GEOTECHNICAL EVALUATION

SR 332/BREVINI DR/JACKSON STREET – NEW ROAD
DELAWARE COUNTY, INDIANA

Prepared for:

AMERICAN STRUCTUREPOINT, INC.
9025 RIVER ROAD, SUITE 200
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By

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May 2, 2024

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Mr. Jamie Stetzel, P.E.
American Structurepoint, Inc. (ASI)
9025 River Road, Suite 200
Indianapolis, IN 46240

Re: Geotechnical Report
SR 332/Brevini Dr/Jackson Street - New Road
Delaware County, IN
Terracon Project No.: CJ235416

Dear Jamie,

We have completed a geotechnical report for the referenced project. This report combines our findings and observations and provides recommendations for the planned construction.

The opinions and recommendations submitted in this report are based, in part, on our interpretation of the subsurface information revealed at the exploratory locations as shown on the attached Drawing No. CJ235416.B1. This report does not reflect variations in subsurface conditions between or beyond these locations. Therefore, variations in these conditions can be expected, and fluctuation of the groundwater levels will occur with time. Other important limitations of this report are attached.

BRIEF PROJECT DESCRIPTION

We understand that representatives of Delaware County, using local funds, are planning to construct a new road (Park One Boulevard) connecting SR 332 with Brevini Drive. In addition, the removal of the barrier wall and inside shoulders along SR 332 and subsequent patching is planned to accommodate a new westbound to southbound left-turn lane at the intersection of SR 332 with Park One Boulevard. Per Stage 2 Plans prepared by ASI, the project limits extend from about Sta. 103+02 to Sta. 108+00, Line “PR-S-2-A” on Park One Boulevard, and the construction limits on SR 332 extend from about Sta. 33+83 to Sta. 40+96, Line “A”. The new pavement areas are planned to consist of full-depth Hot Mix Asphalt (HMA).

Drainage improvements are planned to include new storm sewers and concrete curbs or curb and gutter sections along Park One Boulevard and SR 332. Per the plans, the invert depths of the storm sewers are planned at a maximum depth of about 6 ft below the proposed grade of pavement. The existing ditches in some segments of SR 332 are also planned to be re-graded. In addition, a 4 by 2 ft box culvert is planned to carry Park One Boulevard over the ditch at about Sta. 107+74, Line “PR-S-2-A”. The invert depth of the culvert is planned at about 5 ft below the proposed grade (i.e., El. 880 to 881). Headwalls and wingwalls are planned at the ends of the culvert. From the plans, maximum side slopes are not anticipated to exceed 3 Horizontal (H) : 1 Vertical (V). Cut and fill of up to 7 and 4 ft, respectively, are planned to establish the grade for the new pavement areas and facilitate ditch grading. The projected annual average daily traffic (AADT) in Year 2044 is 18,000 vehicles per day (vpd) along Park One Boulevard. Maintenance of traffic (MOT) along SR 332 will be accomplished by phased lane closures.

If the nature, design, or location of the proposed construction changes, the conclusions, and recommendations contained in this memo shall not be considered valid unless changes are reviewed, and the conclusions are modified or confirmed in writing by Terracon Consultants, Inc. (Terracon). We understand that the Indiana Department of Transportation Standard Specifications (ISS) 2024 will be used for construction.

BRIEF DISCUSSION OF GEOTECHNICAL PROGRAM

Exploratory locations were performed as approximately shown on the attached Drawing No. CJ235416.B1. Terracon selected the exploratory locations in general accordance with INDOT guidelines and ASI approved these locations. Two test borings (designated as CB-01 and CB-02) were performed near the location of the planned culvert to a depth of about 20 ft below the existing surface. Test borings were performed at two locations along the proposed alignment of Park One Boulevard (designated as RB-01 and RB-02) to a depth of about 10 ft below the existing surface and at two locations along SR 332 (designated as RB-03 and RB-04) to a depth of about 5½ ft below the existing surface. Representative samples of the soil conditions were obtained using the Standard Penetration Test (SPT) procedure. Shelby tube samples were obtained between the depth of about 2 to 4 ft below the existing surface at offsets from Borings RB-01 and RB-04. A pavement core was collected at Boring RB-03. In addition, Pavement Cores PC-01 and PC-02 were performed on Brevini Drive and a passing blister on SR 332, respectively. The pavement cores were performed using a 4-in. diameter diamond-impregnated core barrel. After obtaining groundwater observations, each borehole was backfilled with auger cuttings and bentonite chips, and the pavement was repaired with a patch.

Following the field activities, all pavement cores were reviewed and photographed by a Terracon geologist. Detailed pavement core locations and photographs of the cores, the surface of the pavement, and the core hole are included in the attached Pavement Core Logs. The soil samples were visually classified by a Terracon geologist and were reviewed by a Terracon engineer. After visually classifying the soils, representative samples were selected for index property and strength testing. The laboratory testing program included the following: natural moisture content, grain size analysis, Atterberg limits, specific gravity determination, water-soluble sulfate content, soil pH, loss on ignition (LOI), unconfined compression test, unit density, hand penetrometer readings, and topsoil testing for INDOT's plant growth layer.

Soil descriptions on the boring logs are in general accordance with the AASHTO Soil Classification System [AASHTO designation, e.g. A-6 (8)] and the INDOT Standard Specifications (ISS[1]) (textural classification, e.g., clay). The boring logs represent our interpretation of the individual samples, field logs, and results of the laboratory tests. The stratification lines on the boring logs represent the approximate boundary between soil types; although, the transition may be gradual.

SITE CONDITIONS

Surface Conditions

Detailed pavement core locations and information are included in the attached Pavement Core Logs. Pavement Core PC-01 performed on the westbound lane of Brevini Drive consisted of about 5 in. of HMA. Pavement Cores PC-02 and RB-03/PC-03 performed along SR 332 consisted of about 4½ and 4 in. of HMA on about 8¾ and 9 in. of Portland cement concrete pavement (PCCP), respectively. Granular subbase consisting of crushed stone was observed underlying the pavement at all pavement core locations.

Based on our observation of the pavement cores, the asphalt layers and the PCCP were generally in good condition. However, delamination and low-severity stripped asphalt were observed at the interface of the HMA and PCCP in the composite (i.e., HMA on PCCP) pavement cores.

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[1] References the Indiana Department of Transportation (INDOT) Standard Specifications.

Approximately 6 to 8 in. of surficial soil was observed at the test borings performed off the pavement along the proposed alignment of Park One Boulevard. Based on the topsoil testing result, organic matter was not present in the surficial soil sampled near Boring CB-02.

Subsurface Conditions

The subsurface conditions underlying the topsoil or pavement generally consisted of cohesive soils over granular soils. The cohesive soils consisted of A-6 clay and A-4 loam. The clay was typically observed within the limits of Park One Boulevard, and the loam was observed within the limits of SR 332.

The following table summarizes our laboratory testing results for the cohesive soils.

TABLE 1: SUMMARY OF LABORATORY TESTING RESULTS FOR COHESIVE SOILS

Soil Type	A-4: Loam	A-6: Clay	Visual: Clay[2]
Plasticity, Plasticity Indices (PI)	Slight, 6	Medium, 13	Medium, 21
Consistency[1]	Very Stiff to Hard	Very Stiff	Medium Stiff
Typical Moisture Content Range (%)	8 to 13	12 to 19	19 to 23
Typical Hand Penetrometer Readings Range (tons/sq ft [tsf])	3½ to >4½	1 to >4½	1 to 3½
In-situ Dry Density (lbs/cu ft)	Not Tested	119 to 124	98
Unconfined Compression (tsf)	Not Tested	4.40 and 5.86	Not Tested

1. Based on SPT N-value criteria established by INDOT.
2. A grain size analysis was not completed due to low sample recovery. As such, an AASHTO designation was not determined.

The granular soils had textural classifications of sand and sandy gravel. The sandy gravel had AASHTO designation of A-1-a while the sand was visually classified. The relative density of the granular soils generally ranged from medium dense to dense, based on SPT N-value criteria established by INDOT.

The pH level of the soil samples tested ranged from 7.9 and 8.3. Water soluble sulfate test results indicated concentration levels of less than 40 parts per million (ppm). Based on the LOI test result, organic matter (LOI of 5 percent) was present in the visually described clay observed at Boring RB-01.

Groundwater Observations

Groundwater was observed near a depth of about 2½ ft below the pavement surface at Boring RB-02. In addition, based on our review of the *Soil Survey of Delaware County, Indiana,* seasonal changes in the groundwater depth within the project limits are generally expected to remain below 6 ft from the natural ground surface. It should be noted that groundwater levels of any kind will fluctuate due to changes in precipitation, infiltration, surface runoff, and other hydrogeological factors.

DISCUSSION AND RECOMMENDATIONS

General

Based on our understanding of the planned improvements and information obtained from the exploratory locations, it is our opinion that the subsurface conditions are generally conducive to support the planned construction. The risk from a geotechnical perspective is associated with foundation soil preparation and improvement (where necessary) for the new pavement areas and for storm sewer and culvert installation. Additional discussion and recommendations are provided in the following paragraphs.

Site and Foundation Soil Preparation

In all areas to receive new pavement components, we recommend all existing pavement components and surficial soils be removed from within the construction limits, as necessary. We recommend that these removal activities be per Section 201 of the ISS. It should be noted that the observed topsoil thickness was up to 8 in. in some locations. Scalping as defined by Section 201.04 of the ISS accounts for the removal of 4 in. of topsoil. As such, we recommend additional quantities for topsoil removal be included in the contract documents. We recommend that utilities in conflict with the proposed construction be appropriately abandoned or relocated. Where utilities (if any) are relocated or abandoned, we recommend that the resulting excavations be backfilled with B borrow per ISS 203.09 and compacted to 100 percent of the Standard Proctor density (AASHTO T 99). Where root masses are removed via clearing and grubbing, we recommend that the area be regraded immediately to reduce the risk of soft areas developing due to loosely placed fill or ponding water.

After the removal of surficial soils and pavement components, where necessary, we anticipate that granular and cohesive soils will be encountered. We recommend that areas exhibiting cohesive soils be proofrolled in accordance with ISS 203.26. The purpose of proofrolling is to provide a first-order evaluation of how the foundation soil is anticipated to react to construction traffic and gain an additional understanding of the conditions for support of the planned improvements. We recommend that the proofrolling be observed by a geotechnical engineer or engineering technician. Areas of limited access should be evaluated by alternative means (i.e., dynamic cone penetrometer). We also recommend that the subgrade treatment and new pavement components be placed soon after the foundation soil is evaluated in order to reduce the risk of the foundation soil deteriorating due to precipitation or excessive construction traffic.

Based on our review of the conditions of the shallow soil (i.e., depths up to 5 ft below the existing surface), we anticipate the exposed foundation soils will favorably pass a proofroll. However, these cohesive soils are moisture-sensitive and will deteriorate if exposed to moisture. To reduce the risk of deteriorating foundation soils, we recommend that construction take place during the traditionally drier weather months of July through September, if possible.

For areas that yield during proofroll, we recommend foundation soil improvement consisting of undercutting to firm soil or a maximum depth of 18 in. below the subgrade treatment bottom elevation, and the grade be reestablished with 18 in. of No. 53 crushed stone over Type 2A geotextile in accordance with ISS 918.02(c). The depth or extent of the undercutting will require the judgment of a qualified person during construction. For contingency, we recommend that a quantity of this foundation soil improvement equivalent to 50 percent of the new pavement area be included in the contract.

We recommend that areas exhibiting granular soils be compacted in place via several passes of a vibratory roller in accordance with ISS 203.09. In addition, we recommend that the foundation soil be graded at the end of each day to facilitate positive drainage and reduce the risk of ponding water.

Fill Placement and Compaction

As previously mentioned, the maximum earth fill placement height planned on the project is about 4 ft. We recommend that the fill used to raise grades or reestablish the design grades be placed in loose-lift thicknesses not exceeding 8 in. and compacted to 95 percent of the maximum density obtained per AASHTO T 99 as specified in the ISS. The borrow source(s) were not known at the time of this report, but we anticipate it may come from cuts along the new alignment of Park One Boulevard. We anticipate the in-situ soils are suitable for reuse as fill, as needed, provided they satisfy the recommendations for use as fill as outlined in Section 203.08 in the ISS. Moisture conditioning and/or discing may be required to improve the existing conditions.

Based on a review of the plans, side slopes as steep as 3H:1V are anticipated. Global instability of the slopes established at 3H:1V is generally not of concern, but the performance of these slopes will be directly dependent on the foundation soil preparation and the quality of compaction achieved. Benches should be cut into any existing slopes steeper than 4H:1V before fill placement to key the new fill into the slope. Anticipating shallow embankment heights, 10-ft wide benches (i.e., minimum) are recommended. Scarifying the slope will also aid in keying the new fill into the slope. To minimize sloughing and erosion, it is important to provide adequate compaction and erosion and sloughing protection at the face of the embankment via aggressively growing vegetation or riprap.

Pavement Design Parameters

Based on the nature of the project, we recommend Subgrade Treatment, Type II with a Geogrid, Type IB for the new pavement areas. Provided the foundation soils are prepared as previously discussed, the following table summarizes the recommended pavement analysis and design parameters.

TABLE 2: SUMMARY OF PAVEMENT DESIGN PARAMETERS

Design Soil Type	A-6, Clay
Resilient Modulus (M_r) for Subgrade Treatment, Type II, psi	7,500
Resilient Modulus (M_r) for Subgrade Treatment, Type IC, psi	12,000
Resilient Modulus (M_r) for Natural Subgrade[1], psi	4,000
Percent Passing No. 200 Sieve	80
Percent Silt	46
Liquid Limit (LL)	28
Plastic Limit (PL)	15
Plasticity Index (PI)	13
Organic Content, LOI percent	N/A
Soluble Sulfate Content	< 40 ppm
Depth to Water, ft	Seasonal: Spring and Winter: 2½ Summer and Autumn: > 6
Natural Dry Density of Subgrade, pcf	119
In-situ Moisture Content of Subgrade, percent	16
Depth to Rock, ft	Greater than 20
Recommended Subgrade Treatment	Type II with a Geogrid, Type IB

1. Based on our engineering judgment and experience with similar soils.

Per our correspondence with ASI, we understand that Subgrade Treatment, Type IC may be used along SR 332 following their correspondence with INDOT. We do not take exception to the use of Subgrade Treatment, Type IC.

It is important to provide positive drainage during construction before the subgrade treatment is performed in order to reduce the risk of wet soil conditions. The foundation soil should be graded at the end of each day to facilitate positive drainage. The long-term performance of the pavement is a function of routine maintenance (e.g., crack sealing), which will be the responsibility of the owner to perform.

Storm Sewer Considerations

As previously discussed, storm sewer inverts are planned to be established at a maximum depth of about 6 ft below the proposed profile grade. Based on our observations at the exploratory locations, we anticipate that medium stiff to hard cohesive soils will be encountered at the foundation soil grade. The cohesive soils observed at the test boring locations are moisture-sensitive and will soften if exposed to moisture. Thus, the condition of the foundation soils will be a function of the care and workmanship of the contractor. Anticipating a gravity-flow system, preparation of the pipe foundation will be necessary to reduce the risk of settlement of disturbed soils at the base of the trench. Where yielding or otherwise unstable soils are encountered at the pipe foundation elevation, they should be undercut and backfilled with structural backfill. For estimating purposes, we recommend including quantities of undercutting 12 in. and backfill with structural backfill for an area equal to 10 percent of the storm sewer footprint.

Per section 904.05 of the ISS, we recommend that quantities of fill and structural backfill for the sewer be based on 100 percent imported soil. Since the pipes are anticipated to be located beneath or adjacent to the proposed roadways, the trenches should be backfilled to grade with structural backfill material. The structural backfill material should be compacted to 95 percent of the maximum dry density obtained per AASHTO T 99 and INDOT Specifications. Hand or remote-guided vibratory compactors are recommended for compacting the bedding material and material on either side of the pipe. The first several lifts of backfill over the pipes should also be compacted with small vibratory compactors to promote proper compaction and to prevent damage to the pipe from heavier, high-energy compactors.

Culvert and Headwall/Wingwall Considerations

Based on our observation at our exploratory locations, we anticipate the foundation soils for the new culvert to be stiff to hard A-6 clay. These conditions are adequate for the support of the new culvert provided they are prepared as discussed previously for the foundation soils. The cohesive soils are moisture-sensitive and will deteriorate if exposed to excess construction traffic and/or moisture. We recommend that the base of the excavation be exposed immediately prior to the placement of the culvert (i.e., not left open for an extended period of time). Dewatering may be necessary depending on the flow in the channels at the time of construction. Since MOT will be accomplished by closing off the construction area, temporary excavation support will not be required.

Note that INDOT recommends that 6 in. of No. 8 or No. 5 crushed stone is to be placed below the entire base of the culvert underlain by Type 2A (ISS 918.02a) geotextile. Alternatively, a mud mat consisting of 4 in. of Type B concrete could be utilized to level the foundation grade and protect the underlying cohesive soils. We recommend that you include these quantities in your contract over the entire base area of the culverts.

The area around and above the culvert should be backfilled in accordance with ISS 714. Since the structures will be located beneath the existing roadway, the trenches should be backfilled to grade with structural backfill material. In our opinion, the structural backfill should be compacted to 95 percent of the maximum dry density obtained per AASHTO T 99 and INDOT Specifications and at 100 percent for the upper 2 ft. Hand or remote-guided vibratory compactors are recommended for compacting the bedding material and material on either side of the culvert. The first several lifts of backfill over the culvert should be compacted with small vibratory compactors to promote proper compaction and help prevent damage to the structures from heavier, high-energy compactors.

As mentioned earlier, a headwall and wingwalls are planned at the ends of the culvert. We recommend that foundations for the headwall and wingwalls be established a minimum of 4 ft below the flowline per INDOT Design Manual (IDM) 203-2.06(03). The invert of the culvert is planned near El. 880 to 881. As such, flowline is anticipated near El. 880 to 881. We anticipate that the foundations for the headwall and wingwalls will be established near or below El. 876 to 877. Per our observations at the culvert boring locations, conditions exposed at the headwall and wingwall foundation grade are anticipated to consist of stiff to hard A-6 clay, underlain by medium dense to dense A-1-a sandy gravel near El. 871. We anticipate these conditions to be adequate to support headwalls and wingwalls provided the foundations soils are prepared as previously discussed. We recommend that the minimum footing width of the foundation be 3 ft.

Following our attached Bearing Resistance Analysis, headwall and wingwall foundations may be designed in accordance with the table below. The recommended bearing resistances assume that up to 2 ft of scour will occur throughout the lifetime of the culvert.

TABLE 3: GEOTECHNICAL PARAMETERS FOR HEADWALL/WINGWALL DESIGN

Wingwall Bearing Soil Type	Clay
Friction Angle between Headwall/Wingwall and Backfill* (deg)	20
Estimated Unit Weight of Structural Backfill, $\gamma_{\text{moist/saturated}}$ (pcf)	120
Angle of Friction between Footing and Crushed Stone** (δ, deg)	26
Undrained Cohesion of Foundation Soil (s_u, psf) (Clay)	1,800
Adhesion of Foundation Soil (C_a, psf) (Clay)	1,800
Drained Internal Friction Angle of Foundation Soil (Ø’, deg) (Clay)	---
Factored Bearing Resistance (psf)	4,700
Resistance Factor (ϕ)	0.45
Nominal Bearing Resistance (psf)	10,500
*Using Structure Backfill, Type 2 **8 in. of No. 8 crushed stone placed below the headwall/wingwall footings (ISS 714.05)	

All backfill behind the headwall and wingwalls should be placed to a minimum of 95 percent of the maximum dry density as determined by AASHTO T 99 (standard Proctor). In addition, it is recommended that the granular soils used as backfill extend horizontally from the back of the headwall and wingwall a distance equal to half the wall height. Furthermore, compaction of backfill within 3 ft of the walls should be performed with a hand-guided compactor to avoid over-stressing.

Excavations and Dewatering

All excavations should comply with Occupational Safety and Health Administration (OSHA) standards. Stockpiled soil should not be placed adjacent to the excavation, nor should equipment be allowed to operate too closely to excavations. Proper site drainage is recommended to reduce unwanted surface water runoff into excavations during the construction process. The contractor is solely responsible for constructing and maintaining stable excavations.

Based on our review of the *Soil Survey of Delaware County, Indiana*, seasonal high groundwater for the project area typically remains below a depth of 6 ft below the existing surface throughout the year. However, groundwater was observed near depths of about 2½ ft below the existing surface (i.e., near Elevation 891) at Boring RB-02. As such, the groundwater levels at the time of construction may be higher, particularly during the late fall, winter, and early spring months. We recommend the contractor be prepared to dewater during construction. It should be noted that the soil conditions varied within the project limits. As such the dewatering requirements will vary. Within the encountered cohesive soils, traditional dewatering methods (e.g., sumps with filtered pumps, possibly in conjunction with collection trenches) will be necessary to maintain a dry excavation and protect the cohesive foundation soils. Dewatering in granular soils will possibly require the use of well points or high-volume sump pumps in slotted casing outside the excavation. The scope of this evaluation was to provide geotechnical design parameters for the project elements. Our evaluation was not to provide dewatering recommendations for contractors. Dewatering is the responsibility of the contractor based on their means and methods and considers the requirements of foundation soil preparation discussed herein. The effectiveness of the foundation soil preparation activities discussed previously will be directly dependent on the adequacy of the contractor's dewatering efforts.

CLOSING REMARKS

We appreciate the opportunity to provide our services to you on this project. Feel free to contact our office if you have any questions or need further assistance.

Sincerely,

TERRACON CONSULTANTS, INC.

KELLEN PATRICK HEAVIN
PE11011658

Kellen P Heavin

Vladimir H. Abou Sejaan, M.S.
Group Leader

Kellen P. Heavin, P.E.
Senior Project Engineer

Attachments –

Important Information about this Geotechnical Engineering Report
Exploratory Location Plan (Drawing No. CJ235416.B1)
Log of Test Boring - General Notes
Log of Test Boring (8)
Summary of Pavement Cores
Pavement Core Logs (3)
Grain Size Distribution Test Report
Unconfined Compression Test
Summary of Existing Topsoil Test Results for Use with Plant Growth Layer
Bearing Resistance Analysis

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 not 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 not be adequate to develop geotechnical design recommendations for the project.

Do not 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 not rely on an executive summary. Do not 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 not 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 Not 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 not 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 not building-envelope or mold specialists.***

GBA
GEOPROFESSIONAL
BUSINESS
ASSOCIATION

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e-mail: info@geoprofessional.org www.geoprofessional.org

LEGEND

◑ Test Boring Location and Designation

⊛ Test Boring and Pavement Core Location and Designation

○ Pavement Core Location and Designation

NOTES

1. Base map developed using aerial imagery from Indiana Geological and Water Survey. Aerial imagery may not reflect current site conditions.
2. Line work provided by American Structurepoint, Inc.
3. Vicinity map generated using data from Indiana Geological and Water Survey and Esri.
4. Exploratory locations marked in the field by Terracon Consultants, Inc.
5. Exploratory locations are approximate.

EXPLORATORY LOCATION PLAN

PROJECT: SR 332/Brevini Dr/Jackson Street - New Road
LOCATION: Delaware County, IN
CLIENT: American Structurepoint, Inc.
TCI PROJECT NO.: CJ235416
SCALE: 1 in. = 100 ft

PROJECT ENG.: VAS
REVIEWED BY: KPH
DRAWN BY: CPS
DATE: 03/29/2024

Terracon

DRAWING NO.: CJ235416.B1

LOG OF TEST BORING – GENERAL NOTES

DESCRIPTIVE CLASSIFICATION

GRAIN SIZE TERMINOLOGY

Soil Fraction	Particle Size	US Standard Sieve Size
Boulders	Larger than 75 mm	Larger than 3”
Gravel	4.76 mm to 75 mm	#10 to 75 mm
Sand: Coarse	2.00 to 4.76 mm	#40 to #10
Fine	0.075 to 0.42 mm	#200 to #40
Silt	0.002 to 0.075 mm	Smaller than #200
Clay	Smaller than 0.002 mm	Smaller than #200

GENERAL TERMINOLOGY

Physical Characteristics
- Color, moisture, grain shape fineness, etc.

Major Constituents
- Clay silt, sand, gravel

Structure
- Laminated, varved, fibrous, stratified, cemented, fissured, etc.

Geologic Origin
- Glacial, alluvial, eolian, residual, etc.

RELATIVE PROPORTIONS OF COHESIONLESS SOILS

Term	Defining Range by % of Weight
Trace	1 – 10%
Little	11 – 20%
Some	21 – 35%
And	36 – 50%

ORGANIC CONTENT BY COMBUSTION METHOD

Soil Description	LOI
w/ organic matter	4 – 15 %
Organic Soil (A-8)	16 – 30%
Peat (A-8)	More than 30%

RELATIVE DENSITY

Term	“N” Value
Very loose	0 – 5
Loose	6 – 10
Medium dense	11 – 30
Dense	31 – 50
Very Dense	51+

CONSISTENCY

Term	“N Value”
Very soft	0 - 3
Soft	4 - 5
Medium	6 - 10
Stiff	11 - 15
Very Stiff	16 - 30
Hard	31+

PLASTICITY

Term	Plastic Index
None to slight	0 – 4
Slight	5 – 7
Medium	8 – 22
High/Very High	Over 22

The penetration resistance, N, is the summation of the number of blows required to effect two successive 6-in. penetrations of the 2-in. split-barrel sampler. The sampler is driven with a 140-lb weight falling 30 in. and is seated to a depth of 6 in. before commencing the standard penetration test.

SYMBOLS

DRILLING AND SAMPLING

AS – Auger Sample
BS – Bag Sample
C – Casing Size 2½”, NW, 4”, HW
COA – Clean-Out Auger
CS – Continuous Sampling
CW – Clear Water
DC – Driven Casing
DM – Drilling Mud
FA – Flight Auger
FT – Fish Tail
HA – Hand Auger
HSA – Hollow Stem Auger
NR – No Recovery
PMT – Borehole Pressuremeter Test
PT – 3” O.D. Piston Tube Sample
PTS – Peat Sample
RB – Rock Bit
RC – Rock Coring
REC – Recovery
RQD – Rock Quality Designation
RS – Rock Sounding
S – Soil Sounding
SS – 2” O.D. Split-Barrel Sample
2ST – 2” O.D. Thin-Walled Tube Sample
3ST – 3” O.D. Thin-Walled Tube Sample
VS – Vane Shear Test
WPT – Water Pressure Test

LABORATORY TESTS

q_p – Penetrometer Reading, tsf
q_u – Unconfined Strength, tsf
W – Moisture Content, %
LL – Liquid Limit, %
PL – Plastic Limit, %
PI – Plasticity Index
SL – Shrinkage Limit, %
LOI – Loss on Ignition, %
γ_d – Dry Unit Weight, pcf
pH – Measure of Soil Alkalinity/Acidity

WATER LEVEL MEASUREMENT

BF – Backfilled upon Completion
NW – No Water Encountered

Note: Water level measurements shown on the boring logs represent conditions at the time indicated and may not reflect static levels, especially in cohesive soils.

LOG OF TEST BORING

BORING NO.: **CB-01**
SHEET 1 OF 1
CLIENT : American Structurepoint, Inc.
LATITUDE : 40.21821
DES NO. : ---
STRUCTURE #: ---
LONGITUDE : -85.55330
PROJECT TYPE: New Road Construction and Intersection Improvement
DATUM : WGS 84
LOCATION : SR 332-Brevini Drive-Jackson Street
DATE STARTED : 02-16-24
COUNTY : Delaware
PROJECT NO.: CJ235416
DATE COMPLETED : 02-16-24

ELEVATION : 886.0
STATION : 107+36
OFFSET : 83.0 ft Left
LINE : 'S-2-A'
DEPTH : 20.0 ft
BORING METHOD : Hollow Stem Auger
RIG TYPE : 7822
CASING DIA. : ---
CORE SIZE : ---
HAMMER : Auto
DRILLER/INSP : G.B.
TEMPERATURE : 35 °F
WEATHER : Mild

GROUNDWATER: ∇ Encountered at NW ▼ At completion NW ▨ Caved in at 14.0 ft

ELEVATION	SAMPLE DEPTH	SOIL/MATERIAL DESCRIPTION	SAMPLE NUMBER	SPT per 6"	% RECOVERY	MOISTURE CONTENT	DRY DENSITY, pcf	POCKET PEN., tsf	UNCONF. COMP., tsf	ATTERBERG LIMITS LL	PL	PI	REMARKS
	0.5	**Topsoil**											
		Clay, stiff to hard, moist, brown to gray near 5 ft, with sandy loam seam near 10 ft, A-6, Lab No. 38277	SS 1	5-5-6	78	15.1 12.5		1.5 2.0					
			SS 2	3-5-8	44	14.1 12.7		2.0 1.5					
			SS 3	6-10-13	78	14.1		4.0					
			SS 4	11-22-20	33	15.2		2.0					
	15.0		SS 5	15-16-12	44	14.0 14.8		3.0 2.5					
	20.0	**Sandy Gravel**, medium dense, moist, brown, A-1-a(0), Lab No. 38278	SS 6	8-11-12	56					NP	NP	NP	19.5, pH = 8.3
		Bottom of Boring at 20.0 ft											

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LOG OF TEST BORING

BORING NO.: **CB-02**
SHEET 1 OF 1
CLIENT : American Structurepoint, Inc.
LATITUDE : 40.21817
DES NO. : ---
STRUCTURE #: ---
LONGITUDE : -85.55265
PROJECT TYPE: New Road Construction and Intersection Improvement
DATUM : WGS 84
LOCATION : SR 332-Brevini Drive-Jackson Street
DATE STARTED : 02-16-24
COUNTY : Delaware
PROJECT NO.: CJ235416
DATE COMPLETED : 02-16-24

ELEVATION : 885.0
STATION : 35+67
OFFSET : 56.0 ft Right
LINE : 'A'
DEPTH : 20.0 ft

BORING METHOD : Hollow Stem Auger
RIG TYPE : 7822
CASING DIA. : ---
CORE SIZE : ---

HAMMER : Auto
DRILLER/INSP : G.B.
TEMPERATURE : 35 °F
WEATHER : Mild

GROUNDWATER: ∇ Encountered at NW ▼ At completion NW ☒ Caved in at 16.0 ft

ELEVATION	SAMPLE DEPTH	SOIL/MATERIAL DESCRIPTION	SAMPLE NUMBER	SPT per 6"	% RECOVERY	MOISTURE CONTENT	DRY DENSITY, pcf	POCKET PEN., tsf	UNCONF. COMP., tsf	ATTERBERG LIMITS LL	PL	PI	REMARKS
		Topsoil 0.5											
	2.5		SS 1	4-8-8	44	15.5		3.5					
880.0	5.0		SS 2	3-6-7	44	15.7		3.0		28	15	13	4.5, pH = 7.9, SG = 2.73
	7.5	**Clay**, stiff to very stiff, moist, gray, with sandy loam seam near 1 ft, A-6(8), Lab No. 38277	SS 3	5-7-7	67	13.5 18.0		2.5 1.0					
875.0	10.0		SS 4	5-6-7	56	15.6 15.5	118.5	4.0 >4.5	4.40				
	12.5	13.5											
870.0	15.0		SS 5	14-21-25	67								
	17.5	**Sandy Gravel**, dense, moist, brown, A-1-a, Lab No. 38278											
865.0	20.0	20.0	SS 6	11-28-20	56								
		Bottom of Boring at 20.0 ft											
	22.5												
860.0	25.0												
	27.5												
855.0	30.0												

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LOG OF TEST BORING

BORING NO.:	**RB-01**
SHEET	1 OF 1
LATITUDE :	40.21709
LONGITUDE :	-85.55326
DATUM :	WGS 84
DATE STARTED	: 02-16-24
DATE COMPLETED :	02-16-24

CLIENT : American Structurepoint, Inc.
DES NO. : ---
STRUCTURE #: ---
PROJECT TYPE: New Road Construction and Intersection Improvement
LOCATION : SR 332-Brevini Drive-Jackson Street
COUNTY : Delaware
PROJECT NO.: CJ235416

ELEVATION	: 896.0	BORING METHOD	: Hollow Stem Auger	HAMMER	: Auto
STATION	: 103+47	RIG TYPE	: 7822	DRILLER/INSP	: G.B.
OFFSET	: 0.0 ft	CASING DIA.	: ---	TEMPERATURE	: 35 °F
LINE	: 'PR-S-2-A'				
DEPTH	: 10.0 ft	CORE SIZE	: ---	WEATHER	: Mild

GROUNDWATER: ∇ Encountered at NW ▼ At completion NW ▨ Caved in at 8.0 ft

ELEVATION	SAMPLE DEPTH	SOIL/MATERIAL DESCRIPTION	SAMPLE NUMBER	SPT per 6"	% RECOVERY	MOISTURE CONTENT	DRY DENSITY, pcf	POCKET PEN., tsf	UNCONF. COMP., tsf	ATTERBERG LIMITS LL	PL	PI	REMARKS
		Topsoil 0.7											
895.0			SS 1	4-5-5	56	20.1 22.0		1.0 1.5		43	22	21	2.0, pH = 7.3, SG = 2.67, LOI = 5 percent, soluble sulfate < 40 ppm
	2.5	**Clay**, medium stiff, moist, brown, with organic matter, (visual)											
			SS 2	4-4-6	67	19.3 23.4	97.6	1.5 1.0					
	5.0	5.0											
890.0			SS 3	5-7-11	78	14.7 13.0		4.0 >4.5					
	7.5	**Clay**, very stiff, moist, brown, A-6, Lab No. 38277											
			SS 4	6-11-15	67	12.4 12.4	124.0	>4.5 4.0	5.86				
	10.0	10.0											
		Bottom of Boring at 10.0 ft											
885.0													
	12.5												
	15.0												
880.0													
	17.5												
	20.0												

EEI BORING LOG (INDOT FORMAT) LAT./LONG. CJ235416.GPJ IN_DOT1.GDT 3/29/24

LOG OF TEST BORING

BORING NO.: **RB-01ST**
SHEET 1 OF 1
CLIENT : American Structurepoint, Inc.
LATITUDE : 40.21709
DES NO. : ---
STRUCTURE #: ---
LONGITUDE : -85.55326
PROJECT TYPE: New Road Construction and Intersection Improvement
DATUM : WGS 84
LOCATION : SR 332-Brevini Drive-Jackson Street
DATE STARTED : 02-16-24
COUNTY : Delaware
PROJECT NO.: CJ235416
DATE COMPLETED : 02-16-24

ELEVATION : 896.0
STATION : 103+47
OFFSET : 1.0 ft Right
LINE : 'PR-S-2-A'
DEPTH : 4.0 ft

BORING METHOD : Hollow Stem Auger
RIG TYPE : 7822
CASING DIA. : ---
CORE SIZE : ---

HAMMER : Auto
DRILLER/INSP : G.B.
TEMPERATURE : 35 °F
WEATHER : Mild

GROUNDWATER: ∇ Encountered at NW ▼ At completion NW

ELEVATION	SAMPLE DEPTH	SOIL/MATERIAL DESCRIPTION	SAMPLE NUMBER	SPT per 6"	% RECOVERY	MOISTURE CONTENT	DRY DENSITY, pcf	POCKET PEN., tsf	UNCONF. COMP., tsf	ATTERBERG LIMITS LL	PL	PI	REMARKS
895.0		Drilled without sampling											
		2.0											
	2.5	**Clay**, moist, brown, (visual)	ST 1		50	22.4 13.0		3.0 3.5					
		4.0											
		Bottom of Boring at 4.0 ft											
	5.0												
890.0													
	7.5												
	10.0												

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LOG OF TEST BORING

BORING NO.: **RB-02**
SHEET 1 OF 1
LATITUDE : 40.21765
LONGITUDE : -85.55321
DATUM : WGS 84
DATE STARTED : 02-16-24
DATE COMPLETED : 02-16-24

CLIENT : American Structurepoint, Inc.
DES NO. : ---
STRUCTURE #: ---
PROJECT TYPE: New Road Construction and Intersection Improvement
LOCATION : SR 332-Brevini Drive-Jackson Street
COUNTY : Delaware
PROJECT NO.: CJ235416

ELEVATION : 893.0
STATION : 105+52
OFFSET : 0.0 ft
LINE : 'PR-S-2-A'
DEPTH : 10.0 ft

BORING METHOD : Hollow Stem Auger
RIG TYPE : 7822
CASING DIA. : ---
CORE SIZE : ---

HAMMER : Auto
DRILLER/INSP : G.B.
TEMPERATURE : 35 °F
WEATHER : Mild

GROUNDWATER: ▽ Encountered at 2.5 ft ▼ At completion NW ☒ Caved in at 8.0 ft

ELEVATION	SAMPLE DEPTH	SOIL/MATERIAL DESCRIPTION	SAMPLE NUMBER	SPT per 6"	% RECOVERY	MOISTURE CONTENT	DRY DENSITY, pcf	POCKET PEN., tsf	UNCONF. COMP., tsf	ATTERBERG LIMITS			REMARKS
										LL	PL	PI	
		Topsoil 0.6											
	▽ 2.5	**Sand**, medium dense, wet, brown, (possible fill; visual) 4.0	SS 1	4-8-8	67								
890.0	5.0	**Clay**, very stiff, moist, gray, A-6, Lab No. 38277 10.0	SS 2	4-8-12	67	20.5		0.5					
	7.5		SS 3	8-15-15	44	17.7 16.6		0.5 1.0					
885.0 ☒	10.0		SS 4	6-8-16	56	15.9 15.7	121.8	4.0 3.5					
		Bottom of Boring at 10.0 ft											
880.0	12.5												
	15.0												
875.0	17.5												
	20.0												

EEI BORING LOG (INDOT FORMAT) LAT./LONG. CJ235416.GPJ IN_DOT1.GDT 3/29/24

LOG OF TEST BORING

BORING NO.: **RB-03/PC-03**
SHEET 1 OF 1
CLIENT : American Structurepoint, Inc.
DES NO. : ---
STRUCTURE #: ---
LATITUDE : 40.21838
LONGITUDE : -85.55263
PROJECT TYPE: New Road Construction and Intersection Improvement
DATUM : WGS 84
LOCATION : SR 332-Brevini Drive-Jackson Street
DATE STARTED : 02-16-24
COUNTY : Delaware
PROJECT NO.: CJ235416
DATE COMPLETED : 02-16-24

ELEVATION : 888.0
STATION : 35+45
OFFSET : 15.0 ft Left
LINE : 'A'
DEPTH : 5.5 ft

BORING METHOD : Hollow Stem Auger
RIG TYPE : 7822
CASING DIA. : ---
CORE SIZE : ---

HAMMER : Auto
DRILLER/INSP : G.B.
TEMPERATURE : 35 °F
WEATHER : Mild

GROUNDWATER: ▽ Encountered at NW ▼ At completion NW ▨ Caved in at 5.0 ft

ELEVATION	SAMPLE DEPTH	SOIL/MATERIAL DESCRIPTION	SAMPLE NUMBER	SPT per 6"	% RECOVERY	MOISTURE CONTENT	DRY DENSITY, pcf	POCKET PEN., tsf	UNCONF. COMP., tsf	ATTERBERG LIMITS			REMARKS
										LL	PL	PI	
		Asphaltic Concrete 0.3											
		Portland Cement Concrete 1.0											
			SS 1	7-13-20	56	9.3 7.8		3.5 4.5					
	2.5												
885.0		**Loam**, hard, moist, brown, A-4(0), Lab No. 38275	SS 2	17-18-22	44	8.6		4.5		20	14	6	3.5, pH = 8.3, SG = 2.73
			SS 3	12-16-15	44	9.1 9.6		3.5 4.0					
	▨ 5.0	5.5											
		Bottom of Boring at 5.5 ft											
	7.5												
880.0													
	10.0												

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LOG OF TEST BORING

BORING NO.: **RB-04**
SHEET 1 OF 1
CLIENT : American Structurepoint, Inc.
DES NO. : ---
STRUCTURE #: ---
LATITUDE : 40.21774
LONGITUDE : -85.55086
PROJECT TYPE: New Road Construction and Intersection Improvement
DATUM : WGS 84
LOCATION : SR 332-Brevini Drive-Jackson Street
DATE STARTED : 02-16-24
COUNTY : Delaware
PROJECT NO.: CJ235416
DATE COMPLETED : 02-16-24

ELEVATION : 892.0
STATION : 40+89
OFFSET : 15.0 ft Left
LINE : 'A'
DEPTH : 5.5 ft
BORING METHOD : Hollow Stem Auger
RIG TYPE : 7822
CASING DIA. : ---
CORE SIZE : ---
HAMMER : Auto
DRILLER/INSP : G.B.
TEMPERATURE : 35 °F
WEATHER : Mild

GROUNDWATER: ▽ Encountered at NW ▼ At completion NW Caved in at 3.0 ft

ELEVATION	SAMPLE DEPTH	SOIL/MATERIAL DESCRIPTION	SAMPLE NUMBER	SPT per 6"	% RECOVERY	MOISTURE CONTENT	DRY DENSITY, pcf	POCKET PEN., tsf	UNCONF. COMP., tsf	ATTERBERG LIMITS LL	PL	PI	REMARKS
		Asphaltic Concrete 0.3											
		Portland Cement Concrete 1.0											
		Loam, very stiff, moist, brown, A-4, Lab No. 38275 4.0	SS 1	5-8-11	44	15.2 12.9		4.0 >4.5					
890.0	2.5												
			SS 2	5-8-8	44	12.8		4.0					
	5.0	**Clay**, very stiff, moist, gray, A-6, Lab No. 38277 5.5	SS 3	3-5-12	67	19.1 16.1		2.0 3.0					
		Bottom of Boring at 5.5 ft											
885.0	7.5												
	10.0												

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LOG OF TEST BORING

BORING NO.: **RB-04ST**
SHEET 1 OF 1
CLIENT : American Structurepoint, Inc.
LATITUDE : 40.21774
DES NO. : ---
STRUCTURE #: ---
LONGITUDE : -85.55086
PROJECT TYPE: New Road Construction and Intersection Improvement
DATUM : WGS 84
LOCATION : SR 332-Brevini Drive-Jackson Street
DATE STARTED : 02-16-24
COUNTY : Delaware
PROJECT NO.: CJ235416
DATE COMPLETED : 02-16-24

ELEVATION : 892.0
STATION : 40+89
OFFSET : 14.0 ft Left
LINE : 'A'
DEPTH : 4.0 ft
BORING METHOD : Hollow Stem Auger
RIG TYPE : 7822
CASING DIA. : ---
CORE SIZE : ---
HAMMER : Auto
DRILLER/INSP : G.B.
TEMPERATURE : 35 °F
WEATHER : Mild

GROUNDWATER: ▽ Encountered at NW ▼ At completion NW

ELEVATION	SAMPLE DEPTH	SOIL/MATERIAL DESCRIPTION	SAMPLE NUMBER	SPT per 6"	% RECOVERY	MOISTURE CONTENT	DRY DENSITY, pcf	POCKET PEN., tsf	UNCONF. COMP., tsf	ATTERBERG LIMITS LL	PL	PI	REMARKS
		Drilled without sampling											
890.0		2.0											
	2.5	**Loam**, moist, brown, with sand and gravel seam, A-4, Lab No. 38275	ST 1		83	11.5		4.5					
		4.0											
		Bottom of Boring at 4.0 ft											
	5.0												
885.0													
	7.5												
	10.0												

Summary of Pavement Cores
SR 332/Brevini Dr/Jackson Street - New Road
Terracon Project No. CJ235416
Delaware Co., Indiana

Core	Latitude	Longitude	Line	Station	Offset	Direction	Lane	Date	Overall Thickness (in.)	Overall Type	Layer 1 Thickness (in.)	Layer 1 Type	Layer 2 Thickness (in.)	Layer 2 Type	Subbase Type
PC-01	40.216957	-85.553257	PR-S-2-A	103+00	0 ft. Rt.	Westbound	Driving	2/16/24	5.1	HMA	5.1	HMA	---	---	Crushed Stone
PC-02	40.218324	-85.552915	S-2-A	30+84	1 ft. Rt.	Eastbound	Passing Blister	2/16/24	13.1	COMPOSITE	4.4	HMA	8.7	PCCP	Crushed Stone
RB-03/PC-03	40.218376	-85.552627	A	35+45	15 ft. Lt.	Westbound	Passing	2/16/24	12.8	COMPOSITE	3.9	HMA	8.9	PCCP	Crushed Stone

Note: While the measurements of layer and overall core thicknesses are reported to the nearest tenth of an inch, an inherent variation in the pavement thickness will occur due to the size of the aggregate. Depending on the aggregate size, the variation in measurements could be 1/2 to 3/4 in.

PAVEMENT CORE LOG NO. PC-01

Page 1 of 1

PROJECT: **SR 332/Brevini Dr/Jackson Street - New Road**

SITE: **SR 332 - Brevini Drive - Jackson Street**
Delaware County, IN

CLIENT: **American Structurepoint, Inc.**
Indianapolis, IN

Latitude: 40.217° Longitude: -85.5533° Station: 103+00 Offset: 0 ft Rt. Line: "PR-S-2-A"

Direction: Westbound Lane: Driving

GRAPHIC LOG	DEPTH	DEPTH (In.)
■	**HMA**, 9.5 mm surface	
	1.1	1
■	**HMA**, 19.0 mm intermediate	2 3 4
	5.1	5
	Granular Subbase, crushed stone ***Coring Terminated at 5.1 Inches***	

Terracon
7770 W New York St
Indianapolis, IN

Coring Started: 2/16/2024	Coring Completed: 2/16/2024
Drill Rig: Hilti	Driller: C.S.
Project No.: CJ235416	

PAVEMENT CORE LOG NO. PC-02

PROJECT: SR 332/Brevini Dr/Jackson Street - New Road

SITE: SR 332 - Brevini Drive - Jackson Street
Delaware County, IN

CLIENT: American Structurepoint, Inc.
Indianapolis, IN

Latitude: 40.2183° Longitude: -85.5529° Station: 30+84 Offset: 1 ft Rt. Line: "S-2-A"

Direction: Eastbound Lane: Passing Blister

GRAPHIC LOG	DEPTH		DEPTH (In.)
		HMA, 9.5 mm surface	1
	1.6		
		HMA, 19.0 mm intermediate, partially stripped below 4 in., delaminated	2 3 4
	4.4		
		PCCP, 1.0 in. max. aggregate size	5 6 7 8 9 10 11 12 13
	13.1		
		Granular Subbase, crushed stone ***Coring Terminated at 13.1 Inches***	

Landscape photo not available

7770 W New York St
Indianapolis, IN

Coring Started: 2/16/2024	Coring Completed: 2/16/2024
Drill Rig: Hilti	Driller: C.S.
Project No.: CJ235416	

PAVEMENT CORE LOG NO. RB-03/PC-03

Page 1 of 1

PROJECT: SR 332/Brevini Dr/Jackson Street - New Road

SITE: SR 332 - Brevini Drive - Jackson Street
Delaware County, IN

CLIENT: American Structurepoint, Inc.
Indianapolis, IN

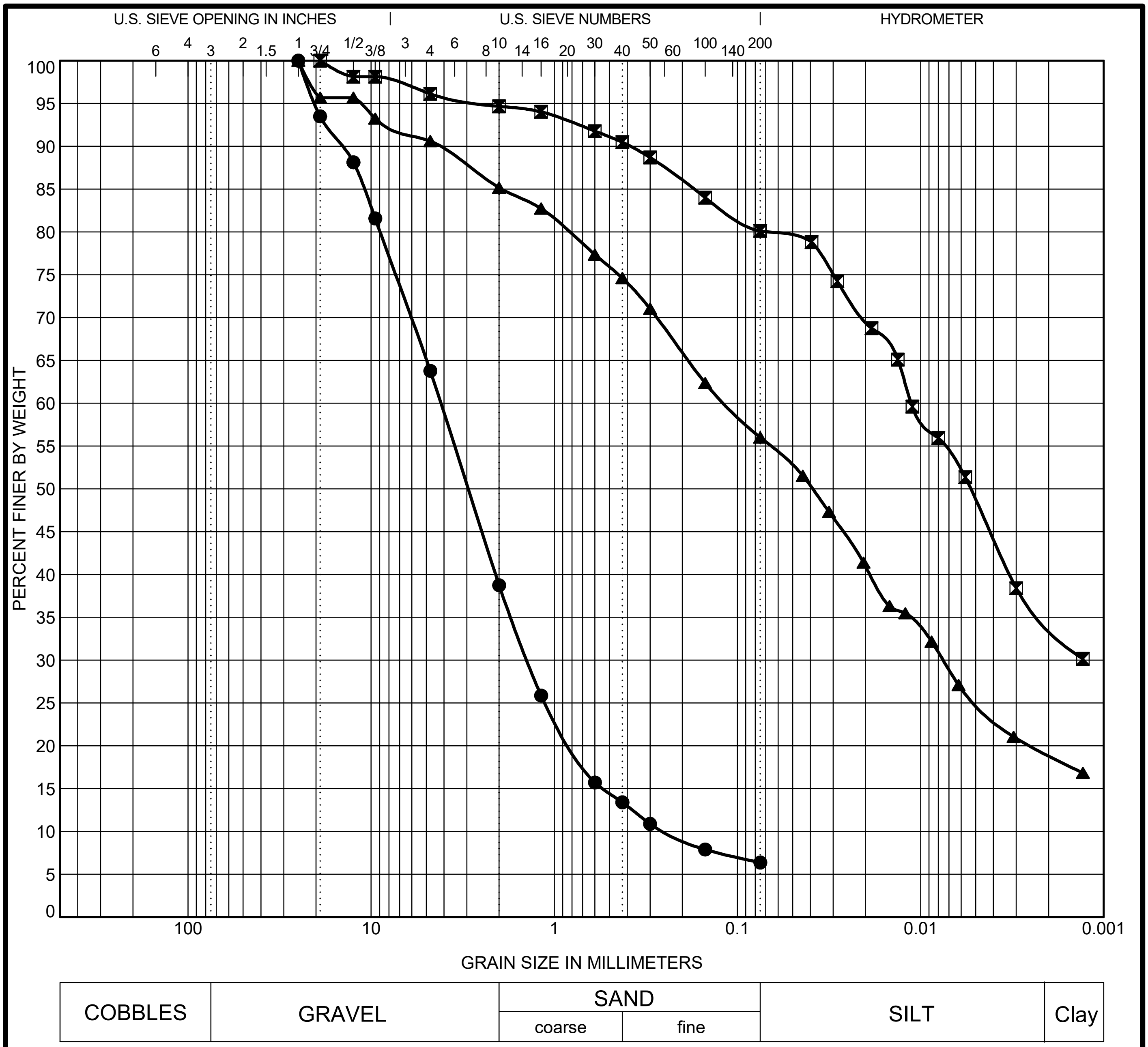
Latitude: 40.2184° Longitude: -85.5526° Station: 35+45 Offset: 15 ft Lt. Line: "A"

Direction: Westbound Lane: Passing

GRAPHIC LOG	DEPTH		DEPTH (In.)
■	1.3	**HMA**, 9.5 mm surface	1
■	3.9	**HMA**, 19.0 mm intermediate, partially stripped below 3 in., delaminated	2 3
▨	12.8	**PCCP**, 1.0 in. max. aggregate size	4 5 6 7 8 9 10 11 12
		Granular Subbase, crushed stone ***Coring Terminated at 12.8 Inches***	

Terracon
7770 W New York St
Indianapolis, IN

Coring Started: 2/16/2024	Coring Completed: 2/16/2024
Drill Rig: Hilti	Driller: C.S.
Project No.: CJ235416	



	Specimen Identification			Lab #	Textural Classification	LL	PL	PI	Cc	Cu
●	**CB-01**	**SS-6**	**18.5**	**38278**	**A-1-a (0) SAND Y GRAVEL**	**NP**	**NP**	**NP**	**1.92**	**17.04**
☒	**CB-02**	**SS-2**	**3.5**	**38277**	**A-6 (8) CLAY**	**28.0**	**15.0**	**13.0**		
▲	**RB-03/PC-03**	**SS-2**	**2.5**	**38275**	**A-4 (0) LOAM**	**20.0**	**14.0**	**6.0**		

	Specimen Identification			D60	D30	D10	LOI	pH	%Gravel	%Sand	%Silt	%Clay	SG
●	**CB-01**	**SS-6**	**18.5**	**4.17**	**1.398**	**0.245**		**8.3**	**61.3**	**32.4**			
☒	**CB-02**	**SS-2**	**3.5**	**0.011**				**7.9**	**5.3**	**14.5**	**45.7**	**34.4**	**2.73**
▲	**RB-03/PC-03**	**SS-2**	**2.5**	**0.116**	**0.008**			**8.3**	**14.8**	**29.2**	**37.1**	**18.9**	**2.73**

Terracon Consultants, Inc.
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Indianapolis, Indiana 46214
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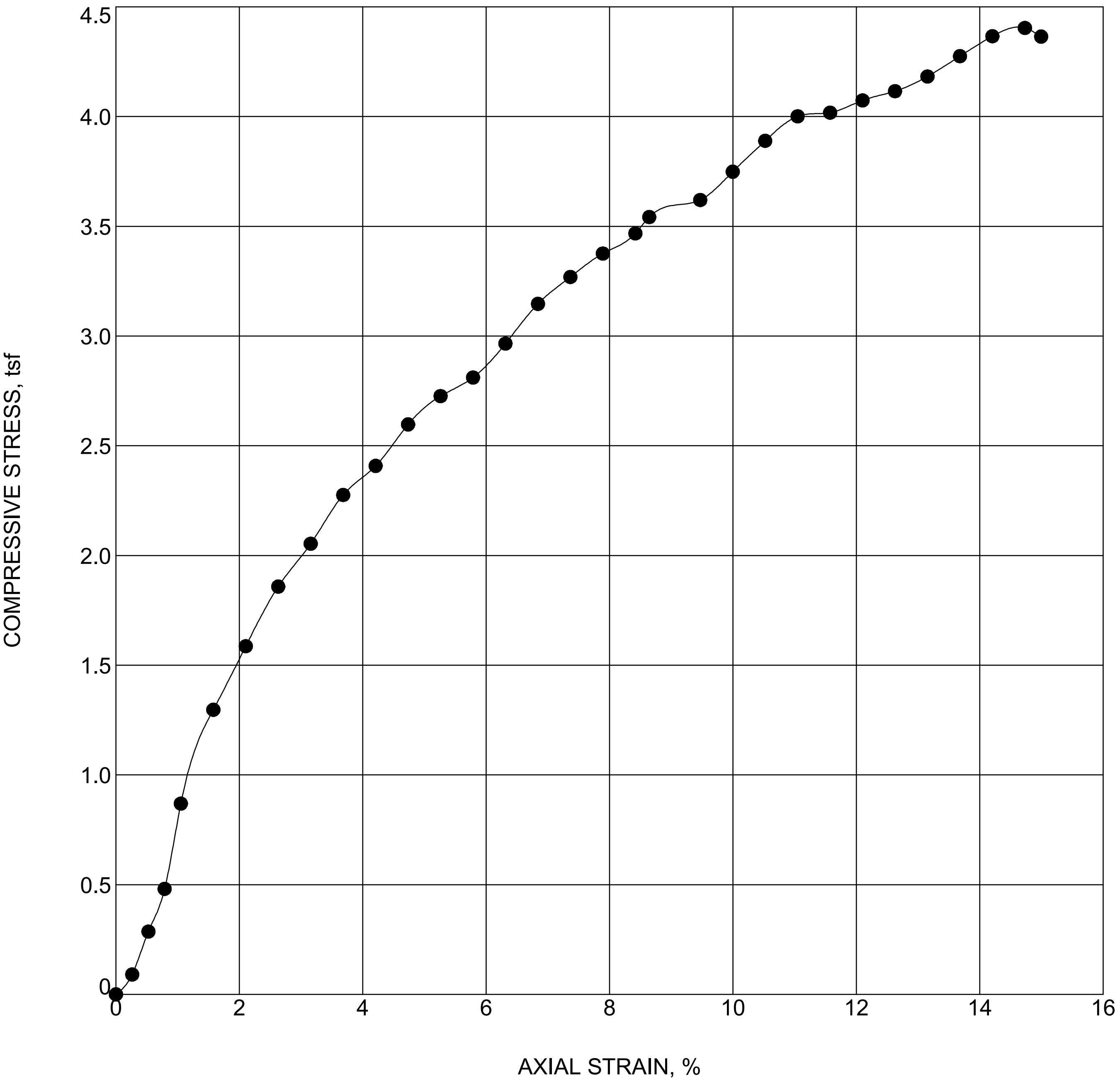
Fax:

GRAIN SIZE DISTRIBUTION TEST REPORT

DES #: --- Structure #: ---
Project #: CJ235416
County: Delaware
Location: SR 332-Brevini Drive-Jackson Street

INDOT GRAIN SIZE (EEI LOGO) CJ235416.GPJ IN DOT1.GDT 3/29/24



Boring	Sample	Depth	Classification
CB-02	SS-4B	8.5 - 10	CLAY A-6

Moisture Content (%)	Moist Density (pcf)	Dry Density (pcf)	Unconfined Strength (tsf)	Strain Rate (%)	Failure Strain (%)
15.5	136.9	118.5	4.40	1.1	14.7
Shear Strength (tsf)	**Saturation (%)**	**Void Ratio**	**Specimen Diameter (mm)**	**Specimen Height (mm)**	**Height/Diameter Ratio**
2.20	98	0.432	35.05	67.59	1.9

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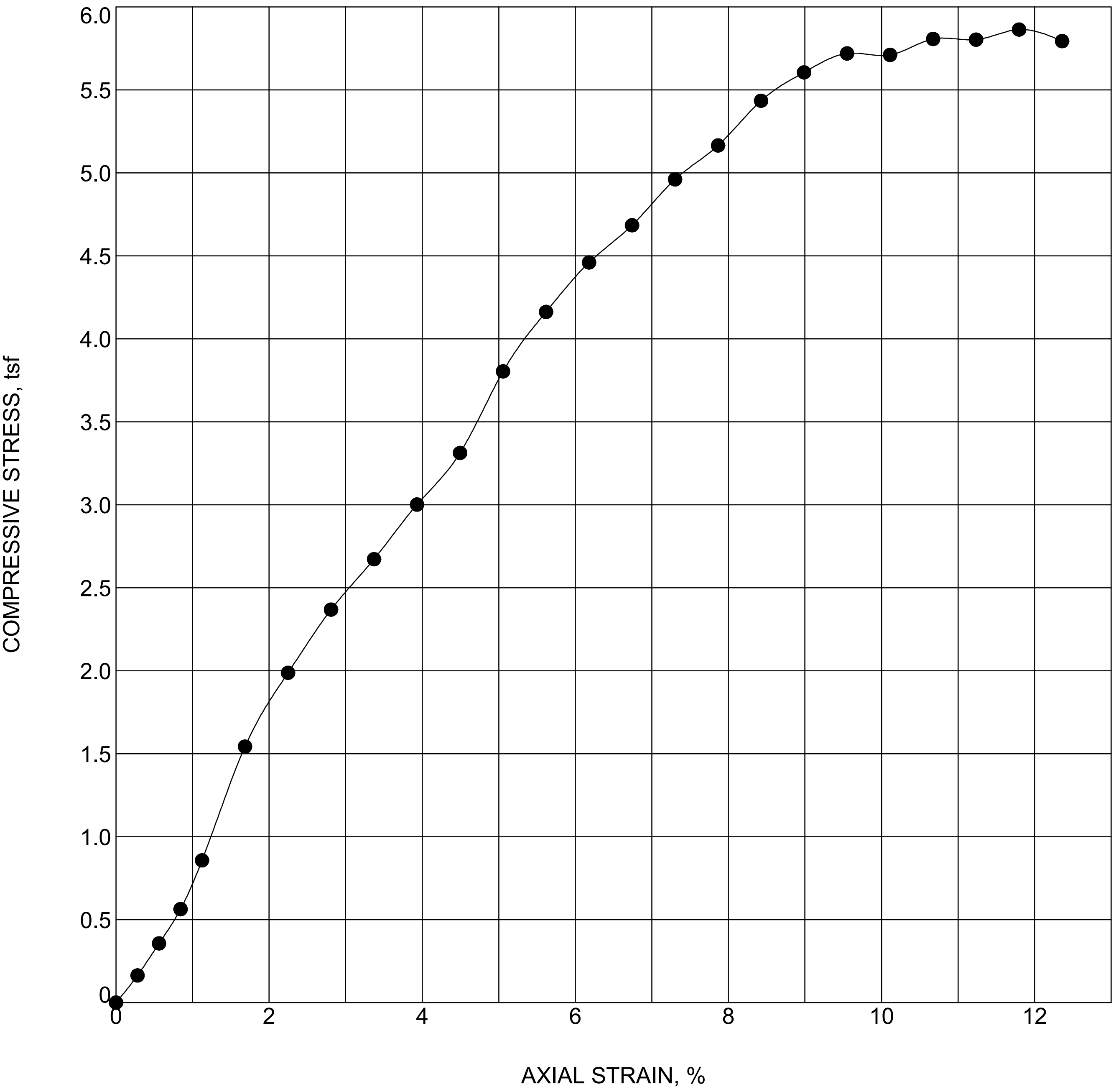
UNCONFINED COMPRESSION TEST

DES #: --- Structure #: ---
Project #: CJ235416
County: Delaware
Location: SR 332-Brevini Drive-Jackson Street

INDOT UNCONFINED TEST (EEI LOGO) CJ235416.GPJ IN DOT1.GDT 3/29/24



Boring	Sample	Depth	Classification
RB-01	SS-4T	8.5 - 10	CLAY A-6

Moisture Content (%)	**Moist Density (pcf)**	**Dry Density (pcf)**	**Unconfined Strength (tsf)**	**Strain Rate (%)**	**Failure Strain (%)**
12.4	139.4	124.0	5.86	1.1	11.8
Shear Strength (tsf)	**Saturation (%)**	**Void Ratio**	**Specimen Diameter (mm)**	**Specimen Height (mm)**	**Height/Diameter Ratio**
2.93	91	0.369	35.28	63.3	1.8

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UNCONFINED COMPRESSION TEST

DES #: --- Structure #: ---
Project #: CJ235416
County: Delaware
Location: SR 332-Brevini Drive-Jackson Street

TERRACON CONSULTANTS, INC.
INDIANAPOLIS OFFICE

Summary of Existing Topsoil Test Results for Use with Plant Growth Layer

Rev 11/21

Date: 3/20/2024
Des. No.: ---
Project: SR 332/Brevini Drive /Jackson Street - New Road
Location: Delaware County, IN

			ANALYSIS							
REF.	LOCATION		AASHTO T 289	AASHTO T 88 and T 89	AASHTO T 88 and T 89	AASHTO T 88 and T 89	AASHTO T 88 and T 89	AASHTO T 267 and T 21[3]	Bray P-1 Equivalent	NCRRP 221, Chapt 7[4]
Boring[1]	Sample	Tested Depth	pH	Gravel[2]	Sand	Silt	Clay	Organic Content (% by Wt)	Phosphorus (ppm)	Potassium (ppm)
				(% by Weight)						
CB-02TS	TS-1	0 - 0.5'	8.2	15.0	38.0	29.6	17.4	1.5	1	64
Acceptable Ranges per RSP 629-R-630 =			6.0 - 7.3	N/A	5 - 50%	30 - 80%	5 - 30%	3 - 10%[3]	20 - 80	105 - 250

[1] Topsoil collected from off the pavement nearest the boring referenced.

[2] For informational purposes only

[3] In Daviess, Gibson, Knox, Pike, Posey, and Vanderburgh Counties, AASHTO T 21 shall also be performed. Acceptable range is 4 - 10%

[4] North Central Regional Research Publication 221, Chapter 7

Note: All existing topsoil test results presented herein are for information only.

Bearing Resistance Analysis
(AASHTO LRFD, 9th Edition)

Project Number: CJ225416
Date: 3/29/2024

Boring Numbers: CB-01 and CB-02
Bearing Soil: A-6 Clay
Footing Elevation: 876 - 877
N-Value: 13 to 42
Comments: Headwall and Wingwalls

Project Name: SR 332/Brevini Dr/Jackson Street - New Road
Location: Delaware County, IN

Soil Parameters

Punching Shear: No

Cohesion (c) =	2000	psf	2.000	ksf
Friction Angle (ϕ_f) =	0	degrees		
Unit Weight Above Footing (γ_q) =	120	pcf	0.120	kcf
Unit Weight Below Footing (γ_f) =	120	pcf	0.120	kcf
Groundwater Depth (D_w) =	0	ft		
Bearing Resistance Factor (φ_b) =	0.45			

Depth Factor Applicable:	**No**
$32° \le \phi_f \le 42°$	No
$1 \le D_f/B \le 8$	No

Footing Parameters

Length (L) =	10	ft
Width (B) =	3	ft
Depth of Footing (D_f) =	2	ft

assumes up to 2 ft of scour occuring over wall design life

Calculations

$N_{cm} = N_c s_c$		$N_{cm} = 5.448$
		$N_c = 5.14$
$\phi_f = 0$ $\phi_f > 0$	$s_c = 1 + \left(\frac{B}{5L}\right)$ $s_c = 1 + \left(\frac{B}{L}\right)\left(\frac{N_q}{N_c}\right)$	$s_c = 1.060$
$N_{qm} = N_q s_q d_q$		$N_{qm} = 1.000$
		$N_q = 1$
$\phi_f = 0$ $\phi_f > 0$	$s_q = 1$ $s_q = 1 + \left(\frac{B}{L}\tan\phi_f\right)$	$s_q = 1.000$
	$d_q = 1 + 2\tan\phi_f\left(1 - \sin\phi_f\right)^2 \arctan\left(\frac{D_f}{B}\right)$	$d_q = 1.000$
$N_{\gamma m} = N_\gamma s_\gamma$		$N_{\gamma m} = 0.000$
		$N_\gamma = 0$
$\phi_f = 0$ $\phi_f > 0$	$s_\Upsilon = 1$ $s_\Upsilon = 1 - 0.4\left(\frac{B}{L}\right)$	$s_\gamma = 1.000$
$0 \le D_w \le D_f$ $D_w > D_f$	$c_{wq} = \frac{0.5D_w}{D_f} + 0.5$ $C_{wq} = 1$	$C_{wq} = 0.50$
$D_w < D_f$ $D_f \le D_w \le 1.5B + D_f$ $D_w > 1.5B + D_f$	$C_{w\gamma} = 0.5$ $c_{w\gamma} = \frac{0.5\left(D_w - D_f\right)}{1.5B} + 0.5$ $C_{w\gamma} = 1$	$C_{w\gamma} = 0.50$
$q_n = cN_{cm} + \gamma_q D_f N_{qm} C_{wq} + 0.5\gamma_f B N_{\gamma m} C_{w\gamma}$	***q_n* =** **11.02**	**kcf**

Results

Nominal Resistance (*q_n*)	**11.02**	**ksf**	**11,017**	**psf**
Factored Resistance (*qR*)	**4.96**	**ksf**	**4,958**	**psf**