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November 6, 2018

Mr. Alan R. Piatak, P.E.
Euthenics, Inc.
8235 Mohawk Drive
Strongsville, Ohio 44136
(440) 260-1555
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Re: Report for Geotechnical Subsurface Exploration
Proposed Bridge Replacement
MED-94-7.66 (PID No. 90938)
Sharon Center, Medina County, Ohio
PSI Project Number: 0142-1838

Dear Mr. Piatak:

In compliance with your instructions, we have conducted a subsurface exploration for the above-referenced project. The results of this exploration, together with our recommendations are to be found in the accompanying report, three (3) copies of which are being transmitted herewith.

Often, during design and construction phases, questions arise concerning subsurface conditions. PSI would be pleased to continue our role as Geotechnical Engineers during the project implementation. PSI also is interested in providing materials testing during the construction of this project.

If you will advise us of the appropriate time to discuss these engineering services, we will be pleased to meet with you at your convenience.

Respectfully submitted,

PROFESSIONAL SERVICE INDUSTRIES, INC.

Surya Thapa, P.E.
Department Manager

A. Veeramani, P.E.
Vice President

Subsurface Exploration Report

For the Proposed

Bridge Replacement
MED-94-7.66 (PID No. 90938)
Sharon Center, Medina County, Ohio

Prepared for

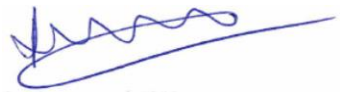
Euthenics, Inc.
8235 Mohawk Drive
Strongsville, Ohio 44136

Prepared by

Professional Service Industries, Inc.
5555 Canal Road
Cleveland, OH 44125

PSI Project No. 0142-1838

Surya Thapa, P.E.
Department Engineer



A. Veeramani, P.E.
Vice President

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APPENDIX: Geotechnical Subsurface Exploration Report 0142-1650 prepared by PSI to ODOT District - 3 Dated on November 30, 2017

EXECUTIVE SUMMARY

The project involves replacement of the existing bridge structure on State Route 94 over Wolf Creek Tributary. The geotechnical exploration was performed by PSI with a total of two (2) SPT soil test borings for proposed bridge replacement area between November 8, 2017 to November 14, 2017. The test borings for this exploration was advanced through the existing surface grade at a location selected by ODOT District-3. The following summary of the preliminary exploration findings and geotechnical considerations for this project are presented below.

- A total of two (2) test borings (B-002-0-17 and B-003-0-17) were advanced along State Route 94 on both sides of the bridge. The subgrade soils consisted of gravel and rock fragments (A-2-4) sandy silt (A-4a), and silt (A-4b), silt and clay (A-6a) and were encountered to the terminal depths ranging from about 68.9 to 98.8 feet below the existing grades. The standard penetration testing (SPT) was performed at each sampling interval. SPT "N" values vary at different sampling depths. The subgrade cohesive soils exhibited a medium stiff to hard consistency and very loose to dense relative density for granular soil, based on the Standard Penetration tests.

- Free water was observed to depths of about 6 and 13.5 feet below the existing grades at the test boring locations B-002-0-17 and B-003-0-17 during field drilling operations, respectively.

- Based on the field drilling operations, the proposed culvert can be supported on shallow foundation bearing on the area's natural soils formation designed utilizing nominal bearing resistance of 5 ksf with a resistance factor of 0.45.

The summary should be used in conjunction with the entire Subsurface Exploration Report since the summary sheet cannot include all details of the investigation's findings.

INTRODUCTION

Project Authorization

Professional Service Industries, Inc. (PSI) has completed a geotechnical subsurface exploration conducted for Euthenics, Inc. in connection with the complete replacement of the existing bridge structure with a new 4-sided box culvert along State Route 94, in Sharon Center, Medina County, Ohio. This exploration was accomplished in general accordance with PSI Proposal No. 0142-249927, dated July 11, 2018. Authorization to perform this exploration and analysis was in the form of signed acceptance of the aforementioned proposal Mr. Alan R. Piatak, P.E. of Euthenics, Inc. dated November 1, 2018.

Project Description

Based on the provided information, it is understood that the proposed project will include complete replacement of the existing bridge structure with new 4-sided box culvert and associated headwalls structure on State Route 94 over Wolf Creek Tributary. Specific information for the existing bridge and proposed culvert structures are as follows:

Design Item	Existing Structure	Proposed Structure
Type	Single reinforced Concrete Slab Bridge with Asphalt Wearing Surface on Reinforced Concrete Abutments on Spread footings	4-sided Reinforced concrete box culvert, 10'-0" by 5'0" with asphalt wearing course, reinforced concrete headwalls, reinforced concrete turnback wingwalls and invert buried 1'-0" below flowline
Span	17'-0" clear span	11'-6 ½"
Roadway	32'-0" F/F Guardrail	32-0" F/F Guardrail
Loading	Unknown	HL-93, 60 psf future wearing surface
Skew	29º 30' ±	30º 00' 00" LF
Approach Slabs	None	None
Wearing Surface	Concrete	Asphalt Concrete
Alignment	Tangent	Tangent
Crown	0.016 ± FT/FT	0.016 FT/FT
Structure File	5205557	---
Year of Built	1920	Proposed
Coordinate:	Latitude: N 41° 5' 31.38" & Longitude: W 81° 44' 8.21"	

If any of the information noted above has changed or is incorrect, please inform PSI so that the recommendations presented in this report can be reviewed and amended, if appropriate.

Purpose and Scope of Services

The purpose of this exploration was to evaluate the soil, rock and groundwater conditions at the site to provide recommendations, from a geotechnical engineering viewpoint, for foundation design and construction, site preparation and other construction considerations. The scope of the exploration and analysis included a reconnaissance of the project site, review of the two (2) SPT soil test borings (B-002-0-17 and B-003-0-17) drilled by PSI within in the project area, and an engineering analysis and evaluation of the subsurface materials.

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

GEOLOGY AND OBSERVATION OF THE REPORT

Site Location and Description

The site for the proposed Bridge Replacement Project, for which this subsurface exploration was completed, is located on Sate Route 94 (Ridge Road Bridge at MED-94-7.66) over Wolf Creek Tributary, in Sharon Center, Medina County, Ohio. Specifically, the proposed bridge structure will be located about 0.3 miles south of the intersection of Sharon Copley Road (State Route 162) and Ridge Road (State Route 94).

The surface of the existing State Route 94 is covered with asphalt concrete. The project area is predominately surrounded by residential and commercial properties. Based on the visual site observations and provided site plan, the surface grades along Ridge Road are relatively flat in the vicinity of the bridge location. The difference in elevation between the bridge and the creek is approximately 5 to 6 feet. Surface drainage was good during the field drilling operations. We recommend that all existing utility lines be marked and checked prior to construction activities.

Site Geology

According to the Medina County Soil Survey, Medina County is in parts of two physiographic provinces: Great Central Lowlands and the glaciated part of the Appalachian Plateau. The topography is nearly level to sloping with a general rise in elevation from west to east. Most of the soils in Medina County are underlain by glacial drift or till deposits from the Wisconsin Glaciation. About two-thirds of Medina County drains into Lake Erie, mainly by way of the

Rocky River and the East Branch of the Black River. The remaining one-third is in the Ohio River watershed.

The availability and quantity of ground water in the vicinity of the project area is dependent on the local aquifer type and specific location. According to Ground-Water Resources of Medina County (ODNR 1978); ground water in the project area is generally obtained from sandstones of the Pottsville group. Principle aquifers are the Massillon sandstone (upper) and Sharon conglomerate (below). Wells may produce sustained yields of as much as 50 gpm. Up to 100 gpm may be available for short periods of intermittent pumping. Sharon conglomerate may be from 150 to 300 feet below land surface.

EXPLORATION

Field Drilling Operations

As discussed in the *Purpose and Scope of Services* section, a total of two (2) test borings (E1 Type) were drilled for the proposed bridge replacement project. The test borings were drilled to depths of about 69.8 to 98.8 feet each below the existing pavement grades. The approximate boring locations are shown on the Boring Location Plan presented in the Appendix of this report. The number of test borings was selected and drilled by PSI. The boring was advanced into the ground using hollow stem augers mounted on a truck mounted drill rig. The split spoon sampling procedures used during this exploration are in basic accordance with Ohio Department of Transportation Specifications for Subsurface Exploration section 303.7 (Type E1).

Laboratory Testing

The soil samples obtained during the field exploration were transported to the laboratory and visually examined. The soil samples obtained from the drilling operations were tested for moisture content (AASHTO T-265), liquid limits (AASHTO T-89), plastic limits (AASHTO T-90), and grain size analyses (AASHTO T-88). The samples were classified in general accordance with the ODOT Specifications for Subsurface Investigations, Classification of Soil. Descriptions and lab test data of the soils encountered in the test boring is provided on the Boring Logs, included in the Appendix. Groundwater conditions, standard penetration resistances, and other pertinent information are also included. Laboratory tests were performed by ODOT.

FINDINGS

Subsurface Conditions

The surface of the site at al test boring locations B-002-0-17 and B-003-0-17 was covered with a layer of asphalt concrete measuring approximately 4 to 6 inches in thickness. The asphalt concrete at both of the test boring locations was underlain by a concrete base measuring approximately 6 to 11 inches in thickness. The thickness of the surface materials should be expected to be variable throughout the area.

The surface materials at all the test boring locations were underlain by natural soils and encountered to the terminal depths of about 68.9 to 98.8 feet below the existing grades. The natural soils consisted of gravel and rock fragments (A-2-4) sandy silt (A-4a), and silt (A-4b), silt and clay (A-6a). The subgrade soils exhibited moisture contents ranging from 7 to 31 percent. The subgrade cohesive soils exhibited a medium stiff to hard consistency and very loose to dense relative density for granular soil, based on the Standard Penetration tests.

Note that the subsurface description is a generalized nature which provided to highlight the major strata encountered. The boring logs and laboratory test data included in the Appendix should be reviewed for specific information at the individual boring locations. The stratifications shown on the boring logs represent the conditions only at the actual test positions. Variations may occur and should be expected between the boring locations. The stratifications represent the approximate boundary between the subsurface materials, and the transition may be gradual or not clearly defined.

Groundwater Conditions

Free water was observed to depths of about 6 and 13.5 feet below the existing grades at the test boring locations B-002-0-17 and B-003-0-17 during field drilling operations, respectively. No groundwater encountered at remaining boring locations. Note that groundwater levels fluctuate seasonally as a function of precipitation. During a time of year or weather different from the time of drilling, there may be a considerable change in the water table or the occurrence of water where not previously encountered. Furthermore, the water levels in the boreholes often are not representative of the actual groundwater level, because the boreholes remain open for a relatively short time. Therefore, we recommend that the contractor determine the actual groundwater levels at the time of construction to evaluate groundwater impact on the construction procedures.

ANALYSIS AND RECOMENDATIONS

Structure Foundation Recommendations

The foundation system for the planned culvert and wingwalls can consist of conventional mat footing and shallow bearing spread footing members, respectively. The foundation for culvert can be designed utilizing nominal bearing resistance of 5 ksf with a resistance factor of 0.45 with foundation bearing level at 1,028' MSL.

Please note that if soft and loose materials are encountered at foundation bearing level, under such circumstances, lowering of the foundation bearing elevation may be necessary to achieve design load capacity conditions. Footing bearing surfaces are to be critically inspected to verify consistency and compatibility with subsoil exploration data. It is recommended that all soft/loose soils identified during probing should be removed. The excavated foundation areas should be replaced with compacted engineered fill. A representative of PSI should be present at the site during foundation excavation and construction. Construction specifications are to specifically preclude the possibility of long-term inundation of excavations and mechanical disturbance of the proposed bearing surfaces.

Long-term Lateral and Vertical Loading

For this condition, the vertical pressure is assumed to be equal to the weight of the structural fill and that the horizontal pressures correspond to the consolidated equilibrium condition i.e., the "at-rest" condition. Assuming an angle of friction of 30 degrees for the granular backfill, the at-rest coefficient would be 0.50.

Higher lateral earth pressure could develop on one side of the culvert than on the other side due to non-uniform fill construction, or when for any reason an excavation would be made in proximity to the culvert. For the design pressure distribution on the culvert, the unit weight of the compacted structural fill may be assumed at 120 pounds per cubic foot (pcf). For earth pressure estimates, the coefficient of lateral earth pressures may be taken as 0.50 for the at-rest cases. Horizontal sliding resistance can be based on an ultimate coefficient of friction of 0.30.

In the above-discussed loading conditions, earth pressures resulting from only the fill loads have been considered. It must be recognized that the magnitude and distribution of the pressures will depend not only on the type of the fill and the degree of compaction but also on the manner in which the fill operations are carried out in the field. It is recommended that the fill on each side of the culvert be placed and compacted in equal lifts to prevent asymmetrical pressure distribution and possible displacement of the culvert.

Pavement and traffic loads are to be added to the vertical as well as lateral pressures as uniformly distributed surcharge. In addition, for the "Long-term and Vertical Loading" conditions,

the effects of the uplift forces due to water head on the proposed culvert should be considered in the design.

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

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

Groundwater Control and Drainage

Free water was observed to depths of about 6 and 13.5 feet below the existing grades at the test boring locations B-002-0-17 and B-003-0-17, respectively, during field drilling operations. It is expected that groundwater will be encountered during foundation excavation. Therefore, dewatering will be required to maintain groundwater levels below the bearing depth of the abutments and the foundations for the headwalls. Adequate dewatering procedures as dictated by the field conditions should be employed to keep water at least 2 feet below the foundation bearing elevations for the abutments.

Excavations

In Federal Register, Volume 54, No. 209 (October, 1989), the United States Department of Labor, Occupational Safety and Health Administration (OSHA) amended its "Construction Standards for Excavations, 29 CFR, Part 1926, Subpart P." This document was issued to better insure the safety of workers entering trenches or excavations. It is mandated by this federal regulation that all excavations, whether they be utility trenches, basement excavations or foundation excavations, be constructed in accordance with the new OSHA guidelines. It is our understanding that these regulations are being strictly enforced. If they are not followed closely, the owner and the contractor could be liable for substantial penalties.

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

We are providing this information solely as a service to our client. PSI is not assuming responsibility for construction site safety or the contractor's activities; such responsibility is not being implied and should not be inferred. If the excavations are left open and exposed to the elements for a significant length of time, desiccation of the clays may create minute shrinkage cracks which could allow large pieces of clay to collapse or slide into the excavation.

Materials removed from the excavation should not be stockpiled immediately adjacent to the excavation, inasmuch as this load may cause a sudden collapse of the embankment.

Weather Considerations

The soils encountered at this site are known to be sensitive to disturbances caused by construction traffic and to changes in moisture content. During wet weather periods, increases in the moisture content of the soil can cause significant reduction in the soil strength and support capabilities. Care should be exercised during the grading operations at the site. Due to the fine-grained nature of the surficial soils, the traffic of heavy equipment, including heavy compaction equipment, may very well create pumping and a general deterioration of those soils in the presence of water. Therefore, the grading should, if at all possible, be performed during a dry season. A layer of crushed stone may be required to allow the movement of construction traffic over the site during the rainy season. The contractor should maintain positive site drainage and if wet/pumping conditions occur, the contractor will be responsible to over excavate the wet soils and replace them with a properly compacted engineered fill. During wet seasons, limestone stabilization may be required to place engineer fill.

GEOTECHNICAL RISK

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

REPORT LIMITATIONS

The recommendations submitted in this report are based on the available subsurface information obtained by PSI and design details furnished by Mr. Alan R. Piatak, P.E of Euthenics, Inc., for the proposed culvert replacement project. If there are any revisions to the plans for the proposed building structure or pavement areas, or if deviations from the subsurface conditions noted in this report are encountered during construction, PSI should be retained to determine if changes in the recommendations are required. If PSI is not retained to perform these functions, PSI will not be responsible for the impact of those conditions on the geotechnical recommendations for the project.

The Geotechnical Engineer warrants that the findings, recommendations, specifications, or professional advice contained herein, have been presented after being prepared in accordance with generally accepted professional engineering practice in the fields of foundation engineering, soil mechanics and engineering geology. No other warranties are implied or expressed.

After the plans and specifications are complete, it is recommended that PSI be provided the opportunity to review the final design and specifications, in order to verify that the earthwork and recommendations are properly interpreted and implemented. At that time, it may be necessary to submit supplementary recommendations. This report has been prepared for the exclusive use of the Euthenics, Inc. for the specific application to the proposed State Route 94 Bridge (MED-94-7.66) Replacement Project (PID 90938) over Wolf Creek Tributary, in Sharon Center, Medina County, Ohio

APPENDIX

Geotechnical Subsurface Exploration
Report 0142-1650
prepared by PSI for ODOT District - 3
Dated November 30, 2017

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November 30, 2017

Mr. Robert A. Shenal II, PE
Consultant Manager
ODOT District 3
906 Clark Avenue
Ashland, Ohio 44805
419.207.7054 – Office
419.565.1744 – Cell
Robert.Shenal@dot.ohio.gov

Re: Report of Geotechnical Subsurface Exploration and Structure Investigation
Proposed Bridge Replacement
MED-94-7.66
PID No. 90938, Task Order No.: 19048-35
Sharon Center, Medina County, Ohio
PSI Project Number: 0142-1650

Dear Mr. Shenal:

In compliance with your instructions, we have conducted a geotechnical subsurface exploration report for the proposed Bridge Replacement Project on State Route 94 (PID 90938) located at Ridge Road over Wolf Creek Tributary. The results of this exploration, together with our recommendations, are to be found in the accompanying report, three (3) copies of which are being transmitted herewith.

After the plans and specifications are complete, PSI should review the final design drawings and specifications in order to verify that the recommendations are properly interpreted and implemented. **It is also considered imperative that the geotechnical engineer or its representative be present during earthwork operations and foundation installations to observe field conditions with respect to the design assumptions and specifications. PSI will not be held responsible for interpretations and field quality control observations made by others.**

Respectfully submitted,

PROFESSIONAL SERVICE INDUSTRIES, INC.

Surya Thapa, P.E.
Department Manager

A. Veeramani, P.E.
Vice President

Subsurface Exploration Report

For the Proposed

Bridge Replacement Project
State Route 94 (PID 90938)
Sharon Center, Medina County, Ohio

Prepared for

ODOT District 3
906 Clark Avenue
Ashland, OH 44805

Prepared by

Professional Service Industries, Inc.
5555 Canal Road
Cleveland, OH 44125

PSI Project No. 0142-1650

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EXECUTIVE SUMMARY

The project involves replacement of the existing bridge structure on State Route 94 over Wolf Creek Tributary. The geotechnical exploration was performed by PSI with a total of four (4) SPT soil test borings within the project area between November 8, 2017 to November 14, 2017. The test borings for this exploration was advanced through the existing surface grade at a location selected by ODOT District-3. The following summary of the preliminary exploration findings and geotechnical considerations for this project are presented below.

- A total of four (4) test borings (B-001 through B-004) were advanced along State Route 94 on both sides of the bridge. The subgrade soils consisted of gravel and rock fragments (A-2-4) sandy silt (A-4a), and silt (A-4b), silt and clay (A-6a) and were encountered to the terminal depths ranging from about 7.2 to 98.8 feet below the existing grades. The standard penetration testing (SPT) was performed at each sampling interval. SPT "N" values vary at different sampling depths. The subgrade cohesive soils exhibited a medium stiff to hard consistency and very loose to dense relative density for granular soil, based on the Standard Penetration tests.

- Free water was observed to depths of about 6 and 13.5 feet below the existing grades at the test boring locations B-002 and B-003 during field drilling operations, respectively.

- Average CBR values of 7 was established for the existing subgrade along Med-94 within the project limits.

- Based on the field drilling operations, the proposed bridge can be supported on cast in place concrete pipe pile or steel H-pile driven into the natural soils formation.

The summary should be used in conjunction with the entire Subsurface Exploration Report since the summary sheet cannot include all details of the investigation's findings.

INTRODUCTION

Project Authorization

This report presents the results of a geotechnical subsurface exploration and foundation evaluation, conducted for ODOT District 3, in connection with the proposed State Route 94 Bridge Replacement Project (PID 90938) over Wolf Creek Tributary, in Sharon Center, Medina County, Ohio. PSI's services for this project were performed in accordance with PSI Proposal No. 0142-217278, dated July 19, 2017. Authorization to perform this exploration was in the form of a letter of approval from ODOT District 3, dated October 6, 2017.

Project Description

Based on the provided information, it is understood that the proposed project will include complete replacement of the existing bridge structure on State Route 94 over Wolf Creek Tributary. The proposed project also includes about 200 feet of pavement improvement at both ends of the bridge.

No other information was available at the time of this report. If any of the information noted above has changed or is incorrect, please inform PSI so that the recommendations presented in this report can be reviewed and amended, if appropriate.

Purpose and Scope of Services

The purpose of this exploration was to evaluate the soil, rock and groundwater conditions at the site to provide recommendations, from a geotechnical engineering viewpoint, for foundation design and construction, site preparation, pavement design, and other construction considerations. The scope of the exploration and analysis included a reconnaissance of the project site, review of the four (4) SPT soil test borings drilled by PSI within the project area, and an engineering analysis and evaluation of the subsurface materials.

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

GEOLOGY AND OBSERVATIONS OF THE REPORT

Site Location and Description

The site for the proposed Bridge Replacement Project, for which this subsurface exploration was completed, is located on Ridge Road (Bridge at MED-94-7.66) over Wolf Creek Tributary, in Sharon Center, Medina County, Ohio. Specifically, the proposed bridge structure will be located about 0.3 miles south of the intersection of Sharon Copley Road (State Route 162) and Ridge Road (State Route 94).

The surface of the existing State Route 94 is covered with asphalt concrete. The project area is predominately surrounded by residential and commercial properties. Based on the visual site observations and provided site plan, the surface grades along Ridge Road are relatively flat in the vicinity of the bridge location. The difference in elevation between the bridge and the creek is approximately 8 to 10 feet. Surface drainage was good during the field drilling operations. We recommend that all existing utility lines be marked and checked prior to construction activities.

Site Geology and Hydrology

According to the Medina County Soil Survey, Medina County is in parts of two physiographic provinces: Great Central Lowlands and the glaciated part of the Appalachian Plateau. The topography is nearly level to sloping with a general rise in elevation from west to east. Most of the soils in Medina County are underlain by glacial drift or till deposits from the Wisconsin Glaciation. About two-thirds of Medina County drains into Lake Erie, mainly by way of the Rocky River and the East Branch of the Black River. The remaining one-third is in the Ohio River watershed.

The availability and quantity of ground water in the vicinity of the project area is dependent on the local aquifer type and specific location. According to Ground-Water Resources of Medina County (ODNR 1978); ground water in the project area is generally obtained from sandstones of the Pottsville group. Principle aquifers are the Massillon sandstone (upper) and Sharon conglomerate (below). Wells may produce sustained yields of as much as 50 gpm. Up to 100 gpm may be available for short periods of intermittent pumping. Sharon conglomerate may be from 150 to 300 feet below land surface.

EXPLORATION

Historical Borings Referenced:

No historical borings available within the proposed project limits.

Field Drilling Operations

As discussed in the *Purpose and Scope of Services* section, a total of four (4) test borings were drilled for the proposed Bridge Replacement Project. The test borings were drilled to depths of about 7.2 to 98.8 feet each below the existing grades. The approximate boring locations are shown on the Boring Location Plan presented in the Appendix of this report. The borings were advanced into the ground using hollow stem augers mounted on a truck mounted drill rig. The split spoon sampling procedures used during this exploration are in basic accordance with Ohio Department of Transportation Specifications for Subsurface Exploration section 303.7 (Type E1 and Type A).

Laboratory Testing

The soil samples obtained during the field exploration were transported to the laboratory and visually examined. The soil samples obtained from the drilling operation were tested for moisture content (AASHTO T-265), liquid limits (AASHTO T-89), plastic limits (AASHTO T-90), and grain size analyses (AASHTO T-88). The samples were classified in general accordance with the ODOT Specifications for Subsurface Investigations, Classification of Soil. Descriptions and lab test data of the soils encountered in the test boring is provided on the Boring Log included in the Appendix. Ground water conditions, standard penetration resistances, and other pertinent information are also included.

FINDINGS

Roadway and Structure Borings:

The surface of the site at al test boring locations B-001 through B-004 was covered with a layer of asphalt concrete measuring approximately 4 to 8 inches in thickness. The asphalt concrete at all of the test boring locations were underlain by a concrete base measuring approximately 6 to 11 inches in thickness. The thickness of the surface materials should be expected to be variable throughout the area.

The surface materials at all the test boring locations were underlain by natural soils and encountered to the terminal depths of about 7.2 to 98.8 feet below the existing grades of gravel and rock fragments (A-2-4) sandy silt (A-4a), and silt (A-4b), silt and clay (A-6a) and were encountered to the terminal depths ranging from about 7.2 to 98.8 feet below the existing grades. The subgrade soils exhibited moisture contents ranging from 8 to 49 percent. Please note that some organics and wood fragments were encountered at test boring locations B-001 and B-004 to depths of about 4 to 7 feet below the existing surface gardes. The subgrade cohesive soils exhibited a medium stiff to hard consistency and very loose to dense relative density for granular soil, based on the Standard Penetration tests.

Note that the subsurface description is a generalized nature which provided to highlight the major strata encountered. The boring logs and laboratory test data included in the Appendix should be reviewed for specific information at the individual boring locations. The stratifications shown on the boring logs represent the conditions only at the actual test positions. Variations may occur and should be expected between the boring locations. The stratifications represent the approximate boundary between the subsurface materials, and the transition may be gradual or not clearly defined.

Groundwater Conditions

Free water was observed to depths of about 6 and 13.5 feet below the existing grades at the test boring locations B-002 and B-003 during field drilling operations, respectively. No groundwater encountered at remaining boring locations. Note that groundwater levels fluctuate seasonally as a function of precipitation. During a time of year or weather different from the time of drilling, there may be a considerable change in the water table or the occurrence of water where not previously encountered. Furthermore, the water levels in the boreholes often are not representative of the actual groundwater level, because the boreholes remain open for a relatively short time. Therefore, we recommend that the contractor determine the actual groundwater levels at the time of construction to evaluate groundwater impact on the construction procedures.

ANALYSIS AND RECOMMENDATIONS

Roadway Subgrade Exploration

Site Preparation and Earthwork Operations

Prior to the initiation of any earthwork operations, general site area clearing should be carried out. All asphalt concrete, concrete, gravel, soft/loose and excessively wet soils and other objectionable materials are to be completely removed from the proposed construction areas.

ODOT's guidelines for geotechnical engineering titled *GB1: Plan Subgrades* dated December 30, 2011 and *GB1: Subgrade Analysis Spreadsheet* has been utilized as a guideline for development of the recommendations included in this report. Per ODOT requirements stated above, typically materials with in-place moisture contents exceeding the optimum moisture content by 3 percent or more, or materials exhibiting low SPT N-Values ("blow counts"), or rock formation at the subgrade require subgrade undercutting or stabilization to obtain adequate pavement support.

Based on the subsurface formations encountered at the test boring locations, the following average CBR values can be used for the design of the proposed pavement structures, provided that the subgrade materials consist of the compacted structural fill.

Boring	Station	Rec. Minimum Undercut (inches)	Recommended CBR Value
B-001	403+22	None	7
B-002	404+27	18"	
B-003	404+63	None	
B-004	405+58	None	

Please refer to the Appendix, table titled *Soil Investigation Summary,* for the exact recommended depths and limits of the undercutting and cement stabilization.

712.09 Geotextile Fabric Type D should be utilized at the bottom of the undercut areas for the undercut/replacement option. The undercut areas can be replaced with compacted 703.16.C granular Type B, C, or D fill materials.

Careful visual control of clearing and stripping operations should be maintained to assure that all deleterious materials are removed. The extent to which deleterious materials are to be removed or chemically stabilized should be determined in the field following visual

observation of the exposed subgrades. Subsequent to the site area clearing and stripping, all structural subgrade sectors should be subjected to critical proof-rolling operations and careful observation of subgrade reactions. Any sectors that exhibit instability are to be undercut or stabilized to such depths as may be necessary to assure satisfactory supporting properties. The undercut areas shall be backfilled with approved fill materials, placed and compacted under carefully controlled procedures as described below.

Pavement Design and Construction

Pavement design for the roadway structures will include proper preparation of subgrade sectors, careful design of the pavement area drainage systems and utilization of an aggregate base course with an asphalt concrete surface course.

Inclusion of adequate permanent surface and subsurface drainage systems along and beneath the roadway is considered imperative in order to maintain the compacted subgrades as close to optimum moisture conditions as possible. A subsurface drainage system consisting of perforated drain pipes bedded in and backfilled with suitable filter materials should be installed along either side of all roadways at an elevation, such that groundwater will be maintained a minimum of 3 feet below the top of the pavement structures. The filter around the drainage members is to terminate in direct contact with the aggregate base course for the pavements. All subgrade sectors should be graded to direct water by gravity toward the drainage lines. At all low points and at regular intervals, lateral underdrain lines connected to suitably located outlet points are to be provided. Site surface grades should be such that no pavement sectors are allowed to impound water. All surface and subsurface water is to be directed to the existing or new storm sewer line or drainage ditches.

All materials to be employed and field operations required in connection with the contemplated pavement structures should follow recommendations and procedural details as per the Ohio Department of Transportation.

Structure Foundation Exploration

Bridge Foundation

Based on the field drilling operations, the proposed construction and evaluation of the subsurface conditions, it is recommended that cast-in-place concrete pipe or H-pile piles bearing on the area's natural soil formation be utilized to support the abutments and piers in connection with the proposed bridge replacement.

The piles should extend to bear within the area's natural soils at minimum elevations listed below. The nominal bearing capacity of the individual cast-in-place concrete pipe piles as a function of penetration are illustrated in the table, hereunder:

ESTIMATED PILE ULTIMATE LOAD CAPACITY

CAST-IN-PLACE CONCRETE PILES					
Rear Abutment (B-002)			Forward Abutment (B-003)		
Pile Depths (ft)	PILE SIZE		Pile Depths (ft)	PILE SIZE	
	12"∅ kips	14"∅ kips		12"∅ kips	14"∅ kips
50*	130	210	50*	195	235
55	155	245	55	230	275
60	180	275	60	265	315
65	210	315	65	300	355
70	255	350	70	330	390
75	290	380	--	--	--
80	330	390	--	--	--
Max.Ultimate Bearing Value	330 kips	390 kips	Max.Ultimate Bearing Value	330 kips	390 kips

*Note: * Minimum pile bearing depth.*

Steel H Piles					
Rear Abutment (B-002)			Forward Abutment (B-003)		
Pile Depths (ft)	PILE SIZE		Pile Depths (ft)	PILE SIZE	
	H-10X42 kips	H-12X53 kips		H-10X42 kips	H-12X53 kips
50*	180	220	50*	195	245
55	210	255	55	230	285
60	240	290	60	265	330
65	275	335	65	305	370
70	300	370	70	340	380
75	325	380	75	350	--
80	350	--	--	--	--
Max.Ultimate Bearing Value	350 kips	380 kips	Max.Ultimate Bearing Value	350 kips	380 kips

*Note: * Minimum pile bearing depth.*

The piles can be designed using a factored resistance of 0.45. However, if piles are installed according to CMS 507 and CMS 523 then the piles can be designed using a factored resistance of 0.70.

The selection of the appropriate pile length, pile tip and corresponding capacity depends on the bridge loads. However, the ultimate bearing values should not exceed the ODOT guidelines presented in Section 202.2.3.2 of the ODOT Bridge Design Manual 2007.

Driven pipe piles frequently have a tendency to “freeze” in place when the pile driving operations are halted. Therefore, each pile should be driven to the desired tip elevation and driving resistance without interruptions in the driving operations. Driving the center piles of a cluster first will facilitate the driving operations. Accurate records of the final tip elevations and driving resistance should be obtained during the pile driving operations. These records should be provided to the geotechnical engineer for review prior to acceptance of the piles.

Steel pile units may be subject to corrosion due to the chemical composition of the soil profile components or because of acidic groundwater in the soil. The possibility of excessive corrosion taking place should be reviewed with an engineer specializing in evaluation and control of corrosion. In general, use two (2) to three (3) mill reductions per year for corrosion of the steel piles.

The structural capacity of the piles should be checked for downward axial loads, tension forces and lateral forces. Also, piles in a group should be spaced at a distance of at

least three (3) pile diameters apart from one another. It must be recognized that failure to meet this criteria will result in a significant reduction in pile supporting capacity.

Lateral loads should be handled by battering some pile members, as required. In the design of the batter piles, two (2) criteria must be satisfied:

a. The axial load in any batter pile must not exceed safe load per pile.
b. The sum of the horizontal components of forces in batter piles must be equal to the horizontal forces to be carried.

Lateral loads may be handled by battering individual pile units at inclinations of up to one (1) horizontal to four (4) vertical.

Bridge Abutments and Wingwalls

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

The abutment walls should be designed for at-rest loading conditions assuming triangular load distribution and an equivalent fluid pressure 60 pounds per square foot (psf), per foot of abutment depth. In the event provisions are made in the design of the superstructure of the bridge to permit sufficient lateral movement of the abutment to develop active earth pressure conditions, then an equivalent fluid pressure of 40 psf per foot of abutment depth may be employed. The wingwalls are to be designed for active earth pressure condition.

The influence of the wheel loads should be considered in the design of the abutments by representing them as an additional 24-inch layer of backfill. For the at-rest condition, an equivalent fluid pressure of 120 psf per foot of abutment depth should be utilized. For the active condition, the equivalent pressure can be reduced to 80 psf per foot of wall depth. Since this pressure is assumed to be uniformly distributed, the resultant force should be assumed at mid-height of the abutment wall.

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

terminate approximately 24 inches below the finish subgrade elevation for the approach slabs or surface grades. A cohesive fill cap is recommended for the top 24 inches in order to prevent direct surface water infiltration.

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

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

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

Ground Water Control and Drainage

Free water was observed to depths of about 6 and 13.5 feet below the existing grades at the test boring locations B-002 and B-003 during field drilling operations, respectively. It is expected that ground water may be encountered during foundation excavation. Therefore, dewatering will be required to maintain ground water levels below the bearing depth of the abutments and the foundations for the headwalls. Adequate dewatering procedures as dictated by the field conditions should be employed to keep water at least 2 feet below the foundation bearing elevations for the abutments.

Scour Analysis Parameters:

The following soil parameters can be utilized for the scour analysis at the proposed culvert location:

Boring No.	Sample #	Depths (ft)	D_{50} mm	D_{95} mm
B-002	SS-4	1030.0-1028.5	0.0282	15.4279
	SS-5	1028.5-1027.0	0.0274	15.5379
	SS-6	1027.0-1025.5	0.0292	13.5812
	SS-7	1025.5-1024.0	0.1199	6.6151
B-003	SS-4	1030.0-1028.5	0.0234	21.0847
	SS-5	1028.5-1027.0	0.0170	9.9959
	SS-6	1027.0-1025.5	0.6140	11.0725
	SS-7	1025.5-1024.0	0.5628	10.9606

REPORT LIMITATIONS

The recommendations submitted in this report are based on the available subsurface information obtained by PSI and design details furnished by ODOT District-3 for the proposed Center Street Bridge Widening Project. If there are any revisions to the plans for the proposed building structure or pavement areas, or if deviations from the subsurface conditions noted in this report are encountered during construction, PSI should be retained to determine if changes in the recommendations are required. If PSI is not retained to perform these functions, PSI will not be responsible for the impact of those conditions on the geotechnical recommendations for the project.

The Geotechnical Engineer warrants that the findings, recommendations, specifications, or professional advice contained herein, have been presented after being prepared in accordance with generally accepted professional engineering practice in the fields of foundation engineering, soil mechanics and engineering geology. No other warranties are implied or expressed.

After the plans and specifications are complete, it is recommended that PSI be provided the opportunity to review the final design and specifications, in order to verify that the earthwork and recommendations are properly interpreted and implemented. At that time, it may be necessary to submit supplementary recommendations. This report has been prepared for the exclusive use of ODOT District-3 for the specific application to the proposed State Route 94 Bridge Replacement Project (PID 90938) over Wolf Creek Tributary, in Sharon Center, Medina County, Ohio.

APPENDIX

Boring Location Plan

GB-1 Subgrade Analysis

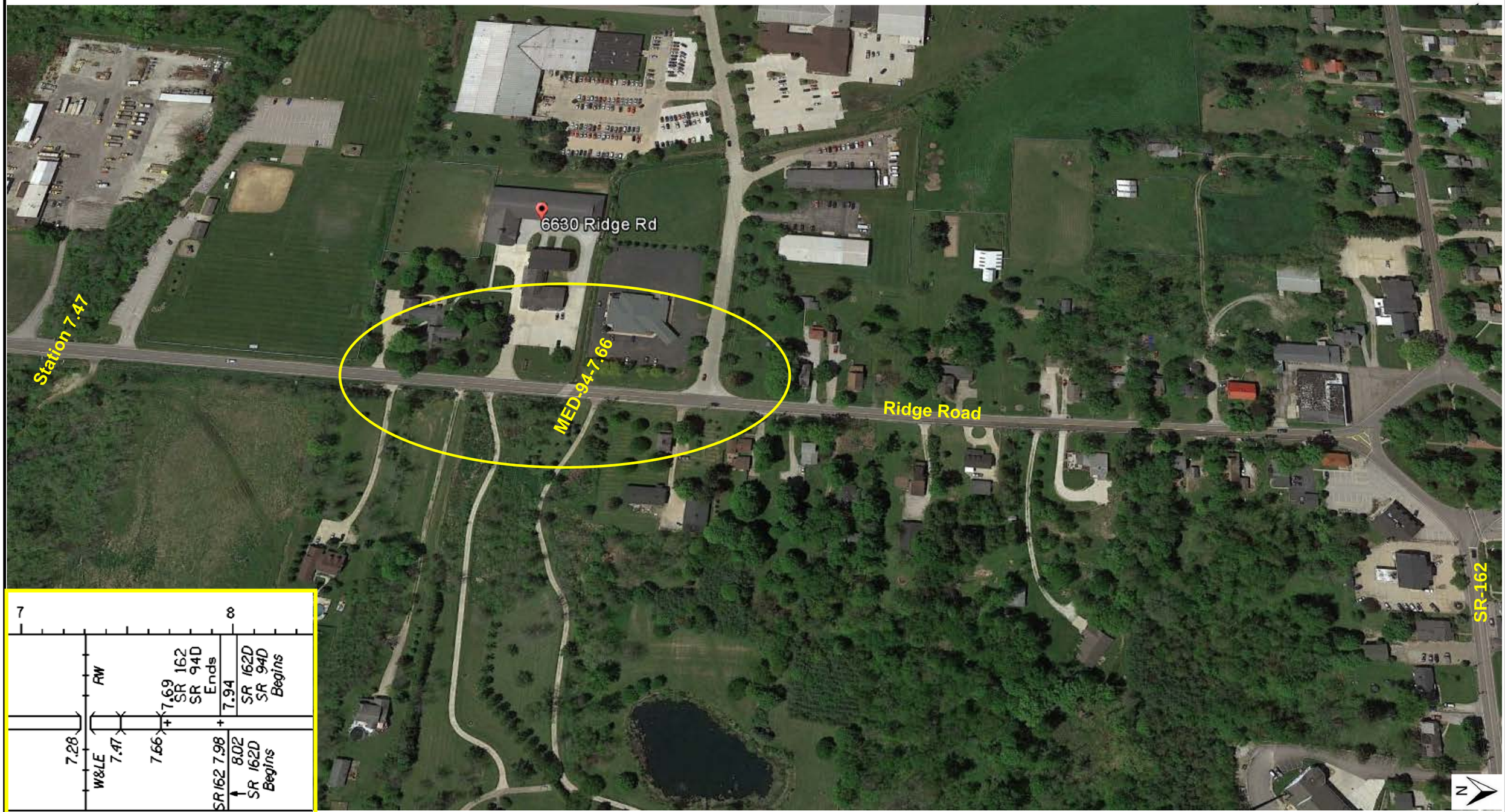
Bridge Boring Logs

Pavement Core Photo Logs

D-50 Values

ODOT Quick Reference for Visual Descriptions of Soils

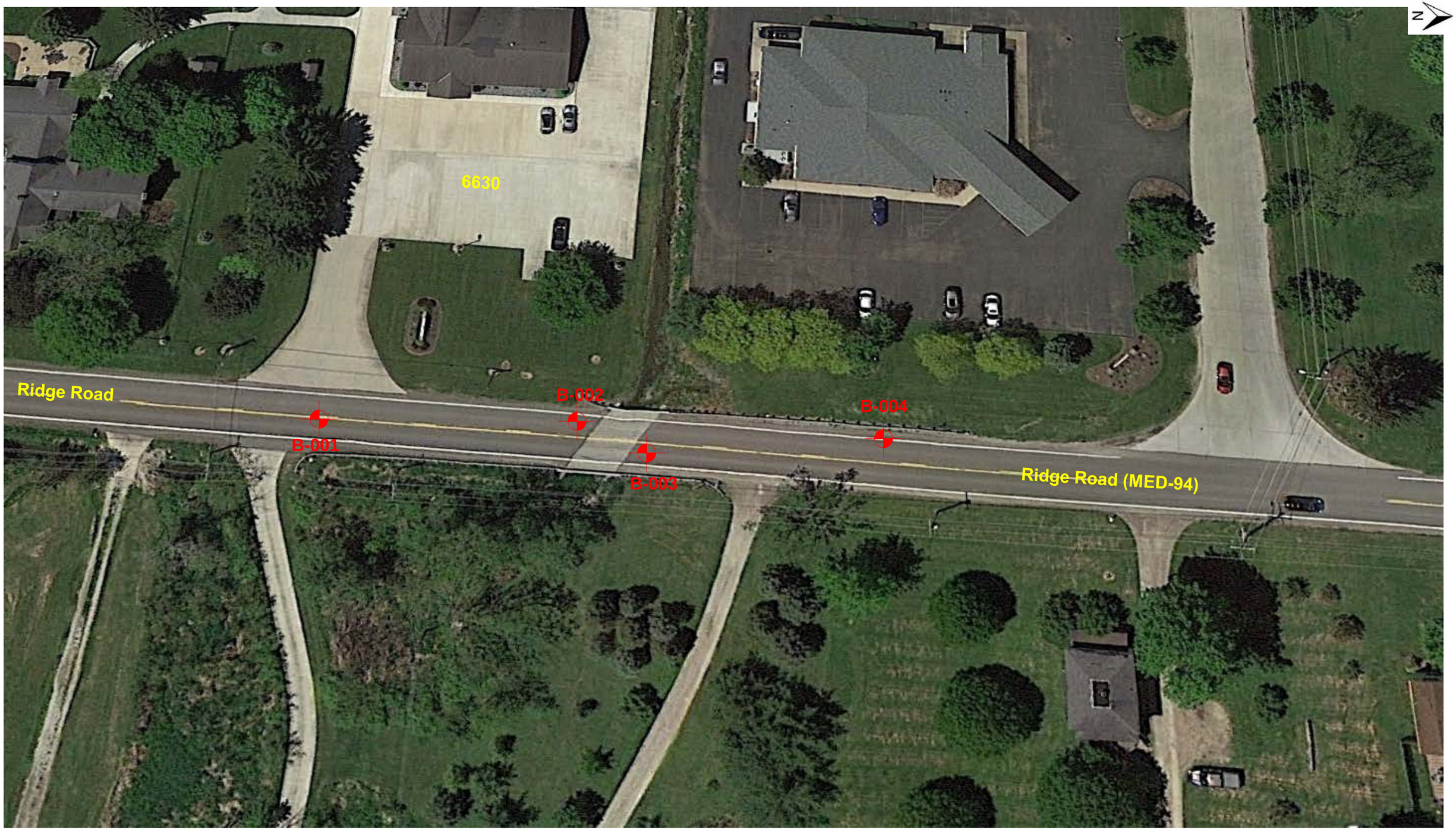
ODOT Classification of Soils



Intertek psi

Bridge Replacement at MED-94-7.66,
PID No.: 90938, TO No: 19048-35
Sharon Center, Medina County, Ohio

Date: 10/6/17	**Site Location Plan**
Drawn By: ST	
Scale: NA	PSI Project No: 0142-1650



Intertek psi

Bridge Replacement at MED-94-7.66,
PID No.: 90938, TO No: 19048-35
Sharon Center, Medina County, Ohio

Date: 10/6/17
Drawn By: ST
Scale: NA

Bore Location Plan

PSI Project No: 0142-1650

OHIO DEPARTMENT OF TRANSPORTATION

Subgrade Analysis

V. 14.00 7/21/2017

PID:	90938
Alignment:	MED-94-7.66
County-Route-Section:	7.66
No. of Borings:	4
No. of Rigs:	1

Geotechnical Consultant:	Professional Service Industries,Inc.
Prepared By:	Surya Thapa, PE
Date prepared:	12/1/2017

Rig	A																								
ER	95																								

Chemical Stabilization Options		
320	Rubblize & Roll	No
206	Cement Stabilization	Option
	Lime Stabilization	No
206	Depth	15''

Excavate and Replace Stabilization Options	
Global Geotextile (N_{60L}, HP)	#N/A
Global Geogrid (N_{60L}, HP)	#N/A

Design CBR	**7**

% Borings			
$N_{60L} \leq 5$	19%	HP ≤ 0.5	0%
$N_{60L} < 12$	25%	0.5 ≤ HP < 1	0%
$12 \leq N_{60L} < 15$	0%	1 ≤ HP < 2	0%
$N_{60L} \geq 20$	0%	HP ≥ 2	0%
M+	13%		
Rock	13%		
Unsuitable	13%		

Excavate and Replace at Surface	
Average	
Maximum	0''
Minimum	0''

% Surface	
Unstable & Unsuitable	0%
Unstable	50%
Unsuitable	0%

	N_{60}	N_{60L}	HP	LL	PL	PI	Silt	Clay	P 200	M_C	M_{OPT}	GI
Average	10	5		21	16	5	39	19	58	22	11	6
Maximum	28	6	0.00	24	17	9	46	30	69	49	14	8
Minimum	5	5	0.00	18	14	3	28	11	43	11	10	2

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	1	0	0	0	0	0	14	0	0	1	0	0	0	0	0	16
Percent	0%	0%	0%	6%	0%	0%	0%	0%	0%	88%	0%	0%	6%	0%	0%	0%	0%	0%	100%
% Rock|Cohesive|Granular	0%	94%									6%								100%
Surface Class Count	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Surface Class Percent																			0%

OHIO DEPARTMENT OF TRANSPORTATION

Subgrade Analysis

V. 14.00 7/21/2017

#	Boring ID	Station	Offset	Dir	Boring EL.	Proposed Subgrade EL	Cut Fill	Rig
1	B-001-0-17	403+22	2	RT	1038.00	1038.00	0.00 F	A
2	B-002-0-17	404+27	5	LT	1038.50	1038.50	0.00 F	A
3	B-003-0-17	404+63	3	RT	1038.50	1038.50	0.00 F	A
4	B-004-0-17	405+58	10	LT	1039.00	1039.00	0.00 F	A

#	Boring ID	Station	Offset	Dir	Boring EL.	Proposed Subgrade EL	Cut Fill	Rig

OHIO DEPARTMENT OF TRANSPORTATION

Subgrade Analysis

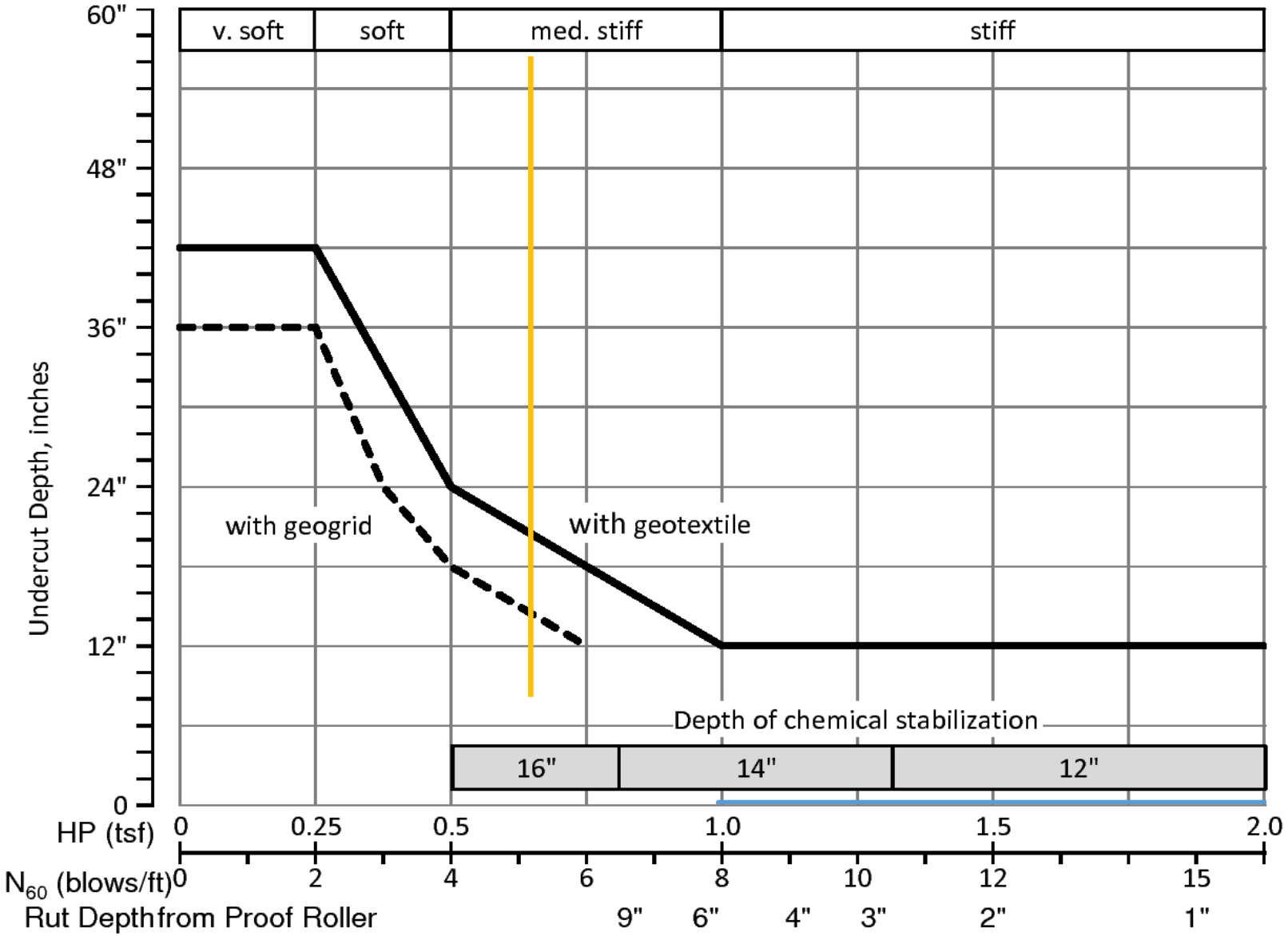
V. 14.00 7/21/2017

#	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
			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	1	1.4	2.9	1.4	2.9	28			18	15	3	28	15	43	11	10	A-4a	2						
	001-0	2	2.9	4.4	2.9	4.4	8			21	16	5	44	16	60	18	11	A-4a	5						
	17	3	4.4	5.9	4.4	5.9	6									36	10	A-4a	8						
		4	5.9	7.4	5.9	7.4	9	6								24	10	A-4a							
2	B	1	1.0	2.5	1.0	2.5	8			23	17	6	46	23	69	19	12	A-4a	7			N_{60} & Mc		18''	
	002-0	2	3.5	5.0	3.5	5.0	6									14	10	A-4a	8						
	17	3	6.0	7.5	6.0	7.5	5			24	17	7	33	11	44	18	12	A-4a							
		4	8.5	10.0	8.5	10.0	13	5								15	14	A-6a							
3	B	1	1.3	2.8	1.3	2.8	16									19	10	A-4a	8			Mc			
	003-0	2	3.5	5.0	3.5	5.0	9			19	16	3	28	30	58	15	11	A-4a	5						
	17	3	6.0	7.5	6.0	7.5	5			19	16	3	44	16	60	21	11	A-4a							
		4	8.5	10.0	8.5	10.0	8	5		23	14	9	39	27	66	13	10	A-4a							
4	B	1	1.2	2.7	1.2	2.7	24			NP	NP	NP	43	15	58	13	11	A-4a	5						
	004-0	2	2.7	4.2	2.7	4.2	11			NP	NP	NP	45	18	63	17	11	A-4a	6						
	17	3	4.2	5.7	4.2	5.7	5									49	10	A-4a	8						
		4	5.7	7.2	5.7	7.2	5	5								48	10	A-2-4							

GB1 Figure B – Subgrade Stabilization

Subgrade Analysis

V. 14.00 9/2/2016



OVERRIDE TABLE

Calculated	New Values	Check to Override
	0.50	☐ HP
5.25	3.00	☐ N60L

Average HP

Average N_{60L}

PROJECT: MED-94-7.66 RIDGE ROAD	DRILLING FIRM / OPERATOR: PSI / KEITH	DRILL RIG: D-50 (15)	STATION / OFFSET: 403+22, 2 RT	EXPLORATION ID B-001
TYPE: BRIDGE REPLACEMENT	SAMPLING FIRM / LOGGER: PSI / JOE	HAMMER: DIEDRICH AUTOMATIC	ALIGNMENT: RIDGE ROAD	
PID: 90938 BR ID: MED-94-7.66	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 7/14/15	ELEVATION: 1038.0 (MSL) EOB: 7.4 ft.	PAGE 1 OF 1
START: 11/14/17 END: 11/14/17	SAMPLING METHOD: SPT	ENERGY RATIO (%): 94.6	LAT / LONG: 41.094403000, -81.735558000	

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)	BACK FILL
8" ASPHALT PAVEMENT OVER 8" CONCRETE BASE	1038.0																	
	1036.6	1																
VERY STIFF, BROWN, **SANDY SILT**, SAND, GRAVEL, LITTLE CLAY, MOIST		2	6 12 6	28	83	SS-1	-	37	15	5	28	15	18	15	3	11	A-4a (2)	
** MEDIUM STIFF, LITTLE GRAVEL @ 2.8'		3	4 3 2	8	83	SS-2	-	19	15	6	44	16	21	16	5	18	A-4a (5)	
		4																
** GRAY, LITTLE ORGANICS AND WOOD FRAGMENTS @ 4.3'		5	3 1 3	6	78	SS-3	-	-	-	-	-	-	-	-	-	36	A-4a (V)	
** STIFF @ 5.8'		6																
	1030.6	7 EOB	3 3 3	9	89	SS-4	-	-	-	-	-	-	-	-	-	24	A-4a (V)	

NOTES: NONE

ABANDONMENT METHODS, MATERIALS, QUANTITIES: NOT RECORDED

PROJECT: MED-94-7.66 RIDGE ROAD	DRILLING FIRM / OPERATOR: PSI / KEITH	DRILL RIG: D-50 (15)	STATION / OFFSET: 404+27, 5 LT
TYPE: BRIDGE REPLACEMENT	SAMPLING FIRM / LOGGER: PSI / JOE	HAMMER: DIEDRICH AUTOMATIC	ALIGNMENT: RIDGE ROAD
PID: 90938 BR ID: MED-94-7.66	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 7/14/15	ELEVATION: 1038.5 (MSL) EOB: 98.8 ft.
START: 11/8/17 END: 11/8/17	SAMPLING METHOD: SPT	ENERGY RATIO (%): 94.6	LAT / LONG: 41.094700000, -81.735594000

EXPLORATION ID B-002

MATERIAL DESCRIPTION AND NOTES	ELEV. 1038.5	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	BACK FILL
6" ASPHALT PAVEMENT OVER 6" CONCRETE BASE	1037.5																	
MEDIUM STIFF, GRAY, **SANDY SILT**, SOME CLAY, TRACE GRAVEL, MOIST		1	3 2 3	8	67	SS-1	-	5	16	10	46	23	23	17	6	19	A-4a (7)	
		2																
		3																
		4	1 2 2	6	89	SS-2	-	-	-	-	-	-	-	-	-	14	A-4a (V)	
		5																
** SOME GRAVEL, LITTLE CLAY @ 6.0'		W 6																
		7	2 1 2	5	67	SS-3	-	35	14	7	33	11	24	17	7	18	A-4a (2)	
	1030.0	8																
STIFF, GRAY, **SILT AND CLAY**, LITTLE SAND, LITTLE GRAVEL, MOIST		9	3 3 5	13	89	SS-4	-	20	10	5	37	28	25	14	11	15	A-6a (6)	
		10																
		11	3 5 3	13	89	SS-5	-	19	10	5	38	28	26	15	11	14	A-6a (7)	
		12	6 5 6	17	89	SS-6	-	19	15	5	33	28	26	15	11	14	A-6a (6)	
	1025.0	13																
MEDIUM DENSE, GRAY, **SANDY SILT**, LITTLE GRAVEL, TRACE CLAY, WET		14	5 6 6	19	100	SS-7	-	13	28	12	38	9	21	19	2	17	A-4a (2)	
		15																
		16																
	1020.0	17																
MEDIUM STIFF, GRAY, **SILT**, TRACE SAND, TRACE CLAY, WET		18																
		19	2 3 3	9	72	SS-8	-	-	-	-	-	-	-	-	-	27	A-4b (V)	
		20																
		21																
		22																
		23																
		24	2 4 2	9	67	SS-9	-	-	-	-	-	-	-	-	-	26	A-4b (V)	
		25																
		26																
		27																
	1010.0	28																
MEDIUM STIFF, GRAY, **SILT AND CLAY**, TRACE SAND, TRACE GRAVEL, MOIST		29	3 2 2	6	100	SS-10	-	-	-	-	-	-	-	-	-	24	A-6a (V)	

PID: 90938	BR ID: MED-94-7.66	PROJECT: MED-94-7.66 RIDGE ROAD	STATION / OFFSET: 404+27, 5 LT	START: 11/8/17	END: 11/8/17	PG 2 OF 4	B-002

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)	BACK FILL
MEDIUM STIFF, GRAY, **SILT AND CLAY**, TRACE SAND, TRACE GRAVEL, MOIST *(continued)*	1008.5	31																
		32																
		33																
** STIFF @ 33.5'		34	2 4 4	13	89	SS-11	-	-	-	-	-	-	-	-	-	21	A-6a (V)	
		35																
		36																
		37																
		38																
		39	5 5 5	16	67	SS-12	-	-	-	-	-	-	-	-	-	14	A-6a (V)	
		40																
		41																
		42																
	995.0	43																
STIFF, GRAY, **SILT**, SOME SAND, TRACE CLAY, WET		44	8 6 4	16	100	SS-13	-	-	-	-	-	-	-	-	-	23	A-4b (V)	
		45																
		46																
		47																
		48																
		49	3 5 7	19	50	SS-14	-	-	-	-	-	-	-	-	-	14	A-4b (V)	
		50																
		51																
		52																
	985.0	53																
HARD, GRAY, **SILT AND CLAY**, TRACE SAND, TRACE GRAVEL, MOIST		54	12 15 13	44	89	SS-15	-	-	-	-	-	-	-	-	-	11	A-6a (V)	
		55																
		56																
		57																
		58																
		59	50	-	100	SS-16	-	-	-	-	-	-	-	-	-	12	A-6a (V)	
		60																
		61																

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)	BACK FILL
HARD, GRAY, **SILT AND CLAY**, TRACE SAND, TRACE GRAVEL, MOIST *(continued)*	976.4	63																
** VERY STIFF @ 63.5'		64	3 5 8	20	67	SS-17	-	-	-	-	-	-	-	-	-	12	A-6a (V)	
		65																
		66																
		67																
		68																
** HARD @ 68.5		69	7 21 27	76	89	SS-18	-	-	-	-	-	-	-	-	-	8	A-6a (V)	
		70																
		71																
		72																
		73																
		74	42 50	-	100	SS-19	-	-	-	-	-	-	-	-	-	7	A-6a (V)	
		75																
		76																
		77																
		78																
		79	37 66	-	100	SS-20	-	-	-	-	-	-	-	-	-	8	A-6a (V)	
		80																
		81																
		82																
		83																
VERY DENSE, GRAY, **GRAVEL WITH SAND AND SILT**, TRACE CLAY, MOIST	955.0	84	33 50/5"	-	91	SS-21	-	-	-	-	-	-	-	-	-	14	A-2-4 (V)	
		85																
		86																
		87																
		88																
		89	50	-	100	SS-22	-	-	-	-	-	-	-	-	-	10	A-2-4 (V)	
		90																
		91																
		92																
		93																
	945.0	94	50	-	100	SS-23	-	-	-	-	-	-	-	-	-	9	A-6a (V)	

PID: 90938	BR ID: MED-94-7.66	PROJECT: MED-94-7.66 RIDGE ROAD	STATION / OFFSET: 404+27, 5 LT	START: 11/8/17	END: 11/8/17	PG 4 OF 4	B-002

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)	BACK FILL
HARD, GRAY, **SILT AND CLAY**, TRACE GRAVEL, TRACE SAND, MOIST *(continued)*	944.2	95	50/3"															
		96																
		97																
		98																
	939.7	EOB	50/3"	-	100	SS-24	-	-	-	-	-	-	-	-	-	11	A-6a (V)	

NOTES: NONE

ABANDONMENT METHODS, MATERIALS, QUANTITIES: NOT RECORDED

PROJECT: MED-94-7.66 RIDGE ROAD
TYPE: BRIDGE REPLACEMENT
PID: 90938 BR ID: MED-94-7.66
START: 11/13/17 END: 11/13/17

DRILLING FIRM / OPERATOR: PSI / KEITH
SAMPLING FIRM / LOGGER: PSI / JOE
DRILLING METHOD: 3.25" HSA
SAMPLING METHOD: SPT

DRILL RIG: D-50 (15)
HAMMER: DIEDRICH AUTOMATIC
CALIBRATION DATE: 7/14/15
ENERGY RATIO (%): 94.6

STATION / OFFSET: 404+63, 3 RT
ALIGNMENT: RIDGE ROAD
ELEVATION: 1038.5 (MSL) EOB: 68.9 ft.
LAT / LONG: 41.094778000, -81.735561000

EXPLORATION ID B-003

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)	BACK FILL
4" ASPHALT CONCTE OVER 11" BROKEN COMCRETE BASE	1038.5																	
	1037.3																	
VERY STIFF, BROWN, **SANDY SILT**, SOME CLAY, LITTLE GRAVEL, MOIST		1																
		2	11 8 2	16	67	SS-1	-	-	-	-	-	-	-	-	-	19	A-4a (V)	
		3																
** STIFF @ 3.5'		4	2 4 2	9	72	SS-2	-	15	19	8	28	30	19	16	3	15	A-4a (5)	
		5																
** MEDIUM STIFF, SOME GRAVEL, LITTLE CLAY @ 6.0'		6																
		7	3 1 2	5	6	SS-3	-	21	13	6	44	16	19	16	3	21	A-4a (5)	
		8																
** STIFF, SOME CLAY @ 8.5'		9	3 1 4	8	50	SS-4	-	23	7	4	39	27	23	14	9	13	A-4a (6)	
		10																
		11	1 3 4	11	89	SS-5	-	15	19	8	28	30	23	17	6	14	A-4a (5)	
		12	4 5 6	17	89	SS-6	-	34	22	5	30	9	24	16	8	15	A-4a (1)	
	W	13																
** VERY STIFF, TRACE CLAY @ 13.5'		14	6 6 6	19	89	SS-7	-	32	23	5	31	9	24	17	7	15	A-4a (1)	
		15																
		16																
		17																
		18																
	1020.0																	
STIFF, GRAY, **SILT AND CLAY**, TRACE SAND, TRACE GRAVEL, WET		19	3 4 6	16	44	SS-8	-	-	-	-	-	-	-	-	-	31	A-6a (V)	
		20																
		21																
		22																
		23																
		24	3 4 5	14	94	SS-9	-	-	-	-	-	-	-	-	-	26	A-6a (V)	
		25																
		26																
		27																
		28																
		29	3 3 4	11	83	SS-10	-	-	-	-	-	-	-	-	-	26	A-6a (V)	

PID: 90938	BR ID: MED-94-7.66	PROJECT: MED-94-7.66 RIDGE ROAD	STATION / OFFSET: 404+63, 3 RT	START: 11/13/17	END: 11/13/17	PG 2 OF 3	B-003

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)	BACK FILL
STIFF, GRAY, **SILT AND CLAY**, TRACE SAND, TRACE GRAVEL, WET *(continued)*	1008.5	31																
		32																
		33																
		34	3 3 5	13	83	SS-11	-	-	-	-	-	-	-	-	-	22	A-6a (V)	
		35																
		36																
		37																
		38																
HARD, GRAY, **SILT**, SOME SAND, TRACE CLAY, WET	1000.0	39	7 50	-	33	SS-12	-	-	-	-	-	-	-	-	-	22	A-4b (V)	
		40																
		41																
		42																
		43																
VERY STIFF, GRAY, **SILT AND CLAY**, SOME SAND, TRACE GRAVEL, MOIST	995.0	44	8 13 6	30	33	SS-13	-	-	-	-	-	-	-	-	-	15	A-6a (V)	
		45																
		46																
		47																
		48																
		49	6 8 11	30	67	SS-14	-	-	-	-	-	-	-	-	-	21	A-6a (V)	
		50																
		51																
		52																
		53																
** HARD @ 53.5		54	16 31 42	115	72	SS-15	-	-	-	-	-	-	-	-	-	14	A-6a (V)	
		55																
		56																
		57																
		58																
		59	41 50/5"	-	55	SS-16	-	-	-	-	-	-	-	-	-	20	A-6a (V)	
		60																
		61																

PID: 90938	BR ID: MED-94-7.66	PROJECT: MED-94-7.66 RIDGE ROAD	STATION / OFFSET: 404+63, 3 RT	START: 11/13/17	END: 11/13/17	PG 3 OF 3	B-003

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)	BACK FILL
VERY STIFF, GRAY, **SILT AND CLAY**, SOME SAND, TRACE GRAVEL, MOIST *(continued)*	976.4	63																
		64	30 41 50/5"	-	71	SS-17	-	-	-	-	-	-	-	-	-	10	A-6a (V)	
		65																
		66																
		67																
		68																
	969.6	EOB	50/4"	-	100	SS-18	-	-	-	-	-	-	-	-	-	7	A-6a (V)	

NOTES: NONE

ABANDONMENT METHODS, MATERIALS, QUANTITIES: NOT RECORDED

PROJECT: MED-94-7.66 RIDGE ROAD
TYPE: BRIDGE REPLACEMENT
PID: 90938 BR ID: MED-94-7.66
START: 11/14/17 END: 11/14/17

DRILLING FIRM / OPERATOR: PSI / KEITH
SAMPLING FIRM / LOGGER: PSI / JOE
DRILLING METHOD: 3.25" HSA
SAMPLING METHOD: SPT

DRILL RIG: D-50 (15)
HAMMER: DIEDRICH AUTOMATIC
CALIBRATION DATE: 7/14/15
ENERGY RATIO (%): 94.6

STATION / OFFSET: 405+58, 10 LT
ALIGNMENT: RIDGE ROAD
ELEVATION: 1039.0 (MSL) EOB: 7.2 ft.
LAT / LONG: 41.095042000, -81.735606000

EXPLORATION ID B-004

MATERIAL DESCRIPTION AND NOTES	ELEV. 1039.0	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	BACK FILL
8" ASPHALT PAVEMENT OVER 6.5" CONCRETE BASE	1037.8	1																
VERY STIFF, BROWN, **SANDY SILT**, LITTLE CLAY, TRACE GRAVEL, MOIST		2	6 7 8	24	83	SS-1	-	9	22	11	43	15	NP	NP	NP	13	A-4a (5)	
** STIFF @ 2.9		3	8 4 3	11	83	SS-2	-	12	16	9	45	18	NP	NP	NP	17	A-4a (6)	
** MEDIUM STIFF, GRAY, LITTLE ORGANICS AND WOOD FRAGMENTS @ 4.3'	1033.4	4 5	4 2 1	5	78	SS-3	-	-	-	-	-	-	-	-	-	49	A-4a (V)	
VERY LOOSE, GRAY, **GRAVEL WITH SAND AND SILT**, MOIST	1031.8	6 EOB 7	2 2 1	5	89	SS-4	-	-	-	-	-	-	-	-	-	48	A-2-4 (V)	

NOTES: NONE

ABANDONMENT METHODS, MATERIALS, QUANTITIES: NOT RECORDED

Pavement Photo C-1

Pavement Photo C-2

Intertek psi	Proposed Bridge Replacement MED-94-7.66 PID No.: 90938, Task Order No.: 19048-35 Sharon Center, Medina County, Ohio			**Pavement Photo Log**
	Scale: NA	**Taken By:** ST	**Date:** 11/29/2017	**PSI Project No:** 0142-1650

Pavement Photo C-3

Pavement Photo C-4

Intertek psi	Proposed Bridge Replacement MED-94-7.66 PID No.: 90938, Task Order No.: 19048-35 Sharon Center, Medina County, Ohio			**Pavement Photo Log**
	Scale: NA	**Taken By:** ST	**Date:** 11/29/2017	**PSI Project No:** 0142-1650

D-50 Values

Professional Service Industries, Inc.

PROJECT MED-94-7.66 RIDGE ROAD **PID** 90938

OGE NUMBER 0142-1650 **PROJECT TYPE** Bridge Replacement

BORING NUMBER	SAMPLE NUMBER	ELEVATION	D-50 VALUE (mm)	D-95 VALUE (mm)
B-002	SS-4	1030.0 - 1028.5	0.0282	15.4279
	SS-5	1028.5 - 1027.0	0.0274	15.5393
	SS-6	1027.0 - 1025.5	0.0292	13.5812
	SS-7	1025.5 - 1024.0	0.1199	6.6151
B-003	SS-4	1030.0 - 1028.5	0.0234	21.0847
	SS-5	1028.5 - 1027.0	0.017	9.9959
	SS-6	1027.0 - 1025.5	0.614	11.0725
	SS-7	1025.5 - 1024.0	0.5628	10.9606

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 x 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	
F.S.	Fine Sand	A-3			51 Min.	10 Max.	NON-PLASTIC		0	
	Coarse and Fine Sand	--	A-3a			35 Max.		6 Max.	0	Min. of 50% combined coarse and fine sand sizes
	Gravel and/or Stone Fragments with Sand and Silt	A-2-4				35 Max.	40 Max.	10 Max.	0	
		A-2-5					41 Min.			
	Gravel and/or Stone Fragments with Sand, Silt and Clay	A-2-6				35 Max.	40 Max.	11 Min.	4	
		A-2-7					41 Min.			
	Sandy Silt	A-4	A-4a	76 Min.		36 Min.	40 Max.	10 Max.	8	Less than 50% silt sizes
	Silt	A-4	A-4b	76 Min.		50 Min.	40 Max.	10 Max.	8	50% or more silt sizes
	Elastic Silt and Clay	A-5		76 Min.		36 Min.	41 Min.	10 Max.	12	
	Silt and Clay	A-6	A-6a	76 Min.		36 Min.	40 Max.	11 - 15	10	
	Silty Clay	A-6	A-6b	76 Min.		36 Min.	40 Max.	16 Min.	16	
	Elastic Clay	A-7-5		76 Min.		36 Min.	41 Min.	$\geq$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.