Report of Preliminary Geotechnical Exploration

Epps Mill Road Interchange Project Bridge Report

TDOT Project No. 75I024-S1-010
GES File No. 7513321 / PIN No. 124683.06
Murfreesboro, Rutherford County, Tennessee

Prepared for
Neel-Schaffer, Inc.
Nashville, Tennessee

Prepared by:
TTL, Inc.
Nashville, Tennessee

Project No. 00024082902.00
September 23, 2025

September 23, 2025

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Mr. Michael Biggs, PE, CPESC
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RE: Report of Preliminary Geotechnical Exploration
Epps Mill Road Interchange Project – Bridge Report
Murfreesboro, Rutherford County, Tennessee
TTL Project No. 000240802902.00
TDOT Project No. 75I024-S1-010
GES File No. 7513321 / PIN No. 124683.06

Dear Mr. Biggs:

We have completed the preliminary geotechnical exploration for the new bridge across Interstate 24 (I-24) as part of the Epps Mill Road Interchange project in Murfreesboro, Tennessee. Our services were provided in accordance with our proposal, dated October 11, 2024. This report documents our preliminary geotechnical exploration, including results of the field exploration and laboratory testing program; presents soil and bedrock information; and provides preliminary recommendations for foundation design and construction. The report appendices provide typed boring logs, laboratory test data, and generalized geotechnical drawings. Please note that the Preliminary Geotechnical Report and supporting documents for the Epps Mill Road realignment, as well as report summarizing Pavement recommendations have been submitted under separate covers.

As always, we enjoy working with your staff and appreciate the opportunity to support your design process. If we can be of further assistance, please contact our office at your convenience.

Sincerely,

TTL, Inc.

ETHAN P. LAIRD
REGISTERED ENGINEER
AGRICULTURE
COMMERCE
No. 128060
STATE OF TENNESSEE

9/23/2025

Ethan P. Laird, PE
Project Engineer

Leanna S. Whitwell, PE
Principal Engineer

Attachments

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Site Location Map

Exploration Location Plan

Legend Sheet – Soil

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Exploration Logs

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Laboratory Results Summary

Compressive Strength of Rock

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EXECUTIVE SUMMARY

Neel-Schaffer is performing preliminary civil design for the improvements planned along Epps Mill Road in Murfreesboro, Tennessee. The improvements will be approximately 4,500 linear feet, beginning at the intersection with Capital Way and ending at the intersection with State Route 2. The improvements consist of widening and re-aligning Epps Mill Road, new on- and off-ramps along I-24, and a new bridge over I-24. The project is in the early stages of development; therefore line and grade drawings, final grades, or stationing are not available for reference in this preliminary report.

This Preliminary Geotechnical Report addresses the new bridge to be constructed to facilitate the planned re-alignment along Epps Mill Road. This report provides the results of the field exploration and laboratory testing program, soil and bedrock information for analyses, and recommendations for foundation design and construction. The report appendices provide typed boring logs and laboratory test data, including boring locations.

At this early stage of the project, we do not have enough information to provide final recommendations for the bridge foundations. Based on the available information and the preliminary geotechnical data collected, we believe driven H-piles can be used to support the planned abutments and either drilled shafts, shallow spread foundations or driven H-piles can be considered for the planned bent. Once the final design is complete, additional geotechnical exploration should be performed to confirm the final design.

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1.0 PROJECT INFORMATION

Project information was provided by Messer's Michael Biggs and Matt Lifsey (NS) in several e-mail transmissions and telephone calls. We were provided with a pdf document titled "124683.06-Concept Report 8-2-24.pdf" prepared by TDOT and STV, dated August 26, 2024. The document contained a summary of the project including a conceptual layout. We were also provided a set of drawings (11 sheets) titled "Proposed Layout," undated, prepared by NS. This drawing set shows the planned alignment and existing site grades.

Information provided suggests TDOT plans to procure a Design-Building Contractor for this project in 2026. Therefore, the project is in a preliminary design phase. We understand our services will be included as part of Owner Representative services within a Functional Design and Procurement Assistance program with final design and ultimate construction completed by the Design-Build contractor awarded the project with construction planned for 2028.

Our understanding of the project is summarized below:

1.1 Project Description

Item	Description
Project Location	The project is located along Epps Mill Road starting at Capital Way (south) and ending at State Route 2 (north) in Murfreesboro, Tennessee. Reference the Site Location Plan in Appendix A.
Proposed Improvements	We understand TDOT is planning to widen and re-align Epps Mill Road from State Route 2 (US Highway 41) to just past Capital Way (about 0.86 miles long) including ramp improvements at the interchange (Exit 89) with Interstate 24 (I-24) and a bridge replacement.
Bridge	A new bridge is planned over the I-24 to replace the existing bridge. The new bridge will be about 250 feet long and include at least one pier.
Cut and Fill Slopes	Since final details about the alignment including existing or proposed grades are not available, we have assumed maximum cut depths and fill thicknesses will be less than 5 feet relative to existing grades. However, fills approaching 30 feet may be required for the new bridge abutments.

If the above information is not correct, please contact us so that we can make the necessary modifications to this document and our evaluation and recommendations, if needed.

1.2 Scope of Services

The purposes of the services for this part of the project were to explore subsurface conditions and develop preliminary geotechnical recommendations for the bridge proposed over I-24. We drilled six soil test borings with rock coring for the new bridge and performed laboratory testing of recovered samples. Assessment of environmental conditions was beyond the scope of our services. As noted previously, our scope also included providing a preliminary geotechnical exploration for the planned roadway improvements along Epps Mill Road and Interstate 24 ramps, as well as pavement section recommendations for the project. These reports will be submitted under separate covers.

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2.0 EXPLORATION FINDINGS

2.1 Site Conditions

Item	Description
Existing Improvements	The Epps Mill Road bridge over I-24 is a two-lane bridge with one pier. The bridge is steel framed with a concrete pier, decking, and guard rails.
Current Ground Cover	The ground surface below the bridge is mostly grass covered. Asphalt pavements are present on the east and west bound travel lanes and shoulders of I-24. The slopes below the abutments are concrete covered.

Photographs depicting general conditions of the study area at the time of our field activities are shown below.

View looking south at existing Epps Mill Road Bridge

2.2 Site Geology

The Geologic Map of the Webbs Jungle Quadrangle, Tennessee, dated 1964, indicates the project site is underline by the Lebanon Limestone formation. This formation is typically a fine-grained, thinly bedded, gray, fossiliferous limestone with clay/shale partings. The limestone weathers to produce a thin layer (less than 5 feet thick) of residual soil which is typically a high plasticity clay. Glades (i.e., areas of very thin soil) are common on which only limited vegetation, other than cedar trees, will grow. This formation is susceptible to solution weathering and sinkhole development.

Limestone is susceptible to solution weathering and development of karst features, such as sinkholes. We did not observe indications of karst features or sinkholes at the site during our field activities and review of the geologic map did not indicate mapped depressions at the site. The scale of the map often precludes the mapping of smaller features and the historical development of the site could have masked indicators of karst.

Some geologic settings in Tennessee contain rock that can produce acid when degraded with water. We did not observe acid producing rock during our exploration.

A few of the borings encountered existing fill below the surface materials of the site. Fill material is typically soil, but may include rock particles, placed by the actions of man. Fill can be problematic for site development when it has not been compacted in thin lifts. Uncompacted or poorly compacted fill can be a source of unpredictable and excessive settlements or other measures of poor structural performance. Fill that has been placed without engineering observation or documentation can sometimes contain objectionable inclusions or constituents, such as fibrous organic pieces (tree trunks or brush piles), junk and debris, trash, excessively wet or high plasticity soils, or large rock boulders. When such undesirable inclusions are present, the consistency or density of the fill cannot necessarily be correlated with conventional indicators, such as drive-sample blow counts or estimates of unconfined compressive strength of cohesive soils. For this reason, consistency descriptions of fill layers are typically not included on boring logs.

2.3 Exploration Procedures

Exploratory borings and pavement cores were located in the field using a recreational grade hand-held GPS unit (Montana 680t) and should be considered approximate. Elevations of the ground surface shown on the respective logs or profiles were interpolated from topographic contours shown on the provided drawings and should be considered approximate. Surveying the test locations for vertical and horizontal control was beyond the scope of this exploration.

The borings were drilled using conventional hollow-stem auger drilling methods by an all-terrain-vehicle drill rig. Soil samples were obtained at selected depths in general accordance with the Standard Penetration Test (SPT) described in ASTM D1586. For this test, a split-barrel sampler is driven into the soil through three increments of 6 inches with blows from a 140-pound hammer falling 30 inches. The number of hammer blows required to advance the split-barrel sampler through each increment is recorded, and the sum of the final two blow counts is called the "N-value," with units of blows per foot (bpf). Where it was not possible to advance the sampler through a full 6-inch increment with 50 hammer blows, driving the sampler was terminated and the sampler penetration was measured. N-values for this condition are reported as "50/x," where x is the sampler penetration in inches. The N-values recorded during the sampling process provide an index to the strength and compressibility of the soil.

Each borehole was checked for the presence of groundwater after removing the drill tools by lowering a measuring tape down the open borehole. The depth to groundwater or the depth at which the borehole caved-in was recorded.

Where rock coring was performed, the borehole was checked for the presence of groundwater through the hollow-stem auger or drill casing after reaching auger refusal but before the start of rock coring. The borehole was again checked for the depth to water after removal of rock coring tools and casing.

Each borehole was backfilled to the ground surface with auger cuttings after making final groundwater measurements. Where rock coring was performed the borings were backfilled with bentonite chips up to the bedrock/soil interface and then cuttings were used up to the surface. Where pavements were penetrated, a patch of asphalt was applied at the surface. Auger cuttings sometimes consolidate after backfilling causing the top of the backfill column to settle and leaving an open hole at the ground surface. Return trips to the site to top-off backfill that has settled were not part of our scope of services.

2.4 Subsurface Stratigraphy

Subsurface conditions within the project limits were evaluated by drilling six exploratory borings labeled as B-01 to B-06 at the approximate locations shown on the Exploration Location Plan (ELP) in Appendix A.

The exploration methods and laboratory testing referenced below are described in Appendix B. Soil descriptions follow the Unified Soil Classification System (USCS), which is described in ASTM D2487 and D2488. Our geoprofessional also logged the recovered core samples for lithology and measured recovery (REC) and Rock Quality Designation (RQD). The results of the measurements, as well as photographs of the recovered rock core are provided in Appendix A.

Information about the subsurface stratigraphy encountered at the test locations is provided on the logs and generalized subsurface cross-section (profile) in Appendix A. The logs and profile represent our interpretation of the subsurface conditions at the test locations based on tests and observations performed during the exploration, visual classification of the soil samples by a geoprofessional, and laboratory tests conducted on select soil samples. The lines designating the interfaces between various strata on the logs and profiles represent the approximate strata boundary. The transition between strata may be gradual. Conditions may vary at locations away from or between boring locations.

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BORING SUMMARY

Boring No.	Depth to Refusal (feet)	Total Hole Depth (feet)
B-01	3-½	18-½
B-02	28-½	38-½
B-03	4-½	14-½
B-04	6-½	16-½
B-05	7-½	17-½
B-06	4-½	14-½

Information from the exploratory borings advanced is summarized in the table below.

SUMMARY OF SUBSURFACE STRATIGRAPHY

<table>
<tr><th>Stratum</th><th>Approximate Depth to Bottom of Stratum[1]</th><th>Material Description</th><th>Properties [2]</th></tr>
<tr><td rowspan="3">Surface Material</td><td>4 to 6 inches</td><td>Topsoil (absent in B-02)</td><td rowspan="3">N/A</td></tr>
<tr><td>6 inches</td><td>Asphalt (B-02 only)</td></tr>
<tr><td>16 inches</td><td>Basestone (B-02 only)</td></tr>
<tr><td>Possible Fill or Fill</td><td>3 feet to 22 feet</td><td>Lean Clay (USCS – CL), brown and red-brown, with variable amounts of chert and limestone fragments and black mineral staining, moist
OR
Fat Clay (USCS – CH), dark brown and red-brown, with variable amounts of chert and limestone fragments and black mineral staining, moist</td><td>N-values: 7 to 29 bpf, with most between 9 and 15 bpf
MC: 18% to 27%
LL: 45 and 62
PI: 25 and 36</td></tr>
<tr><td>Residuum
(Present in B-02 and B-05 only)</td><td>Auger Refusal Depths</td><td>Fat Clay (USCS – CH) soft to very stiff, red with some light brown mottling, with some to abundant chert gravel, moist</td><td>N-values: 9 bpf and 26 bpf
MC: 12% to 46%, with most between 28%
LL: 61
PI: 34</td></tr>
<tr><td colspan="4">Auger refusal was encountered at depths ranging between 3-½ and 7-½ feet below existing grades at each location except for boring B-02 which encountered auger refusal at 28-½ feet below existing grades.</td></tr>
<tr><td>Weathered Bedrock
(Present in B-04 and B-06 only)</td><td>6-½ to 8-½ feet</td><td>Weathered Limestone, moderately hard, gray, fine to medium grained, thin bedded, highly fractured</td><td>RQD: 9%
REC: 56%</td></tr>
<tr><td>Bedrock</td><td colspan="2">Limestone, moderately hard, gray, fine to medium grained, thin to medium bedded, moderately fractured, slightly weathered to fresh, with shale partings throughout</td><td>RQD: 26% to 86%
REC: 88% to 100%</td></tr>
<tr><td colspan="4">[1] Depths rounded to the nearest half-foot or nearest inch.
[2] Includes N-values of applicable samples, not including amplified N-values, bpf = blows per foot, MC = Moisture Content, LL = Liquid Limit, PI = Plasticity Index. REC = recovered rock core and RQD = rock quality designation</td></tr>
</table>

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SUMMARY OF BORING EXTENDED INTO BEDROCK

Boring No.	Auger Refusal and Start of Rock Core Depth (feet)	Length of Rock Core (feet)	Bottom of Hole Depth (feet)
B-01	3-½	15	18-½
B-02	28-½	10	38-½
B-03	4-½	10	14-½
B-04	6-½	10	16-½
B-05	7-½	10	17-½
B-06	4-½	10	14-½

2.5 Laboratory Testing and Results

Laboratory testing was performed in general accordance with ASTM and/or AASHTO procedures. Our geoprofessional reviewed the boring results and selected samples for laboratory testing to best represent the goals of the testing program. Laboratory testing included soils classification testing (Atterberg Limits) and natural moisture content testing. Some of the rock samples were selected for unconfined compressive strength, which are summarized in the table below.

SUMMARY OF UNCONFINED COMPRESSIVE STRENGTH OF ROCK

Boring No.	Test Depth (feet)*	Unconfined Compressive Strength (psi)
B-01	8 to 8-½	7,460
B-02	35 to 35-½	6,730
B-03	6-½ to 7	3,750
B-04	9-½ to 10	3,340
	15-½ to 16	5,850
B-05	15 to 15-½	5,950
B-06	12-½ to 13	3,100
*Depths rounded to nearest ½ foot		

Complete rock laboratory test results are provided in Appendix A.

2.6 Groundwater Conditions

Groundwater was not encountered in the borings at refusal depths. Water level measurements made in the borings after rock coring was completed was encountered at depths ranging between 1 and 3 feet below ground surface (bgs), except for B-02 where the water level was measured at 13 feet bgs. In our opinion, the water levels were likely influenced by fluids introduced into the borehole during rock coring.

The groundwater surface can fluctuate throughout the year due to seasonal changes in climate, precipitation, vegetation, surface runoff, water levels in nearby water bodies, and other factors. The groundwater level below the site may fluctuate in response to such changes and be different after the exploration.

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3.0 PRELIMINARY FOUNDATION COMMENTS

The project is in a preliminary design phase. We do not have enough information to make a final selection of the foundation system appropriate to support the planned bridge. We have developed our preliminary foundation recommendations based on the available data and experience with similar projects.

3.1 Abutments

In our experience, it is standard practice in the middle Tennessee area to support bridge abutments using steel H-piles. End bearing H-piles may be considered, but our rock coring data shows the upper few feet of the bedrock is weathered and contains soil seems. Therefore, standard TDOT Structures Division bridge design practice for abutments is to place H-piles into oversized pre-drilled holes then backfilled with approved clean sand to surround the pile. Bearing depths and total pile lengths should be determined during the design phase geotechnical report.

3.2 Piers

Foundation options to support the piers include spread footings, steel H-piles, and drilled shafts. However, spread foundations may not be suitable for this project given the relatively weathered zones of the upper bedrock encountered in the borings. Final foundation depths and rock socket lengths should be determined during the design phase geotechnical report.

3.3 Seismic Site Class

We used the N-value approach applied to the generalized subsurface profile across the bridge site to determine Seismic Site Class C according to Section 3.10.3.1 of AASHTO LRFD Bridge Specification, 9th Editions Table 3.10.3.1-1 Site Class Definitions may be used for the preliminary design of the bridge. If seismic design parameters based on the recommended site class produces excessive forces or an unfavorable Seismic Design Category, it may be possible to reduce the seismic design parameters by performing additional testing during the design phase geotechnical exploration.

4.0 ADDITIONAL EXPLORATION

We recommend additional exploration be performed at the site once additional project information is available and prior to final design and construction. The additional geotechnical exploration should include a sufficient number of borings with rock coring to assess bedrock quality and finalize foundation design and construction recommendations.

5.0 CLOSING

The preliminary analyses and information submitted in this report are based upon the data obtained from soil borings at the approximate locations shown on the appended test location plans and generalized profiles, as well as on a general understanding of the project scope. As the design process advances, we welcome the opportunity to refine and update geotechnical information to fit the project's specific needs.

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This report does not reflect any variations which may occur away from the location of borings. The nature and extent of variations may not become evident until construction has begun. If variations are then evident, it will be necessary for us to re-evaluate the recommendations of this report after we have conducted further evaluation of the situation.

Sampling and testing of the soil, rock, groundwater, surface water, and air for the presence of environmental contamination was beyond the scope of this exploration.

All information (written or electronic) from TTL concerning TTL's work is for the sole use and reliance of the client. TTL intends no third-party beneficiaries (expressed or implied) and copies of such information received by any third parties are not for reliance unless TTL first receives a signed Secondary Client Agreement from the third party.

Additional information about the use and limitations of a geotechnical report is provided within the Geoprofessional Business Association document included at the end of this report.

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Important Information about This

Geotechnical-Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.

While you cannot eliminate all such risks, you can manage them. The following information is provided to help.

The Geoprofessional Business Association (GBA) has prepared this advisory to help you – assumedly a client representative – interpret and apply this geotechnical-engineering report as effectively as possible. In that way, you can benefit from a lowered exposure to problems associated with subsurface conditions at project sites and development of them that, for decades, have been a principal cause of construction delays, cost overruns, claims, and disputes. If you have questions or want more information about any of the issues discussed herein, contact your GBA-member geotechnical engineer. Active engagement in GBA exposes geotechnical engineers to a wide array of risk-confrontation techniques that can be of genuine benefit for everyone involved with a construction project.

Understand the Geotechnical-Engineering Services Provided for this Report

Geotechnical-engineering services typically include the planning, collection, interpretation, and analysis of exploratory data from widely spaced borings and/or test pits. Field data are combined with results from laboratory tests of soil and rock samples obtained from field exploration (if applicable), observations made during site reconnaissance, and historical information to form one or more models of the expected subsurface conditions beneath the site. Local geology and alterations of the site surface and subsurface by previous and proposed construction are also important considerations. Geotechnical engineers apply their engineering training, experience, and judgment to adapt the requirements of the prospective project to the subsurface model(s). Estimates are made of the subsurface conditions that will likely be exposed during construction as well as the expected performance of foundations and other structures being planned and/or affected by construction activities.

The culmination of these geotechnical-engineering services is typically a geotechnical-engineering report providing the data obtained, a discussion of the subsurface model(s), the engineering and geologic engineering assessments and analyses made, and the recommendations developed to satisfy the given requirements of the project. These reports may be titled investigations, explorations, studies, assessments, or evaluations. Regardless of the title used, the geotechnical-engineering report is an engineering interpretation of the subsurface conditions within the context of the project and does not represent a close examination, systematic inquiry, or thorough investigation of all site and subsurface conditions.

Geotechnical-Engineering Services are Performed for Specific Purposes, Persons, and Projects, and At Specific Times

Geotechnical engineers structure their services to meet the specific needs, goals, and risk management preferences of their clients. A geotechnical-engineering study conducted for a given civil engineer will <u>not</u> likely meet the needs of a civil-works constructor or even a different civil engineer. Because each geotechnical-engineering study is unique, each geotechnical-engineering report is unique, prepared *solely* for the client.

Likewise, geotechnical-engineering services are performed for a specific project and purpose. For example, it is unlikely that a geotechnical-engineering study for a refrigerated warehouse will be the same as one prepared for a parking garage; and a few borings drilled during a preliminary study to evaluate site feasibility will <u>not</u> be adequate to develop geotechnical design recommendations for the project.

Do <u>not</u> rely on this report if your geotechnical engineer prepared it:

- for a different client;
- for a different project or purpose;
- for a different site (that may or may not include all or a portion of the original site); or
- before important events occurred at the site or adjacent to it; e.g., man-made events like construction or environmental remediation, or natural events like floods, droughts, earthquakes, or groundwater fluctuations.

Note, too, the reliability of a geotechnical-engineering report can be affected by the passage of time, because of factors like changed subsurface conditions; new or modified codes, standards, or regulations; or new techniques or tools. *If you are the least bit uncertain* about the continued reliability of this report, contact your geotechnical engineer before applying the recommendations in it. A minor amount of additional testing or analysis after the passage of time – if any is required at all – could prevent major problems.

Read this Report in Full

Costly problems have occurred because those relying on a geotechnical-engineering report did not read the report in its entirety. Do <u>not</u> rely on an executive summary. Do <u>not</u> read selective elements only. *Read and refer to the report in full.*

You Need to Inform Your Geotechnical Engineer About Change

Your geotechnical engineer considered unique, project-specific factors when developing the scope of study behind this report and developing the confirmation-dependent recommendations the report conveys. Typical changes that could erode the reliability of this report include those that affect:

- the site's size or shape;
- the elevation, configuration, location, orientation, function or weight of the proposed structure and the desired performance criteria;
- the composition of the design team; or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project or site changes – even minor ones – and request an assessment of their impact. *The geotechnical engineer who prepared this report cannot accept* *responsibility or liability for problems that arise because the geotechnical engineer was not informed about developments the engineer otherwise would have considered.*

Most of the "Findings" Related in This Report Are Professional Opinions

Before construction begins, geotechnical engineers explore a site's subsurface using various sampling and testing procedures. *Geotechnical engineers can observe actual subsurface conditions only at those specific locations where sampling and testing is performed.* The data derived from that sampling and testing were reviewed by your geotechnical engineer, who then applied professional judgement to form opinions about subsurface conditions throughout the site. Actual sitewide-subsurface conditions may differ – maybe significantly – from those indicated in this report. Confront that risk by retaining your geotechnical engineer to serve on the design team through project completion to obtain informed guidance quickly, whenever needed.

This Report's Recommendations Are Confirmation-Dependent

The recommendations included in this report – including any options or alternatives – are confirmation-dependent. In other words, they are <u>not</u> final, because the geotechnical engineer who developed them relied heavily on judgement and opinion to do so. Your geotechnical engineer can finalize the recommendations *only after observing actual subsurface conditions* exposed during construction. If through observation your geotechnical engineer confirms that the conditions assumed to exist actually do exist, the recommendations can be relied upon, assuming no other changes have occurred. *The geotechnical engineer who prepared this report cannot assume responsibility or liability for confirmation-dependent recommendations if you fail to retain that engineer to perform construction observation.*

This Report Could Be Misinterpreted

Other design professionals' misinterpretation of geotechnical-engineering reports has resulted in costly problems. Confront that risk by having your geotechnical engineer serve as a continuing member of the design team, to:

- confer with other design-team members;
- help develop specifications;
- review pertinent elements of other design professionals' plans and specifications; and
- be available whenever geotechnical-engineering guidance is needed.

You should also confront the risk of constructors misinterpreting this report. Do so by retaining your geotechnical engineer to participate in prebid and preconstruction conferences and to perform construction-phase observations.

Give Constructors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can shift unanticipated-subsurface-conditions liability to constructors by limiting the information they provide for bid preparation. To help prevent the costly, contentious problems this practice has caused, include the complete geotechnical-engineering report, along with any attachments or appendices, with your contract documents, *but be certain to note conspicuously that you've included the material for information purposes only.* To avoid misunderstanding, you may also want to note that "informational purposes" means constructors have no right to rely on the interpretations, opinions, conclusions, or recommendations in the report. Be certain that constructors know they may learn about specific project requirements, including options selected from the report, *only* from the design drawings and specifications. Remind constructors that they may perform their own studies if they want to, and *be sure to allow enough time* to permit them to do so. Only then might you be in a position to give constructors the information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions. Conducting prebid and preconstruction conferences can also be valuable in this respect.

Read Responsibility Provisions Closely

Some client representatives, design professionals, and constructors do not realize that geotechnical engineering is far less exact than other engineering disciplines. This happens in part because soil and rock on project sites are typically heterogeneous and not manufactured materials with well-defined engineering properties like steel and concrete. That lack of understanding has nurtured unrealistic expectations that have resulted in disappointments, delays, cost overruns, claims, and disputes. To confront that risk, geotechnical engineers commonly include explanatory provisions in their reports. Sometimes labeled "limitations," many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely.* Ask questions. Your geotechnical engineer should respond fully and frankly.

Geoenvironmental Concerns Are <u>Not</u> Covered

The personnel, equipment, and techniques used to perform an environmental study – e.g., a "phase-one" or "phase-two" environmental site assessment – differ significantly from those used to perform a geotechnical-engineering study. For that reason, a geotechnical-engineering report does not usually provide environmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated subsurface environmental problems have led to project failures.* If you have not obtained your own environmental information about the project site, ask your geotechnical consultant for a recommendation on how to find environmental risk-management guidance.

Obtain Professional Assistance to Deal with Moisture Infiltration and Mold

While your geotechnical engineer may have addressed groundwater, water infiltration, or similar issues in this report, the engineer's services were not designed, conducted, or intended to prevent migration of moisture – including water vapor – from the soil through building slabs and walls and into the building interior, where it can cause mold growth and material-performance deficiencies. Accordingly, ***proper implementation of the geotechnical engineer's recommendations will <u>not</u> of itself be sufficient to prevent moisture infiltration. Confront the risk of moisture infiltration*** by including building-envelope or mold specialists on the design team. ***Geotechnical engineers are <u>not</u> building-envelope or mold specialists.***

GEOPROFESSIONAL BUSINESS ASSOCIATION

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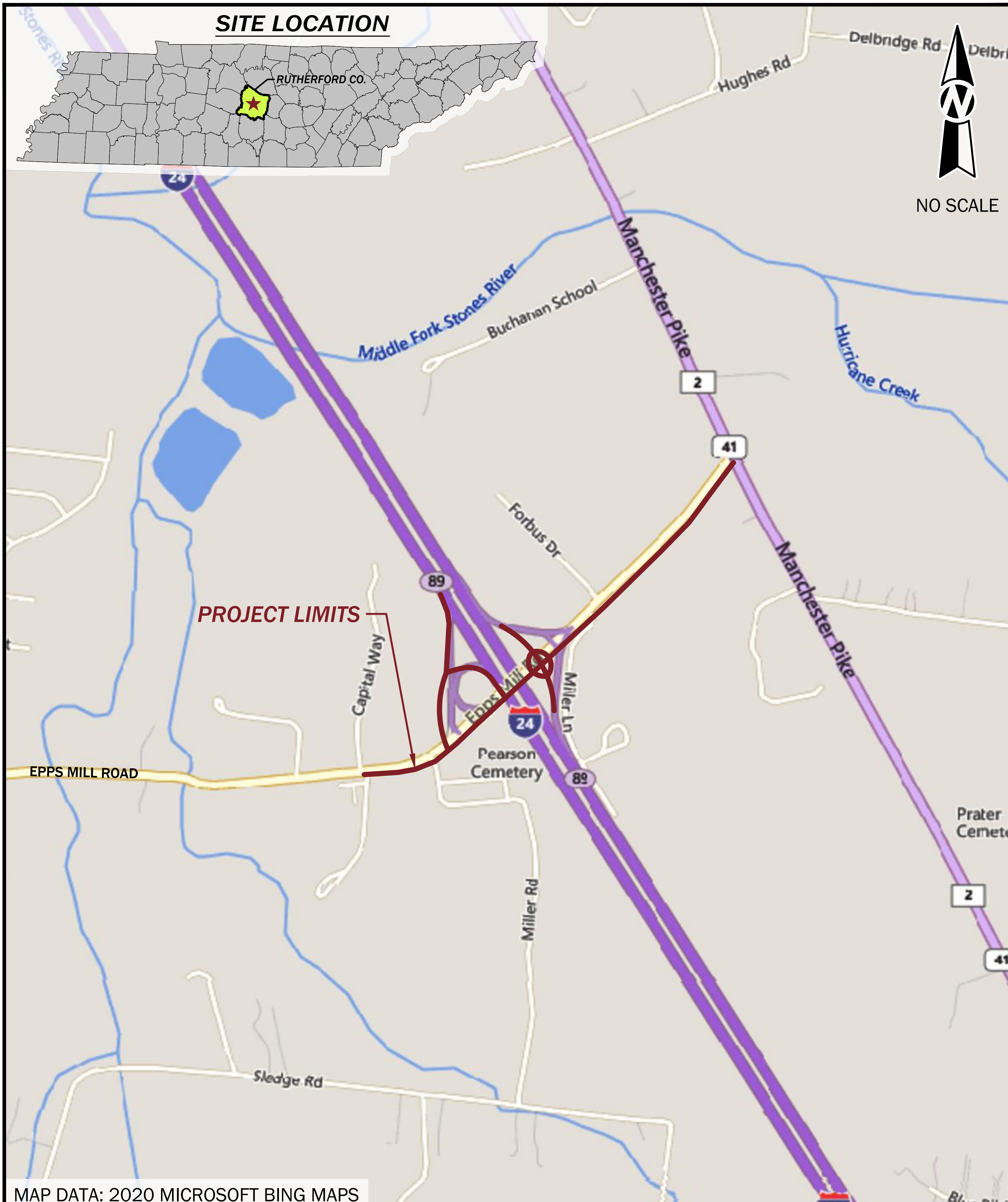
APPENDIX A
ILLUSTRATIONS



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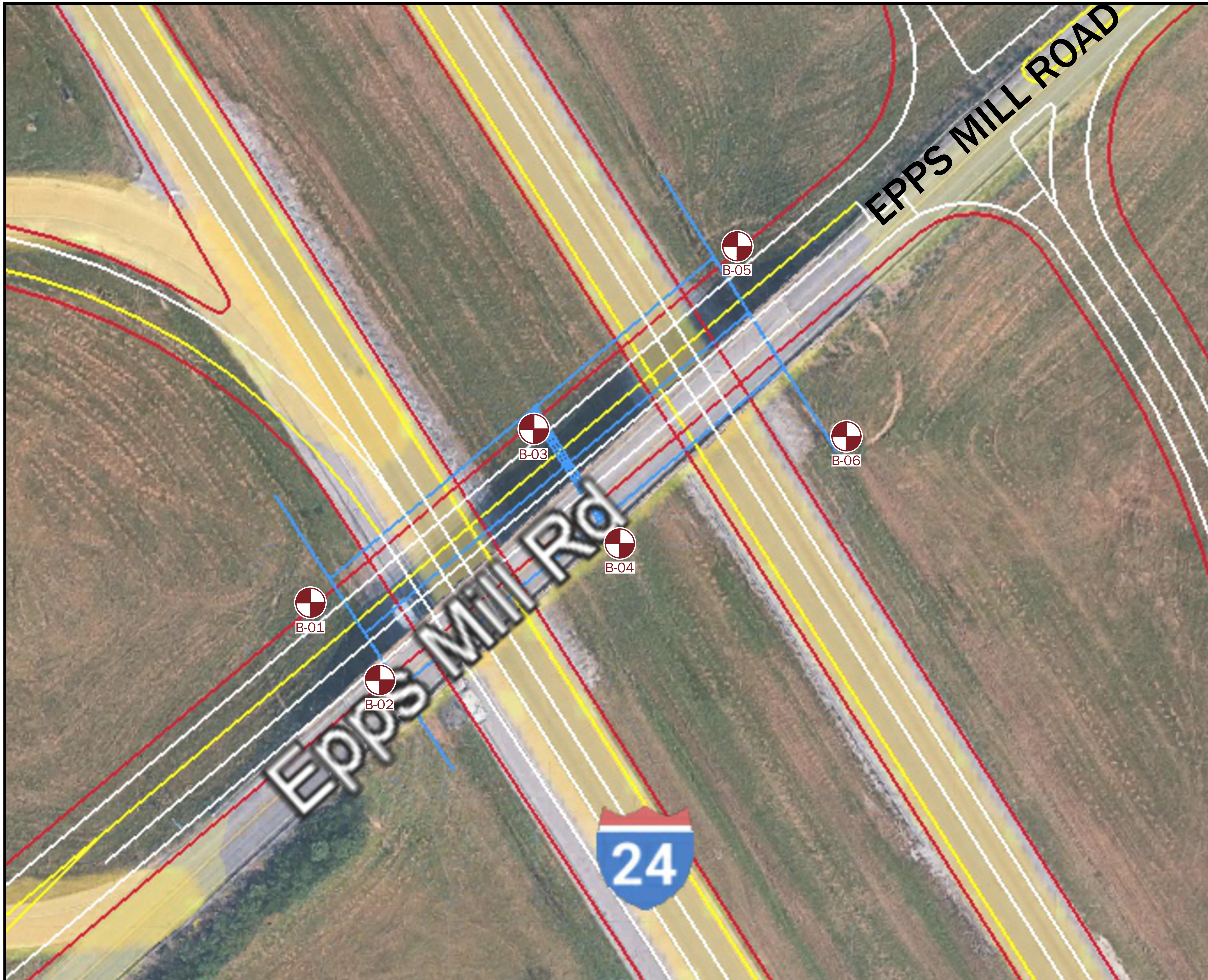
EPPS MIL ROAD INTERCHANGE PROJECT

NEEL-SCHAFFER, INC.

EPPS MILL ROAD
MURFREESBORO, RUTHERFORD COUNTY, TENNESSEE

Drawn By: M H M
Checked By: L S W
Date: 07/14/2025
Proj. No.: 000240802902.00
File Name: 240802902 SLM.dwg

Sheet Title
SITE LOCATION MAP



DRAWING SOURCE: "75I024-08-EPPS MILL RD.KMZ," UNDATED, PREPARED BY NEEL-SCHAFFER

NOTES:

1. TEST LOCATIONS SHOWN ON THIS DRAWING ARE APPROXIMATE.

LEGEND

B-01 SOIL BORING LOCATION AND IDENTIFIER

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EPPS MIL ROAD INTERCHANGE PROJECT

NEEL-SCHAFFER, INC.

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File Name: 240802902 ELP 2.dwg

Sheet Title

EXPLORATION LOCATION PLAN 2

SOIL LEGEND

FINE- AND COARSE-GRAINED SOIL INFORMATION

FINE-GRAINED SOILS (SILTS AND CLAYS)

SPT N-Value	Consistency	Estimated Q_u (TSF)
0 - 1	Very Soft	0 - 0.25
2 - 4	Soft	0.25 - 0.5
5 - 8	Firm	0.5 - 1.0
9 - 15	Stiff	1.0 - 2.0
16 - 30	Very Stiff	2.0 - 4.0
31+	Hard	4.0+

Q_u = Unconfined Compression Strength

COARSE-GRAINED SOILS (SANDS AND GRAVELS)

SPT N-Value	Relative Density
0 - 4	Very Loose
5 - 10	Loose
11 - 30	Medium Dense
31 - 50	Dense
51+	Very Dense

PARTICLE SIZE

Name	Size (US Std. Sieve)
Boulders	>300 mm (>12 in.)
Cobbles	75 mm to 300 mm (3 - 12 in.)
Coarse Gravel	19 mm to 75 mm (3/4 - 3 in.)
Fine Gravel	4.75 mm to 19 mm (#4 - 3/4 in.)
Coarse Sand	2 mm to 4.75 mm (#10 - #4)
Medium Sand	0.425 mm to 2 mm (#40 - #10)
Fine Sand	0.075 mm to 0.425 mm (#200 - #40)
Silts and Clays	< 0.075 mm (< #200)

RELATIVE PROPORTIONS OF SAND AND GRAVEL

Descriptive Terms	Percent of Dry Weight
"Trace"	< 15
"With"	15 - 30
Modifier	> 30

RELATIVE PROPORTIONS OF CLAYS AND SILTS

Descriptive Terms	Percent of Dry Weight
"Trace"	< 5
"With"	5 - 12
Modifier	> 12

CRITERIA FOR DESCRIBING MOISTURE CONDITION

Description	Criteria
Dry	Absence of moisture, dusty, dry to the touch
Moist	Damp, but no visible water
Wet	Visible free water, usually soil is below water table

CRITERIA FOR DESCRIBING CEMENTATION

Description	Criteria
Weak	Crumbles or breaks with handling or little finger pressure
Moderate	Crumbles or breaks with considerable finger pressure
Strong	Will not crumble or break with finger pressure

CRITERIA FOR DESCRIBING STRUCTURE

Description	Criteria
Stratified	Alternating layers of varying material or color with layers at least 6 mm thick; note the thickness
Laminated	Alternating layers of varying material or color with the layers less than 6 mm thick; note thickness
Fissured	Breaks along definite planes of fracture with little resistance to fracturing
Slickensided	Fracture planes appear polished or glossy, sometimes striated
Blocky	Cohesive soil that can be broken down into small angular lumps which resist further breakdown
Lensed	Inclusion of small pockets of different soils such as small lenses of sand scattered through a mass of clay; note thickness
Homogeneous	Same color and appearance throughout

SAMPLERS AND DRILLING METHODS

- AUGER CUTTINGS
- BAG/BULK SAMPLE
- GRAB SAMPLE
- CONTINUOUS SAMPLES
- SHELBY TUBE SAMPLE
- PITCHER SAMPLE
- STANDARD PENETRATION SPLIT-SPOON SAMPLE
- SPLIT-SPOON SAMPLE WITH NO RECOVERY
- DYNAMIC CONE PENETROMETER
- ROCK CORE

WATER LEVEL SYMBOLS

- WATER LEVEL AT TIME OF DRILLING
- PERCHED WATER OBSERVED AT DRILLING
- DELAYED WATER LEVEL OBSERVATION
- CAVE-IN DEPTH
- OBSERVED SEEPAGE

ABBREVIATIONS AND ACRONYMS

WOH	Weight of Hammer	N-Value	Sum of the blows for last two 6-in increments of SPT
WOR	Weight of Rod		
Ref.	Refusal	NA	Not Applicable or Not Available
ATD	At Time of Drilling	OD	Outside Diameter
DCP	Dynamic Cone Penetrometer	PPV	Pocket Penetrometer Value
Elev.	Elevation	SFA	Solid Flight Auger
ft.	feet	SH	Shelby Tube Sampler
HSA	Hollow Stem Auger	SS	Split-Spoon Sampler
ID	Inside Diameter	SPT	Standard Penetration Test
in.	inches	USCS	Unified Soil Classification System
lbs	pounds		

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UNIFIED SOIL CLASSIFICATION SYSTEM (USCS)

Major Division	Subdivision	Fines	Gradation	Symbol	Description
COARSE GRAINED SOILS (>50% of the material is larger than the #200 sieve)	GRAVELS (>50% of coarse fraction is larger than the #4 sieve)	CLEAN GRAVEL WITH <5% FINES	Cu > 4 Cc = 1-3	GW	Well-graded gravels, gravel-sand mixtures with trace or no fines
			Cu ≤ 4 and/or Cc < 1 Cc > 3	GP	Poorly-graded gravels, gravel-sand mixtures with trace or no fines
		GRAVEL WITH 5% TO 12% FINES	Cu > 4 Cc = 1-3	GW-GM	Well-graded gravels, gravel-sand mixtures with silt fines
				GW-GC	Well-graded gravels, gravel-sand mixtures with clay fines
			Cu ≤ 4 and/or Cc < 1 Cc > 3	GP-GM	Poorly-graded gravels, gravel-sand mixtures with silt fines
				GP-GC	Poorly-graded gravels, gravel-sand mixtures with clay fines
		GRAVEL WITH MORE THAN 12% FINES		GM	Silty gravels, gravel-silt-sand mixtures
				GC	Clayey gravels, gravel-sand-clay mixtures
				GC-GM	Clayey gravels, gravel-sand-clay-silt mixtures
	SANDS (>50% of coarse fraction is smaller than the #4 sieve)	CLEAN SAND WITH <5% FINES	Cu > 6 Cc = 1-3	SW	Well-graded sands, sand-gravel mixtures with trace or no fines
			Cu ≤ 6 and/or Cc < 1 Cc > 3	SP	Poorly-graded sands, sand-gravel mixtures with trace or no fines
		SAND WITH 5% TO 12% FINES	Cu > 6 Cc = 1-3	SW-SM	Well-graded sands, sand-gravel mixtures with silt fines
				SW-SC	Well-graded sands, sand-gravel mixtures with clay fines
			Cu ≤ 6 and/or Cc < 1 Cc > 3	SP-SM	Poorly-graded sands, sand-gravel mixtures with silt fines
				SP-SC	Poorly-graded sands, sand-gravel mixtures with clay fines
		SAND WITH MORE THAN 12% FINES		SM	Silty sands, sand-gravel-silt mixtures
				SC	Clayey sands, sand-gravel-clay mixtures
				SC-SM	Clayey sands, sand-gravel-clay-silt mixtures
FINE GRAINED SOILS (>50% of material is smaller than the #200 sieve)	SILTS & CLAYS (Liquid Limit less than 50)			ML	Inorganic silts with low plasticity
				CL	Inorganic clays of low plasticity, gravelly or sandy clays, silty clays, lean clays
				CL-ML	Inorganic clay-silts of low plasticity, gravelly clays, sandy clays, silty clays, lean clays
				OL	Organic silts and organic silty clays of low plasticity
	SILTS & CLAYS (Liquid Limit more than 50)			MH	Inorganic silts of high plasticity, elastic silts
				CH	Inorganic clays of high plasticity, fat clays
				OH	Organic clays and organic silts of high plasticity

USCS - HIGHLY ORGANIC SOILS

Primarily organic matter, dark in color, organic odor	
PT	Peat, humus, swamp soils with high organic contents

OTHER MATERIALS

BITUMINOUS CONCRETE (ASPHALT)
CONCRETE
CRUSHED STONE/AGGREGATE BASE
TOPSOIL
FILL
UNDIFFERENTIATED ALLUVIUM
UNDIFFERENTIATED OVERBURDEN
BOULDERS AND COBBLES

UNIFORMITY COEFFICIENT

$$C_u = D_{60}/D_{10}$$

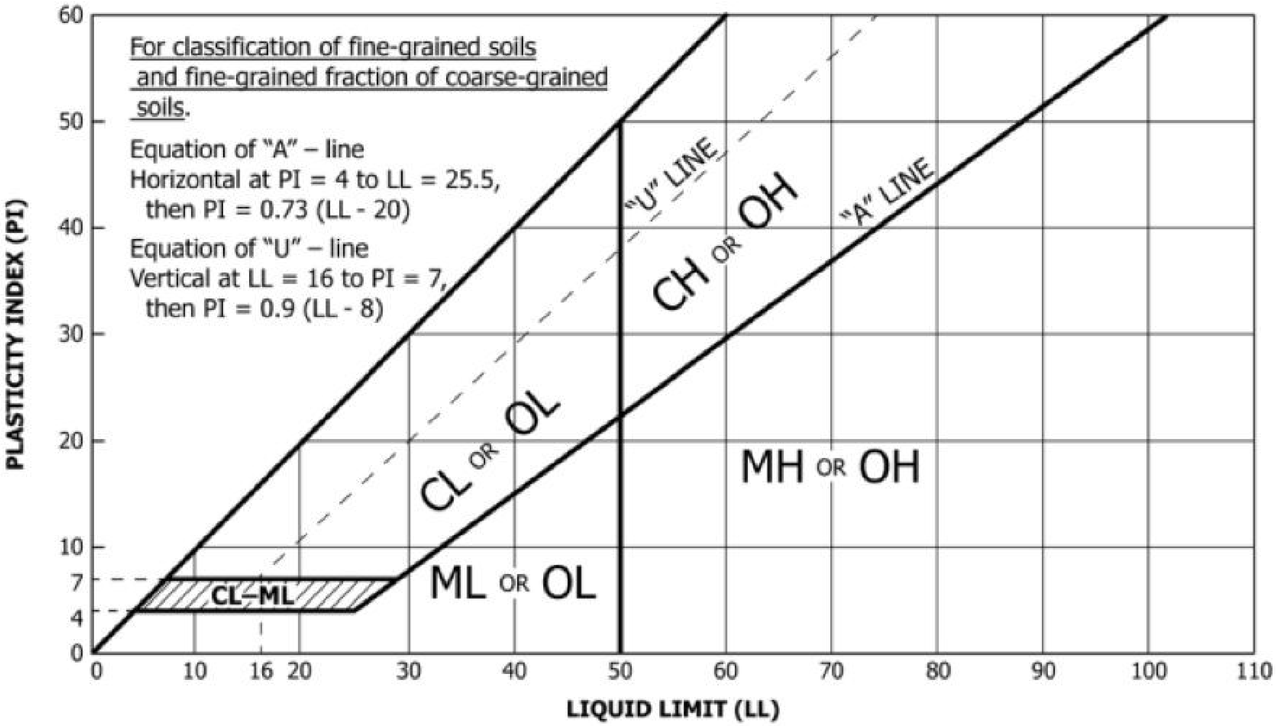
COEFFICIENT OF CURVATURE

$$C_C = (D_{30})^2/(D_{60} x D_{10})$$

Where:

D_{60} = grain diameter at 60% passing
D_{30} = grain diameter at 30% passing
D_{10} = grain diameter at 10% passing

PLASTICITY CHART FOR USCS CLASSIFICATION OF FINE-GRAINED SOILS



IMPORTANT NOTES ON TEST BORING RECORDS

1) The report and graphics key are an integral part of these logs. All data and interpretations in this log are subject to the explanations and limitations stated in the report.

2) Lines separating strata on the logs represent approximate boundaries only. Actual transitions may be gradual or differ from those shown. Solid lines are used to indicate a change in the material type, particularly a change in the USCS classification. Dashed lines are used to separate two materials that have the same material type, but that differ with respect to two or more other characteristics (e.g. color, consistency).

3) No warranty is provided as to the continuity of soil or rock conditions between individual sample locations.

4) Logs represent general soil and rock conditions observed at the point of exploration on the date indicated.

5) In general, Unified Soil Classification System (USCS) designations presented on the logs were based on visual classification in the field and were modified where appropriate based on gradation and index property testing.

6) Fine-grained soils that plot within the hatched area on the Plasticity Chart, and coarse-grained soils with between 5% and 12% passing the #200 sieve require dual USCS symbols as presented on the previous page.

7) If the sampler is not able to be driven at least 6 inches, then 50/X" indicates that the sampler advanced X inches when struck 50 times with a 140-pound hammer falling 30 inches.

8) If the sampler is driven at least 6 inches, but cannot be driven either of the subsequent two 6-inch increments, then either 50/X" or the sum of the second 6-inch increment plus 50/X" for the third 6-inch increment will be indicated.

Example 1: Recorded SPT blow counts are 16 - 50/4", the SPT N-value will be shown as N = 50/4"

Example 2: Recorded SPT blow counts are 18 - 25 - 50/2", the SPT N-value will be shown as N = 75/8"

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TEST BORING RECORD LEGEND FOR ROCK

ROCK CORE INFORMATION

ROCK QUALITY DESIGNATION (RQD)

Percent RQD	Quality
0 - 25	Very Poor
25 - 50	Poor
50 - 75	Fair
75 - 90	Good
90 - 100	Excellent

ROCK HARDNESS CRITERIA

Very Hard	Rock can be broken by heavy hammer blows
Hard	Rock cannot be broken by thumb pressure, but can be broken by moderate hammer blows
Moderately Hard	Small pieces can be broken off along sharp edges by considerable hard thumb pressure; can be broken with light hammer blows
Soft	Rock is cohesive but breaks very easily with thumb pressure at sharp edges and crumbles with firm hand pressure
Very Soft	Rock disintegrates or easily compresses when touched; can be hard soil

$$\text{Recovery (\%)} = \frac{\text{Length of Core Sample Recovered}}{\text{Length of the Core Run}} \times 100$$

$$\text{RQD (\%)} = \frac{\text{Sum of Lengths of Intact Rock Pieces of 4 in. and Longer}}{\text{Length of the Core Run}} \times 100$$

WEATHERING OR ALTERATION

Term	Description
Fresh	No evidence of alteration
Slightly Weathered	Slight discoloration on surface
Moderately Weathered	Discoloring evident; alteration penetrating well below rock surface
Highly Weathered	Entire rock mass discolored
Decomposed	Rock reduced to a soil with relict rock texture

JOINT ROUGHNESS COEFFICIENT (JRC)

Coefficient	Description
14 - 20	Very Rough: Near vertical edges evident
10 - 14	Rough: Smooth ridges, surface abrasion
6 - 10	Slightly Rough: Asperities on surface can be felt
2 - 6	Smooth: Appears and feels smooth
0 - 2	Slickensided: Visible polishing, striated surface

FRACTURE/JOINT DENSITY

Description	Observed Fracture Density
Intact	No fractures or joints less than 6 ft. apart
Slightly Fractured/Jointed	Lengths from 3 ft. to 6 ft.
Moderately Fractured/Jointed	Lengths from 1 ft. to 3 ft.
Highly Fractured/Jointed	Lengths from 4in. to 1 ft.
Intensely Fractured/Jointed	Lengths less than 4 inches

DISCONTINUITY TERMS

Fracture: Collective term for any natural break excluding shears, shear zones, and faults

Joint (JT): Planar break with little or no displacement

Foliation Joint (FJ) or Bedding Joint (BJ): Joint along foliation or bedding

Incipient Joint (IJ) or Incipient Fracture (IF): Joint or fracture not evident until wetted and dried; breaks along existing surface

Random Fracture (RF): Natural, very irregular fracture that does not belong to a set

Bedding Plane Separation or Parting: A separation along bedding after extraction from stress relief or slaking

Fracture Zone (FZ): Planar zone of broken rock without gouge

Mechanical Break (MB): Breaks due to drilling or handling; drilling break is denoted as (DB) and hammer break is denoted as (HB)

Shear (SH): Surface of differential movement evident by presence of slickensides, striations, or polishing

Shear Zone (SZ): Zone of gouge and rock fragments bounded by planar shear surfaces

Fault (FT): Shear zone of significant extent; differentiation from shear zone may be site-specific

BEDDING THICKNESS

Massive	> 3 ft.
Thick	1 ft. to 3 ft.
Medium	4 in. to 1 ft.
Thin	1-1/4 in. to 4 in.
Banded	1/4 in. to 1-1/4 in.
Parting	< 1/4 in.

APERTURE WIDTH

Term	Spacing
Very Tight	< 0.1 mm
Tight	0.1 to 0.25 mm
Partly Open	0.25 to 0.5 mm
Open	0.5 to 2.5 mm
Moderately Wide	2.5 to 10 mm
Wide	10 mm to 1 cm
Very Wide	1 to 10 cm
Extremely Wide	10 cm to 1 m
Cavernous	> 1 m

ROCK CLASSIFICATION

	PARTIALLY WEATHERED ROCK (UNDIFFERENTIATED)
	WEATHERED ROCK (UNDIFFERENTIATED)
CLASTIC SEDIMENTARY ROCKS	BRECCIA
	CONGLOMERATE
	SANDSTONE
	WEATHERED SANDSTONE
	SILTSTONE
	CLAYSTONE
	SHALE
	WEATHERED SHALE
	COAL
CARBONATE SEDIMENTARY ROCKS	LIMESTONE
	WEATHERED LIMESTONE
	DOLOMITE
	CORAL
EVAPORITE ROCKS	CHALK
	WEATHERED CHALK
	GYPSUM
	HALITE
	CALCITE
INTRUSIVE IGNEOUS ROCKS	GRANITE
	GRANO-DIORITE
	DIORITE
	GABBRO

EXTRUSIVE IGNEOUS ROCKS	TUFF
	RYOLITE
	DACITE
	ANDESITE
	BASALT
METAMORPHIC ROCKS	MARBLE
	QUARTZITE
	SLATE
	PHYLLITE
	SCHIST
	GNEISS
	AMPHIBOLITE
	METAGRAYWACKE

FEATURES WITHIN ROCK

FILLED CAVITY
PARTIALLY FILLED CAVITY
OPEN CAVITY

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Epps Mill Road Interchange Project

Neel-Schaffer, Inc.

Murfreesboro, Tennessee

Rutherford County

Log of Soil Boring B-01

Drilling Co.:	TTL, Inc.	Project Number:	000240802902.00
Driller:	R. Bell	Date Drilled:	04/21/2025
Logged By:	B. Miller	Boring Depth:	18.5 ft
Equipment:	CME-550X	Boring Elevation:	~678 ft
Hammer Type:	Auto	Coordinates:	N/A
Drilling Method:	Hollow-stem auger w/SPT sampling and NQ wireline	Water Level At Time Of Drilling	N.E.
		Cave In	N/A

Remarks:
Backfilled with bentonite and auger cuttings upon completion. Delayed water level indicates post rock coring water level. Elevation obtained by interpolating between contours on provided drawing. N.E. = Not encountered

Delayed Water Level	1.5 ft
Delayed Water Date	04/21/25

Elevation (feet)	Depth (feet)	Materials Description	Blow Counts (N/Refusal)	Recovery (%)	RQD (%)	Pocket Penetrometer (tsf)	Moisture Content (%)	Atterberg Limits (LL-PL-PI)	% Fines	Dry Density (pcf)	Compressive Strength (ksf)
	0.3	TOPSOIL, 4 inches									
		POSSIBLE FILL: LEAN CLAY, brown with red mottling, with black mineral staining, a trace of fine roots, and a trace of limestone fragments, moist (CL)	4-8-11 (19)	67			21.1				
	3.5	Auger refusal at 3.5 feet; begin NQ coring									
		LIMESTONE, moderately hard, gray, fine to medium grained, thin to medium bedded, slightly weathered to fresh, with shale partings throughout soil seam; 3.7 to 4.7 feet soil seam; 5.5 to 5.7 feet		88	26						
				100	58						
				100	80						
	18.5	Boring terminated at 18.5 feet									

Elevation scale: 675, 670, 665, 660, 655. Depth scale: 5, 10, 15, 20, 25.

BoreDM Template: AEP

This record shall not be separated from the corresponding Instrument of Service; no third party may rely upon this boring log or the corresponding Instrument of Service absent a written TTL Secondary Client Agreement.

	Epps Mill Road Interchange Project	Log of Soil Boring B-02
TTL	Neel-Schaffer, Inc. Murfreesboro, Tennessee Rutherford County	

Drilling Co.:	TTL, Inc.	Project Number:	000240802902.00	Remarks: Backfilled with bentonite and auger cuttings upon and a patch of asphalt was applied at the surface completion. Delayed water level indicates post rock coring water level. Elevation obtained by interpolating between contours on provided drawing. N.E. = Not encountered	
Driller:	R. Bell	Date Drilled:	04/22/2025		
Logged By:	B. Miller	Boring Depth:	38.5 ft		
Equipment:	CME-550X	Boring Elevation:	~702 ft		
Hammer Type:	Auto	Coordinates:	N/A		
Drilling Method:	Hollow-stem auger w/SPT sampling and NQ wireline	Water Level At Time Of Drilling	N.E.	Delayed Water Level	13 ft
		Cave In	N/A	Delayed Water Date	04/22/25

Elevation (feet)	Depth (feet)	Materials Description	Samples: Blow Counts (N/Refusal)	Recovery (%)	RQD (%)	Pocket Penetrometer (tsf)	Lab: Moisture Content (%)	Atterberg Limits (LL-PL-PI)	% Fines	Dry Density (pcf)	Compressive Strength (ksf)
	0.5	ASPHALT, 6 inches									
700	1.8	BASESTONE; 16 inches	24-21-10 (31)	10			3.5				
		FILL: LEAN CLAY, dark brown and brown, moist (CL) - N-value amplified at 1 foot due to basestone - Bulk Sample obtained from auger cutting between 3 and 10 feet					27.4				
	5		4-5-5 (10)	33							
695			3-4-5 (9)	100			23.6				
							26.8	45-20-25			
			3-5-9 (14)	67			24.0				
	10										
690	12.0	**FILL**: FAT CLAY, dark brown with brown mottling, with trace of limestone fragments, moist (CH)									
			10-13-13 (26)	33			24.9				
	15										
685											
			16-16-13 (29)	67			18.1				
	20										
680	22.0	**RESIDUUM**: FAT CLAY, very stiff, brown, with some chert gravel (coarse),, moist (CH)									
			5-12-14 (26)	67			27.7	61-27-34			
	25										
675		Auger refusal at 28.5 feet; begin NQ coring									
	28.5	**LIMESTONE**, moderately hard, gray, fine to medium grained, moderately fractured, slightly weathered to fresh, with shale partings throughout		100	76						
	30										

BoreDM Template: AEP

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Elevation (feet)	Depth (feet)	Graphic Log	Materials Description	Sample Graphic	Blow Counts (N/Refusal)	Recovery (%)	RQD (%)	Pocket Penetrometer (tsf)	Moisture Content (%)	Atterberg Limits (LL-PL-PI)	% Fines	Dry Density (pcf)	Compressive Strength (ksf)
			LIMESTONE, moderately hard, gray, fine to medium grained, moderately fractured, slightly weathered to fresh, with shale partings throughout			100	76						
	35					100	86						
665			38.5										
			Boring terminated at 38.5 feet										
	40												
660													
	45												
655													
	50												
650													
	55												
645													
	60												
640													

BoreDM Template: AEP

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Epps Mill Road Interchange Project

Neel-Schaffer, Inc.

Murfreesboro, Tennessee

Rutherford County

Log of Soil Boring B-03

Drilling Co.:	TTL, Inc.	Project Number:	000240802902.00
Driller:	R. Bell	Date Drilled:	04/23/2025
Logged By:	B. Miller	Boring Depth:	14.5 ft
Equipment:	CME-550X	Boring Elevation:	~680 ft
Hammer Type:	Auto	Coordinates:	N/A
Drilling Method:	Hollow-stem auger w/SPT sampling and NQ wireline		

Remarks:
Backfilled with bentonite and auger cuttings upon completion. Delayed water level indicates post rock coring water level. Elevation obtained by interpolating between contours on provided drawing. N.E. = Not encountered

Water Level At Time Of Drilling	N.E.	Delayed Water Level	2 ft
Cave In	N/A	Delayed Water Date	04/23/25

Elevation (feet)	Depth (feet)	Materials Description	Blow Counts (N/Refusal)	Recovery (%)	RQD (%)	Pocket Penetrometer (tsf)	Moisture Content (%)	Atterberg Limits (LL-PL-PI)	% Fines	Dry Density (pcf)	Compressive Strength (ksf)
	0.5	TOPSOIL, 6 inches									
		POSSIBLE FILL: FAT CLAY, red-brown, with black mineral staining, trace fine roots, and limestone fragments, moist (CH) - bulk sample obtained between 1 and 3 feet	5-4-3 (7)	67			24.4	62-26-36			
			46-50/3" (50/3")	33							
675	4.5	Auger refusal at 4.5 feet; begin NQ coring									
	5	**LIMESTONE**, moderately hard, gray, fine to medium grained, slightly fractured, slightly weathered to fresh, with shale partings throughout - soil seam at 5.6 to 5.7 feet		94	66						
670	10			100	74						
665	14.5	Boring terminated at 14.5 feet									
	15										
660	20										
655	25										

BoreDM Template: AEP

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Epps Mill Road Interchange Project

Neel-Schaffer, Inc.

Murfreesboro, Tennessee

Rutherford County

Log of Soil Boring B-04

Drilling Co.:	TTL, Inc.	Project Number:	000240802902.00
Driller:	R. Bell	Date Drilled:	04/23/2025
Logged By:	B. Miller	Boring Depth:	16.5 ft
Equipment:	CME-550X	Boring Elevation:	~681 ft
Hammer Type:	Auto	Coordinates:	N/A
Drilling Method:	Hollow-stem auger w/SPT sampling and NQ wireline		

Remarks:
Backfilled with bentonite and auger cuttings upon completion. Delayed water level indicates post rock coring water level. Elevation obtained by interpolating between contours on provided drawing. N.E. = Not encountered

▽ Water Level At Time Of Drilling	N.E.	▼ Delayed Water Level	1 ft
Cave In	N/A	Delayed Water Date	04/23/25

Elevation (feet)	Depth (feet)	Materials Description	Blow Counts (N/Refusal)	Recovery (%)	RQD (%)	Pocket Penetrometer (tsf)	Moisture Content (%)	Atterberg Limits (LL-PL-PI)	% Fines	Dry Density (pcf)	Compressive Strength (ksf)
	0.5	TOPSOIL, 6 inches									
680		**POSSIBLE FILL**: LEAN CLAY, red-brown, with black mineral staining, moist (CL)	3-4-4 (8)	67			23.1				
	3.0	**WEATHERED LIMESTONE**, with interbedded clay	8-35-43 (78)	33							
675	6.5	Auger refusal at 6.5 feet; begin NQ coring	50/3" (50/3")	0							
		LIMESTONE, moderately hard, gray, fine to medium grained, medium bedded, slightly fractured, slightly weathered to fresh, with shale partings and lenses throughout		100	56						
670				100	76						
665	16.5	Boring terminated at 16.5 feet									

BoreDM Template: AEP

This record shall not be separated from the corresponding Instrument of Service; no third party may rely upon this boring log or the corresponding Instrument of Service absent a written TTL Secondary Client Agreement.

TTL	**Epps Mill Road Interchange Project** **Neel-Schaffer, Inc.** **Murfreesboro, Tennessee** Rutherford County	**Log of Soil Boring B-05** Page 1 of 1

Drilling Co.:	TTL, Inc.	Project Number:	000240802902.00	Remarks: Backfilled with bentonite and auger cuttings upon completion. Delayed water level indicates post rock coring water level. Elevation obtained by interpolating between contours on provided drawing. N.E. = Not encountered
Driller:	R. Bell	Date Drilled:	04/24/2025	
Logged By:	B. Miller	Boring Depth:	17.5 ft	
Equipment:	CME-550X	Boring Elevation:	~683 ft	
Hammer Type:	Auto	Coordinates:	N/A	
Drilling Method:	Hollow-stem auger w/SPT sampling and NQ wireline	Water Level At Time Of Drilling: N.E. Cave In: N/A		Delayed Water Level: 3 ft Delayed Water Date: 04/24/25

Elevation (feet)	Depth (feet)	Graphic Log	Materials Description	Samples: Sample Graphic	Samples: Blow Counts (N/Refusal)	Samples: Recovery (%)	Samples: RQD (%)	Samples: Pocket Penetrometer (tsf)	Lab: Moisture Content (%)	Lab: Atterberg Limits (LL-PL-PI)	Lab: % Fines	Lab: Dry Density (pcf)	Lab: Compressive Strength (ksf)
	0.5		TOPSOIL, 6 inches										
680	3.0		**POSSIBLE FILL**: LEAN CLAY, brown, with trace of limestone and chert fragments, moist (CL)		5-4-5 (9)	33			49.4				
675	7.5		**RESIDUUM**: FAT CLAY, stiff, red-brown with tan and gray mottling, with black mineral staining, (CH) - N-value for sample at 6 feet amplified due to refusal Auger refusal at 7.5 feet; begin NQ coring		4-4-5 (9)	100			28.3				
					50/1" (50/1")	0							
670	17.5		**LIMESTONE**, moderately hard, gray, fine to medium grained, medium bedded, slightly fractured, slightly weathered soil seam; 9 to 9.1 feet soil seam; 9.3 to 9.4 feet soil seam; 11 to 11.1 feet			100	62						
						100	84						
665			Boring terminated at 17.5 feet										
660	25												

BoreDM Template: AEP

This record shall not be separated from the corresponding Instrument of Service; no third party may rely upon this boring log or the corresponding Instrument of Service absent a written TTL Secondary Client Agreement.

Epps Mill Road Interchange Project
Neel-Schaffer, Inc.
Murfreesboro, Tennessee
Rutherford County

Log of Soil Boring B-06

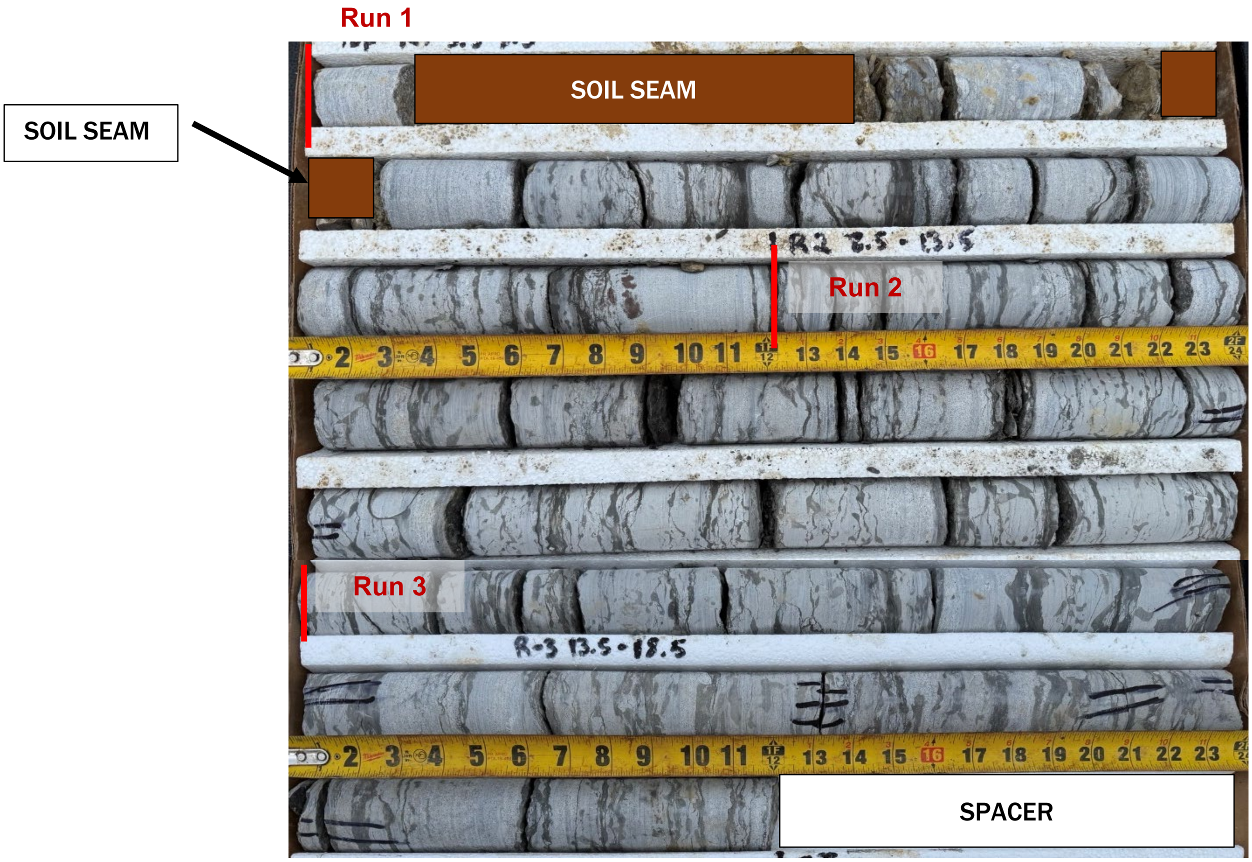
Drilling Co.:	TTL, Inc.	Project Number:	000240802902.00	Remarks: Backfilled with bentonite and auger cuttings upon completion. Delayed water level indicates post rock coring water level. Elevation obtained by interpolating between contours on provided drawing. N.E. = Not encountered
Driller:	R. Bell	Date Drilled:	04/23/2025	
Logged By:	B. Miller	Boring Depth:	14.5 ft	
Equipment:	CME-550X	Boring Elevation:	~685 ft	
Hammer Type:	Auto	Coordinates:	N/A	
Drilling Method:	Hollow-stem auger w/SPT sampling and NQ wireline	Water Level At Time Of Drilling: N.E.; Cave In: N/A		Delayed Water Level: 2.5 ft; Delayed Water Date: 04/23/25

Elevation (feet)	Depth (feet)	Materials Description	Blow Counts (N/Refusal)	Recovery (%)	RQD (%)	Pocket Penetrometer (tsf)	Moisture Content (%)	Atterberg Limits (LL-PL-PI)	% Fines	Dry Density (pcf)	Compressive Strength (ksf)
	0.5	TOPSOIL, 6 inches									
	3.0	**POSSIBLE FILL**: LEAN CLAY, red-brown, with trace chert fragments, some limestone fragments (coarse to fine), and trace fine roots, moist (CL)	3-5-10 (15)	67							
680	4.5	**WEATHERED LIMESTONE**, tan, with some clay, moist. Auger refusal at 4.5 feet; begin NQ coring	43-16-50/1" (66/7")	33							
675	8.5	**WEATHERED LIMESTONE**, moderately hard, gray, fine to medium grained, thinly bedded; soil seam; 5.7 to 5.8 feet; soil seam; 5.9 to 6.2; soil seam; 6.3 to 7.2 feet; soil seam; 7.6 to 8.1 feet		56	9						
670	14.5	**LIMESTONE**, moderately hard, gray, fine to medium grained, slightly fractured, slightly weathered to fresh, with shale partings throughout; - vertical fractures at 8.5 and 9.5 feet; - vertical fracture at 14.5 feet		100	76						
		Boring terminated at 14.5 feet									

BoreDM Template: AEP

This record shall not be separated from the corresponding Instrument of Service; no third party may rely upon this boring log or the corresponding Instrument of Service absent a written TTL Secondary Client Agreement.

Boring B-01
3–½ feet to 18–½ feet



Run No.	Depth (feet)	Recovery (percent)	RQD (percent)	Rock Quality
1	3–½ to 8–½	88	26	Poor
2	8–½ to 13–½	100	58	Fair
3	13–½ to 18–½	100	80	Good

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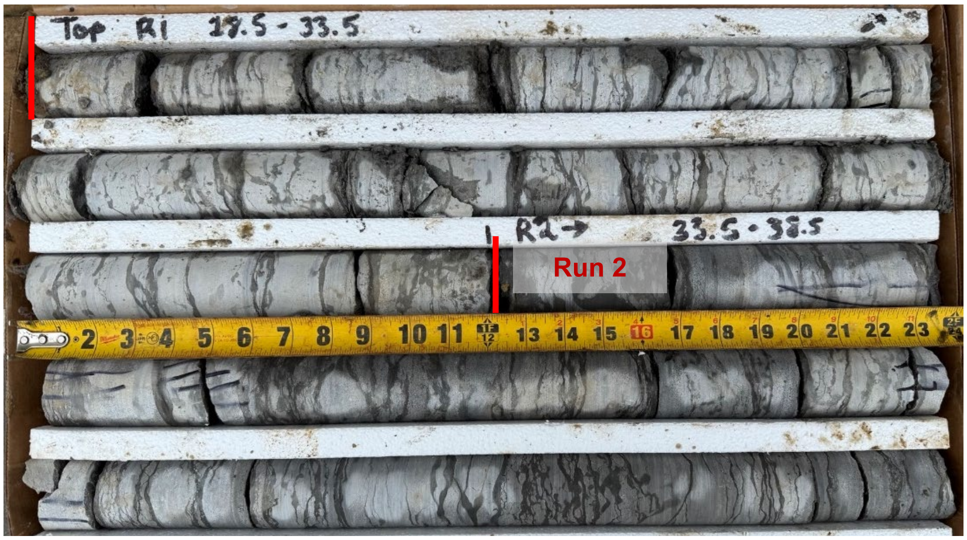
Boring B-02
28–½ feet to 38–½ feet

Run 1



Run No.	Depth (feet)	Recovery (percent)	RQD (percent)	Rock Quality
1	28–½ to 33–½	100	76	Good
2	33–½ to 38–½	100	86	Good

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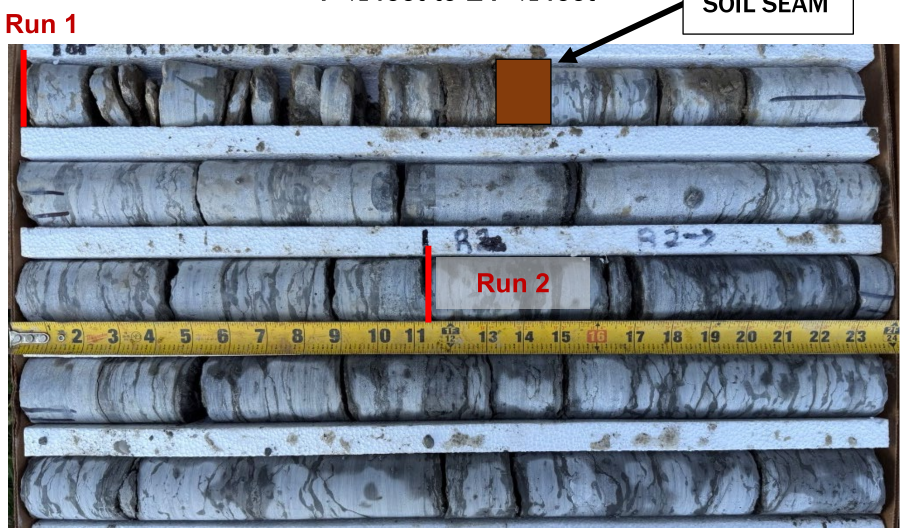
Boring B-03
4-½ feet to 14-½ feet



Run No.	Depth (feet)	Recovery (percent)	RQD (percent)	Rock Quality
1	4-½ to 9-½	94	66	Fair
2	9-½ to 14-½	100	74	Fair

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Boring B-04
6-½ feet to 16-½ feet

Run 1

Run No.	Depth (feet)	Recovery (percent)	RQD (percent)	Rock Quality
1	6-½ to 11-½	100	56	Fair
2	11-½ to 16-½	100	76	Good

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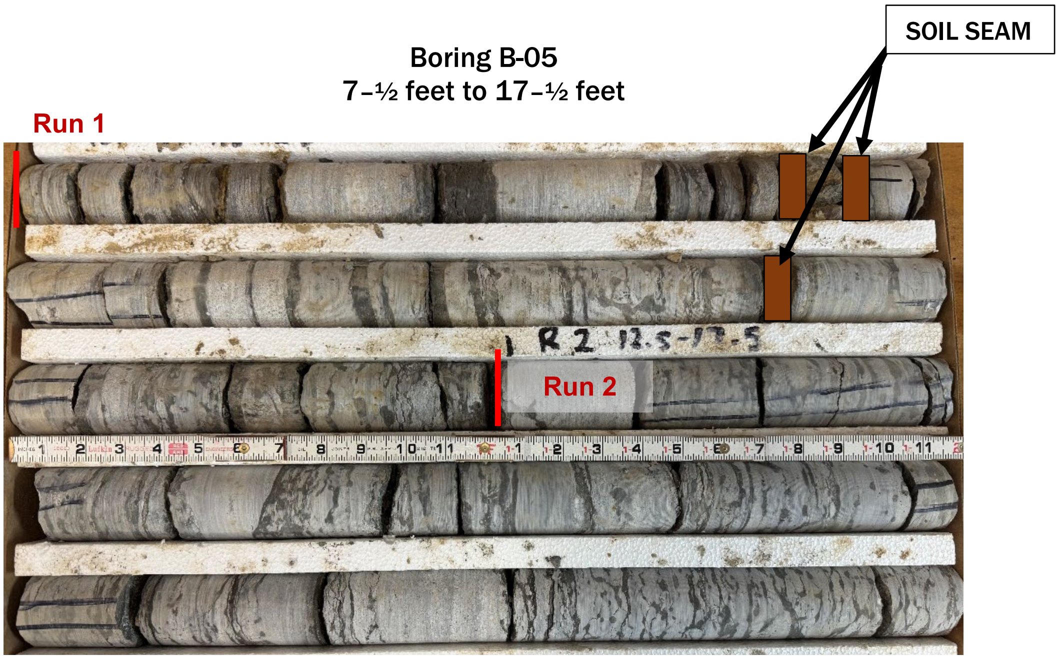
ROCK CORE PHOTOGRAPHS
EPPS MILL ROAD INTERCHANGE PROJECT
MURFREESBORO, RUTHERFORD COUNTY, TENNESSEE
TTL PROJECT NO. 000240802902.00

Boring B-05
7–½ feet to 17–½ feet



Run No.	Depth (feet)	Recovery (percent)	RQD (percent)	Rock Quality
1	7–½ to 12–½	100	62	Fair
2	12–½ to 17–½	100	84	Good

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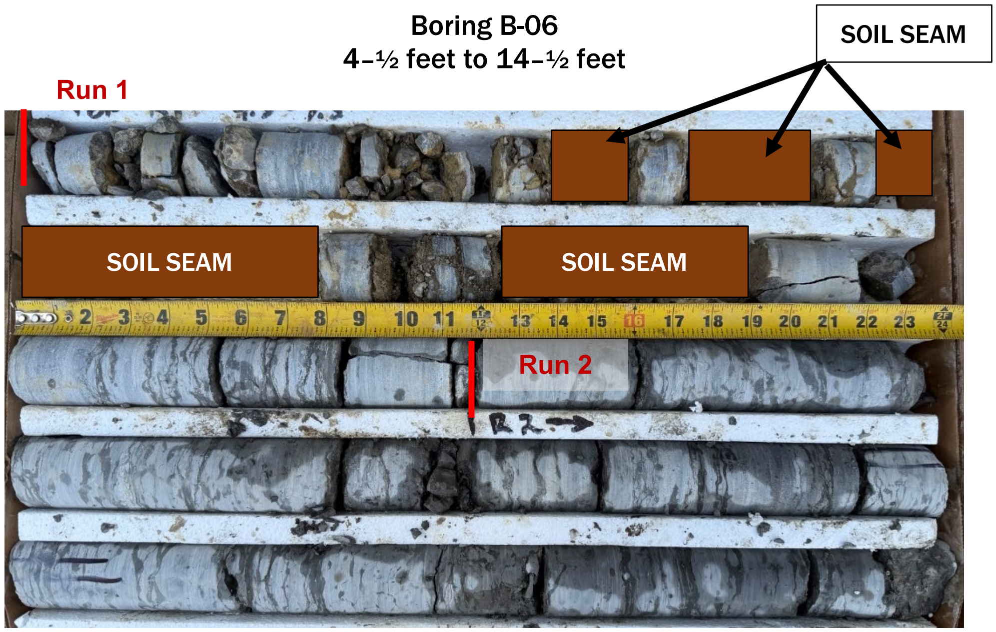
Boring B-06
4–½ feet to 14–½ feet



Run No.	Depth (feet)	Recovery (percent)	RQD (percent)	Rock Quality
1	4–½ to 9–½	56	9	Very Poor
2	9–½ to 14–½	100	76	Good

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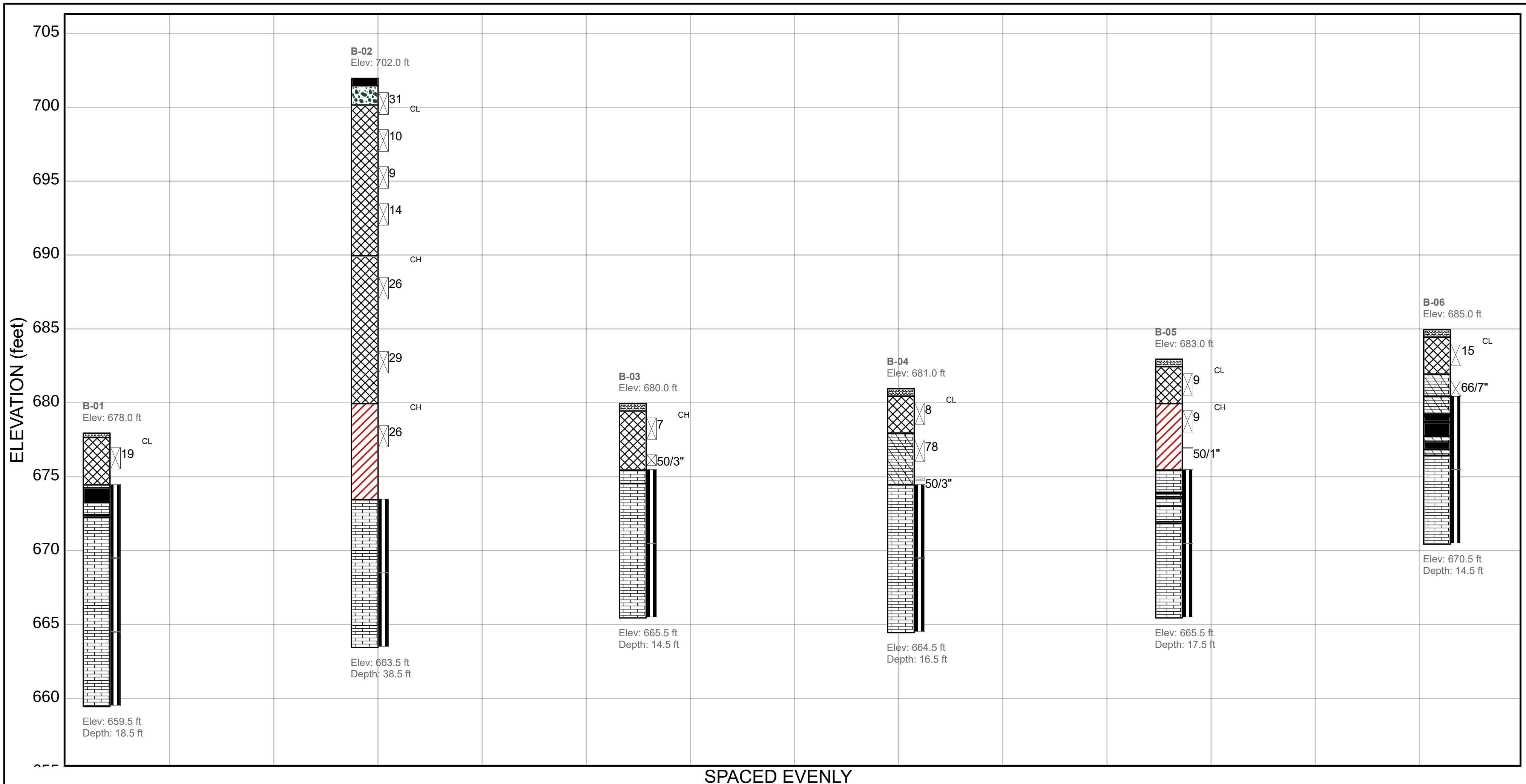


LEGEND KEY

Asphalt, Limestone, CH, weathered Limestone, CL, CL, GP, Topsoil, Asphalt

Scale:
Vertical - As Shown
Horizontal - None

Epps Mill Road Interchange Project
Murfreesboro, Tennessee

CROSS SECTIONS REPORT

TTL

APPENDIX B
REFERENCE MATERIALS

TTL

Laboratory Results Summary

PROJECT Epps Mill Road Interchange Project
CLIENT Neel-Schaffer, Inc.
PROJECT NO. 000240802902.00
LOCATION Murfreesboro, Tennessee

Boring ID	Depth (ft)	Moisture Content (%)	LL	PL	PI	%Gravel	% Sand	% Fines	Dry Density (PCF)	AASHTO	USCS
B-01	1	21.1									
B-02	1	3.5									
B-02	3	27.4									
B-02	3.5	23.7									
B-02	6	23.6									
B-02	3 - 10 (Bulk)	26.8	45	20	25					A-7-6	CL
B-02	8.5	24									
B-02	13.5	24.9									
B-02	18.5	18.1									
B-02	23.5	27.7	61	27	34					A-7-6	CH
B-03	1 - 3 (Bulk)	24.4	62	26	36					A-7-6	CH
B-04	1	23.1									
B-05	1	49.4									
B-05	3.5	28.3									

TTL
624 Grassmere Park, Ste. 14
Nashville, TN 37211
615.331.7770
www.TTLUSA.com

ASTM D 7012 - Compressive Strength of Rock Core Specimens

Client: Neel-Schaffer, Inc

Project: Epps Mill Road Interchange Project
Murfreesboro, Rutherford County, Tennessee

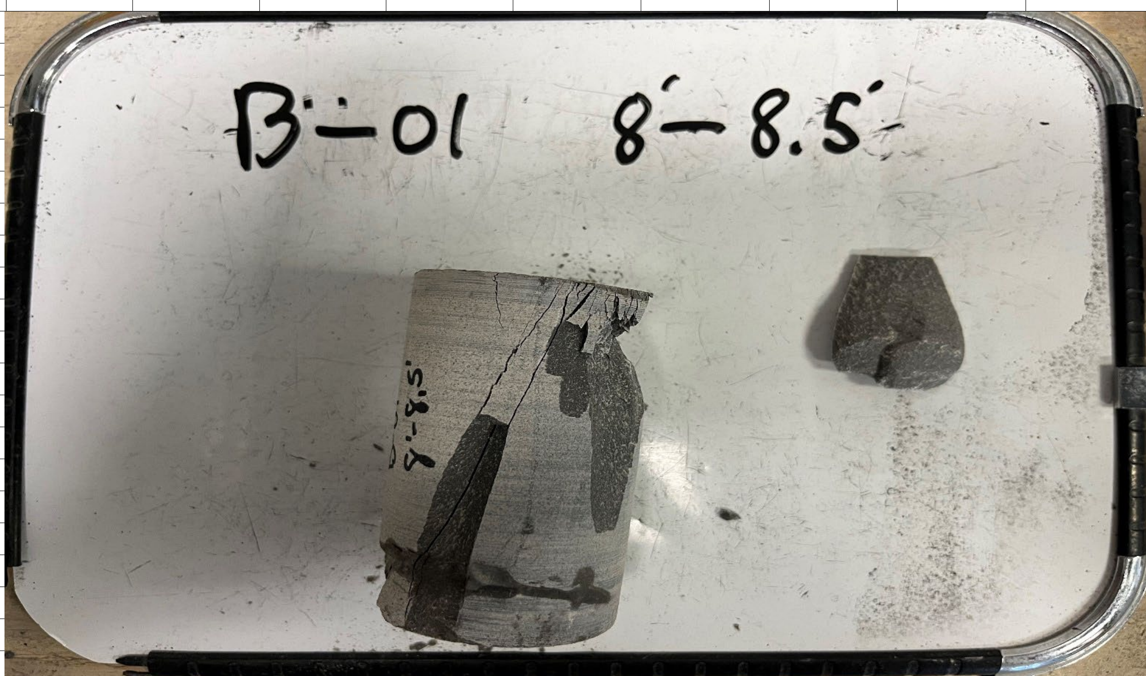
Date: 2025-05-06

Project No: 000240802902.00

Specimen Data

Location: B-01 **Date Cored:** 2025-04-21 **Test Date:** 2025-04-28 **Tech:** JH/KM

Boring No.	Specimen Depth (ft)	Avg. Diameter (in)	Length (in)	Load (lbs)	Area (in^2)	l/d Ratio	Correction Factor	Density (lb/ft^3)	Time to Failure (min:sec)	Compressive Strength (psi)
B-01	8-8.5	1.974	3.404	22,831	3.060	1.7	0.98	165.9	1:44	7,460



Notes:

Stress Rate: 80 psi/s

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ASTM D 7012 - Compressive Strength of Rock Core Specimens

Client: Neel-Schaffer, Inc

Project: Epps Mill Road Interchange Project
Murfreesboro, Rutherford County, Tennessee

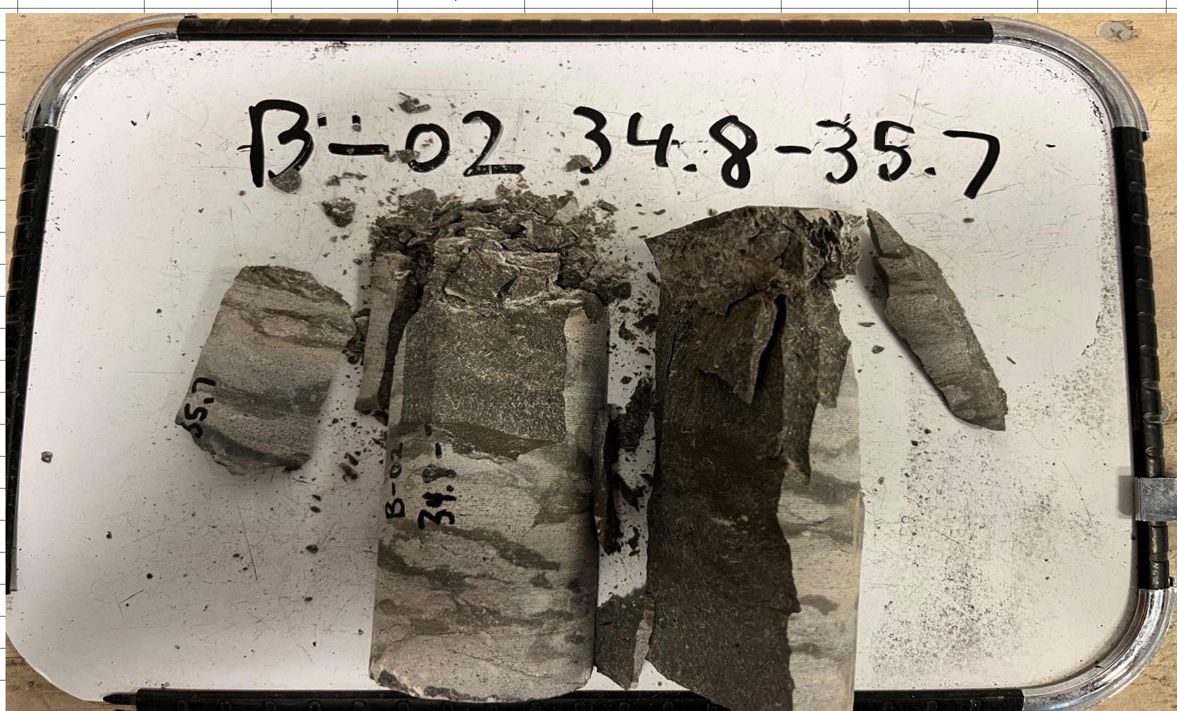
Date: 2025-05-06

Project No: 000240802902.00

Specimen Data

Location: B-02 **Date Cored:** 2025-04-22 **Test Date:** 2025-04-28 **Tech:** JH/KM

Boring No.	Specimen Depth (ft)	Avg. Diameter (in)	Length (in)	Load (lbs)	Area (in^2)	l/d Ratio	Correction Factor	Density (lb/ft^3)	Time to Failure (min:sec)	Compressive Strength (psi)
B-02	34.8-35.7	1.971	4.740	20,542	3.051	2.4	1	167.3	1:58	6,730



Notes:

Stress Rate: 80 psi/s

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ASTM D 7012 - Compressive Strength of Rock Core Specimens

Client: Neel-Schaffer, Inc

Project: Epps Mill Road Interchange Project
Murfreesboro, Rutherford County, Tennessee

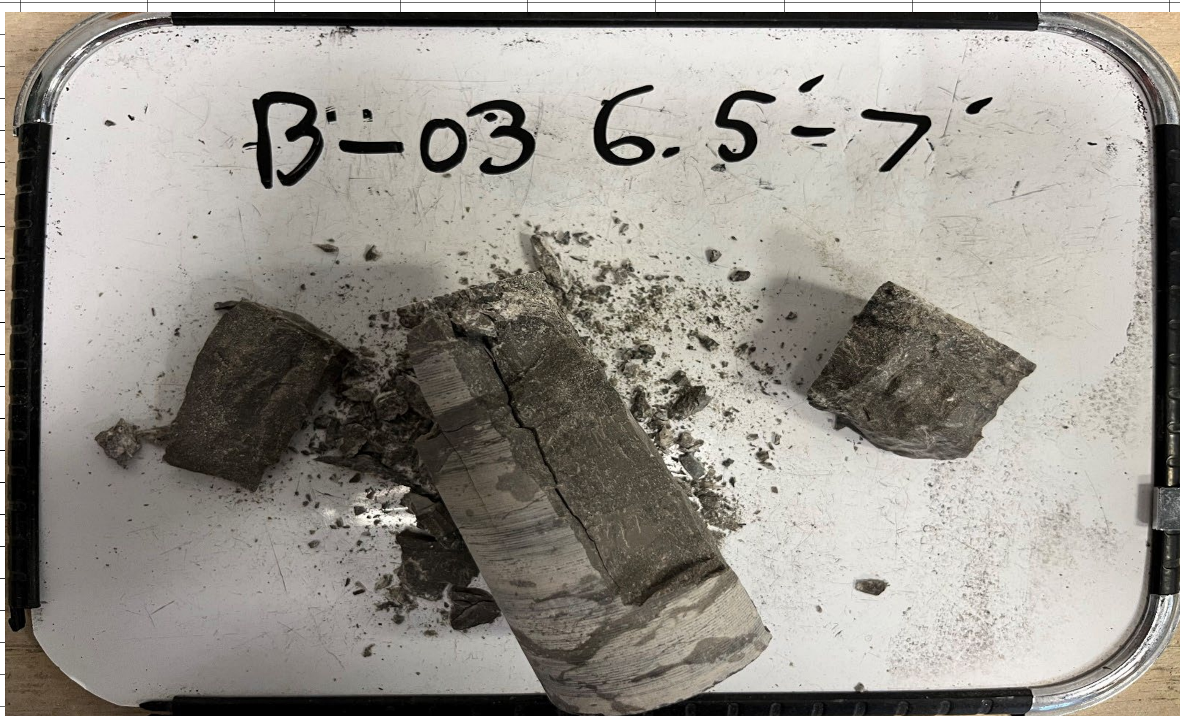
Date: 2025-05-06

Project No: 000240802902.00

Specimen Data

Location: B-03 **Date Cored:** 2025-04-23 **Test Date:** 2025-04-28 **Tech:** JH/KM

Boring No.	Specimen Depth (ft)	Avg. Diameter (in)	Length (in)	Load (lbs)	Area (in^2)	l/d Ratio	Correction Factor	Density (lb/ft^3)	Time to Failure (min:sec)	Compressive Strength (psi)
B-03	6.5-7	1.978	3.963	11,521	3.073	2.0	1	167.4	1:09	3,750



Notes:

Stress Rate: 80 psi/s

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ASTM D 7012 - Compressive Strength of Rock Core Specimens

Client: Neel-Schaffer, Inc

Project: Epps Mill Road Interchange Project
Murfreesboro, Rutherford County, Tennessee

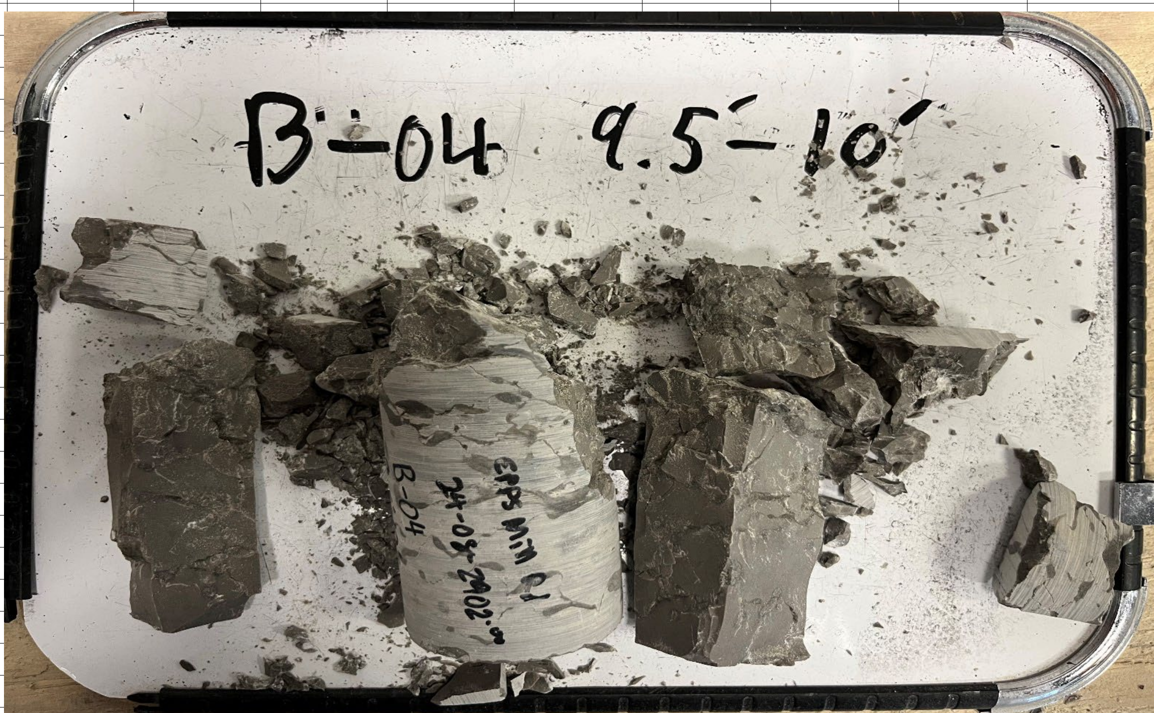
Date: 2025-05-06

Project No: 000240802902.00

Specimen Data

Location: B-04 **Date Cored:** 2025-04-23 **Test Date:** 2025-04-28 **Tech:** JH/KM

Boring No.	Specimen Depth (ft)	Avg. Diameter (in)	Length (in)	Load (lbs)	Area (in^2)	l/d Ratio	Correction Factor	Density (lb/ft^3)	Time to Failure (min:sec)	Compressive Strength (psi)
B-04	9.5-10	1.976	4.246	10,244	3.067	2.1	1	167.2	1:05	3,340



Notes:

Stress Rate: 80 psi/s

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ASTM D 7012 - Compressive Strength of Rock Core Specimens

Client: Neel-Schaffer, Inc

Project: Epps Mill Road Interchange Project
Murfreesboro, Rutherford County, Tennessee

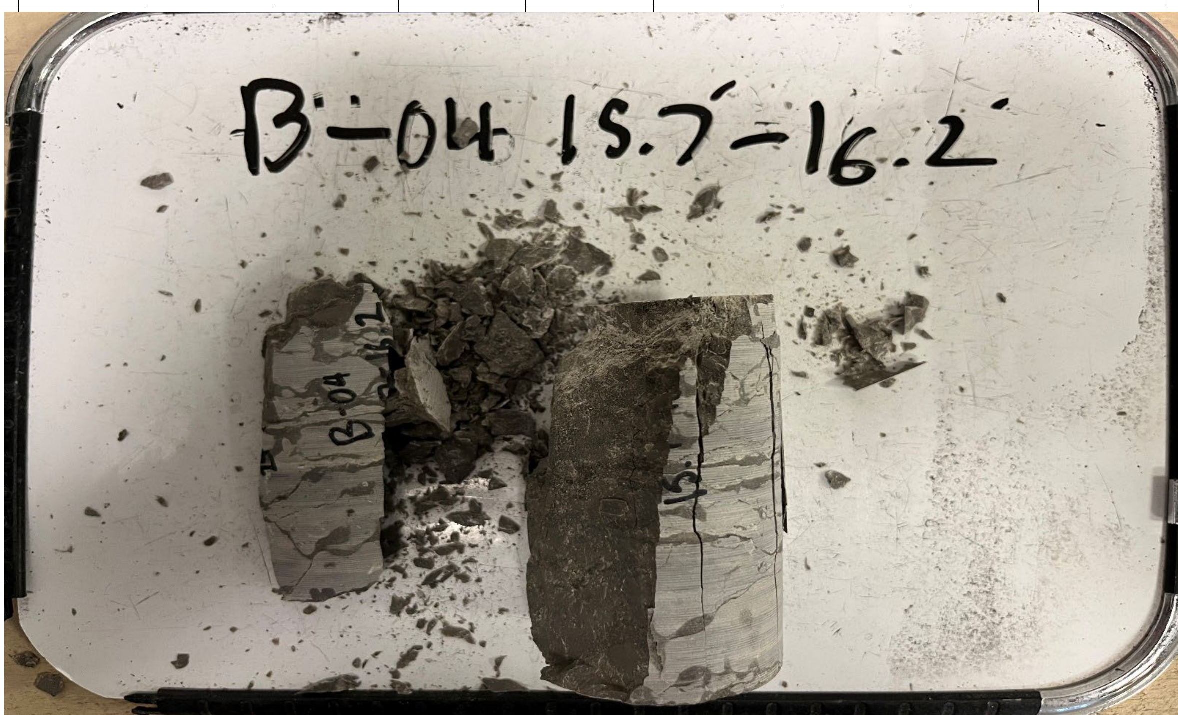
Date: 2025-05-06

Project No: 000240802902.00

Specimen Data

Location: B-04 **Date Cored:** 2025-04-23 **Test Date:** 2025-04-28 **Tech:** JH/KM

Boring No.	Specimen Depth (ft)	Avg. Diameter (in)	Length (in)	Load (lbs)	Area (in^2)	l/d Ratio	Correction Factor	Density (lb/ft^3)	Time to Failure (min:sec)	Compressive Strength (psi)
B-04	15.7-16.2	1.978	3.480	17,982	3.073	1.8	0.98	168.1	1:39	5,850



Notes:

Stress Rate: 80 psi/s

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ASTM D 7012 - Compressive Strength of Rock Core Specimens

Client: Neel-Schaffer, Inc

Project: Epps Mill Road Interchange Project
Murfreesboro, Rutherford County, Tennessee

Date: 2025-05-06

Project No: 000240802902.00

Specimen Data

Location: B-05 **Date Cored:** 2025-04-24 **Test Date:** 2025-04-28 **Tech:** JH/KM

Boring No.	Specimen Depth (ft)	Avg. Diameter (in)	Length (in)	Load (lbs)	Area (in^2)	l/d Ratio	Correction Factor	Density (lb/ft^3)	Time to Failure (min:sec)	Compressive Strength (psi)
B-05	14.9-15.4	1.979	4.748	18,294	3.076	2.4	1	168.0	2:36	5,950

Notes:

Stress Rate: 80 psi/s

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ASTM D 7012 - Compressive Strength of Rock Core Specimens

Client: Neel-Schaffer, Inc

Project: Epps Mill Road Interchange Project
Murfreesboro, Rutherford County, Tennessee

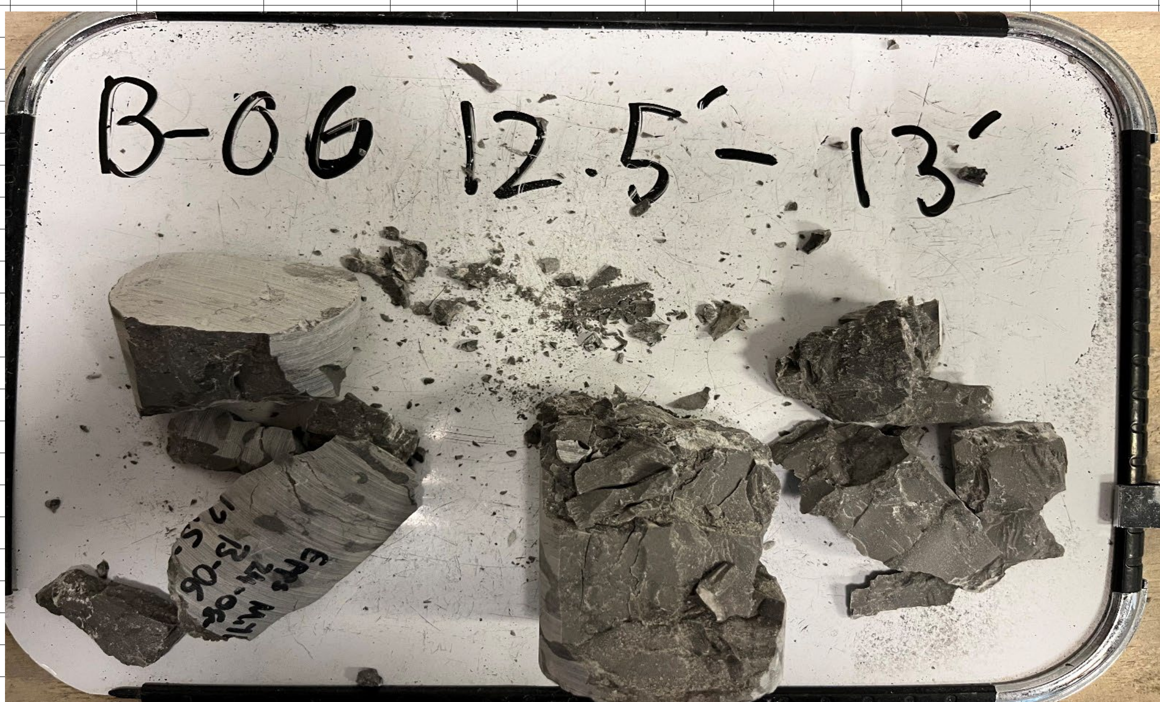
Date: 2025-05-06

Project No: 000240802902.00

Specimen Data

Location: B-06 **Date Cored:** 2025-04-23 **Test Date:** 2025-04-28 **Tech:** JH/KM

Boring No.	Specimen Depth (ft)	Avg. Diameter (in)	Length (in)	Load (lbs)	Area (in^2)	l/d Ratio	Correction Factor	Density (lb/ft^3)	Time to Failure (min:sec)	Compressive Strength (psi)
B-06	12.5-13	1.978	3.759	9,511	3.073	1.9	0.99	167.6	0:50	3,100



Notes:

Stress Rate: 80 psi/s