Proposed Bronzeville Regional Senior Center

Chicago, Illinois

Geotechnical Engineering Report

August 27, 2025 | Terracon Project No. 11255075

Prepared for:

Public Building Commission of Chicago
50 W Washington St Rm 200
Rosemead, California 91770

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August 27, 2025

Public Building Commission of Chicago
50 W Washington St Rm 200
Rosemead, California 91770

Attn: Miguel F. Fernández
P: 312-744-7861
E: miguelfernandez@cityofchicago.org

Re: Geotechnical Engineering Report
Proposed Bronzeville Regional Senior Center
4711 – 4755 S. Calumet Avenue
Chicago, Illinois
Terracon Project No. 11255075

Dear Mr. Fernández:

We have completed the scope of Geotechnical Engineering services for the referenced project in general accordance with Terracon Proposal No. P11255075 dated July 15, 2025. This report presents the findings of the subsurface exploration and provides geotechnical recommendations concerning earthwork and the design and construction of foundations, floor slabs, and pavements for the proposed project.

We appreciate the opportunity to be of service to you on this project. If you have any questions concerning this report or if we may be of further service, please contact us.

Sincerely,

Terracon
(Illinois Firm Registration No. 184.004050-0006)

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Table of Contents

Introduction **3**
Project Description **3**
Site Conditions **4**
Geotechnical Characterization **5**
Subsurface Profile 5
Groundwater Conditions 6
Infiltration Test Results 7
Seismic Site Class 8
Geotechnical Overview **8**
Existing Fill Considerations 8
Foundation Support Considerations 9
Grade Supported Floor Slab and Pavement Subgrade Considerations 10
Earthwork **10**
Site Preparation 11
Subgrade Preparation 11
Fill Material Types 12
Fill Placement and Compaction Requirements 14
Grading and Drainage 14
Earthwork Construction Considerations 15
Construction Observation and Testing 16
Shallow Foundations **17**
Design Parameters – Compressive Loads 17
Shallow Foundation Construction Considerations 19
Floor Slabs **20**
Floor Slab Design Parameters 20
Floor Slab Construction Considerations 21
Pavements **22**
General Pavement Comments 22
Pavement Section Thicknesses 22
Pavement Drainage 24
Pavement Maintenance 25
Exterior Slab Frost Considerations **26**
General Comments **26**

Figures

GeoModel

Attachments

Exploration and Testing Procedures
Site Location and Exploration Plans
Exploration and Laboratory Results
Supporting Information

Introduction

This report presents the results of our subsurface exploration and Geotechnical Engineering services performed for the proposed Regional Senior Center to be located at 4711 – 4755 S. Calumet Avenue in Chicago, Illinois. The purpose of these services was to provide information and geotechnical engineering recommendations relative to:

- Subsurface soil conditions
- Groundwater conditions
- Seismic site class per IBC
- Site/subgrade preparation and earthwork
- Foundation design and construction
- Floor slab design and construction
- Pavement design and construction

The geotechnical engineering Scope of Services for this project included the advancement of test borings, laboratory testing, engineering analysis, and preparation of this report.

Drawings of the site and boring locations are shown on the **Site Location** and **Exploration Plan**, respectively. The results of the laboratory testing performed on soil samples obtained from the site during our field exploration are included on the boring logs and laboratory sheets in the **Exploration and Laboratory Results** section.

Project Description

Our initial understanding of the project was provided in our proposal and was discussed during project planning.

Item	Description
Information Provided	We received an email request from Miguel F. Fernández on July 8, 2025, with the following attachments: ▪ RFP_PBC_MFF_BronzevilleRegSrCtr10030_Geotechnical_20250708.pdf ▪ RFP_Geotech.zip
Project Description	The project includes a proposed two-story building with a total plan area of about 25,500 square feet for a regional senior center serving Bronzeville and nearby Chicago areas.

Item	Description
Building Construction	We anticipate the proposed senior center building will be constructed with steel framing with composite metal deck and concrete slabs, supported by steel columns and girders. It is anticipated that the new building will be supported by conventional shallow foundations.
Finished Floor Elevation	We understand finished floor elevation is planned to be at about +18 feet CCD (City of Chicago Datum).
Maximum Loads	Structural loads were provided in the 50% design schematic design report as follows: ▪ Interior Column load: less than 250 kips ▪ Exterior wall load: less than 1 kip per linear foot (klf) ▪ Slabs (assumed): 150 psf
Grading	Less than about 2 feet of cuts and/or fills are anticipated for the proposed construction (exclusive of excavations to remove unsuitable or unstable materials)
Pavements	The driveway and car park will be constructed for vehicle parking to the north and west sides of the existing building. Anticipated traffic details were not provided hence it is assumed as follows: ▪ Parking stalls for personal autos and pickup trucks ▪ Traffic consisting of personal vehicles with occasional delivery trucks and trash collection trucks

Terracon should be notified if any of the above information is inconsistent with the planned construction, as modifications to our recommendations may be necessary.

Site Conditions

The following description of site conditions is derived from our site visit in association with the field exploration and our review of publicly available geologic and topographic maps.

Item	Description
Parcel Information	The project is located at 4711 – 4755 S. Calumet Avenue in Chicago, Illinois. Approximate Latitude/Longitude 41.8086° N 87.6177° W (See **Site Location**)

Item	Description
Existing and Previous Improvements	Based on our draft Phase I ESA report (Terracon Project No. 11257129) and publicly available historical information, we understand portions of the site were developed with row houses (including basements) between about the 1920's into the 1960's. A commercial building was present beginning in the late 1960's into the 1980's. Our Geophysical Evaluation Report (Terracon Project No. 11257129, dated August 22, 2025) indicated the following: ▪ Possible sewer system at the northwest side of the site ▪ Possible vault at the southeast side of the site ▪ Building foundations (possibly from the row houses or commercial building) and buried debris across the site Existing features at the site includes: ▪ The site is currently a vacant lot between 47th Street and 48th Street in the Bronzeville area of Chicago. The site is near the CTA 47th Street Green Line stop. ▪ The north end of the site is adjacent to a commercial parcel with a one-story retail building. ▪ The east end of the site is defined by a public alley with power poles. ▪ The west side of the site fronts S. Calumet Avenue and the south side is adjacent to a vacant parcel
Current Ground Cover	Gravel and bare earth
Existing Topography	Using Illinois Elevation Finder portal, the site appears relatively flat with surface elevations of about +18 feet CCD

Geotechnical Characterization

Subsurface Profile

We have developed a general characterization of the subsurface conditions based upon our review of the subsurface exploration, laboratory data, and our understanding of the project. This characterization, termed GeoModel, forms the basis of our geotechnical calculations and evaluation of the site. Conditions observed at each exploration point are indicated on the individual logs. The individual logs can be found in the **Exploration and Laboratory Results**.

As part of our analyses, we identified the following model layers within the subsurface profile. For a more detailed view of the model layer depths at each boring location, refer to the GeoModel in the **Figures** section.

Model Layer	Layer Name	General Description
1	**Topsoil/Asphalt**	Approx. 3 to 12 inches of topsoil Approx. 3 inches of asphalt at B-6
2	**Existing Fill**	Variable fill types with urban debris
3	**Granular**	Generally loose to medium dense; very loose zone in B-3
4	**Low to Medium Strength Clay**	Generally very soft to stiff consistency lean clay
5	**Hard Clay**	Lean clay with generally hard consistency

Groundwater Conditions

The borings were advanced using hollow stem augers allowing for short-term groundwater observations to be made while drilling. The boreholes were observed while drilling and shortly after completion for the presence and level of groundwater. The water levels observed in the boreholes are summarized below and can be found on the boring logs in the **Exploration and Laboratory Results** section.

Boring Numbers	While Drilling (feet bgs [1])	Shortly After Completion of Drilling (feet bgs [1])
B-1	7	16
B-2	8	17
B-3	6	11
B-4	7	Dry
B-5	5	5½
B-6	6	9
P-1	7	Dry
P-2	8½	Dry

1. bgs = below existing ground surface

The water levels observed in the borings do not necessarily correspond to stable groundwater levels. Groundwater conditions may change because of seasonal variations in rainfall, runoff, and other conditions not apparent at the time of drilling. Long term observations in piezometers or observation wells sealed from the influence of surface water are often required to define groundwater levels, and subsurface water conditions may be different at the time of construction and over the life of the structure. Long-term groundwater monitoring was outside the scope of services for this project.

Infiltration Test Results

Two single ring infiltration tests were performed at the site. The single ring test generally followed the procedures outlined in the Chicago Stormwater Ordinance Manual (2024). Each test involved drilling a hole to the test depth of 7 to 8 feet bgs, installing a temporary PVC casing in the boring, backfilling the annular space between the casing and the soil with bentonite to form a semi-impermeable seal, saturating the soil at the bottom of the casing, and measuring the rate of a falling head of water inside the casing through several iterations.

Based on review of the borings and samples returned from the field, the infiltration tests appear to have been performed in existing fill materials.

From this data, the rate of infiltration for the soil at the bottom of the casing is estimated.

INFILTRATION TEST RESULTS				
Test Date: 08/08/25				**Tester: Geocon**
Location: Parking				**Weather: 86 F**
Test Location	**Test Depth (feet)**	**Trial No.**	**Water Drop (inches)**	**Elapsed Time (minutes)**
INF-1	**7**	1	1.75	5
		2	1.00	10
		3	1.25	15
		4	3.125	30
		5	2.75	45
		6	2.75	60
		7	3.00	75
		8	2.75	90
	NOTE: Estimated rate of infiltration final trial: 1.1 in./hr			

INF-2	**8**	1	1.25	5
		2	1.00	10
		3	1.00	15
		4	3.25	30
		5	3.00	45
		6	2.75	60
	NOTE: Estimated rate of infiltration final trial: 0.7 in./hr			

Seismic Site Class

The seismic design requirements for buildings and other structures are based on Seismic Design Category. Site Class is required to determine the Seismic Design Category for a structure. The Site Class is based on the upper 100 feet of the site profile defined by a weighted average value of either shear wave velocity, standard penetration resistance, or undrained shear strength in accordance with Section 20.4 of ASCE 7 and the International Building Code (IBC). Based on the soil properties observed at the site and as described on the exploration logs and results, our professional opinion is for that a **Seismic Site Class of D** be considered for the project. Subsurface explorations at this site were extended to a maximum depth of about 70 feet bgs. The site properties below the boring depth to 100 feet were estimated based on our experience and knowledge of geologic conditions of the general area. Additional deeper borings or geophysical testing may be performed to confirm the conditions below the current boring depth.

Geotechnical Overview

The recommendations contained in this report are based upon the results of field and laboratory testing (presented in the **Exploration and Laboratory Results**), engineering analyses, and our current understanding of the proposed project. The **General Comments** section provides an understanding of the report limitations.

Existing Fill Considerations

Our borings encountered existing fill (GeoModel Layer 2) extending to depths of about 5 to 10 feet bgs. The existing fill could be encountered elsewhere onsite at locations not directly explored and to different depths than indicated in this report. Based on the relative age of the structures in the area and appearance of the types of fill, we do not anticipate records of compaction tests on fill are available from previous phases of development and/or demolition.

We understand former buildings at the site might have included row houses with basements. The basement areas might have been backfilled with urban fill and building debris at the time of demolition. Information about the previous structures was not available at the time we prepared this report. Geophysical Evaluation Report (Terracon Project No. 11257129, dated August 22, 2025) indicated a possible sewer system at the northwest side of the site, a possible buried vault at the southeast side of the site, building foundations (possibly from the row houses or commercial building), and buried debris across the site.

Debris laden existing fill, buried rubble, and/or former buried structures could hamper construction. Dedicated efforts to explore and remove these materials prior to construction could reduce delays due to obstructions and "unforeseen" conditions. Borings can misrepresent the quantity of brick, rubble, and other unsuitable materials in the existing fills, and additional test pits should be considered to assist in discovery of undesirable materials.

Risks of existing fill also include the possible presence of unsuitable materials or zones, such as organic layers, low strength soils, or debris buried by the fill that will not be discovered. The risks of unforeseen conditions cannot be eliminated without completely removing the existing fill but can be reduced by following the recommendations contained in this report.

Fills placed in uncontrolled manners (e.g., existing fill material that has not been uniformly placed and compacted with strict moisture and density control) may not perform predictably and could experience higher than tolerable settlements. Risks of existing fill include the possible presence of unsuitable materials or zones, such as organic layers, low strength soils, or debris buried by the fill that will not be discovered.

Foundation Support Considerations

We recommend performing overexcavations to remove existing fill from below the shallow foundation design bearing level. To develop the recommended net allowable bearing pressure of 3,000 psf, we recommend performing overexcavations to develop structural fill to at least the following depths below the design bearing elevations of the foundations:

- 100% of the planned width of continuous wall foundations;
- 50% of the planned width of column foundations; or
- 3 feet.

Deeper overexcavations might be needed to remove the existing fill from below the foundation design bearing levels. A discussion of foundation support is included in **Shallow Foundations**.

As an alternative to overexcavation methods, proprietary ground improvement methods such as aggregate piers or stone columns may be considered. These systems can reinforce the in-place soils and reduce settlement. Their use should be evaluated based on site-specific feasibility and cost.

Grade Supported Floor Slab and Pavement Subgrade Considerations

If the unsuitable materials are overexcavated only below foundations, existing fill materials will likely remain beneath significant portions of the building floor slabs. With the owner's acknowledgement of the risks discussed above, floor slabs could bear on a new layer of structural fill placed above existing fill materials provided the existing fill materials are further tested and probed by representatives of the Geotechnical Engineer during construction to evaluate the potential presence of unsuitable materials (e.g., existing fill with low compaction characteristics, debris, low strength native clay soils, etc.). We recommend preparing the slab areas to accommodate placement of at least 2 feet of low plasticity clay or granular structural fill below the bottom of floor slabs. Additional overexcavation below slabs will be required if any buried foundations, voids, debris, rubble, large particles, and other unsuitable materials are encountered at the base of the planned overexcavation.

If the risk of settlement and potential unpredictable performance cannot be tolerated, alternatives include completely removing the existing fill or possibly performing deeper excavations and replacement with new structural fill, layering of geogrid reinforcing, and/or perhaps more heavily reinforced floor slabs be considered. A discussion of slab support is included in **Floor Slabs** section.

The grade supported slab areas and pavements should be prepared according to recommendations in the **Earthwork** section. Stabilization methods should be anticipated to develop suitable floor slab and pavement subgrade support conditions, and these methods are discussed in the **Subgrade Preparation** subsection.

Earthwork

Earthwork is anticipated to include clearing and grubbing, excavations, and structural fill placement. The following sections provide recommendations for use in the preparation of specifications for the work. Recommendations include quality criteria, as necessary, to render the site in the state considered in our geotechnical engineering evaluation for foundations, floor slabs, and pavements.

Site Preparation

Site preparation should commence with removal of any existing pavements, vegetation, topsoil, and root mats. To the extent practical, existing utilities should be rerouted around the area of new construction.

Overexcavations of unsuitable materials (e.g., existing fill, low strength soils) to designated depths below foundations and floor slabs could be performed during the site preparation. The trench backfill and bedding materials of any rerouted utilities should also be removed and replaced with structural fill as recommended in this report. Sloping or benching of the sides of excavations may be needed to accommodate the new structural fill. Removal of subsurface elements and backfill should be observed by the Geotechnical Engineer and new structural fill placed in accordance with the recommendations in this report.

If the owner accepts the risks of supporting slabs above a portion of the existing fill, floor slab subgrade preparation should accommodate the placement of at least 2 feet of new low plasticity structural fill below floor slabs as discussed in **Geotechnical Overview**.

Once initial stripping and cutting has been completed, we recommend at least the upper 8 inches of subgrade materials be thoroughly scarified, moisture conditioned as necessary and compacted per the compaction requirements in this section. The exposed granular subgrade soils should be proofrolled with a smooth drum vibratory roller with a minimum gross weight of 10 tons, and cohesive subgrades, if encountered (e.g., clay or silty clay) should be proofrolled with a fully loaded tandem axle dump truck with a gross weight of at least 25 tons or similarly loaded equipment. The proofrolling should be performed under the observation of the Geotechnical Engineer. Areas that rut or excessively deflect under the proofrolling should be improved by scarifying and compaction or by removal and replacement with an approved structural fill as discussed in **Fill Material Types**. Excessively wet or dry material should either be removed, or moisture conditioned and recompacted.

Subgrade Preparation

Based on the outcome of the site preparation operations and season of construction, some subgrade stabilization should be expected for the site, especially if construction occurs during wet periods of the year.

If unsuitable areas are observed, subgrade improvement will be necessary to establish a suitable subgrade support condition. Terracon should be retained to discuss stabilization options. Potential methods of subgrade improvement are described below. The appropriate method of improvement, if required, would be dependent on factors such as schedule, weather, the size of area to be stabilized, and the nature of the instability.

More detailed recommendations can be provided during construction as the need for subgrade stabilization occurs.

- **Scarification and Compaction** – It may be feasible to scarify, moisture condition (i.e., dry or moisten), and recompact the exposed soils. The success of this procedure would depend primarily upon favorable weather and sufficient time to dry the soils. Even with adequate time and favorable weather, stable subgrades may not be achieved if the thickness of the unstable material is greater than about 1 to 1½ feet.

- **Crushed Stone/Aggregate** – The use of crushed stone, crushed concrete, and/or gravel could be considered to improve subgrade stability. To limit depths of undercuts, the use of a geosynthetic (such as a geogrid or geotextile) could be considered after underground work, such as utility construction, is completed. The manufacturer's specifications for each reinforcement product should be verified prior to material purchase/delivery and placement at this site.

Fill Material Types

Fill required to achieve design grade should be classified as structural fill and general fill. Structural fill is material used below or within 10 feet of structures, pavements or constructed slopes. General fill is material used to achieve grade outside of these areas. Care should be taken when placing fill to not alternate granular and fine-grained materials.

Excavated on-site soils that satisfy the recommendations in this report may be selectively reused as fill below floor slab, pavement, and landscaping areas. Moisture conditioning (e.g., wetting or drying) will be necessary to achieve compaction requirements if fine-grained materials are used as structural fill for the project.

Material property requirements for on-site soil for use as general fill and structural fill are noted in the table below:

Property	General Fill	Structural Fill
Composition	Free of deleterious material	Free of deleterious material
Maximum particle size	6 inches (or 2/3 of the lift thickness)	3 inches
Plasticity	Not limited	Liquid Limit less than 45 Plasticity Index less than 23

Property	General Fill	Structural Fill
GeoModel Layer Expected to be Suitable[1]	3, 4 & 5	3, 4 & 5

1. GeoModel Layer suitability is based on subsurface exploration. Actual material suitability should be determined in the field at the time of construction. Specific material requirements will need to be satisfied based on intended use.

Imported and on-site materials to be used as structural fill should meet the following material property requirements.

Soil Type [1]	USCS Classification	Acceptable Location for Placement
Granular [3]	GW, GP, GM, GC, SW, SP, SM, SC	▪ Below grade-supported slabs and pavements ▪ Below foundations in overexcavations
Low Plasticity Cohesive [2]	CL, CL-ML	▪ Site mass grading fill ▪ Below aggregate base for grade-supported slabs and pavements
Unsuitable	CL/CH, CH, MH, OL, OH, PT, ML	N/A

1. Structural and general fill should consist of approved materials free of organic matter and debris. Frozen material should not be used, and fill should not be placed on a frozen subgrade. A sample of each material type should be submitted to the Geotechnical Engineer for evaluation prior to use on this site. Additional geotechnical consultation should be provided prior to the use of uniformly graded gravel on the site.
2. By our definition, low plasticity materials should have a liquid limit of 45 or less and a plasticity index of 23 or less (ASTM D4318). Import of moderate to high plasticity fine-grained soil is not recommended. Fine grained materials (e.g., clays) can be difficult to compact in relatively small areas (e.g., excavations for foundations and utilities), and we recommend fine-grained materials are only used where placed with proper equipment during mass grading.
3. Specific material requirements will need to be satisfied based on intended use.

Fill Placement and Compaction Requirements

Structural and general fill should meet the following compaction requirements.

Item	Structural Fill	General Fill
Maximum Lift Thickness	▪ 8 inches or less in loose thickness when heavy, self-propelled compaction equipment is used ▪ 4 to 6 inches in loose thickness when hand-guided equipment (i.e., jumping jack or plate compactor) is used	Same as structural fill
Minimum Compaction Requirements [1,2,3]	95% of the maximum dry density	90% of maximum dry density
Water Content Range [1]	▪ Low Plasticity Cohesive: -2% to +3% of optimum moisture content at the time of placement and compaction ▪ Granular: As required to achieve minimum compaction requirements.	As required to achieve minimum compaction requirements

1. Maximum density and optimum water content as determined by the Modified Proctor test (ASTM D1557).
2. Moisture levels should be maintained to achieve compaction without bulking during placement or pumping when proofrolled.
3. If the granular material is a coarse sand or gravel, or of a uniform size, or has a low fines content, compaction comparison to relative density may be more appropriate. In this case, granular materials should be compacted to at least 70% relative density (ASTM D 4253 and D 4254). Materials not amenable to density testing should be placed and compacted to a stable condition observed by the Geotechnical Engineer or representative.

Grading and Drainage

All grades must provide effective/positive drainage away from the building during and after construction and should be maintained throughout the life of the structure. Water retained next to the building can result in soil movements greater than those discussed in this report. The roof should have gutters/drains with downspouts that discharge onto splash blocks at a distance of at least 5 feet from the building.

Exposed ground should be sloped and maintained at a minimum 5 percent away from the building for at least 10 feet beyond the perimeter of the building. Locally, flatter grades may be necessary to transition ADA access requirements for flatwork. After building construction and landscaping have been completed, final grades should be verified to document effective drainage has been achieved. Grades around the structure should also be periodically inspected and adjusted, as necessary, as part of the structure's maintenance program. Where paving or flatwork abuts the structure, a maintenance program should be established to effectively seal and maintain joints and prevent surface water infiltration.

Planting trees, large shrubs, or other vegetation adjacent to structures supported on shallow foundations and/or with grade-supported slabs is not recommended. Trees and large shrubs can develop extensive root systems that can draw moisture from the subgrade soils, causing them to shrink during dry periods of the year. Drying or desiccation of clay soils below shallow foundations and grade-supported floor slabs can result in settlement of the foundations and slabs.

Earthwork Construction Considerations

Upon completion of filling and grading, care should be taken to maintain the subgrade water content prior to construction of grade-supported improvements such as floor slabs and pavements. Construction traffic over the completed subgrades should be avoided. The site should also be graded to prevent ponding of surface water on the prepared subgrades or in excavations. Water collecting over or adjacent to construction areas should be removed. If the subgrade freezes, desiccates, saturates, or is disturbed, the affected material should be removed, or the materials should be scarified, moisture conditioned, and recompacted prior to floor slab and pavement construction.

Shallow groundwater and perched water could be encountered in excavations (e.g., in existing fill, in the sand seams and layers above clay soils), and this water could seep into excavations. If water seepage is encountered or if surface water collects in open excavations, the contractor should be prepared to remove water from the excavations. Water should not be allowed to accumulate in the bottom of the excavations. Dewatering of excavations extending into sand soils below the water table could require multiple sump pits/pumps, well points, or other measures. Groundwater levels should be maintained at least 2 feet below the deepest excavation level to help improve stability in the base of the excavations.

As a minimum, excavations should be performed in accordance with OSHA 29 CFR, Part 1926, Subpart P, "Excavations" and its appendices, and in accordance with any applicable local and/or state regulations. Temporary excavations will be required during grading operations and/or installation of utilities. Contractors, by their contract, are usually responsible for designing and constructing stable, temporary excavations and should shore, slope, or bench the sides of the excavations as required, to maintain stability of both the excavation sides and bottom. All excavations should comply with applicable local, state and federal safety regulations, including the current OSHA Excavation and Trench Safety Standards.

Construction site safety is the sole responsibility of the contractor who controls the means, methods, and sequencing of construction operations. Under **no** circumstances shall the information provided herein be interpreted to mean Terracon is assuming responsibility for construction site safety or the contractor's activities; such responsibility shall neither be implied nor inferred.

Excavations or other activities resulting in ground disturbance have the potential to affect adjoining properties and structures. Our Scope of Services does not include review of available final grading information or consider potential temporary grading performed by the Contractor for potential effects such as ground movement beyond the project limits. A preconstruction/ precondition survey should be conducted to document nearby property/infrastructure prior to any site development activity. Excavation or ground disturbance activities adjacent or near property lines should be monitored or instrumented for potential ground movements that could negatively affect adjoining property and/or structures.

Construction Observation and Testing

The earthwork efforts should be observed by the Geotechnical Engineer. Observation should include documentation of adequate removal of surficial materials (vegetation, topsoil, and pavements), evaluation and remediation of existing fill materials, as well as proofrolling and mitigation of unsuitable areas identified by the proofroll.

Each lift of compacted fill should be tested, evaluated, and reworked, as necessary, as recommended by the Geotechnical Engineer prior to placement of additional lifts. In areas of foundation excavations, the bearing subgrade should be evaluated by the Geotechnical Engineer or their representative. If unanticipated conditions are observed, the Geotechnical Engineer should recommend mitigation options.

In addition to the documentation of the essential parameters necessary for construction, the continuation of the Geotechnical Engineer into the construction phase of the project provides the continuity to maintain the Geotechnical Engineer’s evaluation of subsurface conditions, including assessing variations and associated design changes.

Shallow Foundations

According to our understanding of the project in **Project Description**, and if the site has been prepared in accordance with the requirements noted in **Earthwork** section, the following design parameters are applicable for shallow foundations. The remedial methods discussed in **Shallow Foundation Construction Considerations** should be implemented.

Design Parameters – Compressive Loads

Item	Description
Maximum Net Allowable Bearing Pressure [1, 2]	3,000 psf
Required Bearing Stratum [3]	▪ New structural fill or lean concrete extending to at least the following depths below the design bearing elevations of the foundations: ○ 100% of the planned width of continuous wall foundations; ○ 50% of the planned width of column foundations; or ○ 3 feet ▪ Deeper overexcavations might be needed to remove the existing fill from below the foundation design bearing levels.
Minimum Foundation Dimensions	▪ Isolated spread footings: 30 inches ▪ Continuous footings: 18 inches
Minimum Embedment below Finished Grade [4]	▪ Exterior footings: 3½ feet ▪ Interior footings in heated areas: 1½ feet
Estimated Total Settlement from Structural Loads [2, 5]	1 inch or less
Estimated Differential Settlement [2, 5]	3/4 or less of the total settlement

Item	Description
Ultimate Passive Pressures [6,7] (equivalent fluid density)	For materials placed adjacent to foundations: ▪ Coarse-grained: 360 pcf
Ultimate Coefficient of Sliding Friction [7]	On suitable bearing material: 0.35

1. The maximum net allowable bearing pressure is the pressure in excess of the minimum surrounding overburden pressure at the footing base elevation.
2. Values provided are for maximum loads noted in **Project Description**. Additional geotechnical consultation will be necessary if higher loads are anticipated.
3. Existing fill, unsuitable, or unstable soils should be overexcavated and replaced per the recommendations presented in **Earthwork**.
4. Recommended embedment depth to reduce the effects of frost and/or seasonal water content variations. For perimeter footings and footings beneath unheated areas, the minimum footing embedment for frost protection should be 3½ feet. The minimum footing embedment for "interior footings" applies to footings that will not be subject to freezing weather and large moisture fluctuations during or after construction.
5. Foundation settlements will depend upon the variations within the subsurface soil profile, the structural loading conditions, the embedment depth of the footings, the thickness of structural fill, and the quality of the earthwork operations and footings construction. Frequent control joints in the structure and sufficiently flexible connections are recommended help to accommodate differential settlement across the length of the structures.
6. Use of passive earth pressures require the sides of the excavation for the spread footing foundation to be nearly vertical and the concrete placed neat against these vertical faces or that the footing forms be removed and compacted structural fill be placed against the vertical footing face. Use of granular values for passive pressure resistance requires that the granular structural fill extend laterally from the side of the foundation beyond a line projecting 60° with respect to vertical from the base of the foundation. Assumes no hydrostatic pressure. Passive resistance in the upper 3½ feet of the soil profile in exterior locations should be neglected due to frost effects.
7. Some horizontal movement of the foundation must occur to mobilize passive and sliding resistance. Sliding resistance should be neglected for foundations subject to net uplift conditions

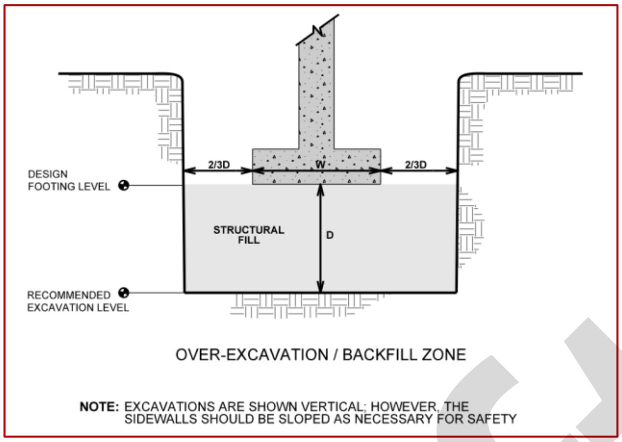
Shallow Foundation Construction Considerations

The base of all foundation excavations should be free of water and loose soil, prior to placing concrete. A granular working surface might be required at the base of excavations reduce disturbance. Concrete should be placed soon after excavating to reduce bearing soil disturbance. If the excavations must remain open overnight or for an extended period, placement of a lean concrete mud-mat over the bearing materials should be considered.

Care should be taken to prevent wetting or drying of the bearing materials during construction. Excessively wet or dry material or any loose/disturbed material in the bottom of the footing excavations should be removed/reconditioned before foundation concrete is placed.

Native loose sands should be compacted to at least a medium dense condition or removed and replaced with new structural fill. Compaction of the exposed sand soils could be performed with a hydraulic compactor or large vibratory plate compactor during the initial exposure of the soils at the designated depths if groundwater is not present near these depths. In-place densification of the exposed sand soils using vibratory methods may not be very effective if groundwater is present within 2 feet of the bearing surface during construction. If the groundwater level cannot be sufficiently lowered, Terracon should be consulted for alternative backfilling scenarios (e.g., might include geogrid and rock layer(s) at the exposed excavation base).

Overexcavation of unsuitable bearing soils observed at the base of the planned footing excavation for structural fill placement, including lean concrete (minimum 28-day compressive strength of 1,000 psi), should extend laterally beyond all edges of the footings at least 8 inches per foot of overexcavation depth below the design footing level. The overexcavation should then be backfilled up to the design footing level with IDOT CA-6 material (or similar approved materials), placed and compacted as recommended in the **Earthwork** section, or lean concrete. Backfill should be placed immediately upon completing excavations. Overexcavations for structural fill placement below footings should be conducted as shown below.



Floor Slabs

Design parameters for floor slabs assume the requirements for **Earthwork** have been followed. Specific attention should be given to positive drainage away from the structure and positive drainage of the aggregate base beneath the floor slab.

If the owner accepts the risks of supporting slabs above the existing fill, they have accepted the inherent risk that compressible fill or unsuitable material, within or buried by the fill may not be discovered. The risk of unforeseen conditions cannot be eliminated without completely removing the existing fill but can be reduced by following the requirements and recommendations in the **Earthwork** section.

Floor Slab Design Parameters

Item	Description
Floor Slab Support [1]	Minimum 4 inches of crushed stone meeting material specifications of ACI 302 Provide at least 2 feet of new structural fill below floor slabs (this can include the crushed stone layer) Subgrade soils and aggregate base prepared according to the **Earthwork** section
Estimated Modulus of Subgrade Reaction [2]	100 pounds per square inch per inch (psi/in) for a soil subgrade prepared as recommended in this report

Item	Description

1. Floor slabs should be structurally independent of building footings or walls to reduce the possibility of floor slab cracking caused by differential movements between the slab and foundation.
2. Modulus of subgrade reaction is an estimated value based upon our experience with the subgrade condition, the requirements noted in **Earthwork**, and the floor slab support as noted in this table. It is provided for point loads (e.g., less than 1 foot x 1 foot loaded area). For large area loads the modulus of subgrade reaction would be lower.

The use of a vapor retarder should be considered beneath concrete slabs on grade covered with wood, tile, carpet, or other moisture sensitive or impervious coverings, when the project includes humidity-controlled areas, or when the slab will support equipment sensitive to moisture. When conditions warrant the use of a vapor retarder, the slab designer should refer to ACI 302 and/or ACI 360 for procedures and cautions regarding the use and placement of a vapor retarder.

Saw-cut contraction joints should be placed in the slab to help control the location and extent of cracking. Joints or cracks should be sealed with a waterproof, non-extruding compressible compound specifically recommended for heavy duty concrete pavement and wet environments.

Where floor slabs are tied to perimeter walls or turn-down slabs to meet structural or other construction objectives, our experience indicates differential movement between the walls and slabs will likely be observed in adjacent slab expansion joints or floor slab cracks beyond the length of the structural dowels. The Structural Engineer should account for potential differential settlement through use of sufficient control joints, appropriate reinforcing, or other means.

Floor Slab Construction Considerations

Finished subgrade, within and for at least 10 feet beyond the floor slab, should be protected from traffic, rutting, or other disturbance and maintained in a relatively moist condition until floor slabs are constructed. If the subgrade should become damaged or desiccated prior to construction of floor slabs, the affected material should be removed, and structural fill should be added to replace the resulting excavation. Final conditioning of the finished subgrade should be performed immediately prior to placement of the floor slab support course.

The Geotechnical Engineer should observe the condition of the floor slab subgrades immediately prior to placement of the floor slab support course, reinforcing steel, and concrete. Attention should be paid to high traffic areas that were rutted and disturbed earlier, and to areas where backfilled trenches are located.

Care will be necessary to avoid contaminating the floor slab granular base with soil prior to floor slab placement. We recommend the floor slab granular base be placed only immediately prior to slab concrete placement.

Pavements

General Pavement Comments

Pavement designs are provided for the traffic conditions and pavement life conditions as noted in **Project Description** and in the following sections of this report. A critical aspect of pavement performance is site preparation. Pavement designs noted in this section must be applied to the site which has been prepared as recommended in the **Earthwork** section.

If the owner elects to construct the pavements above the existing fill, they have accepted the inherent risk that compressible fill or unsuitable material, within or buried by the fill may not be discovered. This risk of unforeseen conditions cannot be eliminated without completely removing the existing fill but can be reduced by following the requirements and recommendations in the **Earthwork** section.

There is often a time lapse between the end of grading operations and the commencement of paving. Subgrades prepared early in the construction process can become disturbed by construction traffic. Non-uniform subgrades often result in poor pavement performance and local failures relatively soon after pavements are constructed. Depending on the paving equipment used by the contractor, measures may be required to improve subgrade strength to greater depths for support of heavily loaded trucks. Improvements should be made as recommended in **Earthwork**.

If removal and replacement of unstable soils is completed with granular soils, then to avoid the "bathtub" effect, the overexcavated areas should be sloped to a drain tile which is in turn sloped to the nearest storm sewer or pond. The drain tile should be a minimum 4 inches in diameter and have a minimum slope of ½ percent.

Pavement Section Thicknesses

Terracon was not provided with anticipated traffic loading information. We have developed recommended minimum pavement sections for both asphaltic concrete (AC) and portland cement concrete (PCC) based on National Asphalt Pavement Association (NAPA) and American Concrete Institute (ACI) guides and the traffic conditions noted in **Project Description**. All pavements should be designed for the types and volumes of traffic, subgrade and drainage conditions that are anticipated. Greater pavement and/or base course thicknesses may be required for greater expected traffic loads and volumes, or if poorer subgrade conditions are encountered.

The following table provides our opinion of minimum thickness for AC sections:

Asphaltic Concrete Design			
Layer	**Thickness (inches)**		
	Parking Areas (Light Duty) [1]	**Driveways (Medium Duty)** [1]	**Dumpster Pad / Heavy Duty Traffic Areas** [2]
AC surface course [3]	2	2	---
AC binder course [3]	2	3	---
Aggregate base course [4]	8	9	---

1. See **Project Description** for more specifics regarding traffic assumptions.
2. Use PCC pavement
3. All materials should meet the current Illinois Department of Transportation (IDOT) Standard Specifications for Highway and Bridge Construction.
    - Asphaltic Surface/Base - IDOT Hot Mix Asphalt: Section 406
4. IDOT requires that the minimum AC binder lift thickness be 3 times the normal aggregate size.
5. IDOT CA-6 or an approved alternate gradation.

The following table provides our estimated minimum thickness of PCC pavements.

Portland Cement Concrete Design			
Layer	**Thickness (inches)**		
	Parking Areas (Light Duty) [1]	**Driveways (Medium Duty)** [1]	**Dumpster Pad / Heavy Duty Traffic Areas** [2]
PCC [3,4]	5	6	7
Aggregate base course [5]	6	6	6

1. See **Project Description** for more specifics regarding traffic classifications.

Portland Cement Concrete Design			
Layer	Thickness (inches)		
	Parking Areas (Light Duty) [1]	Driveways (Medium Duty) [1]	Dumpster Pad / Heavy Duty Traffic Areas [2]

2. Recommended for areas subject to repeated heavy truck traffic, fire trucks, or concentrated loads (e.g., dumpster pads), and areas with repeated turning or maneuvering of heavy vehicles. The dumpster pad should be large enough to support the container and the tipping axle of the collection truck.
3. The PCC should be air-entrained and have a minimum compressive strength of 4,000 psi after 28 days of laboratory curing.
4. All materials should meet the current Department of Transportation (IDOT) Standard Specifications for Highway and Bridge Construction.
    a. Concrete Pavement - IDOT Portland Cement Concrete: Section 420
5. IDOT CA-6 or an approved alternate gradation.

Areas for parking heavy vehicles, concentrated turn areas, and start/stop maneuvers could require thicker pavement sections. Edge restraints (i.e., concrete curbs or aggregate shoulders) should be planned along curves and areas of maneuvering vehicles.

All joints should be sealed and maintained. The pavement designer should select the joint sealant material based on expected joint movement, in accordance with ACI 504 "Guide to Sealing Joints in Concrete Structures". All joint sealant reservoirs should be designed to accommodate the specified joint sealant compound's thermal and shrinkage tolerances.

Pavements and subgrades will be subject to freeze-thaw cycles and seasonal fluctuations in moisture content. Construction traffic on the pavements was not considered in developing the estimated minimum pavement thicknesses. If the pavements will be subject to construction equipment/vehicles, the pavement sections should be revised to consider the additional loading.

Pavement Drainage

Pavements should be sloped to provide rapid drainage of surface water. Water allowed to pond on or adjacent to the pavements could saturate the subgrade and contribute to premature pavement deterioration. In addition, the pavement subgrade should be graded to provide positive drainage within the granular base section. Appropriate sub-drainage or connection to a suitable daylight outlet should be provided to remove water from the granular subbase.

Openings in pavements, such as decorative landscaped areas, are sources for water infiltration into surrounding pavement systems. Water can collect in the islands and migrate into the surrounding subgrade soils thereby degrading support of the pavement. Islands with raised concrete curbs, irrigated foliage, and low permeability near-surface soils are particular areas of concern. The civil design for the pavements with these conditions should include features to restrict or collect and discharge excess water from the islands. Examples of features are edge drains connected to the stormwater collection system, longitudinal subdrains, or other suitable outlets and impermeable barriers preventing lateral migration of water such as a cutoff wall installed to a depth below the pavement structure.

Pavement Maintenance

The pavement sections represent minimum recommended thicknesses and, as such, periodic upkeep should be anticipated. Preventive maintenance should be planned and provided for through an on-going pavement management program. Maintenance activities are intended to slow the rate of pavement deterioration and to preserve the pavement investment. Pavement care consists of both localized (e.g., crack and joint sealing and patching) and global maintenance (e.g., surface sealing). Additional engineering consultation is recommended to determine the type and extent of a cost-effective program. Even with periodic maintenance, some movements and related cracking may still occur, and repairs may be required.

Pavement performance is affected by its surroundings. In addition to providing preventive maintenance, the civil engineer should consider the following recommendations in the design and layout of pavements:

- Final grade adjacent to paved areas should slope down from the edges at a minimum 2%.
- Subgrade and pavement surfaces should have a minimum 2% slope to promote proper surface drainage.
- Install pavement drainage systems surrounding areas anticipated for frequent wetting.
- Install joint sealant and seal cracks immediately.
- Seal all landscaped areas in or adjacent to pavements to reduce moisture migration to subgrade soils.
- Place compacted, low permeability backfill against the exterior side of curb and gutter.
- Place curb, gutter and/or sidewalk directly on clay subgrade soils rather than on unbound granular base course materials.

Exterior Slab Frost Considerations

The soils on this site are frost susceptible, and small amounts of water can affect the performance of the slabs on-grade, sidewalks, and pavements. Exterior slabs should be anticipated to heave during winter months. If frost action needs to be reduced in critical areas, we recommend the use of low-frost susceptible (LFS) fill or structural slabs (for instance, structural stoops in front of building doors). Low-frost susceptible materials should consist of a well-graded, clean granular material with less than 6% passing the No. 200 sieve. Placement of LFS material in large areas may not be feasible; however, the following recommendations are provided to help reduce potential frost heave:

- Provide surface drainage away from the building and slabs, and toward the site drainage system.
- Install drains around the perimeter of the building, stoops, below exterior slabs and pavements, and connect them to the site drainage system.
- Grade clayey subgrades so groundwater potentially perched in overlying fill or aggregate base, slope toward a site drainage system.
- Place LFS fill as backfill beneath slabs and pavements critical to the project.
- Place a 3 horizontal to 1 vertical (3H:1V) transition zone between LFS fill and other soils.
- Place LFS materials in critical sidewalk areas.

As an alternative to extending LFS fill to the full frost depth, consideration can be made to placing extruded polystyrene or cellular concrete under a buffer of at least 2 feet of LFS material.

General Comments

Our analysis and opinions are based upon our understanding of the project, the geotechnical conditions in the area, and the data obtained from our site exploration. Variations will occur between exploration point locations or due to the modifying effects of construction or weather. The nature and extent of such variations may not become evident until during or after construction. Terracon should be retained as the Geotechnical Engineer, where noted in this report, to provide observation and testing services during pertinent construction phases. If variations appear, we can provide further evaluation and supplemental recommendations. If variations are noted in the absence of our observation and testing services on-site, we should be immediately notified so that we can provide evaluation and supplemental recommendations.

Our Scope of Services does not include either specifically or by implication any environmental or biological (e.g., mold, fungi, bacteria) assessment of the site or identification or prevention of pollutants, hazardous materials or conditions. If the owner is concerned about the potential for such contamination or pollution, other studies should be undertaken.

Our services and any correspondence are intended for the sole benefit and exclusive use of our client for specific application to the project discussed and are accomplished in accordance with generally accepted geotechnical engineering practices with no third-party beneficiaries intended. Any third-party access to services or correspondence is solely for information purposes to support the services provided by Terracon to our client. Reliance upon the services and any work product is limited to our client and is not intended for third parties. Any use or reliance of the provided information by third parties is done solely at their own risk. No warranties, either express or implied, are intended or made.

Site characteristics as provided are for design purposes and not to estimate excavation cost. Any use of our report in that regard is done at the sole risk of the excavating cost estimator as there may be variations on the site that are not apparent in the data that could significantly affect excavation cost. Any parties charged with estimating excavation costs should seek their own site characterization for specific purposes to obtain the specific level of detail necessary for costing. Site safety and cost estimating including excavation support and dewatering requirements/design are the responsibility of others. Construction and site development have the potential to affect adjacent properties. Such impacts can include damages due to vibration, modification of groundwater/surface water flow during construction, foundation movement due to undermining or subsidence from excavation, as well as noise or air quality concerns. Evaluation of these items on nearby properties are commonly associated with contractor means and methods and are not addressed in this report. The owner and contractor should consider a preconstruction/precondition survey of surrounding development. If changes in the nature, design, or location of the project are planned, our conclusions and recommendations shall not be considered valid unless we review the changes and either verify or modify our conclusions in writing.

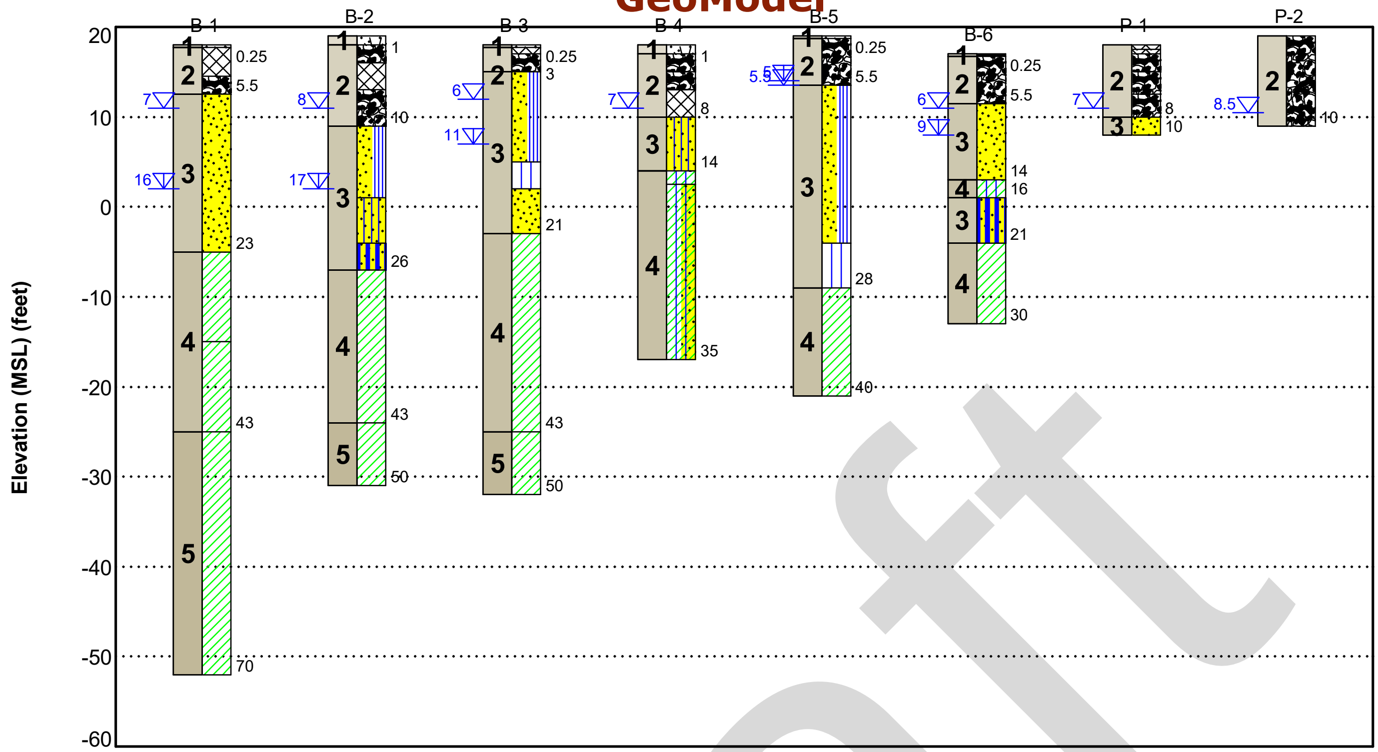
Figures

Contents:

GeoModel

Terracon
650 W Lake St, Ste 420
Chicago, IL

GeoModel



This is not a cross section. This is intended to display the Geotechnical Model only. See individual logs for more detailed conditions.

Model Layer	Layer Name	General Description
1	Topsoil/ Asphalt	Approx. 3 to 12 inches of topsoil Approx. 3 inches of asphalt at B-6
2	Existing Fill	Variable fill types with urban debris
3	Granular	Generally loose to medium dense; very loose zone in B-3
4	Low to Medium Strength Clay	Generally very soft to stiff consistency lean clay
5	Hard Clay	Lean clay with generally hard consistency

LEGEND

Topsoil
Fill
Fill
Poorly-graded Sand
Lean Clay
Poorly-graded Sand with Silt
Silty Sand
Sandy Silt
Silt
Silty Clay
Silty Clay with Sand
Asphalt

First Water Observation
Second Water Observation

The groundwater levels shown are representative of the date and time of our exploration. Significant changes are possible over time.
Water levels shown are as measured during and/or after drilling. In some cases, boring advancement methods mask the presence/absence of groundwater. See individual logs for details.

NOTES:
Layering shown on this figure has been developed by the geotechnical engineer for purposes of modeling the subsurface conditions as required for the subsequent geotechnical engineering for this project.
Numbers adjacent to soil column indicate depth below ground surface.

Attachments

Exploration and Testing Procedures

Field Exploration

Numbers	Boring Depth (feet bgs) [1]	Location
1	70 (B-1)	Proposed primary building footprint
2	50 (B-2, B-3)	Proposed parking and drive-thru lanes
3	30-40 (B-4 to B-6)	Proposed shallow foundation structures
2	10 (P-1, P-2)	Proposed parking area
2 Infiltration tests	7 to 8 (INF-1, INF-2)	Proposed parking area

1. The drilled boring locations are shown on the attached **Exploration Plan**.

Boring Layout and Elevations: We used handheld GPS equipment to locate borings with limited horizontal and vertical accuray. The ground surface elevations indicated on the logs are approximate and obtained from the GPS. The boring locations were laid out using a best-fit overlay of the proposed site diagram on an aerial photograph.

The locations and elevations of the borings are considered accurate only to the degree implied by the means and methods used to define them. If more precise elevations and boring layout are desired, we recommend using a professional surveyor.

Subsurface Exploration Procedures: A subcontracted exploration team advanced the borings with a track-mounted drill rig using continuous hollow stem augers. Soil sampling was performed using split-barrel sampling and thin-wall tube procedures. In the split-barrel sampling procedure, a standard 2-inch outer diameter split-barrel sampling spoon is driven into the ground by a 140-pound automatic hammer falling a distance of 30 inches. The number of blows required to advance the sampling spoon the last 12 inches of a normal 18-inch penetration is recorded as the Standard Penetration Test (SPT) resistance value. The SPT resistance values, also referred to as N-values, are indicated on the boring logs at the test depths. The samples were placed in appropriate containers, taken to our laboratory for testing, and classified by a geologist.

Our field geologist prepared field boring logs as part of the drilling operations. These field logs include visual classifications of the materials encountered during drilling and our interpretation of the subsurface conditions between samples. The sampling depths, penetration distances, and other sampling information were recorded on the field boring logs. The samples were placed in appropriate containers and taken to our soil laboratory for testing. Final boring logs were prepared from the field logs. The final boring logs represent the geotechnical engineer's interpretation of the field logs and include modifications based on observations and tests of the samples in our laboratory.

Laboratory Testing

The project engineer reviewed field data and assigned laboratory tests to understand the engineering properties of various soil strata. The following laboratory testing were performed:

- Water content
- Atterberg limits
- Particle size analysis

Based on the results of our field and laboratory programs, we described and classified soil samples in accordance with the Unified Soil Classification System (USCS).

Site Location and Exploration Plans

Contents:

Site Location Plan
Exploration Plan

Note: All attachments are one page unless noted above.

Site Location

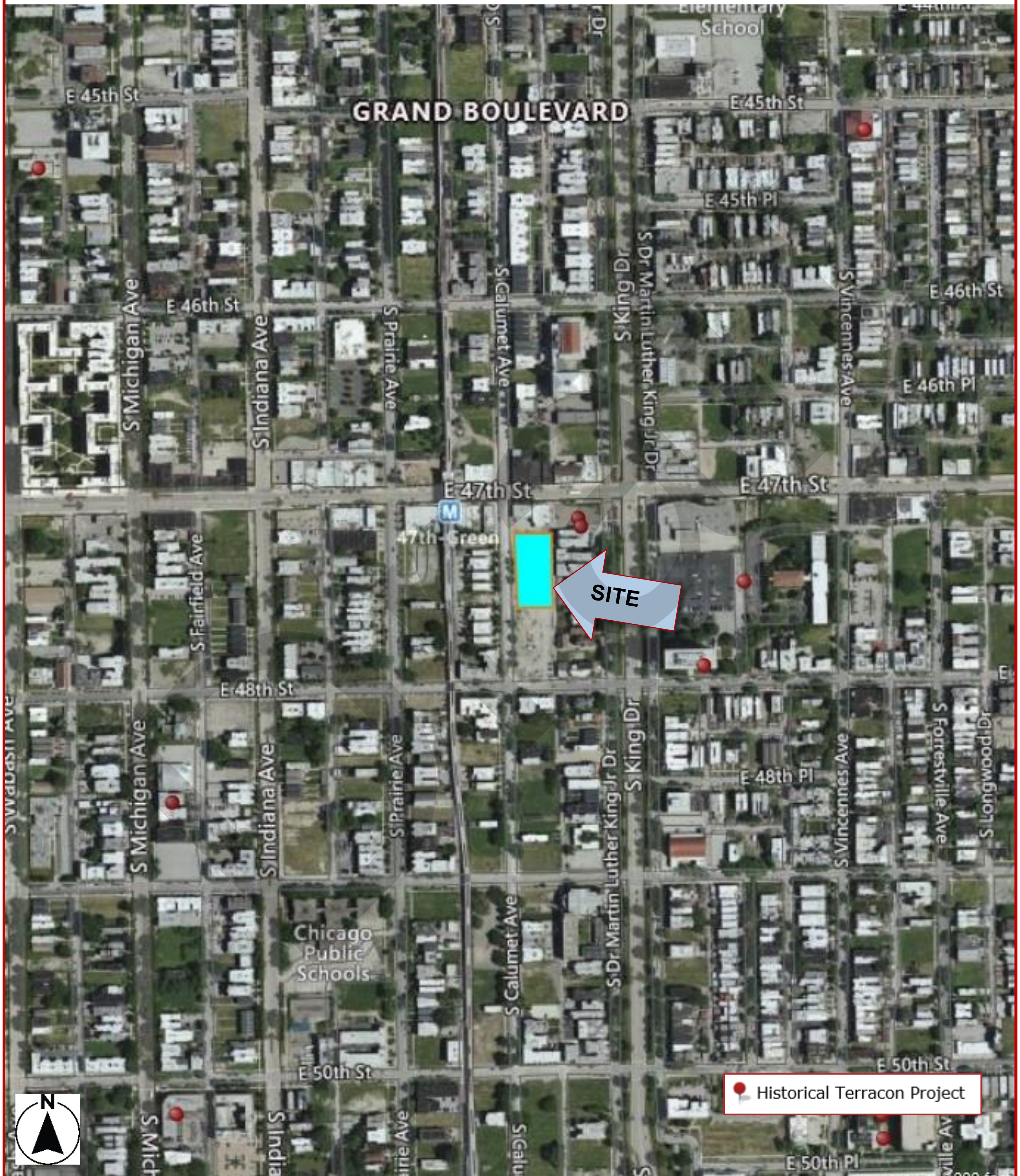


DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES
MAP PROVIDED BY MICROSOFT BING MAPS

Exploration Plan

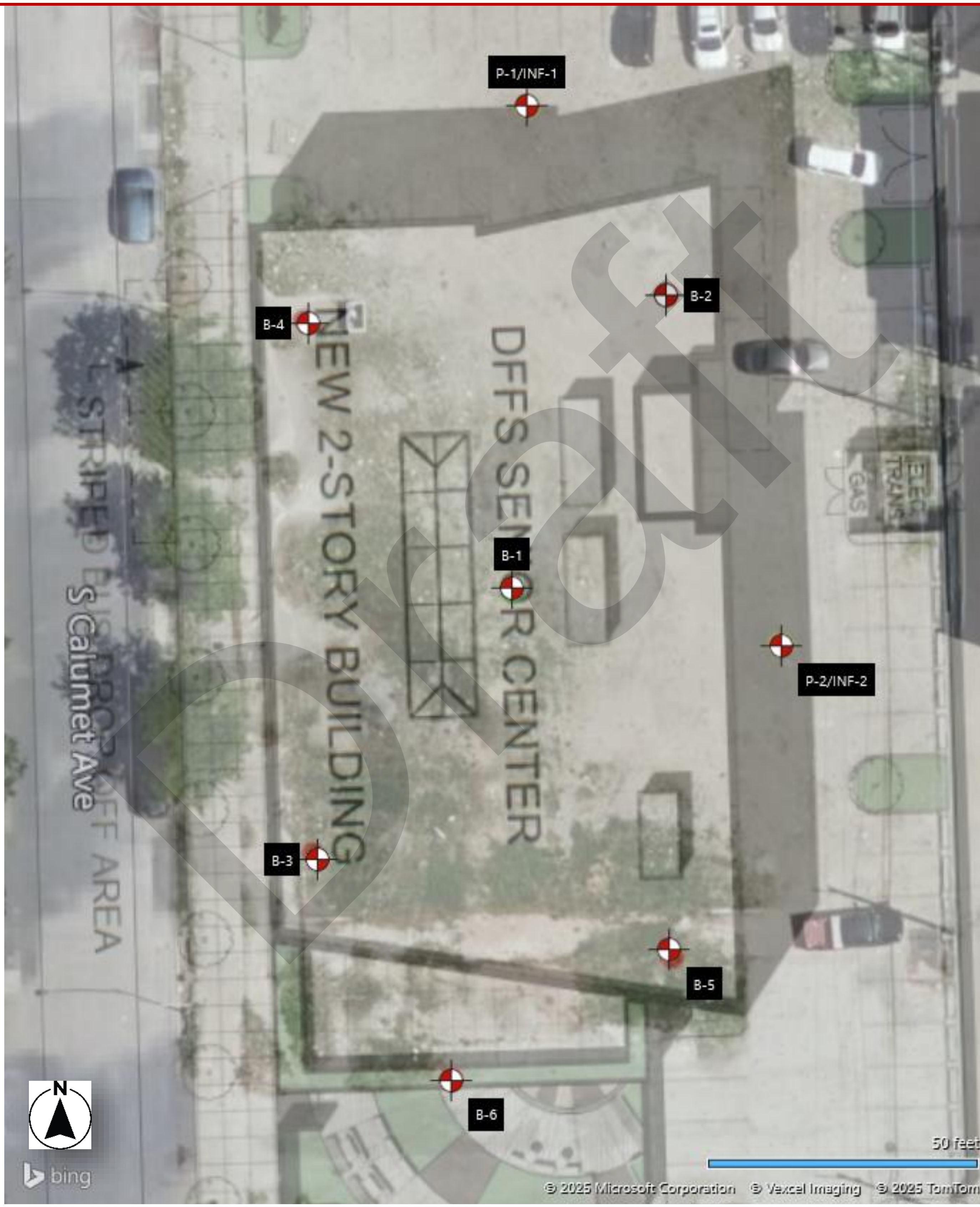


DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES MAP PROVIDED BY MICROSOFT BING MAPS

Exploration and Laboratory Results

Contents:

Boring Logs (B-1 to B-6 and P-1 to P-2)
Soil Profile (In progress)
Particle size analysis

Note: All attachments are one page unless noted above.

Terracon
650 W Lake St, Ste 420
Chicago, IL

Boring Log No. B-1

Location: See Exploration Plan

Latitude: 41.8086° Longitude: -87.6178°

Depth (Ft.) Elevation.: 18 (Ft.)

Model Layer	Depth (Ft.)	Description	Elevation (Ft.)
1	0.3	**Approx. 3 inches of topsoil**, dark brown	17.75
2	3.5	**FILL - SAND AND GRAVEL**, trace wood, dark brown	14.5
2	5.5	**FILL - BRICK WITH SAND**, dark brown	12.5
3	23.0	**SAND (SP)**, brown to gray, medium dense to loose; transition to gray	-5
4	33.0	**LEAN CLAY (CL)**, trace silt and gravel, gray, medium stiff to stiff	-15
4	43.0	**LEAN CLAY (CL)**, trace gravel, gray, stiff	-25
5		**LEAN CLAY (CL)**, trace sand and gravel, gray, hard	

Water Level Observations	Recovery (In.)	Field Test Results	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits LL-PL-PI
	4	35-11-8 N=19	8.6		
	2	3-8-4 N=12	21.3		
▽ (7')	10	3-4-6 N=10 NP	29.5		NP
	12	4-5-5 N=10 NP	26.1		
	18	3-7-9 N=16 NP	24.9		
▽ (16')	18	3-2-2 N=4 NP	26.4		
	18	4-4-5 N=9 NP	21.8		
	14	2-2-3 N=5 2.0 (HP)	20.6		
	12	3-4-7 N=11 2.0 (HP)	18.5		
	16	3-6-10 N=16 2.5 (HP)	19.9		
	18	3-5-8 N=13 1.5 (HP)	21.0		
	14	19-49-50/5" 5.0 (HP)	12.9		
	14	20-47-50/5" 5.0 (HP)	10.7		

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Water Level Observations
- ▽ 7' While drilling
- ▽ 16' At completion of drilling

Drill Rig
CME 55

Hammer Type
Automatic

Driller
Geocon

Logged by
D Gift

Boring Started
08-06-2025

Boring Completed
08-06-2025

Notes

HP=hand penetrometer test (tsf)

NP=non-plastic

Advancement Method
"3.25" ID Hollow Stem Auger"

Abandonment Method
Boring backfilled with Auger Cuttings and/or Bentonite

Bronzeville Regional Senior Center
4711 - 4755 S. Calumet Avenue | Chicago, IL
Terracon Project No. 11255075

Terracon
650 W Lake St, Ste 420
Chicago, IL

Boring Log No. B-1

Location: See Exploration Plan

Latitude: 41.8086° Longitude: -87.6178°

Depth (Ft.) — Elevation.: 18 (Ft.)

Model Layer	Graphic Log	Description	Depth (Ft.)	Water Level Observations	Sample Type	Recovery (In.)	Field Test Results	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits LL-PL-PI
5		**LEAN CLAY (CL)**, trace sand and gravel, gray, hard *(continued)*								
			55		X	16	18-41-50/5" 5.0 (HP)	12.2		
			60		X	16	19-31-50/5" 5.0 (HP)	13.6		
			65		X	16	20-33-47 N=80 5.0 (HP)	11.4		
		70.0 — -52	70		X	18	19-23-28 N=51 4.5 (HP)	12.2		
		Boring Terminated at 70 Feet								

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Water Level Observations
7' While drilling
16' At completion of drilling

Drill Rig
CME 55

Hammer Type
Automatic

Driller
Geocon

Notes
HP=hand penetrometer test (tsf)
NP=non-plastic

Advancement Method
"3.25" ID Hollow Stem Auger"

Abandonment Method
Boring backfilled with Auger Cuttings and/or Bentonite

Logged by
D Gift

Boring Started
08-06-2025

Boring Completed
08-06-2025

Bronzeville Regional Senior Center
4711 - 4755 S. Calumet Avenue | Chicago, IL
Terracon Project No. 11255075

Terracon
650 W Lake St, Ste 420
Chicago, IL

Boring Log No. B-2

Location: See Exploration Plan

Latitude: 41.8088° Longitude: -87.6177°

Elevation.: 19 (Ft.)

Model Layer	Depth (Ft.)	Description	Elevation (Ft.)
1	1.0	**Approx. 12 inches of topsoil**, dark brown	18
2	3.0	**FILL - LEAN CLAY**, brick and asphalt, brown	16
2	6.0	**FILL - SAND AND CINDERS**, with asphalt, trace gravel, dark brown	13
2	10.0	**FILL - SAND AND GRAVEL**, brick, brown	9
3	18.0	**SAND WITH SILT (SP-SM)**, brown to gray, loose	1
3	23.0	**SILTY SAND (SM)**, gray, loose	-4
3	26.0	**SANDY SILT (ML)**, with clay, gray, loose	-7
4	43.0	**LEAN CLAY (CL)**, trace sand and gravel, gray, stiff	-24
5	50.0	**LEAN CLAY (CL)**, trace sand and gravel, dark gray, hard	-31
		Boring Terminated at 50 Feet	

Recovery (In.)	Field Test Results	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits LL-PL-PI
12	3-6-23 N=29	15.9		
12	18-24-17 N=41	5.9		
2	4-8-5 N=13	8.4		
6	17-8-10 N=18	17.0		
14	3-3-5 N=8 NP	24.7		NP
16	3-3-1 N=4 NP	26.0		
12	2-2-3 N=5 NP	24.2		NP
14	3-2-3 N=5 NP	23.5		
18	2-3-5 N=8 1.0 (HP)	25.6		
18	1-3-4 N=7 1.5 (HP)	20.8		
18	3-5-6 N=11 2.0 (HP)	19.4		
14	24-28-49 N=77 5.0 (HP)	9.2		
12	20-27-48 N=75 5.0 (HP)	10.2		

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Water Level Observations
- 8' While drilling
- 17' At completion of drilling

Drill Rig
CME 55

Hammer Type
Automatic

Driller
Geocon

Logged by
D Gift

Boring Started
08-07-2025

Boring Completed
08-07-2025

Notes
HP=hand penetrometer test (tsf)
NP=non-plastic

Advancement Method
"3.25" ID Hollow Stem Auger"

Abandonment Method
Boring backfilled with Auger Cuttings and/or Bentonite

Terracon
650 W Lake St, Ste 420
Chicago, IL

Boring Log No. B-3

Location: See Exploration Plan

Latitude: 41.8085° Longitude: -87.6180°

Elevation.: 18 (Ft.)

Model Layer	Depth (Ft.)	Description	Elevation (Ft.)
1	0.3	**Approx. 3 inches of topsoil**, dark brown	17.75
2	1.0	**FILL - CONCRETE**, trace sand	17
2	3.0	**FILL - SAND AND CONCRETE**, trace gravel, dark brown	15
3	13.0	**SAND (SP-SM)**, trace gravel, brown to gray, medium dense; transition to gray	5
3	16.0	**SILT (ML)**, gray, very loose	2
3	21.0	**SAND (SP)**, gray, loose	-3
4	43.0	**LEAN CLAY (CL)**, trace gravel, gray, stiff to very stiff	-25
5	50.0	**LEAN CLAY (CL)**, trace sand and gravel, gray, hard	-32
		Boring Terminated at 50 Feet	

Water Level Observations	Recovery (In.)	Field Test Results	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits LL-PL-PI
	6	2-2-4 N=6	6.4		
	12	4-6-6 N=12 NP	7.2		
▽ (6')	12	3-5-6 N=11 NP	29.4		NP
	14	4-5-5 N=10 NP	28.0		
▽ (11')	12	2-6-9 N=15 NP	25.4		
	10	1-1-1 N=2 NP	21.7		NP
	14	5-4-4 N=8 NP	26.1		
	18	3-4-5 N=9 2.0 (HP)	23.1		
	14	2-3-4 N=7 1.0 (HP)	21.9		
	16	3-5-8 N=13 2.0 (HP)	20.2		
	14	3-5-14 N=19 2.5 (HP)	19.3		
	12	23-45-47 N=92 4.5 (HP)	8.6		
	16	15-34-49 N=83 5.0 (HP)	13.8		

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Water Level Observations
- ▽ 6' While drilling
- ▽ 11' At completion of drilling

Notes
HP=hand penetrometer test (tsf)
NP=non-plastic

Advancement Method
"3.25" ID Hollow Stem Auger"

Abandonment Method
Boring backfilled with Auger Cuttings and/or Bentonite

Drill Rig
CME 55

Hammer Type
Automatic

Driller
Geocon

Logged by
D Gift

Boring Started
08-07-2025

Boring Completed
08-07-2025

Terracon
650 W Lake St, Ste 420
Chicago, IL

Boring Log No. B-4

Location: See Exploration Plan

Latitude: 41.8088° Longitude: -87.6180°

Elevation.: 18 (Ft.)

Model Layer	Depth (Ft.)	Description	Elevation	Sample Depth (Ft.)	Water Level Observations	Recovery (In.)	Field Test Results	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits LL-PL-PI
1	1.0	**Approx. 12 inches of topsoil**, dark brown	17							
2	3.0	**FILL - GRAVEL WITH BRICK**, gray	15	1.0–2.5		3	5-1-1 N=2			
2	5.0	**FILL - SILTY SAND**, brick, brown	13	3.5–5.0		4	2-3-3 N=6			
2	8.0	**FILL - SILTY SAND WITH GRAVEL**, brown	10	6.0–7.5	7' while drilling	10	3-3-6 N=9			
3	14.0	**SILTY SAND (SM)**, brown, loose to medium dense	4	8.5–10.0		10	1-2-5 N=7 NP			NP
				11.0–12.5		12	3-5-9 N=14 NP			
4	15.5	**SILTY CLAY (CL-ML)**, gray, very soft	2.5	13.5–15.0		18	1-0-0 N=0 NP			25-18-7
4	35.0	**SILTY CLAY WITH SAND (CL-ML)**, gray, medium stiff to stiff	-17	18.5–20.0		10	2-1-4 N=5			
				23.5–25.0		18	2-3-8 N=11 1.25 (HP)			
				28.5–30.0		14	3-5-8 N=13 1.5 (HP)			
				33.5–35.0		18	4-5-8 N=13 4.0 (HP)			

Boring Terminated at 35 Feet

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Water Level Observations
7' While drilling

Drill Rig
CME 55

Hammer Type
Automatic

Driller
Geocon

Logged by
D Gift

Boring Started
08-08-2025

Boring Completed
08-08-2025

Notes
HP=hand penetrometer test (tsf)
NP=non-plastic

Advancement Method
"3.25" ID Hollow Stem Auger"

Abandonment Method
Boring backfilled with Auger Cuttings and/or Bentonite

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Terracon Project No. 11255075

Terracon
650 W Lake St, Ste 420
Chicago, IL

Boring Log No. B-5

Location: See Exploration Plan

Latitude: 41.8085° Longitude: -87.6177°

Model Layer	Depth (Ft.)	Description	Elevation: 19 (Ft.)
1	0.3	**Approx. 3 inches of topsoil**, dark brown	18.75
2	5.5	**FILL - GRAVEL AND SAND**, with brick, brown	13.5
3	23.0	**SAND WITH SILT (SP-SM)**, brown to gray, medium dense to loose; transition to gray	-4
3	28.0	**SILT (ML)**, trace clay, gray, loose	-9
4	40.0	**LEAN CLAY (CL)**, trace gravel, gray, stiff	-21
		Boring Terminated at 40 Feet	

Depth (Ft.)	Water Level Observations	Sample Type	Recovery (In.)	Field Test Results	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits LL-PL-PI
1.0-2.5		X	6	5-4-3 N=7	20.6		
3.5-5.0		X	10	2-3-3 N=6	20.4		
5	▽ ▽						
6.0-7.5		X	16	3-3-7 N=10 NP	30.6		
8.5-10.0		X	18	2-2-4 N=6 NP	30.0		NP
11.0-12.5		X	18	4-9-8 N=17 NP	22.8		
13.5-15.0		X	18	2-4-3 N=7 NP	26.1		
18.5-20.0		X	14	2-3-2 N=5 NP	25.9		
23.5-25.0		X	12	3-2-3 N=5 NP	23.2		
28.5-30.0		X	16	5-6-8 N=14 1.25 (HP)	22.8		
33.5-35.0		X	18	4-2-5 N=7 1.0 (HP)	19.8		
38.5-40.0		X	18	3-4-6 N=10 2.0 (HP)	21.1		

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Water Level Observations
▽ 5.5' While drilling
▽ 5' At completion of drilling

Drill Rig
CME 55

Hammer Type
Automatic

Driller
Geocon

Logged by
D Gift

Boring Started
08-06-2025

Boring Completed
08-06-2025

Notes
HP=hand penetrometer test (tsf)
NP=non-plastic

Advancement Method
"3.25" ID Hollow Stem Auger"

Abandonment Method
Boring backfilled with Auger Cuttings and/or Bentonite

Bronzeville Regional Senior Center
4711 - 4755 S. Calumet Avenue | Chicago, IL
Terracon Project No. 11255075

Terracon
650 W Lake St, Ste 420
Chicago, IL

Boring Log No. B-6

Location: See Exploration Plan

Latitude: 41.8084° Longitude: -87.6179°

Elevation.: 17 (Ft.)

Model Layer	Depth (Ft.)	Description	Elevation (Ft.)
1	0.3	**Approx. 3 inches of asphalt**, dark brown	16.75
2	5.5	**FILL - SAND AND GRAVEL**, with brick, dark brown	11.5
3	14.0	**SAND (SP)**, brown to gray, medium dense; transition to gray	3
4	16.0	**SILTY CLAY (CL-ML)**, gray, very soft	1
3	21.0	**SANDY SILT (ML)**, loose	-4
4	30.0	**LEAN CLAY (CL)**, trace sand and gravel, gray, stiff	-13

Boring Terminated at 30 Feet

Recovery (In.)	Field Test Results	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits LL-PL-PI
6	5-7-16 N=23	12.2		
4	3-5-7 N=12	4.1		
16	3-5-6 N=11 NP	28.6		
12	3-5-7 N=12 NP	29.8		
18	3-7-8 N=15 NP	23.7		
14	1-1-1 N=2	24.5		24-18-6
8	1-2-4 N=6 NP	24.0		
14	4-4-8 N=12 2.5 (HP)	23.9		
12	5-5-5 N=10 2.0 (HP)	14.8		

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes

HP=hand penetrometer test (tsf)

NP=non-plastic

Water Level Observations

6' While drilling

9' At completion of drilling

Advancement Method
"3.25" ID Hollow Stem Auger"

Abandonment Method
Boring backfilled with Auger Cuttings and/or Bentonite

Drill Rig
CME 55

Hammer Type
Automatic

Driller
Geocon

Logged by
D Gift

Boring Started
08-06-2025

Boring Completed
08-06-2025

Bronzeville Regional Senior Center
4711 - 4755 S. Calumet Avenue | Chicago, IL
Terracon Project No. 11255075

Terracon
650 W Lake St, Ste 420
Chicago, IL

Boring Log No. P-1

Location: See Exploration Plan

Latitude: 41.8089° Longitude: -87.6178°

Model Layer	Graphic Log	Depth (Ft.)	Material Description (Elevation.: 18 (Ft.))	Elevation (Ft.)	Water Level Observations	Sample Type	Recovery (In.)	Field Test Results	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits LL-PL-PI
2		0.5	**FILL - GRAVEL**	17.5							
		1.0	**FILL - SILT**	17							
		3.0	**FILL - GRAVEL**, with brick	15		X	10	6-8-18 N=26			
		5.5	**FILL - BRICK**	12.5		X	0	4-5-18 N=23			
		8.0	**FILL - BRICK WITH SAND**	10	▽	X	12	7-6-9 N=15			
3		10.0	**SAND (SP)**, trace gravel, brown, medium dense	8		X	8	5-6-8 N=14 NP			

Boring Terminated at 10 Feet

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes

HP=hand penetrometer test (tsf)

NP=non-plastic

Water Level Observations

▽ 7' While drilling

Advancement Method
"3.25" ID Hollow Stem Auger"

Abandonment Method
Boring backfilled with Auger Cuttings and/or Bentonite

Drill Rig
CME 55

Hammer Type
Automatic

Driller
Geocon

Logged by
D Gift

Boring Started
08-08-2025

Boring Completed
08-08-2025

Bronzeville Regional Senior Center
4711 - 4755 S. Calumet Avenue | Chicago, IL
Terracon Project No. 11255075

650 W Lake St, Ste 420
Chicago, IL

Boring Log No. P-2

Location: See Exploration Plan

Latitude: 41.8086° Longitude: -87.6177°

Model Layer	Graphic Log	Depth (Ft.) / Elevation.: 19 (Ft.)	Depth (Ft.)	Water Level Observations	Sample Type	Recovery (In.)	Field Test Results	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits LL-PL-PI
2		**FILL - SILTY SAND**, with gravel, dark brown to brown								
		concrete layer			X	12	3-3-3 N=6			
		cinders	5		X	10	2-2-3 N=5			
					X	12	3-4-6 N=10			
		10.0 (Elev. 9)	10	▽	X	8	4-5-7 N=12			
		Boring Terminated at 10 Feet								

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes

HP=hand penetrometer test (tsf)

NP=non-plastic

Water Level Observations

▽ 8.5' While drilling

Advancement Method
"3.25" ID Hollow Stem Auger"

Abandonment Method
Boring backfilled with Auger Cuttings and/or Bentonite

Drill Rig
CME 55

Hammer Type
Automatic

Driller
Geocon

Logged by
D Gift

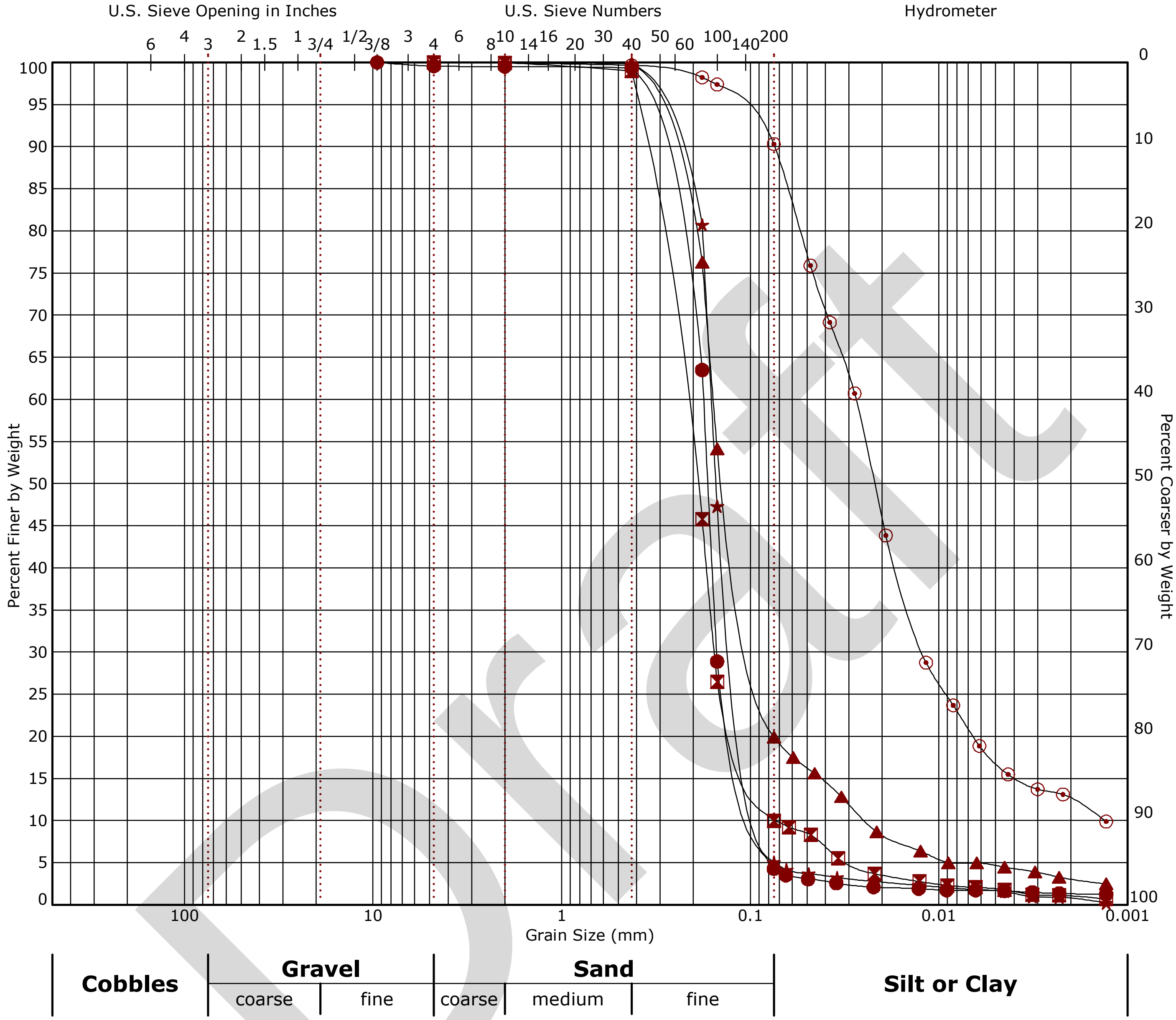
Boring Started
08-08-2025

Boring Completed
08-08-2025

650 W Lake St, Ste 420
Chicago, IL

Grain Size Distribution

ASTM D422 / ASTM C136



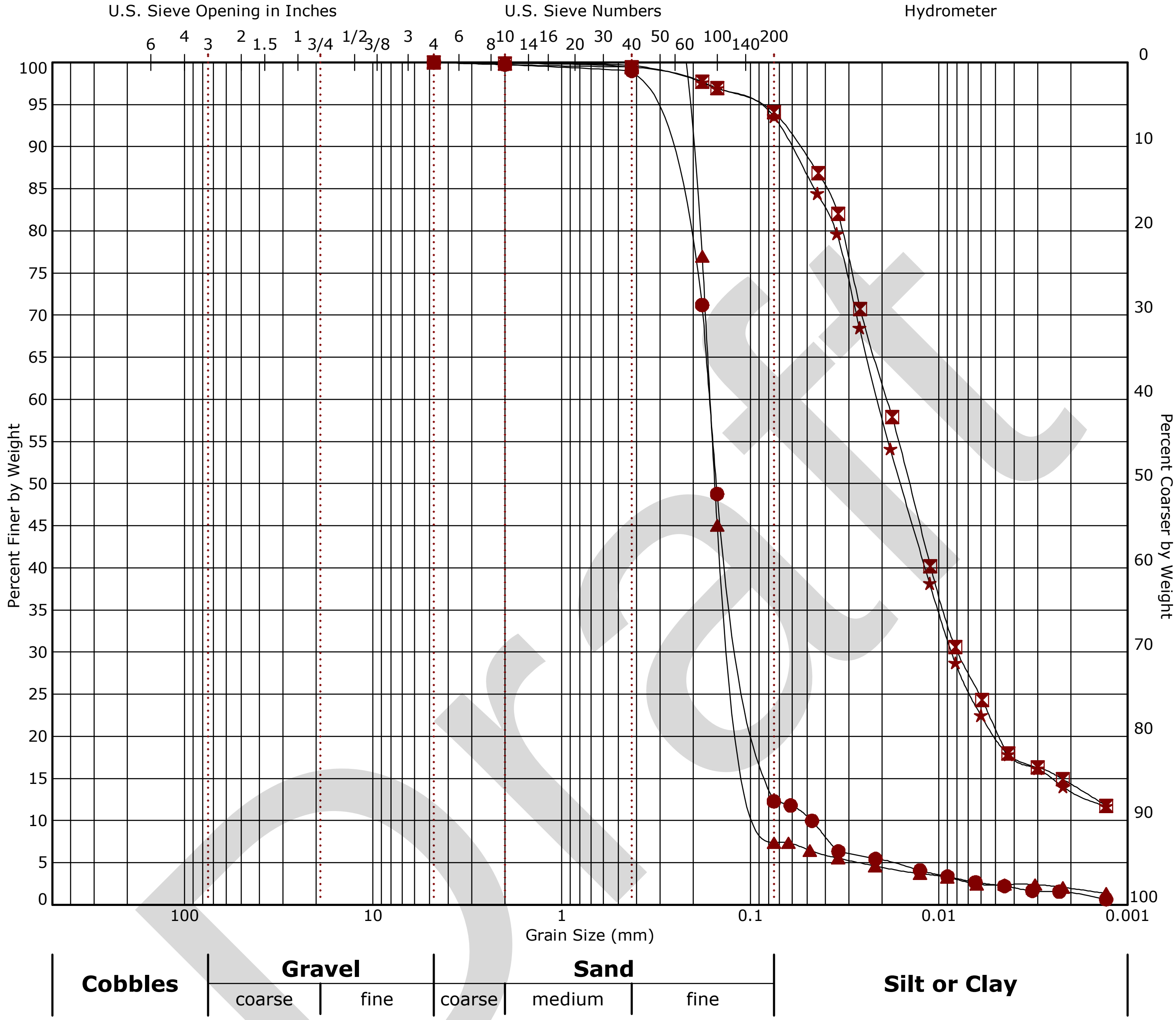
	Boring ID	Depth (Ft)	USCS Classification	USCS	AASHTO	LL	PL	PI	Cc	Cu
●	B-1	6 - 7.5	POORLY GRADED SAND	SP	A-3 (0)	NP	NP	NP	1.46	2.01
⊠	B-2	11 - 12.5	POORLY GRADED SAND with SILT	SP-SM	A-3 (0)	NP	NP	NP	1.41	3.02
▲	B-2	18.5 - 20	SILTY SAND	SM	A-2-4 (0)	NP	NP	NP	2.19	6.40
★	B-3	6 - 7.5	POORLY GRADED SAND with SILT	SP-SM	A-3 (0)	NP	NP	NP	0.98	1.98
⊙	B-3	13.5 - 15	SILT	ML	A-4 (0)	NP	NP	NP	4.07	20.81

	Boring ID	Depth (Ft)	D_{100}	D_{60}	D_{30}	D_{10}	%Cobbles	%Gravel	%Sand	%Fines	%Silt	%Clay
●	B-1	6 - 7.5	9.5	0.177	0.151	0.088	0.0	0.4	95.3		2.6	1.7
⊠	B-2	11 - 12.5	4.75	0.227	0.155	0.075	0.0	0.0	90.0		8.1	1.9
▲	B-2	18.5 - 20	2	0.157	0.092	0.025	0.0	0.0	80.1		15.3	4.6
★	B-3	6 - 7.5	4.75	0.161	0.113	0.081	0.0	0.0	94.9		3.4	1.6
⊙	B-3	13.5 - 15	4.75	0.028	0.012	0.001	0.0	0.0	9.7		73.4	16.9

Terracon
650 W Lake St, Ste 420
Chicago, IL

Grain Size Distribution

ASTM D422 / ASTM C136

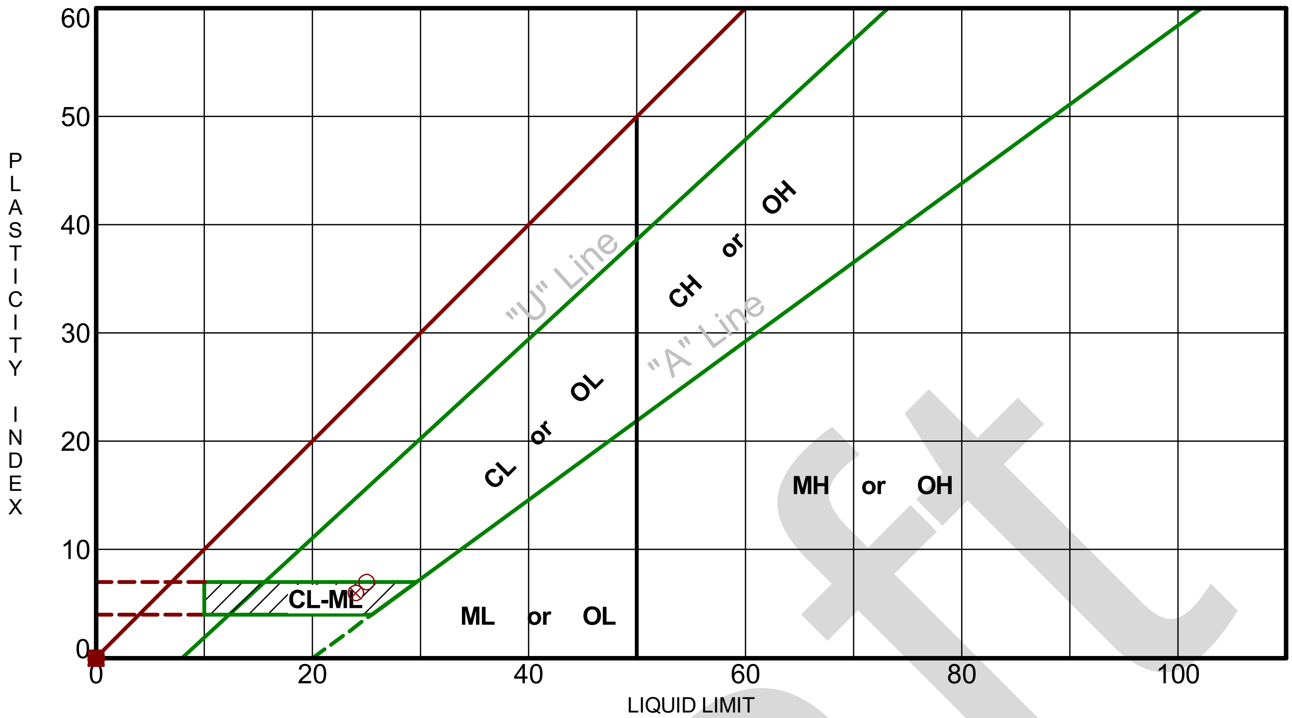


	Boring ID	Depth (Ft)	USCS Classification	USCS	AASHTO	LL	PL	PI	Cc	Cu
●	B-4	8.5 - 10	SILTY SAND	SM	A-2-4 (0)	NP	NP	NP	1.42	3.48
⧗	B-4	13.5 - 15	SILTY CLAY	CL-ML	A-4 (5)	25	18	7		
▲	B-5	8.5 - 10	POORLY GRADED SAND with SILT	SP-SM	A-3 (0)	NP	NP	NP	1.03	2.44
★	B-6	13.5 - 15	SILTY CLAY	CL-ML	A-4 (4)	24	18	6		

	Boring ID	Depth (Ft)	D_{100}	D_{60}	D_{30}	D_{10}	%Cobbles	%Gravel	%Sand	%Fines	%Silt	%Clay
●	B-4	8.5 - 10	4.75	0.164	0.105	0.047	0.0	0.0	87.7		9.9	2.4
⧗	B-4	13.5 - 15	4.75	0.019	0.008		0.0	0.0	5.9		73.1	21.0
▲	B-5	8.5 - 10	4.75	0.163	0.106	0.067	0.0	0.0	92.6		4.9	2.4
★	B-6	13.5 - 15	4.75	0.021	0.009		0.0	0.0	6.4		73.7	20.0

ATTERBERG LIMITS RESULTS

ASTM D4318



Boring ID		Depth (Ft)	LL	PL	PI	Fines	USCS	Description
●	B-1	6 - 7.5	NP	NP	NP	4.3	SP	POORLY GRADED SAND
⧗	B-2	11 - 12.5	NP	NP	NP	10.0	SP-SM	POORLY GRADED SAND with SILT
▲	B-2	18.5 - 20	NP	NP	NP	19.9	SM	SILTY SAND
★	B-3	6 - 7.5	NP	NP	NP	5.1	SP-SM	POORLY GRADED SAND with SILT
⊙	B-3	13.5 - 15	NP	NP	NP	90.3	ML	SILT
✿	B-4	8.5 - 10	NP	NP	NP	12.3	SM	SILTY SAND
○	B-4	13.5 - 15	25	18	7	94.1	CL-ML	SILTY CLAY
△	B-5	8.5 - 10	NP	NP	NP	7.4	SP-SM	POORLY GRADED SAND with SILT
⊗	B-6	13.5 - 15	24	18	6	93.6	CL-ML	SILTY CLAY

PROJECT: Bronzeville Regional Senior Center

SITE: 4711 - 4755 S. Calumet Avenue
Chicago, IL

Terracon
650 W Lake St, Ste 420
Chicago, IL

PROJECT NUMBER: 11255075

CLIENT: Public Building Commission of Chicago
Chicago, IL

Wang Engineering

1145 North Main Street
Lombard, Illinois 60148
Phone (630) 953-9928
www.wangeng.com

LIQUID LIMIT, PLASTIC LIMIT, and PLASTICITY INDEX of SOILS

AASHTO T 89, T 90 / ASTM D 4318

Client: Public Building Commission of Chicago
Project: Bronzeville Regional Senior Center
WEI Job No: 11255075
Prep Method: air dried

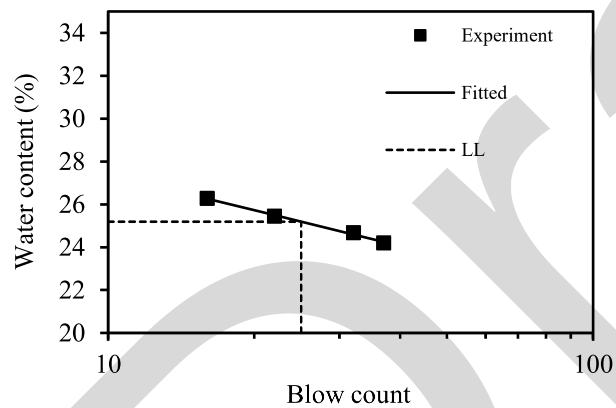
Analyst name: L. Varzaru
Test date: August 21, 2025
Soil Sample ID: B-4, SS#6 (13.5-15ft.)
Sample description: Gray SILTY CLAY (CL-ML)
% retained on #40 sieve: 1%

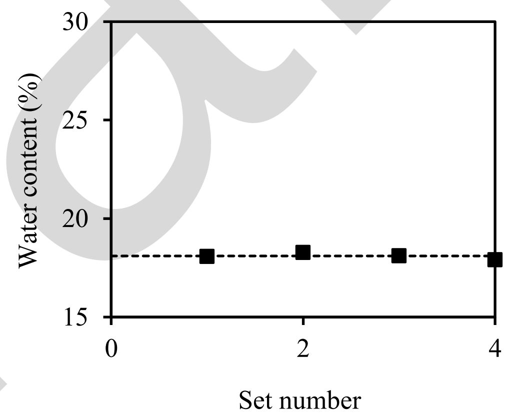
Set #	Tare mass (g) Wc	Tare with wet soil (g) Ww	Tare with dry soil (g) Wd	Blow count N	Water content (%) w	Water content fitted (%)
1	*11.17*	*22.05*	*19.93*	*37*	24.20	24.25
2	*11.09*	*22.71*	*20.41*	*32*	24.68	24.60
3	*11.68*	*21.49*	*19.50*	*22*	25.45	25.50
4	*11.37*	*21.99*	*19.78*	*16*	26.28	26.26

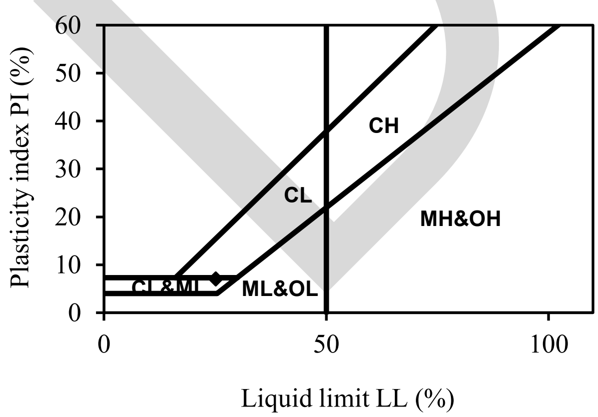
Liquid limit (%) = 25.19
Slope of flow line = 0.095

Set #	Tare mass (g) Mc	Tare with wet soil (g) Mw	Tare with dry soil (g) Md	Water content (%) w
1	*11.12*	*24.05*	*22.07*	18.08
2	*11.56*	*24.69*	*22.66*	18.29
3	*11.27*	*20.72*	*19.27*	18.13
4	*11.16*	*21.10*	*19.59*	17.91

Plastic limit (%) = 18.10







Liquid limit (%) = *25*
Plastic limit (%) = *18*
Plasticity index (%) = *7*

Prepared by: ______________________ Date: ______________

Checked by: ______________________ Date: ______________

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LIQUID LIMIT, PLASTIC LIMIT, and PLASTICITY INDEX of SOILS

AASHTO T 89, T 90 / ASTM D 4318

Client: Public Building Commission of Chicago
Project: Bronzeville Regional Senior Center
WEI Job No: 11255075
Prep Method: air dried

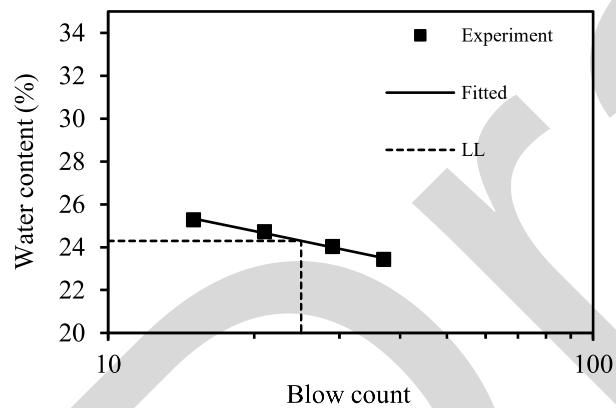
Analyst name: L. Varzaru
Test date: August 21, 2025
Soil Sample ID: B-6, SS#6 (13.5-15ft.)
Sample description: Gray SILTY CLAY (CL-ML)
% retained on #40 sieve: 1%

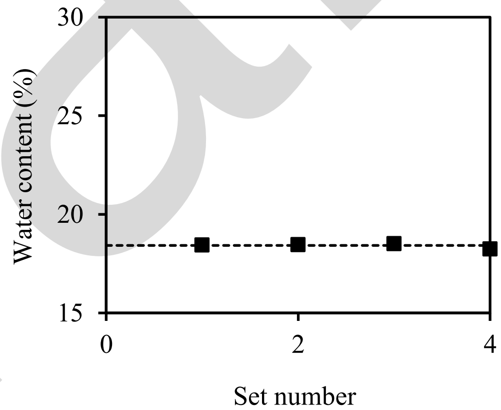
Set #	Tare mass (g) Wc	Tare with wet soil (g) Ww	Tare with dry soil (g) Wd	Blow count N	Water content (%) w	Water content fitted (%)
1	*11.19*	*22.04*	*19.98*	*37*	23.44	23.49
2	*11.31*	*22.51*	*20.34*	*29*	24.03	23.99
3	*11.10*	*22.55*	*20.28*	*21*	24.73	24.65
4	*11.07*	*23.61*	*21.08*	*15*	25.27	25.33

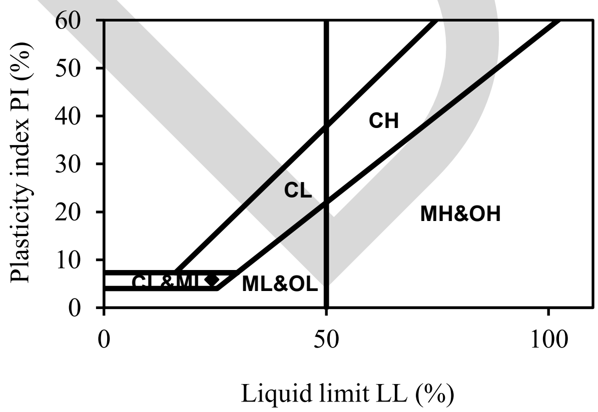
Liquid limit (%) = 24.29
Slope of flow line = 0.084

Set #	Tare mass (g) Mc	Tare with wet soil (g) Mw	Tare with dry soil (g) Md	Water content (%) w
1	*11.34*	*25.01*	*22.88*	18.46
2	*11.17*	*20.02*	*18.64*	18.47
3	*11.15*	*22.03*	*20.33*	18.52
4	*11.15*	*24.50*	*22.44*	18.25

Plastic limit (%) = 18.42







Liquid limit (%) = ***24***
Plastic limit (%) = ***18***
Plasticity index (%) = ***6***

Prepared by: ______________________ Date: ______________

Checked by: ______________________ Date: ______________

Supporting Information

Contents:

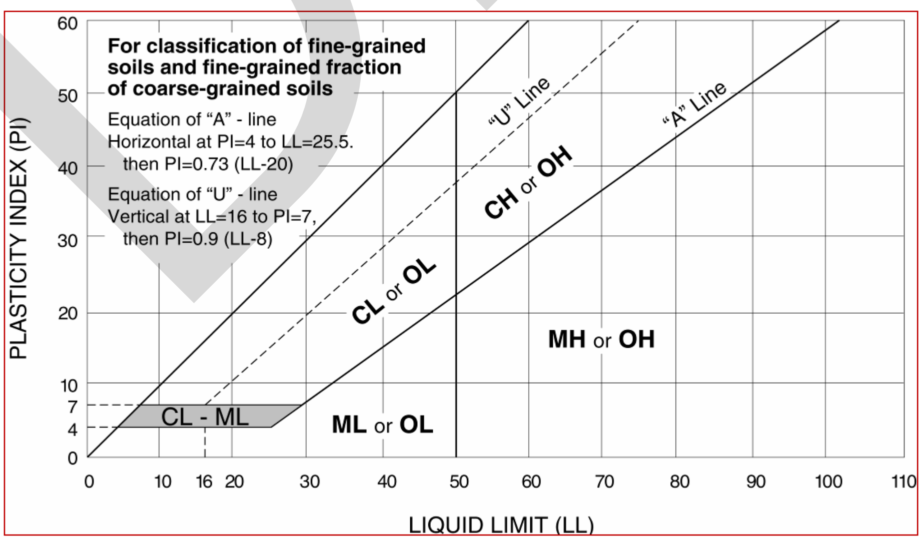
General Notes
Unified Soil Classification System

Note: All attachments are one page unless noted above.

Unified Soil Classification System

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests [A]				Soil Classification	
				Group Symbol	Group Name [B]
Coarse-Grained Soils: More than 50% retained on No. 200 sieve	**Gravels:** More than 50% of coarse fraction retained on No. 4 sieve	**Clean Gravels:** Less than 5% fines [C]	Cu≥4 and 1≤Cc≤3 [E]	GW	Well-graded gravel [F]
			Cu<4 and/or [Cc<1 or Cc>3.0] [E]	GP	Poorly graded gravel [F]
		Gravels with Fines: More than 12% fines [C]	Fines classify as ML or MH	GM	Silty gravel [F, G, H]
			Fines classify as CL or CH	GC	Clayey gravel [F, G, H]
	Sands: 50% or more of coarse fraction passes No. 4 sieve	**Clean Sands:** Less than 5% fines [D]	Cu≥6 and 1≤Cc≤3 [E]	SW	Well-graded sand [I]
			Cu<6 and/or [Cc<1 or Cc>3.0] [E]	SP	Poorly graded sand [I]
		Sands with Fines: More than 12% fines [D]	Fines classify as ML or MH	SM	Silty sand [G, H, I]
			Fines classify as CL or CH	SC	Clayey sand [G, H, I]
Fine-Grained Soils: 50% or more passes the No. 200 sieve	**Silts and Clays:** Liquid limit less than 50	**Inorganic:**	PI > 7 and plots above "A" line [J]	CL	Lean clay [K, L, M]
			PI < 4 or plots below "A" line [J]	ML	Silt [K, L, M]
		Organic:	$\frac{LL\ oven\ dried}{LL\ not\ dried} < 0.75$	OL	Organic clay [K, L, M, N]
					Organic silt [K, L, M, O]
	Silts and Clays: Liquid limit 50 or more	**Inorganic:**	PI plots on or above "A" line	CH	Fat clay [K, L, M]
			PI plots below "A" line	MH	Elastic silt [K, L, M]
		Organic:	$\frac{LL\ oven\ dried}{LL\ not\ dried} < 0.75$	OH	Organic clay [K, L, M, P]
					Organic silt [K, L, M, Q]
Highly organic soils:	Primarily organic matter, dark in color, and organic odor			PT	Peat

[A] Based on the material passing the 3-inch (75-mm) sieve.
[B] If field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.
[C] Gravels with 5 to 12% fines require dual symbols: GW-GM well-graded gravel with silt, GW-GC well-graded gravel with clay, GP-GM poorly graded gravel with silt, GP-GC poorly graded gravel with clay.
[D] Sands with 5 to 12% fines require dual symbols: SW-SM well-graded sand with silt, SW-SC well-graded sand with clay, SP-SM poorly graded sand with silt, SP-SC poorly graded sand with clay.
[E] $Cu = D_{60}/D_{10}$ $Cc = \frac{(D_{30})^2}{D_{10} \times D_{60}}$
[F] If soil contains ≥ 15% sand, add "with sand" to group name.
[G] If fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.
[H] If fines are organic, add "with organic fines" to group name.
[I] If soil contains ≥ 15% gravel, add "with gravel" to group name.
[J] If Atterberg limits plot in shaded area, soil is a CL-ML, silty clay.
[K] If soil contains 15 to 29% plus No. 200, add "with sand" or "with gravel," whichever is predominant.
[L] If soil contains ≥ 30% plus No. 200 predominantly sand, add "sandy" to group name.
[M] If soil contains ≥ 30% plus No. 200, predominantly gravel, add "gravelly" to group name.
[N] PI ≥ 4 and plots on or above "A" line.
[O] PI < 4 or plots below "A" line.
[P] PI plots on or above "A" line.
[Q] PI plots below "A" line.



GENERAL NOTES

DESCRIPTION OF SYMBOLS AND ABBREVIATIONS

SAMPLING

- Auger
- Split Spoon
- Shelby Tube
- Macro Core
- Ring Sampler
- Rock Core
- Grab Sample
- No Recovery

WATER LEVEL

- Water Initially Encountered
- Water Level After a Specified Period of Time
- Water Level After a Specified Period of Time

Water levels indicated on the soil boring logs are the levels measured in the borehole at the times indicated. Groundwater level variations will occur over time. In low permeability soils, accurate determination of groundwater levels is not possible with short term water level observations.

FIELD TESTS

(HP)	Calibrated hand penetromter
(T)	Torvane
(b/f)	Standard Penetration Test (blows per foot)
(PID)	Photo-Ionization Detector
(OVA)	Organic Vapor Analyzer
(B)	Rimac bulge failure
(S)	Rimac shear failure
(NP)	Non-Plastic
(RDR)	Relative Drilling Resistance Criteria

DESCRIPTIVE SOIL CLASSIFICATION

Soil classification is based on the Unified Soil Classification System. Coarse Grained Soils have more than 50% of their dry weight retained on a #200 sieve; their principal descriptors are: boulders, cobbles, gravel or sand. Fine Grained Soils have less than 50% of their dry weight retained on a #200 sieve; they are principally described as clays if they are plastic, and silts if they are slightly plastic or non-plastic. Major constituents may be added as modifiers and minor constituents may be added according to the relative proportions based on grain size. In addition to gradation, coarse-grained soils are defined on the basis of their in-place relative density and fine-grained soils on the basis of their consistency.

LOCATION AND ELEVATION NOTES

Unless otherwise noted, Latitude and Longitude are approximately determined using a hand-held GPS device. The accuracy of such devices is variable. Surface elevation data annotated with +/- indicates that no actual topographical survey was conducted to confirm the surface elevation. Instead, the surface elevation was approximately determined from topographic maps of the area.

STRENGTH TERMS

RELATIVE DENSITY OF COARSE-GRAINED SOILS (More than 50% retained on No. 200 sieve.) Density determined by Standard Penetration Resistance Includes gravels, sands and silts.			CONSISTENCY OF FINE-GRAINED SOILS (50% or more passing the No. 200 sieve.) Consistency determined by laboratory shear strength testing, field visual-manual procedures or standard penetration resistance			
Descriptive Term (Density)	Standard Penetration or N-Value Blows/Ft.	Ring Sampler Blows/Ft.	Descriptive Term (Consistency)	Unconfined Compressive Strength, Qu, psf	Standard Penetration or N-Value Blows/Ft.	Ring Sampler Blows/Ft.
Very Loose	0 - 3	0 - 6	Very Soft	less than 500	0 - 1	< 3
Loose	4 - 9	7 - 18	Soft	500 to 1,000	2 - 4	3 - 4
Medium Dense	10 - 29	19 - 58	Medium-Stiff	1,000 to 2,000	4 - 8	5 - 9
Dense	30 - 50	59 - 98	Stiff	2,000 to 4,000	8 - 15	10 - 18
Very Dense	> 50	≥ 99	Very Stiff	4,000 to 8,000	15 - 30	19 - 42
			Hard	> 8,000	> 30	> 42

RELATIVE PROPORTIONS OF SAND AND GRAVEL

Descriptive Term(s) of other constituents	Percent of Dry Weight
Trace	< 15
With	15 - 29
Modifier	> 30

GRAIN SIZE TERMINOLOGY

Major Component of Sample	Particle Size
Boulders	Over 12 in. (300 mm)
Cobbles	12 in. to 3 in. (300mm to 75mm)
Gravel	3 in. to #4 sieve (75mm to 4.75 mm)
Sand	#4 to #200 sieve (4.75mm to 0.075mm
Silt or Clay	Passing #200 sieve (0.075mm)

RELATIVE PROPORTIONS OF FINES

Descriptive Term(s) of other constituents	Percent of Dry Weight
Trace	< 5
With	5 - 12
Modifier	> 12

PLASTICITY DESCRIPTION

Term	Plasticity Index
Non-plastic	0
Low	1 - 10
Medium	11 - 30
High	> 30