9.99E-10	4.2354	-0.139	-1.40E-10	0.00	3.66E+11	-0.00899	5.36E+07
0.00								
21.8308	3.73E-10	3.2482	-0.176	-7.87E-11	0.00	3.66E+11	-0.00336	5.36E+07
0.00								
22.3269	6.17E-11	2.1420	-0.187	-3.49E-11	0.00	3.66E+11	-5.55E-04	5.36E+07
0.00								
22.8231	-4.25E-11	1.0160	-0.157	-9.23E-12	0.00	3.66E+11	0.01083	1.52E+09
0.00								
23.3192	-4.82E-11	0.2739	-0.08802	1.26E-12	0.00	3.66E+11	0.01230	1.52E+09
0.00								
23.8154	-2.75E-11	-0.03216	-0.03053	3.22E-12	0.00	3.66E+11	0.00701	1.52E+09
0.00								
24.3115	-9.86E-12	-0.08967	-0.00217	2.23E-12	0.00	3.66E+11	0.00252	1.52E+09
0.00								
24.8077	0.00	-0.05801	0.00601	1.03E-12	0.00	3.66E+11	2.33E-04	1.52E+09
0.00								
25.3038	2.42E-12	-0.01808	0.00487	0.00	0.00	3.66E+11	-6.17E-04	1.52E+09
0.00								
25.8000	4.00E-12	0.00	0.00	0.00	0.00	3.66E+11	-0.00102	7.59E+08
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. 3:

```
Pile-head deflection             =     0.38000000 inches
Computed slope at pile head      =     -0.0034797 radians
Maximum bending moment           =       6330285. inch-lbs
Maximum shear force              =       -300509. lbs
Depth of maximum bending moment  =     9.92307692 feet below pile head
Depth of maximum shear force     =    11.41153846 feet below pile head
Number of iterations             =              7
Number of zero deflection points =              6
Pile deflection at ground        =     0.03232788 inches
```

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	15890.	M, in-lb	0.00	177140.	0.02821	-2.59E-04	-78760.	1886215.
2	V, lb	19500.	M, in-lb	0.00	247090.	0.03635	-3.33E-04	-101346.	2388437.
3	y, in	0.3800	M, in-lb	0.00	177140.	0.3800	-0.00348	-300509.	6330285.

Maximum pile-head deflection = 0.3800000000 inches
Maximum pile-head rotation = -0.0034797265 radians = -0.199374 deg.

Summary of Warning Messages

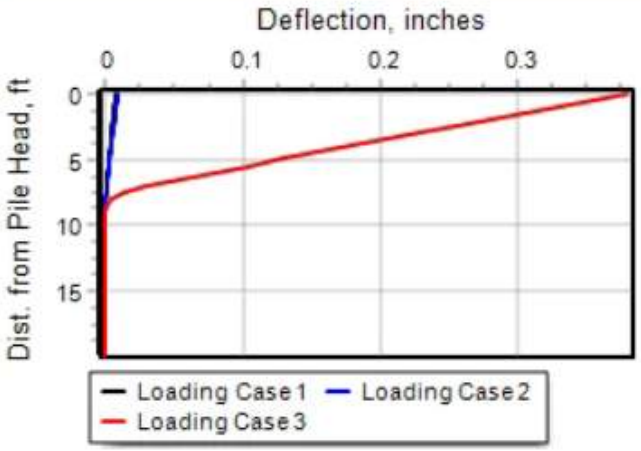
The following warning was reported 224 times

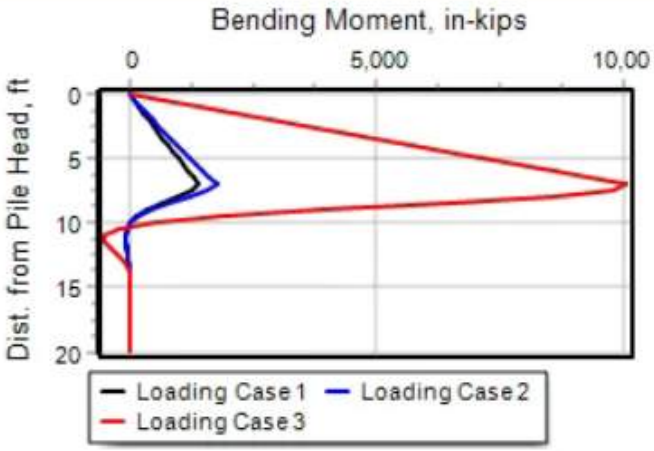
**** Warning ****

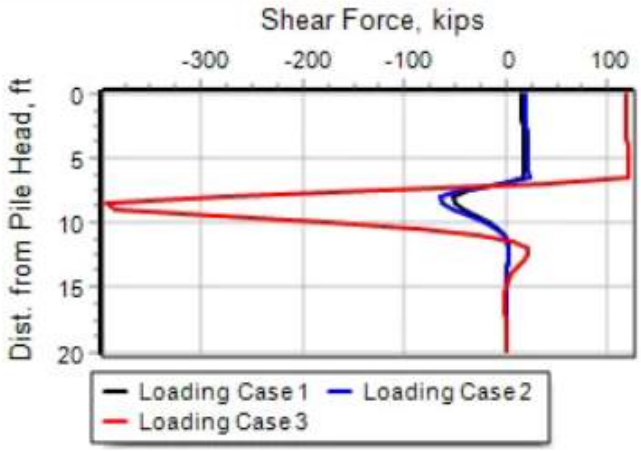
An unreasonable input value for unconfined compressive strength has been specified for a soil defined using the weak rock criteria. The input value is greater than 500 psi. Please check your input data for correctness.

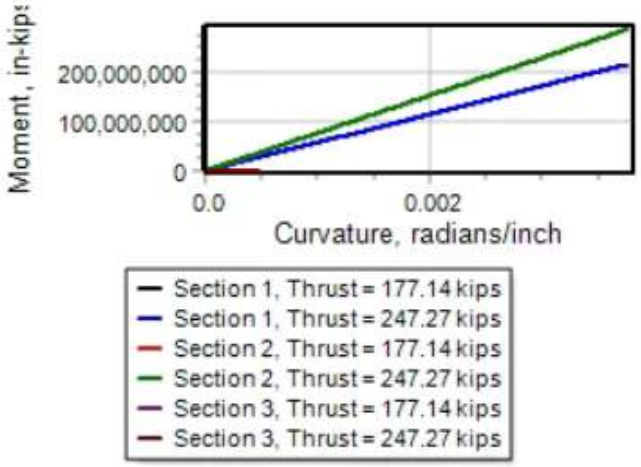
The analysis ended normally.

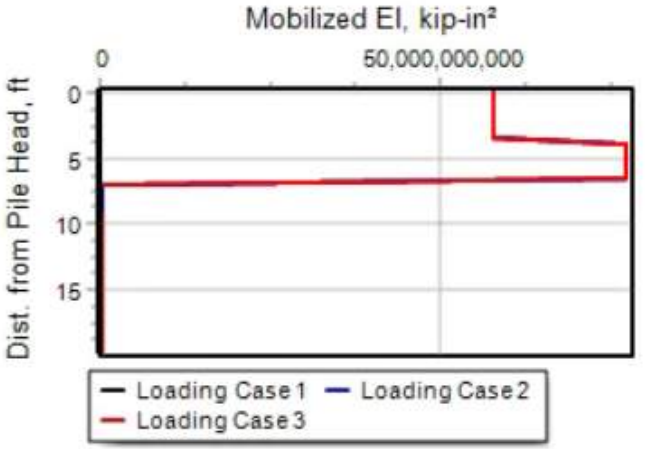
Results for HAS-22-19.12 FA B-145.lp12d

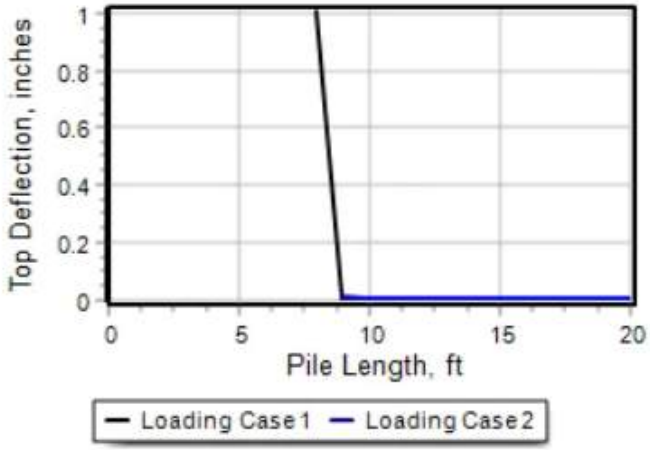












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LPile Version 2022-12.013

License ID : 500128183
License Type : (Single User License)

Analysis of Individual Piles and Drilled Shafts
Subjected to Lateral Loading Using the p-y Method
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Barr Engineering Inc.
Columbus, OH, USA

==========

This model was prepared by:
Zmankoci

Files Used for Analysis

Path to file locations:
\23-0011 113440 HAS-22-15.25\113440\geotechnical\bridges\XXX-YY-ZZ.ZZ (Crossing)\Analysis\Lpile\New folder\

Name of input data file:
HAS-22-19.12 FA B-145.lp12d

Name of output report file:
HAS-22-19.12 FA B-145.lp12o

Name of plot output file:
HAS-22-19.12 FA B-145.lp12p

Name of runtime message file:
HAS-22-19.12 FA B-145.lp12r

Date and Time of Analysis

Date: November 18, 2025 Time: 10:01:50

Problem Title

Project Name: HAS-22-19.12

Job Number: 10059

Client: ODOT

Engineer: ZM

Description: HAS-22-19.12 Forw Abut

```
--------------------------------------------------------------------------------
                         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                           =           40

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)
 - 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 = 19.900 ft
Depth of ground surface below top of pile = 6.7000 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	36.0000
2	3.700	36.0000
3	3.700	48.0000
4	6.700	48.0000
5	6.700	36.0000
6	19.900	36.0000

Input Structural Properties for Pile Sections:

Pile Section No. 1:

Section 1 is an elastic pile
Cross-sectional shape = rectangular
Length of section = 3.700000 ft
Width of top of section = 36.000000 in
Width of bottom of section = 36.000000 in
Top Section Depth = 175.000000 in
Bottom Section Depth = 175.000000 in

```
   Top Area                                          =        6300. sq. in
   Bottom Area                                       =        6300. sq. in
   Moment of Inertia at Top                          =    16078125. in^4
   Moment of Inertia at Bottom                       =    16078125. in^4
   Elastic Modulus                                   =     3604996. psi

Pile Section No. 2:

   Section 2 is an elastic pile
   Cross-sectional shape                             =     rectangular
   Length of section                                 =     3.000000 ft
   Width of top of section                           =    48.000000 in
   Width of bottom of section                        =    48.000000 in
   Top Section Depth                                 =   175.000000 in
   Bottom Section Depth                              =   175.000000 in
   Top Area                                          =        8400. sq. in
   Bottom Area                                       =        8400. sq. in
   Moment of Inertia at Top                          =    21437500. in^4
   Moment of Inertia at Bottom                       =    21437500. in^4
   Elastic Modulus                                   =     3604996. psi

Pile Section No. 3:

   Section 3 is a round drilled shaft, bored pile, or CIDH pile
   Length of section                                 =    13.200000 ft
   Shaft Diameter                                    =    36.000000 in



--------------------------------------------------------------------------------
                      Soil and Rock Layering Information
--------------------------------------------------------------------------------

The soil profile is modelled using 4 layers

Layer 1 is weak rock, p-y criteria by Reese, 1997

   Distance from top of pile to top of layer         =     6.700000 ft
```

Distance from top of pile to bottom of layer	=	6.900000	ft
Effective unit weight at top of layer	=	139.000000	pcf
Effective unit weight at bottom of layer	=	139.000000	pcf
Uniaxial compressive strength at top of layer	=	200.000000	psi
Uniaxial compressive strength at bottom of layer	=	200.000000	psi
Initial modulus of rock at top of layer	=	18000.	psi
Initial modulus of rock at bottom of layer	=	18000.	psi
RQD of rock at top of layer	=	0.0000	%
RQD of rock at bottom of layer	=	0.0000	%
k rm of rock at top of layer	=	0.0005000	
k rm of rock at bottom of layer	=	0.0005000	

Layer 2 is weak rock, p-y criteria by Reese, 1997

Distance from top of pile to top of layer	=	6.900000	ft
Distance from top of pile to bottom of layer	=	15.500000	ft
Effective unit weight at top of layer	=	139.000000	pcf
Effective unit weight at bottom of layer	=	139.000000	pcf
Uniaxial compressive strength at top of layer	=	1354.	psi
Uniaxial compressive strength at bottom of layer	=	1354.	psi
Initial modulus of rock at top of layer	=	120000.	psi
Initial modulus of rock at bottom of layer	=	120000.	psi
RQD of rock at top of layer	=	56.000000	%
RQD of rock at bottom of layer	=	56.000000	%
k rm of rock at top of layer	=	0.0001200	
k rm of rock at bottom of layer	=	0.0001200	

Layer 3 is weak rock, p-y criteria by Reese, 1997

Distance from top of pile to top of layer	=	15.500000	ft
Distance from top of pile to bottom of layer	=	16.900000	ft
Effective unit weight at top of layer	=	127.000000	pcf
Effective unit weight at bottom of layer	=	127.000000	pcf
Uniaxial compressive strength at top of layer	=	200.000000	psi
Uniaxial compressive strength at bottom of layer	=	200.000000	psi
Initial modulus of rock at top of layer	=	18000.	psi

```
   Initial modulus of rock at bottom of layer          =       18000. psi
   RQD of rock at top of layer                         =       0.0000 %
   RQD of rock at bottom of layer                      =       0.0000 %
   k rm of rock at top of layer                        =    0.0005000
   k rm of rock at bottom of layer                     =    0.0005000


Layer 4 is weak rock, p-y criteria by Reese, 1997

   Distance from top of pile to top of layer           =    16.900000 ft
   Distance from top of pile to bottom of layer        =    31.900000 ft
   Effective unit weight at top of layer               =   146.000000 pcf
   Effective unit weight at bottom of layer            =   146.000000 pcf
   Uniaxial compressive strength at top of layer       =        6628. psi
   Uniaxial compressive strength at bottom of layer    =        6628. psi
   Initial modulus of rock at top of layer             =      600000. psi
   Initial modulus of rock at bottom of layer          =      600000. psi
   RQD of rock at top of layer                         =    67.000000 %
   RQD of rock at bottom of layer                      =    67.000000 %
   k rm of rock at top of layer                        =    0.0000500
   k rm of rock at bottom of layer                     =    0.0000500


 (Depth of the lowest soil layer extends 12.000 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	Uniaxial qu psi	RQD %	E50 or krm	Rock Mass Modulus psi
1	Weak	6.7000	139.0000	200.0000	0.00	5.00E-04	18000.
	Rock	6.9000	139.0000	200.0000	0.00	5.00E-04	18000.
2	Weak	6.9000	139.0000	1354.	56.0000	1.20E-04	120000.

	Rock	15.5000	139.0000	1354.	56.0000	1.20E-04	120000.
3	Weak	15.5000	127.0000	200.0000	0.00	5.00E-04	18000.
	Rock	16.9000	127.0000	200.0000	0.00	5.00E-04	18000.
4	Weak	16.9000	146.0000	6628.	67.0000	5.00E-05	600000.
	Rock	31.9000	146.0000	6628.	67.0000	5.00E-05	600000.

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	19.700
2	6.700	36.300

Distributed lateral load intensity for Load Case 2 defined using 2 points

Point No.	Depth X ft	Dist. Load lb/in
1	0.000	31.700
2	6.700	56.500

Distributed lateral load intensity for Load Case 3 defined using 2 points

Point No.	Depth X ft	Dist. Load lb/in
1	0.000	19.700
2	6.700	36.300

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 3

Load No.	Load Type	Condition 1	Condition 2	Axial Thrust Force, lbs	Compute Top y vs. Pile Length	Run Analysis
1	1	V = 15890. lbs	M = 0.0000 in-lbs	177140.	Yes	Yes
2	1	V = 19500. lbs	M = 0.0000 in-lbs	247270.	Yes	Yes
3	4	y = 0.380000 in	M = 0.0000 in-lbs	177140.	N.A.	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:
-------------------
Moment-curvature properties were derived from elastic section properties


Pile Section No. 3:
-------------------

Dimensions and Properties of Drilled Shaft (Bored Pile):
--------------------------------------------------------

Length of Section                                  =    13.200000 ft
Shaft Diameter                                     =    36.000000 in
Concrete Cover Thickness (to edge of trans. reinf.)=     3.000000 in
Number of Reinforcing Bars                         =           10 bars
Yield Stress of Reinforcing Bars                   =      60000. psi
Modulus of Elasticity of Reinforcing Bars          =    29000000. psi
Gross Area of Shaft                                =        1018. sq. in.
Total Area of Reinforcing Steel                    =    10.000000 sq. in.
Area Ratio of Steel Reinforcement                  =         0.98 percent
Edge-to-Edge Bar Spacing                           =     7.407667 in
Maximum Concrete Aggregate Size                    =     0.750000 in
Ratio of Bar Spacing to Aggregate Size             =         9.88
```

Offset of Center of Rebar Cage from Center of Pile = 0.0000 in
Transverse Reinforcement
Type: Spiral
Number of Transverse Reinf. (per spacing) = 1
Spacing of Transverse Reinf. = 5.000000 in
Yield Stress of Transverse Reinf. = 60000. psi
Diameter of Transverse Reinf. = 0.625000 in

Axial Structural Capacities:

Nom. Axial Structural Capacity = 0.85 Fc Ac + Fy As = 4026.778 kips
Tensile Load for Cracking of Concrete = -452.643 kips
Nominal Axial Tensile Capacity = -600.000 kips

Reinforcing Bar Dimensions and Positions Used in Computations:

Bar Number	Bar Diam. inches	Bar Area sq. in.	X inches	Y inches
1	1.128000	1.000000	13.811000	0.00000
2	1.128000	1.000000	11.173334	8.117902
3	1.128000	1.000000	4.267834	13.135042
4	1.128000	1.000000	-4.26783	13.135042
5	1.128000	1.000000	-11.17333	8.117902
6	1.128000	1.000000	-13.81100	0.00000
7	1.128000	1.000000	-11.17333	-8.11790
8	1.128000	1.000000	-4.26783	-13.13504
9	1.128000	1.000000	4.267834	-13.13504
10	1.128000	1.000000	11.173334	-8.11790

NOTE: The positions of the above rebars were computed by LPile

Minimum spacing between any two bars not equal to zero = 7.408 inches
between bars 5 and 6.

Ratio of bar spacing to maximum aggregate size = 9.88

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 = 2

Number	Axial Thrust Force kips
1	177.140
2	247.270

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 = 177.140 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	228.8535619	366165699.	80.7148430	0.00005045	0.00002795	0.2106281	1.3879190	
0.00000125	457.7034710	366162777.	49.3766194	0.00006172	0.00001672	0.2565627	1.6398275	
0.00000188	686.5423860	366155939.	38.9390753	0.00007301	0.00000551	0.3022824	1.8921997	
0.00000250	915.3570327	366142813.	33.7266609	0.00008432	-0.00000568	0.3477856	2.1450329	
0.00000313	1144.	366059273.	30.6033743	0.00009564	-0.00001686	0.3930595	2.3982432	
0.00000375	1372.	365856632.	28.5233513	0.0001070	-0.00002804	0.4380835	2.6516894	
0.00000438	1599.	365549774.	27.0387994	0.0001183	-0.00003921	0.4828453	2.9052851	
0.00000500	1826.	365162798.	25.9260821	0.0001296	-0.00005037	0.5273378	3.1589819	
0.00000563	2052.	364715870.	25.0610856	0.0001410	-0.00006153	0.5715570	3.4127521	
0.00000625	2276.	364223782.	24.3693998	0.0001523	-0.00007269	0.6155005	3.6665787	
0.00000688	2500.	363697122.	23.8037013	0.0001637	-0.00008385	0.6591666	3.9204505	
0.00000750	2724.	363143554.	23.3324578	0.0001750	-0.00009501	0.7025542	4.1743596	
0.00000813	2724.	335209435.	20.3284207	0.0001652	-0.000127	0.6641763	3.8143967	C

```
   0.00000875        2724.    311265904.    19.7534290     0.0001728     -0.000142     0.6933990
3.9619099 C
   0.00000938        2724.    290514843.    19.2409836     0.0001804     -0.000157     0.7219844
4.1055799 C
   0.00001000        2724.    272357666.    18.7783639     0.0001878     -0.000172     0.7499019
4.2451253 C
   0.00001063        2724.    256336626.    18.3598714     0.0001951     -0.000187     0.7772836
4.3814979 C
   0.00001125        2724.    242095703.    17.9791378     0.0002023     -0.000203     0.8041767
-4.528631 C
   0.00001188        2724.    229353824.    17.6310902     0.0002094     -0.000218     0.8306257
-4.900081 C
   0.00001250        2724.    217886133.    17.3114255     0.0002164     -0.000234     0.8566630
-5.273858 C
   0.00001313        2724.    207510602.    17.0167181     0.0002233     -0.000249     0.8823234
-5.649724 C
   0.00001375        2724.    198078302.    16.7442345     0.0002302     -0.000265     0.9076444
-6.027410 C
   0.00001438        2724.    189466202.    16.4893757     0.0002370     -0.000280     0.9325383
-6.407626 C
   0.00001500        2724.    181571777.    16.2526078     0.0002438     -0.000296     0.9571571
-6.789210 C
   0.00001563        2724.    174308906.    16.0323434     0.0002505     -0.000312     0.9815365
-7.171896 C
   0.00001625        2724.    167604717.    15.8240355     0.0002571     -0.000328     1.0055208
-7.556931 C
   0.00001688        2724.    161397135.    15.6303013     0.0002638     -0.000344     1.0293536
-7.942409 C
   0.00001750        2724.    155632952.    15.4462342     0.0002703     -0.000360     1.0528323
-8.329949 C
   0.00001813        2725.    150367263.    15.2744862     0.0002769     -0.000376     1.0761839
-8.717761 C
   0.00001875        2771.    147787831.    15.1103761     0.0002833     -0.000392     1.0991890
-9.107608 C
   0.00001938        2817.    145373075.    14.9568696     0.0002898     -0.000408     1.1221158
-9.497355 C
   0.00002000        2862.    143075233.    14.8096977     0.0002962     -0.000424     1.1446954
-9.889175 C
```

```
   0.00002063         2906.    140910989.    14.6709820     0.0003026     -0.000440     1.1671632
-10.281182 C
   0.00002125         2951.    138863011.    14.5393852     0.0003090     -0.000456     1.1894637
-10.673829 C
   0.00002188         2995.    136909908.    14.4128516     0.0003153     -0.000472     1.2114858
-11.068035 C
   0.00002250         3039.    135063914.    14.2934926     0.0003216     -0.000488     1.2334327
-11.462146 C
   0.00002313         3083.    133307419.    14.1794980     0.0003279     -0.000505     1.2552045
-11.856987 C
   0.00002375         3126.    131626297.    14.0694618     0.0003341     -0.000521     1.2767208
-12.253233 C
   0.00002438         3169.    130030131.    13.9651988     0.0003404     -0.000537     1.2981634
-12.649388 C
   0.00002563         3256.    127049205.    13.7694775     0.0003528     -0.000570     1.3405770
-13.443519 C
   0.00002688         3341.    124320927.    13.5893602     0.0003652     -0.000602     1.3824150
-14.239680 C
   0.00002813         3426.    121816320.    13.4232291     0.0003775     -0.000635     1.4237277
-15.037491 C
   0.00002938         3510.    119504853.    13.2689447     0.0003898     -0.000668     1.4644844
-15.837254 C
   0.00003063         3595.    117376108.    13.1272359     0.0004020     -0.000700     1.5049139
-16.637037 C
   0.00003188         3678.    115389222.    12.9929616     0.0004142     -0.000733     1.5446291
-17.440217 C
   0.00003313         3761.    113548961.    12.8691857     0.0004263     -0.000766     1.5840655
-18.243048 C
   0.00003438         3844.    111835126.    12.7538766     0.0004384     -0.000799     1.6231220
-19.046417 C
   0.00003563         3927.    110224754.    12.6440684     0.0004504     -0.000832     1.6615614
-19.852458 C
   0.00003688         4009.    108720659.    12.5420305     0.0004625     -0.000865     1.6997260
-20.658151 C
   0.00003813         4091.    107312373.    12.4469994     0.0004745     -0.000898     1.7376150
-21.463495 C
   0.00003938         4173.    105981523.    12.3560509     0.0004865     -0.000931     1.7749466
-22.271065 C
```

```
   0.00004063        4255.    104726205.    12.2700683     0.0004985     -0.000964     1.8118873
-23.079377 C
   0.00004188        4336.    103543332.    12.1895175     0.0005104     -0.000997     1.8485563
-23.887339 C
   0.00004313        4417.    102426593.    12.1139089     0.0005224     -0.001030     1.8849528
-24.694951 C
   0.00004438        4498.    101368109.    12.0421877     0.0005344     -0.001063     1.9209877
-25.503047 C
   0.00004563        4579.    100358602.    11.9727239     0.0005463     -0.001096     1.9564831
-26.313342 C
   0.00004688        4659.     99400747.    11.9072286     0.0005582     -0.001129     1.9917095
-27.123284 C
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-60.000000 CYT
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Axial Thrust Force = 247.270 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	227.0510141	363281623.	105.8852974	0.00006618	0.00004368	0.2752896	1.8441335	
0.00000125	454.0990740	363279259.	61.9620007	0.00007745	0.00003245	0.3208302	2.0960475	
0.00000188	681.1360515	363272561.	47.3295008	0.00008874	0.00002124	0.3661558	2.3484291	
0.00000250	908.1564063	363262563.	40.0197004	0.0001000	0.00001005	0.4112653	2.6012783	
0.00000313	1135.	363249464.	35.6389802	0.0001114	-0.00000113	0.4561574	2.8545951	
0.00000375	1362.	363217079.	32.7225820	0.0001227	-0.00001229	0.5008277	3.1083558	
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0.00000500	1815.	362924645.	29.0833749	0.0001454	-0.00003458	0.5894415	3.6167894	
0.00000563	2040.	362656336.	27.8720970	0.0001568	-0.00004572	0.6333614	3.8712982	
0.00000625	2265.	362321446.	26.9037894	0.0001681	-0.00005685	0.6770139	4.1259367	
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0.00000813	2933.	361028692.	24.8949546	0.0002023	-0.00009023	0.8063322	4.8903862	
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    0.0001494         9889.     66199609.    10.4263152     0.0015574     -0.003820     3.8577386
-60.000000 CY
    0.0001544         9944.     64417473.    10.3425764     0.0015966     -0.003961     3.8867282
-60.000000 CY
    0.0001594        10000.     62742828.    10.2651897     0.0016360     -0.004101     3.9125250
-60.000000 CY
    0.0001644        10053.     61157992.    10.1895477     0.0016749     -0.004243     3.9347304
-60.000000 CY
    0.0001694        10105.     59662206.    10.1191003     0.0017139     -0.004384     3.9537470
-60.000000 CY
    0.0001744        10157.     58248287.    10.0537055     0.0017531     -0.004524     3.9695624
-60.000000 CY
    0.0001794        10208.     56909300.     9.9910460     0.0017921     -0.004665     3.9821319
-60.000000 CY
    0.0001844        10258.     55639085.     9.9365116     0.0018320     -0.004805     3.9914096
-60.000000 CY
    0.0001894        10308.     54430591.     9.8830078     0.0018716     -0.004946     3.9973267
-60.000000 CY
    0.0001944        10356.     53277377.     9.8299630     0.0019107     -0.005087     3.9998796
-60.000000 CY
    0.0001994        10403.     52177898.     9.7827676     0.0019504     -0.005227     3.9978733
-60.000000 CY
    0.0002044        10449.     51128635.     9.7378315     0.0019902     -0.005367     3.9999530
-60.000000 CY
    0.0002094        10495.     50125168.     9.6961660     0.0020301     -0.005507     3.9977664
-60.000000 CY
    0.0002144        10540.     49165269.     9.6573632     0.0020703     -0.005647     3.9999107
-60.000000 CY
    0.0002194        10584.     48245080.     9.6202126     0.0021104     -0.005787     3.9969617
-60.000000 CY
    0.0002244        10627.     47362868.     9.5879453     0.0021513     -0.005926     3.9996483
-60.000000 CY
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    0.0002294       10670.     46515733.     9.5568738     0.0021921     -0.006065     3.9951406
-60.000000 CY
    0.0002344       10708.     45686846.     9.5250167     0.0022324     -0.006205     3.9987360
-60.000000 CY
    0.0002394       10742.     44876783.     9.4919616     0.0022721     -0.006345     3.9999959
-60.000000 CY
    0.0002444       10767.     44059063.     9.4548188     0.0023105     -0.006487     3.9960122
-60.000000 CY
    0.0002494       10785.     43249092.     9.4160207     0.0023481     -0.006629     3.9988565
-60.000000 CY
    0.0002544       10798.     42447627.     9.3753070     0.0023848     -0.006773     3.9999710
-60.000000 CY
    0.0002594       10807.     41664658.     9.3349028     0.0024212     -0.006916     3.9941811
-60.000000 CY
    0.0002644       10815.     40906990.     9.2959694     0.0024576     -0.007060     3.9974871
-60.000000 CY
    0.0002694       10823.     40176755.     9.2588467     0.0024941     -0.007203     3.9994305
-60.000000 CY
    0.0002744       10830.     39472361.     9.2234566     0.0025307     -0.007347     3.9992531
-60.000000 CY
    0.0003044       10867.     35702779.     9.0305404     0.0027487     -0.008209     3.9946495
-60.000000 CY
    0.0003344       10897.     32589130.     8.8799278     0.0029692     -0.009068     3.9958705
-60.000000 CY
    0.0003644       10921.     29971629.     8.7562890     0.0031906     -0.009927     3.9940033
-60.000000 CYT
    0.0003944       10940.     27740587.     8.6527119     0.0034124     -0.010785     3.9888991
-60.000000 CYT
    0.0004244       10957.     25819049.     8.5695215     0.0036367     -0.011641     3.9999526
-60.000000 CYT
    0.0004544       10971.     24145996.     8.5025479     0.0038633     -0.012494     3.9948677
-60.000000 CYT


-------------------------------------------------------------------------
   Summary of Results for Nominal Moment Capacity for Section 3
-------------------------------------------------------------------------
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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	177.140	10162.078	0.00300000	-0.01003034
2	247.270	10900.316	0.00300000	-0.00918765

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	177.140000	10162.	115.141000	6605.	84998679.
2	0.65	247.270000	10900.	160.725500	7085.	93165678.
1	0.75	177.140000	10162.	132.855000	7622.	80807819.
2	0.75	247.270000	10900.	185.452500	8175.	86999166.
1	0.90	177.140000	10162.	159.426000	9146.	61912053.
2	0.90	247.270000	10900.	222.543000	9810.	68872292.

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	6.7000	0.00	N.A.	Yes	N.A.	N.A.
2	6.9000	0.2000	No	Yes	N.A.	N.A.
3	15.5000	8.8000	No	Yes	N.A.	N.A.
4	16.9000	10.2000	No	Yes	N.A.	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 = 15890.0 lbs
Applied moment at pile head = 0.0 in-lbs
Axial thrust load on pile head = 177140.0 lbs

Depth X	Deflect. y	Bending Moment	Shear Force	Slope S	Total Stress	Bending Stiffness	Soil Res. p	Soil Spr. Es*H	Distrib. Lat.

Load feet	inches	in-lbs	lbs	radians	psi*	lb-in^2	lb/inch	lb/inch	lb/inch
0.00	0.00692	-8.46E-06	15890.	-7.65E-05	28.1175	5.80E+13	0.00	0.00	20.0082
0.4975	0.00647	95301.	16012.	-7.65E-05	28.2242	5.80E+13	0.00	0.00	20.9326
0.9950	0.00601	191348.	16141.	-7.65E-05	28.3317	5.80E+13	0.00	0.00	22.1652
1.4925	0.00555	288184.	16277.	-7.65E-05	28.4401	5.80E+13	0.00	0.00	23.3978
1.9900	0.00510	385855.	16420.	-7.65E-05	28.5494	5.80E+13	0.00	0.00	24.6304
2.4875	0.00464	484404.	16571.	-7.64E-05	28.6598	5.80E+13	0.00	0.00	25.8631
2.9850	0.00418	583874.	16729.	-7.64E-05	28.7711	5.80E+13	0.00	0.00	27.0957
3.4825	0.00373	684310.	16894.	-7.63E-05	28.8836	5.80E+13	0.00	0.00	28.3283
3.9800	0.00327	785755.	17067.	-7.62E-05	21.9678	7.73E+13	0.00	0.00	29.5609
4.4775	0.00282	888254.	17247.	-7.62E-05	22.0825	7.73E+13	0.00	0.00	30.7935
4.9750	0.00236	991851.	17435.	-7.61E-05	22.1985	7.73E+13	0.00	0.00	32.0261
5.4725	0.00191	1096588.	17630.	-7.60E-05	22.3158	7.73E+13	0.00	0.00	33.2587
5.9700	0.00146	1202511.	17832.	-7.59E-05	22.4343	7.73E+13	0.00	0.00	34.4913
6.4675	0.00100	1309664.	18038.	-7.58E-05	22.5543	7.73E+13	0.00	0.00	34.5376
6.9650	5.50E-04	1418047.	-3898.	-6.42E-05	0.00	3.66E+11	-7383.	8.01E+07	0.00
7.4625	2.36E-04	1263252.	-37269.	-4.23E-05	0.00	3.66E+11	-3796.	9.59E+07	0.00
7.9600	4.51E-05	973141.	-51121.	-2.41E-05	0.00	3.66E+11	-844.459	1.12E+08	

0.00
8.4575 -5.13E-05 652917. -50368. -1.08E-05 0.00 3.66E+11 1097. 1.28E+08
0.00
8.9550 -8.42E-05 371770. -41057. -2.48E-06 0.00 3.66E+11 2023. 1.43E+08
0.00
9.4525 -8.09E-05 162706. -28579. 1.88E-06 0.00 3.66E+11 2158. 1.59E+08
0.00
9.9500 -6.17E-05 30536. -16735. 3.46E-06 0.00 3.66E+11 1810. 1.75E+08
0.00
10.4475 -3.96E-05 -37115. -7551. 3.40E-06 0.00 3.66E+11 1266. 1.91E+08
0.00
10.9450 -2.11E-05 -59634. -1592. 2.61E-06 0.00 3.66E+11 730.0427 2.07E+08
0.00
11.4425 -8.37E-06 -56132. 1518. 1.67E-06 0.00 3.66E+11 312.0180 2.23E+08
0.00
11.9400 -1.12E-06 -41508. 2583. 8.75E-07 0.00 3.66E+11 44.8066 2.38E+08
0.00
12.4375 2.08E-06 -25287. 2452. 3.31E-07 0.00 3.66E+11 -88.737 2.54E+08
0.00
12.9350 2.83E-06 -12228. 1806. 2.48E-08 0.00 3.66E+11 -127.904 2.70E+08
0.00
13.4325 2.38E-06 -3728. 1084. -1.05E-07 0.00 3.66E+11 -113.995 2.86E+08
0.00
13.9300 1.57E-06 710.1474 506.3959 -1.30E-07 0.00 3.66E+11 -79.370 3.02E+08
0.00
14.4275 8.29E-07 2319. 137.7557 -1.05E-07 0.00 3.66E+11 -44.127 3.18E+08
0.00
14.9250 3.14E-07 2355. -46.394 -6.70E-08 0.00 3.66E+11 -17.564 3.34E+08
0.00
15.4225 2.88E-08 1765. -103.852 -3.35E-08 0.00 3.66E+11 -1.685 3.49E+08
0.00
15.9200 -8.50E-08 1115. -106.598 -9.97E-09 0.00 3.66E+11 0.7650 5.37E+07
0.00
16.4175 -9.02E-08 492.4880 -101.891 3.14E-09 0.00 3.66E+11 0.8121 5.37E+07
0.00
16.9150 -4.75E-08 -101.334 -56.902 6.33E-09 0.00 3.66E+11 14.2593 1.79E+09
0.00
17.4125 -1.47E-08 -186.939 -1.181 3.98E-09 0.00 3.66E+11 4.4078 1.79E+09

```
0.00
   17.9100  -5.04E-11   -115.441    12.0217   1.51E-09       0.00   3.66E+11    0.01511   1.79E+09
0.00
   18.4075   3.36E-09    -43.403     9.0620   2.17E-10       0.00   3.66E+11     -1.007   1.79E+09
0.00
   18.9050   2.54E-09     -7.242     3.7854  -1.96E-10       0.00   3.66E+11     -0.761   1.79E+09
0.00
   19.4025   1.01E-09     1.7952     0.6065  -2.41E-10       0.00   3.66E+11     -0.304   1.79E+09
0.00
   19.9000  -3.36E-10       0.00       0.00  -2.26E-10       0.00   3.66E+11     0.1007   8.96E+08
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. 1:

Pile-head deflection             =     0.00692309 inches
Computed slope at pile head      =     -0.0000765 radians
Maximum bending moment           =       1418047. inch-lbs
Maximum shear force              =        -51121. lbs
Depth of maximum bending moment  =     6.96500000 feet below pile head
Depth of maximum shear force     =     7.96000000 feet below pile head
Number of iterations             =              6
Number of zero deflection points =              5
Pile deflection at ground        =     0.00079141 inches



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            Pile-head Deflection vs. Pile Length for Load Case 1
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Boundary Condition Type 1, Shear and Moment

Shear = 15890. lbs
Moment = 0. in-lbs
Axial Load = 177140. lbs

Pile Length feet	Pile Head Deflection inches	Maximum Moment ln-lbs	Maximum Shear lbs
19.90000	0.00692309	1418047.	-51121.
18.90500	0.00706716	1445027.	-52588.
17.91000	0.00827953	1415486.	-52109.
16.91500	0.00827045	1425439.	-53412.
15.92000	0.00818414	1425065.	-53903.
14.92500	0.00802270	1414075.	-53402.
13.93000	0.00691116	1417925.	-52983.
12.93500	0.00796207	1426979.	-54122.
11.94000	0.00799360	1440939.	-55087.
10.94500	0.00787408	1433676.	-54369.
9.95000	0.00777929	1404207.	-58981.
8.95500	0.01048464	1399631.	-83870.
7.96000	1.00568647	1550957.	-186694.

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 = 19500.0 lbs
Applied moment at pile head = 0.0 in-lbs
Axial thrust load on pile head = 247270.0 lbs

Depth	Deflect.	Bending	Shear	Slope	Total	Bending	Soil Res.	Soil Spr.	Distrib.

X	y	Moment	Force	S	Stress	Stiffness	p	Es*H	Lat. Load
feet	inches	in-lbs	lbs	radians	psi*	lb-in^2	lb/inch	lb/inch	lb/inch
0.00	0.00871	2.26E-05	19500.	-9.63E-05	39.2492	5.80E+13	0.00	0.00	32.1604
0.4975	0.00814	117130.	19696.	-9.63E-05	39.3803	5.80E+13	0.00	0.00	33.5415
0.9950	0.00756	235456.	19902.	-9.63E-05	39.5128	5.80E+13	0.00	0.00	35.3830
1.4925	0.00699	355043.	20119.	-9.63E-05	39.6467	5.80E+13	0.00	0.00	37.2245
1.9900	0.00641	475956.	20346.	-9.62E-05	39.7821	5.80E+13	0.00	0.00	39.0660
2.4875	0.00584	598262.	20585.	-9.62E-05	39.9190	5.80E+13	0.00	0.00	40.9075
2.9850	0.00527	722026.	20835.	-9.61E-05	40.0575	5.80E+13	0.00	0.00	42.7490
3.4825	0.00469	847313.	21095.	-9.60E-05	40.1978	5.80E+13	0.00	0.00	44.5904
3.9800	0.00412	974189.	21367.	-9.59E-05	30.5275	7.73E+13	0.00	0.00	46.4319
4.4775	0.00355	1102720.	21650.	-9.59E-05	30.6714	7.73E+13	0.00	0.00	48.2734
4.9750	0.00297	1232971.	21944.	-9.58E-05	30.8173	7.73E+13	0.00	0.00	50.1149
5.4725	0.00240	1365009.	22248.	-9.57E-05	30.9651	7.73E+13	0.00	0.00	51.9564
5.9700	0.00183	1498898.	22564.	-9.56E-05	31.1150	7.73E+13	0.00	0.00	53.7979
6.4675	0.00126	1634704.	22885.	-9.54E-05	31.2670	7.73E+13	0.00	0.00	53.7929
6.9650	6.92E-04	1772427.	-4670.	-8.08E-05	0.00	3.63E+11	-9285.	8.01E+07	0.00
7.4625	2.97E-04	1579187.	-46621.	-5.32E-05	0.00	3.63E+11	-4769.	9.59E+07	

0.00
7.9600 5.65E-05 1215932. -64011. -3.03E-05 0.00 3.63E+11 -1057. 1.12E+08
0.00
8.4575 -6.46E-05 814982. -63043. -1.36E-05 0.00 3.63E+11 1381. 1.28E+08
0.00
8.9550 -1.06E-04 463233. -51338. -3.08E-06 0.00 3.63E+11 2540. 1.43E+08
0.00
9.4525 -1.01E-04 202009. -35681. 2.39E-06 0.00 3.63E+11 2705. 1.59E+08
0.00
9.9500 -7.72E-05 37192. -20844. 4.35E-06 0.00 3.63E+11 2266. 1.75E+08
0.00
10.4475 -4.94E-05 -46882. -9362. 4.27E-06 0.00 3.63E+11 1581. 1.91E+08
0.00
10.9450 -2.62E-05 -74605. -1931. 3.27E-06 0.00 3.63E+11 908.3896 2.07E+08
0.00
11.4425 -1.03E-05 -69950. 1931. 2.09E-06 0.00 3.63E+11 385.5441 2.23E+08
0.00
11.9400 -1.32E-06 -51552. 3239. 1.09E-06 0.00 3.63E+11 52.5402 2.38E+08
0.00
12.4375 2.65E-06 -31281. 3059. 4.07E-07 0.00 3.63E+11 -112.887 2.54E+08
0.00
12.9350 3.55E-06 -15032. 2243. 2.66E-08 0.00 3.63E+11 -160.480 2.70E+08
0.00
13.4325 2.97E-06 -4502. 1339. -1.34E-07 0.00 3.63E+11 -142.181 2.86E+08
0.00
13.9300 1.95E-06 960.6307 620.9636 -1.63E-07 0.00 3.63E+11 -98.482 3.02E+08
0.00
14.4275 1.02E-06 2913. 164.6567 -1.31E-07 0.00 3.63E+11 -54.385 3.18E+08
0.00
14.9250 3.82E-07 2927. -61.385 -8.32E-08 0.00 3.63E+11 -21.341 3.34E+08
0.00
15.4225 2.92E-08 2180. -130.181 -4.12E-08 0.00 3.63E+11 -1.706 3.49E+08
0.00
15.9200 -1.10E-07 1373. -132.324 -1.20E-08 0.00 3.63E+11 0.9881 5.37E+07
0.00
16.4175 -1.14E-07 600.4140 -126.310 4.22E-09 0.00 3.63E+11 1.0264 5.37E+07
0.00
16.9150 -5.94E-08 -135.381 -70.049 8.04E-09 0.00 3.63E+11 17.8215 1.79E+09

0.00								
17.4125	-1.80E-08	-235.998	-0.695	4.99E-09	0.00	3.63E+11	5.4127	1.79E+09
0.00								
17.9100	1.67E-10	-143.698	15.3116	1.87E-09	0.00	3.63E+11	-0.05020	1.79E+09
0.00								
18.4075	4.28E-09	-53.183	11.3301	2.52E-10	0.00	3.63E+11	-1.284	1.79E+09
0.00								
18.9050	3.17E-09	-8.418	4.6572	-2.54E-10	0.00	3.63E+11	-0.952	1.79E+09
0.00								
19.4025	1.24E-09	2.4240	0.7049	-3.04E-10	0.00	3.63E+11	-0.372	1.79E+09
0.00								
19.9000	-4.53E-10	0.00	0.00	-2.84E-10	0.00	3.63E+11	0.1360	8.96E+08
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	=	0.00871337 inches
Computed slope at pile head	=	-0.0000963 radians
Maximum bending moment	=	1772427. inch-lbs
Maximum shear force	=	-64011. lbs
Depth of maximum bending moment	=	6.96500000 feet below pile head
Depth of maximum shear force	=	7.96000000 feet below pile head
Number of iterations	=	6
Number of zero deflection points	=	5
Pile deflection at ground	=	0.00099552 inches

Pile-head Deflection vs. Pile Length for Load Case 2

Boundary Condition Type 1, Shear and Moment

Shear = 19500. lbs
Moment = 0. in-lbs
Axial Load = 247270. lbs

Pile Length feet	Pile Head Deflection inches	Maximum Moment ln-lbs	Maximum Shear lbs
19.90000	0.00871337	1772427.	-64011.
18.90500	0.00889679	1806680.	-65847.
17.91000	0.01048211	1775443.	-65513.
16.91500	0.01046330	1787052.	-67099.
15.92000	0.01034730	1785676.	-67666.
14.92500	0.01013697	1770953.	-66987.
13.93000	0.00869900	1772235.	-66340.
12.93500	0.01004972	1786032.	-67883.
11.94000	0.01008516	1803240.	-69077.
10.94500	0.00993012	1793607.	-68141.
9.95000	0.00981300	1756474.	-73908.
8.95500	0.01400574	1751936.	-108121.

Computed Values of Pile Loading and Deflection
for Lateral Loading for Load Case Number 3

Pile-head conditions are Displacement and Moment (Loading Type 4)
Displacement of pile head = 0.380000 inches
Moment at pile head = 0.0 in-lbs
Axial load at pile head = 177140.0 lbs

Depth	Deflect.	Bending	Shear	Slope	Total	Bending	Soil Res.	Soil Spr.	Distrib.

X	y	Moment	Force	S	Stress	Stiffness	p	Es*H	Lat. Load
feet	inches	in-lbs	lbs	radians	psi*	lb-in^2	lb/inch	lb/inch	lb/inch
0.00	0.3800	0.00	118469.	-0.00421	28.1175	5.80E+13	0.00	0.00	20.0082
0.4975	0.3549	712063.	118591.	-0.00421	28.9146	5.80E+13	0.00	0.00	20.9326
0.9950	0.3298	1424872.	118719.	-0.00421	29.7127	5.80E+13	0.00	0.00	22.1652
1.4925	0.3046	2138471.	118855.	-0.00421	30.5115	5.80E+13	0.00	0.00	23.3978
1.9900	0.2795	2852903.	118999.	-0.00421	31.3114	5.80E+13	0.00	0.00	24.6304
2.4875	0.2544	3568213.	119149.	-0.00421	32.1122	5.80E+13	0.00	0.00	25.8631
2.9850	0.2293	4284445.	119308.	-0.00421	32.9140	5.80E+13	0.00	0.00	27.0957
3.4825	0.2042	5001641.	119473.	-0.00421	33.7170	5.80E+13	0.00	0.00	28.3283
3.9800	0.1791	5719847.	119646.	-0.00421	27.4917	7.73E+13	0.00	0.00	29.5609
4.4775	0.1540	6439106.	119826.	-0.00420	28.2969	7.73E+13	0.00	0.00	30.7935
4.9750	0.1289	7159462.	120013.	-0.00420	29.1034	7.73E+13	0.00	0.00	32.0261
5.4725	0.1038	7880958.	120208.	-0.00420	29.9111	7.73E+13	0.00	0.00	33.2587
5.9700	0.07870	8603640.	120411.	-0.00420	30.7202	7.73E+13	0.00	0.00	34.4913
6.4675	0.05361	9327550.	120617.	-0.00420	31.5306	7.73E+13	0.00	0.00	34.5376
6.9650	0.02852	1.01E+07	38623.	-0.00342	0.00	3.83E+10	-27503.	5756873.	0.00
7.4625	0.01280	9795943.	-124557.	-0.00200	0.00	4.64E+10	-27164.	1.27E+07	

0.00
7.9600 0.00461 8569711. -279203. -0.00102 0.00 7.25E+10 -24643. 3.19E+07
0.00
8.4575 6.26E-04 6464418. -392674. -4.42E-04 0.00 8.57E+10 -13370. 1.28E+08
0.00
8.9550 -6.67E-04 3882118. -384781. -1.12E-04 0.00 1.11E+11 16014. 1.43E+08
0.00
9.4525 -7.13E-04 1870365. -280206. 7.53E-06 0.00 3.65E+11 19019. 1.59E+08
0.00
9.9500 -5.77E-04 536438. -172948. 2.72E-05 0.00 3.66E+11 16913. 1.75E+08
0.00
10.4475 -3.88E-04 -194688. -85404. 3.00E-05 0.00 3.66E+11 12414. 1.91E+08
0.00
10.9450 -2.19E-04 -483347. -25745. 2.45E-05 0.00 3.66E+11 7572. 2.07E+08
0.00
11.4425 -9.61E-05 -502137. 7554. 1.64E-05 0.00 3.66E+11 3584. 2.23E+08
0.00
11.9400 -2.25E-05 -393186. 20934. 9.12E-06 0.00 3.66E+11 898.4485 2.38E+08
0.00
12.4375 1.28E-05 -252207. 21982. 3.86E-06 0.00 3.66E+11 -547.202 2.54E+08
0.00
12.9350 2.36E-05 -130726. 17156. 7.41E-07 0.00 3.66E+11 -1069. 2.70E+08
0.00
13.4325 2.17E-05 -47360. 10862. -7.10E-07 0.00 3.66E+11 -1039. 2.86E+08
0.00
13.9300 1.51E-05 -1037. 5473. -1.11E-06 0.00 3.66E+11 -765.961 3.02E+08
0.00
14.4275 8.50E-06 17986. 1836. -9.67E-07 0.00 3.66E+11 -452.424 3.18E+08
0.00
14.9250 3.61E-06 20884. -115.952 -6.50E-07 0.00 3.66E+11 -201.414 3.34E+08
0.00
15.4225 7.41E-07 16603. -846.642 -3.44E-07 0.00 3.66E+11 -43.373 3.49E+08
0.00
15.9200 -5.07E-07 10775. -962.492 -1.21E-07 0.00 3.66E+11 4.5623 5.37E+07
0.00
16.4175 -7.06E-07 5111. -929.903 8.29E-09 0.00 3.66E+11 6.3555 5.37E+07
0.00
16.9150 -4.08E-07 -327.635 -545.593 4.73E-08 0.00 3.66E+11 122.3914 1.79E+09

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0.00
   17.4125  -1.42E-07     -1404.    -53.395   3.32E-08       0.00   3.66E+11    42.4992   1.79E+09
0.00
   17.9100  -1.20E-08   -965.237    84.2077   1.39E-08       0.00   3.66E+11     3.5988   1.79E+09
0.00
   18.4075   2.37E-08   -398.391    73.7087   2.73E-09       0.00   3.66E+11     -7.116   1.79E+09
0.00
   18.9050   2.07E-08    -85.161    33.9674  -1.21E-09       0.00   3.66E+11     -6.198   1.79E+09
0.00
   19.4025   9.31E-09     7.1814     7.1321  -1.84E-09       0.00   3.66E+11     -2.792   1.79E+09
0.00
   19.9000  -1.34E-09       0.00       0.00  -1.78E-09       0.00   3.66E+11     0.4031   8.96E+08
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. 3:

Pile-head deflection             =     0.38000000 inches
Computed slope at pile head      =     -0.0042074 radians
Maximum bending moment           =      10052690. inch-lbs
Maximum shear force              =       -392674. lbs
Depth of maximum bending moment  =     6.96500000 feet below pile head
Depth of maximum shear force     =     8.45750000 feet below pile head
Number of iterations             =             24
Number of zero deflection points =              5
Pile deflection at ground        =     0.04188310 inches


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            Summary of Pile-head Responses for Conventional Analyses
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HAS-22-19.12 RA B-146 Strength Limit		
Depth (ft)	Shear Force from Lpile(lb)	Average Shear (lb) based on ODOT GDM 1501.7.9
0	19500	19500
0.4962	19695	19597.5
0.9923	19897	19906
1.4885	20109	20126.28571
1.9846	20329	20346.57143
2.4808	20558	20575.42857
2.9769	20796	20813.28571
3.4731	21042	21059.85714
3.9692	21297	21315.14286
4.4654	21562	21579.28571
4.9615	21835	21852.14286
5.4577	22116	22134
5.9538	22407	22424.71429
6.45	22706	22724
6.9462	23015	23032.14286
7.4423	23332	22276.71429
7.9385	23657	19307.57143
8.4346	23992	14148.14286
8.9308	16828	2637.142857
9.4269	1623	-15174
9.9231	-13410	-32613.57143
10.4192	-57562	-46534.8571
10.9154	-101346	-55257.1429
11.4115	-98420	-58406.4286
11.9077	-73457	-57230.2857
12.4038	-44228	-48668.2857
12.9	-20422	-33427.8571
13.3962	-5177	-18648.5714
13.8923	2372	-7766.4286
14.3885	5337	-1321.3400
14.8846	5035	1598.3310
15.3808	2718	2308.2810
15.8769	887.6199	1946.2170
16.3731	15.6968	1173.3404
16.8692	-207.35	451.6517
17.3654	-162.448	63.9543
17.8615	-73.136	-61.8726
18.3577	-16.821	-63.5360
18.8538	4.1182	-33.7444
19.35	6.8315	-10.5361
19.8462	4.053	-0.0913
20.3423	1.1917	2.3061
20.8385	0.00994	1.7112
21.3346	-0.02244	0.7285
21.8308	-0.03913	0.1442
22.3269	-0.04599	-0.0285
22.8231	-0.0478	-0.0305
23.3192	-0.03691	-0.0272
23.8154	-0.01712	-0.0213
24.3115	-0.00424	-0.0148
24.8077	0.00104	-0.0092
25.3038	0.00174	-0.0037
25.8	0	-0.0004

HAS-22-19.12 RA B-146 Thermal Movement		
Depth (ft)	Shear Force from Lpile(lb)	Average Shear (lb) based on ODOT GDM 1501.7.9
0	55085	55085
0.4962	55206	55145.5
0.9923	55333	55338.6
1.4885	55465	55477
1.9846	55604	55615.57143
2.4808	55748	55760
2.9769	55898	55910.14286
3.4731	56055	56066.28571
3.9692	56217	56228.28571
4.4654	56384	56396.14286
4.9615	56558	56570
5.4577	56738	56749.57143
5.9538	56923	56935
6.45	57115	57126.42857
6.9462	57312	57323.71429
7.4423	57515	55641.28571
7.9385	57724	50069
8.4346	57939	40495
8.9308	44961	15097.71429
9.4269	17917	-32701.85714
9.9231	-9903	-83878
10.4192	-120469	-122925.1429
10.9154	-277082	-147146.7143
11.4115	-300509	-157411.1429
11.9077	-215391	-157472.7143
12.4038	-124590	-138788.4286
12.9	-53934	-96751.0000
13.3962	-10334	-51711.5714
13.8923	10321	-19858.4286
14.3885	17180	-1732.4286
14.8846	14767	5957.7109
15.3808	7581	7341.2500
15.8769	2292	5799.2514
16.3731	-103.024	3316.0191
16.8692	-649.226	1200.5359
17.3654	-472.99	119.7213
17.8615	-202.626	-204.7567
18.3577	-41.383	-188.3751
18.8538	15.2982	-95.1615
19.35	20.654	-27.5998
19.8462	11.6473	1.3270
20.3423	3.269	7.2137
20.8385	-0.05776	5.0015
21.3346	-0.139	2.0285
21.8308	-0.176	0.3520
22.3269	-0.187	-0.1193
22.8231	-0.157	-0.1114
23.3192	-0.08802	-0.0907
23.8154	-0.03053	-0.0648
24.3115	-0.00217	-0.0381
24.8077	0.00601	-0.0183
25.3038	0.00487	-0.0044
25.8	0	0.0022

HAS-22-19.12 FA B-145 Strength Limit		
Depth (ft)	Shear Force from Lpile(lb)	Average Shear (lb) based on ODOT GDM 1501.7.9
0	19500	19500
0.4975	19696	19598
0.995	19902	19912.6
1.4925	20119	20140.42857
1.99	20346	20368.28571
2.4875	20585	20607
2.985	20835	20856.71429
3.4825	21095	21117.42857
3.98	21367	21389.14286
4.4775	21650	21671.85714
4.975	21944	21964.71429
5.4725	22248	18284
5.97	22564	8571.428571
6.4675	22885	-3665.85714
6.965	-4670	-15806.8571
7.4625	-46621	-26319.1429
7.96	-64011	-34639.8571
8.4575	-63043	-40886.8571
8.955	-51338	-41557.1429
9.4525	-35681	-35172.8571
9.95	-20844	-25752.5714
10.4475	-9362	-16283.7143
10.945	-1931	-8512.7143
11.4425	1931	-3095.0000
11.94	3239	74.0000
12.4375	3059	1500.1377
12.935	2243	1799.5172
13.4325	1339	1514.8908
13.93	620.9636	1033.5792
14.4275	164.6567	577.6758
14.925	-61.385	239.2029
15.4225	-130.181	37.9102
15.92	-132.324	-50.8982
16.4175	-126.31	-72.2332
16.915	-70.049	-61.8453
17.4125	-0.695	-42.5827
17.91	15.3116	-23.5786
18.4075	11.3301	-5.5343
18.905	4.6572	5.2181
19.4025	0.7049	6.4008
19.9	0	4.1731

HAS-22-19.12 FA B-145 Thermal Movement		
Depth (ft)	Shear Force from Lpile(lb)	Average Shear (lb) based on ODOT GDM 1501.7.9
0	118469	118469
0.4975	118591	118530
0.995	118719	118726.6
1.4925	118855	118870
1.99	118999	119013.4286
2.4875	119149	119164.1429
2.985	119308	119322.2857
3.4825	119473	119487.7143
3.98	119646	119660.4286
4.4775	119826	119840.7143
4.975	120013	120027.7143
5.4725	120208	108477.7143
5.97	120411	73591.57143
6.4675	120617	16587.42857
6.965	38623	-56653.57143
7.4625	-124557	-128794.8571
7.96	-279203	-186025.8571
8.4575	-392674	-227963.7143
8.955	-384781	-245681.8571
9.4525	-280206	-231565.8571
9.95	-172948	-190600.5714
10.4475	-85404	-131513.7143
10.945	-25745	-73404.7143
11.4425	7554	-30924.4286
11.94	20934	-4665.8571
12.4375	21982	8316.5714
12.935	17156	12256.7143
13.4325	10862	11161.0069
13.93	5473	8049.4866
14.4275	1836	4771.7020
14.925	-115.952	2188.0016
15.4225	-846.642	558.3454
15.92	-962.492	-231.1396
16.4175	-929.903	-481.3956
16.915	-545.593	-454.3012
17.4125	-53.395	-328.4999
17.91	84.2077	-189.9822
18.4075	73.7087	-57.1389
18.905	33.9674	24.2702
19.4025	7.1321	39.8032
19.9	0	28.7021