STRUCTURE FOUNDATION EXPLORATION

Proposed Bridge Replacement

FUL-120-14.08, PID 101140

SR 120 over Tenmile Creek

Metamora, Fulton County, Ohio

Submitted to Bergmann
Date *January 2022*

Prepared by

TTL associates inc
Environmental, Geotechnical Engineering & Testing

OHIO DEPARTMENT OF TRANSPORTATION

Bergmann
Toledo, Ohio

Final Report
Structure Foundation Exploration
Proposed Bridge Replacement
FUL-120-14.08, PID 101140
SR 120 over Tenmile Creek
Metamora, Fulton County, Ohio

January 2022

TTL associates inc
Environmental, Geotechnical
Engineering & Testing

TTL associates inc
Environmental, Geotechnical Engineering & Testing

1915 North 12th Street
Toledo, OH 43604-5305
T 419-324-2222
F 419-241-1808
www.ttlassoc.com

January 18, 2022 **TTL Project No. 1987301**

Mr. Mike Gramza, P.E.
Bergmann
3234 Executive Parkway, Suite 111
Toledo, Ohio 43606

Final Report - Structure Foundation Exploration
Proposed Bridge Replacement
FUL-120-14.08, PID 101140
SR 120 over Tenmile Creek
Metamora, Fulton County, Ohio

Dear Mr. Gramza:

Following is the report of our structure foundation exploration performed by TTL Associates, Inc. (TTL) for the referenced project. This study was performed in accordance with TTL Proposal No. 1987301, dated August 6, 2020, and was authorized via a Bergmann Agreement for Professional Services, dated September 16, 2020.

A "draft" version of the report, dated August 13, 2021, was previously provided. This final report contains the results of our study, our engineering interpretation of the results with respect to the project characteristics, evaluations for potential allowable bearing pressures associated with foundations for the existing building to the northeast of the bridge, as well as our recommendations for design and construction of bridge foundations, retaining walls, and pavements. This report also incorporates responses to comments provided by Bergmann after submittal of our draft report.

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

Sincerely,

TTL Associates, Inc.

CHRISTOPHER P IOTT
E-69734

Christopher P. Iott, P.E.
Chief Geotechnical Engineer

Curtis E. Roupe, P.E.
Vice President

T:\Projects\1987301…\Deliverables\1987301 TTL FINAL Geotech Report FUL-120-14.08 Metamora OH.doc

FINAL REPORT
STRUCTURE FOUNDATION EXPLORATION
PROPOSED BRIDGE REPLACEMENT
FUL-120-14.08, PID 101140
SR 120 OVER TENMILE CREEK
METAMORA, FULTON COUNTY, OHIO

FOR

BERGMANN
3234 EXECUTIVE PARKWAY, SUITE 111
TOLEDO, OHIO 43606

SUBMITTED

JANUARY 18, 2022

TTL PROJECT NO. 1987301

TTL ASSOCIATES, INC.
1915 NORTH 12TH STREET
TOLEDO, OHIO 43604
(419) 324-2222
(419) 321-6257 FAX

EXECUTIVE SUMMARY

This structure foundation exploration report has been prepared for the proposed replacement of the SR 120 Bridge (SFN 2601745) over Tenmile Creek in Metamora, Fulton County, Ohio. This exploration included three test borings for bridge foundation and approach pavement evaluations, as well as evaluations of potential bearing pressures associated with a building at the northeast quadrant of the bridge crossing. Additionally, an auger probe boring was performed behind an existing retaining wall at the site in an effort to evaluate thickness and bearing elevation of the wall footing. Subgrade evaluations were performed in accordance with ODOT GB-1 “Plan Subgrades” (July 17, 2020). A summary of the conclusions and recommendations of this study are as follows:

1. The borings were performed in paved areas and encountered asphalt at the surface. The test borings were performed in the roadway where concrete was encountered underlying the asphalt. Underlying the surface materials, medium stiff to stiff cohesive existing fill materials were encountered to depths ranging from approximately 4 to 9 feet below top of pavement. The fill consisted of sandy silt, silt and clay, as well as silty clay. Non-soil materials observed in the fill consisted of crushed stone, wood, as well as asphalt and brick fragments. Organic contents of approximately 10 to 11 percent were determined for two fill samples containing wood.

2. The subsurface profile encountered underlying the surface and fill materials can be generally characterized by five strata of cohesive soils with varying strength and moisture characteristics. **Stratum I** consisted of predominantly **soft** to medium stiff cohesive soils encountered underlying the fill in Borings B-001 and B-002-1 to depths of 11 feet and 8½ feet, respectively. **Stratum II** consisted of predominantly stiff to very stiff cohesive soils encountered underlying the fill in Boring B-004 and Stratum I in Boring B-002-1. Stratum II extended to depths of 11 feet in Boring B-002-1 and 6 feet in Boring B-004. **Stratum III** consisted of predominantly very stiff to hard cohesive soils encountered underlying Stratum I in Boring B-001, as well as Stratum II in Borings B-002-1 and B-004. Stratum III extended to boring termination at a depth of 20 feet in Boring B-004, as well as to depths of 49½ feet in Boring B-001 and 38½ feet in Boring B-002-1. **Stratum IV** consisted of predominantly hard cohesive soils encountered underlying Stratum II in Borings B-001 and B-002-1 to depths of 73 feet and 73½ feet, respectively. **Stratum V** consisted of predominantly “very hard” cohesive soils encountered underlying Stratum IV in Borings B-001 and B-002-1 to termination at a depth of 80 feet.

3. Groundwater was initially encountered during drilling and observed upon completion of drilling operations in only Boring B-001 at a depth of 79.5 feet. Based on the predominantly clayey soil profile at the site, adequate control of seasonal groundwater seepage, perched water, and surface water run-off into shallow excavations should be achievable by minor dewatering systems, such as pumping from prepared sumps. A cofferdam or conveyance system should be considered to maintain creek flow around the project area during construction.

4. The bridge is planned to be replaced with a new pile-supported, three-sided culvert. It is planned to provide preboring in the upper soil profile to reduce vibrations associated with driven pile installation due to the proximity of existing buildings to the bridge crossing. Bridge foundation recommendations are provided in Section 5.1 of this report.

5. For this project, permanent and temporary construction retaining walls are anticipated to be constructed. Wingwalls are anticipated to be pile-supported cast-in-place concrete structures. Pile foundation recommendations from Section 5.1 of this report may be used for pile support considerations for these walls.

6. A post-and-panel (H-pile and lagging) wall may be used for permanent use or temporary construction use in the northeastern portion of the site, due to the proximity of the existing a body shop building. Temporary retaining walls may also be used to reduce the footprint of excavation, compared to a condition where full-depth sloped excavation were used, particularly due to close proximity of buildings in the southwestern and southeastern portions of the site. These walls may consist of post-and-panel walls. If vibrations can be controlled, these walls may also be constructed using sheetpiling. In any case, vibration monitoring should be performed as described in Section 5.1.1 during pile driving in close proximity to the existing structures.
7. The GB-1 analysis indicates options for "planned" subgrade modification of either global cement stabilization to a depth of 14 inches, or undercut of unsuitable subgrade soils and replacement with new granular engineered fill (12 inches undercut planned west of the west (rear) abutment, and 24 inches undercut planned from the east (forward) abutment to the eastern project limit). Due to the relatively small areas where new pavements will be constructed, the use of the overexcavation and replacement is expected to be the more economical subgrade modification for this project.

8. Based on the GB-1 analysis for Borings B-001 and B-002-1, a design CBR value of 6 percent was determined for the project area. The CBR value calculated by the "Subgrade Analysis" worksheet is based on an average condition of all of the soil types included in the GB-1 analysis. Group indices for the tested samples varied from 3 to 16, which would correlate with a CBR value of 4 to 9 percent. A maximum GI of 10 was determined for the samples tested for gradation and plasticity, which would correlate with a CBR value of 6 percent. As such, based on the average design value calculations from GB-1, it does not appear to be unconservative to use the GB-1 design CBR value of 6 percent.

9. Due to proximity of the existing body shop to the bridge structure, consideration is being given to potential loads associated with the structure, as well as possible retrofitting of foundations. It was requested that TTL provide approximate bearing pressures associated with the existing structure shallow spread foundations. Evaluations and recommendations for the auto body shop building foundations are presented in Section 5.5 of this report.

This executive summary highlights our evaluations and recommendations and should only be utilized in conjunction with the accompanying report, including the detailed findings, analysis and recommendations, and qualifications presented herein.

TABLE OF CONTENTS

TABLE OF CONTENTS (CONTINUED)

FIGURES

APPENDICES

1.0 INTRODUCTION

This structure foundation exploration report has been prepared for the proposed replacement of the SR 120 Bridge (SFN 2601745) over Tenmile Creek in Metamora, Fulton County, Ohio. The project site is shown on the attached Site Location Map (Plate 1.0).

This study was performed in accordance with TTL Proposal No. 1987301, dated August 6, 2020, and was authorized via a Bergmann Agreement for Professional Services, dated September 16, 2020.

1.1 Purpose and Scope of Exploration

The purpose of this exploration was to evaluate the subsurface conditions and laboratory data relative to the design and construction of retaining walls, bridge foundations, and approach pavements. Additionally, evaluations were performed for potential allowable bearing pressure for the existing building to the northeast of the bridge. To accomplish this, TTL performed three test borings, two auger probe borings, 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 summarizes our understanding of the proposed construction, describes the investigative and testing procedures utilized to evaluate the subsurface conditions at the site, and presents our findings from the field and laboratory testing. This report also presents our evaluations and conclusions in accordance with ODOT GB-1 "Plan Subgrades" (July 17, 2020), our evaluations of potential allowable bearing pressure for foundations for the building to the northeast of the bridge, and provides our design and construction recommendations for retaining walls, bridge foundations, and pavements.

This report includes:

- A description of the existing surface materials, subsurface soils, and groundwater conditions encountered in the borings.
- Design recommendations for retaining walls, bridge foundations, and pavements.
- Evaluations for potential allowable bearing pressure associated with foundations for a building northeast of the bridge.
- Recommendations concerning soil and groundwater-related construction procedures such as subgrade preparation in accordance with ODOT GB-1

criteria, earthwork, retaining wall, foundation and pavement construction, as well as related field testing.

Appendix B includes pertinent ODOT Geotechnical Engineering Design Checklists that apply to the scope of this report.

The scope of this study did not include an environmental assessment of the surface or subsurface materials at this site.

1.2 Proposed Construction

The project includes replacement of the SR 120 Bridge (SFN 2601745) over Tenmile Creek in Metamora, Fulton County, Ohio. The existing single-span structure will be replaced with a new single-span, three-sided culvert structure. It is planned to support the new structure on driven piles (with partial pre-drilling to avoid vibrations during pile installation due to the close proximity of existing buildings). Bottom of pile cap elevation was indicated at Elev. 698.4. It was indicated that the maximum Ultimate Bearing Value (UBV) prescribed by ODOT for pile foundations was being utilized for design. Our draft report included evaluations for all typical ODOT pile sizes for cast-in-place (CIP) concrete piles with driven pipe shells and H-piles, and they are included in this final report for reference. However, it is our understanding that the design will incorporate HP 12x53 piles with the maximum ODOT prescribed UBV of 380 kips.

The retaining wall at the northeast quadrant of the bridge will be replaced. To facilitate Bergmann's evaluations of this retaining wall, an auger probe boring (and additional offset auger probe boring) was performed by TTL behind the retaining wall in an effort to encounter the rear of the wall footing and core through the footing to determine the footing thickness. However, both probe borings were extended deeper than the indicated bearing elevation of the wall without encountering the wall footing behind the wall.

The aforementioned retaining wall provides support for the existing auto body shop wall behind the wall. Consideration was being given to using temporary support or underpinning of the building as part of removal and replacement of the retaining wall. It is now planned to leave the existing retaining wall in place, and provide a new post-and-panel (H-pile and lagging) retaining wall in front of the existing wall. Preboring is also planned prior to driving the posts.

The existing retaining walls south of the bridge crossing will be replaced with new pile-supported culvert structure and associated wingwalls. Excavation for installation of the wall footings will require temporary sheetpile walls to be installed to reduce the footprint of excavation if it were performed using layback only, and for support of the buildings that are in close proximity to the wall installations.

As part of the design considerations for the new bridge foundations and retaining wall installations in close proximity to the building at the northeast quadrant of the bridge included review of available information regarding the existing building foundations. To facilitate Bergmann's evaluations, TTL performed a structure boring near the southeastern corner of the building to supplement the boring south of the southwestern corner of the building, to provide an allowable bearing pressure for the soils supporting the building foundations.

Final roadway grades in the project area will approximate existing pavement grades. New pavements are anticipated to consist of flexible (asphalt) sections for roadways. New pavement cross-sections are anticipated to approximate the existing pavement cross-section encountered in Boring B-001-0-20 for this exploration (approximately 1.5 feet thick).

2.0 GEOLOGY AND OBSERVATIONS OF THE PROJECT

2.1 General Geology and Hydrogeology

Published geologic maps from the Ohio Department of Natural Resources (ODNR) indicate that the project site is located in the Maumee Lake Plains Physiographic Region of the Huron-Erie Lake Plains Section. Within this region, the geologic deposits consist of Pleistocene-age silt, clay, and wave-planed clayey till overlying Silurian-age carbonate and shale bedrock.

The USDA Natural Resource Conservation Service (NRCS) Web Soil Survey indicates that upper-profile soils in the project area are predominantly mapped as Sloan silty clay loam (So) at the bridge, Haskins loam (HkA) just past the existing auto body shop east of the bridge, and Bixler loamy fine sand (BcA) west of the bridge. The So soils consist of loamy alluvium formed on drainageways, backswamps, and flats on flood plains. The HkA soils consist of lacustrine deposits formed on lake and till plains. The BcA soils consist of sandy lacustrine deposits formed on ridges and knolls on beach ridges, outwash plains, and deltas. The So soils are characterized as very poorly drained and have a moderately high to high permeability. The HkA soils are characterized as somewhat poorly drained and have a low to moderately high permeability. The BcA soils are characterized as somewhat poorly drained and have a moderately high to high permeability.

The alluvial deposits near Tenmile creek are associated with the historic deposition associated with this creek. The lacustrine soils consist of historic lake-laid deposits, consisting of predominantly silts and clays, and often exhibit alternating thin layers of interbedded silts and clays known as varves. Varved soils are characteristic of lacustrine deposits, and the thin layering is typically attributed to seasonal or other cyclic variations of sedimentation in the lake waters. In addition, thin sand seams and partings may be encountered.

The glacial till, also referred to as moraine, was deposited by the advance and retreat of glacial ice. Due to the weight of the ice mass, the till deposits are moderately to highly over-consolidated, that is, the existing soil deposits have experienced a previous vertical stress significantly higher than the present effective vertical stress due to the remaining overlying soil strata in the profile. The till may contain cobbles and/or boulders left in the till soil matrix. Additionally, seams of granular soils may also be encountered within glacial tills.

Bedrock in the project area is broadly mapped on the “Geologic Map of Ohio” as Devonian-age Olentangy and Ohio shales. Bedrock at the site is mapped at Elev. 620±, corresponding to depths on the order of approximately 100 feet below existing grades. A log for a nearby water well indicated shale bedrock was encountered at a depth of approximately 135 feet below grade.

2.2 Observations of the Project

TTL performed a site reconnaissance on October 1, 2020. The project area consisted predominantly of small businesses with a church just west of the bridge. The pavements were in generally fair to poor condition with frequent longitudinal and transverse cracking. The cracks were generally sealed. The concrete sidewalks on either side of the bridge were in generally good to fair condition with little to no distress.

Spalling concrete and large cracks were observed along portions of the headwalls, and connected retaining wall. The bridge girders generally had minor rust. A pipe extends through the western headwall, south of the bridge. Several pipes are present discharging into the creek trough the headwalls and retaining wall. A PVC pipe and a concrete pipe discharging to the creek were present at the ground surface/top of east headwall, south of the bridge. This wall included a turnback beyond a steel I-beam that had been installed possibly for reinforcement later in the life of the wall, In any case, the portion of the wall beyond the turnback included tilting and spalling.

The retaining wall appeared to have a small window placed in it approximately 6 to 12 inches below the top of the wall under the brick portion of the existing auto body shop. At the time of our reconnaissance, water was flowing at the wall/creek bank interface or below. Weep holes were observed in the headwalls.

At the time of our reconnaissance, the Tenmile Creek bottom was approximately 13 feet and 14 feet below roadway grades south and north of the bridge, respectively (Elevs. 706± and 705±, respectively). The water level in the creek was approximately 2 inches and 12 inches above creek bottom south and north of the bridge, respectively (Elev. 706±).

3.0 EXPLORATION

3.1 Historic Borings

Review of ODOT records for the project area indicated numerous historic auger and drive rod structural borings had been performed for the SR 120 Bridge over Tenmile Creek in 1954 for FUL-120(14.06-14.08). Ten borings were performed near the intersections pertinent to this project. Since the historic borings were auger borings or drive rod borings that did not include Standard Penetration Tests, they were not utilized for GB-1 evaluations for this project and are not shown on the test boring location plans. However, the cover sheet, as well as the pertinent plan-and-profile drawings from the historic Soil Profile, are included in Appendix C of this report.

The historic borings were not numerated. For designation within this report, these borings were numerated as B-CCC-D-EE as follows:

- B = Boring.
- CCC = Boring location number (001 for Location No. 1, etc.).
- D = Number of times offset from original boring location (from 0 to 2 based on boring completion date).
- EE = Date which the borings were performed (54 for 1954).

The locations of the historic borings located within and just beyond the extents of the project intersection areas are summarized in the following table:

Table 3.1. Historic Boring Information

Boring Number	Boring Completion Date (mm/dd/yy)	US 23 Station (feet)	Approximate Offset (feet)	Ground Surface Elevation (feet)	Approximate Boring Termination Depth (feet)
B-001-0-54	08/18/54	743+05	26 RT	719.9	19
B-001-1-54	08/24/54	743+10	25 RT	876.15	18
B-001-2-54	09/23/54	743+10	25 RT	720.2	34
B-002-0-54	08/19/54	743+36	18 LT	720.1	17
B-002-1-54	08/24/54	743+36	17 LT	720.13	18
B-002-2-54	09/23/54	743+36	19 LT	720.1	23
B-003-0-54	08/19/54	743+39	31 RT	720.4	18
B-003-1-54	08/24/54	743+42	32 RT	720.45	18
B-004-0-54	08/17/54	743+68	32 LT	707.6	21

Historic information indicates that at least 12 soil samples were tested from the exploration. However, the results of the testing were not available, as such the encountered soils are based purely on historic field logs. The soils encountered in the historic borings at the current planned subgrade elevation consisted of predominantly cohesive soils including sandy silt (ODOT A-4a), silty clay (ODOT A-6b), and clay (ODOT A-7-6). Although SPT-N values were not available, all auger borings were terminated due to the motor of the rig stalling while trying to advance through “dense” material.

Groundwater was not encountered at the time of the historic borings.

We have assumed that the information provided in the historic borings was accurate and correct, at the time of those respective explorations, but cannot guarantee as such. Additionally, subgrade soil conditions may have changed or may have been modified due to construction performed following completion of the historic subsurface explorations.

3.2 Project Exploration Program

This exploration included three test borings, designated as B-001-0-20, B-002-0-20 (and offset Boring B-002-1-20), and B-004-0-20. Additionally, an auger probe boring was performed, designated as X-003-0-20 (along with offset auger probe Boring X-003-1-20). The borings were performed by TTL during October 7 through 9, 2020. The borings have been identified in accordance with ODOT protocol, but the “-0-20” or “-20” portion of the nomenclature is generally omitted for discussion in this report. Boring B-002-0 was terminated due to encountered rebar in concrete underlying the asphalt surface course. An offset boring (B-002-1) was advanced further from the bridge so as to avoid the apparent approach slab. Auger Boring X-003-0 was intended to encounter the footing of an existing retaining wall so it could be cored to determine the footing thickness. Boring X-003-0 was terminated after it was extended deeper than the indicated bearing elevation. An offset boring (X-003-1) was moved closer to the wall but was also terminated after being advanced deeper than the indicated bearing elevation without encountering the retaining wall footing. The borings were located in the field by TTL based on a direction provided from Bergmann. The approximate locations of the borings are shown on the Boring Location Plan (Plate 2.0).

Boring B-001 was performed in the eastbound lane, west of the bridge for roadway and bridge foundation evaluations. Additionally, the boring is being utilized for retaining wall evaluations. Boring B-002-1 was performed in the westbound lane, east of the bridge for roadway, bridge foundation, existing building foundation, and retaining wall evaluations. Auger Borings X-003-0 and X-003-1 were performed behind the retaining wall at the northeast quadrant of the bridge, for exploratory reasons intended to evaluate existing retaining wall footing bearing elevation and thickness. Boring B-004 was performed for existing building foundation evaluations.

Coordinates, stationing, offsets, and ground surface elevations at the boring locations were provided by Bergmann, and are summarized in the following table. Additionally, boring type, termination depths, and elevations are summarized in the following table.

Table 3.2. Boring Data

Boring Number	Type	Coordinates		SR 120 Station	Offset	Ground Surface Elevation (feet)	Boring Termination	
		Northing	Easting				Depth (feet)	Elevation (feet)
B-001	A, E1	748267.02	1583250.67	743+06	10’ Rt	719.0	80	639
B-002-0	A, E1, E3c, E6	748261.59	1583326.61	743+78	11’ Lt	719.3	1	718.3
B-002-1	A, E1, E3c, E6	748261.25	1583339.10	743+90	16’ Lt	719.1	80	639.1
X-003-0	Exploratory	748251.23	1583397.66	744+48	29’ Lt	719.4	23.5	699.4
X-003-1	Exploratory	748277.48	1583342.46	743+87	32’ Lt	719.2	23.5	695.7
B-004	E6	748278.89	1583341.20	743+85	33’ Lt	718.9	20	695.4

In accordance with the ODOT Specifications for Geotechnical Explorations (SGE), Borings B-001 and B-002-1 were performed as ODOT Type E1 bridge borings, extended to encounter a minimum of 30 consecutive feet of 30 blows per foot (bpf) material. The upper portion of each of these borings was performed as ODOT Type A roadway borings to facilitate pavement subgrade evaluations. Additionally, Boring B-002-1 was performed to meet ODOT Type E3c retaining wall and Type E6 building criteria. Boring B-004 was also performed as an ODOT Type E6 building boring.

Experience indicates that the actual subsoil conditions at a site could vary from those generalized on the basis of test borings and auger borings made at specific locations. Therefore, it is essential that a geotechnical engineer be retained to provide soil engineering services during the site preparation, foundation, retaining wall, and pavement construction 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.

3.3 Boring Methods

The test borings performed during this exploration were drilled with an ATV-mounted drilling rig for the bridge borings and with a truck-mounted drilling rig for the building and existing retaining wall exploratory borings. The borings were extended utilizing 3¼-inch inside diameter hollow-stem augers. In Borings B-001 and B-002-1, samples were obtained continuously over 18-inch split-spoon (SS) sample drives to a depth of 7 feet, at 2½-foot intervals to a depth of 30 feet, and at 5-foot intervals thereafter. Additionally, in Boring B-001, samples were obtained continuously over 18-inch SS sample drives from 11 to 20 feet to include sampling for evaluation of potential scour. In Boring B-004, samples were obtained at 2½-foot intervals to a depth of 10 feet, and at 5-foot intervals thereafter. Borings X-003-0 and X-003-1 did not include sampling. Split-spoon soil samples were obtained by the Standard Penetration Test Method (ASTM D 1586). These samples were sealed in jars and transported to our laboratory for further classification and testing.

The Standard Penetration Test (SPT) 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 number of blows per increment was recorded at each depth interval, and these data are presented under the "SPT" column on the Logs of Test Borings attached to this report. 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, or N_m-value, and is typically reported in blows per foot (bpf). The N_m-values were corrected to an equivalent hammer/rod energy ratio of 60 percent, N_{60}. The hammer/rod energy ratio for the ATV-mounted drill rig (CME 550X) was 77.3 percent, and was calibrated on February 20, 2019. The hammer/rod energy ratio for the truck-mounted drill rig (CME 75) was 70.8 percent, and was calibrated on the same date. The N_{60}-values are presented on the attached Logs of Test Borings.

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. In conjunction with published data and typical correlations, the N_{60}-values can be evaluated as a measure of soil compactness/consistency as well as shear strength.

Field and laboratory data were incorporated into gINT™ software for presentation purposes. 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 pavements and soils.

3.4 Laboratory Testing Program

All samples were visually classified in accordance with the ODOT Soil Classification System. All recovered samples of the subsoils were also tested in our laboratory for moisture content (ASTM D 2216). Organic content determinations by the loss-on-ignition (LOI) method (ASTM D 2974) were performed on selected samples. Dry density determinations and unconfined compressive strength tests by the constant rate of strain method (ASTM D 2166) were performed on selected split-spoon samples. Unconfined compressive strength estimates were obtained for the remaining intact cohesive split-spoon samples using a calibrated hand penetrometer. These test results are presented on the Logs of Test Borings and unconfined compressive strength test sheets.

Laboratory testing was performed in accordance with GB-1 "Plan Subgrades" criteria, including mechanical soil classification consisting of an Atterberg limits test (ASTM D 4318) and a particle size analysis (ASTM D 422) [for cohesive soil samples] for at least two samples from Borings B-001 and B-002-1 within 6 feet of the proposed subgrade. Complete classification testing was also performed for selected samples deeper in the subsoil profile. These test results are presented on the Logs of Test Borings and Grain Size Distribution sheets.

Sulfate content determinations (ODOT Supplement 1122) were performed on a subgrade sample from Borings B-001 and B-002-1. These test results are presented on the Logs of Test Borings.

4.0 FINDINGS

4.1 General Site Conditions

At the time of this exploration, the project vicinity consisted predominantly of small businesses with a church just west of the bridge. At the time of our reconnaissance, the Tenmile Creek bottom was approximately 13 feet and 14 feet below roadway grades south and north of the bridge, respectively (Elevs. 706± and 705±, respectively). The water level in the creek was approximately 2 inches and 12 inches above creek bottom south and north of the bridge, respectively (Elev. 706±).

The borings encountered surface materials consisting of asphalt ranging in thickness from 1 to 7 inches. Concrete and crushed stone were encountered underlying the asphalt in some of the borings with varying thicknesses. A description of the surface materials and their thicknesses are summarized in the following table.

Table 4.1. Description of Surface Materials

Boring Number	Approximate Asphalt Thickness (inches)	Approximate Concrete Thickness (inches)	Approximate Crushed Stone Thickness (inches)
B-001	7	8	3
B-002-0	2	> 10 (Note 1)	-
B-002-1	6	3	N.E.
X-003-0	1 (Note 2)	N.E.	35
X-003-1	1 (Note 2)	N.E.	35
B-004	4	8	N.E.

N.E. = Not Encountered

Notes:

1) Boring B-002-0 was terminated at a depth of approximately 12 inches from the top of pavement in the reinforced concrete layer due to encountered rebar.
2) Borings X-003-0 and X-003-1 were performed in an area of delipidated asphalt between the parking area and a guardrail at the top of the retaining wall.

Underlying the surface materials, medium stiff to stiff cohesive existing fill materials were encountered to depths ranging from 3.8 to 8.8 feet below top of pavement. The fill consisted of sandy silt, silt and clay, as well as silty clay. Non-soil materials observed in the fill consisted of crushed stone, wood, as well as asphalt and brick fragments. Organic contents of approximately 10 to 11 percent were determined for two fill samples containing wood [Borings B-001 (SS-4) and B-004 (SS-1)]. SPT N_{60}-values ranged from 6 to 14 blows per foot (bpf). Unconfined compressive strengths varied from 1,000 to 7,000 pounds per square foot (psf). Moisture contents generally ranged from 14 to 22 percent. However, the previously mentioned samples containing organics were determined to have moisture contents on the order of 33 percent and 40 percent.

4.2 General Soil Conditions

Based on the borings completed for this exploration, the subsurface profile encountered underlying the surface and fill materials can be generally characterized by five strata of cohesive soils with varying strength and moisture characteristics.

Stratum I consisted of predominantly **soft** to medium stiff cohesive soils encountered underlying the fill in Borings B-001 and B-002-1 to depths of 11 feet and 8½ feet, respectively (Elevs. 708± and 710±, respectively). The Stratum I soils consisted of silty clay (ODOT A-6b) with little sand and trace gravel. SPT N_{60}-values were on the order of 4 to 6 blows per foot (bpf). Unconfined compressive strengths ranged from 1,000 to 2,000 pounds per square foot (psf). Moisture contents ranged from 23 to 26 percent.

Stratum II consisted of predominantly stiff to very stiff cohesive soils encountered underlying the fill in Boring B-004 and Stratum I in Boring B-002-1. Stratum II extended to depths of 11 feet (Elev. 708±) in Boring B-002-1 and 6 feet (Elev. 713±) in Boring B-004. These cohesive soils consisted of silt and clay (A-6a) as well as silty clay (A-6b) with varying amounts of sand and gravel. An SPT N_{60}-value of 13 bpf was determined for the samples in this stratum. Unconfined compressive strengths for the recovered samples were 6,940 psf and greater than 9,000 psf (maximum reading obtainable using a hand penetrometer). Moisture contents were 14 and 15 percent for the recovered samples.

Stratum III consisted of predominantly very stiff to hard cohesive soils encountered underlying Stratum I in Boring B-001, as well as Stratum II in Borings B-002-1 and B-004. Stratum III extended to boring termination at a depth of 20 feet in Boring B-004, as well as to depths of 49½ feet (Elev. 669±) in Boring B-001 and 38½ feet (Elev. 680±) in Boring B-002-1. These cohesive soils consisted of sandy silt (A-4a), silt and clay (A-6a), as well as silty clay (A-6b). SPT N_{60}-values ranged from 21 to 40 bpf. Unconfined compressive strengths ranged from 4,860 to 9,800 psf. Moisture contents ranged from 12 to 14 percent.

Stratum IV consisted of predominantly hard cohesive soils encountered underlying Stratum II in Borings B-001 and B-002-1 to depths of 73 feet and 73½ feet, respectively (Elevs. 646± and 645±, respectively). These cohesive soils consisted of silt and clay (A-6a) as well as silty clay

(A-6b). SPT N_{60}-values ranged from 31 to 54 bpf. Unconfined compressive strengths ranged from 8,160 to 10,880 psf. Moisture contents ranged from 11 to 14 percent.

Stratum V consisted of predominantly “very hard” cohesive soils encountered underlying Stratum IV in Borings B-001 and B-002-1 to termination at a depth of 80 feet (Elev. 639±). These cohesive soils consisted of sandy silt (A-4a). SPT N_{60}-values ranged from 72 to 95 bpf. Unconfined compressive strengths were greater than 9,000 psf. Moisture contents ranged from 7 to 11 percent.

Additional descriptions of the stratigraphy encountered in the borings are presented on the Logs of Test Borings.

4.3 Groundwater Conditions

Groundwater was initially encountered during drilling and observed upon completion of drilling operations in only Boring B-001 at a depth of 79.5 feet (Elev. 639.5). It should be noted that each boring was generally drilled and backfilled or sealed within the same day. Therefore, stabilized ambient water levels were not observed over this limited time period. Instrumentation was not installed for long-term groundwater readings.

Based on the soil characteristics and moisture conditions encountered in the borings, it is our opinion that “normal” groundwater levels at the site will generally occur at depths of 9 to 14 feet below roadway grades (Elevs. 710± to 705±), corresponding to depths at or slightly above the streamflow levels in Tenmile Creek. It should be noted that groundwater elevations can also fluctuate with seasonal and climatic influences, as well as streamflow conditions in the creek. Therefore, the groundwater conditions may vary at different times of the year from those encountered during this exploration.

4.4 Gradation Results for Potential Scour Evaluations

Particle size analyses were performed on selected samples from Borings B-001 and B-002-1, obtained within a depth of approximately 6 feet below the channel bottom elevation. The particle size analyses were performed to determine D_{50} values of the soils to facilitate scour analysis. Based on the tested samples, D_{50} values ranged from 0.0064 to 0.0115 millimeters (mm). The results for the soil samples within the estimated potential scour zone are summarized as follows:

Table 4.4. Gradation Results for Potential Scour Evaluations				
Boring Number	**Sample Number**	**Sample Depth (feet)**	**Approximate Sample Elevation (feet)**	**D_{50} (mm)**
B-001	SS-8	14 – 15.5	705 – 703½	0.0115
	SS-9	15.5 – 17	703½ – 702	0.0101
	SS-10	17 – 18.5	702 – 700½	0.0103
B-002	SS-7	13.5 – 15	705½ – 704	0.0077
	SS-8	16 – 17.5	704 – 702½	0.0064
	SS-9	18.5 – 20	702½ – 701	0.0072

4.5 Remedial Measures

The bridge is planned to be replaced with a new pile-supported, three-sided culvert. It is planned to provide preboring in the upper soil profile to reduce vibrations associated with driven pile installation due to the proximity of existing buildings to the bridge crossing.

The GB-1 analysis indicates options for "planned" subgrade modification of either global cement stabilization to a depth of 14 inches, or undercut of unsuitable subgrade soils and replacement with new granular engineered fill (12 inches undercut planned west of the west (rear) abutment, and 24 inches undercut planned from the east (forward) abutment to the eastern project limit). Due to the relatively small areas where new pavements will be constructed, the use of the overexcavation and replacement is expected to be the more economical subgrade modification for this project.

A cofferdam or conveyance system should be considered to maintain creek flow around the project area during construction. Additionally, pumping from prepared sumps may be required in excavations.

5.0 ANALYSES AND RECOMMENDATIONS

The following analysis and recommendations are based on our understanding of the proposed construction and on the data obtained during our field exploration. If the project information or subgrade depth should change significantly, a review of these recommendations should be made by TTL.

5.1 Bridge Foundations

5.1.1 Foundation Installation Considerations

It was indicated that, due to proximity of the bridge to existing buildings, there is concern with vibrations and noise associated with driven piles. Additionally, it was indicated that there is concern with drilled shafts that are not socketed into bedrock. Preliminary evaluations and recommendations were provided to Bergmann for drilled shaft evaluations. However, it was determined by Bergmann that drilled shafts are not feasible for this project due to required load resistance and spacing of shafts. Therefore, foundations are planned to consist of soil-bearing "friction" driven piles, which include preboring in the upper portion of the subsoil profile. For our evaluations, we considered preboring down to the top of Stratum IV, which was encountered at depths of 49½ feet below top of pavement (Elev. 669½ ±) and 38½ feet (Elev. 680½ ±) in Borings B-001 (Rear Abutment) and B-002 (Forward Abutment), respectively. Even with preboring, consideration should also be given to the noise associated with driven pile foundation installation due to the proximity of structures and businesses to the bridge.

It is our understanding that the buildings in close proximity to the bridge are supported on shallow spread foundations. The deepest bearing foundation is present in a below-grade area of a building at the northeast quadrant of the bridge crossing. A retaining wall adjacent to that building is indicated to bear at approximately Elev. 703.5, corresponding to approximately 15 feet below roadway grades.

Preboring to depths of 49½ feet and 38½ feet below top of pavement at the Rear Abutment and Forward Abutment, respectively, would be sufficient for eliminating driving and associated higher intensity vibrations at foundation elevations and within the stress influence depth of the foundations associated with the existing buildings at the site.

It should be noted that recordable vibrations may still occur for the existing buildings, even with driving starting at the top of the Stratum IV soils. However, the vibrations at the structure locations should be dampened significantly with pile driving starting at these depths. In any case, we recommend that a condition survey of any existing structures and transportation infrastructure located in the vicinity of the proposed bridge replacement be completed. Although more specifically tailored to pre-blasting, ODOT CMS Section 208.15 may be consulted regarding a condition survey. The condition survey for pre-pile-driving should be performed for structures within a minimum of 100 feet from the pile driving locations. The condition survey should identify existing cracks and other forms of distress to the structures before the start of construction operations. This procedure will be helpful to evaluate possible effects the construction operations may have on nearby structures and to mitigate potential disputes with property owners.

It is also recommended that vibration monitoring equipment (seismographs) be installed for structures within at least 100 feet of pile installation locations. Although more specifically tailored to vibration monitoring for blasting, ODOT CMS Section 208.15 may be consulted regarding such activities for pile driving. Vibration monitors should be located between the construction activities and the structures being monitored, a sufficient distance from the construction activities to avoid damage. For particularly close structures or structures identified in the pre-construction survey with deficiencies, it may be prudent to utilize multiple vibration monitors at differing distances from the construction activities to evaluate the dampening of vibration with increased distance from the source. We recommend that vibration monitoring particle velocity and frequency results be compared to US Bureau of Mines Report of Investigations 8507 Appendix B, Figure B-1 “Safe levels of blasting vibration for houses using a combination of velocity and displacement” to establish “safe vibration limits”.

5.1.2 Vertical Load Resistance Evaluations

As indicated in Section 5.1.1, we considered preboring down to the top of Stratum IV, which was encountered at depths of 49½ feet below top of pavement (Elev. 669½ ±) and 38½ feet (Elev. 680½ ±) in Borings B-001 (Rear Abutment) and B-002 (Forward Abutment), respectively. Side resistance was not considered within the preboring depth.

Due to the depth of preboring, scour will not be a design consideration for vertical load resistance, since the scour depth would not extend as deep as the preboring depth and we have not included contribution of side resistance within the preboring depth.

For piles not driven to refusal on bedrock, the ODOT Bridge Design Manual (BDM) indicates that piles should be specified as CIP concrete piles with driven pipe shells. For our draft report, we evaluated closed-end pipe shells. It is our recent experience that H-piles may be an economical alternative. Therefore, we also included recommendations for use of H-piles. It is our understanding that HP 12x53 piles will be utilized for this project.

Bottom of pile cap was indicated at Elev. 698.4. There will be 2 feet of pile stick-up embedded in the pile caps. It was indicated that maximum ODOT prescribed Ultimate Bearing Values (UBV, or R_{ndr}) were being used for design. Our analyses in the draft report considered the maximum Ultimate Bearing Values (UBV, R_{ndr}) prescribed by ODOT for commonly used pile sizes, and those analyses are included in this final report for reference. The UBV values associated with the various pile sizes are summarized in the following table, and the currently planned pile size is shown with shading.

Table 5.1.2.A. ODOT Prescribed Maximum Ultimate Bearing Values (R_{ndr}) for Common Pile Sizes

Pile Type/Size	Maximum R_{ndr} (kips)
12-Inch CIP Pipe Pile	330
14-Inch CIP Pipe Pile	390
16-Inch CIP Pipe Pile	450
HP 10x42 H-pile	310
HP 12x53 H-pile	380
HP 14x73 H-pile	530

ODOT Bridge Design Manual (BDM) Section C305.3.2.B indicates that, for piles not driven to refusal on bedrock, a dynamic resistance factor of 0.70 is to be utilized for piles installed in accordance with ODOT Construction and Materials Specifications (CMS) 507 and CMS 523. As such, maximum total factored loads (TFLs) for a certain pile size and type are 70 percent of the maximum R_{ndr} values presented in the above table.

Pile resistance analyses were performed using FHWA pile analysis software DRIVEN. In the DRIVEN analyses, adhesion for cohesive soils was modeled using the Tomlinson method (1979).

DRIVEN analyses were initially performed by "assigning" undrained shear strengths for calculation of end-bearing and side frictional capacities of all cohesive soil layers. However, based on TTL experience in Northwest Ohio, the Stratum IV hard and Stratum V very hard cohesive soil layers are better modeled by treating these soils as an FHWA “cohesionless” soil by assigning an effective internal angle of friction (ϕ') to this layer based on the SPT N_{60}-value determined for these cohesive soils [Peck, Hanson, and Thornburn method (1974)]. Therefore, these Strata were modeled using ϕ' values on the order of 35 to 42 degrees.

DRIVEN analyses indicate that the CIP piles and H-piles are expected to achieve the required resistance generally within the Stratum IV hard cohesive soils layer. H-pile tip elevations are anticipated to be only 1 to 4 feet deeper than the tip elevations associated with CIP piles with similar R_{ndr}.

Results of the DRIVEN analyses are attached to this report in Appendix A, and are summarized in the following table. The summary table below includes the estimated pile length and order length. The estimated pile length includes the calculated length from anticipated pile cut-off elevation to pile tip elevation, rounded to the nearest 5 feet. The order length is the estimated length plus 5 feet. Since HP 12x53 piles are currently planned for this project, that row has been shaded.

Table 5.1.2.B. Pile Foundation Recommendations – Bottom of Pile Cap at Elev. 698.4, with 2 Feet Stickup

Pile Type and Size	**Max. R_{ndr} (kips)**	**Rear Abutment (B-001)**				**Forward Abutment (B-002)**			
		Recommended (Minimum) Pile Tip		**Estimated Pile Length (feet)**	**Order Pile Length (feet)**	**Recommended (Minimum) Pile Tip**		**Estimated Pile Length (feet)**	**Order Pile Length (feet)**
		Depth (ft)	**Elev. (ft)**			**Depth (ft)**	**Elev. (ft)**		
12” CIP	330	69	650	55	60	73½	645½	60	65
14” CIP	390	63	656	50	55	66	653	50	55
16” CIP	450	59	660	45	50	61	658	50	55
HP 10x42	310	70	649	55	60	73	646	60	65
HP 12x53	380	66	653	50	55	70	649	55	60
HP 14x73	530	66	653	50	55	70	649	55	60

ODOT specifications indicate that the maximum center-to-center spacing of driven piles should be 8 feet in capped pile abutments. The maximum center-to-center spacing of driven piles should be 7 feet for the front row of wall-type abutments and retaining walls. Although close pile spacing is not anticipated, we recommend that the minimum center-to-center spacing for piles be

3 pile diameters to avoid superposition of stresses and possible reduction in group resistance due to close spacing.

A static pile load test (ASTM D 1143) is required only if the total pile order length for an individual structure exceeds 10,000 feet for piling of the same size and R_{ndr}. As such, a static pile load test is not expected to be required for this project. As mentioned previously, pile design is based on piles installed in accordance with ODOT CMS Item 523 “Dynamic Load Test.” ODOT requires dynamic load testing to establish the driving criteria (i.e., blow count) for all piling not driven to refusal on bedrock. For an individual structure, the designer shall specify one dynamic load testing item for each pile size. If multiple pile capacities are required for a given pile size, the designer shall specify one testing item for each R_{ndr}. Although not anticipated, if static load tests are required, additional provisions include two dynamic load testing items **and** two restrike items for each static load test item. One dynamic load testing item consists of testing a minimum of two piles and performing a Case Pile Wave Analysis Program (CAPWAP) analysis on one of the two piles. One restrike item consists of performing dynamic testing on two piles and performing CAPWAP analysis on one of the two piles. Driven piles should be installed under adequate specifications and monitored by a qualified geotechnical engineer.

Although cobbles and/or boulders were not encountered during this investigation, they are not uncommon in glacial till soils, particularly in the lower-profile very stiff to hard soils. If cobbles or boulders are encountered, these conditions could hamper pile-driving operations and possibly damage some piles. If piles are observed to meet refusal at a depth/elevation less than that indicated above, cobble or 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. If persistent boulder conditions are indicated, a static pile load test should be performed in accordance with the standard referenced above to evaluate the bearing resistance of the pile(s).

If suitable pile resistance is not observed in the field with driving of the entire pile order length, a pile setup period may be required. The ODOT BDM indicates a minimum 7-day waiting period. It is our experience that pile setup can occur within a few days, but more typically occurs within one to three weeks.

5.1.3 Drivability (WEAP) Evaluations

Soils and Groundwater Data

Borings B-001 and B-002 were performed at the rear abutment and forward abutment, respectively. Based on the test borings, the piles are anticipated to be extended from the bottom of prebore depth into Stratum IV hard cohesive soils. As in the DRIVEN analyses for this project, these hard materials were modeled as very dense granular soils.

The "normal" groundwater level is anticipated above the bottom of prebore elevation. As such, the groundwater level was modeled at the top of the soil column (bottom of prebore elevation) for this evaluation. Overburden pressures of approximately 4.2 kips per square foot (ksf) and 3.5 ksf at the rear abutment and forward abutment, respectively, was applied at the "surface" of the evaluated soil profile to model the soils present above the bottom of prebore elevation.

Pile Hammer Data

The planned pile hammer for the project was not indicated at this time. Delmag D12 and D22 hammers were utilized for this evaluation. Pile hammer and associated hammer cushion standard data from GRLWEAP^{TM} software were utilized for our evaluations.

WEAP Results

WEAP evaluations were performed using GRLWEAP^{TM} software considering various "ultimate capacities", which are equivalent to LRFD ultimate bearing values (UBV, or Rndr), including the UBV / maximum Rndr of 380 kips planned for the HP 12x53 piles being used for this project. Results of the WEAP evaluations are attached to this report. Results of the WEAP evaluations at the UBV / maximum Rndr planned or this project for the rear abutment piles and forward abutment piles are also summarized in the following table.

Table 5.1.3. Summary of HP 12x53 pile WEAP Results at UBV / Maximum Rndr of 380 kips

Abutment	Boring Number	Delmag D12		Delmag D22	
		Maximum Compression Stress at UBV (ksi)	Blow Count at UBV (blows/ft)	Maximum Compression Stress at UBV (ksi)	Blow Count at UBV (blows/ft)
Rear Abutment	B-001	22.3	919	30.8	93
Forward Abutment	B-002-1	21.0	1081	29.3	100

If a pile hammer other than what was utilized for this evaluation is planned for this project, the evaluation should be performed using that hammer. Additionally, if the values presented in the above table are not suitable for design, alternative pile hammers could be evaluated.

5.1.4 Lateral Load-Deflection Soil Parameters

For lateral load-deflection evaluations using software, such as LPILE, recommended design parameters are summarized in the following tables based on the conditions encountered in the borings.

Table 5.1.4.A. Subsurface Conditions and Recommended Lateral Load-Deflection Parameters (Rear Abutment - Boring B-001)

Approximate Depth (feet)	Approximate Elevation (feet)	Generalized Layer Description	Approximate Total Unit Weight (pcf)	Average Undrained Shear Strength, Su (psf)	Strain at 50% Maximum Stress, ε_{50}
0 – 9	719 – 710	Existing Medium Stiff to Stiff Cohesive Fill	125	1,000	0.010
9 – 11	710 – 708	I – Soft to Medium Stiff Cohesive	120	700	0.010
Not Encountered	-	II – Stiff to Very Stiff Cohesive	-	-	-
11 – 49½	708 – 669½	III – Very Stiff to Hard Cohesive	140	3,500	0.005
49½ – 73	669½ – 646	IV – Hard Cohesive	135	4,500	0.004
73 - 80	646 – 639	V – Very Hard Cohesive	135	4,500	0.004

Table 5.1.4.B. Subsurface Conditions and Recommended Lateral Load-Deflection Parameters (Forward Abutment - Boring B-002-1)

Approximate Depth (feet)	Approximate Elevation (feet)	Generalized Layer Description	Approximate Total Unit Weight (pcf)	Average Undrained Shear Strength, Su (psf)	Strain at 50% Maximum Stress, ε_{50}
0 – 4	719 – 715	Existing Medium Stiff to Stiff Cohesive Fill	125	1,000	0.010
4 – 8½	715 – 710½	I – Soft to Medium Stiff Cohesive	120	700	0.010
8½ – 11	710½ – 708	II – Stiff to Very Stiff Cohesive	130	1,600	0.007
11 – 38½	708 – 680½	III – Very Stiff to Hard Cohesive	140	3,500	0.005
38½ – 73½	680½ – 645½	IV – Hard Cohesive	135	4,500	0.004
73½ – 80	645½ – 639	V – Very Hard Cohesive	135	4,500	0.004

5.2 Retaining Walls

For this project, permanent and temporary construction retaining walls are anticipated to be constructed. Wingwalls are anticipated to be pile-supported cast-in-place concrete structures. Pile foundation recommendations from Section 5.1 of this report may be used for pile support considerations for these walls.

A post-and-panel (H-pile and lagging) wall is planned for permanent use in the northeastern portion of the site, due to the proximity of the existing auto body shop building. Temporary retaining walls may also be used to reduce the footprint of excavation, compared to a condition where full-depth sloped excavation were used, particularly due to close proximity of buildings in the southwestern and southeastern portions of the site. Initial considerations were given to post-and-panel walls. However, sheetpiling is now planned with vibration monitoring. In either case, vibration monitoring should be performed as described in Section 5.1.1 during pile driving in close proximity to the existing structures.

For retaining walls that are restrained from rotation and are considered rigid and non-yielding, lateral earth pressure should be assumed for “at-rest” conditions. Post-and-panel walls and sheetpile walls are anticipated to support the native cohesive soils encountered at the site. It is anticipated that excavated on-site cohesive soils will be utilized for the majority of the backfill behind the cast-in-place concrete walls. For these soils, an at-rest earth pressure coefficient (k_o) of 0.50 should be used in determining the lateral pressure acting on the walls, along with a total (moist) soil unit weight of 130 pounds per cubic foot (pcf). Alternatively, an equivalent fluid weight of 65 pcf may be used for the at-rest case design.

Retaining walls that are not restrained at the top of the wall may be designed for an “active” lateral earth pressure condition. For retention of the existing site cohesive soils, and considering use of on-site cohesive soils for the backfill behind the abutment walls, a k_a value of 0.33 may be used for design along with a soil unit weight of 130 pcf or, alternatively, an equivalent fluid weight of 45 pcf may be used.

For walls that will be backfilled, if lower at-rest earth pressures are preferred for structural reasons or to improve overturning/sliding stability, we recommend that a select, free-draining granular fill (such as No. 57 or 67 stone) be utilized for the entire wall backfill zone. For these granular fill types, k_o may be taken as 0.40, and the soil unit weight may be assumed as 120 pcf. Alternatively, an equivalent fluid weight of 50 pcf may be used for these granular fills. If a free-draining granular fill is utilized, a k_a value of 0.25 may be used for design along with a soil unit weight of 120 pcf, or, alternatively, an equivalent fluid weight of 30 pcf may be used.

It should also be noted that these earth pressures do not include hydrostatic pressures associated with normal creek level, or that may result from elevated groundwater conditions above the normal creek level. We recommend that consideration be given to wall drainage to prevent build-up of unbalanced hydrostatic pressures behind the walls. Otherwise, the wall design should consider hydrostatic pressures based on flood elevations or other seasonal groundwater conditions.

Additionally, the earth pressures indicated above are based on a level backfill condition behind the retaining walls. However, if there are areas where appreciable sloping backfill is required near the top of the wall, surcharge loading or equivalent higher earth pressure coefficients should be evaluated, based on backfill material, backfill slope, and proximity to the wall. In general, 50 percent of the vertical surcharge load may be assumed for lateral loading in the design of the wall. For walls which include roadway or pavement in close proximity to the top of the wall, traffic surcharge loading should also be included in design.

For the post-and-panel walls and sheetpile walls, a passive earth pressure coefficient (k_p) of 3.0 may be utilized for the portion of the wall that is below a frost protection depth of 3½ feet. For short term, total stress soil parameter evaluations, the undrained shear strengths [Su, or cohesion (c)] presented in Section 5.1.4 may be utilized for design. We recommend a maximum passive earth pressure for the toe side of the retaining wall of 300 pounds per square foot per foot of depth bearing in native cohesive soils below the base of excavation on the toe side of the wall.

As discussed with the Bergmann design team, if the center-to-center spacing of posts supported by cohesive soils in a post-and-panel wall system are closer than 3b (where b is the width of the post), the design should incorporate passive pressure resistance equal to half of the spacing distance rather than 3b typically considered for design. Additionally, there will be some superposition of stresses between two adjacent posts. As discussed, based on current planned spacing of approximately 2b to 2.5b for the northeast quadrant wall, this may result in a reduction of unfactored passive resistance of only approximately 2.5% for the end piles and 5% for the interior piles. In the end, this may be negligible for design, depending on the applied reduction factors for soils and load factors for the structural loads.

We recommend all slopes on the toe side of the wingwalls have erosion protection, such as vegetated topsoil, riprap, and/or man-made materials. Seeding of the exterior slopes should be completed as soon as possible after construction is complete.

5.3 GB-1 "Plan Subgrades" Evaluation

ODOT Geotechnical Bulletin GB-1 "Plan Subgrades" (July 17, 2020) was utilized to evaluate the subgrade soils encountered in Borings B-001 and B-002-1, which were located in the roadway. Evaluations included completion of the ODOT "Subgrade Analysis" worksheet (V.14.5).

Final roadway grades in the project area will approximate existing pavement grades. New pavement cross-sections are anticipated to approximate the existing pavement cross-section encountered in Boring B-001 for this exploration (approximately 1.5 feet thick).

Based on GB-1, soils classified as ODOT A-4b, A-2-5, A-5, A-7-5, A-8a, A-8b, or rock have been designated as being problematic with respect to pavement subgrade support. None of these soils types were encountered within in the upper 6 feet of the subgrade soils during this exploration. The subgrade materials tested during this exploration were found to consist of A-4a, A-6a, and A-6b soils.

The moisture content for five of the eight evaluated samples within the upper 6 feet of the subgrade were greater than 3 percent higher than optimum as determined using GB-1 criteria. Based on GB-1 criteria, subgrade soils with moisture contents greater than 3 percent above optimum are likely to require modification. Four of the five evaluated samples with moisture contents greater than 3 percent above optimum had moisture contents greater than 5 percent above optimum. For these cohesive soils, scarification and aeration methods may not be feasible to achieve timely satisfactory proof rolling and stabilization of subgrades, depending on the construction schedule and seasonal conditions during subgrade preparation.

The type and depth of subgrade modification is determined by GB-1 criteria based on soil type, moisture content, hand penetrometer readings, and the average, low SPT N_{60}-value (N_{60L}) of the subgrade soils in a particular portion of the project area. Using GB-1 criteria based on the encountered conditions, both roadway/bridge structure borings indicated the need for planned subgrade modification. Possible alternatives for modification of the subgrade soils could include:

- global cement stabilization to a depth of 14 inches, or
- undercut and replacement with granular engineered fill.

Based on the relatively small project area, global chemical stabilization is not considered an economical alternative. In any case, as required by GB-1, sulfate content tests (ODOT Supplement 1122) were performed on at least one sample per boring within the upper 3 feet of the anticipated subgrade elevation. The sulfate content test results ranged from 580 to 2,400 parts per million (ppm). GB-1 indicates that chemical stabilization cannot be utilized when sulfate contents for the majority of the samples exceed 3,000 ppm, or individual soil samples exhibit sulfate contents of greater than 5,000 ppm. With sulfate contents below these thresholds, sulfate content will not be a constraint for potential use of global chemical stabilization for this project, if considered economical.

As indicated above, subgrade modification for this project should consist of undercut and replacement with granular engineered fill. A summary of the depths of undercut indicated by GB-1 analyses is presented in the following table.

Table 5.3 GB-1 Recommended Depth of Undercut and Replacement with Granular Engineered Fill

Boring Number	Location	Approximate Stationing	Approximate Length (feet)	GB-1 Recommended Depth of Undercut and Replacement with Granular Engineered Fill (inches)
B-001	Western project limit to west (rear) abutment	742+50 to 743+20	70	12
B-002-1	East (forward) abutment to eastern project limit	743+55 744+50	95	24

Where the undercut and replacement option is utilized, the fill should consist of ODOT Item 703.16C, Granular Material Type B or Type C. In all cases, geotextile fabric (referenced in ODOT Item 204, and specified as ODOT Item 712.09, Type D) should be utilized on the subgrade at the bottom of the undercut zone. For particularly unstable subgrades that require undercuts of 18 inches or greater, a geogrid could be used to reduce the total undercut and replacement of the unsuitable soils by 6 inches.

It should be noted that GB-1 analyses are used as a pre-construction tool to plan subgrade modification alternatives. **Actual subgrade modification will depend on field observations of proof-rolling conditions at the time of construction.** Changes in soil moisture content could create more or less favorable subgrade conditions that may result in adjustments to subgrade modification or soil stabilization requirements at the time of construction. Additionally, much of the pavement subgrade behind the abutments is anticipated to consist of new engineered fill utilized to backfill after installation of the abutments. This new engineered fill should be generally suitable for subgrade support.

5.4 Flexible (Asphalt) Pavement Design

Based on the GB-1 analysis for Borings B-001 and B-002, a design CBR value of 6 percent was determined for the project area. The CBR value calculated by the "Subgrade Analysis" worksheet is based on an average condition of all of the soil types included in the GB-1 analysis. Group indices for the tested samples varied from 3 to 16, which would correlate with a CBR value of 4 to 9 percent. A maximum GI of 10 was determined for the samples tested for gradation and plasticity, which would correlate with a CBR value of 6 percent. As such, based on the average design value calculations from GB-1, it does not appear to be unconservative to use the GB-1 design CBR value of 6 percent.

It should also be noted that the design CBR value is based on subgrades compacted to at least 100 percent of the maximum dry density as determined by ASTM D 698 (Standard Proctor) or verified as stable through proof-rolling in accordance with Section 5.5 of this report.

All pavement design and paving operations should conform to ODOT specifications. The pavement and subgrade preparation procedures outlined in this report should result in a reasonably workable and satisfactory pavement. It should be recognized, however, that all pavements need repairs or overlays over time as a result of progressive yielding under repeated loading for a prolonged period.

It is recommended that proof rolling, placement of aggregate base, and placement of asphalt be performed within as short a time period as possible. Exposure of the aggregate base to rain, snow, or freezing conditions may lead to deterioration of the subgrade and/or base materials due to excessive moisture conditions and to difficulties in achieving the required compaction.

5.5 Existing Body Shop Foundations

Due to proximity of the existing body shop to the bridge structure, consideration is being given to potential loads associated with the structure, as well as possible retrofitting of foundations. It was requested that TTL provide approximate bearing pressures associated with the existing structure shallow spread foundations. Design documents or as-built documents for the structure have not been provided, if available.

It is presumed that the existing body shop at the northeast quadrant of the bridge overpass is supported by shallow spread foundations (strip wall footings and/or individual square column footings). Based on the conditions encountered in Borings B-002-1 and B-004, existing fill materials extended to depths of approximately 4 feet below existing grades. For exterior foundations bearing at the minimum required depth for protection from frost penetration (3½ feet below finished exterior grades) and shallower interior foundations, it is presumed that the existing fill materials were over-excavated and replaced with new engineered fill or that the foundations were extended to native soils underlying the fill materials. As such, for slab-on-grade portions of the structure foundations may be bearing in Stratum I **soft** to medium stiff cohesive soils or Stratum II stiff to very stiff cohesive soils. For deeper foundations associated with below-grade portions of the structure, the bearing materials may consist of Stratum III very stiff to hard cohesive soils.

Based on soil strength evaluations for the various strata encountered in the upper soil profile during this exploration, possible net allowable bearing pressures for the auto body shop building foundations are summarized in the following table.

Table 5.5. Possible Net Allowable Bearing Pressures for Auto Body Shop Shallow Spread Foundations

Stratum	Approximate Elevations in B-002-1	Approximate Elevations in B-004	Possible Net Allowable Bearing Pressure (psf)
I – Soft to Medium Stiff	715 – 710½	Not Encountered	1,200
II – Stiff to Very Stiff	710½ – 708	715½ – 713½	2,750
III – Very Stiff to Hard	708 – 680½	713½ – 699½ (Termination)	6,000

If as-built plans showing foundation size and bearing elevation, existing loads, and possible new loads for the body shop foundations are provided, TTL could evaluate settlement that may have originally occurred and potential additional settlement associated with increased loads. If evaluations of original loads result in more than 1 inch of settlement, lower net allowable bearing pressures than those presented in the above table may be appropriate.

5.6 Site and Subgrade Preparation

In planning the implementation of earthwork operations, special consideration should be given to provide measures to prevent or reduce soil erosion and the subsequent sedimentation into nearby waterways. These measures may include some or all of the following:

1. Scheduling of earthwork operations such that erodible areas are kept as small as possible and are exposed for the shortest possible time.
2. Using special grading practices, along with diversion or interceptor structures, to reduce the amount of run-off water from an erodible area.
3. Providing vegetative buffer zones, filter berms, or sedimentation basins to trap sediment from surface run-off water.

A specific and detailed soil erosion and sedimentation control program and permits may be required by local, state, or federal regulatory agencies.

Site and subgrade preparation activities should conform to ODOT Construction and Materials Specifications (CMS) Item 204 specifications. Site preparation activities should include the removal of vegetation, topsoil, root mats, pavements, and other deleterious non-soil materials from all proposed roadway areas. The actual amount of required stripping should be determined in the field by a geotechnical engineer or qualified representative.

Upon completion of the clearing and undercutting activities, all areas that are to receive fill, or that have been excavated to proposed final subgrade elevation, should be inspected by a geotechnical engineer. Pavement subgrades should be proof rolled in accordance with ODOT CMS 204.06.

Any unsuitable materials observed during the inspection and proof-rolling operations should be undercut and replaced with compacted fill, or stabilized in place utilizing conventional remedial measures such as discing, aeration, and recompaction. As stated previously, based on the conditions encountered during our exploration, where subgrade soil moisture contents were wet of optimum, they were significantly wet of optimum. For these cohesive subgrade soils, scarification and aeration methods may not be feasible to achieve timely satisfactory proof rolling and stabilization of subgrades, depending on the construction schedule and seasonal conditions during subgrade preparation.

The GB-1 analysis indicates options for “planned” subgrade modification of either global cement stabilization to a depth of 14 inches, or undercut of unsuitable subgrade soils and replacement with new granular engineered fill (12 inches undercut planned west of the west (rear) abutment, and 24 inches undercut planned from the east (forward) abutment to the eastern project limit). Due to the relatively small areas where new pavements will be constructed, the use of the overexcavation and replacement is expected to be the more economical subgrade modification for this project compared to global chemical stabilization.

5.7 Groundwater Control

Groundwater conditions encountered in the borings were summarized in Section 4.3. Based on the soil characteristics and moisture conditions encountered in the borings, it is our opinion that "normal" groundwater levels at this structure location will generally occur at depths of 9 to 14 feet below roadway grades (Elevs. 710 to 705), corresponding to depths at or slightly above the streamflow levels in Tenmile Creek. At the time of our field reconnaissance on October 1, 2020, the water level in Tenmile Creek was at approximately Elev. 706.

Groundwater seepage, perched water, and surface water runoff into shallow excavations should be controllable by pumping from prepared sumps. Installation of the three-sided culvert and associated wingwalls may require temporary cofferdams to divert streamflow to manage groundwater in addition to pumping from prepared sumps. In the event excessive seepage is encountered during construction, TTL should be notified to evaluate whether other dewatering methods are required.

5.8 Excavations and Slopes

The sides of temporary excavations for culvert, retaining wall, and utility installations, as well as other 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 Occupational Safety and Health Administration (OSHA) safety standards must be followed. **In addition, OSHA requires that excavations with open-cut slopes higher than 20 feet, or braced excavation support systems be reviewed and designed by a registered professional engineer.**

Based on the encountered soils, excavations may encounter the following OSHA type soils:

- 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
- Type C soils (cohesive soils with unconfined compressive strengths of 1,000 psf or less, as well as existing fill materials).

For temporary excavations in Type A, B, and C soils, side slopes must be no steeper than ¾ horizontal to 1 vertical (¾H:1V), 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 by 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 generally be no steeper than 3H:1V. It should be noted that ODOT routinely uses 2H:1V slopes for roadway embankments and spill-through sections. While these steeper slopes may be used, it is our experience that the embankment faces on these slopes are more prone to erosion and sloughing. All slopes along the channel of Tenmile Creek should be lined with rip-rap or other channel erosion protection.

5.9 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 the Standard Proctor (ASTM D 698) of 90 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 ASTM D 698.

The on-site soils consist of cohesive soils, for which a sheepsfoot roller should provide the most effective soil 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.

6.0 QUALIFICATION OF RECOMMENDATIONS

Our evaluation of the soil conditions for the existing body shop building foundations, as well as bridge foundation, retaining wall, and roadway design and construction conditions have been based on the data obtained during our field exploration. The general surface and subsurface conditions were based on interpretation of the subsurface data at specific boring locations. Regardless of the thoroughness of a subsurface exploration, there is the possibility that conditions between borings will differ from those at the boring locations, that conditions at the time of construction are not as anticipated by the designers, or that the construction process has altered the soil conditions. Therefore, experienced geotechnical engineers should observe earthwork as well as foundation, retaining wall, and pavement 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 design recommendations in this report have been developed on the basis of the previously described project characteristics and subsurface conditions. If project criteria or locations change, TTL should be permitted to determine whether the recommendations must be modified. The findings of such a review will be presented in a supplemental report.

The nature and extent of variations between the pavement cores and 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, our findings derived, and our recommendations prepared 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

LEGEND

APPROXIMATE SITE LOCATION

N

APPROXIMATE SCALE – FEET

0 300 600

PLATE 1.0
SITE LOCATION MAP

PROPOSED BRIDGE REPLACEMENT
FUL-120-14.08, PID 101140 SR 120 OVER TENMILE CREEK
METAMORA, FULTON COUNTY, OHIO

PREPARED FOR
BERGMANN
TOLEDO, OHIO

DRAWN	LGH / 8–10–21	CHECKED	CPI / 8–11–21
REVISED		APPROVED	
JOB NO.	1987301		
DRAWING NUMBER	**1987301–01G**		

TTL associates inc
Environmental, Geotechnical Engineering & Testing

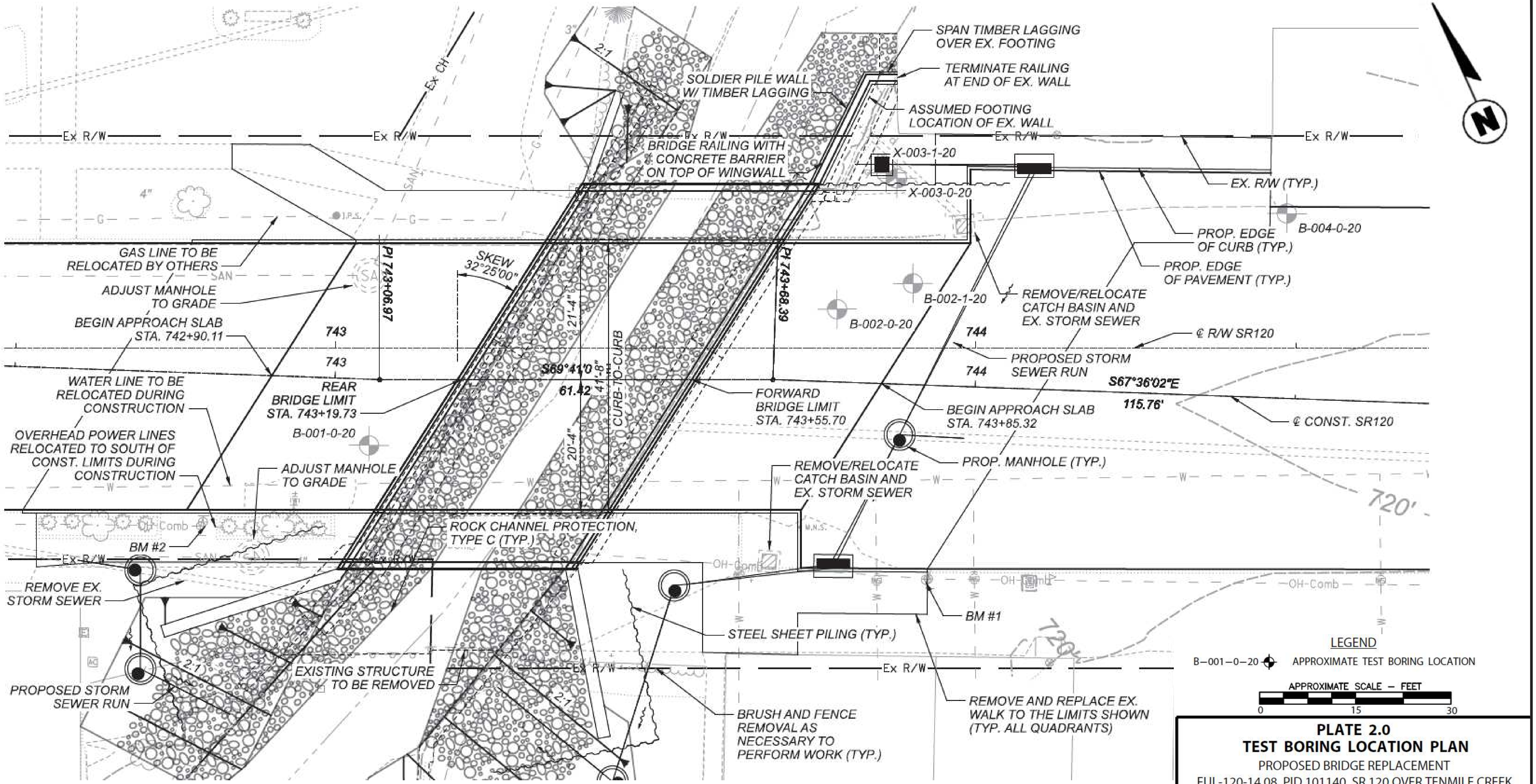


PLATE 2.0
TEST BORING LOCATION PLAN

PROPOSED BRIDGE REPLACEMENT
FUL-120-14.08, PID 101140 SR 120 OVER TENMILE CREEK
METAMORA, FULTON COUNTY, OHIO

PREPARED FOR
BERGMANN
TOLEDO, OHIO

DRAWN	LGH / 8–10–21	CHECKED	CPI / 8–11–21
REVISED		APPROVED	
JOB NO.	1987301		
DRAWING NUMBER	**1987301–01G**		

TTL associates inc
Environmental, Geotechnical Engineering & Testing

BASE PLAN "THREE SIDED CULVERT" DATED MAY 21, 2021 PROVIDED BY BERGMANN

FIGURES

PROJECT: FUL-120-14.08	DRILLING FIRM / OPERATOR: TTL / JW	DRILL RIG: CME 550X ATV	STATION / OFFSET: 743+06, 10' RT.	EXPLORATION ID B-001-0-20
TYPE: BRIDGE	SAMPLING FIRM / LOGGER: TTL / KKC	HAMMER: CME AUTOMATIC	ALIGNMENT: SR 120	
PID: 101140 SFN: 2601745	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 2/20/19	ELEVATION: 719.0 (NAVD88) EOB: 80.0 ft.	PAGE 1 OF 3
START: 10/7/20 END: 10/7/20	SAMPLING METHOD: SPT	ENERGY RATIO (%): 77.3	COORD: 748267.0200 N, 1583250.6700 E	

MATERIAL DESCRIPTION AND NOTES	ELEV. 719.0
ASPHALT - 7 INCHES	718.4
CONCRETE - 8 INCHES	717.7
CRUSHED STONE - 3 INCHES	717.5
STIFF, BROWN, **SILT AND CLAY**, LITTLE SAND AND TRACE CRUSHED STONE, MOIST **FILL** @2.5': "AND" SAND, DAMP	715.0
MEDIUM STIFF, BROWN, **SILTY CLAY**, LITTLE SAND AND TRACE CRUSHED STONE, MOIST **FILL** @5.5': SOME SAND, WITH WOOD, WET (MODERATELY ORGANIC, ORGANIC CONTENT = 10.3%)	710.2
MEDIUM STIFF, GRAY, **SILTY CLAY**, LITTLE SAND AND TRACE GRAVEL, MOIST	708.0
VERY STIFF, GRAY, **SILTY CLAY**, LITTLE SAND AND TRACE GRAVEL, DAMP	706.2
VERY STIFF TO HARD, GRAY, **SILT AND CLAY**, SOME SAND AND TRACE GRAVEL, DAMP @17': LITTLE GRAVEL	700.5
VERY STIFF TO HARD, GRAY, **SILTY CLAY**, LITTLE SAND AND TRACE GRAVEL, DAMP	

SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm
2 4 6	13	78	SS-1	3.50	1	7	11	23	58	29	15	14	18	A-6a (10)	2400
2 6 5	14	78	SS-2	NI	8	16	20	22	34	26	14	12	14	A-6a (5)	580
2 2 4	8	100	SS-3	1.25	-	-	-	-	-	-	-	-	22	A-6b (V)	-
2 2 3	6	83	SS-4	0.75	-	-	-	-	-	-	-	-	33	A-6b (V)	-
2 2 3	6	100	SS-5	0.50	-	-	-	-	-	-	-	-	25	A-6b (V)	-
6 10 12	28	100	SS-6	4.90*	-	-	-	-	-	-	-	-	12	A-6b (V)	-
4 10 12	28	100	SS-7	4.50	-	-	-	-	-	-	-	-	12	A-6a (V)	-
3 8 10	23	100	SS-8	4.50	2	10	24	25	39	26	11	15	12	A-6a (8)	-
5 8 12	26	100	SS-9	4.50	5	8	19	27	41	26	12	14	12	A-6a (8)	-
7 8 11	24	100	SS-10	4.50	10	7	18	24	41	26	14	12	12	A-6a (7)	-
4 8 10	23	100	SS-11	4.50	-	-	-	-	-	-	-	-	13	A-6b (V)	-
12 13 12	32	100	SS-12	4.50	-	-	-	-	-	-	-	-	14	A-6b (V)	-
6 8 13	27	100	SS-13	4.67*	-	-	-	-	-	-	-	-	12	A-6b (V)	-
7 10 12	28	100	SS-14	3.75	-	-	-	-	-	-	-	-	14	A-6b (V)	-
7 10 12	28	100	SS-15	4.50	-	-	-	-	-	-	-	-	13	A-6b (V)	-

DEPTHS: 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30

HOLE SEALED

PID: 101140	SFN: 2601745	PROJECT: FUL-120-14.08	STATION / OFFSET: 743+06, 10' RT.	START: 10/7/20	END: 10/7/20	PG 2 OF 3	B-001-0-20

MATERIAL DESCRIPTION AND NOTES	ELEV. 688.0	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	HOLE SEALED
VERY STIFF TO HARD, GRAY, **SILTY CLAY**, LITTLE SAND AND TRACE GRAVEL, DAMP *(continued)*		32 33																	
@33.5': SOME SAND		34 35	5 9 11	26	100	SS-16	4.50	-	-	-	-	-	-	-	-	12	A-6b (V)	-	
	682.0	36 37																	
HARD, GRAY, **SANDY SILT**, "AND" CLAY, DAMP		38 39 40	17 17 14	40	100	SS-17	4.00	0	0	4	46	50	21	14	7	14	A-4a (8)	-	
	676.0	41 42 43																	
VERY STIFF TO HARD, GRAY, **SILTY CLAY**, LITTLE SAND AND TRACE GRAVEL, DAMP		44 45	4 7 9	21	100	SS-18	4.50	-	-	-	-	-	-	-	-	14	A-6b (V)	-	
		46 47 48																	
	669.5	49 50	9 23 17	52	100	SS-19	4.25	-	-	-	-	-	-	-	-	14	A-6b (V)	-	
HARD, GRAY, **SILTY CLAY**, SOME SAND AND TRACE GRAVEL, DAMP		51 52 53																	
@53.5': LITTLE SAND		54 55	9 13 17	39	100	SS-20	4.50	-	-	-	-	-	-	-	-	14	A-6b (V)	-	
	660.5	56 57 58																	
HARD, GRAY, **SILT AND CLAY**, LITTLE SAND AND TRACE GRAVEL, DAMP		59 60	11 17 24	53	17	SS-21	5.44*	2	3	7	22	66	28	13	15	13	A-6a (10)	-	
	655.5	61 62 63																	
		64	9																

PID: 101140	SFN: 2601745	PROJECT: FUL-120-14.08	STATION / OFFSET: 743+06, 10' RT.	START: 10/7/20	END: 10/7/20	PG 3 OF 3	B-001-0-20

MATERIAL DESCRIPTION AND NOTES	ELEV. 654.8	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	HOLE SEALED
HARD, GRAY, **SILTY CLAY**, LITTLE SAND AND TRACE GRAVEL, DAMP *(continued)*		65	12 18	39	100	SS-22	4.50	-	-	-	-	-	-	-	-	11	A-6b (V)	-	
		66 67 68																	
		69 70	15 20 22	54	100	SS-23	4.50	-	-	-	-	-	-	-	-	11	A-6b (V)	-	
	646.0	71 72 73																	
HARD, GRAY, **SANDY SILT**, LITTLE CLAY AND TRACE GRAVEL, DAMP		74 75	20 29 45	95	89	SS-24	4.50	-	-	-	-	-	-	-	-	8	A-4a (V)	-	
		76 77 78																	
	639.0	▼ 639.5 EOB 79 80	30 32 38	90	100	SS-25	4.50	-	-	-	-	-	-	-	-	11	A-4a (V)	-	

NOTES: "*" - UNCONFINED STRENGTH DETERMINED BY ASTM D 2166. "NI" - NOT INTACT

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLACED 0.25 BAG ASPHALT PATCH; PUMPED 23 CF BENTONITE GROUT

STANDARD ODOT LOG W/ SULFATES (8.5 X 11) - OH DOT.GDT - 8/12/21 15:06 - S:\PROJECTS\1987301.GPJ

PROJECT: FUL-120-14.08
TYPE: BRIDGE
PID: 101140 SFN: 2601745
START: 10/7/20 END: 10/7/20

DRILLING FIRM / OPERATOR: TTL / JW
SAMPLING FIRM / LOGGER: TTL / KKC
DRILLING METHOD: 3.25" HSA
SAMPLING METHOD: SPT

DRILL RIG: CME 550X ATV
HAMMER: CME AUTOMATIC
CALIBRATION DATE: 2/20/19
ENERGY RATIO (%): 77.3

STATION / OFFSET: 743+78, 11' LT.
ALIGNMENT: SR 120
ELEVATION: 719.3 (NAVD88) EOB: 1.0 ft.
COORD: 748261.5900 N, 1583326.6100 E

EXPLORATION ID
B-002-0-20

PAGE
1 OF 1

MATERIAL DESCRIPTION AND NOTES		ELEV. 719.3	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%)					ATTERBERG			WC	ODOT CLASS (GI)	SO4 ppm	ABAN-DONED
									GR	CS	FS	SI	CL	LL	PL	PI				
ASPHALT - 2 INCHES	☒	719.1																		▨
REINFORCED CONCRETE - 10 INCHES		718.3	EOB 1																	

NOTES: BORING TERMINATED AT 1.0' DUE TO REBAR.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: 0.5 BAG ASPHALT PATCH

PROJECT: FUL-120-14.08
TYPE: BRIDGE
PID: 101140 SFN: 2601745
START: 10/7/20 END: 10/8/20

DRILLING FIRM / OPERATOR: TTL / JW
SAMPLING FIRM / LOGGER: TTL / KKC
DRILLING METHOD: 3.25" HSA
SAMPLING METHOD: SPT

DRILL RIG: CME 550X ATV
HAMMER: CME AUTOMATIC
CALIBRATION DATE: 2/20/19
ENERGY RATIO (%): 77.3

STATION / OFFSET: 743+90, 16' LT.
ALIGNMENT: SR 120
ELEVATION: 719.1 (NAVD88) EOB: 80.0 ft.
COORD: 748261.2500 N, 1583339.1000 E

EXPLORATION ID
B-002-1-20

PAGE
1 OF 3

MATERIAL DESCRIPTION AND NOTES	ELEV. 719.1	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	HOLE SEALED
ASPHALT - 6 INCHES	718.6																		
CONCRETE - 3 INCHES	718.3																		
MEDIUM STIFF, GRAY, **SILTY CLAY**, SOME SAND AND TRACE CRUSHED STONE, MOIST **FILL**	716.6		2 3 2	6	100	SS-1	3.00	-	-	-	-	-	-	-	-	18	A-6b (V)	1300	
MEDIUM STIFF, GRAY, **SANDY SILT**, SOME CRUSHED STONE, LITTLE CLAY, TRACE ASPHALT AND BRICK FRAGMENTS, MOIST **FILL**	715.1		4 3 3	8	100	SS-2	0.50	22	20	10	36	12	21	13	8	13	A-4a (3)	-	
SOFT TO MEDIUM STIFF, GRAY, **SILTY CLAY**, LITTLE SAND AND TRACE GRAVEL, MOIST			0 1 2	4	100	SS-3	1.00	2	6	11	21	60	33	17	16	23	A-6b (10)	-	
@6.5': MEDIUM STIFF	710.6		0 0 4	5	100	SS-4	1.00	-	-	-	-	-	-	-	-	26	A-6b (V)	-	
STIFF TO VERY STIFF, BROWN, **SILT AND CLAY**, SOME SAND AND LITTLE GRAVEL, MOIST	708.1		4 5 5	13	100	SS-5	4.50	-	-	-	-	-	-	-	-	14	A-6a (V)	-	
VERY STIFF TO HARD, GRAY, **SILT AND CLAY**, SOME SAND, TRACE GRAVEL, IRON OXIDE STAIN STEAM, DAMP			5 8 12	26	100	SS-6	4.50	-	-	-	-	-	-	-	-	12	A-6a (V)	-	
			5 8 11	24	100	SS-7	4.50	3	9	19	25	44	27	13	14	12	A-6a (8)	-	
	700.6		10 8 13	27	100	SS-8	4.50	8	6	14	26	46	26	11	15	12	A-6a (9)	-	
VERY STIFF TO HARD, GRAY, **SILTY CLAY**, SOME SAND, DAMP			3 6 10	21	100	SS-9	4.50	0	9	20	27	44	26	8	18	13	A-6b (10)	-	
@21': LITTLE SAND, TRACE GRAVEL			5 7 10	22	100	SS-10	4.50	-	-	-	-	-	-	-	-	13	A-6b (V)	-	
			5 6 12	23	100	SS-11	4.50	-	-	-	-	-	-	-	-	13	A-6b (V)	-	
@26.0': VERY STIFF			7 8 11	24	100	SS-12	2.43*	-	-	-	-	-	-	-	-	12	A-6b (V)	-	
@28.5': LITTLE GRAVEL			7 7 11	23	100	SS-13	3.00	-	-	-	-	-	-	-	-	13	A-6b (V)	-	

PID: 101140	SFN: 2601745	PROJECT: FUL-120-14.08	STATION / OFFSET: 743+90, 16' LT.	START: 10/7/20	END: 10/8/20	PG 2 OF 3	B-002-1-20

MATERIAL DESCRIPTION AND NOTES	ELEV. 688.1	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%)					ATTERBERG			WC	ODOT CLASS (GI)	SO4 ppm	HOLE SEALED
								GR	CS	FS	SI	CL	LL	PL	PI				
VERY STIFF TO HARD, GRAY, **SILTY CLAY**, SOME SAND, DAMP *(continued)*		32 33																	
@33.5': VERY STIFF TO HARD		34 35	7 7 9	21	100	SS-14	4.25	-	-	-	-	-	-	-	-	14	A-6b (V)	-	
		36 37 38																	
	680.6																		
HARD, GRAY, **SILTY CLAY**, SOME SAND, TRACE GRAVEL, DAMP		39 40	7 12 12	31	94	SS-15	5.04*	5	8	16	26	45	30	14	16	14	A-6b (10)	-	
		41 42 43																	
		44 45	8 11 16	35	89	SS-16	4.25	-	-	-	-	-	-	-	-	14	A-6b (V)	-	
		46 47 48																	
		49 50	7 15 15	39	83	SS-17	4.08*	-	-	-	-	-	-	-	-	13	A-6b (V)	-	
		51 52 53																	
@53.5': LITTLE SAND AND GRAVEL		54 55	8 13 18	40	100	SS-18	4.50	-	-	-	-	-	-	-	-	14	A-6b (V)	-	
		56 57 58																	
		59 60	7 12 20	41	100	SS-19	4.50	-	-	-	-	-	-	-	-	13	A-6b (V)	-	
		61 62 63																	
		64	10																

PID: 101140	SFN: 2601745	PROJECT: FUL-120-14.08	STATION / OFFSET: 743+90, 16' LT.	START: 10/7/20	END: 10/8/20	PG 3 OF 3	B-002-1-20

MATERIAL DESCRIPTION AND NOTES	ELEV. 654.9	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	HOLE SEALED
HARD, GRAY, **SILTY CLAY**, SOME SAND, TRACE GRAVEL, DAMP *(continued)*		65 66 67 68	14 16	39	89	SS-20	4.50	-	-	-	-	-	-	-	-	12	A-6b (V)	-	
@68.5': SOME SAND	645.6	69 70 71 72 73	11 15 21	46	94	SS-21	4.50	-	-	-	-	-	-	-	-	12	A-6b (V)	-	
HARD, GRAY, **SANDY SILT**, LITTLE CLAY AND TRACE GRAVEL, MOIST		74 75 76 77 78	22 26 30	72	83	SS-22	4.50	-	-	-	-	-	-	-	-	10	A-4a (V)	-	
@78.5': LITTLE GRAVEL	639.1	79 EOB 80	24 29 32	79	78	SS-23	4.50	-	-	-	-	-	-	-	-	7	A-4a (V)	-	

NOTES: "*" - UNCONFINED STRENGTH DETERMINED BY ASTM D 2166.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLACED 0.5 BAG ASPHALT PATCH; PUMPED 23 CF BENTONITE GROUT

PROJECT: FUL-120-14.08
TYPE: RETAINING WALL
PID: 101140 SFN: 2601745
START: 10/9/20 END: 10/9/20

DRILLING FIRM / OPERATOR: TTL / TB
SAMPLING FIRM / LOGGER: TTL / KKC
DRILLING METHOD: 3.25" HSA
SAMPLING METHOD: SPT

DRILL RIG: CME 75 TRUCK 111
HAMMER: CME AUTOMATIC
CALIBRATION DATE: 2/20/19
ENERGY RATIO (%): 70.8

STATION / OFFSET: 743+87, 32' LT.
ALIGNMENT: SR 120
ELEVATION: 719.2 (NAVD88) EOB: 23.5 ft.
COORD: 748277.4800 N, 1583342.4600 E

EXPLORATION ID
X-003-0-20

PAGE
1 OF 1

MATERIAL DESCRIPTION AND NOTES	ELEV. 719.2	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%)					ATTERBERG			WC	ODOT CLASS (GI)	SO4 ppm	HOLE SEALED
								GR	CS	FS	SI	CL	LL	PL	PI				
ASPHALT - 1 INCH	719.1																		
CRUSHED STONE - 35 INCHES	716.2																		
BROWN, **SILTY CLAY**, SOME SAND, LITTLE CRUSHED STONE, AND TRACE BRICK FRAGMENTS **FILL**	712.7																		
GRAY, **SILTY CLAY**, SOME SAND	707.2																		
BROWN, **SILT AND CLAY**, LITTLE SAND @14': GRAY	695.7	EOB																	

NOTES: NONE

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLACED 0.25 BAG ASPHALT PATCH; PUMPED 7 CF BENTONITE GROUT

PROJECT: FUL-120-14.08
TYPE: RETAINING WALL
PID: 101140 SFN: 2601745
START: 10/9/20 END: 10/9/20

DRILLING FIRM / OPERATOR: TTL / TB
SAMPLING FIRM / LOGGER: TTL / KKC
DRILLING METHOD: 3.25" HSA
SAMPLING METHOD: SPT

DRILL RIG: CME 75 TRUCK 111
HAMMER: CME AUTOMATIC
CALIBRATION DATE: 2/20/19
ENERGY RATIO (%): 70.8

STATION / OFFSET: 743+85, 33' LT.
ALIGNMENT: SR 120
ELEVATION: 718.9 (NAVD88) EOB: 23.5 ft.
COORD: 748278.8900 N, 1583341.2000 E

EXPLORATION ID
X-003-1-20

PAGE
1 OF 1

MATERIAL DESCRIPTION AND NOTES	ELEV. 718.9	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%)					ATTERBERG			WC	ODOT CLASS (GI)	SO4 ppm	HOLE SEALED
								GR	CS	FS	SI	CL	LL	PL	PI				
ASPHALT - 1 INCH	718.8																		
CRUSHED STONE - 35 INCHES (WITH CONCRETE FRAGMENTS)	715.9																		
BROWN, **SILTY CLAY**, SOME SAND, LITTLE CRUSHED STONE **FILL**	712.4																		
GRAY, **SILTY CLAY**, SOME SAND AND LITTLE GRAVEL	706.4																		
GRAY, **SILT AND CLAY**, LITTLE SAND @16': TRACE GRAVEL	695.4	EOB																	

NOTES: NONE

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLACED 0.25 BAG ASPHALT PATCH; PUMPED 7 CF BENTONITE GROUT

STANDARD ODOT LOG W/ SULFATES (8.5 X 11) - OH DOT.GDT - 8/12/21 15:07 - S:\PROJECTS\1987301.GPJ

PROJECT: FUL-120-14.08
TYPE: BUILDING
PID: 101140 SFN: 2601745
START: 10/9/20 END: 10/9/20

DRILLING FIRM / OPERATOR: TTL / TB
SAMPLING FIRM / LOGGER: TTL / KKC
DRILLING METHOD: 3.25" HSA
SAMPLING METHOD: SPT

DRILL RIG: CME 75 TRUCK 111
HAMMER: CME AUTOMATIC
CALIBRATION DATE: 2/20/19
ENERGY RATIO (%): 70.8

STATION / OFFSET: 744+48, 29' LT.
ALIGNMENT: SR 120
ELEVATION: 719.4 (NAVD88) EOB: 20.0 ft.
COORD: 748251.2300 N, 1583397.6600 E

EXPLORATION ID
B-004-0-20

PAGE
1 OF 1

MATERIAL DESCRIPTION AND NOTES	ELEV. 719.4	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%)					ATTERBERG			WC	ODOT CLASS (GI)	SO4 ppm	ABAN-DONED
								GR	CS	FS	SI	CL	LL	PL	PI				
ASPHALT - 4 INCHES	719.1																		
CONCRETE - 8 INCHES	718.4																		
MEDIUM STIFF, DARK BROWN, **SILT AND CLAY**, WITH WOOD, LITTLE SAND, AND TRACE CRUSHED STONE, WET **FILL** (HIGHLY ORGANIC, ORGANIC CONTENT = 11.7%)	715.6		1 2 3	6	100	SS-1	1.25	-	-	-	-	-	-	-	-	40	A-6a (V)	-	
STIFF TO VERY STIFF, BROWN, **SILTY CLAY**, LITTLE SAND AND TRACE GRAVEL, DAMP	713.4		3 4 7	13	100	SS-2	3.47*	-	-	-	-	-	-	-	-	15	A-6b (V)	-	
VERY STIFF TO HARD, BROWN, **SILT AND CLAY**, SOME SAND AND TRACE GRAVEL, DAMP			6 8 14	26	100	SS-3	4.50	6	9	19	24	42	28	17	11	14	A-6a (7)	-	
@8.5': HARD			5 12 14	31	100	SS-4	4.50	-	-	-	-	-	-	-	-	13	A-6a (V)	-	
@13.7': VERY STIFF TO HARD GRAY			5 10 11	25	100	SS-5	4.50	-	-	-	-	-	-	-	-	12	A-6a (V)	-	
	699.4	EOB 20	3 8 11	22	100	SS-6	4.50	-	-	-	-	-	-	-	-	13	A-6a (V)	-	

NOTES: "*" - UNCONFINED STRENGTH DETERMINED BY ASTM D 2166.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLACED 0.25 BAG ASPHALT PATCH; PLACED 1 BAG BENTONITE CHIPS

LITHOLOGIC SYMBOLS

(Unified Soil Classification System)

⁘	A-1-B: Ohio DOT: A-1-b, gravel and/or stone fragments with sand
⁘	A-2-4: Ohio DOT: A-2-4, gravel and/or stone fragments with sand and silt
⁘	A-2-6: Ohio DOT: A-2-6, gravel and/or stone fragments with sand, silt and clay
F S	A-3: Ohio DOT: A-3, fine sand
⁙	A-3A: Ohio DOT: A-3a, coarse and fine sand
▥	A-4A: Ohio DOT: A-4a, sandy silt
▨	A-6A: Ohio DOT: A-6a, silt and clay
▤	A-6B: Ohio DOT: A-6b, silty clay
▤	DOLOMITE: Ohio DOT: Dolomite
▩	PAVEMENT OR BASE: Ohio DOT: Pavement or Aggregate base
▧	TOPSOIL: Ohio DOT: Sod and Topsoil

SAMPLER SYMBOLS

▯	NX or NQ Rock Core

WELL CONSTRUCTION SYMBOLS

⁘	Soil Cuttings Backfill mixed with Bentonite Pellets or Chips
▩	Asphalt or Concrete Pavement Patch

Notes:

1. Exploratory borings were drilled on October 7 through 9, 2020, utilizing 3¼ 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.

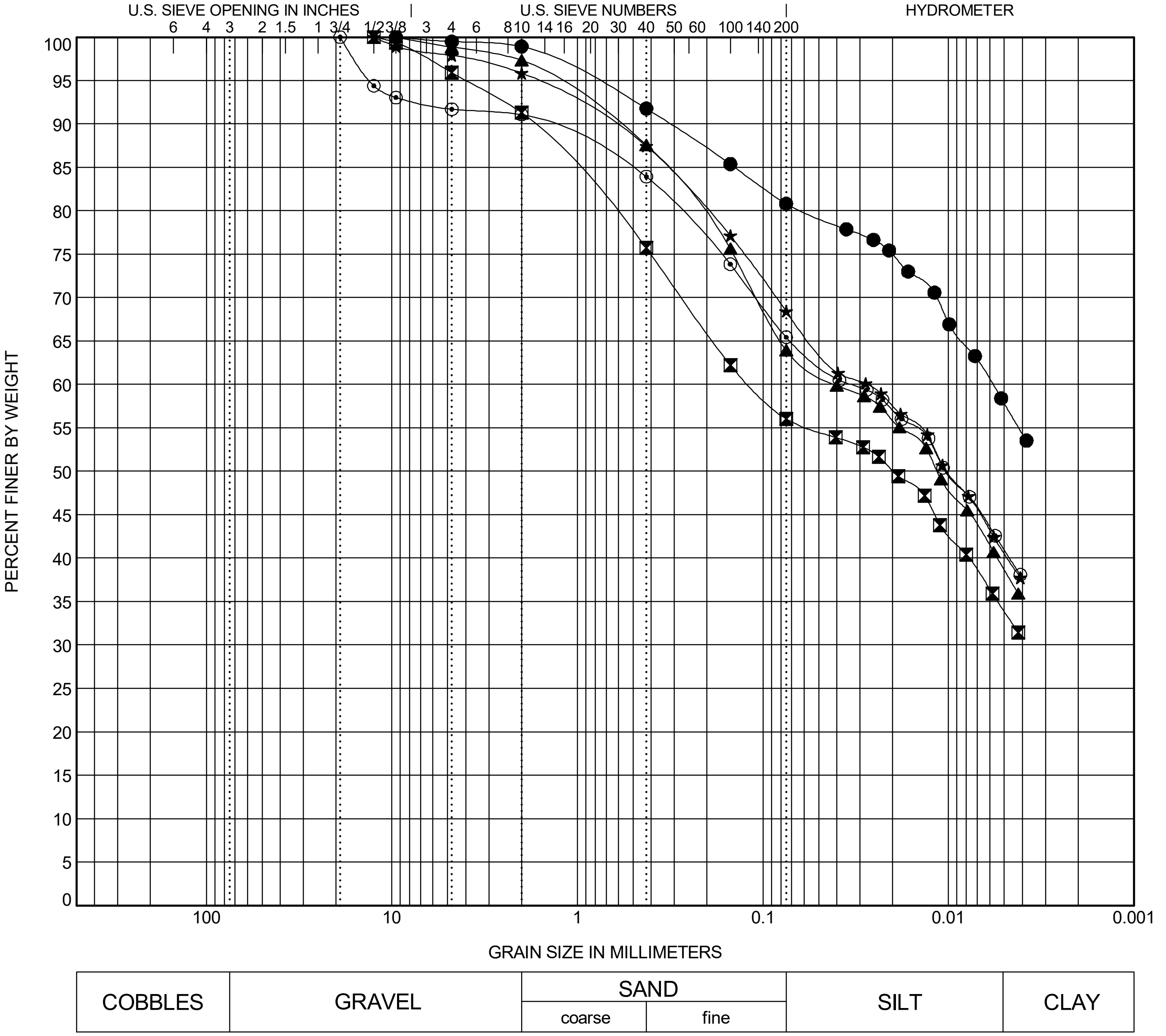
3. The borings were located in the field by TTL Associates, Inc. based on direction from Bergmann. Stationing, offsets, coordinates, and ground surface elevations at the boring locations were provided by Bergmann.

4. HP (tsf):
   Hand Penetrometer Readings.
   NI = Not Intact.
   * = Indicates Unconfined Compressive Strength Test by ASTM D 2166.

GRAIN SIZE DISTRIBUTION

OHIO DEPARTMENT OF TRANSPORTION
OFFICE OF GEOTECHNICAL ENGINEERING

PROJECT FUL-120-14.08
PID 101140
OGE NUMBER N/A
PROJECT TYPE STRUCTURE FOUNDATION



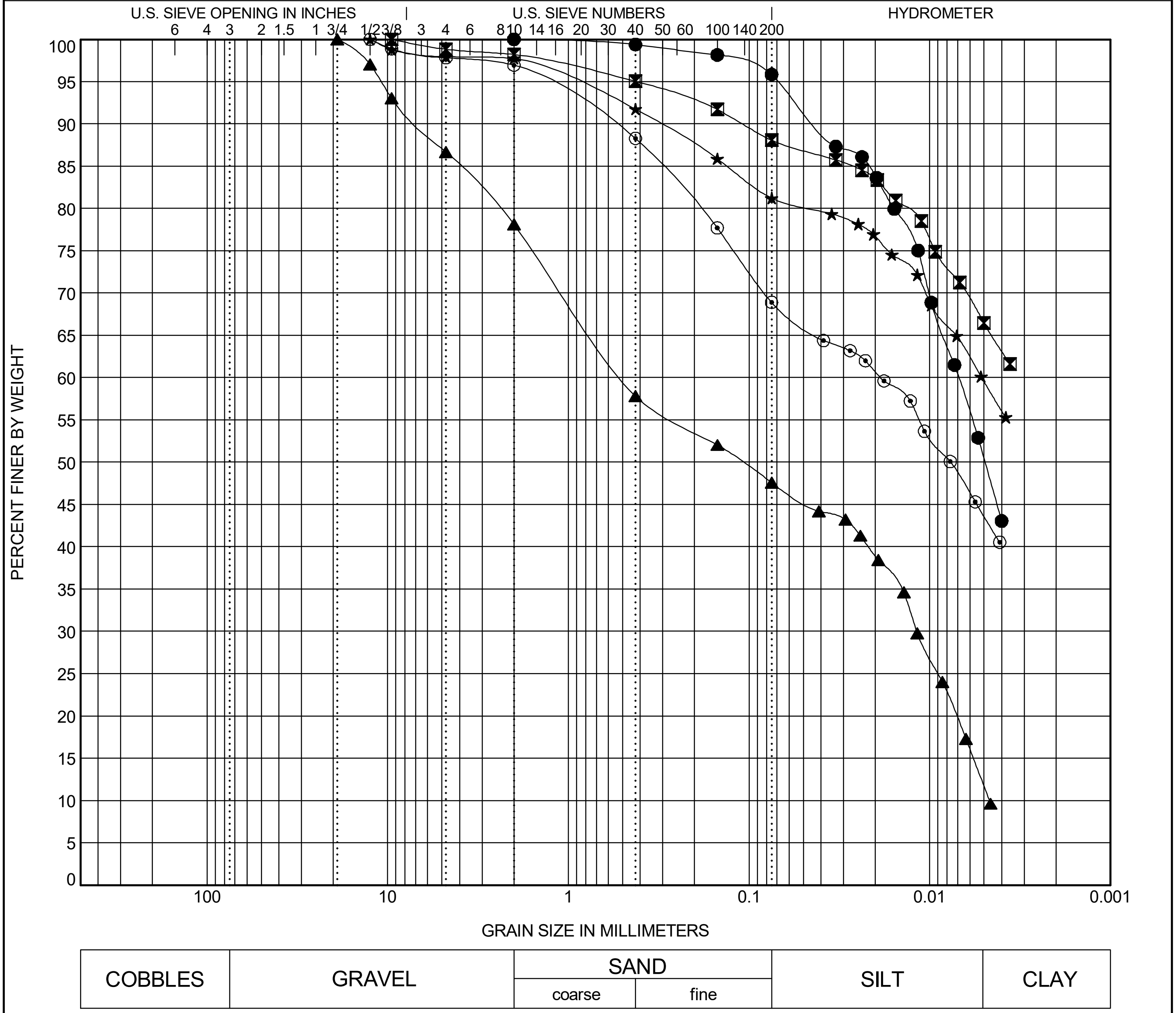
Specimen Identification			ODOT (Modified AASHTO) ~ USCS Classification	LL	PL	PI
●	**B-001-0-20**	**1.0**	**A-6a ~ LEAN CLAY with SAND(CL)**	**29**	**15**	**14**
☒	**B-001-0-20**	**2.5**	**A-6a ~ SANDY LEAN CLAY(CL)**	**26**	**14**	**12**
▲	**B-001-0-20**	**14.0**	**A-6a ~ SANDY LEAN CLAY(CL)**	**26**	**11**	**15**
★	**B-001-0-20**	**15.5**	**A-6a ~ SANDY LEAN CLAY(CL)**	**26**	**12**	**14**
⊙	**B-001-0-20**	**17.0**	**A-6a ~ SANDY LEAN CLAY(CL)**	**26**	**14**	**12**

Specimen Identification			D90	D50	D30	D10	%G	%CS	%FS	%M	%C	Cc	Cu
●	**B-001-0-20**	**1.0**	**0.319**				**1**	**7**	**11**	**23**	**58**		
☒	**B-001-0-20**	**2.5**	**1.758**	**0.02**			**8**	**16**	**20**	**22**	**34**		
▲	**B-001-0-20**	**14.0**	**0.623**	**0.012**			**2**	**10**	**24**	**25**	**39**		
★	**B-001-0-20**	**15.5**	**0.68**	**0.01**			**5**	**8**	**19**	**27**	**41**		
⊙	**B-001-0-20**	**17.0**	**1.582**	**0.01**			**10**	**7**	**18**	**24**	**41**		

GRAIN SIZE DISTRIBUTION

OHIO DEPARTMENT OF TRANSPORTION
OFFICE OF GEOTECHNICAL ENGINEERING

PROJECT FUL-120-14.08 **PID** 101140
OGE NUMBER N/A **PROJECT TYPE** STRUCTURE FOUNDATION



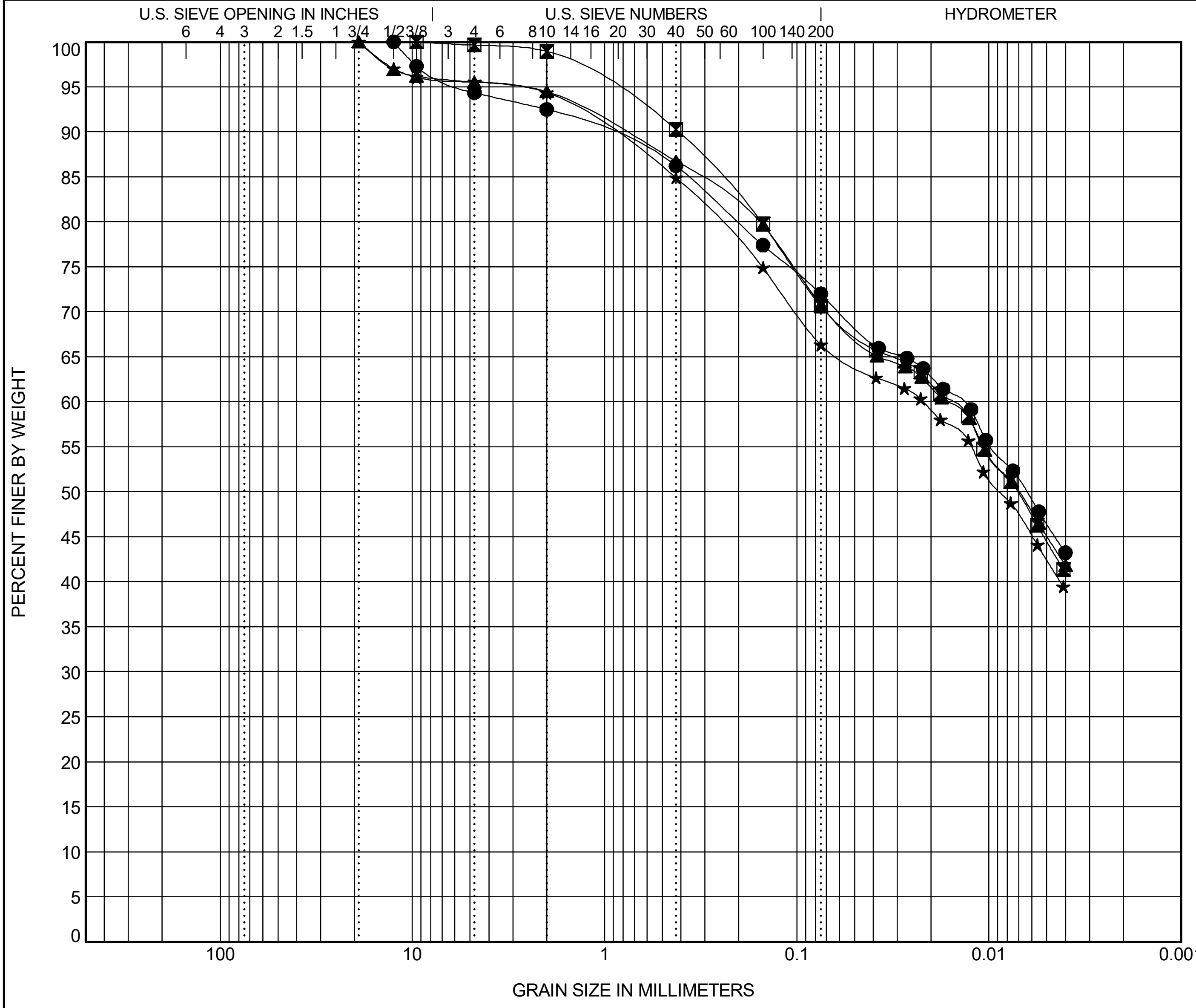
Specimen Identification		ODOT (Modified AASHTO) ~ USCS Classification	LL	PL	PI
● B-001-0-20	38.5	**A-4a ~ SILTY CLAY(CL-ML)**	21	14	7
⧗ B-001-0-20	58.5	**A-6a ~ LEAN CLAY(CL)**	28	13	15
▲ B-002-1-20	2.5	**A-4a ~ CLAYEY SAND(SC)**	21	13	8
★ B-002-1-20	4.0	**A-6b ~ LEAN CLAY with SAND(CL)**	33	17	16
⊙ B-002-1-20	13.5	**A-6a ~ SANDY LEAN CLAY(CL)**	27	13	14

Specimen Identification		D90	D50	D30	D10	%G	%CS	%FS	%M	%C	Cc	Cu
● B-001-0-20	38.5	0.043	0.005			0	0	4	46	50		
⧗ B-001-0-20	58.5	0.108				2	3	7	22	66		
▲ B-002-1-20	2.5	6.827	0.109	0.012	0.005	22	20	10	36	12	0.06	107.49
★ B-002-1-20	4.0	0.311				2	6	11	21	60		
⊙ B-002-1-20	13.5	0.578	0.008			3	9	19	25	44		

GRAIN SIZE DISTRIBUTION

OHIO DEPARTMENT OF TRANSPORTION
OFFICE OF GEOTECHNICAL ENGINEERING

PROJECT FUL-120-14.08 **PID** 101140
OGE NUMBER N/A **PROJECT TYPE** STRUCTURE FOUNDATION



COBBLES	GRAVEL	SAND		SILT	CLAY
		coarse	fine		

	Specimen Identification		ODOT (Modified AASHTO) ~ USCS Classification	LL	PL	PI
●	**B-002-1-20**	**16.0**	**A-6a ~ LEAN CLAY with SAND(CL)**	**26**	**11**	**15**
⧗	**B-002-1-20**	**18.5**	**A-6b ~ LEAN CLAY with SAND(CL)**	**26**	**8**	**18**
▲	**B-002-1-20**	**38.5**	**A-6b ~ LEAN CLAY with SAND(CL)**	**30**	**14**	**16**
★	**B-004-0-20**	**6.0**	**A-6a ~ SANDY LEAN CLAY(CL)**	**28**	**17**	**11**

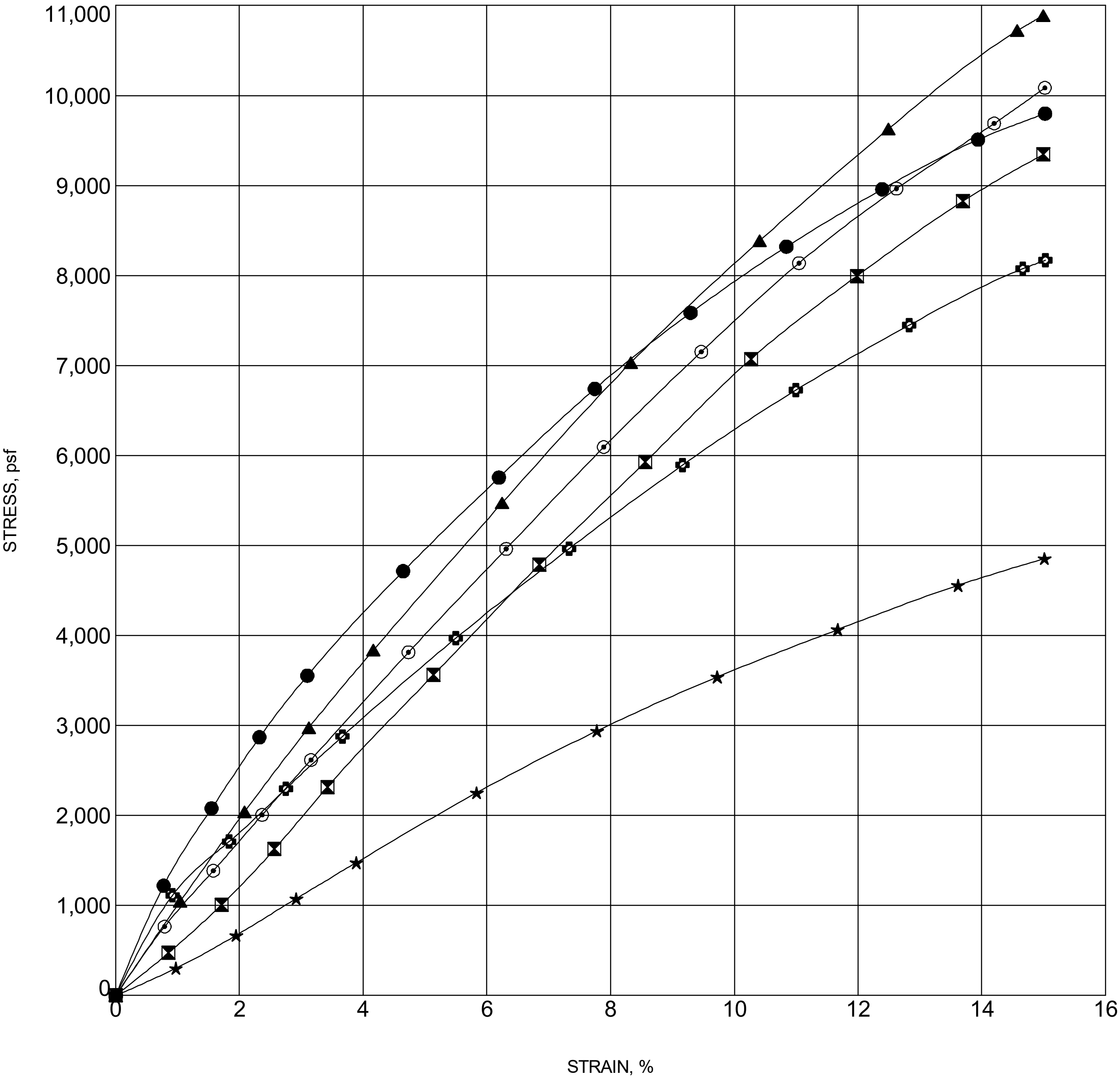
	Specimen Identification		D90	D50	D30	D10	%G	%CS	%FS	%M	%C	Cc	Cu
●	**B-002-1-20**	**16.0**	**1.08**	**0.006**			**8**	**6**	**14**	**26**	**46**		
⧗	**B-002-1-20**	**18.5**	**0.413**	**0.007**			**0**	**9**	**20**	**27**	**44**		
▲	**B-002-1-20**	**38.5**	**0.815**	**0.007**			**5**	**8**	**16**	**26**	**45**		
★	**B-004-0-20**	**6.0**	**0.979**	**0.009**			**6**	**9**	**19**	**24**	**42**		

UNCONFINED COMPRESSION TEST

OHIO DEPARTMENT OF TRANSPORTION
OFFICE OF GEOTECHNICAL ENGINEERING

PROJECT FUL-120-14.08 **PID** 101140

OGE NUMBER N/A **PROJECT TYPE** STRUCTURE FOUNDATION

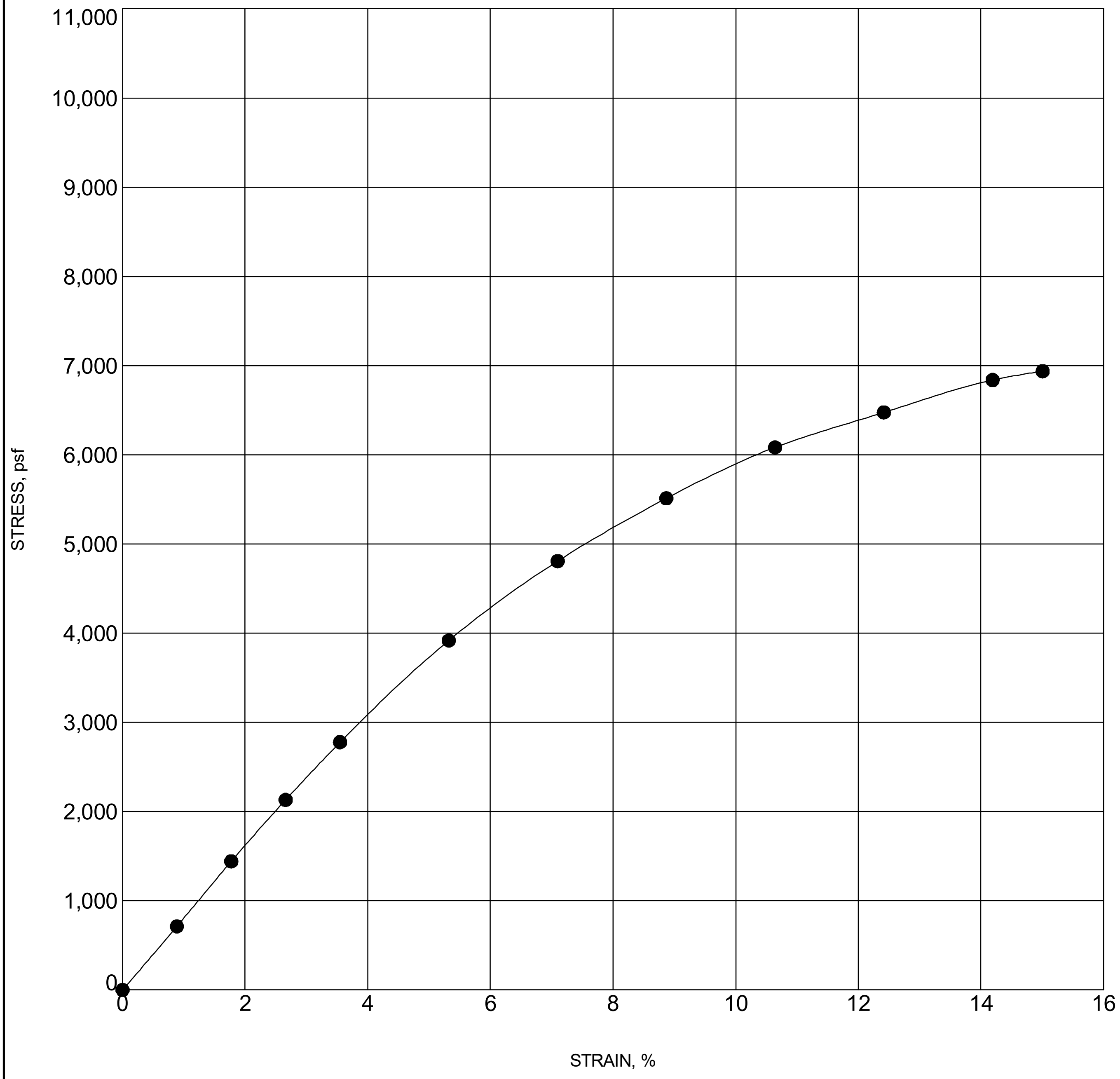


	Specimen Identification		Classification	γ_d	MC%
●	**B-001-0-20**	**11.0**		**130**	**12**
☒	**B-001-0-20**	**23.5**		**130**	**12**
▲	**B-001-0-20**	**58.5**		**126**	**13**
★	**B-002-1-20**	**26.0**		**120**	**12**
⊙	**B-002-1-20**	**38.5**		**119**	**14**
✿	**B-002-1-20**	**48.5**		**117**	**13**

UNCONFINED COMPRESSION TEST

OHIO DEPARTMENT OF TRANSPORTION
OFFICE OF GEOTECHNICAL ENGINEERING

PROJECT FUL-120-14.08
PID 101140
OGE NUMBER N/A
PROJECT TYPE STRUCTURE FOUNDATION



	Specimen Identification		Classification	γ_d	MC%
●	**B-004-0-20**	**3.5**		**118**	**15**

Appendix A:
Engineering Calculations
(Including GB-1 Spreadsheets)

1987301 FUL-120 Average Soil Properties						
Avg B-1&B-2	**Avg Qu (psf) N60*250**	**Avg HP (psf)**	**Avg Qu Test (psf)**	**Recomm Qu (psf)**	**c (psf)**	**Total Wt (pcf)**
Fill	2156	3583	-	**2000**	**1000**	**125**
Stratum 1	1313	1500	-	**1400**	**700**	**120**
Stratum 2	3250	9000	-	**3200**	**1600**	**130**
Stratum 3	6334	8668	7180	**7000**	**3500**	**140**
Stratum 4	10764	8888	9940	**9000**	**4500**	**135**
Stratum 5	21000	9000	-	**9000**	**4500**	**135**

1987301 FUL-120

Evaluation By: CPI 8-11-21

719	Road Elevation
698.4	Bottom of Footing Elevation
20.6	Bottom of Footing Depth
20	Modeled Depth of bottom of footing
2	Pile Stickup

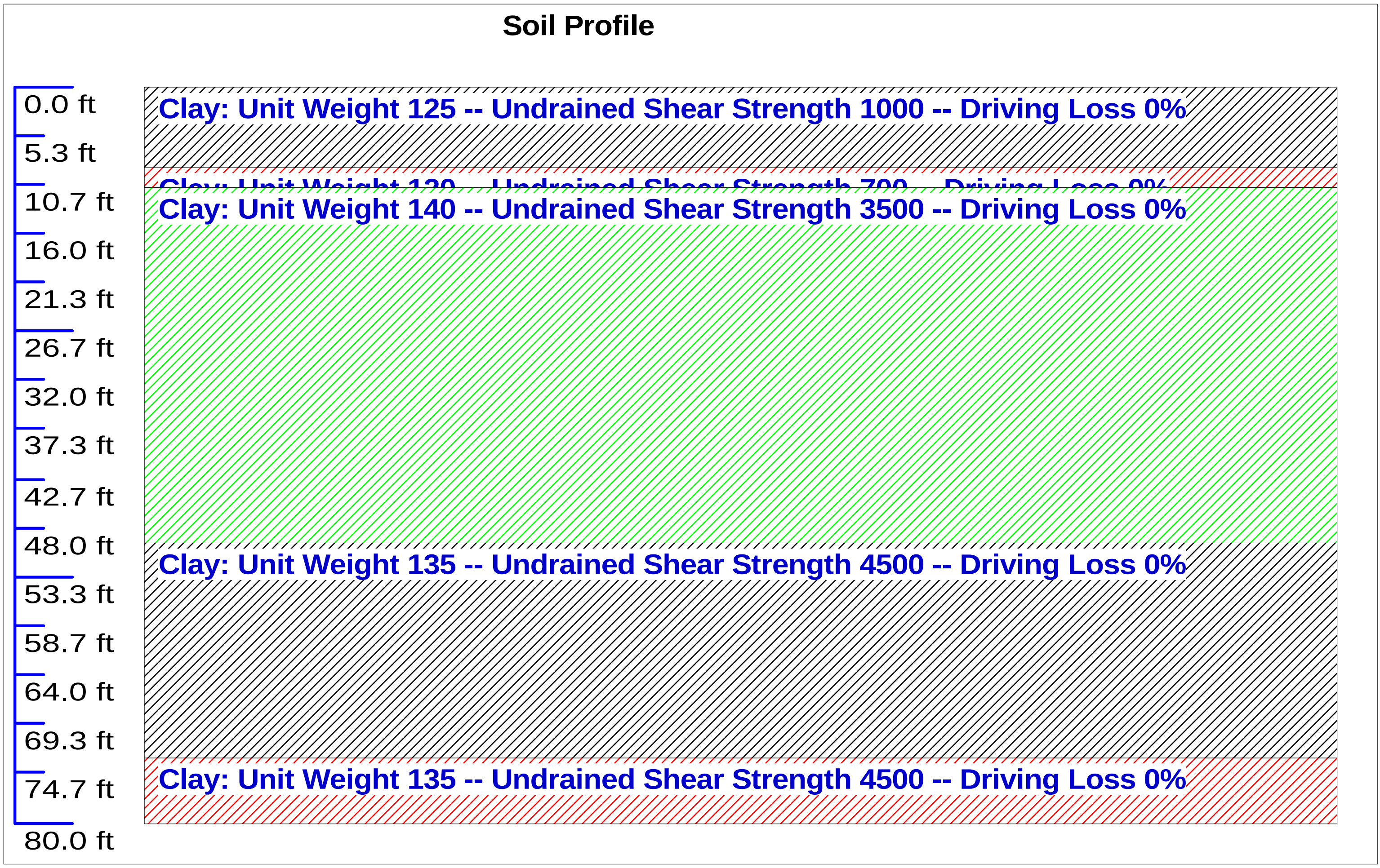
Evaluations Based On Prebore to

Top of Stratum IV at Depth of:	**49.5 ft**	**38.5 ft**
Elev.:	**669.5**	**680.5**

Pile	Max Rndr (k)	Rear Abut B-001 Tip Depth	Tip Elev	Calc Length	Est Length	Order Length	Fwd Abut B-002 Tip Depth	Tip Elev	Calc Length	Est Length	Order Length
12" CIP	330	69	650	51	55	60	73.5	645.5	55.5	60	65
14" CIP	390	63	656	45	50	55	66	653	48	50	55
16" CIP	450	59	660	41	45	50	61	658	43	50	55
10x42	310	70	649	52	55	60	73	646	55	60	65
12x53	380	66	653	48	50	55	70	649	52	55	60
14x73	530	66	653	48	50	55	70	649	52	55	60

All depths, lengths, and elevations in units of feet.

Filename: T:\GEOTECH\DRIVEN\1987301\B-1C.DVN



Superseded Analyses: Cohesion considered but not utilized for Strata IV and V.

DRIVEN 1.2

GENERAL PROJECT INFORMATION

Filename: T:\GEOTECH\DRIVEN\1987301\B-1C.DVN
Project Name: FUL-120 Project Date: 05/03/2021
Project Client: Bergmann
Computed By: CPI
Project Manager: CPI

PILE INFORMATION

Pile Type: Pipe Pile - Closed End
Top of Pile: 49.50 ft
Diameter of Pile: 12.00 in

ULTIMATE CONSIDERATIONS

Water Table Depth At Time Of:	- Drilling:	9.00 ft
	- Driving/Restrike	9.00 ft
	- Ultimate:	9.00 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	9.00 ft	0.00%	125.00 pcf	1000.00 psf	T-79 Steel
2	Cohesive	2.00 ft	0.00%	120.00 pcf	700.00 psf	T-79 Steel
3	Cohesive	38.50 ft	0.00%	140.00 pcf	3500.00 psf	T-79 Steel
4	Cohesive	23.50 ft	0.00%	135.00 pcf	4500.00 psf	T-79 Steel
5	Cohesive	7.00 ft	0.00%	135.00 pcf	4500.00 psf	T-79 Steel

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
8.99 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
10.99 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
11.01 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
20.01 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
29.01 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
38.01 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
47.01 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
49.49 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
49.49 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
49.50 ft	Cohesive	N/A	N/A	1260.00 psf	0.00 Kips
49.51 ft	Cohesive	N/A	N/A	1260.00 psf	0.04 Kips
58.51 ft	Cohesive	N/A	N/A	1260.00 psf	35.67 Kips
67.51 ft	Cohesive	N/A	N/A	1260.00 psf	71.29 Kips
72.99 ft	Cohesive	N/A	N/A	1260.00 psf	92.98 Kips
73.01 ft	Cohesive	N/A	N/A	1260.00 psf	93.06 Kips
79.99 ft	Cohesive	N/A	N/A	1260.00 psf	120.69 Kips

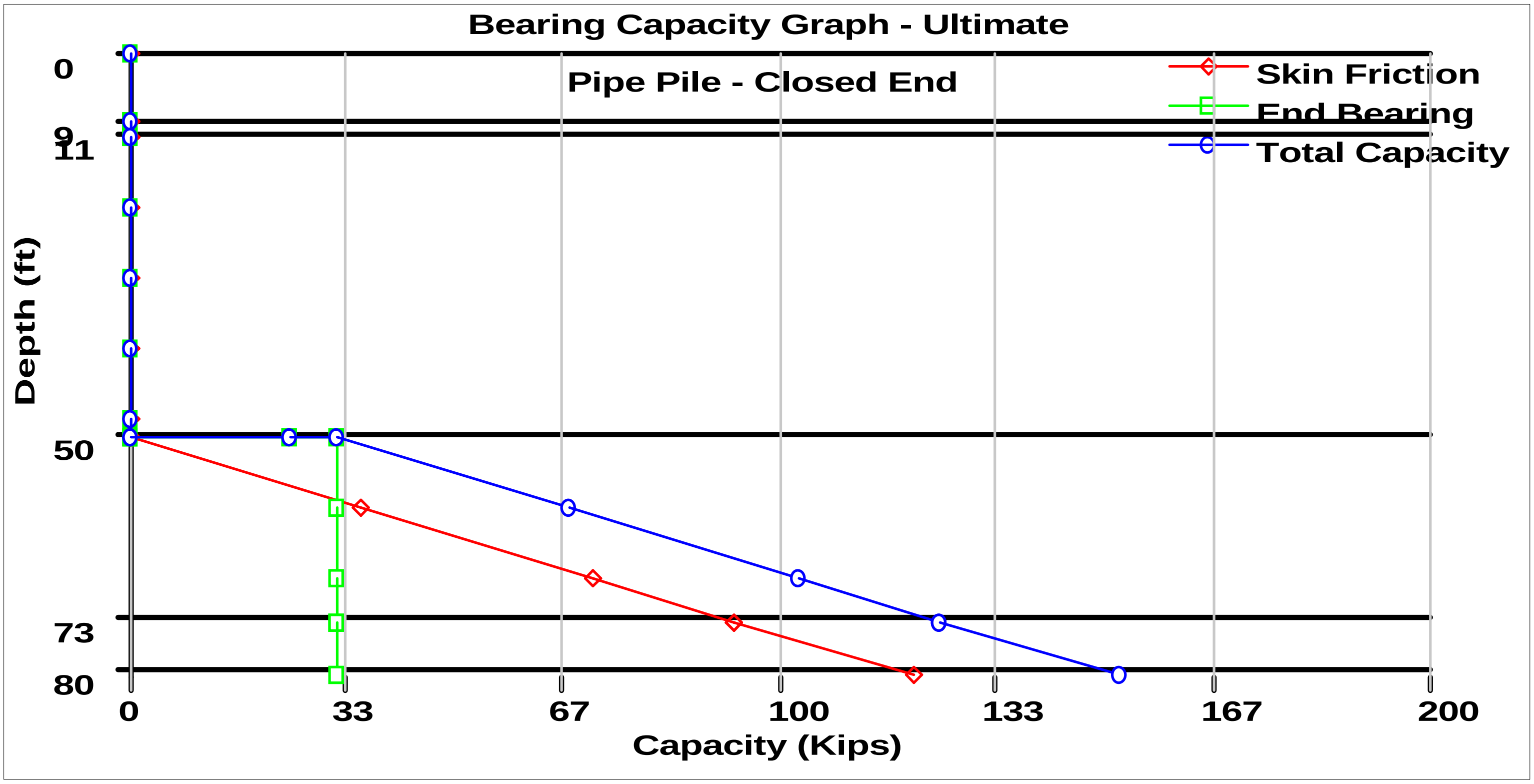
ULTIMATE - END BEARING

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
8.99 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
9.01 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
10.99 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
11.01 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
20.01 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
29.01 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
38.01 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
47.01 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
49.49 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
49.49 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
49.50 ft	Cohesive	N/A	N/A	N/A	24.74 Kips
49.51 ft	Cohesive	N/A	N/A	N/A	31.81 Kips
58.51 ft	Cohesive	N/A	N/A	N/A	31.81 Kips
67.51 ft	Cohesive	N/A	N/A	N/A	31.81 Kips
72.99 ft	Cohesive	N/A	N/A	N/A	31.81 Kips
73.01 ft	Cohesive	N/A	N/A	N/A	31.81 Kips
79.99 ft	Cohesive	N/A	N/A	N/A	31.81 Kips

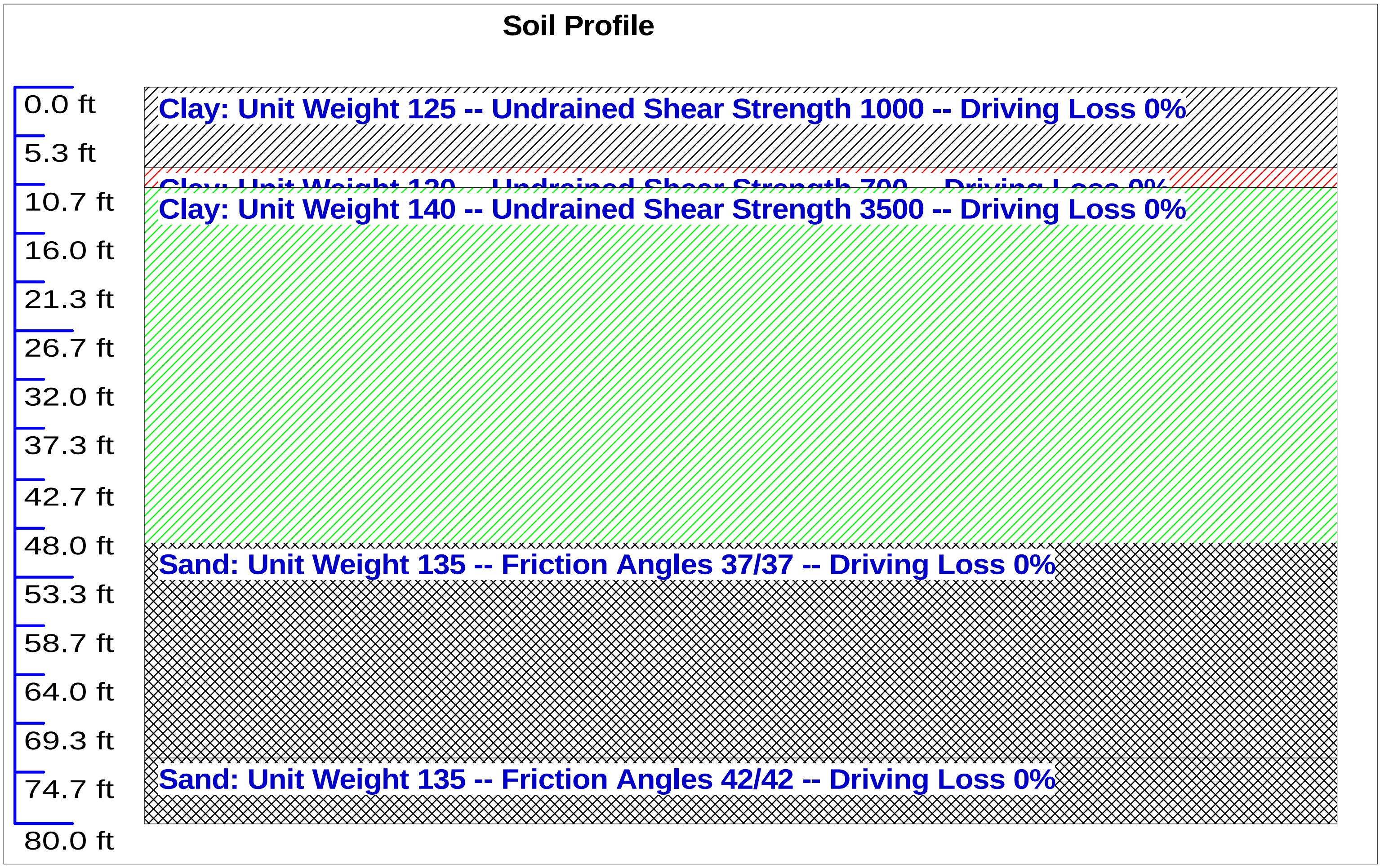
ULTIMATE - SUMMARY OF CAPACITIES

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
8.99 ft	0.00 Kips	0.00 Kips	0.00 Kips
9.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
10.99 ft	0.00 Kips	0.00 Kips	0.00 Kips
11.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
20.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
29.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
38.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
47.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
49.49 ft	0.00 Kips	0.00 Kips	0.00 Kips
49.49 ft	0.00 Kips	0.00 Kips	0.00 Kips
49.50 ft	0.00 Kips	24.74 Kips	24.74 Kips
49.51 ft	0.04 Kips	31.81 Kips	31.85 Kips
58.51 ft	35.67 Kips	31.81 Kips	67.47 Kips
67.51 ft	71.29 Kips	31.81 Kips	103.10 Kips
72.99 ft	92.98 Kips	31.81 Kips	124.79 Kips
73.01 ft	93.06 Kips	31.81 Kips	124.87 Kips
79.99 ft	120.69 Kips	31.81 Kips	152.50 Kips

Filename: T:\GEOTECH\DRIVEN\1987301\B-1C.DVN



Filename: T:\GEOTECH\DRIVEN\1987301\B-1N.DVN



Design Analyses: Strata IV and V modeled as "cohesionless" with phi based on N60 values.

DRIVEN 1.2

GENERAL PROJECT INFORMATION

Filename: T:\GEOTECH\DRIVEN\1987301\B-1N.DVN
Project Name: FUL-120　　Project Date: 05/03/2021
Project Client: Bergmann
Computed By: CPI
Project Manager: CPI

PILE INFORMATION

Pile Type: Pipe Pile - Closed End
Top of Pile: 49.50 ft
Diameter of Pile: 12.00 in

ULTIMATE CONSIDERATIONS

Water Table Depth At Time Of:	- Drilling:	9.00 ft
	- Driving/Restrike	9.00 ft
	- Ultimate:	9.00 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	9.00 ft	0.00%	125.00 pcf	1000.00 psf	T-79 Steel
2	Cohesive	2.00 ft	0.00%	120.00 pcf	700.00 psf	T-79 Steel
3	Cohesive	38.50 ft	0.00%	140.00 pcf	3500.00 psf	T-79 Steel
4	Cohesionless	23.50 ft	0.00%	135.00 pcf	36.9/36.9	Nordlund
5	Cohesionless	7.00 ft	0.00%	135.00 pcf	42.3/42.3	Nordlund

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
8.99 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
10.99 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
11.01 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
20.01 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
29.01 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
38.01 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
47.01 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
49.49 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
49.49 ft	Cohesionless	0.00 psf	0.00	N/A	0.00 Kips
49.50 ft	Cohesionless	1260.00 psf	0.00	N/A	0.00 Kips
49.51 ft	Cohesionless	4228.16 psf	21.72	N/A	0.08 Kips
58.51 ft	Cohesionless	4554.86 psf	21.72	N/A	74.08 Kips
67.51 ft	Cohesionless	4881.56 psf	21.72	N/A	158.71 Kips
72.99 ft	Cohesionless	5080.49 psf	21.72	N/A	215.43 Kips
73.01 ft	Cohesionless	5934.26 psf	24.86	N/A	215.69 Kips
79.99 ft	Cohesionless	6187.64 psf	24.86	N/A	321.22 Kips

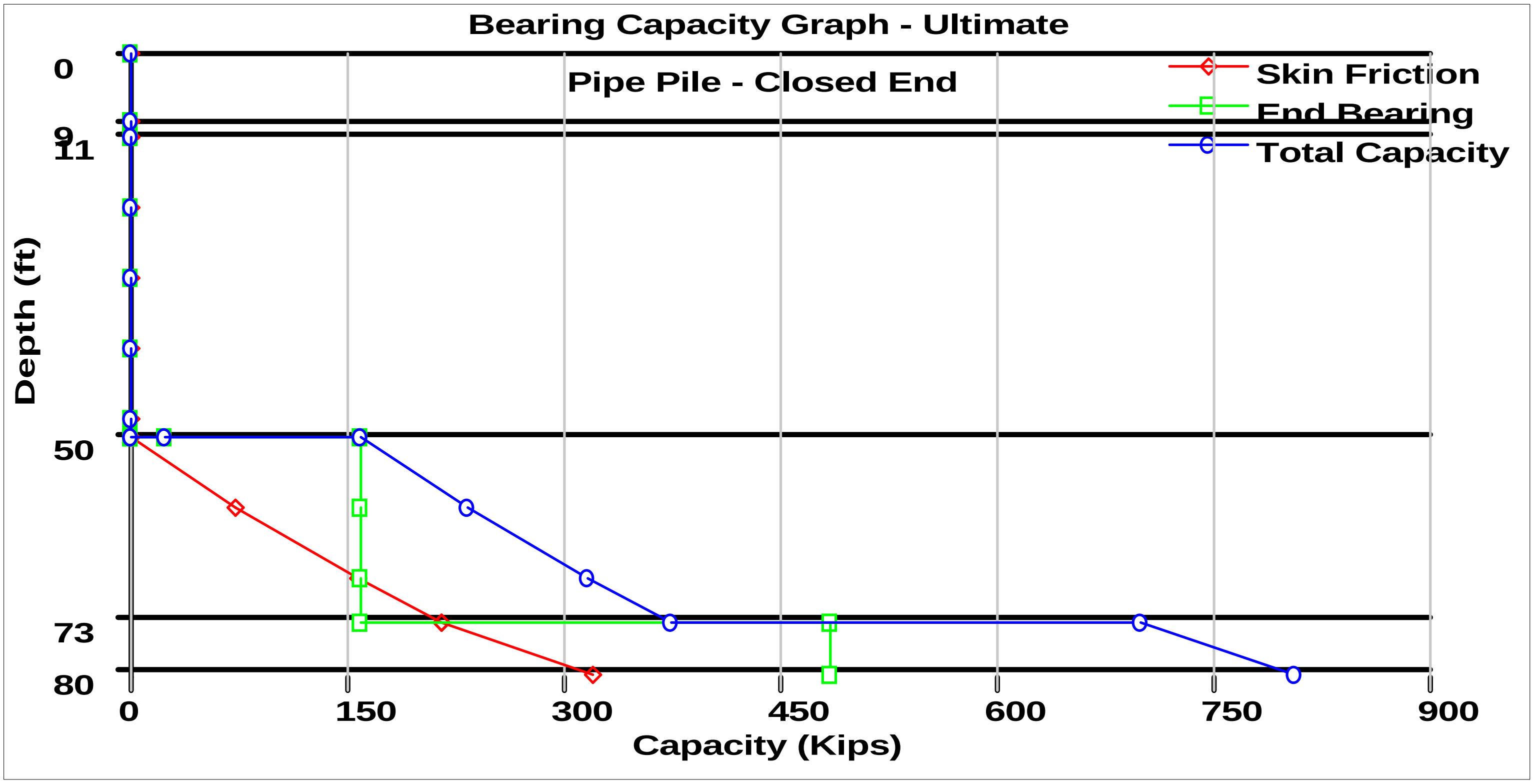
ULTIMATE - END BEARING

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
8.99 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
9.01 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
10.99 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
11.01 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
20.01 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
29.01 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
38.01 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
47.01 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
49.49 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
49.49 ft	Cohesionless	0.00 psf	0.00	0.00 Kips	0.00 Kips
49.50 ft	Cohesionless	4227.80 psf	0.00	24.74 Kips	24.74 Kips
49.51 ft	Cohesionless	4228.53 psf	90.43	159.26 Kips	159.26 Kips
58.51 ft	Cohesionless	4881.93 psf	90.43	159.26 Kips	159.26 Kips
67.51 ft	Cohesionless	5535.33 psf	90.43	159.26 Kips	159.26 Kips
72.99 ft	Cohesionless	5933.17 psf	90.43	159.26 Kips	159.26 Kips
73.01 ft	Cohesionless	5934.63 psf	255.79	485.26 Kips	485.26 Kips
79.99 ft	Cohesionless	6441.37 psf	255.79	485.26 Kips	485.26 Kips

ULTIMATE - SUMMARY OF CAPACITIES

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
8.99 ft	0.00 Kips	0.00 Kips	0.00 Kips
9.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
10.99 ft	0.00 Kips	0.00 Kips	0.00 Kips
11.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
20.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
29.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
38.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
47.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
49.49 ft	0.00 Kips	0.00 Kips	0.00 Kips
49.49 ft	0.00 Kips	0.00 Kips	0.00 Kips
49.50 ft	0.00 Kips	24.74 Kips	24.74 Kips
49.51 ft	0.08 Kips	159.26 Kips	159.33 Kips
58.51 ft	74.08 Kips	159.26 Kips	233.34 Kips
67.51 ft	158.71 Kips	159.26 Kips	317.96 Kips
72.99 ft	215.43 Kips	159.26 Kips	374.69 Kips
73.01 ft	215.69 Kips	485.26 Kips	700.95 Kips
79.99 ft	321.22 Kips	485.26 Kips	806.48 Kips

Filename: T:\GEOTECH\DRIVEN\1987301\B-1N.DVN



DRIVEN 1.2

GENERAL PROJECT INFORMATION

Filename: T:\GEOTECH\DRIVEN\1987301\B-1N.DVN
Project Name: FUL-120 Project Date: 05/03/2021
Project Client: Bergmann
Computed By: CPI
Project Manager: CPI

PILE INFORMATION

Pile Type: Pipe Pile - Closed End
Top of Pile: 49.50 ft
Diameter of Pile: 14.00 in

ULTIMATE CONSIDERATIONS

Water Table Depth At Time Of:	- Drilling:	9.00 ft
	- Driving/Restrike	9.00 ft
	- Ultimate:	9.00 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	9.00 ft	0.00%	125.00 pcf	1000.00 psf	T-79 Steel
2	Cohesive	2.00 ft	0.00%	120.00 pcf	700.00 psf	T-79 Steel
3	Cohesive	38.50 ft	0.00%	140.00 pcf	3500.00 psf	T-79 Steel
4	Cohesionless	23.50 ft	0.00%	135.00 pcf	36.9/36.9	Nordlund
5	Cohesionless	7.00 ft	0.00%	135.00 pcf	42.3/42.3	Nordlund

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
8.99 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
10.99 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
11.01 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
20.01 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
29.01 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
38.01 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
47.01 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
49.49 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
49.49 ft	Cohesionless	0.00 psf	0.00	N/A	0.00 Kips
49.50 ft	Cohesionless	1260.00 psf	0.00	N/A	0.00 Kips
49.51 ft	Cohesionless	4228.16 psf	24.62	N/A	0.12 Kips
58.51 ft	Cohesionless	4554.86 psf	24.62	N/A	112.01 Kips
67.51 ft	Cohesionless	4881.56 psf	24.62	N/A	239.95 Kips
72.99 ft	Cohesionless	5080.49 psf	24.62	N/A	325.71 Kips
73.01 ft	Cohesionless	5934.26 psf	28.18	N/A	326.10 Kips
79.99 ft	Cohesionless	6187.64 psf	28.18	N/A	491.06 Kips

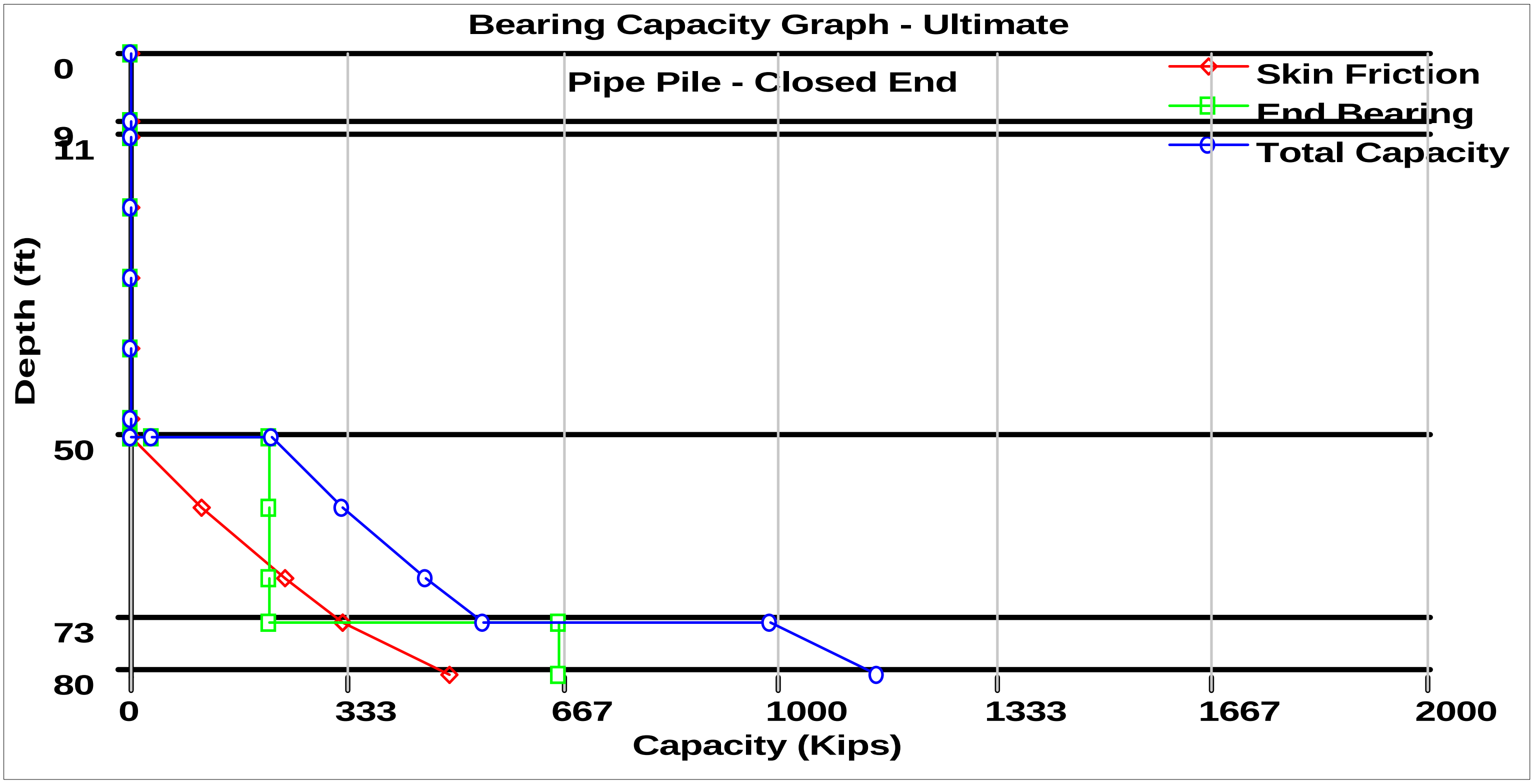
ULTIMATE - END BEARING

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
8.99 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
9.01 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
10.99 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
11.01 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
20.01 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
29.01 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
38.01 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
47.01 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
49.49 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
49.49 ft	Cohesionless	0.00 psf	0.00	0.00 Kips	0.00 Kips
49.50 ft	Cohesionless	4227.80 psf	0.00	33.67 Kips	33.67 Kips
49.51 ft	Cohesionless	4228.53 psf	90.43	216.77 Kips	216.77 Kips
58.51 ft	Cohesionless	4881.93 psf	90.43	216.77 Kips	216.77 Kips
67.51 ft	Cohesionless	5535.33 psf	90.43	216.77 Kips	216.77 Kips
72.99 ft	Cohesionless	5933.17 psf	90.43	216.77 Kips	216.77 Kips
73.01 ft	Cohesionless	5934.63 psf	255.79	660.49 Kips	660.49 Kips
79.99 ft	Cohesionless	6441.37 psf	255.79	660.49 Kips	660.49 Kips

ULTIMATE - SUMMARY OF CAPACITIES

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
8.99 ft	0.00 Kips	0.00 Kips	0.00 Kips
9.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
10.99 ft	0.00 Kips	0.00 Kips	0.00 Kips
11.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
20.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
29.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
38.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
47.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
49.49 ft	0.00 Kips	0.00 Kips	0.00 Kips
49.49 ft	0.00 Kips	0.00 Kips	0.00 Kips
49.50 ft	0.00 Kips	33.67 Kips	33.67 Kips
49.51 ft	0.12 Kips	216.77 Kips	216.88 Kips
58.51 ft	112.01 Kips	216.77 Kips	328.77 Kips
67.51 ft	239.95 Kips	216.77 Kips	456.71 Kips
72.99 ft	325.71 Kips	216.77 Kips	542.48 Kips
73.01 ft	326.10 Kips	660.49 Kips	986.59 Kips
79.99 ft	491.06 Kips	660.49 Kips	1151.55 Kips

Filename: T:\GEOTECH\DRIVEN\1987301\B-1N.DVN



DRIVEN 1.2

GENERAL PROJECT INFORMATION

Filename: T:\GEOTECH\DRIVEN\1987301\B-1N.DVN
Project Name: FUL-120 Project Date: 05/03/2021
Project Client: Bergmann
Computed By: CPI
Project Manager: CPI

PILE INFORMATION

Pile Type: Pipe Pile - Closed End
Top of Pile: 49.50 ft
Diameter of Pile: 16.00 in

ULTIMATE CONSIDERATIONS

Water Table Depth At Time Of:	- Drilling:	9.00 ft
	- Driving/Restrike	9.00 ft
	- Ultimate:	9.00 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	9.00 ft	0.00%	125.00 pcf	1000.00 psf	T-79 Steel
2	Cohesive	2.00 ft	0.00%	120.00 pcf	700.00 psf	T-79 Steel
3	Cohesive	38.50 ft	0.00%	140.00 pcf	3500.00 psf	T-79 Steel
4	Cohesionless	23.50 ft	0.00%	135.00 pcf	36.9/36.9	Nordlund
5	Cohesionless	7.00 ft	0.00%	135.00 pcf	42.3/42.3	Nordlund

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
8.99 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
10.99 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
11.01 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
20.01 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
29.01 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
38.01 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
47.01 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
49.49 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
49.49 ft	Cohesionless	0.00 psf	0.00	N/A	0.00 Kips
49.50 ft	Cohesionless	1213.04 psf	0.00	N/A	0.00 Kips
49.51 ft	Cohesionless	4228.16 psf	27.06	N/A	0.16 Kips
58.51 ft	Cohesionless	4554.86 psf	27.06	N/A	156.49 Kips
67.51 ft	Cohesionless	4881.56 psf	27.06	N/A	335.23 Kips
72.99 ft	Cohesionless	5080.49 psf	27.06	N/A	455.05 Kips
73.01 ft	Cohesionless	5934.26 psf	30.97	N/A	455.60 Kips
79.99 ft	Cohesionless	6187.64 psf	30.97	N/A	691.84 Kips

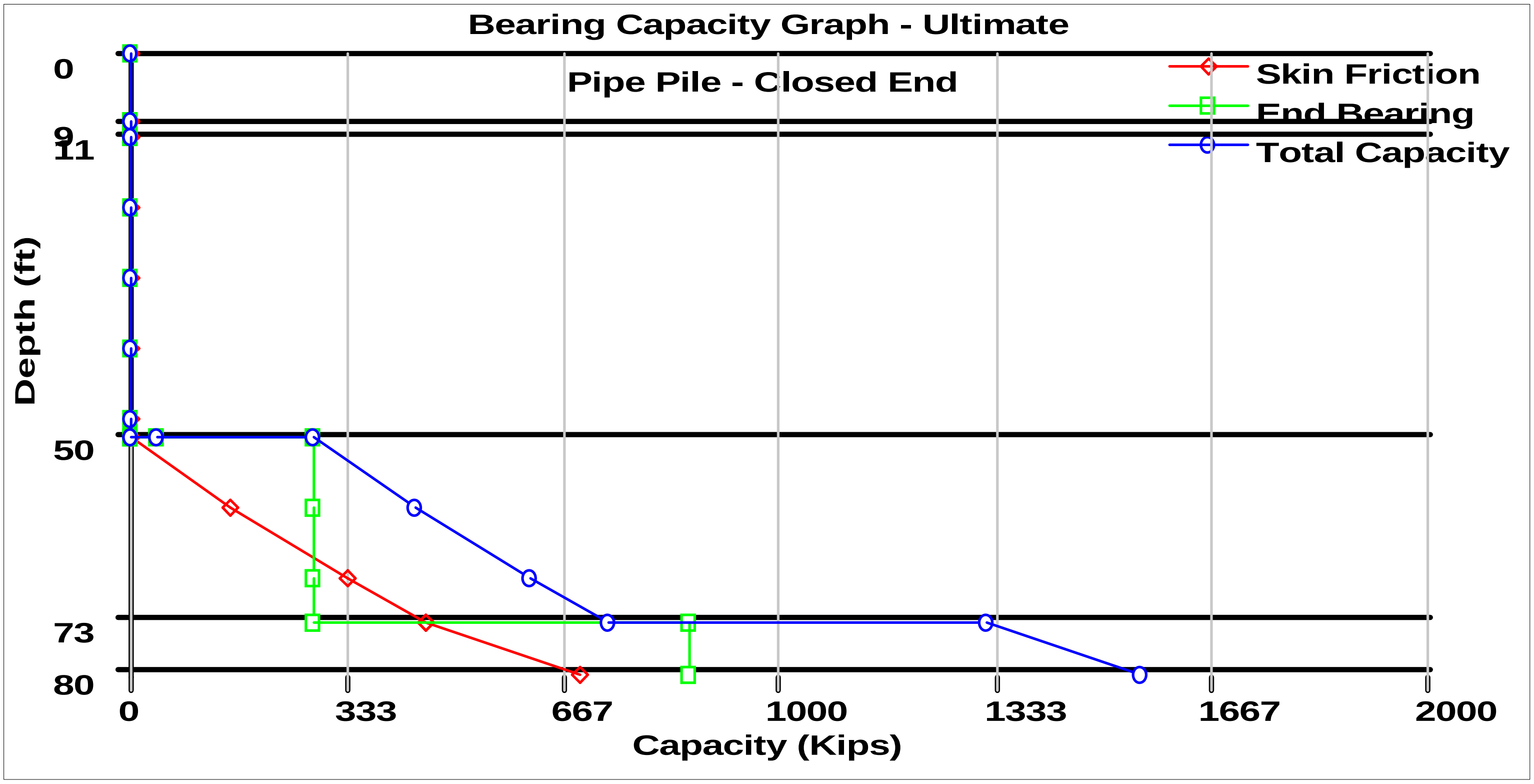
ULTIMATE - END BEARING

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
8.99 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
9.01 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
10.99 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
11.01 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
20.01 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
29.01 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
38.01 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
47.01 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
49.49 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
49.49 ft	Cohesionless	0.00 psf	0.00	0.00 Kips	0.00 Kips
49.50 ft	Cohesionless	4227.80 psf	0.00	43.98 Kips	43.98 Kips
49.51 ft	Cohesionless	4228.53 psf	90.43	283.12 Kips	283.12 Kips
58.51 ft	Cohesionless	4881.93 psf	90.43	283.12 Kips	283.12 Kips
67.51 ft	Cohesionless	5535.33 psf	90.43	283.12 Kips	283.12 Kips
72.99 ft	Cohesionless	5933.17 psf	90.43	283.12 Kips	283.12 Kips
73.01 ft	Cohesionless	5934.63 psf	255.79	862.68 Kips	862.68 Kips
79.99 ft	Cohesionless	6441.37 psf	255.79	862.68 Kips	862.68 Kips

ULTIMATE - SUMMARY OF CAPACITIES

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
8.99 ft	0.00 Kips	0.00 Kips	0.00 Kips
9.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
10.99 ft	0.00 Kips	0.00 Kips	0.00 Kips
11.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
20.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
29.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
38.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
47.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
49.49 ft	0.00 Kips	0.00 Kips	0.00 Kips
49.49 ft	0.00 Kips	0.00 Kips	0.00 Kips
49.50 ft	0.00 Kips	43.98 Kips	43.98 Kips
49.51 ft	0.16 Kips	283.12 Kips	283.28 Kips
58.51 ft	156.49 Kips	283.12 Kips	439.61 Kips
67.51 ft	335.23 Kips	283.12 Kips	618.36 Kips
72.99 ft	455.05 Kips	283.12 Kips	738.18 Kips
73.01 ft	455.60 Kips	862.68 Kips	1318.29 Kips
79.99 ft	691.84 Kips	862.68 Kips	1554.53 Kips

Filename: T:\GEOTECH\DRIVEN\1987301\B-1N.DVN



DRIVEN 1.2

GENERAL PROJECT INFORMATION

Filename: T:\GEOTECH\DRIVEN\1987301\B-1N.DVN
Project Name: FUL-120 Project Date: 05/03/2021
Project Client: Bergmann
Computed By: CPI
Project Manager: CPI

PILE INFORMATION

Pile Type: H Pile - HP10X42
Top of Pile: 49.50 ft
Perimeter Analysis: Box
Tip Analysis: Box Area

ULTIMATE CONSIDERATIONS

Water Table Depth At Time Of:	- Drilling:	9.00 ft
	- Driving/Restrike	9.00 ft
	- Ultimate:	9.00 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	9.00 ft	0.00%	125.00 pcf	1000.00 psf	T-79 Steel
2	Cohesive	2.00 ft	0.00%	120.00 pcf	700.00 psf	T-79 Steel
3	Cohesive	38.50 ft	0.00%	140.00 pcf	3500.00 psf	T-79 Steel
4	Cohesionless	23.50 ft	0.00%	135.00 pcf	36.9/36.9	Nordlund
5	Cohesionless	7.00 ft	0.00%	135.00 pcf	42.3/42.3	Nordlund

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
8.99 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
10.99 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
11.01 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
20.01 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
29.01 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
38.01 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
47.01 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
49.49 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
49.49 ft	Cohesionless	0.00 psf	0.00	N/A	0.00 Kips
49.50 ft	Cohesionless	1260.00 psf	0.00	N/A	0.00 Kips
49.51 ft	Cohesionless	4228.16 psf	27.08	N/A	0.07 Kips
58.51 ft	Cohesionless	4554.86 psf	27.08	N/A	71.20 Kips
67.51 ft	Cohesionless	4881.56 psf	27.08	N/A	152.52 Kips
72.99 ft	Cohesionless	5080.49 psf	27.08	N/A	207.04 Kips
73.01 ft	Cohesionless	5934.26 psf	31.00	N/A	207.28 Kips
79.99 ft	Cohesionless	6187.64 psf	31.00	N/A	306.56 Kips

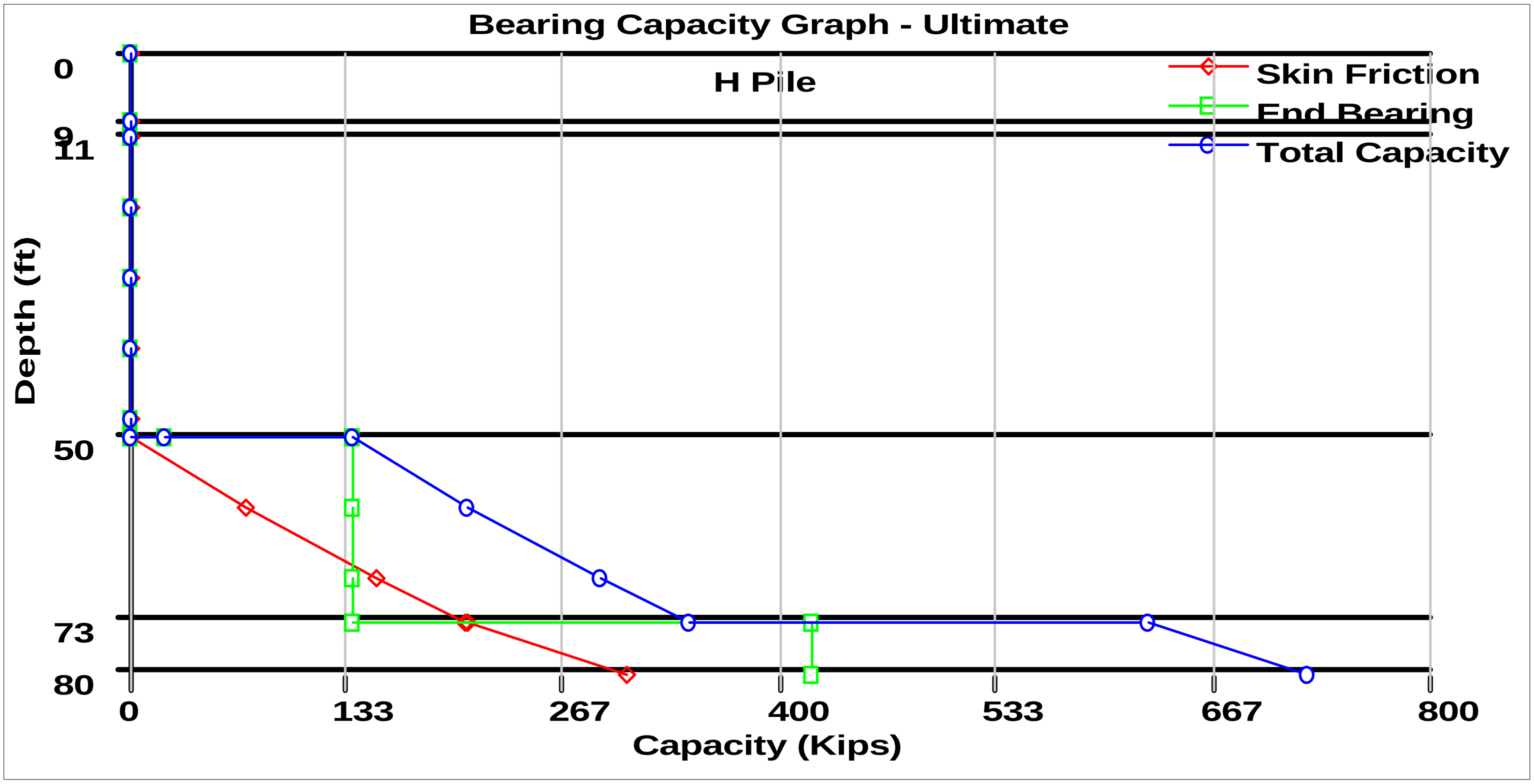
ULTIMATE - END BEARING

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
8.99 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
9.01 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
10.99 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
11.01 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
20.01 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
29.01 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
38.01 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
47.01 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
49.49 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
49.49 ft	Cohesionless	0.00 psf	0.00	0.00 Kips	0.00 Kips
49.50 ft	Cohesionless	4227.80 psf	0.00	21.38 Kips	21.38 Kips
49.51 ft	Cohesionless	4228.53 psf	90.43	137.62 Kips	137.62 Kips
58.51 ft	Cohesionless	4881.93 psf	90.43	137.62 Kips	137.62 Kips
67.51 ft	Cohesionless	5535.33 psf	90.43	137.62 Kips	137.62 Kips
72.99 ft	Cohesionless	5933.17 psf	90.43	137.62 Kips	137.62 Kips
73.01 ft	Cohesionless	5934.63 psf	255.79	419.32 Kips	419.32 Kips
79.99 ft	Cohesionless	6441.37 psf	255.79	419.32 Kips	419.32 Kips

ULTIMATE - SUMMARY OF CAPACITIES

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
8.99 ft	0.00 Kips	0.00 Kips	0.00 Kips
9.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
10.99 ft	0.00 Kips	0.00 Kips	0.00 Kips
11.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
20.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
29.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
38.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
47.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
49.49 ft	0.00 Kips	0.00 Kips	0.00 Kips
49.49 ft	0.00 Kips	0.00 Kips	0.00 Kips
49.50 ft	0.00 Kips	21.38 Kips	21.38 Kips
49.51 ft	0.07 Kips	137.62 Kips	137.69 Kips
58.51 ft	71.20 Kips	137.62 Kips	208.81 Kips
67.51 ft	152.52 Kips	137.62 Kips	290.14 Kips
72.99 ft	207.04 Kips	137.62 Kips	344.66 Kips
73.01 ft	207.28 Kips	419.32 Kips	626.60 Kips
79.99 ft	306.56 Kips	419.32 Kips	725.89 Kips

Filename: T:\GEOTECH\DRIVEN\1987301\B-1N.DVN



DRIVEN 1.2

GENERAL PROJECT INFORMATION

Filename: T:\GEOTECH\DRIVEN\1987301\B-1N.DVN
Project Name: FUL-120 Project Date: 05/03/2021
Project Client: Bergmann
Computed By: CPI
Project Manager: CPI

PILE INFORMATION

Pile Type: H Pile - HP12X53
Top of Pile: 49.50 ft
Perimeter Analysis: Box
Tip Analysis: Box Area

ULTIMATE CONSIDERATIONS

Water Table Depth At Time Of:	- Drilling:	9.00 ft
	- Driving/Restrike	9.00 ft
	- Ultimate:	9.00 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	9.00 ft	0.00%	125.00 pcf	1000.00 psf	T-79 Steel
2	Cohesive	2.00 ft	0.00%	120.00 pcf	700.00 psf	T-79 Steel
3	Cohesive	38.50 ft	0.00%	140.00 pcf	3500.00 psf	T-79 Steel
4	Cohesionless	23.50 ft	0.00%	135.00 pcf	36.9/36.9	Nordlund
5	Cohesionless	7.00 ft	0.00%	135.00 pcf	42.3/42.3	Nordlund

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
8.99 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
10.99 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
11.01 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
20.01 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
29.01 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
38.01 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
47.01 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
49.49 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
49.49 ft	Cohesionless	0.00 psf	0.00	N/A	0.00 Kips
49.50 ft	Cohesionless	1260.00 psf	0.00	N/A	0.00 Kips
49.51 ft	Cohesionless	4228.16 psf	27.82	N/A	0.09 Kips
58.51 ft	Cohesionless	4554.86 psf	27.82	N/A	91.55 Kips
67.51 ft	Cohesionless	4881.56 psf	27.82	N/A	196.13 Kips
72.99 ft	Cohesionless	5080.49 psf	27.82	N/A	266.23 Kips
73.01 ft	Cohesionless	5934.26 psf	31.84	N/A	266.54 Kips
79.99 ft	Cohesionless	6187.64 psf	31.84	N/A	395.41 Kips

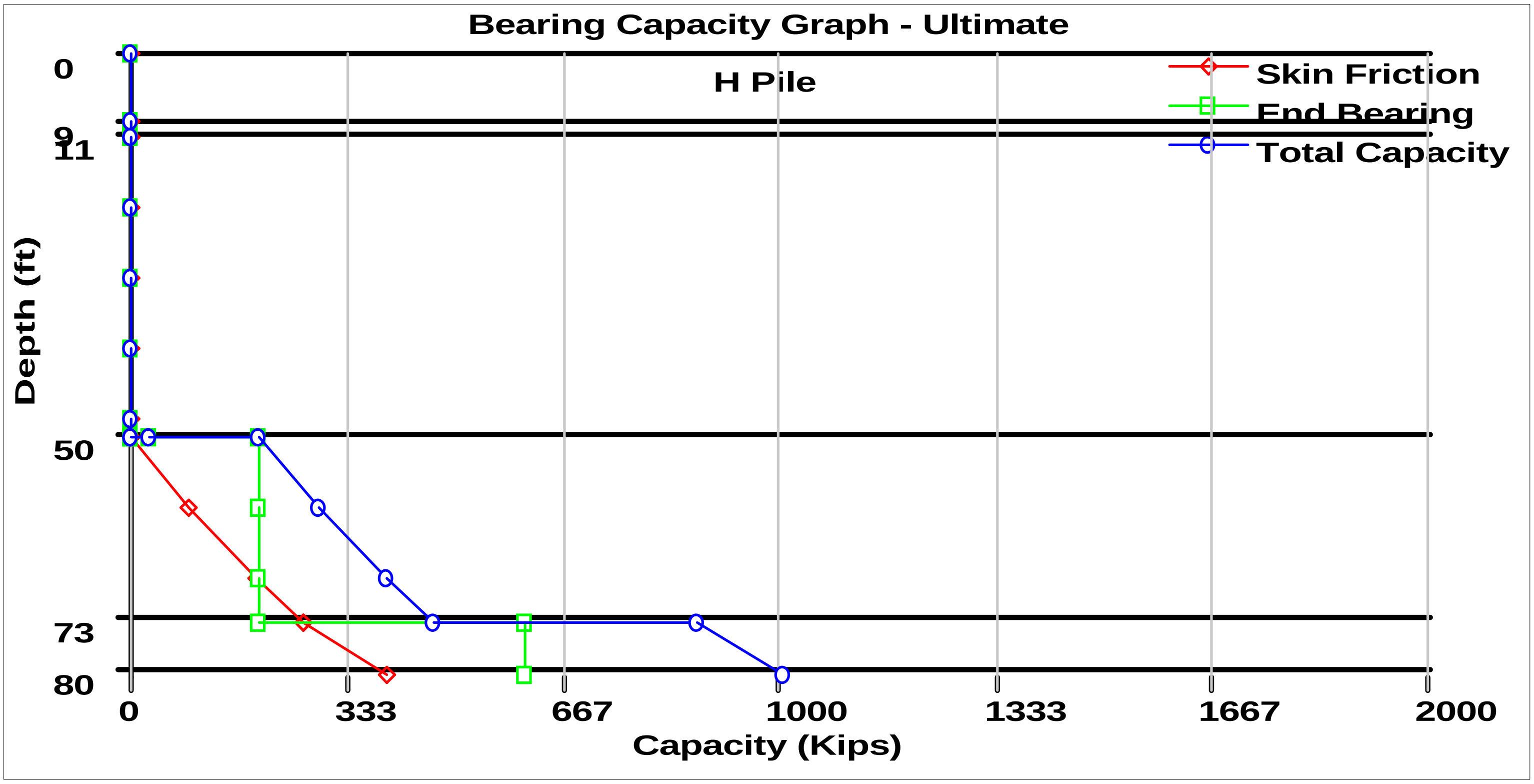
ULTIMATE - END BEARING

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
8.99 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
9.01 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
10.99 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
11.01 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
20.01 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
29.01 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
38.01 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
47.01 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
49.49 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
49.49 ft	Cohesionless	0.00 psf	0.00	0.00 Kips	0.00 Kips
49.50 ft	Cohesionless	4227.80 psf	0.00	31.04 Kips	31.04 Kips
49.51 ft	Cohesionless	4228.53 psf	90.43	199.80 Kips	199.80 Kips
58.51 ft	Cohesionless	4881.93 psf	90.43	199.80 Kips	199.80 Kips
67.51 ft	Cohesionless	5535.33 psf	90.43	199.80 Kips	199.80 Kips
72.99 ft	Cohesionless	5933.17 psf	90.43	199.80 Kips	199.80 Kips
73.01 ft	Cohesionless	5934.63 psf	255.79	608.80 Kips	608.80 Kips
79.99 ft	Cohesionless	6441.37 psf	255.79	608.80 Kips	608.80 Kips

ULTIMATE - SUMMARY OF CAPACITIES

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
8.99 ft	0.00 Kips	0.00 Kips	0.00 Kips
9.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
10.99 ft	0.00 Kips	0.00 Kips	0.00 Kips
11.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
20.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
29.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
38.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
47.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
49.49 ft	0.00 Kips	0.00 Kips	0.00 Kips
49.49 ft	0.00 Kips	0.00 Kips	0.00 Kips
49.50 ft	0.00 Kips	31.04 Kips	31.04 Kips
49.51 ft	0.09 Kips	199.80 Kips	199.89 Kips
58.51 ft	91.55 Kips	199.80 Kips	291.35 Kips
67.51 ft	196.13 Kips	199.80 Kips	395.93 Kips
72.99 ft	266.23 Kips	199.80 Kips	466.03 Kips
73.01 ft	266.54 Kips	608.80 Kips	875.34 Kips
79.99 ft	395.41 Kips	608.80 Kips	1004.21 Kips

Filename: T:\GEOTECH\DRIVEN\1987301\B-1N.DVN



DRIVEN 1.2

GENERAL PROJECT INFORMATION

Filename: T:\GEOTECH\DRIVEN\1987301\B-1N.DVN
Project Name: FUL-120 Project Date: 05/03/2021
Project Client: Bergmann
Computed By: CPI
Project Manager: CPI

PILE INFORMATION

Pile Type: H Pile - HP14X73
Top of Pile: 49.50 ft
Perimeter Analysis: Box
Tip Analysis: Box Area

ULTIMATE CONSIDERATIONS

Water Table Depth At Time Of:	- Drilling:	9.00 ft
	- Driving/Restrike	9.00 ft
	- Ultimate:	9.00 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	9.00 ft	0.00%	125.00 pcf	1000.00 psf	T-79 Steel
2	Cohesive	2.00 ft	0.00%	120.00 pcf	700.00 psf	T-79 Steel
3	Cohesive	38.50 ft	0.00%	140.00 pcf	3500.00 psf	T-79 Steel
4	Cohesionless	23.50 ft	0.00%	135.00 pcf	36.9/36.9	Nordlund
5	Cohesionless	7.00 ft	0.00%	135.00 pcf	42.3/42.3	Nordlund

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
8.99 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
10.99 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
11.01 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
20.01 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
29.01 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
38.01 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
47.01 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
49.49 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
49.49 ft	Cohesionless	0.00 psf	0.00	N/A	0.00 Kips
49.50 ft	Cohesionless	1260.00 psf	0.00	N/A	0.00 Kips
49.51 ft	Cohesionless	4228.16 psf	29.03	N/A	0.13 Kips
58.51 ft	Cohesionless	4554.86 psf	29.03	N/A	126.55 Kips
67.51 ft	Cohesionless	4881.56 psf	29.03	N/A	271.10 Kips
72.99 ft	Cohesionless	5080.49 psf	29.03	N/A	367.99 Kips
73.01 ft	Cohesionless	5934.26 psf	33.23	N/A	368.43 Kips
79.99 ft	Cohesionless	6187.64 psf	33.23	N/A	550.78 Kips

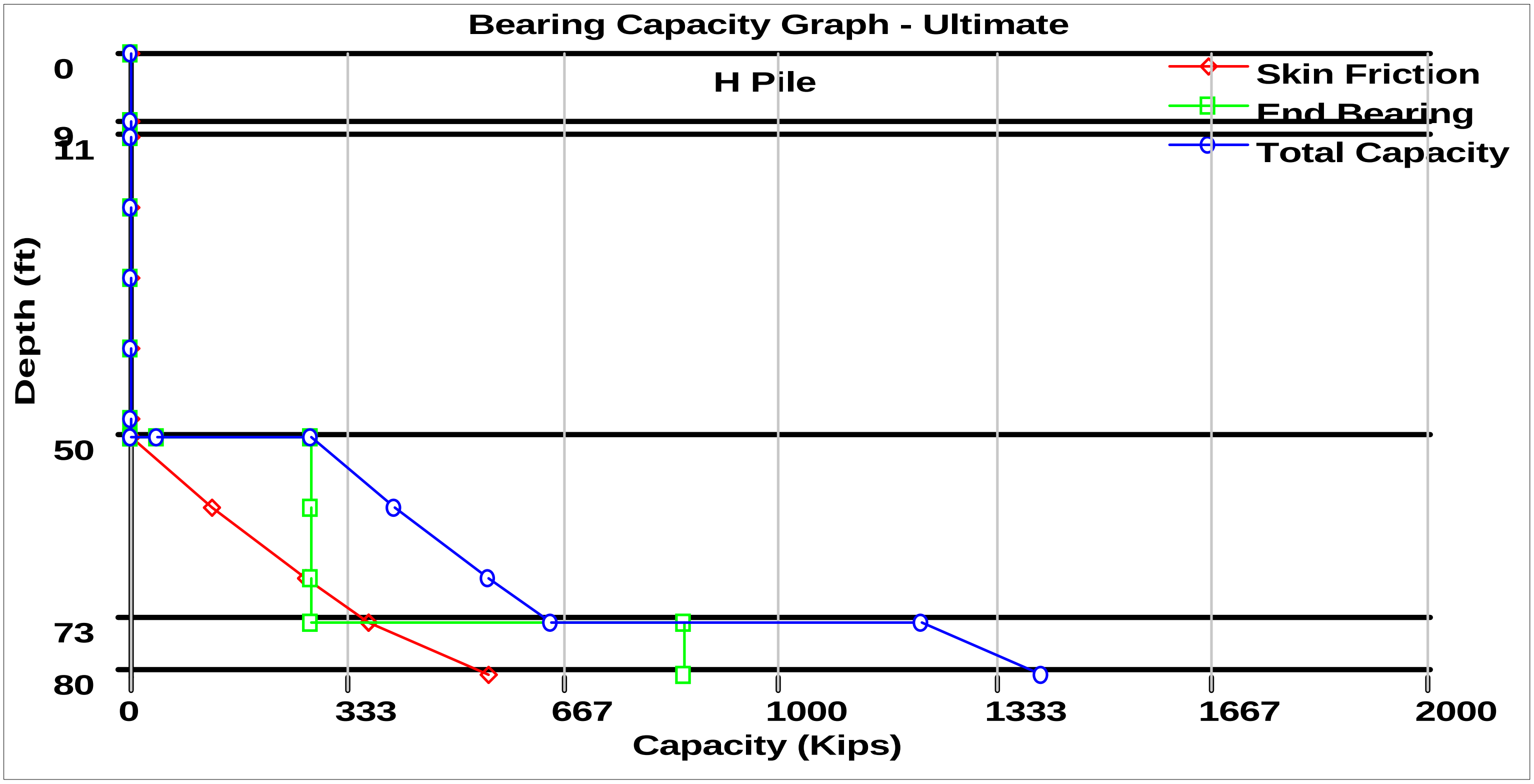
ULTIMATE - END BEARING

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
8.99 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
9.01 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
10.99 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
11.01 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
20.01 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
29.01 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
38.01 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
47.01 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
49.49 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
49.49 ft	Cohesionless	0.00 psf	0.00	0.00 Kips	0.00 Kips
49.50 ft	Cohesionless	4227.80 psf	0.00	43.42 Kips	43.42 Kips
49.51 ft	Cohesionless	4228.53 psf	90.43	279.52 Kips	279.52 Kips
58.51 ft	Cohesionless	4881.93 psf	90.43	279.52 Kips	279.52 Kips
67.51 ft	Cohesionless	5535.33 psf	90.43	279.52 Kips	279.52 Kips
72.99 ft	Cohesionless	5933.17 psf	90.43	279.52 Kips	279.52 Kips
73.01 ft	Cohesionless	5934.63 psf	255.79	851.69 Kips	851.69 Kips
79.99 ft	Cohesionless	6441.37 psf	255.79	851.69 Kips	851.69 Kips

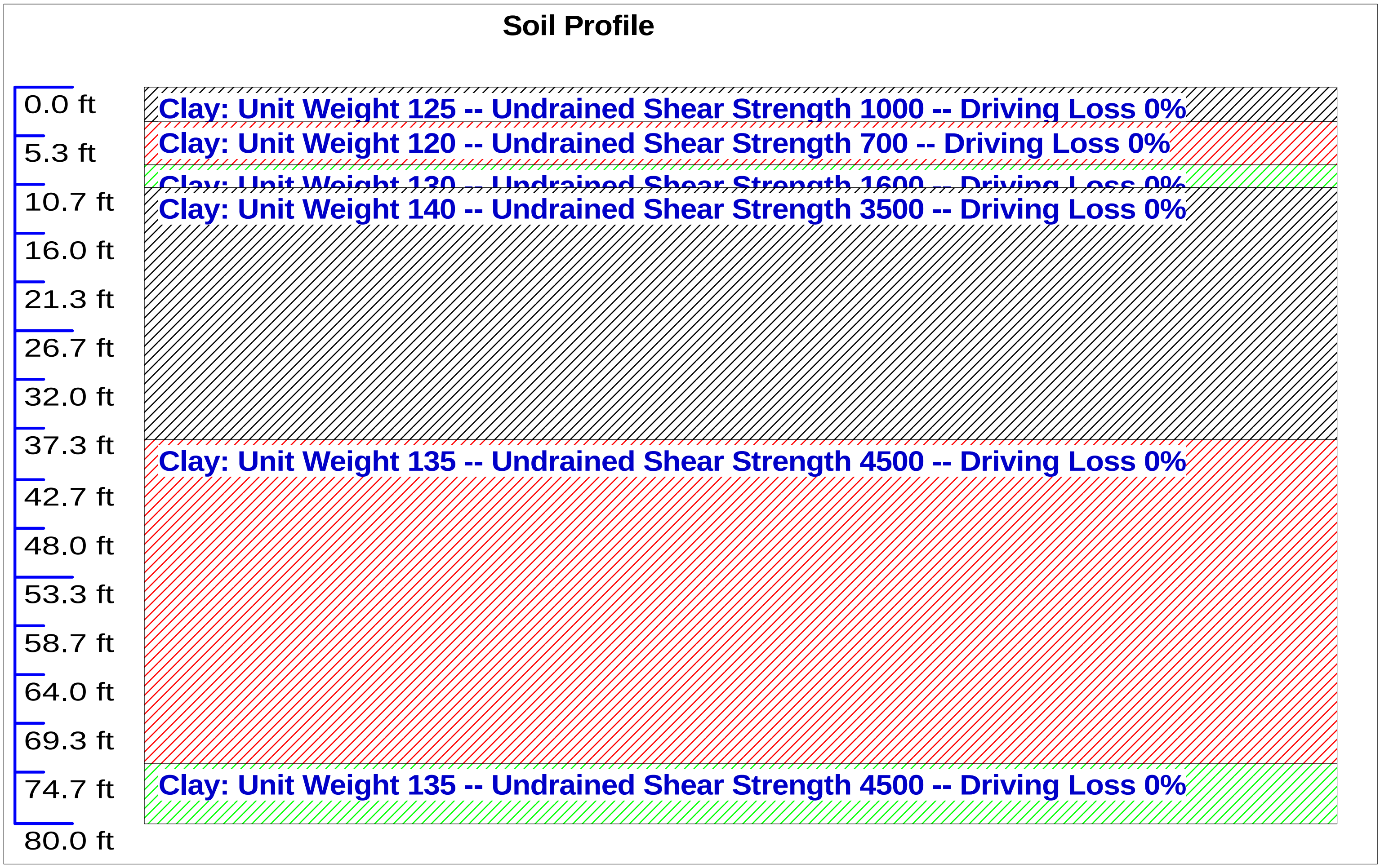
ULTIMATE - SUMMARY OF CAPACITIES

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
8.99 ft	0.00 Kips	0.00 Kips	0.00 Kips
9.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
10.99 ft	0.00 Kips	0.00 Kips	0.00 Kips
11.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
20.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
29.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
38.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
47.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
49.49 ft	0.00 Kips	0.00 Kips	0.00 Kips
49.49 ft	0.00 Kips	0.00 Kips	0.00 Kips
49.50 ft	0.00 Kips	43.42 Kips	43.42 Kips
49.51 ft	0.13 Kips	279.52 Kips	279.65 Kips
58.51 ft	126.55 Kips	279.52 Kips	406.06 Kips
67.51 ft	271.10 Kips	279.52 Kips	550.61 Kips
72.99 ft	367.99 Kips	279.52 Kips	647.51 Kips
73.01 ft	368.43 Kips	851.69 Kips	1220.12 Kips
79.99 ft	550.78 Kips	851.69 Kips	1402.47 Kips

Filename: T:\GEOTECH\DRIVEN\1987301\B-1N.DVN



Filename: T:\GEOTECH\DRIVEN\1987301\B-2C.DVN



Soil Profile

Superseded Analyses: Cohesion considered but not utilized for Strata IV and V.

DRIVEN 1.2

GENERAL PROJECT INFORMATION

Filename: T:\GEOTECH\DRIVEN\1987301\B-2C.DVN
Project Name: FUL-120 Project Date: 05/03/2021
Project Client: Bergmann
Computed By: CPI
Project Manager: CPI

PILE INFORMATION

Pile Type: Pipe Pile - Closed End
Top of Pile: 38.50 ft
Diameter of Pile: 12.00 in

ULTIMATE CONSIDERATIONS

Water Table Depth At Time Of:	- Drilling:	11.00 ft
	- Driving/Restrike	11.00 ft
	- Ultimate:	11.00 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	4.00 ft	0.00%	125.00 pcf	1000.00 psf	T-79 Steel
2	Cohesive	4.50 ft	0.00%	120.00 pcf	700.00 psf	T-79 Steel
3	Cohesive	2.50 ft	0.00%	130.00 pcf	1600.00 psf	T-79 Steel
4	Cohesive	27.50 ft	0.00%	140.00 pcf	3500.00 psf	T-79 Steel
5	Cohesive	35.00 ft	0.00%	135.00 pcf	4500.00 psf	T-79 Steel
6	Cohesive	6.50 ft	0.00%	135.00 pcf	4500.00 psf	T-79 Steel

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
3.99 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
4.01 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
8.49 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
8.51 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
10.99 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
11.01 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
20.01 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
29.01 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
38.01 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
38.49 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
38.49 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
38.50 ft	Cohesive	N/A	N/A	1235.50 psf	0.00 Kips
38.51 ft	Cohesive	N/A	N/A	1235.66 psf	0.04 Kips
47.51 ft	Cohesive	N/A	N/A	1260.00 psf	35.67 Kips
56.51 ft	Cohesive	N/A	N/A	1260.00 psf	71.29 Kips
65.51 ft	Cohesive	N/A	N/A	1260.00 psf	106.92 Kips
73.49 ft	Cohesive	N/A	N/A	1260.00 psf	138.50 Kips
73.51 ft	Cohesive	N/A	N/A	1260.00 psf	138.58 Kips
79.99 ft	Cohesive	N/A	N/A	1260.00 psf	164.23 Kips

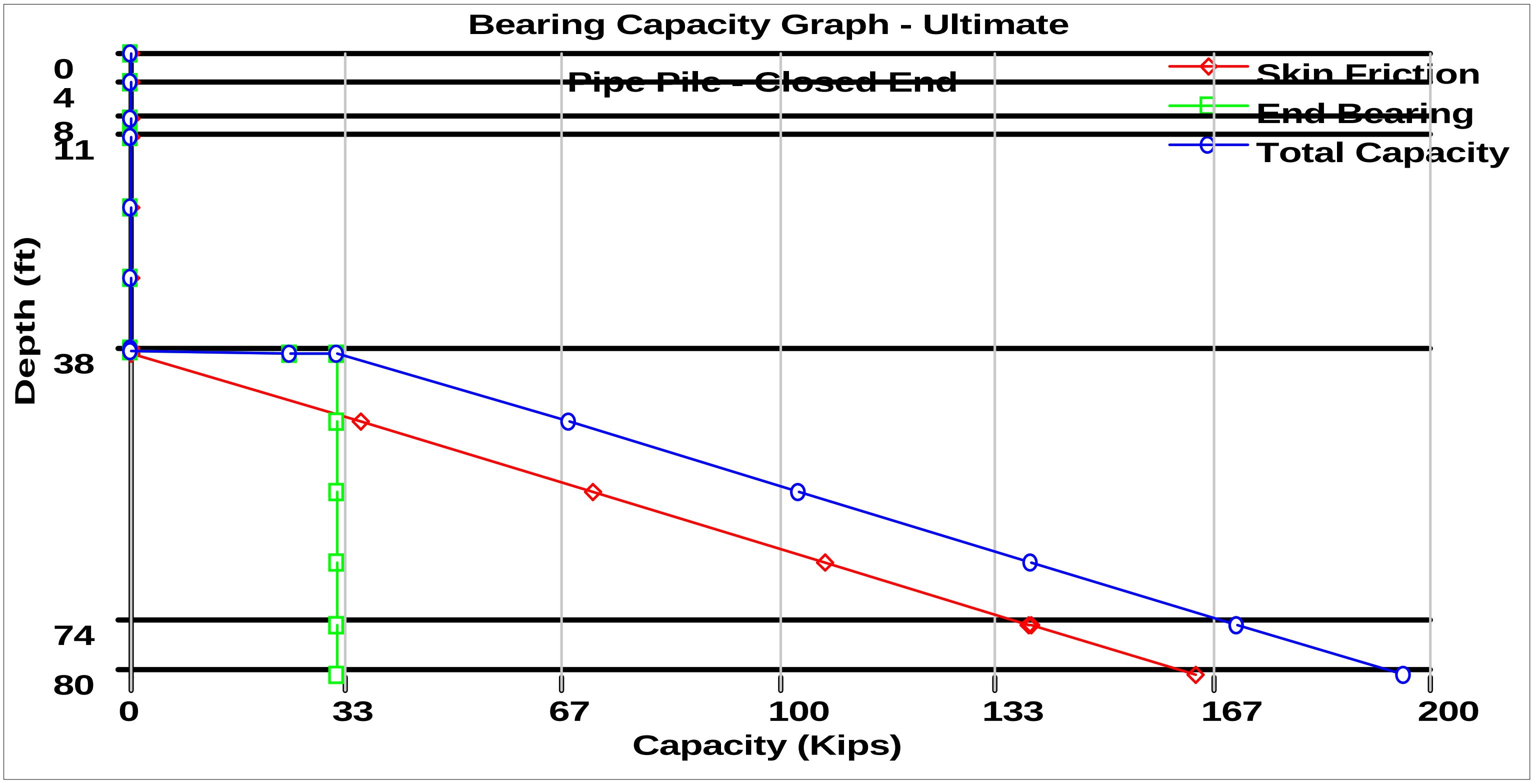
ULTIMATE - END BEARING

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
3.99 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
4.01 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
8.49 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
8.51 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
10.99 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
11.01 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
20.01 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
29.01 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
38.01 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
38.49 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
38.49 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
38.50 ft	Cohesive	N/A	N/A	N/A	24.74 Kips
38.51 ft	Cohesive	N/A	N/A	N/A	31.81 Kips
47.51 ft	Cohesive	N/A	N/A	N/A	31.81 Kips
56.51 ft	Cohesive	N/A	N/A	N/A	31.81 Kips
65.51 ft	Cohesive	N/A	N/A	N/A	31.81 Kips
73.49 ft	Cohesive	N/A	N/A	N/A	31.81 Kips
73.51 ft	Cohesive	N/A	N/A	N/A	31.81 Kips
79.99 ft	Cohesive	N/A	N/A	N/A	31.81 Kips

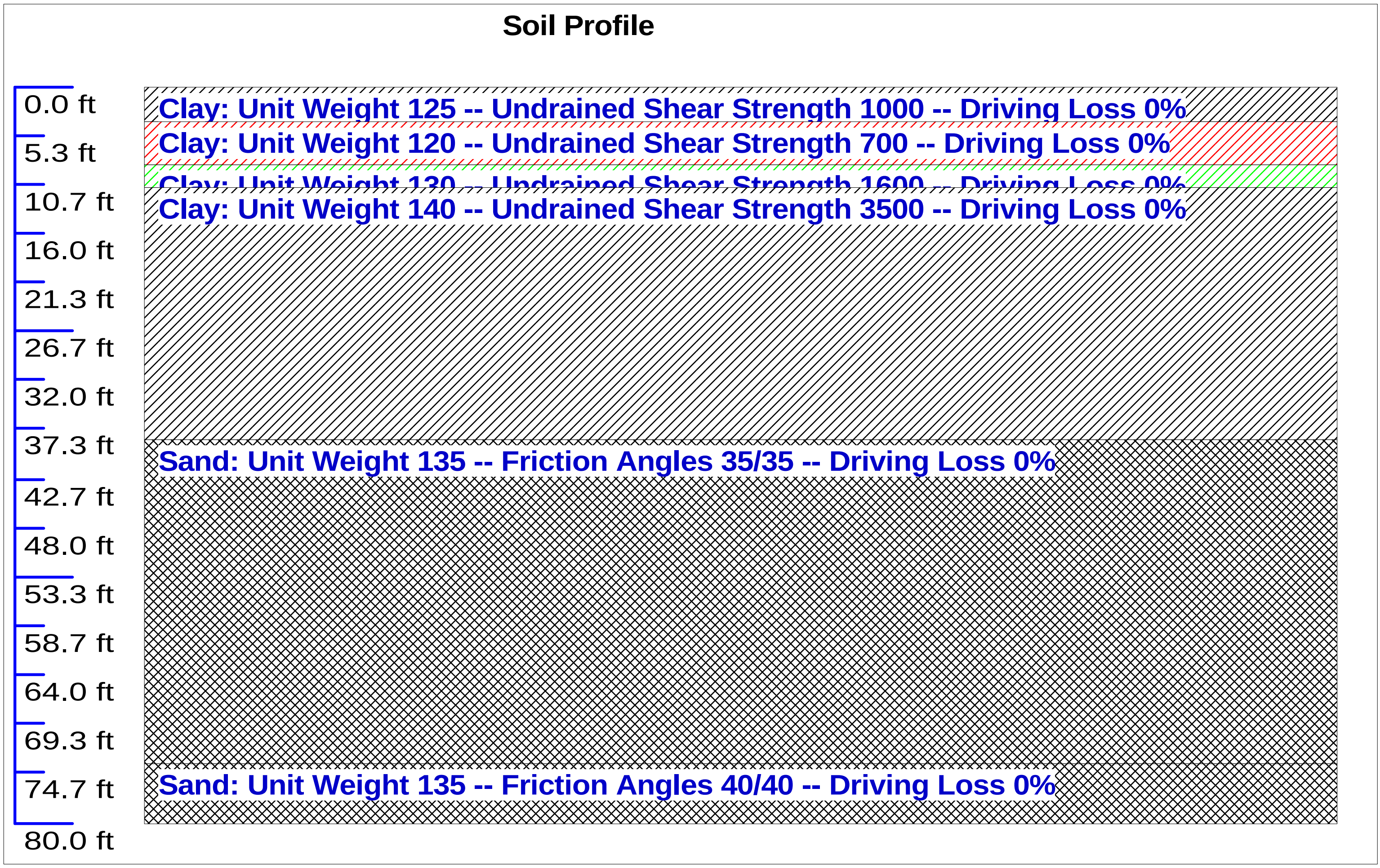
ULTIMATE - SUMMARY OF CAPACITIES

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
3.99 ft	0.00 Kips	0.00 Kips	0.00 Kips
4.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
8.49 ft	0.00 Kips	0.00 Kips	0.00 Kips
8.51 ft	0.00 Kips	0.00 Kips	0.00 Kips
10.99 ft	0.00 Kips	0.00 Kips	0.00 Kips
11.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
20.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
29.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
38.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
38.49 ft	0.00 Kips	0.00 Kips	0.00 Kips
38.49 ft	0.00 Kips	0.00 Kips	0.00 Kips
38.50 ft	0.00 Kips	24.74 Kips	24.74 Kips
38.51 ft	0.04 Kips	31.81 Kips	31.85 Kips
47.51 ft	35.67 Kips	31.81 Kips	67.47 Kips
56.51 ft	71.29 Kips	31.81 Kips	103.10 Kips
65.51 ft	106.92 Kips	31.81 Kips	138.73 Kips
73.49 ft	138.50 Kips	31.81 Kips	170.31 Kips
73.51 ft	138.58 Kips	31.81 Kips	170.39 Kips
79.99 ft	164.23 Kips	31.81 Kips	196.04 Kips

Filename: T:\GEOTECH\DRIVEN\1987301\B-2C.DVN



Filename: T:\GEOTECH\DRIVEN\1987301\B-2N.DVN



Design Analyses: Strata IV and V modeled as "cohesionless" with phi based on N60 values.

DRIVEN 1.2

GENERAL PROJECT INFORMATION

Filename: T:\GEOTECH\DRIVEN\1987301\B-2N.DVN
Project Name: FUL-120 Project Date: 05/03/2021
Project Client: Bergmann
Computed By: CPI
Project Manager: CPI

PILE INFORMATION

Pile Type: Pipe Pile - Closed End
Top of Pile: 38.50 ft
Diameter of Pile: 12.00 in

ULTIMATE CONSIDERATIONS

Water Table Depth At Time Of:	- Drilling:	11.00 ft
	- Driving/Restrike	11.00 ft
	- Ultimate:	11.00 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	4.00 ft	0.00%	125.00 pcf	1000.00 psf	T-79 Steel
2	Cohesive	4.50 ft	0.00%	120.00 pcf	700.00 psf	T-79 Steel
3	Cohesive	2.50 ft	0.00%	130.00 pcf	1600.00 psf	T-79 Steel
4	Cohesive	27.50 ft	0.00%	140.00 pcf	3500.00 psf	T-79 Steel
5	Cohesionless	35.00 ft	0.00%	135.00 pcf	35.2/35.2	Nordlund
6	Cohesionless	6.50 ft	0.00%	135.00 pcf	40.2/40.2	Nordlund

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
3.99 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
4.01 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
8.49 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
8.51 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
10.99 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
11.01 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
20.01 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
29.01 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
38.01 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
38.49 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
38.49 ft	Cohesionless	0.00 psf	0.00	N/A	0.00 Kips
38.50 ft	Cohesionless	1235.50 psf	0.00	N/A	0.00 Kips
38.51 ft	Cohesionless	3499.36 psf	20.67	N/A	0.05 Kips
47.51 ft	Cohesionless	3826.06 psf	20.67	N/A	49.19 Kips
56.51 ft	Cohesionless	4152.76 psf	20.67	N/A	106.73 Kips
65.51 ft	Cohesionless	4479.46 psf	20.67	N/A	172.65 Kips
73.49 ft	Cohesionless	4769.14 psf	20.67	N/A	238.12 Kips
73.51 ft	Cohesionless	6040.36 psf	23.61	N/A	238.36 Kips
79.99 ft	Cohesionless	6275.59 psf	23.61	N/A	337.68 Kips

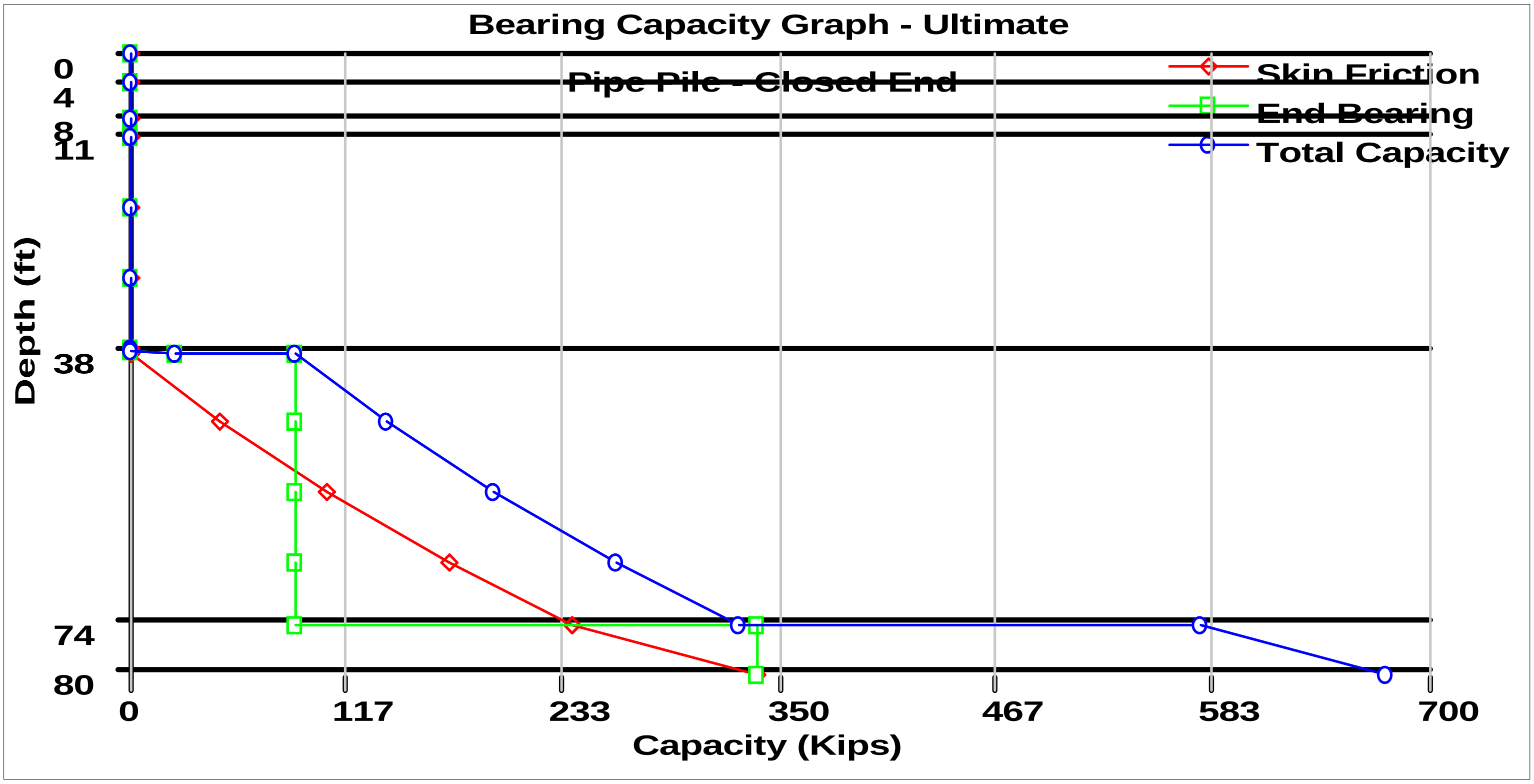
ULTIMATE - END BEARING

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
3.99 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
4.01 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
8.49 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
8.51 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
10.99 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
11.01 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
20.01 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
29.01 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
38.01 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
38.49 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
38.49 ft	Cohesionless	0.00 psf	0.00	0.00 Kips	0.00 Kips
38.50 ft	Cohesionless	3499.00 psf	0.00	24.74 Kips	24.74 Kips
38.51 ft	Cohesionless	3499.73 psf	66.07	89.77 Kips	89.77 Kips
47.51 ft	Cohesionless	4153.13 psf	66.07	89.77 Kips	89.77 Kips
56.51 ft	Cohesionless	4806.53 psf	66.07	89.77 Kips	89.77 Kips
65.51 ft	Cohesionless	5459.93 psf	66.07	89.77 Kips	89.77 Kips
73.49 ft	Cohesionless	6039.27 psf	66.07	89.77 Kips	89.77 Kips
73.51 ft	Cohesionless	6040.73 psf	166.61	338.60 Kips	338.60 Kips
79.99 ft	Cohesionless	6511.17 psf	166.61	338.60 Kips	338.60 Kips

ULTIMATE - SUMMARY OF CAPACITIES

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
3.99 ft	0.00 Kips	0.00 Kips	0.00 Kips
4.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
8.49 ft	0.00 Kips	0.00 Kips	0.00 Kips
8.51 ft	0.00 Kips	0.00 Kips	0.00 Kips
10.99 ft	0.00 Kips	0.00 Kips	0.00 Kips
11.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
20.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
29.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
38.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
38.49 ft	0.00 Kips	0.00 Kips	0.00 Kips
38.49 ft	0.00 Kips	0.00 Kips	0.00 Kips
38.50 ft	0.00 Kips	24.74 Kips	24.74 Kips
38.51 ft	0.05 Kips	89.77 Kips	89.82 Kips
47.51 ft	49.19 Kips	89.77 Kips	138.96 Kips
56.51 ft	106.73 Kips	89.77 Kips	196.49 Kips
65.51 ft	172.65 Kips	89.77 Kips	262.42 Kips
73.49 ft	238.12 Kips	89.77 Kips	327.89 Kips
73.51 ft	238.36 Kips	338.60 Kips	576.96 Kips
79.99 ft	337.68 Kips	338.60 Kips	676.28 Kips

Filename: T:\GEOTECH\DRIVEN\1987301\B-2N.DVN



DRIVEN 1.2

GENERAL PROJECT INFORMATION

Filename: T:\GEOTECH\DRIVEN\1987301\B-2N.DVN
Project Name: FUL-120 Project Date: 05/03/2021
Project Client: Bergmann
Computed By: CPI
Project Manager: CPI

PILE INFORMATION

Pile Type: Pipe Pile - Closed End
Top of Pile: 38.50 ft
Diameter of Pile: 14.00 in

ULTIMATE CONSIDERATIONS

Water Table Depth At Time Of:	- Drilling:	11.00 ft
	- Driving/Restrike	11.00 ft
	- Ultimate:	11.00 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	4.00 ft	0.00%	125.00 pcf	1000.00 psf	T-79 Steel
2	Cohesive	4.50 ft	0.00%	120.00 pcf	700.00 psf	T-79 Steel
3	Cohesive	2.50 ft	0.00%	130.00 pcf	1600.00 psf	T-79 Steel
4	Cohesive	27.50 ft	0.00%	140.00 pcf	3500.00 psf	T-79 Steel
5	Cohesionless	35.00 ft	0.00%	135.00 pcf	35.2/35.2	Nordlund
6	Cohesionless	6.50 ft	0.00%	135.00 pcf	40.2/40.2	Nordlund

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
3.99 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
4.01 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
8.49 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
8.51 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
10.99 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
11.01 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
20.01 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
29.01 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
38.01 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
38.49 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
38.49 ft	Cohesionless	0.00 psf	0.00	N/A	0.00 Kips
38.50 ft	Cohesionless	1145.67 psf	0.00	N/A	0.00 Kips
38.51 ft	Cohesionless	3499.36 psf	23.43	N/A	0.07 Kips
47.51 ft	Cohesionless	3826.06 psf	23.43	N/A	73.34 Kips
56.51 ft	Cohesionless	4152.76 psf	23.43	N/A	159.12 Kips
65.51 ft	Cohesionless	4479.46 psf	23.43	N/A	257.41 Kips
73.49 ft	Cohesionless	4769.14 psf	23.43	N/A	355.02 Kips
73.51 ft	Cohesionless	6040.36 psf	26.76	N/A	355.38 Kips
79.99 ft	Cohesionless	6275.59 psf	26.76	N/A	508.89 Kips

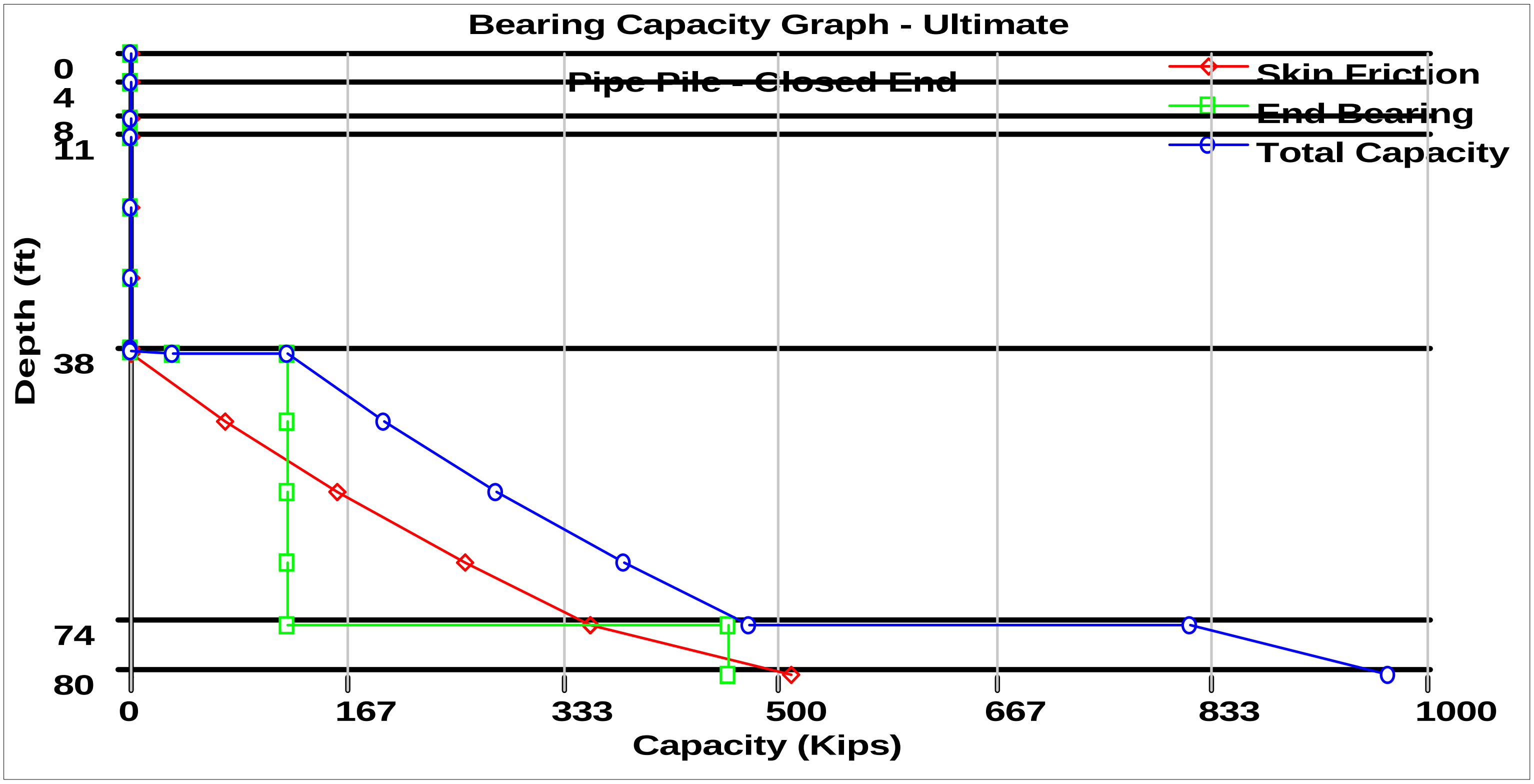
ULTIMATE - END BEARING

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
3.99 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
4.01 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
8.49 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
8.51 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
10.99 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
11.01 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
20.01 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
29.01 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
38.01 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
38.49 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
38.49 ft	Cohesionless	0.00 psf	0.00	0.00 Kips	0.00 Kips
38.50 ft	Cohesionless	3499.00 psf	0.00	33.67 Kips	33.67 Kips
38.51 ft	Cohesionless	3499.73 psf	66.07	122.18 Kips	122.18 Kips
47.51 ft	Cohesionless	4153.13 psf	66.07	122.18 Kips	122.18 Kips
56.51 ft	Cohesionless	4806.53 psf	66.07	122.18 Kips	122.18 Kips
65.51 ft	Cohesionless	5459.93 psf	66.07	122.18 Kips	122.18 Kips
73.49 ft	Cohesionless	6039.27 psf	66.07	122.18 Kips	122.18 Kips
73.51 ft	Cohesionless	6040.73 psf	166.61	460.87 Kips	460.87 Kips
79.99 ft	Cohesionless	6511.17 psf	166.61	460.87 Kips	460.87 Kips

ULTIMATE - SUMMARY OF CAPACITIES

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
3.99 ft	0.00 Kips	0.00 Kips	0.00 Kips
4.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
8.49 ft	0.00 Kips	0.00 Kips	0.00 Kips
8.51 ft	0.00 Kips	0.00 Kips	0.00 Kips
10.99 ft	0.00 Kips	0.00 Kips	0.00 Kips
11.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
20.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
29.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
38.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
38.49 ft	0.00 Kips	0.00 Kips	0.00 Kips
38.49 ft	0.00 Kips	0.00 Kips	0.00 Kips
38.50 ft	0.00 Kips	33.67 Kips	33.67 Kips
38.51 ft	0.07 Kips	122.18 Kips	122.26 Kips
47.51 ft	73.34 Kips	122.18 Kips	195.52 Kips
56.51 ft	159.12 Kips	122.18 Kips	281.30 Kips
65.51 ft	257.41 Kips	122.18 Kips	379.59 Kips
73.49 ft	355.02 Kips	122.18 Kips	477.20 Kips
73.51 ft	355.38 Kips	460.87 Kips	816.25 Kips
79.99 ft	508.89 Kips	460.87 Kips	969.76 Kips

Filename: T:\GEOTECH\DRIVEN\1987301\B-2N.DVN



DRIVEN 1.2

GENERAL PROJECT INFORMATION

Filename: T:\GEOTECH\DRIVEN\1987301\B-2N.DVN
Project Name: FUL-120 Project Date: 05/03/2021
Project Client: Bergmann
Computed By: CPI
Project Manager: CPI

PILE INFORMATION

Pile Type: Pipe Pile - Closed End
Top of Pile: 38.50 ft
Diameter of Pile: 16.00 in

ULTIMATE CONSIDERATIONS

Water Table Depth At Time Of:	- Drilling:	11.00 ft
	- Driving/Restrike	11.00 ft
	- Ultimate:	11.00 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	4.00 ft	0.00%	125.00 pcf	1000.00 psf	T-79 Steel
2	Cohesive	4.50 ft	0.00%	120.00 pcf	700.00 psf	T-79 Steel
3	Cohesive	2.50 ft	0.00%	130.00 pcf	1600.00 psf	T-79 Steel
4	Cohesive	27.50 ft	0.00%	140.00 pcf	3500.00 psf	T-79 Steel
5	Cohesionless	35.00 ft	0.00%	135.00 pcf	35.2/35.2	Nordlund
6	Cohesionless	6.50 ft	0.00%	135.00 pcf	40.2/40.2	Nordlund

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
3.99 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
4.01 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
8.49 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
8.51 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
10.99 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
11.01 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
20.01 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
29.01 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
38.01 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
38.49 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
38.49 ft	Cohesionless	0.00 psf	0.00	N/A	0.00 Kips
38.50 ft	Cohesionless	1078.29 psf	0.00	N/A	0.00 Kips
38.51 ft	Cohesionless	3499.36 psf	25.75	N/A	0.10 Kips
47.51 ft	Cohesionless	3826.06 psf	25.75	N/A	101.38 Kips
56.51 ft	Cohesionless	4152.76 psf	25.75	N/A	219.95 Kips
65.51 ft	Cohesionless	4479.46 psf	25.75	N/A	355.82 Kips
73.49 ft	Cohesionless	4769.14 psf	25.75	N/A	490.76 Kips
73.51 ft	Cohesionless	6040.36 psf	29.41	N/A	491.26 Kips
79.99 ft	Cohesionless	6275.59 psf	29.41	N/A	709.31 Kips

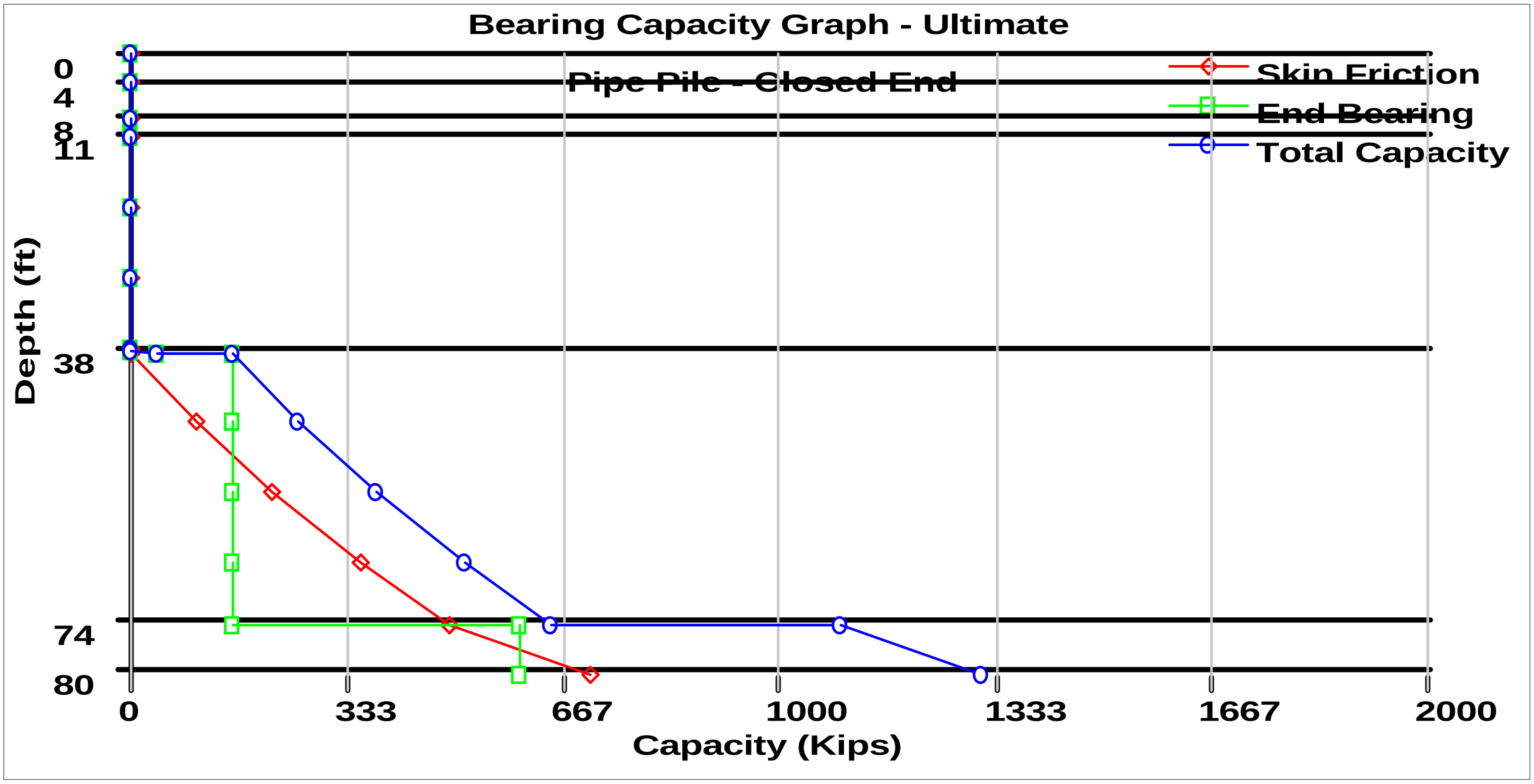
ULTIMATE - END BEARING

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
3.99 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
4.01 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
8.49 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
8.51 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
10.99 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
11.01 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
20.01 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
29.01 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
38.01 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
38.49 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
38.49 ft	Cohesionless	0.00 psf	0.00	0.00 Kips	0.00 Kips
38.50 ft	Cohesionless	3499.00 psf	0.00	43.98 Kips	43.98 Kips
38.51 ft	Cohesionless	3499.73 psf	66.07	159.58 Kips	159.58 Kips
47.51 ft	Cohesionless	4153.13 psf	66.07	159.58 Kips	159.58 Kips
56.51 ft	Cohesionless	4806.53 psf	66.07	159.58 Kips	159.58 Kips
65.51 ft	Cohesionless	5459.93 psf	66.07	159.58 Kips	159.58 Kips
73.49 ft	Cohesionless	6039.27 psf	66.07	159.58 Kips	159.58 Kips
73.51 ft	Cohesionless	6040.73 psf	166.61	601.96 Kips	601.96 Kips
79.99 ft	Cohesionless	6511.17 psf	166.61	601.96 Kips	601.96 Kips

ULTIMATE - SUMMARY OF CAPACITIES

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
3.99 ft	0.00 Kips	0.00 Kips	0.00 Kips
4.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
8.49 ft	0.00 Kips	0.00 Kips	0.00 Kips
8.51 ft	0.00 Kips	0.00 Kips	0.00 Kips
10.99 ft	0.00 Kips	0.00 Kips	0.00 Kips
11.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
20.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
29.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
38.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
38.49 ft	0.00 Kips	0.00 Kips	0.00 Kips
38.49 ft	0.00 Kips	0.00 Kips	0.00 Kips
38.50 ft	0.00 Kips	43.98 Kips	43.98 Kips
38.51 ft	0.10 Kips	159.58 Kips	159.69 Kips
47.51 ft	101.38 Kips	159.58 Kips	260.97 Kips
56.51 ft	219.95 Kips	159.58 Kips	379.54 Kips
65.51 ft	355.82 Kips	159.58 Kips	515.41 Kips
73.49 ft	490.76 Kips	159.58 Kips	650.34 Kips
73.51 ft	491.26 Kips	601.96 Kips	1093.21 Kips
79.99 ft	709.31 Kips	601.96 Kips	1311.27 Kips

Filename: T:\GEOTECH\DRIVEN\1987301\B-2N.DVN



DRIVEN 1.2

GENERAL PROJECT INFORMATION

Filename: T:\GEOTECH\DRIVEN\1987301\B-2N.DVN
Project Name: FUL-120 Project Date: 05/03/2021
Project Client: Bergmann
Computed By: CPI
Project Manager: CPI

PILE INFORMATION

Pile Type: H Pile - HP10X42
Top of Pile: 38.50 ft
Perimeter Analysis: Box
Tip Analysis: Box Area

ULTIMATE CONSIDERATIONS

Water Table Depth At Time Of:	- Drilling:	11.00 ft
	- Driving/Restrike	11.00 ft
	- Ultimate:	11.00 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	4.00 ft	0.00%	125.00 pcf	1000.00 psf	T-79 Steel
2	Cohesive	4.50 ft	0.00%	120.00 pcf	700.00 psf	T-79 Steel
3	Cohesive	2.50 ft	0.00%	130.00 pcf	1600.00 psf	T-79 Steel
4	Cohesive	27.50 ft	0.00%	140.00 pcf	3500.00 psf	T-79 Steel
5	Cohesionless	35.00 ft	0.00%	135.00 pcf	35.2/35.2	Nordlund
6	Cohesionless	6.50 ft	0.00%	135.00 pcf	40.2/40.2	Nordlund

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
3.99 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
4.01 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
8.49 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
8.51 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
10.99 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
11.01 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
20.01 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
29.01 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
38.01 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
38.49 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
38.49 ft	Cohesionless	0.00 psf	0.00	N/A	0.00 Kips
38.50 ft	Cohesionless	1260.00 psf	0.00	N/A	0.00 Kips
38.51 ft	Cohesionless	3499.36 psf	25.77	N/A	0.05 Kips
47.51 ft	Cohesionless	3826.06 psf	25.77	N/A	49.63 Kips
56.51 ft	Cohesionless	4152.76 psf	25.77	N/A	107.68 Kips
65.51 ft	Cohesionless	4479.46 psf	25.77	N/A	174.20 Kips
73.49 ft	Cohesionless	4769.14 psf	25.77	N/A	240.25 Kips
73.51 ft	Cohesionless	6040.36 psf	29.44	N/A	240.48 Kips
79.99 ft	Cohesionless	6275.59 psf	29.44	N/A	332.11 Kips

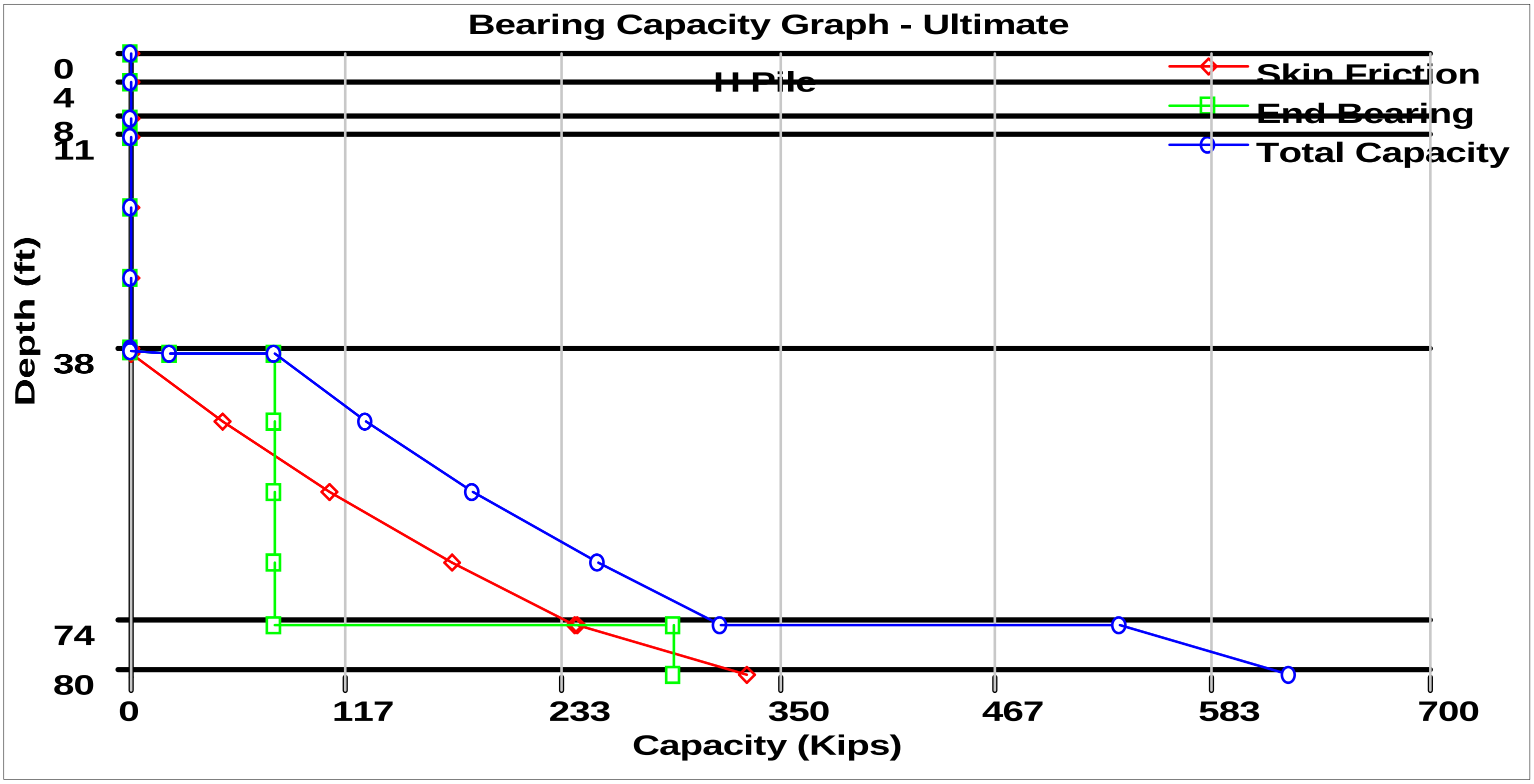
ULTIMATE - END BEARING

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
3.99 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
4.01 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
8.49 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
8.51 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
10.99 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
11.01 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
20.01 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
29.01 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
38.01 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
38.49 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
38.49 ft	Cohesionless	0.00 psf	0.00	0.00 Kips	0.00 Kips
38.50 ft	Cohesionless	3499.00 psf	0.00	21.38 Kips	21.38 Kips
38.51 ft	Cohesionless	3499.73 psf	66.07	77.57 Kips	77.57 Kips
47.51 ft	Cohesionless	4153.13 psf	66.07	77.57 Kips	77.57 Kips
56.51 ft	Cohesionless	4806.53 psf	66.07	77.57 Kips	77.57 Kips
65.51 ft	Cohesionless	5459.93 psf	66.07	77.57 Kips	77.57 Kips
73.49 ft	Cohesionless	6039.27 psf	66.07	77.57 Kips	77.57 Kips
73.51 ft	Cohesionless	6040.73 psf	166.61	292.59 Kips	292.59 Kips
79.99 ft	Cohesionless	6511.17 psf	166.61	292.59 Kips	292.59 Kips

ULTIMATE - SUMMARY OF CAPACITIES

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
3.99 ft	0.00 Kips	0.00 Kips	0.00 Kips
4.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
8.49 ft	0.00 Kips	0.00 Kips	0.00 Kips
8.51 ft	0.00 Kips	0.00 Kips	0.00 Kips
10.99 ft	0.00 Kips	0.00 Kips	0.00 Kips
11.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
20.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
29.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
38.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
38.49 ft	0.00 Kips	0.00 Kips	0.00 Kips
38.49 ft	0.00 Kips	0.00 Kips	0.00 Kips
38.50 ft	0.00 Kips	21.38 Kips	21.38 Kips
38.51 ft	0.05 Kips	77.57 Kips	77.62 Kips
47.51 ft	49.63 Kips	77.57 Kips	127.20 Kips
56.51 ft	107.68 Kips	77.57 Kips	185.25 Kips
65.51 ft	174.20 Kips	77.57 Kips	251.76 Kips
73.49 ft	240.25 Kips	77.57 Kips	317.82 Kips
73.51 ft	240.48 Kips	292.59 Kips	533.07 Kips
79.99 ft	332.11 Kips	292.59 Kips	624.71 Kips

Filename: T:\GEOTECH\DRIVEN\1987301\B-2N.DVN



DRIVEN 1.2

GENERAL PROJECT INFORMATION

Filename: T:\GEOTECH\DRIVEN\1987301\B-2N.DVN
Project Name: FUL-120 Project Date: 05/03/2021
Project Client: Bergmann
Computed By: CPI
Project Manager: CPI

PILE INFORMATION

Pile Type: H Pile - HP12X53
Top of Pile: 38.50 ft
Perimeter Analysis: Box
Tip Analysis: Box Area

ULTIMATE CONSIDERATIONS

Water Table Depth At Time Of:	- Drilling:	11.00 ft
	- Driving/Restrike	11.00 ft
	- Ultimate:	11.00 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	4.00 ft	0.00%	125.00 pcf	1000.00 psf	T-79 Steel
2	Cohesive	4.50 ft	0.00%	120.00 pcf	700.00 psf	T-79 Steel
3	Cohesive	2.50 ft	0.00%	130.00 pcf	1600.00 psf	T-79 Steel
4	Cohesive	27.50 ft	0.00%	140.00 pcf	3500.00 psf	T-79 Steel
5	Cohesionless	35.00 ft	0.00%	135.00 pcf	35.2/35.2	Nordlund
6	Cohesionless	6.50 ft	0.00%	135.00 pcf	40.2/40.2	Nordlund

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
3.99 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
4.01 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
8.49 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
8.51 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
10.99 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
11.01 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
20.01 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
29.01 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
38.01 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
38.49 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
38.49 ft	Cohesionless	0.00 psf	0.00	N/A	0.00 Kips
38.50 ft	Cohesionless	1233.15 psf	0.00	N/A	0.00 Kips
38.51 ft	Cohesionless	3499.36 psf	26.47	N/A	0.06 Kips
47.51 ft	Cohesionless	3826.06 psf	26.47	N/A	63.50 Kips
56.51 ft	Cohesionless	4152.76 psf	26.47	N/A	137.78 Kips
65.51 ft	Cohesionless	4479.46 psf	26.47	N/A	222.89 Kips
73.49 ft	Cohesionless	4769.14 psf	26.47	N/A	307.41 Kips
73.51 ft	Cohesionless	6040.36 psf	30.24	N/A	307.70 Kips
79.99 ft	Cohesionless	6275.59 psf	30.24	N/A	426.37 Kips

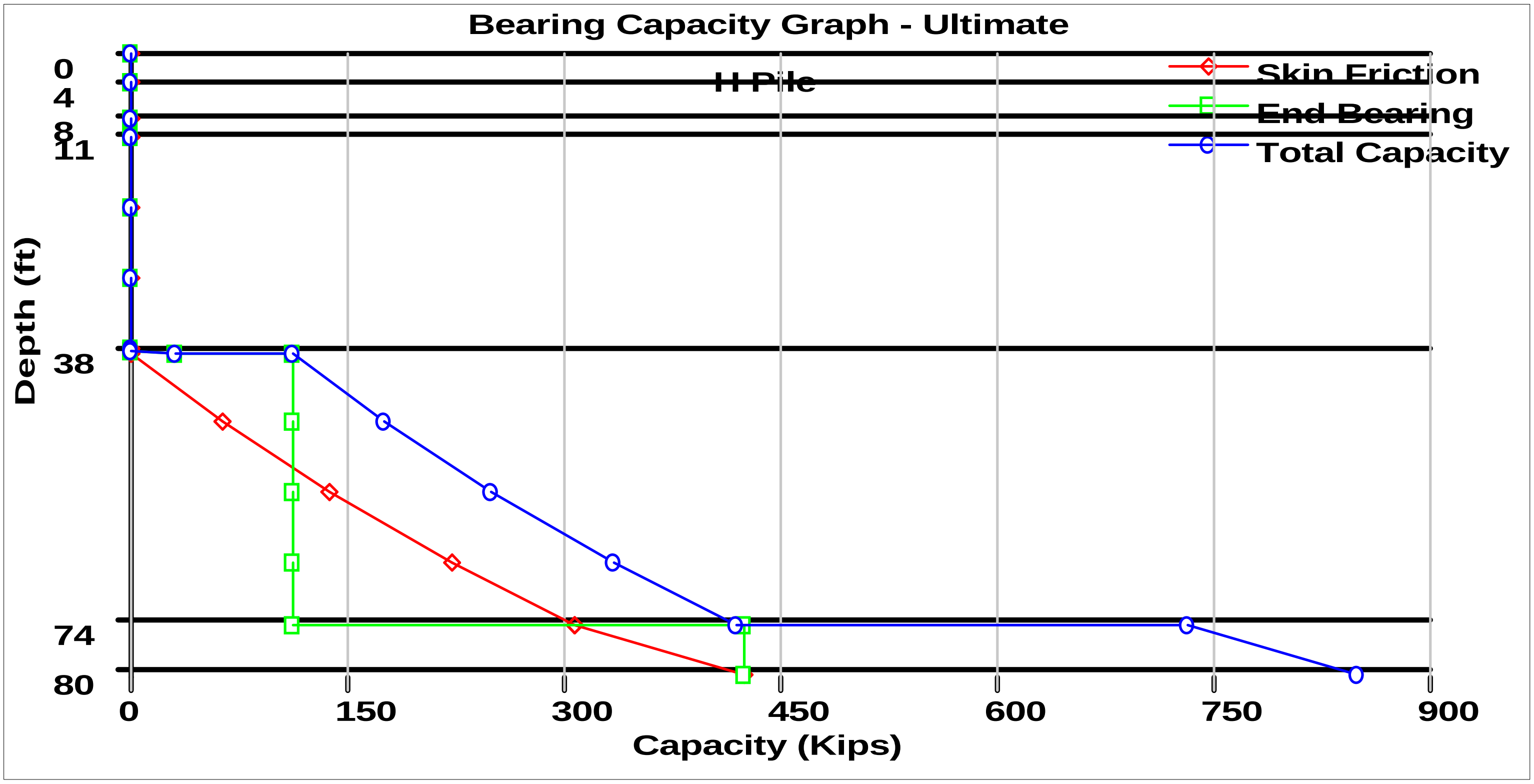
ULTIMATE - END BEARING

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
3.99 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
4.01 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
8.49 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
8.51 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
10.99 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
11.01 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
20.01 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
29.01 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
38.01 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
38.49 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
38.49 ft	Cohesionless	0.00 psf	0.00	0.00 Kips	0.00 Kips
38.50 ft	Cohesionless	3499.00 psf	0.00	31.04 Kips	31.04 Kips
38.51 ft	Cohesionless	3499.73 psf	66.07	112.62 Kips	112.62 Kips
47.51 ft	Cohesionless	4153.13 psf	66.07	112.62 Kips	112.62 Kips
56.51 ft	Cohesionless	4806.53 psf	66.07	112.62 Kips	112.62 Kips
65.51 ft	Cohesionless	5459.93 psf	66.07	112.62 Kips	112.62 Kips
73.49 ft	Cohesionless	6039.27 psf	66.07	112.62 Kips	112.62 Kips
73.51 ft	Cohesionless	6040.73 psf	166.61	424.80 Kips	424.80 Kips
79.99 ft	Cohesionless	6511.17 psf	166.61	424.80 Kips	424.80 Kips

ULTIMATE - SUMMARY OF CAPACITIES

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
3.99 ft	0.00 Kips	0.00 Kips	0.00 Kips
4.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
8.49 ft	0.00 Kips	0.00 Kips	0.00 Kips
8.51 ft	0.00 Kips	0.00 Kips	0.00 Kips
10.99 ft	0.00 Kips	0.00 Kips	0.00 Kips
11.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
20.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
29.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
38.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
38.49 ft	0.00 Kips	0.00 Kips	0.00 Kips
38.49 ft	0.00 Kips	0.00 Kips	0.00 Kips
38.50 ft	0.00 Kips	31.04 Kips	31.04 Kips
38.51 ft	0.06 Kips	112.62 Kips	112.68 Kips
47.51 ft	63.50 Kips	112.62 Kips	176.12 Kips
56.51 ft	137.78 Kips	112.62 Kips	250.40 Kips
65.51 ft	222.89 Kips	112.62 Kips	335.50 Kips
73.49 ft	307.41 Kips	112.62 Kips	420.03 Kips
73.51 ft	307.70 Kips	424.80 Kips	732.50 Kips
79.99 ft	426.37 Kips	424.80 Kips	851.18 Kips

Filename: T:\GEOTECH\DRIVEN\1987301\B-2N.DVN



DRIVEN 1.2

GENERAL PROJECT INFORMATION

Filename: T:\GEOTECH\DRIVEN\1987301\B-2N.DVN
Project Name: FUL-120 Project Date: 05/03/2021
Project Client: Bergmann
Computed By: CPI
Project Manager: CPI

PILE INFORMATION

Pile Type: H Pile - HP14X73
Top of Pile: 38.50 ft
Perimeter Analysis: Box
Tip Analysis: Box Area

ULTIMATE CONSIDERATIONS

Water Table Depth At Time Of:	- Drilling:	11.00 ft
	- Driving/Restrike	11.00 ft
	- Ultimate:	11.00 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	4.00 ft	0.00%	125.00 pcf	1000.00 psf	T-79 Steel
2	Cohesive	4.50 ft	0.00%	120.00 pcf	700.00 psf	T-79 Steel
3	Cohesive	2.50 ft	0.00%	130.00 pcf	1600.00 psf	T-79 Steel
4	Cohesive	27.50 ft	0.00%	140.00 pcf	3500.00 psf	T-79 Steel
5	Cohesionless	35.00 ft	0.00%	135.00 pcf	35.2/35.2	Nordlund
6	Cohesionless	6.50 ft	0.00%	135.00 pcf	40.2/40.2	Nordlund

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
3.99 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
4.01 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
8.49 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
8.51 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
10.99 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
11.01 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
20.01 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
29.01 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
38.01 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
38.49 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
38.49 ft	Cohesionless	0.00 psf	0.00	N/A	0.00 Kips
38.50 ft	Cohesionless	1124.05 psf	0.00	N/A	0.00 Kips
38.51 ft	Cohesionless	3499.36 psf	27.63	N/A	0.09 Kips
47.51 ft	Cohesionless	3826.06 psf	27.63	N/A	86.39 Kips
56.51 ft	Cohesionless	4152.76 psf	27.63	N/A	187.44 Kips
65.51 ft	Cohesionless	4479.46 psf	27.63	N/A	303.22 Kips
73.49 ft	Cohesionless	4769.14 psf	27.63	N/A	418.20 Kips
73.51 ft	Cohesionless	6040.36 psf	31.56	N/A	418.60 Kips
79.99 ft	Cohesionless	6275.59 psf	31.56	N/A	585.99 Kips

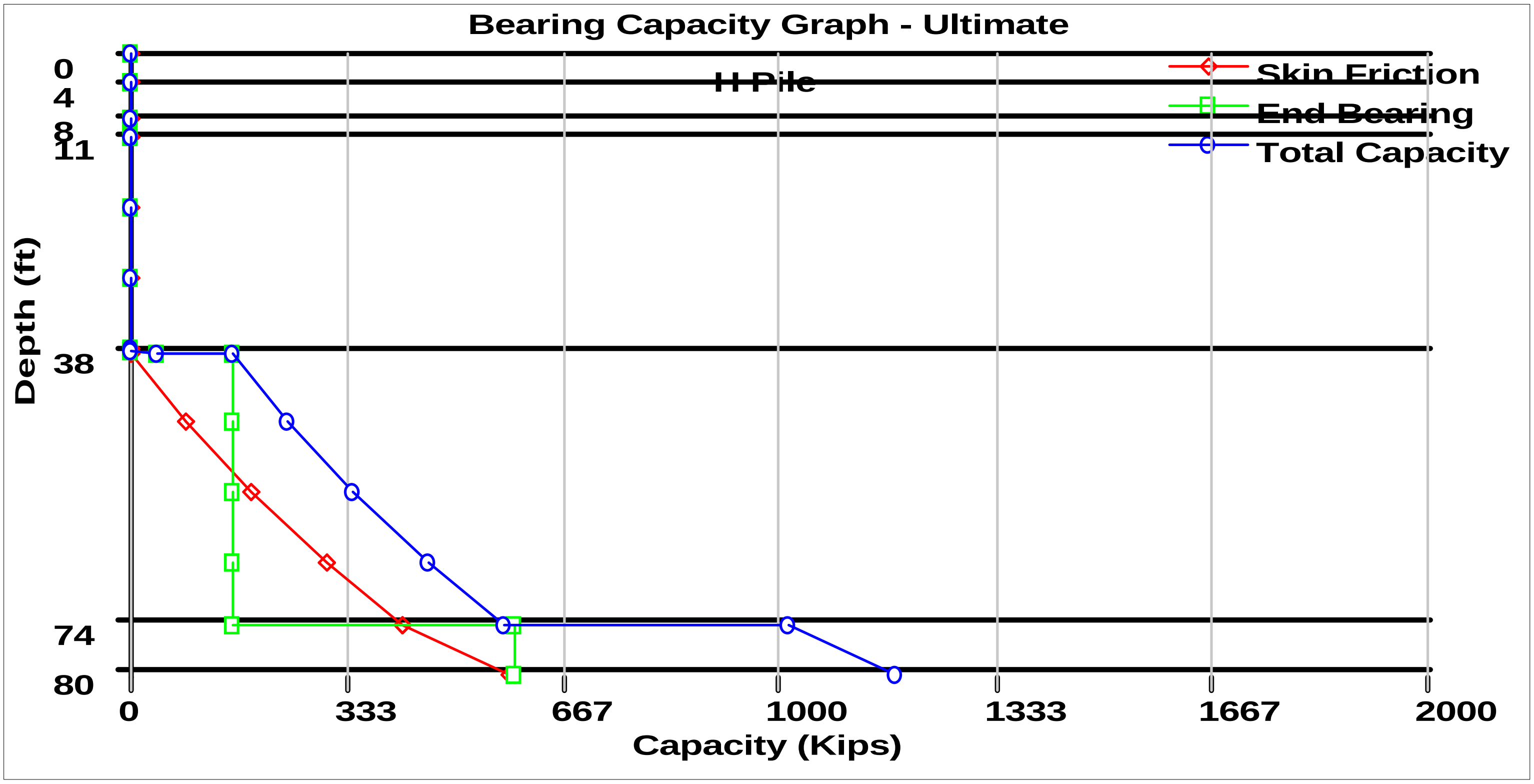
ULTIMATE - END BEARING

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
3.99 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
4.01 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
8.49 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
8.51 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
10.99 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
11.01 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
20.01 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
29.01 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
38.01 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
38.49 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
38.49 ft	Cohesionless	0.00 psf	0.00	0.00 Kips	0.00 Kips
38.50 ft	Cohesionless	3499.00 psf	0.00	43.42 Kips	43.42 Kips
38.51 ft	Cohesionless	3499.73 psf	66.07	157.55 Kips	157.55 Kips
47.51 ft	Cohesionless	4153.13 psf	66.07	157.55 Kips	157.55 Kips
56.51 ft	Cohesionless	4806.53 psf	66.07	157.55 Kips	157.55 Kips
65.51 ft	Cohesionless	5459.93 psf	66.07	157.55 Kips	157.55 Kips
73.49 ft	Cohesionless	6039.27 psf	66.07	157.55 Kips	157.55 Kips
73.51 ft	Cohesionless	6040.73 psf	166.61	594.29 Kips	594.29 Kips
79.99 ft	Cohesionless	6511.17 psf	166.61	594.29 Kips	594.29 Kips

ULTIMATE - SUMMARY OF CAPACITIES

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
3.99 ft	0.00 Kips	0.00 Kips	0.00 Kips
4.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
8.49 ft	0.00 Kips	0.00 Kips	0.00 Kips
8.51 ft	0.00 Kips	0.00 Kips	0.00 Kips
10.99 ft	0.00 Kips	0.00 Kips	0.00 Kips
11.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
20.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
29.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
38.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
38.49 ft	0.00 Kips	0.00 Kips	0.00 Kips
38.49 ft	0.00 Kips	0.00 Kips	0.00 Kips
38.50 ft	0.00 Kips	43.42 Kips	43.42 Kips
38.51 ft	0.09 Kips	157.55 Kips	157.64 Kips
47.51 ft	86.39 Kips	157.55 Kips	243.94 Kips
56.51 ft	187.44 Kips	157.55 Kips	344.99 Kips
65.51 ft	303.22 Kips	157.55 Kips	460.77 Kips
73.49 ft	418.20 Kips	157.55 Kips	575.75 Kips
73.51 ft	418.60 Kips	594.29 Kips	1012.89 Kips
79.99 ft	585.99 Kips	594.29 Kips	1180.28 Kips

Filename: T:\GEOTECH\DRIVEN\1987301\B-2N.DVN



WEAP Evaluations

General

Date 1/17/22
Page 1 of

Project Name FUL-120-14.08
Project No. 1987301
By CPI
Checked by/Date
Subject Drivability Analysis (GRL WEAP)

Now Planning HP 12x53 piles w/ UBV = 380 kips

	B-001 Rear Abutment	B-002 Fwd Abutment
Bottom of Abut Elev	698.4	698.4
Pile Cut off Elev	700.4	700.4
BOTT of Prebore Elev.	669.5	680.5
EST Pile Tip Elev.	653.0	649.0
EST Pile Length(ft)	47.4' roudup to 50'	51.4' Roundup to 55'
Pile Length past Prebore(ft)	16.5'	31.5'
Order Pile Length	55'	60'

All driving past prebore depth is in Stratum IV Hard Cohesive Modeled as very dense granular Material in DRIVEN analyses

$\phi' = 37°$ $\phi' = 35°$

HP12x53 piles: A = 15.5 in² (Section Area)
11.80 in X 12.00 in ≈ 12"x12"
≈ 144 in² (Box Area)

Perimeter ≈ 12" x 4 = 48" = 4'

Pile Size = 11.80 in ≈ 12" ≈ 1'

GWT ~ Elev. 710 to 705, above pre-bore Elevation. ∴ GWT @ 0'

σ_v' @ Prebore bottom (B-001) = (719-710)(125) + (710-708)(120-62.4) +
708-669.5 (140-62.4) = 4228 psf

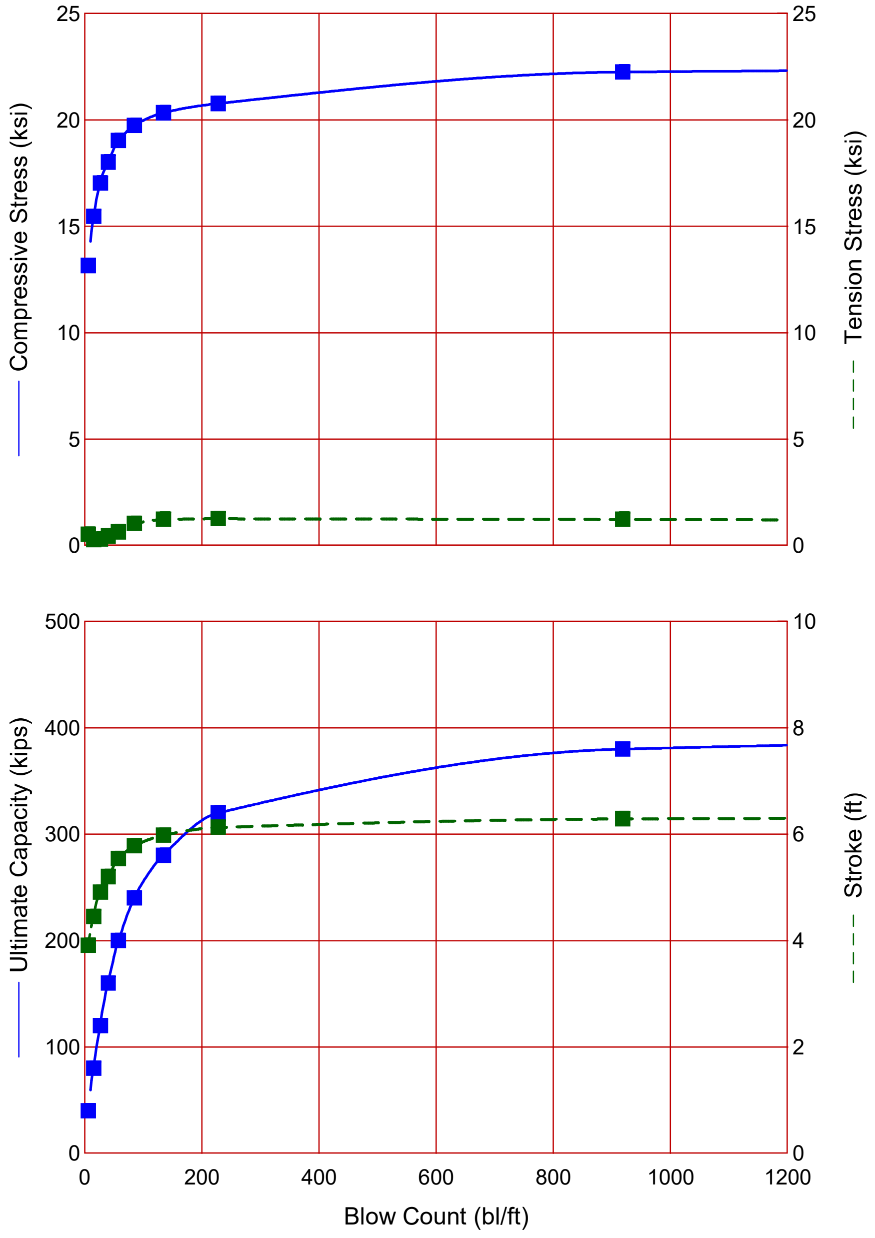
σ_v' @ prebore bottom (B-002) = (719-715)(125) + (715-710.5)(120) +
(710.5-708)(130) + (708-680.5)(140-62.4)
= 3499 psf

WEAP Output

Rear Abutment (Boring B-001)
Delmag D12

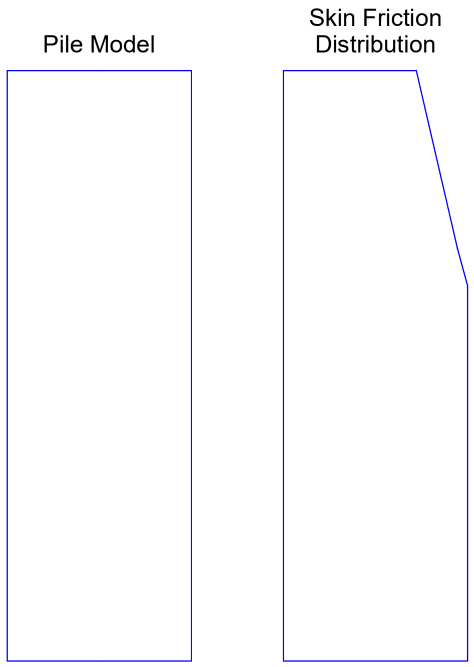
TTL Associates Inc
1987301 Rear Abut, HP 12x53, D-12

17-Jan-2022
GRLWEAP (TM) Version 2005



DELMAG D 12

Efficiency	0.800	
Helmet	2.15	kips
Hammer Cushion	39690	kips/in
Skin Quake	0.100	in
Toe Quake	0.100	in
Skin Damping	0.050	sec/ft
Toe Damping	0.150	sec/ft
Pile Length	55.00	ft
Pile Top Area	15.50	ft
		in2



Res. Shaft = 33 %
(Proportional)

TTL Associates Inc
1987301 Rear Abut, HP 12x53, D-12

17-Jan-2022
GRLWEAP (TM) Version 2005

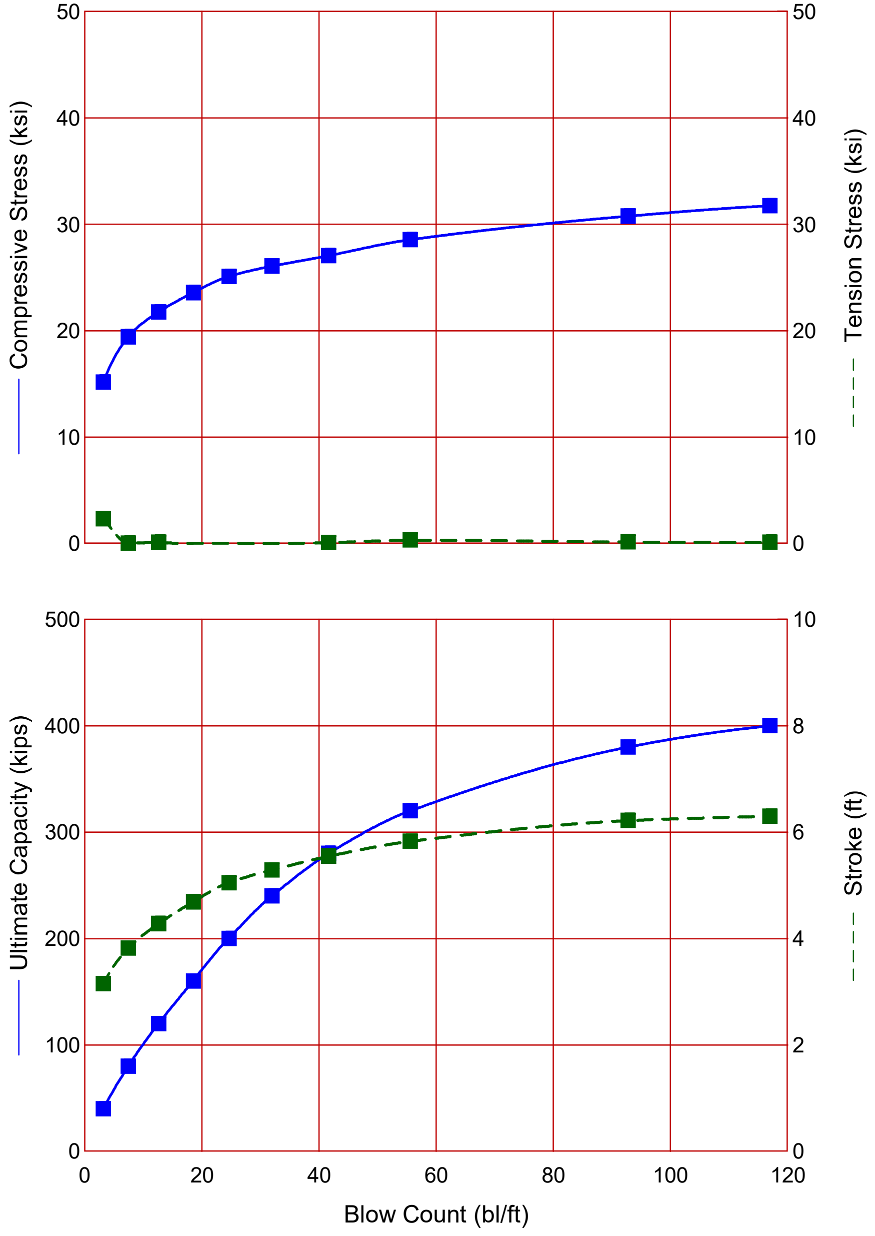
Ultimate Capacity kips	Maximum Compression Stress ksi	Maximum Tension Stress ksi	Blow Count bl/ft	Stroke ft	Energy kips-ft
40.0	13.15	0.53	6.4	3.91	9.76
80.0	15.47	0.27	15.7	4.45	8.54
120.0	17.02	0.30	27.3	4.91	8.24
160.0	18.01	0.44	40.8	5.20	8.14
200.0	19.03	0.64	58.1	5.54	8.36
240.0	19.73	1.03	85.4	5.78	8.48
280.0	20.33	1.23	134.9	5.98	8.74
320.0	20.77	1.27	228.5	6.13	8.94
380.0	22.25	1.23	918.5	6.29	9.06
400.0	22.58	1.14	3107.4	6.35	9.13

WEAP Output

Rear Abutment (Boring B-001)
Delmag D22

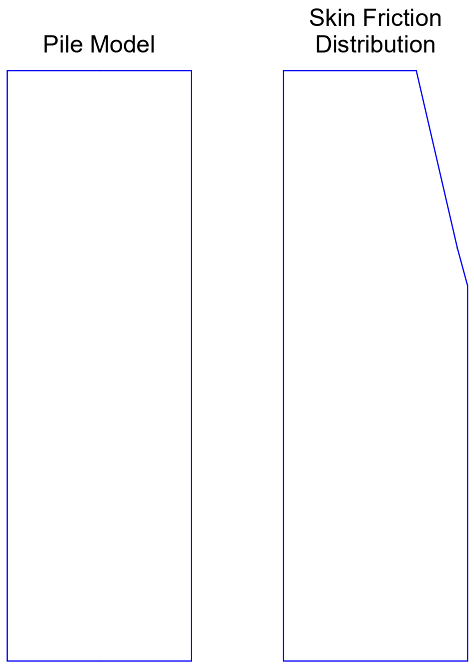
TTL Associates Inc
1987301 Rear Abut, HP 12x53, D-22

17-Jan-2022
GRLWEAP (TM) Version 2005



DELMAG D 22

Efficiency	0.800	
Helmet	2.15	kips
Hammer Cushion	39690	kips/in
Skin Quake	0.100	in
Toe Quake	0.100	in
Skin Damping	0.050	sec/ft
Toe Damping	0.150	sec/ft
Pile Length	55.00	ft
Pile Top Area	15.50	ft
		in2



Res. Shaft = 33 %
(Proportional)

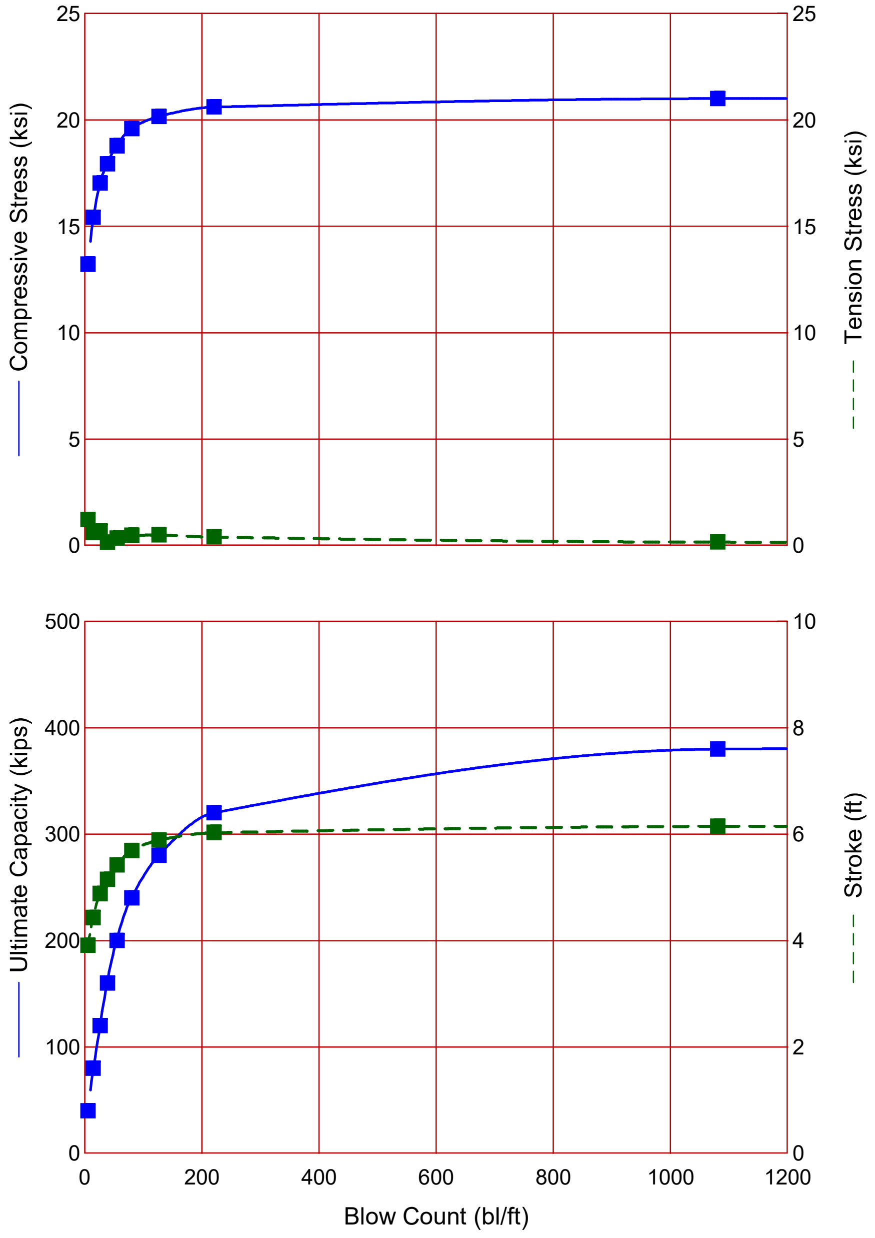
Ultimate Capacity kips	Maximum Compression Stress ksi	Maximum Tension Stress ksi	Blow Count bl/ft	Stroke ft	Energy kips-ft
40.0	15.17	2.30	3.2	3.15	21.20
80.0	19.41	0.03	7.5	3.82	18.35
120.0	21.75	0.10	12.7	4.28	16.86
160.0	23.57	0.00	18.6	4.69	16.18
200.0	25.09	0.00	24.7	5.05	16.16
240.0	26.07	0.00	32.0	5.29	16.12
280.0	27.05	0.09	41.7	5.55	16.32
320.0	28.55	0.32	55.6	5.83	16.59
380.0	30.77	0.15	92.8	6.22	17.18
400.0	31.74	0.11	117.0	6.30	17.19

WEAP Output

Forward Abutment (Boring B-002)
Delmag D12

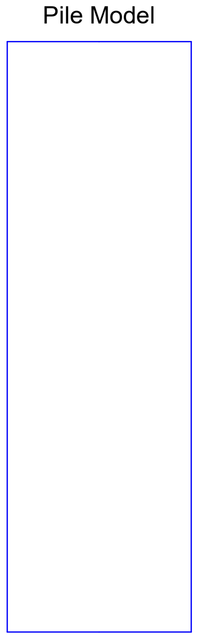
TTL Associates Inc
1987301 Fwd Abut, HP 12x53, D-12

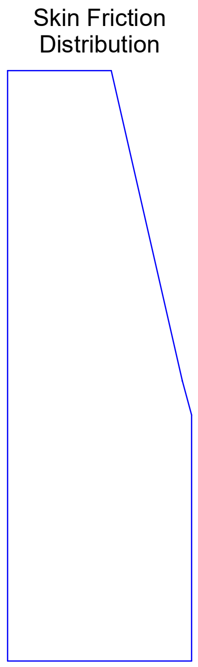
17-Jan-2022
GRLWEAP (TM) Version 2005



DELMAG D 12

Efficiency	0.800	
Helmet	2.15	kips
Hammer Cushion	39690	kips/in
Skin Quake	0.100	in
Toe Quake	0.100	in
Skin Damping	0.050	sec/ft
Toe Damping	0.150	sec/ft
Pile Length	60.00	ft
Pile Top Area	15.50	ft
		in2





Res. Shaft = 48 %
(Proportional)

TTL Associates Inc
1987301 Fwd Abut, HP 12x53, D-12

17-Jan-2022
GRLWEAP (TM) Version 2005

Ultimate Capacity kips	Maximum Compression Stress ksi	Maximum Tension Stress ksi	Blow Count bl/ft	Stroke ft	Energy kips-ft
40.0	13.21	1.22	6.1	3.91	9.79
80.0	15.42	0.60	14.8	4.43	8.52
120.0	17.02	0.68	26.8	4.88	8.20
160.0	17.93	0.15	39.4	5.15	8.03
200.0	18.78	0.34	55.6	5.42	8.10
240.0	19.59	0.47	80.7	5.69	8.39
280.0	20.16	0.50	127.3	5.89	8.61
320.0	20.60	0.40	221.0	6.03	8.70
380.0	21.00	0.17	1080.9	6.15	8.72
400.0	21.19	0.10	9032.1	6.21	8.76

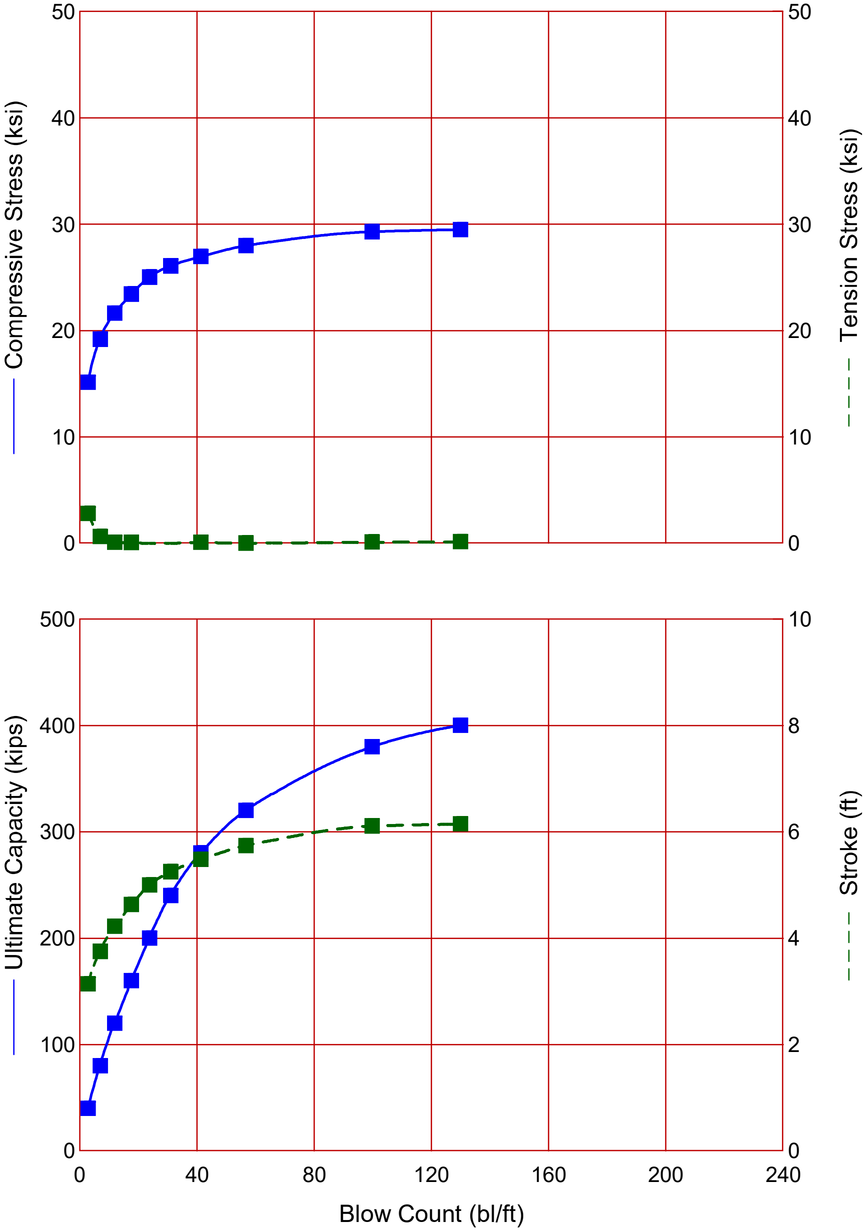
WEAP Output

Forward Abutment (Boring B-002)
Delmag D22

associates | inc
Environmental, Geotechnical
Engineering & Testing

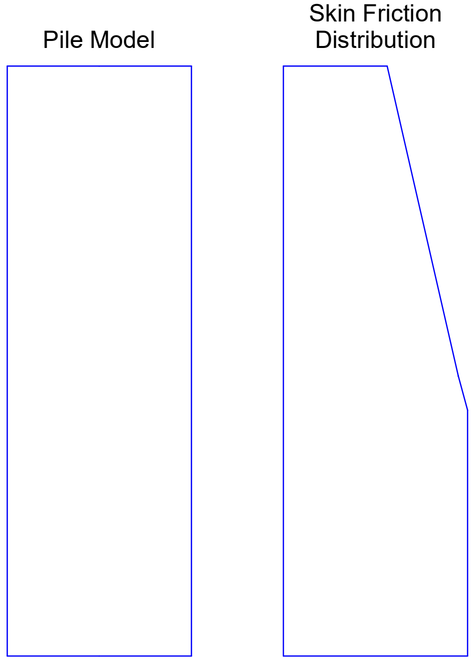
TTL Associates Inc
1987301 Fwd Abut, HP 12x53, D-22

17-Jan-2022
GRLWEAP (TM) Version 2005



DELMAG D 22

Efficiency	0.800	
Helmet	2.15	kips
Hammer Cushion	39690	kips/in
Skin Quake	0.100	in
Toe Quake	0.100	in
Skin Damping	0.050	sec/ft
Toe Damping	0.150	sec/ft
Pile Length	60.00	ft
Pile Top Area	15.50	ft
		in2



Res. Shaft = 48 %
(Proportional)

```
TTL Associates Inc                                                  17-Jan-2022
1987301 Fwd Abut, HP 12x53, D-22                      GRLWEAP (TM) Version 2005

                Maximum      Maximum
  Ultimate  Compression      Tension         Blow
  Capacity       Stress       Stress        Count       Stroke       Energy
      kips          ksi          ksi        bl/ft           ft      kips-ft

      40.0        15.13         2.80          3.0         3.14        21.33
      80.0        19.17         0.63          7.1         3.75        18.30
     120.0        21.62         0.09         12.0         4.22        16.94
     160.0        23.43         0.08         17.7         4.63        16.26
     200.0        25.01         0.00         23.9         5.00        16.09
     240.0        26.07         0.00         31.1         5.25        16.07
     280.0        26.94         0.09         41.4         5.48        16.09
     320.0        27.98         0.02         56.8         5.74        16.32
     380.0        29.30         0.12         99.9         6.11        16.88
     400.0        29.48         0.15        130.0         6.15        16.91
```

OHIO DEPARTMENT OF TRANSPORTATION

OFFICE OF GEOTECHNICAL ENGINEERING

PLAN SUBGRADES
Geotechnical Bulletin GB1

FUL-120-14.08
101140

State Route 120 over Tenmile Creek, Metamora, Ohio

TTL Associates, Inc.

Prepared By: Christopher P. Iott, P.E.
Date prepared: Friday, August 6, 2021

Christopher P. Iott, P.E.
TTL Associates, Inc.
1915 N. 12th Street
Toledo, Ohio 43604
419-214-5020
ciott@ttlassoc.com

NO. OF BORINGS: 2

#	Boring ID	Alignment	Station	Offset	Dir	Drill Rig	ER	Boring EL.	Proposed Subgrade EL	Cut Fill
1	B-001-0-20	SR 120	743+06	10	Rt	CME 550x ATV \06	77	719.0	717.5	1.5 C
2	B-002-1-20	SR 120	743+90	16	Lt	CME 550x ATV \06	77	719.1	717.6	1.5 C

OHIO DEPARTMENT OF TRANSPORTATION

Subgrade Analysis

V. 14.5 1/18/2019

#	Boring	Sample	Sample Depth		Subgrade Depth		Standard Penetration		HP (tsf)	Physical Characteristics						Moisture		Ohio DOT		Sulfate Content (ppm)	Problem		Excavate and Replace (Item 204)		Recommendation (Enter depth in inches)
			From	To	From	To	N_{60}	N_{60L}		LL	PL	PI	% Silt	% Clay	P200	M_C	M_{OPT}	Class	GI		Unsuitable	Unstable	Unsuitable	Unstable	
1	B 001-0 20	SS-1	1.0	2.5	-0.5	1.0	13		3.5	29	15	14	23	58	81	18	14	A-6a	10	2400		N_{60} & Mc		12"	**12" 204 Geotextile**
		SS-2	2.5	4.0	1.0	2.5	14			26	14	12	22	34	56	14	14	A-6a	5	580					
		SS-3	4.0	5.5	2.5	4.0	8		1.25							22	16	A-6b	16						
		SS-4	5.5	9.0	4.0	7.5	6	6	0.75							33	16	A-6b	16						
2	B 002-1 20	SS-1	1.0	2.5	-0.5	1.0	6		3							18	16	A-6b	16	1300		N_{60}		18"	**24" 204 Geotextile**
		SS-2	2.5	4.0	1.0	2.5	8		0.5	21	13	8	36	12	48	13	10	A-4a	3			HP & Mc		24"	
		SS-3	4.0	6.5	2.5	5.0	4		1	33	17	16	21	60	81	23	16	A-6b	10						
		SS-4	6.5	8.5	5.0	7.0	5	4	1							26	16	A-6b	16						

OHIO DEPARTMENT OF TRANSPORTATION

Subgrade Analysis

V. 14.5 1/18/2019

PID: 101140

County-Route-Section: FUL-120-14.08
No. of Borings: 2

Geotechnical Consultant: TTL Associates, Inc.
Prepared By: Christopher P. Iott, P.E.
Date prepared: 8/6/2021

Chemical Stabilization Options		
320	Rubblize & Roll	No
206	Cement Stabilization	Option
	Lime Stabilization	No
206	Depth	14''

Excavate and Replace Stabilization Options	
Global Geotextile Average(N60L): Average(HP):	 21'' 12''
Global Geogrid Average(N60L): Average(HP):	 15'' 0''

Design CBR	6

% Samples within 6 feet of subgrade			
$N_{60} \leq 5$	25%	HP ≤ 0.5	13%
$N_{60} < 12$	75%	0.5 < HP ≤ 1	38%
$12 \leq N_{60} < 15$	25%	1 < HP ≤ 2	13%
$N_{60} \geq 20$	0%	HP > 2	25%
M+	25%		
Rock	0%		
Unsuitable	0%		

Excavate and Replace at Surface	
Average	18''
Maximum	24''
Minimum	12''

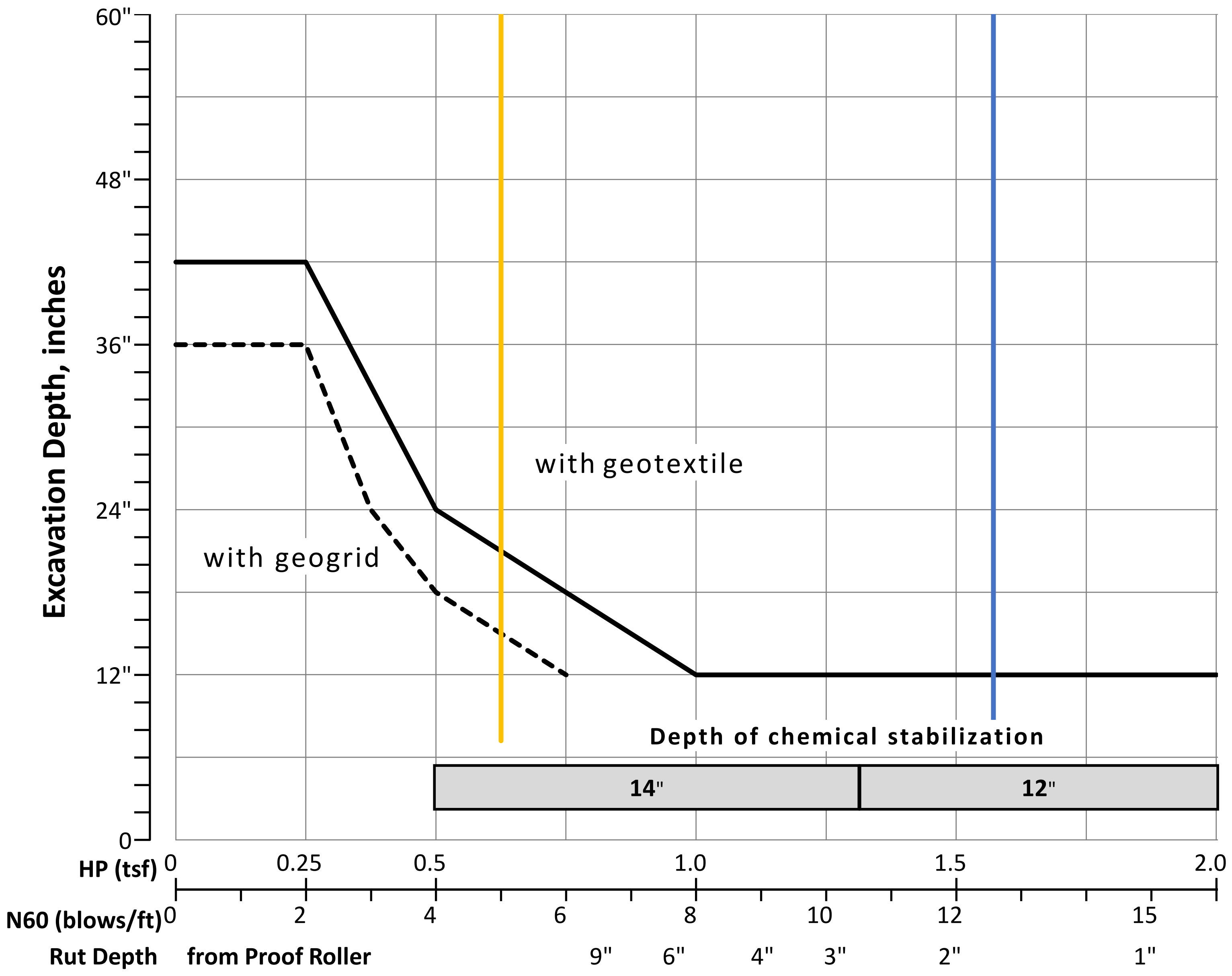
% Proposed Subgrade Surface	
Unstable & Unsuitable	50%
Unstable	50%
Unsuitable	0%

	N_{60}	N_{60L}	HP	LL	PL	PI	Silt	Clay	P 200	M_C	M_{OPT}	GI
Average	8	5	1.57	27	15	13	26	41	67	21	15	12
Maximum	14	6	3.50	33	17	16	36	60	81	33	16	16
Minimum	4	4	0.50	21	13	8	21	12	48	13	10	3

Classification Counts by Sample

ODOT Class	Rock	A-1-a	A-1-b	A-2-4	A-2-5	A-2-6	A-2-7	A-3	A-3a	A-4a	A-4b	A-5	A-6a	A-6b	A-7-5	A-7-6	A-8a	A-8b	Totals
Count	0	0	0	0	0	0	0	0	0	1	0	0	2	5	0	0	0	0	8
Percent	0%	0%	0%	0%	0%	0%	0%	0%	0%	13%	0%	0%	25%	63%	0%	0%	0%	0%	100%
% Rock|Granular|Cohesive	0%	13%									88%								100%
Surface Class Count	0	0	0	0	0	0	0	0	0	1	0	0	2	3	0	0	0	0	6
Surface Class Percent	0%	0%	0%	0%	0%	0%	0%	0%	0%	17%	0%	0%	33%	50%	0%	0%	0%	0%	100%

GB1 Figure B – Subgrade Stabilization



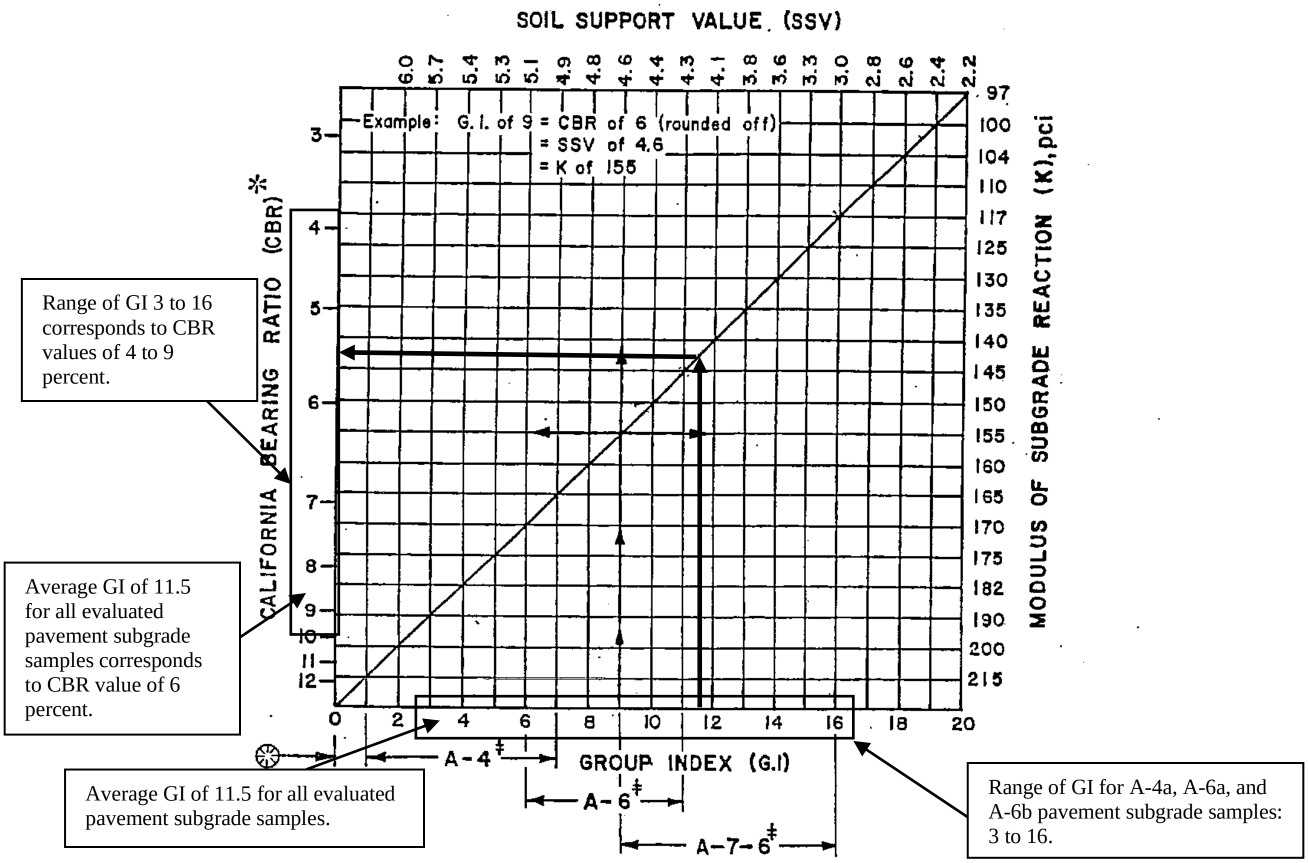
OVERRIDE TABLE

Calculated Average	New Values	Check to Override
1.57		☐ HP
5.00		☐ N60L

Average HP ▬

Average N_{60L} ▬

Fig.1301-3
Feb.1978



Range of GI 3 to 16 corresponds to CBR values of 4 to 9 percent.

Average GI of 11.5 for all evaluated pavement subgrade samples corresponds to CBR value of 6 percent.

Average GI of 11.5 for all evaluated pavement subgrade samples.

Range of GI for A-4a, A-6a, and A-6b pavement subgrade samples: 3 to 16.

⊛ AASHTO Classes A-1, A-2 & A-3 lie below 0. SSV=6-10; K=200+.

‡ Usual range of AASHTO Classes.

* 5-1/2 Lb. hammer, 12" drop, 4 layers, 45 blows per layer, compacted at optimum moisture as determined by AASHTO T-99.

CORRELATION CHART FOR
SUBGRADE STRENGTHS

Based on the GB-1 analysis for Borings B-001 and B-002, a design CBR value of 6 percent was determined for the project area. The CBR value calculated by the “Subgrade Analysis” worksheet is based on an average condition of all of the soil types included in the GB-1 analysis. Group indices for the tested samples varied from 3 to 16, which would correlate with a CBR value of 4 to 9 percent. A maximum GI of 10 was determined for the samples tested for gradation and plasticity, which would correlate with a CBR value of 6 percent. As such, based on the average design value calculations from GB-1, it does not appear to be unconservative to use the GB-1 design CBR value of 6 percent.

1987301 FUL-120
CPI 8-12-21

Existing Body Shop Possible Net Allowable Bearing Pressures

Soils: Cohesive
Phi: 0
Nc: 5.14

Stratum I (Soft to Medium Stiff)

c (psf): 700 From Average Soil Properties Spreadsheet
qult(net), psf: 3598
FOS: 3
qallow(net), psf: 1199
Say qallow(net), psf: **1200** FOS= 3.0

Stratum II (Stiff to Very Stiff)

c (psf): 1600 From Average Soil Properties Spreadsheet
qult(net), psf: 8224
FOS: 3
qallow(net), psf: 2741
Say qallow(net), psf: **2750** FOS= 3.0

Stratum III (Very Stiff to Hard)

c (psf): 3500 From Average Soil Properties Spreadsheet
qult(net), psf: 17990
FOS: 3
qallow(net), psf: 5997
Say qallow(net), psf: **6000** FOS= 3.0

Appendix B:
Geotechnical Engineering Design Checklists

I. Geotechnical Design Checklists

Project: FUL-120-14.08 **PDP Path:**

PID: 101140 **Review Stage:**

Checklist	**Included in This Submission**
II. Reconnaissance and Planning	✓
III. A. Centerline Cuts	
III. B. Embankments	
III. C. Subgrade	✓
IV. A. Foundations of Structures	✓
IV. B. Retaining Wall	✓
V. A. Landslide Remediation	
V. B. Rockfall Remediation	
V. C. Wetland or Peat Remediation	
V. D. Underground Mine Remediation	
V. E. Surface Mine Remediation	
V. F. Karst Remediation	
VI. A. Soil Profile	
VI. B. Geotechnical Reports	✓

II. Reconnaissance and Planning Checklist

C-R-S: FUL-120-14.08	**PID:** 101140	**Reviewer:** CPI	**Date:** 1/18/2022

Reconnaissance		(Y/N/X)	Notes:
1	Based on Section 302.1 in the SGE, have the necessary plans been developed in the following areas prior to the commencement of the subsurface exploration reconnaissance:	Y	Preliminary Plan-and-Profile drawing provided by Bergmann
	Roadway plans		
	Structures plans		
	Geohazards plans		
2	Have the resources listed in Section 302.2.1 of the SGE been reviewed as part of the office reconnaissance?	Y	
3	Have all the features listed in Section 302.3 of the SGE been observed and evaluated during the field reconnaissance?	Y	
4	If notable features were discovered in the field reconnaissance, were the GPS coordinates of these features recorded?	X	

Planning - General		(Y/N/X)	Notes:
5	In planning the geotechnical exploration program for the project, have the specific geologic conditions, the proposed work, and historic subsurface exploration work been considered?	Y	
6	Has the ODOT Transportation Information Mapping System (TIMS) been accessed to find all available historic boring information and inventoried geohazards?	Y	
7	Have the borings been located to develop the maximum subsurface information while using a minimum number of borings, utilizing historic geotechnical explorations to the fullest extent possible?	Y	Historic exploration consisted only of auger and drive rod borings.
8	Have the topography, geologic origin of materials, surface manifestation of soil conditions, and any other special design considerations been utilized in determining the spacing and depth of borings?	Y	
9	Have the borings been located so as to provide adequate overhead clearance for the equipment, clearance of underground utilities, minimize damage to private property, and minimize disruption of traffic, without compromising the quality of the exploration?	Y	

II. Reconnaissance and Planning Checklist

Planning - General		(Y/N/X)	Notes:
10	Have the scaled boring plans, showing all project and historic borings, and a schedule of borings in tabular format, been submitted to the District Geotechnical Engineer?		
	The schedule of borings should present the following information for each boring:		
a.	exploration identification number		
b.	location by station and offset		
c.	estimated amount of rock and soil, including the total for each for the entire program.		
Planning – Exploration Number		(Y/N/X)	Notes:
11	Have the coordinates, stations and offsets of all explorations (borings, probes, test pits, etc.) been identified?		
12	Has each exploration been assigned a unique identification number, in the following format X-ZZZ-W-YY, as per Section 303.2 of the SGE?		
13	When referring to historic explorations that did not use the identification scheme in 12 above, have the historic explorations been assigned identification numbers according to Section 303.2 of the SGE?		

II. Reconnaissance and Planning Checklist

Planning – Boring Types		(Y/N/X)	Notes:
14	Based on Sections 303.3 to 303.7.6 of the SGE, have the location, depth, and sampling requirements for the following boring types been determined for the project?	Y	
	Check all boring types utilized for this project:		
	Existing Subgrades (Type A)	✓	
	Roadway Borings (Type B)		
	Embankment Foundations (Type B1)		
	Cut Sections (Type B2)		
	Sidehill Cut Sections (Type B3)		
	Sidehill Cut-Fill Sections (Type B4)		
	Sidehill Fill Sections on Unstable Slopes (Type B5)		
	Geohazard Borings (Type C)		
	Lakes, Ponds, and Low-Lying Areas (Type C1)		
	Peat Deposits, Compressible Soils, and Low Strength Soils (Type C2)		
	Uncontrolled Fills, Waste Pits, and Reclaimed Surface Mines (Type C3)		
	Underground Mines (C4)		
	Landslides (Type C5)		
	Rockfall (Type C6)		
	Karst (Type C7)		
	Proposed Underground Utilities (Type D)		
	Structure Borings (Type E)	✓	
	Bridges (Type E1)	✓	
	Culverts (Type E2 a,b,c)		
	Retaining Walls (Type E3 a,b,c)	✓	
	Noise Barrier (Type E4)		
	CCTV & High Mast Lighting Towers (Type E5)		
	Buildings and Salt Domes (Type E6)		

III.C. Subgrade Checklist

C-R-S: FUL-120-14.08 | **PID:** 101140 | **Reviewer:** CPI | **Date:** 1/18/2022

If you do not have any subgrade work on the project, you do not have to fill out this checklist.

Subgrade		(Y/N/X)	Notes:
1	Has the subsurface exploration adequately characterized the soil or rock according to Geotechnical Bulletin 1: Plan Subgrades (GB1)?	Y	
a.	Has each sample been visually classified and inspected for the presence of gypsum? Has a moisture content been performed on each sample?	Y	
b.	Has mechanical classification (Plastic Limit (PL), Liquid Limit (LL), and gradation testing) been done on at least two samples from each boring within six feet of the proposed subgrade?	Y	
c.	Has the sulfate content of at least one sample from each boring within 3 feet of the proposed subgrade been determined, per Supplement 1122, Determining Sulfate Content in Soils?	Y	
d.	Has the sulfate content of all samples that exhibit gypsum crystals been determined?	X	
e.	Have A-2-5, A-4b, A-5, A-7-5, A-8a, or A-8b soils within the top 3 feet of the proposed subgrade been mechanically classified?	X	
2	If soils classified as A-2-5, A-4b, A-5, A-7-5, A-8a, or A-8b, or having a LL>65, are present at the proposed subgrade (soil profile), do the plans specify that these materials need to be removed and replaced or chemically stabilized?	X	
a.	If these materials are to be removed and replaced, have the station limits, depth, and lateral limits for the planned removal been provided?	X	
3	If there is any rock, shale, or coal present at the proposed subgrade (C&MS 204.05), do the plans specify the removal of the material?	X	
a.	If removal of any rock, shale, or coal is required, have the station limits, depth, and lateral limits for the planned removal of the material at proposed subgrade been provided?	X	

III.C. Subgrade Checklist

Subgrade		(Y/N/X)	Notes:
4	In accordance with GB1, do the SPT (N_{60})/HP values and existing moisture contents for the proposed subgrade soils indicate the need for subgrade stabilization?	Y	
a.	If removal and replacement is applicable, has the detail of subgrade removal been shown on the plans, including depth of removal, station limits, lateral extent, replacement material, and plan notes (Item 204 - Subgrade Compaction and Proof Rolling)?	X	Plans to be prepared by others. Extents described in the geotech report.
b.	If chemical stabilization is applicable, has the detail of this treatment been shown on the plans, including depth, percentage of chemical, station limits, lateral extent, and plan notes?	X	Plans to be prepared by others. Geotech report indicates option of cement stabilizaiton, but this method is not anticipated to be economical compared to over-excavate and replace.
	Indicate type of chemcial stabilization specified:		
	cement stabilization		
	lime stabilization		
5	If removal and replacement has been specified, do the plans include Plan Note G121 from L&D3?	X	Plans to be prepared by others.
6	If drainage or groundwater is an issue with the proposed subgrade, has an appropriate drainage system (e.g., pipe, underdrains) been provided?	X	
7	Has an appropriate quantity of Proof Rolling (C&MS 204.06) and has Plan Note G111 from L&D3 been included in the plans?	X	Plans to be prepared by others.
8	Has a design CBR value been provided?	Y	

IV.A Foundations of Structures Checklist

C-R-S: FUL-120-14.08 | **PID:** 101140 | **Reviewer:** CPI | **Date:** 1/18/2022

If you do not have such a foundation or structure on the project, you do not have to fill out this checklist.

Soil and Bedrock Strength Data		(Y/N/X)	Notes:
1	Has the shear strength of the foundation soils been determined?	Y	
	Check method used:		
	laboratory shear tests	✓	
	estimation from SPT or field tests	✓	
2	Have sufficient soil shear strength, consolidation, and other parameters been determined so that the required allowable loads for the foundation/structure can be designed?	Y	
3	Has the shear strength of the foundation bedrock been determined?	X	
	Check method used:		
	laboratory shear tests		
	other (describe other methods)		
Spread Footings		(Y/N/X)	Notes:
4	Are there spread footings on the project? If no, go to Question 11	Y	Evaluation of allowable capacity for existing building foundations.
5	Have the recommended bottom of footing elevation and reason for this recommendation been provided?	X	
a.	Has the recommended bottom of footing elevation taken scour from streams or other water flow into account?	X	
6	Were representative sections analyzed for the entire length of the structure for the following:	X	Building would have originally been designed using ASD.
a.	factored bearing resistance?	X	
b.	factored sliding resistance?	X	
c.	eccentric load limitations (overturning)?	X	
d.	predicted settlement?	N	Not requested for the existing structure associated with this Exploration.
e.	overall (global) stability?	X	
7	Has the need for a shear key been evaluated?	X	
a.	If needed, have the details been included in the plans?	X	
8	If special conditions exist (e.g. geometry, sloping rock, varying soil conditions), was the bottom of footing “stepped” to accommodate them?	X	
9	Have the Service I and Maximum Strength Limit States for bearing pressure on soil or rock been provided?	X	

IV.A Foundations of Structures Checklist

Spread Footings		(Y/N/X)	Notes:
10	If weak soil is present at the proposed foundation level, has the removal / treatment of this soil been developed and included in the plans?	Y	Indicated presumption that existing fill or particularly soft soils would have been over-excavated prior to foundaiton construction.
a.	Have the procedure and quantities related to this removal / treatment been included in the plans?	X	
Pile Structures		(Y/N/X)	Notes:
11	Are there piles on the project? If no, go to Question 17	Y	
12	Has an appropriate pile type been selected?		Alternatives for CIP or H-pile provided, both with preboring. Final design incorporates HP 12x53
	Check the type selected:		
	H-pile (driven)		
	H-pile (prebored)	✓	
	Cast In-place Reinforced Concrete Pipe	✓	
	Micropile		
	Continuous Flight Auger (CFA)		
	other (describe other types)		
13	Have the estimated pile length or tip elevation and section (diameter) based on either the Ultimate Bearing Value (UBV) or the depth to top of bedrock been specified? Indicate method used.	Y	
14	If scour is predicted, has pile resistance in the scour zone been neglected?	X	Scour will not extend deeper than the preboring depth, so scour is not a design consideration.
15	Has a wave equation drivability analysis been performed as per BDM 305.4.1.2 to determine whether the pile can be driven to either the UBV, the pile tip elevation, or refusal on bedrock without overstressing the pile?	Y	
16	If required for design, have sufficient soil parameters been provided and calculations performed to evaluate the:	X	
a.	Nominal unit tip resistance and maximum settlement of the piles?	X	
b.	Nominal unit side resistance for each contributing soil layer and maximum deflection of the piles?	X	
c.	Downdrag load on piles driven through new embankment or compressible soil layers, as per BDM 305.4.2.2?	X	
d.	Potential for and impact of lateral squeeze from soft foundation soils?	X	

IV.A Foundations of Structures Checklist

Pile Structures		(Y/N/X)	Notes:
17	If piles are to be driven to strong bedrock (Q_u >7.5 ksi) or through very dense granular soils or overburden containing boulders, have “pile points” been recommended in order to protect the tips of the steel piling, as per BDM 305.4.5.6?	X	
18	If subsurface obstacles exist, has preboring been recommended to avoid these obstructions?	X	Preboring was considered to reduce vibration due to installation in close proximity to existing buildings.
19	If piles will be driven through 15 feet or more of new embankment, has preboring been specified as per BDM 305.4.5.7?	X	

IV.A Foundations of Structures Checklist

Drilled Shafts		(Y/N/X)	Notes:
20	Are there drilled shafts on the project? If no, go to the next checklist.	N	
21	Have the drilled shaft diameter and embedment length been specified?		
22	Have the recommended drilled shaft diameter and embedment been developed based on the nominal unit side resistance and nominal unit tip resistance for vertical loading situations?		
23	For shafts undergoing lateral loading, have the following been determined:		
a.	total factored lateral shear?		
b.	total factored bending moment?		
c.	maximum deflection?		
d.	reinforcement design?		
24	If a bedrock socket is required, has a minimum rock socket length equal to 1.5 times the rock socket diameter been used, as per BDM 305.5.2?		
25	Generally, bedrock sockets are 6" smaller in diameter than the soil embedment section of the drilled shaft. Has this factor been accounted for in the drilled shaft design?		
26	If scour is predicted, has shaft resistance in the scour zone been neglected?		
27	Has the site been assessed for groundwater influence?		
a.	If yes, and if artesian flow is a potential concern, does the design address control of groundwater flow during construction?		
28	Have all the proper items been included in the plans for integrity testing?		
29	If special construction features (e.g., slurry, casing, load tests) are required, have all the proper items been included in the plans?		
30	If necessary, have wet construction methods been specified?		
General		(Y/N/X)	Notes:
31	Has the need for load testing of the foundations been evaluated?		
a.	If needed, have details and plan notes for load testing been included in the plans?		

IV.B. Retaining Wall Checklist

C-R-S: FUL-120-14.08 **PID:** 101140 **Reviewer:** CPI **Date:** 1/18/2022

PDP Path:

If you do not have a retaining wall on the project, you do not have to fill out this checklist.

	Soil Data and Preliminary Calculations	(Y/N/X)	Notes:
1	Has a justification study been performed to determine the necessity of a wall as opposed to ROW purchase or other project alternatives?	X	Wingwalls for the culvert, and temporary construction walls.
2	Have the necessary soil strength parameters and unit weights been determined?	Y	
	Check method used:		
	laboratory shear tests	✓	
	estimation from SPT or field tests	✓	
3	Has the groundwater elevation been determined?	Y	
4	Have the proper loading conditions been determined?	Y	
a.	If yes, check which loading conditions apply:		
	Backfill (Active Earth Pressure Loading):	✓	
	Backfill (Apparent Earth Pressure (AEP) Loading for Ground Anchors):		
	Backfill (At-Rest Earth Pressure Loading):	✓	
	Backfill (Flat, No Slope):	✓	
	Backfill (Infinite Slope):		
	Backfill (Broken Back Slope):		
	Earth Surcharge:		
	Live Load Surcharge:	✓	
	Other (describe):		
5	Have the correct Load Factors, Load Combinations, and Limit States been considered, per AASHTO LRFD 8th Ed. Articles 3.4.1, 10.5, and 11.5?	X	Walls will be pile-supported cast-in-place concrete walls, post-and-panel walls, and/or sheetpile walls.
6	Are earth pressure loads inclined at the soil-structure interaction friction angle, δ and has δ been determined per BDM 307.1.1?	X	
7	Have the correct Resistance Factors been considered, per AASHTO LRFD 8th Ed. Articles 10.5 and 11.5?	X	
8	If applicable, has the influence of groundwater been taken into account with regards to soil unit weights and active pressures?	Y	
9	Has the Coulomb method been utilized to determine the lateral earth pressure?	X	To be completed by structural engineer.

IV.B. Retaining Wall Checklist

Design		(Y/N/X)	Notes:
10	For preliminary wall design, have the design criteria and wall type selection process been followed as instructed in BDM 201.2.5?	X	Prime consultant consideration.
11	Was an economic analysis performed to evaluate the cost benefits of the chosen wall type compared to others?	X	Prime consultant consideration.
12	Were representative sections analyzed for the entire length of the retaining wall for the following:	X	Prime consultant consideration. Walls will NOT be supported on spread foundations.
a.	bearing resistance?		
b.	sliding resistance?		
c.	limiting eccentricity and overturning resistance? Analyze moment equilibrium about toe for non-gravity cantilever walls.		
d.	total and differential settlement?		
e.	overall (global) stability?		
13	If poor foundation soils are present, has a solution been determined with respect to the following:		
a.	excessive settlement?		
b.	inadequate bearing resistance?		
c.	inadequate sliding resistance?		
d.	overall (global) instability?		
14	For non-proprietary walls, each wall type has design recommendations which need to be determined. For the wall type being evaluated, have the following design recommendations been determined by accepted design methods or, where applicable, FHWA design guidelines:	X	Prime consultant considerations.
a.	Rigid Gravity and Semigravity -- footing width and elevation, maximum factored Service and Strength Limit State bearing pressures, factored bearing resistance (BDM 307.1.5 & 307.2)		
b.	Drilled Shafts - diameter, spacing, embedment, arrangement and percent reinforcement, maximum moment and lateral shear, maximum deflection (see BDM 307.6)		
c.	Soldier Pile -pile size and type, drilled hole diameter, embedment, spacing, lagging design, facing, maximum moment and lateral shear, section modulus, maximum deflection		

IV.B. Retaining Wall Checklist

Design		(Y/N/X)	Notes:
d.	Sheet Pile - pile size, embedment, maximum moment and lateral shear, section modulus, maximum deflection (BDM 307.7.1)		
e.	Cellular - type, maximum factored Service and Strength Limit State bearing pressures, factored bearing resistance, fill material (BDM 307.7.2)		
f.	Soil Anchor - load per anchor, number of rows, wale design, anchor inclination and minimum length, type of anchor, pile size, type, spacing, and embedment, maximum moment and lateral shear, section modulus, lagging design, facing (BDM 307.8)		
g.	Soil Nail - nail size, spacing, inclination, and length, loading per nail, facing (BDM 307.9)		
15	Has the need for load testing of the retaining wall elements been evaluated?	Y	Recommendations provided for testing associated with pile-supported 3-sided culvert and associated wingwalls.
a.	If needed, have details and plan notes for load testing been included in the plans?	X	Plans to be prepared by others.
16	Proprietary wall designs require a special process for detail design, as outlined in BDM 307.3 and 307.4. Has this procedure been followed for this project?	X	Prime consultant considerations.
17	Temporary walls - have the same design requirements as permanent walls of the same type been followed, except the design service life is no more than three years (BDM 307.10)?	X	Prime consultant considerations.
18	The presence and quality of water behind the wall structure and in the backfill can be a major source of overloading and failure.	X	Prime consultant considerations.
a.	Has the quality / chemistry of the groundwater been accounted for in the drainage system?		
b.	Has an adequate drainage system been included in the detail wall design?		
c.	If there is a water source behind the wall, has additional drainage been added to control the effect of this water source on the wall?		
19	Have the effects of the wall design and construction procedure been determined and accounted for on the construction schedule?		

IV.B. Retaining Wall Checklist

Design		(Y/N/X)	Notes:
20	Has the effect of the wall design and construction been evaluated with regard to structures (e.g., bridges, culverts, buildings, utilities), which may be subject to unusual stresses or require special design or construction considerations?	X	Prime consultant considerations.
Plans and Contract Documents		(Y/N/X)	Notes:
21	Have all the necessary notes, specifications, special provisions, and details for the construction of the wall system been included in the plans?	X	Prime consultant considerations.
22	Have the need, location, type, plan notes, and reading schedule for any instrumentation been determined and included in the plans?	X	Prime consultant considerations.
	Check the types of instrumentation specified:		
	settlement cells		
	settlement platforms		
	inclinometers		
	monitoring wells / piezometers		
	load cells		
	strain gages		
	other (describe other types)		

VI.B. Geotechnical Reports

C-R-S: FUL-120-14.08	**PID:** 101140	**Reviewer:** CPI	**Date:** 1/18/2022

General		(Y/N/X)	Notes:
1	Has an electronic copy of all geotechnical submissions been provided to the District Geotechnical Engineer (DGE)?	X	Report being submitted to Prime Consultant, who will provide to DGE.
2	Has the first complete version of a geotechnical report being submitted been labeled as 'Draft'?	Y	
3	Subsequent to ODOT's review and approval, has the complete version of the revised geotechnical report being submitted been labeled 'Final'?	Y	
4	Has the boring data been submitted in a native format that is DIGGS (Data Interchange for Geotechnical and Geoenvironmental) compatable? gINT files may be used for this.	Y	gINT files are provided with submittal of this final report.
5	Does the report cover format follow ODOT's Brand and Identity Guidelines Report Standards found at http://www.dot.state.oh.us/brand/Pages/default.aspx ?	Y	
6	Have all geotechnical reports being submitted been titled correctly as prescribed in Section 705.1 of the SGE?	Y	
Report Body		(Y/N/X)	Notes:
7	Do all geotechnical reports being submitted contain the following:		
a.	an Executive Summary as described in Section 705.2 of the SGE?	Y	
b.	an Introduction as described in Section 705.3 of the SGE?	Y	
c.	a section titled "Geology and Observations of the Project," as described in Section 705.4 of the SGE?	Y	
d.	a section titled "Exploration," as described in Section 705.5 of the SGE?	Y	
e.	a section titled "Findings," as described in Section 705.6 of the SGE?	Y	
f.	a section titled "Analyses and Recommendations," as described in Section 705.7 of the SGE?	Y	
Appendices		(Y/N/X)	Notes:
8	Do all geotechnical reports being submitted contain all applicable Appendices as described in Section 705.8 of the SGE?	Y	
9	Do the Appendices present a site Boring Plan showing all boring locations as described in Section 705.8.1 of the SGE?	Y	

VI.B. Geotechnical Reports

Appendices		(Y/N/X)	Notes:
10	Do the Appendices include boring logs and color pictures of rock, if applicable, as described in Section 705.8.2 of the SGE?	Y	
11	Do the Appendices include reports of undisturbed test data as described in Section 705.8.3 of the SGE?	X	
12	Do the Appendices include calculations in a logical format to support recommendations as described in Section 705.8.4 of the SGE?	Y	

Appendix C:
Historic Borings

1954
Year

Job. No. 02138
Changes

003360

County FULTON.
Bridge No. Ful-120-1400B
Section Ful-120-14.06 14.08
☒ over ☐ under
Location TEN Mile CREEK
OLD-#·Ful-120-1400B

FES-7 46-41
File No. 7D-066.

DESIGN BY

	RECON	AUGER	CORE	DRIVE ROD
By		WHITE		SANDERS
Dates		8/24-9/23/54		8/13-19/54
No. of Holes or Soundings		5		4
Footage		101.3		81.0.
Samples Tested		12.		

SITE PLANS	
Date Rec'd	
Revised Plan	

Topo Sheet

☐ Samples Accounted For

Transmittal Date 10/1/54

No. of Tracings

Filed with year

Revisions

Remarks

Refer To

Auger Data			Drive Rod		Core Data		
No. of Holes	Footage	Samples	No. of Soundings	Footage	No. of Holes	Footage	Samples
5	101.3	12.	4	81.0	—	—	-

FIELD DATA - SOIL LOG

Location No. 1

County: Fulton

R. RT [redacted]-Abut.

Bridge No. 120-140.B

Station: 743+10

Over: Ten Mile Creek

Offset: 25. RT

Started: 9/23/54

Equipment: Hardsocg

Completed: 9/23/54

#6 Diameter 3"

Proposed Footer:

Water Level:

Depth Feet	Log	Samples	Elevation	Ground Line
0			720.2	Brown Sandy Silt + Larg Gravel Not Hard To Drill
5			715.2	Brown Sandy Silt Clay Not Hard To Drill
10				
			707.2	Wet Brow Sandy Silt Small % of Gravel
15				
				Grayn Silty Clay Not Hard To Drill
20				
			698.2	Dry Gray Silty Clay
25				
26			720.2 694.2	Dry Gray Silty Clay Stalled Motor but Slow Drilling
30				
			685.2	Dry Gray Dense Silty Clay Stalled Out Motor Could Not Drill
35				
40				
45				
50				
55				
60				

Remarks:

Party WP JF

Chief of Party TGW

FIELD DATA - SOIL LOG

Location No. 1

County: FULTON

BACK RT [redacted] **Abut.**

Bridge No. 120-140 B

Station: 743+10

Over: TEN Mile Creek

Offset: 25 RT

Started: 8/24/54

Equipment: Hardsocg

Completed: 8/24/54

6" **Diameter** 3"

720.15
34
686.

Proposed Footer: 704.1

Water Level: No Water

Depth Feet	Log	Samples	Elevation	Ground Line
0			720.15	
	Samples 1			Dry Gray Silt + Gravel Fill
			716.15	Brown Sandy Silt Not Hard To Drill
5				
	Samples 2			
10				
				Dry Brown Silty Clay Slow Drilling
	Sample 3		705.15	
15				Dry Dense Gray Clay Small % of Silt Slow Drilling
	Samples 4		702.15	Dry Dense Gray Clay Stalled Motor Could Not Drill Stop At Elv 702.15
20				
25				

26				
30				
35				
40				
45				
50				
55				
60				

Remarks:

Party TC FMc

Chief of Party TSW.

FIELD DATA - SOIL LOG

Location No. 2 **County:** Fulton

Back LT [redacted] **-Abut.** **Bridge No.** 120-140 B

Station: 743 + 36 **Over:** Ten Mile Creek

Offset: 17 LT

Started: 8/24/54 **Equipment:** Hardsocg

Completed: 8/24/54 6 # **Diameter** 3

Proposed Footer: 704.1

Water Level: No water

Depth Feet	Log	Samples	Elevation	
0			720.13	Ground Line
	#1	1		Dry Gray Silt + Rock Fill
	4		716.13	
5				Brown Sandy Silt Not Hard To Drill
		2		
	#2			
10				
	12		708.13	
	#3	3		Brow Dry Silty Clay Dense Slow Drilling
15				
	16		704.13	Dry Dense Gray Clay Some Silt Slow Drilling
	#4	4		
			702.13	
				Dry Dense Gray Clay Stalled Motor Could Not Drill Stop At Elv 702.13
20				
25				

Depth Feet			
26			
30			
35			
40			
45			
50			
55			
60			

Remarks:

Party TC FMc

Chief of Party TGW

FIELD DATA - SOIL LOG

Location No. 2

R.LT [redacted]-Abut.

Station: 743+36

Offset: 19LT

Started: 9/23/54

Completed: 9/23/54

County: FULTON

Bridge No. 120-1468

Over: TEN Mile Creek

Equipment: Haydsacg 6" Diameter 3"

Proposed Footer:

Water Level:

Depth Feet	Log	Samples	Elevation	Ground Line
0			720.1	
				Rock + Large Gravel
				Fill
			726.1	
5				Brown Sandy Silt
				NOT Hard To Drill
10			710.1	Gray DENSE SilTy Clay
				Slow Drilling
				Flakes 12
15				
20				
				Dry
			698.1	Gray DENSE Clay Hard
				+ Slow Drilling
	23.3		696.8	Dry Gray DENSE Clay
25				STAllED OUT MOTOR
				Could NOT Drill 696.8

Depth Feet	Log	Samples	Elevation	
26				
30				
35				
40				
45				
50				
55				
60				

Remarks:

Party

Chief of Party

FIELD DATA - SOIL LOG

Location No. 3 **County:** Fulton
FrontRt [redacted]**-Abut.** **Bridge No.** 120-1408
Station: 743.42 **Over:** Ten Mile Creek
Offset: 32' RT
Started: 8/24/54 **Equipment:** Hardsocg
Completed: 8/24/54 6" **Diameter** 3"
Proposed Footer: 704.1
Water Level: No Water

Depth Feet	Log	Samples	Elevation	Ground Line
0			720.45	
	SAME AS 2			Brown Sandy Silt Not Hard To Drill
5				
10				
			708.45	Dry DENSE Brown Silty clay Slow Drilling
15	SAME AS 3 16			
	SAME AS 4		704.45	Dry DENSE Grey Silty Clay Slow Drilling
			702.45	
20				Dry DENSE Gray clAy STAlled MoTor Could NoT Drill STop AT Elv. 702.45
25				
26				
30				
35				
40				
45				
50				
55				
60				

Remarks:

Party TC F Mc

Chief of Party TBW

FIELD DATA - ROD PENETRATION

Location No. 1 **County:** Fulton

Rear ~~Pier~~-**Abut.** **Bridge No.** 120-140B

Station: 243+05 **Over:** Ten Mile Creek.

Offset: 26' Rt of ℄

Started: 8-17-54

Completed: 8-18-54 **Equipment:** Drive Rod. #2 **Diameter** 1.3125

Elevation 719.9 **Ground Line**

15.8 casing

Depth Feet	Penetration	Elevation	Proposed Footer
0	4 15/16	704.1	
	2 3/8		Dry hole
	1 5/16		
	7/8		tightened at check.
	11/16		4.3 tighter
5	9/16	699.1	
	7/16		
	3/16		
	7/16		Dense Gray clayey
	5/16		Silt-Very hard when
10	5/16	694.1	Dry.
	1/4		1/8 - 20 hr. interval
	1/4		
	5/16		
	3/8		
15	5/16	689.1	
	3/16		
	1/4		
	1/16+		
	1/16+		
20		684.1	
			Hole open to bottom.
25			

Party H.E.P. W.H.F.

25		
30		
35		
40		
45		
50		
55		
60		

Rod Condition: Good.

Chief of Party

FIELD DATA - ROD PENETRATION

Location No. #2 **County:** Fulton
Rear ~~Pier~~-**Abut.** **Bridge No.** 120-1908
Station: 743+36 **Over:** Ten Mile Creek
Offset: 18' Lt of ℄ 56876
Started: 8-13-54
Completed: 8-19-54 **Equipment:** Drive Rod #2 **Diameter** 1.35

Depth Feet	Penetration	Elevation	
		720.1	**Ground Line** 16.0 casing
0	3 13/16	704.1	**Proposed Footer**
	1 13/16		Dry Hole
	1 3/16		
	15/16		
	3/4		
5	11/16	699.1	
	9/16		
	1/2		Dense gray silt, moist
	7/16		(very hard when dry)
	9/16		
10	3/16	694.1	
	1/4		
	5/16		
	1/4		
	3/16		
15	3/16	689.1	
	1/8		
	1/16		
	1/16		
20		684.1	Hole open to Bottom
			Attempted to put
			down 5 holes before
			we were able to get
25		679.1	casing down to (over)

Party H.F.P. W.H.F.

25			
			proposed footer.
			Had to move outside
			bridge limits. Finished
			other holes & then
30			returned to this one.
			Either an old bridge
			abutment or rip-rap
			back-fill caused rod
			& casing to bend. Ruined
35			4 sections of rod &
			4 " of casing.
40			
45			
50			
55			
60			

Rod Condition: Good.

Chief of Party

FIELD DATA - ROD PENETRATION

Location No. 3 **County:** Fulton

Front ~~Pier~~-**Abut.** **Bridge No.** 120-1406

Station: 743+39 **Over:** Ten Mile Creek

Offset: 34 Rt of ℄

Started: 8-18-54

Completed: 8-19-54 **Equipment:** Drive Rod #2 **Diameter** 1.3125"

Ground Line 16.3 casing

Proposed Footer

Depth Feet	Penetration	Elevation	
		720.4	
0	13/16	704.1	
	1 1/8		Dry Hole
	7/8		
	9/16		
	1/2		
5	1/2	699.1	
	5/16		
	3/8		
	5/16		
	5/16		
10	1/4	694.1	
	1/4		
	1/4		
	3/8		
	5/16		
15	5/16	689.1	
	1/4		
	1/8+		
	1/16+		
20		684.1	Hole open to bottom
25			

Party H.F.R. W.H.F.

25			
30			
35			
40			
45			
50			
55			
60			

Rod Condition: Good.

Chief of Party

FIELD DATA - ROD PENETRATION

Location No. 4 County: Fulton

Front ~~Pier~~ - Abut. Bridge No. 120-1408

Station: 243+68 Over: Ten Mile Creek

Offset: 32' Lt. of ℄

Started: 8-17-54

Completed: 8-17-54 Equipment: Drive Rod #2 Diameter 1.35

Ground Line

Proposed Footer

Depth Feet	Penetration	Elevation
		707.6
		▨
0		704.1
	1 1/8	
5	7/8	702.6
	3/4	
	9/16	
	1/2	
	5/16	
10	5/16	697.6
	1/4	
	1/4	
	5/16	
	3/16	
15	1/8	692.6
	3/16	
	1/8	
	3/16	
	1/8	
20	1/16+	687.6
	1/16+	
25		
30		
35		
40		
45		
50		
55		
60		

Dry hole in spite of driving practically from stream bed.

Hole open to bottom

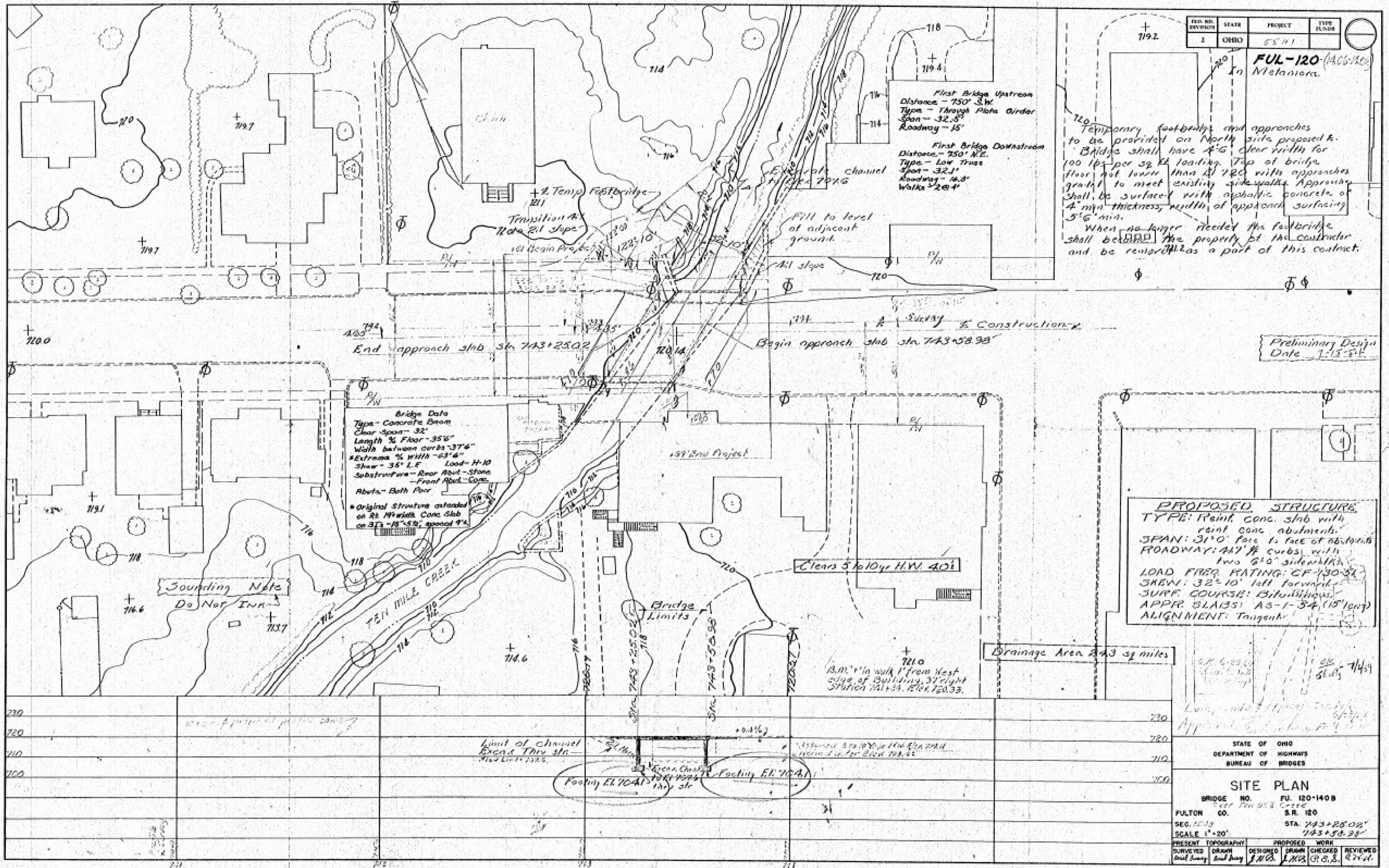
Party H.F.P. W.H.F.
S.R.W.

Rod Condition: Good.

Chief of Party

End approach permit (Sta. 743+24.45 / Sta. 743+51.57)

Approach pavement T-35, 41.7' F/F Curbs



First Bridge Upstream
Distance – 750' S.W.
Type – Through Plate Girder
Span – 32.5'
Roadway – 15'

First Bridge Downstream
Distance – 750' N.E.
Type – Low Truss
Span – 32.1'
Roadway – 16.8'
Walks – 2@4'

Temporary footbridge and approaches to be provided on North side proposed ℄. Bridge shall have 4'6" clear width for 100 lbs per sq ft loading. Top of bridge floor not lower than El 720 with approaches graded to meet existing sidewalks. Approaches shall be surfaced with asphaltic concrete of 4" min thickness, width of approach surfacing 5'6" min.

When no longer needed the footbridge shall become the property of the contractor and be removed as a part of this contract.

Bridge Data
Type – Concrete Beam
Clear Span – 32'
Length % Floor – 35'6"
Width between curbs – 37'6"
*Extreme % width – 43'6"
Skew – 35° L.F. Load – H-10
Substructure – Rear Abut. – Stone
– Front Abut. – Conc.
Abuts. – Both Poor

*Original Structure extended on Rt. 19' width Conc. Slab on 31 I's – 15" 55#, spaced 4's.

B.M. "+" in walk 1' from West edge of Building, 37' right Station 741+34. Elev. 720.33.

PROPOSED STRUCTURE
TYPE: Reinf. conc. slab with reinf. conc. abutments.
SPAN: 31'0" face to face of abutments
ROADWAY: 44'7" F/F curbs with two 6'0" sidewalks
LOAD FREQ. RATING: CF-130-54
SKEW: 32°10' left forward
SURF. COURSE: Bituminous
APPR. SLABS: AS-1-54 (15' long)
ALIGNMENT: Tangent

Assumed 5 to 10 yr H.W. Elev. 709.11
Normal water Elev. 703.4±

OK 7/4/54

FED. RD. DIVISION	STATE	PROJECT	TYPE FUNDS
3	OHIO	5541	

FUL-120-(14.06-14.09)
In Metamora.

STATE OF OHIO
DEPARTMENT OF HIGHWAYS
BUREAU OF BRIDGES

SITE PLAN

BRIDGE NO. FU. 120-140B
Over Ten Mile Creek
FULTON CO. S.R. 120
SEC. 14.09 STA. 743+25.02
SCALE 1"=20' 743+58.98

PRESENT TOPOGRAPHY		PROPOSED WORK			
SURVEYED	DRAWN	DESIGNED	DRAWN	CHECKED	REVIEWED
Aerial Survey	Aerial Survey	J.W.B.	J.K.B.	G.E.S.	E.W.A.

0-2139