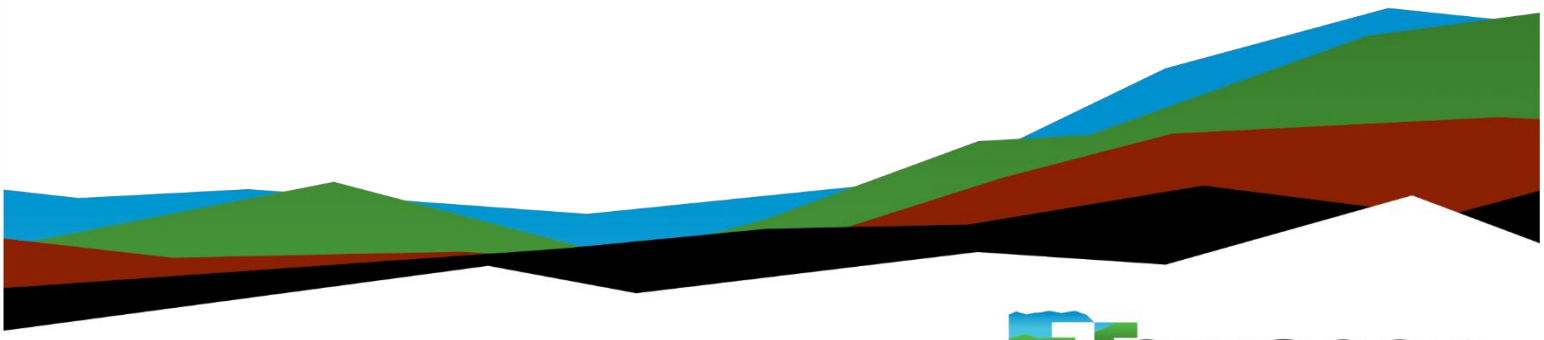
ATH-Blackburn Road Slip

Geotechnical Engineering Report

December 24, 2024 | Terracon Project No. N4245394

Prepared for:

Athens Township Board of Trustees
313 West Union Street
Athens, Ohio 45701



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December 24, 2024

Athens Township Board of Trustees
313 West Union Street
Athens, Ohio 45701

Attn: Mr. Ted Linscott
P: (740) 592-1523
E: tlinscott@ategnstwp.com

Re: Geotechnical Engineering Report
ATH-Blackburn Road Slip
South Blackburn Road
Athens, Athens County, Ohio
Terracon Project No. N4245394

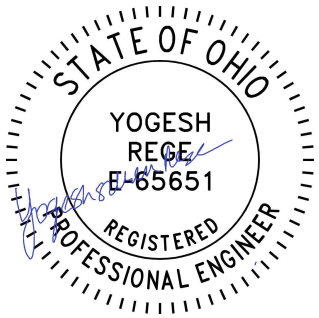
Dear Mr. Linscott:

We have completed the scope of Geotechnical Engineering services for the above referenced project in general accordance with Terracon Proposal No. PN424394 dated November 25, 2024. This report provides geotechnical recommendations concerning the remediation of an existing landslide located along South Blackburn Road in Athens, Ohio. Subsurface information collected during our 2017 exploration (Terracon Project No. N4175279) at this site was used in our analyses.

We appreciate the opportunity to be of service to you on this project. If you have any questions concerning this report or if we may be of further service, please contact us.

Sincerely,
Terracon Consultants, Inc.

Yogesh S. Rege, P.E.
Senior Principal



Kevin M. Ernst, P.E.
Principal/Regional Manager

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Note: This report was originally delivered in a web-based format. **Blue Bold** text in the report indicates a referenced section heading. The PDF version also includes hyperlinks which direct the reader to that section and clicking on the terracon logo will bring you back to this page. For more interactive features, please view your project online at **client.terracon.com**.

Refer to each individual Attachment for a listing of contents.

Introduction

This report presents the results of our subsurface exploration and Geotechnical Engineering services performed to provide the geotechnical recommendations concerning the remediation of an existing landslide located along South Blackburn Road in Athens, Athens County, Ohio. The purpose of these services was to provide information and geotechnical engineering recommendations relative to:

- Recommendation for landslide stabilization
- Construction recommendations

The 2017 geotechnical exploration scope for this project involved the advancement of a total of three (3) test borings to depths ranging from 29 to 35 feet. A copy of the 2017 geotechnical report is included in the **Supporting Information** section.

Site Visit Information

The slip is located south of an existing concrete driveway on the east side of South Blackburn Road. Based on our site visit, the minimum estimated wall length required for remediating the more pronounced slip would be about 188 feet and to ensure stabilization of the entire active slip area would be about 250 feet. The minimum northern limit is at the south end of the concrete driveway and the extended northern limit, to cover the entire active slip, is at the north end of the concrete driveway. Our senior engineer marked the 188-foot northern limit of the slip remediation with white paint on the roadway (see picture with painted line and paint can). The average road width is about 15 feet outside of slip area (as the pavement has been widened in the area of the slip as the result of apparent repaving following the slip). No visible bedrock outcroppings, or overhead utilities were observed in the slip area.

Drainage appears to be an issue on the project site and would require storm drain replacement and improvements. A considerable amount of surface water is draining over the slip area from the concrete curb along the existing concrete driveway.

There are two driveways for homes accessed from the concrete driveway and then at the very end of the driveway is Blackburn Hill Church. A catch basin inlet(s) could be installed within the concrete curb near Blackburn Road to catch much of the drainage and direct it under the Blackburn Road and outlet through the proposed wall. Damaged or defective storm drains under the roadway may be further saturating the embankment. A cross-pipe outlet was observed within the middle of the project area. Another cross-pipe is located south of the project area next to the temporary traffic sign. A cross-pipe outlet was also observed within the project site on the north end with no evidence of recent flow of water. We could not find any inlets in the ditch on the west side of the roadway within the project area. A cross pipe was observed going underneath the concrete driveway; however, we could not find an outlet on the west side of Blackburn Road. Due to the condition of visible storm drains and some inlets/outlets not being visible, we recommend a private utility locater be engaged to map the storm drains in the area and use camera video inspection to check for damage and functionality. Tree clearing would be needed along the wall side of the road along with removal of one overhanging tree from the west side. It did not appear the west hillside adjacent to Blackburn Road has experienced any recent movement and the top of the scarp is confined to the roadway and west ditch line. A soldier pile wall using concrete lagging panels or plug piles will likely require guardrail due to narrow right-of-way and drop-off.

Geotechnical Characterization

Subsurface Profile

We have developed a general characterization of the subsurface conditions based upon our review of the subsurface exploration, geologic setting and our understanding of the project. This characterization, termed GeoModel, forms the basis of our geotechnical calculations and evaluation of the site. Conditions observed at each exploration point are indicated on the individual logs. The individual logs can be found in the **Supporting Information**.

As part of our analyses, we identified the following model layers within the subsurface profile.

Model Layer	Layer Name	General Description
1	**Surface Cover**	Asphalt and aggregate base
2	**Uncontrolled Fill**	Gravel with sand, silt and clay
3	**Native Fine-Grained Soils**	Soft to medium stiff silty clay
4	**Native Fine Grained Soils 2**	Stiff to very stiff silty clay
5	**Bedrock**	Very weak to weak claystone, sandstone and shale and moderately strong limestone

Groundwater Conditions

The borings were observed during drilling and immediately after completion for the presence and level of groundwater. Groundwater was observed in Boring B-003-0-17 at a depth of about 14.5 feet below ground surface. The other two borings did not indicate groundwater at the time of our exploration.

Absence of groundwater in borings does not necessarily mean these borings were terminated above groundwater. Due to the low permeability of the soils encountered in the borings, a relatively long period of time may be necessary for a groundwater level to develop and stabilize in a borehole in these materials. Long term observations in piezometers or observation wells sealed from the influence of surface water are often required to define groundwater levels in some of the materials encountered in the borings.

Groundwater level fluctuations occur due to seasonal variations in the amount of rainfall, runoff and other factors not evident at the time the borings were performed. Therefore, groundwater levels during construction or at other times in the life of the structures may be higher or lower than the levels indicated on the boring logs. The possibility of groundwater level fluctuations should be considered when developing the design and construction plans for the project.

Geotechnical Overview

The borings encountered marginal strength native soils and existing fill to depths ranging from about 8.5 to 11 feet below the existing ground surface. Below these marginal strength soils, very stiff native soils and/or shale, claystone or sandstone bedrock was encountered. Based on the subsurface conditions and our site visit, it

appears that the slip extends to a maximum depth of about 11 feet below the existing ground surface. We recommend a minimum soldier pile wall length of about 188 feet based on our site visit and a length of 250 feet to ensure stabilization of the entire active slip area.

We have designed the retaining wall to retain lateral forces imparted by the proposed retained soil height as indicated above. The results of our analyses are included in **Retaining Wall Analyses** section.

The following section presents our detailed recommendations and considerations for slope remediation. The **General Comments** section provides an understanding of the report limitations.

Soldier Pile Cantilever Retaining Wall – Design Considerations

A Soldier Pile Cantilever retaining wall is proposed as the recommended remedial design to stabilize and protect the slope from ongoing movement. The approximate location of the proposed Soldier Pile Cantilever wall alignment is assumed to be approximately 5 feet away from the eastern edge of the existing road. It is estimated that the wall will be at least 188 feet in length, and 250 feet to ensure stabilization of the entire active slip area. However, the engineer/contractor should confirm the actual length to be stabilized based on the extent of the area affected by the landslide, considering conditions at the site, with a buffer on each side extending beyond the slip area.

The retaining wall was designed to resist lateral forces imparted by a retained soil height of approximately 11 feet, which corresponds to the depth of marginal strength soils encountered in the borings. The analyses were completed using the software program L-Pile. Soil strength parameters used in our analysis were developed from SPT N-values and hand penetrometer field test results, our experience with similar soils/bedrock. Lateral deformations were analyzed using L-Pile software for the lateral forces from retained soil mass calculated using "Wedge Method". A design traffic load of 250 psf was considered for the wall design.

Stability and strength checks for the chosen structural steel section were performed to ensure its adequacy against lateral failure, the steel section is checked for deflection and strength requirement.

The results of our analyses indicate that a soldier pile lagging wall consisting of a series of minimum 26 feet pile length, and 30-inch diameter structural drilled shafts reinforced with HP12x84 steel sections spaced at 4 feet center-to-center; installed within 5 feet of the eastern edge of existing road. The analysis indicated that the pile head deflection is less than 2 inches, which meets ODOT requirement.

The following tables provide a summary of the recommended "Soldier Pile Cantilever" retaining wall design wall design with plug piles or precast concrete panels as lagging:

Item	Requirement
Center-to-Center Structural Drilled Shaft Spacing	4 feet
Minimum Diameter of Structural Drilled Shaft	30 inches
Maximum Diameter of Plug Pile	36 inches
Maximum Retained Height	11 feet
Minimum Steel Pile Length	26 feet
Minimum Drilled Shaft Embedment in Weathered Bedrock	15 feet
Structural Steel Section[1]	HP 12x84, Grade 50
Minimum 28-day Unconfined Compressive Strength of Concrete (f'_c) for drilled shafts	4,000 psi

Notes:

1. The steel sections be painted or galvanized for corrosion protection. If sacrificial steel is being considered as corrosion protection, a larger section than that recommended should be used.

The drilled concrete shafts are reinforced with HP 12X84 steel beam section placed centrally along the entire length of the drilled shaft excavation. Steel beam sections (structural drilled shafts/ soldier piles) are inserted vertically into the shafts and should be oriented such that the strong axis is parallel to the length of the wall.

Plug piles or precast lagging (if used) should be installed after installation of soldier piles to transfer the soil loads to the piles. Lagging may be designed for 50 percent of the lateral soil pressure. Any void between plug piles/lagging must be backfilled with a permeable granular soil material that does not allow the buildup of hydrostatic pressure.

Soldier Pile Cantilever Wall – Construction Considerations

The following construction considerations should be adhered to during drilled shaft installation.

- The drilled shaft wall should be constructed by a "Specialty Contractor". Consideration should be given to contractor's previous experience in such type of construction during the bid approval process.

- The actual bearing elevation at each shaft location should be determined in the field during construction through inspection by an authorized representative of the geotechnical engineer.
- Temporary steel casing should be made available on site and used on an as needed basis.
- The bearing surface of each shaft should be cleaned of any loose material prior to concrete placement.
- If water seepage is encountered during drilling, specifications should state that no more than 1 inch water should be allowed to collect at the bottom of the shaft hole prior to concreting. If water cannot be pumped out, then the concrete should be placed with a tremie pipe.
- The bearing surface of each shaft should be cleaned of any loose material prior to concrete placement.
- It is recommended that no shaft holes be left open overnight without being filled with concrete.
- Drilled shaft installation should either be bid per lineal foot for each diameter used or lump sum for the designated diameter and length, with an add or deduct for drill footage. An extra cost item should be included for any obstructions encountered in the overburden.
- Particular attention should be paid to the placement and orientation of the steel beam reinforcement. The steel beam should be oriented such that the strong axis is parallel to the length of the wall to resist the lateral force which will act in an upslope to downslope direction. The soldier pile that is placed within the hole must be vertical and not inclined more than 1 inch between top to bottom.
- The installation sequence shall be such that no drilled shaft is installed adjacent to either an open drilled shaft excavation or a drilled shaft in which the concrete has less than a 48-hour cure. Installing the shafts in an alternating sequence or any other sequence that meets this criterion is permissible.
- For the drilled shaft wall with plug piles, we anticipate the structural drilled shaft with rolled steel section would be extended to the top of the wall. The plug piles would be installed in between just behind the structural drilled shafts to retain the soils in between the structural drilled shafts. If lagging is used the wall face could be constructed of precast concrete lagging panels supported by the flanges of the rolled steel sections. The lagging panels can be placed between the flanges of the rolled steel sections.

- It is recommended that plug piles be installed to bear at least one foot into weathered bedrock. Concrete lagging panels if used should be embedded to a depth of at least 3 feet below the downslope bench level (created to facilitate the drilled shaft construction).

- Contractor must provide precast concrete lagging from a precast concrete manufacturer certified according to Supplement 1073 for permanent lagging. Class QC1 concrete with a 28-day design strength of at least 4000 psi according to C&MS 499 can be used. Reinforcing steel should be epoxy coated according to C&MS 709.00. Instead of epoxy coating, a corrosion inhibiting concrete admixture may be used at the specified dosage rate. The dimensions of the lagging or location of the reinforcing steel should not vary by more than ¼-inch. The panel must be placed between the flanges of the soldier piles and bearing against the flanges on the exposed side of the wall so that the soldier pile flange overlaps the end of the lagging by at least one inch more than the concrete cover over the reinforcing steel at both ends of the lagging. When installing the precast concrete lagging panels, hardwood wedges may be placed to hold the lagging panels against the front inside flange of the steel piles. The lagging can be placed after 12 hours of concrete placing in the shaft.

- As indicated in the site visit section, drainage corrections should be made at the site to prevent the buildup of hydrostatic pressures on the wall. Surface water should be directed away from the wall. We recommend installing rock protection at drainage points when water is discharged on slopes.

General Comments

Our analysis and opinions are based upon our understanding of the project, the geotechnical conditions in the area, and the data obtained from our site exploration. Variations will occur between exploration point locations or due to the modifying effects of construction or weather. The nature and extent of such variations may not become evident until during or after construction. Terracon should be retained as the Geotechnical Engineer, where noted in this report, to provide observation and testing services during pertinent construction phases. If variations appear, we can provide further evaluation and supplemental recommendations. If variations are noted in the absence of our observation and testing services on-site, we should be immediately notified so that we can provide evaluation and supplemental recommendations.

Our Scope of Services does not include either specifically or by implication any environmental or biological (e.g., mold, fungi, bacteria) assessment of the site or identification or prevention of pollutants, hazardous materials or conditions. If the owner is concerned about the potential for such contamination or pollution, other studies should be undertaken.

Our services and any correspondence are intended for the sole benefit and exclusive use of our client for specific application to the project discussed and are accomplished in accordance with generally accepted geotechnical engineering practices with no third-party beneficiaries intended. Any third-party access to services or correspondence is solely for information purposes to support the services provided by Terracon to our client. Reliance upon the services and any work product is limited to our client and is not intended for third parties. Any use or reliance of the provided information by third parties is done solely at their own risk. No warranties, either express or implied, are intended or made.

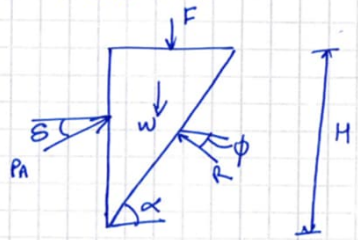
Site characteristics as provided are for design purposes and not to estimate excavation cost. Any use of our report in that regard is done at the sole risk of the excavating cost estimator as there may be variations on the site that are not apparent in the data that could significantly affect excavation cost. Any parties charged with estimating excavation costs should seek their own site characterization for specific purposes to obtain the specific level of detail necessary for costing. Site safety and cost estimating including excavation support and dewatering requirements/design are the responsibility of others. Construction and site development have the potential to affect adjacent properties. Such impacts can include damages due to vibration, modification of groundwater/surface water flow during construction, foundation movement due to undermining or subsidence from excavation, as well as noise or air quality concerns. Evaluation of these items on nearby properties are commonly associated with contractor means and methods and are not addressed in this report. The owner and contractor should consider a preconstruction/precondition survey of surrounding development. If changes in the nature, design, or location of the project are planned, our conclusions and recommendations shall not be considered valid unless we review the changes and either verify or modify our conclusions in writing.

Attachments

Retaining Wall Analyses

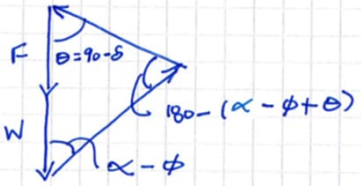
CLIENT:	Athens Township
PROJECT:	Blackburn Rd Slip
PROJECT NO.:	N4245394
CASE:	Boring B-001-17

CONSIDER THE FOLLOWING FORCE MODEL TO CALCULATE THE FORCE ACTING ON THE CANTILEVER WALL



WHERE F = TRAFFIC SURCHARGE related FORCE
W = WEIGHT OF THE UNSTABLE SOIL WEDGE
P_A = LATERAL FORCE DUE TO ACTIVE PRESSURE
ϕ = ANGLE OF INTERNAL FRICTION AT THE FAILURE SURFACE
δ = ANGLE OF FRICTION BETWEEN THE PIER AND THE SOIL SURFACE
α = Failure Surface inclination

CONSIDER THE FOLLOWING FORCE POLYGON!



AREA OF ACTIVE SOIL WEDGE $= \frac{1}{2} H \frac{H}{\tan\alpha}$

$= \frac{0.5 H^2}{\tan\alpha}$

$\therefore$ WT. OF WEDGE $= \frac{0.5 H^2}{\tan\alpha} \gamma_{bulk}$

F = traffic intensity $\times$ $H/\tan\alpha$

USING SINE RULE ON THE FORCE TRIANGLE

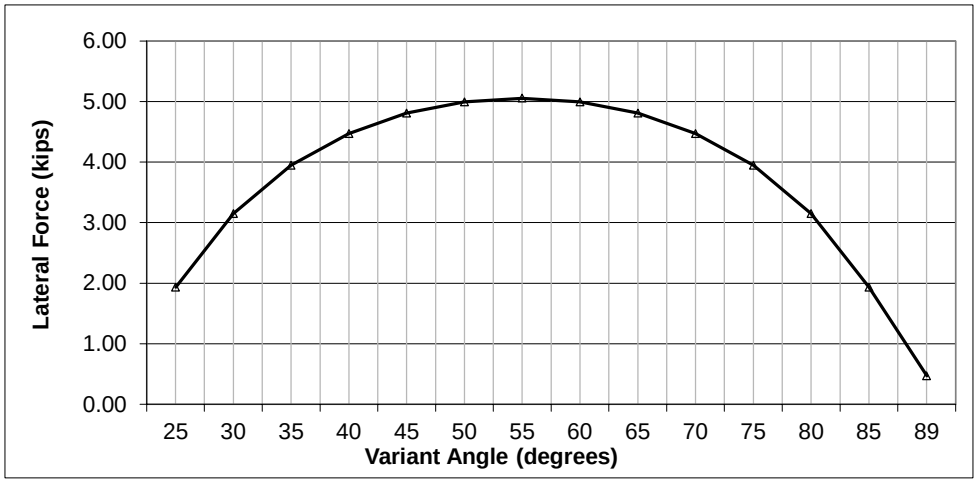
$$\frac{P_A}{\sin(\alpha-\phi)} = \frac{W+F}{\sin(180-\alpha+\phi-\theta)}$$

$$\therefore P_A = \frac{(W+F)(\sin\alpha-\phi)}{\sin(180-\alpha+\phi-90+\delta)}$$

CLIENT:	Athens Township
PROJECT:	Blackburn Rd Slip
PROJECT NO.:	N4245394
CASE:	Boring B-001-17

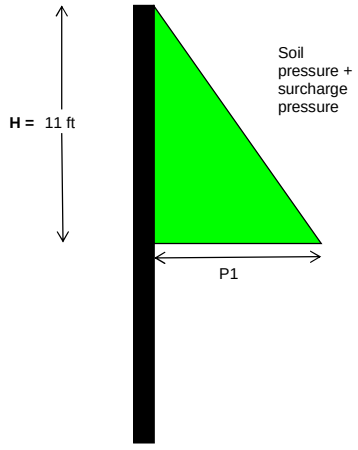
Angle of Internal Friction Φ:	20	degrees
Angle of Wall Friction δ:	0	degrees
Bulk Unit Weight γ:	0.125	kcf
Traffic Surcharge Intensity:	0.25	ksf
Depth to slip surface H:	11	feet

Variant Angle (α)	W (kips)	F (kips)	P_A (kips)
25	16.22	5.90	1.93
30	13.10	4.76	3.15
35	10.80	3.93	3.95
40	9.01	3.28	4.47
45	7.56	2.75	4.81
50	6.35	2.31	5.00
55	5.30	1.93	5.06
60	4.37	1.59	5.00
65	3.53	1.28	4.81
70	2.75	1.00	4.47
75	2.03	0.74	3.95
80	1.33	0.48	3.15
85	0.66	0.24	1.93
89	0.13	0.05	0.47



Maximum Value of P_A =	5.06	kips

Distribute this P_A over the depth of the wall on a per foot basis.



P1 = 0.92 kips/ft.

CLIENT:	Athens Township
PROJECT:	Blackburn Rd Slip
PROJECT NO.:	N4245394
CASE:	Boring B-001-17

Pile Spacing = 4 feet

Therefore contributing pressure for the wall section on each pier will be:

= 3.68 kips/ft.

= 306.43 lbs/in.

Perform L-pile Analysis:

Steel Section	Width, bf (in.)	Depth, d (in.)	Equivalent Diameter (in.)	Section Area ($in.^2$)	Ixx ($in.^4$)	Sxx (in.3)
HP 8 x 36	8.155	8.02	9.12	10.36	119	29.8
HP 10 x 42	10.075	9.7	11.15	12.4	210	43.4
HP 10 x 57	10.225	9.99	11.40	16.8	294	58.8
HP 12 x 53	12.045	11.78	13.44	15.5	393	66.8
HP 12 x 84	12.295	12.28	13.86	24.6	650	106
HP 14 x 73	14.585	13.61	15.90	21.4	729	107
HP 14 x 89	14.695	13.83	16.09	26.1	904	131
HP 14 x 117	14.885	14.21	16.41	34.4	1220	172
W 21 x 93	8.42	21.62	15.22	27.3	2070	192
W 21 x 132	12.44	21.83	18.59	38.8	3220	295
W 21 x 147	12.51	22.06	18.74	43.2	3630	329

Lpile Analyses: used HP12x84

Steel Section top displacement: 1.1 (less than 1% of drilled shaft length above bedrock)

Bending Moment Check

Maximum bending moment from Lpile Analyses: 2.31E+06 in-lbs — Strength Limit

192.18 kips-ft.

For 50 ksi steel

F_b allowable = 33 Ksi

S_{XX} (required) = 70 in^3

S_{XX} for selected section = 106 in^3 OK

==

LPile for Windows, Version 2022-12.010

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

==

This copy of LPile is being used by:

Terracon Consultants, Inc
Columbus, Ohio

Serial Number of Security Device: 138584418

This copy of LPile is licensed for exclusive use by:

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Use of this software by employees of Terracon
other than those of the office site in LPILE Global, Global License
is a violation of the software license agreement.

Files Used for Analysis

Path to file locations:
\Projects\2024\N4245394\Working Files\Calculations-Analyses\

Name of input data file:
Lpile Pile Wall Analysis N4245394.lp12d

Name of output report file:
Lpile Pile Wall Analysis N4245394.lp12o

Name of plot output file:
Lpile Pile Wall Analysis N4245394.lp12p

Name of runtime message file:
Lpile Pile Wall Analysis N4245394.lp12r

Date and Time of Analysis

Date: December 24, 2024 Time: 11:09:14

Problem Title

Blackburn Road Slip

Job Number: N4245394

Client: Athens Township

Engineer: YSR

Description: Boring B-001-0-17

Program Options and Settings

Computational Options:
- Conventional Analysis

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

Analysis Control Options:

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

Loading Type and Number of Cycles of Loading:
- Static loading specified

- Use of p-y modification factors for p-y curves not selected

- Analysis uses layering correction (Method of Georgiadis)
- Analysis includes loading by multiple distributed lateral loads acting on pile
- Loading by lateral soil movements acting on pile not selected
- Input of shear resistance at the pile tip not selected
- Input of moment resistance at the pile tip not selected
- Computation of pile-head foundation stiffness matrix not selected
- Push-over analysis of pile not selected
- Buckling analysis of pile not selected

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

Pile Structural Properties and Geometry

Number of pile sections defined = 2
Total length of pile = 26.000 ft
Depth of ground surface below top of pile = 11.0000 ft

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

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

Point No.	Depth Below Pile Head feet	Pile Diameter inches
1	0.000	12.3000
2	11.000	12.3000
3	11.000	12.3000
4	26.000	12.3000

Input Structural Properties for Pile Sections:

Pile Section No. 1:

Section 1 is an elastic pile
Cross-sectional Shape = Strong AISC Section Pile
Length of section = 11.000000 ft

AISC Section Type = HP

AISC Section Name = HP12X84

Flange Width	=	12.300000 in
Section Depth	=	12.300000 in
Flange Thickness	=	0.685000 in
Web Thickness	=	0.685000 in
Section Area	=	24.600000 sq. in
Moment of Inertia	=	650.000000 in^4
Elastic Modulus	=	29000000. psi

Pile Section No. 2:

Section 2 is an elastic pile

Cross-sectional Shape = Strong AISC Section Pile

Length of section = 15.000000 ft

AISC Section Type = HP

AISC Section Name = HP12X84

Flange Width	=	12.300000 in
Section Depth	=	12.300000 in
Flange Thickness	=	0.685000 in
Web Thickness	=	0.685000 in
Section Area	=	24.600000 sq. in
Moment of Inertia	=	650.000000 in^4
Elastic Modulus	=	29000000. psi

Soil and Rock Layering Information

The soil profile is modelled using 3 layers

Layer 1 is stiff clay with water-induced erosion

Distance from top of pile to top of layer	=	11.000000 ft
Distance from top of pile to bottom of layer	=	13.500000 ft
Effective unit weight at top of layer	=	120.000000 pcf
Effective unit weight at bottom of layer	=	120.000000 pcf

```
   Undrained cohesion at top of layer                  =        2000. psf
   Undrained cohesion at bottom of layer               =        2000. psf
   Epsilon-50 at top of layer                          =      0.0000
   Epsilon-50 at bottom of layer                       =      0.0000
   Subgrade k at top of layer                          =      0.0000 pci
   Subgrade k at bottom of layer                       =      0.0000 pci

   NOTE: Default values for Epsilon-50 will be computed for this layer.

   NOTE: Default values for subgrade k will be computed for this layer.

Layer 2 is stiff clay with water-induced erosion

   Distance from top of pile to top of layer           =    13.500000 ft
   Distance from top of pile to bottom of layer        =    23.500000 ft
   Effective unit weight at top of layer               =   125.000000 pcf
   Effective unit weight at bottom of layer            =   125.000000 pcf
   Undrained cohesion at top of layer                  =        3000. psf
   Undrained cohesion at bottom of layer               =        3000. psf
   Epsilon-50 at top of layer                          =      0.0000
   Epsilon-50 at bottom of layer                       =      0.0000
   Subgrade k at top of layer                          =      0.0000 pci
   Subgrade k at bottom of layer                       =      0.0000 pci

   NOTE: Default values for Epsilon-50 will be computed for this layer.

   NOTE: Default values for subgrade k will be computed for this layer.

Layer 3 is weak rock, p-y criteria by Reese, 1997

   Distance from top of pile to top of layer           =    23.500000 ft
   Distance from top of pile to bottom of layer        =    30.000000 ft
   Effective unit weight at top of layer               =   135.000000 pcf
   Effective unit weight at bottom of layer            =   135.000000 pcf
   Uniaxial compressive strength at top of layer       =   250.000000 psi
   Uniaxial compressive strength at bottom of layer    =   250.000000 psi
   Initial modulus of rock at top of layer             =        5000. psi
   Initial modulus of rock at bottom of layer          =        5000. psi
   RQD of rock at top of layer                         =    50.000000 %
   RQD of rock at bottom of layer                      =       0.0000 %
   k rm of rock at top of layer                        =    0.0005000
   k rm of rock at bottom of layer                     =    0.0005000


 (Depth of the lowest soil layer extends 4.000 ft below the pile tip)



--------------------------------------------------------------------------------
                      Summary of Input Soil Properties
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Layer Num.	Soil Type or (p-y Curve Type)	Layer Depth ft	Effective Unit Wt. pcf	Cohesion psf	Uniaxial qu psi	E50 kpy pci	Rock Mass Modulus krm psi	RQD %
1	Stiff Clay	11.0000	120.0000	2000.	--	--	--	--
	default	default						
	with Free Water	13.5000	120.0000	2000.	--	--	--	--
	default	default						
2	Stiff Clay	13.5000	125.0000	3000.	--	--	--	--
	default	default						
	with Free Water	23.5000	125.0000	3000.	--	--	--	--
	default	default						
3	Weak	23.5000	135.0000	--	250.0000	50.0000	5.00E-04	--
	Rock	30.0000	135.0000	--	250.0000	0.00	5.00E-04	--

Static Loading Type

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

Distributed Lateral Loading for Individual Load Cases

Distributed lateral load intensity for Load Case 1 defined using 2 points

Point No.	Depth X ft	Dist. Load lb/in
1	0.000	0.000
2	11.000	306.500

Distributed lateral load intensity for Load Case 2 defined using 2 points

Point No.	Depth X ft	Dist. Load lb/in
1	0.000	0.000
2	11.000	460.000

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 2

Load No.	Load Type	Condition 1	Condition 2	Axial Thrust Force, lbs	Compute Top y vs. Pile Length	Run Analysis
1	1	V = 0.0000 lbs	M = 0.0000 in-lbs	0.0000000	Yes	Yes
2	1	V = 0.0000 lbs	M = 0.0000 in-lbs	0.0000000	No	Yes

V = shear force applied normal to pile axis
M = bending moment applied to pile head
y = lateral deflection normal to pile axis
S = pile slope relative to original pile batter angle
R = rotational stiffness applied to pile head
Values of top y vs. pile lengths can be computed only for load types with specified shear loading (Load Types 1, 2, and 3).
Thrust force is assumed to be acting axially for all pile batter angles.

Computations of Nominal Moment Capacity and Nonlinear Bending Stiffness

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Axial thrust force values were determined from pile-head loading conditions

Number of Pile Sections Analyzed = 2

Pile Section No. 1:

Moment-curvature properties were derived from elastic section properties

Pile Section No. 2:

Moment-curvature properties were derived from elastic section properties

Layering Correction Equivalent Depths of Soil & Rock Layers

Layer No.	Top of Layer Below Pile Head ft	Equivalent Top Depth Below Grnd Surf ft	Same Layer Type As Layer Above	Layer is Rock or is Below Rock Layer	F0 Integral for Layer lbs	F1 Integral for Layer lbs
1	11.0000	0.00	N.A.	No	0.00	2168.
2	13.5000	2.5020	Yes	No	2168.	30046.
3	23.5000	12.5000	No	Yes	N.A.	N.A.

Notes: The F0 integral of Layer n+1 equals the sum of the F0 and F1 integrals for Layer n. Layering correction equivalent depths are computed only for soil types with both shallow-depth and deep-depth expressions for peak lateral load transfer. These soil types are soft and stiff clays, non-liquefied sands, and cemented c-phi soil.

Computed Values of Pile Loading and Deflection for Lateral Loading for Load Case Number 1

Pile-head conditions are Shear and Moment (Loading Type 1)

Shear force at pile head = 0.0 lbs
Applied moment at pile head = 0.0 in-lbs
Axial thrust load on pile head = 0.0 lbs

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness lb-in^2	Soil Res. Spr. Distrib. p Es*H lb/inch	Lat. Load lb/inch
0.00	1.0439	2.58E-06	0.00	-0.00668	2.44E-08	1.88E+10	0.00	0.00 1.8111
0.2600	1.0231	8.8152	14.1269	-0.00668	0.08341	1.88E+10	0.00	0.00 7.2445
0.5200	1.0022	88.1516	48.0313	-0.00668	0.8341	1.88E+10	0.00	0.00 14.4891
0.7800	0.9814	308.5307	104.5388	-0.00668	2.9192	1.88E+10	0.00	0.00 21.7336

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    1.0400     0.9606   740.4737   183.6492   -0.00668     7.0060   1.88E+10
0.00       0.00    28.9782
    1.3000     0.9397      1455.   285.3626   -0.00668    13.7618   1.88E+10
0.00       0.00    36.2227
    1.5600     0.9189      2521.   409.6790   -0.00668    23.8538   1.88E+10
0.00       0.00    43.4673
    1.8200     0.8980      4011.   556.5984   -0.00668    37.9493   1.88E+10
0.00       0.00    50.7118
    2.0800     0.8772      5994.   726.1208   -0.00668    56.7154   1.88E+10
0.00       0.00    57.9564
    2.3400     0.8564      8542.   918.2461   -0.00668    80.8194   1.88E+10
0.00       0.00    65.2009
    2.6000     0.8356     11724.      1133.   -0.00667   110.9287   1.88E+10
0.00       0.00    72.4455
    2.8600     0.8147     15612.      1370.   -0.00667   147.7103   1.88E+10
0.00       0.00    79.6900
    3.1200     0.7939     20275.      1630.   -0.00667   191.8315   1.88E+10
0.00       0.00    86.9345
    3.3800     0.7731     25784.      1913.   -0.00666   243.9596   1.88E+10
0.00       0.00    94.1791
    3.6400     0.7524     32211.      2218.   -0.00666   304.7619   1.88E+10
0.00       0.00   101.4236
    3.9000     0.7316     39624.      2546.   -0.00665   374.9055   1.88E+10
0.00       0.00   108.6682
    4.1600     0.7108     48096.      2896.   -0.00665   455.0577   1.88E+10
0.00       0.00   115.9127
    4.4200     0.6901     57695.      3269.   -0.00664   545.8857   1.88E+10
0.00       0.00   123.1573
    4.6800     0.6694     68494.      3665.   -0.00663   648.0569   1.88E+10
0.00       0.00   130.4018
    4.9400     0.6488     80562.      4083.   -0.00661   762.2383   1.88E+10
0.00       0.00   137.6464
    5.2000     0.6281     93970.      4523.   -0.00660   889.0973   1.88E+10
0.00       0.00   144.8909
    5.4600     0.6076    108788.      4987.   -0.00658      1029.   1.88E+10
0.00       0.00   152.1355
    5.7200     0.5871    125087.      5473.   -0.00656      1184.   1.88E+10
0.00       0.00   159.3800
    5.9800     0.5666    142938.      5981.   -0.00654      1352.   1.88E+10
0.00       0.00   166.6245
    6.2400     0.5462    162411.      6512.   -0.00652      1537.   1.88E+10
0.00       0.00   173.8691
    6.5000     0.5259    183576.      7066.   -0.00649      1737.   1.88E+10
0.00       0.00   181.1136
    6.7600     0.5058    206504.      7643.   -0.00646      1954.   1.88E+10
0.00       0.00   188.3582
    7.0200     0.4857    231266.      8242.   -0.00642      2188.   1.88E+10
0.00       0.00   195.6027
    7.2800     0.4657    257932.      8863.   -0.00638      2440.   1.88E+10
0.00       0.00   202.8473
    7.5400     0.4459    286572.      9507.   -0.00633      2711.   1.88E+10
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0.00       0.00   210.0918
    7.8000     0.4262    317258.     10174.   -0.00628      3002.   1.88E+10
0.00       0.00   217.3364
    8.0600     0.4066    350059.     10864.   -0.00623      3312.   1.88E+10
0.00       0.00   224.5809
    8.3200     0.3873    385046.     11576.   -0.00617      3643.   1.88E+10
0.00       0.00   231.8255
    8.5800     0.3682    422290.     12310.   -0.00610      3996.   1.88E+10
0.00       0.00   239.0700
    8.8400     0.3492    461862.     13067.   -0.00603      4370.   1.88E+10
0.00       0.00   246.3145
    9.1000     0.3305    503831.     13847.   -0.00595      4767.   1.88E+10
0.00       0.00   253.5591
    9.3600     0.3121    548268.     14650.   -0.00586      5187.   1.88E+10
0.00       0.00   260.8036
    9.6200     0.2940    595244.     15475.   -0.00577      5632.   1.88E+10
0.00       0.00   268.0482
    9.8800     0.2761    644829.     16322.   -0.00566      6101.   1.88E+10
0.00       0.00   275.2927
   10.1400     0.2586    697094.     17192.   -0.00555      6596.   1.88E+10
0.00       0.00   282.5373
   10.4000     0.2415    752110.     18085.   -0.00543      7116.   1.88E+10
0.00       0.00   289.7818
   10.6600     0.2247    809946.     19001.   -0.00530      7663.   1.88E+10
0.00       0.00   297.0264
   10.9200     0.2084    870674.     19846.   -0.00516      8238.   1.88E+10
0.00       0.00   245.1946
   11.1800     0.1925    933788.     20127.   -0.00502      8835.   1.88E+10
-65.405      1060.       0.00
   11.4400     0.1771    996266.     19799.   -0.00486      9426.   1.88E+10
-144.751      2550.       0.00
   11.7000     0.1622   1057335.     19201.   -0.00469     10004.   1.88E+10
-238.723      4592.       0.00
   11.9600     0.1479   1116080.     18291.   -0.00451     10560.   1.88E+10
-344.652      7273.       0.00
   12.2200     0.1341   1171469.     17061.   -0.00432     11084.   1.88E+10
-443.518     10320.       0.00
   12.4800     0.1209   1222542.     15542.   -0.00412     11567.   1.88E+10
-530.266     13681.       0.00
   12.7400     0.1084   1268453.     13770.   -0.00391     12002.   1.88E+10
-605.541     17430.       0.00
   13.0000    0.09652   1308469.     11781.   -0.00370     12380.   1.88E+10
-669.730     21650.       0.00
   13.2600    0.08531   1341966.      9608.   -0.00348     12697.   1.88E+10
-723.054     26443.       0.00
   13.5200    0.07480   1368424.      6697.   -0.00326     12947.   1.88E+10
-1143.     47665.       0.00
   13.7800    0.06500   1383758.      3058.   -0.00303     13092.   1.88E+10
-1190.     57120.       0.00
   14.0400    0.05591   1387507.   -702.529   -0.00280     13128.   1.88E+10
-1221.     68113.       0.00
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   14.3000    0.04754   1379374.     -4489.   -0.00257     13051.   1.88E+10
-1206.     79171.       0.00
   14.5600    0.03988   1359497.     -8131.   -0.00234     12863.   1.88E+10
-1128.     88263.       0.00
   14.8200    0.03293   1328636.    -11500.   -0.00212     12571.   1.88E+10
-1031.     97716.       0.00
   15.0800    0.02666   1287737.    -14556.   -0.00190     12184.   1.88E+10
-927.902    108603.       0.00
   15.3400    0.02105   1237805.    -17290.   -0.00169     11712.   1.88E+10
-824.589    122211.       0.00
   15.6000    0.01609   1179846.    -19701.   -0.00149     11163.   1.88E+10
-720.789    139811.       0.00
   15.8600    0.01173   1114871.    -21786.   -0.00130     10548.   1.88E+10
-615.473    163735.       0.00
   16.1200    0.00795   1043905.    -23507.   -0.00113      9877.   1.88E+10
-488.234    191693.       0.00
   16.3800    0.00470    968185.    -24743.  -9.59E-04      9161.   1.88E+10
-303.703    201427.       0.00
   16.6400    0.00196    889510.    -25424.  -8.05E-04      8416.   1.88E+10
-132.779    211162.       0.00
   16.9000  -3.21E-04    809542.    -25595.  -6.65E-04      7660.   1.88E+10
22.7356    220896.       0.00
   17.1600   -0.00219    729795.    -25308.  -5.37E-04      6905.   1.88E+10
161.5927    230630.       0.00
   17.4200   -0.00367    651621.    -24614.  -4.23E-04      6165.   1.88E+10
283.0524    240365.       0.00
   17.6800   -0.00483    576203.    -23569.  -3.21E-04      5452.   1.88E+10
386.8232    250099.       0.00
   17.9400   -0.00568    504550.    -22298.  -2.32E-04      4774.   1.88E+10
428.2977    235278.       0.00
   18.2000   -0.00627    437066.    -20927.  -1.54E-04      4135.   1.88E+10
450.1184    223874.       0.00
   18.4600   -0.00664    373964.    -19503.  -8.69E-05      3538.   1.88E+10
463.1243    217588.       0.00
   18.7200   -0.00682    315371.    -18048.  -2.99E-05      2984.   1.88E+10
469.1738    214783.       0.00
   18.9800   -0.00683    261344.    -16584.   1.79E-05      2473.   1.88E+10
469.5783    214598.       0.00
   19.2400   -0.00670    211888.    -15125.   5.70E-05      2005.   1.88E+10
465.3218    216562.       0.00
   19.5000   -0.00647    166962.    -13686.   8.84E-05      1580.   1.88E+10
457.1769    220421.       0.00
   19.7600   -0.00615    126487.    -12278.   1.13E-04      1197.   1.88E+10
445.7714    226061.       0.00
   20.0200   -0.00577     90350.    -10909.   1.31E-04   854.8530   1.88E+10
431.6293    233468.       0.00
   20.2800   -0.00534     58416.     -9588.   1.43E-04   552.7019   1.88E+10
415.1969    242708.       0.00
   20.5400   -0.00488     30523.     -8321.   1.50E-04   288.7914   1.88E+10
396.8610    253923.       0.00
   20.8000   -0.00440      6493.     -7114.   1.53E-04    61.4327   1.88E+10
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376.9611    267328.       0.00
   21.0600   -0.00392    -13867.     -5971.   1.53E-04   131.2069   1.88E+10
355.7982    283229.       0.00
   21.3200   -0.00345    -30764.     -4895.   1.49E-04   291.0766   1.88E+10
333.6410    302039.       0.00
   21.5800   -0.00299    -44413.     -3890.   1.43E-04   420.2172   1.88E+10
310.7304    324309.       0.00
   21.8400   -0.00256    -55037.     -2957.   1.35E-04   520.7388   1.88E+10
287.2823    350780.       0.00
   22.1000   -0.00215    -62865.     -2098.   1.25E-04   594.8009   1.88E+10
263.4898    382456.       0.00
   22.3600   -0.00178    -68128.     -1313.   1.14E-04   644.5951   1.88E+10
239.5227    420726.       0.00
   22.6200   -0.00144    -71059.   -626.643   1.02E-04   672.3286   1.88E+10
200.5380    435053.       0.00
   22.8800   -0.00114    -72038.    -60.990   9.06E-05   681.5921   1.88E+10
162.0604    444787.       0.00
   23.1400  -8.73E-04    -71440.   390.1342   7.88E-05   675.9295   1.88E+10
127.1217    454522.       0.00
   23.4000  -6.45E-04    -69604.   738.2419   6.71E-05   658.5586   1.88E+10
96.0242    464256.       0.00
   23.6600  -4.54E-04    -66833.      1316.   5.58E-05   632.3437   1.88E+10
274.2352   1884683.       0.00
   23.9200  -2.97E-04    -61393.      2102.   4.52E-05   580.8710   1.88E+10
229.7518   2412293.       0.00
   24.1800  -1.72E-04    -53716.      2713.   3.57E-05   508.2377   1.88E+10
162.1016   2939902.       0.00
   24.4400  -7.46E-05    -44462.      3096.   2.75E-05   420.6744   1.88E+10
82.9626   3467512.       0.00
   24.7000  -2.25E-07    -34399.      3226.   2.10E-05   325.4700   1.88E+10
0.2882   3995122.       0.00
   24.9600   5.64E-05    -24334.      3098.   1.61E-05   230.2392   1.88E+10
-81.806   4522732.       0.00
   25.2200   1.01E-04    -15066.      2717.   1.29E-05   142.5428   1.88E+10
-162.722   5050341.       0.00
   25.4800   1.37E-04     -7381.      2081.   1.10E-05    69.8335   1.88E+10
-244.641   5577951.       0.00
   25.7400   1.69E-04     -2077.      1183.   1.02E-05    19.6562   1.88E+10
-331.382   6105561.       0.00
   26.0000   2.01E-04       0.00       0.00   1.01E-05       0.00   1.88E+10
-426.834   3316585.       0.00

* The above values of total stress are combined axial and bending stresses.


Output Summary for Load Case No. 1:

Pile-head deflection             =     1.04389680 inches
Computed slope at pile head      =     -0.0066782 radians
Maximum bending moment           =       1387507. inch-lbs
Maximum shear force              =        -25595. lbs
```

Depth of maximum bending moment = 14.04000000 feet below pile head
Depth of maximum shear force = 16.90000000 feet below pile head
Number of iterations = 17
Number of zero deflection points = 2
Pile deflection at ground = 0.20350125 inches

Pile-head Deflection vs. Pile Length for Load Case 1

Boundary Condition Type 1, Shear and Moment

Shear = 0. lbs
Moment = 0. in-lbs
Axial Load = 0. lbs

Pile Length feet	Pile Head Deflection inches	Maximum Moment ln-lbs	Maximum Shear lbs
26.00000	1.04389680	1387507.	-25595.
24.70000	1.04936652	1389115.	-25626.
23.40000	1.05126644	1390626.	-25444.
22.10000	1.05993678	1391895.	-25650.
20.80000	1.08749518	1388669.	-28148.

Computed Values of Pile Loading and Deflection
for Lateral Loading for Load Case Number 2

Pile-head conditions are Shear and Moment (Loading Type 1)

Shear force at pile head = 0.0 lbs
Applied moment at pile head = 0.0 in-lbs
Axial thrust load on pile head = 0.0 lbs

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness lb-in^2	Soil Res. Es*H lb/inch	Soil Spr. Lat. Load lb/inch	Distrib. p lb/inch
0.00	1.9804	1.72E-06	0.00	-0.01204	1.63E-08	1.88E+10	0.00	0.00	2.7182

```
    0.2600     1.9428    13.2299    21.2018   -0.01204     0.1252   1.88E+10
0.00       0.00    10.8727
    0.5200     1.9053   132.2993    72.0862   -0.01204     1.2518   1.88E+10
0.00       0.00    21.7455
    0.7800     1.8677   463.0477   156.8935   -0.01204     4.3811   1.88E+10
0.00       0.00    32.6182
    1.0400     1.8302      1111.   275.6236   -0.01204    10.5147   1.88E+10
0.00       0.00    43.4909
    1.3000     1.7926      2183.   428.2767   -0.01204    20.6540   1.88E+10
0.00       0.00    54.3636
    1.5600     1.7550      3784.   614.8527   -0.01204    35.8002   1.88E+10
0.00       0.00    65.2364
    1.8200     1.7175      6020.   835.3516   -0.01204    56.9549   1.88E+10
0.00       0.00    76.1091
    2.0800     1.6799      8996.      1090.   -0.01203    85.1194   1.88E+10
0.00       0.00    86.9818
    2.3400     1.6424     12820.      1378.   -0.01203   121.2951   1.88E+10
0.00       0.00    97.8545
    2.6000     1.6049     17596.      1700.   -0.01203   166.4835   1.88E+10
0.00       0.00   108.7273
    2.8600     1.5673     23430.      2057.   -0.01203   221.6859   1.88E+10
0.00       0.00   119.6000
    3.1200     1.5298     30429.      2447.   -0.01202   287.9037   1.88E+10
0.00       0.00   130.4727
    3.3800     1.4923     38698.      2871.   -0.01202   366.1384   1.88E+10
0.00       0.00   141.3455
    3.6400     1.4548     48342.      3329.   -0.01201   457.3914   1.88E+10
0.00       0.00   152.2182
    3.9000     1.4174     59469.      3821.   -0.01200   562.6640   1.88E+10
0.00       0.00   163.0909
    4.1600     1.3799     72183.      4346.   -0.01199   682.9577   1.88E+10
0.00       0.00   173.9636
    4.4200     1.3426     86590.      4906.   -0.01198   819.2739   1.88E+10
0.00       0.00   184.8364
    4.6800     1.3052    102797.      5500.   -0.01196   972.6139   1.88E+10
0.00       0.00   195.7091
    4.9400     1.2679    120908.      6127.   -0.01194      1144.   1.88E+10
0.00       0.00   206.5818
    5.2000     1.2307    141031.      6789.   -0.01192      1334.   1.88E+10
0.00       0.00   217.4545
    5.4600     1.1935    163271.      7484.   -0.01190      1545.   1.88E+10
0.00       0.00   228.3273
    5.7200     1.1565    187733.      8214.   -0.01187      1776.   1.88E+10
0.00       0.00   239.2000
    5.9800     1.1195    214523.      8977.   -0.01183      2030.   1.88E+10
0.00       0.00   250.0727
    6.2400     1.0826    243748.      9774.   -0.01180      2306.   1.88E+10
0.00       0.00   260.9455
    6.5000     1.0459    275513.     10605.   -0.01175      2607.   1.88E+10
0.00       0.00   271.8182
    6.7600     1.0093    309924.     11470.   -0.01170      2932.   1.88E+10
```

```
0.00       0.00   282.6909
    7.0200     0.9729    347087.     12369.   -0.01165      3284.   1.88E+10
0.00       0.00   293.5636
    7.2800     0.9366    387108.     13302.   -0.01159      3663.   1.88E+10
0.00       0.00   304.4364
    7.5400     0.9006    430092.     14269.   -0.01152      4069.   1.88E+10
0.00       0.00   315.3091
    7.8000     0.8647    476145.     15270.   -0.01145      4505.   1.88E+10
0.00       0.00   326.1818
    8.0600     0.8291    525374.     16304.   -0.01136      4971.   1.88E+10
0.00       0.00   337.0545
    8.3200     0.7938    577884.     17373.   -0.01127      5468.   1.88E+10
0.00       0.00   347.9273
    8.5800     0.7588    633780.     18475.   -0.01117      5997.   1.88E+10
0.00       0.00   358.8000
    8.8400     0.7241    693169.     19612.   -0.01106      6558.   1.88E+10
0.00       0.00   369.6727
    9.1000     0.6898    756157.     20782.   -0.01094      7154.   1.88E+10
0.00       0.00   380.5455
    9.3600     0.6558    822849.     21986.   -0.01081      7785.   1.88E+10
0.00       0.00   391.4182
    9.6200     0.6223    893351.     23224.   -0.01067      8452.   1.88E+10
0.00       0.00   402.2909
    9.8800     0.5893    967770.     24497.   -0.01051      9157.   1.88E+10
0.00       0.00   413.1636
   10.1400     0.5567   1046210.     25803.   -0.01035      9899.   1.88E+10
0.00       0.00   424.0364
   10.4000     0.5247   1128778.     27143.   -0.01017     10680.   1.88E+10
0.00       0.00   434.9091
   10.6600     0.4932   1215580.     28516.   -0.00997     11501.   1.88E+10
0.00       0.00   445.7818
   10.9200     0.4624   1306721.     29786.   -0.00977     12364.   1.88E+10
0.00       0.00   367.9920
   11.1800     0.4323   1401444.     30341.   -0.00954     13260.   1.88E+10
-12.302    88.7858       0.00
   11.4400     0.4029   1496047.     30278.   -0.00930     14155.   1.88E+10
-27.892   215.9888       0.00
   11.7000     0.3743   1590379.     30090.   -0.00905     15047.   1.88E+10
-92.388   770.1718       0.00
   11.9600     0.3465   1683812.     29664.   -0.00878     15931.   1.88E+10
-181.045      1630.       0.00
   12.2200     0.3195   1775482.     28944.   -0.00849     16799.   1.88E+10
-280.308      2737.       0.00
   12.4800     0.2935   1864424.     27903.   -0.00819     17640.   1.88E+10
-387.365      4118.       0.00
   12.7400     0.2684   1949594.     26519.   -0.00787     18446.   1.88E+10
-499.851      5810.       0.00
   13.0000     0.2444   2029900.     24778.   -0.00754     19206.   1.88E+10
-615.791      7862.       0.00
   13.2600     0.2214   2104210.     22673.   -0.00720     19909.   1.88E+10
-733.575     10340.       0.00
```

```
   13.5200     0.1994   2171380.     19573.   -0.00685     20545.   1.88E+10
-1254.     19611.       0.00
   13.7800     0.1786   2226348.     15451.   -0.00648     21065.   1.88E+10
-1389.     24264.       0.00
   14.0400     0.1590   2267793.     10935.   -0.00611     21457.   1.88E+10
-1506.     29552.       0.00
   14.3000     0.1405   2294579.      6141.   -0.00573     21710.   1.88E+10
-1567.     34794.       0.00
   14.5600     0.1232   2306114.      1285.   -0.00535     21819.   1.88E+10
-1546.     39162.       0.00
   14.8200     0.1071   2302595.     -3489.   -0.00497     21786.   1.88E+10
-1514.     44091.       0.00
   15.0800    0.09218   2284344.     -8141.   -0.00459     21613.   1.88E+10
-1469.     49704.       0.00
   15.3400    0.07845   2251796.    -12634.   -0.00422     21305.   1.88E+10
-1412.     56156.       0.00
   15.6000    0.06588   2205504.    -16934.   -0.00385     20867.   1.88E+10
-1344.     63658.       0.00
   15.8600    0.05444   2146129.    -21004.   -0.00349     20306.   1.88E+10
-1265.     72488.       0.00
   16.1200    0.04412   2074441.    -24808.   -0.00314     19627.   1.88E+10
-1174.     82995.       0.00
   16.3800    0.03486   1991329.    -28294.   -0.00280     18841.   1.88E+10
-1061.     94967.       0.00
   16.6400    0.02664   1897887.    -31396.   -0.00248     17957.   1.88E+10
-927.532    108647.       0.00
   16.9000    0.01939   1795417.    -34078.   -0.00217     16987.   1.88E+10
-791.383    127339.       0.00
   17.1600    0.01307   1685243.    -36326.   -0.00189     15945.   1.88E+10
-649.774    155092.       0.00
   17.4200    0.00762   1568744.    -38114.   -0.00162     14843.   1.88E+10
-496.220    203089.       0.00
   17.6800    0.00299   1447415.    -39261.   -0.00137     13695.   1.88E+10
-239.287    250099.       0.00
   17.9400  -9.06E-04   1323756.    -39517.   -0.00114     12525.   1.88E+10
75.4174    259834.       0.00
   18.2000   -0.00411   1200831.    -38845.  -9.29E-04     11362.   1.88E+10
355.3364    269568.       0.00
   18.4600   -0.00670   1081366.    -37565.  -7.40E-04     10231.   1.88E+10
465.1662    216626.       0.00
   18.7200   -0.00873    966428.    -36011.  -5.70E-04      9144.   1.88E+10
530.9420    189791.       0.00
   18.9800   -0.01026    856659.    -34284.  -4.19E-04      8105.   1.88E+10
575.5865    175072.       0.00
   19.2400   -0.01134    752493.    -32442.  -2.86E-04      7120.   1.88E+10
605.3194    166473.       0.00
   19.5000   -0.01204    654219.    -30525.  -1.70E-04      6190.   1.88E+10
623.6764    161574.       0.00
   19.7600   -0.01240    562017.    -28565.  -6.91E-05      5318.   1.88E+10
632.9462    159208.       0.00
   20.0200   -0.01247    475975.    -26587.   1.68E-05      4503.   1.88E+10
```

```
634.7404    158758.       0.00
   20.2800   -0.01230    396113.    -24614.   8.90E-05      3748.   1.88E+10
630.2625    159886.       0.00
   20.5400   -0.01192    322386.    -22663.   1.48E-04      3050.   1.88E+10
620.4509    162415.       0.00
   20.8000   -0.01137    254698.    -20749.   1.96E-04      2410.   1.88E+10
606.0615    166271.       0.00
   21.0600   -0.01069    192910.    -18887.   2.33E-04      1825.   1.88E+10
587.7188    171461.       0.00
   21.3200   -0.00992    136844.    -17087.   2.61E-04      1295.   1.88E+10
565.9494    178056.       0.00
   21.5800   -0.00907     86286.    -15360.   2.79E-04   816.3980   1.88E+10
541.2037    186198.       0.00
   21.8400   -0.00818     40997.    -13714.   2.90E-04   387.8917   1.88E+10
513.8725    196101.       0.00
   22.1000   -0.00726   709.6282    -12157.   2.93E-04     6.7142   1.88E+10
484.2980    208077.       0.00
   22.3600   -0.00635    -34863.    -10695.   2.90E-04   329.8583   1.88E+10
452.7828    222560.       0.00
   22.6200   -0.00545    -66028.     -9334.   2.82E-04   624.7284   1.88E+10
419.5968    240162.       0.00
   22.8800   -0.00459    -93109.     -8079.   2.69E-04   880.9526   1.88E+10
384.9830    261756.       0.00
   23.1400   -0.00377   -116442.     -6934.   2.51E-04      1102.   1.88E+10
349.1637    288609.       0.00
   23.4000   -0.00302   -136376.     -5902.   2.30E-04      1290.   1.88E+10
312.3472    322627.       0.00
   23.6600   -0.00234   -153270.     -3866.   2.06E-04      1450.   1.88E+10
992.7148   1325338.       0.00
   23.9200   -0.00173   -160500.   -424.906   1.80E-04      1519.   1.88E+10
1213.   2184644.       0.00
   24.1800   -0.00121   -155921.      3248.   1.54E-04      1475.   1.88E+10
1141.   2939902.       0.00
   24.4400  -7.70E-04   -140235.      6362.   1.30E-04      1327.   1.88E+10
855.5969   3467512.       0.00
   24.7000  -4.01E-04   -116221.      8498.   1.09E-04      1100.   1.88E+10
513.7375   3995122.       0.00
   24.9600  -9.26E-05    -87205.      9509.   9.17E-05   825.0949   1.88E+10
134.1997   4522732.       0.00
   25.2200   1.71E-04    -56883.      9287.   7.98E-05   538.2038   1.88E+10
-276.823   5050341.       0.00
   25.4800   4.05E-04    -29256.      7725.   7.26E-05   276.8087   1.88E+10
-724.478   5577951.       0.00
   25.7400   6.24E-04     -8681.      4688.   6.95E-05    82.1398   1.88E+10
-1222.   6105561.       0.00
   26.0000   8.39E-04       0.00       0.00   6.88E-05       0.00   1.88E+10
-1784.   3316585.       0.00
```

* The above values of total stress are combined axial and bending stresses.

Output Summary for Load Case No. 2:

```
Pile-head deflection             =     1.98038407 inches
Computed slope at pile head      =     -0.0120374 radians
Maximum bending moment           =       2306114. inch-lbs
Maximum shear force              =        -39517. lbs
Depth of maximum bending moment  =    14.56000000 feet below pile head
Depth of maximum shear force     =    17.94000000 feet below pile head
Number of iterations             =             30
Number of zero deflection points =              2
Pile deflection at ground        =     0.45316909 inches
```

Summary of Pile-head Responses for Conventional Analyses

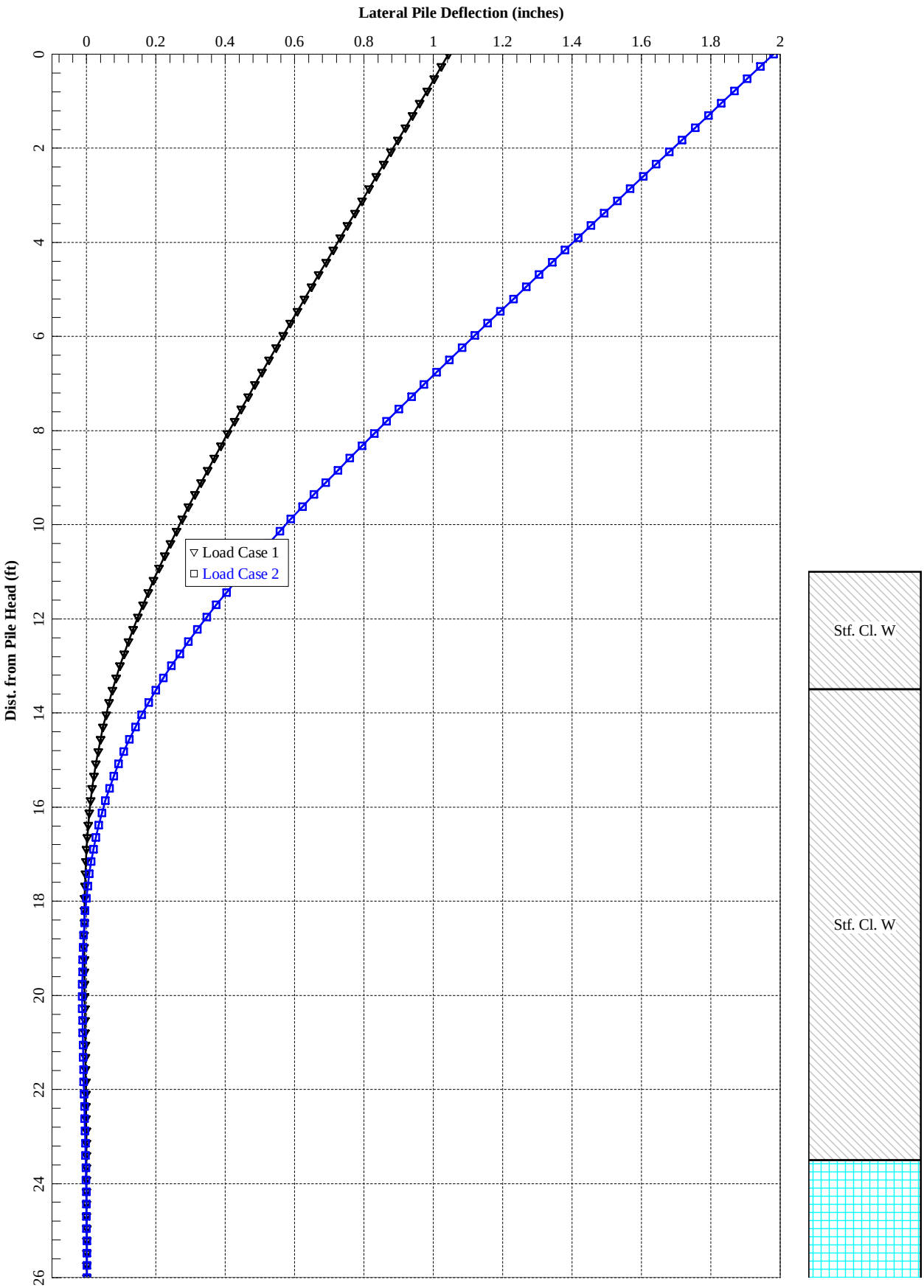
Definitions of Pile-head Loading Conditions:

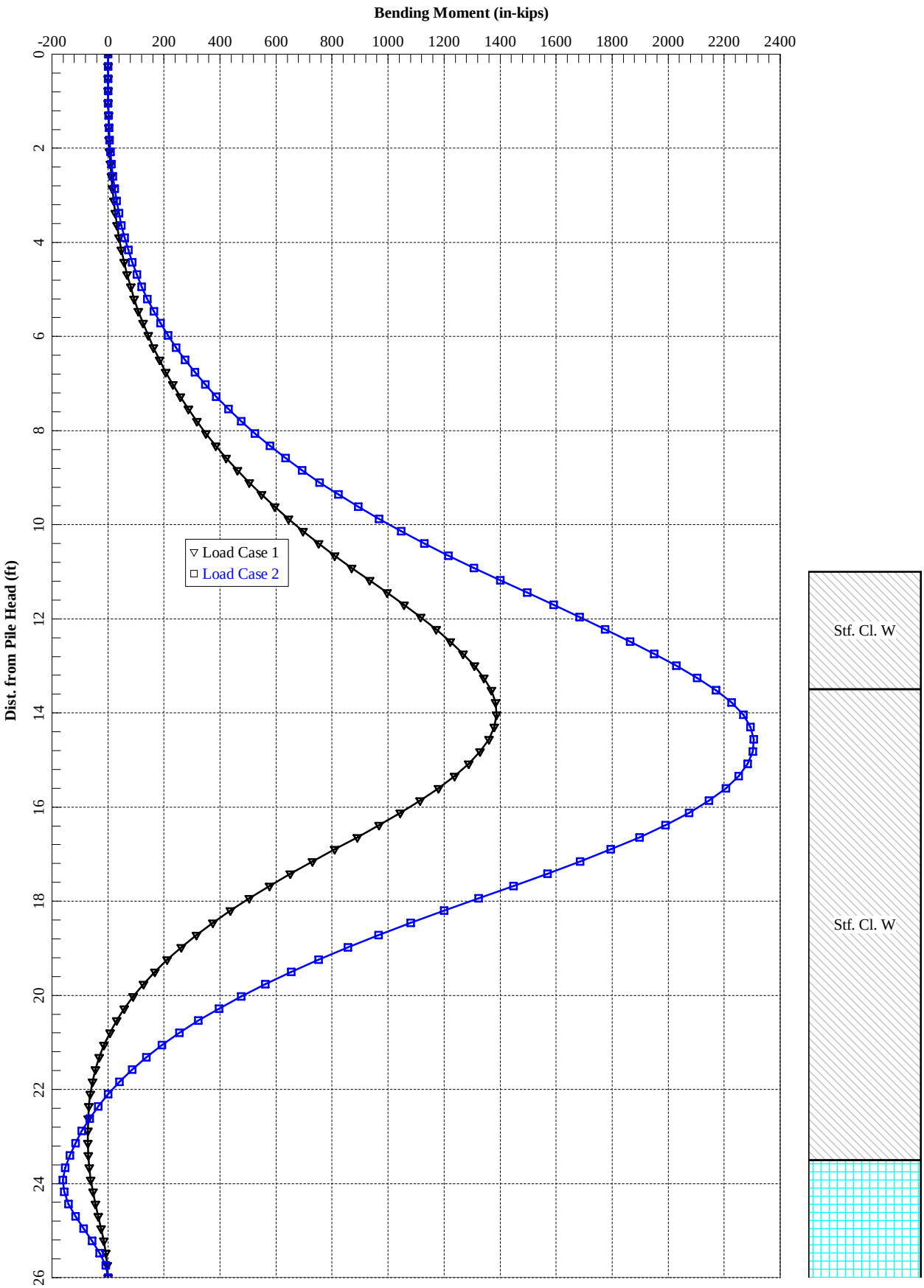
Load Type 1: Load 1 = Shear, V, lbs, and Load 2 = Moment, M, in-lbs
Load Type 2: Load 1 = Shear, V, lbs, and Load 2 = Slope, S, radians
Load Type 3: Load 1 = Shear, V, lbs, and Load 2 = Rot. Stiffness, R, in-lbs/rad.
Load Type 4: Load 1 = Top Deflection, y, inches, and Load 2 = Moment, M, in-lbs
Load Type 5: Load 1 = Top Deflection, y, inches, and Load 2 = Slope, S, radians

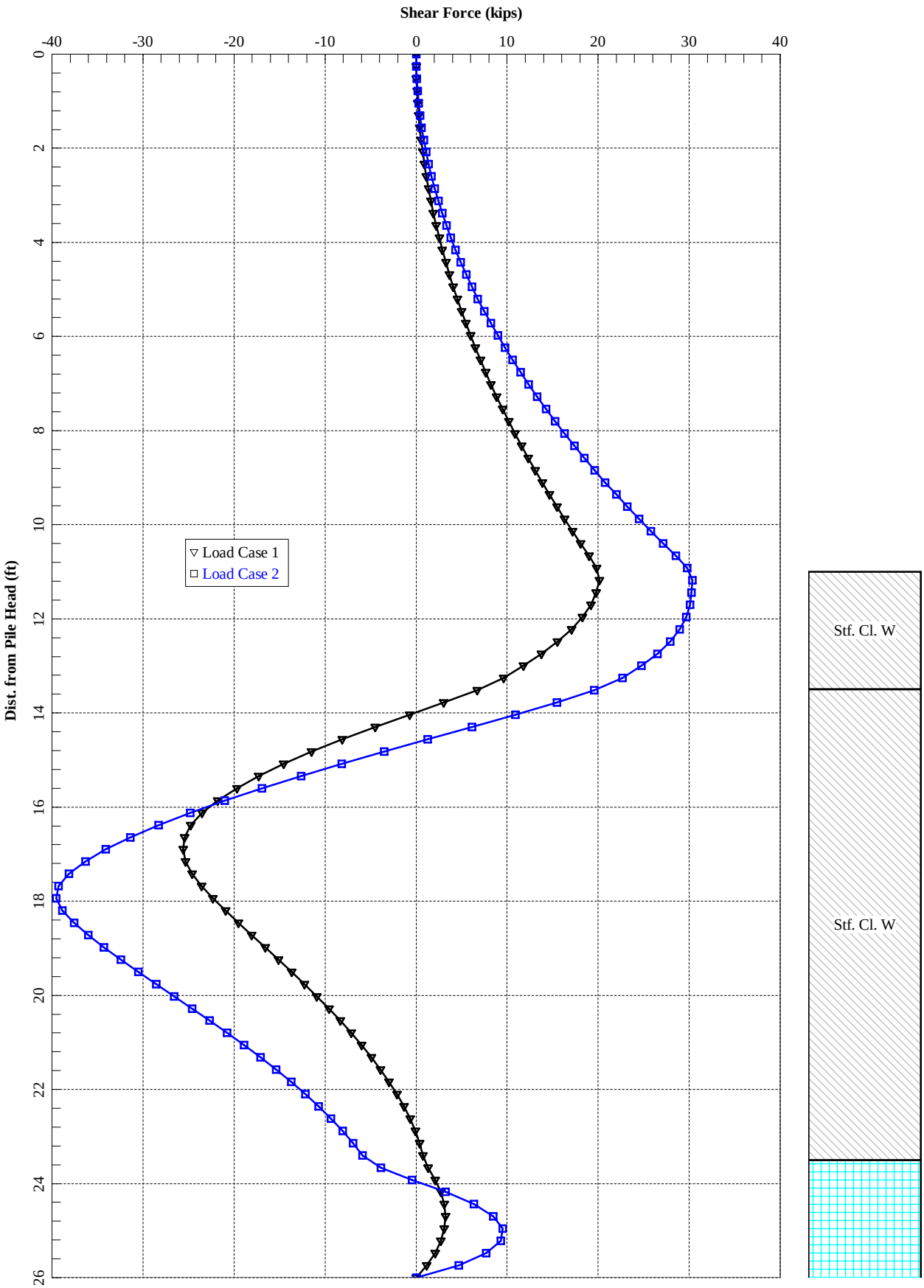
Load Case No.	Load Type	Pile-head Load 1	Load Type	Pile-head Load 2	Axial Loading lbs	Pile-head Deflection inches	Pile-head Rotation radians	Max Shear in Pile lbs	Max Moment in Pile in-lbs
1	V, lb	0.00	M, in-lb	0.00	0.00	1.0439	-0.00668	-25595.	1387507.
2	V, lb	0.00	M, in-lb	0.00	0.00	1.9804	-0.01204	-39517.	2306114.

Maximum pile-head deflection = 1.9803840656 inches
Maximum pile-head rotation = -0.0120374400 radians = -0.689695 deg.

The analysis ended normally.


Lateral Pile Deflection (inches)
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
Dist. from Pile Head (ft)
0
2
4
6
8
10
12
14
16
18
20
22
24
26
Load Case 1
Load Case 2
Stf. Cl. W
Stf. Cl. W


Bending Moment (in-kips)
-200
0
200
400
600
800
1000
1200
1400
1600
1800
2000
2200
2400
Dist. from Pile Head (ft)
0
2
4
6
8
10
12
14
16
18
20
22
24
26
Load Case 1
Load Case 2
Stf. Cl. W
Stf. Cl. W


Shear Force (kips)
-40
-30
-20
-10
0
10
20
30
40
Dist. from Pile Head (ft)
0
2
4
6
8
10
12
14
16
18
20
22
24
26
Load Case 1
Load Case 2
Stf. Cl. W
Stf. Cl. W

Supporting Information

Contents:

Geotechnical Drilling Services Report (Terracon Project N4175279)

August 10, 2017

Athens Township Board of Trustee
313 West Union St
Athens, Ohio 45701

Attn: Mr. Ted J. Linscott
Office: [740] 592 1523
Cell: [740] 707 5182
Email: tlinscott@athenstwp.com

Re: Geotechnical Drilling Services
South Blackburn Road Slip
Athens County, Ohio
Terracon Project No. N475279

Mr. Linscott:

Terracon Consultants, Inc. (Terracon) is pleased to submit the soil boring logs enclosed as Exhibit A-4. We have completed drilling services to perform three test borings along South Blackburn Road in Athens County, Ohio. The approximate boring locations are illustrated on Exhibit A-3.

This services were performed in general accordance with Terracon proposal number PN4175279 dated June 21, 2017, and a supplemental change order dated July 31, 2017, via signed agreement of services.

As part of the subject project, three (3) borings were completed at locations designated by Mr. Donnie Stevens of the Athens County Engineer's Office. The field exploration phase of the current project was completed on July 11, 2017. Final boring logs are presented in Appendix A with this transmittal letter. A field exploration description is also enclosed as Exhibit A-1.

We appreciate the opportunity to be of service to you on this project. Please contact us concerning any questions that may arise during the review of the logs, or if you require additional information about this project.

Sincerely,
Terracon Consultants, Inc.

Abdul K. Mohammed, GISP
Geotechnical Staff Engineer

Kevin M. Ernst, P.E.
Senior Associate/Office Manager

Attachments:

Appendix A	**Field Exploration**
Exhibit A-1	Field Exploration Description
Exhibit A-2	Site Location Plan
Exhibit A-3	Boring Location Plan
Exhibit A-4 to A-6	Boring Logs

APPENDIX A
FIELD EXPLORATION

Field Exploration Description

The subsurface exploration consisted of drilling and sampling a total of three (3) test borings, designated as B-001-0-17 through B-003-0-17, to completion depths ranging from about 29 to 35 feet beneath the existing ground surface.

The boring locations were marked by Mr. Donnie Stevens of Athens County Engineer's office prior to drilling operations. Coordinates at the test boring locations and elevations were collected through GPS by Terracon after the borings were performed. The locations/ elevations of the borings should be considered accurate only to the degree implied by the means and methods used to define them.

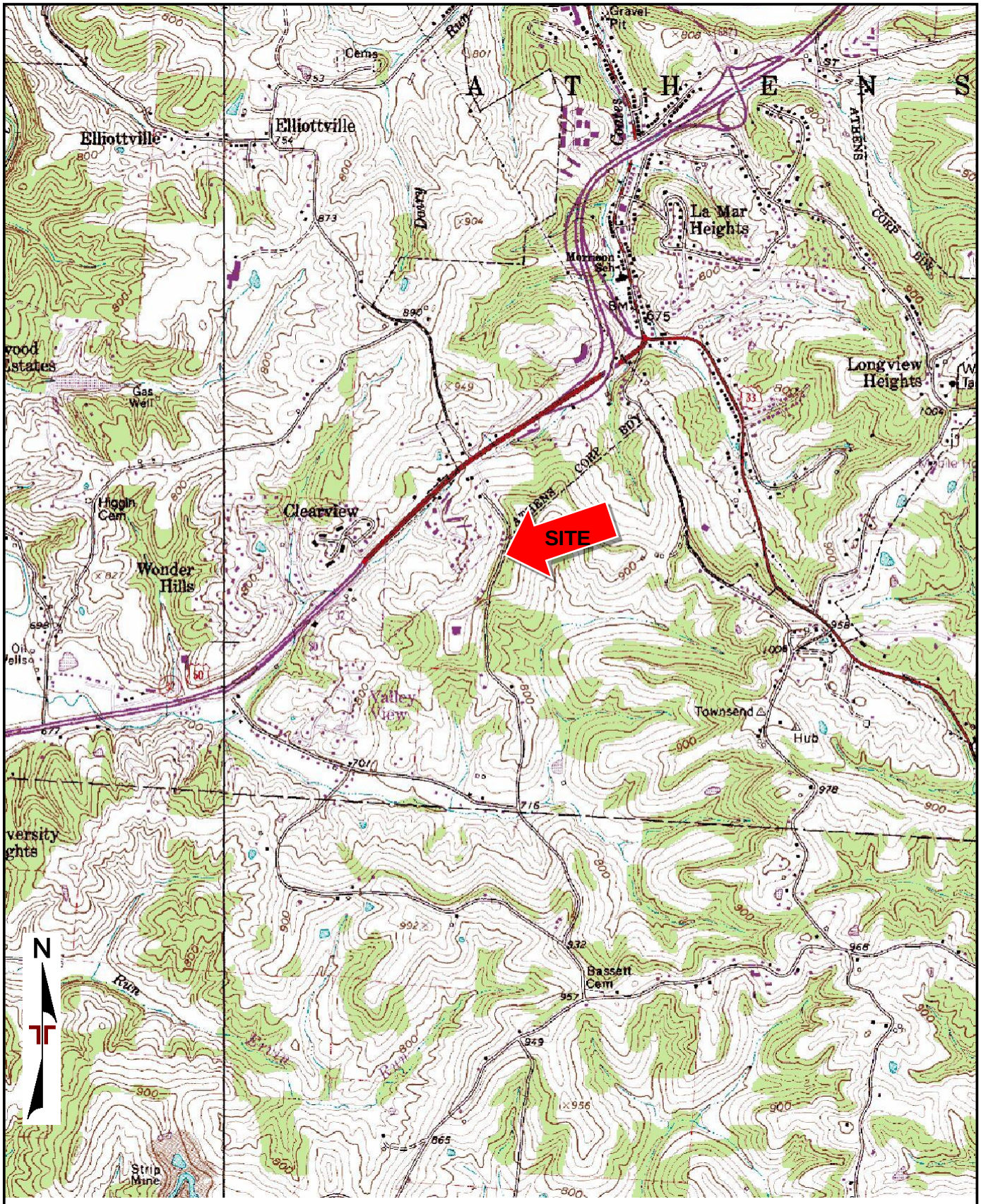
Borings for the subject project were drilled with truck-mounted rotary drill rigs using continuous flight hollow stem augers to advance the boreholes. Samples of the soil encountered in the borings were obtained using the split-barrel sampling procedure. In the split-barrel sampling procedure, the number of blows required to advance a standard 2-inch O.D. split-barrel sampler the last 12 inches of the typical total 18-inch penetration by means of a 140-pound C.M.E. auto-hammer with a free fall of 30 inches, is the standard penetration resistance value (SPT-N). This value is corrected to an equivalent (60 percent) energy ratio (N_{60}) utilizing the drill rod energy ratio. In accordance with the ODOT SGE, the hammer system for the CME-45B truck rig was used for this project was calibrated and has a drill rod energy ratio of 90.3 percent.

An automatic SPT hammer was used to advance the split-barrel sampler in the boring performed on this site. A significantly greater efficiency is typically achieved with the automatic hammer compared to the conventional safety hammer operated with a cathead and rope. This higher efficiency affects the standard penetration resistance blow count (N) value by increasing the penetration per hammer blow over what would be obtained using the cathead and rope method.

The spilt-barrel samples were sealed in watertight glass jars. All samples were returned to the laboratory for testing and classification. Upon completion, the borings were backfilled with a cement-bentonite grout.

Where competent bedrock was encountered at the boring locations, as defined by auger refusal, a changeover to rock coring techniques was made. Rock coring was performed in the borings using an NQ-size core barrel with water as a circulating fluid. Percent recovery and rock quality designation (RQD) were calculated for the core samples and are noted at their depths of occurrence on the boring logs. RQD is the percent of total length cored consisting only of rock pieces at least 4 inches or more in length and is a measure of the integrity of the rock mass in-situ.

A field log of each boring was prepared by the drill crew. These logs included visual classifications of the materials encountered during drilling as well as the driller's interpretation of the subsurface conditions between samples. Final boring logs included with this report represent the engineer's interpretation of the field logs and include modifications based on laboratory observation and tests of the samples.



TOPOGRAPHIC MAP IMAGE COURTESY OF THE U.S. GEOLOGICAL SURVEY
QUADRANGLES INCLUDE: THE PLAINS, OH (1/1/1995) and ATHENS, OH (1/1/2002).

Project Manager: KME	Project No. N4175279	Terracon 800 Morrison Rd Gahanna, OH 43230-6643	SITE LOCATION	Exhibit
Drawn by: AKM	Scale: 1"=2,000'		Athens Township Soil Borings **South Blackburn Road** **Athens, OH**	A-2
Checked by: KME	File Name: BLP			
Approved by: KME	Date: 08.08.2017			

APPROXIMATE BORING LOCATION

DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

Project Manager:	KME
Drawn by:	AKM
Checked by:	KME
Approved by:	KME

Proposal No.	N4165279
Scale:	N.T.S.
File Name:	BLP
Date:	08.08.2017

Terracon
Consulting Engineers & Scientists
800 Morrison Road Columbus, Ohio 43230
PH. (614) 863-3113 FAX. (614) 863-0475

BORING LOCATION PLAN

Athens Township Soil Borings South Blackburn Road
Athens, Ohio

Exhibit

A-3

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - N:\PROJECTS\2017\N4175279\WORKING FILES\LABORATORY-FIELD DATA-BORING LOGS\N4175279 ATHENS TC

PROJECT: BLACKBURN RD SLIP	DRILLING FIRM / OPERATOR: TERRACON / MATT M.	DRILL RIG: CME 45 B (#3924)	STATION / OFFSET:	EXPLORATION ID B-001-0-17	
TYPE: LANDSLIDE	SAMPLING FIRM / LOGGER: TERRACON / ABDUL M.	HAMMER: CME AUTOMATIC	ALIGNMENT: BLACKBURN RD CENTERLINE		
PID: SFN:	DRILLING METHOD: 3.25" HSA / NQ2	CALIBRATION DATE: 4/16/15	ELEVATION: 880.1 (MSL) EOB: 30.0 ft.	PAGE 1 OF 1	
START: 7/10/17 END: 7/10/17	SAMPLING METHOD: SPT / NQ2	ENERGY RATIO (%): 90.3	LAT / LONG: 39.293199, -82.111153		

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	HOLE SEALED
0.75' - ASPHALT (9.75")	880.1 879.4																	
0.35' - AGGREGATE BASE (3.25")	879.0																	
STIFF, BROWN, **SILTY CLAY**, TRACE FINE TO COARSE SAND, TRACE FINE TO COARSE GRAVEL, DAMP TO MOIST		1	2 2 4	9	78	SS-1	1.50	-	-	-	-	-	-	-	-	-	A-6b (V)	
		2																
		3																
		4	1 2 2	6	67	SS-2	1.00	-	-	-	-	-	-	-	-	-	A-6b (V)	
		5																
		6																
		7	1 2 2	6	72	SS-3	1.00	-	-	-	-	-	-	-	-	-	A-6b (V)	
		8																
		9			88	ST-4	-	-	-	-	-	-	-	-	-	-	A-6b (V)	
	869.1	10																
VERY STIFF, BROWN, **SILTY CLAY**, SOME FINE TO COARSE GRAVEL, TRACE FINE TO COARSE SAND, DAMP		11	5 6 11	26	100	SS-5	2.00	-	-	-	-	-	-	-	-	-	A-6b (V)	
	866.6	12																
		13																
CLAYSTONE, BROWN, SEVERELY WEATHERED, VERY WEAK.		14	14 24 32	84	100	SS-6	-	-	-	-	-	-	-	-	-	-	Rock (V)	
		15																
		16																
		17																
		18																
		19	24 22 22	66	100	SS-7	-	-	-	-	-	-	-	-	-	-	Rock (V)	
		20																
		21																
		22																
		23																
	856.6	24																
CLAYSTONE, BROWN TO GRAY, SEVERELY WEATHERED, VERY WEAK, VERY THIN TO LAMINATED, MODERATELY FACTURED WITH TIGHT, SLIGHTLY ROUGH JOINTS		25	67		78	NQ2-1											CORE	
@26 TO 30, CORE BARREL STUCK - UNABLE TO RETRIEVE SAMPLE; RQD 67%, REC 78%. -CORE BARREL STUCK FROM 26' TO 30' - UNABLE TO RETREIVE SAMPLE		26																
		27																
		28	0		0	NQ2-2											CORE	
		29																
	850.1	EOB																

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLACED ASPHALT PATCH; TREMIED BENTONITE GROUT

Exhibit A-4

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 8/10/17 11:21 - N:\PROJECTS\2017\N4175279\WORKING FILES\LABORATORY-FIELD DATA-BORING LOGS\N4175279 ATHENS TC

PROJECT: BLACKBURN RD SLIP	DRILLING FIRM / OPERATOR: TERRACON / MATT M.	DRILL RIG: CME 45 B (#3924)	STATION / OFFSET:	EXPLORATION ID B-002-0-17	
TYPE: LANDSLIDE	SAMPLING FIRM / LOGGER: TERRACON / ABDUL M.	HAMMER: CME AUTOMATIC	ALIGNMENT: BLACKBURN RD CENTERLINE		
PID: SFN:	DRILLING METHOD: 3.25" HSA / NQ2	CALIBRATION DATE: 4/16/15	ELEVATION: 875.7 (MSL) EOB: 35.0 ft.	PAGE 1 OF 2	
START: 7/11/17 END: 7/11/17	SAMPLING METHOD: SPT / NQ2	ENERGY RATIO (%): 90.3	LAT / LONG: 39.293119, -82.111170		

MATERIAL DESCRIPTION AND NOTES	ELEV. 875.7	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	HOLE SEALED
1.5' - ASPHALT (18")	874.2	1																
MEDIUM DENSE, BROWN TO GRAY, **GRAVEL WITH SAND, SILT, AND CLAY**, CONTAINS ASPHALT FRAGMENTS, DAMP **(FILL)**	872.2	2	19 8 3	17	100	SS-1	-	-	-	-	-	-	-	-	-	-	A-2-6 (V)	
SOFT, REDDISH-BROWN, **SILTY CLAY**, TRACE FINE TO COARSE GRAVEL, TRACE FINE TO COARSE SAND		3																
		4	1 2 2	6	67	SS-2	0.75	-	-	-	-	-	-	-	-	-	A-6b (V)	
		5																
		6																
		7	1 1 2	5	78	SS-3	1.00	-	-	-	-	-	-	-	-	-	A-6b (V)	
	867.2	8																
SHALE, BROWN, SEVERLY WEATHERED, VERY WEAK.		TR 9	3 5 9	21	100	SS-4	-	-	-	-	-	-	-	-	-	-	Rock (V)	
		10																
		11																
		12	4 7 10	26	100	SS-5	-	-	-	-	-	-	-	-	-	-	Rock (V)	
		13																
		14	6 8 12	30	83	SS-6	-	-	-	-	-	-	-	-	-	-	Rock (V)	
		15																
		16																
		17																
		18																
	857.2	19																
LIMESTONE, GRAY, SEVERLY WEATHERED, MODERATELY STRONG.		20	8 14 15	44	100	SS-7	-	-	-	-	-	-	-	-	-	-	Rock (V)	
		21																
		22																
		23																
		24	50/2"	-	50	SS-8	-	-	-	-	-	-	-	-	-	-	Rock (V)	
	850.7	25																
CLAYSTONE, REDDISH BROWN, SEVERLY WEATHERED, VERY WEAK, LAMINATED, MODERATELY FRACTURED WITH TIGHT SLICKENSIDED JOINTS; RQD 66%, REC 100%.		26	82		100	NQ2-1											CORE	
		27																
		28																
		29																

Exhibit A-5

PID:	SFN:	PROJECT: BLACKBURN RD SLIP	STATION / OFFSET:	START: 7/11/17	END: 7/11/17	PG 2 OF 2	B-002-0-17

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	HOLE SEALED
CLAYSTONE, REDDISH BROWN, SEVERLY WEATHERED, VERY WEAK, LAMINATED, MODERATELY FRACTURED WITH TIGHT SLICKENSIDED JOINTS; RQD 66%, REC 100%. *(continued)*	845.7	31 32 33 34	82		100	NQ2-2											CORE	
	840.7	EOB 35																

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLACED ASPHALT PATCH; TREMIED BENTONITE GROUT

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 8/10/17 11:21 - N:\PROJECTS\2017\N4175279\WORKING FILES\LABORATORY-FIELD DATA-BORING LOGS\N4175279 ATHENS TC

PROJECT: BLACKBURN RD SLIP	DRILLING FIRM / OPERATOR: TERRACON / MATT M.	DRILL RIG: CME 45 B (#3924)	STATION / OFFSET:	EXPLORATION ID B-003-0-17	
TYPE: LANDSLIDE	SAMPLING FIRM / LOGGER: TERRACON / ABDUL M.	HAMMER: CME AUTOMATIC	ALIGNMENT: BLACKBURN RD CENTERLINE		
PID: SFN:	DRILLING METHOD: 3.25" HSA / NQ2	CALIBRATION DATE: 4/16/15	ELEVATION: 872.8 (MSL) EOB: 29.0 ft.	PAGE 1 OF 1	
START: 7/11/17 END: 7/11/17	SAMPLING METHOD: SPT / NQ2	ENERGY RATIO (%): 90.3	LAT / LONG: 39.293051, -82.111181		

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	HOLE SEALED
1.5' - ASPHALT (18")	872.8																	
	871.3																	
VERY LOOSE TO LOOSE, BROWN TO GRAY, **GRAVEL WITH SAND, SILT, AND CLAY**, MOIST **(FILL)**			9 4 3	11	56	SS-1	-	-	-	-	-	-	-	-	-	-	A-2-6 (V)	
			2 1 1	3	6	SS-2	-	-	-	-	-	-	-	-	-	-	A-2-6 (V)	
			2 2 2	6	56	SS-3	-	-	-	-	-	-	-	-	-	-	A-2-6 (V)	
	864.3																	
MEDIUM DENSE, BROWN TO GRAY, **GRAVEL WITH SAND, SILT, AND CLAY**, MOIST **(POSSIBLE FILL)**			2 8 16	36	100	SS-4	-	-	-	-	-	-	-	-	-	-	A-2-6 (V)	
	861.8	TR																
SANDSTONE, BROWN, SEVERELY WEATHERED, VERY WEAK.			8 11 12	35	100	SS-5	-	-	-	-	-	-	-	-	-	-	Rock (V)	
		W	11 24 18	63	100	SS-6	-	-	-	-	-	-	-	-	-	-	Rock (V)	
	853.8		50/4"	-	100	SS-7	-	-	-	-	-	-	-	-	-	-	Rock (V)	
CLAYSTONE, REDDISH-BROWN TO GRAY, SEVERELY WEATHERED, VERY WEAK TO WEAK, LAMINATED, LOW ANGLE FRACTURES, TIGHT, SLICKEN-SIDED JOINTS; RQD 0%, REC 83%.	850.7		0		83	NQ2-1											CORE	
LIMESTONE, GRAY, MODERATELY WEATHERED, MODERATELY STRONG, THIN BEDDED, MODERATELY FRACTURED WITH NARROW SLIGHTLY ROUGH JOINTS; RQD 27%, REC 100%.	847.8		27		100	NQ2-2											CORE	
CLAYSTONE, REDDISH-BROWN TO GRAY, SEVERELY WEATHERED, WEAK, LAMINATED, SLIGHTLY FRACTURED WITH TIGHT SLICKEN-SIDED JOINTS; RQD 90%, REC 90%.	843.8	EOB	73		90	NQ2-3											CORE	

NOTES: WATER ENCOUNTERED @ 14.5'.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLACED ASPHALT PATCH; TREMIED BENTONITE GROUT

Exhibit A-6