IV–1 Geotechnical Investigation

The attached geotechnical investigation prepared by GSG Consultants, Inc. consists of field work, testing, and reports for a total of (14) soil borings; (9) borings for the proposed building complex and (5) borings for proposed pavements.

Geotechnical Investigation Report

IDOT Materials Lab and Training Center
2300 South Dirksen Parkway
Springfield, Illinois

Prepared for:

CAPITAL
Development
BOARD

CBD Project No. 630-442-057

Project Architect:

Tilton, Kelly + Bell, L.L.C.

Prepared by:

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August 9, 2022

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Ms. Martha Bell, FAIA, LEED BD+C
Principal
Tilton, Kelly + Bell, L.L.C.
55 West Monroe Street, Suite 1975
Chicago, IL 60603

Geotechnical Investigation Report
IDOT Materials Lab and Training Center
2300 South Dirksen Parkway
Springfield, Illinois 62703

Dear Ms. Bell:

Attached is a copy of the Geotechnical Investigation Report for the proposed Materials Lab and Training Center for the Illinois Department of Transportation at the Hanley Complex. The report provides a brief description of the site investigation, site conditions, pavement design and foundation recommendations for the proposed building complex. The site investigation included advancing fourteen (14) soil borings to depths of 10 to 40 feet below the existing surface.

Should you have any questions or require additional information, please call us at 630-994-2600.

Sincerely,

Matthew J Heron, E.I.T.
Project Engineer

Dawn Edgell, P.E.
Sr. Project Engineer

TABLE OF CONTENTS

Appendices

Geotechnical Investigation Report
IDOT Materials Lab and Training Center
2300 South Dirksen Parkway
Springfield, Illinois

1.0 INTRODUCTION

GSG Consultants, Inc. (GSG) completed a geotechnical investigation for design of the proposed Materials Lab and Training Center at the Hanley Complex. The proposed building complex will be located south of the existing Harry R. Hanley Building, between Executive Parkway Drive and Reilly Drive in Springfield, Illinois. The purpose of the investigation was to explore and characterize the subsurface soil and groundwater conditions to determine engineering properties of the subsurface soil, and to develop design and construction recommendations for the project. **Exhibit 1** shows the general project location of the proposed building complex.

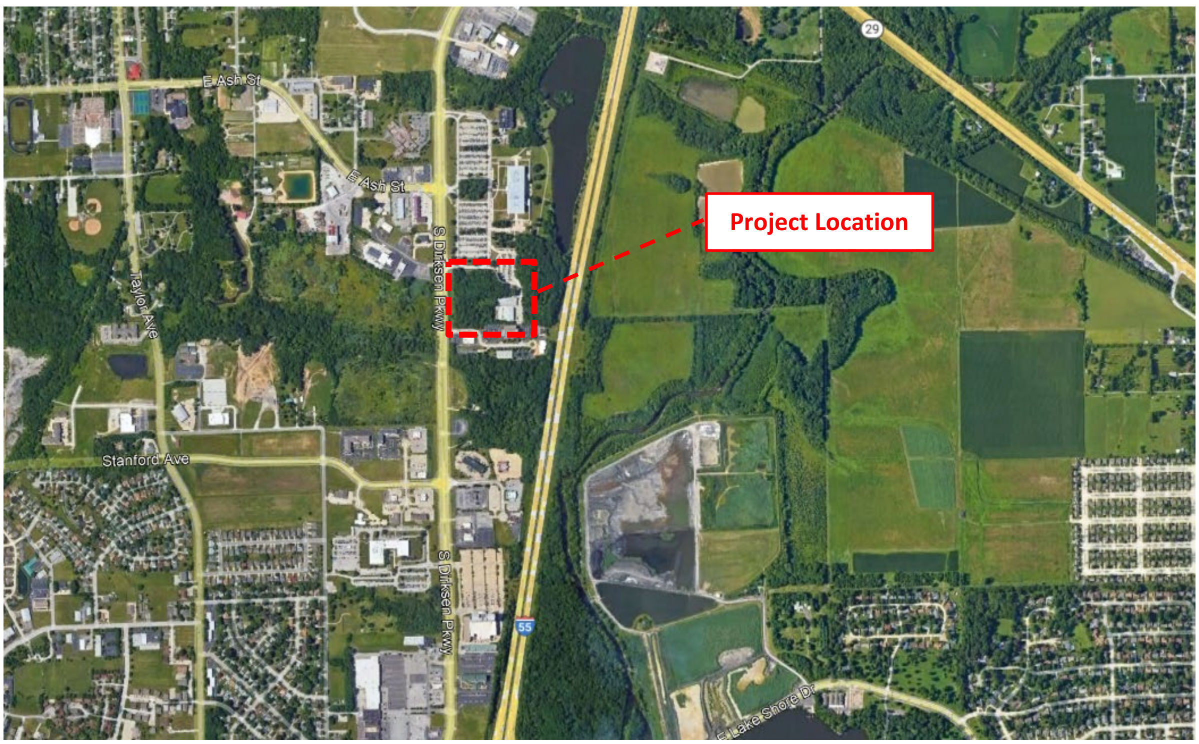


Exhibit 1: Project Location Map

1.1 Existing Site Conditions

The project site consists of an existing warehouse surrounded by light use parking and an undeveloped heavily wooded area. The proposed new building location is surrounded by wooded areas, existing buildings, and parking lots.

1.2 Proposed Project Information

Based on concept information and drawings provided by Tilton, Kelly + Bell, the proposed improvements will include the demolition of the existing warehouse and parking lots, and the construction of a new materials lab and training center. The new facility will consist of a high-bay central laboratory surrounded by administrative and storage space. The new facility will be a single-story building with an approximate footprint of 67,000 square feet. New parking lots and access drives will be constructed around the new structure. The building loads are assumed to be light to moderate.

1.3 Project and Scope of Services

The objective of this study was to explore and characterize the subsurface soil conditions and provide recommendations regarding the suitability of the subsurface soil to support the proposed improvements. The scope of the geotechnical investigation included the following:

1. Advancing a total of fourteen (14) soil borings. Nine (9) borings to depths of 20 to 40 feet for the proposed building, and five (4) borings to depths of 10 feet each for the proposed new parking and drive areas.
2. Perform the geotechnical laboratory testing program on selected representative soil samples obtained during the field investigation to evaluate relevant engineering parameters of the subsurface soils.
3. Perform engineering analysis and evaluation of the data collected during the field investigation and laboratory testing to develop geotechnical engineering design recommendations for the proposed improvements.

1.4 Site Geology

GSG reviewed several published documents to determine the regional geological setting in the area. The site is in central Sangamon County, in Springfield, Illinois. The surficial deposits in this area are typically glacial drift deposited during the Illinois Glacial Age and sediments deposited by Sugar Creek and the South Fork Sangamon River. The subsurface profile in the area consists of deposits of silty clay, silt and sand extending less than 25 feet below ground surface, at which point bedrock is typically encountered, consistent with the soil borings.

Deposits in the area are primarily from the Cahokia Formation, which consists of mostly bedded silts, clays, sands and gravel deposited in floodplains and channels of modern rivers and streams. Underlying the surficial deposits, the bedrock consists of the Shelburn-Patoka

Formations of the Pennsylvanian System which consists of almost entirely shale with deposits of sandstone, limestone and coal.

2.0 SITE SUBSURFACE EXPLORATION PROGRAM

This section describes the subsurface exploration program and laboratory testing program completed as part of this project. The subsurface exploration program was performed in accordance with applicable IDOT geotechnical manuals and AASHTO requirements.

2.1 Subsurface Site Investigation

The subsurface investigation was conducted between June 27 and June 30, 2022 and included advancing fourteen (14) soil borings. The borings were advanced to depths of 10 to 40 feet below the existing ground surface. The locations of the soil borings were provided by Tilton, Kelly + Bell and were completed based on field conditions and accessibility. The existing ground surface elevations shown in the soil boring logs were obtained by GSG's field crew using hand-held GPS equipment. The **Boring Location Plan (Appendix A)** shows the as-drilled locations of the soil borings completed; **Table 1** presents a summary of the borings.

Table 1 – Summary of Subsurface Exploration Borings

Boring	Northing* (ft)	Easting* (ft)	Ground Surface Elevation (ft)	Depth (ft)
B-1	1132238.442	2454462.754	581.94	20.0
B-2	1132202.659	2454287.587	581.48	40.0
B-3	1132042.697	2454522.552	584.39	20.0
B-4	1132045.251	2454352.152	585.00	20.0
B-5	1132044.131	2454173.391	584.50	20.0
B-6	1131953.513	2454355.566	588.00	20.0
B-7	1131881.750	2454536.278	582.83	40.0
B-8	1131858.072	2454361.603	583.71	20.0
B-9	1131866.004	2454198.014	585.07	20.0
PB-1	1132203.894	2454207.526	578.00	10.0
PB-2	1132038.634	2454100.836	584.68	10.0
PB-3	1131943.167	2453988.79	574.00	10.0
PB-4	1131809.050	2454094.754	584.00	10.0
PB-5	1131724.471	2454141.943	580.00	10.0

*Based off Illinois West state plane coordinate system

The soil borings were drilled using a Diedrich D-50 ATV drill rig, equipped with 3¼-inch I.D. hollow stem augers and an automatic hammer. Soil sampling was performed according to AASHTO T 206, "Penetration Test and Split Barrel Sampling of Soils." Soil samples were obtained at 2.5-foot intervals to depths of 10 to 15 feet below existing grade, and at 5-foot intervals thereafter using a split spoon soil sampler. GSG's field representative inspected, visually classified and logged the soil samples during the subsurface exploration activities and performed unconfined compressive strength tests on cohesive soil samples using a calibrated hand penetrometer. Representative soil samples were collected from each sample interval and returned to the laboratory for further testing and evaluation.

2.2 Laboratory Testing Program

All samples were inspected in the laboratory to verify the field classifications. A laboratory testing program was undertaken to characterize and determine engineering properties of the subsurface soils encountered in the area of the proposed improvements. The following laboratory tests were performed on representative soil samples:

- Moisture content ASTM D2216 / AASHTO T-265
- Atterberg Limits ASTM D4318 / AASHTO T-89 / AASHTO T-90
- Dry Unit Weight ATSM D7263
- Particle Size Analysis ASTM D422 / AASHTO T-88

The laboratory tests were performed in accordance with test procedures outlined in the IDOT Geotechnical Manual (2020), and per ASTM and AASHTO requirements. Based on the laboratory test results, the soils encountered were classified according to the AASHTO and the Illinois Division of Highways (IDH) classification systems. The results of the laboratory testing program are included in the Laboratory Test Results (**Appendix C**) and are also shown along with the field test results in the Soil Boring Logs (**Appendix B**).

2.3 Subsurface Soil Conditions

This section provides a brief description of the soils encountered in the borings. Variations in the general subsurface soil profile were noted during the drilling activities. Detailed descriptions of the subsurface soils are provided in the Soil Boring Logs (**Appendix B**). The soil boring logs provides specific conditions encountered at the boring locations. The logs include soil descriptions, stratifications, penetration resistance, elevations, and laboratory test data. Unless otherwise noted, soil descriptions indicated on boring logs are visual identifications. The stratifications shown on the boring logs represent the conditions only at the actual boring locations and represent the approximate boundary between subsurface materials; however, the actual transition may be gradual.

Proposed Building

Borings B-1, B-2, B-3, and B-7 were drilled on the existing parking lots and access roads, and generally encountered between 6 and 8 inches of asphalt, with B-2 encountering 6 inches of reinforced concrete instead of asphalt. Borings B-4, B-5, B-6, B-8, and B-9 were drilled in the wooded area on the west side of the property and initially encountered between 2 and 3 inches of topsoil. The borings then generally encountered soft to hard brown and gray silty clay to a depth of 18.5 feet (elevations 563.0 to 569.5). Within the top 10 feet of the silty clay, loose to medium dense brown silt layers were encountered at varying thicknesses in borings B-4, B-5, and B-6. Boring B-1 also noted a sand seam at 13.5 feet; boring B-2 noted cobbles at 2.5 and 8.5 feet; and boring B-4 noted roots at 13.5 feet. Following the silty clay, the borings encountered medium dense to very dense brown and gray silt with shale to the boring termination depths of 20 to 40 feet.

The brown and gray silty clay had unconfined compressive strengths ranging from 0.25 to 4.5 tsf, with an average strength of 2.05 tsf. The brown loose to medium dense silt layers had SPT blow count 'N' values between 6 and 15 blows per foot (bpf), with an average 'N' value of 11 bpf. The brown and gray medium dense to very dense silt with shale had SPT blow count 'N' values between 22 bpf and 50 blows for 3 inches, with an average 'N' value of 70 bpf.

Proposed Parking Areas

PB-1 through PB-5 were drilled in the wooded area on the west side of the property and initially encountered between 2 and 3 inches of topsoil. The borings then encountered soft to hard brown and gray silty clay to the boring termination depths of 10 feet. Borings PB-2 PB-3 and PB-5 noted loose to medium dense brown silt from a depth of 3.5 to 5 feet and extending to the boring termination depths of 10 feet.

The brown and gray silty clay had unconfined compressive strengths ranging from 0.25 to 4.5 tsf, with an average strength of 2.6 tsf. The brown loose to medium dense silt layers had SPT blow count 'N' values between 6 and 15 blows per foot (bpf), with an average 'N' value of 11 bpf.

2.4 Groundwater Conditions

Water levels were checked in each boring to determine the general groundwater conditions present at the site and were measured while drilling and after each boring was completed. Groundwater was observed in borings B-2, B-8, and B-9 during drilling activities at depths ranging from 6 to 18.5 feet below grade (elevations 563.0 to 579.1). Groundwater was not encountered in the remaining borings. Water was also checked after the augers were removed and prior to backfilling the boreholes with soil cuttings. No water was encountered after the completion of drilling. It normally takes an extended period of time for water levels to reach equilibrium in cohesive soils. Long term readings made in cased piezometers would accurately determine the groundwater table elevation for this site.

Based on the overall color change from brown to gray, it is anticipated that the long-term groundwater level may range between elevations 562.5 to 564.5 feet. Water level readings were made in the boreholes at times and under conditions shown on the boring logs and stated in the text of this report. However, it should be noted that water may be trapped in near surface fill materials and fluctuations in groundwater level may occur due to variations in rainfall, seasonal changes, other climatic conditions, or other factors not evident at the time measurements were made and reported herein.

3.0 GEOTECHNICAL ANALYSIS

This section provides GSG's geotechnical analysis for the design of the proposed facility based on the results of the field exploration and laboratory testing. All applicable requirements within IDOT reference and design manuals, as well as the AASHTO design manual were followed.

3.1 Derivation of Soil Parameters

GSG determined the geotechnical parameters to be used for the project design based on the results of field and laboratory test data on individual boring logs as well as our experience. Unit weights, friction angles and shear strength parameters were estimated using corrected standard penetration test (SPT) using published correlations for N values results for the fill and cohesionless soils and in-situ and laboratory test results for cohesive soils. The SPT values were corrected for hammer efficiency. The hammer efficiency correction factor considers the use of a safety hammer/rope/cat-head system, generally estimated to be 60% efficient. Thus, correlations should be based upon what is currently termed as N60 data. The efficiency of the automatic hammer used for this exploration was estimated to be approximately 102% for the Diedrich D-50 ATV based on previous efficiency testing. The correction for hammer efficiency is a direct ratio of relative efficiencies as follows:

$$N_{60} = N_{Field} * (102/60)\text{: Diedrich D-50 ATV}$$

Where the N_{Field} value is the field recorded blow counts.

Based on the field investigation data collected, generalized soil parameters for use in design are presented in **Table 2**.

Table 2 – Summary of Soil Parameters

Depth (feet)	Soil Description	In situ Unit Weight γ (pcf)	Undrained		Drained	
			Cohesion c (psf)	Friction Angle ϕ (°)	Cohesion c (psf)	Friction Angle ϕ (°)
	New Engineered Clay Fill	125	1,000	0	50	25
	New Engineered Granular Fill	125	0	30	0	30
0.5-18.5	Brown and Gray Soft to Hard Silty Clay	138	1,500	0	150	28
18.5-40.0	Brown and Gray Medium Dense to Very Dense Silt with Shale	138	0	42	0	42
0.5-10* (various depths / thicknesses)	Brown Loose to Medium Dense Silt	124	0	35	0	35

* For borings B-4, B-5, B-6, PB-2, PB-3, and PB-5 only

3.2 Seismic Parameters

The Seismic Soil Site Class was determined per Chapter 1613.2.2 of IBC 2018, and the soil properties evaluated in accordance with Chapter 20 of ASCE 7-16. The Site Class of the site was estimated as Class D based on the average SPT blow counts and undrained shear strength for the upper 100 feet of the soil profiles. Seismic Design Maps tool developed by Office of Statewide Health Planning and Development (OSHPD) was used to determine the peak ground acceleration coefficient (PGA), and the short (S_{DS}) and long (S_{D1}) period design spectral acceleration coefficients for the proposed structure as shown in **Table 3**. According to ASCE 7-16, the seismic design category was Category C.

Table 3 - Seismic Design Parameters

Building Code Reference	Site Class	PGA	PGA_M	S_{DS}	S_{D1}	Occupancy Category	Seismic Design Category
IBC 2018 & ASCE 7-16	D	0.096	0.154	0.210	0.163	II	C

4.0 GEOTECHNICAL RECOMMENDATIONS

This section provides GSG's geotechnical recommendations for the design based on the results of the field exploration and laboratory testing. All applicable requirements within IDOT reference and design manuals, as well as the AASHTO design manual were followed.

4.1 Foundations Design Recommendation

The types of foundations utilized for a structure is normally dependent upon soil type, soil consistency, and magnitude of loads. Based on GSG's analysis, a shallow foundation system or spread footings is a feasible option for this project due to the anticipated loads and presence of suitable native stiff clay soils. The following sections provide recommendations regarding the foundation system for the proposed improvements based on available information and subsurface conditions.

4.1.1 Shallow Foundations

Based on the results of the subsurface investigation and the design information provided, the proposed materials lab and training center could be supported upon a conventional shallow spread and continuous footing foundation system, bearing on the native, stiff silty clay or new engineered fill overlying suitable natural soils. The minimum depth of any exterior footings should be 3.0 feet below the final exterior grade to alleviate the effects of frost. Interior footings may bear at a depth of 2 feet below grade. Foundations bearing on the native soils or new engineered fill can be designed using an allowable bearing capacity of 2,500 psf, which includes a factor of safety of 3.

The above bearing capacity is based on an allowable settlement of less than one inch and an allowable differential settlement of approximately ½ inch. If any of the assumptions or design loading information above is not correct or has been changed, GSG should be contacted to re-evaluate the foundation design recommendations.

It is assumed that the finished floor elevation of the proposed building will be near existing grade at elevation 582.0 feet. Due to the presence of medium stiff silty clay material in isolated areas of the site, undercuts to reach suitable stiff silty clay will be required to alleviate excessive settlement. The depth of fill may vary within the footprint of the proposed structure. Based on the anticipated loads, if a higher bearing capacity is required, aggregate piers or rigid inclusions could be considered which would limit the required undercuts. Additional foundation recommendations for these alternatives are included in Section 4.1.3.

Following undercutting to suitable natural silty clay, the over-excavations should be backfilled to the design bearing grade with granular structural fill. The granular structural fill should be placed in accordance with the Construction Considerations section of this report. Additional undercuts for the continuous footings may be required based on field observations during construction and the bearing soils should be verified prior to construction of the footings. The approximate suitable bearing depths and the anticipated undercuts for the spread footings are shown in **Table 4**.

Table 4 – Anticipated Undercut Depths
(Assumed Floor Elev. 582 and Bottom Footing Elev. 579)

Boring #	Maximum Undercut Depth/Elevation (ft)	Comment/Reason for Remediation
B-1	3.0 / 576.0	Low Strength Silty Clay (1.0 tsf) – High Settlement
B-2	3.5 / 575.5	Low Strength Silty Clay (1.0 tsf) – High Settlement
B-3	3.0 / 576.0	Low Strength Silty Clay (1.5 tsf) – High Settlement
B-4	12.5 / 566.5	Low Strength Silty Clay (1.0 tsf), Significant roots within brown clay – Field verification needed
B-5	N/A	N/A
B-6	2.0 / 577.0	Low Strength Silty Clay (1.25 tsf) – High Settlement
B-7	5.0 / 574.0	Low Strength Silty Clay (0.5 tsf) – Low Bearing Capacity
B-8	1.5 / 577.5	High Moisture Content (27%) – High Settlement
B-9	2.5 / 576.5	Low Strength Silty Clay (1.0 tsf) – High Settlement

*Below bottom of footing (3.0 feet below finished grade)

Spread footings should have a maximum plan dimension of 6 feet and should be at least 12 inches thick. Continuous footings should have a minimum width of 2 feet and should be at least 10 inches thick. The actual footing thickness and reinforcement should be determined by a structural analysis of the individual footings with chosen plan dimensions. If any of the assumptions or design loading information above is not correct or has been changed, GSG should be contacted to re-evaluate the foundation design recommendations.

If the native silty clay or silt soils at the base of the excavations become disturbed, the exposed subgrade should be compacted prior to placing structural fill. The lateral limit of engineered structural fill placed beneath the footing should extend a minimum 1 foot beyond the outside edges of the footing and from that point outward laterally 1 foot for every 2 feet of fill thickness below the footing. The granular structural fill should be placed and compacted in accordance with the Construction Considerations Section 5.0 of this report. **Figure 2** illustrates the structural fill placement below the footings.

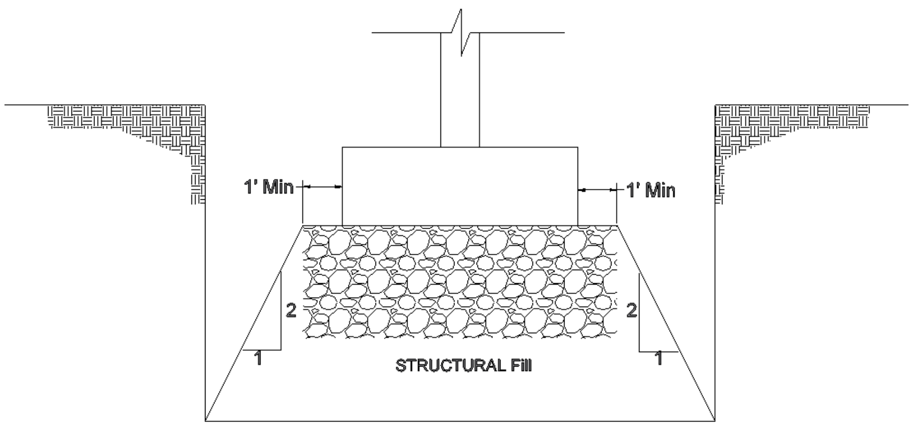


Figure 2: Structural Fill Placement Below Footing

4.1.2 Lateral Load Resistance for Shallow Foundations

Resistance to lateral loads can be provided by a combination of friction at the foundation base and slab-on-grade, and by passive resistance acting against the vertical faces of foundation elements. A coefficient of friction of 0.35 may be used for footings. For the floor slab, a coefficient of friction of 0.35 may be used between the floor slab and subgrade. For passive resistance, an equivalent fluid pressure of 275 pounds per cubic foot (pcf) acting against the footing may be used. Passive resistance in the upper one foot of soil should be neglected unless the area is covered by concrete or pavement. The friction and passive resistance may be used concurrently provided the passive resistance is reduced by 50%.

4.1.3 Aggregate Piers/Rigid Inclusions Option

Based on the anticipated depths of recommended undercuts and the anticipated loads for the new structures, a system of rammed aggregate piers or rigid inclusions may be considered for support of the new foundations.

Rammed aggregate piers or stone columns below the footings could be considered to stabilize the poor soils and limit the need for undercutting below the foundations. Aggregate columns normally act similar to wick drains in accelerating drainage at the site, and decreasing the time frame for consolidation settlement. Typical column diameters range from 18 to 36 inches and, in general, are most economical options for sites requiring column lengths less than 20 feet similar to this project.

Rigid inclusions are a ground improvement technique that transfers loads through weak strata to a firm underlying stratum using high modulus, controlled stiffness columns. Rigid Inclusions are columns of grout used to reinforce the ground to increase bearing capacity and reduce settlement of a structure or embankment. The improved performance results from the reinforcement of the compressible strata with the high modulus columns. The technique has been used to increase allowable bearing pressure and decrease settlement for planned structures, embankments and tanks.

These site improvement techniques would provide a higher net allowable bearing capacity by transferring the building loads to the very stiff to hard clay soils and limiting the influence of building loads on the shallower compressible materials (low strength silty clay and loose silty soils). Based on the subsurface conditions the columns should be designed to bear within the very stiff to hard natural silty clay soils.

4.1.4 Floor Slab Recommendations – Slab-on-Grade

Floor slab-on-grade should be structurally independent of the rest of the foundation system and should be designed based on the anticipated use and loading. Concrete floor slabs should be supported on a layer of compacted granular fill consisting of a minimum of 8 inches of IDOT CA-6 stone placed upon a minimum of 4 inches of free draining stone such as CA-7. The free draining stone will act as a capillary cutoff layer and may reduce the potential for soil moisture migrating upwards toward the slab, and thus will provide drainage and minimize dampness in the floor slab.

If unsuitable or soft materials are observed, they should be over excavated an additional 12 inches below the bottom of the proposed floor slab subbase. The over excavation should be backfilled with CA-6 gradation crushed stone. The existing soils present at the exposed subgrade level should be evaluated during construction, and any unsuitable material should be removed in accordance with the Construction Considerations section of this report. Prior to the placement of any granular fill, the subgrade should also be prepared in accordance with the procedures outlined in the Construction Considerations of this report.

The slab-on-grade for the floor slab should be designed using a coefficient of vertical subgrade reaction (modulus of subgrade reaction) of 100 pounds per cubic inch (pci) based on Terzaghi's recommended values, which are based on a 1 foot by 1 foot square plate resting on granular medium dense sand soils. The above value is based on the slab being supported upon structural fill materials.

4.2 Pavement Design Recommendation

4.2.1 Settlement

Based on the information provided, the earthwork required will involve minimal cut and fill in the new pavement areas. The settlement of subsurface soils in the proposed improvement areas is anticipated to be negligible.

4.2.2 Drainage Characteristics

The drainage characteristics of the site were evaluated per the IDOT Geotechnical Manual, Section 3.4.1, based on the subgrade soil type, moisture condition of the in-situ soil and the proposed grading. The soils encountered at the proposed subgrade depth were typically silty clay. Based on this information, GSG utilized Table 6.3.4.1-1, Drainage Classification in the IDOT Geotechnical Manual, to assign the drainage classes for the site. The drainage classes for the subgrade soils are classified as Fair to Poor for the pavement design.

4.2.3 Frost Susceptibility

The frost susceptibility of the subgrade soils was evaluated per Section 6.3.2.2.3 of the IDOT Geotechnical Manual. The maximum anticipated frost penetration depth below pavement in central Illinois is 35 to 45 inches for extreme weather conditions. Fine grained soils that contain at least 65% silt and fine sand with PI less than 12% are considered susceptible to frost heaving when shallow groundwater or the level of capillary rise is within the depth of frost penetration.

GSG used Table 6.3.2.2.3-1, Frost Susceptibility Classification of Soils in the IDOT Geotechnical Manual, to assign the Frost Class for the subgrade soils. Due to silty soil at the site, the frost class for the subgrade soil are considered very high susceptibility (F4). GSG does not anticipate any treatment measures to prevent frost heave.

4.2.4 Subgrade Support Rating

The subgrade support rating (SSR) was determined based on the physical properties of in-situ soils present beneath the proposed pavement section. The SSR includes three categories (poor, fair, and granular), and are used to determine the depth of soil treatment to provide a stable working platform that is required to prevent excessive rutting, and moisture related problems during construction activities. Granular soils have the highest rating and provide a stable working platform that may require lower subbase thickness for pavement, while poor subgrade may require thicker subbase to provide stable subgrade during construction activities. The near surface soils that form the subgrade for the proposed improvements consists of silty clay and silt. It is recommended that a Subgrade Support Rating of Poor to Fair be used.

4.2.5 Illinois Bearing Ratio

The Illinois Bearing Ratio (IBR) is a measure of the support provided by the roadbed soils for the new pavement. Where the existing clay soils remain as the pavement subgrade, it is recommended that an IBR value of 2 be used for the new pavement design and correlated to the subgrade resilient modulus based on the AASHTO recommended pavement design formula for fine grained soils (M_r = 1,500 x IBR).

4.2.6 Pavement Recommendations

It is our understanding that the proposed project will include light duty parking areas, along with access drives that will experience loading from moderate truck traffic. GSG is providing recommendation for flexible and ridge pavement since no information was provided regarding the preferred pavement type for the site. GSG assumes that the final pavement elevations will be maintained at approximately the existing elevations.

No information was provided regarding the traffic volume at the facility; it is our understanding that the proposed facility will incorporate vehicle parking/storage for approximately 240 light duty vehicles (passenger vehicles – PV). To determine a pavement section, it was assumed that a maximum Average Daily Traffic (ADT) for the site would consist of 300 PV. Concrete pavement should be used in areas that experience high volumes of truck traffic, including the entrances and exits.

Based on the soil conditions encountered, and the design information mentioned above, recommended pavement sections for both flexible and rigid pavements are included in **Table 6**.

Table 6 – Recommended Pavement Section

Material	Rigid Pavement (PCC)	Flexible Pavement (HMA)
Pavement Thickness (inches)	6.0	6.0
Crushed Stone Subbase thickness (inches)	6.0	8.0

The concrete pavement should consist of 12’x12’ traditional jointed plain concrete pavements (JPCP). No dowel bars are required based on the anticipated truck loads. For the lightweight employees parking lot area, flexible pavement section consisting of 1.5 inch surface course, and 2.0 inch of binders, supported upon 8 inches of stone subbase could be utilized.

5.0 CONSTRUCTION CONSIDERATIONS

All work performed for the proposed project should conform to the requirements in the IDOT Standard Specifications for Construction (2021). Any deviation from the requirements in the manuals above should be approved by the design engineer.

5.1 Site Preparation

GSG recommends removing all soft or unsuitable/deleterious materials, and existing building foundations and slabs from the area of the proposed building footprint. After any unsuitable material is removed from the site, the exposed subgrade soils should be evaluated, and any unsuitable/deleterious material should be removed. Although not encountered in the borings, any underground utility lines, buried slabs and foundation remnants that will impact the proposed building footprint should be completely removed from beneath the proposed structure or where they may interfere with new construction.

GSG recommends removing all existing pavements, concrete, vegetation, topsoil, root mats, any soft or unsuitable/deleterious materials, and existing building foundations and slabs from the proposed building area. After any unsuitable material is removed from the site, the exposed subgrade soils should be evaluated, and any unsuitable/deleterious material should be removed. All existing underground utility lines should be completely removed from beneath the proposed structures. Existing utility lines that are to be abandoned should be removed to the property line and should be plugged with a minimum of 2 feet of cement grout. All excavations resulting from foundation and underground utilities removal activities should be cleaned of loose and disturbed materials, including all previously placed backfill, and backfilled with suitable fill materials.

Site preparation in areas where the new pavements will be constructed will require removal of existing asphalt and associated subbase. Stripping topsoil from undeveloped areas, and removal of all deleterious materials from proposed pavement areas. Stripping depths of up to 6 inches should be anticipated. Subgrade improvements, including any undercuts or compaction of existing soils should be completed to the proposed elevations in the design plan and in accordance with the IDOT Standards and Specifications for Roads and Bridges Construction, Section 301-Subgrade Preparation. Any necessary undercutting shall be performed in a manner to minimize disturbance to the undercut subgrade and heavy equipment traffic directly on the undercut subgrade should be minimized.

The stability of the exposed subgrade should be evaluated in the field in accordance with the IDOT Subgrade Stability Manual (2005) to determine if additional treatment is required. Subgrade preparation should consist of a combination of the following: reconditioning existing subgrade soils; replacing soft existing soils with structural fill. GSG recommends, all exposed subgrade areas, once properly cleared, should be scarified to a minimum depth of 9 inches, conditioned to near optimum moisture content and compacted to reduce the risk of local discontinuities. Subgrade soils exposed to the elements for more than 24 hours should be checked for density and moisture content prior to placing additional fill and/or pavements. Proof-rolling should be conducted to determine the presence of any soft subgrade areas at the site. Soft areas could be treated with geotextile fabric or undercut to a maximum depth of 2 feet and replaced with structural fill.

5.2 Existing Utilities

Before proceeding with construction, any existing underground utility lines that will interfere with subgrade construction should be completely rerouted or removed from beneath the proposed construction areas. Existing utility lines that are to be abandoned in place should be removed and/or plugged with a minimum of 2 feet of cement grout. All excavations resulting from underground utility removal activities should be cleaned of loose and disturbed materials, including all previously placed backfill, and backfilled with suitable fill materials in accordance with the requirements of this section. During the clearing and stripping operations, positive surface drainage should be maintained to prevent the accumulation of water.

5.3 Excavations

The contractor will be responsible to provide a safe excavation during the construction activities of the project. All excavations should be conducted in accordance with applicable federal, state, and local safety regulations, including, but not limited to the Occupational Safety and Health administration (OSHA) excavation safety standards. Excavation stability is dependent on soil conditions, depth of excavations and the magnitude of any surcharge loads on the ground surface adjacent to the excavation. Excavation near existing structures and underground utilities should be performed with extreme care to avoid undermining existing structures.

5.4 Borrow Material and Compaction Requirements

If borrow material is to be used for onsite construction, it should conform to Section 204 “Borrow and Furnish Excavations” of the IDOT Construction Manual (2020). The fill material should be free of organic matter and debris and should be placed and compacted in accordance with Section 205, Embankment, of the IDOT Construction Manual. Earth-moving operations should be avoided during excessively cold or wet weather to avoid freezing or softening of subgrade soils.

GSG recommends that subgrade preparation and compaction be inspected by a GSG geotechnical engineer to verify the type and strength of soil materials present at the site and their conformance with the geotechnical recommendations in this report.

5.5 Approved Fill Material and Placement for Shallow Foundation

Reuse of onsite native materials can be considered provided the materials meet the following soil properties. These on-site soils are not considered expansive.

Suitable structural fill should have the following soil properties:

1. A maximum dry density greater than 100 pounds per cubic foot (pcf) when determined in accordance with ASTM D1557, Modified Proctor.
2. Shall not contain organic material in excess of 3% when tested in accordance with ASTM D2974.
3. Suitable fine-gained soils include materials that comply with ASTM D2487 soil classification group CL.
4. Suitable coarse-grained soils include materials that comply with ASTM D2487 soil classification groups GW, GP, GM, SW, SP and SC.
5. Should not contain deleterious material, should be within ±4% of optimum moisture content, and have a maximum particle size of three inches.
6. Shall consist of a locally available material.

For the proposed building, we recommend using non-frost susceptible structural fill consisting of coarse-grained soils that comply with ASTM D2487 soil classification groups GW, GP, GW-GM, GP-GM. Suitable structural fill materials shall be of a nature that will compact and develop stability satisfactory to the geotechnical engineer. Structural fill is recommended beneath buildings and other similar structures or equipment sensitive to settlement. It is recommended that structural fill generally consist of crushed limestone or recycled concrete consistent with IDOT CA-6 gradation. Materials to be used as structural fill shall be inorganic, free of waste and debris, and shall not contain frozen material or any material which, by decay or otherwise, might cause settlement. Structural fill shall be placed in lifts not to exceed 8 inches in loose thickness and should be compacted to a minimum of 95% of the material's modified proctor maximum dry density obtained according to the ASTM D1557 method.

Materials unsatisfactory for use as a structural fill include soils classified as silt or organic silt (ML, MH, PT, OL, and OH) in the Unified Soil Classification System (ASTM D2487). Soils with these classifications may be used for general purpose landscaping or in areas where fill will not support structures and uncontrolled settlement is acceptable.

Frozen materials should not be used, and fill materials should not be placed on frozen subgrade. If fill is to be placed during cool, wet seasons, the use of granular fill may be necessary since weather conditions will make compaction of cohesive soils more difficult.

5.6 Groundwater Management

Groundwater was observed in borings B-2, B-8, and B-9 during drilling activities at depths ranging from 6 to 18.5 feet below grade (elevations 563.0 to 579.1). Based on the overall color change from brown to gray, it is anticipated that the long-term groundwater level is between elevations 562.5 to 564.5 feet. If rainwater run-off or perched water is accumulated at the base of excavation, the contractor should remove accumulated water using conventional sump pit and pump procedures and maintain a dry and stable excavation. The location of the sump should be determined by the contractor based on field conditions. During earthmoving activities at the site, grading should be performed to ensure that drainage is maintained throughout the construction period. Undercut and excavated areas should be sloped toward one corner to facilitate removal of any collected rainwater or surface run-off. Grades should be sloped away from the excavations to minimize runoff from entering the areas.

If water seepage occurs during excavations or where wet conditions are encountered such that the water cannot be removed with conventional sumping, we recommend placing open grade stone similar to IDOT CA-7 to stabilize the bottom of the excavation below the water table. The CA-7 stone should be placed to 12 inches above the water table, in 12-inch lifts, and should be compacted with the use of a heavy smooth drum roller or heavy vibratory plate compactor until stable. The remaining portion of the excavation should be backfilled using approved embankment fill.

6.0 LIMITATIONS

This report has been prepared for the exclusive use of the Illinois Department of Transportation and its design consultant, Tilton, Kelly + Bell. The recommendations provided in the report are specific to the project described herein and are based on the information obtained from the soil boring locations within the proposed project limits. The analyses performed and the recommendations provided in this report are based on subsurface conditions determined at the location of the borings. This report may not reflect all variations that may occur between boring locations or at some other time, the nature and extent of which may not become evident until during the time of construction. If variations in subsurface conditions become evident after submission of this report, it will be necessary to evaluate their nature and review the recommendations presented herein.

APPENDIX A

BORING LOCATION PLAN

GSG CONSULTANTS, INC.
735 Remington Road, Schaumburg, IL 60173
Tel: 630.994.2600, www.gsg-consultants.com

DRAWN BY:	MH
CHECKED BY:	DE
DATE:	07/26/2022
SCALE:	AS NOTED

tkb ARCHITECTURE & DESIGN

APPENDIX A: BORING LOCATION PLAN
IDOT HANLEY COMPLEX
2300 SOUTH DIRKSEN PARKWAY
SPRINFIELD, IL 62703

APPENDIX B

SOIL BORING LOGS

BORING NUMBER B-1

GSG CONSULTANTS, INC.
735 Remington Road, Schaumburg, IL 60173
Tel: 630.994.2600, www.gsg-consultants.com

CLIENT Tilton, Kelly + Bell, LLC

PROJECT NAME IDOT Hanley Building Complex

PROJECT NUMBER 21-2106

PROJECT LOCATION 2300 S. Dirksen Parkway, Springfield, IL

DATE STARTED 6/30/22 **COMPLETED** 6/30/22

GROUND ELEVATION 581.94 ft **HOLE SIZE** 3 1/4"

DRILLING CONTRACTOR GSG Drilling

GROUND WATER LEVELS:

DRILLING METHOD Hollow Stem Auger

AT TIME OF DRILLING --- None

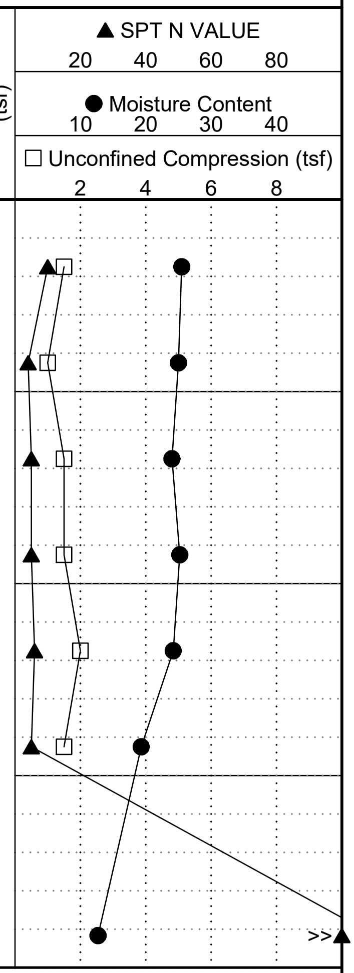
LOGGED BY KA **CHECKED BY** MH

AT END OF DRILLING --- N/A

NOTES Drill rig: Diedrich D-50 ATV

AFTER DRILLING --- N/A

DEPTH (ft)	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY (%)	BLOW COUNTS (N VALUE)	UNCONFINED COMPRESSION (tsf)
0	8 inches of Asphalt				
	SILTY CLAY (CL/ML) - Brown - Stiff - Moist to Very Moist	SS 1	78	4-5-5 (10)	1.5
5		SS 2	67	2-2-2 (4)	1.0
		SS 3	89	2-2-3 (5)	1.5
10	SILTY CLAY (CL/ML) - Brown and Gray - Stiff to Very Stiff - Moist to Very Moist	SS 4	100	2-2-3 (5)	1.5
		SS 5	100	2-3-3 (6)	2.0
15	Sand seam at 13.5 feet	SS 6	100	1-2-3 (5)	1.5
20	SILT, with shale (ML) - Gray - Very Dense - Moist	SS 7	75	7-12-50/4"	



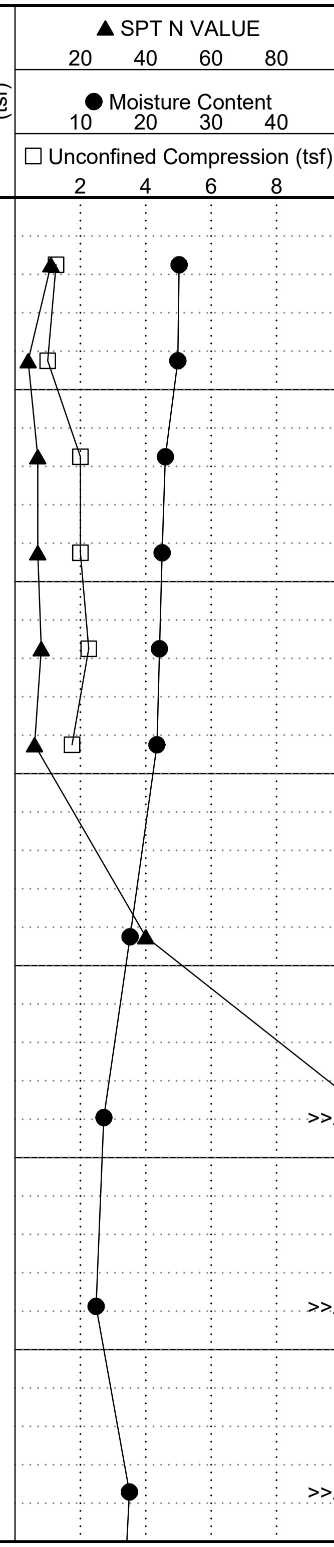
Bottom of borehole at 20.0 feet.

GSG CONSULTANTS, INC.
735 Remington Road, Schaumburg, IL 60173
Tel: 630.994.2600, www.gsg-consultants.com

BORING NUMBER B-2

CLIENT Tilton, Kelly + Bell, LLC
PROJECT NAME IDOT Hanley Building Complex
PROJECT NUMBER 21-2106
PROJECT LOCATION 2300 S. Dirksen Parkway, Springfield, IL
DATE STARTED 6/29/22 **COMPLETED** 6/29/22
GROUND ELEVATION 581.48 ft **HOLE SIZE** 3 1/4"
DRILLING CONTRACTOR GSG Drilling
GROUND WATER LEVELS:
DRILLING METHOD Hollow Stem Auger
▽ **AT TIME OF DRILLING** 18.50 ft / Elev 562.98 ft
LOGGED BY KA **CHECKED BY** MH
AT END OF DRILLING --- N/A
NOTES Drill rig: Diedrich D-50 ATV
AFTER DRILLING --- N/A

DEPTH (ft)	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY (%)	BLOW COUNTS (N VALUE)	UNCONFINED COMPRESSION (tsf)
0	6 inches of Reinforced Concrete				
	CLAY (CL) - Brown - Stiff to Very Stiff - Moist to Very Moist	SS 1	44	9-7-4 (11)	1.25
	Cobbles at 2.5 feet				
5		SS 2	89	2-2-2 (4)	1.0
		SS 3	100	3-3-4 (7)	2.0
10	Cobble at 8.5 feet	SS 4	100	2-3-4 (7)	2.0
	SILTY CLAY (CL/ML) - Brown and Gray - Stiff to Very Stiff - Moist	SS 5	100	2-4-4 (8)	2.25
15		SS 6	100	2-3-3 (6)	1.75
20	▽ SILT, with shale (ML) - Gray - Dense to Very Dense - Moist	SS 7	100	12-17-23 (40)	
25		SS 8	100	12-50/5"	
30		SS 9	100	33-50/3"	
35		SS 10	100	50/5"	



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GSG CONSULTANTS, INC.
735 Remington Road, Schaumburg, IL 60173
Tel: 630.994.2600, www.gsg-consultants.com

BORING NUMBER B-2

CLIENT Tilton, Kelly + Bell, LLC
PROJECT NAME IDOT Hanley Building Complex
PROJECT NUMBER 21-2106
PROJECT LOCATION 2300 S. Dirksen Parkway, Springfield, IL

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY (%)	BLOW COUNTS (N VALUE)	UNCONFINED COMPRESSION (tsf)	▲ SPT N VALUE 20 40 60 80 / ● Moisture Content 10 20 30 40 / □ Unconfined Compression (tsf) 2 4 6 8
35		SILT, with shale (ML) - Gray - Dense to Very Dense - Moist *(continued)*					
40			SS 11	100	50/5"		>>▲

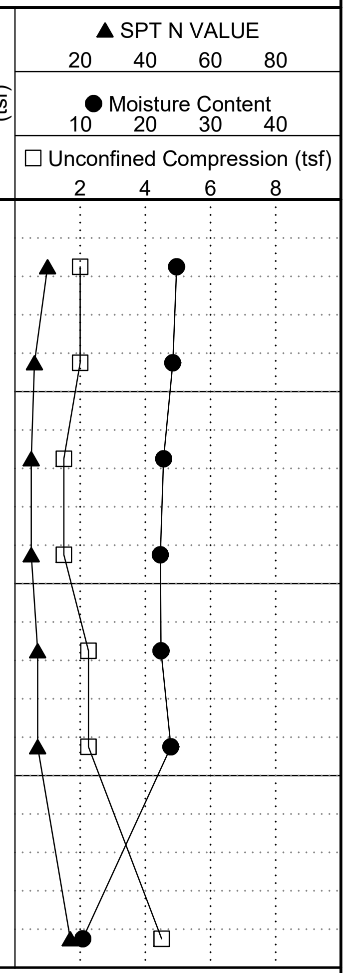
Bottom of borehole at 40.0 feet.

BORING NUMBER B-3

GSG CONSULTANTS, INC.
735 Remington Road, Schaumburg, IL 60173
Tel: 630.994.2600, www.gsg-consultants.com

CLIENT Tilton, Kelly + Bell, LLC
PROJECT NAME IDOT Hanley Building Complex
PROJECT NUMBER 21-2106
PROJECT LOCATION 2300 S. Dirksen Parkway, Springfield, IL
DATE STARTED 6/29/22 **COMPLETED** 6/29/22
GROUND ELEVATION 584.39 ft **HOLE SIZE** 3 1/4"
DRILLING CONTRACTOR GSG Drilling
GROUND WATER LEVELS:
DRILLING METHOD Hollow Stem Auger
AT TIME OF DRILLING --- None
LOGGED BY KA **CHECKED BY** MH
AT END OF DRILLING --- N/A
NOTES Drill rig: Diedrich D-50 ATV
AFTER DRILLING --- N/A

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY (%)	BLOW COUNTS (N VALUE)	UNCONFINED COMPRESSION (tsf)
0		6 inches of Asphalt				
		SILTY CLAY (CL/ML) - Brown - Stiff to Very Stiff - Moist	SS 1	56	2-5-5 (10)	2.0
5			SS 2	89	2-3-3 (6)	2.0
			SS 3	100	2-3-2 (5)	1.5
10			SS 4	100	2-2-3 (5)	1.5
		SILTY CLAY (CL/ML) - Brown and Gray - Very Stiff to Hard - Moist	SS 5	100	2-3-4 (7)	2.25
15			SS 6	100	2-3-4 (7)	2.25
20			SS 7	56	2-6-11 (17)	4.5



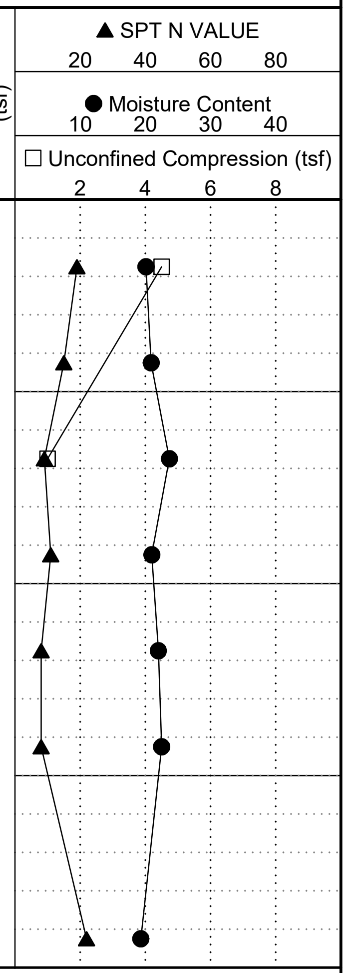
Bottom of borehole at 20.0 feet.

BORING NUMBER B-4

GSG CONSULTANTS, INC.
735 Remington Road, Schaumburg, IL 60173
Tel: 630.994.2600, www.gsg-consultants.com

CLIENT Tilton, Kelly + Bell, LLC
PROJECT NAME IDOT Hanley Building Complex
PROJECT NUMBER 21-2106
PROJECT LOCATION 2300 S. Dirksen Parkway, Springfield, IL
DATE STARTED 6/27/22 **COMPLETED** 6/27/22
GROUND ELEVATION 585.00 ft **HOLE SIZE** 3 1/4"
DRILLING CONTRACTOR GSG Drilling
GROUND WATER LEVELS:
DRILLING METHOD Hollow Stem Auger
AT TIME OF DRILLING --- None
LOGGED BY KA **CHECKED BY** MH
AT END OF DRILLING --- N/A
NOTES Drill rig: Diedrich D-50 ATV
AFTER DRILLING --- N/A

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY (%)	BLOW COUNTS (N VALUE)	UNCONFINED COMPRESSION (tsf)
0		2 inches of Topsoil				
		SILTY CLAY (CL/ML) - Brown - Hard - Moist	SS 1	56	6-8-11 (19)	4.5
5		SILT (ML) - Brown - Medium Dense - Very Moist	SS 2	56	6-7-8 (15)	
		SILTY CLAY, with roots (CL/ML) - Brown - Stiff - Moist	SS 3	67	4-5-4 (9)	1.0
10			SS 4	11	5-6-5 (11)	
			SS 5	11	4-4-4 (8)	
15		Roots at 13.5 feet	SS 6	11	3-4-4 (8)	
20		SILT (ML) - Brown - Medium Dense - Moist	SS 7	89	6-7-15 (22)	



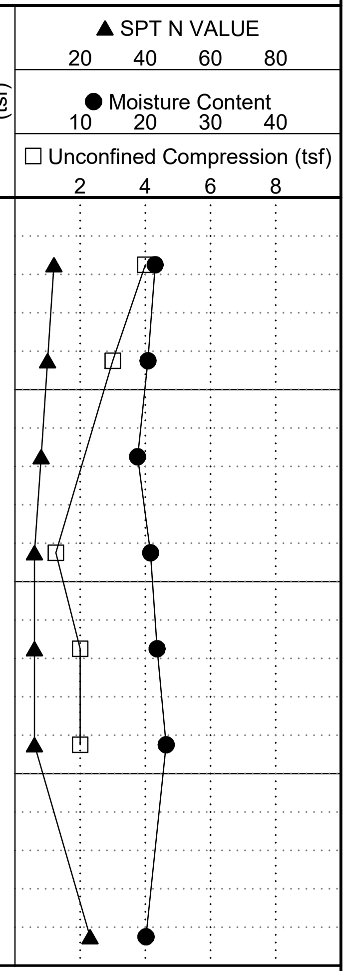
Bottom of borehole at 20.0 feet.

GSG CONSULTANTS, INC.
735 Remington Road, Schaumburg, IL 60173
Tel: 630.994.2600, www.gsg-consultants.com

BORING NUMBER B-5

CLIENT Tilton, Kelly + Bell, LLC
PROJECT NAME IDOT Hanley Building Complex
PROJECT NUMBER 21-2106
PROJECT LOCATION 2300 S. Dirksen Parkway, Springfield, IL
DATE STARTED 6/27/22 **COMPLETED** 6/27/22
GROUND ELEVATION 584.50 ft **HOLE SIZE** 3 1/4"
DRILLING CONTRACTOR GSG Drilling
GROUND WATER LEVELS:
DRILLING METHOD Hollow Stem Auger
AT TIME OF DRILLING --- None
LOGGED BY KA **CHECKED BY** MH
AT END OF DRILLING --- N/A
NOTES Drill rig: Diedrich D-50 ATV
AFTER DRILLING --- N/A

DEPTH (ft)	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY (%)	BLOW COUNTS (N VALUE)	UNCONFINED COMPRESSION (tsf)
0	2 inches of Topsoil				
	SILTY CLAY (CL/ML) - Brown - Very Stiff - Moist	SS 1	67	3-5-7 (12)	4.0
5		SS 2	67	3-4-6 (10)	3.0
	SILTY LOAM (ML) - Brown - Loose - Moist	SS 3	89	3-4-4 (8)	
10	SILTY CLAY, trace gravel (CL/ML) - Brown - Stiff to Very Stiff - Moist	SS 4	89	2-3-3 (6)	1.25
		SS 5	100	4-2-4 (6)	2.0
15		SS 6	100	3-3-3 (6)	2.0
20	SILT, trace gravel (ML) - Brown - Medium Dense - Very Moist	SS 7	100	3-9-14 (23)	



Bottom of borehole at 20.0 feet.

BORING NUMBER B-6

GSG CONSULTANTS, INC.
735 Remington Road, Schaumburg, IL 60173
Tel: 630.994.2600, www.gsg-consultants.com

CLIENT Tilton, Kelly + Bell, LLC

PROJECT NAME IDOT Hanley Building Complex

PROJECT NUMBER 21-2106

PROJECT LOCATION 2300 S. Dirksen Parkway, Springfield, IL

DATE STARTED 6/29/22 **COMPLETED** 6/29/22

GROUND ELEVATION 588.00 ft **HOLE SIZE** 3 1/4"

DRILLING CONTRACTOR GSG Drilling

GROUND WATER LEVELS:

DRILLING METHOD Hollow Stem Auger

AT TIME OF DRILLING --- None

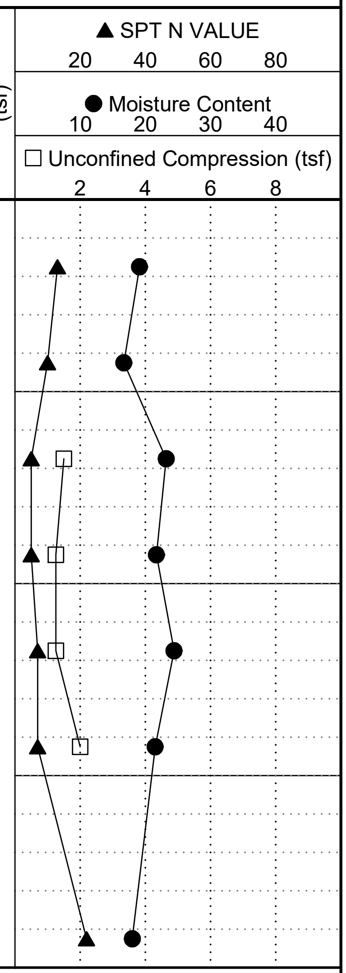
LOGGED BY KA **CHECKED BY** MH

AT END OF DRILLING --- N/A

NOTES Drill rig: Diedrich D-50 ATV

AFTER DRILLING --- N/A

DEPTH (ft)	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY (%)	BLOW COUNTS (N VALUE)	UNCONFINED COMPRESSION (tsf)
0	2 inches of Topsoil				
	SILTY LOAM (ML) - Brown - Loose to Medium Dense - Moist	SS 1	44	6-7-6 (13)	
5		SS 2	67	4-5-5 (10)	
	SILTY CLAY (CL/ML) - Brown and Gray - Stiff to Very Stiff - Moist	SS 3	89	2-3-2 (5)	1.5
10		SS 4	100	2-2-3 (5)	1.25
		SS 5	100	2-3-4 (7)	1.25
15		SS 6	100	2-3-4 (7)	2.0
20	SILT (ML) - Brown - Medium Dense - Moist	SS 7	100	4-10-12 (22)	



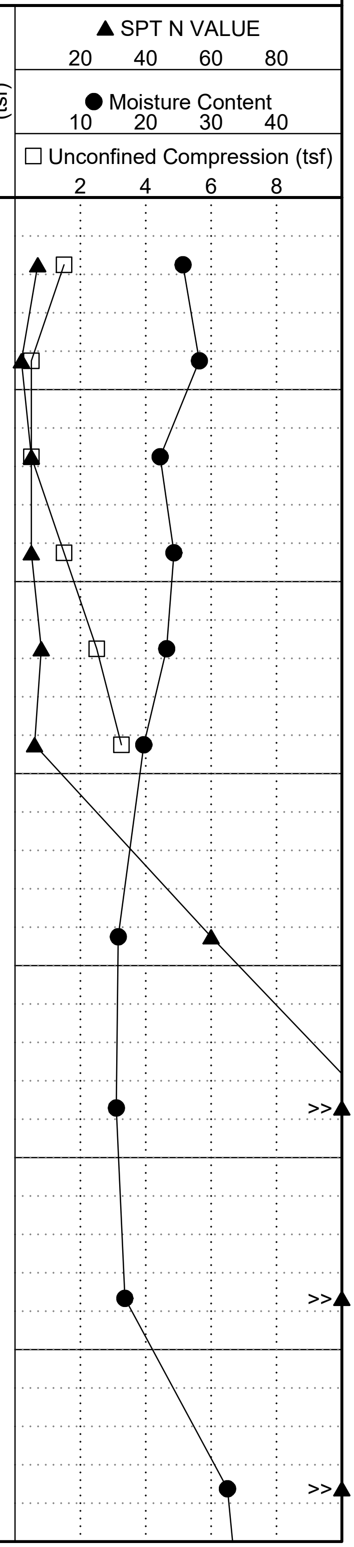
Bottom of borehole at 20.0 feet.

GSG CONSULTANTS, INC.
735 Remington Road, Schaumburg, IL 60173
Tel: 630.994.2600, www.gsg-consultants.com

BORING NUMBER B-7

CLIENT Tilton, Kelly + Bell, LLC
PROJECT NAME IDOT Hanley Building Complex
PROJECT NUMBER 21-2106
PROJECT LOCATION 2300 S. Dirksen Parkway, Springfield, IL
DATE STARTED 6/30/22 **COMPLETED** 6/30/22
GROUND ELEVATION 582.83 ft **HOLE SIZE** 3 1/4"
DRILLING CONTRACTOR GSG Drilling
GROUND WATER LEVELS:
DRILLING METHOD Mud Rotary
AT TIME OF DRILLING --- None
LOGGED BY KA **CHECKED BY** MH
AT END OF DRILLING --- N/A
NOTES Drill rig: Diedrich D-50 ATV
AFTER DRILLING --- N/A

DEPTH (ft)	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY (%)	BLOW COUNTS (N VALUE)	UNCONFINED COMPRESSION (tsf)
0	6 inches of Asphalt				
	SILTY CLAY (CL/ML) - Brown - Medium Stiff to Stiff - Moist to Very Moist	SS 1	44	2-3-4 (7)	1.5
5		SS 2	67	1-1-1 (2)	0.5
		SS 3	56	1-3-2 (5)	0.5
10		SS 4	100	2-2-3 (5)	1.5
	SILTY CLAY (CL/ML) - Brown and Gray - Very Stiff - Moist	SS 5	100	2-3-5 (8)	2.5
15		SS 6	100	2-2-4 (6)	3.25
	SILT, with shale (ML) - Gray- Very Dense - Moist to Very Moist	SS 7	100	19-29-31 (60)	
20					
		SS 8	100	50/5"	
25					
		SS 9	100	50/4"	
30					
35	Clay seam at 33.5 feet	SS 10	100	50/3"	



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GSG CONSULTANTS, INC.
735 Remington Road, Schaumburg, IL 60173
Tel: 630.994.2600, www.gsg-consultants.com

BORING NUMBER B-7

CLIENT Tilton, Kelly + Bell, LLC
PROJECT NAME IDOT Hanley Building Complex
PROJECT NUMBER 21-2106
PROJECT LOCATION 2300 S. Dirksen Parkway, Springfield, IL

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY (%)	BLOW COUNTS (N VALUE)	UNCONFINED COMPRESSION (tsf)	▲ SPT N VALUE (20 40 60 80) / ● Moisture Content (10 20 30 40) / □ Unconfined Compression (tsf) (2 4 6 8)
35		SILT, with shale (ML) - Gray- Very Dense - Moist to Very Moist *(continued)*					
40			SS 11	100	50/3"		>>▲

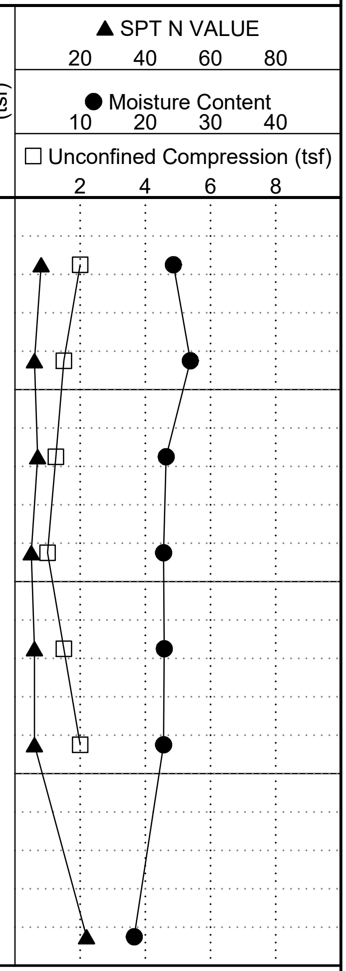
Bottom of borehole at 40.0 feet.

GSG CONSULTANTS, INC.
735 Remington Road, Schaumburg, IL 60173
Tel: 630.994.2600, www.gsg-consultants.com

BORING NUMBER B-8

CLIENT Tilton, Kelly + Bell, LLC	**PROJECT NAME** IDOT Hanley Building Complex
PROJECT NUMBER 21-2106	**PROJECT LOCATION** 2300 S. Dirksen Parkway, Springfield, IL
DATE STARTED 6/28/22 **COMPLETED** 6/28/22	**GROUND ELEVATION** 583.71 ft **HOLE SIZE** 3 1/4"
DRILLING CONTRACTOR GSG Drilling	**GROUND WATER LEVELS:**
DRILLING METHOD Hollow Stem Auger	▽ **AT TIME OF DRILLING** 18.50 ft / Elev 565.21 ft
LOGGED BY KA **CHECKED BY** MH	**AT END OF DRILLING** --- N/A
NOTES Drill rig: Diedrich D-50 ATV	**AFTER DRILLING** --- N/A

DEPTH (ft)	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY (%)	BLOW COUNTS (N VALUE)	UNCONFINED COMPRESSION (tsf)
0	3 inches of Topsoil				
	CLAY (CL) - Brown - Stiff to Very Stiff - Moist to Very Moist	SS 1	44	3-4-4 (8)	2.0
5		SS 2	100	2-3-3 (6)	1.5
		SS 3	100	1-3-4 (7)	1.25
10		SS 4	100	1-2-3 (5)	1.0
		SS 5	100	2-3-3 (6)	1.5
15		SS 6	100	2-3-3 (6)	2.0
	▽ SILT (ML) - Brown - Medium Dense - Moist Sand seam at 18.5 feet	SS 7	100	3-8-14 (22)	
20	Bottom of borehole at 20.0 feet.				

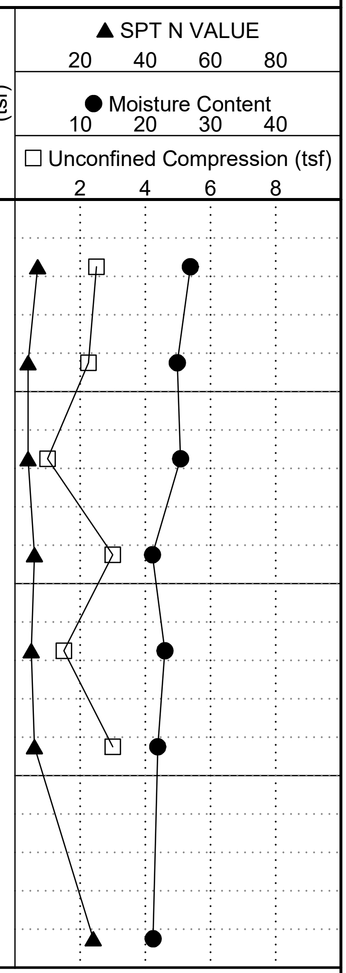


BORING NUMBER B-9

GSG CONSULTANTS, INC.
735 Remington Road, Schaumburg, IL 60173
Tel: 630.994.2600, www.gsg-consultants.com

CLIENT Tilton, Kelly + Bell, LLC
PROJECT NAME IDOT Hanley Building Complex
PROJECT NUMBER 21-2106
PROJECT LOCATION 2300 S. Dirksen Parkway, Springfield, IL
DATE STARTED 6/28/22 **COMPLETED** 6/28/22
GROUND ELEVATION 585.07 ft **HOLE SIZE** 3 1/4"
DRILLING CONTRACTOR GSG Drilling
GROUND WATER LEVELS:
DRILLING METHOD Hollow Stem Auger
▽ **AT TIME OF DRILLING** 6.00 ft / Elev 579.07 ft
LOGGED BY KA **CHECKED BY** MH
AT END OF DRILLING --- N/A
NOTES Drill rig: Diedrich D-50 ATV
AFTER DRILLING --- N/A

DEPTH (ft)	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY (%)	BLOW COUNTS (N VALUE)	UNCONFINED COMPRESSION (tsf)
0	2 inches of Topsoil				
	SILTY CLAY (CL/ML) - Brown - Stiff to Very Stiff - Moist to Very Moist	SS 1	67	2-3-4 (7)	2.5
5		SS 2	100	2-3-1 (4)	2.25
	▽	SS 3	100	1-2-2 (4)	1.0
10		SS 4	100	2-3-3 (6)	3.0
		SS 5	100	2-2-3 (5)	1.5
15		SS 6	100	2-3-3 (6)	3.0
20	SILT (ML) - Brown - Medium Dense - Very Moist	SS 7	100	4-9-15 (24)	



Bottom of borehole at 20.0 feet.

BORING NUMBER PB-1

GSG CONSULTANTS, INC.
735 Remington Road, Schaumburg, IL 60173
Tel: 630.994.2600, www.gsg-consultants.com

CLIENT Tilton, Kelly + Bell, LLC

PROJECT NAME IDOT Hanley Building Complex

PROJECT NUMBER 21-2106

PROJECT LOCATION 2300 S. Dirksen Parkway, Springfield, IL

DATE STARTED 6/29/22 **COMPLETED** 6/29/22

GROUND ELEVATION 578.00 ft **HOLE SIZE** 3 1/4"

DRILLING CONTRACTOR GSG Drilling

GROUND WATER LEVELS:

DRILLING METHOD Hollow Stem Auger

AT TIME OF DRILLING --- None

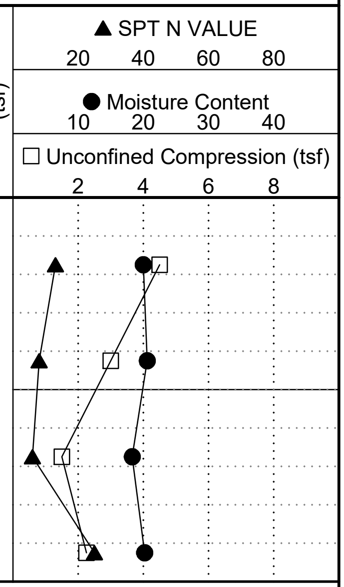
LOGGED BY KA **CHECKED BY** MH

AT END OF DRILLING --- N/A

NOTES Drill rig: Diedrich D-50 ATV

AFTER DRILLING --- N/A

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY (%)	BLOW COUNTS (N VALUE)	UNCONFINED COMPRESSION (tsf)
0		2 inches of Topsoil				
		SILTY CLAY (CL/ML) - Brown and Gray - Stiff to Hard - Moist				
			SS 1	39	4-6-7 (13)	4.5
5			SS 2	67	3-3-5 (8)	3.0
			SS 3	100	2-3-3 (6)	1.5
10			SS 4	44	3-10-15 (25)	2.25



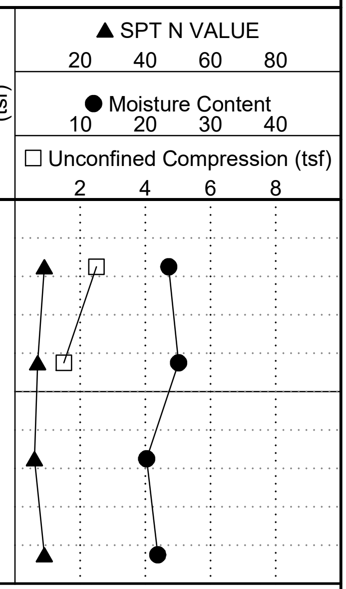
Bottom of borehole at 10.0 feet.

BORING NUMBER PB-2

GSG CONSULTANTS, INC.
735 Remington Road, Schaumburg, IL 60173
Tel: 630.994.2600, www.gsg-consultants.com

CLIENT Tilton, Kelly + Bell, LLC
PROJECT NAME IDOT Hanley Building Complex
PROJECT NUMBER 21-2106
PROJECT LOCATION 2300 S. Dirksen Parkway, Springfield, IL
DATE STARTED 6/28/22 **COMPLETED** 6/28/22
GROUND ELEVATION 584.68 ft **HOLE SIZE** 3 1/4"
DRILLING CONTRACTOR GSG Drilling
GROUND WATER LEVELS:
DRILLING METHOD Hollow Stem Auger
AT TIME OF DRILLING --- None
LOGGED BY KA **CHECKED BY** MH
AT END OF DRILLING --- N/A
NOTES Drill rig: Diedrich D-50 ATV
AFTER DRILLING --- N/A

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY (%)	BLOW COUNTS (N VALUE)	UNCONFINED COMPRESSION (tsf)
0		2 inches of Topsoil				
		CLAY (CL) - Brown - Very Stiff to Stiff - Moist to Very Moist	SS 1	67	3-4-5 (9)	2.5
5			SS 2	89	2-4-3 (7)	1.5
		SILT (ML) - Light Brown - Loose - Very Moist	SS 3	100	3-3-3 (6)	
10			SS 4	100	2-4-5 (9)	



Bottom of borehole at 10.0 feet.

BORING NUMBER PB-3

GSG CONSULTANTS, INC.
735 Remington Road, Schaumburg, IL 60173
Tel: 630.994.2600, www.gsg-consultants.com

CLIENT Tilton, Kelly + Bell, LLC

PROJECT NAME IDOT Hanley Building Complex

PROJECT NUMBER 21-2106

PROJECT LOCATION 2300 S. Dirksen Parkway, Springfield, IL

DATE STARTED 6/28/22 **COMPLETED** 6/28/22

GROUND ELEVATION 574.00 ft **HOLE SIZE** 3 1/4"

DRILLING CONTRACTOR GSG Drilling

GROUND WATER LEVELS:

DRILLING METHOD Hollow Stem Auger

AT TIME OF DRILLING --- None

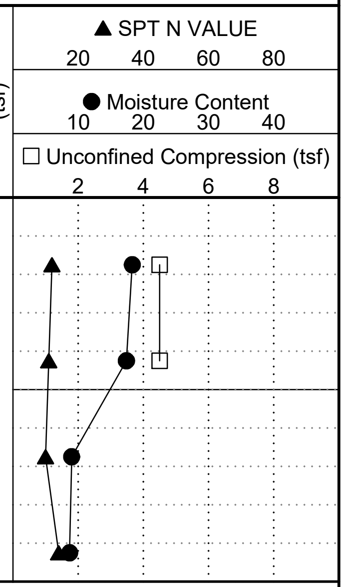
LOGGED BY KA **CHECKED BY** MH

AT END OF DRILLING --- N/A

NOTES Drill rig: Diedrich D-50 ATV

AFTER DRILLING --- N/A

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY (%)	BLOW COUNTS (N VALUE)	UNCONFINED COMPRESSION (tsf)
0		2 inches of Topsoil				
		SILTY CLAY (CL/ML) - Brown - Hard - Moist	SS 1	56	4-5-7 (12)	4.5
5			SS 2	67	4-5-6 (11)	4.5
		SILT (ML) - Light Brown - Loose to Medium Dense - Moist	SS 3	67	4-5-5 (10)	
10			SS 4	67	4-7-7 (14)	



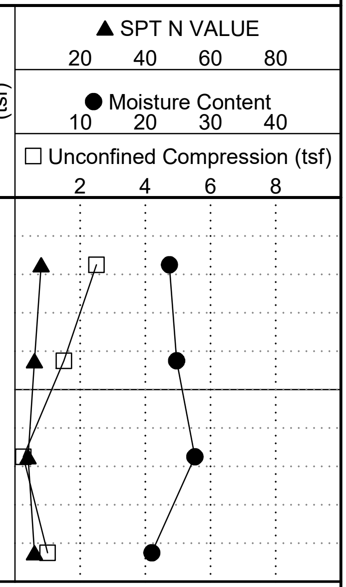
Bottom of borehole at 10.0 feet.

BORING NUMBER PB-4

GSG CONSULTANTS, INC.
735 Remington Road, Schaumburg, IL 60173
Tel: 630.994.2600, www.gsg-consultants.com

CLIENT Tilton, Kelly + Bell, LLC
PROJECT NAME IDOT Hanley Building Complex
PROJECT NUMBER 21-2106
PROJECT LOCATION 2300 S. Dirksen Parkway, Springfield, IL
DATE STARTED 6/28/22 **COMPLETED** 6/28/22
GROUND ELEVATION 584.00 ft **HOLE SIZE** 3 1/4"
DRILLING CONTRACTOR GSG Drilling
GROUND WATER LEVELS:
DRILLING METHOD Hollow Stem Auger
AT TIME OF DRILLING --- None
LOGGED BY KA **CHECKED BY** MH
AT END OF DRILLING --- N/A
NOTES Drill rig: Diedrich D-50 ATV
AFTER DRILLING --- N/A

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY (%)	BLOW COUNTS (N VALUE)	UNCONFINED COMPRESSION (tsf)
0		2 inches of Topsoil				
		SILTY CLAY (CL/ML) - Brown - Soft to Very Stiff - Moist to Very Moist	SS 1	56	3-3-5 (8)	2.5
5			SS 2	89	2-2-4 (6)	1.5
			SS 3	100	1-2-2 (4)	0.25
10			SS 4	100	1-2-4 (6)	1.0
		Bottom of borehole at 10.0 feet.				

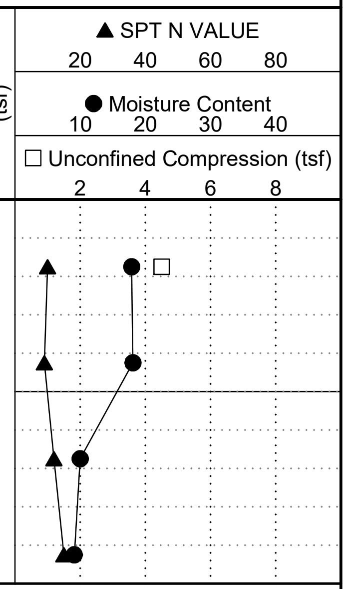


GSG CONSULTANTS, INC.
735 Remington Road, Schaumburg, IL 60173
Tel: 630.994.2600, www.gsg-consultants.com

BORING NUMBER PB-5

CLIENT	Tilton, Kelly + Bell, LLC	**PROJECT NAME**	IDOT Hanley Building Complex
PROJECT NUMBER	21-2106	**PROJECT LOCATION**	2300 S. Dirksen Parkway, Springfield, IL
DATE STARTED	6/28/22 **COMPLETED** 6/28/22	**GROUND ELEVATION**	580.00 ft **HOLE SIZE** 3 1/4"
DRILLING CONTRACTOR	GSG Drilling	**GROUND WATER LEVELS:**	
DRILLING METHOD	Hollow Stem Auger	**AT TIME OF DRILLING**	--- None
LOGGED BY	KA **CHECKED BY** MH	**AT END OF DRILLING**	--- N/A
NOTES	Drill rig: Diedrich D-50 ATV	**AFTER DRILLING**	--- N/A

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY (%)	BLOW COUNTS (N VALUE)	UNCONFINED COMPRESSION (tsf)
0		2 inches of Topsoil				
		SILTY CLAY (CL/ML) - Brown - Hard - Moist	SS 1	67	5-4-6 (10)	4.5
5		SILT (ML) - Brown - Loose to Medium Dense - Moist	SS 2	67	4-4-5 (9)	
			SS 3	89	3-6-6 (12)	
10			SS 4	89	5-8-7 (15)	



Bottom of borehole at 10.0 feet.

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Unified Soil Classification

Soil Classification is based on the Unified Soil Classification System and ASTM Designations D-2487 and D-2488. Coarse Grained Soils have more than 50% of their dry weight retained on a #200 sieve; they are 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 basis of their relative in-place density and fine grained soils on the basis of their consistency. Example: Lean clay with sand, trace gravel, stiff (CL); silty sand, trace gravel, medium dense (SM).

Drilling & Sampling Symbols

SS : Split Spoon
ST : Thin-Walled Tube
HA: Hand Auger
AU: Auger Sample
HS: Hand Sample

Water Level (ft)

▽ While Drilling
▽ After Drilling
▼ 24-hour

Standard "N" Penetration: Blows per foot of a 140 pound hammer falling 30 inches on a 2 inch OD split spoon, except where noted.

Major Divisions			Group Symbols	Typical Names
Coarse Grained Soils (More than Half of material is larger than No. 200 sieve size)	**Gravels** (More than hall of coarse fraction is larger than No. 4 sieve size)	**Clean Gravels** (Little or no fines)	GW	Well graded gravels, gravel-sand mixtures, little or no fines
			GP	Poorly graded gravels, gravel-sand mixtures, little or no fines
		Gravels with fines (Appreciable amount of fines)	GM d / u	Silty gravels, gravel-sand-clay mixtures
			GC	Clayey gravels, gravel-sand-clay mixtures
	Sands (More than hall of coarse fraction is smaller than No. 4 sieve size)	**Clean Sands** (Little or no fines)	SW	Well graded sands, gravelly sands, little or no fines
			SP	Poorly graded sands, gravelly sands, little or no fines
		Sands with fines (Appreciable amount of fines)	SM d / u	Silty sands, sand-silt mixtures
			SC	Clayey sands, sand-clay mixtures
Fine Grained Soils More than half of material is smaller than No. 200 sieve size)	**Silts and Clays** (liquid limit less than 50)		ML	Inorganic silts and very fine sands, rock flour, silty or claye fine sands or clayey silts with slight plasticity
			CL	Inorganic clay of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
			OL	Organic silts and organic silty clays of low plasticity
	Silts and Clays (liquid limit greater than 50)		MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts
			CH	Inorganic clays of high plasticity, fat clays
			OH	Organic clays of medium to high plasticity, organic silts
	Highly Organic Soils		Pt	Peat and other highly organic soils

Consistency of Cohesive Soil

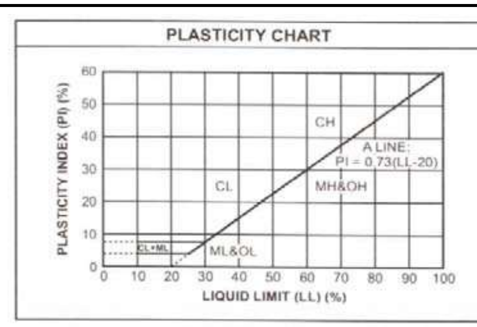
Unconfined Compressive strength, Qu, tsf	N-Blows/ft.	Consistency
< 0.25	Below 2	< Very Soft
0.25 - 0.50	2-4	- Soft
0.50 - 1.0	4-8	- Medium Stiff
1.0 - 2.0	8-15	- Stiff
2.0 - 4.0	15-30	- Very Stiff
4.0 - 8.0	30-50	- Hard
> - 8.0	> 50	- Very Hard

Relative Density of Coarse-Grained Soils

N-Blows/ft.	Relative Density
0-3	Very Loose
4-10	Loose
11-29	Medium Dense
30-49	Dense
50-80	Very Dense
>80	Extremely Dense

Description Term(s) of Components Present in Sample

Trace < 10%	Little 10-19%
Some 20-34%	And 35-50%



APPENDIX C

LABORATORY TEST RESULTS

GSG CONSULTANTS, INC.

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Schaumburg, IL 60173
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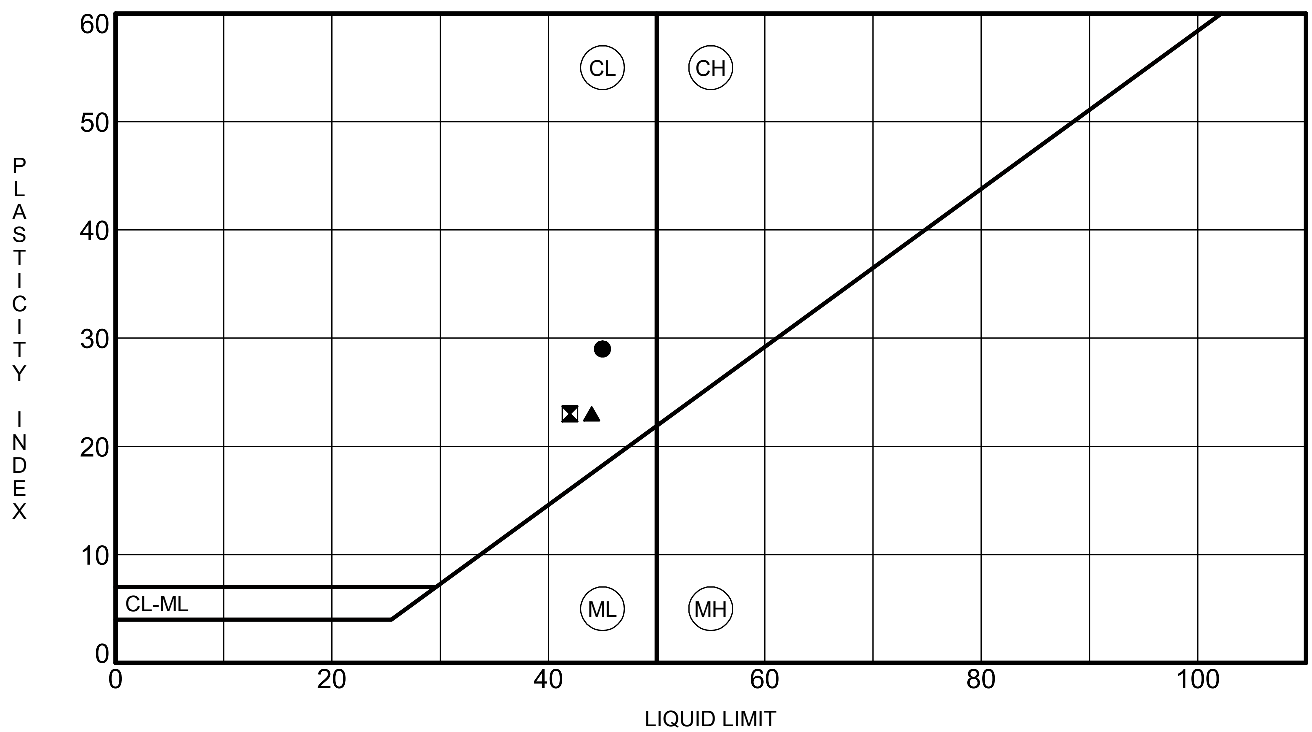
www.gsg-consultants.com

Table C1 –Dry Unit Weight Results

Boring ID	Sample Depth (ft)	Dry Unit Weight (pcf)	Wet Unit Weight (pcf)	Soil Classification
B-2	6.0-7.5	102.2	125.7	CL
B-8	3.5-5.0	99.1	124.3	CL
PB-2	3.5-5.0	95.4	119.3	CL



	Specimen Identification		LL	PL	PI	Fines	Classification
●	**B-2**	**6.00**	**45.0**	**16.0**	**29.0**		
⧗	**B-8**	**3.50**	**42.0**	**19.0**	**23.0**		
▲	**PB-2**	**3.50**	**44.0**	**21.0**	**23.0**		

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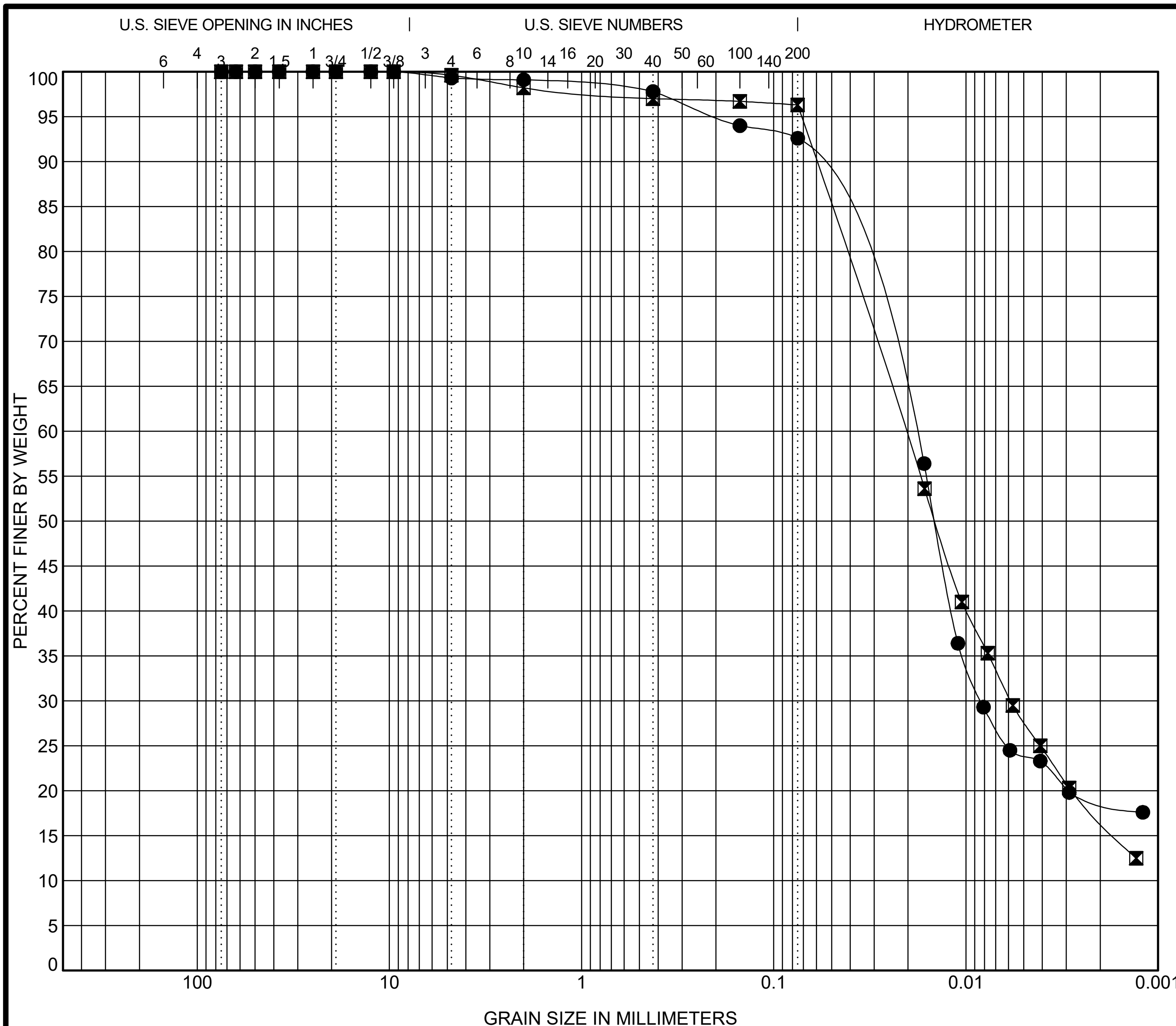
ATTERBERG LIMITS RESULTS

Project No: 21-2106

Section: IDOT Materials Lab and Training Center

Location: Springfield, IL



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	**B-5**	**6.00**	**SILTY LOAM**					
⊠	**B-6**	**18.50**	**SILTY LOAM**					

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**B-5**	**6.00**		**0.019**	**0.008**		**0.7**	**6.7**	**73.7**	**18.9**
⊠	**B-6**	**18.50**		**0.021**	**0.006**		**0.4**	**3.3**	**79.6**	**16.7**

GSG CONSULTANTS, INC.
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GRAIN SIZE DISTRIBUTION

Project No.: 21-2106

Section: IDOT Materials Lab and Training Center

Location: Springfield, IL