



Project Number: 01051704

September 14, 2021

(Revised May 15, 2023)

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Re: Geotechnical Exploration Report
SHE-SPRUC-022709 Bridge Replacement
ODOT PID: 114201
Sidney, Shelby County, Ohio

Dear Mr. Springer:

Thank you for choosing Professional Service Industries, Inc. (PSI), an Intertek Company, as your consultant for the Proposed SHE-SPRUC-022709 Bridge Replacement project in Sidney, Shelby County, Ohio. Per your authorization, PSI has completed a geotechnical exploration for the referenced project. The results of the study are discussed in the accompanying report.

If you have any questions pertaining to this report, please contact our office at (937) 898-1200. PSI would be pleased to continue providing geotechnical services throughout the implementation of the project, and we look forward to working with you and your organization on this and future projects.

This report with appendix was revised by Mr. Raymond France Branch Manager for PSI and Mr. John Xu, P.E., Senior Project Manager, for PSI, on May 15, 2023.

Respectfully submitted,
PROFESSIONAL SERVICE INDUSTRIES, INC.

A handwritten signature in blue ink that reads "R. Andrew Schlarman II".

R. Andrew Schlarman II, P.E.
Branch Manager

A handwritten signature in blue ink that reads "Alagaiya Veeramani".

Alagaiya Veeramani, P.E.
Chief Engineer/Principal Consultant

Raymond France
Branch Manager

John Xu, P.E.
Senior Project Manager

cc: Client – Electronic Copy
Enclosures



Geotechnical Exploration Report

**SHE-SPRUC-022709 Bridge Replacement
ODOT PID: 114201
Sidney, Shelby County, Ohio**

Prepared for

**LJB, Inc.
2500 Newmark Drive
Miamisburg, Ohio 45342**

Prepared by

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Dayton, Ohio 45414**

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PSI Project No. 01051704

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1 EXECUTIVE SUMMARY

The SHE-SPRUC-022709 Bridge Replacement project involves construction of a new, 3-span bridge structure along Spruce Avenue over the CSX Railroad between Lincoln Street and Greenacre Street in Sidney, Shelby County, Ohio. A geotechnical field exploration was performed between May 17, 2021 through May 21, 2021. Four (4) SPT soil test borings were performed within the project area, a laboratory testing program was conducted, and an engineering analysis and evaluation of the subsurface materials were completed. The test borings for this exploration were selected and located by PSI.

According to our exploration findings, the following brief summary of the exploration findings and geotechnical considerations for this project are presented below.

SHE-SPRUC-022709 Bridge Replacement

- The existing bridge spans over a CSX railroad, between Lincoln Street and Greenacre Street in Sidney, Shelby County, Ohio. According to the information provided to PSI, the existing bridge was built in 1924 and consists of 5-span arched reinforced concrete I-beam superstructure on reinforced concrete column-type piers and reinforced concrete abutments. The existing bridge length is 125 feet. The new bridge will consist of a prestressed concrete, composite, adjacent box beam superstructure on reinforced concrete wall-type abutments and piers. The vertical profile on the bridge will be raised 1.25 feet to increase vertical clearance over the CSX railroad to the required 23 feet.
- Soil test boring B-001-0-21 was advanced near the rear (southern) abutment. The soil test boring was terminated at a depth of 75 feet below the existing surface grade. Free groundwater was observed at a depth of 11.5 feet below existing surface grades in the soil test boring during drilling.
- Soil test boring B-002-0-21 was advanced near pier #1 (southern pier). The soil test boring was terminated at a depth of 55 feet (elevation of 964.9 feet, MSL). Free groundwater was observed at a depth of 13 feet (elevation of 1006.9 feet, MSL) below existing surface grades in the soil test boring during drilling.
- Soil test boring B-003-0-21 was advanced near pier #2 (northern pier). The soil test boring was terminated at a depth of 55 feet (elevation of 960.8 feet, MSL). Free groundwater was observed at a depth of 17.8 feet (elevation of 1003.0 feet, MSL) below existing surface grades in the soil test boring during drilling.
- Soil test boring B-004-0-21 was advanced near the forward (northern) abutment. The soil test boring was terminated at a depth of 70 feet below the existing surface grade. Free groundwater was observed at a depth of 13.5 feet below existing surface grades in the soil test boring during drilling.
- Cast-In-Place Reinforced Concrete (CIPRC) piles can be considered for the proposed bridge abutments and piers. Please refer to the *“Proposed Bridge Foundation Recommendations”* section of this report for additional information.

The soil test boring logs, site location plan, soil test boring location plan, water well log, Known and Probable Karst Map of Ohio and laboratory testing data sheets are included in the Appendix of the report.

The summary should be used in conjunction with the entire exploration report since this summary sheet cannot include all details of the exploration findings.

2 PROJECT INFORMATION

2.1 PROJECT AUTHORIZATION

The following table summarizes, in chronological order, the Project Authorization History for the services performed and represented in this report by Professional Service Industries, Inc. (PSI).

DOCUMENT AND REFERENCE	DATE	REQUESTED/PROVIDED BY
Request for Proposal	1/7/2021	Mr. Dan Springer, P.E., PMP, of LJB, Inc.
PSI Quotation Number 0105-331454	1/27/2021	Mr. R Andrew Schlarman II, P.E. and Mr. Alagaiya Veeramani, P.E. of PSI
Revised PSI Quotation Number 0105-331454R1	2/3/2021	Mr. R Andrew Schlarman II, P.E. and Mr. Alagaiya Veeramani, P.E. of PSI
Master Subcontractor Agreement	9/21/2010	Mr. Mark Salveter of PSI and Mr. Stephen D. Williams, VP Finance & Administration of LJB, Inc.
Signed Subcontractor Statement of Work No. 0115012A.02	2/18/2021	Signed by Mr. R. Andrew Schlarman II, P.E. of PSI and Mr. Thomas J. Laubie, Chief Administration Officer, of LJB, Inc. on 2/18/2021.

2.2 PROJECT DESCRIPTION

The following table lists the material and information provided for this project:

DESCRIPTION OF MATERIAL	PROVIDER/SOURCE	DATE
A drawing from LJB, Inc. titled, “ <i>Complete Bridge Replacement: Alternative 1 Construction Limits – Adjacent Box Beam Bridge (Sheet 1 of 1).</i> ”	Mr. Dan Springer, P.E., PMP LJB, Inc.	1/7/2021
A document from LJB, Inc. titled, “ <i>Spruce Avenue Bridge Feasibility Study (75 Pages)</i> ” dated August 14, 2020 and updated study dated July 27, 2022.	Mr. Dan Springer, P.E., PMP LJB, Inc.	1/7/2021
A Word document titled, “ <i>LPA Scope of Services Form</i> ” with January 5th, 2021 scope meeting notes and project information.	Mr. Dan Springer, P.E., PMP LJB, Inc.	1/7/2021
A drawing from LJB, Inc. titled, “ <i>Site Plan (Sheet P.0).</i> ”	Mr. Joseph Mellman, P.E. LJB, Inc.	9/1/2021

The project includes the construction of a new three-span, steel rolled beam on semi-integral abutments and T-Type piers. The spans for the new bridge will be 26’3”, 97’6”, and 26’3”. There will be no skew for the bridge and there will be a 20-foot and 30-foot approach slab. The factored load for the abutments is 195 kips per pile. The factored load for the piers is 230 kips per pile.

The geotechnical recommendations presented in this report are based on the available project information for the proposed SHE-SPRUC-022709 Bridge Replacement Project in Sidney, Shelby County, Ohio and the subsurface materials described in this report. If any of the information noted above is incorrect, please inform PSI in writing so that we may amend the recommendations presented in this report if appropriate and if desired by the client. PSI will not be responsible for the implementation of its recommendations when it is not notified of changes in the project.

2.3 PURPOSE AND SCOPE OF SERVICES

The purpose of this study was to explore the subsurface conditions at the site to prepare recommendations for the proposed bridge structure. PSI's contracted scope of services included drilling four (4) Type E1 borings per ODOT SGE requirements, select laboratory testing, and preparation of this geotechnical report. This report briefly outlines general site geology setting, subgrade conditions, type of foundation system, recommendation for soil improvement (if required), and soil parameters for lateral earth pressure calculations.

The scope of services did not include an environmental assessment for determining the presence or absence of wetlands, or hazardous or toxic materials in the soil, bedrock, surface water, groundwater, or air on, below, or around this site. Any statements in this report or on the boring logs regarding odors, colors, and unusual or suspicious items or conditions are strictly for informational purposes.

PSI's scope also did not provide any service to investigate or detect the presence of moisture, mold or other biological contaminants in or around any structure, or any service that was designed or intended to prevent or lower the risk of the occurrence or the amplification of the same. The Client should be aware that mold is ubiquitous to the environment with mold amplification occurring when building materials are impacted by moisture. The Client should also be aware that site conditions are outside of PSI's control, and that mold amplification will likely occur, or continue to occur, in the presence of moisture. As such, PSI cannot and shall not be held responsible for the occurrence or reoccurrence of mold amplification.

2.4 SITE RECONNAISSANCE AND PLANNING

The site for the proposed bridge replacement project is located along Spruce Avenue over the CSX Railroad between Lincoln Street and Greenacre Street in Sidney, Shelby County, Ohio. The site latitude and longitude for the proposed bridge are approximately 40.2739° N and 84.1641° W, respectively. PSI conducted reconnaissance of the site prior to drilling to stake the borings and verify public utility clearance.

2.5 SITE GEOLOGY AND KARST

Based on the on-line geologic map provided by the Ohio Geological Survey (available at <http://www.dnr.state.oh.us/OhioGeologicalSurvey/SurficialGeology/tabid/23586/Default.aspx>), the proposed site area is located in the Central Lowland Province, Till Plains Section, near the Central Ohio Clayey Till Plan and Southern Ohio Loamy Till Plains Regions, with predominately ground and ridge moraine topography with outwash underlain by Silurian and Ordovician age bedrock (as part of the Wisconsin Glaciation Period).



Additionally, this project site is located within an area close to an active Karst region. This means that the region is prone to solution activity within the soluble carbonate bedrock. Sinkhole development at this site may result from raveling or movement of soil fines from the soil overburden by infiltrating water flowing downward to poor-quality bedrock media where the rock mass has partially dissolved in the geologic past creating solution channels, clay-filled joints, and voids. Thus, a sinkhole may consist of a relatively localized weathered feature or a larger feature resulting from a collapse within a void formed in the overburden during migration of the soil fines. Solution activity could also be present along bedrock fracture zones or along geologic contacts. The Ohio Department of Natural Resources Department of Geologic Survey provides a “Known and Probably Karst Map of Ohio”. Areas of known sinkhole activity are also plotted in red on the map. There is an existing sink hole noted

within the region within approximately ten to fifteen (10-15) miles of the project area. The Karst map was developed by state agencies to assist in identifying subsurface features in carbonate bedrock areas and existing sinkholes that exhibit some surface expression. However, sinkholes may still occur in areas where there is no discernible surface expression.

2.6 PLANNING

PSI personnel marked the boring locations in the field, contacted Ohio Utility Protection Services (OUPS), and coordinated drilling services with the client, CSX representatives and the City of Sidney. During our field activities, a flagman with CSX was with PSI during drilling of the pier borings. Additionally, the City of Sidney temporarily closed the road and provided road closure signs for the abutment borings.

As discussed in section 2.3, four (4) SPT soil test borings were advanced for the new bridge structure. The approximate drilled test boring locations are shown on the Boring Location Plan in the attached *Appendix*. Elevations are based on information provided by LJB, Inc. and are included on the boring logs in the *Appendix*.

2.7 EXPLORATORY TEST BORINGS

The field exploration was performed in accordance with applicable ASTM Specifications and basic ODOT SGE (Current Edition) type E1 borings. A CME 45C ATV-mounted drilling rig was mobilized to advance the soil test borings between May 17, 2021 and May 21, 2021. Representative disturbed samples of soil were collected at center-to-center intervals of 2.5 feet and 5.0 feet and a Standard Penetration Test (ASTM D-1586) was performed at each sampling interval.

PSI monitored the water levels in the borehole for the presence of groundwater during the drilling operations. Long term groundwater monitoring was not planned for this project. The drilling logs, included in the *Appendix* of this report, indicate the SPT resistance (N_{60}) values for each soil sample obtained in the soil test borings, and present the classification and description of soil encountered at various depths.

A geotechnical engineer visually examined the soil samples obtained during the field investigation. The engineer selected representative soil samples to be tested in the laboratory for assistance in soil classification and determination of engineering properties of the soils. The tests consisted of Moisture Content Determination,

Particle-Size Analysis, Liquid Limit, Plastic Limit and Plasticity Index Determinations. All tests were performed in accordance with ASTM, AASHTO or other applicable standards. The soils were classified in accordance with the ODOT Soil Classification System (OSCS).

2.8 SUBSURFACE CONDITIONS

SURFACE MATERIALS: At test borings B-001-0-21 and B-004-0-21, asphalt underlain by aggregate base material was encountered. The asphalt thickness was approximately 4 to 8 inches and the aggregate base thickness ranged from 7 to 10 inches. At test borings B-002-0-21 and B-003-0-21, railroad ballast/base material was encountered. The railroad ballast/base thickness was approximately 12 inches at both borings.

FILL MATERIALS: Underlying the surface materials at the borings, fill material was encountered. The fill material extended to depths ranging from 2.5 to 6.6 feet below the existing grade. The fill material consisted of variable material including, Silty Clay (A-6b), Sandy Silt (A-4a), Coarse and Fine Sand (A-3a), and Gravel (A-1-a). Some of the fill materials contained cinders, brick fragments, asphalt fragments and broken tile. The fill material exhibited moisture contents ranging from 11 to 54 percent.

NATURAL SOILS: Underlying the surface materials and fill materials at the soil test boring locations, natural soils were encountered.

B-001-0-21: The test boring was advanced behind the rear (southern) abutment, approximately 5 feet east of the centerline of the roadway. Overburden soils consisted of alternating layers of cohesive and non-cohesive soils. Based on the results of laboratory tests and visual classification, the soils consisted of Silt and Clay (A-6a), Sandy Silt (A-4a), Coarse and Fine Sand (A-3a), Gravel with Sand (A-1-b), and Gravel with Sand, Silt and Clay (A-2-6). The Standard Penetration Test values (“N₆₀”-values) for the natural soils ranged from 6 blows per foot to 50 blows per 2 inches of penetration (split-spoon refusal). Groundwater was observed at a depth of approximately 11.5 feet below existing grades during drilling operations.

B-002-0-21: The test boring was advanced in the railroad base/ballast on the west side of the existing bridge, near Pier #1 (southern pier). Overburden soils consisted of alternating layers of cohesive and non-cohesive soils. Based on the results of laboratory tests and visual classification, the soils consisted of Silt and Clay (A-6a), Sandy Silt (A-4a), Coarse and Fine Sand (A-3a), Gravel (A-1-a), Gravel with Sand, Silt and Clay (A-2-6), and Silty Clay (A-6b). The Standard Penetration Test values (“N₆₀”-values) for the natural soils ranged from 4 blows per foot to 50 blows per 5 inches of penetration (split-spoon refusal). Groundwater was observed at a depth of approximately 13 feet below existing grades during drilling operations.

B-003-0-21: The test boring was advanced in the railroad base/ballast on the east side of the existing bridge, near Pier #2 (northern pier). Overburden soils consisted of alternating layers of cohesive and non-cohesive soils. Based on the results of laboratory tests and visual classification, the soils consisted of Sandy Silt (A-4a), Silt and Clay (A-6a), and Gravel (A-1-a). The Standard Penetration Test values (“N₆₀”-values) for the natural soils ranged from 9 blows per foot to 50 blows per 4 inches of penetration (split-spoon refusal). Groundwater was observed at a depth of approximately 17.8 feet below existing grades during drilling operations.

B-004-0-21: The test boring was advanced behind the forward (northern) abutment, approximately 5 feet west of the centerline of the roadway. Overburden soils consisted of alternating layers of cohesive and non-cohesive soils. Based on the results of laboratory tests and visual classification, the soils consisted of Silty Clay (A-6b), Sandy Silt (A-4a), Silt and Clay (A-6a), Silt (A-4b), and Gravel (A-1-a). The Standard Penetration Test values (“N₆₀”-values) for the natural soils ranged from 4 blows per foot to 50 blows per 6 inches of penetration (split-spoon refusal). Groundwater was observed at a depth of approximately 13.5 feet below existing grades during drilling operations.

The above subsurface descriptions are of a generalized nature to highlight the major subsurface stratification features and material characteristics. The boring logs included in the Appendix should be reviewed for specific information at individual boring locations. These records include soil descriptions, stratifications, penetration resistances, and locations of the samples and laboratory test data. The stratifications shown on the boring logs represent the conditions only at the actual boring locations. Variations may occur and should be expected between boring locations. The stratifications represent the approximate boundary between subsurface materials and the actual transition may be gradual. Water level information obtained during field operations is also shown on these boring logs. The samples that were not altered by laboratory testing will be retained for 60 days from the date of this report and then will be discarded.

2.9 WATER LEVEL MEASUREMENTS

Free groundwater was observed during drilling operations in the soil test borings at depths ranging from 11.5 to 17.8 feet below the existing ground surface.

The groundwater level at the site, as well as perched water levels and volumes, will fluctuate based on variations in rainfall, snowmelt, evaporation, surface run-off and other related hydrogeologic factors. The water level measurements presented in this report are the levels that were measured at the time of PSI’s field activities.

In relatively pervious soils, such as sandy soils, the indicated depths are usually reliable groundwater levels. In relatively impervious soils, a suitable estimate of the groundwater depth may not be possible, even after several days of observation. Seasonal variations, temperature, land-use, proximity to a river, canal, or large body of water and recent rainfall conditions may influence the depths to the groundwater. Volumes of water will largely depend on the permeability of the soils.

2.10 LABORATORY TEST RESULTS

Laboratory testing was performed on representative split-spoon samples obtained during drilling. The laboratory tests included natural moisture content, percent fines, and Atterberg Limits. The laboratory test results are summarized in the following table:

Table 2: Summary of Laboratory Index Test Results

Sample Location	Sample Depth (ft)	Moisture Content (%)	Percent Passing 200 (%)	Atterberg Limits			ODOT Soil Classification
				LL	PL	PI	
B-001-0-21	18.5 to 20.0	10	23	-	-	-	A-1-b
B-001-0-21	21.0 to 22.5	12	61	26	14	12	A-6a
B-001-0-21	28.5 to 30.0	13	60	23	14	9	A-4a
B-001-0-21	38.5 to 40.0	10	32	-	-	-	A-2-6
B-001-0-21	48.5 to 50.0	13	49	27	15	12	A-6a
B-001-0-21	68.5 to 70.0	10	54	20	12	8	A-4a
B-002-0-21	8.5 to 10.0	14	70	20	15	5	A-4a
B-002-0-21	16.0 to 17.5	13	6	-	-	-	A-1-a
B-002-0-21	23.5 to 25.0	16	77	33	17	16	A-6b
B-002-0-21	28.5 to 30.0	11	58	24	15	9	A-4a
B-002-0-21	43.5 to 45.0	10	58	21	13	8	A-4a
B-002-0-21	53.5 to 55.0	11	52	20	13	7	A-4a
B-003-0-21	6.0 to 7.5	13	69	21	13	8	A-4a
B-003-0-21	11.0 to 12.5	14	73	21	15	6	A-4a
B-003-0-21	18.5 to 20.0	9	5	-	-	-	A-1-a
B-003-0-21	26.0 to 27.5	17	79	31	17	14	A-6a
B-003-0-21	38.5 to 40.0	10	55	21	12	9	A-4a
B-003-0-21	48.5 to 50.0	11	43	19	11	8	A-4a
B-003-0-21	58.5 to 60.0	10	53	19	12	7	A-4a
B-004-0-21	18.5 to 20.0	20	87	22	18	4	A-4b
B-004-0-21	26.0 to 27.5	12	65	20	14	6	A-4a
B-004-0-21	38.5 to 40.0	9	6	-	-	-	A-1-a
B-004-0-21	53.5 to 55.0	11	56	21	14	7	A-4a
B-004-0-21	63.5 to 65.0	16	50	23	13	10	A-4a

3 GEOTECHNICAL RECOMMENDATIONS

3.1 DESIGN CONSIDERATIONS FOR PROPOSED BRIDGE FOUNDATIONS

Pile Foundations. Cast-In-Place Reinforced Concrete (CIPRC) piles can be considered for this project. According to our investigation, thirty (30) feet of hard soils were encountered at soil test boring B-001-0-21 at a depth of approximately 75 feet, at soil test boring B-002-0-21 at a depth of 55 feet, at soil test boring B-003-0-21 at a depth of 60 feet, and at soil test boring B-004-0-21 at a depth of 70 feet below the existing surface grades.

3.2 PROPOSED BRIDGE FOUNDATIONS

Pile Foundations: CIPRC piles can be used for this project. CIPRC piles should be driven to refusal (defined in the ODOT BDM 202.2.3.2) hard soils to develop friction and end-bearing resistance for axial compression load. Assumed pile size and soil parameters determined during the exploration were used to estimate the capacity. We have estimated the pile capacity in the following tables for CIPRC piles for this project. Pile bearing capacities listed in the table are for axial compression only. The table was prepared for pile length estimation purposes only.

Following table is the estimated pile termination depth for this project. Minimum wall thickness for CIPRC pile should be designed in accordance with Item 507 of the ODOT CMS. According to our estimation, high stress may occur on pile during pile driving, therefore wall thickness may be selected according to the maximum UBV.

Pile bearing capacities listed in the table are for axial compression only. PSI assumes these piles will be driven to refusal in very hard soils. The table was prepared for pile length estimation purposes only. Pile bearing capacity calculation data sheets are included in the appendix of this report.

Table 2: Estimated Single Driven Pile Bearing Capacity (14")

Pile Type & Size	Structure Location (Station)	Bottom of Footing Elevation ¹ (ft.)	Estimated Pile Tip Elevation (ft)	Strength Limit State Resistance ² (Axial Compression) Factor, _{DYN}	Ultimate Bearing Resistance ³ , UBV Vertical (kips/pile)	Ultimate Bearing Resistance ³ , UBV Batter (kips/pile)
14" CIPRC Pile	Rear Abutment B-001-0-21	1028.83	1004.0	0.70	252	261
			994.0	0.70	369	370
			984.0	0.70	467	473
14" CIPRC Pile	Pier #1 B-002-0-21	1015.08	994.0	0.70	136	128
			980.0	0.70	299	282
			970.0	0.70	429	400
14" CIPRC Pile	Pier #2 B-003-0-21	1014.99	990.0	0.70	155	147
			980.0	0.70	225	218
			970.0	0.70	334	321
14" CIPRC Pile	Forward Abutment B-004-0-21	1028.74	998.0	0.70	161	160
			988.0	0.70	252	251
			979.0	0.70	341	331

Table 3: Estimated Single Driven Pile Bearing Capacity (16")

Pile Type & Size	Structure Location (Station)	Bottom of Footing Elevation ¹ (ft.)	Estimated Pile Tip Elevation (ft)	Strength Limit State Resistance ² (Axial Compression) Factor, _{DYN}	Ultimate Bearing Resistance ³ , UBV Vertical (kips/pile)	Ultimate Bearing Resistance ³ , UBV Batter (kips/pile)
16" CIPRC Pile	Rear Abutment B-001-0-21	1028.83	1004.0	0.70	299	309
			994.0	0.70	445	446
			984.0	0.70	579	584
16" CIPRC Pile	Pier #1 B-002-0-21	1015.18	994.0	0.70	166	175
			980.0	0.70	378	400
			970.0	0.70	531	539
16" CIPRC Pile	Pier #2 B-003-0-21	1014.99	990.0	0.70	185	194
			980.0	0.70	274	282
			970.0	0.70	412	418
16" CIPRC Pile	Forward Abutment B-004-0-21	1028.74	998.0	0.70	197	196
			988.0	0.70	318	317
			979.0	0.70	424	422

1) Elevations based on the Site Plan Drawing provided by LJB, Inc.

2) For piles installed according to CMS 507 and CMS 523

3) The UBV values listed in the above table are for pile length estimation purpose. The Max. UBV of 390 for 14" diameter piles and 450 kips/pile for 16" diameter piles should not be exceeded for each (CIPRC) pile according to C305.3.4 of the 2020 ODOT BDM.

Minimum pile spacing must be controlled in accordance with the ODOT specifications to reduce the potential for pile rebound and a reduction in the capacity due to group effects. The project design engineer and the project owner should make final decisions to select a proper foundation system according to the ODOT design specifications, economic and feasibility analysis. Loading capacity of group piles may not be a mathematical summation of loading capacity of each individual pile. When friction piles are installed as a group, the pile group can result in larger amounts of settlement than an individual pile and increase or decrease loading capacity than that of summation of each individual pile if highly compressible soils were below the pile tips.

When piles are driven into cohesive or non-cohesive soils, ultimate loading capacity of the pile group may be calculated using the summation of the loading capacity of each individual piles times a Pile Group Efficiency Factor, “ η ”. When pile spacing is selected to be greater than 3 times the pile diameter, Pile Group Efficiency Factor, “ η ”, equal to 1.0 may be a good estimation for pile groups installed in non-cohesive soils. The “ η ” value should be checked by the project design engineer since it varies with other factors also. Loading capacity and possible settlement of piles groups must be calculated using final design data by the structure engineer for the project. Pile group settlement can be estimated according to AASHTO LRFD Bridge Specifications – C10.7.2.3.1 when piles are not tipped into dense soils and subject to down-drag.

The actual bearing capacity of the piles will depend on their type, size, length and subsurface conditions encountered and must be designed by the project design engineer. Our pile estimation is to provide pile loading capacity information to the project design engineer. All other pile installation details (including pile type and size, shell thickness, drivability, taper section length, etc.) should be completed by the project structure design engineer. The potential construction contractor must use information presented in the project design plans provided or prepared by the client for the project construction

The final pile length must be determined in the field based on the pile driving results. The project design engineer should verify the pile estimation and verify the pile loading capacity in the field by dynamic loading test (According to Item 523 of ODOT’s CMS) during pile driving or other estimation methods.

Article C10.6.3.2.1 of the 2007 AASHTO LRFD recommends that “the designer should verify overall adequate stability at each service limit state and size the footing based on eccentricity requirements at the strength limit state before checking nominal bearing resistance at both the service and strength limit states.”

A resistance factor of 1.0 (according to Reference Manual LRFD for Highway Bridge Structures, (FHWA Contract No. DTFH61-94-00098) may be used to assess foundation settlement, horizontal movement, overall stability under anticipated poor conditions to ensure the design satisfy the structure’s Service Limit State.

Since there is the possibility of constructing below the ground water table at certain times of the year, PSI recommends that dewatering of the site prior to excavating be considered. Dewatering should be accomplished to lower the groundwater level at least 2 feet below the deepest excavation.

Based on the known subsurface conditions and site geology, laboratory testing and past experience, PSI anticipates that properly designed and constructed piles as outlined in this report should experience negligible total settlement.

3.3 BRIDGE ABUTMENTS

The bridge abutments will be expected to retain backfill materials to some height. In addition to the lateral earth pressures, the abutments will be expected to resist the reaction of the superstructure of the bridge and the increase in earth pressures due to surface loads on the backfill adjacent to the abutments. Consideration should be given to the following factors regarding the design of the abutments:

The following typical values for Equivalent fluid unit Weight of Soil (listed in AASHTO LRFD Bridge Design Specifications, 2012) can be used in the lateral earth pressure design. These soil parameters can be used for leveled fill or backfill with typical (25 degree) slope.

Table 3.11.5.5-1—Typical Values for Equivalent Fluid Unit Weights of Soils

Type of Soil	Level Backfill		Backfill with $\beta = 25$ degrees	
	At-Rest γ_{eq} (kcf)	Active $\Delta/H = 1/240$ γ_{eq} (kcf)	At-Rest γ_{eq} (kcf)	Active $\Delta/H = 1/240$ γ_{eq} (kcf)
Loose sand or gravel	0.055	0.040	0.065	0.050
Medium dense sand or gravel	0.050	0.035	0.060	0.045
Dense sand or gravel	0.045	0.030	0.055	0.040

The abutments should include an adequate drainage system in the form of weep holes and/or perforated drainpipes to preclude the possibility of any water buildup against the back face of these members. A well-graded granular material is to be employed as backfill around tile members or weep holes to avoid any clogging and to ensure positive drainage. A non-woven geotextile wrap for the pipe or a portion of the granular fill can also be utilized. It is further recommended that free draining materials or proprietary wall drain panels be placed against the entire face of the walls along their full length. The drainage blanket should have a minimum thickness of 18 inches and is to terminate approximately 24 inches below the finish subgrade elevation for the approach slabs or surface grades. A cohesive fill cap is recommended for the top 24 inches to prevent direct surface water infiltration.

During high water periods, the backfill behind the abutments may become saturated by water. This will result in additional lateral pressures on the retaining structures during the period of receding water and until the drainage of the granular backfill is accomplished. Therefore, in addition to the previously discussed lateral earth pressures, the unbalanced water pressure should also be considered in the retaining wall design.

The appropriate safety factors should be considered in the stability analysis assuming that the earth pressures, water pressures, and highway surcharge loads could occur coincidently.

Once the abutments are in place, over-compaction of the materials against these structures should be avoided under all circumstances, to prevent undue lateral earth pressures. Further, it is recommended that backfilling of cut excavations at the bridge abutments be undertaken only subsequent to installation of structural members of the new superstructure.

The following typical values for Equivalent Height of Soil for Vehicular Loading on Retaining Walls Parallel to the Traffic (listed in AASHTO LRFD Bridge Design Specifications, 2012) can be used in the lateral earth pressure design for the project head/wing walls.

Table 3.11.6.4-1—Equivalent Height of Soil for Vehicular Loading on Abutments Perpendicular to Traffic

Abutment Height (ft)	h_{eq} (ft)
5.0	4.0
10.0	3.0
≥ 20.0	2.0

3.4 CHANNEL SCOUR PROTECTION

Scour sampling was not required for this project.

3.5 SLOPES

The benched placement of engineered structural fill on natural slopes steeper than five (5) horizontal to one (1) vertical where the final area will be uncontained is recommended. The placement of fill should begin at the base of the natural slope with benches or terraces. The benches or terraces should be a minimum of eight (8) feet wide laterally and should be cut into the slope every five (5) feet of vertical rise. The naturally occurring existing soils should be prepared and fill placed in accordance with the previously described structural fill guidelines. A representative of the geotechnical engineer should monitor the benching and fill placement operations.

Unless specifically designed, temporary slopes shall not exceed steeper than a ratio of two (2) horizontal to one (1) vertical where workers or equipment will occupy space at the toe or of the movement of the excavated slope will jeopardize the stability of an adjacent structure. Temporary slopes exceeding ten (10) feet in vertical height should have a slope stability analysis. Temporary slopes exceeding twenty (20) feet in vertical height should have shear strength testing performed to assess the in-situ strength characteristics.

Permanent cut slopes shall not be excavated to a final grade steeper than a ratio of three (3) horizontal to one (1) vertical without a specific slope stability analysis. Specific shear strength testing should be performed to assess the in-situ strength characteristics for permanent slopes steeper than four (4) horizontal to one (1) vertical.

Special consideration must also be given to the stability of the natural cut ground when supporting substantial fills, to structural fills themselves, and to cut surfaces in natural soil and rock excavations. The evaluation of slope stability aspects of this site and the proposed development is beyond the scope of this exploration.

3.6 SILTATION CONTROL

The Clean Water Act implemented in 1990 includes a federal permit program called the National Pollutant Discharge Elimination System (NPDES). This program requires that projects sites in excess of one (1) acre or are part of a development which exceeds one (1) acre be covered under a permit. This typically includes the development of a storm water pollution prevention plan (SWPPP) as well as period inspections (typically once a week plus after significant rainfall). PSI is available to assist with these services.

4 CONSTRUCTION CONSIDERATIONS

PSI should be retained to provide observation and testing of construction activities involved in the foundation, earthwork, and related activities of this project. PSI cannot accept responsibility for conditions that deviate from those described in this report, nor for the performance of the foundation system if not engaged to also provide construction observation and testing for this project.

4.1 SITE PREPARATION

PSI recommends that topsoil, vegetation, roots, soft, organic, frozen, or unsuitable soils in the construction areas be stripped from the site and either wasted or stockpiled for later use in non-structural areas. It should also be noted that it is not unusual for topsoil thickness to vary from these values in the open field. Oftentimes the topsoil can be deeper in low-lying areas, where erosion, wind and precipitation can deposit this material. A representative of the geotechnical engineer should determine and document the depth of removal at the time of construction.

Most likely the project will be constructed after the removal of the existing trees and vegetation. Shoring and dewatering pumping should be considered for this project during foundation construction. Embankments should be constructed in accordance with Item 203 and Item 204 of the ODOT CMS.

PSI should be retained to provide observation and testing of construction activities involved in the foundation, earthwork, and related activities of this project. PSI cannot accept responsibility for conditions that deviate from those described in this report, nor for the performance of the foundation system if not engaged to also provide construction observation and testing for this project.

4.2 MOISTURE SENSITIVE SOILS/WEATHER RELATED CONCERNS

PSI recommends that the Contractor determine the actual groundwater levels at the site at the time of the construction activities to assess the impact groundwater may have on construction. Water should not be allowed to collect in the foundation excavation on prepared subgrades of the construction area during construction. Temporary channel re-routing may be required during foundation installation.

Since there is the possibility of constructing concrete structures below groundwater table at certain times of the year, PSI recommends that dewatering the site or temporary re-routing the channel prior to excavating be considered. The water table, if encountered, should be lowered at least 2 feet below the bottom of the excavation. Dewatering pumping is anticipated during the foundation construction especially where the excavated area is in the granular strata below the channel water level. Should excessive and uncontrolled amounts of seepage occur, the geotechnical engineer should be consulted.

4.3 BACKFILL AND COMPACTION

Backfill of the proposed abutments and wing walls may consist of low plastic soils or granular material. PSI suggests using granular material to provide improved drainage and to reduce lateral pressures on the walls resulting from water pressure. The backfill materials should be placed in lifts that do not exceed 8-inches loose.

The lift thickness may need to be reduced to thinner lifts immediately behind the walls to achieve the desired amount of compaction without overstressing the wall with the compaction process.

Backfill should be placed in thin lifts and mechanically compacted in accordance with Items 203 and 204 of the ODOT CMS. PSI advises performing field density tests on the backfill to monitor compliance with the recommendations provided. Care should be exercised during the backfilling operation to prevent overstressing and damaging the walls.

4.4 EXCAVATION SAFETY

In Federal Register, Volume 54, Number 209 (October 1989), the United States Department of Labor, Occupational Safety and Health Administration (OSHA) amended its "Construction Standards for Excavations, 29 CFR, part 1926, Subpart P". This document was issued to better enhance the safety of workers entering trenches or excavations. It is mandated by this federal regulation that excavations, whether they be utility trenches, basement excavation or footing excavations, be constructed in accordance with the new OSHA guidelines. It is PSI's understanding that these regulations are being strictly enforced and if they are not closely followed, the owner and the contractor could be liable for substantial penalties.

The contractor is solely responsible for designing and constructing stable, temporary excavations and should shore, slope, or bench the sides of the excavations as required to maintain stability of both the excavation sides and bottom. The contractor's "responsible person", as defined in 29 CFR Part 1926, should evaluate the soil exposed in the excavations as part of the contractor's safety procedures. In no case should slope height, slope inclination, or excavation depth, including utility trench excavation depth, exceed those specified in local, state, and federal safety regulations.

PSI is providing this information solely as a service to our client. PSI does not assume responsibility for construction site safety or the contractor's or other parties' compliance with local, state, and federal safety or other regulations. A trench safety plan was beyond the scope of our services for this project.

5 GEOTECHNICAL RISK

The concept of risk is an important aspect of the geotechnical evaluation. The primary reason is the analytical methods used to develop geotechnical recommendations do not comprise an exact science. The analytical tools which geotechnical engineers use are generally empirical and must be used in conjunction with engineering judgment and experience. Therefore, the solutions and recommendations presented in the geotechnical evaluation should not be considered risk-free and, more importantly, are not a guarantee that the interaction between the soils and the proposed structure will perform as planned. The engineering recommendations presented in the preceding section constitutes PSI's professional estimate of those measures that are necessary for the proposed structure to perform according to the proposed design based on the information generated and referenced during this evaluation, and PSI's experience in working with these conditions.

6 REPORT LIMITATIONS

The recommendations submitted are based on the available subsurface information obtained by PSI and design details furnished by the LJB, Inc. If there are revisions to the plans for this project or if deviations from the subsurface conditions noted in this report are encountered during construction, PSI should be notified immediately to determine if changes in the foundation recommendations are required. If PSI is not retained to perform these functions, PSI will not be responsible for the impact of those conditions on the project.

The geotechnical engineer warrants that the findings, recommendations, specifications, or professional advice contained herein have been made in accordance with generally accepted professional geotechnical engineering practices in the local area. No other warranties are implied or expressed.

After the plans and specifications are more complete, the geotechnical engineer should be retained and provided the opportunity to review the final design plans and specifications to check that our engineering recommendations have been properly incorporated into the design documents. At that time, it may be necessary to submit supplementary recommendations. This report has been prepared for the exclusive use of the LJB, Inc. for the specific application to the proposed SHE-SPRUC-022709 Bridge Replacement located on Spruce Avenue, between Lincoln Street and Greenacre Street in Sidney, Shelby County, Ohio.



APPENDIX

Boring Location Plan

Boring Logs

Pile Analysis Output

ODOT Quick Reference for Visual Descriptions of Soils

ODOT General Classification of Soils and Rock

Boring Location Plan

01051704 - SHE-Spruce-2.27

Legend

○ Approx. Boring Location

Lincoln St

B-004-0-21

B-003-0-21

B-002-0-21

B-001-0-21

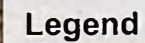
Google Earth

© 2021 Google



100 ft

01051704 - SHE-Spruce-2.27



● Approx. Boring Location



100 ft

[illegible]

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 10/4/21 07:30 - \\PSIPRODDBW02\BENTLEY_GINT\PROJECTS\0105 ODOT DAYTON-OH\01051704.GPJ

PROJECT: SHE-SPRUCE-02.27		DRILLING FIRM / OPERATOR: PSI / J.E.		DRILL RIG: CME 45C (350574)		STATION / OFFSET: 9+80, 21' LT.						EXPLORATION ID B-002-0-21							
TYPE: BRIDGE		SAMPLING FIRM / LOGGER: PSI / C.W.		HAMMER: CME AUTOMATIC		ALIGNMENT: ROADWAY CENTERLINE													
PID: 114201 SFN:		DRILLING METHOD: 3.25" HSA		CALIBRATION DATE: 8/18/20		ELEVATION: 1019.9 (MSL) EOB: 55.0 ft.						PAGE 1 OF 2							
START: 5/17/21 END: 5/17/21		SAMPLING METHOD: SPT		ENERGY RATIO (%): 86.8		LAT / LONG: 40.273900, -84.164200													
MATERIAL DESCRIPTION AND NOTES		ELEV.	DEPTHS	SPT/RQD	N ₆₀	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%)					ATTERBERG			WC	ODOT CLASS (GI)	HOLE SEALED
									GR	CS	FS	SI	CL	LL	PL	PI			
12" RAILROAD BASE/BALLAST		1019.9																	
LOOSE, BLACK, SANDY SILT, TRACE CLAY, WITH CINDERS, MOIST , FILL		1018.9	1	3	6	67	SS-1	1.50	-	-	-	-	-	-	-	54	A-4a (V)		
SOFT, GRAY, SILT AND CLAY, LITTLE SAND, MOIST		1017.4	2	2															
			3																
			4	1	4	6	SS-2	-	-	-	-	-	-	-	-	26	A-6a (V)		
		1014.4	5	2															
			6																
STIFF TO VERY STIFF, GRAY, SANDY SILT, SOME CLAY, TRACE GRAVEL, DAMP			7	3	9	83	SS-3	1.50	-	-	-	-	-	-	-	14	A-4a (V)		
			8																
			9	2	12	78	SS-4	3.25	8	7	15	45	25	20	15	5	14	A-4a (7)	
			10	3	5														
			11	3															
		1006.9	12	5	19	39	SS-5	4.00	-	-	-	-	-	-	-	12	A-4a (V)		
			13	8															
MEDIUM DENSE, GRAY, COARSE AND FINE SAND, TRACE GRAVEL, TRACE CLAY, MOIST			14	4	33	78	SS-6	-	-	-	-	-	-	-	-	11	A-3a (V)		
		1003.9	15	9	14														
VERY DENSE, GRAY, GRAVEL, LITTLE SAND, TRACE SILT, TRACE CLAY, WET			16	13	59	78	SS-7	-	76	14	4	-	6	-	-	13	A-1-a (V)		
		1001.9	17	17	24														
DENSE, GRAY, GRAVEL WITH SAND, SILT, AND CLAY, WET			18																
		999.9	19	14	42	72	SS-8	4.50	-	-	-	-	-	-	-	11	A-2-6 (V)		
VERY STIFF TO HARD, GRAY, SILTY CLAY, LITTLE SAND, TRACE GRAVEL, DAMP			20	17	12														
			21	4	27	89	SS-9	3.75	-	-	-	-	-	-	-	17	A-6b (V)		
			22	8	11														
			23																
		993.9	24	4	33	89	SS-10	4.00	10	5	8	26	51	33	17	16	16	A-6b (10)	
			25	9	14														
HARD, GRAY, SILT AND CLAY, SOME SAND, TRACE GRAVEL, DAMP			26	8	50/5"	-	100	SS-11	4.50	-	-	-	-	-	-	9	A-6a (V)		
		991.9	27																
HARD, GRAY, SANDY SILT, SOME CLAY, LITTLE GRAVEL, MOIST			28																
			29	18	120	100	SS-12	4.50	11	11	20	28	30	24	15	9	11	A-4a (5)	
			30	33	50														

[illegible]

NOTES: NONE

ABANDONMENT METHODS, MATERIALS, QUANTITIES: NOT RECORDED

PROJECT: SHE-SPRUCE-02.27		DRILLING FIRM / OPERATOR: PSI / J.E.		DRILL RIG: CME 45C (350574)		STATION / OFFSET: 10+22, 20' RT.				EXPLORATION ID B-003-0-21									
TYPE: BRIDGE		SAMPLING FIRM / LOGGER: PSI / C.W.		HAMMER: CME AUTOMATIC		ALIGNMENT: ROADWAY CENTERLINE				PAGE 1 OF 2									
PID: 114201 SFN:		DRILLING METHOD: 3.25" HSA		CALIBRATION DATE: 8/18/20		ELEVATION: 1020.8 (MSL) EOB: 60.0 ft.													
START: 5/18/21 END: 5/19/21		SAMPLING METHOD: SPT		ENERGY RATIO (%): 86.8		LAT / LONG: 40.274000, -84.164100													
MATERIAL DESCRIPTION AND NOTES		ELEV.	DEPTHS	SPT/RQD	N ₆₀	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%)					ATTERBERG				ODOT CLASS (GI)	HOLE SEALED
		1020.8							GR	CS	FS	SI	CL	LL	PL	PI	WC		
12" RAILOAD BASE/BALLAST																			
VERY STIFF, GRAY AND BLACK, SANDY SILT, AND CLAY, LITTLE GRAVEL, TRACE CINDERS, MOIST , FILL		1019.8		1	4	17	67	SS-1	1.50	-	-	-	-	-	-	-	21	A-4a (V)	
		1017.8		2	8														
LOOSE, DARK BROWN AND BLACK, GRAVEL, AND SAND, BRICK FRAGMENTS AND BROKEN TILE, MOIST , FILL				3															
				4	4	10	11	SS-2	-	-	-	-	-	-	-	-	16	A-1-a (V)	
		1014.8		5	4														
STIFF, GRAY, SANDY SILT, SOME CLAY, TRACE GRAVEL, DAMP				6															
				7	1	9	72	SS-3	2.00	9	7	15	44	25	21	13	8	13	A-4a (7)
				8	3														
				9	2	13	83	SS-4	2.00	-	-	-	-	-	-	-	14	A-4a (V)	
				10	4	5													
				11	3	12	94	SS-5	2.25	8	6	13	47	26	21	15	6	14	A-4a (8)
				12	3	5													
				13															
				14	2	12	94	SS-6	3.50	-	-	-	-	-	-	-	12	A-4a (V)	
		1004.8		15	3	5													
HARD, GRAY, SILT AND CLAY, LITTLE SAND, MOIST				16	13														
		1002.8	W 1003.0	17	13	41	6	SS-7	-	-	-	-	-	-	-	-	18	A-6a (V)	
				18	15														
DENSE, GRAY, GRAVEL, SOME SAND, TRACE SILT, TRACE CLAY, WET				19	5	32	61	SS-8	-	73	13	9	-	5	-	-	9	A-1-a (V)	
		999.8		20	10	12													
HARD, GRAY, SANDY SILT, SOME SAND, TRACE GRAVEL, DAMP				21	10														
		997.8		22	15	46	72	SS-9	4.50	-	-	-	-	-	-	-	9	A-4a (V)	
				23	17														
HARD, GRAY, SILT AND CLAY, LITTLE SAND, TRACE GRAVEL, DAMP				24	5														
		994.8		25	10	35	78	SS-10	4.00	-	-	-	-	-	-	-	17	A-6a (V)	
				26	14														
VERY STIFF, GRAY, SILT AND CLAY, LITTLE SAND, TRACE GRAVEL, DAMP				27	5	27	89	SS-11	3.25	5	6	10	27	52	31	17	14	17	A-6a (10)
		992.8		28	8	11													
HARD, GRAY, SANDY SILT, SOME CLAY, TRACE GRAVEL, DAMP				29	9														
				30	16	71	89	SS-12	4.50	-	-	-	-	-	-	-	11	A-4a (V)	
					33														

[illegible]

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 10/4/21 07:30 - \\PSIPRODDBW02\BENTLEY GINT\PROJECTS\105 ODOT DAYTON-OH\1051704.GPJ

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT GDT - 10/4/21 07:30 - \\PSIPRODD\B\W02\BENTLEY_GINT\PROJECTS\0105 ODOT DAYTON-OH\1051704.GPJ

PID: 114201	SFN:	PROJECT: SHE-SPRUCE-02.27	STATION / OFFSET: 10+72, 15' LT.	START: 5/19/21	END: 5/20/21	PG 2 OF 3	B-004-0-21													
MATERIAL DESCRIPTION AND NOTES		ELEV. 1014.0	DEPTHS	SPT/ RQD	N ₆₀	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%)					ATTERBERG			WC	ODOT CLASS (GI)	HOLE SEALED	
									GR	CS	FS	SI	CL	LL	PL	PI				
STIFF, GRAY, SANDY SILT , SOME CLAY, LITTLE GRAVEL, MOIST <i>(continued)</i>		1007.0	32																	
			33																	
			34	1																
			35	3 4	10	83	SS-13	2.00	-	-	-	-	-	-	-	-	13	A-4a (V)		
			36																	
DENSE, GRAY, GRAVEL , SOME SAND, TRACE SILT, TRACE CLAY, WET		1003.0	37																	
			38																	
			39	10																
			40	13 12	36	89	SS-14	-	60	24	10	-	6	-	-	-	9	A-1-a (V)		
			41																	
HARD, GRAY, SANDY SILT , SOME CLAY, LITTLE GRAVEL, MOIST TO DAMP		983.0	42																	
			43																	
			44	6																
			45	10 14	35	94	SS-15	4.50	-	-	-	-	-	-	-	-	16	A-4a (V)		
			46																	
			47																	
			48																	
			49	8																
			50	12 27	56	78	SS-16	4.50	-	-	-	-	-	-	-	-	14	A-4a (V)		
			51																	
			52																	
			53																	
			54	21 39 42	117	89	SS-17	4.50	11	11	22	35	21	21	14	7	11	A-4a (4)		
			55																	
			56																	
			57																	
			58																	
			59	13 16 22	55	100	SS-18	3.00	-	-	-	-	-	-	-	-	12	A-4a (V)		
			60																	
			HARD, GRAY, SANDY SILT , SOME GRAVEL, SOME CLAY, MOIST		983.0	61														
62																				
63																				
64	48	-				58	SS-19	-	21	10	19	26	24	23	13	10	16	A-4a (3)		

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT GDT - 10/4/21 07:30 - \\PSIPRODDBW02\BENTLEY_GINT\PROJECTS\0105 ODOT DAYTON-OH\01051704.GPJ

PID: 114201		SFN:		PROJECT: SHE-SPRUCE-02.27		STATION / OFFSET: 10+72, 15' LT.		START: 5/19/21		END: 5/20/21		PG 3 OF 3		B-004-0-21									
MATERIAL DESCRIPTION AND NOTES				ELEV.	DEPTHS		SPT/ RQD	N ₆₀	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%)					ATTERBERG			WC	ODOT CLASS (GI)	HOLE SEALED	
				980.8			GR	CS	FS	SI	CL	LL	PL	PI									
HARD, GRAY, SANDY SILT , SOME GRAVEL, SOME CLAY, MOIST (continued)				979.0	65	50																	
HARD, GRAY, SANDY SILT , SOME CLAY, TRACE GRAVEL, DAMP					66																		
					67																		
					68																		
				975.0	69	31	40	123	100	SS-20	4.50	-	-	-	-	-	-	-	10	A-4a (V)			
					70	45																	
					EOB																		
NOTES: NONE																							
ABANDONMENT METHODS, MATERIALS, QUANTITIES: NOT RECORDED																							

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APILE for Windows, Version 2019.9.3

Serial Number : 138584419

A Program for Analyzing the Axial Capacity
and Short-term Settlement of Driven Piles
under Axial Loading.
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Path to file locations : \\Dayton-fs1\PROJECTS\2021\GEO
Projects\01051704 - LJB, Inc. - Spruce Avenue Bridge Replacement (SHE-
SPRUC-02270) - ODOT PID 114201 - Sidney, Ohio\Pile Analysis\Ray\Andy's
Updated with New Elevations\
Name of input data file : 14-Inch CIPRC Pile - B-001-0-21 rf no
batter.ap9d
Name of output file : 14-Inch CIPRC Pile - B-001-0-21 rf no
batter.ap9o
Name of plot output file : 14-Inch CIPRC Pile - B-001-0-21 rf no
batter.ap9p

Time and Date of Analysis

Date: May 12, 2023 Time: 10:54:52

1

* INPUT INFORMATION *

SHE-Spruce-02.27 - 14" CIPRC Pile - B-001-0-21

DESIGNER : PSI

JOB NUMBER : 01051704

METHOD FOR UNIT LOAD TRANSFERS :

- FHWA (Federal Highway Administration)
Unfactored Unit Side Friction and Unit Side Resistance are
used.

COMPUTATION METHOD(S) FOR PILE CAPACITY :

- FHWA (Federal Highway Administration)
- API RP 2A (American Petroleum Institute)

TYPE OF LOADING :

- COMPRESSION

PILE TYPE :

Steel pipe pile or non-tapered portion of monotube pile
- Close-Ended Pile

DATA FOR AXIAL STIFFNESS :

- MODULUS OF ELASTICITY = 0.290E+08 PSI
- CROSS SECTION AREA = 21.21 IN²

CIRCULAR PILE PROPERTIES :

- OUTSIDE DIAMETER, OD = 14.00 IN.
- INTERNAL DIAMETER, ID = 13.00 IN.
- TOTAL PILE LENGTH, TL = 55.00 FT.
- BATTER ANGLE = 0.00 DEG
- PILE STICKUP LENGTH, PSL = 0.50 FT.
- ZERO FRICTION LENGTH, ZFL = 5.00 FT.
- INCREMENT OF PILE LENGTH
USED IN COMPUTATION = 1.00 FT.
- LENGTH OF ENHANCED
END SECTION = 55.00 FT.
- INTERNAL DIAMETER OF
ENHANCED END SECTION = 13.00 IN.

PLUGGED/UNPLUGGED CONDITIONS :

Internal Pile Plug Calculated by Program

SOIL INFORMATIONS :

DEPTH FT.	SOIL TYPE	LATERAL EARTH PRESSURE	EFFECTIVE UNIT WEIGHT LB/FT^3	FRICTION ANGLE DEGREES	BEARING CAPACITY FACTOR
0.00	CLAY	0.80*	62.60	0.00	8.00**
1.00	CLAY	0.80*	62.60	0.00	8.00**
1.00	SAND	0.80*	72.60	30.00	22.00
4.50	SAND	0.80*	72.60	30.00	22.00
4.50	CLAY	0.80*	67.60	0.00	8.00**
16.00	CLAY	0.80*	67.60	0.00	8.00**
16.00	CLAY	0.80*	57.60	0.00	8.00**
22.50	CLAY	0.80*	62.60	0.00	8.00**
22.50	SAND	0.80*	72.60	32.00	29.00
27.50	SAND	0.80*	72.60	32.00	29.00
27.50	CLAY	0.80*	67.60	0.00	8.00**
36.50	CLAY	0.80*	67.60	0.00	8.00**
36.50	CLAY	0.80*	72.60	0.00	8.00**
58.50	CLAY	0.80*	72.60	0.00	8.00**

* VALUE ASSUMED BY THE PROGRAM

** VALUE ESTIMATED BY THE PROGRAM BASED ON FRICTION ANGLE

END	MAXIMUM UNIT	MAXIMUM UNIT	UNDISTURB SHEAR	REMOLDED SHEAR	BLOW COUNT	UNIT SKIN FRICTION	UNIT
BEARING	FRICTION	BEARING	STRENGTH	STRENGTH			
KSF	KSF	KSF	KSF	KSF		KSF	
0.00	0.10E+08*	0.10E+08*	3.00	0.00	0.00	0.00	
0.00	0.10E+08*	0.10E+08*	3.00	0.00	0.00	0.00	
0.00	0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	
0.00	0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	
0.00	0.10E+08*	0.10E+08*	4.50	0.00	0.00	0.00	
0.00	0.10E+08*	0.10E+08*	4.50	0.00	0.00	0.00	
0.00	0.10E+08*	0.10E+08*	1.00	0.00	0.00	0.00	
0.00	0.10E+08*	0.10E+08*	2.00	0.00	0.00	0.00	
0.00	0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	

0.00	0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00
0.00	0.10E+08*	0.10E+08*	5.50	0.00	0.00	0.00
0.00	0.10E+08*	0.10E+08*	5.50	0.00	0.00	0.00
0.00	0.10E+08*	0.10E+08*	6.00	0.00	0.00	0.00
0.00	0.10E+08*	0.10E+08*	6.00	0.00	0.00	0.00

* MAXIMUM UNIT FRICTION AND/OR MAXIMUM UNIT BEARING
WERE SET TO BE 0.10E+08 BECAUSE THE USER DOES NOT
PLAN TO LIMIT THE COMPUTED DATA.

DEPTH FT.	LRFD FACTOR ON UNIT FRICTION	LRFD FACTOR ON UNIT BEARING
0.00	1.000	1.000
1.00	1.000	1.000
1.00	1.000	1.000
4.50	1.000	1.000
4.50	1.000	1.000
16.00	1.000	1.000
16.00	1.000	1.000
22.50	1.000	1.000
22.50	1.000	1.000
27.50	1.000	1.000
27.50	1.000	1.000
36.50	1.000	1.000
36.50	1.000	1.000
58.50	1.000	1.000

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* COMPUTATION RESULT *

* FED. HWY. METHOD *

PILE PENETRATION FT.	TOTAL SKIN FRICTION KIP	END BEARING KIP	ULTIMATE CAPACITY KIP
0.00	0.0	8.6	8.6
1.00	0.0	1.2	1.2

2.00	0.0	8.6	8.6
3.00	0.0	3.9	3.9
4.00	0.0	13.0	13.0
5.00	0.2	24.3	24.6
6.00	8.5	35.3	43.9
7.00	24.7	43.3	68.0
8.00	40.9	43.3	84.2
9.00	57.1	43.3	100.4
10.00	73.3	43.3	116.6
11.00	89.5	43.3	132.8
12.00	105.7	43.3	149.0
13.00	121.9	43.3	165.2
14.00	138.1	43.3	181.4
15.00	154.3	36.2	190.6
16.00	168.5	27.1	195.7
17.00	176.6	18.5	195.1
18.00	180.8	12.6	193.4
19.00	185.6	14.1	199.7
20.00	191.0	15.5	206.5
21.00	196.9	17.0	213.9
22.00	203.1	21.6	224.7
23.00	209.8	26.9	236.7
24.00	214.4	31.8	246.3
25.00	217.0	35.3	252.3
26.00	219.7	35.3	254.9
27.00	222.4	39.1	261.5
28.00	225.3	44.1	269.4
29.00	233.6	49.1	282.8
30.00	247.3	52.9	300.3
31.00	261.0	52.9	314.0
32.00	274.8	52.9	327.7
33.00	288.5	52.9	341.4
34.00	302.2	52.9	355.1
35.00	315.9	52.9	368.8
36.00	328.2	53.9	382.2
37.00	337.9	55.3	393.2
38.00	346.5	56.7	403.2
39.00	355.5	57.7	413.2
40.00	364.5	57.7	422.3
41.00	373.5	57.7	431.3
42.00	382.6	57.7	440.3
43.00	391.6	57.7	449.3
44.00	400.6	57.7	458.3
45.00	409.6	57.7	467.3
46.00	418.6	57.7	476.4
47.00	427.6	57.7	485.4
48.00	436.7	57.7	494.4
49.00	445.7	57.7	503.4
50.00	454.7	57.7	512.4
51.00	463.7	57.7	521.4
52.00	472.7	57.7	530.4
53.00	481.7	57.7	539.5
54.00	490.8	57.7	548.5

 * API RP-2A (2010) *

PILE PENETRATION FT.	TOTAL SKIN FRICTION KIP	END BEARING KIP	ULTIMATE CAPACITY KIP
0.00	0.0	8.7	8.7
1.00	0.0	1.5	1.5
2.00	0.0	9.2	9.2
3.00	0.0	4.9	4.9
4.00	0.0	14.0	14.0
5.00	0.2	25.1	25.3
6.00	2.8	35.7	38.4
7.00	7.4	43.3	50.7
8.00	12.2	43.3	55.5
9.00	17.2	43.3	60.5
10.00	22.3	43.3	65.6
11.00	27.5	43.3	70.8
12.00	32.8	43.3	76.1
13.00	38.3	43.3	81.6
14.00	43.8	43.3	87.1
15.00	49.5	36.2	85.7
16.00	55.3	27.1	82.4
17.00	59.2	18.5	77.6
18.00	61.3	12.6	73.9
19.00	63.7	14.1	77.7
20.00	66.3	15.5	81.8
21.00	69.1	17.0	86.1
22.00	72.2	24.3	96.5
23.00	75.5	33.8	109.3
24.00	78.4	43.5	121.9
25.00	80.8	51.6	132.4
26.00	83.4	53.8	137.2
27.00	86.0	54.7	140.8
28.00	88.8	54.6	143.4
29.00	94.1	53.9	148.0
30.00	101.9	52.9	154.8
31.00	109.8	52.9	162.7
32.00	117.7	52.9	170.6
33.00	125.7	52.9	178.6
34.00	133.8	52.9	186.7
35.00	141.9	52.9	194.8
36.00	150.1	53.9	204.0
37.00	158.3	55.3	213.6
38.00	166.9	56.7	223.6
39.00	175.8	57.7	233.5
40.00	184.8	57.7	242.5
41.00	193.8	57.7	251.6
42.00	202.9	57.7	260.7
43.00	212.1	57.7	269.8
44.00	221.3	57.7	279.0

45.00	230.6	57.7	288.3
46.00	239.9	57.7	297.6
47.00	249.3	57.7	307.0
48.00	258.7	57.7	316.4
49.00	268.2	57.7	325.9
50.00	277.7	57.7	335.5
51.00	287.3	57.7	345.1
52.00	297.0	57.7	354.7
53.00	306.7	57.7	364.4
54.00	316.4	57.7	374.1

NOTES:

- AN ASTERISK IS PLACED IN THE END-BEARING COLUMN
IF THE TIP RESISTANCE IS CONTROLLED BY THE FRICTION
OF SOIL PLUG INSIDE AN OPEN-ENDED PIPE PILE.

 * COMPUTE LOAD-DISTRIBUTION AND LOAD-SETTLEMENT *
 * CURVES FOR AXIAL LOADING *

MOVEMENT	T-Z CURVE NO.	NO. OF POINTS	DEPTH TO CURVE FT.	LOAD TRANSFER PSI	PILE IN.
	1	10	0.0000E+00	0.0000E+00	0.0000E+00
				0.0000E+00	0.2240E-01
				0.0000E+00	0.4340E-01
				0.0000E+00	0.7980E-01
				0.0000E+00	0.1120E+00
				0.0000E+00	0.1400E+00
				0.0000E+00	0.2800E+00
				0.0000E+00	0.4200E+00
				0.0000E+00	0.7000E+00
				0.0000E+00	0.2800E+01
	2	10	0.5250E+00	0.0000E+00	0.0000E+00
				0.0000E+00	0.2240E-01
				0.0000E+00	0.4340E-01
				0.0000E+00	0.7980E-01
				0.0000E+00	0.1120E+00
				0.0000E+00	0.1400E+00
				0.0000E+00	0.2800E+00
				0.0000E+00	0.4200E+00
				0.0000E+00	0.7000E+00
				0.0000E+00	0.2800E+01
	3	10	0.9583E+00	0.0000E+00	0.0000E+00
				0.0000E+00	0.2240E-01

			0.0000E+00	0.4340E-01
			0.0000E+00	0.7980E-01
			0.0000E+00	0.1120E+00
			0.0000E+00	0.1400E+00
			0.0000E+00	0.2800E+00
			0.0000E+00	0.4200E+00
			0.0000E+00	0.7000E+00
			0.0000E+00	0.2800E+01
4	10	0.1000E+01		
			0.0000E+00	0.0000E+00
			0.0000E+00	0.2240E-01
			0.0000E+00	0.4340E-01
			0.0000E+00	0.7980E-01
			0.0000E+00	0.1120E+00
			0.0000E+00	0.1400E+00
			0.0000E+00	0.2800E+00
			0.0000E+00	0.4200E+00
			0.0000E+00	0.7000E+00
			0.0000E+00	0.2800E+01
5	10	0.2775E+01		
			0.0000E+00	0.0000E+00
			0.0000E+00	0.2240E-01
			0.0000E+00	0.4340E-01
			0.0000E+00	0.7980E-01
			0.0000E+00	0.1120E+00
			0.0000E+00	0.1400E+00
			0.0000E+00	0.2800E+00
			0.0000E+00	0.4200E+00
			0.0000E+00	0.7000E+00
			0.0000E+00	0.2800E+01
6	10	0.4458E+01		
			0.0000E+00	0.0000E+00
			0.1145E+00	0.2240E-01
			0.1908E+00	0.4340E-01
			0.2861E+00	0.7980E-01
			0.3434E+00	0.1120E+00
			0.3815E+00	0.1400E+00
			0.3815E+00	0.2800E+00
			0.3815E+00	0.4200E+00
			0.3815E+00	0.7000E+00
			0.3815E+00	0.2800E+01
7	10	0.4500E+01		
			0.0000E+00	0.0000E+00
			0.1249E+00	0.2240E-01
			0.2081E+00	0.4340E-01
			0.3121E+00	0.7980E-01
			0.3746E+00	0.1120E+00
			0.4162E+00	0.1400E+00
			0.3746E+00	0.2800E+00
			0.3746E+00	0.4200E+00
			0.3746E+00	0.7000E+00
			0.3746E+00	0.2800E+01
8	10	0.1028E+02		
			0.0000E+00	0.0000E+00

			0.9208E+01	0.2240E-01
			0.1535E+02	0.4340E-01
			0.2302E+02	0.7980E-01
			0.2762E+02	0.1120E+00
			0.3069E+02	0.1400E+00
			0.2762E+02	0.2800E+00
			0.2762E+02	0.4200E+00
			0.2762E+02	0.7000E+00
			0.2762E+02	0.2800E+01
9	10	0.1596E+02	0.0000E+00	0.0000E+00
			0.7032E+01	0.2240E-01
			0.1172E+02	0.4340E-01
			0.1758E+02	0.7980E-01
			0.2110E+02	0.1120E+00
			0.2344E+02	0.1400E+00
			0.2110E+02	0.2800E+00
			0.2110E+02	0.4200E+00
			0.2110E+02	0.7000E+00
			0.2110E+02	0.2800E+01
10	10	0.1600E+02	0.0000E+00	0.0000E+00
			0.6938E+01	0.2240E-01
			0.1156E+02	0.4340E-01
			0.1734E+02	0.7980E-01
			0.2081E+02	0.1120E+00
			0.2313E+02	0.1400E+00
			0.2081E+02	0.2800E+00
			0.2081E+02	0.4200E+00
			0.2081E+02	0.7000E+00
			0.2081E+02	0.2800E+01
11	10	0.1928E+02	0.0000E+00	0.0000E+00
			0.2971E+01	0.2240E-01
			0.4951E+01	0.4340E-01
			0.7427E+01	0.7980E-01
			0.8912E+01	0.1120E+00
			0.9902E+01	0.1400E+00
			0.8912E+01	0.2800E+00
			0.8912E+01	0.4200E+00
			0.8912E+01	0.7000E+00
			0.8912E+01	0.2800E+01
12	10	0.2246E+02	0.0000E+00	0.0000E+00
			0.3764E+01	0.2240E-01
			0.6273E+01	0.4340E-01
			0.9409E+01	0.7980E-01
			0.1129E+02	0.1120E+00
			0.1255E+02	0.1400E+00
			0.1129E+02	0.2800E+00
			0.1129E+02	0.4200E+00
			0.1129E+02	0.7000E+00
			0.1129E+02	0.2800E+01
13	10	0.2250E+02		

			0.0000E+00	0.0000E+00
			0.3776E+01	0.2240E-01
			0.6293E+01	0.4340E-01
			0.9440E+01	0.7980E-01
			0.1133E+02	0.1120E+00
			0.1259E+02	0.1400E+00
			0.1259E+02	0.2800E+00
			0.1259E+02	0.4200E+00
			0.1259E+02	0.7000E+00
			0.1259E+02	0.2800E+01
14	10	0.2503E+02		
			0.0000E+00	0.0000E+00
			0.1480E+01	0.2240E-01
			0.2467E+01	0.4340E-01
			0.3701E+01	0.7980E-01
			0.4441E+01	0.1120E+00
			0.4934E+01	0.1400E+00
			0.4934E+01	0.2800E+00
			0.4934E+01	0.4200E+00
			0.4934E+01	0.7000E+00
			0.4934E+01	0.2800E+01
15	10	0.2746E+02		
			0.0000E+00	0.0000E+00
			0.1637E+01	0.2240E-01
			0.2729E+01	0.4340E-01
			0.4093E+01	0.7980E-01
			0.4912E+01	0.1120E+00
			0.5457E+01	0.1400E+00
			0.5457E+01	0.2800E+00
			0.5457E+01	0.4200E+00
			0.5457E+01	0.7000E+00
			0.5457E+01	0.2800E+01
16	10	0.2750E+02		
			0.0000E+00	0.0000E+00
			0.1640E+01	0.2240E-01
			0.2733E+01	0.4340E-01
			0.4100E+01	0.7980E-01
			0.4920E+01	0.1120E+00
			0.5466E+01	0.1400E+00
			0.4920E+01	0.2800E+00
			0.4920E+01	0.4200E+00
			0.4920E+01	0.7000E+00
			0.4920E+01	0.2800E+01
17	10	0.3203E+02		
			0.0000E+00	0.0000E+00
			0.7792E+01	0.2240E-01
			0.1299E+02	0.4340E-01
			0.1948E+02	0.7980E-01
			0.2337E+02	0.1120E+00
			0.2597E+02	0.1400E+00
			0.2337E+02	0.2800E+00
			0.2337E+02	0.4200E+00
			0.2337E+02	0.7000E+00
			0.2337E+02	0.2800E+01

18	10	0.3646E+02	0.0000E+00	0.0000E+00
			0.5536E+01	0.2240E-01
			0.9226E+01	0.4340E-01
			0.1384E+02	0.7980E-01
			0.1661E+02	0.1120E+00
			0.1845E+02	0.1400E+00
			0.1661E+02	0.2800E+00
			0.1661E+02	0.4200E+00
			0.1661E+02	0.7000E+00
			0.1661E+02	0.2800E+01
19	10	0.3650E+02	0.0000E+00	0.0000E+00
			0.5471E+01	0.2240E-01
			0.9119E+01	0.4340E-01
			0.1368E+02	0.7980E-01
			0.1641E+02	0.1120E+00
			0.1824E+02	0.1400E+00
			0.1641E+02	0.2800E+00
			0.1641E+02	0.4200E+00
			0.1641E+02	0.7000E+00
			0.1641E+02	0.2800E+01
20	10	0.4753E+02	0.0000E+00	0.0000E+00
			0.5125E+01	0.2240E-01
			0.8542E+01	0.4340E-01
			0.1281E+02	0.7980E-01
			0.1537E+02	0.1120E+00
			0.1708E+02	0.1400E+00
			0.1537E+02	0.2800E+00
			0.1537E+02	0.4200E+00
			0.1537E+02	0.7000E+00
			0.1537E+02	0.2800E+01
21	10	0.5846E+02	0.0000E+00	0.0000E+00
			0.5125E+01	0.2240E-01
			0.8542E+01	0.4340E-01
			0.1281E+02	0.7980E-01
			0.1537E+02	0.1120E+00
			0.1708E+02	0.1400E+00
			0.1537E+02	0.2800E+00
			0.1537E+02	0.4200E+00
			0.1537E+02	0.7000E+00
			0.1537E+02	0.2800E+01

TIP LOAD KIP	TIP MOVEMENT IN.
0.0000E+00	0.0000E+00
0.3608E+01	0.7000E-02
0.7216E+01	0.1400E-01
0.1443E+02	0.2800E-01

0.2886E+02	0.1820E+00
0.4330E+02	0.5880E+00
0.5195E+02	0.1022E+01
0.5773E+02	0.1400E+01
0.5773E+02	0.2100E+01
0.5773E+02	0.2800E+01

LOAD VERSUS SETTLEMENT CURVE

TOP LOAD KIP	TOP MOVEMENT IN.	TIP LOAD KIP	TIP MOVEMENT IN.
0.1954E+01	0.8956E-03	0.5154E-01	0.1000E-03
0.1979E+02	0.9003E-02	0.5154E+00	0.1000E-02
0.9806E+02	0.4522E-01	0.2577E+01	0.5000E-02
0.1752E+03	0.8589E-01	0.5154E+01	0.1000E-01
0.2847E+03	0.1523E+00	0.1031E+02	0.2000E-01
0.4138E+03	0.2655E+00	0.1649E+02	0.5000E-01
0.4622E+03	0.3391E+00	0.1930E+02	0.8000E-01
0.4807E+03	0.3774E+00	0.2118E+02	0.1000E+00
0.4865E+03	0.4885E+00	0.2950E+02	0.2000E+00
0.4877E+03	0.7917E+00	0.4017E+02	0.5000E+00
0.4950E+03	0.1100E+01	0.4752E+02	0.8000E+00
0.4990E+03	0.1304E+01	0.5152E+02	0.1000E+01
0.5052E+03	0.2311E+01	0.5773E+02	0.2000E+01

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APILE for Windows, Version 2019.9.3

Serial Number : 138584419

A Program for Analyzing the Axial Capacity
and Short-term Settlement of Driven Piles
under Axial Loading.
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Path to file locations : \\Dayton-fs1\PROJECTS\2021\GEO
Projects\01051704 - LJB, Inc. - Spruce Avenue Bridge Replacement (SHE-
SPRUC-02270) - ODOT PID 114201 - Sidney, Ohio\Pile Analysis\Ray\Andy's
Updated with New Elevations\
Name of input data file : 14-Inch CIPRC Pile - B-002-0-21 rf no
batter.ap9d
Name of output file : 14-Inch CIPRC Pile - B-002-0-21 rf no
batter.ap9o
Name of plot output file : 14-Inch CIPRC Pile - B-002-0-21 rf no
batter.ap9p

Time and Date of Analysis

Date: May 12, 2023 Time: 10:56:21

1

* INPUT INFORMATION *

SHE-Spruce-02.27 - 14" CIPRC Pile - B-002-0-21

DESIGNER : PSI

JOB NUMBER : 01051704

METHOD FOR UNIT LOAD TRANSFERS :

- FHWA (Federal Highway Administration)
Unfactored Unit Side Friction and Unit Side Resistance are
used.

COMPUTATION METHOD(S) FOR PILE CAPACITY :

- FHWA (Federal Highway Administration)
- API RP 2A (American Petroleum Institute)

TYPE OF LOADING :

- COMPRESSION

PILE TYPE :

Steel pipe pile or non-tapered portion of monotube pile
- Close-Ended Pile

DATA FOR AXIAL STIFFNESS :

- MODULUS OF ELASTICITY = 0.290E+08 PSI
- CROSS SECTION AREA = 21.21 IN²

CIRCULAR PILE PROPERTIES :

- OUTSIDE DIAMETER, OD = 14.00 IN.
- INTERNAL DIAMETER, ID = 13.00 IN.
- TOTAL PILE LENGTH, TL = 45.00 FT.
- BATTER ANGLE = 0.00 DEG
- PILE STICKUP LENGTH, PSL = 0.50 FT.
- ZERO FRICTION LENGTH, ZFL = 5.00 FT.
- INCREMENT OF PILE LENGTH
USED IN COMPUTATION = 1.00 FT.
- LENGTH OF ENHANCED
END SECTION = 45.00 FT.
- INTERNAL DIAMETER OF
ENHANCED END SECTION = 13.00 IN.

PLUGGED/UNPLUGGED CONDITIONS :

Internal Pile Plug Calculated by Program

SOIL INFORMATIONS :

DEPTH FT.	SOIL TYPE	LATERAL EARTH PRESSURE	EFFECTIVE UNIT WEIGHT LB/FT^3	FRICTION ANGLE DEGREES	BEARING CAPACITY FACTOR
0.00	CLAY	0.80*	120.00	0.00	8.00**
6.50	CLAY	0.80*	120.00	0.00	8.00**
6.50	SAND	0.80*	67.60	28.00	17.00
13.50	SAND	0.80*	72.60	32.00	28.00
13.50	CLAY	0.80*	62.60	0.00	8.00**
19.50	CLAY	0.80*	62.60	0.00	8.00**
19.50	CLAY	0.80*	67.60	0.00	8.00**
48.50	CLAY	0.80*	67.60	0.00	8.00**

* VALUE ASSUMED BY THE PROGRAM

** VALUE ESTIMATED BY THE PROGRAM BASED ON FRICTION ANGLE

END	MAXIMUM UNIT	MAXIMUM UNIT	UNDISTURB SHEAR	REMOLDED SHEAR	BLOW COUNT	UNIT SKIN FRICTION	UNIT
BEARING	FRICTION	BEARING	STRENGTH	STRENGTH			
	KSF	KSF	KSF	KSF		KSF	
0.00	0.10E+08*	0.10E+08*	1.20	0.00	0.00	0.00	
0.00	0.10E+08*	0.10E+08*	2.00	0.00	0.00	0.00	
0.00	0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	
0.00	0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	
0.00	0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	
0.00	0.10E+08*	0.10E+08*	3.50	0.00	0.00	0.00	
0.00	0.10E+08*	0.10E+08*	3.50	0.00	0.00	0.00	
0.00	0.10E+08*	0.10E+08*	6.00	0.00	0.00	0.00	
0.00	0.10E+08*	0.10E+08*	6.00	0.00	0.00	0.00	

* MAXIMUM UNIT FRICTION AND/OR MAXIMUM UNIT BEARING
WERE SET TO BE 0.10E+08 BECAUSE THE USER DOES NOT
PLAN TO LIMIT THE COMPUTED DATA.

LRFD FACTOR LRFD FACTOR
ON UNIT ON UNIT

DEPTH FT.	FRICTION	BEARING
0.00	1.000	1.000
6.50	1.000	1.000
6.50	1.000	1.000
13.50	1.000	1.000
13.50	1.000	1.000
19.50	1.000	1.000
19.50	1.000	1.000
48.50	1.000	1.000

1

 * COMPUTATION RESULT *

 * FED. HWY. METHOD *

PILE PENETRATION FT.	TOTAL SKIN FRICTION KIP	END BEARING KIP	ULTIMATE CAPACITY KIP
0.00	0.0	6.3	6.3
1.00	0.0	6.9	6.9
2.00	0.0	13.9	13.9
3.00	0.0	15.1	15.1
4.00	0.0	16.3	16.3
5.00	2.4	17.5	19.9
6.00	7.4	17.0	24.4
7.00	12.5	16.1	28.5
8.00	15.5	14.9	30.4
9.00	16.6	14.4	31.0
10.00	17.8	16.3	34.1
11.00	19.2	19.5	38.6
12.00	20.7	24.6	45.3
13.00	22.4	29.3	51.7
14.00	24.4	32.5	56.9
15.00	31.8	33.9	65.7
16.00	44.4	33.7	78.0
17.00	57.0	33.7	90.6
18.00	69.6	33.7	103.2
19.00	81.3	38.8	120.2
20.00	90.2	45.7	135.9
21.00	99.6	52.6	152.2
22.00	111.4	57.7	169.2
23.00	123.2	57.7	181.0
24.00	135.1	57.7	192.8
25.00	146.9	57.7	204.6
26.00	158.7	57.7	216.4

27.00	170.5	57.7	228.3
28.00	182.3	57.7	240.1
29.00	194.2	57.7	251.9
30.00	206.0	57.7	263.7
31.00	217.8	57.7	275.5
32.00	229.6	57.7	287.4
33.00	241.4	57.7	299.2
34.00	253.3	57.7	311.0
35.00	265.1	57.7	322.8
36.00	276.9	57.7	334.6
37.00	288.7	57.7	346.5
38.00	300.6	57.7	358.3
39.00	312.4	57.7	370.1
40.00	324.2	57.7	381.9
41.00	336.0	57.7	393.7
42.00	347.8	57.7	405.6
43.00	359.7	57.7	417.4
44.00	371.5	57.7	429.2

* API RP-2A (2010) *

PILE PENETRATION FT.	TOTAL SKIN FRICTION KIP	END BEARING KIP	ULTIMATE CAPACITY KIP
0.00	0.0	6.3	6.3
1.00	0.0	6.9	6.9
2.00	0.0	13.9	13.9
3.00	0.0	15.1	15.1
4.00	0.0	16.3	16.3
5.00	1.2	17.5	18.7
6.00	3.8	18.0	21.8
7.00	6.6	18.6	25.3
8.00	8.7	19.9	28.6
9.00	9.9	22.0	31.9
10.00	11.3	25.3	36.6
11.00	12.7	28.9	41.6
12.00	14.4	32.7	47.1
13.00	16.1	34.8	50.9
14.00	18.0	35.4	53.4
15.00	21.6	34.8	56.4
16.00	26.7	33.7	60.4
17.00	31.9	33.7	65.6
18.00	37.1	33.7	70.8
19.00	42.4	38.8	81.2
20.00	47.8	45.7	93.5
21.00	54.5	52.6	107.1
22.00	62.6	57.7	120.4
23.00	70.9	57.7	128.6
24.00	79.2	57.7	136.9
25.00	87.5	57.7	145.3

26.00	96.0	57.7	153.7
27.00	104.5	57.7	162.2
28.00	113.0	57.7	170.8
29.00	121.7	57.7	179.4
30.00	130.4	57.7	188.1
31.00	139.1	57.7	196.9
32.00	148.0	57.7	205.7
33.00	156.8	57.7	214.6
34.00	165.8	57.7	223.5
35.00	174.8	57.7	232.5
36.00	183.8	57.7	241.6
37.00	192.9	57.7	250.7
38.00	202.1	57.7	259.8
39.00	211.3	57.7	269.0
40.00	220.6	57.7	278.3
41.00	229.9	57.7	287.6
42.00	239.3	57.7	297.0
43.00	248.7	57.7	306.4
44.00	258.2	57.7	315.9

NOTES:

- AN ASTERISK IS PLACED IN THE END-BEARING COLUMN IF THE TIP RESISTANCE IS CONTROLLED BY THE FRICTION OF SOIL PLUG INSIDE AN OPEN-ENDED PIPE PILE.

 * COMPUTE LOAD-DISTRIBUTION AND LOAD-SETTLEMENT *
 * CURVES FOR AXIAL LOADING *

MOVEMENT	T-Z CURVE NO.	NO. OF POINTS	DEPTH TO CURVE FT.	LOAD TRANSFER PSI	PILE IN.
	1	10	0.0000E+00	0.0000E+00	0.0000E+00
				0.0000E+00	0.2240E-01
				0.0000E+00	0.4340E-01
				0.0000E+00	0.7980E-01
				0.0000E+00	0.1120E+00
				0.0000E+00	0.1400E+00
				0.0000E+00	0.2800E+00
				0.0000E+00	0.4200E+00
				0.0000E+00	0.7000E+00
				0.0000E+00	0.2800E+01
	2	10	0.3275E+01	0.0000E+00	0.0000E+00
				0.0000E+00	0.2240E-01
				0.0000E+00	0.4340E-01
				0.0000E+00	0.7980E-01

			0.0000E+00	0.1120E+00
			0.0000E+00	0.1400E+00
			0.0000E+00	0.2800E+00
			0.0000E+00	0.4200E+00
			0.0000E+00	0.7000E+00
			0.0000E+00	0.2800E+01
3	10	0.6458E+01		
			0.0000E+00	0.0000E+00
			0.2882E+01	0.2240E-01
			0.4804E+01	0.4340E-01
			0.7205E+01	0.7980E-01
			0.8646E+01	0.1120E+00
			0.9607E+01	0.1400E+00
			0.8646E+01	0.2800E+00
			0.8646E+01	0.4200E+00
			0.8646E+01	0.7000E+00
			0.8646E+01	0.2800E+01
4	10	0.6500E+01		
			0.0000E+00	0.0000E+00
			0.2884E+01	0.2240E-01
			0.4807E+01	0.4340E-01
			0.7211E+01	0.7980E-01
			0.8653E+01	0.1120E+00
			0.9615E+01	0.1400E+00
			0.9615E+01	0.2800E+00
			0.9615E+01	0.4200E+00
			0.9615E+01	0.7000E+00
			0.9615E+01	0.2800E+01
5	10	0.1003E+02		
			0.0000E+00	0.0000E+00
			0.7268E+00	0.2240E-01
			0.1211E+01	0.4340E-01
			0.1817E+01	0.7980E-01
			0.2180E+01	0.1120E+00
			0.2422E+01	0.1400E+00
			0.2422E+01	0.2800E+00
			0.2422E+01	0.4200E+00
			0.2422E+01	0.7000E+00
			0.2422E+01	0.2800E+01
6	10	0.1346E+02		
			0.0000E+00	0.0000E+00
			0.1114E+01	0.2240E-01
			0.1856E+01	0.4340E-01
			0.2785E+01	0.7980E-01
			0.3342E+01	0.1120E+00
			0.3713E+01	0.1400E+00
			0.3713E+01	0.2800E+00
			0.3713E+01	0.4200E+00
			0.3713E+01	0.7000E+00
			0.3713E+01	0.2800E+01
7	10	0.1350E+02		
			0.0000E+00	0.0000E+00
			0.1119E+01	0.2240E-01
			0.1866E+01	0.4340E-01

			0.2798E+01	0.7980E-01
			0.3358E+01	0.1120E+00
			0.3731E+01	0.1400E+00
			0.3358E+01	0.2800E+00
			0.3358E+01	0.4200E+00
			0.3358E+01	0.7000E+00
			0.3358E+01	0.2800E+01
8	10	0.1653E+02	0.0000E+00	0.0000E+00
			0.7161E+01	0.2240E-01
			0.1194E+02	0.4340E-01
			0.1790E+02	0.7980E-01
			0.2148E+02	0.1120E+00
			0.2387E+02	0.1400E+00
			0.2148E+02	0.2800E+00
			0.2148E+02	0.4200E+00
			0.2148E+02	0.7000E+00
			0.2148E+02	0.2800E+01
9	10	0.1946E+02	0.0000E+00	0.0000E+00
			0.5168E+01	0.2240E-01
			0.8613E+01	0.4340E-01
			0.1292E+02	0.7980E-01
			0.1550E+02	0.1120E+00
			0.1723E+02	0.1400E+00
			0.1550E+02	0.2800E+00
			0.1550E+02	0.4200E+00
			0.1550E+02	0.7000E+00
			0.1550E+02	0.2800E+01
10	10	0.1950E+02	0.0000E+00	0.0000E+00
			0.5072E+01	0.2240E-01
			0.8453E+01	0.4340E-01
			0.1268E+02	0.7980E-01
			0.1521E+02	0.1120E+00
			0.1691E+02	0.1400E+00
			0.1521E+02	0.2800E+00
			0.1521E+02	0.4200E+00
			0.1521E+02	0.7000E+00
			0.1521E+02	0.2800E+01
11	10	0.3403E+02	0.0000E+00	0.0000E+00
			0.6719E+01	0.2240E-01
			0.1120E+02	0.4340E-01
			0.1680E+02	0.7980E-01
			0.2016E+02	0.1120E+00
			0.2240E+02	0.1400E+00
			0.2016E+02	0.2800E+00
			0.2016E+02	0.4200E+00
			0.2016E+02	0.7000E+00
			0.2016E+02	0.2800E+01
12	10	0.4846E+02	0.0000E+00	0.0000E+00
			0.6719E+01	0.2240E-01

0.1120E+02	0.4340E-01
0.1680E+02	0.7980E-01
0.2016E+02	0.1120E+00
0.2240E+02	0.1400E+00
0.2016E+02	0.2800E+00
0.2016E+02	0.4200E+00
0.2016E+02	0.7000E+00
0.2016E+02	0.2800E+01

TIP LOAD KIP	TIP MOVEMENT IN.
0.0000E+00	0.0000E+00
0.3608E+01	0.7000E-02
0.7216E+01	0.1400E-01
0.1443E+02	0.2800E-01
0.2886E+02	0.1820E+00
0.4330E+02	0.5880E+00
0.5195E+02	0.1022E+01
0.5773E+02	0.1400E+01
0.5773E+02	0.2100E+01
0.5773E+02	0.2800E+01

LOAD VERSUS SETTLEMENT CURVE

TOP LOAD KIP	TOP MOVEMENT IN.	TIP LOAD KIP	TIP MOVEMENT IN.
0.9814E+00	0.5844E-03	0.5154E-01	0.1000E-03
0.9814E+01	0.5844E-02	0.5154E+00	0.1000E-02
0.5011E+02	0.2964E-01	0.2577E+01	0.5000E-02
0.9701E+02	0.5864E-01	0.5154E+01	0.1000E-01
0.1712E+03	0.1092E+00	0.1031E+02	0.2000E-01
0.2890E+03	0.2065E+00	0.1649E+02	0.5000E-01
0.3519E+03	0.2766E+00	0.1930E+02	0.8000E-01
0.3742E+03	0.3128E+00	0.2118E+02	0.1000E+00
0.3810E+03	0.4232E+00	0.2950E+02	0.2000E+00
0.3812E+03	0.7251E+00	0.4017E+02	0.5000E+00
0.3885E+03	0.1032E+01	0.4752E+02	0.8000E+00
0.3925E+03	0.1235E+01	0.5152E+02	0.1000E+01
0.3987E+03	0.2241E+01	0.5773E+02	0.2000E+01

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APILE for Windows, Version 2019.9.3

Serial Number : 138584419

A Program for Analyzing the Axial Capacity
and Short-term Settlement of Driven Piles
under Axial Loading.
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Path to file locations : \\Dayton-fs1\PROJECTS\2021\GEO
Projects\01051704 - LJB, Inc. - Spruce Avenue Bridge Replacement (SHE-
SPRUC-02270) - ODOT PID 114201 - Sidney, Ohio\Pile Analysis\Ray\Andy's
Updated with New Elevations\
Name of input data file : 14-Inch CIPRC Pile - B-003-0-21 rf no
batter.ap9d
Name of output file : 14-Inch CIPRC Pile - B-003-0-21 rf no
batter.ap9o
Name of plot output file : 14-Inch CIPRC Pile - B-003-0-21 rf no
batter.ap9p

Time and Date of Analysis

Date: May 12, 2023 Time: 10:56:59

1

* INPUT INFORMATION *

SHE-Spruce-02.27 - 14" CIPRC Pile - B-003-0-21

DESIGNER : PSI

JOB NUMBER : 01051704

METHOD FOR UNIT LOAD TRANSFERS :

- FHWA (Federal Highway Administration)
Unfactored Unit Side Friction and Unit Side Resistance are
used.

COMPUTATION METHOD(S) FOR PILE CAPACITY :

- FHWA (Federal Highway Administration)
- API RP 2A (American Petroleum Institute)

TYPE OF LOADING :

- COMPRESSION

PILE TYPE :

Steel pipe pile or non-tapered portion of monotube pile
- Close-Ended Pile

DATA FOR AXIAL STIFFNESS :

- MODULUS OF ELASTICITY = 0.290E+08 PSI
- CROSS SECTION AREA = 21.21 IN²

CIRCULAR PILE PROPERTIES :

- OUTSIDE DIAMETER, OD = 14.00 IN.
- INTERNAL DIAMETER, ID = 13.00 IN.
- TOTAL PILE LENGTH, TL = 55.00 FT.
- BATTER ANGLE = 0.00 DEG
- PILE STICKUP LENGTH, PSL = 0.50 FT.
- ZERO FRICTION LENGTH, ZFL = 5.00 FT.
- INCREMENT OF PILE LENGTH
USED IN COMPUTATION = 1.00 FT.
- LENGTH OF ENHANCED
END SECTION = 55.00 FT.
- INTERNAL DIAMETER OF
ENHANCED END SECTION = 13.00 IN.

PLUGGED/UNPLUGGED CONDITIONS :

Internal Pile Plug Calculated by Program

SOIL INFORMATIONS :

DEPTH FT.	SOIL TYPE	LATERAL EARTH PRESSURE	EFFECTIVE UNIT WEIGHT LB/FT^3	FRICTION ANGLE DEGREES	BEARING CAPACITY FACTOR
0.00	CLAY	0.80*	120.00	0.00	8.00**
8.00	CLAY	0.80*	120.00	0.00	8.00**
8.00	CLAY	0.80*	125.00	0.00	8.00**
10.00	CLAY	0.80*	125.00	0.00	8.00**
10.00	SAND	0.80*	77.60	32.00	28.00**
13.00	SAND	0.80*	77.60	32.00	28.00**
13.00	CLAY	0.80*	62.60	0.00	8.00**
36.00	CLAY	0.80*	62.60	0.00	8.00**
36.00	CLAY	0.80*	67.60	0.00	8.00**
52.00	CLAY	0.80*	67.60	0.00	8.00**
52.00	CLAY	0.80*	67.60	0.00	8.00**
60.00	CLAY	0.80*	67.60	0.00	8.00**

* VALUE ASSUMED BY THE PROGRAM

** VALUE ESTIMATED BY THE PROGRAM BASED ON FRICTION ANGLE

END	MAXIMUM UNIT	MAXIMUM UNIT	UNDISTURB SHEAR	REMOLDED SHEAR	BLOW COUNT	UNIT SKIN FRICTION	UNIT
BEARING	FRICTION	BEARING	STRENGTH	STRENGTH			
KSF	KSF	KSF	KSF	KSF		KSF	
0.00	0.10E+08*	0.10E+08*	1.50	0.00	0.00	0.00	
0.00	0.10E+08*	0.10E+08*	2.00	0.00	0.00	0.00	
0.00	0.10E+08*	0.10E+08*	4.00	0.00	0.00	0.00	
0.00	0.10E+08*	0.10E+08*	4.00	0.00	0.00	0.00	
0.00	0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	
0.00	0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	
0.00	0.10E+08*	0.10E+08*	4.00	0.00	0.00	0.00	
0.00	0.10E+08*	0.10E+08*	3.00	0.00	0.00	0.00	
0.00	0.10E+08*	0.10E+08*	6.00	0.00	0.00	0.00	
0.00	0.10E+08*	0.10E+08*	6.00	0.00	0.00	0.00	

0.00	0.10E+08*	0.10E+08*	5.00	0.00	0.00	0.00
0.00	0.10E+08*	0.10E+08*	5.00	0.00	0.00	0.00

* MAXIMUM UNIT FRICTION AND/OR MAXIMUM UNIT BEARING
WERE SET TO BE 0.10E+08 BECAUSE THE USER DOES NOT
PLAN TO LIMIT THE COMPUTED DATA.

DEPTH FT.	LRFD FACTOR ON UNIT FRICTION	LRFD FACTOR ON UNIT BEARING
0.00	1.000	1.000
8.00	1.000	1.000
8.00	1.000	1.000
10.00	1.000	1.000
10.00	1.000	1.000
13.00	1.000	1.000
13.00	1.000	1.000
36.00	1.000	1.000
36.00	1.000	1.000
52.00	1.000	1.000
52.00	1.000	1.000
60.00	1.000	1.000

1

* COMPUTATION RESULT *

* FED. HWY. METHOD *

PILE PENETRATION FT.	TOTAL SKIN FRICTION KIP	END BEARING KIP	ULTIMATE CAPACITY KIP
0.00	0.0	7.5	7.5
1.00	0.0	7.8	7.8
2.00	0.0	15.6	15.6
3.00	0.0	16.2	16.2
4.00	0.0	16.8	16.8
5.00	2.4	17.4	19.9
6.00	7.4	18.0	25.4
7.00	12.3	22.7	35.0
8.00	17.4	28.6	46.0
9.00	21.8	33.2	55.0

10.00	25.3	36.4	61.7
11.00	28.0	35.5	63.5
12.00	30.1	35.6	65.7
13.00	32.3	36.6	69.0
14.00	37.9	37.3	75.2
15.00	46.6	37.6	84.3
16.00	55.3	37.2	92.5
17.00	63.9	36.8	100.7
18.00	72.4	36.4	108.8
19.00	80.8	36.0	116.7
20.00	89.0	35.6	124.6
21.00	97.2	35.1	132.4
22.00	105.3	34.7	140.1
23.00	113.3	34.3	147.6
24.00	121.2	33.9	155.1
25.00	129.1	33.5	162.5
26.00	136.8	33.0	169.8
27.00	144.4	32.6	177.0
28.00	152.0	32.2	184.2
29.00	159.5	31.8	191.3
30.00	166.9	31.4	198.3
31.00	174.2	31.0	205.2
32.00	181.4	30.5	212.0
33.00	188.6	30.1	218.7
34.00	195.7	29.7	225.4
35.00	202.7	35.5	238.2
36.00	208.6	43.5	252.1
37.00	215.4	51.6	267.0
38.00	224.2	57.7	281.9
39.00	233.0	57.7	290.7
40.00	241.8	57.7	299.5
41.00	250.6	57.7	308.3
42.00	259.4	57.7	317.1
43.00	268.2	57.7	325.9
44.00	277.0	57.7	334.7
45.00	285.8	57.7	343.5
46.00	294.6	57.7	352.3
47.00	303.4	57.7	361.1
48.00	312.2	57.7	369.9
49.00	321.0	57.7	378.7
50.00	329.8	57.7	387.5
51.00	338.6	55.7	394.2
52.00	347.4	52.9	400.3
53.00	355.4	50.2	405.6
54.00	362.8	48.1	410.9

* API RP-2A (2010) *

FILE	TOTAL SKIN	END	ULTIMATE
PENETRATION	FRICTION	BEARING	CAPACITY

FT.	KIP	KIP	KIP
0.00	0.0	7.5	7.5
1.00	0.0	7.8	7.8
2.00	0.0	15.6	15.6
3.00	0.0	16.2	16.2
4.00	0.0	16.8	16.8
5.00	1.2	17.4	18.7
6.00	3.8	18.0	21.9
7.00	6.6	22.7	29.3
8.00	9.5	28.6	38.1
9.00	13.7	34.0	47.7
10.00	19.0	38.4	57.4
11.00	22.7	39.2	61.9
12.00	24.7	39.6	64.3
13.00	26.8	39.6	66.4
14.00	30.7	38.8	69.6
15.00	36.4	37.6	74.1
16.00	42.2	37.2	79.4
17.00	47.9	36.8	84.7
18.00	53.7	36.4	90.1
19.00	59.4	36.0	95.4
20.00	65.2	35.6	100.7
21.00	70.9	35.1	106.0
22.00	76.6	34.7	111.4
23.00	82.4	34.3	116.7
24.00	88.1	33.9	122.0
25.00	93.8	33.5	127.3
26.00	99.5	33.0	132.6
27.00	105.2	32.6	137.8
28.00	110.9	32.2	143.1
29.00	116.5	31.8	148.3
30.00	122.2	31.4	153.5
31.00	127.8	31.0	158.7
32.00	133.4	30.5	163.9
33.00	138.9	30.1	169.0
34.00	144.5	29.7	174.2
35.00	150.0	35.5	185.5
36.00	155.5	43.5	199.0
37.00	162.8	51.6	214.4
38.00	172.0	57.7	229.8
39.00	181.3	57.7	239.1
40.00	190.7	57.7	248.4
41.00	200.1	57.7	257.8
42.00	209.5	57.7	267.2
43.00	219.0	57.7	276.7
44.00	228.5	57.7	286.2
45.00	238.1	57.7	295.8
46.00	247.7	57.7	305.4
47.00	257.4	57.7	315.1
48.00	267.1	57.7	324.8
49.00	276.9	57.7	334.6
50.00	286.7	57.7	344.4
51.00	296.5	55.7	352.2
52.00	306.4	52.9	359.3

53.00	315.7	50.2	365.9
54.00	324.4	48.1	372.5

NOTES:

- AN ASTERISK IS PLACED IN THE END-BEARING COLUMN
IF THE TIP RESISTANCE IS CONTROLLED BY THE FRICTION
OF SOIL PLUG INSIDE AN OPEN-ENDED PIPE PILE.

* COMPUTE LOAD-DISTRIBUTION AND LOAD-SETTLEMENT *
* CURVES FOR AXIAL LOADING *

MOVEMENT	T-Z CURVE NO.	NO. OF POINTS	DEPTH TO CURVE FT.	LOAD TRANSFER PSI	PILE IN.
	1	10	0.0000E+00	0.0000E+00	0.0000E+00
				0.0000E+00	0.2240E-01
				0.0000E+00	0.4340E-01
				0.0000E+00	0.7980E-01
				0.0000E+00	0.1120E+00
				0.0000E+00	0.1400E+00
				0.0000E+00	0.2800E+00
				0.0000E+00	0.4200E+00
				0.0000E+00	0.7000E+00
				0.0000E+00	0.2800E+01
	2	10	0.4025E+01	0.0000E+00	0.0000E+00
				0.6955E-01	0.2240E-01
				0.1159E+00	0.4340E-01
				0.1739E+00	0.7980E-01
				0.2087E+00	0.1120E+00
				0.2318E+00	0.1400E+00
				0.2087E+00	0.2800E+00
				0.2087E+00	0.4200E+00
				0.2087E+00	0.7000E+00
				0.2087E+00	0.2800E+01
	3	10	0.7958E+01	0.0000E+00	0.0000E+00
				0.2959E+01	0.2240E-01
				0.4932E+01	0.4340E-01
				0.7398E+01	0.7980E-01
				0.8877E+01	0.1120E+00
				0.9864E+01	0.1400E+00
				0.8877E+01	0.2800E+00
				0.8877E+01	0.4200E+00
				0.8877E+01	0.7000E+00
				0.8877E+01	0.2800E+01

4	10	0.8000E+01	0.0000E+00	0.0000E+00
			0.2964E+01	0.2240E-01
			0.4941E+01	0.4340E-01
			0.7411E+01	0.7980E-01
			0.8893E+01	0.1120E+00
			0.9881E+01	0.1400E+00
			0.8893E+01	0.2800E+00
			0.8893E+01	0.4200E+00
			0.8893E+01	0.7000E+00
			0.8893E+01	0.2800E+01
5	10	0.9025E+01	0.0000E+00	0.0000E+00
			0.1983E+01	0.2240E-01
			0.3306E+01	0.4340E-01
			0.4959E+01	0.7980E-01
			0.5950E+01	0.1120E+00
			0.6612E+01	0.1400E+00
			0.5950E+01	0.2800E+00
			0.5950E+01	0.4200E+00
			0.5950E+01	0.7000E+00
			0.5950E+01	0.2800E+01
6	10	0.9958E+01	0.0000E+00	0.0000E+00
			0.1989E+01	0.2240E-01
			0.3315E+01	0.4340E-01
			0.4973E+01	0.7980E-01
			0.5968E+01	0.1120E+00
			0.6631E+01	0.1400E+00
			0.5968E+01	0.2800E+00
			0.5968E+01	0.4200E+00
			0.5968E+01	0.7000E+00
			0.5968E+01	0.2800E+01
7	10	0.1000E+02	0.0000E+00	0.0000E+00
			0.1989E+01	0.2240E-01
			0.3316E+01	0.4340E-01
			0.4974E+01	0.7980E-01
			0.5968E+01	0.1120E+00
			0.6631E+01	0.1400E+00
			0.6631E+01	0.2800E+00
			0.6631E+01	0.4200E+00
			0.6631E+01	0.7000E+00
			0.6631E+01	0.2800E+01
8	10	0.1153E+02	0.0000E+00	0.0000E+00
			0.1180E+01	0.2240E-01
			0.1967E+01	0.4340E-01
			0.2951E+01	0.7980E-01
			0.3541E+01	0.1120E+00
			0.3935E+01	0.1400E+00
			0.3935E+01	0.2800E+00
			0.3935E+01	0.4200E+00
			0.3935E+01	0.7000E+00

9	10	0.1296E+02	0.3935E+01	0.2800E+01
			0.0000E+00	0.0000E+00
			0.1279E+01	0.2240E-01
			0.2132E+01	0.4340E-01
			0.3198E+01	0.7980E-01
			0.3838E+01	0.1120E+00
			0.4264E+01	0.1400E+00
			0.4264E+01	0.2800E+00
			0.4264E+01	0.4200E+00
			0.4264E+01	0.7000E+00
			0.4264E+01	0.2800E+01
10	10	0.1300E+02	0.0000E+00	0.0000E+00
			0.1282E+01	0.2240E-01
			0.2137E+01	0.4340E-01
			0.3205E+01	0.7980E-01
			0.3847E+01	0.1120E+00
			0.4274E+01	0.1400E+00
			0.3847E+01	0.2800E+00
			0.3847E+01	0.4200E+00
			0.3847E+01	0.7000E+00
			0.3847E+01	0.2800E+01
11	10	0.2453E+02	0.0000E+00	0.0000E+00
			0.4437E+01	0.2240E-01
			0.7396E+01	0.4340E-01
			0.1109E+02	0.7980E-01
			0.1331E+02	0.1120E+00
			0.1479E+02	0.1400E+00
			0.1331E+02	0.2800E+00
			0.1331E+02	0.4200E+00
			0.1331E+02	0.7000E+00
			0.1331E+02	0.2800E+01
12	10	0.3596E+02	0.0000E+00	0.0000E+00
			0.2809E+01	0.2240E-01
			0.4681E+01	0.4340E-01
			0.7022E+01	0.7980E-01
			0.8426E+01	0.1120E+00
			0.9363E+01	0.1400E+00
			0.8426E+01	0.2800E+00
			0.8426E+01	0.4200E+00
			0.8426E+01	0.7000E+00
			0.8426E+01	0.2800E+01
13	10	0.3600E+02	0.0000E+00	0.0000E+00
			0.2759E+01	0.2240E-01
			0.4598E+01	0.4340E-01
			0.6897E+01	0.7980E-01
			0.8277E+01	0.1120E+00
			0.9197E+01	0.1400E+00
			0.8277E+01	0.2800E+00
			0.8277E+01	0.4200E+00

14	10	0.4403E+02	0.8277E+01	0.7000E+00
			0.8277E+01	0.2800E+01
			0.0000E+00	0.0000E+00
			0.5000E+01	0.2240E-01
			0.8333E+01	0.4340E-01
			0.1250E+02	0.7980E-01
			0.1500E+02	0.1120E+00
			0.1667E+02	0.1400E+00
			0.1500E+02	0.2800E+00
			0.1500E+02	0.4200E+00
			0.1500E+02	0.7000E+00
			0.1500E+02	0.2800E+01
			0.0000E+00	0.0000E+00
			0.5000E+01	0.2240E-01
15	10	0.5196E+02	0.8333E+01	0.4340E-01
			0.1250E+02	0.7980E-01
			0.1500E+02	0.1120E+00
			0.1667E+02	0.1400E+00
			0.1500E+02	0.2800E+00
			0.1500E+02	0.4200E+00
			0.1500E+02	0.7000E+00
			0.1500E+02	0.2800E+01
			0.0000E+00	0.0000E+00
			0.5000E+01	0.2240E-01
			0.8333E+01	0.4340E-01
			0.1250E+02	0.7980E-01
			0.1500E+02	0.1120E+00
			0.1667E+02	0.1400E+00
16	10	0.5200E+02	0.1500E+02	0.2800E+00
			0.1500E+02	0.4200E+00
			0.1500E+02	0.7000E+00
			0.1500E+02	0.2800E+01
			0.0000E+00	0.0000E+00
			0.5000E+01	0.2240E-01
			0.8333E+01	0.4340E-01
			0.1250E+02	0.7980E-01
			0.1500E+02	0.1120E+00
			0.1667E+02	0.1400E+00
			0.1500E+02	0.2800E+00
			0.1500E+02	0.4200E+00
			0.1500E+02	0.7000E+00
			0.1500E+02	0.2800E+01
17	10	0.5603E+02	0.0000E+00	0.0000E+00
			0.4167E+01	0.2240E-01
			0.6944E+01	0.4340E-01
			0.1042E+02	0.7980E-01
			0.1250E+02	0.1120E+00
			0.1389E+02	0.1400E+00
			0.1250E+02	0.2800E+00
			0.1250E+02	0.4200E+00
			0.1250E+02	0.7000E+00
			0.1250E+02	0.2800E+01
			0.0000E+00	0.0000E+00
			0.4167E+01	0.2240E-01
			0.6944E+01	0.4340E-01
			0.1042E+02	0.7980E-01
18	10	0.5996E+02	0.1250E+02	0.1120E+00
			0.1389E+02	0.1400E+00
			0.1250E+02	0.2800E+00
			0.1250E+02	0.4200E+00
			0.1250E+02	0.7000E+00
			0.1250E+02	0.2800E+01
			0.0000E+00	0.0000E+00
			0.4167E+01	0.2240E-01
			0.6944E+01	0.4340E-01
			0.1042E+02	0.7980E-01
			0.1250E+02	0.1120E+00
			0.1389E+02	0.1400E+00
			0.1250E+02	0.2800E+00
			0.1250E+02	0.4200E+00
			0.1250E+02	0.7000E+00

0.1250E+02	0.4200E+00
0.1250E+02	0.7000E+00
0.1250E+02	0.2800E+01

TIP LOAD KIP	TIP MOVEMENT IN.
0.0000E+00	0.0000E+00
0.3007E+01	0.7000E-02
0.6013E+01	0.1400E-01
0.1203E+02	0.2800E-01
0.2405E+02	0.1820E+00
0.3608E+02	0.5880E+00
0.4330E+02	0.1022E+01
0.4811E+02	0.1400E+01
0.4811E+02	0.2100E+01
0.4811E+02	0.2800E+01

LOAD VERSUS SETTLEMENT CURVE

TOP LOAD KIP	TOP MOVEMENT IN.	TIP LOAD KIP	TIP MOVEMENT IN.
0.1107E+01	0.6719E-03	0.4295E-01	0.1000E-03
0.1108E+02	0.6720E-02	0.4295E+00	0.1000E-02
0.5616E+02	0.3399E-01	0.2148E+01	0.5000E-02
0.1056E+03	0.6636E-01	0.4295E+01	0.1000E-01
0.1807E+03	0.1216E+00	0.8590E+01	0.2000E-01
0.2918E+03	0.2246E+00	0.1374E+02	0.5000E-01
0.3421E+03	0.2953E+00	0.1609E+02	0.8000E-01
0.3592E+03	0.3316E+00	0.1765E+02	0.1000E+00
0.3638E+03	0.4420E+00	0.2459E+02	0.2000E+00
0.3639E+03	0.7439E+00	0.3347E+02	0.5000E+00
0.3700E+03	0.1050E+01	0.3960E+02	0.8000E+00
0.3734E+03	0.1254E+01	0.4293E+02	0.1000E+01
0.3785E+03	0.2260E+01	0.4811E+02	0.2000E+01

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APILE for Windows, Version 2019.9.3

Serial Number : 138584419

A Program for Analyzing the Axial Capacity
and Short-term Settlement of Driven Piles
under Axial Loading.
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Path to file locations : \\Dayton-fs1\PROJECTS\2021\GEO
Projects\01051704 - LJB, Inc. - Spruce Avenue Bridge Replacement (SHE-
SPRUC-02270) - ODOT PID 114201 - Sidney, Ohio\Pile Analysis\Ray\Andy's
Updated with New Elevations\
Name of input data file : 14-Inch CIPRC Pile - B-004-0-21 rf no
batter.ap9d
Name of output file : 14-Inch CIPRC Pile - B-004-0-21 rf no
batter.ap9o
Name of plot output file : 14-Inch CIPRC Pile - B-004-0-21 rf no
batter.ap9p

Time and Date of Analysis

Date: May 12, 2023 Time: 10:58:33

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* INPUT INFORMATION *

SHE-Spruce-02.27 - 14" CIPRC Pile - B-004-0-21

DESIGNER : PSI

JOB NUMBER : 01051704

METHOD FOR UNIT LOAD TRANSFERS :

- FHWA (Federal Highway Administration)
Unfactored Unit Side Friction and Unit Side Resistance are
used.

COMPUTATION METHOD(S) FOR PILE CAPACITY :

- FHWA (Federal Highway Administration)
- API RP 2A (American Petroleum Institute)

TYPE OF LOADING :

- COMPRESSION

PILE TYPE :

Steel pipe pile or non-tapered portion of monotube pile
- Close-Ended Pile

DATA FOR AXIAL STIFFNESS :

- MODULUS OF ELASTICITY = 0.290E+08 PSI
- CROSS SECTION AREA = 21.21 IN²

CIRCULAR PILE PROPERTIES :

- OUTSIDE DIAMETER, OD = 14.00 IN.
- INTERNAL DIAMETER, ID = 13.00 IN.
- TOTAL PILE LENGTH, TL = 50.00 FT.
- BATTER ANGLE = 0.00 DEG
- PILE STICKUP LENGTH, PSL = 0.50 FT.
- ZERO FRICTION LENGTH, ZFL = 5.00 FT.
- INCREMENT OF PILE LENGTH
USED IN COMPUTATION = 1.00 FT.
- LENGTH OF ENHANCED
END SECTION = 50.00 FT.
- INTERNAL DIAMETER OF
ENHANCED END SECTION = 13.00 IN.

PLUGGED/UNPLUGGED CONDITIONS :

Internal Pile Plug Calculated by Program

SOIL INFORMATIONS :

DEPTH FT.	SOIL TYPE	LATERAL EARTH PRESSURE	EFFECTIVE UNIT WEIGHT LB/FT^3	FRICITION ANGLE DEGREES	BEARING CAPACITY FACTOR
0.00	CLAY	0.80*	62.60	0.00	8.00**
6.50	CLAY	0.80*	67.60	0.00	8.00**
6.50	CLAY	0.80*	62.60	0.00	8.00**
21.50	CLAY	0.80*	57.60	0.00	8.00**
21.50	SAND	0.80*	77.60	32.00	28.00
25.50	SAND	0.80*	77.60	32.00	28.00
25.50	CLAY	0.80*	62.60	0.00	8.00**
45.50	CLAY	0.80*	67.60	0.00	8.00**
45.50	CLAY	0.80*	67.60	0.00	8.00**
53.50	CLAY	0.80*	67.60	0.00	8.00**

* VALUE ASSUMED BY THE PROGRAM

** VALUE ESTIMATED BY THE PROGRAM BASED ON FRICTION ANGLE

END	MAXIMUM UNIT	MAXIMUM UNIT	UNDISTURB SHEAR	REMOLDED SHEAR	BLOW COUNT	UNIT SKIN FRICTION	UNIT
BEARING	FRICITION	BEARING	STRENGTH	STRENGTH			
KSF	KSF	KSF	KSF	KSF		KSF	
0.00	0.10E+08*	0.10E+08*	1.50	0.00	0.00	0.00	
0.00	0.10E+08*	0.10E+08*	2.00	0.00	0.00	0.00	
0.00	0.10E+08*	0.10E+08*	1.50	0.00	0.00	0.00	
0.00	0.10E+08*	0.10E+08*	1.00	0.00	0.00	0.00	
0.00	0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	
0.00	0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	
0.00	0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	
0.00	0.10E+08*	0.10E+08*	4.50	0.00	0.00	0.00	
0.00	0.10E+08*	0.10E+08*	5.50	0.00	0.00	0.00	
0.00	0.10E+08*	0.10E+08*	6.00	0.00	0.00	0.00	
0.00	0.10E+08*	0.10E+08*	6.00	0.00	0.00	0.00	

* MAXIMUM UNIT FRICTION AND/OR MAXIMUM UNIT BEARING
WERE SET TO BE 0.10E+08 BECAUSE THE USER DOES NOT

PLAN TO LIMIT THE COMPUTED DATA.

DEPTH FT.	LRFD FACTOR ON UNIT FRICTION	LRFD FACTOR ON UNIT BEARING
0.00	1.000	1.000
6.50	1.000	1.000
6.50	1.000	1.000
21.50	1.000	1.000
21.50	1.000	1.000
25.50	1.000	1.000
25.50	1.000	1.000
45.50	1.000	1.000
45.50	1.000	1.000
53.50	1.000	1.000

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 * COMPUTATION RESULT *

 * FED. HWY. METHOD *

PILE PENETRATION FT.	TOTAL SKIN FRICTION KIP	END BEARING KIP	ULTIMATE CAPACITY KIP
0.00	0.0	7.6	7.6
1.00	0.0	7.9	7.9
2.00	0.0	15.9	15.9
3.00	0.0	16.7	16.7
4.00	0.0	17.4	17.4
5.00	2.5	18.1	20.6
6.00	7.5	17.6	25.1
7.00	12.7	16.4	29.2
8.00	17.9	15.0	32.8
9.00	22.6	13.6	36.2
10.00	27.2	13.3	40.5
11.00	31.7	13.0	44.7
12.00	36.1	12.7	48.8
13.00	40.5	12.3	52.8
14.00	44.7	12.0	56.8
15.00	48.9	11.7	60.6
16.00	53.0	11.4	64.4
17.00	57.0	11.1	68.1
18.00	60.9	10.7	71.6

19.00	64.7	10.4	75.1
20.00	68.4	10.1	78.5
21.00	72.1	15.3	87.4
22.00	75.7	22.5	98.2
23.00	78.5	29.8	108.3
24.00	80.8	35.3	116.1
25.00	83.3	37.1	120.4
26.00	85.8	39.6	125.4
27.00	91.1	42.3	133.4
28.00	99.1	44.5	143.6
29.00	107.2	45.0	152.2
30.00	115.4	45.5	160.8
31.00	123.6	45.9	169.6
32.00	132.0	46.4	178.4
33.00	140.4	46.9	187.3
34.00	149.0	47.4	196.4
35.00	157.6	47.9	205.5
36.00	166.3	48.3	214.6
37.00	175.1	48.8	223.9
38.00	184.0	49.3	233.3
39.00	192.9	49.8	242.7
40.00	202.0	50.3	252.3
41.00	211.1	50.8	261.9
42.00	220.4	51.2	271.6
43.00	229.7	51.7	281.4
44.00	239.1	52.2	291.3
45.00	247.8	53.6	301.4
46.00	256.0	55.2	311.2
47.00	264.8	56.7	321.5
48.00	274.0	57.7	331.7
49.00	283.2	57.7	340.9

 * API RP-2A (2010) *

PILE PENETRATION FT.	TOTAL SKIN FRICTION KIP	END BEARING KIP	ULTIMATE CAPACITY KIP
0.00	0.0	7.6	7.6
1.00	0.0	7.9	7.9
2.00	0.0	15.9	15.9
3.00	0.0	16.7	16.7
4.00	0.0	17.4	17.4
5.00	1.1	18.1	19.2
6.00	3.4	17.6	21.0
7.00	5.8	16.4	22.3
8.00	8.1	15.0	23.1
9.00	10.2	13.6	23.8
10.00	12.3	13.3	25.6
11.00	14.4	13.0	27.4
12.00	16.6	12.7	29.2

13.00	18.7	12.3	31.0
14.00	20.8	12.0	32.8
15.00	22.9	11.7	34.6
16.00	25.0	11.4	36.4
17.00	27.1	11.1	38.2
18.00	29.2	10.7	40.0
19.00	31.3	10.4	41.7
20.00	33.4	10.1	43.5
21.00	35.5	16.7	52.2
22.00	37.6	26.2	63.8
23.00	39.8	36.5	76.2
24.00	42.0	45.2	87.2
25.00	44.3	46.1	90.4
26.00	46.7	45.9	92.6
27.00	51.2	45.2	96.5
28.00	57.8	44.5	102.3
29.00	64.6	45.0	109.5
30.00	71.4	45.5	116.8
31.00	78.3	45.9	124.3
32.00	85.4	46.4	131.8
33.00	92.5	46.9	139.4
34.00	99.8	47.4	147.2
35.00	107.2	47.9	155.1
36.00	114.7	48.3	163.0
37.00	122.3	48.8	171.1
38.00	130.0	49.3	179.3
39.00	137.9	49.8	187.6
40.00	145.8	50.3	196.1
41.00	153.8	50.8	204.6
42.00	162.0	51.2	213.2
43.00	170.2	51.7	222.0
44.00	178.6	52.2	230.8
45.00	187.1	53.6	240.7
46.00	195.7	55.2	250.9
47.00	204.6	56.7	261.3
48.00	213.9	57.7	271.7
49.00	223.3	57.7	281.0

NOTES:

- AN ASTERISK IS PLACED IN THE END-BEARING COLUMN IF THE TIP RESISTANCE IS CONTROLLED BY THE FRICTION OF SOIL PLUG INSIDE AN OPEN-ENDED PIPE PILE.

 * COMPUTE LOAD-DISTRIBUTION AND LOAD-SETTLEMENT *
 * CURVES FOR AXIAL LOADING *

T-Z CURVE NO. OF DEPTH TO CURVE LOAD TRANSFER PILE
 MOVEMENT

NO.	POINTS	FT.	PSI	IN.
1	10	0.0000E+00	0.0000E+00	0.0000E+00
			0.0000E+00	0.2240E-01
			0.0000E+00	0.4340E-01
			0.0000E+00	0.7980E-01
			0.0000E+00	0.1120E+00
			0.0000E+00	0.1400E+00
			0.0000E+00	0.2800E+00
			0.0000E+00	0.4200E+00
			0.0000E+00	0.7000E+00
			0.0000E+00	0.2800E+01
2	10	0.3275E+01	0.0000E+00	0.0000E+00
			0.0000E+00	0.2240E-01
			0.0000E+00	0.4340E-01
			0.0000E+00	0.7980E-01
			0.0000E+00	0.1120E+00
			0.0000E+00	0.1400E+00
			0.0000E+00	0.2800E+00
			0.0000E+00	0.4200E+00
			0.0000E+00	0.7000E+00
			0.0000E+00	0.2800E+01
3	10	0.6458E+01	0.0000E+00	0.0000E+00
			0.2985E+01	0.2240E-01
			0.4975E+01	0.4340E-01
			0.7462E+01	0.7980E-01
			0.8954E+01	0.1120E+00
			0.9949E+01	0.1400E+00
			0.8954E+01	0.2800E+00
			0.8954E+01	0.4200E+00
			0.8954E+01	0.7000E+00
			0.8954E+01	0.2800E+01
4	10	0.6500E+01	0.0000E+00	0.0000E+00
			0.2995E+01	0.2240E-01
			0.4991E+01	0.4340E-01
			0.7487E+01	0.7980E-01
			0.8984E+01	0.1120E+00
			0.9983E+01	0.1400E+00
			0.8984E+01	0.2800E+00
			0.8984E+01	0.4200E+00
			0.8984E+01	0.7000E+00
			0.8984E+01	0.2800E+01
5	10	0.1403E+02	0.0000E+00	0.0000E+00
			0.2396E+01	0.2240E-01
			0.3994E+01	0.4340E-01
			0.5991E+01	0.7980E-01
			0.7189E+01	0.1120E+00
			0.7988E+01	0.1400E+00
			0.7189E+01	0.2800E+00

6	10	0.2146E+02	0.7189E+01	0.4200E+00
			0.7189E+01	0.7000E+00
			0.7189E+01	0.2800E+01
			0.0000E+00	0.0000E+00
			0.2048E+01	0.2240E-01
			0.3414E+01	0.4340E-01
			0.5121E+01	0.7980E-01
			0.6145E+01	0.1120E+00
			0.6828E+01	0.1400E+00
			0.6145E+01	0.2800E+00
7	10	0.2150E+02	0.6145E+01	0.4200E+00
			0.6145E+01	0.7000E+00
			0.6145E+01	0.2800E+01
			0.0000E+00	0.0000E+00
			0.2044E+01	0.2240E-01
			0.3406E+01	0.4340E-01
			0.5109E+01	0.7980E-01
			0.6131E+01	0.1120E+00
			0.6812E+01	0.1400E+00
			0.6812E+01	0.2800E+00
8	10	0.2353E+02	0.6812E+01	0.4200E+00
			0.6812E+01	0.7000E+00
			0.6812E+01	0.2800E+01
			0.0000E+00	0.0000E+00
			0.1310E+01	0.2240E-01
			0.2184E+01	0.4340E-01
			0.3276E+01	0.7980E-01
			0.3931E+01	0.1120E+00
			0.4368E+01	0.1400E+00
			0.4368E+01	0.2800E+00
9	10	0.2546E+02	0.4368E+01	0.4200E+00
			0.4368E+01	0.7000E+00
			0.4368E+01	0.2800E+01
			0.0000E+00	0.0000E+00
			0.1444E+01	0.2240E-01
			0.2406E+01	0.4340E-01
			0.3609E+01	0.7980E-01
			0.4331E+01	0.1120E+00
			0.4812E+01	0.1400E+00
			0.4812E+01	0.2800E+00
10	10	0.2550E+02	0.4812E+01	0.4200E+00
			0.4812E+01	0.7000E+00
			0.4812E+01	0.2800E+01
			0.0000E+00	0.0000E+00
			0.1446E+01	0.2240E-01
			0.2411E+01	0.4340E-01
			0.3616E+01	0.7980E-01
			0.4339E+01	0.1120E+00
			0.4822E+01	0.1400E+00

			0.4339E+01	0.2800E+00
			0.4339E+01	0.4200E+00
			0.4339E+01	0.7000E+00
			0.4339E+01	0.2800E+01
11	10	0.3553E+02		
			0.0000E+00	0.0000E+00
			0.4950E+01	0.2240E-01
			0.8251E+01	0.4340E-01
			0.1238E+02	0.7980E-01
			0.1485E+02	0.1120E+00
			0.1650E+02	0.1400E+00
			0.1485E+02	0.2800E+00
			0.1485E+02	0.4200E+00
			0.1485E+02	0.7000E+00
			0.1485E+02	0.2800E+01
12	10	0.4546E+02		
			0.0000E+00	0.0000E+00
			0.4653E+01	0.2240E-01
			0.7754E+01	0.4340E-01
			0.1163E+02	0.7980E-01
			0.1396E+02	0.1120E+00
			0.1551E+02	0.1400E+00
			0.1396E+02	0.2800E+00
			0.1396E+02	0.4200E+00
			0.1396E+02	0.7000E+00
			0.1396E+02	0.2800E+01
13	10	0.4550E+02		
			0.0000E+00	0.0000E+00
			0.4663E+01	0.2240E-01
			0.7771E+01	0.4340E-01
			0.1166E+02	0.7980E-01
			0.1399E+02	0.1120E+00
			0.1554E+02	0.1400E+00
			0.1399E+02	0.2800E+00
			0.1399E+02	0.4200E+00
			0.1399E+02	0.7000E+00
			0.1399E+02	0.2800E+01
14	10	0.4953E+02		
			0.0000E+00	0.0000E+00
			0.5219E+01	0.2240E-01
			0.8698E+01	0.4340E-01
			0.1305E+02	0.7980E-01
			0.1566E+02	0.1120E+00
			0.1740E+02	0.1400E+00
			0.1566E+02	0.2800E+00
			0.1566E+02	0.4200E+00
			0.1566E+02	0.7000E+00
			0.1566E+02	0.2800E+01
15	10	0.5346E+02		
			0.0000E+00	0.0000E+00
			0.5219E+01	0.2240E-01
			0.8698E+01	0.4340E-01
			0.1305E+02	0.7980E-01
			0.1566E+02	0.1120E+00

0.1740E+02	0.1400E+00
0.1566E+02	0.2800E+00
0.1566E+02	0.4200E+00
0.1566E+02	0.7000E+00
0.1566E+02	0.2800E+01

TIP LOAD KIP	TIP MOVEMENT IN.
0.0000E+00	0.0000E+00
0.3608E+01	0.7000E-02
0.7216E+01	0.1400E-01
0.1443E+02	0.2800E-01
0.2886E+02	0.1820E+00
0.4330E+02	0.5880E+00
0.5195E+02	0.1022E+01
0.5773E+02	0.1400E+01
0.5773E+02	0.2100E+01
0.5773E+02	0.2800E+01

LOAD VERSUS SETTLEMENT CURVE

TOP LOAD KIP	TOP MOVEMENT IN.	TIP LOAD KIP	TIP MOVEMENT IN.
0.7627E+00	0.5022E-03	0.5154E-01	0.1000E-03
0.7627E+01	0.5022E-02	0.5154E+00	0.1000E-02
0.3874E+02	0.2533E-01	0.2577E+01	0.5000E-02
0.7458E+02	0.5018E-01	0.5154E+01	0.1000E-01
0.1323E+03	0.9476E-01	0.1031E+02	0.2000E-01
0.2233E+03	0.1822E+00	0.1649E+02	0.5000E-01
0.2691E+03	0.2467E+00	0.1930E+02	0.8000E-01
0.2878E+03	0.2821E+00	0.2118E+02	0.1000E+00
0.2981E+03	0.3950E+00	0.2950E+02	0.2000E+00
0.3002E+03	0.6987E+00	0.4017E+02	0.5000E+00
0.3076E+03	0.1006E+01	0.4752E+02	0.8000E+00
0.3116E+03	0.1210E+01	0.5152E+02	0.1000E+01
0.3178E+03	0.2216E+01	0.5773E+02	0.2000E+01

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APILE for Windows, Version 2019.9.3

Serial Number: 138584419

A Program for Analyzing the Axial Capacity
and Short-term Settlement of Driven Piles
under Axial Loading.
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Path to file locations: \\Dayton-fs1\PROJECTS\2021\GEO
Projects\01051704 - LJB, Inc. - Spruce Avenue Bridge Replacement
(SHE-SPRUC-02270) - ODOT PID 114201 - Sidney, Ohio\Pile
Analysis\Ray\
Name of input data file: 14-Inch CIPRC Pile - B-001-0-21 rf new
elevation.ap9d
Name of output file: 14-Inch CIPRC Pile - B-001-0-21 rf new
elevation.ap9o
Name of plot output file: 14-Inch CIPRC Pile - B-001-0-21 rf new
elevation.ap9p

Time and Date of Analysis

Date: May 12, 2023 Time: 10:36:13

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* INPUT INFORMATION *

SHE-Spruce-02.27 - 14" CIPRC Pile - B-001-0-21

DESIGNER: PSI

JOB NUMBER: 01051704

METHOD FOR UNIT LOAD TRANSFERS:-FHWA (Federal Highway
Administration)

Unfactored Unit Side Friction and Unit Side Resistance are used.

COMPUTATION METHOD(S) FOR PILE CAPACITY :

- FHWA (Federal Highway Administration)
- API RP 2A (American Petroleum Institute)

TYPE OF LOADING:- COMPRESSION

PILE TYPE:Steel pipe pile or non-tapered portion of monotube pile - Close-Ended Pile

DATA FOR AXIAL STIFFNESS:

- MODULUS OF ELASTICITY = 0.290E+08 PSI
- CROSS SECTION AREA = 21.21 IN²

CIRCULAR PILE PROPERTIES :

- OUTSIDE DIAMETER, OD = 14.00 IN.
- INTERNAL DIAMETER, ID = 13.00 IN.
- TOTAL PILE LENGTH, TL = 55.00 FT.
- BATTER ANGLE = 14.00 DEG
- PILE STICKUP LENGTH, PSL = 0.50 FT.
- ZERO FRICTION LENGTH, ZFL = 5.00 FT.
- INCREMENT OF PILE LENGTH USED IN COMPUTATION = 1.00 FT.
- LENGTH OF ENHANCED END SECTION = 55.00 FT.
- INTERNAL DIAMETER OF ENHANCED END SECTION = 13.00 IN.

PLUGGED/UNPLUGGED CONDITIONS:

Internal Pile Plug Calculated by Program

SOIL INFORMATIONS:

DEPTH FT.	SOIL TYPE	LATERAL EARTH PRESSURE	EFFECTIVE UNIT WEIGHT LB/FT ³	FRICTION ANGLE DEGREES	BEARING CAPACITY FACTOR
0.00	CLAY	0.80*	62.60	0.00	8.00**

1.00	CLAY	0.80*	62.60	0.00	8.00**
1.00	SAND	0.80*	72.60	30.00	22.00
4.50	SAND	0.80*	72.60	30.00	22.00
4.50	CLAY	0.80*	67.60	0.00	8.00**
16.00	CLAY	0.80*	67.60	0.00	8.00**
16.00	CLAY	0.80*	57.60	0.00	8.00**
22.50	CLAY	0.80*	62.60	0.00	8.00**
22.50	SAND	0.80*	72.60	32.00	29.00
27.50	SAND	0.80*	72.60	32.00	29.00
27.50	CLAY	0.80*	67.60	0.00	8.00**
36.50	CLAY	0.80*	67.60	0.00	8.00**
36.50	CLAY	0.80*	72.60	0.00	8.00**
58.50	CLAY	0.80*	72.60	0.00	8.00**

* VALUE ASSUMED BY THE PROGRAM

** VALUE ESTIMATED BY THE PROGRAM BASED ON FRICTION ANGLE

	MAXIMUM UNIT	MAXIMUM UNIT	UNDISTURB SHEAR	REMOLDED SHEAR	BLOW	UNIT SKIN	UNIT
END	FRICTION	BEARING	STRENGTH	STRENGTH	COUNT	FRICTION	
BEARING	KSF	KSF	KSF	KSF		KSF	
KSF	0.10E+08*	0.10E+08*	3.00	0.00	0.00	0.00	
0.00	0.10E+08*	0.10E+08*	3.00	0.00	0.00	0.00	
0.00	0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	
0.00	0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	
0.00	0.10E+08*	0.10E+08*	4.50	0.00	0.00	0.00	
0.00	0.10E+08*	0.10E+08*	4.50	0.00	0.00	0.00	
0.00	0.10E+08*	0.10E+08*	1.00	0.00	0.00	0.00	
0.00	0.10E+08*	0.10E+08*	2.00	0.00	0.00	0.00	
0.00	0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	
0.00	0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	
0.00	0.10E+08*	0.10E+08*	5.50	0.00	0.00	0.00	
0.00	0.10E+08*	0.10E+08*	5.50	0.00	0.00	0.00	
0.00	0.10E+08*	0.10E+08*	6.00	0.00	0.00	0.00	
0.00	0.10E+08*	0.10E+08*	6.00	0.00	0.00	0.00	

* MAXIMUM UNIT FRICTION AND/OR MAXIMUM UNIT BEARING
WERE SET TO BE 0.10E+08 BECAUSE THE USER DOES NOT
PLAN TO LIMIT THE COMPUTED DATA.

DEPTH FT.	LRFD FACTOR ON UNIT FRICTION	LRFD FACTOR ON UNIT BEARING
0.00	1.000	1.000
1.00	1.000	1.000
1.00	1.000	1.000
4.50	1.000	1.000
4.50	1.000	1.000
16.00	1.000	1.000
16.00	1.000	1.000
22.50	1.000	1.000
22.50	1.000	1.000
27.50	1.000	1.000
27.50	1.000	1.000
36.50	1.000	1.000
36.50	1.000	1.000
58.50	1.000	1.000

1

* COMPUTATION RESULT *

* FED. HWY. METHOD *

PILE LENGTH BELOW GND. FT.	DEPTH BELOW GND. FT.	TOTAL SKIN FRICTION KIP	END BEARING KIP	ULTIMATE CAPACITY KIP
0.00	0.00	0.0	14.4	14.4
1.00	0.97	0.0	8.6	8.6
2.00	1.94	0.0	16.2	16.2
3.00	2.91	0.0	9.6	9.6
4.00	3.88	0.0	13.0	13.0
5.00	4.85	0.0	24.2	24.2
6.00	5.82	8.1	34.9	43.0
7.00	6.79	24.3	43.3	67.6
8.00	7.76	40.5	43.3	83.8
9.00	8.73	56.7	43.3	100.0
10.00	9.70	72.9	43.3	116.2
11.00	10.67	89.1	43.3	132.4
12.00	11.64	105.3	43.3	148.6
13.00	12.61	121.5	43.3	164.8
14.00	13.58	137.7	43.3	181.0
15.00	14.55	153.9	43.3	197.2
16.00	15.52	168.1	36.1	204.2
17.00	16.50	181.1	27.5	208.6

18.00	17.47	190.2	19.3	209.5
19.00	18.44	194.7	13.2	207.9
20.00	19.41	199.7	14.7	214.4
21.00	20.38	205.3	16.1	221.4
22.00	21.35	211.4	17.5	228.9
23.00	22.32	217.8	22.1	239.9
24.00	23.29	224.5	27.2	251.7
25.00	24.26	229.3	31.8	261.1
26.00	25.23	231.9	35.3	267.1
27.00	26.20	234.5	35.3	269.8
28.00	27.17	237.3	39.2	276.5
29.00	28.14	240.2	44.1	284.3
30.00	29.11	248.5	49.0	297.5
31.00	30.08	262.2	52.9	315.1
32.00	31.05	275.9	52.9	328.9
33.00	32.02	289.6	52.9	342.6
34.00	32.99	303.4	52.9	356.3
35.00	33.96	317.1	52.9	370.0
36.00	34.93	330.8	52.9	383.7
37.00	35.90	343.1	54.0	397.1
38.00	36.87	352.7	55.3	408.1
39.00	37.84	361.4	56.7	418.0
40.00	38.81	370.4	57.7	428.1
41.00	39.78	379.4	57.7	437.1
42.00	40.75	388.4	57.7	446.2
43.00	41.72	397.5	57.7	455.2
44.00	42.69	406.5	57.7	464.2
45.00	43.66	415.5	57.7	473.2
46.00	44.63	424.5	57.7	482.2
47.00	45.60	433.5	57.7	491.2
48.00	46.57	442.5	57.7	500.3
49.00	47.54	451.5	57.7	509.3
50.00	48.51	460.6	57.7	518.3
51.00	49.49	469.6	57.7	527.3
52.00	50.46	478.6	57.7	536.3
53.00	51.43	487.6	57.7	545.3
54.00	52.40	496.6	57.7	554.4

* API RP-2A (2010) *

PILE LENGTH BELOW GND. FT.	DEPTH BELOW GND. FT.	TOTAL SKIN FRICTION KIP	END BEARING KIP	ULTIMATE CAPACITY KIP
0.00	0.00	0.0	14.4	14.4
1.00	0.97	0.0	8.8	8.8
2.00	1.94	0.0	16.6	16.6
3.00	2.91	0.0	10.5	10.5
4.00	3.88	0.0	13.9	13.9
5.00	4.85	0.0	24.8	24.8
6.00	5.82	2.2	35.2	37.5
7.00	6.79	6.8	43.3	50.1

8.00	7.76	11.6	43.3	54.9
9.00	8.73	16.5	43.3	59.8
10.00	9.70	21.5	43.3	64.8
11.00	10.67	26.7	43.3	70.0
12.00	11.64	32.0	43.3	75.3
13.00	12.61	37.4	43.3	80.7
14.00	13.58	42.9	43.3	86.2
15.00	14.55	48.5	43.3	91.8
16.00	15.52	54.2	36.1	90.3
17.00	16.50	59.9	27.5	87.4
18.00	17.47	63.9	19.3	83.2
19.00	18.44	66.2	13.2	79.4
20.00	19.41	68.6	14.7	83.3
21.00	20.38	71.3	16.1	87.4
22.00	21.35	74.2	17.5	91.8
23.00	22.32	77.4	25.0	102.4
24.00	23.29	80.8	34.2	115.0
25.00	24.26	83.7	43.7	127.4
26.00	25.23	86.2	51.8	138.0
27.00	26.20	88.7	54.0	142.7
28.00	27.17	91.4	54.8	146.2
29.00	28.14	94.1	54.7	148.8
30.00	29.11	99.4	53.9	153.4
31.00	30.08	107.2	52.9	160.1
32.00	31.05	115.1	52.9	168.0
33.00	32.02	123.0	52.9	176.0
34.00	32.99	131.0	52.9	184.0
35.00	33.96	139.1	52.9	192.0
36.00	34.93	147.2	52.9	200.1
37.00	35.90	155.4	54.0	209.4
38.00	36.87	163.6	55.3	218.9
39.00	37.84	172.2	56.7	228.8
40.00	38.81	181.1	57.7	238.8
41.00	39.78	190.0	57.7	247.8
42.00	40.75	199.1	57.7	256.8
43.00	41.72	208.1	57.7	265.9
44.00	42.69	217.3	57.7	275.0
45.00	43.66	226.5	57.7	284.2
46.00	44.63	235.7	57.7	293.4
47.00	45.60	245.0	57.7	302.7
48.00	46.57	254.4	57.7	312.1
49.00	47.54	263.8	57.7	321.5
50.00	48.51	273.2	57.7	331.0
51.00	49.49	282.7	57.7	340.5
52.00	50.46	292.3	57.7	350.0
53.00	51.43	301.9	57.7	359.6
54.00	52.40	311.6	57.7	369.3

NOTES:

- AN ASTERISK IS PLACED IN THE END-BEARING COLUMN IF THE TIP RESISTANCE IS CONTROLLED BY THE FRICTION OF SOIL PLUG INSIDE AN OPEN-ENDED PIPE PILE.

 * COMPUTE LOAD-DISTRIBUTION AND LOAD-SETTLEMENT *
 * CURVES FOR AXIAL LOADING *

MOVEMENT	T-Z CURVE	NO. OF	DEPTH TO CURVE	LOAD TRANSFER	PILE
	NO.	POINTS	FT.	PSI	IN.
	1	10	0.0000E+00	0.0000E+00	0.0000E+00
				0.0000E+00	0.2240E-01
				0.0000E+00	0.4340E-01
				0.0000E+00	0.7980E-01
				0.0000E+00	0.1120E+00
				0.0000E+00	0.1400E+00
				0.0000E+00	0.2800E+00
				0.0000E+00	0.4200E+00
				0.0000E+00	0.7000E+00
				0.0000E+00	0.2800E+01
	2	10	0.5250E+00	0.0000E+00	0.0000E+00
				0.0000E+00	0.2240E-01
				0.0000E+00	0.4340E-01
				0.0000E+00	0.7980E-01
				0.0000E+00	0.1120E+00
				0.0000E+00	0.1400E+00
				0.0000E+00	0.2800E+00
				0.0000E+00	0.4200E+00
				0.0000E+00	0.7000E+00
				0.0000E+00	0.2800E+01
	3	10	0.9583E+00	0.0000E+00	0.0000E+00
				0.0000E+00	0.2240E-01
				0.0000E+00	0.4340E-01
				0.0000E+00	0.7980E-01
				0.0000E+00	0.1120E+00
				0.0000E+00	0.1400E+00
				0.0000E+00	0.2800E+00
				0.0000E+00	0.4200E+00
				0.0000E+00	0.7000E+00
				0.0000E+00	0.2800E+01
	4	10	0.1000E+01	0.0000E+00	0.0000E+00
				0.0000E+00	0.2240E-01
				0.0000E+00	0.4340E-01
				0.0000E+00	0.7980E-01
				0.0000E+00	0.1120E+00
				0.0000E+00	0.1400E+00
				0.0000E+00	0.2800E+00
				0.0000E+00	0.4200E+00
				0.0000E+00	0.7000E+00
				0.0000E+00	0.2800E+01

5	10	0.2775E+01	0.0000E+00	0.2800E+01
			0.0000E+00	0.0000E+00
			0.0000E+00	0.2240E-01
			0.0000E+00	0.4340E-01
			0.0000E+00	0.7980E-01
			0.0000E+00	0.1120E+00
			0.0000E+00	0.1400E+00
			0.0000E+00	0.2800E+00
			0.0000E+00	0.4200E+00
			0.0000E+00	0.7000E+00
6	10	0.4458E+01	0.0000E+00	0.2800E+01
			0.0000E+00	0.0000E+00
			0.0000E+00	0.2240E-01
			0.0000E+00	0.4340E-01
			0.0000E+00	0.7980E-01
			0.0000E+00	0.1120E+00
			0.0000E+00	0.1400E+00
			0.0000E+00	0.2800E+00
			0.0000E+00	0.4200E+00
			0.0000E+00	0.7000E+00
7	10	0.4500E+01	0.0000E+00	0.2800E+01
			0.0000E+00	0.0000E+00
			0.0000E+00	0.2240E-01
			0.0000E+00	0.4340E-01
			0.0000E+00	0.7980E-01
			0.0000E+00	0.1120E+00
			0.0000E+00	0.1400E+00
			0.0000E+00	0.2800E+00
			0.0000E+00	0.4200E+00
			0.0000E+00	0.7000E+00
8	10	0.1028E+02	0.0000E+00	0.2800E+01
			0.0000E+00	0.0000E+00
			0.9208E+01	0.2240E-01
			0.1535E+02	0.4340E-01
			0.2302E+02	0.7980E-01
			0.2762E+02	0.1120E+00
			0.3069E+02	0.1400E+00
			0.2762E+02	0.2800E+00
			0.2762E+02	0.4200E+00
			0.2762E+02	0.7000E+00
9	10	0.1596E+02	0.2762E+02	0.2800E+01
			0.0000E+00	0.0000E+00
			0.7032E+01	0.2240E-01
			0.1172E+02	0.4340E-01
			0.1758E+02	0.7980E-01
			0.2110E+02	0.1120E+00
			0.2344E+02	0.1400E+00
			0.2110E+02	0.2800E+00
			0.2110E+02	0.4200E+00
			0.2110E+02	0.4200E+00

			0.2110E+02	0.7000E+00
			0.2110E+02	0.2800E+01
10	10	0.1600E+02		
			0.0000E+00	0.0000E+00
			0.6938E+01	0.2240E-01
			0.1156E+02	0.4340E-01
			0.1734E+02	0.7980E-01
			0.2081E+02	0.1120E+00
			0.2313E+02	0.1400E+00
			0.2081E+02	0.2800E+00
			0.2081E+02	0.4200E+00
			0.2081E+02	0.7000E+00
			0.2081E+02	0.2800E+01
11	10	0.1928E+02		
			0.0000E+00	0.0000E+00
			0.2794E+01	0.2240E-01
			0.4657E+01	0.4340E-01
			0.6985E+01	0.7980E-01
			0.8382E+01	0.1120E+00
			0.9313E+01	0.1400E+00
			0.8382E+01	0.2800E+00
			0.8382E+01	0.4200E+00
			0.8382E+01	0.7000E+00
			0.8382E+01	0.2800E+01
12	10	0.2246E+02		
			0.0000E+00	0.0000E+00
			0.3639E+01	0.2240E-01
			0.6065E+01	0.4340E-01
			0.9097E+01	0.7980E-01
			0.1092E+02	0.1120E+00
			0.1213E+02	0.1400E+00
			0.1092E+02	0.2800E+00
			0.1092E+02	0.4200E+00
			0.1092E+02	0.7000E+00
			0.1092E+02	0.2800E+01
13	10	0.2250E+02		
			0.0000E+00	0.0000E+00
			0.3644E+01	0.2240E-01
			0.6073E+01	0.4340E-01
			0.9109E+01	0.7980E-01
			0.1093E+02	0.1120E+00
			0.1215E+02	0.1400E+00
			0.1215E+02	0.2800E+00
			0.1215E+02	0.4200E+00
			0.1215E+02	0.7000E+00
			0.1215E+02	0.2800E+01
14	10	0.2503E+02		
			0.0000E+00	0.0000E+00
			0.1425E+01	0.2240E-01
			0.2375E+01	0.4340E-01
			0.3563E+01	0.7980E-01
			0.4275E+01	0.1120E+00
			0.4751E+01	0.1400E+00
			0.4751E+01	0.2800E+00

			0.4751E+01	0.4200E+00
			0.4751E+01	0.7000E+00
			0.4751E+01	0.2800E+01
15	10	0.2746E+02		
			0.0000E+00	0.0000E+00
			0.1577E+01	0.2240E-01
			0.2629E+01	0.4340E-01
			0.3944E+01	0.7980E-01
			0.4732E+01	0.1120E+00
			0.5258E+01	0.1400E+00
			0.5258E+01	0.2800E+00
			0.5258E+01	0.4200E+00
			0.5258E+01	0.7000E+00
			0.5258E+01	0.2800E+01
16	10	0.2750E+02		
			0.0000E+00	0.0000E+00
			0.1580E+01	0.2240E-01
			0.2633E+01	0.4340E-01
			0.3950E+01	0.7980E-01
			0.4740E+01	0.1120E+00
			0.5267E+01	0.1400E+00
			0.4740E+01	0.2800E+00
			0.4740E+01	0.4200E+00
			0.4740E+01	0.7000E+00
			0.4740E+01	0.2800E+01
17	10	0.3203E+02		
			0.0000E+00	0.0000E+00
			0.7792E+01	0.2240E-01
			0.1299E+02	0.4340E-01
			0.1948E+02	0.7980E-01
			0.2337E+02	0.1120E+00
			0.2597E+02	0.1400E+00
			0.2337E+02	0.2800E+00
			0.2337E+02	0.4200E+00
			0.2337E+02	0.7000E+00
			0.2337E+02	0.2800E+01
18	10	0.3646E+02		
			0.0000E+00	0.0000E+00
			0.7083E+01	0.2240E-01
			0.1180E+02	0.4340E-01
			0.1771E+02	0.7980E-01
			0.2125E+02	0.1120E+00
			0.2361E+02	0.1400E+00
			0.2125E+02	0.2800E+00
			0.2125E+02	0.4200E+00
			0.2125E+02	0.7000E+00
			0.2125E+02	0.2800E+01
19	10	0.3650E+02		
			0.0000E+00	0.0000E+00
			0.7018E+01	0.2240E-01
			0.1170E+02	0.4340E-01
			0.1755E+02	0.7980E-01
			0.2105E+02	0.1120E+00
			0.2339E+02	0.1400E+00

			0.2105E+02	0.2800E+00
			0.2105E+02	0.4200E+00
			0.2105E+02	0.7000E+00
			0.2105E+02	0.2800E+01
20	10	0.4753E+02		
			0.0000E+00	0.0000E+00
			0.5125E+01	0.2240E-01
			0.8542E+01	0.4340E-01
			0.1281E+02	0.7980E-01
			0.1537E+02	0.1120E+00
			0.1708E+02	0.1400E+00
			0.1537E+02	0.2800E+00
			0.1537E+02	0.4200E+00
			0.1537E+02	0.7000E+00
			0.1537E+02	0.2800E+01
21	10	0.5846E+02		
			0.0000E+00	0.0000E+00
			0.5125E+01	0.2240E-01
			0.8542E+01	0.4340E-01
			0.1281E+02	0.7980E-01
			0.1537E+02	0.1120E+00
			0.1708E+02	0.1400E+00
			0.1537E+02	0.2800E+00
			0.1537E+02	0.4200E+00
			0.1537E+02	0.7000E+00
			0.1537E+02	0.2800E+01

TIP LOAD KIP	TIP MOVEMENT IN.
0.0000E+00	0.0000E+00
0.3608E+01	0.7000E-02
0.7216E+01	0.1400E-01
0.1443E+02	0.2800E-01
0.2886E+02	0.1820E+00
0.4330E+02	0.5880E+00
0.5195E+02	0.1022E+01
0.5773E+02	0.1400E+01
0.5773E+02	0.2100E+01
0.5773E+02	0.2800E+01

LOAD VERSUS SETTLEMENT CURVE

TOP LOAD KIP	TOP MOVEMENT IN.	TIP LOAD KIP	TIP MOVEMENT IN.
0.1987E+01	0.9091E-03	0.5154E-01	0.1000E-03
0.2013E+02	0.9139E-02	0.5154E+00	0.1000E-02

0.9983E+02	0.4592E-01	0.2577E+01	0.5000E-02
0.1779E+03	0.8694E-01	0.5154E+01	0.1000E-01
0.2891E+03	0.1540E+00	0.1031E+02	0.2000E-01
0.4206E+03	0.2680E+00	0.1649E+02	0.5000E-01
0.4673E+03	0.3409E+00	0.1930E+02	0.8000E-01
0.4861E+03	0.3795E+00	0.2118E+02	0.1000E+00
0.4925E+03	0.4911E+00	0.2950E+02	0.2000E+00
0.4935E+03	0.7942E+00	0.4017E+02	0.5000E+00
0.5009E+03	0.1102E+01	0.4752E+02	0.8000E+00
0.5048E+03	0.1306E+01	0.5152E+02	0.1000E+01
0.5111E+03	0.2313E+01	0.5773E+02	0.2000E+01

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APILE for Windows, Version 2019.9.3

Serial Number : 138584419

A Program for Analyzing the Axial Capacity
and Short-term Settlement of Driven Piles
under Axial Loading.
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Path to file locations : \\Dayton-fs1\PROJECTS\2021\GEO
Projects\01051704 - LJB, Inc. - Spruce Avenue Bridge Replacement (SHE-
SPRUC-02270) - ODOT PID 114201 - Sidney, Ohio\Pile Analysis\Ray\
Name of input data file : 14-Inch CIPRC Pile - B-002-0-21 rf new
elevations.ap9d
Name of output file : 14-Inch CIPRC Pile - B-002-0-21 rf new
elevations.ap9o
Name of plot output file : 14-Inch CIPRC Pile - B-002-0-21 rf new
elevations.ap9p

Time and Date of Analysis

Date: May 12, 2023 Time: 10:41:38

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* INPUT INFORMATION *

SHE-Spruce-02.27 - 14" CIPRC Pile - B-002-0-21

DESIGNER : PSI

JOB NUMBER : 01051704

METHOD FOR UNIT LOAD TRANSFERS :

- FHWA (Federal Highway Administration)
Unfactored Unit Side Friction and Unit Side Resistance are
used.

COMPUTATION METHOD(S) FOR PILE CAPACITY :

- FHWA (Federal Highway Administration)
- API RP 2A (American Petroleum Institute)

TYPE OF LOADING :

- COMPRESSION

PILE TYPE :

Steel pipe pile or non-tapered portion of monotube pile
- Close-Ended Pile

DATA FOR AXIAL STIFFNESS :

- MODULUS OF ELASTICITY = 0.290E+08 PSI
- CROSS SECTION AREA = 21.21 IN²

CIRCULAR PILE PROPERTIES :

- OUTSIDE DIAMETER, OD = 14.00 IN.
- INTERNAL DIAMETER, ID = 13.00 IN.
- TOTAL PILE LENGTH, TL = 45.00 FT.
- BATTER ANGLE = 14.00 DEG
- PILE STICKUP LENGTH, PSL = 0.50 FT.
- ZERO FRICTION LENGTH, ZFL = 5.00 FT.
- INCREMENT OF PILE LENGTH
USED IN COMPUTATION = 1.00 FT.
- LENGTH OF ENHANCED
END SECTION = 45.00 FT.
- INTERNAL DIAMETER OF
ENHANCED END SECTION = 13.00 IN.

PLUGGED/UNPLUGGED CONDITIONS :

Internal Pile Plug Calculated by Program

SOIL INFORMATIONS :

DEPTH FT.	SOIL TYPE	LATERAL EARTH PRESSURE	EFFECTIVE UNIT WEIGHT LB/FT^3	FRICTION ANGLE DEGREES	BEARING CAPACITY FACTOR
0.00	CLAY	0.80*	120.00	0.00	8.00**
6.50	CLAY	0.80*	120.00	0.00	8.00**
6.50	SAND	0.80*	67.60	28.00	17.00
13.50	SAND	0.80*	72.60	32.00	28.00
13.50	CLAY	0.80*	62.60	0.00	8.00**
19.50	CLAY	0.80*	62.60	0.00	8.00**
19.50	CLAY	0.80*	67.60	0.00	8.00**
48.50	CLAY	0.80*	67.60	0.00	8.00**

* VALUE ASSUMED BY THE PROGRAM

** VALUE ESTIMATED BY THE PROGRAM BASED ON FRICTION ANGLE

END	MAXIMUM UNIT	MAXIMUM UNIT	UNDISTURB SHEAR	REMOLDED SHEAR	BLOW COUNT	UNIT SKIN FRICTION	UNIT
BEARING	FRICTION	BEARING	STRENGTH	STRENGTH			
	KSF	KSF	KSF	KSF		KSF	
0.00	0.10E+08*	0.10E+08*	1.20	0.00	0.00	0.00	
0.00	0.10E+08*	0.10E+08*	2.00	0.00	0.00	0.00	
0.00	0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	
0.00	0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	
0.00	0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	
0.00	0.10E+08*	0.10E+08*	3.50	0.00	0.00	0.00	
0.00	0.10E+08*	0.10E+08*	3.50	0.00	0.00	0.00	
0.00	0.10E+08*	0.10E+08*	6.00	0.00	0.00	0.00	
0.00	0.10E+08*	0.10E+08*	6.00	0.00	0.00	0.00	

* MAXIMUM UNIT FRICTION AND/OR MAXIMUM UNIT BEARING
WERE SET TO BE 0.10E+08 BECAUSE THE USER DOES NOT
PLAN TO LIMIT THE COMPUTED DATA.

DEPTH	LRFD FACTOR ON UNIT FRICTION	LRFD FACTOR ON UNIT BEARING
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FT.		
0.00	1.000	1.000
6.50	1.000	1.000
6.50	1.000	1.000
13.50	1.000	1.000
13.50	1.000	1.000
19.50	1.000	1.000
19.50	1.000	1.000
48.50	1.000	1.000

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 * COMPUTATION RESULT *

 * FED. HWY. METHOD *

PILE LENGTH BELOW GND. FT.	DEPTH BELOW GND. FT.	TOTAL SKIN FRICTION KIP	END BEARING KIP	ULTIMATE CAPACITY KIP
0.00	0.00	0.0	6.3	6.3
1.00	0.97	0.0	6.9	6.9
2.00	1.94	0.0	13.8	13.8
3.00	2.91	0.0	15.0	15.0
4.00	3.88	0.0	16.1	16.1
5.00	4.85	0.0	17.3	17.3
6.00	5.82	2.5	16.6	19.1
7.00	6.79	7.6	15.7	23.3
8.00	7.76	10.6	14.7	25.3
9.00	8.73	11.6	13.9	25.5
10.00	9.70	12.8	15.6	28.4
11.00	10.67	14.1	18.0	32.1
12.00	11.64	15.5	22.4	38.0
13.00	12.61	17.2	27.2	44.4
14.00	13.58	19.1	31.0	50.0
15.00	14.55	26.3	33.3	59.6
16.00	15.52	38.9	33.7	72.6
17.00	16.50	51.5	33.7	85.2
18.00	17.47	64.1	33.7	97.8
19.00	18.44	76.7	33.7	110.4
20.00	19.41	88.5	39.0	127.5
21.00	20.38	97.4	45.7	143.1
22.00	21.35	106.8	52.4	159.2
23.00	22.32	118.6	57.7	176.3
24.00	23.29	130.4	57.7	188.2
25.00	24.26	142.3	57.7	200.0
26.00	25.23	154.1	57.7	211.8
27.00	26.20	165.9	57.7	223.6

28.00	27.17	177.7	57.7	235.4
29.00	28.14	189.5	57.7	247.3
30.00	29.11	201.4	57.7	259.1
31.00	30.08	213.2	57.7	270.9
32.00	31.05	225.0	57.7	282.7
33.00	32.02	236.8	57.7	294.5
34.00	32.99	248.6	57.7	306.4
35.00	33.96	260.5	57.7	318.2
36.00	34.93	272.3	57.7	330.0
37.00	35.90	284.1	57.7	341.8
38.00	36.87	295.9	57.7	353.6
39.00	37.84	307.7	57.7	365.5
40.00	38.81	319.6	57.7	377.3
41.00	39.78	331.4	57.7	389.1
42.00	40.75	343.2	57.7	400.9
43.00	41.72	355.0	57.7	412.7
44.00	42.69	366.8	57.7	424.6

* API RP-2A (2010) *

PILE LENGTH BELOW GND. FT.	DEPTH BELOW GND. FT.	TOTAL SKIN FRICTION KIP	END BEARING KIP	ULTIMATE CAPACITY KIP
0.00	0.00	0.0	6.3	6.3
1.00	0.97	0.0	6.9	6.9
2.00	1.94	0.0	13.8	13.8
3.00	2.91	0.0	15.0	15.0
4.00	3.88	0.0	16.1	16.1
5.00	4.85	0.0	17.3	17.3
6.00	5.82	1.3	17.6	18.9
7.00	6.79	4.1	18.1	22.2
8.00	7.76	6.1	19.1	25.2
9.00	8.73	7.3	20.9	28.2
10.00	9.70	8.6	24.0	32.7
11.00	10.67	10.0	27.4	37.4
12.00	11.64	11.6	31.0	42.6
13.00	12.61	13.3	33.3	46.6
14.00	13.58	15.1	34.4	49.5
15.00	14.55	18.6	34.4	53.0
16.00	15.52	23.7	33.7	57.4
17.00	16.50	28.8	33.7	62.5
18.00	17.47	34.0	33.7	67.7
19.00	18.44	39.3	33.7	72.9
20.00	19.41	44.6	39.0	83.6
21.00	20.38	49.9	45.7	95.6
22.00	21.35	56.6	52.4	109.0
23.00	22.32	64.8	57.7	122.5
24.00	23.29	73.0	57.7	130.8
25.00	24.26	81.3	57.7	139.1
26.00	25.23	89.7	57.7	147.4

27.00	26.20	98.1	57.7	155.9
28.00	27.17	106.6	57.7	164.4
29.00	28.14	115.2	57.7	172.9
30.00	29.11	123.8	57.7	181.6
31.00	30.08	132.5	57.7	190.2
32.00	31.05	141.3	57.7	199.0
33.00	32.02	150.1	57.7	207.8
34.00	32.99	158.9	57.7	216.7
35.00	33.96	167.9	57.7	225.6
36.00	34.93	176.8	57.7	234.6
37.00	35.90	185.9	57.7	243.6
38.00	36.87	195.0	57.7	252.7
39.00	37.84	204.1	57.7	261.8
40.00	38.81	213.3	57.7	271.0
41.00	39.78	222.5	57.7	280.3
42.00	40.75	231.8	57.7	289.6
43.00	41.72	241.2	57.7	298.9
44.00	42.69	250.6	57.7	308.3

NOTES:

- AN ASTERISK IS PLACED IN THE END-BEARING COLUMN
IF THE TIP RESISTANCE IS CONTROLLED BY THE FRICTION
OF SOIL PLUG INSIDE AN OPEN-ENDED PIPE PILE.

* COMPUTE LOAD-DISTRIBUTION AND LOAD-SETTLEMENT *
* CURVES FOR AXIAL LOADING *

MOVEMENT	T-Z CURVE	NO. OF	DEPTH TO CURVE	LOAD TRANSFER	PILE
	NO.	POINTS	FT.	PSI	IN.
1	1	10	0.0000E+00	0.0000E+00	0.0000E+00
				0.0000E+00	0.2240E-01
				0.0000E+00	0.4340E-01
				0.0000E+00	0.7980E-01
				0.0000E+00	0.1120E+00
				0.0000E+00	0.1400E+00
				0.0000E+00	0.2800E+00
				0.0000E+00	0.4200E+00
				0.0000E+00	0.7000E+00
				0.0000E+00	0.2800E+01
2	2	10	0.3275E+01	0.0000E+00	0.0000E+00
				0.0000E+00	0.2240E-01
				0.0000E+00	0.4340E-01
				0.0000E+00	0.7980E-01
				0.0000E+00	0.1120E+00

3	10	0.6458E+01	0.0000E+00	0.1400E+00
			0.0000E+00	0.2800E+00
			0.0000E+00	0.4200E+00
			0.0000E+00	0.7000E+00
			0.0000E+00	0.2800E+01
			0.0000E+00	0.0000E+00
			0.2874E+01	0.2240E-01
			0.4790E+01	0.4340E-01
			0.7185E+01	0.7980E-01
			0.8622E+01	0.1120E+00
4	10	0.6500E+01	0.9580E+01	0.1400E+00
			0.8622E+01	0.2800E+00
			0.8622E+01	0.4200E+00
			0.8622E+01	0.7000E+00
			0.8622E+01	0.2800E+01
			0.0000E+00	0.0000E+00
			0.2876E+01	0.2240E-01
			0.4794E+01	0.4340E-01
			0.7191E+01	0.7980E-01
			0.8629E+01	0.1120E+00
5	10	0.1003E+02	0.9588E+01	0.1400E+00
			0.9588E+01	0.2800E+00
			0.9588E+01	0.4200E+00
			0.9588E+01	0.7000E+00
			0.9588E+01	0.2800E+01
			0.0000E+00	0.0000E+00
			0.6957E+00	0.2240E-01
			0.1160E+01	0.4340E-01
			0.1739E+01	0.7980E-01
			0.2087E+01	0.1120E+00
6	10	0.1346E+02	0.2319E+01	0.1400E+00
			0.2319E+01	0.2800E+00
			0.2319E+01	0.4200E+00
			0.2319E+01	0.7000E+00
			0.2319E+01	0.2800E+01
			0.0000E+00	0.0000E+00
			0.1054E+01	0.2240E-01
			0.1757E+01	0.4340E-01
			0.2636E+01	0.7980E-01
			0.3163E+01	0.1120E+00
7	10	0.1350E+02	0.3514E+01	0.1400E+00
			0.3514E+01	0.2800E+00
			0.3514E+01	0.4200E+00
			0.3514E+01	0.7000E+00
			0.3514E+01	0.2800E+01
			0.0000E+00	0.0000E+00
			0.1059E+01	0.2240E-01
			0.1766E+01	0.4340E-01
			0.2648E+01	0.7980E-01

			0.3178E+01	0.1120E+00
			0.3531E+01	0.1400E+00
			0.3178E+01	0.2800E+00
			0.3178E+01	0.4200E+00
			0.3178E+01	0.7000E+00
			0.3178E+01	0.2800E+01
8	10	0.1653E+02	0.0000E+00	0.0000E+00
			0.7161E+01	0.2240E-01
			0.1194E+02	0.4340E-01
			0.1790E+02	0.7980E-01
			0.2148E+02	0.1120E+00
			0.2387E+02	0.1400E+00
			0.2148E+02	0.2800E+00
			0.2148E+02	0.4200E+00
			0.2148E+02	0.7000E+00
			0.2148E+02	0.2800E+01
9	10	0.1946E+02	0.0000E+00	0.0000E+00
			0.6732E+01	0.2240E-01
			0.1122E+02	0.4340E-01
			0.1683E+02	0.7980E-01
			0.2020E+02	0.1120E+00
			0.2244E+02	0.1400E+00
			0.2020E+02	0.2800E+00
			0.2020E+02	0.4200E+00
			0.2020E+02	0.7000E+00
			0.2020E+02	0.2800E+01
10	10	0.1950E+02	0.0000E+00	0.0000E+00
			0.6693E+01	0.2240E-01
			0.1115E+02	0.4340E-01
			0.1673E+02	0.7980E-01
			0.2008E+02	0.1120E+00
			0.2231E+02	0.1400E+00
			0.2008E+02	0.2800E+00
			0.2008E+02	0.4200E+00
			0.2008E+02	0.7000E+00
			0.2008E+02	0.2800E+01
11	10	0.3403E+02	0.0000E+00	0.0000E+00
			0.6719E+01	0.2240E-01
			0.1120E+02	0.4340E-01
			0.1680E+02	0.7980E-01
			0.2016E+02	0.1120E+00
			0.2240E+02	0.1400E+00
			0.2016E+02	0.2800E+00
			0.2016E+02	0.4200E+00
			0.2016E+02	0.7000E+00
			0.2016E+02	0.2800E+01
12	10	0.4846E+02	0.0000E+00	0.0000E+00
			0.6719E+01	0.2240E-01
			0.1120E+02	0.4340E-01

0.1680E+02	0.7980E-01
0.2016E+02	0.1120E+00
0.2240E+02	0.1400E+00
0.2016E+02	0.2800E+00
0.2016E+02	0.4200E+00
0.2016E+02	0.7000E+00
0.2016E+02	0.2800E+01

TIP LOAD KIP	TIP MOVEMENT IN.
0.0000E+00	0.0000E+00
0.3608E+01	0.7000E-02
0.7216E+01	0.1400E-01
0.1443E+02	0.2800E-01
0.2886E+02	0.1820E+00
0.4330E+02	0.5880E+00
0.5195E+02	0.1022E+01
0.5773E+02	0.1400E+01
0.5773E+02	0.2100E+01
0.5773E+02	0.2800E+01

LOAD VERSUS SETTLEMENT CURVE

TOP LOAD KIP	TOP MOVEMENT IN.	TIP LOAD KIP	TIP MOVEMENT IN.
0.9315E+00	0.5758E-03	0.5154E-01	0.1000E-03
0.9315E+01	0.5758E-02	0.5154E+00	0.1000E-02
0.4758E+02	0.2919E-01	0.2577E+01	0.5000E-02
0.9263E+02	0.5785E-01	0.5154E+01	0.1000E-01
0.1645E+03	0.1079E+00	0.1031E+02	0.2000E-01
0.2800E+03	0.2047E+00	0.1649E+02	0.5000E-01
0.3431E+03	0.2748E+00	0.1930E+02	0.8000E-01
0.3656E+03	0.3110E+00	0.2118E+02	0.1000E+00
0.3726E+03	0.4214E+00	0.2950E+02	0.2000E+00
0.3728E+03	0.7234E+00	0.4017E+02	0.5000E+00
0.3801E+03	0.1030E+01	0.4752E+02	0.8000E+00
0.3841E+03	0.1233E+01	0.5152E+02	0.1000E+01
0.3903E+03	0.2239E+01	0.5773E+02	0.2000E+01

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APILE for Windows, Version 2019.9.3

Serial Number : 138584419

A Program for Analyzing the Axial Capacity
and Short-term Settlement of Driven Piles
under Axial Loading.
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Path to file locations : \\Dayton-fs1\PROJECTS\2021\GEO
Projects\01051704 - LJB, Inc. - Spruce Avenue Bridge Replacement (SHE-
SPRUC-02270) - ODOT PID 114201 - Sidney, Ohio\Pile Analysis\Ray\
Name of input data file : 14-Inch CIPRC Pile - B-003-0-21 rf new
elevation.ap9d
Name of output file : 14-Inch CIPRC Pile - B-003-0-21 rf new
elevation.ap9o
Name of plot output file : 14-Inch CIPRC Pile - B-003-0-21 rf new
elevation.ap9p

Time and Date of Analysis

Date: May 12, 2023 Time: 10:49:33

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* INPUT INFORMATION *

SHE-Spruce-02.27 - 14" CIPRC Pile - B-003-0-21

DESIGNER : PSI

JOB NUMBER : 01051704

METHOD FOR UNIT LOAD TRANSFERS :

- FHWA (Federal Highway Administration)
Unfactored Unit Side Friction and Unit Side Resistance are
used.

COMPUTATION METHOD(S) FOR PILE CAPACITY :

- FHWA (Federal Highway Administration)
- API RP 2A (American Petroleum Institute)

TYPE OF LOADING :

- COMPRESSION

PILE TYPE :

Steel pipe pile or non-tapered portion of monotube pile
- Close-Ended Pile

DATA FOR AXIAL STIFFNESS :

- MODULUS OF ELASTICITY = 0.290E+08 PSI
- CROSS SECTION AREA = 21.21 IN²

CIRCULAR PILE PROPERTIES :

- OUTSIDE DIAMETER, OD = 14.00 IN.
- INTERNAL DIAMETER, ID = 13.00 IN.
- TOTAL PILE LENGTH, TL = 55.00 FT.
- BATTER ANGLE = 14.00 DEG
- PILE STICKUP LENGTH, PSL = 0.50 FT.
- ZERO FRICTION LENGTH, ZFL = 5.00 FT.
- INCREMENT OF PILE LENGTH
USED IN COMPUTATION = 1.00 FT.
- LENGTH OF ENHANCED
END SECTION = 55.00 FT.
- INTERNAL DIAMETER OF
ENHANCED END SECTION = 13.00 IN.

PLUGGED/UNPLUGGED CONDITIONS :

Internal Pile Plug Calculated by Program

SOIL INFORMATIONS :

DEPTH FT.	SOIL TYPE	LATERAL EARTH PRESSURE	EFFECTIVE UNIT WEIGHT LB/FT^3	FRICTION ANGLE DEGREES	BEARING CAPACITY FACTOR
0.00	CLAY	0.80*	120.00	0.00	8.00**
8.00	CLAY	0.80*	120.00	0.00	8.00**
8.00	CLAY	0.80*	125.00	0.00	8.00**
10.00	CLAY	0.80*	125.00	0.00	8.00**
10.00	SAND	0.80*	77.60	32.00	28.00**
13.00	SAND	0.80*	77.60	32.00	28.00**
13.00	CLAY	0.80*	62.60	0.00	8.00**
36.00	CLAY	0.80*	62.60	0.00	8.00**
36.00	CLAY	0.80*	67.60	0.00	8.00**
52.00	CLAY	0.80*	67.60	0.00	8.00**
52.00	CLAY	0.80*	67.60	0.00	8.00**
60.00	CLAY	0.80*	67.60	0.00	8.00**

* VALUE ASSUMED BY THE PROGRAM

** VALUE ESTIMATED BY THE PROGRAM BASED ON FRICTION ANGLE

END	MAXIMUM UNIT	MAXIMUM UNIT	UNDISTURB SHEAR	REMOLDED SHEAR	BLOW COUNT	UNIT SKIN FRICTION	UNIT
BEARING	FRICTION	BEARING	STRENGTH	STRENGTH			
KSF	KSF	KSF	KSF	KSF		KSF	
0.00	0.10E+08*	0.10E+08*	1.50	0.00	0.00	0.00	
0.00	0.10E+08*	0.10E+08*	2.00	0.00	0.00	0.00	
0.00	0.10E+08*	0.10E+08*	4.00	0.00	0.00	0.00	
0.00	0.10E+08*	0.10E+08*	4.00	0.00	0.00	0.00	
0.00	0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	
0.00	0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	
0.00	0.10E+08*	0.10E+08*	4.00	0.00	0.00	0.00	
0.00	0.10E+08*	0.10E+08*	3.00	0.00	0.00	0.00	
0.00	0.10E+08*	0.10E+08*	6.00	0.00	0.00	0.00	
0.00	0.10E+08*	0.10E+08*	6.00	0.00	0.00	0.00	
0.00	0.10E+08*	0.10E+08*	5.00	0.00	0.00	0.00	

0.00

0.10E+08* 0.10E+08* 5.00 0.00 0.00 0.00

* MAXIMUM UNIT FRICTION AND/OR MAXIMUM UNIT BEARING
WERE SET TO BE 0.10E+08 BECAUSE THE USER DOES NOT
PLAN TO LIMIT THE COMPUTED DATA.

DEPTH FT.	LRFD FACTOR ON UNIT FRICTION	LRFD FACTOR ON UNIT BEARING
0.00	1.000	1.000
8.00	1.000	1.000
8.00	1.000	1.000
10.00	1.000	1.000
10.00	1.000	1.000
13.00	1.000	1.000
13.00	1.000	1.000
36.00	1.000	1.000
36.00	1.000	1.000
52.00	1.000	1.000
52.00	1.000	1.000
60.00	1.000	1.000

1

* COMPUTATION RESULT *

* FED. HWY. METHOD *

PILE LENGTH BELOW GND. FT.	DEPTH BELOW GND. FT.	TOTAL SKIN FRICTION KIP	END BEARING KIP	ULTIMATE CAPACITY KIP
0.00	0.00	0.0	7.5	7.5
1.00	0.97	0.0	7.8	7.8
2.00	1.94	0.0	15.6	15.6
3.00	2.91	0.0	16.2	16.2
4.00	3.88	0.0	16.8	16.8
5.00	4.85	0.0	17.3	17.3
6.00	5.82	2.5	17.9	20.4
7.00	6.79	7.4	18.5	25.9
8.00	7.76	12.5	23.2	35.7
9.00	8.73	17.6	28.8	46.4
10.00	9.70	21.9	33.5	55.4
11.00	10.67	25.4	36.8	62.2

12.00	11.64	28.3	35.9	64.2
13.00	12.61	30.4	35.9	66.3
14.00	13.58	32.8	36.6	69.3
15.00	14.55	38.3	37.1	75.5
16.00	15.52	47.0	37.4	84.5
17.00	16.50	55.7	37.0	92.7
18.00	17.47	64.2	36.6	100.8
19.00	18.44	72.6	36.2	108.9
20.00	19.41	81.0	35.8	116.8
21.00	20.38	89.2	35.4	124.6
22.00	21.35	97.4	35.0	132.4
23.00	22.32	105.5	34.6	140.1
24.00	23.29	113.4	34.2	147.6
25.00	24.26	121.3	33.8	155.1
26.00	25.23	129.1	33.4	162.5
27.00	26.20	136.8	33.0	169.8
28.00	27.17	144.4	32.6	177.0
29.00	28.14	152.0	32.2	184.1
30.00	29.11	159.5	31.7	191.2
31.00	30.08	166.9	31.3	198.2
32.00	31.05	174.2	30.9	205.1
33.00	32.02	181.4	30.5	211.9
34.00	32.99	188.6	30.1	218.7
35.00	33.96	195.7	29.7	225.4
36.00	34.93	202.7	29.3	232.0
37.00	35.90	208.6	35.5	244.0
38.00	36.87	213.4	43.3	256.7
39.00	37.84	220.2	51.3	271.5
40.00	38.81	229.0	57.7	286.8
41.00	39.78	237.8	57.7	295.6
42.00	40.75	246.6	57.7	304.4
43.00	41.72	255.4	57.7	313.1
44.00	42.69	264.2	57.7	321.9
45.00	43.66	273.0	57.7	330.7
46.00	44.63	281.8	57.7	339.5
47.00	45.60	290.6	57.7	348.3
48.00	46.57	299.4	57.7	357.1
49.00	47.54	308.2	57.7	365.9
50.00	48.51	317.0	57.7	374.7
51.00	49.49	325.8	57.7	383.5
52.00	50.46	334.6	57.7	392.3
53.00	51.43	343.4	55.6	399.0
54.00	52.40	352.2	52.9	405.1

 * API RP-2A (2010) *

PILE LENGTH	DEPTH	TOTAL SKIN	END	ULTIMATE
BELOW GND.	BELOW GND.	FRICTION	BEARING	CAPACITY
FT.	FT.	KIP	KIP	KIP
0.00	0.00	0.0	7.5	7.5

1.00	0.97	0.0	7.8	7.8
2.00	1.94	0.0	15.6	15.6
3.00	2.91	0.0	16.2	16.2
4.00	3.88	0.0	16.8	16.8
5.00	4.85	0.0	17.3	17.3
6.00	5.82	1.3	17.9	19.3
7.00	6.79	4.0	18.5	22.6
8.00	7.76	6.9	23.2	30.2
9.00	8.73	10.0	28.8	38.8
10.00	9.70	14.3	34.5	48.7
11.00	10.67	19.7	39.6	59.3
12.00	11.64	23.5	41.1	64.6
13.00	12.61	25.6	41.3	66.9
14.00	13.58	27.8	40.6	68.4
15.00	14.55	31.8	39.2	71.0
16.00	15.52	37.6	37.4	75.0
17.00	16.50	43.3	37.0	80.4
18.00	17.47	49.1	36.6	85.7
19.00	18.44	54.9	36.2	91.1
20.00	19.41	60.7	35.8	96.5
21.00	20.38	66.4	35.4	101.8
22.00	21.35	72.2	35.0	107.2
23.00	22.32	78.0	34.6	112.6
24.00	23.29	83.7	34.2	117.9
25.00	24.26	89.5	33.8	123.3
26.00	25.23	95.2	33.4	128.6
27.00	26.20	100.9	33.0	133.9
28.00	27.17	106.6	32.6	139.2
29.00	28.14	112.3	32.2	144.5
30.00	29.11	118.0	31.7	149.7
31.00	30.08	123.6	31.3	155.0
32.00	31.05	129.3	30.9	160.2
33.00	32.02	134.9	30.5	165.4
34.00	32.99	140.5	30.1	170.6
35.00	33.96	146.0	29.7	175.7
36.00	34.93	151.6	29.3	180.9
37.00	35.90	157.1	35.5	192.5
38.00	36.87	162.6	43.3	205.9
39.00	37.84	169.9	51.3	221.2
40.00	38.81	179.2	57.7	236.9
41.00	39.78	188.6	57.7	246.3
42.00	40.75	198.0	57.7	255.7
43.00	41.72	207.4	57.7	265.1
44.00	42.69	216.9	57.7	274.6
45.00	43.66	226.5	57.7	284.2
46.00	44.63	236.0	57.7	293.8
47.00	45.60	245.7	57.7	303.4
48.00	46.57	255.3	57.7	313.1
49.00	47.54	265.1	57.7	322.8
50.00	48.51	274.8	57.7	332.6
51.00	49.49	284.6	57.7	342.4
52.00	50.46	294.5	57.7	352.2
53.00	51.43	304.4	55.6	360.0
54.00	52.40	314.3	52.9	367.2

NOTES:

- AN ASTERISK IS PLACED IN THE END-BEARING COLUMN
IF THE TIP RESISTANCE IS CONTROLLED BY THE FRICTION
OF SOIL PLUG INSIDE AN OPEN-ENDED PIPE PILE.

* COMPUTE LOAD-DISTRIBUTION AND LOAD-SETTLEMENT *
* CURVES FOR AXIAL LOADING *

MOVEMENT	T-Z CURVE	NO. OF	DEPTH TO CURVE	LOAD TRANSFER	PILE
	NO.	POINTS	FT.	PSI	IN.
	1	10	0.0000E+00	0.0000E+00	0.0000E+00
				0.0000E+00	0.2240E-01
				0.0000E+00	0.4340E-01
				0.0000E+00	0.7980E-01
				0.0000E+00	0.1120E+00
				0.0000E+00	0.1400E+00
				0.0000E+00	0.2800E+00
				0.0000E+00	0.4200E+00
				0.0000E+00	0.7000E+00
				0.0000E+00	0.2800E+01
				0.0000E+00	0.0000E+00
				0.0000E+00	0.2240E-01
				0.0000E+00	0.4340E-01
	2	10	0.4025E+01	0.0000E+00	0.0000E+00
				0.0000E+00	0.2240E-01
				0.0000E+00	0.4340E-01
				0.0000E+00	0.7980E-01
				0.0000E+00	0.1120E+00
				0.0000E+00	0.1400E+00
				0.0000E+00	0.2800E+00
				0.0000E+00	0.4200E+00
				0.0000E+00	0.7000E+00
				0.0000E+00	0.2800E+01
				0.0000E+00	0.0000E+00
				0.2954E+01	0.2240E-01
				0.4923E+01	0.4340E-01
	3	10	0.7958E+01	0.7384E+01	0.7980E-01
				0.8861E+01	0.1120E+00
				0.9845E+01	0.1400E+00
				0.8861E+01	0.2800E+00
				0.8861E+01	0.4200E+00
				0.8861E+01	0.7000E+00
				0.8861E+01	0.2800E+01
				0.0000E+00	0.0000E+00
				0.0000E+00	0.2240E-01
				0.0000E+00	0.4340E-01
				0.0000E+00	0.7980E-01
				0.0000E+00	0.1120E+00
				0.0000E+00	0.1400E+00
	4	10	0.8000E+01	0.0000E+00	0.0000E+00
				0.0000E+00	0.0000E+00

			0.2959E+01	0.2240E-01
			0.4931E+01	0.4340E-01
			0.7397E+01	0.7980E-01
			0.8876E+01	0.1120E+00
			0.9863E+01	0.1400E+00
			0.8876E+01	0.2800E+00
			0.8876E+01	0.4200E+00
			0.8876E+01	0.7000E+00
			0.8876E+01	0.2800E+01
5	10	0.9025E+01	0.0000E+00	0.0000E+00
			0.2835E+01	0.2240E-01
			0.4726E+01	0.4340E-01
			0.7088E+01	0.7980E-01
			0.8506E+01	0.1120E+00
			0.9451E+01	0.1400E+00
			0.8506E+01	0.2800E+00
			0.8506E+01	0.4200E+00
			0.8506E+01	0.7000E+00
			0.8506E+01	0.2800E+01
6	10	0.9958E+01	0.0000E+00	0.0000E+00
			0.2026E+01	0.2240E-01
			0.3376E+01	0.4340E-01
			0.5064E+01	0.7980E-01
			0.6077E+01	0.1120E+00
			0.6752E+01	0.1400E+00
			0.6077E+01	0.2800E+00
			0.6077E+01	0.4200E+00
			0.6077E+01	0.7000E+00
			0.6077E+01	0.2800E+01
7	10	0.1000E+02	0.0000E+00	0.0000E+00
			0.1989E+01	0.2240E-01
			0.3316E+01	0.4340E-01
			0.4974E+01	0.7980E-01
			0.5968E+01	0.1120E+00
			0.6631E+01	0.1400E+00
			0.6631E+01	0.2800E+00
			0.6631E+01	0.4200E+00
			0.6631E+01	0.7000E+00
			0.6631E+01	0.2800E+01
8	10	0.1153E+02	0.0000E+00	0.0000E+00
			0.1591E+01	0.2240E-01
			0.2652E+01	0.4340E-01
			0.3977E+01	0.7980E-01
			0.4773E+01	0.1120E+00
			0.5303E+01	0.1400E+00
			0.5303E+01	0.2800E+00
			0.5303E+01	0.4200E+00
			0.5303E+01	0.7000E+00
			0.5303E+01	0.2800E+01
9	10	0.1296E+02		

			0.0000E+00	0.0000E+00
			0.1278E+01	0.2240E-01
			0.2130E+01	0.4340E-01
			0.3195E+01	0.7980E-01
			0.3834E+01	0.1120E+00
			0.4260E+01	0.1400E+00
			0.4260E+01	0.2800E+00
			0.4260E+01	0.4200E+00
			0.4260E+01	0.7000E+00
			0.4260E+01	0.2800E+01
10	10	0.1300E+02		
			0.0000E+00	0.0000E+00
			0.1281E+01	0.2240E-01
			0.2134E+01	0.4340E-01
			0.3202E+01	0.7980E-01
			0.3842E+01	0.1120E+00
			0.4269E+01	0.1400E+00
			0.3842E+01	0.2800E+00
			0.3842E+01	0.4200E+00
			0.3842E+01	0.7000E+00
			0.3842E+01	0.2800E+01
11	10	0.2453E+02		
			0.0000E+00	0.0000E+00
			0.4477E+01	0.2240E-01
			0.7461E+01	0.4340E-01
			0.1119E+02	0.7980E-01
			0.1343E+02	0.1120E+00
			0.1492E+02	0.1400E+00
			0.1343E+02	0.2800E+00
			0.1343E+02	0.4200E+00
			0.1343E+02	0.7000E+00
			0.1343E+02	0.2800E+01
12	10	0.3596E+02		
			0.0000E+00	0.0000E+00
			0.3960E+01	0.2240E-01
			0.6600E+01	0.4340E-01
			0.9900E+01	0.7980E-01
			0.1188E+02	0.1120E+00
			0.1320E+02	0.1400E+00
			0.1188E+02	0.2800E+00
			0.1188E+02	0.4200E+00
			0.1188E+02	0.7000E+00
			0.1188E+02	0.2800E+01
13	10	0.3600E+02		
			0.0000E+00	0.0000E+00
			0.3958E+01	0.2240E-01
			0.6597E+01	0.4340E-01
			0.9895E+01	0.7980E-01
			0.1187E+02	0.1120E+00
			0.1319E+02	0.1400E+00
			0.1187E+02	0.2800E+00
			0.1187E+02	0.4200E+00
			0.1187E+02	0.7000E+00
			0.1187E+02	0.2800E+01

14	10	0.4403E+02	0.0000E+00	0.0000E+00
			0.5000E+01	0.2240E-01
			0.8333E+01	0.4340E-01
			0.1250E+02	0.7980E-01
			0.1500E+02	0.1120E+00
			0.1667E+02	0.1400E+00
			0.1500E+02	0.2800E+00
			0.1500E+02	0.4200E+00
			0.1500E+02	0.7000E+00
			0.1500E+02	0.2800E+01
15	10	0.5196E+02	0.0000E+00	0.0000E+00
			0.5000E+01	0.2240E-01
			0.8333E+01	0.4340E-01
			0.1250E+02	0.7980E-01
			0.1500E+02	0.1120E+00
			0.1667E+02	0.1400E+00
			0.1500E+02	0.2800E+00
			0.1500E+02	0.4200E+00
			0.1500E+02	0.7000E+00
			0.1500E+02	0.2800E+01
16	10	0.5200E+02	0.0000E+00	0.0000E+00
			0.5000E+01	0.2240E-01
			0.8333E+01	0.4340E-01
			0.1250E+02	0.7980E-01
			0.1500E+02	0.1120E+00
			0.1667E+02	0.1400E+00
			0.1500E+02	0.2800E+00
			0.1500E+02	0.4200E+00
			0.1500E+02	0.7000E+00
			0.1500E+02	0.2800E+01
17	10	0.5603E+02	0.0000E+00	0.0000E+00
			0.5000E+01	0.2240E-01
			0.8333E+01	0.4340E-01
			0.1250E+02	0.7980E-01
			0.1500E+02	0.1120E+00
			0.1667E+02	0.1400E+00
			0.1500E+02	0.2800E+00
			0.1500E+02	0.4200E+00
			0.1500E+02	0.7000E+00
			0.1500E+02	0.2800E+01
18	10	0.5996E+02	0.0000E+00	0.0000E+00
			0.5000E+01	0.2240E-01
			0.8333E+01	0.4340E-01
			0.1250E+02	0.7980E-01
			0.1500E+02	0.1120E+00
			0.1667E+02	0.1400E+00
			0.1500E+02	0.2800E+00
			0.1500E+02	0.4200E+00
			0.1500E+02	0.7000E+00

0.1500E+02 0.2800E+01

TIP LOAD	TIP MOVEMENT
KIP	IN.
0.0000E+00	0.0000E+00
0.3307E+01	0.7000E-02
0.6615E+01	0.1400E-01
0.1323E+02	0.2800E-01
0.2646E+02	0.1820E+00
0.3969E+02	0.5880E+00
0.4762E+02	0.1022E+01
0.5292E+02	0.1400E+01
0.5292E+02	0.2100E+01
0.5292E+02	0.2800E+01

LOAD VERSUS SETTLEMENT CURVE

TOP LOAD	TOP MOVEMENT	TIP LOAD	TIP MOVEMENT
KIP	IN.	KIP	IN.
0.1051E+01	0.6647E-03	0.4725E-01	0.1000E-03
0.1052E+02	0.6648E-02	0.4725E+00	0.1000E-02
0.5340E+02	0.3363E-01	0.2362E+01	0.5000E-02
0.1009E+03	0.6577E-01	0.4725E+01	0.1000E-01
0.1735E+03	0.1206E+00	0.9449E+01	0.2000E-01
0.2817E+03	0.2231E+00	0.1512E+02	0.5000E-01
0.3318E+03	0.2936E+00	0.1770E+02	0.8000E-01
0.3487E+03	0.3297E+00	0.1941E+02	0.1000E+00
0.3539E+03	0.4407E+00	0.2704E+02	0.2000E+00
0.3551E+03	0.7437E+00	0.3682E+02	0.5000E+00
0.3619E+03	0.1051E+01	0.4356E+02	0.8000E+00
0.3655E+03	0.1255E+01	0.4722E+02	0.1000E+01
0.3712E+03	0.2261E+01	0.5292E+02	0.2000E+01

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APILE for Windows, Version 2019.9.3

Serial Number : 138584419

A Program for Analyzing the Axial Capacity
and Short-term Settlement of Driven Piles
under Axial Loading.
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Path to file locations : \\Dayton-fs1\PROJECTS\2021\GEO
Projects\01051704 - LJB, Inc. - Spruce Avenue Bridge Replacement (SHE-
SPRUC-02270) - ODOT PID 114201 - Sidney, Ohio\Pile Analysis\Ray\
Name of input data file : 14-Inch CIPRC Pile - B-004-0-21 rf new
elevation.ap9d
Name of output file : 14-Inch CIPRC Pile - B-004-0-21 rf new
elevation.ap9o
Name of plot output file : 14-Inch CIPRC Pile - B-004-0-21 rf new
elevation.ap9p

Time and Date of Analysis

Date: May 12, 2023 Time: 10:51:29

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* INPUT INFORMATION *

SHE-Spruce-02.27 - 14" CIPRC Pile - B-004-0-21

DESIGNER : PSI

JOB NUMBER : 01051704

METHOD FOR UNIT LOAD TRANSFERS :

- FHWA (Federal Highway Administration)
Unfactored Unit Side Friction and Unit Side Resistance are
used.

COMPUTATION METHOD(S) FOR PILE CAPACITY :

- FHWA (Federal Highway Administration)
- API RP 2A (American Petroleum Institute)

TYPE OF LOADING :

- COMPRESSION

PILE TYPE :

Steel pipe pile or non-tapered portion of monotube pile
- Close-Ended Pile

DATA FOR AXIAL STIFFNESS :

- MODULUS OF ELASTICITY = 0.290E+08 PSI
- CROSS SECTION AREA = 21.21 IN²

CIRCULAR PILE PROPERTIES :

- OUTSIDE DIAMETER, OD = 14.00 IN.
- INTERNAL DIAMETER, ID = 13.00 IN.
- TOTAL PILE LENGTH, TL = 50.00 FT.
- BATTER ANGLE = 14.00 DEG
- PILE STICKUP LENGTH, PSL = 0.50 FT.
- ZERO FRICTION LENGTH, ZFL = 5.00 FT.
- INCREMENT OF PILE LENGTH
USED IN COMPUTATION = 1.00 FT.
- LENGTH OF ENHANCED
END SECTION = 50.00 FT.
- INTERNAL DIAMETER OF
ENHANCED END SECTION = 13.00 IN.

PLUGGED/UNPLUGGED CONDITIONS :

Internal Pile Plug Calculated by Program

SOIL INFORMATIONS :

DEPTH FT.	SOIL TYPE	LATERAL EARTH PRESSURE	EFFECTIVE UNIT WEIGHT LB/FT^3	FRICITION ANGLE DEGREES	BEARING CAPACITY FACTOR
0.00	CLAY	0.80*	62.60	0.00	8.00**
6.50	CLAY	0.80*	67.60	0.00	8.00**
6.50	CLAY	0.80*	62.60	0.00	8.00**
21.50	CLAY	0.80*	57.60	0.00	8.00**
21.50	SAND	0.80*	77.60	32.00	28.00
25.50	SAND	0.80*	77.60	32.00	28.00
25.50	CLAY	0.80*	62.60	0.00	8.00**
45.50	CLAY	0.80*	67.60	0.00	8.00**
45.50	CLAY	0.80*	67.60	0.00	8.00**
53.50	CLAY	0.80*	67.60	0.00	8.00**

* VALUE ASSUMED BY THE PROGRAM

** VALUE ESTIMATED BY THE PROGRAM BASED ON FRICTION ANGLE

END	MAXIMUM UNIT	MAXIMUM UNIT	UNDISTURB SHEAR	REMOLEDDED SHEAR	BLOW COUNT	UNIT SKIN FRICTION	UNIT
BEARING	FRICITION	BEARING	STRENGTH	STRENGTH			
	KSF	KSF	KSF	KSF		KSF	
0.00	0.10E+08*	0.10E+08*	1.50	0.00	0.00	0.00	
0.00	0.10E+08*	0.10E+08*	2.00	0.00	0.00	0.00	
0.00	0.10E+08*	0.10E+08*	1.50	0.00	0.00	0.00	
0.00	0.10E+08*	0.10E+08*	1.00	0.00	0.00	0.00	
0.00	0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	
0.00	0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	
0.00	0.10E+08*	0.10E+08*	4.50	0.00	0.00	0.00	
0.00	0.10E+08*	0.10E+08*	5.50	0.00	0.00	0.00	
0.00	0.10E+08*	0.10E+08*	6.00	0.00	0.00	0.00	
0.00	0.10E+08*	0.10E+08*	6.00	0.00	0.00	0.00	

* MAXIMUM UNIT FRICTION AND/OR MAXIMUM UNIT BEARING WERE SET TO BE 0.10E+08 BECAUSE THE USER DOES NOT PLAN TO LIMIT THE COMPUTED DATA.

DEPTH FT.	LRFD FACTOR	LRFD FACTOR
	ON UNIT FRICTION	ON UNIT BEARING
0.00	1.000	1.000
6.50	1.000	1.000
6.50	1.000	1.000
21.50	1.000	1.000
21.50	1.000	1.000
25.50	1.000	1.000
25.50	1.000	1.000
45.50	1.000	1.000
45.50	1.000	1.000
53.50	1.000	1.000

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 * COMPUTATION RESULT *

 * FED. HWY. METHOD *

PILE LENGTH BELOW GND. FT.	DEPTH BELOW GND. FT.	TOTAL SKIN FRICTION KIP	END BEARING KIP	ULTIMATE CAPACITY KIP
0.00	0.00	0.0	7.6	7.6
1.00	0.97	0.0	7.9	7.9
2.00	1.94	0.0	15.9	15.9
3.00	2.91	0.0	16.6	16.6
4.00	3.88	0.0	17.3	17.3
5.00	4.85	0.0	18.0	18.0
6.00	5.82	2.5	17.5	20.0
7.00	6.79	7.8	16.4	24.2
8.00	7.76	12.9	15.1	27.9
9.00	8.73	17.6	13.7	31.3
10.00	9.70	22.2	13.4	35.7
11.00	10.67	26.8	13.1	39.9
12.00	11.64	31.3	12.8	44.0
13.00	12.61	35.7	12.5	48.1
14.00	13.58	39.9	12.2	52.1
15.00	14.55	44.2	11.8	56.0
16.00	15.52	48.3	11.5	59.8
17.00	16.50	52.3	11.2	63.5
18.00	17.47	56.3	10.9	67.2
19.00	18.44	60.1	10.6	70.7

20.00	19.41	63.9	10.3	74.2
21.00	20.38	67.5	10.0	77.5
22.00	21.35	71.2	15.5	86.7
23.00	22.32	74.7	22.5	97.2
24.00	23.29	77.6	29.5	107.1
25.00	24.26	79.9	35.3	115.2
26.00	25.23	82.4	37.2	119.5
27.00	26.20	84.9	39.7	124.6
28.00	27.17	90.2	42.3	132.5
29.00	28.14	98.2	44.6	142.8
30.00	29.11	106.3	45.0	151.4
31.00	30.08	114.5	45.5	160.0
32.00	31.05	122.8	46.0	168.8
33.00	32.02	131.2	46.4	177.6
34.00	32.99	139.6	46.9	186.5
35.00	33.96	148.1	47.4	195.5
36.00	34.93	156.8	47.8	204.6
37.00	35.90	165.5	48.3	213.8
38.00	36.87	174.3	48.8	223.0
39.00	37.84	183.1	49.2	232.4
40.00	38.81	192.1	49.7	241.8
41.00	39.78	201.1	50.2	251.3
42.00	40.75	210.2	50.6	260.9
43.00	41.72	219.5	51.1	270.6
44.00	42.69	228.7	51.6	280.3
45.00	43.66	238.1	52.0	290.2
46.00	44.63	246.8	53.5	300.3
47.00	45.60	255.0	55.1	310.1
48.00	46.57	263.8	56.6	320.4
49.00	47.54	273.0	57.7	330.7

* API RP-2A (2010) *

PILE LENGTH BELOW GND. FT.	DEPTH BELOW GND. FT.	TOTAL SKIN FRICTION KIP	END BEARING KIP	ULTIMATE CAPACITY KIP
0.00	0.00	0.0	7.6	7.6
1.00	0.97	0.0	7.9	7.9
2.00	1.94	0.0	15.9	15.9
3.00	2.91	0.0	16.6	16.6
4.00	3.88	0.0	17.3	17.3
5.00	4.85	0.0	18.0	18.0
6.00	5.82	1.2	17.5	18.7
7.00	6.79	3.6	16.4	20.0
8.00	7.76	5.9	15.1	20.9
9.00	8.73	7.9	13.7	21.7
10.00	9.70	10.0	13.4	23.4
11.00	10.67	12.2	13.1	25.2
12.00	11.64	14.3	12.8	27.1
13.00	12.61	16.4	12.5	28.9

14.00	13.58	18.5	12.2	30.7
15.00	14.55	20.6	11.8	32.5
16.00	15.52	22.8	11.5	34.3
17.00	16.50	24.9	11.2	36.1
18.00	17.47	26.9	10.9	37.9
19.00	18.44	29.0	10.6	39.6
20.00	19.41	31.1	10.3	41.4
21.00	20.38	33.2	10.0	43.2
22.00	21.35	35.3	17.0	52.3
23.00	22.32	37.5	26.4	63.9
24.00	23.29	39.6	36.5	76.1
25.00	24.26	41.8	45.6	87.4
26.00	25.23	44.2	46.3	90.4
27.00	26.20	46.6	46.1	92.7
28.00	27.17	51.1	45.4	96.5
29.00	28.14	57.8	44.6	102.3
30.00	29.11	64.5	45.0	109.5
31.00	30.08	71.3	45.5	116.8
32.00	31.05	78.3	46.0	124.2
33.00	32.02	85.3	46.4	131.8
34.00	32.99	92.5	46.9	139.4
35.00	33.96	99.8	47.4	147.1
36.00	34.93	107.1	47.8	155.0
37.00	35.90	114.6	48.3	162.9
38.00	36.87	122.2	48.8	171.0
39.00	37.84	129.9	49.2	179.1
40.00	38.81	137.7	49.7	187.4
41.00	39.78	145.6	50.2	195.8
42.00	40.75	153.6	50.6	204.3
43.00	41.72	161.8	51.1	212.9
44.00	42.69	170.0	51.6	221.6
45.00	43.66	178.3	52.0	230.4
46.00	44.63	186.8	53.5	240.3
47.00	45.60	195.3	55.1	250.4
48.00	46.57	204.2	56.6	260.8
49.00	47.54	213.5	57.7	271.2

NOTES:

- AN ASTERISK IS PLACED IN THE END-BEARING COLUMN IF THE TIP RESISTANCE IS CONTROLLED BY THE FRICTION OF SOIL PLUG INSIDE AN OPEN-ENDED PIPE PILE.

 * COMPUTE LOAD-DISTRIBUTION AND LOAD-SETTLEMENT *
 * CURVES FOR AXIAL LOADING *

T-Z CURVE MOVEMENT	NO. OF POINTS	DEPTH TO CURVE FT.	LOAD TRANSFER PSI	PILE IN.
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1	10	0.0000E+00	0.0000E+00	0.0000E+00
			0.0000E+00	0.2240E-01
			0.0000E+00	0.4340E-01
			0.0000E+00	0.7980E-01
			0.0000E+00	0.1120E+00
			0.0000E+00	0.1400E+00
			0.0000E+00	0.2800E+00
			0.0000E+00	0.4200E+00
			0.0000E+00	0.7000E+00
			0.0000E+00	0.2800E+01
2	10	0.3275E+01	0.0000E+00	0.0000E+00
			0.0000E+00	0.2240E-01
			0.0000E+00	0.4340E-01
			0.0000E+00	0.7980E-01
			0.0000E+00	0.1120E+00
			0.0000E+00	0.1400E+00
			0.0000E+00	0.2800E+00
			0.0000E+00	0.4200E+00
			0.0000E+00	0.7000E+00
			0.0000E+00	0.2800E+01
3	10	0.6458E+01	0.0000E+00	0.0000E+00
			0.2979E+01	0.2240E-01
			0.4965E+01	0.4340E-01
			0.7447E+01	0.7980E-01
			0.8937E+01	0.1120E+00
			0.9929E+01	0.1400E+00
			0.8937E+01	0.2800E+00
			0.8937E+01	0.4200E+00
			0.8937E+01	0.7000E+00
			0.8937E+01	0.2800E+01
4	10	0.6500E+01	0.0000E+00	0.0000E+00
			0.2989E+01	0.2240E-01
			0.4981E+01	0.4340E-01
			0.7472E+01	0.7980E-01
			0.8966E+01	0.1120E+00
			0.9962E+01	0.1400E+00
			0.8966E+01	0.2800E+00
			0.8966E+01	0.4200E+00
			0.8966E+01	0.7000E+00
			0.8966E+01	0.2800E+01
5	10	0.1403E+02	0.0000E+00	0.0000E+00
			0.2417E+01	0.2240E-01
			0.4028E+01	0.4340E-01
			0.6042E+01	0.7980E-01
			0.7251E+01	0.1120E+00
			0.8056E+01	0.1400E+00
			0.7251E+01	0.2800E+00
			0.7251E+01	0.4200E+00

6	10	0.2146E+02	0.7251E+01	0.7000E+00
			0.7251E+01	0.2800E+01
			0.0000E+00	0.0000E+00
			0.2067E+01	0.2240E-01
			0.3445E+01	0.4340E-01
			0.5167E+01	0.7980E-01
			0.6200E+01	0.1120E+00
			0.6889E+01	0.1400E+00
			0.6200E+01	0.2800E+00
			0.6200E+01	0.4200E+00
			0.6200E+01	0.7000E+00
			0.6200E+01	0.2800E+01
			0.0000E+00	0.0000E+00
			0.2068E+01	0.2240E-01
7	10	0.2150E+02	0.3446E+01	0.4340E-01
			0.5169E+01	0.7980E-01
			0.6203E+01	0.1120E+00
			0.6892E+01	0.1400E+00
			0.6892E+01	0.2800E+00
			0.6892E+01	0.4200E+00
			0.6892E+01	0.7000E+00
			0.6892E+01	0.2800E+01
			0.0000E+00	0.0000E+00
			0.1610E+01	0.2240E-01
			0.2683E+01	0.4340E-01
			0.4024E+01	0.7980E-01
			0.4829E+01	0.1120E+00
			0.5365E+01	0.1400E+00
8	10	0.2353E+02	0.5365E+01	0.2800E+00
			0.5365E+01	0.4200E+00
			0.5365E+01	0.7000E+00
			0.5365E+01	0.2800E+01
			0.0000E+00	0.0000E+00
			0.1385E+01	0.2240E-01
			0.2308E+01	0.4340E-01
			0.3462E+01	0.7980E-01
			0.4154E+01	0.1120E+00
			0.4616E+01	0.1400E+00
			0.4616E+01	0.2800E+00
			0.4616E+01	0.4200E+00
			0.4616E+01	0.7000E+00
			0.4616E+01	0.2800E+01
9	10	0.2546E+02	0.0000E+00	0.0000E+00
			0.1385E+01	0.2240E-01
			0.2308E+01	0.4340E-01
			0.3462E+01	0.7980E-01
			0.4154E+01	0.1120E+00
			0.4616E+01	0.1400E+00
			0.4616E+01	0.2800E+00
			0.4616E+01	0.4200E+00
			0.4616E+01	0.7000E+00
			0.4616E+01	0.2800E+01
			0.0000E+00	0.0000E+00
			0.1388E+01	0.2240E-01
			0.2313E+01	0.4340E-01
			0.3469E+01	0.7980E-01
10	10	0.2550E+02	0.4163E+01	0.1120E+00
			0.4625E+01	0.1400E+00
			0.4163E+01	0.2800E+00
			0.0000E+00	0.0000E+00
			0.1388E+01	0.2240E-01
			0.2313E+01	0.4340E-01

			0.4163E+01	0.4200E+00
			0.4163E+01	0.7000E+00
			0.4163E+01	0.2800E+01
11	10	0.3553E+02		
			0.0000E+00	0.0000E+00
			0.4899E+01	0.2240E-01
			0.8164E+01	0.4340E-01
			0.1225E+02	0.7980E-01
			0.1470E+02	0.1120E+00
			0.1633E+02	0.1400E+00
			0.1470E+02	0.2800E+00
			0.1470E+02	0.4200E+00
			0.1470E+02	0.7000E+00
			0.1470E+02	0.2800E+01
12	10	0.4546E+02		
			0.0000E+00	0.0000E+00
			0.4976E+01	0.2240E-01
			0.8293E+01	0.4340E-01
			0.1244E+02	0.7980E-01
			0.1493E+02	0.1120E+00
			0.1659E+02	0.1400E+00
			0.1493E+02	0.2800E+00
			0.1493E+02	0.4200E+00
			0.1493E+02	0.7000E+00
			0.1493E+02	0.2800E+01
13	10	0.4550E+02		
			0.0000E+00	0.0000E+00
			0.4941E+01	0.2240E-01
			0.8236E+01	0.4340E-01
			0.1235E+02	0.7980E-01
			0.1482E+02	0.1120E+00
			0.1647E+02	0.1400E+00
			0.1482E+02	0.2800E+00
			0.1482E+02	0.4200E+00
			0.1482E+02	0.7000E+00
			0.1482E+02	0.2800E+01
14	10	0.4953E+02		
			0.0000E+00	0.0000E+00
			0.5219E+01	0.2240E-01
			0.8698E+01	0.4340E-01
			0.1305E+02	0.7980E-01
			0.1566E+02	0.1120E+00
			0.1740E+02	0.1400E+00
			0.1566E+02	0.2800E+00
			0.1566E+02	0.4200E+00
			0.1566E+02	0.7000E+00
			0.1566E+02	0.2800E+01
15	10	0.5346E+02		
			0.0000E+00	0.0000E+00
			0.5219E+01	0.2240E-01
			0.8698E+01	0.4340E-01
			0.1305E+02	0.7980E-01
			0.1566E+02	0.1120E+00
			0.1740E+02	0.1400E+00

0.1566E+02	0.2800E+00
0.1566E+02	0.4200E+00
0.1566E+02	0.7000E+00
0.1566E+02	0.2800E+01

TIP LOAD KIP	TIP MOVEMENT IN.
0.0000E+00	0.0000E+00
0.3608E+01	0.7000E-02
0.7216E+01	0.1400E-01
0.1443E+02	0.2800E-01
0.2886E+02	0.1820E+00
0.4330E+02	0.5880E+00
0.5195E+02	0.1022E+01
0.5773E+02	0.1400E+01
0.5773E+02	0.2100E+01
0.5773E+02	0.2800E+01

LOAD VERSUS SETTLEMENT CURVE

TOP LOAD KIP	TOP MOVEMENT IN.	TIP LOAD KIP	TIP MOVEMENT IN.
0.6997E+00	0.4816E-03	0.5154E-01	0.1000E-03
0.6997E+01	0.4816E-02	0.5154E+00	0.1000E-02
0.3550E+02	0.2428E-01	0.2577E+01	0.5000E-02
0.6876E+02	0.4816E-01	0.5154E+01	0.1000E-01
0.1230E+03	0.9131E-01	0.1031E+02	0.2000E-01
0.2096E+03	0.1765E+00	0.1649E+02	0.5000E-01
0.2544E+03	0.2399E+00	0.1930E+02	0.8000E-01
0.2724E+03	0.2749E+00	0.2118E+02	0.1000E+00
0.2832E+03	0.3881E+00	0.2950E+02	0.2000E+00
0.2857E+03	0.6920E+00	0.4017E+02	0.5000E+00
0.2930E+03	0.9992E+00	0.4752E+02	0.8000E+00
0.2970E+03	0.1203E+01	0.5152E+02	0.1000E+01
0.3032E+03	0.2209E+01	0.5773E+02	0.2000E+01

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APILE for Windows, Version 2019.9.3

Serial Number : 138584419

A Program for Analyzing the Axial Capacity
and Short-term Settlement of Driven Piles
under Axial Loading.
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Path to file locations : \\Dayton-fs1\PROJECTS\2021\GEO
Projects\01051704 - LJB, Inc. - Spruce Avenue Bridge Replacement (SHE-
SPRUC-02270) - ODOT PID 114201 - Sidney, Ohio\Pile Analysis\Ray\Andy's
Updated with New Elevations\
Name of input data file : 16-Inch CIPRC Pile - B-001-0-21 rf no
batter.ap9d
Name of output file : 16-Inch CIPRC Pile - B-001-0-21 rf no
batter.ap9o
Name of plot output file : 16-Inch CIPRC Pile - B-001-0-21 rf no
batter.ap9p

Time and Date of Analysis

Date: May 19, 2023 Time: 15:59:13

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* INPUT INFORMATION *

SHE-Spruce-02.27 - 14" CIPRC Pile - B-001-0-21

DESIGNER : PSI

JOB NUMBER : 01051704

METHOD FOR UNIT LOAD TRANSFERS :

- FHWA (Federal Highway Administration)
Unfactored Unit Side Friction and Unit Side Resistance are
used.

COMPUTATION METHOD(S) FOR PILE CAPACITY :

- FHWA (Federal Highway Administration)
- API RP 2A (American Petroleum Institute)

TYPE OF LOADING :

- COMPRESSION

PILE TYPE :

Steel pipe pile or non-tapered portion of monotube pile
- Close-Ended Pile

DATA FOR AXIAL STIFFNESS :

- MODULUS OF ELASTICITY = 0.290E+08 PSI
- CROSS SECTION AREA = 24.35 IN²

CIRCULAR PILE PROPERTIES :

- OUTSIDE DIAMETER, OD = 16.00 IN.
- INTERNAL DIAMETER, ID = 15.00 IN.
- TOTAL PILE LENGTH, TL = 55.00 FT.
- BATTER ANGLE = 0.00 DEG
- PILE STICKUP LENGTH, PSL = 0.50 FT.
- ZERO FRICTION LENGTH, ZFL = 5.00 FT.
- INCREMENT OF PILE LENGTH
USED IN COMPUTATION = 1.00 FT.
- LENGTH OF ENHANCED
END SECTION = 55.00 FT.
- INTERNAL DIAMETER OF
ENHANCED END SECTION = 15.00 IN.

PLUGGED/UNPLUGGED CONDITIONS :

Internal Pile Plug Calculated by Program

SOIL INFORMATIONS :

DEPTH FT.	SOIL TYPE	LATERAL EARTH PRESSURE	EFFECTIVE UNIT WEIGHT LB/FT^3	FRICTION ANGLE DEGREES	BEARING CAPACITY FACTOR
0.00	CLAY	0.80*	62.60	0.00	8.00**
1.00	CLAY	0.80*	62.60	0.00	8.00**
1.00	SAND	0.80*	72.60	30.00	22.00
4.50	SAND	0.80*	72.60	30.00	22.00
4.50	CLAY	0.80*	67.60	0.00	8.00**
16.00	CLAY	0.80*	67.60	0.00	8.00**
16.00	CLAY	0.80*	57.60	0.00	8.00**
22.50	CLAY	0.80*	62.60	0.00	8.00**
22.50	SAND	0.80*	72.60	32.00	29.00
27.50	SAND	0.80*	72.60	32.00	29.00
27.50	CLAY	0.80*	67.60	0.00	8.00**
36.50	CLAY	0.80*	67.60	0.00	8.00**
36.50	CLAY	0.80*	72.60	0.00	8.00**
58.50	CLAY	0.80*	72.60	0.00	8.00**

* VALUE ASSUMED BY THE PROGRAM

** VALUE ESTIMATED BY THE PROGRAM BASED ON FRICTION ANGLE

END	MAXIMUM UNIT	MAXIMUM UNIT	UNDISTURB SHEAR	REMOLDED SHEAR	BLOW COUNT	UNIT SKIN FRICTION	UNIT
BEARING	FRICTION	BEARING	STRENGTH	STRENGTH			
KSF	KSF	KSF	KSF	KSF		KSF	
0.00	0.10E+08*	0.10E+08*	3.00	0.00	0.00	0.00	
0.00	0.10E+08*	0.10E+08*	3.00	0.00	0.00	0.00	
0.00	0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	
0.00	0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	
0.00	0.10E+08*	0.10E+08*	4.50	0.00	0.00	0.00	
0.00	0.10E+08*	0.10E+08*	4.50	0.00	0.00	0.00	
0.00	0.10E+08*	0.10E+08*	1.00	0.00	0.00	0.00	
0.00	0.10E+08*	0.10E+08*	2.00	0.00	0.00	0.00	
0.00	0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	

0.00	0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00
0.00	0.10E+08*	0.10E+08*	5.50	0.00	0.00	0.00
0.00	0.10E+08*	0.10E+08*	5.50	0.00	0.00	0.00
0.00	0.10E+08*	0.10E+08*	6.00	0.00	0.00	0.00
0.00	0.10E+08*	0.10E+08*	6.00	0.00	0.00	0.00

* MAXIMUM UNIT FRICTION AND/OR MAXIMUM UNIT BEARING
WERE SET TO BE 0.10E+08 BECAUSE THE USER DOES NOT
PLAN TO LIMIT THE COMPUTED DATA.

DEPTH FT.	LRFD FACTOR ON UNIT FRICTION	LRFD FACTOR ON UNIT BEARING
0.00	1.000	1.000
1.00	1.000	1.000
1.00	1.000	1.000
4.50	1.000	1.000
4.50	1.000	1.000
16.00	1.000	1.000
16.00	1.000	1.000
22.50	1.000	1.000
22.50	1.000	1.000
27.50	1.000	1.000
27.50	1.000	1.000
36.50	1.000	1.000
36.50	1.000	1.000
58.50	1.000	1.000

1

* COMPUTATION RESULT *

* FED. HWY. METHOD *

FILE PENETRATION FT.	TOTAL SKIN FRICTION KIP	END BEARING KIP	ULTIMATE CAPACITY KIP
0.00	0.0	10.0	10.0
1.00	0.0	1.6	1.6

2.00	0.0	3.1	3.1
3.00	0.0	5.0	5.0
4.00	0.0	18.6	18.6
5.00	0.3	31.7	32.0
6.00	10.0	44.3	54.3
7.00	28.9	56.5	85.4
8.00	47.7	56.5	104.3
9.00	66.6	56.5	123.1
10.00	85.4	56.5	142.0
11.00	104.3	56.5	160.8
12.00	123.1	56.5	179.6
13.00	142.0	56.5	198.5
14.00	160.8	56.5	217.3
15.00	179.6	45.8	225.4
16.00	196.6	35.5	232.1
17.00	206.4	25.7	232.1
18.00	211.2	16.4	227.7
19.00	216.7	18.4	235.1
20.00	222.8	20.3	243.1
21.00	229.6	22.2	251.8
22.00	236.8	28.9	265.7
23.00	244.6	35.1	279.7
24.00	250.3	40.8	291.1
25.00	253.6	46.1	299.7
26.00	257.2	46.1	303.2
27.00	260.8	51.8	312.7
28.00	264.7	57.6	322.3
29.00	275.1	63.4	338.4
30.00	291.9	69.1	361.1
31.00	308.8	69.1	377.9
32.00	325.7	69.1	394.8
33.00	342.6	69.1	411.7
34.00	359.4	69.1	428.6
35.00	376.3	69.1	445.4
36.00	391.8	70.7	462.5
37.00	404.6	72.3	476.9
38.00	416.6	73.8	490.4
39.00	429.1	75.4	504.5
40.00	441.5	75.4	516.9
41.00	454.0	75.4	529.4
42.00	466.5	75.4	541.9
43.00	478.9	75.4	554.3
44.00	491.4	75.4	566.8
45.00	503.9	75.4	579.3
46.00	516.4	75.4	591.8
47.00	528.8	75.4	604.2
48.00	541.3	75.4	616.7
49.00	553.8	75.4	629.2
50.00	566.2	75.4	641.6
51.00	578.7	75.4	654.1
52.00	591.2	75.4	666.6
53.00	603.7	75.4	679.1
54.00	616.1	75.4	691.5

 * API RP-2A (2010) *

PILE PENETRATION FT.	TOTAL SKIN FRICTION KIP	END BEARING KIP	ULTIMATE CAPACITY KIP
0.00	0.0	10.2	10.2
1.00	0.0	2.1	2.1
2.00	0.0	4.0	4.0
3.00	0.0	6.4	6.4
4.00	0.0	19.8	19.8
5.00	0.3	32.6	32.9
6.00	3.2	44.8	48.0
7.00	8.5	56.5	65.0
8.00	14.0	56.5	70.5
9.00	19.6	56.5	76.2
10.00	25.5	56.5	82.0
11.00	31.4	56.5	88.0
12.00	37.5	56.5	94.1
13.00	43.8	56.5	100.3
14.00	50.1	56.5	106.7
15.00	56.6	45.8	102.4
16.00	63.1	35.5	98.7
17.00	67.6	25.7	93.4
18.00	70.1	16.4	86.5
19.00	72.8	18.4	91.1
20.00	75.8	20.3	96.1
21.00	79.0	22.2	101.2
22.00	82.5	33.1	115.6
23.00	86.3	44.3	130.6
24.00	89.6	55.7	145.3
25.00	92.4	67.4	159.7
26.00	95.3	70.3	165.6
27.00	98.3	71.1	169.4
28.00	101.5	71.2	172.6
29.00	107.5	70.5	178.0
30.00	116.4	69.1	185.5
31.00	125.4	69.1	194.5
32.00	134.5	69.1	203.6
33.00	143.7	69.1	212.8
34.00	152.9	69.1	222.0
35.00	162.2	69.1	231.3
36.00	171.5	70.7	242.2
37.00	180.9	72.3	253.2
38.00	190.7	73.8	264.6
39.00	200.9	75.4	276.3
40.00	211.2	75.4	286.6
41.00	221.5	75.4	296.9
42.00	231.9	75.4	307.3
43.00	242.4	75.4	317.8
44.00	252.9	75.4	328.3

45.00	263.5	75.4	338.9
46.00	274.2	75.4	349.6
47.00	284.9	75.4	360.3
48.00	295.7	75.4	371.1
49.00	306.5	75.4	381.9
50.00	317.4	75.4	392.8
51.00	328.4	75.4	403.8
52.00	339.4	75.4	414.8
53.00	350.5	75.4	425.9
54.00	361.6	75.4	437.0

NOTES:

- AN ASTERISK IS PLACED IN THE END-BEARING COLUMN
IF THE TIP RESISTANCE IS CONTROLLED BY THE FRICTION
OF SOIL PLUG INSIDE AN OPEN-ENDED PIPE PILE.

 * COMPUTE LOAD-DISTRIBUTION AND LOAD-SETTLEMENT *
 * CURVES FOR AXIAL LOADING *

MOVEMENT	T-Z CURVE NO.	NO. OF POINTS	DEPTH TO CURVE FT.	LOAD TRANSFER PSI	PILE IN.
	1	10	0.0000E+00	0.0000E+00	0.0000E+00
				0.0000E+00	0.2560E-01
				0.0000E+00	0.4960E-01
				0.0000E+00	0.9120E-01
				0.0000E+00	0.1280E+00
				0.0000E+00	0.1600E+00
				0.0000E+00	0.3200E+00
				0.0000E+00	0.4800E+00
				0.0000E+00	0.8000E+00
				0.0000E+00	0.3200E+01
	2	10	0.5250E+00	0.0000E+00	0.0000E+00
				0.0000E+00	0.2560E-01
				0.0000E+00	0.4960E-01
				0.0000E+00	0.9120E-01
				0.0000E+00	0.1280E+00
				0.0000E+00	0.1600E+00
				0.0000E+00	0.3200E+00
				0.0000E+00	0.4800E+00
				0.0000E+00	0.8000E+00
				0.0000E+00	0.3200E+01
	3	10	0.9583E+00	0.0000E+00	0.0000E+00
				0.0000E+00	0.2560E-01

			0.0000E+00	0.4960E-01
			0.0000E+00	0.9120E-01
			0.0000E+00	0.1280E+00
			0.0000E+00	0.1600E+00
			0.0000E+00	0.3200E+00
			0.0000E+00	0.4800E+00
			0.0000E+00	0.8000E+00
			0.0000E+00	0.3200E+01
4	10	0.1000E+01	0.0000E+00	0.0000E+00
			0.0000E+00	0.2560E-01
			0.0000E+00	0.4960E-01
			0.0000E+00	0.9120E-01
			0.0000E+00	0.1280E+00
			0.0000E+00	0.1600E+00
			0.0000E+00	0.3200E+00
			0.0000E+00	0.4800E+00
			0.0000E+00	0.8000E+00
			0.0000E+00	0.3200E+01
5	10	0.2775E+01	0.0000E+00	0.0000E+00
			0.0000E+00	0.2560E-01
			0.0000E+00	0.4960E-01
			0.0000E+00	0.9120E-01
			0.0000E+00	0.1280E+00
			0.0000E+00	0.1600E+00
			0.0000E+00	0.3200E+00
			0.0000E+00	0.4800E+00
			0.0000E+00	0.8000E+00
			0.0000E+00	0.3200E+01
6	10	0.4458E+01	0.0000E+00	0.0000E+00
			0.1319E+00	0.2560E-01
			0.2199E+00	0.4960E-01
			0.3298E+00	0.9120E-01
			0.3958E+00	0.1280E+00
			0.4398E+00	0.1600E+00
			0.4398E+00	0.3200E+00
			0.4398E+00	0.4800E+00
			0.4398E+00	0.8000E+00
			0.4398E+00	0.3200E+01
7	10	0.4500E+01	0.0000E+00	0.0000E+00
			0.1439E+00	0.2560E-01
			0.2399E+00	0.4960E-01
			0.3598E+00	0.9120E-01
			0.4318E+00	0.1280E+00
			0.4797E+00	0.1600E+00
			0.4318E+00	0.3200E+00
			0.4318E+00	0.4800E+00
			0.4318E+00	0.8000E+00
			0.4318E+00	0.3200E+01
8	10	0.1028E+02	0.0000E+00	0.0000E+00

			0.9375E+01	0.2560E-01
			0.1562E+02	0.4960E-01
			0.2344E+02	0.9120E-01
			0.2812E+02	0.1280E+00
			0.3125E+02	0.1600E+00
			0.2812E+02	0.3200E+00
			0.2812E+02	0.4800E+00
			0.2812E+02	0.8000E+00
			0.2812E+02	0.3200E+01
9	10	0.1596E+02	0.0000E+00	0.0000E+00
			0.7578E+01	0.2560E-01
			0.1263E+02	0.4960E-01
			0.1895E+02	0.9120E-01
			0.2273E+02	0.1280E+00
			0.2526E+02	0.1600E+00
			0.2273E+02	0.3200E+00
			0.2273E+02	0.4800E+00
			0.2273E+02	0.8000E+00
			0.2273E+02	0.3200E+01
10	10	0.1600E+02	0.0000E+00	0.0000E+00
			0.7500E+01	0.2560E-01
			0.1250E+02	0.4960E-01
			0.1875E+02	0.9120E-01
			0.2250E+02	0.1280E+00
			0.2500E+02	0.1600E+00
			0.2250E+02	0.3200E+00
			0.2250E+02	0.4800E+00
			0.2250E+02	0.8000E+00
			0.2250E+02	0.3200E+01
11	10	0.1928E+02	0.0000E+00	0.0000E+00
			0.2971E+01	0.2560E-01
			0.4952E+01	0.4960E-01
			0.7428E+01	0.9120E-01
			0.8914E+01	0.1280E+00
			0.9904E+01	0.1600E+00
			0.8914E+01	0.3200E+00
			0.8914E+01	0.4800E+00
			0.8914E+01	0.8000E+00
			0.8914E+01	0.3200E+01
12	10	0.2246E+02	0.0000E+00	0.0000E+00
			0.3851E+01	0.2560E-01
			0.6418E+01	0.4960E-01
			0.9627E+01	0.9120E-01
			0.1155E+02	0.1280E+00
			0.1284E+02	0.1600E+00
			0.1155E+02	0.3200E+00
			0.1155E+02	0.4800E+00
			0.1155E+02	0.8000E+00
			0.1155E+02	0.3200E+01
13	10	0.2250E+02		

			0.0000E+00	0.0000E+00
			0.3862E+01	0.2560E-01
			0.6437E+01	0.4960E-01
			0.9656E+01	0.9120E-01
			0.1159E+02	0.1280E+00
			0.1287E+02	0.1600E+00
			0.1287E+02	0.3200E+00
			0.1287E+02	0.4800E+00
			0.1287E+02	0.8000E+00
			0.1287E+02	0.3200E+01
14	10	0.2503E+02		
			0.0000E+00	0.0000E+00
			0.1719E+01	0.2560E-01
			0.2865E+01	0.4960E-01
			0.4297E+01	0.9120E-01
			0.5157E+01	0.1280E+00
			0.5730E+01	0.1600E+00
			0.5730E+01	0.3200E+00
			0.5730E+01	0.4800E+00
			0.5730E+01	0.8000E+00
			0.5730E+01	0.3200E+01
15	10	0.2746E+02		
			0.0000E+00	0.0000E+00
			0.1901E+01	0.2560E-01
			0.3169E+01	0.4960E-01
			0.4753E+01	0.9120E-01
			0.5704E+01	0.1280E+00
			0.6338E+01	0.1600E+00
			0.6338E+01	0.3200E+00
			0.6338E+01	0.4800E+00
			0.6338E+01	0.8000E+00
			0.6338E+01	0.3200E+01
16	10	0.2750E+02		
			0.0000E+00	0.0000E+00
			0.1904E+01	0.2560E-01
			0.3174E+01	0.4960E-01
			0.4761E+01	0.9120E-01
			0.5713E+01	0.1280E+00
			0.6348E+01	0.1600E+00
			0.5713E+01	0.3200E+00
			0.5713E+01	0.4800E+00
			0.5713E+01	0.8000E+00
			0.5713E+01	0.3200E+01
17	10	0.3203E+02		
			0.0000E+00	0.0000E+00
			0.8393E+01	0.2560E-01
			0.1399E+02	0.4960E-01
			0.2098E+02	0.9120E-01
			0.2518E+02	0.1280E+00
			0.2798E+02	0.1600E+00
			0.2518E+02	0.3200E+00
			0.2518E+02	0.4800E+00
			0.2518E+02	0.8000E+00
			0.2518E+02	0.3200E+01

18	10	0.3646E+02	0.0000E+00	0.0000E+00
			0.6419E+01	0.2560E-01
			0.1070E+02	0.4960E-01
			0.1605E+02	0.9120E-01
			0.1926E+02	0.1280E+00
			0.2140E+02	0.1600E+00
			0.1926E+02	0.3200E+00
			0.1926E+02	0.4800E+00
			0.1926E+02	0.8000E+00
			0.1926E+02	0.3200E+01
19	10	0.3650E+02	0.0000E+00	0.0000E+00
			0.6363E+01	0.2560E-01
			0.1060E+02	0.4960E-01
			0.1591E+02	0.9120E-01
			0.1909E+02	0.1280E+00
			0.2121E+02	0.1600E+00
			0.1909E+02	0.3200E+00
			0.1909E+02	0.4800E+00
			0.1909E+02	0.8000E+00
			0.1909E+02	0.3200E+01
20	10	0.4753E+02	0.0000E+00	0.0000E+00
			0.6203E+01	0.2560E-01
			0.1034E+02	0.4960E-01
			0.1551E+02	0.9120E-01
			0.1861E+02	0.1280E+00
			0.2068E+02	0.1600E+00
			0.1861E+02	0.3200E+00
			0.1861E+02	0.4800E+00
			0.1861E+02	0.8000E+00
			0.1861E+02	0.3200E+01
21	10	0.5846E+02	0.0000E+00	0.0000E+00
			0.6203E+01	0.2560E-01
			0.1034E+02	0.4960E-01
			0.1551E+02	0.9120E-01
			0.1861E+02	0.1280E+00
			0.2068E+02	0.1600E+00
			0.1861E+02	0.3200E+00
			0.1861E+02	0.4800E+00
			0.1861E+02	0.8000E+00
			0.1861E+02	0.3200E+01

TIP LOAD KIP	TIP MOVEMENT IN.
0.0000E+00	0.0000E+00
0.4712E+01	0.8000E-02
0.9425E+01	0.1600E-01
0.1885E+02	0.3200E-01

0.3770E+02	0.2080E+00
0.5655E+02	0.6720E+00
0.6786E+02	0.1168E+01
0.7540E+02	0.1600E+01
0.7540E+02	0.2400E+01
0.7540E+02	0.3200E+01

LOAD VERSUS SETTLEMENT CURVE

TOP LOAD KIP	TOP MOVEMENT IN.	TIP LOAD KIP	TIP MOVEMENT IN.
0.2082E+01	0.8689E-03	0.5890E-01	0.1000E-03
0.2104E+02	0.8723E-02	0.5890E+00	0.1000E-02
0.1059E+03	0.4410E-01	0.2945E+01	0.5000E-02
0.1928E+03	0.8472E-01	0.5890E+01	0.1000E-01
0.3220E+03	0.1536E+00	0.1178E+02	0.2000E-01
0.4969E+03	0.2793E+00	0.2078E+02	0.5000E-01
0.5622E+03	0.3587E+00	0.2399E+02	0.8000E-01
0.5906E+03	0.4020E+00	0.2613E+02	0.1000E+00
0.6183E+03	0.5305E+00	0.3684E+02	0.2000E+00
0.6119E+03	0.8284E+00	0.4956E+02	0.5000E+00
0.6218E+03	0.1138E+01	0.5947E+02	0.8000E+00
0.6264E+03	0.1342E+01	0.6403E+02	0.1000E+01
0.6378E+03	0.2353E+01	0.7540E+02	0.2000E+01

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APILE for Windows, Version 2019.9.3

Serial Number : 138584419

A Program for Analyzing the Axial Capacity
and Short-term Settlement of Driven Piles
under Axial Loading.
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Path to file locations : \\Dayton-fs1\PROJECTS\2021\GEO
Projects\01051704 - LJB, Inc. - Spruce Avenue Bridge Replacement (SHE-
SPRUC-02270) - ODOT PID 114201 - Sidney, Ohio\Pile Analysis\Ray\Andy's
Updated with New Elevations\
Name of input data file : 16-Inch CIPRC Pile - B-002-0-21 rf no
batter.ap9d
Name of output file : 16-Inch CIPRC Pile - B-002-0-21 rf no
batter.ap9o
Name of plot output file : 16-Inch CIPRC Pile - B-002-0-21 rf no
batter.ap9p

Time and Date of Analysis

Date: May 19, 2023 Time: 16:01:48

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* INPUT INFORMATION *

SHE-Spruce-02.27 - 14" CIPRC Pile - B-002-0-21

DESIGNER : PSI

JOB NUMBER : 01051704

METHOD FOR UNIT LOAD TRANSFERS :

- FHWA (Federal Highway Administration)
Unfactored Unit Side Friction and Unit Side Resistance are
used.

COMPUTATION METHOD(S) FOR PILE CAPACITY :

- FHWA (Federal Highway Administration)
- API RP 2A (American Petroleum Institute)

TYPE OF LOADING :

- COMPRESSION

PILE TYPE :

Steel pipe pile or non-tapered portion of monotube pile
- Close-Ended Pile

DATA FOR AXIAL STIFFNESS :

- MODULUS OF ELASTICITY = 0.290E+08 PSI
- CROSS SECTION AREA = 24.35 IN²

CIRCULAR PILE PROPERTIES :

- OUTSIDE DIAMETER, OD = 16.00 IN.
- INTERNAL DIAMETER, ID = 15.00 IN.
- TOTAL PILE LENGTH, TL = 45.00 FT.
- BATTER ANGLE = 0.00 DEG
- PILE STICKUP LENGTH, PSL = 0.50 FT.
- ZERO FRICTION LENGTH, ZFL = 5.00 FT.
- INCREMENT OF PILE LENGTH
USED IN COMPUTATION = 1.00 FT.
- LENGTH OF ENHANCED
END SECTION = 45.00 FT.
- INTERNAL DIAMETER OF
ENHANCED END SECTION = 15.00 IN.

PLUGGED/UNPLUGGED CONDITIONS :

Internal Pile Plug Calculated by Program

SOIL INFORMATIONS :

DEPTH FT.	SOIL TYPE	LATERAL EARTH PRESSURE	EFFECTIVE UNIT WEIGHT LB/FT^3	FRICTION ANGLE DEGREES	BEARING CAPACITY FACTOR
0.00	CLAY	0.80*	120.00	0.00	8.00**
6.50	CLAY	0.80*	120.00	0.00	8.00**
6.50	SAND	0.80*	67.60	28.00	17.00
13.50	SAND	0.80*	72.60	32.00	28.00
13.50	CLAY	0.80*	62.60	0.00	8.00**
19.50	CLAY	0.80*	62.60	0.00	8.00**
19.50	CLAY	0.80*	67.60	0.00	8.00**
48.50	CLAY	0.80*	67.60	0.00	8.00**

* VALUE ASSUMED BY THE PROGRAM

** VALUE ESTIMATED BY THE PROGRAM BASED ON FRICTION ANGLE

END BEARING	MAXIMUM UNIT FRICTION KSF	MAXIMUM UNIT BEARING KSF	UNDISTURB SHEAR STRENGTH KSF	REMOLDED SHEAR STRENGTH KSF	BLOW COUNT	UNIT SKIN FRICTION KSF	UNIT
0.00	0.10E+08*	0.10E+08*	1.20	0.00	0.00	0.00	
0.00	0.10E+08*	0.10E+08*	2.00	0.00	0.00	0.00	
0.00	0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	
0.00	0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	
0.00	0.10E+08*	0.10E+08*	3.50	0.00	0.00	0.00	
0.00	0.10E+08*	0.10E+08*	3.50	0.00	0.00	0.00	
0.00	0.10E+08*	0.10E+08*	6.00	0.00	0.00	0.00	
0.00	0.10E+08*	0.10E+08*	6.00	0.00	0.00	0.00	

* MAXIMUM UNIT FRICTION AND/OR MAXIMUM UNIT BEARING
WERE SET TO BE 0.10E+08 BECAUSE THE USER DOES NOT
PLAN TO LIMIT THE COMPUTED DATA.

LRFD FACTOR LRFD FACTOR
ON UNIT ON UNIT

DEPTH FT.	FRICTION	BEARING
0.00	1.000	1.000
6.50	1.000	1.000
6.50	1.000	1.000
13.50	1.000	1.000
13.50	1.000	1.000
19.50	1.000	1.000
19.50	1.000	1.000
48.50	1.000	1.000

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 * COMPUTATION RESULT *

 * FED. HWY. METHOD *

PILE PENETRATION FT.	TOTAL SKIN FRICTION KIP	END BEARING KIP	ULTIMATE CAPACITY KIP
0.00	0.0	8.3	8.3
1.00	0.0	9.1	9.1
2.00	0.0	14.2	14.2
3.00	0.0	19.7	19.7
4.00	0.0	21.3	21.3
5.00	2.8	22.8	25.6
6.00	8.4	21.9	30.3
7.00	14.1	21.0	35.1
8.00	17.7	19.7	37.4
9.00	19.1	18.8	37.9
10.00	20.7	21.5	42.2
11.00	22.5	25.6	48.1
12.00	24.5	32.3	56.8
13.00	26.8	37.9	64.7
14.00	29.4	42.0	71.5
15.00	38.1	44.3	82.4
16.00	52.8	44.0	96.8
17.00	67.5	44.0	111.4
18.00	82.1	44.0	126.1
19.00	96.1	51.8	147.9
20.00	107.1	59.7	166.8
21.00	119.2	67.5	186.8
22.00	134.5	75.4	209.9
23.00	149.8	75.4	225.2
24.00	165.1	75.4	240.5
25.00	180.3	75.4	255.7
26.00	195.6	75.4	271.0

27.00	210.9	75.4	286.3
28.00	226.2	75.4	301.6
29.00	241.4	75.4	316.8
30.00	256.7	75.4	332.1
31.00	272.0	75.4	347.4
32.00	287.3	75.4	362.7
33.00	302.5	75.4	377.9
34.00	317.8	75.4	393.2
35.00	333.1	75.4	408.5
36.00	348.4	75.4	423.8
37.00	363.6	75.4	439.0
38.00	378.9	75.4	454.3
39.00	394.2	75.4	469.6
40.00	409.5	75.4	484.9
41.00	424.8	75.4	500.2
42.00	440.0	75.4	515.4
43.00	455.3	75.4	530.7
44.00	470.6	75.4	546.0

 * API RP-2A (2010) *

PILE PENETRATION FT.	TOTAL SKIN FRICTION KIP	END BEARING KIP	ULTIMATE CAPACITY KIP
0.00	0.0	8.3	8.3
1.00	0.0	9.1	9.1
2.00	0.0	14.2	14.2
3.00	0.0	19.7	19.7
4.00	0.0	21.3	21.3
5.00	1.4	22.8	24.2
6.00	4.4	23.4	27.7
7.00	7.6	24.5	32.1
8.00	9.9	26.3	36.2
9.00	11.3	28.8	40.1
10.00	12.9	33.1	46.0
11.00	14.6	37.8	52.3
12.00	16.4	42.8	59.2
13.00	18.4	45.0	63.4
14.00	20.6	46.0	66.6
15.00	24.7	45.7	70.3
16.00	30.5	44.0	74.5
17.00	36.5	44.0	80.4
18.00	42.4	44.0	86.4
19.00	48.5	51.8	100.3
20.00	54.6	59.7	114.3
21.00	62.3	67.5	129.8
22.00	71.6	75.4	147.0
23.00	81.0	75.4	156.4
24.00	90.5	75.4	165.9
25.00	100.0	75.4	175.4

26.00	109.7	75.4	185.1
27.00	119.4	75.4	194.8
28.00	129.2	75.4	204.6
29.00	139.1	75.4	214.5
30.00	149.0	75.4	224.4
31.00	159.0	75.4	234.4
32.00	169.1	75.4	244.5
33.00	179.2	75.4	254.6
34.00	189.5	75.4	264.9
35.00	199.7	75.4	275.1
36.00	210.1	75.4	285.5
37.00	220.5	75.4	295.9
38.00	231.0	75.4	306.4
39.00	241.5	75.4	316.9
40.00	252.1	75.4	327.5
41.00	262.7	75.4	338.1
42.00	273.4	75.4	348.8
43.00	284.2	75.4	359.6
44.00	295.0	75.4	370.4

NOTES:

- AN ASTERISK IS PLACED IN THE END-BEARING COLUMN
IF THE TIP RESISTANCE IS CONTROLLED BY THE FRICTION
OF SOIL PLUG INSIDE AN OPEN-ENDED PIPE PILE.

 * COMPUTE LOAD-DISTRIBUTION AND LOAD-SETTLEMENT *
 * CURVES FOR AXIAL LOADING *

MOVEMENT	T-Z CURVE	NO. OF	DEPTH TO CURVE	LOAD TRANSFER	PILE
	NO.	POINTS	FT.	PSI	IN.
1	10	0.0000E+00	0.0000E+00	0.0000E+00	
			0.0000E+00	0.2560E-01	
			0.0000E+00	0.4960E-01	
			0.0000E+00	0.9120E-01	
			0.0000E+00	0.1280E+00	
			0.0000E+00	0.1600E+00	
			0.0000E+00	0.3200E+00	
			0.0000E+00	0.4800E+00	
			0.0000E+00	0.8000E+00	
			0.0000E+00	0.3200E+01	
			0.0000E+00	0.0000E+00	
			0.0000E+00	0.2560E-01	
			0.0000E+00	0.4960E-01	
			0.0000E+00	0.9120E-01	
2	10	0.3275E+01	0.0000E+00	0.0000E+00	
			0.0000E+00	0.2560E-01	
			0.0000E+00	0.4960E-01	
			0.0000E+00	0.9120E-01	

3	10	0.6458E+01	0.0000E+00	0.1280E+00
			0.0000E+00	0.1600E+00
			0.0000E+00	0.3200E+00
			0.0000E+00	0.4800E+00
			0.0000E+00	0.8000E+00
			0.0000E+00	0.3200E+01
			0.0000E+00	0.0000E+00
			0.2846E+01	0.2560E-01
			0.4744E+01	0.4960E-01
			0.7116E+01	0.9120E-01
4	10	0.6500E+01	0.8539E+01	0.1280E+00
			0.9488E+01	0.1600E+00
			0.8539E+01	0.3200E+00
			0.8539E+01	0.4800E+00
			0.8539E+01	0.8000E+00
			0.8539E+01	0.3200E+01
			0.0000E+00	0.0000E+00
			0.2848E+01	0.2560E-01
			0.4747E+01	0.4960E-01
			0.7120E+01	0.9120E-01
5	10	0.1003E+02	0.8544E+01	0.1280E+00
			0.9494E+01	0.1600E+00
			0.9494E+01	0.3200E+00
			0.9494E+01	0.4800E+00
			0.9494E+01	0.8000E+00
			0.9494E+01	0.3200E+01
			0.0000E+00	0.0000E+00
			0.8372E+00	0.2560E-01
			0.1395E+01	0.4960E-01
			0.2093E+01	0.9120E-01
6	10	0.1346E+02	0.2512E+01	0.1280E+00
			0.2791E+01	0.1600E+00
			0.2791E+01	0.3200E+00
			0.2791E+01	0.4800E+00
			0.2791E+01	0.8000E+00
			0.2791E+01	0.3200E+01
			0.0000E+00	0.0000E+00
			0.1292E+01	0.2560E-01
			0.2154E+01	0.4960E-01
			0.3230E+01	0.9120E-01
7	10	0.1350E+02	0.3876E+01	0.1280E+00
			0.4307E+01	0.1600E+00
			0.4307E+01	0.3200E+00
			0.4307E+01	0.4800E+00
			0.4307E+01	0.8000E+00
			0.4307E+01	0.3200E+01
			0.0000E+00	0.0000E+00
			0.1299E+01	0.2560E-01
			0.2164E+01	0.4960E-01

			0.3246E+01	0.9120E-01
			0.3896E+01	0.1280E+00
			0.4329E+01	0.1600E+00
			0.3896E+01	0.3200E+00
			0.3896E+01	0.4800E+00
			0.3896E+01	0.8000E+00
			0.3896E+01	0.3200E+01
8	10	0.1653E+02	0.0000E+00	0.0000E+00
			0.7292E+01	0.2560E-01
			0.1215E+02	0.4960E-01
			0.1823E+02	0.9120E-01
			0.2187E+02	0.1280E+00
			0.2431E+02	0.1600E+00
			0.2187E+02	0.3200E+00
			0.2187E+02	0.4800E+00
			0.2187E+02	0.8000E+00
			0.2187E+02	0.3200E+01
9	10	0.1946E+02	0.0000E+00	0.0000E+00
			0.5598E+01	0.2560E-01
			0.9331E+01	0.4960E-01
			0.1400E+02	0.9120E-01
			0.1680E+02	0.1280E+00
			0.1866E+02	0.1600E+00
			0.1680E+02	0.3200E+00
			0.1680E+02	0.4800E+00
			0.1680E+02	0.8000E+00
			0.1680E+02	0.3200E+01
10	10	0.1950E+02	0.0000E+00	0.0000E+00
			0.5509E+01	0.2560E-01
			0.9181E+01	0.4960E-01
			0.1377E+02	0.9120E-01
			0.1653E+02	0.1280E+00
			0.1836E+02	0.1600E+00
			0.1653E+02	0.3200E+00
			0.1653E+02	0.4800E+00
			0.1653E+02	0.8000E+00
			0.1653E+02	0.3200E+01
11	10	0.3403E+02	0.0000E+00	0.0000E+00
			0.7598E+01	0.2560E-01
			0.1266E+02	0.4960E-01
			0.1899E+02	0.9120E-01
			0.2279E+02	0.1280E+00
			0.2533E+02	0.1600E+00
			0.2279E+02	0.3200E+00
			0.2279E+02	0.4800E+00
			0.2279E+02	0.8000E+00
			0.2279E+02	0.3200E+01
12	10	0.4846E+02	0.0000E+00	0.0000E+00
			0.7598E+01	0.2560E-01

0.1266E+02	0.4960E-01
0.1899E+02	0.9120E-01
0.2279E+02	0.1280E+00
0.2533E+02	0.1600E+00
0.2279E+02	0.3200E+00
0.2279E+02	0.4800E+00
0.2279E+02	0.8000E+00
0.2279E+02	0.3200E+01

TIP LOAD KIP	TIP MOVEMENT IN.
0.0000E+00	0.0000E+00
0.4712E+01	0.8000E-02
0.9425E+01	0.1600E-01
0.1885E+02	0.3200E-01
0.3770E+02	0.2080E+00
0.5655E+02	0.6720E+00
0.6786E+02	0.1168E+01
0.7540E+02	0.1600E+01
0.7540E+02	0.2400E+01
0.7540E+02	0.3200E+01

LOAD VERSUS SETTLEMENT CURVE

TOP LOAD KIP	TOP MOVEMENT IN.	TIP LOAD KIP	TIP MOVEMENT IN.
0.1067E+01	0.5672E-03	0.5890E-01	0.1000E-03
0.1067E+02	0.5672E-02	0.5890E+00	0.1000E-02
0.5450E+02	0.2875E-01	0.2945E+01	0.5000E-02
0.1071E+03	0.5728E-01	0.5890E+01	0.1000E-01
0.1940E+03	0.1086E+00	0.1178E+02	0.2000E-01
0.3419E+03	0.2123E+00	0.2078E+02	0.5000E-01
0.4243E+03	0.2864E+00	0.2399E+02	0.8000E-01
0.4579E+03	0.3265E+00	0.2613E+02	0.1000E+00
0.4898E+03	0.4520E+00	0.3684E+02	0.2000E+00
0.4816E+03	0.7495E+00	0.4956E+02	0.5000E+00
0.4915E+03	0.1057E+01	0.5947E+02	0.8000E+00
0.4961E+03	0.1261E+01	0.6403E+02	0.1000E+01
0.5075E+03	0.2269E+01	0.7540E+02	0.2000E+01

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APILE for Windows, Version 2019.9.3

Serial Number : 138584419

A Program for Analyzing the Axial Capacity
and Short-term Settlement of Driven Piles
under Axial Loading.
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Path to file locations : \\Dayton-fs1\PROJECTS\2021\GEO
Projects\01051704 - LJB, Inc. - Spruce Avenue Bridge Replacement (SHE-
SPRUC-02270) - ODOT PID 114201 - Sidney, Ohio\Pile Analysis\Ray\Andy's
Updated with New Elevations\
Name of input data file : 16-Inch CIPRC Pile - B-003-0-21 rf no
batter.ap9d
Name of output file : 16-Inch CIPRC Pile - B-003-0-21 rf no
batter.ap9o
Name of plot output file : 16-Inch CIPRC Pile - B-003-0-21 rf no
batter.ap9p

Time and Date of Analysis

Date: May 19, 2023 Time: 16:04:29

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* INPUT INFORMATION *

SHE-Spruce-02.27 - 14" CIPRC Pile - B-003-0-21

DESIGNER : PSI

JOB NUMBER : 01051704

METHOD FOR UNIT LOAD TRANSFERS :

- FHWA (Federal Highway Administration)
Unfactored Unit Side Friction and Unit Side Resistance are
used.

COMPUTATION METHOD(S) FOR PILE CAPACITY :

- FHWA (Federal Highway Administration)
- API RP 2A (American Petroleum Institute)

TYPE OF LOADING :

- COMPRESSION

PILE TYPE :

Steel pipe pile or non-tapered portion of monotube pile
- Close-Ended Pile

DATA FOR AXIAL STIFFNESS :

- MODULUS OF ELASTICITY = 0.290E+08 PSI
- CROSS SECTION AREA = 24.35 IN²

CIRCULAR PILE PROPERTIES :

- OUTSIDE DIAMETER, OD = 16.00 IN.
- INTERNAL DIAMETER, ID = 15.00 IN.
- TOTAL PILE LENGTH, TL = 55.00 FT.
- BATTER ANGLE = 0.00 DEG
- PILE STICKUP LENGTH, PSL = 0.50 FT.
- ZERO FRICTION LENGTH, ZFL = 5.00 FT.
- INCREMENT OF PILE LENGTH
USED IN COMPUTATION = 1.00 FT.
- LENGTH OF ENHANCED
END SECTION = 55.00 FT.
- INTERNAL DIAMETER OF
ENHANCED END SECTION = 15.00 IN.

PLUGGED/UNPLUGGED CONDITIONS :

Internal Pile Plug Calculated by Program

SOIL INFORMATIONS :

DEPTH FT.	SOIL TYPE	LATERAL EARTH PRESSURE	EFFECTIVE UNIT WEIGHT LB/FT^3	FRICTION ANGLE DEGREES	BEARING CAPACITY FACTOR
0.00	CLAY	0.80*	120.00	0.00	8.00**
8.00	CLAY	0.80*	120.00	0.00	8.00**
8.00	CLAY	0.80*	125.00	0.00	8.00**
10.00	CLAY	0.80*	125.00	0.00	8.00**
10.00	SAND	0.80*	77.60	32.00	28.00**
13.00	SAND	0.80*	77.60	32.00	28.00**
13.00	CLAY	0.80*	62.60	0.00	8.00**
36.00	CLAY	0.80*	62.60	0.00	8.00**
36.00	CLAY	0.80*	67.60	0.00	8.00**
52.00	CLAY	0.80*	67.60	0.00	8.00**
52.00	CLAY	0.80*	67.60	0.00	8.00**
60.00	CLAY	0.80*	67.60	0.00	8.00**

* VALUE ASSUMED BY THE PROGRAM

** VALUE ESTIMATED BY THE PROGRAM BASED ON FRICTION ANGLE

END	MAXIMUM UNIT	MAXIMUM UNIT	UNDISTURB SHEAR	REMOLDED SHEAR	BLOW COUNT	UNIT SKIN FRICTION	UNIT
BEARING	FRICTION	BEARING	STRENGTH	STRENGTH			
KSF	KSF	KSF	KSF	KSF		KSF	
0.00	0.10E+08*	0.10E+08*	1.50	0.00	0.00	0.00	
0.00	0.10E+08*	0.10E+08*	2.00	0.00	0.00	0.00	
0.00	0.10E+08*	0.10E+08*	4.00	0.00	0.00	0.00	
0.00	0.10E+08*	0.10E+08*	4.00	0.00	0.00	0.00	
0.00	0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	
0.00	0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	
0.00	0.10E+08*	0.10E+08*	4.00	0.00	0.00	0.00	
0.00	0.10E+08*	0.10E+08*	3.00	0.00	0.00	0.00	
0.00	0.10E+08*	0.10E+08*	6.00	0.00	0.00	0.00	
0.00	0.10E+08*	0.10E+08*	6.00	0.00	0.00	0.00	

0.00	0.10E+08*	0.10E+08*	5.00	0.00	0.00	0.00
0.00	0.10E+08*	0.10E+08*	5.00	0.00	0.00	0.00

* MAXIMUM UNIT FRICTION AND/OR MAXIMUM UNIT BEARING
WERE SET TO BE 0.10E+08 BECAUSE THE USER DOES NOT
PLAN TO LIMIT THE COMPUTED DATA.

DEPTH FT.	LRFD FACTOR ON UNIT FRICTION	LRFD FACTOR ON UNIT BEARING
0.00	1.000	1.000
8.00	1.000	1.000
8.00	1.000	1.000
10.00	1.000	1.000
10.00	1.000	1.000
13.00	1.000	1.000
13.00	1.000	1.000
36.00	1.000	1.000
36.00	1.000	1.000
52.00	1.000	1.000
52.00	1.000	1.000
60.00	1.000	1.000

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* COMPUTATION RESULT *

* FED. HWY. METHOD *

PILE PENETRATION FT.	TOTAL SKIN FRICTION KIP	END BEARING KIP	ULTIMATE CAPACITY KIP
0.00	0.0	9.8	9.8
1.00	0.0	10.2	10.2
2.00	0.0	15.6	15.6
3.00	0.0	21.2	21.2
4.00	0.0	22.0	22.0
5.00	2.8	22.8	25.6
6.00	8.4	23.6	32.0
7.00	14.1	30.5	44.6
8.00	19.9	37.3	57.2
9.00	24.8	42.3	67.1

10.00	28.8	47.6	76.4
11.00	32.1	46.5	78.7
12.00	34.9	46.5	81.4
13.00	37.8	47.8	85.6
14.00	44.8	48.6	93.4
15.00	55.9	49.2	105.1
16.00	66.8	48.6	115.5
17.00	77.6	48.1	125.7
18.00	88.3	47.5	135.9
19.00	98.9	47.0	145.9
20.00	109.3	46.4	155.8
21.00	119.7	45.9	165.6
22.00	129.9	45.3	175.2
23.00	139.9	44.8	184.7
24.00	149.9	44.3	194.2
25.00	159.7	43.7	203.4
26.00	169.5	43.2	212.6
27.00	179.1	42.6	221.7
28.00	188.6	42.1	230.6
29.00	198.0	41.5	239.5
30.00	207.2	41.0	248.2
31.00	216.4	40.4	256.9
32.00	225.5	39.9	265.4
33.00	234.4	39.3	273.8
34.00	243.3	38.8	282.1
35.00	252.0	47.7	299.7
36.00	259.1	56.8	315.9
37.00	267.6	66.0	333.7
38.00	279.1	75.4	354.5
39.00	290.6	75.4	366.0
40.00	302.1	75.4	377.5
41.00	313.5	75.4	388.9
42.00	325.0	75.4	400.4
43.00	336.5	75.4	411.9
44.00	348.0	75.4	423.4
45.00	359.5	75.4	434.9
46.00	371.0	75.4	446.4
47.00	382.4	75.4	457.8
48.00	393.9	75.4	469.3
49.00	405.4	75.4	480.8
50.00	416.9	75.4	492.3
51.00	428.4	72.3	500.6
52.00	439.1	69.1	508.2
53.00	448.6	66.0	514.6
54.00	457.5	62.8	520.3

 * API RP-2A (2010) *

FILE PENETRATION	TOTAL SKIN FRICTION	END BEARING	ULTIMATE CAPACITY
---------------------	------------------------	----------------	----------------------

FT.	KIP	KIP	KIP
0.00	0.0	9.8	9.8
1.00	0.0	10.2	10.2
2.00	0.0	15.6	15.6
3.00	0.0	21.2	21.2
4.00	0.0	22.0	22.0
5.00	1.4	22.8	24.2
6.00	4.4	23.6	27.9
7.00	7.5	30.5	38.1
8.00	10.9	37.3	48.2
9.00	15.6	43.5	59.1
10.00	21.7	50.3	72.0
11.00	26.0	51.5	77.4
12.00	28.2	51.4	79.6
13.00	30.6	51.5	82.2
14.00	35.1	50.8	85.9
15.00	41.7	49.2	90.8
16.00	48.2	48.6	96.8
17.00	54.8	48.1	102.8
18.00	61.3	47.5	108.9
19.00	67.9	47.0	114.9
20.00	74.5	46.4	120.9
21.00	81.0	45.9	126.9
22.00	87.6	45.3	132.9
23.00	94.1	44.8	138.9
24.00	100.7	44.3	144.9
25.00	107.2	43.7	150.9
26.00	113.7	43.2	156.9
27.00	120.2	42.6	162.8
28.00	126.7	42.1	168.8
29.00	133.2	41.5	174.7
30.00	139.6	41.0	180.6
31.00	146.0	40.4	186.5
32.00	152.4	39.9	192.3
33.00	158.8	39.3	198.1
34.00	165.1	38.8	203.9
35.00	171.4	47.7	219.1
36.00	177.7	56.8	234.5
37.00	186.1	66.0	252.1
38.00	196.6	75.4	272.0
39.00	207.2	75.4	282.6
40.00	217.9	75.4	293.3
41.00	228.6	75.4	304.0
42.00	239.4	75.4	314.8
43.00	250.3	75.4	325.7
44.00	261.1	75.4	336.5
45.00	272.1	75.4	347.5
46.00	283.1	75.4	358.5
47.00	294.2	75.4	369.6
48.00	305.3	75.4	380.7
49.00	316.4	75.4	391.8
50.00	327.6	75.4	403.0
51.00	338.9	72.3	411.1
52.00	350.2	69.1	419.3

53.00	360.8	66.0	426.8
54.00	370.8	62.8	433.6

NOTES:

- AN ASTERISK IS PLACED IN THE END-BEARING COLUMN
IF THE TIP RESISTANCE IS CONTROLLED BY THE FRICTION
OF SOIL PLUG INSIDE AN OPEN-ENDED PIPE PILE.

* COMPUTE LOAD-DISTRIBUTION AND LOAD-SETTLEMENT *
* CURVES FOR AXIAL LOADING *

MOVEMENT	T-Z CURVE NO.	NO. OF POINTS	DEPTH TO CURVE FT.	LOAD TRANSFER PSI	PILE IN.
	1	10	0.0000E+00	0.0000E+00	0.0000E+00
				0.0000E+00	0.2560E-01
				0.0000E+00	0.4960E-01
				0.0000E+00	0.9120E-01
				0.0000E+00	0.1280E+00
				0.0000E+00	0.1600E+00
				0.0000E+00	0.3200E+00
				0.0000E+00	0.4800E+00
				0.0000E+00	0.8000E+00
				0.0000E+00	0.3200E+01
	2	10	0.4025E+01	0.0000E+00	0.0000E+00
				0.6955E-01	0.2560E-01
				0.1159E+00	0.4960E-01
				0.1739E+00	0.9120E-01
				0.2087E+00	0.1280E+00
				0.2318E+00	0.1600E+00
				0.2087E+00	0.3200E+00
				0.2087E+00	0.4800E+00
				0.2087E+00	0.8000E+00
				0.2087E+00	0.3200E+01
	3	10	0.7958E+01	0.0000E+00	0.0000E+00
				0.2912E+01	0.2560E-01
				0.4853E+01	0.4960E-01
				0.7280E+01	0.9120E-01
				0.8736E+01	0.1280E+00
				0.9707E+01	0.1600E+00
				0.8736E+01	0.3200E+00
				0.8736E+01	0.4800E+00
				0.8736E+01	0.8000E+00
				0.8736E+01	0.3200E+01

4	10	0.8000E+01	0.0000E+00	0.0000E+00
			0.2915E+01	0.2560E-01
			0.4859E+01	0.4960E-01
			0.7288E+01	0.9120E-01
			0.8746E+01	0.1280E+00
			0.9718E+01	0.1600E+00
			0.8746E+01	0.3200E+00
			0.8746E+01	0.4800E+00
			0.8746E+01	0.8000E+00
			0.8746E+01	0.3200E+01
5	10	0.9025E+01	0.0000E+00	0.0000E+00
			0.1983E+01	0.2560E-01
			0.3306E+01	0.4960E-01
			0.4958E+01	0.9120E-01
			0.5950E+01	0.1280E+00
			0.6611E+01	0.1600E+00
			0.5950E+01	0.3200E+00
			0.5950E+01	0.4800E+00
			0.5950E+01	0.8000E+00
			0.5950E+01	0.3200E+01
6	10	0.9958E+01	0.0000E+00	0.0000E+00
			0.1983E+01	0.2560E-01
			0.3306E+01	0.4960E-01
			0.4958E+01	0.9120E-01
			0.5950E+01	0.1280E+00
			0.6611E+01	0.1600E+00
			0.5950E+01	0.3200E+00
			0.5950E+01	0.4800E+00
			0.5950E+01	0.8000E+00
			0.5950E+01	0.3200E+01
7	10	0.1000E+02	0.0000E+00	0.0000E+00
			0.1983E+01	0.2560E-01
			0.3306E+01	0.4960E-01
			0.4958E+01	0.9120E-01
			0.5950E+01	0.1280E+00
			0.6611E+01	0.1600E+00
			0.6611E+01	0.3200E+00
			0.6611E+01	0.4800E+00
			0.6611E+01	0.8000E+00
			0.6611E+01	0.3200E+01
8	10	0.1153E+02	0.0000E+00	0.0000E+00
			0.1371E+01	0.2560E-01
			0.2285E+01	0.4960E-01
			0.3427E+01	0.9120E-01
			0.4113E+01	0.1280E+00
			0.4569E+01	0.1600E+00
			0.4569E+01	0.3200E+00
			0.4569E+01	0.4800E+00
			0.4569E+01	0.8000E+00

9	10	0.1296E+02	0.4569E+01	0.3200E+01
			0.0000E+00	0.0000E+00
			0.1486E+01	0.2560E-01
			0.2476E+01	0.4960E-01
			0.3714E+01	0.9120E-01
			0.4457E+01	0.1280E+00
			0.4952E+01	0.1600E+00
			0.4952E+01	0.3200E+00
			0.4952E+01	0.4800E+00
			0.4952E+01	0.8000E+00
			0.4952E+01	0.3200E+01
10	10	0.1300E+02	0.0000E+00	0.0000E+00
			0.1489E+01	0.2560E-01
			0.2482E+01	0.4960E-01
			0.3722E+01	0.9120E-01
			0.4467E+01	0.1280E+00
			0.4963E+01	0.1600E+00
			0.4467E+01	0.3200E+00
			0.4467E+01	0.4800E+00
			0.4467E+01	0.8000E+00
			0.4467E+01	0.3200E+01
11	10	0.2453E+02	0.0000E+00	0.0000E+00
			0.4891E+01	0.2560E-01
			0.8152E+01	0.4960E-01
			0.1223E+02	0.9120E-01
			0.1467E+02	0.1280E+00
			0.1630E+02	0.1600E+00
			0.1467E+02	0.3200E+00
			0.1467E+02	0.4800E+00
			0.1467E+02	0.8000E+00
			0.1467E+02	0.3200E+01
12	10	0.3596E+02	0.0000E+00	0.0000E+00
			0.2824E+01	0.2560E-01
			0.4706E+01	0.4960E-01
			0.7059E+01	0.9120E-01
			0.8471E+01	0.1280E+00
			0.9412E+01	0.1600E+00
			0.8471E+01	0.3200E+00
			0.8471E+01	0.4800E+00
			0.8471E+01	0.8000E+00
			0.8471E+01	0.3200E+01
13	10	0.3600E+02	0.0000E+00	0.0000E+00
			0.2759E+01	0.2560E-01
			0.4598E+01	0.4960E-01
			0.6897E+01	0.9120E-01
			0.8277E+01	0.1280E+00
			0.9197E+01	0.1600E+00
			0.8277E+01	0.3200E+00
			0.8277E+01	0.4800E+00

			0.8277E+01	0.8000E+00
			0.8277E+01	0.3200E+01
14	10	0.4403E+02		
			0.0000E+00	0.0000E+00
			0.5711E+01	0.2560E-01
			0.9518E+01	0.4960E-01
			0.1428E+02	0.9120E-01
			0.1713E+02	0.1280E+00
			0.1904E+02	0.1600E+00
			0.1713E+02	0.3200E+00
			0.1713E+02	0.4800E+00
			0.1713E+02	0.8000E+00
			0.1713E+02	0.3200E+01
15	10	0.5196E+02		
			0.0000E+00	0.0000E+00
			0.5030E+01	0.2560E-01
			0.8383E+01	0.4960E-01
			0.1257E+02	0.9120E-01
			0.1509E+02	0.1280E+00
			0.1677E+02	0.1600E+00
			0.1509E+02	0.3200E+00
			0.1509E+02	0.4800E+00
			0.1509E+02	0.8000E+00
			0.1509E+02	0.3200E+01
16	10	0.5200E+02		
			0.0000E+00	0.0000E+00
			0.5000E+01	0.2560E-01
			0.8333E+01	0.4960E-01
			0.1250E+02	0.9120E-01
			0.1500E+02	0.1280E+00
			0.1667E+02	0.1600E+00
			0.1500E+02	0.3200E+00
			0.1500E+02	0.4800E+00
			0.1500E+02	0.8000E+00
			0.1500E+02	0.3200E+01
17	10	0.5603E+02		
			0.0000E+00	0.0000E+00
			0.4417E+01	0.2560E-01
			0.7362E+01	0.4960E-01
			0.1104E+02	0.9120E-01
			0.1325E+02	0.1280E+00
			0.1472E+02	0.1600E+00
			0.1325E+02	0.3200E+00
			0.1325E+02	0.4800E+00
			0.1325E+02	0.8000E+00
			0.1325E+02	0.3200E+01
18	10	0.5996E+02		
			0.0000E+00	0.0000E+00
			0.4417E+01	0.2560E-01
			0.7362E+01	0.4960E-01
			0.1104E+02	0.9120E-01
			0.1325E+02	0.1280E+00
			0.1472E+02	0.1600E+00
			0.1325E+02	0.3200E+00

0.1325E+02	0.4800E+00
0.1325E+02	0.8000E+00
0.1325E+02	0.3200E+01

TIP LOAD KIP	TIP MOVEMENT IN.
0.0000E+00	0.0000E+00
0.3927E+01	0.8000E-02
0.7854E+01	0.1600E-01
0.1571E+02	0.3200E-01
0.3142E+02	0.2080E+00
0.4712E+02	0.6720E+00
0.5655E+02	0.1168E+01
0.6283E+02	0.1600E+01
0.6283E+02	0.2400E+01
0.6283E+02	0.3200E+01

LOAD VERSUS SETTLEMENT CURVE

TOP LOAD KIP	TOP MOVEMENT IN.	TIP LOAD KIP	TIP MOVEMENT IN.
0.1189E+01	0.6457E-03	0.4909E-01	0.1000E-03
0.1189E+02	0.6457E-02	0.4909E+00	0.1000E-02
0.6062E+02	0.3269E-01	0.2454E+01	0.5000E-02
0.1164E+03	0.6449E-01	0.4909E+01	0.1000E-01
0.2043E+03	0.1204E+00	0.9817E+01	0.2000E-01
0.3460E+03	0.2304E+00	0.1731E+02	0.5000E-01
0.4149E+03	0.3058E+00	0.1999E+02	0.8000E-01
0.4408E+03	0.3457E+00	0.2178E+02	0.1000E+00
0.4645E+03	0.4712E+00	0.3070E+02	0.2000E+00
0.4579E+03	0.7686E+00	0.4130E+02	0.5000E+00
0.4661E+03	0.1076E+01	0.4956E+02	0.8000E+00
0.4699E+03	0.1280E+01	0.5336E+02	0.1000E+01
0.4794E+03	0.2289E+01	0.6283E+02	0.2000E+01

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APILE for Windows, Version 2019.9.3

Serial Number : 138584419

A Program for Analyzing the Axial Capacity
and Short-term Settlement of Driven Piles
under Axial Loading.
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Path to file locations : \\Dayton-fs1\PROJECTS\2021\GEO
Projects\01051704 - LJB, Inc. - Spruce Avenue Bridge Replacement (SHE-
SPRUC-02270) - ODOT PID 114201 - Sidney, Ohio\Pile Analysis\Ray\Andy's
Updated with New Elevations\
Name of input data file : 16-Inch CIPRC Pile - B-004-0-21 rf no
batter.ap9d
Name of output file : 16-Inch CIPRC Pile - B-004-0-21 rf no
batter.ap9o
Name of plot output file : 16-Inch CIPRC Pile - B-004-0-21 rf no
batter.ap9p

Time and Date of Analysis

Date: May 19, 2023 Time: 16:06:39

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* INPUT INFORMATION *

SHE-Spruce-02.27 - 14" CIPRC Pile - B-004-0-21

DESIGNER : PSI

JOB NUMBER : 01051704

METHOD FOR UNIT LOAD TRANSFERS :

- FHWA (Federal Highway Administration)
Unfactored Unit Side Friction and Unit Side Resistance are
used.

COMPUTATION METHOD(S) FOR PILE CAPACITY :

- FHWA (Federal Highway Administration)
- API RP 2A (American Petroleum Institute)

TYPE OF LOADING :

- COMPRESSION

PILE TYPE :

Steel pipe pile or non-tapered portion of monotube pile
- Close-Ended Pile

DATA FOR AXIAL STIFFNESS :

- MODULUS OF ELASTICITY = 0.290E+08 PSI
- CROSS SECTION AREA = 47.12 IN²

CIRCULAR PILE PROPERTIES :

- OUTSIDE DIAMETER, OD = 16.00 IN.
- INTERNAL DIAMETER, ID = 14.00 IN.
- TOTAL PILE LENGTH, TL = 50.00 FT.
- BATTER ANGLE = 0.00 DEG
- PILE STICKUP LENGTH, PSL = 0.50 FT.
- ZERO FRICTION LENGTH, ZFL = 5.00 FT.
- INCREMENT OF PILE LENGTH
USED IN COMPUTATION = 1.00 FT.
- LENGTH OF ENHANCED
END SECTION = 50.00 FT.
- INTERNAL DIAMETER OF
ENHANCED END SECTION = 14.00 IN.

PLUGGED/UNPLUGGED CONDITIONS :

Internal Pile Plug Calculated by Program

SOIL INFORMATIONS :

DEPTH FT.	SOIL TYPE	LATERAL EARTH PRESSURE	EFFECTIVE UNIT WEIGHT LB/FT^3	FRICTION ANGLE DEGREES	BEARING CAPACITY FACTOR
0.00	CLAY	0.80*	62.60	0.00	8.00**
6.50	CLAY	0.80*	67.60	0.00	8.00**
6.50	CLAY	0.80*	62.60	0.00	8.00**
21.50	CLAY	0.80*	57.60	0.00	8.00**
21.50	SAND	0.80*	77.60	32.00	28.00
25.50	SAND	0.80*	77.60	32.00	28.00
25.50	CLAY	0.80*	62.60	0.00	8.00**
45.50	CLAY	0.80*	67.60	0.00	8.00**
45.50	CLAY	0.80*	67.60	0.00	8.00**
53.50	CLAY	0.80*	67.60	0.00	8.00**

* VALUE ASSUMED BY THE PROGRAM

** VALUE ESTIMATED BY THE PROGRAM BASED ON FRICTION ANGLE

END	MAXIMUM UNIT	MAXIMUM UNIT	UNDISTURB SHEAR	REMOLDED SHEAR	BLOW COUNT	UNIT SKIN FRICTION	UNIT
BEARING	FRICTION	BEARING	STRENGTH	STRENGTH			
KSF	KSF	KSF	KSF	KSF		KSF	
0.00	0.10E+08*	0.10E+08*	1.50	0.00	0.00	0.00	
0.00	0.10E+08*	0.10E+08*	2.00	0.00	0.00	0.00	
0.00	0.10E+08*	0.10E+08*	1.50	0.00	0.00	0.00	
0.00	0.10E+08*	0.10E+08*	1.00	0.00	0.00	0.00	
0.00	0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	
0.00	0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	
0.00	0.10E+08*	0.10E+08*	4.50	0.00	0.00	0.00	
0.00	0.10E+08*	0.10E+08*	5.50	0.00	0.00	0.00	
0.00	0.10E+08*	0.10E+08*	6.00	0.00	0.00	0.00	
0.00	0.10E+08*	0.10E+08*	6.00	0.00	0.00	0.00	

* MAXIMUM UNIT FRICTION AND/OR MAXIMUM UNIT BEARING
WERE SET TO BE 0.10E+08 BECAUSE THE USER DOES NOT

PLAN TO LIMIT THE COMPUTED DATA.

DEPTH FT.	LRFD FACTOR ON UNIT FRICTION	LRFD FACTOR ON UNIT BEARING
0.00	1.000	1.000
6.50	1.000	1.000
6.50	1.000	1.000
21.50	1.000	1.000
21.50	1.000	1.000
25.50	1.000	1.000
25.50	1.000	1.000
45.50	1.000	1.000
45.50	1.000	1.000
53.50	1.000	1.000

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 * COMPUTATION RESULT *

 * FED. HWY. METHOD *

PILE PENETRATION FT.	TOTAL SKIN FRICTION KIP	END BEARING KIP	ULTIMATE CAPACITY KIP
0.00	0.0	9.9	9.9
1.00	0.0	10.4	10.4
2.00	0.0	15.9	15.9
3.00	0.0	21.7	21.7
4.00	0.0	22.7	22.7
5.00	2.8	23.7	26.5
6.00	8.5	22.7	31.2
7.00	14.4	21.4	35.9
8.00	20.2	19.8	40.0
9.00	25.5	17.8	43.3
10.00	30.7	17.4	48.0
11.00	35.8	17.0	52.7
12.00	40.8	16.5	57.3
13.00	45.7	16.1	61.8
14.00	50.5	15.7	66.2
15.00	55.2	15.3	70.5
16.00	59.9	14.9	74.7
17.00	64.4	14.5	78.8
18.00	68.8	14.0	82.8

19.00	73.1	13.6	86.7
20.00	77.3	13.2	90.5
21.00	81.5	21.3	102.7
22.00	85.5	29.4	115.0
23.00	89.0	37.7	126.7
24.00	92.1	46.1	138.1
25.00	95.3	48.9	144.1
26.00	98.6	51.8	150.4
27.00	105.7	54.9	160.5
28.00	116.3	58.1	174.4
29.00	127.1	58.7	185.8
30.00	137.9	59.4	197.3
31.00	148.9	60.0	208.9
32.00	160.0	60.6	220.7
33.00	171.3	61.3	232.5
34.00	182.6	61.9	244.5
35.00	194.1	62.5	256.6
36.00	205.6	63.1	268.8
37.00	217.3	63.8	281.1
38.00	229.1	64.4	293.5
39.00	241.0	65.0	306.1
40.00	253.1	65.7	318.7
41.00	265.2	66.3	331.5
42.00	277.5	66.9	344.4
43.00	289.9	67.5	357.4
44.00	302.4	68.2	370.6
45.00	313.2	70.2	383.5
46.00	323.6	72.1	395.7
47.00	335.7	73.8	409.5
48.00	348.3	75.4	423.7
49.00	361.0	75.4	436.4

 * API RP-2A (2010) *

PILE PENETRATION FT.	TOTAL SKIN FRICTION KIP	END BEARING KIP	ULTIMATE CAPACITY KIP
0.00	0.0	9.9	9.9
1.00	0.0	10.4	10.4
2.00	0.0	15.9	15.9
3.00	0.0	21.7	21.7
4.00	0.0	22.7	22.7
5.00	1.2	23.7	24.9
6.00	3.9	22.7	26.6
7.00	6.6	21.4	28.1
8.00	9.3	19.8	29.1
9.00	11.7	17.8	29.5
10.00	14.1	17.4	31.5
11.00	16.5	17.0	33.5
12.00	18.9	16.5	35.5

13.00	21.3	16.1	37.5
14.00	23.8	15.7	39.5
15.00	26.2	15.3	41.5
16.00	28.6	14.9	43.5
17.00	31.0	14.5	45.5
18.00	33.4	14.0	47.4
19.00	35.8	13.6	49.4
20.00	38.2	13.2	51.4
21.00	40.6	23.4	64.0
22.00	43.0	34.4	77.4
23.00	45.5	46.3	91.8
24.00	48.0	59.1	107.1
25.00	50.6	59.7	110.4
26.00	53.4	59.8	113.2
27.00	58.6	59.3	117.8
28.00	66.1	58.1	124.2
29.00	73.8	58.7	132.5
30.00	81.6	59.4	141.0
31.00	89.5	60.0	149.5
32.00	97.6	60.6	158.2
33.00	105.8	61.3	167.0
34.00	114.1	61.9	176.0
35.00	122.5	62.5	185.0
36.00	131.1	63.1	194.2
37.00	139.8	63.8	203.6
38.00	148.6	64.4	213.0
39.00	157.5	65.0	222.6
40.00	166.6	65.7	232.3
41.00	175.8	66.3	242.1
42.00	185.1	66.9	252.0
43.00	194.6	67.5	262.1
44.00	204.1	68.2	272.3
45.00	213.8	70.2	284.0
46.00	223.6	72.1	295.7
47.00	233.9	73.8	307.7
48.00	244.5	75.4	319.9
49.00	255.2	75.4	330.6

NOTES:

- AN ASTERISK IS PLACED IN THE END-BEARING COLUMN IF THE TIP RESISTANCE IS CONTROLLED BY THE FRICTION OF SOIL PLUG INSIDE AN OPEN-ENDED PIPE PILE.

 * COMPUTE LOAD-DISTRIBUTION AND LOAD-SETTLEMENT *
 * CURVES FOR AXIAL LOADING *

T-Z CURVE NO. OF DEPTH TO CURVE LOAD TRANSFER PILE
 MOVEMENT

NO.	POINTS	FT.	PSI	IN.
1	10	0.0000E+00	0.0000E+00	0.0000E+00
			0.0000E+00	0.2560E-01
			0.0000E+00	0.4960E-01
			0.0000E+00	0.9120E-01
			0.0000E+00	0.1280E+00
			0.0000E+00	0.1600E+00
			0.0000E+00	0.3200E+00
			0.0000E+00	0.4800E+00
			0.0000E+00	0.8000E+00
			0.0000E+00	0.3200E+01
2	10	0.3275E+01	0.0000E+00	0.0000E+00
			0.0000E+00	0.2560E-01
			0.0000E+00	0.4960E-01
			0.0000E+00	0.9120E-01
			0.0000E+00	0.1280E+00
			0.0000E+00	0.1600E+00
			0.0000E+00	0.3200E+00
			0.0000E+00	0.4800E+00
			0.0000E+00	0.8000E+00
			0.0000E+00	0.3200E+01
3	10	0.6458E+01	0.0000E+00	0.0000E+00
			0.2937E+01	0.2560E-01
			0.4894E+01	0.4960E-01
			0.7342E+01	0.9120E-01
			0.8810E+01	0.1280E+00
			0.9789E+01	0.1600E+00
			0.8810E+01	0.3200E+00
			0.8810E+01	0.4800E+00
			0.8810E+01	0.8000E+00
			0.8810E+01	0.3200E+01
4	10	0.6500E+01	0.0000E+00	0.0000E+00
			0.2945E+01	0.2560E-01
			0.4909E+01	0.4960E-01
			0.7363E+01	0.9120E-01
			0.8835E+01	0.1280E+00
			0.9817E+01	0.1600E+00
			0.8835E+01	0.3200E+00
			0.8835E+01	0.4800E+00
			0.8835E+01	0.8000E+00
			0.8835E+01	0.3200E+01
5	10	0.1403E+02	0.0000E+00	0.0000E+00
			0.2371E+01	0.2560E-01
			0.3951E+01	0.4960E-01
			0.5927E+01	0.9120E-01
			0.7112E+01	0.1280E+00
			0.7902E+01	0.1600E+00
			0.7112E+01	0.3200E+00

6	10	0.2146E+02	0.7112E+01	0.4800E+00
			0.7112E+01	0.8000E+00
			0.7112E+01	0.3200E+01
			0.0000E+00	0.0000E+00
			0.2029E+01	0.2560E-01
			0.3382E+01	0.4960E-01
			0.5072E+01	0.9120E-01
			0.6087E+01	0.1280E+00
			0.6763E+01	0.1600E+00
			0.6087E+01	0.3200E+00
7	10	0.2150E+02	0.6087E+01	0.4800E+00
			0.6087E+01	0.8000E+00
			0.6087E+01	0.3200E+01
			0.0000E+00	0.0000E+00
			0.2025E+01	0.2560E-01
			0.3374E+01	0.4960E-01
			0.5061E+01	0.9120E-01
			0.6074E+01	0.1280E+00
			0.6748E+01	0.1600E+00
			0.6748E+01	0.3200E+00
8	10	0.2353E+02	0.6748E+01	0.4800E+00
			0.6748E+01	0.8000E+00
			0.6748E+01	0.3200E+01
			0.0000E+00	0.0000E+00
			0.1522E+01	0.2560E-01
			0.2536E+01	0.4960E-01
			0.3804E+01	0.9120E-01
			0.4565E+01	0.1280E+00
			0.5072E+01	0.1600E+00
			0.5072E+01	0.3200E+00
9	10	0.2546E+02	0.5072E+01	0.4800E+00
			0.5072E+01	0.8000E+00
			0.5072E+01	0.3200E+01
			0.0000E+00	0.0000E+00
			0.1676E+01	0.2560E-01
			0.2794E+01	0.4960E-01
			0.4191E+01	0.9120E-01
			0.5029E+01	0.1280E+00
			0.5588E+01	0.1600E+00
			0.5588E+01	0.3200E+00
10	10	0.2550E+02	0.5588E+01	0.4800E+00
			0.5588E+01	0.8000E+00
			0.5588E+01	0.3200E+01
			0.0000E+00	0.0000E+00
			0.1680E+01	0.2560E-01
			0.2800E+01	0.4960E-01
			0.4199E+01	0.9120E-01
			0.5039E+01	0.1280E+00
			0.5599E+01	0.1600E+00

11	10	0.3553E+02	0.5039E+01	0.3200E+00
			0.5039E+01	0.4800E+00
			0.5039E+01	0.8000E+00
			0.5039E+01	0.3200E+01
12	10	0.4546E+02	0.0000E+00	0.0000E+00
			0.5757E+01	0.2560E-01
			0.9595E+01	0.4960E-01
			0.1439E+02	0.9120E-01
			0.1727E+02	0.1280E+00
			0.1919E+02	0.1600E+00
			0.1727E+02	0.3200E+00
			0.1727E+02	0.4800E+00
			0.1727E+02	0.8000E+00
			0.1727E+02	0.3200E+01
			0.0000E+00	0.0000E+00
			0.5101E+01	0.2560E-01
13	10	0.4550E+02	0.8501E+01	0.4960E-01
			0.1275E+02	0.9120E-01
			0.1530E+02	0.1280E+00
			0.1700E+02	0.1600E+00
			0.1530E+02	0.3200E+00
			0.1530E+02	0.4800E+00
			0.1530E+02	0.8000E+00
			0.1530E+02	0.3200E+01
			0.0000E+00	0.0000E+00
			0.5152E+01	0.2560E-01
			0.8586E+01	0.4960E-01
			0.1288E+02	0.9120E-01
14	10	0.4953E+02	0.1545E+02	0.1280E+00
			0.1717E+02	0.1600E+00
			0.1545E+02	0.3200E+00
			0.1545E+02	0.4800E+00
			0.1545E+02	0.8000E+00
			0.1545E+02	0.3200E+01
			0.0000E+00	0.0000E+00
			0.6285E+01	0.2560E-01
			0.1048E+02	0.4960E-01
			0.1571E+02	0.9120E-01
			0.1886E+02	0.1280E+00
			0.2095E+02	0.1600E+00
15	10	0.5346E+02	0.1886E+02	0.3200E+00
			0.1886E+02	0.4800E+00
			0.1886E+02	0.8000E+00
			0.1886E+02	0.3200E+01
			0.0000E+00	0.0000E+00
			0.6285E+01	0.2560E-01
			0.1048E+02	0.4960E-01
			0.1571E+02	0.9120E-01
			0.1886E+02	0.1280E+00

0.2095E+02	0.1600E+00
0.1886E+02	0.3200E+00
0.1886E+02	0.4800E+00
0.1886E+02	0.8000E+00
0.1886E+02	0.3200E+01

TIP LOAD KIP	TIP MOVEMENT IN.
0.0000E+00	0.0000E+00
0.4712E+01	0.8000E-02
0.9425E+01	0.1600E-01
0.1885E+02	0.3200E-01
0.3770E+02	0.2080E+00
0.5655E+02	0.6720E+00
0.6786E+02	0.1168E+01
0.7540E+02	0.1600E+01
0.7540E+02	0.2400E+01
0.7540E+02	0.3200E+01

LOAD VERSUS SETTLEMENT CURVE

TOP LOAD KIP	TOP MOVEMENT IN.	TIP LOAD KIP	TIP MOVEMENT IN.
0.6517E+00	0.2752E-03	0.5890E-01	0.1000E-03
0.6517E+01	0.2752E-02	0.5890E+00	0.1000E-02
0.3270E+02	0.1377E-01	0.2945E+01	0.5000E-02
0.6569E+02	0.2762E-01	0.5890E+01	0.1000E-01
0.1263E+03	0.5468E-01	0.1178E+02	0.2000E-01
0.2385E+03	0.1171E+00	0.2078E+02	0.5000E-01
0.3096E+03	0.1679E+00	0.2399E+02	0.8000E-01
0.3438E+03	0.1986E+00	0.2613E+02	0.1000E+00
0.3893E+03	0.3166E+00	0.3684E+02	0.2000E+00
0.3815E+03	0.6156E+00	0.4956E+02	0.5000E+00
0.3914E+03	0.9200E+00	0.5947E+02	0.8000E+00
0.3959E+03	0.1122E+01	0.6403E+02	0.1000E+01
0.4073E+03	0.2127E+01	0.7540E+02	0.2000E+01

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APILE for Windows, Version 2019.9.3

Serial Number : 138584419

A Program for Analyzing the Axial Capacity
and Short-term Settlement of Driven Piles
under Axial Loading.
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Path to file locations : \\Dayton-fs1\PROJECTS\2021\GEO
Projects\01051704 - LJB, Inc. - Spruce Avenue Bridge Replacement (SHE-
SPRUC-02270) - ODOT PID 114201 - Sidney, Ohio\Pile Analysis\Ray\
Name of input data file : 16-Inch CIPRC Pile - B-001-0-21 rf new
elevation.ap9d
Name of output file : 16-Inch CIPRC Pile - B-001-0-21 rf new
elevation.ap9o
Name of plot output file : 16-Inch CIPRC Pile - B-001-0-21 rf new
elevation.ap9p

Time and Date of Analysis

Date: May 19, 2023 Time: 15:41:16

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* INPUT INFORMATION *

SHE-Spruce-02.27 - 14" CIPRC Pile - B-001-0-21

DESIGNER : PSI

JOB NUMBER : 01051704

METHOD FOR UNIT LOAD TRANSFERS :

- FHWA (Federal Highway Administration)
Unfactored Unit Side Friction and Unit Side Resistance are
used.

COMPUTATION METHOD(S) FOR PILE CAPACITY :

- FHWA (Federal Highway Administration)
- API RP 2A (American Petroleum Institute)

TYPE OF LOADING :

- COMPRESSION

PILE TYPE :

Steel pipe pile or non-tapered portion of monotube pile
- Close-Ended Pile

DATA FOR AXIAL STIFFNESS :

- MODULUS OF ELASTICITY = 0.290E+08 PSI
- CROSS SECTION AREA = 24.35 IN²

CIRCULAR PILE PROPERTIES :

- OUTSIDE DIAMETER, OD = 16.00 IN.
- INTERNAL DIAMETER, ID = 15.00 IN.
- TOTAL PILE LENGTH, TL = 55.00 FT.
- BATTER ANGLE = 14.00 DEG
- PILE STICKUP LENGTH, PSL = 0.50 FT.
- ZERO FRICTION LENGTH, ZFL = 5.00 FT.
- INCREMENT OF PILE LENGTH
USED IN COMPUTATION = 1.00 FT.
- LENGTH OF ENHANCED
END SECTION = 55.00 FT.
- INTERNAL DIAMETER OF
ENHANCED END SECTION = 15.00 IN.

PLUGGED/UNPLUGGED CONDITIONS :

Internal Pile Plug Calculated by Program

SOIL INFORMATIONS :

DEPTH FT.	SOIL TYPE	LATERAL EARTH PRESSURE	EFFECTIVE UNIT WEIGHT LB/FT^3	FRICTION ANGLE DEGREES	BEARING CAPACITY FACTOR
0.00	CLAY	0.80*	62.60	0.00	8.00**
1.00	CLAY	0.80*	62.60	0.00	8.00**
1.00	SAND	0.80*	72.60	30.00	22.00
4.50	SAND	0.80*	72.60	30.00	22.00
4.50	CLAY	0.80*	67.60	0.00	8.00**
16.00	CLAY	0.80*	67.60	0.00	8.00**
16.00	CLAY	0.80*	57.60	0.00	8.00**
22.50	CLAY	0.80*	62.60	0.00	8.00**
22.50	SAND	0.80*	72.60	32.00	29.00
27.50	SAND	0.80*	72.60	32.00	29.00
27.50	CLAY	0.80*	67.60	0.00	8.00**
36.50	CLAY	0.80*	67.60	0.00	8.00**
36.50	CLAY	0.80*	72.60	0.00	8.00**
58.50	CLAY	0.80*	72.60	0.00	8.00**

* VALUE ASSUMED BY THE PROGRAM

** VALUE ESTIMATED BY THE PROGRAM BASED ON FRICTION ANGLE

END	MAXIMUM UNIT	MAXIMUM UNIT	UNDISTURB SHEAR	REMOLDED SHEAR	BLOW COUNT	UNIT SKIN FRICTION	UNIT
BEARING	FRICTION	BEARING	STRENGTH	STRENGTH			
KSF	KSF	KSF	KSF	KSF		KSF	
0.00	0.10E+08*	0.10E+08*	3.00	0.00	0.00	0.00	
0.00	0.10E+08*	0.10E+08*	3.00	0.00	0.00	0.00	
0.00	0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	
0.00	0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	
0.00	0.10E+08*	0.10E+08*	4.50	0.00	0.00	0.00	
0.00	0.10E+08*	0.10E+08*	4.50	0.00	0.00	0.00	
0.00	0.10E+08*	0.10E+08*	1.00	0.00	0.00	0.00	
0.00	0.10E+08*	0.10E+08*	2.00	0.00	0.00	0.00	
0.00	0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	
0.00	0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	

0.00	0.10E+08*	0.10E+08*	5.50	0.00	0.00	0.00
0.00	0.10E+08*	0.10E+08*	5.50	0.00	0.00	0.00
0.00	0.10E+08*	0.10E+08*	6.00	0.00	0.00	0.00
0.00	0.10E+08*	0.10E+08*	6.00	0.00	0.00	0.00

* MAXIMUM UNIT FRICTION AND/OR MAXIMUM UNIT BEARING
WERE SET TO BE 0.10E+08 BECAUSE THE USER DOES NOT
PLAN TO LIMIT THE COMPUTED DATA.

DEPTH FT.	LRFD FACTOR ON UNIT FRICTION	LRFD FACTOR ON UNIT BEARING
0.00	1.000	1.000
1.00	1.000	1.000
1.00	1.000	1.000
4.50	1.000	1.000
4.50	1.000	1.000
16.00	1.000	1.000
16.00	1.000	1.000
22.50	1.000	1.000
22.50	1.000	1.000
27.50	1.000	1.000
27.50	1.000	1.000
36.50	1.000	1.000
36.50	1.000	1.000
58.50	1.000	1.000

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* COMPUTATION RESULT *

* FED. HWY. METHOD *

PILE LENGTH BELOW GND. FT.	DEPTH BELOW GND. FT.	TOTAL SKIN FRICTION KIP	END BEARING KIP	ULTIMATE CAPACITY KIP
0.00	0.00	0.0	18.3	18.3
1.00	0.97	0.0	10.1	10.1
2.00	1.94	0.0	11.5	11.5
3.00	2.91	0.0	14.6	14.6

4.00	3.88	0.0	19.1	19.1
5.00	4.85	0.0	31.4	31.4
6.00	5.82	9.4	43.8	53.3
7.00	6.79	28.3	55.8	84.1
8.00	7.76	47.1	56.5	103.7
9.00	8.73	66.0	56.5	122.5
10.00	9.70	84.8	56.5	141.4
11.00	10.67	103.7	56.5	160.2
12.00	11.64	122.5	56.5	179.1
13.00	12.61	141.4	56.5	197.9
14.00	13.58	160.2	56.5	216.8
15.00	14.55	179.1	55.9	235.0
16.00	15.52	196.0	45.7	241.8
17.00	16.50	212.0	36.0	248.0
18.00	17.47	222.8	26.7	249.6
19.00	18.44	228.0	17.9	245.9
20.00	19.41	233.7	19.2	252.9
21.00	20.38	240.1	21.0	261.1
22.00	21.35	247.0	23.2	270.2
23.00	22.32	254.5	29.5	284.0
24.00	23.29	262.4	35.4	297.8
25.00	24.26	268.2	40.8	309.0
26.00	25.23	271.6	45.8	317.3
27.00	26.20	275.1	46.4	321.5
28.00	27.17	278.8	52.0	330.8
29.00	28.14	282.6	57.6	340.2
30.00	29.11	293.0	63.2	356.2
31.00	30.08	309.9	68.8	378.7
32.00	31.05	326.8	69.1	395.9
33.00	32.02	343.7	69.1	412.8
34.00	32.99	360.5	69.1	429.6
35.00	33.96	377.4	69.1	446.5
36.00	34.93	394.3	69.2	463.5
37.00	35.90	409.8	70.7	480.5
38.00	36.87	422.6	72.3	494.8
39.00	37.84	434.5	73.8	508.3
40.00	38.81	447.0	75.3	522.3
41.00	39.78	459.5	75.4	534.9
42.00	40.75	472.0	75.4	547.4
43.00	41.72	484.4	75.4	559.8
44.00	42.69	496.9	75.4	572.3
45.00	43.66	509.4	75.4	584.8
46.00	44.63	521.8	75.4	597.2
47.00	45.60	534.3	75.4	609.7
48.00	46.57	546.8	75.4	622.2
49.00	47.54	559.3	75.4	634.7
50.00	48.51	571.7	75.4	647.1
51.00	49.49	584.2	75.4	659.6
52.00	50.46	596.7	75.4	672.1
53.00	51.43	609.2	75.4	684.6
54.00	52.40	621.6	75.4	697.0

 * API RP-2A (2010) *

PILE LENGTH BELOW GND. FT.	DEPTH BELOW GND. FT.	TOTAL SKIN FRICTION KIP	END BEARING KIP	ULTIMATE CAPACITY KIP
0.00	0.00	0.0	18.3	18.3
1.00	0.97	0.0	10.4	10.4
2.00	1.94	0.0	12.1	12.1
3.00	2.91	0.0	15.6	15.6
4.00	3.88	0.0	20.2	20.2
5.00	4.85	0.0	32.3	32.3
6.00	5.82	2.6	44.3	46.9
7.00	6.79	7.8	55.9	63.7
8.00	7.76	13.2	56.5	69.8
9.00	8.73	18.8	56.5	75.4
10.00	9.70	24.6	56.5	81.2
11.00	10.67	30.5	56.5	87.1
12.00	11.64	36.5	56.5	93.1
13.00	12.61	42.7	56.5	99.3
14.00	13.58	49.0	56.5	105.5
15.00	14.55	55.4	55.9	111.3
16.00	15.52	61.9	45.7	107.6
17.00	16.50	68.5	36.0	104.5
18.00	17.47	73.1	26.7	99.8
19.00	18.44	75.6	17.9	93.5
20.00	19.41	78.4	19.2	97.6
21.00	20.38	81.5	21.0	102.5
22.00	21.35	84.9	23.4	108.3
23.00	22.32	88.5	34.0	122.5
24.00	23.29	92.3	44.8	137.1
25.00	24.26	95.7	55.9	151.6
26.00	25.23	98.5	67.2	165.6
27.00	26.20	101.4	70.5	171.8
28.00	27.17	104.4	71.2	175.6
29.00	28.14	107.6	71.2	178.8
30.00	29.11	113.6	70.6	184.2
31.00	30.08	122.6	69.2	191.8
32.00	31.05	131.5	69.1	200.7
33.00	32.02	140.6	69.1	209.7
34.00	32.99	149.8	69.1	218.9
35.00	33.96	159.0	69.1	228.1
36.00	34.93	168.2	69.2	237.4
37.00	35.90	177.6	70.7	248.3
38.00	36.87	187.0	72.3	259.2
39.00	37.84	196.8	73.8	270.5
40.00	38.81	206.9	75.3	282.2
41.00	39.78	217.2	75.4	292.6
42.00	40.75	227.5	75.4	302.9
43.00	41.72	237.9	75.4	313.3
44.00	42.69	248.3	75.4	323.7
45.00	43.66	258.8	75.4	334.2
46.00	44.63	269.4	75.4	344.8

47.00	45.60	280.0	75.4	355.4
48.00	46.57	290.7	75.4	366.1
49.00	47.54	301.5	75.4	376.9
50.00	48.51	312.3	75.4	387.7
51.00	49.49	323.1	75.4	398.5
52.00	50.46	334.1	75.4	409.5
53.00	51.43	345.0	75.4	420.4
54.00	52.40	356.1	75.4	431.5

NOTES:

- AN ASTERISK IS PLACED IN THE END-BEARING COLUMN
IF THE TIP RESISTANCE IS CONTROLLED BY THE FRICTION
OF SOIL PLUG INSIDE AN OPEN-ENDED PIPE PILE.

 * COMPUTE LOAD-DISTRIBUTION AND LOAD-SETTLEMENT *
 * CURVES FOR AXIAL LOADING *

MOVEMENT	T-Z CURVE NO.	NO. OF POINTS	DEPTH TO CURVE FT.	LOAD TRANSFER PSI	PILE IN.
	1	10	0.0000E+00	0.0000E+00	0.0000E+00
				0.0000E+00	0.2560E-01
				0.0000E+00	0.4960E-01
				0.0000E+00	0.9120E-01
				0.0000E+00	0.1280E+00
				0.0000E+00	0.1600E+00
				0.0000E+00	0.3200E+00
				0.0000E+00	0.4800E+00
				0.0000E+00	0.8000E+00
				0.0000E+00	0.3200E+01
	2	10	0.5250E+00	0.0000E+00	0.0000E+00
				0.0000E+00	0.2560E-01
				0.0000E+00	0.4960E-01
				0.0000E+00	0.9120E-01
				0.0000E+00	0.1280E+00
				0.0000E+00	0.1600E+00
				0.0000E+00	0.3200E+00
				0.0000E+00	0.4800E+00
				0.0000E+00	0.8000E+00
				0.0000E+00	0.3200E+01
	3	10	0.9583E+00	0.0000E+00	0.0000E+00
				0.0000E+00	0.2560E-01
				0.0000E+00	0.4960E-01
				0.0000E+00	0.9120E-01

4	10	0.1000E+01	0.0000E+00	0.1280E+00
			0.0000E+00	0.1600E+00
			0.0000E+00	0.3200E+00
			0.0000E+00	0.4800E+00
			0.0000E+00	0.8000E+00
			0.0000E+00	0.3200E+01
			0.0000E+00	0.0000E+00
			0.0000E+00	0.2560E-01
			0.0000E+00	0.4960E-01
			0.0000E+00	0.9120E-01
5	10	0.2775E+01	0.0000E+00	0.1280E+00
			0.0000E+00	0.1600E+00
			0.0000E+00	0.3200E+00
			0.0000E+00	0.4800E+00
			0.0000E+00	0.8000E+00
			0.0000E+00	0.3200E+01
			0.0000E+00	0.0000E+00
			0.0000E+00	0.2560E-01
			0.0000E+00	0.4960E-01
			0.0000E+00	0.9120E-01
6	10	0.4458E+01	0.0000E+00	0.1280E+00
			0.0000E+00	0.1600E+00
			0.0000E+00	0.3200E+00
			0.0000E+00	0.4800E+00
			0.0000E+00	0.8000E+00
			0.0000E+00	0.3200E+01
			0.0000E+00	0.0000E+00
			0.0000E+00	0.2560E-01
			0.0000E+00	0.4960E-01
			0.0000E+00	0.9120E-01
7	10	0.4500E+01	0.0000E+00	0.1280E+00
			0.0000E+00	0.1600E+00
			0.0000E+00	0.3200E+00
			0.0000E+00	0.4800E+00
			0.0000E+00	0.8000E+00
			0.0000E+00	0.3200E+01
			0.0000E+00	0.0000E+00
			0.0000E+00	0.2560E-01
			0.0000E+00	0.4960E-01
			0.0000E+00	0.9120E-01
8	10	0.1028E+02	0.0000E+00	0.1280E+00
			0.0000E+00	0.1600E+00
			0.0000E+00	0.3200E+00
			0.0000E+00	0.4800E+00
			0.0000E+00	0.8000E+00
			0.0000E+00	0.3200E+01
			0.0000E+00	0.0000E+00
			0.9375E+01	0.2560E-01
			0.1562E+02	0.4960E-01

			0.2344E+02	0.9120E-01
			0.2812E+02	0.1280E+00
			0.3125E+02	0.1600E+00
			0.2812E+02	0.3200E+00
			0.2812E+02	0.4800E+00
			0.2812E+02	0.8000E+00
			0.2812E+02	0.3200E+01
9	10	0.1596E+02	0.0000E+00	0.0000E+00
			0.7578E+01	0.2560E-01
			0.1263E+02	0.4960E-01
			0.1895E+02	0.9120E-01
			0.2273E+02	0.1280E+00
			0.2526E+02	0.1600E+00
			0.2273E+02	0.3200E+00
			0.2273E+02	0.4800E+00
			0.2273E+02	0.8000E+00
			0.2273E+02	0.3200E+01
10	10	0.1600E+02	0.0000E+00	0.0000E+00
			0.7500E+01	0.2560E-01
			0.1250E+02	0.4960E-01
			0.1875E+02	0.9120E-01
			0.2250E+02	0.1280E+00
			0.2500E+02	0.1600E+00
			0.2250E+02	0.3200E+00
			0.2250E+02	0.4800E+00
			0.2250E+02	0.8000E+00
			0.2250E+02	0.3200E+01
11	10	0.1928E+02	0.0000E+00	0.0000E+00
			0.2794E+01	0.2560E-01
			0.4657E+01	0.4960E-01
			0.6985E+01	0.9120E-01
			0.8382E+01	0.1280E+00
			0.9313E+01	0.1600E+00
			0.8382E+01	0.3200E+00
			0.8382E+01	0.4800E+00
			0.8382E+01	0.8000E+00
			0.8382E+01	0.3200E+01
12	10	0.2246E+02	0.0000E+00	0.0000E+00
			0.3698E+01	0.2560E-01
			0.6163E+01	0.4960E-01
			0.9244E+01	0.9120E-01
			0.1109E+02	0.1280E+00
			0.1233E+02	0.1600E+00
			0.1109E+02	0.3200E+00
			0.1109E+02	0.4800E+00
			0.1109E+02	0.8000E+00
			0.1109E+02	0.3200E+01
13	10	0.2250E+02	0.0000E+00	0.0000E+00
			0.3706E+01	0.2560E-01

			0.6177E+01	0.4960E-01
			0.9265E+01	0.9120E-01
			0.1112E+02	0.1280E+00
			0.1235E+02	0.1600E+00
			0.1235E+02	0.3200E+00
			0.1235E+02	0.4800E+00
			0.1235E+02	0.8000E+00
			0.1235E+02	0.3200E+01
14	10	0.2503E+02	0.0000E+00	0.0000E+00
			0.1655E+01	0.2560E-01
			0.2758E+01	0.4960E-01
			0.4137E+01	0.9120E-01
			0.4965E+01	0.1280E+00
			0.5517E+01	0.1600E+00
			0.5517E+01	0.3200E+00
			0.5517E+01	0.4800E+00
			0.5517E+01	0.8000E+00
			0.5517E+01	0.3200E+01
15	10	0.2746E+02	0.0000E+00	0.0000E+00
			0.1832E+01	0.2560E-01
			0.3053E+01	0.4960E-01
			0.4580E+01	0.9120E-01
			0.5496E+01	0.1280E+00
			0.6106E+01	0.1600E+00
			0.6106E+01	0.3200E+00
			0.6106E+01	0.4800E+00
			0.6106E+01	0.8000E+00
			0.6106E+01	0.3200E+01
16	10	0.2750E+02	0.0000E+00	0.0000E+00
			0.1835E+01	0.2560E-01
			0.3058E+01	0.4960E-01
			0.4587E+01	0.9120E-01
			0.5505E+01	0.1280E+00
			0.6116E+01	0.1600E+00
			0.5505E+01	0.3200E+00
			0.5505E+01	0.4800E+00
			0.5505E+01	0.8000E+00
			0.5505E+01	0.3200E+01
17	10	0.3203E+02	0.0000E+00	0.0000E+00
			0.8393E+01	0.2560E-01
			0.1399E+02	0.4960E-01
			0.2098E+02	0.9120E-01
			0.2518E+02	0.1280E+00
			0.2798E+02	0.1600E+00
			0.2518E+02	0.3200E+00
			0.2518E+02	0.4800E+00
			0.2518E+02	0.8000E+00
			0.2518E+02	0.3200E+01
18	10	0.3646E+02	0.0000E+00	0.0000E+00

			0.7773E+01	0.2560E-01
			0.1295E+02	0.4960E-01
			0.1943E+02	0.9120E-01
			0.2332E+02	0.1280E+00
			0.2591E+02	0.1600E+00
			0.2332E+02	0.3200E+00
			0.2332E+02	0.4800E+00
			0.2332E+02	0.8000E+00
			0.2332E+02	0.3200E+01
19	10	0.3650E+02	0.0000E+00	0.0000E+00
			0.7716E+01	0.2560E-01
			0.1286E+02	0.4960E-01
			0.1929E+02	0.9120E-01
			0.2315E+02	0.1280E+00
			0.2572E+02	0.1600E+00
			0.2315E+02	0.3200E+00
			0.2315E+02	0.4800E+00
			0.2315E+02	0.8000E+00
			0.2315E+02	0.3200E+01
20	10	0.4753E+02	0.0000E+00	0.0000E+00
			0.6203E+01	0.2560E-01
			0.1034E+02	0.4960E-01
			0.1551E+02	0.9120E-01
			0.1861E+02	0.1280E+00
			0.2068E+02	0.1600E+00
			0.1861E+02	0.3200E+00
			0.1861E+02	0.4800E+00
			0.1861E+02	0.8000E+00
			0.1861E+02	0.3200E+01
21	10	0.5846E+02	0.0000E+00	0.0000E+00
			0.6203E+01	0.2560E-01
			0.1034E+02	0.4960E-01
			0.1551E+02	0.9120E-01
			0.1861E+02	0.1280E+00
			0.2068E+02	0.1600E+00
			0.1861E+02	0.3200E+00
			0.1861E+02	0.4800E+00
			0.1861E+02	0.8000E+00
			0.1861E+02	0.3200E+01

TIP	LOAD	TIP MOVEMENT
KIP		IN.
0.0000E+00		0.0000E+00
0.4712E+01		0.8000E-02
0.9425E+01		0.1600E-01
0.1885E+02		0.3200E-01
0.3770E+02		0.2080E+00
0.5655E+02		0.6720E+00

0.6786E+02	0.1168E+01
0.7540E+02	0.1600E+01
0.7540E+02	0.2400E+01
0.7540E+02	0.3200E+01

LOAD VERSUS SETTLEMENT CURVE

TOP LOAD KIP	TOP MOVEMENT IN.	TIP LOAD KIP	TIP MOVEMENT IN.
0.2100E+01	0.8747E-03	0.5890E-01	0.1000E-03
0.2124E+02	0.8786E-02	0.5890E+00	0.1000E-02
0.1069E+03	0.4440E-01	0.2945E+01	0.5000E-02
0.1945E+03	0.8516E-01	0.5890E+01	0.1000E-01
0.3248E+03	0.1543E+00	0.1178E+02	0.2000E-01
0.5020E+03	0.2802E+00	0.2078E+02	0.5000E-01
0.5661E+03	0.3590E+00	0.2399E+02	0.8000E-01
0.5934E+03	0.4019E+00	0.2613E+02	0.1000E+00
0.6218E+03	0.5311E+00	0.3684E+02	0.2000E+00
0.6157E+03	0.8290E+00	0.4956E+02	0.5000E+00
0.6256E+03	0.1138E+01	0.5947E+02	0.8000E+00
0.6302E+03	0.1343E+01	0.6403E+02	0.1000E+01
0.6416E+03	0.2353E+01	0.7540E+02	0.2000E+01

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APILE for Windows, Version 2019.9.3

Serial Number : 138584419

A Program for Analyzing the Axial Capacity
and Short-term Settlement of Driven Piles
under Axial Loading.
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Path to file locations : \\Dayton-fs1\PROJECTS\2021\GEO
Projects\01051704 - LJB, Inc. - Spruce Avenue Bridge Replacement (SHE-
SPRUC-02270) - ODOT PID 114201 - Sidney, Ohio\File Analysis\Ray\
Name of input data file : 16-Inch CIPRC Pile - B-002-0-21 rf new
elevations.ap9d
Name of output file : 16-Inch CIPRC Pile - B-002-0-21 rf new
elevations.ap9o
Name of plot output file : 16-Inch CIPRC Pile - B-002-0-21 rf new
elevations.ap9p

Time and Date of Analysis

Date: May 19, 2023 Time: 15:49:48

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* INPUT INFORMATION *

SHE-Spruce-02.27 - 14" CIPRC Pile - B-002-0-21

DESIGNER : PSI

JOB NUMBER : 01051704

METHOD FOR UNIT LOAD TRANSFERS :

- FHWA (Federal Highway Administration)
Unfactored Unit Side Friction and Unit Side Resistance are
used.

COMPUTATION METHOD(S) FOR PILE CAPACITY :

- FHWA (Federal Highway Administration)
- API RP 2A (American Petroleum Institute)

TYPE OF LOADING :

- COMPRESSION

PILE TYPE :

Steel pipe pile or non-tapered portion of monotube pile
- Close-Ended Pile

DATA FOR AXIAL STIFFNESS :

- MODULUS OF ELASTICITY = 0.290E+08 PSI
- CROSS SECTION AREA = 24.35 IN²

CIRCULAR PILE PROPERTIES :

- OUTSIDE DIAMETER, OD = 16.00 IN.
- INTERNAL DIAMETER, ID = 15.00 IN.
- TOTAL PILE LENGTH, TL = 45.00 FT.
- BATTER ANGLE = 14.00 DEG
- PILE STICKUP LENGTH, PSL = 0.50 FT.
- ZERO FRICTION LENGTH, ZFL = 5.00 FT.
- INCREMENT OF PILE LENGTH
USED IN COMPUTATION = 1.00 FT.
- LENGTH OF ENHANCED
END SECTION = 45.00 FT.
- INTERNAL DIAMETER OF
ENHANCED END SECTION = 15.00 IN.

PLUGGED/UNPLUGGED CONDITIONS :

Internal Pile Plug Calculated by Program

SOIL INFORMATIONS :

DEPTH FT.	SOIL TYPE	LATERAL EARTH PRESSURE	EFFECTIVE UNIT WEIGHT LB/FT^3	FRICTION ANGLE DEGREES	BEARING CAPACITY FACTOR
0.00	CLAY	0.80*	120.00	0.00	8.00**
6.50	CLAY	0.80*	120.00	0.00	8.00**
6.50	SAND	0.80*	67.60	28.00	17.00
13.50	SAND	0.80*	72.60	32.00	28.00
13.50	CLAY	0.80*	62.60	0.00	8.00**
19.50	CLAY	0.80*	62.60	0.00	8.00**
19.50	CLAY	0.80*	67.60	0.00	8.00**
48.50	CLAY	0.80*	67.60	0.00	8.00**

* VALUE ASSUMED BY THE PROGRAM

** VALUE ESTIMATED BY THE PROGRAM BASED ON FRICTION ANGLE

END	MAXIMUM UNIT	MAXIMUM UNIT	UNDISTURB SHEAR	REMOLDED SHEAR	BLOW COUNT	UNIT SKIN FRICTION	UNIT
BEARING	FRICTION	BEARING	STRENGTH	STRENGTH			
	KSF	KSF	KSF	KSF		KSF	
0.00	0.10E+08*	0.10E+08*	1.20	0.00	0.00	0.00	
0.00	0.10E+08*	0.10E+08*	2.00	0.00	0.00	0.00	
0.00	0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	
0.00	0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	
0.00	0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	
0.00	0.10E+08*	0.10E+08*	3.50	0.00	0.00	0.00	
0.00	0.10E+08*	0.10E+08*	3.50	0.00	0.00	0.00	
0.00	0.10E+08*	0.10E+08*	6.00	0.00	0.00	0.00	
0.00	0.10E+08*	0.10E+08*	6.00	0.00	0.00	0.00	

* MAXIMUM UNIT FRICTION AND/OR MAXIMUM UNIT BEARING
WERE SET TO BE 0.10E+08 BECAUSE THE USER DOES NOT
PLAN TO LIMIT THE COMPUTED DATA.

DEPTH	LRFD FACTOR ON UNIT FRICTION	LRFD FACTOR ON UNIT BEARING
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FT.		
0.00	1.000	1.000
6.50	1.000	1.000
6.50	1.000	1.000
13.50	1.000	1.000
13.50	1.000	1.000
19.50	1.000	1.000
19.50	1.000	1.000
48.50	1.000	1.000

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 * COMPUTATION RESULT *

 * FED. HWY. METHOD *

PILE LENGTH BELOW GND. FT.	DEPTH BELOW GND. FT.	TOTAL SKIN FRICTION KIP	END BEARING KIP	ULTIMATE CAPACITY KIP
0.00	0.00	0.0	8.3	8.3
1.00	0.97	0.0	9.1	9.1
2.00	1.94	0.0	14.0	14.0
3.00	2.91	0.0	19.6	19.6
4.00	3.88	0.0	21.1	21.1
5.00	4.85	0.0	22.4	22.4
6.00	5.82	2.8	21.4	24.2
7.00	6.79	8.5	20.6	29.1
8.00	7.76	12.1	19.5	31.5
9.00	8.73	13.4	18.3	31.7
10.00	9.70	14.9	20.6	35.5
11.00	10.67	16.6	23.9	40.5
12.00	11.64	18.6	29.5	48.0
13.00	12.61	20.7	35.4	56.1
14.00	13.58	23.2	40.0	63.2
15.00	14.55	31.9	43.2	75.1
16.00	15.52	46.5	43.9	90.5
17.00	16.50	61.2	44.0	105.2
18.00	17.47	75.8	44.0	119.8
19.00	18.44	90.5	44.4	134.9
20.00	19.41	104.4	52.1	156.5
21.00	20.38	115.5	59.7	175.2
22.00	21.35	127.6	67.3	194.9
23.00	22.32	142.9	74.9	217.8
24.00	23.29	158.2	75.4	233.6
25.00	24.26	173.4	75.4	248.8
26.00	25.23	188.7	75.4	264.1
27.00	26.20	204.0	75.4	279.4

28.00	27.17	219.3	75.4	294.7
29.00	28.14	234.5	75.4	309.9
30.00	29.11	249.8	75.4	325.2
31.00	30.08	265.1	75.4	340.5
32.00	31.05	280.4	75.4	355.8
33.00	32.02	295.7	75.4	371.0
34.00	32.99	310.9	75.4	386.3
35.00	33.96	326.2	75.4	401.6
36.00	34.93	341.5	75.4	416.9
37.00	35.90	356.8	75.4	432.2
38.00	36.87	372.0	75.4	447.4
39.00	37.84	387.3	75.4	462.7
40.00	38.81	402.6	75.4	478.0
41.00	39.78	417.9	75.4	493.3
42.00	40.75	433.1	75.4	508.5
43.00	41.72	448.4	75.4	523.8
44.00	42.69	463.7	75.4	539.1

 * API RP-2A (2010) *

PILE LENGTH BELOW GND. FT.	DEPTH BELOW GND. FT.	TOTAL SKIN FRICTION KIP	END BEARING KIP	ULTIMATE CAPACITY KIP
0.00	0.00	0.0	8.3	8.3
1.00	0.97	0.0	9.1	9.1
2.00	1.94	0.0	14.0	14.0
3.00	2.91	0.0	19.6	19.6
4.00	3.88	0.0	21.1	21.1
5.00	4.85	0.0	22.5	22.5
6.00	5.82	1.5	22.9	24.4
7.00	6.79	4.7	23.8	28.5
8.00	7.76	7.0	25.3	32.3
9.00	8.73	8.4	27.4	35.8
10.00	9.70	9.8	31.5	41.3
11.00	10.67	11.5	35.9	47.3
12.00	11.64	13.2	40.5	53.7
13.00	12.61	15.2	43.1	58.3
14.00	13.58	17.3	44.6	61.9
15.00	14.55	21.3	45.0	66.2
16.00	15.52	27.1	44.1	71.1
17.00	16.50	32.9	44.0	76.9
18.00	17.47	38.9	44.0	82.9
19.00	18.44	44.9	44.4	89.3
20.00	19.41	50.9	52.1	103.0
21.00	20.38	57.0	59.7	116.7
22.00	21.35	64.7	67.3	132.1
23.00	22.32	74.1	74.9	149.0
24.00	23.29	83.5	75.4	158.9
25.00	24.26	92.9	75.4	168.3
26.00	25.23	102.5	75.4	177.9

27.00	26.20	112.2	75.4	187.5
28.00	27.17	121.9	75.4	197.3
29.00	28.14	131.7	75.4	207.1
30.00	29.11	141.5	75.4	216.9
31.00	30.08	151.4	75.4	226.8
32.00	31.05	161.4	75.4	236.8
33.00	32.02	171.5	75.4	246.9
34.00	32.99	181.6	75.4	257.0
35.00	33.96	191.8	75.4	267.2
36.00	34.93	202.1	75.4	277.5
37.00	35.90	212.4	75.4	287.8
38.00	36.87	222.8	75.4	298.2
39.00	37.84	233.3	75.4	308.7
40.00	38.81	243.8	75.4	319.2
41.00	39.78	254.3	75.4	329.7
42.00	40.75	265.0	75.4	340.4
43.00	41.72	275.6	75.4	351.0
44.00	42.69	286.4	75.4	361.8

NOTES:

- AN ASTERISK IS PLACED IN THE END-BEARING COLUMN
IF THE TIP RESISTANCE IS CONTROLLED BY THE FRICTION
OF SOIL PLUG INSIDE AN OPEN-ENDED PIPE PILE.

* COMPUTE LOAD-DISTRIBUTION AND LOAD-SETTLEMENT *
* CURVES FOR AXIAL LOADING *

MOVEMENT	T-Z CURVE	NO. OF	DEPTH TO CURVE	LOAD TRANSFER	PILE
	NO.	POINTS	FT.	PSI	IN.
1	1	10	0.0000E+00	0.0000E+00	0.0000E+00
				0.0000E+00	0.2560E-01
				0.0000E+00	0.4960E-01
				0.0000E+00	0.9120E-01
				0.0000E+00	0.1280E+00
				0.0000E+00	0.1600E+00
				0.0000E+00	0.3200E+00
				0.0000E+00	0.4800E+00
				0.0000E+00	0.8000E+00
				0.0000E+00	0.3200E+01
2	2	10	0.3275E+01	0.0000E+00	0.0000E+00
				0.0000E+00	0.2560E-01
				0.0000E+00	0.4960E-01
				0.0000E+00	0.9120E-01
				0.0000E+00	0.1280E+00

			0.0000E+00	0.1600E+00
			0.0000E+00	0.3200E+00
			0.0000E+00	0.4800E+00
			0.0000E+00	0.8000E+00
			0.0000E+00	0.3200E+01
3	10	0.6458E+01		
			0.0000E+00	0.0000E+00
			0.2839E+01	0.2560E-01
			0.4731E+01	0.4960E-01
			0.7097E+01	0.9120E-01
			0.8516E+01	0.1280E+00
			0.9463E+01	0.1600E+00
			0.8516E+01	0.3200E+00
			0.8516E+01	0.4800E+00
			0.8516E+01	0.8000E+00
			0.8516E+01	0.3200E+01
4	10	0.6500E+01		
			0.0000E+00	0.0000E+00
			0.2841E+01	0.2560E-01
			0.4735E+01	0.4960E-01
			0.7102E+01	0.9120E-01
			0.8522E+01	0.1280E+00
			0.9469E+01	0.1600E+00
			0.9469E+01	0.3200E+00
			0.9469E+01	0.4800E+00
			0.9469E+01	0.8000E+00
			0.9469E+01	0.3200E+01
5	10	0.1003E+02		
			0.0000E+00	0.0000E+00
			0.8011E+00	0.2560E-01
			0.1335E+01	0.4960E-01
			0.2003E+01	0.9120E-01
			0.2403E+01	0.1280E+00
			0.2670E+01	0.1600E+00
			0.2670E+01	0.3200E+00
			0.2670E+01	0.4800E+00
			0.2670E+01	0.8000E+00
			0.2670E+01	0.3200E+01
6	10	0.1346E+02		
			0.0000E+00	0.0000E+00
			0.1222E+01	0.2560E-01
			0.2037E+01	0.4960E-01
			0.3055E+01	0.9120E-01
			0.3666E+01	0.1280E+00
			0.4073E+01	0.1600E+00
			0.4073E+01	0.3200E+00
			0.4073E+01	0.4800E+00
			0.4073E+01	0.8000E+00
			0.4073E+01	0.3200E+01
7	10	0.1350E+02		
			0.0000E+00	0.0000E+00
			0.1228E+01	0.2560E-01
			0.2047E+01	0.4960E-01
			0.3070E+01	0.9120E-01

8	10	0.1653E+02	0.3684E+01	0.1280E+00
			0.4093E+01	0.1600E+00
			0.3684E+01	0.3200E+00
			0.3684E+01	0.4800E+00
			0.3684E+01	0.8000E+00
			0.3684E+01	0.3200E+01
			0.0000E+00	0.0000E+00
			0.7292E+01	0.2560E-01
			0.1215E+02	0.4960E-01
			0.1823E+02	0.9120E-01
			0.2187E+02	0.1280E+00
			0.2431E+02	0.1600E+00
			0.2187E+02	0.3200E+00
			0.2187E+02	0.4800E+00
9	10	0.1946E+02	0.2187E+02	0.8000E+00
			0.2187E+02	0.3200E+01
			0.0000E+00	0.0000E+00
			0.6968E+01	0.2560E-01
			0.1161E+02	0.4960E-01
			0.1742E+02	0.9120E-01
			0.2090E+02	0.1280E+00
			0.2323E+02	0.1600E+00
			0.2090E+02	0.3200E+00
			0.2090E+02	0.4800E+00
			0.2090E+02	0.8000E+00
			0.2090E+02	0.3200E+01
10	10	0.1950E+02	0.0000E+00	0.0000E+00
			0.6938E+01	0.2560E-01
			0.1156E+02	0.4960E-01
			0.1735E+02	0.9120E-01
			0.2082E+02	0.1280E+00
			0.2313E+02	0.1600E+00
			0.2082E+02	0.3200E+00
			0.2082E+02	0.4800E+00
			0.2082E+02	0.8000E+00
			0.2082E+02	0.3200E+01
11	10	0.3403E+02	0.0000E+00	0.0000E+00
			0.7598E+01	0.2560E-01
			0.1266E+02	0.4960E-01
			0.1899E+02	0.9120E-01
			0.2279E+02	0.1280E+00
			0.2533E+02	0.1600E+00
			0.2279E+02	0.3200E+00
			0.2279E+02	0.4800E+00
			0.2279E+02	0.8000E+00
			0.2279E+02	0.3200E+01
12	10	0.4846E+02	0.0000E+00	0.0000E+00
			0.7598E+01	0.2560E-01
			0.1266E+02	0.4960E-01

0.1899E+02	0.9120E-01
0.2279E+02	0.1280E+00
0.2533E+02	0.1600E+00
0.2279E+02	0.3200E+00
0.2279E+02	0.4800E+00
0.2279E+02	0.8000E+00
0.2279E+02	0.3200E+01

TIP LOAD KIP	TIP MOVEMENT IN.
0.0000E+00	0.0000E+00
0.4712E+01	0.8000E-02
0.9425E+01	0.1600E-01
0.1885E+02	0.3200E-01
0.3770E+02	0.2080E+00
0.5655E+02	0.6720E+00
0.6786E+02	0.1168E+01
0.7540E+02	0.1600E+01
0.7540E+02	0.2400E+01
0.7540E+02	0.3200E+01

LOAD VERSUS SETTLEMENT CURVE

TOP LOAD KIP	TOP MOVEMENT IN.	TIP LOAD KIP	TIP MOVEMENT IN.
0.1010E+01	0.5572E-03	0.5890E-01	0.1000E-03
0.1010E+02	0.5572E-02	0.5890E+00	0.1000E-02
0.5158E+02	0.2824E-01	0.2945E+01	0.5000E-02
0.1018E+03	0.5632E-01	0.5890E+01	0.1000E-01
0.1856E+03	0.1071E+00	0.1178E+02	0.2000E-01
0.3297E+03	0.2099E+00	0.2078E+02	0.5000E-01
0.4116E+03	0.2838E+00	0.2399E+02	0.8000E-01
0.4453E+03	0.3238E+00	0.2613E+02	0.1000E+00
0.4777E+03	0.4494E+00	0.3684E+02	0.2000E+00
0.4697E+03	0.7469E+00	0.4956E+02	0.5000E+00
0.4796E+03	0.1055E+01	0.5947E+02	0.8000E+00
0.4841E+03	0.1258E+01	0.6403E+02	0.1000E+01
0.4955E+03	0.2267E+01	0.7540E+02	0.2000E+01

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APILE for Windows, Version 2019.9.3

Serial Number : 138584419

A Program for Analyzing the Axial Capacity
and Short-term Settlement of Driven Piles
under Axial Loading.
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Path to file locations : \\Dayton-fs1\PROJECTS\2021\GEO
Projects\01051704 - LJB, Inc. - Spruce Avenue Bridge Replacement (SHE-
SPRUC-02270) - ODOT PID 114201 - Sidney, Ohio\Pile Analysis\Ray\
Name of input data file : 16-Inch CIPRC Pile - B-003-0-21 rf new
elevation.ap9d
Name of output file : 16-Inch CIPRC Pile - B-003-0-21 rf new
elevation.ap9o
Name of plot output file : 16-Inch CIPRC Pile - B-003-0-21 rf new
elevation.ap9p

Time and Date of Analysis

Date: May 19, 2023 Time: 15:53:36

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* INPUT INFORMATION *

SHE-Spruce-02.27 - 14" CIPRC Pile - B-003-0-21

DESIGNER : PSI

JOB NUMBER : 01051704

METHOD FOR UNIT LOAD TRANSFERS :

- FHWA (Federal Highway Administration)
Unfactored Unit Side Friction and Unit Side Resistance are
used.

COMPUTATION METHOD(S) FOR PILE CAPACITY :

- FHWA (Federal Highway Administration)
- API RP 2A (American Petroleum Institute)

TYPE OF LOADING :

- COMPRESSION

PILE TYPE :

Steel pipe pile or non-tapered portion of monotube pile
- Close-Ended Pile

DATA FOR AXIAL STIFFNESS :

- MODULUS OF ELASTICITY = 0.290E+08 PSI
- CROSS SECTION AREA = 24.35 IN²

CIRCULAR PILE PROPERTIES :

- OUTSIDE DIAMETER, OD = 16.00 IN.
- INTERNAL DIAMETER, ID = 15.00 IN.
- TOTAL PILE LENGTH, TL = 55.00 FT.
- BATTER ANGLE = 14.00 DEG
- PILE STICKUP LENGTH, PSL = 0.50 FT.
- ZERO FRICTION LENGTH, ZFL = 5.00 FT.
- INCREMENT OF PILE LENGTH
USED IN COMPUTATION = 1.00 FT.
- LENGTH OF ENHANCED
END SECTION = 55.00 FT.
- INTERNAL DIAMETER OF
ENHANCED END SECTION = 15.00 IN.

PLUGGED/UNPLUGGED CONDITIONS :

Internal Pile Plug Calculated by Program

SOIL INFORMATIONS :

DEPTH FT.	SOIL TYPE	LATERAL EARTH PRESSURE	EFFECTIVE UNIT WEIGHT LB/FT^3	FRICITION ANGLE DEGREES	BEARING CAPACITY FACTOR
0.00	CLAY	0.80*	120.00	0.00	8.00**
8.00	CLAY	0.80*	120.00	0.00	8.00**
8.00	CLAY	0.80*	125.00	0.00	8.00**
10.00	CLAY	0.80*	125.00	0.00	8.00**
10.00	SAND	0.80*	77.60	32.00	28.00**
13.00	SAND	0.80*	77.60	32.00	28.00**
13.00	CLAY	0.80*	62.60	0.00	8.00**
36.00	CLAY	0.80*	62.60	0.00	8.00**
36.00	CLAY	0.80*	67.60	0.00	8.00**
52.00	CLAY	0.80*	67.60	0.00	8.00**
52.00	CLAY	0.80*	67.60	0.00	8.00**
60.00	CLAY	0.80*	67.60	0.00	8.00**

* VALUE ASSUMED BY THE PROGRAM

** VALUE ESTIMATED BY THE PROGRAM BASED ON FRICTION ANGLE

END	MAXIMUM UNIT	MAXIMUM UNIT	UNDISTURB SHEAR	REMOLDED SHEAR	BLOW COUNT	UNIT SKIN FRICTION	UNIT
BEARING	FRICITION	BEARING	STRENGTH	STRENGTH			
KSF	KSF	KSF	KSF	KSF		KSF	
0.00	0.10E+08*	0.10E+08*	1.50	0.00	0.00	0.00	
0.00	0.10E+08*	0.10E+08*	2.00	0.00	0.00	0.00	
0.00	0.10E+08*	0.10E+08*	4.00	0.00	0.00	0.00	
0.00	0.10E+08*	0.10E+08*	4.00	0.00	0.00	0.00	
0.00	0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	
0.00	0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	
0.00	0.10E+08*	0.10E+08*	4.00	0.00	0.00	0.00	
0.00	0.10E+08*	0.10E+08*	3.00	0.00	0.00	0.00	
0.00	0.10E+08*	0.10E+08*	6.00	0.00	0.00	0.00	
0.00	0.10E+08*	0.10E+08*	6.00	0.00	0.00	0.00	
0.00	0.10E+08*	0.10E+08*	5.00	0.00	0.00	0.00	

0.00

0.10E+08* 0.10E+08* 5.00 0.00 0.00 0.00

* MAXIMUM UNIT FRICTION AND/OR MAXIMUM UNIT BEARING
WERE SET TO BE 0.10E+08 BECAUSE THE USER DOES NOT
PLAN TO LIMIT THE COMPUTED DATA.

DEPTH FT.	LRFD FACTOR ON UNIT FRICTION	LRFD FACTOR ON UNIT BEARING
0.00	1.000	1.000
8.00	1.000	1.000
8.00	1.000	1.000
10.00	1.000	1.000
10.00	1.000	1.000
13.00	1.000	1.000
13.00	1.000	1.000
36.00	1.000	1.000
36.00	1.000	1.000
52.00	1.000	1.000
52.00	1.000	1.000
60.00	1.000	1.000

1

* COMPUTATION RESULT *

* FED. HWY. METHOD *

PILE LENGTH BELOW GND. FT.	DEPTH BELOW GND. FT.	TOTAL SKIN FRICTION KIP	END BEARING KIP	ULTIMATE CAPACITY KIP
0.00	0.00	0.0	9.8	9.8
1.00	0.97	0.0	10.2	10.2
2.00	1.94	0.0	15.4	15.4
3.00	2.91	0.0	21.1	21.1
4.00	3.88	0.0	21.9	21.9
5.00	4.85	0.0	22.7	22.7
6.00	5.82	2.8	23.4	26.2
7.00	6.79	8.5	24.5	33.0
8.00	7.76	14.3	31.2	45.4
9.00	8.73	20.1	37.5	57.6
10.00	9.70	24.9	42.7	67.6
11.00	10.67	28.9	47.7	76.7

12.00	11.64	32.3	47.1	79.5
13.00	12.61	35.2	47.0	82.2
14.00	13.58	38.3	47.7	86.0
15.00	14.55	45.4	48.3	93.7
16.00	15.52	56.4	48.8	105.2
17.00	16.50	67.3	48.4	115.6
18.00	17.47	78.0	47.8	125.8
19.00	18.44	88.6	47.3	135.9
20.00	19.41	99.1	46.8	145.9
21.00	20.38	109.5	46.2	155.8
22.00	21.35	119.8	45.7	165.5
23.00	22.32	130.0	45.2	175.2
24.00	23.29	140.0	44.6	184.7
25.00	24.26	149.9	44.1	194.1
26.00	25.23	159.8	43.6	203.3
27.00	26.20	169.5	43.1	212.5
28.00	27.17	179.0	42.5	221.6
29.00	28.14	188.5	42.0	230.5
30.00	29.11	197.9	41.5	239.4
31.00	30.08	207.2	40.9	248.1
32.00	31.05	216.3	40.4	256.7
33.00	32.02	225.4	39.9	265.3
34.00	32.99	234.3	39.3	273.7
35.00	33.96	243.2	38.8	282.0
36.00	34.93	251.9	38.9	290.8
37.00	35.90	259.0	47.7	306.7
38.00	36.87	264.9	56.6	321.5
39.00	37.84	273.7	65.6	339.3
40.00	38.81	285.2	74.8	360.0
41.00	39.78	296.7	75.4	372.1
42.00	40.75	308.1	75.4	383.5
43.00	41.72	319.6	75.4	395.0
44.00	42.69	331.1	75.4	406.5
45.00	43.66	342.6	75.4	418.0
46.00	44.63	354.1	75.4	429.5
47.00	45.60	365.6	75.4	440.9
48.00	46.57	377.0	75.4	452.4
49.00	47.54	388.5	75.4	463.9
50.00	48.51	400.0	75.4	475.4
51.00	49.49	411.5	75.4	486.9
52.00	50.46	423.0	75.2	498.2
53.00	51.43	433.7	72.2	505.9
54.00	52.40	444.1	69.1	513.2

* API RP-2A (2010) *

PILE LENGTH BELOW GND. FT.	DEPTH BELOW GND. FT.	TOTAL SKIN FRICTION KIP	END BEARING KIP	ULTIMATE CAPACITY KIP
0.00	0.00	0.0	9.8	9.8

1.00	0.97	0.0	10.2	10.2
2.00	1.94	0.0	15.4	15.4
3.00	2.91	0.0	21.1	21.1
4.00	3.88	0.0	21.9	21.9
5.00	4.85	0.0	22.7	22.7
6.00	5.82	1.5	23.4	24.9
7.00	6.79	4.6	24.5	29.2
8.00	7.76	7.9	31.2	39.1
9.00	8.73	11.4	37.6	49.0
10.00	9.70	16.3	44.3	60.6
11.00	10.67	22.5	51.5	74.0
12.00	11.64	26.9	53.6	80.5
13.00	12.61	29.3	53.5	82.7
14.00	13.58	31.8	52.8	84.6
15.00	14.55	36.4	51.3	87.7
16.00	15.52	42.9	49.0	92.0
17.00	16.50	49.5	48.4	97.9
18.00	17.47	56.1	47.8	104.0
19.00	18.44	62.7	47.3	110.0
20.00	19.41	69.3	46.8	116.1
21.00	20.38	75.9	46.2	122.2
22.00	21.35	82.5	45.7	128.2
23.00	22.32	89.1	45.2	134.3
24.00	23.29	95.7	44.6	140.3
25.00	24.26	102.3	44.1	146.4
26.00	25.23	108.8	43.6	152.4
27.00	26.20	115.3	43.1	158.4
28.00	27.17	121.9	42.5	164.4
29.00	28.14	128.4	42.0	170.4
30.00	29.11	134.9	41.5	176.3
31.00	30.08	141.3	40.9	182.2
32.00	31.05	147.7	40.4	188.2
33.00	32.02	154.2	39.9	194.0
34.00	32.99	160.5	39.3	199.9
35.00	33.96	166.9	38.8	205.7
36.00	34.93	173.2	38.9	212.1
37.00	35.90	179.5	47.7	227.2
38.00	36.87	185.8	56.6	242.4
39.00	37.84	194.2	65.6	259.8
40.00	38.81	204.8	74.8	279.7
41.00	39.78	215.5	75.4	290.9
42.00	40.75	226.3	75.4	301.7
43.00	41.72	237.0	75.4	312.4
44.00	42.69	247.9	75.4	323.3
45.00	43.66	258.8	75.4	334.2
46.00	44.63	269.8	75.4	345.2
47.00	45.60	280.8	75.4	356.2
48.00	46.57	291.8	75.4	367.2
49.00	47.54	302.9	75.4	378.3
50.00	48.51	314.1	75.4	389.5
51.00	49.49	325.3	75.4	400.7
52.00	50.46	336.5	75.2	411.8
53.00	51.43	347.8	72.2	420.0
54.00	52.40	359.2	69.1	428.3

NOTES:

- AN ASTERISK IS PLACED IN THE END-BEARING COLUMN
IF THE TIP RESISTANCE IS CONTROLLED BY THE FRICTION
OF SOIL PLUG INSIDE AN OPEN-ENDED PIPE PILE.

* COMPUTE LOAD-DISTRIBUTION AND LOAD-SETTLEMENT *
* CURVES FOR AXIAL LOADING *

MOVEMENT	T-Z CURVE	NO. OF	DEPTH TO CURVE	LOAD TRANSFER	PILE
	NO.	POINTS	FT.	PSI	IN.
	1	10	0.0000E+00	0.0000E+00	0.0000E+00
				0.0000E+00	0.2560E-01
				0.0000E+00	0.4960E-01
				0.0000E+00	0.9120E-01
				0.0000E+00	0.1280E+00
				0.0000E+00	0.1600E+00
				0.0000E+00	0.3200E+00
				0.0000E+00	0.4800E+00
				0.0000E+00	0.8000E+00
				0.0000E+00	0.3200E+01
	2	10	0.4025E+01	0.0000E+00	0.0000E+00
				0.0000E+00	0.2560E-01
				0.0000E+00	0.4960E-01
				0.0000E+00	0.9120E-01
				0.0000E+00	0.1280E+00
				0.0000E+00	0.1600E+00
				0.0000E+00	0.3200E+00
				0.0000E+00	0.4800E+00
				0.0000E+00	0.8000E+00
				0.0000E+00	0.3200E+01
	3	10	0.7958E+01	0.0000E+00	0.0000E+00
				0.2907E+01	0.2560E-01
				0.4845E+01	0.4960E-01
				0.7268E+01	0.9120E-01
				0.8721E+01	0.1280E+00
				0.9690E+01	0.1600E+00
				0.8721E+01	0.3200E+00
				0.8721E+01	0.4800E+00
				0.8721E+01	0.8000E+00
				0.8721E+01	0.3200E+01
	4	10	0.8000E+01	0.0000E+00	0.0000E+00

5	10	0.9025E+01	0.2910E+01	0.2560E-01
			0.4851E+01	0.4960E-01
			0.7276E+01	0.9120E-01
			0.8731E+01	0.1280E+00
			0.9701E+01	0.1600E+00
			0.8731E+01	0.3200E+00
			0.8731E+01	0.4800E+00
			0.8731E+01	0.8000E+00
			0.8731E+01	0.3200E+01
			0.0000E+00	0.0000E+00
6	10	0.9958E+01	0.2835E+01	0.2560E-01
			0.4725E+01	0.4960E-01
			0.7088E+01	0.9120E-01
			0.8506E+01	0.1280E+00
			0.9451E+01	0.1600E+00
			0.8506E+01	0.3200E+00
			0.8506E+01	0.4800E+00
			0.8506E+01	0.8000E+00
			0.8506E+01	0.3200E+01
			0.0000E+00	0.0000E+00
7	10	0.1000E+02	0.2020E+01	0.2560E-01
			0.3366E+01	0.4960E-01
			0.5049E+01	0.9120E-01
			0.6059E+01	0.1280E+00
			0.6732E+01	0.1600E+00
			0.6059E+01	0.3200E+00
			0.6059E+01	0.4800E+00
			0.6059E+01	0.8000E+00
			0.6059E+01	0.3200E+01
			0.0000E+00	0.0000E+00
8	10	0.1153E+02	0.1983E+01	0.2560E-01
			0.3306E+01	0.4960E-01
			0.4958E+01	0.9120E-01
			0.5950E+01	0.1280E+00
			0.6611E+01	0.1600E+00
			0.6611E+01	0.3200E+00
			0.6611E+01	0.4800E+00
			0.6611E+01	0.8000E+00
			0.6611E+01	0.3200E+01
			0.0000E+00	0.0000E+00
9	10	0.1296E+02	0.1682E+01	0.2560E-01
			0.2803E+01	0.4960E-01
			0.4205E+01	0.9120E-01
			0.5046E+01	0.1280E+00
			0.5607E+01	0.1600E+00
			0.5607E+01	0.3200E+00
			0.5607E+01	0.4800E+00
			0.5607E+01	0.8000E+00
			0.5607E+01	0.3200E+01
			0.0000E+00	0.0000E+00

			0.0000E+00	0.0000E+00
			0.1484E+01	0.2560E-01
			0.2473E+01	0.4960E-01
			0.3710E+01	0.9120E-01
			0.4452E+01	0.1280E+00
			0.4947E+01	0.1600E+00
			0.4947E+01	0.3200E+00
			0.4947E+01	0.4800E+00
			0.4947E+01	0.8000E+00
			0.4947E+01	0.3200E+01
10	10	0.1300E+02		
			0.0000E+00	0.0000E+00
			0.1487E+01	0.2560E-01
			0.2479E+01	0.4960E-01
			0.3718E+01	0.9120E-01
			0.4462E+01	0.1280E+00
			0.4957E+01	0.1600E+00
			0.4462E+01	0.3200E+00
			0.4462E+01	0.4800E+00
			0.4462E+01	0.8000E+00
			0.4462E+01	0.3200E+01
11	10	0.2453E+02		
			0.0000E+00	0.0000E+00
			0.4934E+01	0.2560E-01
			0.8224E+01	0.4960E-01
			0.1234E+02	0.9120E-01
			0.1480E+02	0.1280E+00
			0.1645E+02	0.1600E+00
			0.1480E+02	0.3200E+00
			0.1480E+02	0.4800E+00
			0.1480E+02	0.8000E+00
			0.1480E+02	0.3200E+01
12	10	0.3596E+02		
			0.0000E+00	0.0000E+00
			0.4317E+01	0.2560E-01
			0.7194E+01	0.4960E-01
			0.1079E+02	0.9120E-01
			0.1295E+02	0.1280E+00
			0.1439E+02	0.1600E+00
			0.1295E+02	0.3200E+00
			0.1295E+02	0.4800E+00
			0.1295E+02	0.8000E+00
			0.1295E+02	0.3200E+01
13	10	0.3600E+02		
			0.0000E+00	0.0000E+00
			0.4314E+01	0.2560E-01
			0.7191E+01	0.4960E-01
			0.1079E+02	0.9120E-01
			0.1294E+02	0.1280E+00
			0.1438E+02	0.1600E+00
			0.1294E+02	0.3200E+00
			0.1294E+02	0.4800E+00
			0.1294E+02	0.8000E+00
			0.1294E+02	0.3200E+01

14	10	0.4403E+02	0.0000E+00	0.0000E+00
			0.5711E+01	0.2560E-01
			0.9518E+01	0.4960E-01
			0.1428E+02	0.9120E-01
			0.1713E+02	0.1280E+00
			0.1904E+02	0.1600E+00
			0.1713E+02	0.3200E+00
			0.1713E+02	0.4800E+00
			0.1713E+02	0.8000E+00
			0.1713E+02	0.3200E+01
15	10	0.5196E+02	0.0000E+00	0.0000E+00
			0.5711E+01	0.2560E-01
			0.9518E+01	0.4960E-01
			0.1428E+02	0.9120E-01
			0.1713E+02	0.1280E+00
			0.1904E+02	0.1600E+00
			0.1713E+02	0.3200E+00
			0.1713E+02	0.4800E+00
			0.1713E+02	0.8000E+00
			0.1713E+02	0.3200E+01
16	10	0.5200E+02	0.0000E+00	0.0000E+00
			0.5711E+01	0.2560E-01
			0.9518E+01	0.4960E-01
			0.1428E+02	0.9120E-01
			0.1713E+02	0.1280E+00
			0.1904E+02	0.1600E+00
			0.1713E+02	0.3200E+00
			0.1713E+02	0.4800E+00
			0.1713E+02	0.8000E+00
			0.1713E+02	0.3200E+01
17	10	0.5603E+02	0.0000E+00	0.0000E+00
			0.5301E+01	0.2560E-01
			0.8835E+01	0.4960E-01
			0.1325E+02	0.9120E-01
			0.1590E+02	0.1280E+00
			0.1767E+02	0.1600E+00
			0.1590E+02	0.3200E+00
			0.1590E+02	0.4800E+00
			0.1590E+02	0.8000E+00
			0.1590E+02	0.3200E+01
18	10	0.5996E+02	0.0000E+00	0.0000E+00
			0.5301E+01	0.2560E-01
			0.8835E+01	0.4960E-01
			0.1325E+02	0.9120E-01
			0.1590E+02	0.1280E+00
			0.1767E+02	0.1600E+00
			0.1590E+02	0.3200E+00
			0.1590E+02	0.4800E+00
			0.1590E+02	0.8000E+00

0.1590E+02 0.3200E+01

TIP LOAD	TIP MOVEMENT
KIP	IN.
0.0000E+00	0.0000E+00
0.4320E+01	0.8000E-02
0.8639E+01	0.1600E-01
0.1728E+02	0.3200E-01
0.3456E+02	0.2080E+00
0.5184E+02	0.6720E+00
0.6220E+02	0.1168E+01
0.6911E+02	0.1600E+01
0.6911E+02	0.2400E+01
0.6911E+02	0.3200E+01

LOAD VERSUS SETTLEMENT CURVE

TOP LOAD	TOP MOVEMENT	TIP LOAD	TIP MOVEMENT
KIP	IN.	KIP	IN.
0.1138E+01	0.6434E-03	0.5400E-01	0.1000E-03
0.1138E+02	0.6434E-02	0.5400E+00	0.1000E-02
0.5801E+02	0.3256E-01	0.2700E+01	0.5000E-02
0.1118E+03	0.6431E-01	0.5400E+01	0.1000E-01
0.1970E+03	0.1202E+00	0.1080E+02	0.2000E-01
0.3353E+03	0.2301E+00	0.1905E+02	0.5000E-01
0.4034E+03	0.3053E+00	0.2199E+02	0.8000E-01
0.4291E+03	0.3452E+00	0.2395E+02	0.1000E+00
0.4532E+03	0.4713E+00	0.3377E+02	0.2000E+00
0.4481E+03	0.7698E+00	0.4543E+02	0.5000E+00
0.4572E+03	0.1078E+01	0.5451E+02	0.8000E+00
0.4613E+03	0.1282E+01	0.5869E+02	0.1000E+01
0.4718E+03	0.2292E+01	0.6911E+02	0.2000E+01

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APILE for Windows, Version 2019.9.3

Serial Number : 138584419

A Program for Analyzing the Axial Capacity
and Short-term Settlement of Driven Piles
under Axial Loading.
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Path to file locations : \\Dayton-fs1\PROJECTS\2021\GEO
Projects\01051704 - LJB, Inc. - Spruce Avenue Bridge Replacement (SHE-
SPRUC-02270) - ODOT PID 114201 - Sidney, Ohio\Pile Analysis\Ray\
Name of input data file : 16-Inch CIPRC Pile - B-004-0-21 rf new
elevation.ap9d
Name of output file : 16-Inch CIPRC Pile - B-004-0-21 rf new
elevation.ap9o
Name of plot output file : 16-Inch CIPRC Pile - B-004-0-21 rf new
elevation.ap9p

Time and Date of Analysis

Date: May 19, 2023 Time: 15:56:11

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* INPUT INFORMATION *

SHE-Spruce-02.27 - 14" CIPRC Pile - B-004-0-21

DESIGNER : PSI

JOB NUMBER : 01051704

METHOD FOR UNIT LOAD TRANSFERS :

- FHWA (Federal Highway Administration)
Unfactored Unit Side Friction and Unit Side Resistance are
used.

COMPUTATION METHOD(S) FOR PILE CAPACITY :

- FHWA (Federal Highway Administration)
- API RP 2A (American Petroleum Institute)

TYPE OF LOADING :

- COMPRESSION

PILE TYPE :

Steel pipe pile or non-tapered portion of monotube pile
- Close-Ended Pile

DATA FOR AXIAL STIFFNESS :

- MODULUS OF ELASTICITY = 0.290E+08 PSI
- CROSS SECTION AREA = 24.35 IN²

CIRCULAR PILE PROPERTIES :

- OUTSIDE DIAMETER, OD = 16.00 IN.
- INTERNAL DIAMETER, ID = 15.00 IN.
- TOTAL PILE LENGTH, TL = 50.00 FT.
- BATTER ANGLE = 14.00 DEG
- PILE STICKUP LENGTH, PSL = 0.50 FT.
- ZERO FRICTION LENGTH, ZFL = 5.00 FT.
- INCREMENT OF PILE LENGTH
USED IN COMPUTATION = 1.00 FT.
- LENGTH OF ENHANCED
END SECTION = 50.00 FT.
- INTERNAL DIAMETER OF
ENHANCED END SECTION = 15.00 IN.

PLUGGED/UNPLUGGED CONDITIONS :

Internal Pile Plug Calculated by Program

SOIL INFORMATIONS :

DEPTH FT.	SOIL TYPE	LATERAL EARTH PRESSURE	EFFECTIVE UNIT WEIGHT LB/FT^3	FRICTION ANGLE DEGREES	BEARING CAPACITY FACTOR
0.00	CLAY	0.80*	62.60	0.00	8.00**
6.50	CLAY	0.80*	67.60	0.00	8.00**
6.50	CLAY	0.80*	62.60	0.00	8.00**
21.50	CLAY	0.80*	57.60	0.00	8.00**
21.50	SAND	0.80*	77.60	32.00	28.00
25.50	SAND	0.80*	77.60	32.00	28.00
25.50	CLAY	0.80*	62.60	0.00	8.00**
45.50	CLAY	0.80*	67.60	0.00	8.00**
45.50	CLAY	0.80*	67.60	0.00	8.00**
53.50	CLAY	0.80*	67.60	0.00	8.00**

* VALUE ASSUMED BY THE PROGRAM

** VALUE ESTIMATED BY THE PROGRAM BASED ON FRICTION ANGLE

END	MAXIMUM UNIT	MAXIMUM UNIT	UNDISTURB SHEAR	REMOLED SHEAR	BLOW COUNT	UNIT SKIN FRICTION	UNIT
BEARING	FRICTION	BEARING	STRENGTH	STRENGTH			
	KSF	KSF	KSF	KSF		KSF	
0.00	0.10E+08*	0.10E+08*	1.50	0.00	0.00	0.00	
0.00	0.10E+08*	0.10E+08*	2.00	0.00	0.00	0.00	
0.00	0.10E+08*	0.10E+08*	1.50	0.00	0.00	0.00	
0.00	0.10E+08*	0.10E+08*	1.00	0.00	0.00	0.00	
0.00	0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	
0.00	0.10E+08*	0.10E+08*	0.00	0.00	0.00	0.00	
0.00	0.10E+08*	0.10E+08*	4.50	0.00	0.00	0.00	
0.00	0.10E+08*	0.10E+08*	5.50	0.00	0.00	0.00	
0.00	0.10E+08*	0.10E+08*	6.00	0.00	0.00	0.00	
0.00	0.10E+08*	0.10E+08*	6.00	0.00	0.00	0.00	

* MAXIMUM UNIT FRICTION AND/OR MAXIMUM UNIT BEARING WERE SET TO BE 0.10E+08 BECAUSE THE USER DOES NOT PLAN TO LIMIT THE COMPUTED DATA.

DEPTH FT.	LRFD FACTOR	LRFD FACTOR
	ON UNIT FRICTION	ON UNIT BEARING
0.00	1.000	1.000
6.50	1.000	1.000
6.50	1.000	1.000
21.50	1.000	1.000
21.50	1.000	1.000
25.50	1.000	1.000
25.50	1.000	1.000
45.50	1.000	1.000
45.50	1.000	1.000
53.50	1.000	1.000

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 * COMPUTATION RESULT *

 * FED. HWY. METHOD *

PILE LENGTH BELOW GND. FT.	DEPTH BELOW GND. FT.	TOTAL SKIN FRICTION KIP	END BEARING KIP	ULTIMATE CAPACITY KIP
0.00	0.00	0.0	9.9	9.9
1.00	0.97	0.0	10.4	10.4
2.00	1.94	0.0	15.8	15.8
3.00	2.91	0.0	21.7	21.7
4.00	3.88	0.0	22.6	22.6
5.00	4.85	0.0	23.4	23.4
6.00	5.82	2.9	22.6	25.4
7.00	6.79	8.8	21.4	30.1
8.00	7.76	14.5	19.8	34.4
9.00	8.73	19.8	18.0	37.8
10.00	9.70	25.0	17.5	42.5
11.00	10.67	30.2	17.1	47.3
12.00	11.64	35.2	16.7	51.9
13.00	12.61	40.2	16.3	56.5
14.00	13.58	45.0	15.9	60.9
15.00	14.55	49.8	15.5	65.3
16.00	15.52	54.4	15.1	69.5
17.00	16.50	59.0	14.7	73.7
18.00	17.47	63.5	14.3	77.7
19.00	18.44	67.8	13.8	81.7

20.00	19.41	72.1	13.4	85.6
21.00	20.38	76.3	13.5	89.8
22.00	21.35	80.4	21.4	101.8
23.00	22.32	84.4	29.4	113.8
24.00	23.29	87.9	37.4	125.3
25.00	24.26	91.0	45.7	136.7
26.00	25.23	94.2	49.0	143.2
27.00	26.20	97.6	51.9	149.4
28.00	27.17	104.6	54.9	159.5
29.00	28.14	115.3	58.0	173.3
30.00	29.11	126.1	58.8	184.9
31.00	30.08	137.0	59.4	196.4
32.00	31.05	148.0	60.0	208.0
33.00	32.02	159.1	60.6	219.7
34.00	32.99	170.3	61.3	231.6
35.00	33.96	181.6	61.9	243.5
36.00	34.93	193.1	62.5	255.6
37.00	35.90	204.7	63.1	267.7
38.00	36.87	216.3	63.7	280.0
39.00	37.84	228.1	64.3	292.4
40.00	38.81	240.0	64.9	304.9
41.00	39.78	252.0	65.5	317.6
42.00	40.75	264.2	66.1	330.3
43.00	41.72	276.4	66.7	343.2
44.00	42.69	288.8	67.4	356.1
45.00	43.66	301.2	68.0	369.3
46.00	44.63	312.0	70.1	382.1
47.00	45.60	322.4	72.0	394.3
48.00	46.57	334.5	73.7	408.2
49.00	47.54	347.1	75.3	422.4

* API RP-2A (2010) *

PILE LENGTH BELOW GND.	DEPTH BELOW GND.	TOTAL SKIN FRICTION	END BEARING	ULTIMATE CAPACITY
FT.	FT.	KIP	KIP	KIP
0.00	0.00	0.0	9.9	9.9
1.00	0.97	0.0	10.4	10.4
2.00	1.94	0.0	15.8	15.8
3.00	2.91	0.0	21.7	21.7
4.00	3.88	0.0	22.6	22.6
5.00	4.85	0.0	23.4	23.4
6.00	5.82	1.3	22.6	23.9
7.00	6.79	4.1	21.4	25.5
8.00	7.76	6.7	19.8	26.6
9.00	8.73	9.1	18.0	27.1
10.00	9.70	11.5	17.5	29.0
11.00	10.67	13.9	17.1	31.0
12.00	11.64	16.3	16.7	33.0
13.00	12.61	18.7	16.3	35.0

14.00	13.58	21.2	15.9	37.1
15.00	14.55	23.6	15.5	39.1
16.00	15.52	26.0	15.1	41.1
17.00	16.50	28.4	14.7	43.1
18.00	17.47	30.8	14.3	45.1
19.00	18.44	33.2	13.8	47.0
20.00	19.41	35.6	13.4	49.0
21.00	20.38	38.0	13.7	51.6
22.00	21.35	40.4	23.8	64.1
23.00	22.32	42.8	34.7	77.5
24.00	23.29	45.3	46.4	91.7
25.00	24.26	47.8	58.8	106.7
26.00	25.23	50.5	60.0	110.5
27.00	26.20	53.3	60.0	113.3
28.00	27.17	58.5	59.5	117.9
29.00	28.14	66.0	58.3	124.4
30.00	29.11	73.7	58.8	132.5
31.00	30.08	81.5	59.4	140.9
32.00	31.05	89.5	60.0	149.5
33.00	32.02	97.5	60.6	158.2
34.00	32.99	105.7	61.3	167.0
35.00	33.96	114.0	61.9	175.9
36.00	34.93	122.4	62.5	184.9
37.00	35.90	131.0	63.1	194.1
38.00	36.87	139.7	63.7	203.4
39.00	37.84	148.5	64.3	212.8
40.00	38.81	157.4	64.9	222.3
41.00	39.78	166.4	65.5	231.9
42.00	40.75	175.6	66.1	241.7
43.00	41.72	184.9	66.7	251.6
44.00	42.69	194.3	67.4	261.6
45.00	43.66	203.8	68.0	271.8
46.00	44.63	213.4	70.1	283.5
47.00	45.60	223.2	72.0	295.2
48.00	46.57	233.4	73.7	307.1
49.00	47.54	244.0	75.3	319.3

NOTES:

- AN ASTERISK IS PLACED IN THE END-BEARING COLUMN IF THE TIP RESISTANCE IS CONTROLLED BY THE FRICTION OF SOIL PLUG INSIDE AN OPEN-ENDED PIPE PILE.

 * COMPUTE LOAD-DISTRIBUTION AND LOAD-SETTLEMENT *
 * CURVES FOR AXIAL LOADING *

T-Z CURVE MOVEMENT	NO. OF POINTS	DEPTH TO CURVE FT.	LOAD TRANSFER PSI	PILE IN.
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1	10	0.0000E+00	0.0000E+00	0.0000E+00
			0.0000E+00	0.2560E-01
			0.0000E+00	0.4960E-01
			0.0000E+00	0.9120E-01
			0.0000E+00	0.1280E+00
			0.0000E+00	0.1600E+00
			0.0000E+00	0.3200E+00
			0.0000E+00	0.4800E+00
			0.0000E+00	0.8000E+00
			0.0000E+00	0.3200E+01
2	10	0.3275E+01	0.0000E+00	0.0000E+00
			0.0000E+00	0.2560E-01
			0.0000E+00	0.4960E-01
			0.0000E+00	0.9120E-01
			0.0000E+00	0.1280E+00
			0.0000E+00	0.1600E+00
			0.0000E+00	0.3200E+00
			0.0000E+00	0.4800E+00
			0.0000E+00	0.8000E+00
			0.0000E+00	0.3200E+01
3	10	0.6458E+01	0.0000E+00	0.0000E+00
			0.2931E+01	0.2560E-01
			0.4886E+01	0.4960E-01
			0.7328E+01	0.9120E-01
			0.8794E+01	0.1280E+00
			0.9771E+01	0.1600E+00
			0.8794E+01	0.3200E+00
			0.8794E+01	0.4800E+00
			0.8794E+01	0.8000E+00
			0.8794E+01	0.3200E+01
4	10	0.6500E+01	0.0000E+00	0.0000E+00
			0.2940E+01	0.2560E-01
			0.4900E+01	0.4960E-01
			0.7349E+01	0.9120E-01
			0.8819E+01	0.1280E+00
			0.9799E+01	0.1600E+00
			0.8819E+01	0.3200E+00
			0.8819E+01	0.4800E+00
			0.8819E+01	0.8000E+00
			0.8819E+01	0.3200E+01
5	10	0.1403E+02	0.0000E+00	0.0000E+00
			0.2390E+01	0.2560E-01
			0.3984E+01	0.4960E-01
			0.5976E+01	0.9120E-01
			0.7171E+01	0.1280E+00
			0.7968E+01	0.1600E+00
			0.7171E+01	0.3200E+00
			0.7171E+01	0.4800E+00

6	10	0.2146E+02	0.7171E+01	0.8000E+00
			0.7171E+01	0.3200E+01
			0.0000E+00	0.0000E+00
			0.2049E+01	0.2560E-01
			0.3414E+01	0.4960E-01
			0.5121E+01	0.9120E-01
			0.6146E+01	0.1280E+00
			0.6828E+01	0.1600E+00
			0.6146E+01	0.3200E+00
			0.6146E+01	0.4800E+00
7	10	0.2150E+02	0.6146E+01	0.8000E+00
			0.6146E+01	0.3200E+01
			0.0000E+00	0.0000E+00
			0.2049E+01	0.2560E-01
			0.3415E+01	0.4960E-01
			0.5123E+01	0.9120E-01
			0.6147E+01	0.1280E+00
			0.6830E+01	0.1600E+00
			0.6830E+01	0.3200E+00
			0.6830E+01	0.4800E+00
8	10	0.2353E+02	0.6830E+01	0.8000E+00
			0.6830E+01	0.3200E+01
			0.0000E+00	0.0000E+00
			0.1712E+01	0.2560E-01
			0.2853E+01	0.4960E-01
			0.4280E+01	0.9120E-01
			0.5136E+01	0.1280E+00
			0.5706E+01	0.1600E+00
			0.5706E+01	0.3200E+00
			0.5706E+01	0.4800E+00
9	10	0.2546E+02	0.5706E+01	0.8000E+00
			0.5706E+01	0.3200E+01
			0.0000E+00	0.0000E+00
			0.1608E+01	0.2560E-01
			0.2680E+01	0.4960E-01
			0.4020E+01	0.9120E-01
			0.4824E+01	0.1280E+00
			0.5360E+01	0.1600E+00
			0.5360E+01	0.3200E+00
			0.5360E+01	0.4800E+00
10	10	0.2550E+02	0.5360E+01	0.8000E+00
			0.5360E+01	0.3200E+01
			0.0000E+00	0.0000E+00
			0.1611E+01	0.2560E-01
			0.2685E+01	0.4960E-01
			0.4028E+01	0.9120E-01
			0.4834E+01	0.1280E+00
			0.5371E+01	0.1600E+00
			0.4834E+01	0.3200E+00

11	10	0.3553E+02	0.4834E+01	0.4800E+00
			0.4834E+01	0.8000E+00
			0.4834E+01	0.3200E+01
			0.0000E+00	0.0000E+00
			0.5697E+01	0.2560E-01
			0.9495E+01	0.4960E-01
			0.1424E+02	0.9120E-01
			0.1709E+02	0.1280E+00
			0.1899E+02	0.1600E+00
			0.1709E+02	0.3200E+00
12	10	0.4546E+02	0.1709E+02	0.4800E+00
			0.1709E+02	0.8000E+00
			0.1709E+02	0.3200E+01
			0.0000E+00	0.0000E+00
			0.5449E+01	0.2560E-01
			0.9081E+01	0.4960E-01
			0.1362E+02	0.9120E-01
			0.1635E+02	0.1280E+00
			0.1816E+02	0.1600E+00
			0.1635E+02	0.3200E+00
13	10	0.4550E+02	0.1635E+02	0.4800E+00
			0.1635E+02	0.8000E+00
			0.1635E+02	0.3200E+01
			0.0000E+00	0.0000E+00
			0.5378E+01	0.2560E-01
			0.8963E+01	0.4960E-01
			0.1344E+02	0.9120E-01
			0.1613E+02	0.1280E+00
			0.1793E+02	0.1600E+00
			0.1613E+02	0.3200E+00
14	10	0.4953E+02	0.1613E+02	0.4800E+00
			0.1613E+02	0.8000E+00
			0.1613E+02	0.3200E+01
			0.0000E+00	0.0000E+00
			0.6285E+01	0.2560E-01
			0.1048E+02	0.4960E-01
			0.1571E+02	0.9120E-01
			0.1886E+02	0.1280E+00
			0.2095E+02	0.1600E+00
			0.1886E+02	0.3200E+00
15	10	0.5346E+02	0.1886E+02	0.4800E+00
			0.1886E+02	0.8000E+00
			0.1886E+02	0.3200E+01
			0.0000E+00	0.0000E+00
			0.6285E+01	0.2560E-01
			0.1048E+02	0.4960E-01
			0.1571E+02	0.9120E-01
			0.1886E+02	0.1280E+00
			0.2095E+02	0.1600E+00

0.1886E+02	0.3200E+00
0.1886E+02	0.4800E+00
0.1886E+02	0.8000E+00
0.1886E+02	0.3200E+01

TIP LOAD KIP	TIP MOVEMENT IN.
0.0000E+00	0.0000E+00
0.4706E+01	0.8000E-02
0.9413E+01	0.1600E-01
0.1883E+02	0.3200E-01
0.3765E+02	0.2080E+00
0.5648E+02	0.6720E+00
0.6777E+02	0.1168E+01
0.7530E+02	0.1600E+01
0.7530E+02	0.2400E+01
0.7530E+02	0.3200E+01

LOAD VERSUS SETTLEMENT CURVE

TOP LOAD KIP	TOP MOVEMENT IN.	TIP LOAD KIP	TIP MOVEMENT IN.
0.7539E+00	0.4706E-03	0.5883E-01	0.1000E-03
0.7539E+01	0.4706E-02	0.5883E+00	0.1000E-02
0.3822E+02	0.2371E-01	0.2941E+01	0.5000E-02
0.7516E+02	0.4730E-01	0.5883E+01	0.1000E-01
0.1379E+03	0.9117E-01	0.1177E+02	0.2000E-01
0.2460E+03	0.1822E+00	0.2075E+02	0.5000E-01
0.3052E+03	0.2489E+00	0.2396E+02	0.8000E-01
0.3305E+03	0.2865E+00	0.2610E+02	0.1000E+00
0.3629E+03	0.4139E+00	0.3679E+02	0.2000E+00
0.3600E+03	0.7141E+00	0.4950E+02	0.5000E+00
0.3699E+03	0.1022E+01	0.5939E+02	0.8000E+00
0.3745E+03	0.1226E+01	0.6395E+02	0.1000E+01
0.3858E+03	0.2236E+01	0.7530E+02	0.2000E+01

APPENDIX A.1 - ODOT Quick Reference for Visual Description of Soils

1) STRENGTH OF SOIL:

Non-Cohesive (granular) Soils - Compactness	
Description	Blows Per Ft.
Very Loose	≤ 4
Loose	5 – 10
Medium Dense	11 – 30
Dense	31 – 50
Very Dense	> 50

2) COLOR :

If a color is a uniform color throughout, the term is single, modified by an adjective such as light or dark. If the predominate color is shaded by a secondary color, the secondary color precedes the primary color. If two major and distinct colors are swirled throughout the soil, the colors are modified by the term “mottled”

3) PRIMARY COMPONENT

Use **DESCRIPTION** from ODOT Soil Classification Chart on Back

Cohesive (fine grained) Soils - Consistency

Description	Qu (TSF)	Blows Per Ft.	Hand Manipulation
Very Soft	<0.25	<2	Easily penetrates 2” by fist
Soft	0.25-0.5	2 - 4	Easily penetrates 2” by thumb
Medium Stiff	0.5-1.0	5 - 8	Penetrates by thumb with moderate effort
Stiff	1.0-2.0	9 - 15	Readily indents by thumb, but not penetrate
Very Stiff	2.0-4.0	16 - 30	Readily indents by thumbnail
Hard	>4.0	>30	Indent with difficulty by thumbnail

4) COMPONENT MODIFIERS:

Description	Percentage By Weight
Trace	0% - 10%
Little	10% - 20%
Some	20% - 35%
“And”	35% -50%

5) Soil Organic Content

Description	% by Weight
Slightly Organic	2% - 4%
Moderately Organic	4% - 10%
Highly Organic	> 10%

6) Relative Visual Moisture

Description	Criteria	
	Cohesive Soil	Non-cohesive Soils
Dry	Powdery; Cannot be rolled; Water content well below the plastic limit	No moisture present
Damp	Leaves very little moisture when pressed between fingers; Crumbles at or before rolled to $\frac{1}{8}$ ”; Water content below plastic limit	Internal moisture, but no to little surface moisture
Moist	Leaves small amounts of moisture when pressed between fingers; Rolled to $\frac{1}{8}$ ” or smaller before crumbling; Water content above plastic limit to -3% of the liquid limit	Free water on surface, moist (shiny) appearance
Wet	Very mushy; Rolled multiple times to $\frac{1}{8}$ ” or smaller before crumbles; Near or above the liquid limit	Voids filled with free water, can be poured from split spoon.



CLASSIFICATION OF SOILS

Ohio Department of Transportation

(The classification of a soil is found by proceeding from top to bottom of the chart.
The first classification that the test data fits is the correct classification.)

SYMBOL	DESCRIPTION	Classification		LL _O /LL x 100*	% Pass #40	% Pass #200	Liquid Limit (LL)	Plastic Index (PI)	Group Index Max.	REMARKS
		AASHTO	OHIO							
	Gravel and/or Stone Fragments	A-1-a			30 Max.	15 Max.		6 Max.	0	Min. of 50% combined gravel, cobble and boulder sizes
	Gravel and/or Stone Fragments with Sand	A-1-b			50 Max.	25 Max.		6 Max.	0	
	Fine Sand	A-3			51 Min.	10 Max.	NON-PLASTIC		0	
	Coarse and Fine Sand	--	A-3a			35 Max.		6 Max.	0	Min. of 50% combined coarse and fine sand sizes
	Gravel and/or Stone Fragments with Sand and Silt	A-2-4				35 Max.	40 Max.	10 Max.	0	
		A-2-5					41 Min.			
	Gravel and/or Stone Fragments with Sand, Silt and Clay	A-2-6				35 Max.	40 Max.	11 Min.	4	
		A-2-7					41 Min.			
	Sandy Silt	A-4	A-4a	76 Min.		36 Min.	40 Max.	10 Max.	8	Less than 50% silt sizes
	Silt	A-4	A-4b	76 Min.		50 Min.	40 Max.	10 Max.	8	50% or more silt sizes
	Elastic Silt and Clay	A-5		76 Min.		36 Min.	41 Min.	10 Max.	12	
	Silt and Clay	A-6	A-6a	76 Min.		36 Min.	40 Max.	11 - 15	10	
	Silty Clay	A-6	A-6b	76 Min.		36 Min.	40 Max.	16 Min.	16	
	Elastic Clay	A-7-5		76 Min.		36 Min.	41 Min.	≤ LL-30	20	
	Clay	A-7-6		76 Min.		36 Min.	41 Min.	> LL-30	20	
	Organic Silt	A-8	A-8a	75 Max.		36 Min.				W/o organics would classify as A-4a or A-4b
	Organic Clay	A-8	A-8b	75 Max.		36 Min.				W/o organics would classify as A-5, A-6a, A-6b, A-7-5 or A-7-6
MATERIAL CLASSIFIED BY VISUAL INSPECTION Sod and Topsoil Uncontrolled Fill (Describe) Bouldery Zone Peat, S-Sedimentary, W-Woody, F-Fibrous, L-Loamy & etc										

* Only perform the oven-dried liquid limit test and this calculation if organic material is present in the sample.