DGL Consulting Engineers, LLC
Maumee, Ohio

Geotechnical Subsurface Investigation
OTIC 71-19-01 -Bridge Widening
MP 40.3 over SR 109
Fulton County, Ohio

December 2019

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December 31, 2019 **TTL Project No. 1852802**

Mr. Ahmed Hamid, P.E.
DGL Consulting Engineers, LLC (DGL)
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Maumee, Ohio 43537

Geotechnical Subsurface Investigation
OTIC 71-19-02 -Bridge Widening
MP 40.3 over SR109
Fulton County, Ohio

Dear Mr. Hamid:

Following is the report of the geotechnical subsurface investigation performed by TTL Associates, Inc. (TTL) at the site of the referenced project. This investigation was performed in general accordance with TTL Proposal No. 1852802-rev2, dated July 19, 2019 and subsequent authorization.

This report contains the results of our study and provides our geotechnical design and construction recommendations for bridge widening.

Soil samples collected during this investigation will be stored at our laboratory for 90 days from the date of this report. The samples will be discarded after this time unless you request that they be saved or delivered to you.

Should you have any questions regarding this report or require additional information, please contact our office.

Sincerely,

TTL Associates, Inc.

Imad El Hajjar
Geotechnical Project Manager

David M. Vovak, P.E.
Cleveland Operations Director

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GEOTECHNICAL SUBSURFACE INVESTIGATION
OTIC 71-19-01 -BRIDGE WIDENING
MP 40.3 OVER SR109
FULTON COUNTY, OHIO

FOR

DGL CONSULTING ENGINEERS, LLC (DGL)
3455 BRIARFIELD BOULEVARD, SUITE E
MAUMEE, OHIO 43537

SUBMITTED

December 31, 2019
TTL PROJECT NO. 1852802

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1.0 INTRODUCTION

This geotechnical subsurface investigation report has been prepared for the bridge widening project in Fulton County, Ohio. The project is located at mile post (MP) 40.3 of the James W. Shocknessy Ohio Turnpike (Interstate Route 90 [IR-90]) approximately ¼ mile west of State Route (SR) 109, as shown on the attached Site Location Map (Plate 1.0).

This report summarizes our understanding of the proposed construction, describes the investigative and testing procedures utilized to evaluate the subsurface conditions at the site, presents our findings from the field and laboratory testing, and provides our design and construction recommendations for bridge widening project.

This investigation was performed in general accordance with TTL Proposal No. 1852802-rev2, dated July 19, 2019 and subsequent authorization.

The purpose of this investigation was to evaluate the subsurface conditions relative to the design and construction of widening project. at the referenced location. To accomplish this, TTL performed two test borings, field and laboratory soil testing, a geotechnical engineering evaluation of the test results, and review of available geologic and soils data for the project area.

This report includes:

- A description of the subsurface soil and groundwater conditions encountered in the borings.
- Geotechnical design recommendations for the bridge widening.
- Recommendations concerning soil and groundwater-related construction procedures such as site preparation, earthwork, foundation construction, and related field testing.

An asbestos survey was performed on this project and is provided under a separate cover. The scope of this study did not include an environmental assessment of the subsurface materials at this site.

2.0 INVESTIGATIVE PROCEDURES

Two test borings, designated as Borings B-3 and B-4, were drilled by TTL on November 22 and December 4, 2019. Boring B-3 was performed on the east side of the existing twin bridges, and Boring B-4 was performed on the west side. The boring locations were established in the field by TTL based on a site plan provided by DGL. Ground surface elevations at the boring locations were depicted from plans that were provided by DGL. The approximate locations of the test borings are shown on the attached Test Boring Location Plan (Plate 2.0).

The test borings were performed in general accordance with geotechnical investigative procedures outlined in ASTM Standards D 1586 and D 5434. Boring B-3 was drilled with a ATV-mounted rotary drilling rig utilizing 3¼-inch inside diameter hollow-stem augers. Boring B-4 was drilled with a truck-mounted rotary drilling rig utilizing 4¼-inch inside diameter hollow-stem augers. Borings B-3 and B-4 were extended to the depth of 90 and 80 feet below existing grades, respectively.

During auger advancement, soil samples were collected at 2½-foot intervals to a depth of 10 feet and at 5-foot intervals thereafter using a split-spoon sampler. The soil samples were sealed in jars and transported to our laboratory for further classification and testing.

Split-spoon (SS) samples were obtained by the Standard Penetration Test (SPT) Method (ASTM D 1586), which consists of driving a 2-inch outside diameter split-spoon sampler into the soil with a 140-pound weight falling freely through a distance of 30 inches. The sampler was driven in three successive 6-inch increments with the number of blows per increment being recorded. The sum of the number of blows required to advance the sampler the second and third 6-inch increments is termed the Standard Penetration Resistance (N-value) and is presented on the Logs of Test Boring attached to this report. The samples were sealed in jars and shipped to our laboratory for further classification and testing.

Shelby tube samples, designated ST on the Logs of Test Borings, were obtained from 16 to 18 feet and from 41 to 43 feet in Boring B-3, as well as from 11 to 13 feet and from 21 to 23 feet in Boring B-4. Each of the Shelby tube samples were obtained by hydraulically advancing a 3-inch diameter, thin walled sampler approximately 24 inches beyond the hollow stem auger into relatively undisturbed soil in accordance with ASTM D 1587. The Shelby tubes were then extracted from the subsoils, and the ends were capped and sealed. The samples were transported to our laboratory where they were extruded, classified, and tested.

Soil conditions encountered in the test borings are presented in the Logs of Test Borings, along with information related to sample data, SPT results, water conditions observed in the borings,

and laboratory test data. It should be noted that these logs have been prepared on the basis of laboratory classification and testing, as well as field logs of the encountered soils.

All of the recovered samples of the subsoils were visually or manually classified in accordance with the Unified Soil Classification System (USCS) (ASTM D 2487 and D 2488). All samples of the subsoils were tested in our laboratory for moisture content (ASTM D 2216). The Shelby tube samples and selected intact cohesive split-spoon samples were tested for dry density and unconfined compressive strength utilizing constant rate of strain methods (ASTM D 2166). Unconfined compressive strength estimates were obtained for the remaining intact cohesive samples using a calibrated hand penetrometer. Atterberg limits tests (ASTM D 4318) and particle size analyses (ASTM D 422) were performed on four selected samples from each boring. The results of these tests are presented on the Logs of Test Borings, and Tabulation of Test Data sheets attached to this report.

One-dimensional consolidation tests (ASTM D 2435) were performed on samples from Boring B-3 (ST-2) and B-4 (ST-2). The results of these tests are attached to this report.

Experience indicates that the actual subsoil conditions at a site could vary from those generalized on the basis of test borings made at specific locations, especially at previously developed sites such as this site. Therefore, it is essential that a geotechnical engineer be retained to provide soil engineering services during the site preparation, excavation, and foundation phases of the proposed project. This is to observe compliance with the design concepts, specifications, and recommendations, and to allow design changes in the event subsurface conditions differ from those anticipated prior to the start of construction.

3.0 PROPOSED CONSTRUCTION

We understand that it is planned to widen the existing twin bridges located at milepost (MP) 40.5 of the James W. Shocknessy Ohio Turnpike (Interstate Route 90 [IR-90]), approximately ¼ mile west of State Route (SR) 109, in Fulton County, Ohio. We understand that the project consists of replacing the existing bridge decks and widening the turnpike. The widening will be constructed within the existing median area between the existing twin bridges.

Based upon a review of the available plans noted above, the existing 3-span structures measure roughly 130 feet each in length with the abutments supported on 40-ton capacity HP 10X42 driven piles and piers supported on shallow foundations, as noted in the table below:

Abutment K Line Driven Depth (ft)	Abutment M Line Driven Depth (ft)	Abutment K Pile Top Elev. (ft)	Abutment M Pile Top Elev. (ft)	Pier Max. Soil Pressure (psf)	Pier Bearing Elev (ft)
43	36	764.0	757.0	3,000	738.0

Based upon the Original Construction Plans, Spans 1 and 3 of the duel bridges are approximately 44 feet in length and the middle span (Span 2) is approximately 46 feet in length. Existing grades below the bridges are roughly Elev. 747 to 749 feet msl, and roadway elevation across the existing bridges range from roughly Elev. 764 to 766 feet msl.

4.0 GENERAL SITE AND SUBSURFACE CONDITIONS

4.1 General Site Conditions

Borings B-3 and B-4 were located in the grass median on either side of the bridge. Surface grades at the boring location ranged from 763 to 766 feet msl and roughly 5-to-8 inches of topsoil were encountered at the surface.

Ground elevations along the roadway across the bridge ranged from 764 to 766 feet msl. Ground elevations along SR109 ranged from 747 to 749 feet msl indicating roughly 15 to 17 feet of grade variation between the existing roadway and the SR109 pavement.

4.2 Site Geology

Published geologic maps from the Ohio Department of Natural Resources (ODNR) indicate that the project site is located within the glaciated portion of Ohio, with surface elevation ranging from approximately 764 to 766 feet, as depicted from google earth. Quaternary soil deposits consist of **Lacustrine Sand (LS)**, deposited in glacial lakes as shallow-water deltas or nearshore bars and sheets; includes many small areas of dunes. These lacustrine deposits are underlain by predominantly silty and clayey glacial till, before encountering bedrock. By comparing surface grades on the Turnpike and the surrounding agricultural fields (+/- 747 feet msl), up to about **20 feet of fill** is predicted to have been used to construct the roadway embankment.

Bedrock at the site consist of Mississippian and Upper Devonian aged **Shale** of the Sunbury and Bedford Shales undivided formations. Top of rock was reported to be roughly 600 feet msl, which is anticipated around 150 to 175 feet below existing grades. No Mining has been reported on or near the site.

4.3 Pavement Along Existing Shoulders

All the pavement cores were performed within the existing shoulder areas along the project length. Detailed information regarding the encountered surface materials and the general composition of the subgrade material at the core locations along with the photographic core logs are provided in the geotechnical report pertinent to the bridge structure at MP 40.5.

4.4 General Soil Conditions

Based on the results of our field and laboratory tests, the subsoils encountered underlying the topsoil can generally be characterized by a layer of fill material overlying native lacustrine soils overlying a layer of cohesive glacial till. Additional descriptions of the soil stratigraphy encountered in the borings are presented on the Logs of Test Borings attached to the report.

Embankment Fill consisted of cohesive fill soils and was encountered underlying the topsoil in Borings B-3 and B-4 to depths of 18 ½ feet below existing grades (approximate Elev. 745 to 748 feet msl). The cohesive fill predominantly consisted of lean clay with varying amounts of sand, gravel and organics. SPT N-values for the cohesive fill generally ranged from 8 to 19 blows per foot (bpf), indicating medium stiff to stiff consistency. Unconfined compressive strength ranged from 2.5 to greater than 4.5 tons per square foot (tsf) were recorded within this stratum using a hand penetrometer (the highest obtainable reading using a calibrated hand penetrometer). These relatively high strengths are likely indicative of desiccation. Unconfined compressive strengths of 2.4 tsf were determined for one Stratum I sample obtained from Borings B-4 (SS-3). Moisture contents were on the order of 13 percent to 22 percent. A liquid limit of 27 percent and a plasticity index of 14 percent were determined for one cohesive fill sample obtained from Boring B-3 (ST-1).

Stratum I consisted of predominantly very stiff native cohesive soils encountered underlying the embankment fill to depths of 24 feet below existing grade in Boring B-3 (approximate Elev. 742 feet msl). Stratum I consisted of sandy lean clay and varying amounts of gravel. SPT N-values for the Stratum I soils was 25 bpf. Unconfined compressive strength of 3.25 tsf were recorded within this stratum using a hand penetrometer. Moisture content measured roughly 13 percent. Please note that this stratum was only encountered in Boring B-3.

Stratum II consisted of predominantly very stiff native cohesive glacial till deposits encountered underlying Stratum I to depth of 58.5 feet in Borings B-3 and underlying the cohesive embankment fill to depth of 58.5 feet in Boring B-4 (approximate Elevs. 707.5 and 704.5 feet msl, respectively). Stratum II consisted predominantly of lean clay with sand and trace amounts of gravel. SPT N-values for the Stratum II soils ranged from 16 to 26 bpf. Unconfined compressive strengths ranging from 3.5 to greater than 4.5 tsf were recorded within this stratum using a hand penetrometer (the highest obtainable reading using a calibrated hand penetrometer). Unconfined compressive strengths of 2.64 was determined for one Stratum II sample obtained from Boring B-4 (SS-9). Moisture contents ranged from 14 to 20 percent. Liquid limits ranged from 30 to 35 percent and plasticity index ranged from 14 to 21 percent were determined for three Stratum II samples obtained from Borings B-3 (SS-7 and

ST-2) and B-4 (ST-2). These values, along with gradation results, are indicative of lean clay (CL) in accordance with USCS designations. Based correlations from moisture content results and Atterberg limits testing, these soils are considered over-consolidated and slightly compressible. A layer of hard lean clay was encountered within this stratum in Boring B-4 between 24 and 28 feet below existing grades (Approximate elevation 744.5 to 739 feet msl.). SPT N-value was 39 bpf with a moisture content of 13 %.

Stratum III consisted of predominantly very stiff to hard native cohesive glacial till deposits encountered underlying Stratum II to depth of 68.5 feet in Boring B-1 and 72.0 feet in Boring B-2 (approximate Elev. 694 feet msl). Stratum III consisted predominantly of lean clay with sand and trace amounts of gravel. SPT N-values for the Stratum III soils ranged from 18 to 37 blows per foot (bpf). Unconfined compressive strengths ranging from 3.25 to 4.0 tsf were recorded within this stratum using a hand penetrometer. Moisture contents ranged from 15 to 16 percent. Liquid limits measured 29 percent and plasticity index ranged from 14 to 16 percent were determined for two Stratum III samples obtained from Borings B-3 (SS-14) and B-4 (SS-15). These values, along with gradation results, are indicative of lean clay (CL) in accordance with USCS designations. Based correlations from moisture content results and Atterberg limits testing, these soils are considered over-consolidated and in- compressible.

Stratum IV consisted of stiff to very stiff cohesive glacial till deposits encountered underlying Stratum III to depth of 90 feet in Boring B-3 and to depth of 80 feet in B-4 (approximate Elev. 683 to 676 feet msl). Note that both boring were terminated in this stratum. Stratum IV consisted predominantly of lean clay with varying amounts of sand and trace amounts of gravel. SPT N-values ranged from 15 to 27 blows per foot (bpf). Unconfined compressive strengths ranging from 1.5 to greater than 4.25 tsf were recorded within this stratum using a hand penetrometer (the highest obtainable reading using a calibrated hand penetrometer). Moisture contents ranged from 15 to 30 percent. Liquid limits ranged from 42 to 46 percent and plasticity index ranged from 28 to 131 percent were determined for two Stratum IV samples obtained from Borings B-3 (SS-18) and B-4 (SS-17). These values, along with gradation results, are indicative of lean clay (CL) in accordance with USCS designations. Based correlations from moisture content results and Atterberg limits testing, these soils are considered over-consolidated and slightly compressible.

4.5 Groundwater Conditions

Groundwater was not initially encountered during the drilling operations at Borings B-3 and B-4. Groundwater was only observed upon completion of drilling at Borings B-4 at depths of 73.3 feet below existing grades (approximate Elev. 689.7 feet msl). It should be noted that each of the borings was drilled and backfilled within the same day. As such, stabilized water levels may not have occurred over this limited time period. Instrumentation was not installed to observe long-term groundwater levels.

Based on the soil characteristics and groundwater conditions encountered in the borings, it is our opinion that the "normal" long-term groundwater table will be generally encountered at depths of approximately 50 feet or lower, corresponding to approximate Elev. 713 feet msl or deeper. However, groundwater elevations can fluctuate with seasonal and climatic influences. In particular, "perched" water may be encountered in fill materials or granular soils that are underlain by relatively impermeable cohesive soils. Therefore, the groundwater conditions may vary at different times of the year from those encountered during this investigation.

5.0 DESIGN RECOMMENDATIONS

The following conclusions and recommendations are based on our understanding of the proposed construction and the data obtained during our field investigation. If the project information or location as outlined is incorrect or should change significantly, a review of these recommendations should be made by TTL. These recommendations are subject to satisfactory completion of the recommended site and subgrade preparation and fill placement operations described in Section 6.0, "Construction Recommendations."

5.1 Bridge Foundations

We understand that the existing bridges are 3-span structures, with abutments on pile foundations and piers on shallow foundations. For this specific widening project, we understand that the 2004 Bridge Design Manual (BDM) will govern in the foundation design. As such, differential settlement must be considered in the design, as detailed in the exert below from **Section 409.3.1 Widened Structures of the 2004 BDM**:

> *Differential foundation settlements shall be considered. For example, if it is required to widen a bridge adjacent to an existing spread footing, it is possible that the existing foundation has settled as much as it is going to. However, if the widened portion is placed on a new spread footing, then that portion will settle with respect to the original and distress to the structure will result. Consequently, the new portion should be placed on piling or drilled shafts in an attempt to limit differential settlement.*

Based upon the discussion above including the "attempt to limit differential settlement", there may not be an allowance for the differential settlement that is anticipated (as noted above) with shallow foundations for widening projects; nonetheless, we have provided shallow foundation design recommendations (including maximum anticipated differential settlement) for your consideration. If shallow foundations are not permitted due to design restrictions, we have also provided recommendations for pile foundations. The 2 foundation design alternatives are provided in the sections below:

5.1.1 Shallow Foundations

Based on the retrieved as-built drawings, the existing shallow pier foundations were designed for a maximum soil pressure of 3,000 psf bearing at Elev. +/- 739 feet msl with a footing width of roughly 11.5 feet. Therefore, we recommend the proposed piers for the widening be

supported on a similar shallow foundation system on the same stratum using a similar bearing capacity (3,000 psf) and foundation width (11.5 feet). We understand that due to the new standards and loading requirements or modifications in the existing structure, the bearing capacity of the widening area may vary somewhat from the existing structure; nonetheless, our calculations find that bearing capacities up to 3,500 psf are acceptable for design. Moreover, the designer may utilize linear interpolation to determine settlement between bearing capacities of 3,000 to 3,500 psf.

The table below provides estimated settlement for different bearing capacities:

Bearing Capacity (psf)	**Footing Width (ft)**	**Estimated maximum total/differential settlement (in)**
3,000	11.5	1.4
3,500	11.5	1.5

Settlement of the structure foundations was calculated based on conventional consolidation theory utilizing the recompression index for the over-consolidated clays. As noted in the BDM and discussed above, the differential settlement between the existing and proposed foundations is anticipated to be equal to the total settlement with a maximum range of roughly 1.5 inches as noted in the table above.

The bearing material should be field-verified as being native stiff to very stiff lean clay (USCS CL) consistent with what was encountered during our field explorations and shown on the attached boring logs. Although unlikely, if loose granular soils or soft cohesive soils are encountered, they will require in-place densification using a backhoe-mounted vibratory compactor (hoe-pac) or similar equipment to provide a consistent bearing stratum and reduce post-construction settlement. Otherwise, these soils could be over-excavated and replaced with new granular engineered fill or low strength mortar backfill meeting the requirements of ODOT 613. If groundwater is encountered during excavation, excessive vibratory compaction may be detrimental to the footing subgrade, and compaction by “static” methods or removal and replacement with new engineered fill would be required. Temporary lowering of elevated water levels using one or more well points will also help in modifying the granular soils in place.

We recommend that the bearing surface at the bottom of all footing excavations be inspected during construction by a TTL geotechnical engineer or qualified representative. Inspection should be performed to verify that the exposed soil conditions at the bearing elevations are consistent with the subsurface conditions encountered in the test borings and are suitable for foundation bearing. Additionally, the presence of our engineer will help facilitate the timely remediation of unsuitable soil conditions. If the results of hand penetrometer, DCP, or other strength tests indicate the exposed soil conditions are not suitable for the design bearing pressure, it may be necessary to over-excavate and backfill with engineered fill or flowable fill.

Care should be taken where over-excavation is required in the proximity of existing foundations such that the existing foundations are not undermined. Temporary bracing or sheeting may be required if over-excavation is required in these areas.

All foundations should be constructed at a minimum frost penetration depth of 3½ feet below finished exterior grades (assumed at Elev. 743 feet msl). It should be noted that use of trench footings (i.e., placement of foundation concrete without forming) is acceptable due to the cohesive nature of the bearing soils encountered in both Borings B-3 and B-4.

5.1.2 Driven Pile Foundations

Based on the retrieved as-built drawings, the abutment piles are indicated to be HP10x42 H-piles and have estimated lengths of 43 feet below approximate Elev. 764 feet msl along Pile Line "K," as well as 36 feet below approximate Elev. 757 feet msl along Pile Line "M." The abutment piles are indicated to have a maximum load of 40 tons. Additionally, the piles along Pile Line "M" are indicated at a battered ratio of 1 horizontal to 4 vertical (1H:4V). There appear to be roughly a 1-foot change in grades between the eastern and western abutments and the pile stickup is shown to be roughly 1 foot vertical within each footing.

Loads for the bridge expansion were unavailable at the time of preparing this report, so our analyses considered the maximum Ultimate Bearing Value of 150 tons that is prescribed by ODOT for HP 10x42 pile size, as well as lower Ultimate Bearing Values. Table 5.1.2.A show the pile driving elevation that was utilized in our analysis. These pile driving elevations were depicted from the as built drawing that were provided through DGL.

Table 5.1.2.A. Bottom of Pile Cap Elevation			
Abutment	**K Line Assumed Bottom of Pile Cap Elevation (ft)**	**M Line Assumed Bottom of Pile Cap Elevation (ft)**	**Pier Assumed Bottom of Pile Cap Elevation (ft)**
Eastern	764.0	757.0	748.0
Western	764.5	757.5	748.0

We anticipate that the bridge expansion will consist of the same structural elements and loading as the existing structure, and have performed our evaluation as such.

Pile resistance analyses were performed for each substructure location using FHWA pile analysis software DRIVEN. In the DRIVEN analyses, adhesion for cohesive soils was modeled using the Tomlinson method (1979), and capacities in the "cohesionless" soils were determined by the Peck, Hanson, and Thornburn method (1974), using SPT N-values to estimate the internal angle of friction (ϕ).

Results of the DRIVEN analyses are attached to this report, and are summarized in the following tables. Recommended minimum tip bearing elevations for the H-piles were determined from DRIVEN analyses that included a factor of safety of 2, assuming load tests will be performed. The summary table includes the estimated pile length and order length for each abutment. The estimated pile length includes the calculated length from anticipated pile cut-off elevation to pile tip elevation, rounded upward to the nearest 5 feet. The order length is the estimated length plus 5 feet.

Table 5.1.2.B. Eastern Abutment Pile Foundation Recommendations – Existing Bridge Structure Pile Line "K"							
Pile Type and Size	**Assumed Bottom of Pile Cap Elevation (feet)**	**Assumed Cut-Off Pile Elevation (feet)**	**Ultimate Bearing Value (tons)**	**Service Load (tons)**	**Recommended (Minimum) Pile Tip Elevation (feet)**	**Estimated Pile Length (feet)**	**Order Pile Length (feet)**
HP 10x42	764.0	765.0	150	75	693.0	75	80
			100	50	715.0	50	55
			80	40	725.0	40	45
			40	20	744.0	20	25

Table 5.1.2.C. Eastern Abutment Pile Foundation Recommendations – Existing Bridge Structure Pile Line "M"							
Pile Type and Size	**Assumed Bottom of Pile Cap Elevation (feet)**	**Assumed Cut-Off Pile Elevation (feet)**	**Ultimate Bearing Value (tons)**	**Service Load (tons)**	**Recommended (Minimum) Pile Tip Elevation (feet)**	**Estimated Pile Length (feet)**	**Order Pile Length (feet)**
HP 10x42	757.5	758.5	150	75	685.0	75	80
			100	50	708.0	50	55
			80	40	717.5	40	45
			40	20	724.5	25	30

Table 5.1.2.D. Eastern Piers Pile Foundation Recommendations							
Pile Type and Size	**Assumed Bottom of Pile Cap Elevation (feet)**	**Assumed Cut-Off Pile Elevation (feet)**	**Ultimate Bearing Value (tons)**	**Service Load (tons)**	**Recommended (Minimum) Pile Tip Elevation (feet)**	**Estimated Pile Length (feet)**	**Order Pile Length (feet)**
HP 10x42	748.0	749.0	150	75	677.5	75	80
			100	50	699.5	50	55
			80	40	709.0	40	45
			40	20	728.5	20	25

Table 5.1.2.E. Western Abutment Pile Foundation Recommendations – Existing Bridge Structure Pile Line "K"							
Pile Type and Size	**Assumed Bottom of Pile Cap Elevation (feet)**	**Assumed Cut-Off Pile Elevation (feet)**	**Ultimate Bearing Value (tons)**	**Service Load (tons)**	**Recommended (Minimum) Pile Tip Elevation (feet)**	**Estimated Pile Length (feet)**	**Order Pile Length (feet)**
HP 10x42	764.5	765.5	150	75	692.5	75	80
			100	50	716.5	50	55
			80	40	726.0	40	45
			40	20	746.0	20	25

Table 5.1.2.F. Western Abutment Pile Foundation Recommendations – Existing Bridge Structure Pile Line "M"							
Pile Type and Size	**Assumed Bottom of Pile Cap Elevation (feet)**	**Assumed Cut-Off Pile Elevation (feet)**	**Ultimate Bearing Value (tons)**	**Service Load (tons)**	**Recommended (Minimum) Pile Tip Elevation (feet)**	**Estimated Pile Length (feet)**	**Order Pile Length (feet)**
HP 10x42	757.5	758.5	150	75	685.25	80	85
			100	50	708.75	50	55
			80	40	718.75	40	45
			40	20	737.25	25	30

Table 5.1.2.G. Western Piers Pile Foundation Recommendations							
Pile Type and Size	**Assumed Bottom of Pile Cap Elevation (feet)**	**Assumed Cut-Off Pile Elevation (feet)**	**Ultimate Bearing Value (tons)**	**Service Load (tons)**	**Recommended (Minimum) Pile Tip Elevation (feet)**	**Estimated Pile Length (feet)**	**Order Pile Length (feet)**
HP 10x42	748.0	749.0	150	75	686.0*	75*	80*
			100	50	700.0	50	55
			80	40	710.0	40	48
			40	20	730.0	20	25

*: Values extrapolated from Boring B-3

DRIVEN analyses performed for each substructure location indicate that the HP 10x42 piles are expected to generally drive into the Stratum I, II or III consisting of predominantly stiff to hard cohesive soil to achieve the required resistance.

Battered piles are indicated for this project, it should be noted that the estimated lengths in the above table do not include additional allowance for battered piles. In any case, additional allowance for battered piles is expected to be on the order of only 1 foot for the indicated lengths, within the 5-foot add-on for order length determination, using piles battered at 1 horizontal to 4 vertical (1H:4V).

Driven piles should be installed in accordance with ODOT Construction and Material Specifications (CMS) Items 507 and 523. The bearing capacity of each pile must be substantiated in the field with dynamic driving records in accordance to ODOT Item 507.05, specifically using the results of dynamic pile testing as specified in Item 523. It should be also noted that the Ohio Building Code (OBC) requires load tests for any piles with allowable compressive load above 40 tons and, in the case of driven piles, the OBC also requires wave equation analysis to evaluate stresses during driving. For driven piles, dynamic load tests may be performed using a pile driving analyzer, in accordance with ASTM D 4945, "Standard Test Method for High-Strain Dynamic Testing of Piles." Dynamic load testing is quicker and less expensive that static load testing, and has become the more prevalent test method for driven piles. During the installation of the first pile at each of the bridge substructures, if the ultimate bearing value (R) of a driven pile does not meet or exceed the bearing capacity presented on the construction plans we recommend a pile setup period of 1 week for re-strike. It is our experience that pile setup can occur within a few days, but more typically occurs within one to three weeks. If pile capacity is still not met upon re-strike, static load test could be performed on a test pile to evaluate the ultimate bearing capacity of the pile. The static load test should be performed in accordance with ODOT Item 506 and ASTM D 1143, "Standard Test Method for Piles Under Static Axial Compressive Load." Driven piles should be installed under adequate specifications and monitored by a qualified geotechnical engineer.

Evidence of cobbles or boulders was not encountered in the limited borings drilled for this investigation. However, the presence of cobbles or boulders within the glacial till encountered in the lower soil profile at this site would not be unusual for this region, and these conditions could hamper pile-driving operations and possibly damage some piles. Review of bedrock topography maps indicates that the bedrock surface is on the order of Elevs. 600 feet msl in the vicinity of the project site, nominally 150 to 185 feet below existing grades. Therefore, bedrock is not anticipated to be encountered based on the pile order lengths recommended

above. If piles are observed to meet refusal at a depth/elevation less than that indicated above, boulder obstruction may be indicated. For an isolated occurrence, one or more replacement piles could be driven with relatively little additional cost on pile cap re-design.

5.2 Groundwater Control

As stated previously, groundwater was not encountered during the drilling operations at Borings B-3 and B-4. Groundwater was only observed upon completion of drilling at Borings B-4 at depths of 73.3 feet below existing grades (approximate Elev. 689.7 feet msl).

Based on the soil and groundwater conditions encountered in the borings, it is our opinion that the "normal" long-term groundwater table will be generally encountered at depths of approximately 50 feet or deeper, corresponding to approximate Elev. 713 or deeper.

It is our experience that adequate control of groundwater seepage or surface water run-off into shallow excavations should be achievable by minor dewatering systems, such as pumping from prepared sumps. Although excavations extending below the groundwater table are not expected for this project, if such excavations are performed, installation of point wells in addition to pumping from prepared sumps would likely be required for groundwater management. In the event excessive seepage is encountered during construction, TTL may be notified to evaluate whether other dewatering methods are required. Additionally, the contractor will need to exercise diligence to control seepage and runoff to maintain a stable subgrade.

5.3 Excavations and Temporary Slopes

The sides of temporary excavations for construction should be adequately sloped to provide stable sides and safe working conditions. Otherwise, the excavation must be properly braced against lateral movements. In any case, applicable OSHA safety standards must be followed.

Based on the test borings, it is likely that excavations will encounter a range of soil conditions that include the following OSHA designations:

- Type A soils (cohesive soils with unconfined compressive strengths of 3,000 pounds per square foot (psf) or greater),
- Type B soils (cohesive soils with unconfined compressive strengths greater than 1,000 psf but less than 3,000 psf), and

For temporary excavations in Type A and B soils, side slopes must be no steeper than 1 horizontal to 1 vertical (1H:1V) and 1½H:1V, respectively. For situations where a higher strength soil is underlain by a lower strength soil and the excavation extends into the lower strength soil, the slope of the entire excavation is governed by that required for the lower strength soil. In all cases, flatter slopes may be required if lower strength soils or adverse seepage conditions are encountered during construction.

For permanent excavations and slopes, we recommend that grades be no steeper than 3H:1V without a more extensive geotechnical evaluation of the proposed construction plans and site conditions.

6.0 CONSTRUCTION RECOMMENDATIONS

6.1 Site Preparation

Site preparation activities should include the removal of topsoil, root mats, vegetation, pavements, and other deleterious non-soil materials from all proposed construction areas. Suitable topsoil may be stockpiled for later use in landscaped areas. The actual amount of required stripping should be determined in the field by a geotechnical engineer or qualified representative.

6.2 Fill

Material for engineered fill or backfill required to achieve design grades should meet ODOT Item 203 "Embankment Fill" placement and compaction requirements. In general, suitable fills may consist of any non-organic soils having a maximum dry density as determined by Supplement 1015 of 100 pounds per cubic foot (pcf) or greater. On-site soils may be used as engineered fill materials provided that they are free of organic matter, debris, excessive moisture, and rock or stone fragments larger than 3 inches in diameter. Depending on seasonal conditions, the on-site soils may be wet of optimum and may require scarification and aeration to achieve satisfactory compaction. If the construction schedule does not allow for scarification and aeration activities, it may be more practical or economical to utilize imported granular fill.

Fill should be placed in uniform layers not more than 8 inches thick (loose measure) and adequately keyed into stripped and scarified soils. All fill placed within pavement areas should be compacted to a dry density consistent with the requirements of ODOT Item 203, based on the maximum dry density as determined by Supplement 1015.

Fill placement shall be performed as symmetrical as possible across the entire site to prevent lateral stresses from developing on the existing bridge piers and their foundation components. Compaction of the new fill placement around the existing bridge piers and abutments shall be accomplished through the use of portable compaction equipment (hand operated tampers or other equipment approved by the engineer). Furthermore, it is recommended to that self-propelled heavy compaction equipment be kept at least 5 feet away from the existing substructure elements.

The on-site soils consist of native cohesive soils. For the cohesive soils, a sheepsfoot roller should provide the most effective soil compaction. For granular soils, or if new granular

engineered fill is placed, a vibratory smooth-drum roller would be required to provide effective compaction.

Scarified subgrade soils and all fill material should be within 3 percent of the optimum moisture content to facilitate compaction. Furthermore, fill material should not be frozen or placed on a frozen base. It is recommended that all earthwork and site preparation activities be conducted under adequate specifications and properly monitored in the field by a qualified geotechnical testing firm.

6.3 Foundation Excavations

As mentioned previously, shallow foundations used to support the structure should have a detailed footing inspection performed in each spread or column foundation excavation. These inspections should be performed by a TTL geotechnical engineer or qualified representative to verify that the exposed materials are similar to those encountered in the borings and/or the engineered fill has been satisfactorily placed and compacted.

We recommend that the foundation excavations be concreted as soon as practical after they are excavated and that water not be allowed to pond in any excavation. If it is necessary to leave the bearing surface open for any extended period of time, we recommend that a thin mat of lean concrete be placed over the bottom of the excavation to reduce damage to the surface from weather or construction. Foundation concrete should not be placed on frozen or saturated subgrade.

Additional foundation excavation recommendations are presented in Section 5.1.

7.0 QUALIFICATIONS OF RECOMMENDATIONS

Our evaluation and recommendations were based on our understanding of the site and project information and the data obtained during our field investigation. The general subsurface conditions were based on interpretation of the subsurface data at specific boring locations. Regardless of the thoroughness of a subsurface investigation, there is the possibility that conditions between borings will differ from those at the boring locations, that conditions are not as anticipated by the designers, or that the construction process has altered the soil conditions. Therefore, experienced geotechnical engineers should observe earthwork and foundation construction to confirm that the conditions anticipated in design are noted. Otherwise, TTL assumes no responsibility for construction compliance with the design concepts, specifications, or recommendations.

The evaluations and recommendations presented in this report have been formulated on the basis of reported or assumed data relating to the location and finished grades for the proposed structure. Any significant change in this data in the final design plans should be brought to our attention for review and evaluation with respect to the prevailing subsoil conditions.

The nature and extent of variations between the borings may not become evident until the course of construction. If such variations are encountered, it will be necessary to reevaluate the recommendations of this report after on-site observations of the conditions.

Our professional services have been performed and our findings have been derived in accordance with generally accepted geotechnical engineering principles and practices. This warranty is in lieu of all other warranties either expressed or implied. TTL is not responsible for the conclusions, opinions, or recommendations of others based on this data.

Plates

Plate 1.0 Site Location Map
Plate 2.0 Test Boring Location Plan

LEGEND

APPROXIMATE SITE LOCATION

N

APPROXIMATE SCALE – FEET

0 400 800

PLATE 1.0
SITE LOCATION MAP

OTIC 71–19–01 DECK WIDENING EASTBOUND AND WESTBOUND
MP 40.3 OVER SR 109
FULTON COUNTY, OHIO

PREPARED FOR
DGL CONSULTING ENGINEERS, LLC
MAUMEE, OHIO

DRAWN	TRR/12–17–19	CHECKED	
REVISED		APPROVED	
JOB NO.	1852802		
DRAWING NUMBER	**1852802–01.0G**		

TTL associates inc
Environmental, Geotechnical Engineering & Testing

36" INV=741.35

15" INV=-5.29

36" INV=740.45

12" INV=743.05

60" INV=740.66

N

EX EX STM 109
T/GR=766.78
12" INV=764.12 (N)

BENCHMARK 1
749.539
CROSS CUT

762.023
POWER LINE

B-4

B-3

EX EX STM 120
T/GR=762.15
INV=755.40 (N)

953+00

955+00

956+00

957+00

EX EX STM 106
T/GR=763.86

EX EX STM 108
T/GR=766.82
15" INV=764.33 (S)

10706
768.382
MISC CK SBM2

10707
749.037
BENCHMARK 7

EX EX STM 107
T/GR=763.65
15" INV=760.88 (N)
15" INV=760.97 (S)

EX EX STM 125
T/GR=747.91
24" INV=743.33 (N)

15478
746.541
FIBER OPTIC

48" INV=741.47

12" INV=741.74

15" INV=740.96

60" INV=739.62

48" INV=742.00

15" INV=-4.86

B-3

LEGEND

APPROXIMATE BORING LOCATION

APPROXIMATE SCALE – FEET

0 15 30

PLATE 2.0
TEST BORING LOCATION PLAN
OTIC 71-19-01 DECK REPLACEMENT EASTBOUND AND WESTBOUND
MP 40.3 OVER SR 109
FULTON COUNTY, OHIO

PREPARED FOR
DGL CONSULTING ENGINEERS, LLC
MAUMEE, OHIO

DRAWN TRR/12-17-19	CHECKED
REVISED	APPROVED
JOB NO. 1852802	
DRAWING NUMBER 1852802-02G	

TTL associates inc
Environmental, Geotechnical Engineering & Testing

APPENDIX A

Log of Test Borings

TTL Associates, Inc.
1915 N 12th Street
Toledo, Ohio 43624
Telephone: 419-324-2222
Fax: 419-241-1808

BORING NUMBER B-3

CLIENT DGL
PROJECT NAME OTIC 71-19-01
PROJECT NUMBER 1852802
PROJECT LOCATION Delta, OH
DRILLING CONTRACTOR TTL Associates CW JP
RIG NO. 550
GROUND ELEVATION 766 ft
DRILLING METHOD 3-1/4 in. HSA
GROUND WATER LEVELS:
DATE STARTED 12/4/19 **COMPLETED** 12/4/19
AT TIME OF DRILLING None
LOGGED BY KKC **CHECKED BY**
AT END OF DRILLING None
NOTES A bulk sample was taken from auger cuttings and 0 - 5'.
0hrs AFTER DRILLING Backfilled w/Cuttings and Bentonite Chips

ELEVATION (ft)	DEPTH (ft)	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	UNCONF. COMP. STR. (tsf)	DRY UNIT WT. (pcf)	PL MC LL (20 40 60 80) / SPT N VALUE (20 40 60 80)
	0	TOPSOIL - 8 Inches (0.7')						
765		FILL - Moist Stiff Gray/Brown LEAN CLAY w/Sand, Trace Gravel, Calcite Stain Seam, and Organics (CL)	SS 1	78	3-5-9 (14)	3.50		14
	5		SS 2	78	3-5-9 (14)	2.50		16
760		@6': Very Stiff	SS 3	89	6-8-11 (19)	>4.5		15
	10	@9': Brown/Gray	SS 4	100	6-7-9 (16)	>4.5		13
755								
	15	@13.5': Stiff	SS 5	89	4-4-7 (11)	3.00		22
750		16.0' FILL - Moist Stiff Brown/Gray SANDY LEAN CLAY w/Trace Gravel (CL)	ST 1	92		>4.5		14
		18.5' Moist Very Stiff Brown/Gray SANDY LEAN CLAY w/Trace Gravel (CL)	SS 6	100	11-15-10 (25)	3.25		13
	20							
745								
		24.0' Moist Very Stiff Brown/Gray LEAN CLAY w/Sand and Trace Gravel (CL)	SS 7	100	2-6-10 (16)	>4.5		14
	25							
740								
	30		SS 8	100	6-10-12 (22)	>4.5		12
735								

(Continued Next Page)

TTL Associates, Inc.
1915 N 12th Street
Toledo, Ohio 43624
Telephone: 419-324-2222
Fax: 419-241-1808

BORING NUMBER B-3

CLIENT DGL **PROJECT NAME** OTIC 71-19-01

PROJECT NUMBER 1852802 **PROJECT LOCATION** Delta, OH

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	UNCONF. COMP. STR. (tsf)	DRY UNIT WT. (pcf)	PL MC LL 20 40 60 80 ▲ SPT N VALUE ▲ 20 40 60 80
735			Moist Very Stiff Brown/Gray LEAN CLAY w/Sand and Trace Gravel (CL) *(continued)*						
	35			SS 9	100	8-11-16 (27)	>4.5		14
730			@37': Gray						
	40			SS 10	100	4-8-10 (18)	4.00		15
725				ST 2	54		4.50	117	15
	45			SS 11	100	6-7-12 (19)	4.00		15
720									
	50			SS 12	100	5-10-13 (23)	4.00		15
715									
	55			SS 13	100	5-9-13 (22)	4.00		15
710			58.5'						
	60		Moist Very Stiff Gray SANDY LEAN CLAY w/Trace Gravel (CL)	SS 14	100	5-8-12 (20)	3.50	120	15
705									
	65			SS 15	100	6-7-11 (18)	3.75		16
700									

(Continued Next Page)

TTL Associates, Inc.
1915 N 12th Street
Toledo, Ohio 43624
Telephone: 419-324-2222
Fax: 419-241-1808

BORING NUMBER B-3

CLIENT DGL **PROJECT NAME** OTIC 71-19-01

PROJECT NUMBER 1852802 **PROJECT LOCATION** Delta, OH

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	UNCONF. COMP. STR. (tsf)	DRY UNIT WT. (pcf)	PL MC LL 20 40 60 80 ▲ SPT N VALUE ▲ 20 40 60 80
			Moist Very Stiff Gray SANDY LEAN CLAY w/Trace Gravel (CL) *(continued)*						
	70			SS 16	100	5-8-13 (21)	3.25		16
695			72.0'						
			Moist Stiff Gray LEAN CLAY w/Trace Sand and Gravel (CL)						
	75			SS 17	100	5-6-9 (15)	2.25		25
690									
	80			SS 18	100	5-6-9 (15)	1.75	95	27
685									
	85			SS 19	100	5-6-9 (15)	2.00		30
680									
	90		90.0'	SS 20	100	5-6-9 (15)	1.50		23
			Bottom of hole at 90.0 feet.						

TTL_GEOTECH_STANDARD 1852802.GPJ TTL DATATMPL.GDT 12/20/19

TTL Associates, Inc.
1915 N 12th Street
Toledo, Ohio 43624
Telephone: 419-324-2222
Fax: 419-241-1808

BORING NUMBER B-4

CLIENT DGL
PROJECT NAME OTIC 71-19-01
PROJECT NUMBER 1852802
PROJECT LOCATION Delta, OH
DRILLING CONTRACTOR TTL Associates CW JP
RIG NO. 111
GROUND ELEVATION 763 ft
DRILLING METHOD 4-1/4 in. HSA
GROUND WATER LEVELS:
DATE STARTED 11/22/19
COMPLETED 11/25/19
AT TIME OF DRILLING None
LOGGED BY KKC
CHECKED BY
AT END OF DRILLING 73.3 ft / Elev 689.7 ft
NOTES A bulk sample was taken from auger cuttings and 0 - 5'.
0hrs AFTER DRILLING Backfilled w/Cuttings and Bentonite Chips

ELEVATION (ft)	DEPTH (ft)	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	UNCONF. COMP. STR. (tsf)	DRY UNIT WT. (pcf)	PL MC LL (20 40 60 80) / SPT N VALUE (20 40 60 80)
	0	TOPSOIL - 5 Inches (0.4')						
760		FILL - Moist Stiff Brown/Gray LEAN CLAY w/Sand, Trace Gravel, Organics, and Calcite Stain Seam (3.8')	SS 1	89	5-5-6 (11)	>4.5		13
	5	FILL - Moist Medium Stiff Brown/Gray LEAN CLAY w/Sand, Trace Gravel, and Calcite Stain Seam (6.0')	SS 2	100	3-4-4 (8)	>4.5		16
755		FILL - Moist Stiff Brown/Gray LEAN CLAY w/Sand, Trace Gravel, and Calcite Stain Seam	SS 3	94	7-6-6 (12)	2.40	112	16
	10	@8.5': w/Trace Organics	SS 4	100	4-4-7 (11)	3.75		16
750		@12': Very Stiff, Gray	ST 1	75				
	15		SS 5	100	3-7-9 (16)	>4.5		16
745		(18.5')						
	20	Moist Very Stiff Brown/Gray LEAN CLAY w/Sand, Trace Gravel	SS 6	100	7-7-9 (16)	3.50		20
740			ST 2	67			109	19
	25	(24.0') Moist Hard Gray LEAN CLAY w/Sand and Trace Gravel (CL)	SS 7	100	12-17-22 (39)	>4.5		13
735		(28.5')						
	30	Moist Very Stiff Gray LEAN CLAY w/Sand and Trace Gravel (CL)	SS 8	100	7-13-17 (30)	>4.5		14

(Continued Next Page)

TTL_GEOTECH_STANDARD 1852802.GPJ TTL DATATMPL.GDT 12/20/19

TTL Associates, Inc.
1915 N 12th Street
Toledo, Ohio 43624
Telephone: 419-324-2222
Fax: 419-241-1808

BORING NUMBER B-4

CLIENT DGL **PROJECT NAME** OTIC 71-19-01

PROJECT NUMBER 1852802 **PROJECT LOCATION** Delta, OH

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	UNCONF. COMP. STR. (tsf)	DRY UNIT WT. (pcf)	PL MC LL 20 40 60 80 ▲ SPT N VALUE ▲ 20 40 60 80
			Moist Very Stiff Gray LEAN CLAY w/Sand and Trace Gravel (CL) *(continued)*						
730									
	35			SS 9	100	8-10-13 (23)	2.64	119	14
725									
	40			SS 10	100	7-9-13 (22)	4.25		15
720									
	45			SS 11	100	7-10-15 (25)	3.75		15
715									
	50			SS 12	100	7-11-15 (26)	>4.5		15
710									
	55			SS 13	100	5-10-15 (25)	3.50		16
705			58.5'						
	60		Moist Hard Gray LEAN CLAY w/Sand and Trace Gravel (CL)	SS 14	100	8-14-23 (37)	3.75		16
700									
	65			SS 15	100	8-14-20 (34)	4.00	118	16

(Continued Next Page)

TTL Associates, Inc.
1915 N 12th Street
Toledo, Ohio 43624
Telephone: 419-324-2222
Fax: 419-241-1808

BORING NUMBER B-4

CLIENT DGL **PROJECT NAME** OTIC 71-19-01

PROJECT NUMBER 1852802 **PROJECT LOCATION** Delta, OH

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	UNCONF. COMP. STR. (tsf)	DRY UNIT WT. (pcf)	PL MC LL 20 40 60 80 ▲ SPT N VALUE ▲ 20 40 60 80
695			Moist Hard Gray LEAN CLAY w/Sand and Trace Gravel (CL) *(continued)* 68.5'						
	70		Moist Very Stiff Gray LEAN CLAY w/Sand and Trace Gravel (CL)	SS 16	100	6-11-16 (27)	4.25		15
690			▼ @73': w/Trace Sand						
	75			SS 17	100	7-8-11 (19)	2.75		26
685									
	80		80.0'	SS 18	100	6-9-12 (21)	2.25	91	28

Bottom of hole at 80.0 feet.

APPENDIX B

Legend Key

LEGEND KEY

Unified Soil Classification System Soil Symbols

- GW - WELL GRADED GRAVEL Includes Gravel-Sand mixtures, little or no fines.
- GP - POORLY GRADED GRAVEL Includes Gravel-Sand mixtures, little or no fines.
- GM - SILTY GRAVEL Includes Gravel-Sand-Silt mixtures.
- GC - CLAYEY GRAVEL Includes Gravel-Sand-Clay mixtures.
- SW - WELL GRADED SAND Includes Gravelly Sands, little or no fines.
- SP - POORLY GRADED SAND Includes Gravelly Sands, little or no fines.
- SM - SILTY SAND Includes Sand-Silt mixtures.
- SC - CLAYEY SAND Includes Sand-Clay mixtures.
- ML - SILT Includes Silt with Sand and Sandy Silt.
- CL - LEAN CLAY Includes Sandy Lean Clay and Lean Clay with Sand and Gravel.
- MH - ELASTIC SILT Includes Sandy Elastic Silt and Elastic Silt with Sand.
- CH - FAT CLAY Includes Sandy Fat Clay and Fat Clay with Sand.
- CL-ML - SILTY CLAY Includes Clayey Silt of low plasticity.
- OL - ORGANIC SILT and ORGANIC CLAY of low plasticity.
- OH - ORGANIC SILT and ORGANIC CLAY of medium to high plasticity.
- Pt - PEAT Includes humus, swamp and other soils with high organic content.
- FILL MATERIAL - Includes controlled and non-controlled soil and non-soil materials.
- TOPSOIL
- ASPHALT - Bituminous Asphalt
- CONCRETE - Includes broken concrete rubble.

Sample Symbols

- SS - Split Spoon
- ST - Shelby Tube
- RC - Rock Core
- GS - Geoprobe Sleeve
- AU - Auger Cuttings
- GB - Grab

Notes:

1. Exploratory Boring B-3 was drilled on December 4, 2019, using 3¼ -inch diameter hollow-stem augers. Exploratory Boring B-4 was drilled between November 22 and November 25, 2019, using ¼ -inch diameter hollow-stem augers.

2. These logs are subject to the limitations, conclusions, and recommendations in the report and should not be interpreted separate from the report.

3. The test borings were located in the field by TTL Associates, Inc. in accordance with a proposed boring location plan provided by DGL.

4. Unconfined Compressive Strength (tsf):
   NP = Non-Plastic
   NI = Not Intact

APPENDIX C

Tabulation of Test Data

PROJECT: OTIC 71-19-91 Deck Replacement and Widening, Delta, Ohio	**TTL Associates, Inc.**	PROJECT NO: 1852802

TABULATION OF TEST DATA

Boring Number	Sample Number	Sample Interval Depth (Feet)		Standard Penetration (Blows per Foot)	Natural Moisture Content (% of Dry Weight)	In-Place Dry Density (Pounds per Cubic Foot)	Unconfined Compressive Strength (Pounds per Square Foot)		Particle Size Distribution (%)						Atterberg Limits (%)			Unified Soil Classification
									Gravel	Coarse Sand	Medium Sand	Fine Sand	Silt	Clay	Liquid Limit	Plastic Limit	Plasticity Index	
B-3	SS-1	1.0-2.5		14	14.4		*7,000											
	SS-2	3.5-5.0		14	16.2		*5,000											
	SS-3	6.0-7.5		19	14.5		*9,000+											
	SS-4	8.5-10.0		16	13.4		*9,000+											
	SS-5	13.5-15.0		11	22.0		*6,000											
	ST-1	16.0-18.0			13.9		*9,000+		1	3	5	29	24	38	27	13	14	CL
	SS-6	18.5-20.0		25	13.2		*6,500											
	SS-7	23.5-25.0		16	13.9		*9,000+		2	4	6	14	24	50	30	15	15	CL
	SS-8	28.5-30.0		22	12.1		*9,000+											
	SS-9	33.5-35.0		27	14.0		*9,000+											
	SS-10	38.5-40.0		18	15.0		*8,000											
	ST-2	41.0-43.0			15.0	116.8	*9,000		2	4	4	9	22	59	30	16	14	CL
	SS-11	43.5-45.0		19	15.0		*8,000											
	SS-12	48.5-50.0		23	15.0		*8,000											
	SS-13	53.5-55.0		22	15.1		*8,000											
	SS-14	58.5-60.0		20	14.8	119.9	*7,000		4	4	7	17	22	46	29	13	16	CL
	SS-15	63.5-65.0		18	15.6		*7,500											

*Unconfined compressive strength derived from a calibrated hand penetrometer

PROJECT: OTIC 71-19-91 Deck Replacement and Widening, Delta, Ohio	**TTL Associates, Inc.**	PROJECT NO: 1852802

TABULATION OF TEST DATA

Boring Number	Sample Number	Sample Interval Depth (Feet)		Standard Penetration (Blows per Foot)	Natural Moisture Content (% of Dry Weight)	In-Place Dry Density (Pounds per Cubic Foot)	Unconfined Compressive Strength (Pounds per Square Foot)		Particle Size Distribution (%)						Atterberg Limits (%)			Unified Soil Classification
									Gravel	Coarse Sand	Medium Sand	Fine Sand	Silt	Clay	Liquid Limit	Plastic Limit	Plasticity Index	
B-3	SS-16	68.5-70.0		21	15.8		*6,500											
	SS-17	73.5-75.0		15	25.4		*4,500											
	SS-18	78.5-80.0		15	26.7	94.7	*3,500		1	3	1	3	22	70	42	14	28	CL
	SS-19	83.5-85.0		15	30.4		*4,000											
	SS-20	88.5-90.0		15	23.5		*3,000											
B-4	SS-1	1.0-2.5		11	13.2		*9,000+											
	SS-2	3.5-5.0		8	16.4		*9,000+											
	SS-3	6.0-7.5		12	16.4	111.5	4,795											
	SS-4	8.5-10.0		11	15.7		*7,500											
	ST-1	11.0-13.0																
	SS-5	13.5-15.0		16	16.2		*9,000+											
	SS-6	18.5-20.0		16	19.6		*7,000											
	ST-2	21.0-23.0			18.7	109.2			2	1	6	16	21	54	35	14	21	CL
	SS-7	23.5-25.0		39	13.1		*9,000+											
	SS-8	28.5-30.0		30	13.9		*9,000+											
	SS-9	33.5-35.0		23	14.4	118.5	5,280											

*Unconfined compressive strength derived from a calibrated hand penetrometer

PROJECT: OTIC 71-19-91 Deck Replacement and Widening, Delta, Ohio	**TTL Associates, Inc.**	PROJECT NO: 1852802

TABULATION OF TEST DATA

Boring Number	Sample Number	Sample Interval Depth (Feet)		Standard Penetration (Blows per Foot)	Natural Moisture Content (% of Dry Weight)	In-Place Dry Density (Pounds per Cubic Foot)	Unconfined Compressive Strength (Pounds per Square Foot)		Particle Size Distribution (%)						Atterberg Limits (%)			Unified Soil Classification
									Gravel	Coarse Sand	Medium Sand	Fine Sand	Silt	Clay	Liquid Limit	Plastic Limit	Plasticity Index	
B-4	SS-10	38.5-40.0		22	14.8		*8,500											
	SS-11	43.5-45.0		25	15.3		*7,500											
	SS-12	48.5-50.0		26	15.4		*9,000+		2	6	7	14	22	49	29	14	15	CL
	SS-13	53.5-55.0		25	16.4		*7,000											
	SS-14	58.5-60.0		37	15.7		*7,500											
	SS-15	63.5-65.0		34	15.9	117.9	*8,000		1	6	5	11	25	52	29	15	14	CL
	SS-16	68.5-70.0		27	15.5		*8,500											
	SS-17	73.5-75.0		19	25.6		*5,500		0	0	2	5	16	77	46	15	31	CL
	SS-18	78.5-80.0		21	27.8	90.7	*4,500											

*Unconfined compressive strength derived from a calibrated hand penetrometer

APPENDIX D

Laboratory Test Results

TTL Associates, Inc.
1915 N 12th Street
Toledo, Ohio 43624
Telephone: 419-324-2222
Fax: 419-241-1808

SUMMARY OF LABORATORY RESULTS

CLIENT DGL **PROJECT NAME** OTIC 71-19-01

PROJECT NUMBER 1852802 **PROJECT LOCATION** Delta, OH

Borehole	Depth	Liquid Limit	Plastic Limit	Plasticity Index	Maximum Size (mm)	%<#200 Sieve	Class-ification	Water Content (%)	Dry Density (pcf)	Satur-ation (%)	Void Ratio
B-3	1.0							14.4			
B-3	3.5							16.2			
B-3	6.0							14.5			
B-3	8.5							13.4			
B-3	13.5							22.0			
B-3	16.0	27	13	14	9.5	62	CL	13.9			
B-3	18.5							13.2			
B-3	23.5	30	15	15	12.5	74	CL	13.9			
B-3	28.5							12.1			
B-3	33.5							14.0			
B-3	38.5							15.0			
B-3	41.0	30	16	14	12.5	80	CL	15.0	116.8		
B-3	43.5							15.0			
B-3	48.5							15.0			
B-3	53.5							15.1			
B-3	58.5	29	13	16	12.5	69	CL	14.8	119.9		
B-3	63.5							15.6			
B-3	68.5							15.8			
B-3	73.5							25.4			
B-3	78.5	42	14	28	12.5	92	CL	26.7	94.7		
B-3	83.5							30.4			
B-3	88.5							23.5			
B-4	1.0							13.2			
B-4	3.5							16.4			
B-4	6.0							16.4	111.5		
B-4	8.5							15.7			
B-4	13.5							16.2			
B-4	18.5							19.6			
B-4	21.0	35	14	21	19	75	CL	18.7	109.2		
B-4	23.5							13.1			
B-4	28.5							13.9			
B-4	33.5							14.4	118.5		
B-4	38.5							14.8			
B-4	43.5							15.3			
B-4	48.5	29	14	15	9.5	72	CL	15.4			
B-4	53.5							16.4			
B-4	58.5							15.7			
B-4	63.5	29	15	14	9.5	76	CL	15.9	117.9		
B-4	68.5							15.5			
B-4	73.5	46	15	31	2	93	CL	25.6			
B-4	78.5							27.8	90.7		

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Toledo, Ohio 43624
Telephone: 419-324-2222
Fax: 419-241-1808

ATTERBERG LIMITS' RESULTS

CLIENT DGL **PROJECT NAME** OTIC 71-19-01

PROJECT NUMBER 1852802 **PROJECT LOCATION** Delta, OH

	Specimen Identification		LL	PL	PI	Fines	Classification
●	B-3	16.0	27	13	14	62	SANDY LEAN CLAY (CL)
⊠	B-3	23.5	30	15	15	74	LEAN CLAY with SAND (CL)
▲	B-3	41.0	30	16	14	80	LEAN CLAY with SAND (CL)
★	B-3	58.5	29	13	16	69	SANDY LEAN CLAY (CL)
⊙	B-3	78.5	42	14	28	92	LEAN CLAY (CL)
✿	B-4	21.0	35	14	21	75	LEAN CLAY with SAND (CL)
○	B-4	48.5	29	14	15	72	LEAN CLAY with SAND (CL)
△	B-4	63.5	29	15	14	76	LEAN CLAY with SAND (CL)
⊗	B-4	73.5	46	15	31	93	LEAN CLAY (CL)

TTL Associates, Inc.
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GRAIN SIZE DISTRIBUTION

CLIENT DGL **PROJECT NAME** OTIC 71-19-01

PROJECT NUMBER 1852802 **PROJECT LOCATION** Delta, OH

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		USCS Classification	LL	PL	PI	Cc	Cu
●	B-3	16.0	**SANDY LEAN CLAY (CL)**	27	13	14		
⊠	B-3	23.5	**LEAN CLAY with SAND (CL)**	30	15	15		
▲	B-3	41.0	**LEAN CLAY with SAND (CL)**	30	16	14		
★	B-3	58.5	**SANDY LEAN CLAY (CL)**	29	13	16		
⊙	B-3	78.5	**LEAN CLAY (CL)**	42	14	28		

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	B-3	16.0	9.5	0.046	0.003		0.8	37.0	24.0	38.2
⊠	B-3	23.5	12.5	0.011			2.4	23.8	24.2	49.6
▲	B-3	41.0	12.5	0.005			2.2	17.3	21.4	59.0
★	B-3	58.5	12.5	0.015	0.001		3.8	27.5	22.5	46.2
⊙	B-3	78.5	12.5	0.002			1.1	6.5	22.0	70.3

TTL Associates, Inc.
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Toledo, Ohio 43624
Telephone: 419-324-2222
Fax: 419-241-1808

GRAIN SIZE DISTRIBUTION

CLIENT DGL **PROJECT NAME** OTIC 71-19-01

PROJECT NUMBER 1852802 **PROJECT LOCATION** Delta, OH

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		USCS Classification	LL	PL	PI	Cc	Cu
●	B-4	21.0	**LEAN CLAY with SAND (CL)**	**35**	**14**	**21**		
⊠	B-4	48.5	**LEAN CLAY with SAND (CL)**	**29**	**14**	**15**		
▲	B-4	63.5	**LEAN CLAY with SAND (CL)**	**29**	**15**	**14**		
★	B-4	73.5	**LEAN CLAY (CL)**	**46**	**15**	**31**		

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	B-4	21.0	**19**	**0.008**			**2.5**	**22.8**	**21.2**	**53.5**
⊠	B-4	48.5	**9.5**	**0.011**			**1.5**	**26.6**	**22.5**	**49.5**
▲	B-4	63.5	**9.5**	**0.01**			**1.5**	**22.2**	**24.7**	**51.6**
★	B-4	73.5	**2**	**0.002**			**0.0**	**6.8**	**15.9**	**77.3**

Project No.: 1852802
Date: 12/6/2019
Client: DGL
Project: OTIC 71-19-01
Delta, OH
Boring No.: B-3
Sample No.: ST-2
Depth: 41.0 - 43.0'

Initial H= 1.02 inches

Pressure tsf	Final Height (in)	Initial Height (in)	DH	Average H (in)	e	Ave P (tsf)
0.125	1.02000	1.02000	0.00000	1.0200	0.444	0.0625
0.25	1.01660	1.02000	0.00340	1.0183	0.439	0.1875
0.5	1.01070	1.01660	0.00930	1.0137	0.430	0.375
1	1.00330	1.01070	0.01670	1.0070	0.420	0.75
2	0.99315	1.00330	0.02685	0.9982	0.406	1.5
4	0.98390	0.99315	0.03610	0.9885	0.393	3
8	0.96960	0.98390	0.05040	0.9768	0.372	6
16	0.95360	0.96960	0.06640	0.9616	0.350	12
4	0.95800	0.95360	0.06200	0.9558	0.356	10
1	0.96590	0.95800	0.05410	0.9620	0.367	2.5
0.25	0.97495	0.96590	0.04505	0.9704	0.380	0.625

Estimated Cc: 0.075
Estimated Cr: 0.017

Soil Description: Brown/Gray LEAN CLAY w/Sand and Trace Gravel (CL)
Specific Gravity: 2.723
Liquid Limit: 30
Plastic Limit: 16
Plasticity Index: 14

Initial Water Content: 14.7 %
Inital Dry Density: 117.8 pcf
Initial Void Ratio: 0.444
Initial Degree of Saturation: 90.5 %

Final Water Content: %
Final Dry Density: pcf
Final Void Ratio:
Final Degree of Saturation %

Estimated Preconsolidation Pressure: tsf

The sample for the test was trimmed from a Shelby tube sample using a cutting shoe. Test Method B was used with the specimen inundated during testing. Coefficients of consolidation

Project No.: 1852802
Date: 12/6/2019
Client: DGL
Project: OTIC 71-19-01
Delta, OH
Boring No.: B-3
Sample No.: ST-2
Depth: 41.0 - 43.0'

Project No.: 1852802
Date: 11/22/2019
Client: DGL
Project: OTIC 71-19-01
Delta, OH
Boring No.: B-4
Sample No.: ST-2
Depth: 21.0 - 23.0'

Initial H= 1 inches

Pressure tsf	Final Height (in)	Initial Height (in)	DH	Average H (in)	e	Ave P (tsf)
0.125	1.00000	1.00000	0.00000	1.0000	0.517	0.0625
0.25	0.99720	1.00000	0.00280	0.9986	0.512	0.1875
0.5	0.99290	0.99720	0.00710	0.9951	0.506	0.375
1	0.98030	0.99290	0.01970	0.9866	0.487	0.75
2	0.96420	0.98030	0.03580	0.9723	0.462	1.5
4	0.94770	0.96420	0.05230	0.9560	0.437	3
8	0.92835	0.94770	0.07165	0.9380	0.408	6
16	0.90435	0.92835	0.09565	0.9164	0.372	12
4	0.90990	0.90435	0.09010	0.9071	0.380	10
1	0.92110	0.90990	0.07890	0.9155	0.397	2.5
0.25	0.93250	0.92110	0.06750	0.9268	0.414	0.625

Estimated Cc: 0.121
Estimated Cr: 0.024

Soil Description: Brown/Gray LEAN CLAY with Sand and Trace Gravel (CL)
Specific Gravity: 2.700
Liquid Limit: 35
Plastic Limit: 14
Plasticity Index: 21

Initial Water Content: 17.3 %
Inital Dry Density: 111.1 pcf
Initial Void Ratio: 0.517
Initial Degree of Saturation: 90.3 %

Final Water Content: %
Final Dry Density: pcf
Final Void Ratio:
Final Degree of Saturation %

Estimated Preconsolidation Pressure: tsf

The sample for the test was trimmed from a Shelby tube sample using a cutting shoe. Test Method B was used with the specimen inundated during testing. Coefficients of consolidation

Project No.: 1852802
Date: 11/22/2019
Client: DGL
Project: OTIC 71-19-01
Delta, OH
Boring No.: B-4
Sample No.: ST-2
Depth: 21.0 - 23.0'

Project No.: 1852802
Date: 11/22/2019
Client: DGL
Project: OTIC 71-19-01
Delta, OH
Boring No.: B-4
Sample No.: ST-2
Depth: 21.0 - 23.0'

Initial H= 1 inches

Pressure tsf	Final Height (in)	Initial Height (in)	DH	Average H (in)	e	Ave P (tsf)
0.125	1.00000	1.00000	0.00000	1.0000	0.517	0.0625
0.25	0.99720	1.00000	0.00280	0.9986	0.512	0.1875
0.5	0.99290	0.99720	0.00710	0.9951	0.506	0.375
1	0.98030	0.99290	0.01970	0.9866	0.487	0.75
2	0.96420	0.98030	0.03580	0.9723	0.462	1.5
4	0.94770	0.96420	0.05230	0.9560	0.437	3
8	0.92835	0.94770	0.07165	0.9380	0.408	6
16	0.90435	0.92835	0.09565	0.9164	0.372	12
4	0.90990	0.90435	0.09010	0.9071	0.380	10
1	0.92110	0.90990	0.07890	0.9155	0.397	2.5
0.25	0.93250	0.92110	0.06750	0.9268	0.414	0.625

Estimated Cc: 0.121
Estimated Cr: 0.024

Soil Description: Brown/Gray LEAN CLAY with Sand and Trace Gravel (CL)
Specific Gravity: 2.700
Liquid Limit: 35
Plastic Limit: 14
Plasticity Index: 21

Initial Water Content: 17.3 %
Inital Dry Density: 111.1 pcf
Initial Void Ratio: 0.517
Initial Degree of Saturation: 90.3 %

Final Water Content: %
Final Dry Density: pcf
Final Void Ratio:
Final Degree of Saturation %

Estimated Preconsolidation Pressure: tsf

The sample for the test was trimmed from a Shelby tube sample using a cutting shoe. Test Method B was used with the specimen inundated during testing. Coefficients of consolidation

Project No.: 1852802
Date: 11/22/2019
Client: DGL
Project: OTIC 71-19-01
Delta, OH
Boring No.: B-4
Sample No.: ST-2
Depth: 21.0 - 23.0'

APPENDIX E

Settlement Analysis Data

Project Name: OTIC MP 40.3 Bridge Widening
Project Number: 1852802
Calculated by: IJH 12/30/19

Boring B-3 and B-4
Analysis Type Boussinesq Continuous

Layer	H (feet)	C_r	e_o	sigma v (psf)	z (feet)	b (feet)	(z-Df)/b	I_z	delta p@	3000 psf	(check) sigma v+ΔP	delta H (inches)
B-4 ST-2	7	0.024	0.41	1563	3.5	11.5	0.3	0.9	2700		4263	0.63
SS-11	10	0.015	0.41	2625	12	11.5	1.0	0.5	1500		4125	0.25
SS-13	10	0.015	0.41	3875	22	11.5	1.9	0.3	900		4775	0.12
SS-15	10	0.016	0.43	4751	32	11.5	2.8	0.2	600		5351	0.07
SS-17	10	0.025	0.68	5377	42	11.5	3.7	0.2	600		5977	0.08
SS-19	10	0.03	0.81	6003	52	11.5	4.5	0.1	300		6303	0.04
											Total delta H (in.)	1.19
											+15%	1.36
											-15%	1.01

settlement q = 3000 - 11.5 ft wide strip footing.xlsx

Project Name: OTIC MP 40.3 Bridge Widening
Project Number: 1852802
Calculated by: IJH 12/30/19

Boring B-3 and B-4
Analysis Type Boussinesq Continuous

Layer	H (feet)	C_r	e_o	sigma v (psf)	z (feet)	b (feet)	(z-Df)/b	I_z	delta p@	3500 psf	(check) sigma v+ΔP	delta H (inches)
B-4 ST-2	7	0.024	0.41	1563	3.5	11.5	0.3	0.9	3150		4713	0.69
SS-11	10	0.015	0.41	2625	12	11.5	1.0	0.5	1750		4375	0.28
SS-13	10	0.015	0.41	3875	22	11.5	1.9	0.3	1050		4925	0.13
SS-15	10	0.016	0.43	4751	32	11.5	2.8	0.2	700		5451	0.08
SS-17	10	0.025	0.68	5377	42	11.5	3.7	0.2	700		6077	0.10
SS-19	10	0.03	0.81	6003	52	11.5	4.5	0.1	350		6353	0.05
											Total delta H (in.)	1.33
											+15%	1.53
											-15%	1.13

settlement q = 3000 - 11.5 ft wide strip footing.xlsx

APPENDIX F

FHWA Driven Output

Filename: T:\GEOTECH\DRIVEN\1852802\B-3.DVN

Filename: T:\GEOTECH\DRIVEN\1852802\B-3.DVN

DRIVEN 1.2

GENERAL PROJECT INFORMATION

Filename: T:\GEOTECH\DRIVEN\1852802\B-3.DVN
Project Name: 71-19-01 Project Date: 12/17/2019
Project Client: DGL
Computed By: IJH
Project Manager: IJH

PILE INFORMATION

Pile Type: H Pile - HP10X42
Top of Pile: 2.00 ft
Perimeter Analysis: Box
Tip Analysis: Pile Area

ULTIMATE CONSIDERATIONS

Water Table Depth At Time Of:	- Drilling:	50.00 ft
	- Driving/Restrike	50.00 ft
	- Ultimate:	50.00 ft
Ultimate Considerations:	- Local Scour:	0.00 ft
	- Long Term Scour:	0.00 ft
	- Soft Soil:	0.00 ft

ULTIMATE PROFILE

Layer	Type	Thickness	Driving Loss	Unit Weight	Strength	Ultimate Curve
1	Cohesive	18.50 ft	0.00%	125.00 pcf	2383.50 psf	T-79 Steel
2	Cohesive	5.50 ft	0.00%	125.00 pcf	3250.00 psf	T-79 Steel
3	Cohesive	34.50 ft	0.00%	125.00 pcf	3382.00 psf	T-79 Steel
4	Cohesive	13.50 ft	0.00%	125.00 pcf	3167.00 psf	T-79 Steel
5	Cohesive	18.00 ft	0.00%	125.00 pcf	1750.00 psf	T-79 Steel

RESTRIKE - SKIN FRICTION

Depth	Soil Type	Effective Stress At Midpoint	Sliding Friction Angle	Adhesion	Skin Friction
0.01 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
1.99 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
2.00 ft	Cohesive	N/A	N/A	1057.43 psf	0.00 Kips
9.01 ft	Cohesive	N/A	N/A	1057.43 psf	24.43 Kips
18.01 ft	Cohesive	N/A	N/A	1208.09 psf	63.75 Kips
18.49 ft	Cohesive	N/A	N/A	1217.59 psf	66.17 Kips
18.51 ft	Cohesive	N/A	N/A	966.76 psf	66.26 Kips
23.99 ft	Cohesive	N/A	N/A	1073.37 psf	85.65 Kips
24.01 ft	Cohesive	N/A	N/A	1073.76 psf	85.72 Kips
33.01 ft	Cohesive	N/A	N/A	1248.85 psf	122.77 Kips
42.01 ft	Cohesive	N/A	N/A	1260.00 psf	160.48 Kips
51.01 ft	Cohesive	N/A	N/A	1260.00 psf	197.85 Kips
58.49 ft	Cohesive	N/A	N/A	1260.00 psf	228.91 Kips
58.51 ft	Cohesive	N/A	N/A	1260.00 psf	229.00 Kips
67.51 ft	Cohesive	N/A	N/A	1260.00 psf	266.37 Kips
71.99 ft	Cohesive	N/A	N/A	1260.00 psf	284.98 Kips
72.01 ft	Cohesive	N/A	N/A	1430.00 psf	285.06 Kips
81.01 ft	Cohesive	N/A	N/A	1430.00 psf	327.48 Kips
89.99 ft	Cohesive	N/A	N/A	1430.00 psf	369.80 Kips

RESTRIKE - END BEARING

Depth	Soil Type	Effective Stress At Tip	Bearing Cap. Factor	Limiting End Bearing	End Bearing
0.01 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
1.99 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
2.00 ft	Cohesive	N/A	N/A	N/A	1.85 Kips
9.01 ft	Cohesive	N/A	N/A	N/A	1.85 Kips
18.01 ft	Cohesive	N/A	N/A	N/A	1.85 Kips
18.49 ft	Cohesive	N/A	N/A	N/A	1.85 Kips
18.51 ft	Cohesive	N/A	N/A	N/A	2.52 Kips
23.99 ft	Cohesive	N/A	N/A	N/A	2.52 Kips
24.01 ft	Cohesive	N/A	N/A	N/A	2.62 Kips
33.01 ft	Cohesive	N/A	N/A	N/A	2.62 Kips
42.01 ft	Cohesive	N/A	N/A	N/A	2.62 Kips
51.01 ft	Cohesive	N/A	N/A	N/A	2.62 Kips
58.49 ft	Cohesive	N/A	N/A	N/A	2.62 Kips
58.51 ft	Cohesive	N/A	N/A	N/A	2.45 Kips
67.51 ft	Cohesive	N/A	N/A	N/A	2.45 Kips
71.99 ft	Cohesive	N/A	N/A	N/A	2.45 Kips
72.01 ft	Cohesive	N/A	N/A	N/A	1.36 Kips
81.01 ft	Cohesive	N/A	N/A	N/A	1.36 Kips
89.99 ft	Cohesive	N/A	N/A	N/A	1.36 Kips

RESTRIKE - SUMMARY OF CAPACITIES

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
1.99 ft	0.00 Kips	0.00 Kips	0.00 Kips
2.00 ft	0.00 Kips	1.85 Kips	1.85 Kips
9.01 ft	24.43 Kips	1.85 Kips	26.28 Kips
18.01 ft	63.75 Kips	1.85 Kips	65.59 Kips
18.49 ft	66.17 Kips	1.85 Kips	68.02 Kips
18.51 ft	66.26 Kips	2.52 Kips	68.78 Kips
23.99 ft	85.65 Kips	2.52 Kips	88.17 Kips
24.01 ft	85.72 Kips	2.62 Kips	88.34 Kips
33.01 ft	122.77 Kips	2.62 Kips	125.39 Kips
42.01 ft	160.48 Kips	2.62 Kips	163.10 Kips
51.01 ft	197.85 Kips	2.62 Kips	200.47 Kips
58.49 ft	228.91 Kips	2.62 Kips	231.53 Kips
58.51 ft	229.00 Kips	2.45 Kips	231.45 Kips
67.51 ft	266.37 Kips	2.45 Kips	268.83 Kips
71.99 ft	284.98 Kips	2.45 Kips	287.43 Kips
72.01 ft	285.06 Kips	1.36 Kips	286.42 Kips
81.01 ft	327.48 Kips	1.36 Kips	328.84 Kips
89.99 ft	369.80 Kips	1.36 Kips	371.16 Kips

DRIVING - SKIN FRICTION

Depth	Soil Type	Effective Stress At Midpoint	Sliding Friction Angle	Adhesion	Skin Friction
0.01 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
1.99 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
2.00 ft	Cohesive	N/A	N/A	1057.43 psf	0.00 Kips
9.01 ft	Cohesive	N/A	N/A	1057.43 psf	24.43 Kips
18.01 ft	Cohesive	N/A	N/A	1208.09 psf	63.75 Kips
18.49 ft	Cohesive	N/A	N/A	1217.59 psf	66.17 Kips
18.51 ft	Cohesive	N/A	N/A	966.76 psf	66.26 Kips
23.99 ft	Cohesive	N/A	N/A	1073.37 psf	85.65 Kips
24.01 ft	Cohesive	N/A	N/A	1073.76 psf	85.72 Kips
33.01 ft	Cohesive	N/A	N/A	1248.85 psf	122.77 Kips
42.01 ft	Cohesive	N/A	N/A	1260.00 psf	160.48 Kips
51.01 ft	Cohesive	N/A	N/A	1260.00 psf	197.85 Kips
58.49 ft	Cohesive	N/A	N/A	1260.00 psf	228.91 Kips
58.51 ft	Cohesive	N/A	N/A	1260.00 psf	229.00 Kips
67.51 ft	Cohesive	N/A	N/A	1260.00 psf	266.37 Kips
71.99 ft	Cohesive	N/A	N/A	1260.00 psf	284.98 Kips
72.01 ft	Cohesive	N/A	N/A	1430.00 psf	285.06 Kips
81.01 ft	Cohesive	N/A	N/A	1430.00 psf	327.48 Kips
89.99 ft	Cohesive	N/A	N/A	1430.00 psf	369.80 Kips

DRIVING - END BEARING

Depth	Soil Type	Effective Stress At Tip	Bearing Cap. Factor	Limiting End Bearing	End Bearing
0.01 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
1.99 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
2.00 ft	Cohesive	N/A	N/A	N/A	1.85 Kips
9.01 ft	Cohesive	N/A	N/A	N/A	1.85 Kips
18.01 ft	Cohesive	N/A	N/A	N/A	1.85 Kips
18.49 ft	Cohesive	N/A	N/A	N/A	1.85 Kips
18.51 ft	Cohesive	N/A	N/A	N/A	2.52 Kips
23.99 ft	Cohesive	N/A	N/A	N/A	2.52 Kips
24.01 ft	Cohesive	N/A	N/A	N/A	2.62 Kips
33.01 ft	Cohesive	N/A	N/A	N/A	2.62 Kips
42.01 ft	Cohesive	N/A	N/A	N/A	2.62 Kips
51.01 ft	Cohesive	N/A	N/A	N/A	2.62 Kips
58.49 ft	Cohesive	N/A	N/A	N/A	2.62 Kips
58.51 ft	Cohesive	N/A	N/A	N/A	2.45 Kips
67.51 ft	Cohesive	N/A	N/A	N/A	2.45 Kips
71.99 ft	Cohesive	N/A	N/A	N/A	2.45 Kips
72.01 ft	Cohesive	N/A	N/A	N/A	1.36 Kips
81.01 ft	Cohesive	N/A	N/A	N/A	1.36 Kips
89.99 ft	Cohesive	N/A	N/A	N/A	1.36 Kips

DRIVING - SUMMARY OF CAPACITIES

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
1.99 ft	0.00 Kips	0.00 Kips	0.00 Kips
2.00 ft	0.00 Kips	1.85 Kips	1.85 Kips
9.01 ft	24.43 Kips	1.85 Kips	26.28 Kips
18.01 ft	63.75 Kips	1.85 Kips	65.59 Kips
18.49 ft	66.17 Kips	1.85 Kips	68.02 Kips
18.51 ft	66.26 Kips	2.52 Kips	68.78 Kips
23.99 ft	85.65 Kips	2.52 Kips	88.17 Kips
24.01 ft	85.72 Kips	2.62 Kips	88.34 Kips
33.01 ft	122.77 Kips	2.62 Kips	125.39 Kips
42.01 ft	160.48 Kips	2.62 Kips	163.10 Kips
51.01 ft	197.85 Kips	2.62 Kips	200.47 Kips
58.49 ft	228.91 Kips	2.62 Kips	231.53 Kips
58.51 ft	229.00 Kips	2.45 Kips	231.45 Kips
67.51 ft	266.37 Kips	2.45 Kips	268.83 Kips
71.99 ft	284.98 Kips	2.45 Kips	287.43 Kips
72.01 ft	285.06 Kips	1.36 Kips	286.42 Kips
81.01 ft	327.48 Kips	1.36 Kips	328.84 Kips
89.99 ft	369.80 Kips	1.36 Kips	371.16 Kips

ULTIMATE - SKIN FRICTION

Depth	Soil Type	Effective Stress At Midpoint	Sliding Friction Angle	Adhesion	Skin Friction
0.01 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
1.99 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
2.00 ft	Cohesive	N/A	N/A	1057.43 psf	0.00 Kips
9.01 ft	Cohesive	N/A	N/A	1057.43 psf	24.43 Kips
18.01 ft	Cohesive	N/A	N/A	1208.09 psf	63.75 Kips
18.49 ft	Cohesive	N/A	N/A	1217.59 psf	66.17 Kips
18.51 ft	Cohesive	N/A	N/A	966.76 psf	66.26 Kips
23.99 ft	Cohesive	N/A	N/A	1073.37 psf	85.65 Kips
24.01 ft	Cohesive	N/A	N/A	1073.76 psf	85.72 Kips
33.01 ft	Cohesive	N/A	N/A	1248.85 psf	122.77 Kips
42.01 ft	Cohesive	N/A	N/A	1260.00 psf	160.48 Kips
51.01 ft	Cohesive	N/A	N/A	1260.00 psf	197.85 Kips
58.49 ft	Cohesive	N/A	N/A	1260.00 psf	228.91 Kips
58.51 ft	Cohesive	N/A	N/A	1260.00 psf	229.00 Kips
67.51 ft	Cohesive	N/A	N/A	1260.00 psf	266.37 Kips
71.99 ft	Cohesive	N/A	N/A	1260.00 psf	284.98 Kips
72.01 ft	Cohesive	N/A	N/A	1430.00 psf	285.06 Kips
81.01 ft	Cohesive	N/A	N/A	1430.00 psf	327.48 Kips
89.99 ft	Cohesive	N/A	N/A	1430.00 psf	369.80 Kips

ULTIMATE - END BEARING

Depth	Soil Type	Effective Stress At Tip	Bearing Cap. Factor	Limiting End Bearing	End Bearing
0.01 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
1.99 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
2.00 ft	Cohesive	N/A	N/A	N/A	1.85 Kips
9.01 ft	Cohesive	N/A	N/A	N/A	1.85 Kips
18.01 ft	Cohesive	N/A	N/A	N/A	1.85 Kips
18.49 ft	Cohesive	N/A	N/A	N/A	1.85 Kips
18.51 ft	Cohesive	N/A	N/A	N/A	2.52 Kips
23.99 ft	Cohesive	N/A	N/A	N/A	2.52 Kips
24.01 ft	Cohesive	N/A	N/A	N/A	2.62 Kips
33.01 ft	Cohesive	N/A	N/A	N/A	2.62 Kips
42.01 ft	Cohesive	N/A	N/A	N/A	2.62 Kips
51.01 ft	Cohesive	N/A	N/A	N/A	2.62 Kips
58.49 ft	Cohesive	N/A	N/A	N/A	2.62 Kips
58.51 ft	Cohesive	N/A	N/A	N/A	2.45 Kips
67.51 ft	Cohesive	N/A	N/A	N/A	2.45 Kips
71.99 ft	Cohesive	N/A	N/A	N/A	2.45 Kips
72.01 ft	Cohesive	N/A	N/A	N/A	1.36 Kips
81.01 ft	Cohesive	N/A	N/A	N/A	1.36 Kips
89.99 ft	Cohesive	N/A	N/A	N/A	1.36 Kips

ULTIMATE - SUMMARY OF CAPACITIES

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
1.99 ft	0.00 Kips	0.00 Kips	0.00 Kips
2.00 ft	0.00 Kips	1.85 Kips	1.85 Kips
9.01 ft	24.43 Kips	1.85 Kips	26.28 Kips
18.01 ft	63.75 Kips	1.85 Kips	65.59 Kips
18.49 ft	66.17 Kips	1.85 Kips	68.02 Kips
18.51 ft	66.26 Kips	2.52 Kips	68.78 Kips
23.99 ft	85.65 Kips	2.52 Kips	88.17 Kips
24.01 ft	85.72 Kips	2.62 Kips	88.34 Kips
33.01 ft	122.77 Kips	2.62 Kips	125.39 Kips
42.01 ft	160.48 Kips	2.62 Kips	163.10 Kips
51.01 ft	197.85 Kips	2.62 Kips	200.47 Kips
58.49 ft	228.91 Kips	2.62 Kips	231.53 Kips
58.51 ft	229.00 Kips	2.45 Kips	231.45 Kips
67.51 ft	266.37 Kips	2.45 Kips	268.83 Kips
71.99 ft	284.98 Kips	2.45 Kips	287.43 Kips
72.01 ft	285.06 Kips	1.36 Kips	286.42 Kips
81.01 ft	327.48 Kips	1.36 Kips	328.84 Kips
89.99 ft	369.80 Kips	1.36 Kips	371.16 Kips

Filename: T:\GEOTECH\DRIVEN\1852802\B-3.DVN

DRIVEN 1.2

GENERAL PROJECT INFORMATION

Filename: T:\GEOTECH\DRIVEN\1852802\B-3.DVN
Project Name: 71-19-01 Project Date: 12/17/2019
Project Client: DGL
Computed By: IJH
Project Manager: IJH

PILE INFORMATION

Pile Type: H Pile - HP10X42
Top of Pile: 8.70 ft
Perimeter Analysis: Box
Tip Analysis: Pile Area

ULTIMATE CONSIDERATIONS

Water Table Depth At Time Of:	- Drilling:	50.00 ft
	- Driving/Restrike	50.00 ft
	- Ultimate:	50.00 ft
Ultimate Considerations:	- Local Scour:	0.00 ft
	- Long Term Scour:	0.00 ft
	- Soft Soil:	0.00 ft

ULTIMATE PROFILE

Layer	Type	Thickness	Driving Loss	Unit Weight	Strength	Ultimate Curve
1	Cohesive	18.50 ft	0.00%	125.00 pcf	2383.50 psf	T-79 Steel
2	Cohesive	5.50 ft	0.00%	125.00 pcf	3250.00 psf	T-79 Steel
3	Cohesive	34.50 ft	0.00%	125.00 pcf	3382.00 psf	T-79 Steel
4	Cohesive	13.50 ft	0.00%	125.00 pcf	3167.00 psf	T-79 Steel
5	Cohesive	18.00 ft	0.00%	125.00 pcf	1750.00 psf	T-79 Steel

RESTRIKE - SKIN FRICTION

Depth	Soil Type	Effective Stress At Midpoint	Sliding Friction Angle	Adhesion	Skin Friction
0.01 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
8.69 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
8.70 ft	Cohesive	N/A	N/A	1057.43 psf	0.00 Kips
9.01 ft	Cohesive	N/A	N/A	1057.43 psf	1.08 Kips
18.01 ft	Cohesive	N/A	N/A	1075.51 psf	33.00 Kips
18.49 ft	Cohesive	N/A	N/A	1085.01 psf	35.01 Kips
18.51 ft	Cohesive	N/A	N/A	966.76 psf	35.08 Kips
23.99 ft	Cohesive	N/A	N/A	1073.37 psf	54.47 Kips
24.01 ft	Cohesive	N/A	N/A	1073.76 psf	54.55 Kips
33.01 ft	Cohesive	N/A	N/A	1248.85 psf	91.60 Kips
42.01 ft	Cohesive	N/A	N/A	1260.00 psf	129.30 Kips
51.01 ft	Cohesive	N/A	N/A	1260.00 psf	166.68 Kips
58.49 ft	Cohesive	N/A	N/A	1260.00 psf	197.74 Kips
58.51 ft	Cohesive	N/A	N/A	1260.00 psf	197.82 Kips
67.51 ft	Cohesive	N/A	N/A	1260.00 psf	235.20 Kips
71.99 ft	Cohesive	N/A	N/A	1260.00 psf	253.80 Kips
72.01 ft	Cohesive	N/A	N/A	1430.00 psf	253.89 Kips
81.01 ft	Cohesive	N/A	N/A	1430.00 psf	296.31 Kips
89.99 ft	Cohesive	N/A	N/A	1430.00 psf	338.63 Kips

RESTRIKE - END BEARING

Depth	Soil Type	Effective Stress At Tip	Bearing Cap. Factor	Limiting End Bearing	End Bearing
0.01 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
8.69 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
8.70 ft	Cohesive	N/A	N/A	N/A	1.85 Kips
9.01 ft	Cohesive	N/A	N/A	N/A	1.85 Kips
18.01 ft	Cohesive	N/A	N/A	N/A	1.85 Kips
18.49 ft	Cohesive	N/A	N/A	N/A	1.85 Kips
18.51 ft	Cohesive	N/A	N/A	N/A	2.52 Kips
23.99 ft	Cohesive	N/A	N/A	N/A	2.52 Kips
24.01 ft	Cohesive	N/A	N/A	N/A	2.62 Kips
33.01 ft	Cohesive	N/A	N/A	N/A	2.62 Kips
42.01 ft	Cohesive	N/A	N/A	N/A	2.62 Kips
51.01 ft	Cohesive	N/A	N/A	N/A	2.62 Kips
58.49 ft	Cohesive	N/A	N/A	N/A	2.62 Kips
58.51 ft	Cohesive	N/A	N/A	N/A	2.45 Kips
67.51 ft	Cohesive	N/A	N/A	N/A	2.45 Kips
71.99 ft	Cohesive	N/A	N/A	N/A	2.45 Kips
72.01 ft	Cohesive	N/A	N/A	N/A	1.36 Kips
81.01 ft	Cohesive	N/A	N/A	N/A	1.36 Kips
89.99 ft	Cohesive	N/A	N/A	N/A	1.36 Kips

RESTRIKE - SUMMARY OF CAPACITIES

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
8.69 ft	0.00 Kips	0.00 Kips	0.00 Kips
8.70 ft	0.00 Kips	1.85 Kips	1.85 Kips
9.01 ft	1.08 Kips	1.85 Kips	2.93 Kips
18.01 ft	33.00 Kips	1.85 Kips	34.85 Kips
18.49 ft	35.01 Kips	1.85 Kips	36.86 Kips
18.51 ft	35.08 Kips	2.52 Kips	37.60 Kips
23.99 ft	54.47 Kips	2.52 Kips	56.99 Kips
24.01 ft	54.55 Kips	2.62 Kips	57.17 Kips
33.01 ft	91.60 Kips	2.62 Kips	94.22 Kips
42.01 ft	129.30 Kips	2.62 Kips	131.92 Kips
51.01 ft	166.68 Kips	2.62 Kips	169.30 Kips
58.49 ft	197.74 Kips	2.62 Kips	200.36 Kips
58.51 ft	197.82 Kips	2.45 Kips	200.28 Kips
67.51 ft	235.20 Kips	2.45 Kips	237.65 Kips
71.99 ft	253.80 Kips	2.45 Kips	256.26 Kips
72.01 ft	253.89 Kips	1.36 Kips	255.25 Kips
81.01 ft	296.31 Kips	1.36 Kips	297.66 Kips
89.99 ft	338.63 Kips	1.36 Kips	339.99 Kips

DRIVING - SKIN FRICTION

Depth	Soil Type	Effective Stress At Midpoint	Sliding Friction Angle	Adhesion	Skin Friction
0.01 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
8.69 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
8.70 ft	Cohesive	N/A	N/A	1057.43 psf	0.00 Kips
9.01 ft	Cohesive	N/A	N/A	1057.43 psf	1.08 Kips
18.01 ft	Cohesive	N/A	N/A	1075.51 psf	33.00 Kips
18.49 ft	Cohesive	N/A	N/A	1085.01 psf	35.01 Kips
18.51 ft	Cohesive	N/A	N/A	966.76 psf	35.08 Kips
23.99 ft	Cohesive	N/A	N/A	1073.37 psf	54.47 Kips
24.01 ft	Cohesive	N/A	N/A	1073.76 psf	54.55 Kips
33.01 ft	Cohesive	N/A	N/A	1248.85 psf	91.60 Kips
42.01 ft	Cohesive	N/A	N/A	1260.00 psf	129.30 Kips
51.01 ft	Cohesive	N/A	N/A	1260.00 psf	166.68 Kips
58.49 ft	Cohesive	N/A	N/A	1260.00 psf	197.74 Kips
58.51 ft	Cohesive	N/A	N/A	1260.00 psf	197.82 Kips
67.51 ft	Cohesive	N/A	N/A	1260.00 psf	235.20 Kips
71.99 ft	Cohesive	N/A	N/A	1260.00 psf	253.80 Kips
72.01 ft	Cohesive	N/A	N/A	1430.00 psf	253.89 Kips
81.01 ft	Cohesive	N/A	N/A	1430.00 psf	296.31 Kips
89.99 ft	Cohesive	N/A	N/A	1430.00 psf	338.63 Kips

DRIVING - END BEARING

Depth	Soil Type	Effective Stress At Tip	Bearing Cap. Factor	Limiting End Bearing	End Bearing
0.01 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
8.69 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
8.70 ft	Cohesive	N/A	N/A	N/A	1.85 Kips
9.01 ft	Cohesive	N/A	N/A	N/A	1.85 Kips
18.01 ft	Cohesive	N/A	N/A	N/A	1.85 Kips
18.49 ft	Cohesive	N/A	N/A	N/A	1.85 Kips
18.51 ft	Cohesive	N/A	N/A	N/A	2.52 Kips
23.99 ft	Cohesive	N/A	N/A	N/A	2.52 Kips
24.01 ft	Cohesive	N/A	N/A	N/A	2.62 Kips
33.01 ft	Cohesive	N/A	N/A	N/A	2.62 Kips
42.01 ft	Cohesive	N/A	N/A	N/A	2.62 Kips
51.01 ft	Cohesive	N/A	N/A	N/A	2.62 Kips
58.49 ft	Cohesive	N/A	N/A	N/A	2.62 Kips
58.51 ft	Cohesive	N/A	N/A	N/A	2.45 Kips
67.51 ft	Cohesive	N/A	N/A	N/A	2.45 Kips
71.99 ft	Cohesive	N/A	N/A	N/A	2.45 Kips
72.01 ft	Cohesive	N/A	N/A	N/A	1.36 Kips
81.01 ft	Cohesive	N/A	N/A	N/A	1.36 Kips
89.99 ft	Cohesive	N/A	N/A	N/A	1.36 Kips

DRIVING - SUMMARY OF CAPACITIES

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
8.69 ft	0.00 Kips	0.00 Kips	0.00 Kips
8.70 ft	0.00 Kips	1.85 Kips	1.85 Kips
9.01 ft	1.08 Kips	1.85 Kips	2.93 Kips
18.01 ft	33.00 Kips	1.85 Kips	34.85 Kips
18.49 ft	35.01 Kips	1.85 Kips	36.86 Kips
18.51 ft	35.08 Kips	2.52 Kips	37.60 Kips
23.99 ft	54.47 Kips	2.52 Kips	56.99 Kips
24.01 ft	54.55 Kips	2.62 Kips	57.17 Kips
33.01 ft	91.60 Kips	2.62 Kips	94.22 Kips
42.01 ft	129.30 Kips	2.62 Kips	131.92 Kips
51.01 ft	166.68 Kips	2.62 Kips	169.30 Kips
58.49 ft	197.74 Kips	2.62 Kips	200.36 Kips
58.51 ft	197.82 Kips	2.45 Kips	200.28 Kips
67.51 ft	235.20 Kips	2.45 Kips	237.65 Kips
71.99 ft	253.80 Kips	2.45 Kips	256.26 Kips
72.01 ft	253.89 Kips	1.36 Kips	255.25 Kips
81.01 ft	296.31 Kips	1.36 Kips	297.66 Kips
89.99 ft	338.63 Kips	1.36 Kips	339.99 Kips

ULTIMATE - SKIN FRICTION

Depth	Soil Type	Effective Stress At Midpoint	Sliding Friction Angle	Adhesion	Skin Friction
0.01 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
8.69 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
8.70 ft	Cohesive	N/A	N/A	1057.43 psf	0.00 Kips
9.01 ft	Cohesive	N/A	N/A	1057.43 psf	1.08 Kips
18.01 ft	Cohesive	N/A	N/A	1075.51 psf	33.00 Kips
18.49 ft	Cohesive	N/A	N/A	1085.01 psf	35.01 Kips
18.51 ft	Cohesive	N/A	N/A	966.76 psf	35.08 Kips
23.99 ft	Cohesive	N/A	N/A	1073.37 psf	54.47 Kips
24.01 ft	Cohesive	N/A	N/A	1073.76 psf	54.55 Kips
33.01 ft	Cohesive	N/A	N/A	1248.85 psf	91.60 Kips
42.01 ft	Cohesive	N/A	N/A	1260.00 psf	129.30 Kips
51.01 ft	Cohesive	N/A	N/A	1260.00 psf	166.68 Kips
58.49 ft	Cohesive	N/A	N/A	1260.00 psf	197.74 Kips
58.51 ft	Cohesive	N/A	N/A	1260.00 psf	197.82 Kips
67.51 ft	Cohesive	N/A	N/A	1260.00 psf	235.20 Kips
71.99 ft	Cohesive	N/A	N/A	1260.00 psf	253.80 Kips
72.01 ft	Cohesive	N/A	N/A	1430.00 psf	253.89 Kips
81.01 ft	Cohesive	N/A	N/A	1430.00 psf	296.31 Kips
89.99 ft	Cohesive	N/A	N/A	1430.00 psf	338.63 Kips

ULTIMATE - END BEARING

Depth	Soil Type	Effective Stress At Tip	Bearing Cap. Factor	Limiting End Bearing	End Bearing
0.01 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
8.69 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
8.70 ft	Cohesive	N/A	N/A	N/A	1.85 Kips
9.01 ft	Cohesive	N/A	N/A	N/A	1.85 Kips
18.01 ft	Cohesive	N/A	N/A	N/A	1.85 Kips
18.49 ft	Cohesive	N/A	N/A	N/A	1.85 Kips
18.51 ft	Cohesive	N/A	N/A	N/A	2.52 Kips
23.99 ft	Cohesive	N/A	N/A	N/A	2.52 Kips
24.01 ft	Cohesive	N/A	N/A	N/A	2.62 Kips
33.01 ft	Cohesive	N/A	N/A	N/A	2.62 Kips
42.01 ft	Cohesive	N/A	N/A	N/A	2.62 Kips
51.01 ft	Cohesive	N/A	N/A	N/A	2.62 Kips
58.49 ft	Cohesive	N/A	N/A	N/A	2.62 Kips
58.51 ft	Cohesive	N/A	N/A	N/A	2.45 Kips
67.51 ft	Cohesive	N/A	N/A	N/A	2.45 Kips
71.99 ft	Cohesive	N/A	N/A	N/A	2.45 Kips
72.01 ft	Cohesive	N/A	N/A	N/A	1.36 Kips
81.01 ft	Cohesive	N/A	N/A	N/A	1.36 Kips
89.99 ft	Cohesive	N/A	N/A	N/A	1.36 Kips

ULTIMATE - SUMMARY OF CAPACITIES

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
8.69 ft	0.00 Kips	0.00 Kips	0.00 Kips
8.70 ft	0.00 Kips	1.85 Kips	1.85 Kips
9.01 ft	1.08 Kips	1.85 Kips	2.93 Kips
18.01 ft	33.00 Kips	1.85 Kips	34.85 Kips
18.49 ft	35.01 Kips	1.85 Kips	36.86 Kips
18.51 ft	35.08 Kips	2.52 Kips	37.60 Kips
23.99 ft	54.47 Kips	2.52 Kips	56.99 Kips
24.01 ft	54.55 Kips	2.62 Kips	57.17 Kips
33.01 ft	91.60 Kips	2.62 Kips	94.22 Kips
42.01 ft	129.30 Kips	2.62 Kips	131.92 Kips
51.01 ft	166.68 Kips	2.62 Kips	169.30 Kips
58.49 ft	197.74 Kips	2.62 Kips	200.36 Kips
58.51 ft	197.82 Kips	2.45 Kips	200.28 Kips
67.51 ft	235.20 Kips	2.45 Kips	237.65 Kips
71.99 ft	253.80 Kips	2.45 Kips	256.26 Kips
72.01 ft	253.89 Kips	1.36 Kips	255.25 Kips
81.01 ft	296.31 Kips	1.36 Kips	297.66 Kips
89.99 ft	338.63 Kips	1.36 Kips	339.99 Kips

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DRIVEN 1.2

GENERAL PROJECT INFORMATION

Filename: T:\GEOTECH\DRIVEN\1852802\B-3.DVN
Project Name: 71-19-01 Project Date: 12/17/2019
Project Client: DGL
Computed By: IJH
Project Manager: IJH

PILE INFORMATION

Pile Type: H Pile - HP10X42
Top of Pile: 19.00 ft
Perimeter Analysis: Box
Tip Analysis: Pile Area

ULTIMATE CONSIDERATIONS

Water Table Depth At Time Of:	- Drilling:	50.00 ft
	- Driving/Restrike	50.00 ft
	- Ultimate:	50.00 ft
Ultimate Considerations:	- Local Scour:	0.00 ft
	- Long Term Scour:	0.00 ft
	- Soft Soil:	0.00 ft

ULTIMATE PROFILE

Layer	Type	Thickness	Driving Loss	Unit Weight	Strength	Ultimate Curve
1	Cohesive	18.50 ft	0.00%	125.00 pcf	2383.50 psf	T-79 Steel
2	Cohesive	5.50 ft	0.00%	125.00 pcf	3250.00 psf	T-79 Steel
3	Cohesive	34.50 ft	0.00%	125.00 pcf	3382.00 psf	T-79 Steel
4	Cohesive	13.50 ft	0.00%	125.00 pcf	3167.00 psf	T-79 Steel
5	Cohesive	18.00 ft	0.00%	125.00 pcf	1750.00 psf	T-79 Steel

RESTRIKE - SKIN FRICTION

Depth	Soil Type	Effective Stress At Midpoint	Sliding Friction Angle	Adhesion	Skin Friction
0.01 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
9.01 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
18.01 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
18.49 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
18.51 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
18.99 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
19.00 ft	Cohesive	N/A	N/A	976.29 psf	0.00 Kips
23.99 ft	Cohesive	N/A	N/A	1073.37 psf	17.65 Kips
24.01 ft	Cohesive	N/A	N/A	1073.76 psf	17.73 Kips
33.01 ft	Cohesive	N/A	N/A	1248.85 psf	54.78 Kips
42.01 ft	Cohesive	N/A	N/A	1260.00 psf	92.48 Kips
51.01 ft	Cohesive	N/A	N/A	1260.00 psf	129.86 Kips
58.49 ft	Cohesive	N/A	N/A	1260.00 psf	160.92 Kips
58.51 ft	Cohesive	N/A	N/A	1260.00 psf	161.00 Kips
67.51 ft	Cohesive	N/A	N/A	1260.00 psf	198.38 Kips
71.99 ft	Cohesive	N/A	N/A	1260.00 psf	216.98 Kips
72.01 ft	Cohesive	N/A	N/A	1430.00 psf	217.07 Kips
81.01 ft	Cohesive	N/A	N/A	1430.00 psf	259.49 Kips
89.99 ft	Cohesive	N/A	N/A	1430.00 psf	301.81 Kips

RESTRIKE - END BEARING

Depth	Soil Type	Effective Stress At Tip	Bearing Cap. Factor	Limiting End Bearing	End Bearing
0.01 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
9.01 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
18.01 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
18.49 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
18.51 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
18.99 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
19.00 ft	Cohesive	N/A	N/A	N/A	2.52 Kips
23.99 ft	Cohesive	N/A	N/A	N/A	2.52 Kips
24.01 ft	Cohesive	N/A	N/A	N/A	2.62 Kips
33.01 ft	Cohesive	N/A	N/A	N/A	2.62 Kips
42.01 ft	Cohesive	N/A	N/A	N/A	2.62 Kips
51.01 ft	Cohesive	N/A	N/A	N/A	2.62 Kips
58.49 ft	Cohesive	N/A	N/A	N/A	2.62 Kips
58.51 ft	Cohesive	N/A	N/A	N/A	2.45 Kips
67.51 ft	Cohesive	N/A	N/A	N/A	2.45 Kips
71.99 ft	Cohesive	N/A	N/A	N/A	2.45 Kips
72.01 ft	Cohesive	N/A	N/A	N/A	1.36 Kips
81.01 ft	Cohesive	N/A	N/A	N/A	1.36 Kips
89.99 ft	Cohesive	N/A	N/A	N/A	1.36 Kips

RESTRIKE - SUMMARY OF CAPACITIES

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
9.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
18.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
18.49 ft	0.00 Kips	0.00 Kips	0.00 Kips
18.51 ft	0.00 Kips	0.00 Kips	0.00 Kips
18.99 ft	0.00 Kips	0.00 Kips	0.00 Kips
19.00 ft	0.00 Kips	2.52 Kips	2.52 Kips
23.99 ft	17.65 Kips	2.52 Kips	20.17 Kips
24.01 ft	17.73 Kips	2.62 Kips	20.35 Kips
33.01 ft	54.78 Kips	2.62 Kips	57.40 Kips
42.01 ft	92.48 Kips	2.62 Kips	95.10 Kips
51.01 ft	129.86 Kips	2.62 Kips	132.48 Kips
58.49 ft	160.92 Kips	2.62 Kips	163.54 Kips
58.51 ft	161.00 Kips	2.45 Kips	163.46 Kips
67.51 ft	198.38 Kips	2.45 Kips	200.83 Kips
71.99 ft	216.98 Kips	2.45 Kips	219.44 Kips
72.01 ft	217.07 Kips	1.36 Kips	218.43 Kips
81.01 ft	259.49 Kips	1.36 Kips	260.84 Kips
89.99 ft	301.81 Kips	1.36 Kips	303.17 Kips

DRIVING - SKIN FRICTION

Depth	Soil Type	Effective Stress At Midpoint	Sliding Friction Angle	Adhesion	Skin Friction
0.01 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
9.01 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
18.01 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
18.49 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
18.51 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
18.99 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
19.00 ft	Cohesive	N/A	N/A	976.29 psf	0.00 Kips
23.99 ft	Cohesive	N/A	N/A	1073.37 psf	17.65 Kips
24.01 ft	Cohesive	N/A	N/A	1073.76 psf	17.73 Kips
33.01 ft	Cohesive	N/A	N/A	1248.85 psf	54.78 Kips
42.01 ft	Cohesive	N/A	N/A	1260.00 psf	92.48 Kips
51.01 ft	Cohesive	N/A	N/A	1260.00 psf	129.86 Kips
58.49 ft	Cohesive	N/A	N/A	1260.00 psf	160.92 Kips
58.51 ft	Cohesive	N/A	N/A	1260.00 psf	161.00 Kips
67.51 ft	Cohesive	N/A	N/A	1260.00 psf	198.38 Kips
71.99 ft	Cohesive	N/A	N/A	1260.00 psf	216.98 Kips
72.01 ft	Cohesive	N/A	N/A	1430.00 psf	217.07 Kips
81.01 ft	Cohesive	N/A	N/A	1430.00 psf	259.49 Kips
89.99 ft	Cohesive	N/A	N/A	1430.00 psf	301.81 Kips

DRIVING - END BEARING

Depth	Soil Type	Effective Stress At Tip	Bearing Cap. Factor	Limiting End Bearing	End Bearing
0.01 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
9.01 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
18.01 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
18.49 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
18.51 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
18.99 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
19.00 ft	Cohesive	N/A	N/A	N/A	2.52 Kips
23.99 ft	Cohesive	N/A	N/A	N/A	2.52 Kips
24.01 ft	Cohesive	N/A	N/A	N/A	2.62 Kips
33.01 ft	Cohesive	N/A	N/A	N/A	2.62 Kips
42.01 ft	Cohesive	N/A	N/A	N/A	2.62 Kips
51.01 ft	Cohesive	N/A	N/A	N/A	2.62 Kips
58.49 ft	Cohesive	N/A	N/A	N/A	2.62 Kips
58.51 ft	Cohesive	N/A	N/A	N/A	2.45 Kips
67.51 ft	Cohesive	N/A	N/A	N/A	2.45 Kips
71.99 ft	Cohesive	N/A	N/A	N/A	2.45 Kips
72.01 ft	Cohesive	N/A	N/A	N/A	1.36 Kips
81.01 ft	Cohesive	N/A	N/A	N/A	1.36 Kips
89.99 ft	Cohesive	N/A	N/A	N/A	1.36 Kips

DRIVING - SUMMARY OF CAPACITIES

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
9.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
18.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
18.49 ft	0.00 Kips	0.00 Kips	0.00 Kips
18.51 ft	0.00 Kips	0.00 Kips	0.00 Kips
18.99 ft	0.00 Kips	0.00 Kips	0.00 Kips
19.00 ft	0.00 Kips	2.52 Kips	2.52 Kips
23.99 ft	17.65 Kips	2.52 Kips	20.17 Kips
24.01 ft	17.73 Kips	2.62 Kips	20.35 Kips
33.01 ft	54.78 Kips	2.62 Kips	57.40 Kips
42.01 ft	92.48 Kips	2.62 Kips	95.10 Kips
51.01 ft	129.86 Kips	2.62 Kips	132.48 Kips
58.49 ft	160.92 Kips	2.62 Kips	163.54 Kips
58.51 ft	161.00 Kips	2.45 Kips	163.46 Kips
67.51 ft	198.38 Kips	2.45 Kips	200.83 Kips
71.99 ft	216.98 Kips	2.45 Kips	219.44 Kips
72.01 ft	217.07 Kips	1.36 Kips	218.43 Kips
81.01 ft	259.49 Kips	1.36 Kips	260.84 Kips
89.99 ft	301.81 Kips	1.36 Kips	303.17 Kips

ULTIMATE - SKIN FRICTION

Depth	Soil Type	Effective Stress At Midpoint	Sliding Friction Angle	Adhesion	Skin Friction
0.01 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
9.01 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
18.01 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
18.49 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
18.51 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
18.99 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
19.00 ft	Cohesive	N/A	N/A	976.29 psf	0.00 Kips
23.99 ft	Cohesive	N/A	N/A	1073.37 psf	17.65 Kips
24.01 ft	Cohesive	N/A	N/A	1073.76 psf	17.73 Kips
33.01 ft	Cohesive	N/A	N/A	1248.85 psf	54.78 Kips
42.01 ft	Cohesive	N/A	N/A	1260.00 psf	92.48 Kips
51.01 ft	Cohesive	N/A	N/A	1260.00 psf	129.86 Kips
58.49 ft	Cohesive	N/A	N/A	1260.00 psf	160.92 Kips
58.51 ft	Cohesive	N/A	N/A	1260.00 psf	161.00 Kips
67.51 ft	Cohesive	N/A	N/A	1260.00 psf	198.38 Kips
71.99 ft	Cohesive	N/A	N/A	1260.00 psf	216.98 Kips
72.01 ft	Cohesive	N/A	N/A	1430.00 psf	217.07 Kips
81.01 ft	Cohesive	N/A	N/A	1430.00 psf	259.49 Kips
89.99 ft	Cohesive	N/A	N/A	1430.00 psf	301.81 Kips

ULTIMATE - END BEARING

Depth	Soil Type	Effective Stress At Tip	Bearing Cap. Factor	Limiting End Bearing	End Bearing
0.01 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
9.01 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
18.01 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
18.49 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
18.51 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
18.99 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
19.00 ft	Cohesive	N/A	N/A	N/A	2.52 Kips
23.99 ft	Cohesive	N/A	N/A	N/A	2.52 Kips
24.01 ft	Cohesive	N/A	N/A	N/A	2.62 Kips
33.01 ft	Cohesive	N/A	N/A	N/A	2.62 Kips
42.01 ft	Cohesive	N/A	N/A	N/A	2.62 Kips
51.01 ft	Cohesive	N/A	N/A	N/A	2.62 Kips
58.49 ft	Cohesive	N/A	N/A	N/A	2.62 Kips
58.51 ft	Cohesive	N/A	N/A	N/A	2.45 Kips
67.51 ft	Cohesive	N/A	N/A	N/A	2.45 Kips
71.99 ft	Cohesive	N/A	N/A	N/A	2.45 Kips
72.01 ft	Cohesive	N/A	N/A	N/A	1.36 Kips
81.01 ft	Cohesive	N/A	N/A	N/A	1.36 Kips
89.99 ft	Cohesive	N/A	N/A	N/A	1.36 Kips

ULTIMATE - SUMMARY OF CAPACITIES

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
9.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
18.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
18.49 ft	0.00 Kips	0.00 Kips	0.00 Kips
18.51 ft	0.00 Kips	0.00 Kips	0.00 Kips
18.99 ft	0.00 Kips	0.00 Kips	0.00 Kips
19.00 ft	0.00 Kips	2.52 Kips	2.52 Kips
23.99 ft	17.65 Kips	2.52 Kips	20.17 Kips
24.01 ft	17.73 Kips	2.62 Kips	20.35 Kips
33.01 ft	54.78 Kips	2.62 Kips	57.40 Kips
42.01 ft	92.48 Kips	2.62 Kips	95.10 Kips
51.01 ft	129.86 Kips	2.62 Kips	132.48 Kips
58.49 ft	160.92 Kips	2.62 Kips	163.54 Kips
58.51 ft	161.00 Kips	2.45 Kips	163.46 Kips
67.51 ft	198.38 Kips	2.45 Kips	200.83 Kips
71.99 ft	216.98 Kips	2.45 Kips	219.44 Kips
72.01 ft	217.07 Kips	1.36 Kips	218.43 Kips
81.01 ft	259.49 Kips	1.36 Kips	260.84 Kips
89.99 ft	301.81 Kips	1.36 Kips	303.17 Kips

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DRIVEN 1.2

GENERAL PROJECT INFORMATION

Filename: T:\GEOTECH\DRIVEN\1852802\B-4.DVN
Project Name: 71-19-01 Project Date: 12/17/2019
Project Client: DGL
Computed By: IJH
Project Manager: IJH

PILE INFORMATION

Pile Type: H Pile - HP10X42
Top of Pile: 1.00 ft
Perimeter Analysis: Box
Tip Analysis: Pile Area

ULTIMATE CONSIDERATIONS

Water Table Depth At Time Of:	- Drilling:	50.00 ft
	- Driving/Restrike	50.00 ft
	- Ultimate:	50.00 ft
Ultimate Considerations:	- Local Scour:	0.00 ft
	- Long Term Scour:	0.00 ft
	- Soft Soil:	0.00 ft

ULTIMATE PROFILE

Layer	Type	Thickness	Driving Loss	Unit Weight	Strength	Ultimate Curve
1	Cohesive	18.50 ft	0.00%	125.00 pcf	1711.00 psf	T-79 Steel
2	Cohesive	40.00 ft	0.00%	125.00 pcf	3798.00 psf	T-79 Steel
3	Cohesive	10.00 ft	0.00%	125.00 pcf	3875.00 psf	T-79 Steel
4	Cohesive	11.50 ft	0.00%	125.00 pcf	3000.00 psf	T-79 Steel

RESTRIKE - SKIN FRICTION

Depth	Soil Type	Effective Stress At Midpoint	Sliding Friction Angle	Adhesion	Skin Friction
0.01 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
0.99 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
1.00 ft	Cohesive	N/A	N/A	1124.40 psf	0.00 Kips
9.01 ft	Cohesive	N/A	N/A	1124.40 psf	29.68 Kips
18.01 ft	Cohesive	N/A	N/A	1222.25 psf	68.52 Kips
18.49 ft	Cohesive	N/A	N/A	1227.70 psf	70.77 Kips
18.51 ft	Cohesive	N/A	N/A	966.76 psf	70.85 Kips
27.51 ft	Cohesive	N/A	N/A	1141.85 psf	104.72 Kips
36.51 ft	Cohesive	N/A	N/A	1260.00 psf	145.61 Kips
45.51 ft	Cohesive	N/A	N/A	1260.00 psf	182.98 Kips
54.51 ft	Cohesive	N/A	N/A	1260.00 psf	220.36 Kips
58.49 ft	Cohesive	N/A	N/A	1260.00 psf	236.89 Kips
58.51 ft	Cohesive	N/A	N/A	1260.00 psf	236.97 Kips
67.51 ft	Cohesive	N/A	N/A	1260.00 psf	274.34 Kips
68.49 ft	Cohesive	N/A	N/A	1260.00 psf	278.41 Kips
68.51 ft	Cohesive	N/A	N/A	1300.00 psf	278.50 Kips
77.51 ft	Cohesive	N/A	N/A	1300.00 psf	317.06 Kips
79.99 ft	Cohesive	N/A	N/A	1300.00 psf	327.68 Kips

RESTRIKE - END BEARING

Depth	Soil Type	Effective Stress At Tip	Bearing Cap. Factor	Limiting End Bearing	End Bearing
0.01 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
0.99 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
1.00 ft	Cohesive	N/A	N/A	N/A	1.33 Kips
9.01 ft	Cohesive	N/A	N/A	N/A	1.33 Kips
18.01 ft	Cohesive	N/A	N/A	N/A	1.33 Kips
18.49 ft	Cohesive	N/A	N/A	N/A	1.33 Kips
18.51 ft	Cohesive	N/A	N/A	N/A	2.94 Kips
27.51 ft	Cohesive	N/A	N/A	N/A	2.94 Kips
36.51 ft	Cohesive	N/A	N/A	N/A	2.94 Kips
45.51 ft	Cohesive	N/A	N/A	N/A	2.94 Kips
54.51 ft	Cohesive	N/A	N/A	N/A	2.94 Kips
58.49 ft	Cohesive	N/A	N/A	N/A	2.94 Kips
58.51 ft	Cohesive	N/A	N/A	N/A	3.00 Kips
67.51 ft	Cohesive	N/A	N/A	N/A	3.00 Kips
68.49 ft	Cohesive	N/A	N/A	N/A	3.00 Kips
68.51 ft	Cohesive	N/A	N/A	N/A	2.32 Kips
77.51 ft	Cohesive	N/A	N/A	N/A	2.32 Kips
79.99 ft	Cohesive	N/A	N/A	N/A	2.32 Kips

RESTRIKE - SUMMARY OF CAPACITIES

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
0.99 ft	0.00 Kips	0.00 Kips	0.00 Kips
1.00 ft	0.00 Kips	1.33 Kips	1.33 Kips
9.01 ft	29.68 Kips	1.33 Kips	31.01 Kips
18.01 ft	68.52 Kips	1.33 Kips	69.85 Kips
18.49 ft	70.77 Kips	1.33 Kips	72.10 Kips
18.51 ft	70.85 Kips	2.94 Kips	73.79 Kips
27.51 ft	104.72 Kips	2.94 Kips	107.67 Kips
36.51 ft	145.61 Kips	2.94 Kips	148.55 Kips
45.51 ft	182.98 Kips	2.94 Kips	185.93 Kips
54.51 ft	220.36 Kips	2.94 Kips	223.30 Kips
58.49 ft	236.89 Kips	2.94 Kips	239.83 Kips
58.51 ft	236.97 Kips	3.00 Kips	239.97 Kips
67.51 ft	274.34 Kips	3.00 Kips	277.35 Kips
68.49 ft	278.41 Kips	3.00 Kips	281.42 Kips
68.51 ft	278.50 Kips	2.32 Kips	280.82 Kips
77.51 ft	317.06 Kips	2.32 Kips	319.38 Kips
79.99 ft	327.68 Kips	2.32 Kips	330.01 Kips

DRIVING - SKIN FRICTION

Depth	Soil Type	Effective Stress At Midpoint	Sliding Friction Angle	Adhesion	Skin Friction
0.01 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
0.99 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
1.00 ft	Cohesive	N/A	N/A	1124.40 psf	0.00 Kips
9.01 ft	Cohesive	N/A	N/A	1124.40 psf	29.68 Kips
18.01 ft	Cohesive	N/A	N/A	1222.25 psf	68.52 Kips
18.49 ft	Cohesive	N/A	N/A	1227.70 psf	70.77 Kips
18.51 ft	Cohesive	N/A	N/A	966.76 psf	70.85 Kips
27.51 ft	Cohesive	N/A	N/A	1141.85 psf	104.72 Kips
36.51 ft	Cohesive	N/A	N/A	1260.00 psf	145.61 Kips
45.51 ft	Cohesive	N/A	N/A	1260.00 psf	182.98 Kips
54.51 ft	Cohesive	N/A	N/A	1260.00 psf	220.36 Kips
58.49 ft	Cohesive	N/A	N/A	1260.00 psf	236.89 Kips
58.51 ft	Cohesive	N/A	N/A	1260.00 psf	236.97 Kips
67.51 ft	Cohesive	N/A	N/A	1260.00 psf	274.34 Kips
68.49 ft	Cohesive	N/A	N/A	1260.00 psf	278.41 Kips
68.51 ft	Cohesive	N/A	N/A	1300.00 psf	278.50 Kips
77.51 ft	Cohesive	N/A	N/A	1300.00 psf	317.06 Kips
79.99 ft	Cohesive	N/A	N/A	1300.00 psf	327.68 Kips

DRIVING - END BEARING

Depth	Soil Type	Effective Stress At Tip	Bearing Cap. Factor	Limiting End Bearing	End Bearing
0.01 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
0.99 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
1.00 ft	Cohesive	N/A	N/A	N/A	1.33 Kips
9.01 ft	Cohesive	N/A	N/A	N/A	1.33 Kips
18.01 ft	Cohesive	N/A	N/A	N/A	1.33 Kips
18.49 ft	Cohesive	N/A	N/A	N/A	1.33 Kips
18.51 ft	Cohesive	N/A	N/A	N/A	2.94 Kips
27.51 ft	Cohesive	N/A	N/A	N/A	2.94 Kips
36.51 ft	Cohesive	N/A	N/A	N/A	2.94 Kips
45.51 ft	Cohesive	N/A	N/A	N/A	2.94 Kips
54.51 ft	Cohesive	N/A	N/A	N/A	2.94 Kips
58.49 ft	Cohesive	N/A	N/A	N/A	2.94 Kips
58.51 ft	Cohesive	N/A	N/A	N/A	3.00 Kips
67.51 ft	Cohesive	N/A	N/A	N/A	3.00 Kips
68.49 ft	Cohesive	N/A	N/A	N/A	3.00 Kips
68.51 ft	Cohesive	N/A	N/A	N/A	2.32 Kips
77.51 ft	Cohesive	N/A	N/A	N/A	2.32 Kips
79.99 ft	Cohesive	N/A	N/A	N/A	2.32 Kips

DRIVING - SUMMARY OF CAPACITIES

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
0.99 ft	0.00 Kips	0.00 Kips	0.00 Kips
1.00 ft	0.00 Kips	1.33 Kips	1.33 Kips
9.01 ft	29.68 Kips	1.33 Kips	31.01 Kips
18.01 ft	68.52 Kips	1.33 Kips	69.85 Kips
18.49 ft	70.77 Kips	1.33 Kips	72.10 Kips
18.51 ft	70.85 Kips	2.94 Kips	73.79 Kips
27.51 ft	104.72 Kips	2.94 Kips	107.67 Kips
36.51 ft	145.61 Kips	2.94 Kips	148.55 Kips
45.51 ft	182.98 Kips	2.94 Kips	185.93 Kips
54.51 ft	220.36 Kips	2.94 Kips	223.30 Kips
58.49 ft	236.89 Kips	2.94 Kips	239.83 Kips
58.51 ft	236.97 Kips	3.00 Kips	239.97 Kips
67.51 ft	274.34 Kips	3.00 Kips	277.35 Kips
68.49 ft	278.41 Kips	3.00 Kips	281.42 Kips
68.51 ft	278.50 Kips	2.32 Kips	280.82 Kips
77.51 ft	317.06 Kips	2.32 Kips	319.38 Kips
79.99 ft	327.68 Kips	2.32 Kips	330.01 Kips

ULTIMATE - SKIN FRICTION

Depth	Soil Type	Effective Stress At Midpoint	Sliding Friction Angle	Adhesion	Skin Friction
0.01 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
0.99 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
1.00 ft	Cohesive	N/A	N/A	1124.40 psf	0.00 Kips
9.01 ft	Cohesive	N/A	N/A	1124.40 psf	29.68 Kips
18.01 ft	Cohesive	N/A	N/A	1222.25 psf	68.52 Kips
18.49 ft	Cohesive	N/A	N/A	1227.70 psf	70.77 Kips
18.51 ft	Cohesive	N/A	N/A	966.76 psf	70.85 Kips
27.51 ft	Cohesive	N/A	N/A	1141.85 psf	104.72 Kips
36.51 ft	Cohesive	N/A	N/A	1260.00 psf	145.61 Kips
45.51 ft	Cohesive	N/A	N/A	1260.00 psf	182.98 Kips
54.51 ft	Cohesive	N/A	N/A	1260.00 psf	220.36 Kips
58.49 ft	Cohesive	N/A	N/A	1260.00 psf	236.89 Kips
58.51 ft	Cohesive	N/A	N/A	1260.00 psf	236.97 Kips
67.51 ft	Cohesive	N/A	N/A	1260.00 psf	274.34 Kips
68.49 ft	Cohesive	N/A	N/A	1260.00 psf	278.41 Kips
68.51 ft	Cohesive	N/A	N/A	1300.00 psf	278.50 Kips
77.51 ft	Cohesive	N/A	N/A	1300.00 psf	317.06 Kips
79.99 ft	Cohesive	N/A	N/A	1300.00 psf	327.68 Kips

ULTIMATE - END BEARING

Depth	Soil Type	Effective Stress At Tip	Bearing Cap. Factor	Limiting End Bearing	End Bearing
0.01 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
0.99 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
1.00 ft	Cohesive	N/A	N/A	N/A	1.33 Kips
9.01 ft	Cohesive	N/A	N/A	N/A	1.33 Kips
18.01 ft	Cohesive	N/A	N/A	N/A	1.33 Kips
18.49 ft	Cohesive	N/A	N/A	N/A	1.33 Kips
18.51 ft	Cohesive	N/A	N/A	N/A	2.94 Kips
27.51 ft	Cohesive	N/A	N/A	N/A	2.94 Kips
36.51 ft	Cohesive	N/A	N/A	N/A	2.94 Kips
45.51 ft	Cohesive	N/A	N/A	N/A	2.94 Kips
54.51 ft	Cohesive	N/A	N/A	N/A	2.94 Kips
58.49 ft	Cohesive	N/A	N/A	N/A	2.94 Kips
58.51 ft	Cohesive	N/A	N/A	N/A	3.00 Kips
67.51 ft	Cohesive	N/A	N/A	N/A	3.00 Kips
68.49 ft	Cohesive	N/A	N/A	N/A	3.00 Kips
68.51 ft	Cohesive	N/A	N/A	N/A	2.32 Kips
77.51 ft	Cohesive	N/A	N/A	N/A	2.32 Kips
79.99 ft	Cohesive	N/A	N/A	N/A	2.32 Kips

ULTIMATE - SUMMARY OF CAPACITIES

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
0.99 ft	0.00 Kips	0.00 Kips	0.00 Kips
1.00 ft	0.00 Kips	1.33 Kips	1.33 Kips
9.01 ft	29.68 Kips	1.33 Kips	31.01 Kips
18.01 ft	68.52 Kips	1.33 Kips	69.85 Kips
18.49 ft	70.77 Kips	1.33 Kips	72.10 Kips
18.51 ft	70.85 Kips	2.94 Kips	73.79 Kips
27.51 ft	104.72 Kips	2.94 Kips	107.67 Kips
36.51 ft	145.61 Kips	2.94 Kips	148.55 Kips
45.51 ft	182.98 Kips	2.94 Kips	185.93 Kips
54.51 ft	220.36 Kips	2.94 Kips	223.30 Kips
58.49 ft	236.89 Kips	2.94 Kips	239.83 Kips
58.51 ft	236.97 Kips	3.00 Kips	239.97 Kips
67.51 ft	274.34 Kips	3.00 Kips	277.35 Kips
68.49 ft	278.41 Kips	3.00 Kips	281.42 Kips
68.51 ft	278.50 Kips	2.32 Kips	280.82 Kips
77.51 ft	317.06 Kips	2.32 Kips	319.38 Kips
79.99 ft	327.68 Kips	2.32 Kips	330.01 Kips

Filename: T:\GEOTECH\DRIVEN\1852802\B-4.DVN

DRIVEN 1.2

GENERAL PROJECT INFORMATION

Filename: T:\GEOTECH\DRIVEN\1852802\B-4.DVN
Project Name: 71-19-01 Project Date: 12/17/2019
Project Client: DGL
Computed By: IJH
Project Manager: IJH

PILE INFORMATION

Pile Type: H Pile - HP10X42
Top of Pile: 6.25 ft
Perimeter Analysis: Box
Tip Analysis: Pile Area

ULTIMATE CONSIDERATIONS

Water Table Depth At Time Of:	- Drilling:	50.00 ft
	- Driving/Restrike	50.00 ft
	- Ultimate:	50.00 ft
Ultimate Considerations:	- Local Scour:	0.00 ft
	- Long Term Scour:	0.00 ft
	- Soft Soil:	0.00 ft

ULTIMATE PROFILE

Layer	Type	Thickness	Driving Loss	Unit Weight	Strength	Ultimate Curve
1	Cohesive	18.50 ft	0.00%	125.00 pcf	1711.00 psf	T-79 Steel
2	Cohesive	40.00 ft	0.00%	125.00 pcf	3798.00 psf	T-79 Steel
3	Cohesive	10.00 ft	0.00%	125.00 pcf	3875.00 psf	T-79 Steel
4	Cohesive	11.50 ft	0.00%	125.00 pcf	3000.00 psf	T-79 Steel

RESTRIKE - SKIN FRICTION

Depth	Soil Type	Effective Stress At Midpoint	Sliding Friction Angle	Adhesion	Skin Friction
0.01 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
6.24 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
6.25 ft	Cohesive	N/A	N/A	1124.40 psf	0.00 Kips
9.01 ft	Cohesive	N/A	N/A	1124.40 psf	10.23 Kips
18.01 ft	Cohesive	N/A	N/A	1162.61 psf	45.06 Kips
18.49 ft	Cohesive	N/A	N/A	1168.07 psf	47.12 Kips
18.51 ft	Cohesive	N/A	N/A	966.76 psf	47.20 Kips
27.51 ft	Cohesive	N/A	N/A	1141.85 psf	81.07 Kips
36.51 ft	Cohesive	N/A	N/A	1260.00 psf	121.96 Kips
45.51 ft	Cohesive	N/A	N/A	1260.00 psf	159.33 Kips
54.51 ft	Cohesive	N/A	N/A	1260.00 psf	196.70 Kips
58.49 ft	Cohesive	N/A	N/A	1260.00 psf	213.23 Kips
58.51 ft	Cohesive	N/A	N/A	1260.00 psf	213.32 Kips
67.51 ft	Cohesive	N/A	N/A	1260.00 psf	250.69 Kips
68.49 ft	Cohesive	N/A	N/A	1260.00 psf	254.76 Kips
68.51 ft	Cohesive	N/A	N/A	1300.00 psf	254.84 Kips
77.51 ft	Cohesive	N/A	N/A	1300.00 psf	293.41 Kips
79.99 ft	Cohesive	N/A	N/A	1300.00 psf	304.03 Kips

RESTRIKE - END BEARING

Depth	Soil Type	Effective Stress At Tip	Bearing Cap. Factor	Limiting End Bearing	End Bearing
0.01 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
6.24 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
6.25 ft	Cohesive	N/A	N/A	N/A	1.33 Kips
9.01 ft	Cohesive	N/A	N/A	N/A	1.33 Kips
18.01 ft	Cohesive	N/A	N/A	N/A	1.33 Kips
18.49 ft	Cohesive	N/A	N/A	N/A	1.33 Kips
18.51 ft	Cohesive	N/A	N/A	N/A	2.94 Kips
27.51 ft	Cohesive	N/A	N/A	N/A	2.94 Kips
36.51 ft	Cohesive	N/A	N/A	N/A	2.94 Kips
45.51 ft	Cohesive	N/A	N/A	N/A	2.94 Kips
54.51 ft	Cohesive	N/A	N/A	N/A	2.94 Kips
58.49 ft	Cohesive	N/A	N/A	N/A	2.94 Kips
58.51 ft	Cohesive	N/A	N/A	N/A	3.00 Kips
67.51 ft	Cohesive	N/A	N/A	N/A	3.00 Kips
68.49 ft	Cohesive	N/A	N/A	N/A	3.00 Kips
68.51 ft	Cohesive	N/A	N/A	N/A	2.32 Kips
77.51 ft	Cohesive	N/A	N/A	N/A	2.32 Kips
79.99 ft	Cohesive	N/A	N/A	N/A	2.32 Kips

RESTRIKE - SUMMARY OF CAPACITIES

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
6.24 ft	0.00 Kips	0.00 Kips	0.00 Kips
6.25 ft	0.00 Kips	1.33 Kips	1.33 Kips
9.01 ft	10.23 Kips	1.33 Kips	11.55 Kips
18.01 ft	45.06 Kips	1.33 Kips	46.39 Kips
18.49 ft	47.12 Kips	1.33 Kips	48.45 Kips
18.51 ft	47.20 Kips	2.94 Kips	50.14 Kips
27.51 ft	81.07 Kips	2.94 Kips	84.02 Kips
36.51 ft	121.96 Kips	2.94 Kips	124.90 Kips
45.51 ft	159.33 Kips	2.94 Kips	162.27 Kips
54.51 ft	196.70 Kips	2.94 Kips	199.65 Kips
58.49 ft	213.23 Kips	2.94 Kips	216.18 Kips
58.51 ft	213.32 Kips	3.00 Kips	216.32 Kips
67.51 ft	250.69 Kips	3.00 Kips	253.69 Kips
68.49 ft	254.76 Kips	3.00 Kips	257.76 Kips
68.51 ft	254.84 Kips	2.32 Kips	257.17 Kips
77.51 ft	293.41 Kips	2.32 Kips	295.73 Kips
79.99 ft	304.03 Kips	2.32 Kips	306.36 Kips

DRIVING - SKIN FRICTION

Depth	Soil Type	Effective Stress At Midpoint	Sliding Friction Angle	Adhesion	Skin Friction
0.01 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
6.24 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
6.25 ft	Cohesive	N/A	N/A	1124.40 psf	0.00 Kips
9.01 ft	Cohesive	N/A	N/A	1124.40 psf	10.23 Kips
18.01 ft	Cohesive	N/A	N/A	1162.61 psf	45.06 Kips
18.49 ft	Cohesive	N/A	N/A	1168.07 psf	47.12 Kips
18.51 ft	Cohesive	N/A	N/A	966.76 psf	47.20 Kips
27.51 ft	Cohesive	N/A	N/A	1141.85 psf	81.07 Kips
36.51 ft	Cohesive	N/A	N/A	1260.00 psf	121.96 Kips
45.51 ft	Cohesive	N/A	N/A	1260.00 psf	159.33 Kips
54.51 ft	Cohesive	N/A	N/A	1260.00 psf	196.70 Kips
58.49 ft	Cohesive	N/A	N/A	1260.00 psf	213.23 Kips
58.51 ft	Cohesive	N/A	N/A	1260.00 psf	213.32 Kips
67.51 ft	Cohesive	N/A	N/A	1260.00 psf	250.69 Kips
68.49 ft	Cohesive	N/A	N/A	1260.00 psf	254.76 Kips
68.51 ft	Cohesive	N/A	N/A	1300.00 psf	254.84 Kips
77.51 ft	Cohesive	N/A	N/A	1300.00 psf	293.41 Kips
79.99 ft	Cohesive	N/A	N/A	1300.00 psf	304.03 Kips

DRIVING - END BEARING

Depth	Soil Type	Effective Stress At Tip	Bearing Cap. Factor	Limiting End Bearing	End Bearing
0.01 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
6.24 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
6.25 ft	Cohesive	N/A	N/A	N/A	1.33 Kips
9.01 ft	Cohesive	N/A	N/A	N/A	1.33 Kips
18.01 ft	Cohesive	N/A	N/A	N/A	1.33 Kips
18.49 ft	Cohesive	N/A	N/A	N/A	1.33 Kips
18.51 ft	Cohesive	N/A	N/A	N/A	2.94 Kips
27.51 ft	Cohesive	N/A	N/A	N/A	2.94 Kips
36.51 ft	Cohesive	N/A	N/A	N/A	2.94 Kips
45.51 ft	Cohesive	N/A	N/A	N/A	2.94 Kips
54.51 ft	Cohesive	N/A	N/A	N/A	2.94 Kips
58.49 ft	Cohesive	N/A	N/A	N/A	2.94 Kips
58.51 ft	Cohesive	N/A	N/A	N/A	3.00 Kips
67.51 ft	Cohesive	N/A	N/A	N/A	3.00 Kips
68.49 ft	Cohesive	N/A	N/A	N/A	3.00 Kips
68.51 ft	Cohesive	N/A	N/A	N/A	2.32 Kips
77.51 ft	Cohesive	N/A	N/A	N/A	2.32 Kips
79.99 ft	Cohesive	N/A	N/A	N/A	2.32 Kips

DRIVING - SUMMARY OF CAPACITIES

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
6.24 ft	0.00 Kips	0.00 Kips	0.00 Kips
6.25 ft	0.00 Kips	1.33 Kips	1.33 Kips
9.01 ft	10.23 Kips	1.33 Kips	11.55 Kips
18.01 ft	45.06 Kips	1.33 Kips	46.39 Kips
18.49 ft	47.12 Kips	1.33 Kips	48.45 Kips
18.51 ft	47.20 Kips	2.94 Kips	50.14 Kips
27.51 ft	81.07 Kips	2.94 Kips	84.02 Kips
36.51 ft	121.96 Kips	2.94 Kips	124.90 Kips
45.51 ft	159.33 Kips	2.94 Kips	162.27 Kips
54.51 ft	196.70 Kips	2.94 Kips	199.65 Kips
58.49 ft	213.23 Kips	2.94 Kips	216.18 Kips
58.51 ft	213.32 Kips	3.00 Kips	216.32 Kips
67.51 ft	250.69 Kips	3.00 Kips	253.69 Kips
68.49 ft	254.76 Kips	3.00 Kips	257.76 Kips
68.51 ft	254.84 Kips	2.32 Kips	257.17 Kips
77.51 ft	293.41 Kips	2.32 Kips	295.73 Kips
79.99 ft	304.03 Kips	2.32 Kips	306.36 Kips

ULTIMATE - SKIN FRICTION

Depth	Soil Type	Effective Stress At Midpoint	Sliding Friction Angle	Adhesion	Skin Friction
0.01 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
6.24 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
6.25 ft	Cohesive	N/A	N/A	1124.40 psf	0.00 Kips
9.01 ft	Cohesive	N/A	N/A	1124.40 psf	10.23 Kips
18.01 ft	Cohesive	N/A	N/A	1162.61 psf	45.06 Kips
18.49 ft	Cohesive	N/A	N/A	1168.07 psf	47.12 Kips
18.51 ft	Cohesive	N/A	N/A	966.76 psf	47.20 Kips
27.51 ft	Cohesive	N/A	N/A	1141.85 psf	81.07 Kips
36.51 ft	Cohesive	N/A	N/A	1260.00 psf	121.96 Kips
45.51 ft	Cohesive	N/A	N/A	1260.00 psf	159.33 Kips
54.51 ft	Cohesive	N/A	N/A	1260.00 psf	196.70 Kips
58.49 ft	Cohesive	N/A	N/A	1260.00 psf	213.23 Kips
58.51 ft	Cohesive	N/A	N/A	1260.00 psf	213.32 Kips
67.51 ft	Cohesive	N/A	N/A	1260.00 psf	250.69 Kips
68.49 ft	Cohesive	N/A	N/A	1260.00 psf	254.76 Kips
68.51 ft	Cohesive	N/A	N/A	1300.00 psf	254.84 Kips
77.51 ft	Cohesive	N/A	N/A	1300.00 psf	293.41 Kips
79.99 ft	Cohesive	N/A	N/A	1300.00 psf	304.03 Kips

ULTIMATE - END BEARING

Depth	Soil Type	Effective Stress At Tip	Bearing Cap. Factor	Limiting End Bearing	End Bearing
0.01 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
6.24 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
6.25 ft	Cohesive	N/A	N/A	N/A	1.33 Kips
9.01 ft	Cohesive	N/A	N/A	N/A	1.33 Kips
18.01 ft	Cohesive	N/A	N/A	N/A	1.33 Kips
18.49 ft	Cohesive	N/A	N/A	N/A	1.33 Kips
18.51 ft	Cohesive	N/A	N/A	N/A	2.94 Kips
27.51 ft	Cohesive	N/A	N/A	N/A	2.94 Kips
36.51 ft	Cohesive	N/A	N/A	N/A	2.94 Kips
45.51 ft	Cohesive	N/A	N/A	N/A	2.94 Kips
54.51 ft	Cohesive	N/A	N/A	N/A	2.94 Kips
58.49 ft	Cohesive	N/A	N/A	N/A	2.94 Kips
58.51 ft	Cohesive	N/A	N/A	N/A	3.00 Kips
67.51 ft	Cohesive	N/A	N/A	N/A	3.00 Kips
68.49 ft	Cohesive	N/A	N/A	N/A	3.00 Kips
68.51 ft	Cohesive	N/A	N/A	N/A	2.32 Kips
77.51 ft	Cohesive	N/A	N/A	N/A	2.32 Kips
79.99 ft	Cohesive	N/A	N/A	N/A	2.32 Kips

ULTIMATE - SUMMARY OF CAPACITIES

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
6.24 ft	0.00 Kips	0.00 Kips	0.00 Kips
6.25 ft	0.00 Kips	1.33 Kips	1.33 Kips
9.01 ft	10.23 Kips	1.33 Kips	11.55 Kips
18.01 ft	45.06 Kips	1.33 Kips	46.39 Kips
18.49 ft	47.12 Kips	1.33 Kips	48.45 Kips
18.51 ft	47.20 Kips	2.94 Kips	50.14 Kips
27.51 ft	81.07 Kips	2.94 Kips	84.02 Kips
36.51 ft	121.96 Kips	2.94 Kips	124.90 Kips
45.51 ft	159.33 Kips	2.94 Kips	162.27 Kips
54.51 ft	196.70 Kips	2.94 Kips	199.65 Kips
58.49 ft	213.23 Kips	2.94 Kips	216.18 Kips
58.51 ft	213.32 Kips	3.00 Kips	216.32 Kips
67.51 ft	250.69 Kips	3.00 Kips	253.69 Kips
68.49 ft	254.76 Kips	3.00 Kips	257.76 Kips
68.51 ft	254.84 Kips	2.32 Kips	257.17 Kips
77.51 ft	293.41 Kips	2.32 Kips	295.73 Kips
79.99 ft	304.03 Kips	2.32 Kips	306.36 Kips

Filename: T:\GEOTECH\DRIVEN\1852802\B-4.DVN

DRIVEN 1.2

GENERAL PROJECT INFORMATION

Filename: T:\GEOTECH\DRIVEN\1852802\B-4.DVN
Project Name: 71-19-01 Project Date: 12/17/2019
Project Client: DGL
Computed By: IJH
Project Manager: IJH

PILE INFORMATION

Pile Type: H Pile - HP10X42
Top of Pile: 16.00 ft
Perimeter Analysis: Box
Tip Analysis: Pile Area

ULTIMATE CONSIDERATIONS

Water Table Depth At Time Of:	- Drilling:	50.00 ft
	- Driving/Restrike	50.00 ft
	- Ultimate:	50.00 ft
Ultimate Considerations:	- Local Scour:	0.00 ft
	- Long Term Scour:	0.00 ft
	- Soft Soil:	0.00 ft

ULTIMATE PROFILE

Layer	Type	Thickness	Driving Loss	Unit Weight	Strength	Ultimate Curve
1	Cohesive	18.50 ft	0.00%	125.00 pcf	1711.00 psf	T-79 Steel
2	Cohesive	40.00 ft	0.00%	125.00 pcf	3798.00 psf	T-79 Steel
3	Cohesive	10.00 ft	0.00%	125.00 pcf	3875.00 psf	T-79 Steel
4	Cohesive	11.50 ft	0.00%	125.00 pcf	3000.00 psf	T-79 Steel

RESTRIKE - SKIN FRICTION

Depth	Soil Type	Effective Stress At Midpoint	Sliding Friction Angle	Adhesion	Skin Friction
0.01 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
9.01 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
15.99 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
16.00 ft	Cohesive	N/A	N/A	1124.40 psf	0.00 Kips
18.01 ft	Cohesive	N/A	N/A	1124.40 psf	7.45 Kips
18.49 ft	Cohesive	N/A	N/A	1124.40 psf	9.23 Kips
18.51 ft	Cohesive	N/A	N/A	966.76 psf	9.30 Kips
27.51 ft	Cohesive	N/A	N/A	1141.85 psf	43.17 Kips
36.51 ft	Cohesive	N/A	N/A	1260.00 psf	84.06 Kips
45.51 ft	Cohesive	N/A	N/A	1260.00 psf	121.43 Kips
54.51 ft	Cohesive	N/A	N/A	1260.00 psf	158.81 Kips
58.49 ft	Cohesive	N/A	N/A	1260.00 psf	175.33 Kips
58.51 ft	Cohesive	N/A	N/A	1260.00 psf	175.42 Kips
67.51 ft	Cohesive	N/A	N/A	1260.00 psf	212.79 Kips
68.49 ft	Cohesive	N/A	N/A	1260.00 psf	216.86 Kips
68.51 ft	Cohesive	N/A	N/A	1300.00 psf	216.94 Kips
77.51 ft	Cohesive	N/A	N/A	1300.00 psf	255.51 Kips
79.99 ft	Cohesive	N/A	N/A	1300.00 psf	266.13 Kips

RESTRIKE - END BEARING

Depth	Soil Type	Effective Stress At Tip	Bearing Cap. Factor	Limiting End Bearing	End Bearing
0.01 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
9.01 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
15.99 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
16.00 ft	Cohesive	N/A	N/A	N/A	1.33 Kips
18.01 ft	Cohesive	N/A	N/A	N/A	1.33 Kips
18.49 ft	Cohesive	N/A	N/A	N/A	1.33 Kips
18.51 ft	Cohesive	N/A	N/A	N/A	2.94 Kips
27.51 ft	Cohesive	N/A	N/A	N/A	2.94 Kips
36.51 ft	Cohesive	N/A	N/A	N/A	2.94 Kips
45.51 ft	Cohesive	N/A	N/A	N/A	2.94 Kips
54.51 ft	Cohesive	N/A	N/A	N/A	2.94 Kips
58.49 ft	Cohesive	N/A	N/A	N/A	2.94 Kips
58.51 ft	Cohesive	N/A	N/A	N/A	3.00 Kips
67.51 ft	Cohesive	N/A	N/A	N/A	3.00 Kips
68.49 ft	Cohesive	N/A	N/A	N/A	3.00 Kips
68.51 ft	Cohesive	N/A	N/A	N/A	2.32 Kips
77.51 ft	Cohesive	N/A	N/A	N/A	2.32 Kips
79.99 ft	Cohesive	N/A	N/A	N/A	2.32 Kips

RESTRIKE - SUMMARY OF CAPACITIES

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
9.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
15.99 ft	0.00 Kips	0.00 Kips	0.00 Kips
16.00 ft	0.00 Kips	1.33 Kips	1.33 Kips
18.01 ft	7.45 Kips	1.33 Kips	8.77 Kips
18.49 ft	9.23 Kips	1.33 Kips	10.55 Kips
18.51 ft	9.30 Kips	2.94 Kips	12.24 Kips
27.51 ft	43.17 Kips	2.94 Kips	46.12 Kips
36.51 ft	84.06 Kips	2.94 Kips	87.00 Kips
45.51 ft	121.43 Kips	2.94 Kips	124.37 Kips
54.51 ft	158.81 Kips	2.94 Kips	161.75 Kips
58.49 ft	175.33 Kips	2.94 Kips	178.28 Kips
58.51 ft	175.42 Kips	3.00 Kips	178.42 Kips
67.51 ft	212.79 Kips	3.00 Kips	215.79 Kips
68.49 ft	216.86 Kips	3.00 Kips	219.86 Kips
68.51 ft	216.94 Kips	2.32 Kips	219.27 Kips
77.51 ft	255.51 Kips	2.32 Kips	257.83 Kips
79.99 ft	266.13 Kips	2.32 Kips	268.46 Kips

DRIVING - SKIN FRICTION

Depth	Soil Type	Effective Stress At Midpoint	Sliding Friction Angle	Adhesion	Skin Friction
0.01 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
9.01 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
15.99 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
16.00 ft	Cohesive	N/A	N/A	1124.40 psf	0.00 Kips
18.01 ft	Cohesive	N/A	N/A	1124.40 psf	7.45 Kips
18.49 ft	Cohesive	N/A	N/A	1124.40 psf	9.23 Kips
18.51 ft	Cohesive	N/A	N/A	966.76 psf	9.30 Kips
27.51 ft	Cohesive	N/A	N/A	1141.85 psf	43.17 Kips
36.51 ft	Cohesive	N/A	N/A	1260.00 psf	84.06 Kips
45.51 ft	Cohesive	N/A	N/A	1260.00 psf	121.43 Kips
54.51 ft	Cohesive	N/A	N/A	1260.00 psf	158.81 Kips
58.49 ft	Cohesive	N/A	N/A	1260.00 psf	175.33 Kips
58.51 ft	Cohesive	N/A	N/A	1260.00 psf	175.42 Kips
67.51 ft	Cohesive	N/A	N/A	1260.00 psf	212.79 Kips
68.49 ft	Cohesive	N/A	N/A	1260.00 psf	216.86 Kips
68.51 ft	Cohesive	N/A	N/A	1300.00 psf	216.94 Kips
77.51 ft	Cohesive	N/A	N/A	1300.00 psf	255.51 Kips
79.99 ft	Cohesive	N/A	N/A	1300.00 psf	266.13 Kips

DRIVING - END BEARING

Depth	Soil Type	Effective Stress At Tip	Bearing Cap. Factor	Limiting End Bearing	End Bearing
0.01 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
9.01 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
15.99 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
16.00 ft	Cohesive	N/A	N/A	N/A	1.33 Kips
18.01 ft	Cohesive	N/A	N/A	N/A	1.33 Kips
18.49 ft	Cohesive	N/A	N/A	N/A	1.33 Kips
18.51 ft	Cohesive	N/A	N/A	N/A	2.94 Kips
27.51 ft	Cohesive	N/A	N/A	N/A	2.94 Kips
36.51 ft	Cohesive	N/A	N/A	N/A	2.94 Kips
45.51 ft	Cohesive	N/A	N/A	N/A	2.94 Kips
54.51 ft	Cohesive	N/A	N/A	N/A	2.94 Kips
58.49 ft	Cohesive	N/A	N/A	N/A	2.94 Kips
58.51 ft	Cohesive	N/A	N/A	N/A	3.00 Kips
67.51 ft	Cohesive	N/A	N/A	N/A	3.00 Kips
68.49 ft	Cohesive	N/A	N/A	N/A	3.00 Kips
68.51 ft	Cohesive	N/A	N/A	N/A	2.32 Kips
77.51 ft	Cohesive	N/A	N/A	N/A	2.32 Kips
79.99 ft	Cohesive	N/A	N/A	N/A	2.32 Kips

DRIVING - SUMMARY OF CAPACITIES

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
9.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
15.99 ft	0.00 Kips	0.00 Kips	0.00 Kips
16.00 ft	0.00 Kips	1.33 Kips	1.33 Kips
18.01 ft	7.45 Kips	1.33 Kips	8.77 Kips
18.49 ft	9.23 Kips	1.33 Kips	10.55 Kips
18.51 ft	9.30 Kips	2.94 Kips	12.24 Kips
27.51 ft	43.17 Kips	2.94 Kips	46.12 Kips
36.51 ft	84.06 Kips	2.94 Kips	87.00 Kips
45.51 ft	121.43 Kips	2.94 Kips	124.37 Kips
54.51 ft	158.81 Kips	2.94 Kips	161.75 Kips
58.49 ft	175.33 Kips	2.94 Kips	178.28 Kips
58.51 ft	175.42 Kips	3.00 Kips	178.42 Kips
67.51 ft	212.79 Kips	3.00 Kips	215.79 Kips
68.49 ft	216.86 Kips	3.00 Kips	219.86 Kips
68.51 ft	216.94 Kips	2.32 Kips	219.27 Kips
77.51 ft	255.51 Kips	2.32 Kips	257.83 Kips
79.99 ft	266.13 Kips	2.32 Kips	268.46 Kips

ULTIMATE - SKIN FRICTION

Depth	Soil Type	Effective Stress At Midpoint	Sliding Friction Angle	Adhesion	Skin Friction
0.01 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
9.01 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
15.99 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
16.00 ft	Cohesive	N/A	N/A	1124.40 psf	0.00 Kips
18.01 ft	Cohesive	N/A	N/A	1124.40 psf	7.45 Kips
18.49 ft	Cohesive	N/A	N/A	1124.40 psf	9.23 Kips
18.51 ft	Cohesive	N/A	N/A	966.76 psf	9.30 Kips
27.51 ft	Cohesive	N/A	N/A	1141.85 psf	43.17 Kips
36.51 ft	Cohesive	N/A	N/A	1260.00 psf	84.06 Kips
45.51 ft	Cohesive	N/A	N/A	1260.00 psf	121.43 Kips
54.51 ft	Cohesive	N/A	N/A	1260.00 psf	158.81 Kips
58.49 ft	Cohesive	N/A	N/A	1260.00 psf	175.33 Kips
58.51 ft	Cohesive	N/A	N/A	1260.00 psf	175.42 Kips
67.51 ft	Cohesive	N/A	N/A	1260.00 psf	212.79 Kips
68.49 ft	Cohesive	N/A	N/A	1260.00 psf	216.86 Kips
68.51 ft	Cohesive	N/A	N/A	1300.00 psf	216.94 Kips
77.51 ft	Cohesive	N/A	N/A	1300.00 psf	255.51 Kips
79.99 ft	Cohesive	N/A	N/A	1300.00 psf	266.13 Kips

ULTIMATE - END BEARING

Depth	Soil Type	Effective Stress At Tip	Bearing Cap. Factor	Limiting End Bearing	End Bearing
0.01 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
9.01 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
15.99 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
16.00 ft	Cohesive	N/A	N/A	N/A	1.33 Kips
18.01 ft	Cohesive	N/A	N/A	N/A	1.33 Kips
18.49 ft	Cohesive	N/A	N/A	N/A	1.33 Kips
18.51 ft	Cohesive	N/A	N/A	N/A	2.94 Kips
27.51 ft	Cohesive	N/A	N/A	N/A	2.94 Kips
36.51 ft	Cohesive	N/A	N/A	N/A	2.94 Kips
45.51 ft	Cohesive	N/A	N/A	N/A	2.94 Kips
54.51 ft	Cohesive	N/A	N/A	N/A	2.94 Kips
58.49 ft	Cohesive	N/A	N/A	N/A	2.94 Kips
58.51 ft	Cohesive	N/A	N/A	N/A	3.00 Kips
67.51 ft	Cohesive	N/A	N/A	N/A	3.00 Kips
68.49 ft	Cohesive	N/A	N/A	N/A	3.00 Kips
68.51 ft	Cohesive	N/A	N/A	N/A	2.32 Kips
77.51 ft	Cohesive	N/A	N/A	N/A	2.32 Kips
79.99 ft	Cohesive	N/A	N/A	N/A	2.32 Kips

ULTIMATE - SUMMARY OF CAPACITIES

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
9.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
15.99 ft	0.00 Kips	0.00 Kips	0.00 Kips
16.00 ft	0.00 Kips	1.33 Kips	1.33 Kips
18.01 ft	7.45 Kips	1.33 Kips	8.77 Kips
18.49 ft	9.23 Kips	1.33 Kips	10.55 Kips
18.51 ft	9.30 Kips	2.94 Kips	12.24 Kips
27.51 ft	43.17 Kips	2.94 Kips	46.12 Kips
36.51 ft	84.06 Kips	2.94 Kips	87.00 Kips
45.51 ft	121.43 Kips	2.94 Kips	124.37 Kips
54.51 ft	158.81 Kips	2.94 Kips	161.75 Kips
58.49 ft	175.33 Kips	2.94 Kips	178.28 Kips
58.51 ft	175.42 Kips	3.00 Kips	178.42 Kips
67.51 ft	212.79 Kips	3.00 Kips	215.79 Kips
68.49 ft	216.86 Kips	3.00 Kips	219.86 Kips
68.51 ft	216.94 Kips	2.32 Kips	219.27 Kips
77.51 ft	255.51 Kips	2.32 Kips	257.83 Kips
79.99 ft	266.13 Kips	2.32 Kips	268.46 Kips