A UES Company

August 16, 2024

Dr. Roberto Soria
The Crossroads Center
311 Martin Luther King Drive E
Cincinnati, Ohio 45219

Subject: Geotechnical Report Addendum No. 1
Proposed Crossroads Center
2114 Reading Road
Cincinnati, Ohio
CSI Job No. CN230236

Dear Dr. Soria:

Consulting Services Incorporated (CSI), completed three (3) test pit excavations and eight (8) additional soil borings at the proposed Crossroads Center site to further evaluate the subsurface conditions: 1) within the updated building footprint; 2) within the north/northwest portion of the site; and, 3) along the approximate alignment of the proposed retaining wall planned along a portion of the toe of the existing slope. The findings in this report is an addendum to our Preliminary Geotechnical Report, dated January 4, 2023 and should be used in conjunction with the above referenced report. As part of our scope, CSI performed a total of 4 test borings within the approximate updated building footprint to support final foundation design and construction recommendations, 4 test borings within the north/northwest portion of the site to further evaluate existing fill materials for pavement subgrade support and underground stormwater system support, and 3 test pit excavations within the vicinity of the referenced retaining wall to support design and construction recommendations. Refer to the attached Boring and Test Pit Location Plan (Figure 2) for approximate locations of the borings and test pits performed as part of this addendum. CSI's initial Borings B-1 through B-5 performed as part of the preliminary geotechnical exploration are also shown on the referenced Figure 2. Ground surface elevations for each boring and test pit location were obtained by CSI using an RTK GPS unit. The following sections of this addendum provide the project background information, the subsurface conditions encountered in the test borings/test pits and corresponding conclusions and recommendations.

**PROJECT INFORMATION**

CSI previously completed a preliminary geotechnical investigation for the proposed Crossroads Center development consisting of five (5) soil borings in December 2023 to support preliminary design and construction of the new Crossroads Center building and associated pavements. The findings of CSI's geotechnical investigation revealed up to about 6 feet of existing fill soil underlain by residual soil and shale bedrock. Bedrock was present between depths of about 3.5 and 13.5 feet bgs and sloped downward from

east to west. The subsurface findings, preliminary conclusions and geotechnical engineering recommendations for the project are included in the Preliminary Geotechnical Report for Crossroads Center dated January 4, 2024. In general, the preliminary recommendations included supporting the proposed structure atop shallow depth spread foundations bearing on natural soil and/or bedrock with a net allowable bearing capacity of 3,000 pounds per square foot (psf), slab on grade constructed atop the existing fill (with some acceptance of settlement risk), natural soil or engineered fill placed atop natural soil, and pavements constructed at grade.

Subsequent to performing the above referenced preliminary geotechnical exploration, design plans have progressed into the permitting stages which include an adjustment to the proposed building location from the north end of the site to the south end of the site and the addition of two relatively small retaining walls. The design plans are titled The Crossroads Center prepared by Emboss Design dated 8/2/2024. Based on our review of the referenced plans, the proposed building will be three stories with plan dimensions of approximately 135 feet long by 90 feet wide oriented lengthwise in an approximate east-west direction within the southern portion of the site. The proposed finish floor elevation for the proposed structure is planned for 678 feet amsl which will require about 2 feet of excavation at the east end of the building and between about 4 and 6 feet of fill at the west end of the building. The northern portion of the site will be comprised of parking and drive lanes with proposed grades ranging from about 684 feet amsl at the north end to about 678 feet amsl at the south end of the pavement near the proposed building. The exception being at the northeast corner of the development which will consist of a 3 horizontal to 1 vertical (3H:1V) fill slope placed to buttress an existing concrete wall associated with the existing structure on-site that will remain in place. In addition to the soil buttress, the structural engineer for the project has advised to leave the perpendicular exterior and interior walls of the existing building that extend to the west in place to provide supplement lateral support for the existing building wall. Based on the proposed pavement grades, up to about 6 feet of excavation will be required to achieve finish grades. An underground stormwater system is planned below the proposed pavement near the southwest corner of the parking lot. The proposed depth of the stormwater system did not appear to be shown on the referenced plans; however, a plan note on Sheet C400 Site Utility Plan indicates the stormwater system requires a minimum subgrade bearing resistance of 4,300 psf.

**SUBSURFACE FINDINGS**

CSI performed eight (8) test borings and three (3) test pit excavations to supplement the preliminary boring data and to address site specific geotechnical design and construction recommendations based on the updated design plans. In general, the borings and test pits encountered topsoil and/or an existing asphalt or concrete pavement section overlying existing fill underlain by residual clay soils and weathered shale bedrock. Test pits performed along the toe of existing slope to the east encountered colluvium soils over weathered shale bedrock. A more detailed description of the encountered subsurface conditions as part of this supplementary exploration is provided in the subsections below.

SURFICIAL MATERIALS

The existing ground surface at the site is either comprised of topsoil, asphalt or concrete pavement. Based on the borings and test pits, the topsoil was approximately 4 inches thick and the asphalt and concrete pavement thickness ranged from about 2 to 4 inches thick. The surficial material type and thickness encountered at each boring location is included on the individual test boring logs attached to this report.

COLLUVIUM

Test Pits TP-1 through TP-3 located along or at the toe of the existing slope encountered about 2 to 3 feet of colluvium soil below the topsoil or asphalt pavement. Colluvium soils are generally deposited from past hillside/landslide movements, soil sloughing and/or soil erosion. The colluvium is described as brown and gray fat clay with rock fragments and trace amounts of roots. Based on visual review, the colluvium soil is considered stiff.

*EXISTING FILL*

Existing fill soils were encountered in Borings B-7 and B-9 through B-13 that extended to depths generally about 3.5 to 8 feet bgs; however, at Boring B-10 located within the approximate location of the planned underground stormwater system, about 18.5 feet of previously placed fill was encountered. The depth of existing fill is most significant within the northern/northwestern portion of the site. The existing fill encountered within the referenced borings is variable with respect to material type and is described as either fat clay, well graded and poorly graded sand or rock and shale fragments. At Boring B-13, existing fill described as brown and black sand with a strong fuel/petroleum odor was present between depths of about 3.5 and 8 feet. Similar to the variability in material type, the existing fill is variable with respect to strength/compaction. Based on Standard Penetration Test (SPT) results, the existing fill is considered firm or loose to dense with SPT N values ranging from 5 to 8 blows per foot (bpf) within the cohesive fill soil and 4 to 52 bpf within the sand and rock fragment fill material. Higher SPT N values of 30 to 52 bpf were obtained within the fill consisting primarily of rock fragments.

RESIDUAL SOIL

Natural residual soils were encountered underlying the asphalt pavement or topsoil in Borings B-6 and B-8 that extended to the underlying bedrock surface at depths between about 6 and 13.5 feet bgs. The residual soil is described as light brown lean clay and fat clay with a variable amount of limestone fragments. The consistency description of the residual soil ranged from firm to very stiff corresponding to SPT N values ranging from 5 to 24 bpf; however, is generally considered stiff with N values primarily ranging between 10 and 14 bpf. Unconfined compressive strengths were consistently in excess of 4.5 tsf based on the results from a Hand Penetrometer.

*BEDROCK*

Shale bedrock interbedded with thin hard limestone layers was visually observed through SPT sampling in Borings B-6 through B-10, and B-12 and within the test pit excavations TP-1 through TP-3. Auger refusal on the estimated bedrock surface was encountered at Borings B-11 and B-13 at depths of about 8.2 and 8.3 feet bgs without obtaining visual confirmation through SPT sampling. In addition, the excavator encounter refusal atop a hard interbedded limestone layer at depths of about 3.8 and 6.8 feet bgs. Borings B-7 through B-9 and B-12 encountered auger refusal after about 1.5 to 4 feet of penetration into the bedrock. Based on the depths/elevations of the encountered bedrock, the bedrock surface slopes downward in an east to west direction. Auger refusal on the apparent/estimated bedrock surface was encountered at Borings B-1 and B-7 at a depth of about 8 feet.

For details of subsurface conditions encountered at a particular test boring location please refer to the test boring logs contained in the Appendix. The test boring locations and existing ground surface elevations

shown in the attached Figure 2 should be considered accurate only to the degree implied by the method used.

*GROUNDWATER*

Groundwater was encountered during drilling at Boring B-13 within the existing fill soils at a depth of about 3 feet. The remainder of the borings and test pits did not encounter groundwater or seepage at the time of drilling or excavation.

**SUPPLEMENTAL CONCLUSIONS/RECOMMENDATIONS**

Based on the findings from the supplemental borings and test pit excavations, it is CSI's opinion that the subsurface conditions appear suitable to support the proposed development. In general, the proposed structure can be supported using shallow depth spread foundations bearing on natural soil, bedrock or engineered fill placed atop natural soil or bedrock and floor slabs and pavement supported at grade. It is CSI's opinion that the conclusions and recommendations contained within the Preliminary Geotechnical Report dated January 4, 2023 are still applicable to the proposed development and should be used in conjunction with this Geotechnical Report Addendum. Based on the proposed site layout, grading, etc., CSI has developed supplemental recommendations in the subsections below to further address building foundation design, site excavations, underground stormwater system, floor slab and pavement subgrade support and retaining wall design.

*FOUNDATIONS*

CSI recommends that the proposed structure be supported atop shallow depth spread foundations bearing on stiff natural soil, bedrock or engineered fill placed atop stiff natural soil or bedrock. Based on the subsurface conditions, about 3.5 to 4.5 feet of previously placed fill soil is present at/near the vicinity of preliminary Borings B-4 and B-5 and supplemental Borings B-7 and B-9. In addition, existing fill may also be present within the footprint of the existing building currently located within the northern portion of the proposed building. Based on the proposed finish floor elevation of 678 feet amsl, a portion of the existing fill will be removed within the eastern portion of the proposed building footprint such that building foundations will likely penetrate the existing fill at the design bearing elevation. However, within the western portion of the building pad which will require about 2 to 6 feet of new fill to achieve proposed finish floor elevation, existing fill will either need to be removed as part of the mass earthwork activities prior to placing new fill for the building pad or the building foundations will need to be extended through the new fill and underlying existing fill to bear directly atop stiff natural soil or bedrock. Shallow depth spread foundations bearing atop stiff natural soil, shale bedrock or engineered fill placed atop natural soil or bedrock can be designed using a net allowable bearing capacity of 3,000 psf.

As discussed in Section 7C "Differential Support Conditions" of the Preliminary Geotechnical Report, it is expected the building foundations will expose both shale bedrock and soil at the foundation bearing elevation. In general, it is expected that the foundations within the eastern portion of the building will likely encounter shale bedrock while the building foundations within the western portion of the site may encounter residual soil, engineered fill or bedrock at the foundation bearing elevation. To avoid differential settlement caused by foundations supported on both bedrock and soil, consideration should be given to either: 1) over-excavating the foundations encountering bedrock to a depth of about 12 inches and re-establishing the bearing elevation with compacted site soils meeting the engineered fill requirements in the Preliminary Geotechnical Report; or, 2) over-excavating the foundations encountering soil to bear directly

atop bedrock. For foundations bearing entirely within shale bedrock, an increased bearing capacity of 5,000 psf can be used for foundation design.

*SITE EXCAVATIONS*

The existing fill at the site is variable with respect to strength/compaction and material type. Site excavations to install underground utilities, underground stormwater system and/or building foundations will encounter existing fill comprised of loose sand, rock fragments and/or relatively weak cohesive soils that will be prone to excavation sidewall instability and/or cause excavations to be wider. As a result, site excavations may require flatter temporary slopes to maintain stability, require additional backfill material as a result of larger excavations and/or the use of trench box support. As noted above, the existing fill present within the vicinity of Boring B-13 exhibited a strong fuel/petroleum odor below a depth of about 3.5 feet. If these materials are encountered within site excavations, CSI recommends that environmental laboratory testing be performed prior to re-using the materials on-site as fill and/or hauling off site to evaluate for environmental contaminants.

In addition, excavations at the site, specifically within the eastern half of the site, will likely encounter shale bedrock interbedded with hard limestone layers. Bedrock excavations that extend within the upper two feet or so of the shale bedrock should be able to be completed using a large hydraulic excavator; however, excavations that extend several feet into the shale bedrock will encounter more competent shale bedrock as well as hard interbedded layers of limestone that may require the use of more advanced rock removal techniques such as rock ripping, hydraulic hammering, etc.

*UNDERGROUND STORMWATER SYSTEM*

An underground stormwater system is planned at the southwest portion of the proposed pavement area at/near the location of Boring B-10. Based on review of the civil drawings, the depth of the stormwater system was not shown; however, the planned pavement finish grade overtop the system system is about 5 feet below existing grades. A plan note indicates that the chambers associated with the system require a bearing resistance of 4,300 psf. Based on the subsurface conditions encountered within Boring B-10, existing fill comprised of about 13.5 feet of loose sand underlain by 5 feet of soft lean clay (I.e., total fill depth of about 18.5 feet/elevation of about 663.1 feet amsl). Based on the depth of the existing fill, it is expected that the subgrade elevation for the stormwater system will expose either loose sand or soft lean clay that is not suitable to provide a bearing resistance of 4,300 psf. Depending on the design depth of the system, it may be feasible to over-excavate the bottom of the stormwater system to remove the existing fill and re-establish the design bottom with compacted aggregate. Alternately, if the over-excavation depth to remove the existing fill is determined unfeasible due to depth, a limited over-excavation depth could be considered in conjunction with the use of a reinforcing geotextile/fabric and compacted aggregate to establish a suitable bearing surface for the system. The depth of the limits over-excavation limits, reinforcing geotextile type and compacted aggregate thickness would need to be evaluated once the depth of the system and exposed subgrade conditions are known; however, should be expected to be about 2 to 3 feet.

*FLOOR SLAB AND PAVEMENT SUBGRADE SUPPORT*

As discussed in the Preliminary Geotechnical Report and based on the findings from the supplemental explorations, existing fill material will likely be present at and below the proposed subgrade for the building floor slab and pavements. Consistent with the recommendations provided in the referenced preliminary report, the existing fill can be left in place within the limits of the floor slab provided a thorough proof roll

is performed prior to floor slab construction and/or placing new fill and the owner is willing to accept some risk that differential settlement could occur. As noted in the Foundations section of this report, to eliminate the depth of foundation over-excavations within the western portion of the building where new fill will be placed overtop the existing fill, consideration could be given to performing a mass over-excavation of the existing fill within the limits of the building footprint, which would also eliminate the differential floor slab settlement risk associated with the existing fill below the floor slab.

Existing fill will be present at the design pavement subgrade elevation within the northern portion of the site. In general, the existing fill should provide suitable subgrade support for the expected lightly loaded pavements; however, it should be expected that prior to pavement construction, some remediation of the subgrade to repair areas that yield to construction traffic and/or proof rolls will be required. It is expected that subgrade remediation will likely consist of shallow over-excavations and replacement with engineered fill and/or incorporated a reinforcing geotextile (i.e., geogrid) or fabric in conjunction with a thicker aggregate section. CSI recommends that a contingency budget be included for the project to address pavement subgrade remediation.

*RETAINING WALLS*

Based on the proposed site layout, two proposed retaining walls are planned along the eastern portion of the site that are aligned in an approximate north-south direction approximately 5 to 10 feet in front of the toe of the existing slope that extends upward to the east beyond the site. The retaining walls are about 60 to 80 feet long and have a maximum height of less than about 5 to 6 feet. CSI recommends that the retaining walls for the project be designed to meet the site needs including maximum retention height, location, tolerable deflection at the top of the structure, and constructibility. It is recommended that the retaining wall be designed and sealed by a professional engineer licensed in the state of Ohio acknowledging that the appropriate internal, external, and global stability factors of safety for the particular retaining wall structure.

Retaining walls should be designed to resist lateral loads imposed by the surrounding soils, hydrostatic pressure (if adequate drainage of the backfill is not provided), and surface surcharge loads adjacent to the wall (i.e., structures, foundations, pavements, traffic loads, stockpiles, inclined backfill, etc.). Depending on the lateral movement acceptance criteria, the structure may be designed as: 1) cantilevered (not fixed at the top allowing lateral deflection); or, 2) restrained or anchored (fixed at the top). With respect to the lateral earth pressure design, CSI recommends that "active" earth pressures be used for cantilevered designs and “at-rest” lateral earth pressures be used for restrained/anchored designs (i.e., basement foundation walls). Should wall backfill be placed before floor joists are constructed, it may be necessary to provide temporary bracing if the walls cannot accommodate construction phase stresses, or the walls should be designed for the active earth pressure condition as self-supporting cantilever walls.

The lateral earth pressure coefficients should be selected based on the predominate soil within the retained zone of the soil retention structure or retaining wall. The retained zone should be considered as an imaginary line drawn upward at a 45 degree angle from the top of footing. The following table presents granular backfill and on-site materials earth pressure design parameters for Equivalent Fluid Density’s (EFD’s) and Earth Pressure coefficients. The values given assume the backfill surface is level, drained or undrained backfill, the zone of backfill conforms to the minimum zone size given above, and no surcharge is placed on the backfill.

**Table 1: Equivalent Fluid Density (EFD) and Earth Pressure Coefficient**

| Condition | Granular Backfill | | On-Site Materials (1) | |
|---|---|---|---|---|
| | Coefficients | EFD (Drained) (pcf) | Coefficients | EFD (Drained) (pcf) |
| At-Rest | Ko = 0.35 | 45 | Ko = 0.56 | 70 |
| Active | Ka = 0.22 | 30 | Ka = 0.39 | 49 |
| Passive | Kp = 2.75 | 300 | Kp = 2.56 | 343205 |

(1) On-site soil having a unit weight of 125 pcf and friction angle of 26 degrees.

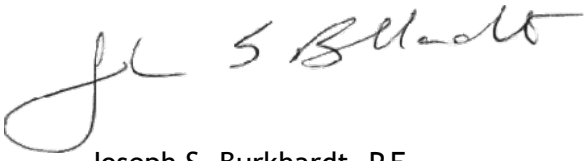
CSI recommends that the wall design include sufficient drainage of the backfill soils to relieve hydrostatic pressure. For this purpose, CSI recommends that drainage backfill be constructed immediately behind the wall and extend from the foundation elevation to the top of the wall. This backfill should be effectively drained using a piping system connected to a storm sewer, gravity outlet, weep holes or a sump. Where possible, CSI recommends that the immediate backfill soils (within a minimum of 2 feet laterally from the wall) consist of a free-draining compacted granular material. The free-draining granular material should consist of a uniformly-graded aggregate that is between ½ inch to 1-inch in size and contain less than 5 percent passing a #200 size sieve. The free draining granular backfill should be separated from clayey soil using a non-woven geotextile filter fabric. Alternately, a drainage geocomposite may be used as the drainage layer behind the back face of the wall. CSI recommends that the drainage system be comprised of a minimum 8 inch diameter perforated pipe placed at the base of the free draining granular backfill (i.e., adjacent to and continuously along the wall foundation) or geocomposite and gravity drained to a storm outlet, weep holes or sump.

CSI recommends the retaining wall foundations be extended to bear a minimum of 12 inches within the shale bedrock.

We appreciate the opportunity to provide our continued services to Rumpke for this project. If specific questions arise, please contact CSI for assistance.

Sincerely,

James P. Haines, P.E.
Senior Project Engineer

Joseph S. Burkhardt, P.E.
Principal Geotechnical Engineer

**APPENDIX**

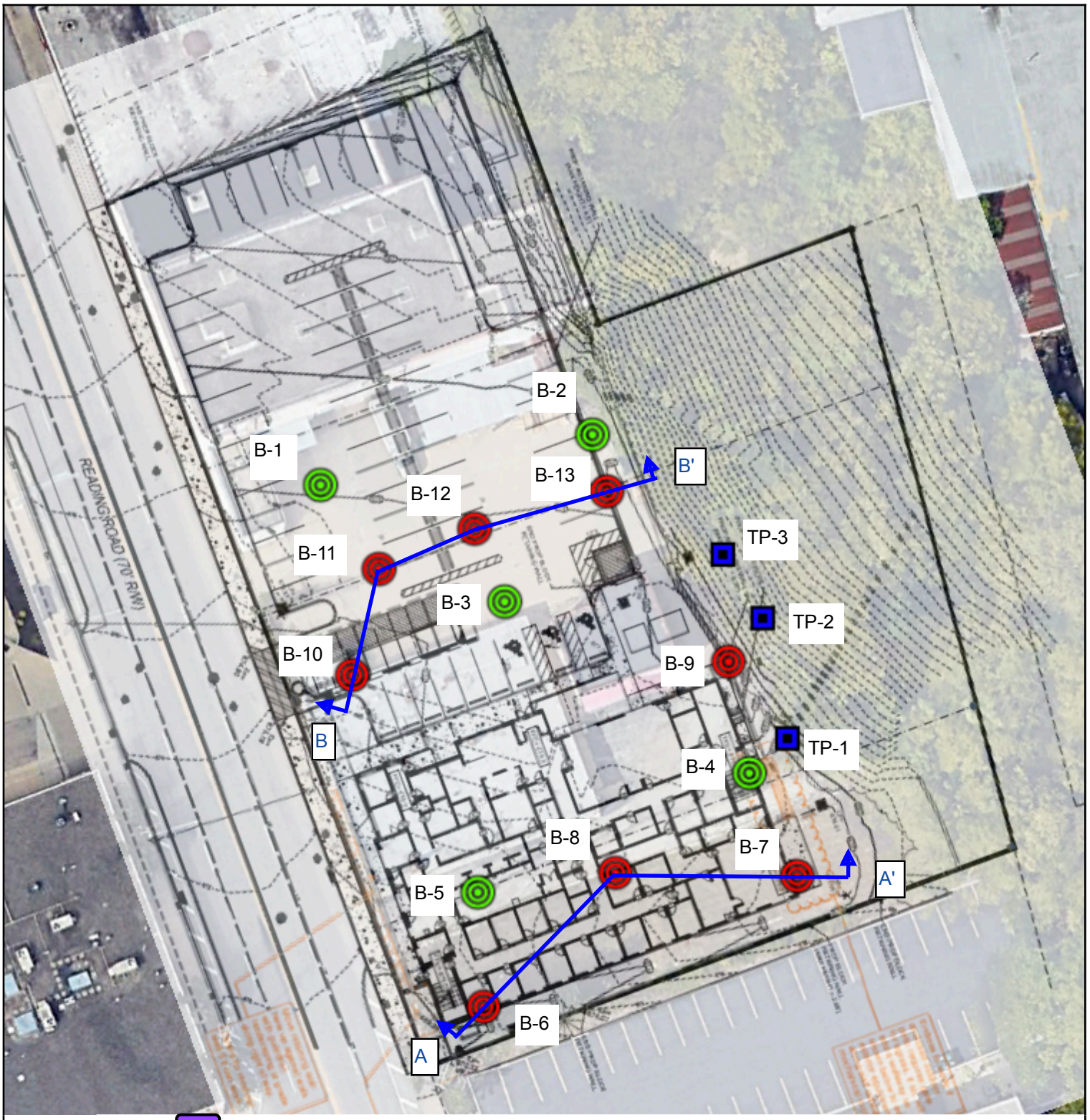
Figure 1 - Site Location Map
Figure 2 - Boring Location Plan
General Boring Profiles
Geotechnical Boring Information Sheet
Test Boring Logs
Field Testing Procedures


N

ADAPTED FROM TOPOGRAPHIC MAPPING
FOR ILLUSTRATION PURPOSES

CSI Cincinnati, LLC
11785 Highway Drive
Cincinnati, Ohio 45241
513.252.2059 Office | 888.792.3121 Fax
www.csiohio.com

| | | | |
|---|---|---|---|
| TITLE: | SITE LOCATION PLAN | PROJECT NO: CN230236 | DRAWN BY: JPH |
| PROJECT: | PROPOSED CROSSROADS CENTER<br>2114 READING ROAD<br>CINCINNATI, OHIO | DATE: 8/14/2024 | CHECKED BY: JB |
| | | NOT TO SCALE | DRAWING NO 1 OF 2 |

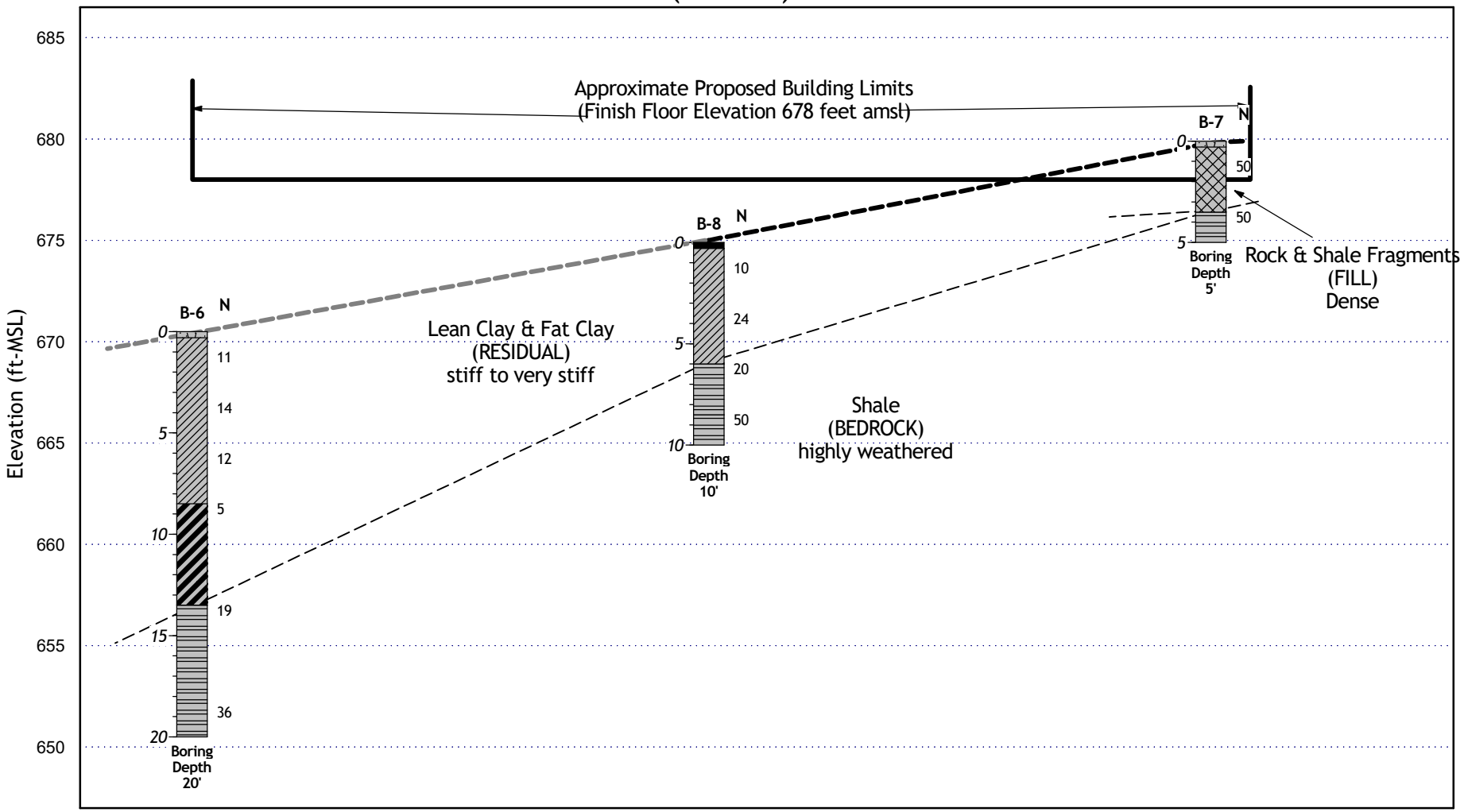



FOR ILLUSTRATION PURPOSES

CSI Cincinnati, LLC
11785 Highway Drive
Cincinnati, Ohio 45241
513.252.2059 Office | 888.792.3121 Fax
www.csiohio.com

| | | | |
|---|---|---|---|
| TITLE: | BORING LOCATION PLAN | PROJECT NO: CN230236 | DRAWN BY: JPH |
| PROJECT: | PROPOSED CROSSROADS CENTER<br>2114 READING ROAD<br>CINCINNATI, OHIO | DATE: 8/14/2024 | CHECKED BY: JB |
| | | NOT TO SCALE | DRAWING NO 2 OF 2 |

# CROSS SECTION A-A'
# (N.T.S.)




**SOIL TYPES**

(Shown in Graphic Log)

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Fill | Topsoil | Lean Clay | Sandy Silt | Limestone |
| Asphalt | Gravel | Fat Clay | Clayey Silt | Sandstone |
| | Sand | Silty Sand | Sandy Clay | Siltstone |
| | Silt | Clayey Sand | Silty Clay | Shale |

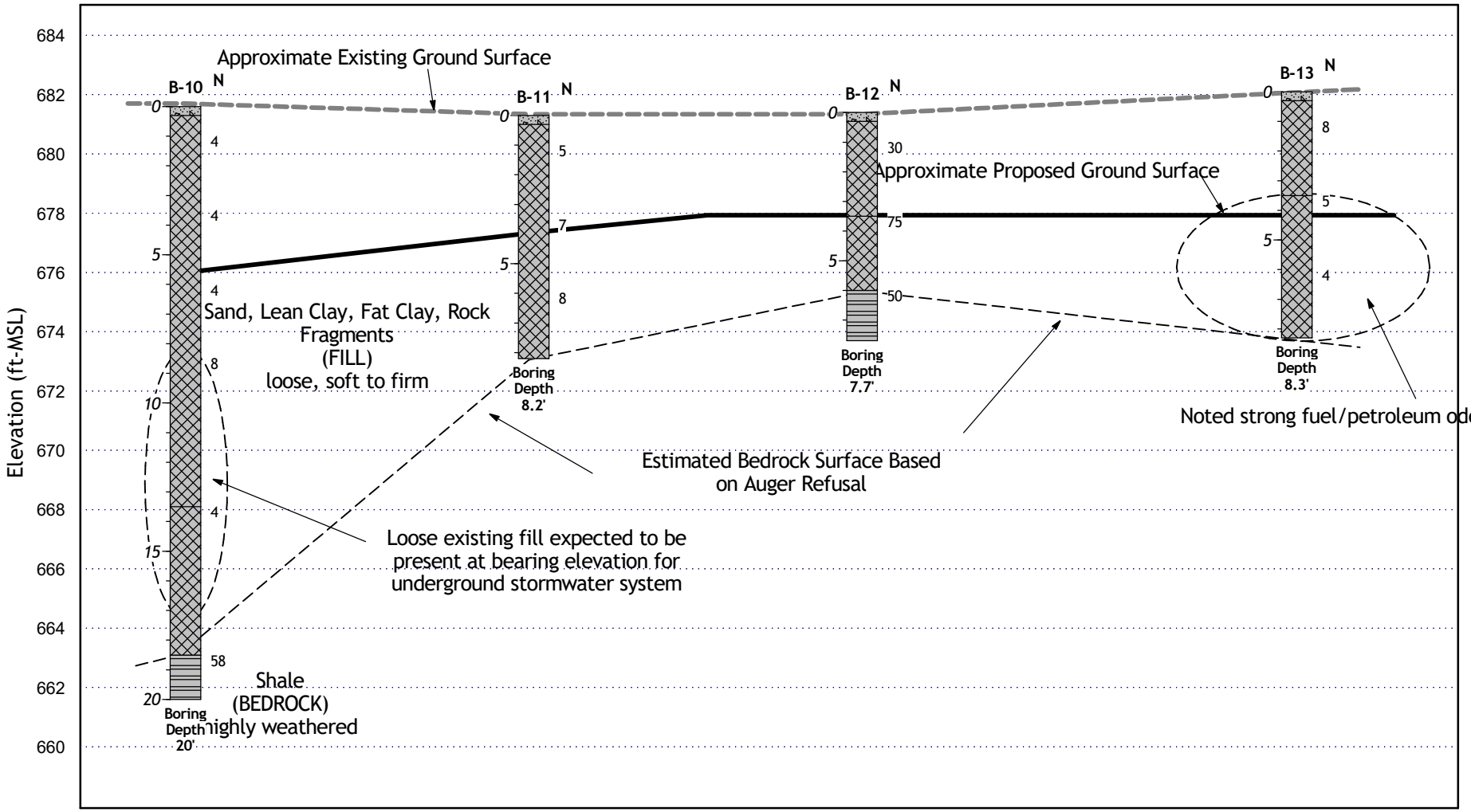

CSI of Cincinnati
11785 Highway Drive
Cincinnati, OH 45241
Phone: 513.252.2059
Fax: 888.792.3121


Proposed Crossroads
Center Building
CN230236

SECTION A-A'

Fig. 1

# CROSS SECTION B-B'
(N.T.S.)




**SOIL TYPES**

(Shown in Graphic Log)

- Fill
- Asphalt
- Topsoil
- Gravel
- Sand
- Silt
- Lean Clay
- Fat Clay
- Silty Sand
- Clayey Sand
- Sandy Silt
- Clayey Silt
- Sandy Clay
- Silty Clay
- Limestone
- Sandstone
- Siltstone
- Shale


CSI of Cincinnati
11785 Highway Drive
Cincinnati, OH 45241
Phone: 513.252.2059
Fax: 888.792.3121


Proposed Crossroads
Center Building
CN230236

BORING PROFILE

Fig. 1

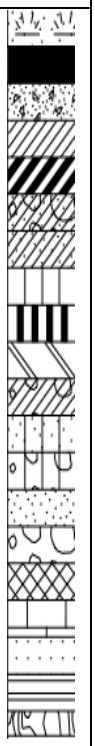
Consulting Services Incorporated
LEXINGTON | LOUISVILLE | CINCINNATI

# Geotechnical Boring Information Sheet

## Sample Type Symbols

Splitspoon (SPT)
Shelby Tube
Grab
Rock Core
Auger Cuttings

## Surface Symbols



Topsoil
Asphalt
Concrete
Lean Clay
Fat Clay
Glacial Till
Sandy Clay
Silt
Elastic Silt
Lean Clay to Fat Clay
Gravelly Clay
Sandy Silt
Gravelly Silt
Sand
Gravel
Fill
Limestone
Sandstone
Shale/Siltstone
Weathered Rock

## Samples Strength Descriptors

| **Cohesive Soils:** | **N** |
|---|---|
| Very Soft | 0-1 |
| Soft | 2-4 |
| Firm | 5-8 |
| Stiff | 9-15 |
| Very Stiff | 16-30 |
| Hard | 31+ |
| **Non-cohesive Soils:** | |
| Very Loose | 0-4 |
| Loose | 5-10 |
| Firm | 11-20 |
| Very Firm | 21-30 |
| Dense | 30-50 |
| Very Dense | 51+ |

## Definitions

SPT-"Splitspoon" or standard penetration test. Blow counts are number of drops required for a 140 lb hammer dropping 30 inches to drive the sampler 6 inches.

N-value is the addition of the last two intervals of the 18-inch sample.

Shelby tubes are often called "undisturbed samples". They are directly pushed into the ground, twisted, allowed to rest for a small period of time and then pulled out of the ground. Tops and bottoms are cleaned and then sealed.

Sample classification is done in general accordance with ASTM D2487 and 2488 using the Unified Soil Classification System (USCS) as a general guide.

Soil moisture descriptions are based on the recovered sample observations. The descriptors are dry, slightly moist, moist, very moist and wet. These are typically based on relative estimates of the moisture condition of a visual estimation of the soils optimum moisture content (EOMC). Dry is almost in a "dusty" condition usually 6 or more percent below EOMC. Slightly moist is from about 6 to 2 percent below EOMC at a point at which the soil color does not readily change with the addition of water. Moist is usually 2 percent below to 2 percent above EOMC and the point at which the soil will tend to begin forming "balls" under some pressure in the hand. Very moist is usually from about 2 percent to 6 percent above EOMC and also the point at which it's often considered "muddy". Wet soil is usually 6 or more percent above EOMC and often contains free water or the soil is in a saturated state.

Silt or Clay is defined at material finer than a standard #200 US sieve (<0.075mm) Sand is defined as material between the size of #200 sieve up to #4 sieve. Gravel is from #4 size sieve material to 3". Cobbles are from 3" to 12". Boulders are over 12".

Rock hardness is classified as follows:

| | |
|---|---|
| Very Soft: | Easily broken by hand pressure |
| Soft: | Ends can be broken by hand pressure; easily broken with hammer |
| Medium: | Ends easily broken with hammer; middle requires moderate blow |
| Hard: | Ends require moderate hammer blow; middle requires several blows |
| Very Hard: | Many blows with a hammer required to break core |

Rock Quality Designation (RQD) is defined as total combined length of 4" or longer pieces of core divided by the total core run length; defined in percentage.

Water or cave-in observed in borings is at completion of drilling each boring unless otherwise noted.

Strata lengths shown on borings represents a rough estimate. Transition may be more abrupt or gradual. Soil borings are representative of that estimated location at that time and are based on recovered samples. Conditions may be different between borings and between sample intervals. Boring information is not to be considered stand alone but should be taken in context with comments and information in the geotechnical report and the means by which the borings are logged, sampled and drilled.

CSI of Cincinnati
11785 Highway Drive
Cincinnati, OH 45241
Phone: 513.252.2059
Fax: 888.792.3121

# TEST BORING LOG

CLIENT: The Cross Roads Center
PROJECT NAME: Proposed Crossroads Center Building
PROJECT LOCATION: 2114 Reading Road, Cincinnati, OH

BORING #: B-6
JOB #: CN230236
LOGGED BY: CG
APPROVED BY: JPH

DRILLING and SAMPLING INFORMATION

| | | | |
|---|---|---|---|
| Date Started | 8/2/2024 | Contractor | CSI |
| Date Completed | 8/2/2024 | Boring Size | 4 in. |
| Drill Rig | Mobile B-57 | Boring Method | 4" O.D. SFA |
| Weather | Sunny 80s | Hammer Type | Automatic |

SOIL CLASSIFICATION

SURFACE ELEVATION: 670.5

| Elev. (ft) | Depth Scale | Water Level | SOIL CLASSIFICATION | Sample No. | Sample Type | Sample Graphics | Recovery (in) | Standard Penetration Test Blows per 6" [ *N-Value* ] *blows/foot* | Qu-tsf Unconfined (Pocket Pen.) Compressive Strength | Moisture Content % | Liquid Limit (LL) | Plasticity Index (PI) | Percent Passing #200 Sieve | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 670 | 0 | | TOPSOIL (4 inches) | | | | | | | | | | | |
| | | | Light brown LEAN CLAY (CL) with trace sand, few rock fragments [RESIDUAL] - moist, stiff | 1 | SS | | 14 | 5-5-6 [ *11* ] | 4.5 | | | | | |
| 668 | 2 | | | | | | | | | | | | | |
| | | | | 2 | SS | | 10 | 6-7-7 [ *14* ] | 4.5 | | | | | |
| 666 | 4 | | | | | | | | | | | | | |
| | | | | 3 | SS | | 16 | 4-5-7 [ *12* ] | 4.5 | | | | | |
| 664 | 6 | | | | | | | | | | | | | |
| | 8 | | | | | | | | | | | | | |
| 662 | | | Light brown FAT CLAY (CH) with shale and rock fragments [RESIDUAL] - moist, firm | 4 | SS | | 7 | 3-2-3 [ *5* ] | 2 | | | | | |
| | 10 | | | | | | | | | | | | | |
| 660 | | | | | | | | | | | | | | |
| | 12 | | | | | | | | | | | | | |
| 658 | | | | | | | | | | | | | | |
| | 14 | | Light brown SHALE, completely to highly weathered, very soft | 5 | SS | | 10 | 7-4-15 [ *19* ] | | | | | | |
| 656 | | | | | | | | | | | | | | |
| | 16 | | | | | | | | | | | | | |
| 654 | | | | | | | | | | | | | | |
| | 18 | | | | | | | | | | | | | |
| 652 | | | | 6 | SS | | 16 | 9-17-19 [ *36* ] | | | | | | |
| | 20 | | Boring Terminated at 20 feet | | | | | | | | | | | |
| 650 | | | | | | | | | | | | | | |
| | 22 | | | | | | | | | | | | | |
| 648 | | | | | | | | | | | | | | |
| | 24 | | | | | | | | | | | | | |
| 646 | | | | | | | | | | | | | | |

Depth to Groundwater
- Noted on Drilling Tools _____ ft.
- At Completion _____ ft.
- After _____ hours _____ ft.
- Cave Depth _____ ft.

Sample Type
- SPT- Standard Penetration Test
- SS- Split Spoon
- ST- Shelby Tube
- RC- Rock Core
- CU- Auger Cuttings

Boring Method
- HSA- Hollow Stem Augers
- CFA- Continuous Flight Augers
- MD- Mud Drilling

CSI of Cincinnati
11785 Highway Drive
Cincinnati, OH 45241
Phone: 513.252.2059
Fax: 888.792.3121

# TEST BORING LOG

CLIENT: The Cross Roads Center
PROJECT NAME: Proposed Crossroads Center Building
PROJECT LOCATION: 2114 Reading Road, Cincinnati, OH

BORING #: B-7
JOB #: CN230236
LOGGED BY: CG
APPROVED BY: JPH

DRILLING and SAMPLING INFORMATION

| | | | |
|---|---|---|---|
| Date Started | 8/2/2024 | Contractor | CSI |
| Date Completed | 8/2/2024 | Boring Size | 4 in. |
| Drill Rig | Mobile B-57 | Boring Method | 4" O.D. SFA |
| Weather | Sunny 80s | Hammer Type | Automatic |

SURFACE ELEVATION: 679.9

| Elev. (ft) | Depth Scale | Water Level | SOIL CLASSIFICATION | Sample No. | Sample Type | Sample Graphics | Recovery (in) | Standard Penetration Test Blows per 6" [ *N-Value* ] *blows/foot* | Qu-tsf Unconfined (Pocket Pen.) Compressive Strength | Moisture Content % | Liquid Limit (LL) | Plasticity Index (PI) | Percent Passing #200 Sieve | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 678 | 2 | | TOPSOIL (4 inches)<br>Gray ROCK and SHALE FRAGMENTS [FILL] - dry, very dense | 1 | SS | | 4 | 50--<br>[ *50* ] | | | | | | |
| 676 | 4 | | Brown and gray SHALE, highly weathered, interbedded with thin hard limestoen layers, soft | 2 | SS | | 6 | 17-50-<br>[ *50* ] | | | | | | |
| 674 | 6 | | Auger Refusal on Bedrock Encountered at 5 feet | | | | | | | | | | | |
| 672 | 8 | | | | | | | | | | | | | |
| 670 | 10 | | | | | | | | | | | | | |
| 668 | 12 | | | | | | | | | | | | | |
| 666 | 14 | | | | | | | | | | | | | |
| 664 | 16 | | | | | | | | | | | | | |
| 662 | 18 | | | | | | | | | | | | | |
| 660 | 20 | | | | | | | | | | | | | |
| 658 | 22 | | | | | | | | | | | | | |
| 656 | 24 | | | | | | | | | | | | | |

Depth to Groundwater
- Noted on Drilling Tools _____ ft.
- At Completion _____ ft.
- After _____ hours _____ ft.
- Cave Depth _____ ft.

Sample Type
- SPT- Standard Penetration Test
- SS- Split Spoon
- ST- Shelby Tube
- RC- Rock Core
- CU- Auger Cuttings

Boring Method
- HSA- Hollow Stem Augers
- CFA- Continuous Flight Augers
- MD- Mud Drilling

CSI of Cincinnati
11785 Highway Drive
Cincinnati, OH 45241
Phone: 513.252.2059
Fax: 888.792.3121

# TEST BORING LOG

CLIENT: The Cross Roads Center
PROJECT NAME: Proposed Crossroads Center Building
PROJECT LOCATION: 2114 Reading Road, Cincinnati, OH

BORING #: B-8
JOB #: CN230236
LOGGED BY: CG
APPROVED BY: JPH

DRILLING and SAMPLING INFORMATION

| | | | |
|---|---|---|---|
| Date Started | 8/2/2024 | Contractor | CSI |
| Date Completed | 8/2/2024 | Boring Size | 4 in. |
| Drill Rig | Mobile B-57 | Boring Method | 4" O.D. SFA |
| Weather | Sunny 80s | Hammer Type | Automatic |

SOIL CLASSIFICATION

SURFACE ELEVATION: 674.9

| Sample No. | Sample Type | Recovery (in) | Standard Penetration Test Blows per 6" [ *N-Value* ] *blows/foot* | Qu-tsf Unconfined (Pocket Pen.) Compressive Strength | Moisture Content % | Liquid Limit (LL) | Plasticity Index (PI) | Percent Passing #200 Sieve | Remarks |
|---|---|---|---|---|---|---|---|---|---|
| 1 | SS | 8 | 3-4-6 [ *10* ] | 4.5 | | | | | |
| 2 | SS | 12 | 3-9-15 [ *24* ] | 4.5 | | | | | |
| 3 | SS | 12 | 2-8-12 [ *20* ] | | | | | | |
| 4 | SS | 6 | 9-50- [ *50* ] | | | | | | |

Asphalt (4 inches)

Light brown LEAN CLAY (CL) with trace sand, few rock fragments [RESIDUAL] - moist, stiff to very stiff

Light brown SHALE, completely weathered, very soft

Light brown and gray SHALE, highly weathered, interbedded with few thin hard limestone layers, soft

Auger Refusal on Bedrock Encountered at 10 feet

Elev. (ft): 674, 672, 670, 668, 666, 664, 662, 660, 658, 656, 654, 652
Depth Scale: 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24

Depth to Groundwater

| | |
|---|---|
| Noted on Drilling Tools | _____ ft. |
| At Completion | _____ ft. |
| After _____ hours | _____ ft. |
| Cave Depth | _____ ft. |

Sample Type
SPT- Standard Penetration Test
SS- Split Spoon
ST- Shelby Tube
RC- Rock Core
CU- Auger Cuttings

Boring Method
HSA- Hollow Stem Augers
CFA- Continuous Flight Augers
MD- Mud Drilling

CSI of Cincinnati
11785 Highway Drive
Cincinnati, OH 45241
Phone: 513.252.2059
Fax: 888.792.3121

# TEST BORING LOG

CLIENT: The Cross Roads Center
PROJECT NAME: Proposed Crossroads Center Building
PROJECT LOCATION: 2114 Reading Road, Cincinnati, OH

BORING #: B-9
JOB #: CN230236
LOGGED BY: CG
APPROVED BY: JPH

DRILLING and SAMPLING INFORMATION

| | | | |
|---|---|---|---|
| Date Started | 8/2/2024 | Contractor | CSI |
| Date Completed | 8/2/2024 | Boring Size | 4 in. |
| Drill Rig | Mobile B-57 | Boring Method | 4" O.D. SFA |
| Weather | Sunny 80s | Hammer Type | Automatic |

SOIL CLASSIFICATION

SURFACE ELEVATION: 680.4

Asphalt (4 inches)

Gray ROCK FRAGMENTS with shale fragments [FILL] - dry, very dense

Gray SHALE, h[illegible]weathered, soft

Auger Refusal on Bedrock Encountered at 5.3 feet

TEST DATA

| Elev. (ft) | Depth Scale | Water Level | Sample No. | Sample Type | Sample Graphics | Recovery (in) | Standard Penetration Test Blows per 6" [ *N-Value* ] *blows/foot* | Qu-tsf Unconfined (Pocket Pen.) Compressive Strength | Moisture Content % | Liquid Limit (LL) | Plasticity Index (PI) | Percent Passing #200 Sieve | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 680 | 0 | | | | | | | | | | | | |
| | 2 | | 1 | SS | | 6 | 5-19-33 [ *52* ] | | | | | | |
| 678 | | | | | | | | | | | | | |
| | 4 | | 2 | SS | | 8 | 14-20-50 [ *70* ] | | | | | | |
| 676 | | | | | | | | | | | | | |
| | 6 | | | | | | | | | | | | |
| 674 | | | | | | | | | | | | | |
| | 8 | | | | | | | | | | | | |
| 672 | | | | | | | | | | | | | |
| | 10 | | | | | | | | | | | | |
| 670 | | | | | | | | | | | | | |
| | 12 | | | | | | | | | | | | |
| 668 | | | | | | | | | | | | | |
| | 14 | | | | | | | | | | | | |
| 666 | | | | | | | | | | | | | |
| | 16 | | | | | | | | | | | | |
| 664 | | | | | | | | | | | | | |
| | 18 | | | | | | | | | | | | |
| 662 | | | | | | | | | | | | | |
| | 20 | | | | | | | | | | | | |
| 660 | | | | | | | | | | | | | |
| | 22 | | | | | | | | | | | | |
| 658 | | | | | | | | | | | | | |
| | 24 | | | | | | | | | | | | |
| 656 | | | | | | | | | | | | | |

Depth to Groundwater

| | | |
|---|---|---|
| Noted on Drilling Tools | _____ ft. | |
| At Completion | _____ ft. | |
| After _____ hours | _____ ft. | |
| Cave Depth | _____ ft. | |

Sample Type
SPT- Standard Penetration Test
SS- Split Spoon
ST- Shelby Tube
RC- Rock Core
CU- Auger Cuttings

Boring Method
HSA- Hollow Stem Augers
CFA- Continuous Flight Augers
MD- Mud Drilling

CSI of Cincinnati
11785 Highway Drive
Cincinnati, OH 45241
Phone: 513.252.2059
Fax: 888.792.3121

# TEST BORING LOG

CLIENT: The Cross Roads Center
PROJECT NAME: Proposed Crossroads Center Building
PROJECT LOCATION: 2114 Reading Road, Cincinnati, OH

BORING #: B-10
JOB #: CN230236
LOGGED BY: CG
APPROVED BY: JPH

DRILLING and SAMPLING INFORMATION

| | | | |
|---|---|---|---|
| Date Started | 8/2/2024 | Contractor | CSI |
| Date Completed | 8/2/2024 | Boring Size | 4 in. |
| Drill Rig | Mobile B-57 | Boring Method | 4" O.D. SFA |
| Weather | Sunny 80s | Hammer Type | Automatic |

SURFACE ELEVATION: 681.6

| Elev. (ft) | Depth Scale | Water Level | SOIL CLASSIFICATION | Sample No. | Sample Type | Sample Graphics | Recovery (in) | Standard Penetration Test Blows per 6" [ *N-Value* ] *blows/foot* | Qu-tsf Unconfined (Pocket Pen.) Compressive Strength | Moisture Content % | Liquid Limit (LL) | Plasticity Index (PI) | Percent Passing #200 Sieve | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 680 | 2 | | CONCRETE (4 inches) | | | | | | | | | | | |
| | | | Brown well graded SAND (SW) with some gravel [FILL] - moist, loose | 1 | SS | | 6 | 3-3-1 [ *4* ] | | | | | | |
| 678 | 4 | | | 2 | SS | | 9 | 3-3-1 [ *4* ] | | | | | | |
| 676 | 6 | | | 3 | SS | | 9 | 3-2-2 [ *4* ] | | | | | | |
| 674 | 8 | | | | | | | | | | | | | |
| 672 | 10 | | | 4 | SS | | 12 | 5-3-5 [ *8* ] | | | | | | |
| 670 | 12 | | | | | | | | | | | | | |
| 668 | 14 | | Gray LEAN CLAY (CL) with trace sand, noted organic odor [FILL] - moist, soft | 5 | SS | | 13 | 3-2-2 [ *4* ] | 1 | | | | | |
| 666 | 16 | | | | | | | | | | | | | |
| 664 | 18 | | | | | | | | | | | | | |
| 662 | 20 | | Brown SHALE, highly weathered, soft | 6 | SS | | 16 | 10-22-36 [ *58* ] | | | | | | |
| | | | Boring Terminated at 20 feet | | | | | | | | | | | |
| 660 | 22 | | | | | | | | | | | | | |
| 658 | 24 | | | | | | | | | | | | | |

TEST DATA

Depth to Groundwater
- Noted on Drilling Tools _____ ft.
- At Completion _____ ft.
- After _____ hours _____ ft.
- Cave Depth _____ ft.

Sample Type
- SPT- Standard Penetration Test
- SS- Split Spoon
- ST- Shelby Tube
- RC- Rock Core
- CU- Auger Cuttings

Boring Method
- HSA- Hollow Stem Augers
- CFA- Continuous Flight Augers
- MD- Mud Drilling

CSI of Cincinnati
11785 Highway Drive
Cincinnati, OH 45241
Phone: 513.252.2059
Fax: 888.792.3121

# TEST BORING LOG

CLIENT: The Cross Roads Center
PROJECT NAME: Proposed Crossroads Center Building
PROJECT LOCATION: 2114 Reading Road, Cincinnati, OH

BORING #: B-11
JOB #: CN230236
LOGGED BY: CG
APPROVED BY: JPH

DRILLING and SAMPLING INFORMATION

| | | | |
|---|---|---|---|
| Date Started | 8/2/2024 | Contractor | CSI |
| Date Completed | 8/2/2024 | Boring Size | 4 in. |
| Drill Rig | Mobile B-57 | Boring Method | 4" O.D. SFA |
| Weather | Sunny 80s | Hammer Type | Automatic |

SOIL CLASSIFICATION

SURFACE ELEVATION: 681.3

CONCRETE (4 inches)

Brown, dark brown and gray FAT CLAY (CH) with trace sand, noted organic odor [FILL] - moist, firm

Auger Refusal on Bedrock Encountered at 8.2 feet

TEST DATA

| Sample No. | Sample Type | Sample Graphics | Recovery (in) | Standard Penetration Test Blows per 6" [ *N-Value* ] *blows/foot* | Qu-tsf Unconfined (Pocket Pen.) Compressive Strength | Moisture Content % | Liquid Limit (LL) | Plasticity Index (PI) | Percent Passing #200 Sieve | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | SS | | 10 | 3-2-3 [ 5 ] | 2.5 | | | | | |
| 2 | SS | | 14 | 2-3-4 [ 7 ] | 2 | | | | | |
| 3 | SS | | 10 | 2-3-5 [ 8 ] | 2.5 | | | | | |

Depth to Groundwater
- Noted on Drilling Tools _____ ft.
- At Completion _____ ft.
- After _____ hours _____ ft.
- Cave Depth _____ ft.

Sample Type
- SPT- Standard Penetration Test
- SS- Split Spoon
- ST- Shelby Tube
- RC- Rock Core
- CU- Auger Cuttings

Boring Method
- HSA- Hollow Stem Augers
- CFA- Continuous Flight Augers
- MD- Mud Drilling

CSI of Cincinnati
11785 Highway Drive
Cincinnati, OH 45241
Phone: 513.252.2059
Fax: 888.792.3121

# TEST BORING LOG

CLIENT: The Cross Roads Center
PROJECT NAME: Proposed Crossroads Center Building
PROJECT LOCATION: 2114 Reading Road, Cincinnati, OH

BORING #: B-12
JOB #: CN230236
LOGGED BY: CG
APPROVED BY: JPH

DRILLING and SAMPLING INFORMATION

| | | | |
|---|---|---|---|
| Date Started | 8/2/2024 | Contractor | CSI |
| Date Completed | 8/2/2024 | Boring Size | 4 in. |
| Drill Rig | Mobile B-57 | Boring Method | 4" O.D. SFA |
| Weather | Sunny 80s | Hammer Type | Automatic |

SURFACE ELEVATION: 681.4

| Elev. (ft) | Depth Scale | Soil Classification | Sample No. | Sample Type | Recovery (in) | Standard Penetration Test Blows per 6" [ *N-Value* ] *blows/foot* | Remarks |
|---|---|---|---|---|---|---|---|
| 680 | 2 | CONCRETE (4 inches) | | | | | |
| | | Gray ROCK FRAGMENTS with clay and shale fragments [FILL] - moist to dry, dense | 1 | SS | 6 | 14-14-16 [ *30* ] | |
| 678 | 4 | Brown LEAN CLAY (CL) with many rock fragments [FILL] - moist, hard | 2 | SS | 3 | 9-25-50 [ *75* ] | |
| 676 | 6 | Gray SHALE, hihgly weathered, soft | 3 | SS | 1 | 50-- [ *50* ] | |
| 674 | 8 | Auger Refusal on Bedrock Encountered at 7.7 feet | | | | | |
| 672 | 10 | | | | | | |
| 670 | 12 | | | | | | |
| 668 | 14 | | | | | | |
| 666 | 16 | | | | | | |
| 664 | 18 | | | | | | |
| 662 | 20 | | | | | | |
| 660 | 22 | | | | | | |
| 658 | 24 | | | | | | |

TEST DATA: Qu-tsf Unconfined (Pocket Pen.) Compressive Strength; Moisture Content %; Liquid Limit (LL); Plasticity Index (PI); Percent Passing #200 Sieve

Depth to Groundwater
- Noted on Drilling Tools _____ ft.
- At Completion _____ ft.
- After _____ hours _____ ft.
- Cave Depth _____ ft.

Sample Type
- SPT- Standard Penetration Test
- SS- Split Spoon
- ST- Shelby Tube
- RC- Rock Core
- CU- Auger Cuttings

Boring Method
- HSA- Hollow Stem Augers
- CFA- Continuous Flight Augers
- MD- Mud Drilling

CSI of Cincinnati
11785 Highway Drive
Cincinnati, OH 45241
Phone: 513.252.2059
Fax: 888.792.3121

# TEST BORING LOG

CLIENT: The Cross Roads Center
PROJECT NAME: Proposed Crossroads Center Building
PROJECT LOCATION: 2114 Reading Road, Cincinnati, OH

BORING #: B-13
JOB #: CN230236
LOGGED BY: CG
APPROVED BY: JPH

DRILLING and SAMPLING INFORMATION

| | | | |
|---|---|---|---|
| Date Started | 8/2/2024 | Contractor | CSI |
| Date Completed | 8/2/2024 | Boring Size | 4 in. |
| Drill Rig | Mobile B-57 | Boring Method | 4" O.D. SFA |
| Weather | Sunny 80s | Hammer Type | Automatic |

SOIL CLASSIFICATION

SURFACE ELEVATION: 682.1

| Elev. (ft) | Depth Scale | Water Level | Sample No. | Sample Type | Sample Graphics | Recovery (in) | Standard Penetration Test Blows per 6" [ *N-Value* ] *blows/foot* | Qu-tsf Unconfined (Pocket Pen.) Compressive Strength | Moisture Content % | Liquid Limit (LL) | Plasticity Index (PI) | Percent Passing #200 Sieve | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 682 | 0 | | | | | | | | | | | | |
| | | | | | | | CONCRETE (3 inches) | | | | | | |
| 680 | 2 | ▼ | 1 | SS | | 8 | 7-5-3 [ *8* ] | | | | | | |
| | | | | | | | Brown coarse grained SAND with gravel [FILL] - moist, loose | | | | | | |
| 678 | 4 | | 2 | SS | | 14 | 3-2-3 [ *5* ] | | | | | | |
| | | | | | | | Brown and black SAND (SW) with some clay, noted strong fuel odor [FILL] - wet, loose | | | | | | |
| 676 | 6 | | 3 | SS | | 10 | 3-2-2 [ *4* ] | | | | | | |
| 674 | 8 | | | | | | Auger Refusal on Bedrock Encountered at 8.3 feet | | | | | | |
| 672 | 10 | | | | | | | | | | | | |
| 670 | 12 | | | | | | | | | | | | |
| 668 | 14 | | | | | | | | | | | | |
| 666 | 16 | | | | | | | | | | | | |
| 664 | 18 | | | | | | | | | | | | |
| 662 | 20 | | | | | | | | | | | | |
| 660 | 22 | | | | | | | | | | | | |
| 658 | 24 | | | | | | | | | | | | |

Depth to Groundwater

| | | |
|---|---|---|
| ▼ Noted on Drilling Tools | 3.0 | ft. |
| ▽ At Completion | | ft. |
| ▼ After _____ hours | | ft. |
| Cave Depth | | ft. |

Sample Type
SPT- Standard Penetration Test
SS- Split Spoon
ST- Shelby Tube
RC- Rock Core
CU- Auger Cuttings

Boring Method
HSA- Hollow Stem Augers
CFA- Continuous Flight Augers
MD- Mud Drilling

CSI of Cincinnati
11785 Highway Drive
Cincinnati, OH 45241
Phone: 513.252.2059
Fax: 888.792.3121

# TEST BORING LOG

CLIENT: The Cross Roads Center
PROJECT NAME: Proposed Crossroads Center Building
PROJECT LOCATION: 2114 Reading Road, Cincinnati, OH

BORING #: TP-1
JOB #: CN230236
LOGGED BY: CG
APPROVED BY: JPH

DRILLING and SAMPLING INFORMATION

| | | | |
|---|---|---|---|
| Date Started | 8/2/2024 | Contractor | CSI |
| Date Completed | 8/2/2024 | Boring Size | 24 in. |
| Drill Rig | Mobile B-57 | Boring Method | 4" O.D. SFA |
| Weather | Sunny 80s | Hammer Type | Automatic |

SOIL CLASSIFICATION

| Elev. (ft) | Depth Scale | Water Level | SURFACE ELEVATION: 679.3 |
|---|---|---|---|
| 678 | 2 | | ASPHALT (2 inches) |
| | | | Gray GRAVEL (GP) with sand [FILL] - moist, loose |
| 676 | 4 | | Brown to gray FAT CLAY (CH) with trace limestone fragments [COLLUVIUM] - moist, stiff |
| 674 | 6 | | Gray SHALE, highly weathered, few interbedded thin hard limestone layers, soft |
| 672 | 8 | | Excavator Refusal on Limestone Layer Encountered at 3.8 feet |
| 670 | 10 | | |
| 668 | 12 | | |
| 666 | 14 | | |
| 664 | 16 | | |
| 662 | 18 | | |
| 660 | 20 | | |
| 658 | 22 | | |
| 656 | 24 | | |

TEST DATA

| Sample No. | Sample Type | Sample Graphics | Recovery (in) | Standard Penetration Test N-Value (blows/foot) | Qu-tsf Unconfined (Pocket Pen.) Compressive Strength | Moisture Content % | Liquid Limit (LL) | Plasticity Index (PI) | Percent Passing #200 Sieve | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|

Depth to Groundwater
- Noted on Drilling Tools _____ ft.
- At Completion _____ ft.
- After _____ hours _____ ft.
- Cave Depth _____ ft.

Sample Type
- SPT- Standard Penetration Test
- SS- Split Spoon
- ST- Shelby Tube
- RC- Rock Core
- CU- Auger Cuttings

Boring Method
- HSA- Hollow Stem Augers
- CFA- Continuous Flight Augers
- MD- Mud Drilling

CSI of Cincinnati
11785 Highway Drive
Cincinnati, OH 45241
Phone: 513.252.2059
Fax: 888.792.3121

# TEST BORING LOG

CLIENT: The Cross Roads Center
PROJECT NAME: Proposed Crossroads Center Building
PROJECT LOCATION: 2114 Reading Road, Cincinnati, OH

BORING #: TP-2
JOB #: CN230236
LOGGED BY: CG
APPROVED BY: JPH

DRILLING and SAMPLING INFORMATION

| | | | |
|---|---|---|---|
| Date Started | 8/2/2024 | Contractor | CSI |
| Date Completed | 8/2/2024 | Boring Size | 24 in. |
| Drill Rig | Mobile B-57 | Boring Method | 4" O.D. SFA |
| Weather | Sunny 80s | Hammer Type | Automatic |

SOIL CLASSIFICATION

SURFACE ELEVATION: 686.9

| Elev. (ft) | Depth Scale | Water Level | Soil Classification |
|---|---|---|---|
| 686 | 0 | | TOPSOIL (4 inches) |
| | 2 | | Brown and gray FAT CLAY (CH) with trace rock fragments, trace roots [COLLUVIUM] - moist, stiff |
| 684 | 4 | | Brown and gray SHALE, highly weathered, interbedded with thin hard limestone layers, soft |
| 682 | 6 | | |
| 680 | 8 | | Excavator Refusal on Limestone Layer Encountered at 6.8 feet |
| 678 | 10 | | |
| 676 | 12 | | |
| 674 | 14 | | |
| 672 | 16 | | |
| 670 | 18 | | |
| 668 | 20 | | |
| 666 | 22 | | |
| 664 | 24 | | |

TEST DATA

| Sample No. | Sample Type | Sample Graphics | Recovery (in) | Standard Penetration Test N-Value (blows/foot) | Qu-tsf Unconfined (Pocket Pen.) Compressive Strength | Moisture Content % | Liquid Limit (LL) | Plasticity Index (PI) | Percent Passing #200 Sieve | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|

Depth to Groundwater
- Noted on Drilling Tools _____ ft.
- At Completion _____ ft.
- After _____ hours _____ ft.
- Cave Depth _____ ft.

Sample Type
- SPT- Standard Penetration Test
- SS- Split Spoon
- ST- Shelby Tube
- RC- Rock Core
- CU- Auger Cuttings

Boring Method
- HSA- Hollow Stem Augers
- CFA- Continuous Flight Augers
- MD- Mud Drilling

CSI of Cincinnati
11785 Highway Drive
Cincinnati, OH 45241
Phone: 513.252.2059
Fax: 888.792.3121

# TEST BORING LOG

CLIENT: The Cross Roads Center
PROJECT NAME: Proposed Crossroads Center Building
PROJECT LOCATION: 2114 Reading Road, Cincinnati, OH

BORING #: TP-3
JOB #: CN230236
LOGGED BY: CG
APPROVED BY: JPH

DRILLING and SAMPLING INFORMATION

| | | | |
|---|---|---|---|
| Date Started | 8/2/2024 | Contractor | CSI |
| Date Completed | 8/2/2024 | Boring Size | 24 in. |
| Drill Rig | Mobile B-57 | Boring Method | 4" O.D. SFA |
| Weather | Sunny 80s | Hammer Type | Automatic |

SOIL CLASSIFICATION

SURFACE ELEVATION: 689.6

| Elev. (ft) | Depth Scale | Water Level | Soil Classification |
|---|---|---|---|
| 688 | 2 | | TOPSOIL (3 inches) |
| | | | Brown and gray FAT CLAY (CH) with trace rock fragments, trace roots [COLLUVIUM] - moist, stiff |
| 686 | 4 | | Brown SHALE, highly weathered, interbedded with thin hard limestone layers, soft |
| 684 | 6 | | Gray SHALE, highly weathered, interbedded with thin hard limestone layers, soft |
| 682 | 8 | | Excavator Refusal on Limestone Layer Encountered at 6 feet |
| 680 | 10 | | |
| 678 | 12 | | |
| 676 | 14 | | |
| 674 | 16 | | |
| 672 | 18 | | |
| 670 | 20 | | |
| 668 | 22 | | |
| 666 | 24 | | |

TEST DATA

| Sample No. | Sample Type | Sample Graphics | Recovery (in) | Standard Penetration Test N-Value (blows/foot) | Qu-tsf Unconfined (Pocket Pen.) Compressive Strength | Moisture Content % | Liquid Limit (LL) | Plasticity Index (PI) | Percent Passing #200 Sieve | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|

Depth to Groundwater
- Noted on Drilling Tools _____ ft.
- At Completion _____ ft.
- After _____ hours _____ ft.
- Cave Depth _____ ft.

Sample Type
- SPT- Standard Penetration Test
- SS- Split Spoon
- ST- Shelby Tube
- RC- Rock Core
- CU- Auger Cuttings

Boring Method
- HSA- Hollow Stem Augers
- CFA- Continuous Flight Augers
- MD- Mud Drilling

## FIELD TESTING PROCEDURES

Field Operations: The general field procedures employed by CSI are summarized in ASTM D 420 which is entitled "Investigating and Sampling Soils and Rocks for Engineering Purposes." This recommended practice lists recognized methods for determining soil and rock distribution and ground water conditions. These methods include geophysical and in situ methods as well as borings.

Borings are drilled to obtain subsurface samples using one of several alternate techniques depending upon the subsurface conditions. These techniques are:

a. Continuous 2-1/2 or 3-1/4 inch I.D. hollow stem augers;

b. Wash borings using roller cone or drag bits (mud or water);

c. Continuous flight augers (ASTM D 1425).

These drilling methods are not capable of penetrating through material designated as "refusal materials." Refusal, thus indicated, may result from hard cemented soil, soft weathered rock, coarse gravel or boulders, thin rock seams, or the upper surface of sound continuous rock. Core drilling procedures are required to determine the character and continuity of refusal materials.

The subsurface conditions encountered during drilling are reported on a field test boring record by the chief driller. The record contains information concerning the boring method, samples attempted and recovered, indications of the presence of various materials such as coarse gravel, cobbles, etc., and observations between samples. Therefore, these boring records contain both factual and interpretive information. The field boring records are on file in our office.

The soil and rock samples plus the field boring records are reviewed by a geotechnical engineer. The engineer classifies the soils in general accordance with the procedures outlined in ASTM D 2488 and prepares the final boring records which are the basis for all evaluations and recommendations.

The final boring records represent our interpretation of the contents of the field records based on the results of the engineering examinations and tests of the field samples. These records depict subsurface conditions at the specific locations and at the particular time when drilled. Soil conditions at other locations may differ from conditions occurring at these boring locations. Also, the passage of time may result in a change in the subsurface soil and ground water conditions at these boring locations. The lines designating the interface between soil or refusal materials on the records and on profiles represent approximate boundaries. The transition between materials may be gradual. The final boring records are included with this report.

The detailed data collection methods using during this study are discussed on the following pages.

Soil Test Borings: Soil test borings were made at the site at locations shown on the attached Boring Plan. Soil sampling and penetration testing were performed in accordance with ASTM D 1586.

The borings were made by mechanically twisting a hollow stem steel auger into the soil. At regular intervals, the drilling tools were removed and soil samples obtained with a standard 1.4 inch I.D., 2 inch O.D., split tube sampler. The sampler was first seated 6 inches to penetrate any loose cuttings, then driven an additional foot with blows of a 140-pound hammer falling 30 inches. The number of hammer blows required to drive the sampler the final foot was recorded and is designated the "penetration resistance". The penetration resistance, when properly evaluated, is an index to the soil strength and foundation supporting capability.

Representative portions of the soil samples, thus obtained, were placed in glass jars and transported to the laboratory. In the laboratory, the samples were examined to verify the driller's field classifications. Test Boring Records are attached which graphically show the soil descriptions and penetration resistances.

Core Drilling: Refusal materials are materials that cannot be penetrated with the soil drilling methods employed. Refusal, thus indicated, may result from hard cemented soil, soft weathered rock, coarse gravel or boulders, thin rock seams or the upper surface of sound continuous rock. Core drilling procedures are required to determine the character and continuity of refusal materials.

Prior to coring, casing is set in the drilled hole through the overburden soils, if necessary, to keep the hole from caving. Refusal materials are then cored according to ASTM D 2113 using a diamond-studded bit fastened to the

end of a hollow double tube core barrel. This device is rotated at high speeds, and the cuttings are brought to the surface by circulating water. Core samples of the material penetrated are protected and retained in the swivel-mounted inner tube. Upon completion of each drill run, the core barrel is brought to the surface, the core recovered is measured, the samples are removed and the core is placed in boxes for storage.

The core samples are returned to our laboratory where the refusal material is identified and the percent core recovery and rock quality designation is determined by a soils engineer or geologist. The percent core recovery is the ratio of the sample length obtained to the depth drilled, expressed as a percent. The rock quality designation (RQD) is obtained by summing up the length of core recovered, including only the pieces of core which are four inches or longer, and dividing by the total length drilled. The percent core recovery and RQD are related to soundness and continuity of the refusal material. Refusal material descriptions, recoveries, and RQDs are shown on the "Test Boring Records".

Hand Auger Borings and Dynamic Cone Penetration Testing: Hand auger borings are performed manually by CSI field personnel. This consists of manually twisting hand auger tools into the subsurface and extracting “grab” or baggie samples at intervals determined by the project engineer. At the sample intervals, dynamic cone penetration (DCP) testing is performed. This testing involves the manual raising and dropping of a 20 pound hammer, 18 inches. This “driver” head drives a solid-1¾ inch diameter cone into the ground. DCP “counts” are the number of drops it takes for the hammer to drive three 1¾ inch increments, recorded as X-Y-Z values.

Test Pits: Test pits are excavated by the equipment available, often a backhoe or trackhoe. The dimensions of the test pits are based on the equipment used and the power capacity of the equipment. Samples are taken from the spoils of typical buckets of the excavator and sealed in jars or “Ziplock” baggies. Dynamic Cone Penetration or hand probe testing is often performed in the upper few feet as OSHA standards allow. Refusal is deemed as the lack of advancement of the equipment with reasonable to full machine effort.

Water Level Readings: Water table readings are normally taken in conjunction with borings and are recorded on the "Test Boring Records". These readings indicate the approximate location of the hydrostatic water table at the time of our field investigation. Where impervious soils are encountered (clayey soils) the amount of water seepage into the boring is small, and it is generally not possible to establish the location of the hydrostatic water table through water level readings. The ground water table may also be dependent upon the amount of precipitation at the site during a particular period of time. Fluctuations in the water table should be expected with variations in precipitation, surface run-off, evaporation and other factors.

The time of boring water level reported on the boring records is determined by field crews as the drilling tools are advanced. The time of boring water level is detected by changes in the drilling rate, soil samples obtained, etc. Additional water table readings are generally obtained at least 24 hours after the borings are completed. The time lag of at least 24 hours is used to permit stabilization of the ground water table which has been disrupted by the drilling operations. The readings are taken by dropping a weighted line down the boring or using an electrical probe to detect the water level surface.

Occasionally the borings will cave-in, preventing water level readings from being obtained or trapping drilling water above the caved-in zone. The cave-in depth is also measured and recorded on the boring records.