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GEOTECHNICAL CONSULTANTS INC.

GCI PROJECT No. 18-G-21913

Geotechnical Engineering Report

PER CR 64-1.80 Bridge Replacement over Valley Run
Hopewell Indian Road
Perry County, Ohio

Prepared for:
Perry County

September 13, 2018

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September 13, 2018

Mr. Kent Cannon, P.E.
Perry County Engineer
2645 Old Somerset Road
New Lexington, Ohio 43764

Reference: Subsurface Exploration and Geotechnical Engineering Report
PER CR64-1.80 Bridge Replacement
Hopewell Indian Road over Valley Run
Perry County, Ohio
GCI Project No. 18-G-21913

Dear Mr. Cannon:

As you authorized, Geotechnical Consultants, Inc. (GCI) has performed a subsurface exploration and prepared a geotechnical report for the referenced project. The purpose of this exploration was to supplement the findings of the Structure Foundation Report prepared by Resources International, Inc. (dated September, 2017) and to address comments made by ODOT District 5 in their Stage 1 review. Specifically, GCI performed three additional borings – one for the east/rear abutment structure and two for the roadway approaches. GCI also performed laboratory testing on select retrieved soil samples to aid in our classification and selection of soil parameters for our analyses.

In summary, our findings supported the deep foundation recommendations made by Resource International, Inc. for the bridge support. We also conclude that the proposed roadway embankments will be stable when constructed as discussed herein and that laboratory California Bearing Ratio (CBR) testing showed the existing site soils are capable of CBR values of 5.5 and 5.8 for the west and east approaches, respectively.

After you have reviewed the report, feel free to contact GCI with any questions you may have. GCI appreciates the opportunity to provide our services for this project, and we hope to continue service through construction.

Sincerely,
Geotechnical Consultants, Inc.

STATE OF OHIO
TODD R. MEEK
E-61105
REGISTERED PROFESSIONAL ENGINEER

Todd R. Meek, PE, LEED AP
Manager of Engineering Operations

Curtis L. Miller, P.E.
In-House Reviewer

Distribution: Mr. Kent Cannon, P.E. @ Perry County Engineer – 1 .pdf
Mr. Sean Jenq @ OHM Advisors – 1 .pdf
GCI File – 1 copy

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1.0 INTRODUCTION

As authorized by Mr. Kent Cannon, P.E., Perry County Engineer, Geotechnical Consultants, Inc. (GCI) performed subsurface exploration and analyses for foundation and roadway approach design for the proposed bridge PER CR64-1.80 replacement in Perry County, Ohio. Our study was aimed to supplement the original Structure Foundation Exploration Report prepared by Resource International, Inc. (their project No. W-16-092, dated September 2017) and address comments made by ODOT District 5 during their Stage 1 review. Available for our use was the Resource International, Inc. Structure Foundation Report, Stage 1 plans, ODOT District 5 Stage 1 review comments, and supplemental plans prepared OHM Advisors.

2.0 SITE AND PROJECT DESCRIPTIONS

The existing bridge is located on County Road 64 (Hopewell Indian Road), just east of County Road 65 (Mound Builders Road) in Perry County, Ohio. The bridge spans over Valley Run. We attached a *Site Location Map* in the Appendix showing the general site location and the below aerial photograph shows the general overall site features.

Aerial Photograph Courtesy Google Earth (April - 2008)

We discuss the bridge, approaches, and Valley Run below, followed by discussion of the proposed bridge.

Existing Bridge

The existing bridge was built in 1932 and is a 2-span steel beam superstructure with an asphalt surfaced timber deck and placed on poured concrete abutments and center pier. The bridge is 19.7 feet wide edge to edge and about 61 feet in length. The bridge steel beams are showing moderate to extensive deterioration. The existing bridge does not have a skew to Valley Run, which results in a significant bend in the roadway alignment at the bridge location.

Roadway Alignment and Utilities

The east and west roadway approaches have been filled to create a rise of several feet towards the existing bridge. The lane width does not neck down across the bridge. The edges of the embankments fall towards the surrounding land where there is a swale that directs surface water runoff towards Valley Run. There are guardrails along the sides of the bridge and along the outside radii of the roadway approaches.

Valley Run

Valley Run is southerly flowing below the bridge and meanders to the east north of the bridge and to the southwest south of the bridge. Two significant swales empty into Valley Run northwest and southeast of the bridge. Valley Run had several feet of water within its alignment below the bridge and we were not able to see the bottom of the waterway at the time of our site visit.

The provided Stage 1 plans show a normal water elevation of 848.25 feet and an ordinary high water mark at elevation 854.12 feet at the bridge location. The 10-year flood level is 857.66 feet and the 100-year flood level is at elevation 862.63 feet.

The upstream and downstream embankments are vegetated with trees and brush/weeds with steep to near vertical slopes at the water's edge before becoming fairly flat to gently rolling away from the waterway alignment. Some trees at the edge of the water are leaning toward the creek and have exposed roots as a result of erosion.

Proposed Bridge and Alignment

The proposed bridge consists of a single-span composite pre-stressed box beam superstructure on concrete integral abutments founded on driven cast-in-place pipe piles. The superstructure will span 75'-0" and be 24'-0" wide from front to front of railing. The approach slabs will be 20'-0" feet long (ODOT AS-1-15 & AS-2-15 design). The replacement structure will be designed for HL-93 loading with a future wearing surface of 60 psf. The new bridge/approach alignment will be straight as to remove the S-bend in the current alignment.

3.0 INVESTIGATIVE PROCEDURES

GCI performed one boring for the east/rear abutment structure and two approach borings, one for each approach to obtain a generalized profile of existing subsurface conditions. These borings were performed to supplement the original Structure Foundation Report borings per the request of ODOT's District 5 Stage 1 review comments. Boring B-001-1-18 was performed for the west approach, boring B-002-1-18 was performed for the east/rear structure abutment, and boring B-003-1-18 was performed for the east

approach. The roadway approach borings were drilled to 10-foot depths and the structure boring was terminated at a depth of 70 feet after obtaining over 40 feet of 30-plus blows per foot soil.

The borings were drilled on July 2, 2018 using a CME-45 truck-mounted rotary drilling machine and 3.5-inch solid-stem augers. Soil sampling was performed using standard penetration test split-spoon sampling. The boring locations are shown on the attached *Boring Location Plan* in the appendix. Copies of the boring logs are attached following the *Boring Location Plan.*

We discuss the site geology and summarize the boring findings in Section 4.0 *General Subsurface Conditions* below.

4.0 FINDINGS - GENERAL SUBSURFACE CONDITIONS

4.1 Site Geologic Conditions – Published Data

The Ohio Department of Natural Resources (ODNR) Division of Geological Survey *Shaded Drift-Thickness Map of Ohio* shows the site is situated within an area of Illinoian-aged glacial ground moraine (130,000 to 300,000 years old). The United States Department of Agriculture, Natural Resources Conservation Service web soil survey for Perry County, Ohio shows the west approach and Valley Run is composed of Nolin silt loam, with Euclid silt loam and Luray silt loam within the east approach. The publication notes that the Nolin silt loam as having a flood plain landform setting with occasional flooding and 0 to 3 percent slopes. The parent material is fine-silty alluvium derived from sedimentary rock. The Euclid and Luray silt loams have a terrace landform with parent material of glaciofluvial and glaciolacustrine deposits derived from sedimentary rock.

The Ohio Department of Natural Resources (ODNR) Division of Geological Survey *Bedrock Geology Map of Ohio* shows the site is underlain by bedrock of the Mississippian age (about 322 to 359 million years ago). This rock is described as sedimentary rocks: sandstone, shale, siltstone, conglomerate, and minor limestone of marine to marginal marine origin. The ODNR *Physiographic Regions of Ohio* map shows the site is within the Glaciated Allegheny Plateau.

4.2 Subsurface Profile – Boring Findings

Pavement

Approach borings B-001-1-18 and B-003-1-18 were performed within the existing roadway and encountered 3 and 2.5 inches of asphalt over 6 and 3.5 inches of aggregate, respectively.

Fill

Structure boring B-002-1-18 was performed within the north shoulder and encountered 8 feet of fill materials at the surface associated with backfill of the existing east abutment and the roadway embankment. The roadway approach borings also encountered fill materials below the existing pavement cover associated with the embankment construction, which extended to 3.5 feet below grade. The fill materials consisted of very stiff brown silt and clay (ODOT A-6a soils) at boring B-001-1-18, very stiff brown sandy silt (ODOT A-4a soils) at boring B-002-1-18, and medium dense brown gravel with silt and sand (ODOT A-2-4 soils) at boring B-003-1-18.

Natural Soil

West approach boring B-001-1-18 and east/rear structure boring B-002-1-18 encountered natural soils below the fill materials consisting of medium stiff to very stiff brown and brown mottled gray silt and clay (ODOT A-6a soils). Boring B-001-1-18 terminated within brown mottled gray silt and clay at 10 feet below grade. The natural soils in structure boring B-002-1-18 transitioned to loose gray sandy silt (ODOT A-4a soils) at a depth of 14 feet, which transitioned to medium dense gray silt (ODOT A-4b soils) at a depth of 18 feet. The natural soils in boring B-002-1-18 transitioned to stiff to very stiff deposits of gray silt and clay (ODOT A-6a soils – Glacial Till) at a depth of 22 feet below grade. The gray glacial till persisted to the termination depth of the boring of 70 feet below grade; boring B-002-1-18 was terminated after encountering over 40 feet of 30+ blow per foot material sampling.

East approach boring B-003-1-18 encountered loose brown mottled gray silt (ODOT A-4b soils) below the fill cover, extending to a depth of 7 feet below grade. The silt was underlain by loose brown and gray gravel with silt and sand (ODOT A-2-6 soils), which extended to the terminus of the boring at a depth of 10 feet below grade.

Bedrock

The borings did not encounter bedrock within the drilled depth of the borings (up to 70 feet below grade). Review of the Ground Water Resources of Perry County map indicates that the depth of bedrock could exceed 100 feet below grade.

4.3 Groundwater and Soil Moisture Conditions – Boring Findings

Borings B-002-1-18 and B-003-1-18 encountered water seepage at respective depths of 11 and 7 feet below grade during the drilling process. Groundwater was observed to be at respective depths of 10 and 7 feet upon completion of drilling activities.

4.4 Laboratory Testing

Laboratory testing was performed on retrieved soil split-spoon samples of each soil strata to help refine soil classifications. Soil testing included moisture content determinations on each retrieved split-spoon sample and index testing on each soil strata. The test results have been incorporated into the above *Subsurface Profile* descriptions and the attached boring logs, and results of the testing are appended to this report.

5.0 GEOTECHNICAL CONCLUSIONS AND RECOMMENDATIONS

Geotechnical Consultants, Inc. performed analyses for the proposed bridge replacement based on preliminary structure data, the boring findings, laboratory test results, and guidelines set forth in ODOT manuals and AASHTO guides and specifications. For the proposed bridge replacement, we confirmed that the calculated capacities presented by Rii in their Structure Foundation Report are valid based on our additional structure foundation boring (B-002-1-18). We discuss our analysis and findings below.

5.1 Foundations

The structure foundation borings (both Rii's – B-001-0-18 and GCI's B-002-1-18) encountered loose and soft to medium stiff fill and natural soil materials extending to depths of up to about 20 feet below grade. These soils are not suitable for support of a shallow foundation system due to settlement and possibly scour concerns. The bridge will need to be supported on an extended foundation system. The borings did not encounter bedrock within the drilled boring depths, and per the ODOT Bridge Design Manual, the preferred extended foundation consists of cast-in-place piles (pipe piles driven to desired capacity). This is in agreement with Rii's recommendations.

Rii's Structure Foundation Report recommended the extended foundations consist of

driven 14-inch diameter steel pipe piles. GCI concurs that driven steel pipe piles are the appropriate foundation system for the proposed bridge replacement. The piles will be subjected to maximum loadings of 175.8 kips and installed in accordance with the ODOT CMS Item 507 – *Bearing Piles*. Dynamic load testing will be performed during driving activities to verify capacities in accordance with ODOT CMS Item 523 – *Dynamic Load Test*. As such, a reduction factor of 0.7 should be applied to the provided maximum anticipated load of 175.8 kips, resulting in a required ultimate load of 251 kips to be achieved during driving. This is the same analogy used by Rii in their Structure Foundation report.

GCI performed static pile capacity analysis using the DrivenPiles software analysis program for the east/rear abutment based on the findings from structure boring B-002-1-18 and an anticipated top of pile near elevation 851 to 852 feet. A computer printout of our analysis is attached in the Appendix. Our analysis indicated that a 14-inch diameter pipe pile driven to a depth of 63 feet below the bottom of abutment would achieve the required 251 kip ultimate load. Assuming the pile will extend 2 feet into the abutment, a pile length of 65 feet would be required. These findings agree with those of Rii. The table below summarizes our findings for the east/rear abutment.

Substructure	Bottom of Abutment Elevation	Pile Diameter	Pile Elevation		Pile Length	Ultimate Capacity (kips)	Reduction Factor
			Top[1]	Bottom			
East/Rear Abutment	852’	14”	850’	785	65’	251	0.7

1. Top of pile assumes the pile will be embedded 2 feet into the concrete abutment.

Piles designed and driven as noted above will be subject to settlements of less than 1 inch. We also provide the following assumptions/comments with our analysis and conclusions:

- An axially loaded pile with negligible moment.
- No appreciable loss of section due to corrosion.
    - We note that common practice is to account for 1/16 inch of sacrificial surface steel due to potential corrosion.
- A steel yield strength of 50 ksi.
- The pipe pile will have a closed end.
- A fully braced pile.
    - A scour analysis was beyond our scope of work. Pile design should consider unbraced lengths due to potential scour.
- GCI concurs with dynamic load testing and drivability comments and recommendations made in the Rii Structure Foundation Report.

5.2 Wing Walls/Abutments

Abutment walls restrained at the top and bottom should be designed to resist *at-rest* lateral soil pressures where abutments allowed to move freely at the top of the wall can be designed using *active* lateral soil pressures. Both types of wall design should take into account hydrostatic pressures that may develop behind the wall, as well as surcharges behind the wall, including live loads and sloped fills. GCI's structure boring B-002-1-18 found similar conditions when compared to the RII boring B-001-0-18, and as such, we concur that Rii's provided soil parameters for wall design are appropriate for the east structure.

For effective drainage, free draining gravel such as No. 57 stone should be used directly behind the wing walls in accordance with Section 303.2.3 - *Abutment Drainage* of the latest ODOT Bridge Design Manual. The type of backfill beyond the No. 57 stone drain (wing walls and abutments) will govern the magnitude of the forces behind the wall to be used for design. Granular fill should be placed in a wedge shaped area extending from

the base of the wall upward at an angle of 35° from the vertical to utilize the lower equivalent fluid weight design values stated below for “sand and gravel” in the Rii report. Cohesive soil backfill directly behind the walls is not recommended because of its poor drainage characteristics and tendencies to creep, resulting in high lateral pressures with time. The wall backfill should be placed and compacted in accordance with ODOT Construction and Materials Specifications Items 503 – *Excavation for Structures* and Item 518 – *Drainage of Structures.*

5.3 Channel Scour Protection

We recommend protection be placed in front and along the entire length of the abutments and wingwalls consisting of Rock Channel Protection in accordance with Section 203.3 - *Scour* of the ODOT Bridge Design Manual. As stated in the Federal Highways Administration (FHWA) “Hydraulic Engineering Circular No. 18” (HEC-18), rip-rap is not a permanent countermeasure against scour, nor does it eliminate the potential for scour. Therefore, we recommend that the bridge be periodically inspected, particularly after major storm events, to ensure the rip-rap blanket is properly preserved.

5.4 Construction Dewatering

The bridge site may need to be dewatered to allow construction in dry conditions. Some form of cofferdam system and rerouting of stream water will be required, followed by placement of strategically placed sumps to dewater the overburden soils and allow foundation excavations to be performed in dry conditions.

5.5 Excavation

The existing bridge will need to be razed to complete the project. All structure elements, including below-grade walls and foundations will need to be removed and hauled off site. Excavations for the proposed new bridge will extend through the overburden soils. Typical track-hoe equipment will be able to excavate the site soils. Sidewall stability will be an issue where excavations extend into soft/saturated soils, and may require laybacks or trench box construction techniques. **Excavations should comply with OSHA requirements**.

5.6 Structural Fill and Embankment Construction

Earthwork should be performed in general accordance with ODOT Construction and Materials Specifications section 203 – *Roadway Excavation and Embankment* and embankments constructed in accordance with ODOT Geotechnical Bulletin GB-2 – *Special Benching and Sidehill Embankment Fills.* Once the vegetation, topsoil, and excessively organic fill soils are removed, proof-roll the exposed soil subgrades with a fully-loaded, tandem-axle dump truck to identify potential soft subgrade areas. Undercut soft areas or otherwise stabilize soft spots identified during the proof-roll prior to placing controlled fill to design grade. Subgrades should be firm and stable prior to placing fill.

On-site soils from excavated areas can be used for structural fill outside the recommended granular drainage backfill (provided the appropriate lateral earth pressure is selected). Structural fill should be placed in accordance with ODOT Construction and Materials Specifications section 203.07 – *Compaction and Moisture Requirements.* As per associated Table 203.07-1, each lift of fill shall be compacted to at least 98% to 102% of the maximum Standard Proctor dry density. To reach the desired compaction, fill

materials will need to be placed within 3% of the Standard Proctor “optimum” moisture content. We recommend fill materials should be placed in loose lift thicknesses not to exceed 8 inches.

5.7 Embankment Slope Stability

Structural fill placement will be required to construct the new roadway approaches and embankments proposed in the Stage 1 cross section plans. The deepest fills will be at the east/rear abutment where about 10 feet of fill will be placed to straighten out the roadway alignment. An average of about 5 feet of fill or less will also be required along the edges of the east and west approaches. The embankments will be in accordance with above and will have a final 2H:1V slope.

We performed slope stability analyses for the proposed embankments using the GSTABL 7 with STEDwin slope stability analysis software at boring B-002-1-18 (east/rear abutment) and boring B-003-1-18 (east approach) locations. Soil profiles were modeled using the boring findings and proposed embankment profiles. GCI concurs that the soil parameters provided in the Rii Structure Foundation Report, specifically Table 4 and Table 5, are appropriate for assessing slope stability analysis based on our boring findings and were used for our analysis. Our analysis showed that properly constructed as discussed herein, the proposed embankments will have safety factors of 1.96 at the east/rear abutment and 2.15 for the east and west approaches, and greater than the minimum required factor of safety of 1.5. As such, we conclude the proposed embankments are feasible and have an adequate factor of safety when constructed as noted herein.

5.7 Pavements

Subgrades should be prepared in accordance with ODOT CMS requirements and as discussed in above section 5.6 - Structural Fill and Embankment Construction. We performed a CBR test at each approach on bulk bag samples obtained from 1' to 5'. The tests resulted in CBR values of 5.5 for the west approach and 5.8 for the east approach, with respective swell values of 0.9% and 1.1% after soaking in water for 96 hours. Based on the laboratory CBR test results, it is GCI's opinion that the "simplified pavement design method" is suitable for pavement design.

GCI prepared an ODOT GB-1 spreadsheet based on the boring and laboratory test results. A copy of the spreadsheet is attached. The spreadsheet calculated a slightly higher CBR value (CBR=7) when compared to the above noted actual CBR test results. The spreadsheet also notes there should be a contingency for 12 to 24 inches of undercutting during subgrade preparation due to in-situ moisture contents. The spreadsheet also flags the silt (ODOT A-4b soils) encountered in boring B-003-1-18 could be problematic. These soils are 3.5 feet below existing grade and provided the overburden is stable at the time of earthwork, it is GCI's opinion that these soils should be suitable. Although we caution that repeated construction traffic, particularly large rubber tire equipment, could create pore-water pressures to rise and result in pumping of subgrades.

6.0 FINAL

Our study was performed based on our understanding of the site, preliminary information provided, boring findings, and laboratory testing. In the event that any changes to the nature, design, or location of the proposed bridge and approaches are planned, the conclusions and recommendations contained in this report shall not be considered valid, unless the changes are reviewed and conclusions of this report are modified or verified by Geotechnical Consultants, Inc. This report is for design purposes only and is not sufficient to prepare an accurate bid.

It is recommended that we have the opportunity to review the final design plans and specifications to establish that our recommendations have been appropriately interpreted and integrated into contract plans and specifications.

GCI appreciates the opportunity to work with you on this project. If you have any questions or the need for additional service, please call.

GEOTECHNICAL CONSULTANTS INC.

APPENDIX – PER CR64-1.80 Bridge Replacement over Valley Run

ODOT Quick Reference for Visual Description of Soils
ODOT Classification of Soils
General Site Location Map (DeLorme Street Atlas USA – 2014)
Boring Location Plan
Boring Logs
Laboratory Test Results
DrivenPiles Analysis Computer Printouts
GSTABL 7 Slope Stability Analysis Computer Printouts
ODOT GB-1 Spreadsheet

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

1) STRENGTH OF SOIL:

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

2) COLOR :

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

3) PRIMARY COMPONENT

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

Cohesive (fine grained) Soils - Consistency

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

4) COMPONENT MODIFIERS:

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

5) Soil Organic Content

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

6) Relative Visual Moisture

Description	Criteria	
	Cohesive Soil	**Non-cohesive Soils**
Dry	Powdery; Cannot be rolled; Water content well below the plastic limit	No moisture present
Damp	Leaves very little moisture when pressed between fingers; Crumbles at or before rolled to $^1/_8$"; Water content below plastic limit	Internal moisture, but no to little surface moisture
Moist	Leaves small amounts of moisture when pressed between fingers; Rolled to $^1/_8$" or smaller before crumbling; Water content above plastic limit to -3% of the liquid limit	Free water on surface, moist (shiny) appearance
Wet	Very mushy; Rolled multiple times to $^1/_8$" or smaller before crumbles; Near or above the liquid limit	Voids filled with free water, can be poured from split spoon.

CLASSIFICATION OF SOILS

Ohio Department of Transportation

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

SYMBOL	DESCRIPTION	Classifcation AASHTO	Classifcation OHIO	$LL_0/LL \times 100$*	% Pass #40	% Pass #200	Liquid Limit (LL)	Plastic Index (PI)	Group Index Max.	REMARKS
	Gravel and/or Stone Fragments	A-1-a			30 Max.	15 Max.		6 Max.	0	Min. of 50% combined gravel, cobble and boulder sizes
	Gravel and/or Stone Fragments with Sand	A-1-b			50 Max.	25 Max.		6 Max.	0	
	Fine Sand	A-3			51 Min.	10 Max.	NON-PLASTIC		0	
	Coarse and Fine Sand	--	A-3a			35 Max.		6 Max.	0	Min. of 50% combined coarse and fine sand sizes
	Gravel and/or Stone Fragments with Sand and Silt	A-2-4 A-2-5				35 Max.	40 Max. 41 Min.	10 Max.	0	
	Gravel and/or Stone Fragments with Sand, Silt and Clay	A-2-6 A-2-7				35 Max.	40 Max. 41 Min.	11 Min.	4	
	Sandy Silt	A-4	A-4a	76 Min.		36 Min.	40 Max.	10 Max.	8	Less than 50% silt sizes
	Silt	A-4	A-4b	76 Min.		50 Min.	40 Max.	10 Max.	8	50% or more silt sizes
	Elastic Silt and Clay	A-5		76 Min.		36 Min.	41 Min.	10 Max.	12	
	Silt and Clay	A-6	A-6a	76 Min.		36 Min.	40 Max.	11 - 15	10	
	Silty Clay	A-6	A-6b	76 Min.		36 Min.	40 Max.	16 Min.	16	
	Elastic Clay	A-7-5		76 Min.		36 Min.	41 Min.	$\leq$LL-30	20	
	Clay	A-7-6		76 Min.		36 Min.	41 Min.	>LL-30	20	
	Organic Silt	A-8	A-8a	75 Max.		36 Min.				W/o organics would classify as A-4a or A-4b
	Organic Clay	A-8	A-8b	75 Max.		36 Min.				W/o organics would classify as A-5, A-6a, A-6b, A-7-5 or A-7-6

MATERIAL CLASSIFIED BY VISUAL INSPECTION

 Sod and Topsoil

 Pavement or Base

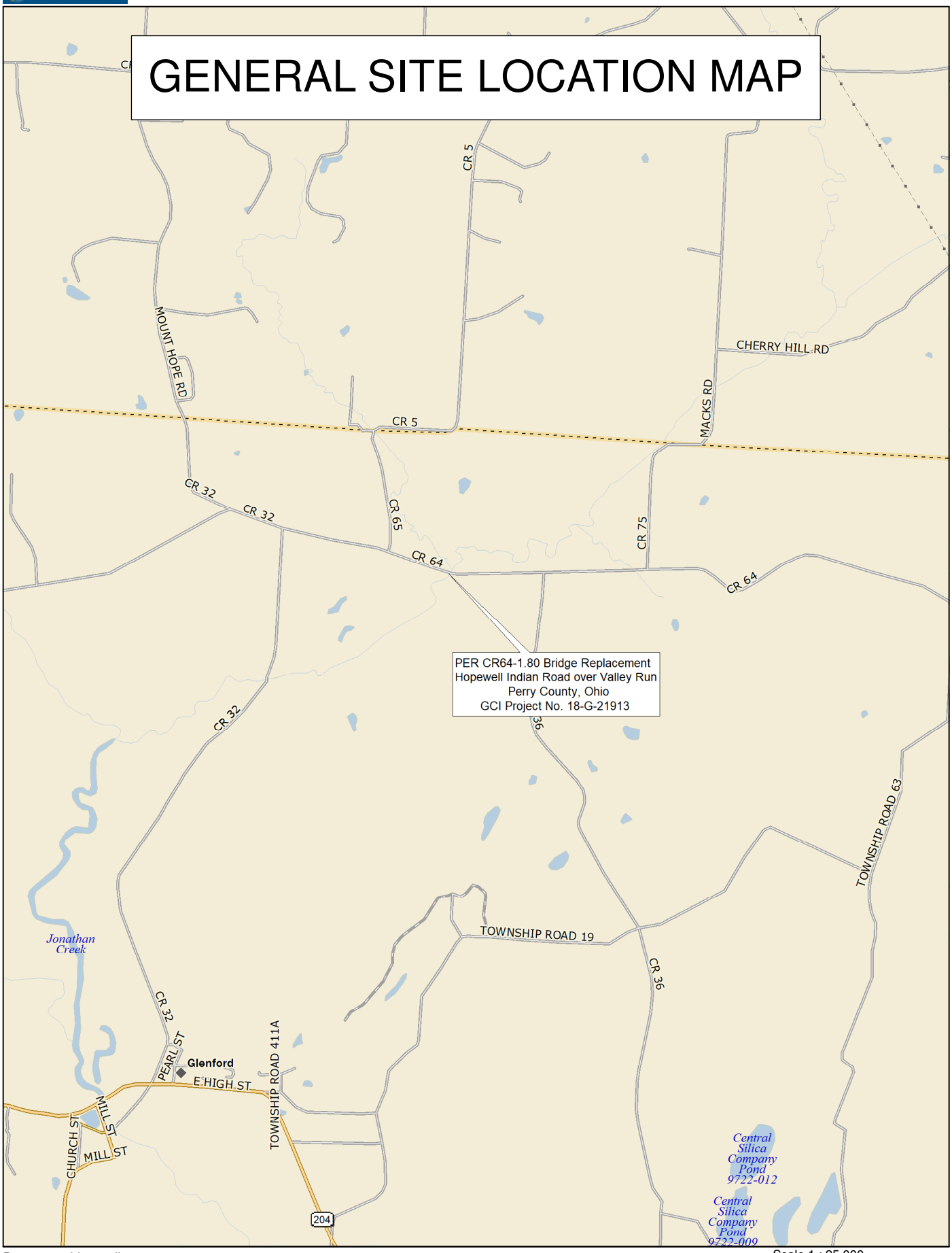
 Uncontrolled Fill (Describe)

 Bouldery Zone

 Peat, S-Sedimentary W-Woody F-Fibrous L-Loamy & etc

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

GENERAL SITE LOCATION MAP



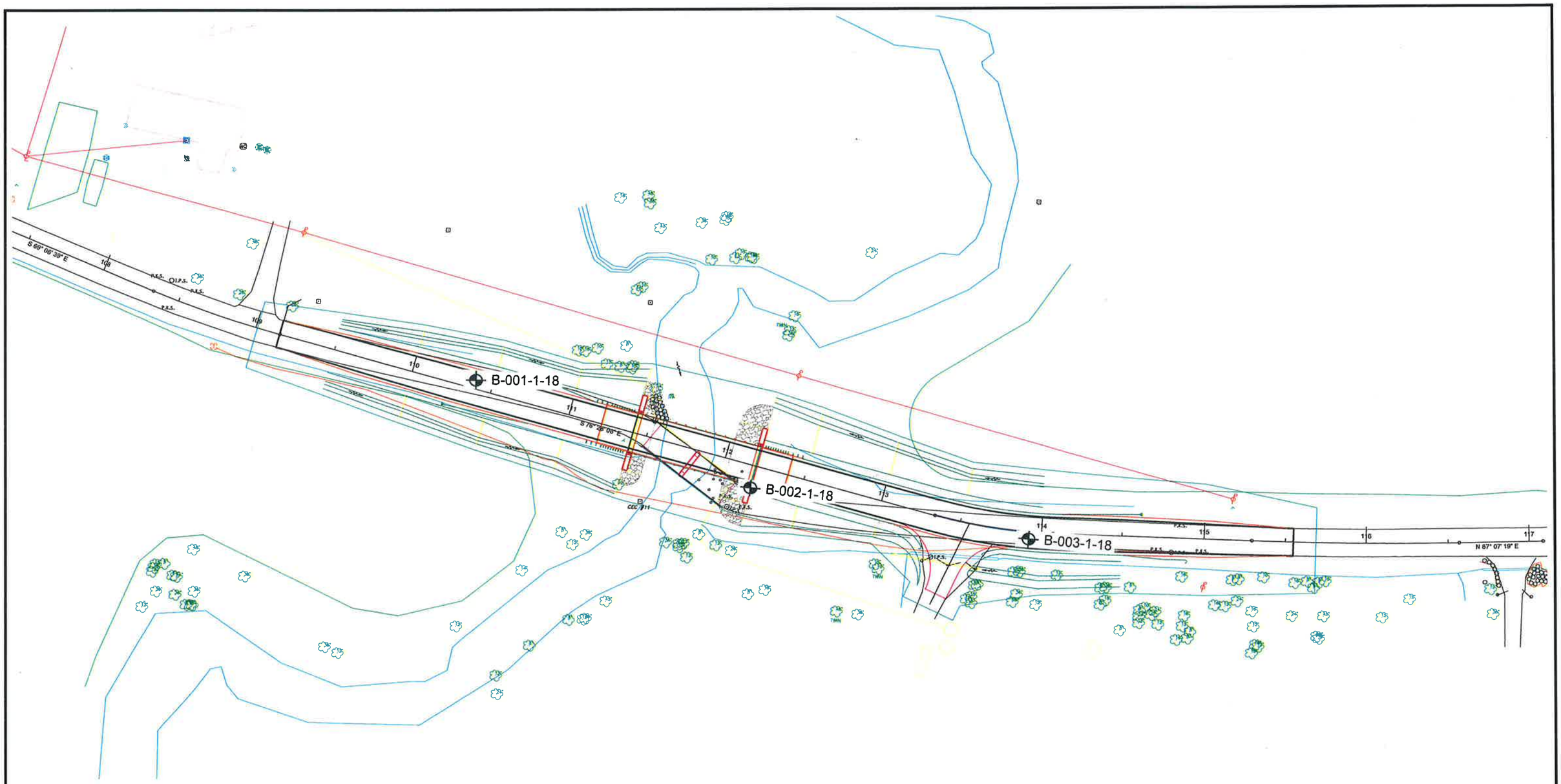
TN
MN (7.8°W)

Scale 1 : 25,000

0 600 1200 1800 2400 3000 ft
0 200 400 600 800 1000 m

1" = 2,083.3 ft

Data Zoom 13-0



Approximate Boring Location

BORING LOCATION PLAN

PER CR64-1.80 Bridge Replacement

Hopewell Indian Road over Valley Run

Base Map: OHM Advisors	
Project No.: 18-G-21913	
Date: 9-10-2018	**Drawn By:** TRM
Scale: 1" = 60'	

PROJECT: PER CR64-1.80	DRILLING FIRM / OPERATOR: GCI / R. BRANDUM	DRILL RIG: CME 45 (RIG 2)	STATION / OFFSET: 110+39, 5.1 LT	EXPLORATION ID B-001-1-18
TYPE: BRIDGE REPLACEMENT	SAMPLING FIRM / LOGGER: GCI / R. BRANDUM	HAMMER: CME AUTOMATIC	ALIGNMENT: NEW CENTERLINE	
PID: 97449 BR ID: 6431941	DRILLING METHOD: 3.5" SSA	CALIBRATION DATE: 10/29/16	ELEVATION: 857.9 (MSL) EOB: 10.0 ft.	PAGE 1 OF 1
START: 7/2/18 END: 7/2/18	SAMPLING METHOD: SPT	ENERGY RATIO (%): 88.1	LAT / LONG: Not Recorded	

MATERIAL DESCRIPTION AND NOTES	ELEV. 857.9	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	INST.
ASPHALT (3")	857.6																	
STONE FRAGMENTS (6")	857.1																	
VERY STIFF, BROWN, **UNCONTROLLED FILL**, SILT AND CLAY (A-6A), LITTLE SAND, TRACE GRAVEL, DAMP	854.4	1	4 4 8	18	100	SS-S-1	2.75	9	5	11	41	34	31	18	13	14	A-6a (9)	
STIFF TO VERY STIFF, BROWN MOTTLED GRAY, **SILT AND CLAY**, (A-6A), TRACE SAND, MOIST		2 3 3	9	100	SS-S-2	3.50	0	1	4	59	36	35	21	14	22	A-6a (10)		
BOTTOM OF BORING: 10.0'	847.9	EOB 10	2 3 3	9	100	SS-S-3	1.00	-	-	-	-	-	-	-	-	24	A-6a (V)	

NOTES: NO WATER SEEPAGE DURING DRILLING AND BOREHOLE WAS DRY AT COMPLETION

ABANDONMENT METHODS, MATERIALS, QUANTITIES: AUGER CUTTINGS AND ASPHALT PATCH

GCI Job No: 18-G-21913

GCI ODOT LOG - GCI OH DOT.GDT - 9/10/18 06:33 - S:\GINT\PROJECTS\18G21913.GPJ

PROJECT: PER CR64-1.80	DRILLING FIRM / OPERATOR: GCI / R. BRANDUM	DRILL RIG: CME 45 (RIG 2)	STATION / OFFSET: 112+19, 15.0 RT	EXPLORATION ID B-002-1-18
TYPE: BRIDGE REPLACEMENT	SAMPLING FIRM / LOGGER: GCI / R. BRANDUM	HAMMER: CME AUTOMATIC	ALIGNMENT: NEW CENTERLINE	
PID: 97449 BR ID: 6431941	DRILLING METHOD: 3.5" SSA	CALIBRATION DATE: 10/29/16	ELEVATION: 859.5 (MSL) EOB: 70.0 ft.	PAGE 1 OF 3
START: 7/2/18 END: 7/2/18	SAMPLING METHOD: 3.5" SSA	ENERGY RATIO (%): 88.1	LAT / LONG: Not Recorded	

MATERIAL DESCRIPTION AND NOTES	ELEV. 859.5	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	INST.
VERY STIFF, BROWN, **UNCONTROLLED FILL**, SANDY SILT (A-4A), SOME SAND, LITTLE GRAVEL, DAMP contains trace wood			2 2 2	6	100	SS-S-1	2.00	-	-	-	-	-	-	-	-	20	A-4a (V)	
			2 2 3	7	100	SS-S-2	3.00	-	-	-	-	-	-	-	-	16	A-4a (V)	
			2 3 2	7	100	SS-S-3	2.50	23	4	14	31	28	28	18	10	13	A-4a (5)	
	851.5																	
MEDIUM STIFF, BROWN, **SILT AND CLAY**, (A-6A), TRACE SAND, MOIST TO WET		▼ 10	1 1 1	3	100	SS-S-4	0.75	-	-	-	-	-	-	-	-	26	A-6a (V)	
		W 11																
	845.5																	
LOOSE, GRAY, **SANDY SILT**, (A-4A), SOME SAND, LITTLE GRAVEL, WET			3 4 5	13	100	SS-S-5	--	25	7	15	42	11	NP	NP	NP	19	A-4a (4)	
	841.5																	
MEDIUM DENSE, DARK GRAY, **SILT**, (A-4B), LITTLE SAND, WET			5 5 7	18	100	SS-S-6	1.50	1	1	13	63	22	NP	NP	NP	19	A-4b (8)	
	837.5																	
STIFF TO VERY STIFF, GRAY, **SILT AND CLAY**, (A-6A), LITTLE SAND, TRACE GRAVEL, DAMP TO MOIST			7 7 10	25	100	SS-S-7	1.75	-	-	-	-	-	-	-	-	15	A-6a (V)	

GCI ODOT LOG - GCI OH DOT GDT - 9/10/18 11:16 - S:\GINT\PROJECTS\18G21913.GPJ

PID: 97449	BR ID: 6431941	PROJECT: PER CR64-1.80	STATION / OFFSET: 112+19, 15.0 RT	START: 7/2/18	END: 7/2/18	PG 2 OF 3	B-002-1-18

MATERIAL DESCRIPTION AND NOTES	ELEV. 834.5	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	INST.
STIFF TO VERY STIFF, GRAY, **SILT AND CLAY**, (A-6A), LITTLE SAND, TRACE GRAVEL, DAMP TO MOIST *(continued)*		26																
		27																
		28																
		29	9 13 18	46	100	SS-S-8	3.75	5	5	9	29	52	32	17	15	15	A-6a (10)	
		30																
		31																
		32																
		33																
		34	11 15 16	46	100	SS-S-9	1.75	-	-	-	-	-	-	-	-	20	A-6a (V)	
		35																
		36																
		37																
		38																
		39	12 15 15	44	100	SS-S-10	1.75	-	-	-	-	-	-	-	-	20	A-6a (V)	
		40																
		41																
		42																
		43																
		44	9 12 18	44	100	SS-S-11	2.50	3	4	8	37	48	29	16	13	18	A-6a (9)	
		45																
		46																
		47																
		48																
		49	9 13 20	48	100	SS-S-12	2.00	-	-	-	-	-	-	-	-	15	A-6a (V)	
		50																
		51																

PID: 97449	BR ID: 6431941	PROJECT: PER CR64-1.80	STATION / OFFSET: 112+19, 15.0 RT	START: 7/2/18	END: 7/2/18	PG 3 OF 3	B-002-1-18

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	INST.
STIFF TO VERY STIFF, GRAY, **SILT AND CLAY**, (A-6A), LITTLE SAND, TRACE GRAVEL, DAMP TO MOIST *(continued)*	807.7	52																
		53																
		54	13 17 17	50	100	SS-S-13	2.00	-	-	-	-	-	-	-	-	17	A-6a (V)	
		55																
		56																
		57																
		58																
		59	12 15 18	48	100	SS-S-14	3.75	6	4	9	35	46	30	17	13	17	A-6a (9)	
		60																
	797.5	61																
VERY STIFF, GRAY, **SILT AND CLAY**, (A-6A), TRACE SAND, MOIST		62																
		63																
		64	8 16 19	51	100	SS-S-15	2.50	0	0	2	47	51	29	18	11	26	A-6a (8)	
		65																
		66																
		67																
		68																
		69	9 13 22	51	100	SS-S-16	3.75	-	-	-	-	-	-	-	-	26	A-6a (V)	
	789.5	70																
		EOB																

NOTES: WATER SEEPAGE ENCOUNTERED AT 11' DURING DRILLING AND MEASURED AT 10' AT COMPLETION

ABANDONMENT METHODS, MATERIALS, QUANTITIES: AUGER CUTTINGS

GCI Job No: 18-G-21913

PROJECT: PER CR64-1.80	DRILLING FIRM / OPERATOR: GCI / R. BRANDUM	DRILL RIG: CME 45 (RIG 2)	STATION / OFFSET: 113+93, 5.3 RT	EXPLORATION ID B-003-1-18
TYPE: BRIDGE REPLACEMENT	SAMPLING FIRM / LOGGER: GCI / R. BRANDUM	HAMMER: CME AUTOMATIC	ALIGNMENT: NEW CENTERLINE	
PID: 97449 BR ID: 6431941	DRILLING METHOD: 3.5" SSA	CALIBRATION DATE: 10/29/16	ELEVATION: 857.6 (MSL) EOB: 10.0 ft.	PAGE 1 OF 1
START: 7/2/18 END: 7/2/18	SAMPLING METHOD: 3.5" SSA	ENERGY RATIO (%): 88.1	COORD: 0.000 N, 300.000 E	

MATERIAL DESCRIPTION AND NOTES	ELEV. 857.6	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	INST.
ASPHALT (2.5")	857.4																	
STONE FRAGMENTS (3.5")	857.1																	
MEDIUM DENSE, BROWN, **UNCONTROLLED FILL**, GRAVEL WITH SILT AND SAND (A-2-4), DRY							-	-	-	-	-	-	-	-	-	-		
			5 7 7	21	100	SS-S-1	-	50	13	11	- 26 -		NP	NP	NP	4	A-2-4 (0)	
	854.1																	
LOOSE, BROWN MOTTLED GRAY, **SILT**, (A-4B), TRACE SAND, DAMP			3 4 4	12	100	SS-S-2	3.00	0	2	5	66	27	26	19	7	19	A-4b (8)	
	850.6																	
LOOSE, BROWN AND GRAY, **GRAVEL WITH SAND, SILT, AND CLAY**, (A-2-6), MOSTLY SAND, LITTLE CLAY, LITTLE GRAVEL, WET			2 2 3	7	100	SS-S-3	1.50	-	-	-	-	-	-	-	-	20	A-6a (V)	
	847.6	EOB 10																

NOTES: WATER SEEPAGE ENCOUNTERED AT 7' DURING DRILLING AND MEASURED AT 7' AT COMPLETION

ABANDONMENT METHODS, MATERIALS, QUANTITIES: AUGER CUTTINGS AND ASPHALT PATCH

GCI Job No: 18-G-21913

GCI ODOT LOG - GCI OH DOT.GDT - 9/13/18 13:20 - S:\GINT\PROJECTS\18G21913.GPJ

Summary of Laboratory Results

PER CR64-1.80
GCI Job Number: 97449

Test Hole	Depth	Water Content (%)	Liquid Limit	Plastic Limit	Plasticity Index	% Fines (< #200 Sieve)	% Clay (< 0.005 mm)	C.B.R.	Swell (%)	ODOT Class-ification	ODOT Group Index
B-001-1-18	1.0							5.5	0.9		
B-001-1-18	2.0	14.4	31	18	13	75.4	34	-	-	A-6a	9
B-001-1-18	4.0	21.5	35	21	14	94.6	36	-	-	A-6a	10
B-001-1-18	8.5	24.0						-	-		
B-002-1-18	0.0	19.6						-	-		
B-002-1-18	2.0	16.2						-	-		
B-002-1-18	4.0	12.7	28	18	10	59.4	28	-	-	A-4a	5
B-002-1-18	8.5	25.8						-	-		
B-002-1-18	13.5	19.1	NP	NP	NP	53.4	11	-	-	A-4a	0
B-002-1-18	18.5	18.5	NP	NP	NP	84.7	22	-	-	A-4b	0
B-002-1-18	23.5	14.6						-	-		
B-002-1-18	28.5	15.1	32	17	15	81.1	52	-	-	A-6a	10
B-002-1-18	33.5	20.3						-	-		
B-002-1-18	38.5	20.1						-	-		
B-002-1-18	43.5	18.1	29	16	13	84.7	48	-	-	A-6a	9
B-002-1-18	48.5	14.7						-	-		
B-002-1-18	53.5	17.3						-	-		
B-002-1-18	58.5	17.2	30	17	13	80.9	46	-	-	A-6a	9
B-002-1-18	63.5	26.3	29	18	11	97.8	51	-	-	A-6a	8
B-002-1-18	68.5	26.3						-	-		
B-003-1-18	1.0							5.8	1.1		
B-003-1-18	2.0	4.3	NP	NP	NP	25.8		-	-	A-2-4	0
B-003-1-18	4.0	18.5	26	19	7	92.5	27	-	-	A-4b	8

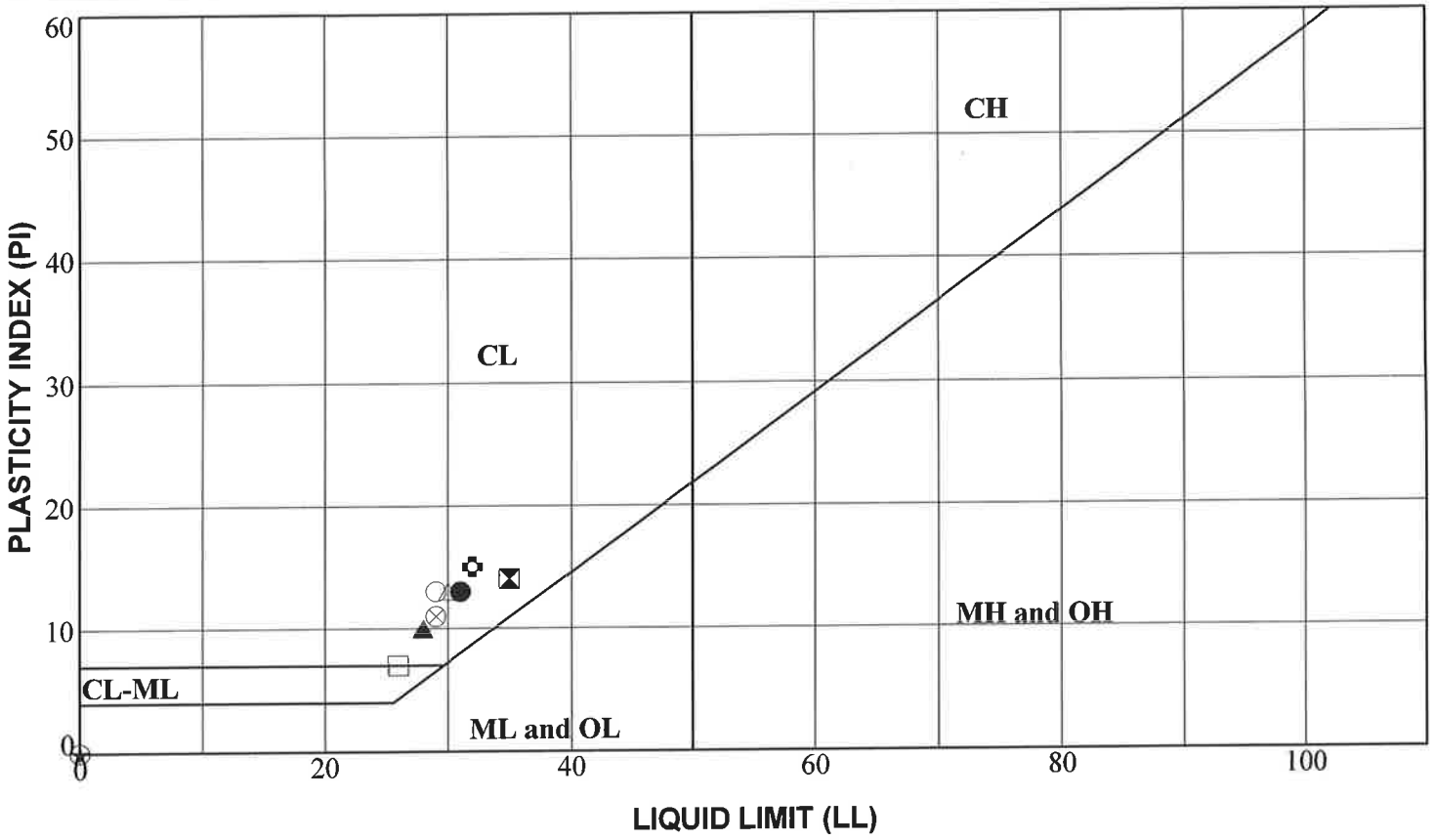
September 2018

Summary of Laboratory Results

PER CR64-1.80
GCI Job Number: 97449

Test Hole	Depth	Water Content (%)	Liquid Limit	Plastic Limit	Plasticity Index	% Fines (< #200 Sieve)	% Clay (< 0.005 mm)	C.B.R.	Swell (%)	ODOT Class-ification	ODOT Group Index
B-003-1-18	8.5	20.2						-	-		

September 2018



LEGEND:

	TEST HOLE	DEPTH	w_n	LL	PL	PI	ODOT CLASS-IFICATION	ODOT GROUP INDEX
●	B-001-1-18	2.0	14.4	31	18	13	A-6a	9
⊠	B-001-1-18	4.0	21.5	35	21	14	A-6a	10
▲	B-002-1-18	4.0	12.7	28	18	10	A-4a	5
★	B-002-1-1813.5		19.1	NP	NP	NP	A-4a	4
⊙	B-002-1-1818.5		18.5	NP	NP	NP	A-4b	8
✿	B-002-1-1828.5		15.1	32	17	15	A-6a	10
○	B-002-1-1843.5		18.1	29	16	13	A-6a	9
△	B-002-1-1858.5		17.2	30	17	13	A-6a	9
⊗	B-002-1-1863.5		26.3	29	18	11	A-6a	8
⊕	B-003-1-18	2.0	4.3	NP	NP	NP	A-2-4	0
□	B-003-1-18	4.0	18.5	26	19	7	A-4b	8

Job No: *18-G-21913*

Method: *ASTM D4318*

Date: *August 2018*

ATTERBERG LIMITS TEST RESULTS

PER-CR 64-1.80

PER-CR 64-1.80

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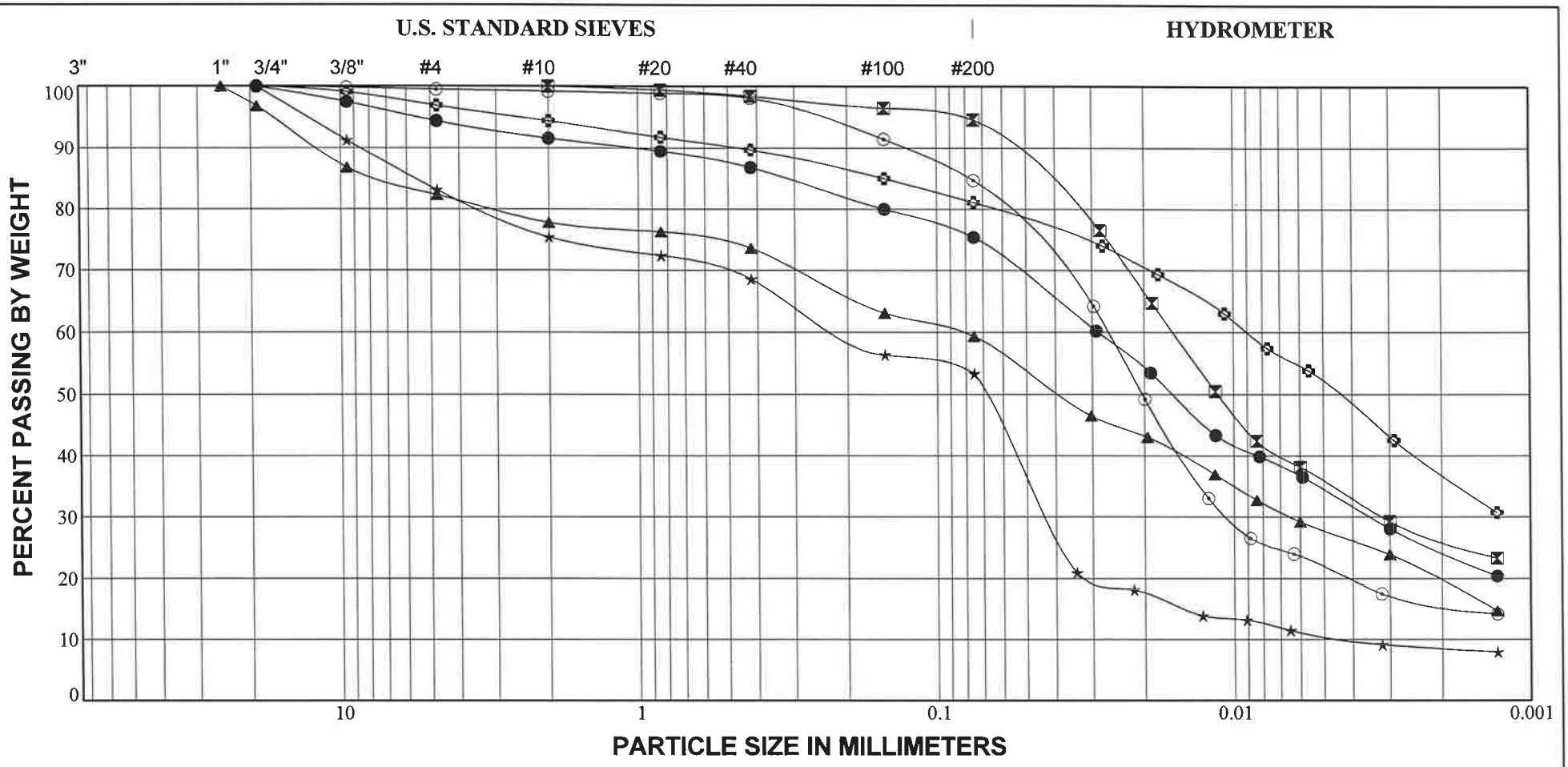


GRAVEL		SAND		SILT	CLAY
coarse	fine	coarse	fine		

LEGEND:

	TEST HOLE	DEPTH	LL	w_n	PL	ODOT CLASSIFICATION	ODOT GROUP INDEX	C.B.R.
●	B-001-1-18	2.0	31	14.4	18	A-6a	9	---
⊠	B-001-1-18	4.0	35	21.5	21	A-6a	10	---
▲	B-002-1-18	4.0	28	12.7	18	A-4a	5	---
★	B-002-1-18	13.5	NP	19.1	NP	A-4a	4	---
⊙	B-002-1-18	18.5	NP	18.5	NP	A-4b	8	---
✿	B-002-1-18	28.5	32	15.1	17	A-6a	10	---

Job No: *18-G-21913*

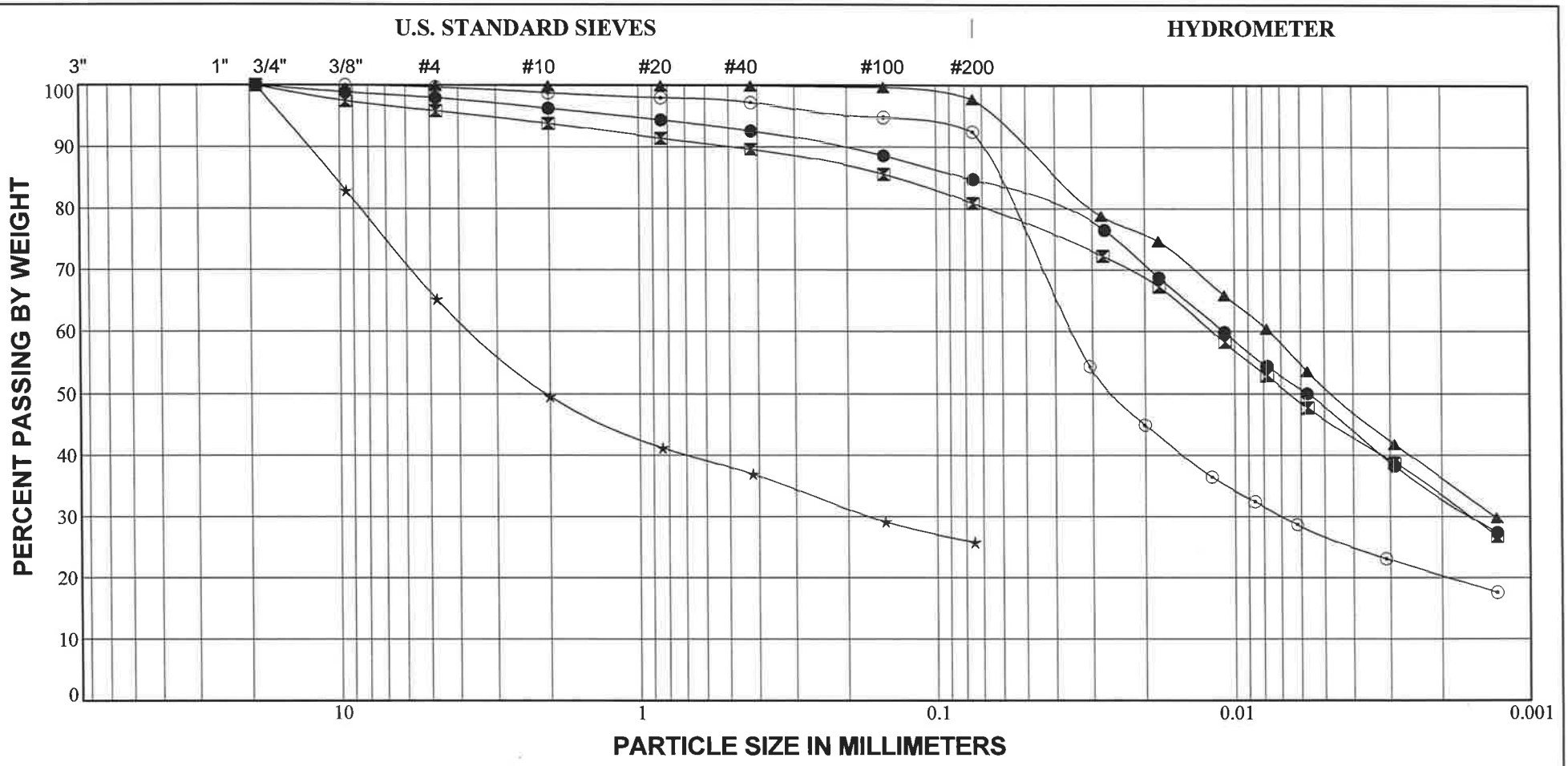
Method: *ASTM D421 D422*

Date: *August 2018*

COMBINED PARTICLE SIZE DISTRIBUTION

PER-CR 64-1.80 - PER-CR 64-1.80

Geotechnical Consultants, Inc. - Westerville, OH 43081



GRAVEL		SAND		SILT	CLAY
coarse	fine	coarse	fine		

LEGEND:

	TEST HOLE	DEPTH	LL	w_n	PL	ODOT CLASSIFICATION	ODOT GROUP INDEX	C.B.R.
●	B-002-1-18	43.5	29	18.1	16	A-6a	9	---
⊠	B-002-1-18	58.5	30	17.2	17	A-6a	9	---
▲	B-002-1-18	63.5	29	26.3	18	A-6a	8	---
★	B-003-1-18	2.0	NP	4.3	NP	A-2-4	0	---
⊙	B-003-1-18	4.0	26	18.5	19	A-4b	8	---

Job No: *18-G-21913*

Method: *ASTM D421 D422*

Date: *August 2018*

COMBINED PARTICLE SIZE DISTRIBUTION

PER-CR 64-1.80 - PER-CR 64-1.80

Geotechnical Consultants, Inc. - Westerville, OH 43081

DrivenPiles - Report

General Project Information

Filename: ...8 Folders\18-G-21751 to 18-G-22000\18-G-21913 - PER CR 64-1.80 Bridge Replacement\Driven.dvn
Project Name: PER CR64-1.80
Project Client: Perry County
Prepared By: Todd R. Meek, P.E.
Project Manager: Todd R. Meek, P.E.

Pile Information

Pile Type: Pipe Pile - Closed End
Top of Pile: 0.00 ft
Diameter of Pile: 14.00 in

Nominal Considerations

Water Table Depth At Time Of:

Drilling:	2.00 ft
Driving/Restrike:	2.00 ft
Nominal:	2.00 ft

Nominal Considations:

Local Scour:	0.00 ft
Long Term Scour:	0.00 ft
Soft Soil:	0.00 ft

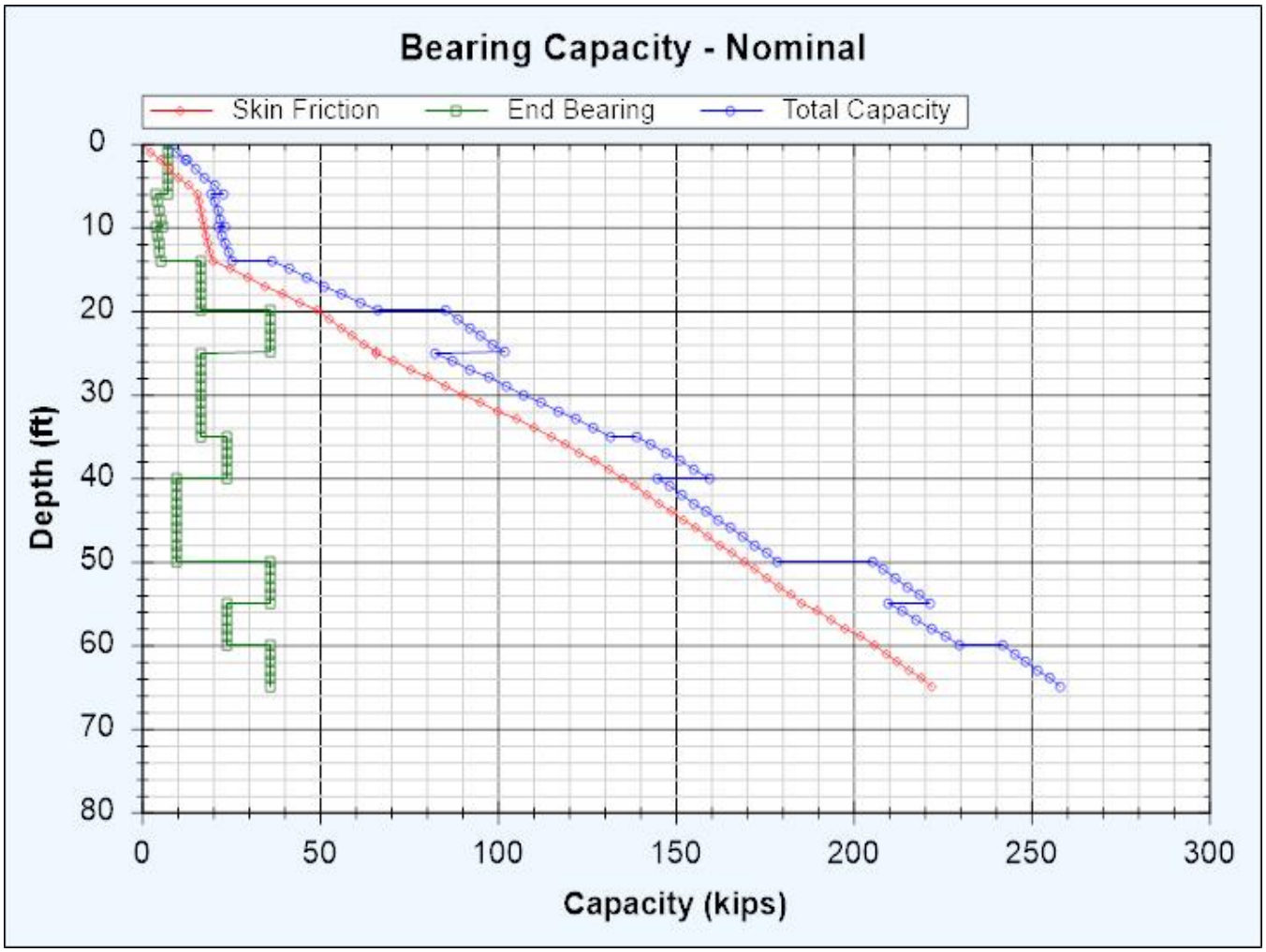
Nominal Profile

Layer	Soil Type	Thickness	Setup Factor	Unit Weight	Strength	Nominal Curve
1	Cohesive	6.00 ft	1.000	110.00 pcf	750.00 psf	T-80 Same
2	Cohesionless	4.00 ft	1.000	115.00 pcf	26.0/26.0	Nordlund
3	Cohesionless	4.00 ft	1.000	115.00 pcf	24.0/24.0	Nordlund
4	Cohesive	6.00 ft	1.000	120.00 pcf	1750.00 psf	T-80 Same
5	Cohesive	5.00 ft	1.000	125.00 pcf	3750.00 psf	T-80 Same
6	Cohesive	10.00 ft	1.000	120.00 pcf	1750.00 psf	T-80 Same
7	Cohesive	5.00 ft	1.000	125.00 pcf	2500.00 psf	T-80 Same
8	Cohesive	10.00 ft	1.000	100.00 pcf	1000.00 psf	T-80 Same
9	Cohesive	5.00 ft	1.000	125.00 pcf	3750.00 psf	T-80 Same
10	Cohesive	5.00 ft	1.000	125.00 pcf	2500.00 psf	T-80 Same
11	Cohesive	5.00 ft	1.100	125.00 pcf	3750.00 psf	T-80 Same

Nominal - Summary of Capacities

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.03 kips	7.22 kips	7.24 kips
1.00 ft	2.62 kips	7.22 kips	9.84 kips
1.99 ft	5.22 kips	7.22 kips	12.43 kips
2.01 ft	5.27 kips	7.22 kips	12.49 kips
3.00 ft	7.86 kips	7.22 kips	15.08 kips
4.00 ft	10.49 kips	7.22 kips	17.70 kips
5.00 ft	13.11 kips	7.22 kips	20.32 kips
5.99 ft	15.70 kips	7.22 kips	22.92 kips
6.01 ft	15.73 kips	3.76 kips	19.49 kips
7.00 ft	16.11 kips	4.24 kips	20.35 kips
8.00 ft	16.55 kips	4.72 kips	21.26 kips
9.00 ft	17.02 kips	5.20 kips	22.22 kips
9.99 ft	17.54 kips	5.68 kips	23.22 kips
10.01 ft	17.55 kips	4.11 kips	21.66 kips
11.00 ft	18.05 kips	4.45 kips	22.51 kips
12.00 ft	18.60 kips	4.80 kips	23.40 kips
13.00 ft	19.18 kips	5.15 kips	24.33 kips
13.99 ft	19.80 kips	5.49 kips	25.29 kips
14.01 ft	19.85 kips	16.84 kips	36.69 kips
15.00 ft	24.74 kips	16.84 kips	41.57 kips
16.00 ft	29.67 kips	16.84 kips	46.50 kips
17.00 ft	34.60 kips	16.84 kips	51.44 kips
18.00 ft	39.53 kips	16.84 kips	56.37 kips
19.00 ft	44.46 kips	16.84 kips	61.30 kips
19.99 ft	49.35 kips	16.84 kips	66.18 kips
20.01 ft	49.43 kips	36.08 kips	85.51 kips
21.00 ft	52.67 kips	36.08 kips	88.75 kips
22.00 ft	55.94 kips	36.08 kips	92.02 kips
23.00 ft	59.21 kips	36.08 kips	95.29 kips
24.00 ft	62.48 kips	36.08 kips	98.56 kips
24.99 ft	65.72 kips	36.08 kips	101.80 kips
25.01 ft	65.80 kips	16.84 kips	82.64 kips
26.00 ft	70.68 kips	16.84 kips	87.52 kips
27.00 ft	75.61 kips	16.84 kips	92.45 kips
28.00 ft	80.55 kips	16.84 kips	97.38 kips
29.00 ft	85.48 kips	16.84 kips	102.32 kips
30.00 ft	90.41 kips	16.84 kips	107.25 kips
31.00 ft	95.34 kips	16.84 kips	112.18 kips
32.00 ft	100.27 kips	16.84 kips	117.11 kips
33.00 ft	105.21 kips	16.84 kips	122.04 kips
34.00 ft	110.14 kips	16.84 kips	126.97 kips

Depth	Skin Friction	End Bearing	Total Capacity
34.99 ft	115.02 kips	16.84 kips	131.86 kips
35.01 ft	115.11 kips	24.05 kips	139.16 kips
36.00 ft	119.13 kips	24.05 kips	143.19 kips
37.00 ft	123.20 kips	24.05 kips	147.25 kips
38.00 ft	127.26 kips	24.05 kips	151.31 kips
39.00 ft	131.32 kips	24.05 kips	155.38 kips
39.99 ft	135.35 kips	24.05 kips	159.40 kips
40.01 ft	135.42 kips	9.62 kips	145.04 kips
41.00 ft	138.77 kips	9.62 kips	148.39 kips
42.00 ft	142.15 kips	9.62 kips	151.77 kips
43.00 ft	145.54 kips	9.62 kips	155.16 kips
44.00 ft	148.92 kips	9.62 kips	158.54 kips
45.00 ft	152.30 kips	9.62 kips	161.92 kips
46.00 ft	155.68 kips	9.62 kips	165.31 kips
47.00 ft	159.07 kips	9.62 kips	168.69 kips
48.00 ft	162.45 kips	9.62 kips	172.07 kips
49.00 ft	165.83 kips	9.62 kips	175.45 kips
49.99 ft	169.18 kips	9.62 kips	178.80 kips
50.01 ft	169.25 kips	36.08 kips	205.33 kips
51.00 ft	172.49 kips	36.08 kips	208.57 kips
52.00 ft	175.76 kips	36.08 kips	211.84 kips
53.00 ft	179.03 kips	36.08 kips	215.11 kips
54.00 ft	182.30 kips	36.08 kips	218.38 kips
54.99 ft	185.54 kips	36.08 kips	221.62 kips
55.01 ft	185.61 kips	24.05 kips	209.67 kips
56.00 ft	189.64 kips	24.05 kips	213.69 kips
57.00 ft	193.70 kips	24.05 kips	217.75 kips
58.00 ft	197.76 kips	24.05 kips	221.81 kips
59.00 ft	201.83 kips	24.05 kips	225.88 kips
59.99 ft	205.85 kips	24.05 kips	229.90 kips
60.01 ft	205.92 kips	36.08 kips	242.00 kips
61.00 ft	209.16 kips	36.08 kips	245.24 kips
62.00 ft	212.43 kips	36.08 kips	248.51 kips
63.00 ft	215.70 kips	36.08 kips	251.78 kips
64.00 ft	218.97 kips	36.08 kips	255.05 kips
64.99 ft	222.21 kips	36.08 kips	258.29 kips


Bearing Capacity - Nominal
Skin Friction
End Bearing
Total Capacity
Depth (ft)
0
10
20
30
40
50
60
70
80
0
50
100
150
200
250
300
Capacity (kips)

PER CR64-1.80 Slope at Bridge

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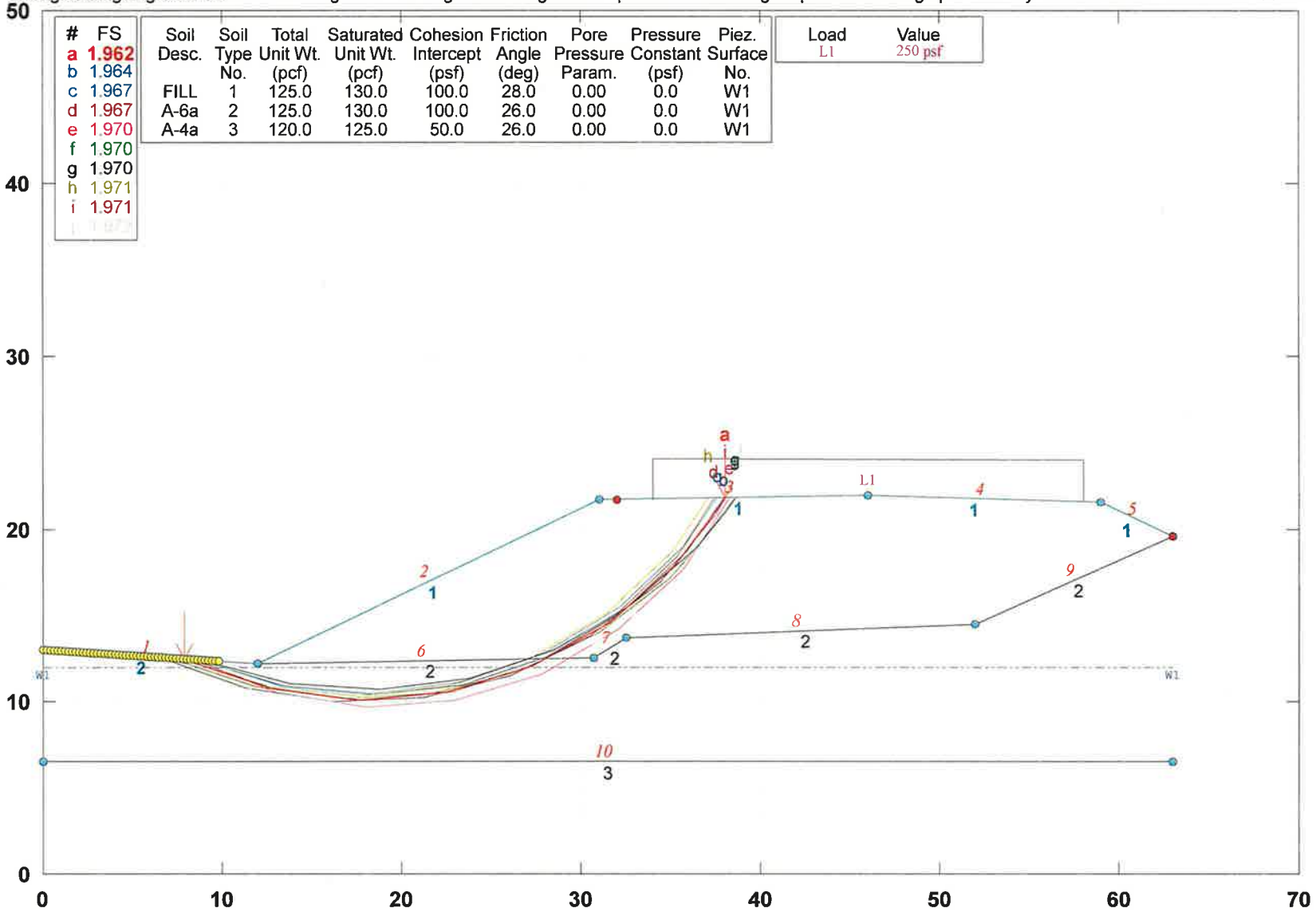
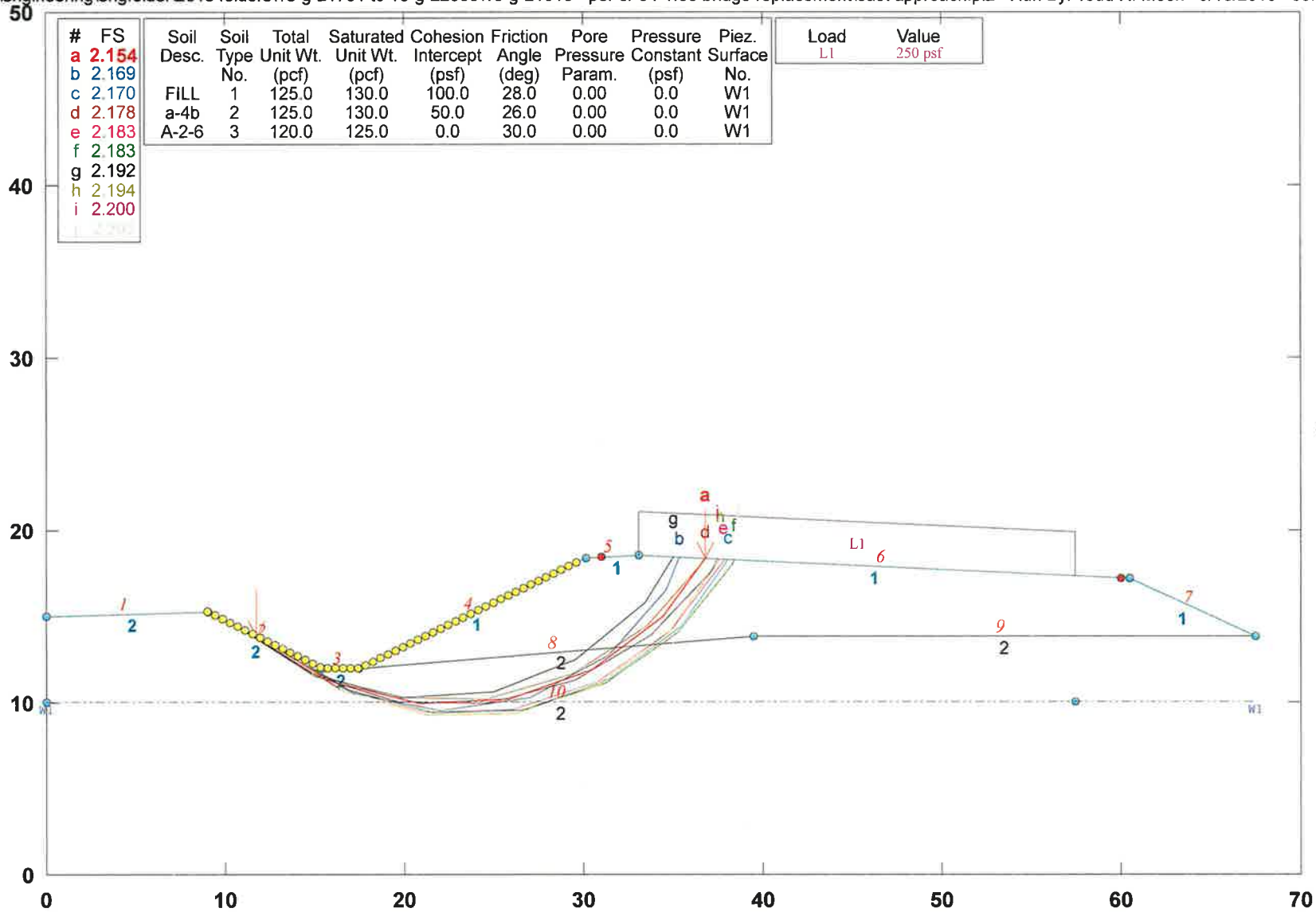


GSTABL7 v.2 FSmin=1.962

Safety Factors Are Calculated By The Modified Bishop Method

PER CR64-1.80 East Approach at B-003

s:\engineering\engfolder\2018 folders\18-g-21751 to 18-g-22000\18-g-21913 - per cr 64-1.80 bridge replacement\east approach.pl2 Run By: Todd R. Meek 9/10/2018 06:28AM



GSTABL7 v.2 FSmin=2.154

Safety Factors Are Calculated By The Modified Bishop Method

Subgrade Analysis
V. 13.00 01/15/16

Design CBR 7

Global Options		
320	R&R	No
206	CS	Option
	LS	No
206	Depth	15

Classification Counts by Sample																
R	1a	1b	3	3a	2-4	2-5	2-6	2-7	4a	4b	5	6a	6b	7-5	7-6	8a	8b
0	0	0	0	0	1	0	0	0	0	1	0	2	0	0	0	0	0
					25%					25%		50%					
0%	25%								75%								

Surface Class	
2-5	0
4b	0
5	0
7-5	0
7-6	0
8a	0
8b	0
R	0

% Borings	
N_{60L}<= 5	50%
<=10	100%
>=20	0%
M+	100%
R	0%

% Surface	
50%	
0%	50%

UC @ Surface
Undercut
12.0
12
12

Rig	ER
A	88
B	
C	
D	
E	
F	
G	
H	

Total Borings	2
PID	
Location	PER CR64

	N_{60}	N_{60L}			PI		Clay		M	M_{OPT}		GI
Average	8.0	5.0			8.5		24.3		14.8	13.5		6.75
Maximum	12	6	35	21	14	66	36	95	22	16		10
Minimum	4	4	0	0	0	26	0	26	4	10		0

	Boring					Subgrade		Standard Penetration						Physical Characteristics						Moisture		Class		Sulfate		Problem		Undercuts		Analysis / Comments
#	B #	Boring Location	Depth	To	Cut Fill	Depth	To	n_2	n_3	N	Rig	N_{60}	N_{60L}	LL	PL	PI	% Silt	% Clay	P 200	M	M_{OPT}	Ohio DOT	GI			w/ Class	w/ MN	UC Class	UC MN	
B-001	S-1		2.0	3.5	0.0	2.0	3.5	4	4	8	A	12		31	18	13	41	34	75	14	14	6a	9							
	S-2		4.0	5.5		4.0	5.5	2	3	3	A	4		35	21	14	59	36	95	22	16	6a	10				N		24	
													4																	
B-003	S-1		2.0	3.5	0.0	2.0	3.5	5	7	7	A	10		0	0	0	26	0	26	4	10	2-4	0				N		12	
	S-2		4.0	5.5		4.0	5.5	3	4	4	A	6		26	19	7	66	27	93	19	14	4b	8			4b	N	36	18	
													6																	
3					0.0						A																			
4					0.0						A																			
5					0.0						A																			
6					0.0						A																			
7					0.0						A																			
8					0.0						A																			