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2nd Revision February 18, 2026

EMH&T, Inc.
5500 New Albany Road
Columbus, OH 43054

Attention: Mr. Tyler Adams, P.E
Senior Bridge Engineer

Reference: Structure Foundation Exploration- Final Report
BRO-50-4.49 Bridge Replacement over East Fork Little Miami River
PID No. 109971, Structure File No. 0800512
Perry Township, Brown County, Ohio
CTL Project No. 24050024COL

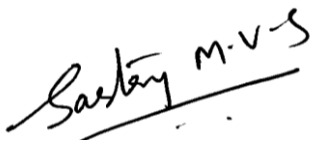
Dear Mr. Adams:

CTL Engineering, Inc. has completed the Structure Foundation Exploration report for the above referenced project. A pdf copy of the final report is being submitted.

Thank you for the opportunity to work with you on this project. If you have any questions or need further information, please feel free to contact our office.

Respectfully Submitted

CTL ENGINEERING, INC.



Sastry Malladi, P.E
Project Engineer

STRUCTURE FOUNDATION EXPLORATION
FINAL REPORT

BRO-50-4.49 BRIDGE REPLACEMENT
OVER EAST FORK LITTLE MIAMI RIVER
PID NO. 109971, STRUCTURE FILE NO. 0800512
PERRY TOWNSHIP, BROWN COUNTY, OHIO
CTL PROJECT NO. 24050024COL

PREPARED FOR:

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February 18, 2026

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I. EXECUTIVE SUMMARY

The project designated as BRO-50-4.49 involves replacement of an existing bridge along US 50 over East Fork Little Miami River in Perry Township, Brown County, Ohio. The proposed structure will be a single-span bridge with a span of 180.0 feet. The bridge will consist of steel plate girder with composite reinforced concrete deck supported on semi-integral abutments.

Four (4) test borings, identified as B-001-0-24 through B-004-0-24, were drilled for this bridge structure. Below the surface cover or from the surface, the test borings encountered both coarse grained and fine-grained soils extending down to the top of bedrock. The coarse-grained soils were described as gravel and/or stone fragments with sand (A-1-b), gravel and/or stone fragments with sand and silt (A-2-4), or coarse and fine sand (A-3a). The fine-grained soils were described as sandy silt (A-4a), silt (A-4b), silt and clay (A-6a), silty clay (A-6b), or clay (A-7-6). Two (2) additional test borings were performed identified as B-001-1-24 and B-004-1-24 at offset locations from boring B-001-0-24 and B-004-0-24, respectively. The additional borings were performed to collect a total of 5 undisturbed Shelby tube samples for scour testing.

Beneath the soil overburden, the borings encountered bedrock at depths ranging from 28.5 to 65.0 feet below grade, with top of bedrock elevations ranging from 850.9 to 863.7 feet. The upper portion of the bedrock in borings B-001-0-24, B-003-0-24 and B-004-0-24 were augered and sampled using soil techniques, and was described as gray shale. Rock coring was performed below the auger refusals depths in all borings, and the recovered samples from the rock coring operations were described as interbedded shale and limestone.

Prior to rock coring operations groundwater was measured in the borings at depths ranging from 0.0 (River Level) to 31.0 feet below grade. These groundwater depths correspond to elevations ranging from 884.9 to 889.3 feet.

Based upon the soil and rock information obtained from the test borings, it is CTL's opinion that the proposed bridge can be supported onto drilled shafts socketed into the underlying bedrock. Please refer to *Paragraph VI. Analyses and Recommendation*s for additional details.

II. INTRODUCTION

The project designated as BRO-50-4.49 involves replacement of an existing bridge along US 50 over East Fork Little Miami River in Perry Township, Brown County, Ohio. The proposed structure will be a single-span bridge with a span of 180.0 feet. The bridge will consist of steel plate girder with composite reinforced concrete deck supported on semi-integral abutments.

This is a Final Structure Foundation Exploration Report.

III. GEOLOGY AND OBSERVATIONS OF THE PROJECT

According to the Ohio Department of Natural Resources (ODNR), Physiographic Regions of Ohio, the project site is in the Illinoian Till Plain region, which is in the Till Plain section of Ohio. The geology of this region consists of silt-loam, high lime, Illinoian-age till with loess cap.

According to the Bedrock Geologic Map of Ohio (2006), the underlying bedrock within the project area consists of Ordovician-age shale and limestone interbedded of the Arnheim Formation.

According to the mapping of historic and active mines (ODNR Mines of Ohio), there are no documented mines in the general vicinity of the project area.

According to the ODNR's Karst Interactive Map, no karst features have been identified within the project area. However, there is one Karst-Suspect-Not Visited feature mapped within 0.25 mile south of the proposed bridge location. It should be noted that karst features were not observed at the ground surface during our field exploration.

According to the Natural Resources Conservation Service Web Soil Survey, surficial soils in the site vicinity are mapped as Genesee silt loam, 0 to 2 percent slopes, occasionally flooded (Ge), and Rossmoyne silt loam, 6 to 12 percent slopes, eroded (RpC2). These soils are described as having a low to moderate corrosion risk to concrete and low to high corrosion risk to steel.

An initial site visit was performed by CTL personnel on May 24, 2024. The existing structure is a three-span bridge with span lengths of 80'-100'-80' for a total length of 260 feet. The existing abutments are supported on pedestal spread footings that extend to a depth of approximately 35 feet below the pavement. The US 50, within the project limits is a bi-directional roadway having an asphalt surface. East Fork Little Miami River flows north to south below the structure.

During the site visit, deck deterioration, leaking joints, and rusting of riveted steel beams were noted. Erosion was noted along the river banks as well as the spill through slopes of the abutment. The area surrounding the bridge is primarily wooded, with some residential properties.

IV. EXPLORATION

Four (4) structure test borings, identified as B-001-0-24 through B-004-0-24, were drilled and cored to depths ranging from 40.0 to 76.0 feet below the existing ground surface. The borings were performed between June 11, 2024 and June 21, 2024, with a track mounted drill rig utilizing 3.25-inch Hollow Stem Augers (HSA). Standard Penetration Tests (SPTs)

were conducted using a 140-pound automatic hammer, falling 30 inches, to drive 2-inch O.D. split barrel samplers. Rock coring was performed in all borings, using an NQ-size core barrel. The hammer system used was calibrated on November 4, 2022. The energy transfer ratio associated with the automatic SPT hammer was 79.3 percent.

Soil samples obtained were preserved in glass jars, visually classified in the field and laboratory, and tested for natural moisture content. Representative soil samples were subjected to laboratory testing including grain size distribution and Atterberg limits.

The recovered rock from the coring operations were placed in core boxes, visually described, and the Rock Quality Designation (RQD) and percent core recovery values were determined. Representative samples of the recovered rock were subjected to compressive strength, point load and unit weight testing.

CTL performed two (2) additional test borings identified as B-001-1-24 and B-004-1-24 at offset locations from B-001-0-24 and B-004-0-24 respectively, between February 26, 2025 and February 28, 2025. The additional test borings were performed to collect a total of five (5) undisturbed Shelby tube samples. The samples were collected by ODOT OGE personnel for erosion testing.

Ground surface elevations, latitude, longitude, station, and offset information were provided by personnel from EMH&T.

V. FINDINGS

Borings B-001-0-24 and B-004-0-24 exhibited 7 to 9 inches of asphalt overlying 3 to 5 inches of aggregate base at the surface. Below the surface cover or from the surface, the test borings encountered both coarse grained and fine-grained soils extending down to the top of bedrock. The coarse-grained soils were described as gravel and/or stone fragments with sand (A-1-b), gravel and/or stone fragments with sand and silt (A-2-4), or coarse and fine sand (A-3a). The fine-grained soils were described as sandy silt (A-4a), silt (A-4b), silt and clay (A-6a), silty clay (A-6b), or clay (A-7-6). These soils exhibited corrected standard penetration (SPT) N_{60} values ranging from 3 blows per foot to 50 blows for 2 inches of penetration, with moisture content values ranging from 7 to 29 percent.

Beneath the soil overburden, the borings encountered bedrock at depths ranging from 28.5 to 65.0 feet below grade, with top of bedrock elevations ranging from 850.9 to 863.7 feet. The upper 1.0 to 1.5 feet of bedrock was augerable in borings B-001-0-24, B-003-0-24 and B-004-0-24, and was described as gray shale. The augerable bedrock exhibited SPT blow counts ranging from 50 blows for 4 inches to 50 blows for 1 inch of penetration.

Rock coring was performed in all borings, and the recovered samples from the rock coring operations were described as shale, limestone or interbedded shale and limestone. The rock

cores exhibited rock quality designation (RQD) values ranging from 0 to 30 percent, with core recovery values ranging from 90 to 100 percent.

Unconfined Compressive Strength (UCS) testing was performed on selected bedrock core samples representative of the bedrock units. Table 1 shows the results of these UCS tests.

Table 1. Rock UCS Results

Boring No.	Sample Elevation (Feet)	Sample Depth (Feet)	S_c (psi)	Q_u (psi)	Lithology
B-001-0-24	861.7-861.2	53.5-54.0	-	1,290	Shale
B-002-0-24	858.1-857.7	36.2-36.6	-	1,640	Shale
B-003-0-24	850.1-849.6	36.8-37.3	-	1,120	Shale
B-004-0-24	849.9-844.9	66.0-71.0	202	-	Shale

S_c= Point load strength value, ASTM D5731
Q_u= Unconfined compression test, ASTM D7012

Prior to rock coring operations groundwater was measured in the borings at depths ranging from 0.0 (River Level) to 31.0 feet below grade. These groundwater depths correspond to elevations ranging from 884.9 to 889.3 feet.

VI. ANALYSES AND RECOMMENDATIONS

Based on the soil and rock data obtained from the field and laboratory testing, the following recommendations are provided for the proposed structure.

A. Scour Data

A total of five (5) Shelby tube samples were collected from varying depths by OGE personnel for erosion testing purposes. These samples were subsequently submitted to the FHWA Hydraulics Laboratory, where critical shear stress values were determined and documented in the FHWA report. The reported values are presented in Table 2.

CTL Engineering evaluated the erosion category for each sample based on the corresponding Plasticity Index (PI) values. However, PI testing was not performed on Sample ST-2C; therefore, the erodibility index for this sample could not be computed.

Table 2. Scour Information

Boring	Sample No.	Sample Elevation (feet)	τ_c (Pa)	Erosion Category (EC)
B-001-1-24	ST-1B	894.2 to 892.2	1.34	3.07
	ST-2C	884.2 to 882.2	0.34	-
B-004-1-24	ST-1A	891.9 to 889.9	0.87	3.41
	ST-1B	889.9 to 887.9	1.55	3.34
	ST-2A	879.4 to 877.9	4.14	2.63

B. Foundation Support

It is understood that the replacement structure will be a single span bridge. It is also understood that the new bridge will be constructed in the general vicinity the existing structure.

It is understood that the abutments of the proposed structure will be supported on drilled shaft foundations socketed into the underlying bedrock. The drilled shaft foundations may be proportioned using a nominal unit tip resistance value not exceeding those provided in Table 5. The bottom of pier cap elevations and rock socket lengths at rear and forward abutments were taken from bridge site plan.

Table 5. Nominal Unit Tip Resistance

Location/Boring No.	Bottom of Pier Cap Elevation (feet)	Top of Bedrock Elevation (feet)	Nominal Unit Tip Resistance, q_p (ksf)
Rear Abutment/ B-002-0-24	893.5	860.3*	590.4
Forward Abutment/ B-003-0-24 & B-004-0-24	891.5	855.7**	238.0

*Top of rock core elevation in boring B-002-0-24
** Boring B-003-0-24 was performed approximately 46 feet west of the proposed Forward Abutment. Boring B-004-0-24 was performed approximately 80 feet east of the proposed Forward Abutment. The top of rock elevation at the Forward Abutment was interpolated based on the top of rock encountered in borings B-003-0-24 and B-004-0-24, in general accordance with GDM Section 1304.1.3 and BDM Section 305.3.5.2.

According to AASHTO Table 10.5.5.2.4-1, a resistance factor of 0.5 should be used for Unit Tip Resistance for the Strength Limit State.

The socket tip should extend at least 1.5 times the socket diameter into the bedrock per ODOT BDM 305.4.2 (AASHTO LRFD 10.8.3.5.4c).

The criteria outlined ODOT BDM 305.4.1.1 should be used to determine the minimum length of the socket into the bedrock. The socket length should be determined by the structural engineer.

Per ODOT GDM 1306.4.2, the drilled shafts should be designed for tip resistance or side resistance, but not both. If both tip and side resistance are used, then each value should be modified according to deflection and mobilization of resistance in accordance with ODOT GDM 1306.3.2.

Additionally, capacity can be achieved along the shafts from side resistance. Side resistance within the soil overburden and upper portion of the rock socket should be neglected as outlined in ODOT BDM section 305.4.2. Unfactored unit side resistance values are included in Table 6.

Table 6: Unfactored Unit Side Resistance

Location	Bottom of Pier Cap Elevation (feet)	Boring No.	Elevation (feet)	Nominal Unit Side Resistance, q_p (ksf)
Rear Abutment	893.5	B-002-0-24	860.3 to 850.3	22.4
Forward Abutment	891.5	B-003-0-24 & B-004-0-24	855.7 to 854.3	2.4
			854.3 to 844.3	14.2

The resistance factors in Table 7 should be used for Shaft Side Resistance. The resistance factors were obtained from AASHTO Table 10.5.5.2.4-1.

Table 7: Resistance Factors for Shaft Side Resistance

Material Type	Resistance Factors	
	Compressive	Uplift
Rock	0.55	0.40

Drilled shaft design calculations are provided in Appendix E.

C. Settlement and Negative Skin Friction (Downdrag Force)

According to the bridge site plan, it is understood that embankment fill will be placed in the vicinity of the proposed bridge approach embankments. The maximum fill height will be approximately 15 feet and 17 feet in the area of the proposed Rear and Forward Abutments, respectively.

Settlement analyses were performed using soil and rock data from borings B-001-0-24, B-002-0-24 (at Rear Abutment) and B-004-0-24 (at Forward Abutment) considering that the embankment fill is constructed up to the level of the subgrade elevation behind the proposed abutments. It is estimated that the underlying soils will settle about 2.46 inch at the Rear Abutment, and 2.17 inch at the Forward Abutment as a result of the fill placement.

According to the ODOT BDM, the amount of relative settlement between the soil and pile that is necessary to mobilize negative shaft resistance is about 0.4 inch. Since the settlement of the soils below the proposed Rear and Forward Abutment is in excess of 0.4 inch, downdrag forces should be included in the design of the drilled shafts.

The estimated downdrag force for the drilled shafts proposed near the Rear and Forward Abutments are summarized in Table 8. Downdrag calculations are appended to this report in Appendix F.

Table 8: Downdrag Forces

Location	Bottom of the Pier Cap	Unfactored Downdrag Force (Kips)	Factored Downdrag Force (Kips)
Rear Abutment	893.5	22.1	23.1
Forward Abutment	891.5	12.1	12.7

The factored downdrag force was computed using a load factor of 1.05. This load factor was obtained from ODOT BDM 305.4.1 and ODOT GDM 1306.2.2.

Alternatively, to eliminate the need for including downdrag forces on the drilled shafts, the approach embankments could be constructed, and the underlying soils allowed to settle, prior to installation of the drilled shafts and abutments. Based on the settlement analysis, it is estimated that approximately 2.5 weeks will be required for the residual settlement to reduce to about 0.4 inch. Approximately 90% of the settlement is expected to occur within 4 weeks of fill placement. If this timeframe can be accommodated within the construction project schedule, settlement monitoring may not be necessary.

D. Lateral Earth Parameters

Backfill behind the abutments and wingwalls shall consist of Granular Material Type B in accordance with ODOT BDM Table 307-1. For design purposes, the backfill soil may be assumed to be cohesionless with a unit weight of 120 pcf and a friction angle of 32°.

E. Lateral Pile Analysis

Lateral pile analysis was performed by EMH&T for both the rear and forward abutments using the LPile computer program. The soil and rock parameters used in the analysis are provided in Appendix G. The detailed LPile input data, assumptions, and output results prepared by EMH&T have been incorporated into this report and are presented in Appendix H.

F. General Construction and Earthwork

1. Site preparation and earthwork should be performed in accordance with the ODOT Construction and Material Specifications (CMS), and applicable sections of the ODOT Geotechnical Design Manual (GDM). However, contrary to CMS 516.07, backfill behind the abutments should be limited to the elevation of top of slope or fill in front of the existing abutment prior to the completion of bearing connections for the superstructure, unless determined and noted otherwise by the Bridge Engineer, to mitigate the risk of excessive deflection of the "free-standing" abutment.

2. Embankment side slopes should be seeded and vegetation growth permitted to limit erosion, sloughing and slope failure.

3. Temporary excavations in excess of 4 feet in depth should be sloped or shored according to OSHA requirements.

VII. CHANGED CONDITIONS

The evaluations, conclusions, and recommendations in this report are based on our interpretation of the field and laboratory data obtained during the exploration, our understanding of the project and our experience with similar sites and subsurface conditions using generally accepted geotechnical engineering practices. Although individual test borings are representative of the subsurface conditions at the boring locations on the dates drilled, they are not necessarily representative of the subsurface conditions between boring locations or subsurface conditions during other seasons of the year.

In the event that changes in the project are proposed, additional information becomes available, or if it is apparent that subsurface conditions are different from those provided in this report, CTL Engineering should be notified so that our recommendations can modified, if required.

VIII. TESTING AND OBSERVATION

During the design process, it is recommended that CTL Engineering work with the project designers to confirm that the geotechnical recommendations are properly incorporated into the final plans and specifications, and to assist with establishing criteria for the construction observation and testing.

CTL Engineering is not responsible for independent conclusions, opinions and recommendations made by others based on the data and recommendations provided in this report. It is recommended that CTL be retained to provide construction quality control services on this project. If CTL Engineering is not retained for these services, CTL shall assume no responsibility for compliance with the design concepts or recommendations provided.

IX. CLOSING

This report has been prepared for the exclusive use by the client for use only on this project. Our services have been performed in accordance with generally accepted Geotechnical Engineering principles and practices. No warranty is either expressed or implied.

CTL Engineering's assignment does not include, nor does this geotechnical report address the environmental aspects of this particular site.

Specific design and construction recommendations have been provided in this report. Therefore, the report should be used in its entirety.

Respectfully Submitted,

CTL ENGINEERING, INC.

Shahedur Rahman
Project Engineer

Sastry Malladi, P.E.
Project Manager

APPENDIX A
GEOTECHNICAL PROFILE BRIDGE

PROJECT DESCRIPTION

THE PROJECT DESIGNATED AS BRO-50-4.49 INVOLVES REPLACEMENT OF AN EXISTING BRIDGE ALONG US 50 OVER EAST FORK OF THE LITTLE MIAMI RIVER, JUST WEST OF FAYETTEVILLE IN BROWN COUNTY, OHIO. THE PROPOSED BRIDGE WILL CONSIST OF A SINGLE SPAN STEEL PLATE GIRDER SUPERSTRUCTURE WITH COMPOSITE REINFORCED CONCRETE DECK SUPPORTED ON SEMI-INTEGRAL ABUTMENTS.

HISTORIC RECORDS

HISTORIC GEOTECHNICAL RECORDS WERE SEARCHED ON THE ODOT TIMS WEBSITE. NO HISTORIC STRUCTURE BORING DATA WAS AVAILABLE FOR THE EXISTING BRIDGE.

GEOLOGY

ACCORDING TO THE OHIO DEPARTMENT OF NATURAL RESOURCES (ODNR), PHYSIOGRAPHIC REGIONS OF OHIO, THE PROJECT SITE IS IN THE ILLINOIAN TILL PLAIN REGION, WHICH IS IN THE TILL PLAIN SECTION OF OHIO. THE GEOLOGY OF THIS REGION CONSISTS OF SILT-LOAM, HIGH LIME, ILLINOIAN-AGE TILL WITH LOESS CAP.

ACCORDING TO THE BEDROCK GEOLOGIC MAP OF OHIO (2006), THE UNDERLYING BEDROCK WITHIN THE PROJECT AREA CONSISTS OF ORDOVICIAN- AGE SHALE AND LIMESTONE INTERBEDDED OF THE ARNHEIM FORMATION.

ACCORDING TO THE MAPPING OF HISTORIC AND ACTIVE MINES (ODNR MINES OF OHIO), THERE ARE NO DOCUMENTED MINES IN THE GENERAL VICINITY OF THE PROJECT AREA.

ACCORDING TO THE ODNR'S KARST INTERACTIVE MAP, NO KARST FEATURES HAVE BEEN IDENTIFIED WITHIN THE PROJECT AREA. HOWEVER, THERE IS ONE KARST-SUSPECT-NOT VISITED FEATURE MAPPED WITHIN 0.25 MILE SOUTH OF THE PROPOSED BRIDGE LOCATION. IT SHOULD BE NOTED THAT KARST FEATURES WERE NOT OBSERVED AT THE GROUND SURFACE DURING OUR FIELD EXPLORATION.

RECONNAISSANCE

AN INITIAL SITE VISIT WAS PERFORMED BY CTL PERSONNEL ON MAY 24, 2024. THE EXISTING STRUCTURE IS A THREE-SPAN BRIDGE WITH SPAN LENGTHS OF 80'-100'-80' FOR A TOTAL LENGTH OF 260 FEET. THE EXISTING ABUTMENTS ARE SUPPORTED ON PEDESTAL SPREAD FOOTINGS THAT EXTEND TO A DEPTH OF APPROXIMATELY 35 FEET BELOW THE PAVEMENT. THE US 50, WITHIN THE PROJECT LIMITS IS A BI-DIRECTIONAL ROADWAY HAVING AN ASPHALT SURFACE. EAST FORK LITTLE MIAMI RIVER FLOWS NORTH TO SOUTH BELOW THE STRUCTURE.

SUBSURFACE EXPLORATION

FOUR (4) STRUCTURE TEST BORINGS, IDENTIFIED AS B-001-0-24 THROUGH B-004-0-24, WERE PERFORMED FOR THIS PROJECT. THE BORINGS WERE PERFORMED BETWEEN JUNE 11, 2024 AND JUNE 21, 2024, WITH A TRACK MOUNTED DRILL RIG UTILIZING 3.25-INCH HOLLOW STEM AUGERS (HSA). STANDARD PENETRATION TESTS (SPTS) WERE CONDUCTED USING A 140-POUND AUTOMATIC HAMMER, FALLING 30 INCHES, TO DRIVE 2-INCH O.D. SPLIT BARREL SAMPLERS. ROCK CORING WAS PERFORMED IN ALL BORINGS, USING AN NQ-SIZE CORE BARREL. THE HAMMER SYSTEM USED WAS CALIBRATED ON NOVEMBER 4, 2022. THE ENERGY TRANSFER RATIO ASSOCIATED WITH THE AUTOMATIC SPT HAMMER WAS 79.3 PERCENT. CTL PERFORMED TWO (2) ADDITIONAL TEST BORINGS IDENTIFIED AS B-001-1-24 AND B-004-1-24 AT OFFSET LOCATIONS FROM B-001-0-24 AND B-004-0-24 RESPECTIVELY, BETWEEN FEBRUARY 26, 2025 AND FEBRUARY 28, 2025. THE ADDITIONAL TEST BORINGS WERE PERFORMED TO COLLECT A TOTAL OF 5 UNDISTURBED SHELBY TUBE SAMPLES. THE SAMPLES WERE COLLECTED BY ODOT OGE PERSONNEL FOR EROSION TESTING.

EXPLORATION FINDINGS

BELOW THE SURFACE COVER OR FROM THE SURFACE, THE TEST BORINGS ENCOUNTERED BOTH COARSE GRAINED AND FINE-GRAINED SOILS EXTENDING DOWN TO THE TOP OF BEDROCK. THE COARSE-GRAINED SOILS WERE DESCRIBED AS GRAVEL AND/OR STONE FRAGMENTS WITH SAND (A-1-b), GRAVEL AND/OR STONE FRAGMENTS WITH SAND AND SILT (A-2-4), OR COARSE AND FINE SAND (A-3a). THE FINE-GRAINED SOILS WERE DESCRIBED AS SANDY SILT (A-4a), SILT (A-4b), SILT AND CLAY (A-6a), SILTY CLAY (A-6b), OR CLAY (A-7-6).

BENEATH THE SOIL OVERBURDEN, THE BORINGS ENCOUNTERED BEDROCK AT DEPTHS RANGING FROM 28.5 TO 65.0 FEET BELOW GRADE, WITH TOP OF BEDROCK ELEVATIONS RANGING FROM 850.9 TO 863.7 FEET. THE UPPER 1.0 TO 1.5 FEET OF BEDROCK WAS AUGERABLE IN BORINGS B-001-0-24, B-003-0-24 AND B-004-0-24, AND WAS DESCRIBED AS GRAY SHALE. ROCK CORING WAS PERFORMED BELOW AUGER REFUSAL DEPTHS IN ALL BORINGS, AND THE RECOVERED SAMPLES FROM THE ROCK CORING OPERATIONS WERE DESCRIBED AS INTERBEDDED SHALE AND LIMESTONE.

PRIOR TO ROCK CORING OPERATIONS GROUNDWATER WAS MEASURED IN THE BORINGS AT DEPTHS RANGING FROM 0.0 (RIVER LEVEL) TO 31.0 FEET BELOW GRADE. THESE GROUNDWATER DEPTHS CORRESPOND TO ELEVATIONS RANGING FROM 884.9 TO 889.3 FEET.

LEGEND

	DESCRIPTION	ODOT CLASS	CLASSIFIED MECH./VISUAL	
	GRAVEL AND/OR STONE FRAGMENTS WITH SAND	A-1-b	2	0
	GRAVEL AND/OR STONE FRAGMENTS W/SAND AND SILT	A-2-4	1	0
	COARSE AND FINE SAND	A-3a	0	1
	SANDY SILT	A-4a	7	3
	SILT	A-4b	1	1
	SILT AND CLAY	A-6a	11	8
	SILTY CLAY	A-6b	11	6
	CLAY	A-7-6	2	7
		TOTAL	35	26
	INTERBEDDED SHALE AND LIMESTONE	VISUAL		
	SHALE	VISUAL		
	SOD AND TOPSOIL = X = APPROXIMATE THICKNESS	VISUAL		

EXPLORATION LOCATION - PLAN VIEW

DRIVE SAMPLE AND/OR ROCK CORE BORING PLOTTED TO VERTICAL SCALE ONLY. HORIZONTAL BAR INDICATES A CHANGE IN STRATIGRAPHY.

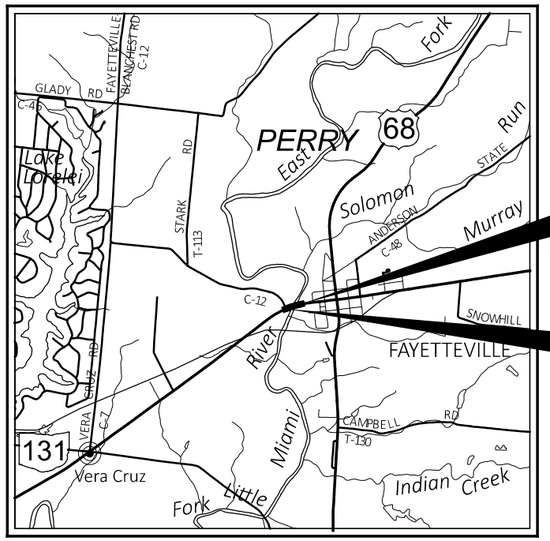
WC	INDICATES WATER CONTENT IN PERCENT.
N_{60}	INDICATES STANDARD PENETRATION RESISTANCE NORMALIZED TO 60% DRILL ROD ENERGY RATIO.
X/D"	NUMBER OF BLOWS FOR STANDARD PENETRATION TEST (SPT): X/D" = NUMBER OF BLOWS (UNCORRECTED) FOR D" PENETRATION AT REFUSAL.
X/Y/D"	NUMBER OF BLOWS FOR STANDARD PENETRATION TEST (SPT): X = NUMBER BLOWS FOR 6 INCHES (UNCORRECTED). Y/D" = NUMBER OF BLOWS (UNCORRECTED) FOR D" PENETRATION AT REFUSAL.
X/Y/Z/D"	NUMBER OF BLOWS FOR STANDARD PENETRATION TEST (SPT): X = NUMBER BLOWS FOR FIRST 6 INCHES (UNCORRECTED). Y = NUMBER BLOWS FOR SECOND 6 INCHES (UNCORRECTED). Z/D" = NUMBER OF BLOWS (UNCORRECTED) FOR D" PENETRATION AT REFUSAL.
●	INDICATES A PLASTIC MATERIAL WITH MOISTURE CONTENT EQUAL TO OR GREATER THAN THE LIQUID LIMIT MINUS 3.
W——	INDICATES FREE WATER ELEVATION.
NP	INDICATES A NON-PLASTIC SAMPLE.
NQ	"N" SERIES ROCK CORE BARREL OF "Q" WIRELINE BIT SIZE.
Qu	INDICATES UNCONFINED COMPRESSION TEST, ASTM D7012.
Sc	INDICATES POINT LOAD STRENGTH VALUE, ASTM D5731.
SS	INDICATES A SPLIT-SPOON SAMPLE.
TR	INDICATES THE TOP OF ROCK.

SPECIFICATIONS

THIS GEOTECHNICAL EXPLORATION WAS PERFORMED IN ACCORDANCE WITH THE STATE OF OHIO, DEPARTMENT OF TRANSPORTATION, OFFICE OF GEOTECHNICAL ENGINEERING, SPECIFICATIONS FOR GEOTECHNICAL EXPLORATIONS, DATED JANUARY 19, 2024.

AVAILABLE INFORMATION

THE SOIL AND GROUNDWATER INFORMATION COLLECTED FOR THIS SUBSURFACE EXPLORATION THAT CAN BE CONVENIENTLY DISPLAYED ON THE GEOTECHNICAL PROFILE SHEETS HAS BEEN PRESENTED. GEOTECHNICAL REPORTS, IF PREPARED, ARE AVAILABLE FOR REVIEW ON THE OFFICE OF CONTRACT SALES WEBSITE.



LOCATION MAP

SCALE : NOT TO SCALE

PARTICLE SIZE DEFINITIONS

12"	3"	2.0 mm	0.42 mm	0.074 mm	0.005 mm
BOULDERS	COBBLES	GRAVEL	COARSE SAND	FINE SAND	SILT	CLAY
		No. 10 SIEVE	No. 40 SIEVE	No. 200 SIEVE		

RECON. - EH 05/24/2024
DRILLING - CTL 06/11/2024 - 06/21/2024
DRAWN - NKS 10/06/2025
REVIEWED - SM 10/06/2025

GEOTECHNICAL PROFILE - BRIDGE
BRIDGE NO. BRO-50-4.49
US-50 OVER EAST FORK LITTLE MIAMI RIVER

DESIGN AGENCY

CTL ENGINEERING
6777 ENGLE RD, BLDG.111
CLEVELAND, OHIO 44130
PHONE: (440)239-9526
FAX: (440)239-9529

DESIGNER N.K.S

REVIEWER SM 10-06-25

PROJECT ID 109971

SUBSET 1 TOTAL 13

SHEET P.42 TOTAL 54

BRO-50-4.49

MODEL: Sheet PAPERSIZE: 17x11 (in.) DATE: 06-10-2025 TIME: 19:26:23 USER: hp
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BEDROCK TEST SUMMARY					
BORING ID	SAMPLE ELEVATION (FEET)	SAMPLE DEPTH (FEET)	Sc (PSI)	Qu (PSI)	LITHOLOGY
B-001-0-24	861.7 - 861.2	53.5 - 54.0	-	1,290	SHALE
B-002-0-24	858.1 - 857.7	36.2 - 36.6	-	1,640	SHALE
B-003-0-24	850.1 - 849.6	36.8 - 37.3	-	1,120	SHALE
B-004-0-24	849.9 - 844.9	66.0 - 71.0	202	-	SHALE

SCOUR SAMPLES				
BORING ID	SAMPLE NO.	SAMPLE ELEVATION (FEET)	Tc (Pa)	EROSION CATEGORY (EC)
B-001-1-24	ST - 1B	894.2 TO 892.2	1.34	3.07
	ST - 2C	884.2 TO 882.2	0.34	-
B-004-1-24	ST - 1A	891.9 TO 889.9	0.87	3.41
	ST - 1B	889.9 TO 887.9	1.55	3.34
	ST - 2A	879.4 TO 877.9	4.14	2.63

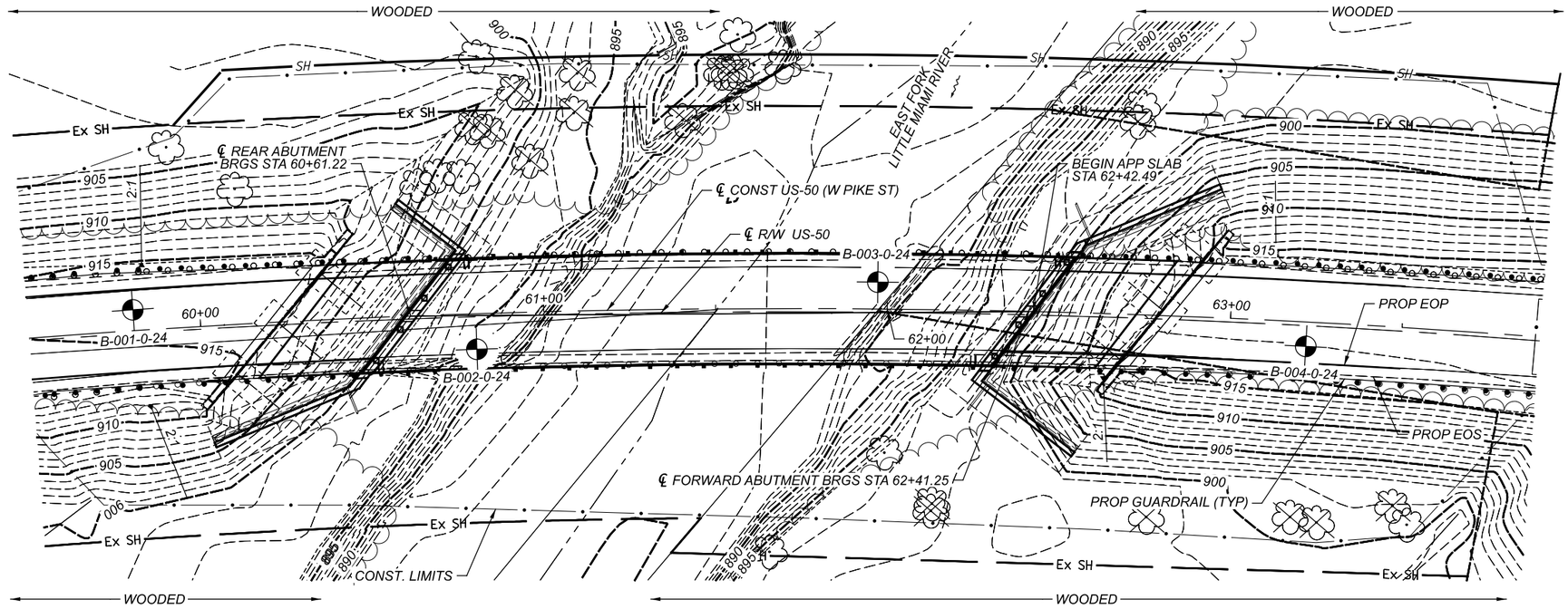
GEOTECHNICAL PROFILE - BRIDGE
BRIDGE NO. BRO-50-4.49
US-50 OVER EAST FORK LITTLE MIAMI RIVER

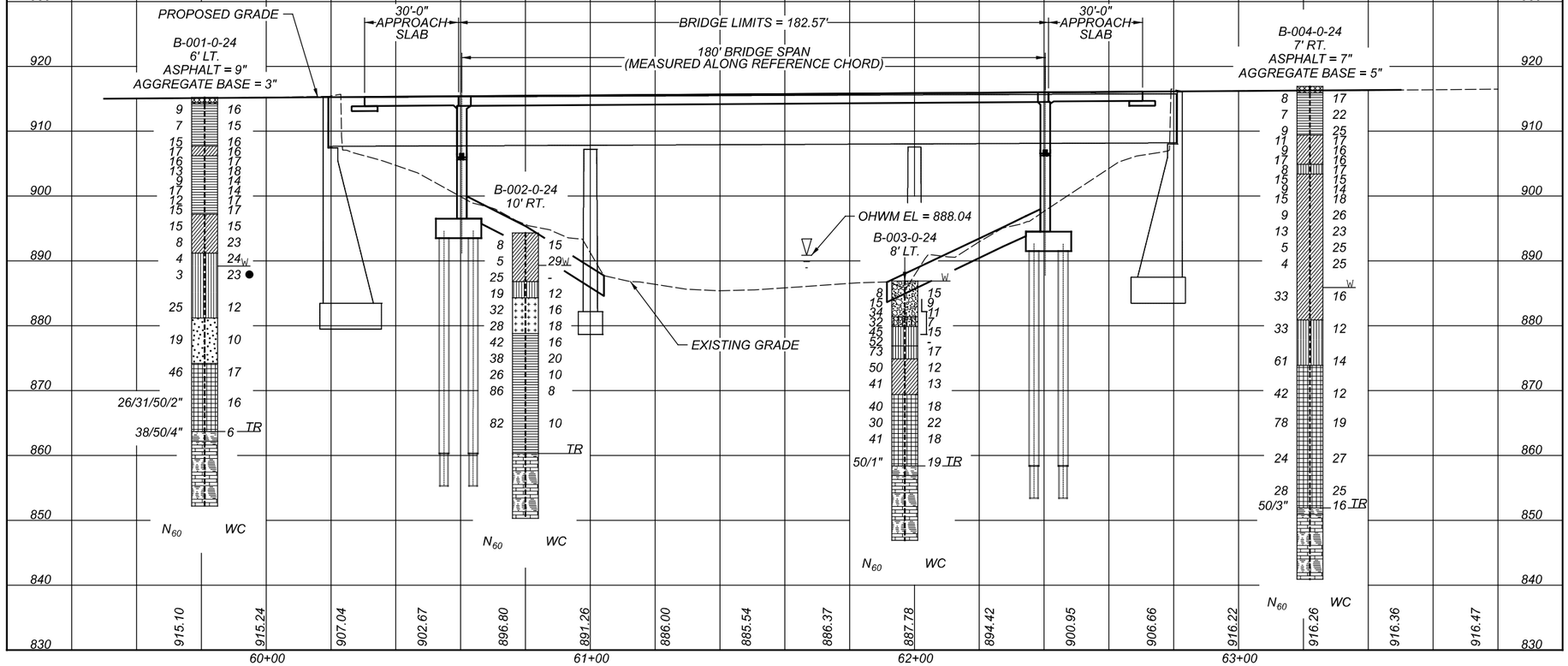
DESIGN AGENCY
CTL ENGINEERING
6777 ENGLE RD, BLDG 111
CLEVELAND, OHIO 44130
PHONE: (440)239-9526
FAX: (440)239-9529

DESIGNER N.K.S
REVIEWER SM 10-06-25
PROJECT ID 109971
SUBSET 2 | TOTAL 13
SHEET P.43 | TOTAL 54

BRO-50-4.49

MODEL: Sheet PAPERSIZE: 17x11 (in.) DATE: 06-10-2025 TIME: 19:34:04 USER: hp
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BRO-50-4.49

MODEL: CLP_1 - Plan 1 PAPERSIZE: 17x11 (in.) DATE: 06-10-2025 TIME: 19:37:21 USER: hp
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HORIZONTAL SCALE IN FEET
0 10 20 40

GEOTECHNICAL PROFILE - BRIDGE
BRIDGE NO. - BRO-50-4.49
US-50 OVER EAST FORK LITTLE MIAMI RIVER

DESIGN AGENCY
CTL ENGINEERING
2860 FISHER ROAD
COLUMBUS, OHIO 43204
PHONE: (614)276-8123
FAX: (614)276-6377

DESIGNER N.K.S
REVIEWER SM 10-06-25
PROJECT ID 109971
SUBSET 3 TOTAL 13
SHEET P.44 TOTAL 54

MODEL: Sheet PAPERSIZE: 17x11 (in.) DATE: 06-10-2025 TIME: 19:39:30 USER: hp
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PROJECT: BRO-50-4.49	DRILLING FIRM / OPERATOR: CTL / TM	DRILL RIG: CME 55 #393	STATION / OFFSET: 59+81, 6' LT.	EXPLORATION ID B-001-0-24
TYPE: BRIDGE	SAMPLING FIRM / LOGGER: CTL / TM	HAMMER: CME AUTOMATIC	ALIGNMENT: US 50	
PID: 109971 SFN: 0800512	DRILLING METHOD: 3.25" HSA / NQ2	CALIBRATION DATE: 11-4-22	ELEVATION: 915.2 (MSL) EOB: 63.0 ft.	PAGE 1 OF 2
START: 6-11-24 END: 6-11-24	SAMPLING METHOD: SPT / NQ2	ENERGY RATIO (%): 79.3	LAT / LONG: 39.185814, -83.938372	

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	HOLE SEALED
ASPHALT (9")	914.4																		
AGGREGATE BASE (3")	914.2																		
VERY STIFF, BROWN, **SILTY CLAY**, SOME SAND, TRACE GRAVEL, MOIST			3 3 4	9	100	SS-1	2.75	7	8	26	32	27	33	15	18	16	A-6b (8)	-	
			2 2 3	7	100	SS-2	2.50	-	-	-	-	-	-	-	-	15	A-6b (V)	-	
	907.7		5 6 5	15	100	SS-3	3.25	5	5	18	42	30	32	15	17	16	A-6b (10)	-	
VERY STIFF, BROWN, **SILT AND CLAY**, SOME SAND, TRACE GRAVEL, MOIST	906.2		6 6 7	17	100	SS-4	2.50	6	8	26	34	26	30	15	15	16	A-6a (7)	-	
VERY STIFF, GRAY, **SILTY CLAY**, SOME SAND, TRACE GRAVEL, MOIST			3 3 9	16	83	SS-5	2.75	4	9	25	33	29	31	15	16	17	A-6b (8)	-	
@10.5'; STIFF, "AND" SAND			3 4 6	13	100	SS-6	2.00	2	7	30	31	30	31	15	16	18	A-6b (8)	-	
@12.0'; VERY STIFF, SOME SAND, DAMP			2 3 4	9	100	SS-7	2.75	1	8	23	39	29	30	14	16	14	A-6b (9)	-	
			4 6 7	17	100	SS-8	3.00	2	6	22	41	29	33	16	17	14	A-6b (10)	-	
@15.0'; MOIST			3 4 5	12	100	SS-9	2.75	2	7	26	35	30	32	16	16	17	A-6b (8)	-	
	897.2		3 5 6	15	100	SS-10	3.25	-	-	-	-	-	-	-	-	17	A-6b (V)	-	
VERY STIFF, GRAY, **SILT AND CLAY**, SOME SAND, TRACE GRAVEL, DAMP			2 5 6	15	100	SS-11	4.00	4	6	24	42	24	27	15	12	15	A-6a (7)	-	
@21.5'; MOIST			2 3 3	8	100	SS-12	2.25	0	1	23	53	23	28	17	11	23	A-6a (8)	-	
	891.2																		
STIFF, GRAY, **SANDY SILT**, LITTLE CLAY, WET		W 889.2	1 1 2	4	78	SS-13	2.00	-	-	-	-	-	-	-	-	24	A-4a (V)	-	
			1 1 1	3	89	SS-14	1.50	0	4	51	25	20	25	15	10	23	A-4a (2)	-	
@31.5'; DAMP			12 9 10	25	100	SS-15	4.50	8	8	17	42	25	21	14	7	12	A-4a (6)	-	
	881.2																		
MEDIUM DENSE, GRAY, **COARSE AND FINE SAND**, LITTLE GRAVEL, MOIST			4 6 8	19	83	SS-16	-	-	-	-	-	-	-	-	-	10	A-3a (V)	-	
	874.2																		
HARD, GRAY, **CLAY**, SOME SAND, TRACE GRAVEL, CONTAINS COBBLES, MOIST			6 13 22	46	100	SS-17	4.50	-	-	-	-	-	-	-	-	17	A-7-6 (V)	-	
			26 31 50/2"	-	100	SS-18	4.00	-	-	-	-	-	-	-	-	16	A-7-6 (V)	-	
	863.7	TR																	
SHALE, GRAY, SEVERELY WEATHERED, WEAK.	862.2		38 50/4"	-	100	SS-19	-	-	-	-	-	-	-	-	-	6	Rock (V)	-	
INTERBEDDED SHALE (75%) AND LIMESTONE (25%), RQD 19%, REC. 100%; **SHALE**, GRAY, MODERATELY WEATHERED, WEAK; **LIMESTONE**, GRAY, MODERATELY TO SEVERLY WEATHERED, SLIGHTLY STRONG. @ 53.5'; COMPRESSIVE STRENGTH (SHALE)= 1,290 PSI			30		100	NQ2-1											CORE		

STANDARD ODOT LOG W/ SULFATES (11 X 17) - OH DOT.GDT - 10-9-25 17:47 - G:\2025\SEPTEMBER\10\24050024COL\24050024COL.GPJ

SHEET	SUBSET	PROJECT ID	REVIEWER	DESIGNER
P 45 / TOTAL 54	4 / TOTAL 13	109971	SM 10-06-25	N.K.S

DESIGN AGENCY

GTC ENGINEERING
CONSULTANTS, INC.
COLUMBUS, OHIO 43204
PHONE: (614) 276-8577
FAX: (614) 276-8577

GEOTECHNICAL PROFILE - BRIDGE
BRIDGE NO. BRO-50-4.49 OVER EAST FORK LITTLE MIAMI RIVER
BORING LOG B-001-0-24

MODEL: Sheet PAPERSIZE: 17x11 (in.) DATE: 06-10-2025 TIME: 19:42:54 USER: hp
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PID: 109971	SFN: 0800512	PROJECT: BRO-50-4.49	STATION / OFFSET: 59+81, 6' LT.	START: 6-11-24	END: 6-11-24	PG 2 OF 2	B-001-0-24

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	HOLE SEALED
	855.2	61	8		100	NQ2-2											CORE		
	852.2	EOB 63																	

NOTES: NONE

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLACED ASPHALT PATCH; BACKFILLED WITH GROUT

STANDARD ODOT LOG W/ SULFATES (11 X 17) - OH DOT.GDT - 10-9-25 17:47 - G:\2025\SEPTEMBER\10\24050024COL\24050024COL.GPJ

GEOTECHNICAL PROFILE - BRIDGE
BRIDGE NO. BRO-50-4.49 OVER EAST FORK LITTLE MIAMI RIVER
BORING LOG B-001-0-24 CONTINUED

DESIGN AGENCY

GTC ENGINEERING
CLEVELAND, OHIO 44094
COLUMBUS, OHIO 43204
PHONE: (614)276-8123
FAX: (614)276-8377

DESIGNER N.K.S

REVIEWER SM 10-06-25

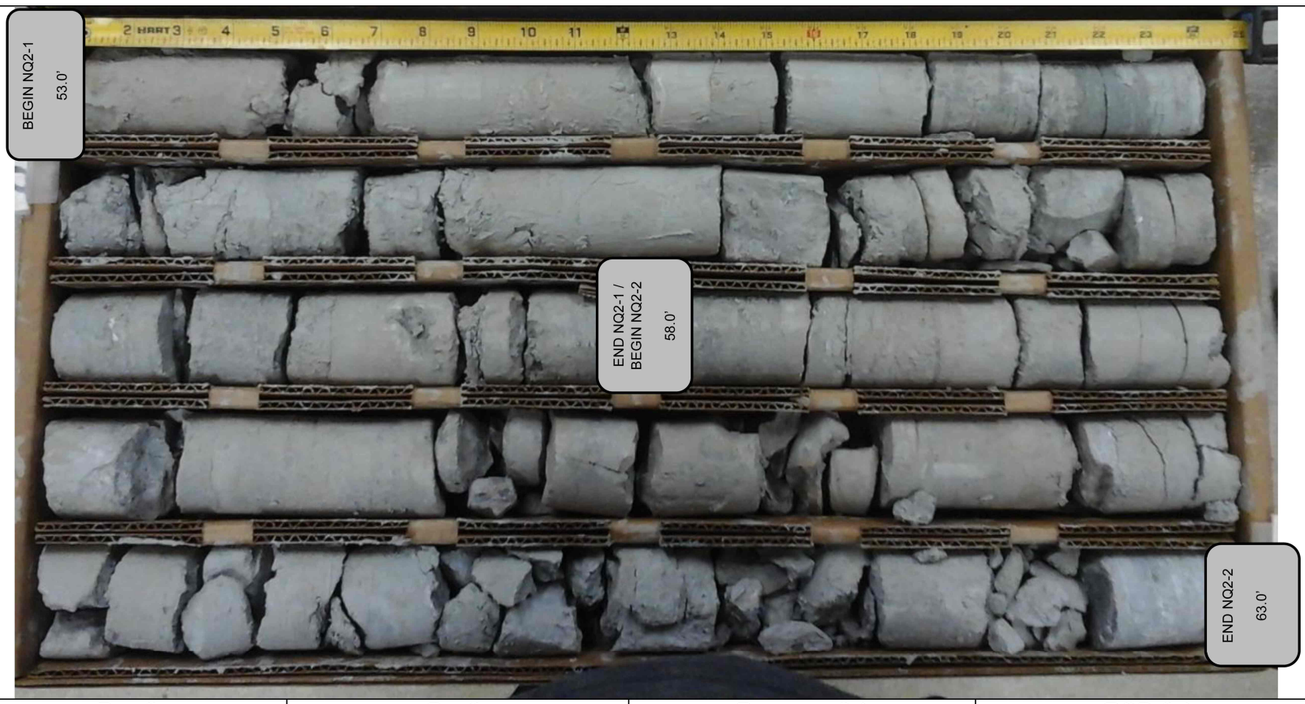
PROJECT ID 109971

SUBSET 5 TOTAL 13

SHEET P 46 TOTAL 54

MODEL: Sheet PAPERSIZE: 17x11 (in.) DATE: 06-10-2025 TIME: 19:45:21 USER: hp
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B-001-0-24



Run #:	Depth		Recovery (in)		RQD (in)	
NQ2-1	53.0’	58.0’	60/60	100%	18/60	30%
NQ2-2	58.0’	63.0’	60/60	100%	5/60	8%

BRO-50-4.49 BRIDGE REPLACEMENT

GEOTECHNICAL PROFILE - BRIDGE
BRIDGE NO. BRO-50-4.49 OVER EAST FORK LITTLE MIAMI RIVER
ROCK CORE PHOTO FOR B-001-0-24

MODEL: Sheet PAPERSIZE: 17x11 (in.) DATE: 06-10-2025 TIME: 19:47:05 USER: hp
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PROJECT: BRO-50-4.49	DRILLING FIRM / OPERATOR: CTL / TM	DRILL RIG: CME 55 #393	STATION / OFFSET: 60+80, 10' RT.	EXPLORATION ID B-002-0-24
TYPE: BRIDGE	SAMPLING FIRM / LOGGER: CTL / TM	HAMMER: CME AUTOMATIC	ALIGNMENT: US 50	
PID: 109971 SFN: 0800512	DRILLING METHOD: 3.25" HSA / NQ2	CALIBRATION DATE: 11-4-22	ELEVATION: 894.3 (MSL) EOB: 44.0 ft.	PAGE 1 OF 1
START: 6-20-24 END: 6-21-24	SAMPLING METHOD: SPT / NQ2	ENERGY RATIO (%): 79.3	LAT / LONG: 39.185864, -83.938022	

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	HOLE SEALED
VERY STIFF, BROWN, **SILT AND CLAY**, SOME GRAVEL, SOME SAND, DAMP	894.3		3 3 3	8	83	SS-1	2.25	26	8	17	29	20	31	18	13	15	A-6a (4)	-
@3.5'; MEDIUM STIFF, WET		W 889.3	1 2 2	5	100	SS-2	1.00	-	-	-	-	-	-	-	-	29	A-6a (V)	-
@6.0'; VERY STIFF, NO RECOVERY	886.8		8 10 9	25	0	SS-3	-	-	-	-	-	-	-	-	-	-	A-6a (V)	-
HARD, GRAY AND BROWN, **SANDY SILT**, SOME CLAY, TRACE GRAVEL, DAMP	884.3		5 6 8	19	83	SS-4	4.25	6	11	19	39	25	21	13	8	12	A-4a (6)	-
HARD, GRAY, **SILT**, SOME CLAY, LITTLE SAND, MOIST			8 11 13	32	100	SS-5	4.50	-	-	-	-	-	-	-	-	16	A-4b (V)	-
@13.5'; VERY STIFF	878.8		6 10 11	28	100	SS-6	4.00	0	8	10	57	25	24	15	9	18	A-4b (8)	-
VERY STIFF, GRAY, **SILTY CLAY**, LITTLE SAND, TRACE GRAVEL, CONTAINS COBBLES, DAMP			17 11 21	42	100	SS-7	3.50	-	-	-	-	-	-	-	-	16	A-6b (V)	-
@18.5'; MOIST			7 13 16	38	83	SS-8	3.00	9	6	8	28	49	37	18	19	20	A-6b (12)	-
@21.0'; DAMP			7 7 13	26	100	SS-9	2.75	-	-	-	-	-	-	-	-	10	A-6b (V)	-
			27 19 46	86	100	SS-10	3.50	4	6	6	34	50	34	18	16	8	A-6b (10)	-
			31 19 43	82	100	SS-11	3.25	-	-	-	-	-	-	-	-	10	A-6b (V)	-
	860.3	TR																
INTERBEDDED SHALE (75%) AND LIMESTONE (25%), RQD 15%, REC. 100%; **SHALE**, GRAY, MODERATELY WEATHERED, SLIGHTLY STRONG; **LIMESTONE**, GRAY, MODERATELY WEATHERED, SLIGHTLY TO MODERATELY STRONG. @ 36.2'; COMPRESSIVE STRENGTH (SHALE)= 1,640 PSI			17		100	NQ2-1											CORE	
	850.3	EOB	13		100	NQ2-2											CORE	

NOTES: FROM TOP OF BRIDGE DECK TO THE GROUND SURFACE=21'.0. STARTED SAMPLING FROM BELOW THE GROUND SURFACE.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: BACKFILLED WITH GROUT

STANDARD ODOT LOG W/ SULFATES (11 X 17) - OH DOT.GDT - 10-9-25 17:47 - G:\2025\SEPTEMBER\10\24050024COL\24050024COL.GPJ

SHEET	SUBSET	PROJECT ID	REVIEWER	DESIGNER	DESIGN AGENCY
P 48 / TOTAL 54	7 / TOTAL 13	109971	SM 10-06-25	N.K.S	GTC ENGINEERING & CONSULTING, INC. 6000 LINDEN AVE. DAYTON, OHIO 45432 PHONE: (937) 426-6377 FAX: (937) 426-6377

GEOTECHNICAL PROFILE - BRIDGE
BRIDGE NO. BRO-50-4.49 OVER EAST FORK LITTLE MIAMI RIVER
BORING LOG B-002-0-24

B-002-0-24



Run #:	Depth		Recovery (in)		RQD (in)	
NQ2-1	34.0’	39.0’	60/60	100%	10/60	17%
NQ2-2	39.0’	44.0’	60/60	100%	8/60	13%
BRO-50-4.49 BRIDGE REPLACEMENT						

CTL ENGINEERING, INC.
COLUMBUS, OHIO 43204
PHONE: (614) 276-8123
FAX: (614) 276-6377

GEOTECHNICAL PROFILE - BRIDGE
BRIDGE NO. BRO-50-4.49 OVER EAST FORK LITTLE MIAMI RIVER
ROCK CORE PHOTO FOR B-002-0-24

MODEL: Sheet PAPERSIZE: 17x11 (in.) DATE: 06-10-2025 TIME: 19:52:05 USER: hp
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PROJECT: BRO-50-4.49	DRILLING FIRM / OPERATOR: CTL / TM	DRILL RIG: CME 55 #393	STATION / OFFSET: 61+97, 8' RT.	EXPLORATION ID B-003-0-24
TYPE: BRIDGE	SAMPLING FIRM / LOGGER: CTL / TM	HAMMER: CME AUTOMATIC	ALIGNMENT: US 50	
PID: 109971 SFN: 0800512	DRILLING METHOD: 3.25" HSA / NQ2	CALIBRATION DATE: 11-4-22	ELEVATION: 886.9 (MSL) EOB: 40.0 ft.	PAGE 1 OF 1
START: 6-19-24 END: 6-19-24	SAMPLING METHOD: SPT / NQ2	ENERGY RATIO (%): 79.3	LAT / LONG: 39.186008, -83.937650	

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	HOLE SEALED
LOOSE, BROWN, **GRAVEL AND/OR STONE FRAGMENTS WITH SAND**, TRACE SILT, TRACE CLAY, WET	886.9	W 886.9	7 3 3	8	56	SS-1	-	46	33	12	5	4	NP	NP	NP	15	A-1-b (0)	-	
@2.5'; MEDIUM DENSE			2 4 7	15	100	SS-2	-	-	-	-	-	-	-	-	-	9	A-1-b (V)	-	
@4.0'; DENSE, LITTLE SILT, MOIST	881.4		11 12 14	34	100	SS-3	-	27	26	23	14	10	NP	NP	NP	11	A-1-b (0)	-	
DENSE, GRAY AND BROWN, **GRAVEL AND/OR STONE FRAGMENTS WITH SAND AND SILT**, LITTLE CLAY, DAMP	879.9		12 13 11	32	100	SS-4	-	29	16	20	19	16	21	12	9	7	A-2-4 (0)	-	
VERY STIFF, BROWN, **SANDY SILT**, SOME CLAY, LITTLE GRAVEL, MOIST			10 17 17	45	83	SS-5	3.00	12	9	15	38	26	22	14	8	15	A-4a (6)	-	
@8.5'; HARD, NO RECOVERY	876.9		9 12 27	52	0	SS-6	-	-	-	-	-	-	-	-	-	-	A-4a (V)	-	
VERY DENSE, BROWN, **SANDY SILT**, LITTLE CLAY, TRACE GRAVEL, CONTAINS COBBLES, MOIST	874.9		12 27 28	73	100	SS-7	-	8	9	19	48	16	NP	NP	NP	17	A-4a (6)	-	
HARD, GRAY AND BROWN, **SILT AND CLAY**, SOME SAND, LITTLE GRAVEL, DAMP			9 17 21	50	100	SS-8	4.25	11	10	15	31	33	27	14	13	12	A-6a (7)	-	
			8 12 19	41	100	SS-9	4.25	-	-	-	-	-	-	-	-	13	A-6a (V)	-	
	869.4																		
HARD, GRAY, **CLAY**, SOME SILT, LITTLE SAND, TRACE GRAVEL, CONTAINS COBBLES, DAMP			6 12 18	40	100	SS-10	4.50	-	-	-	-	-	-	-	-	18	A-7-6 (V)	-	
@21.0'; VERY STIFF, MOIST			10 10 13	30	100	SS-11	4.00	2	4	8	32	54	44	21	23	22	A-7-6 (14)	-	
@23.5'; DAMP			8 13 18	41	100	SS-12	3.50	-	-	-	-	-	-	-	-	18	A-7-6 (V)	-	
	858.4	TR																	
SHALE, GRAY, SEVERELY WEATHERED, WEAK.	856.9		50/1"	-	100	SS-13	2.50	-	-	-	-	-	-	-	-	19	Rock (V)	-	
INTERBEDDED SHALE (80%) AND LIMESTONE (20%), RQD 14%, REC. 95%; **SHALE**, GRAY, MODERATELY WEATHERED, WEAK; **LIMESTONE**, GRAY, MODERATELY TO SEVERLY WEATHERED, SLIGHTLY TO MODERATELY STRONG.			0		90	NQ2-1											CORE		
@ 36.8'; COMPRESSIVE STRENGTH (SHALE)= 1,120 PSI			28		100	NQ2-2											CORE		
	846.9	EOB																	

NOTES: FROM TOP OF BRIDGE DECK TO THE GROUND SURFACE=29'.0. STARTED SAMPLING FROM BELOW THE GROUND SURFACE.
ABANDONMENT METHODS, MATERIALS, QUANTITIES: BACKFILLED WITH GROUT

STANDARD ODOT LOG W/ SULFATES (11 X 17) - OH DOT.GDT - 10-9-25 17:47 - G:\2025\SEPTEMBER\10\24050024COL\24050024COL.GPJ

SHEET	SUBSET	PROJECT ID	REVIEWER	DESIGNER	DESIGN AGENCY
P-50 / TOTAL 54	9 / TOTAL 13	109971	SM 10-06-25	N.K.S	CTL ENGINEERING, INC. COLUMBUS, OHIO 43204 PHONE (614)276-8577 FAX (614)276-8577

GEOTECHNICAL PROFILE - BRIDGE
BRIDGE NO. BRO-50-4.49 OVER EAST FORK LITTLE MIAMI RIVER
BORING LOG B-003-0-24

B-003-0-24



Run #:	Depth		Recovery (in)		RQD (in)	
NQ2-1	30.0’	35.0’	54/60	90%	0	0%
NQ2-2	35.0’	40.0’	60/60	100%	17/60	28%
BRO-50-4.49 BRIDGE REPLACEMENT						

CTL ENGINEERING, INC.
COLUMBUS, OHIO 43204
PHONE: (614) 276-8123
FAX: (614) 276-6377

GEOTECHNICAL PROFILE - BRIDGE
BRIDGE NO. BRO-50-4.49 OVER EAST FORK LITTLE MIAMI RIVER
ROCK CORE PHOTO FOR B-003-0-24

MODEL: Sheet PAPERSIZE: 17x11 (in.) DATE: 06-10-2025 TIME: 19:56:46 USER: hp
D:\Drop Box\CTL 2025\October\Dept 05\COL\Shahed\24050024COL_ODOT\Mod_06.10.24\109971ZL008.dgn

PROJECT: BRO-50-4.49	DRILLING FIRM / OPERATOR: CTL / TM	DRILL RIG: CME 55 #393	STATION / OFFSET: 63+22, 7' RT.	EXPLORATION ID B-004-0-24
TYPE: BRIDGE	SAMPLING FIRM / LOGGER: CTL / TM	HAMMER: CME AUTOMATIC	ALIGNMENT: US 50	
PID: 109971 SFN: 0800512	DRILLING METHOD: 3.25" HSA / NQ2	CALIBRATION DATE: 11-4-22	ELEVATION: 915.9 (MSL) EOB: 76.0 ft.	PAGE 1 OF 2
START: 6-12-24 END: 6-14-24	SAMPLING METHOD: SPT / NQ2	ENERGY RATIO (%): 79.3	LAT / LONG: 39.186061, -83.937211	

MATERIAL DESCRIPTION AND NOTES	ELEV. 915.9	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	HOLE SEALED
ASPHALT (7")	915.3																		
AGGREGATE BASE (5")	914.9																		
VERY STIFF, BROWN, **SILTY CLAY**, SOME SAND, MOIST		1	3 3 3	8	56	SS-1	3.75	0	8	24	37	31	34	16	18	17	A-6b (10)	-	
		2																	
		3																	
		4	1 2 3	7	100	SS-2	3.25	-	-	-	-	-	-	-	-	22	A-6b (V)	-	
		5																	
		6																	
		7	3 3 4	9	100	SS-3	3.25	0	2	27	38	33	34	16	18	25	A-6b (10)	-	
	908.4																		
VERY STIFF, BROWN, **SILT AND CLAY**, "AND" SAND, TRACE GRAVEL, MOIST		8	3 4 4	11	100	SS-4	3.00	1	4	33	36	26	29	15	14	17	A-6a (7)	-	
@9.0'; SOME SAND, NO GRAVEL		9																	
		10	3 3 4	9	100	SS-5	3.75	0	2	29	41	28	29	15	14	16	A-6a (8)	-	
@10.5'; TRACE GRAVEL, DAMP		11																	
		12	5 6 7	17	100	SS-6	4.00	1	2	29	40	28	28	16	12	16	A-6a (7)	-	
	903.9																		
VERY STIFF, BROWN, **SANDY SILT**, SOME CLAY, DAMP		13	2 2 4	8	100	SS-7	3.75	0	3	29	41	27	27	19	8	17	A-4a (7)	-	
	902.4																		
VERY STIFF, BROWN AND GRAY, **SILT AND CLAY**, "AND" SAND, MOIST		14	5 5 6	15	100	SS-8	3.25	0	5	34	35	26	27	14	13	15	A-6a (6)	-	
@15.0'; DAMP		15	2 3 4	9	100	SS-9	3.50	-	-	-	-	-	-	-	-	14	A-6a (V)	-	
@16.5'; SOME SAND, TRACE GRAVEL, MOIST		16																	
		17	4 5 6	15	100	SS-10	4.00	4	9	19	46	22	28	16	12	18	A-6a (7)	-	
@19.0'; HARD, WET		18																	
		19	3 3 4	9	100	SS-11	4.25	-	-	-	-	-	-	-	-	26	A-6a (V)	-	
@21.0'; VERY STIFF, MOIST		20																	
		21	3 5 5	13	100	SS-12	3.50	-	-	-	-	-	-	-	-	23	A-6a (V)	-	
@24.0'; STIFF, NO GRAVEL		22																	
		23	1 2 2	5	100	SS-13	1.50	0	0	29	44	27	32	17	15	25	A-6a (9)	-	
		24																	
		25	1 1 2	4	100	SS-14	1.50	-	-	-	-	-	-	-	-	25	A-6a (V)	-	
		26																	
		27																	
		28																	
		29																	
		30																	
	W 884.9	31																	
@31.5'; HARD, DAMP		32	9 11 14	33	11	SS-15	-	-	-	-	-	-	-	-	-	16	A-6a (V)	-	
		33																	
		34																	
		35																	
		36																	
	879.9																		
VERY STIFF, GRAY, **SANDY SILT**, SOME CLAY, LITTLE GRAVEL, CONTAINS COBBLES, DAMP		37	7 11 14	33	100	SS-16	3.50	16	11	16	36	21	22	13	9	12	A-4a (4)	-	
		38																	
		39																	
		40																	
		41																	
	872.9	42	7 16 30	61	100	SS-17	3.75	-	-	-	-	-	-	-	-	14	A-4a (V)	-	
HARD, GRAY, **CLAY**, SOME SILT, TRACE SAND, TRACE GRAVEL, CONTAINS COBBLES, DAMP		43																	
		44																	
		45																	
		46																	
		47	9 14 18	42	100	SS-18	4.25	-	-	-	-	-	-	-	-	12	A-7-6 (V)	-	
		48																	
		49																	
		50																	
@51.0'; VERY STIFF, MOIST		51																	
		52	41 26 33	78	100	SS-19	2.75	-	-	-	-	-	-	-	-	19	A-7-6 (V)	-	
		53																	
		54																	
		55																	
		56																	
		57	19 10 8	24	100	SS-20	2.75	3	3	3	25	66	51	22	29	27	A-7-6 (18)	-	
		58																	
		59																	

STANDARD ODOT LOG W/ SULFATES (11 X 17) - OH DOT.GDT - 10-9-25 17:47 - G:\2025\SEPTEMBER\10\24050024COL\24050024COL.GPJ

SHEET	TOTAL	SUBSET	TOTAL	PROJECT ID	REVIEWER	DESIGNER
P-52	54	11	13	109971	SM 10-06-25	N.K.S

GEOTECHNICAL ENGINEERING
CONSTRUCTION LABORATORIES
COLUMBUS, OHIO 43204
PHONE: (614) 276-8123
FAX: (614) 276-6377

DESIGN AGENCY

GEOTECHNICAL PROFILE - BRIDGE
BRIDGE NO. BRO-50-4.49 OVER EAST FORK LITTLE MIAMI RIVER
BORING LOG B-004-0-24

MODEL: Sheet PAPERSIZE: 17x11 (in.) DATE: 06-10-2025 TIME: 20:00:03 USER: hp
D:\Drop Box\CTL 2025\October\Dept 05\COL\Shahed\24050024COL_ODOT\Mod_06.10.24\109971ZL009.dgn

PID: 109971 | SFN: 0800512 | PROJECT: BRO-50-4.49 | STATION / OFFSET: 63+22, 7' RT. | START: 6-12-24 | END: 6-14-24 | PG 2 OF 2 | B-004-0-24

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	HOLE SEALED
HARD, GRAY, **CLAY**, SOME SILT, TRACE SAND, TRACE GRAVEL, CONTAINS COBBLES, DAMP *(continued)* @61.0'; CONTAINS ROCK FRAGMENTS	855.9		8 11 10	28	100	SS-21	3.25	-	-	-	-	-	-	-	-	25	A-7-6 (V)	-	
	850.9	TR																	
SHALE, GRAY, SEVERELY WEATHERED, WEAK.	849.9		50/3"	-	100	SS-22	-	-	-	-	-	-	-	-	-	16	Rock (V)	-	
INTERBEDDED SHALE (60%) AND LIMESTONE (40%), RQD 4%, REC. 91%; **SHALE**, GRAY, MODERATELY TO SEVERELY WEATHERED, VERY WEAK; **LIMESTONE**, GRAY, MODERATELY TO SEVERELY WEATHERED, SLIGHTLY STRONG. @ 66.0'; COMPRESSIVE STRENGTH (SHALE)= 202 PSI (BASED ON THE POINT LOAD TEST)			8		90	NQ2-1											CORE		
			0		92	NQ2-2											CORE		
	839.9	EOB																	

NOTES: NONE

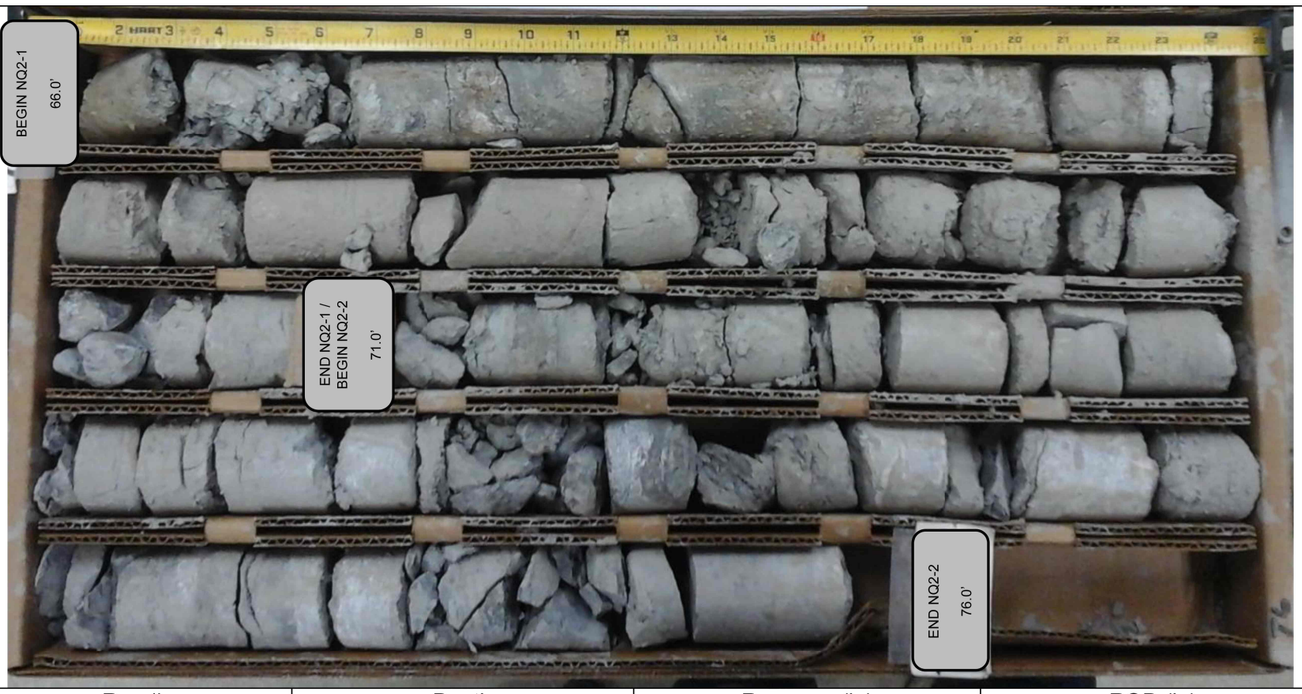
ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLACED ASPHALT PATCH; BACKFILLED WITH GROUT

STANDARD ODOT LOG W/ SULFATES (11 X 17) - OH DOT.GDT - 10-9-25 17:47 - G:\2025\SEPTEMBER\10\24050024COL\24050024COL.GPJ

DESIGN AGENCY
GEOTECHNICAL ENGINEERING, INC.
6175 HUNTLEY ROAD
COLUMBUS, OHIO 43229
PHONE: (614) 276-8123
FAX: (614) 276-8377

GEOTECHNICAL PROFILE - BRIDGE
BRIDGE NO. BRO-50-4.49 OVER EAST FORK LITTLE MIAMI RIVER
BORING LOG B-004-0-24 CONTINUED

B-004-0-24



Run #:	Depth		Recovery (in)		RQD (in)	
NQ2-1	66.0’	71.0’	54/60	90%	5/60	8%
NQ2-2	71.0’	76.0’	55/60	92%	0	0%

BRO-50-4.49 BRIDGE REPLACEMENT

CTL ENGINEERING, INC.
COLUMBUS, OHIO 43204
PHONE: (614) 276-8123
FAX: (614) 276-6377

GEOTECHNICAL PROFILE - BRIDGE
BRIDGE NO. BRO-50-4.49 OVER EAST FORK LITTLE MIAMI RIVER
ROCK CORE PHOTO FOR B-004-0-24

APPENDIX B
TEST BORING RECORDS

PROJECT: BRO-50-4.49	DRILLING FIRM / OPERATOR: CTL / TM	DRILL RIG: CME 55 #393	STATION / OFFSET: 59+81, 6' LT.	EXPLORATION ID B-001-0-24
TYPE: BRIDGE	SAMPLING FIRM / LOGGER: CTL / TM	HAMMER: CME AUTOMATIC	ALIGNMENT: US 50	
PID: 109971 SFN: 0800512	DRILLING METHOD: 3.25" HSA / NQ2	CALIBRATION DATE: 11/4/22	ELEVATION: 915.2 (MSL) EOB: 63.0 ft.	PAGE 1 OF 3
START: 6/11/24 END: 6/11/24	SAMPLING METHOD: SPT / NQ2	ENERGY RATIO (%): 79.3	LAT / LONG: 39.185814, -83.938372	

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	HOLE SEALED
ASPHALT (9")	915.2 914.4																	
AGGREGATE BASE (3")	914.2																	
VERY STIFF, BROWN, **SILTY CLAY**, SOME SAND, TRACE GRAVEL, MOIST		1 2 3 4 5 6 7	3 3 4 2 2 3 5 6 5	9 7 15	100 100 100	SS-1 SS-2 SS-3	2.75 2.50 3.25	7 - 5	8 - 5	26 - 18	32 - 42	27 - 30	33 - 32	15 - 15	18 - 17	16 15 16	A-6b (8) A-6b (V) A-6b (10)	
VERY STIFF, BROWN, **SILT AND CLAY**, SOME SAND, TRACE GRAVEL, MOIST	907.7 906.2	8	6 6 7	17	100	SS-4	2.50	6	8	26	34	26	30	15	15	16	A-6a (7)	
VERY STIFF, GRAY, **SILTY CLAY**, SOME SAND, TRACE GRAVEL, MOIST		9 10	3 3 9	16	83	SS-5	2.75	4	9	25	33	29	31	15	16	17	A-6b (8)	
@10.5'; STIFF, "AND" SAND		11	3 4 6	13	100	SS-6	2.00	2	7	30	31	30	31	15	16	18	A-6b (8)	
@12.0'; VERY STIFF, SOME SAND, DAMP		12 13	2 3 4	9	100	SS-7	2.75	1	8	23	39	29	30	14	16	14	A-6b (9)	
		14	4 6 7	17	100	SS-8	3.00	2	6	22	41	29	33	16	17	14	A-6b (10)	
@15.0'; MOIST		15 16	3 4 5	12	100	SS-9	2.75	2	7	26	35	30	32	16	16	17	A-6b (8)	
	897.2	17	3 5 6	15	100	SS-10	3.25	-	-	-	-	-	-	-	-	17	A-6b (V)	
VERY STIFF, GRAY, **SILT AND CLAY**, SOME SAND, TRACE GRAVEL, DAMP		18 19 20	2 5 6	15	100	SS-11	4.00	4	6	24	42	24	27	15	12	15	A-6a (7)	
@21.5'; MOIST		21 22	2 3 3	8	100	SS-12	2.25	0	1	23	53	23	28	17	11	23	A-6a (8)	
	891.2	23																
STIFF, GRAY, **SANDY SILT**, LITTLE CLAY, WET		24 25	1 1 2	4	78	SS-13	2.00	-	-	-	-	-	-	-	-	24	A-4a (V)	
W 889.2		26																
		27 28 29	1 1 1	3	89	SS-14	1.50	0	4	51	25	20	25	15	10	23	A-4a (2)	

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 9/9/25 15:39 - O:\PROJECT\2024\COL-05\240500024COL_EMHANDT_BRO-50-4-49 BRIDGE REPLACEMENT\LAB AND LOGS\GINT\2405

PID: 109971	SFN: 0800512	PROJECT: BRO-50-4.49	STATION / OFFSET: 59+81, 6' LT.	START: 6/11/24	END: 6/11/24	PG 2 OF 3	B-001-0-24

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	HOLE SEALED
STIFF, GRAY, **SANDY SILT**, LITTLE CLAY, WET *(continued)*	885.2																	
@31.5'; DAMP		31																
		32	12 9 10	25	100	SS-15	4.50	8	8	17	42	25	21	14	7	12	A-4a (6)	
		33																
	881.2	34																
MEDIUM DENSE, GRAY, **COARSE AND FINE SAND**, LITTLE GRAVEL, MOIST		35																
		36																
		37	4 6 8	19	83	SS-16	-	-	-	-	-	-	-	-	-	10	A-3a (V)	
		38																
		39																
		40																
	874.2	41																
HARD, GRAY, **CLAY**, SOME SAND, TRACE GRAVEL, CONTAINS COBBLES, MOIST		42	6 13 22	46	100	SS-17	4.50	-	-	-	-	-	-	-	-	17	A-7-6 (V)	
		43																
		44																
		45																
		46																
		47	26 31 50/2"	-	100	SS-18	4.00	-	-	-	-	-	-	-	-	16	A-7-6 (V)	
		48																
		49																
		50																
		51																
	863.7	TR																
SHALE, GRAY, SEVERELY WEATHERED, WEAK.		52	38 50/4"	-	100	SS-19	-	-	-	-	-	-	-	-	-	6	Rock (V)	
	862.2	53																
INTERBEDDED SHALE (75%) AND LIMESTONE (25%), RQD 19%, REC. 100%; **SHALE**, GRAY, MODERATELY WEATHERED, WEAK; **LIMESTONE**, GRAY, MODERATELY TO SEVERLY WEATHERED, SLIGHTLY STRONG. @ 53.5'; COMPRESSIVE STRENGTH (SHALE)= 1,290 PSI		54																
		55	30		100	NQ2-1											CORE	
		56																
		57																
		58																
		59																
		60	8		100	NQ2-2											CORE	
		61																

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 9/9/25 15:39 - O:\PROJECT\2024\COL-05\24050024COL_EMHANDT_BRO-50-4.49 BRIDGE REPLACEMENT\LAB AND LOGS\GINT\24050024COL_EMHANDT_BRO-50-4.49 BRIDGE REPLACEMENT.GPJ

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 9/9/25 15:39 - O:\PROJECT\2024\COL-05\240500024COL_EMHANDT_BRO-50-4-49 BRIDGE REPLACEMENT\LAB AND LOGS\GINT\24005

PID: 109971	SFN: 0800512	PROJECT: BRO-50-4.49	STATION / OFFSET: 59+81, 6' LT.	START: 6/11/24	END: 6/11/24	PG 3 OF 3	B-001-0-24

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
	853.1																	
	852.2	EOB 63																

NOTES: NONE

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLACED ASPHALT PATCH; BACKFILLED WITH GROUT

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 9/9/25 15:39 - O:\PROJECT\2024\COL-05\240500024COL_EMHANDT_BRO-50-4.49 BRIDGE REPLACEMENT\LAB AND LOGS\GINT\2405

PROJECT: BRO-50-4.49	DRILLING FIRM / OPERATOR: CTL / TM	DRILL RIG: CME 55 #393	STATION / OFFSET: 60+80, 10' RT.	EXPLORATION ID B-002-0-24
TYPE: BRIDGE	SAMPLING FIRM / LOGGER: CTL / TM	HAMMER: CME AUTOMATIC	ALIGNMENT: US 50	
PID: 109971 SFN: 0800512	DRILLING METHOD: 3.25" HSA / NQ2	CALIBRATION DATE: 11/4/22	ELEVATION: 894.3 (MSL) EOB: 44.0 ft.	PAGE 1 OF 2
START: 6/20/24 END: 6/21/24	SAMPLING METHOD: SPT / NQ2	ENERGY RATIO (%): 79.3	LAT / LONG: 39.185864, -83.938022	

MATERIAL DESCRIPTION AND NOTES	ELEV. 894.3	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	HOLE SEALED
VERY STIFF, BROWN, **SILT AND CLAY**, SOME GRAVEL, SOME SAND, DAMP			3 3 3	8	83	SS-1	2.25	26	8	17	29	20	31	18	13	15	A-6a (4)	
@3.5'; MEDIUM STIFF, WET		W 889.3	1 2 2	5	100	SS-2	1.00	-	-	-	-	-	-	-	-	29	A-6a (V)	
@6.0'; VERY STIFF, NO RECOVERY	886.8		8 10 9	25	0	SS-3	-	-	-	-	-	-	-	-	-	-	A-6a (V)	
HARD, GRAY AND BROWN, **SANDY SILT**, SOME CLAY, TRACE GRAVEL, DAMP	884.3		5 6 8	19	83	SS-4	4.25	6	11	19	39	25	21	13	8	12	A-4a (6)	
HARD, GRAY, **SILT**, SOME CLAY, LITTLE SAND, MOIST			8 11 13	32	100	SS-5	4.50	-	-	-	-	-	-	-	-	16	A-4b (V)	
@13.5'; VERY STIFF	878.8		6 10 11	28	100	SS-6	4.00	0	8	10	57	25	24	15	9	18	A-4b (8)	
VERY STIFF, GRAY, **SILTY CLAY**, LITTLE SAND, TRACE GRAVEL, CONTAINS COBBLES, DAMP			17 11 21	42	100	SS-7	3.50	-	-	-	-	-	-	-	-	16	A-6b (V)	
@18.5'; MOIST			7 13 16	38	83	SS-8	3.00	9	6	8	28	49	37	18	19	20	A-6b (12)	
@21.0'; DAMP			7 7 13	26	100	SS-9	2.75	-	-	-	-	-	-	-	-	10	A-6b (V)	
			27 19 46	86	100	SS-10	3.50	4	6	6	34	50	34	18	16	8	A-6b (10)	
			31 19 43	82	100	SS-11	3.25	-	-	-	-	-	-	-	-	10	A-6b (V)	

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 9/9/25 15:39 - O:\PROJECT\2024\COL-05\240500024COL_EMHANDT_BRO-50-4.49 BRIDGE REPLACEMENT\LAB AND LOGS\GINT\2405

PID: 109971	SFN: 0800512	PROJECT: BRO-50-4.49	STATION / OFFSET: 60+80, 10' RT.	START: 6/20/24	END: 6/21/24	PG 2 OF 2	B-002-0-24

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	HOLE SEALED
VERY STIFF, GRAY, **SILTY CLAY**, LITTLE SAND, TRACE GRAVEL, CONTAINS COBBLES, DAMP *(continued)*	864.3	31 32 33																
	860.3	TR 34																
INTERBEDDED SHALE (75%) AND LIMESTONE (25%), RQD 15%, REC. 100%; **SHALE**, GRAY, MODERATELY WEATHERED, SLIGHTLY STRONG; **LIMESTONE**, GRAY, MODERATELY WEATHERED, SLIGHTLY TO MODERATELY STRONG. @ 36.2'; COMPRESSIVE STRENGTH (SHALE)= 1,640 PSI		35 36 37 38 39	17		100	NQ2-1											CORE	
		40 41 42 43	13		100	NQ2-2											CORE	
	850.3	EOB 44																

NOTES: FROM TOP OF BRIDGE DECK TO THE GROUND SURFACE=21'.0. STARTED SAMPLING FROM BELOW THE GROUND SURFACE.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: BACKFILLED WITH GROUT

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 9/9/25 15:39 - O:\PROJECT\2024\COL-05\240500024COL_EMHANDT_BRO-50-4.49 BRIDGE REPLACEMENT\LAB AND LOGS\GINT\2405

PROJECT: BRO-50-4.49	DRILLING FIRM / OPERATOR: CTL / TM	DRILL RIG: CME 55 #393	STATION / OFFSET: 61+97, 8' RT.	EXPLORATION ID B-003-0-24	
TYPE: BRIDGE	SAMPLING FIRM / LOGGER: CTL / TM	HAMMER: CME AUTOMATIC	ALIGNMENT: US 50		
PID: 109971 SFN: 0800512	DRILLING METHOD: 3.25" HSA / NQ2	CALIBRATION DATE: 11/4/22	ELEVATION: 886.9 (MSL) EOB: 40.0 ft.	PAGE 1 OF 2	
START: 6/19/24 END: 6/19/24	SAMPLING METHOD: SPT / NQ2	ENERGY RATIO (%): 79.3	LAT / LONG: 39.186008, -83.937650		

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
LOOSE, BROWN, **GRAVEL AND/OR STONE FRAGMENTS WITH SAND**, TRACE SILT, TRACE CLAY, WET	886.9	886.9 W	7 3 3	8	56	SS-1	-	46	33	12	5	4	NP	NP	NP	15	A-1-b (0)	
@2.5'; MEDIUM DENSE			2 4 7	15	100	SS-2	-	-	-	-	-	-	-	-	-	9	A-1-b (V)	
@4.0'; DENSE, LITTLE SILT, MOIST	881.4		11 12 14	34	100	SS-3	-	27	26	23	14	10	NP	NP	NP	11	A-1-b (0)	
DENSE, GRAY AND BROWN, **GRAVEL AND/OR STONE FRAGMENTS WITH SAND AND SILT**, LITTLE CLAY, DAMP	879.9		12 13 11	32	100	SS-4	-	29	16	20	19	16	21	12	9	7	A-2-4 (0)	
VERY STIFF, BROWN, **SANDY SILT**, SOME CLAY, LITTLE GRAVEL, MOIST			10 17 17	45	83	SS-5	3.00	12	9	15	38	26	22	14	8	15	A-4a (6)	
@8.5'; HARD, NO RECOVERY	876.9		9 12 27	52	0	SS-6	-	-	-	-	-	-	-	-	-	-	A-4a (V)	
VERY DENSE, BROWN, **SANDY SILT**, LITTLE CLAY, TRACE GRAVEL, CONTAINS COBBLES, MOIST	874.9		12 27 28	73	100	SS-7	-	8	9	19	48	16	NP	NP	NP	17	A-4a (6)	
HARD, GRAY AND BROWN, **SILT AND CLAY**, SOME SAND, LITTLE GRAVEL, DAMP			9 17 21	50	100	SS-8	4.25	11	10	15	31	33	27	14	13	12	A-6a (7)	
			8 12 19	41	100	SS-9	4.25	-	-	-	-	-	-	-	-	13	A-6a (V)	
	869.4																	
HARD, GRAY, **CLAY**, SOME SILT, LITTLE SAND, TRACE GRAVEL, CONTAINS COBBLES, DAMP			6 12 18	40	100	SS-10	4.50	-	-	-	-	-	-	-	-	18	A-7-6 (V)	
@21.0'; VERY STIFF, MOIST			10 10 13	30	100	SS-11	4.00	2	4	8	32	54	44	21	23	22	A-7-6 (14)	
@23.5'; DAMP			8 13 18	41	100	SS-12	3.50	-	-	-	-	-	-	-	-	18	A-7-6 (V)	
	858.4	TR																
SHALE, GRAY, SEVERELY WEATHERED, WEAK.	856.9		50/1"	-	100	SS-13	2.50	-	-	-	-	-	-	-	-	19	Rock (V)	

PID: 109971	SFN: 0800512	PROJECT: BRO-50-4.49	STATION / OFFSET: 61+97, 8' RT.	START: 6/19/24	END: 6/19/24	PG 2 OF 2	B-003-0-24

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 (80%) AND LIMESTONE (20%), RQD 14%, REC. 95%; **SHALE**, GRAY, MODERATELY WEATHERED, WEAK; **LIMESTONE**, GRAY, MODERATELY TO SEVERLY WEATHERED, SLIGHTLY TO MODERATELY STRONG.	856.9	31 32 33 34 35	0		90	NQ2-1											CORE	
@ 36.8'; COMPRESSIVE STRENGTH (SHALE)= 1,120 PSI		36 37 38 39	28		100	NQ2-2											CORE	
	846.9	EOB 40																

NOTES: FROM TOP OF BRIDGE DECK TO THE GROUND SURFACE=29'.0. STARTED SAMPLING FROM BELOW THE GROUND SURFACE.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: BACKFILLED WITH GROUT

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 9/9/25 15:39 - O:\PROJECT\2024\COL-05\240500024COL_EMHANDT_BRO-50-4.49 BRIDGE REPLACEMENT\LAB AND LOGS\GINT\240500024COL_EMHANDT_BRO-50-4.49 BRIDGE REPLACEMENT.GPJ

PROJECT: BRO-50-4.49	DRILLING FIRM / OPERATOR: CTL / TM	DRILL RIG: CME 55 #393	STATION / OFFSET: 63+22, 7' RT.	EXPLORATION ID B-004-0-24
TYPE: BRIDGE	SAMPLING FIRM / LOGGER: CTL / TM	HAMMER: CME AUTOMATIC	ALIGNMENT: US 50	
PID: 109971 SFN: 0800512	DRILLING METHOD: 3.25" HSA / NQ2	CALIBRATION DATE: 11/4/22	ELEVATION: 915.9 (MSL) EOB: 76.0 ft.	PAGE 1 OF 3
START: 6/12/24 END: 6/14/24	SAMPLING METHOD: SPT / NQ2	ENERGY RATIO (%): 79.3	LAT / LONG: 39.186061, -83.937211	

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	HOLE SEALED
ASPHALT (7")	915.3																	
AGGREGATE BASE (5")	914.9																	
VERY STIFF, BROWN, **SILTY CLAY**, SOME SAND, MOIST		1 2	3 3	8	56	SS-1	3.75	0	8	24	37	31	34	16	18	17	A-6b (10)	
		3																
		4 5	1 2	7	100	SS-2	3.25	-	-	-	-	-	-	-	-	22	A-6b (V)	
		6	3															
	908.4	7	3 4	9	100	SS-3	3.25	0	2	27	38	33	34	16	18	25	A-6b (10)	
VERY STIFF, BROWN, **SILT AND CLAY**, "AND" SAND, TRACE GRAVEL, MOIST		8	3 4	11	100	SS-4	3.00	1	4	33	36	26	29	15	14	17	A-6a (7)	
@9.0'; SOME SAND, NO GRAVEL		9 10	3 4	9	100	SS-5	3.75	0	2	29	41	28	29	15	14	16	A-6a (8)	
@10.5'; TRACE GRAVEL, DAMP	903.9	11	5 6	17	100	SS-6	4.00	1	2	29	40	28	28	16	12	16	A-6a (7)	
VERY STIFF, BROWN, **SANDY SILT**, SOME CLAY, DAMP	902.4	12 13	2 2 4	8	100	SS-7	3.75	0	3	29	41	27	27	19	8	17	A-4a (7)	
VERY STIFF, BROWN AND GRAY, **SILT AND CLAY**, "AND" SAND, MOIST		14	5 5 6	15	100	SS-8	3.25	0	5	34	35	26	27	14	13	15	A-6a (6)	
@15.0'; DAMP		15 16	2 3 4	9	100	SS-9	3.50	-	-	-	-	-	-	-	-	14	A-6a (V)	
@16.5'; SOME SAND, TRACE GRAVEL, MOIST		17	4 5 6	15	100	SS-10	4.00	4	9	19	46	22	28	16	12	18	A-6a (7)	
@19.0'; HARD, WET		18 19 20	3 3 4	9	100	SS-11	4.25	-	-	-	-	-	-	-	-	26	A-6a (V)	
@21.0'; VERY STIFF, MOIST		21 22 23	3 5 5	13	100	SS-12	3.50	-	-	-	-	-	-	-	-	23	A-6a (V)	
@24.0'; STIFF, NO GRAVEL		24 25 26	1 2 2	5	100	SS-13	1.50	0	0	29	44	27	32	17	15	25	A-6a (9)	
		27 28 29	1 1 2	4	100	SS-14	1.50	-	-	-	-	-	-	-	-	25	A-6a (V)	

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 9/9/25 15:39 - O:\PROJECT\2024\COL-05\240500024COL_EMHANDT_BRO-50-4.49 BRIDGE REPLACEMENT\LAB AND LOGS\GINT\2405

PID: 109971	SFN: 0800512	PROJECT: BRO-50-4.49	STATION / OFFSET: 63+22, 7' RT.	START: 6/12/24	END: 6/14/24	PG 2 OF 3	B-004-0-24

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	HOLE SEALED
VERY STIFF, BROWN AND GRAY, **SILT AND CLAY**, "AND" SAND, MOIST *(continued)*	885.9	W 884.9																
@31.5'; HARD, DAMP		31	9 11 14	33	11	SS-15	-	-	-	-	-	-	-	-	-	16	A-6a (V)	
	879.9	32–36																
VERY STIFF, GRAY, **SANDY SILT**, SOME CLAY, LITTLE GRAVEL, CONTAINS COBBLES, DAMP		37	7 11 14	33	100	SS-16	3.50	16	11	16	36	21	22	13	9	12	A-4a (4)	
		38–41																
	872.9	42	7 16 30	61	100	SS-17	3.75	-	-	-	-	-	-	-	-	14	A-4a (V)	
HARD, GRAY, **CLAY**, SOME SILT, TRACE SAND, TRACE GRAVEL, CONTAINS COBBLES, DAMP		43–46																
		47	9 14 18	42	100	SS-18	4.25	-	-	-	-	-	-	-	-	12	A-7-6 (V)	
		48–50																
@51.0'; VERY STIFF, MOIST		51	41 26 33	78	100	SS-19	2.75	-	-	-	-	-	-	-	-	19	A-7-6 (V)	
		52–56																
		57	19 10 8	24	100	SS-20	2.75	3	3	3	25	66	51	22	29	27	A-7-6 (18)	
		58–61																
@61.0'; CONTAINS ROCK FRAGMENTS			8															

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 9/9/25 15:39 - O:\PROJECT\2024\COL-05\240500024COL_EMHANDT_BRO-50-4.49 BRIDGE REPLACEMENT\LAB AND LOGS\GINT\2405

PID: 109971	SFN: 0800512	PROJECT: BRO-50-4.49	STATION / OFFSET: 63+22, 7' RT.	START: 6/12/24	END: 6/14/24	PG 3 OF 3	B-004-0-24

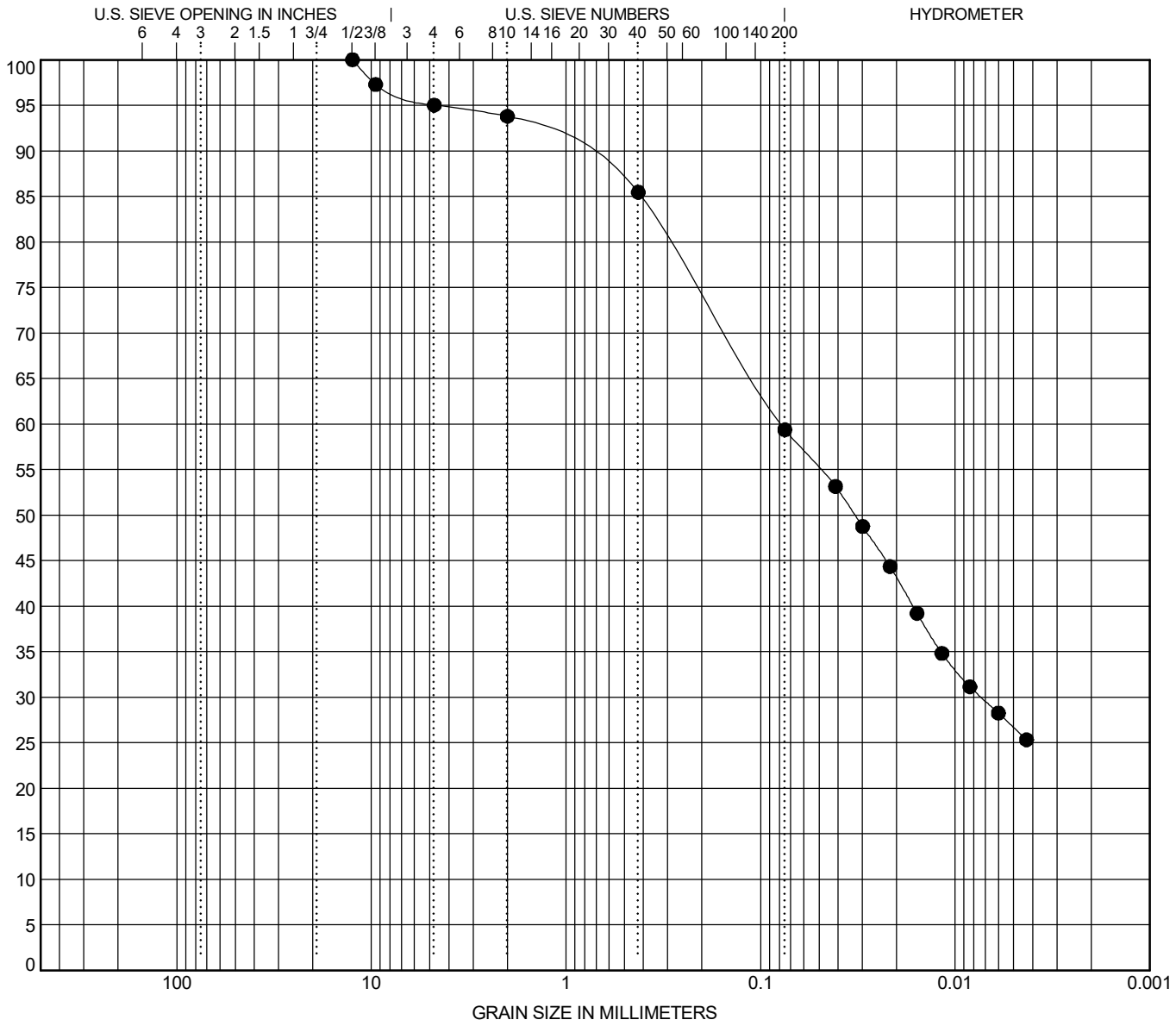
MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	HOLE SEALED
HARD, GRAY, **CLAY**, SOME SILT, TRACE SAND, TRACE GRAVEL, CONTAINS COBBLES, DAMP *(continued)*	853.8	63	11 10	28	100	SS-21	3.25	-	-	-	-	-	-	-	-	25	A-7-6 (V)	
	850.9	64																
SHALE, GRAY, SEVERELY WEATHERED, WEAK.	849.9	TR 65	50/3"	-	100	SS-22	-	-	-	-	-	-	-	-	-	16	Rock (V)	
INTERBEDDED SHALE (60%) AND LIMESTONE (40%), RQD 4%, REC. 91%; **SHALE**, GRAY, MODERATELY TO SEVERELY WEATHERED, VERY WEAK; **LIMESTONE**, GRAY, MODERATELY TO SEVERELY WEATHERED, SLIGHTLY STRONG. @ 66.0'; COMPRESSIVE STRENGTH (SHALE)= 202 PSI (BASED ON THE POINT LOAD TEST)		66 67 68 69 70	8		90	NQ2-1											CORE	
		71 72 73 74 75	0		92	NQ2-2											CORE	
	839.9	EOB 76																

NOTES: NONE

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLACED ASPHALT PATCH; BACKFILLED WITH GROUT

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 9/9/25 15:39 - O:\PROJECT\2024\COL-05\24050024COL_EMHANDT_BRO-50-4.49 BRIDGE REPLACEMENT\LAB AND LOGS\GINT\24050024COL_EMHANDT_BRO-50-4.49 BRIDGE REPLACEMENT.GPJ

APPENDIX C
LABORATORY TEST RESULTS



COBBLES	GRAVEL		SAND		SILT OR CLAY
	coarse	fine	coarse	fine	

Specimen Identification	Depth	Classification	MC	LL	PL	PI	Cc	Cu
B-001-0-24	**1.0**	**A-6b(8)**	**16**	**33**	**15**	**18**		

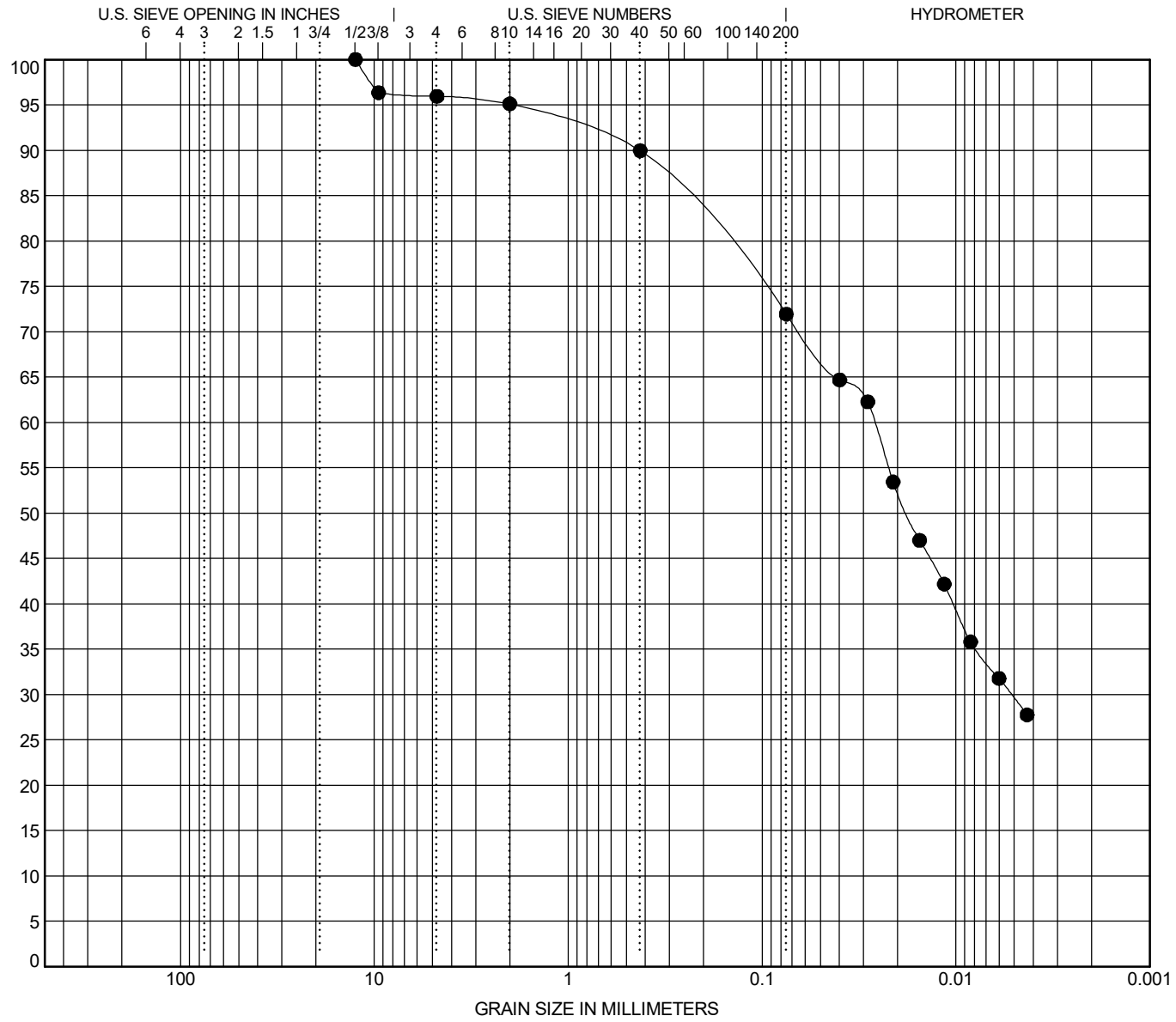
Specimen Identification	Depth	D100	D60	D50	D30	D10	%Gravel	%Coarse Sand	%Fine Sand	%Silt	%Clay
B-001-0-24	**1.0**	**12.5**	**0.078**	**0.033**	**0.007**		**7**	**8**	**26**	**32**	**27**

CTL Engineering, Inc.
2860 Fisher Road
Columbus, Ohio 43204
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Fax: 614-276-6377

GRAIN SIZE DISTRIBUTION

Project: BRO-50-4.49
Location:BRO COUNTY
CTL Project Number:

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COBBLES	GRAVEL		SAND		SILT OR CLAY
	coarse	fine	coarse	fine	

Specimen Identification	Depth	Classification	MC	LL	PL	PI	Cc	Cu
B-001-0-24	**6.0**	**A-6b(10)**	**16**	**32**	**15**	**17**		

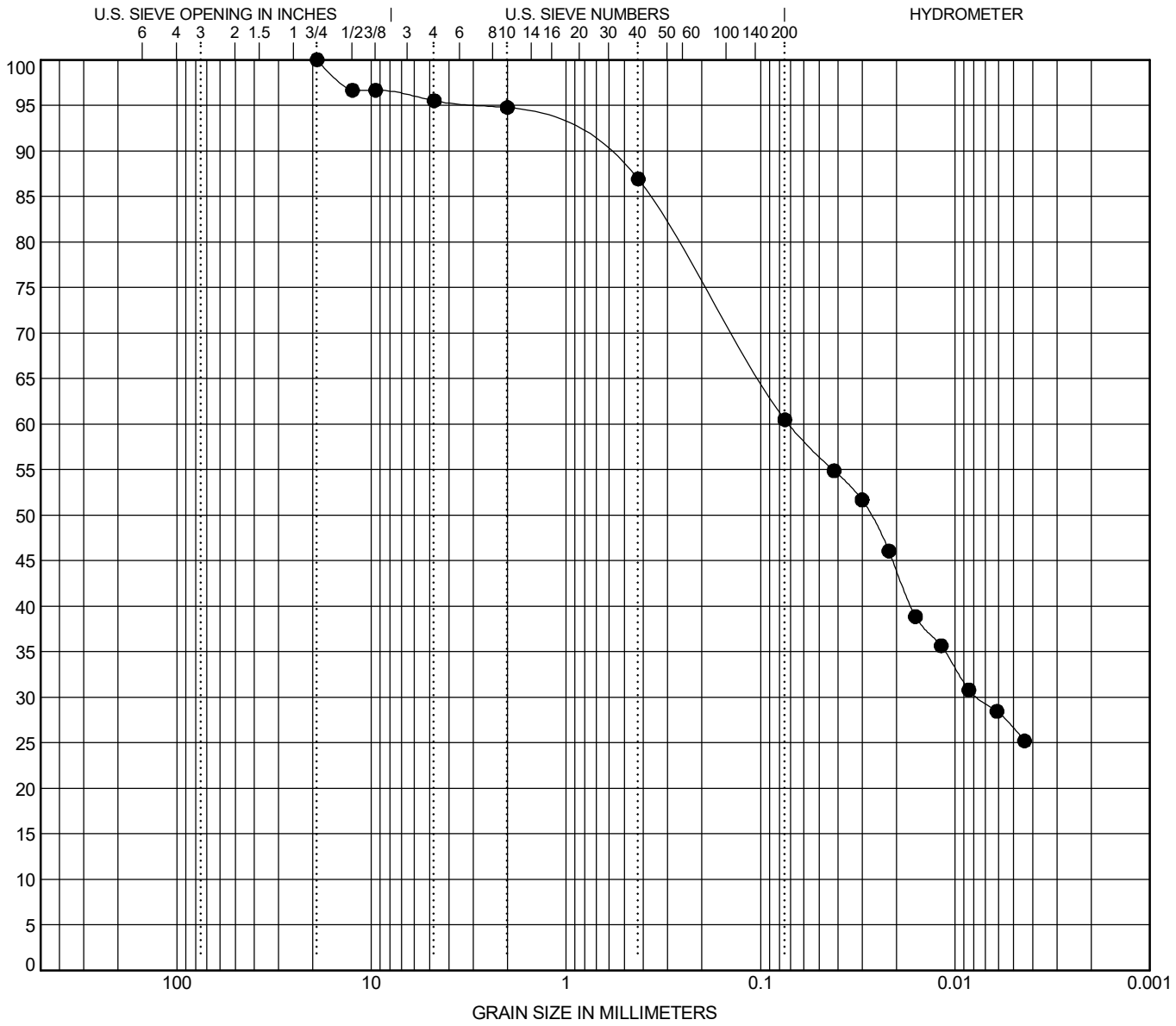
Specimen Identification	Depth	D100	D60	D50	D30	D10	%Gravel	%Coarse Sand	%Fine Sand	%Silt	%Clay
B-001-0-24	**6.0**	**12.5**	**0.026**	**0.018**	**0.005**		**5**	**5**	**18**	**42**	**30**

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GRAIN SIZE DISTRIBUTION

Project: BRO-50-4.49
Location:BRO COUNTY
CTL Project Number:

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COBBLES	GRAVEL		SAND		SILT OR CLAY
	coarse	fine	coarse	fine	

Specimen Identification	Depth	Classification	MC	LL	PL	PI	Cc	Cu
B-001-0-24	**7.5**	**A-6a(7)**	**16**	**30**	**15**	**15**		

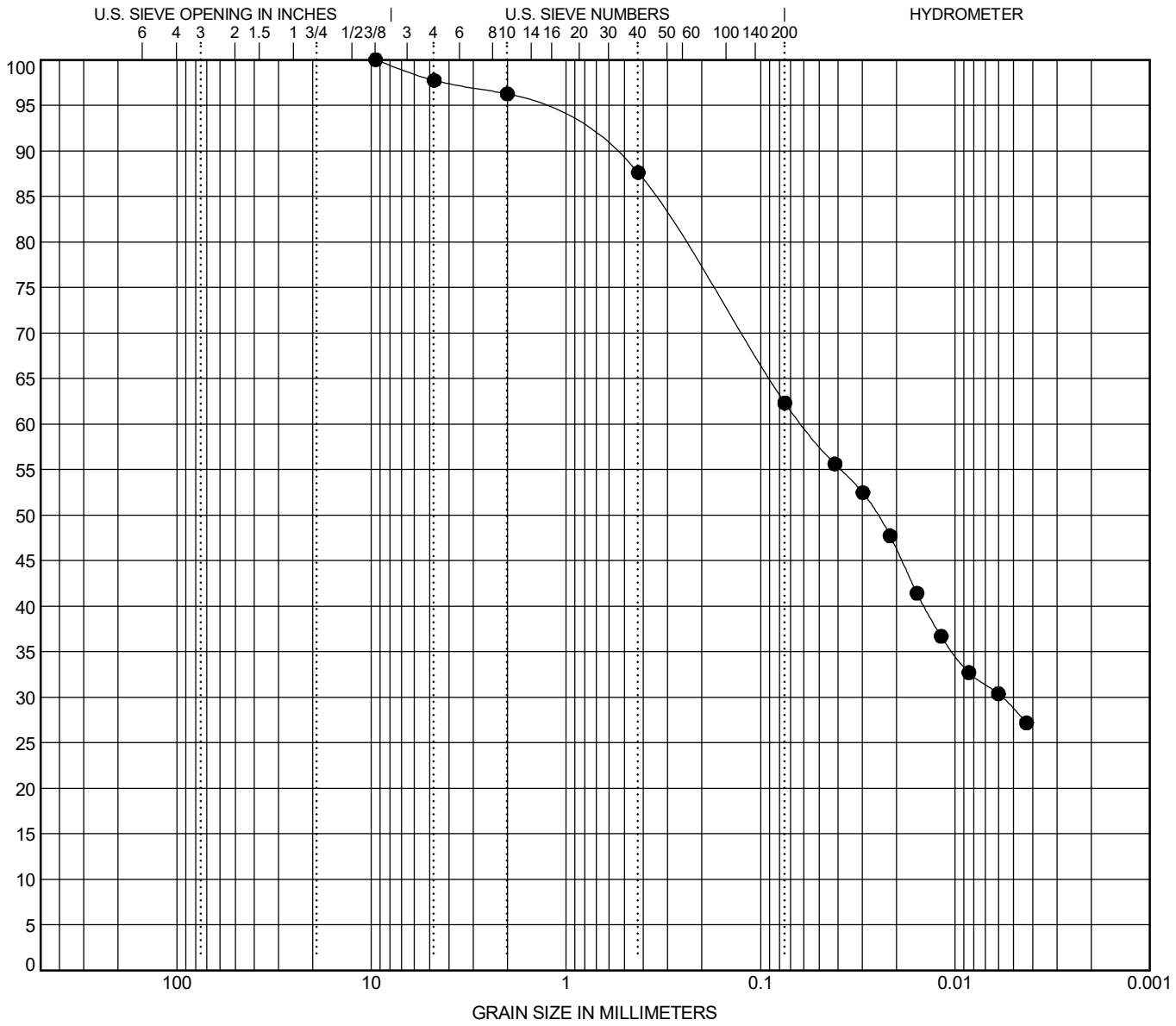
Specimen Identification	Depth	D100	D60	D50	D30	D10	%Gravel	%Coarse Sand	%Fine Sand	%Silt	%Clay
B-001-0-24	**7.5**	**19**	**0.071**	**0.027**	**0.008**		**6**	**8**	**26**	**34**	**26**

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GRAIN SIZE DISTRIBUTION

Project: BRO-50-4.49
Location:BRO COUNTY
CTL Project Number:

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COBBLES	GRAVEL		SAND		SILT OR CLAY
	coarse	fine	coarse	fine	

Specimen Identification	Depth	Classification	MC	LL	PL	PI	Cc	Cu
B-001-0-24	**9.0**	**A-6b(8)**	**17**	**31**	**15**	**16**		

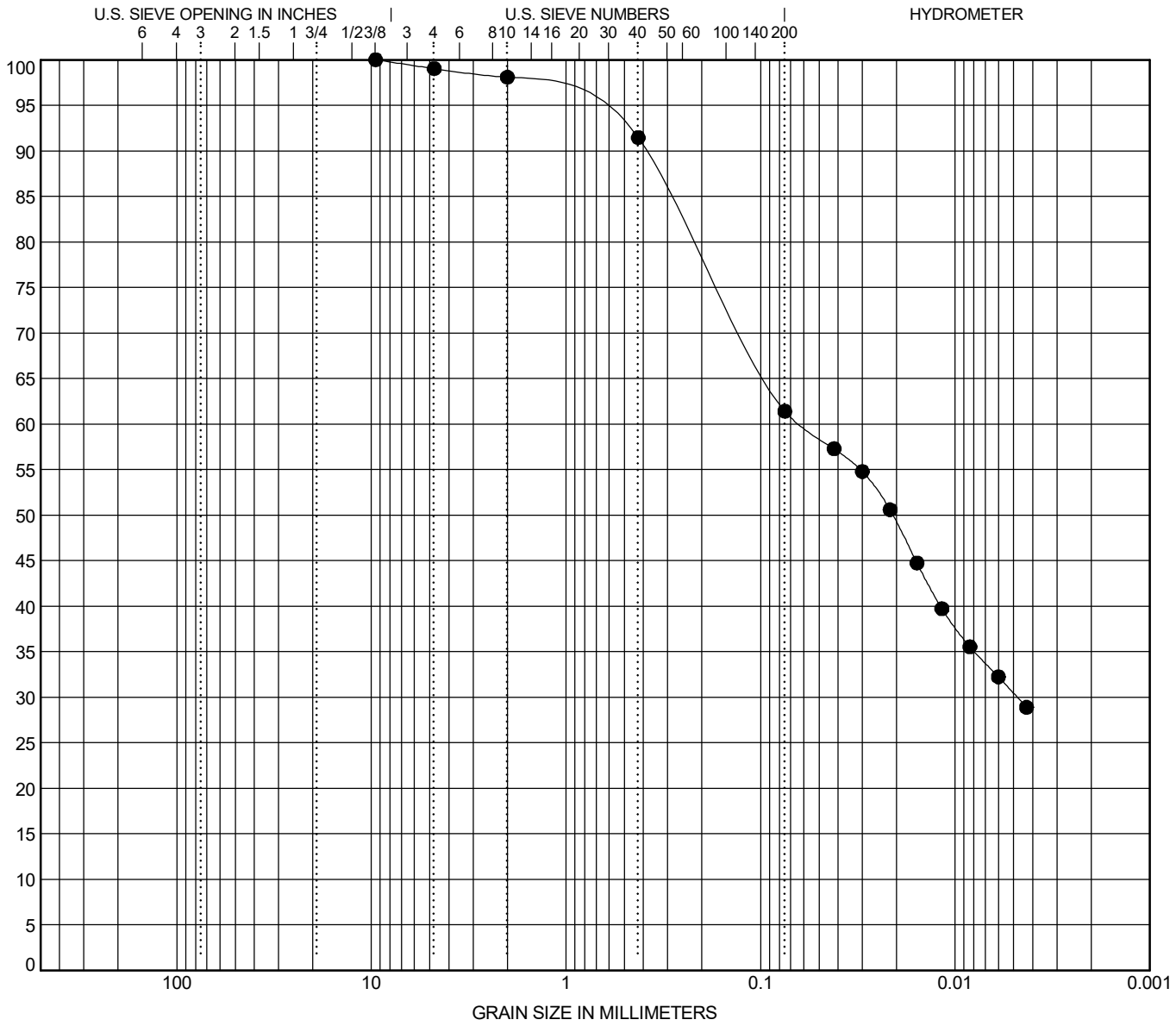
Specimen Identification	Depth	D100	D60	D50	D30	D10	%Gravel	%Coarse Sand	%Fine Sand	%Silt	%Clay
B-001-0-24	**9.0**	**9.5**	**0.061**	**0.025**	**0.006**		**4**	**9**	**25**	**33**	**29**

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GRAIN SIZE DISTRIBUTION

Project: BRO-50-4.49
Location:BRO COUNTY
CTL Project Number:

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COBBLES	GRAVEL		SAND		SILT OR CLAY
	coarse	fine	coarse	fine	

Specimen Identification	Depth	Classification	MC	LL	PL	PI	Cc	Cu
B-001-0-24	**10.5**	**A-6b(8)**	**18**	**31**	**15**	**16**		

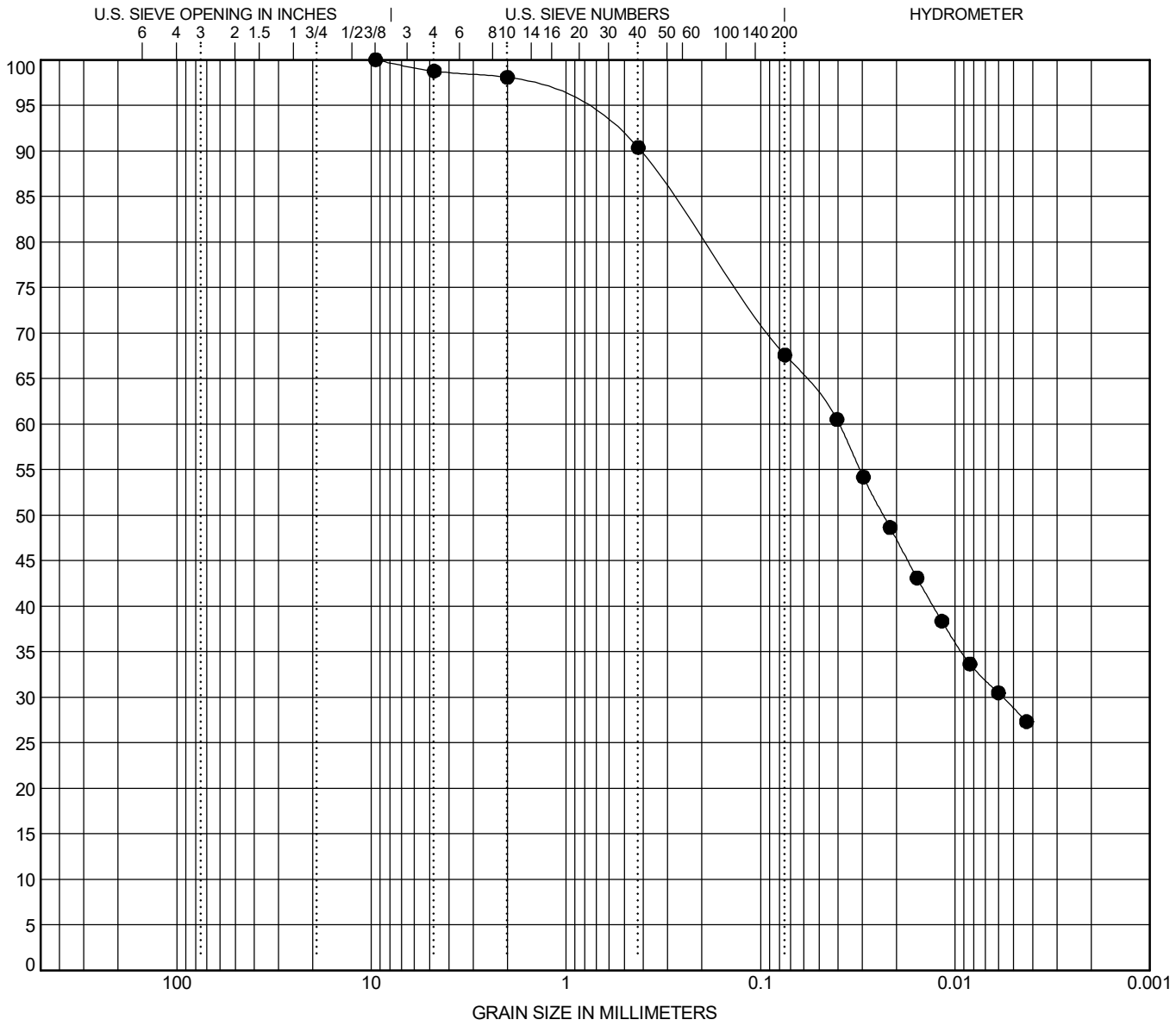
Specimen Identification	Depth	D100	D60	D50	D30	D10	%Gravel	%Coarse Sand	%Fine Sand	%Silt	%Clay
B-001-0-24	**10.5**	**9.5**	**0.062**	**0.021**	**0.005**		**2**	**7**	**30**	**31**	**30**

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GRAIN SIZE DISTRIBUTION

Project: BRO-50-4.49
Location:BRO COUNTY
CTL Project Number:

CTL GRADATION - 2014 ODOT.GDT - 2/26/25 14:01 - O:\PROJECT\2024\COL-05\24050024COL_EMHANDT_BRO-50-4.49 BRIDGE REPLACEMENT\LAB AND LOGS\GINT\24050024COL.GPJ



COBBLES	GRAVEL		SAND		SILT OR CLAY
	coarse	fine	coarse	fine	

Specimen Identification	Depth	Classification	MC	LL	PL	PI	Cc	Cu
B-001-0-24	**12.0**	**A-6b(9)**	**14**	**30**	**14**	**16**		

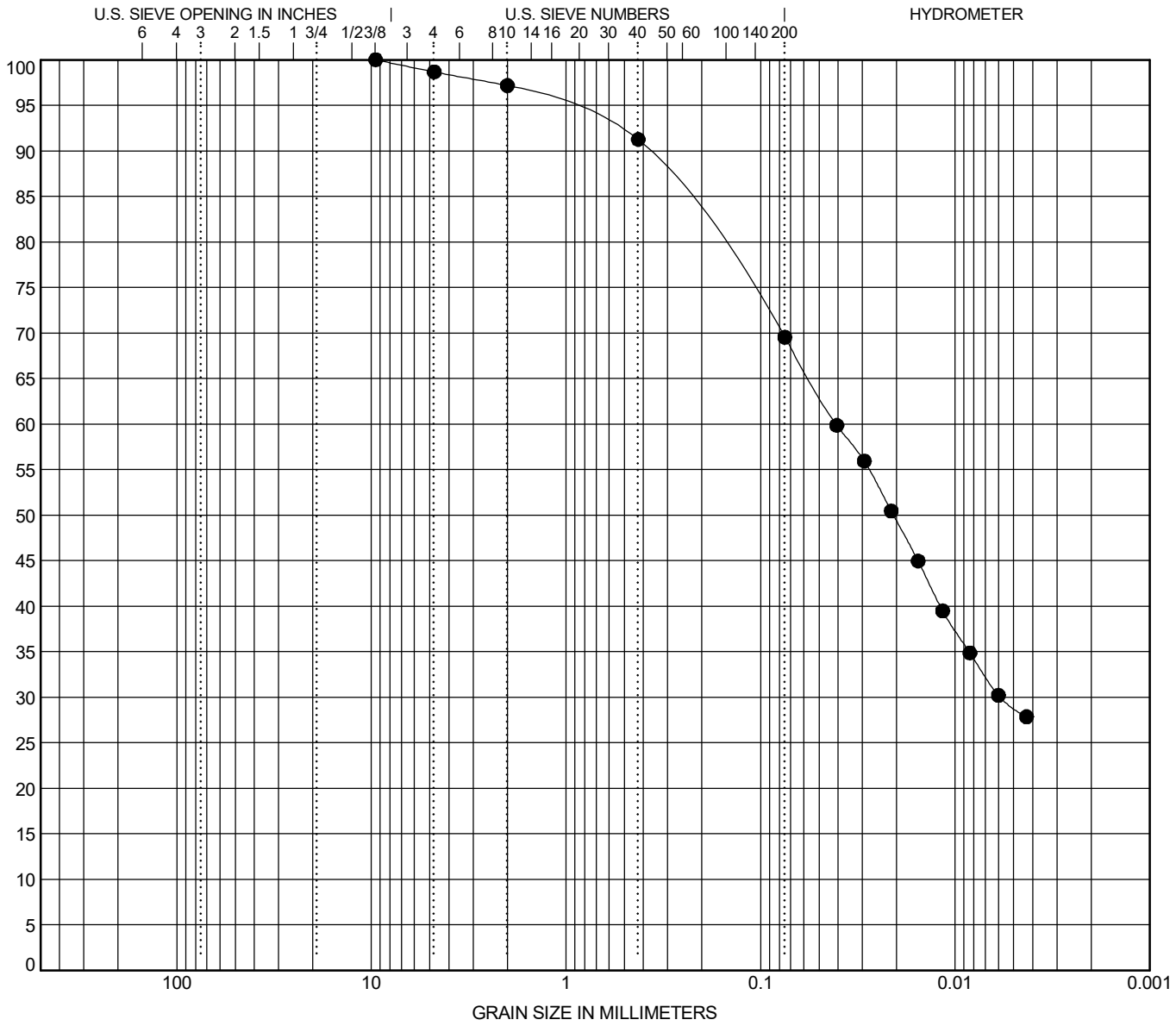
Specimen Identification	Depth	D100	D60	D50	D30	D10	%Gravel	%Coarse Sand	%Fine Sand	%Silt	%Clay
B-001-0-24	**12.0**	**9.5**	**0.04**	**0.023**	**0.006**		**1**	**8**	**23**	**39**	**29**

CTL Engineering, Inc.
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Fax: 614-276-6377

GRAIN SIZE DISTRIBUTION

Project: BRO-50-4.49
Location:BRO COUNTY
CTL Project Number:

CTL GRADATION - 2014 ODOT.GDT - 2/26/25 14:01 - O:\PROJECT\2024\COL-05\24050024COL_EMHANDT_BRO-50-4-49 BRIDGE REPLACEMENT\LAB AND LOGS\GINT\24050024COL.GPJ



COBBLES	GRAVEL		SAND		SILT OR CLAY
	coarse	fine	coarse	fine	

Specimen Identification	Depth	Classification	MC	LL	PL	PI	Cc	Cu
B-001-0-24	**13.5**	**A-6b(10)**	**14**	**33**	**16**	**17**		

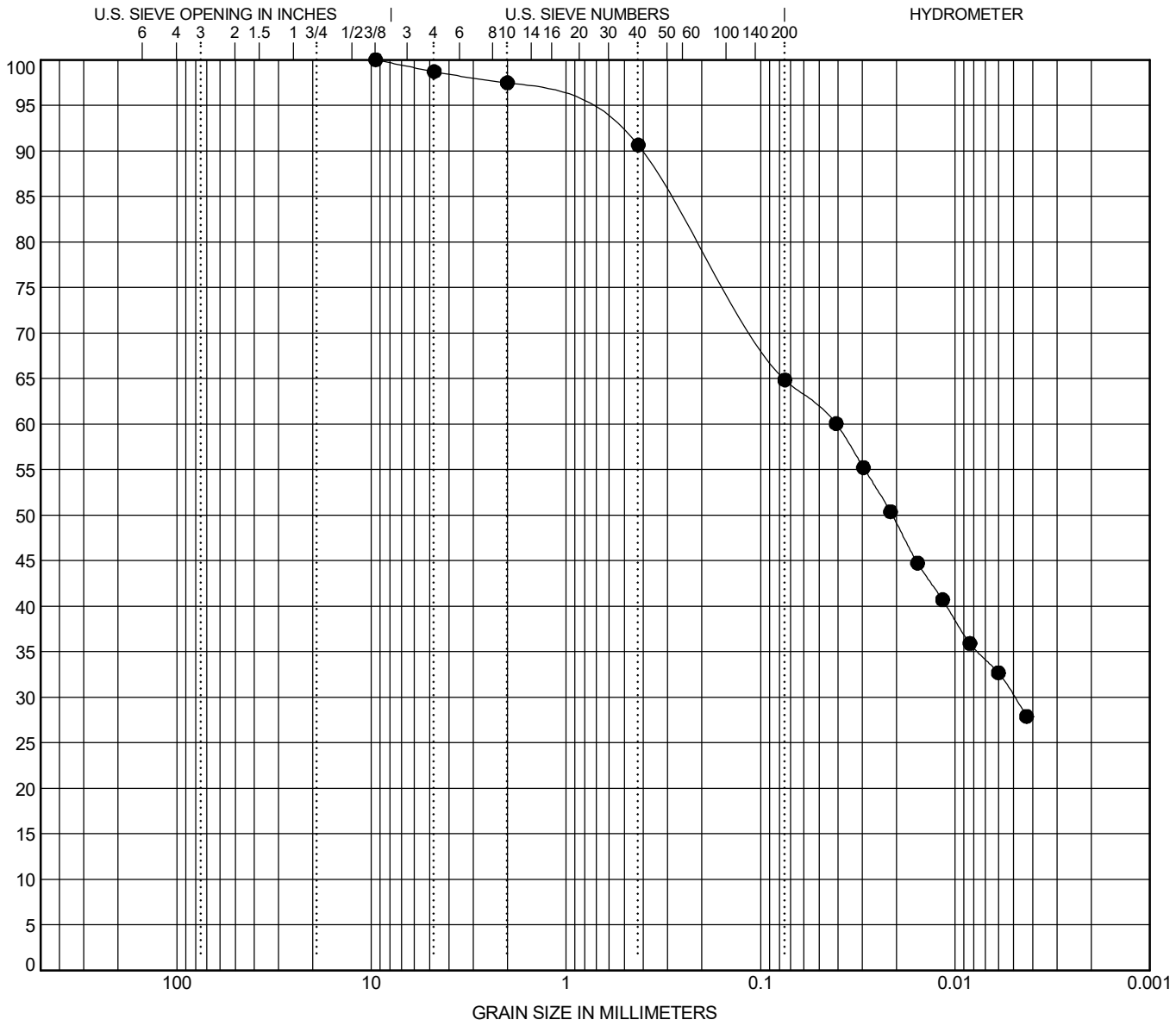
Specimen Identification	Depth	D100	D60	D50	D30	D10	%Gravel	%Coarse Sand	%Fine Sand	%Silt	%Clay
B-001-0-24	**13.5**	**9.5**	**0.041**	**0.021**	**0.006**		**2**	**6**	**22**	**41**	**29**

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GRAIN SIZE DISTRIBUTION

Project: BRO-50-4.49
Location:BRO COUNTY
CTL Project Number:

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COBBLES	GRAVEL		SAND		SILT OR CLAY
	coarse	fine	coarse	fine	

Specimen Identification	Depth	Classification	MC	LL	PL	PI	Cc	Cu
B-001-0-24	**15.0**	**A-6b(8)**	**17**	**32**	**16**	**16**		

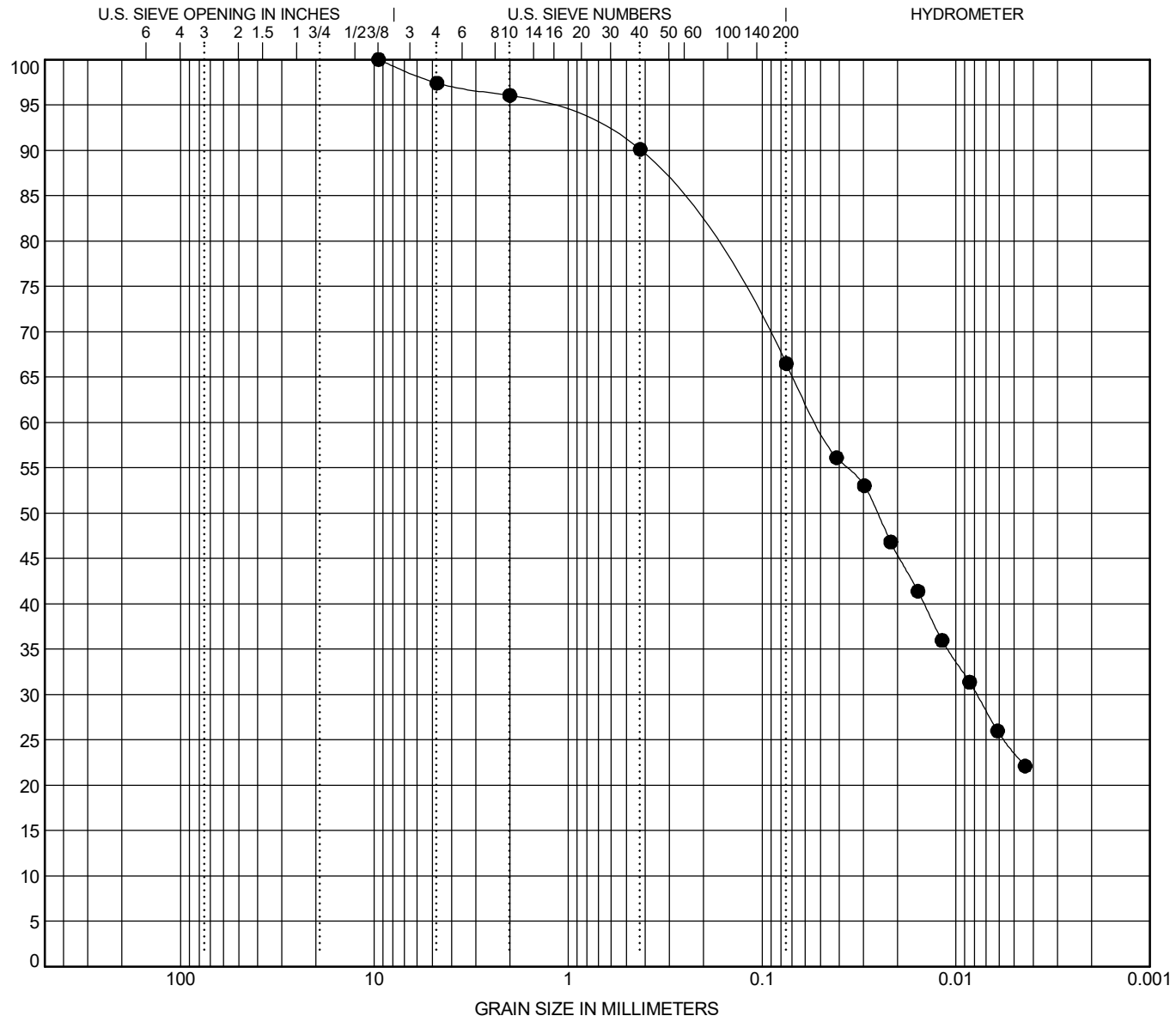
Specimen Identification	Depth	D100	D60	D50	D30	D10	%Gravel	%Coarse Sand	%Fine Sand	%Silt	%Clay
B-001-0-24	**15.0**	**9.5**	**0.041**	**0.021**	**0.005**		**2**	**7**	**26**	**35**	**30**

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GRAIN SIZE DISTRIBUTION

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COBBLES	GRAVEL		SAND		SILT OR CLAY
	coarse	fine	coarse	fine	

Specimen Identification	Depth	Classification	MC	LL	PL	PI	Cc	Cu
B-001-0-24	**19.0**	**A-6a(7)**	**15**	**27**	**15**	**12**		

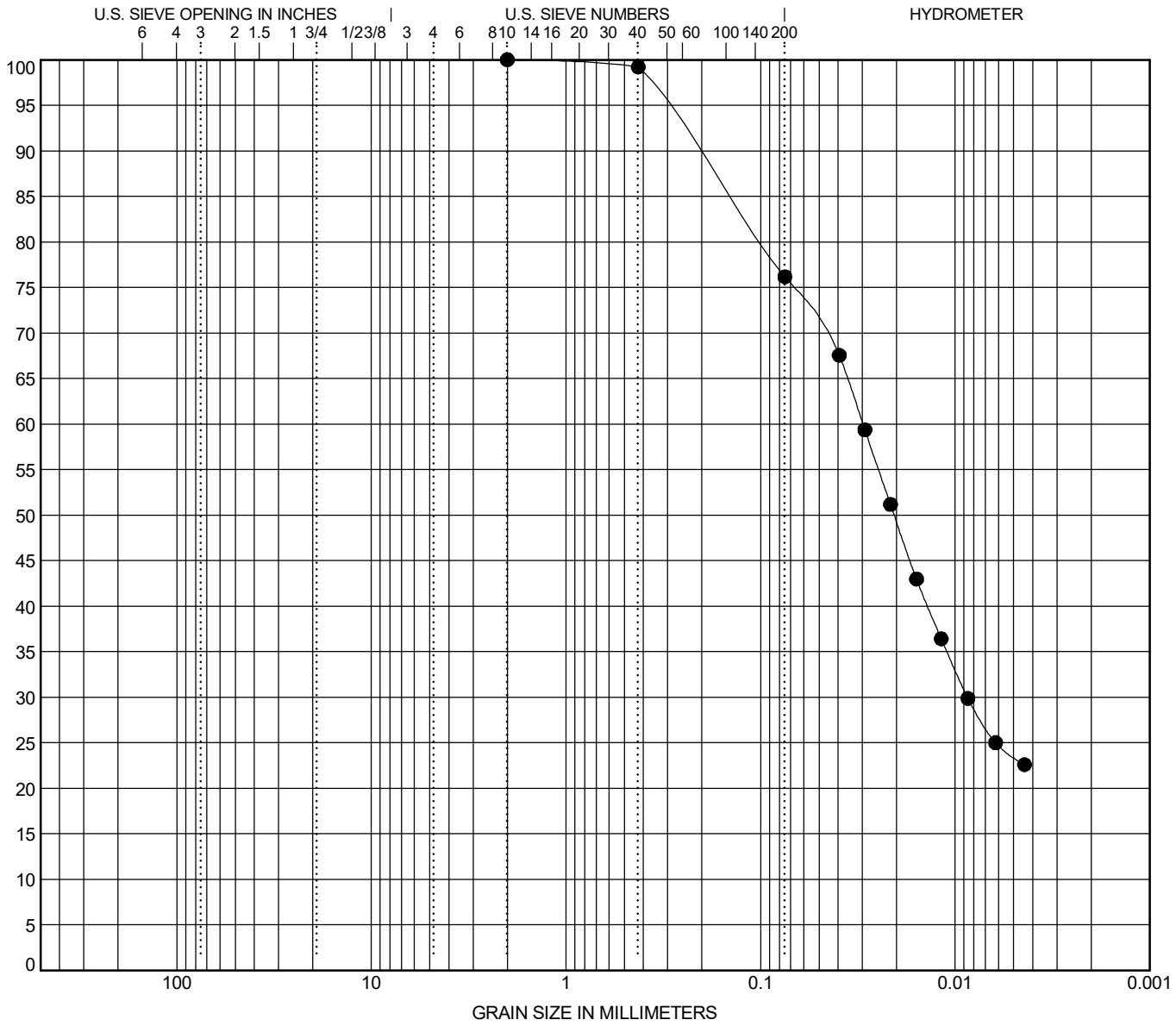
Specimen Identification	Depth	D100	D60	D50	D30	D10	%Gravel	%Coarse Sand	%Fine Sand	%Silt	%Clay
B-001-0-24	**19.0**	**9.5**	**0.052**	**0.026**	**0.008**		**4**	**6**	**24**	**42**	**24**

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COBBLES	GRAVEL		SAND		SILT OR CLAY
	coarse	fine	coarse	fine	

Specimen Identification	Depth	Classification	MC	LL	PL	PI	Cc	Cu
B-001-0-24	**21.5**	**A-6a(8)**	**23**	**28**	**17**	**11**		

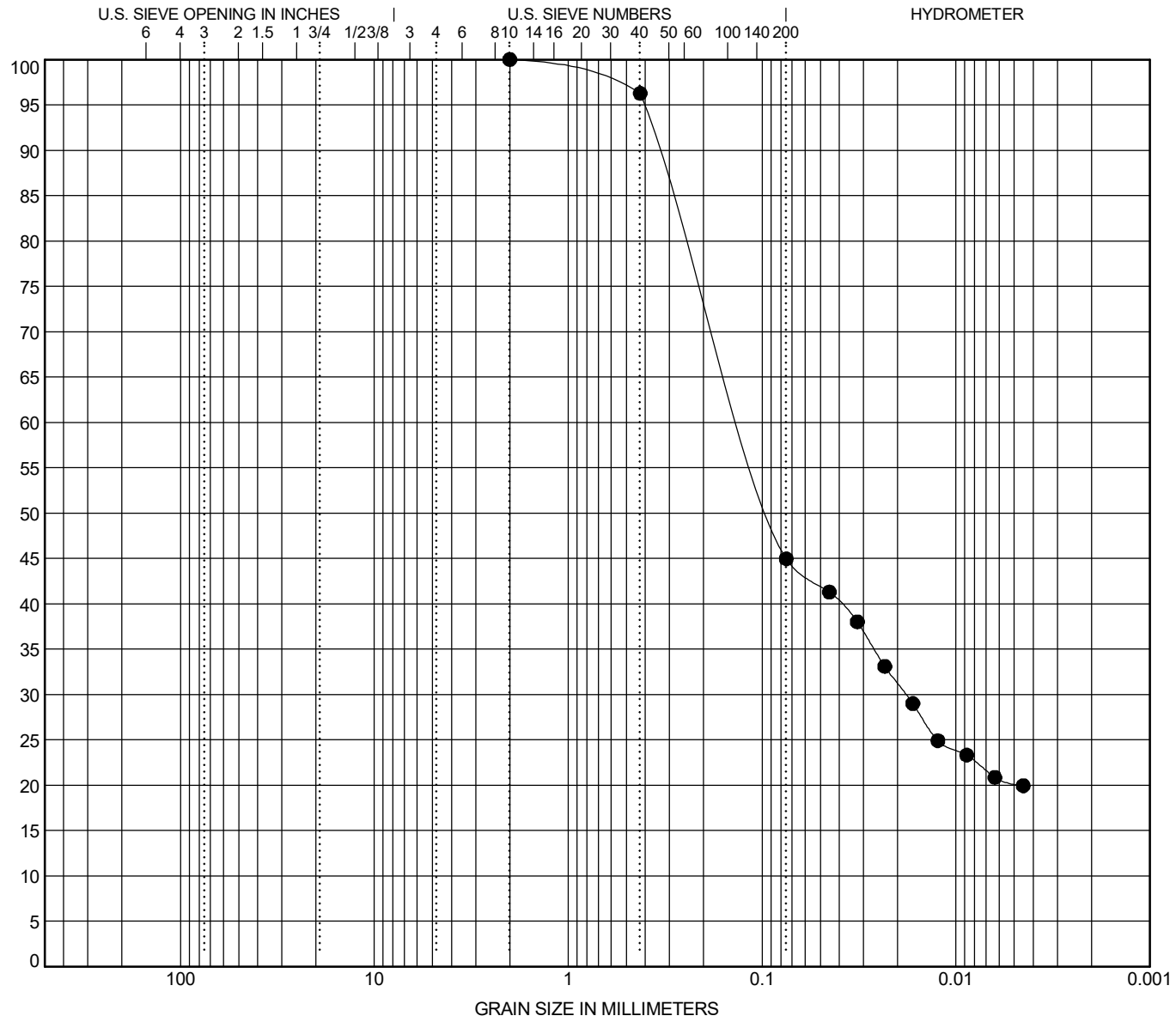
Specimen Identification	Depth	D100	D60	D50	D30	D10	%Gravel	%Coarse Sand	%Fine Sand	%Silt	%Clay
B-001-0-24	**21.5**	**2**	**0.03**	**0.021**	**0.009**		**0**	**1**	**23**	**53**	**23**

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COBBLES	GRAVEL		SAND		SILT OR CLAY
	coarse	fine	coarse	fine	

Specimen Identification	Depth	Classification	MC	LL	PL	PI	Cc	Cu
B-001-0-24	**26.5**	**A-4a(2)**	**23**	**25**	**15**	**10**		

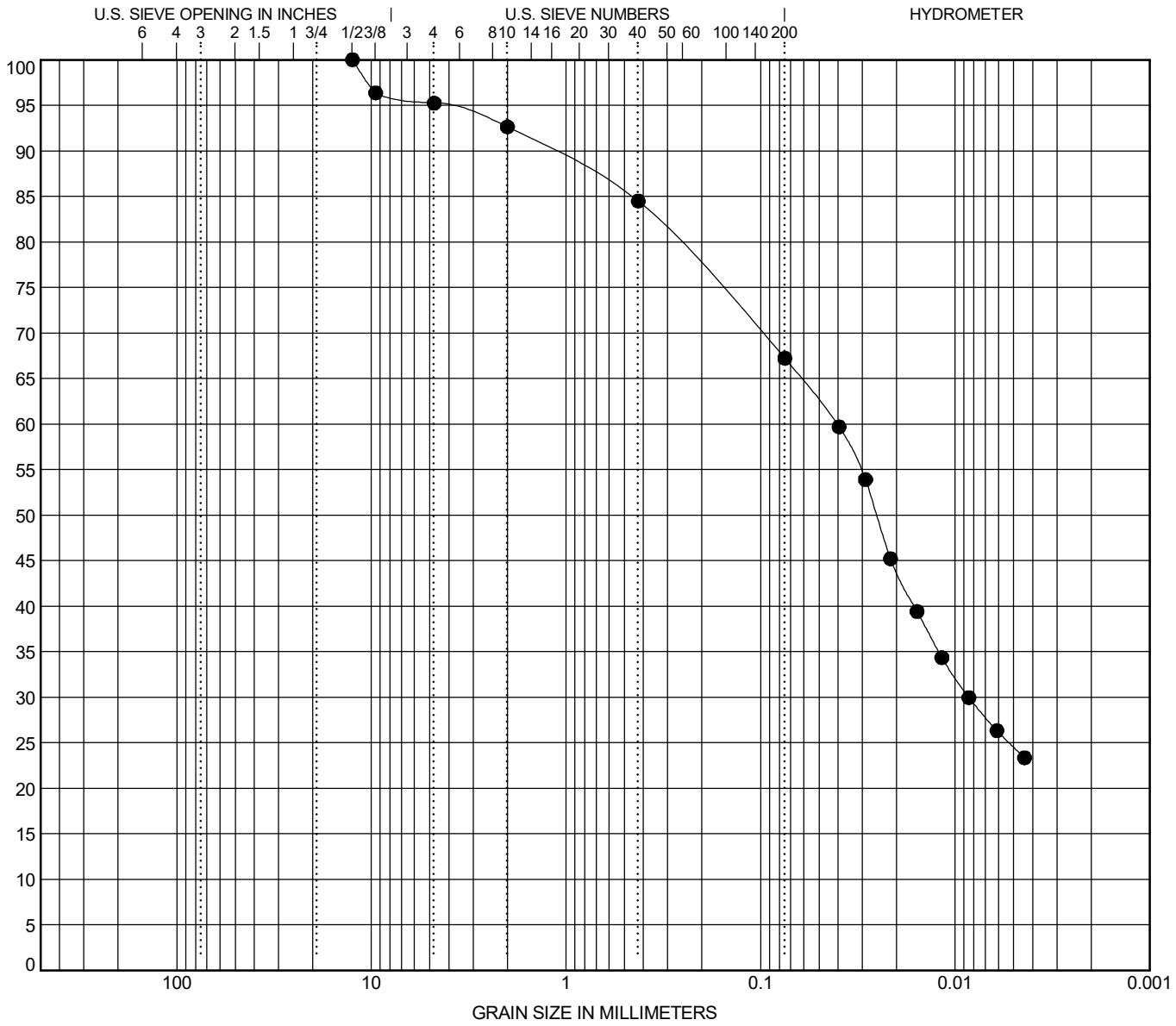
Specimen Identification	Depth	D100	D60	D50	D30	D10	%Gravel	%Coarse Sand	%Fine Sand	%Silt	%Clay
B-001-0-24	**26.5**	**2**	**0.125**	**0.089**	**0.018**		**0**	**4**	**51**	**25**	**20**

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COBBLES	GRAVEL		SAND		SILT OR CLAY
	coarse	fine	coarse	fine	

Specimen Identification	Depth	Classification	MC	LL	PL	PI	Cc	Cu
B-001-0-24	**31.5**	**A-4a(6)**	**12**	**21**	**14**	**7**		

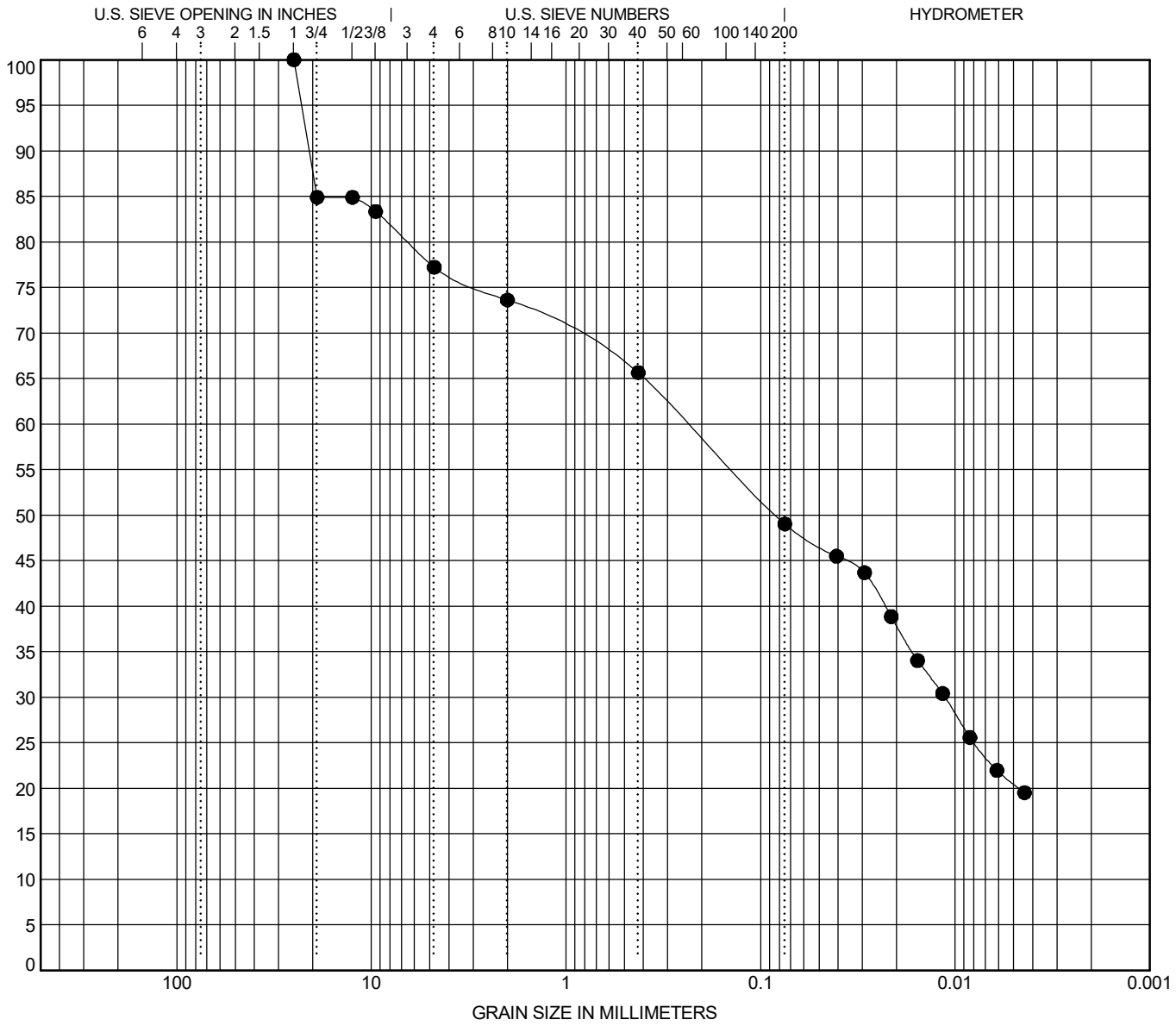
Specimen Identification	Depth	D100	D60	D50	D30	D10	%Gravel	%Coarse Sand	%Fine Sand	%Silt	%Clay
B-001-0-24	**31.5**	**12.5**	**0.041**	**0.025**	**0.009**		**8**	**8**	**17**	**42**	**25**

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COBBLES	GRAVEL		SAND		SILT OR CLAY
	coarse	fine	coarse	fine	

Specimen Identification	Depth	Classification	MC	LL	PL	PI	Cc	Cu
B-002-0-24	**1.0**	**A-6a(4)**	**15**	**31**	**18**	**13**		

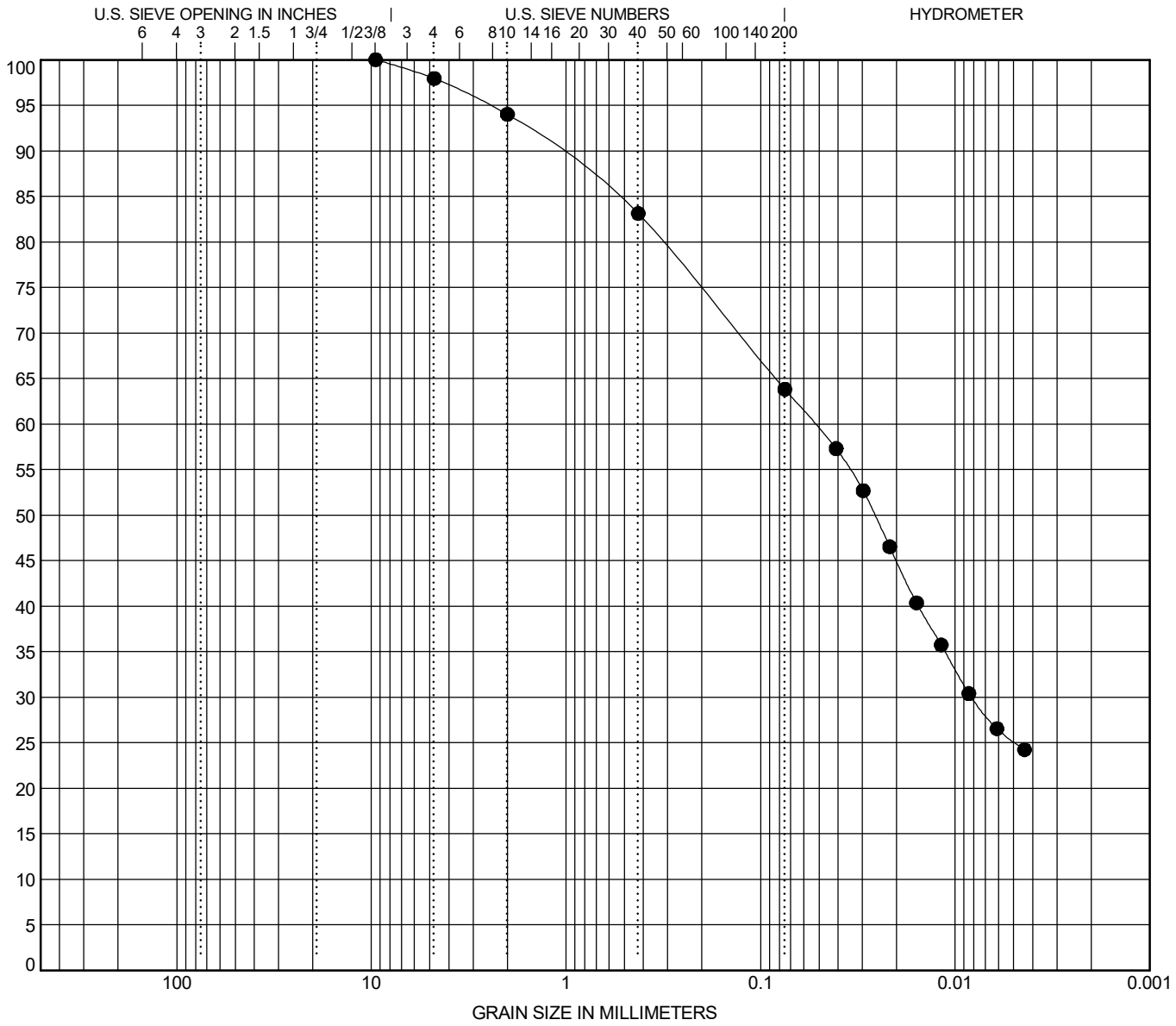
Specimen Identification	Depth	D100	D60	D50	D30	D10	%Gravel	%Coarse Sand	%Fine Sand	%Silt	%Clay
B-002-0-24	**1.0**	**25**	**0.236**	**0.083**	**0.011**		**26**	**8**	**17**	**29**	**20**

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COBBLES	GRAVEL		SAND		SILT OR CLAY
	coarse	fine	coarse	fine	

Specimen Identification	Depth	Classification	MC	LL	PL	PI	Cc	Cu
B-002-0-24	**8.5**	**A-4a(6)**	**12**	**21**	**13**	**8**		

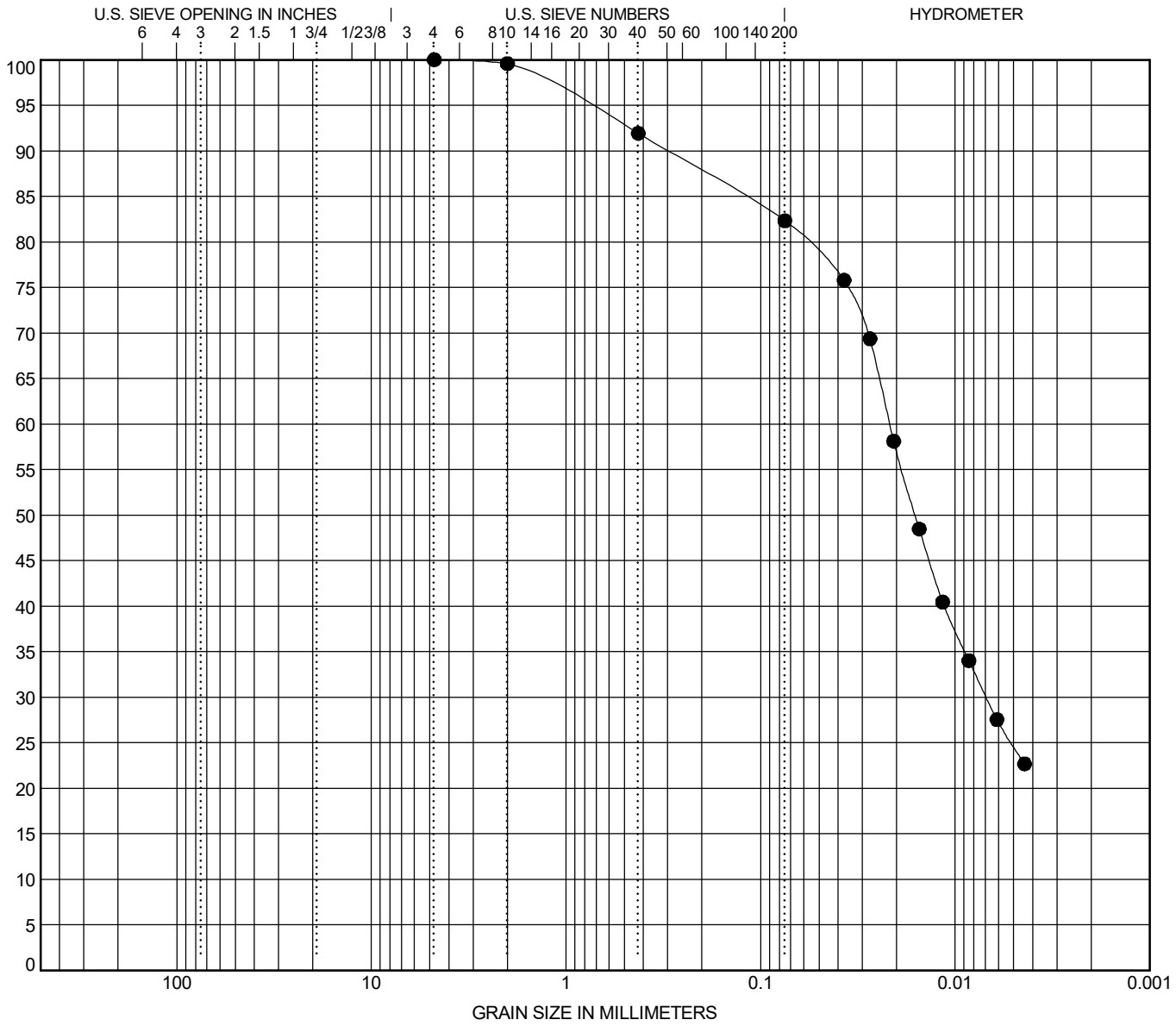
Specimen Identification	Depth	D100	D60	D50	D30	D10	%Gravel	%Coarse Sand	%Fine Sand	%Silt	%Clay
B-002-0-24	**8.5**	**9.5**	**0.053**	**0.026**	**0.008**		**6**	**11**	**19**	**39**	**25**

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COBBLES	GRAVEL		SAND		SILT OR CLAY
	coarse	fine	coarse	fine	

Specimen Identification	Depth	Classification	MC	LL	PL	PI	Cc	Cu
B-002-0-24	**13.5**	**A-4b(8)**	**18**	**24**	**15**	**9**		

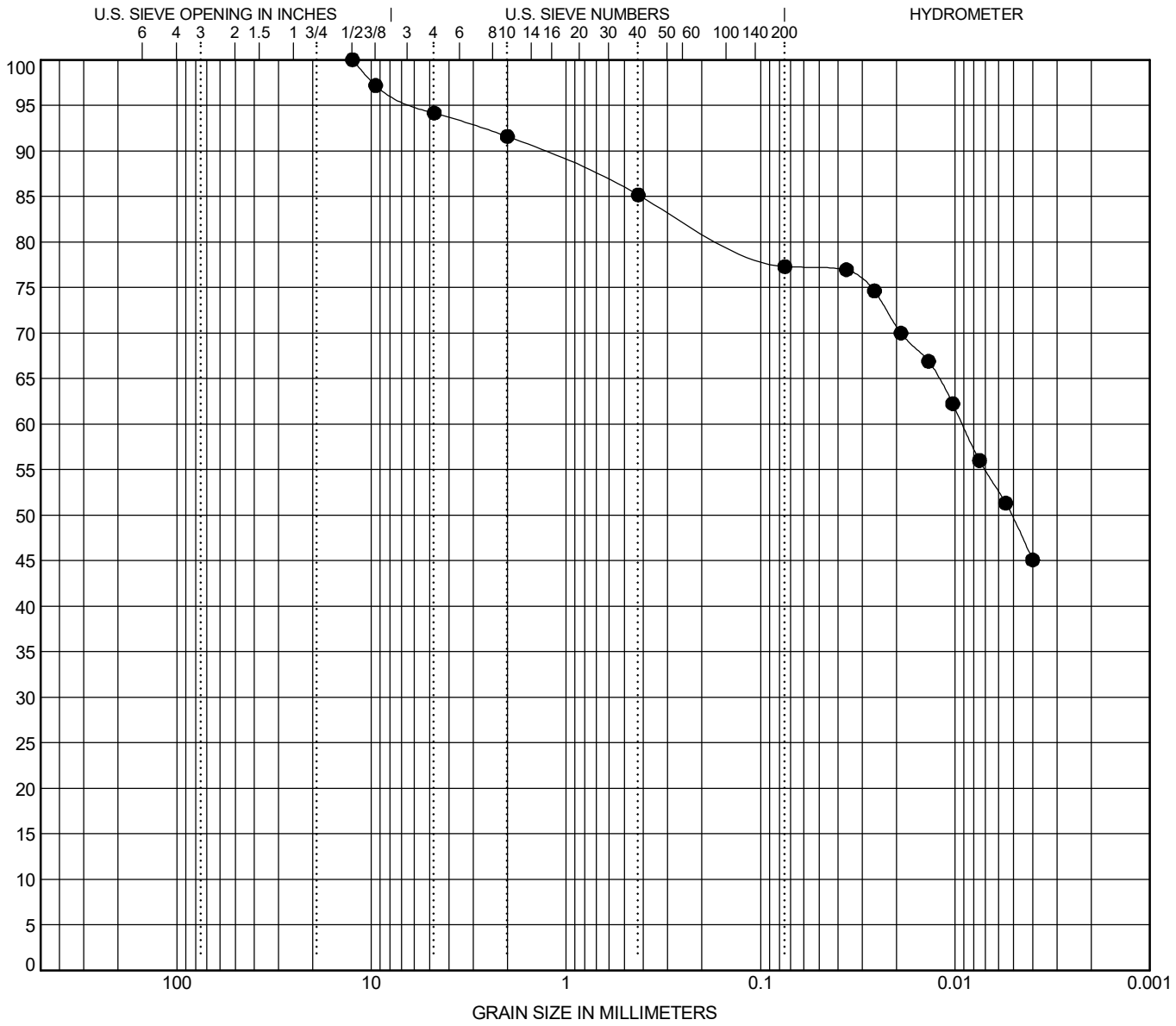
Specimen Identification	Depth	D100	D60	D50	D30	D10	%Gravel	%Coarse Sand	%Fine Sand	%Silt	%Clay
B-002-0-24	**13.5**	**4.75**	**0.022**	**0.016**	**0.007**		**0**	**8**	**10**	**57**	**25**

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COBBLES	GRAVEL		SAND		SILT OR CLAY
	coarse	fine	coarse	fine	

Specimen Identification	Depth	Classification	MC	LL	PL	PI	Cc	Cu
B-002-0-24	**18.5**	**A-6b(12)**	**20**	**37**	**18**	**19**		

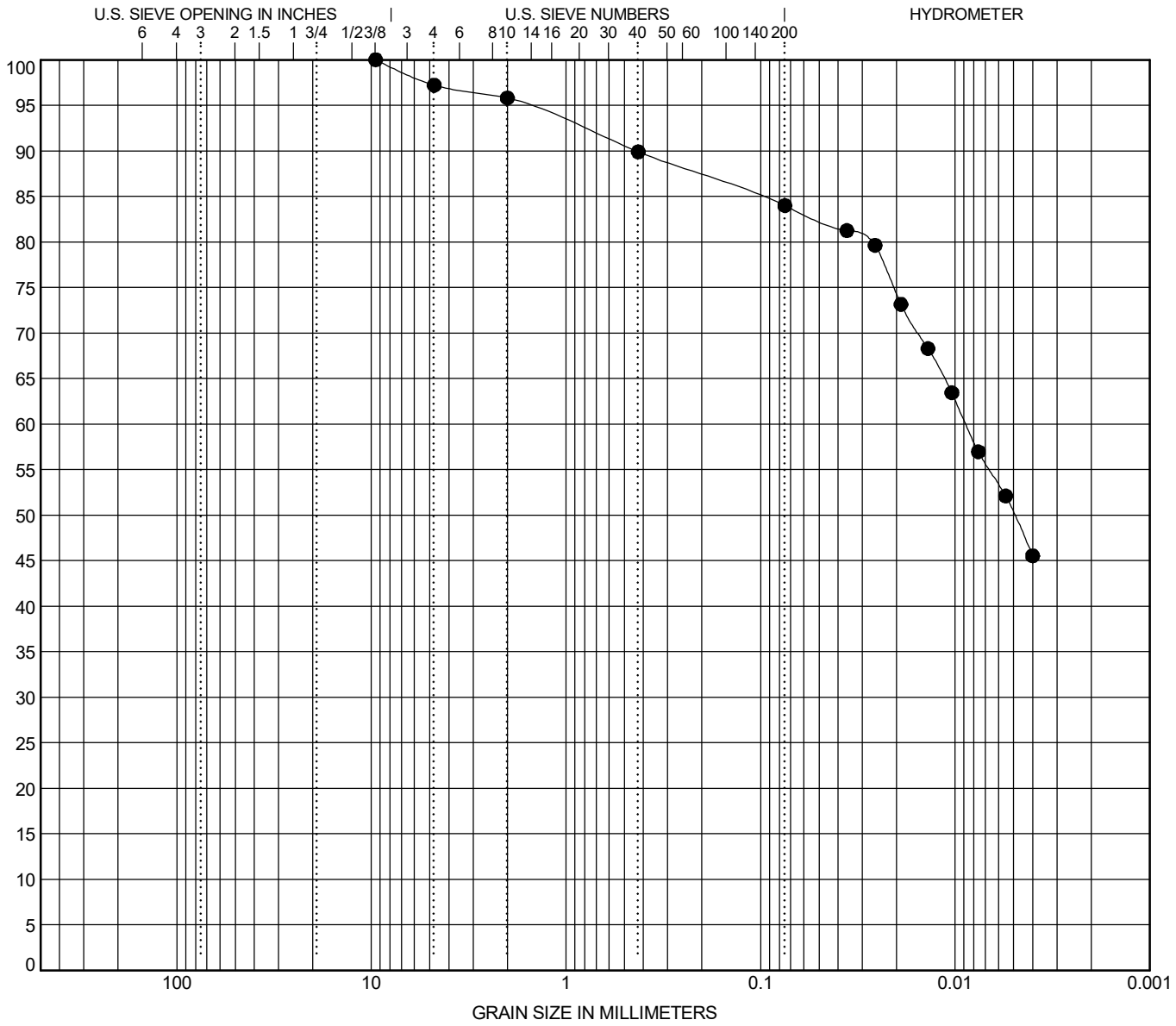
Specimen Identification	Depth	D100	D60	D50	D30	D10	%Gravel	%Coarse Sand	%Fine Sand	%Silt	%Clay
B-002-0-24	**18.5**	**12.5**	**0.009**	**0.005**			**9**	**6**	**8**	**28**	**49**

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GRAIN SIZE DISTRIBUTION

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COBBLES	GRAVEL		SAND		SILT OR CLAY
	coarse	fine	coarse	fine	

Specimen Identification	Depth	Classification	MC	LL	PL	PI	Cc	Cu
B-002-0-24	**23.5**	**A-6b(10)**	**8**	**34**	**18**	**16**		

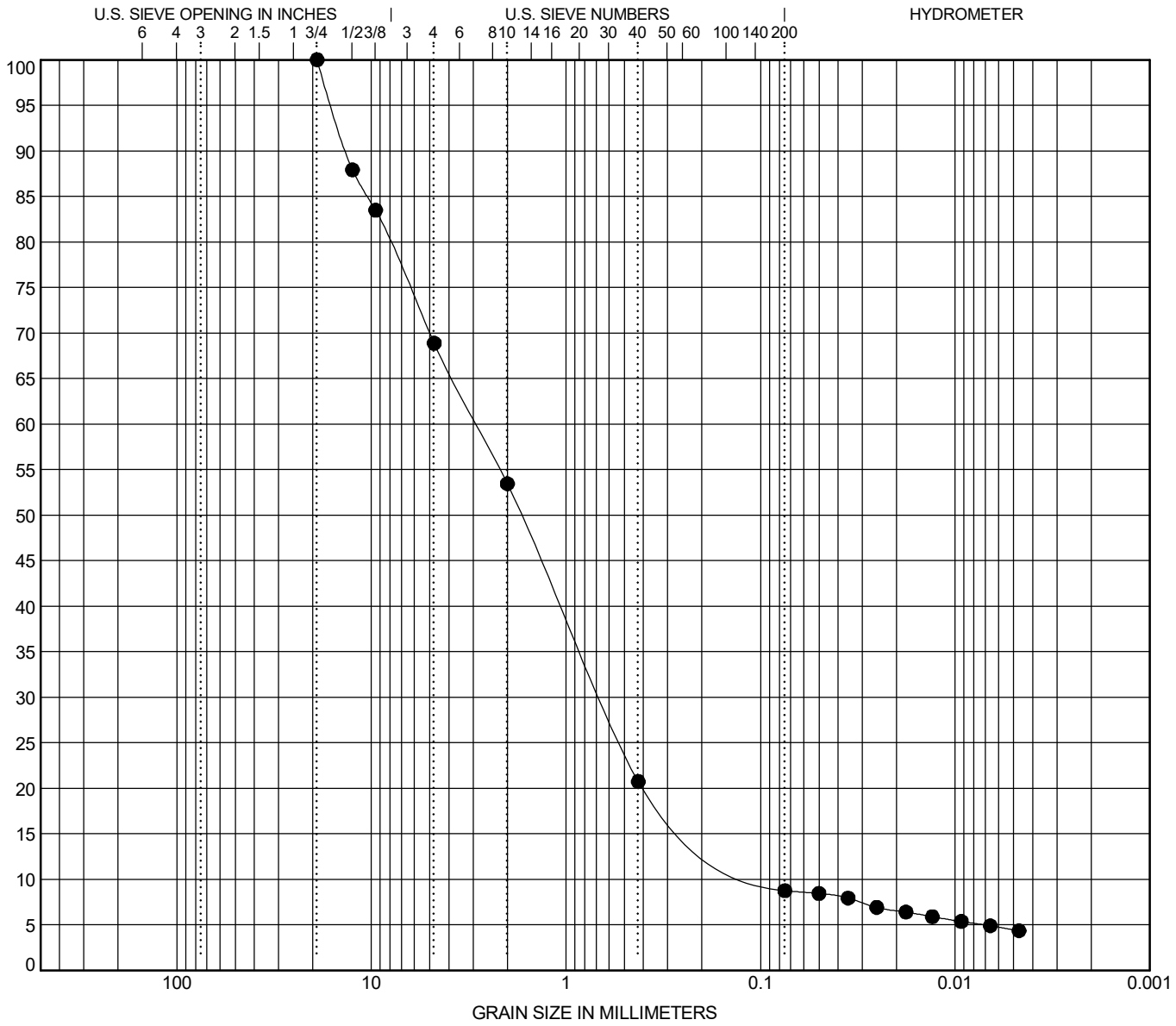
Specimen Identification	Depth	D100	D60	D50	D30	D10	%Gravel	%Coarse Sand	%Fine Sand	%Silt	%Clay
B-002-0-24	**23.5**	**9.5**	**0.009**	**0.005**			**4**	**6**	**6**	**34**	**50**

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COBBLES	GRAVEL		SAND		SILT OR CLAY
	coarse	fine	coarse	fine	

Specimen Identification	Depth	Classification	MC	LL	PL	PI	Cc	Cu
B-003-0-24	**1.0**	**A-1-b(0)**	**15**	**NP**	**NP**	**NP**	**1.67**	**32.09**

Specimen Identification	Depth	D100	D60	D50	D30	D10	%Gravel	%Coarse Sand	%Fine Sand	%Silt	%Clay
B-003-0-24	**1.0**	**19**	**2.89**	**1.7**	**0.659**	**0.09**	**46**	**33**	**12**	**5**	**4**

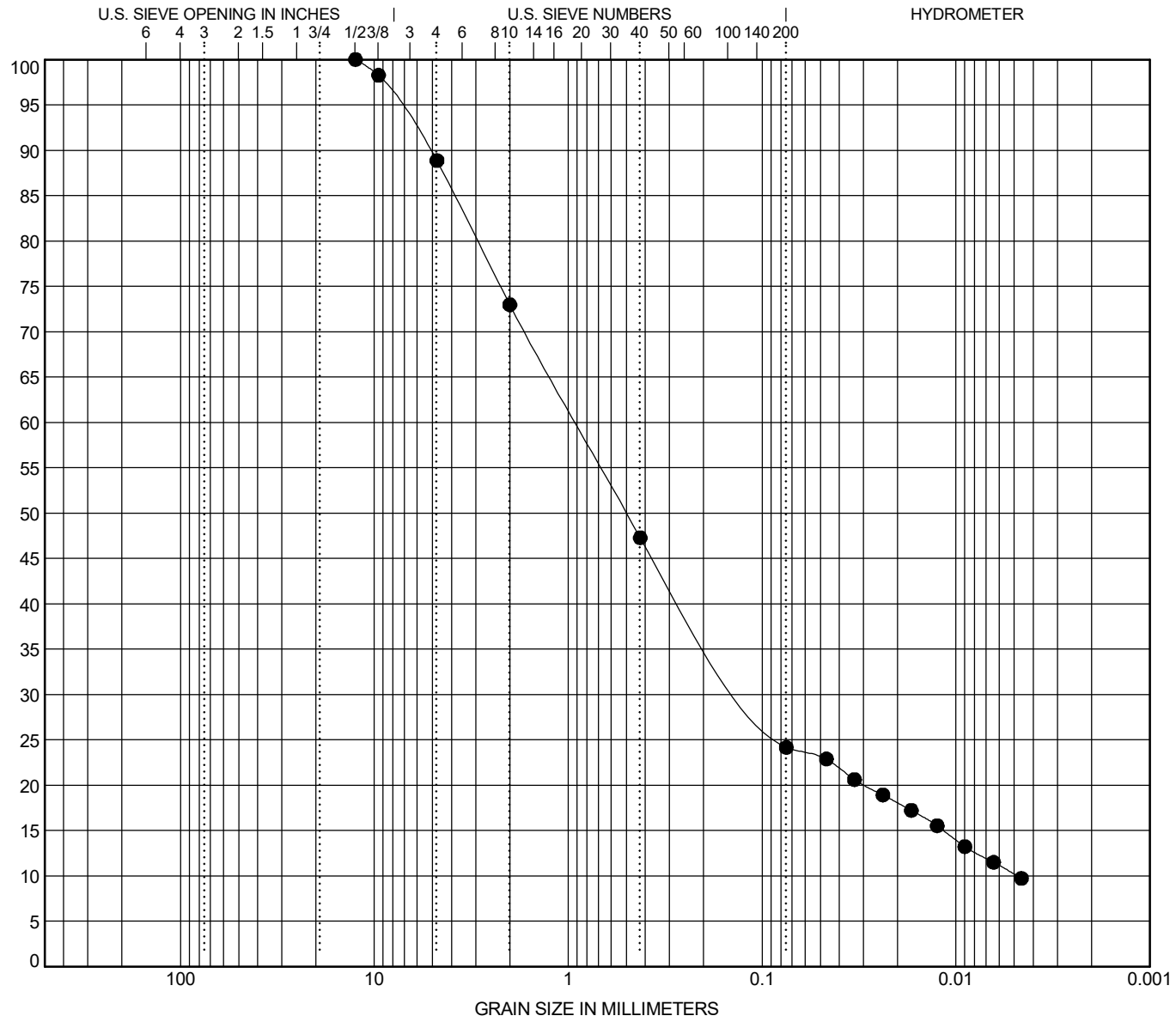
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COBBLES	GRAVEL		SAND		SILT OR CLAY
	coarse	fine	coarse	fine	

Specimen Identification	Depth	Classification	MC	LL	PL	PI	Cc	Cu
B-003-0-24	**4.0**	**A-1-b(0)**	**11**	**NP**	**NP**	**NP**	**3.05**	**188.66**

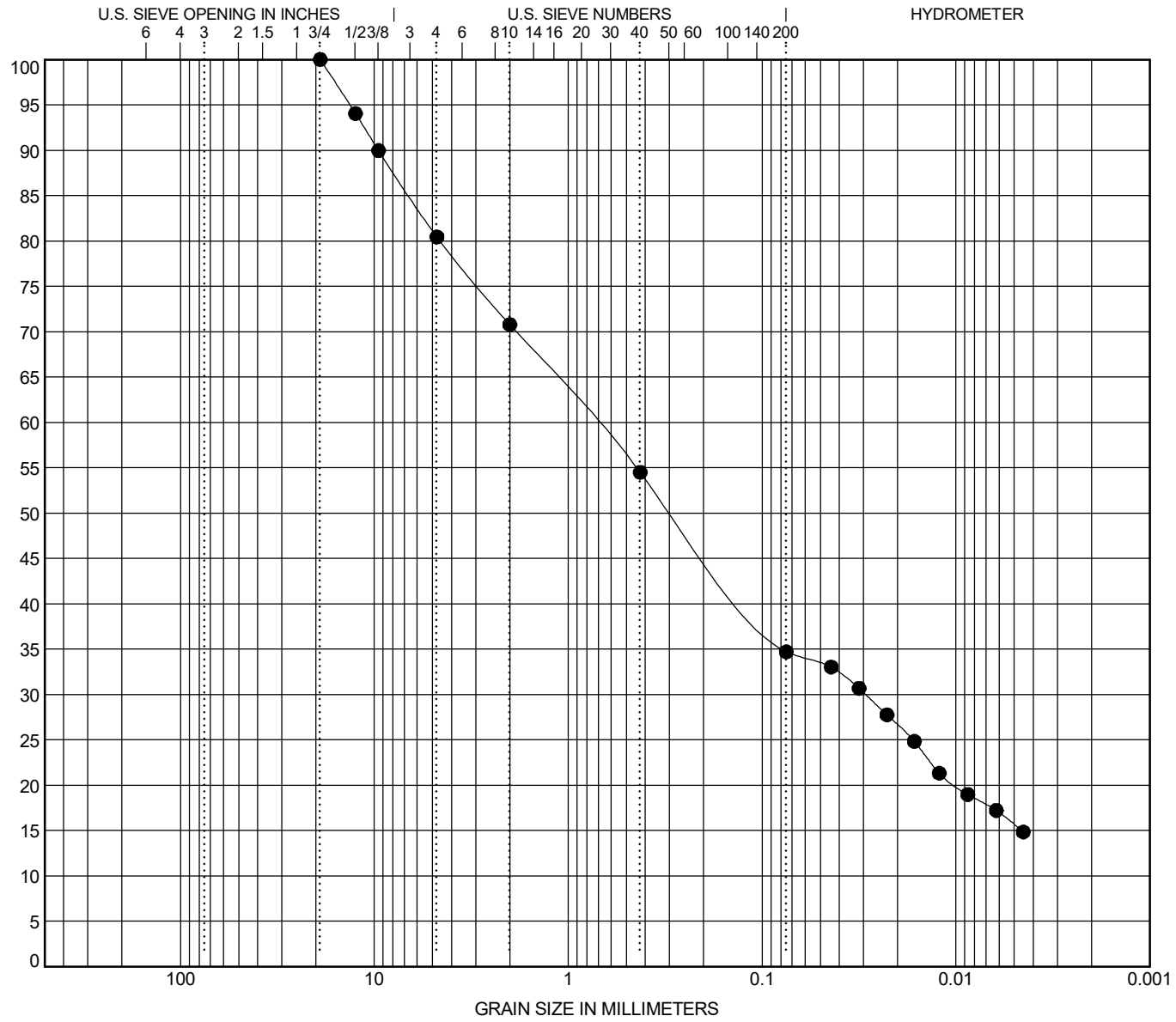
Specimen Identification	Depth	D100	D60	D50	D30	D10	%Gravel	%Coarse Sand	%Fine Sand	%Silt	%Clay
B-003-0-24	**4.0**	**12.5**	**0.916**	**0.501**	**0.116**	**0.005**	**27**	**26**	**23**	**14**	**10**

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COBBLES	GRAVEL		SAND		SILT OR CLAY
	coarse	fine	coarse	fine	

Specimen Identification	Depth	Classification	MC	LL	PL	PI	Cc	Cu
B-003-0-24	**5.5**	**A-2-4(0)**	**7**	**21**	**12**	**9**		

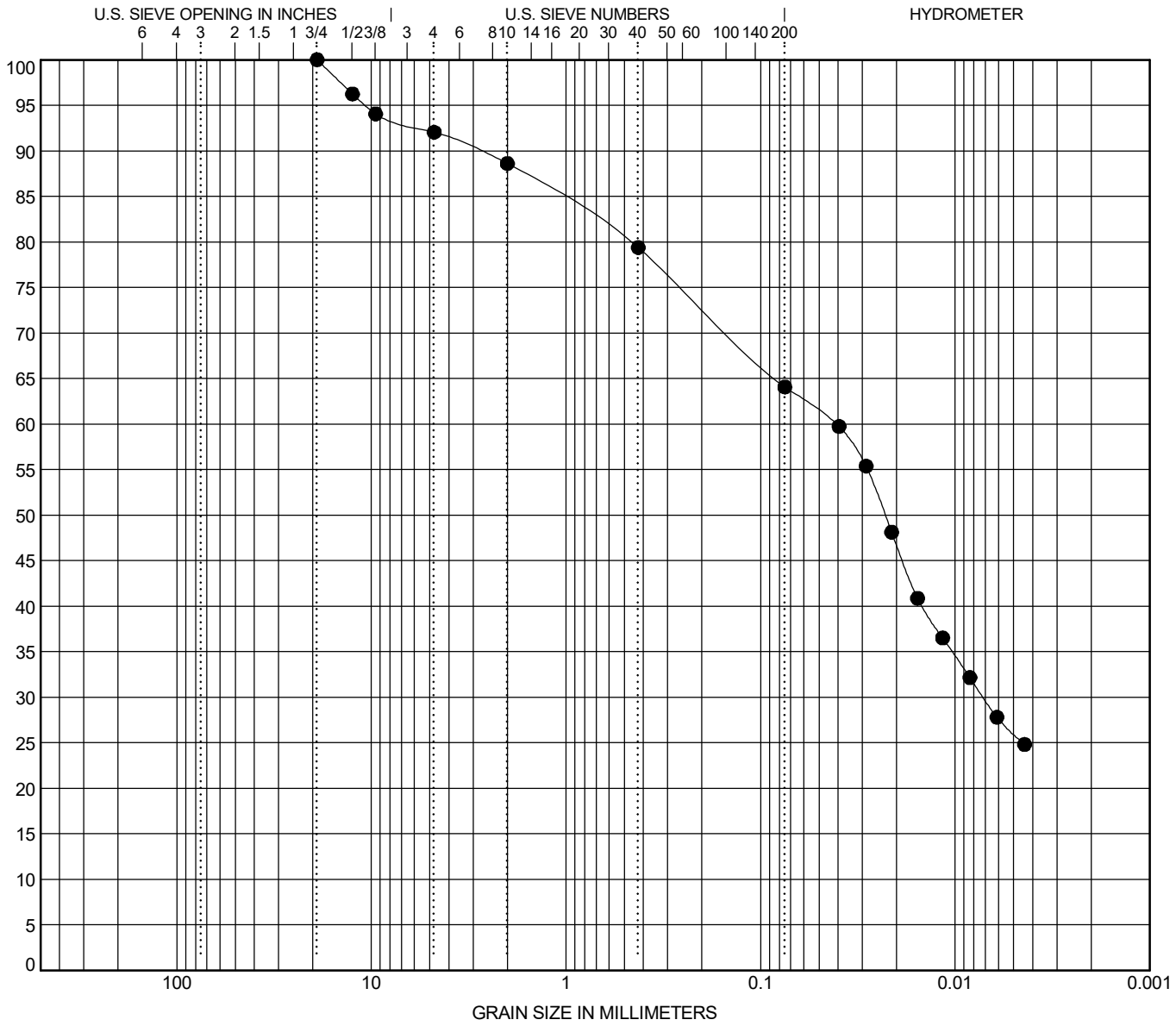
Specimen Identification	Depth	D100	D60	D50	D30	D10	%Gravel	%Coarse Sand	%Fine Sand	%Silt	%Clay
B-003-0-24	**5.5**	**19**	**0.718**	**0.287**	**0.029**		**29**	**16**	**20**	**19**	**16**

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COBBLES	GRAVEL		SAND		SILT OR CLAY
	coarse	fine	coarse	fine	

Specimen Identification	Depth	Classification	MC	LL	PL	PI	Cc	Cu
B-003-0-24	**7.0**	**A-4a(6)**	**15**	**22**	**14**	**8**		

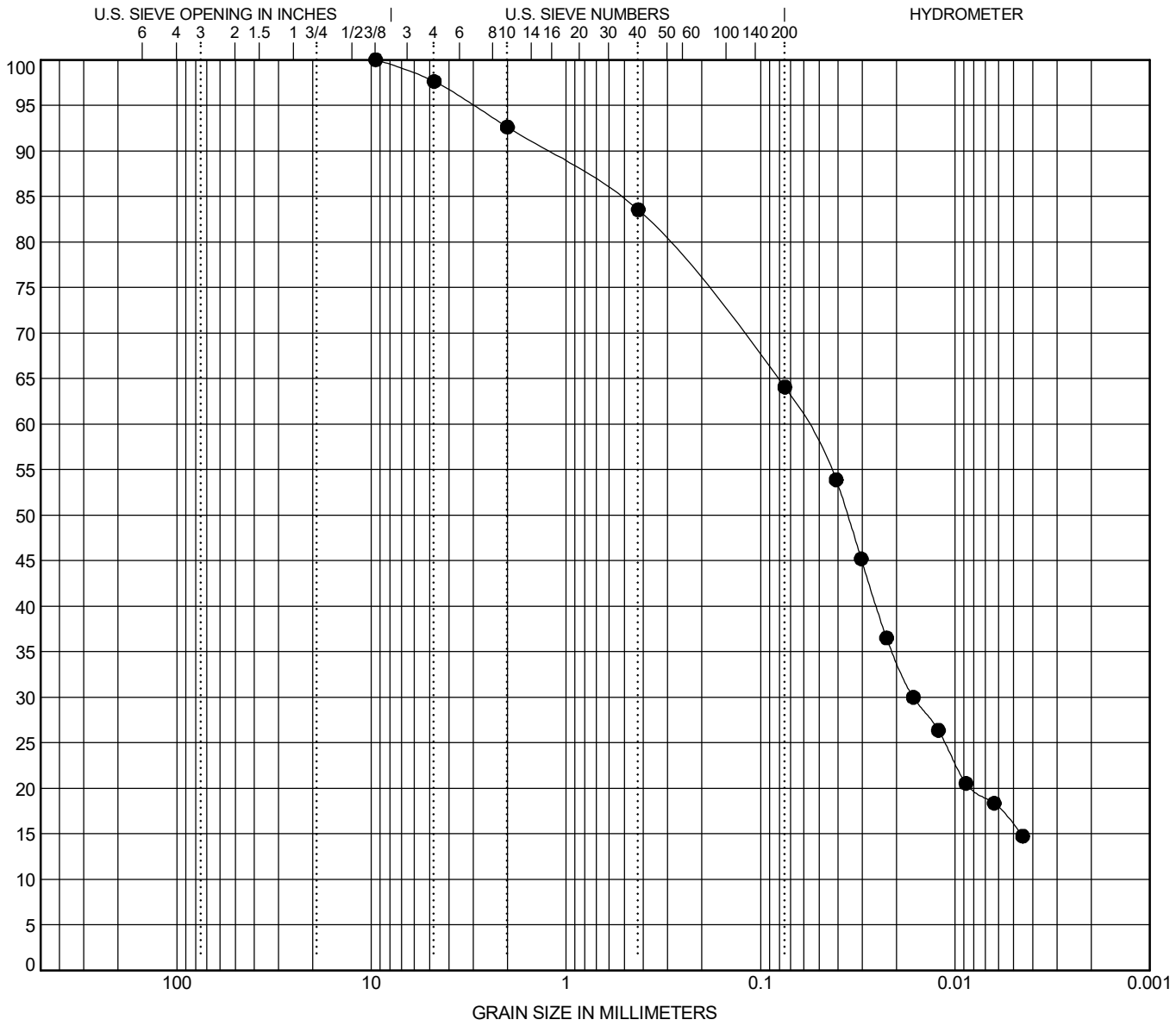
Specimen Identification	Depth	D100	D60	D50	D30	D10	%Gravel	%Coarse Sand	%Fine Sand	%Silt	%Clay
B-003-0-24	**7.0**	**19**	**0.041**	**0.023**	**0.007**		**12**	**9**	**15**	**38**	**26**

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COBBLES	GRAVEL		SAND		SILT OR CLAY
	coarse	fine	coarse	fine	

Specimen Identification	Depth	Classification	MC	LL	PL	PI	Cc	Cu
B-003-0-24	**10.0**	**A-4a(0)**	**17**	**NP**	**NP**	**NP**		

Specimen Identification	Depth	D100	D60	D50	D30	D10	%Gravel	%Coarse Sand	%Fine Sand	%Silt	%Clay
B-003-0-24	**10.0**	**9.5**	**0.059**	**0.036**	**0.016**		**8**	**9**	**19**	**48**	**16**

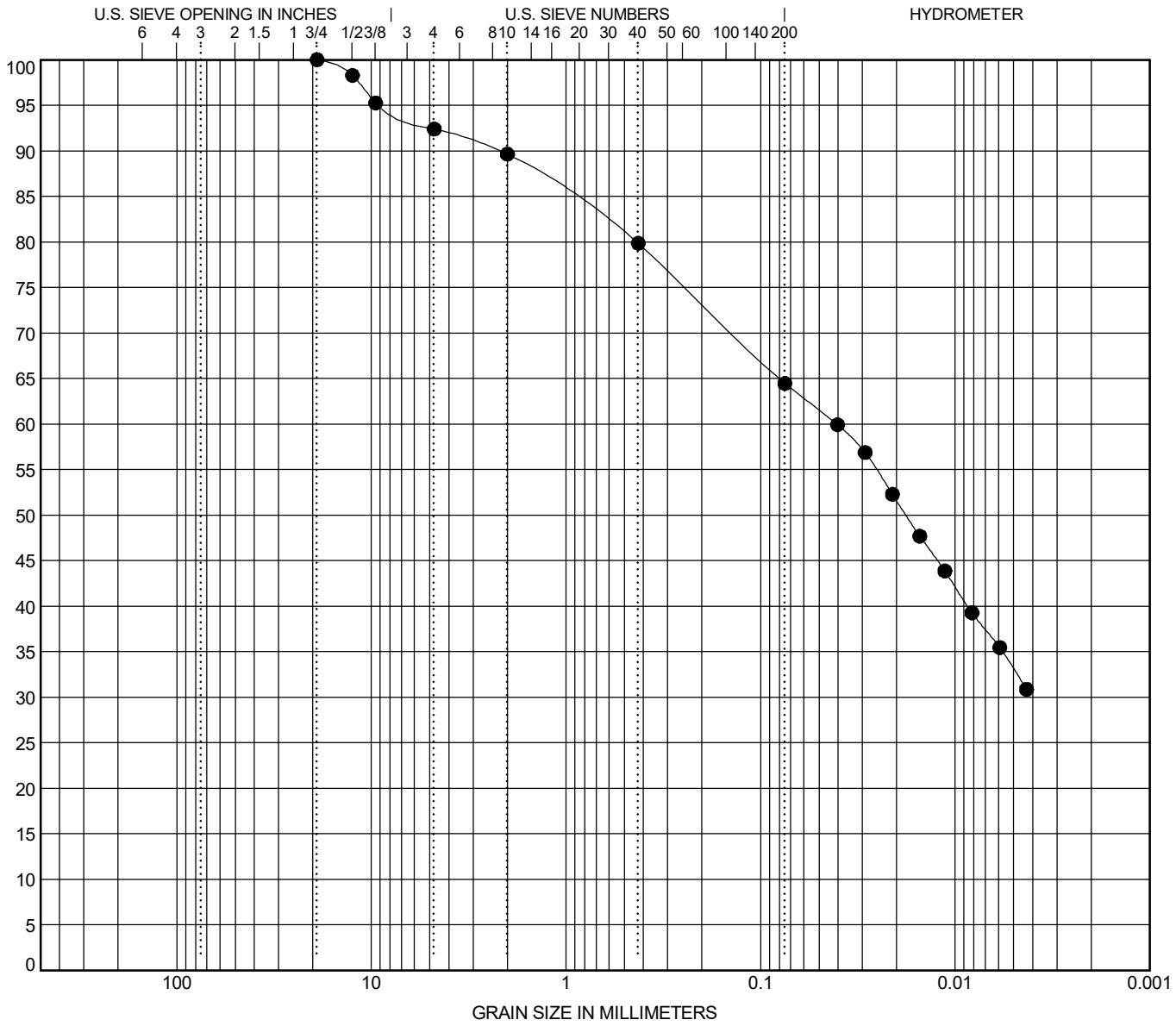
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COBBLES	GRAVEL		SAND		SILT OR CLAY
	coarse	fine	coarse	fine	

Specimen Identification	Depth	Classification	MC	LL	PL	PI	Cc	Cu
B-003-0-24	**12.5**	**A-6a(7)**	**12**	**27**	**14**	**13**		

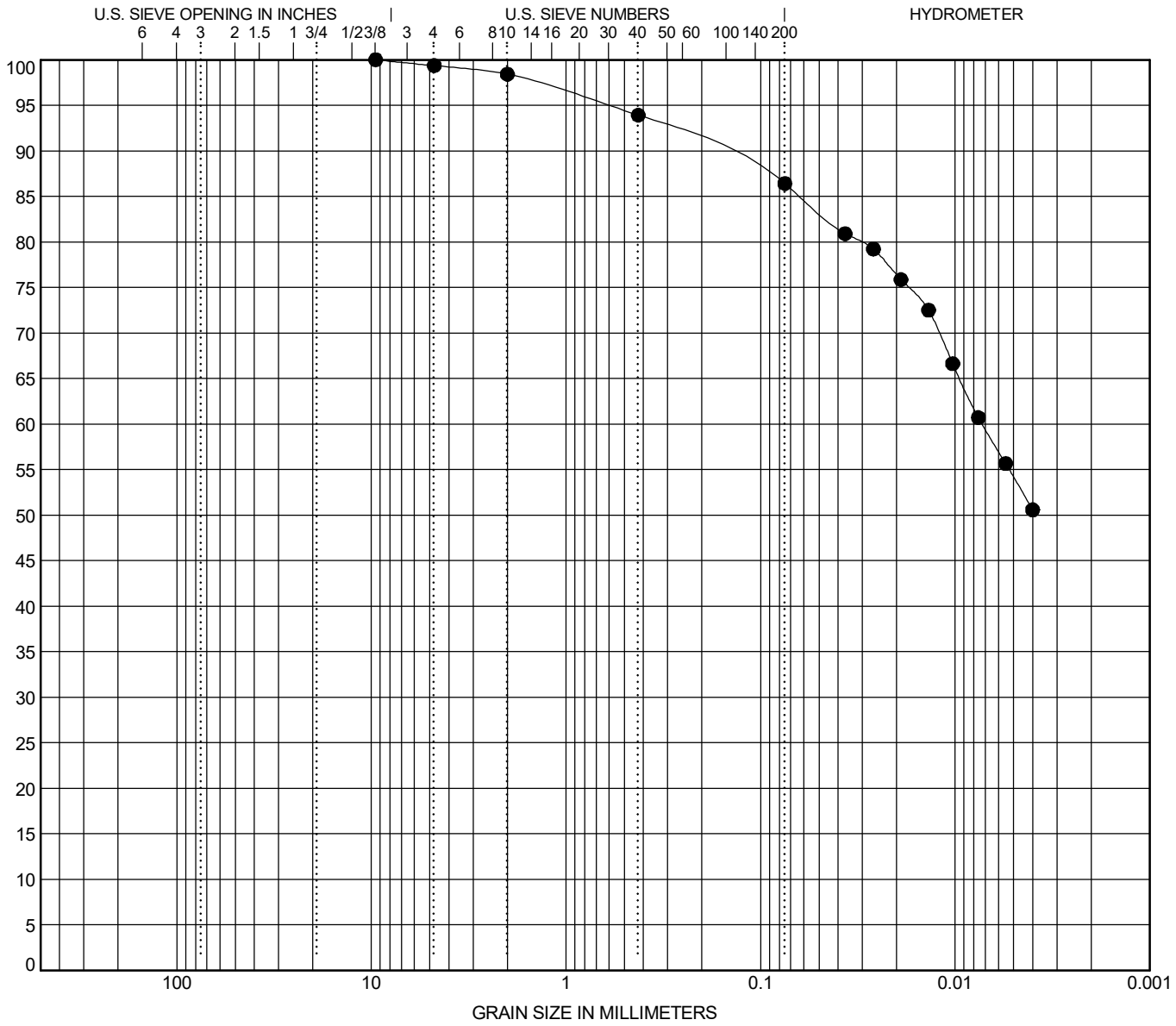
Specimen Identification	Depth	D100	D60	D50	D30	D10	%Gravel	%Coarse Sand	%Fine Sand	%Silt	%Clay
B-003-0-24	**12.5**	**19**	**0.041**	**0.018**			**11**	**10**	**15**	**31**	**33**

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COBBLES	GRAVEL		SAND		SILT OR CLAY
	coarse	fine	coarse	fine	

Specimen Identification	Depth	Classification	MC	LL	PL	PI	Cc	Cu
B-003-0-24	**21.0**	**A-7-6(14)**	**22**	**44**	**21**	**23**		

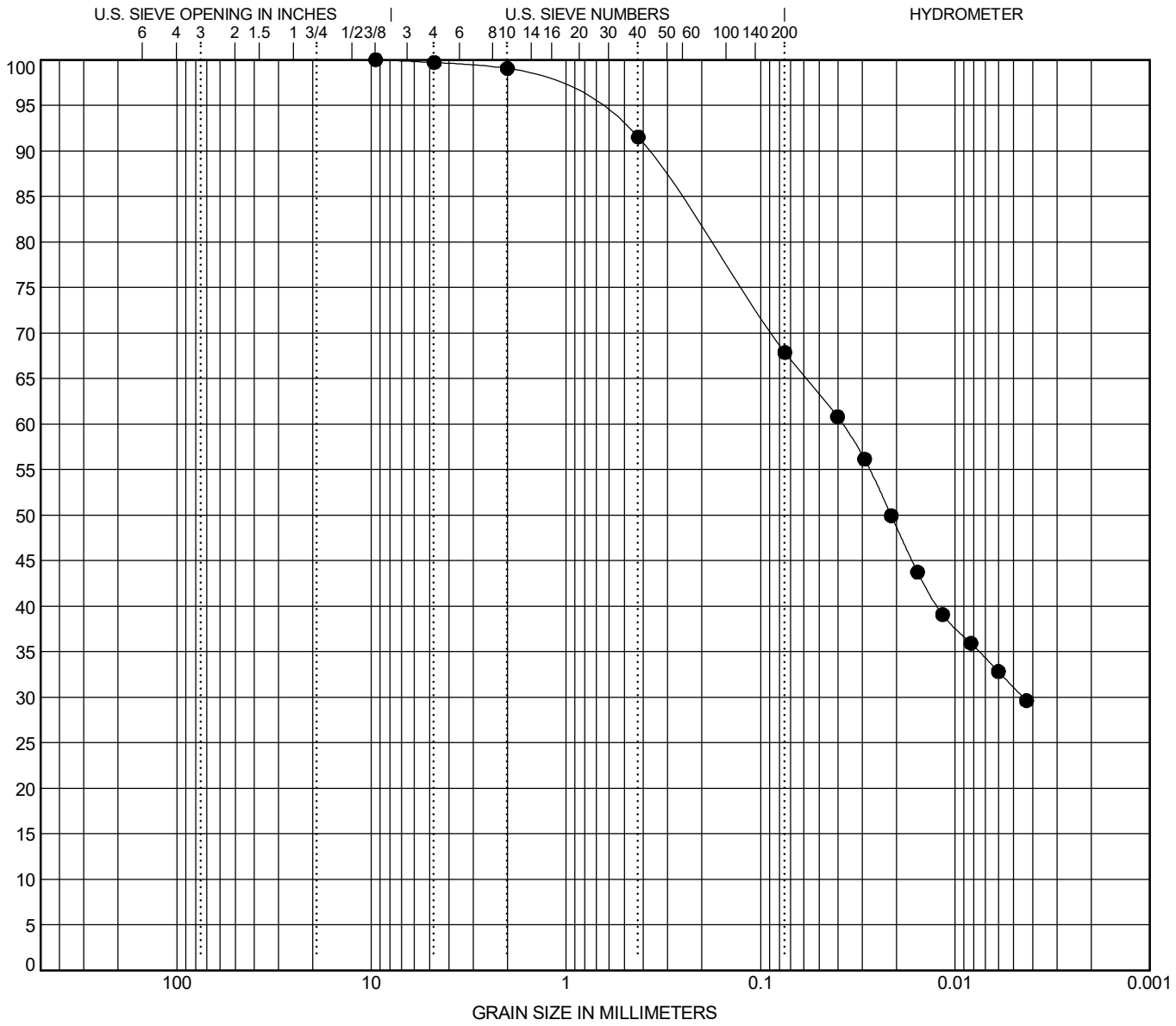
Specimen Identification	Depth	D100	D60	D50	D30	D10	%Gravel	%Coarse Sand	%Fine Sand	%Silt	%Clay
B-003-0-24	**21.0**	**9.5**	**0.007**				**2**	**4**	**8**	**32**	**54**

CTL Engineering, Inc.
2860 Fisher Road
Columbus, Ohio 43204
Telephone: 614-276-8123
Fax: 614-276-6377

GRAIN SIZE DISTRIBUTION

Project: BRO-50-4.49
Location:BRO COUNTY
CTL Project Number:

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COBBLES	GRAVEL		SAND		SILT OR CLAY
	coarse	fine	coarse	fine	

Specimen Identification	Depth	Classification	MC	LL	PL	PI	Cc	Cu
B-004-0-24	**1.0**	**A-6b(10)**	**17**	**34**	**16**	**18**		

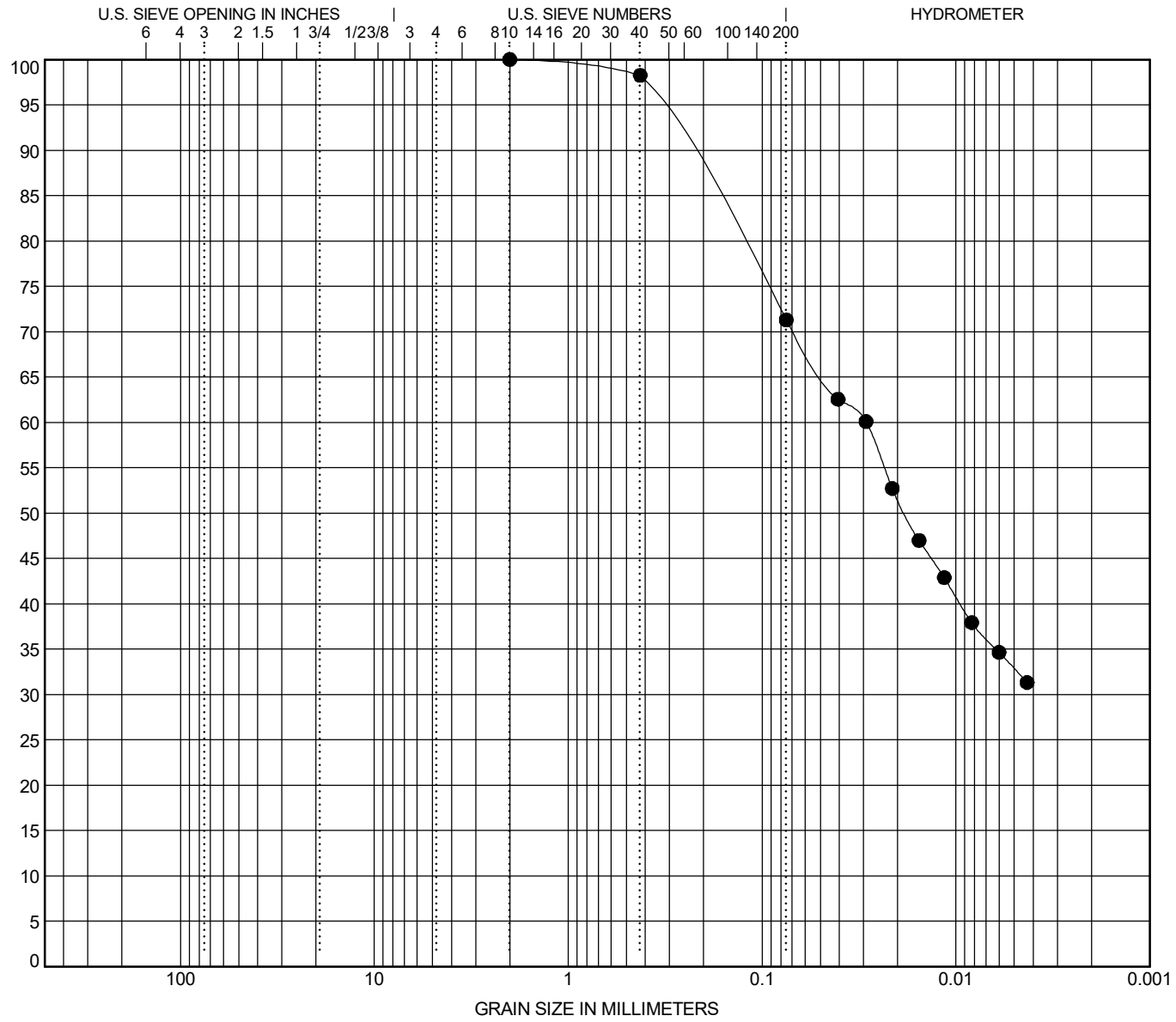
Specimen Identification	Depth	D100	D60	D50	D30	D10	%Gravel	%Coarse Sand	%Fine Sand	%Silt	%Clay
B-004-0-24	**1.0**	**9.5**	**0.038**	**0.021**	**0.004**		**0**	**8**	**24**	**37**	**31**

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GRAIN SIZE DISTRIBUTION

Project: BRO-50-4.49
Location:BRO COUNTY
CTL Project Number:

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COBBLES	GRAVEL		SAND		SILT OR CLAY
	coarse	fine	coarse	fine	

Specimen Identification	Depth	Classification	MC	LL	PL	PI	Cc	Cu
B-004-0-24	**6.0**	**A-6b(10)**	**25**	**34**	**16**	**18**		

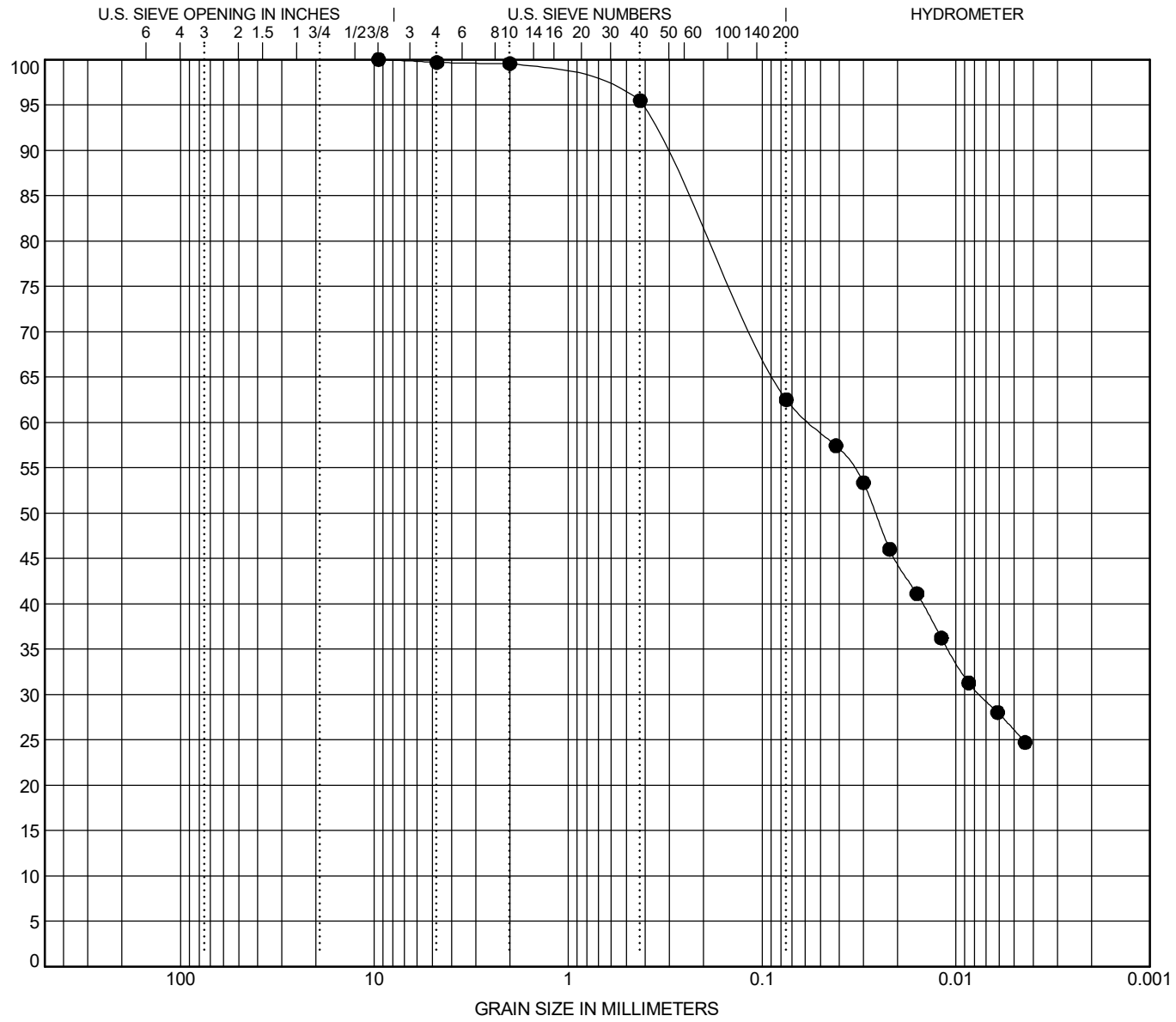
Specimen Identification	Depth	D100	D60	D50	D30	D10	%Gravel	%Coarse Sand	%Fine Sand	%Silt	%Clay
B-004-0-24	**6.0**	**2**	**0.029**	**0.018**			**0**	**2**	**27**	**38**	**33**

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Fax: 614-276-6377

GRAIN SIZE DISTRIBUTION

Project: BRO-50-4.49
Location:BRO COUNTY
CTL Project Number:

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COBBLES	GRAVEL		SAND		SILT OR CLAY
	coarse	fine	coarse	fine	

Specimen Identification	Depth	Classification	MC	LL	PL	PI	Cc	Cu
B-004-0-24	**7.5**	**A-6a(7)**	**17**	**29**	**15**	**14**		

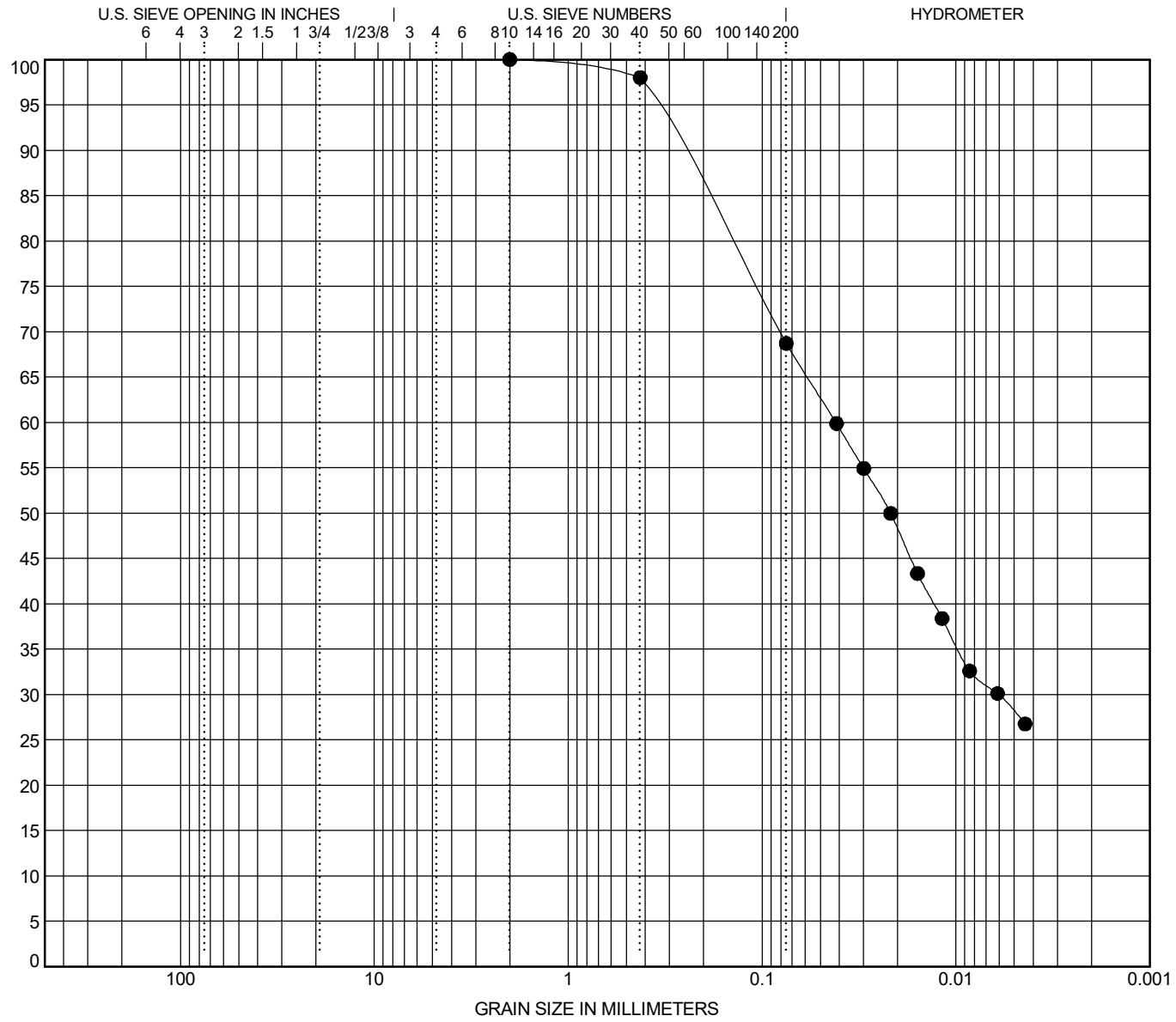
Specimen Identification	Depth	D100	D60	D50	D30	D10	%Gravel	%Coarse Sand	%Fine Sand	%Silt	%Clay
B-004-0-24	**7.5**	**9.5**	**0.056**	**0.026**	**0.008**		**1**	**4**	**33**	**36**	**26**

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GRAIN SIZE DISTRIBUTION

Project: BRO-50-4.49
Location:BRO COUNTY
CTL Project Number:

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COBBLES	GRAVEL		SAND		SILT OR CLAY
	coarse	fine	coarse	fine	

Specimen Identification	Depth	Classification	MC	LL	PL	PI	Cc	Cu
B-004-0-24	**9.0**	**A-6a(8)**	**16**	**29**	**15**	**14**		

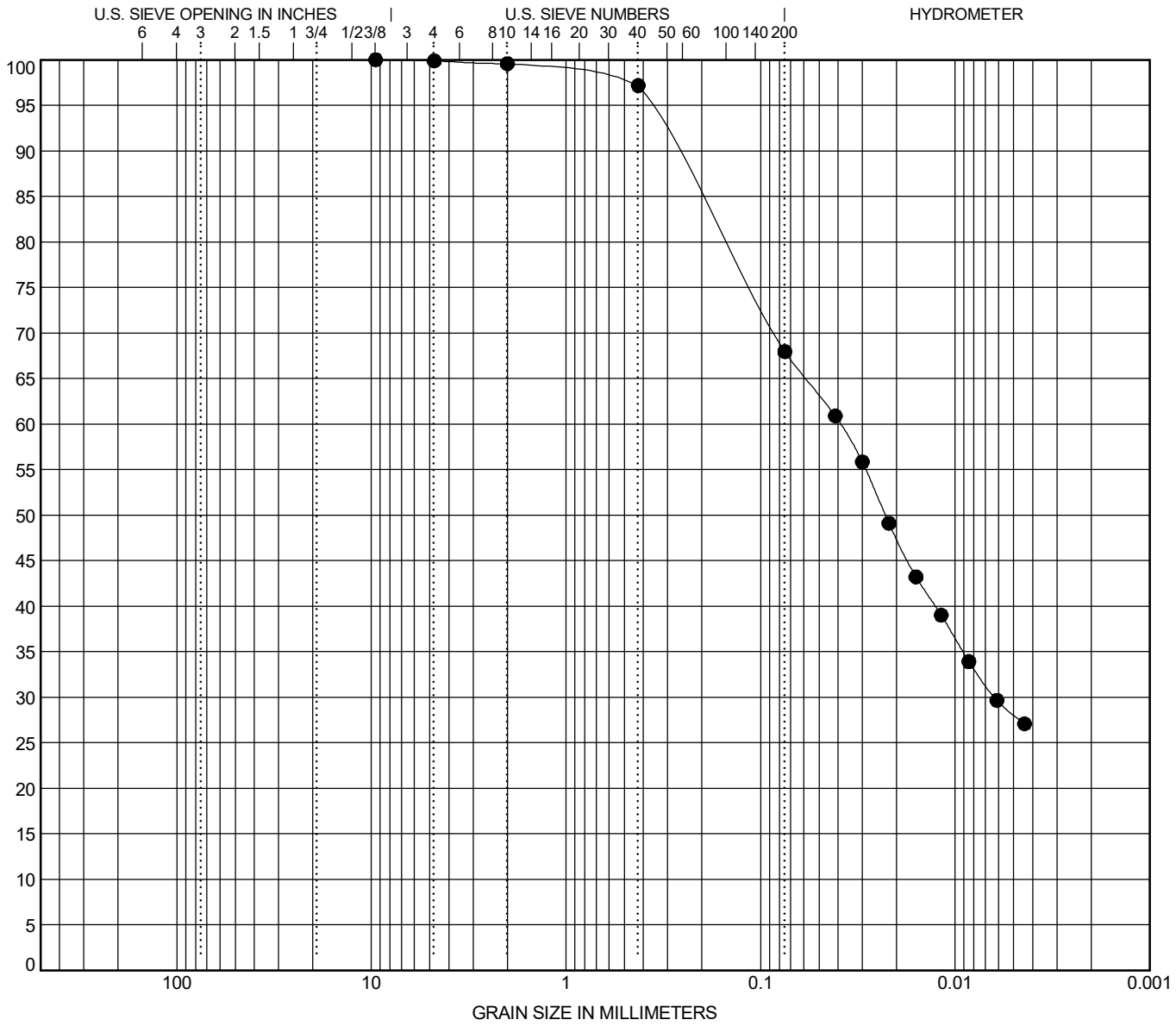
Specimen Identification	Depth	D100	D60	D50	D30	D10	%Gravel	%Coarse Sand	%Fine Sand	%Silt	%Clay
B-004-0-24	**9.0**	**2**	**0.042**	**0.022**	**0.006**		**0**	**2**	**29**	**41**	**28**

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GRAIN SIZE DISTRIBUTION

Project: BRO-50-4.49
Location:BRO COUNTY
CTL Project Number:

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COBBLES	GRAVEL		SAND		SILT OR CLAY
	coarse	fine	coarse	fine	

Specimen Identification	Depth	Classification	MC	LL	PL	PI	Cc	Cu
B-004-0-24	**10.5**	**A-6a(7)**	**16**	**28**	**16**	**12**		

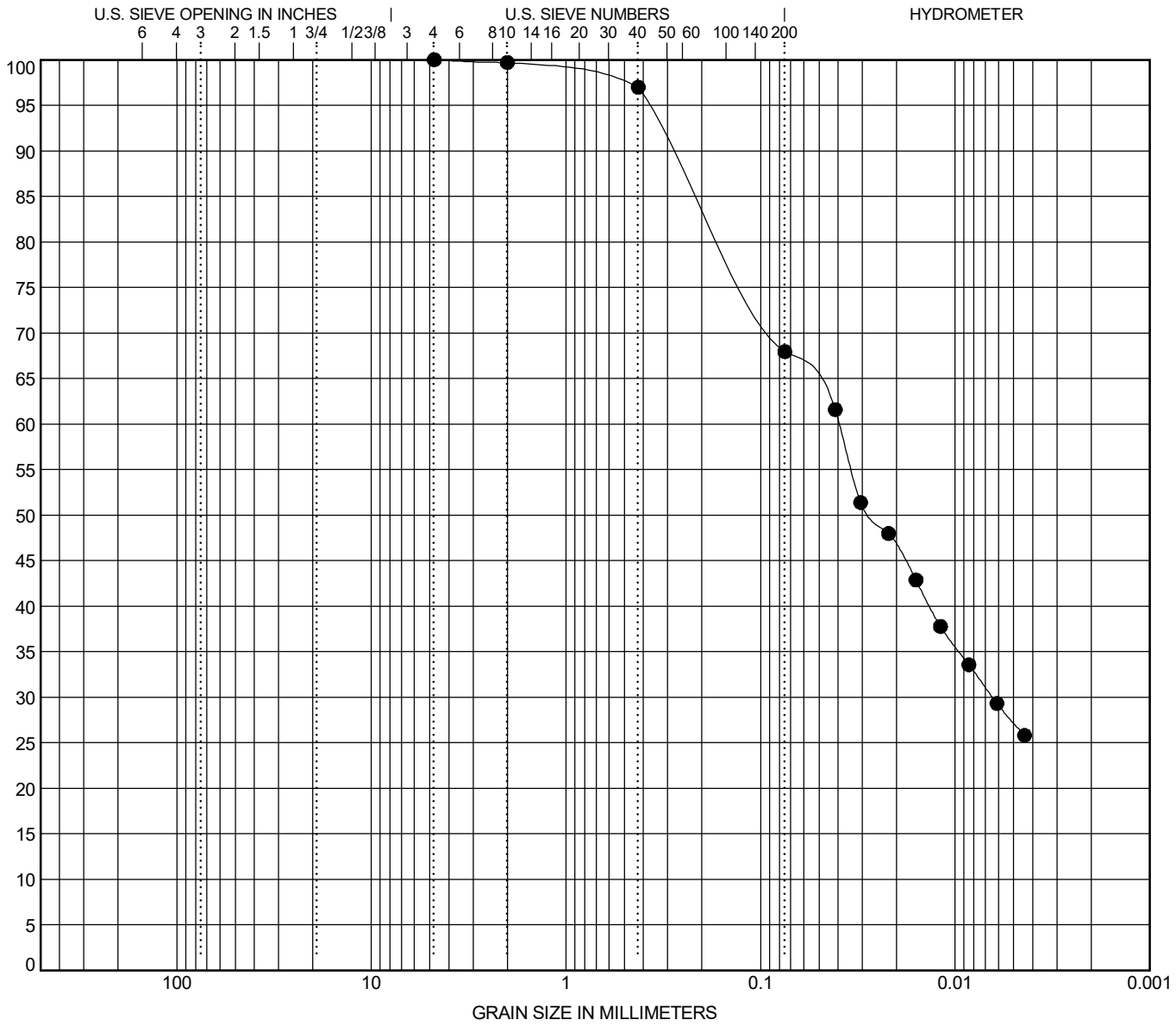
Specimen Identification	Depth	D100	D60	D50	D30	D10	%Gravel	%Coarse Sand	%Fine Sand	%Silt	%Clay
B-004-0-24	**10.5**	**9.5**	**0.039**	**0.023**	**0.006**		**1**	**2**	**29**	**40**	**28**

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GRAIN SIZE DISTRIBUTION

Project: BRO-50-4.49
Location:BRO COUNTY
CTL Project Number:

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COBBLES	GRAVEL		SAND		SILT OR CLAY
	coarse	fine	coarse	fine	

Specimen Identification	Depth	Classification	MC	LL	PL	PI	Cc	Cu
B-004-0-24	**12.0**	**A-4a(7)**	**17**	**27**	**19**	**8**		

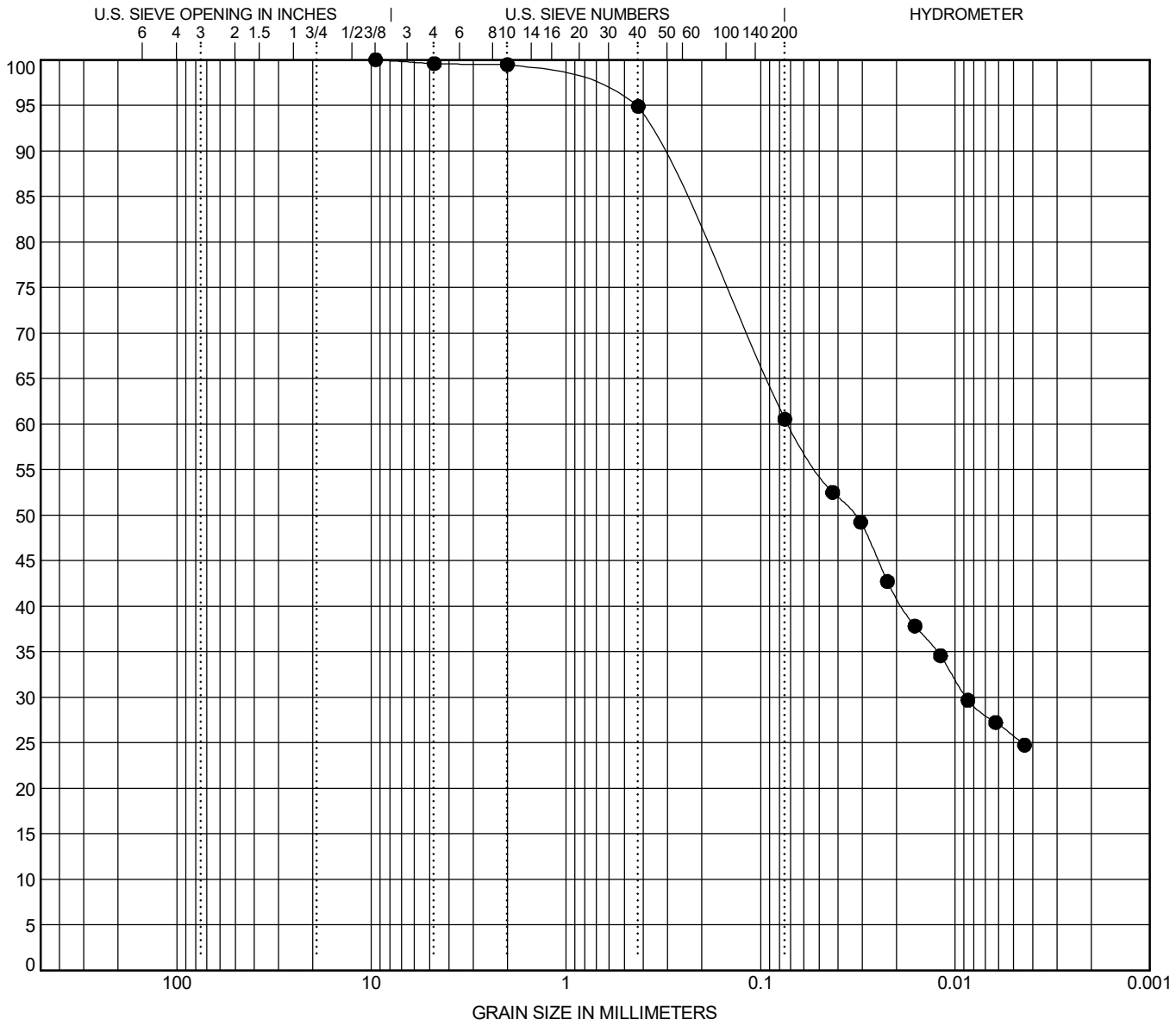
Specimen Identification	Depth	D100	D60	D50	D30	D10	%Gravel	%Coarse Sand	%Fine Sand	%Silt	%Clay
B-004-0-24	**12.0**	**4.75**	**0.039**	**0.027**	**0.006**		**0**	**3**	**29**	**41**	**27**

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GRAIN SIZE DISTRIBUTION

Project: BRO-50-4.49
Location:BRO COUNTY
CTL Project Number:

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COBBLES	GRAVEL		SAND		SILT OR CLAY
	coarse	fine	coarse	fine	

Specimen Identification	Depth	Classification	MC	LL	PL	PI	Cc	Cu
B-004-0-24	**13.5**	**A-6a(6)**	**15**	**27**	**14**	**13**		

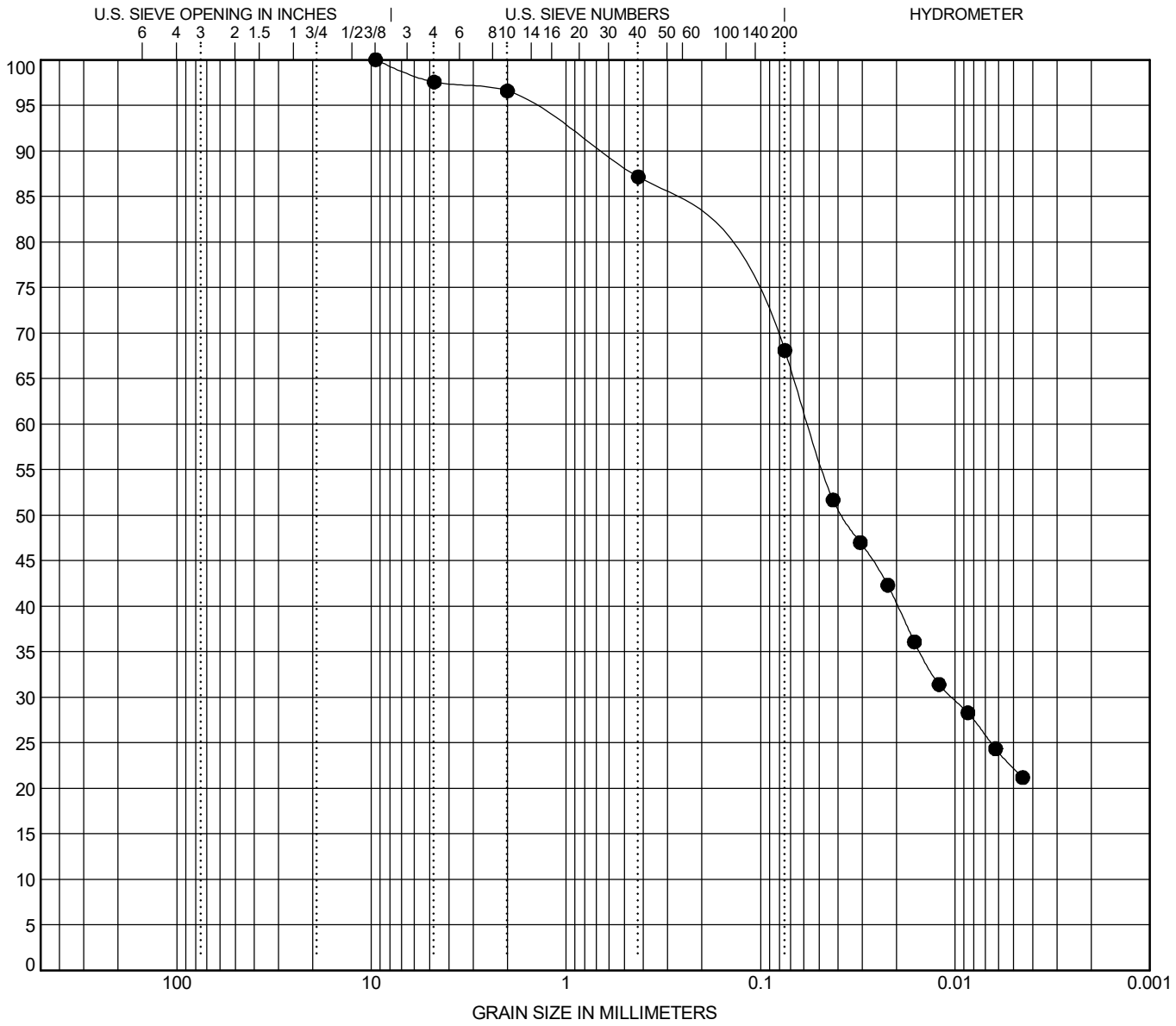
Specimen Identification	Depth	D100	D60	D50	D30	D10	%Gravel	%Coarse Sand	%Fine Sand	%Silt	%Clay
B-004-0-24	**13.5**	**9.5**	**0.072**	**0.033**	**0.009**		**0**	**5**	**34**	**35**	**26**

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GRAIN SIZE DISTRIBUTION

Project: BRO-50-4.49
Location:BRO COUNTY
CTL Project Number:

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COBBLES	GRAVEL		SAND		SILT OR CLAY
	coarse	fine	coarse	fine	

Specimen Identification	Depth	Classification	MC	LL	PL	PI	Cc	Cu
B-004-0-24	**16.5**	**A-6a(7)**	**18**	**28**	**16**	**12**		

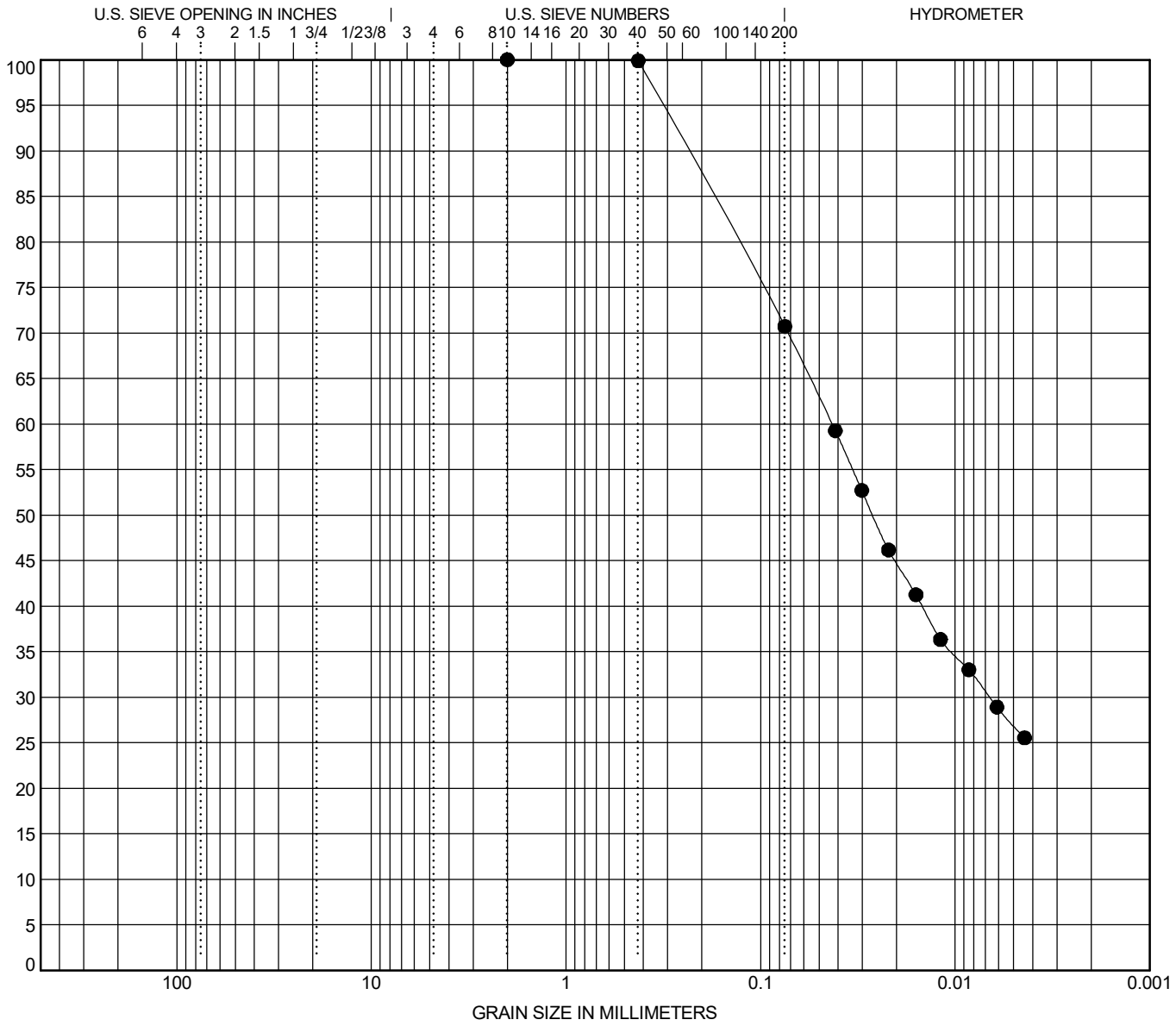
Specimen Identification	Depth	D100	D60	D50	D30	D10	%Gravel	%Coarse Sand	%Fine Sand	%Silt	%Clay
B-004-0-24	**16.5**	**9.5**	**0.057**	**0.038**	**0.01**		**4**	**9**	**19**	**46**	**22**

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Columbus, Ohio 43204
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GRAIN SIZE DISTRIBUTION

Project: BRO-50-4.49
Location:BRO COUNTY
CTL Project Number:

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COBBLES	GRAVEL		SAND		SILT OR CLAY
	coarse	fine	coarse	fine	

Specimen Identification	Depth	Classification	MC	LL	PL	PI	Cc	Cu
B-004-0-24	**24.0**	**A-6a(9)**	**25**	**32**	**17**	**15**		

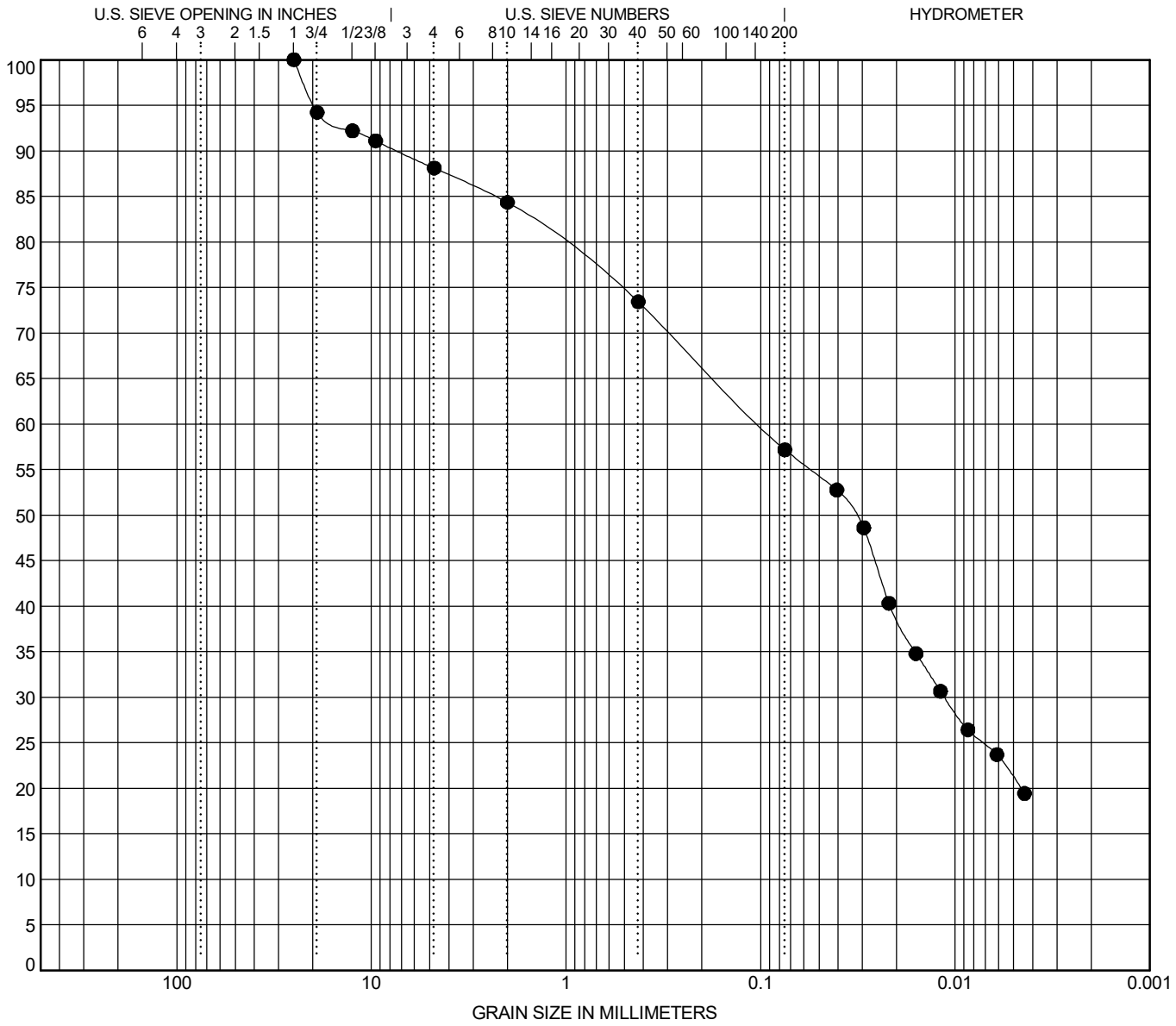
Specimen Identification	Depth	D100	D60	D50	D30	D10	%Gravel	%Coarse Sand	%Fine Sand	%Silt	%Clay
B-004-0-24	**24.0**	**2**	**0.043**	**0.026**	**0.007**		**0**	**0**	**29**	**44**	**27**

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Columbus, Ohio 43204
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Fax: 614-276-6377

GRAIN SIZE DISTRIBUTION

Project: BRO-50-4.49
Location:BRO COUNTY
CTL Project Number:

CTL GRADATION - 2014 ODOT.GDT - 2/26/25 14:02 - O:\PROJECT\2024\COL-05\24050024COL_EMHANDT_BRO-50-4-49 BRIDGE REPLACEMENT\LAB AND LOGS\GINT\24050024COL.GPJ



COBBLES	GRAVEL		SAND		SILT OR CLAY
	coarse	fine	coarse	fine	

Specimen Identification	Depth	Classification	MC	LL	PL	PI	Cc	Cu
B-004-0-24	**36.5**	**A-4a(4)**	**12**	**22**	**13**	**9**		

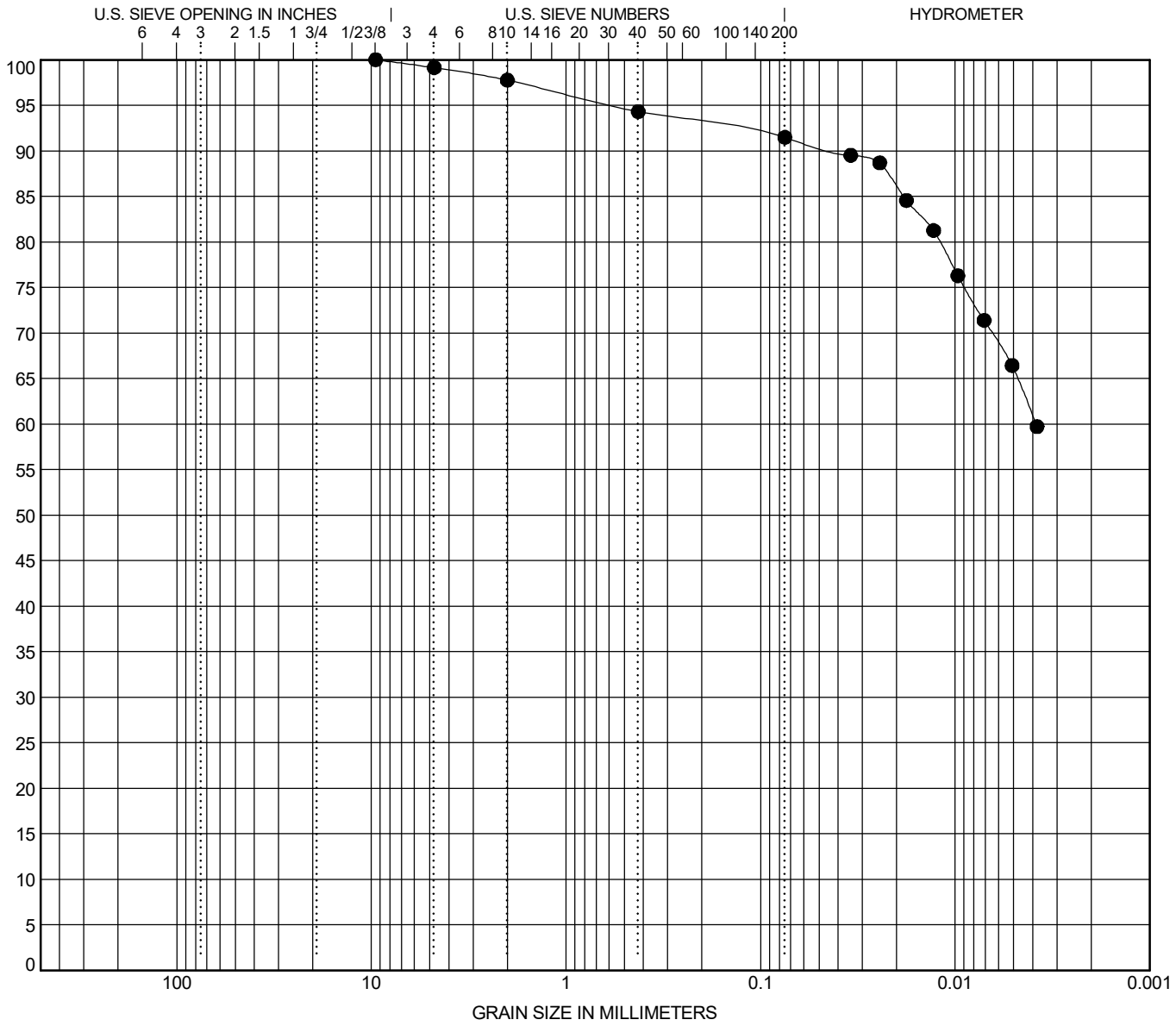
Specimen Identification	Depth	D100	D60	D50	D30	D10	%Gravel	%Coarse Sand	%Fine Sand	%Silt	%Clay
B-004-0-24	**36.5**	**25**	**0.102**	**0.033**	**0.011**		**16**	**11**	**16**	**36**	**21**

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Columbus, Ohio 43204
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Fax: 614-276-6377

GRAIN SIZE DISTRIBUTION

Project: BRO-50-4.49
Location:BRO COUNTY
CTL Project Number:

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COBBLES	GRAVEL		SAND		SILT OR CLAY
	coarse	fine	coarse	fine	

Specimen Identification	Depth	Classification	MC	LL	PL	PI	Cc	Cu
B-004-0-24	**56.5**	**A-7-6(18)**	**27**	**51**	**22**	**29**		

Specimen Identification	Depth	D100	D60	D50	D30	D10	%Gravel	%Coarse Sand	%Fine Sand	%Silt	%Clay
B-004-0-24	**56.5**	**9.5**	**0.004**				**3**	**3**	**3**	**25**	**66**

CTL Engineering, Inc.
2860 Fisher Road
Columbus, Ohio 43204
Telephone: 614-276-8123
Fax: 614-276-6377

GRAIN SIZE DISTRIBUTION

Project: BRO-50-4.49
Location:BRO COUNTY
CTL Project Number:

CTL GRADATION - 2014 ODOT.GDT - 2/26/25 14:02 - O:\PROJECT\2024\COL-05\24050024COL_EMHANDT_BRO-50-4-49 BRIDGE REPLACEMENT\LAB AND LOGS\GINT\24050024COL.GPJ

PROJECT NO:	24050024COL
DATE:	10/10/2024

UNIAXIAL COMPRESSIVE STRENGTH OF INTACT ROCK CORE - ASTM D 7012

Method C

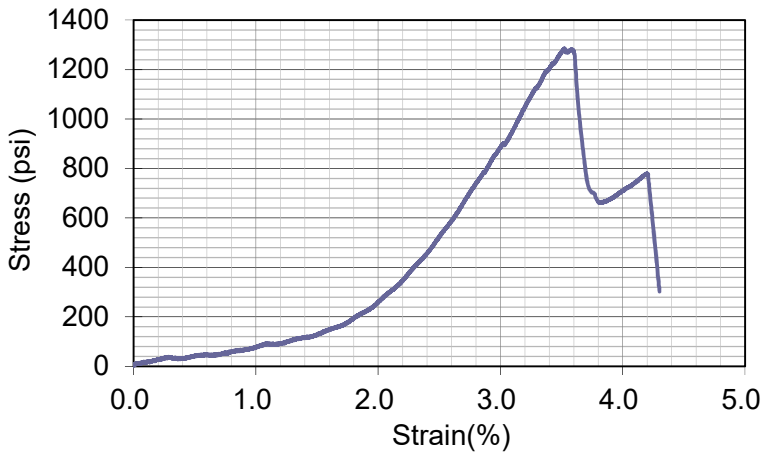
BORING NUMBER	B-001-0-24	TOP DEPTH(FT)	53.5	BOTTOM DEPTH(FT)	54.0
SAMPLE NUMBER	NQ-1	DISTRICT	9	PID NO.	109971
COUNTY	BRO	ROUTE	US 50	SECTION	0.49

FORMATION	Arnheim
DESCRIPTION	Shale, Gray, Moderatly Weatherd, Weak
MOISTURE CONDITION	As Received

MEASUREMENT	LENGTH(INCHES)	DIAMETER(INCHES)
1	4.054	1.962
2	4.056	1.963
3	4.069	1.920
AVERAGE	4.060	1.948

LENGTH/DIAMETER	2.1
CORRECTION FACTOR	1
AREA(IN^2)	3.0
MASS (GRAMS)	477.4
UNIT WEIGHT(LBS/FT^3)	150.3

RATE OF LOADING (in/min)
0.11
COMPRESSIVE STRENGTH (PSI)
1,290
Equip. ID - 68897
NON-CONFORMANCES - None
TIME OF TEST (MINUTES)
1.87
LOADING DIRECTION
PERP. TO BEDDING
TECHNICIAN - MW
TEMPERATURE - Room





BEFORE TESTING



AFTER TESTING

Physical Appearance after Test - Sample sheared through middle portion - No signs of cracking, spalling or shearing at the platen-specimen interface

≤ Prepared in accordance with ASTM D 4543: **Yes; see report**

≤ Received sample preserved in accordance with SGE: **Yes**

≤ Sampled preserved after preparation: **N; Tested immediately after preparation.**

PROJECT NO:	24050024COL
DATE:	10/10/2024

UNIAXIAL COMPRESSIVE STRENGTH OF INTACT ROCK CORE - ASTM D 7012

Method C

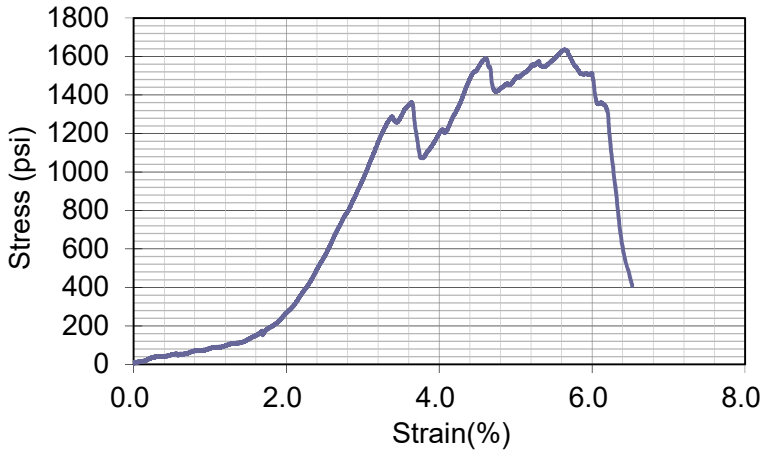
BORING NUMBER	B-002-0-24	TOP DEPTH(FT)	36.2	BOTTOM DEPTH(FT)	36.6
SAMPLE NUMBER	NQ2-1	DISTRICT	9	PID NO.	109971
COUNTY	BRO	ROUTE	US 50	SECTION	0.49

FORMATION	Arnheim
DESCRIPTION	Shale, Gray, moderatly Weatherd, Slightly Strong
MOISTURE CONDITION	As Received

MEASUREMENT	LENGTH(INCHES)	DIAMETER(INCHES)
1	4.077	1.973
2	4.080	1.968
3	4.084	1.979
AVERAGE	4.080	1.973

LENGTH/DIAMETER	2.1
CORRECTION FACTOR	1
AREA(IN^2)	3.1
MASS (GRAMS)	508.1
UNIT WEIGHT(LBS/FT^3)	155.1

RATE OF LOADING (in/min)
0.11
COMPRESSIVE STRENGTH (PSI)
1,640
Equip. ID - 68897
NON-CONFORMANCES - None
TIME OF TEST (MINUTES)
2.28
LOADING DIRECTION
PERP. TO BEDDING
TECHNICIAN - MW
TEMPERATURE - Room





BEFORE TESTING



AFTER TESTING

Physical Appearance after Test - Sample sheared through middle portion - No signs of cracking, spalling or shearing at the platen-specimen interface

≤ Prepared in accordance with ASTM D 4543: **Yes; see report**

≤ Received sample preserved in accordance with SGE: **Yes**

≤ Sampled preserved after preparation: **N; Tested immediately after preparation.**

PROJECT NO:	24050024COL
DATE:	10/10/2024

UNIAXIAL COMPRESSIVE STRENGTH OF INTACT ROCK CORE - ASTM D 7012

Method C

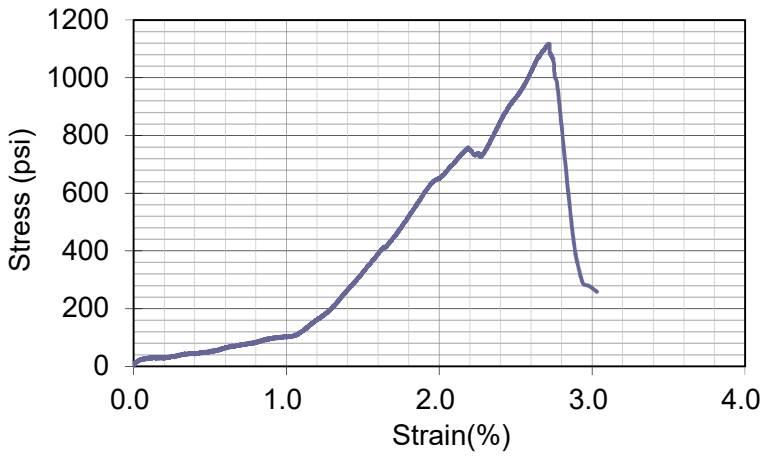
BORING NUMBER	B-003-0-24	TOP DEPTH(FT)	36.8	BOTTOM DEPTH(FT)	37.3
SAMPLE NUMBER	NQ-2	DISTRICT	9	PID NO.	109971
COUNTY	BRO	ROUTE	US 50	SECTION	0.49

FORMATION	Arhheim
DESCRIPTION	Shale, Gray, Moderately Weatherd, Weak
MOISTURE CONDITION	As Received

MEASUREMENT	LENGTH(INCHES)	DIAMETER(INCHES)
1	4.068	1.989
2	4.060	1.981
3	4.065	1.986
AVERAGE	4.064	1.985

LENGTH/DIAMETER	2.0
CORRECTION FACTOR	1
AREA(IN^2)	3.1
MASS (GRAMS)	528.1
UNIT WEIGHT(LBS/FT^3)	159.9

RATE OF LOADING (in/min)
0.10
COMPRESSIVE STRENGTH (PSI)
1,120
Equip. ID - 68897
NON-CONFORMANCES - None
TIME OF TEST (MINUTES)
1.10
LOADING DIRECTION
PERP. TO BEDDING
TECHNICIAN - MW
TEMPERATURE - Room





BEFORE TESTING



AFTER TESTING

Physical Appearance after Test - Sample sheared through middle portion - No signs of cracking, spalling or shearing at the platen-specimen interface

≤ Prepared in accordance with ASTM D 4543: **Yes; see report**

≤ Received sample preserved in accordance with SGE: **Yes**

≤ Sampled preserved after preparation: **N; Tested immediately after preparation.**

Point Load Strength Index of Rock ASTM D 5731	CTL ENGINEERING, INC. 2860 Fisher Road Columbus, Ohio 43204
Sample ID: B-004-0-24, NQ 1, 66.0'-71.0' Sample Description: Gray, Shale Avg Uncorrected Point Load Strength Index (psi) 18.91 Avg Corrected Point Load Strength Index (psi):16.9 Estimated Uniaxial Compressive Strength Ş(psi): 202 Point Load Strength Anisotropy Index: $I_{a(50)}$ (psi) : 32.4	Client: EMH&T Project: BRO-50-4.49 Bridge Replacemen Location: Brown County, Ohic Project No. 24050024COL Lab Code No. NA Date Tested: 7/30/24 Reviewed by: SM

Specimen Number	Test Type	Width (W), (in)	Diameter D (in)	Effective Diameter (in)	Load lbs)	Is(psi)	F	Is(50) (psi)
1	Axial	1.985	1.349	1.846	201	58.963	0.9412	55.496
2	Axial	1.985	1.178	1.725	75	25.195	0.9066	22.842
3	Axial	1.985	0.950	1.549	38	15.832	0.8545	13.529
4	Axial	1.985	0.805	1.427	101	49.631	0.8171	40.551
5	Axial	1.985	1.222	1.758	72	23.310	0.9159	21.349
6	Diametrical	---	1.997	1.997	9	2.256	0.9831	2.218
7	Diametrical	---	2.006	2.006	7	1.739	0.9855	1.714
8	Diametrical	---	1.990	1.990	21	5.304	0.9810	5.203
9	Diametrical	---	2.066	2.066	20	4.684	1.0017	4.692
10	Diametrical	---	1.977	1.977	100	25.588	0.9775	25.012



CTL ENGINEERING INC.

APPENDIX D
ROCK CORE PHOTOS

B-001-0-24



Run #:	Depth		Recovery (in)		RQD (in)	
NQ2-1	53.0’	58.0’	60/60	100%	18/60	30%
NQ2-2	58.0’	63.0’	60/60	100%	5/60	8%
BRO-50-4.49 BRIDGE REPLACEMENT						

B-002-0-24



Run #:	Depth		Recovery (in)		RQD (in)	
NQ2-1	34.0’	39.0’	60/60	100%	10/60	17%
NQ2-2	39.0’	44.0’	60/60	100%	8/60	13%
BRO-50-4.49 BRIDGE REPLACEMENT						

B-003-0-24



Run #:	Depth		Recovery (in)		RQD (in)	
NQ2-1	30.0’	35.0’	54/60	90%	0	0%
NQ2-2	35.0’	40.0’	60/60	100%	17/60	28%
BRO-50-4.49 BRIDGE REPLACEMENT						

B-004-0-24



Run #:	Depth		Recovery (in)		RQD (in)	
NQ2-1	66.0’	71.0’	54/60	90%	5/60	8%
NQ2-2	71.0’	76.0’	55/60	92%	0	0%
BRO-50-4.49 BRIDGE REPLACEMENT						

APPENDIX E
DRILLED SHAFT DESIGN CALCULATIONS

Drilled Shaft - Tip Resistance

BRO-50-4.49
Rear Abutment

Bottom of Pier Cap Elevation	893.5	feet	(From Plans)
Top of Rock Elevation	860.3	feet	(From Boring B-002-0-24)

LRFD Tip Resistance

Unconfined Compressive Strength, $q_{u\,(1)}$ (psi)	Unconfined Compressive Strength, q_u (ksf)	Nominal Unit Tip Resistance, q_p [(2)] (ksf)	Resistance Factor, Tip Resistance [(3)]	Factored Unit Tip Resistance, q_p (ksf)
1640	236.2	590.4	0.50	295.2

Reference Key

(1)	Compressive Strength Test Result, B-002-0-24, NQ-1, 36.2'-36.6'
(2)	AASHTO 10.8.3.5.4c-1
(3)	AASHTO Table 10.5.5.2.4-1

Drilled Shaft - Side Resistance in Rock

BRO-50-4.49
Rear Abutment

Bottom of Pier Cap Elevation	893.5	feet	(From Plans)
Top of Rock Elevation	860.3	feet	(From Boring B-002-0-24)

LRFD Side Resistance

											Compressive		Uplift	
Top Elevation	**Bottom Elevation**	**Layer Thickness (feet)**	**Material**	**q_u (ksf)**	**P_a (ksf)**	**C**	**f'_c (ksf)**	**q_s (ksf)**	**$q_s$max (ksf)**	**Check**	**Resistance Factor**	**Factored Side Resistance (ksf)**	**Resistance Factor**	**Factored Side Resistance (ksf)**
860.3	850.3	10	Rock	236.2	2.12	1.00	576	**22.4**	34.9	**OK**	0.55	12.3	0.4	9.0

* Side Friction within upper several feet of rock should be neglected per ODOT BDM section 305.4.2- To be determined by the structural engineer

Notes

P_a(ksf)= Atmospheric Pressure

C = regression Coefficient **(C=1 for corable rock and for augerable rock lowerbound value per AASHTO TABLE 10.8.3.5.4b-1)**

f'_c(ksi)= Concrete Compressive Strength **(4.0 ksi as per ODOT BDM Section C304.2.1)**

$q_s = CP_a(q_u/P_a)^{0.5}$ **(AASHTO Equation 10.8.3.5.4b-1)**

$q_s$max$= P_a(f'_c/P_a)^{0.5}$

q_u (psi)= 1640.0 **Compressive Strength Test Result, B-002-0-24, NQ-1, 36.2'-36.6'**

Resistance Factor= 0.55 Compressive **(AASHTO TABLE 10.5.5.2.4-1)**

0.40 Uplift **(AASHTO TABLE 10.5.5.2.4-1)**

Drilled Shaft - Tip Resistance

BRO-50-4.49
Forward Abutment

Bottom of Pier Cap Elevation	891.5	feet	(From Plans)
Top of Rock Elevation	855.7	feet	(From Borings B-003-0-24 and B-004-0-24)

LRFD Tip Resistance

Unconfined Compressive Strength, $q_{u\,(1)}$ (psi)	Unconfined Compressive Strength, q_u (ksf)	Nominal Unit Tip Resistance, q_p (2) (ksf)	Resistance Factor, Tip Resistance (3)	Factored Unit Tip Resistance, q_p (ksf)
661	95.2	238.0	0.50	119.0

Reference Key

(1) Average compressive strength computed based on Compressive Strength Test Result, B-003-0-24, NQ2-2 & Point Load Strength Test Result, B-004-0-24, NQ2-1

(2) AASHTO 10.8.3.5.4c-1

(3) AASHTO Table 10.5.5.2.4-1

Drilled Shaft - Side Resistance in Rock

BRO-50-4.49
Forward Abutment

Bottom of Pier Cap Elevation	891.5	feet	(From Plans)
Top of Rock Elevation	855.7	feet	(From Borings B-003-0-24 and B-004-0-24)

LRFD Side Resistance

											Compressive		Uplift	
Top Elevation	**Bottom Elevation**	**Layer Thickness (feet)**	**Material**	**q_u (ksf)**	**P_a (ksf)**	**C**	**f'_c (ksf)**	**q_s (ksf)**	**$q_s$max (ksf)**	**Check**	**Resistance Factor**	**Factored Side Resistance (ksf)**	**Resistance Factor**	**Factored Side Resistance (ksf)**
855.7	854.3	1.3	Rock	32.4	2.12	0.29	576	**2.4**	34.9	**OK**	0.55	1.3	0.4	1.0
854.3	844.3	10.0	Rock	95.2	2.12	1.00	576	**14.2**	34.9	**OK**	0.55	7.8	0.4	5.7

* Side Friction within upper several feet of rock should be neglected per ODOT BDM section 305.4.2- To be determined by the structural engineer

Notes

P_a(ksf)= Atmospheric Pressure

C = regression Coefficient **(C=1 for corable rock and for augerable rock lowerbound value per AASHTO TABLE 10.8.3.5.4b-1)**

f'_c(ksi)= Concrete Compressive Strength **(4.0 ksi as per BDM 2020, Section C304.2.1)**

$q_s = CP_a(q_u/P_a)^{0.5}$ **(AASHTO Equation 10.8.3.5.4b-1)**

$q_s max = P_a(f'_c/P_a)^{0.5}$

Resistance Factor= 0.55 Compressive **(AASHTO TABLE 10.5.5.2.4-1)**

0.40 Uplift **(AASHTO TABLE 10.5.5.2.4-1)**

Mean blowcount for augerable rock N=	400	bpf	
Energy ratio of SPT hammer=	79.3%		
$q_{u\,1}$ (ksf)= 0.092x(79.3/90xN)=	32.42	ksf	**(ODOT GDM 404.3)**
$q_{u\,2}$ (psi)= 661.0			**(Average compressive strength computed based on Compressive Strength Test Result, B-003-0-24, NQ2-2 & Point Load Strength Test Result, B-004-0-24, NQ2-1)**

APPENDIX F
SETTLEMENT AND DOWNDRAG CALCULATIONS

Soil Parameters

Project: **BRO-50-4.49**
Boring No.: **B-001-0-24 and B-002-0-24**
Location: **Rear Abutment**
Existing Grade **900.35**

Layer No.	Top Elev	Bottom Elev	Thickness (feet)	Type	Total Weight (pcf)	N_{60} value (bpf)	Moisture Content (%)	Liquid Limit (LL)	Plastic Limit (PL)	Gs	e_0	C_c	C_r	C_v (cm^2/sec)	Su (psf)	Pre-Consolidation Stress Ó'p (psf)	Reference
1	900.35	893.5	6.85	A-6b/A-6a	122	12	17	32	16	2.7							
						15	17										
						15	15	27	15								
			Avg	A-6b/A-6a	122	14	16	30	16	2.7	0.43	0.189	0.038	0.0200	1750	10816	1,2,3
2	893.5	888	5.5	A-6b	118	8	15	31	18	2.7							
						5	29										
			Avg	A-6b	118	7	22	31	18	2.7	0.59	0.176	0.035	0.0200	875	5534	1,2,3
3	888	884.3	3.7	A-6a/A-4a	125	25				2.7							
						19	12	21	13								
			Avg	A-6a/A-4a	125	22	12	21	13	2.7	0.32	0.108	0.022	0.0200	2750	19699	1,2,3

Soil parameters for layer 1 were taken from boring B-001-0-24 and soil parameters for subsequent layers were taken from boring B-002-0-24
Soil/bedrock layers encountered below elevation 884.3 are considered incompressible

Reference Key

1 Skempton (1957), FHWA-IF-03-017- GEC-N0.7, TABLE 3.7 used for computing Ó'p if no consolidation data is available
2 Kulhawy and Mayne (1990) per GEC 5 (2016), Figure 6-36 used for computing Cc and Cr if no consolidation data is available
3 FHWA GEC 5 (2016) Figure 6-37, Reloading (lower bound) curve used for Cv computation of cohesive soil if no consolidation data is available

Settlement Calculations

Project	**BRO-50-4.49**
Boring No.	**B-001-0-24 and B-002-0-24**
Location	**Rear Abutment**

		Elevation		
Top of Embankment		915.38		
			Emb. Fill Unit Wt. =	125 pcf
Existing Grade		900.35	Height =	15.03 ft
			N_{60} Avg =	14 bpf
	Layer 1		Unit Wt. =	122 pcf
		893.5		
			N_{60} Avg =	7 bpf
	Layer 2		Unit Wt. =	118 pcf
		888		
			N_{60} Avg =	22 bpf
	Layer 3		Unit Wt. =	125 pcf
		884.3		
			Incompressible Layers	

Emb. Fill Ht.	15.03	ft
Unit Wt. =	125	pcf
q =	1878.75	psf

Trapezoid section
Embankment Geometry

B_1 =	22.5	ft
B_2 =	30.06	ft

Layer	Thickness (H_c) (ft)	Effective Unit Weight (pcf)	z (ft)	σ'_o (psf)	B_1 / z	B_2 / z	I*	N_{60} Avg	σ'_p (psf)	σ'_f (psf)	Consolidation	Settlement (in) **
1	6.85	122.0	3.425	417.85	6.6	8.8	1.00	14	10,816	2,296.6	OC	1.61
2	5.5	118.0	9.6	1160.2	2.3	3.1	1.00	7	5,534	3,039.0	OC	0.61
3	3.7	62.6	14.2	1600.51	1.6	2.1	0.98	22	19,699	3,441.7	OC	0.24
											Total	2.46
											0.4" @ Elev.=	888.6

*The influence value (I) for embankment loading was computed based on "Influence Values for Vertical Stresses in Semi- Infinite Loading" charts (After Osterberg 1957).

**The settlement value of cohesive soils is computed based on LRFD Equation 10.6.2.4.3-1

Downdrag Calculations

Project	**BRO-50-4.49**
Location	**Rear Abutment**
Boring No.	**B-001-0-24 and B-002-0-24**
Bottom of Pier Cap Elev.	**893.5**
0.4" Settlement Elev.	**888.6**

	Layer 1	**Layer 2**	**Layer 3**		
Top Elevation	900.35	893.5	888		
Bottom Elevation	893.5	888	884.3		
N_{60} Avg. =	14	7	22	bpf	
$S_u = c_u$ =	1.75	0.875	2.75	ksf	
p_a =	2.12	2.12	2.12	ksf	
S_u / p_a =	0.8	0.4	1.3		
α =	0.55	0.55	0.55		AASHTO 10.8.3.5.1b-2 & AASHTO 10.8.3.5.1b-3
q_s =	0.96	0.48	1.51	ksf	AASHTO 10.8.3.5.1b-1
Shaft Length for Downdrag	0	4.9	0	ft	
Shaft Diameter		3.0		ft	
Perimeter		9.42		ft	
A_S	0.0	46.0	0.0	ft^2	
Unfactored Downdrag	0.0	22.1	0.0	kips	
Total Downdrag Load		22.1		kips	
Load Factor =		1.05			ODOT BDM 305.3.2.2 and ODOT GDM 1304.5

From AASHTO C10.8.1.6.2:

Shaft length assumed to not contribute to nominal side resistance should also be assumed to not contribute to downdrag loads.

Time Rate of Settlement Determination

Project: **BRO-50-4.49**
Location: **Rear Abutment**
Boring No.: **B-001-0-24 and B-002-0-24**
Bottom of Pier Cap Elev: **893.5**

Top Elev	Bottom Elev	1 or 2 sides Drained	Total Settlement (in)	H (feet)	Cv (cm2/sec)	Cv (ft2/day)	t (days)	Tv	U (%)	Settlement Remaining (in)	
900.35	893.5	1	1.61	6.85	0.0200	1.86	14	0.554958	0.79	0.3	
893.5	888	1	0.61	5.5	0.0200	1.86	14	0.860826	0.90	0.1	
888	884.3	1	0.24	3.7	0.0200	1.86	14	1.902118	0.99	0.0	
	Net=		2.46	in					Total	0.4	in

Soil Parameters

Project: **BRO-50-4.49**
Boring No.: **B-004-0-24**
Location: **Forward Abutment**
Existing Grade **898.95**

Layer No.	Top Elev	Bottom Elev	Thickness (feet)	Type	Total Weight (pcf)	N_{60} value (bpf)	Moisture Content (%)	Liquid Limit (LL)	Plastic Limit (PL)	Gs	e_0	C_c	C_r	C_v (cm^2/sec)	Su (psf)	Pre-Consolidation Stress σ'p (psf)	Reference
1	899	891.5	7.45	A-6a	120	9 13	26 23	28	16	2.7							
			Avg	A-6a	120	11	25	28	16	2.7	0.68	0.162	0.032	0.0200	1375	8905	1,2,3
2	891.5	884.5	7.0	A-6a	115	5 4	25 25	32	17	2.7							
			Avg	A-6a	115	5	25	32	17	2.7	0.68	0.203	0.041	0.0200	625	3776	1,2,3

Soil/bedrock layers encountered below elevation 884.5 are considered incompressible

Reference Key

1 Skempton (1957), FHWA-IF-03-017- GEC-N0.7, TABLE 3.7 used for computing σ'p if no consolidation data is available
2 Kulhawy and Mayne (1990) per GEC 5 (2016), Figure 6-36 used for computing Cc and Cr if no consolidation data is available
3 FHWA GEC 5 (2016) Figure 6-37, Reloading (lower bound) curve used for Cv computation of cohesive soil if no consolidation data is available

Settlement Calculations

Project	**BRO-50-4.49**
Boring No.	**B-004-0-24**
Location	**Forward Abutment**

Emb. Fill Ht.	17.05 ft
Unit Wt. =	125 pcf
q =	2131.25 psf

Trapezoid section
Embankment Geometry

B_1 =	22.5 ft
B_2 =	34.1 ft

	Elevation			
Top of Embankment	916			
			Emb. Fill Unit Wt. =	125 pcf
Existing Grade	898.95		Height =	17.05 ft
			N_{60} Avg =	11 bpf
		Layer 1	Unit Wt. =	120 pcf
	891.5			
			N_{60} Avg =	5 bpf
		Layer 2	Unit Wt. =	115 pcf
	884.5			
			Incompressible Layers	

Layer	Thickness (H_c) (ft)	Effective Unit Weight (pcf)	z (ft)	σ'_o (psf)	B_1 / z	B_2 / z	I*	N_{60} Avg	σ'_p (psf)	σ'_f (psf)	Consolidation	Settlement (in) **
1	7.45	120	3.725	447	6.0	9.15	1.00	11	8905	2578.25	OC	1.31
2	7	115	10.95	1296.5	2.1	3.11	1.00	5	3776	3427.75	OC	0.86
											Total	2.17
											0.4" @ Elev.=	887.8

*The influence value (I) for embankment loading was computed based on "Influence Values for Vertical Stresses in Semi- Infinite Loading" charts (After Osterberg 1957).

**The settlement value of cohesive soils is computed based on LRFD Equation 10.6.2.4.3-1

Downdrag Calculations

Project	**BRO-50-4.49**
Location	**Forward Abutment**
Boring No.	**B-004-0-24**
Bottom of Pier Cap Elev.	**891.5**
0.4" Settlement Elev.	**887.8**

	Layer 1	Layer 2		
Top Elevation	898.95	891.5		
Bottom Elevation	891.5	884.5		
N_{60} Avg. =	11	5	bpf	
$S_u = c_u$ =	1.375	0.625	ksf	
p_a =	2.12	2.12	ksf	
S_u / p_a =	0.6	0.3		
α =	0.55	0.55		AASHTO 10.8.3.5.1b-2 & AASHTO 10.8.3.5.1b-3
q_s =	0.76	0.34	ksf	AASHTO 10.8.3.5.1b-1
Shaft Length for Downdrag	0	3.7	ft	
Shaft Diameter	3.0		ft	
Perimeter	9.42		ft	
A_S	0.0	35.1	ft^2	
Unfactored Downdrag	0.0	12.1	kips	
Total Downdrag Load	12.1		kips	
Load Factor =	1.05			ODOT BDM 305.3.2.2 and ODOT GDM 1304.5

From AASHTO C10.8.1.6.2:

Shaft length assumed to not contribute to nominal side resistance should also be assumed to not contribute to downdrag loads.

Time Rate of Settlement Determination

Project: **BRO-50-4.49**
Location **Forward Abutment**
Boring No.: **B-004-0-24**
Bottom of Pier Cap Elev: **891.5**

Top Elev	Bottom Elev	1 or 2 sides Drained	Total Settlement (in)	H (feet)	Cv (cm2/sec)	Cv (ft2/day)	t (days)	Tv	U (%)	Settlement Remaining (in)	
898.95	891.5	1	1.31	7.45	0.0200	1.86	16	0.536192	0.78	0.3	
891.5	884.5	1	0.86	7	0.0200	1.86	16	0.607347	0.82	0.2	
	Net=		2.17	in					Total	0.4	in

APPENDIX G
LPILE PARAMETERS

L-PILE Soil and Rock Parameters

Project BRO-50-4.49
PID No. 109971
Structure Rear Abutment

Boring No	B-002-0-24	
Bottom of Foundation Elevation	893.5	(From Plans)

From Bottom of Footing Elevation to 888.3 feet

Use Soil Type-	Stiff Clay w/o Free Water (Reese)		
Effective Unit Weight =	115	pcf	ODOT GDM Table 400-4
Undrained Cohesion =	800	psf	ODOT GDM Section 404.1
Strain Factor E50 =	0.010		From L-pile Table 3.2
k =	500	pci	From L-pile Table 3.3

From 888.3 to 878.8 feet

Use Soil Type-	Stiff Clay with Free Water (Reese)		
Effective Unit Weight =	62.6	pcf	ODOT GDM Table 400-4
Undrained Cohesion =	3200	psf	ODOT GDM Section 404.1
Strain Factor E50 =	0.005		From L-pile Table 3.4
k =	1000	pci	From L-pile Table 3.3

From 878.8 to 860.3 feet

Use Soil Type-	Stiff Clay with Free Water (Reese)		
Effective Unit Weight =	67.6	pcf	ODOT GDM Table 400-4
Undrained Cohesion =	4800	psf	ODOT GDM Section 404.1
Strain Factor E50 =	0.004		From L-pile Table 3.4
k =	2000	pci	From L-pile Table 3.3

Below 860.3 feet

Use Rock Type-	Weak Rock (Reese)		
Effective Unit Weight =	92.7	pcf	B-002-0-24, NQ2-1, Compressive strength test result
Strain Factor K_{rm} =	0.0005		From L-pile
Compressive Strength q_u =	1640	psi	B-002-0-24, NQ2-1, Compressive strength test result
Initial Rock Modulus =	150000	psi	ODOT GDM Table 400-6, weak rock
RQD =	15%		B-002-0-24, Average RQD

L-PILE Soil and Rock Parameters

Project BRO-50-4.49
PID No. 109971
Structure Forward Abutment

Boring No	B-003-0-24		
Bottom of Foundation Elevation	891.5	(From Plans)	

From Bottom of Footing Elevation to 879.9 feet

Use Soil Type-	Sand (Reese)		
Effective Unit Weight =	62.6	pcf	ODOT GDM Table 400-4
Friction Angle=	36	Degrees	ODOT GDM Section 404.2
k =	60	pci	From L-pile Table 3.6

From 879.9 to 876.9 feet

Use Soil Type-	Stiff Clay with Free Water (Reese)		
Effective Unit Weight =	72.6	pcf	ODOT GDM Table 400-4
Undrained Cohesion =	6000	psf	ODOT GDM Section 404.1
Strain Factor E50 =	0.004		From L-pile Table 3.4
k =	2000	pci	From L-pile Table 3.3

From 876.9 to 874.9 feet

Use Soil Type-	Sand (Reese)		
Effective Unit Weight =	72.6	pcf	ODOT GDM Table 400-4
Friction Angle=	40	Degrees	ODOT GDM Section 404.2
k =	125	pci	From L-pile Table 3.6

From 874.9 to 869.4 feet

Use Soil Type-	Stiff Clay with Free Water (Reese)		
Effective Unit Weight =	72.6	pcf	ODOT GDM Table 400-4
Undrained Cohesion =	5600	psf	ODOT GDM Section 404.1
Strain Factor E50 =	0.004		From L-pile Table 3.4
k =	2000	pci	From L-pile Table 3.3

From 869.4 to 855.7 feet

Use Soil Type-	Stiff Clay with Free Water (Reese)		
Effective Unit Weight =	67.6	pcf	ODOT GDM Table 400-4
Undrained Cohesion =	4600	psf	ODOT GDM Section 404.1
Strain Factor E50 =	0.004		From L-pile Table 3.4
k =	2000	pci	From L-pile Table 3.3

Below 855.7 feet

Use Rock Type-	Weak Rock (Reese)		
Effective Unit Weight =	97.5	pcf	B-003-0-24, NQ2-2, Compressive strength test result
Strain Factor K_{rm} =	0.0005		From L-pile
Compressive Strength q_u =	661	psi	B-003-0-24, NQ2-2, Compressive strength test result & B-004-0-24, NQ2-1, Point Load Strength Test result
Initial Rock Modulus =	60000	psi	ODOT GDM Table 400-6, weak rock
RQD =	9%		B-003-0-24 & B-004-0-24, Average RQD

APPENDIX H
LPILE ANALYSIS

BRO-50-4.49 PID 109971 LPile Analysis

Rear Abutment Drilled Shaft

ODOT District 9

2/12/2026

Engineers, Surveyors, Planners, Scientists
5500 New Albany Rd., Columbus, OH 43054
p. 614.775.4500 f. 614.775.4800
emht.com

Type Project Number Here

EMH&T
Engineers, Surveyors, Planners, Scientists

Made by:	AI	Date:	7/16/2025	Job No:	20240280
Checked by:	TDA/RMW	Date:	9/10/2025	Sheet No:	1
Project:	BRO-50-4.49		PID:		
Subject:	Semi-Integral Abutment Design				

Semi-Integral Abutment Data

Stem Dimensions (ft)

Diaphragm	3.00	ft
Stem Width 1	3.00	ft
Stem Width 2	3.00	ft
Stem Length	45.58	ft
Seat Width	3.00	ft
β =	90.00	ft

Footer Dimensions (ft)

Toe	4.50	ft
Stem Width (at Footer)	3.00	ft
Heel	6.50	ft
Total Footing Width, B	14.00	ft

Diaphragm	7.91	
Stem Height 1	6.98	
Stem Height 2	4.00	
Total Stem Height	18.89	
Footer Height	3.00	
Total Ht. of Wall	21.89	

BOF Elev =	893.5	
Profile Elev =	915.39	
	18.9	

Vertical Reactions

Number of Girders	4	
Exterior Girder (DC)	151.97	kips
Exterior Girder (DW)	43.20	kips
Interior Girder (DC)	137.82	kips
Interior Girder (DW)	43.20	kips
Total DC =	579.58	kips
	12.71	kips/ft
Total DW =	172.8	kips
	3.79	kips/ft

Skew =	38	degrees
Live Load per beam (LL)	122.85	kips
DF =	0.976	axles/bm
Impact =	1	
LL per Lane =	125.87	kips
Number of Lanes =	2	
Total LL =	251.74	kips
Pedestrian LL =	0.00	kips
Along Abutment	**5.52**	**kips/ft.**

Horizontal Reactions

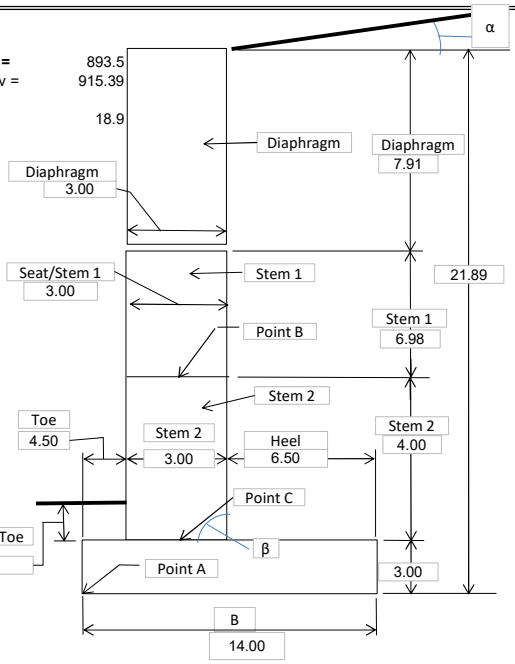
Thermal (TU)	1.017	kips/ft
Height of Bearing	13.98	ft

Live Load Surcharge

Live Ld. Surcharge Height, h_{eq} (ft) 2.00 AASHTO Table 3.11.6.4-1

Material

Soil Unit Weight (k/ft^3)	0.12	Concrete Unit Wt. (k/ft^3)	0.15
Φ (°)	32	Earth on Toe (ft)	2.6
δ (degrees) =	21.33	Toe Slope =	2 :1
α (degrees) =	-0.19	Roadway Grade =	0.0034 :1
K_a	0.274		



Sum Moments …….Clockwise is positive

Item	Height (ft)	Width (ft)	Unit Weight (k/ft^3)	P (kips)	About "A" Arm (ft.)	About "A" Moment (ft-k)	About "B" P (kips)	About "B" Arm (ft.)	About "B" Moment (ft-k)	About "C" P (kips)	About "C" Arm (ft.)	About "C" Moment (ft-k)
Vertical Loads												
Concrete (DC)												
Diaphragm	7.91	3.00	0.15	3.56	6.00	21.35				3.56	0.00	0.00
Stem 1	6.98	3.00	0.15	3.14	6.00	18.86				3.14	0.00	0.00
Stem 2	4.00	3.00	0.15	1.98	6.00	11.88	-	-	-	1.98	0.00	0.00
Footer	3.00	14.00	0.15	6.30	7.00	44.10	-	-	-	-	-	-
Approach Slab	1.42	10.00	0.15	2.13	7.25	15.44	2.13	1.25	2.66	2.13	1.25	2.66
Girders				12.71	6.00	76.29	-	-	-	12.71	0.00	0.00
Dead Load (DW)												
Future Wearing Surf.				3.79	6.00	22.75	-	-	-	3.79	0.00	0.00
Earth Load (EV)												
Soil Above Toe	2.60	4.50	0.12	1.40	2.25	3.16	-	-	-	-	-	-
Soil Above Heel	18.89	6.50	0.12	14.73	10.75	158.39	-	-	-	-	-	-
Vertical Component of Horizontal Earth Pressure from Soil Friction (EH_V)												
Vert. Load from EH_V	21.89	-	0.12	2.87	14.00	40.18	-	-	-	-	-	-
Live Load (LL)												
Vehicle Reaction				5.52	6.00	33.14	-	-	-	5.52	0.00	0.00
Live Load (LS_V)												
Live Load Surcharge	2.00	6.50	0.125	1.63	10.75	17.47	-	-	-	-	-	-
Horizontal Loads												
Earth Load (EH_H)												
Active Earth Pressure	13.98		0.12	6.39	5.90	-37.69	2.44	3.14	-7.66	4.51	4.74	-21.40
Live Load (LS_H)												
Live Load Surcharge	13.98	2.00	0.125	0.96	6.99	-6.71	0.48	3.49	-1.67	0.75	5.49	-4.14
Thermal Uniform (TU)												
Bearing Pads				1.02	13.98	-14.22	1.02	6.98	-7.10	1.02	10.98	-11.17

AASHTO LRFD Load Factors - AASHTO Table 3.4.1-1

	Vertical					Horizontal		
	DC	DW	EV	EH_V	LL & LS_V	EH	LS_H	TU
Service I	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Strength I.a - Sliding & Eccentricity	0.90	0.00	1.00	1.50	0.00	1.50	1.75	0.50
Strength I.b - Bearing	1.25	1.50	1.35	1.50	1.75	1.50	1.75	0.50
Extreme Event II	1.00	1.00	1.00	1.00	0.50	1.00	0.50	0.00

Load Case	Footing/Piles (About A) Per Foot of Abutmemt			Stem 1 (About B) Per Foot of Abutmemt		Stem 2 (About C) Per Foot of Abutmemt	
	P_V (kips)	M_A (ft-k)	P_H (kips)	M_B (ft-k)	P_H (kips)	M_C (ft-k)	P_H (kips)
Service I	59.77	404.38	8.37	-13.77	3.94	-34.05	6.28
Strength I.a	45.88	312.41	11.77	-15.57	5.01	-42.54	8.60
Strength I.b	81.57	560.55	11.77	-14.63	5.01	-41.60	8.60
Extreme Event II	56.20	396.65	6.87	-5.83	2.68	-20.81	4.89

Drilled Shaft Foundation

Dia Above Rock: 3 ft
Dia Below Rock: 2.5 ft

$\eta_i \gamma_p DD$ Anticipated Down Drag = 23.2 kips/ shaft (factored)

Location	Bottom of the Pier Cap	Unfactored Downdrag Force (Kips)	Factored Downdrag Force (Kips)
Rear Abutment	893.5	22.1	23.2
Forward Abutment	891.5	12.1	12.7

Tip Resistance

Ap = 4.91 sf
Φqp = 0.5 *BDM 305-1*
qp = 590.4 ksf (from Geotech Report)

Side Resistance

BOF Elev = 893.50 BOF to TOR = 33.20
TOR Elev = 860.30 TOR to BDS = 5.00
DS Depth Above Rock= 33.20 ft
DS Depth Into Rock= 5.00 ft (Assume 5' below bedrock)
BDS Elev = 855.30
Design Scour Depth = 875.50 ft
Check Scour Depth = 873.17 ft

Layer 1
Start EL 875.50 (Per BDM 305.4.1.1 neglect the shaft resistance of non-scour resistant rock in the scour zone)
End EL 855.30
Layer Thickness 20.20
Perimeter = 7.85 ft
Contributing Depth = 5.00 ft
As = 39.27 sf
Φqp = 0.45 *BDM 305-1*
qp = 0 ksf (Neglect)

Φqp*Rp = 1449.06 kips
Φqs*Rs = 0.00 kips
ΦRn = **1449.06** kips

Pile Size 36" Dia DS above Rock Pile Capacity (kip) 1449.06 <-- Based on Tip Resistance Only
Center to center spacing of piles along footer (ft) 12 BDM 1010.17 - S10.8.1.2 - Min spacing is 2D for rock socketed shafts
Length of segment to be analyzed, L (ft) 12 144

S/B 4
P_m = 1 (BDM - C305.1.2)

$P_m=0.64(S/D)^{0.34}$, for $1 \le S/D < 3.75$, where $0.5 \le P_m \le 1.0$

Lpile Soil Inputs

Top of Ground Elevation at Boring = 894.30 At Boring B-002-0-24
Top of Ground at Abutment = 915.39
Beam Seat Elevation = 907.48
Bottom of Footing Elevation = 893.50
Approx Top of Rock at Abutment = 860.30
Design Scour Depth = 875.50
Check Scour Depth = 873.17
Top of footing Depth = 18.89 ft
Height of Abutment in Lpile = 13.98 ft (Starting at beam seat elevation)
Location of Top of Rock in Lpile = 33.20 ft (Starting at beam BOF elevation)
Location of top of footing in Lpile = 10.98

B-002-0-24										
	EL START	EL END	GAMMA	C	E50	K =	km	qu	initial rock modu	RQD
Stiff Clay w/o Free Wate	893.5	888.3	115	800	0.01	500				
Still Clay with Free Wate	888.3	878.8	62.6	3200	0.005	100				
Still Clay with Free Wate	878.8	860.3	67.6	4800	0.004	2000				
Weak Rock (Reese)	860.3	793.5	92.7	-	-	-	0.0005	1640	150000	15

	Distance From Bottom of Footing	Layer Thickness	Layer End depth from top of boring
Still Clay with Free Wate	18.00	15.20	33.20
Weak Rock (Reese)	33.2	66.8	100

For Extreme Event II (using Check STM elevations)

	Distance From Bottom of Footing	Layer Thickness	Layer End depth from top of boring
Still Clay with Free Water (Reese)	20.33	12.87	33.2
Weak Rock (Reese)	33.2	66.8	100

Resolve Forces in Drilled Shafts

	Piles Per Segment	Dist. From Toe, A (ft)	Battered? (y,n)	Batter Rate (x:1)	Centroid of Pile Group from Toe, X_Y (ft)
Row 0					7.00
Row 1	1	2.5	n		
Row 2	1	11.50	n		
Row 3					
Sum of Piles	2				

10.8.1.2—Shaft Spacing, Clearance, and Embedment into Cap

If the center-to-center spacing of drilled shafts is less than 4.0 diameters, the interaction effects between adjacent shafts shall be evaluated. If the center-to-center spacing of drilled shafts is less than 6.0 diameters, the sequence of construction should be specified in the contract documents.

Shafts used in groups should be located such that the distance from the side of any shaft to the nearest edge of the cap is not less than 12.0 in. Shafts shall be embedded sufficiently into the cap to develop the required structural resistance.

Forces acting on the the Segment

	P_V (kips)	M_A (ft-kip)	e (ft)	e-X_Y	M_Y (ft-kip)	P_H (kips)
Service I	717.25	4852.54	6.77	-0.23	-168.21	100.40
Strength I.a	550.59	3748.87	6.81	-0.19	-105.25	141.27
Strength I.b	978.80	6726.60	6.87	-0.13	-124.97	141.27
Extreme Event II	674.36	4759.78	7.06	0.06	39.24	82.44

	Vertical Capacity (kip)	Dist. From Y, x_i (ft)	$(x_i)^2$	Pile Σ $A(x_i)^2$
Row 0				
Row 1	1449.1	-4.50	20.25	20.25
Row 2	1449.1	4.50	20.25	20.25
Row 3				
			Σ $(x)^2$	40.50

Vertical Loads

Vertical Load on a Single Pile in the Row

	Service I (kip)	Strength I.a (kip)	Strength I.b (kip)	Extreme Event II (kip)
Row 0				
Row 1	400.51	310.19	526.48	356.02
Row 2	363.14	286.80	498.71	364.74
Row 3				

Concurrent Lateral Resistance

Lateral Resistance Based on Batter of Piles (if present)

	Service I (k/ft)	Strength I.a (k/ft)	Strength I.b (k/ft)	Extreme Event II (kip)
Row 0				
Row 1	0.00	0.00	0.00	0.00
Row 2	0.00	0.00	0.00	0.00
Row 3				
SUM =	0.00	0.00	0.00	0.00
Lat. Pile Resistance =	8.37	11.77	11.77	6.87

P-Multiplier Calculation for Lpile

Pile Spa Dir of Load, S 9.00 ft

Pile Spa Normal to Load, S 12 ft

Pile Dia, B 3 ft

Spacing Ratio Direction of Loading, S/B 3.00 B

Space Ratio Normal Loading, S/B = 4.00 B

P-Multipliers, Pm			
	Direction of Loading (10.7.2.4-1)	Normal to Loading BDM 305.1.2	Composite Pm
Row 1	0.700	1.000	0.700
Row 2	0.500	1.000	0.500

BDM C305.1.2 --> FHWA GEC 10, 11.5.1

$$P_m = 0.64\,(S/B)^{0.34} \text{ for } 1.0 \le S/B \le 3.75$$

TABLE 11-1 RECOMMENDED P-MULTIPLIER, P_M, VALUES FOR DESIGN BY ROW POSITION

Row Position	*Design P-multiplier, P_m*			
Pile Spacing (c-c)	3D	4D	5D	≥ 6D
Lead Row	0.7	0.85	1.0	1.0
2nd Row	0.5	0.65	0.85	1.0
3rd and higher Rows	0.35	0.5	0.7	1.0

Lpile Results

Capacity To Deisgn Scour Depth to 875.5 (STRENGTH I.a.)

Results - 3'-0" Dia Drilled Shaft

Axial Load in Row 1 =	310.19	k	Check Lpile with and without axial load.	
Axial Load in Row 2 =	286.80	k	Check Lpile with and without axial load.	

	Row 1	Row 2		
	0.700	0.500	Pm applies to soils above rock	
Deflection	1.75	1.75	in	
Resistance	73.9	67.8	k	
# of Drilled Shafts	1	1		
Total Resistance	73.9	67.8	k	
Total Resistance @ Abutment		141.7	k	
Total Shear on Abutment, Vu		141.27	k	OK

Capacity To Deisgn Scour Depth to 875.5 (SERVICE I)

Results - 3'-0" Dia Drilled Shaft

Axial Load in Row 1 =	400.51	k	Check Lpile with and without axial load.	
Axial Load in Row 2 =	363.14	k	Check Lpile with and without axial load.	

	Row 1	Row 2		
	0.700	0.500	Pm applies to soils above rock	
Deflection	1	1	in	
Resistance	60.7	55.3	k	
# of Drilled Shafts	1	1		
Total Resistance	60.7	55.3	k	
Total Resistance @ Abutment		116	k	
Total Shear on Abutment, Vu		100.40	k	OK
Max Allowable Deflection =		1.68	in	OK

Capacity To Deisgn Scour Depth to 873.17 (EXTREME EVENT II)

Results - 3'-0" Dia Drilled Shaft

Axial Load in Row 1 =	356.02	k	Check Lpile with and without axial load.	
Axial Load in Row 2 =	364.74	k	Check Lpile with and without axial load.	

	Row 1	Row 2		
	0.700	0.500	Pm applies to soils above rock	
Deflection	1	1	in	
Resistance	49.3	46.9	k	
# of Drilled Shafts	1	1		
Total Resistance	49.3	46.9	k	
Total Resistance @ Abutment		96.2	k	
Total Shear on Abutment, Vu		82.44	k	OK

305.4.1.1 SCOUR

Neglect the shaft resistance provided by soil or non-scour resistant rock in the scour zone. Assess scour resistant rock according to BDM Section 305.2.1.2.b. Use the depth of scour resulting from the design flood, with Strength and Service Limit State checks. Use the depth of scour resulting from the check flood with Extreme Event II Limit State checks.

Extend friction drilled shafts to penetrate a minimum of 15-ft below the controlling scour elevation. If socketed into non-scour resistant bedrock, when the rock has Q_u < 2.5-ksi, extend drilled shafts to penetrate a minimum of 10-ft below the controlling scour elevation in the bedrock; when the rock has Qu ≥ 2.5-ksi, extend drilled shafts to penetrate a minimum of 5-ft below the controlling scour elevation in the bedrock. If socketed into scour resistant bedrock, design the length of the bedrock socket based solely on the requirements of axial resistance in accordance with *LRFD 10.8.3.5.4* and of lateral stability.

Because the drilled shaft will lose support along the scour depth, investigate the structural capacity of the shaft considering the depth of the scour as an unbraced length. Also perform a p-y analysis on the drilled shaft according to BDM Section 305.1.2 to demonstrate lateral stability against:

A. Overturning failure in the Strength Limit State with the maximum estimated scour depth at the design flood, and

B. Overturning failure in the Extreme Event II Limit State with the maximum estimated scour depth at the check flood, and

C. Excessive deflection in the Service Limit State.

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LPile for Windows, Version 2022-12.011

Analysis of Individual Piles and Drilled Shafts
Subjected to Lateral Loading Using the p-y Method
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Files Used for Analysis

Path to file locations:
\20240280\ODOT\109971\400-Engineering\Structures\SFN_0800512\Engdata\04_Abutment Design\Stage 2\Drilled Shaft\Lpile\Abutment\Rear Abutment\

Name of input data file:
RA_Scour Service - Front DS.lp12d

Name of output report file:
RA_Scour Service - Front DS.lp12o

Name of plot output file:
RA_Scour Service - Front DS.lp12p

Name of runtime message file:
RA_Scour Service - Front DS.lp12r

Date and Time of Analysis

Date: February 12, 2026 Time: 14:14:47

Problem Title

Project Name:

Job Number:

Client:

Engineer:

Description:

Program Options and Settings

Computational Options:
- Conventional Analysis

Engineering Units Used for Data Input and Computations:
- US Customary System Units (pounds, feet, inches)

Analysis Control Options:

- Maximum number of iterations allowed	=	500
- Deflection tolerance for convergence	=	1.0000E-05 in
- Maximum allowable deflection	=	100.0000 in
- Number of pile increments	=	100

Loading Type and Number of Cycles of Loading:

- Static loading specified

- Analysis uses p-y modification factors for p-y curves
- Analysis uses layering correction (Method of Georgiadis)
- No distributed lateral loads are entered
- Loading by lateral soil movements acting on pile not selected
- Input of shear resistance at the pile tip not selected
- Input of moment resistance at the pile tip not selected
- Computation of pile-head foundation stiffness matrix not selected
- Push-over analysis of pile not selected
- Buckling analysis of pile not selected

Output Options:
- Output files use decimal points to denote decimal symbols.
- Values of pile-head deflection, bending moment, shear force, and soil reaction are printed for full length of pile.
- Printing Increment (nodal spacing of output points) = 1
- No p-y curves to be computed and reported for user-specified depths
- Print using wide report formats

Pile Structural Properties and Geometry

Number of pile sections defined = 2
Total length of pile = 38.200 ft
Depth of ground surface below top of pile = 18.0000 ft

Pile diameters used for p-y curve computations are defined using 4 points.

p-y curves are computed using pile diameter values interpolated with depth over the length of the pile. A summary of values of pile diameter vs. depth follows.

Point No.	Depth Below Pile Head feet	Pile Diameter inches
1	0.000	36.0000
2	33.200	36.0000
3	33.200	30.0000
4	38.200	30.0000

Input Structural Properties for Pile Sections:

Pile Section No. 1:

Section 1 is a round drilled shaft, bored pile, or CIDH pile
Length of section = 33.200000 ft
Shaft Diameter = 36.000000 in

Pile Section No. 2:

Section 2 is a round drilled shaft, bored pile, or CIDH pile
Length of section = 5.000000 ft
Shaft Diameter = 30.000000 in

Soil and Rock Layering Information

The soil profile is modelled using 2 layers

Layer 1 is stiff clay with water-induced erosion

Distance from top of pile to top of layer = 18.000000 ft
Distance from top of pile to bottom of layer = 33.200000 ft
Effective unit weight at top of layer = 67.600000 pcf
Effective unit weight at bottom of layer = 67.600000 pcf
Undrained cohesion at top of layer = 4800. psf
Undrained cohesion at bottom of layer = 4800. psf
Epsilon-50 at top of layer = 0.004000
Epsilon-50 at bottom of layer = 0.004000
Subgrade k at top of layer = 2000. pci
Subgrade k at bottom of layer = 2000. pci

Layer 2 is weak rock, p-y criteria by Reese, 1997

Distance from top of pile to top of layer = 33.200000 ft
Distance from top of pile to bottom of layer = 50.000000 ft
Effective unit weight at top of layer = 92.700000 pcf
Effective unit weight at bottom of layer = 92.700000 pcf
Uniaxial compressive strength at top of layer = 1640. psi
Uniaxial compressive strength at bottom of layer = 1640. psi
Initial modulus of rock at top of layer = 150000. psi
Initial modulus of rock at bottom of layer = 150000. 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

(Depth of the lowest soil layer extends 11.800 ft below the pile tip)

Summary of Input Soil Properties

Layer Num.	Soil Type or (p-y Curve Type)	Layer Depth ft	Effective Unit Wt. pcf	Cohesion psf	Uniaxial qu psi	RQD %	E50 krm	kpy pci	Rock Mass Modulus psi
1	Stiff Clay with Free Water	18.0000	67.6000	4800.	--	--	0.00400	2000.	--
		33.2000	67.6000	4800.	--	--	0.00400	2000.	--
2	Weak Rock	33.2000	92.7000	--	1640.	15.0000	5.00E-04	--	150000.
		50.0000	92.7000	--	1640.	15.0000	5.00E-04	--	150000.

Modification Factors for p-y Curves

Distribution of p-y modifiers with depth defined using 4 points

Point No.	Depth X ft	p-mult	y-mult
1	18.000	0.7000	1.0000
2	33.200	0.7000	1.0000
3	33.300	1.0000	1.0000
4	100.000	1.0000	1.0000

Static Loading Type

Static loading criteria were used when computing p-y curves for all analyses.

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 1

Load No.	Load Type	Condition 1	Condition 2	Axial Thrust Force, lbs	Compute Top y vs. Pile Length	Run Analysis
1	5	y = 1.000000 in	S = 0.0000 in/in	400510.	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 = 2

Pile Section No. 1:

Dimensions and Properties of Drilled Shaft (Bored Pile):

Length of Section	=	33.200000 ft
Shaft Diameter	=	36.000000 in
Concrete Cover Thickness (to edge of trans. reinf.)	=	6.000000 in
Number of Reinforcing Bars	=	15 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	=	15.000000 sq. in.
Area Ratio of Steel Reinforcement	=	1.47 percent
Edge-to-Edge Bar Spacing	=	3.367467 in

Maximum Concrete Aggregate Size = 0.375000 in
Ratio of Bar Spacing to Aggregate Size = 8.98
Offset of Center of Rebar Cage from Center of Pile = 0.0000 in
Transverse Reinforcement
Type: Hoop
Number of Transverse Reinf. (per spacing) = 1
Spacing of Transverse Reinf. = 4.500000 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 = 4309.778 kips
Tensile Load for Cracking of Concrete = -467.292 kips
Nominal Axial Tensile Capacity = -900.000 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	10.811000	0.00000
2	1.128000	1.000000	9.876340	4.397230
3	1.128000	1.000000	7.233971	8.034139
4	1.128000	1.000000	3.340783	10.281872
5	1.128000	1.000000	-1.13006	10.751776
6	1.128000	1.000000	-5.40550	9.362601
7	1.128000	1.000000	-8.74628	6.354546
8	1.128000	1.000000	-10.57475	2.247733
9	1.128000	1.000000	-10.57475	-2.24773
10	1.128000	1.000000	-8.74628	-6.35455
11	1.128000	1.000000	-5.40550	-9.36260
12	1.128000	1.000000	-1.13006	-10.75178
13	1.128000	1.000000	3.340783	-10.28187
14	1.128000	1.000000	7.233971	-8.03414
15	1.128000	1.000000	9.876340	-4.39723

NOTE: The positions of the above rebars were computed by LPile

Minimum spacing between any two bars not equal to zero = 3.367 inches
between bars 7 and 8.

Ratio of bar spacing to maximum aggregate size = 8.98

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 = 0.375000 in

Number of Axial Thrust Force Values Determined from Pile-head Loadings = 1

Number	Axial Thrust Force kips
1	400.510

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 = 400.510 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	222.1488622	355438180.	157.6243653	0.00009852	0.00007602	0.4064570	2.7362291	
0.00000125	444.2984095	355438728.	87.8313335	0.0001098	0.00006479	0.4511850	2.9424608	
0.00000188	666.4369798	355433056.	64.5754978	0.0001211	0.00005358	0.4956963	3.1491552	

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0.00000250   888.5590859    355423634.    52.9539616     0.0001324    0.00004238
0.5399896     3.3563122
0.00000313         1111.    355410957.    45.9861456     0.0001437    0.00003121
0.5840637     3.5639320
0.00000375         1333.    355395188.    41.3451902     0.0001550    0.00002004
0.6279174     3.7720144
0.00000438         1555.    355376397.    38.0338698     0.0001664    0.00000890
0.6715495     3.9805597
0.00000500         1777.    355354596.    35.5535716     0.0001778   -0.00000223
0.7149589     4.1895679
0.00000563         1999.    355321832.    33.6271840     0.0001892   -0.00001335
0.7581421     4.3990219
0.00000625         2220.    355252915.    32.0881515     0.0002006   -0.00002445
0.8010887     4.6088525
0.00000688         2442.    355132588.    30.8304600     0.0002120   -0.00003554
0.8437883     4.8189854
0.00000750         2662.    354957122.    29.7748576     0.0002233   -0.00004669
0.8862324     5.0293618
0.00000813         2882.    354728600.    28.8932378     0.0002348   -0.00005774
0.9284147     5.2399370
0.00000875         3101.    354451579.    28.1375584     0.0002462   -0.00006880
0.9703303     5.4506772
0.00000938         3320.    354131433.    27.4826247     0.0002576   -0.00007985
1.0119757     5.6615579
0.00001000         3538.    353773284.    26.9095770     0.0002691   -0.00009090
1.0533481     5.8725598
0.00001063         3755.    353381809.    26.4039826     0.0002805    -0.000102
1.0944453     6.0836680
0.00001125         3971.    352961074.    25.9546140     0.0002920    -0.000113
1.1352655     6.2948702
0.00001188         3971.    334384176.    24.2549649     0.0002880    -0.000139
1.1206234     6.0592660 C
0.00001250         3971.    317664967.    23.7581862     0.0002970    -0.000153
1.1523348     6.1980925 C
0.00001313         3971.    302538064.    23.3002422     0.0003058    -0.000167
1.1834746     6.3336922 C
0.00001375         3971.    288786333.    22.8758810     0.0003145    -0.000180
1.2140602     6.4661535 C
0.00001438         3971.    276230406.    22.4813519     0.0003232    -0.000194
1.2441039     6.5955261 C
0.00001500         3971.    264720806.    22.1133629     0.0003317    -0.000208
1.2736604     6.7222129 C
0.00001563         3971.    254131973.    21.7695168     0.0003401    -0.000222
1.3027694     6.8464998 C
0.00001625         3971.    244357667.    21.4466356     0.0003485    -0.000236
1.3314248     6.9682977 C
0.00001688         3971.    235307383.    21.1431282     0.0003568    -0.000251
1.3596488     7.0877520 C
0.00001750         4013.    229331100.    20.8573765     0.0003650    -0.000265
1.3874834     7.2051821 C
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0.00001813        4080.    225120982.    20.5879003     0.0003732     -0.000279
1.4149649     7.3208622 C
0.00001875        4146.    221124128.    20.3337156     0.0003813     -0.000294
1.4421303     7.4350829 C
0.00001938        4210.    217289143.    20.0915998     0.0003893     -0.000308
1.4688724     7.5468982 C
0.00002000        4273.    213645483.    19.8626076     0.0003973     -0.000323
1.4953364     7.6575245 C
0.00002063        4335.    210178435.    19.6456341     0.0004052     -0.000337
1.5215335     7.7670400 C
0.00002125        4395.    206843218.    19.4378839     0.0004131     -0.000352
1.5473432     7.8743757 C
0.00002188        4455.    203679133.    19.2413423     0.0004209     -0.000367
1.5729697     7.9812891 C
0.00002250        4514.    200624781.    19.0522708     0.0004287     -0.000381
1.5982073     8.0859582 C
0.00002313        4572.    197722931.    18.8730600     0.0004364     -0.000396
1.6232856     8.1903841 C
0.00002375        4629.    194918650.    18.7002647     0.0004441     -0.000411
1.6479992     8.2927317 C
0.00002438        4686.    192254181.    18.5364616     0.0004518     -0.000426
1.6725941     8.3951738 C
0.00002563        4797.    187204440.    18.2266562     0.0004671     -0.000455
1.7208900     8.5954714 C
0.00002688        4906.    182538164.    17.9410475     0.0004822     -0.000485
1.7682869     -8.884050 C
0.00002813        5012.    178219764.    17.6772956     0.0004972     -0.000515
1.8148726     -9.512393 C
0.00002938        5118.    174217519.    17.4333974     0.0005121     -0.000545
1.8607316    -10.142937 C
0.00003063        5221.    170472752.    17.2051317     0.0005269     -0.000576
1.9057024    -10.777279 C
0.00003188        5323.    166982986.    16.9926875     0.0005416     -0.000606
1.9499941    -11.413545 C
0.00003313        5423.    163720588.    16.7943558     0.0005563     -0.000636
1.9936214    -12.051654 C
0.00003438        5522.    160652166.    16.6076006     0.0005709     -0.000667
2.0364888    -12.692601 C
0.00003563        5621.    157778243.    16.4331295     0.0005854     -0.000697
2.0788075    -13.334394 C
0.00003688        5718.    155063866.    16.2680503     0.0005999     -0.000728
2.1204042    -13.978790 C
0.00003813        5814.    152508276.    16.1129259     0.0006143     -0.000758
2.1614506    -14.624145 C
0.00003938        5910.    150096417.    15.9667478     0.0006287     -0.000789
2.2019378    -15.270582 C
0.00004063        6005.    147806150.    15.8275556     0.0006430     -0.000820
2.2417557    -15.919273 C
0.00004188        6099.    145647210.    15.6971285     0.0006573     -0.000850
2.2811758    -16.567463 C
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0.00004313 6192. 143588781. 15.5724146 0.0006716 -0.000881
2.3199182 -17.218086 C
0.00004438 6285. 141633352. 15.4539422 0.0006858 -0.000912
2.3581491 -17.869456 C
0.00004563 6377. 139780196. 15.3424325 0.0007000 -0.000943
2.3959861 -18.520330 C
0.00004688 6469. 138007685. 15.2356105 0.0007142 -0.000973
2.4332033 -19.173154 C
0.00004813 6560. 136314069. 15.1333863 0.0007283 -0.001004
2.4698818 -19.827105 C
0.00004938 6651. 134701793. 15.0364373 0.0007424 -0.001035
2.5061702 -20.480561 C
0.00005063 6741. 133164798. 14.9448157 0.0007566 -0.001066
2.5420670 -21.133519 C
0.00005188 6831. 131681215. 14.8557791 0.0007706 -0.001097
2.5772462 -21.789700 C
0.00005313 6920. 130262439. 14.7708406 0.0007847 -0.001128
2.6120189 -22.445611 C
0.00005438 7009. 128904941. 14.6897221 0.0007988 -0.001159
2.6464037 -23.101025 C
0.00005563 7098. 127604558. 14.6129010 0.0008128 -0.001190
2.6803993 -23.755940 C
0.00005688 7186. 126350230. 14.5389970 0.0008269 -0.001221
2.7138340 -24.412404 C
0.00005813 7274. 125140358. 14.4671505 0.0008409 -0.001252
2.7467432 -25.070047 C
0.00005938 7361. 123977845. 14.3986205 0.0008549 -0.001283
2.7792664 -25.727188 C
0.00006063 7448. 122859742. 14.3332033 0.0008690 -0.001314
2.8114022 -26.383825 C
0.00006188 7535. 121783347. 14.2700401 0.0008830 -0.001345
2.8431494 -27.039954 C
0.00006313 7622. 120744673. 14.2101119 0.0008970 -0.001375
2.8744649 -27.696107 C
0.00006438 7708. 119735077. 14.1516887 0.0009110 -0.001406
2.9051658 -28.354679 C
0.00006563 7794. 118760715. 14.0952114 0.0009250 -0.001438
2.9354807 -29.012738 C
0.00006688 7879. 117819594. 14.0411109 0.0009390 -0.001469
2.9654083 -29.670283 C
0.00006813 7964. 116909867. 13.9892578 0.0009530 -0.001499
2.9949471 -30.327311 C
0.00006938 8050. 116029816. 13.9395321 0.0009671 -0.001530
3.0240957 -30.983818 C
0.00007063 8134. 115177863. 13.8918217 0.0009811 -0.001561
3.0528528 -31.639799 C
0.00007188 8219. 114350554. 13.8447465 0.0009951 -0.001592
3.0811496 -32.296211 C
0.00007313 8303. 113544320. 13.7999996 0.0010091 -0.001623
3.1089066 -32.954229 C

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0.00007438        8387.    112762311.    13.7564757     0.0010231     -0.001654
3.1362739    -33.611714 C
0.00007938        8720.    109853312.    13.5979360     0.0010793     -0.001778
3.2418183    -36.236265 C
0.00008438        9049.    107242881.    13.4596903     0.0011357     -0.001902
3.3408180    -38.855244 C
0.00008938        9373.    104874879.    13.3389100     0.0011922     -0.002025
3.4329713    -41.472825 C
0.00009438        9694.    102719593.    13.2336401     0.0012489     -0.002149
3.5186617    -44.081096 C
0.00009938       10011.    100743988.    13.1422855     0.0013060     -0.002271
3.5977806    -46.679788 C
 0.0001044       10324.     98914513.    13.0599488     0.0013631     -0.002394
3.6698468    -49.277378 C
 0.0001094       10633.     97217265.    12.9885007     0.0014206     -0.002517
3.7351829    -51.864912 C
 0.0001144       10938.     95634134.    12.9264120     0.0014785     -0.002639
3.7936754    -54.441822 C
 0.0001194       11239.     94149843.    12.8715385     0.0015365     -0.002761
3.8451939    -57.007754 C
 0.0001244       11536.     92751486.    12.8254457     0.0015952     -0.002882
3.8896007    -59.562346 C
 0.0001294       11820.     91366086.    12.7841645     0.0016540     -0.003004
3.9265490    -60.000000 CY
 0.0001344       12061.     89758580.    12.7328785     0.0017110     -0.003127
3.9552656    -60.000000 CY
 0.0001394       12262.     87977846.    12.6750196     0.0017666     -0.003251
3.9764357    -60.000000 CY
 0.0001444       12433.     86114787.    12.6142425     0.0018212     -0.003376
3.9906746    -60.000000 CY
 0.0001494       12588.     84271043.    12.5553637     0.0018755     -0.003502
3.9984021    -60.000000 CY
 0.0001544       12726.     82437671.    12.4975556     0.0019293     -0.003628
3.9981721    -60.000000 CY
 0.0001594       12846.     80603011.    12.4399361     0.0019826     -0.003755
3.9975068    -60.000000 CY
 0.0001644       12958.     78829803.    12.3845911     0.0020357     -0.003882
3.9995270    -60.000000 CY
 0.0001694       13063.     77121919.    12.3324524     0.0020888     -0.004009
3.9998671    -60.000000 CY
 0.0001744       13154.     75433152.    12.2789998     0.0021412     -0.004136
3.9991629    -60.000000 CY
 0.0001794       13233.     73771936.    12.2299804     0.0021938     -0.004264
3.9974441    -60.000000 CY
 0.0001844       13307.     72170973.    12.1822674     0.0022461     -0.004391
3.9999693    -60.000000 CY
 0.0001894       13378.     70642963.    12.1389570     0.0022988     -0.004519
3.9989478    -60.000000 CY
 0.0001944       13446.     69176305.    12.0987398     0.0023517     -0.004646
3.9966816    -60.000000 CY
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   0.0001994        13508.     67751791.    12.0601979     0.0024045     -0.004773
  3.9995466    -60.000000 CY
   0.0002044        13561.     66354514.    12.0195397     0.0024565     -0.004901
  3.9965831    -60.000000 CY
   0.0002094        13606.     64984040.    11.9790644     0.0025081     -0.005029
  3.9996009    -60.000000 CY
   0.0002144        13649.     63667345.    11.9411583     0.0025599     -0.005158
  3.9960136    -60.000000 CY
   0.0002194        13690.     62403624.    11.9055591     0.0026118     -0.005286
  3.9993170    -60.000000 CY
   0.0002244        13730.     61191502.    11.8735701     0.0026641     -0.005413
  3.9967081    -60.000000 CY
   0.0002294        13769.     60026897.    11.8437450     0.0027167     -0.005541
  3.9984900    -60.000000 CY
   0.0002344        13806.     58905181.    11.8156142     0.0027693     -0.005668
  3.9999904    -60.000000 CY
   0.0002394        13840.     57815586.    11.7886753     0.0028219     -0.005796
  3.9965534    -60.000000 CY
   0.0002444        13870.     56755223.    11.7619267     0.0028743     -0.005923
  3.9993705    -60.000000 CY
   0.0002494        13896.     55724401.    11.7357222     0.0029266     -0.006051
  3.9975193    -60.000000 CY
   0.0002544        13919.     54717383.    11.7096114     0.0029786     -0.006179
  3.9969225    -60.000000 CY
   0.0002594        13939.     53741378.    11.6832650     0.0030303     -0.006307
  3.9993995    -60.000000 CY
   0.0002644        13958.     52797531.    11.6575119     0.0030820     -0.006436
  3.9981147    -60.000000 CY
   0.0002694        13977.     51885294.    11.6336080     0.0031338     -0.006564
  3.9957315    -60.000000 CY
   0.0002744        13994.     51004890.    11.6111262     0.0031858     -0.006692
  3.9987057    -60.000000 CY
   0.0003044        14089.     46289882.    11.5006804     0.0035005     -0.007457
  3.9921169    -60.000000 CYT
   0.0003344        14144.     42299761.    11.4108790     0.0038155     -0.008222
  3.9963739    -60.000000 CYT


--------------------------------------------------------------------------------
   Summary of Results for Nominal Moment Capacity for Section 1
--------------------------------------------------------------------------------

Moment values interpolated at maximum compressive strain = 0.003
or maximum developed moment if pile fails at smaller strains.

 Load           Axial Thrust        Nominal Mom. Cap.      Max. Comp.      Max.
Tens.
  No.              kips                 in-kip               Strain
Strain
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   1               400.510             13927.178           0.00300000
-0.00623187
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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	400.510000	13927.	260.331500	9053.	107213352.
1	0.75	400.510000	13927.	300.382500	10445.	98248762.
1	0.90	400.510000	13927.	360.459000	12534.	84907077.

Pile Section No. 2:

Dimensions and Properties of Drilled Shaft (Bored Pile):

Length of Section	=	5.000000 ft
Shaft Diameter	=	30.000000 in
Concrete Cover Thickness (to edge of trans. reinf.)	=	3.000000 in
Number of Reinforcing Bars	=	15 bars
Yield Stress of Reinforcing Bars	=	60000. psi
Modulus of Elasticity of Reinforcing Bars	=	29000000. psi
Gross Area of Shaft	=	706.858347 sq. in.
Total Area of Reinforcing Steel	=	15.000000 sq. in.

Area Ratio of Steel Reinforcement	=	2.12 percent
Edge-to-Edge Bar Spacing	=	3.367467 in
Maximum Concrete Aggregate Size	=	0.375000 in
Ratio of Bar Spacing to Aggregate Size	=	8.98
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.	=	4.500000 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	=	3252.318 kips
Tensile Load for Cracking of Concrete	=	-337.937 kips
Nominal Axial Tensile Capacity	=	-900.000 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	10.811000	0.00000
2	1.128000	1.000000	9.876340	4.397230
3	1.128000	1.000000	7.233971	8.034139
4	1.128000	1.000000	3.340783	10.281872
5	1.128000	1.000000	-1.13006	10.751776
6	1.128000	1.000000	-5.40550	9.362601
7	1.128000	1.000000	-8.74628	6.354546
8	1.128000	1.000000	-10.57475	2.247733
9	1.128000	1.000000	-10.57475	-2.24773
10	1.128000	1.000000	-8.74628	-6.35455
11	1.128000	1.000000	-5.40550	-9.36260
12	1.128000	1.000000	-1.13006	-10.75178
13	1.128000	1.000000	3.340783	-10.28187
14	1.128000	1.000000	7.233971	-8.03414
15	1.128000	1.000000	9.876340	-4.39723

NOTE: The positions of the above rebars were computed by LPile

Minimum spacing between any two bars not equal to zero = 3.367 inches
between bars 7 and 8.

Ratio of bar spacing to maximum aggregate size = 8.98

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	=	0.375000 in

Number of Axial Thrust Force Values Determined from Pile-head Loadings = 1

Number	Axial Thrust Force kips
1	400.510

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 = 400.510 kips

Bending Curvature rad/in.	Bending Moment in-kip	Bending Stiffness kip-in2	Depth to N Axis in	Max Comp Strain in/in	Max Tens Strain in/in	Max Conc Stress ksi	Max Steel Stress ksi	Run Msg
0.00000125	224.6023890	179681911.	112.8772392	0.0001411	0.0001036	0.5752977	3.9558624	
0.00000250	449.1994279	179679771.	63.9644170	0.0001599	0.00008491	0.6480065	4.3655452	

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0.00000375   673.7682711    179671539.    47.6716047     0.0001788    0.00006627
0.7201001     4.7764745
0.00000500   898.2948225    179658965.    39.5337962     0.0001977    0.00004767
0.7915733     5.1886505
0.00000625        1123.     179642397.    34.6579907     0.0002166    0.00002911
0.8624207     5.6020733
0.00000750        1347.     179621952.    31.4131883     0.0002356    0.00001060
0.9326368     6.0167435
0.00000875        1571.     179597344.    29.1003822     0.0002546   -0.00000787
1.0022161     6.4326595
0.00001000        1796.     179554425.    27.3697499     0.0002737   -0.00002630
1.0711413     6.8497275
0.00001125        2019.     179468546.    26.0265097     0.0002928   -0.00004470
1.1393781     7.2677111
0.00001250        2242.     179331230.    24.9451244     0.0003118   -0.00006319
1.2068976     7.6864064
0.00001375        2463.     179144331.    24.0728537     0.0003310   -0.00008150
1.2736795     8.1056710
0.00001500        2684.     178912911.    23.3461851     0.0003502   -0.00009981
1.3397088     8.5254009
0.00001625        2684.     165150379.    22.1113672     0.0003593    -0.000128
1.3703782     8.6527942 C
0.00001750        2684.     153353924.    21.4517777     0.0003754    -0.000150
1.4248006     8.9836520 C
0.00001875        2774.     147973208.    20.8650277     0.0003912    -0.000171
1.4777002     9.3062963 C
0.00002000        2882.     144089679.    20.3387808     0.0004068    -0.000193
1.5291948     9.6214929 C
0.00002125        2984.     140437565.    19.8639838     0.0004221    -0.000215
1.5794250     9.9302426 C
0.00002250        3083.     137006955.    19.4329587     0.0004372    -0.000238
1.6284793    10.2331306 C
0.00002375        3178.     133796807.    19.0401243     0.0004522    -0.000260
1.6764865    10.5311302 C
0.00002500        3269.     130774182.    18.6795016     0.0004670    -0.000283
1.7234247    10.8238887 C
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1.7694219    11.1124163 C
0.00002750        3445.     125276247.    18.0409150     0.0004961    -0.000329
1.8145238    11.3970048 C
0.00002875        3530.     122772254.    17.7565928     0.0005105    -0.000352
1.8587803    11.6779968 C
0.00003000        3612.     120416520.    17.4923000     0.0005248    -0.000375
1.9022464    11.9558010 C
0.00003125        3694.     118199989.    17.2461137     0.0005389    -0.000399
1.9449822    12.2308891 C
0.00003250        3773.     116100050.    17.0152511     0.0005530    -0.000422
1.9869222    12.5025466 C
0.00003375        3852.     114119283.    16.7991692     0.0005670    -0.000446
2.0281940    12.7719065 C
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0.00003500        3929.    112251458.    16.5967855     0.0005809     -0.000469
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0.00003750        4080.    108795064.    16.2257859     0.0006085     -0.000517
2.1481947    13.5674254 C
0.00003875        4154.    107205251.    16.0565385     0.0006222     -0.000540
2.1870506    13.8294773 C
0.00004000        4227.    105681013.    15.8950211     0.0006358     -0.000564
2.2251728    14.0882272 C
0.00004125        4300.    104243006.    15.7433914     0.0006494     -0.000588
2.2629012    14.3470945 C
0.00004250        4372.    102860265.    15.5980610     0.0006629     -0.000612
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2.3365745    14.8588101 C
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2.3725596    15.1119562 C
0.00004625        4583.     99098750.    15.2058902     0.0007033     -0.000684
2.4081614    15.3652129 C
0.00004750        4653.     97952680.    15.0872235     0.0007166     -0.000708
2.4432376    15.6170255 C
0.00004875        4722.     96853626.    14.9737653     0.0007300     -0.000733
2.4778118    -15.941771 C
0.00005125        4858.     94794379.    14.7623697     0.0007566     -0.000781
2.5456520    -17.073490 C
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2.6759407    -19.345874 C
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2.7386135    -20.484247 C
0.00006125        5389.     87989042.    14.0745477     0.0008621     -0.000975
2.7994447    -21.626641 C
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2.8588468    -22.768086 C
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0.00006875        5775.     84004332.    13.6820723     0.0009406     -0.001122
2.9726625    -25.057280 C
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3.0271951    -26.203728 C
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3.0802400    -27.350185 C
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3.1818853    -29.642850 C
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3.3673798    -34.227242 C
0.00009125        6886.     75457974.    12.8829422     0.0011756     -0.001562
3.4100886    -35.372339 C
0.00009375        7005.     74723563.    12.8188616     0.0012018     -0.001611
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3.4913110    -37.657117 C
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3.5296102    -38.800644 C
 0.0001013        7360.     72695568.    12.6464616     0.0012805     -0.001757
3.5664665    -39.943012 C
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3.6996225    -44.493412 C
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3.7572335    -46.763939 C
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3.8547134    -51.281979 C
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3.8753322    -52.406173 C
 0.0001313        8723.     66459541.    12.1866123     0.0015995     -0.002338
3.8944258    -53.528181 C
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3.9423400    -56.885663 C
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3.9551640    -58.001695 C
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0.0001463	9368.	64053736.	12.0496039	0.0017623	-0.002625
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0.0001788	10278.	57499544.	11.7326496	0.0020972	-0.003265
3.9989629	-60.000000 CY				
0.0001888	10449.	55361426.	11.6325701	0.0021956	-0.003467
3.9999952	-60.000000 CY				
0.0001988	10595.	53308363.	11.5381874	0.0022932	-0.003669
3.9981882	-60.000000 CY				
0.0002088	10726.	51382544.	11.4507885	0.0023904	-0.003872
3.9991043	-60.000000 CY				
0.0002188	10831.	49514286.	11.3641007	0.0024859	-0.004077
3.9993627	-60.000000 CY				
0.0002288	10924.	47755746.	11.2839140	0.0025812	-0.004281
3.9992610	-60.000000 CY				
0.0002388	11013.	46128827.	11.2113323	0.0026767	-0.004486
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3.9985154	60.0000000 CY				
0.0003388	11503.	33958633.	10.6630217	0.0036121	-0.006550
3.9968970	60.0000000 CYT				
0.0003488	11523.	33040594.	10.6261603	0.0037059	-0.006757
3.9998556	60.0000000 CYT				
0.0003588	11539.	32163097.	10.5941718	0.0038007	-0.006962
3.9933921	60.0000000 CYT				

Summary of Results for Nominal Moment Capacity for Section 2

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	400.510	11238.837	0.00300000	-0.00519729

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.

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	400.510000	11239.	260.331500	7305.	73000235.
1	0.75	400.510000	11239.	300.382500	8429.	67646159.
1	0.90	400.510000	11239.	360.459000	10115.	59197876.

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	18.0000	0.00	N.A.	No	0.00	168434.
2	33.2000	15.2000	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 Displacement and Pile-head Rotation (Loading Type 5)
Displacement of pile head = 1.000000 inches
Rotation of pile head = 0.000E+00 radians
Axial load on pile head = 400510.0 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. Es*H lb/inch	Spr. Distrib. p Lat. Load lb/inch
0.00	1.0000	-9074975.	60679.	0.00	0.00	1.07E+11	0.00	0.00
0.3820	0.9991	-8796479.	60676.	-3.83E-04	0.00	1.07E+11	0.00	0.00
0.7640	0.9965	-8517291.	60676.	-7.46E-04	0.00	1.12E+11	0.00	0.00
1.1460	0.9923	-8237461.	60676.	-0.00109	0.00	1.14E+11	0.00	0.00
1.5280	0.9865	-7957023.	60676.	-0.00141	0.00	1.17E+11	0.00	0.00
1.9100	0.9794	-7676013.	60676.	-0.00171	0.00	1.20E+11	0.00	0.00
2.2920	0.9709	-7394465.	60676.	-0.00199	0.00	1.24E+11		

0.00 0.00 0.00
2.6740 0.9611 -7112414. 60676. -0.00226 0.00 1.27E+11
0.00 0.00 0.00
3.0560 0.9501 -6829892. 60676. -0.00251 0.00 1.32E+11
0.00 0.00 0.00
3.4380 0.9381 -6546935. 60676. -0.00273 0.00 1.37E+11
0.00 0.00 0.00
3.8200 0.9251 -6263573. 60676. -0.00295 0.00 1.42E+11
0.00 0.00 0.00
4.2020 0.9111 -5979841. 60676. -0.00314 0.00 1.48E+11
0.00 0.00 0.00
4.5840 0.8963 -5695769. 60676. -0.00331 0.00 1.56E+11
0.00 0.00 0.00
4.9660 0.8807 -5411390. 60676. -0.00347 0.00 1.64E+11
0.00 0.00 0.00
5.3480 0.8645 -5126733. 60676. -0.00362 0.00 1.74E+11
0.00 0.00 0.00
5.7300 0.8476 -4841828. 60676. -0.00375 0.00 1.85E+11
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6.1120 0.8301 -4556703. 60676. -0.00386 0.00 1.98E+11
0.00 0.00 0.00
6.4940 0.8122 -4271384. 60676. -0.00396 0.00 2.14E+11
0.00 0.00 0.00
6.8760 0.7938 -3985898. 60676. -0.00404 0.00 2.33E+11
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7.2580 0.7751 -3700267. 60676. -0.00410 0.00 3.53E+11
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7.6400 0.7562 -3414548. 60676. -0.00415 0.00 3.54E+11
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8.0220 0.7371 -3128748. 60676. -0.00419 0.00 3.54E+11
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8.7860 0.6983 -2556932. 60676. -0.00427 0.00 3.55E+11
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9.1680 0.6787 -2270930. 60676. -0.00430 0.00 3.55E+11
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11.4600 0.5586 -554023. 60676. -0.00441 0.00 3.55E+11
0.00 0.00 0.00
11.8420 0.5384 -267787. 60676. -0.00441 0.00 3.55E+11

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   12.9880     0.4778    590934.     60676.   -0.00441       0.00   3.55E+11
0.00       0.00       0.00
   13.3700     0.4576    877155.     60676.   -0.00440       0.00   3.55E+11
0.00       0.00       0.00
   13.7520     0.4374   1163356.     60676.   -0.00438       0.00   3.55E+11
0.00       0.00       0.00
   14.1340     0.4174   1449529.     60676.   -0.00437       0.00   3.55E+11
0.00       0.00       0.00
   14.5160     0.3974   1735667.     60676.   -0.00435       0.00   3.55E+11
0.00       0.00       0.00
   14.8980     0.3775   2021765.     60676.   -0.00432       0.00   3.55E+11
0.00       0.00       0.00
   15.2800     0.3578   2307814.     60676.   -0.00429       0.00   3.55E+11
0.00       0.00       0.00
   15.6620     0.3382   2593809.     60676.   -0.00426       0.00   3.55E+11
0.00       0.00       0.00
   16.0440     0.3187   2879743.     60676.   -0.00423       0.00   3.55E+11
0.00       0.00       0.00
   16.4260     0.2994   3165608.     60676.   -0.00419       0.00   3.54E+11
0.00       0.00       0.00
   16.8080     0.2803   3451398.     60676.   -0.00414       0.00   3.54E+11
0.00       0.00       0.00
   17.1900     0.2614   3737105.     60676.   -0.00410       0.00   3.53E+11
0.00       0.00       0.00
   17.5720     0.2428   4022724.     60676.   -0.00403       0.00   2.29E+11
0.00       0.00       0.00
   17.9540     0.2245   4308195.     60676.   -0.00395       0.00   2.12E+11
0.00       0.00       0.00
   18.3360     0.2066   4593494.     59557.   -0.00385       0.00   1.97E+11
-488.357     10837.       0.00
   18.7180     0.1892   4868335.     56770.   -0.00373       0.00   1.84E+11
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   19.1000     0.1724   5127663.     52952.   -0.00360       0.00   1.74E+11
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   24.8300    0.01571   5431614.    -47633.  -9.07E-04       0.00   1.63E+11
-1185.    345647.       0.00
   25.2120    0.01190   5202340.    -52814.  -7.61E-04       0.00   1.71E+11
-1075.    414099.       0.00
   25.5940    0.00874   4950212.    -57477.  -6.28E-04       0.00   1.81E+11
-959.085    503251.       0.00
   25.9760    0.00614   4677701.    -61562.  -5.10E-04       0.00   1.93E+11
-823.149    614241.       0.00
   26.3580    0.00406   4387688.    -64755.  -4.06E-04       0.00   2.07E+11
-570.105    643660.       0.00
   26.7400    0.00242   4085517.    -66877.  -3.16E-04       0.00   2.25E+11
-355.633    673078.       0.00
   27.1220    0.00117   3775721.    -68101.  -2.50E-04       0.00   3.53E+11
-178.649    702496.       0.00
   27.5040   1.34E-04   3462080.    -68560.  -2.03E-04       0.00   3.54E+11
-21.392    731914.       0.00
   27.8860  -6.92E-04   3147908.    -68345.  -1.60E-04       0.00   3.54E+11
114.9659    761333.       0.00
   28.2680   -0.00133   2836077.    -67555.  -1.21E-04       0.00   3.55E+11
229.7296    790751.       0.00
   28.6500   -0.00180   2529006.    -66289.  -8.65E-05       0.00   3.55E+11
322.6470    820169.       0.00
   29.0320   -0.00213   2228655.    -64647.  -5.58E-05       0.00   3.55E+11
393.8772    849588.       0.00
   29.4140   -0.00232   1936527.    -62727.  -2.90E-05       0.00   3.55E+11
443.9606    879006.       0.00
   29.7960   -0.00239   1653683.    -60623.  -5.81E-06       0.00   3.55E+11
473.7887    908424.       0.00
   30.1780   -0.00237   1380755.    -58427.   1.38E-05       0.00   3.55E+11
484.5808    937842.       0.00
   30.5600   -0.00226   1117977.    -56221.   2.99E-05       0.00   3.55E+11
477.8608    967261.       0.00
   30.9420   -0.00209    865214.    -54082.   4.27E-05       0.00   3.55E+11
```

```
455.4359    996679.       0.00
   31.3240   -0.00187    622000.    -52077.   5.23E-05       0.00   3.55E+11
419.3792   1026097.       0.00
   31.7060   -0.00162    387585.    -50263.   5.88E-05       0.00   3.55E+11
372.0170   1055516.       0.00
   32.0880   -0.00133    160977.    -48686.   6.23E-05       0.00   3.55E+11
315.9213   1084934.       0.00
   32.4700   -0.00104    -58996.    -47380.   6.30E-05       0.00   3.55E+11
253.9077   1114352.       0.00
   32.8520  -7.58E-04   -273633.    -46365.   6.08E-05       0.00   3.55E+11
189.0379   1143770.       0.00
   33.2340  -4.87E-04   -484290.    -28886.   5.29E-05       0.00   1.80E+11
7437.   7.00E+07       0.00
   33.6160  -2.73E-04   -538656.   -376.649   3.98E-05       0.00   1.80E+11
5002.   8.40E+07       0.00
   33.9980  -1.22E-04   -487889.     17061.   2.67E-05       0.00   1.80E+11
2606.   9.80E+07       0.00
   34.3800  -2.79E-05   -382335.     24597.   1.56E-05       0.00   1.80E+11
681.7567   1.12E+08       0.00
   34.7620   2.14E-05   -262437.     24813.   7.40E-06       0.00   1.80E+11
-587.698   1.26E+08       0.00
   35.1440   4.00E-05   -154876.     20668.   2.08E-06       0.00   1.80E+11
-1221.   1.40E+08       0.00
   35.5260   4.04E-05    -72957.     14757.  -8.29E-07       0.00   1.80E+11
-1358.   1.54E+08       0.00
   35.9080   3.24E-05    -19577.      8925.  -2.01E-06       0.00   1.80E+11
-1186.   1.68E+08       0.00
   36.2900   2.20E-05      8879.      4204.  -2.15E-06       0.00   1.80E+11
-873.693   1.82E+08       0.00
   36.6720   1.27E-05     18975.   958.6530  -1.79E-06       0.00   1.80E+11
-542.363   1.96E+08       0.00
   37.0540   5.58E-06     17674.   -870.719  -1.32E-06       0.00   1.80E+11
-255.792   2.10E+08       0.00
   37.4360   5.50E-07     10998.     -1519.  -9.57E-07       0.00   1.80E+11
-26.888   2.24E+08       0.00
   37.8180  -3.19E-06      3755.     -1200.  -7.69E-07       0.00   1.80E+11
165.9600   2.38E+08       0.00
   38.2000  -6.50E-06       0.00       0.00  -7.21E-07       0.00   1.80E+11
357.5437   1.26E+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             =     1.00000000 inches
Computed slope at pile head      =       0.000000 radians
Maximum bending moment           =      -9074975. inch-lbs
Maximum shear force              =        -68560. lbs
Depth of maximum bending moment  =       0.000000 feet below pile head
Depth of maximum shear force     =    27.50400000 feet below pile head
Number of iterations             =             14
Number of zero deflection points =              3
Pile deflection at ground        =     0.22230517 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 Load                Load                  Axial    Pile-head  Pile-head  Max
Shear Max Moment
Case Type   Pile-head    Type     Pile-head   Loading  Deflection  Rotation    in
Pile    in Pile
 No.  1      Load 1       2        Load 2       lbs      inches     radians      lbs
     in-lbs
---- ----- ---------- ---------- ---------- ---------- ---------- ----------
---------- ----------
  1  y, in     1.0000   S, rad         0.00    400510.     1.0000       0.00
-68560.  -9074975.


Maximum pile-head deflection = 1.0000000000 inches
Maximum pile-head rotation   = 0.0000000000 radians = 0.000000 deg.

--------------------------------------------------------------------------------
                           Summary of Warning Messages
--------------------------------------------------------------------------------

The following warning was reported 210 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.

==========

LPile for Windows, Version 2022-12.011

Analysis of Individual Piles and Drilled Shafts
Subjected to Lateral Loading Using the p-y Method
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Files Used for Analysis

Path to file locations:
\20240280\ODOT\109971\400-Engineering\Structures\SFN_0800512\Engdata\04_Abutment Design\Stage 2\Drilled Shaft\Lpile\Abutment\Rear Abutment\

Name of input data file:
RA_Scour Service - Back DS.lp12d

Name of output report file:
RA_Scour Service - Back DS.lp12o

Name of plot output file:
RA_Scour Service - Back DS.lp12p

Name of runtime message file:
RA_Scour Service - Back DS.lp12r

Date and Time of Analysis

Date: February 12, 2026 Time: 14:14:20

Problem Title

Project Name:

Job Number:

Client:

Engineer:

Description:

Program Options and Settings

Computational Options:
- Conventional Analysis

Engineering Units Used for Data Input and Computations:
- US Customary System Units (pounds, feet, inches)

Analysis Control Options:

- Maximum number of iterations allowed	=	500
- Deflection tolerance for convergence	=	1.0000E-05 in
- Maximum allowable deflection	=	100.0000 in
- Number of pile increments	=	100

Loading Type and Number of Cycles of Loading:

- Static loading specified

- Analysis uses p-y modification factors for p-y curves
- Analysis uses layering correction (Method of Georgiadis)
- No distributed lateral loads are entered
- Loading by lateral soil movements acting on pile not selected
- Input of shear resistance at the pile tip not selected
- Input of moment resistance at the pile tip not selected
- Computation of pile-head foundation stiffness matrix not selected
- Push-over analysis of pile not selected
- Buckling analysis of pile not selected

Output Options:
- Output files use decimal points to denote decimal symbols.
- Values of pile-head deflection, bending moment, shear force, and soil reaction are printed for full length of pile.
- Printing Increment (nodal spacing of output points) = 1
- No p-y curves to be computed and reported for user-specified depths
- Print using wide report formats

Pile Structural Properties and Geometry

Number of pile sections defined = 2
Total length of pile = 38.200 ft
Depth of ground surface below top of pile = 18.0000 ft

Pile diameters used for p-y curve computations are defined using 4 points.

p-y curves are computed using pile diameter values interpolated with depth over the length of the pile. A summary of values of pile diameter vs. depth follows.

Point No.	Depth Below Pile Head feet	Pile Diameter inches
1	0.000	36.0000
2	33.200	36.0000
3	33.200	30.0000
4	38.200	30.0000

Input Structural Properties for Pile Sections:

Pile Section No. 1:

Section 1 is a round drilled shaft, bored pile, or CIDH pile
Length of section = 33.200000 ft
Shaft Diameter = 36.000000 in

Pile Section No. 2:

Section 2 is a round drilled shaft, bored pile, or CIDH pile
Length of section = 5.000000 ft
Shaft Diameter = 30.000000 in

Soil and Rock Layering Information

The soil profile is modelled using 2 layers

Layer 1 is stiff clay with water-induced erosion

Distance from top of pile to top of layer = 18.000000 ft
Distance from top of pile to bottom of layer = 33.200000 ft
Effective unit weight at top of layer = 67.600000 pcf
Effective unit weight at bottom of layer = 67.600000 pcf
Undrained cohesion at top of layer = 4800. psf
Undrained cohesion at bottom of layer = 4800. psf
Epsilon-50 at top of layer = 0.004000
Epsilon-50 at bottom of layer = 0.004000
Subgrade k at top of layer = 2000. pci
Subgrade k at bottom of layer = 2000. pci

Layer 2 is weak rock, p-y criteria by Reese, 1997

Distance from top of pile to top of layer = 33.200000 ft
Distance from top of pile to bottom of layer = 50.000000 ft
Effective unit weight at top of layer = 92.700000 pcf
Effective unit weight at bottom of layer = 92.700000 pcf
Uniaxial compressive strength at top of layer = 1640. psi
Uniaxial compressive strength at bottom of layer = 1640. psi
Initial modulus of rock at top of layer = 150000. psi
Initial modulus of rock at bottom of layer = 150000. 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

(Depth of the lowest soil layer extends 11.800 ft below the pile tip)

Summary of Input Soil Properties

Layer Num.	Soil Type Name or (p-y Curve Type)	Layer Depth ft	Effective Unit Wt. pcf	Cohesion psf	Uniaxial qu psi	RQD %	E50 kpy	Rock Mass Modulus pci	krm psi
1	Stiff Clay with Free Water	18.0000	67.6000	4800.	--	--	0.00400	2000.	--
		33.2000	67.6000	4800.	--	--	0.00400	2000.	--
2	Weak Rock	33.2000	92.7000	--	1640.	15.0000	5.00E-04	--	150000.
		50.0000	92.7000	--	1640.	15.0000	5.00E-04	--	150000.

Modification Factors for p-y Curves

Distribution of p-y modifiers with depth defined using 4 points

Point No.	Depth X ft	p-mult	y-mult
1	18.000	0.5000	1.0000
2	33.200	0.5000	1.0000
3	33.300	1.0000	1.0000
4	100.000	1.0000	1.0000

Static Loading Type

Static loading criteria were used when computing p-y curves for all analyses.

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 1

Load No.	Load Type	Condition 1	Condition 2	Axial Thrust Force, lbs	Compute Top y vs. Pile Length	Run Analysis
1	5	y = 1.000000 in	S = 0.0000 in/in	363140.	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 = 2

Pile Section No. 1:

Dimensions and Properties of Drilled Shaft (Bored Pile):

Length of Section	=	33.200000 ft
Shaft Diameter	=	36.000000 in
Concrete Cover Thickness (to edge of trans. reinf.)	=	6.000000 in
Number of Reinforcing Bars	=	15 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	=	15.000000 sq. in.
Area Ratio of Steel Reinforcement	=	1.47 percent
Edge-to-Edge Bar Spacing	=	3.367467 in

Maximum Concrete Aggregate Size = 0.375000 in
Ratio of Bar Spacing to Aggregate Size = 8.98
Offset of Center of Rebar Cage from Center of Pile = 0.0000 in
Transverse Reinforcement
Type: Hoop
Number of Transverse Reinf. (per spacing) = 1
Spacing of Transverse Reinf. = 4.500000 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 = 4309.778 kips
Tensile Load for Cracking of Concrete = -467.292 kips
Nominal Axial Tensile Capacity = -900.000 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	10.811000	0.00000
2	1.128000	1.000000	9.876340	4.397230
3	1.128000	1.000000	7.233971	8.034139
4	1.128000	1.000000	3.340783	10.281872
5	1.128000	1.000000	-1.13006	10.751776
6	1.128000	1.000000	-5.40550	9.362601
7	1.128000	1.000000	-8.74628	6.354546
8	1.128000	1.000000	-10.57475	2.247733
9	1.128000	1.000000	-10.57475	-2.24773
10	1.128000	1.000000	-8.74628	-6.35455
11	1.128000	1.000000	-5.40550	-9.36260
12	1.128000	1.000000	-1.13006	-10.75178
13	1.128000	1.000000	3.340783	-10.28187
14	1.128000	1.000000	7.233971	-8.03414
15	1.128000	1.000000	9.876340	-4.39723

NOTE: The positions of the above rebars were computed by LPile

Minimum spacing between any two bars not equal to zero = 3.367 inches
between bars 7 and 8.

Ratio of bar spacing to maximum aggregate size = 8.98

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 = 0.375000 in

Number of Axial Thrust Force Values Determined from Pile-head Loadings = 1

Number	Axial Thrust Force kips
1	363.140

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 = 363.140 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	223.1012901	356962064.	144.3400757	0.00009021	0.00006771	0.3730034	2.4954514	
0.00000125	446.2026983	356962159.	81.1891092	0.0001015	0.00005649	0.4179394	2.7016802	
0.00000188	669.2931751	356956360.	60.1472600	0.0001128	0.00004528	0.4626586	2.9083698	

```
0.00000250   892.3672561    356946902.    49.6326905     0.0001241    0.00003408
0.5071600     3.1155201
0.00000313         1115.    356934232.    43.3290333     0.0001354    0.00002290
0.5514422     3.3231312
0.00000375         1338.    356918499.    39.1308328     0.0001467    0.00001174
0.5955040     3.5312031
0.00000438         1561.    356899765.    36.1357507     0.0001581   5.93910E-07
0.6393444     3.7397359
0.00000500         1784.    356873296.    33.8925565     0.0001695   -0.00001054
0.6829609     3.9487207
0.00000563         2007.    356811353.    32.1502209     0.0001808   -0.00002166
0.7263436     4.1580923
0.00000625         2229.    356693236.    30.7580288     0.0001922   -0.00003276
0.7694807     4.3677677
0.00000688         2451.    356514142.    29.6129096     0.0002036   -0.00004391
0.8123628     4.5776817
0.00000750         2672.    356276950.    28.6687166     0.0002150   -0.00005498
0.8549832     4.7877860
0.00000813         2892.    355987579.    27.8697600     0.0002264   -0.00006606
0.8973366     4.9980457
0.00000875         3112.    355652536.    27.1849302     0.0002379   -0.00007713
0.9394197     5.2084357
0.00000938         3331.    355277879.    26.5914294     0.0002493   -0.00008821
0.9812295     5.4189367
0.00001000         3549.    354868947.    26.0721541     0.0002607   -0.00009928
1.0227638     5.6295338
0.00001063         3766.    354430349.    25.6140454     0.0002721     -0.000110
1.0640210     5.8402153
0.00001125         3766.    334739774.    23.7867833     0.0002676     -0.000137
1.0470627     5.5876131 C
0.00001188         3766.    317121891.    23.2777106     0.0002764     -0.000151
1.0787134     5.7227241 C
0.00001250         3766.    301265796.    22.8094469     0.0002851     -0.000165
1.1097385     5.8541745 C
0.00001313         3766.    286919806.    22.3769557     0.0002937     -0.000179
1.1401826     5.9822663 C
0.00001375         3766.    273877997.    21.9766657     0.0003022     -0.000193
1.1701165     6.1075205 C
0.00001438         3766.    261970258.    21.6046927     0.0003106     -0.000207
1.1995618     6.2300688 C
0.00001500         3766.    251054830.    21.2577922     0.0003189     -0.000221
1.2285414     6.3500564 C
0.00001563         3766.    241012637.    20.9334843     0.0003271     -0.000235
1.2570846     6.4676845 C
0.00001625         3766.    231742920.    20.6296403     0.0003352     -0.000250
1.2852246     6.5831930 C
0.00001688         3766.    223159849.    20.3443795     0.0003433     -0.000264
1.3129934     6.6968150 C
0.00001750         3824.    218502329.    20.0747776     0.0003513     -0.000279
1.3403305     6.8080141 C
```

0.00001813 3887. 214459775. 19.8208530 0.0003593 -0.000293
1.3673463 6.9176825 C
0.00001875 3949. 210633851. 19.5815804 0.0003672 -0.000308
1.3940778 7.0261108 C
0.00001938 4010. 206978415. 19.3540436 0.0003750 -0.000323
1.4204297 7.1324689 C
0.00002000 4070. 203503080. 19.1384167 0.0003828 -0.000337
1.4464907 7.2374834 C
0.00002063 4129. 200201751. 18.9341933 0.0003905 -0.000352
1.4723037 7.3415027 C
0.00002125 4187. 197033862. 18.7387153 0.0003982 -0.000367
1.4977527 7.4435087 C
0.00002188 4244. 194032169. 18.5539221 0.0004059 -0.000382
1.5230375 7.5452067 C
0.00002250 4301. 191138351. 18.3759970 0.0004135 -0.000397
1.5479401 7.6446881 C
0.00002313 4357. 188393532. 18.2076052 0.0004211 -0.000411
1.5727104 7.7441128 C
0.00002375 4411. 185747079. 18.0452970 0.0004286 -0.000426
1.5971380 7.8416234 C
0.00002438 4466. 183225109. 17.8908810 0.0004361 -0.000441
1.6214104 -8.093071 C
0.00002563 4573. 178474909. 17.6003153 0.0004510 -0.000471
1.6692181 -8.724053 C
0.00002688 4679. 174098663. 17.3329372 0.0004658 -0.000502
1.7162123 -9.358005 C
0.00002813 4783. 170059403. 17.0865459 0.0004806 -0.000532
1.7624800 -9.994223 C
0.00002938 4885. 166292319. 16.8563832 0.0004952 -0.000562
1.8078372 -10.634478 C
0.00003063 4986. 162798238. 16.6431513 0.0005097 -0.000593
1.8525533 -11.276382 C
0.00003188 5085. 159540534. 16.4444237 0.0005242 -0.000623
1.8965912 -11.920335 C
0.00003313 5184. 156489900. 16.2580788 0.0005385 -0.000654
1.9399095 -12.566798 C
0.00003438 5281. 153638584. 16.0842045 0.0005529 -0.000685
1.9826654 -13.214337 C
0.00003563 5378. 150957082. 15.9204864 0.0005672 -0.000715
2.0247510 -13.864035 C
0.00003688 5474. 148436632. 15.7666400 0.0005814 -0.000746
2.0662702 -14.514940 C
0.00003813 5569. 146067239. 15.6224619 0.0005956 -0.000777
2.1072873 -15.166453 C
0.00003938 5663. 143819737. 15.4849798 0.0006097 -0.000808
2.1476053 -15.820572 C
0.00004063 5757. 141705254. 15.3564461 0.0006239 -0.000839
2.1875367 -16.474210 C
0.00004188 5850. 139697893. 15.2343383 0.0006379 -0.000870
2.2268660 -17.129563 C

0.00004313 5942. 137790367. 15.1180514 0.0006520 -0.000901
2.2656282 -17.786325 C
0.00004438 6034. 135985561. 15.0084471 0.0006660 -0.000932
2.3040076 -18.442607 C
0.00004563 6126. 134267943. 14.9046613 0.0006800 -0.000962
2.3418760 -19.099757 C
0.00004688 6217. 132624146. 14.8046063 0.0006940 -0.000994
2.3791172 -19.759051 C
0.00004813 6307. 131061442. 14.7100911 0.0007079 -0.001025
2.4159794 -20.417867 C
0.00004938 6398. 129573660. 14.6202818 0.0007219 -0.001056
2.4524614 -21.076203 C
0.00005063 6487. 128146940. 14.5346954 0.0007358 -0.001087
2.4883835 -21.736038 C
0.00005188 6577. 126777757. 14.4519711 0.0007497 -0.001118
2.5237677 -22.397178 C
0.00005313 6666. 125469163. 14.3734516 0.0007636 -0.001149
2.5587751 -23.057839 C
0.00005438 6754. 124216958. 14.2988484 0.0007775 -0.001180
2.5934042 -23.718017 C
0.00005563 6843. 123017333. 14.2272212 0.0007914 -0.001211
2.6276540 -24.377708 C
0.00005688 6931. 121856710. 14.1584763 0.0008053 -0.001242
2.6612594 -25.040026 C
0.00005813 7018. 120741255. 14.0920892 0.0008191 -0.001273
2.6944552 -25.702260 C
0.00005938 7105. 119669348. 14.0287812 0.0008330 -0.001305
2.7272746 -26.364005 C
0.00006063 7192. 118638278. 13.9683633 0.0008468 -0.001336
2.7597161 -27.025259 C
0.00006188 7279. 117645550. 13.9106618 0.0008607 -0.001367
2.7917786 -27.686020 C
0.00006313 7366. 116688227. 13.8544174 0.0008746 -0.001398
2.8234399 -28.346545 C
0.00006438 7452. 115757794. 13.8007809 0.0008884 -0.001429
2.8544924 -29.009476 C
0.00006563 7538. 114859725. 13.7488497 0.0009023 -0.001460
2.8851683 -29.671908 C
0.00006688 7623. 113992187. 13.6989630 0.0009161 -0.001491
2.9154662 -30.333836 C
0.00006813 7709. 113153483. 13.6511631 0.0009300 -0.001523
2.9453847 -30.995259 C
0.00006938 7794. 112342036. 13.6053388 0.0009439 -0.001554
2.9749223 -31.656172 C
0.00007063 7879. 111556384. 13.5613865 0.0009578 -0.001585
3.0040778 -32.316574 C
0.00007188 7963. 110795175. 13.5192094 0.0009717 -0.001616
3.0328499 -32.976459 C
0.00007313 8048. 110054462. 13.4780095 0.0009856 -0.001647
3.0611302 -33.637331 C

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0.00007438        8132.    109333568.    13.4373073     0.0009994     -0.001678
3.0889345    -34.299012 C
0.00007938        8465.    106650976.    13.2920180     0.0010551     -0.001802
3.1963190    -36.940449 C
0.00008438        8796.    104246372.    13.1670179     0.0011110     -0.001927
3.2975006    -39.573264 C
0.00008938        9122.    102064038.    13.0560332     0.0011669     -0.002051
3.3919539    -42.204737 C
0.00009438        9444.    100073869.    12.9602300     0.0012231     -0.002174
3.4799510    -44.829383 C
0.00009938        9763.     98248339.    12.8769009     0.0012796     -0.002298
3.5615303    -47.444596 C
 0.0001044       10079.     96562907.    12.8047624     0.0013365     -0.002421
3.6365821    -50.050094 C
 0.0001094       10390.     94994754.    12.7398556     0.0013934     -0.002544
3.7048057    -52.650266 C
 0.0001144       10697.     93529129.    12.6849227     0.0014508     -0.002667
3.7662130    -55.242809 C
 0.0001194       11001.     92153854.    12.6367743     0.0015085     -0.002789
3.8208043    -57.824480 C
 0.0001244       11300.     90852396.    12.5954096     0.0015666     -0.002911
3.8684263    -60.000000 CY
 0.0001294       11578.     89488239.    12.5544044     0.0016242     -0.003033
3.9084721    -60.000000 CY
 0.0001344       11806.     87855454.    12.5034569     0.0016802     -0.003157
3.9403702    -60.000000 CY
 0.0001394       11997.     86077744.    12.4468085     0.0017348     -0.003283
3.9649629    -60.000000 CY
 0.0001444       12164.     84250954.    12.3872032     0.0017884     -0.003409
3.9827895    -60.000000 CY
 0.0001494       12316.     82452099.    12.3300425     0.0018418     -0.003536
3.9942755    -60.000000 CY
 0.0001544       12449.     80641095.    12.2714329     0.0018944     -0.003663
3.9995657    -60.000000 CY
 0.0001594       12567.     78848722.    12.2139593     0.0019466     -0.003791
3.9992555    -60.000000 CY
 0.0001644       12680.     77140564.    12.1617205     0.0019991     -0.003918
3.9986129    -60.000000 CY
 0.0001694       12783.     75470132.    12.1115215     0.0020514     -0.004046
3.9973779    -60.000000 CY
 0.0001744       12870.     73808919.    12.0611001     0.0021032     -0.004174
3.9999910    -60.000000 CY
 0.0001794       12948.     72183242.    12.0099740     0.0021543     -0.004303
3.9994274    -60.000000 CY
 0.0001844       13023.     70634768.    11.9633786     0.0022057     -0.004432
3.9976639    -60.000000 CY
 0.0001894       13097.     69157043.    11.9208783     0.0022575     -0.004560
3.9999845    -60.000000 CY
 0.0001944       13164.     67722869.    11.8804287     0.0023093     -0.004688
3.9988598    -60.000000 CY
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 0.0001994        13221.     66313946.    11.8398304     0.0023606     -0.004817
3.9975676    -60.000000 CY
 0.0002044        13271.     64936294.    11.7992674     0.0024115     -0.004946
3.9992116    -60.000000 CY
 0.0002094        13318.     63606646.    11.7615339     0.0024626     -0.005075
3.9965285    -60.000000 CY
 0.0002144        13362.     62329600.    11.7256160     0.0025137     -0.005204
3.9990982    -60.000000 CY
 0.0002194        13405.     61105366.    11.6936457     0.0025653     -0.005332
3.9975474    -60.000000 CY
 0.0002244        13446.     59927938.    11.6613646     0.0026165     -0.005461
3.9984710    -60.000000 CY
 0.0002294        13486.     58795317.    11.6327217     0.0026683     -0.005589
3.9999931    -60.000000 CY
 0.0002344        13522.     57694623.    11.6035481     0.0027196     -0.005718
3.9969046    -60.000000 CY
 0.0002394        13554.     56623041.    11.5758382     0.0027710     -0.005847
3.9995439    -60.000000 CY
 0.0002444        13583.     55581667.    11.5481702     0.0028221     -0.005975
3.9962127    -60.000000 CY
 0.0002494        13607.     54562556.    11.5202894     0.0028729     -0.006105
3.9976411    -60.000000 CY
 0.0002544        13629.     53578193.    11.4936928     0.0029237     -0.006234
3.9997238    -60.000000 CY
 0.0002594        13650.     52626328.    11.4685331     0.0029747     -0.006363
3.9954310    -60.000000 CY
 0.0002644        13670.     51707742.    11.4451467     0.0030258     -0.006492
3.9971728    -60.000000 CY
 0.0002694        13690.     50821617.    11.4231687     0.0030771     -0.006620
3.9994879    -60.000000 CY
 0.0002744        13709.     49965717.    11.4025726     0.0031286     -0.006749
3.9976021    -60.000000 CY
 0.0003044        13807.     45362847.    11.2989771     0.0034391     -0.007518
3.9985445    -60.000000 CYT
 0.0003344        13858.     41443205.    11.2032887     0.0037461     -0.008291
3.9999602    -60.000000 CYT
 0.0003644        13858.     38031072.    11.2164007     0.0040870     -0.009031
3.9899151    -60.000000 CYT


--------------------------------------------------------------------------------
   Summary of Results for Nominal Moment Capacity for Section 1
--------------------------------------------------------------------------------

Moment values interpolated at maximum compressive strain = 0.003
or maximum developed moment if pile fails at smaller strains.

 Load           Axial Thrust        Nominal Mom. Cap.      Max. Comp.      Max.
Tens.
  No.              kips                 in-kip               Strain
```

Strain				
1	363.140	13660.003	0.00300000	-0.00642669

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	363.140000	13660.	236.041000	8879.	103689632.
1	0.75	363.140000	13660.	272.355000	10245.	95725435.
1	0.90	363.140000	13660.	326.826000	12294.	82714821.

Pile Section No. 2:

Dimensions and Properties of Drilled Shaft (Bored Pile):

Length of Section	=	5.000000 ft
Shaft Diameter	=	30.000000 in
Concrete Cover Thickness (to edge of trans. reinf.)	=	3.000000 in
Number of Reinforcing Bars	=	15 bars
Yield Stress of Reinforcing Bars	=	60000. psi
Modulus of Elasticity of Reinforcing Bars	=	29000000. psi

Gross Area of Shaft	=	706.858347 sq. in.
Total Area of Reinforcing Steel	=	15.000000 sq. in.
Area Ratio of Steel Reinforcement	=	2.12 percent
Edge-to-Edge Bar Spacing	=	3.367467 in
Maximum Concrete Aggregate Size	=	0.375000 in
Ratio of Bar Spacing to Aggregate Size	=	8.98
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.	=	4.500000 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	=	3252.318 kips
Tensile Load for Cracking of Concrete	=	-337.937 kips
Nominal Axial Tensile Capacity	=	-900.000 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	10.811000	0.00000
2	1.128000	1.000000	9.876340	4.397230
3	1.128000	1.000000	7.233971	8.034139
4	1.128000	1.000000	3.340783	10.281872
5	1.128000	1.000000	-1.13006	10.751776
6	1.128000	1.000000	-5.40550	9.362601
7	1.128000	1.000000	-8.74628	6.354546
8	1.128000	1.000000	-10.57475	2.247733
9	1.128000	1.000000	-10.57475	-2.24773
10	1.128000	1.000000	-8.74628	-6.35455
11	1.128000	1.000000	-5.40550	-9.36260
12	1.128000	1.000000	-1.13006	-10.75178
13	1.128000	1.000000	3.340783	-10.28187
14	1.128000	1.000000	7.233971	-8.03414
15	1.128000	1.000000	9.876340	-4.39723

NOTE: The positions of the above rebars were computed by LPile

Minimum spacing between any two bars not equal to zero = 3.367 inches
between bars 7 and 8.

Ratio of bar spacing to maximum aggregate size = 8.98

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	=	0.375000 in

Number of Axial Thrust Force Values Determined from Pile-head Loadings = 1

Number	Axial Thrust Force kips
1	363.140

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 = 363.140 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
0.00000125	225.8843741	180707499.	103.4998228	0.0001294	0.00009187	0.5291430	3.6159311	

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0.00000250   451.7626357    180705054.    59.2755617     0.0001482    0.00007319
0.6023412     4.0256032
0.00000375   677.6128623    180696763.    44.5455376     0.0001670    0.00005455
0.6749245     4.4365147
0.00000500   903.4210385    180684208.    37.1890742     0.0001859    0.00003595
0.7468877     4.8486658
0.00000625        1129.     180667703.    32.7820365     0.0002049    0.00001739
0.8182253     5.2620566
0.00000750        1355.     180647354.    29.8497132     0.0002239   -0.00000113
0.8889320     5.6766877
0.00000875        1580.     180615516.    27.7599141     0.0002429   -0.00001960
0.9589968     6.0925157
0.00001000        1805.     180542056.    26.1959082     0.0002620   -0.00003804
1.0283859     6.5093133
0.00001125        2030.     180412201.    24.9735675     0.0002810   -0.00005655
1.0970651     6.9268410
0.00001250        2253.     180227181.    24.0076650     0.0003001   -0.00007490
1.1650110     7.3449346
0.00001375        2475.     179993132.    23.2176017     0.0003192   -0.00009326
1.2322071     7.7634788
0.00001500        2696.     179717010.    22.5593947     0.0003384    -0.000112
1.2986416     8.1823915
0.00001625        2696.     165892624.    21.1982042     0.0003445    -0.000143
1.3191032     8.2224661 C
0.00001750        2696.     154043151.    20.5784859     0.0003601    -0.000165
1.3725315     8.5404566 C
0.00001875        2696.     143773608.    20.0267210     0.0003755    -0.000187
1.4244856     8.8504671 C
0.00002000        2777.     138841406.    19.5321241     0.0003906    -0.000209
1.4751256     9.1536320 C
0.00002125        2873.     135215645.    19.0862731     0.0004056    -0.000232
1.5246043     9.4510731 C
0.00002250        2966.     131831502.    18.6815808     0.0004203    -0.000255
1.5729489     9.7428565 C
0.00002375        3056.     128674902.    18.3121180     0.0004349    -0.000278
1.6202549    10.0296588 C
0.00002500        3143.     125730877.    17.9735421     0.0004493    -0.000301
1.6666087    10.3121041 C
0.00002625        3228.     122979830.    17.6619656     0.0004636    -0.000324
1.7120597    10.5905093 C
0.00002750        3311.     120406353.    17.3740996     0.0004778    -0.000347
1.7566665    10.8652876 C
0.00002875        3392.     117996857.    17.1074982     0.0004918    -0.000371
1.8004865    11.1368600 C
0.00003000        3472.     115738786.    16.8599074     0.0005058    -0.000394
1.8435732    11.4056272 C
0.00003125        3551.     113620939.    16.6294584     0.0005197    -0.000418
1.8859800    11.6720093 C
0.00003250        3628.     111619997.    16.4133478     0.0005334    -0.000442
1.9276315    11.9352166 C
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0.00003375        3704.    109734518.    16.2109250     0.0005471     -0.000465
1.9686302    12.1961369 C
0.00003500        3779.    107961689.    16.0216077     0.0005608     -0.000489
2.0090776    12.4556827 C
0.00003625        3853.    106277206.    15.8426114     0.0005743     -0.000513
2.0488251    12.7123595 C
0.00003750        3926.    104686905.    15.6743528     0.0005878     -0.000537
2.0880403    12.9677345 C
0.00003875        3998.    103178889.    15.5154644     0.0006012     -0.000561
2.1266903    13.2214402 C
0.00004000        4070.    101746584.    15.3650731     0.0006146     -0.000585
2.1647811    13.4734848 C
0.00004125        4141.    100386600.    15.2228166     0.0006279     -0.000610
2.2023657    13.7243570 C
0.00004250        4211.     99093038.    15.0879423     0.0006412     -0.000634
2.2394436    13.9740141 C
0.00004375        4281.     97858650.    14.9595962     0.0006545     -0.000658
2.2759924    -14.324689 C
0.00004500        4351.     96687908.    14.8384494     0.0006677     -0.000682
2.3121657    -14.892061 C
0.00004625        4420.     95560926.    14.7218532     0.0006809     -0.000707
2.3477022    -15.462127 C
0.00004750        4488.     94490347.    14.6116784     0.0006941     -0.000731
2.3828982    -16.031788 C
0.00004875        4556.     93465302.    14.5064486     0.0007072     -0.000755
2.4176237    -16.602446 C
0.00005125        4691.     91539749.    14.3095369     0.0007334     -0.000804
2.4856965    -17.746512 C
0.00005375        4825.     89765817.    14.1290838     0.0007594     -0.000853
2.5520178    -18.893474 C
0.00005625        4957.     88132049.    13.9643250     0.0007855     -0.000902
2.6168056    -20.041000 C
0.00005875        5088.     86609572.    13.8111121     0.0008114     -0.000951
2.6797565    -21.192741 C
0.00006125        5219.     85200899.    13.6709723     0.0008373     -0.001000
2.7413240    -22.343475 C
0.00006375        5347.     83880713.    13.5399043     0.0008632     -0.001049
2.8011377    -23.497753 C
0.00006625        5476.     82649759.    13.4190584     0.0008890     -0.001098
2.8595452    -24.651393 C
0.00006875        5603.     81495736.    13.3067256     0.0009148     -0.001148
2.9164470    -25.805653 C
0.00007125        5729.     80407933.    13.2012856     0.0009406     -0.001197
2.9717523    -26.961808 C
0.00007375        5855.     79386742.    13.1037886     0.0009664     -0.001246
3.0257264    -28.116334 C
0.00007625        5980.     78421841.    13.0125201     0.0009922     -0.001295
3.0782092    -29.271377 C
0.00007875        6104.     77506425.    12.9262865     0.0010179     -0.001345
3.1291424    -30.427837 C
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0.00008125        6227.    76640844.    12.8461328    0.0010437    -0.001394
3.1787387   -31.582629 C
0.00008375        6350.    75820572.    12.7714577    0.0010696    -0.001443
3.2269892   -32.735738 C
0.00008625        6472.    75037345.    12.7005867    0.0010954    -0.001492
3.2736779   -33.890470 C
0.00008875        6593.    74290447.    12.6335689    0.0011212    -0.001541
3.3189291   -35.044925 C
0.00009125        6714.    73578599.    12.5709987    0.0011471    -0.001590
3.3628263   -36.197644 C
0.00009375        6834.    72898934.    12.5124112    0.0011730    -0.001639
3.4053602   -37.348610 C
0.00009625        6954.    72248887.    12.4575033    0.0011990    -0.001688
3.4465215   -38.497803 C
0.00009875        7073.    71622835.    12.4049204    0.0012250    -0.001738
3.4861096   -39.648847 C
 0.0001013        7191.    71021742.    12.3551718    0.0012510    -0.001787
3.5242894   -40.798689 C
 0.0001038        7309.    70444293.    12.3082161    0.0012770    -0.001836
3.5610850   -41.946689 C
 0.0001063        7426.    69888759.    12.2642727    0.0013031    -0.001884
3.5964863   -43.092826 C
 0.0001088        7542.    69353572.    12.2229494    0.0013292    -0.001933
3.6304830   -44.237076 C
 0.0001113        7658.    68837303.    12.1840768    0.0013555    -0.001982
3.6630650   -45.379417 C
 0.0001138        7774.    68338507.    12.1474651    0.0013818    -0.002031
3.6942122   -46.520059 C
 0.0001163        7888.    67854169.    12.1121655    0.0014080    -0.002079
3.7237924   -47.662174 C
 0.0001188        8002.    67385345.    12.0787374    0.0014344    -0.002128
3.7519412   -48.802286 C
 0.0001213        8115.    66931021.    12.0472651    0.0014607    -0.002177
3.7786474   -49.940367 C
 0.0001238        8228.    66490262.    12.0173902    0.0014872    -0.002225
3.8038997   -51.076390 C
 0.0001263        8340.    66062204.    11.9895091    0.0015137    -0.002274
3.8276862   -52.210329 C
 0.0001288        8452.    65646050.    11.9632815    0.0015403    -0.002322
3.8499953   -53.342155 C
 0.0001313        8563.    65241063.    11.9386192    0.0015669    -0.002371
3.8708147   -54.471838 C
 0.0001338        8673.    64846559.    11.9154411    0.0015937    -0.002419
3.8901320   -55.599350 C
 0.0001363        8783.    64461905.    11.8936725    0.0016205    -0.002467
3.9079347   -56.724658 C
 0.0001388        8892.    64086509.    11.8732448    0.0016474    -0.002515
3.9242099   -57.847732 C
 0.0001413        9000.    63719821.    11.8540830    0.0016744    -0.002563
3.9389442   -58.968539 C
```

```
 0.0001438        9108.     63359510.    11.8357695     0.0017014     -0.002611
3.9520878    -60.000000 CY
 0.0001463        9213.     62992303.    11.8174558     0.0017283     -0.002659
3.9636135    -60.000000 CY
 0.0001488        9312.     62598339.    11.7981721     0.0017550     -0.002708
3.9734745    -60.000000 CY
 0.0001588        9634.     60688249.    11.7046969     0.0018581     -0.002904
3.9969692    -60.000000 CY
 0.0001688        9880.     58549100.    11.6012416     0.0019577     -0.003105
3.9999785    -60.000000 CY
 0.0001788       10085.     56420326.    11.5016566     0.0020559     -0.003307
3.9996342    -60.000000 CY
 0.0001888       10249.     54299175.    11.4008407     0.0021519     -0.003511
3.9976418    -60.000000 CY
 0.0001988       10397.     52310183.    11.3097525     0.0022478     -0.003715
3.9992502    -60.000000 CY
 0.0002088       10522.     50405582.    11.2245127     0.0023431     -0.003919
3.9998146    -60.000000 CY
 0.0002188       10622.     48559518.    11.1371363     0.0024362     -0.004126
3.9999311    -60.000000 CY
 0.0002288       10717.     46850091.    11.0596734     0.0025299     -0.004333
3.9999224    -60.000000 CY
 0.0002388       10807.     45264327.    10.9907908     0.0026241     -0.004538
3.9997707    -60.000000 CY
 0.0002488       10881.     43744498.    10.9218862     0.0027168     -0.004746
3.9991412    -60.000000 CY
 0.0002588       10942.     42289456.    10.8521071     0.0028080     -0.004955
3.9973446    -60.000000 CY
 0.0002688       10998.     40922643.    10.7871502     0.0028990     -0.005163
3.9984439    -60.000000 CY
 0.0002788       11052.     39648162.    10.7279226     0.0029904     -0.005372
3.9993205    -60.000000 CY
 0.0002888       11105.     38457933.    10.6758675     0.0030827     -0.005580
3.9959963    -60.000000 CY
 0.0002988       11155.     37339228.    10.6259375     0.0031745     -0.005788
3.9998556    -60.000000 CY
 0.0003088       11198.     36267413.    10.5762419     0.0032654     -0.005997
3.9964057    60.0000000 CY
 0.0003188       11233.     35241512.    10.5269726     0.0033555     -0.006207
3.9998104    60.0000000 CY
 0.0003288       11262.     34255988.    10.4811814     0.0034457     -0.006417
3.9948182    60.0000000 CYT
 0.0003388       11288.     33321174.    10.4379448     0.0035359     -0.006627
3.9991664    60.0000000 CYT
 0.0003488       11309.     32427780.    10.4011534     0.0036274     -0.006835
3.9953035    60.0000000 CYT
 0.0003588       11330.     31580964.    10.3689823     0.0037199     -0.007043
3.9972079    60.0000000 CYT
 0.0003688       11347.     30772748.    10.3408328     0.0038132     -0.007249
3.9999084    60.0000000 CYT
```

Summary of Results for Nominal Moment Capacity for Section 2

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	363.140	11057.415	0.00300000	-0.00539369

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	363.140000	11057.	236.041000	7187.	71040210.
1	0.75	363.140000	11057.	272.355000	8293.	66242655.
1	0.90	363.140000	11057.	326.826000	9952.	57806388.

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	18.0000	0.00	N.A.	No	0.00	168434.
2	33.2000	15.2000	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 Displacement and Pile-head Rotation (Loading Type 5)
Displacement of pile head = 1.000000 inches
Rotation of pile head = 0.000E+00 radians
Axial load on pile head = 363140.0 lbs

Depth X	Deflect. y	Bending Moment	Shear Force	Slope S	Total Stress	Bending Stiffness	Soil Res. Es*H	Soil Spr. Lat. Load	Distrib. p
feet	inches	in-lbs	lbs	radians	psi*	lb-in^2	lb/inch	lb/inch	lb/inch
0.00	1.0000	-8479866.	55284.	0.00	0.00	1.07E+11	0.00	0.00	0.00
0.3820	0.9992	-8226152.	55282.	-3.59E-04	0.00	1.07E+11	0.00	0.00	0.00
0.7640	0.9967	-7971848.	55282.	-7.01E-04	0.00	1.11E+11	0.00	0.00	0.00
1.1460	0.9927	-7716995.	55282.	-0.00102	0.00	1.13E+11	0.00	0.00	0.00
1.5280	0.9873	-7461622.	55282.	-0.00133	0.00	1.16E+11			

```
0.00       0.00       0.00
    1.9100     0.9806  -7205756.     55282.   -0.00161       0.00   1.18E+11
0.00       0.00       0.00
    2.2920     0.9725  -6949425.     55282.   -0.00188       0.00   1.22E+11
0.00       0.00       0.00
    2.6740     0.9633  -6692659.     55282.   -0.00214       0.00   1.25E+11
0.00       0.00       0.00
    3.0560     0.9529  -6435485.     55282.   -0.00238       0.00   1.29E+11
0.00       0.00       0.00
    3.4380     0.9415  -6177929.     55282.   -0.00260       0.00   1.33E+11
0.00       0.00       0.00
    3.8200     0.9291  -5920020.     55282.   -0.00280       0.00   1.38E+11
0.00       0.00       0.00
    4.2020     0.9158  -5661785.     55282.   -0.00299       0.00   1.44E+11
0.00       0.00       0.00
    4.5840     0.9017  -5403249.     55282.   -0.00316       0.00   1.50E+11
0.00       0.00       0.00
    4.9660     0.8869  -5144438.     55282.   -0.00332       0.00   1.58E+11
0.00       0.00       0.00
    5.3480     0.8713  -4885379.     55282.   -0.00346       0.00   1.66E+11
0.00       0.00       0.00
    5.7300     0.8551  -4626095.     55282.   -0.00359       0.00   1.76E+11
0.00       0.00       0.00
    6.1120     0.8384  -4366611.     55282.   -0.00370       0.00   1.88E+11
0.00       0.00       0.00
    6.4940     0.8212  -4106950.     55282.   -0.00380       0.00   2.01E+11
0.00       0.00       0.00
    6.8760     0.8035  -3847133.     55282.   -0.00389       0.00   2.17E+11
0.00       0.00       0.00
    7.2580     0.7855  -3587181.     55282.   -0.00395       0.00   3.55E+11
0.00       0.00       0.00
    7.6400     0.7673  -3327152.     55282.   -0.00400       0.00   3.55E+11
0.00       0.00       0.00
    8.0220     0.7489  -3067051.     55282.   -0.00404       0.00   3.56E+11
0.00       0.00       0.00
    8.4040     0.7303  -2806884.     55282.   -0.00408       0.00   3.56E+11
0.00       0.00       0.00
    8.7860     0.7115  -2546658.     55282.   -0.00411       0.00   3.56E+11
0.00       0.00       0.00
    9.1680     0.6926  -2286377.     55282.   -0.00414       0.00   3.57E+11
0.00       0.00       0.00
    9.5500     0.6735  -2026046.     55282.   -0.00417       0.00   3.57E+11
0.00       0.00       0.00
    9.9320     0.6544  -1765673.     55282.   -0.00419       0.00   3.57E+11
0.00       0.00       0.00
   10.3140     0.6351  -1505262.     55282.   -0.00422       0.00   3.57E+11
0.00       0.00       0.00
   10.6960     0.6157  -1244818.     55282.   -0.00423       0.00   3.57E+11
0.00       0.00       0.00
   11.0780     0.5963   -984348.     55282.   -0.00425       0.00   3.57E+11
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0.00       0.00       0.00
   11.4600     0.5768   -723857.     55282.   -0.00426       0.00   3.57E+11
0.00       0.00       0.00
   11.8420     0.5572   -463351.     55282.   -0.00427       0.00   3.57E+11
0.00       0.00       0.00
   12.2240     0.5377   -202834.     55282.   -0.00427       0.00   3.57E+11
0.00       0.00       0.00
   12.6060     0.5181     57686.     55282.   -0.00427       0.00   3.57E+11
0.00       0.00       0.00
   12.9880     0.4985    318206.     55282.   -0.00427       0.00   3.57E+11
0.00       0.00       0.00
   13.3700     0.4790    578719.     55282.   -0.00426       0.00   3.57E+11
0.00       0.00       0.00
   13.7520     0.4594    839219.     55282.   -0.00425       0.00   3.57E+11
0.00       0.00       0.00
   14.1340     0.4400   1099702.     55282.   -0.00424       0.00   3.57E+11
0.00       0.00       0.00
   14.5160     0.4206   1360160.     55282.   -0.00423       0.00   3.57E+11
0.00       0.00       0.00
   14.8980     0.4012   1620590.     55282.   -0.00421       0.00   3.57E+11
0.00       0.00       0.00
   15.2800     0.3820   1880986.     55282.   -0.00418       0.00   3.57E+11
0.00       0.00       0.00
   15.6620     0.3629   2141340.     55282.   -0.00416       0.00   3.57E+11
0.00       0.00       0.00
   16.0440     0.3439   2401650.     55282.   -0.00413       0.00   3.57E+11
0.00       0.00       0.00
   16.4260     0.3250   2661907.     55282.   -0.00410       0.00   3.56E+11
0.00       0.00       0.00
   16.8080     0.3063   2922108.     55282.   -0.00406       0.00   3.56E+11
0.00       0.00       0.00
   17.1900     0.2878   3182246.     55282.   -0.00402       0.00   3.56E+11
0.00       0.00       0.00
   17.5720     0.2695   3442316.     55282.   -0.00398       0.00   3.55E+11
0.00       0.00       0.00
   17.9540     0.2513   3702312.     55282.   -0.00393       0.00   3.55E+11
0.00       0.00       0.00
   18.3360     0.2334   3962228.     54579.   -0.00386       0.00   2.10E+11
-306.676      6023.       0.00
   18.7180     0.2159   4215556.     52757.   -0.00377       0.00   1.96E+11
-488.272     10367.       0.00
   19.1000     0.1988   4458459.     50139.   -0.00367       0.00   1.84E+11
-653.602     15069.       0.00
   19.4820     0.1823   4687443.     46807.   -0.00355       0.00   1.74E+11
-800.435     20130.       0.00
   19.8640     0.1663   4899401.     42841.   -0.00342       0.00   1.66E+11
-929.807     25632.       0.00
   20.2460     0.1509   5091596.     38321.   -0.00328       0.00   1.59E+11
-1042.     31660.       0.00
   20.6280     0.1362   5261644.     33323.   -0.00313       0.00   1.54E+11
```

-1138. 38308. 0.00
21.0100 0.1222 5407511. 27921. -0.00297 0.00 1.50E+11
-1218. 45680. 0.00
21.3920 0.1090 5527505. 22192. -0.00280 0.00 1.47E+11
-1282. 53893. 0.00
21.7740 0.09659 5620278. 16208. -0.00262 0.00 1.45E+11
-1329. 63069. 0.00
22.1560 0.08498 5684830. 10047. -0.00244 0.00 1.43E+11
-1359. 73314. 0.00
22.5380 0.07419 5720520. 3800. -0.00226 0.00 1.43E+11
-1366. 84415. 0.00
22.9200 0.06426 5727194. -2414. -0.00208 0.00 1.42E+11
-1345. 95938. 0.00
23.3020 0.05516 5705302. -8508. -0.00189 0.00 1.43E+11
-1314. 109188. 0.00
23.6840 0.04691 5655496. -14440. -0.00171 0.00 1.44E+11
-1274. 124525. 0.00
24.0660 0.03948 5578614. -20171. -0.00153 0.00 1.46E+11
-1226. 142408. 0.00
24.4480 0.03285 5475668. -25667. -0.00136 0.00 1.48E+11
-1171. 163420. 0.00
24.8300 0.02700 5347830. -30894. -0.00120 0.00 1.52E+11
-1109. 188320. 0.00
25.2120 0.02189 5196411. -35824. -0.00104 0.00 1.56E+11
-1042. 218100. 0.00
25.5940 0.01748 5022849. -40433. -8.91E-04 0.00 1.62E+11
-969.139 254084. 0.00
25.9760 0.01373 4828686. -44700. -7.54E-04 0.00 1.68E+11
-892.617 298062. 0.00
26.3580 0.01057 4615546. -48610. -6.28E-04 0.00 1.77E+11
-813.133 352507. 0.00
26.7400 0.00797 4385121. -52151. -5.15E-04 0.00 1.87E+11
-731.716 420903. 0.00
27.1220 0.00586 4139142. -55297. -4.13E-04 0.00 2.00E+11
-641.105 501783. 0.00
27.5040 0.00418 3879532. -57859. -3.24E-04 0.00 2.15E+11
-476.737 522796. 0.00
27.8860 0.00288 3609768. -59736. -2.60E-04 0.00 3.55E+11
-341.991 543809. 0.00
28.2680 0.00180 3332739. -61028. -2.15E-04 0.00 3.55E+11
-221.697 564822. 0.00
28.6500 9.13E-04 3050980. -61803. -1.74E-04 0.00 3.56E+11
-116.662 585835. 0.00
29.0320 2.07E-04 2766705. -62133. -1.36E-04 0.00 3.56E+11
-27.358 606848. 0.00
29.4140 -3.36E-04 2481795. -62091. -1.02E-04 0.00 3.56E+11
46.0623 627861. 0.00
29.7960 -7.33E-04 2197800. -61747. -7.24E-05 0.00 3.57E+11
103.7522 648874. 0.00
30.1780 -0.00100 1915938. -61174. -4.60E-05 0.00 3.57E+11

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146.1588    669887.       0.00
   30.5600   -0.00115   1637106.    -60441.  -2.32E-05       0.00   3.57E+11
174.0100    690900.       0.00
   30.9420   -0.00121   1361896.    -59610.  -3.90E-06       0.00   3.57E+11
188.3068    711914.       0.00
   31.3240   -0.00119   1090614.    -58742.   1.18E-05       0.00   3.57E+11
190.3152    732927.       0.00
   31.7060   -0.00110    823308.    -57890.   2.41E-05       0.00   3.57E+11
181.5602    753940.       0.00
   32.0880  -9.69E-04    559799.    -57098.   3.30E-05       0.00   3.57E+11
163.8194    774953.       0.00
   32.4700  -8.01E-04    299720.    -56404.   3.85E-05       0.00   3.57E+11
139.1200    795966.       0.00
   32.8520  -6.16E-04     42558.    -55834.   4.07E-05       0.00   3.57E+11
109.7375    816979.       0.00
   33.2340  -4.28E-04   -212298.    -40609.   3.83E-05       0.00   1.81E+11
6533.   7.00E+07       0.00
   33.6160  -2.64E-04   -329876.    -14527.   3.14E-05       0.00   1.81E+11
4847.   8.40E+07       0.00
   33.9980  -1.40E-04   -345586.      3421.   2.29E-05       0.00   1.81E+11
2984.   9.80E+07       0.00
   34.3800  -5.48E-05   -298584.     13329.   1.47E-05       0.00   1.81E+11
1339.   1.12E+08       0.00
   34.7620  -4.77E-06   -223431.     16699.   8.08E-06       0.00   1.81E+11
131.0606   1.26E+08       0.00
   35.1440   1.93E-05   -145515.     15650.   3.40E-06       0.00   1.81E+11
-588.920   1.40E+08       0.00
   35.5260   2.64E-05    -79968.     12266.   5.39E-07       0.00   1.81E+11
-887.175   1.54E+08       0.00
   35.9080   2.42E-05    -33059.      8198.  -8.94E-07       0.00   1.81E+11
-888.027   1.68E+08       0.00
   36.2900   1.82E-05     -4809.      4505.  -1.37E-06       0.00   1.81E+11
-722.882   1.82E+08       0.00
   36.6720   1.16E-05      8251.      1709.  -1.33E-06       0.00   1.81E+11
-497.013   1.96E+08       0.00
   37.0540   6.00E-06     10867.    -59.848  -1.09E-06       0.00   1.81E+11
-274.897   2.10E+08       0.00
   37.4360   1.64E-06      7706.   -873.733  -8.53E-07       0.00   1.81E+11
-80.201   2.24E+08       0.00
   37.8180  -1.82E-06      2859.   -840.764  -7.19E-07       0.00   1.81E+11
94.5849   2.38E+08       0.00
   38.2000  -4.95E-06       0.00       0.00  -6.83E-07       0.00   1.81E+11
272.2407   1.26E+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             =     1.00000000 inches
Computed slope at pile head      =       0.000000 radians
Maximum bending moment           =      -8479866. inch-lbs
Maximum shear force              =        -62133. lbs
Depth of maximum bending moment  =       0.000000 feet below pile head
Depth of maximum shear force     =    29.03200000 feet below pile head
Number of iterations             =             34
Number of zero deflection points =              3
Pile deflection at ground        =     0.24916555 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	Pile-head Load 1	Load Type	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	y, in	1.0000	S, rad	0.00	363140.	1.0000	0.00	-62133.	-8479866.

Maximum pile-head deflection = 1.0000000000 inches
Maximum pile-head rotation = 0.0000000000 radians = 0.000000 deg.

Summary of Warning Messages

The following warning was reported 490 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.

==

LPile for Windows, Version 2022-12.011

Analysis of Individual Piles and Drilled Shafts
Subjected to Lateral Loading Using the p-y Method
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Files Used for Analysis

Path to file locations:
\20240280\ODOT\109971\400-Engineering\Structures\SFN_0800512\Engdata\04_Abutment Design\Stage 2\Drilled Shaft\Lpile\Abutment\Rear Abutment\

Name of input data file:
RA_Scour Strength 1 - Front DS.lp12d

Name of output report file:
RA_Scour Strength 1 - Front DS.lp12o

Name of plot output file:
RA_Scour Strength 1 - Front DS.lp12p

Name of runtime message file:
RA_Scour Strength 1 - Front DS.lp12r

Date and Time of Analysis

Date: February 12, 2026 Time: 14:16:25

Problem Title

Project Name:

Job Number:

Client:

Engineer:

Description:

Program Options and Settings

Computational Options:
- Conventional Analysis

Engineering Units Used for Data Input and Computations:
- US Customary System Units (pounds, feet, inches)

Analysis Control Options:

- Maximum number of iterations allowed	=	500
- Deflection tolerance for convergence	=	1.0000E-05 in
- Maximum allowable deflection	=	100.0000 in
- Number of pile increments	=	100

Loading Type and Number of Cycles of Loading:

- Static loading specified

- Analysis uses p-y modification factors for p-y curves
- Analysis uses layering correction (Method of Georgiadis)
- No distributed lateral loads are entered
- Loading by lateral soil movements acting on pile not selected
- Input of shear resistance at the pile tip not selected
- Input of moment resistance at the pile tip not selected
- Computation of pile-head foundation stiffness matrix not selected
- Push-over analysis of pile not selected
- Buckling analysis of pile not selected

Output Options:
- Output files use decimal points to denote decimal symbols.
- Values of pile-head deflection, bending moment, shear force, and soil reaction are printed for full length of pile.
- Printing Increment (nodal spacing of output points) = 1
- No p-y curves to be computed and reported for user-specified depths
- Print using wide report formats

Pile Structural Properties and Geometry

Number of pile sections defined = 2
Total length of pile = 38.200 ft
Depth of ground surface below top of pile = 18.0000 ft

Pile diameters used for p-y curve computations are defined using 4 points.

p-y curves are computed using pile diameter values interpolated with depth over the length of the pile. A summary of values of pile diameter vs. depth follows.

Point No.	Depth Below Pile Head feet	Pile Diameter inches
1	0.000	36.0000
2	33.200	36.0000
3	33.200	30.0000
4	38.200	30.0000

Input Structural Properties for Pile Sections:

Pile Section No. 1:

Section 1 is a round drilled shaft, bored pile, or CIDH pile
Length of section = 33.200000 ft
Shaft Diameter = 36.000000 in

Pile Section No. 2:

Section 2 is a round drilled shaft, bored pile, or CIDH pile
Length of section = 5.000000 ft
Shaft Diameter = 30.000000 in

Soil and Rock Layering Information

The soil profile is modelled using 2 layers

Layer 1 is stiff clay with water-induced erosion

Distance from top of pile to top of layer = 18.000000 ft
Distance from top of pile to bottom of layer = 33.200000 ft
Effective unit weight at top of layer = 67.600000 pcf
Effective unit weight at bottom of layer = 67.600000 pcf
Undrained cohesion at top of layer = 4800. psf
Undrained cohesion at bottom of layer = 4800. psf
Epsilon-50 at top of layer = 0.004000
Epsilon-50 at bottom of layer = 0.004000
Subgrade k at top of layer = 2000. pci
Subgrade k at bottom of layer = 2000. pci

Layer 2 is weak rock, p-y criteria by Reese, 1997

Distance from top of pile to top of layer = 33.200000 ft
Distance from top of pile to bottom of layer = 50.000000 ft
Effective unit weight at top of layer = 92.700000 pcf
Effective unit weight at bottom of layer = 92.700000 pcf
Uniaxial compressive strength at top of layer = 1640. psi
Uniaxial compressive strength at bottom of layer = 1640. psi
Initial modulus of rock at top of layer = 150000. psi
Initial modulus of rock at bottom of layer = 150000. 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

(Depth of the lowest soil layer extends 11.800 ft below the pile tip)

Summary of Input Soil Properties

Layer Num.	Soil Type or (p-y Curve Type)	Layer Depth ft	Effective Unit Wt. pcf	Cohesion psf	Uniaxial qu psi	RQD %	E50 krm	kpy pci	Rock Mass Modulus psi
1	Stiff Clay with Free Water	18.0000	67.6000	4800.	--	--	0.00400	2000.	--
		33.2000	67.6000	4800.	--	--	0.00400	2000.	--
2	Weak Rock	33.2000	92.7000	--	1640.	15.0000	5.00E-04	--	150000.
		50.0000	92.7000	--	1640.	15.0000	5.00E-04	--	150000.

Modification Factors for p-y Curves

Distribution of p-y modifiers with depth defined using 4 points

Point No.	Depth X ft	p-mult	y-mult
1	18.000	0.7000	1.0000
2	33.200	0.7000	1.0000
3	33.300	1.0000	1.0000
4	100.000	1.0000	1.0000

Static Loading Type

Static loading criteria were used when computing p-y curves for all analyses.

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 1

Load No.	Load Type	Condition Run Analysis 1	Condition 2	Axial Thrust Force, lbs	Compute Top y vs. Pile Length
1	5	y = 1.750000 in	S = 0.0000 in/in	310190.	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 = 2

Pile Section No. 1:

Dimensions and Properties of Drilled Shaft (Bored Pile):

Length of Section	=	33.200000 ft
Shaft Diameter	=	36.000000 in
Concrete Cover Thickness (to edge of trans. reinf.)	=	6.000000 in
Number of Reinforcing Bars	=	15 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	=	15.000000 sq. in.
Area Ratio of Steel Reinforcement	=	1.47 percent
Edge-to-Edge Bar Spacing	=	3.367467 in

Maximum Concrete Aggregate Size = 0.375000 in
Ratio of Bar Spacing to Aggregate Size = 8.98
Offset of Center of Rebar Cage from Center of Pile = 0.0000 in
Transverse Reinforcement
Type: Hoop
Number of Transverse Reinf. (per spacing) = 1
Spacing of Transverse Reinf. = 4.500000 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 = 4309.778 kips
Tensile Load for Cracking of Concrete = -467.292 kips
Nominal Axial Tensile Capacity = -900.000 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	10.811000	0.00000
2	1.128000	1.000000	9.876340	4.397230
3	1.128000	1.000000	7.233971	8.034139
4	1.128000	1.000000	3.340783	10.281872
5	1.128000	1.000000	-1.13006	10.751776
6	1.128000	1.000000	-5.40550	9.362601
7	1.128000	1.000000	-8.74628	6.354546
8	1.128000	1.000000	-10.57475	2.247733
9	1.128000	1.000000	-10.57475	-2.24773
10	1.128000	1.000000	-8.74628	-6.35455
11	1.128000	1.000000	-5.40550	-9.36260
12	1.128000	1.000000	-1.13006	-10.75178
13	1.128000	1.000000	3.340783	-10.28187
14	1.128000	1.000000	7.233971	-8.03414
15	1.128000	1.000000	9.876340	-4.39723

NOTE: The positions of the above rebars were computed by LPile

Minimum spacing between any two bars not equal to zero = 3.367 inches
between bars 7 and 8.

Ratio of bar spacing to maximum aggregate size = 8.98

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 = 0.375000 in

Number of Axial Thrust Force Values Determined from Pile-head Loadings = 1

Number	Axial Thrust Force kips
1	310.190

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 = 310.190 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	224.4440659	359110505.	125.6112738	0.00007851	0.00005601	0.3255757	2.1559918	
0.00000125	448.8874511	359109961.	71.8245972	0.00008978	0.00004478	0.3708048	2.3622167	
0.00000188	673.3199684	359103983.	53.9041287	0.0001011	0.00003357	0.4158174	2.5688995	

```
0.00000250   897.7361854    359094474.    44.9502126     0.0001124    0.00002238
0.4606120     2.7760404
0.00000313         1122.    359081814.    39.5829179     0.0001237    0.00001120
0.5051876     2.9836394
0.00000375         1346.    359066129.    36.0089343     0.0001350   3.35035E-08
0.5495429     3.1916966
0.00000438         1571.    359039541.    33.4595974     0.0001464   -0.00001111
0.5936750     3.4001989
0.00000500         1795.    358964661.    31.5501090     0.0001578   -0.00002225
0.6375720     3.6090658
0.00000563         2018.    358820216.    30.0666257     0.0001691   -0.00003338
0.6812207     3.8182058
0.00000625         2241.    358605344.    28.8809772     0.0001805   -0.00004449
0.7246115     4.0275521
0.00000688         2463.    358327025.    27.9098045     0.0001919   -0.00005562
0.7677378     4.2370585
0.00000750         2685.    357994226.    27.1038474     0.0002033   -0.00006672
0.8105951     4.4466935
0.00000813         2906.    357615280.    26.4218920     0.0002147   -0.00007782
0.8531801     4.6564343
0.00000875         3125.    357197388.    25.8373936     0.0002261   -0.00008892
0.8954904     4.8662639
0.00000938         3344.    356746632.    25.3309692     0.0002375     -0.000100
0.9375240     5.0761698
0.00001000         3344.    334449967.    23.3508151     0.0002335     -0.000126
0.9223563     4.8403364 C
0.00001063         3344.    314776440.    22.7940131     0.0002422     -0.000140
0.9541400     4.9712928 C
0.00001125         3344.    297288860.    22.2868558     0.0002507     -0.000154
0.9852524     5.0982617 C
0.00001188         3344.    281642078.    21.8237449     0.0002592     -0.000168
1.0158015     5.2220351 C
0.00001250         3344.    267559974.    21.3980621     0.0002675     -0.000183
1.0457852     5.3425475 C
0.00001313         3344.    254819023.    21.0047443     0.0002757     -0.000197
1.0752309     5.4599683 C
0.00001375         3344.    243236340.    20.6406231     0.0002838     -0.000211
1.1042036     5.5747735 C
0.00001438         3344.    232660847.    20.3025024     0.0002918     -0.000226
1.1327399     5.6872182 C
0.00001500         3344.    222966645.    19.9875729     0.0002998     -0.000240
1.1608688     5.7975032 C
0.00001563         3351.    214476600.    19.6926035     0.0003077     -0.000255
1.1885666     5.9054036 C
0.00001625         3413.    210046773.    19.4163499     0.0003155     -0.000269
1.2159003     6.0114326 C
0.00001688         3474.    205876649.    19.1573108     0.0003233     -0.000284
1.2429076     6.1158728 C
0.00001750         3534.    201945459.    18.9139545     0.0003310     -0.000299
1.2696105     6.2188825 C
```

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0.00001813        3592.    198203636.    18.6829941     0.0003386     -0.000314
1.2959061     6.3195860 C
0.00001875        3650.    194677493.    18.4657919     0.0003462     -0.000329
1.3219679     6.4193993 C
0.00001938        3707.    191328516.    18.2598755     0.0003538     -0.000344
1.3477210     6.5176801 C
0.00002000        3763.    188148154.    18.0645446     0.0003613     -0.000359
1.3731927     6.6146359 C
0.00002063        3818.    185132617.    17.8795682     0.0003688     -0.000374
1.3984393     -6.854750 C
0.00002125        3873.    182255066.    17.7031462     0.0003762     -0.000389
1.4233908     -7.171211 C
0.00002188        3927.    179521245.    17.5356954     0.0003836     -0.000404
1.4481422     -7.488356 C
0.00002250        3980.    176910913.    17.3757821     0.0003910     -0.000419
1.4726402     -7.806652 C
0.00002313        4033.    174416779.    17.2229929     0.0003983     -0.000434
1.4969023     -8.125967 C
0.00002375        4086.    172044929.    17.0778984     0.0004056     -0.000449
1.5210198     -8.445522 C
0.00002438        4138.    169757140.    16.9375369     0.0004129     -0.000465
1.5448013     -8.766989 C
0.00002563        4241.    165491796.    16.6762812     0.0004273     -0.000495
1.5919301     -9.410721 C
0.00002688        4342.    161563375.    16.4354149     0.0004417     -0.000526
1.6382597    -10.057501 C
0.00002813        4442.    157931745.    16.2123092     0.0004560     -0.000557
1.6838084    -10.707254 C
0.00002938        4541.    154584867.    16.0071453     0.0004702     -0.000587
1.7288124    -11.357926 C
0.00003063        4638.    151459842.    15.8146026     0.0004843     -0.000618
1.7729821    -12.012196 C
0.00003188        4736.    148568059.    15.6371825     0.0004984     -0.000649
1.8167100    -12.666542 C
0.00003313        4831.    145854567.    15.4696886     0.0005124     -0.000680
1.8596638    -13.324070 C
0.00003438        4927.    143332432.    15.3149061     0.0005264     -0.000711
1.9022401    -13.981134 C
0.00003563        5021.    140952743.    15.1680242     0.0005404     -0.000742
1.9440506    -14.641422 C
0.00003688        5116.    138725803.    15.0308091     0.0005543     -0.000773
1.9854445    -15.301669 C
0.00003813        5209.    136631854.    14.9023461     0.0005682     -0.000804
2.0263440    -15.962631 C
0.00003938        5302.    134647809.    14.7797730     0.0005820     -0.000836
2.0665835    -16.625959 C
0.00004063        5394.    132781018.    14.6647774     0.0005958     -0.000867
2.1064543    -17.288832 C
0.00004188        5486.    131016601.    14.5569679     0.0006096     -0.000898
2.1458746    -17.952059 C
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0.00004313 5578. 129334343. 14.4531817 0.0006233 -0.000929
2.1846297 -18.617827 C
0.00004438 5669. 127742507. 14.3555290 0.0006370 -0.000960
2.2230198 -19.283141 C
0.00004563 5759. 126233637. 14.2635719 0.0006508 -0.000992
2.2610436 -19.948000 C
0.00004688 5850. 124793471. 14.1755288 0.0006645 -0.001023
2.2985279 -20.614203 C
0.00004813 5939. 123416855. 14.0911181 0.0006781 -0.001054
2.3354798 -21.281721 C
0.00004938 6029. 122106079. 14.0113007 0.0006918 -0.001086
2.3720686 -21.948782 C
0.00005063 6118. 120856246. 13.9357381 0.0007055 -0.001117
2.4082932 -22.615383 C
0.00005188 6208. 119662930. 13.8641240 0.0007192 -0.001148
2.4441524 -23.281522 C
0.00005313 6296. 118512285. 13.7941685 0.0007328 -0.001180
2.4793692 -23.950254 C
0.00005438 6384. 117410454. 13.7276544 0.0007464 -0.001211
2.5142068 -24.618717 C
0.00005563 6472. 116354735. 13.6643925 0.0007601 -0.001242
2.5486818 -25.286715 C
0.00005688 6560. 115342068. 13.6041952 0.0007737 -0.001274
2.5827929 -25.954243 C
0.00005813 6648. 114369657. 13.5468664 0.0007874 -0.001305
2.6165388 -26.621302 C
0.00005938 6735. 113433904. 13.4919768 0.0008011 -0.001336
2.6498820 -27.288315 C
0.00006063 6822. 112527527. 13.4381817 0.0008147 -0.001368
2.6826460 -27.957382 C
0.00006188 6909. 111654716. 13.3868284 0.0008283 -0.001399
2.7150471 -28.625972 C
0.00006313 6995. 110813460. 13.3377702 0.0008419 -0.001431
2.7470841 -29.294082 C
0.00006438 7081. 110001904. 13.2908761 0.0008556 -0.001462
2.7787557 -29.961708 C
0.00006563 7167. 109218336. 13.2460236 0.0008693 -0.001493
2.8100606 -30.628849 C
0.00006688 7253. 108461169. 13.2030997 0.0008830 -0.001525
2.8409975 -31.295502 C
0.00006813 7339. 107728934. 13.1619998 0.0008967 -0.001556
2.8715651 -31.961663 C
0.00006938 7424. 107018262. 13.1220344 0.0009103 -0.001587
2.9016710 -32.628518 C
0.00007063 7509. 106327551. 13.0830071 0.0009240 -0.001619
2.9312959 -33.296351 C
0.00007188 7594. 105658191. 13.0455782 0.0009377 -0.001650
2.9605533 -33.963682 C
0.00007313 7679. 105009071. 13.0096671 0.0009513 -0.001681
2.9894417 -34.630507 C

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0.00007438        7763.    104379155.    12.9752017     0.0009650     -0.001712
3.0179599    -35.296824 C
0.00007938        8099.    102033103.    12.8504242     0.0010200     -0.001837
3.1283024    -37.956943 C
0.00008438        8431.     99923792.    12.7425440     0.0010752     -0.001962
3.2324020    -40.611897 C
0.00008938        8760.     98008670.    12.6475232     0.0011304     -0.002087
3.3300556    -43.263989 C
0.00009438        9085.     96261690.    12.5664474     0.0011860     -0.002212
3.4215665    -45.907117 C
0.00009938        9407.     94656627.    12.4964431     0.0012418     -0.002336
3.5068337    -48.541027 C
 0.0001044        9725.     93172260.    12.4362795     0.0012980     -0.002459
3.5857522    -51.165446 C
 0.0001094       10039.     91789107.    12.3832983     0.0013544     -0.002583
3.6580222    -53.784532 C
 0.0001144       10350.     90494633.    12.3369562     0.0014110     -0.002706
3.7236924    -56.395227 C
 0.0001194       10658.     89277719.    12.2985808     0.0014681     -0.002829
3.7827312    -58.995263 C
 0.0001244       10957.     88093697.    12.2643358     0.0015254     -0.002952
3.8348464    -60.000000 CY
 0.0001294       11216.     86691922.    12.2228690     0.0015813     -0.003076
3.8788860    -60.000000 CY
 0.0001344       11428.     85044028.    12.1716450     0.0016356     -0.003202
3.9150466    -60.000000 CY
 0.0001394       11609.     83290094.    12.1162783     0.0016887     -0.003329
3.9442681    -60.000000 CY
 0.0001444       11772.     81537027.    12.0616591     0.0017414     -0.003456
3.9671819    -60.000000 CY
 0.0001494       11917.     79778225.    12.0041691     0.0017931     -0.003584
3.9838228    -60.000000 CY
 0.0001544       12043.     78009197.    11.9468731     0.0018443     -0.003713
3.9945290    -60.000000 CY
 0.0001594       12162.     76311262.    11.8922581     0.0018953     -0.003842
3.9995728    -60.000000 CY
 0.0001644       12273.     74665881.    11.8422839     0.0019466     -0.003971
3.9990895    -60.000000 CY
 0.0001694       12369.     73027671.    11.7912337     0.0019971     -0.004100
3.9980574    -60.000000 CY
 0.0001744       12454.     71418025.    11.7412284     0.0020474     -0.004230
3.9986931    -60.000000 CY
 0.0001794       12535.     69878896.    11.6937436     0.0020976     -0.004360
3.9997653    -60.000000 CY
 0.0001844       12613.     68408795.    11.6512981     0.0021482     -0.004489
3.9984847    -60.000000 CY
 0.0001894       12685.     66983205.    11.6096868     0.0021986     -0.004619
3.9982672    -60.000000 CY
 0.0001944       12747.     65579521.    11.5679712     0.0022485     -0.004749
3.9994254    -60.000000 CY
```

0.0001994	12801.	64204658.	11.5265879	0.0022981	-0.004879
3.9966369	-60.000000 CY				
0.0002044	12851.	62877829.	11.4874457	0.0023477	-0.005010
3.9996842	-60.000000 CY				
0.0002094	12899.	61605143.	11.4505965	0.0023975	-0.005140
3.9967257	-60.000000 CY				
0.0002144	12945.	60385979.	11.4165242	0.0024474	-0.005270
3.9996622	-60.000000 CY				
0.0002194	12991.	59216497.	11.3867792	0.0024980	-0.005400
3.9960338	-60.000000 CY				
0.0002244	13033.	58086345.	11.3588052	0.0025486	-0.005529
3.9993402	-60.000000 CY				
0.0002294	13073.	56993182.	11.3291432	0.0025986	-0.005659
3.9965957	-60.000000 CY				
0.0002344	13105.	55915906.	11.3007806	0.0026486	-0.005789
3.9982713	-60.000000 CY				
0.0002394	13135.	54873050.	11.2716507	0.0026982	-0.005919
3.9999484	-60.000000 CY				
0.0002444	13161.	53854275.	11.2428122	0.0027475	-0.006050
3.9956021	-60.000000 CY				
0.0002494	13185.	52872148.	11.2156406	0.0027969	-0.006181
3.9988483	-60.000000 CY				
0.0002544	13208.	51925206.	11.1899103	0.0028464	-0.006311
3.9999980	-60.000000 CY				
0.0002594	13231.	51011091.	11.1664242	0.0028963	-0.006441
3.9954251	-60.000000 CY				
0.0002644	13253.	50129732.	11.1443389	0.0029463	-0.006571
3.9986620	-60.000000 CY				
0.0002694	13275.	49279345.	11.1236647	0.0029964	-0.006701
3.9999714	-60.000000 CY				
0.0002744	13295.	48456936.	11.1046516	0.0030468	-0.006831
3.9938244	-60.000000 CY				
0.0003044	13393.	44000587.	11.0042430	0.0033494	-0.007608
3.9997080	-60.000000 CYT				
0.0003344	13441.	40196302.	10.9101119	0.0036481	-0.008389
3.9948707	-60.000000 CYT				
0.0003644	13441.	36886830.	10.8724224	0.0039616	-0.009156
3.9911095	-60.000000 CYT				

Summary of Results for Nominal Moment Capacity for Section 1

Moment values interpolated at maximum compressive strain = 0.003
or maximum developed moment if pile fails at smaller strains.

Load No.	Axial Thrust kips	Nominal Mom. Cap. in-kip	Max. Comp. Strain	Max. Tens.

Strain				
1	310.190	13276.090	0.00300000	-0.00671022

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	310.190000	13276.	201.623500	8629.	98767047.
1	0.75	310.190000	13276.	232.642500	9957.	92151256.
1	0.90	310.190000	13276.	279.171000	11948.	79333725.

Pile Section No. 2:

Dimensions and Properties of Drilled Shaft (Bored Pile):

Length of Section	=	5.000000 ft
Shaft Diameter	=	30.000000 in
Concrete Cover Thickness (to edge of trans. reinf.)	=	3.000000 in
Number of Reinforcing Bars	=	15 bars
Yield Stress of Reinforcing Bars	=	60000. psi
Modulus of Elasticity of Reinforcing Bars	=	29000000. psi

Gross Area of Shaft	=	706.858347 sq. in.
Total Area of Reinforcing Steel	=	15.000000 sq. in.
Area Ratio of Steel Reinforcement	=	2.12 percent
Edge-to-Edge Bar Spacing	=	3.367467 in
Maximum Concrete Aggregate Size	=	0.375000 in
Ratio of Bar Spacing to Aggregate Size	=	8.98
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.	=	4.500000 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	=	3252.318 kips
Tensile Load for Cracking of Concrete	=	-337.937 kips
Nominal Axial Tensile Capacity	=	-900.000 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	10.811000	0.00000
2	1.128000	1.000000	9.876340	4.397230
3	1.128000	1.000000	7.233971	8.034139
4	1.128000	1.000000	3.340783	10.281872
5	1.128000	1.000000	-1.13006	10.751776
6	1.128000	1.000000	-5.40550	9.362601
7	1.128000	1.000000	-8.74628	6.354546
8	1.128000	1.000000	-10.57475	2.247733
9	1.128000	1.000000	-10.57475	-2.24773
10	1.128000	1.000000	-8.74628	-6.35455
11	1.128000	1.000000	-5.40550	-9.36260
12	1.128000	1.000000	-1.13006	-10.75178
13	1.128000	1.000000	3.340783	-10.28187
14	1.128000	1.000000	7.233971	-8.03414
15	1.128000	1.000000	9.876340	-4.39723

NOTE: The positions of the above rebars were computed by LPile

Minimum spacing between any two bars not equal to zero = 3.367 inches
between bars 7 and 8.

Ratio of bar spacing to maximum aggregate size = 8.98

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	=	0.375000 in

Number of Axial Thrust Force Values Determined from Pile-head Loadings = 1

Number	Axial Thrust Force kips
1	310.190

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 = 310.190 kips

Bending Curvature rad/in.	Bending Moment in-kip	Bending Stiffness kip-in2	Depth to N Axis in	Max Comp Strain in/in	Max Tens Strain in/in	Max Conc Stress ksi	Max Steel Stress ksi	Run Msg
0.00000125	227.6884134	182150731.	90.3036932	0.0001129	0.00007538	0.4636696	3.1375714	

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0.00000250   455.3696412    182147856.    52.6772927     0.0001317    0.00005669
0.5375566     3.5472287
0.00000375   683.0230574    182139482.    40.1464647     0.0001505    0.00003805
0.6108291     3.9581155
0.00000500   910.6347579    182126952.    33.8895312     0.0001694    0.00001945
0.6834817     4.3702320
0.00000625        1138.     182110534.    30.1421569     0.0001884   8.88481E-07
0.7555092     4.7835785
0.00000750        1366.     182082527.    27.6493914     0.0002074   -0.00001763
0.8269012     5.1981177
0.00000875        1593.     182004842.    25.8616873     0.0002263   -0.00003621
0.8976207     5.6136009
0.00001000        1819.     181860329.    24.5369063     0.0002454   -0.00005463
0.9676293     6.0297607
0.00001125        2044.     181653380.    23.5068139     0.0002645   -0.00007305
1.0369022     6.4464230
0.00001250        2267.     181393239.    22.6829254     0.0002835   -0.00009146
1.1054228     6.8634719
0.00001375        2490.     181089248.    22.0089979     0.0003026     -0.000110
1.1731798     7.2808298
0.00001500        2490.     165998478.    20.4834017     0.0003073     -0.000143
1.1889805     7.2790297 C
0.00001625        2490.     153229364.    19.8465446     0.0003225     -0.000165
1.2422974     7.5854967 C
0.00001750        2490.     142284409.    19.2853882     0.0003375     -0.000188
1.2941711     7.8842095 C
0.00001875        2516.     134164786.    18.7865611     0.0003522     -0.000210
1.3447496     8.1761856 C
0.00002000        2607.     130357748.    18.3392832     0.0003668     -0.000233
1.3940982     8.4617843 C
0.00002125        2696.     126853168.    17.9359593     0.0003811     -0.000256
1.4423689     8.7421230 C
0.00002250        2781.     123621776.    17.5703026     0.0003953     -0.000280
1.4896496     9.0178121 C
0.00002375        2865.     120631385.    17.2368829     0.0004094     -0.000303
1.5359830     9.2890906 C
0.00002500        2947.     117861515.    16.9314669     0.0004233     -0.000327
1.5814520     9.5565636 C
0.00002625        3026.     115293382.    16.6508824     0.0004371     -0.000350
1.6261342     9.8208110 C
0.00002750        3105.     112898564.    16.3914185     0.0004508     -0.000374
1.6700070    10.0815391 C
0.00002875        3182.     110665818.    16.1510863     0.0004643     -0.000398
1.7131546    10.3394097 C
0.00003000        3257.     108582215.    15.9280391     0.0004778     -0.000422
1.7556378    10.5948959 C
0.00003125        3332.     106636416.    15.7207753     0.0004913     -0.000446
1.7975201    10.8485159 C
0.00003250        3406.     104804106.    15.5264242     0.0005046     -0.000470
1.8387009    11.0992795 C
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0.00003375        3479.    103084598.    15.3446994     0.0005179     -0.000495
1.8793088    11.3483120 C
0.00003500        3551.    101471067.    15.1748478     0.0005311     -0.000519
1.9194130    11.5962206 C
0.00003625        3623.     99942286.    15.0142502     0.0005443     -0.000543
1.9588642    11.8415431 C
0.00003750        3694.     98507873.    14.8641487     0.0005574     -0.000568
1.9979229    -12.382028 C
0.00003875        3764.     97142055.    14.7214797     0.0005705     -0.000592
2.0363276    -12.955175 C
0.00004000        3834.     95856133.    14.5876974     0.0005835     -0.000616
2.0743654    -13.528271 C
0.00004125        3904.     94631193.    14.4603491     0.0005965     -0.000641
2.1118300    -14.103370 C
0.00004250        3972.     93469706.    14.3399944     0.0006094     -0.000666
2.1488657    -14.679081 C
0.00004375        4041.     92368117.    14.2262670     0.0006224     -0.000690
2.1855033    -15.255110 C
0.00004500        4109.     91312068.    14.1171249     0.0006353     -0.000715
2.2215542    -15.833399 C
0.00004625        4177.     90310351.    14.0141647     0.0006482     -0.000739
2.2572800    -16.411309 C
0.00004750        4244.     89353978.    13.9160885     0.0006610     -0.000764
2.2925729    -16.989956 C
0.00004875        4311.     88435462.    13.8218190     0.0006738     -0.000789
2.3273414    -17.570330 C
0.00005125        4445.     86725215.    13.6477941     0.0006994     -0.000838
2.3959028    -18.730028 C
0.00005375        4577.     85144295.    13.4869879     0.0007249     -0.000888
2.4626138    -19.894312 C
0.00005625        4708.     83694048.    13.3412198     0.0007504     -0.000937
2.5280098    -21.057448 C
0.00005875        4838.     82343719.    13.2054651     0.0007758     -0.000987
2.5916402    -22.224551 C
0.00006125        4967.     81095607.    13.0816711     0.0008013     -0.001036
2.6539932    -23.390141 C
0.00006375        5095.     79928874.    12.9663707     0.0008266     -0.001086
2.7147373    -24.558110 C
0.00006625        5223.     78839692.    12.8596635     0.0008520     -0.001136
2.7740849    -25.726004 C
0.00006875        5350.     77822575.    12.7615580     0.0008774     -0.001185
2.8321514    -26.892358 C
0.00007125        5476.     76862351.    12.6691227     0.0009027     -0.001235
2.8885953    -28.061488 C
0.00007375        5602.     75959568.    12.5831370     0.0009280     -0.001284
2.9437123    -29.229670 C
0.00007625        5727.     75109522.    12.5036271     0.0009534     -0.001334
2.9975432    -30.396275 C
0.00007875        5852.     74305442.    12.4295088     0.0009788     -0.001384
3.0499900    -31.562546 C
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0.00008125        5975.     73540508.    12.3590783     0.0010042     -0.001433
3.1009122    -32.730484 C
0.00008375        6098.     72815330.    12.2935217     0.0010296     -0.001483
3.1505414    -33.896797 C
0.00008625        6221.     72126397.    12.2321552     0.0010550     -0.001532
3.1988692    -35.061467 C
0.00008875        6343.     71470585.    12.1751230     0.0010805     -0.001582
3.2458870    -36.224478 C
0.00009125        6464.     70843079.    12.1213288     0.0011061     -0.001631
3.2914518    -37.387996 C
0.00009375        6585.     70241887.    12.0700498     0.0011316     -0.001681
3.3355834    -38.551739 C
0.00009625        6705.     69666638.    12.0220521     0.0011571     -0.001730
3.3783955    -39.713760 C
0.00009875        6825.     69115307.    11.9770931     0.0011827     -0.001780
3.4198790    -40.874038 C
 0.0001013        6944.     68586073.    11.9345803     0.0012084     -0.001829
3.4600249    -42.032551 C
 0.0001038        7063.     68077279.    11.8950544     0.0012341     -0.001878
3.4988237    -43.189283 C
 0.0001063        7181.     67587431.    11.8579763     0.0012599     -0.001928
3.5362659    -44.344210 C
 0.0001088        7299.     67113650.    11.8227517     0.0012857     -0.001977
3.5722167    -45.499934 C
 0.0001113        7415.     66655912.    11.7890640     0.0013115     -0.002026
3.6067658    -46.654595 C
 0.0001138        7532.     66213563.    11.7574310     0.0013374     -0.002075
3.6399436    -47.807362 C
 0.0001163        7648.     65785558.    11.7277274     0.0013633     -0.002124
3.6717397    -48.958212 C
 0.0001188        7763.     65370938.    11.6998385     0.0013894     -0.002173
3.7021437    -50.107120 C
 0.0001213        7877.     64968825.    11.6732487     0.0014154     -0.002222
3.7311451    -51.254058 C
 0.0001238        7992.     64578405.    11.6486891     0.0014415     -0.002271
3.7587330    -52.399005 C
 0.0001263        8105.     64198932.    11.6256569     0.0014677     -0.002320
3.7848963    -53.541931 C
 0.0001288        8218.     63829715.    11.6040738     0.0014940     -0.002368
3.8096237    -54.682811 C
 0.0001313        8330.     63470115.    11.5838628     0.0015204     -0.002417
3.8329039    -55.821616 C
 0.0001338        8442.     63119540.    11.5649524     0.0015468     -0.002466
3.8547249    -56.958318 C
 0.0001363        8553.     62777353.    11.5472367     0.0015733     -0.002514
3.8750665    -58.093210 C
 0.0001388        8664.     62442643.    11.5304237     0.0015998     -0.002563
3.8938795    -59.227895 C
 0.0001413        8773.     62110146.    11.5141727     0.0016264     -0.002611
3.9111789    -60.000000 CY
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 0.0001438        8879.     61765164.    11.4978400     0.0016528     -0.002660
3.9268867    -60.000000 CY
 0.0001463        8979.     61392350.    11.4804183     0.0016790     -0.002708
3.9409431    -60.000000 CY
 0.0001488        9069.     60968789.    11.4603657     0.0017047     -0.002758
3.9532813    -60.000000 CY
 0.0001588        9367.     59003349.    11.3661788     0.0018044     -0.002958
3.9874512    -60.000000 CY
 0.0001688        9601.     56895594.    11.2656973     0.0019011     -0.003161
3.9998805    -60.000000 CY
 0.0001788        9796.     54804398.    11.1673779     0.0019962     -0.003366
3.9993435    -60.000000 CY
 0.0001888        9956.     52747137.    11.0704317     0.0020895     -0.003573
3.9984055    -60.000000 CY
 0.0001988       10101.     50824542.    10.9829840     0.0021829     -0.003780
3.9989129    -60.000000 CY
 0.0002088       10216.     48940558.    10.8962168     0.0022746     -0.003988
3.9996048    -60.000000 CY
 0.0002188       10317.     47164477.    10.8136547     0.0023655     -0.004197
3.9998114    -60.000000 CY
 0.0002288       10414.     45525225.    10.7414428     0.0024571     -0.004405
3.9998250    -60.000000 CY
 0.0002388       10499.     43974365.    10.6735157     0.0025483     -0.004614
3.9996191    -60.000000 CY
 0.0002488       10566.     42475065.    10.6029493     0.0026375     -0.004825
3.9988235    -60.000000 CY
 0.0002588       10625.     41061681.    10.5356923     0.0027261     -0.005036
3.9968602    -60.000000 CY
 0.0002688       10682.     39746918.    10.4752699     0.0028152     -0.005247
3.9994449    -60.000000 CY
 0.0002788       10738.     38520833.    10.4206451     0.0029048     -0.005458
3.9992003    -60.000000 CY
 0.0002888       10791.     37370686.    10.3716432     0.0029948     -0.005668
3.9958309    -60.000000 CY
 0.0002988       10837.     36273325.    10.3209579     0.0030834     -0.005879
3.9998199    -60.000000 CY
 0.0003088       10874.     35220724.    10.2701422     0.0031709     -0.006092
3.9961622    -60.000000 CY
 0.0003188       10906.     34216306.    10.2194644     0.0032575     -0.006305
3.9997342    -60.000000 CY
 0.0003288       10936.     33264861.    10.1718799     0.0033440     -0.006518
3.9944035    60.0000000 CYT
 0.0003388       10964.     32367012.    10.1303164     0.0034316     -0.006731
3.9990007    60.0000000 CYT
 0.0003488       10991.     31514382.    10.0928412     0.0035199     -0.006943
3.9962629    60.0000000 CYT
 0.0003588       11016.     30706458.    10.0575650     0.0036082     -0.007154
3.9967886    60.0000000 CYT
 0.0003688       11039.     29935402.    10.0275043     0.0036976     -0.007365
3.9997891    60.0000000 CYT
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    0.0003788        11059.     29198946.    10.0014378     0.0037880     -0.007574
   3.9915573    60.0000000 CYT
    0.0003888        11059.     28447848.    10.0001952     0.0038876     -0.007775
   3.9982364    60.0000000 CYT


--------------------------------------------------------------------------------
   Summary of Results for Nominal Moment Capacity for Section 2
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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               310.190             10793.472           0.00300000
-0.00568007

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         310.190000        10793.    201.623500         7016.
68279895.

   1       0.75         310.190000        10793.    232.642500         8095.
64232392.
```

```
   1       0.90         310.190000        10793.    279.171000         9714.
55684802.
```

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	18.0000	0.00	N.A.	No	0.00	168434.
2	33.2000	15.2000	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 Displacement and Pile-head Rotation (Loading Type 5)
Displacement of pile head = 1.750000 inches
Rotation of pile head = 0.000E+00 radians
Axial load on pile head = 310190.0 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. Es*H lb/inch	Soil Spr. Lat. Load lb/inch	Distrib. p lb/inch
0.00	1.7500	-1.14E+07	73927.	0.00	0.00	8.54E+10	0.00	0.00	0.00
0.3820	1.7486	-1.10E+07	73924.	-6.01E-04	0.00	8.54E+10	0.00	0.00	0.00
0.7640	1.7445	-1.07E+07	73924.	-0.00117	0.00	8.91E+10			

```
0.00       0.00       0.00
    1.1460     1.7379  -1.04E+07     73924.   -0.00171       0.00   9.05E+10
0.00       0.00       0.00
    1.5280     1.7288  -1.00E+07     73924.   -0.00222       0.00   9.19E+10
0.00       0.00       0.00
    1.9100     1.7175  -9670540.     73924.   -0.00271       0.00   9.34E+10
0.00       0.00       0.00
    2.2920     1.7040  -9327484.     73924.   -0.00317       0.00   9.50E+10
0.00       0.00       0.00
    2.6740     1.6884  -8983789.     73924.   -0.00361       0.00   9.68E+10
0.00       0.00       0.00
    3.0560     1.6709  -8639489.     73924.   -0.00402       0.00   9.87E+10
0.00       0.00       0.00
    3.4380     1.6515  -8294618.     73924.   -0.00441       0.00   1.01E+11
0.00       0.00       0.00
    3.8200     1.6305  -7949210.     73924.   -0.00478       0.00   1.03E+11
0.00       0.00       0.00
    4.2020     1.6077  -7603300.     73924.   -0.00512       0.00   1.06E+11
0.00       0.00       0.00
    4.5840     1.5835  -7256920.     73924.   -0.00544       0.00   1.08E+11
0.00       0.00       0.00
    4.9660     1.5579  -6910104.     73924.   -0.00573       0.00   1.12E+11
0.00       0.00       0.00
    5.3480     1.5310  -6562885.     73924.   -0.00600       0.00   1.15E+11
0.00       0.00       0.00
    5.7300     1.5028  -6215294.     73924.   -0.00625       0.00   1.20E+11
0.00       0.00       0.00
    6.1120     1.4736  -5867365.     73924.   -0.00648       0.00   1.25E+11
0.00       0.00       0.00
    6.4940     1.4434  -5519129.     73924.   -0.00669       0.00   1.30E+11
0.00       0.00       0.00
    6.8760     1.4123  -5170616.     73924.   -0.00687       0.00   1.37E+11
0.00       0.00       0.00
    7.2580     1.3804  -4821859.     73924.   -0.00703       0.00   1.46E+11
0.00       0.00       0.00
    7.6400     1.3479  -4472886.     73924.   -0.00717       0.00   1.57E+11
0.00       0.00       0.00
    8.0220     1.3147  -4123728.     73924.   -0.00729       0.00   1.70E+11
0.00       0.00       0.00
    8.4040     1.2810  -3774412.     73924.   -0.00740       0.00   1.88E+11
0.00       0.00       0.00
    8.7860     1.2469  -3424964.     73924.   -0.00748       0.00   2.09E+11
0.00       0.00       0.00
    9.1680     1.2124  -3075410.     73924.   -0.00754       0.00   3.57E+11
0.00       0.00       0.00
    9.5500     1.1778  -2725800.     73924.   -0.00757       0.00   3.58E+11
0.00       0.00       0.00
    9.9320     1.1430  -2376140.     73924.   -0.00761       0.00   3.58E+11
0.00       0.00       0.00
   10.3140     1.1081  -2026437.     73924.   -0.00763       0.00   3.59E+11
```

```
0.00       0.00       0.00
   10.6960     1.0730  -1676697.     73924.   -0.00766       0.00   3.59E+11
0.00       0.00       0.00
   11.0780     1.0379  -1326927.     73924.   -0.00768       0.00   3.59E+11
0.00       0.00       0.00
   11.4600     1.0026   -977133.     73924.   -0.00769       0.00   3.59E+11
0.00       0.00       0.00
   11.8420     0.9673   -627321.     73924.   -0.00770       0.00   3.59E+11
0.00       0.00       0.00
   12.2240     0.9320   -277497.     73924.   -0.00771       0.00   3.59E+11
0.00       0.00       0.00
   12.6060     0.8967     72331.     73924.   -0.00771       0.00   3.59E+11
0.00       0.00       0.00
   12.9880     0.8614    422159.     73924.   -0.00771       0.00   3.59E+11
0.00       0.00       0.00
   13.3700     0.8260    771978.     73924.   -0.00770       0.00   3.59E+11
0.00       0.00       0.00
   13.7520     0.7908   1121784.     73924.   -0.00769       0.00   3.59E+11
0.00       0.00       0.00
   14.1340     0.7556   1471569.     73924.   -0.00767       0.00   3.59E+11
0.00       0.00       0.00
   14.5160     0.7205   1821327.     73924.   -0.00765       0.00   3.59E+11
0.00       0.00       0.00
   14.8980     0.6855   2171053.     73924.   -0.00762       0.00   3.59E+11
0.00       0.00       0.00
   15.2800     0.6506   2520739.     73924.   -0.00759       0.00   3.58E+11
0.00       0.00       0.00
   15.6620     0.6158   2870379.     73924.   -0.00756       0.00   3.58E+11
0.00       0.00       0.00
   16.0440     0.5813   3219966.     73924.   -0.00752       0.00   3.57E+11
0.00       0.00       0.00
   16.4260     0.5469   3569495.     73924.   -0.00746       0.00   2.00E+11
0.00       0.00       0.00
   16.8080     0.5129   3918908.     73924.   -0.00737       0.00   1.80E+11
0.00       0.00       0.00
   17.1900     0.4794   4268178.     73924.   -0.00726       0.00   1.64E+11
0.00       0.00       0.00
   17.5720     0.4464   4617280.     73924.   -0.00713       0.00   1.52E+11
0.00       0.00       0.00
   17.9540     0.4140   4966183.     73924.   -0.00698       0.00   1.42E+11
0.00       0.00       0.00
   18.3360     0.3824   5314859.     73229.   -0.00681       0.00   1.34E+11
-303.223      3635.       0.00
   18.7180     0.3516   5656905.     71390.   -0.00662       0.00   1.28E+11
-499.053      6506.       0.00
   19.1000     0.3217   5988177.     68596.   -0.00640       0.00   1.23E+11
-719.760     10255.       0.00
   19.4820     0.2929   6304006.     64701.   -0.00617       0.00   1.18E+11
-979.802     15334.       0.00
   19.8640     0.2652   6598900.     59586.   -0.00592       0.00   1.15E+11
```

```
-1252.     21640.       0.00
   20.2460     0.2387   6867113.     53305.   -0.00564       0.00   1.12E+11
-1489.     28590.       0.00
   20.6280     0.2135   7103646.     46017.   -0.00535       0.00   1.10E+11
-1691.     36319.       0.00
   21.0100     0.1896   7304220.     37876.   -0.00505       0.00   1.08E+11
-1860.     44983.       0.00
   21.3920     0.1671   7465261.     29035.   -0.00474       0.00   1.07E+11
-1997.     54765.       0.00
   21.7740     0.1462   7583885.     19643.   -0.00441       0.00   1.06E+11
-2101.     65886.       0.00
   22.1560     0.1267   7657895.      9848.   -0.00408       0.00   1.05E+11
-2173.     78607.       0.00
   22.5380     0.1088   7685775.   -202.156   -0.00374       0.00   1.05E+11
-2212.     93235.       0.00
   22.9200    0.09237   7666691.    -10357.   -0.00341       0.00   1.05E+11
-2218.    110086.       0.00
   23.3020    0.07751   7600520.    -20439.   -0.00308       0.00   1.06E+11
-2180.    128961.       0.00
   23.6840    0.06415   7488061.    -30218.   -0.00275       0.00   1.06E+11
-2086.    149075.       0.00
   24.0660    0.05228   7331305.    -39529.   -0.00243       0.00   1.08E+11
-1976.    173256.       0.00
   24.4480    0.04183   7132586.    -48298.   -0.00213       0.00   1.10E+11
-1850.    202757.       0.00
   24.8300    0.03275   6894562.    -56460.   -0.00184       0.00   1.12E+11
-1711.    239391.       0.00
   25.2120    0.02497   6620193.    -63950.   -0.00157       0.00   1.15E+11
-1558.    285907.       0.00
   25.5940    0.01840   6312718.    -70711.   -0.00131       0.00   1.18E+11
-1392.    346722.       0.00
   25.9760    0.01296   5975644.    -76684.   -0.00108       0.00   1.23E+11
-1214.    429530.       0.00
   26.3580    0.00853   5612741.    -81811.  -8.65E-04       0.00   1.29E+11
-1023.    549429.       0.00
   26.7400    0.00502   5228066.    -85845.  -6.78E-04       0.00   1.36E+11
-737.501    673078.       0.00
   27.1220    0.00232   4827643.    -88350.  -5.14E-04       0.00   1.46E+11
-355.570    702496.       0.00
   27.5040   3.13E-04   4419534.    -89279.  -3.74E-04       0.00   1.59E+11
-49.918    731914.       0.00
   27.8860   -0.00111   4010193.    -88971.  -2.58E-04       0.00   1.76E+11
184.3287    761333.       0.00
   28.2680   -0.00205   3604578.    -87737.  -1.64E-04       0.00   1.97E+11
354.0098    790751.       0.00
   28.6500   -0.00261   3206282.    -85855.  -1.01E-04       0.00   3.57E+11
467.1557    820169.       0.00
   29.0320   -0.00298   2817744.    -83518.  -6.27E-05       0.00   3.58E+11
552.4987    849588.       0.00
   29.4140   -0.00319   2440764.    -80852.  -2.90E-05       0.00   3.58E+11
```

```
610.8558    879006.       0.00
   29.7960   -0.00325   2076576.    -77977.  -1.37E-07       0.00   3.59E+11
643.4758    908424.       0.00
   30.1780   -0.00319   1725871.    -75008.   2.41E-05       0.00   3.59E+11
652.0006    937842.       0.00
   30.5600   -0.00303   1388836.    -72050.   4.40E-05       0.00   3.59E+11
638.4362    967261.       0.00
   30.9420   -0.00278   1065191.    -69200.   5.97E-05       0.00   3.59E+11
605.1307    996679.       0.00
   31.3240   -0.00248    754242.    -66541.   7.13E-05       0.00   3.59E+11
554.7600   1026097.       0.00
   31.7060   -0.00213    454937.    -64146.   7.90E-05       0.00   3.59E+11
490.3142   1055516.       0.00
   32.0880   -0.00175    165926.    -62071.   8.30E-05       0.00   3.59E+11
415.0891   1084934.       0.00
   32.4700   -0.00137   -114365.    -60357.   8.33E-05       0.00   3.59E+11
332.6832   1114352.       0.00
   32.8520  -9.90E-04   -387664.    -59028.   8.01E-05       0.00   3.59E+11
247.0018   1143770.       0.00
   33.2340  -6.34E-04   -655765.    -36269.   6.94E-05       0.00   1.82E+11
9683.   7.00E+07       0.00
   33.6160  -3.54E-04   -720377.   784.9006   5.21E-05       0.00   1.82E+11
6484.   8.40E+07       0.00
   33.9980  -1.57E-04   -648717.     23322.   3.48E-05       0.00   1.82E+11
3349.   9.80E+07       0.00
   34.3800  -3.43E-05   -506656.     32921.   2.03E-05       0.00   1.82E+11
838.7630   1.12E+08       0.00
   34.7620   2.95E-05   -346952.     32982.   9.56E-06       0.00   1.82E+11
-812.106   1.26E+08       0.00
   35.1440   5.34E-05   -204300.     27384.   2.63E-06       0.00   1.82E+11
-1630.   1.40E+08       0.00
   35.5260   5.36E-05    -95901.     19516.  -1.15E-06       0.00   1.82E+11
-1802.   1.54E+08       0.00
   35.9080   4.28E-05    -25370.     11787.  -2.68E-06       0.00   1.82E+11
-1570.   1.68E+08       0.00
   36.2900   2.91E-05     12169.      5539.  -2.84E-06       0.00   1.82E+11
-1156.   1.82E+08       0.00
   36.6720   1.68E-05     25423.      1246.  -2.37E-06       0.00   1.82E+11
-717.435   1.96E+08       0.00
   37.0540   7.38E-06     23600.     -1174.  -1.75E-06       0.00   1.82E+11
-338.249   2.10E+08       0.00
   37.4360   7.11E-07     14668.     -2029.  -1.27E-06       0.00   1.82E+11
-34.759   2.24E+08       0.00
   37.8180  -4.27E-06      5006.     -1600.  -1.02E-06       0.00   1.82E+11
221.5958   2.38E+08       0.00
   38.2000  -8.67E-06       0.00       0.00  -9.60E-07       0.00   1.82E+11
476.6070   1.26E+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 interpolated from the output for nonlinear bending properties relative to the magnitude of bending moment developed in the pile.

Output Summary for Load Case No. 1:

```
Pile-head deflection             =     1.75000000 inches
Computed slope at pile head      =       0.000000 radians
Maximum bending moment           =     -11374959. inch-lbs
Maximum shear force              =        -89279. lbs
Depth of maximum bending moment  =       0.000000 feet below pile head
Depth of maximum shear force     =    27.50400000 feet below pile head
Number of iterations             =             21
Number of zero deflection points =              3
Pile deflection at ground        =     0.41021573 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	Load 1	Load Type	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	1	y, in	1.7500	S, rad	0.00	310190.	1.7500	0.00	-89279.	-1.14E+07

Maximum pile-head deflection = 1.7500000000 inches
Maximum pile-head rotation = 0.0000000000 radians = 0.000000 deg.

Summary of Warning Messages

The following warning was reported 308 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.

==========

LPile for Windows, Version 2022-12.011

Analysis of Individual Piles and Drilled Shafts
Subjected to Lateral Loading Using the p-y Method
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Files Used for Analysis

Path to file locations:
\20240280\ODOT\109971\400-Engineering\Structures\SFN_0800512\Engdata\04_Abutment Design\Stage 2\Drilled Shaft\Lpile\Abutment\Rear Abutment\

Name of input data file:
RA_Scour Strength 1 - Back DS.lp12d

Name of output report file:
RA_Scour Strength 1 - Back DS.lp12o

Name of plot output file:
RA_Scour Strength 1 - Back DS.lp12p

Name of runtime message file:
RA_Scour Strength 1 - Back DS.lp12r

Date and Time of Analysis

Date: February 12, 2026 Time: 14:15:28

Problem Title

Project Name:

Job Number:

Client:

Engineer:

Description:

Program Options and Settings

Computational Options:
- Conventional Analysis

Engineering Units Used for Data Input and Computations:
- US Customary System Units (pounds, feet, inches)

Analysis Control Options:

- Maximum number of iterations allowed	=	500
- Deflection tolerance for convergence	=	1.0000E-05 in
- Maximum allowable deflection	=	100.0000 in
- Number of pile increments	=	100

Loading Type and Number of Cycles of Loading:

- Static loading specified

- Analysis uses p-y modification factors for p-y curves
- Analysis uses layering correction (Method of Georgiadis)
- No distributed lateral loads are entered
- Loading by lateral soil movements acting on pile not selected
- Input of shear resistance at the pile tip not selected
- Input of moment resistance at the pile tip not selected
- Computation of pile-head foundation stiffness matrix not selected
- Push-over analysis of pile not selected
- Buckling analysis of pile not selected

Output Options:
- Output files use decimal points to denote decimal symbols.
- Values of pile-head deflection, bending moment, shear force, and soil reaction are printed for full length of pile.
- Printing Increment (nodal spacing of output points) = 1
- No p-y curves to be computed and reported for user-specified depths
- Print using wide report formats

Pile Structural Properties and Geometry

Number of pile sections defined = 2
Total length of pile = 38.200 ft
Depth of ground surface below top of pile = 18.0000 ft

Pile diameters used for p-y curve computations are defined using 4 points.

p-y curves are computed using pile diameter values interpolated with depth over the length of the pile. A summary of values of pile diameter vs. depth follows.

Point No.	Depth Below Pile Head feet	Pile Diameter inches
1	0.000	36.0000
2	33.200	36.0000
3	33.200	30.0000
4	38.200	30.0000

Input Structural Properties for Pile Sections:

Pile Section No. 1:

Section 1 is a round drilled shaft, bored pile, or CIDH pile
Length of section = 33.200000 ft
Shaft Diameter = 36.000000 in

Pile Section No. 2:

Section 2 is a round drilled shaft, bored pile, or CIDH pile
Length of section = 5.000000 ft
Shaft Diameter = 30.000000 in

Soil and Rock Layering Information

The soil profile is modelled using 2 layers

Layer 1 is stiff clay with water-induced erosion

Distance from top of pile to top of layer = 18.000000 ft
Distance from top of pile to bottom of layer = 33.200000 ft
Effective unit weight at top of layer = 67.600000 pcf
Effective unit weight at bottom of layer = 67.600000 pcf
Undrained cohesion at top of layer = 4800. psf
Undrained cohesion at bottom of layer = 4800. psf
Epsilon-50 at top of layer = 0.004000
Epsilon-50 at bottom of layer = 0.004000
Subgrade k at top of layer = 2000. pci
Subgrade k at bottom of layer = 2000. pci

Layer 2 is weak rock, p-y criteria by Reese, 1997

Distance from top of pile to top of layer = 33.200000 ft
Distance from top of pile to bottom of layer = 50.000000 ft
Effective unit weight at top of layer = 92.700000 pcf
Effective unit weight at bottom of layer = 92.700000 pcf
Uniaxial compressive strength at top of layer = 1640. psi
Uniaxial compressive strength at bottom of layer = 1640. psi
Initial modulus of rock at top of layer = 150000. psi
Initial modulus of rock at bottom of layer = 150000. 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

(Depth of the lowest soil layer extends 11.800 ft below the pile tip)

Summary of Input Soil Properties

Layer Num.	Soil Type Name or (p-y Curve Type)	Layer Depth ft	Effective Unit Wt. pcf	Cohesion psf	Uniaxial qu psi	RQD %	E50 kpy	Rock Mass Modulus pci	krm psi
1	Stiff Clay with Free Water	18.0000	67.6000	4800.	--	--	0.00400	2000.	--
		33.2000	67.6000	4800.	--	--	0.00400	2000.	--
2	Weak Rock	33.2000	92.7000	--	1640.	15.0000	5.00E-04	--	150000.
		50.0000	92.7000	--	1640.	15.0000	5.00E-04	--	150000.

Modification Factors for p-y Curves

Distribution of p-y modifiers with depth defined using 4 points

Point No.	Depth X ft	p-mult	y-mult
1	18.000	0.5000	1.0000
2	33.200	0.5000	1.0000
3	33.300	1.0000	1.0000
4	100.000	1.0000	1.0000

Static Loading Type

Static loading criteria were used when computing p-y curves for all analyses.

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 1

Load No.	Load Type	Condition 1	Condition 2	Axial Thrust Force, lbs	Compute Top y vs. Pile Length	Run Analysis
1	5	y = 1.750000 in	S = 0.0000 in/in	286800.	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 = 2

Pile Section No. 1:

Dimensions and Properties of Drilled Shaft (Bored Pile):

Length of Section	=	33.200000 ft
Shaft Diameter	=	36.000000 in
Concrete Cover Thickness (to edge of trans. reinf.)	=	6.000000 in
Number of Reinforcing Bars	=	15 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	=	15.000000 sq. in.
Area Ratio of Steel Reinforcement	=	1.47 percent
Edge-to-Edge Bar Spacing	=	3.367467 in

Maximum Concrete Aggregate Size = 0.375000 in
Ratio of Bar Spacing to Aggregate Size = 8.98
Offset of Center of Rebar Cage from Center of Pile = 0.0000 in
Transverse Reinforcement
Type: Hoop
Number of Transverse Reinf. (per spacing) = 1
Spacing of Transverse Reinf. = 4.500000 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 = 4309.778 kips
Tensile Load for Cracking of Concrete = -467.292 kips
Nominal Axial Tensile Capacity = -900.000 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	10.811000	0.00000
2	1.128000	1.000000	9.876340	4.397230
3	1.128000	1.000000	7.233971	8.034139
4	1.128000	1.000000	3.340783	10.281872
5	1.128000	1.000000	-1.13006	10.751776
6	1.128000	1.000000	-5.40550	9.362601
7	1.128000	1.000000	-8.74628	6.354546
8	1.128000	1.000000	-10.57475	2.247733
9	1.128000	1.000000	-10.57475	-2.24773
10	1.128000	1.000000	-8.74628	-6.35455
11	1.128000	1.000000	-5.40550	-9.36260
12	1.128000	1.000000	-1.13006	-10.75178
13	1.128000	1.000000	3.340783	-10.28187
14	1.128000	1.000000	7.233971	-8.03414
15	1.128000	1.000000	9.876340	-4.39723

NOTE: The positions of the above rebars were computed by LPile

Minimum spacing between any two bars not equal to zero = 3.367 inches
between bars 7 and 8.

Ratio of bar spacing to maximum aggregate size = 8.98

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 = 0.375000 in

Number of Axial Thrust Force Values Determined from Pile-head Loadings = 1

Number	Axial Thrust Force kips
1	286.800

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 = 286.800 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	225.0347386	360055582.	117.3726694	0.00007336	0.00005086	0.3046151	2.0066671	
0.00000125	450.0684454	360054756.	67.7052466	0.00008463	0.00003963	0.3499733	2.2128902	
0.00000188	675.0913120	360048700.	51.1578412	0.00009592	0.00002842	0.3951148	2.4195701	

```
0.00000250   900.0979199    360039168.    42.8904405     0.0001072    0.00001723
0.4400385     2.6267069
0.00000313         1125.    360026512.    37.9350421     0.0001185    0.00000605
0.4847431     2.8343007
0.00000375         1350.    360010046.    34.6356352     0.0001299   -0.00000512
0.5292274     3.0423503
0.00000438         1575.    359963081.    32.2821494     0.0001412   -0.00001627
0.5734839     3.2508102
0.00000500         1799.    359847065.    30.5191560     0.0001526   -0.00002740
0.6174978     3.4595776
0.00000563         2023.    359653695.    29.1493182     0.0001640   -0.00003854
0.6612573     3.6685701
0.00000625         2246.    359389248.    28.0543794     0.0001753   -0.00004966
0.7047543     3.8777313
0.00000688         2469.    359064034.    27.1584493     0.0001867   -0.00006079
0.7479834     4.0870243
0.00000750         2690.    358687991.    26.4135186     0.0001981   -0.00007190
0.7909410     4.2964233
0.00000813         2911.    358269636.    25.7832233     0.0002095   -0.00008301
0.8336244     4.5059095
0.00000875         3131.    357816066.    25.2431308     0.0002209   -0.00009412
0.8760315     4.7154695
0.00000938         3350.    357333011.    24.7752841     0.0002323     -0.000105
0.9181608     4.9250929
0.00001000         3350.    334999698.    22.6082188     0.0002261     -0.000134
0.8946683     4.6249835 C
0.00001063         3350.    315293833.    22.0769933     0.0002346     -0.000148
0.9258798     4.7503611 C
0.00001125         3350.    297777509.    21.5931713     0.0002429     -0.000162
0.9564518     4.8719615 C
0.00001188         3350.    282105009.    21.1511411     0.0002512     -0.000176
0.9864692     4.9903963 C
0.00001250         3350.    267999758.    20.7449581     0.0002593     -0.000191
1.0159576     5.1058206 C
0.00001313         3350.    255237865.    20.3701899     0.0002674     -0.000205
1.0449503     5.2184552 C
0.00001375         3350.    243636144.    20.0231058     0.0002753     -0.000220
1.0734834     5.3285467 C
0.00001438         3350.    233043268.    19.7006146     0.0002832     -0.000234
1.1015883     5.4363107 C
0.00001500         3350.    223333132.    19.4000941     0.0002910     -0.000249
1.1292936     5.5419432 C
0.00001563         3350.    214399806.    19.1194714     0.0002987     -0.000264
1.1566344     5.6456990 C
0.00001625         3350.    206153660.    18.8570714     0.0003064     -0.000279
1.1836499     5.7478703 C
0.00001688         3350.    198518339.    18.6099665     0.0003140     -0.000293
1.2102889     5.8480147 C
0.00001750         3397.    194142641.    18.3772637     0.0003216     -0.000308
1.2366011     5.9465114 C
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0.00001813        3454.    190591141.    18.1589742     0.0003291     -0.000323
1.2626845     6.0441484 C
0.00001875        3510.    187211729.    17.9513949     0.0003366     -0.000338
1.2883931     -6.192551 C
0.00001938        3566.    184027133.    17.7560348     0.0003440     -0.000353
1.3139007     -6.508740 C
0.00002000        3620.    180999081.    17.5703069     0.0003514     -0.000369
1.3391097     -6.826422 C
0.00002063        3674.    178131580.    17.3945339     0.0003588     -0.000384
1.3641075     -7.144882 C
0.00002125        3727.    175397439.    17.2268417     0.0003661     -0.000399
1.3888229     -7.464733 C
0.00002188        3780.    172807459.    17.0681687     0.0003734     -0.000414
1.4133799     -7.784942 C
0.00002250        3832.    170322503.    16.9155579     0.0003806     -0.000429
1.4376106     -8.106947 C
0.00002313        3884.    167969444.    16.7713807     0.0003878     -0.000445
1.4617417     -8.428827 C
0.00002375        3936.    165707444.    16.6323208     0.0003950     -0.000460
1.4855615     -8.752409 C
0.00002438        3987.    163550584.    16.4998119     0.0004022     -0.000475
1.5092216     -9.076401 C
0.00002563        4087.    159511745.    16.2514403     0.0004164     -0.000506
1.5559734     -9.726422 C
0.00002688        4187.    155810899.    16.0239804     0.0004306     -0.000537
1.6020892    -10.378148 C
0.00002813        4286.    152380086.    15.8120707     0.0004447     -0.000568
1.6473394    -11.033676 C
0.00002938        4383.    149223451.    15.6176234     0.0004588     -0.000599
1.6920979    -11.689749 C
0.00003063        4480.    146284650.    15.4357366     0.0004727     -0.000630
1.7361174    -12.348634 C
0.00003188        4576.    143562940.    15.2679456     0.0004867     -0.000661
1.7796763    -13.007855 C
0.00003313        4671.    141012255.    15.1097447     0.0005005     -0.000692
1.8225031    -13.669939 C
0.00003438        4766.    138641340.    14.9632857     0.0005144     -0.000723
1.8649611    -14.331573 C
0.00003563        4860.    136407272.    14.8247284     0.0005281     -0.000754
1.9066959    -14.996090 C
0.00003688        4953.    134314754.    14.6951512     0.0005419     -0.000786
1.9479949    -15.660835 C
0.00003813        5046.    132353291.    14.5740203     0.0005556     -0.000817
1.9889100    -16.325314 C
0.00003938        5138.    130490221.    14.4583461     0.0005693     -0.000848
2.0290852    -16.992988 C
0.00004063        5230.    128737157.    14.3498937     0.0005830     -0.000880
2.0689000    -17.660219 C
0.00004188        5322.    127084220.    14.2482829     0.0005966     -0.000911
2.1083534    -18.327005 C
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0.00004313 5413. 125510655. 14.1508787 0.0006103 -0.000942
2.1471901 -18.995895 C
0.00004438 5503. 124016754. 14.0584969 0.0006238 -0.000974
2.1855649 -19.665384 C
0.00004563 5594. 122600630. 13.9715142 0.0006375 -0.001005
2.2235816 -20.334428 C
0.00004688 5684. 121256038. 13.8895003 0.0006511 -0.001036
2.2612390 -21.003024 C
0.00004813 5774. 119969826. 13.8105976 0.0006646 -0.001068
2.2983402 -21.673221 C
0.00004938 5863. 118740585. 13.7351476 0.0006782 -0.001099
2.3349677 -22.344198 C
0.00005063 5952. 117568411. 13.6637301 0.0006917 -0.001131
2.3712389 -23.014724 C
0.00005188 6041. 116449159. 13.5960558 0.0007053 -0.001162
2.4071524 -23.684796 C
0.00005313 6130. 115379075. 13.5318620 0.0007189 -0.001194
2.4427071 -24.354413 C
0.00005438 6218. 114350717. 13.4699887 0.0007324 -0.001225
2.4777710 -25.025023 C
0.00005563 6306. 113361045. 13.4102200 0.0007459 -0.001257
2.5123383 -25.696724 C
0.00005688 6393. 112411651. 13.3533601 0.0007595 -0.001288
2.5465493 -26.367964 C
0.00005813 6481. 111499920. 13.2992198 0.0007730 -0.001319
2.5804027 -27.038740 C
0.00005938 6568. 110623456. 13.2476300 0.0007866 -0.001351
2.6138973 -27.709050 C
0.00006063 6655. 109780061. 13.1984345 0.0008002 -0.001382
2.6470319 -28.378891 C
0.00006188 6742. 108967714. 13.1514894 0.0008137 -0.001414
2.6798053 -29.048260 C
0.00006313 6829. 108180533. 13.1055455 0.0008273 -0.001445
2.7120469 -29.719197 C
0.00006438 6915. 107419714. 13.0612734 0.0008408 -0.001477
2.7438724 -30.390345 C
0.00006563 7001. 106685058. 13.0189405 0.0008544 -0.001508
2.7753388 -31.061013 C
0.00006688 7087. 105975083. 12.9784393 0.0008679 -0.001540
2.8064446 -31.731197 C
0.00006813 7173. 105288415. 12.9396737 0.0008815 -0.001571
2.8371887 -32.400895 C
0.00006938 7258. 104623780. 12.9025460 0.0008951 -0.001602
2.8675697 -33.070103 C
0.00007063 7344. 103979991. 12.8669729 0.0009087 -0.001634
2.8975863 -33.738819 C
0.00007188 7429. 103355948. 12.8328748 0.0009224 -0.001665
2.9272373 -34.407040 C
0.00007313 7514. 102750621. 12.8001773 0.0009360 -0.001696
2.9565213 -35.074763 C

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0.00007438        7598.    102161942.    12.7684121     0.0009497     -0.001728
2.9853737    -35.742842 C
0.00007938        7934.     99961196.    12.6509408     0.0010042     -0.001853
3.0966716    -38.416123 C
0.00008438        8267.     97984647.    12.5508121     0.0010590     -0.001979
3.2020516    -41.081044 C
0.00008938        8597.     96193829.    12.4651953     0.0011141     -0.002103
3.3014224    -43.737386 C
0.00009438        8924.     94556413.    12.3907989     0.0011694     -0.002228
3.3945225    -46.387842 C
0.00009938        9247.     93047939.    12.3255638     0.0012249     -0.002353
3.4812217    -49.033471 C
 0.0001044        9566.     91651932.    12.2696450     0.0012806     -0.002477
3.5616857    -51.669586 C
 0.0001094        9882.     90352142.    12.2220823     0.0013368     -0.002601
3.6358058    -54.295895 C
 0.0001144       10195.     89135122.    12.1816535     0.0013933     -0.002724
3.7034683    -56.912092 C
 0.0001194       10504.     87989645.    12.1476267     0.0014501     -0.002847
3.7645542    -59.517845 C
 0.0001244       10800.     86837035.    12.1162830     0.0015070     -0.002971
3.8185965    -60.000000 CY
 0.0001294       11049.     85404356.    12.0741721     0.0015621     -0.003095
3.8643259    -60.000000 CY
 0.0001344       11256.     83762976.    12.0227383     0.0016156     -0.003222
3.9022954    -60.000000 CY
 0.0001394       11433.     82029745.    11.9674498     0.0016680     -0.003350
3.9334338    -60.000000 CY
 0.0001444       11594.     80302756.    11.9131351     0.0017200     -0.003478
3.9584273    -60.000000 CY
 0.0001494       11736.     78564162.    11.8577620     0.0017713     -0.003606
3.9773615    -60.000000 CY
 0.0001544       11860.     76824663.    11.8020856     0.0018219     -0.003736
3.9904615    -60.000000 CY
 0.0001594       11980.     75171452.    11.7513041     0.0018729     -0.003865
3.9980079    -60.000000 CY
 0.0001644       12090.     73549623.    11.7018799     0.0019235     -0.003994
3.9976052    -60.000000 CY
 0.0001694       12182.     71921629.    11.6489661     0.0019730     -0.004124
3.9999753    -60.000000 CY
 0.0001744       12266.     70341515.    11.5985267     0.0020225     -0.004255
3.9995176    -60.000000 CY
 0.0001794       12348.     68837936.    11.5527612     0.0020723     -0.004385
3.9982007    -60.000000 CY
 0.0001844       12426.     67395985.    11.5104408     0.0021222     -0.004515
3.9988540    -60.000000 CY
 0.0001894       12497.     65988612.    11.4695031     0.0021720     -0.004645
3.9995034    -60.000000 CY
 0.0001944       12558.     64605032.    11.4286627     0.0022214     -0.004776
3.9972251    -60.000000 CY
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0.0001994	12611.	63252535.	11.3884836	0.0022706	-0.004907
3.9998771	-60.000000 CY				
0.0002044	12662.	61952510.	11.3511570	0.0023199	-0.005038
3.9977622	-60.000000 CY				
0.0002094	12711.	60706979.	11.3152390	0.0023691	-0.005168
3.9999441	-60.000000 CY				
0.0002144	12758.	59511898.	11.2820396	0.0024186	-0.005299
3.9975696	-60.000000 CY				
0.0002194	12804.	58365408.	11.2512023	0.0024682	-0.005429
3.9998795	-60.000000 CY				
0.0002244	12845.	57249922.	11.2213224	0.0025178	-0.005560
3.9965900	-60.000000 CY				
0.0002294	12883.	56163709.	11.1918333	0.0025671	-0.005690
3.9995027	-60.000000 CY				
0.0002344	12916.	55108036.	11.1631313	0.0026164	-0.005821
3.9959553	-60.000000 CY				
0.0002394	12943.	54071772.	11.1325460	0.0026649	-0.005953
3.9982226	-60.000000 CY				
0.0002444	12970.	53073660.	11.1062695	0.0027141	-0.006083
3.9999293	-60.000000 CY				
0.0002494	12995.	52109434.	11.0805026	0.0027632	-0.006214
3.9951471	-60.000000 CY				
0.0002544	13019.	51180593.	11.0565180	0.0028125	-0.006345
3.9985986	-60.000000 CY				
0.0002594	13043.	50285524.	11.0340127	0.0028619	-0.006476
3.9999747	-60.000000 CY				
0.0002644	13066.	49420893.	11.0134554	0.0029117	-0.006606
3.9946319	-60.000000 CY				
0.0002694	13088.	48586400.	10.9938481	0.0029615	-0.006736
3.9982091	-60.000000 CY				
0.0002744	13110.	47779713.	10.9758326	0.0030115	-0.006866
3.9998715	-60.000000 CY				
0.0003044	13202.	43374620.	10.8687696	0.0033082	-0.007649
3.9963034	-60.000000 CYT				
0.0003344	13252.	39633579.	10.7779672	0.0036039	-0.008434
3.9991296	-60.000000 CYT				
0.0003644	13252.	36370437.	10.7448562	0.0039152	-0.009202
3.9999790	-60.000000 CYT				

Summary of Results for Nominal Moment Capacity for Section 1

Moment values interpolated at maximum compressive strain = 0.003
or maximum developed moment if pile fails at smaller strains.

Load No.	Axial Thrust kips	Nominal Mom. Cap. in-kip	Max. Comp. Strain	Max. Tens.

Strain				
1	286.800	13104.596	0.00300000	-0.00683614

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	286.800000	13105.	186.420000	8518.	96624533.
1	0.75	286.800000	13105.	215.100000	9828.	90573444.
1	0.90	286.800000	13105.	258.120000	11794.	77743787.

Pile Section No. 2:

Dimensions and Properties of Drilled Shaft (Bored Pile):

Length of Section	=	5.000000 ft
Shaft Diameter	=	30.000000 in
Concrete Cover Thickness (to edge of trans. reinf.)	=	3.000000 in
Number of Reinforcing Bars	=	15 bars
Yield Stress of Reinforcing Bars	=	60000. psi
Modulus of Elasticity of Reinforcing Bars	=	29000000. psi

Gross Area of Shaft	=	706.858347 sq. in.
Total Area of Reinforcing Steel	=	15.000000 sq. in.
Area Ratio of Steel Reinforcement	=	2.12 percent
Edge-to-Edge Bar Spacing	=	3.367467 in
Maximum Concrete Aggregate Size	=	0.375000 in
Ratio of Bar Spacing to Aggregate Size	=	8.98
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.	=	4.500000 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	=	3252.318 kips
Tensile Load for Cracking of Concrete	=	-337.937 kips
Nominal Axial Tensile Capacity	=	-900.000 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	10.811000	0.00000
2	1.128000	1.000000	9.876340	4.397230
3	1.128000	1.000000	7.233971	8.034139
4	1.128000	1.000000	3.340783	10.281872
5	1.128000	1.000000	-1.13006	10.751776
6	1.128000	1.000000	-5.40550	9.362601
7	1.128000	1.000000	-8.74628	6.354546
8	1.128000	1.000000	-10.57475	2.247733
9	1.128000	1.000000	-10.57475	-2.24773
10	1.128000	1.000000	-8.74628	-6.35455
11	1.128000	1.000000	-5.40550	-9.36260
12	1.128000	1.000000	-1.13006	-10.75178
13	1.128000	1.000000	3.340783	-10.28187
14	1.128000	1.000000	7.233971	-8.03414
15	1.128000	1.000000	9.876340	-4.39723

NOTE: The positions of the above rebars were computed by LPile

Minimum spacing between any two bars not equal to zero = 3.367 inches
between bars 7 and 8.

Ratio of bar spacing to maximum aggregate size = 8.98

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	=	0.375000 in

Number of Axial Thrust Force Values Determined from Pile-head Loadings = 1

Number	Axial Thrust Force kips
1	286.800

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 = 286.800 kips

Bending Curvature rad/in.	Bending Moment in-kip	Bending Stiffness kip-in2	Depth to N Axis in	Max Comp Strain in/in	Max Tens Strain in/in	Max Conc Stress ksi	Max Steel Stress ksi	Run Msg
0.00000125	228.4807667	182784613.	84.5078077	0.0001056	0.00006813	0.4347196	2.9274705	

```
0.00000250   456.9538767    182781551.    49.7792612     0.0001244    0.00004945
0.5089092     3.3371214
0.00000375   685.3992719    182773139.    38.2143452     0.0001433    0.00003080
0.5824843     3.7479976
0.00000500   913.8030969    182760619.    32.4403381     0.0001622    0.00001220
0.6554398     4.1600990
0.00000625        1142.     182743872.    28.9826882     0.0001811   -0.00000636
0.7277700     4.5734248
0.00000750        1370.     182698851.    26.6826685     0.0002001   -0.00002488
0.7994541     4.9878554
0.00000875        1598.     182586536.    25.0361873     0.0002191   -0.00004343
0.8704469     5.4030796
0.00001000        1824.     182403308.    23.8121501     0.0002381   -0.00006188
0.9407154     5.8188651
0.00001125        2049.     182158853.    22.8603215     0.0002572   -0.00008032
1.0102384     6.2350656
0.00001250        2273.     181864322.    22.0990162     0.0002762   -0.00009876
1.0790023     6.6515858
0.00001375        2273.     165331202.    20.5249870     0.0002822     -0.000130
1.0999530     6.6890261 C
0.00001500        2273.     151553602.    19.8300026     0.0002975     -0.000153
1.1540262     6.9948012 C
0.00001625        2273.     139895632.    19.2240529     0.0003124     -0.000175
1.2065605     7.2921475 C
0.00001750        2345.     133983346.    18.6904778     0.0003271     -0.000198
1.2577334     7.5822925 C
0.00001875        2436.     129922722.    18.2157288     0.0003415     -0.000221
1.3076333     7.8657691 C
0.00002000        2524.     126204344.    17.7904760     0.0003558     -0.000244
1.3563890     8.1434761 C
0.00002125        2609.     122789863.    17.4067018     0.0003699     -0.000268
1.4040833     8.4159540 C
0.00002250        2692.     119656597.    17.0591182     0.0003838     -0.000291
1.4508523     8.6842263 C
0.00002375        2773.     116771063.    16.7425233     0.0003976     -0.000315
1.4967470     8.9486155 C
0.00002500        2853.     114104795.    16.4526068     0.0004113     -0.000339
1.5418113     9.2093979 C
0.00002625        2930.     111634921.    16.1860190     0.0004249     -0.000363
1.5860963     9.4669233 C
0.00002750        3007.     109342886.    15.9401225     0.0004384     -0.000387
1.6296608     9.7216244 C
0.00002875        3082.     107212961.    15.7127990     0.0004517     -0.000411
1.6725674     9.9739843 C
0.00003000        3157.     105221926.    15.5012370     0.0004650     -0.000435
1.7147762    10.2235760 C
0.00003125        3230.     103359556.    15.3040348     0.0004783     -0.000459
1.7563441    10.4708441 C
0.00003250        3303.     101622702.    15.1208235     0.0004914     -0.000484
1.7974100    10.7170012 C
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0.00003375        3375.     99985995.    14.9485570     0.0005045     -0.000508
1.8378213    -11.061277 C
0.00003500        3446.     98452409.    14.7876749     0.0005176     -0.000532
1.8777568    -11.634260 C
0.00003625        3516.     97005951.    14.6362563     0.0005306     -0.000557
1.9171400    -12.208948 C
0.00003750        3587.     95643803.    14.4940483     0.0005435     -0.000581
1.9560539    -12.784598 C
0.00003875        3656.     94353490.    14.3595308     0.0005564     -0.000606
1.9944282    -13.361914 C
0.00004000        3726.     93138162.    14.2333616     0.0005693     -0.000631
2.0324318    -13.939299 C
0.00004125        3794.     91977764.    14.1127249     0.0005821     -0.000655
2.0698151    -14.519213 C
0.00004250        3863.     90882695.    13.9994855     0.0005950     -0.000680
2.1068772    -15.098755 C
0.00004375        3930.     89839176.    13.8916284     0.0006078     -0.000705
2.1434424    -15.679677 C
0.00004500        3998.     88844212.    13.7889134     0.0006205     -0.000729
2.1795418    -16.261708 C
0.00004625        4065.     87900380.    13.6920249     0.0006333     -0.000754
2.2153228    -16.843370 C
0.00004750        4132.     86997013.    13.5992856     0.0006460     -0.000779
2.2506202    -17.426359 C
0.00004875        4199.     86132166.    13.5105409     0.0006586     -0.000804
2.2854660    -18.010383 C
0.00005125        4332.     84521572.    13.3467534     0.0006840     -0.000853
2.3541980    -19.177450 C
0.00005375        4463.     83033990.    13.1953954     0.0007093     -0.000903
2.4211308    -20.348797 C
0.00005625        4594.     81670149.    13.0584174     0.0007345     -0.000953
2.4868065    -21.518674 C
0.00005875        4724.     80401482.    12.9309952     0.0007597     -0.001003
2.5507727    -22.692122 C
0.00006125        4853.     79227799.    12.8146080     0.0007849     -0.001053
2.6134547    -23.864440 C
0.00006375        4981.     78134569.    12.7071843     0.0008101     -0.001102
2.6747072    -25.037280 C
0.00006625        5109.     77110838.    12.6068555     0.0008352     -0.001152
2.7344533    -26.211611 C
0.00006875        5236.     76154667.    12.5146920     0.0008604     -0.001202
2.7929430    -27.384430 C
0.00007125        5362.     75257117.    12.4293838     0.0008856     -0.001252
2.8500803    -28.556848 C
0.00007375        5488.     74408685.    12.3487842     0.0009107     -0.001302
2.9056824    -29.731225 C
0.00007625        5613.     73609652.    12.2739201     0.0009359     -0.001352
2.9600226    -30.904049 C
0.00007875        5737.     72855253.    12.2047060     0.0009611     -0.001401
3.0130930    -32.075304 C
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0.00008125        5861.    72140592.    12.1402895    0.0009864    -0.001451
3.0648410   -33.245607 C
0.00008375        5985.    71458843.    12.0789552    0.0010116    -0.001501
3.1150568   -34.417925 C
0.00008625        6107.    70811017.    12.0216661    0.0010369    -0.001551
3.1639955   -35.588620 C
0.00008875        6230.    70194192.    11.9682417    0.0010622    -0.001600
3.2116486   -36.757676 C
0.00009125        6352.    69605770.    11.9179667    0.0010875    -0.001650
3.2580080   -37.925073 C
0.00009375        6473.    69043421.    11.8713527    0.0011129    -0.001700
3.3030649   -39.090796 C
0.00009625        6593.    68503682.    11.8274359    0.0011384    -0.001749
3.3467008   -40.256683 C
0.00009875        6714.    67984909.    11.7855242    0.0011638    -0.001799
3.3889221   -41.422642 C
 0.0001013        6833.    67486789.    11.7461762    0.0011893    -0.001848
3.4298296   -42.586853 C
 0.0001038        6952.    67007777.    11.7093126    0.0012148    -0.001898
3.4694143   -43.749294 C
 0.0001063        7071.    66546472.    11.6747649    0.0012404    -0.001947
3.5076669   -44.909944 C
 0.0001088        7189.    66101607.    11.6418727    0.0012661    -0.001996
3.5445781   -46.068781 C
 0.0001113        7306.    65672016.    11.6115082    0.0012918    -0.002046
3.5801380   -47.225784 C
 0.0001138        7423.    65256643.    11.5830442    0.0013176    -0.002095
3.6143369   -48.380931 C
 0.0001163        7539.    64854519.    11.5563653    0.0013434    -0.002144
3.6471650   -49.534198 C
 0.0001188        7655.    64463946.    11.5310704    0.0013693    -0.002193
3.6785276   -50.687596 C
 0.0001213        7770.    64084721.    11.5070827    0.0013952    -0.002242
3.7084785   -51.839783 C
 0.0001238        7885.    63716403.    11.4844182    0.0014212    -0.002291
3.7370397   -52.989982 C
 0.0001263        7999.    63358292.    11.4632015    0.0014472    -0.002340
3.7642002   -54.138166 C
 0.0001288        8113.    63009743.    11.4433557    0.0014733    -0.002389
3.7899491   -55.284308 C
 0.0001313        8225.    62670156.    11.4248099    0.0014995    -0.002438
3.8142749   -56.428381 C
 0.0001338        8338.    62338977.    11.4074986    0.0015258    -0.002487
3.8371661   -57.570354 C
 0.0001363        8450.    62015696.    11.3909710    0.0015520    -0.002535
3.8586109   -58.710195 C
 0.0001388        8561.    61699827.    11.3759792    0.0015784    -0.002584
3.8785971   -59.847880 C
 0.0001413        8669.    61376293.    11.3611758    0.0016048    -0.002633
3.8970304   -60.000000 CY
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 0.0001438        8773.     61026973.    11.3454479     0.0016309     -0.002682
3.9138176    -60.000000 CY
 0.0001463        8868.     60632975.    11.3275171     0.0016566     -0.002731
3.9288869    -60.000000 CY
 0.0001488        8954.     60194288.    11.3076388     0.0016820     -0.002780
3.9422882    -60.000000 CY
 0.0001588        9243.     58224883.    11.2150063     0.0017804     -0.002982
3.9810907    -60.000000 CY
 0.0001688        9473.     56138324.    11.1155782     0.0018758     -0.003187
3.9985568    -60.000000 CY
 0.0001788        9663.     54060667.    11.0178567     0.0019694     -0.003393
3.9991429    -60.000000 CY
 0.0001888        9824.     52045291.    10.9245694     0.0020620     -0.003600
3.9994336    -60.000000 CY
 0.0001988        9965.     50136522.    10.8366263     0.0021538     -0.003809
3.9999993    -60.000000 CY
 0.0002088       10077.     48271216.    10.7493105     0.0022439     -0.004019
3.9972599    -60.000000 CY
 0.0002188       10179.     46534465.    10.6714484     0.0023344     -0.004228
3.9978181    -60.000000 CY
 0.0002288       10276.     44923853.    10.6005132     0.0024249     -0.004438
3.9977521    -60.000000 CY
 0.0002388       10356.     43375045.    10.5294589     0.0025139     -0.004649
3.9968658    -60.000000 CY
 0.0002488       10421.     41893847.    10.4599305     0.0026019     -0.004861
3.9978996    -60.000000 CY
 0.0002588       10481.     40507154.    10.3962889     0.0026900     -0.005072
3.9998566    -60.000000 CY
 0.0002688       10539.     39216732.    10.3389067     0.0027786     -0.005284
3.9986325    -60.000000 CY
 0.0002788       10595.     38009838.    10.2847223     0.0028669     -0.005496
3.9952914    -60.000000 CY
 0.0002888       10646.     36869278.    10.2335466     0.0029549     -0.005708
3.9997750    -60.000000 CY
 0.0002988       10689.     35779345.    10.1830258     0.0030422     -0.005920
3.9967187    -60.000000 CY
 0.0003088       10725.     34738261.    10.1329541     0.0031285     -0.006134
3.9999253    -60.000000 CY
 0.0003188       10757.     33748848.    10.0849925     0.0032146     -0.006348
3.9961865    -60.000000 CY
 0.0003288       10788.     32815371.    10.0396550     0.0033005     -0.006562
3.9997195    -60.000000 CYT
 0.0003388       10817.     31930857.     9.9968232     0.0033864     -0.006776
3.9936704    60.0000000 CYT
 0.0003488       10845.     31095657.     9.9573233     0.0034726     -0.006990
3.9985958    60.0000000 CYT
 0.0003588       10871.     30301339.     9.9227720     0.0035598     -0.007203
3.9983270    60.0000000 CYT
 0.0003688       10896.     29547391.     9.8915793     0.0036475     -0.007415
3.9953860    60.0000000 CYT
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    0.0003788        10917.     28824407.     9.8617531     0.0037351     -0.007627
   3.9992718    60.0000000 CYT
    0.0003888        10936.     28130807.     9.8386111     0.0038248     -0.007838
   3.9955497    60.0000000 CYT


--------------------------------------------------------------------------------
   Summary of Results for Nominal Moment Capacity for Section 2
--------------------------------------------------------------------------------

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               286.800             10668.254           0.00300000
-0.00581746

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         286.800000        10668.    186.420000         6934.
67078981.

   1       0.75         286.800000        10668.    215.100000         8001.
63351520.
```

```
   1       0.90         286.800000        10668.    258.120000         9601.
54737712.
```

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	18.0000	0.00	N.A.	No	0.00	168434.
2	33.2000	15.2000	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 Displacement and Pile-head Rotation (Loading Type 5)
Displacement of pile head = 1.750000 inches
Rotation of pile head = 0.000E+00 radians
Axial load on pile head = 286800.0 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. Es*H lb/inch	Soil Spr. Lat. Load lb/inch	p Distrib. lb/inch
0.00	1.7500	-1.07E+07	67677.	0.00	0.00	8.71E+10	0.00	0.00	0.00
0.3820	1.7487	-1.04E+07	67675.	-5.56E-04	0.00	8.71E+10	0.00	0.00	0.00
0.7640	1.7449	-1.01E+07	67675.	-0.00109	0.00	8.95E+10			

```
0.00       0.00       0.00
    1.1460     1.7387  -9784880.     67675.   -0.00159       0.00   9.07E+10
0.00       0.00       0.00
    1.5280     1.7303  -9472238.     67675.   -0.00208       0.00   9.20E+10
0.00       0.00       0.00
    1.9100     1.7197  -9158975.     67675.   -0.00254       0.00   9.34E+10
0.00       0.00       0.00
    2.2920     1.7070  -8845122.     67675.   -0.00298       0.00   9.49E+10
0.00       0.00       0.00
    2.6740     1.6924  -8530707.     67675.   -0.00339       0.00   9.65E+10
0.00       0.00       0.00
    3.0560     1.6759  -8215759.     67675.   -0.00379       0.00   9.83E+10
0.00       0.00       0.00
    3.4380     1.6577  -7900308.     67675.   -0.00416       0.00   1.00E+11
0.00       0.00       0.00
    3.8200     1.6378  -7584381.     67675.   -0.00451       0.00   1.02E+11
0.00       0.00       0.00
    4.2020     1.6164  -7268008.     67675.   -0.00484       0.00   1.05E+11
0.00       0.00       0.00
    4.5840     1.5935  -6951215.     67675.   -0.00515       0.00   1.07E+11
0.00       0.00       0.00
    4.9660     1.5692  -6634031.     67675.   -0.00543       0.00   1.10E+11
0.00       0.00       0.00
    5.3480     1.5437  -6316484.     67675.   -0.00570       0.00   1.13E+11
0.00       0.00       0.00
    5.7300     1.5169  -5998601.     67675.   -0.00594       0.00   1.17E+11
0.00       0.00       0.00
    6.1120     1.4892  -5680409.     67675.   -0.00617       0.00   1.21E+11
0.00       0.00       0.00
    6.4940     1.4604  -5361934.     67675.   -0.00637       0.00   1.26E+11
0.00       0.00       0.00
    6.8760     1.4307  -5043204.     67675.   -0.00656       0.00   1.32E+11
0.00       0.00       0.00
    7.2580     1.4002  -4724244.     67675.   -0.00672       0.00   1.40E+11
0.00       0.00       0.00
    7.6400     1.3691  -4405080.     67675.   -0.00687       0.00   1.49E+11
0.00       0.00       0.00
    8.0220     1.3373  -4085738.     67675.   -0.00700       0.00   1.60E+11
0.00       0.00       0.00
    8.4040     1.3049  -3766241.     67675.   -0.00710       0.00   1.73E+11
0.00       0.00       0.00
    8.7860     1.2721  -3446613.     67675.   -0.00720       0.00   1.91E+11
0.00       0.00       0.00
    9.1680     1.2390  -3126877.     67675.   -0.00726       0.00   3.58E+11
0.00       0.00       0.00
    9.5500     1.2056  -2807088.     67675.   -0.00729       0.00   3.58E+11
0.00       0.00       0.00
    9.9320     1.1721  -2487252.     67675.   -0.00733       0.00   3.59E+11
0.00       0.00       0.00
   10.3140     1.1384  -2167374.     67675.   -0.00736       0.00   3.59E+11
```

```
0.00       0.00       0.00
   10.6960     1.1046  -1847460.     67675.   -0.00738       0.00   3.60E+11
0.00       0.00       0.00
   11.0780     1.0707  -1527515.     67675.   -0.00741       0.00   3.60E+11
0.00       0.00       0.00
   11.4600     1.0367  -1207544.     67675.   -0.00742       0.00   3.60E+11
0.00       0.00       0.00
   11.8420     1.0027   -887553.     67675.   -0.00744       0.00   3.60E+11
0.00       0.00       0.00
   12.2240     0.9686   -567547.     67675.   -0.00745       0.00   3.60E+11
0.00       0.00       0.00
   12.6060     0.9344   -247532.     67675.   -0.00745       0.00   3.60E+11
0.00       0.00       0.00
   12.9880     0.9003     72487.     67675.   -0.00745       0.00   3.60E+11
0.00       0.00       0.00
   13.3700     0.8661    392506.     67675.   -0.00745       0.00   3.60E+11
0.00       0.00       0.00
   13.7520     0.8320    712517.     67675.   -0.00744       0.00   3.60E+11
0.00       0.00       0.00
   14.1340     0.7979   1032517.     67675.   -0.00743       0.00   3.60E+11
0.00       0.00       0.00
   14.5160     0.7639   1352500.     67675.   -0.00742       0.00   3.60E+11
0.00       0.00       0.00
   14.8980     0.7299   1672459.     67675.   -0.00740       0.00   3.60E+11
0.00       0.00       0.00
   15.2800     0.6961   1992391.     67675.   -0.00737       0.00   3.60E+11
0.00       0.00       0.00
   15.6620     0.6623   2312290.     67675.   -0.00735       0.00   3.59E+11
0.00       0.00       0.00
   16.0440     0.6287   2632149.     67675.   -0.00731       0.00   3.59E+11
0.00       0.00       0.00
   16.4260     0.5953   2951965.     67675.   -0.00728       0.00   3.58E+11
0.00       0.00       0.00
   16.8080     0.5620   3271731.     67675.   -0.00724       0.00   3.57E+11
0.00       0.00       0.00
   17.1900     0.5289   3591441.     67675.   -0.00717       0.00   1.83E+11
0.00       0.00       0.00
   17.5720     0.4962   3911033.     67675.   -0.00707       0.00   1.67E+11
0.00       0.00       0.00
   17.9540     0.4641   4230484.     67675.   -0.00696       0.00   1.54E+11
0.00       0.00       0.00
   18.3360     0.4325   4549769.     67248.   -0.00682       0.00   1.44E+11
-186.324      1975.       0.00
   18.7180     0.4015   4864950.     66084.   -0.00667       0.00   1.36E+11
-321.537      3671.       0.00
   19.1000     0.3713   5173158.     64259.   -0.00649       0.00   1.30E+11
-474.689      5860.       0.00
   19.4820     0.3420   5471152.     61696.   -0.00630       0.00   1.25E+11
-643.403      8624.       0.00
   19.8640     0.3136   5755361.     58304.   -0.00609       0.00   1.20E+11
```

```
-836.742     12233.       0.00
   20.2460     0.2861   6021699.     54023.   -0.00586       0.00   1.17E+11
-1031.     16516.       0.00
   20.6280     0.2598   6266063.     48905.   -0.00562       0.00   1.14E+11
-1202.     21210.       0.00
   21.0100     0.2346   6484835.     43054.   -0.00536       0.00   1.11E+11
-1351.     26392.       0.00
   21.3920     0.2107   6674873.     36571.   -0.00509       0.00   1.10E+11
-1477.     32150.       0.00
   21.7740     0.1880   6833497.     29558.   -0.00480       0.00   1.08E+11
-1582.     38589.       0.00
   22.1560     0.1666   6958488.     22113.   -0.00451       0.00   1.07E+11
-1666.     45831.       0.00
   22.5380     0.1466   7048079.     14333.   -0.00421       0.00   1.06E+11
-1728.     54020.       0.00
   22.9200     0.1281   7100956.      6317.   -0.00390       0.00   1.06E+11
-1769.     63326.       0.00
   23.3020     0.1109   7116256.     -1837.   -0.00359       0.00   1.06E+11
-1789.     73943.       0.00
   23.6840    0.09511   7093568.    -10029.   -0.00329       0.00   1.06E+11
-1786.     86065.       0.00
   24.0660    0.08075   7032952.    -18142.   -0.00298       0.00   1.06E+11
-1754.     99573.       0.00
   24.4480    0.06778   6935080.    -26018.   -0.00268       0.00   1.07E+11
-1682.    113775.       0.00
   24.8300    0.05617   6801468.    -33541.   -0.00239       0.00   1.08E+11
-1600.    130576.       0.00
   25.2120    0.04587   6633858.    -40664.   -0.00211       0.00   1.10E+11
-1508.    150674.       0.00
   25.5940    0.03685   6434198.    -47345.   -0.00184       0.00   1.12E+11
-1407.    175024.       0.00
   25.9760    0.02903   6204629.    -53545.   -0.00158       0.00   1.15E+11
-1298.    204971.       0.00
   26.3580    0.02235   5947457.    -59229.   -0.00134       0.00   1.18E+11
-1182.    242472.       0.00
   26.7400    0.01673   5665140.    -64369.   -0.00112       0.00   1.22E+11
-1060.    290488.       0.00
   27.1220    0.01209   5360263.    -68938.  -9.15E-04       0.00   1.26E+11
-933.177    353743.       0.00
   27.5040    0.00835   5035521.    -72898.  -7.30E-04       0.00   1.33E+11
-794.467    436397.       0.00
   27.8860    0.00540   4693857.    -76183.  -5.67E-04       0.00   1.40E+11
-638.850    542713.       0.00
   28.2680    0.00315   4338567.    -78537.  -4.24E-04       0.00   1.51E+11
-388.025    564822.       0.00
   28.6500    0.00151   3974949.    -79867.  -3.03E-04       0.00   1.64E+11
-192.652    585835.       0.00
   29.0320   3.75E-04   3607138.    -80423.  -2.02E-04       0.00   1.82E+11
-49.634    606848.       0.00
   29.4140  -3.40E-04   3238163.    -80430.  -1.35E-04       0.00   3.58E+11
```

```
46.6332    627861.       0.00
   29.7960  -8.66E-04   2870115.    -80042.  -9.62E-05       0.00   3.58E+11
122.5225    648874.       0.00
   30.1780   -0.00122   2504592.    -79352.  -6.18E-05       0.00   3.59E+11
178.6309    669887.       0.00
   30.5600   -0.00143   2142781.    -78447.  -3.22E-05       0.00   3.60E+11
215.9149    690900.       0.00
   30.9420   -0.00152   1785471.    -77412.  -7.16E-06       0.00   3.60E+11
235.6748    711914.       0.00
   31.3240   -0.00150   1433084.    -76323.   1.33E-05       0.00   3.60E+11
239.5436    732927.       0.00
   31.7060   -0.00140   1085706.    -75248.   2.94E-05       0.00   3.60E+11
229.4773    753940.       0.00
   32.0880   -0.00123    743131.    -74246.   4.10E-05       0.00   3.60E+11
207.7544    774953.       0.00
   32.4700   -0.00102    404910.    -73364.   4.83E-05       0.00   3.60E+11
176.9757    795966.       0.00
   32.8520  -7.86E-04     70401.    -72638.   5.13E-05       0.00   3.60E+11
140.0628    816979.       0.00
   33.2340  -5.48E-04   -261166.    -53119.   4.85E-05       0.00   1.83E+11
8376.   7.00E+07       0.00
   33.6160  -3.41E-04   -416723.    -19596.   4.00E-05       0.00   1.83E+11
6250.   8.40E+07       0.00
   33.9980  -1.82E-04   -440926.      3627.   2.93E-05       0.00   1.83E+11
3882.   9.80E+07       0.00
   34.3800  -7.27E-05   -383549.     16596.   1.89E-05       0.00   1.83E+11
1777.   1.12E+08       0.00
   34.7620  -7.98E-06   -288821.     21172.   1.05E-05       0.00   1.83E+11
219.5051   1.26E+08       0.00
   35.1440   2.35E-05   -189471.     20027.   4.50E-06       0.00   1.83E+11
-719.082   1.40E+08       0.00
   35.5260   3.33E-05   -105224.     15816.   8.05E-07       0.00   1.83E+11
-1118.   1.54E+08       0.00
   35.9080   3.09E-05    -44473.     10655.  -1.07E-06       0.00   1.83E+11
-1133.   1.68E+08       0.00
   36.2900   2.34E-05     -7538.      5923.  -1.72E-06       0.00   1.83E+11
-931.188   1.82E+08       0.00
   36.6720   1.51E-05      9831.      2307.  -1.70E-06       0.00   1.83E+11
-646.167   1.96E+08       0.00
   37.0540   7.90E-06     13621.     -3.321  -1.40E-06       0.00   1.83E+11
-361.982   2.10E+08       0.00
   37.4360   2.26E-06      9804.     -1086.  -1.11E-06       0.00   1.83E+11
-110.294   2.24E+08       0.00
   37.8180  -2.26E-06      3669.     -1070.  -9.39E-07       0.00   1.83E+11
117.3326   2.38E+08       0.00
   38.2000  -6.35E-06       0.00       0.00  -8.93E-07       0.00   1.83E+11
349.3536   1.26E+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 interpolated from the output for nonlinear bending properties relative to the magnitude of bending moment developed in the pile.

Output Summary for Load Case No. 1:

```
Pile-head deflection             =     1.75000000 inches
Computed slope at pile head      =       0.000000 radians
Maximum bending moment           =     -10718779. inch-lbs
Maximum shear force              =        -80430. lbs
Depth of maximum bending moment  =       0.000000 feet below pile head
Depth of maximum shear force     =    29.41400000 feet below pile head
Number of iterations             =             33
Number of zero deflection points =              3
Pile deflection at ground        =     0.46025273 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	Load 1	Load Type	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	1	y, in	1.7500	S, rad	0.00	286800.	1.7500	0.00	-80430.	-1.07E+07

Maximum pile-head deflection = 1.7500000000 inches
Maximum pile-head rotation = 0.0000000000 radians = 0.000000 deg.

Summary of Warning Messages

The following warning was reported 476 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.

==

LPile for Windows, Version 2022-12.011

Analysis of Individual Piles and Drilled Shafts
Subjected to Lateral Loading Using the p-y Method
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Files Used for Analysis

Path to file locations:
\20240280\ODOT\109971\400-Engineering\Structures\SFN_0800512\Engdata\04_Abutment Design\Stage 2\Drilled Shaft\Lpile\Abutment\Rear Abutment\

Name of input data file:
RA_Scour Extreme II - Front DS.lp12d

Name of output report file:
RA_Scour Extreme II - Front DS.lp12o

Name of plot output file:
RA_Scour Extreme II - Front DS.lp12p

Name of runtime message file:
RA_Scour Extreme II - Front DS.lp12r

Date and Time of Analysis

Date: February 12, 2026 Time: 14:08:25

Problem Title

Project Name:

Job Number:

Client:

Engineer:

Description:

Program Options and Settings

Computational Options:
- Conventional Analysis

Engineering Units Used for Data Input and Computations:
- US Customary System Units (pounds, feet, inches)

Analysis Control Options:

- Maximum number of iterations allowed	=	500
- Deflection tolerance for convergence	=	1.0000E-05 in
- Maximum allowable deflection	=	100.0000 in
- Number of pile increments	=	100

Loading Type and Number of Cycles of Loading:

- Static loading specified

- Analysis uses p-y modification factors for p-y curves
- Analysis uses layering correction (Method of Georgiadis)
- No distributed lateral loads are entered
- Loading by lateral soil movements acting on pile not selected
- Input of shear resistance at the pile tip not selected
- Input of moment resistance at the pile tip not selected
- Computation of pile-head foundation stiffness matrix not selected
- Push-over analysis of pile not selected
- Buckling analysis of pile not selected

Output Options:
- Output files use decimal points to denote decimal symbols.
- Values of pile-head deflection, bending moment, shear force, and soil reaction are printed for full length of pile.
- Printing Increment (nodal spacing of output points) = 1
- No p-y curves to be computed and reported for user-specified depths
- Print using wide report formats

Pile Structural Properties and Geometry

Number of pile sections defined = 2
Total length of pile = 38.200 ft
Depth of ground surface below top of pile = 20.3300 ft

Pile diameters used for p-y curve computations are defined using 4 points.

p-y curves are computed using pile diameter values interpolated with depth over the length of the pile. A summary of values of pile diameter vs. depth follows.

Point No.	Depth Below Pile Head feet	Pile Diameter inches
1	0.000	36.0000
2	33.200	36.0000
3	33.200	30.0000
4	38.200	30.0000

Input Structural Properties for Pile Sections:

Pile Section No. 1:

Section 1 is a round drilled shaft, bored pile, or CIDH pile
Length of section = 33.200000 ft
Shaft Diameter = 36.000000 in

Pile Section No. 2:

Section 2 is a round drilled shaft, bored pile, or CIDH pile
Length of section = 5.000000 ft
Shaft Diameter = 30.000000 in

Soil and Rock Layering Information

The soil profile is modelled using 2 layers

Layer 1 is stiff clay with water-induced erosion

Distance from top of pile to top of layer = 20.330000 ft
Distance from top of pile to bottom of layer = 33.200000 ft
Effective unit weight at top of layer = 67.600000 pcf
Effective unit weight at bottom of layer = 67.600000 pcf
Undrained cohesion at top of layer = 4800. psf
Undrained cohesion at bottom of layer = 4800. psf
Epsilon-50 at top of layer = 0.004000
Epsilon-50 at bottom of layer = 0.004000
Subgrade k at top of layer = 2000. pci
Subgrade k at bottom of layer = 2000. pci

Layer 2 is weak rock, p-y criteria by Reese, 1997

Distance from top of pile to top of layer = 33.200000 ft
Distance from top of pile to bottom of layer = 50.000000 ft
Effective unit weight at top of layer = 92.700000 pcf
Effective unit weight at bottom of layer = 92.700000 pcf
Uniaxial compressive strength at top of layer = 1640. psi
Uniaxial compressive strength at bottom of layer = 1640. psi
Initial modulus of rock at top of layer = 150000. psi
Initial modulus of rock at bottom of layer = 150000. 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

(Depth of the lowest soil layer extends 11.800 ft below the pile tip)

Summary of Input Soil Properties

Layer Num.	Soil Type Name or (p-y Curve Type)	Layer Depth ft	Effective Unit Wt. pcf	Cohesion psf	Uniaxial qu psi	RQD %	E50 krm	kpy pci	Rock Mass Modulus psi
1	Stiff Clay with Free Water	20.3300	67.6000	4800.	--	--	0.00400	2000.	--
		33.2000	67.6000	4800.	--	--	0.00400	2000.	--
2	Weak Rock	33.2000	92.7000	--	1640.	15.0000	5.00E-04	--	150000.
		50.0000	92.7000	--	1640.	15.0000	5.00E-04	--	150000.

Modification Factors for p-y Curves

Distribution of p-y modifiers with depth defined using 4 points

Point No.	Depth X ft	p-mult	y-mult
1	20.330	0.7000	1.0000
2	33.200	0.7000	1.0000
3	33.300	1.0000	1.0000
4	33.300	1.0000	1.0000

Static Loading Type

Static loading criteria were used when computing p-y curves for all analyses.

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 1

Load No.	Load Type	Condition 1	Condition 2	Axial Thrust Force, lbs	Compute Top y vs. Pile Length	Run Analysis
1	5	y = 1.000000 in	S = 0.0000 in/in	356020.	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 = 2

Pile Section No. 1:

Dimensions and Properties of Drilled Shaft (Bored Pile):

Length of Section	=	33.200000 ft
Shaft Diameter	=	36.000000 in
Concrete Cover Thickness (to edge of trans. reinf.)	=	6.000000 in
Number of Reinforcing Bars	=	15 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	=	15.000000 sq. in.
Area Ratio of Steel Reinforcement	=	1.47 percent
Edge-to-Edge Bar Spacing	=	3.367467 in

Maximum Concrete Aggregate Size = 0.375000 in
Ratio of Bar Spacing to Aggregate Size = 8.98
Offset of Center of Rebar Cage from Center of Pile = 0.0000 in
Transverse Reinforcement
Type: Hoop
Number of Transverse Reinf. (per spacing) = 1
Spacing of Transverse Reinf. = 4.500000 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 = 4309.778 kips
Tensile Load for Cracking of Concrete = -467.292 kips
Nominal Axial Tensile Capacity = -900.000 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	10.811000	0.00000
2	1.128000	1.000000	9.876340	4.397230
3	1.128000	1.000000	7.233971	8.034139
4	1.128000	1.000000	3.340783	10.281872
5	1.128000	1.000000	-1.13006	10.751776
6	1.128000	1.000000	-5.40550	9.362601
7	1.128000	1.000000	-8.74628	6.354546
8	1.128000	1.000000	-10.57475	2.247733
9	1.128000	1.000000	-10.57475	-2.24773
10	1.128000	1.000000	-8.74628	-6.35455
11	1.128000	1.000000	-5.40550	-9.36260
12	1.128000	1.000000	-1.13006	-10.75178
13	1.128000	1.000000	3.340783	-10.28187
14	1.128000	1.000000	7.233971	-8.03414
15	1.128000	1.000000	9.876340	-4.39723

NOTE: The positions of the above rebars were computed by LPile

Minimum spacing between any two bars not equal to zero = 3.367 inches
between bars 7 and 8.

Ratio of bar spacing to maximum aggregate size = 8.98

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 = 0.375000 in

Number of Axial Thrust Force Values Determined from Pile-head Loadings = 1

Number	Axial Thrust Force kips
1	356.020

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 = 356.020 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	223.2823054	357251689.	141.8153066	0.00008863	0.00006613	0.3666278	2.4496899	
0.00000125	446.5646212	357251697.	79.9267096	0.00009991	0.00005491	0.4116033	2.6559182	
0.00000188	669.8360142	357245874.	59.3056436	0.0001112	0.00004370	0.4563621	2.8626069	

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0.8490223     4.7418418
0.00000813         2894.    356217568.    27.6749097     0.0002249   -0.00006764
0.8914077     4.9520365
0.00000875         3114.    355871354.    27.0035748     0.0002363   -0.00007872
0.9335220     5.1623555
0.00000938         3333.    355486324.    26.4217747     0.0002477   -0.00008980
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1.0169271     5.5832966
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1.0704940     5.6570050 C
0.00001250         3768.    301427323.    22.6240888     0.0002828     -0.000167
1.1013794     5.7869822 C
0.00001313         3768.    287073641.    22.1972640     0.0002913     -0.000181
1.1317231     5.9139070 C
0.00001375         3768.    274024840.    21.8021074     0.0002998     -0.000195
1.1615511     6.0379419 C
0.00001438         3768.    262110716.    21.4344900     0.0003081     -0.000209
1.1908818     6.1591902 C
0.00001500         3768.    251189436.    21.0916376     0.0003164     -0.000224
1.2197403     6.2778155 C
0.00001563         3768.    241141859.    20.7708634     0.0003245     -0.000238
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1.2761661     6.5080704 C
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1.3038061     6.6202335 C
0.00001750         3786.    216363339.    19.9226271     0.0003486     -0.000281
1.3311128     6.7307860 C
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1.4369334     7.1557686 C
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0.00002188        4203.    192127261.    18.4194115     0.0004029     -0.000385
1.5132076     7.4598767 C
0.00002250        4259.    189284124.    18.2448549     0.0004105     -0.000399
1.5381321     7.5591179 C
0.00002313        4314.    186558881.    18.0776825     0.0004180     -0.000414
1.5627740     7.6569834 C
0.00002375        4369.    183954155.    17.9181024     0.0004256     -0.000429
1.5871991     -7.866819 C
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1.6114187     -8.181576 C
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0.00002938        4840.    164761288.    16.7453825     0.0004919     -0.000566
1.7975879    -10.729035 C
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1.8421349    -11.373490 C
0.00003188        5039.    158095784.    16.3381862     0.0005208     -0.000627
1.8861622    -12.018552 C
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1.9294101    -12.666709 C
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2.0557875    -14.617892 C
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2.0966206    -15.272335 C
0.00003938        5615.    142608194.    15.3921080     0.0006061     -0.000811
2.1370380    -15.926601 C
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2.7171557 -26.486424 C
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2.7497090 -27.147896 C
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3.9625060    -60.000000 CY
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3.9809608    -60.000000 CY
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3.9931822    -60.000000 CY
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3.9992181    -60.000000 CY
 0.0001594       12513.     78511821.    12.1713073     0.0019398     -0.003798
3.9988103    -60.000000 CY
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3.9980162    -60.000000 CY
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3.9982364    -60.000000 CY
 0.0001744       12815.     73489497.    12.0174404     0.0020955     -0.004182
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3.9989692    -60.000000 CY
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 0.0001894       13042.     68867495.    11.8789914     0.0022496     -0.004568
3.9998474    -60.000000 CY
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3.9982089    -60.000000 CY
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0.0001994	13166.	66038255.	11.7985745	0.0023523	-0.004825
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0.0002094	13262.	63342326.	11.7208583	0.0024541	-0.005083
3.9991970	-60.000000 CY				
0.0002144	13307.	62071884.	11.6852984	0.0025050	-0.005212
3.9984537	-60.000000 CY				
0.0002194	13350.	60853589.	11.6519259	0.0025561	-0.005341
3.9999977	-60.000000 CY				
0.0002244	13391.	59683202.	11.6208533	0.0026074	-0.005470
3.9976000	-60.000000 CY				
0.0002294	13431.	58554684.	11.5913733	0.0026588	-0.005599
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0.0002344	13467.	57460969.	11.5632634	0.0027101	-0.005727
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0.0002394	13499.	56390716.	11.5347859	0.0027611	-0.005856
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0.0002444	13527.	55355210.	11.5074158	0.0028121	-0.005985
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0.0002494	13551.	54338203.	11.4795375	0.0028627	-0.006115
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0.0002544	13573.	53358682.	11.4533698	0.0029135	-0.006244
3.9992440	-60.000000 CY				
0.0002594	13594.	52412448.	11.4285056	0.0029643	-0.006373
3.9986845	-60.000000 CY				
0.0002644	13615.	51498708.	11.4056093	0.0030154	-0.006502
3.9958715	-60.000000 CY				
0.0002694	13635.	50617263.	11.3840825	0.0030666	-0.006631
3.9988580	-60.000000 CY				
0.0002744	13655.	49766317.	11.3637383	0.0031179	-0.006760
3.9999899	-60.000000 CY				
0.0003044	13752.	45181213.	11.2581942	0.0034267	-0.007531
3.9973701	-60.000000 CYT				
0.0003344	13802.	41277054.	11.1635993	0.0037328	-0.008305
3.9995841	-60.000000 CYT				
0.0003644	13802.	37878601.	11.1774399	0.0040728	-0.009045
3.9930161	-60.000000 CYT				

Summary of Results for Nominal Moment Capacity for Section 1

Moment values interpolated at maximum compressive strain = 0.003
or maximum developed moment if pile fails at smaller strains.

Load No.	Axial Thrust kips	Nominal Mom. Cap. in-kip	Max. Comp. Strain	Max. Tens.

Strain				
1	356.020	13608.811	0.00300000	-0.00646339

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	356.020000	13609.	231.413000	8846.	103021867.
1	0.75	356.020000	13609.	267.015000	10207.	95243303.
1	0.90	356.020000	13609.	320.418000	12248.	82287981.

Pile Section No. 2:

Dimensions and Properties of Drilled Shaft (Bored Pile):

Length of Section	=	5.000000 ft
Shaft Diameter	=	30.000000 in
Concrete Cover Thickness (to edge of trans. reinf.)	=	3.000000 in
Number of Reinforcing Bars	=	15 bars
Yield Stress of Reinforcing Bars	=	60000. psi
Modulus of Elasticity of Reinforcing Bars	=	29000000. psi

Gross Area of Shaft	=	706.858347 sq. in.
Total Area of Reinforcing Steel	=	15.000000 sq. in.
Area Ratio of Steel Reinforcement	=	2.12 percent
Edge-to-Edge Bar Spacing	=	3.367467 in
Maximum Concrete Aggregate Size	=	0.375000 in
Ratio of Bar Spacing to Aggregate Size	=	8.98
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.	=	4.500000 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	=	3252.318 kips
Tensile Load for Cracking of Concrete	=	-337.937 kips
Nominal Axial Tensile Capacity	=	-900.000 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	10.811000	0.00000
2	1.128000	1.000000	9.876340	4.397230
3	1.128000	1.000000	7.233971	8.034139
4	1.128000	1.000000	3.340783	10.281872
5	1.128000	1.000000	-1.13006	10.751776
6	1.128000	1.000000	-5.40550	9.362601
7	1.128000	1.000000	-8.74628	6.354546
8	1.128000	1.000000	-10.57475	2.247733
9	1.128000	1.000000	-10.57475	-2.24773
10	1.128000	1.000000	-8.74628	-6.35455
11	1.128000	1.000000	-5.40550	-9.36260
12	1.128000	1.000000	-1.13006	-10.75178
13	1.128000	1.000000	3.340783	-10.28187
14	1.128000	1.000000	7.233971	-8.03414
15	1.128000	1.000000	9.876340	-4.39723

NOTE: The positions of the above rebars were computed by LPile

Minimum spacing between any two bars not equal to zero = 3.367 inches
between bars 7 and 8.

Ratio of bar spacing to maximum aggregate size = 8.98

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	=	0.375000 in

Number of Axial Thrust Force Values Determined from Pile-head Loadings = 1

Number	Axial Thrust Force kips
1	356.020

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 = 356.020 kips

Bending Curvature rad/in.	Bending Moment in-kip	Bending Stiffness kip-in2	Depth to N Axis in	Max Comp Strain in/in	Max Tens Strain in/in	Max Conc Stress ksi	Max Steel Stress ksi	Run Msg
0.00000125	226.1277987	180902239.	101.7192293	0.0001271	0.00008965	0.5203442	3.5513846	

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0.00000250   452.2493400    180899736.    58.3852372     0.0001460    0.00007096
0.5936353     3.9610547
0.00000375   678.3428768    180891434.    43.9519571     0.0001648    0.00005232
0.6663117     4.3719629
0.00000500   904.3944085    180878882.    36.7438564     0.0001837    0.00003372
0.7383679     4.7841092
0.00000625        1130.     180862389.    32.4258290     0.0002027    0.00001516
0.8097985     5.1974940
0.00000750        1356.     180842032.    29.5528392     0.0002216   -0.00000335
0.8805983     5.6121175
0.00000875        1582.     180806818.    27.5053390     0.0002407   -0.00002183
0.9507538     6.0279171
0.00001000        1807.     180725516.    25.9729193     0.0002597   -0.00004027
1.0202288     6.4446465
0.00001125        2032.     180586145.    24.7760698     0.0002787   -0.00005877
1.0889901     6.8620726
0.00001250        2255.     180391435.    23.8292927     0.0002979   -0.00007713
1.1570153     7.2800386
0.00001375        2477.     180148099.    23.0548677     0.0003170   -0.00009550
1.2242886     7.6984342
0.00001500        2698.     179863368.    22.4096867     0.0003361    -0.000114
1.2907987     8.1171816
0.00001625        2698.     166027724.    21.0204698     0.0003416    -0.000146
1.3090657     8.1387089 C
0.00001750        2698.     154168601.    20.4083089     0.0003571    -0.000168
1.3622847     8.4540917 C
0.00001875        2698.     143890694.    19.8636713     0.0003724    -0.000190
1.4140709     8.7618088 C
0.00002000        2756.     137778998.    19.3756949     0.0003875    -0.000212
1.4645725     9.0629030 C
0.00002125        2851.     134153291.    18.9349678     0.0004024    -0.000235
1.5138544     9.3577365 C
0.00002250        2943.     130786741.    18.5353490     0.0004170    -0.000258
1.5620737     9.6474994 C
0.00002375        3032.     127654246.    18.1710919     0.0004316    -0.000281
1.6092903     9.9325698 C
0.00002500        3118.     124728902.    17.8369081     0.0004459    -0.000304
1.6555302    10.2130403 C
0.00002625        3202.     121996296.    17.5292582     0.0004601    -0.000327
1.7008694    10.4894604 C
0.00002750        3285.     119445601.    17.2453310     0.0004742    -0.000351
1.7454000    10.7625471 C
0.00002875        3365.     117054977.    16.9819954     0.0004882    -0.000374
1.7891230    11.0322117 C
0.00003000        3444.     114813382.    16.7372232     0.0005021    -0.000398
1.8320982    11.2989068 C
0.00003125        3522.     112710331.    16.5092355     0.0005159    -0.000422
1.8743819    11.5630710 C
0.00003250        3599.     110736310.    16.2965913     0.0005296    -0.000445
1.9160311    11.8251702 C
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0.00003375 3674. 108873513. 16.0971347 0.0005433 -0.000469
1.9570062 12.0847624 C
0.00003500 3749. 107112016. 15.9094684 0.0005568 -0.000493
1.9973166 12.3418627 C
0.00003625 3823. 105456155. 15.7338962 0.0005704 -0.000517
2.0371341 12.5980718 C
0.00003750 3895. 103878316. 15.5672284 0.0005838 -0.000541
2.0762428 12.8512353 C
0.00003875 3968. 102391656. 15.4108622 0.0005972 -0.000565
2.1149074 13.1038938 C
0.00004000 4039. 100974618. 15.2622614 0.0006105 -0.000590
2.1529479 13.3542233 C
0.00004125 4110. 99635461. 15.1224269 0.0006238 -0.000614
2.1905725 13.6042657 C
0.00004250 4180. 98353996. 14.9888574 0.0006370 -0.000638
2.2275748 -13.879357 C
0.00004375 4250. 97142560. 14.8631487 0.0006503 -0.000662
2.2642341 -14.446948 C
0.00004500 4319. 95978513. 14.7425761 0.0006634 -0.000687
2.3002577 -15.017188 C
0.00004625 4388. 94872416. 14.6284525 0.0006766 -0.000711
2.3359062 -15.587401 C
0.00004750 4456. 93817116. 14.5199460 0.0006897 -0.000735
2.3711268 -16.158150 C
0.00004875 4524. 92801722. 14.4155601 0.0007028 -0.000760
2.4057822 -16.730940 C
0.00005125 4659. 90907611. 14.2222073 0.0007289 -0.000809
2.4739947 -17.876305 C
0.00005375 4792. 89157627. 14.0442138 0.0007549 -0.000858
2.5403540 -19.025764 C
0.00005625 4924. 87544461. 13.8813351 0.0007808 -0.000907
2.6051389 -20.176374 C
0.00005875 5055. 86047753. 13.7310911 0.0008067 -0.000956
2.6682770 -21.329072 C
0.00006125 5185. 84657437. 13.5925594 0.0008325 -0.001005
2.7298723 -22.482749 C
0.00006375 5314. 83358449. 13.4638260 0.0008583 -0.001054
2.7898509 -23.638394 C
0.00006625 5442. 82149077. 13.3455552 0.0008841 -0.001103
2.8484867 -24.792664 C
0.00006875 5569. 81007829. 13.2338445 0.0009098 -0.001153
2.9053651 -25.950873 C
0.00007125 5696. 79939375. 13.1307800 0.0009356 -0.001202
2.9609229 -27.107474 C
0.00007375 5821. 78934760. 13.0351422 0.0009613 -0.001251
3.0150917 -28.263277 C
0.00007625 5946. 77981477. 12.9443791 0.0009870 -0.001300
3.0676132 -29.421873 C
0.00007875 6070. 77082105. 12.8601603 0.0010127 -0.001350
3.1188086 -30.578826 C

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0.00008125        6194.     76231601.    12.7818283     0.0010385     -0.001399
3.1686691    -31.734120 C
0.00008375        6317.     75421848.    12.7078600     0.0010643     -0.001448
3.2170091    -32.890472 C
0.00008625        6439.     74650248.    12.6379299     0.0010900     -0.001497
3.2638783    -34.047190 C
0.00008875        6560.     73916160.    12.5724463     0.0011158     -0.001547
3.3094050    -35.202199 C
0.00009125        6681.     73216439.    12.5113377     0.0011417     -0.001596
3.3535801    -36.355482 C
0.00009375        6801.     72548275.    12.4541309     0.0011676     -0.001645
3.3963944    -37.507019 C
0.00009625        6921.     71905364.    12.3993018     0.0011934     -0.001694
3.4376209    -38.660761 C
0.00009875        7040.     71289232.    12.3475819     0.0012193     -0.001743
3.4774661    -39.813050 C
 0.0001013        7158.     70698150.    12.2988081     0.0012453     -0.001792
3.5159396    -40.963527 C
 0.0001038        7276.     70130247.    12.2531974     0.0012713     -0.001841
3.5530316    -42.112172 C
 0.0001063        7393.     69583830.    12.2103363     0.0012973     -0.001890
3.5887323    -43.258963 C
 0.0001088        7510.     69057362.    12.1700423     0.0013235     -0.001939
3.6230314    -44.403878 C
 0.0001113        7626.     68548322.    12.1318557     0.0013497     -0.001988
3.6558430    -45.548663 C
 0.0001138        7741.     68055453.    12.0950965     0.0013758     -0.002037
3.6871592    -46.693488 C
 0.0001163        7856.     67578878.    12.0605017     0.0014020     -0.002085
3.7170583    -47.836346 C
 0.0001188        7970.     67117513.    12.0279417     0.0014283     -0.002134
3.7455295    -48.977214 C
 0.0001213        8084.     66670363.    11.9970308     0.0014546     -0.002183
3.7725617    -50.116062 C
 0.0001238        8197.     66236507.    11.9681975     0.0014811     -0.002231
3.7981434    -51.252867 C
 0.0001263        8309.     65815101.    11.9410742     0.0015076     -0.002280
3.8222633    -52.387601 C
 0.0001288        8421.     65405362.    11.9155715     0.0015341     -0.002328
3.8449095    -53.520235 C
 0.0001313        8532.     65006569.    11.8916031     0.0015608     -0.002377
3.8660699    -54.650741 C
 0.0001338        8643.     64618049.    11.8690891     0.0015875     -0.002425
3.8857324    -55.779089 C
 0.0001363        8753.     64239102.    11.8479257     0.0016143     -0.002473
3.9038788    -56.905493 C
 0.0001388        8862.     63868476.    11.8275969     0.0016411     -0.002521
3.9204520    -58.032144 C
 0.0001413        8970.     63506480.    11.8083771     0.0016679     -0.002570
3.9355008    -59.156498 C
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 0.0001438        9078.     63148582.    11.7901465     0.0016948     -0.002618
3.9489953    -60.000000 CY
 0.0001463        9182.     62782100.    11.7721116     0.0017217     -0.002666
3.9608815    -60.000000 CY
 0.0001488        9281.     62391179.    11.7530680     0.0017483     -0.002714
3.9711159    -60.000000 CY
 0.0001588        9599.     60465934.    11.6597788     0.0018510     -0.002912
3.9960755    -60.000000 CY
 0.0001688        9843.     58331765.    11.5570754     0.0019503     -0.003112
3.9998427    -60.000000 CY
 0.0001788       10047.     56209154.    11.4567629     0.0020479     -0.003315
3.9992364    -60.000000 CY
 0.0001888       10210.     54094028.    11.3566883     0.0021436     -0.003519
3.9992189    -60.000000 CY
 0.0001988       10358.     52115305.    11.2668434     0.0022393     -0.003723
3.9986719    -60.000000 CY
 0.0002088       10482.     50210798.    11.1798340     0.0023338     -0.003929
3.9994483    -60.000000 CY
 0.0002188       10582.     48374444.    11.0936824     0.0024267     -0.004136
3.9996623    -60.000000 CY
 0.0002288       10677.     46675505.    11.0174898     0.0025203     -0.004342
3.9996375    -60.000000 CY
 0.0002388       10766.     45095009.    10.9491739     0.0026141     -0.004548
3.9993406    -60.000000 CY
 0.0002488       10840.     43576724.    10.8785775     0.0027060     -0.004756
3.9983412    -60.000000 CY
 0.0002588       10900.     42126717.    10.8094228     0.0027969     -0.004966
3.9960005    -60.000000 CY
 0.0002688       10956.     40766987.    10.7455364     0.0028879     -0.005175
3.9999565    -60.000000 CY
 0.0002788       11010.     39499288.    10.6875172     0.0029791     -0.005383
3.9985516    -60.000000 CY
 0.0002888       11063.     38314235.    10.6352871     0.0030709     -0.005592
3.9952248    -60.000000 CY
 0.0002988       11113.     37197081.    10.5842603     0.0031620     -0.005800
3.9993640    -60.000000 CY
 0.0003088       11155.     36130582.    10.5348865     0.0032526     -0.006010
3.9945990    60.0000000 CY
 0.0003188       11191.     35107489.    10.4861115     0.0033424     -0.006220
3.9992395    60.0000000 CY
 0.0003288       11219.     34126232.    10.4397900     0.0034321     -0.006430
3.9946317    60.0000000 CYT
 0.0003388       11245.     33195305.    10.3973319     0.0035221     -0.006640
3.9981115    60.0000000 CYT
 0.0003488       11268.     32309618.    10.3603271     0.0036132     -0.006849
3.9998164    60.0000000 CYT
 0.0003588       11288.     31465696.    10.3268826     0.0037048     -0.007058
3.9952590    60.0000000 CYT
 0.0003688       11307.     30663598.    10.2964482     0.0037968     -0.007266
3.9992754    60.0000000 CYT
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    0.0003788        11307.     29853998.    10.2966419     0.0038999     -0.007463
   3.9921164    60.0000000 CYT


-------------------------------------------------------------------------------
   Summary of Results for Nominal Moment Capacity for Section 2
-------------------------------------------------------------------------------

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               356.020             11022.424           0.00300000
-0.00543066

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         356.020000        11022.    231.413000         7165.
70667360.

   1       0.75         356.020000        11022.    267.015000         8267.
65973850.

   1       0.90         356.020000        11022.    320.418000         9920.
57533355.
```

Layering Correction Equivalent Depths of Soil & Rock Layers

Layer No.	Top of Layer Below Pile Head ft	Equivalent Top Depth Below Grnd Surf ft	Same Layer Type As Layer Above	Layer is Rock or is Below Rock Layer	F0 Integral for Layer lbs	F1 Integral for Layer lbs
1	20.3300	0.00	N.A.	No	0.00	133423.
2	33.2000	12.8700	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 Displacement and Pile-head Rotation (Loading Type 5)
Displacement of pile head = 1.000000 inches
Rotation of pile head = 0.000E+00 radians
Axial load on pile head = 356020.0 lbs

Depth X	Deflect. y	Bending Moment	Shear Force	Slope S	Total Stress	Bending Stiffness	Soil Res. Es*H	Soil Spr. Lat. Load	Distrib. p
feet	inches	in-lbs	lbs	radians	psi*	lb-in^2	lb/inch	lb/inch	lb/inch
0.00	1.0000	-7987778.	49237.	0.00	0.00	1.09E+11	0.00	0.00	0.00
0.3820	0.9992	-7761809.	49236.	-3.30E-04	0.00	1.09E+11	0.00	0.00	0.00
0.7640	0.9970	-7535310.	49236.	-6.44E-04	0.00	1.14E+11	0.00	0.00	0.00
1.1460	0.9933	-7308315.	49236.	-9.41E-04	0.00	1.16E+11			

```
0.00       0.00       0.00
    1.5280     0.9884  -7080848.     49236.   -0.00122       0.00   1.19E+11
0.00       0.00       0.00
    1.9100     0.9821  -6852935.     49236.   -0.00149       0.00   1.21E+11
0.00       0.00       0.00
    2.2920     0.9747  -6624599.     49236.   -0.00174       0.00   1.24E+11
0.00       0.00       0.00
    2.6740     0.9662  -6395864.     49236.   -0.00198       0.00   1.28E+11
0.00       0.00       0.00
    3.0560     0.9566  -6166756.     49236.   -0.00220       0.00   1.32E+11
0.00       0.00       0.00
    3.4380     0.9460  -5937297.     49236.   -0.00241       0.00   1.36E+11
0.00       0.00       0.00
    3.8200     0.9345  -5707511.     49236.   -0.00260       0.00   1.41E+11
0.00       0.00       0.00
    4.2020     0.9222  -5477421.     49236.   -0.00278       0.00   1.46E+11
0.00       0.00       0.00
    4.5840     0.9091  -5247050.     49236.   -0.00294       0.00   1.52E+11
0.00       0.00       0.00
    4.9660     0.8952  -5016421.     49236.   -0.00310       0.00   1.59E+11
0.00       0.00       0.00
    5.3480     0.8807  -4785556.     49236.   -0.00323       0.00   1.67E+11
0.00       0.00       0.00
    5.7300     0.8656  -4554476.     49236.   -0.00336       0.00   1.76E+11
0.00       0.00       0.00
    6.1120     0.8499  -4323202.     49236.   -0.00347       0.00   1.86E+11
0.00       0.00       0.00
    6.4940     0.8337  -4091754.     49236.   -0.00357       0.00   1.98E+11
0.00       0.00       0.00
    6.8760     0.8171  -3860152.     49236.   -0.00366       0.00   2.12E+11
0.00       0.00       0.00
    7.2580     0.8002  -3628413.     49236.   -0.00373       0.00   3.55E+11
0.00       0.00       0.00
    7.6400     0.7830  -3396598.     49236.   -0.00377       0.00   3.55E+11
0.00       0.00       0.00
    8.0220     0.7656  -3164711.     49236.   -0.00381       0.00   3.56E+11
0.00       0.00       0.00
    8.4040     0.7480  -2932758.     49236.   -0.00385       0.00   3.56E+11
0.00       0.00       0.00
    8.7860     0.7303  -2700743.     49236.   -0.00389       0.00   3.56E+11
0.00       0.00       0.00
    9.1680     0.7124  -2468672.     49236.   -0.00392       0.00   3.57E+11
0.00       0.00       0.00
    9.5500     0.6943  -2236549.     49236.   -0.00395       0.00   3.57E+11
0.00       0.00       0.00
    9.9320     0.6761  -2004379.     49236.   -0.00398       0.00   3.57E+11
0.00       0.00       0.00
   10.3140     0.6578  -1772167.     49236.   -0.00400       0.00   3.57E+11
0.00       0.00       0.00
   10.6960     0.6394  -1539917.     49236.   -0.00403       0.00   3.57E+11
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0.00       0.00       0.00
   11.0780     0.6209  -1307636.     49236.   -0.00404       0.00   3.57E+11
0.00       0.00       0.00
   11.4600     0.6023  -1075327.     49236.   -0.00406       0.00   3.57E+11
0.00       0.00       0.00
   11.8420     0.5837   -842996.     49236.   -0.00407       0.00   3.57E+11
0.00       0.00       0.00
   12.2240     0.5650   -610647.     49236.   -0.00408       0.00   3.57E+11
0.00       0.00       0.00
   12.6060     0.5463   -378285.     49236.   -0.00409       0.00   3.57E+11
0.00       0.00       0.00
   12.9880     0.5275   -145915.     49236.   -0.00409       0.00   3.57E+11
0.00       0.00       0.00
   13.3700     0.5088     86458.     49236.   -0.00409       0.00   3.57E+11
0.00       0.00       0.00
   13.7520     0.4900    318829.     49236.   -0.00409       0.00   3.57E+11
0.00       0.00       0.00
   14.1340     0.4713    551193.     49236.   -0.00408       0.00   3.57E+11
0.00       0.00       0.00
   14.5160     0.4526    783546.     49236.   -0.00407       0.00   3.57E+11
0.00       0.00       0.00
   14.8980     0.4340   1015882.     49236.   -0.00406       0.00   3.57E+11
0.00       0.00       0.00
   15.2800     0.4154   1248197.     49236.   -0.00405       0.00   3.57E+11
0.00       0.00       0.00
   15.6620     0.3968   1480486.     49236.   -0.00403       0.00   3.57E+11
0.00       0.00       0.00
   16.0440     0.3784   1712744.     49236.   -0.00401       0.00   3.57E+11
0.00       0.00       0.00
   16.4260     0.3601   1944966.     49236.   -0.00399       0.00   3.57E+11
0.00       0.00       0.00
   16.8080     0.3419   2177148.     49236.   -0.00396       0.00   3.57E+11
0.00       0.00       0.00
   17.1900     0.3238   2409283.     49236.   -0.00393       0.00   3.57E+11
0.00       0.00       0.00
   17.5720     0.3058   2641369.     49236.   -0.00390       0.00   3.57E+11
0.00       0.00       0.00
   17.9540     0.2880   2873398.     49236.   -0.00386       0.00   3.56E+11
0.00       0.00       0.00
   18.3360     0.2704   3105368.     49236.   -0.00382       0.00   3.56E+11
0.00       0.00       0.00
   18.7180     0.2530   3337272.     49236.   -0.00378       0.00   3.55E+11
0.00       0.00       0.00
   19.1000     0.2357   3569106.     49236.   -0.00374       0.00   3.55E+11
0.00       0.00       0.00
   19.4820     0.2187   3800864.     49236.   -0.00367       0.00   2.15E+11
0.00       0.00       0.00
   19.8640     0.2021   4032491.     49236.   -0.00359       0.00   2.01E+11
0.00       0.00       0.00
   20.2460     0.1858   4263968.     49236.   -0.00349       0.00   1.89E+11
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0.00       0.00       0.00
   20.6280     0.1701   4495276.     47999.   -0.00338       0.00   1.78E+11
-539.726     14549.       0.00
   21.0100     0.1548   4715054.     45048.   -0.00326       0.00   1.69E+11
-747.668     22137.       0.00
   21.3920     0.1402   4918913.     41206.   -0.00313       0.00   1.62E+11
-928.391     30361.       0.00
   21.7740     0.1262   5103037.     36594.   -0.00298       0.00   1.56E+11
-1084.     39380.       0.00
   22.1560     0.1128   5264142.     31326.   -0.00283       0.00   1.51E+11
-1215.     49359.       0.00
   22.5380     0.1002   5399456.     25509.   -0.00266       0.00   1.48E+11
-1323.     60478.       0.00
   22.9200    0.08842   5506707.     19254.   -0.00249       0.00   1.45E+11
-1407.     72924.       0.00
   23.3020    0.07739   5584117.     12669.   -0.00232       0.00   1.43E+11
-1466.     86862.       0.00
   23.6840    0.06718   5630421.      5882.   -0.00214       0.00   1.42E+11
-1495.    102006.       0.00
   24.0660    0.05780   5645017.   -945.372   -0.00195       0.00   1.42E+11
-1484.    117688.       0.00
   24.4480    0.04926   5628134.     -7692.   -0.00177       0.00   1.42E+11
-1460.    135846.       0.00
   24.8300    0.04155   5580282.    -14300.   -0.00159       0.00   1.43E+11
-1423.    157020.       0.00
   25.2120    0.03465   5502235.    -20713.   -0.00142       0.00   1.45E+11
-1375.    181899.       0.00
   25.5940    0.02855   5395011.    -26882.   -0.00125       0.00   1.48E+11
-1317.    211363.       0.00
   25.9760    0.02322   5259850.    -32762.   -0.00108       0.00   1.52E+11
-1249.    246550.       0.00
   26.3580    0.01862   5098185.    -38315.  -9.29E-04       0.00   1.56E+11
-1174.    288938.       0.00
   26.7400    0.01470   4911614.    -43507.  -7.85E-04       0.00   1.62E+11
-1092.    340457.       0.00
   27.1220    0.01142   4701873.    -48315.  -6.52E-04       0.00   1.70E+11
-1006.    403631.       0.00
   27.5040    0.00872   4470792.    -52721.  -5.32E-04       0.00   1.79E+11
-916.602    481739.       0.00
   27.8860    0.00655   4220265.    -56717.  -4.24E-04       0.00   1.91E+11
-826.850    578958.       0.00
   28.2680    0.00484   3952198.    -60090.  -3.29E-04       0.00   2.06E+11
-644.819    611315.       0.00
   28.6500    0.00353   3670438.    -62698.  -2.62E-04       0.00   3.55E+11
-492.960    640733.       0.00
   29.0320    0.00244   3378241.    -64644.  -2.16E-04       0.00   3.55E+11
-356.085    670151.       0.00
   29.4140    0.00154   3078492.    -66000.  -1.75E-04       0.00   3.56E+11
-235.689    699570.       0.00
   29.7960   8.35E-04   2773724.    -66844.  -1.37E-04       0.00   3.56E+11
```

```
-132.755    728988.       0.00
   30.1780   2.89E-04   2466110.    -67258.  -1.03E-04       0.00   3.57E+11
-47.772    758406.       0.00
   30.5600  -1.12E-04   2157439.    -67323.  -7.36E-05       0.00   3.57E+11
19.2553    787825.       0.00
   30.9420  -3.86E-04   1849128.    -67122.  -4.79E-05       0.00   3.57E+11
68.7871    817243.       0.00
   31.3240  -5.51E-04   1542224.    -66731.  -2.61E-05       0.00   3.57E+11
101.7383    846661.       0.00
   31.7060  -6.25E-04   1237425.    -66224.  -8.26E-06       0.00   3.57E+11
119.4679    876079.       0.00
   32.0880  -6.27E-04    935111.    -65666.   5.68E-06       0.00   3.57E+11
123.7719    905498.       0.00
   32.4700  -5.73E-04    635378.    -65115.   1.58E-05       0.00   3.57E+11
116.8766    934916.       0.00
   32.8520  -4.82E-04    338087.    -64614.   2.20E-05       0.00   3.57E+11
101.4323    964334.       0.00
   33.2340  -3.71E-04     42921.    -51382.   2.47E-05       0.00   1.81E+11
5672.   7.00E+07       0.00
   33.6160  -2.56E-04   -133067.    -27645.   2.36E-05       0.00   1.81E+11
4685.   8.40E+07       0.00
   33.9980  -1.55E-04   -210607.     -9296.   1.92E-05       0.00   1.81E+11
3321.   9.80E+07       0.00
   34.3800  -7.95E-05   -218355.      2766.   1.38E-05       0.00   1.81E+11
1942.   1.12E+08       0.00
   34.7620  -2.90E-05   -185292.      9042.   8.67E-06       0.00   1.81E+11
796.4300   1.26E+08       0.00
   35.1440  -3.25E-09   -135486.     10868.   4.60E-06       0.00   1.81E+11
0.09935   1.40E+08       0.00
   35.5260   1.32E-05    -85673.      9849.   1.80E-06       0.00   1.81E+11
-444.335   1.54E+08       0.00
   35.9080   1.65E-05    -45192.      7445.   1.41E-07       0.00   1.81E+11
-604.737   1.68E+08       0.00
   36.2900   1.45E-05    -17417.      4737.  -6.52E-07       0.00   1.81E+11
-576.635   1.82E+08       0.00
   36.6720   1.05E-05     -1759.      2384.  -8.95E-07       0.00   1.81E+11
-449.911   1.96E+08       0.00
   37.0540   6.31E-06      4446.   689.9922  -8.61E-07       0.00   1.81E+11
-289.378   2.10E+08       0.00
   37.4360   2.63E-06      4570.   -267.550  -7.47E-07       0.00   1.81E+11
-128.398   2.24E+08       0.00
   37.8180  -5.30E-07      1996.   -498.701  -6.63E-07       0.00   1.81E+11
27.5469   2.38E+08       0.00
   38.2000  -3.46E-06       0.00       0.00  -6.38E-07       0.00   1.81E+11
190.0363   1.26E+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             =     1.00000000 inches
Computed slope at pile head      =       0.000000 radians
Maximum bending moment           =      -7987778. inch-lbs
Maximum shear force              =        -67323. lbs
Depth of maximum bending moment  =       0.000000 feet below pile head
Depth of maximum shear force     =    30.56000000 feet below pile head
Number of iterations             =             18
Number of zero deflection points =              3
Pile deflection at ground        =     0.18235111 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	Load Pile-head		Load Type	Load Pile-head	Axial Loading	Pile-head Deflection	Pile-head Rotation	Max Shear in Pile	Max Moment in Pile
		Load 1	2	Load 2		lbs	inches	radians	lbs	in-lbs
1	y, in	1.0000	S, rad	0.00		356020.	1.0000	0.00	-67323.	-7987778.

```
Maximum pile-head deflection = 1.0000000000 inches
Maximum pile-head rotation   = 0.0000000000 radians = 0.000000 deg.
```

Summary of Warning Messages

The following warning was reported 266 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.

==

LPile for Windows, Version 2022-12.011

Analysis of Individual Piles and Drilled Shafts
Subjected to Lateral Loading Using the p-y Method
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Files Used for Analysis

Path to file locations:
\20240280\ODOT\109971\400-Engineering\Structures\SFN_0800512\Engdata\04_Abutment Design\Stage 2\Drilled Shaft\Lpile\Abutment\Rear Abutment\

Name of input data file:
RA_Scour Extreme II - Back DS.lp12d

Name of output report file:
RA_Scour Extreme II - Back DS.lp12o

Name of plot output file:
RA_Scour Extreme II - Back DS.lp12p

Name of runtime message file:
RA_Scour Extreme II - Back DS.lp12r

Date and Time of Analysis

Date: February 12, 2026 Time: 14:07:53

Problem Title

Project Name:

Job Number:

Client:

Engineer:

Description:

Program Options and Settings

Computational Options:
- Conventional Analysis

Engineering Units Used for Data Input and Computations:
- US Customary System Units (pounds, feet, inches)

Analysis Control Options:

- Maximum number of iterations allowed	=	500
- Deflection tolerance for convergence	=	1.0000E-05 in
- Maximum allowable deflection	=	100.0000 in
- Number of pile increments	=	100

Loading Type and Number of Cycles of Loading:

- Static loading specified

- Analysis uses p-y modification factors for p-y curves
- Analysis uses layering correction (Method of Georgiadis)
- No distributed lateral loads are entered
- Loading by lateral soil movements acting on pile not selected
- Input of shear resistance at the pile tip not selected
- Input of moment resistance at the pile tip not selected
- Computation of pile-head foundation stiffness matrix not selected
- Push-over analysis of pile not selected
- Buckling analysis of pile not selected

Output Options:
- Output files use decimal points to denote decimal symbols.
- Values of pile-head deflection, bending moment, shear force, and soil reaction are printed for full length of pile.
- Printing Increment (nodal spacing of output points) = 1
- No p-y curves to be computed and reported for user-specified depths
- Print using wide report formats

Pile Structural Properties and Geometry

Number of pile sections defined = 2
Total length of pile = 38.200 ft
Depth of ground surface below top of pile = 20.3300 ft

Pile diameters used for p-y curve computations are defined using 4 points.

p-y curves are computed using pile diameter values interpolated with depth over the length of the pile. A summary of values of pile diameter vs. depth follows.

Point No.	Depth Below Pile Head feet	Pile Diameter inches
1	0.000	36.0000
2	33.200	36.0000
3	33.200	30.0000
4	38.200	30.0000

Input Structural Properties for Pile Sections:

Pile Section No. 1:

Section 1 is a round drilled shaft, bored pile, or CIDH pile
Length of section = 33.200000 ft
Shaft Diameter = 36.000000 in

Pile Section No. 2:

Section 2 is a round drilled shaft, bored pile, or CIDH pile
Length of section = 5.000000 ft
Shaft Diameter = 30.000000 in

Soil and Rock Layering Information

The soil profile is modelled using 2 layers

Layer 1 is stiff clay with water-induced erosion

Distance from top of pile to top of layer = 20.330000 ft
Distance from top of pile to bottom of layer = 33.200000 ft
Effective unit weight at top of layer = 67.600000 pcf
Effective unit weight at bottom of layer = 67.600000 pcf
Undrained cohesion at top of layer = 4800. psf
Undrained cohesion at bottom of layer = 4800. psf
Epsilon-50 at top of layer = 0.004000
Epsilon-50 at bottom of layer = 0.004000
Subgrade k at top of layer = 2000. pci
Subgrade k at bottom of layer = 2000. pci

Layer 2 is weak rock, p-y criteria by Reese, 1997

Distance from top of pile to top of layer = 33.200000 ft
Distance from top of pile to bottom of layer = 50.000000 ft
Effective unit weight at top of layer = 92.700000 pcf
Effective unit weight at bottom of layer = 92.700000 pcf
Uniaxial compressive strength at top of layer = 1640. psi
Uniaxial compressive strength at bottom of layer = 1640. psi
Initial modulus of rock at top of layer = 150000. psi
Initial modulus of rock at bottom of layer = 150000. 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

(Depth of the lowest soil layer extends 11.800 ft below the pile tip)

Summary of Input Soil Properties

Layer Num.	Soil Type Name or (p-y Curve Type)	Layer Depth ft	Effective Unit Wt. pcf	Cohesion psf	Uniaxial qu psi	RQD %	E50 krm	kpy pci	Rock Mass Modulus psi
1	Stiff Clay with Free Water	20.3300	67.6000	4800.	--	--	0.00400	2000.	--
		33.2000	67.6000	4800.	--	--	0.00400	2000.	--
2	Weak Rock	33.2000	92.7000	--	1640.	15.0000	5.00E-04	--	150000.
		50.0000	92.7000	--	1640.	15.0000	5.00E-04	--	150000.

Modification Factors for p-y Curves

Distribution of p-y modifiers with depth defined using 4 points

Point No.	Depth X ft	p-mult	y-mult
1	20.330	0.5000	1.0000
2	33.200	0.5000	1.0000
3	33.300	1.0000	1.0000
4	33.300	1.0000	1.0000

Static Loading Type

Static loading criteria were used when computing p-y curves for all analyses.

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 1

Load No.	Load Type	Condition 1	Condition 2	Axial Thrust Force, lbs	Compute Top y vs. Pile Length	Run Analysis
1	5	y = 1.000000 in	S = 0.0000 in/in	364740.	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 = 2

Pile Section No. 1:

Dimensions and Properties of Drilled Shaft (Bored Pile):

Length of Section	=	33.200000 ft
Shaft Diameter	=	36.000000 in
Concrete Cover Thickness (to edge of trans. reinf.)	=	6.000000 in
Number of Reinforcing Bars	=	15 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	=	15.000000 sq. in.
Area Ratio of Steel Reinforcement	=	1.47 percent
Edge-to-Edge Bar Spacing	=	3.367467 in

Maximum Concrete Aggregate Size = 0.375000 in
Ratio of Bar Spacing to Aggregate Size = 8.98
Offset of Center of Rebar Cage from Center of Pile = 0.0000 in
Transverse Reinforcement
Type: Hoop
Number of Transverse Reinf. (per spacing) = 1
Spacing of Transverse Reinf. = 4.500000 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 = 4309.778 kips
Tensile Load for Cracking of Concrete = -467.292 kips
Nominal Axial Tensile Capacity = -900.000 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	10.811000	0.00000
2	1.128000	1.000000	9.876340	4.397230
3	1.128000	1.000000	7.233971	8.034139
4	1.128000	1.000000	3.340783	10.281872
5	1.128000	1.000000	-1.13006	10.751776
6	1.128000	1.000000	-5.40550	9.362601
7	1.128000	1.000000	-8.74628	6.354546
8	1.128000	1.000000	-10.57475	2.247733
9	1.128000	1.000000	-10.57475	-2.24773
10	1.128000	1.000000	-8.74628	-6.35455
11	1.128000	1.000000	-5.40550	-9.36260
12	1.128000	1.000000	-1.13006	-10.75178
13	1.128000	1.000000	3.340783	-10.28187
14	1.128000	1.000000	7.233971	-8.03414
15	1.128000	1.000000	9.876340	-4.39723

NOTE: The positions of the above rebars were computed by LPile

Minimum spacing between any two bars not equal to zero = 3.367 inches
between bars 7 and 8.

Ratio of bar spacing to maximum aggregate size = 8.98

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 = 0.375000 in

Number of Axial Thrust Force Values Determined from Pile-head Loadings = 1

Number	Axial Thrust Force kips
1	364.740

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 = 364.740 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	223.0605928	356896949.	144.9077137	0.00009057	0.00006807	0.3744360	2.5057398	
0.00000125	446.1213280	356897062.	81.4729316	0.0001018	0.00005684	0.4193631	2.7119688	
0.00000188	669.1711298	356891269.	60.3364787	0.0001131	0.00004563	0.4640735	2.9186585	

```
0.00000250   892.2045329    356881813.    49.7746085     0.0001244    0.00003444
0.5085659     3.1258091
0.00000313         1115.    356869143.    43.4425718     0.0001358    0.00002326
0.5528392     3.3334206
0.00000375         1338.    356853408.    39.2254523     0.0001471    0.00001210
0.5968922     3.5414929
0.00000438         1561.    356834671.    36.2168574     0.0001584   9.48751E-07
0.6407237     3.7500263
0.00000500         1784.    356808730.    33.9635360     0.0001698   -0.00001018
0.6843314     3.9590127
0.00000563         2007.    356748550.    32.2133432     0.0001812   -0.00002130
0.7277058     4.1683891
0.00000625         2229.    356632904.    30.8148827     0.0001926   -0.00003241
0.7708349     4.3780725
0.00000688         2451.    356456561.    29.6644214     0.0002039   -0.00004356
0.8137094     4.5879970
0.00000750         2672.    356222147.    28.7160484     0.0002154   -0.00005463
0.8563223     4.7981140
0.00000813         2892.    355935440.    27.9135544     0.0002268   -0.00006570
0.8986686     5.0083882
0.00000875         3112.    355602907.    27.2256897     0.0002382   -0.00007678
0.9407446     5.2187939
0.00000938         3330.    355230589.    26.6295598     0.0002497   -0.00008785
0.9825475     5.4293119
0.00001000         3548.    354823811.    26.1079834     0.0002611   -0.00009892
1.0240750     5.6399269
0.00001063         3765.    354387208.    25.6478369     0.0002725     -0.000110
1.0653255     5.8506273
0.00001125         3765.    334699029.    23.8308215     0.0002681     -0.000137
1.0488678     5.6019805 C
0.00001188         3765.    317083291.    23.3201284     0.0002769     -0.000151
1.0805388     5.7373317 C
0.00001250         3765.    301229126.    22.8510433     0.0002856     -0.000164
1.1116166     5.8692844 C
0.00001313         3765.    286884882.    22.4173431     0.0002942     -0.000178
1.1420832     5.9976388 C
0.00001375         3765.    273844660.    22.0159053     0.0003027     -0.000192
1.1720409     6.1231673 C
0.00001438         3765.    261938371.    21.6429280     0.0003111     -0.000206
1.2015120     6.2460081 C
0.00001500         3765.    251024272.    21.2951776     0.0003194     -0.000221
1.2305188     6.3663023 C
0.00001563         3765.    240983301.    20.9700696     0.0003277     -0.000235
1.2590904     6.4842503 C
0.00001625         3765.    231714713.    20.6654905     0.0003358     -0.000249
1.2872597     6.6000875 C
0.00001688         3767.    223253291.    20.3789119     0.0003439     -0.000264
1.3150188     6.7137157 C
0.00001750         3832.    218977984.    20.1087441     0.0003519     -0.000278
1.3423860     6.8252531 C
```

```
0.00001813        3896.    214931005.    19.8543231     0.0003599     -0.000293
1.3694333     6.9352759 C
0.00001875        3958.    211101141.    19.6146352     0.0003678     -0.000307
1.3961988     7.0440830 C
0.00001938        4019.    207429921.    19.3860427     0.0003756     -0.000322
1.4225409     7.1504487 C
0.00002000        4079.    203951476.    19.1701028     0.0003834     -0.000337
1.4486377     7.2558615 C
0.00002063        4138.    200635912.    18.9649328     0.0003912     -0.000351
1.4744408     7.3598889 C
0.00002125        4196.    197465514.    18.7692283     0.0003988     -0.000366
1.4999272     7.4623124 C
0.00002188        4254.    194450894.    18.5835770     0.0004065     -0.000381
1.5252020     7.5640190 C
0.00002250        4310.    191554932.    18.4054927     0.0004141     -0.000396
1.5501433     7.6639340 C
0.00002313        4366.    188798310.    18.2363175     0.0004217     -0.000411
1.5749035     7.7633680 C
0.00002375        4421.    186149884.    18.0739011     0.0004293     -0.000426
1.5993706     7.8613245 C
0.00002438        4476.    183617082.    17.9187811     0.0004368     -0.000441
1.6236328     -8.073360 C
0.00002563        4583.    178855206.    17.6274832     0.0004517     -0.000471
1.6714714     -8.703864 C
0.00002688        4689.    174468402.    17.3594985     0.0004665     -0.000501
1.7184993     -9.337304 C
0.00002813        4793.    170415789.    17.1122831     0.0004813     -0.000531
1.7647756     -9.973230 C
0.00002938        4895.    166636271.    16.8813509     0.0004959     -0.000562
1.8101393    -10.613209 C
0.00003063        4996.    163134216.    16.6677469     0.0005104     -0.000592
1.8548933    -11.254538 C
0.00003188        5096.    159862638.    16.4680833     0.0005249     -0.000623
1.8989099    -11.898466 C
0.00003313        5194.    156805290.    16.2814757     0.0005393     -0.000653
1.9422676    -12.544324 C
0.00003438        5292.    153941870.    16.1067793     0.0005537     -0.000684
1.9850018    -13.191834 C
0.00003563        5388.    151254505.    15.9428733     0.0005680     -0.000715
2.0271272    -13.840906 C
0.00003688        5484.    148723389.    15.7882992     0.0005822     -0.000745
2.0686244    -14.491781 C
0.00003813        5580.    146348875.    15.6440054     0.0005964     -0.000776
2.1096828    -15.142634 C
0.00003938        5674.    144091893.    15.5058720     0.0006105     -0.000807
2.1499784    -15.796720 C
0.00004063        5767.    141968511.    15.3767242     0.0006247     -0.000838
2.1898873    -16.450325 C
0.00004188        5861.    139957089.    15.2545932     0.0006388     -0.000869
2.2292602    -17.104966 C
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0.00004313 5953. 138041561. 15.1377481 0.0006528 -0.000900
2.2679996 -17.761691 C
0.00004438 6045. 136229201. 15.0276230 0.0006669 -0.000931
2.3063561 -18.417937 C
0.00004563 6137. 134508282. 14.9238494 0.0006809 -0.000962
2.3442705 -19.074317 C
0.00004688 6228. 132857628. 14.8233496 0.0006948 -0.000993
2.3814884 -19.733572 C
0.00004813 6318. 131288421. 14.7283760 0.0007088 -0.001024
2.4183271 -20.392348 C
0.00004938 6409. 129794461. 14.6381400 0.0007228 -0.001055
2.4547855 -21.050644 C
0.00005063 6498. 128365153. 14.5526227 0.0007367 -0.001086
2.4907546 -21.709653 C
0.00005188 6588. 126990304. 14.4695387 0.0007506 -0.001117
2.5261148 -22.370750 C
0.00005313 6677. 125676309. 14.3906342 0.0007645 -0.001148
2.5610980 -23.031367 C
0.00005438 6765. 124418949. 14.3156640 0.0007784 -0.001179
2.5957029 -23.691501 C
0.00005563 6854. 123214397. 14.2436976 0.0007923 -0.001210
2.6299283 -24.351147 C
0.00005688 6942. 122051793. 14.1750873 0.0008062 -0.001241
2.6635806 -25.012578 C
0.00005813 7029. 120931772. 14.1084009 0.0008201 -0.001272
2.6967515 -25.674764 C
0.00005938 7116. 119855490. 14.0447778 0.0008339 -0.001304
2.7295458 -26.336461 C
0.00006063 7203. 118820224. 13.9840579 0.0008478 -0.001335
2.7619622 -26.997666 C
0.00006188 7290. 117823467. 13.9260669 0.0008617 -0.001366
2.7939994 -27.658377 C
0.00006313 7377. 116862928. 13.8706434 0.0008756 -0.001397
2.8256561 -28.318590 C
0.00006438 7463. 115930287. 13.8158938 0.0008894 -0.001428
2.8567322 -28.980843 C
0.00006563 7549. 115028594. 13.7639233 0.0009033 -0.001459
2.8873821 -29.643221 C
0.00006688 7634. 114157567. 13.7137830 0.0009171 -0.001490
2.9176538 -30.305095 C
0.00006813 7720. 113315500. 13.6657391 0.0009310 -0.001522
2.9475460 -30.966462 C
0.00006938 7805. 112500809. 13.6196797 0.0009449 -0.001553
2.9770573 -31.627320 C
0.00007063 7890. 111712026. 13.5755009 0.0009588 -0.001584
3.0061863 -32.287666 C
0.00007188 7974. 110947792. 13.5331055 0.0009727 -0.001615
3.0349316 -32.947494 C
0.00007313 8059. 110205866. 13.4921518 0.0009866 -0.001646
3.0632538 -33.607343 C

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0.00007438        8143.    109482117.    13.4510308     0.0010004     -0.001677
3.0910306    -34.268963 C
0.00007938        8476.    106788983.    13.3051815     0.0010561     -0.001801
3.1983041    -36.910148 C
0.00008438        8807.    104375059.    13.1795074     0.0011120     -0.001925
3.2993724    -39.542704 C
0.00008938        9133.    102185628.    13.0681579     0.0011680     -0.002050
3.3937734    -42.172803 C
0.00009438        9455.    100187929.    12.9720075     0.0012242     -0.002173
3.4816494    -44.797149 C
0.00009938        9774.     98355597.    12.8881935     0.0012808     -0.002297
3.5631047    -47.412052 C
 0.0001044       10089.     96663984.    12.8156204     0.0013376     -0.002420
3.6380294    -50.017229 C
 0.0001094       10401.     95090937.    12.7505407     0.0013946     -0.002543
3.7061747    -52.615768 C
 0.0001144       10708.     93620075.    12.6954367     0.0014520     -0.002665
3.7674444    -55.207936 C
 0.0001194       11011.     92239969.    12.6469608     0.0015097     -0.002788
3.8218943    -57.789216 C
 0.0001244       11310.     90934459.    12.6053177     0.0015678     -0.002910
3.8693725    -60.000000 CY
 0.0001294       11588.     89571386.    12.5642786     0.0016255     -0.003032
3.9092899    -60.000000 CY
 0.0001344       11817.     87937320.    12.5119646     0.0016813     -0.003156
3.9410459    -60.000000 CY
 0.0001394       12008.     86159466.    12.4564469     0.0017361     -0.003281
3.9654957    -60.000000 CY
 0.0001444       12175.     84332171.    12.3969756     0.0017898     -0.003408
3.9831887    -60.000000 CY
 0.0001494       12328.     82530881.    12.3398699     0.0018433     -0.003534
3.9945086    -60.000000 CY
 0.0001544       12461.     80719761.    12.2812357     0.0018959     -0.003662
3.9996300    -60.000000 CY
 0.0001594       12579.     78924343.    12.2235695     0.0019481     -0.003789
3.9993415    -60.000000 CY
 0.0001644       12692.     77213260.    12.1711545     0.0020006     -0.003917
3.9987327    -60.000000 CY
 0.0001694       12795.     75541203.    12.1208709     0.0020530     -0.004045
3.9975471    -60.000000 CY
 0.0001744       12883.     73879745.    12.0704466     0.0021048     -0.004173
3.9999984    -60.000000 CY
 0.0001794       12960.     72252311.    12.0196667     0.0021560     -0.004301
3.9995122    -60.000000 CY
 0.0001844       13036.     70701326.    11.9729214     0.0022075     -0.004430
3.9978407    -60.000000 CY
 0.0001894       13109.     69222028.    11.9303161     0.0022593     -0.004558
3.9999958    -60.000000 CY
 0.0001944       13176.     67785603.    11.8897394     0.0023111     -0.004686
3.9989857    -60.000000 CY
```

0.0001994	13234.	66375818.	11.8491332	0.0023624	-0.004815
3.9969862	-60.000000 CY				
0.0002044	13284.	64997394.	11.8085063	0.0024134	-0.004944
3.9993204	-60.000000 CY				
0.0002094	13330.	63665977.	11.7707068	0.0024645	-0.005073
3.9959268	-60.000000 CY				
0.0002144	13374.	62387220.	11.7346688	0.0025156	-0.005202
3.9992173	-60.000000 CY				
0.0002194	13417.	61161609.	11.7027568	0.0025673	-0.005330
3.9969085	-60.000000 CY				
0.0002244	13459.	59982862.	11.6704734	0.0026186	-0.005459
3.9986405	-60.000000 CY				
0.0002294	13499.	58849319.	11.6420508	0.0026704	-0.005587
3.9999999	-60.000000 CY				
0.0002344	13534.	57747060.	11.6124770	0.0027217	-0.005716
3.9971547	-60.000000 CY				
0.0002394	13567.	56675182.	11.5851021	0.0027732	-0.005844
3.9996388	-60.000000 CY				
0.0002444	13595.	55632358.	11.5573525	0.0028243	-0.005973
3.9955093	-60.000000 CY				
0.0002494	13619.	54612912.	11.5294864	0.0028752	-0.006102
3.9978713	-60.000000 CY				
0.0002544	13641.	53627351.	11.5027764	0.0029260	-0.006231
3.9997992	-60.000000 CY				
0.0002594	13662.	52674335.	11.4775651	0.0029770	-0.006361
3.9946967	-60.000000 CY				
0.0002644	13683.	51754660.	11.4540700	0.0030282	-0.006489
3.9974326	-60.000000 CY				
0.0002694	13702.	50867477.	11.4319923	0.0030795	-0.006618
3.9995956	-60.000000 CY				
0.0002744	13722.	50010434.	11.4113417	0.0031310	-0.006747
3.9968485	-60.000000 CY				
0.0003044	13820.	45403608.	11.3081696	0.0034419	-0.007516
3.9987620	-60.000000 CYT				
0.0003344	13870.	41480493.	11.2122961	0.0037491	-0.008288
3.9999902	-60.000000 CYT				
0.0003644	13870.	38065289.	11.2252072	0.0040902	-0.009027
3.9905864	-60.000000 CYT				

Summary of Results for Nominal Moment Capacity for Section 1

Moment values interpolated at maximum compressive strain = 0.003
or maximum developed moment if pile fails at smaller strains.

Load No.	Axial Thrust kips	Nominal Mom. Cap. in-kip	Max. Comp. Strain	Max. Tens.

Strain				
1	364.740	13671.501	0.00300000	-0.00641842

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	364.740000	13672.	237.081000	8886.	103839235.
1	0.75	364.740000	13672.	273.555000	10254.	95833550.
1	0.90	364.740000	13672.	328.266000	12304.	82810637.

Pile Section No. 2:

Dimensions and Properties of Drilled Shaft (Bored Pile):

Length of Section	=	5.000000 ft
Shaft Diameter	=	30.000000 in
Concrete Cover Thickness (to edge of trans. reinf.)	=	3.000000 in
Number of Reinforcing Bars	=	15 bars
Yield Stress of Reinforcing Bars	=	60000. psi
Modulus of Elasticity of Reinforcing Bars	=	29000000. psi

Gross Area of Shaft	=	706.858347 sq. in.
Total Area of Reinforcing Steel	=	15.000000 sq. in.
Area Ratio of Steel Reinforcement	=	2.12 percent
Edge-to-Edge Bar Spacing	=	3.367467 in
Maximum Concrete Aggregate Size	=	0.375000 in
Ratio of Bar Spacing to Aggregate Size	=	8.98
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.	=	4.500000 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	=	3252.318 kips
Tensile Load for Cracking of Concrete	=	-337.937 kips
Nominal Axial Tensile Capacity	=	-900.000 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	10.811000	0.00000
2	1.128000	1.000000	9.876340	4.397230
3	1.128000	1.000000	7.233971	8.034139
4	1.128000	1.000000	3.340783	10.281872
5	1.128000	1.000000	-1.13006	10.751776
6	1.128000	1.000000	-5.40550	9.362601
7	1.128000	1.000000	-8.74628	6.354546
8	1.128000	1.000000	-10.57475	2.247733
9	1.128000	1.000000	-10.57475	-2.24773
10	1.128000	1.000000	-8.74628	-6.35455
11	1.128000	1.000000	-5.40550	-9.36260
12	1.128000	1.000000	-1.13006	-10.75178
13	1.128000	1.000000	3.340783	-10.28187
14	1.128000	1.000000	7.233971	-8.03414
15	1.128000	1.000000	9.876340	-4.39723

NOTE: The positions of the above rebars were computed by LPile

Minimum spacing between any two bars not equal to zero = 3.367 inches
between bars 7 and 8.

Ratio of bar spacing to maximum aggregate size = 8.98

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	=	0.375000 in

Number of Axial Thrust Force Values Determined from Pile-head Loadings = 1

Number	Axial Thrust Force kips
1	364.740

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 = 364.740 kips

Bending Max Conc Curvature Stress rad/in. ksi	Bending Max Steel Stress Moment in-kip ksi	Bending Stiffness kip-in2	Depth to N Axis in	Max Comp Strain in/in	Max Tens Strain in/in	Run Msg
0.00000125	225.8296357	180663709.	103.9002216	0.0001299	0.00009238	
0.5311200	3.6304455					

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0.00000250   451.6531914    180661277.    59.4757673     0.0001487    0.00007369
0.6042973     4.0401181
0.00000375   677.4487053    180652988.    44.6790150     0.0001675    0.00005505
0.6768598     4.4510304
0.00000500   903.2021585    180640432.    37.2891895     0.0001864    0.00003645
0.7488020     4.8631825
0.00000625        1129.     180623924.    32.8621362     0.0002054    0.00001789
0.8201187     5.2765747
0.00000750        1355.     180603571.    29.9164707     0.0002244  -6.26470E-07
0.8908044     5.6912074
0.00000875        1580.     180572379.    27.8171572     0.0002434   -0.00001910
0.9608488     6.1070412
0.00001000        1805.     180500596.    26.2460463     0.0002625   -0.00003754
1.0302184     6.5238533
0.00001125        2029.     180372836.    25.0179614     0.0002815   -0.00005605
1.0988791     6.9414033
0.00001250        2252.     180189973.    24.0477615     0.0003006   -0.00007440
1.1668071     7.3595249
0.00001375        2474.     179957996.    23.2541787     0.0003197   -0.00009276
1.2339858     7.7781020
0.00001500        2695.     179683810.    22.5930449     0.0003389     -0.000111
1.3004033     8.1970515
0.00001625        2695.     165861978.    21.2377859     0.0003451     -0.000142
1.3213360     8.2411190 C
0.00001750        2695.     154014694.    20.6162938     0.0003608     -0.000164
1.3748053     8.5596441 C
0.00001875        2695.     143747048.    20.0630988     0.0003762     -0.000186
1.4268063     8.8702475 C
0.00002000        2782.     139080076.    19.5673085     0.0003913     -0.000209
1.4774961     9.1740390 C
0.00002125        2878.     135447722.    19.1200819     0.0004063     -0.000231
1.5269898     9.4718130 C
0.00002250        2971.     132066202.    18.7144525     0.0004211     -0.000254
1.5753917     9.7643054 C
0.00002375        3061.     128904185.    18.3438257     0.0004357     -0.000277
1.6227177    10.0514975 C
0.00002500        3149.     125955267.    18.0042235     0.0004501     -0.000300
1.6690928    10.3343495 C
0.00002625        3234.     123199722.    17.6917404     0.0004644     -0.000323
1.7145662    10.6131764 C
0.00002750        3317.     120621946.    17.4031226     0.0004786     -0.000346
1.7591954    10.8883837 C
0.00002875        3398.     118208433.    17.1357729     0.0004927     -0.000370
1.8030387    11.1604006 C
0.00003000        3478.     115946659.    16.8875015     0.0005066     -0.000393
1.8461503    11.4296345 C
0.00003125        3557.     113824129.    16.6563515     0.0005205     -0.000417
1.8885725    11.6964009 C
0.00003250        3634.     111816061.    16.4393721     0.0005343     -0.000441
1.9302128    11.9597454 C
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0.00003375 3710. 109927918. 16.2365237 0.0005480 -0.000465
1.9712407 12.2211921 C
0.00003500 3785. 108152541. 16.0468361 0.0005616 -0.000488
2.0117187 12.4812887 C
0.00003625 3859. 106460950. 15.8669928 0.0005752 -0.000512
2.0514423 12.7379907 C
0.00003750 3933. 104868524. 15.6984538 0.0005887 -0.000536
2.0906894 12.9939436 C
0.00003875 4005. 103354165. 15.5388114 0.0006021 -0.000560
2.1293152 13.2476763 C
0.00004000 4077. 101919973. 15.3882037 0.0006155 -0.000584
2.1674381 13.5003162 C
0.00004125 4148. 100554290. 15.2452704 0.0006289 -0.000609
2.2049982 13.7512174 C
0.00004250 4219. 99259028. 15.1102349 0.0006422 -0.000633
2.2421084 14.0014897 C
0.00004375 4288. 98019484. 14.9812828 0.0006554 -0.000657
2.2786324 -14.297183 C
0.00004500 4358. 96845671. 14.8597103 0.0006687 -0.000681
2.3148120 -14.864194 C
0.00004625 4427. 95715561. 14.7428677 0.0006819 -0.000706
2.3503505 -15.433941 C
0.00004750 4495. 94640537. 14.6321641 0.0006950 -0.000730
2.3855212 -16.003569 C
0.00004875 4564. 93614334. 14.5268985 0.0007082 -0.000754
2.4202819 -16.573535 C
0.00005125 4699. 91680819. 14.3290375 0.0007344 -0.000803
2.4883033 -17.717529 C
0.00005375 4832. 89902403. 14.1481803 0.0007605 -0.000852
2.5546357 -18.863708 C
0.00005625 4965. 88261936. 13.9826206 0.0007865 -0.000901
2.6193710 -20.011156 C
0.00005875 5096. 86735737. 13.8291182 0.0008125 -0.000950
2.6823328 -21.162064 C
0.00006125 5226. 85321338. 13.6882914 0.0008384 -0.000999
2.7438464 -22.312713 C
0.00006375 5355. 83997989. 13.5570240 0.0008643 -0.001048
2.8036703 -23.466104 C
0.00006625 5483. 82762074. 13.4355804 0.0008901 -0.001097
2.8620225 -24.619653 C
0.00006875 5610. 81605291. 13.3231169 0.0009160 -0.001147
2.9189331 -25.772973 C
0.00007125 5737. 80513141. 13.2171522 0.0009417 -0.001196
2.9741815 -26.929027 C
0.00007375 5862. 79487894. 13.1191653 0.0009675 -0.001245
3.0280984 -28.083451 C
0.00007625 5987. 78520712. 13.0278370 0.0009934 -0.001294
3.0805855 -29.237508 C
0.00007875 6111. 77601692. 12.9411684 0.0010191 -0.001343
3.1314597 -30.393856 C

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0.00008125        6235.    76732725.    12.8606049    0.0010449    -0.001393
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0.00008375        6357.    75909264.    12.7855451    0.0010708    -0.001442
3.2291869   -32.701530 C
0.00008625        6479.    75124247.    12.7146889    0.0010966    -0.001491
3.2758744   -33.855197 C
0.00008875        6601.    74374471.    12.6474641    0.0011225    -0.001540
3.3210636   -35.009527 C
0.00009125        6721.    73659899.    12.5844268    0.0011483    -0.001589
3.3648982   -36.162119 C
0.00009375        6842.    72977651.    12.5255288    0.0011743    -0.001638
3.4073690   -37.312956 C
0.00009625        6961.    72325150.    12.4703271    0.0012003    -0.001687
3.4484665   -38.462017 C
0.00009875        7080.    71697715.    12.4178268    0.0012263    -0.001736
3.4880452   -39.611886 C
 0.0001013        7198.    71094375.    12.3678083    0.0012522    -0.001785
3.5261589   -40.761585 C
 0.0001038        7316.    70514779.    12.3208134    0.0012783    -0.001834
3.5628877   -41.909441 C
 0.0001063        7433.    69957198.    12.2764138    0.0013044    -0.001883
3.5982215   -43.055428 C
 0.0001088        7549.    69420052.    12.2348590    0.0013305    -0.001932
3.6321502   -44.199528 C
 0.0001113        7665.    68901908.    12.1957659    0.0013568    -0.001981
3.6646633   -45.341717 C
 0.0001138        7781.    68401455.    12.1589797    0.0013831    -0.002029
3.6957504   -46.481970 C
 0.0001163        7895.    67915944.    12.1237963    0.0014094    -0.002078
3.7252972   -47.622964 C
 0.0001188        8009.    67445446.    12.0901729    0.0014357    -0.002127
3.7533734   -48.762904 C
 0.0001213        8122.    66989510.    12.0585142    0.0014621    -0.002175
3.7800062   -49.900812 C
 0.0001238        8235.    66547198.    12.0287087    0.0014886    -0.002224
3.8051841   -51.036660 C
 0.0001263        8347.    66117647.    12.0004137    0.0015151    -0.002272
3.8288956   -52.170418 C
 0.0001288        8459.    65700051.    11.9740230    0.0015417    -0.002321
3.8511286   -53.302061 C
 0.0001313        8570.    65293672.    11.9492048    0.0015683    -0.002369
3.8718711   -54.431559 C
 0.0001338        8680.    64897824.    11.9258773    0.0015951    -0.002417
3.8911107   -55.558881 C
 0.0001363        8790.    64511870.    11.9039656    0.0016219    -0.002466
3.9088347   -56.683997 C
 0.0001388        8899.    64135215.    11.8834010    0.0016488    -0.002514
3.9250301   -57.806875 C
 0.0001413        9007.    63767309.    11.8641080    0.0016758    -0.002562
3.9396838   -58.927483 C
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 0.0001438        9115.     63406819.    11.8459640     0.0017029     -0.002610
3.9527709    -60.000000 CY
 0.0001463        9219.     63038445.    11.8276057     0.0017298     -0.002658
3.9642115    -60.000000 CY
 0.0001488        9318.     62644803.    11.8082909     0.0017565     -0.002706
3.9739918    -60.000000 CY
 0.0001588        9642.     60738127.    11.7148156     0.0018597     -0.002903
3.9971547    -60.000000 CY
 0.0001688        9888.     58597513.    11.6111799     0.0019594     -0.003103
3.9999918    -60.000000 CY
 0.0001788       10094.     56467704.    11.5117746     0.0020577     -0.003305
3.9997039    -60.000000 CY
 0.0001888       10258.     54345190.    11.4107912     0.0021538     -0.003509
3.9978313    -60.000000 CY
 0.0001988       10405.     52353912.    11.3194253     0.0022497     -0.003713
3.9993579    -60.000000 CY
 0.0002088       10531.     50449292.    11.2345728     0.0023452     -0.003917
3.9998703    -60.000000 CY
 0.0002188       10631.     48601050.    11.1469090     0.0024384     -0.004124
3.9999637    -60.000000 CY
 0.0002288       10726.     46889269.    11.0691872     0.0025321     -0.004330
3.9999577    -60.000000 CY
 0.0002388       10816.     45301621.    11.0000745     0.0026263     -0.004536
3.9998363    -60.000000 CY
 0.0002488       10891.     43782153.    10.9316582     0.0027192     -0.004743
3.9992856    -60.000000 CY
 0.0002588       10952.     42325984.    10.8617389     0.0028105     -0.004952
3.9976099    -60.000000 CY
 0.0002688       11007.     40957532.    10.7965556     0.0029016     -0.005161
3.9976514    -60.000000 CY
 0.0002788       11061.     39681578.    10.7370846     0.0029930     -0.005370
3.9994543    -60.000000 CY
 0.0002888       11114.     38490020.    10.6848350     0.0030852     -0.005577
3.9963363    -60.000000 CY
 0.0002988       11164.     37370515.    10.6352192     0.0031773     -0.005785
3.9999176    -60.000000 CY
 0.0003088       11207.     36297878.    10.5855243     0.0032683     -0.005994
3.9967608    60.0000000 CY
 0.0003188       11243.     35271595.    10.5362000     0.0033584     -0.006204
3.9998866    60.0000000 CY
 0.0003288       11271.     34285116.    10.4905357     0.0034488     -0.006414
3.9952769    60.0000000 CYT
 0.0003388       11297.     33349430.    10.4469338     0.0035389     -0.006624
3.9993459    60.0000000 CYT
 0.0003488       11318.     32454300.    10.4105022     0.0036307     -0.006832
3.9942838    60.0000000 CYT
 0.0003588       11339.     31606630.    10.3781242     0.0037232     -0.007039
3.9975633    60.0000000 CYT
 0.0003688       11356.     30797203.    10.3507936     0.0038169     -0.007246
3.9999678    60.0000000 CYT
```

Summary of Results for Nominal Moment Capacity for Section 2

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	364.740	11065.263	0.00300000	-0.00538538

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	364.740000	11065.	237.081000	7192.	71124423.
1	0.75	364.740000	11065.	273.555000	8299.	66303069.
1	0.90	364.740000	11065.	328.266000	9959.	57867010.

Layering Correction Equivalent Depths of Soil & Rock Layers

Layer No.	Top of Layer Below Pile Head ft	Equivalent Top Depth Below Grnd Surf ft	Same Layer Type As Layer Above	Layer is Rock or is Below Rock Layer	F0 Integral for Layer lbs	F1 Integral for Layer lbs
1	20.3300	0.00	N.A.	No	0.00	133423.
2	33.2000	12.8700	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 Displacement and Pile-head Rotation (Loading Type 5)
Displacement of pile head = 1.000000 inches
Rotation of pile head = 0.000E+00 radians
Axial load on pile head = 364740.0 lbs

Depth X	Deflect. y	Bending Moment	Shear Force	Slope S	Total Stress	Bending Stiffness	Soil Res. Es*H	Soil Spr. p	Distrib. Lat. Load
feet	inches	in-lbs	lbs	radians	psi*	lb-in^2	lb/inch	lb/inch	lb/inch
0.00	1.0000	-7808222.	46885.	0.00	0.00	1.12E+11	0.00	0.00	0.00
0.3820	0.9993	-7593042.	46883.	-3.14E-04	0.00	1.12E+11	0.00	0.00	0.00
0.7640	0.9971	-7377345.	46883.	-6.13E-04	0.00	1.17E+11	0.00	0.00	0.00
1.1460	0.9936	-7161164.	46883.	-8.96E-04	0.00	1.19E+11	0.00	0.00	0.00
1.5280	0.9889	-6944523.	46883.	-0.00116	0.00	1.22E+11			

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0.00       0.00       0.00
    1.9100     0.9830  -6727446.     46883.   -0.00142       0.00   1.25E+11
0.00       0.00       0.00
    2.2920     0.9759  -6509956.     46883.   -0.00166       0.00   1.28E+11
0.00       0.00       0.00
    2.6740     0.9678  -6292077.     46883.   -0.00188       0.00   1.32E+11
0.00       0.00       0.00
    3.0560     0.9587  -6073832.     46883.   -0.00210       0.00   1.36E+11
0.00       0.00       0.00
    3.4380     0.9486  -5855244.     46883.   -0.00229       0.00   1.40E+11
0.00       0.00       0.00
    3.8200     0.9376  -5636335.     46883.   -0.00248       0.00   1.45E+11
0.00       0.00       0.00
    4.2020     0.9259  -5417129.     46883.   -0.00265       0.00   1.50E+11
0.00       0.00       0.00
    4.5840     0.9133  -5197646.     46883.   -0.00281       0.00   1.57E+11
0.00       0.00       0.00
    4.9660     0.9001  -4977910.     46883.   -0.00295       0.00   1.64E+11
0.00       0.00       0.00
    5.3480     0.8862  -4757940.     46883.   -0.00309       0.00   1.72E+11
0.00       0.00       0.00
    5.7300     0.8718  -4537758.     46883.   -0.00321       0.00   1.81E+11
0.00       0.00       0.00
    6.1120     0.8568  -4317383.     46883.   -0.00332       0.00   1.91E+11
0.00       0.00       0.00
    6.4940     0.8414  -4096836.     46883.   -0.00342       0.00   2.03E+11
0.00       0.00       0.00
    6.8760     0.8255  -3876134.     46883.   -0.00350       0.00   2.16E+11
0.00       0.00       0.00
    7.2580     0.8093  -3655294.     46883.   -0.00357       0.00   3.55E+11
0.00       0.00       0.00
    7.6400     0.7928  -3434376.     46883.   -0.00361       0.00   3.55E+11
0.00       0.00       0.00
    8.0220     0.7761  -3213383.     46883.   -0.00366       0.00   3.55E+11
0.00       0.00       0.00
    8.4040     0.7593  -2992321.     46883.   -0.00370       0.00   3.56E+11
0.00       0.00       0.00
    8.7860     0.7422  -2771194.     46883.   -0.00373       0.00   3.56E+11
0.00       0.00       0.00
    9.1680     0.7250  -2550008.     46883.   -0.00377       0.00   3.56E+11
0.00       0.00       0.00
    9.5500     0.7077  -2328767.     46883.   -0.00380       0.00   3.57E+11
0.00       0.00       0.00
    9.9320     0.6902  -2107476.     46883.   -0.00383       0.00   3.57E+11
0.00       0.00       0.00
   10.3140     0.6726  -1886139.     46883.   -0.00385       0.00   3.57E+11
0.00       0.00       0.00
   10.6960     0.6549  -1664763.     46883.   -0.00388       0.00   3.57E+11
0.00       0.00       0.00
   11.0780     0.6371  -1443350.     46883.   -0.00390       0.00   3.57E+11
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0.00       0.00       0.00
   11.4600     0.6192  -1221906.     46883.   -0.00391       0.00   3.57E+11
0.00       0.00       0.00
   11.8420     0.6012  -1000436.     46883.   -0.00393       0.00   3.57E+11
0.00       0.00       0.00
   12.2240     0.5831   -778945.     46883.   -0.00394       0.00   3.57E+11
0.00       0.00       0.00
   12.6060     0.5651   -557437.     46883.   -0.00395       0.00   3.57E+11
0.00       0.00       0.00
   12.9880     0.5470   -335917.     46883.   -0.00395       0.00   3.57E+11
0.00       0.00       0.00
   13.3700     0.5288   -114390.     46883.   -0.00396       0.00   3.57E+11
0.00       0.00       0.00
   13.7520     0.5107    107140.     46883.   -0.00396       0.00   3.57E+11
0.00       0.00       0.00
   14.1340     0.4925    328668.     46883.   -0.00395       0.00   3.57E+11
0.00       0.00       0.00
   14.5160     0.4744    550188.     46883.   -0.00395       0.00   3.57E+11
0.00       0.00       0.00
   14.8980     0.4564    771697.     46883.   -0.00394       0.00   3.57E+11
0.00       0.00       0.00
   15.2800     0.4383    993189.     46883.   -0.00393       0.00   3.57E+11
0.00       0.00       0.00
   15.6620     0.4203   1214659.     46883.   -0.00391       0.00   3.57E+11
0.00       0.00       0.00
   16.0440     0.4024   1436104.     46883.   -0.00390       0.00   3.57E+11
0.00       0.00       0.00
   16.4260     0.3846   1657518.     46883.   -0.00388       0.00   3.57E+11
0.00       0.00       0.00
   16.8080     0.3669   1878896.     46883.   -0.00385       0.00   3.57E+11
0.00       0.00       0.00
   17.1900     0.3493   2100233.     46883.   -0.00383       0.00   3.57E+11
0.00       0.00       0.00
   17.5720     0.3318   2321526.     46883.   -0.00380       0.00   3.57E+11
0.00       0.00       0.00
   17.9540     0.3144   2542769.     46883.   -0.00377       0.00   3.56E+11
0.00       0.00       0.00
   18.3360     0.2972   2763957.     46883.   -0.00373       0.00   3.56E+11
0.00       0.00       0.00
   18.7180     0.2802   2985085.     46883.   -0.00370       0.00   3.56E+11
0.00       0.00       0.00
   19.1000     0.2633   3206150.     46883.   -0.00366       0.00   3.55E+11
0.00       0.00       0.00
   19.4820     0.2467   3427145.     46883.   -0.00362       0.00   3.55E+11
0.00       0.00       0.00
   19.8640     0.2302   3648066.     46883.   -0.00357       0.00   3.55E+11
0.00       0.00       0.00
   20.2460     0.2139   3868908.     46883.   -0.00351       0.00   2.17E+11
0.00       0.00       0.00
   20.6280     0.1981   4089614.     46088.   -0.00342       0.00   2.03E+11
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   21.0100     0.1826   4302875.     44119.   -0.00332       0.00   1.92E+11
-512.256     12860.       0.00
   21.3920     0.1676   4505199.     41435.   -0.00321       0.00   1.82E+11
-658.705     18015.       0.00
   21.7740     0.1531   4693494.     38120.   -0.00309       0.00   1.74E+11
-787.870     23583.       0.00
   22.1560     0.1392   4865026.     34249.   -0.00297       0.00   1.68E+11
-900.686     29652.       0.00
   22.5380     0.1260   5017409.     29898.   -0.00283       0.00   1.62E+11
-997.722     36312.       0.00
   22.9200     0.1133   5148591.     25138.   -0.00268       0.00   1.58E+11
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   23.3020     0.1014   5256843.     20038.   -0.00253       0.00   1.55E+11
-1146.     51814.       0.00
   23.6840    0.09011   5340763.     14670.   -0.00237       0.00   1.53E+11
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   24.4480    0.06984   5431639.      3438.   -0.00205       0.00   1.50E+11
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   24.8300    0.06084   5437637.     -2227.   -0.00188       0.00   1.50E+11
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   25.2120    0.05261   5417508.     -7820.   -0.00171       0.00   1.50E+11
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   25.5940    0.04513   5371672.    -13304.   -0.00155       0.00   1.52E+11
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   25.9760    0.03840   5300720.    -18643.   -0.00139       0.00   1.54E+11
-1147.    136964.       0.00
   26.3580    0.03239   5205397.    -23807.   -0.00123       0.00   1.56E+11
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   26.7400    0.02708   5086586.    -28767.   -0.00109       0.00   1.60E+11
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   27.1220    0.02243   4945289.    -33501.  -9.44E-04       0.00   1.65E+11
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   27.5040    0.01842   4782605.    -37990.  -8.11E-04       0.00   1.71E+11
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   27.8860    0.01500   4599712.    -42220.  -6.88E-04       0.00   1.78E+11
-893.984    273278.       0.00
   28.2680    0.01211   4397835.    -46183.  -5.75E-04       0.00   1.87E+11
-835.327    316093.       0.00
   28.6500    0.00973   4178225.    -49879.  -4.73E-04       0.00   1.98E+11
-776.980    366216.       0.00
   29.0320    0.00778   3942128.    -53311.  -3.82E-04       0.00   2.12E+11
-720.421    424489.       0.00
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   29.7960    0.00489   3425271.    -59293.  -2.69E-04       0.00   3.55E+11
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-443.645    541719.       0.00
   30.5600    0.00281   2861442.    -63389.  -1.88E-04       0.00   3.56E+11
-344.507    562732.       0.00
   30.9420    0.00203   2567532.    -64770.  -1.53E-04       0.00   3.56E+11
-258.190    583745.       0.00
   31.3240    0.00140   2268141.    -65785.  -1.22E-04       0.00   3.57E+11
-184.708    604758.       0.00
   31.7060   9.06E-04   1964820.    -66492.  -9.51E-05       0.00   3.57E+11
-123.719    625771.       0.00
   32.0880   5.28E-04   1658857.    -66947.  -7.18E-05       0.00   3.57E+11
-74.531    646784.       0.00
   32.4700   2.48E-04   1351293.    -67200.  -5.25E-05       0.00   3.57E+11
-36.109    667797.       0.00
   32.8520   4.71E-05   1042941.    -67299.  -3.71E-05       0.00   3.57E+11
-7.073    688810.       0.00
   33.2340  -9.23E-05    734417.    -64084.  -2.11E-05       0.00   1.81E+11
1410.   7.00E+07       0.00
   33.6160  -1.46E-04    455486.    -54709.  -5.99E-06       0.00   1.81E+11
2681.   8.40E+07       0.00
   33.9980  -1.47E-04    232869.    -41347.   2.74E-06       0.00   1.81E+11
3149.   9.80E+07       0.00
   34.3800  -1.21E-04     76406.    -27344.   6.66E-06       0.00   1.81E+11
2961.   1.12E+08       0.00
   34.7620  -8.61E-05    -17847.    -15129.   7.41E-06       0.00   1.81E+11
2369.   1.26E+08       0.00
   35.1440  -5.32E-05    -62323.     -5972.   6.39E-06       0.00   1.81E+11
1626.   1.40E+08       0.00
   35.5260  -2.76E-05    -72623.   -121.491   4.68E-06       0.00   1.81E+11
926.3789   1.54E+08       0.00
   35.9080  -1.03E-05    -63453.      2871.   2.95E-06       0.00   1.81E+11
379.2095   1.68E+08       0.00
   36.2900  -5.02E-07    -46312.      3786.   1.56E-06       0.00   1.81E+11
19.9249   1.82E+08       0.00
   36.6720   3.95E-06    -28750.      3444.   6.07E-07       0.00   1.81E+11
-169.094   1.96E+08       0.00
   37.0540   5.06E-06    -14741.      2524.   5.53E-08       0.00   1.81E+11
-232.079   2.10E+08       0.00
   37.4360   4.46E-06     -5607.      1493.  -2.03E-07       0.00   1.81E+11
-218.034   2.24E+08       0.00
   37.8180   3.20E-06     -1055.   611.5136  -2.87E-07       0.00   1.81E+11
-166.422   2.38E+08       0.00
   38.2000   1.83E-06       0.00       0.00  -3.01E-07       0.00   1.81E+11
-100.382   1.26E+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	=	1.00000000 inches
Computed slope at pile head	=	0.000000 radians
Maximum bending moment	=	-7808222. inch-lbs
Maximum shear force	=	-67299. lbs
Depth of maximum bending moment	=	0.000000 feet below pile head
Depth of maximum shear force	=	32.85200000 feet below pile head
Number of iterations	=	22
Number of zero deflection points	=	2
Pile deflection at ground	=	0.21043760 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	Load 1	Load Type	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	y, in	1.0000	S, rad	0.00	364740.	1.0000	0.00	-67299.	-7808222.

Maximum pile-head deflection = 1.0000000000 inches
Maximum pile-head rotation = 0.0000000000 radians = 0.000000 deg.

Summary of Warning Messages

The following warning was reported 322 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.

BRO-50-4.49 PID 109971 LPile Analysis

Rear Abutment Wingwalls Drilled Shaft

ODOT District 9

2/12/2026

Engineers, Surveyors, Planners, Scientists
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Made by:	AI	Date:	8/6/2025	Job No:	20230339
Checked by:	TDA/RMW	Date:	9/10/2025	Sheet No:	1
Project:	BRO-50-4.49		PID:	119880	
Subject:	Rear Abutment Wingwall				

Retaining Wall Data

Stem Dimensions (ft)

			Top of Wall	914.19
			Max Elevation Behind Wall =	915.95
Stem Width 1	1.50	ft	Bottom of Footing	893.50
Stem Width 2	1.50	ft		
Stem Length	42.50	ft	Stem Height 1	13.52
Seat Width	0.00	ft	Stem Height 2	4.17
β =	90.00	ft	Total Stem Height	17.69

Footer Dimensions (ft)

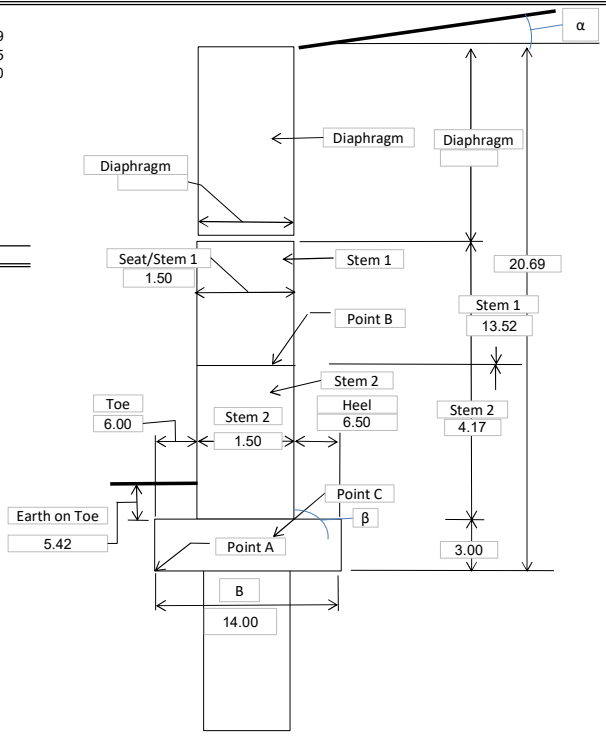
Toe	6.00	ft		
Stem Width (at Footer)	1.50	ft	Footer Height	3.00
Heel	6.50	ft	Total Ht. of Wall	20.69
Total Footing Width, B	14.00	ft		
			Design Height =	**21.11**

Live Load Surcharge

Live Ld. Surcharge Height, h_{eq} (ft) 2.00 AASHTO Table 3.11.6.4-2

Material

Soil Unit Weight (k/ft^3)	0.12	kips/ft^2	Concrete Unit Wt. (k/ft^3)	0.15
Soil Sat. Unit Weight =	0.145	kips/ft^3	Earth on Toe (ft)	5.42
Φ (°)	30			
δ (degrees) =	20			
α (degrees) =	3.71	GDM FIGURE 1500-3 AND AAHSHTO C3.11.5.8.1-1		
K_a	0.311			



Sum Moments .....Clockwise is positive

Item	Height (ft)	Width (ft)	Unit Weight (k/ft^3)	P (kips)	About "A" Arm (ft.)	About "A" Moment (ft-k)	About "B" P (kips)	About "B" Arm (ft.)	About "B" Moment (ft-k)	About "C" P (kips)	About "C" Arm (ft.)	About "C" Moment (ft-k)
Vertical Loads												
Concrete (DC)												
Stem 1	13.52	1.50	0.15	3.04	6.75	20.53	-	-	-	-	-	-
Stem 2	4.17	1.50	0.15	0.94	6.75	6.33	-	-	-	-	-	-
Footer	3.00	14.00	0.15	6.30	7.00	44.10	-	-	-	-	-	-
Earth Load (EV)												
Soil Above Toe	5.42	6.00	0.12	3.90	3.00	11.71	-	-	-	-	-	-
Soil Above Heel 1	17.69	6.50	0.12	13.80	10.75	148.31						
Soil Above Heel 2	0.42	6.50	0.12	0.16	11.83	1.94						
Vertical Component of Horizontal Earth Pressure from Soil Friction (EH_V)												
Vert. Load from EH_V	21.11	-	0.12	2.85	14.00	39.84	-	-	-	-	-	-
Live Load (LS_V)												
Live Load Surcharge	2.00	6.50	0.13	1.63	10.75	17.47	-	-	-	-	-	-
Horizontal Loads												
Earth Load (EH_H)												
Active Earth Pressure	21.11	-	0.120	**-7.82**	7.04	**-55.01**	-3.41	4.65	**-15.85**	-5.75	6.04	**-34.73**
Live Load (LS_H)												
Live Load Surcharge	21.11	2.00	0.13	-1.64	10.55	-17.33	-1.08	6.97	-7.56	-1.41	9.05	-12.76

AASHTO LRFD Load Factors - AASHTO Table 3.4.1-1

	Vertical Loads				Horizontal Loads		
Limit State	DC	EV	EH_V	LS_V	EH	LS_H	CT
Service I	1.00	1.00	1.00	1.00	1.00	1.00	0.00
Strength I.a-Sliding & Eccent.	0.90	1.00	1.50	0.00	1.50	1.75	0.00
Strength I.b-Bearing	1.25	1.35	1.50	1.75	1.50	1.75	0.00
Extreme Event II	1.00	1.00	1.00	0.50	1.00	0.50	0.00

Load Case	Footing/Piles (About A) Per Foot of Abutmemt			Stem 1 (About B) Per Foot of Abutmemt		Stem 2 (About C) Per Foot of Abutmemt	
	P_V (kips)	M_A (ft-k)	P_H (kips)	M_B (ft-k)	P_H (kips)	M_C (ft-k)	P_H (kips)
Service I	32.61	217.89	-9.46	-23.41	-4.50	-47.48	-7.16
Strength I.a	27.48	161.03	-14.60	-37.01	-7.01	-74.42	-11.10
Strength I.b	44.08	284.84	-14.60	-37.01	-7.01	-74.42	-11.10
Extreme Event II	31.80	217.83	-8.64	-19.63	-3.95	-41.11	-6.46

Drilled Shaft Foundation

Dia Above Rock: 3 ft
Dia Below Rock: 2.5 ft

$\eta_i \gamma_p DD$ Anticipated Down Drag = 23.2 kips/ shaft

Location	Bottom of the Pier Cap	Unfactored Downdrag Force (Kips)	Factored Downdrag Force (Kips)
Rear Abutment	893.5	22.1	23.2
Forward Abutment	891.5	12.1	12.7

Tip Resistance

Ap = 4.91 sf
Φqp = 0.5 *BDM 305-1*
qp = 590.4 ksf (from Geotech Report)

Side Resistance

BOF Elev = 893.50 BOF to TOR = 33.20
TOR Elev = 860.30 TOR to BDS = 5.00
DS Depth Above Rock= 33.20 ft
DS Depth Into Rock= 5.00 ft (Assume 5' below bedrock)
BDS Elev = 855.30
Design Scour Depth = 875.50
Check Scour Depth = 873.17 ft

Layer 1

Start EL 875.50 (Per BDM 305.4.1.1 neglect the shaft resistance of non-scour resistant rock in the scour zone)
End EL 855.30
Layer Thickness 20.20
Perimeter = 7.85 ft
Contributing Depth = 5.00 ft
As = 39.27 sf
Φqp = 0.55 *BDM 305-1*
qp = 0 ksf (from geotech)

Φqp*Rp = 1449.06 kips
Φqs*Rs = 0.00 kips
ΦRn = **1449.06** kips

Pile Capacity (kip) = **1449.06** <-- Based on Tip Resistance Only

Center to center spacing of piles along footer (ft) 12
Length of segment to be analyzed, L (ft) 12

$P_m = 0.64(S/D)^{0.34}$, for $1 \le S/D < 3.75$, where $0.5 \le P_m \le 1.0$

S/B 4
P_m = 1

Lpile Soil Inputs

Top of Wall Ground at Boring = 894.30
Top of Wall = 914.19

Bottom of Footing Elevation = 893.50
Approx Top of Rock= 860.30
Design Scour Depth = 875.50
Check Scour Depth = 873.17
Top of footing Depth = 17.69 ft
Height of Abutment in Lpile = 20.69 ft (Starting at beam seat elevation)
Location of Top of Rock in Lpile = 33.20 ft (Starting at beam BOF elevation)
Location of top of footing in Lpile = 17.69

B-002-0-24										
	EL START	EL END	GAMMA	C	E50	K =	km	qu	initial rock mod	RQD
Stiff Clay w/o Free Water (R	893.5	888.3	115	800	0.01	500				
Still Clay with Free Water (R	888.3	878.8	62.6	3200	0.005	100				
Still Clay with Free Water (R	878.8	860.3	67.6	4800	0.004	2000				
Weak Rock (Reese)	860.3	793.5	92.7	-	-	-	0.0005	1640	150000	15

	Distance From Bottom of Footing	Layer Thickness	Layer End depth from top of boring
Still Clay with Free Water (R	18.00	15.20	33.20
Weak Rock (Reese)	33.2	66.8	100

For Extreme Event II (using Check STM elevations)	Distance From Bottom of Footing	Layer Thickness	Layer End depth from top of boring
Still Clay with Free Water (Reese)	20.33	12.87	33.20
Weak Rock (Reese)	33.2	66.8	100

Resolve Forces in Drilled Shafts

	Piles Per Segment	Dist. From Toe, A (ft)	Battered? (y,n)	Batter Rate (x:1)	Centroid of Pile Group from Toe, X_Y (ft)
Row 0					7.00
Row 1	1	2.5	n		
Row 2	1	11.50	n		
Row 3					
Sum of Piles	2				

Forces acting on the the Segment

	P_V (kips)	M_A (ft-kip)	e (ft)	e-X_Y	M_Y (ft-kip)	P_H (kips)
Service I	391.37	2614.72	6.68	-0.32	-124.89	-113.52
Strength I.a	329.76	1932.39	5.86	-1.14	-375.96	-175.20
Strength I.b	528.94	3418.07	6.46	-0.54	-284.51	-175.20
Extreme Event II	381.62	2613.90	6.85	-0.15	-57.46	-103.66

	Vertical Capacity (kip)	Dist. From Y, x_i (ft)	$(x_i)^2$	Pile $\Sigma A(x_i)^2$
Row 0				
Row 1	1449.1	-4.50	20.25	20.25
Row 2	1449.1	4.50	20.25	20.25
Row 3				
			$\Sigma (x)^2$	40.50

Vertical Loads

Vertical Load on a Single Pile in the Row

	Service I (kip)	Strength I.a (kip)	Strength I.b (kip)	Extreme Event II (kip)
Row 0				
Row 1	209.56	206.66	296.08	197.20
Row 2	181.81	123.11	232.86	184.43
Row 3				

Vertical Loads with Down Drag

Location	Service I (kip)	Strength I.a (kip)	Strength I.b (kip)	Extreme Event II (kip)
Row 0				
Row 1	232.76	229.86	319.28	220.40
Row 2	205.01	146.31	256.06	207.63
Row 3				

Concurrent Lateral Resistance

Lateral Resistance Based on Batter of Piles (if present)

	Service I (k/ft)	Strength I.a (k/ft)	Strength I.b (k/ft)	Extreme Event II (kip)
Row 0				
Row 1	0.00	0.00	0.00	0.00
Row 2	0.00	0.00	0.00	0.00
Row 3				
Lat. Pile Resistance =	9.46	14.60	14.60	8.64
Lat. Pile Resistance =	-8.46	-14.60	-14.60	-8.64

Pile Spa Dir of Load, S 9.00 ft
Pile Spa Normal to Load, S 12.00 ft
Pile Dia, B 3 ft

Space Ratio Direction of Loading, S/B 3.00 B

P-Multipliers, Pm			
	Direction of Loading (10.7.2.4-1)	Normal to Loading BDM 305.1.2	Composite Pm
Row 1	0.700	1.000	0.700
Row 2	0.500	1.000	0.500

Space Ratio Normal Loading, S/B = 4.00 B
Space Ratio Normal Loading, S/B (3rd row) = 12.00 B

BDM C305.1.2 --> FHWA GEC 10, 11.5.1

$$P_m = 0.64\,(S/B)^{0.34} \text{ for } 1.0 \le S/B \le 3.75$$

TABLE 11-1 RECOMMENDED P-MULTIPLIER, P_M, VALUES FOR DESIGN BY ROW POSITION

Row Position	*Design P-multiplier, P_m*			
Pile Spacing (c-c)	3D	4D	5D	≥ 6D
Lead Row	0.7	0.85	1.0	1.0
2nd Row	0.5	0.65	0.85	1.0
3rd and higher Rows	0.35	0.5	0.7	1.0

Lpile Results

Capacity To Deisgn Scour Depth to 875.5 (STRENGTH I.a.)

Results - 3'-0" Dia Drilled Shaft

Axial Load in Row 1 =	229.86	k	Check Lpile with and without axial load.	
Axial Load in Row 2 =	146.31	k	Check Lpile with and without axial load.	

	Row 1	Row 2		
	0.700	0.500	Pm applies to soils above rock	
Deflection	2.2	2.2	in	
Resistance			k	
# of Piles	1	1		
Total Resistance	89.631	79.04	k	
Total Resistance @ Abutment		168.671	k	
Total Shear on Abutment, Vu		175.20	k	OK, within 5% and this is not accounting for orrientation of turnback wingwalls which adds capacity to the overall system

Capacity To Deisgn Scour Depth to 875.5 (SERVICE I)

Results - 3'-0" Dia Drilled Shaft

Axial Load in Row 1 =	232.76	k	Check Lpile with and without axial load.
Axial Load in Row 2 =	205.01	k	Check Lpile with and without axial load.

Not checking this condition as deflection is only ~2.2" in the strength case

	Row 1	Row 2		
	0.700	0.500	Pm applies to soils above rock	
Deflection			in	
Resistance			k	
# of Piles				
Total Resistance			k	
Total Resistance @ Abutment			k	
Total Shear on Abutment, Vu			k	OK

Capacity To Deisgn Scour Depth to 873.17 (EXTREME EVENT II)

Results - 3'-0" Dia Drilled Shaft

Axial Load in Row 1 =	220.40	k	Check Lpile with and without axial load.
Axial Load in Row 2 =	207.63	k	Check Lpile with and without axial load.

	Row 1	Row 2		
	0.700	0.500	Pm applies to soils above rock	
Deflection	1.5	1.5	in	
Resistance			k	
# of Piles	1	1		
Total Resistance	59.666	54.986	k	
Total Resistance @ Abutment		114.652	k	
Total Shear on Abutment, Vu		103.66	k	OK

305.4.1.1 SCOUR

Neglect the shaft resistance provided by soil or non-scour resistant rock in the scour zone. Assess scour resistant rock according to BDM Section 305.2.1.2.b. Use the depth of scour resulting from the design flood, with Strength and Service Limit State checks. Use the depth of scour resulting from the check flood with Extreme Event II Limit State checks.

3-

BDM Section 300 – Detail Design

Extend friction drilled shafts to penetrate a minimum of 15-ft below the controlling scour elevation. If socketed into non-scour resistant bedrock, when the rock has Q_u < 2.5-ksi, extend drilled shafts to penetrate a minimum of 10-ft below the controlling scour elevation in the bedrock; when the rock has $Q_u \geq 2.5$-ksi, extend drilled shafts to penetrate a minimum of 5-ft below the controlling scour elevation in the bedrock. If socketed into scour resistant bedrock, design the length of the bedrock socket based solely on the requirements of axial resistance in accordance with *LRFD 10.8.3.5.4* and of lateral stability.

Because the drilled shaft will lose support along the scour depth, investigate the structural capacity of the shaft considering the depth of the scour as an unbraced length. Also perform a p-y analysis on the drilled shaft according to BDM Section 305.1.2 to demonstrate lateral stability against:

A. Overturning failure in the Strength Limit State with the maximum estimated scour depth at the design flood, and
B. Overturning failure in the Extreme Event II Limit State with the maximum estimated scour depth at the check flood, and
C. Excessive deflection in the Service Limit State.

==========

LPile for Windows, Version 2022-12.011

Analysis of Individual Piles and Drilled Shafts
Subjected to Lateral Loading Using the p-y Method
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Files Used for Analysis

Path to file locations:
\20240280\ODOT\109971\400-Engineering\Structures\SFN_0800512\Engdata\04_Abutment Design\Stage 2\Drilled Shaft\Lpile\Wingwalls\Rear Abutment Wingwalls\

Name of input data file:
RA WW_Scour Strength 1 - Front DS.lp12d

Name of output report file:
RA WW_Scour Strength 1 - Front DS.lp12o

Name of plot output file:
RA WW_Scour Strength 1 - Front DS.lp12p

Name of runtime message file:
RA WW_Scour Strength 1 - Front DS.lp12r

Date and Time of Analysis

Date: February 12, 2026 Time: 13:45:56

Problem Title

Project Name:

Job Number:

Client:

Engineer:

Description:

Program Options and Settings

Computational Options:
- Conventional Analysis

Engineering Units Used for Data Input and Computations:
- US Customary System Units (pounds, feet, inches)

Analysis Control Options:

- Maximum number of iterations allowed	=	500
- Deflection tolerance for convergence	=	1.0000E-05 in
- Maximum allowable deflection	=	100.0000 in
- Number of pile increments	=	100

Loading Type and Number of Cycles of Loading:

- Static loading specified

- Analysis uses p-y modification factors for p-y curves
- Analysis uses layering correction (Method of Georgiadis)
- No distributed lateral loads are entered
- Loading by lateral soil movements acting on pile not selected
- Input of shear resistance at the pile tip not selected
- Input of moment resistance at the pile tip not selected
- Computation of pile-head foundation stiffness matrix not selected
- Push-over analysis of pile not selected
- Buckling analysis of pile not selected

Output Options:
- Output files use decimal points to denote decimal symbols.
- Values of pile-head deflection, bending moment, shear force, and soil reaction are printed for full length of pile.
- Printing Increment (nodal spacing of output points) = 1
- No p-y curves to be computed and reported for user-specified depths
- Print using wide report formats

Pile Structural Properties and Geometry

Number of pile sections defined = 2
Total length of pile = 38.200 ft
Depth of ground surface below top of pile = 18.0000 ft

Pile diameters used for p-y curve computations are defined using 4 points.

p-y curves are computed using pile diameter values interpolated with depth over the length of the pile. A summary of values of pile diameter vs. depth follows.

Point No.	Depth Below Pile Head feet	Pile Diameter inches
1	0.000	36.0000
2	33.200	36.0000
3	33.200	30.0000
4	38.200	30.0000

Input Structural Properties for Pile Sections:

Pile Section No. 1:

Section 1 is a round drilled shaft, bored pile, or CIDH pile
Length of section = 33.200000 ft
Shaft Diameter = 36.000000 in

Pile Section No. 2:

Section 2 is a round drilled shaft, bored pile, or CIDH pile
Length of section = 5.000000 ft
Shaft Diameter = 30.000000 in

Soil and Rock Layering Information

The soil profile is modelled using 2 layers

Layer 1 is stiff clay with water-induced erosion

Distance from top of pile to top of layer = 18.000000 ft
Distance from top of pile to bottom of layer = 33.200000 ft
Effective unit weight at top of layer = 67.600000 pcf
Effective unit weight at bottom of layer = 67.600000 pcf
Undrained cohesion at top of layer = 4800. psf
Undrained cohesion at bottom of layer = 4800. psf
Epsilon-50 at top of layer = 0.004000
Epsilon-50 at bottom of layer = 0.004000
Subgrade k at top of layer = 2000. pci
Subgrade k at bottom of layer = 2000. pci

Layer 2 is weak rock, p-y criteria by Reese, 1997

Distance from top of pile to top of layer = 33.200000 ft
Distance from top of pile to bottom of layer = 50.000000 ft
Effective unit weight at top of layer = 92.700000 pcf
Effective unit weight at bottom of layer = 92.700000 pcf
Uniaxial compressive strength at top of layer = 1640. psi
Uniaxial compressive strength at bottom of layer = 1640. psi
Initial modulus of rock at top of layer = 150000. psi
Initial modulus of rock at bottom of layer = 150000. 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

(Depth of the lowest soil layer extends 11.800 ft below the pile tip)

Summary of Input Soil Properties

Layer Num.	Soil Type or (p-y Curve Type)	Layer Depth ft	Effective Unit Wt. pcf	Cohesion psf	Uniaxial qu psi	RQD %	E50 krm	kpy pci	Rock Mass Modulus psi
1	Stiff Clay with Free Water	18.0000	67.6000	4800.	--	--	0.00400	2000.	--
		33.2000	67.6000	4800.	--	--	0.00400	2000.	--
2	Weak Rock	33.2000	92.7000	--	1640.	15.0000	5.00E-04	--	150000.
		50.0000	92.7000	--	1640.	15.0000	5.00E-04	--	150000.

Modification Factors for p-y Curves

Distribution of p-y modifiers with depth defined using 2 points

Point No.	Depth X ft	p-mult	y-mult
1	18.000	0.7000	1.0000
2	33.200	0.7000	1.0000

Static Loading Type

Static loading criteria were used when computing p-y curves for all analyses.

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 1

Load No.	Load Type	Condition 1	Condition 2	Axial Thrust Force, lbs	Compute Top y vs. Pile Length	Run Analysis
1	5	y = 2.200000 in	S = 0.0000 in/in	229860.	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 = 2

Pile Section No. 1:

Dimensions and Properties of Drilled Shaft (Bored Pile):

Length of Section	=	33.200000 ft
Shaft Diameter	=	36.000000 in
Concrete Cover Thickness (to edge of trans. reinf.)	=	6.000000 in
Number of Reinforcing Bars	=	17 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	=	21.590000 sq. in.
Area Ratio of Steel Reinforcement	=	2.12 percent
Edge-to-Edge Bar Spacing	=	2.676940 in
Maximum Concrete Aggregate Size	=	0.375000 in
Ratio of Bar Spacing to Aggregate Size	=	7.14

Offset of Center of Rebar Cage from Center of Pile = 0.0000 in
Transverse Reinforcement
Type: Hoop
Number of Transverse Reinf. (per spacing) = 1
Spacing of Transverse Reinf. = 4.500000 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 = 4682.772 kips
Tensile Load for Cracking of Concrete = -486.599 kips
Nominal Axial Tensile Capacity = -1295.400 kips

Reinforcing Bar Dimensions and Positions Used in Computations:

Bar Number	Bar Diam. inches	Bar Area sq. in.	X inches	Y inches
1	1.270000	1.270000	10.740000	0.00000
2	1.270000	1.270000	10.014752	3.879735
3	1.270000	1.270000	7.936956	7.235491
4	1.270000	1.270000	4.787230	9.614054
5	1.270000	1.270000	0.990962	10.694185
6	1.270000	1.270000	-2.93914	10.330007
7	1.270000	1.270000	-6.47230	8.570705
8	1.270000	1.270000	-9.13133	5.653881
9	1.270000	1.270000	-10.55713	1.973470
10	1.270000	1.270000	-10.55713	-1.97347
11	1.270000	1.270000	-9.13133	-5.65388
12	1.270000	1.270000	-6.47230	-8.57071
13	1.270000	1.270000	-2.93914	-10.33001
14	1.270000	1.270000	0.990962	-10.69419
15	1.270000	1.270000	4.787230	-9.61405
16	1.270000	1.270000	7.936956	-7.23549
17	1.270000	1.270000	10.014752	-3.87974

NOTE: The positions of the above rebars were computed by LPile

Minimum spacing between any two bars not equal to zero = 2.677 inches
between bars 6 and 7.

Ratio of bar spacing to maximum aggregate size = 7.14

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 = 0.375000 in

Number of Axial Thrust Force Values Determined from Pile-head Loadings = 1

Number	Axial Thrust Force kips
1	229.860

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 = 229.860 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	232.4045005	371847201.	94.6661222	0.00005917	0.00003667	0.2465369	1.5951110	
0.00000125	464.8245841	371859667.	56.3511482	0.00007044	0.00002544	0.2922470	1.8013041	
0.00000188	697.2343509	371858320.	43.5875089	0.00008173	0.00001423	0.3377381	2.0079333	

```
0.00000250   929.6286528    371851461.    37.2117035    0.00009303    0.00000303
0.3830090     2.2149985
0.00000313         1162.    371834519.    33.3909549     0.0001043   -0.00000815
0.4280577     2.4224928
0.00000375         1394.    371751127.    30.8469415     0.0001157   -0.00001932
0.4728711     2.6303299
0.00000438         1626.    371568016.    29.0315848     0.0001270   -0.00003049
0.5174327     2.8383947
0.00000500         1856.    371293342.    27.6711335     0.0001384   -0.00004164
0.5617321     3.0466143
0.00000563         2087.    370944490.    26.6136899     0.0001497   -0.00005280
0.6057629     3.2549456
0.00000625         2316.    370537080.    25.7682008     0.0001611   -0.00006395
0.6495213     3.4633614
0.00000688         2544.    370083488.    25.0767690     0.0001724   -0.00007510
0.6930046     3.6718433
0.00000750         2772.    369593234.    24.5008233     0.0001838   -0.00008624
0.7362109     3.8803791
0.00000813         2999.    369073562.    24.0136756     0.0001951   -0.00009739
0.7791391     4.0889598
0.00000875         2999.    342711164.    21.6007799     0.0001890     -0.000126
0.7554369     3.7912301 C
0.00000938         2999.    319863753.    21.0564434     0.0001974     -0.000140
0.7870058     3.9140413 C
0.00001000         2999.    299872269.    20.5672654     0.0002057     -0.000154
0.8179322     4.0331094 C
0.00001063         2999.    282232724.    20.1266743     0.0002138     -0.000169
0.8483515     4.1494240 C
0.00001125         2999.    266553128.    19.7273632     0.0002219     -0.000183
0.8783006     4.2632297 C
0.00001188         2999.    252524016.    19.3633938     0.0002299     -0.000198
0.9078106     4.3747323 C
0.00001250         2999.    239897815.    19.0299705     0.0002379     -0.000212
0.9369091     4.4841147 C
0.00001313         2999.    228474110.    18.7233403     0.0002457     -0.000227
0.9656295     4.5916088 C
0.00001375         2999.    218088923.    18.4405720     0.0002536     -0.000241
0.9940119     4.6975031 C
0.00001438         2999.    208606796.    18.1793086     0.0002613     -0.000256
1.0220986     4.8021118 C
0.00001500         2999.    199914846.    17.9352594     0.0002690     -0.000271
1.0498049    -4.961059 C
0.00001563         3053.    195365334.    17.7087692     0.0002767     -0.000286
1.0772696    -5.270401 C
0.00001625         3119.    191921298.    17.4977558     0.0002843     -0.000301
1.1044922    -5.580658 C
0.00001688         3184.    188682582.    17.2992262     0.0002919     -0.000316
1.1313966    -5.892454 C
0.00001750         3249.    185661031.    17.1143635     0.0002995     -0.000330
1.1581435    -6.204510 C
```

0.00001813 3313. 182799990. 16.9389430 0.0003070 -0.000345
1.1845518 -6.518305 C
0.00001875 3377. 180122251. 16.7751395 0.0003145 -0.000360
1.2108316 -6.832141 C
0.00001938 3441. 177582679. 16.6194180 0.0003220 -0.000375
1.2368186 -7.147374 C
0.00002000 3504. 175189779. 16.4728801 0.0003295 -0.000391
1.2626454 -7.462925 C
0.00002063 3567. 172927852. 16.3344146 0.0003369 -0.000406
1.2882920 -7.778966 C
0.00002125 3629. 170774742. 16.2022692 0.0003443 -0.000421
1.3136847 -8.096118 C
0.00002188 3691. 168741639. 16.0778693 0.0003517 -0.000436
1.3389720 -8.413152 C
0.00002250 3753. 166805193. 15.9592050 0.0003591 -0.000451
1.3640468 -8.730969 C
0.00002313 3815. 164958313. 15.8458084 0.0003664 -0.000466
1.3889159 -9.049521 C
0.00002375 3876. 163205906. 15.7385713 0.0003738 -0.000481
1.4136809 -9.367957 C
0.00002438 3937. 161535866. 15.6364951 0.0003811 -0.000496
1.4382961 -9.686665 C
0.00002563 4059. 158402062. 15.4441221 0.0003958 -0.000527
1.4869133 -10.326324 C
0.00002688 4180. 155544382. 15.2696195 0.0004104 -0.000557
1.5350510 -10.966103 C
0.00002813 4300. 152905625. 15.1078298 0.0004249 -0.000588
1.5824694 -11.608114 C
0.00002938 4420. 150482922. 14.9602007 0.0004395 -0.000618
1.6294790 -12.249665 C
0.00003063 4540. 148228875. 14.8224540 0.0004539 -0.000649
1.6757842 -12.893396 C
0.00003188 4658. 146140465. 14.6953857 0.0004684 -0.000679
1.7216338 -13.537115 C
0.00003313 4777. 144201952. 14.5781083 0.0004829 -0.000710
1.7670727 -14.180414 C
0.00003438 4894. 142380080. 14.4675089 0.0004973 -0.000740
1.8118048 -14.826015 C
0.00003563 5012. 140679224. 14.3648980 0.0005117 -0.000771
1.8561339 -15.471152 C
0.00003688 5129. 139087046. 14.2696792 0.0005262 -0.000801
1.9000588 -16.115825 C
0.00003813 5246. 137587358. 14.1801010 0.0005406 -0.000832
1.9434591 -16.761163 C
0.00003938 5362. 136170181. 14.0953961 0.0005550 -0.000862
1.9863097 -17.407432 C
0.00004063 5478. 134834246. 14.0163043 0.0005694 -0.000893
2.0287576 -18.053229 C
0.00004188 5593. 133572247. 13.9423249 0.0005838 -0.000924
2.0708015 -18.698552 C

0.00004313 5709. 132377726. 13.8730153 0.0005983 -0.000954
2.1124401 -19.343398 C
0.00004438 5824. 131238628. 13.8065619 0.0006127 -0.000985
2.1534904 -19.989593 C
0.00004563 5938. 130155128. 13.7437796 0.0006271 -0.001015
2.1940932 -20.635749 C
0.00004688 6053. 129124224. 13.6847031 0.0006415 -0.001046
2.2342918 -21.281419 C
0.00004813 6167. 128141790. 13.6290456 0.0006559 -0.001077
2.2740849 -21.926601 C
0.00004938 6281. 127204119. 13.5765492 0.0006703 -0.001107
2.3134712 -22.571291 C
0.00005063 6394. 126307869. 13.5269818 0.0006848 -0.001138
2.3524492 -23.215488 C
0.00005188 6508. 125447962. 13.4795585 0.0006993 -0.001168
2.3909373 -23.860053 C
0.00005313 6621. 124621243. 13.4339511 0.0007137 -0.001199
2.4289121 -24.505255 C
0.00005438 6733. 123827998. 13.3907633 0.0007281 -0.001229
2.4664792 -25.149952 C
0.00005563 6846. 123065954. 13.3498318 0.0007426 -0.001260
2.5036372 -25.794140 C
0.00005688 6958. 122333031. 13.3110103 0.0007571 -0.001290
2.5403849 -26.437815 C
0.00005813 7070. 121627326. 13.2741645 0.0007716 -0.001321
2.5767206 -27.080974 C
0.00005938 7181. 120947097. 13.2391714 0.0007861 -0.001351
2.6126431 -27.723615 C
0.00006063 7293. 120290744. 13.2059183 0.0008006 -0.001382
2.6481508 -28.365733 C
0.00006188 7404. 119656800. 13.1743015 0.0008152 -0.001412
2.6832423 -29.007326 C
0.00006313 7515. 119043908. 13.1442255 0.0008297 -0.001443
2.7179161 -29.648391 C
0.00006438 7625. 118448886. 13.1148565 0.0008443 -0.001473
2.7520571 -30.290314 C
0.00006563 7735. 117872319. 13.0867680 0.0008588 -0.001504
2.7857621 -30.931931 C
0.00006688 7845. 117313478. 13.0600112 0.0008734 -0.001534
2.8190491 -31.573001 C
0.00006813 7955. 116771366. 13.0345146 0.0008880 -0.001565
2.8519165 -32.213522 C
0.00006938 8065. 116245058. 13.0102135 0.0009026 -0.001595
2.8843628 -32.853489 C
0.00007063 8174. 115733692. 12.9870434 0.0009172 -0.001625
2.9163864 -33.492899 C
0.00007188 8283. 115236469. 12.9649482 0.0009319 -0.001656
2.9479858 -34.131748 C
0.00007313 8391. 114752641. 12.9438747 0.0009465 -0.001686
2.9791593 -34.770033 C

```
0.00007438        8500.    114281511.    12.9237731     0.0009612     -0.001716
3.0099054    -35.407750 C
0.00007938        8931.    112511584.    12.8522005     0.0010201     -0.001837
3.1285816    -37.952854 C
0.00008438        9357.    110899620.    12.7929562     0.0010794     -0.001958
3.2402840    -40.488550 C
0.00008938        9779.    109416331.    12.7429240     0.0011389     -0.002079
3.3447247    -43.017544 C
0.00009438       10196.    108041447.    12.7010293     0.0011987     -0.002199
3.4419479    -45.537352 C
0.00009938       10609.    106757909.    12.6679879     0.0012589     -0.002319
3.5318939    -48.046655 C
 0.0001044       11017.    105551359.    12.6412200     0.0013194     -0.002438
3.6144328    -50.545120 C
 0.0001094       11420.    104410002.    12.6204274     0.0013804     -0.002557
3.6894288    -53.032394 C
 0.0001144       11818.    103324039.    12.6049395     0.0014417     -0.002676
3.7567391    -55.508104 C
 0.0001194       12210.    102285245.    12.5942045     0.0015034     -0.002794
3.8162135    -57.971852 C
 0.0001244       12597.    101280798.    12.5875329     0.0015656     -0.002912
3.8676716    -60.000000 CY
 0.0001294       12959.    100167760.    12.5788471     0.0016274     -0.003030
3.9104896    -60.000000 CY
 0.0001344       13262.     98695293.    12.5558398     0.0016872     -0.003150
3.9440169    -60.000000 CY
 0.0001394       13514.     96964337.    12.5238120     0.0017455     -0.003272
3.9690883    -60.000000 CY
 0.0001444       13738.     95153677.    12.4868181     0.0018028     -0.003395
3.9865747    -60.000000 CY
 0.0001494       13933.     93275809.    12.4480048     0.0018594     -0.003518
3.9967724    -60.000000 CY
 0.0001544       14109.     91395799.    12.4078032     0.0019155     -0.003642
3.9994959    -60.000000 CY
 0.0001594       14271.     89541596.    12.3692988     0.0019714     -0.003766
3.9999989    -60.000000 CY
 0.0001644       14412.     87679482.    12.3260868     0.0020261     -0.003891
3.9999327    -60.000000 CY
 0.0001694       14540.     85843751.    12.2881132     0.0020813     -0.004016
3.9996200    -60.000000 CY
 0.0001744       14660.     84072552.    12.2508161     0.0021362     -0.004141
3.9988110    -60.000000 CY
 0.0001794       14771.     82348039.    12.2151005     0.0021911     -0.004266
3.9971502    -60.000000 CY
 0.0001844       14870.     80648264.    12.1792624     0.0022456     -0.004392
3.9999625    -60.000000 CY
 0.0001894       14957.     78981223.    12.1439103     0.0022998     -0.004518
3.9990113    -60.000000 CY
 0.0001944       15039.     77369828.    12.1088370     0.0023537     -0.004644
3.9963314    -60.000000 CY
```

0.0001994	15118.	75826589.	12.0799685	0.0024084	-0.004769
3.9997072	-60.000000 CY				
0.0002044	15193.	74338584.	12.0512188	0.0024630	-0.004895
3.9973347	-60.000000 CY				
0.0002094	15259.	72881068.	12.0211994	0.0025169	-0.005021
3.9998871	-60.000000 CY				
0.0002144	15319.	71459590.	11.9916529	0.0025707	-0.005147
3.9973312	-60.000000 CY				
0.0002194	15373.	70078143.	11.9626350	0.0026243	-0.005273
3.9998318	-60.000000 CY				
0.0002244	15422.	68732686.	11.9341198	0.0026777	-0.005400
3.9963870	-60.000000 CY				
0.0002294	15469.	67441088.	11.9078389	0.0027314	-0.005526
3.9994585	-60.000000 CY				
0.0002344	15516.	66199831.	11.8836785	0.0027852	-0.005652
3.9959152	-60.000000 CY				
0.0002394	15560.	65003244.	11.8612957	0.0028393	-0.005778
3.9983779	-60.000000 CY				
0.0002444	15603.	63848940.	11.8388420	0.0028931	-0.005904
3.9999768	-60.000000 CY				
0.0002494	15641.	62720170.	11.8189272	0.0029473	-0.006030
3.9958012	-60.000000 CY				
0.0002544	15676.	61627210.	11.7984390	0.0030012	-0.006156
3.9990068	-60.000000 CY				
0.0002594	15707.	60558110.	11.7758173	0.0030544	-0.006283
3.9995973	-60.000000 CY				
0.0002644	15736.	59522037.	11.7574046	0.0031084	-0.006409
3.9955713	-60.000000 CY				
0.0002694	15761.	58510276.	11.7370000	0.0031617	-0.006536
3.9987177	-60.000000 CY				
0.0002744	15786.	57533651.	11.7178641	0.0032151	-0.006662
3.9999757	-60.000000 CY				
0.0003044	15915.	52288610.	11.6193587	0.0035366	-0.007421
3.9974113	-60.000000 CYT				
0.0003344	15943.	47680870.	11.5651361	0.0038671	-0.008170
3.9999676	-60.000000 CYT				

Summary of Results for Nominal Moment Capacity for Section 1

Moment values interpolated at maximum compressive strain = 0.003
or maximum developed moment if pile fails at smaller strains.

Load No.	Axial Thrust kips	Nominal Mom. Cap. in-kip	Max. Comp. Strain	Max. Tens. Strain
----	---	---	---	

```
------------
   1               229.860             15675.611           0.00300000
-0.00615340

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         229.860000        15676.    149.409000        10189.
108065380.

   1       0.75         229.860000        15676.    172.395000        11757.
103490488.

   1       0.90         229.860000        15676.    206.874000        14108.
91408358.


Pile Section No. 2:
-------------------

Dimensions and Properties of Drilled Shaft (Bored Pile):
-------------------------------------------------------

Length of Section                                    =     5.000000 ft
Shaft Diameter                                       =    30.000000 in
Concrete Cover Thickness (to edge of trans. reinf.)  =     3.000000 in
Number of Reinforcing Bars                           =           17 bars
Yield Stress of Reinforcing Bars                     =       60000. psi
Modulus of Elasticity of Reinforcing Bars            =    29000000. psi
Gross Area of Shaft                                  =   706.858347 sq. in.
Total Area of Reinforcing Steel                      =    21.590000 sq. in.
```

Area Ratio of Steel Reinforcement = 3.05 percent
Edge-to-Edge Bar Spacing = 2.676940 in
Maximum Concrete Aggregate Size = 0.375000 in
Ratio of Bar Spacing to Aggregate Size = 7.14
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. = 4.500000 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 = 3625.312 kips
Tensile Load for Cracking of Concrete = -357.244 kips
Nominal Axial Tensile Capacity = -1295.400 kips

Reinforcing Bar Dimensions and Positions Used in Computations:

Bar Number	Bar Diam. inches	Bar Area sq. in.	X inches	Y inches
1	1.270000	1.270000	10.740000	0.00000
2	1.270000	1.270000	10.014752	3.879735
3	1.270000	1.270000	7.936956	7.235491
4	1.270000	1.270000	4.787230	9.614054
5	1.270000	1.270000	0.990962	10.694185
6	1.270000	1.270000	-2.93914	10.330007
7	1.270000	1.270000	-6.47230	8.570705
8	1.270000	1.270000	-9.13133	5.653881
9	1.270000	1.270000	-10.55713	1.973470
10	1.270000	1.270000	-10.55713	-1.97347
11	1.270000	1.270000	-9.13133	-5.65388
12	1.270000	1.270000	-6.47230	-8.57071
13	1.270000	1.270000	-2.93914	-10.33001
14	1.270000	1.270000	0.990962	-10.69419
15	1.270000	1.270000	4.787230	-9.61405
16	1.270000	1.270000	7.936956	-7.23549
17	1.270000	1.270000	10.014752	-3.87974

NOTE: The positions of the above rebars were computed by LPile

Minimum spacing between any two bars not equal to zero = 2.677 inches
between bars 6 and 7.

Ratio of bar spacing to maximum aggregate size = 7.14

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	=	0.375000 in

Number of Axial Thrust Force Values Determined from Pile-head Loadings = 1

Number	Axial Thrust Force kips
1	229.860

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 = 229.860 kips

Bending Curvature rad/in.	Bending Moment in-kip	Bending Stiffness kip-in2	Depth to N Axis in	Max Comp Strain in/in	Max Tens Strain in/in	Max Conc Stress ksi	Max Steel Stress ksi	Run Msg
0.00000125	242.2472814	193797825.	67.8331733	0.00008479	0.00004729	0.3507730	2.3230150	

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0.00000250   484.5104119    193804165.    41.4403171     0.0001036    0.00002860
0.4258192     2.7325480
0.00000375   726.7478580    193799429.    32.6532179     0.0001224    0.00000995
0.5002421     3.1432250
0.00000500   968.9376412    193787528.    28.2675216     0.0001413   -0.00000866
0.5740362     3.5550406
0.00000625        1211.     193722027.    25.6413230     0.0001603   -0.00002724
0.6471706     3.9678023
0.00000750        1452.     193562500.    23.8932625     0.0001792   -0.00004580
0.7195949     4.3811596
0.00000875        1692.     193320997.    22.6457436     0.0001982   -0.00006435
0.7912792     4.7949052
0.00001000        1930.     193016394.    21.7117764     0.0002171   -0.00008288
0.8622066     5.2089206
0.00001125        2167.     192664350.    20.9856659     0.0002361    -0.000101
0.9323669     5.6231360
0.00001250        2167.     173397915.    19.1830621     0.0002398    -0.000135
0.9453972     5.5944850 C
0.00001375        2167.     157634468.    18.5230878     0.0002547    -0.000158
0.9996995     5.8907862 C
0.00001500        2167.     144498262.    17.9570436     0.0002694    -0.000181
1.0526343     6.1800742 C
0.00001625        2189.     134735097.    17.4655930     0.0002838    -0.000204
1.1043654     6.4634733 C
0.00001750        2290.     130871487.    17.0344923     0.0002981    -0.000227
1.1550241     6.7418917 C
0.00001875        2389.     127414090.    16.6538115     0.0003123    -0.000250
1.2047643     7.0164533 C
0.00002000        2486.     124292520.    16.3139543     0.0003263    -0.000274
1.2535907     7.2870942 C
0.00002125        2581.     121469346.    16.0091553     0.0003402    -0.000297
1.3016231     7.5547055 C
0.00002250        2675.     118905036.    15.7342272     0.0003540    -0.000321
1.3489210     7.8197078 C
0.00002375        2768.     116561667.    15.4844542     0.0003678    -0.000345
1.3954934     8.0821053 C
0.00002500        2860.     114414168.    15.2566465     0.0003814    -0.000369
1.4413977     8.3423188 C
0.00002625        2952.     112444131.    15.0485794     0.0003950    -0.000392
1.4867212     8.6010437 C
0.00002750        3042.     110632148.    14.8580207     0.0004086    -0.000416
1.5315158     -9.085060 C
0.00002875        3132.     108947613.    14.6814069     0.0004221    -0.000440
1.5756485     -9.645314 C
0.00003000        3222.     107392862.    14.5191406     0.0004356    -0.000464
1.6193516    -10.205848 C
0.00003125        3311.     105940450.    14.3678643     0.0004490    -0.000489
1.6624555    -10.768186 C
0.00003250        3399.     104592121.    14.2281645     0.0004624    -0.000513
1.7051594    -11.330580 C
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0.00003375        3487.    103324322.    14.0969097     0.0004758     -0.000537
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1.8302127    -13.024227 C
0.00003750        3749.     99979471.    13.7535213     0.0005158     -0.000609
1.8709972    -13.589914 C
0.00003875        3836.     98995254.    13.6535605     0.0005291     -0.000633
1.9114329    -14.155240 C
0.00004000        3922.     98058482.    13.5582125     0.0005423     -0.000658
1.9512826    -14.722461 C
0.00004125        4008.     97174507.    13.4688718     0.0005556     -0.000682
1.9907768    -15.289408 C
0.00004250        4094.     96339029.    13.3850800     0.0005689     -0.000706
2.0299239    -15.855993 C
0.00004375        4180.     95543451.    13.3054412     0.0005821     -0.000730
2.0686013    -16.423409 C
0.00004500        4265.     94785434.    13.2297490     0.0005953     -0.000755
2.1068380    -16.991394 C
0.00004625        4351.     94065200.    13.1584397     0.0006086     -0.000779
2.1447288    -17.559014 C
0.00004750        4436.     93379753.    13.0911491     0.0006218     -0.000803
2.1822727    -18.126268 C
0.00004875        4520.     92724384.    13.0271174     0.0006351     -0.000827
2.2194008    -18.693850 C
0.00005125        4689.     91494057.    12.9073745     0.0006615     -0.000876
2.2923755    -19.830397 C
0.00005375        4857.     90367176.    12.7997606     0.0006880     -0.000925
2.3639626    -20.965456 C
0.00005625        5025.     89326122.    12.7016360     0.0007145     -0.000973
2.4339936    -22.100769 C
0.00005875        5191.     88359982.    12.6115632     0.0007409     -0.001022
2.5024713    -23.236322 C
0.00006125        5357.     87462978.    12.5297787     0.0007674     -0.001070
2.5695521    -24.370344 C
0.00006375        5522.     86626891.    12.4552444     0.0007940     -0.001118
2.6352279    -25.502819 C
0.00006625        5687.     85840484.    12.3857789     0.0008206     -0.001167
2.6992487    -26.636635 C
0.00006875        5851.     85102169.    12.3219237     0.0008471     -0.001215
2.7618413    -27.769102 C
0.00007125        6014.     84407136.    12.2631499     0.0008737     -0.001264
2.8230177    -28.899967 C
0.00007375        6177.     83750904.    12.2092659     0.0009004     -0.001312
2.8827692    -30.029215 C
0.00007625        6339.     83129583.    12.1596548     0.0009272     -0.001360
2.9410873    -31.156827 C
0.00007875        6500.     82537815.    12.1132216     0.0009539     -0.001409
2.9978109    -32.284867 C
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0.00008125        6660.    81974295.    12.0699377    0.0009807    -0.001457
3.0530540   -33.411772 C
0.00008375        6820.    81436917.    12.0299404    0.0010075    -0.001505
3.1068490   -34.536970 C
0.00008625        6980.    80923338.    11.9929516    0.0010344    -0.001553
3.1591866   -35.660443 C
0.00008875        7138.    80431477.    11.9584616    0.0010613    -0.001601
3.2100575   -36.782171 C
0.00009125        7296.    79959476.    11.9267683    0.0010883    -0.001649
3.2594521   -37.902135 C
0.00009375        7454.    79505678.    11.8974227    0.0011154    -0.001697
3.3073608   -39.020315 C
0.00009625        7610.    79068595.    11.8702492    0.0011425    -0.001745
3.3537736   -40.136691 C
0.00009875        7766.    78646720.    11.8450287    0.0011697    -0.001793
3.3986604   -41.251594 C
 0.0001013        7922.    78238356.    11.8213440    0.0011969    -0.001841
3.4419512   -42.366141 C
 0.0001038        8076.    77843175.    11.7992194    0.0012242    -0.001888
3.4837249   -43.478786 C
 0.0001063        8230.    77460179.    11.7787608    0.0012515    -0.001936
3.5239708   -44.589505 C
 0.0001088        8383.    77088459.    11.7598610    0.0012789    -0.001984
3.5626781   -45.698276 C
 0.0001113        8536.    76727187.    11.7424224    0.0013063    -0.002031
3.5998355   -46.805072 C
 0.0001138        8688.    76375607.    11.7263563    0.0013339    -0.002079
3.6354317   -47.909870 C
 0.0001163        8839.    76033025.    11.7115819    0.0013615    -0.002126
3.6694553   -49.012643 C
 0.0001188        8989.    75698807.    11.6977519    0.0013891    -0.002173
3.7018945   -50.113363 C
 0.0001213        9139.    75372365.    11.6853529    0.0014168    -0.002221
3.7327372   -51.212006 C
 0.0001238        9288.    75053161.    11.6740433    0.0014447    -0.002268
3.7619712   -52.308544 C
 0.0001263        9436.    74740697.    11.6637660    0.0014726    -0.002315
3.7895840   -53.402947 C
 0.0001288        9583.    74434512.    11.6544709    0.0015005    -0.002362
3.8155629   -54.495187 C
 0.0001313        9730.    74134178.    11.6461086    0.0015286    -0.002409
3.8398949   -55.585234 C
 0.0001338        9876.    73839299.    11.6386333    0.0015567    -0.002456
3.8625666   -56.673057 C
 0.0001363       10021.    73549506.    11.6320037    0.0015849    -0.002503
3.8835646   -57.758626 C
 0.0001388       10165.    73264454.    11.6261818    0.0016131    -0.002549
3.9028749   -58.841907 C
 0.0001413       10309.    72983821.    11.6211233    0.0016415    -0.002596
3.9204835   -59.922868 C
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 0.0001438        10449.     72690960.    11.6159564     0.0016698     -0.002643
3.9363101    -60.000000 CY
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3.9502817    -60.000000 CY
 0.0001488        10709.     71993305.    11.6009623     0.0017256     -0.002737
3.9623850    -60.000000 CY
 0.0001588        11124.     70071469.    11.5449405     0.0018328     -0.002930
3.9932856    -60.000000 CY
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3.9984096    -60.000000 CY
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3.9999690    -60.000000 CY
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3.9981802    -60.000000 CY
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3.9992723    -60.000000 CY
 0.0002188        12440.     56869846.    11.0940351     0.0024268     -0.004136
3.9996650    -60.000000 CY
 0.0002288        12562.     54917272.    11.0232538     0.0025216     -0.004341
3.9996887    -60.000000 CY
 0.0002388        12675.     53087613.    10.9580902     0.0026162     -0.004546
3.9994514    -60.000000 CY
 0.0002488        12781.     51381349.    10.8970561     0.0027106     -0.004752
3.9987145    -60.000000 CY
 0.0002588        12875.     49758825.    10.8373799     0.0028042     -0.004958
3.9969118    -60.000000 CY
 0.0002688        12956.     48207766.    10.7780052     0.0028966     -0.005166
3.9992143    -60.000000 CY
 0.0002788        13027.     46732348.    10.7193910     0.0029880     -0.005374
3.9991842    -60.000000 CY
 0.0002888        13095.     45352057.    10.6663072     0.0030799     -0.005583
3.9956585    -60.000000 CY
 0.0002988        13163.     44058966.    10.6175009     0.0031720     -0.005791
3.9997842    -60.000000 CY
 0.0003088        13225.     42833913.    10.5705143     0.0032636     -0.005999
3.9961773    60.0000000 CY
 0.0003188        13280.     41663672.    10.5242981     0.0033546     -0.006208
3.9997847    60.0000000 CY
 0.0003288        13326.     40536740.    10.4813496     0.0034457     -0.006417
3.9948261    60.0000000 CYT
 0.0003388        13367.     39461240.    10.4394134     0.0035364     -0.006626
3.9991966    60.0000000 CYT
 0.0003488        13401.     38425862.    10.4027951     0.0036280     -0.006835
3.9951739    60.0000000 CYT
 0.0003588        13432.     37441277.    10.3675260     0.0037193     -0.007043
3.9972005    60.0000000 CYT
 0.0003688        13460.     36501333.    10.3393584     0.0038126     -0.007250
3.9998970    60.0000000 CYT
```

Summary of Results for Nominal Moment Capacity for Section 2

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	229.860	13035.602	0.00300000	-0.00540159

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	229.860000	13036.	149.409000	8473.	76875833.
1	0.75	229.860000	13036.	172.395000	9777.	74040011.
1	0.90	229.860000	13036.	206.874000	11732.	65309301.

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	18.0000	0.00	N.A.	No	0.00	168434.
2	33.2000	15.2000	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 Displacement and Pile-head Rotation (Loading Type 5)
Displacement of pile head = 2.200000 inches
Rotation of pile head = 0.000E+00 radians
Axial load on pile head = 229860.0 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. Es*H lb/inch	Spr. Distrib. p Lat. Load lb/inch
0.00	2.2000	-1.42E+07	89631.	0.00	0.00	9.08E+10	0.00	0.00
0.3820	2.1984	-1.37E+07	89629.	-7.04E-04	0.00	9.08E+10	0.00	0.00
0.7640	2.1935	-1.33E+07	89629.	-0.00136	0.00	9.82E+10	0.00	0.00
1.1460	2.1859	-1.29E+07	89629.	-0.00197	0.00	1.00E+11	0.00	0.00
1.5280	2.1755	-1.25E+07	89629.	-0.00255	0.00	1.01E+11		

0.00 0.00 0.00
1.9100 2.1625 -1.21E+07 89629. -0.00310 0.00 1.03E+11
0.00 0.00 0.00
2.2920 2.1471 -1.17E+07 89629. -0.00363 0.00 1.04E+11
0.00 0.00 0.00
2.6740 2.1292 -1.13E+07 89629. -0.00413 0.00 1.05E+11
0.00 0.00 0.00
3.0560 2.1092 -1.09E+07 89629. -0.00461 0.00 1.06E+11
0.00 0.00 0.00
3.4380 2.0869 -1.04E+07 89629. -0.00507 0.00 1.07E+11
0.00 0.00 0.00
3.8200 2.0627 -1.00E+07 89629. -0.00551 0.00 1.09E+11
0.00 0.00 0.00
4.2020 2.0365 -9602923. 89629. -0.00592 0.00 1.10E+11
0.00 0.00 0.00
4.5840 2.0084 -9185620. 89629. -0.00631 0.00 1.12E+11
0.00 0.00 0.00
4.9660 1.9786 -8767918. 89629. -0.00667 0.00 1.13E+11
0.00 0.00 0.00
5.3480 1.9472 -8349843. 89629. -0.00702 0.00 1.15E+11
0.00 0.00 0.00
5.7300 1.9143 -7931416. 89629. -0.00734 0.00 1.17E+11
0.00 0.00 0.00
6.1120 1.8799 -7512662. 89629. -0.00764 0.00 1.19E+11
0.00 0.00 0.00
6.4940 1.8443 -7093603. 89629. -0.00792 0.00 1.21E+11
0.00 0.00 0.00
6.8760 1.8073 -6674261. 89629. -0.00817 0.00 1.24E+11
0.00 0.00 0.00
7.2580 1.7693 -6254661. 89629. -0.00841 0.00 1.27E+11
0.00 0.00 0.00
7.6400 1.7302 -5834823. 89629. -0.00863 0.00 1.31E+11
0.00 0.00 0.00
8.0220 1.6902 -5414770. 89629. -0.00882 0.00 1.36E+11
0.00 0.00 0.00
8.4040 1.6494 -4994525. 89629. -0.00899 0.00 1.41E+11
0.00 0.00 0.00
8.7860 1.6078 -4574108. 89629. -0.00914 0.00 1.48E+11
0.00 0.00 0.00
9.1680 1.5656 -4153541. 89629. -0.00928 0.00 1.56E+11
0.00 0.00 0.00
9.5500 1.5228 -3732847. 89629. -0.00939 0.00 1.67E+11
0.00 0.00 0.00
9.9320 1.4795 -3312044. 89629. -0.00948 0.00 1.83E+11
0.00 0.00 0.00
10.3140 1.4358 -2891154. 89629. -0.00954 0.00 3.69E+11
0.00 0.00 0.00
10.6960 1.3920 -2470226. 89629. -0.00957 0.00 3.70E+11
0.00 0.00 0.00
11.0780 1.3481 -2049266. 89629. -0.00960 0.00 3.71E+11

0.00 0.00 0.00
11.4600 1.3040 -1628279. 89629. -0.00962 0.00 3.72E+11
0.00 0.00 0.00
11.8420 1.2598 -1207271. 89629. -0.00964 0.00 3.72E+11
0.00 0.00 0.00
12.2240 1.2156 -786247. 89629. -0.00965 0.00 3.72E+11
0.00 0.00 0.00
12.6060 1.1713 -365213. 89629. -0.00966 0.00 3.72E+11
0.00 0.00 0.00
12.9880 1.1270 55826. 89629. -0.00966 0.00 3.72E+11
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13.3700 1.0828 476863. 89629. -0.00966 0.00 3.72E+11
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0.00 0.00 0.00
14.1340 0.9943 1318915. 89629. -0.00964 0.00 3.72E+11
0.00 0.00 0.00
14.5160 0.9501 1739918. 89629. -0.00962 0.00 3.71E+11
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14.8980 0.9061 2160899. 89629. -0.00959 0.00 3.71E+11
0.00 0.00 0.00
15.2800 0.8622 2581851. 89629. -0.00956 0.00 3.70E+11
0.00 0.00 0.00
15.6620 0.8184 3002769. 89629. -0.00951 0.00 2.00E+11
0.00 0.00 0.00
16.0440 0.7750 3423615. 89629. -0.00944 0.00 1.78E+11
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16.4260 0.7319 3844368. 89629. -0.00934 0.00 1.64E+11
0.00 0.00 0.00
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17.1900 0.6474 4685514. 89629. -0.00908 0.00 1.46E+11
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17.9540 0.5655 5526038. 89629. -0.00875 0.00 1.34E+11
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   21.3920     0.2509   8770790.     48781.   -0.00624       0.00   1.13E+11
-2093.     38240.       0.00
   21.7740     0.2231   8978803.     38781.   -0.00588       0.00   1.12E+11
-2270.     46641.       0.00
   22.1560     0.1969   9138736.     28052.   -0.00551       0.00   1.12E+11
-2412.     56130.       0.00
   22.5380     0.1725   9247598.     16751.   -0.00513       0.00   1.11E+11
-2519.     66918.       0.00
   22.9200     0.1499   9303133.      5039.   -0.00475       0.00   1.11E+11
-2591.     79261.       0.00
   23.3020     0.1290   9303809.     -6928.   -0.00437       0.00   1.11E+11
-2630.     93468.       0.00
   23.6840     0.1098   9248824.    -18990.   -0.00399       0.00   1.11E+11
-2633.    109899.       0.00
   24.0660    0.09242   9138111.    -30982.   -0.00361       0.00   1.12E+11
-2599.    128913.       0.00
   24.4480    0.07674   8972386.    -42683.   -0.00324       0.00   1.12E+11
-2506.    149690.       0.00
   24.8300    0.06274   8753617.    -53853.   -0.00288       0.00   1.13E+11
-2367.    172961.       0.00
   25.2120    0.05036   8484729.    -64348.   -0.00253       0.00   1.14E+11
-2212.    201315.       0.00
   25.5940    0.03955   8169005.    -74094.   -0.00220       0.00   1.16E+11
-2040.    236518.       0.00
   25.9760    0.03021   7810064.    -83020.   -0.00188       0.00   1.17E+11
-1854.    281277.       0.00
   26.3580    0.02227   7411847.    -91056.   -0.00159       0.00   1.20E+11
-1652.    340019.       0.00
   26.7400    0.01564   6978615.    -98131.   -0.00132       0.00   1.22E+11
-1435.    420638.       0.00
   27.1220    0.01020   6514954.   -104170.   -0.00107       0.00   1.25E+11
-1200.    539153.       0.00
   27.5040    0.00586   6025829.   -109056.  -8.41E-04       0.00   1.29E+11
-931.771    729182.       0.00
   27.8860    0.00249   5516900.   -112140.  -6.40E-04       0.00   1.34E+11
-413.922    761333.       0.00
   28.2680  -1.05E-05   4999074.   -113085.  -4.65E-04       0.00   1.41E+11
1.8178    790751.       0.00
   28.6500   -0.00177   4481116.   -112356.  -3.15E-04       0.00   1.49E+11
316.2482    820169.       0.00
   29.0320   -0.00289   3969657.   -110402.  -1.89E-04       0.00   1.61E+11
536.3472    849588.       0.00
   29.4140   -0.00350   3469350.   -107634.  -8.74E-05       0.00   1.76E+11
671.3521    879006.       0.00
   29.7960   -0.00370   2983055.   -104417.  -2.38E-05       0.00   3.69E+11
732.2852    908424.       0.00
   30.1780   -0.00372   2512108.   -101036.   1.03E-05       0.00   3.70E+11
```

```
742.5132    915101.       0.00
   30.5600   -0.00360   2056731.    -97660.   3.85E-05       0.00   3.71E+11
730.6046    930015.       0.00
   30.9420   -0.00337   1616680.    -94366.   6.12E-05       0.00   3.72E+11
706.3801    961906.       0.00
   31.3240   -0.00304   1191450.    -91209.   7.85E-05       0.00   3.72E+11
671.2759   1012207.       0.00
   31.7060   -0.00265    780311.    -88274.   9.07E-05       0.00   3.72E+11
609.3673   1055516.       0.00
   32.0880   -0.00221    381966.    -85679.   9.78E-05       0.00   3.72E+11
522.7592   1084934.       0.00
   32.4700   -0.00175     -5398.    -83506.   1.00E-04       0.00   3.72E+11
425.2863   1114352.       0.00
   32.8520   -0.00129   -383827.    -81793.   9.78E-05       0.00   3.72E+11
321.9946   1143770.       0.00
   33.2340  -8.53E-04   -755484.    -55801.   8.65E-05       0.00   1.94E+11
11018.   5.92E+07       0.00
   33.6160  -4.98E-04   -895596.     -9634.   6.69E-05       0.00   1.94E+11
9125.   8.40E+07       0.00
   33.9980  -2.40E-04   -843952.     23022.   4.64E-05       0.00   1.94E+11
5123.   9.80E+07       0.00
   34.3800  -7.28E-05   -684628.     38846.   2.83E-05       0.00   1.94E+11
1780.   1.12E+08       0.00
   34.7620   1.97E-05   -487875.     41687.   1.44E-05       0.00   1.94E+11
-540.622   1.26E+08       0.00
   35.1440   5.93E-05   -302469.     36297.   5.06E-06       0.00   1.94E+11
-1811.   1.40E+08       0.00
   35.5260   6.61E-05   -155111.     27056.  -3.47E-07       0.00   1.94E+11
-2221.   1.54E+08       0.00
   35.9080   5.61E-05    -54424.     17251.  -2.83E-06       0.00   1.94E+11
-2057.   1.68E+08       0.00
   36.2900   4.02E-05      3049.      8878.  -3.43E-06       0.00   1.94E+11
-1596.   1.82E+08       0.00
   36.6720   2.46E-05     26977.      2805.  -3.08E-06       0.00   1.94E+11
-1053.   1.96E+08       0.00
   37.0540   1.20E-05     28773.   -866.713  -2.42E-06       0.00   1.94E+11
-548.840   2.10E+08       0.00
   37.4360   2.45E-06     19036.     -2399.  -1.85E-06       0.00   1.94E+11
-119.730   2.24E+08       0.00
   37.8180  -5.01E-06      6782.     -2077.  -1.55E-06       0.00   1.94E+11
260.3890   2.38E+08       0.00
   38.2000  -1.17E-05       0.00       0.00  -1.47E-06       0.00   1.94E+11
645.6701   1.26E+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             =     2.20000000 inches
Computed slope at pile head      =       0.000000 radians
Maximum bending moment           =     -14159945. inch-lbs
Maximum shear force              =       -113085. lbs
Depth of maximum bending moment  =       0.000000 feet below pile head
Depth of maximum shear force     =    28.26800000 feet below pile head
Number of iterations             =             21
Number of zero deflection points =              3
Pile deflection at ground        =     0.56075416 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	Load 1	Load 2 Type	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	y, in	2.2000	S, rad	0.00	229860.	2.2000	0.00	-113085.	-1.42E+07

Maximum pile-head deflection = 2.2000000000 inches
Maximum pile-head rotation = 0.0000000000 radians = 0.000000 deg.

Summary of Warning Messages

The following warning was reported 308 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.

==========

LPile for Windows, Version 2022-12.011

Analysis of Individual Piles and Drilled Shafts
Subjected to Lateral Loading Using the p-y Method
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Files Used for Analysis

Path to file locations:
\20240280\ODOT\109971\400-Engineering\Structures\SFN_0800512\Engdata\04_Abutment Design\Stage 2\Drilled Shaft\Lpile\Wingwalls\Rear Abutment Wingwalls\

Name of input data file:
RA WW_Scour Strength 1 - Back DS.lp12d

Name of output report file:
RA WW_Scour Strength 1 - Back DS.lp12o

Name of plot output file:
RA WW_Scour Strength 1 - Back DS.lp12p

Name of runtime message file:
RA WW_Scour Strength 1 - Back DS.lp12r

Date and Time of Analysis

Date: February 12, 2026 Time: 13:45:27

Problem Title

Project Name:

Job Number:

Client:

Engineer:

Description:

Program Options and Settings

Computational Options:
- Conventional Analysis

Engineering Units Used for Data Input and Computations:
- US Customary System Units (pounds, feet, inches)

Analysis Control Options:

- Maximum number of iterations allowed	=	500
- Deflection tolerance for convergence	=	1.0000E-05 in
- Maximum allowable deflection	=	100.0000 in
- Number of pile increments	=	100

Loading Type and Number of Cycles of Loading:

- Static loading specified

- Analysis uses p-y modification factors for p-y curves
- Analysis uses layering correction (Method of Georgiadis)
- No distributed lateral loads are entered
- Loading by lateral soil movements acting on pile not selected
- Input of shear resistance at the pile tip not selected
- Input of moment resistance at the pile tip not selected
- Computation of pile-head foundation stiffness matrix not selected
- Push-over analysis of pile not selected
- Buckling analysis of pile not selected

Output Options:
- Output files use decimal points to denote decimal symbols.
- Values of pile-head deflection, bending moment, shear force, and soil reaction are printed for full length of pile.
- Printing Increment (nodal spacing of output points) = 1
- No p-y curves to be computed and reported for user-specified depths
- Print using wide report formats

Pile Structural Properties and Geometry

Number of pile sections defined = 2
Total length of pile = 38.200 ft
Depth of ground surface below top of pile = 18.0000 ft

Pile diameters used for p-y curve computations are defined using 4 points.

p-y curves are computed using pile diameter values interpolated with depth over the length of the pile. A summary of values of pile diameter vs. depth follows.

Point No.	Depth Below Pile Head feet	Pile Diameter inches
1	0.000	36.0000
2	33.200	36.0000
3	33.200	30.0000
4	38.200	30.0000

Input Structural Properties for Pile Sections:

Pile Section No. 1:

Section 1 is a round drilled shaft, bored pile, or CIDH pile
Length of section = 33.200000 ft
Shaft Diameter = 36.000000 in

Pile Section No. 2:

Section 2 is a round drilled shaft, bored pile, or CIDH pile
Length of section = 5.000000 ft
Shaft Diameter = 30.000000 in

Soil and Rock Layering Information

The soil profile is modelled using 2 layers

Layer 1 is stiff clay with water-induced erosion

Distance from top of pile to top of layer = 18.000000 ft
Distance from top of pile to bottom of layer = 33.200000 ft
Effective unit weight at top of layer = 67.600000 pcf
Effective unit weight at bottom of layer = 67.600000 pcf
Undrained cohesion at top of layer = 4800. psf
Undrained cohesion at bottom of layer = 4800. psf
Epsilon-50 at top of layer = 0.004000
Epsilon-50 at bottom of layer = 0.004000
Subgrade k at top of layer = 2000. pci
Subgrade k at bottom of layer = 2000. pci

Layer 2 is weak rock, p-y criteria by Reese, 1997

Distance from top of pile to top of layer = 33.200000 ft
Distance from top of pile to bottom of layer = 50.000000 ft
Effective unit weight at top of layer = 92.700000 pcf
Effective unit weight at bottom of layer = 92.700000 pcf
Uniaxial compressive strength at top of layer = 1640. psi
Uniaxial compressive strength at bottom of layer = 1640. psi
Initial modulus of rock at top of layer = 150000. psi
Initial modulus of rock at bottom of layer = 150000. 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

(Depth of the lowest soil layer extends 11.800 ft below the pile tip)

Summary of Input Soil Properties

Layer Num.	Soil Type or (p-y Curve Type)	Layer Depth ft	Effective Unit Wt. pcf	Cohesion psf	Uniaxial qu psi	RQD %	E50 krm	Rock Mass kpy	Modulus pci	Rock Mass Modulus psi
1	Stiff Clay with Free Water	18.0000	67.6000	4800.	--	--	0.00400	2000.	--	
		33.2000	67.6000	4800.	--	--	0.00400	2000.	--	
2	Weak Rock	33.2000	92.7000	--	1640.	15.0000	5.00E-04	--	150000.	
		50.0000	92.7000	--	1640.	15.0000	5.00E-04	--	150000.	

Modification Factors for p-y Curves

Distribution of p-y modifiers with depth defined using 2 points

Point No.	Depth X ft	p-mult	y-mult
1	18.000	0.5000	1.0000
2	33.200	0.5000	1.0000

Static Loading Type

Static loading criteria were used when computing p-y curves for all analyses.

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 1

Load No.	Load Type	Condition 1	Condition 2	Axial Thrust Force, lbs	Compute Top y vs. Pile Length	Run Analysis
1	5	y = 2.200000 in	S = 0.0000 in/in	146310.	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 = 2

Pile Section No. 1:

Dimensions and Properties of Drilled Shaft (Bored Pile):

Length of Section	=	33.200000 ft
Shaft Diameter	=	36.000000 in
Concrete Cover Thickness (to edge of trans. reinf.)	=	6.000000 in
Number of Reinforcing Bars	=	17 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	=	21.590000 sq. in.
Area Ratio of Steel Reinforcement	=	2.12 percent
Edge-to-Edge Bar Spacing	=	2.676940 in
Maximum Concrete Aggregate Size	=	0.375000 in
Ratio of Bar Spacing to Aggregate Size	=	7.14

Offset of Center of Rebar Cage from Center of Pile = 0.0000 in
Transverse Reinforcement
Type: Hoop
Number of Transverse Reinf. (per spacing) = 1
Spacing of Transverse Reinf. = 4.500000 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 = 4682.772 kips
Tensile Load for Cracking of Concrete = -486.599 kips
Nominal Axial Tensile Capacity = -1295.400 kips

Reinforcing Bar Dimensions and Positions Used in Computations:

Bar Number	Bar Diam. inches	Bar Area sq. in.	X inches	Y inches
1	1.270000	1.270000	10.740000	0.00000
2	1.270000	1.270000	10.014752	3.879735
3	1.270000	1.270000	7.936956	7.235491
4	1.270000	1.270000	4.787230	9.614054
5	1.270000	1.270000	0.990962	10.694185
6	1.270000	1.270000	-2.93914	10.330007
7	1.270000	1.270000	-6.47230	8.570705
8	1.270000	1.270000	-9.13133	5.653881
9	1.270000	1.270000	-10.55713	1.973470
10	1.270000	1.270000	-10.55713	-1.97347
11	1.270000	1.270000	-9.13133	-5.65388
12	1.270000	1.270000	-6.47230	-8.57071
13	1.270000	1.270000	-2.93914	-10.33001
14	1.270000	1.270000	0.990962	-10.69419
15	1.270000	1.270000	4.787230	-9.61405
16	1.270000	1.270000	7.936956	-7.23549
17	1.270000	1.270000	10.014752	-3.87974

NOTE: The positions of the above rebars were computed by LPile

Minimum spacing between any two bars not equal to zero = 2.677 inches
between bars 6 and 7.

Ratio of bar spacing to maximum aggregate size = 7.14

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 = 0.375000 in

Number of Axial Thrust Force Values Determined from Pile-head Loadings = 1

Number	Axial Thrust Force kips
1	146.310

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 = 146.310 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	234.4136148	375061784.	66.6047119	0.00004163	0.00001913	0.1741365	1.0864979	
0.00000125	468.8352477	375068198.	42.3202944	0.00005290	0.00000790	0.2202859	1.2926857	
0.00000188	703.2448079	375063898.	34.2334295	0.00006419	-0.00000331	0.2662163	1.4993052	

```
0.00000250   937.4541087    374981643.    30.1949936    0.00007549   -0.00001451
0.3119168     1.7062870
0.00000313         1171.    374746616.    27.7741551    0.00008679   -0.00002571
0.3573640     1.9134703
0.00000375         1404.    374390318.    26.1613003    0.00009810   -0.00003690
0.4025451     2.1207664
0.00000438         1636.    373950122.    25.0098203     0.0001094   -0.00004808
0.4474541     2.3281335
0.00000500         1867.    373451762.    24.1465452     0.0001207   -0.00005927
0.4920876     2.5355491
0.00000563         2098.    372912107.    23.4753281     0.0001320   -0.00007045
0.5364438     2.7430004
0.00000625         2327.    372342331.    22.9385085     0.0001434   -0.00008163
0.5805215     2.9504797
0.00000688         2556.    371750026.    22.4994077     0.0001547   -0.00009282
0.6243201     3.1579819
0.00000750         2556.    340770857.    19.3272062     0.0001450     -0.000125
0.5858657     2.7551177 C
0.00000813         2556.    314557714.    18.8076574     0.0001528     -0.000140
0.6161480     2.8622917 C
0.00000875         2556.    292089306.    18.3507689     0.0001606     -0.000154
0.6459026     2.9665326 C
0.00000938         2556.    272616686.    17.9460701     0.0001682     -0.000169
0.6752094     -3.097724 C
0.00001000         2556.    255578143.    17.5847098     0.0001758     -0.000184
0.7041084     -3.409034 C
0.00001063         2556.    240544134.    17.2598308     0.0001834     -0.000199
0.7326357     -3.722202 C
0.00001125         2556.    227180571.    16.9661818     0.0001909     -0.000214
0.7608300     -4.036958 C
0.00001188         2556.    215223699.    16.6997563     0.0001983     -0.000229
0.7887358     -4.352984 C
0.00001250         2556.    204462514.    16.4557257     0.0002057     -0.000244
0.8163201     -4.670548 C
0.00001313         2556.    194726204.    16.2320030     0.0002130     -0.000259
0.8436404     -4.989228 C
0.00001375         2556.    185875013.    16.0273624     0.0002204     -0.000275
0.8707783     -5.308409 C
0.00001438         2556.    177793491.    15.8367182     0.0002277     -0.000290
0.8975952     -5.629172 C
0.00001500         2556.    170385428.    15.6620600     0.0002349     -0.000305
0.9243023     -5.949891 C
0.00001563         2556.    163570011.    15.4979173     0.0002422     -0.000320
0.9506942     -6.272175 C
0.00001625         2605.    160305061.    15.3465850     0.0002494     -0.000336
0.9769834     -6.594372 C
0.00001688         2667.    158032163.    15.2044648     0.0002566     -0.000351
1.0030311     -6.917578 C
0.00001750         2728.    155909289.    15.0715159     0.0002638     -0.000366
1.0289119     -7.241213 C
```

0.00001813 2790. 153929572. 14.9480016 0.0002709 -0.000382
1.0546940 -7.564741 C
0.00001875 2851. 152058240. 14.8303456 0.0002781 -0.000397
1.0801944 -7.889625 C
0.00001938 2912. 150303219. 14.7201858 0.0002852 -0.000412
1.1055839 -8.214508 C
0.00002000 2973. 148655005. 14.6169308 0.0002923 -0.000428
1.1308758 -8.539284 C
0.00002063 3034. 147093735. 14.5189348 0.0002995 -0.000443
1.1559594 -8.864850 C
0.00002125 3094. 145615693. 14.4258436 0.0003065 -0.000458
1.1808796 -9.190849 C
0.00002188 3155. 144219524. 14.3382405 0.0003136 -0.000474
1.2057032 -9.516741 C
0.00002250 3215. 142898398. 14.2556686 0.0003208 -0.000489
1.2304301 -9.842526 C
0.00002313 3275. 141639833. 14.1766443 0.0003278 -0.000505
1.2549727 -10.168925 C
0.00002375 3335. 140440043. 14.1010758 0.0003349 -0.000520
1.2793477 -10.495809 C
0.00002438 3395. 139299494. 14.0295346 0.0003420 -0.000536
1.3036268 -10.822585 C
0.00002563 3515. 137178761. 13.8973566 0.0003561 -0.000566
1.3518971 -11.475815 C
0.00002688 3634. 135235971. 13.7758814 0.0003702 -0.000597
1.3995850 -12.130285 C
0.00002813 3753. 133453455. 13.6648468 0.0003843 -0.000628
1.4468056 -12.785047 C
0.00002938 3872. 131815104. 13.5637742 0.0003984 -0.000659
1.4936440 -13.439372 C
0.00003063 3990. 130299840. 13.4706598 0.0004125 -0.000690
1.5400190 -14.093958 C
0.00003188 4108. 128889558. 13.3837114 0.0004266 -0.000721
1.5858416 -14.749594 C
0.00003313 4226. 127579070. 13.3037889 0.0004407 -0.000752
1.6312834 -15.404785 C
0.00003438 4344. 126357466. 13.2301265 0.0004548 -0.000783
1.6763433 -16.059530 C
0.00003563 4461. 125215358. 13.1620681 0.0004689 -0.000814
1.7210199 -16.713826 C
0.00003688 4578. 124140547. 13.0978707 0.0004830 -0.000845
1.7651749 -17.368928 C
0.00003813 4694. 123128396. 13.0377058 0.0004971 -0.000875
1.8088769 -18.024223 C
0.00003938 4811. 122174891. 12.9817640 0.0005112 -0.000906
1.8521966 -18.679060 C
0.00004063 4927. 121274597. 12.9296573 0.0005253 -0.000937
1.8951329 -19.333433 C
0.00004188 5043. 120422722. 12.8810463 0.0005394 -0.000968
1.9376845 -19.987342 C

0.00004313 5158. 119615031. 12.8356261 0.0005535 -0.000999
1.9798502 -20.640783 C
0.00004438 5274. 118847763. 12.7931303 0.0005677 -0.001030
2.0216288 -21.293753 C
0.00004563 5389. 118115552. 12.7525473 0.0005818 -0.001061
2.0629148 -21.947274 C
0.00004688 5504. 117416672. 12.7141235 0.0005960 -0.001092
2.1037650 -22.600800 C
0.00004813 5619. 116749407. 12.6780436 0.0006101 -0.001122
2.1442280 -23.253842 C
0.00004938 5733. 116111339. 12.6441311 0.0006243 -0.001153
2.1843028 -23.906396 C
0.00005063 5847. 115500281. 12.6122277 0.0006385 -0.001184
2.2239879 -24.558459 C
0.00005188 5961. 114914259. 12.5821900 0.0006527 -0.001215
2.2632821 -25.210028 C
0.00005313 6075. 114351480. 12.5538882 0.0006669 -0.001246
2.3021841 -25.861100 C
0.00005438 6188. 113810320. 12.5272046 0.0006812 -0.001276
2.3406926 -26.511673 C
0.00005563 6302. 113289297. 12.5020346 0.0006954 -0.001307
2.3788061 -27.161743 C
0.00005688 6415. 112787064. 12.4782755 0.0007097 -0.001338
2.4165233 -27.811307 C
0.00005813 6528. 112302384. 12.4558403 0.0007240 -0.001369
2.4538429 -28.460362 C
0.00005938 6640. 111834129. 12.4346473 0.0007383 -0.001399
2.4907635 -29.108905 C
0.00006063 6752. 111380999. 12.4144597 0.0007526 -0.001430
2.5272585 -29.757215 C
0.00006188 6865. 110941642. 12.3949614 0.0007669 -0.001461
2.5632868 -30.405754 C
0.00006313 6976. 110515921. 12.3765263 0.0007813 -0.001491
2.5989151 -31.053760 C
0.00006438 7088. 110103026. 12.3590937 0.0007956 -0.001522
2.6341421 -31.701228 C
0.00006563 7199. 109702186. 12.3426091 0.0008100 -0.001553
2.6689659 -32.348158 C
0.00006688 7310. 109312711. 12.3270208 0.0008244 -0.001583
2.7033853 -32.994545 C
0.00006813 7421. 108933955. 12.3122813 0.0008388 -0.001614
2.7373987 -33.640385 C
0.00006938 7532. 108565319. 12.2983466 0.0008532 -0.001644
2.7710047 -34.285674 C
0.00007063 7642. 108206244. 12.2851756 0.0008676 -0.001675
2.8042017 -34.930409 C
0.00007188 7752. 107856212. 12.2727305 0.0008821 -0.001705
2.8369882 -35.574587 C
0.00007313 7862. 107514738. 12.2609756 0.0008966 -0.001736
2.8693627 -36.218202 C

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0.00007438        7972.    107181372.    12.2498781     0.0009111     -0.001766
2.9013235    -36.861252 C
0.00007938        8407.    105920935.    12.2114746     0.0009693     -0.001888
3.0249984    -39.427718 C
0.00008438        8839.    104760874.    12.1814556     0.0010278     -0.002010
3.1419257    -41.984813 C
0.00008938        9267.    103683181.    12.1585133     0.0010867     -0.002131
3.2519967    -44.532266 C
0.00009438        9690.    102673607.    12.1416298     0.0011459     -0.002252
3.3550985    -47.069790 C
0.00009938       10108.    101720717.    12.1299956     0.0012054     -0.002372
3.4511127    -49.597082 C
 0.0001044       10523.    100815209.    12.1229619     0.0012653     -0.002492
3.5399156    -52.113824 C
 0.0001094       10932.     99949423.    12.1200044     0.0013256     -0.002612
3.6213775    -54.619676 C
 0.0001144       11337.     99116989.    12.1206961     0.0013863     -0.002731
3.6953628    -57.114276 C
 0.0001194       11736.     98312515.    12.1246893     0.0014474     -0.002850
3.7617283    -59.597251 C
 0.0001244       12120.     97450385.    12.1284168     0.0015085     -0.002969
3.8199569    -60.000000 CY
 0.0001294       12451.     96239085.    12.1192376     0.0015679     -0.003090
3.8687894    -60.000000 CY
 0.0001344       12724.     94688904.    12.0950031     0.0016253     -0.003212
3.9086680    -60.000000 CY
 0.0001394       12960.     92986336.    12.0661131     0.0016817     -0.003336
3.9407458    -60.000000 CY
 0.0001444       13169.     91210539.    12.0310460     0.0017370     -0.003461
3.9655288    -60.000000 CY
 0.0001494       13354.     89400673.    11.9945440     0.0017917     -0.003586
3.9834432    -60.000000 CY
 0.0001544       13526.     87615317.    11.9584942     0.0018461     -0.003711
3.9948190    -60.000000 CY
 0.0001594       13676.     85811174.    11.9189414     0.0018996     -0.003838
3.9997430    -60.000000 CY
 0.0001644       13812.     84029377.    11.8823758     0.0019532     -0.003964
3.9994624    -60.000000 CY
 0.0001694       13941.     82310093.    11.8470027     0.0020066     -0.004091
3.9988400    -60.000000 CY
 0.0001744       14059.     80625986.    11.8125515     0.0020598     -0.004218
3.9976038    -60.000000 CY
 0.0001794       14163.     78958003.    11.7775114     0.0021126     -0.004345
3.9999024    -60.000000 CY
 0.0001844       14256.     77320773.    11.7429828     0.0021651     -0.004472
3.9995574    -60.000000 CY
 0.0001894       14345.     75747670.    11.7098214     0.0022175     -0.004600
3.9978800    -60.000000 CY
 0.0001944       14430.     74236219.    11.6810152     0.0022705     -0.004727
3.9999995    -60.000000 CY
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 0.0001994        14508.     72767641.    11.6516883     0.0023231     -0.004854
3.9990048    -60.000000 CY
 0.0002044        14579.     71333458.    11.6213581     0.0023751     -0.004982
3.9966012    -60.000000 CY
 0.0002094        14640.     69924463.    11.5928475     0.0024273     -0.005110
3.9993345    -60.000000 CY
 0.0002144        14697.     68555570.    11.5639092     0.0024790     -0.005238
3.9956327    -60.000000 CY
 0.0002194        14750.     67237605.    11.5361622     0.0025307     -0.005367
3.9992034    -60.000000 CY
 0.0002244        14803.     65972994.    11.5124511     0.0025831     -0.005494
3.9967870    -60.000000 CY
 0.0002294        14853.     64755171.    11.4898607     0.0026355     -0.005622
3.9986034    -60.000000 CY
 0.0002344        14902.     63580440.    11.4685214     0.0026879     -0.005750
3.9999681    -60.000000 CY
 0.0002394        14945.     62431888.    11.4472734     0.0027402     -0.005877
3.9970855    -60.000000 CY
 0.0002444        14984.     61316363.    11.4262725     0.0027923     -0.006005
3.9996473    -60.000000 CY
 0.0002494        15019.     60228338.    11.4053233     0.0028442     -0.006133
3.9952048    -60.000000 CY
 0.0002544        15051.     59169485.    11.3847010     0.0028960     -0.006262
3.9978824    -60.000000 CY
 0.0002594        15080.     58141393.    11.3642973     0.0029476     -0.006390
3.9998261    -60.000000 CY
 0.0002644        15108.     57147822.    11.3455420     0.0029995     -0.006518
3.9941364    -60.000000 CY
 0.0002694        15135.     56186999.    11.3271272     0.0030512     -0.006646
3.9974940    -60.000000 CY
 0.0002744        15162.     55259189.    11.3095201     0.0031030     -0.006774
3.9996394    -60.000000 CY
 0.0003044        15295.     50252151.    11.2206750     0.0034153     -0.007542
3.9959814    -60.000000 CYT
 0.0003344        15375.     45982528.    11.1403743     0.0037251     -0.008312
3.9991792    -60.000000 CYT
 0.0003644        15375.     42196659.    11.1518659     0.0040635     -0.009054
3.9959672    -60.000000 CYT


-------------------------------------------------------------------------------
   Summary of Results for Nominal Moment Capacity for Section 1
-------------------------------------------------------------------------------

Moment values interpolated at maximum compressive strain = 0.003
or maximum developed moment if pile fails at smaller strains.

 Load           Axial Thrust        Nominal Mom. Cap.      Max. Comp.      Max.
Tens.
  No.              kips                 in-kip               Strain
```

Strain				
1	146.310	15108.727	0.00300000	-0.00651932

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	146.310000	15109.	95.101500	9821.	102375794.
1	0.75	146.310000	15109.	109.732500	11332.	99127196.
1	0.90	146.310000	15109.	131.679000	13598.	86749568.

Pile Section No. 2:

Dimensions and Properties of Drilled Shaft (Bored Pile):

Length of Section	=	5.000000 ft
Shaft Diameter	=	30.000000 in
Concrete Cover Thickness (to edge of trans. reinf.)	=	3.000000 in
Number of Reinforcing Bars	=	17 bars
Yield Stress of Reinforcing Bars	=	60000. psi
Modulus of Elasticity of Reinforcing Bars	=	29000000. psi

Gross Area of Shaft	=	706.858347 sq. in.
Total Area of Reinforcing Steel	=	21.590000 sq. in.
Area Ratio of Steel Reinforcement	=	3.05 percent
Edge-to-Edge Bar Spacing	=	2.676940 in
Maximum Concrete Aggregate Size	=	0.375000 in
Ratio of Bar Spacing to Aggregate Size	=	7.14
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.	=	4.500000 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	=	3625.312 kips
Tensile Load for Cracking of Concrete	=	-357.244 kips
Nominal Axial Tensile Capacity	=	-1295.400 kips

Reinforcing Bar Dimensions and Positions Used in Computations:

Bar Number	Bar Diam. inches	Bar Area sq. in.	X inches	Y inches
1	1.270000	1.270000	10.740000	0.00000
2	1.270000	1.270000	10.014752	3.879735
3	1.270000	1.270000	7.936956	7.235491
4	1.270000	1.270000	4.787230	9.614054
5	1.270000	1.270000	0.990962	10.694185
6	1.270000	1.270000	-2.93914	10.330007
7	1.270000	1.270000	-6.47230	8.570705
8	1.270000	1.270000	-9.13133	5.653881
9	1.270000	1.270000	-10.55713	1.973470
10	1.270000	1.270000	-10.55713	-1.97347
11	1.270000	1.270000	-9.13133	-5.65388
12	1.270000	1.270000	-6.47230	-8.57071
13	1.270000	1.270000	-2.93914	-10.33001
14	1.270000	1.270000	0.990962	-10.69419
15	1.270000	1.270000	4.787230	-9.61405
16	1.270000	1.270000	7.936956	-7.23549
17	1.270000	1.270000	10.014752	-3.87974

NOTE: The positions of the above rebars were computed by LPile

Minimum spacing between any two bars not equal to zero = 2.677 inches
between bars 6 and 7.

Ratio of bar spacing to maximum aggregate size = 7.14

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	=	0.375000 in

Number of Axial Thrust Force Values Determined from Pile-head Loadings = 1

Number	Axial Thrust Force kips
1	146.310

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 = 146.310 kips

Bending Max Conc Curvature Stress rad/in. ksi	Bending Max Steel Moment Stress in-kip ksi	Bending Stiffness kip-in2	Depth to N Axis in	Max Comp Strain in/in	Max Tens Strain in/in	Run Msg

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0.00000125   244.8800268    195904021.    48.4556416    0.00006057    0.00002307
0.2519918     1.6205795
0.00000250   489.7654839    195906194.    31.7512957    0.00007938    0.00000438
0.3280495     2.0300939
0.00000375   734.5495108    195879870.    26.1931585    0.00009822   -0.00001428
0.4034781     2.4406934
0.00000500   978.6152127    195723043.    23.4187707     0.0001171   -0.00003291
0.4782170     2.8519717
0.00000625        1222.     195445362.    21.7559907     0.0001360   -0.00005153
0.5522168     3.2635858
0.00000750        1463.     195088957.    20.6483513     0.0001549   -0.00007014
0.6254565     3.6753914
0.00000875        1703.     194681732.    19.8576727     0.0001738   -0.00008875
0.6979267     4.0873220
0.00001000        1703.     170346515.    17.5776220     0.0001758     -0.000124
0.7049918     4.0100209 C
0.00001125        1703.     151419125.    16.8844808     0.0001900     -0.000148
0.7586099     4.2851254 C
0.00001250        1703.     136277212.    16.3121066     0.0002039     -0.000171
0.8109438     4.5537639 C
0.00001375        1703.     123888375.    15.8300036     0.0002177     -0.000195
0.8621393     4.8169011 C
0.00001500        1772.     118125173.    15.4186603     0.0002313     -0.000219
0.9123846     5.0758672 C
0.00001625        1865.     114798507.    15.0626958     0.0002448     -0.000243
0.9617496     5.3311079 C
0.00001750        1958.     111886580.    14.7522780     0.0002582     -0.000267
1.0103763     -5.835094 C
0.00001875        2050.     109316636.    14.4791100     0.0002715     -0.000291
1.0583284     -6.400421 C
0.00002000        2141.     107032998.    14.2370132     0.0002847     -0.000315
1.1056711     -6.967532 C
0.00002125        2231.     104982753.    14.0198621     0.0002979     -0.000340
1.1523608     -7.536822 C
0.00002250        2321.     103137811.    13.8248164     0.0003111     -0.000364
1.1985095     -8.107430 C
0.00002375        2410.     101472870.    13.6494904     0.0003242     -0.000388
1.2442129     -8.678601 C
0.00002500        2499.      99949864.    13.4888623     0.0003372     -0.000413
1.2892940     -9.251818 C
0.00002625        2587.      98566005.    13.3438626     0.0003503     -0.000437
1.3340319     -9.824797 C
0.00002750        2675.      97289335.    13.2098142     0.0003633     -0.000462
1.3781894    -10.399533 C
0.00002875        2763.      96118951.    13.0878332     0.0003763     -0.000486
1.4220174    -10.973935 C
0.00003000        2851.      95034378.    12.9748775     0.0003892     -0.000511
1.4653573    -11.549356 C
0.00003125        2938.      94028870.    12.8705279     0.0004022     -0.000535
1.5082916    -12.125109 C
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0.00003250        3026.     93096559.    12.7745904     0.0004152     -0.000560
1.5508975    -12.700526 C
0.00003375        3113.     92223706.    12.6847756     0.0004281     -0.000584
1.5930203    -13.276963 C
0.00003500        3199.     91407380.    12.6011660     0.0004410     -0.000609
1.6347590    -13.853566 C
0.00003625        3286.     90643659.    12.5235616     0.0004540     -0.000634
1.6761704    -14.429831 C
0.00003750        3372.     89927268.    12.4515101     0.0004669     -0.000658
1.7172538    -15.005754 C
0.00003875        3458.     89248465.    12.3830245     0.0004798     -0.000683
1.7578244    -15.583014 C
0.00004000        3544.     88608642.    12.3189921     0.0004928     -0.000707
1.7980643    -16.159969 C
0.00004125        3630.     88004358.    12.2589933     0.0005057     -0.000732
1.8379770    -16.736579 C
0.00004250        3716.     87432463.    12.2029191     0.0005186     -0.000756
1.8775616    -17.312842 C
0.00004375        3801.     86890168.    12.1503229     0.0005316     -0.000781
1.9168172    -17.888757 C
0.00004500        3887.     86371666.    12.0999306     0.0005445     -0.000806
1.9555842    -18.465840 C
0.00004625        3972.     85878272.    12.0523596     0.0005574     -0.000830
1.9940222    -19.042585 C
0.00004750        4057.     85408021.    12.0075501     0.0005704     -0.000855
2.0321318    -19.618975 C
0.00004875        4142.     84959123.    11.9652907     0.0005833     -0.000879
2.0699121    -20.195008 C
0.00005125        4311.     84119091.    11.8874253     0.0006092     -0.000928
2.1444815    -21.345997 C
0.00005375        4480.     83345293.    11.8174398     0.0006352     -0.000977
2.2176046    -22.496753 C
0.00005625        4648.     82628714.    11.7535097     0.0006611     -0.001026
2.2892683    -23.647400 C
0.00005875        4815.     81963805.    11.6958942     0.0006871     -0.001075
2.3596010    -24.796558 C
0.00006125        4982.     81344159.    11.6438285     0.0007132     -0.001124
2.4285952    -25.944212 C
0.00006375        5149.     80764374.    11.5966676     0.0007393     -0.001173
2.4962433    -27.090349 C
0.00006625        5315.     80219866.    11.5534388     0.0007654     -0.001222
2.5625376    -28.234951 C
0.00006875        5480.     79705342.    11.5140691     0.0007916     -0.001271
2.6273221    -29.379732 C
0.00007125        5644.     79218836.    11.4777751     0.0008178     -0.001320
2.6907304    -30.523109 C
0.00007375        5808.     78757565.    11.4446783     0.0008440     -0.001368
2.7527703    -31.664882 C
0.00007625        5972.     78318976.    11.4144853     0.0008704     -0.001417
2.8134337    -32.805032 C
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0.00007875        6135.     77900840.    11.3869273     0.0008967     -0.001466
2.8727121    -33.943542 C
0.00008125        6297.     77501200.    11.3617686     0.0009231     -0.001514
2.9305970    -35.080395 C
0.00008375        6459.     77118332.    11.3388021     0.0009496     -0.001563
2.9870796    -36.215572 C
0.00008625        6620.     76750711.    11.3178444     0.0009762     -0.001611
3.0421511    -37.349055 C
0.00008875        6780.     76396981.    11.2987334     0.0010028     -0.001660
3.0958026    -38.480823 C
0.00009125        6940.     76055938.    11.2807446     0.0010294     -0.001708
3.1480250    -39.610857 C
0.00009375        7099.     75726497.    11.2649059     0.0010561     -0.001756
3.1988088    -40.739139 C
0.00009625        7258.     75407691.    11.2511115     0.0010829     -0.001805
3.2481447    -41.865647 C
0.00009875        7416.     75098431.    11.2373507     0.0011097     -0.001853
3.2959684    -42.991251 C
 0.0001013        7573.     74798171.    11.2254380     0.0011366     -0.001901
3.3423259    -44.115081 C
 0.0001038        7730.     74506216.    11.2147192     0.0011635     -0.001949
3.3872123    -45.237033 C
 0.0001063        7886.     74221913.    11.2051045     0.0011905     -0.001997
3.4306172    -46.357084 C
 0.0001088        8041.     73944672.    11.1964254     0.0012176     -0.002045
3.4725301    -47.475211 C
 0.0001113        8196.     73673951.    11.1887405     0.0012447     -0.002093
3.5129404    -48.591388 C
 0.0001138        8350.     73409257.    11.1819919     0.0012720     -0.002141
3.5518370    -49.705591 C
 0.0001163        8504.     73150136.    11.1761267     0.0012992     -0.002188
3.5892089    -50.817795 C
 0.0001188        8656.     72896172.    11.1710967     0.0013266     -0.002236
3.6250448    -51.927973 C
 0.0001213        8808.     72646982.    11.1668579     0.0013540     -0.002284
3.6593331    -53.036098 C
 0.0001238        8960.     72402212.    11.1633700     0.0013815     -0.002331
3.6920619    -54.142143 C
 0.0001263        9110.     72161535.    11.1605961     0.0014090     -0.002378
3.7232193    -55.246080 C
 0.0001288        9260.     71924648.    11.1585023     0.0014367     -0.002426
3.7527929    -56.347880 C
 0.0001313        9409.     71691269.    11.1570574     0.0014644     -0.002473
3.7807703    -57.447513 C
 0.0001338        9558.     71461136.    11.1562330     0.0014921     -0.002520
3.8071386    -58.544949 C
 0.0001363        9706.     71234005.    11.1560027     0.0015200     -0.002567
3.8318848    -59.640157 C
 0.0001388        9851.     70997084.    11.1556824     0.0015479     -0.002615
3.8549215    -60.000000 CY
```

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 0.0001413        9990.     70729042.    11.1540892     0.0015755     -0.002662
3.8761261    -60.000000 CY
 0.0001438       10122.     70411864.    11.1501549     0.0016028     -0.002710
3.8954202    -60.000000 CY
 0.0001463       10243.     70038914.    11.1433962     0.0016297     -0.002758
3.9128112    -60.000000 CY
 0.0001488       10355.     69615782.    11.1340043     0.0016562     -0.002806
3.9283805    -60.000000 CY
 0.0001588       10728.     67575095.    11.0769632     0.0017585     -0.003004
3.9741572    -60.000000 CY
 0.0001688       11028.     65351346.    11.0084487     0.0018577     -0.003205
3.9967330    -60.000000 CY
 0.0001788       11279.     63101789.    10.9363424     0.0019549     -0.003408
3.9998425    -60.000000 CY
 0.0001888       11490.     60875978.    10.8616317     0.0020501     -0.003612
3.9986754    -60.000000 CY
 0.0001988       11672.     58725088.    10.7893258     0.0021444     -0.003818
3.9998829    -60.000000 CY
 0.0002088       11833.     56686089.    10.7216944     0.0022382     -0.004024
3.9976551    -60.000000 CY
 0.0002188       11967.     54706797.    10.6537895     0.0023305     -0.004232
3.9974174    -60.000000 CY
 0.0002288       12087.     52837366.    10.5878130     0.0024220     -0.004441
3.9974505    -60.000000 CY
 0.0002388       12200.     51098731.    10.5284687     0.0025137     -0.004649
3.9968377    -60.000000 CY
 0.0002488       12299.     49443664.    10.4707007     0.0026046     -0.004858
3.9970596    -60.000000 CY
 0.0002588       12383.     47855926.    10.4127121     0.0026943     -0.005068
3.9999442    -60.000000 CY
 0.0002688       12457.     46352065.    10.3571685     0.0027835     -0.005279
3.9989903    -60.000000 CY
 0.0002788       12529.     44947538.    10.3048160     0.0028725     -0.005490
3.9960712    -60.000000 CY
 0.0002888       12599.     43631319.    10.2564638     0.0029616     -0.005701
3.9999363    -60.000000 CY
 0.0002988       12662.     42384029.    10.2102277     0.0030503     -0.005912
3.9976312    -60.000000 CY
 0.0003088       12719.     41194273.    10.1642890     0.0031382     -0.006124
3.9995248    -60.000000 CY
 0.0003188       12768.     40057596.    10.1189687     0.0032254     -0.006337
3.9974729    -60.000000 CY
 0.0003288       12812.     38972855.    10.0735379     0.0033117     -0.006551
3.9999785    60.0000000 CYT
 0.0003388       12853.     37942283.    10.0323289     0.0033985     -0.006764
3.9955370    60.0000000 CYT
 0.0003488       12892.     36967646.     9.9920200     0.0034847     -0.006978
3.9993928    60.0000000 CYT
 0.0003588       12929.     36038842.     9.9573075     0.0035722     -0.007190
3.9944426    60.0000000 CYT
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    0.0003688        12965.     35158748.     9.9250539     0.0036599     -0.007403
   3.9969951    60.0000000 CYT
    0.0003788        12996.     34312191.     9.8969469     0.0037485     -0.007614
   3.9998211    60.0000000 CYT
    0.0003888        13023.     33500738.     9.8711154     0.0038374     -0.007825
   3.9915898    60.0000000 CYT


-------------------------------------------------------------------------------
   Summary of Results for Nominal Moment Capacity for Section 2
-------------------------------------------------------------------------------

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              146.310             12626.131           0.00300000
-0.00579246

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         146.310000        12626.     95.101500         8207.
73655469.

   1       0.75         146.310000        12626.    109.732500         9470.
```

71598068.

1 0.90 146.310000 12626. 131.679000 11364.
62214477.

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	18.0000	0.00	N.A.	No	0.00	168434.
2	33.2000	15.2000	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 Displacement and Pile-head Rotation (Loading Type 5)
Displacement of pile head = 2.200000 inches
Rotation of pile head = 0.000E+00 radians
Axial load on pile head = 146310.0 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. Es*H lb/inch	Soil Spr. Lat. Load lb/inch	Distrib. p lb/inch
0.00	2.2000	-1.28E+07	79039.	0.00	0.00	9.40E+10	0.00	0.00	0.00
0.3820	2.1986	-1.25E+07	79038.	-6.17E-04	0.00	9.40E+10			

```
0.00       0.00       0.00
    0.7640     2.1943  -1.21E+07     79038.   -0.00121       0.00   9.75E+10
0.00       0.00       0.00
    1.1460     2.1875  -1.17E+07     79038.   -0.00176       0.00   9.83E+10
0.00       0.00       0.00
    1.5280     2.1782  -1.14E+07     79038.   -0.00230       0.00   9.90E+10
0.00       0.00       0.00
    1.9100     2.1664  -1.10E+07     79038.   -0.00282       0.00   9.98E+10
0.00       0.00       0.00
    2.2920     2.1524  -1.06E+07     79038.   -0.00331       0.00   1.01E+11
0.00       0.00       0.00
    2.6740     2.1361  -1.03E+07     79038.   -0.00379       0.00   1.01E+11
0.00       0.00       0.00
    3.0560     2.1177  -9913140.     79038.   -0.00424       0.00   1.02E+11
0.00       0.00       0.00
    3.4380     2.0972  -9547835.     79038.   -0.00468       0.00   1.03E+11
0.00       0.00       0.00
    3.8200     2.0748  -9182246.     79038.   -0.00509       0.00   1.04E+11
0.00       0.00       0.00
    4.2020     2.0505  -8816385.     79038.   -0.00549       0.00   1.05E+11
0.00       0.00       0.00
    4.5840     2.0245  -8450265.     79038.   -0.00586       0.00   1.06E+11
0.00       0.00       0.00
    4.9660     1.9968  -8083899.     79038.   -0.00622       0.00   1.07E+11
0.00       0.00       0.00
    5.3480     1.9675  -7717301.     79038.   -0.00656       0.00   1.08E+11
0.00       0.00       0.00
    5.7300     1.9367  -7350483.     79038.   -0.00687       0.00   1.09E+11
0.00       0.00       0.00
    6.1120     1.9044  -6983458.     79038.   -0.00717       0.00   1.10E+11
0.00       0.00       0.00
    6.4940     1.8709  -6616239.     79038.   -0.00745       0.00   1.12E+11
0.00       0.00       0.00
    6.8760     1.8361  -6248838.     79038.   -0.00772       0.00   1.14E+11
0.00       0.00       0.00
    7.2580     1.8002  -5881268.     79038.   -0.00796       0.00   1.15E+11
0.00       0.00       0.00
    7.6400     1.7631  -5513541.     79038.   -0.00818       0.00   1.17E+11
0.00       0.00       0.00
    8.0220     1.7251  -5145670.     79038.   -0.00839       0.00   1.20E+11
0.00       0.00       0.00
    8.4040     1.6862  -4777666.     79038.   -0.00858       0.00   1.22E+11
0.00       0.00       0.00
    8.7860     1.6465  -4409543.     79038.   -0.00875       0.00   1.26E+11
0.00       0.00       0.00
    9.1680     1.6060  -4041312.     79038.   -0.00890       0.00   1.30E+11
0.00       0.00       0.00
    9.5500     1.5649  -3672984.     79038.   -0.00903       0.00   1.35E+11
0.00       0.00       0.00
    9.9320     1.5232  -3304573.     79038.   -0.00915       0.00   1.41E+11
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0.00       0.00       0.00
   10.3140     1.4810  -2936090.     79038.   -0.00925       0.00   1.50E+11
0.00       0.00       0.00
   10.6960     1.4384  -2567547.     79038.   -0.00933       0.00   1.63E+11
0.00       0.00       0.00
   11.0780     1.3955  -2198955.     79038.   -0.00938       0.00   3.73E+11
0.00       0.00       0.00
   11.4600     1.3525  -1830345.     79038.   -0.00940       0.00   3.74E+11
0.00       0.00       0.00
   11.8420     1.3093  -1461720.     79038.   -0.00942       0.00   3.74E+11
0.00       0.00       0.00
   12.2240     1.2661  -1093083.     79038.   -0.00944       0.00   3.75E+11
0.00       0.00       0.00
   12.6060     1.2228   -724437.     79038.   -0.00945       0.00   3.75E+11
0.00       0.00       0.00
   12.9880     1.1794   -355785.     79038.   -0.00946       0.00   3.75E+11
0.00       0.00       0.00
   13.3700     1.1361     12869.     79038.   -0.00946       0.00   3.75E+11
0.00       0.00       0.00
   13.7520     1.0927    381524.     79038.   -0.00946       0.00   3.75E+11
0.00       0.00       0.00
   14.1340     1.0494    750176.     79038.   -0.00945       0.00   3.75E+11
0.00       0.00       0.00
   14.5160     1.0061   1118821.     79038.   -0.00944       0.00   3.75E+11
0.00       0.00       0.00
   14.8980     0.9628   1487457.     79038.   -0.00942       0.00   3.74E+11
0.00       0.00       0.00
   15.2800     0.9197   1856081.     79038.   -0.00940       0.00   3.73E+11
0.00       0.00       0.00
   15.6620     0.8766   2224690.     79038.   -0.00938       0.00   3.73E+11
0.00       0.00       0.00
   16.0440     0.8337   2593281.     79038.   -0.00933       0.00   1.61E+11
0.00       0.00       0.00
   16.4260     0.7911   2961821.     79038.   -0.00924       0.00   1.49E+11
0.00       0.00       0.00
   16.8080     0.7490   3330301.     79038.   -0.00914       0.00   1.41E+11
0.00       0.00       0.00
   17.1900     0.7073   3698708.     79038.   -0.00903       0.00   1.34E+11
0.00       0.00       0.00
   17.5720     0.6662   4067030.     79038.   -0.00889       0.00   1.29E+11
0.00       0.00       0.00
   17.9540     0.6258   4435256.     79038.   -0.00874       0.00   1.25E+11
0.00       0.00       0.00
   18.3360     0.5861   4803373.     78824.   -0.00857       0.00   1.22E+11
-93.411   730.5571       0.00
   18.7180     0.5473   5169406.     78107.   -0.00838       0.00   1.20E+11
-219.529      1839.       0.00
   19.1000     0.5093   5530693.     76767.   -0.00817       0.00   1.17E+11
-364.967      3285.       0.00
   19.4820     0.4724   5884166.     74722.   -0.00795       0.00   1.15E+11
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-527.308 5117. 0.00
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-1097. 13658. 0.00
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-1303. 17769. 0.00
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-1484. 22287. 0.00
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-1641. 27281. 0.00
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-2070. 98378. 0.00
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-859.031 403576. 0.00
28.6500 0.00603 4940470. -95771. -7.20E-04 0.00 1.21E+11
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-418.284    606848.       0.00
   29.4140    0.00105   4040188.    -99565.  -3.90E-04       0.00   1.30E+11
-143.187    627861.       0.00
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58.6328    648874.       0.00
   30.1780   -0.00132   3125948.    -99182.  -1.48E-04       0.00   1.45E+11
192.9809    669887.       0.00
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267.3036    690900.       0.00
   30.9420   -0.00187   2226401.    -96848.  -7.46E-06       0.00   3.73E+11
290.4938    711914.       0.00
   31.3240   -0.00184   1785495.    -95508.   1.72E-05       0.00   3.74E+11
294.4964    732927.       0.00
   31.7060   -0.00171   1350764.    -94187.   3.64E-05       0.00   3.74E+11
281.7204    753940.       0.00
   32.0880   -0.00151    921941.    -92957.   5.03E-05       0.00   3.75E+11
254.9474    774953.       0.00
   32.4700   -0.00125    498468.    -91874.   5.90E-05       0.00   3.75E+11
217.3259    795966.       0.00
   32.8520  -9.67E-04     79557.    -90981.   6.25E-05       0.00   3.75E+11
172.3759    816979.       0.00
   33.2340  -6.78E-04   -335732.    -66842.   5.91E-05       0.00   1.96E+11
10359.   7.00E+07       0.00
   33.6160  -4.25E-04   -533333.    -25225.   4.89E-05       0.00   1.96E+11
7798.   8.40E+07       0.00
   33.9980  -2.30E-04   -567063.      3913.   3.60E-05       0.00   1.96E+11
4915.   9.80E+07       0.00
   34.3800  -9.50E-05   -497507.     20501.   2.36E-05       0.00   1.96E+11
2322.   1.12E+08       0.00
   34.7620  -1.36E-05   -379143.     26679.   1.33E-05       0.00   1.96E+11
373.2185   1.26E+08       0.00
   35.1440   2.72E-05   -252931.     25629.   5.94E-06       0.00   1.96E+11
-831.308   1.40E+08       0.00
   35.5260   4.09E-05   -144183.     20576.   1.29E-06       0.00   1.96E+11
-1373.   1.54E+08       0.00
   35.9080   3.91E-05    -64290.     14147.  -1.15E-06       0.00   1.96E+11
-1432.   1.68E+08       0.00
   36.2900   3.03E-05    -14482.      8103.  -2.07E-06       0.00   1.96E+11
-1205.   1.82E+08       0.00
   36.6720   2.01E-05     10000.      3372.  -2.12E-06       0.00   1.96E+11
-859.027   1.96E+08       0.00
   37.0540   1.09E-05     16432.   258.4177  -1.81E-06       0.00   1.96E+11
-499.268   2.10E+08       0.00
   37.4360   3.47E-06     12372.     -1274.  -1.48E-06       0.00   1.96E+11
-169.515   2.24E+08       0.00
   37.8180  -2.63E-06      4750.     -1350.  -1.27E-06       0.00   1.96E+11
136.6949   2.38E+08       0.00
   38.2000  -8.22E-06       0.00       0.00  -1.22E-06       0.00   1.96E+11
452.1606   1.26E+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 = 2.20000000 inches
Computed slope at pile head = 0.000000 radians
Maximum bending moment = -12823676. inch-lbs
Maximum shear force = -99759. lbs
Depth of maximum bending moment = 0.000000 feet below pile head
Depth of maximum shear force = 29.79600000 feet below pile head
Number of iterations = 27
Number of zero deflection points = 3
Pile deflection at ground = 0.62102768 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	Load 1	Load Type 2	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	y, in	2.2000	S, rad	0.00	146310.	2.2000	0.00	-99759.	-1.28E+07

Maximum pile-head deflection = 2.2000000000 inches
Maximum pile-head rotation = 0.0000000000 radians = 0.000000 deg.

Summary of Warning Messages

The following warning was reported 392 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.

==========

LPile for Windows, Version 2022-12.011

Analysis of Individual Piles and Drilled Shafts
Subjected to Lateral Loading Using the p-y Method
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Files Used for Analysis

Path to file locations:
\20240280\ODOT\109971\400-Engineering\Structures\SFN_0800512\Engdata\04_Abutment Design\Stage 2\Drilled Shaft\Lpile\Wingwalls\Rear Abutment Wingwalls\

Name of input data file:
RA WW_Scour Extreme II - Front DS.lp12d

Name of output report file:
RA WW_Scour Extreme II - Front DS.lp12o

Name of plot output file:
RA WW_Scour Extreme II - Front DS.lp12p

Name of runtime message file:
RA WW_Scour Extreme II - Front DS.lp12r

Date and Time of Analysis

Date: February 12, 2026 Time: 13:44:11

Problem Title

Project Name:

Job Number:

Client:

Engineer:

Description:

Program Options and Settings

Computational Options:
- Conventional Analysis

Engineering Units Used for Data Input and Computations:
- US Customary System Units (pounds, feet, inches)

Analysis Control Options:

- Maximum number of iterations allowed	=	500
- Deflection tolerance for convergence	=	1.0000E-05 in
- Maximum allowable deflection	=	100.0000 in
- Number of pile increments	=	100

Loading Type and Number of Cycles of Loading:

- Static loading specified

- Analysis uses p-y modification factors for p-y curves
- Analysis uses layering correction (Method of Georgiadis)
- No distributed lateral loads are entered
- Loading by lateral soil movements acting on pile not selected
- Input of shear resistance at the pile tip not selected
- Input of moment resistance at the pile tip not selected
- Computation of pile-head foundation stiffness matrix not selected
- Push-over analysis of pile not selected
- Buckling analysis of pile not selected

Output Options:
- Output files use decimal points to denote decimal symbols.
- Values of pile-head deflection, bending moment, shear force, and soil reaction are printed for full length of pile.
- Printing Increment (nodal spacing of output points) = 1
- No p-y curves to be computed and reported for user-specified depths
- Print using wide report formats

Pile Structural Properties and Geometry

Number of pile sections defined = 2
Total length of pile = 38.200 ft
Depth of ground surface below top of pile = 20.3300 ft

Pile diameters used for p-y curve computations are defined using 4 points.

p-y curves are computed using pile diameter values interpolated with depth over the length of the pile. A summary of values of pile diameter vs. depth follows.

Point No.	Depth Below Pile Head feet	Pile Diameter inches
1	0.000	36.0000
2	33.200	36.0000
3	33.200	30.0000
4	38.200	30.0000

Input Structural Properties for Pile Sections:

Pile Section No. 1:

Section 1 is a round drilled shaft, bored pile, or CIDH pile
Length of section = 33.200000 ft
Shaft Diameter = 36.000000 in

Pile Section No. 2:

Section 2 is a round drilled shaft, bored pile, or CIDH pile
Length of section = 5.000000 ft
Shaft Diameter = 30.000000 in

Soil and Rock Layering Information

The soil profile is modelled using 2 layers

Layer 1 is stiff clay with water-induced erosion

Distance from top of pile to top of layer = 20.330000 ft
Distance from top of pile to bottom of layer = 33.200000 ft
Effective unit weight at top of layer = 67.600000 pcf
Effective unit weight at bottom of layer = 67.600000 pcf
Undrained cohesion at top of layer = 4800. psf
Undrained cohesion at bottom of layer = 4800. psf
Epsilon-50 at top of layer = 0.004000
Epsilon-50 at bottom of layer = 0.004000
Subgrade k at top of layer = 2000. pci
Subgrade k at bottom of layer = 2000. pci

Layer 2 is weak rock, p-y criteria by Reese, 1997

Distance from top of pile to top of layer = 33.200000 ft
Distance from top of pile to bottom of layer = 50.000000 ft
Effective unit weight at top of layer = 92.700000 pcf
Effective unit weight at bottom of layer = 92.700000 pcf
Uniaxial compressive strength at top of layer = 1640. psi
Uniaxial compressive strength at bottom of layer = 1640. psi
Initial modulus of rock at top of layer = 150000. psi
Initial modulus of rock at bottom of layer = 150000. 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

(Depth of the lowest soil layer extends 11.800 ft below the pile tip)

Summary of Input Soil Properties

Layer Num.	Soil Type Name or (p-y Curve Type)	Layer Depth ft	Effective Unit Wt. pcf	Cohesion psf	Uniaxial qu psi	RQD %	E50 krm	kpy pci	Rock Mass Modulus psi
1	Stiff Clay with Free Water	20.3300	67.6000	4800.	--	--	0.00400	2000.	--
		33.2000	67.6000	4800.	--	--	0.00400	2000.	--
2	Weak Rock	33.2000	92.7000	--	1640.	15.0000	5.00E-04	--	150000.
		50.0000	92.7000	--	1640.	15.0000	5.00E-04	--	150000.

Modification Factors for p-y Curves

Distribution of p-y modifiers with depth defined using 2 points

Point No.	Depth X ft	p-mult	y-mult
1	20.330	0.7000	1.0000
2	33.200	0.7000	1.0000

Static Loading Type

Static loading criteria were used when computing p-y curves for all analyses.

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 1

Load No.	Load Type	Condition 1	Condition 2	Axial Thrust Force, lbs	Compute Top y vs. Pile Length	Run Analysis
1	5	y = 1.500000 in	S = 0.0000 in/in	220400.	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 = 2

Pile Section No. 1:

Dimensions and Properties of Drilled Shaft (Bored Pile):

Length of Section	=	33.200000 ft
Shaft Diameter	=	36.000000 in
Concrete Cover Thickness (to edge of trans. reinf.)	=	6.000000 in
Number of Reinforcing Bars	=	17 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	=	21.590000 sq. in.
Area Ratio of Steel Reinforcement	=	2.12 percent
Edge-to-Edge Bar Spacing	=	2.676940 in
Maximum Concrete Aggregate Size	=	0.375000 in
Ratio of Bar Spacing to Aggregate Size	=	7.14

Offset of Center of Rebar Cage from Center of Pile = 0.0000 in
Transverse Reinforcement
Type: Hoop
Number of Transverse Reinf. (per spacing) = 1
Spacing of Transverse Reinf. = 4.500000 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 = 4682.772 kips
Tensile Load for Cracking of Concrete = -486.599 kips
Nominal Axial Tensile Capacity = -1295.400 kips

Reinforcing Bar Dimensions and Positions Used in Computations:

Bar Number	Bar Diam. inches	Bar Area sq. in.	X inches	Y inches
1	1.270000	1.270000	10.740000	0.00000
2	1.270000	1.270000	10.014752	3.879735
3	1.270000	1.270000	7.936956	7.235491
4	1.270000	1.270000	4.787230	9.614054
5	1.270000	1.270000	0.990962	10.694185
6	1.270000	1.270000	-2.93914	10.330007
7	1.270000	1.270000	-6.47230	8.570705
8	1.270000	1.270000	-9.13133	5.653881
9	1.270000	1.270000	-10.55713	1.973470
10	1.270000	1.270000	-10.55713	-1.97347
11	1.270000	1.270000	-9.13133	-5.65388
12	1.270000	1.270000	-6.47230	-8.57071
13	1.270000	1.270000	-2.93914	-10.33001
14	1.270000	1.270000	0.990962	-10.69419
15	1.270000	1.270000	4.787230	-9.61405
16	1.270000	1.270000	7.936956	-7.23549
17	1.270000	1.270000	10.014752	-3.87974

NOTE: The positions of the above rebars were computed by LPile

Minimum spacing between any two bars not equal to zero = 2.677 inches
between bars 6 and 7.

Ratio of bar spacing to maximum aggregate size = 7.14

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 = 0.375000 in

Number of Axial Thrust Force Values Determined from Pile-head Loadings = 1

Number	Axial Thrust Force kips
1	220.400

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 = 220.400 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	232.6328188	372212510.	91.4771966	0.00005717	0.00003467	0.2383441	1.5373117	
0.00000125	465.2803605	372224288.	54.7566684	0.00006845	0.00002345	0.2841041	1.7435042	
0.00000188	697.9175949	372222717.	42.5245034	0.00007973	0.00001223	0.3296451	1.9501324	

```
0.00000250   930.5393790    372215752.    36.4144296    0.00009104    0.00000104
0.3749660     2.1571962
0.00000313         1163.    372191818.    32.7530276     0.0001024   -0.00001015
0.4200635     2.3646806
0.00000375         1395.    372085754.    30.3149883     0.0001137   -0.00002132
0.4649220     2.5724799
0.00000438         1627.    371875721.    28.5751452     0.0001250   -0.00003248
0.5095257     2.7804840
0.00000500         1858.    371575431.    27.2712203     0.0001364   -0.00004364
0.5538651     2.9886269
0.00000563         2088.    371203706.    26.2576726     0.0001477   -0.00005480
0.5979345     3.1968703
0.00000625         2317.    370776251.    25.4472532     0.0001590   -0.00006595
0.6417306     3.4051896
0.00000688         2546.    370305194.    24.7844821     0.0001704   -0.00007711
0.6852508     3.6135686
0.00000750         2773.    369799711.    24.2323969     0.0001817   -0.00008826
0.7284937     3.8219963
0.00000813         3000.    369266703.    23.7654211     0.0001931   -0.00009941
0.7714580     4.0304649
0.00000875         3000.    342890510.    21.2562234     0.0001860     -0.000129
0.7439104     3.7037965 C
0.00000938         3000.    320031142.    20.7261036     0.0001943     -0.000143
0.7752236     3.8242324 C
0.00001000         3000.    300029196.    20.2502841     0.0002025     -0.000157
0.8059301     3.9411838 C
0.00001063         3000.    282380420.    19.8215374     0.0002106     -0.000172
0.8361341     4.0554014 C
0.00001125         3000.    266692619.    19.4330868     0.0002186     -0.000186
0.8658842     4.1672207 C
0.00001188         3000.    252656165.    19.0790876     0.0002266     -0.000201
0.8952082     4.2768237 C
0.00001250         3000.    240023357.    18.7549594     0.0002344     -0.000216
0.9241374     4.3844226 C
0.00001313         3000.    228593673.    18.4571581     0.0002423     -0.000230
0.9527105     4.4902933 C
0.00001375         3000.    218203052.    18.1828141     0.0002500     -0.000245
0.9809672     4.5947222 C
0.00001438         3000.    208715962.    17.9276105     0.0002577     -0.000260
1.0088440     -4.757536 C
0.00001500         3000.    200019464.    17.6913199     0.0002654     -0.000275
1.0364618     -5.067176 C
0.00001563         3000.    192018685.    17.4721534     0.0002730     -0.000289
1.0638509     -5.377618 C
0.00001625         3063.    188503947.    17.2660123     0.0002806     -0.000304
1.0908875     -5.689867 C
0.00001688         3128.    185378187.    17.0745933     0.0002881     -0.000319
1.1177659     -6.002383 C
0.00001750         3193.    182428616.    16.8936342     0.0002956     -0.000334
1.1443180     -6.316530 C
```

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0.00001813         3257.    179674807.    16.7250544     0.0003031     -0.000349
1.1707406     -6.630731 C
0.00001875         3320.    177063151.    16.5646536     0.0003106     -0.000364
1.1968372     -6.946592 C
0.00001938         3383.    174616516.    16.4148151     0.0003180     -0.000379
1.2228273     -7.262334 C
0.00002000         3446.    172293887.    16.2721416     0.0003254     -0.000395
1.2485417     -7.579351 C
0.00002063         3508.    170100908.    16.1375647     0.0003328     -0.000410
1.2740969     -7.896697 C
0.00002125         3571.    168031823.    16.0109088     0.0003402     -0.000425
1.2995317     -8.214052 C
0.00002188         3632.    166053025.    15.8890670     0.0003476     -0.000440
1.3246666     -8.532918 C
0.00002250         3694.    164181298.    15.7741899     0.0003549     -0.000455
1.3496978     -8.851668 C
0.00002313         3756.    162407952.    15.6656941     0.0003623     -0.000470
1.3746250     -9.170302 C
0.00002375         3817.    160704762.    15.5608134     0.0003696     -0.000485
1.3992601     -9.490415 C
0.00002438         3878.    159085177.    15.4612393     0.0003769     -0.000501
1.4237818     -9.810504 C
0.00002563         3999.    156071060.    15.2767366     0.0003915     -0.000531
1.4724676    -10.450763 C
0.00002688         4120.    153298769.    15.1062621     0.0004060     -0.000562
1.5204127    -11.093419 C
0.00002813         4240.    150764070.    14.9513553     0.0004205     -0.000592
1.5679508    -11.735620 C
0.00002938         4360.    148412823.    14.8070966     0.0004350     -0.000623
1.6147581    -12.380217 C
0.00003063         4479.    146243600.    14.6745027     0.0004494     -0.000653
1.6611345    -13.024600 C
0.00003188         4597.    144232469.    14.5525312     0.0004639     -0.000684
1.7070354    -13.669166 C
0.00003313         4715.    142351621.    14.4377771     0.0004783     -0.000714
1.7522933    -14.315448 C
0.00003438         4833.    140600534.    14.3318296     0.0004927     -0.000745
1.7971500    -14.961270 C
0.00003563         4951.    138965519.    14.2333655     0.0005071     -0.000775
1.8416042    -15.606630 C
0.00003688         5068.    137423778.    14.1407482     0.0005214     -0.000806
1.8854235    -16.253700 C
0.00003813         5184.    135975024.    14.0539151     0.0005358     -0.000837
1.9288030    -16.900678 C
0.00003938         5300.    134612143.    13.9730048     0.0005502     -0.000867
1.9717817    -17.547188 C
0.00004063         5416.    133327179.    13.8974725     0.0005646     -0.000898
2.0143582    -18.193228 C
0.00004188         5532.    132109037.    13.8257271     0.0005790     -0.000929
2.0564198    -18.839889 C
```

0.00004313 5647. 130951587. 13.7579748 0.0005933 -0.000959
2.0979585 -19.487270 C
0.00004438 5762. 129853934. 13.6942123 0.0006077 -0.000990
2.1390962 -20.134173 C
0.00004563 5877. 128811136. 13.6343074 0.0006221 -0.001020
2.1798317 -20.780595 C
0.00004688 5992. 127818777. 13.5779534 0.0006365 -0.001051
2.2201635 -21.426532 C
0.00004813 6106. 126872901. 13.5248754 0.0006509 -0.001082
2.2600904 -22.071984 C
0.00004938 6220. 125967294. 13.4741025 0.0006653 -0.001112
2.2995121 -22.717983 C
0.00005063 6333. 125099142. 13.4254955 0.0006797 -0.001143
2.3384351 -23.364481 C
0.00005188 6446. 124268139. 13.3795637 0.0006941 -0.001173
2.3769538 -24.010481 C
0.00005313 6559. 123471647. 13.3361182 0.0007085 -0.001204
2.4150669 -24.655980 C
0.00005438 6672. 122707262. 13.2949900 0.0007229 -0.001235
2.4527731 -25.300975 C
0.00005563 6785. 121972795. 13.2560248 0.0007374 -0.001265
2.4900709 -25.945463 C
0.00005688 6897. 121266250. 13.2190818 0.0007518 -0.001296
2.5269590 -26.589440 C
0.00005813 7009. 120585803. 13.1840323 0.0007663 -0.001326
2.5634358 -27.232904 C
0.00005938 7121. 119929782. 13.1507586 0.0007808 -0.001357
2.5995001 -27.875851 C
0.00006063 7232. 119294931. 13.1185213 0.0007953 -0.001387
2.6350554 -28.519389 C
0.00006188 7343. 118680854. 13.0875692 0.0008098 -0.001418
2.6701513 -29.162954 C
0.00006313 7454. 118087116. 13.0581348 0.0008243 -0.001448
2.7048343 -29.805988 C
0.00006438 7565. 117512518. 13.0301308 0.0008388 -0.001479
2.7391031 -30.448484 C
0.00006563 7675. 116955946. 13.0034791 0.0008534 -0.001509
2.7729562 -31.090441 C
0.00006688 7785. 116416367. 12.9781028 0.0008679 -0.001540
2.8063921 -31.731854 C
0.00006813 7895. 115892824. 12.9539346 0.0008825 -0.001570
2.8394092 -32.372720 C
0.00006938 8005. 115384428. 12.9309111 0.0008971 -0.001600
2.8720060 -33.013036 C
0.00007063 8114. 114890355. 12.9089733 0.0009117 -0.001631
2.9041810 -33.652797 C
0.00007188 8223. 114409836. 12.8880662 0.0009263 -0.001661
2.9359324 -34.292000 C
0.00007313 8332. 113942154. 12.8681388 0.0009410 -0.001692
2.9672589 -34.930641 C

```
0.00007438        8441.    113486642.    12.8491433     0.0009557     -0.001722
2.9981586    -35.568717 C
0.00007938        8872.    111774391.    12.7816340     0.0010145     -0.001843
3.1174583    -38.115291 C
0.00008438        9299.    110210893.    12.7242418     0.0010736     -0.001964
3.2295303    -40.656681 C
0.00008938        9722.    108772853.    12.6767289     0.0011330     -0.002085
3.3345749    -43.188354 C
0.00009438       10140.    107439192.    12.6385077     0.0011928     -0.002205
3.4324827    -45.709896 C
0.00009938       10553.    106192938.    12.6074916     0.0012529     -0.002325
3.5231308    -48.220998 C
 0.0001044       10961.    105020312.    12.5830054     0.0013134     -0.002444
3.6063905    -50.721328 C
 0.0001094       11365.    103909993.    12.5642636     0.0013742     -0.002563
3.6821268    -53.210540 C
 0.0001144       11764.    102852572.    12.5506242     0.0014355     -0.002682
3.7501981    -55.688263 C
 0.0001194       12157.    101840154.    12.5415595     0.0014971     -0.002800
3.8104558    -58.154104 C
 0.0001244       12544.    100857642.    12.5362986     0.0015592     -0.002918
3.8627105    -60.000000 CY
 0.0001294       12903.     99734920.    12.5276458     0.0016208     -0.003037
3.9062376    -60.000000 CY
 0.0001344       13204.     98263824.    12.5050269     0.0016804     -0.003157
3.9405420    -60.000000 CY
 0.0001394       13453.     96526243.    12.4732580     0.0017385     -0.003279
3.9663954    -60.000000 CY
 0.0001444       13675.     94716152.    12.4365037     0.0017955     -0.003402
3.9847244    -60.000000 CY
 0.0001494       13869.     92846626.    12.3979274     0.0018519     -0.003526
3.9957961    -60.000000 CY
 0.0001544       14045.     90977352.    12.3577830     0.0019077     -0.003650
3.9999557    -60.000000 CY
 0.0001594       14205.     89126542.    12.3173628     0.0019631     -0.003774
3.9999071    -60.000000 CY
 0.0001644       14345.     87272947.    12.2770189     0.0020180     -0.003899
3.9997110    -60.000000 CY
 0.0001694       14473.     85450274.    12.2366297     0.0020726     -0.004025
3.9991917    -60.000000 CY
 0.0001744       14594.     83692643.    12.2017771     0.0021277     -0.004150
3.9981034    -60.000000 CY
 0.0001794       14704.     81975489.    12.1663541     0.0021823     -0.004275
3.9982815    -60.000000 CY
 0.0001844       14802.     80280882.    12.1307933     0.0022366     -0.004401
3.9997565    -60.000000 CY
 0.0001894       14889.     78621622.    12.0957529     0.0022906     -0.004527
3.9983097    -60.000000 CY
 0.0001944       14971.     77022794.    12.0624495     0.0023446     -0.004653
3.9988632    -60.000000 CY
```

0.0001994	15050.	75487004.	12.0317093	0.0023988	-0.004779
3.9992539	-60.000000 CY				
0.0002044	15125.	74007378.	12.0017953	0.0024529	-0.004905
3.9961300	-60.000000 CY				
0.0002094	15191.	72555339.	11.9724502	0.0025067	-0.005031
3.9995421	-60.000000 CY				
0.0002144	15250.	71137408.	11.9430321	0.0025603	-0.005157
3.9960672	-60.000000 CY				
0.0002194	15304.	69760794.	11.9140635	0.0026136	-0.005284
3.9994134	-60.000000 CY				
0.0002244	15353.	68424924.	11.8863060	0.0026670	-0.005411
3.9958123	-60.000000 CY				
0.0002294	15401.	67141632.	11.8591178	0.0027202	-0.005537
3.9987932	-60.000000 CY				
0.0002344	15447.	65908741.	11.8369720	0.0027743	-0.005663
3.9993472	-60.000000 CY				
0.0002394	15492.	64719527.	11.8151913	0.0028283	-0.005789
3.9972984	-60.000000 CY				
0.0002444	15534.	63567850.	11.7940619	0.0028822	-0.005915
3.9997190	-60.000000 CY				
0.0002494	15573.	62446746.	11.7732853	0.0029360	-0.006042
3.9945824	-60.000000 CY				
0.0002544	15607.	61354854.	11.7526716	0.0029896	-0.006168
3.9980757	-60.000000 CY				
0.0002594	15638.	60292244.	11.7320689	0.0030430	-0.006294
3.9998772	-60.000000 CY				
0.0002644	15666.	59258562.	11.7119548	0.0030963	-0.006421
3.9937139	-60.000000 CY				
0.0002694	15692.	58252197.	11.6915888	0.0031494	-0.006548
3.9976199	-60.000000 CY				
0.0002744	15716.	57279644.	11.6715499	0.0032024	-0.006675
3.9996616	-60.000000 CY				
0.0003044	15847.	52062677.	11.5739278	0.0035228	-0.007435
3.9957078	-60.000000 CYT				
0.0003344	15934.	47653898.	11.4926657	0.0038429	-0.008195
3.9990162	-60.000000 CYT				

Summary of Results for Nominal Moment Capacity for Section 1

Moment values interpolated at maximum compressive strain = 0.003
or maximum developed moment if pile fails at smaller strains.

Load No.	Axial Thrust kips	Nominal Mom. Cap. in-kip	Max. Comp. Strain	Max. Tens. Strain
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   1               220.400             15613.216           0.00300000
-0.00619259
```

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	220.400000	15613.	143.260000	10149.	107412007.
1	0.75	220.400000	15613.	165.300000	11710.	102995428.
1	0.90	220.400000	15613.	198.360000	14052.	90893263.

Pile Section No. 2:

Dimensions and Properties of Drilled Shaft (Bored Pile):

Length of Section	=	5.000000 ft
Shaft Diameter	=	30.000000 in
Concrete Cover Thickness (to edge of trans. reinf.)	=	3.000000 in
Number of Reinforcing Bars	=	16 bars
Yield Stress of Reinforcing Bars	=	60000. psi
Modulus of Elasticity of Reinforcing Bars	=	29000000. psi
Gross Area of Shaft	=	706.858347 sq. in.
Total Area of Reinforcing Steel	=	20.320000 sq. in.

Area Ratio of Steel Reinforcement = 2.87 percent
Edge-to-Edge Bar Spacing = 2.920540 in
Maximum Concrete Aggregate Size = 0.375000 in
Ratio of Bar Spacing to Aggregate Size = 7.79
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. = 4.500000 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 = 3553.430 kips
Tensile Load for Cracking of Concrete = -353.523 kips
Nominal Axial Tensile Capacity = -1219.200 kips

Reinforcing Bar Dimensions and Positions Used in Computations:

Bar Number	Bar Diam. inches	Bar Area sq. in.	X inches	Y inches
1	1.270000	1.270000	10.740000	0.00000
2	1.270000	1.270000	9.922466	4.110020
3	1.270000	1.270000	7.594327	7.594327
4	1.270000	1.270000	4.110020	9.922466
5	1.270000	1.270000	0.00000	10.740000
6	1.270000	1.270000	-4.11002	9.922466
7	1.270000	1.270000	-7.59433	7.594327
8	1.270000	1.270000	-9.92247	4.110020
9	1.270000	1.270000	-10.74000	0.00000
10	1.270000	1.270000	-9.92247	-4.11002
11	1.270000	1.270000	-7.59433	-7.59433
12	1.270000	1.270000	-4.11002	-9.92247
13	1.270000	1.270000	0.00000	-10.74000
14	1.270000	1.270000	4.110020	-9.92247
15	1.270000	1.270000	7.594327	-7.59433
16	1.270000	1.270000	9.922466	-4.11002

NOTE: The positions of the above rebars were computed by LPile

Minimum spacing between any two bars not equal to zero = 2.921 inches
between bars 11 and 12.

Ratio of bar spacing to maximum aggregate size = 7.79

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	=	0.375000 in

Number of Axial Thrust Force Values Determined from Pile-head Loadings = 1

Number	Axial Thrust Force kips
1	220.400

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 = 220.400 kips

Bending Curvature rad/in.	Bending Moment in-kip	Bending Stiffness kip-in2	Depth to N Axis in	Max Comp Strain in/in	Max Tens Strain in/in	Max Conc Stress ksi	Max Steel Stress ksi	Run Msg
0.00000125	240.2003880	192160310.	66.0977647	0.00008262	0.00004512	0.3419802	2.2601065	
0.00000250	480.4139483	192165579.	40.5728519	0.0001014	0.00002643			

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0.4171195     2.6696568
0.00000375   720.6015157    192160404.    32.0751748     0.0001203    0.00000778
0.4916375     3.0803628
0.00000500   960.7303929    192146079.    27.8342258     0.0001392   -0.00001083
0.5655273     3.4922128
0.00000625        1200.    192066888.    25.2946489     0.0001581   -0.00002941
0.6387521     3.9049676
0.00000750        1439.    191890757.    23.6041608     0.0001770   -0.00004797
0.7112618     4.3182800
0.00000875        1677.    191633629.    22.3978190     0.0001960   -0.00006652
0.7830282     4.7319537
0.00001000        1913.    191315343.    21.4944116     0.0002149   -0.00008506
0.8540356     5.1458792
0.00001125        2148.    190951585.    20.7921255     0.0002339    -0.000104
0.9242747     5.5599935
0.00001250        2148.    171856426.    18.9226623     0.0002365    -0.000138
0.9333215     5.5000901 C
0.00001375        2148.    156233115.    18.2742526     0.0002513    -0.000161
0.9871182     5.7915593 C
0.00001500        2148.    143213689.    17.7178483     0.0002658    -0.000184
1.0395573     6.0760216 C
0.00001625        2148.    132197251.    17.2349071     0.0002801    -0.000207
1.0908225     6.3547625 C
0.00001750        2224.    127113306.    16.8100264     0.0002942    -0.000231
1.1409560     6.6279709 C
0.00001875        2319.    123678026.    16.4344659     0.0003081    -0.000254
1.1901637     6.8971816 C
0.00002000        2412.    120585033.    16.0995384     0.0003220    -0.000278
1.2384997     7.1627335 C
0.00002125        2503.    117785511.    15.7986802     0.0003357    -0.000302
1.2860205     7.4249993 C
0.00002250        2593.    115240934.    15.5268489     0.0003494    -0.000326
1.3327860     7.6843938 C
0.00002375        2682.    112921788.    15.2802953     0.0003629    -0.000350
1.3788730     7.9414909 C
0.00002500        2770.    110802621.    15.0559609     0.0003764    -0.000374
1.4243512     8.1968217 C
0.00002625        2858.    108861318.    14.8512714     0.0003898    -0.000398
1.4692841     -8.677238 C
0.00002750        2944.    107064112.    14.6623298     0.0004032    -0.000422
1.5135485     -9.241167 C
0.00002875        3031.    105409380.    14.4890122     0.0004166    -0.000446
1.5573505     -9.805724 C
0.00003000        3116.    103873120.    14.3285471     0.0004299    -0.000470
1.6006066    -10.371665 C
0.00003125        3201.    102445457.    14.1798660     0.0004431    -0.000494
1.6433693    -10.938558 C
0.00003250        3286.    101113016.    14.0414725     0.0004563    -0.000519
1.6856269    -11.506535 C
0.00003375        3371.     99870242.    13.9129100     0.0004696    -0.000543
```

1.7274569 -12.074924 C
0.00003500 3455. 98701075. 13.7920449 0.0004827 -0.000567
1.7687408 -12.644820 C
0.00003625 3538. 97608602. 13.6798534 0.0004959 -0.000592
1.8096847 -13.214359 C
0.00003750 3622. 96576165. 13.5738158 0.0005090 -0.000616
1.8500951 -13.785340 C
0.00003875 3705. 95603338. 13.4743162 0.0005221 -0.000640
1.8900931 -14.356660 C
0.00004000 3788. 94687784. 13.3813419 0.0005353 -0.000665
1.9297531 -14.927624 C
0.00004125 3870. 93818150. 13.2930559 0.0005483 -0.000689
1.9689162 -15.499744 C
0.00004250 3952. 92993140. 13.2095414 0.0005614 -0.000714
2.0076570 -16.072333 C
0.00004375 4034. 92212079. 13.1311004 0.0005745 -0.000738
2.0460614 -16.644564 C
0.00004500 4116. 91471292. 13.0572921 0.0005876 -0.000762
2.0841284 -17.216435 C
0.00004625 4198. 90761324. 12.9863334 0.0006006 -0.000787
2.1216619 -17.789893 C
0.00004750 4279. 90085117. 12.9191230 0.0006137 -0.000811
2.1588379 -18.363212 C
0.00004875 4360. 89440735. 12.8556568 0.0006267 -0.000836
2.1956779 -18.936169 C
0.00005125 4522. 88237098. 12.7385530 0.0006529 -0.000885
2.2683078 -20.081388 C
0.00005375 4683. 87126647. 12.6309450 0.0006789 -0.000934
2.3392484 -21.228702 C
0.00005625 4843. 86105006. 12.5336990 0.0007050 -0.000982
2.4088419 -22.374534 C
0.00005875 5003. 85160434. 12.4456383 0.0007312 -0.001031
2.4770650 -23.519048 C
0.00006125 5162. 84277983. 12.3637750 0.0007573 -0.001080
2.5436304 -24.665407 C
0.00006375 5320. 83455943. 12.2890873 0.0007834 -0.001129
2.6088402 -25.810237 C
0.00006625 5478. 82687401. 12.2206488 0.0008096 -0.001178
2.6726866 -26.953524 C
0.00006875 5635. 81966441. 12.1581276 0.0008359 -0.001227
2.7351614 -28.095252 C
0.00007125 5792. 81284936. 12.0997258 0.0008621 -0.001275
2.7960481 -29.238004 C
0.00007375 5947. 80641385. 12.0456388 0.0008884 -0.001324
2.8555252 -30.379577 C
0.00007625 6102. 80032456. 11.9958313 0.0009147 -0.001373
2.9136191 -31.519531 C
0.00007875 6257. 79454785. 11.9496179 0.0009410 -0.001421
2.9703216 -32.657846 C
0.00008125 6411. 78905415. 11.9072028 0.0009675 -0.001470

3.0256237 -33.794507 C
0.00008375 6564. 78381744. 11.8680096 0.0009939 -0.001519
3.0795169 -34.929494 C
0.00008625 6717. 77880632. 11.8315256 0.0010205 -0.001567
3.1319104 -36.063991 C
0.00008875 6869. 77400187. 11.7971816 0.0010470 -0.001616
3.1828049 -37.197941 C
0.00009125 7021. 76939445. 11.7652997 0.0010736 -0.001664
3.2322745 -38.330138 C
0.00009375 7172. 76496765. 11.7357707 0.0011002 -0.001712
3.2803096 -39.460561 C
0.00009625 7322. 76070673. 11.7084184 0.0011269 -0.001761
3.3269007 -40.589190 C
0.00009875 7471. 75659845. 11.6830851 0.0011537 -0.001809
3.3720380 -41.716003 C
0.0001013 7620. 75263086. 11.6596285 0.0011805 -0.001857
3.4157116 -42.840979 C
0.0001038 7769. 74879319. 11.6375414 0.0012074 -0.001905
3.4579115 -43.964094 C
0.0001063 7916. 74507556. 11.6174658 0.0012344 -0.001953
3.4986272 -45.085329 C
0.0001088 8063. 74146909. 11.5989193 0.0012614 -0.002001
3.5378482 -46.204658 C
0.0001113 8210. 73796564. 11.5818061 0.0012885 -0.002049
3.5755640 -47.322058 C
0.0001138 8356. 73455780. 11.5660393 0.0013156 -0.002097
3.6117636 -48.437505 C
0.0001163 8501. 73123875. 11.5515393 0.0013429 -0.002145
3.6464359 -49.550974 C
0.0001188 8645. 72799961. 11.5380711 0.0013701 -0.002192
3.6795234 -50.663559 C
0.0001213 8789. 72483735. 11.5257181 0.0013975 -0.002240
3.7110601 -51.774250 C
0.0001238 8932. 72174711. 11.5142733 0.0014249 -0.002288
3.7410419 -52.882839 C
0.0001263 9074. 71872395. 11.5038625 0.0014524 -0.002335
3.7694567 -53.989296 C
0.0001288 9215. 71576332. 11.4944348 0.0014799 -0.002383
3.7962921 -55.093591 C
0.0001313 9356. 71286099. 11.4859420 0.0015075 -0.002430
3.8215352 -56.195695 C
0.0001338 9496. 71001304. 11.4783398 0.0015352 -0.002477
3.8451731 -57.295577 C
0.0001363 9636. 70721582. 11.4715870 0.0015630 -0.002524
3.8671925 -58.393204 C
0.0001388 9774. 70446593. 11.4656460 0.0015909 -0.002572
3.8875798 -59.488544 C
0.0001413 9911. 70163317. 11.4597976 0.0016187 -0.002619
3.9062585 -60.000000 CY
0.0001438 10042. 69857866. 11.4532402 0.0016464 -0.002666

3.9231643 -60.000000 CY
0.0001463 10168. 69524361. 11.4455764 0.0016739 -0.002714
3.9382879 -60.000000 CY
0.0001488 10288. 69162186. 11.4365251 0.0017012 -0.002761
3.9516532 -60.000000 CY
0.0001588 10660. 67146736. 11.3699167 0.0018050 -0.002958
3.9875865 -60.000000 CY
0.0001688 10954. 64911230. 11.2909064 0.0019053 -0.003157
3.9999587 -60.000000 CY
0.0001788 11229. 62820222. 11.2233632 0.0020062 -0.003356
3.9997758 -60.000000 CY
0.0001888 11429. 60553303. 11.1388662 0.0021025 -0.003560
3.9983230 -60.000000 CY
0.0001988 11581. 58271042. 11.0495664 0.0021961 -0.003766
3.9996314 -60.000000 CY
0.0002088 11727. 56179516. 10.9724244 0.0022905 -0.003972
3.9999910 -60.000000 CY
0.0002188 11869. 54257251. 10.9046017 0.0023854 -0.004177
3.9978294 -60.000000 CY
0.0002288 12006. 52485621. 10.8453080 0.0024809 -0.004382
3.9964632 -60.000000 CY
0.0002388 12135. 50829036. 10.7917549 0.0025765 -0.004586
3.9969202 -60.000000 CY
0.0002488 12242. 49213113. 10.7349554 0.0026703 -0.004792
3.9998438 -60.000000 CY
0.0002588 12316. 47597969. 10.6696562 0.0027608 -0.005002
3.9996282 -60.000000 CY
0.0002688 12373. 46039730. 10.6010301 0.0028490 -0.005213
3.9977177 -60.000000 CY
0.0002788 12427. 44581144. 10.5366706 0.0029371 -0.005425
3.9982619 -60.000000 CY
0.0002888 12480. 43219613. 10.4784596 0.0030257 -0.005637
3.9989846 -60.000000 CY
0.0002988 12531. 41946426. 10.4251359 0.0031145 -0.005848
3.9942837 -60.000000 CY
0.0003088 12582. 40752940. 10.3765122 0.0032037 -0.006059
3.9992641 -60.000000 CY
0.0003188 12632. 39628363. 10.3317287 0.0032932 -0.006269
3.9936391 60.0000000 CY
0.0003288 12679. 38566725. 10.2899118 0.0033828 -0.006480
3.9988380 60.0000000 CYT
0.0003388 12724. 37561267. 10.2529906 0.0034732 -0.006689
3.9963185 60.0000000 CYT
0.0003488 12767. 36608864. 10.2200047 0.0035642 -0.006898
3.9973712 60.0000000 CYT
0.0003588 12809. 35704124. 10.1910101 0.0036560 -0.007106
3.9999588 60.0000000 CYT
0.0003688 12848. 34843011. 10.1656390 0.0037486 -0.007314
3.9939152 60.0000000 CYT
0.0003788 12886. 34022144. 10.1437335 0.0038419 -0.007521

3.9987932 60.0000000 CYT

Summary of Results for Nominal Moment Capacity for Section 2

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	220.400	12464.405	0.00300000	-0.00557559

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	220.400000	12464.	143.260000	8102.	74055041.
1	0.75	220.400000	12464.	165.300000	9348.	71302577.
1	0.90	220.400000	12464.	198.360000	11218.	62904897.

Layering Correction Equivalent Depths of Soil & Rock Layers

Layer No.	Top of Layer Below Pile Head ft	Equivalent Top Depth Below Grnd Surf ft	Same Layer Type As Layer Above	Layer is Rock or is Below Rock Layer	F0 Integral for Layer lbs	F1 Integral for Layer lbs
1	20.3300	0.00	N.A.	No	0.00	133423.
2	33.2000	12.8700	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 Displacement and Pile-head Rotation (Loading Type 5)
Displacement of pile head = 1.500000 inches
Rotation of pile head = 0.000E+00 radians
Axial load on pile head = 220400.0 lbs

Depth X	Deflect. y	Bending Moment	Shear Force	Slope S	Total Stress	Bending Stiffness	Soil Res. Es*H	Soil Spr. Lat. Load	Distrib. p
feet	inches	in-lbs	lbs	radians	psi*	lb-in^2	lb/inch	lb/inch	lb/inch
0.00	1.5000	-9917009.	59666.	0.00	0.00	1.08E+11	0.00	0.00	0.00
0.3820	1.4990	-9643293.	59665.	-4.15E-04	0.00	1.08E+11	0.00	0.00	0.00
0.7640	1.4962	-9369163.	59665.	-8.14E-04	0.00	1.10E+11	0.00	0.00	0.00
1.1460	1.4916	-9094639.	59665.	-0.00120	0.00	1.11E+11	0.00	0.00	0.00

1.5280	1.4852	-8819735.	59665.	-0.00157	0.00	1.12E+11
0.00	0.00	0.00				
1.9100	1.4772	-8544467.	59665.	-0.00192	0.00	1.13E+11
0.00	0.00	0.00				
2.2920	1.4676	-8268848.	59665.	-0.00226	0.00	1.14E+11
0.00	0.00	0.00				
2.6740	1.4565	-7992894.	59665.	-0.00258	0.00	1.15E+11
0.00	0.00	0.00				
3.0560	1.4439	-7716620.	59665.	-0.00289	0.00	1.17E+11
0.00	0.00	0.00				
3.4380	1.4300	-7440039.	59665.	-0.00319	0.00	1.18E+11
0.00	0.00	0.00				
3.8200	1.4147	-7163167.	59665.	-0.00347	0.00	1.20E+11
0.00	0.00	0.00				
4.2020	1.3982	-6886017.	59665.	-0.00374	0.00	1.21E+11
0.00	0.00	0.00				
4.5840	1.3804	-6608605.	59665.	-0.00399	0.00	1.23E+11
0.00	0.00	0.00				
4.9660	1.3616	-6330944.	59665.	-0.00423	0.00	1.25E+11
0.00	0.00	0.00				
5.3480	1.3416	-6053049.	59665.	-0.00446	0.00	1.27E+11
0.00	0.00	0.00				
5.7300	1.3207	-5774933.	59665.	-0.00467	0.00	1.30E+11
0.00	0.00	0.00				
6.1120	1.2989	-5496612.	59665.	-0.00486	0.00	1.32E+11
0.00	0.00	0.00				
6.4940	1.2761	-5218098.	59665.	-0.00505	0.00	1.36E+11
0.00	0.00	0.00				
6.8760	1.2526	-4939406.	59665.	-0.00522	0.00	1.39E+11
0.00	0.00	0.00				
7.2580	1.2283	-4660549.	59665.	-0.00537	0.00	1.43E+11
0.00	0.00	0.00				
7.6400	1.2033	-4381542.	59665.	-0.00551	0.00	1.48E+11
0.00	0.00	0.00				
8.0220	1.1777	-4102398.	59665.	-0.00564	0.00	1.54E+11
0.00	0.00	0.00				
8.4040	1.1516	-3823130.	59665.	-0.00576	0.00	1.61E+11
0.00	0.00	0.00				
8.7860	1.1249	-3543752.	59665.	-0.00586	0.00	1.69E+11
0.00	0.00	0.00				
9.1680	1.0979	-3264277.	59665.	-0.00595	0.00	1.79E+11
0.00	0.00	0.00				
9.5500	1.0704	-2984717.	59665.	-0.00601	0.00	3.21E+11
0.00	0.00	0.00				
9.9320	1.0427	-2705114.	59665.	-0.00605	0.00	3.70E+11
0.00	0.00	0.00				
10.3140	1.0149	-2425478.	59665.	-0.00608	0.00	3.71E+11
0.00	0.00	0.00				
10.6960	0.9869	-2145811.	59665.	-0.00611	0.00	3.71E+11
0.00	0.00	0.00				

11.0780	0.9588	-1866117.	59665.	-0.00614	0.00	3.72E+11
0.00	0.00	0.00				
11.4600	0.9307	-1586400.	59665.	-0.00616	0.00	3.72E+11
0.00	0.00	0.00				
11.8420	0.9024	-1306664.	59665.	-0.00618	0.00	3.72E+11
0.00	0.00	0.00				
12.2240	0.8740	-1026911.	59665.	-0.00619	0.00	3.72E+11
0.00	0.00	0.00				
12.6060	0.8456	-747145.	59665.	-0.00620	0.00	3.72E+11
0.00	0.00	0.00				
12.9880	0.8172	-467370.	59665.	-0.00621	0.00	3.72E+11
0.00	0.00	0.00				
13.3700	0.7887	-187589.	59665.	-0.00621	0.00	3.72E+11
0.00	0.00	0.00				
13.7520	0.7602	92194.	59665.	-0.00621	0.00	3.72E+11
0.00	0.00	0.00				
14.1340	0.7317	371976.	59665.	-0.00621	0.00	3.72E+11
0.00	0.00	0.00				
14.5160	0.7032	651753.	59665.	-0.00621	0.00	3.72E+11
0.00	0.00	0.00				
14.8980	0.6748	931522.	59665.	-0.00620	0.00	3.72E+11
0.00	0.00	0.00				
15.2800	0.6464	1211280.	59665.	-0.00618	0.00	3.72E+11
0.00	0.00	0.00				
15.6620	0.6181	1491023.	59665.	-0.00617	0.00	3.72E+11
0.00	0.00	0.00				
16.0440	0.5899	1770747.	59665.	-0.00615	0.00	3.72E+11
0.00	0.00	0.00				
16.4260	0.5618	2050448.	59665.	-0.00612	0.00	3.71E+11
0.00	0.00	0.00				
16.8080	0.5338	2330125.	59665.	-0.00609	0.00	3.71E+11
0.00	0.00	0.00				
17.1900	0.5059	2609772.	59665.	-0.00606	0.00	3.70E+11
0.00	0.00	0.00				
17.5720	0.4782	2889387.	59665.	-0.00603	0.00	3.70E+11
0.00	0.00	0.00				
17.9540	0.4506	3168965.	59665.	-0.00597	0.00	1.83E+11
0.00	0.00	0.00				
18.3360	0.4234	3448464.	59665.	-0.00589	0.00	1.72E+11
0.00	0.00	0.00				
18.7180	0.3967	3727869.	59665.	-0.00579	0.00	1.63E+11
0.00	0.00	0.00				
19.1000	0.3704	4007169.	59665.	-0.00568	0.00	1.56E+11
0.00	0.00	0.00				
19.4820	0.3446	4286350.	59665.	-0.00555	0.00	1.50E+11
0.00	0.00	0.00				
19.8640	0.3195	4565398.	59665.	-0.00542	0.00	1.45E+11
0.00	0.00	0.00				
20.2460	0.2950	4844300.	59665.	-0.00526	0.00	1.40E+11
0.00	0.00	0.00				

```
   20.6280     0.2712   5123043.     58793.   -0.00510       0.00   1.37E+11
-380.474      6431.       0.00
   21.0100     0.2482   5393617.     56561.   -0.00492       0.00   1.34E+11
-593.473     10960.       0.00
   21.3920     0.2261   5651533.     53235.   -0.00473       0.00   1.31E+11
-857.366     17384.       0.00
   21.7740     0.2049   5891234.     48776.   -0.00453       0.00   1.29E+11
-1088.     24353.       0.00
   22.1560     0.1846   6107853.     43328.   -0.00431       0.00   1.27E+11
-1289.     32000.       0.00
   22.5380     0.1653   6297170.     37029.   -0.00408       0.00   1.25E+11
-1460.     40466.       0.00
   22.9200     0.1472   6455585.     30011.   -0.00385       0.00   1.24E+11
-1602.     49911.       0.00
   23.3020     0.1300   6580091.     22404.   -0.00361       0.00   1.23E+11
-1717.     60520.       0.00
   23.6840     0.1141   6668272.     14333.   -0.00336       0.00   1.23E+11
-1804.     72508.       0.00
   24.0660    0.09923   6718288.      5925.   -0.00311       0.00   1.22E+11
-1864.     86110.       0.00
   24.4480    0.08554   6728883.     -2690.   -0.00286       0.00   1.22E+11
-1895.    101553.       0.00
   24.8300    0.07301   6699403.    -11357.   -0.00261       0.00   1.23E+11
-1887.    118452.       0.00
   25.2120    0.06163   6630028.    -19884.   -0.00236       0.00   1.23E+11
-1834.    136402.       0.00
   25.5940    0.05138   6521871.    -28135.   -0.00212       0.00   1.24E+11
-1766.    157576.       0.00
   25.9760    0.04223   6376359.    -36044.   -0.00188       0.00   1.25E+11
-1684.    182824.       0.00
   26.3580    0.03417   6195215.    -43548.   -0.00165       0.00   1.26E+11
-1590.    213306.       0.00
   26.7400    0.02713   5980437.    -50592.   -0.00143       0.00   1.28E+11
-1483.    250639.       0.00
   27.1220    0.02108   5734272.    -57123.   -0.00122       0.00   1.30E+11
-1366.    297146.       0.00
   27.5040    0.01595   5459194.    -63096.   -0.00102       0.00   1.33E+11
-1240.    356282.       0.00
   27.8860    0.01168   5157878.    -68469.  -8.44E-04       0.00   1.36E+11
-1105.    433415.       0.00
   28.2680    0.00822   4833174.    -73208.  -6.78E-04       0.00   1.41E+11
-963.026    537359.       0.00
   28.6500    0.00547   4488074.    -77168.  -5.29E-04       0.00   1.46E+11
-764.357    640733.       0.00
   29.0320    0.00337   4126770.    -80048.  -3.97E-04       0.00   1.53E+11
-492.274    670151.       0.00
   29.4140    0.00183   3754997.    -81817.  -2.82E-04       0.00   1.62E+11
-279.634    699570.       0.00
   29.7960   7.83E-04   3377242.    -82743.  -1.85E-04       0.00   1.75E+11
-124.544    728988.       0.00
```

```
   30.1780   1.40E-04   2996779.    -83082.  -1.19E-04       0.00   3.17E+11
-23.140    758406.       0.00
   30.5600  -3.05E-04   2615787.    -83015.  -8.08E-05       0.00   3.70E+11
52.4163    787825.       0.00
   30.9420  -6.01E-04   2235864.    -82649.  -5.08E-05       0.00   3.71E+11
107.2074    817243.       0.00
   31.3240  -7.71E-04   1858165.    -82077.  -2.56E-05       0.00   3.72E+11
142.4073    846661.       0.00
   31.7060  -8.36E-04   1483435.    -81384.  -4.95E-06       0.00   3.72E+11
159.7023    876079.       0.00
   32.0880  -8.16E-04   1112043.    -80649.   1.10E-05       0.00   3.72E+11
161.2741    905498.       0.00
   32.4700  -7.34E-04    744026.    -79936.   2.25E-05       0.00   3.72E+11
149.7950    934916.       0.00
   32.8520  -6.10E-04    379148.    -79298.   2.94E-05       0.00   3.72E+11
128.4277    964334.       0.00
   33.2340  -4.65E-04     16963.    -62723.   3.19E-05       0.00   1.92E+11
7103.   7.00E+07       0.00
   33.6160  -3.18E-04   -195964.    -33090.   2.98E-05       0.00   1.92E+11
5826.   8.40E+07       0.00
   33.9980  -1.92E-04   -286467.    -10324.   2.40E-05       0.00   1.92E+11
4107.   9.80E+07       0.00
   34.3800  -9.76E-05   -290659.      4556.   1.71E-05       0.00   1.92E+11
2385.   1.12E+08       0.00
   34.7620  -3.49E-05   -244730.     12221.   1.08E-05       0.00   1.92E+11
959.2331   1.26E+08       0.00
   35.1440   1.05E-06   -178638.     14346.   5.71E-06       0.00   1.92E+11
-32.057   1.40E+08       0.00
   35.5260   1.75E-05   -113216.     12928.   2.23E-06       0.00   1.92E+11
-586.474   1.54E+08       0.00
   35.9080   2.15E-05    -60114.      9780.   1.60E-07       0.00   1.92E+11
-787.224   1.68E+08       0.00
   36.2900   1.89E-05    -23553.      6253.  -8.38E-07       0.00   1.92E+11
-751.448   1.82E+08       0.00
   36.6720   1.38E-05     -2782.      3179.  -1.15E-06       0.00   1.92E+11
-589.897   1.96E+08       0.00
   37.0540   8.36E-06      5594.   948.9576  -1.12E-06       0.00   1.92E+11
-383.060   2.10E+08       0.00
   37.4360   3.54E-06      5921.   -325.364  -9.81E-07       0.00   1.92E+11
-172.927   2.24E+08       0.00
   37.8180  -6.36E-07      2613.   -645.981  -8.79E-07       0.00   1.92E+11
33.0414   2.38E+08       0.00
   38.2000  -4.52E-06       0.00       0.00  -8.48E-07       0.00   1.92E+11
248.8000   1.26E+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             =     1.50000000 inches
Computed slope at pile head      =       0.000000 radians
Maximum bending moment           =      -9917009. inch-lbs
Maximum shear force              =        -83082. lbs
Depth of maximum bending moment  =       0.000000 feet below pile head
Depth of maximum shear force     =    30.17800000 feet below pile head
Number of iterations             =             83
Number of zero deflection points =              3
Pile deflection at ground        =     0.28973741 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	Load Pile-head 1	Load Type	Load Pile-head 2	Axial Loading lbs	Pile-head Deflection inches	Pile-head Rotation radians	Max Shear in Pile lbs	Max Moment in Pile in-lbs
1	y, in	1.5000	S, rad	0.00	220400.	1.5000	0.00	-83082.	-9917009.

Maximum pile-head deflection = 1.5000000000 inches
Maximum pile-head rotation = 0.0000000000 radians = 0.000000 deg.

Summary of Warning Messages

The following warning was reported 1176 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.

==========

LPile for Windows, Version 2022-12.011

Analysis of Individual Piles and Drilled Shafts
Subjected to Lateral Loading Using the p-y Method
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Files Used for Analysis

Path to file locations:
\20240280\ODOT\109971\400-Engineering\Structures\SFN_0800512\Engdata\04_Abutment Design\Stage 2\Drilled Shaft\Lpile\Wingwalls\Rear Abutment Wingwalls\

Name of input data file:
RA WW_Scour Extreme II - Back DS.lp12d

Name of output report file:
RA WW_Scour Extreme II - Back DS.lp12o

Name of plot output file:
RA WW_Scour Extreme II - Back DS.lp12p

Name of runtime message file:
RA WW_Scour Extreme II - Back DS.lp12r

Date and Time of Analysis

Date: February 12, 2026 Time: 13:44:52

Problem Title

Project Name:

Job Number:

Client:

Engineer:

Description:

Program Options and Settings

Computational Options:
- Conventional Analysis

Engineering Units Used for Data Input and Computations:
- US Customary System Units (pounds, feet, inches)

Analysis Control Options:

- Maximum number of iterations allowed	=	500
- Deflection tolerance for convergence	=	1.0000E-05 in
- Maximum allowable deflection	=	100.0000 in
- Number of pile increments	=	100

Loading Type and Number of Cycles of Loading:

- Static loading specified

- Analysis uses p-y modification factors for p-y curves
- Analysis uses layering correction (Method of Georgiadis)
- No distributed lateral loads are entered
- Loading by lateral soil movements acting on pile not selected
- Input of shear resistance at the pile tip not selected
- Input of moment resistance at the pile tip not selected
- Computation of pile-head foundation stiffness matrix not selected
- Push-over analysis of pile not selected
- Buckling analysis of pile not selected

Output Options:
- Output files use decimal points to denote decimal symbols.
- Values of pile-head deflection, bending moment, shear force, and soil reaction are printed for full length of pile.
- Printing Increment (nodal spacing of output points) = 1
- No p-y curves to be computed and reported for user-specified depths
- Print using wide report formats

Pile Structural Properties and Geometry

Number of pile sections defined = 2
Total length of pile = 38.200 ft
Depth of ground surface below top of pile = 20.3300 ft

Pile diameters used for p-y curve computations are defined using 4 points.

p-y curves are computed using pile diameter values interpolated with depth over the length of the pile. A summary of values of pile diameter vs. depth follows.

Point No.	Depth Below Pile Head feet	Pile Diameter inches
1	0.000	36.0000
2	33.200	36.0000
3	33.200	30.0000
4	38.200	30.0000

Input Structural Properties for Pile Sections:

Pile Section No. 1:

Section 1 is a round drilled shaft, bored pile, or CIDH pile
Length of section = 33.200000 ft
Shaft Diameter = 36.000000 in

Pile Section No. 2:

Section 2 is a round drilled shaft, bored pile, or CIDH pile
Length of section = 5.000000 ft
Shaft Diameter = 30.000000 in

Soil and Rock Layering Information

The soil profile is modelled using 2 layers

Layer 1 is stiff clay with water-induced erosion

Distance from top of pile to top of layer = 20.330000 ft
Distance from top of pile to bottom of layer = 33.200000 ft
Effective unit weight at top of layer = 67.600000 pcf
Effective unit weight at bottom of layer = 67.600000 pcf
Undrained cohesion at top of layer = 4800. psf
Undrained cohesion at bottom of layer = 4800. psf
Epsilon-50 at top of layer = 0.004000
Epsilon-50 at bottom of layer = 0.004000
Subgrade k at top of layer = 2000. pci
Subgrade k at bottom of layer = 2000. pci

Layer 2 is weak rock, p-y criteria by Reese, 1997

Distance from top of pile to top of layer = 33.200000 ft
Distance from top of pile to bottom of layer = 50.000000 ft
Effective unit weight at top of layer = 92.700000 pcf
Effective unit weight at bottom of layer = 92.700000 pcf
Uniaxial compressive strength at top of layer = 1640. psi
Uniaxial compressive strength at bottom of layer = 1640. psi
Initial modulus of rock at top of layer = 150000. psi
Initial modulus of rock at bottom of layer = 150000. 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

(Depth of the lowest soil layer extends 11.800 ft below the pile tip)

Summary of Input Soil Properties

Layer Num.	Soil Type Name or (p-y Curve Type)	Layer Depth ft	Effective Unit Wt. pcf	Cohesion psf	Uniaxial qu psi	RQD %	E50 krm	kpy pci	Rock Mass Modulus psi
1	Stiff Clay with Free Water	20.3300	67.6000	4800.	--	--	0.00400	2000.	--
		33.2000	67.6000	4800.	--	--	0.00400	2000.	--
2	Weak Rock	33.2000	92.7000	--	1640.	15.0000	5.00E-04	--	150000.
		50.0000	92.7000	--	1640.	15.0000	5.00E-04	--	150000.

Modification Factors for p-y Curves

Distribution of p-y modifiers with depth defined using 2 points

Point No.	Depth X ft	p-mult	y-mult
1	20.330	0.5000	1.0000
2	33.200	0.5000	1.0000

Static Loading Type

Static loading criteria were used when computing p-y curves for all analyses.

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 1

Load No.	Load Type	Condition 1	Condition 2	Axial Thrust Force, lbs	Compute Top y vs. Pile Length	Run Analysis
1	5	y = 1.500000 in	S = 0.0000 in/in	207630.	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 = 2

Pile Section No. 1:

Dimensions and Properties of Drilled Shaft (Bored Pile):

Length of Section	=	33.200000 ft
Shaft Diameter	=	36.000000 in
Concrete Cover Thickness (to edge of trans. reinf.)	=	6.000000 in
Number of Reinforcing Bars	=	17 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	=	21.590000 sq. in.
Area Ratio of Steel Reinforcement	=	2.12 percent
Edge-to-Edge Bar Spacing	=	2.676940 in
Maximum Concrete Aggregate Size	=	0.375000 in
Ratio of Bar Spacing to Aggregate Size	=	7.14

Offset of Center of Rebar Cage from Center of Pile = 0.0000 in
Transverse Reinforcement
Type: Hoop
Number of Transverse Reinf. (per spacing) = 1
Spacing of Transverse Reinf. = 4.500000 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 = 4682.772 kips
Tensile Load for Cracking of Concrete = -486.599 kips
Nominal Axial Tensile Capacity = -1295.400 kips

Reinforcing Bar Dimensions and Positions Used in Computations:

Bar Number	Bar Diam. inches	Bar Area sq. in.	X inches	Y inches
1	1.270000	1.270000	10.740000	0.00000
2	1.270000	1.270000	10.014752	3.879735
3	1.270000	1.270000	7.936956	7.235491
4	1.270000	1.270000	4.787230	9.614054
5	1.270000	1.270000	0.990962	10.694185
6	1.270000	1.270000	-2.93914	10.330007
7	1.270000	1.270000	-6.47230	8.570705
8	1.270000	1.270000	-9.13133	5.653881
9	1.270000	1.270000	-10.55713	1.973470
10	1.270000	1.270000	-10.55713	-1.97347
11	1.270000	1.270000	-9.13133	-5.65388
12	1.270000	1.270000	-6.47230	-8.57071
13	1.270000	1.270000	-2.93914	-10.33001
14	1.270000	1.270000	0.990962	-10.69419
15	1.270000	1.270000	4.787230	-9.61405
16	1.270000	1.270000	7.936956	-7.23549
17	1.270000	1.270000	10.014752	-3.87974

NOTE: The positions of the above rebars were computed by LPile

Minimum spacing between any two bars not equal to zero = 2.677 inches
between bars 6 and 7.

Ratio of bar spacing to maximum aggregate size = 7.14

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 = 0.375000 in

Number of Axial Thrust Force Values Determined from Pile-head Loadings = 1

Number	Axial Thrust Force kips
1	207.630

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 = 207.630 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	232.9406840	372705094.	87.1772333	0.00005449	0.00003199	0.2272827	1.4593749	
0.00000125	465.8949312	372715945.	52.6066638	0.00006576	0.00002076	0.2731100	1.6655666	
0.00000188	698.8388842	372714072.	41.0911417	0.00007705	0.00000955	0.3187184	1.8721933	

```
0.00000250   931.7672962    372706918.    35.3393811    0.00008835   -0.00000165
0.3641066     2.0792551
0.00000313         1165.    372666811.    31.8927538    0.00009966   -0.00001284
0.4092689     2.2867183
0.00000375         1397.    372525514.    29.5975346     0.0001110   -0.00002401
0.4541868     2.4944568
0.00000438         1629.    372277367.    27.9594746     0.0001223   -0.00003518
0.4988461     2.7023708
0.00000500         1860.    371942153.    26.7317528     0.0001337   -0.00004634
0.5432385     2.9104041
0.00000563         2090.    371539732.    25.7773870     0.0001450   -0.00005750
0.5873594     3.1185237
0.00000625         2319.    371085670.    25.0142548     0.0001563   -0.00006866
0.6312056     3.3267087
0.00000688         2548.    370591595.    24.3901325     0.0001677   -0.00007982
0.6747753     3.5349452
0.00000750         2775.    370066137.    23.8702252     0.0001790   -0.00009097
0.7180669     3.7432240
0.00000813         2775.    341599511.    21.3575130     0.0001735     -0.000119
0.6964821     3.4631015 C
0.00000875         2775.    317199546.    20.7828594     0.0001819     -0.000133
0.7280426     3.5836856 C
0.00000938         2775.    296052909.    20.2721902     0.0001901     -0.000147
0.7589970     3.7008155 C
0.00001000         2775.    277549602.    19.8146324     0.0001981     -0.000162
0.7893981     3.8148458 C
0.00001063         2775.    261223155.    19.4027296     0.0002062     -0.000176
0.8193271     3.9263545 C
0.00001125         2775.    246710758.    19.0293746     0.0002141     -0.000191
0.8488104     4.0355088 C
0.00001188         2775.    233725981.    18.6890754     0.0002219     -0.000206
0.8778785     4.1425127 C
0.00001250         2775.    222039682.    18.3776320     0.0002297     -0.000220
0.9065708     4.2476416 C
0.00001313         2775.    211466364.    18.0917266     0.0002375     -0.000235
0.9349298     4.3512010 C
0.00001375         2775.    201854256.    17.8284609     0.0002451     -0.000250
0.9629900     -4.590209 C
0.00001438         2791.    194169158.    17.5836881     0.0002528     -0.000265
0.9906842     -4.900913 C
0.00001500         2857.    190478719.    17.3572366     0.0002604     -0.000280
1.0181396     -5.212502 C
0.00001563         2923.    187045981.    17.1467263     0.0002679     -0.000295
1.0453454     -5.525077 C
0.00001625         2987.    183831647.    16.9493747     0.0002754     -0.000310
1.0722476     -5.839081 C
0.00001688         3052.    180839219.    16.7659209     0.0002829     -0.000325
1.0989828     -6.153439 C
0.00001750         3115.    178018461.    16.5925213     0.0002904     -0.000340
1.1254037     -6.469343 C
```

0.00001813 3179. 175382164. 16.4307548 0.0002978 -0.000355
1.1516825 -6.785418 C
0.00001875 3242. 172893736. 16.2777175 0.0003052 -0.000370
1.1777036 -7.102610 C
0.00001938 3304. 170550931. 16.1336818 0.0003126 -0.000385
1.2035453 -7.420291 C
0.00002000 3367. 168346498. 15.9983811 0.0003200 -0.000400
1.2292480 -7.738139 C
0.00002063 3429. 166248376. 15.8689701 0.0003273 -0.000415
1.2546677 -8.057343 C
0.00002125 3491. 164270665. 15.7473758 0.0003346 -0.000430
1.2799840 -8.376433 C
0.00002188 3552. 162397294. 15.6323100 0.0003420 -0.000446
1.3051478 -8.695816 C
0.00002250 3614. 160607676. 15.5218177 0.0003492 -0.000461
1.3300555 -9.016364 C
0.00002313 3675. 158912088. 15.4174024 0.0003565 -0.000476
1.3548611 -9.336799 C
0.00002375 3736. 157303097. 15.3186974 0.0003638 -0.000491
1.3795643 -9.657120 C
0.00002438 3797. 155758998. 15.2234353 0.0003711 -0.000506
1.4040095 -9.978647 C
0.00002563 3918. 152882566. 15.0461772 0.0003856 -0.000537
1.4525205 -10.622008 C
0.00002688 4038. 150254582. 14.8848338 0.0004000 -0.000567
1.5005016 -11.265995 C
0.00002813 4158. 147833660. 14.7357914 0.0004144 -0.000598
1.5478461 -11.911558 C
0.00002938 4277. 145610530. 14.5997328 0.0004289 -0.000629
1.5947891 -12.556668 C
0.00003063 4396. 143543899. 14.4730450 0.0004432 -0.000659
1.6410612 -13.203714 C
0.00003188 4514. 141628862. 14.3560971 0.0004576 -0.000690
1.6868855 -13.850745 C
0.00003313 4633. 139851128. 14.2480767 0.0004720 -0.000721
1.7323104 -14.497321 C
0.00003438 4750. 138185493. 14.1472341 0.0004863 -0.000751
1.7771332 -15.145288 C
0.00003563 4867. 136626303. 14.0528753 0.0005006 -0.000782
1.8214810 -15.793511 C
0.00003688 4984. 135166383. 13.9653444 0.0005150 -0.000813
1.8654312 -16.441273 C
0.00003813 5101. 133795939. 13.8839718 0.0005293 -0.000843
1.9089824 -17.088572 C
0.00003938 5217. 132499929. 13.8067741 0.0005436 -0.000874
1.9519664 -17.737002 C
0.00004063 5333. 131275037. 13.7341190 0.0005579 -0.000905
1.9944785 -18.385678 C
0.00004188 5449. 130117618. 13.6661892 0.0005723 -0.000935
2.0365930 -19.033884 C

0.00004313 5564. 129021777. 13.6025760 0.0005866 -0.000966
2.0783086 -19.681616 C
0.00004438 5679. 127982283. 13.5429164 0.0006010 -0.000997
2.1196240 -20.328872 C
0.00004563 5794. 126993058. 13.4865137 0.0006153 -0.001027
2.1604888 -20.976145 C
0.00004688 5908. 126047132. 13.4323201 0.0006296 -0.001058
2.2007982 -21.624502 C
0.00004813 6023. 125145392. 13.3812907 0.0006440 -0.001089
2.2407083 -22.272374 C
0.00004938 6137. 124284465. 13.3331872 0.0006583 -0.001119
2.2802177 -22.919755 C
0.00005063 6250. 123461303. 13.2877948 0.0006727 -0.001150
2.3193251 -23.566644 C
0.00005188 6364. 122673149. 13.2449194 0.0006871 -0.001180
2.3580291 -24.213037 C
0.00005313 6477. 121917510. 13.2043852 0.0007015 -0.001211
2.3963285 -24.858932 C
0.00005438 6590. 121192119. 13.1660326 0.0007159 -0.001242
2.4342218 -25.504326 C
0.00005563 6702. 120494024. 13.1294084 0.0007303 -0.001272
2.4716626 -26.149712 C
0.00005688 6815. 119820195. 13.0939618 0.0007447 -0.001303
2.5085870 -26.795808 C
0.00005813 6927. 119171140. 13.0603466 0.0007591 -0.001333
2.5451053 -27.441389 C
0.00005938 7039. 118545282. 13.0284487 0.0007736 -0.001364
2.5812163 -28.086450 C
0.00006063 7150. 117941161. 12.9981653 0.0007880 -0.001394
2.6169184 -28.730988 C
0.00006188 7261. 117357440. 12.9693977 0.0008025 -0.001425
2.6522103 -29.374999 C
0.00006313 7373. 116792883. 12.9420589 0.0008170 -0.001456
2.6870905 -30.018481 C
0.00006438 7483. 116246352. 12.9160673 0.0008315 -0.001486
2.7215575 -30.661429 C
0.00006563 7594. 115716796. 12.8913479 0.0008460 -0.001517
2.7556098 -31.303841 C
0.00006688 7704. 115203241. 12.8678310 0.0008605 -0.001547
2.7892459 -31.945713 C
0.00006813 7814. 114704785. 12.8454522 0.0008751 -0.001577
2.8224643 -32.587042 C
0.00006938 7924. 114220591. 12.8241517 0.0008897 -0.001608
2.8552634 -33.227823 C
0.00007063 8034. 113749881. 12.8038740 0.0009043 -0.001638
2.8876418 -33.868054 C
0.00007188 8143. 113291929. 12.7845676 0.0009189 -0.001669
2.9195977 -34.507731 C
0.00007313 8252. 112845285. 12.7657585 0.0009335 -0.001699
2.9510621 -35.147753 C

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0.00007438        8360.    112409924.    12.7477109     0.0009481     -0.001729
2.9820823    -35.787492 C
0.00007938        8793.    110772468.    12.6837283     0.0010068     -0.001851
3.1019092    -38.340652 C
0.00008438        9220.    109278336.    12.6312076     0.0010658     -0.001972
3.2148495    -40.884326 C
0.00008938        9644.    107902263.    12.5883279     0.0011251     -0.002092
3.3207916    -43.418240 C
0.00009438       10063.    106624282.    12.5536641     0.0011848     -0.002213
3.4196191    -45.942103 C
0.00009938       10477.    105428387.    12.5260824     0.0012448     -0.002333
3.5112103    -48.455610 C
 0.0001044       10886.    104301578.    12.5046721     0.0013052     -0.002452
3.5954377    -50.958435 C
 0.0001094       11291.    103233182.    12.4886944     0.0013660     -0.002572
3.6721681    -53.450233 C
 0.0001144       11691.    102214306.    12.4775474     0.0014271     -0.002690
3.7412612    -55.930645 C
 0.0001194       12085.    101237498.    12.4696058     0.0014886     -0.002809
3.8025700    -58.399283 C
 0.0001244       12473.    100284582.    12.4666741     0.0015505     -0.002927
3.8558929    -60.000000 CY
 0.0001294       12827.     99148858.    12.4587897     0.0016119     -0.003046
3.9003639    -60.000000 CY
 0.0001344       13123.     97657300.    12.4362109     0.0016711     -0.003166
3.9356330    -60.000000 CY
 0.0001394       13371.     95932492.    12.4035725     0.0017287     -0.003289
3.9625657    -60.000000 CY
 0.0001444       13589.     94120962.    12.3678531     0.0017856     -0.003412
3.9819674    -60.000000 CY
 0.0001494       13782.     92263144.    12.3287085     0.0018416     -0.003536
3.9942434    -60.000000 CY
 0.0001544       13956.     90405704.    12.2891226     0.0018971     -0.003660
3.9996783    -60.000000 CY
 0.0001594       14115.     88564598.    12.2500327     0.0019523     -0.003785
3.9995510    -60.000000 CY
 0.0001644       14255.     86722551.    12.2101215     0.0020070     -0.003910
3.9991701    -60.000000 CY
 0.0001694       14383.     84917569.    12.1711276     0.0020615     -0.004036
3.9983655    -60.000000 CY
 0.0001744       14504.     83178301.    12.1346261     0.0021160     -0.004162
3.9968952    -60.000000 CY
 0.0001794       14614.     81470603.    12.0998687     0.0021704     -0.004287
3.9999562    -60.000000 CY
 0.0001844       14710.     79783538.    12.0642412     0.0022243     -0.004413
3.9991978    -60.000000 CY
 0.0001894       14796.     78132895.    12.0297017     0.0022781     -0.004539
3.9970433    -60.000000 CY
 0.0001944       14879.     76548292.    11.9962792     0.0023318     -0.004666
3.9999021    -60.000000 CY
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 0.0001994        14958.     75025523.    11.9656076     0.0023856     -0.004792
3.9982954    -60.000000 CY
 0.0002044        15032.     73552648.    11.9363238     0.0024395     -0.004918
3.9995602    -60.000000 CY
 0.0002094        15099.     72114312.    11.9073549     0.0024931     -0.005044
3.9987153    -60.000000 CY
 0.0002144        15157.     70701271.    11.8770645     0.0025461     -0.005171
3.9987268    -60.000000 CY
 0.0002194        15210.     69331194.    11.8489945     0.0025994     -0.005298
3.9984561    -60.000000 CY
 0.0002244        15259.     68008254.    11.8205291     0.0026522     -0.005425
3.9999988    -60.000000 CY
 0.0002294        15308.     66736256.    11.7960950     0.0027057     -0.005552
3.9974898    -60.000000 CY
 0.0002344        15355.     65513582.    11.7745327     0.0027597     -0.005678
3.9998229    -60.000000 CY
 0.0002394        15400.     64335458.    11.7534264     0.0028135     -0.005804
3.9954231    -60.000000 CY
 0.0002444        15441.     63187337.    11.7323393     0.0028671     -0.005930
3.9989271    -60.000000 CY
 0.0002494        15480.     62076664.    11.7121510     0.0029207     -0.006057
3.9993620    -60.000000 CY
 0.0002544        15513.     60985751.    11.6901500     0.0029737     -0.006184
3.9963326    -60.000000 CY
 0.0002594        15545.     59930669.    11.6696013     0.0030268     -0.006311
3.9992012    -60.000000 CY
 0.0002644        15571.     58899100.    11.6478119     0.0030794     -0.006438
3.9989241    -60.000000 CY
 0.0002694        15597.     57900019.    11.6272755     0.0031321     -0.006565
3.9954932    -60.000000 CY
 0.0002744        15621.     56934421.    11.6079067     0.0031849     -0.006693
3.9986379    -60.000000 CY
 0.0003044        15753.     51756849.    11.5132471     0.0035043     -0.007453
3.9927601    -60.000000 CYT
 0.0003344        15839.     47370377.    11.4330266     0.0038229     -0.008215
3.9972441    -60.000000 CYT


-------------------------------------------------------------------------------
   Summary of Results for Nominal Moment Capacity for Section 1
-------------------------------------------------------------------------------

Moment values interpolated at maximum compressive strain = 0.003
or maximum developed moment if pile fails at smaller strains.

 Load           Axial Thrust        Nominal Mom. Cap.      Max. Comp.      Max.
Tens.
  No.              kips                 in-kip               Strain
Strain
 ----         ---------------     ------------------     ------------
```

```
------------
   1               207.630             15528.741           0.00300000
-0.00624668

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         207.630000        15529.    134.959500        10094.
106534751.

   1       0.75         207.630000        15529.    155.722500        11647.
102327010.

   1       0.90         207.630000        15529.    186.867000        13976.
90179499.


Pile Section No. 2:
-------------------

Dimensions and Properties of Drilled Shaft (Bored Pile):
-------------------------------------------------------

Length of Section                                    =     5.000000 ft
Shaft Diameter                                       =    30.000000 in
Concrete Cover Thickness (to edge of trans. reinf.)  =     3.000000 in
Number of Reinforcing Bars                           =           16 bars
Yield Stress of Reinforcing Bars                     =       60000. psi
Modulus of Elasticity of Reinforcing Bars            =    29000000. psi
Gross Area of Shaft                                  =   706.858347 sq. in.
Total Area of Reinforcing Steel                      =    20.320000 sq. in.
```

Area Ratio of Steel Reinforcement = 2.87 percent
Edge-to-Edge Bar Spacing = 2.920540 in
Maximum Concrete Aggregate Size = 0.375000 in
Ratio of Bar Spacing to Aggregate Size = 7.79
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. = 4.500000 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 = 3553.430 kips
Tensile Load for Cracking of Concrete = -353.523 kips
Nominal Axial Tensile Capacity = -1219.200 kips

Reinforcing Bar Dimensions and Positions Used in Computations:

Bar Number	Bar Diam. inches	Bar Area sq. in.	X inches	Y inches
1	1.270000	1.270000	10.740000	0.00000
2	1.270000	1.270000	9.922466	4.110020
3	1.270000	1.270000	7.594327	7.594327
4	1.270000	1.270000	4.110020	9.922466
5	1.270000	1.270000	0.00000	10.740000
6	1.270000	1.270000	-4.11002	9.922466
7	1.270000	1.270000	-7.59433	7.594327
8	1.270000	1.270000	-9.92247	4.110020
9	1.270000	1.270000	-10.74000	0.00000
10	1.270000	1.270000	-9.92247	-4.11002
11	1.270000	1.270000	-7.59433	-7.59433
12	1.270000	1.270000	-4.11002	-9.92247
13	1.270000	1.270000	0.00000	-10.74000
14	1.270000	1.270000	4.110020	-9.92247
15	1.270000	1.270000	7.594327	-7.59433
16	1.270000	1.270000	9.922466	-4.11002

NOTE: The positions of the above rebars were computed by LPile

Minimum spacing between any two bars not equal to zero = 2.921 inches
between bars 11 and 12.

Ratio of bar spacing to maximum aggregate size = 7.79

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	=	0.375000 in

Number of Axial Thrust Force Values Determined from Pile-head Loadings = 1

Number	Axial Thrust Force kips
1	207.630

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 = 207.630 kips

Bending Max Conc Curvature Stress rad/in. ksi	Bending Max Steel Moment Stress in-kip ksi	Bending Stiffness kip-in2	Depth to N Axis in	Max Comp Strain in/in	Max Tens Strain in/in	Run Msg
0.00000125	240.6086706	192486936.	63.0977405	0.00007887	0.00004137	
0.3267549	2.1513556					
0.00000250	481.2289929	192491597.	39.0727991	0.00009768	0.00002268	

```
0.4020509     2.5609029
0.00000375   721.8233664    192486231.    31.0750944     0.0001165    0.00000403
0.4767255     2.9716040
0.00000500   962.3243247    192464865.    27.0839700     0.0001354   -0.00001458
0.5507692     3.3834257
0.00000625        1202.    192358849.    24.6937387     0.0001543   -0.00003316
0.6241348     3.7960526
0.00000750        1441.    192153331.    23.1024695     0.0001733   -0.00005173
0.6967758     4.2091620
0.00000875        1679.    191869762.    21.9669960     0.0001922   -0.00007029
0.7686677     4.6225820
0.00001000        1915.    191529032.    21.1162761     0.0002112   -0.00008884
0.8397969     5.0362201
0.00001125        2150.    191146341.    20.4550452     0.0002301    -0.000107
0.9101554     5.4500210
0.00001250        2150.    172031707.    18.4976672     0.0002312    -0.000144
0.9135637     5.3460442 C
0.00001375        2150.    156392461.    17.8749600     0.0002458    -0.000167
0.9668778     5.6323592 C
0.00001500        2150.    143359756.    17.3402226     0.0002601    -0.000190
1.0188549     5.9117629 C
0.00001625        2150.    132332082.    16.8761636     0.0002742    -0.000213
1.0696993     6.1857066 C
0.00001750        2176.    124321836.    16.4688228     0.0002882    -0.000237
1.1195053     6.4548058 C
0.00001875        2269.    121001216.    16.1087257     0.0003020    -0.000260
1.1684111     6.7200583 C
0.00002000        2360.    118016606.    15.7876250     0.0003158    -0.000284
1.2164725     6.9818226 C
0.00002125        2451.    115319967.    15.4992884     0.0003294    -0.000308
1.2637491     7.2404990 C
0.00002250        2540.    112875217.    15.2391451     0.0003429    -0.000332
1.3103200     7.4966673 C
0.00002375        2628.    110651719.    15.0035034     0.0003563    -0.000356
1.3562552     7.7508505 C
0.00002500        2716.    108623411.    14.7893716     0.0003697    -0.000380
1.4016192     -8.308956 C
0.00002625        2803.    106762282.    14.5935386     0.0003831    -0.000404
1.4464043     -8.873481 C
0.00002750        2889.    105045973.    14.4133560     0.0003964    -0.000429
1.4906012     -9.439724 C
0.00002875        2975.    103468007.    14.2484671     0.0004096    -0.000453
1.5343765    -10.006278 C
0.00003000        3060.    101995679.    14.0945856     0.0004228    -0.000477
1.5774960    -10.575209 C
0.00003125        3145.    100636555.    13.9534053     0.0004360    -0.000501
1.6202751    -11.143787 C
0.00003250        3229.     99360946.    13.8207310     0.0004492    -0.000526
1.6624252    -11.714582 C
0.00003375        3313.     98175234.    13.6981753     0.0004623    -0.000550
```

1.7042302 -12.285092 C
0.00003500 3397. 97062243. 13.5832807 0.0004754 -0.000575
1.7455363 -12.856711 C
0.00003625 3481. 96016722. 13.4756550 0.0004885 -0.000599
1.7863927 -13.429017 C
0.00003750 3564. 95037183. 13.3755272 0.0005016 -0.000623
1.8269134 -14.000972 C
0.00003875 3647. 94109687. 13.2806605 0.0005146 -0.000648
1.8669135 -14.574295 C
0.00004000 3729. 93234056. 13.1914449 0.0005277 -0.000672
1.9065130 -15.147893 C
0.00004125 3812. 92408147. 13.1079503 0.0005407 -0.000697
1.9457785 -15.721139 C
0.00004250 3894. 91625516. 13.0292221 0.0005537 -0.000721
1.9846489 -16.294609 C
0.00004375 3976. 90878976. 12.9539789 0.0005667 -0.000746
2.0230198 -16.869327 C
0.00004500 4058. 90170873. 12.8831352 0.0005797 -0.000770
2.0610580 -17.443689 C
0.00004625 4139. 89498076. 12.8164297 0.0005928 -0.000795
2.0987628 -18.017694 C
0.00004750 4221. 88857787. 12.7534949 0.0006058 -0.000819
2.1361332 -18.591340 C
0.00004875 4302. 88242501. 12.6927888 0.0006188 -0.000844
2.1729824 -19.166507 C
0.00005125 4464. 87093394. 12.5806069 0.0006448 -0.000893
2.2456595 -20.315989 C
0.00005375 4625. 86040957. 12.4798659 0.0006708 -0.000942
2.3170000 -21.464012 C
0.00005625 4785. 85067506. 12.3876243 0.0006968 -0.000991
2.3867701 -22.613000 C
0.00005875 4945. 84165425. 12.3033290 0.0007228 -0.001040
2.4550948 -23.761641 C
0.00006125 5104. 83327949. 12.2265770 0.0007489 -0.001089
2.5220749 -24.908777 C
0.00006375 5262. 82547396. 12.1568149 0.0007750 -0.001138
2.5877026 -26.054395 C
0.00006625 5420. 81813608. 12.0919029 0.0008011 -0.001186
2.6517354 -27.201244 C
0.00006875 5577. 81124633. 12.0321384 0.0008272 -0.001235
2.7143848 -28.346862 C
0.00007125 5734. 80476087. 11.9773306 0.0008534 -0.001284
2.7756713 -29.490903 C
0.00007375 5890. 79863792. 11.9266901 0.0008796 -0.001333
2.8355868 -30.633353 C
0.00007625 6045. 79284108. 11.8803529 0.0009059 -0.001382
2.8941230 -31.774193 C
0.00007875 6200. 78733263. 11.8375117 0.0009322 -0.001430
2.9512171 -32.914132 C
0.00008125 6354. 78207748. 11.7972937 0.0009585 -0.001479

3.0067895 -34.054189 C
0.00008375 6508. 77706642. 11.7600097 0.0009849 -0.001528
3.0609685 -35.192564 C
0.00008625 6661. 77227757. 11.7255669 0.0010113 -0.001576
3.1137450 -36.329238 C
0.00008875 6813. 76769149. 11.6937328 0.0010378 -0.001625
3.1651102 -37.464193 C
0.00009125 6965. 76329086. 11.6643004 0.0010644 -0.001673
3.2150547 -38.597408 C
0.00009375 7116. 75906022. 11.6366771 0.0010909 -0.001722
3.2635695 -39.728863 C
0.00009625 7267. 75498564. 11.6115064 0.0011176 -0.001770
3.3106447 -40.858539 C
0.00009875 7417. 75105464. 11.5882407 0.0011443 -0.001818
3.3562709 -41.986415 C
0.0001013 7566. 74725596. 11.5667463 0.0011711 -0.001866
3.4004382 -43.112468 C
0.0001038 7715. 74357860. 11.5468654 0.0011980 -0.001915
3.4431245 -44.236901 C
0.0001063 7863. 74000965. 11.5283088 0.0012249 -0.001963
3.4842617 -45.360817 C
0.0001088 8010. 73654590. 11.5110999 0.0012518 -0.002011
3.5239178 -46.482806 C
0.0001113 8157. 73317964. 11.4951470 0.0012788 -0.002059
3.5620822 -47.602844 C
0.0001138 8303. 72990380. 11.4804943 0.0013059 -0.002107
3.5987438 -48.720907 C
0.0001163 8448. 72671191. 11.4670657 0.0013330 -0.002154
3.6338915 -49.836967 C
0.0001188 8593. 72359805. 11.4547913 0.0013603 -0.002202
3.6675141 -50.951000 C
0.0001213 8737. 72055674. 11.4436076 0.0013875 -0.002250
3.6995998 -52.062977 C
0.0001238 8880. 71758295. 11.4334560 0.0014149 -0.002298
3.7301370 -53.172872 C
0.0001263 9023. 71467205. 11.4242830 0.0014423 -0.002345
3.7591135 -54.280657 C
0.0001288 9165. 71181971. 11.4160394 0.0014698 -0.002393
3.7865170 -55.386301 C
0.0001313 9306. 70902197. 11.4086798 0.0014974 -0.002440
3.8123351 -56.489776 C
0.0001338 9446. 70627512. 11.4018733 0.0015250 -0.002487
3.8365548 -57.591049 C
0.0001363 9586. 70357569. 11.3961823 0.0015527 -0.002535
3.8591631 -58.690093 C
0.0001388 9725. 70092048. 11.3912596 0.0015805 -0.002582
3.8801465 -59.786872 C
0.0001413 9861. 69811374. 11.3860223 0.0016083 -0.002629
3.8993934 -60.000000 CY
0.0001438 9991. 69503660. 11.3797841 0.0016358 -0.002677

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3.9168525    -60.000000 CY
 0.0001463        10116.     69166049.    11.3722950     0.0016632     -0.002724
3.9325317    -60.000000 CY
 0.0001488        10232.     68786642.    11.3630184     0.0016902     -0.002772
3.9464085    -60.000000 CY
 0.0001588        10596.     66743866.    11.2961460     0.0017933     -0.002969
3.9846578    -60.000000 CY
 0.0001688        10891.     64538721.    11.2195663     0.0018933     -0.003169
3.9996290    -60.000000 CY
 0.0001788        11164.     62454900.    11.1516984     0.0019934     -0.003369
3.9991824    -60.000000 CY
 0.0001888        11358.     60173939.    11.0662926     0.0020888     -0.003574
3.9986504    -60.000000 CY
 0.0001988        11510.     57910374.    10.9790845     0.0021821     -0.003780
3.9988405    -60.000000 CY
 0.0002088        11656.     55838805.    10.9026168     0.0022759     -0.003987
3.9996592    -60.000000 CY
 0.0002188        11799.     53936024.    10.8359709     0.0023704     -0.004192
3.9999264    -60.000000 CY
 0.0002288        11937.     52182910.    10.7786406     0.0024656     -0.004397
3.9999823    -60.000000 CY
 0.0002388        12066.     50536210.    10.7261569     0.0025609     -0.004602
3.9999617    -60.000000 CY
 0.0002488        12166.     48908317.    10.6678057     0.0026536     -0.004809
3.9997048    -60.000000 CY
 0.0002588        12237.     47292595.    10.6004757     0.0027429     -0.005020
3.9985361    -60.000000 CY
 0.0002688        12294.     45744400.    10.5320895     0.0028305     -0.005232
3.9954669    -60.000000 CY
 0.0002788        12348.     44298097.    10.4698674     0.0029185     -0.005444
3.9998081    -60.000000 CY
 0.0002888        12401.     42948086.    10.4134105     0.0030069     -0.005656
3.9973188    -60.000000 CY
 0.0002988        12454.     41685767.    10.3616527     0.0030955     -0.005867
3.9999995    -60.000000 CY
 0.0003088        12504.     40499959.    10.3113020     0.0031836     -0.006079
3.9976936    -60.000000 CY
 0.0003188        12554.     39385486.    10.2672101     0.0032727     -0.006290
4.0000000    60.0000000 CY
 0.0003288        12602.     38332161.    10.2269031     0.0033621     -0.006500
3.9968583    60.0000000 CYT
 0.0003388        12648.     37338001.    10.1902205     0.0034519     -0.006711
3.9998981    60.0000000 CYT
 0.0003488        12692.     36393050.    10.1585035     0.0035428     -0.006920
3.9945219    60.0000000 CYT
 0.0003588        12735.     35498692.    10.1295161     0.0036340     -0.007129
3.9991111    60.0000000 CYT
 0.0003688        12775.     34644303.    10.1050813     0.0037262     -0.007336
3.9953798    60.0000000 CYT
 0.0003788        12814.     33832843.    10.0829897     0.0038189     -0.007544
```

3.9965031 60.0000000 CYT

Summary of Results for Nominal Moment Capacity for Section 2

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	207.630	12397.127	0.00300000	-0.00563918

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	207.630000	12397.	134.959500	8058.	73543988.
1	0.75	207.630000	12397.	155.722500	9298.	70918180.
1	0.90	207.630000	12397.	186.867000	11157.	62503764.

Layering Correction Equivalent Depths of Soil & Rock Layers

Layer No.	Top of Layer Below Pile Head ft	Equivalent Top Depth Below Grnd Surf ft	Same Layer Type As Layer Above	Layer is Rock or is Below Rock Layer	F0 Integral for Layer lbs	F1 Integral for Layer lbs
1	20.3300	0.00	N.A.	No	0.00	133423.
2	33.2000	12.8700	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 Displacement and Pile-head Rotation (Loading Type 5)
Displacement of pile head = 1.500000 inches
Rotation of pile head = 0.000E+00 radians
Axial load on pile head = 207630.0 lbs

Depth X	Deflect. y	Bending Moment	Shear Force	Slope S	Total Stress	Bending Stiffness	Soil Res. Es*H	Soil Spr. Lat. Load	Distrib. p
feet	inches	in-lbs	lbs	radians	psi*	lb-in^2	lb/inch	lb/inch	lb/inch
0.00	1.5000	-9385810.	54986.	0.00	0.00	1.09E+11	0.00	0.00	0.00
0.3820	1.4991	-9133570.	54985.	-3.90E-04	0.00	1.09E+11	0.00	0.00	0.00
0.7640	1.4964	-8880964.	54985.	-7.67E-04	0.00	1.10E+11	0.00	0.00	0.00
1.1460	1.4921	-8628007.	54985.	-0.00113	0.00	1.11E+11	0.00	0.00	0.00

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    1.5280     1.4861  -8374713.     54985.   -0.00148       0.00   1.12E+11
0.00       0.00       0.00
    1.9100     1.4785  -8121092.     54985.   -0.00181       0.00   1.13E+11
0.00       0.00       0.00
    2.2920     1.4695  -7867160.     54985.   -0.00213       0.00   1.14E+11
0.00       0.00       0.00
    2.6740     1.4589  -7612928.     54985.   -0.00244       0.00   1.16E+11
0.00       0.00       0.00
    3.0560     1.4471  -7358408.     54985.   -0.00274       0.00   1.17E+11
0.00       0.00       0.00
    3.4380     1.4338  -7103613.     54985.   -0.00302       0.00   1.18E+11
0.00       0.00       0.00
    3.8200     1.4194  -6848557.     54985.   -0.00329       0.00   1.20E+11
0.00       0.00       0.00
    4.2020     1.4037  -6593250.     54985.   -0.00354       0.00   1.21E+11
0.00       0.00       0.00
    4.5840     1.3869  -6337707.     54985.   -0.00379       0.00   1.23E+11
0.00       0.00       0.00
    4.9660     1.3690  -6081938.     54985.   -0.00402       0.00   1.25E+11
0.00       0.00       0.00
    5.3480     1.3500  -5825956.     54985.   -0.00423       0.00   1.27E+11
0.00       0.00       0.00
    5.7300     1.3301  -5569774.     54985.   -0.00444       0.00   1.29E+11
0.00       0.00       0.00
    6.1120     1.3093  -5313403.     54985.   -0.00463       0.00   1.31E+11
0.00       0.00       0.00
    6.4940     1.2877  -5056856.     54985.   -0.00481       0.00   1.34E+11
0.00       0.00       0.00
    6.8760     1.2652  -4800145.     54985.   -0.00498       0.00   1.38E+11
0.00       0.00       0.00
    7.2580     1.2421  -4543281.     54985.   -0.00513       0.00   1.41E+11
0.00       0.00       0.00
    7.6400     1.2182  -4286278.     54985.   -0.00527       0.00   1.45E+11
0.00       0.00       0.00
    8.0220     1.1937  -4029145.     54985.   -0.00540       0.00   1.50E+11
0.00       0.00       0.00
    8.4040     1.1687  -3771896.     54985.   -0.00552       0.00   1.56E+11
0.00       0.00       0.00
    8.7860     1.1432  -3514541.     54985.   -0.00562       0.00   1.64E+11
0.00       0.00       0.00
    9.1680     1.1172  -3257093.     54985.   -0.00571       0.00   1.72E+11
0.00       0.00       0.00
    9.5500     1.0908  -2999562.     54985.   -0.00579       0.00   1.83E+11
0.00       0.00       0.00
    9.9320     1.0640  -2741960.     54985.   -0.00585       0.00   3.70E+11
0.00       0.00       0.00
   10.3140     1.0371  -2484325.     54985.   -0.00588       0.00   3.71E+11
0.00       0.00       0.00
   10.6960     1.0101  -2226661.     54985.   -0.00591       0.00   3.71E+11
0.00       0.00       0.00
```

11.0780	0.9830	-1968971.	54985.	-0.00594	0.00	3.72E+11
0.00	0.00	0.00				
11.4600	0.9557	-1711258.	54985.	-0.00596	0.00	3.72E+11
0.00	0.00	0.00				
11.8420	0.9283	-1453525.	54985.	-0.00598	0.00	3.72E+11
0.00	0.00	0.00				
12.2240	0.9009	-1195775.	54985.	-0.00600	0.00	3.73E+11
0.00	0.00	0.00				
12.6060	0.8734	-938011.	54985.	-0.00601	0.00	3.73E+11
0.00	0.00	0.00				
12.9880	0.8458	-680235.	54985.	-0.00602	0.00	3.73E+11
0.00	0.00	0.00				
13.3700	0.8182	-422452.	54985.	-0.00602	0.00	3.73E+11
0.00	0.00	0.00				
13.7520	0.7906	-164664.	54985.	-0.00603	0.00	3.73E+11
0.00	0.00	0.00				
14.1340	0.7629	93126.	54985.	-0.00603	0.00	3.73E+11
0.00	0.00	0.00				
14.5160	0.7353	350915.	54985.	-0.00603	0.00	3.73E+11
0.00	0.00	0.00				
14.8980	0.7077	608699.	54985.	-0.00602	0.00	3.73E+11
0.00	0.00	0.00				
15.2800	0.6801	866477.	54985.	-0.00601	0.00	3.73E+11
0.00	0.00	0.00				
15.6620	0.6526	1124245.	54985.	-0.00600	0.00	3.73E+11
0.00	0.00	0.00				
16.0440	0.6251	1381999.	54985.	-0.00598	0.00	3.73E+11
0.00	0.00	0.00				
16.4260	0.5977	1639737.	54985.	-0.00597	0.00	3.72E+11
0.00	0.00	0.00				
16.8080	0.5704	1897456.	54985.	-0.00594	0.00	3.72E+11
0.00	0.00	0.00				
17.1900	0.5432	2155153.	54985.	-0.00592	0.00	3.71E+11
0.00	0.00	0.00				
17.5720	0.5161	2412824.	54985.	-0.00589	0.00	3.71E+11
0.00	0.00	0.00				
17.9540	0.4892	2670467.	54985.	-0.00586	0.00	3.70E+11
0.00	0.00	0.00				
18.3360	0.4624	2928079.	54985.	-0.00581	0.00	1.87E+11
0.00	0.00	0.00				
18.7180	0.4360	3185622.	54985.	-0.00573	0.00	1.75E+11
0.00	0.00	0.00				
19.1000	0.4099	3443086.	54985.	-0.00564	0.00	1.66E+11
0.00	0.00	0.00				
19.4820	0.3843	3700459.	54985.	-0.00554	0.00	1.58E+11
0.00	0.00	0.00				
19.8640	0.3591	3957730.	54985.	-0.00542	0.00	1.52E+11
0.00	0.00	0.00				
20.2460	0.3345	4214887.	54985.	-0.00530	0.00	1.47E+11
0.00	0.00	0.00				

```
   20.6280     0.3106   4471919.     54416.   -0.00516       0.00   1.42E+11
-248.347      3666.       0.00
   21.0100     0.2872   4723596.     52957.   -0.00501       0.00   1.39E+11
-388.237      6196.       0.00
   21.3920     0.2646   4966966.     50781.   -0.00485       0.00   1.35E+11
-560.989      9718.       0.00
   21.7740     0.2428   5198387.     47784.   -0.00468       0.00   1.33E+11
-746.721     14100.       0.00
   22.1560     0.2217   5413947.     43984.   -0.00449       0.00   1.30E+11
-911.323     18839.       0.00
   22.5380     0.2016   5610176.     39475.   -0.00430       0.00   1.29E+11
-1056.     24010.       0.00
   22.9200     0.1824   5784026.     34347.   -0.00409       0.00   1.27E+11
-1181.     29692.       0.00
   23.3020     0.1641   5932856.     28687.   -0.00388       0.00   1.26E+11
-1288.     35978.       0.00
   23.6840     0.1468   6054415.     22581.   -0.00366       0.00   1.25E+11
-1376.     42970.       0.00
   24.0660     0.1306   6146845.     16112.   -0.00343       0.00   1.24E+11
-1446.     50786.       0.00
   24.4480     0.1153   6208665.      9362.   -0.00321       0.00   1.24E+11
-1498.     59562.       0.00
   24.8300     0.1012   6238779.      2415.   -0.00298       0.00   1.24E+11
-1532.     69441.       0.00
   25.2120    0.08805   6236472.     -4643.   -0.00274       0.00   1.24E+11
-1547.     80552.       0.00
   25.5940    0.07600   6201434.    -11706.   -0.00251       0.00   1.24E+11
-1534.     92543.       0.00
   25.9760    0.06500   6133938.    -18644.   -0.00229       0.00   1.24E+11
-1493.    105264.       0.00
   26.3580    0.05504   6034861.    -25368.   -0.00206       0.00   1.25E+11
-1441.    120040.       0.00
   26.7400    0.04610   5905285.    -31838.   -0.00184       0.00   1.26E+11
-1381.    137344.       0.00
   27.1220    0.03814   5746482.    -38012.   -0.00163       0.00   1.27E+11
-1313.    157786.       0.00
   27.5040    0.03112   5559898.    -43856.   -0.00143       0.00   1.29E+11
-1237.    182173.       0.00
   27.8860    0.02502   5347135.    -49337.   -0.00124       0.00   1.31E+11
-1155.    211578.       0.00
   28.2680    0.01977   5109931.    -54430.   -0.00106       0.00   1.34E+11
-1067.    247456.       0.00
   28.6500    0.01532   4850139.    -59110.  -8.89E-04       0.00   1.37E+11
-975.095    291805.       0.00
   29.0320    0.01161   4569703.    -63362.  -7.33E-04       0.00   1.41E+11
-880.255    347406.       0.00
   29.4140    0.00859   4270628.    -67177.  -5.92E-04       0.00   1.46E+11
-783.983    418172.       0.00
   29.7960    0.00619   3954951.    -70542.  -4.65E-04       0.00   1.52E+11
-684.131    506723.       0.00
```

```
   30.1780    0.00433   3624786.    -73283.  -3.54E-04       0.00   1.60E+11
-511.747    541719.       0.00
   30.5600    0.00295   3283768.    -75285.  -2.58E-04       0.00   1.71E+11
-361.780    562732.       0.00
   30.9420    0.00197   2935065.    -76688.  -1.78E-04       0.00   1.86E+11
-250.424    583745.       0.00
   31.3240    0.00132   2581031.    -77660.  -1.26E-04       0.00   3.71E+11
-173.729    604758.       0.00
   31.7060   8.14E-04   2223315.    -78313.  -9.61E-05       0.00   3.71E+11
-111.061    625771.       0.00
   32.0880   4.36E-04   1863240.    -78709.  -7.09E-05       0.00   3.72E+11
-61.533    646784.       0.00
   32.4700   1.64E-04   1501850.    -78904.  -5.01E-05       0.00   3.72E+11
-23.880    667797.       0.00
   32.8520  -2.35E-05   1139941.    -78951.  -3.39E-05       0.00   3.73E+11
3.5340    688810.       0.00
   33.2340  -1.47E-04    778093.    -73808.  -1.76E-05       0.00   1.92E+11
2240.   7.00E+07       0.00
   33.6160  -1.85E-04    463300.    -60906.  -2.82E-06       0.00   1.92E+11
3389.   8.40E+07       0.00
   33.9980  -1.73E-04    219709.    -44681.   5.31E-06       0.00   1.92E+11
3690.   9.80E+07       0.00
   34.3800  -1.36E-04     53650.    -28594.   8.57E-06       0.00   1.92E+11
3329.   1.12E+08       0.00
   34.7620  -9.40E-05    -42455.    -15038.   8.70E-06       0.00   1.92E+11
2585.   1.26E+08       0.00
   35.1440  -5.65E-05    -84236.     -5159.   7.19E-06       0.00   1.92E+11
1725.   1.40E+08       0.00
   35.5260  -2.81E-05    -89765.   959.3268   5.12E-06       0.00   1.92E+11
944.3280   1.54E+08       0.00
   35.9080  -9.53E-06    -75450.      3925.   3.15E-06       0.00   1.92E+11
349.5347   1.68E+08       0.00
   36.2900   7.95E-07    -53788.      4654.   1.61E-06       0.00   1.92E+11
-31.569   1.82E+08       0.00
   36.6720   5.25E-06    -32789.      4066.   5.82E-07       0.00   1.92E+11
-224.624   1.96E+08       0.00
   37.0540   6.13E-06    -16508.      2908.  -5.26E-09       0.00   1.92E+11
-280.865   2.10E+08       0.00
   37.4360   5.20E-06     -6129.      1681.  -2.75E-07       0.00   1.92E+11
-254.362   2.24E+08       0.00
   37.8180   3.61E-06     -1095.   668.4893  -3.61E-07       0.00   1.92E+11
-187.448   2.38E+08       0.00
   38.2000   1.89E-06       0.00       0.00  -3.74E-07       0.00   1.92E+11
-104.214   1.26E+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             =     1.50000000 inches
Computed slope at pile head      =       0.000000 radians
Maximum bending moment           =      -9385810. inch-lbs
Maximum shear force              =        -78951. lbs
Depth of maximum bending moment  =       0.000000 feet below pile head
Depth of maximum shear force     =    32.85200000 feet below pile head
Number of iterations             =             52
Number of zero deflection points =              2
Pile deflection at ground        =     0.32926651 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	Load 1	Load 2 Type	Load 2	Axial Pile-head Loading lbs	Pile-head Deflection inches	Pile-head Rotation radians	Max Shear in Pile lbs	Max Moment in Pile in-lbs
1	y, in	1.5000	S, rad	0.00	207630.	1.5000	0.00	-78951.	-9385810.

Maximum pile-head deflection = 1.5000000000 inches
Maximum pile-head rotation = 0.0000000000 radians = 0.000000 deg.

Summary of Warning Messages

The following warning was reported 742 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.

BRO-50-4.49 PID 109971 LPile Analysis

Forward Abutment Drilled Shaft

ODOT District 9

2/12/2026

Engineers, Surveyors, Planners, Scientists
5500 New Albany Rd., Columbus, OH 43054
p. 614.775.4500 f. 614.775.4800
emht.com

Type Project Number Here

EMH&T
Engineers, Surveyors, Planners, Scientists

Made by:	AI	Date:	7/16/2025	Job No:	20240280
Checked by:	TDA/RMW	Date:	9/10/2025	Sheet No:	1
Project:	BRO-50-4.49		PID:		
Subject:	Semi-Integral Abutment Design				

Semi-Integral Abutment Data

Stem Dimensions (ft)

Diaphragm	3.00	ft
Stem Width 1	3.00	ft
Stem Width 2	3.00	ft
Stem Length	43.58	ft
Seat Width	3.00	ft
β =	90.00	ft

Footer Dimensions (ft)

Toe	4.50	ft
Stem Width (at Footer)	3.00	ft
Heel	6.50	ft
Total Footing Width, B	14.00	ft

Diaphragm	7.91	
Stem Height 1	9.59	
Stem Height 2	4.00	
Total Stem Height	21.50	
Footer Height	3.00	
Total Ht. of Wall	24.50	

BOF Elev = 891.5
Profile Elev = 915.995

Vertical Reactions

Number of Girders	4	
Exterior Girder (DC)	146.80	kips
Exterior Girder (DW)	43.20	kips
Interior Girder (DC)	137.80	kips
Interior Girder (DW)	43.20	kips
Total DC =	569.2	kips
	13.06	kips/ft
Total DW =	172.8	kips
	3.96	kips/ft

Skew =	38	degrees
Live Load per beam (LL)	122.85	kips
DF =	0.976	axles/bm
Impact =	1	
LL per Lane =	125.87	kips
Number of Lanes =	2	
Total LL =	251.74	kips
Pedestrian LL =	0.00	kips
Along Abutment	**5.78**	**kips/ft.**

Horizontal Reactions

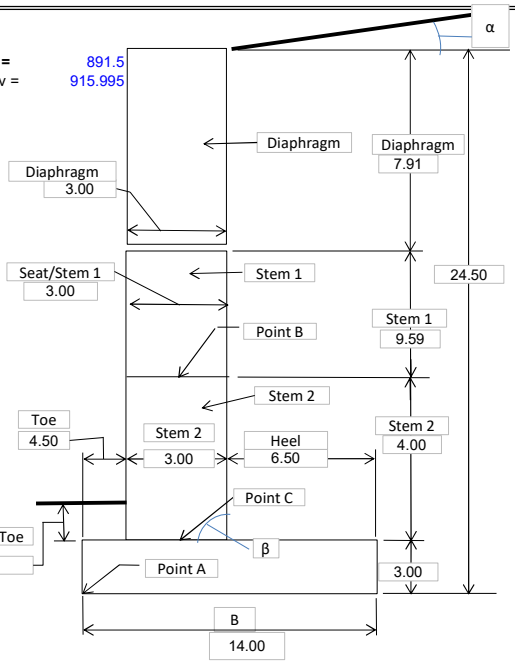
Thermal (TU)	1.063	kips/ft
Height of Bearing	16.59	ft

Live Load Surcharge

Live Ld. Surcharge Height, h_{eq} (ft) 2.00 AASHTO Table 3.11.6.4-1

Material

Soil Unit Weight (k/ft³)	0.12	Concrete Unit Wt. (k/ft³)	0.15
Φ (°)	32	Earth on Toe (ft)	2.6
δ (degrees) =	21.33	Toe Slope =	2 :1
α (degrees) =	0.19	Roadway Grade =	0.0034 :1
K_a	0.276		



Sum Moments …….Clockwise is positive

Item	Height (ft)	Width (ft)	Unit Weight (k/ft³)	P (kips)	About "A" Arm (ft.)	About "A" Moment (ft-k)	About "B" P (kips)	About "B" Arm (ft.)	About "B" Moment (ft-k)	About "C" P (kips)	About "C" Arm (ft.)	About "C" Moment (ft-k)
Vertical Loads												
Concrete (DC)												
Diaphragm	7.91	3.00	0.15	3.56	6.00	21.35				3.56	0.00	0.00
Stem 1	9.59	3.00	0.15	4.31	6.00	25.89				4.31	0.00	0.00
Stem 2	4.00	3.00	0.15	1.98	6.00	11.88	-	-	-	1.98	0.00	0.00
Footer	3.00	14.00	0.15	6.30	7.00	44.10	-	-	-	-	-	-
Approach Slab	1.42	10.00	0.15	2.13	7.25	15.44	2.13	1.25	2.66	2.13	1.25	2.66
Girders				13.06	6.00	78.36	-	-	-	13.06	0.00	0.00
Dead Load (DW)												
Future Wearing Surf.				3.96	6.00	23.79	-	-	-	3.96	0.00	0.00
Earth Load (EV)												
Soil Above Toe	2.60	4.50	0.12	1.40	2.25	3.16	-	-	-	-	-	-
Soil Above Heel	21.50	6.50	0.12	16.77	10.75	180.24	-	-	-	-	-	-
Vertical Component of Horizontal Earth Pressure from Soil Friction (EH_V)												
Vert. Load from EH_V	24.50	-	0.12	3.61	14.00	50.54	-	-	-	-	-	-
Live Load (LL)												
Vehicle Reaction				5.78	6.00	34.66	-	-	-	5.78	0.00	0.00
Live Load (LS_V)												
Live Load Surcharge	2.00	6.50	0.125	1.63	10.75	17.47	-	-	-	-	-	-
Horizontal Loads												
Earth Load (EH_H)												
Active Earth Pressure	16.59		0.12	8.28	6.88	-56.96	3.75	4.19	-15.73	6.15	5.75	-35.37
Live Load (LS_H)												
Live Load Surcharge	16.59	2.00	0.125	1.14	8.29	-9.48	0.66	4.79	-3.17	0.94	6.79	-6.36
Thermal Uniform (TU)												
Bearing Pads				1.06	16.59	-17.64	1.06	9.59	-10.20	1.06	13.59	-14.45

AASHTO LRFD Load Factors - AASHTO Table 3.4.1-1

	Vertical					Horizontal		
	DC	DW	EV	EH_V	LL & LS_V	EH	LS_H	TU
Service I	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Strength I.a - Sliding & Eccentricity	0.90	0.00	1.00	1.50	0.00	1.50	1.75	0.50
Strength I.b - Bearing	1.25	1.50	1.35	1.50	1.75	1.50	1.75	0.50
Extreme Event II	1.00	1.00	1.00	1.00	0.50	1.00	0.50	0.00

Load Case	Footing/Piles (About A) Per Foot of Abutmemt			Stem 1 (About B) Per Foot of Abutmemt		Stem 2 (About C) Per Foot of Abutmemt	
	P_V (kips)	M_A (ft-k)	P_H (kips)	M_B (ft-k)	P_H (kips)	M_C (ft-k)	P_H (kips)
Service I	64.49	422.78	10.49	-26.43	5.48	-53.52	8.15
Strength I.a	50.39	322.51	14.95	-31.83	7.32	-69.02	11.40
Strength I.b	88.02	585.71	14.95	-30.90	7.32	-68.09	11.40
Extreme Event II	60.79	419.10	8.85	-14.65	4.08	-35.89	6.62

Drilled Shaft Foundation

Dia Above Rock: 3 ft $\eta_i \gamma_p DD$ Anticipated Down Drag = 12.7 kips/ shaft (factored)
Dia Below Rock: 2.5 ft

Location	Bottom of the Pier Cap	Unfactored Downdrag Force (Kips)	Factored Downdrag Force (Kips)
Rear Abutment	893.5	22.1	23.2
Forward Abutment	891.5	12.1	12.7

Tip Resistance

Ap = 4.91 sf
Φqp = 0.5 *BDM 305-1*
qp = 238 ksf (from Geotech Report)

Side Resistance

BOF Elev = 891.50 BOF to TOR = 35.80
TOR Elev = 855.70 TOR to BDS = 5.00
DS Depth Above Rock= 35.80 ft
DS Depth Into Rock= 5.00 ft (Assume 5' below bedrock)
BDS Elev = 850.70
Design Scour Depth = 876.75 ft
Check Scour Depth = 873.17 ft

Layer 1
Start EL 876.75 (Per BDM 305.4.1.1 neglect the shaft resistance of non-scour resistant rock in the scour zone)
End EL 850.70
Layer Thickness 26.05
Perimeter = 7.85 ft
Contributing Depth = 5.00 ft
As = 39.27 sf
Φqp = 0.55 *BDM 305-1*
qp = 0 ksf (Assumed for now)

Φqp*Rp = 584.14 kips
Φqs*Rs = 0.00 kips
ΦRn = **584.14** kips

Pile Size 36" Dia DS above Rock Pile Capacity (kip) 584.14 <-- Based on Tip Resistance Only
Center to center spacing of piles along footer (ft) 12 BDM 1010.17 - S10.8.1.2 - Min spacing is 2D for rock socketed shafts
Length of segment to be analyzed, L (ft) 12 144

S/B 4
P_m = 1 (BDM - C305.1.2)

$$P_m = 0.64(S/D)^{0.34}, \text{ for } 1 \le S/D < 3.75, \text{ where } 0.5 \le P_m \le 1.0$$

Lpile Soil Inputs

Top of Ground Elevation at Boring = 886.90 At Boring B-003-0-24
Top of Ground at Abutment = 916.00
Beam Seat Elevation = 908.09
Bottom of Footing Elevation = 891.50
Approx Top of Rock at Abutment = 855.70
Design Scour Depth = 876.75
Check Scour Depth = 873.17
Top of footing Depth = 21.50 ft
Height of Abutment in Lpile = 16.59 ft (Starting at beam seat elevation)
Location of Top of Rock in Lpile = 35.80 ft (Starting at beam BOF elevation)
Location of top of footing in Lpile = 13.59

B-003-0-24											
	EL START	EL END	GAMMA	C	E50	K =	km	qu	initial rock mod	RQD	Friction angle
Sand (Reese)	891.50	879.9	62.6			60					36
Still Clay with Free Wate	879.9	876.9	72.6	6000	0.004	2000					
Sand (Reese)	876.9	874.9	72.6			125					40
Still Clay with Free Wate	874.9	869.4	72.6	5600	0.004	2000					
Still Clay with Free Wate	869.4	855.7	67.6	4600	0.004	2000					
Weak Rock (Reese)	855.7	791.5	97.5				0.0005	661	60000	9	

	Distance From Bottom of Footing	Layer Thickness	Layer End depth from top of boring
Sand (Reese)	14.75	1.85	16.60
Still Clay with Free Wate	16.60	5.5	22.10
Still Clay with Free Wate	22.1	13.7	35.8
Weak Rock (Reese)	35.8	64.2	

For Extreme Event II (using Check STM elevations)	Distance From Bottom of Footing	Layer Thickness	Layer End depth from top of boring
Still Clay with Free Water (Reese)	18.33	3.77	22.10
Still Clay with Free Water (Reese)	22.1	13.7	35.8
Weak Rock (Reese)	35.8	64.2	100

Resolve Forces in Drilled Shafts

	Piles Per Segment	Dist. From Toe, A (ft)	Battered? (y,n)	Batter Rate (x:1)	Centroid of Pile Group from Toe, X_Y (ft)
Row 0					7.00
Row 1	1	2.5	n		
Row 2	1	11.50	n		
Row 3					
Sum of Piles	2				

10.8.1.2—Shaft Spacing, Clearance, and Embedment into Cap

If the center-to-center spacing of drilled shafts is less than 4.0 diameters, the interaction effects between adjacent shafts shall be evaluated. If the center-to-center spacing of drilled shafts is less than 6.0 diameters, the sequence of construction should be specified in the contract documents.

Shafts used in groups should be located such that the distance from the side of any shaft to the nearest edge of the cap is not less than 12.0 in. Shafts shall be embedded sufficiently into the cap to develop the required structural resistance.

Forces acting on the the Segment

	P_V (kips)	M_A (ft-kip)	e (ft)	$e\text{-}X_Y$	M_Y (ft-kip)	P_H (kips)
Service I	773.84	5073.40	6.56	-0.44	-343.52	125.84
Strength I.a	604.67	3870.14	6.40	-0.60	-362.56	179.42
Strength I.b	1056.24	7028.57	6.65	-0.35	-365.10	179.42
Extreme Event II	729.44	5029.23	6.89	-0.11	-76.84	106.22

	Vertical Capacity (kip)	Dist. From Y, x_i (ft)	$(x_i)^2$	Pile $\Sigma A(x_i)^2$
Row 0				
Row 1	584.1	-4.50	20.25	20.25
Row 2	584.1	4.50	20.25	20.25
Row 3				
			$\Sigma (x)^2$	40.50

Vertical Loads

Vertical Load on a Single Pile in the Row

	Service I (kip)	Strength I.a (kip)	Strength I.b (kip)	Extreme Event II (kip)
Row 0				
Row 1	425.09	342.62	568.69	373.26
Row 2	348.75	262.05	487.55	356.18
Row 3				

Vertical Load on a Single Pile in the Row with Down Drag

	Service I (kip)	Strength I.a (kip)	Strength I.b (kip)	Extreme Event II (kip)
Row 0				
Row 1	437.79	355.32	581.39	385.96
Row 2	361.45	274.75	500.25	368.88
Row 3				

Concurrent Lateral Resistance

Lateral Resistance Based on Batter of Piles (if present)

	Service I (k/ft)	Strength I.a (k/ft)	Strength I.b (k/ft)	Extreme Event II (kip)
Row 0				
Row 1	0.00	0.00	0.00	0.00
Row 2	0.00	0.00	0.00	0.00
Row 3				
SUM =	0.00	0.00	0.00	0.00
Lat. Pile Resistance =	10.49	14.95	14.95	8.85

P-Multiplier Calculation for Lpile

Pile Spa Dir of Load, S 9.00 ft
Pile Spa Normal to Load, S 12 ft
Pile Dia, B 3 ft

Spacing Ratio Direction of Loading, S/B 3.00 B

Space Ratio Normal Loading, S/B = 4.00 B

P-Multipliers, Pm			
	Direction of Loading (10.7.2.4-1)	Normal to Loading BDM 305.1.2	Composite Pm
Row 1	0.700	1.000	0.700
Row 2	0.500	1.000	0.500

BDM C305.1.2 --> FHWA GEC 10, 11.5.1

$$P_m = 0.64\,(S/B)^{0.34} \text{ for } 1.0 \le S/B \le 3.75$$

TABLE 11-1 RECOMMENDED P-MULTIPLIER, P_M, VALUES FOR DESIGN BY ROW POSITION

Row Position	*Design P-multiplier, P_m*			
Pile Spacing (c-c)	3D	4D	5D	≥ 6D
Lead Row	0.7	0.85	1.0	1.0
2nd Row	0.5	0.65	0.85	1.0
3rd and higher Rows	0.35	0.5	0.7	1.0

Lpile Results

Capacity To Deisgn Scour Depth to 876.75 (STRENGTH I.a.)

Results - 3'-0" Dia Drilled Shaft

Axial Load in Row 1 =	355.32 k		Check Lpile with and without axial load.
Axial Load in Row 2 =	274.75 k		Check Lpile with and without axial load.

	Row 1	Row 2		
	0.700	0.500	Pm applies to soils above rock	
Deflection	1.25	1.25	in	
Resistance	97.35	86.7	k	
# of Piles	1	1		
Total Resistance	97.35	86.7	k	
Total Resistance @ Abutment		184.05	k	
Total Shear on Abutment, Vu		179.42	k	OK

Capacity To Deisgn Scour Depth to 876.75 (SERVICE I)

Results - 3'-0" Dia Drilled Shaft

Axial Load in Row 1 =	437.79 k		Check Lpile with and without axial load.
Axial Load in Row 2 =	361.45 k		Check Lpile with and without axial load.

	Row 1	Row 2		
	0.700	0.500	Pm applies to soils above rock	
Deflection	1	1	in	
Resistance	90.8	81.7	k	
# of Piles	1	1		
Total Resistance	90.8	81.7	k	
Total Resistance @ Abutment		172.5	k	
Total Shear on Abutment, Vu		125.84	k	OK
Max Allowable Deflection =		1.99	in	OK

Capacity To Deisgn Scour Depth to 873.17 (EXTREME EVENT II)

Results - 3'-0" Dia Drilled Shaft

Axial Load in Row 1 =	385.96 k		Check Lpile with and without axial load.
Axial Load in Row 2 =	368.88 k		Check Lpile with and without axial load.

	Row 1	Row 2		
	0.700	0.500	Pm applies to soils above rock	
Deflection	1	1	in	
Resistance	59.5	55.2	k	
# of Piles	1	1		
Total Resistance	59.5	55.2	k	
Total Resistance @ Abutment		114.7	k	
Total Shear on Abutment, Vu		106.22	k	OK

305.4.1.1 SCOUR

Neglect the shaft resistance provided by soil or non-scour resistant rock in the scour zone. Assess scour resistant rock according to BDM Section 305.2.1.2.b. Use the depth of scour resulting from the design flood, with Strength and Service Limit State checks. Use the depth of scour resulting from the check flood with Extreme Event II Limit State checks.

Extend friction drilled shafts to penetrate a minimum of 15-ft below the controlling scour elevation. If socketed into non-scour resistant bedrock, when the rock has Q_u < 2.5-ksi, extend drilled shafts to penetrate a minimum of 10-ft below the controlling scour elevation in the bedrock; when the rock has Qu ≥ 2.5-ksi, extend drilled shafts to penetrate a minimum of 5-ft below the controlling scour elevation in the bedrock. If socketed into scour resistant bedrock, design the length of the bedrock socket based solely on the requirements of axial resistance in accordance with *LRFD 10.8.3.5.4* and of lateral stability.

Because the drilled shaft will lose support along the scour depth, investigate the structural capacity of the shaft considering the depth of the scour as an unbraced length. Also perform a p-y analysis on the drilled shaft according to BDM Section 305.1.2 to demonstrate lateral stability against:

A. Overturning failure in the Strength Limit State with the maximum estimated scour depth at the design flood, and

B. Overturning failure in the Extreme Event II Limit State with the maximum estimated scour depth at the check flood, and

C. Excessive deflection in the Service Limit State.

==========

LPile for Windows, Version 2022-12.011

Analysis of Individual Piles and Drilled Shafts
Subjected to Lateral Loading Using the p-y Method
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Files Used for Analysis

Path to file locations:
\20240280\ODOT\109971\400-Engineering\Structures\SFN_0800512\Engdata\04_Abutment Design\Stage 2\Drilled Shaft\Lpile\Abutment\Forward Abutment\

Name of input data file:
FA_Scour Service - Front DS.lp12d

Name of output report file:
FA_Scour Service - Front DS.lp12o

Name of plot output file:
FA_Scour Service - Front DS.lp12p

Name of runtime message file:
FA_Scour Service - Front DS.lp12r

Date and Time of Analysis

Date: February 12, 2026 Time: 14:20:23

Problem Title

Project Name:

Job Number:

Client:

Engineer:

Description:

Program Options and Settings

Computational Options:
- Conventional Analysis

Engineering Units Used for Data Input and Computations:
- US Customary System Units (pounds, feet, inches)

Analysis Control Options:

- Maximum number of iterations allowed	=	500
- Deflection tolerance for convergence	=	1.0000E-05 in
- Maximum allowable deflection	=	100.0000 in
- Number of pile increments	=	100

Loading Type and Number of Cycles of Loading:

- Static loading specified

- Analysis uses p-y modification factors for p-y curves
- Analysis uses layering correction (Method of Georgiadis)
- No distributed lateral loads are entered
- Loading by lateral soil movements acting on pile not selected
- Input of shear resistance at the pile tip not selected
- Input of moment resistance at the pile tip not selected
- Computation of pile-head foundation stiffness matrix not selected
- Push-over analysis of pile not selected
- Buckling analysis of pile not selected

Output Options:
- Output files use decimal points to denote decimal symbols.
- Values of pile-head deflection, bending moment, shear force, and soil reaction are printed for full length of pile.
- Printing Increment (nodal spacing of output points) = 1
- No p-y curves to be computed and reported for user-specified depths
- Print using wide report formats

Pile Structural Properties and Geometry

Number of pile sections defined = 2
Total length of pile = 40.800 ft
Depth of ground surface below top of pile = 14.7500 ft

Pile diameters used for p-y curve computations are defined using 4 points.

p-y curves are computed using pile diameter values interpolated with depth over the length of the pile. A summary of values of pile diameter vs. depth follows.

Point No.	Depth Below Pile Head feet	Pile Diameter inches
1	0.000	36.0000
2	35.800	36.0000
3	35.800	30.0000
4	40.800	30.0000

Input Structural Properties for Pile Sections:

Pile Section No. 1:

Section 1 is a round drilled shaft, bored pile, or CIDH pile
Length of section = 35.800000 ft
Shaft Diameter = 36.000000 in

Pile Section No. 2:

Section 2 is a round drilled shaft, bored pile, or CIDH pile
Length of section = 5.000000 ft
Shaft Diameter = 30.000000 in

Soil and Rock Layering Information

The soil profile is modelled using 4 layers

Layer 1 is sand, p-y criteria by Reese et al., 1974

Distance from top of pile to top of layer = 14.750000 ft
Distance from top of pile to bottom of layer = 16.600000 ft
Effective unit weight at top of layer = 72.600000 pcf
Effective unit weight at bottom of layer = 72.600000 pcf
Friction angle at top of layer = 40.000000 deg.
Friction angle at bottom of layer = 40.000000 deg.
Subgrade k at top of layer = 125.000000 pci
Subgrade k at bottom of layer = 125.000000 pci

Layer 2 is stiff clay with water-induced erosion

Distance from top of pile to top of layer = 16.600000 ft
Distance from top of pile to bottom of layer = 22.100000 ft
Effective unit weight at top of layer = 72.600000 pcf
Effective unit weight at bottom of layer = 72.600000 pcf
Undrained cohesion at top of layer = 5600. psf
Undrained cohesion at bottom of layer = 5600. psf
Epsilon-50 at top of layer = 0.004000
Epsilon-50 at bottom of layer = 0.004000
Subgrade k at top of layer = 2000. pci
Subgrade k at bottom of layer = 2000. pci

Layer 3 is stiff clay with water-induced erosion

Distance from top of pile to top of layer = 22.100000 ft
Distance from top of pile to bottom of layer = 35.800000 ft
Effective unit weight at top of layer = 67.600000 pcf

```
   Effective unit weight at bottom of layer            =    67.600000 pcf
   Undrained cohesion at top of layer                  =        4600. psf
   Undrained cohesion at bottom of layer               =        4600. psf
   Epsilon-50 at top of layer                          =     0.004000
   Epsilon-50 at bottom of layer                       =     0.004000
   Subgrade k at top of layer                          =        2000. pci
   Subgrade k at bottom of layer                       =        2000. pci


Layer 4 is weak rock, p-y criteria by Reese, 1997

   Distance from top of pile to top of layer           =    35.800000 ft
   Distance from top of pile to bottom of layer        =   100.000000 ft
   Effective unit weight at top of layer               =    97.500000 pcf
   Effective unit weight at bottom of layer            =    97.500000 pcf
   Uniaxial compressive strength at top of layer       =   661.000000 psi
   Uniaxial compressive strength at bottom of layer    =   661.000000 psi
   Initial modulus of rock at top of layer             =       60000. psi
   Initial modulus of rock at bottom of layer          =       60000. 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                        =    0.0005000
   k rm of rock at bottom of layer                     =    0.0005000


 (Depth of the lowest soil layer extends 59.200 ft below the pile tip)



--------------------------------------------------------------------------------
                        Summary of Input Soil Properties
--------------------------------------------------------------------------------

Layer         Soil Type          Layer      Effective    Cohesion     Angle of
Uniaxial                      E50                      Rock Mass
 Num.           Name            Depth       Unit Wt.                  Friction
 qu          RQD %         or           kpy        Modulus
          (p-y Curve Type)        ft           pcf          psf          deg.
 psi                        krm          pci          psi
-----   ------------------   ----------   ----------   ----------   ----------
----------   ----------   ----------   ----------   ----------
  1            Sand              14.7500      72.6000       --          40.0000
 --            --            --          125.0000       --
          (Reese, et al.)        16.6000      72.6000       --          40.0000
 --            --            --          125.0000       --
  2         Stiff Clay           16.6000      72.6000        5600.       --
 --            --           0.00400        2000.       --
          with Free Water        22.1000      72.6000        5600.       --
 --            --           0.00400        2000.       --
  3         Stiff Clay           22.1000      67.6000        4600.       --
```

```
 --           --          0.00400        2000.       --
          with Free Water        35.8000      67.6000        4600.       --
 --           --          0.00400        2000.       --
  4            Weak              35.8000      97.5000       --           --
661.0000       9.0000     5.00E-04       --           60000.
               Rock             100.0000      97.5000       --           --
661.0000       9.0000     5.00E-04       --           60000.
```

Modification Factors for p-y Curves

Distribution of p-y modifiers with depth defined using 2 points

Point No.	Depth X ft	p-mult	y-mult
1	14.750	0.7000	1.0000
2	35.800	0.7000	1.0000

Static Loading Type

Static loading criteria were used when computing p-y curves for all analyses.

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 1

Load No.	Load Type	Condition 1	Condition 2	Axial Thrust Force, lbs	Compute Top y vs. Pile Length	Run Analysis
1	5	y = 1.000000 in	S = 0.0000 in/in	437790.	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 = 2

Pile Section No. 1:

Dimensions and Properties of Drilled Shaft (Bored Pile):

Length of Section	=	35.800000 ft
Shaft Diameter	=	36.000000 in
Concrete Cover Thickness (to edge of trans. reinf.)	=	6.000000 in
Number of Reinforcing Bars	=	15 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	=	15.000000 sq. in.
Area Ratio of Steel Reinforcement	=	1.47 percent
Edge-to-Edge Bar Spacing	=	3.367467 in
Maximum Concrete Aggregate Size	=	0.375000 in
Ratio of Bar Spacing to Aggregate Size	=	8.98
Offset of Center of Rebar Cage from Center of Pile	=	0.0000 in

Transverse Reinforcement
Type: Hoop

Number of Transverse Reinf. (per spacing)	=	1
Spacing of Transverse Reinf.	=	4.500000 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	=	4309.778 kips
Tensile Load for Cracking of Concrete	=	-467.292 kips
Nominal Axial Tensile Capacity	=	-900.000 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	10.811000	0.00000
2	1.128000	1.000000	9.876340	4.397230
3	1.128000	1.000000	7.233971	8.034139
4	1.128000	1.000000	3.340783	10.281872
5	1.128000	1.000000	-1.13006	10.751776
6	1.128000	1.000000	-5.40550	9.362601
7	1.128000	1.000000	-8.74628	6.354546
8	1.128000	1.000000	-10.57475	2.247733
9	1.128000	1.000000	-10.57475	-2.24773
10	1.128000	1.000000	-8.74628	-6.35455
11	1.128000	1.000000	-5.40550	-9.36260
12	1.128000	1.000000	-1.13006	-10.75178
13	1.128000	1.000000	3.340783	-10.28187
14	1.128000	1.000000	7.233971	-8.03414
15	1.128000	1.000000	9.876340	-4.39723

NOTE: The positions of the above rebars were computed by LPile

Minimum spacing between any two bars not equal to zero = 3.367 inches
between bars 7 and 8.

Ratio of bar spacing to maximum aggregate size = 8.98

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	=	0.375000 in

Number of Axial Thrust Force Values Determined from Pile-head Loadings = 1

Number	Axial Thrust Force kips
1	437.790

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 = 437.790 kips

Bending Curvature rad/in.	Bending Max Conc Stress ksi	Bending Max Steel Stress ksi	Bending Moment in-kip	Bending Stiffness kip-in2	Depth to N Axis in	Max Comp Strain in/in	Max Tens Strain in/in	Run Msg
6.25000E-07	221.1947556	353911609.	170.9320640	0.0001068	0.00008433	0.4398141	2.9774312	
0.00000125	442.3907644	353912612.	94.4852631	0.0001181	0.00007311	0.4843338	3.1836658	
0.00000188	663.5757502	353907067.	69.0115402	0.0001294	0.00006190	0.5286367	3.3903650	
0.00000250	884.7442028	353897681.	56.2810870	0.0001407	0.00005070	0.5727216	3.5975288	
0.00000313	1106.	353884996.	48.6479423	0.0001520	0.00003952	0.6165872	3.8051573	
0.00000375	1327.	353869190.	43.5634522	0.0001634	0.00002836	0.6602324	4.0132504	
0.00000438	1548.	353850343.	39.9353367	0.0001747	0.00001722	0.7036560	4.2218084	
0.00000500	1769.	353828490.	37.2174558	0.0001861	0.00000609	0.7468568	4.4308311	
0.00000563	1990.	353803373.	35.1063950	0.0001975	-0.00000503	0.7898334	4.6403182	
0.00000625	2211.	353763951.	33.4199608	0.0002089	-0.00001613	0.8325812	4.8502429	
0.00000688	2432.	353688778.	32.0420001	0.0002203	-0.00002721	0.8750901	5.0605361	
0.00000750	2652.	353566309.	30.8950874	0.0002317	-0.00003829	0.9173506	5.2711314	

```
0.00000813        2871.    353393563.    29.9155911     0.0002431   -0.00004944
0.9593550     5.4819748
0.00000875        3090.    353172031.    29.0891395     0.0002545   -0.00006047
1.0010974     5.6930244
0.00000938        3308.    352905323.    28.3728948     0.0002660   -0.00007150
1.0425732     5.9042482
0.00001000        3526.    352597861.    27.7461762     0.0002775   -0.00008254
1.0837789     6.1156219
0.00001063        3743.    352254021.    27.1932046     0.0002889   -0.00009357
1.1247118     6.3271266
0.00001125        3959.    351877879.    26.7017081     0.0003004    -0.000105
1.1653696     6.5387471
0.00001188        3959.    333357991.    25.1955860     0.0002992    -0.000128
1.1606765     6.3831926 C
0.00001250        3959.    316690091.    24.6723521     0.0003084    -0.000142
1.1930797     6.5294777 C
0.00001313        3959.    301609611.    24.1885166     0.0003175    -0.000155
1.2248133     6.6717916 C
0.00001375        3959.    287900083.    23.7407573     0.0003264    -0.000169
1.2559845     6.8109520 C
0.00001438        3959.    275382688.    23.3246764     0.0003353    -0.000182
1.2866153     6.9470870 C
0.00001500        3959.    263908409.    22.9365625     0.0003440    -0.000196
1.3167247     7.0803047 C
0.00001563        3965.    253770536.    22.5733251     0.0003527    -0.000210
1.3463413     7.2107955 C
0.00001625        4042.    248761761.    22.2328858     0.0003613    -0.000224
1.3754964     7.3387779 C
0.00001688        4117.    243988179.    21.9129247     0.0003698    -0.000238
1.4042175     7.4644436 C
0.00001750        4190.    239438014.    21.6116506     0.0003782    -0.000252
1.4325291     7.5879627 C
0.00001813        4261.    235101537.    21.3273855     0.0003866    -0.000266
1.4604597     7.7095445 C
0.00001875        4331.    230970604.    21.0588346     0.0003949    -0.000280
1.4880419     7.8294382 C
0.00001938        4398.    226994539.    20.8031796     0.0004031    -0.000294
1.5151768     7.9467573 C
0.00002000        4464.    223206809.    20.5611769     0.0004112    -0.000309
1.5420058     8.0626938 C
0.00002063        4529.    219601703.    20.3319988     0.0004193    -0.000323
1.5685676     8.1775643 C
0.00002125        4593.    216122764.    20.1123788     0.0004274    -0.000338
1.5947148     8.2900507 C
0.00002188        4655.    212810414.    19.9041153     0.0004354    -0.000352
1.6206306     8.4017397 C
0.00002250        4717.    209630525.    19.7050771     0.0004434    -0.000367
1.6462372     8.5119232 C
0.00002313        4777.    206579847.    19.5148459     0.0004513    -0.000381
1.6715581     8.6207879 C
```

```
0.00002375        4837.    203655769.    19.3331276     0.0004592     -0.000396
1.6966276     8.7286209 C
0.00002438        4896.    200841730.    19.1587629     0.0004670     -0.000411
1.7214081     8.8350656 C
0.00002563        5011.    195542499.    18.8316675     0.0004826     -0.000440
1.7702523     9.0450712 C
0.00002688        5123.    190637998.    18.5302520     0.0004980     -0.000469
1.8181677     9.2513775 C
0.00002813        5233.    186068327.    18.2502569     0.0005133     -0.000499
1.8650947     9.4533033 C
0.00002938        5341.    181818158.    17.9904948     0.0005285     -0.000529
1.9111877     -9.668360 C
0.00003063        5447.    177863863.    17.7494615     0.0005436     -0.000559
1.9565479    -10.293847 C
0.00003188        5551.    174162638.    17.5242252     0.0005586     -0.000589
2.0011131    -10.922207 C
0.00003313        5654.    170689327.    17.3130083     0.0005735     -0.000619
2.0448945    -11.553428 C
0.00003438        5756.    167443121.    17.1162266     0.0005884     -0.000649
2.0880977    -12.185573 C
0.00003563        5856.    164368987.    16.9295006     0.0006031     -0.000679
2.1304307    -12.821594 C
0.00003688        5955.    161492093.    16.7555464     0.0006179     -0.000710
2.1723017    -13.457493 C
0.00003813        6053.    158756639.    16.5896031     0.0006325     -0.000740
2.2133317    -14.097145 C
0.00003938        6150.    156184647.    16.4342716     0.0006471     -0.000770
2.2539045    -14.736710 C
0.00004063        6246.    153741128.    16.2864780     0.0006616     -0.000801
2.2937842    -15.378651 C
0.00004188        6341.    151424473.    16.1465529     0.0006761     -0.000831
2.3330940    -16.021750 C
0.00004313        6436.    149235430.    16.0150693     0.0006906     -0.000862
2.3719791    -16.664491 C
0.00004438        6529.    147135752.    15.8880578     0.0007050     -0.000892
2.4100679    -17.310890 C
0.00004563        6622.    145146021.    15.7684354     0.0007194     -0.000923
2.4477528    -17.956775 C
0.00004688        6715.    143256440.    15.6555108     0.0007339     -0.000954
2.4850173    -18.602308 C
0.00004813        6807.    141437252.    15.5459450     0.0007481     -0.000984
2.5215191    -19.251328 C
0.00004938        6898.    139705545.    15.4421154     0.0007625     -0.001015
2.5576207    -19.899836 C
0.00005063        6989.    138054807.    15.3438706     0.0007768     -0.001046
2.5933206    -20.547832 C
0.00005188        7079.    136468840.    15.2494481     0.0007911     -0.001076
2.6284321    -21.197474 C
0.00005313        7169.    134944443.    15.1584223     0.0008053     -0.001107
2.6629833    -21.848493 C
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0.00005438        7258.    133485983.    15.0716608     0.0008195     -0.001138
2.6971367    -22.499000 C
0.00005563        7347.    132088983.    14.9893228     0.0008338     -0.001169
2.7308905    -23.148992 C
0.00005688        7436.    130743728.    14.9103367     0.0008480     -0.001199
2.7641247    -23.799926 C
0.00005813        7524.    129443188.    14.8333330     0.0008622     -0.001230
2.7967624    -24.452801 C
0.00005938        7611.    128193648.    14.7598712     0.0008764     -0.001261
2.8290041    -25.105160 C
0.00006063        7699.    126991940.    14.6893181     0.0008905     -0.001292
2.8608485    -25.756999 C
0.00006188        7786.    125835133.    14.6222698     0.0009048     -0.001323
2.8922940    -26.408318 C
0.00006313        7873.    124716753.    14.5578220     0.0009190     -0.001354
2.9232445    -27.060360 C
0.00006438        7959.    123631068.    14.4947015     0.0009331     -0.001384
2.9536133    -27.714317 C
0.00006563        8045.    122583359.    14.4341222     0.0009472     -0.001415
2.9835863    -28.367749 C
0.00006688        8130.    121571479.    14.3760798     0.0009614     -0.001446
3.0131621    -29.020653 C
0.00006813        8215.    120593434.    14.3204362     0.0009756     -0.001477
3.0423392    -29.673027 C
0.00006938        8301.    119647390.    14.2663788     0.0009897     -0.001508
3.0711162    -30.324865 C
0.00007063        8385.    118730955.    14.2150528     0.0010039     -0.001539
3.0994719    -30.976449 C
0.00007188        8469.    117836165.    14.1648946     0.0010181     -0.001569
3.1272120    -31.630610 C
0.00007313        8553.    116968922.    14.1160773     0.0010322     -0.001600
3.1545545    -32.284231 C
0.00007438        8637.    116127820.    14.0691533     0.0010464     -0.001631
3.1814978    -32.937308 C
0.00007938        8969.    112999784.    13.8976500     0.0011031     -0.001754
3.2852487    -35.544105 C
0.00008438        9297.    110184700.    13.7483098     0.0011600     -0.001877
3.3819702    -38.150917 C
0.00008938        9620.    107638920.    13.6172170     0.0012170     -0.002000
3.4719947    -40.751490 C
0.00009438        9940.    105322957.    13.5022305     0.0012743     -0.002123
3.5553991    -43.342581 C
0.00009938       10255.    103191247.    13.4011380     0.0013317     -0.002246
3.6316320    -45.933808 C
 0.0001044       10565.    101226334.    13.3118367     0.0013894     -0.002368
3.7010921    -48.515248 C
 0.0001094       10872.     99404688.    13.2339892     0.0014475     -0.002490
3.7636732    -51.086250 C
 0.0001144       11175.     97706514.    13.1651450     0.0015058     -0.002612
3.8192467    -53.646492 C
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 0.0001194        11473.     96112924.    13.1057291     0.0015645     -0.002733
3.8675596    -56.200068 C
 0.0001244        11767.     94611398.    13.0529690     0.0016235     -0.002854
3.9085599    -58.745285 C
 0.0001294        12055.     93177565.    13.0066331     0.0016827     -0.002975
3.9421591    -60.000000 CY
 0.0001344        12308.     91597529.    12.9568072     0.0017411     -0.003096
3.9677438    -60.000000 CY
 0.0001394        12517.     89806840.    12.8992400     0.0017978     -0.003220
3.9855149    -60.000000 CY
 0.0001444        12697.     87941644.    12.8388605     0.0018536     -0.003344
3.9961522    -60.000000 CY
 0.0001494        12852.     86041710.    12.7785363     0.0019088     -0.003469
3.9999802    -60.000000 CY
 0.0001544        12996.     84184153.    12.7197440     0.0019636     -0.003594
3.9999602    -60.000000 CY
 0.0001594        13118.     82311717.    12.6603703     0.0020177     -0.003720
3.9998391    -60.000000 CY
 0.0001644        13228.     80475584.    12.6028570     0.0020716     -0.003846
3.9994663    -60.000000 CY
 0.0001694        13334.     78723676.    12.5505730     0.0021258     -0.003972
3.9986303    -60.000000 CY
 0.0001744        13430.     77015962.    12.5005551     0.0021798     -0.004098
3.9969894    -60.000000 CY
 0.0001794        13512.     75327263.    12.4507886     0.0022334     -0.004224
3.9999267    -60.000000 CY
 0.0001844        13584.     73676640.    12.4016652     0.0022866     -0.004351
3.9989091    -60.000000 CY
 0.0001894        13653.     72096555.    12.3548472     0.0023397     -0.004478
3.9967732    -60.000000 CY
 0.0001944        13720.     70587621.    12.3122042     0.0023932     -0.004604
3.9996399    -60.000000 CY
 0.0001994        13783.     69130999.    12.2719819     0.0024467     -0.004731
3.9972307    -60.000000 CY
 0.0002044        13839.     67712512.    12.2325172     0.0025000     -0.004857
3.9998487    -60.000000 CY
 0.0002094        13887.     66327454.    12.1939572     0.0025531     -0.004984
3.9972795    -60.000000 CY
 0.0002144        13929.     64977197.    12.1553217     0.0026058     -0.005112
3.9997954    -60.000000 CY
 0.0002194        13969.     63677882.    12.1200812     0.0026588     -0.005239
3.9963995    -60.000000 CY
 0.0002244        14008.     62431151.    12.0857951     0.0027118     -0.005366
3.9994416    -60.000000 CY
 0.0002294        14046.     61233948.    12.0555246     0.0027652     -0.005492
3.9961696    -60.000000 CY
 0.0002344        14082.     60081139.    12.0268252     0.0028188     -0.005619
3.9983940    -60.000000 CY
 0.0002394        14116.     58970030.    11.9984539     0.0028721     -0.005745
3.9999702    -60.000000 CY
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    0.0002444        14147.     57890895.    11.9712340     0.0029255     -0.005872
   3.9958869    -60.000000 CY
    0.0002494        14175.     56841425.    11.9443057     0.0029786     -0.005999
   3.9989985    -60.000000 CY
    0.0002544        14199.     55820527.    11.9176127     0.0030315     -0.006126
   3.9998168    -60.000000 CY
    0.0002594        14220.     54824642.    11.8913800     0.0030843     -0.006253
   3.9956080    -60.000000 CY
    0.0002644        14239.     53858278.    11.8657181     0.0031370     -0.006381
   3.9986901    -60.000000 CY
    0.0002694        14257.     52924776.    11.8413274     0.0031898     -0.006508
   3.9999638    -60.000000 CY
    0.0002744        14273.     52021495.    11.8184598     0.0032427     -0.006635
   3.9935414    -60.000000 CY
    0.0003044        14364.     47193418.    11.7069249     0.0035633     -0.007394
   3.9995059    -60.000000 CYT
    0.0003344        14364.     42959242.    11.6489484     0.0038951     -0.008142
   3.9928959    -60.000000 CYT


-------------------------------------------------------------------------------
   Summary of Results for Nominal Moment Capacity for Section 1
-------------------------------------------------------------------------------

Moment values interpolated at maximum compressive strain = 0.003
or maximum developed moment if pile fails at smaller strains.

 Load           Axial Thrust        Nominal Mom. Cap.      Max. Comp.      Max.
Tens.
  No.              kips                 in-kip               Strain
Strain
 ----         ----------------     ------------------     ------------
------------
   1               437.790             14184.737           0.00300000
-0.00605024

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.
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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	437.790000	14185.	284.563500	9220.	110844509.
1	0.75	437.790000	14185.	328.342500	10639.	100792696.
1	0.90	437.790000	14185.	394.011000	12766.	87092390.

Pile Section No. 2:

Dimensions and Properties of Drilled Shaft (Bored Pile):

Length of Section	=	5.000000 ft
Shaft Diameter	=	30.000000 in
Concrete Cover Thickness (to edge of trans. reinf.)	=	3.000000 in
Number of Reinforcing Bars	=	15 bars
Yield Stress of Reinforcing Bars	=	60000. psi
Modulus of Elasticity of Reinforcing Bars	=	29000000. psi
Gross Area of Shaft	=	706.858347 sq. in.
Total Area of Reinforcing Steel	=	19.050000 sq. in.
Area Ratio of Steel Reinforcement	=	2.70 percent
Edge-to-Edge Bar Spacing	=	3.195943 in
Maximum Concrete Aggregate Size	=	0.375000 in
Ratio of Bar Spacing to Aggregate Size	=	8.52
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.	=	4.500000 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	=	3481.548 kips
Tensile Load for Cracking of Concrete	=	-349.802 kips
Nominal Axial Tensile Capacity	=	-1143.000 kips

Reinforcing Bar Dimensions and Positions Used in Computations:

Bar Number	Bar Diam. inches	Bar Area sq. in.	X inches	Y inches
1	1.270000	1.270000	10.740000	0.00000
2	1.270000	1.270000	9.811478	4.368352
3	1.270000	1.270000	7.186463	7.981375
4	1.270000	1.270000	3.318843	10.214347
5	1.270000	1.270000	-1.12264	10.681165
6	1.270000	1.270000	-5.37000	9.301113
7	1.270000	1.270000	-8.68884	6.312814
8	1.270000	1.270000	-10.50531	2.232972
9	1.270000	1.270000	-10.50531	-2.23297
10	1.270000	1.270000	-8.68884	-6.31281
11	1.270000	1.270000	-5.37000	-9.30111
12	1.270000	1.270000	-1.12264	-10.68117
13	1.270000	1.270000	3.318843	-10.21435
14	1.270000	1.270000	7.186463	-7.98138
15	1.270000	1.270000	9.811478	-4.36835

NOTE: The positions of the above rebars were computed by LPile

Minimum spacing between any two bars not equal to zero = 3.196 inches
between bars 9 and 10.

Ratio of bar spacing to maximum aggregate size = 8.52

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	=	0.375000 in

Number of Axial Thrust Force Values Determined from Pile-head Loadings = 1

Number	Axial Thrust Force kips
1	437.790

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 = 437.790 kips

Bending Curvature rad/in.	Bending Moment in-kip	Bending Stiffness kip-in2	Depth to N Axis in	Max Comp Strain in/in	Max Tens Strain in/in	Max Conc Stress ksi	Max Steel Stress ksi	Run Msg
0.00000125	230.7100746	184568060.	118.9713695	0.0001487	0.0001112	0.6051269	4.1767746	
0.00000250	461.4572230	184582889.	67.0106801	0.0001675	0.00009253	0.6775088	4.5863993	
0.00000375	692.1772145	184580591.	49.7015338	0.0001864	0.00007388	0.7492696	4.9972293	
0.00000500	922.8564965	184571299.	41.0552745	0.0002053	0.00005528	0.8204043	5.4092648	
0.00000625	1153.	184557042.	35.8741714	0.0002242	0.00003671	0.8909074	5.8225061	
0.00000750	1384.	184538493.	32.4256478	0.0002432	0.00001819	0.9607738	6.2369534	
0.00000875	1615.	184515942.	29.9671713	0.0002622	-2.87251E-07	1.0299984	6.6526072	
0.00001000	1845.	184484786.	28.1273728	0.0002813	-0.00001873	1.0985720	7.0694381	
0.00001125	2075.	184422409.	26.6994716	0.0003004	-0.00003713	1.1664674	7.4872649	
0.00001250	2304.	184313863.	25.5593094	0.0003195	-0.00005551	1.2336541	7.9058746	
0.00001375	2532.	184156946.	24.6216459	0.0003385	-0.00007395	1.3001096	8.3251076	

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0.00001500        2759.    183955093.    23.8495450     0.0003577   -0.00009226
1.3658179     8.7448525
0.00001625        2985.    183713169.    23.1965273     0.0003769     -0.000111
1.4307668     9.1650248
0.00001750        2985.    170590800.    22.0206885     0.0003854     -0.000140
1.4585692     9.2723743 C
0.00001875        2985.    159218080.    21.4175070     0.0004016     -0.000161
1.5124672     9.6067070 C
0.00002000        3062.    153080595.    20.8779193     0.0004176     -0.000182
1.5650064     9.9341932 C
0.00002125        3177.    149513325.    20.3913494     0.0004333     -0.000204
1.6162569    10.2552316 C
0.00002250        3289.    146160290.    19.9508993     0.0004489     -0.000226
1.6663833    10.5710868 C
0.00002375        3396.    142983117.    19.5484611     0.0004643     -0.000248
1.7153414    10.8811901 C
0.00002500        3500.    140002812.    19.1805144     0.0004795     -0.000270
1.7633244    11.1871230 C
0.00002625        3602.    137202393.    18.8423393     0.0004946     -0.000293
1.8103739    11.4891342 C
0.00002750        3701.    134565842.    18.5303570     0.0005096     -0.000315
1.8565229    11.7874054 C
0.00002875        3797.    132080110.    18.2412890     0.0005244     -0.000338
1.9018086    12.0821667 C
0.00003000        3892.    129735105.    17.9726430     0.0005392     -0.000361
1.9462768    12.3737410 C
0.00003125        3985.    127522546.    17.7224024     0.0005538     -0.000384
1.9899791    12.6625210 C
0.00003250        4077.    125435221.    17.4889388     0.0005684     -0.000407
2.0329702    12.9489499 C
0.00003375        4167.    123462258.    17.2703909     0.0005829     -0.000430
2.0752705    13.2331499 C
0.00003500        4256.    121586877.    17.0647903     0.0005973     -0.000453
2.1168312    13.5145614 C
0.00003625        4343.    119816211.    16.8721145     0.0006116     -0.000476
2.1578053    13.7946320 C
0.00003750        4430.    118137002.    16.6907162     0.0006259     -0.000499
2.1981667    14.0730534 C
0.00003875        4516.    116535768.    16.5190037     0.0006401     -0.000522
2.2378589    14.3491849 C
0.00004000        4601.    115022413.    16.3576901     0.0006543     -0.000546
2.2770720    14.6249315 C
0.00004125        4685.    113568562.    16.2036879     0.0006684     -0.000569
2.3155643    14.8977316 C
0.00004250        4768.    112194550.    16.0589668     0.0006825     -0.000592
2.3536474    15.1708060 C
0.00004375        4851.    110871382.    15.9202864     0.0006965     -0.000616
2.3910330    15.4410537 C
0.00004500        4933.    109616175.    15.7894788     0.0007105     -0.000639
2.4280093    15.7115214 C
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0.00004625         5014.    108410160.    15.6643286     0.0007245     -0.000663
2.4643841    15.9800941 C
0.00004750         5095.    107257318.    15.5453076     0.0007384     -0.000687
2.5002766    16.2480357 C
0.00004875         5175.    106157158.    15.4323429     0.0007523     -0.000710
2.5357389    16.5159121 C
0.00005125         5334.    104078944.    15.2201747     0.0007800     -0.000757
2.6050350    17.0475473 C
0.00005375         5491.    102162708.    15.0263178     0.0008077     -0.000805
2.6724641    17.5769606 C
0.00005625         5647.    100394759.    14.8492686     0.0008353     -0.000852
2.7381844    -18.597221 C
0.00005875         5801.     98742739.    14.6851095     0.0008628     -0.000900
2.8019039    -19.703682 C
0.00006125         5954.     97212379.    14.5348709     0.0008903     -0.000947
2.8640618    -20.808998 C
0.00006375         6106.     95774727.    14.3945800     0.0009177     -0.000995
2.9243066    -21.917709 C
0.00006625         6256.     94435270.    14.2657824     0.0009451     -0.001042
2.9830387    -23.024676 C
0.00006875         6405.     93170201.    14.1447904     0.0009725     -0.001090
3.0398989    -24.134758 C
0.00007125         6554.     91982509.    14.0327913     0.0009998     -0.001138
3.0951957    -25.243801 C
0.00007375         6701.     90863627.    13.9287097     0.0010272     -0.001185
3.1488987    -26.352159 C
0.00007625         6847.     89800253.    13.8303648     0.0010546     -0.001233
3.2008029    -27.462904 C
0.00007875         6993.     88795719.    13.7390537     0.0010820     -0.001281
3.2511878    -28.571853 C
0.00008125         7137.     87844504.    13.6541311     0.0011094     -0.001328
3.3000433    -29.678990 C
0.00008375         7281.     86934040.    13.5731264     0.0011367     -0.001376
3.3470856    -30.788921 C
0.00008625         7423.     86067974.    13.4974565     0.0011642     -0.001423
3.3925828    -31.897254 C
0.00008875         7565.     85242865.    13.4267742     0.0011916     -0.001471
3.4365394    -33.003722 C
0.00009125         7707.     84455263.    13.3606774     0.0012192     -0.001518
3.4789448    -34.108306 C
0.00009375         7847.     83697576.    13.2974753     0.0012466     -0.001566
3.5196047    -35.214600 C
0.00009625         7986.     82971048.    13.2379854     0.0012742     -0.001613
3.5586713    -36.319695 C
0.00009875         8125.     82274114.    13.1821896     0.0013017     -0.001661
3.5961721    -37.422839 C
 0.0001013         8262.     81604506.    13.1298221     0.0013294     -0.001708
3.6320957    -38.524007 C
 0.0001038         8400.     80960170.    13.0806431     0.0013571     -0.001755
3.6664306    -39.623176 C
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 0.0001063        8536.     80338131.    13.0340682     0.0013849     -0.001803
3.6991142    -40.721590 C
 0.0001088        8671.     79735865.    12.9894769     0.0014126     -0.001850
3.7300989    -41.820375 C
 0.0001113        8806.     79154044.    12.9474858     0.0014404     -0.001897
3.7594753    -42.917072 C
 0.0001138        8940.     78591244.    12.9080275     0.0014683     -0.001944
3.7872308    -44.011657 C
 0.0001163        9073.     78046163.    12.8709020     0.0014962     -0.001991
3.8133529    -45.104100 C
 0.0001188        9205.     77517605.    12.8359700     0.0015243     -0.002038
3.8378287    -46.194375 C
 0.0001213        9337.     77004473.    12.8031041     0.0015524     -0.002085
3.8606449    -47.282452 C
 0.0001238        9468.     76505757.    12.7721874     0.0015806     -0.002132
3.8817881    -48.368302 C
 0.0001263        9598.     76020161.    12.7429749     0.0016088     -0.002179
3.9012286    -49.452595 C
 0.0001288        9727.     75546135.    12.7148705     0.0016370     -0.002225
3.9189259    -50.536789 C
 0.0001313        9855.     75084079.    12.6884040     0.0016654     -0.002272
3.9349214    -51.618631 C
 0.0001338        9982.     74633245.    12.6635937     0.0016938     -0.002319
3.9492003    -52.698086 C
 0.0001363       10109.     74192938.    12.6403073     0.0017222     -0.002365
3.9617477    -53.775120 C
 0.0001388       10235.     73762511.    12.6184711     0.0017508     -0.002412
3.9725480    -54.849696 C
 0.0001413       10359.     73341362.    12.5980134     0.0017795     -0.002458
3.9815856    -55.921777 C
 0.0001438       10484.     72928927.    12.5788783     0.0018082     -0.002504
3.9888444    -56.991325 C
 0.0001463       10607.     72524680.    12.5610041     0.0018370     -0.002550
3.9943078    -58.058301 C
 0.0001488       10729.     72128128.    12.5443367     0.0018660     -0.002597
3.9979590    -59.122664 C
 0.0001588       11186.     70462629.    12.4805109     0.0019813     -0.002781
3.9993500    -60.000000 CY
 0.0001688       11536.     68359884.    12.3983675     0.0020922     -0.002970
3.9994628    -60.000000 CY
 0.0001788       11807.     66051560.    12.3064919     0.0021998     -0.003163
3.9986190    -60.000000 CY
 0.0001888       12034.     63755086.    12.2161525     0.0023058     -0.003357
3.9999715    -60.000000 CY
 0.0001988       12222.     61494293.    12.1277811     0.0024104     -0.003552
3.9979873    -60.000000 CY
 0.0002088       12384.     59325486.    12.0409611     0.0025136     -0.003749
3.9989691    -60.000000 CY
 0.0002188       12533.     57295024.    11.9620390     0.0026167     -0.003946
3.9993382    -60.000000 CY
```

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    0.0002288        12657.     55329436.    11.8832979     0.0027183     -0.004144
   3.9992529    -60.000000 CY
    0.0002388        12763.     53455914.    11.8055731     0.0028186     -0.004344
   3.9986520    -60.000000 CY
    0.0002488        12864.     51715933.    11.7343512     0.0029189     -0.004544
   3.9972550    -60.000000 CY
    0.0002588        12961.     50092322.    11.6693178     0.0030194     -0.004743
   3.9976164    -60.000000 CY
    0.0002688        13045.     48538451.    11.6063408     0.0031192     -0.004943
   3.9996845    60.0000000 CY
    0.0002788        13114.     47045921.    11.5449453     0.0032182     -0.005144
   3.9974219    60.0000000 CY
    0.0002888        13172.     45618960.    11.4848009     0.0033162     -0.005346
   3.9997953    60.0000000 CY
    0.0002988        13223.     44262257.    11.4337614     0.0034158     -0.005547
   3.9983012    60.0000000 CY
    0.0003088        13271.     42983683.    11.3892687     0.0035164     -0.005746
   3.9971067    60.0000000 CY
    0.0003188        13313.     41766888.    11.3534296     0.0036189     -0.005944
   3.9985082    60.0000000 CY
    0.0003288        13351.     40611000.    11.3215564     0.0037220     -0.006141
   3.9965039    60.0000000 CY
    0.0003388        13382.     39504152.    11.2925213     0.0038253     -0.006337
   3.9979588    60.0000000 CY


-------------------------------------------------------------------------------
   Summary of Results for Nominal Moment Capacity for Section 2
-------------------------------------------------------------------------------

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              437.790             12942.622           0.00300000
-0.00470449

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,
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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	437.790000	12943.	284.563500	8413.	80900448.
1	0.75	437.790000	12943.	328.342500	9707.	75618139.
1	0.90	437.790000	12943.	394.011000	11648.	67400476.

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	14.7500	0.00	N.A.	No	0.00	5873.
2	16.6000	24.8941	No	No	5873.	89095.
3	22.1000	11.9423	Yes	No	94968.	188706.
4	35.8000	21.0500	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 Displacement and Pile-head Rotation (Loading Type 5)
Displacement of pile head = 1.000000 inches
Rotation of pile head = 0.000E+00 radians
Axial load on pile head = 437790.0 lbs

Depth X	Deflect. y	Bending Moment	Shear Force	Slope S	Total Stress	Bending Stiffness	Soil Res. Es*H	Soil Spr. Lat. Load	Distrib. p
feet	inches	in-lbs	lbs	radians	psi*	lb-in^2	lb/inch	lb/inch	lb/inch
0.00	1.0000	-1.14E+07	90888.	0.00	0.00	9.64E+10	0.00	0.00	0.00
0.4080	0.9986	-1.10E+07	90883.	-5.68E-04	0.00	9.64E+10	0.00	0.00	0.00
0.8160	0.9944	-1.05E+07	90883.	-0.00110	0.00	1.02E+11	0.00	0.00	0.00
1.2240	0.9878	-1.01E+07	90883.	-0.00159	0.00	1.04E+11	0.00	0.00	0.00
1.6320	0.9789	-9622788.	90883.	-0.00205	0.00	1.08E+11	0.00	0.00	0.00
2.0400	0.9678	-9172973.	90883.	-0.00247	0.00	1.11E+11	0.00	0.00	0.00
2.4480	0.9547	-8722292.	90883.	-0.00285	0.00	1.15E+11	0.00	0.00	0.00
2.8560	0.9398	-8270817.	90883.	-0.00321	0.00	1.20E+11	0.00	0.00	0.00
3.2640	0.9233	-7818618.	90883.	-0.00353	0.00	1.25E+11	0.00	0.00	0.00
3.6720	0.9053	-7365766.	90883.	-0.00382	0.00	1.32E+11	0.00	0.00	0.00
4.0800	0.8859	-6912327.	90883.	-0.00408	0.00	1.39E+11	0.00	0.00	0.00
4.4880	0.8654	-6458367.	90883.	-0.00430	0.00	1.49E+11	0.00	0.00	0.00
4.8960	0.8438	-6003952.	90883.	-0.00450	0.00	1.60E+11	0.00	0.00	0.00
5.3040	0.8213	-5549144.	90883.	-0.00467	0.00	1.74E+11	0.00	0.00	0.00
5.7120	0.7981	-5094001.	90883.	-0.00481	0.00	1.92E+11	0.00	0.00	0.00
6.1200	0.7742	-4638579.	90883.	-0.00493	0.00	2.14E+11	0.00	0.00	0.00
6.5280	0.7498	-4182930.	90883.	-0.00503	0.00	2.40E+11			

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0.00       0.00       0.00
    6.9360     0.7249  -3727098.     90883.   -0.00510       0.00   3.52E+11
0.00       0.00       0.00
    7.3440     0.6998  -3271155.     90883.   -0.00515       0.00   3.53E+11
0.00       0.00       0.00
    7.7520     0.6745  -2815114.     90883.   -0.00519       0.00   3.53E+11
0.00       0.00       0.00
    8.1600     0.6490  -2358990.     90883.   -0.00522       0.00   3.54E+11
0.00       0.00       0.00
    8.5680     0.6234  -1902796.     90883.   -0.00525       0.00   3.54E+11
0.00       0.00       0.00
    8.9760     0.5976  -1446545.     90883.   -0.00528       0.00   3.54E+11
0.00       0.00       0.00
    9.3840     0.5717   -990252.     90883.   -0.00529       0.00   3.54E+11
0.00       0.00       0.00
    9.7920     0.5458   -533929.     90883.   -0.00530       0.00   3.54E+11
0.00       0.00       0.00
   10.2000     0.5198    -77591.     90883.   -0.00531       0.00   3.54E+11
0.00       0.00       0.00
   10.6080     0.4938    378750.     90883.   -0.00531       0.00   3.54E+11
0.00       0.00       0.00
   11.0160     0.4678    835080.     90883.   -0.00530       0.00   3.54E+11
0.00       0.00       0.00
   11.4240     0.4419   1291385.     90883.   -0.00528       0.00   3.54E+11
0.00       0.00       0.00
   11.8320     0.4161   1747652.     90883.   -0.00526       0.00   3.54E+11
0.00       0.00       0.00
   12.2400     0.3904   2203866.     90883.   -0.00523       0.00   3.54E+11
0.00       0.00       0.00
   12.6480     0.3649   2660016.     90883.   -0.00520       0.00   3.54E+11
0.00       0.00       0.00
   13.0560     0.3395   3116086.     90883.   -0.00516       0.00   3.53E+11
0.00       0.00       0.00
   13.4640     0.3143   3572064.     90883.   -0.00511       0.00   3.53E+11
0.00       0.00       0.00
   13.8720     0.2894   4027936.     90883.   -0.00505       0.00   2.50E+11
0.00       0.00       0.00
   14.2800     0.2649   4483638.     90883.   -0.00496       0.00   2.22E+11
0.00       0.00       0.00
   14.6880     0.2408   4939128.     90883.   -0.00485       0.00   1.99E+11
0.00       0.00       0.00
   15.0960     0.2174   5394358.     90799.   -0.00472       0.00   1.80E+11
-34.206   770.4188       0.00
   15.5040     0.1946   5848453.     90525.   -0.00456       0.00   1.65E+11
-77.741      1955.        0.00
   15.9120     0.1728   6300311.     90035.   -0.00437       0.00   1.52E+11
-122.546      3473.        0.00
   16.3200     0.1519   6748798.     89327.   -0.00415       0.00   1.43E+11
-166.667      5373.        0.00
   16.7280     0.1321   7192794.     78171.   -0.00390       0.00   1.35E+11
```

-4390. 162696. 0.00
  17.1360 0.1136 7530988. 56272. -0.00363 0.00 1.29E+11
-4555. 196255. 0.00
  17.5440 0.09657 7759373. 34416. -0.00334 0.00 1.26E+11
-4373. 221703. 0.00
  17.9520 0.08096 7882295. 13818. -0.00303 0.00 1.25E+11
-4041. 244390. 0.00
  18.3600 0.06687 7907678. -5066. -0.00272 0.00 1.24E+11
-3673. 268899. 0.00
  18.7680 0.05431 7844351. -22161. -0.00241 0.00 1.25E+11
-3310. 298378. 0.00
  19.1760 0.04325 7701023. -37494. -0.00211 0.00 1.27E+11
-2954. 334350. 0.00
  19.5840 0.03365 7486254. -51103. -0.00182 0.00 1.30E+11
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  19.9920 0.02542 7208431. -62961. -0.00155 0.00 1.34E+11
-2239. 431169. 0.00
  20.4000 0.01848 6876377. -72737. -0.00130 0.00 1.40E+11
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   27.3360   -0.00615   710769.   -42305.   6.79E-05   0.00   3.54E+11
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   28.5600   -0.00499   184890.   -29505.   8.59E-05   0.00   3.54E+11
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   28.9680   -0.00456   50121.   -25560.   8.75E-05   0.00   3.54E+11
787.7260   846093.   0.00
   29.3760   -0.00413   -65768.   -21797.   8.74E-05   0.00   3.54E+11
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   29.7840   -0.00370   -163686.   -18223.   8.58E-05   0.00   3.54E+11
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   30.1920   -0.00329   -244580.   -14848.   8.30E-05   0.00   3.54E+11
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   31.0080   -0.00251   -359238.   -8708.   7.46E-05   0.00   3.54E+11
584.8415   1139860.   0.00
   31.4160   -0.00216   -395015.   -5949.   6.93E-05   0.00   3.54E+11
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   31.8240   -0.00183   -417783.   -3398.   6.37E-05   0.00   3.54E+11
499.6109   1334442.   0.00
   32.2320   -0.00154   -428563.   -1071.   5.79E-05   0.00   3.54E+11
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   32.6400   -0.00127   -428521.   964.2717   5.19E-05   0.00   3.54E+11
380.6251   1471503.   0.00
   33.0480   -0.00103   -419343.   2669.   4.61E-05   0.00   3.54E+11
315.5971   1505062.   0.00
   33.4560 -8.15E-04   -402587.   4068.   4.04E-05   0.00   3.54E+11
256.2079   1538621.   0.00
   33.8640 -6.31E-04   -379678.   5192.   3.50E-05   0.00   3.54E+11
202.6770   1572180.   0.00
   34.2720 -4.73E-04   -351900.   6067.   2.99E-05   0.00   3.54E+11
155.0563   1605739.   0.00
   34.6800 -3.38E-04   -320394.   6724.   2.53E-05   0.00   3.54E+11
113.2447   1639298.   0.00
   35.0880 -2.25E-04   -286164.   7190.   2.11E-05   0.00   3.54E+11
77.0031   1672857.   0.00
   35.4960 -1.32E-04   -250080.   7491.   1.74E-05   0.00   3.54E+11
45.9697   1706417.   0.00
   35.9040 -5.54E-05   -212886.   8462.   1.28E-05   0.00   1.85E+11
350.5899   3.10E+07   0.00
   36.3120 -6.48E-06   -167276.   9441.   7.77E-06   0.00   1.85E+11
49.4624   3.74E+07   0.00
   36.7200   2.07E-05   -120471.   9109.   3.95E-06   0.00   1.85E+11
-185.006   4.38E+07   0.00
   37.1280   3.22E-05   -78094.   7849.   1.32E-06   0.00   1.85E+11

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-330.028   5.02E+07       0.00
   37.5360   3.36E-05    -43624.      6091.  -2.98E-07       0.00   1.85E+11
-387.917   5.66E+07       0.00
   37.9440   2.93E-05    -18450.      4220.  -1.12E-06       0.00   1.85E+11
-376.522   6.30E+07       0.00
   38.3520   2.26E-05     -2300.      2515.  -1.40E-06       0.00   1.85E+11
-319.969   6.94E+07       0.00
   38.7600   1.56E-05      6179.      1141.  -1.35E-06       0.00   1.85E+11
-241.324   7.58E+07       0.00
   39.1680   9.41E-06      8874.   163.3257  -1.15E-06       0.00   1.85E+11
-157.894   8.21E+07       0.00
   39.5760   4.38E-06      7784.   -416.960  -9.25E-07       0.00   1.85E+11
-79.151   8.85E+07       0.00
   39.9840   3.54E-07      4795.   -627.527  -7.58E-07       0.00   1.85E+11
-6.864   9.49E+07       0.00
   40.3920  -3.05E-06      1642.   -490.011  -6.73E-07       0.00   1.85E+11
63.0390   1.01E+08       0.00
   40.8000  -6.23E-06       0.00       0.00  -6.51E-07       0.00   1.85E+11
137.1290   5.39E+07       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             =     1.00000000 inches
Computed slope at pile head      =       0.000000 radians
Maximum bending moment           =     -11411891. inch-lbs
Maximum shear force              =         90888. lbs
Depth of maximum bending moment  =       0.000000 feet below pile head
Depth of maximum shear force     =       0.000000 feet below pile head
Number of iterations             =             16
Number of zero deflection points =              3
Pile deflection at ground        =     0.23726411 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	Load Type	Pile-head Load 1	Load Type	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	y, in	1.0000	S, rad	0.00	437790.	1.0000	0.00	90888.	-1.14E+07

Maximum pile-head deflection = 1.0000000000 inches
Maximum pile-head rotation = 0.0000000000 radians = 0.000000 deg.

Summary of Warning Messages

The following warning was reported 221 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.

==========

LPile for Windows, Version 2022-12.011

Analysis of Individual Piles and Drilled Shafts
Subjected to Lateral Loading Using the p-y Method
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Files Used for Analysis

Path to file locations:
\20240280\ODOT\109971\400-Engineering\Structures\SFN_0800512\Engdata\04_Abutment Design\Stage 2\Drilled Shaft\Lpile\Abutment\Forward Abutment\

Name of input data file:
FA_Scour Service - Back DS.lp12d

Name of output report file:
FA_Scour Service - Back DS.lp12o

Name of plot output file:
FA_Scour Service - Back DS.lp12p

Name of runtime message file:
FA_Scour Service - Back DS.lp12r

Date and Time of Analysis

Date: February 12, 2026 Time: 14:19:52

Problem Title

Project Name:

Job Number:

Client:

Engineer:

Description:

Program Options and Settings

Computational Options:
- Conventional Analysis

Engineering Units Used for Data Input and Computations:
- US Customary System Units (pounds, feet, inches)

Analysis Control Options:

- Maximum number of iterations allowed	=	500
- Deflection tolerance for convergence	=	1.0000E-05 in
- Maximum allowable deflection	=	100.0000 in
- Number of pile increments	=	100

Loading Type and Number of Cycles of Loading:

- Static loading specified

- Analysis uses p-y modification factors for p-y curves
- Analysis uses layering correction (Method of Georgiadis)
- No distributed lateral loads are entered
- Loading by lateral soil movements acting on pile not selected
- Input of shear resistance at the pile tip not selected
- Input of moment resistance at the pile tip not selected
- Computation of pile-head foundation stiffness matrix not selected
- Push-over analysis of pile not selected
- Buckling analysis of pile not selected

Output Options:
- Output files use decimal points to denote decimal symbols.
- Values of pile-head deflection, bending moment, shear force, and soil reaction are printed for full length of pile.
- Printing Increment (nodal spacing of output points) = 1
- No p-y curves to be computed and reported for user-specified depths
- Print using wide report formats

Pile Structural Properties and Geometry

Number of pile sections defined = 2
Total length of pile = 40.800 ft
Depth of ground surface below top of pile = 14.7500 ft

Pile diameters used for p-y curve computations are defined using 4 points.

p-y curves are computed using pile diameter values interpolated with depth over the length of the pile. A summary of values of pile diameter vs. depth follows.

Point No.	Depth Below Pile Head feet	Pile Diameter inches
1	0.000	36.0000
2	35.800	36.0000
3	35.800	30.0000
4	40.800	30.0000

Input Structural Properties for Pile Sections:

Pile Section No. 1:

Section 1 is a round drilled shaft, bored pile, or CIDH pile
Length of section = 35.800000 ft
Shaft Diameter = 36.000000 in

Pile Section No. 2:

Section 2 is a round drilled shaft, bored pile, or CIDH pile
Length of section = 5.000000 ft
Shaft Diameter = 30.000000 in

Soil and Rock Layering Information

The soil profile is modelled using 4 layers

Layer 1 is sand, p-y criteria by Reese et al., 1974

Distance from top of pile to top of layer = 14.750000 ft
Distance from top of pile to bottom of layer = 16.600000 ft
Effective unit weight at top of layer = 72.600000 pcf
Effective unit weight at bottom of layer = 72.600000 pcf
Friction angle at top of layer = 40.000000 deg.
Friction angle at bottom of layer = 40.000000 deg.
Subgrade k at top of layer = 125.000000 pci
Subgrade k at bottom of layer = 125.000000 pci

Layer 2 is stiff clay with water-induced erosion

Distance from top of pile to top of layer = 16.600000 ft
Distance from top of pile to bottom of layer = 22.100000 ft
Effective unit weight at top of layer = 72.600000 pcf
Effective unit weight at bottom of layer = 72.600000 pcf
Undrained cohesion at top of layer = 5600. psf
Undrained cohesion at bottom of layer = 5600. psf
Epsilon-50 at top of layer = 0.004000
Epsilon-50 at bottom of layer = 0.004000
Subgrade k at top of layer = 2000. pci
Subgrade k at bottom of layer = 2000. pci

Layer 3 is stiff clay with water-induced erosion

Distance from top of pile to top of layer = 22.100000 ft
Distance from top of pile to bottom of layer = 35.800000 ft
Effective unit weight at top of layer = 67.600000 pcf

```
   Effective unit weight at bottom of layer            =    67.600000 pcf
   Undrained cohesion at top of layer                  =        4600. psf
   Undrained cohesion at bottom of layer               =        4600. psf
   Epsilon-50 at top of layer                          =     0.004000
   Epsilon-50 at bottom of layer                       =     0.004000
   Subgrade k at top of layer                          =        2000. pci
   Subgrade k at bottom of layer                       =        2000. pci


Layer 4 is weak rock, p-y criteria by Reese, 1997

   Distance from top of pile to top of layer           =    35.800000 ft
   Distance from top of pile to bottom of layer        =   100.000000 ft
   Effective unit weight at top of layer               =    97.500000 pcf
   Effective unit weight at bottom of layer            =    97.500000 pcf
   Uniaxial compressive strength at top of layer       =   661.000000 psi
   Uniaxial compressive strength at bottom of layer    =   661.000000 psi
   Initial modulus of rock at top of layer             =       60000. psi
   Initial modulus of rock at bottom of layer          =       60000. 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                        =    0.0005000
   k rm of rock at bottom of layer                     =    0.0005000


 (Depth of the lowest soil layer extends 59.200 ft below the pile tip)



--------------------------------------------------------------------------------
                        Summary of Input Soil Properties
--------------------------------------------------------------------------------

Layer         Soil Type          Layer      Effective    Cohesion     Angle of
Uniaxial                      E50                      Rock Mass
 Num.           Name            Depth       Unit Wt.                  Friction
 qu          RQD %         or           kpy        Modulus
          (p-y Curve Type)        ft           pcf          psf          deg.
 psi                        krm          pci          psi
-----   ------------------   ----------   ----------   ----------   ----------
----------   ----------   ----------   ----------   ----------
  1            Sand              14.7500      72.6000       --          40.0000
 --            --            --          125.0000       --
          (Reese, et al.)        16.6000      72.6000       --          40.0000
 --            --            --          125.0000       --
  2         Stiff Clay           16.6000      72.6000        5600.       --
 --            --           0.00400        2000.       --
          with Free Water        22.1000      72.6000        5600.       --
 --            --           0.00400        2000.       --
  3         Stiff Clay           22.1000      67.6000        4600.       --
```

```
 --           --          0.00400        2000.       --
          with Free Water        35.8000      67.6000        4600.       --
 --           --          0.00400        2000.       --
  4            Weak              35.8000      97.5000       --           --
661.0000       9.0000     5.00E-04       --           60000.
               Rock             100.0000      97.5000       --           --
661.0000       9.0000     5.00E-04       --           60000.
```

Modification Factors for p-y Curves

Distribution of p-y modifiers with depth defined using 2 points

Point No.	Depth X ft	p-mult	y-mult
1	14.750	0.5000	1.0000
2	35.800	0.5000	1.0000

Static Loading Type

Static loading criteria were used when computing p-y curves for all analyses.

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 1

Load No.	Load Type	Condition 1	Condition 2	Axial Thrust Force, lbs	Compute Top y vs. Pile Length	Run Analysis
1	5	y = 1.000000 in	S = 0.0000 in/in	361450.	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 = 2

Pile Section No. 1:

Dimensions and Properties of Drilled Shaft (Bored Pile):

Length of Section	=	35.800000 ft
Shaft Diameter	=	36.000000 in
Concrete Cover Thickness (to edge of trans. reinf.)	=	6.000000 in
Number of Reinforcing Bars	=	15 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	=	15.000000 sq. in.
Area Ratio of Steel Reinforcement	=	1.47 percent
Edge-to-Edge Bar Spacing	=	3.367467 in
Maximum Concrete Aggregate Size	=	0.375000 in
Ratio of Bar Spacing to Aggregate Size	=	8.98
Offset of Center of Rebar Cage from Center of Pile	=	0.0000 in

Transverse Reinforcement
Type: Hoop

Number of Transverse Reinf. (per spacing)	=	1
Spacing of Transverse Reinf.	=	4.500000 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	=	4309.778 kips
Tensile Load for Cracking of Concrete	=	-467.292 kips
Nominal Axial Tensile Capacity	=	-900.000 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	10.811000	0.00000
2	1.128000	1.000000	9.876340	4.397230
3	1.128000	1.000000	7.233971	8.034139
4	1.128000	1.000000	3.340783	10.281872
5	1.128000	1.000000	-1.13006	10.751776
6	1.128000	1.000000	-5.40550	9.362601
7	1.128000	1.000000	-8.74628	6.354546
8	1.128000	1.000000	-10.57475	2.247733
9	1.128000	1.000000	-10.57475	-2.24773
10	1.128000	1.000000	-8.74628	-6.35455
11	1.128000	1.000000	-5.40550	-9.36260
12	1.128000	1.000000	-1.13006	-10.75178
13	1.128000	1.000000	3.340783	-10.28187
14	1.128000	1.000000	7.233971	-8.03414
15	1.128000	1.000000	9.876340	-4.39723

NOTE: The positions of the above rebars were computed by LPile

Minimum spacing between any two bars not equal to zero = 3.367 inches
between bars 7 and 8.

Ratio of bar spacing to maximum aggregate size = 8.98

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	=	0.375000 in

Number of Axial Thrust Force Values Determined from Pile-head Loadings = 1

Number	Axial Thrust Force kips
1	361.450

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 = 361.450 kips

Bending Max Conc Stress	Bending Curvature rad/in.	Bending Max Steel Stress ksi	Bending Moment in-kip	Run Msg	Depth to Stiffness N Axis kip-in2	Max Comp Strain in	Max Comp Strain in/in	Max Tens Strain in/in
6.25000E-07	223.1442687	357030830.	143.7406174	0.00008984	0.00006734	0.3714901	2.4845862	
0.00000125	446.2886300	357030904.	80.8893765	0.0001011	0.00005611	0.4164355	2.6908149	
0.00000188	669.4220619	357025100.	59.9474342	0.0001124	0.00004490	0.4611641	2.8975042	
0.00000250	892.5391010	357015640.	49.4828170	0.0001237	0.00003371	0.5056749	3.1046542	
0.00000313	1116.	357002971.	43.2091302	0.0001350	0.00002253	0.5499664	3.3122649	
0.00000375	1339.	356987239.	39.0309092	0.0001464	0.00001137	0.5940377	3.5203364	
0.00000438	1562.	356968507.	36.0500975	0.0001577	2.19177E-07	0.6378875	3.7288686	
0.00000500	1785.	356941432.	33.8175975	0.0001691	-0.00001091	0.6815132	3.9378516	
0.00000563	2007.	356877575.	32.0835585	0.0001805	-0.00002203	0.7249047	4.1472180	
0.00000625	2230.	356756814.	30.6979857	0.0001919	-0.00003314	0.7680502	4.3568849	
0.00000688	2451.	356574795.	29.5585056	0.0002032	-0.00004429	0.8109404	4.5667876	
0.00000750	2673.	356334664.	28.6187269	0.0002146	-0.00005536	0.8535685	4.7768784	

```
0.00000813         2893.    356042470.    27.8235061     0.0002261   -0.00006643
0.8959296     4.9871228
0.00000875         3112.    355704777.    27.1418801     0.0002375   -0.00007751
0.9380201     5.1974961
0.00000938         3331.    355327650.    26.5511565     0.0002489   -0.00008858
0.9798371     5.4079791
0.00001000         3549.    354916443.    26.0343121     0.0002603   -0.00009966
1.0213787     5.6185571
0.00001063         3766.    354475742.    25.5783565     0.0002718    -0.000111
1.0626431     5.8292186
0.00001125         3766.    334782645.    23.7402796     0.0002671    -0.000138
1.0451560     5.5724412 C
0.00001188         3766.    317162506.    23.2329180     0.0002759    -0.000152
1.0767852     5.7072987 C
0.00001250         3766.    301304381.    22.7654314     0.0002846    -0.000165
1.1077546     5.8382189 C
0.00001313         3766.    286956553.    22.3343079     0.0002931    -0.000179
1.1381749     5.9660335 C
0.00001375         3766.    273913073.    21.9352300     0.0003016    -0.000193
1.1680837     6.0909980 C
0.00001438         3766.    262003809.    21.5642645     0.0003100    -0.000208
1.1975018     6.2132375 C
0.00001500         3766.    251086984.    21.2183571     0.0003183    -0.000222
1.2264527     6.3329014 C
0.00001563         3766.    241043505.    20.8948810     0.0003265    -0.000236
1.2549657     6.4501918 C
0.00001625         3766.    231772601.    20.5917679     0.0003346    -0.000250
1.2830748     6.5653535 C
0.00001688         3766.    223188430.    20.3073280     0.0003427    -0.000265
1.3108170     6.6786612 C
0.00001750         3815.    217999882.    20.0389109     0.0003507    -0.000279
1.3381593     6.7898107 C
0.00001813         3878.    213962001.    19.7855107     0.0003586    -0.000294
1.3651417     6.8991050 C
0.00001875         3940.    210140238.    19.5466729     0.0003665    -0.000308
1.3918371     7.0071334 C
0.00001938         4001.    206501474.    19.3202550     0.0003743    -0.000323
1.4181995     7.1134836 C
0.00002000         4061.    203029422.    19.1049588     0.0003821    -0.000338
1.4442226     7.2180776 C
0.00002063         4120.    199743131.    18.9017348     0.0003898    -0.000353
1.4700461     7.3220883 C
0.00002125         4177.    196577878.    18.7064968     0.0003975    -0.000367
1.4954555     7.4236532 C
0.00002188         4235.    193583789.    18.5222169     0.0004052    -0.000382
1.5207222     7.5250938 C
0.00002250         4291.    190698297.    18.3448524     0.0004128    -0.000397
1.5456125     7.6243662 C
0.00002313         4347.    187965054.    18.1772264     0.0004203    -0.000412
1.5703888     7.7237400 C
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0.00002375        4401.    185321577.    18.0150941     0.0004279     -0.000427
1.5947794     7.8208211 C
0.00002438        4456.    182811048.    17.8614164     0.0004354     -0.000442
1.6190626     -8.113884 C
0.00002563        4563.    178073180.    17.5716290     0.0004503     -0.000472
1.6668377     -8.745371 C
0.00002688        4668.    173708087.    17.3048918     0.0004651     -0.000502
1.7137962     -9.379863 C
0.00002813        4772.    169679062.    17.0590417     0.0004798     -0.000533
1.7600257    -10.016655 C
0.00002938        4874.    165928980.    16.8300205     0.0004944     -0.000563
1.8054052    -10.656935 C
0.00003063        4975.    162443320.    16.6171818     0.0005089     -0.000594
1.8500811    -11.299445 C
0.00003188        5075.    159200272.    16.4194424     0.0005234     -0.000624
1.8941416    -11.943427 C
0.00003313        5173.    156156728.    16.2333752     0.0005377     -0.000655
1.9374182    -12.590528 C
0.00003438        5270.    153318199.    16.0603689     0.0005521     -0.000685
1.9801970    -13.238096 C
0.00003563        5367.    150642889.    15.8967978     0.0005663     -0.000716
2.0222405    -13.888455 C
0.00003688        5462.    148133705.    15.7437713     0.0005806     -0.000747
2.0637830    -14.539392 C
0.00003813        5557.    145769720.    15.5997158     0.0005947     -0.000778
2.1047565    -15.191602 C
0.00003938        5652.    143532232.    15.4629212     0.0006089     -0.000809
2.1450981    -15.845756 C
0.00004063        5745.    141427150.    15.3350361     0.0006230     -0.000840
2.1850532    -16.499429 C
0.00004188        5838.    139424076.    15.2129528     0.0006370     -0.000870
2.2243364    -17.155533 C
0.00004313        5931.    137525006.    15.0970446     0.0006511     -0.000901
2.2631227    -17.812332 C
0.00004438        6023.    135728176.    14.9882009     0.0006651     -0.000932
2.3015264    -18.468653 C
0.00004563        6114.    134014043.    14.8843614     0.0006791     -0.000963
2.3393459    -19.126617 C
0.00004688        6205.    132377490.    14.7848171     0.0006930     -0.000994
2.3766119    -19.785952 C
0.00004813        6296.    130821656.    14.6907859     0.0007070     -0.001026
2.4134988    -20.444810 C
0.00004938        6386.    129340399.    14.6014272     0.0007209     -0.001057
2.4500057    -21.103188 C
0.00005063        6476.    127916413.    14.5157212     0.0007349     -0.001088
2.4858780    -21.763894 C
0.00005188        6565.    126553215.    14.4334236     0.0007487     -0.001119
2.5212877    -22.425081 C
0.00005313        6654.    125250326.    14.3553106     0.0007626     -0.001150
2.5563206    -23.085788 C
```

```
0.00005438        6743.    124003566.    14.2810949     0.0007765     -0.001181
2.5909753    -23.746012 C
0.00005563        6831.    122807537.    14.2096763     0.0007904     -0.001212
2.6252094    -24.406233 C
0.00005688        6919.    121650614.    14.1409075     0.0008043     -0.001243
2.6588066    -25.069003 C
0.00005813        7006.    120539981.    14.0748681     0.0008181     -0.001274
2.6920287    -25.731288 C
0.00005938        7094.    119472696.    14.0118929     0.0008320     -0.001306
2.7248745    -26.393085 C
0.00006063        7181.    118446058.    13.9517938     0.0008458     -0.001337
2.7573426    -27.054391 C
0.00006188        7268.    117457598.    13.8943974     0.0008597     -0.001368
2.7894319    -27.715202 C
0.00006313        7354.    116502014.    13.8381764     0.0008735     -0.001399
2.8210455    -28.376717 C
0.00006438        7440.    115575558.    13.7847511     0.0008874     -0.001430
2.8521254    -29.039705 C
0.00006563        7526.    114681316.    13.7329359     0.0009012     -0.001461
2.8828288    -29.702194 C
0.00006688        7612.    113817464.    13.6833170     0.0009151     -0.001492
2.9131543    -30.364180 C
0.00006813        7697.    112982313.    13.6357749     0.0009289     -0.001524
2.9431005    -31.025660 C
0.00006938        7782.    112174293.    13.5901987     0.0009428     -0.001555
2.9726660    -31.686632 C
0.00007063        7867.    111391948.    13.5464856     0.0009567     -0.001586
3.0018495    -32.347093 C
0.00007188        7952.    110633935.    13.5045391     0.0009706     -0.001617
3.0306496    -33.007037 C
0.00007313        8036.    109894502.    13.4630803     0.0009845     -0.001648
3.0588857    -33.668990 C
0.00007438        8120.    109176625.    13.4228193     0.0009983     -0.001679
3.0867189    -34.330736 C
0.00007938        8454.    106505167.    13.2781215     0.0010540     -0.001804
3.1942207    -36.972437 C
0.00008438        8784.    104110409.    13.1538330     0.0011099     -0.001928
3.2955220    -39.605526 C
0.00008938        9110.    101935570.    13.0432337     0.0011657     -0.002052
3.3900302    -42.238449 C
0.00009438        9433.     99953355.    12.9477972     0.0012219     -0.002176
3.4781551    -44.863410 C
0.00009938        9752.     98135009.    12.8649802     0.0012785     -0.002299
3.5598653    -47.478950 C
 0.0001044       10068.     96456107.    12.7933005     0.0013353     -0.002422
3.6350511    -50.084788 C
 0.0001094       10379.     94893121.    12.7285765     0.0013922     -0.002545
3.7033572    -52.686682 C
 0.0001144       10686.     93433027.    12.6738245     0.0014496     -0.002668
3.7649097    -55.279620 C
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 0.0001194        10990.     92062855.    12.6260220     0.0015072     -0.002790
3.8196503    -57.861703 C
 0.0001244        11289.     90765684.    12.5849508     0.0015653     -0.002912
3.8674239    -60.000000 CY
 0.0001294        11566.     89400377.    12.5439823     0.0016229     -0.003035
3.9076051    -60.000000 CY
 0.0001344        11794.     87766990.    12.4918735     0.0016786     -0.003159
3.9396461    -60.000000 CY
 0.0001394        11985.     85991390.    12.4366363     0.0017334     -0.003284
3.9643961    -60.000000 CY
 0.0001444        12151.     84165131.    12.3768902     0.0017869     -0.003411
3.9823632    -60.000000 CY
 0.0001494        12304.     82368849.    12.3196719     0.0018403     -0.003537
3.9940242    -60.000000 CY
 0.0001544        12436.     80557968.    12.2610891     0.0018928     -0.003665
3.9994922    -60.000000 CY
 0.0001594        12554.     78768812.    12.2038187     0.0019450     -0.003793
3.9991591    -60.000000 CY
 0.0001644        12667.     77063743.    12.1517660     0.0019974     -0.003920
3.9984807    -60.000000 CY
 0.0001694        12770.     75395031.    12.1016565     0.0020497     -0.004048
3.9971934    -60.000000 CY
 0.0001744        12857.     73733239.    12.0507653     0.0021014     -0.004176
3.9999759    -60.000000 CY
 0.0001794        12935.     72110254.    11.9997482     0.0021525     -0.004305
3.9993305    -60.000000 CY
 0.0001844        13010.     70564434.    11.9533111     0.0022039     -0.004434
3.9974698    -60.000000 CY
 0.0001894        13084.     69088370.    11.9109039     0.0022556     -0.004562
3.9999647    -60.000000 CY
 0.0001944        13151.     67656574.    11.8706064     0.0023073     -0.004690
3.9987190    -60.000000 CY
 0.0001994        13208.     66248565.    11.8300168     0.0023586     -0.004819
3.9981811    -60.000000 CY
 0.0002044        13258.     64871728.    11.7895216     0.0024095     -0.004948
3.9990882    -60.000000 CY
 0.0002094        13305.     63543951.    11.7518580     0.0024605     -0.005077
3.9971633    -60.000000 CY
 0.0002144        13349.     62268712.    11.7160668     0.0025116     -0.005206
3.9989635    -60.000000 CY
 0.0002194        13392.     61045677.    11.6839215     0.0025632     -0.005334
3.9982370    -60.000000 CY
 0.0002244        13433.     59869896.    11.6517571     0.0026144     -0.005463
3.9982815    -60.000000 CY
 0.0002294        13473.     58738247.    11.6228828     0.0026660     -0.005592
3.9999748    -60.000000 CY
 0.0002344        13509.     57639208.    11.5941306     0.0027174     -0.005720
3.9966293    -60.000000 CY
 0.0002394        13541.     56567937.    11.5660687     0.0027686     -0.005849
3.9994318    -60.000000 CY
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    0.0002444        13570.     55528101.    11.5384863     0.0028197     -0.005978
   3.9969545    -60.000000 CY
    0.0002494        13593.     54509343.    11.5105909     0.0028705     -0.006107
   3.9973854    -60.000000 CY
    0.0002544        13616.     53526213.    11.4841088     0.0029213     -0.006236
   3.9996312    -60.000000 CY
    0.0002594        13637.     52575599.    11.4590085     0.0029722     -0.006365
   3.9962053    -60.000000 CY
    0.0002644        13657.     51658159.    11.4357371     0.0030233     -0.006494
   3.9968853    -60.000000 CY
    0.0002694        13677.     50773149.    11.4138646     0.0030746     -0.006623
   3.9993606    -60.000000 CY
    0.0002744        13696.     49918463.    11.3933252     0.0031260     -0.006751
   3.9983969    -60.000000 CY
    0.0003044        13794.     45319771.    11.2892410     0.0034362     -0.007521
   3.9982961    -60.000000 CYT
    0.0003344        13844.     41403801.    11.1937951     0.0037429     -0.008295
   3.9999066    -60.000000 CYT
    0.0003644        13844.     37994911.    11.2071195     0.0040836     -0.009034
   3.9896279    -60.000000 CYT


-------------------------------------------------------------------------------
   Summary of Results for Nominal Moment Capacity for Section 1
-------------------------------------------------------------------------------

Moment values interpolated at maximum compressive strain = 0.003
or maximum developed moment if pile fails at smaller strains.

 Load           Axial Thrust        Nominal Mom. Cap.      Max. Comp.      Max.
Tens.
  No.              kips                 in-kip               Strain
Strain
 ----         ----------------     ------------------     ------------
------------
   1               361.450             13647.855           0.00300000
-0.00643541

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
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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	361.450000	13648.	234.942500	8871.	103531723.
1	0.75	361.450000	13648.	271.087500	10236.	95611255.
1	0.90	361.450000	13648.	325.305000	12283.	82613578.

Pile Section No. 2:

Dimensions and Properties of Drilled Shaft (Bored Pile):

Length of Section	=	5.000000 ft
Shaft Diameter	=	30.000000 in
Concrete Cover Thickness (to edge of trans. reinf.)	=	3.000000 in
Number of Reinforcing Bars	=	15 bars
Yield Stress of Reinforcing Bars	=	60000. psi
Modulus of Elasticity of Reinforcing Bars	=	29000000. psi
Gross Area of Shaft	=	706.858347 sq. in.
Total Area of Reinforcing Steel	=	19.050000 sq. in.
Area Ratio of Steel Reinforcement	=	2.70 percent
Edge-to-Edge Bar Spacing	=	3.195943 in
Maximum Concrete Aggregate Size	=	0.375000 in
Ratio of Bar Spacing to Aggregate Size	=	8.52
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.	=	4.500000 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	=	3481.548 kips

Tensile Load for Cracking of Concrete = -349.802 kips
Nominal Axial Tensile Capacity = -1143.000 kips

Reinforcing Bar Dimensions and Positions Used in Computations:

Bar Number	Bar Diam. inches	Bar Area sq. in.	X inches	Y inches
1	1.270000	1.270000	10.740000	0.00000
2	1.270000	1.270000	9.811478	4.368352
3	1.270000	1.270000	7.186463	7.981375
4	1.270000	1.270000	3.318843	10.214347
5	1.270000	1.270000	-1.12264	10.681165
6	1.270000	1.270000	-5.37000	9.301113
7	1.270000	1.270000	-8.68884	6.312814
8	1.270000	1.270000	-10.50531	2.232972
9	1.270000	1.270000	-10.50531	-2.23297
10	1.270000	1.270000	-8.68884	-6.31281
11	1.270000	1.270000	-5.37000	-9.30111
12	1.270000	1.270000	-1.12264	-10.68117
13	1.270000	1.270000	3.318843	-10.21435
14	1.270000	1.270000	7.186463	-7.98138
15	1.270000	1.270000	9.811478	-4.36835

NOTE: The positions of the above rebars were computed by LPile

Minimum spacing between any two bars not equal to zero = 3.196 inches
between bars 9 and 10.

Ratio of bar spacing to maximum aggregate size = 8.52

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 = 0.375000 in

Number of Axial Thrust Force Values Determined from Pile-head Loadings = 1

Number	Axial Thrust Force kips

1 361.450

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 = 361.450 kips

Bending Max Conc Curvature Stress rad/in. ksi	Bending Max Steel Moment Stress in-kip ksi	Bending Stiffness kip-in2	Depth to N Axis in	Max Comp Strain in/in	Max Tens Strain in/in	Run Msg
0.00000125	233.2433595	186594688.	100.3888833	0.0001255	0.00008799	
0.5137630	3.5031595					
0.00000250	466.5148376	186605935.	57.7191652	0.0001443	0.00006930	
0.5871150	3.9127645					
0.00000375	699.7594541	186602521.	43.5068888	0.0001632	0.00005065	
0.6598464	4.3235617					
0.00000500	932.9638038	186592761.	36.4089740	0.0001820	0.00003204	
0.7319521	4.7355512					
0.00000625	1166.	186578316.	32.1568052	0.0002010	0.00001348	
0.8034269	5.1487335					
0.00000750	1399.	186559635.	29.3275086	0.0002200	-0.00000504	
0.8742656	5.5631081					
0.00000875	1632.	186522906.	27.3109757	0.0002390	-0.00002353	
0.9444530	5.9785975					
0.00001000	1864.	186436732.	25.7915497	0.0002579	-0.00004208	
1.0139526	6.3949506					
0.00001125	2096.	186291355.	24.6241696	0.0002770	-0.00006048	
1.0827331	6.8119480					
0.00001250	2326.	186090735.	23.6906677	0.0002961	-0.00007887	
1.1507738	7.2294440					

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0.00001375        2555.    185842061.    22.9271894     0.0003152   -0.00009725
1.2180600     7.6473368
0.00001500        2555.    170355222.    21.5991431     0.0003240     -0.000126
1.2481692     7.7643773 C
0.00001625        2555.    157250974.    20.9189712     0.0003399     -0.000148
1.3033251     8.0908777 C
0.00001750        2643.    151035696.    20.3203952     0.0003556     -0.000169
1.3569834     8.4094756 C
0.00001875        2755.    146942481.    19.7884803     0.0003710     -0.000191
1.4092610     8.7209237 C
0.00002000        2863.    143148711.    19.3130209     0.0003863     -0.000214
1.4603383     9.0265522 C
0.00002125        2967.    139620111.    18.8843564     0.0004013     -0.000236
1.5102570     9.3265471 C
0.00002250        3068.    136353433.    18.4964951     0.0004162     -0.000259
1.5591769     9.6221355 C
0.00002375        3166.    133315691.    18.1431655     0.0004309     -0.000282
1.6071210     9.9133875 C
0.00002500        3262.    130481243.    17.8195520     0.0004455     -0.000305
1.6541175    10.2004253 C
0.00002625        3356.    127842012.    17.5222663     0.0004600     -0.000328
1.7002792    10.4841378 C
0.00002750        3448.    125381907.    17.2483564     0.0004743     -0.000351
1.7456664    10.7649734 C
0.00002875        3538.    123076938.    16.9945663     0.0004886     -0.000374
1.7902619    11.0426874 C
0.00003000        3628.    120919577.    16.7591188     0.0005028     -0.000397
1.8341484    11.3179531 C
0.00003125        3716.    118898902.    16.5402617     0.0005169     -0.000421
1.8773783    11.5911871 C
0.00003250        3803.    117005297.    16.3365837     0.0005309     -0.000444
1.9200072    11.8628552 C
0.00003375        3888.    115212084.    16.1450184     0.0005449     -0.000468
1.9619016    12.1316286 C
0.00003500        3973.    113526437.    15.9659358     0.0005588     -0.000491
2.0032432    12.3991771 C
0.00003625        4058.    111935632.    15.7978581     0.0005727     -0.000515
2.0440166    12.6653120 C
0.00003750        4141.    110426736.    15.6391755     0.0005865     -0.000539
2.0841701    12.9294775 C
0.00003875        4224.    109002816.    15.4901957     0.0006002     -0.000562
2.1238473    13.1930448 C
0.00004000        4306.    107647158.    15.3488898     0.0006140     -0.000586
2.1629210    13.4547122 C
0.00004125        4387.    106363376.    15.2157323     0.0006276     -0.000610
2.2015347    13.7158823 C
0.00004250        4469.    105141978.    15.0895356     0.0006413     -0.000634
2.2396341    13.9759778 C
0.00004375        4549.    103976992.    14.9696074     0.0006549     -0.000658
2.2772113   -14.311993 C
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0.00004500        4629.    102873124.    14.8565629     0.0006685     -0.000681
2.3144218    -14.868305 C
0.00004625        4709.    101810710.    14.7480392     0.0006821     -0.000705
2.3510018    -15.427005 C
0.00004750        4788.    100799920.    14.6452946     0.0006957     -0.000729
2.3872013    -15.985482 C
0.00004875        4867.     99837410.    14.5480647     0.0007092     -0.000753
2.4230310    -16.543611 C
0.00005125        5023.     98019304.    14.3648357     0.0007362     -0.000801
2.4930828    -17.664327 C
0.00005375        5179.     96351809.    14.1985373     0.0007632     -0.000849
2.5615279    -18.785215 C
0.00005625        5333.     94807405.    14.0456280     0.0007901     -0.000897
2.6281877    -19.908377 C
0.00005875        5486.     93378370.    13.9056654     0.0008170     -0.000946
2.6932566    -21.031652 C
0.00006125        5638.     92044991.    13.7759842     0.0008438     -0.000994
2.7565791    -22.156957 C
0.00006375        5789.     90806362.    13.6573580     0.0008707     -0.001042
2.8184589    -23.280627 C
0.00006625        5939.     89640325.    13.5460769     0.0008974     -0.001090
2.8785206    -24.407382 C
0.00006875        6088.     88549259.    13.4435526     0.0009242     -0.001138
2.9371154    -25.532813 C
0.00007125        6236.     87525832.    13.3490190     0.0009511     -0.001186
2.9942571    -26.656622 C
0.00007375        6383.     86554665.    13.2595215     0.0009779     -0.001235
3.0496145    -27.783315 C
0.00007625        6530.     85638958.    13.1766705     0.0010047     -0.001283
3.1035225    -28.908311 C
0.00007875        6676.     84773351.    13.0998302     0.0010316     -0.001331
3.1559718    -30.031593 C
0.00008125        6821.     83951328.    13.0279719     0.0010585     -0.001379
3.2068709    -31.154404 C
0.00008375        6965.     83166840.    12.9598568     0.0010854     -0.001427
3.2561197    -32.278284 C
0.00008625        7109.     82420422.    12.8964489     0.0011123     -0.001475
3.3038980    -33.400394 C
0.00008875        7252.     81708783.    12.8373087     0.0011393     -0.001523
3.3501962    -34.520714 C
0.00009125        7394.     81028991.    12.7820931     0.0011664     -0.001571
3.3950041    -35.639226 C
0.00009375        7535.     80377064.    12.7300846     0.0011934     -0.001619
3.4382371    -36.757270 C
0.00009625        7676.     79750050.    12.6805817     0.0012205     -0.001667
3.4798505    -37.875639 C
0.00009875        7816.     79148096.    12.6341379     0.0012476     -0.001715
3.5199581    -38.992125 C
 0.0001013        7955.     78569274.    12.5907302     0.0012748     -0.001763
3.5585493    -40.106706 C
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 0.0001038        8094.     78011842.    12.5500558     0.0013021     -0.001810
3.5956132    -41.219360 C
 0.0001063        8232.     77474221.    12.5119293     0.0013294     -0.001858
3.6311389    -42.330064 C
 0.0001088        8369.     76954974.    12.4761827     0.0013568     -0.001906
3.6651151    -43.438793 C
 0.0001113        8505.     76452405.    12.4425646     0.0013842     -0.001953
3.6975048    -44.546159 C
 0.0001138        8641.     75964436.    12.4102933     0.0014117     -0.002001
3.7282397    -45.653732 C
 0.0001163        8776.     75491411.    12.3800023     0.0014392     -0.002048
3.7574031    -46.759230 C
 0.0001188        8910.     75032317.    12.3514695     0.0014667     -0.002096
3.7849830    -47.862625 C
 0.0001213        9044.     74586223.    12.3248422     0.0014944     -0.002143
3.8109669    -48.963890 C
 0.0001238        9176.     74152272.    12.2998934     0.0015221     -0.002190
3.8353421    -50.062996 C
 0.0001263        9308.     73729673.    12.2765315     0.0015499     -0.002238
3.8580958    -51.159913 C
 0.0001288        9440.     73317695.    12.2546736     0.0015778     -0.002285
3.8792146    -52.254612 C
 0.0001313        9570.     72915661.    12.2342411     0.0016057     -0.002332
3.8986853    -53.347062 C
 0.0001338        9700.     72522944.    12.2151615     0.0016338     -0.002379
3.9164939    -54.437230 C
 0.0001363        9829.     72138960.    12.1973684     0.0016619     -0.002426
3.9326265    -55.525085 C
 0.0001388        9957.     71763165.    12.1808003     0.0016901     -0.002472
3.9470687    -56.610592 C
 0.0001413       10085.     71395055.    12.1653941     0.0017184     -0.002519
3.9598058    -57.693717 C
 0.0001438       10211.     71034155.    12.1511091     0.0017467     -0.002566
3.9708228    -58.774425 C
 0.0001463       10337.     70679677.    12.1375922     0.0017751     -0.002612
3.9800881    -59.854249 C
 0.0001488       10460.     70318079.    12.1242515     0.0018035     -0.002659
3.9875816    -60.000000 CY
 0.0001588       10887.     68577734.    12.0592472     0.0019144     -0.002848
3.9986386    -60.000000 CY
 0.0001688       11206.     66406154.    11.9742573     0.0020207     -0.003042
3.9979463    -60.000000 CY
 0.0001788       11462.     64123297.    11.8852301     0.0021245     -0.003238
3.9999901    -60.000000 CY
 0.0001888       11677.     61866014.    11.7981588     0.0022269     -0.003436
3.9991541    -60.000000 CY
 0.0001988       11854.     59644835.    11.7100154     0.0023274     -0.003635
3.9999583    -60.000000 CY
 0.0002088       12017.     57566421.    11.6308349     0.0024279     -0.003835
3.9970659    -60.000000 CY
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    0.0002188        12153.     55557351.    11.5529680     0.0025272     -0.004035
   3.9973972    -60.000000 CY
    0.0002288        12267.     53624859.    11.4736211     0.0026246     -0.004238
   3.9970911    -60.000000 CY
    0.0002388        12374.     51830146.    11.4022330     0.0027223     -0.004440
   3.9961359    -60.000000 CY
    0.0002488        12477.     50158635.    11.3376563     0.0028202     -0.004642
   3.9996367    -60.000000 CY
    0.0002588        12565.     48558790.    11.2739028     0.0029171     -0.004845
   3.9996718    -60.000000 CY
    0.0002688        12638.     47026422.    11.2087109     0.0030123     -0.005050
   3.9979221    -60.000000 CY
    0.0002788        12704.     45575127.    11.1450304     0.0031067     -0.005256
   3.9975407    -60.000000 CY
    0.0002888        12766.     44212343.    11.0877190     0.0032016     -0.005461
   3.9991572    60.0000000 CY
    0.0002988        12826.     42933580.    11.0366068     0.0032972     -0.005665
   3.9948173    60.0000000 CY
    0.0003088        12882.     41723930.    10.9912178     0.0033935     -0.005869
   3.9995021    60.0000000 CY
    0.0003188        12930.     40565846.    10.9510173     0.0034906     -0.006072
   3.9946365    60.0000000 CY
    0.0003288        12971.     39454876.    10.9109083     0.0035870     -0.006276
   3.9992834    60.0000000 CY
    0.0003388        13001.     38380755.    10.8747557     0.0036838     -0.006479
   3.9940000    60.0000000 CYT
    0.0003488        13026.     37350652.    10.8397510     0.0037804     -0.006682
   3.9980666    60.0000000 CYT
    0.0003588        13026.     36309519.    10.8314308     0.0038858     -0.006877
   3.9973438    60.0000000 CYT


-------------------------------------------------------------------------------
   Summary of Results for Nominal Moment Capacity for Section 2
-------------------------------------------------------------------------------

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               361.450             12628.791           0.00300000
-0.00502362

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	361.450000	12629.	234.942500	8209.	77563581.
1	0.75	361.450000	12629.	271.087500	9472.	73219318.
1	0.90	361.450000	12629.	325.305000	11366.	64980505.

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	14.7500	0.00	N.A.	No	0.00	5873.
2	16.6000	24.8941	No	No	5873.	89095.
3	22.1000	11.9423	Yes	No	94968.	188706.
4	35.8000	21.0500	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 Displacement and Pile-head Rotation (Loading Type 5)
Displacement of pile head = 1.000000 inches
Rotation of pile head = 0.000E+00 radians
Axial load on pile head = 361450.0 lbs

Depth X	Deflect. y	Bending Moment	Shear Force	Slope S	Total Stress	Bending Stiffness	Soil Res. Spr. Es*H	Distrib. p Lat. Load
feet	inches	in-lbs	lbs	radians	psi*	lb-in^2	lb/inch	lb/inch
0.00	1.0000	-1.05E+07	81737.	0.00	0.00	9.45E+10	0.00	0.00
0.4080	0.9987	-1.01E+07	81733.	-5.32E-04	0.00	9.45E+10	0.00	0.00
0.8160	0.9948	-9660898.	81733.	-0.00103	0.00	9.86E+10	0.00	0.00
1.2240	0.9886	-9258480.	81733.	-0.00150	0.00	1.01E+11	0.00	0.00
1.6320	0.9801	-8855267.	81733.	-0.00193	0.00	1.04E+11	0.00	0.00
2.0400	0.9697	-8451314.	81733.	-0.00233	0.00	1.07E+11	0.00	0.00
2.4480	0.9573	-8046674.	81733.	-0.00271	0.00	1.10E+11	0.00	0.00
2.8560	0.9432	-7641398.	81733.	-0.00305	0.00	1.14E+11	0.00	0.00
3.2640	0.9274	-7235540.	81733.	-0.00337	0.00	1.18E+11	0.00	0.00
3.6720	0.9102	-6829149.	81733.	-0.00365	0.00	1.23E+11	0.00	0.00
4.0800	0.8916	-6422277.	81733.	-0.00391	0.00	1.29E+11	0.00	0.00
4.4880	0.8719	-6014973.	81733.	-0.00414	0.00	1.36E+11	0.00	0.00
4.8960	0.8511	-5607285.	81733.	-0.00434	0.00	1.45E+11	0.00	0.00
5.3040	0.8294	-5199261.	81733.	-0.00452	0.00	1.55E+11		

```
0.00       0.00       0.00
    5.7120     0.8068  -4790947.     81733.   -0.00467       0.00   1.69E+11
0.00       0.00       0.00
    6.1200     0.7836  -4382387.     81733.   -0.00480       0.00   1.86E+11
0.00       0.00       0.00
    6.5280     0.7598  -3973624.     81733.   -0.00490       0.00   2.08E+11
0.00       0.00       0.00
    6.9360     0.7356  -3564695.     81733.   -0.00498       0.00   3.55E+11
0.00       0.00       0.00
    7.3440     0.7111  -3155679.     81733.   -0.00502       0.00   3.56E+11
0.00       0.00       0.00
    7.7520     0.6864  -2746586.     81733.   -0.00506       0.00   3.56E+11
0.00       0.00       0.00
    8.1600     0.6615  -2337427.     81733.   -0.00510       0.00   3.57E+11
0.00       0.00       0.00
    8.5680     0.6365  -1928211.     81733.   -0.00513       0.00   3.57E+11
0.00       0.00       0.00
    8.9760     0.6113  -1518947.     81733.   -0.00515       0.00   3.57E+11
0.00       0.00       0.00
    9.3840     0.5860  -1109647.     81733.   -0.00517       0.00   3.57E+11
0.00       0.00       0.00
    9.7920     0.5607   -700320.     81733.   -0.00518       0.00   3.57E+11
0.00       0.00       0.00
   10.2000     0.5353   -290977.     81733.   -0.00519       0.00   3.57E+11
0.00       0.00       0.00
   10.6080     0.5099    118374.     81733.   -0.00519       0.00   3.57E+11
0.00       0.00       0.00
   11.0160     0.4845    527723.     81733.   -0.00518       0.00   3.57E+11
0.00       0.00       0.00
   11.4240     0.4591    937058.     81733.   -0.00517       0.00   3.57E+11
0.00       0.00       0.00
   11.8320     0.4338   1346370.     81733.   -0.00516       0.00   3.57E+11
0.00       0.00       0.00
   12.2400     0.4086   1755650.     81733.   -0.00514       0.00   3.57E+11
0.00       0.00       0.00
   12.6480     0.3835   2164888.     81733.   -0.00511       0.00   3.57E+11
0.00       0.00       0.00
   13.0560     0.3586   2574072.     81733.   -0.00508       0.00   3.56E+11
0.00       0.00       0.00
   13.4640     0.3338   2983194.     81733.   -0.00504       0.00   3.56E+11
0.00       0.00       0.00
   13.8720     0.3092   3392244.     81733.   -0.00500       0.00   3.55E+11
0.00       0.00       0.00
   14.2800     0.2849   3801211.     81733.   -0.00493       0.00   2.19E+11
0.00       0.00       0.00
   14.6880     0.2610   4210027.     81733.   -0.00483       0.00   1.95E+11
0.00       0.00       0.00
   15.0960     0.2376   4618657.     81672.   -0.00472       0.00   1.76E+11
-25.011   515.4759       0.00
   15.5040     0.2148   5026459.     81471.   -0.00458       0.00   1.61E+11
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```
-57.026      1300.       0.00
   15.9120     0.1927   5432623.     81111.   -0.00441       0.00   1.49E+11
-90.234      2292.       0.00
   16.3200     0.1716   5836308.     80588.   -0.00422       0.00   1.39E+11
-123.258     3517.       0.00
   16.7280     0.1514   6236676.     71488.   -0.00400       0.00   1.32E+11
-3594.    116211.       0.00
   17.1360     0.1324   6550475.     54123.   -0.00376       0.00   1.27E+11
-3499.    129384.       0.00
   17.5440     0.1146   6779952.     37405.   -0.00350       0.00   1.23E+11
-3330.    142246.       0.00
   17.9520    0.09816   6929122.     21557.   -0.00322       0.00   1.22E+11
-3144.    156795.       0.00
   18.3600    0.08306   7002444.      6703.   -0.00294       0.00   1.21E+11
-2924.    172350.       0.00
   18.7680    0.06936   7005173.     -6995.   -0.00266       0.00   1.21E+11
-2672.    188613.       0.00
   19.1760    0.05704   6943353.    -19467.   -0.00238       0.00   1.21E+11
-2423.    207977.       0.00
   19.5840    0.04610   6822954.    -30731.   -0.00210       0.00   1.23E+11
-2178.    231347.       0.00
   19.9920    0.03649   6649860.    -40808.   -0.00183       0.00   1.25E+11
-1938.    260038.       0.00
   20.4000    0.02815   6429852.    -49719.   -0.00158       0.00   1.29E+11
-1702.    296063.       0.00
   20.8080    0.02101   6168611.    -57485.   -0.00135       0.00   1.33E+11
-1470.    342713.       0.00
   21.2160    0.01498   5871721.    -63929.   -0.00113       0.00   1.39E+11
-1162.    379890.       0.00
   21.6240    0.00996   5546610.    -68785.  -9.31E-04       0.00   1.46E+11
-821.633    403861.       0.00
   22.0320    0.00586   5201475.    -72049.  -7.56E-04       0.00   1.55E+11
-511.688    427832.       0.00
   22.4400    0.00255   4843784.    -73878.  -6.03E-04       0.00   1.67E+11
-235.630    451803.       0.00
   22.8480  -5.36E-05   4480193.    -74442.  -4.72E-04       0.00   1.82E+11
5.2090    475774.       0.00
   23.2560   -0.00207   4116514.    -73913.  -3.61E-04       0.00   2.00E+11
211.2516    499745.       0.00
   23.6640   -0.00359   3757720.    -72455.  -2.70E-04       0.00   2.26E+11
384.2411    523715.       0.00
   24.0720   -0.00472   3407993.    -70223.  -2.06E-04       0.00   3.55E+11
527.5226    547686.       0.00
   24.4800   -0.00561   3070827.    -67404.  -1.61E-04       0.00   3.56E+11
624.0904    544721.       0.00
   24.8880   -0.00630   2748547.    -64257.  -1.21E-04       0.00   3.56E+11
661.2100    514172.       0.00
   25.2960   -0.00680   2442050.    -60957.  -8.57E-05       0.00   3.57E+11
687.0674    494843.       0.00
   25.7040   -0.00714   2151963.    -57552.  -5.42E-05       0.00   3.57E+11
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703.9329    483002.       0.00
   26.1120   -0.00733   1878697.    -54082.  -2.65E-05       0.00   3.57E+11
713.3995    476604.       0.00
   26.5200   -0.00740   1622487.    -50581.  -2.53E-06       0.00   3.57E+11
716.6530    474449.       0.00
   26.9280   -0.00735   1383416.    -47077.   1.81E-05       0.00   3.57E+11
714.6160    475809.       0.00
   27.3360   -0.00722   1161441.    -43595.   3.55E-05       0.00   3.57E+11
708.0309    480241.       0.00
   27.7440   -0.00701    956411.    -40154.   5.01E-05       0.00   3.57E+11
697.5114    487489.       0.00
   28.1520   -0.00673    768077.    -36773.   6.19E-05       0.00   3.57E+11
683.5756    497432.       0.00
   28.5600   -0.00640    596110.    -33468.   7.12E-05       0.00   3.57E+11
666.6683    510052.       0.00
   28.9680   -0.00603    440109.    -30251.   7.83E-05       0.00   3.57E+11
647.1763    525418.       0.00
   29.3760   -0.00563    299611.    -27136.   8.34E-05       0.00   3.57E+11
625.4398    543683.       0.00
   29.7840   -0.00521    174098.    -24132.   8.67E-05       0.00   3.57E+11
601.7598    565081.       0.00
   30.1920   -0.00478     63005.    -21248.   8.83E-05       0.00   3.57E+11
576.4048    589941.       0.00
   30.6000   -0.00435    -34272.    -18491.   8.85E-05       0.00   3.57E+11
549.6142    618701.       0.00
   31.0080   -0.00392   -118373.    -15869.   8.74E-05       0.00   3.57E+11
521.6019    651932.       0.00
   31.4160   -0.00349   -189969.    -13386.   8.53E-05       0.00   3.57E+11
492.5575    690378.       0.00
   31.8240   -0.00308   -249753.    -11048.   8.23E-05       0.00   3.57E+11
462.6475    735015.       0.00
   32.2320   -0.00269   -298441.     -8858.   7.85E-05       0.00   3.57E+11
432.0148    787136.       0.00
   32.6400   -0.00231   -336766.     -6819.   7.42E-05       0.00   3.57E+11
400.7772    848492.       0.00
   33.0480   -0.00196   -365475.     -4935.   6.94E-05       0.00   3.57E+11
369.0231    921508.       0.00
   33.4560   -0.00163   -385330.     -3207.   6.42E-05       0.00   3.57E+11
336.8053   1009662.       0.00
   33.8640   -0.00133   -397103.     -1638.   5.89E-05       0.00   3.57E+11
304.1287   1118150.       0.00
   34.2720   -0.00106   -401575.   -287.130   5.34E-05       0.00   3.57E+11
247.5695   1146957.       0.00
   34.6800  -8.09E-04   -400103.   792.4894   4.79E-05       0.00   3.57E+11
193.4514   1170927.       0.00
   35.0880  -5.88E-04   -393984.      1617.   4.24E-05       0.00   3.57E+11
143.4616   1194898.       0.00
   35.4960  -3.93E-04   -384417.      2208.   3.71E-05       0.00   3.57E+11
97.8925   1218869.       0.00
   35.9040  -2.24E-04   -372494.      5927.   2.96E-05       0.00   1.87E+11
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1421.   3.10E+07       0.00
   36.3120  -1.03E-04   -326486.     11341.   2.04E-05       0.00   1.87E+11
790.4191   3.74E+07       0.00
   36.7200  -2.45E-05   -261515.     13812.   1.27E-05       0.00   1.87E+11
218.9109   4.38E+07       0.00
   37.1280   2.09E-05   -191285.     13823.   6.77E-06       0.00   1.87E+11
-214.557   5.02E+07       0.00
   37.5360   4.18E-05   -126189.     12116.   2.60E-06       0.00   1.87E+11
-482.647   5.66E+07       0.00
   37.9440   4.64E-05    -72656.      9474.  -8.59E-09       0.00   1.87E+11
-596.660   6.30E+07       0.00
   38.3520   4.17E-05    -33423.      6567.  -1.40E-06       0.00   1.87E+11
-590.523   6.94E+07       0.00
   38.7600   3.27E-05     -8343.      3884.  -1.95E-06       0.00   1.87E+11
-505.658   7.58E+07       0.00
   39.1680   2.26E-05      4616.      1718.  -2.00E-06       0.00   1.87E+11
-379.302   8.21E+07       0.00
   39.5760   1.31E-05      8482.   207.9762  -1.83E-06       0.00   1.87E+11
-237.362   8.85E+07       0.00
   39.9840   4.73E-06      6659.   -597.793  -1.63E-06       0.00   1.87E+11
-91.792   9.49E+07       0.00
   40.3920  -2.80E-06      2634.   -680.538  -1.50E-06       0.00   1.87E+11
57.9906   1.01E+08       0.00
   40.8000  -1.00E-05       0.00       0.00  -1.47E-06       0.00   1.87E+11
220.0069   5.39E+07       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             =     1.00000000 inches
Computed slope at pile head      =       0.000000 radians
Maximum bending moment           =     -10463114. inch-lbs
Maximum shear force              =         81737. lbs
Depth of maximum bending moment  =       0.000000 feet below pile head
Depth of maximum shear force     =       0.000000 feet below pile head
Number of iterations             =             14
Number of zero deflection points =              3
Pile deflection at ground        =     0.25740720 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	Load 1	Load 2	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	y, in	1.0000	S, rad	0.00	361450.	1.0000	0.00	81737.	-1.05E+07

Maximum pile-head deflection = 1.0000000000 inches
Maximum pile-head rotation = 0.0000000000 radians = 0.000000 deg.

Summary of Warning Messages

The following warning was reported 195 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.

==========

LPile for Windows, Version 2022-12.011

Analysis of Individual Piles and Drilled Shafts
Subjected to Lateral Loading Using the p-y Method
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Files Used for Analysis

Path to file locations:
\20240280\ODOT\109971\400-Engineering\Structures\SFN_0800512\Engdata\04_Abutment Design\Stage 2\Drilled Shaft\Lpile\Abutment\Forward Abutment\

Name of input data file:
FA_Scour Strength 1 - Front DS.lp12d

Name of output report file:
FA_Scour Strength 1 - Front DS.lp12o

Name of plot output file:
FA_Scour Strength 1 - Front DS.lp12p

Name of runtime message file:
FA_Scour Strength 1 - Front DS.lp12r

Date and Time of Analysis

Date: February 12, 2026 Time: 14:22:01

Problem Title

Project Name:

Job Number:

Client:

Engineer:

Description:

Program Options and Settings

Computational Options:
- Conventional Analysis

Engineering Units Used for Data Input and Computations:
- US Customary System Units (pounds, feet, inches)

Analysis Control Options:

- Maximum number of iterations allowed	=	500
- Deflection tolerance for convergence	=	1.0000E-05 in
- Maximum allowable deflection	=	100.0000 in
- Number of pile increments	=	100

Loading Type and Number of Cycles of Loading:

- Static loading specified

- Analysis uses p-y modification factors for p-y curves
- Analysis uses layering correction (Method of Georgiadis)
- No distributed lateral loads are entered
- Loading by lateral soil movements acting on pile not selected
- Input of shear resistance at the pile tip not selected
- Input of moment resistance at the pile tip not selected
- Computation of pile-head foundation stiffness matrix not selected
- Push-over analysis of pile not selected
- Buckling analysis of pile not selected

Output Options:
- Output files use decimal points to denote decimal symbols.
- Values of pile-head deflection, bending moment, shear force, and soil reaction are printed for full length of pile.
- Printing Increment (nodal spacing of output points) = 1
- No p-y curves to be computed and reported for user-specified depths
- Print using wide report formats

Pile Structural Properties and Geometry

Number of pile sections defined = 2
Total length of pile = 40.800 ft
Depth of ground surface below top of pile = 14.7500 ft

Pile diameters used for p-y curve computations are defined using 4 points.

p-y curves are computed using pile diameter values interpolated with depth over the length of the pile. A summary of values of pile diameter vs. depth follows.

Point No.	Depth Below Pile Head feet	Pile Diameter inches
1	0.000	36.0000
2	35.800	36.0000
3	35.800	30.0000
4	40.800	30.0000

Input Structural Properties for Pile Sections:

Pile Section No. 1:

Section 1 is a round drilled shaft, bored pile, or CIDH pile
Length of section = 35.800000 ft
Shaft Diameter = 36.000000 in

Pile Section No. 2:

Section 2 is a round drilled shaft, bored pile, or CIDH pile
Length of section = 5.000000 ft
Shaft Diameter = 30.000000 in

Soil and Rock Layering Information

The soil profile is modelled using 4 layers

Layer 1 is sand, p-y criteria by Reese et al., 1974

Distance from top of pile to top of layer = 14.750000 ft
Distance from top of pile to bottom of layer = 16.600000 ft
Effective unit weight at top of layer = 72.600000 pcf
Effective unit weight at bottom of layer = 72.600000 pcf
Friction angle at top of layer = 40.000000 deg.
Friction angle at bottom of layer = 40.000000 deg.
Subgrade k at top of layer = 125.000000 pci
Subgrade k at bottom of layer = 125.000000 pci

Layer 2 is stiff clay with water-induced erosion

Distance from top of pile to top of layer = 16.600000 ft
Distance from top of pile to bottom of layer = 22.100000 ft
Effective unit weight at top of layer = 72.600000 pcf
Effective unit weight at bottom of layer = 72.600000 pcf
Undrained cohesion at top of layer = 5600. psf
Undrained cohesion at bottom of layer = 5600. psf
Epsilon-50 at top of layer = 0.004000
Epsilon-50 at bottom of layer = 0.004000
Subgrade k at top of layer = 2000. pci
Subgrade k at bottom of layer = 2000. pci

Layer 3 is stiff clay with water-induced erosion

Distance from top of pile to top of layer = 22.100000 ft
Distance from top of pile to bottom of layer = 35.800000 ft
Effective unit weight at top of layer = 67.600000 pcf

```
   Effective unit weight at bottom of layer            =    67.600000 pcf
   Undrained cohesion at top of layer                  =        4600. psf
   Undrained cohesion at bottom of layer               =        4600. psf
   Epsilon-50 at top of layer                          =     0.004000
   Epsilon-50 at bottom of layer                       =     0.004000
   Subgrade k at top of layer                          =        2000. pci
   Subgrade k at bottom of layer                       =        2000. pci


Layer 4 is weak rock, p-y criteria by Reese, 1997

   Distance from top of pile to top of layer           =    35.800000 ft
   Distance from top of pile to bottom of layer        =   100.000000 ft
   Effective unit weight at top of layer               =    97.500000 pcf
   Effective unit weight at bottom of layer            =    97.500000 pcf
   Uniaxial compressive strength at top of layer       =   661.000000 psi
   Uniaxial compressive strength at bottom of layer    =   661.000000 psi
   Initial modulus of rock at top of layer             =       60000. psi
   Initial modulus of rock at bottom of layer          =       60000. 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                        =    0.0005000
   k rm of rock at bottom of layer                     =    0.0005000


 (Depth of the lowest soil layer extends 59.200 ft below the pile tip)



--------------------------------------------------------------------------------
                        Summary of Input Soil Properties
--------------------------------------------------------------------------------

Layer         Soil Type          Layer      Effective    Cohesion     Angle of
Uniaxial                      E50                      Rock Mass
 Num.           Name            Depth       Unit Wt.                  Friction
 qu          RQD %         or           kpy        Modulus
          (p-y Curve Type)        ft           pcf          psf          deg.
 psi                        krm          pci          psi
-----   ------------------   ----------   ----------   ----------   ----------
----------   ----------   ----------   ----------   ----------
  1            Sand              14.7500      72.6000       --          40.0000
 --            --            --          125.0000       --
          (Reese, et al.)        16.6000      72.6000       --          40.0000
 --            --            --          125.0000       --
  2         Stiff Clay           16.6000      72.6000        5600.       --
 --            --           0.00400        2000.       --
          with Free Water        22.1000      72.6000        5600.       --
 --            --           0.00400        2000.       --
  3         Stiff Clay           22.1000      67.6000        4600.       --
```

```
 --           --          0.00400        2000.       --
          with Free Water        35.8000      67.6000        4600.       --
 --           --          0.00400        2000.       --
  4            Weak              35.8000      97.5000       --           --
661.0000       9.0000     5.00E-04       --           60000.
               Rock             100.0000      97.5000       --           --
661.0000       9.0000     5.00E-04       --           60000.
```

Modification Factors for p-y Curves

Distribution of p-y modifiers with depth defined using 2 points

Point No.	Depth X ft	p-mult	y-mult
1	14.750	0.7000	1.0000
2	35.800	0.7000	1.0000

Static Loading Type

Static loading criteria were used when computing p-y curves for all analyses.

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 1

Load No.	Load Type	Condition 1	Condition 2	Axial Thrust Force, lbs	Compute Top y vs. Pile Length	Run Analysis
1	5	y = 1.250000 in	S = 0.0000 in/in	355320.	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 = 2

Pile Section No. 1:

Dimensions and Properties of Drilled Shaft (Bored Pile):

Length of Section	=	35.800000 ft
Shaft Diameter	=	36.000000 in
Concrete Cover Thickness (to edge of trans. reinf.)	=	6.000000 in
Number of Reinforcing Bars	=	15 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	=	15.000000 sq. in.
Area Ratio of Steel Reinforcement	=	1.47 percent
Edge-to-Edge Bar Spacing	=	3.367467 in
Maximum Concrete Aggregate Size	=	0.375000 in
Ratio of Bar Spacing to Aggregate Size	=	8.98
Offset of Center of Rebar Cage from Center of Pile	=	0.0000 in

Transverse Reinforcement
Type: Hoop

Number of Transverse Reinf. (per spacing)	=	1
Spacing of Transverse Reinf.	=	4.500000 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	=	4309.778 kips
Tensile Load for Cracking of Concrete	=	-467.292 kips
Nominal Axial Tensile Capacity	=	-900.000 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	10.811000	0.00000
2	1.128000	1.000000	9.876340	4.397230
3	1.128000	1.000000	7.233971	8.034139
4	1.128000	1.000000	3.340783	10.281872
5	1.128000	1.000000	-1.13006	10.751776
6	1.128000	1.000000	-5.40550	9.362601
7	1.128000	1.000000	-8.74628	6.354546
8	1.128000	1.000000	-10.57475	2.247733
9	1.128000	1.000000	-10.57475	-2.24773
10	1.128000	1.000000	-8.74628	-6.35455
11	1.128000	1.000000	-5.40550	-9.36260
12	1.128000	1.000000	-1.13006	-10.75178
13	1.128000	1.000000	3.340783	-10.28187
14	1.128000	1.000000	7.233971	-8.03414
15	1.128000	1.000000	9.876340	-4.39723

NOTE: The positions of the above rebars were computed by LPile

Minimum spacing between any two bars not equal to zero = 3.367 inches
between bars 7 and 8.

Ratio of bar spacing to maximum aggregate size = 8.98

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	=	0.375000 in

Number of Axial Thrust Force Values Determined from Pile-head Loadings = 1

Number	Axial Thrust Force kips
1	355.320

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 = 355.320 kips

Bending Max Conc Stress	Bending Max Steel Stress	Bending Stiffness	Depth to N Axis	Max Comp Strain	Max Tens Strain	Run Msg
rad/in.	in-kip	kip-in2	in	in/in	in/in	
ksi	ksi					
6.25000E-07	223.3000941	357280151.	141.5671924	0.00008848	0.00006598	
0.3660009	2.4451929					
0.00000125	446.6001881	357280150.	79.8026510	0.00009975	0.00005475	
0.4109803	2.6514211					
0.00000188	669.8893601	357274325.	59.2229362	0.0001110	0.00004354	
0.4557430	2.8581097					
0.00000250	893.1621505	357264860.	48.9394284	0.0001223	0.00003235	
0.5002878	3.0652586					
0.00000313	1116.	357252192.	42.7744038	0.0001337	0.00002117	
0.5446134	3.2728679					
0.00000375	1340.	357236465.	38.6686213	0.0001450	0.00001001	
0.5887187	3.4809376					
0.00000438	1563.	357217741.	35.7395491	0.0001564	-0.00000114	
0.6326025	3.6894678					
0.00000500	1786.	357188016.	33.5458163	0.0001677	-0.00001227	
0.6762616	3.8984434					
0.00000563	2009.	357116784.	31.8418518	0.0001791	-0.00002339	
0.7196849	4.1077896					
0.00000625	2231.	356986142.	30.4802730	0.0001905	-0.00003450	
0.7628607	4.3174245					
0.00000688	2453.	356793357.	29.3611914	0.0002019	-0.00004564	
0.8057800	4.5272853					
0.00000750	2674.	356542473.	28.4374277	0.0002133	-0.00005672	
0.8484362	4.7373262					

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0.00000813        2894.    356240001.    27.6557555     0.0002247   -0.00006780
0.8908247     4.9475145
0.00000875        3114.    355892686.    26.9857480     0.0002361   -0.00007887
0.9329420     5.1578263
0.00000938        3333.    355506639.    26.4050979     0.0002475   -0.00008995
0.9747855     5.3682436
0.00001000        3551.    355087176.    25.8970722     0.0002590    -0.000101
1.0163531     5.5787519
0.00001063        3768.    354638892.    25.4489350     0.0002704    -0.000112
1.0576432     5.7893406
0.00001125        3768.    334936731.    23.5715638     0.0002652    -0.000140
1.0382331     5.5173977 C
0.00001188        3768.    317308482.    23.0680288     0.0002739    -0.000154
1.0696816     5.6505150 C
0.00001250        3768.    301443058.    22.6058766     0.0002826    -0.000167
1.1005574     5.7803803 C
0.00001313        3768.    287088627.    22.1796196     0.0002911    -0.000181
1.1308912     5.9071905 C
0.00001375        3768.    274039144.    21.7849644     0.0002995    -0.000195
1.1607089     6.0311057 C
0.00001438        3768.    262124398.    21.4177695     0.0003079    -0.000210
1.1900263     6.1522104 C
0.00001500        3768.    251202548.    21.0753239     0.0003161    -0.000224
1.2188748     6.2707179 C
0.00001563        3768.    241154447.    20.7548936     0.0003243    -0.000238
1.2472784     6.3867849 C
0.00001625        3768.    231879276.    20.4545151     0.0003324    -0.000253
1.2752753     6.5006899 C
0.00001688        3768.    223291154.    20.1725194     0.0003404    -0.000267
1.3029022     6.6127055 C
0.00001750        3783.    216149378.    19.9074894     0.0003484    -0.000282
1.3301950     6.7231035 C
0.00001813        3845.    212156139.    19.6574076     0.0003563    -0.000296
1.3571431     6.8317686 C
0.00001875        3907.    208349461.    19.4201748     0.0003641    -0.000311
1.3837078     6.9383486 C
0.00001938        3967.    204747720.    19.1964362     0.0003719    -0.000326
1.4100187     7.0439120 C
0.00002000        4026.    201311030.    18.9836895     0.0003797    -0.000340
1.4359936     7.1477409 C
0.00002063        4085.    198036989.    18.7815132     0.0003874    -0.000355
1.4616757     7.2501805 C
0.00002125        4142.    194923642.    18.5897199     0.0003950    -0.000370
1.4871207     7.3516897 C
0.00002188        4199.    191939464.    18.4061665     0.0004026    -0.000385
1.5122386     7.4514744 C
0.00002250        4255.    189101787.    18.2319717     0.0004102    -0.000400
1.5371675     7.5507116 C
0.00002313        4310.    186377575.    18.0648579     0.0004177    -0.000415
1.5617921     7.6483829 C
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0.00002375        4365.    183777846.    17.9056029     0.0004253     -0.000430
1.5862216     -7.875424 C
0.00002438        4419.    181288174.    17.7532488     0.0004327     -0.000445
1.6104231     -8.190385 C
0.00002563        4526.    176615681.    17.4676621     0.0004476     -0.000475
1.6582001     -8.822631 C
0.00002688        4630.    172291055.    17.2032483     0.0004623     -0.000505
1.7050292     -9.459080 C
0.00002813        4733.    168299127.    16.9593680     0.0004770     -0.000536
1.7511198    -10.097951 C
0.00002938        4835.    164609157.    16.7343424     0.0004916     -0.000566
1.7965666    -10.738445 C
0.00003063        4935.    161155603.    16.5230671     0.0005060     -0.000596
1.8411101    -11.383029 C
0.00003188        5035.    157952003.    16.3275827     0.0005204     -0.000627
1.8851200    -12.028353 C
0.00003313        5133.    154947890.    16.1438502     0.0005348     -0.000658
1.9283773    -12.676523 C
0.00003438        5230.    152144358.    15.9728173     0.0005491     -0.000688
1.9711128    -13.325410 C
0.00003563        5326.    149502887.    15.8111316     0.0005633     -0.000719
2.0131296    -13.976950 C
0.00003688        5422.    147034578.    15.6608985     0.0005775     -0.000750
2.0547563    -14.628004 C
0.00003813        5516.    144690196.    15.5172891     0.0005916     -0.000781
2.0955712    -15.282735 C
0.00003938        5611.    142489042.    15.3829860     0.0006057     -0.000812
2.1359984    -15.937015 C
0.00004063        5704.    140408762.    15.2564126     0.0006198     -0.000843
2.1759000    -16.592226 C
0.00004188        5797.    138430527.    15.1354596     0.0006338     -0.000874
2.2151548    -17.249639 C
0.00004313        5889.    136562127.    15.0216656     0.0006478     -0.000905
2.2540286    -17.906576 C
0.00004438        5981.    134789104.    14.9143694     0.0006618     -0.000936
2.2924294    -18.563983 C
0.00004563        6072.    133092738.    14.8108042     0.0006757     -0.000967
2.3301621    -19.223942 C
0.00004688        6163.    131482467.    14.7131110     0.0006897     -0.000998
2.3675175    -19.883428 C
0.00004813        6254.    129951568.    14.6204248     0.0007036     -0.001029
2.4044944    -20.542436 C
0.00004938        6344.    128485190.    14.5321427     0.0007175     -0.001060
2.4409056    -21.203001 C
0.00005063        6433.    127079886.    14.4469704     0.0007314     -0.001091
2.4767824    -21.864829 C
0.00005188        6523.    125738403.    14.3662195     0.0007452     -0.001122
2.5122842    -22.526181 C
0.00005313        6612.    124456215.    14.2895794     0.0007591     -0.001153
2.5474095    -23.187055 C
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0.00005438        6701.    123228675.    14.2160384     0.0007730     -0.001185
2.5821432    -23.847606 C
0.00005563        6789.    122041355.    14.1452438     0.0007868     -0.001216
2.6162086    -24.511041 C
0.00005688        6876.    120902708.    14.0772525     0.0008006     -0.001247
2.6499007    -25.173994 C
0.00005813        6964.    119809572.    14.0124729     0.0008145     -0.001278
2.6832182    -25.836463 C
0.00005938        7051.    118759055.    13.9507035     0.0008283     -0.001309
2.7161598    -26.498446 C
0.00006063        7139.    117748514.    13.8917592     0.0008422     -0.001340
2.7487242    -27.159937 C
0.00006188        7225.    116771870.    13.8340391     0.0008560     -0.001372
2.7807966    -27.822342 C
0.00006313        7312.    115826232.    13.7791776     0.0008698     -0.001403
2.8123503    -28.486030 C
0.00006438        7398.    114914204.    13.7260872     0.0008836     -0.001434
2.8435293    -29.149223 C
0.00006563        7483.    114033848.    13.6752810     0.0008974     -0.001465
2.8743322    -29.811918 C
0.00006688        7569.    113183370.    13.6266325     0.0009113     -0.001496
2.9047576    -30.474113 C
0.00006813        7655.    112361109.    13.5800243     0.0009251     -0.001527
2.9348042    -31.135803 C
0.00006938        7740.    111565522.    13.5353475     0.0009390     -0.001558
2.9644706    -31.796987 C
0.00007063        7825.    110794242.    13.4922528     0.0009529     -0.001590
2.9937184    -32.458167 C
0.00007188        7909.    110042631.    13.4497760     0.0009667     -0.001621
3.0224144    -33.121183 C
0.00007313        7994.    109313945.    13.4089074     0.0009805     -0.001652
3.0507321    -33.783682 C
0.00007438        8078.    108607013.    13.3698294     0.0009944     -0.001683
3.0786701    -34.445662 C
0.00007938        8412.    105975954.    13.2277794     0.0010500     -0.001808
3.1865963    -37.088319 C
0.00008438        8742.    103613375.    13.1048664     0.0011057     -0.001932
3.2881492    -39.725339 C
0.00008938        9069.    101469249.    12.9964018     0.0011616     -0.002056
3.3830363    -42.360563 C
0.00009438        9392.     99515890.    12.9027628     0.0012177     -0.002180
3.4716241    -44.986665 C
0.00009938        9711.     97723622.    12.8218011     0.0012742     -0.002303
3.5538081    -47.603382 C
 0.0001044       10027.     96066255.    12.7492229     0.0013307     -0.002427
3.6293322    -50.213746 C
 0.0001094       10339.     94524127.    12.6877256     0.0013877     -0.002550
3.6980813    -52.818569 C
 0.0001144       10646.     93084100.    12.6336313     0.0014450     -0.002673
3.7601592    -55.412937 C
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 0.0001194        10951.     91732440.    12.5870828     0.0015026     -0.002795
3.8154398    -57.996507 C
 0.0001244        11250.     90450794.    12.5470775     0.0015605     -0.002917
3.8637619    -60.000000 CY
 0.0001294        11525.     89081359.    12.5060655     0.0016180     -0.003040
3.9044313    -60.000000 CY
 0.0001344        11750.     87445518.    12.4544318     0.0016736     -0.003164
3.9369871    -60.000000 CY
 0.0001394        11941.     85676161.    12.3979625     0.0017280     -0.003290
3.9622534    -60.000000 CY
 0.0001444        12106.     83853511.    12.3393494     0.0017815     -0.003416
3.9807764    -60.000000 CY
 0.0001494        12259.     82066567.    12.2821388     0.0018346     -0.003543
3.9930698    -60.000000 CY
 0.0001544        12390.     80256141.    12.2236576     0.0018870     -0.003670
3.9991785    -60.000000 CY
 0.0001594        12508.     78478664.    12.1671240     0.0019391     -0.003798
3.9987610    -60.000000 CY
 0.0001644        12622.     76784814.    12.1157457     0.0019915     -0.003926
3.9979519    -60.000000 CY
 0.0001694        12723.     75119317.    12.0657482     0.0020436     -0.004054
3.9984549    -60.000000 CY
 0.0001744        12809.     73458048.    12.0131541     0.0020948     -0.004183
3.9998593    -60.000000 CY
 0.0001794        12887.     71845217.    11.9627615     0.0021458     -0.004312
3.9989170    -60.000000 CY
 0.0001844        12963.     70309034.    11.9168974     0.0021972     -0.004440
3.9967030    -60.000000 CY
 0.0001894        13036.     68838989.    11.8748854     0.0022488     -0.004569
3.9998264    -60.000000 CY
 0.0001944        13103.     67412942.    11.8348373     0.0023004     -0.004697
3.9981366    -60.000000 CY
 0.0001994        13161.     66011062.    11.7945350     0.0023515     -0.004826
3.9999982    -60.000000 CY
 0.0002044        13210.     64637289.    11.7547739     0.0024024     -0.004955
3.9985671    -60.000000 CY
 0.0002094        13257.     63316313.    11.7168719     0.0024532     -0.005084
3.9994586    -60.000000 CY
 0.0002144        13301.     62046319.    11.6812463     0.0025042     -0.005213
3.9983782    -60.000000 CY
 0.0002194        13344.     60828750.    11.6478095     0.0025552     -0.005342
3.9999939    -60.000000 CY
 0.0002244        13386.     59659112.    11.6167813     0.0026065     -0.005471
3.9975041    -60.000000 CY
 0.0002294        13426.     58530998.    11.5873228     0.0026578     -0.005600
3.9998132    -60.000000 CY
 0.0002344        13462.     57437970.    11.5592526     0.0027092     -0.005728
3.9955367    -60.000000 CY
 0.0002394        13493.     56367846.    11.5291727     0.0027598     -0.005858
3.9989244    -60.000000 CY
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    0.0002444        13522.     55332585.    11.5033743     0.0028111     -0.005986
   3.9996461    -60.000000 CY
    0.0002494        13545.     54316122.    11.4755462     0.0028617     -0.006116
   3.9963523    -60.000000 CY
    0.0002544        13568.     53337066.    11.4494192     0.0029124     -0.006245
   3.9991843    -60.000000 CY
    0.0002594        13589.     52391399.    11.4245858     0.0029633     -0.006374
   3.9990031    -60.000000 CY
    0.0002644        13610.     51478135.    11.4017373     0.0030143     -0.006503
   3.9957309    -60.000000 CY
    0.0002694        13630.     50597147.    11.3788220     0.0030652     -0.006632
   3.9987830    -60.000000 CY
    0.0002744        13649.     49746649.    11.3599404     0.0031169     -0.006761
   3.9999818    -60.000000 CY
    0.0003044        13747.     45163334.    11.2542055     0.0034255     -0.007532
   3.9972366    -60.000000 CYT
    0.0003344        13797.     41260700.    11.1597127     0.0037315     -0.008306
   3.9995260    -60.000000 CYT
    0.0003644        13797.     37863593.    11.1736295     0.0040714     -0.009046
   3.9934511    -60.000000 CYT


-------------------------------------------------------------------------------
   Summary of Results for Nominal Moment Capacity for Section 1
-------------------------------------------------------------------------------

Moment values interpolated at maximum compressive strain = 0.003
or maximum developed moment if pile fails at smaller strains.

 Load           Axial Thrust        Nominal Mom. Cap.      Max. Comp.      Max.
Tens.
  No.              kips                 in-kip               Strain
Strain
 ----         ----------------     ------------------     ------------
------------
   1               355.320             13603.776           0.00300000
-0.00646699

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	355.320000	13604.	230.958000	8842.	102956047.
1	0.75	355.320000	13604.	266.490000	10203.	95195804.
1	0.90	355.320000	13604.	319.788000	12243.	82245977.

Pile Section No. 2:

Dimensions and Properties of Drilled Shaft (Bored Pile):

Length of Section	=	5.000000 ft
Shaft Diameter	=	30.000000 in
Concrete Cover Thickness (to edge of trans. reinf.)	=	3.000000 in
Number of Reinforcing Bars	=	15 bars
Yield Stress of Reinforcing Bars	=	60000. psi
Modulus of Elasticity of Reinforcing Bars	=	29000000. psi
Gross Area of Shaft	=	706.858347 sq. in.
Total Area of Reinforcing Steel	=	15.000000 sq. in.
Area Ratio of Steel Reinforcement	=	2.12 percent
Edge-to-Edge Bar Spacing	=	3.367467 in
Maximum Concrete Aggregate Size	=	0.375000 in
Ratio of Bar Spacing to Aggregate Size	=	8.98
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.	=	4.500000 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	=	3252.318 kips

Tensile Load for Cracking of Concrete = -337.937 kips
Nominal Axial Tensile Capacity = -900.000 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	10.811000	0.00000
2	1.128000	1.000000	9.876340	4.397230
3	1.128000	1.000000	7.233971	8.034139
4	1.128000	1.000000	3.340783	10.281872
5	1.128000	1.000000	-1.13006	10.751776
6	1.128000	1.000000	-5.40550	9.362601
7	1.128000	1.000000	-8.74628	6.354546
8	1.128000	1.000000	-10.57475	2.247733
9	1.128000	1.000000	-10.57475	-2.24773
10	1.128000	1.000000	-8.74628	-6.35455
11	1.128000	1.000000	-5.40550	-9.36260
12	1.128000	1.000000	-1.13006	-10.75178
13	1.128000	1.000000	3.340783	-10.28187
14	1.128000	1.000000	7.233971	-8.03414
15	1.128000	1.000000	9.876340	-4.39723

NOTE: The positions of the above rebars were computed by LPile

Minimum spacing between any two bars not equal to zero = 3.367 inches
between bars 7 and 8.

Ratio of bar spacing to maximum aggregate size = 8.98

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 = 0.375000 in

Number of Axial Thrust Force Values Determined from Pile-head Loadings = 1

Number	Axial Thrust Force kips

1 355.320

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 = 355.320 kips

Bending Max Conc Curvature Stress rad/in. ksi	Bending Max Steel Moment Stress in-kip ksi	Bending Stiffness kip-in2	Depth to N Axis in	Max Comp Strain in/in	Max Tens Strain in/in	Run Msg
0.00000125	226.1517166	180921373.	101.5442749	0.0001269	0.00008943	
0.5194790	3.5450425					
0.00000250	452.2971617	180918865.	58.2977573	0.0001457	0.00007074	
0.5927793	3.9547124					
0.00000375	678.4146052	180910561.	43.8936342	0.0001646	0.00005210	
0.6654648	4.3656202					
0.00000500	904.4900481	180898010.	36.7001110	0.0001835	0.00003350	
0.7375301	4.7777661					
0.00000625	1131.	180881518.	32.3908294	0.0002024	0.00001494	
0.8089700	5.1911503					
0.00000750	1356.	180861157.	29.5236694	0.0002214	-0.00000357	
0.8797789	5.6057731					
0.00000875	1582.	180825566.	27.4803243	0.0002405	-0.00002205	
0.9499433	6.0215696					
0.00001000	1807.	180743461.	25.9510073	0.0002595	-0.00004049	
1.0194267	6.4382920					
0.00001125	2032.	180603137.	24.7566586	0.0002785	-0.00005899	
1.0881960	6.8557079					
0.00001250	2255.	180407466.	23.8117598	0.0002976	-0.00007735	
1.1562289	7.2736611					

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0.00001375        2477.    180163212.    23.0388731     0.0003168   -0.00009572
1.2235098     7.6920419
0.00001500        2698.    179877635.    22.3949719     0.0003359     -0.000114
1.2900273     8.1107729
0.00001625        2698.    166040894.    21.0029445     0.0003413     -0.000146
1.3080749     8.1304501 C
0.00001750        2698.    154180830.    20.3915494     0.0003569     -0.000168
1.3612745     8.4455863 C
0.00001875        2698.    143902108.    19.8475376     0.0003721     -0.000190
1.4130392     8.7530361 C
0.00002000        2753.    137674519.    19.3601390     0.0003872     -0.000213
1.4635347     9.0539903 C
0.00002125        2849.    134047890.    18.9200317     0.0004021     -0.000235
1.5127930     9.3485321 C
0.00002250        2940.    130683996.    18.5209947     0.0004167     -0.000258
1.5610041     9.6381323 C
0.00002375        3029.    127553870.    18.1570703     0.0004312     -0.000281
1.6082119     9.9230327 C
0.00002500        3116.    124627434.    17.8233098     0.0004456     -0.000304
1.6544226    10.2031496 C
0.00002625        3200.    121897055.    17.5160205     0.0004598     -0.000328
1.6997519    10.4793831 C
0.00002750        3282.    119348425.    17.2324783     0.0004739     -0.000351
1.7442722    10.7522765 C
0.00002875        3363.    116962345.    16.9696679     0.0004879     -0.000375
1.7880053    11.0219327 C
0.00003000        3442.    114722368.    16.7251752     0.0005018     -0.000398
1.8309695    11.2884245 C
0.00003125        3519.    112620772.    16.4974290     0.0005155     -0.000422
1.8732410    11.5523710 C
0.00003250        3596.    110648109.    16.2849960     0.0005293     -0.000446
1.9148773    11.8142414 C
0.00003375        3672.    108788831.    16.0859583     0.0005429     -0.000470
1.9558627    12.0738234 C
0.00003500        3746.    107028447.    15.8984546     0.0005564     -0.000494
1.9961596    12.3306836 C
0.00003625        3820.    105373659.    15.7230232     0.0005700     -0.000518
2.0359629    12.5866416 C
0.00003750        3892.    103798787.    15.5567071     0.0005834     -0.000542
2.0750822    12.8397934 C
0.00003875        3965.    102313071.    15.4004502     0.0005968     -0.000566
2.1137325    13.0921933 C
0.00004000        4036.    100898689.    15.2521640     0.0006101     -0.000590
2.1517837    13.3425103 C
0.00004125        4107.     99560375.    15.1124120     0.0006234     -0.000614
2.1893939    13.5922855 C
0.00004250        4177.     98281303.    14.9791248     0.0006366     -0.000638
2.2264070   -13.891351 C
0.00004375        4247.     97072125.    14.8536715     0.0006498     -0.000663
2.2630772   -14.458955 C
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0.00004500 4316. 95908735. 14.7331596 0.0006630 -0.000687
2.2990860 -15.029477 C
0.00004625 4385. 94804692. 14.6192799 0.0006761 -0.000711
2.3347455 -15.599703 C
0.00004750 4453. 93749963. 14.5107966 0.0006893 -0.000736
2.3699504 -16.170753 C
0.00004875 4521. 92736448. 14.4066344 0.0007023 -0.000760
2.4046169 -16.743559 C
0.00005125 4656. 90844567. 14.2134889 0.0007284 -0.000809
2.4728240 -17.889262 C
0.00005375 4789. 89097800. 14.0358795 0.0007544 -0.000858
2.5392061 -19.038755 C
0.00005625 4921. 87486465. 13.8731502 0.0007804 -0.000907
2.6039856 -20.189725 C
0.00005875 5052. 85992485. 13.7232332 0.0008062 -0.000956
2.6671471 -21.342460 C
0.00006125 5182. 84603709. 13.5848064 0.0008321 -0.001005
2.7287372 -22.496520 C
0.00006375 5311. 83307069. 13.4563555 0.0008578 -0.001055
2.7887397 -23.652204 C
0.00006625 5439. 82099030. 13.3381559 0.0008837 -0.001104
2.8473709 -24.806880 C
0.00006875 5566. 80959826. 13.2266919 0.0009093 -0.001153
2.9042740 -25.965132 C
0.00007125 5692. 79893275. 13.1238572 0.0009351 -0.001202
2.9598565 -27.121777 C
0.00007375 5818. 78889749. 13.0282556 0.0009608 -0.001252
3.0140225 -28.278006 C
0.00007625 5943. 77938149. 12.9376956 0.0009865 -0.001301
3.0665696 -29.436650 C
0.00007875 6067. 77040355. 12.8536678 0.0010122 -0.001350
3.1177907 -30.593651 C
0.00008125 6191. 76191334. 12.7755147 0.0010380 -0.001399
3.1676772 -31.748993 C
0.00008375 6313. 75382424. 12.7015469 0.0010638 -0.001449
3.2160167 -32.905805 C
0.00008625 6435. 74612156. 12.6317784 0.0010895 -0.001498
3.2629127 -34.062577 C
0.00008875 6557. 73879329. 12.5664454 0.0011153 -0.001547
3.3084664 -35.217640 C
0.00009125 6678. 73180800. 12.5054804 0.0011411 -0.001596
3.3526688 -36.370978 C
0.00009375 6798. 72513658. 12.4483891 0.0011670 -0.001645
3.3955043 -37.522680 C
0.00009625 6918. 71871499. 12.3935486 0.0011929 -0.001695
3.4367399 -38.676820 C
0.00009875 7037. 71256400. 12.3419530 0.0012188 -0.001744
3.4766137 -39.829170 C
0.0001013 7155. 70666302. 12.2932952 0.0012447 -0.001793
3.5151160 -40.979709 C

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 0.0001038        7273.     70099338.    12.2477964     0.0012707     -0.001842
3.5522371    -42.128417 C
 0.0001063        7390.     69553818.    12.2050416     0.0012968     -0.001891
3.5879671    -43.275272 C
 0.0001088        7507.     69028207.    12.1648487     0.0013229     -0.001940
3.6222959    -44.420252 C
 0.0001113        7623.     68519663.    12.1266014     0.0013491     -0.001988
3.6551154    -45.565614 C
 0.0001138        7738.     68027590.    12.0899360     0.0013752     -0.002037
3.6864626    -46.710511 C
 0.0001163        7853.     67551779.    12.0554305     0.0014014     -0.002086
3.7163930    -47.853442 C
 0.0001188        7967.     67091147.    12.0229559     0.0014277     -0.002135
3.7448957    -48.994384 C
 0.0001213        8081.     66644703.    11.9921245     0.0014540     -0.002183
3.7719599    -50.133307 C
 0.0001238        8194.     66211526.    11.9633692     0.0014805     -0.002232
3.7975740    -51.270189 C
 0.0001263        8306.     65790773.    11.9363203     0.0015070     -0.002281
3.8217265    -52.405000 C
 0.0001288        8418.     65381666.    11.9108889     0.0015335     -0.002329
3.8444057    -53.537714 C
 0.0001313        8529.     64983481.    11.8869886     0.0015602     -0.002377
3.8655996    -54.668300 C
 0.0001338        8640.     64595550.    11.8645398     0.0015869     -0.002426
3.8852959    -55.796730 C
 0.0001363        8750.     64216978.    11.8433634     0.0016137     -0.002474
3.9034630    -56.923814 C
 0.0001388        8859.     63846909.    11.8230212     0.0016404     -0.002522
3.9200718    -58.050556 C
 0.0001413        8967.     63485453.    11.8038598     0.0016673     -0.002570
3.9351568    -59.175002 C
 0.0001438        9075.     63127809.    11.7856694     0.0016942     -0.002618
3.9486866    -60.000000 CY
 0.0001463        9179.     62761197.    11.7676497     0.0017210     -0.002666
3.9606073    -60.000000 CY
 0.0001488        9278.     62370777.    11.7486578     0.0017476     -0.002715
3.9708791    -60.000000 CY
 0.0001588        9595.     60444046.    11.6553724     0.0018503     -0.002912
3.9959816    -60.000000 CY
 0.0001688        9840.     58310308.    11.5527413     0.0019495     -0.003113
3.9998226    -60.000000 CY
 0.0001788       10044.     56188363.    11.4523607     0.0020471     -0.003315
3.9991896    -60.000000 CY
 0.0001888       10206.     54073830.    11.3523590     0.0021428     -0.003520
3.9994751    -60.000000 CY
 0.0001988       10354.     52096120.    11.2626366     0.0022384     -0.003724
3.9986064    -60.000000 CY
 0.0002088       10478.     50191624.    11.1754610     0.0023329     -0.003930
3.9994019    -60.000000 CY
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    0.0002188        10578.     48356226.    11.0894240     0.0024258     -0.004137
   3.9996250    -60.000000 CY
    0.0002288        10673.     46658320.    11.0133559     0.0025193     -0.004343
   3.9995983    -60.000000 CY
    0.0002388        10762.     45078038.    10.9448789     0.0026131     -0.004549
   3.9992836    -60.000000 CY
    0.0002488        10836.     43560210.    10.8743351     0.0027050     -0.004758
   3.9982488    -60.000000 CY
    0.0002588        10896.     42110701.    10.8052418     0.0027959     -0.004967
   3.9958541    -60.000000 CY
    0.0002688        10952.     40751650.    10.7414657     0.0028868     -0.005176
   3.9999399    -60.000000 CY
    0.0002788        11006.     39484637.    10.6835477     0.0029780     -0.005384
   3.9984608    -60.000000 CY
    0.0002888        11059.     38299957.    10.6311611     0.0030697     -0.005593
   3.9955984    -60.000000 CY
    0.0002988        11108.     37183083.    10.5801780     0.0031608     -0.005802
   3.9992971    -60.000000 CY
    0.0003088        11151.     36116901.    10.5307909     0.0032514     -0.006011
   3.9944002    60.0000000 CY
    0.0003188        11186.     35094300.    10.4821116     0.0033412     -0.006221
   3.9991632    60.0000000 CY
    0.0003288        11215.     34113463.    10.4357383     0.0034307     -0.006432
   3.9950493    60.0000000 CYT
    0.0003388        11241.     33182918.    10.3933574     0.0035207     -0.006642
   3.9979854    60.0000000 CYT
    0.0003488        11264.     32297968.    10.3562924     0.0036118     -0.006851
   3.9999992    60.0000000 CYT
    0.0003588        11284.     31454271.    10.3226229     0.0037032     -0.007059
   3.9950333    60.0000000 CYT
    0.0003688        11303.     30652849.    10.2921117     0.0037952     -0.007267
   3.9991812    60.0000000 CYT
    0.0003788        11303.     29843533.    10.2921518     0.0038982     -0.007464
   3.9926279    60.0000000 CYT


-------------------------------------------------------------------------------
   Summary of Results for Nominal Moment Capacity for Section 2
-------------------------------------------------------------------------------

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               355.320             11018.979           0.00300000
```

-0.00543434

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	355.320000	11019.	230.958000	7162.	70630828.
1	0.75	355.320000	11019.	266.490000	8264.	65947423.
1	0.90	355.320000	11019.	319.788000	9917.	57506358.

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	14.7500	0.00	N.A.	No	0.00	5873.
2	16.6000	24.8941	No	No	5873.	89095.
3	22.1000	11.9423	Yes	No	94968.	188706.
4	35.8000	21.0500	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 Displacement and Pile-head Rotation (Loading Type 5)
Displacement of pile head = 1.250000 inches
Rotation of pile head = 0.000E+00 radians
Axial load on pile head = 355320.0 lbs

Depth X	Deflect. y	Bending Moment	Shear Force	Slope S	Total Stress	Bending Stiffness	Soil Res. Es*H	Soil Spr. Lat. Load	Distrib. p
feet	inches	in-lbs	lbs	radians	psi*	lb-in^2	lb/inch	lb/inch	lb/inch
0.00	1.2500	-1.22E+07	97350.	0.00	0.00	8.25E+10	0.00	0.00	0.00
0.4080	1.2482	-1.17E+07	97345.	-7.11E-04	0.00	8.25E+10	0.00	0.00	0.00
0.8160	1.2430	-1.13E+07	97345.	-0.00136	0.00	9.04E+10	0.00	0.00	0.00
1.2240	1.2349	-1.08E+07	97345.	-0.00196	0.00	9.24E+10	0.00	0.00	0.00
1.6320	1.2239	-1.03E+07	97345.	-0.00251	0.00	9.47E+10	0.00	0.00	0.00
2.0400	1.2103	-9825861.	97345.	-0.00302	0.00	9.71E+10	0.00	0.00	0.00
2.4480	1.1943	-9343571.	97345.	-0.00350	0.00	9.98E+10	0.00	0.00	0.00
2.8560	1.1760	-8860483.	97345.	-0.00394	0.00	1.03E+11	0.00	0.00	0.00
3.2640	1.1557	-8376661.	97345.	-0.00434	0.00	1.06E+11	0.00	0.00	0.00
3.6720	1.1335	-7892167.	97345.	-0.00471	0.00	1.10E+11	0.00	0.00	0.00
4.0800	1.1096	-7407064.	97345.	-0.00505	0.00	1.15E+11	0.00	0.00	0.00
4.4880	1.0841	-6921411.	97345.	-0.00534	0.00	1.20E+11			

0.00 0.00 0.00
4.8960 1.0572 -6435268. 97345. -0.00561 0.00 1.27E+11
0.00 0.00 0.00
5.3040 1.0292 -5948693. 97345. -0.00584 0.00 1.35E+11
0.00 0.00 0.00
5.7120 1.0001 -5461745. 97345. -0.00604 0.00 1.46E+11
0.00 0.00 0.00
6.1200 0.9700 -4974477. 97345. -0.00621 0.00 1.60E+11
0.00 0.00 0.00
6.5280 0.9393 -4486945. 97345. -0.00634 0.00 1.78E+11
0.00 0.00 0.00
6.9360 0.9079 -3999198. 97345. -0.00645 0.00 2.03E+11
0.00 0.00 0.00
7.3440 0.8761 -3511284. 97345. -0.00653 0.00 3.55E+11
0.00 0.00 0.00
7.7520 0.8440 -3023285. 97345. -0.00657 0.00 3.56E+11
0.00 0.00 0.00
8.1600 0.8117 -2535214. 97345. -0.00661 0.00 3.57E+11
0.00 0.00 0.00
8.5680 0.7793 -2047082. 97345. -0.00664 0.00 3.57E+11
0.00 0.00 0.00
8.9760 0.7467 -1558901. 97345. -0.00667 0.00 3.57E+11
0.00 0.00 0.00
9.3840 0.7140 -1070683. 97345. -0.00668 0.00 3.57E+11
0.00 0.00 0.00
9.7920 0.6812 -582440. 97345. -0.00670 0.00 3.57E+11
0.00 0.00 0.00
10.2000 0.6484 -94183. 97345. -0.00670 0.00 3.57E+11
0.00 0.00 0.00
10.6080 0.6156 394076. 97345. -0.00670 0.00 3.57E+11
0.00 0.00 0.00
11.0160 0.5828 882326. 97345. -0.00669 0.00 3.57E+11
0.00 0.00 0.00
11.4240 0.5501 1370555. 97345. -0.00667 0.00 3.57E+11
0.00 0.00 0.00
11.8320 0.5175 1858752. 97345. -0.00665 0.00 3.57E+11
0.00 0.00 0.00
12.2400 0.4850 2346904. 97345. -0.00662 0.00 3.57E+11
0.00 0.00 0.00
12.6480 0.4526 2834999. 97345. -0.00659 0.00 3.56E+11
0.00 0.00 0.00
13.0560 0.4205 3323028. 97345. -0.00655 0.00 3.56E+11
0.00 0.00 0.00
13.4640 0.3885 3810976. 97345. -0.00648 0.00 2.14E+11
0.00 0.00 0.00
13.8720 0.3570 4298773. 97345. -0.00638 0.00 1.87E+11
0.00 0.00 0.00
14.2800 0.3261 4786375. 97345. -0.00625 0.00 1.66E+11
0.00 0.00 0.00
14.6880 0.2958 5273731. 97345. -0.00610 0.00 1.51E+11

```
0.00       0.00       0.00
   15.0960     0.2664   5760789.     97257.   -0.00591       0.00   1.39E+11
-36.087   663.2952       0.00
   15.5040     0.2379   6246630.     96968.   -0.00569       0.00   1.30E+11
-82.076      1689.       0.00
   15.9120     0.2106   6730095.     96450.   -0.00544       0.00   1.23E+11
-129.480      3010.       0.00
   16.3200     0.1847   7209989.     95701.   -0.00515       0.00   1.17E+11
-176.210      4672.       0.00
   16.7280     0.1602   7685134.     82545.   -0.00484       0.00   1.12E+11
-5198.    158882.       0.00
   17.1360     0.1373   8035096.     57685.   -0.00449       0.00   1.09E+11
-4957.    176741.       0.00
   17.5440     0.1162   8265600.     34079.   -0.00412       0.00   1.07E+11
-4686.    197355.       0.00
   17.9520    0.09701   8383128.     11885.   -0.00374       0.00   1.06E+11
-4381.    221099.       0.00
   18.3600    0.07967   8394972.     -8654.   -0.00335       0.00   1.06E+11
-4009.    246378.       0.00
   18.7680    0.06422   8310042.    -27279.   -0.00296       0.00   1.07E+11
-3600.    274407.       0.00
   19.1760    0.05065   8138165.    -43916.   -0.00259       0.00   1.08E+11
-3196.    309010.       0.00
   19.5840    0.03887   7889026.    -58596.   -0.00223       0.00   1.10E+11
-2800.    352715.       0.00
   19.9920    0.02881   7572149.    -71354.   -0.00189       0.00   1.13E+11
-2411.    409674.       0.00
   20.4000    0.02036   7196909.    -81987.   -0.00158       0.00   1.17E+11
-1933.    464728.       0.00
   20.8080    0.01338   6774819.    -90051.   -0.00129       0.00   1.22E+11
-1362.    498287.       0.00
   21.2160    0.00773   6319614.    -95440.   -0.00103       0.00   1.29E+11
-839.546    531847.       0.00
   21.6240    0.00325   5843868.    -98415.  -8.10E-04       0.00   1.37E+11
-375.616    565406.       0.00
   22.0320  -2.04E-04   5358755.    -99273.  -6.18E-04       0.00   1.49E+11
25.0038    598965.       0.00
   22.4400   -0.00280   4873935.    -98327.  -4.56E-04       0.00   1.63E+11
361.3648    632524.       0.00
   22.8480   -0.00467   4397523.    -95886.  -3.24E-04       0.00   1.82E+11
635.8972    666083.       0.00
   23.2560   -0.00597   3936148.    -92240.  -2.19E-04       0.00   2.07E+11
853.5055    699642.       0.00
   23.6640   -0.00681   3495070.    -87793.  -1.48E-04       0.00   3.55E+11
963.1386    691986.       0.00
   24.0720   -0.00742   3076995.    -82975.  -1.03E-04       0.00   3.56E+11
1005.    663133.       0.00
   24.4800   -0.00782   2682939.    -77989.  -6.30E-05       0.00   3.57E+11
1032.    646005.       0.00
   24.8880   -0.00804   2313549.    -72903.  -2.87E-05       0.00   3.57E+11
```

```
1046.    637172.       0.00
   25.2960   -0.00810   1969176.    -67771.   6.48E-07       0.00   3.57E+11
1050.    634692.       0.00
   25.7040   -0.00803   1649929.    -62641.   2.55E-05       0.00   3.57E+11
1046.    637423.       0.00
   26.1120   -0.00785   1355705.    -57551.   4.61E-05       0.00   3.57E+11
1034.    644687.       0.00
   26.5200   -0.00758   1086229.    -52534.   6.28E-05       0.00   3.57E+11
1016.    656107.       0.00
   26.9280   -0.00724    841078.    -47617.   7.60E-05       0.00   3.57E+11
992.4898    671514.       0.00
   27.3360   -0.00684    619697.    -42826.   8.60E-05       0.00   3.57E+11
964.6488    690893.       0.00
   27.7440   -0.00639    421424.    -38181.   9.31E-05       0.00   3.57E+11
932.9518    714364.       0.00
   28.1520   -0.00592    245506.    -33699.   9.77E-05       0.00   3.57E+11
897.9989    742167.       0.00
   28.5600   -0.00544     91107.    -29394.   1.00E-04       0.00   3.57E+11
860.3273    774662.       0.00
   28.9680   -0.00494    -42672.    -25280.   1.00E-04       0.00   3.57E+11
820.4220    812339.       0.00
   29.3760   -0.00445   -156783.    -21365.   9.90E-05       0.00   3.57E+11
778.7242    855834.       0.00
   29.7840   -0.00398   -252223.    -17658.   9.62E-05       0.00   3.57E+11
735.6376    905957.       0.00
   30.1920   -0.00351   -330024.    -14164.   9.22E-05       0.00   3.57E+11
691.5330    963734.       0.00
   30.6000   -0.00307   -391241.    -10888.   8.72E-05       0.00   3.57E+11
646.7515   1030459.       0.00
   31.0080   -0.00266   -436945.     -7832.   8.16E-05       0.00   3.57E+11
601.6067   1107780.       0.00
   31.4160   -0.00227   -468217.     -4997.   7.54E-05       0.00   3.57E+11
556.3852   1197811.       0.00
   31.8240   -0.00192   -486141.     -2384.   6.88E-05       0.00   3.57E+11
511.3462   1303306.       0.00
   32.2320   -0.00160   -491797.    10.7055   6.21E-05       0.00   3.57E+11
466.7178   1427922.       0.00
   32.6400   -0.00131   -486253.      2119.   5.54E-05       0.00   3.57E+11
394.5040   1471503.       0.00
   33.0480   -0.00106   -471240.      3881.   4.89E-05       0.00   3.57E+11
325.1000   1505062.       0.00
   33.4560  -8.34E-04   -448424.      5318.   4.26E-05       0.00   3.57E+11
262.1355   1538621.       0.00
   33.8640  -6.41E-04   -419314.      6464.   3.66E-05       0.00   3.57E+11
205.7692   1572180.       0.00
   34.2720  -4.76E-04   -385260.      7349.   3.11E-05       0.00   3.57E+11
155.9792   1605739.       0.00
   34.6800  -3.36E-04   -347459.      8007.   2.61E-05       0.00   3.57E+11
112.5790   1639298.       0.00
   35.0880  -2.20E-04   -306951.      8466.   2.16E-05       0.00   3.57E+11
```

```
75.2335   1672857.       0.00
   35.4960  -1.25E-04   -264632.      8757.   1.77E-05       0.00   3.57E+11
43.4749   1706417.       0.00
   35.9040  -4.70E-05   -221265.      9593.   1.29E-05       0.00   1.81E+11
297.8996   3.10E+07       0.00
   36.3120   1.34E-06   -170747.     10297.   7.57E-06       0.00   1.81E+11
-10.231   3.74E+07       0.00
   36.7200   2.71E-05   -120465.      9678.   3.63E-06       0.00   1.81E+11
-242.355   4.38E+07       0.00
   37.1280   3.69E-05    -75988.      8159.   9.73E-07       0.00   1.81E+11
-378.144   5.02E+07       0.00
   37.5360   3.66E-05    -40571.      6198.  -6.04E-07       0.00   1.81E+11
-423.179   5.66E+07       0.00
   37.9440   3.10E-05    -15296.      4187.  -1.36E-06       0.00   1.81E+11
-398.375   6.30E+07       0.00
   38.3520   2.33E-05   429.9501      2403.  -1.56E-06       0.00   1.81E+11
-330.117   6.94E+07       0.00
   38.7600   1.57E-05      8243.      1001.  -1.44E-06       0.00   1.81E+11
-242.704   7.58E+07       0.00
   39.1680   9.16E-06     10237.    30.6105  -1.19E-06       0.00   1.81E+11
-153.727   8.21E+07       0.00
   39.5760   3.99E-06      8547.   -522.559  -9.40E-07       0.00   1.81E+11
-72.242   8.85E+07       0.00
   39.9840  -4.03E-08      5124.   -697.493  -7.55E-07       0.00   1.81E+11
0.7816   9.49E+07       0.00
   40.3920  -3.40E-06      1719.   -523.503  -6.62E-07       0.00   1.81E+11
70.2929   1.01E+08       0.00
   40.8000  -6.53E-06       0.00       0.00  -6.39E-07       0.00   1.81E+11
143.5564   5.39E+07       0.00
```

* This analysis computed pile response using nonlinear moment-curvature relationships. Values of total stress due to combined axial and bending stresses are computed only for elastic sections only and do not equal the actual stresses in concrete and steel. Stresses in concrete and steel may be interpolated from the output for nonlinear bending properties relative to the magnitude of bending moment developed in the pile.

Output Summary for Load Case No. 1:

```
Pile-head deflection             =     1.25000000 inches
Computed slope at pile head      =       0.000000 radians
Maximum bending moment           =     -12222976. inch-lbs
Maximum shear force              =        -99273. lbs
Depth of maximum bending moment  =       0.000000 feet below pile head
Depth of maximum shear force     =    22.03200000 feet below pile head
Number of iterations             =             15
Number of zero deflection points =              3
Pile deflection at ground        =     0.29132452 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	Load 1	Load Type	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	y, in	1.2500	S, rad	0.00	355320.	1.2500	0.00	-99273.	-1.22E+07

Maximum pile-head deflection = 1.2500000000 inches
Maximum pile-head rotation = 0.0000000000 radians = 0.000000 deg.

Summary of Warning Messages

The following warning was reported 208 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.

==========

LPile for Windows, Version 2022-12.011

Analysis of Individual Piles and Drilled Shafts
Subjected to Lateral Loading Using the p-y Method
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Files Used for Analysis

Path to file locations:
\20240280\ODOT\109971\400-Engineering\Structures\SFN_0800512\Engdata\04_Abutment Design\Stage 2\Drilled Shaft\Lpile\Abutment\Forward Abutment\

Name of input data file:
FA_Scour Strength 1 - Back DS.lp12d

Name of output report file:
FA_Scour Strength 1 - Back DS.lp12o

Name of plot output file:
FA_Scour Strength 1 - Back DS.lp12p

Name of runtime message file:
FA_Scour Strength 1 - Back DS.lp12r

Date and Time of Analysis

Date: February 12, 2026 Time: 14:21:14

Problem Title

Project Name:

Job Number:

Client:

Engineer:

Description:

Program Options and Settings

Computational Options:
- Conventional Analysis

Engineering Units Used for Data Input and Computations:
- US Customary System Units (pounds, feet, inches)

Analysis Control Options:

- Maximum number of iterations allowed	=	500
- Deflection tolerance for convergence	=	1.0000E-05 in
- Maximum allowable deflection	=	100.0000 in
- Number of pile increments	=	100

Loading Type and Number of Cycles of Loading:

- Static loading specified

- Analysis uses p-y modification factors for p-y curves
- Analysis uses layering correction (Method of Georgiadis)
- No distributed lateral loads are entered
- Loading by lateral soil movements acting on pile not selected
- Input of shear resistance at the pile tip not selected
- Input of moment resistance at the pile tip not selected
- Computation of pile-head foundation stiffness matrix not selected
- Push-over analysis of pile not selected
- Buckling analysis of pile not selected

Output Options:
- Output files use decimal points to denote decimal symbols.
- Values of pile-head deflection, bending moment, shear force, and soil reaction are printed for full length of pile.
- Printing Increment (nodal spacing of output points) = 1
- No p-y curves to be computed and reported for user-specified depths
- Print using wide report formats

Pile Structural Properties and Geometry

Number of pile sections defined = 2
Total length of pile = 40.800 ft
Depth of ground surface below top of pile = 14.7500 ft

Pile diameters used for p-y curve computations are defined using 4 points.

p-y curves are computed using pile diameter values interpolated with depth over the length of the pile. A summary of values of pile diameter vs. depth follows.

Point No.	Depth Below Pile Head feet	Pile Diameter inches
1	0.000	36.0000
2	35.800	36.0000
3	35.800	30.0000
4	40.800	30.0000

Input Structural Properties for Pile Sections:

Pile Section No. 1:

Section 1 is a round drilled shaft, bored pile, or CIDH pile
Length of section = 35.800000 ft
Shaft Diameter = 36.000000 in

Pile Section No. 2:

Section 2 is a round drilled shaft, bored pile, or CIDH pile
Length of section = 5.000000 ft
Shaft Diameter = 30.000000 in

Soil and Rock Layering Information

The soil profile is modelled using 4 layers

Layer 1 is sand, p-y criteria by Reese et al., 1974

Distance from top of pile to top of layer = 14.750000 ft
Distance from top of pile to bottom of layer = 16.600000 ft
Effective unit weight at top of layer = 72.600000 pcf
Effective unit weight at bottom of layer = 72.600000 pcf
Friction angle at top of layer = 40.000000 deg.
Friction angle at bottom of layer = 40.000000 deg.
Subgrade k at top of layer = 125.000000 pci
Subgrade k at bottom of layer = 125.000000 pci

Layer 2 is stiff clay with water-induced erosion

Distance from top of pile to top of layer = 16.600000 ft
Distance from top of pile to bottom of layer = 22.100000 ft
Effective unit weight at top of layer = 72.600000 pcf
Effective unit weight at bottom of layer = 72.600000 pcf
Undrained cohesion at top of layer = 5600. psf
Undrained cohesion at bottom of layer = 5600. psf
Epsilon-50 at top of layer = 0.004000
Epsilon-50 at bottom of layer = 0.004000
Subgrade k at top of layer = 2000. pci
Subgrade k at bottom of layer = 2000. pci

Layer 3 is stiff clay with water-induced erosion

Distance from top of pile to top of layer = 22.100000 ft
Distance from top of pile to bottom of layer = 35.800000 ft
Effective unit weight at top of layer = 67.600000 pcf

```
   Effective unit weight at bottom of layer            =    67.600000 pcf
   Undrained cohesion at top of layer                  =        4600. psf
   Undrained cohesion at bottom of layer               =        4600. psf
   Epsilon-50 at top of layer                          =     0.004000
   Epsilon-50 at bottom of layer                       =     0.004000
   Subgrade k at top of layer                          =        2000. pci
   Subgrade k at bottom of layer                       =        2000. pci


Layer 4 is weak rock, p-y criteria by Reese, 1997

   Distance from top of pile to top of layer           =    35.800000 ft
   Distance from top of pile to bottom of layer        =   100.000000 ft
   Effective unit weight at top of layer               =    97.500000 pcf
   Effective unit weight at bottom of layer            =    97.500000 pcf
   Uniaxial compressive strength at top of layer       =   661.000000 psi
   Uniaxial compressive strength at bottom of layer    =   661.000000 psi
   Initial modulus of rock at top of layer             =       60000. psi
   Initial modulus of rock at bottom of layer          =       60000. 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                        =    0.0005000
   k rm of rock at bottom of layer                     =    0.0005000


 (Depth of the lowest soil layer extends 59.200 ft below the pile tip)



--------------------------------------------------------------------------------
                        Summary of Input Soil Properties
--------------------------------------------------------------------------------

Layer         Soil Type          Layer      Effective    Cohesion     Angle of
Uniaxial                      E50                      Rock Mass
 Num.           Name            Depth       Unit Wt.                  Friction
 qu          RQD %         or           kpy        Modulus
          (p-y Curve Type)        ft           pcf          psf          deg.
 psi                        krm          pci          psi
-----   ------------------   ----------   ----------   ----------   ----------
----------   ----------   ----------   ----------   ----------
  1            Sand              14.7500      72.6000       --          40.0000
 --            --            --          125.0000       --
          (Reese, et al.)        16.6000      72.6000       --          40.0000
 --            --            --          125.0000       --
  2         Stiff Clay           16.6000      72.6000        5600.       --
 --            --           0.00400        2000.       --
          with Free Water        22.1000      72.6000        5600.       --
 --            --           0.00400        2000.       --
  3         Stiff Clay           22.1000      67.6000        4600.       --
```

```
 --           --          0.00400        2000.       --
          with Free Water        35.8000      67.6000        4600.       --
 --           --          0.00400        2000.       --
  4            Weak              35.8000      97.5000       --           --
661.0000       9.0000     5.00E-04       --           60000.
               Rock             100.0000      97.5000       --           --
661.0000       9.0000     5.00E-04       --           60000.
```

Modification Factors for p-y Curves

Distribution of p-y modifiers with depth defined using 2 points

Point No.	Depth X ft	p-mult	y-mult
1	14.750	0.5000	1.0000
2	35.800	0.5000	1.0000

Static Loading Type

Static loading criteria were used when computing p-y curves for all analyses.

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 1

Load No.	Load Type	Condition 1	Condition 2	Axial Thrust Force, lbs	Compute Top y vs. Pile Length	Run Analysis
1	5	y = 1.250000 in	S = 0.0000 in/in	274750.	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 = 2

Pile Section No. 1:

Dimensions and Properties of Drilled Shaft (Bored Pile):

Length of Section	=	35.800000 ft
Shaft Diameter	=	36.000000 in
Concrete Cover Thickness (to edge of trans. reinf.)	=	6.000000 in
Number of Reinforcing Bars	=	15 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	=	15.000000 sq. in.
Area Ratio of Steel Reinforcement	=	1.47 percent
Edge-to-Edge Bar Spacing	=	3.367467 in
Maximum Concrete Aggregate Size	=	0.375000 in
Ratio of Bar Spacing to Aggregate Size	=	8.98
Offset of Center of Rebar Cage from Center of Pile	=	0.0000 in

Transverse Reinforcement
Type: Hoop

Number of Transverse Reinf. (per spacing)	=	1
Spacing of Transverse Reinf.	=	4.500000 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	=	4309.778 kips
Tensile Load for Cracking of Concrete	=	-467.292 kips
Nominal Axial Tensile Capacity	=	-900.000 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	10.811000	0.00000
2	1.128000	1.000000	9.876340	4.397230
3	1.128000	1.000000	7.233971	8.034139
4	1.128000	1.000000	3.340783	10.281872
5	1.128000	1.000000	-1.13006	10.751776
6	1.128000	1.000000	-5.40550	9.362601
7	1.128000	1.000000	-8.74628	6.354546
8	1.128000	1.000000	-10.57475	2.247733
9	1.128000	1.000000	-10.57475	-2.24773
10	1.128000	1.000000	-8.74628	-6.35455
11	1.128000	1.000000	-5.40550	-9.36260
12	1.128000	1.000000	-1.13006	-10.75178
13	1.128000	1.000000	3.340783	-10.28187
14	1.128000	1.000000	7.233971	-8.03414
15	1.128000	1.000000	9.876340	-4.39723

NOTE: The positions of the above rebars were computed by LPile

Minimum spacing between any two bars not equal to zero = 3.367 inches
between bars 7 and 8.

Ratio of bar spacing to maximum aggregate size = 8.98

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	=	0.375000 in

Number of Axial Thrust Force Values Determined from Pile-head Loadings = 1

Number	Axial Thrust Force kips
1	274.750

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 = 274.750 kips

Bending Max Conc Curvature Stress rad/in. ksi	Bending Max Steel Moment Stress in-kip ksi	Bending Stiffness kip-in2	Depth to N Axis in	Max Comp Strain in/in	Max Tens Strain in/in	Run Msg
6.25000E-07	225.3384521	360541523.	113.1365239	0.00007071	0.00004821	
0.2938144	1.9298870					
0.00000125	450.6756918	360540553.	65.5871491	0.00008198	0.00003698	
0.3392389	2.1361092					
0.00000188	676.0021055	360534456.	49.7457487	0.00009327	0.00002577	
0.3844467	2.3427876					
0.00000250	901.3122819	360524913.	41.8313422	0.0001046	0.00001458	
0.4294367	2.5499223					
0.00000313	1127.	360512259.	37.0877337	0.0001159	0.00000340	
0.4742077	2.7575134					
0.00000375	1352.	360493233.	33.9294815	0.0001272	-0.00000776	
0.5187578	2.9655561					
0.00000438	1577.	360429349.	31.6766070	0.0001386	-0.00001891	
0.5630767	3.1739820					
0.00000500	1801.	360288026.	29.9888689	0.0001499	-0.00003006	
0.6071491	3.3826860					
0.00000563	2025.	360067267.	28.6774201	0.0001613	-0.00004119	
0.6509640	3.5915917					
0.00000625	2249.	359776390.	27.6290969	0.0001727	-0.00005232	
0.6945144	3.8006488					
0.00000688	2471.	359426761.	26.7716091	0.0001841	-0.00006345	
0.7377954	4.0098245					
0.00000750	2693.	359028532.	26.0581106	0.0001954	-0.00007456	
0.7808036	4.2190953					

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0.00000813        2914.    358590189.    25.4544606     0.0002068   -0.00008568
0.8235368     4.4284448
0.00000875        3134.    358118653.    24.9372844     0.0002182   -0.00009680
0.8659930     4.6378609
0.00000938        3134.    334244076.    22.7892914     0.0002136    -0.000124
0.8484589     4.3851511 C
0.00001000        3134.    313353821.    22.2165623     0.0002222    -0.000138
0.8800181     4.5114247 C
0.00001063        3134.    294921244.    21.6987851     0.0002305    -0.000152
0.9109207     4.6338257 C
0.00001125        3134.    278536730.    21.2272896     0.0002388    -0.000166
0.9412042     4.7525876 C
0.00001188        3134.    263876902.    20.7963791     0.0002470    -0.000181
0.9709426     4.8682384 C
0.00001250        3134.    250683057.    20.4006115     0.0002550    -0.000195
1.0001680     4.9809853 C
0.00001313        3134.    238745769.    20.0355347     0.0002630    -0.000210
1.0289162     5.0910706 C
0.00001375        3134.    227893688.    19.6974983     0.0002708    -0.000224
1.0572188     5.1987065 C
0.00001438        3134.    217985267.    19.3834201     0.0002786    -0.000239
1.0851031     5.3040777 C
0.00001500        3134.    208902548.    19.0908631     0.0002864    -0.000254
1.1126035     5.4074263 C
0.00001563        3152.    201752991.    18.8178667     0.0002940    -0.000268
1.1397581     5.5090337 C
0.00001625        3211.    197610405.    18.5623376     0.0003016    -0.000283
1.1665796     5.6089765 C
0.00001688        3269.    193695204.    18.3212957     0.0003092    -0.000298
1.1930086     5.7067466 C
0.00001750        3325.    190021119.    18.0954519     0.0003167    -0.000313
1.2191887     5.8034919 C
0.00001813        3381.    186553101.    17.8824979     0.0003241    -0.000328
1.2450767     -6.022334 C
0.00001875        3436.    183269335.    17.6809589     0.0003315    -0.000343
1.2706572     -6.339604 C
0.00001938        3491.    180175576.    17.4913013     0.0003389    -0.000359
1.2960445     -6.657488 C
0.00002000        3545.    177226164.    17.3102533     0.0003462    -0.000374
1.3210880     -6.977253 C
0.00002063        3598.    174443490.    17.1396925     0.0003535    -0.000389
1.3459805     -7.297308 C
0.00002125        3650.    171785078.    16.9764110     0.0003607    -0.000404
1.3705555     -7.619061 C
0.00002188        3703.    169264642.    16.8217367     0.0003680    -0.000420
1.3949622     -7.941271 C
0.00002250        3754.    166863113.    16.6742313     0.0003752    -0.000435
1.4191459     -8.264410 C
0.00002313        3806.    164566591.    16.5329361     0.0003823    -0.000450
1.4430788     -8.588731 C
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0.00002375        3857.    162388658.    16.3992514     0.0003895     -0.000466
1.4669141     -8.912932 C
0.00002438        3907.    160290643.    16.2698329     0.0003966     -0.000481
1.4904259     -9.238962 C
0.00002563        4007.    156385653.    16.0294898     0.0004108     -0.000512
1.5370829     -9.891350 C
0.00002688        4106.    152783181.    15.8067445     0.0004248     -0.000543
1.5828811    -10.547443 C
0.00002813        4204.    149478088.    15.6027399     0.0004388     -0.000574
1.6281461    -11.204453 C
0.00002938        4301.    146415364.    15.4129596     0.0004528     -0.000605
1.6726990    -11.864011 C
0.00003063        4397.    143582330.    15.2377146     0.0004667     -0.000636
1.7167165    -12.524592 C
0.00003188        4493.    140941669.    15.0735773     0.0004805     -0.000667
1.7600743    -13.187361 C
0.00003313        4588.    138490659.    14.9221347     0.0004943     -0.000698
1.8030130    -13.850162 C
0.00003438        4681.    136185628.    14.7784429     0.0005080     -0.000729
1.8452045    -14.516052 C
0.00003563        4775.    134037003.    14.6449332     0.0005217     -0.000761
1.8870339    -15.181501 C
0.00003688        4868.    132017214.    14.5197994     0.0005354     -0.000792
1.9283058    -15.848352 C
0.00003813        4961.    130112832.    14.4011662     0.0005490     -0.000823
1.9690096    -16.516748 C
0.00003938        5053.    128324611.    14.2904500     0.0005627     -0.000855
2.0093548    -17.184705 C
0.00004063        5145.    126635823.    14.1858267     0.0005763     -0.000886
2.0492201    -17.853398 C
0.00004188        5236.    125031459.    14.0859965     0.0005899     -0.000918
2.0884811    -18.524080 C
0.00004313        5327.    123515844.    13.9922156     0.0006034     -0.000949
2.1273870    -19.194323 C
0.00004438        5417.    122081457.    13.9040613     0.0006170     -0.000981
2.1659365    -19.864124 C
0.00004563        5508.    120715397.    13.8198851     0.0006305     -0.001012
2.2039749    -20.535051 C
0.00004688        5597.    119411656.    13.7392564     0.0006440     -0.001043
2.2414902    -21.207261 C
0.00004813        5687.    118171871.    13.6631337     0.0006575     -0.001075
2.2786522    -21.879027 C
0.00004938        5776.    116991167.    13.5911771     0.0006711     -0.001106
2.3154596    -22.550346 C
0.00005063        5866.    115865147.    13.5230794     0.0006846     -0.001138
2.3519114    -23.221217 C
0.00005188        5954.    114784014.    13.4572596     0.0006981     -0.001169
2.3878244    -23.893596 C
0.00005313        6043.    113747259.    13.3941405     0.0007116     -0.001201
2.4232856    -24.566588 C
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0.00005438        6131.    112754850.    13.3342131     0.0007250     -0.001232
2.4583937    -25.239125 C
0.00005563        6219.    111803780.    13.2772605     0.0007385     -0.001264
2.4931474    -25.911207 C
0.00005688        6307.    110891306.    13.2230893     0.0007521     -0.001295
2.5275456    -26.582830 C
0.00005813        6395.    110014920.    13.1715216     0.0007656     -0.001327
2.5615870    -27.253992 C
0.00005938        6482.    109170162.    13.1218099     0.0007791     -0.001358
2.5951834    -27.925695 C
0.00006063        6569.    108353508.    13.0734140     0.0007926     -0.001390
2.6282723    -28.598690 C
0.00006188        6656.    107566923.    13.0272349     0.0008061     -0.001421
2.6610065    -29.271215 C
0.00006313        6742.    106808605.    12.9831425     0.0008196     -0.001453
2.6933848    -29.943268 C
0.00006438        6829.    106076891.    12.9410194     0.0008331     -0.001484
2.7254061    -30.614847 C
0.00006563        6915.    105370246.    12.9007499     0.0008466     -0.001516
2.7570690    -31.285948 C
0.00006688        7001.    104687249.    12.8622334     0.0008602     -0.001547
2.7883723    -31.956569 C
0.00006813        7087.    104026582.    12.8253748     0.0008737     -0.001579
2.8193148    -32.626707 C
0.00006938        7172.    103387024.    12.7900860     0.0008873     -0.001610
2.8498951    -33.296359 C
0.00007063        7258.    102765004.    12.7554478     0.0009009     -0.001642
2.8799796    -33.967235 C
0.00007188        7343.    102161035.    12.7219099     0.0009144     -0.001673
2.9096486    -34.638329 C
0.00007313        7428.    101575178.    12.6897538     0.0009279     -0.001705
2.9389569    -35.308925 C
0.00007438        7512.    101006506.    12.6589113     0.0009415     -0.001736
2.9679032    -35.979019 C
0.00007938        7849.     98887147.    12.5474678     0.0009960     -0.001862
3.0800419    -38.654310 C
0.00008438        8183.     96982548.    12.4526193     0.0010507     -0.001987
3.1862803    -41.321311 C
0.00008938        8513.     95252219.    12.3698490     0.0011056     -0.002112
3.2862373    -43.984507 C
0.00009438        8840.     93669492.    12.2980152     0.0011606     -0.002237
3.3799877    -46.641774 C
0.00009938        9164.     92213445.    12.2365902     0.0012160     -0.002361
3.4676288    -49.289889 C
 0.0001044        9484.     90865063.    12.1841609     0.0012717     -0.002486
3.5490576    -51.928581 C
 0.0001094        9801.     89608769.    12.1395860     0.0013278     -0.002610
3.6241670    -54.557565 C
 0.0001144       10114.     88431682.    12.1019258     0.0013842     -0.002733
3.6928449    -57.176534 C
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 0.0001194        10424.     87323011.    12.0704050     0.0014409     -0.002857
3.7549734    -59.785174 C
 0.0001244        10719.     86185846.    12.0394941     0.0014974     -0.002980
3.8098994    -60.000000 CY
 0.0001294        10962.     84734294.    11.9963415     0.0015520     -0.003105
3.8562920    -60.000000 CY
 0.0001344        11166.     83093094.    11.9451245     0.0016051     -0.003232
3.8951913    -60.000000 CY
 0.0001394        11341.     81371096.    11.8906036     0.0016573     -0.003360
3.9274094    -60.000000 CY
 0.0001444        11502.     79664071.    11.8373082     0.0017090     -0.003488
3.9535592    -60.000000 CY
 0.0001494        11640.     77927087.    11.7822879     0.0017600     -0.003618
3.9736215    -60.000000 CY
 0.0001544        11765.     76211799.    11.7282646     0.0018106     -0.003747
3.9879553    -60.000000 CY
 0.0001594        11886.     74579910.    11.6779723     0.0018612     -0.003876
3.9967482    -60.000000 CY
 0.0001644        11992.     72954534.    11.6259737     0.0019110     -0.004006
3.9999737    -60.000000 CY
 0.0001694        12083.     71341014.    11.5738897     0.0019603     -0.004137
3.9996595    -60.000000 CY
 0.0001744        12168.     69782291.    11.5247998     0.0020096     -0.004268
3.9987331    -60.000000 CY
 0.0001794        12251.     68299058.    11.4802714     0.0020593     -0.004398
3.9968411    -60.000000 CY
 0.0001844        12329.     66870546.    11.4387381     0.0021090     -0.004528
3.9998972    -60.000000 CY
 0.0001894        12399.     65471006.    11.3969141     0.0021583     -0.004659
3.9986581    -60.000000 CY
 0.0001944        12459.     64096071.    11.3571655     0.0022075     -0.004790
3.9979776    -60.000000 CY
 0.0001994        12512.     62756009.    11.3169569     0.0022563     -0.004921
3.9993134    -60.000000 CY
 0.0002044        12563.     61469097.    11.2767826     0.0023047     -0.005053
3.9960200    -60.000000 CY
 0.0002094        12612.     60236986.    11.2429353     0.0023540     -0.005184
3.9994450    -60.000000 CY
 0.0002144        12660.     59056508.    11.2104647     0.0024032     -0.005314
3.9957008    -60.000000 CY
 0.0002194        12706.     57918312.    11.1800742     0.0024526     -0.005445
3.9992427    -60.000000 CY
 0.0002244        12748.     56816161.    11.1509654     0.0025020     -0.005576
3.9968915    -60.000000 CY
 0.0002294        12784.     55733179.    11.1213666     0.0025510     -0.005707
3.9984448    -60.000000 CY
 0.0002344        12816.     54683469.    11.0926074     0.0025998     -0.005838
3.9999852    -60.000000 CY
 0.0002394        12844.     53656983.    11.0640957     0.0026485     -0.005969
3.9964156    -60.000000 CY
```

```
    0.0002444        12871.     52668047.    11.0372559     0.0026972     -0.006100
   3.9993083    -60.000000 CY
    0.0002494        12896.     51714640.    11.0120631     0.0027461     -0.006231
   3.9978015    -60.000000 CY
    0.0002544        12921.     50795104.    10.9889273     0.0027953     -0.006362
   3.9969017    -60.000000 CY
    0.0002594        12945.     49908257.    10.9662978     0.0028444     -0.006493
   3.9994397    -60.000000 CY
    0.0002644        12968.     49052088.    10.9446033     0.0028935     -0.006624
   3.9975317    -60.000000 CY
    0.0002694        12991.     48224789.    10.9246254     0.0029428     -0.006755
   3.9961317    -60.000000 CY
    0.0002744        13012.     47423171.    10.9054306     0.0029922     -0.006885
   3.9989878    -60.000000 CY
    0.0003044        13103.     43049747.    10.7992753     0.0032870     -0.007670
   3.9930795    -60.000000 CYT
    0.0003344        13155.     39341785.    10.7115694     0.0035817     -0.008456
   3.9971865    -60.000000 CYT
    0.0003644        13155.     36102667.    10.6808042     0.0038918     -0.009226
   3.9991395    -60.000000 CYT


-------------------------------------------------------------------------------
   Summary of Results for Nominal Moment Capacity for Section 1
-------------------------------------------------------------------------------

Moment values interpolated at maximum compressive strain = 0.003
or maximum developed moment if pile fails at smaller strains.

 Load           Axial Thrust        Nominal Mom. Cap.      Max. Comp.      Max.
Tens.
  No.              kips                 in-kip               Strain
Strain
 ----         ----------------     ------------------     ------------
------------
   1               274.750             13014.161           0.00300000
-0.00690615

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	274.750000	13014.	178.587500	8459.	95534941.
1	0.75	274.750000	13014.	206.062500	9761.	89768674.
1	0.90	274.750000	13014.	247.275000	11713.	76932491.

Pile Section No. 2:

Dimensions and Properties of Drilled Shaft (Bored Pile):

Length of Section	=	5.000000 ft
Shaft Diameter	=	30.000000 in
Concrete Cover Thickness (to edge of trans. reinf.)	=	3.000000 in
Number of Reinforcing Bars	=	15 bars
Yield Stress of Reinforcing Bars	=	60000. psi
Modulus of Elasticity of Reinforcing Bars	=	29000000. psi
Gross Area of Shaft	=	706.858347 sq. in.
Total Area of Reinforcing Steel	=	15.000000 sq. in.
Area Ratio of Steel Reinforcement	=	2.12 percent
Edge-to-Edge Bar Spacing	=	3.367467 in
Maximum Concrete Aggregate Size	=	0.375000 in
Ratio of Bar Spacing to Aggregate Size	=	8.98
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.	=	4.500000 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	=	3252.318 kips

Tensile Load for Cracking of Concrete = -337.937 kips
Nominal Axial Tensile Capacity = -900.000 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	10.811000	0.00000
2	1.128000	1.000000	9.876340	4.397230
3	1.128000	1.000000	7.233971	8.034139
4	1.128000	1.000000	3.340783	10.281872
5	1.128000	1.000000	-1.13006	10.751776
6	1.128000	1.000000	-5.40550	9.362601
7	1.128000	1.000000	-8.74628	6.354546
8	1.128000	1.000000	-10.57475	2.247733
9	1.128000	1.000000	-10.57475	-2.24773
10	1.128000	1.000000	-8.74628	-6.35455
11	1.128000	1.000000	-5.40550	-9.36260
12	1.128000	1.000000	-1.13006	-10.75178
13	1.128000	1.000000	3.340783	-10.28187
14	1.128000	1.000000	7.233971	-8.03414
15	1.128000	1.000000	9.876340	-4.39723

NOTE: The positions of the above rebars were computed by LPile

Minimum spacing between any two bars not equal to zero = 3.367 inches
between bars 7 and 8.

Ratio of bar spacing to maximum aggregate size = 8.98

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 = 0.375000 in

Number of Axial Thrust Force Values Determined from Pile-head Loadings = 1

Number	Axial Thrust Force kips

1 274.750

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 = 274.750 kips

Bending Max Conc Curvature Stress rad/in. ksi	Bending Max Steel Moment Stress in-kip ksi	Run Msg	Bending Stiffness kip-in2	Depth to N Axis in	Max Comp Strain in/in	Max Tens Strain in/in
0.00000125	228.8878935		183110315.	81.5297670	0.0001019	0.00006441
0.4197987	2.8195166					
0.00000250	457.7678880		183107155.	48.2901955	0.0001207	0.00004573
0.4941437	3.2291642					
0.00000375	686.6202173		183098725.	37.2215844	0.0001396	0.00002708
0.5678743	3.6400348					
0.00000500	915.4310507		183086210.	31.6957146	0.0001585	0.00000848
0.6409854	4.0521286					
0.00000625	1144.		183068060.	28.3869042	0.0001774	-0.00001008
0.7134705	4.4654389					
0.00000750	1373.		183009232.	26.1857983	0.0001964	-0.00002861
0.7853010	4.8797862					
0.00000875	1600.		182876354.	24.6113767	0.0002153	-0.00004715
0.8564309	5.2948511					
0.00001000	1827.		182671979.	23.4391502	0.0002344	-0.00006561
0.9268299	5.7104223					
0.00001125	2052.		182407787.	22.5275933	0.0002534	-0.00008406
0.9964790	6.1263666					
0.00001250	2276.		182095548.	21.7985058	0.0002725	-0.000103
1.0653658	6.5425993					

0.00001375 2276. 165541407. 20.1623749 0.0002772 -0.000135
1.0819196 6.5444345 C
0.00001500 2276. 151746290. 19.4861304 0.0002923 -0.000158
1.1355436 6.8452168 C
0.00001625 2276. 140073498. 18.8966207 0.0003071 -0.000180
1.1876704 7.1378450 C
0.00001750 2304. 131637998. 18.3773397 0.0003216 -0.000203
1.2384561 7.4233749 C
0.00001875 2393. 127626878. 17.9154168 0.0003359 -0.000227
1.2880037 7.7024651 C
0.00002000 2479. 123964608. 17.5017723 0.0003500 -0.000250
1.3364431 7.9760280 C
0.00002125 2563. 120610221. 17.1286351 0.0003640 -0.000274
1.3838547 8.2445910 C
0.00002250 2645. 117537635. 16.7907533 0.0003778 -0.000297
1.4303662 8.5091068 C
0.00002375 2724. 114711790. 16.4829782 0.0003915 -0.000321
1.4760219 8.7698466 C
0.00002500 2803. 112104446. 16.2012068 0.0004050 -0.000345
1.5208702 9.0271287 C
0.00002625 2879. 109693128. 15.9422685 0.0004185 -0.000369
1.5649691 9.2813660 C
0.00002750 2955. 107459091. 15.7036346 0.0004318 -0.000393
1.6083805 9.5330241 C
0.00002875 3030. 105380202. 15.4825737 0.0004451 -0.000417
1.6511047 9.7820332 C
0.00003000 3103. 103438797. 15.2768372 0.0004583 -0.000442
1.6931446 10.0283484 C
0.00003125 3176. 101632080. 15.0860452 0.0004714 -0.000466
1.7346538 10.2732911 C
0.00003250 3248. 99940052. 14.9078437 0.0004845 -0.000490
1.7755750 -10.689953 C
0.00003375 3319. 98351891. 14.7409909 0.0004975 -0.000515
1.8159211 -11.264443 C
0.00003500 3390. 96864652. 14.5852423 0.0005105 -0.000540
1.8558125 -11.839729 C
0.00003625 3460. 95459036. 14.4381348 0.0005234 -0.000564
1.8951021 -12.417224 C
0.00003750 3530. 94138557. 14.3004380 0.0005363 -0.000589
1.9339832 -12.995148 C
0.00003875 3599. 92888046. 14.1701219 0.0005491 -0.000613
1.9723260 -13.574761 C
0.00004000 3668. 91705362. 14.0471573 0.0005619 -0.000638
2.0102147 -14.155294 C
0.00004125 3737. 90588759. 13.9315220 0.0005747 -0.000663
2.0477307 -14.735979 C
0.00004250 3805. 89521795. 13.8207758 0.0005874 -0.000688
2.0846521 -15.319010 C
0.00004375 3872. 88513037. 13.7166484 0.0006001 -0.000712
2.1212575 -15.901678 C

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0.00004500        3940.    87553388.    13.6178209    0.0006128    -0.000737
2.1574454   -16.484994 C
0.00004625        4007.    86634539.    13.5230211    0.0006254    -0.000762
2.1931116   -17.070037 C
0.00004750        4074.    85761544.    13.4334852    0.0006381    -0.000787
2.2284645   -17.654718 C
0.00004875        4140.    84930720.    13.3487826    0.0006508    -0.000812
2.2634990   -18.239077 C
0.00005125        4272.    83364544.    13.1885535    0.0006759    -0.000862
2.3320732   -19.412511 C
0.00005375        4404.    81934654.    13.0440836    0.0007011    -0.000911
2.3993792   -20.584722 C
0.00005625        4534.    80609556.    12.9100443    0.0007262    -0.000961
2.4649602   -21.760673 C
0.00005875        4664.    79389289.    12.7883205    0.0007513    -0.001011
2.5292989   -22.935164 C
0.00006125        4793.    78253723.    12.6755995    0.0007764    -0.001061
2.5920977   -24.111529 C
0.00006375        4921.    77196415.    12.5713566    0.0008014    -0.001111
2.6535080   -25.288110 C
0.00006625        5049.    76211851.    12.4758703    0.0008265    -0.001161
2.7136724   -26.463203 C
0.00006875        5176.    75286535.    12.3866193    0.0008516    -0.001211
2.7723143   -27.640115 C
0.00007125        5302.    74417469.    12.3035463    0.0008766    -0.001261
2.8296014   -28.816860 C
0.00007375        5428.    73600971.    12.2265509    0.0009017    -0.001311
2.8856377   -29.992078 C
0.00007625        5553.    72831810.    12.1555242    0.0009269    -0.001361
2.9404155   -31.165754 C
0.00007875        5678.    72100685.    12.0882854    0.0009520    -0.001411
2.9936378   -32.341816 C
0.00008125        5802.    71408324.    12.0254186    0.0009771    -0.001460
3.0455750   -33.516670 C
0.00008375        5925.    70751622.    11.9669606    0.0010022    -0.001510
3.0962469   -34.689933 C
0.00008625        6048.    70127427.    11.9121220    0.0010274    -0.001560
3.1456457   -35.861585 C
0.00008875        6171.    69532934.    11.8613705    0.0010527    -0.001610
3.1937628   -37.031612 C
0.00009125        6293.    68963320.    11.8134068    0.0010780    -0.001660
3.2404093   -38.202834 C
0.00009375        6414.    68418179.    11.7678680    0.0011032    -0.001709
3.2857128   -39.373296 C
0.00009625        6535.    67896275.    11.7253016    0.0011286    -0.001759
3.3297249   -40.542065 C
0.00009875        6655.    67395792.    11.6854886    0.0011539    -0.001809
3.3724368   -41.709120 C
 0.0001013        6775.    66915091.    11.6482317    0.0011794    -0.001858
3.4138396   -42.874444 C
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 0.0001038        6894.     66452697.    11.6128027     0.0012048     -0.001908
3.4539246    -44.038012 C
 0.0001063        7013.     66007258.    11.5801326     0.0012304     -0.001957
3.4926822    -45.199808 C
 0.0001088        7132.     65577559.    11.5500999     0.0012561     -0.002006
3.5301033    -46.359810 C
 0.0001113        7249.     65161105.    11.5204247     0.0012816     -0.002056
3.5660363    -47.520944 C
 0.0001138        7366.     64758397.    11.4928280     0.0013073     -0.002105
3.6006261    -48.680221 C
 0.0001163        7483.     64368504.    11.4668759     0.0013330     -0.002154
3.6338632    -49.837607 C
 0.0001188        7599.     63990567.    11.4425728     0.0013588     -0.002204
3.6657375    -50.993078 C
 0.0001213        7714.     63623794.    11.4198237     0.0013847     -0.002253
3.6962387    -52.146608 C
 0.0001238        7829.     63267460.    11.3985416     0.0014106     -0.002302
3.7253563    -53.298173 C
 0.0001263        7944.     62920894.    11.3786465     0.0014366     -0.002351
3.7530795    -54.447745 C
 0.0001288        8058.     62583480.    11.3595511     0.0014625     -0.002400
3.7793975    -55.595295 C
 0.0001313        8171.     62254637.    11.3422412     0.0014887     -0.002449
3.8042990    -56.740801 C
 0.0001338        8284.     61933838.    11.3261167     0.0015149     -0.002498
3.8277726    -57.884232 C
 0.0001363        8396.     61620588.    11.3111188     0.0015411     -0.002546
3.8498068    -59.025559 C
 0.0001388        8507.     61311924.    11.2971214     0.0015675     -0.002595
3.8703742    -60.000000 CY
 0.0001413        8615.     60992750.    11.2830569     0.0015937     -0.002644
3.8893803    -60.000000 CY
 0.0001438        8718.     60644025.    11.2677321     0.0016197     -0.002693
3.9067259    -60.000000 CY
 0.0001463        8810.     60239200.    11.2495673     0.0016452     -0.002742
3.9222975    -60.000000 CY
 0.0001488        8894.     59789377.    11.2286959     0.0016703     -0.002792
3.9361556    -60.000000 CY
 0.0001588        9179.     57817925.    11.1355253     0.0017678     -0.002995
3.9772293    -60.000000 CY
 0.0001688        9407.     55745270.    11.0381755     0.0018627     -0.003200
3.9973127    -60.000000 CY
 0.0001788        9594.     53670092.    10.9410527     0.0019557     -0.003407
3.9998641    -60.000000 CY
 0.0001888        9754.     51677700.    10.8458291     0.0020472     -0.003615
3.9984651    -60.000000 CY
 0.0001988        9893.     49778247.    10.7609182     0.0021387     -0.003824
3.9997175    -60.000000 CY
 0.0002088       10004.     47924459.    10.6747620     0.0022284     -0.004034
3.9999941    -60.000000 CY
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0.0002188	10107.	46205196.	10.5968900	0.0023181	-0.004244
3.9983583	-60.000000 CY				
0.0002288	10203.	44603088.	10.5257966	0.0024078	-0.004455
3.9978625	-60.000000 CY				
0.0002388	10282.	43063987.	10.4557862	0.0024963	-0.004666
3.9996126	-60.000000 CY				
0.0002488	10346.	41592247.	10.3875053	0.0025839	-0.004879
3.9998560	-60.000000 CY				
0.0002588	10406.	40218256.	10.3244218	0.0026714	-0.005091
3.9989957	-60.000000 CY				
0.0002688	10465.	38938771.	10.2662164	0.0027590	-0.005303
3.9966715	-60.000000 CY				
0.0002788	10521.	37743377.	10.2131799	0.0028469	-0.005516
3.9999990	-60.000000 CY				
0.0002888	10571.	36608713.	10.1631601	0.0029346	-0.005728
3.9986642	-60.000000 CY				
0.0002988	10613.	35523777.	10.1130283	0.0030213	-0.005941
3.9953963	-60.000000 CY				
0.0003088	10648.	34487522.	10.0636889	0.0031072	-0.006155
3.9990187	-60.000000 CY				
0.0003188	10680.	33504883.	10.0146868	0.0031922	-0.006370
3.9953043	-60.000000 CYT				
0.0003288	10710.	32577910.	9.9686137	0.0032772	-0.006585
3.9982767	-60.000000 CYT				
0.0003388	10739.	31703143.	9.9265587	0.0033626	-0.006800
3.9991258	60.0000000 CYT				
0.0003488	10768.	30875288.	9.8885591	0.0034486	-0.007014
3.9960436	60.0000000 CYT				
0.0003588	10795.	30091030.	9.8540186	0.0035351	-0.007227
3.9995801	60.0000000 CYT				
0.0003688	10820.	29343414.	9.8238048	0.0036225	-0.007440
3.9932368	60.0000000 CYT				
0.0003788	10843.	28628428.	9.7942364	0.0037096	-0.007653
3.9970164	60.0000000 CYT				
0.0003888	10861.	27938867.	9.7689871	0.0037977	-0.007865
3.9998133	60.0000000 CYT				
0.0003988	10861.	27238205.	9.7673764	0.0038947	-0.008068
3.9918898	60.0000000 CYT				

Summary of Results for Nominal Moment Capacity for Section 2

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	274.750	10602.430	0.00300000	-0.00588887

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	274.750000	10602.	178.587500	6892.	66463889.
1	0.75	274.750000	10602.	206.062500	7952.	62897010.
1	0.90	274.750000	10602.	247.275000	9542.	54241329.

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	14.7500	0.00	N.A.	No	0.00	5873.

2	16.6000	24.8941	No	No	5873.	89095.
3	22.1000	11.9423	Yes	No	94968.	188706.
4	35.8000	21.0500	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 Displacement and Pile-head Rotation (Loading Type 5)
Displacement of pile head = 1.250000 inches
Rotation of pile head = 0.000E+00 radians
Axial load on pile head = 274750.0 lbs

Depth X	Deflect. y	Bending Moment	Shear Force	Slope S	Total Stress	Bending Stiffness	Soil Res. Es*H	Soil Spr. Lat. Load	Distrib. p
feet	inches	in-lbs	lbs	radians	psi*	lb-in^2	lb/inch	lb/inch	lb/inch
0.00	1.2500	-1.11E+07	86678.	0.00	0.00	8.34E+10	0.00	0.00	0.00
0.4080	1.2484	-1.07E+07	86674.	-6.40E-04	0.00	8.34E+10	0.00	0.00	0.00
0.8160	1.2437	-1.03E+07	86674.	-0.00124	0.00	8.79E+10	0.00	0.00	0.00
1.2240	1.2363	-9844095.	86674.	-0.00180	0.00	8.94E+10	0.00	0.00	0.00
1.6320	1.2262	-9416961.	86674.	-0.00232	0.00	9.11E+10	0.00	0.00	0.00
2.0400	1.2136	-8989146.	86674.	-0.00281	0.00	9.30E+10	0.00	0.00	0.00
2.4480	1.1987	-8560694.	86674.	-0.00326	0.00	9.50E+10	0.00	0.00	0.00
2.8560	1.1816	-8131649.	86674.	-0.00369	0.00	9.73E+10	0.00	0.00	0.00
3.2640	1.1625	-7702053.	86674.	-0.00408	0.00	9.98E+10	0.00	0.00	0.00
3.6720	1.1416	-7271949.	86674.	-0.00445	0.00	1.03E+11			

0.00 0.00 0.00
4.0800 1.1190 -6841379. 86674. -0.00478 0.00 1.06E+11
0.00 0.00 0.00
4.4880 1.0948 -6410383. 86674. -0.00508 0.00 1.10E+11
0.00 0.00 0.00
4.8960 1.0693 -5979003. 86674. -0.00535 0.00 1.14E+11
0.00 0.00 0.00
5.3040 1.0424 -5547279. 86674. -0.00559 0.00 1.20E+11
0.00 0.00 0.00
5.7120 1.0145 -5115250. 86674. -0.00580 0.00 1.27E+11
0.00 0.00 0.00
6.1200 0.9856 -4682957. 86674. -0.00598 0.00 1.36E+11
0.00 0.00 0.00
6.5280 0.9559 -4250438. 86674. -0.00614 0.00 1.48E+11
0.00 0.00 0.00
6.9360 0.9255 -3817729. 86674. -0.00627 0.00 1.64E+11
0.00 0.00 0.00
7.3440 0.8946 -3384867. 86674. -0.00637 0.00 1.86E+11
0.00 0.00 0.00
7.7520 0.8632 -2951885. 86674. -0.00643 0.00 3.59E+11
0.00 0.00 0.00
8.1600 0.8316 -2518849. 86674. -0.00647 0.00 3.59E+11
0.00 0.00 0.00
8.5680 0.7998 -2085767. 86674. -0.00650 0.00 3.60E+11
0.00 0.00 0.00
8.9760 0.7679 -1652647. 86674. -0.00653 0.00 3.60E+11
0.00 0.00 0.00
9.3840 0.7359 -1219496. 86674. -0.00655 0.00 3.61E+11
0.00 0.00 0.00
9.7920 0.7038 -786324. 86674. -0.00656 0.00 3.61E+11
0.00 0.00 0.00
10.2000 0.6717 -353137. 86674. -0.00657 0.00 3.61E+11
0.00 0.00 0.00
10.6080 0.6395 80057. 86674. -0.00657 0.00 3.61E+11
0.00 0.00 0.00
11.0160 0.6074 513249. 86674. -0.00656 0.00 3.61E+11
0.00 0.00 0.00
11.4240 0.5753 946432. 86674. -0.00655 0.00 3.61E+11
0.00 0.00 0.00
11.8320 0.5432 1379597. 86674. -0.00654 0.00 3.60E+11
0.00 0.00 0.00
12.2400 0.5112 1812738. 86674. -0.00652 0.00 3.60E+11
0.00 0.00 0.00
12.6480 0.4794 2245845. 86674. -0.00649 0.00 3.60E+11
0.00 0.00 0.00
13.0560 0.4477 2678911. 86674. -0.00646 0.00 3.59E+11
0.00 0.00 0.00
13.4640 0.4162 3111927. 86674. -0.00642 0.00 3.58E+11
0.00 0.00 0.00
13.8720 0.3848 3544887. 86674. -0.00635 0.00 1.77E+11

```
0.00       0.00       0.00
   14.2800     0.3540   3977715.     86674.   -0.00624       0.00   1.58E+11
0.00       0.00       0.00
   14.6880     0.3238   4410376.     86674.   -0.00610       0.00   1.43E+11
0.00       0.00       0.00
   15.0960     0.2943   4842835.     86609.   -0.00593       0.00   1.33E+11
-26.462   440.2401       0.00
   15.5040     0.2657   5274419.     86397.   -0.00574       0.00   1.24E+11
-60.400      1113.       0.00
   15.9120     0.2381   5704276.     86015.   -0.00552       0.00   1.18E+11
-95.684      1968.       0.00
   16.3200     0.2116   6131520.     85460.   -0.00527       0.00   1.13E+11
-130.847      3027.       0.00
   16.7280     0.1865   6555270.     75660.   -0.00499       0.00   1.08E+11
-3873.    101655.       0.00
   17.1360     0.1628   6885795.     57047.   -0.00468       0.00   1.06E+11
-3731.    112177.       0.00
   17.5440     0.1407   7126463.     39178.   -0.00435       0.00   1.04E+11
-3569.    124179.       0.00
   17.9520     0.1202   7281134.     22152.   -0.00401       0.00   1.03E+11
-3387.    137918.       0.00
   18.3600     0.1015   7354155.      6067.   -0.00366       0.00   1.02E+11
-3184.    153651.       0.00
   18.7680    0.08441   7350380.     -8943.   -0.00331       0.00   1.02E+11
-2948.    170976.       0.00
   19.1760    0.06908   7275475.    -22687.   -0.00296       0.00   1.03E+11
-2667.    188988.       0.00
   19.5840    0.05546   7136180.    -35064.   -0.00261       0.00   1.04E+11
-2389.    210924.       0.00
   19.9920    0.04349   6939157.    -46093.   -0.00228       0.00   1.05E+11
-2116.    238195.       0.00
   20.4000    0.03310   6690983.    -55791.   -0.00197       0.00   1.07E+11
-1846.    273036.       0.00
   20.8080    0.02420   6398152.    -64173.   -0.00167       0.00   1.10E+11
-1578.    319293.       0.00
   21.2160    0.01670   6067102.    -71210.   -0.00140       0.00   1.13E+11
-1296.    379890.       0.00
   21.6240    0.01048   5704635.    -76499.   -0.00115       0.00   1.18E+11
-864.709    403861.       0.00
   22.0320    0.00542   5321122.    -79776.  -9.28E-04       0.00   1.24E+11
-473.891    427832.       0.00
   22.4400    0.00140   4925966.    -81251.  -7.30E-04       0.00   1.31E+11
-128.754    451803.       0.00
   22.8480   -0.00173   4527476.    -81155.  -5.59E-04       0.00   1.40E+11
168.1066    475774.       0.00
   23.2560   -0.00408   4132802.    -79724.  -4.13E-04       0.00   1.52E+11
416.4537    499745.       0.00
   23.6640   -0.00578   3747931.    -77191.  -2.92E-04       0.00   1.67E+11
618.0286    523715.       0.00
   24.0720   -0.00694   3377728.    -73979.  -1.93E-04       0.00   1.87E+11
```

694.1693   489865.   0.00
   24.4800   -0.00766   3024046.   -70494. -1.28E-04   0.00   3.58E+11
729.6202   466064.   0.00
   24.8880   -0.00819   2687797.   -66861. -8.88E-05   0.00   3.59E+11
754.1687   450893.   0.00
   25.2960   -0.00853   2369577.   -63131. -5.43E-05   0.00   3.60E+11
769.8907   441685.   0.00
   25.7040   -0.00872   2069769.   -59341. -2.41E-05   0.00   3.60E+11
778.2813   436924.   0.00
   26.1120   -0.00877   1788578.   -55525.   2.10E-06   0.00   3.60E+11
780.4741   435696.   0.00
   26.5200   -0.00870   1526064.   -51711.   2.46E-05   0.00   3.60E+11
777.3630   437440.   0.00
   26.9280   -0.00853   1282156.   -47924.   4.37E-05   0.00   3.60E+11
769.6737   441811.   0.00
   27.3360   -0.00827   1056674.   -44184.   5.96E-05   0.00   3.61E+11
758.0110   448608.   0.00
   27.7440   -0.00795   849343.   -40510.   7.25E-05   0.00   3.61E+11
742.8889   457740.   0.00
   28.1520   -0.00756   659804.   -36917.   8.28E-05   0.00   3.61E+11
724.7516   469196.   0.00
   28.5600   -0.00714   487626.   -33420.   9.06E-05   0.00   3.61E+11
703.9880   483034.   0.00
   28.9680   -0.00668   332314.   -30029.   9.61E-05   0.00   3.61E+11
680.9417   499383.   0.00
   29.3760   -0.00619   193319.   -26757.   9.97E-05   0.00   3.61E+11
655.9187   518434.   0.00
   29.7840   -0.00570   70043.   -23611.   1.01E-04   0.00   3.61E+11
629.1935   540455.   0.00
   30.1920   -0.00520   -38151.   -20599.   1.02E-04   0.00   3.61E+11
601.0126   565797.   0.00
   30.6000   -0.00470   -131939.   -17729.   1.01E-04   0.00   3.61E+11
571.5978   594913.   0.00
   31.0080   -0.00422   -212022.   -15005.   9.82E-05   0.00   3.61E+11
541.1479   628389.   0.00
   31.4160   -0.00374   -279130.   -12432.   9.49E-05   0.00   3.61E+11
509.8403   666977.   0.00
   31.8240   -0.00329   -334011.   -10014.   9.07E-05   0.00   3.61E+11
477.8306   711657.   0.00
   32.2320   -0.00285   -377432.   -7754.   8.59E-05   0.00   3.61E+11
445.2522   763729.   0.00
   32.6400   -0.00245   -410173.   -5655.   8.05E-05   0.00   3.61E+11
412.2132   824942.   0.00
   33.0480   -0.00207   -433026.   -3719.   7.48E-05   0.00   3.61E+11
378.7928   897727.   0.00
   33.4560   -0.00171   -446791.   -1947.   6.88E-05   0.00   3.61E+11
345.0331   985565.   0.00
   33.8640   -0.00139   -452276.   -341.249   6.27E-05   0.00   3.61E+11
310.9258   1093678.   0.00
   34.2720   -0.00110   -450301.   1051.   5.66E-05   0.00   3.61E+11

```
257.6553   1146957.       0.00
   34.6800  -8.38E-04   -442141.      2172.   5.05E-05       0.00   3.61E+11
200.3531   1170927.       0.00
   35.0880  -6.05E-04   -429170.      3024.   4.46E-05       0.00   3.61E+11
147.6586   1194898.       0.00
   35.4960  -4.01E-04   -412652.      3630.   3.89E-05       0.00   3.61E+11
99.7888   1218869.       0.00
   35.9040  -2.24E-04   -393734.      7348.   3.08E-05       0.00   1.83E+11
1419.   3.10E+07       0.00
   36.3120  -9.89E-05   -340786.     12671.   2.10E-05       0.00   1.83E+11
755.3094   3.74E+07       0.00
   36.7200  -1.83E-05   -269719.     14920.   1.29E-05       0.00   1.83E+11
163.6003   4.38E+07       0.00
   37.1280   2.70E-05   -194722.     14643.   6.65E-06       0.00   1.83E+11
-276.647   5.02E+07       0.00
   37.5360   4.68E-05   -126348.     12643.   2.35E-06       0.00   1.83E+11
-540.585   5.66E+07       0.00
   37.9440   5.00E-05    -70929.      9744.  -2.84E-07       0.00   1.83E+11
-643.484   6.30E+07       0.00
   38.3520   4.40E-05    -30932.      6643.  -1.65E-06       0.00   1.83E+11
-623.335   6.94E+07       0.00
   38.7600   3.39E-05     -5875.      3833.  -2.14E-06       0.00   1.83E+11
-524.782   7.58E+07       0.00
   39.1680   2.31E-05      6602.      1600.  -2.13E-06       0.00   1.83E+11
-386.997   8.21E+07       0.00
   39.5760   1.31E-05      9803.    74.1475  -1.91E-06       0.00   1.83E+11
-236.505   8.85E+07       0.00
   39.9840   4.37E-06      7333.   -712.439  -1.68E-06       0.00   1.83E+11
-84.813   9.49E+07       0.00
   40.3920  -3.37E-06      2831.   -749.339  -1.54E-06       0.00   1.83E+11
69.7400   1.01E+08       0.00
   40.8000  -1.07E-05       0.00       0.00  -1.51E-06       0.00   1.83E+11
236.3626   5.39E+07       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             =     1.25000000 inches
Computed slope at pile head      =       0.000000 radians
Maximum bending moment           =     -11120940. inch-lbs
Maximum shear force              =         86678. lbs
Depth of maximum bending moment  =       0.000000 feet below pile head
Depth of maximum shear force     =       0.000000 feet below pile head
```

```
Number of iterations             =            73
Number of zero deflection points =             3
Pile deflection at ground        =     0.31929984 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 Load                Load                  Axial    Pile-head  Pile-head  Max
Shear Max Moment
Case Type   Pile-head    Type     Pile-head   Loading  Deflection  Rotation    in
Pile    in Pile
 No.  1      Load 1       2        Load 2       lbs      inches     radians      lbs
     in-lbs
---- ----- ---------- ---------- ---------- ---------- ---------- ----------
---------- ----------
  1  y, in     1.2500   S, rad         0.00    274750.     1.2500       0.00
86678.  -1.11E+07


Maximum pile-head deflection = 1.2500000000 inches
Maximum pile-head rotation   = 0.0000000000 radians = 0.000000 deg.

--------------------------------------------------------------------------------
                           Summary of Warning Messages
--------------------------------------------------------------------------------

The following warning was reported 962 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.
```

==

LPile for Windows, Version 2022-12.011

Analysis of Individual Piles and Drilled Shafts
Subjected to Lateral Loading Using the p-y Method
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Files Used for Analysis

Path to file locations:
\20240280\ODOT\109971\400-Engineering\Structures\SFN_0800512\Engdata\04_Abutment Design\Stage 2\Drilled Shaft\Lpile\Abutment\Forward Abutment\

Name of input data file:
FA_Scour Extreme II - Front DS.lp12d

Name of output report file:
FA_Scour Extreme II - Front DS.lp12o

Name of plot output file:
FA_Scour Extreme II - Front DS.lp12p

Name of runtime message file:
FA_Scour Extreme II - Front DS.lp12r

Date and Time of Analysis

Date: February 12, 2026 Time: 14:18:38

Problem Title

Project Name:

Job Number:

Client:

Engineer:

Description:

Program Options and Settings

Computational Options:
- Conventional Analysis

Engineering Units Used for Data Input and Computations:
- US Customary System Units (pounds, feet, inches)

Analysis Control Options:

- Maximum number of iterations allowed	=	500
- Deflection tolerance for convergence	=	1.0000E-05 in
- Maximum allowable deflection	=	100.0000 in
- Number of pile increments	=	100

Loading Type and Number of Cycles of Loading:

- Static loading specified

- Analysis uses p-y modification factors for p-y curves
- Analysis uses layering correction (Method of Georgiadis)
- No distributed lateral loads are entered
- Loading by lateral soil movements acting on pile not selected
- Input of shear resistance at the pile tip not selected
- Input of moment resistance at the pile tip not selected
- Computation of pile-head foundation stiffness matrix not selected
- Push-over analysis of pile not selected
- Buckling analysis of pile not selected

Output Options:
- Output files use decimal points to denote decimal symbols.
- Values of pile-head deflection, bending moment, shear force, and soil reaction are printed for full length of pile.
- Printing Increment (nodal spacing of output points) = 1
- No p-y curves to be computed and reported for user-specified depths
- Print using wide report formats

Pile Structural Properties and Geometry

Number of pile sections defined = 2
Total length of pile = 40.800 ft
Depth of ground surface below top of pile = 18.3200 ft

Pile diameters used for p-y curve computations are defined using 4 points.

p-y curves are computed using pile diameter values interpolated with depth over the length of the pile. A summary of values of pile diameter vs. depth follows.

Point No.	Depth Below Pile Head feet	Pile Diameter inches
1	0.000	36.0000
2	35.800	36.0000
3	35.800	30.0000
4	40.800	30.0000

Input Structural Properties for Pile Sections:

Pile Section No. 1:

```
   Section 1 is a round drilled shaft, bored pile, or CIDH pile
   Length of section                                  =    35.800000 ft
   Shaft Diameter                                     =    36.000000 in

Pile Section No. 2:

   Section 2 is a round drilled shaft, bored pile, or CIDH pile
   Length of section                                  =     5.000000 ft
   Shaft Diameter                                     =    30.000000 in



--------------------------------------------------------------------------------
                       Soil and Rock Layering Information
--------------------------------------------------------------------------------

The soil profile is modelled using 3 layers

Layer 1 is stiff clay with water-induced erosion

   Distance from top of pile to top of layer          =    18.320000 ft
   Distance from top of pile to bottom of layer       =    22.100000 ft
   Effective unit weight at top of layer              =    72.600000 pcf
   Effective unit weight at bottom of layer           =    72.600000 pcf
   Undrained cohesion at top of layer                 =        5600. psf
   Undrained cohesion at bottom of layer              =        5600. psf
   Epsilon-50 at top of layer                         =     0.004000
   Epsilon-50 at bottom of layer                      =     0.004000
   Subgrade k at top of layer                         =        2000. pci
   Subgrade k at bottom of layer                      =        2000. pci


Layer 2 is stiff clay with water-induced erosion

   Distance from top of pile to top of layer          =    22.100000 ft
   Distance from top of pile to bottom of layer       =    35.800000 ft
   Effective unit weight at top of layer              =    67.600000 pcf
   Effective unit weight at bottom of layer           =    67.600000 pcf
   Undrained cohesion at top of layer                 =        4600. psf
   Undrained cohesion at bottom of layer              =        4600. psf
   Epsilon-50 at top of layer                         =     0.004000
   Epsilon-50 at bottom of layer                      =     0.004000
   Subgrade k at top of layer                         =        2000. pci
   Subgrade k at bottom of layer                      =        2000. pci


Layer 3 is weak rock, p-y criteria by Reese, 1997

   Distance from top of pile to top of layer          =    35.800000 ft
```

Distance from top of pile to bottom of layer	=	100.000000 ft
Effective unit weight at top of layer	=	97.500000 pcf
Effective unit weight at bottom of layer	=	97.500000 pcf
Uniaxial compressive strength at top of layer	=	661.000000 psi
Uniaxial compressive strength at bottom of layer	=	661.000000 psi
Initial modulus of rock at top of layer	=	60000. psi
Initial modulus of rock at bottom of layer	=	60000. 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	=	0.0005000
k rm of rock at bottom of layer	=	0.0005000

(Depth of the lowest soil layer extends 59.200 ft below the pile tip)

Summary of Input Soil Properties

Layer Num.	Soil Type Name or (p-y Curve Type)	Layer Depth ft	Effective Unit Wt. pcf	Cohesion psf	Uniaxial qu psi	RQD %
	E50 krm	kpy pci	Rock Mass Modulus psi			
1	Stiff Clay	18.3200	72.6000	5600.	--	--
	0.00400	2000.	--			
	with Free Water	22.1000	72.6000	5600.	--	--
	0.00400	2000.	--			
2	Stiff Clay	22.1000	67.6000	4600.	--	--
	0.00400	2000.	--			
	with Free Water	35.8000	67.6000	4600.	--	--
	0.00400	2000.	--			
3	Weak	35.8000	97.5000	--	661.0000	9.0000
	5.00E-04	--	60000.			
	Rock	100.0000	97.5000	--	661.0000	9.0000
	5.00E-04	--	60000.			

Modification Factors for p-y Curves

Distribution of p-y modifiers with depth defined using 2 points

Point	Depth X	p-mult	y-mult

No.	ft		
1	18.320	0.7000	1.0000
2	35.800	0.7000	1.0000

Static Loading Type

Static loading criteria were used when computing p-y curves for all analyses.

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 1

Load No.	Load Compute Top y vs. Pile Length Type	Condition 1 Run Analysis	Condition 2	Axial Thrust Force, lbs
1	5	y = 1.000000 in	S = 0.0000 in/in	385960.
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 = 2

Pile Section No. 1:

Dimensions and Properties of Drilled Shaft (Bored Pile):

Length of Section	=	35.800000 ft
Shaft Diameter	=	36.000000 in
Concrete Cover Thickness (to edge of trans. reinf.)	=	6.000000 in
Number of Reinforcing Bars	=	15 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	=	15.000000 sq. in.
Area Ratio of Steel Reinforcement	=	1.47 percent
Edge-to-Edge Bar Spacing	=	3.367467 in
Maximum Concrete Aggregate Size	=	0.375000 in
Ratio of Bar Spacing to Aggregate Size	=	8.98
Offset of Center of Rebar Cage from Center of Pile	=	0.0000 in
Transverse Reinforcement		
Type: Hoop		
Number of Transverse Reinf. (per spacing)	=	1
Spacing of Transverse Reinf.	=	4.500000 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	=	4309.778 kips
Tensile Load for Cracking of Concrete	=	-467.292 kips
Nominal Axial Tensile Capacity	=	-900.000 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	10.811000	0.00000
2	1.128000	1.000000	9.876340	4.397230
3	1.128000	1.000000	7.233971	8.034139
4	1.128000	1.000000	3.340783	10.281872
5	1.128000	1.000000	-1.13006	10.751776
6	1.128000	1.000000	-5.40550	9.362601
7	1.128000	1.000000	-8.74628	6.354546
8	1.128000	1.000000	-10.57475	2.247733
9	1.128000	1.000000	-10.57475	-2.24773
10	1.128000	1.000000	-8.74628	-6.35455
11	1.128000	1.000000	-5.40550	-9.36260

12	1.128000	1.000000	-1.13006	-10.75178
13	1.128000	1.000000	3.340783	-10.28187
14	1.128000	1.000000	7.233971	-8.03414
15	1.128000	1.000000	9.876340	-4.39723

NOTE: The positions of the above rebars were computed by LPile

Minimum spacing between any two bars not equal to zero = 3.367 inches
between bars 7 and 8.

Ratio of bar spacing to maximum aggregate size = 8.98

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	=	0.375000 in

Number of Axial Thrust Force Values Determined from Pile-head Loadings = 1

Number	Axial Thrust Force kips
1	385.960

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 = 385.960 kips

Bending Curvature rad/in.	Bending Max Conc Stress ksi	Bending Max Steel Moment in-kip	Bending Stiffness kip-in2	Depth to N Axis in	Max Comp Strain in/in	Max Tens Strain in/in	Run Msg
6.25000E-07	222.5201610	356032258.	152.4455588	0.00009528	0.00007278	0.3934337	2.6423633
0.00000125	445.0407860	356032629.	85.2418991	0.0001066	0.00006155	0.4382428	2.8485938
0.00000188	667.5504518	356026908.	62.8491738	0.0001178	0.00005034	0.4828352	3.0552863
0.00000250	890.0436802	356017472.	51.6591823	0.0001291	0.00003915	0.5272096	3.2624407
0.00000313	1113.	356004798.	44.9502849	0.0001405	0.00002797	0.5713648	3.4700571
0.00000375	1335.	355989042.	40.4819349	0.0001518	0.00001681	0.6152997	3.6781354
0.00000438	1557.	355970274.	37.2938983	0.0001632	0.00000566	0.6590130	3.8866759
0.00000500	1780.	355948025.	34.9060516	0.0001745	-0.00000547	0.7025034	4.0956775
0.00000563	2002.	355906879.	33.0514581	0.0001859	-0.00001659	0.7457654	4.3051066
0.00000625	2224.	355821017.	31.5697065	0.0001973	-0.00002769	0.7887873	4.5148843
0.00000688	2445.	355679246.	30.3478837	0.0002086	-0.00003886	0.8315590	4.7249389
0.00000750	2666.	355480600.	29.3440111	0.0002201	-0.00004992	0.8740726	4.9352156
0.00000813	2886.	355228808.	28.4945904	0.0002315	-0.00006098	0.9163223	5.1456732
0.00000875	3106.	354929379.	27.7665026	0.0002430	-0.00007204	0.9583038	5.3562817
0.00000938	3324.	354588045.	27.1354907	0.0002544	-0.00008310	1.0000139	5.5670187
0.00001000	3542.	354210059.	26.5833829	0.0002658	-0.00009417	1.0414499	5.7778667
0.00001063	3759.	353800101.	26.0962703	0.0002773	-0.000105	1.0826100	5.9888121
0.00001125	3759.	334144539.	24.4068716	0.0002746	-0.000130	1.0724288	5.7899169 C
0.00001188	3759.	316557985.	23.8787589	0.0002836	-0.000144	1.1045255	5.9297101 C
0.00001250	3759.	300730085.	23.3929188	0.0002924	-0.000158	1.1359725	6.0656831 C

0.00001313 3759. 286409605. 22.9448860 0.0003012 -0.000171
1.1668514 6.1984347 C
0.00001375 3759. 273390987. 22.5297908 0.0003098 -0.000185
1.1971890 6.3281321 C
0.00001438 3759. 261504422. 22.1441138 0.0003183 -0.000199
1.2270164 6.4549805 C
0.00001500 3759. 250608405. 21.7843979 0.0003268 -0.000213
1.2563590 6.5791439 C
0.00001563 3759. 240584068. 21.4476431 0.0003351 -0.000227
1.2852363 6.7007397 C
0.00001625 3805. 234169321. 21.1319199 0.0003434 -0.000242
1.3136757 6.8199575 C
0.00001688 3874. 229564845. 20.8351694 0.0003516 -0.000256
1.3417085 6.9370206 C
0.00001750 3941. 225197230. 20.5559397 0.0003597 -0.000270
1.3693707 7.0521980 C
0.00001813 4007. 221055961. 20.2928644 0.0003678 -0.000285
1.3966993 7.1657744 C
0.00001875 4071. 217106593. 20.0436217 0.0003758 -0.000299
1.4236514 7.2773597 C
0.00001938 4134. 213342459. 19.8073628 0.0003838 -0.000314
1.4502578 7.3871845 C
0.00002000 4195. 209773229. 19.5842026 0.0003917 -0.000328
1.4766134 7.4960391 C
0.00002063 4256. 206348965. 19.3710820 0.0003995 -0.000343
1.5025924 7.6028197 C
0.00002125 4316. 203089253. 19.1688101 0.0004073 -0.000358
1.5283170 7.7085563 C
0.00002188 4374. 199973303. 18.9760518 0.0004151 -0.000372
1.5537601 7.8129964 C
0.00002250 4432. 196988944. 18.7918686 0.0004228 -0.000387
1.5789132 7.9160448 C
0.00002313 4489. 194136826. 18.6162543 0.0004305 -0.000402
1.6038311 8.0181628 C
0.00002375 4546. 191400748. 18.4480561 0.0004381 -0.000417
1.6284785 8.1190236 C
0.00002438 4601. 188777143. 18.2870469 0.0004457 -0.000432
1.6528847 8.2188688 C
0.00002563 4711. 183843579. 17.9848161 0.0004609 -0.000462
1.7010074 -8.438320 C
0.00002688 4818. 179292658. 17.7066224 0.0004759 -0.000492
1.7482828 -9.066764 C
0.00002813 4924. 175087072. 17.4500910 0.0004908 -0.000522
1.7947956 -9.697707 C
0.00002938 5028. 171161678. 17.2105223 0.0005056 -0.000552
1.8403774 -10.332798 C
0.00003063 5130. 167516408. 16.9883518 0.0005203 -0.000582
1.8852793 -10.969805 C
0.00003188 5231. 164119331. 16.7815957 0.0005349 -0.000613
1.9295141 -11.608670 C

0.00003313 5331. 160929368. 16.5871061 0.0005494 -0.000643
1.9729478 -12.250739 C
0.00003438 5430. 157953717. 16.4062702 0.0005640 -0.000674
2.0158708 -12.893296 C
0.00003563 5527. 155142693. 16.2348511 0.0005784 -0.000704
2.0579903 -13.539230 C
0.00003688 5624. 152509535. 16.0748694 0.0005928 -0.000735
2.0996383 -14.185360 C
0.00003813 5720. 150019964. 15.9233648 0.0006071 -0.000765
2.1406077 -14.833767 C
0.00003938 5815. 147670191. 15.7804385 0.0006214 -0.000796
2.1810251 -15.483246 C
0.00004063 5909. 145456495. 15.6465023 0.0006356 -0.000827
2.2210054 -16.132652 C
0.00004188 6003. 143343789. 15.5178097 0.0006498 -0.000858
2.2602265 -16.785322 C
0.00004313 6096. 141348489. 15.3968329 0.0006640 -0.000889
2.2990573 -17.437502 C
0.00004438 6188. 139457033. 15.2828426 0.0006782 -0.000919
2.3374383 -18.089804 C
0.00004563 6280. 137644678. 15.1727224 0.0006923 -0.000950
2.3751043 -18.745079 C
0.00004688 6371. 135924406. 15.0686041 0.0007063 -0.000981
2.4123836 -19.399866 C
0.00004813 6463. 134289010. 14.9704290 0.0007205 -0.001012
2.4492749 -20.054163 C
0.00004938 6553. 132719428. 14.8759992 0.0007345 -0.001043
2.4855364 -20.710641 C
0.00005063 6643. 131217266. 14.7854389 0.0007485 -0.001074
2.5212980 -21.367915 C
0.00005188 6733. 129783413. 14.6995681 0.0007625 -0.001105
2.5566753 -22.024700 C
0.00005313 6822. 128413035. 14.6176268 0.0007766 -0.001136
2.5916670 -22.680993 C
0.00005438 6911. 127094425. 14.5393844 0.0007906 -0.001167
2.6261063 -23.338721 C
0.00005563 6999. 125824593. 14.4634262 0.0008045 -0.001198
2.6600071 -23.997773 C
0.00005688 7087. 124606899. 14.3911058 0.0008185 -0.001229
2.6935257 -24.656333 C
0.00005813 7175. 123437958. 14.3221900 0.0008325 -0.001260
2.7266606 -25.314397 C
0.00005938 7262. 122314682. 14.2557913 0.0008464 -0.001291
2.7594106 -25.971961 C
0.00006063 7350. 121229861. 14.1925938 0.0008604 -0.001322
2.7916552 -26.630505 C
0.00006188 7436. 120179714. 14.1310536 0.0008744 -0.001353
2.8233559 -27.290553 C
0.00006313 7522. 119167860. 14.0719364 0.0008883 -0.001384
2.8546746 -27.950099 C

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0.00006438        7609.    118192049.    14.0153856     0.0009022     -0.001415
2.8856097    -28.609140 C
0.00006563        7695.    117250204.    13.9612561     0.0009162     -0.001446
2.9161601    -29.267673 C
0.00006688        7780.    116340413.    13.9094130     0.0009302     -0.001477
2.9463243    -29.925693 C
0.00006813        7866.    115460837.    13.8586938     0.0009441     -0.001508
2.9760994    -30.583219 C
0.00006938        7951.    114603158.    13.8102390     0.0009581     -0.001539
3.0052590    -31.243333 C
0.00007063        8035.    113772883.    13.7633490     0.0009720     -0.001570
3.0340347    -31.902928 C
0.00007188        8120.    112968564.    13.7180499     0.0009860     -0.001602
3.0624249    -32.562002 C
0.00007313        8204.    112188853.    13.6745470     0.0010000     -0.001633
3.0904283    -33.220552 C
0.00007438        8288.    111432494.    13.6327511     0.0010139     -0.001664
3.1180433    -33.878573 C
0.00007938        8621.    108615926.    13.4804093     0.0010700     -0.001787
3.2244956    -36.506793 C
0.00008438        8950.    106078474.    13.3457755     0.0011260     -0.001911
3.3240523    -39.135868 C
0.00008938        9276.    103785871.    13.2296683     0.0011824     -0.002035
3.4172735    -41.755968 C
0.00009438        9598.    101697250.    13.1288387     0.0012390     -0.002158
3.5040006    -44.367919 C
0.00009938        9915.     99774760.    13.0385798     0.0012957     -0.002282
3.5838011    -46.978655 C
 0.0001044       10229.     98001210.    12.9602315     0.0013527     -0.002405
3.6570303    -49.579512 C
 0.0001094       10539.     96355257.    12.8922557     0.0014101     -0.002527
3.7235709    -52.170187 C
 0.0001144       10845.     94819228.    12.8319695     0.0014677     -0.002650
3.7833000    -54.750363 C
 0.0001194       11147.     93378381.    12.7813434     0.0015258     -0.002772
3.8360889    -57.319699 C
 0.0001244       11445.     92017939.    12.7370690     0.0015842     -0.002893
3.8816503    -59.883884 C
 0.0001294       11728.     90647399.    12.6948213     0.0016424     -0.003015
3.9197558    -60.000000 CY
 0.0001344       11962.     89019857.    12.6430641     0.0016989     -0.003139
3.9496889    -60.000000 CY
 0.0001394       12159.     87240207.    12.5857795     0.0017541     -0.003263
3.9722130    -60.000000 CY
 0.0001444       12329.     85394503.    12.5263362     0.0018085     -0.003389
3.9878945    -60.000000 CY
 0.0001494       12483.     83568038.    12.4671466     0.0018623     -0.003515
3.9971163    -60.000000 CY
 0.0001544       12620.     81748917.    12.4106283     0.0019159     -0.003642
3.9993846    -60.000000 CY
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 0.0001594        12738.     79924137.    12.3502260     0.0019683     -0.003769
3.9999842    -60.000000 CY
 0.0001644        12850.     78174318.    12.2959845     0.0020212     -0.003896
3.9998141    -60.000000 CY
 0.0001694        12954.     76480851.    12.2457610     0.0020741     -0.004023
3.9992659    -60.000000 CY
 0.0001744        13044.     74803298.    12.1946492     0.0021264     -0.004151
3.9979869    -60.000000 CY
 0.0001794        13123.     73157671.    12.1444657     0.0021784     -0.004279
3.9995057    -60.000000 CY
 0.0001844        13197.     71577853.    12.0975852     0.0022305     -0.004407
3.9995185    -60.000000 CY
 0.0001894        13270.     70070741.    12.0561124     0.0022831     -0.004534
3.9975919    -60.000000 CY
 0.0001944        13337.     68614820.    12.0143018     0.0023353     -0.004662
3.9999618    -60.000000 CY
 0.0001994        13397.     67193802.    11.9727710     0.0023871     -0.004790
3.9984323    -60.000000 CY
 0.0002044        13449.     65805129.    11.9332039     0.0024388     -0.004919
3.9997600    -60.000000 CY
 0.0002094        13494.     64450454.    11.8935153     0.0024902     -0.005047
3.9984868    -60.000000 CY
 0.0002144        13538.     63148983.    11.8558770     0.0025416     -0.005176
3.9999998    -60.000000 CY
 0.0002194        13579.     61899916.    11.8223204     0.0025935     -0.005304
3.9979312    -60.000000 CY
 0.0002244        13620.     60702587.    11.7913787     0.0026457     -0.005432
3.9999291    -60.000000 CY
 0.0002294        13660.     59551746.    11.7609404     0.0026977     -0.005560
3.9965656    -60.000000 CY
 0.0002344        13696.     58437790.    11.7348597     0.0027504     -0.005687
3.9994633    -60.000000 CY
 0.0002394        13731.     57361570.    11.7087024     0.0028028     -0.005815
3.9963433    -60.000000 CY
 0.0002444        13759.     56302423.    11.6804720     0.0028544     -0.005943
3.9978661    -60.000000 CY
 0.0002494        13785.     55278593.    11.6524557     0.0029058     -0.006072
3.9998172    -60.000000 CY
 0.0002544        13806.     54276073.    11.6248510     0.0029571     -0.006200
3.9944490    -60.000000 CY
 0.0002594        13827.     53309016.    11.5987335     0.0030084     -0.006329
3.9977197    -60.000000 CY
 0.0002644        13847.     52374878.    11.5737322     0.0030598     -0.006458
3.9997075    -60.000000 CY
 0.0002694        13866.     51472993.    11.5504845     0.0031114     -0.006586
3.9959293    -60.000000 CY
 0.0002744        13884.     50601625.    11.5289771     0.0031633     -0.006714
3.9964154    -60.000000 CY
 0.0003044        13981.     45934267.    11.4236472     0.0034771     -0.007480
3.9993842    -60.000000 CYT
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    0.0003344        14034.     41970303.    11.3334748     0.0037896     -0.008248
   3.9922874    -60.000000 CYT
    0.0003644        14034.     38514772.    11.4148403     0.0041593     -0.008958
   3.9994283    -60.000000 CYT


--------------------------------------------------------------------------------
   Summary of Results for Nominal Moment Capacity for Section 1
--------------------------------------------------------------------------------

Moment values interpolated at maximum compressive strain = 0.003
or maximum developed moment if pile fails at smaller strains.

 Load           Axial Thrust        Nominal Mom. Cap.      Max. Comp.      Max.
Tens.
  No.              kips                 in-kip               Strain
Strain
 ----         ----------------     ------------------     ------------
------------
   1               385.960             13823.656           0.00300000
-0.00630798

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         385.960000        13824.    250.874000         8985.
105831914.

   1       0.75         385.960000        13824.    289.470000        10368.
97263852.
```

1 0.90 385.960000 13824. 347.364000 12441.
84061971.

Pile Section No. 2:

Dimensions and Properties of Drilled Shaft (Bored Pile):

Length of Section	=	5.000000 ft
Shaft Diameter	=	30.000000 in
Concrete Cover Thickness (to edge of trans. reinf.)	=	3.000000 in
Number of Reinforcing Bars	=	15 bars
Yield Stress of Reinforcing Bars	=	60000. psi
Modulus of Elasticity of Reinforcing Bars	=	29000000. psi
Gross Area of Shaft	=	706.858347 sq. in.
Total Area of Reinforcing Steel	=	15.000000 sq. in.
Area Ratio of Steel Reinforcement	=	2.12 percent
Edge-to-Edge Bar Spacing	=	3.367467 in
Maximum Concrete Aggregate Size	=	0.375000 in
Ratio of Bar Spacing to Aggregate Size	=	8.98
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.	=	4.500000 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	=	3252.318 kips
Tensile Load for Cracking of Concrete	=	-337.937 kips
Nominal Axial Tensile Capacity	=	-900.000 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	10.811000	0.00000
2	1.128000	1.000000	9.876340	4.397230
3	1.128000	1.000000	7.233971	8.034139
4	1.128000	1.000000	3.340783	10.281872
5	1.128000	1.000000	-1.13006	10.751776
6	1.128000	1.000000	-5.40550	9.362601
7	1.128000	1.000000	-8.74628	6.354546

8	1.128000	1.000000	-10.57475	2.247733
9	1.128000	1.000000	-10.57475	-2.24773
10	1.128000	1.000000	-8.74628	-6.35455
11	1.128000	1.000000	-5.40550	-9.36260
12	1.128000	1.000000	-1.13006	-10.75178
13	1.128000	1.000000	3.340783	-10.28187
14	1.128000	1.000000	7.233971	-8.03414
15	1.128000	1.000000	9.876340	-4.39723

NOTE: The positions of the above rebars were computed by LPile

Minimum spacing between any two bars not equal to zero = 3.367 inches
between bars 7 and 8.

Ratio of bar spacing to maximum aggregate size = 8.98

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	=	0.375000 in

Number of Axial Thrust Force Values Determined from Pile-head Loadings = 1

Number	Axial Thrust Force kips
1	385.960

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 = 385.960 kips

Bending Curvature rad/in.	Bending Moment in-kip	Bending Stiffness kip-in2	Depth to N Axis in	Max Comp Strain in/in	Max Tens Strain in/in	Max Conc Stress ksi	Max Steel Stress ksi	Run Msg
0.00000125	225.1024019	180081922.	109.2197645	0.0001365	0.00009902	0.5573328	3.8232790	
0.00000250	450.1991563	180079663.	62.1356221	0.0001553	0.00008034	0.6302324	4.2329576	
0.00000375	675.2677780	180071407.	46.4523441	0.0001742	0.00006170	0.7025170	4.6438799	
0.00000500	900.2942023	180058840.	38.6192835	0.0001931	0.00004310	0.7741813	5.0560461	
0.00000625	1125.	180042298.	33.9263114	0.0002120	0.00002454	0.8452199	5.4694565	
0.00000750	1350.	180021890.	30.8033852	0.0002310	0.00000603	0.9156274	5.8841113	
0.00000875	1575.	179996050.	28.5775943	0.0002501	-0.00001245	0.9853972	6.3000021	
0.00001000	1799.	179943416.	26.9120067	0.0002691	-0.00003088	1.0545055	6.7169817	
0.00001125	2023.	179841738.	25.6191312	0.0002882	-0.00004928	1.1229170	7.1348040	
0.00001250	2246.	179686548.	24.5798732	0.0003072	-0.00006775	1.1906046	7.5532784	
0.00001375	2468.	179481663.	23.7396317	0.0003264	-0.00008608	1.2575496	7.9722745	
0.00001500	2688.	179232980.	23.0396426	0.0003456	-0.000104	1.3237383	8.3916966	
0.00001625	2688.	165445828.	21.7596313	0.0003536	-0.000134	1.3506866	8.4870391	C
0.00001750	2688.	153628269.	21.1150429	0.0003695	-0.000155	1.4047083	8.8127593	C
0.00001875	2738.	146020882.	20.5422065	0.0003852	-0.000177	1.4572737	9.1307623	C
0.00002000	2842.	142120028.	20.0279844	0.0004006	-0.000199	1.5084318	9.4412310	C
0.00002125	2942.	138467303.	19.5641351	0.0004157	-0.000222	1.5583572	9.7454608	C
0.00002250	3039.	135049943.	19.1432389	0.0004307	-0.000244	1.6071437	10.0440884	C

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0.00002375        3132.    131861097.    18.7596882     0.0004455     -0.000267
1.6549105    10.3380065 C
0.00002500        3222.    128864660.    18.4076330     0.0004602     -0.000290
1.7016259    10.6267840 C
0.00002625        3309.    126057256.    18.0834509     0.0004747     -0.000313
1.7474080    10.9113396 C
0.00002750        3394.    123425254.    17.7839996     0.0004891     -0.000336
1.7923188    11.1921148 C
0.00002875        3477.    120955409.    17.5065217     0.0005033     -0.000359
1.8364128    11.4695001 C
0.00003000        3559.    118636863.    17.2487462     0.0005175     -0.000383
1.8797508    11.7439632 C
0.00003125        3639.    116446894.    17.0078308     0.0005315     -0.000406
1.9222843    12.0149527 C
0.00003250        3718.    114385344.    16.7828252     0.0005454     -0.000430
1.9641286    12.2834668 C
0.00003375        3795.    112444207.    16.5724135     0.0005593     -0.000453
2.0053380    12.5499558 C
0.00003500        3871.    110611106.    16.3750096     0.0005731     -0.000477
2.0459167    12.8143961 C
0.00003625        3946.    108867538.    16.1883742     0.0005868     -0.000501
2.0857761    13.0758478 C
0.00003750        4021.    107224195.    16.0133496     0.0006005     -0.000524
2.1251343    13.3363965 C
0.00003875        4094.    105657371.    15.8472707     0.0006141     -0.000548
2.1638226    13.5943100 C
0.00004000        4167.    104173669.    15.6906890     0.0006276     -0.000572
2.2020072    13.8512002 C
0.00004125        4239.    102758948.    15.5419767     0.0006411     -0.000596
2.2396024    14.1061516 C
0.00004250        4310.    101415482.    15.4013218     0.0006546     -0.000620
2.2767190    14.3602541 C
0.00004375        4381.    100130033.    15.2671503     0.0006679     -0.000645
2.3132528    14.6123846 C
0.00004500        4451.     98911209.    15.1405540     0.0006813     -0.000669
2.3494101    14.8646731 C
0.00004625        4520.     97736709.    15.0186814     0.0006946     -0.000693
2.3849115    15.1141190 C
0.00004750        4589.     96621004.    14.9034741     0.0007079     -0.000717
2.4200652    -15.629768 C
0.00004875        4658.     95550808.    14.7933203     0.0007212     -0.000741
2.4547094    -16.196881 C
0.00005125        4794.     93543099.    14.5876353     0.0007476     -0.000790
2.5226604    -17.333190 C
0.00005375        4928.     91689221.    14.3986545     0.0007739     -0.000839
2.5887548    -18.473285 C
0.00005625        5061.     89981633.    14.2260930     0.0008002     -0.000887
2.6532843    -19.613996 C
0.00005875        5193.     88390289.    14.0658287     0.0008264     -0.000936
2.7159667    -20.758776 C
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0.00006125 5324. 86915724. 13.9187937 0.0008525 -0.000985
2.7771765 -21.903295 C
0.00006375 5453. 85533856. 13.7814677 0.0008786 -0.001034
2.8366259 -23.051181 C
0.00006625 5581. 84248027. 13.6553585 0.0009047 -0.001083
2.8947200 -24.197428 C
0.00006875 5709. 83033927. 13.5363330 0.0009306 -0.001132
2.9510149 -25.347833 C
0.00007125 5835. 81896805. 13.4263265 0.0009566 -0.001181
3.0059389 -26.496859 C
0.00007375 5961. 80826490. 13.3239056 0.0009826 -0.001230
3.0594004 -27.645684 C
0.00007625 6086. 79811220. 13.2269719 0.0010086 -0.001279
3.1112077 -28.797071 C
0.00007875 6210. 78853525. 13.1369615 0.0010345 -0.001328
3.1616601 -29.946776 C
0.00008125 6333. 77948021. 13.0532106 0.0010606 -0.001377
3.2107487 -31.094783 C
0.00008375 6456. 77082636. 12.9732000 0.0010865 -0.001426
3.2581526 -32.246028 C
0.00008625 6577. 76260801. 12.8982845 0.0011125 -0.001475
3.3041809 -33.395756 C
0.00008875 6699. 75479067. 12.8283395 0.0011385 -0.001524
3.3488382 -34.543741 C
0.00009125 6819. 74734074. 12.7628933 0.0011646 -0.001573
3.3921149 -35.689964 C
0.00009375 6939. 74018714. 12.7003526 0.0011907 -0.001622
3.4337982 -36.838104 C
0.00009625 7058. 73333704. 12.6411214 0.0012167 -0.001671
3.4740455 -37.985406 C
0.00009875 7177. 72677707. 12.5856425 0.0012428 -0.001720
3.5129022 -39.130886 C
0.0001013 7295. 72048514. 12.5335318 0.0012690 -0.001768
3.5503583 -40.274523 C
0.0001038 7412. 71444126. 12.4845531 0.0012953 -0.001817
3.5864038 -41.416297 C
0.0001063 7529. 70861920. 12.4383246 0.0013216 -0.001866
3.6209818 -42.557219 C
0.0001088 7645. 70298819. 12.3937022 0.0013478 -0.001915
3.6540008 -43.699299 C
0.0001113 7760. 69755823. 12.3516862 0.0013741 -0.001963
3.6855950 -44.839435 C
0.0001138 7875. 69231551. 12.3119222 0.0014005 -0.002012
3.7157536 -45.977602 C
0.0001163 7989. 68724733. 12.2746396 0.0014269 -0.002061
3.7444656 -47.113776 C
0.0001188 8103. 68234209. 12.2395147 0.0014534 -0.002109
3.7717198 -48.247931 C
0.0001213 8216. 67758912. 12.2064217 0.0014800 -0.002157
3.7975048 -49.380041 C

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 0.0001238        8328.     67297862.    12.1752448     0.0015067     -0.002206
3.8218090    -50.510079 C
 0.0001263        8440.     66849934.    12.1458143     0.0015334     -0.002254
3.8446070    -51.638484 C
 0.0001288        8551.     66413227.    12.1173805     0.0015601     -0.002302
3.8658242    -52.767668 C
 0.0001313        8661.     65988398.    12.0904825     0.0015869     -0.002351
3.8855389    -53.894663 C
 0.0001338        8771.     65574721.    12.0651623     0.0016137     -0.002399
3.9037382    -55.019440 C
 0.0001363        8880.     65171524.    12.0411807     0.0016406     -0.002447
3.9204093    -56.141963 C
 0.0001388        8988.     64778179.    12.0187965     0.0016676     -0.002495
3.9355388    -57.262202 C
 0.0001413        9096.     64394104.    11.9977614     0.0016947     -0.002543
3.9491132    -58.380122 C
 0.0001438        9203.     64018753.    11.9780317     0.0017218     -0.002591
3.9611184    -59.495689 C
 0.0001463        9308.     63643041.    11.9590336     0.0017490     -0.002638
3.9715139    -60.000000 CY
 0.0001488        9409.     63254095.    11.9399478     0.0017761     -0.002686
3.9802636    -60.000000 CY
 0.0001588        9744.     61377727.    11.8492361     0.0018811     -0.002881
3.9990558    -60.000000 CY
 0.0001688        9996.     59236191.    11.7445373     0.0019819     -0.003081
3.9989236    -60.000000 CY
 0.0001788       10204.     57086819.    11.6431063     0.0020812     -0.003281
3.9977279    -60.000000 CY
 0.0001888       10372.     54953073.    11.5424379     0.0021786     -0.003484
3.9996023    -60.000000 CY
 0.0001988       10518.     52922762.    11.4491959     0.0022755     -0.003687
3.9994688    -60.000000 CY
 0.0002088       10647.     51005026.    11.3623739     0.0023719     -0.003891
3.9975503    -60.000000 CY
 0.0002188       10751.     49146910.    11.2770083     0.0024668     -0.004096
3.9979349    -60.000000 CY
 0.0002288       10844.     47405916.    11.1967977     0.0025613     -0.004301
3.9976658    -60.000000 CY
 0.0002388       10933.     45793686.    11.1245725     0.0026560     -0.004507
3.9967258    -60.000000 CY
 0.0002488       11012.     44270579.    11.0565335     0.0027503     -0.004712
3.9981645    -60.000000 CY
 0.0002588       11076.     42806423.    10.9887147     0.0028433     -0.004919
3.9998025    -60.000000 CY
 0.0002688       11131.     41418864.    10.9226771     0.0029355     -0.005127
3.9982690    -60.000000 CY
 0.0002788       11184.     40122979.    10.8607753     0.0030274     -0.005335
3.9961647    -60.000000 CY
 0.0002888       11236.     38912782.    10.8048413     0.0031199     -0.005543
3.9994341    -60.000000 CY
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 0.0002988        11286.     37776395.    10.7541942     0.0032128     -0.005750
3.9955884    60.0000000 CY
 0.0003088        11330.     36697695.    10.7065569     0.0033056     -0.005957
3.9997010    60.0000000 CY
 0.0003188        11367.     35662337.    10.6618620     0.0033985     -0.006164
3.9951599    60.0000000 CY
 0.0003288        11398.     34670312.    10.6163084     0.0034901     -0.006372
3.9993806    60.0000000 CY
 0.0003388        11420.     33713076.    10.5743413     0.0035821     -0.006580
3.9940312    60.0000000 CYT
 0.0003488        11441.     32804840.    10.5364827     0.0036746     -0.006788
3.9979589    60.0000000 CYT
 0.0003588        11458.     31939319.    10.5041655     0.0037684     -0.006994
3.9999980    60.0000000 CYT
 0.0003688        11458.     31073168.    10.5007981     0.0038722     -0.007190
3.9958689    60.0000000 CYT


-------------------------------------------------------------------------------
   Summary of Results for Nominal Moment Capacity for Section 2
-------------------------------------------------------------------------------

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               385.960             11168.479           0.00300000
-0.00527299

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 No.	Factor	Ax. Thrust kips	Moment Cap in-kips	Ax. Thrust kips	Moment Cap in-kips	at Ult Mom kip-in^2
1	0.65	385.960000	11168.	250.874000	7260.	72237295.
1	0.75	385.960000	11168.	289.470000	8376.	67104369.
1	0.90	385.960000	11168.	347.364000	10052.	58662882.

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	18.3200	0.00	N.A.	No	0.00	14762.
2	22.1000	3.7789	Yes	No	14762.	169403.
3	35.8000	17.4800	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 Displacement and Pile-head Rotation (Loading Type 5)
Displacement of pile head = 1.000000 inches
Rotation of pile head = 0.000E+00 radians
Axial load on pile head = 385960.0 lbs

Depth X	Deflect. y	Bending Moment	Shear Force	Slope S	Total Stress	Bending Stiffness	Soil Res. Es*H	Soil Spr. Lat. Load	Distrib. p
feet	inches	in-lbs	lbs	radians	psi*	lb-in^2	lb/inch	lb/inch	lb/inch
0.00	1.0000	-8928794.	59572.	0.00	0.00	1.06E+11	0.00	0.00	0.00
0.4080	0.9990	-8636753.	59570.	-4.05E-04	0.00	1.06E+11	0.00	0.00	0.00
0.8160	0.9960	-8343959.	59570.	-7.88E-04	0.00	1.11E+11	0.00	0.00	0.00
1.2240	0.9913	-8050469.	59570.	-0.00115	0.00	1.14E+11	0.00	0.00	0.00
1.6320	0.9848	-7756324.	59570.	-0.00148	0.00	1.17E+11	0.00	0.00	0.00
2.0400	0.9768	-7461563.	59570.	-0.00180	0.00	1.20E+11	0.00	0.00	0.00
2.4480	0.9672	-7166226.	59570.	-0.00209	0.00	1.24E+11	0.00	0.00	0.00
2.8560	0.9563	-6870353.	59570.	-0.00237	0.00	1.28E+11	0.00	0.00	0.00
3.2640	0.9441	-6573982.	59570.	-0.00262	0.00	1.32E+11	0.00	0.00	0.00
3.6720	0.9306	-6277151.	59570.	-0.00285	0.00	1.38E+11	0.00	0.00	0.00
4.0800	0.9161	-5979899.	59570.	-0.00306	0.00	1.44E+11	0.00	0.00	0.00
4.4880	0.9006	-5682262.	59570.	-0.00326	0.00	1.51E+11	0.00	0.00	0.00
4.8960	0.8842	-5384276.	59570.	-0.00343	0.00	1.59E+11	0.00	0.00	0.00
5.3040	0.8670	-5085979.	59570.	-0.00359	0.00	1.69E+11	0.00	0.00	0.00
5.7120	0.8491	-4787402.	59570.	-0.00373	0.00	1.81E+11	0.00	0.00	0.00
6.1200	0.8305	-4488581.	59570.	-0.00385	0.00	1.94E+11	0.00	0.00	0.00
6.5280	0.8114	-4189545.	59570.	-0.00396	0.00	2.10E+11	0.00	0.00	0.00
6.9360	0.7918	-3890325.	59570.	-0.00405	0.00	2.28E+11	0.00	0.00	0.00
7.3440	0.7718	-3590948.	59570.	-0.00411	0.00	3.54E+11	0.00	0.00	0.00
7.7520	0.7515	-3291476.	59570.	-0.00416	0.00	3.55E+11	0.00	0.00	0.00
8.1600	0.7310	-2991919.	59570.	-0.00420	0.00	3.55E+11	0.00	0.00	0.00

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    8.5680     0.7103  -2692284.     59570.   -0.00424       0.00   3.55E+11
0.00       0.00       0.00
    8.9760     0.6895  -2392579.     59570.   -0.00428       0.00   3.56E+11
0.00       0.00       0.00
    9.3840     0.6685  -2092811.     59570.   -0.00431       0.00   3.56E+11
0.00       0.00       0.00
    9.7920     0.6473  -1792990.     59570.   -0.00434       0.00   3.56E+11
0.00       0.00       0.00
   10.2000     0.6260  -1493121.     59570.   -0.00436       0.00   3.56E+11
0.00       0.00       0.00
   10.6080     0.6046  -1193214.     59570.   -0.00438       0.00   3.56E+11
0.00       0.00       0.00
   11.0160     0.5831   -893276.     59570.   -0.00439       0.00   3.56E+11
0.00       0.00       0.00
   11.4240     0.5616   -593314.     59570.   -0.00440       0.00   3.56E+11
0.00       0.00       0.00
   11.8320     0.5401   -293337.     59570.   -0.00441       0.00   3.56E+11
0.00       0.00       0.00
   12.2400     0.5185      6647.     59570.   -0.00441       0.00   3.56E+11
0.00       0.00       0.00
   12.6480     0.4969    306632.     59570.   -0.00441       0.00   3.56E+11
0.00       0.00       0.00
   13.0560     0.4753    606608.     59570.   -0.00440       0.00   3.56E+11
0.00       0.00       0.00
   13.4640     0.4538    906569.     59570.   -0.00439       0.00   3.56E+11
0.00       0.00       0.00
   13.8720     0.4323   1206506.     59570.   -0.00438       0.00   3.56E+11
0.00       0.00       0.00
   14.2800     0.4109   1506411.     59570.   -0.00436       0.00   3.56E+11
0.00       0.00       0.00
   14.6880     0.3897   1806278.     59570.   -0.00433       0.00   3.56E+11
0.00       0.00       0.00
   15.0960     0.3685   2106097.     59570.   -0.00431       0.00   3.56E+11
0.00       0.00       0.00
   15.5040     0.3475   2405862.     59570.   -0.00428       0.00   3.56E+11
0.00       0.00       0.00
   15.9120     0.3266   2705565.     59570.   -0.00424       0.00   3.55E+11
0.00       0.00       0.00
   16.3200     0.3060   3005196.     59570.   -0.00420       0.00   3.55E+11
0.00       0.00       0.00
   16.7280     0.2855   3304750.     59570.   -0.00416       0.00   3.55E+11
0.00       0.00       0.00
   17.1360     0.2652   3604217.     59570.   -0.00411       0.00   3.54E+11
0.00       0.00       0.00
   17.5440     0.2452   3903590.     59570.   -0.00404       0.00   2.28E+11
0.00       0.00       0.00
   17.9520     0.2256   4202805.     59570.   -0.00395       0.00   2.09E+11
0.00       0.00       0.00
   18.3600     0.2065   4501834.     59230.   -0.00385       0.00   1.94E+11
-138.794      3290.       0.00
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   18.7680     0.1880   4797320.     57214.   -0.00372       0.00   1.80E+11
-684.828     17836.       0.00
   19.1760     0.1701   5076144.     53196.   -0.00359       0.00   1.69E+11
-956.324     27531.       0.00
   19.5840     0.1529   5331767.     47941.   -0.00343       0.00   1.61E+11
-1190.     38125.       0.00
   19.9920     0.1365   5558548.     41625.   -0.00326       0.00   1.54E+11
-1390.     49852.       0.00
   20.4000     0.1209   5751685.     34416.   -0.00308       0.00   1.49E+11
-1555.     62959.       0.00
   20.8080     0.1063   5907188.     26477.   -0.00289       0.00   1.45E+11
-1688.     77724.       0.00
   21.2160    0.09268   6021854.     17968.   -0.00268       0.00   1.43E+11
-1788.     94446.       0.00
   21.6240    0.08005   6093274.      9053.   -0.00247       0.00   1.41E+11
-1854.    113404.       0.00
   22.0320    0.06845   6119847.    -76.649   -0.00226       0.00   1.41E+11
-1875.    134104.       0.00
   22.4400    0.05790   6101074.     -8384.   -0.00205       0.00   1.41E+11
-1519.    128418.       0.00
   22.8480    0.04838   6045497.    -15723.   -0.00184       0.00   1.42E+11
-1479.    149716.       0.00
   23.2560    0.03988   5954066.    -22836.   -0.00164       0.00   1.44E+11
-1426.    175073.       0.00
   23.6640    0.03236   5828073.    -29653.   -0.00144       0.00   1.47E+11
-1359.    205623.       0.00
   24.0720    0.02579   5669136.    -36114.   -0.00125       0.00   1.51E+11
-1280.    242953.       0.00
   24.4800    0.02013   5479169.    -42159.   -0.00107       0.00   1.57E+11
-1189.    289354.       0.00
   24.8880    0.01530   5260365.    -47735.  -9.07E-04       0.00   1.63E+11
-1088.    348311.       0.00
   25.2960    0.01124   5015176.    -52791.  -7.57E-04       0.00   1.72E+11
-976.863    425472.       0.00
   25.7040    0.00789   4746301.    -57275.  -6.22E-04       0.00   1.82E+11
-854.971    530870.       0.00
   26.1120    0.00515   4456690.    -61019.  -5.02E-04       0.00   1.96E+11
-674.578    640914.       0.00
   26.5200    0.00297   4150698.    -63671.  -3.99E-04       0.00   2.12E+11
-408.729    674473.       0.00
   26.9280    0.00125   3834729.    -65114.  -3.10E-04       0.00   2.32E+11
-180.667    708032.       0.00
   27.3360  -7.24E-05   3514275.    -65529.  -2.46E-04       0.00   3.54E+11
10.9725    741591.       0.00
   27.7440   -0.00116   3193993.    -65054.  -1.99E-04       0.00   3.55E+11
183.0832    775150.       0.00
   28.1520   -0.00202   2878016.    -63788.  -1.57E-04       0.00   3.55E+11
334.4083    808710.       0.00
   28.5600   -0.00270   2569980.    -61832.  -1.20E-04       0.00   3.56E+11
464.2255    842269.       0.00
```

```
   28.9680   -0.00320   2273006.    -59295.  -8.66E-05       0.00   3.56E+11
572.2879    875828.       0.00
   29.3760   -0.00355   1989690.    -56281.  -5.73E-05       0.00   3.56E+11
658.7695    909387.       0.00
   29.7840   -0.00376   1722114.    -52917.  -3.18E-05       0.00   3.56E+11
715.4367    931528.       0.00
   30.1920   -0.00386   1471643.    -49392.  -9.81E-06       0.00   3.56E+11
724.6615    919676.       0.00
   30.6000   -0.00386   1238504.    -45844.   8.83E-06       0.00   3.56E+11
724.5195    919862.       0.00
   31.0080   -0.00377   1022700.    -42317.   2.44E-05       0.00   3.56E+11
716.4987    930163.       0.00
   31.4160   -0.00362    824045.    -38845.   3.71E-05       0.00   3.56E+11
701.7394    949730.       0.00
   31.8240   -0.00341    642190.    -35460.   4.72E-05       0.00   3.56E+11
681.1409    978454.       0.00
   32.2320   -0.00316    476645.    -32188.   5.49E-05       0.00   3.56E+11
655.4248   1016848.       0.00
   32.6400   -0.00287    326799.    -29053.   6.04E-05       0.00   3.56E+11
625.1733   1066054.       0.00
   33.0480   -0.00256    191931.    -26076.   6.39E-05       0.00   3.56E+11
590.8521   1127981.       0.00
   33.4560   -0.00225     71221.    -23276.   6.58E-05       0.00   3.56E+11
552.8213   1205582.       0.00
   33.8640   -0.00192    -36240.    -20695.   6.60E-05       0.00   3.56E+11
501.5827   1278538.       0.00
   34.2720   -0.00160   -131676.    -18418.   6.48E-05       0.00   3.56E+11
428.4867   1312097.       0.00
   34.6800   -0.00129   -216837.    -16504.   6.24E-05       0.00   3.56E+11
353.4148   1345656.       0.00
   35.0880  -9.87E-04   -293522.    -14958.   5.89E-05       0.00   3.56E+11
278.1644   1379215.       0.00
   35.4960  -7.09E-04   -363531.    -13777.   5.44E-05       0.00   3.56E+11
204.5256   1412774.       0.00
   35.9040  -4.55E-04   -428627.     -6228.   4.61E-05       0.00   1.80E+11
2879.   3.10E+07       0.00
   36.3120  -2.57E-04   -424691.      5634.   3.45E-05       0.00   1.80E+11
1967.   3.74E+07       0.00
   36.7200  -1.17E-04   -373587.     13009.   2.36E-05       0.00   1.80E+11
1046.   4.38E+07       0.00
   37.1280  -2.60E-05   -297401.     16221.   1.45E-05       0.00   1.80E+11
266.8882   5.02E+07       0.00
   37.5360   2.52E-05   -214802.     16161.   7.55E-06       0.00   1.80E+11
-291.592   5.66E+07       0.00
   37.9440   4.79E-05   -139181.     13939.   2.74E-06       0.00   1.80E+11
-616.236   6.30E+07       0.00
   38.3520   5.21E-05    -78326.     10624.  -2.16E-07       0.00   1.80E+11
-737.651   6.94E+07       0.00
   38.7600   4.58E-05    -35148.      7084.  -1.76E-06       0.00   1.80E+11
-708.603   7.58E+07       0.00
```

```
   39.1680   3.48E-05     -8954.      3918.  -2.36E-06       0.00   1.80E+11
-584.685   8.21E+07       0.00
   39.5760   2.27E-05      3224.      1481.  -2.44E-06       0.00   1.80E+11
-410.620   8.85E+07       0.00
   39.9840   1.10E-05      5560.    -45.706  -2.32E-06       0.00   1.80E+11
-213.172   9.49E+07       0.00
   40.3920   2.20E-08      2786.   -568.667  -2.20E-06       0.00   1.80E+11
-0.456   1.01E+08       0.00
   40.8000  -1.06E-05       0.00       0.00  -2.17E-06       0.00   1.80E+11
232.7546   5.39E+07       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             =     1.00000000 inches
Computed slope at pile head      =       0.000000 radians
Maximum bending moment           =      -8928794. inch-lbs
Maximum shear force              =        -65529. lbs
Depth of maximum bending moment  =       0.000000 feet below pile head
Depth of maximum shear force     =    27.33600000 feet below pile head
Number of iterations             =             16
Number of zero deflection points =              3
Pile deflection at ground        =     0.20841170 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 Load                Load                  Axial    Pile-head  Pile-head  Max
Shear Max Moment
Case Type   Pile-head    Type     Pile-head   Loading  Deflection  Rotation    in
Pile    in Pile
 No.  1      Load 1       2        Load 2       lbs      inches     radians      lbs
```

```
     in-lbs
---- ----- ---------- ---------- ---------- ---------- ---------- ----------
---------- ----------
  1  y, in     1.0000   S, rad         0.00    385960.     1.0000       0.00
-65529.  -8928794.


Maximum pile-head deflection = 1.0000000000 inches
Maximum pile-head rotation   = 0.0000000000 radians = 0.000000 deg.

------------------------------------------------------------------------------
                            Summary of Warning Messages
------------------------------------------------------------------------------

The following warning was reported 221 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.
```

==

LPile for Windows, Version 2022-12.011

Analysis of Individual Piles and Drilled Shafts
Subjected to Lateral Loading Using the p-y Method
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Files Used for Analysis

Path to file locations:
\20240280\ODOT\109971\400-Engineering\Structures\SFN_0800512\Engdata\04_Abutment Design\Stage 2\Drilled Shaft\Lpile\Abutment\Forward Abutment\

Name of input data file:
FA_Scour Extreme II - Back DS.lp12d

Name of output report file:
FA_Scour Extreme II - Back DS.lp12o

Name of plot output file:
FA_Scour Extreme II - Back DS.lp12p

Name of runtime message file:
FA_Scour Extreme II - Back DS.lp12r

Date and Time of Analysis

Date: February 12, 2026 Time: 14:19:08

Problem Title

Project Name:

Job Number:

Client:

Engineer:

Description:

Program Options and Settings

Computational Options:
- Conventional Analysis

Engineering Units Used for Data Input and Computations:
- US Customary System Units (pounds, feet, inches)

Analysis Control Options:

- Maximum number of iterations allowed	=	500
- Deflection tolerance for convergence	=	1.0000E-05 in
- Maximum allowable deflection	=	100.0000 in
- Number of pile increments	=	100

Loading Type and Number of Cycles of Loading:

- Static loading specified

- Analysis uses p-y modification factors for p-y curves
- Analysis uses layering correction (Method of Georgiadis)
- No distributed lateral loads are entered
- Loading by lateral soil movements acting on pile not selected
- Input of shear resistance at the pile tip not selected
- Input of moment resistance at the pile tip not selected
- Computation of pile-head foundation stiffness matrix not selected
- Push-over analysis of pile not selected
- Buckling analysis of pile not selected

Output Options:
- Output files use decimal points to denote decimal symbols.
- Values of pile-head deflection, bending moment, shear force, and soil reaction are printed for full length of pile.
- Printing Increment (nodal spacing of output points) = 1
- No p-y curves to be computed and reported for user-specified depths
- Print using wide report formats

Pile Structural Properties and Geometry

Number of pile sections defined = 2
Total length of pile = 40.800 ft
Depth of ground surface below top of pile = 18.3200 ft

Pile diameters used for p-y curve computations are defined using 4 points.

p-y curves are computed using pile diameter values interpolated with depth over the length of the pile. A summary of values of pile diameter vs. depth follows.

Point No.	Depth Below Pile Head feet	Pile Diameter inches
1	0.000	36.0000
2	35.800	36.0000
3	35.800	30.0000
4	40.800	30.0000

Input Structural Properties for Pile Sections:

Pile Section No. 1:

```
   Section 1 is a round drilled shaft, bored pile, or CIDH pile
   Length of section                                  =    35.800000 ft
   Shaft Diameter                                     =    36.000000 in

Pile Section No. 2:

   Section 2 is a round drilled shaft, bored pile, or CIDH pile
   Length of section                                  =     5.000000 ft
   Shaft Diameter                                     =    30.000000 in



--------------------------------------------------------------------------------
                       Soil and Rock Layering Information
--------------------------------------------------------------------------------

The soil profile is modelled using 3 layers

Layer 1 is stiff clay with water-induced erosion

   Distance from top of pile to top of layer          =    18.320000 ft
   Distance from top of pile to bottom of layer       =    22.100000 ft
   Effective unit weight at top of layer              =    72.600000 pcf
   Effective unit weight at bottom of layer           =    72.600000 pcf
   Undrained cohesion at top of layer                 =        5600. psf
   Undrained cohesion at bottom of layer              =        5600. psf
   Epsilon-50 at top of layer                         =     0.004000
   Epsilon-50 at bottom of layer                      =     0.004000
   Subgrade k at top of layer                         =        2000. pci
   Subgrade k at bottom of layer                      =        2000. pci


Layer 2 is stiff clay with water-induced erosion

   Distance from top of pile to top of layer          =    22.100000 ft
   Distance from top of pile to bottom of layer       =    35.800000 ft
   Effective unit weight at top of layer              =    67.600000 pcf
   Effective unit weight at bottom of layer           =    67.600000 pcf
   Undrained cohesion at top of layer                 =        4600. psf
   Undrained cohesion at bottom of layer              =        4600. psf
   Epsilon-50 at top of layer                         =     0.004000
   Epsilon-50 at bottom of layer                      =     0.004000
   Subgrade k at top of layer                         =        2000. pci
   Subgrade k at bottom of layer                      =        2000. pci


Layer 3 is weak rock, p-y criteria by Reese, 1997

   Distance from top of pile to top of layer          =    35.800000 ft
```

Distance from top of pile to bottom of layer	=	100.000000 ft
Effective unit weight at top of layer	=	97.500000 pcf
Effective unit weight at bottom of layer	=	97.500000 pcf
Uniaxial compressive strength at top of layer	=	661.000000 psi
Uniaxial compressive strength at bottom of layer	=	661.000000 psi
Initial modulus of rock at top of layer	=	60000. psi
Initial modulus of rock at bottom of layer	=	60000. 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	=	0.0005000
k rm of rock at bottom of layer	=	0.0005000

(Depth of the lowest soil layer extends 59.200 ft below the pile tip)

Summary of Input Soil Properties

Layer Num.	Soil Type Name or (p-y Curve Type)	Layer Depth ft	Effective Unit Wt. pcf	Cohesion psf	Uniaxial qu psi	RQD %
	E50 krm	kpy pci	Rock Mass Modulus psi			
1	Stiff Clay	18.3200	72.6000	5600.	--	--
	0.00400	2000.	--			
	with Free Water	22.1000	72.6000	5600.	--	--
	0.00400	2000.	--			
2	Stiff Clay	22.1000	67.6000	4600.	--	--
	0.00400	2000.	--			
	with Free Water	35.8000	67.6000	4600.	--	--
	0.00400	2000.	--			
3	Weak	35.8000	97.5000	--	661.0000	9.0000
	5.00E-04	--	60000.			
	Rock	100.0000	97.5000	--	661.0000	9.0000
	5.00E-04	--	60000.			

Modification Factors for p-y Curves

Distribution of p-y modifiers with depth defined using 2 points

Point	Depth X	p-mult	y-mult

No.	ft		
1	18.320	0.5000	1.0000
2	35.800	0.5000	1.0000

Static Loading Type

Static loading criteria were used when computing p-y curves for all analyses.

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 1

Load No.	Load Compute Top y vs. Pile Length Type	Condition 1 Run Analysis	Condition 2	Axial Thrust Force, lbs
1	5	y = 1.000000 in	S = 0.0000 in/in	368880.
	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 = 2

Pile Section No. 1:

Dimensions and Properties of Drilled Shaft (Bored Pile):

Length of Section	=	35.800000 ft
Shaft Diameter	=	36.000000 in
Concrete Cover Thickness (to edge of trans. reinf.)	=	6.000000 in
Number of Reinforcing Bars	=	15 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	=	15.000000 sq. in.
Area Ratio of Steel Reinforcement	=	1.47 percent
Edge-to-Edge Bar Spacing	=	3.367467 in
Maximum Concrete Aggregate Size	=	0.375000 in
Ratio of Bar Spacing to Aggregate Size	=	8.98
Offset of Center of Rebar Cage from Center of Pile	=	0.0000 in
Transverse Reinforcement		
Type: Hoop		
Number of Transverse Reinf. (per spacing)	=	1
Spacing of Transverse Reinf.	=	4.500000 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	=	4309.778 kips
Tensile Load for Cracking of Concrete	=	-467.292 kips
Nominal Axial Tensile Capacity	=	-900.000 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	10.811000	0.00000
2	1.128000	1.000000	9.876340	4.397230
3	1.128000	1.000000	7.233971	8.034139
4	1.128000	1.000000	3.340783	10.281872
5	1.128000	1.000000	-1.13006	10.751776
6	1.128000	1.000000	-5.40550	9.362601
7	1.128000	1.000000	-8.74628	6.354546
8	1.128000	1.000000	-10.57475	2.247733
9	1.128000	1.000000	-10.57475	-2.24773
10	1.128000	1.000000	-8.74628	-6.35455
11	1.128000	1.000000	-5.40550	-9.36260

12	1.128000	1.000000	-1.13006	-10.75178
13	1.128000	1.000000	3.340783	-10.28187
14	1.128000	1.000000	7.233971	-8.03414
15	1.128000	1.000000	9.876340	-4.39723

NOTE: The positions of the above rebars were computed by LPile

Minimum spacing between any two bars not equal to zero = 3.367 inches
between bars 7 and 8.

Ratio of bar spacing to maximum aggregate size = 8.98

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	=	0.375000 in

Number of Axial Thrust Force Values Determined from Pile-head Loadings = 1

Number	Axial Thrust Force kips
1	368.880

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 = 368.880 kips

Bending Max Conc Curvature Stress rad/in. ksi	Bending Max Steel Moment Stress in-kip ksi	Bending Stiffness kip-in2	Depth to N Axis in	Max Comp Strain in/in	Max Tens Strain in/in	Run Msg
6.25000E-07	222.9552551	356728408.	146.3769446	0.00009149	0.00006899	
0.3781429	2.5323696					
0.00000125	445.9107153	356728572.	82.2075558	0.0001028	0.00005776	
0.4230470	2.7385989					
0.00000188	668.8552371	356722793.	60.8262379	0.0001140	0.00004655	
0.4677343	2.9452892					
0.00000250	891.7833527	356713341.	50.1419381	0.0001254	0.00003535	
0.5122038	3.1524405					
0.00000313	1115.	356700670.	43.7364460	0.0001367	0.00002418	
0.5564540	3.3600529					
0.00000375	1338.	356684931.	39.4703581	0.0001480	0.00001301	
0.6004840	3.5681265					
0.00000438	1560.	356666188.	36.4267875	0.0001594	0.00000187	
0.6442924	3.7766612					
0.00000500	1783.	356641411.	34.1472511	0.0001707	-0.00000926	
0.6878774	3.9856514					
0.00000563	2006.	356585588.	32.3767187	0.0001821	-0.00002038	
0.7312301	4.1950398					
0.00000625	2228.	356476204.	30.9620312	0.0001935	-0.00003149	
0.7743385	4.4047432					
0.00000688	2450.	356306877.	29.7977208	0.0002049	-0.00004264	
0.8171932	4.6146945					
0.00000750	2671.	356079611.	28.8385249	0.0002163	-0.00005371	
0.8597870	4.8248440					
0.00000813	2891.	355799780.	28.0268795	0.0002277	-0.00006478	
0.9021146	5.0351550					
0.00000875	3110.	355473736.	27.3311696	0.0002391	-0.00007585	
0.9441723	5.2456013					
0.00000938	3329.	355107464.	26.7282350	0.0002506	-0.00008692	
0.9859572	5.4561629					
0.00001000	3547.	354706276.	26.2007021	0.0002620	-0.00009799	
1.0274670	5.6668241					
0.00001063	3764.	354274835.	25.7352873	0.0002734	-0.000109	
1.0686999	5.8775729					
0.00001125	3764.	334592899.	23.9447451	0.0002694	-0.000136	
1.0535349	5.6391481					C
0.00001188	3764.	316982747.	23.4299331	0.0002782	-0.000149	
1.0852614	5.7751457					C
0.00001250	3764.	301133609.	22.9573786	0.0002870	-0.000163	
1.1164011	5.9077998					C

```
0.00001313        3764.    286793914.    22.5213994     0.0002956     -0.000177
1.1469832     6.0372933 C
0.00001375        3764.    273757827.    22.1174857     0.0003041     -0.000191
1.1770196     6.1636725 C
0.00001438        3764.    261855313.    21.7419093     0.0003125     -0.000205
1.2065572     6.2872710 C
0.00001500        3764.    250944675.    21.3918600     0.0003209     -0.000219
1.2356343     6.4083591 C
0.00001563        3764.    240906888.    21.0645017     0.0003291     -0.000233
1.2642748     6.5270951 C
0.00001625        3764.    231641238.    20.7571030     0.0003373     -0.000248
1.2924615     6.6432989 C
0.00001688        3788.    224496075.    20.4683095     0.0003454     -0.000262
1.3202587     6.7574685 C
0.00001750        3854.    220208583.    20.1966775     0.0003534     -0.000277
1.3477034     6.8698820 C
0.00001813        3918.    216150153.    19.9409946     0.0003614     -0.000291
1.3748324     6.9808228 C
0.00001875        3980.    212279723.    19.6985313     0.0003693     -0.000306
1.4015796     7.0897087 C
0.00001938        4042.    208598031.    19.4688844     0.0003772     -0.000320
1.4280025     7.1969963 C
0.00002000        4102.    205111536.    19.2521393     0.0003850     -0.000335
1.4541920     7.3034408 C
0.00002063        4161.    201759142.    19.0445149     0.0003928     -0.000350
1.4799693     7.4074892 C
0.00002125        4220.    198582247.    18.8482246     0.0004005     -0.000364
1.5055527     7.5109940 C
0.00002188        4277.    195534181.    18.6603519     0.0004082     -0.000379
1.5308015     7.6127229 C
0.00002250        4334.    192632668.    18.4818564     0.0004158     -0.000394
1.5558429     7.7137612 C
0.00002313        4390.    189845508.    18.3106531     0.0004234     -0.000409
1.5805769     7.8132193 C
0.00002375        4446.    187191971.    18.1479574     0.0004310     -0.000424
1.6051460     7.9123307 C
0.00002438        4500.    184631139.    17.9909941     0.0004385     -0.000439
1.6293818     -8.022329 C
0.00002563        4608.    179839057.    17.6978222     0.0004535     -0.000469
1.6773003     -8.651593 C
0.00002688        4715.    175424926.    17.4282678     0.0004684     -0.000499
1.7244153     -9.283707 C
0.00002813        4819.    171327651.    17.1780686     0.0004831     -0.000529
1.7706377     -9.919574 C
0.00002938        4921.    167526077.    16.9459954     0.0004978     -0.000560
1.8160942    -10.558140 C
0.00003063        5023.    164003384.    16.7314345     0.0005124     -0.000590
1.8609461    -11.197982 C
0.00003188        5122.    160695912.    16.5293420     0.0005269     -0.000621
1.9049074    -11.841841 C
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0.00003313 5221. 157621187. 16.3420736 0.0005413 -0.000651
1.9483670 -12.486133 C
0.00003438 5319. 154726451. 16.1652303 0.0005557 -0.000682
1.9910451 -13.133569 C
0.00003563 5416. 152023911. 16.0008391 0.0005700 -0.000712
2.0332732 -13.781021 C
0.00003688 5512. 149465202. 15.8443805 0.0005843 -0.000743
2.0747135 -14.431816 C
0.00003813 5607. 147068495. 15.6986600 0.0005985 -0.000774
2.1157616 -15.082121 C
0.00003938 5701. 144795922. 15.5600680 0.0006127 -0.000805
2.1561160 -15.734960 C
0.00004063 5795. 142649519. 15.4292305 0.0006268 -0.000836
2.1959668 -16.388478 C
0.00004188 5889. 140626090. 15.3066944 0.0006410 -0.000867
2.2354293 -17.041510 C
0.00004313 5981. 138691355. 15.1887504 0.0006550 -0.000897
2.2741324 -17.697907 C
0.00004438 6073. 136859453. 15.0772767 0.0006691 -0.000928
2.3124295 -18.354058 C
0.00004563 6165. 135123273. 14.9724479 0.0006831 -0.000959
2.3503422 -19.009728 C
0.00004688 6256. 133461589. 14.8718847 0.0006971 -0.000990
2.3876203 -19.667594 C
0.00004813 6347. 131875559. 14.7757241 0.0007111 -0.001021
2.4243983 -20.326268 C
0.00004938 6437. 130365619. 14.6843829 0.0007250 -0.001052
2.4607956 -20.984460 C
0.00005063 6527. 128926103. 14.5982031 0.0007390 -0.001083
2.4968109 -21.642169 C
0.00005188 6616. 127540096. 14.5150306 0.0007530 -0.001115
2.5321840 -22.302313 C
0.00005313 6705. 126212128. 14.4351293 0.0007669 -0.001146
2.5671046 -22.962816 C
0.00005438 6794. 124941433. 14.3592087 0.0007808 -0.001177
2.6016467 -23.622836 C
0.00005563 6882. 123724128. 14.2870020 0.0007947 -0.001208
2.6358088 -24.282369 C
0.00005688 6970. 122556395. 14.2175482 0.0008086 -0.001239
2.6695823 -24.941501 C
0.00005813 7058. 121424564. 14.1506419 0.0008225 -0.001270
2.7026885 -25.603562 C
0.00005938 7145. 120336965. 14.0862028 0.0008364 -0.001301
2.7354180 -26.265132 C
0.00006063 7232. 119290842. 14.0247012 0.0008502 -0.001332
2.7677693 -26.926210 C
0.00006188 7319. 118283662. 13.9659606 0.0008641 -0.001363
2.7997410 -27.586793 C
0.00006313 7405. 117313095. 13.9098184 0.0008781 -0.001394
2.8313319 -28.246878 C

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0.00006438        7492.    116376439.    13.8550313     0.0008919     -0.001426
2.8625225    -28.906692 C
0.00006563        7577.    115465375.    13.8027679     0.0009058     -0.001457
2.8931050    -29.568929 C
0.00006688        7663.    114585320.    13.7521631     0.0009197     -0.001488
2.9233089    -30.230661 C
0.00006813        7748.    113734552.    13.7034872     0.0009336     -0.001519
2.9531331    -30.891886 C
0.00006938        7833.    112911470.    13.6568192     0.0009474     -0.001550
2.9825760    -31.552600 C
0.00007063        7918.    112114587.    13.6120540     0.0009614     -0.001581
3.0116363    -32.212800 C
0.00007188        8003.    111342519.    13.5690936     0.0009753     -0.001612
3.0403125    -32.872484 C
0.00007313        8087.    110593988.    13.5278464     0.0009892     -0.001643
3.0686034    -33.531647 C
0.00007438        8171.    109866316.    13.4878345     0.0010032     -0.001674
3.0964482    -34.191137 C
0.00007938        8505.    107145913.    13.3392736     0.0010588     -0.001799
3.2034340    -36.831672 C
0.00008438        8835.    104707866.    13.2118550     0.0011148     -0.001923
3.3042084    -39.463557 C
0.00008938        9161.    102500072.    13.1007547     0.0011709     -0.002047
3.3984735    -42.090090 C
0.00009438        9483.    100482893.    13.0025127     0.0012271     -0.002170
3.4860355    -44.713660 C
0.00009938        9802.     98632965.    12.9174431     0.0012837     -0.002294
3.5671694    -47.327757 C
 0.0001044       10117.     96925360.    12.8437450     0.0013406     -0.002417
3.6417649    -49.932099 C
 0.0001094       10428.     95339637.    12.7782188     0.0013976     -0.002540
3.7097062    -52.526405 C
 0.0001144       10735.     93855225.    12.7222252     0.0014551     -0.002662
3.7706191    -55.117597 C
 0.0001194       11038.     92462618.    12.6733490     0.0015129     -0.002785
3.8247023    -57.697862 C
 0.0001244       11336.     91146629.    12.6309857     0.0015710     -0.002907
3.8718078    -60.000000 CY
 0.0001294       11616.     89786366.    12.5898612     0.0016288     -0.003029
3.9113914    -60.000000 CY
 0.0001344       11845.     88148998.    12.5384298     0.0016849     -0.003153
3.9427789    -60.000000 CY
 0.0001394       12038.     86370771.    12.4814217     0.0017396     -0.003278
3.9668575    -60.000000 CY
 0.0001444       12206.     84541814.    12.4222106     0.0017935     -0.003404
3.9841945    -60.000000 CY
 0.0001494       12358.     82734567.    12.3651668     0.0018470     -0.003530
3.9950902    -60.000000 CY
 0.0001544       12493.     80923156.    12.3066323     0.0018998     -0.003658
3.9997727    -60.000000 CY
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 0.0001594        12610.     79119861.    12.2484801     0.0019521     -0.003785
3.9995398    -60.000000 CY
 0.0001644        12723.     77401212.    12.1956089     0.0020047     -0.003913
3.9990180    -60.000000 CY
 0.0001694        12826.     75724956.    12.1451072     0.0020571     -0.004040
3.9979593    -60.000000 CY
 0.0001744        12914.     74060756.    12.0945566     0.0021090     -0.004169
3.9990578    -60.000000 CY
 0.0001794        12992.     72430881.    12.0447991     0.0021605     -0.004297
3.9997005    -60.000000 CY
 0.0001844        13067.     70873402.    11.9976651     0.0022121     -0.004425
3.9982669    -60.000000 CY
 0.0001894        13140.     69388403.    11.9547066     0.0022639     -0.004554
3.9991565    -60.000000 CY
 0.0001944        13207.     67947793.    11.9138830     0.0023158     -0.004682
3.9992778    -60.000000 CY
 0.0001994        13266.     66535786.    11.8732580     0.0023672     -0.004810
3.9963021    -60.000000 CY
 0.0002044        13316.     65155366.    11.8324672     0.0024183     -0.004939
3.9995648    -60.000000 CY
 0.0002094        13362.     63819379.    11.7944972     0.0024695     -0.005068
3.9962953    -60.000000 CY
 0.0002144        13406.     62536194.    11.7581484     0.0025207     -0.005197
3.9994869    -60.000000 CY
 0.0002194        13449.     61305987.    11.7259171     0.0025724     -0.005325
3.9953900    -60.000000 CY
 0.0002244        13491.     60124854.    11.6961173     0.0026243     -0.005453
3.9990337    -60.000000 CY
 0.0002294        13531.     58988560.    11.6657984     0.0026758     -0.005582
3.9983602    -60.000000 CY
 0.0002344        13566.     57882623.    11.6356398     0.0027271     -0.005710
3.9977545    -60.000000 CY
 0.0002394        13599.     56809982.    11.6091393     0.0027789     -0.005839
3.9998335    -60.000000 CY
 0.0002444        13627.     55763412.    11.5811764     0.0028301     -0.005967
3.9948274    -60.000000 CY
 0.0002494        13652.     54743104.    11.5533509     0.0028811     -0.006096
3.9984136    -60.000000 CY
 0.0002544        13674.     53754435.    11.5249135     0.0029316     -0.006226
3.9999390    -60.000000 CY
 0.0002594        13695.     52798456.    11.5010021     0.0029831     -0.006354
3.9944309    -60.000000 CY
 0.0002644        13715.     51875962.    11.4772264     0.0030343     -0.006483
3.9980482    -60.000000 CY
 0.0002694        13734.     50986057.    11.4544928     0.0030856     -0.006612
3.9998159    -60.000000 CY
 0.0002744        13753.     50126051.    11.4340963     0.0031372     -0.006740
3.9948927    -60.000000 CY
 0.0003044        13852.     45508979.    11.3320390     0.0034492     -0.007508
3.9992448    -60.000000 CYT
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    0.0003344        13902.     41576691.    11.2357361     0.0037569     -0.008281
   3.9984702    -60.000000 CYT
    0.0003644        13902.     38153568.    11.2480838     0.0040985     -0.009019
   3.9922223    -60.000000 CYT


-------------------------------------------------------------------------------
   Summary of Results for Nominal Moment Capacity for Section 1
-------------------------------------------------------------------------------

Moment values interpolated at maximum compressive strain = 0.003
or maximum developed moment if pile fails at smaller strains.

 Load           Axial Thrust        Nominal Mom. Cap.      Max. Comp.      Max.
Tens.
  No.              kips                 in-kip               Strain
Strain
 ----         ----------------     ------------------     ------------
------------
   1               368.880             13701.245           0.00300000
-0.00639699

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         368.880000        13701.    239.772000         8906.
104226787.

   1       0.75         368.880000        13701.    276.660000        10276.
96113363.
```

1 0.90 368.880000 13701. 331.992000 12331.
83058217.

Pile Section No. 2:

Dimensions and Properties of Drilled Shaft (Bored Pile):

Length of Section	=	5.000000 ft
Shaft Diameter	=	30.000000 in
Concrete Cover Thickness (to edge of trans. reinf.)	=	3.000000 in
Number of Reinforcing Bars	=	15 bars
Yield Stress of Reinforcing Bars	=	60000. psi
Modulus of Elasticity of Reinforcing Bars	=	29000000. psi
Gross Area of Shaft	=	706.858347 sq. in.
Total Area of Reinforcing Steel	=	15.000000 sq. in.
Area Ratio of Steel Reinforcement	=	2.12 percent
Edge-to-Edge Bar Spacing	=	3.367467 in
Maximum Concrete Aggregate Size	=	0.375000 in
Ratio of Bar Spacing to Aggregate Size	=	8.98
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.	=	4.500000 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	=	3252.318 kips
Tensile Load for Cracking of Concrete	=	-337.937 kips
Nominal Axial Tensile Capacity	=	-900.000 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	10.811000	0.00000
2	1.128000	1.000000	9.876340	4.397230
3	1.128000	1.000000	7.233971	8.034139
4	1.128000	1.000000	3.340783	10.281872
5	1.128000	1.000000	-1.13006	10.751776
6	1.128000	1.000000	-5.40550	9.362601
7	1.128000	1.000000	-8.74628	6.354546

8	1.128000	1.000000	-10.57475	2.247733
9	1.128000	1.000000	-10.57475	-2.24773
10	1.128000	1.000000	-8.74628	-6.35455
11	1.128000	1.000000	-5.40550	-9.36260
12	1.128000	1.000000	-1.13006	-10.75178
13	1.128000	1.000000	3.340783	-10.28187
14	1.128000	1.000000	7.233971	-8.03414
15	1.128000	1.000000	9.876340	-4.39723

NOTE: The positions of the above rebars were computed by LPile

Minimum spacing between any two bars not equal to zero = 3.367 inches
between bars 7 and 8.

Ratio of bar spacing to maximum aggregate size = 8.98

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	=	0.375000 in

Number of Axial Thrust Force Values Determined from Pile-head Loadings = 1

Number	Axial Thrust Force kips
1	368.880

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 = 368.880 kips

Bending Curvature rad/in.	Bending Max Conc Stress ksi	Bending Max Steel Moment in-kip	Bending Stiffness kip-in2	Depth to N Axis in	Max Comp Strain in/in	Max Tens Strain in/in	Run Msg
0.00000125	225.6879380	180550350.	104.9367064	0.0001312	0.00009367	0.5362352	3.6680181
0.00000250	451.3698804	180547952.	59.9940259	0.0001500	0.00007499	0.6093584	4.0776919
0.00000375	677.0237633	180539670.	45.0245387	0.0001688	0.00005634	0.6818668	4.4886061
0.00000500	902.6355588	180527112.	37.5483512	0.0001877	0.00003774	0.7537548	4.9007609
0.00000625	1128.	180510598.	33.0694850	0.0002067	0.00001918	0.8250173	5.3141567
0.00000750	1354.	180490234.	30.0892811	0.0002257	6.69608E-07	0.8956488	5.7287937
0.00000875	1579.	180460538.	27.9653345	0.0002447	-0.00001780	0.9656400	6.1446412
0.00001000	1804.	180392941.	26.3758271	0.0002638	-0.00003624	1.0349592	6.5614897
0.00001125	2028.	180270520.	25.1328514	0.0002827	-0.00005476	1.1035718	6.9790960
0.00001250	2251.	180093194.	24.1515197	0.0003019	-0.00007311	1.1714534	7.3972895
0.00001375	2473.	179866570.	23.3488431	0.0003210	-0.00009145	1.2385869	7.8159508
0.00001500	2694.	179597376.	22.6801330	0.0003402	-0.000110	1.3049600	8.2349947
0.00001625	2694.	165782194.	21.3402597	0.0003468	-0.000141	1.3271123	8.2894099 C
0.00001750	2694.	153940608.	20.7141767	0.0003625	-0.000163	1.3806874	8.6093196 C
0.00001875	2694.	143677901.	20.1572808	0.0003779	-0.000185	1.4328099	8.9214589 C
0.00002000	2794.	139695297.	19.6582748	0.0003932	-0.000207	1.4836199	9.2267994 C
0.00002125	2891.	136048097.	19.2072168	0.0004082	-0.000229	1.5331607	9.5255099 C
0.00002250	2985.	132660700.	18.7986096	0.0004230	-0.000252	1.5816491	9.8192966 C

0.00002375 3076. 129497322. 18.4259215 0.0004376 -0.000275
1.6290885 10.1080410 C
0.00002500 3163. 126535741. 18.0837190 0.0004521 -0.000298
1.6755185 10.3919463 C
0.00002625 3249. 123768560. 17.7688715 0.0004664 -0.000321
1.7210494 10.6718660 C
0.00002750 3332. 121179655. 17.4781311 0.0004806 -0.000344
1.7657365 10.9481846 C
0.00002875 3414. 118755748. 17.2088945 0.0004948 -0.000368
1.8096401 11.2213534 C
0.00003000 3494. 116482505. 16.9587521 0.0005088 -0.000391
1.8528005 11.4916508 C
0.00003125 3573. 114338650. 16.7249990 0.0005227 -0.000415
1.8951780 11.7586165 C
0.00003250 3651. 112323236. 16.5067571 0.0005365 -0.000439
1.9368890 12.0232583 C
0.00003375 3727. 110428198. 16.3028141 0.0005502 -0.000462
1.9779922 12.2860691 C
0.00003500 3802. 108634122. 16.1108754 0.0005639 -0.000486
2.0184156 12.5462934 C
0.00003625 3876. 106936243. 15.9301260 0.0005775 -0.000510
2.0582110 12.8043601 C
0.00003750 3950. 105336286. 15.7606301 0.0005910 -0.000534
2.0975154 13.0615614 C
0.00003875 4023. 103807547. 15.5992671 0.0006045 -0.000558
2.1361036 13.3156130 C
0.00004000 4095. 102368471. 15.4480999 0.0006179 -0.000582
2.1743093 13.5697960 C
0.00004125 4166. 100988041. 15.3034143 0.0006313 -0.000606
2.2118059 13.8207720 C
0.00004250 4237. 99685430. 15.1675787 0.0006446 -0.000630
2.2489538 14.0721659 C
0.00004375 4307. 98435496. 15.0374257 0.0006579 -0.000655
2.2854593 14.3209215 C
0.00004500 4376. 97249082. 14.9144181 0.0006711 -0.000679
2.3215743 -14.792884 C
0.00004625 4445. 96115532. 14.7972865 0.0006844 -0.000703
2.3571984 -15.360952 C
0.00004750 4514. 95029007. 14.6852135 0.0006975 -0.000727
2.3923037 -15.930493 C
0.00004875 4582. 93995343. 14.5791756 0.0007107 -0.000752
2.4270672 -16.499628 C
0.00005125 4717. 92045694. 14.3795371 0.0007370 -0.000801
2.4950437 -17.642475 C
0.00005375 4851. 90255670. 14.1976343 0.0007631 -0.000849
2.5614045 -18.786622 C
0.00005625 4984. 88597876. 14.0300007 0.0007892 -0.000898
2.6260037 -19.933868 C
0.00005875 5115. 87062042. 13.8757498 0.0008152 -0.000947
2.6889929 -21.082617 C

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0.00006125         5245.     85632830.    13.7331438     0.0008412     -0.000996
2.7503671    -22.233046 C
0.00006375         5374.     84301293.    13.6013613     0.0008671     -0.001045
2.8102169    -23.384140 C
0.00006625         5502.     83052544.    13.4783697     0.0008929     -0.001095
2.8684258    -24.537449 C
0.00006875         5630.     81886870.    13.3651344     0.0009189     -0.001144
2.9252977    -25.689138 C
0.00007125         5756.     80785222.    13.2582455     0.0009446     -0.001193
2.9804597    -26.844127 C
0.00007375         5882.     79749482.    13.1589900     0.0009705     -0.001242
3.0342282    -27.998286 C
0.00007625         6007.     78774669.    13.0669884     0.0009964     -0.001291
3.0866554    -29.150795 C
0.00007875         6131.     77848049.    12.9797890     0.0010222     -0.001340
3.1374472    -30.305844 C
0.00008125         6254.     76970323.    12.8980885     0.0010480     -0.001390
3.1868297    -31.460230 C
0.00008375         6377.     76138612.    12.8220326     0.0010738     -0.001439
3.2348647    -32.612927 C
0.00008625         6499.     75348852.    12.7510683     0.0010998     -0.001488
3.2815432    -33.763916 C
0.00008875         6620.     74591738.    12.6830882     0.0011256     -0.001537
3.3265767    -34.917839 C
0.00009125         6741.     73870119.    12.6192082     0.0011515     -0.001586
3.3702492    -36.070102 C
0.00009375         6861.     73181188.    12.5595060     0.0011775     -0.001635
3.4125563    -37.220604 C
0.00009625         6980.     72522340.    12.5035436     0.0012035     -0.001684
3.4534888    -38.369325 C
0.00009875         7099.     71891229.    12.4510443     0.0012295     -0.001733
3.4930369    -39.516247 C
 0.0001013         7217.     71282164.    12.4005415     0.0012556     -0.001782
3.5309845    -40.665472 C
 0.0001038         7335.     70697021.    12.3528834     0.0012816     -0.001831
3.5675401    -41.812950 C
 0.0001063         7452.     70134141.    12.3078640     0.0013077     -0.001880
3.6026991    -42.958554 C
 0.0001088         7568.     69591928.    12.2657098     0.0013339     -0.001929
3.6364512    -44.102264 C
 0.0001113         7684.     69068933.    12.2260461     0.0013601     -0.001977
3.6687860    -45.244055 C
 0.0001138         7799.     68563830.    12.1887162     0.0013865     -0.002026
3.6996929    -46.383906 C
 0.0001163         7914.     68075408.    12.1535767     0.0014129     -0.002075
3.7291610    -47.521791 C
 0.0001188         8028.     67600806.    12.1197979     0.0014392     -0.002123
3.7570643    -48.660883 C
 0.0001213         8141.     67140701.    12.0876566     0.0014656     -0.002172
3.7835067    -49.798340 C
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 0.0001238        8253.     66694377.    12.0573901     0.0014921     -0.002220
3.8084920    -50.933729 C
 0.0001263        8365.     66260958.    12.0286641     0.0015186     -0.002269
3.8320088    -52.067021 C
 0.0001288        8477.     65839632.    12.0018515     0.0015452     -0.002317
3.8540448    -53.198190 C
 0.0001313        8588.     65429653.    11.9766294     0.0015719     -0.002366
3.8745880    -54.327205 C
 0.0001338        8698.     65030327.    11.9529153     0.0015987     -0.002414
3.8936259    -55.454036 C
 0.0001363        8807.     64641007.    11.9306334     0.0016255     -0.002462
3.9111457    -56.578652 C
 0.0001388        8916.     64261096.    11.9097141     0.0016525     -0.002510
3.9271345    -57.701021 C
 0.0001413        9024.     63890036.    11.8900816     0.0016795     -0.002558
3.9415790    -58.821111 C
 0.0001438        9132.     63527304.    11.8716968     0.0017066     -0.002606
3.9544654    -59.938887 C
 0.0001463        9237.     63157532.    11.8536242     0.0017336     -0.002654
3.9657303    -60.000000 CY
 0.0001488        9336.     62764874.    11.8345106     0.0017604     -0.002702
3.9753085    -60.000000 CY
 0.0001588        9662.     60863570.    11.7412188     0.0018639     -0.002899
3.9976041    -60.000000 CY
 0.0001688        9909.     58722591.    11.6369440     0.0019637     -0.003099
3.9994855    -60.000000 CY
 0.0001788       10115.     56590165.    11.5374734     0.0020623     -0.003300
3.9998503    -60.000000 CY
 0.0001888       10280.     54464137.    11.4365904     0.0021587     -0.003504
3.9982855    -60.000000 CY
 0.0001988       10428.     52466518.    11.3444838     0.0022547     -0.003708
3.9995979    -60.000000 CY
 0.0002088       10554.     50559321.    11.2598578     0.0023505     -0.003912
3.9999666    -60.000000 CY
 0.0002188       10655.     48708414.    11.1723548     0.0024440     -0.004119
4.0000000    -60.000000 CY
 0.0002288       10749.     46990548.    11.0938632     0.0025377     -0.004325
3.9999997    -60.000000 CY
 0.0002388       10839.     45398037.    11.0241536     0.0026320     -0.004530
3.9999551    -60.000000 CY
 0.0002488       10915.     43879075.    10.9566501     0.0027255     -0.004737
3.9995945    -60.000000 CY
 0.0002588       10976.     42420428.    10.8867300     0.0028169     -0.004946
3.9982333    -60.000000 CY
 0.0002688       11032.     41047739.    10.8209587     0.0029081     -0.005154
3.9955952    -60.000000 CY
 0.0002788       11085.     39767975.    10.7608571     0.0029996     -0.005363
3.9997330    -60.000000 CY
 0.0002888       11138.     38572685.    10.7080534     0.0030920     -0.005571
3.9971463    -60.000000 CY
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 0.0002988        11188.     37450945.    10.6587722     0.0031843     -0.005778
3.9999974    -60.000000 CY
 0.0003088        11231.     36376644.    10.6096174     0.0032757     -0.005987
3.9975964    60.0000000 CY
 0.0003188        11267.     35348462.    10.5597379     0.0033659     -0.006197
3.9999940    60.0000000 CY
 0.0003288        11296.     34360430.    10.5148219     0.0034567     -0.006406
3.9963686    60.0000000 CYT
 0.0003388        11322.     33421415.    10.4713845     0.0035472     -0.006615
3.9997158    60.0000000 CYT
 0.0003488        11342.     32522865.    10.4347791     0.0036391     -0.006823
3.9931697    60.0000000 CYT
 0.0003588        11363.     31672979.    10.4018672     0.0037317     -0.007031
3.9983733    60.0000000 CYT
 0.0003688        11379.     30859561.    10.3749592     0.0038258     -0.007237
3.9988830    60.0000000 CYT


-------------------------------------------------------------------------------
   Summary of Results for Nominal Moment Capacity for Section 2
-------------------------------------------------------------------------------

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               368.880            11085.557          0.00300000
-0.00536384

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.
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Load No.	Factor	Ax. Thrust kips	Moment Cap in-kips	Ax. Thrust kips	Moment Cap in-kips	at Ult Mom kip-in^2
1	0.65	368.880000	11086.	239.772000	7206.	71342560.
1	0.75	368.880000	11086.	276.660000	8314.	66459365.
1	0.90	368.880000	11086.	331.992000	9977.	58023382.

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	18.3200	0.00	N.A.	No	0.00	14762.
2	22.1000	3.7789	Yes	No	14762.	169403.
3	35.8000	17.4800	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 Displacement and Pile-head Rotation (Loading Type 5)
Displacement of pile head = 1.000000 inches
Rotation of pile head = 0.000E+00 radians
Axial load on pile head = 368880.0 lbs

Depth X	Deflect. y	Bending Moment	Shear Force	Slope S	Total Stress	Bending Stiffness	Soil Res. Es*H	Soil Spr. Lat. Load	Distrib. p
feet	inches	in-lbs	lbs	radians	psi*	lb-in^2	lb/inch	lb/inch	lb/inch
0.00	1.0000	-8494631.	55186.	0.00	0.00	1.07E+11	0.00	0.00	0.00
0.4080	0.9991	-8224100.	55184.	-3.82E-04	0.00	1.07E+11	0.00	0.00	0.00
0.8160	0.9963	-7952892.	55184.	-7.44E-04	0.00	1.12E+11	0.00	0.00	0.00
1.2240	0.9918	-7681054.	55184.	-0.00108	0.00	1.14E+11	0.00	0.00	0.00
1.6320	0.9857	-7408622.	55184.	-0.00140	0.00	1.17E+11	0.00	0.00	0.00
2.0400	0.9780	-7135632.	55184.	-0.00170	0.00	1.20E+11	0.00	0.00	0.00
2.4480	0.9690	-6862119.	55184.	-0.00198	0.00	1.24E+11	0.00	0.00	0.00
2.8560	0.9586	-6588115.	55184.	-0.00224	0.00	1.28E+11	0.00	0.00	0.00
3.2640	0.9470	-6313657.	55184.	-0.00249	0.00	1.32E+11	0.00	0.00	0.00
3.6720	0.9343	-6038777.	55184.	-0.00271	0.00	1.38E+11	0.00	0.00	0.00
4.0800	0.9205	-5763509.	55184.	-0.00292	0.00	1.43E+11	0.00	0.00	0.00
4.4880	0.9058	-5487885.	55184.	-0.00310	0.00	1.50E+11	0.00	0.00	0.00
4.8960	0.8901	-5211938.	55184.	-0.00327	0.00	1.58E+11	0.00	0.00	0.00
5.3040	0.8737	-4935699.	55184.	-0.00343	0.00	1.67E+11	0.00	0.00	0.00
5.7120	0.8566	-4659199.	55184.	-0.00356	0.00	1.78E+11	0.00	0.00	0.00
6.1200	0.8388	-4382467.	55184.	-0.00368	0.00	1.90E+11	0.00	0.00	0.00
6.5280	0.8205	-4105531.	55184.	-0.00379	0.00	2.05E+11	0.00	0.00	0.00
6.9360	0.8017	-3828418.	55184.	-0.00388	0.00	2.22E+11	0.00	0.00	0.00
7.3440	0.7825	-3551152.	55184.	-0.00395	0.00	3.55E+11	0.00	0.00	0.00
7.7520	0.7630	-3273798.	55184.	-0.00399	0.00	3.55E+11	0.00	0.00	0.00
8.1600	0.7434	-2996363.	55184.	-0.00404	0.00	3.56E+11	0.00	0.00	0.00

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    8.5680     0.7235  -2718852.     55184.   -0.00408       0.00   3.56E+11
0.00       0.00       0.00
    8.9760     0.7034  -2441275.     55184.   -0.00411       0.00   3.56E+11
0.00       0.00       0.00
    9.3840     0.6832  -2163637.     55184.   -0.00414       0.00   3.57E+11
0.00       0.00       0.00
    9.7920     0.6629  -1885945.     55184.   -0.00417       0.00   3.57E+11
0.00       0.00       0.00
   10.2000     0.6424  -1608206.     55184.   -0.00420       0.00   3.57E+11
0.00       0.00       0.00
   10.6080     0.6218  -1330427.     55184.   -0.00422       0.00   3.57E+11
0.00       0.00       0.00
   11.0160     0.6011  -1052616.     55184.   -0.00423       0.00   3.57E+11
0.00       0.00       0.00
   11.4240     0.5803   -774778.     55184.   -0.00425       0.00   3.57E+11
0.00       0.00       0.00
   11.8320     0.5595   -496921.     55184.   -0.00425       0.00   3.57E+11
0.00       0.00       0.00
   12.2400     0.5387   -219052.     55184.   -0.00426       0.00   3.57E+11
0.00       0.00       0.00
   12.6480     0.5178     58822.     55184.   -0.00426       0.00   3.57E+11
0.00       0.00       0.00
   13.0560     0.4970    336695.     55184.   -0.00426       0.00   3.57E+11
0.00       0.00       0.00
   13.4640     0.4761    614560.     55184.   -0.00425       0.00   3.57E+11
0.00       0.00       0.00
   13.8720     0.4553    892410.     55184.   -0.00424       0.00   3.57E+11
0.00       0.00       0.00
   14.2800     0.4346   1170237.     55184.   -0.00423       0.00   3.57E+11
0.00       0.00       0.00
   14.6880     0.4140   1448036.     55184.   -0.00421       0.00   3.57E+11
0.00       0.00       0.00
   15.0960     0.3934   1725798.     55184.   -0.00419       0.00   3.57E+11
0.00       0.00       0.00
   15.5040     0.3730   2003518.     55184.   -0.00416       0.00   3.57E+11
0.00       0.00       0.00
   15.9120     0.3527   2281188.     55184.   -0.00413       0.00   3.56E+11
0.00       0.00       0.00
   16.3200     0.3325   2558801.     55184.   -0.00410       0.00   3.56E+11
0.00       0.00       0.00
   16.7280     0.3125   2836351.     55184.   -0.00406       0.00   3.56E+11
0.00       0.00       0.00
   17.1360     0.2927   3113831.     55184.   -0.00402       0.00   3.55E+11
0.00       0.00       0.00
   17.5440     0.2732   3391233.     55184.   -0.00398       0.00   3.55E+11
0.00       0.00       0.00
   17.9520     0.2538   3668550.     55184.   -0.00393       0.00   3.54E+11
0.00       0.00       0.00
   18.3600     0.2347   3945776.     54908.   -0.00386       0.00   2.14E+11
-112.662      2350.       0.00
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   18.7680     0.2161   4220139.     53549.   -0.00376       0.00   1.99E+11
-442.390     10025.       0.00
   19.1760     0.1979   4483709.     50859.   -0.00365       0.00   1.85E+11
-656.412     16239.       0.00
   19.5840     0.1803   4731331.     47185.   -0.00352       0.00   1.75E+11
-844.600     22931.       0.00
   19.9920     0.1634   4958467.     42648.   -0.00338       0.00   1.66E+11
-1009.     30228.       0.00
   20.4000     0.1472   5161155.     37361.   -0.00323       0.00   1.59E+11
-1151.     38265.       0.00
   20.8080     0.1318   5335979.     31436.   -0.00307       0.00   1.54E+11
-1270.     47186.       0.00
   21.2160     0.1172   5480053.     24978.   -0.00289       0.00   1.50E+11
-1368.     57153.       0.00
   21.6240     0.1035   5591016.     18095.   -0.00271       0.00   1.47E+11
-1444.     68344.       0.00
   22.0320    0.09063   5667028.     10892.   -0.00252       0.00   1.46E+11
-1498.     80943.       0.00
   22.4400    0.07875   5706779.      4144.   -0.00233       0.00   1.45E+11
-1258.     78223.       0.00
   22.8480    0.06781   5716021.     -1999.   -0.00214       0.00   1.44E+11
-1251.     90330.       0.00
   23.2560    0.05782   5694924.     -8064.   -0.00194       0.00   1.45E+11
-1226.    103854.       0.00
   23.6640    0.04877   5644080.    -13984.   -0.00175       0.00   1.46E+11
-1192.    119645.       0.00
   24.0720    0.04065   5564325.    -19712.   -0.00157       0.00   1.48E+11
-1148.    138247.       0.00
   24.4800    0.03343   5456725.    -25202.   -0.00139       0.00   1.51E+11
-1095.    160384.       0.00
   24.8880    0.02707   5322556.    -30414.   -0.00121       0.00   1.55E+11
-1034.    187031.       0.00
   25.2960    0.02154   5163293.    -35311.   -0.00105       0.00   1.59E+11
-965.988    219548.       0.00
   25.7040    0.01679   4980588.    -39857.  -8.97E-04       0.00   1.65E+11
-891.154    259883.       0.00
   26.1120    0.01276   4776256.    -44022.  -7.56E-04       0.00   1.73E+11
-810.265    310967.       0.00
   26.5200    0.00939   4552256.    -47777.  -6.27E-04       0.00   1.82E+11
-723.747    377455.       0.00
   26.9280    0.00662   4310686.    -51095.  -5.11E-04       0.00   1.94E+11
-631.678    467373.       0.00
   27.3360    0.00438   4053779.    -53802.  -4.09E-04       0.00   2.08E+11
-473.864    529708.       0.00
   27.7440    0.00261   3785339.    -55684.  -3.28E-04       0.00   2.73E+11
-295.168    553679.       0.00
   28.1520    0.00117   3509702.    -56745.  -2.69E-04       0.00   3.55E+11
-138.317    577650.       0.00
   28.5600  -2.83E-05   3230662.    -57075.  -2.23E-04       0.00   3.55E+11
3.4723    601620.       0.00
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   28.9680   -0.00101   2951624.    -56751.  -1.80E-04       0.00   3.56E+11
129.1649    625591.       0.00
   29.3760   -0.00179   2675610.    -55852.  -1.42E-04       0.00   3.56E+11
238.0896    649562.       0.00
   29.7840   -0.00240   2405236.    -54461.  -1.07E-04       0.00   3.56E+11
329.9092    673533.       0.00
   30.1920   -0.00284   2142710.    -52663.  -7.55E-05       0.00   3.57E+11
404.5884    697504.       0.00
   30.6000   -0.00314   1889830.    -50541.  -4.78E-05       0.00   3.57E+11
462.3637    721475.       0.00
   31.0080   -0.00331   1647986.    -48235.  -2.36E-05       0.00   3.57E+11
479.4062    709474.       0.00
   31.4160   -0.00337   1417593.    -45878.  -2.51E-06       0.00   3.57E+11
483.7154    703116.       0.00
   31.8240   -0.00333   1198760.    -43516.   1.54E-05       0.00   3.57E+11
481.1607    706821.       0.00
   32.2320   -0.00322    991431.    -41181.   3.05E-05       0.00   3.57E+11
472.7124    719430.       0.00
   32.6400   -0.00303    795409.    -38900.   4.27E-05       0.00   3.57E+11
459.0996    740743.       0.00
   33.0480   -0.00280    610372.    -36696.   5.24E-05       0.00   3.57E+11
440.8818    771334.       0.00
   33.4560   -0.00252    435889.    -34593.   5.96E-05       0.00   3.57E+11
418.4897    812591.       0.00
   33.8640   -0.00222    271426.    -32608.   6.44E-05       0.00   3.57E+11
392.2463    866944.       0.00
   34.2720   -0.00189    116358.    -30762.   6.71E-05       0.00   3.57E+11
361.9165    937212.       0.00
   34.6800   -0.00156    -30037.    -29127.   6.77E-05       0.00   3.57E+11
305.9266    961183.       0.00
   35.0880   -0.00123   -169097.    -27773.   6.63E-05       0.00   3.57E+11
247.0886    985154.       0.00
   35.4960  -9.09E-04   -302231.    -26710.   6.31E-05       0.00   3.57E+11
187.3580   1009124.       0.00
   35.9040  -6.10E-04   -430866.    -16789.   5.52E-05       0.00   1.81E+11
3865.   3.10E+07       0.00
   36.3120  -3.69E-04   -466827.   -428.759   4.30E-05       0.00   1.81E+11
2818.   3.74E+07       0.00
   36.7200  -1.89E-04   -435219.     10617.   3.08E-05       0.00   1.81E+11
1694.   4.38E+07       0.00
   37.1280  -6.77E-05   -362979.     16464.   1.99E-05       0.00   1.81E+11
694.2660   5.02E+07       0.00
   37.5360   5.76E-06   -274078.     18000.   1.13E-05       0.00   1.81E+11
-66.596   5.66E+07       0.00
   37.9440   4.29E-05   -186761.     16487.   5.05E-06       0.00   1.81E+11
-551.397   6.30E+07       0.00
   38.3520   5.52E-05   -112652.     13224.   9.88E-07       0.00   1.81E+11
-781.841   6.94E+07       0.00
   38.7600   5.25E-05    -57278.      9319.  -1.32E-06       0.00   1.81E+11
-813.041   7.58E+07       0.00
```

```
   39.1680   4.23E-05    -21391.      5592.  -2.38E-06       0.00   1.81E+11
-709.760   8.21E+07       0.00
   39.5760   2.92E-05     -2517.      2561.  -2.71E-06       0.00   1.81E+11
-528.370   8.85E+07       0.00
   39.9840   1.58E-05      3692.   517.2849  -2.69E-06       0.00   1.81E+11
-306.333   9.49E+07       0.00
   40.3920   2.87E-06      2558.   -378.028  -2.61E-06       0.00   1.81E+11
-59.399   1.01E+08       0.00
   40.8000  -9.72E-06       0.00       0.00  -2.57E-06       0.00   1.81E+11
213.8226   5.39E+07       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             =     1.00000000 inches
Computed slope at pile head      =       0.000000 radians
Maximum bending moment           =      -8494631. inch-lbs
Maximum shear force              =        -57075. lbs
Depth of maximum bending moment  =       0.000000 feet below pile head
Depth of maximum shear force     =    28.56000000 feet below pile head
Number of iterations             =             28
Number of zero deflection points =              3
Pile deflection at ground        =     0.23658596 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 Load                Load                  Axial    Pile-head  Pile-head  Max
Shear Max Moment
Case Type   Pile-head    Type     Pile-head   Loading  Deflection  Rotation    in
Pile    in Pile
 No.  1      Load 1       2        Load 2       lbs      inches     radians      lbs
```

```
     in-lbs
---- ----- ---------- ---------- ---------- ---------- ---------- ----------
---------- ----------
  1  y, in     1.0000   S, rad         0.00    368880.     1.0000       0.00
-57075.  -8494631.


Maximum pile-head deflection = 1.0000000000 inches
Maximum pile-head rotation   = 0.0000000000 radians = 0.000000 deg.

-------------------------------------------------------------------------------
                           Summary of Warning Messages
-------------------------------------------------------------------------------

The following warning was reported 377 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.
```

BRO-50-4.49 PID 109971 LPile Analysis

Forward Abutment Wingwall Drilled Shaft

ODOT District 9

2/12/2026

Engineers, Surveyors, Planners, Scientists
5500 New Albany Rd., Columbus, OH 43054
p. 614.775.4500 f. 614.775.4800
emht.com

Type Project Number Here

EMH&T
Engineers, Surveyors, Planners, Scientists

Made by:	AI	Date:	8/6/2025	Job No:	20230339
Checked by:	TDA/RMW	Date:	9/10/2025	Sheet No:	1
Project:	BRO-50-4.49		PID:	119880	
Subject:	Forward Abutment Wingwall				

Retaining Wall Data

Stem Dimensions (ft)

			Top of Wall	914.17
			Max Elevation Behind Wall =	916.7
Stem Width 1	1.50	ft	Bottom of Footing	891.50
Stem Width 2	1.50	ft		
Stem Length	42.50	ft	Stem Height 1	14.92
Seat Width	0.00	ft	Stem Height 2	4.75
β =	90.00	ft	Total Stem Height	19.67

Footer Dimensions (ft)

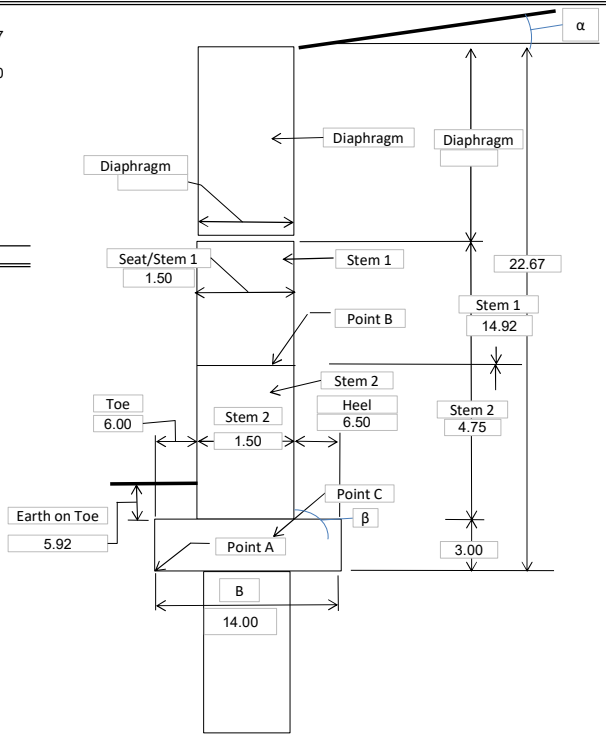
Toe	6.00	ft		
Stem Width (at Footer)	1.50	ft	Footer Height	3.00
Heel	6.50	ft	Total Ht. of Wall	22.67
Total Footing Width, B	14.00	ft		
			Design Height =	**23.23**

Live Load Surcharge

Live Ld. Surcharge Height, h_{eq} (ft) 2.00 AASHTO Table 3.11.6.4-2

Material

Soil Unit Weight (k/ft^3)	0.12	kips/ft^2	Concrete Unit Wt. (k/ft^3)	0.15
Soil Sat. Unit Weight =	0.145	kips/ft^3	Earth on Toe (ft)	5.92
Φ (°)	30			
δ (degrees) =	20			
α (degrees) =	4.97	GDM FIGURE 1500-3 AND AAHSHTO C3.11.5.8.1-1		
K_a	0.316			



Sum Moments .....Clockwise is positive

Item	Height (ft)	Width (ft)	Unit Weight (k/ft^3)	P (kips)	About "A" Arm (ft.)	About "A" Moment (ft-k)	About "B" P (kips)	About "B" Arm (ft.)	About "B" Moment (ft-k)	About "C" P (kips)	About "C" Arm (ft.)	About "C" Moment (ft-k)
Vertical Loads												
Concrete (DC)												
Stem 1	14.92	1.50	0.15	3.36	6.75	22.65	-	-	-	-	-	-
Stem 2	4.75	1.50	0.15	1.07	6.75	7.21	-	-	-	-	-	-
Footer	3.00	14.00	0.15	6.30	7.00	44.10	-	-	-	-	-	-
Earth Load (EV)												
Soil Above Toe	5.92	6.00	0.12	4.26	3.00	12.78	-	-	-	-	-	-
Soil Above Heel 1	19.67	6.50	0.12	15.34	10.75	164.89						
Soil Above Heel 2	0.56	6.50	0.12	0.22	11.83	2.61						
Vertical Component of Horizontal Earth Pressure from Soil Friction (EH_V)												
Vert. Load from EH_V	23.23	-	0.12	3.50	14.00	49.04	-	-	-	-	-	-
Live Load (LS_V)												
Live Load Surcharge	2.00	6.50	0.13	1.63	10.75	17.47	-	-	-	-	-	-
Horizontal Loads												
Earth Load (EH_H)												
Active Earth Pressure	23.23	-	0.120	**-9.62**	7.74	**-74.53**	-4.27	5.16	**-22.05**	-7.30	6.74	**-49.22**
Live Load (LS_H)												
Live Load Surcharge	23.23	2.00	0.13	-1.84	11.61	-21.34	-1.22	7.74	-9.48	-1.60	10.11	-16.18

AASHTO LRFD Load Factors - AASHTO Table 3.4.1-1

	Vertical Loads				Horizontal Loads		
Limit State	DC	EV	EH_V	LS_V	EH	LS_H	CT
Service I	1.00	1.00	1.00	1.00	1.00	1.00	0.00
Strength I.a-Sliding & Eccent.	0.90	1.00	1.50	0.00	1.50	1.75	0.00
Strength I.b-Bearing	1.25	1.35	1.50	1.75	1.50	1.75	0.00
Extreme Event II	1.00	1.00	1.00	0.50	1.00	0.50	0.00

Load Case	Footing/Piles (About A) Per Foot of Abutmemt			Stem 1 (About B) Per Foot of Abutmemt		Stem 2 (About C) Per Foot of Abutmemt	
	P_V (kips)	M_A (ft-k)	P_H (kips)	M_B (ft-k)	P_H (kips)	M_C (ft-k)	P_H (kips)
Service I	35.67	224.89	-11.46	-31.53	-5.50	-65.40	-8.90
Strength I.a	30.47	158.50	-17.65	-49.66	-8.55	-102.15	-13.75
Strength I.b	48.26	290.84	-17.65	-49.66	-8.55	-102.15	-13.75
Extreme Event II	34.86	226.83	-10.54	-26.79	-4.89	-57.31	-8.10

Drilled Shaft Foundation

Dia Above Rock: 3 ft
Dia Below Rock: 2.5 ft

$\eta_i \gamma_p DD$ Anticipated Down Drag = 12.7 kips/ shaft

Location	Bottom of the Pier Cap	Unfactored Downdrag Force (Kips)	Factored Downdrag Force (Kips)
Rear Abutment	893.5	22.1	23.2
Forward Abutment	891.5	12.1	12.7

Tip Resistance

Ap = 4.91 sf
Φqp = 0.5 *BDM 305-1*
qp = 238 ksf (from Geotech Report)

Side Resistance

BOF Elev = 891.50 BOF to TOR = 35.80
TOR Elev = 855.70 TOR to BDS = 5.00
DS Depth Above Rock= 35.80 ft
DS Depth Into Rock= 5.00 ft (Assume 5' below bedrock)
BDS Elev = 850.70
Design Scour Depth = 876.75
Check Scour Depth = 873.17 ft

Layer 1
Start EL 876.75 (Per BDM 305.4.1.1 neglect the shaft resistance of non-scour resistant rock in the scour zone)
End EL 850.70
Layer Thickness 26.05
Perimeter = 7.85 ft
Contributing Depth = 5.00 ft
As = 39.27 sf
Φqp = 0.55 *BDM 305-1*
qp = 0 ksf (from geotech)

Φqp*Rp = 584.14 kips
Φqs*Rs = 0.00 kips
ΦRn = **584.14** kips

Pile Capacity (kip) = **584.14** <-- Based on Tip Resistance Only

Center to center spacing of piles along footer (ft) 12
Length of segment to be analyzed, L (ft) 12

$P_m = 0.64(S/D)^{0.34}$, for $1 \le S/D < 3.75$, where $0.5 \le P_m \le 1.0$

S/B 4
P_m = 1

Lpile Soil Inputs

Top of Wall Ground at Boring = 894.30
Top of Wall = 914.17

Bottom of Footing Elevation = 891.50
Approx Top of Rock= 855.70
Design Scour Depth = 876.75
Check Scour Depth = 873.17
Top of footing Depth = 19.67 ft
Height of Abutment in Lpile = 22.67 ft (Starting at beam seat elevation)
Location of Top of Rock in Lpile = 35.80 ft (Starting at beam BOF elevation)
Location of top of footing in Lpile = 19.67

B-003-0-24											
	EL START	EL END	GAMMA	C	E50	K =	km	qu	initial rock mod	RQD	Friction angle
Sand (Reese)	891.50	879.9	62.6			60					36
Still Clay with Free Water (R	879.9	876.9	72.6	6000	0.004	2000					
Sand (Reese)	876.9	874.9	72.6			125					40
Still Clay with Free Water (R	874.9	869.4	72.6	5600	0.004	2000					
Still Clay with Free Water (R	869.4	855.7	67.6	4600	0.004	2000					
Weak Rock (Reese)	855.7	791.5	97.5				0.0005	661	60000	9	

	Distance From Bottom of Footing	Layer Thickness	Layer End depth from top of boring
Sand (Reese)	14.75	1.85	16.60
Still Clay with Free Water (R	16.60	5.5	22.1
Still Clay with Free Water (R	22.1	13.7	35.8
Weak Rock (Reese)	35.8	64.2	

For Extreme Event II (using Check STM elevations)	Distance From Bottom of Footing	Layer Thickness	Layer End depth from top of boring
Still Clay with Free Water (Reese)	18.33	3.77	22.10
Still Clay with Free Water (Reese)	22.1	13.7	35.8
Weak Rock (Reese)	35.8	64.2	100

Resolve Forces in Drilled Shafts

	Piles Per Segment	Dist. From Toe, A (ft)	Battered? (y,n)	Batter Rate (x:1)	Centroid of Pile Group from Toe, X_Y (ft)
Row 0					7.00
Row 1	1	2.5	n		
Row 2	1	11.50	n		
Row 3					
Sum of Piles	2				

Forces acting on the the Segment

	P_V (kips)	M_A (ft-kip)	e (ft)	e-X_Y	M_Y (ft-kip)	P_H (kips)
Service I	428.06	2698.70	6.30	-0.70	-297.70	-137.54
Strength I.a	365.59	1902.02	5.20	-1.80	-657.10	-211.82
Strength I.b	579.11	3490.04	6.03	-0.97	-563.75	-211.82
Extreme Event II	418.31	2721.91	6.51	-0.49	-206.24	-126.52

	Vertical Capacity (kip)	Dist. From Y, x_i (ft)	$(x_i)^2$	Pile $\Sigma A(x_i)^2$
Row 0				
Row 1	584.1	-4.50	20.25	20.25
Row 2	584.1	4.50	20.25	20.25
Row 3				
			$\Sigma (x)^2$	40.50

Vertical Loads

Vertical Load on a Single Pile in the Row

	Service I (kip)	Strength I.a (kip)	Strength I.b (kip)	Extreme Event II (kip)
Row 0				
Row 1	247.11	255.81	352.20	232.07
Row 2	180.95	109.78	226.92	186.24
Row 3				

Vertical Loads with Down Drag

Location	Service I (kip)	Strength I.a (kip)	Strength I.b (kip)	Extreme Event II (kip)
Row 0				
Row 1	259.81	268.51	364.90	244.77
Row 2	193.65	122.48	239.62	198.94
Row 3				

Concurrent Lateral Resistance

Lateral Resistance Based on Batter of Piles (if present)

	Service I (k/ft)	Strength I.a (k/ft)	Strength I.b (k/ft)	Extreme Event II (kip)
Row 0				
Row 1	0.00	0.00	0.00	0.00
Row 2	0.00	0.00	0.00	0.00
Row 3				
Lat. Pile Resistance =	**11.46**	**17.65**	**17.65**	**10.54**
Lat. Pile Resistance =	**-10.46**	**-17.65**	**-17.65**	**-10.54**

Pile Spa Dir of Load, S 9.00 ft
Pile Spa Normal to Load, S 12.00 ft
Pile Dia, B 3 ft

Space Ratio Direction of Loading, S/B 3.00 B

Space Ratio Normal Loading, S/B = 4.00 B
Space Ratio Normal Loading, S/B (3rd row) = 12.00 B

	P-Multipliers, Pm		
	Direction of Loading (10.7.2.4-1)	Normal to Loading BDM 305.1.2	Composite Pm
Row 1	0.700	1.000	0.700
Row 2	0.500	1.000	0.500

BDM C305.1.2 --> FHWA GEC 10, 11.5.1

$$P_m = 0.64\,(S/B)^{0.34} \text{ for } 1.0 \le S/B \le 3.75$$

TABLE 11-1 RECOMMENDED P-MULTIPLIER, P_M, VALUES FOR DESIGN BY ROW POSITION

Row Position	*Design P-multiplier, P_m*			
Pile Spacing (c-c)	3D	4D	5D	≥ 6D
Lead Row	0.7	0.85	1.0	1.0
2nd Row	0.5	0.65	0.85	1.0
3rd and higher Rows	0.35	0.5	0.7	1.0

Lpile Results

Capacity To Deisgn Scour Depth to 875.5 (STRENGTH I.a.)

Results - 3'-0" Dia Drilled Shaft

Axial Load in Row 1 =		268.51	k	Check Lpile with and without axial load.
Axial Load in Row 2 =		122.48	k	Check Lpile with and without axial load.

Shear Corresponding to Deflection = 1% (Used to determine corresponding shear in each pile)

	Row 1	Row 2		
	0.700	0.500	Pm applies to soils above rock	
Deflection	1.4	1.4	in	
Resistance			k	
# of Piles	1	1		
Total Resistance	111.71	95.771	k	
Total Resistance @ Abutment		207.481	k	
Total Shear on Abutment, Vu		211.82	k	OK, within 5% and this is not accounting for orrientation of turnback wingwalls which adds capacity to the overall system

Capacity To Deisgn Scour Depth to 875.5 (SERVICE I)

Results - 3'-0" Dia Drilled Shaft

Axial Load in Row 1 =		259.81	k	Check Lpile with and without axial load.
Axial Load in Row 2 =		193.65	k	Check Lpile with and without axial load.

Not checking this condition as deflection is only 1.4" in the strength case

	Row 1	Row 2		
	0.700	0.500	Pm applies to soils above rock	
Deflection			in	
Resistance			k	
# of Piles				
Total Resistance			k	
Total Resistance @ Abutment			k	
Total Shear on Abutment, Vu			k	OK

Capacity To Deisgn Scour Depth to 873.17 (EXTREME EVENT II)

Results - 3'-0" Dia Drilled Shaft

Axial Load in Row 1 =		244.77	k	Check Lpile with and without axial load.
Axial Load in Row 2 =		198.94	k	Check Lpile with and without axial load.

Shear Corresponding to Deflection = 1% (Used to determine corresponding shear in each pile)

	Row 1	Row 2		
	0.700	0.500	Pm applies to soils above rock	
Deflection	1.4	1.4	in	
Resistance			k	
# of Piles	1	1		
Total Resistance	69.802	62.54	k	
Total Resistance @ Abutment		132.342	k	
Total Shear on Abutment, Vu		126.52	k	OK

305.4.1.1 SCOUR

Neglect the shaft resistance provided by soil or non-scour resistant rock in the scour zone. Assess scour resistant rock according to BDM Section 305.2.1.2.b. Use the depth of scour resulting from the design flood, with Strength and Service Limit State checks. Use the depth of scour resulting from the check flood with Extreme Event II Limit State checks.

Extend friction drilled shafts to penetrate a minimum of 15-ft below the controlling scour elevation. If socketed into non-scour resistant bedrock, when the rock has Q_u < 2.5-ksi, extend drilled shafts to penetrate a minimum of 10-ft below the controlling scour elevation in the bedrock; when the rock has $Q_u \geq 2.5$-ksi, extend drilled shafts to penetrate a minimum of 5-ft below the controlling scour elevation in the bedrock. If socketed into scour resistant bedrock, design the length of the bedrock socket based solely on the requirements of axial resistance in accordance with *LRFD 10.8.3.5.4* and of lateral stability.

Because the drilled shaft will lose support along the scour depth, investigate the structural capacity of the shaft considering the depth of the scour as an unbraced length. Also perform a p-y analysis on the drilled shaft according to BDM Section 305.1.2 to demonstrate lateral stability against:

A. Overturning failure in the Strength Limit State with the maximum estimated scour depth at the design flood, and

B. Overturning failure in the Extreme Event II Limit State with the maximum estimated scour depth at the check flood, and

C. Excessive deflection in the Service Limit State.

==========

LPile for Windows, Version 2022-12.011

Analysis of Individual Piles and Drilled Shafts
Subjected to Lateral Loading Using the p-y Method
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Files Used for Analysis

Path to file locations:
\20240280\ODOT\109971\400-Engineering\Structures\SFN_0800512\Engdata\04_Abutment Design\Stage 2\Drilled Shaft\Lpile\Wingwalls\Forward Abutment Wingwalls\

Name of input data file:
FA WW_Scour Strength 1 - Front DS.lp12d

Name of output report file:
FA WW_Scour Strength 1 - Front DS.lp12o

Name of plot output file:
FA WW_Scour Strength 1 - Front DS.lp12p

Name of runtime message file:
FA WW_Scour Strength 1 - Front DS.lp12r

Date and Time of Analysis

Date: February 12, 2026 Time: 14:03:02

Problem Title

Project Name:

Job Number:

Client:

Engineer:

Description:

Program Options and Settings

Computational Options:
- Conventional Analysis

Engineering Units Used for Data Input and Computations:
- US Customary System Units (pounds, feet, inches)

Analysis Control Options:

- Maximum number of iterations allowed	=	500
- Deflection tolerance for convergence	=	1.0000E-05 in
- Maximum allowable deflection	=	100.0000 in
- Number of pile increments	=	100

Loading Type and Number of Cycles of Loading:

- Static loading specified

- Analysis uses p-y modification factors for p-y curves
- Analysis uses layering correction (Method of Georgiadis)
- No distributed lateral loads are entered
- Loading by lateral soil movements acting on pile not selected
- Input of shear resistance at the pile tip not selected
- Input of moment resistance at the pile tip not selected
- Computation of pile-head foundation stiffness matrix not selected
- Push-over analysis of pile not selected
- Buckling analysis of pile not selected

Output Options:
- Output files use decimal points to denote decimal symbols.
- Values of pile-head deflection, bending moment, shear force, and soil reaction are printed for full length of pile.
- Printing Increment (nodal spacing of output points) = 1
- No p-y curves to be computed and reported for user-specified depths
- Print using wide report formats

Pile Structural Properties and Geometry

Number of pile sections defined = 2
Total length of pile = 40.800 ft
Depth of ground surface below top of pile = 14.7500 ft

Pile diameters used for p-y curve computations are defined using 4 points.

p-y curves are computed using pile diameter values interpolated with depth over the length of the pile. A summary of values of pile diameter vs. depth follows.

Point No.	Depth Below Pile Head feet	Pile Diameter inches
1	0.000	36.0000
2	35.800	36.0000
3	35.800	30.0000
4	40.800	30.0000

Input Structural Properties for Pile Sections:

Pile Section No. 1:

Section 1 is a round drilled shaft, bored pile, or CIDH pile
Length of section = 35.800000 ft
Shaft Diameter = 36.000000 in

Pile Section No. 2:

Section 2 is a round drilled shaft, bored pile, or CIDH pile
Length of section = 5.000000 ft
Shaft Diameter = 30.000000 in

Soil and Rock Layering Information

The soil profile is modelled using 4 layers

Layer 1 is sand, p-y criteria by Reese et al., 1974

Distance from top of pile to top of layer = 14.750000 ft
Distance from top of pile to bottom of layer = 16.600000 ft
Effective unit weight at top of layer = 72.600000 pcf
Effective unit weight at bottom of layer = 72.600000 pcf
Friction angle at top of layer = 40.000000 deg.
Friction angle at bottom of layer = 40.000000 deg.
Subgrade k at top of layer = 125.000000 pci
Subgrade k at bottom of layer = 125.000000 pci

Layer 2 is stiff clay with water-induced erosion

Distance from top of pile to top of layer = 16.600000 ft
Distance from top of pile to bottom of layer = 22.100000 ft
Effective unit weight at top of layer = 72.600000 pcf
Effective unit weight at bottom of layer = 72.600000 pcf
Undrained cohesion at top of layer = 5600. psf
Undrained cohesion at bottom of layer = 5600. psf
Epsilon-50 at top of layer = 0.004000
Epsilon-50 at bottom of layer = 0.004000
Subgrade k at top of layer = 2000. pci
Subgrade k at bottom of layer = 2000. pci

Layer 3 is stiff clay with water-induced erosion

Distance from top of pile to top of layer = 22.100000 ft
Distance from top of pile to bottom of layer = 35.800000 ft
Effective unit weight at top of layer = 67.600000 pcf

```
   Effective unit weight at bottom of layer            =    67.600000 pcf
   Undrained cohesion at top of layer                  =        4600. psf
   Undrained cohesion at bottom of layer               =        4600. psf
   Epsilon-50 at top of layer                          =     0.004000
   Epsilon-50 at bottom of layer                       =     0.004000
   Subgrade k at top of layer                          =        2000. pci
   Subgrade k at bottom of layer                       =        2000. pci


Layer 4 is weak rock, p-y criteria by Reese, 1997

   Distance from top of pile to top of layer           =    35.800000 ft
   Distance from top of pile to bottom of layer        =   100.000000 ft
   Effective unit weight at top of layer               =    97.500000 pcf
   Effective unit weight at bottom of layer            =    97.500000 pcf
   Uniaxial compressive strength at top of layer       =   661.000000 psi
   Uniaxial compressive strength at bottom of layer    =   661.000000 psi
   Initial modulus of rock at top of layer             =       60000. psi
   Initial modulus of rock at bottom of layer          =       60000. 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                        =    0.0005000
   k rm of rock at bottom of layer                     =    0.0005000


 (Depth of the lowest soil layer extends 59.200 ft below the pile tip)



--------------------------------------------------------------------------------
                        Summary of Input Soil Properties
--------------------------------------------------------------------------------

Layer         Soil Type          Layer      Effective    Cohesion     Angle of
Uniaxial                      E50                      Rock Mass
 Num.           Name            Depth       Unit Wt.                  Friction
 qu          RQD %         or           kpy        Modulus
          (p-y Curve Type)        ft           pcf          psf          deg.
 psi                        krm          pci          psi
-----   ------------------   ----------   ----------   ----------   ----------
----------   ----------   ----------   ----------   ----------
  1            Sand              14.7500      72.6000       --          40.0000
 --            --            --          125.0000       --
          (Reese, et al.)        16.6000      72.6000       --          40.0000
 --            --            --          125.0000       --
  2         Stiff Clay           16.6000      72.6000        5600.       --
 --            --           0.00400        2000.       --
          with Free Water        22.1000      72.6000        5600.       --
 --            --           0.00400        2000.       --
  3         Stiff Clay           22.1000      67.6000        4600.       --
```

```
 --           --          0.00400        2000.       --
          with Free Water        35.8000      67.6000        4600.       --
 --           --          0.00400        2000.       --
  4            Weak              35.8000      97.5000       --           --
661.0000       9.0000     5.00E-04       --           60000.
               Rock             100.0000      97.5000       --           --
661.0000       9.0000     5.00E-04       --           60000.
```

Modification Factors for p-y Curves

Distribution of p-y modifiers with depth defined using 2 points

Point No.	Depth X ft	p-mult	y-mult
1	14.750	0.7000	1.0000
2	35.800	0.7000	1.0000

Static Loading Type

Static loading criteria were used when computing p-y curves for all analyses.

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 1

Load No.	Load Type	Condition 1	Condition 2	Axial Thrust Force, lbs	Compute Top y vs. Pile Length	Run Analysis
1	5	y = 1.400000 in	S = 0.0000 in/in	268510.	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 = 2

Pile Section No. 1:

Dimensions and Properties of Drilled Shaft (Bored Pile):

Length of Section	=	35.800000 ft
Shaft Diameter	=	36.000000 in
Concrete Cover Thickness (to edge of trans. reinf.)	=	6.000000 in
Number of Reinforcing Bars	=	17 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	=	21.590000 sq. in.
Area Ratio of Steel Reinforcement	=	2.12 percent
Edge-to-Edge Bar Spacing	=	2.676940 in
Maximum Concrete Aggregate Size	=	0.375000 in
Ratio of Bar Spacing to Aggregate Size	=	7.14
Offset of Center of Rebar Cage from Center of Pile	=	0.0000 in

Transverse Reinforcement
Type: Hoop

Number of Transverse Reinf. (per spacing)	=	1
Spacing of Transverse Reinf.	=	4.500000 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	=	4682.772 kips
Tensile Load for Cracking of Concrete	=	-486.599 kips
Nominal Axial Tensile Capacity	=	-1295.400 kips

Reinforcing Bar Dimensions and Positions Used in Computations:

Bar Number	Bar Diam. inches	Bar Area sq. in.	X inches	Y inches
1	1.270000	1.270000	10.740000	0.00000
2	1.270000	1.270000	10.014752	3.879735
3	1.270000	1.270000	7.936956	7.235491
4	1.270000	1.270000	4.787230	9.614054
5	1.270000	1.270000	0.990962	10.694185
6	1.270000	1.270000	-2.93914	10.330007
7	1.270000	1.270000	-6.47230	8.570705
8	1.270000	1.270000	-9.13133	5.653881
9	1.270000	1.270000	-10.55713	1.973470
10	1.270000	1.270000	-10.55713	-1.97347
11	1.270000	1.270000	-9.13133	-5.65388
12	1.270000	1.270000	-6.47230	-8.57071
13	1.270000	1.270000	-2.93914	-10.33001
14	1.270000	1.270000	0.990962	-10.69419
15	1.270000	1.270000	4.787230	-9.61405
16	1.270000	1.270000	7.936956	-7.23549
17	1.270000	1.270000	10.014752	-3.87974

NOTE: The positions of the above rebars were computed by LPile

Minimum spacing between any two bars not equal to zero = 2.677 inches
between bars 6 and 7.

Ratio of bar spacing to maximum aggregate size = 7.14

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	=	0.375000 in

Number of Axial Thrust Force Values Determined from Pile-head Loadings = 1

Number	Axial Thrust Force kips
1	268.510

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 = 268.510 kips

Bending Max Conc Curvature Stress rad/in.	Bending Max Steel Moment Stress in-kip ksi	Bending Stiffness kip-in2	Depth to N Axis in	Max Comp Strain in/in	Max Tens Strain in/in	Run Msg
6.25000E-07	231.4694353	370351097.	107.7261707	0.00006733	0.00004483	
0.2799969	1.8318243					
0.00000125	462.9579787	370366383.	62.8812425	0.00007860	0.00003360	
0.3255025	2.0380200					
0.00000188	694.4361651	370365955.	47.9409827	0.00008989	0.00002239	
0.3707891	2.2446534					
0.00000250	925.8988269	370359531.	40.4768904	0.0001012	0.00001119	
0.4158554	2.4517246					
0.00000313	1157.	370349055.	36.0032655	0.0001125	1.02047E-08	
0.4607004	2.6592334					
0.00000375	1389.	370323470.	33.0247279	0.0001238	-0.00001116	
0.5053208	2.8671642					
0.00000438	1620.	370233094.	30.8997888	0.0001352	-0.00002231	
0.5497027	3.0754232					
0.00000500	1850.	370057089.	29.3076759	0.0001465	-0.00003346	
0.5938321	3.2839130					
0.00000563	2080.	369800742.	28.0703807	0.0001579	-0.00004460	
0.6376997	3.4925682					
0.00000625	2309.	369476607.	27.0812329	0.0001693	-0.00005574	
0.6812996	3.7013484					
0.00000688	2538.	369096926.	26.2723500	0.0001806	-0.00006688	
0.7246279	3.9102262					

```
0.00000750         2765.    368671967.    25.5987696     0.0001920   -0.00007801
0.7676818     4.1191824
0.00000813         2992.    368209985.    25.0290337     0.0002034   -0.00008914
0.8104593     4.3282036
0.00000875         3218.    367717574.    24.5409062     0.0002147     -0.000100
0.8529591     4.5372800
0.00000938         3218.    343203070.    22.3578992     0.0002096     -0.000128
0.8332154     4.2678664 C
0.00001000         3218.    321752878.    21.8186649     0.0002182     -0.000142
0.8650950     4.3960247 C
0.00001063         3218.    302826238.    21.3316672     0.0002266     -0.000156
0.8963656     4.5207075 C
0.00001125         3218.    286002558.    20.8896370     0.0002350     -0.000170
0.9270993     4.6424239 C
0.00001188         3218.    270949792.    20.4864538     0.0002433     -0.000184
0.9573428     4.7614965 C
0.00001250         3218.    257402302.    20.1169863     0.0002515     -0.000199
0.9871315     4.8781642 C
0.00001313         3218.    245145050.    19.7770452     0.0002596     -0.000213
1.0165018     4.9926790 C
0.00001375         3218.    234002093.    19.4631868     0.0002676     -0.000227
1.0454867     5.1052726 C
0.00001438         3218.    223828089.    19.1725651     0.0002756     -0.000242
1.0741188     5.2161764 C
0.00001500         3218.    214501918.    18.9028041     0.0002835     -0.000256
1.1024297     5.3256201 C
0.00001563         3269.    209217534.    18.6499521     0.0002914     -0.000271
1.1303408     5.4329469 C
0.00001625         3338.    205389016.    18.4142718     0.0002992     -0.000286
1.1579846     5.5392006 C
0.00001688         3405.    201806062.    18.1942466     0.0003070     -0.000300
1.1853862     5.6445720 C
0.00001750         3472.    198415928.    17.9863063     0.0003148     -0.000315
1.2124302     -5.762000 C
0.00001813         3539.    195243269.    17.7921135     0.0003225     -0.000330
1.2393057     -6.069858 C
0.00001875         3604.    192232301.    17.6078547     0.0003301     -0.000345
1.2658531     -6.379354 C
0.00001938         3670.    189404804.    17.4351834     0.0003378     -0.000360
1.2922518     -6.689019 C
0.00002000         3734.    186710668.    17.2705000     0.0003454     -0.000375
1.3183277     -7.000310 C
0.00002063         3799.    184176319.    17.1160082     0.0003530     -0.000389
1.3442926     -7.311475 C
0.00002125         3862.    181751929.    16.9678747     0.0003606     -0.000404
1.3699317     -7.624321 C
0.00002188         3926.    179458669.    16.8280586     0.0003681     -0.000419
1.3954354     -7.937261 C
0.00002250         3989.    177278262.    16.6951864     0.0003756     -0.000434
1.4207518     -8.250738 C
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0.00002313 4051. 175191036. 16.5677517 0.0003831 -0.000449
1.4458079 -8.565385 C
0.00002375 4114. 173210748. 16.4472008 0.0003906 -0.000464
1.4707558 -8.879909 C
0.00002438 4176. 171317956. 16.3319307 0.0003981 -0.000479
1.4955067 -9.195079 C
0.00002563 4299. 167771701. 16.1158343 0.0004130 -0.000510
1.5444400 -9.827193 C
0.00002688 4422. 164523188. 15.9181578 0.0004278 -0.000540
1.5927383 -10.460648 C
0.00002813 4543. 161534620. 15.7365254 0.0004426 -0.000570
1.6404229 -11.095297 C
0.00002938 4664. 158772897. 15.5688388 0.0004573 -0.000600
1.6874790 -11.731308 C
0.00003063 4784. 156213524. 15.4135499 0.0004720 -0.000630
1.7339470 -12.368356 C
0.00003188 4904. 153841004. 15.2703739 0.0004867 -0.000661
1.7799208 -13.005611 C
0.00003313 5022. 151619226. 15.1357464 0.0005014 -0.000691
1.8251975 -13.644961 C
0.00003438 5141. 149551530. 15.0112294 0.0005160 -0.000721
1.8700584 -14.283837 C
0.00003563 5259. 147613852. 14.8950612 0.0005306 -0.000752
1.9143763 -14.923427 C
0.00003688 5376. 145788770. 14.7853210 0.0005452 -0.000782
1.9580829 -15.564410 C
0.00003813 5493. 144076682. 14.6829550 0.0005598 -0.000813
2.0013759 -16.204915 C
0.00003938 5610. 142466789. 14.5877106 0.0005744 -0.000843
2.0442541 -16.844941 C
0.00004063 5726. 140937016. 14.4969144 0.0005889 -0.000874
2.0864606 -17.487010 C
0.00004188 5841. 139491370. 14.4114663 0.0006035 -0.000904
2.1282309 -18.128838 C
0.00004313 5957. 138123646. 14.3313592 0.0006180 -0.000934
2.1695882 -18.770182 C
0.00004438 6072. 136827237. 14.2556960 0.0006326 -0.000965
2.2105311 -19.411037 C
0.00004563 6186. 135591566. 14.1844668 0.0006472 -0.000995
2.2509392 -20.052635 C
0.00004688 6301. 134411782. 14.1161003 0.0006617 -0.001026
2.2908136 -20.694989 C
0.00004813 6414. 133288028. 14.0516185 0.0006762 -0.001056
2.3302750 -21.336847 C
0.00004938 6528. 132216021. 13.9907493 0.0006908 -0.001087
2.3693220 -21.978209 C
0.00005063 6642. 131191902. 13.9332268 0.0007054 -0.001117
2.4079531 -22.619069 C
0.00005188 6755. 130212182. 13.8788110 0.0007200 -0.001148
2.4461670 -23.259427 C

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0.00005313        6867.    129269943.    13.8260799     0.0007345     -0.001178
2.4838357    -23.900685 C
0.00005438        6980.    128364262.    13.7761667     0.0007491     -0.001208
2.5210175    -24.542220 C
0.00005563        7092.    127494689.    13.7285375     0.0007636     -0.001239
2.5577828    -25.183240 C
0.00005688        7204.    126658819.    13.6833157     0.0007782     -0.001269
2.5941303    -25.823744 C
0.00005813        7315.    125854451.    13.6403477     0.0007928     -0.001300
2.6300584    -26.463727 C
0.00005938        7427.    125079573.    13.5994929     0.0008075     -0.001330
2.6655658    -27.103186 C
0.00006063        7538.    124332337.    13.5606224     0.0008221     -0.001360
2.7006507    -27.742119 C
0.00006188        7648.    123611043.    13.5236177     0.0008368     -0.001391
2.7353119    -28.380522 C
0.00006313        7759.    122913024.    13.4880240     0.0008514     -0.001421
2.7694964    -29.019025 C
0.00006438        7869.    122235902.    13.4529978     0.0008660     -0.001451
2.8031555    -29.658241 C
0.00006563        7979.    121580567.    13.4204402     0.0008807     -0.001482
2.8363908    -30.296912 C
0.00006688        8088.    120945785.    13.3889669     0.0008954     -0.001512
2.8692008    -30.935035 C
0.00006813        8198.    120330402.    13.3589284     0.0009101     -0.001542
2.9015839    -31.572605 C
0.00006938        8307.    119733347.    13.3302487     0.0009248     -0.001573
2.9335386    -32.209618 C
0.00007063        8415.    119153625.    13.3028575     0.0009395     -0.001603
2.9650632    -32.846073 C
0.00007188        8524.    118590310.    13.2766893     0.0009543     -0.001633
2.9961561    -33.481963 C
0.00007313        8632.    118042538.    13.2516833     0.0009690     -0.001663
3.0268158    -34.117287 C
0.00007438        8740.    117509505.    13.2277824     0.0009838     -0.001694
3.0570404    -34.752040 C
0.00007938        9169.    115510424.    13.1422195     0.0010432     -0.001814
3.1735560    -37.285265 C
0.00008438        9593.    113690418.    13.0680998     0.0011026     -0.001935
3.2826392    -39.814477 C
0.00008938       10012.    112022954.    13.0066684     0.0011625     -0.002055
3.3845637    -42.333954 C
0.00009438       10427.    110482657.    12.9551679     0.0012226     -0.002175
3.4792202    -44.843238 C
0.00009938       10837.    109049078.    12.9124944     0.0012832     -0.002294
3.5664830    -47.342019 C
 0.0001044       11242.    107705625.    12.8774881     0.0013441     -0.002413
3.6462209    -49.829968 C
 0.0001094       11642.    106438690.    12.8492067     0.0014054     -0.002532
3.7182964    -52.306733 C
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 0.0001144        12036.    105236945.    12.8258868     0.0014670     -0.002651
3.7825646    -54.771950 C
 0.0001194        12426.    104090920.    12.8090336     0.0015291     -0.002768
3.8388739    -57.225223 C
 0.0001244        12810.    102992584.    12.7969641     0.0015916     -0.002886
3.8870646    -59.666135 C
 0.0001294        13178.    101859884.    12.7861732     0.0016542     -0.003003
3.9267425    -60.000000 CY
 0.0001344        13498.    100446528.    12.7659322     0.0017154     -0.003122
3.9572356    -60.000000 CY
 0.0001394        13761.     98735195.    12.7329518     0.0017747     -0.003243
3.9789908    -60.000000 CY
 0.0001444        13989.     96892074.    12.6945448     0.0018328     -0.003365
3.9928976    -60.000000 CY
 0.0001494        14191.     95004509.    12.6542596     0.0018902     -0.003487
3.9994090    -60.000000 CY
 0.0001544        14370.     93081809.    12.6122250     0.0019470     -0.003610
3.9994247    -60.000000 CY
 0.0001594        14532.     91182720.    12.5713946     0.0020036     -0.003734
3.9992317    -60.000000 CY
 0.0001644        14679.     89303128.    12.5312427     0.0020598     -0.003858
3.9987338    -60.000000 CY
 0.0001694        14809.     87431593.    12.4907317     0.0021156     -0.003982
3.9977193    -60.000000 CY
 0.0001744        14928.     85611424.    12.4522639     0.0021714     -0.004106
3.9991833    -60.000000 CY
 0.0001794        15042.     83858773.    12.4168259     0.0022273     -0.004230
3.9997744    -60.000000 CY
 0.0001844        15143.     82133623.    12.3801194     0.0022826     -0.004355
3.9986131    -60.000000 CY
 0.0001894        15232.     80435216.    12.3430749     0.0023375     -0.004480
3.9974723    -60.000000 CY
 0.0001944        15313.     78778913.    12.3070032     0.0023922     -0.004605
3.9995980    -60.000000 CY
 0.0001994        15390.     77190278.    12.2721071     0.0024468     -0.004731
3.9972720    -60.000000 CY
 0.0002044        15464.     75664947.    12.2432289     0.0025022     -0.004855
3.9998996    -60.000000 CY
 0.0002094        15534.     74191454.    12.2145084     0.0025574     -0.004980
3.9977315    -60.000000 CY
 0.0002144        15596.     72751495.    12.1850558     0.0026122     -0.005105
3.9999426    -60.000000 CY
 0.0002194        15651.     71342720.    12.1564615     0.0026668     -0.005231
3.9973419    -60.000000 CY
 0.0002244        15701.     69977922.    12.1276692     0.0027211     -0.005356
3.9998092    -60.000000 CY
 0.0002294        15747.     68652534.    12.1004365     0.0027755     -0.005482
3.9959414    -60.000000 CY
 0.0002344        15792.     67379152.    12.0765226     0.0028304     -0.005607
3.9992313    -60.000000 CY
```

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    0.0002394        15836.     66154463.    12.0529822     0.0028852     -0.005732
   3.9975234    -60.000000 CY
    0.0002444        15878.     64971890.    12.0302421     0.0029399     -0.005858
   3.9976142    -60.000000 CY
    0.0002494        15918.     63830509.    12.0086690     0.0029947     -0.005983
   3.9997861    -60.000000 CY
    0.0002544        15953.     62715201.    11.9869024     0.0030492     -0.006108
   3.9942908    -60.000000 CY
    0.0002594        15987.     61635397.    11.9661233     0.0031037     -0.006234
   3.9979099    -60.000000 CY
    0.0002644        16015.     60578190.    11.9444445     0.0031578     -0.006360
   3.9998005    -60.000000 CY
    0.0002694        16043.     59555874.    11.9241223     0.0032121     -0.006485
   3.9947871    -60.000000 CY
    0.0002744        16066.     58554777.    11.9030859     0.0032659     -0.006612
   3.9968915    -60.000000 CY
    0.0003044        16192.     53198339.    11.8004436     0.0035918     -0.007366
   3.9977618    -60.000000 CYT
    0.0003344        16223.     48516913.    11.7468286     0.0039278     -0.008110
   3.9952613    -60.000000 CYT


-------------------------------------------------------------------------------
   Summary of Results for Nominal Moment Capacity for Section 1
-------------------------------------------------------------------------------

Moment values interpolated at maximum compressive strain = 0.003
or maximum developed moment if pile fails at smaller strains.

 Load           Axial Thrust        Nominal Mom. Cap.      Max. Comp.      Max.
Tens.
  No.              kips                 in-kip               Strain
Strain
 ----         ----------------     ------------------     ------------
------------
   1               268.510             15921.205           0.00300000
-0.00599513

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	268.510000	15921.	174.531500	10349.	110772399.
1	0.75	268.510000	15921.	201.382500	11941.	105527902.
1	0.90	268.510000	15921.	241.659000	14329.	93517909.

Pile Section No. 2:

Dimensions and Properties of Drilled Shaft (Bored Pile):

Length of Section	=	5.000000 ft
Shaft Diameter	=	30.000000 in
Concrete Cover Thickness (to edge of trans. reinf.)	=	3.000000 in
Number of Reinforcing Bars	=	17 bars
Yield Stress of Reinforcing Bars	=	60000. psi
Modulus of Elasticity of Reinforcing Bars	=	29000000. psi
Gross Area of Shaft	=	706.858347 sq. in.
Total Area of Reinforcing Steel	=	21.590000 sq. in.
Area Ratio of Steel Reinforcement	=	3.05 percent
Edge-to-Edge Bar Spacing	=	2.676940 in
Maximum Concrete Aggregate Size	=	0.375000 in
Ratio of Bar Spacing to Aggregate Size	=	7.14
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.	=	4.500000 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	=	3625.312 kips

Tensile Load for Cracking of Concrete = -357.244 kips
Nominal Axial Tensile Capacity = -1295.400 kips

Reinforcing Bar Dimensions and Positions Used in Computations:

Bar Number	Bar Diam. inches	Bar Area sq. in.	X inches	Y inches
1	1.270000	1.270000	10.740000	0.00000
2	1.270000	1.270000	10.014752	3.879735
3	1.270000	1.270000	7.936956	7.235491
4	1.270000	1.270000	4.787230	9.614054
5	1.270000	1.270000	0.990962	10.694185
6	1.270000	1.270000	-2.93914	10.330007
7	1.270000	1.270000	-6.47230	8.570705
8	1.270000	1.270000	-9.13133	5.653881
9	1.270000	1.270000	-10.55713	1.973470
10	1.270000	1.270000	-10.55713	-1.97347
11	1.270000	1.270000	-9.13133	-5.65388
12	1.270000	1.270000	-6.47230	-8.57071
13	1.270000	1.270000	-2.93914	-10.33001
14	1.270000	1.270000	0.990962	-10.69419
15	1.270000	1.270000	4.787230	-9.61405
16	1.270000	1.270000	7.936956	-7.23549
17	1.270000	1.270000	10.014752	-3.87974

NOTE: The positions of the above rebars were computed by LPile

Minimum spacing between any two bars not equal to zero = 2.677 inches
between bars 6 and 7.

Ratio of bar spacing to maximum aggregate size = 7.14

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 = 0.375000 in

Number of Axial Thrust Force Values Determined from Pile-head Loadings = 1

Number	Axial Thrust Force

	kips
1	268.510

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 = 268.510 kips

Bending Max Conc Curvature Stress rad/in.	Bending Max Steel Stress ksi	Bending Stiffness kip-in2	Depth to N Axis in	Max Comp Strain in/in	Max Tens Strain in/in	Run Msg	Moment in-kip
0.00000125	241.0196346	192815708.	76.8688407	0.00009609	0.00005859		0.3963833
2.6505580							
0.00000250	482.0599834	192823993.	45.9582718	0.0001149	0.00003990		0.4709578
3.0600997							
0.00000375	723.0745168	192819871.	35.6653221	0.0001337	0.00002124		0.5449088
3.4707913							
0.00000500	964.0503555	192810071.	30.5267781	0.0001526	0.00000263		0.6182314
3.8826328							
0.00000625	1205.	192787332.	27.4498176	0.0001716	-0.00001594		0.6909163
4.2955920							
0.00000750	1445.	192701922.	25.4024253	0.0001905	-0.00003448		0.7629236
4.7094025							
0.00000875	1685.	192535701.	23.9400118	0.0002095	-0.00005302		0.8342125
5.1237794							
0.00001000	1923.	192299314.	22.8477808	0.0002285	-0.00007152		0.9047587
5.5385540							
0.00001125	2160.	192006734.	21.9985529	0.0002475	-0.00009002		0.9745473
5.9536211							

0.00001250 2396. 191670098. 21.3194192 0.0002665 -0.000109
1.0435686 6.3689145
0.00001375 2396. 174245544. 19.6644408 0.0002704 -0.000142
1.0570653 6.3458833 C
0.00001500 2396. 159725082. 19.0351919 0.0002855 -0.000164
1.1112156 6.6490585 C
0.00001625 2396. 147438537. 18.4883991 0.0003004 -0.000187
1.1640332 6.9454936 C
0.00001750 2424. 138527228. 18.0082856 0.0003151 -0.000210
1.2156517 7.2360945 C
0.00001875 2527. 134798969. 17.5834667 0.0003297 -0.000233
1.2662263 7.5219826 C
0.00002000 2628. 131409345. 17.2039934 0.0003441 -0.000256
1.3157917 7.8033162 C
0.00002125 2727. 128323602. 16.8630462 0.0003583 -0.000279
1.3644607 8.0809179 C
0.00002250 2824. 125508520. 16.5552629 0.0003725 -0.000303
1.4123222 8.3554405 C
0.00002375 2920. 122930628. 16.2759101 0.0003866 -0.000326
1.4594259 8.6272238 C
0.00002500 3014. 120562350. 16.0212054 0.0004005 -0.000349
1.5058219 8.8966254 C
0.00002625 3107. 118374637. 15.7874897 0.0004144 -0.000373
1.5515057 9.1635396 C
0.00002750 3200. 116348255. 15.5722050 0.0004282 -0.000397
1.5965128 9.4282082 C
0.00002875 3291. 114473706. 15.3740559 0.0004420 -0.000420
1.6409540 9.6915566 C
0.00003000 3382. 112731240. 15.1907553 0.0004557 -0.000444
1.6848195 9.9534572 C
0.00003125 3472. 111103064. 15.0201194 0.0004694 -0.000468
1.7280736 10.2135458 C
0.00003250 3562. 109589271. 14.8622370 0.0004830 -0.000492
1.7708878 -10.732908 C
0.00003375 3651. 108163228. 14.7139633 0.0004966 -0.000516
1.8130614 -11.290896 C
0.00003500 3739. 106832781. 14.5763727 0.0005102 -0.000540
1.8548485 -11.848732 C
0.00003625 3827. 105575545. 14.4465905 0.0005237 -0.000564
1.8960450 -12.408335 C
0.00003750 3915. 104394475. 14.3253100 0.0005372 -0.000588
1.9368250 -12.968101 C
0.00003875 4002. 103280468. 14.2113870 0.0005507 -0.000612
1.9771515 -13.528390 C
0.00004000 4089. 102222753. 14.1034146 0.0005641 -0.000636
2.0169402 -14.090037 C
0.00004125 4176. 101225341. 14.0022977 0.0005776 -0.000660
2.0563717 -14.651311 C
0.00004250 4262. 100277649. 13.9065089 0.0005910 -0.000684
2.0953302 -15.213348 C

0.00004375 4348. 99374486. 13.8154190 0.0006044 -0.000708
2.1337961 -15.776368 C
0.00004500 4433. 98518051. 13.7296759 0.0006178 -0.000732
2.1719066 -16.339014 C
0.00004625 4519. 97704411. 13.6488304 0.0006313 -0.000756
2.2096574 -16.901319 C
0.00004750 4604. 96921920. 13.5708383 0.0006446 -0.000780
2.2468297 -17.465530 C
0.00004875 4689. 96176402. 13.4971192 0.0006580 -0.000805
2.2836480 -18.029365 C
0.00005125 4858. 94785411. 13.3612307 0.0006848 -0.000853
2.3562187 -19.155903 C
0.00005375 5026. 93501383. 13.2365069 0.0007115 -0.000901
2.4270112 -20.284739 C
0.00005625 5193. 92319534. 13.1235805 0.0007382 -0.000949
2.4963497 -21.412412 C
0.00005875 5359. 91225212. 13.0205678 0.0007650 -0.000998
2.5641640 -22.539645 C
0.00006125 5525. 90204318. 12.9252385 0.0007917 -0.001046
2.6303168 -23.668008 C
0.00006375 5690. 89253759. 12.8382768 0.0008184 -0.001094
2.6950409 -24.794799 C
0.00006625 5854. 88365486. 12.7587033 0.0008453 -0.001142
2.7583277 -25.920005 C
0.00006875 6018. 87527877. 12.6843088 0.0008720 -0.001190
2.8199313 -27.046597 C
0.00007125 6180. 86739643. 12.6155572 0.0008989 -0.001239
2.8800629 -28.171958 C
0.00007375 6342. 85996271. 12.5523163 0.0009257 -0.001287
2.9387457 -29.295679 C
0.00007625 6504. 85293270. 12.4939713 0.0009527 -0.001335
2.9959707 -30.417744 C
0.00007875 6664. 84626106. 12.4399426 0.0009796 -0.001383
3.0516896 -31.538689 C
0.00008125 6824. 83989501. 12.3888526 0.0010066 -0.001431
3.1057700 -32.660328 C
0.00008375 6983. 83383178. 12.3415104 0.0010336 -0.001479
3.1583783 -33.780244 C
0.00008625 7142. 82804430. 12.2974440 0.0010607 -0.001527
3.2095053 -34.898417 C
0.00008875 7300. 82250853. 12.2566921 0.0010878 -0.001575
3.2591411 -36.014828 C
0.00009125 7457. 81720306. 12.2188470 0.0011150 -0.001623
3.3072760 -37.129458 C
0.00009375 7614. 81210874. 12.1836838 0.0011422 -0.001670
3.3539002 -38.242286 C
0.00009625 7769. 80720840. 12.1510010 0.0011695 -0.001718
3.3990035 -39.353293 C
0.00009875 7924. 80247328. 12.1200417 0.0011969 -0.001766
3.4424549 -40.464668 C

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 0.0001013        8079.     79790374.    12.0910425     0.0012242     -0.001813
3.4843708    -41.574239 C
 0.0001038        8232.     79348763.    12.0640774     0.0012516     -0.001861
3.5247455    -42.681895 C
 0.0001063        8385.     78921342.    12.0390103     0.0012791     -0.001908
3.5635680    -43.787612 C
 0.0001088        8538.     78507061.    12.0157179     0.0013067     -0.001956
3.6008273    -44.891368 C
 0.0001113        8689.     78104968.    11.9938804     0.0013343     -0.002003
3.6365120    -45.993135 C
 0.0001138        8840.     77714185.    11.9738132     0.0013620     -0.002050
3.6706105    -47.092891 C
 0.0001163        8990.     77333914.    11.9552149     0.0013898     -0.002098
3.7031111    -48.190608 C
 0.0001188        9139.     76963423.    11.9380004     0.0014176     -0.002145
3.7340019    -49.286262 C
 0.0001213        9288.     76602035.    11.9220918     0.0014456     -0.002192
3.7632705    -50.379824 C
 0.0001238        9436.     76249130.    11.9074178     0.0014735     -0.002239
3.7909045    -51.471267 C
 0.0001263        9583.     75904133.    11.8939127     0.0015016     -0.002286
3.8168912    -52.560562 C
 0.0001288        9729.     75566514.    11.8815181     0.0015297     -0.002333
3.8412177    -53.647681 C
 0.0001313        9875.     75235781.    11.8701773     0.0015580     -0.002380
3.8638705    -54.732593 C
 0.0001338       10019.     74911476.    11.8598382     0.0015863     -0.002426
3.8848363    -55.815269 C
 0.0001363       10163.     74593175.    11.8504531     0.0016146     -0.002473
3.9041012    -56.895675 C
 0.0001388       10306.     74280345.    11.8418639     0.0016431     -0.002519
3.9216323    -57.974703 C
 0.0001413       10449.     73972776.    11.8340326     0.0016716     -0.002566
3.9374377    -59.051406 C
 0.0001438       10590.     73668089.    11.8269391     0.0017001     -0.002612
3.9514968    -60.000000 CY
 0.0001463       10728.     73352995.    11.8198606     0.0017287     -0.002659
3.9637556    -60.000000 CY
 0.0001488       10859.     73000133.    11.8112400     0.0017569     -0.002706
3.9741416    -60.000000 CY
 0.0001588       11296.     71158049.    11.7560873     0.0018663     -0.002896
3.9978428    -60.000000 CY
 0.0001688       11630.     68918847.    11.6802987     0.0019711     -0.003091
3.9980468    -60.000000 CY
 0.0001788       11902.     66586534.    11.6001887     0.0020735     -0.003289
3.9999999    -60.000000 CY
 0.0001888       12133.     64280355.    11.5209803     0.0021746     -0.003488
3.9994107    -60.000000 CY
 0.0001988       12327.     62022656.    11.4422749     0.0022742     -0.003688
3.9999001    -60.000000 CY
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0.0002088	12494.	59852028.	11.3654603	0.0023725	-0.003890
3.9976172	-60.000000 CY				
0.0002188	12647.	57813088.	11.2949873	0.0024708	-0.004092
3.9982962	-60.000000 CY				
0.0002288	12775.	55849097.	11.2241390	0.0025675	-0.004295
3.9982626	-60.000000 CY				
0.0002388	12886.	53973935.	11.1534632	0.0026629	-0.004500
3.9975093	-60.000000 CY				
0.0002488	12994.	52235250.	11.0903126	0.0027587	-0.004704
3.9959030	-60.000000 CY				
0.0002588	13092.	50598341.	11.0309996	0.0028543	-0.004908
3.9999940	-60.000000 CY				
0.0002688	13177.	49031309.	10.9719977	0.0029487	-0.005114
3.9992411	-60.000000 CY				
0.0002788	13251.	47535928.	10.9121789	0.0030418	-0.005321
3.9963393	-60.000000 CY				
0.0002888	13318.	46123843.	10.8544147	0.0031342	-0.005528
3.9999259	-60.000000 CY				
0.0002988	13384.	44798702.	10.8007871	0.0032267	-0.005736
3.9973874	60.0000000 CY				
0.0003088	13447.	43552326.	10.7548307	0.0033206	-0.005942
3.9999978	60.0000000 CY				
0.0003188	13503.	42360888.	10.7123982	0.0034146	-0.006148
3.9972588	60.0000000 CY				
0.0003288	13552.	41222327.	10.6721052	0.0035085	-0.006354
3.9999704	60.0000000 CY				
0.0003388	13590.	40118253.	10.6342803	0.0036024	-0.006560
3.9956301	60.0000000 CYT				
0.0003488	13624.	39064412.	10.5963180	0.0036955	-0.006767
3.9994685	60.0000000 CYT				
0.0003588	13650.	38050043.	10.5630075	0.0037895	-0.006973
3.9936688	60.0000000 CYT				
0.0003688	13650.	37018177.	10.5545397	0.0038920	-0.007171
3.9981243	60.0000000 CYT				

Summary of Results for Nominal Moment Capacity for Section 2

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	268.510	13217.655	0.00300000	

-0.00522782

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	268.510000	13218.	174.531500	8591.	78364217.
1	0.75	268.510000	13218.	201.382500	9913.	75149401.
1	0.90	268.510000	13218.	241.659000	11896.	66641809.

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	14.7500	0.00	N.A.	No	0.00	5873.
2	16.6000	24.8941	No	No	5873.	89095.
3	22.1000	11.9423	Yes	No	94968.	188706.
4	35.8000	21.0500	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 Displacement and Pile-head Rotation (Loading Type 5)
Displacement of pile head = 1.400000 inches
Rotation of pile head = 0.000E+00 radians
Axial load on pile head = 268510.0 lbs

Depth X	Deflect. y	Bending Moment	Shear Force	Slope S	Total Stress	Bending Stiffness	Soil Res. Es*H	Soil Spr. Lat. Load	Distrib. p
feet	inches	in-lbs	lbs	radians	psi*	lb-in^2	lb/inch	lb/inch	lb/inch
0.00	1.4000	-1.42E+07	111707.	0.00	0.00	9.46E+10	0.00	0.00	0.00
0.4080	1.3982	-1.37E+07	111703.	-7.22E-04	0.00	9.46E+10	0.00	0.00	0.00
0.8160	1.3929	-1.31E+07	111703.	-0.00139	0.00	1.02E+11	0.00	0.00	0.00
1.2240	1.3846	-1.26E+07	111703.	-0.00200	0.00	1.04E+11	0.00	0.00	0.00
1.6320	1.3733	-1.20E+07	111703.	-0.00258	0.00	1.05E+11	0.00	0.00	0.00
2.0400	1.3593	-1.15E+07	111703.	-0.00312	0.00	1.07E+11	0.00	0.00	0.00
2.4480	1.3427	-1.09E+07	111703.	-0.00363	0.00	1.09E+11	0.00	0.00	0.00
2.8560	1.3237	-1.04E+07	111703.	-0.00411	0.00	1.11E+11	0.00	0.00	0.00
3.2640	1.3025	-9826603.	111703.	-0.00455	0.00	1.13E+11	0.00	0.00	0.00
3.6720	1.2792	-9273442.	111703.	-0.00496	0.00	1.15E+11	0.00	0.00	0.00
4.0800	1.2539	-8719762.	111703.	-0.00534	0.00	1.18E+11	0.00	0.00	0.00
4.4880	1.2269	-8165604.	111703.	-0.00569	0.00	1.21E+11			

```
0.00       0.00       0.00
    4.8960     1.1982  -7611011.    111703.   -0.00600       0.00   1.24E+11
0.00       0.00       0.00
    5.3040     1.1681  -7056022.    111703.   -0.00629       0.00   1.28E+11
0.00       0.00       0.00
    5.7120     1.1366  -6500677.    111703.   -0.00655       0.00   1.32E+11
0.00       0.00       0.00
    6.1200     1.1040  -5945017.    111703.   -0.00677       0.00   1.38E+11
0.00       0.00       0.00
    6.5280     1.0703  -5389080.    111703.   -0.00697       0.00   1.46E+11
0.00       0.00       0.00
    6.9360     1.0357  -4832905.    111703.   -0.00713       0.00   1.55E+11
0.00       0.00       0.00
    7.3440     1.0004  -4276529.    111703.   -0.00727       0.00   1.68E+11
0.00       0.00       0.00
    7.7520     0.9645  -3719990.    111703.   -0.00738       0.00   1.87E+11
0.00       0.00       0.00
    8.1600     0.9282  -3163323.    111703.   -0.00745       0.00   3.68E+11
0.00       0.00       0.00
    8.5680     0.8916  -2606601.    111703.   -0.00749       0.00   3.69E+11
0.00       0.00       0.00
    8.9760     0.8548  -2049833.    111703.   -0.00752       0.00   3.70E+11
0.00       0.00       0.00
    9.3840     0.8179  -1493029.    111703.   -0.00755       0.00   3.70E+11
0.00       0.00       0.00
    9.7920     0.7809   -936200.    111703.   -0.00756       0.00   3.70E+11
0.00       0.00       0.00
   10.2000     0.7439   -379354.    111703.   -0.00757       0.00   3.70E+11
0.00       0.00       0.00
   10.6080     0.7068    177498.    111703.   -0.00757       0.00   3.70E+11
0.00       0.00       0.00
   11.0160     0.6697    734347.    111703.   -0.00757       0.00   3.70E+11
0.00       0.00       0.00
   11.4240     0.6327   1291184.    111703.   -0.00755       0.00   3.70E+11
0.00       0.00       0.00
   11.8320     0.5958   1847998.    111703.   -0.00753       0.00   3.70E+11
0.00       0.00       0.00
   12.2400     0.5590   2404780.    111703.   -0.00750       0.00   3.69E+11
0.00       0.00       0.00
   12.6480     0.5223   2961520.    111703.   -0.00747       0.00   3.68E+11
0.00       0.00       0.00
   13.0560     0.4858   3518208.    111703.   -0.00740       0.00   1.96E+11
0.00       0.00       0.00
   13.4640     0.4498   4074781.    111703.   -0.00730       0.00   1.74E+11
0.00       0.00       0.00
   13.8720     0.4143   4631203.    111703.   -0.00717       0.00   1.59E+11
0.00       0.00       0.00
   14.2800     0.3796   5187439.    111703.   -0.00702       0.00   1.49E+11
0.00       0.00       0.00
   14.6880     0.3456   5743450.    111703.   -0.00683       0.00   1.41E+11
```

```
0.00       0.00       0.00
   15.0960     0.3127   6299198.    111611.   -0.00662       0.00   1.34E+11
-37.642   589.4488       0.00
   15.5040     0.2808   6853743.    111308.   -0.00637       0.00   1.29E+11
-85.834      1497.       0.00
   15.9120     0.2502   7405889.    110766.   -0.00610       0.00   1.25E+11
-135.822      2657.       0.00
   16.3200     0.2211   7954398.    109979.   -0.00579       0.00   1.22E+11
-185.476      4107.       0.00
   16.7280     0.1935   8498041.     96128.   -0.00546       0.00   1.19E+11
-5473.    138466.       0.00
   17.1360     0.1676   8910040.     69839.   -0.00510       0.00   1.17E+11
-5267.    153817.       0.00
   17.5440     0.1436   9195302.     44637.   -0.00472       0.00   1.15E+11
-5028.    171447.       0.00
   17.9520     0.1215   9359518.     20679.   -0.00432       0.00   1.15E+11
-4758.    191795.       0.00
   18.3600     0.1013   9409149.     -1874.   -0.00392       0.00   1.14E+11
-4455.    215322.       0.00
   18.7680    0.08309   9351468.    -22802.   -0.00352       0.00   1.15E+11
-4094.    241255.       0.00
   19.1760    0.06684   9195118.    -41815.   -0.00312       0.00   1.15E+11
-3672.    268985.       0.00
   19.5840    0.05250   8950231.    -58771.   -0.00274       0.00   1.16E+11
-3255.    303500.       0.00
   19.9920    0.04001   8626834.    -73693.   -0.00237       0.00   1.18E+11
-2841.    347686.       0.00
   20.4000    0.02926   8234866.    -86596.   -0.00203       0.00   1.20E+11
-2430.    406544.       0.00
   20.8080    0.02016   7784217.    -97480.   -0.00170       0.00   1.23E+11
-2017.    489800.       0.00
   21.2160    0.01258   7284819.   -105762.   -0.00141       0.00   1.26E+11
-1366.    531847.       0.00
   21.6240    0.00638   6752300.   -110910.   -0.00114       0.00   1.30E+11
-736.766    565406.       0.00
   22.0320    0.00143   6201787.   -113140.  -9.00E-04       0.00   1.35E+11
-174.452    598965.       0.00
   22.4400   -0.00243   5646797.   -112799.  -6.90E-04       0.00   1.42E+11
313.9561    632524.       0.00
   22.8480   -0.00533   5099077.   -110254.  -5.10E-04       0.00   1.50E+11
725.5130    666083.       0.00
   23.2560   -0.00742   4568529.   -106017.  -3.57E-04       0.00   1.61E+11
1005.    663066.       0.00
   23.6640   -0.00883   4061894.   -100873.  -2.31E-04       0.00   1.75E+11
1096.    607880.       0.00
   24.0720   -0.00968   3581392.    -95378.  -1.29E-04       0.00   1.93E+11
1148.    580523.       0.00
   24.4800   -0.01009   3128291.    -89698.  -6.25E-05       0.00   3.68E+11
1172.    568674.       0.00
   24.8880   -0.01029   2703229.    -83931.  -2.37E-05       0.00   3.69E+11
```

```
1184.    563015.       0.00
   25.2960   -0.01032   2306497.    -78132.   9.53E-06       0.00   3.69E+11
1185.    562246.       0.00
   25.7040   -0.01020   1938139.    -72345.   3.76E-05       0.00   3.70E+11
1178.    565584.       0.00
   26.1120   -0.00995   1597996.    -66611.   6.10E-05       0.00   3.70E+11
1164.    572560.       0.00
   26.5200   -0.00960   1285728.    -60962.   8.01E-05       0.00   3.70E+11
1143.    582916.       0.00
   26.9280   -0.00917   1000845.    -55428.   9.52E-05       0.00   3.70E+11
1117.    596543.       0.00
   27.3360   -0.00867    742726.    -50033.   1.07E-04       0.00   3.70E+11
1086.    613451.       0.00
   27.7440   -0.00812    510638.    -44799.   1.15E-04       0.00   3.70E+11
1052.    633751.       0.00
   28.1520   -0.00754    303750.    -39744.   1.20E-04       0.00   3.70E+11
1013.    657645.       0.00
   28.5600   -0.00695    121150.    -34883.   1.23E-04       0.00   3.70E+11
972.3657    685430.       0.00
   28.9680   -0.00634    -38143.    -30228.   1.24E-04       0.00   3.70E+11
928.8939    717508.       0.00
   29.3760   -0.00573   -175170.    -25792.   1.22E-04       0.00   3.70E+11
883.4755    754394.       0.00
   29.7840   -0.00514   -291016.    -21581.   1.19E-04       0.00   3.70E+11
836.5151    796743.       0.00
   30.1920   -0.00457   -386805.    -17603.   1.15E-04       0.00   3.70E+11
788.3845    845383.       0.00
   30.6000   -0.00402   -463689.    -13863.   1.09E-04       0.00   3.70E+11
739.4261    901357.       0.00
   31.0080   -0.00350   -522840.    -10364.   1.03E-04       0.00   3.70E+11
689.9544    965986.       0.00
   31.4160   -0.00301   -565444.     -7108.   9.54E-05       0.00   3.70E+11
640.2577   1040964.       0.00
   31.8240   -0.00256   -592690.     -4095.   8.78E-05       0.00   3.70E+11
590.5968   1128494.       0.00
   32.2320   -0.00215   -605769.     -1324.   7.99E-05       0.00   3.70E+11
541.2036   1231485.       0.00
   32.6400   -0.00178   -605864.      1206.   7.19E-05       0.00   3.70E+11
492.2755   1353883.       0.00
   33.0480   -0.00145   -594148.      3498.   6.39E-05       0.00   3.70E+11
443.9675   1501197.       0.00
   33.4560   -0.00115   -571780.      5473.   5.62E-05       0.00   3.70E+11
362.7088   1538621.       0.00
   33.8640  -8.97E-04   -540707.      7066.   4.89E-05       0.00   3.70E+11
288.1629   1572180.       0.00
   34.2720  -6.76E-04   -502718.      8314.   4.20E-05       0.00   3.70E+11
221.5743   1605739.       0.00
   34.6800  -4.86E-04   -459409.      9255.   3.56E-05       0.00   3.70E+11
162.8394   1639298.       0.00
   35.0880  -3.27E-04   -412188.      9927.   2.99E-05       0.00   3.70E+11
```

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111.6695   1672857.       0.00
   35.4960  -1.94E-04   -362283.     10366.   2.47E-05       0.00   3.70E+11
67.6109   1706417.       0.00
   35.9040  -8.46E-05   -310751.     11843.   1.84E-05       0.00   1.93E+11
535.7286   3.10E+07       0.00
   36.3120  -1.38E-05   -246367.     13413.   1.13E-05       0.00   1.93E+11
105.6872   3.74E+07       0.00
   36.7200   2.63E-05   -179441.     13096.   5.92E-06       0.00   1.93E+11
-235.183   4.38E+07       0.00
   37.1280   4.41E-05   -118147.     11413.   2.14E-06       0.00   1.93E+11
-452.195   5.02E+07       0.00
   37.5360   4.73E-05    -67688.      8970.  -2.19E-07       0.00   1.93E+11
-546.024   5.66E+07       0.00
   37.9440   4.20E-05    -30316.      6311.  -1.46E-06       0.00   1.93E+11
-539.816   6.30E+07       0.00
   38.3520   3.29E-05     -5883.      3848.  -1.92E-06       0.00   1.93E+11
-466.430   6.94E+07       0.00
   38.7600   2.31E-05      7370.      1830.  -1.90E-06       0.00   1.93E+11
-358.102   7.58E+07       0.00
   39.1680   1.43E-05     12039.   366.5272  -1.66E-06       0.00   1.93E+11
-239.608   8.21E+07       0.00
   39.5760   6.91E-06     10964.   -526.121  -1.37E-06       0.00   1.93E+11
-125.035   8.85E+07       0.00
   39.9840   9.10E-07      6891.   -875.422  -1.14E-06       0.00   1.93E+11
-17.653   9.49E+07       0.00
   40.3920  -4.24E-06      2395.   -703.998  -1.02E-06       0.00   1.93E+11
87.6789   1.01E+08       0.00
   40.8000  -9.09E-06       0.00       0.00  -9.91E-07       0.00   1.93E+11
199.9021   5.39E+07       0.00
```

* This analysis computed pile response using nonlinear moment-curvature relationships. Values of total stress due to combined axial and bending stresses are computed only for elastic sections only and do not equal the actual stresses in concrete and steel. Stresses in concrete and steel may be interpolated from the output for nonlinear bending properties relative to the magnitude of bending moment developed in the pile.

Output Summary for Load Case No. 1:

Pile-head deflection	=	1.40000000 inches
Computed slope at pile head	=	0.000000 radians
Maximum bending moment	=	-14227964. inch-lbs
Maximum shear force	=	-113140. lbs
Depth of maximum bending moment	=	0.000000 feet below pile head
Depth of maximum shear force	=	22.03200000 feet below pile head
Number of iterations	=	37
Number of zero deflection points	=	3
Pile deflection at ground	=	0.34061169 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	Load 1	Load Type	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	y, in	1.4000	S, rad	0.00	268510.	1.4000	0.00	-113140.	-1.42E+07

Maximum pile-head deflection = 1.4000000000 inches
Maximum pile-head rotation = 0.0000000000 radians = 0.000000 deg.

Summary of Warning Messages

The following warning was reported 494 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.

==========

LPile for Windows, Version 2022-12.011

Analysis of Individual Piles and Drilled Shafts
Subjected to Lateral Loading Using the p-y Method
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Files Used for Analysis

Path to file locations:
\20240280\ODOT\109971\400-Engineering\Structures\SFN_0800512\Engdata\04_Abutment Design\Stage 2\Drilled Shaft\Lpile\Wingwalls\Forward Abutment Wingwalls\

Name of input data file:
FA WW_Scour Strength 1 - Back DS.lp12d

Name of output report file:
FA WW_Scour Strength 1 - Back DS.lp12o

Name of plot output file:
FA WW_Scour Strength 1 - Back DS.lp12p

Name of runtime message file:
FA WW_Scour Strength 1 - Back DS.lp12r

Date and Time of Analysis

Date: February 12, 2026 Time: 14:02:21

Problem Title

Project Name:

Job Number:

Client:

Engineer:

Description:

Program Options and Settings

Computational Options:
- Conventional Analysis

Engineering Units Used for Data Input and Computations:
- US Customary System Units (pounds, feet, inches)

Analysis Control Options:

- Maximum number of iterations allowed	=	500
- Deflection tolerance for convergence	=	1.0000E-05 in
- Maximum allowable deflection	=	100.0000 in
- Number of pile increments	=	100

Loading Type and Number of Cycles of Loading:

- Static loading specified

- Analysis uses p-y modification factors for p-y curves
- Analysis uses layering correction (Method of Georgiadis)
- No distributed lateral loads are entered
- Loading by lateral soil movements acting on pile not selected
- Input of shear resistance at the pile tip not selected
- Input of moment resistance at the pile tip not selected
- Computation of pile-head foundation stiffness matrix not selected
- Push-over analysis of pile not selected
- Buckling analysis of pile not selected

Output Options:
- Output files use decimal points to denote decimal symbols.
- Values of pile-head deflection, bending moment, shear force, and soil reaction are printed for full length of pile.
- Printing Increment (nodal spacing of output points) = 1
- No p-y curves to be computed and reported for user-specified depths
- Print using wide report formats

Pile Structural Properties and Geometry

Number of pile sections defined = 2
Total length of pile = 40.800 ft
Depth of ground surface below top of pile = 14.7500 ft

Pile diameters used for p-y curve computations are defined using 4 points.

p-y curves are computed using pile diameter values interpolated with depth over the length of the pile. A summary of values of pile diameter vs. depth follows.

Point No.	Depth Below Pile Head feet	Pile Diameter inches
1	0.000	36.0000
2	35.800	36.0000
3	35.800	30.0000
4	40.800	30.0000

Input Structural Properties for Pile Sections:

Pile Section No. 1:

Section 1 is a round drilled shaft, bored pile, or CIDH pile
Length of section = 35.800000 ft
Shaft Diameter = 36.000000 in

Pile Section No. 2:

Section 2 is a round drilled shaft, bored pile, or CIDH pile
Length of section = 5.000000 ft
Shaft Diameter = 30.000000 in

Soil and Rock Layering Information

The soil profile is modelled using 4 layers

Layer 1 is sand, p-y criteria by Reese et al., 1974

Distance from top of pile to top of layer = 14.750000 ft
Distance from top of pile to bottom of layer = 16.600000 ft
Effective unit weight at top of layer = 72.600000 pcf
Effective unit weight at bottom of layer = 72.600000 pcf
Friction angle at top of layer = 40.000000 deg.
Friction angle at bottom of layer = 40.000000 deg.
Subgrade k at top of layer = 125.000000 pci
Subgrade k at bottom of layer = 125.000000 pci

Layer 2 is stiff clay with water-induced erosion

Distance from top of pile to top of layer = 16.600000 ft
Distance from top of pile to bottom of layer = 22.100000 ft
Effective unit weight at top of layer = 72.600000 pcf
Effective unit weight at bottom of layer = 72.600000 pcf
Undrained cohesion at top of layer = 5600. psf
Undrained cohesion at bottom of layer = 5600. psf
Epsilon-50 at top of layer = 0.004000
Epsilon-50 at bottom of layer = 0.004000
Subgrade k at top of layer = 2000. pci
Subgrade k at bottom of layer = 2000. pci

Layer 3 is stiff clay with water-induced erosion

Distance from top of pile to top of layer = 22.100000 ft
Distance from top of pile to bottom of layer = 35.800000 ft
Effective unit weight at top of layer = 67.600000 pcf

```
   Effective unit weight at bottom of layer            =    67.600000 pcf
   Undrained cohesion at top of layer                  =        4600. psf
   Undrained cohesion at bottom of layer               =        4600. psf
   Epsilon-50 at top of layer                          =     0.004000
   Epsilon-50 at bottom of layer                       =     0.004000
   Subgrade k at top of layer                          =        2000. pci
   Subgrade k at bottom of layer                       =        2000. pci


Layer 4 is weak rock, p-y criteria by Reese, 1997

   Distance from top of pile to top of layer           =    35.800000 ft
   Distance from top of pile to bottom of layer        =   100.000000 ft
   Effective unit weight at top of layer               =    97.500000 pcf
   Effective unit weight at bottom of layer            =    97.500000 pcf
   Uniaxial compressive strength at top of layer       =   661.000000 psi
   Uniaxial compressive strength at bottom of layer    =   661.000000 psi
   Initial modulus of rock at top of layer             =       60000. psi
   Initial modulus of rock at bottom of layer          =       60000. 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                        =    0.0005000
   k rm of rock at bottom of layer                     =    0.0005000


 (Depth of the lowest soil layer extends 59.200 ft below the pile tip)



--------------------------------------------------------------------------------
                        Summary of Input Soil Properties
--------------------------------------------------------------------------------

Layer         Soil Type          Layer      Effective    Cohesion     Angle of
Uniaxial                      E50                      Rock Mass
 Num.           Name            Depth       Unit Wt.                  Friction
 qu          RQD %         or           kpy        Modulus
          (p-y Curve Type)        ft           pcf          psf          deg.
 psi                        krm          pci          psi
-----   ------------------   ----------   ----------   ----------   ----------
----------   ----------   ----------   ----------   ----------
  1            Sand              14.7500      72.6000       --          40.0000
 --            --            --          125.0000       --
          (Reese, et al.)        16.6000      72.6000       --          40.0000
 --            --            --          125.0000       --
  2         Stiff Clay           16.6000      72.6000        5600.       --
 --            --           0.00400        2000.       --
          with Free Water        22.1000      72.6000        5600.       --
 --            --           0.00400        2000.       --
  3         Stiff Clay           22.1000      67.6000        4600.       --
```

```
 --           --          0.00400        2000.       --
          with Free Water        35.8000      67.6000        4600.       --
 --           --          0.00400        2000.       --
  4            Weak              35.8000      97.5000       --           --
661.0000       9.0000     5.00E-04       --           60000.
               Rock             100.0000      97.5000       --           --
661.0000       9.0000     5.00E-04       --           60000.
```

Modification Factors for p-y Curves

Distribution of p-y modifiers with depth defined using 2 points

Point No.	Depth X ft	p-mult	y-mult
1	14.750	0.5000	1.0000
2	35.800	0.5000	1.0000

Static Loading Type

Static loading criteria were used when computing p-y curves for all analyses.

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 1

Load No.	Load Type	Condition 1	Condition 2	Axial Thrust Force, lbs	Compute Top y vs. Pile Length	Run Analysis
1	5	y = 1.400000 in	S = 0.0000 in/in	122480.	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 = 2

Pile Section No. 1:

Dimensions and Properties of Drilled Shaft (Bored Pile):

Length of Section	=	35.800000 ft
Shaft Diameter	=	36.000000 in
Concrete Cover Thickness (to edge of trans. reinf.)	=	6.000000 in
Number of Reinforcing Bars	=	17 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	=	21.590000 sq. in.
Area Ratio of Steel Reinforcement	=	2.12 percent
Edge-to-Edge Bar Spacing	=	2.676940 in
Maximum Concrete Aggregate Size	=	0.375000 in
Ratio of Bar Spacing to Aggregate Size	=	7.14
Offset of Center of Rebar Cage from Center of Pile	=	0.0000 in

Transverse Reinforcement
Type: Hoop

Number of Transverse Reinf. (per spacing)	=	1
Spacing of Transverse Reinf.	=	4.500000 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	=	4682.772 kips
Tensile Load for Cracking of Concrete	=	-486.599 kips
Nominal Axial Tensile Capacity	=	-1295.400 kips

Reinforcing Bar Dimensions and Positions Used in Computations:

Bar Number	Bar Diam. inches	Bar Area sq. in.	X inches	Y inches
1	1.270000	1.270000	10.740000	0.00000
2	1.270000	1.270000	10.014752	3.879735
3	1.270000	1.270000	7.936956	7.235491
4	1.270000	1.270000	4.787230	9.614054
5	1.270000	1.270000	0.990962	10.694185
6	1.270000	1.270000	-2.93914	10.330007
7	1.270000	1.270000	-6.47230	8.570705
8	1.270000	1.270000	-9.13133	5.653881
9	1.270000	1.270000	-10.55713	1.973470
10	1.270000	1.270000	-10.55713	-1.97347
11	1.270000	1.270000	-9.13133	-5.65388
12	1.270000	1.270000	-6.47230	-8.57071
13	1.270000	1.270000	-2.93914	-10.33001
14	1.270000	1.270000	0.990962	-10.69419
15	1.270000	1.270000	4.787230	-9.61405
16	1.270000	1.270000	7.936956	-7.23549
17	1.270000	1.270000	10.014752	-3.87974

NOTE: The positions of the above rebars were computed by LPile

Minimum spacing between any two bars not equal to zero = 2.677 inches
between bars 6 and 7.

Ratio of bar spacing to maximum aggregate size = 7.14

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	=	0.375000 in

Number of Axial Thrust Force Values Determined from Pile-head Loadings = 1

Number	Axial Thrust Force kips
1	122.480

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 = 122.480 kips

Bending Max Conc Stress ksi	Bending Max Steel Stress ksi	Bending Stiffness kip-in2	Depth to N Axis in	Max Comp Strain in/in	Max Tens Strain in/in	Run Msg
6.25000E-07	234.9836316	375973811.	58.6432241	0.00003665	0.00001415	
0.1534694	0.9421959					
0.00000125	469.9731374	375978510.	38.3395088	0.00004792	0.00000292	
0.1997435	1.1483822					
0.00000188	704.9100034	375952002.	31.5792514	0.00005921	-0.00000829	
0.2457964	1.3549843					
0.00000250	939.4135725	375765429.	28.2027698	0.00007051	-0.00001949	
0.2916058	1.5618508					
0.00000313	1173.	375422918.	26.1782829	0.00008181	-0.00003069	
0.3371519	1.7688444					
0.00000375	1406.	374978543.	24.8292765	0.00009311	-0.00004189	
0.3824263	1.9759088					
0.00000438	1638.	374468294.	23.8660523	0.0001044	-0.00005309	
0.4274254	2.1830179					
0.00000500	1870.	373913950.	23.1438482	0.0001157	-0.00006428	
0.4721471	2.3901580					
0.00000563	2100.	373328953.	22.5822774	0.0001270	-0.00007547	
0.5165903	2.5973215					
0.00000625	2330.	372721893.	22.1331243	0.0001383	-0.00008667	
0.5607543	2.8045038					
0.00000688	2330.	338838084.	18.7147799	0.0001287	-0.000119	
0.5221836	2.4034217	C				

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0.00000750         2330.    310601577.    18.1851450     0.0001364     -0.000134
0.5522213     2.5067191 C
0.00000813         2330.    286709148.    17.7238289     0.0001440     -0.000148
0.5817093     -2.737060 C
0.00000875         2330.    266229924.    17.3195601     0.0001515     -0.000163
0.6107682     -3.050187 C
0.00000938         2330.    248481262.    16.9618489     0.0001590     -0.000178
0.6394355     -3.365310 C
0.00001000         2330.    232951183.    16.6429308     0.0001664     -0.000194
0.6677518     -3.682149 C
0.00001063         2330.    219248172.    16.3570472     0.0001738     -0.000209
0.6957645     -4.000372 C
0.00001125         2330.    207067718.    16.0980762     0.0001811     -0.000224
0.7234499     -4.320174 C
0.00001188         2330.    196169417.    15.8632358     0.0001884     -0.000239
0.7508767     -4.641055 C
0.00001250         2330.    186360946.    15.6504044     0.0001956     -0.000254
0.7781169     -4.962478 C
0.00001313         2330.    177486616.    15.4538170     0.0002028     -0.000270
0.8050449     -5.285414 C
0.00001375         2330.    169419042.    15.2748445     0.0002100     -0.000285
0.8318428     -5.608481 C
0.00001438         2330.    162052997.    15.1082447     0.0002172     -0.000300
0.8583573     -5.932863 C
0.00001500         2330.    155300789.    14.9556877     0.0002243     -0.000316
0.8847741     -6.257139 C
0.00001563         2387.    152783214.    14.8126292     0.0002314     -0.000331
0.9109123     -6.582715 C
0.00001625         2449.    150688966.    14.6803572     0.0002386     -0.000346
0.9369320     -6.908357 C
0.00001688         2510.    148742707.    14.5575523     0.0002457     -0.000362
0.9628210     -7.234160 C
0.00001750         2571.    146916178.    14.4414043     0.0002527     -0.000377
0.9884639     -7.561037 C
0.00001813         2632.    145212557.    14.3334658     0.0002598     -0.000393
1.0140113     -7.887810 C
0.00001875         2693.    143619544.    14.2329163     0.0002669     -0.000408
1.0394632     -8.214477 C
0.00001938         2753.    142113974.    14.1369992     0.0002739     -0.000424
1.0646755     -8.542186 C
0.00002000         2814.    140697908.    14.0469526     0.0002809     -0.000439
1.0897711     -8.869967 C
0.00002063         2874.    139365017.    13.9625390     0.0002880     -0.000455
1.1147719     -9.197644 C
0.00002125         2935.    138107955.    13.8832618     0.0002950     -0.000470
1.1396779     -9.525215 C
0.00002188         2995.    136913171.    13.8073516     0.0003020     -0.000485
1.1643851     -9.853524 C
0.00002250         3055.    135779366.    13.7352519     0.0003090     -0.000501
1.1889526    -10.182098 C
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0.00002313        3115.    134704514.    13.6672072     0.0003161     -0.000516
1.2134261    -10.510567 C
0.00002375        3175.    133683960.    13.6028977     0.0003231     -0.000532
1.2378055    -10.838929 C
0.00002438        3235.    132713523.    13.5420366     0.0003301     -0.000547
1.2620906    -11.167185 C
0.00002563        3354.    130899714.    13.4277356     0.0003441     -0.000578
1.3102068    -11.824802 C
0.00002688        3473.    129242037.    13.3235820     0.0003581     -0.000609
1.3578516    -12.482796 C
0.00002813        3592.    127724089.    13.2292152     0.0003721     -0.000640
1.4051214    -13.140359 C
0.00002938        3711.    126328004.    13.1433884     0.0003861     -0.000671
1.4520150    -13.797489 C
0.00003063        3829.    125031032.    13.0629372     0.0004001     -0.000702
1.4983136    -14.456067 C
0.00003188        3947.    123828795.    12.9891837     0.0004140     -0.000733
1.5442289    -15.114285 C
0.00003313        4065.    122710827.    12.9214581     0.0004280     -0.000764
1.5897692    -15.772061 C
0.00003438        4182.    121667910.    12.8591064     0.0004420     -0.000795
1.6349333    -16.429391 C
0.00003563        4300.    120692117.    12.8015626     0.0004561     -0.000826
1.6797202    -17.086273 C
0.00003688        4417.    119774017.    12.7474405     0.0004701     -0.000857
1.7240224    -17.743669 C
0.00003813        4533.    118908839.    12.6967098     0.0004841     -0.000888
1.7678784    -18.401239 C
0.00003938        4650.    118093135.    12.6496027     0.0004981     -0.000919
1.8113578    -19.058346 C
0.00004063        4766.    117322281.    12.6057880     0.0005121     -0.000950
1.8544591    -19.714992 C
0.00004188        4882.    116592248.    12.5649727     0.0005262     -0.000981
1.8971811    -20.371172 C
0.00004313        4998.    115899458.    12.5268980     0.0005402     -0.001012
1.9395227    -21.026883 C
0.00004438        5114.    115240740.    12.4913345     0.0005543     -0.001043
1.9814826    -21.682123 C
0.00004563        5229.    114613265.    12.4580805     0.0005684     -0.001074
2.0230595    -22.336890 C
0.00004688        5344.    114014514.    12.4269485     0.0005825     -0.001105
2.0642523    -22.991180 C
0.00004813        5459.    113440943.    12.3971271     0.0005966     -0.001136
2.1049683    -23.645898 C
0.00004938        5574.    112891536.    12.3689657     0.0006107     -0.001167
2.1452729    -24.300401 C
0.00005063        5688.    112364853.    12.3425313     0.0006248     -0.001198
2.1851930    -24.954410 C
0.00005188        5803.    111859243.    12.3177005     0.0006390     -0.001229
2.2247273    -25.607921 C
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0.00005313        5917.    111373172.    12.2943630     0.0006531     -0.001259
2.2638742    -26.260933 C
0.00005438        6030.    110905280.    12.2724175     0.0006673     -0.001290
2.3026327    -26.913442 C
0.00005563        6144.    110454319.    12.2517720     0.0006815     -0.001321
2.3410012    -27.565446 C
0.00005688        6257.    110019151.    12.2323427     0.0006957     -0.001352
2.3789786    -28.216940 C
0.00005813        6370.    109598734.    12.2140531     0.0007099     -0.001383
2.4165634    -28.867921 C
0.00005938        6483.    109192117.    12.1968331     0.0007242     -0.001413
2.4537542    -29.518387 C
0.00006063        6596.    108798423.    12.1806184     0.0007384     -0.001444
2.4905497    -30.168334 C
0.00006188        6708.    108416850.    12.1653498     0.0007527     -0.001475
2.5269485    -30.817758 C
0.00006313        6820.    108046655.    12.1509732     0.0007670     -0.001505
2.5629491    -31.466657 C
0.00006438        6932.    107687155.    12.1374382     0.0007813     -0.001536
2.5985501    -32.115027 C
0.00006563        7044.    107337718.    12.1246987     0.0007957     -0.001567
2.6337501    -32.762864 C
0.00006688        7155.    106997761.    12.1127119     0.0008100     -0.001597
2.6685477    -33.410165 C
0.00006813        7267.    106666738.    12.1014417     0.0008244     -0.001628
2.7029413    -34.056927 C
0.00006938        7378.    106344151.    12.0908443     0.0008388     -0.001659
2.7369295    -34.703145 C
0.00007063        7488.    106029529.    12.0808891     0.0008532     -0.001689
2.7705108    -35.348817 C
0.00007188        7599.    105722438.    12.0715442     0.0008676     -0.001720
2.8036836    -35.993938 C
0.00007313        7709.    105422471.    12.0627800     0.0008821     -0.001750
2.8364466    -36.638505 C
0.00007438        7819.    105129116.    12.0543983     0.0008965     -0.001781
2.8687693    -37.282883 C
0.00007938        8256.    104016360.    12.0257127     0.0009545     -0.001903
2.9938790    -39.855327 C
0.00008438        8690.    102987242.    12.0043064     0.0010129     -0.002025
3.1123136    -42.418274 C
0.00008938        9119.    102026545.    11.9890669     0.0010715     -0.002146
3.2239639    -44.971447 C
0.00009438        9543.    101122241.    11.9791221     0.0011305     -0.002267
3.3287167    -47.514549 C
0.00009938        9964.    100264661.    11.9737814     0.0011899     -0.002388
3.4264530    -50.047267 C
 0.0001044       10380.     99445929.    11.9724925     0.0012496     -0.002508
3.5170484    -52.569269 C
 0.0001094       10791.     98659548.    11.9739554     0.0013097     -0.002628
3.6003727    -55.080205 C
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 0.0001144        11197.     97900100.    11.9797565     0.0013702     -0.002747
3.6762887    -57.579703 C
 0.0001194        11599.     97162019.    11.9884218     0.0014311     -0.002866
3.7446474    -60.000000 CY
 0.0001244        11980.     96324343.    11.9948158     0.0014919     -0.002986
3.8047315    -60.000000 CY
 0.0001294        12299.     95062856.    11.9846351     0.0015505     -0.003107
3.8550718    -60.000000 CY
 0.0001344        12563.     93494882.    11.9609801     0.0016073     -0.003230
3.8966489    -60.000000 CY
 0.0001394        12796.     91810190.    11.9318792     0.0016630     -0.003354
3.9306591    -60.000000 CY
 0.0001444        13000.     90042821.    11.8983181     0.0017178     -0.003480
3.9574972    -60.000000 CY
 0.0001494        13184.     88264234.    11.8635305     0.0017721     -0.003605
3.9776355    -60.000000 CY
 0.0001544        13352.     86491209.    11.8281343     0.0018260     -0.003732
3.9912762    -60.000000 CY
 0.0001594        13501.     84709732.    11.7911063     0.0018792     -0.003858
3.9985631    -60.000000 CY
 0.0001644        13637.     82963154.    11.7549656     0.0019322     -0.003985
3.9979396    -60.000000 CY
 0.0001694        13767.     81280271.    11.7208773     0.0019852     -0.004112
3.9976133    -60.000000 CY
 0.0001744        13882.     79611523.    11.6872310     0.0020380     -0.004240
3.9999690    -60.000000 CY
 0.0001794        13984.     77957648.    11.6511481     0.0020899     -0.004368
3.9994393    -60.000000 CY
 0.0001844        14076.     76343755.    11.6153231     0.0021416     -0.004496
3.9979019    -60.000000 CY
 0.0001894        14166.     74803269.    11.5848123     0.0021939     -0.004624
3.9997444    -60.000000 CY
 0.0001944        14251.     73316740.    11.5556366     0.0022461     -0.004751
3.9992970    -60.000000 CY
 0.0001994        14328.     71862170.    11.5265146     0.0022981     -0.004879
3.9966354    -60.000000 CY
 0.0002044        14396.     70438562.    11.4974465     0.0023498     -0.005008
3.9997565    -60.000000 CY
 0.0002094        14458.     69050806.    11.4686290     0.0024012     -0.005136
3.9971579    -60.000000 CY
 0.0002144        14514.     67703333.    11.4396709     0.0024524     -0.005265
3.9998275    -60.000000 CY
 0.0002194        14569.     66410289.    11.4151012     0.0025042     -0.005393
3.9968198    -60.000000 CY
 0.0002244        14622.     65168368.    11.3927987     0.0025563     -0.005521
3.9996902    -60.000000 CY
 0.0002294        14674.     63973034.    11.3697659     0.0026079     -0.005650
3.9956270    -60.000000 CY
 0.0002344        14720.     62806827.    11.3504197     0.0026603     -0.005777
3.9991450    -60.000000 CY
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    0.0002394        14764.     61678662.    11.3296941     0.0027120     -0.005905
   3.9977702    -60.000000 CY
    0.0002444        14801.     60567023.    11.3071409     0.0027632     -0.006034
   3.9975351    -60.000000 CY
    0.0002494        14836.     59493515.    11.2856731     0.0028144     -0.006163
   3.9997623    -60.000000 CY
    0.0002544        14867.     58443718.    11.2639176     0.0028653     -0.006292
   3.9945286    -60.000000 CY
    0.0002594        14896.     57430910.    11.2436943     0.0029163     -0.006421
   3.9978483    -60.000000 CY
    0.0002644        14925.     56452726.    11.2245955     0.0029675     -0.006550
   3.9998017    -60.000000 CY
    0.0002694        14952.     55507847.    11.2053512     0.0030184     -0.006679
   3.9945443    -60.000000 CY
    0.0002744        14979.     54594936.    11.1906990     0.0030704     -0.006807
   3.9971326    -60.000000 CY
    0.0003044        15113.     49652652.    11.1053745     0.0033802     -0.007577
   3.9954022    -60.000000 CYT
    0.0003344        15191.     45432333.    11.0280294     0.0036875     -0.008350
   3.9953105    -60.000000 CYT
    0.0003644        15191.     41691763.    11.0432639     0.0040239     -0.009094
   3.9991981    -60.000000 CYT


-------------------------------------------------------------------------------
   Summary of Results for Nominal Moment Capacity for Section 1
-------------------------------------------------------------------------------

Moment values interpolated at maximum compressive strain = 0.003
or maximum developed moment if pile fails at smaller strains.

 Load           Axial Thrust        Nominal Mom. Cap.      Max. Comp.      Max.
Tens.
  No.              kips                 in-kip               Strain
Strain
 ----         ----------------     ------------------     ------------
------------
   1              122.480             14942.385           0.00300000
-0.00663233

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	122.480000	14942.	79.612000	9713.	100777204.
1	0.75	122.480000	14942.	91.860000	11207.	97882697.
1	0.90	122.480000	14942.	110.232000	13448.	85339016.

Pile Section No. 2:

Dimensions and Properties of Drilled Shaft (Bored Pile):

Length of Section	=	5.000000 ft
Shaft Diameter	=	30.000000 in
Concrete Cover Thickness (to edge of trans. reinf.)	=	3.000000 in
Number of Reinforcing Bars	=	17 bars
Yield Stress of Reinforcing Bars	=	60000. psi
Modulus of Elasticity of Reinforcing Bars	=	29000000. psi
Gross Area of Shaft	=	706.858347 sq. in.
Total Area of Reinforcing Steel	=	21.590000 sq. in.
Area Ratio of Steel Reinforcement	=	3.05 percent
Edge-to-Edge Bar Spacing	=	2.676940 in
Maximum Concrete Aggregate Size	=	0.375000 in
Ratio of Bar Spacing to Aggregate Size	=	7.14
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.	=	4.500000 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 = 3625.312 kips
Tensile Load for Cracking of Concrete = -357.244 kips
Nominal Axial Tensile Capacity = -1295.400 kips

Reinforcing Bar Dimensions and Positions Used in Computations:

Bar Number	Bar Diam. inches	Bar Area sq. in.	X inches	Y inches
1	1.270000	1.270000	10.740000	0.00000
2	1.270000	1.270000	10.014752	3.879735
3	1.270000	1.270000	7.936956	7.235491
4	1.270000	1.270000	4.787230	9.614054
5	1.270000	1.270000	0.990962	10.694185
6	1.270000	1.270000	-2.93914	10.330007
7	1.270000	1.270000	-6.47230	8.570705
8	1.270000	1.270000	-9.13133	5.653881
9	1.270000	1.270000	-10.55713	1.973470
10	1.270000	1.270000	-10.55713	-1.97347
11	1.270000	1.270000	-9.13133	-5.65388
12	1.270000	1.270000	-6.47230	-8.57071
13	1.270000	1.270000	-2.93914	-10.33001
14	1.270000	1.270000	0.990962	-10.69419
15	1.270000	1.270000	4.787230	-9.61405
16	1.270000	1.270000	7.936956	-7.23549
17	1.270000	1.270000	10.014752	-3.87974

NOTE: The positions of the above rebars were computed by LPile

Minimum spacing between any two bars not equal to zero = 2.677 inches
between bars 6 and 7.

Ratio of bar spacing to maximum aggregate size = 7.14

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 = 0.375000 in

Number of Axial Thrust Force Values Determined from Pile-head Loadings = 1

Number	Axial Thrust Force kips
1	122.480

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 = 122.480 kips

Bending Max Conc Curvature Stress rad/in.	Bending Max Steel Stress ksi	Bending Stiffness kip-in2	Depth to N Axis in	Max Comp Strain in/in	Max Tens Strain in/in	Run Msg
0.00000125	245.6257531	196500603.	42.9669160	0.00005371	0.00001621	
0.2237721	1.4216132					
0.00000250	491.2536490	196501460.	29.0068589	0.00007252	-0.00000248	
0.3001163	1.8311222					
0.00000375	736.5742463	196419799.	24.3622264	0.00009136	-0.00002114	
0.3758129	2.2415796					
0.00000500	980.8838527	196176771.	22.0429960	0.0001102	-0.00003979	
0.4507888	2.6524844					
0.00000625	1224.	195829074.	20.6526265	0.0001291	-0.00005842	
0.5250099	3.0636011					
0.00000750	1466.	195419447.	19.7262738	0.0001479	-0.00007705	
0.5984631	3.4748396					
0.00000875	1706.	194971473.	19.0649152	0.0001668	-0.00009568	
0.6711426	3.8861597					
0.00001000	1706.	170600038.	16.5263750	0.0001653	-0.000135	
0.6644005	3.7051501	C				

```
0.00001125         1706.    151644479.    15.9152525     0.0001790     -0.000158
0.7168467     3.9689139 C
0.00001250         1706.    136480031.    15.4113352     0.0001926     -0.000182
0.7681618     4.2272340 C
0.00001375         1706.    124072755.    14.9876581     0.0002061     -0.000206
0.8184809     -4.490859 C
0.00001500         1706.    113733359.    14.6273822     0.0002194     -0.000231
0.8679992     -5.055839 C
0.00001625         1762.    108426306.    14.3167136     0.0002326     -0.000255
0.9167769     -5.623561 C
0.00001750         1853.    105882791.    14.0457945     0.0002458     -0.000279
0.9648725     -6.193634 C
0.00001875         1943.    103644086.    13.8075793     0.0002589     -0.000304
1.0123552     -6.765565 C
0.00002000         2033.    101660787.    13.5969167     0.0002719     -0.000328
1.0593013     -7.338788 C
0.00002125         2123.     99887408.    13.4086791     0.0002849     -0.000353
1.1056958     -7.913458 C
0.00002250         2212.     98293188.    13.2396308     0.0002979     -0.000377
1.1515822     -8.489256 C
0.00002375         2300.     96855406.    13.0877671     0.0003108     -0.000402
1.1970507     -9.065473 C
0.00002500         2389.     95546286.    12.9495081     0.0003237     -0.000426
1.2420116     -9.642857 C
0.00002625         2477.     94353439.    12.8240725     0.0003366     -0.000451
1.2865828    -10.220458 C
0.00002750         2565.     93260695.    12.7096780     0.0003495     -0.000475
1.3307493    -10.798407 C
0.00002875         2652.     92252365.    12.6041389     0.0003624     -0.000500
1.3744491    -11.377237 C
0.00003000         2740.     91323719.    12.5076989     0.0003752     -0.000525
1.4178269    -11.955737 C
0.00003125         2827.     90462698.    12.4187947     0.0003881     -0.000549
1.4608094    -12.534530 C
0.00003250         2914.     89659595.    12.3358166     0.0004009     -0.000574
1.5033392    -13.114118 C
0.00003375         3001.     88912146.    12.2593253     0.0004138     -0.000599
1.5455479    -13.693373 C
0.00003500         3088.     88214374.    12.1884940     0.0004266     -0.000623
1.5874349    -14.272293 C
0.00003625         3174.     87559210.    12.1224955     0.0004394     -0.000648
1.6289246    -14.851539 C
0.00003750         3260.     86941712.    12.0602417     0.0004523     -0.000673
1.6699901    -15.431362 C
0.00003875         3346.     86360716.    12.0023070     0.0004651     -0.000697
1.7107345    -16.010845 C
0.00004000         3433.     85812786.    11.9482877     0.0004779     -0.000722
1.7511570    -16.589986 C
0.00004125         3518.     85294906.    11.8976090     0.0004908     -0.000747
1.7912567    -17.168784 C
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0.00004250 3604. 84804409. 11.8503806 0.0005036 -0.000771
1.8310328 -17.747237 C
0.00004375 3690. 84336369. 11.8053302 0.0005165 -0.000796
1.8703425 -18.326675 C
0.00004500 3775. 83891408. 11.7628125 0.0005293 -0.000821
1.9093279 -18.905780 C
0.00004625 3860. 83467677. 11.7228557 0.0005422 -0.000845
1.9479900 -19.484532 C
0.00004750 3946. 83063487. 11.6852588 0.0005550 -0.000870
1.9863280 -20.062931 C
0.00004875 4031. 82677325. 11.6498414 0.0005679 -0.000895
2.0243410 -20.640974 C
0.00005125 4200. 81953763. 11.5849120 0.0005937 -0.000944
2.0993886 -21.795987 C
0.00005375 4369. 81286570. 11.5262691 0.0006195 -0.000993
2.1730401 -22.950423 C
0.00005625 4538. 80667801. 11.4732157 0.0006454 -0.001042
2.2452585 -24.104629 C
0.00005875 4705. 80092567. 11.4254384 0.0006712 -0.001091
2.3161618 -25.257347 C
0.00006125 4873. 79555461. 11.3824080 0.0006972 -0.001140
2.3857427 -26.408560 C
0.00006375 5040. 79051920. 11.3435744 0.0007232 -0.001189
2.4539936 -27.558254 C
0.00006625 5206. 78578071. 11.3084705 0.0007492 -0.001238
2.5209068 -28.706414 C
0.00006875 5371. 78130601. 11.2766974 0.0007753 -0.001287
2.5864746 -29.853023 C
0.00007125 5537. 77706607. 11.2478604 0.0008014 -0.001336
2.6506800 -30.998171 C
0.00007375 5701. 77303020. 11.2208420 0.0008275 -0.001385
2.7134175 -32.143026 C
0.00007625 5865. 76918465. 11.1968614 0.0008538 -0.001434
2.7747933 -33.286252 C
0.00007875 6028. 76551063. 11.1748680 0.0008800 -0.001482
2.8347992 -34.427832 C
0.00008125 6191. 76199161. 11.1549347 0.0009063 -0.001531
2.8934266 -35.567747 C
0.00008375 6353. 75861305. 11.1368846 0.0009327 -0.001580
2.9506669 -36.705979 C
0.00008625 6515. 75536207. 11.1205616 0.0009591 -0.001628
3.0065112 -37.842508 C
0.00008875 6676. 75222722. 11.1058273 0.0009856 -0.001677
3.0609507 -38.977314 C
0.00009125 6836. 74919831. 11.0925587 0.0010122 -0.001725
3.1139762 -40.110379 C
0.00009375 6996. 74626622. 11.0806460 0.0010388 -0.001774
3.1655786 -41.241681 C
0.00009625 7155. 74342277. 11.0699910 0.0010655 -0.001822
3.2157483 -42.371200 C

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0.00009875        7314.     74066057.    11.0605055     0.0010922     -0.001870
3.2644758    -43.498915 C
 0.0001013        7472.     73797298.    11.0521104     0.0011190     -0.001918
3.3117514    -44.624804 C
 0.0001038        7629.     73535397.    11.0447341     0.0011459     -0.001967
3.3575651    -45.748844 C
 0.0001063        7786.     73279807.    11.0383121     0.0011728     -0.002015
3.4019069    -46.871014 C
 0.0001088        7942.     73030029.    11.0327859     0.0011998     -0.002063
3.4447664    -47.991290 C
 0.0001113        8097.     72785610.    11.0281024     0.0012269     -0.002111
3.4861331    -49.109648 C
 0.0001138        8252.     72546133.    11.0242136     0.0012540     -0.002158
3.5259964    -50.226064 C
 0.0001163        8406.     72311217.    11.0210754     0.0012812     -0.002206
3.5643454    -51.340514 C
 0.0001188        8560.     72080514.    11.0180544     0.0013084     -0.002254
3.6011690    -52.452969 C
 0.0001213        8712.     71853696.    11.0163234     0.0013357     -0.002302
3.6364559    -53.563408 C
 0.0001238        8864.     71630466.    11.0152345     0.0013631     -0.002349
3.6701944    -54.671802 C
 0.0001263        9016.     71410549.    11.0147571     0.0013906     -0.002397
3.7023730    -55.778124 C
 0.0001288        9166.     71193689.    11.0148667     0.0014182     -0.002444
3.7329794    -56.882346 C
 0.0001313        9316.     70979648.    11.0155354     0.0014458     -0.002492
3.7620016    -57.984440 C
 0.0001338        9465.     70768205.    11.0167372     0.0014735     -0.002539
3.7894270    -59.084376 C
 0.0001363        9613.     70555959.    11.0183672     0.0015013     -0.002586
3.8152224    -60.000000 CY
 0.0001388        9758.     70326752.    11.0194091     0.0015289     -0.002634
3.8392790    -60.000000 CY
 0.0001413        9895.     70053516.    11.0183084     0.0015563     -0.002681
3.8614392    -60.000000 CY
 0.0001438       10021.     69712591.    11.0138849     0.0015832     -0.002729
3.8815951    -60.000000 CY
 0.0001463       10137.     69315441.    11.0065149     0.0016097     -0.002778
3.8998655    -60.000000 CY
 0.0001488       10244.     68869644.    10.9969568     0.0016358     -0.002827
3.9163442    -60.000000 CY
 0.0001588       10608.     66822771.    10.9419164     0.0017370     -0.003025
3.9663321    -60.000000 CY
 0.0001688       10902.     64602617.    10.8736039     0.0018349     -0.003228
3.9933928    -60.000000 CY
 0.0001788       11151.     62383011.    10.8032819     0.0019311     -0.003431
3.9985735    -60.000000 CY
 0.0001888       11357.     60168680.    10.7302759     0.0020253     -0.003637
3.9999930    -60.000000 CY
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 0.0001988        11538.     58052568.    10.6615762     0.0021190     -0.003844
3.9985756    -60.000000 CY
 0.0002088        11696.     56029119.    10.5938965     0.0022115     -0.004051
3.9995842    -60.000000 CY
 0.0002188        11826.     54063511.    10.5247776     0.0023023     -0.004260
3.9998758    -60.000000 CY
 0.0002288        11947.     52228074.    10.4624155     0.0023933     -0.004469
3.9999337    -60.000000 CY
 0.0002388        12060.     50512760.    10.4056341     0.0024843     -0.004678
3.9998704    -60.000000 CY
 0.0002488        12155.     48865394.    10.3485871     0.0025742     -0.004888
3.9995043    -60.000000 CY
 0.0002588        12236.     47288683.    10.2894669     0.0026624     -0.005100
3.9982959    -60.000000 CY
 0.0002688        12311.     45806945.    10.2342957     0.0027505     -0.005312
3.9955392    -60.000000 CY
 0.0002788        12384.     44425577.    10.1841452     0.0028388     -0.005524
3.9999093    -60.000000 CY
 0.0002888        12453.     43126427.    10.1381801     0.0029274     -0.005735
3.9980610    -60.000000 CY
 0.0002988        12515.     41889990.    10.0935401     0.0030154     -0.005947
3.9972217    -60.000000 CY
 0.0003088        12569.     40708045.    10.0469548     0.0031020     -0.006161
3.9986845    -60.000000 CY
 0.0003188        12616.     39578408.    10.0016621     0.0031880     -0.006374
3.9966067    -60.000000 CYT
 0.0003288        12659.     38506104.     9.9567442     0.0032733     -0.006589
3.9979161    -60.000000 CYT
 0.0003388        12700.     37491845.     9.9149379     0.0033587     -0.006804
3.9999985    60.0000000 CYT
 0.0003488        12741.     36532030.     9.8770715     0.0034446     -0.007018
3.9954911    60.0000000 CYT
 0.0003588        12780.     35623002.     9.8423292     0.0035309     -0.007232
3.9993779    60.0000000 CYT
 0.0003688        12816.     34754516.     9.8119732     0.0036182     -0.007444
3.9946053    60.0000000 CYT
 0.0003788        12848.     33922985.     9.7811680     0.0037046     -0.007658
3.9964516    60.0000000 CYT
 0.0003888        12876.     33121190.     9.7553387     0.0037924     -0.007870
3.9996305    60.0000000 CYT
 0.0003988        12876.     32290565.     9.7496684     0.0038877     -0.008075
3.9913477    60.0000000 CYT


-------------------------------------------------------------------------------
   Summary of Results for Nominal Moment Capacity for Section 2
-------------------------------------------------------------------------------

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	122.480	12503.780	0.00300000	-0.00590987

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	122.480000	12504.	79.612000	8127.	72739088.
1	0.75	122.480000	12504.	91.860000	9378.	70892110.
1	0.90	122.480000	12504.	110.232000	11253.	61281214.

Layering Correction Equivalent Depths of Soil & Rock Layers

Layer	Top of Layer Below	Equivalent Top Depth Below	Same Layer Type As	Layer is Rock or	F0 Integral	F1 Integral

No.	Pile Head ft	Grnd Surf ft	Layer Above	is Below Rock Layer	for Layer lbs	for Layer lbs
1	14.7500	0.00	N.A.	No	0.00	5873.
2	16.6000	24.8941	No	No	5873.	89095.
3	22.1000	11.9423	Yes	No	94968.	188706.
4	35.8000	21.0500	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 Displacement and Pile-head Rotation (Loading Type 5)
Displacement of pile head = 1.400000 inches
Rotation of pile head = 0.000E+00 radians
Axial load on pile head = 122480.0 lbs

Depth X	Deflect. y	Bending Moment	Shear Force	Slope S	Total Stress	Bending Stiffness	Soil Res. Es*H	Soil Spr. Distrib. p Lat. Load
feet	inches	in-lbs	lbs	radians	psi*	lb-in^2	lb/inch	lb/inch
0.00	1.4000	-1.25E+07	95771.	0.00	0.00	9.41E+10	0.00	0.00
0.4080	1.3984	-1.20E+07	95770.	-6.36E-04	0.00	9.41E+10	0.00	0.00
0.8160	1.3938	-1.15E+07	95770.	-0.00124	0.00	9.73E+10	0.00	0.00
1.2240	1.3863	-1.10E+07	95770.	-0.00180	0.00	9.82E+10	0.00	0.00
1.6320	1.3761	-1.06E+07	95770.	-0.00234	0.00	9.91E+10	0.00	0.00
2.0400	1.3634	-1.01E+07	95770.	-0.00285	0.00	1.00E+11	0.00	0.00
2.4480	1.3482	-9633886.	95770.	-0.00333	0.00	1.01E+11	0.00	0.00
2.8560	1.3308	-9162861.	95770.	-0.00378	0.00	1.02E+11		

0.00 0.00 0.00
3.2640 1.3112 -8691571. 95770. -0.00421 0.00 1.03E+11
0.00 0.00 0.00
3.6720 1.2896 -8220034. 95770. -0.00461 0.00 1.04E+11
0.00 0.00 0.00
4.0800 1.2661 -7748265. 95770. -0.00498 0.00 1.05E+11
0.00 0.00 0.00
4.4880 1.2408 -7276280. 95770. -0.00533 0.00 1.07E+11
0.00 0.00 0.00
4.8960 1.2139 -6804095. 95770. -0.00565 0.00 1.08E+11
0.00 0.00 0.00
5.3040 1.1855 -6331725. 95770. -0.00595 0.00 1.10E+11
0.00 0.00 0.00
5.7120 1.1557 -5859185. 95770. -0.00622 0.00 1.12E+11
0.00 0.00 0.00
6.1200 1.1246 -5386492. 95770. -0.00646 0.00 1.14E+11
0.00 0.00 0.00
6.5280 1.0924 -4913659. 95770. -0.00668 0.00 1.16E+11
0.00 0.00 0.00
6.9360 1.0592 -4440702. 95770. -0.00687 0.00 1.20E+11
0.00 0.00 0.00
7.3440 1.0251 -3967637. 95770. -0.00704 0.00 1.24E+11
0.00 0.00 0.00
7.7520 0.9902 -3494477. 95770. -0.00719 0.00 1.29E+11
0.00 0.00 0.00
8.1600 0.9547 -3021238. 95770. -0.00731 0.00 1.36E+11
0.00 0.00 0.00
8.5680 0.9187 -2547933. 95770. -0.00740 0.00 1.48E+11
0.00 0.00 0.00
8.9760 0.8822 -2074578. 95770. -0.00746 0.00 3.73E+11
0.00 0.00 0.00
9.3840 0.8456 -1601207. 95770. -0.00748 0.00 3.75E+11
0.00 0.00 0.00
9.7920 0.8089 -1127823. 95770. -0.00750 0.00 3.75E+11
0.00 0.00 0.00
10.2000 0.7722 -654430. 95770. -0.00751 0.00 3.76E+11
0.00 0.00 0.00
10.6080 0.7354 -181032. 95770. -0.00752 0.00 3.76E+11
0.00 0.00 0.00
11.0160 0.6985 292367. 95770. -0.00752 0.00 3.76E+11
0.00 0.00 0.00
11.4240 0.6617 765764. 95770. -0.00751 0.00 3.76E+11
0.00 0.00 0.00
11.8320 0.6250 1239155. 95770. -0.00750 0.00 3.75E+11
0.00 0.00 0.00
12.2400 0.5883 1712536. 95770. -0.00748 0.00 3.74E+11
0.00 0.00 0.00
12.6480 0.5517 2185904. 95770. -0.00745 0.00 3.73E+11
0.00 0.00 0.00
13.0560 0.5153 2659255. 95770. -0.00739 0.00 1.44E+11

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0.00       0.00       0.00
   13.4640     0.4793   3132552.     95770.   -0.00729       0.00   1.34E+11
0.00       0.00       0.00
   13.8720     0.4439   3605780.     95770.   -0.00717       0.00   1.28E+11
0.00       0.00       0.00
   14.2800     0.4092   4078925.     95770.   -0.00702       0.00   1.23E+11
0.00       0.00       0.00
   14.6880     0.3752   4551972.     95770.   -0.00684       0.00   1.19E+11
0.00       0.00       0.00
   15.0960     0.3422   5024907.     95702.   -0.00664       0.00   1.16E+11
-27.534   393.9665       0.00
   15.5040     0.3102   5497055.     95481.   -0.00642       0.00   1.13E+11
-62.980   994.0928       0.00
   15.9120     0.2794   5967550.     95082.   -0.00616       0.00   1.11E+11
-100.025      1753.       0.00
   16.3200     0.2498   6435490.     94501.   -0.00589       0.00   1.09E+11
-137.171      2688.       0.00
   16.7280     0.2217   6899970.     84287.   -0.00559       0.00   1.08E+11
-4035.     89118.       0.00
   17.1360     0.1951   7267534.     64820.   -0.00527       0.00   1.07E+11
-3917.     98303.       0.00
   17.5440     0.1701   7541003.     45984.   -0.00492       0.00   1.06E+11
-3778.    108712.       0.00
   17.9520     0.1469   7723711.     27881.   -0.00457       0.00   1.05E+11
-3617.    120577.       0.00
   18.3600     0.1254   7819497.     10615.   -0.00421       0.00   1.05E+11
-3436.    134173.       0.00
   18.7680     0.1057   7832703.     -5710.   -0.00384       0.00   1.05E+11
-3233.    149810.       0.00
   19.1760    0.08773   7768191.    -20976.   -0.00348       0.00   1.05E+11
-3003.    167576.       0.00
   19.5840    0.07157   7631481.    -34972.   -0.00312       0.00   1.06E+11
-2714.    185674.       0.00
   19.9920    0.05715   7429494.    -47554.   -0.00278       0.00   1.06E+11
-2425.    207795.       0.00
   20.4000    0.04440   7169162.    -58725.   -0.00244       0.00   1.07E+11
-2138.    235754.       0.00
   20.8080    0.03325   6857390.    -68487.   -0.00212       0.00   1.08E+11
-1850.    272409.       0.00
   21.2160    0.02363   6501082.    -76834.   -0.00182       0.00   1.09E+11
-1560.    323138.       0.00
   21.6240    0.01544   6107211.    -83738.   -0.00154       0.00   1.11E+11
-1261.    399789.       0.00
   22.0320    0.00857   5682959.    -88658.   -0.00128       0.00   1.12E+11
-748.876    427832.       0.00
   22.4400    0.00291   5240607.    -91149.   -0.00104       0.00   1.15E+11
-268.810    451803.       0.00
   22.8480   -0.00165   4791678.    -91415.  -8.31E-04       0.00   1.17E+11
160.0838    475774.       0.00
   23.2560   -0.00523   4346465.    -89717.  -6.43E-04       0.00   1.20E+11
```

533.5628 499745. 0.00
  23.6640 -0.00794 3913937. -86593. -4.77E-04 0.00 1.24E+11
742.6512 457860. 0.00
  24.0720 -0.00990 3499117. -82745. -3.34E-04 0.00 1.29E+11
829.1903 410085. 0.00
  24.4800 -0.01121 3104095. -78556. -2.11E-04 0.00 1.35E+11
882.2626 385421. 0.00
  24.8880 -0.01196 2730153. -74164. -1.08E-04 0.00 1.43E+11
911.5407 373045. 0.00
  25.2960 -0.01226 2378006. -69674. -2.27E-05 0.00 1.53E+11
922.8045 368493. 0.00
  25.7040 -0.01219 2047933. -65163. 2.87E-05 0.00 3.73E+11
919.9902 369622. 0.00
  26.1120 -0.01198 1739898. -60678. 5.35E-05 0.00 3.74E+11
912.1763 372789. 0.00
  26.5200 -0.01166 1453714. -56241. 7.44E-05 0.00 3.75E+11
900.0045 377832. 0.00
  26.9280 -0.01125 1189093. -51874. 9.16E-05 0.00 3.75E+11
884.0215 384664. 0.00
  27.3360 -0.01077 945653. -47593. 1.06E-04 0.00 3.76E+11
864.6999 393260. 0.00
  27.7440 -0.01022 722933. -43414. 1.16E-04 0.00 3.76E+11
842.4533 403646. 0.00
  28.1520 -0.00963 520402. -39350. 1.24E-04 0.00 3.76E+11
817.6475 415893. 0.00
  28.5600 -0.00900 337466. -35413. 1.30E-04 0.00 3.76E+11
790.6090 430117. 0.00
  28.9680 -0.00835 173480. -31613. 1.33E-04 0.00 3.76E+11
761.6319 446482. 0.00
  29.3760 -0.00769 27749. -27959. 1.35E-04 0.00 3.76E+11
730.9825 465204. 0.00
  29.7840 -0.00703 -100460. -24459. 1.34E-04 0.00 3.76E+11
698.9023 486559. 0.00
  30.1920 -0.00638 -211915. -21119. 1.32E-04 0.00 3.76E+11
665.6112 510896. 0.00
  30.6000 -0.00574 -307413. -17944. 1.29E-04 0.00 3.76E+11
631.3083 538657. 0.00
  31.0080 -0.00512 -387776. -14939. 1.24E-04 0.00 3.76E+11
596.1739 570404. 0.00
  31.4160 -0.00452 -453845. -12108. 1.19E-04 0.00 3.76E+11
560.3690 606851. 0.00
  31.8240 -0.00395 -506477. -9453. 1.13E-04 0.00 3.76E+11
524.0353 648929. 0.00
  32.2320 -0.00342 -546545. -6977. 1.06E-04 0.00 3.76E+11
487.2938 697860. 0.00
  32.6400 -0.00292 -574927. -4682. 9.84E-05 0.00 3.76E+11
450.2417 755292. 0.00
  33.0480 -0.00246 -592512. -2569. 9.08E-05 0.00 3.76E+11
412.9478 823506. 0.00
  33.4560 -0.00203 -600193. -639.240 8.30E-05 0.00 3.76E+11

```
375.4436    905772.       0.00
   33.8640   -0.00164   -598871.      1107.   7.52E-05       0.00   3.76E+11
337.7096   1006982.       0.00
   34.2720   -0.00129   -589448.      2667.   6.75E-05       0.00   3.76E+11
299.6491   1134890.       0.00
   34.6800  -9.81E-04   -572838.      3975.   5.99E-05       0.00   3.76E+11
234.6248   1170927.       0.00
   35.0880  -7.06E-04   -550600.      4971.   5.26E-05       0.00   3.76E+11
172.2764   1194898.       0.00
   35.4960  -4.66E-04   -524227.      5676.   4.56E-05       0.00   3.76E+11
115.9732   1218869.       0.00
   35.9040  -2.59E-04   -495071.      9979.   3.60E-05       0.00   1.96E+11
1642.   3.10E+07       0.00
   36.3120  -1.13E-04   -426556.     16111.   2.46E-05       0.00   1.97E+11
863.1331   3.74E+07       0.00
   36.7200  -1.88E-05   -337344.     18635.   1.50E-05       0.00   1.97E+11
168.2125   4.38E+07       0.00
   37.1280   3.42E-05   -244096.     18188.   7.79E-06       0.00   1.97E+11
-350.870   5.02E+07       0.00
   37.5360   5.75E-05   -159254.     15703.   2.77E-06       0.00   1.97E+11
-664.373   5.66E+07       0.00
   37.9440   6.13E-05    -90335.     12146.  -3.42E-07       0.00   1.97E+11
-788.772   6.30E+07       0.00
   38.3520   5.41E-05    -40323.      8337.  -1.97E-06       0.00   1.97E+11
-767.075   6.94E+07       0.00
   38.7600   4.20E-05     -8698.      4867.  -2.58E-06       0.00   1.97E+11
-650.513   7.58E+07       0.00
   39.1680   2.89E-05      7335.      2088.  -2.60E-06       0.00   1.97E+11
-484.546   8.21E+07       0.00
   39.5760   1.66E-05     11752.   166.5637  -2.36E-06       0.00   1.97E+11
-300.386   8.85E+07       0.00
   39.9840   5.78E-06      8969.   -842.916  -2.10E-06       0.00   1.97E+11
-111.984   9.49E+07       0.00
   40.3920  -3.97E-06      3501.   -916.141  -1.95E-06       0.00   1.97E+11
82.0715   1.01E+08       0.00
   40.8000  -1.33E-05       0.00       0.00  -1.90E-06       0.00   1.97E+11
292.1691   5.39E+07       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             =     1.40000000 inches
Computed slope at pile head      =       0.000000 radians
```

```
Maximum bending moment           =     -12453561. inch-lbs
Maximum shear force              =         95771. lbs
Depth of maximum bending moment  =       0.000000 feet below pile head
Depth of maximum shear force     =       0.000000 feet below pile head
Number of iterations             =             17
Number of zero deflection points =              3
Pile deflection at ground        =     0.37018567 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 Load                Load                  Axial    Pile-head  Pile-head  Max
Shear Max Moment
Case Type   Pile-head    Type     Pile-head   Loading  Deflection  Rotation    in
Pile    in Pile
 No.  1      Load 1       2        Load 2       lbs      inches     radians      lbs
     in-lbs
---- ----- ---------- ---------- ---------- ---------- ---------- ----------
---------- ----------
  1  y, in     1.4000   S, rad         0.00    122480.     1.4000       0.00
95771.  -1.25E+07


Maximum pile-head deflection = 1.4000000000 inches
Maximum pile-head rotation   = 0.0000000000 radians = 0.000000 deg.

--------------------------------------------------------------------------------
                           Summary of Warning Messages
--------------------------------------------------------------------------------

The following warning was reported 234 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.

==========

LPile for Windows, Version 2022-12.011

Analysis of Individual Piles and Drilled Shafts
Subjected to Lateral Loading Using the p-y Method
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Files Used for Analysis

Path to file locations:
\20240280\ODOT\109971\400-Engineering\Structures\SFN_0800512\Engdata\04_Abutment Design\Stage 2\Drilled Shaft\Lpile\Wingwalls\Forward Abutment Wingwalls\

Name of input data file:
FA WW_Scour Extreme II - Front DS.lp12d

Name of output report file:
FA WW_Scour Extreme II - Front DS.lp12o

Name of plot output file:
FA WW_Scour Extreme II - Front DS.lp12p

Name of runtime message file:
FA WW_Scour Extreme II - Front DS.lp12r

Date and Time of Analysis

Date: February 12, 2026 Time: 14:01:49

Problem Title

Project Name:

Job Number:

Client:

Engineer:

Description:

Program Options and Settings

Computational Options:
- Conventional Analysis

Engineering Units Used for Data Input and Computations:
- US Customary System Units (pounds, feet, inches)

Analysis Control Options:

- Maximum number of iterations allowed	=	500
- Deflection tolerance for convergence	=	1.0000E-05 in
- Maximum allowable deflection	=	100.0000 in
- Number of pile increments	=	100

Loading Type and Number of Cycles of Loading:

- Static loading specified

- Analysis uses p-y modification factors for p-y curves
- Analysis uses layering correction (Method of Georgiadis)
- No distributed lateral loads are entered
- Loading by lateral soil movements acting on pile not selected
- Input of shear resistance at the pile tip not selected
- Input of moment resistance at the pile tip not selected
- Computation of pile-head foundation stiffness matrix not selected
- Push-over analysis of pile not selected
- Buckling analysis of pile not selected

Output Options:
- Output files use decimal points to denote decimal symbols.
- Values of pile-head deflection, bending moment, shear force, and soil reaction are printed for full length of pile.
- Printing Increment (nodal spacing of output points) = 1
- No p-y curves to be computed and reported for user-specified depths
- Print using wide report formats

Pile Structural Properties and Geometry

Number of pile sections defined = 2
Total length of pile = 40.800 ft
Depth of ground surface below top of pile = 18.3200 ft

Pile diameters used for p-y curve computations are defined using 4 points.

p-y curves are computed using pile diameter values interpolated with depth over the length of the pile. A summary of values of pile diameter vs. depth follows.

Point No.	Depth Below Pile Head feet	Pile Diameter inches
1	0.000	36.0000
2	35.800	36.0000
3	35.800	30.0000
4	40.800	30.0000

Input Structural Properties for Pile Sections:

Pile Section No. 1:

```
   Section 1 is a round drilled shaft, bored pile, or CIDH pile
   Length of section                                  =    35.800000 ft
   Shaft Diameter                                     =    36.000000 in

Pile Section No. 2:

   Section 2 is a round drilled shaft, bored pile, or CIDH pile
   Length of section                                  =     5.000000 ft
   Shaft Diameter                                     =    30.000000 in



--------------------------------------------------------------------------------
                       Soil and Rock Layering Information
--------------------------------------------------------------------------------

The soil profile is modelled using 3 layers

Layer 1 is stiff clay with water-induced erosion

   Distance from top of pile to top of layer          =    18.320000 ft
   Distance from top of pile to bottom of layer       =    22.100000 ft
   Effective unit weight at top of layer              =    72.600000 pcf
   Effective unit weight at bottom of layer           =    72.600000 pcf
   Undrained cohesion at top of layer                 =        5600. psf
   Undrained cohesion at bottom of layer              =        5600. psf
   Epsilon-50 at top of layer                         =     0.004000
   Epsilon-50 at bottom of layer                      =     0.004000
   Subgrade k at top of layer                         =        2000. pci
   Subgrade k at bottom of layer                      =        2000. pci


Layer 2 is stiff clay with water-induced erosion

   Distance from top of pile to top of layer          =    22.100000 ft
   Distance from top of pile to bottom of layer       =    35.800000 ft
   Effective unit weight at top of layer              =    67.600000 pcf
   Effective unit weight at bottom of layer           =    67.600000 pcf
   Undrained cohesion at top of layer                 =        4600. psf
   Undrained cohesion at bottom of layer              =        4600. psf
   Epsilon-50 at top of layer                         =     0.004000
   Epsilon-50 at bottom of layer                      =     0.004000
   Subgrade k at top of layer                         =        2000. pci
   Subgrade k at bottom of layer                      =        2000. pci


Layer 3 is weak rock, p-y criteria by Reese, 1997

   Distance from top of pile to top of layer          =    35.800000 ft
```

Distance from top of pile to bottom of layer	=	100.000000 ft
Effective unit weight at top of layer	=	97.500000 pcf
Effective unit weight at bottom of layer	=	97.500000 pcf
Uniaxial compressive strength at top of layer	=	661.000000 psi
Uniaxial compressive strength at bottom of layer	=	661.000000 psi
Initial modulus of rock at top of layer	=	60000. psi
Initial modulus of rock at bottom of layer	=	60000. 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	=	0.0005000
k rm of rock at bottom of layer	=	0.0005000

(Depth of the lowest soil layer extends 59.200 ft below the pile tip)

Summary of Input Soil Properties

Layer Num.	Soil Type Name or (p-y Curve Type)	Layer Depth ft	Effective Unit Wt. pcf	Cohesion psf	Uniaxial qu psi	RQD %
	E50 krm	kpy pci	Rock Mass Modulus psi			
1	Stiff Clay	18.3200	72.6000	5600.	--	--
	0.00400	2000.	--			
	with Free Water	22.1000	72.6000	5600.	--	--
	0.00400	2000.	--			
2	Stiff Clay	22.1000	67.6000	4600.	--	--
	0.00400	2000.	--			
	with Free Water	35.8000	67.6000	4600.	--	--
	0.00400	2000.	--			
3	Weak	35.8000	97.5000	--	661.0000	9.0000
	5.00E-04	--	60000.			
	Rock	100.0000	97.5000	--	661.0000	9.0000
	5.00E-04	--	60000.			

Modification Factors for p-y Curves

Distribution of p-y modifiers with depth defined using 2 points

Point	Depth X	p-mult	y-mult

No.	ft		
1	18.320	0.7000	1.0000
2	35.800	0.7000	1.0000

Static Loading Type

Static loading criteria were used when computing p-y curves for all analyses.

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 1

Load No.	Load Compute Top y vs. Pile Length Type	Condition 1 Run Analysis	Condition 2	Axial Thrust Force, lbs
1	5	y = 1.400000 in	S = 0.0000 in/in	244770.
	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 = 2

Pile Section No. 1:

Dimensions and Properties of Drilled Shaft (Bored Pile):

Length of Section	=	35.800000 ft
Shaft Diameter	=	36.000000 in
Concrete Cover Thickness (to edge of trans. reinf.)	=	6.000000 in
Number of Reinforcing Bars	=	17 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	=	21.590000 sq. in.
Area Ratio of Steel Reinforcement	=	2.12 percent
Edge-to-Edge Bar Spacing	=	2.676940 in
Maximum Concrete Aggregate Size	=	0.375000 in
Ratio of Bar Spacing to Aggregate Size	=	7.14
Offset of Center of Rebar Cage from Center of Pile	=	0.0000 in

Transverse Reinforcement
Type: Hoop

Number of Transverse Reinf. (per spacing)	=	1
Spacing of Transverse Reinf.	=	4.500000 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	=	4682.772 kips
Tensile Load for Cracking of Concrete	=	-486.599 kips
Nominal Axial Tensile Capacity	=	-1295.400 kips

Reinforcing Bar Dimensions and Positions Used in Computations:

Bar Number	Bar Diam. inches	Bar Area sq. in.	X inches	Y inches
1	1.270000	1.270000	10.740000	0.00000
2	1.270000	1.270000	10.014752	3.879735
3	1.270000	1.270000	7.936956	7.235491
4	1.270000	1.270000	4.787230	9.614054
5	1.270000	1.270000	0.990962	10.694185
6	1.270000	1.270000	-2.93914	10.330007
7	1.270000	1.270000	-6.47230	8.570705
8	1.270000	1.270000	-9.13133	5.653881
9	1.270000	1.270000	-10.55713	1.973470
10	1.270000	1.270000	-10.55713	-1.97347
11	1.270000	1.270000	-9.13133	-5.65388

12	1.270000	1.270000	-6.47230	-8.57071
13	1.270000	1.270000	-2.93914	-10.33001
14	1.270000	1.270000	0.990962	-10.69419
15	1.270000	1.270000	4.787230	-9.61405
16	1.270000	1.270000	7.936956	-7.23549
17	1.270000	1.270000	10.014752	-3.87974

NOTE: The positions of the above rebars were computed by LPile

Minimum spacing between any two bars not equal to zero = 2.677 inches
between bars 6 and 7.

Ratio of bar spacing to maximum aggregate size = 7.14

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	=	0.375000 in

Number of Axial Thrust Force Values Determined from Pile-head Loadings = 1

Number	Axial Thrust Force kips
1	244.770

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 = 244.770 kips

Bending Max Conc Curvature Stress rad/in. ksi	Bending Max Steel Moment Stress in-kip ksi	Bending Stiffness kip-in2	Depth to N Axis in	Max Comp Strain in/in	Max Tens Strain in/in	Run Msg
6.25000E-07	232.0442086	371270734.	99.6983212	0.00006231	0.00003981	
0.2594472	1.6863196					
0.00000125	464.1053582	371284287.	58.8672746	0.00007358	0.00002858	
0.3050785	1.8925137					
0.00000188	696.1561755	371283294.	45.2649563	0.00008487	0.00001737	
0.3504908	2.0991445					
0.00000250	928.1915050	371276602.	38.4698204	0.00009617	0.00000617	
0.3956829	2.3062120					
0.00000313	1160.	371264813.	34.3975437	0.0001075	-0.00000501	
0.4406535	2.5137149					
0.00000375	1392.	371210551.	31.6861996	0.0001188	-0.00001618	
0.4853941	2.7215992					
0.00000438	1623.	371066881.	29.7516215	0.0001302	-0.00002734	
0.5298879	2.9297495					
0.00000500	1854.	370831724.	28.3019429	0.0001415	-0.00003849	
0.5741229	3.1380816					
0.00000563	2084.	370518898.	27.1752173	0.0001529	-0.00004964	
0.6180918	3.3465448					
0.00000625	2313.	370143468.	26.2743827	0.0001642	-0.00006079	
0.6617899	3.5551068					
0.00000688	2542.	369717993.	25.5377246	0.0001756	-0.00007193	
0.7052142	3.7637464					
0.00000750	2769.	369252405.	24.9241306	0.0001869	-0.00008307	
0.7483624	3.9724484					
0.00000813	2996.	368754420.	24.4051569	0.0001983	-0.00009421	
0.7912330	4.1812026					
0.00000875	2996.	342414819.	22.1346712	0.0001937	-0.000121	
0.7732558	3.9266996 C					
0.00000938	2996.	319587164.	21.5664720	0.0002022	-0.000135	
0.8051552	4.0527050 C					
0.00001000	2996.	299612967.	21.0587248	0.0002106	-0.000149	
0.8364976	4.1756459 C					
0.00001063	2996.	281988674.	20.5993460	0.0002189	-0.000164	
0.8672295	4.2950638 C					
0.00001125	2996.	266322637.	20.1828905	0.0002271	-0.000178	
0.8974723	4.4118492 C					
0.00001188	2996.	252305656.	19.8033822	0.0002352	-0.000192	
0.9272636	4.5262554 C					

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0.00001250         2996.    239690373.    19.4558656     0.0002432     -0.000207
0.9566356     4.6385028 C
0.00001313         2996.    228276546.    19.1363167     0.0002512     -0.000221
0.9856189     4.7487987 C
0.00001375         2996.    217900339.    18.8415063     0.0002591     -0.000236
1.0142463     4.8573753 C
0.00001438         3001.    208789767.    18.5683034     0.0002669     -0.000251
1.0425261     4.9642740 C
0.00001500         3070.    204653349.    18.3136678     0.0002747     -0.000265
1.0704427     5.0693455 C
0.00001563         3138.    200803049.    18.0771115     0.0002825     -0.000280
1.0980975     5.1733787 C
0.00001625         3205.    197206008.    17.8564782     0.0002902     -0.000295
1.1254905     -5.411593 C
0.00001688         3271.    193821269.    17.6490300     0.0002978     -0.000310
1.1525587     -5.721268 C
0.00001750         3337.    190662876.    17.4558228     0.0003055     -0.000325
1.1794649     -6.031220 C
0.00001813         3401.    187667628.    17.2723638     0.0003131     -0.000339
1.2060136     -6.343052 C
0.00001875         3466.    184868270.    17.1013649     0.0003207     -0.000354
1.2324521     -6.654757 C
0.00001938         3530.    182201786.    16.9380442     0.0003282     -0.000369
1.2585368     -6.968348 C
0.00002000         3594.    179698112.    16.7851133     0.0003357     -0.000384
1.2845106     -7.281833 C
0.00002063         3657.    177317018.    16.6393925     0.0003432     -0.000399
1.3102133     -7.596548 C
0.00002125         3720.    175061650.    16.5014624     0.0003507     -0.000414
1.3357363     -7.911744 C
0.00002188         3783.    172930019.    16.3714209     0.0003581     -0.000429
1.3611375     -8.226942 C
0.00002250         3845.    170886249.    16.2461380     0.0003655     -0.000444
1.3862283     -8.543736 C
0.00002313         3907.    168950065.    16.1278124     0.0003730     -0.000460
1.4112133     -8.860411 C
0.00002375         3969.    167112052.    16.0158140     0.0003804     -0.000475
1.4360844     -9.177033 C
0.00002438         4030.    165342741.    15.9072968     0.0003877     -0.000490
1.4606531     -9.495221 C
0.00002563         4153.    162055375.    15.7066564     0.0004025     -0.000520
1.5094761    -10.131246 C
0.00002688         4274.    159035898.    15.5220973     0.0004172     -0.000550
1.5575900    -10.769328 C
0.00002813         4395.    156266775.    15.3533694     0.0004318     -0.000581
1.6051931    -11.407778 C
0.00002938         4515.    153704709.    15.1971687     0.0004464     -0.000611
1.6521376    -12.047924 C
0.00003063         4635.    151333826.    15.0527888     0.0004610     -0.000642
1.6985466    -12.688708 C
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0.00003188        4754.    149137398.    14.9199906     0.0004756     -0.000672
1.7444921    -13.329496 C
0.00003313        4872.    147080290.    14.7948595     0.0004901     -0.000702
1.7897414    -13.972426 C
0.00003438        4990.    145165534.    14.6790595     0.0005046     -0.000733
1.8345824    -14.614889 C
0.00003563        5108.    143376880.    14.5719217     0.0005191     -0.000763
1.8789916    -15.257091 C
0.00003688        5225.    141688038.    14.4701860     0.0005336     -0.000794
1.9227180    -15.901407 C
0.00003813        5341.    140103464.    14.3753849     0.0005481     -0.000824
1.9660380    -16.545253 C
0.00003938        5458.    138613195.    14.2870171     0.0005626     -0.000855
2.0089504    -17.188625 C
0.00004063        5574.    137206349.    14.2038373     0.0005770     -0.000885
2.0514042    -17.832007 C
0.00004188        5690.    135868859.    14.1248142     0.0005915     -0.000916
2.0932439    -18.476941 C
0.00004313        5805.    134603198.    14.0505285     0.0006059     -0.000947
2.1346774    -19.121395 C
0.00004438        5920.    133403269.    13.9808026     0.0006204     -0.000977
2.1757034    -19.765367 C
0.00004563        6035.    132263641.    13.9152636     0.0006349     -0.001008
2.2163205    -20.408855 C
0.00004688        6149.    131178700.    13.8534021     0.0006494     -0.001038
2.2565043    -21.052094 C
0.00004813        6263.    130138704.    13.7936697     0.0006638     -0.001069
2.2960858    -21.696847 C
0.00004938        6377.    129146362.    13.7373069     0.0006783     -0.001099
2.3352595    -22.341106 C
0.00005063        6490.    128198119.    13.6840663     0.0006928     -0.001130
2.3740239    -22.984868 C
0.00005188        6603.    127290760.    13.6337239     0.0007072     -0.001160
2.4123778    -23.628129 C
0.00005313        6716.    126421376.    13.5860771     0.0007218     -0.001191
2.4503197    -24.270888 C
0.00005438        6829.    125587321.    13.5409417     0.0007363     -0.001221
2.4878482    -24.913141 C
0.00005563        6941.    124786012.    13.4980963     0.0007508     -0.001252
2.5249543    -25.554971 C
0.00005688        7053.    124011554.    13.4563068     0.0007653     -0.001282
2.5614797    -26.198165 C
0.00005813        7165.    123266078.    13.4166240     0.0007798     -0.001313
2.5975922    -26.840840 C
0.00005938        7276.    122547731.    13.3789150     0.0007944     -0.001343
2.6332903    -27.482993 C
0.00006063        7387.    121854812.    13.3430602     0.0008089     -0.001374
2.6685726    -28.124620 C
0.00006188        7498.    121185756.    13.3089489     0.0008235     -0.001404
2.7034375    -28.765717 C
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0.00006313        7609.    120539122.    13.2764793     0.0008381     -0.001434
2.7378836    -29.406283 C
0.00006438        7719.    119913583.    13.2455577     0.0008527     -0.001465
2.7719094    -30.046312 C
0.00006563        7830.    119307910.    13.2160973     0.0008673     -0.001495
2.8055133    -30.685803 C
0.00006688        7939.    118720967.    13.1880179     0.0008819     -0.001526
2.8386938    -31.324751 C
0.00006813        8049.    118151702.    13.1612452     0.0008966     -0.001556
2.8714493    -31.963154 C
0.00006938        8158.    117598821.    13.1355778     0.0009113     -0.001586
2.9037580    -32.601272 C
0.00007063        8267.    117060227.    13.1104606     0.0009259     -0.001617
2.9355421    -33.240124 C
0.00007188        8376.    116536700.    13.0864888     0.0009406     -0.001647
2.9669007    -33.878410 C
0.00007313        8485.    116027447.    13.0636048     0.0009553     -0.001677
2.9978321    -34.516128 C
0.00007438        8593.    115531726.    13.0416928     0.0009700     -0.001708
3.0283347    -35.153272 C
0.00007938        9023.    113670975.    12.9637671     0.0010290     -0.001829
3.1460237    -37.696041 C
0.00008438        9448.    111978632.    12.8988986     0.0010883     -0.001949
3.2567164    -40.229321 C
0.00008938        9869.    110425195.    12.8450541     0.0011480     -0.002069
3.3602996    -42.752840 C
0.00009438       10286.    108987372.    12.8005854     0.0012081     -0.002189
3.4566556    -45.266308 C
0.00009938       10697.    107645910.    12.7623695     0.0012683     -0.002309
3.5455870    -47.770923 C
 0.0001044       11104.    106385920.    12.7326014     0.0013290     -0.002429
3.6269836    -50.266417 C
 0.0001094       11506.    105195664.    12.7091357     0.0013901     -0.002547
3.7008058    -52.750606 C
 0.0001144       11902.    104064728.    12.6908620     0.0014515     -0.002666
3.7669090    -55.223109 C
 0.0001194       12294.    102984372.    12.6774918     0.0015134     -0.002784
3.8251411    -57.683520 C
 0.0001244       12679.    101945376.    12.6685959     0.0015757     -0.002902
3.8753349    -60.000000 CY
 0.0001294       13046.    100834953.    12.6593433     0.0016378     -0.003020
3.9169748    -60.000000 CY
 0.0001344       13353.     99373088.    12.6370577     0.0016981     -0.003139
3.9493042    -60.000000 CY
 0.0001394       13610.     97652663.    12.6043998     0.0017567     -0.003261
3.9731228    -60.000000 CY
 0.0001444       13835.     95826573.    12.5673997     0.0018144     -0.003383
3.9892382    -60.000000 CY
 0.0001494       14034.     93948145.    12.5279770     0.0018714     -0.003506
3.9980365    -60.000000 CY
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 0.0001544        14210.     92048639.    12.4873519     0.0019277     -0.003630
3.9980265    -60.000000 CY
 0.0001594        14373.     90181783.    12.4482988     0.0019839     -0.003754
3.9976459    -60.000000 CY
 0.0001644        14517.     88317733.    12.4084466     0.0020396     -0.003878
3.9982976    -60.000000 CY
 0.0001694        14644.     86461882.    12.3670542     0.0020947     -0.004003
3.9999718    -60.000000 CY
 0.0001744        14764.     84669359.    12.3286201     0.0021498     -0.004128
3.9995961    -60.000000 CY
 0.0001794        14876.     82933347.    12.2924619     0.0022050     -0.004253
3.9985045    -60.000000 CY
 0.0001844        14976.     81224724.    12.2563001     0.0022598     -0.004378
3.9973590    -60.000000 CY
 0.0001894        15064.     79546251.    12.2191837     0.0023140     -0.004503
3.9997409    -60.000000 CY
 0.0001944        15145.     77915137.    12.1857075     0.0023686     -0.004629
3.9979709    -60.000000 CY
 0.0001994        15224.     76356155.    12.1542405     0.0024233     -0.004754
3.9999980    -60.000000 CY
 0.0002044        15298.     74852147.    12.1250369     0.0024781     -0.004879
3.9987305    -60.000000 CY
 0.0002094        15366.     73390000.    12.0962495     0.0025327     -0.005005
3.9982053    -60.000000 CY
 0.0002144        15428.     71965220.    12.0682524     0.0025871     -0.005130
3.9988298    -60.000000 CY
 0.0002194        15482.     70571830.    12.0390908     0.0026411     -0.005256
3.9985759    -60.000000 CY
 0.0002244        15530.     69216259.    12.0101072     0.0026948     -0.005383
3.9982334    -60.000000 CY
 0.0002294        15577.     67911549.    11.9827869     0.0027486     -0.005509
3.9999746    -60.000000 CY
 0.0002344        15623.     66656576.    11.9569508     0.0028024     -0.005635
3.9967259    -60.000000 CY
 0.0002394        15667.     65448997.    11.9345799     0.0028568     -0.005761
3.9995302    -60.000000 CY
 0.0002444        15710.     64285713.    11.9130937     0.0029113     -0.005886
3.9958368    -60.000000 CY
 0.0002494        15748.     63149815.    11.8914917     0.0029654     -0.006012
3.9979196    -60.000000 CY
 0.0002544        15785.     62052225.    11.8708948     0.0030197     -0.006138
3.9998565    -60.000000 CY
 0.0002594        15815.     60974879.    11.8486841     0.0030733     -0.006264
3.9939487    -60.000000 CY
 0.0002644        15845.     59932796.    11.8292064     0.0031273     -0.006390
3.9978450    -60.000000 CY
 0.0002694        15870.     58915173.    11.8084346     0.0031809     -0.006517
3.9997625    -60.000000 CY
 0.0002744        15894.     57928820.    11.7885296     0.0032345     -0.006643
3.9953673    -60.000000 CY
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    0.0003044        16023.     52643591.    11.6917774     0.0035587     -0.007399
   3.9992401    -60.000000 CYT
    0.0003344        16053.     48008891.    11.6367032     0.0038910     -0.008146
   3.9941702    -60.000000 CYT


--------------------------------------------------------------------------------
   Summary of Results for Nominal Moment Capacity for Section 1
--------------------------------------------------------------------------------

Moment values interpolated at maximum compressive strain = 0.003
or maximum developed moment if pile fails at smaller strains.

 Load           Axial Thrust        Nominal Mom. Cap.      Max. Comp.      Max.
Tens.
  No.              kips                 in-kip               Strain
Strain
 ----         ----------------     ------------------     ------------
------------
   1               244.770             15771.282           0.00300000
-0.00609223

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         244.770000        15771.    159.100500        10251.
109105973.

   1       0.75         244.770000        15771.    183.577500        11828.
104275564.
```

1 0.90 244.770000 15771. 220.293000 14194.
92219262.

Pile Section No. 2:

Dimensions and Properties of Drilled Shaft (Bored Pile):

Length of Section	=	5.000000 ft
Shaft Diameter	=	30.000000 in
Concrete Cover Thickness (to edge of trans. reinf.)	=	3.000000 in
Number of Reinforcing Bars	=	17 bars
Yield Stress of Reinforcing Bars	=	60000. psi
Modulus of Elasticity of Reinforcing Bars	=	29000000. psi
Gross Area of Shaft	=	706.858347 sq. in.
Total Area of Reinforcing Steel	=	21.590000 sq. in.
Area Ratio of Steel Reinforcement	=	3.05 percent
Edge-to-Edge Bar Spacing	=	2.676940 in
Maximum Concrete Aggregate Size	=	0.375000 in
Ratio of Bar Spacing to Aggregate Size	=	7.14
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.	=	4.500000 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	=	3625.312 kips
Tensile Load for Cracking of Concrete	=	-357.244 kips
Nominal Axial Tensile Capacity	=	-1295.400 kips

Reinforcing Bar Dimensions and Positions Used in Computations:

Bar Number	Bar Diam. inches	Bar Area sq. in.	X inches	Y inches
1	1.270000	1.270000	10.740000	0.00000
2	1.270000	1.270000	10.014752	3.879735
3	1.270000	1.270000	7.936956	7.235491
4	1.270000	1.270000	4.787230	9.614054
5	1.270000	1.270000	0.990962	10.694185
6	1.270000	1.270000	-2.93914	10.330007
7	1.270000	1.270000	-6.47230	8.570705

8	1.270000	1.270000	-9.13133	5.653881
9	1.270000	1.270000	-10.55713	1.973470
10	1.270000	1.270000	-10.55713	-1.97347
11	1.270000	1.270000	-9.13133	-5.65388
12	1.270000	1.270000	-6.47230	-8.57071
13	1.270000	1.270000	-2.93914	-10.33001
14	1.270000	1.270000	0.990962	-10.69419
15	1.270000	1.270000	4.787230	-9.61405
16	1.270000	1.270000	7.936956	-7.23549
17	1.270000	1.270000	10.014752	-3.87974

NOTE: The positions of the above rebars were computed by LPile

Minimum spacing between any two bars not equal to zero = 2.677 inches
between bars 6 and 7.

Ratio of bar spacing to maximum aggregate size = 7.14

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	=	0.375000 in

Number of Axial Thrust Force Values Determined from Pile-head Loadings = 1

Number	Axial Thrust Force kips
1	244.770

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 = 244.770 kips

Bending Max Conc Curvature Stress rad/in. ksi	Bending Max Steel Moment Stress in-kip ksi	Run Msg	Bending Stiffness kip-in2	Depth to N Axis in	Max Comp Strain in/in	Max Tens Strain in/in
0.00000125	241.7744323		193419546.	71.3134194	0.00008914	0.00005164
0.3683746	2.4491740					
0.00000250	483.5665870		193426635.	43.1804866	0.0001080	0.00003295
0.4432391	2.8587103					
0.00000375	725.3330070		193422135.	33.8133825	0.0001268	0.00001430
0.5174802	3.2693929					
0.00000500	967.0600228		193412005.	29.1377332	0.0001457	-0.00000431
0.5910931	3.6812213					
0.00000625	1209.		193368473.	26.3380432	0.0001646	-0.00002289
0.6640576	4.0940828					
0.00000750	1449.		193239916.	24.4747620	0.0001836	-0.00004144
0.7363241	4.5076358					
0.00000875	1689.		193028267.	23.1446968	0.0002025	-0.00005998
0.8078585	4.9216419					
0.00001000	1928.		192750050.	22.1497253	0.0002215	-0.00007850
0.8786409	5.3359639					
0.00001125	2165.		192420690.	21.3761117	0.0002405	-0.00009702
0.9486596	5.7505190					
0.00001250	2165.		173178621.	19.6590081	0.0002457	-0.000129
0.9674070	5.7670155	C				
0.00001375	2165.		157435110.	18.9697973	0.0002608	-0.000152
1.0222163	6.0688942	C				
0.00001500	2165.		144315518.	18.3790413	0.0002757	-0.000174
1.0756329	6.3636330	C				
0.00001625	2241.		137894471.	17.8661962	0.0002903	-0.000197
1.1278135	6.6522982	C				
0.00001750	2343.		133909540.	17.4154028	0.0003048	-0.000220
1.1788162	6.9351980	C				
0.00001875	2444.		130332595.	17.0169646	0.0003191	-0.000243
1.2288541	7.2139250	C				
0.00002000	2542.		127105213.	16.6620101	0.0003332	-0.000267
1.2780004	7.4889725	C				
0.00002125	2639.		124176140.	16.3432359	0.0003473	-0.000290
1.3262959	7.7605817	C				

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0.00002250        2734.    121508561.    16.0553485     0.0003612     -0.000314
1.3738096     8.0292412 C
0.00002375        2828.    119066927.    15.7936946     0.0003751     -0.000337
1.4205678     8.2950948 C
0.00002500        2921.    116827220.    15.5550477     0.0003889     -0.000361
1.4666396     8.5586594 C
0.00002625        3013.    114768776.    15.3368123     0.0004026     -0.000385
1.5120928     8.8204609 C
0.00002750        3104.    112873536.    15.1368661     0.0004163     -0.000409
1.5569933     9.0810258 C
0.00002875        3194.    111110785.    14.9515400     0.0004299     -0.000433
1.6012243     -9.420085 C
0.00003000        3284.    109479543.    14.7807932     0.0004434     -0.000457
1.6449656     -9.978210 C
0.00003125        3374.    107959929.    14.6223122     0.0004569     -0.000481
1.6881646    -10.537592 C
0.00003250        3463.    106541996.    14.4749482     0.0004704     -0.000505
1.7308522    -11.097987 C
0.00003375        3551.    105215068.    14.3375426     0.0004839     -0.000529
1.7730397    -11.659318 C
0.00003500        3639.    103973117.    14.2094814     0.0004973     -0.000553
1.8147800    -12.221125 C
0.00003625        3727.    102801574.    14.0888938     0.0005107     -0.000577
1.8559724    -12.784361 C
0.00003750        3814.    101704035.    13.9766815     0.0005241     -0.000601
1.8968117    -13.347231 C
0.00003875        3901.    100663572.    13.8703582     0.0005375     -0.000625
1.9370989    -13.911618 C
0.00004000        3987.     99681217.    13.7704571     0.0005508     -0.000649
1.9769697    -14.476263 C
0.00004125        4074.     98754711.    13.6769162     0.0005642     -0.000673
2.0164891    -15.040542 C
0.00004250        4160.     97872206.    13.5878499     0.0005775     -0.000698
2.0554896    -15.606088 C
0.00004375        4245.     97033813.    13.5036091     0.0005908     -0.000722
2.0940692    -16.171967 C
0.00004500        4331.     96238648.    13.4243294     0.0006041     -0.000746
2.1322988    -16.737479 C
0.00004625        4416.     95483155.    13.3496057     0.0006174     -0.000770
2.1701766    -17.302633 C
0.00004750        4501.     94757205.    13.2775473     0.0006307     -0.000794
2.2074967    -17.869521 C
0.00004875        4586.     94065415.    13.2094493     0.0006440     -0.000819
2.2444680    -18.436039 C
0.00005125        4755.     92774270.    13.0839693     0.0006706     -0.000867
2.3173609    -19.567957 C
0.00005375        4923.     91584991.    12.9694187     0.0006971     -0.000915
2.3885940    -20.701106 C
0.00005625        5090.     90488014.    12.8651961     0.0007237     -0.000964
2.4583223    -21.833862 C
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0.00005875        5257.     89474102.    12.7707823     0.0007503     -0.001012
2.5266437    -22.965092 C
0.00006125        5422.     88527991.    12.6835336     0.0007769     -0.001061
2.5933202    -24.097436 C
0.00006375        5587.     87645108.    12.6033625     0.0008035     -0.001109
2.6585160    -25.229034 C
0.00006625        5752.     86819649.    12.5301399     0.0008301     -0.001157
2.7222948    -26.359060 C
0.00006875        5916.     86045267.    12.4630388     0.0008568     -0.001206
2.7846484    -27.487498 C
0.00007125        6079.     85313321.    12.4003847     0.0008835     -0.001254
2.8453770    -28.616767 C
0.00007375        6241.     84621817.    12.3423244     0.0009102     -0.001302
2.9046253    -29.745041 C
0.00007625        6403.     83967492.    12.2886469     0.0009370     -0.001350
2.9624360    -30.871667 C
0.00007875        6564.     83346727.    12.2392530     0.0009638     -0.001399
3.0188001    -31.996627 C
0.00008125        6724.     82756351.    12.1936134     0.0009907     -0.001447
3.0737087    -33.119904 C
0.00008375        6884.     82193569.    12.1513995     0.0010177     -0.001495
3.1271526    -34.241481 C
0.00008625        7043.     81653985.    12.1115674     0.0010446     -0.001543
3.1789623    -35.363754 C
0.00008875        7201.     81137459.    12.0744319     0.0010716     -0.001591
3.2292936    -36.484368 C
0.00009125        7359.     80642099.    12.0400037     0.0010987     -0.001639
3.2781435    -37.603203 C
0.00009375        7516.     80166144.    12.0080737     0.0011258     -0.001687
3.3255023    -38.720237 C
0.00009625        7672.     79708011.    11.9782085     0.0011529     -0.001735
3.3713600    -39.835450 C
0.00009875        7828.     79266277.    11.9507281     0.0011801     -0.001782
3.4157065    -40.948821 C
 0.0001013        7983.     78839656.    11.9252407     0.0012074     -0.001830
3.4585313    -42.060328 C
 0.0001038        8137.     78426989.    11.9016100     0.0012348     -0.001878
3.4998240    -43.169949 C
 0.0001063        8290.     78027222.    11.8797122     0.0012622     -0.001925
3.5395739    -44.277660 C
 0.0001088        8443.     77639396.    11.8594354     0.0012897     -0.001973
3.5777701    -45.383439 C
 0.0001113        8595.     77262357.    11.8405536     0.0013173     -0.002020
3.6143651    -46.488062 C
 0.0001138        8747.     76895359.    11.8228690     0.0013449     -0.002068
3.6493529    -47.591498 C
 0.0001163        8898.     76537977.    11.8064290     0.0013725     -0.002115
3.6827614    -48.692889 C
 0.0001188        9048.     76189532.    11.7912830     0.0014002     -0.002162
3.7145787    -49.792206 C
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 0.0001213        9197.     75849405.    11.7773589     0.0014280     -0.002209
3.7447927    -50.889424 C
 0.0001238        9345.     75517022.    11.7645905     0.0014559     -0.002257
3.7733908    -51.984513 C
 0.0001263        9493.     75191853.    11.7529169     0.0014838     -0.002304
3.8003606    -53.077446 C
 0.0001288        9640.     74873410.    11.7422824     0.0015118     -0.002351
3.8256889    -54.168191 C
 0.0001313        9786.     74561237.    11.7326356     0.0015399     -0.002398
3.8493627    -55.256719 C
 0.0001338        9932.     74254914.    11.7237493     0.0015681     -0.002444
3.8713684    -56.342997 C
 0.0001363       10076.     73954048.    11.7159537     0.0015963     -0.002491
3.8916923    -57.426996 C
 0.0001388       10220.     73658273.    11.7090144     0.0016246     -0.002538
3.9103204    -58.508681 C
 0.0001413       10363.     73367247.    11.7028852     0.0016530     -0.002584
3.9272382    -59.588019 C
 0.0001438       10504.     73069815.    11.6969761     0.0016814     -0.002631
3.9423893    -60.000000 CY
 0.0001463       10640.     72749302.    11.6903424     0.0017097     -0.002678
3.9557136    -60.000000 CY
 0.0001488       10768.     72391584.    11.6822732     0.0017377     -0.002725
3.9671861    -60.000000 CY
 0.0001588       11191.     70495573.    11.6264378     0.0018457     -0.002917
3.9953394    -60.000000 CY
 0.0001688       11519.     68262276.    11.5528913     0.0019496     -0.003113
3.9998226    -60.000000 CY
 0.0001788       11785.     65932516.    11.4730360     0.0020508     -0.003312
3.9993973    -60.000000 CY
 0.0001888       12015.     63653604.    11.3953204     0.0021509     -0.003512
3.9975333    -60.000000 CY
 0.0001988       12204.     61404575.    11.3156026     0.0022490     -0.003714
3.9993206    -60.000000 CY
 0.0002088       12372.     59265831.    11.2433090     0.0023470     -0.003915
3.9999106    -60.000000 CY
 0.0002188       12520.     57236380.    11.1716336     0.0024438     -0.004119
3.9999999    -60.000000 CY
 0.0002288       12645.     55278909.    11.1001647     0.0025392     -0.004323
3.9997008    -60.000000 CY
 0.0002388       12757.     53430944.    11.0328231     0.0026341     -0.004528
3.9999797    -60.000000 CY
 0.0002488       12864.     51715144.    10.9725974     0.0027294     -0.004733
3.9997462    -60.000000 CY
 0.0002588       12960.     50085286.    10.9129244     0.0028237     -0.004939
3.9987858    -60.000000 CY
 0.0002688       13042.     48526722.    10.8526357     0.0029166     -0.005146
3.9962101    -60.000000 CY
 0.0002788       13113.     47043409.    10.7927613     0.0030085     -0.005354
3.9999525    -60.000000 CY
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    0.0002888        13182.     45650447.    10.7375871     0.0031005     -0.005562
   3.9980658    -60.000000 CY
    0.0002988        13249.     44347214.    10.6890004     0.0031933     -0.005769
   3.9976468    60.0000000 CY
    0.0003088        13311.     43113831.    10.6431174     0.0032861     -0.005976
   3.9985514    60.0000000 CY
    0.0003188        13367.     41935372.    10.5974051     0.0033779     -0.006185
   3.9970326    60.0000000 CY
    0.0003288        13414.     40803862.    10.5544362     0.0034698     -0.006393
   3.9978420    60.0000000 CY
    0.0003388        13455.     39719254.    10.5138072     0.0035616     -0.006601
   3.9999974    60.0000000 CYT
    0.0003488        13487.     38673485.    10.4762916     0.0036536     -0.006809
   3.9954620    60.0000000 CYT
    0.0003588        13518.     37679898.    10.4413265     0.0037458     -0.007017
   3.9993734    60.0000000 CYT
    0.0003688        13543.     36727913.    10.4138183     0.0038401     -0.007222
   3.9943883    60.0000000 CYT


-------------------------------------------------------------------------------
   Summary of Results for Nominal Moment Capacity for Section 2
-------------------------------------------------------------------------------

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               244.770             13106.719           0.00300000
-0.00533479

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	244.770000	13107.	159.100500	8519.	77450860.
1	0.75	244.770000	13107.	183.577500	9830.	74468819.
1	0.90	244.770000	13107.	220.293000	11796.	65827013.

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	18.3200	0.00	N.A.	No	0.00	14762.
2	22.1000	3.7789	Yes	No	14762.	169403.
3	35.8000	17.4800	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 Displacement and Pile-head Rotation (Loading Type 5)
Displacement of pile head = 1.400000 inches
Rotation of pile head = 0.000E+00 radians

Axial load on pile head = 244770.0 lbs

Depth X	Deflect. y	Bending Moment	Shear Force	Slope S	Total Stress	Bending Stiffness	Soil Res. Es*H	Soil Spr. Lat. Load	Distrib. p
feet	inches	in-lbs	lbs	radians	psi*	lb-in^2	lb/inch	lb/inch	lb/inch
0.00	1.4000	-1.07E+07	69802.	0.00	0.00	1.08E+11	0.00	0.00	0.00
0.4080	1.3988	-1.04E+07	69801.	-4.80E-04	0.00	1.08E+11	0.00	0.00	0.00
0.8160	1.3953	-1.00E+07	69801.	-9.40E-04	0.00	1.10E+11	0.00	0.00	0.00
1.2240	1.3896	-9691650.	69801.	-0.00138	0.00	1.11E+11	0.00	0.00	0.00
1.6320	1.3818	-9348000.	69801.	-0.00179	0.00	1.12E+11	0.00	0.00	0.00
2.0400	1.3720	-9003862.	69801.	-0.00219	0.00	1.14E+11	0.00	0.00	0.00
2.4480	1.3604	-8659259.	69801.	-0.00257	0.00	1.15E+11	0.00	0.00	0.00
2.8560	1.3469	-8314216.	69801.	-0.00293	0.00	1.17E+11	0.00	0.00	0.00
3.2640	1.3317	-7968755.	69801.	-0.00327	0.00	1.19E+11	0.00	0.00	0.00
3.6720	1.3149	-7622900.	69801.	-0.00359	0.00	1.20E+11	0.00	0.00	0.00
4.0800	1.2966	-7276673.	69801.	-0.00389	0.00	1.23E+11	0.00	0.00	0.00
4.4880	1.2768	-6930098.	69801.	-0.00417	0.00	1.25E+11	0.00	0.00	0.00
4.8960	1.2558	-6583198.	69801.	-0.00443	0.00	1.27E+11	0.00	0.00	0.00
5.3040	1.2335	-6235994.	69801.	-0.00467	0.00	1.30E+11	0.00	0.00	0.00
5.7120	1.2100	-5888510.	69801.	-0.00490	0.00	1.34E+11	0.00	0.00	0.00
6.1200	1.1855	-5540767.	69801.	-0.00510	0.00	1.38E+11	0.00	0.00	0.00
6.5280	1.1600	-5192788.	69801.	-0.00529	0.00	1.42E+11	0.00	0.00	0.00
6.9360	1.1337	-4844595.	69801.	-0.00546	0.00	1.48E+11	0.00	0.00	0.00
7.3440	1.1065	-4496209.	69801.	-0.00561	0.00	1.54E+11	0.00	0.00	0.00
7.7520	1.0787	-4147652.	69801.	-0.00575	0.00	1.62E+11	0.00	0.00	0.00

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    8.1600     1.0502  -3798944.     69801.   -0.00586       0.00   1.72E+11
0.00       0.00       0.00
    8.5680     1.0213  -3450108.     69801.   -0.00596       0.00   1.86E+11
0.00       0.00       0.00
    8.9760     0.9918  -3101162.     69801.   -0.00605       0.00   2.03E+11
0.00       0.00       0.00
    9.3840     0.9620  -2752127.     69801.   -0.00610       0.00   3.69E+11
0.00       0.00       0.00
    9.7920     0.9321  -2403048.     69801.   -0.00614       0.00   3.70E+11
0.00       0.00       0.00
   10.2000     0.9019  -2053931.     69801.   -0.00617       0.00   3.71E+11
0.00       0.00       0.00
   10.6080     0.8717  -1704781.     69801.   -0.00619       0.00   3.71E+11
0.00       0.00       0.00
   11.0160     0.8413  -1355604.     69801.   -0.00621       0.00   3.71E+11
0.00       0.00       0.00
   11.4240     0.8109  -1006406.     69801.   -0.00623       0.00   3.71E+11
0.00       0.00       0.00
   11.8320     0.7803   -657192.     69801.   -0.00624       0.00   3.71E+11
0.00       0.00       0.00
   12.2400     0.7498   -307968.     69801.   -0.00624       0.00   3.71E+11
0.00       0.00       0.00
   12.6480     0.7192     41261.     69801.   -0.00625       0.00   3.71E+11
0.00       0.00       0.00
   13.0560     0.6886    390490.     69801.   -0.00624       0.00   3.71E+11
0.00       0.00       0.00
   13.4640     0.6581    739712.     69801.   -0.00624       0.00   3.71E+11
0.00       0.00       0.00
   13.8720     0.6276   1088923.     69801.   -0.00622       0.00   3.71E+11
0.00       0.00       0.00
   14.2800     0.5971   1438116.     69801.   -0.00621       0.00   3.71E+11
0.00       0.00       0.00
   14.6880     0.5668   1787287.     69801.   -0.00619       0.00   3.71E+11
0.00       0.00       0.00
   15.0960     0.5365   2136430.     69801.   -0.00616       0.00   3.70E+11
0.00       0.00       0.00
   15.5040     0.5065   2485538.     69801.   -0.00613       0.00   3.70E+11
0.00       0.00       0.00
   15.9120     0.4765   2834608.     69801.   -0.00609       0.00   3.69E+11
0.00       0.00       0.00
   16.3200     0.4468   3183632.     69801.   -0.00604       0.00   1.98E+11
0.00       0.00       0.00
   16.7280     0.4174   3532562.     69801.   -0.00595       0.00   1.82E+11
0.00       0.00       0.00
   17.1360     0.3885   3881378.     69801.   -0.00585       0.00   1.70E+11
0.00       0.00       0.00
   17.5440     0.3602   4230060.     69801.   -0.00573       0.00   1.60E+11
0.00       0.00       0.00
   17.9520     0.3325   4578587.     69801.   -0.00559       0.00   1.52E+11
0.00       0.00       0.00
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   18.3600     0.3055   4926937.     69298.   -0.00543       0.00   1.46E+11
-205.279      3290.       0.00
   18.7680     0.2793   5270170.     67536.   -0.00526       0.00   1.41E+11
-514.489      9019.       0.00
   19.1760     0.2540   5600850.     64320.   -0.00507       0.00   1.37E+11
-799.404     15409.       0.00
   19.5840     0.2297   5912128.     59611.   -0.00486       0.00   1.33E+11
-1124.     23960.       0.00
   19.9920     0.2064   6196201.     53419.   -0.00463       0.00   1.31E+11
-1405.     33332.       0.00
   20.4000     0.1843   6446306.     45948.   -0.00439       0.00   1.29E+11
-1646.     43723.       0.00
   20.8080     0.1634   6656658.     37395.   -0.00414       0.00   1.27E+11
-1848.     55356.       0.00
   21.2160     0.1438   6822411.     27949.   -0.00388       0.00   1.26E+11
-2011.     68488.       0.00
   21.6240     0.1254   6939638.     17795.   -0.00361       0.00   1.25E+11
-2137.     83422.       0.00
   22.0320     0.1084   7005312.      7115.   -0.00334       0.00   1.24E+11
-2226.    100515.       0.00
   22.4400    0.09274   7017308.     -2917.   -0.00306       0.00   1.24E+11
-1873.     98866.       0.00
   22.8480    0.07842   6984085.    -12102.   -0.00279       0.00   1.24E+11
-1879.    117316.       0.00
   23.2560    0.06546   6905487.    -21174.   -0.00251       0.00   1.25E+11
-1827.    136647.       0.00
   23.6640    0.05381   6782775.    -29936.   -0.00225       0.00   1.26E+11
-1753.    159460.       0.00
   24.0720    0.04346   6617736.    -38294.   -0.00199       0.00   1.27E+11
-1661.    187178.       0.00
   24.4800    0.03435   6412565.    -46165.   -0.00174       0.00   1.29E+11
-1554.    221481.       0.00
   24.8880    0.02644   6169852.    -53472.   -0.00150       0.00   1.31E+11
-1431.    264942.       0.00
   25.2960    0.01966   5892566.    -60137.   -0.00128       0.00   1.34E+11
-1292.    321756.       0.00
   25.7040    0.01393   5584056.    -66081.   -0.00107       0.00   1.37E+11
-1136.    399419.       0.00
   26.1120    0.00918   5248066.    -71218.  -8.79E-04       0.00   1.41E+11
-962.230    513228.       0.00
   26.5200    0.00532   4888794.    -75368.  -7.07E-04       0.00   1.47E+11
-732.725    674473.       0.00
   26.9280    0.00226   4511762.    -77960.  -5.54E-04       0.00   1.54E+11
-326.346    708032.       0.00
   27.3360  -1.02E-04   4126735.    -78721.  -4.20E-04       0.00   1.63E+11
15.4837    741591.       0.00
   27.7440   -0.00185   3741930.    -77965.  -3.05E-04       0.00   1.74E+11
293.4070    775150.       0.00
   28.1520   -0.00309   3364033.    -75997.  -2.09E-04       0.00   1.89E+11
510.3370    808710.       0.00
```

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   28.5600   -0.00390   2998264.    -73106.  -1.35E-04       0.00   2.39E+11
670.9647    842269.       0.00
   28.9680   -0.00441   2648506.    -69566.  -8.65E-05       0.00   3.69E+11
774.7924    860252.       0.00
   29.3760   -0.00475   2317278.    -65702.  -5.36E-05       0.00   3.70E+11
803.8989    829100.       0.00
   29.7840   -0.00493   2005283.    -61727.  -2.50E-05       0.00   3.71E+11
819.6184    813195.       0.00
   30.1920   -0.00499   1712903.    -57703.  -5.01E-07       0.00   3.71E+11
824.4025    808473.       0.00
   30.6000   -0.00494   1440258.    -53677.   2.03E-05       0.00   3.71E+11
820.0230    812789.       0.00
   31.0080   -0.00479   1187247.    -49692.   3.76E-05       0.00   3.71E+11
807.8207    825065.       0.00
   31.4160   -0.00457    953581.    -45784.   5.17E-05       0.00   3.71E+11
788.8445    844911.       0.00
   31.8240   -0.00429    738810.    -41982.   6.29E-05       0.00   3.71E+11
763.9346    872460.       0.00
   32.2320   -0.00396    542338.    -38316.   7.14E-05       0.00   3.71E+11
733.7735    908320.       0.00
   32.6400   -0.00359    363448.    -34809.   7.73E-05       0.00   3.71E+11
698.9167    953619.       0.00
   33.0480   -0.00320    201305.    -31483.   8.10E-05       0.00   3.71E+11
659.8116   1010137.       0.00
   33.4560   -0.00279     54975.    -28358.   8.27E-05       0.00   3.71E+11
616.8055   1080566.       0.00
   33.8640   -0.00239    -76570.    -25452.   8.26E-05       0.00   3.71E+11
570.1434   1169002.       0.00
   34.2720   -0.00199   -194447.    -22783.   8.08E-05       0.00   3.71E+11
519.9531   1281843.       0.00
   34.6800   -0.00160   -299858.    -20436.   7.75E-05       0.00   3.71E+11
438.8248   1345656.       0.00
   35.0880   -0.00123   -394745.    -18516.   7.30E-05       0.00   3.71E+11
345.5407   1379215.       0.00
   35.4960  -8.82E-04   -481342.    -17047.   6.72E-05       0.00   3.71E+11
254.5385   1412774.       0.00
   35.9040  -5.69E-04   -561831.     -7608.   5.69E-05       0.00   1.93E+11
3601.   3.10E+07       0.00
   36.3120  -3.25E-04   -555976.      7283.   4.28E-05       0.00   1.93E+11
2482.   3.74E+07       0.00
   36.7200  -1.50E-04   -490620.     16641.   2.95E-05       0.00   1.93E+11
1341.   4.38E+07       0.00
   37.1280  -3.59E-05   -393096.     20825.   1.83E-05       0.00   1.93E+11
367.6454   5.02E+07       0.00
   37.5360   2.95E-05   -286747.     20890.   9.73E-06       0.00   1.93E+11
-341.073   5.66E+07       0.00
   37.9440   5.94E-05   -188566.     18186.   3.71E-06       0.00   1.93E+11
-763.497   6.30E+07       0.00
   38.3520   6.58E-05   -108680.     14033.  -5.19E-08       0.00   1.93E+11
-932.806   6.94E+07       0.00
```

```
   38.7600   5.89E-05    -51151.      9521.  -2.07E-06       0.00   1.93E+11
-910.645   7.58E+07       0.00
   39.1680   4.55E-05    -15450.      5421.  -2.92E-06       0.00   1.93E+11
-763.876   8.21E+07       0.00
   39.5760   3.03E-05      1941.      2211.  -3.09E-06       0.00   1.93E+11
-547.681   8.85E+07       0.00
   39.9840   1.53E-05      6204.   144.4444  -2.99E-06       0.00   1.93E+11
-296.347   9.49E+07       0.00
   40.3920   1.05E-06      3363.   -634.259  -2.86E-06       0.00   1.93E+11
-21.751   1.01E+08       0.00
   40.8000  -1.28E-05       0.00       0.00  -2.82E-06       0.00   1.93E+11
280.8437   5.39E+07       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             =     1.40000000 inches
Computed slope at pile head      =       0.000000 radians
Maximum bending moment           =     -10719425. inch-lbs
Maximum shear force              =        -78721. lbs
Depth of maximum bending moment  =       0.000000 feet below pile head
Depth of maximum shear force     =    27.33600000 feet below pile head
Number of iterations             =             17
Number of zero deflection points =              3
Pile deflection at ground        =     0.30812115 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 Load                Load                  Axial    Pile-head  Pile-head  Max
Shear Max Moment
Case Type   Pile-head    Type     Pile-head   Loading  Deflection  Rotation    in
```

Pile No.	in Pile 1	Load 1	2	Load 2	lbs	inches	radians	lbs in-lbs
1	y, in	1.4000	S, rad	0.00	244770.	1.4000	0.00	-78721. -1.07E+07

Maximum pile-head deflection = 1.4000000000 inches
Maximum pile-head rotation = 0.0000000000 radians = 0.000000 deg.

Summary of Warning Messages

The following warning was reported 234 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.

==========

LPile for Windows, Version 2022-12.011

Analysis of Individual Piles and Drilled Shafts
Subjected to Lateral Loading Using the p-y Method
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Files Used for Analysis

Path to file locations:
\20240280\ODOT\109971\400-Engineering\Structures\SFN_0800512\Engdata\04_Abutment Design\Stage 2\Drilled Shaft\Lpile\Wingwalls\Forward Abutment Wingwalls\

Name of input data file:
FA WW_Scour Extreme II - Back DS.lp12d

Name of output report file:
FA WW_Scour Extreme II - Back DS.lp12o

Name of plot output file:
FA WW_Scour Extreme II - Back DS.lp12p

Name of runtime message file:
FA WW_Scour Extreme II - Back DS.lp12r

Date and Time of Analysis

Date: February 12, 2026 Time: 14:01:14

Problem Title

Project Name:

Job Number:

Client:

Engineer:

Description:

Program Options and Settings

Computational Options:
- Conventional Analysis

Engineering Units Used for Data Input and Computations:
- US Customary System Units (pounds, feet, inches)

Analysis Control Options:

- Maximum number of iterations allowed	=	500
- Deflection tolerance for convergence	=	1.0000E-05 in
- Maximum allowable deflection	=	100.0000 in
- Number of pile increments	=	100

Loading Type and Number of Cycles of Loading:

- Static loading specified

- Analysis uses p-y modification factors for p-y curves
- Analysis uses layering correction (Method of Georgiadis)
- No distributed lateral loads are entered
- Loading by lateral soil movements acting on pile not selected
- Input of shear resistance at the pile tip not selected
- Input of moment resistance at the pile tip not selected
- Computation of pile-head foundation stiffness matrix not selected
- Push-over analysis of pile not selected
- Buckling analysis of pile not selected

Output Options:
- Output files use decimal points to denote decimal symbols.
- Values of pile-head deflection, bending moment, shear force, and soil reaction are printed for full length of pile.
- Printing Increment (nodal spacing of output points) = 1
- No p-y curves to be computed and reported for user-specified depths
- Print using wide report formats

Pile Structural Properties and Geometry

Number of pile sections defined = 2
Total length of pile = 40.800 ft
Depth of ground surface below top of pile = 18.3200 ft

Pile diameters used for p-y curve computations are defined using 4 points.

p-y curves are computed using pile diameter values interpolated with depth over the length of the pile. A summary of values of pile diameter vs. depth follows.

Point No.	Depth Below Pile Head feet	Pile Diameter inches
1	0.000	36.0000
2	35.800	36.0000
3	35.800	30.0000
4	40.800	30.0000

Input Structural Properties for Pile Sections:

Pile Section No. 1:

```
   Section 1 is a round drilled shaft, bored pile, or CIDH pile
   Length of section                                  =    35.800000 ft
   Shaft Diameter                                     =    36.000000 in

Pile Section No. 2:

   Section 2 is a round drilled shaft, bored pile, or CIDH pile
   Length of section                                  =     5.000000 ft
   Shaft Diameter                                     =    30.000000 in



--------------------------------------------------------------------------------
                       Soil and Rock Layering Information
--------------------------------------------------------------------------------

The soil profile is modelled using 3 layers

Layer 1 is stiff clay with water-induced erosion

   Distance from top of pile to top of layer          =    18.320000 ft
   Distance from top of pile to bottom of layer       =    22.100000 ft
   Effective unit weight at top of layer              =    72.600000 pcf
   Effective unit weight at bottom of layer           =    72.600000 pcf
   Undrained cohesion at top of layer                 =        5600. psf
   Undrained cohesion at bottom of layer              =        5600. psf
   Epsilon-50 at top of layer                         =     0.004000
   Epsilon-50 at bottom of layer                      =     0.004000
   Subgrade k at top of layer                         =        2000. pci
   Subgrade k at bottom of layer                      =        2000. pci


Layer 2 is stiff clay with water-induced erosion

   Distance from top of pile to top of layer          =    22.100000 ft
   Distance from top of pile to bottom of layer       =    35.800000 ft
   Effective unit weight at top of layer              =    67.600000 pcf
   Effective unit weight at bottom of layer           =    67.600000 pcf
   Undrained cohesion at top of layer                 =        4600. psf
   Undrained cohesion at bottom of layer              =        4600. psf
   Epsilon-50 at top of layer                         =     0.004000
   Epsilon-50 at bottom of layer                      =     0.004000
   Subgrade k at top of layer                         =        2000. pci
   Subgrade k at bottom of layer                      =        2000. pci


Layer 3 is weak rock, p-y criteria by Reese, 1997

   Distance from top of pile to top of layer          =    35.800000 ft
```

Distance from top of pile to bottom of layer	=	100.000000 ft
Effective unit weight at top of layer	=	97.500000 pcf
Effective unit weight at bottom of layer	=	97.500000 pcf
Uniaxial compressive strength at top of layer	=	661.000000 psi
Uniaxial compressive strength at bottom of layer	=	661.000000 psi
Initial modulus of rock at top of layer	=	60000. psi
Initial modulus of rock at bottom of layer	=	60000. 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	=	0.0005000
k rm of rock at bottom of layer	=	0.0005000

(Depth of the lowest soil layer extends 59.200 ft below the pile tip)

Summary of Input Soil Properties

Layer Num.	Soil Type Name or (p-y Curve Type)	Layer Depth ft	Effective Unit Wt. pcf	Cohesion psf	Uniaxial qu psi	RQD %
	E50 krm	kpy pci	Rock Mass Modulus psi			
1	Stiff Clay	18.3200	72.6000	5600.	--	--
	0.00400	2000.	--			
	with Free Water	22.1000	72.6000	5600.	--	--
	0.00400	2000.	--			
2	Stiff Clay	22.1000	67.6000	4600.	--	--
	0.00400	2000.	--			
	with Free Water	35.8000	67.6000	4600.	--	--
	0.00400	2000.	--			
3	Weak	35.8000	97.5000	--	661.0000	9.0000
	5.00E-04	--	60000.			
	Rock	100.0000	97.5000	--	661.0000	9.0000
	5.00E-04	--	60000.			

Modification Factors for p-y Curves

Distribution of p-y modifiers with depth defined using 2 points

Point	Depth X	p-mult	y-mult

No.	ft		
1	18.320	0.5000	1.0000
2	35.800	0.5000	1.0000

Static Loading Type

Static loading criteria were used when computing p-y curves for all analyses.

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 1

Load No.	Load Type	Condition 1	Condition 2	Axial Thrust Force, lbs	Compute Top y vs. Pile Length	Run Analysis
1	5	y = 1.400000 in	S = 0.0000 in/in	198940.	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 = 2

Pile Section No. 1:

Dimensions and Properties of Drilled Shaft (Bored Pile):

Length of Section	=	35.800000 ft
Shaft Diameter	=	36.000000 in
Concrete Cover Thickness (to edge of trans. reinf.)	=	6.000000 in
Number of Reinforcing Bars	=	17 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	=	21.590000 sq. in.
Area Ratio of Steel Reinforcement	=	2.12 percent
Edge-to-Edge Bar Spacing	=	2.676940 in
Maximum Concrete Aggregate Size	=	0.375000 in
Ratio of Bar Spacing to Aggregate Size	=	7.14
Offset of Center of Rebar Cage from Center of Pile	=	0.0000 in

Transverse Reinforcement
Type: Hoop

Number of Transverse Reinf. (per spacing)	=	1
Spacing of Transverse Reinf.	=	4.500000 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	=	4682.772 kips
Tensile Load for Cracking of Concrete	=	-486.599 kips
Nominal Axial Tensile Capacity	=	-1295.400 kips

Reinforcing Bar Dimensions and Positions Used in Computations:

Bar Number	Bar Diam. inches	Bar Area sq. in.	X inches	Y inches
1	1.270000	1.270000	10.740000	0.00000
2	1.270000	1.270000	10.014752	3.879735
3	1.270000	1.270000	7.936956	7.235491
4	1.270000	1.270000	4.787230	9.614054
5	1.270000	1.270000	0.990962	10.694185
6	1.270000	1.270000	-2.93914	10.330007
7	1.270000	1.270000	-6.47230	8.570705
8	1.270000	1.270000	-9.13133	5.653881
9	1.270000	1.270000	-10.55713	1.973470
10	1.270000	1.270000	-10.55713	-1.97347
11	1.270000	1.270000	-9.13133	-5.65388

12	1.270000	1.270000	-6.47230	-8.57071
13	1.270000	1.270000	-2.93914	-10.33001
14	1.270000	1.270000	0.990962	-10.69419
15	1.270000	1.270000	4.787230	-9.61405
16	1.270000	1.270000	7.936956	-7.23549
17	1.270000	1.270000	10.014752	-3.87974

NOTE: The positions of the above rebars were computed by LPile

Minimum spacing between any two bars not equal to zero = 2.677 inches
between bars 6 and 7.

Ratio of bar spacing to maximum aggregate size = 7.14

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	=	0.375000 in

Number of Axial Thrust Force Values Determined from Pile-head Loadings = 1

Number	Axial Thrust Force kips
1	198.940

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 = 198.940 kips

Bending Max Conc Curvature Stress rad/in. ksi	Bending Max Steel Moment Stress in-kip ksi	Run Msg	Bending Stiffness kip-in2	Depth to N Axis in	Max Comp Strain in/in	Max Tens Strain in/in
6.25000E-07	233.1499638		373039942.	84.2542137	0.00005266	0.00003016
0.2197542	1.4063951					
0.00000125	466.3127026		373050162.	51.1451385	0.00006393	0.00001893
0.2656273	1.6125863					
0.00000188	699.4651561		373048083.	40.1167742	0.00007522	0.00000772
0.3112814	1.8192121					
0.00000250	932.6007554		373040302.	34.6085810	0.00008652	-0.00000348
0.3567153	2.0262721					
0.00000313	1166.		372983977.	31.3078813	0.00009784	-0.00001466
0.4019207	2.2337142					
0.00000375	1398.		372816026.	29.1097009	0.0001092	-0.00002584
0.4468781	2.4414049					
0.00000438	1630.		372541117.	27.5408092	0.0001205	-0.00003701
0.4915744	2.6492526					
0.00000500	1861.		372182044.	26.3648788	0.0001318	-0.00004818
0.5360024	2.8572074					
0.00000563	2091.		371758972.	25.4507404	0.0001432	-0.00005934
0.5801578	3.0652395					
0.00000625	2321.		371287173.	24.7197535	0.0001545	-0.00007050
0.6240378	3.2733303					
0.00000688	2549.		370777860.	24.1219068	0.0001658	-0.00008166
0.6676406	3.4814677					
0.00000750	2777.		370239225.	23.6238768	0.0001772	-0.00009282
0.7109651	3.6896432					
0.00000813	2777.		341759284.	21.0140020	0.0001707	-0.000122
0.6857159	3.3821617	C				
0.00000875	2777.		317347907.	20.4545629	0.0001790	-0.000136
0.7170140	3.5003764	C				
0.00000938	2777.		296191380.	19.9583555	0.0001871	-0.000150
0.7477548	3.6154904	C				
0.00001000	2777.		277679419.	19.5133614	0.0001951	-0.000165
0.7779403	3.7274759	C				
0.00001063	2777.		261345335.	19.1128111	0.0002031	-0.000179
0.8076665	3.8370228	C				
0.00001125	2777.		246826150.	18.7498477	0.0002109	-0.000194
0.8369614	3.9443127	C				
0.00001188	2777.		233835300.	18.4192887	0.0002187	-0.000209
0.8658628	4.0496051	C				

```
0.00001250         2777.    222143535.    18.1171040     0.0002265     -0.000224
0.8944127     4.1532002 C
0.00001313         2777.    211565271.    17.8396327     0.0002341     -0.000238
0.9226353     -4.377314 C
0.00001375         2777.    201948668.    17.5829805     0.0002418     -0.000253
0.9505012     -4.688112 C
0.00001438         2777.    193168291.    17.3461495     0.0002494     -0.000268
0.9781098     -4.999937 C
0.00001500         2806.    187054594.    17.1269173     0.0002569     -0.000283
1.0054753     -5.312691 C
0.00001563         2871.    183713535.    16.9215987     0.0002644     -0.000298
1.0325094     -5.627087 C
0.00001625         2935.    180616125.    16.7315898     0.0002719     -0.000313
1.0593923     -5.941713 C
0.00001688         2999.    177699576.    16.5520749     0.0002793     -0.000328
1.0859344     -6.258088 C
0.00001750         3062.    174987555.    16.3856161     0.0002867     -0.000343
1.1123708     -6.574346 C
0.00001813         3125.    172422545.    16.2274788     0.0002941     -0.000358
1.1384815     -6.892263 C
0.00001875         3188.    170023792.    16.0799768     0.0003015     -0.000374
1.1644800     -7.210129 C
0.00001938         3250.    167758780.    15.9404280     0.0003088     -0.000389
1.1902506     -7.528884 C
0.00002000         3312.    165619379.    15.8084591     0.0003162     -0.000404
1.2158260     -7.848276 C
0.00002063         3374.    163606555.    15.6846993     0.0003235     -0.000419
1.2412984     -8.167554 C
0.00002125         3436.    161689630.    15.5662785     0.0003308     -0.000434
1.2665057     -8.488056 C
0.00002188         3497.    159874431.    15.4541556     0.0003381     -0.000449
1.2915687     -8.808795 C
0.00002250         3559.    158157305.    15.3484784     0.0003453     -0.000465
1.3165298     -9.129422 C
0.00002313         3620.    156519933.    15.2474864     0.0003526     -0.000480
1.3412868     -9.450792 C
0.00002375         3680.    154956863.    15.1507613     0.0003598     -0.000495
1.3658487     -9.772838 C
0.00002438         3741.    153471448.    15.0590423     0.0003671     -0.000510
1.3903099    -10.094772 C
0.00002563         3862.    150701485.    14.8885158     0.0003815     -0.000541
1.4388176    -10.739259 C
0.00002688         3982.    148160140.    14.7315606     0.0003959     -0.000572
1.4866724    -11.385452 C
0.00002813         4102.    145836143.    14.5888807     0.0004103     -0.000602
1.5341274    -12.031197 C
0.00002938         4221.    143681872.    14.4562014     0.0004247     -0.000633
1.5808806    -12.679136 C
0.00003063         4339.    141694352.    14.3344368     0.0004390     -0.000664
1.6272155    -13.326816 C
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0.00003188 4458. 139855259. 14.2223392 0.0004533 -0.000694
1.6731527 -13.974044 C
0.00003313 4576. 138133270. 14.1172791 0.0004676 -0.000725
1.7184140 -14.623326 C
0.00003438 4693. 136529331. 14.0199055 0.0004819 -0.000756
1.7632734 -15.272219 C
0.00003563 4810. 135031336. 13.9298073 0.0004962 -0.000786
1.8077368 -15.920656 C
0.00003688 4927. 133626732. 13.8458774 0.0005106 -0.000817
1.8517606 -16.569028 C
0.00003813 5044. 132299823. 13.7661227 0.0005248 -0.000848
1.8951823 -17.218868 C
0.00003938 5160. 131051219. 13.6918383 0.0005391 -0.000878
1.9382092 -17.868245 C
0.00004063 5276. 129873667. 13.6225213 0.0005534 -0.000909
1.9808404 -18.517155 C
0.00004188 5392. 128760778. 13.5577291 0.0005677 -0.000940
2.0230744 -19.165596 C
0.00004313 5507. 127706583. 13.4969870 0.0005821 -0.000970
2.0648995 -19.813668 C
0.00004438 5622. 126700489. 13.4384968 0.0005963 -0.001001
2.1061259 -20.463246 C
0.00004563 5737. 125744375. 13.3835752 0.0006106 -0.001032
2.1469562 -21.112344 C
0.00004688 5852. 124834218. 13.3319371 0.0006249 -0.001063
2.1873890 -21.760960 C
0.00004813 5966. 123966411. 13.2833292 0.0006393 -0.001093
2.2274231 -22.409091 C
0.00004938 6080. 123137711. 13.2375233 0.0006536 -0.001124
2.2670570 -23.056734 C
0.00005063 6194. 122345198. 13.1943136 0.0006680 -0.001155
2.3062896 -23.703886 C
0.00005188 6307. 121586230. 13.1535144 0.0006823 -0.001185
2.3451194 -24.350545 C
0.00005313 6420. 120856206. 13.1142121 0.0006967 -0.001216
2.3834382 -24.997856 C
0.00005438 6533. 120154212. 13.0766537 0.0007110 -0.001246
2.4212994 -25.645263 C
0.00005563 6646. 119479433. 13.0410989 0.0007254 -0.001277
2.4587579 -26.292163 C
0.00005688 6758. 118830061. 13.0074169 0.0007398 -0.001308
2.4958126 -26.938552 C
0.00005813 6871. 118204432. 12.9754904 0.0007542 -0.001338
2.5324619 -27.584426 C
0.00005938 6983. 117601026. 12.9452077 0.0007686 -0.001369
2.5687046 -28.229783 C
0.00006063 7094. 117018446. 12.9164700 0.0007831 -0.001399
2.6045391 -28.874619 C
0.00006188 7206. 116455406. 12.8891856 0.0007975 -0.001430
2.6399640 -29.518930 C

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0.00006313        7317.    115910724.    12.8632699     0.0008120     -0.001461
2.6749779    -30.162714 C
0.00006438        7428.    115383310.    12.8386450     0.0008265     -0.001491
2.7095792    -30.805968 C
0.00006563        7538.    114872154.    12.8152388     0.0008410     -0.001521
2.7437666    -31.448687 C
0.00006688        7649.    114376324.    12.7929848     0.0008555     -0.001552
2.7775384    -32.090869 C
0.00006813        7759.    113894465.    12.7715722     0.0008701     -0.001582
2.8108540    -32.733002 C
0.00006938        7869.    113425581.    12.7508260     0.0008846     -0.001613
2.8436929    -33.375343 C
0.00007063        7978.    112969689.    12.7310871     0.0008991     -0.001643
2.8761151    -34.017128 C
0.00007188        8088.    112526098.    12.7123044     0.0009137     -0.001674
2.9081193    -34.658351 C
0.00007313        8197.    112094157.    12.6944307     0.0009283     -0.001704
2.9397037    -35.299008 C
0.00007438        8306.    111673258.    12.6774219     0.0009429     -0.001735
2.9708669    -35.939095 C
0.00007938        8738.    110089250.    12.6172552     0.0010015     -0.001856
3.0912742    -38.493668 C
0.00008438        9167.    108642420.    12.5680753     0.0010604     -0.001977
3.2048084    -41.038803 C
0.00008938        9591.    107308545.    12.5281443     0.0011197     -0.002098
3.3113586    -43.574229 C
0.00009438       10010.    106068479.    12.4960971     0.0011793     -0.002218
3.4108090    -46.099658 C
0.00009938       10425.    104906872.    12.4708491     0.0012393     -0.002338
3.5030388    -48.614786 C
 0.0001044       10835.    103811267.    12.4515284     0.0012996     -0.002458
3.5879217    -51.119290 C
 0.0001094       11241.    102771400.    12.4374301     0.0013603     -0.002577
3.6653248    -53.612836 C
 0.0001144       11641.    101778758.    12.4265939     0.0014213     -0.002696
3.7351095    -56.095062 C
 0.0001194       12036.    100826188.    12.4215261     0.0014828     -0.002815
3.7971297    -58.565584 C
 0.0001244       12424.     99893420.    12.4206400     0.0015448     -0.002933
3.8511750    -60.000000 CY
 0.0001294       12776.     98748731.    12.4118168     0.0016058     -0.003052
3.8962546    -60.000000 CY
 0.0001344       13067.     97241468.    12.3885633     0.0016647     -0.003173
3.9321075    -60.000000 CY
 0.0001394       13314.     95525610.    12.3564008     0.0017222     -0.003295
3.9597699    -60.000000 CY
 0.0001444       13530.     93714102.    12.3200606     0.0017787     -0.003419
3.9799489    -60.000000 CY
 0.0001494       13722.     91864961.    12.2815230     0.0018346     -0.003543
3.9930535    -60.000000 CY
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 0.0001544        13896.     90014172.    12.2424448     0.0018899     -0.003668
3.9993454    -60.000000 CY
 0.0001594        14054.     88181113.    12.2037581     0.0019450     -0.003793
3.9991585    -60.000000 CY
 0.0001644        14193.     86346962.    12.1642589     0.0019995     -0.003918
3.9986457    -60.000000 CY
 0.0001694        14321.     84554051.    12.1263224     0.0020539     -0.004044
3.9976431    -60.000000 CY
 0.0001744        14443.     82827319.    12.0909037     0.0021084     -0.004169
3.9992303    -60.000000 CY
 0.0001794        14552.     81125543.    12.0565335     0.0021626     -0.004295
3.9997733    -60.000000 CY
 0.0001844        14647.     79441629.    12.0198592     0.0022162     -0.004421
3.9986093    -60.000000 CY
 0.0001894        14733.     77797753.    11.9838133     0.0022694     -0.004548
3.9974286    -60.000000 CY
 0.0001944        14816.     76224096.    11.9511316     0.0023230     -0.004674
3.9996314    -60.000000 CY
 0.0001994        14895.     74710572.    11.9209269     0.0023767     -0.004801
3.9974261    -60.000000 CY
 0.0002044        14969.     73241698.    11.8917566     0.0024304     -0.004927
3.9999333    -60.000000 CY
 0.0002094        15035.     71808312.    11.8631163     0.0024838     -0.005054
3.9979104    -60.000000 CY
 0.0002144        15093.     70403253.    11.8330167     0.0025367     -0.005181
3.9999676    -60.000000 CY
 0.0002194        15145.     69038069.    11.8051799     0.0025898     -0.005308
3.9975519    -60.000000 CY
 0.0002244        15195.     67723258.    11.7772554     0.0026425     -0.005435
3.9998713    -60.000000 CY
 0.0002294        15244.     66459658.    11.7533914     0.0026959     -0.005562
3.9963420    -60.000000 CY
 0.0002344        15292.     65243828.    11.7323702     0.0027498     -0.005688
3.9994342    -60.000000 CY
 0.0002394        15338.     64073405.    11.7117036     0.0028035     -0.005814
3.9961184    -60.000000 CY
 0.0002444        15378.     62927200.    11.6900580     0.0028568     -0.005941
3.9980894    -60.000000 CY
 0.0002494        15416.     61820290.    11.6688580     0.0029099     -0.006068
3.9999137    -60.000000 CY
 0.0002544        15449.     60731863.    11.6466497     0.0029626     -0.006195
3.9947492    -60.000000 CY
 0.0002594        15480.     59681029.    11.6257500     0.0030154     -0.006322
3.9983742    -60.000000 CY
 0.0002644        15506.     58652866.    11.6040654     0.0030678     -0.006450
3.9999256    -60.000000 CY
 0.0002694        15532.     57659720.    11.5840163     0.0031204     -0.006577
3.9936781    -60.000000 CY
 0.0002744        15557.     56698852.    11.5649689     0.0031731     -0.006704
3.9975604    -60.000000 CY
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    0.0003044        15690.     51548191.    11.4726394     0.0034920     -0.007466
   3.9947089    -60.000000 CYT
    0.0003344        15775.     47176975.    11.3928530     0.0038095     -0.008228
   3.9955463    -60.000000 CYT


-------------------------------------------------------------------------------
   Summary of Results for Nominal Moment Capacity for Section 1
-------------------------------------------------------------------------------

Moment values interpolated at maximum compressive strain = 0.003
or maximum developed moment if pile fails at smaller strains.

 Load           Axial Thrust        Nominal Mom. Cap.      Max. Comp.      Max.
Tens.
  No.              kips                 in-kip               Strain
Strain
 ----         ----------------     ------------------     ------------
------------
   1               198.940             15470.681           0.00300000
-0.00628491

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         198.940000        15471.    129.311000        10056.
105940449.

   1       0.75         198.940000        15471.    149.205000        11603.
101872820.
```

1 0.90 198.940000 15471. 179.046000 13924. 89692944.

Pile Section No. 2:

Dimensions and Properties of Drilled Shaft (Bored Pile):

Length of Section	=	5.000000 ft
Shaft Diameter	=	30.000000 in
Concrete Cover Thickness (to edge of trans. reinf.)	=	3.000000 in
Number of Reinforcing Bars	=	17 bars
Yield Stress of Reinforcing Bars	=	60000. psi
Modulus of Elasticity of Reinforcing Bars	=	29000000. psi
Gross Area of Shaft	=	706.858347 sq. in.
Total Area of Reinforcing Steel	=	21.590000 sq. in.
Area Ratio of Steel Reinforcement	=	3.05 percent
Edge-to-Edge Bar Spacing	=	2.676940 in
Maximum Concrete Aggregate Size	=	0.375000 in
Ratio of Bar Spacing to Aggregate Size	=	7.14
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.	=	4.500000 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	=	3625.312 kips
Tensile Load for Cracking of Concrete	=	-357.244 kips
Nominal Axial Tensile Capacity	=	-1295.400 kips

Reinforcing Bar Dimensions and Positions Used in Computations:

Bar Number	Bar Diam. inches	Bar Area sq. in.	X inches	Y inches
1	1.270000	1.270000	10.740000	0.00000
2	1.270000	1.270000	10.014752	3.879735
3	1.270000	1.270000	7.936956	7.235491
4	1.270000	1.270000	4.787230	9.614054
5	1.270000	1.270000	0.990962	10.694185
6	1.270000	1.270000	-2.93914	10.330007
7	1.270000	1.270000	-6.47230	8.570705

8	1.270000	1.270000	-9.13133	5.653881
9	1.270000	1.270000	-10.55713	1.973470
10	1.270000	1.270000	-10.55713	-1.97347
11	1.270000	1.270000	-9.13133	-5.65388
12	1.270000	1.270000	-6.47230	-8.57071
13	1.270000	1.270000	-2.93914	-10.33001
14	1.270000	1.270000	0.990962	-10.69419
15	1.270000	1.270000	4.787230	-9.61405
16	1.270000	1.270000	7.936956	-7.23549
17	1.270000	1.270000	10.014752	-3.87974

NOTE: The positions of the above rebars were computed by LPile

Minimum spacing between any two bars not equal to zero = 2.677 inches
between bars 6 and 7.

Ratio of bar spacing to maximum aggregate size = 7.14

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	=	0.375000 in

Number of Axial Thrust Force Values Determined from Pile-head Loadings = 1

Number	Axial Thrust Force kips
1	198.940

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 = 198.940 kips

Bending Max Conc Curvature Stress rad/in. ksi	Bending Max Steel Moment Stress in-kip ksi	Run Msg	Bending Stiffness kip-in2	Depth to N Axis in	Max Comp Strain in/in	Max Tens Strain in/in
0.00000125	243.2249297		194579944.	60.6375070	0.00007580	0.00003830
0.3142455	2.0621721					
0.00000250	486.4618371		194584735.	37.8423884	0.00009461	0.00001961
0.3896673	2.4716982					
0.00000375	729.6731635		194579510.	30.2544928	0.0001135	9.54348E-07
0.4644661	2.8823636					
0.00000500	972.7415300		194548306.	26.4679607	0.0001323	-0.00001766
0.5386282	3.2941043					
0.00000625	1215.		194417634.	24.1999619	0.0001512	-0.00003625
0.6120998	3.7065554					
0.00000750	1456.		194187493.	22.6898903	0.0001702	-0.00005483
0.6848391	4.1194261					
0.00000875	1696.		193882833.	21.6123237	0.0001891	-0.00007339
0.7568246	4.5325664					
0.00001000	1935.		193524535.	20.8048108	0.0002080	-0.00009195
0.8280445	4.9458952					
0.00001125	1935.		172021809.	18.8734270	0.0002123	-0.000125
0.8434743	4.9340181	C				
0.00001250	1935.		154819628.	18.1654621	0.0002271	-0.000148
0.8980767	5.2256420	C				
0.00001375	1935.		140745116.	17.5673135	0.0002416	-0.000171
0.9512334	5.5096728	C				
0.00001500	1977.		131832522.	17.0543901	0.0002558	-0.000194
1.0031351	5.7874189	C				
0.00001625	2077.		127805962.	16.6105398	0.0002699	-0.000218
1.0540096	6.0605304	C				
0.00001750	2174.		124231996.	16.2213007	0.0002839	-0.000241
1.1038942	6.3291867	C				
0.00001875	2270.		121048698.	15.8776083	0.0002977	-0.000265
1.1529265	6.5943875	C				
0.00002000	2364.		118194377.	15.5715465	0.0003114	-0.000289
1.2011619	6.8564968	C				
0.00002125	2457.		115622255.	15.2972399	0.0003251	-0.000312
1.2486676	7.1159866	C				

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0.00002250         2549.    113294980.    15.0501637     0.0003386     -0.000336
1.2955118     7.3733569 C
0.00002375         2641.    111181746.    14.8267452     0.0003521     -0.000360
1.3417607     -7.867767 C
0.00002500         2731.    109246613.    14.6227529     0.0003656     -0.000384
1.3873610     -8.429754 C
0.00002625         2821.    107473996.    14.4364740     0.0003790     -0.000409
1.4324137     -8.993047 C
0.00002750         2911.    105847574.    14.2662787     0.0003923     -0.000433
1.4769959     -9.557018 C
0.00002875         3000.    104338225.    14.1084447     0.0004056     -0.000457
1.5209537    -10.123021 C
0.00003000         3088.    102947654.    13.9638610     0.0004189     -0.000481
1.5645349    -10.688939 C
0.00003125         3177.    101648333.    13.8287232     0.0004321     -0.000505
1.6075122    -11.256779 C
0.00003250         3264.    100442827.    13.7040818     0.0004454     -0.000530
1.6501178    -11.824522 C
0.00003375         3352.     99315139.    13.5877291     0.0004586     -0.000554
1.6922379    -12.393189 C
0.00003500         3439.     98257995.    13.4789601     0.0004718     -0.000578
1.7338961    -12.962593 C
0.00003625         3526.     97269775.    13.3780256     0.0004850     -0.000603
1.7752131    -13.531647 C
0.00003750         3613.     96336720.    13.2827605     0.0004981     -0.000627
1.8160232    -14.101873 C
0.00003875         3699.     95457447.    13.1933568     0.0005112     -0.000651
1.8564260    -14.672374 C
0.00004000         3785.     94629549.    13.1098631     0.0005244     -0.000676
1.8964891    -15.242523 C
0.00004125         3871.     93846643.    13.0313669     0.0005375     -0.000700
1.9361618    -15.812790 C
0.00004250         3957.     93101197.    12.9565291     0.0005507     -0.000724
1.9753376    -16.384203 C
0.00004375         4042.     92395100.    12.8861972     0.0005638     -0.000749
2.0141746    -16.955260 C
0.00004500         4128.     91725059.    12.8200873     0.0005769     -0.000773
2.0526721    -17.525960 C
0.00004625         4213.     91088137.    12.7578181     0.0005900     -0.000797
2.0908289    -18.096300 C
0.00004750         4298.     90477518.    12.6980257     0.0006032     -0.000822
2.1284879    -18.667845 C
0.00004875         4382.     89894684.    12.6413263     0.0006163     -0.000846
2.1657842    -19.239262 C
0.00005125         4551.     88805958.    12.5368583     0.0006425     -0.000895
2.2393568    -20.381005 C
0.00005375         4720.     87807325.    12.4430452     0.0006688     -0.000944
2.3115395    -21.521527 C
0.00005625         4887.     86881518.    12.3566159     0.0006951     -0.000992
2.3820687    -22.663583 C
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0.00005875 5054. 86024722. 12.2782247 0.0007213 -0.001041
2.4512299 -23.804137 C
0.00006125 5220. 85228402. 12.2072146 0.0007477 -0.001090
2.5190154 -24.943175 C
0.00006375 5386. 84484926. 12.1425127 0.0007741 -0.001138
2.5853887 -26.081011 C
0.00006625 5551. 83785533. 12.0822495 0.0008004 -0.001187
2.6501602 -27.219790 C
0.00006875 5715. 83128475. 12.0270555 0.0008269 -0.001236
2.7135444 -28.356996 C
0.00007125 5879. 82509219. 11.9765047 0.0008533 -0.001284
2.7755332 -29.492610 C
0.00007375 6042. 81923849. 11.9298560 0.0008798 -0.001333
2.8361183 -30.626616 C
0.00007625 6204. 81368956. 11.8872433 0.0009064 -0.001381
2.8952911 -31.758998 C
0.00007875 6366. 80841492. 11.8480345 0.0009330 -0.001429
2.9530358 -32.889835 C
0.00008125 6527. 80337394. 11.8113322 0.0009597 -0.001478
3.0091987 -34.021111 C
0.00008375 6688. 79856075. 11.7772523 0.0009863 -0.001526
3.0639336 -35.150686 C
0.00008625 6848. 79395483. 11.7458355 0.0010131 -0.001574
3.1172315 -36.278541 C
0.00008875 7007. 78953798. 11.7168642 0.0010399 -0.001623
3.1690832 -37.404658 C
0.00009125 7166. 78529397. 11.6901450 0.0010667 -0.001671
3.2194793 -38.529017 C
0.00009375 7324. 78120830. 11.6655051 0.0010936 -0.001719
3.2684101 -39.651596 C
0.00009625 7481. 77726798. 11.6424137 0.0011206 -0.001767
3.3158661 -40.772375 C
0.00009875 7638. 77346126. 11.6214814 0.0011476 -0.001815
3.3618372 -41.891334 C
0.0001013 7794. 76977759. 11.6022119 0.0011747 -0.001863
3.4063133 -43.008451 C
0.0001038 7949. 76620741. 11.5844924 0.0012019 -0.001911
3.4492843 -44.123703 C
0.0001063 8104. 76274206. 11.5682210 0.0012291 -0.001958
3.4907397 -45.237068 C
0.0001088 8258. 75937364. 11.5533052 0.0012564 -0.002006
3.5306689 -46.348523 C
0.0001113 8412. 75609279. 11.5395274 0.0012838 -0.002054
3.5690196 -47.458907 C
0.0001138 8564. 75289478. 11.5269100 0.0013112 -0.002101
3.6058135 -48.567600 C
0.0001163 8716. 74977440. 11.5153266 0.0013387 -0.002149
3.6410548 -49.674267 C
0.0001188 8867. 74672606. 11.5047708 0.0013662 -0.002196
3.6747317 -50.778883 C

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 0.0001213        9018.     74374466.    11.4952418     0.0013938     -0.002244
3.7068323    -51.881418 C
 0.0001238        9168.     74082545.    11.4866850     0.0014215     -0.002291
3.7373446    -52.981847 C
 0.0001263        9317.     73796409.    11.4790505     0.0014492     -0.002338
3.7662562    -54.080139 C
 0.0001288        9465.     73515652.    11.4722925     0.0014771     -0.002385
3.7935544    -55.176265 C
 0.0001313        9613.     73239899.    11.4663687     0.0015050     -0.002433
3.8192263    -56.270196 C
 0.0001338        9760.     72968803.    11.4612405     0.0015329     -0.002480
3.8432589    -57.361901 C
 0.0001363        9906.     72702039.    11.4568719     0.0015610     -0.002527
3.8656385    -58.451348 C
 0.0001388       10051.     72439304.    11.4532300     0.0015891     -0.002573
3.8863516    -59.538504 C
 0.0001413       10194.     72169901.    11.4497364     0.0016173     -0.002620
3.9053335    -60.000000 CY
 0.0001438       10332.     71875798.    11.4453873     0.0016453     -0.002667
3.9224993    -60.000000 CY
 0.0001463       10463.     71540683.    11.4392197     0.0016730     -0.002715
3.9377972    -60.000000 CY
 0.0001488       10584.     71154580.    11.4304568     0.0017003     -0.002762
3.9512283    -60.000000 CY
 0.0001588       10981.     69172118.    11.3726633     0.0018054     -0.002957
3.9876921    -60.000000 CY
 0.0001688       11297.     66943243.    11.3007109     0.0019070     -0.003156
3.9999781    -60.000000 CY
 0.0001788       11555.     64641747.    11.2234864     0.0020062     -0.003356
3.9997837    -60.000000 CY
 0.0001888       11776.     62391805.    11.1485125     0.0021043     -0.003558
3.9984825    -60.000000 CY
 0.0001988       11959.     60173436.    11.0718355     0.0022005     -0.003762
3.9997896    -60.000000 CY
 0.0002088       12127.     58092208.    11.0019747     0.0022967     -0.003966
3.9989512    -60.000000 CY
 0.0002188       12269.     56085330.    10.9326642     0.0023915     -0.004171
3.9968939    -60.000000 CY
 0.0002288       12389.     54157840.    10.8623632     0.0024848     -0.004378
3.9967891    -60.000000 CY
 0.0002388       12502.     52363641.    10.7989788     0.0025783     -0.004584
3.9963795    -60.000000 CY
 0.0002488       12607.     50682818.    10.7406152     0.0026717     -0.004791
3.9994060    -60.000000 CY
 0.0002588       12697.     49070550.    10.6822166     0.0027640     -0.004998
3.9997492    -60.000000 CY
 0.0002688       12774.     47531106.    10.6234262     0.0028550     -0.005207
3.9982868    -60.000000 CY
 0.0002788       12845.     46079290.    10.5665008     0.0029454     -0.005417
3.9956644    -60.000000 CY
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    0.0002888        12914.     44722962.    10.5148554     0.0030362     -0.005626
   3.9995706    -60.000000 CY
    0.0002988        12980.     43448550.    10.4670710     0.0031270     -0.005835
   3.9961136    -60.000000 CY
    0.0003088        13041.     42239618.    10.4201811     0.0032172     -0.006045
   3.9998416    -60.000000 CY
    0.0003188        13095.     41082580.    10.3764287     0.0033075     -0.006255
   3.9958207    60.0000000 CY
    0.0003288        13142.     39976642.    10.3315691     0.0033965     -0.006466
   3.9996171    60.0000000 CYT
    0.0003388        13181.     38909902.    10.2883630     0.0034852     -0.006677
   3.9931777    60.0000000 CYT
    0.0003488        13217.     37898809.    10.2478180     0.0035739     -0.006889
   3.9983206    60.0000000 CYT
    0.0003588        13250.     36933343.    10.2132135     0.0036640     -0.007099
   3.9993908    60.0000000 CYT
    0.0003688        13281.     36015328.    10.1827863     0.0037549     -0.007308
   3.9949071    60.0000000 CYT
    0.0003788        13310.     35140705.    10.1559355     0.0038466     -0.007516
   3.9991097    60.0000000 CYT


-------------------------------------------------------------------------------
   Summary of Results for Nominal Moment Capacity for Section 2
-------------------------------------------------------------------------------

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              198.940             12886.198           0.00300000
-0.00554295

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
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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	198.940000	12886.	129.311000	8376.	75685240.
1	0.75	198.940000	12886.	149.205000	9665.	73144060.
1	0.90	198.940000	12886.	179.046000	11598.	64206799.

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	18.3200	0.00	N.A.	No	0.00	14762.
2	22.1000	3.7789	Yes	No	14762.	169403.
3	35.8000	17.4800	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 Displacement and Pile-head Rotation (Loading Type 5)

Displacement of pile head = 1.400000 inches
Rotation of pile head = 0.000E+00 radians
Axial load on pile head = 198940.0 lbs

Depth X	Deflect. y	Bending Moment	Shear Force	Slope S	Total Stress	Bending Stiffness	Soil Res. Es*H	Soil Spr. Lat. Load	Distrib. p
feet	inches	in-lbs	lbs	radians	psi*	lb-in^2	lb/inch	lb/inch	lb/inch
0.00	1.4000	-9874748.	62544.	0.00	0.00	1.06E+11	0.00	0.00	0.00
0.4080	1.3989	-9568318.	62543.	-4.47E-04	0.00	1.06E+11	0.00	0.00	0.00
0.8160	1.3956	-9261460.	62543.	-8.76E-04	0.00	1.08E+11	0.00	0.00	0.00
1.2240	1.3903	-8954194.	62543.	-0.00129	0.00	1.09E+11	0.00	0.00	0.00
1.6320	1.3830	-8646537.	62543.	-0.00168	0.00	1.10E+11	0.00	0.00	0.00
2.0400	1.3739	-8338507.	62543.	-0.00205	0.00	1.12E+11	0.00	0.00	0.00
2.4480	1.3629	-8030121.	62543.	-0.00241	0.00	1.13E+11	0.00	0.00	0.00
2.8560	1.3503	-7721394.	62543.	-0.00275	0.00	1.14E+11	0.00	0.00	0.00
3.2640	1.3360	-7412345.	62543.	-0.00307	0.00	1.15E+11	0.00	0.00	0.00
3.6720	1.3202	-7102990.	62543.	-0.00338	0.00	1.17E+11	0.00	0.00	0.00
4.0800	1.3029	-6793346.	62543.	-0.00367	0.00	1.19E+11	0.00	0.00	0.00
4.4880	1.2843	-6483428.	62543.	-0.00394	0.00	1.20E+11	0.00	0.00	0.00
4.8960	1.2643	-6173253.	62543.	-0.00420	0.00	1.22E+11	0.00	0.00	0.00
5.3040	1.2432	-5862838.	62543.	-0.00443	0.00	1.25E+11	0.00	0.00	0.00
5.7120	1.2209	-5552200.	62543.	-0.00466	0.00	1.27E+11	0.00	0.00	0.00
6.1200	1.1976	-5241353.	62543.	-0.00486	0.00	1.30E+11	0.00	0.00	0.00
6.5280	1.1733	-4930314.	62543.	-0.00505	0.00	1.34E+11	0.00	0.00	0.00
6.9360	1.1481	-4619099.	62543.	-0.00522	0.00	1.38E+11	0.00	0.00	0.00
7.3440	1.1222	-4307724.	62543.	-0.00538	0.00	1.42E+11	0.00	0.00	0.00

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    7.7520     1.0955  -3996205.     62543.   -0.00552       0.00   1.48E+11
0.00       0.00       0.00
    8.1600     1.0681  -3684556.     62543.   -0.00564       0.00   1.55E+11
0.00       0.00       0.00
    8.5680     1.0402  -3372794.     62543.   -0.00575       0.00   1.64E+11
0.00       0.00       0.00
    8.9760     1.0118  -3060934.     62543.   -0.00585       0.00   1.75E+11
0.00       0.00       0.00
    9.3840     0.9830  -2748991.     62543.   -0.00591       0.00   3.70E+11
0.00       0.00       0.00
    9.7920     0.9540  -2437012.     62543.   -0.00594       0.00   3.71E+11
0.00       0.00       0.00
   10.2000     0.9248  -2125002.     62543.   -0.00597       0.00   3.72E+11
0.00       0.00       0.00
   10.6080     0.8955  -1812964.     62543.   -0.00600       0.00   3.72E+11
0.00       0.00       0.00
   11.0160     0.8661  -1500904.     62543.   -0.00602       0.00   3.73E+11
0.00       0.00       0.00
   11.4240     0.8366  -1188824.     62543.   -0.00604       0.00   3.73E+11
0.00       0.00       0.00
   11.8320     0.8070   -876729.     62543.   -0.00605       0.00   3.73E+11
0.00       0.00       0.00
   12.2400     0.7774   -564622.     62543.   -0.00606       0.00   3.73E+11
0.00       0.00       0.00
   12.6480     0.7477   -252509.     62543.   -0.00606       0.00   3.73E+11
0.00       0.00       0.00
   13.0560     0.7180     59608.     62543.   -0.00607       0.00   3.73E+11
0.00       0.00       0.00
   13.4640     0.6883    371724.     62543.   -0.00606       0.00   3.73E+11
0.00       0.00       0.00
   13.8720     0.6586    683835.     62543.   -0.00606       0.00   3.73E+11
0.00       0.00       0.00
   14.2800     0.6290    995938.     62543.   -0.00604       0.00   3.73E+11
0.00       0.00       0.00
   14.6880     0.5994   1308027.     62543.   -0.00603       0.00   3.73E+11
0.00       0.00       0.00
   15.0960     0.5699   1620100.     62543.   -0.00601       0.00   3.73E+11
0.00       0.00       0.00
   15.5040     0.5406   1932153.     62543.   -0.00599       0.00   3.72E+11
0.00       0.00       0.00
   15.9120     0.5113   2244180.     62543.   -0.00596       0.00   3.71E+11
0.00       0.00       0.00
   16.3200     0.4822   2556179.     62543.   -0.00593       0.00   3.71E+11
0.00       0.00       0.00
   16.7280     0.4533   2868145.     62543.   -0.00587       0.00   1.84E+11
0.00       0.00       0.00
   17.1360     0.4247   3180036.     62543.   -0.00579       0.00   1.70E+11
0.00       0.00       0.00
   17.5440     0.3966   3491838.     62543.   -0.00569       0.00   1.60E+11
0.00       0.00       0.00
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   17.9520     0.3690   3803537.     62543.   -0.00557       0.00   1.52E+11
0.00       0.00       0.00
   18.3600     0.3420   4115116.     62141.   -0.00544       0.00   1.46E+11
-164.161      2350.       0.00
   18.7680     0.3157   4422625.     60905.   -0.00530       0.00   1.40E+11
-340.629      5283.       0.00
   19.1760     0.2901   4721819.     58790.   -0.00514       0.00   1.36E+11
-523.225      8830.       0.00
   19.5840     0.2654   5008305.     55667.   -0.00496       0.00   1.33E+11
-752.831     13888.       0.00
   19.9920     0.2416   5276565.     51430.   -0.00477       0.00   1.30E+11
-977.753     19817.       0.00
   20.4000     0.2187   5521194.     46161.   -0.00456       0.00   1.28E+11
-1175.     26299.       0.00
   20.8080     0.1969   5737456.     39992.   -0.00434       0.00   1.26E+11
-1345.     33450.       0.00
   21.2160     0.1762   5921254.     33051.   -0.00412       0.00   1.24E+11
-1490.     41405.       0.00
   21.6240     0.1566   6069111.     25465.   -0.00388       0.00   1.23E+11
-1609.     50314.       0.00
   22.0320     0.1382   6178158.     17354.   -0.00363       0.00   1.22E+11
-1704.     60358.       0.00
   22.4400     0.1210   6246126.      9612.   -0.00339       0.00   1.22E+11
-1459.     59035.       0.00
   22.8480     0.1050   6278874.      2379.   -0.00313       0.00   1.22E+11
-1496.     69712.       0.00
   23.2560    0.09032   6275524.     -4981.   -0.00288       0.00   1.22E+11
-1511.     81892.       0.00
   23.6640    0.07683   6235715.    -12341.   -0.00263       0.00   1.22E+11
-1496.     95320.       0.00
   24.0720    0.06456   6159808.    -19543.   -0.00238       0.00   1.23E+11
-1446.    109688.       0.00
   24.4800    0.05350   6048991.    -26475.   -0.00214       0.00   1.23E+11
-1385.    126764.       0.00
   24.8880    0.04361   5904735.    -33079.   -0.00190       0.00   1.24E+11
-1312.    147341.       0.00
   25.2960    0.03486   5728792.    -39300.   -0.00168       0.00   1.26E+11
-1229.    172560.       0.00
   25.7040    0.02721   5523176.    -45085.   -0.00146       0.00   1.28E+11
-1134.    204130.       0.00
   26.1120    0.02059   5290163.    -50381.   -0.00125       0.00   1.30E+11
-1029.    244768.       0.00
   26.5200    0.01495   5032284.    -55136.   -0.00106       0.00   1.32E+11
-913.137    299137.       0.00
   26.9280    0.01021   4752336.    -59293.  -8.81E-04       0.00   1.36E+11
-784.824    376188.       0.00
   27.3360    0.00632   4453407.    -62783.  -7.17E-04       0.00   1.40E+11
-641.003    496391.       0.00
   27.7440    0.00319   4138961.    -65236.  -5.69E-04       0.00   1.45E+11
-361.122    553679.       0.00
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   28.1520   7.48E-04   3815723.    -66336.  -4.38E-04       0.00   1.52E+11
-88.230    577650.       0.00
   28.5600   -0.00109   3490250.    -66223.  -3.23E-04       0.00   1.60E+11
134.5305    601620.       0.00
   28.9680   -0.00241   3167898.    -65138.  -2.24E-04       0.00   1.71E+11
308.5513    625591.       0.00
   29.3760   -0.00329   2852853.    -63314.  -1.41E-04       0.00   1.85E+11
436.5021    649562.       0.00
   29.7840   -0.00379   2548198.    -60989.  -8.63E-05       0.00   3.71E+11
513.3958    662353.       0.00
   30.1920   -0.00414   2255817.    -58420.  -5.46E-05       0.00   3.71E+11
535.9076    634529.       0.00
   30.6000   -0.00433   1976253.    -55766.  -2.67E-05       0.00   3.72E+11
548.3674    620111.       0.00
   31.0080   -0.00440   1709809.    -53071.  -2.48E-06       0.00   3.72E+11
552.6038    615357.       0.00
   31.4160   -0.00435   1456589.    -50372.   1.83E-05       0.00   3.73E+11
549.9012    618381.       0.00
   31.8240   -0.00422   1216532.    -47701.   3.59E-05       0.00   3.73E+11
541.2076    628314.       0.00
   32.2320   -0.00400    989433.    -45085.   5.04E-05       0.00   3.73E+11
527.2469    644951.       0.00
   32.6400   -0.00372    774959.    -42550.   6.19E-05       0.00   3.73E+11
508.5832    668618.       0.00
   33.0480   -0.00340    572667.    -40116.   7.08E-05       0.00   3.73E+11
485.6603    700177.       0.00
   33.4560   -0.00303    382009.    -37804.   7.70E-05       0.00   3.73E+11
458.8237    741130.       0.00
   33.8640   -0.00264    202345.    -35632.   8.09E-05       0.00   3.73E+11
428.3312    793890.       0.00
   34.2720   -0.00224     32945.    -33618.   8.24E-05       0.00   3.73E+11
394.3514    862296.       0.00
   34.6800   -0.00183   -127002.    -31779.   8.18E-05       0.00   3.73E+11
356.9473    952655.       0.00
   35.0880   -0.00144   -278391.    -30197.   7.91E-05       0.00   3.73E+11
289.3529    985154.       0.00
   35.4960   -0.00106   -422841.    -28954.   7.45E-05       0.00   3.73E+11
218.3683   1009124.       0.00
   35.9040  -7.08E-04   -562050.    -17442.   6.47E-05       0.00   1.95E+11
4484.   3.10E+07       0.00
   36.3120  -4.26E-04   -593758.      1500.   5.02E-05       0.00   1.95E+11
3253.   3.74E+07       0.00
   36.7200  -2.17E-04   -547464.     14214.   3.58E-05       0.00   1.95E+11
1940.   4.38E+07       0.00
   37.1280  -7.54E-05   -454648.     20854.   2.32E-05       0.00   1.95E+11
772.5272   5.02E+07       0.00
   37.5360   1.02E-05   -343303.     22458.   1.32E-05       0.00   1.95E+11
-117.621   5.66E+07       0.00
   37.9440   5.34E-05   -234768.     20487.   5.88E-06       0.00   1.95E+11
-687.253   6.30E+07       0.00
```

```
   38.3520   6.78E-05   -142702.     16455.   1.13E-06       0.00   1.95E+11
-960.126   6.94E+07       0.00
   38.7600   6.45E-05    -73648.     11660.  -1.59E-06       0.00   1.95E+11
-998.439   7.58E+07       0.00
   39.1680   5.22E-05    -28525.      7071.  -2.87E-06       0.00   1.95E+11
-876.064   8.21E+07       0.00
   39.5760   3.64E-05     -4401.      3316.  -3.29E-06       0.00   1.95E+11
-657.985   8.85E+07       0.00
   39.9840   2.00E-05      3950.   755.1120  -3.29E-06       0.00   1.95E+11
-388.059   9.49E+07       0.00
   40.3920   4.13E-06      2999.   -404.045  -3.21E-06       0.00   1.95E+11
-85.453   1.01E+08       0.00
   40.8000  -1.14E-05       0.00       0.00  -3.17E-06       0.00   1.95E+11
250.5041   5.39E+07       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             =     1.40000000 inches
Computed slope at pile head      =       0.000000 radians
Maximum bending moment           =      -9874748. inch-lbs
Maximum shear force              =        -66336. lbs
Depth of maximum bending moment  =       0.000000 feet below pile head
Depth of maximum shear force     =    28.15200000 feet below pile head
Number of iterations             =             61
Number of zero deflection points =              3
Pile deflection at ground        =     0.34464832 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 Load                Load                  Axial    Pile-head  Pile-head  Max
```

Shear Max Moment
Case Type Pile-head Type Pile-head Loading Deflection Rotation in Pile in Pile
No. 1 Load 1 2 Load 2 lbs inches radians lbs in-lbs
---- ----- ---------- ---------- ---------- ---------- ---------- ---------- ---------- ----------
1 y, in 1.4000 S, rad 0.00 198940. 1.4000 0.00 -66336. -9874748.

Maximum pile-head deflection = 1.4000000000 inches
Maximum pile-head rotation = 0.0000000000 radians = 0.000000 deg.

Summary of Warning Messages

The following warning was reported 806 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.