EARTH SCIENCE ENGINEERING, LLC
201 West Dunbar Cave Road
Clarksville, TN 37040
931-645-8008 Fax: 931-645-0180

Wednesday, August 12, 2020

J Clark Architecture Design
Attn. Mr. Jon Clark, AIA, NCARB
55 North 1st Street, Suite 300
Clarksville, TN 37040
jon@jclarkarchitecture.com

RE: **Hopkinsville Industrial Spec Building**
Hopkinsville, Christian County, Kentucky
ESE Project No.: 08416

Dear Mr. Clark:

Per our July 9, 2020 proposal and project authorization and notice to proceed via executed proposal on July 10, 2020, Earth Science Engineering, LLC (ESE) is pleased to submit these subsurface investigation results and foundation recommendations for your Hopkinsville Industrial Spec Building in Hopkinsville, Christian County, Kentucky. Included are the results of the exploration, boring logs, a boring location plan, and ESE's conclusions and recommendations.

Background: It is understood a single level industrial building with a plan area on the order of 101,000 square feet is planned at the site. Pre-engineered metal construction is assumed.

Structural loading information has not been provided. For the purpose of this report, maximum column loads of 150 kips and maximum wall loads of 6 kips per linear foot of wall are assumed. No basements or other below ground construction are expected.

Site grading information has been assumed to require less than three feet of cut or fill to achieve design subgrade elevation for the new building.

In addition to the proposed building construction, new concrete drive/parking areas are planned. Although detailed traffic loading information has not been provided to ESE, it is understood that vehicle loading will be primarily automobile traffic with bus/truck traffic in designated areas only.

Soil Sampling: In order to investigate the subsurface conditions at the site, ESE performed six geotechnical soil borings. The borings were performed in locations staked in the field by ESE representatives via the project site plan and hand held GPS coordinates.

The soil borings were advanced to the point of auger refusal, ranging from approximately 9 to 17 feet below the ground surface.

The soil borings were performed with ESE's track-mounted rotary drill rig, Model 6620DT, manufactured by Geoprobe, Inc.. The borings were advanced with 2.25 inch inside diameter hollow stem augers.

At preselected intervals throughout the boring depths, soil samples were recovered with a two inch O.D. split spoon sampler in accordance with the Standard Penetration Test (ASTM D 1586). The Standard Penetration Test consists of the measurement of the number of blows with a 140 pound hammer that is required to drive the split spoon sampler into the soil. Each test involves three 6 inch increments which comprise a total length of 18 inches. The values (blow counts) for the second and third increments are added together, designating the N-value for the respective soil sample.

Upon completion of auguring, water level observations were made in all borings. After drilling, the borings were back filled with soil cuttings. It should be noted that, over time, the cuttings may settle and leave a void at the surface, requiring corrective measures by the Client.

Laboratory Testing: The soil samples recovered during the field exploration were transported to the ESE soils laboratory where they were examined and visually classified by an experienced laboratory technician under the direction of a registered professional engineer. All soil samples were tested for natural moisture content (ASTM D 2216). Four select samples were tested for Atterberg limits (ASTM D 4318).

Additionally, unconfined compressive strengths were determined on several samples with the use of a RIMAC® field test device. The RIMAC® device consists of a calibrated spring apparatus which measures ultimate load to axial failure versus overall strain of the sample.

All laboratory testing results are shown on the attached subsurface exploration logs and laboratory data sheets. It should be noted that transitions between the soil types can be more gradual than shown on the logs. Those portions of the soil samples not altered by testing will be retained for 60 days after submittal of this report, at which time they will be discarded unless ESE is instructed otherwise.

Subsurface Description: Based on drill crew observations, approximately eight inches of topsoil were noted at the surface of all the borings; except for boring H-4 were three inches gravel and seven inches of topsoil were observed.

Below the surficial materials noted above, the subsurface soils consist of varying layers of generally brown to brownish red silty to moderately plastic clays. The soils underlain by these clays consist of tan to brown high plasticity clay soils in borings H-1, H-2, H-4, and H-5. Soil plasticity tends to increase with depth. Soils that are visually indicative of fill were encountered in all the borings performed on the project site.

VERY SOFT, SOFT, and lower strength (firm) soils were encountered in several of the borings as shown in the table below. Auger refusal was encountered at each boring also as shown below:

Boring	Depth of Lower Strength (firm) Soils	Depth of SOFT/VERY SOFT Soils	Approximate Fill Depth (ft.)	Refusal Depth (ft.)
H-1	0 to 8 feet	13.5-15 feet	6	15.1
H-2	0 to 3 feet; 6 to 7.5 feet	-	8	15
H-3	-	-	9	9
H-4	0 to 3 feet; 6 to 7.5 feet; 13.5 to 15 feet	-	8	13.5
H-5	0 to 6 feet	6 to 7.5 feet	12	17
H-6	0 to 3 feet; 6 to 7.5 feet; 13.5 to 15 feet	-	12	17

No free water was noted in any of the borings during drilling and the holes were dry at completion.

These soils are classified as CL (low plasticity silty clay), CL-CH (moderately plastic clay), and CH (highly plastic clay) in general accordance with the Unified Soil Classification System (USCS). FL is used to designate those soils that are visually indicative of fill.

Conclusions:

Sinkholes Bedrock in the general project area is susceptible to solutioning and sinkhole formation. Known as karst terrain, the bedrock is often very pinnacled and can be very weathered at the bedrock surface. Sinkholes typically occur due to collapse of subsoil caused by fluctuating groundwater levels in the bedrock and/or near the soil-bedrock interface. Groundwater can be influenced by a multitude of factors including precipitation variations and changes in surface drainage patterns. In many instances, modifications to surface drainage patterns at one site can affect subsurface drainage conditions at other properties. There are many publications about sinkholes and karst terrain. One excellent publication with numerous photographs and diagrams is *Building on Sinkholes* by George F. Sowers.

It is noted that, due to the characteristics of karst terrain, the risk of future sinkhole development is an inherent risk builders and owners assume when building in the general project area. This risk can be effectively eliminated through the use of structural slabs and foundations supported on micro piles which have been grouted into competent bedrock or caissons socketed into previously explored and verified sound bedrock. Other measures, including grouting programs can be effective in reducing future sinkhole risk. Such foundations and techniques are expensive and are typically cost-prohibitive for many developments. Therefore, Owners are often willing to tolerate this potential risk.

Review of available USGS topographical mapping does not indicate any mapped closed depressions (likely sinkholes) within the proposed development area. Additionally, no apparent voids or sudden drop of the drilling tools were noted during the field exploration. Although sporadic closed depressions are depicted in the general project area, the absence of closed depressions on the site combined with the information obtained from the borings indicates the site is at typical, not elevated, risk for sinkhole related conditions.

Foundations Based on the field and laboratory test results, it appears as though the site can be utilized for the anticipated construction with the preferred method of shallow footing foundations. It is noted the majority of the soils encountered in the borings are marginal to moderate in strength.

The near surface marginal strength soils identified at five of the six borings do not appear readily able to receive any necessary fill. For this reason, some over excavation and replacement of the near surface soils prior to fill placement and compaction may be necessary for successful fill placement and compaction, especially depending upon the weather conditions at the time. The vertical and horizontal extent of soil removal can be better defined by observing proof rolling and backhoe pits after topsoil stripping is complete.

The near surface soils, due to their more silty nature and sensitivity to increased moisture, can prove problematic during site grading activities and shallow foundation construction. If site grading is performed during the wet season or after significant rainfall, additional undercutting may be necessary. In general, the need for undercutting activities is reduced if site grading is performed during the dry season. Likewise, more undercutting can be expected if grading is performed during periods of wet weather (typically November through May).

Recommendations: Based on the information obtained from the soil borings performed at the site, the following recommendations are provided. As is the case of all construction projects, actual subsurface conditions can differ from that indicated by soil borings or other investigative methods during grading and foundation construction. If such different conditions become apparent, ESE should be notified so that our recommendations can be reviewed and revised, if necessary.

Sinkhole Risk The risk for sinkhole development is ultimately the Owner's to accept. The risk for future sinkhole development difficulties can be reduced, but not eliminated, by following the recommended steps:

- Careful design planning on the part of the Owners and project designers
- Thoroughly investigating site subsurface conditions for the presence of soils that are potentially indicative of sinkhole conditions.
- Adequately draining developments so that water is not allowed to pond at the ongoing construction project and at the site when construction is complete.
- Providing adequate roof drainage on the finished structure.
- Limiting deeper excavations where possible (as in the case of subsurface storm water detention, manholes, etc.).
- Maintaining a sinkhole endorsement on insurance policies for buildings and other improvements. (We would also recommend earthquake coverage on all insurance policies).

Treatment of any on-site sinkholes should be performed in accordance with applicable State and Federal regulations. If voids or dropouts are discovered during site grading, ESE should be contacted for evaluation and recommendations regarding sinkhole repair.

Shallow Foundations Foundations should be designed to bear at a minimum depth of 24 inches below exterior grade for frost protection. Interior footings may bear at depths of 18 inches provided the bearing soil is not disturbed by construction traffic.

Based on soil data from borings H-2 and H-4, foundations bearing on firm or stronger soils and/or structural fill compacted to at least 95% Standard Proctor can be designed not to exceed the following:

Allowable Bearing Capacity

Columns (dead load and design live load)	2,700 psf
Strip (dead load and design live load)	2,250 psf
Maximum allowable passive resistance	1,300 psf
Friction coefficient (between soil and concrete)	0.35
Allowable side adhesion	545 psf

The values in the above table include a safety factor of 3 for allowable bearing capacity and a safety factor of 2 for allowable passive resistance. A safety factor of 1.5 has been applied to side adhesion.

The allowable bearing capacity values include dead load and design live load considerations. The top 18 inches, due to the potential for disturbance during construction, should be neglected when calculating passive resistance and side adhesion. All foundations should be sized and design by structural analysis. In order to reduce the potential for differential settlements, it is recommended that, as practically possible, all column footings be designed at the same allowable column bearing pressure and all wall footings be designed at the same allowable wall bearing pressure.

If it is necessary to leave footings open overnight, they should be covered and the ground surface along the sides of the footings sloped away from the inside of the footing excavation. Footings should not be placed in standing water or on frozen ground. The bearing surface of the footings should be cleaned of loose soil which may have been disturbed during excavation or sloughed during reinforcing steel placement.

Due to the potential for isolated soft soil zones at the site, it is recommended that all footing excavations be observed by a representative of the Project Geotechnical Engineer to verify the condition of the bearing soils. Any unstable pockets within the footings should be excavated to a depth and extent determined by the Engineer and back filled with Engineer recommended compacted structural fill, gravel, or concrete.

Grading Based on the surface material measurements obtained by the drill crew, stripping of at least 12 inches of topsoil is suggested for the project.

The location of any underground utilities in the building area should be verified. The top nine inches of exposed subgrade, after cutting to desired subgrade elevation and/or before placement of fill, should be scarified and recompacted to the compaction requirements outlined in the table below*.

After stripping, and before placement of any structural fill and prior to foundation construction, the entire building area (and drive/parking areas) should be proof rolled as practically possible with a fully loaded rubber tired dump truck under the direction and observation of a representative of the project Geotechnical Engineer. If proof rolling is not practical, the exposed subgrade should be observed with a probe rod and as otherwise deemed necessary by the Engineer. Based on these observations, it may become necessary to excavate several shallow back hoe test pits for additional observations or perform localized undercutting in which unsuitable soils are excavated from the subgrade and replaced with compacted structural fill.

It is recommended that structural fill be placed in nine inch or thinner loose lifts and be compacted to no less than the following percentages shown below of the Standard Proctor maximum dry density (ASTM D 698) at moisture contents within two percent (+ or -) of the optimum value.

Area	Minimum Compaction, %
Beneath buildings (foundations and slabs)	95
Beneath Pavements and exterior concrete	95
Top 9" of existing subgrade beneath buildings, pavements, and exterior concrete (scarify & compact)*	95
Landscaping and other non essential areas	85

Structural fill should be free of organic or other deleterious materials and have a maximum particle size less than four inches. Fine-grained structural fill obtained from off-site sources should have a PI between 15 and 28. Variations of the structural fill properties may be permitted after review and approval by ESE.

Those on-site soils which are free of any debris or organics may be used as structural fill at the discretion of the Geotechnical Engineer. Generally, reddish soils can be expected to perform better than brownish silty soils. Due to the moisture contents of these soils being slightly higher than what would typically be the soils' optimum moisture content(s), aeration and/or additional compactive effort of the excavated soils will likely be required before the recommended compaction can be achieved.

Slopes Fill slopes should be designed for a 3H:1V or flatter slope angle unless a site specific slope stability analysis is performed. Fill should extend horizontally a minimum of four feet (or 3 x the adjacent wall footing width, whichever is greater) beyond the building/structure perimeter prior to sloping downward. Measures should be incorporated into project design to limit erosion of slopes; including adequate piping and structures for roof and/or pavement drainage.

Slabs Based on the soil encountered at the boring locations and our past experience, a subgrade modulus no greater than 100 pci should be used for soil-supported slab design. It is recommended that a layer of crushed stone (no. 57 or similar) be placed beneath the soil-supported floor slab to enhance drainage and provide a uniform bearing surface for the floor slab concrete.

The thickness of the crushed stone layer is dependent upon the anticipated slab loading conditions and preference of the structural designer. However, ESE recommends that the layer be no less than four inches in thickness. Polyethylene sheeting should be placed beneath the floor slab to act as a moisture vapor retarder. The floor slab should have an adequate number of expansion joints and, where practical, should not be rigidly connected to foundations, walls, or columns.

Wall Design In order to facilitate drainage behind subsurface walls and minimize potential disturbance due to over compaction of fine-grained back fill soil, it is recommended that all back fill material for on-site walls be a free draining granular material with minimal fines (less than 15%). As a minimum, the zone of back fill should extend from the heel of the wall footing and slope at an angle of 60 degrees from the horizontal. The upper two feet of back fill should consist of a relatively low permeability fine-grained soil to minimize surface water infiltration. The placement of a woven filter fabric between the fine-grained soil and the granular material to prevent segregation of the fine-grained particles into the granular back fill is advised. A perimeter drainage system with piping, either gravity flow or a sump system pumps is recommended.

For design purposes, the unit weight of the granular back fill material can be taken as 135 pounds per cubic foot (pcf) or as determined by laboratory testing. Given that design of retaining walls can experience movement at the top, retaining walls can be treated under the active condition. Basement, foundation, or other subsurface walls, being fixed at the top, should be designed for the at-rest condition. The following table outlines recommended equivalent fluid pressures (EQFP) to be used for wall design:

Backslope (%)	EQFP (active), pcf	EQFP (at-rest), pcf
0	40	58
15	48	70
30	55	85
50	65	100

Seismic Site Class In order to determine seismic site class, ESE performed shear wave testing at the site via a refraction microtremor (referred to as ReMi).

ReMi provides an effective and efficient means to estimate shear wave velocity profiles and provide site-specific NEHRP and IBC Vs30 soil classification data. Testing is performed at the ground surface utilizing ambient seismic "noise" such as nearby roadways and foot traffic. It can be conducted in seismically noisy areas such as construction zones and urban environments. The data acquisition consists of setting up a linear array of geophones and recording ambient seismic "noise". A shear-wave dispersion curve is derived and used to model subsurface shear-wave velocity. The effective depth of investigation is related to the length of the geophone array and the frequency response of the measurement system. More information can be found at: www.ce.memphis.edu/7137/PDFs/ReMi/satish.pdf .

ReMi testing results indicate the site can be classified as seismic site class C. The ReMi test results are attached to this report.

Pavement Recommendations: Pavements for the project will be designed for automobile traffic with truck traffic in designated areas only. In the project area, both asphalt concrete and Portland cement concrete pavements are used successfully. Asphalt pavements typically have a lower initial cost than concrete but require more routine maintenance over the life of the asphalt pavement and, depending upon factors such as the contractor's expertise and weather, can be more difficult to control during construction.

When parking and drive areas are proof rolled, it may become apparent that undercutting of soils observed to deflect and rut under the load of the dump truck will be necessary for successful use of the design pavement sections. Please refer to the low strength soils identified in the table at the top of page 3 of this report. The actual depth of undercutting, if necessary, will be dependent upon the condition of the soils at the time and the thickness of structural fill (if any) necessary to achieve design subgrade.

In entrance and exit ways, loading areas, trash dumpster areas, tight turn areas, docks, and any other high traffic areas, the use of Portland cement concrete pavements is recommended. The concrete pavements should be sufficiently large enough to cover the area beneath the front wheels of the vehicle, particularly in trash dumpster area(s).

In the following sections, recommendations for both asphalt concrete and Portland cement pavements are presented:

Asphalt Pavements Based on the soils encountered at the site, assumed traffic conditions, and past experience, the following minimum pavement section is provided for regular duty asphalt paving (automobiles only - no trucks):

Wearing surface:	1 inch
Asphalt binder course:	2 inches
Dense graded aggregate: (95% Standard Proctor)	6 inches
Compacted fill or subgrade: (95% Standard Proctor)	9 inches

In any areas expected to receive more frequent passes and truck traffic, the following is recommended:

Wearing surface:	2 inches
Asphalt binder course:	3 inches
Dense graded aggregate: (95% Standard Proctor)	9 inches
Compacted fill or subgrade: (95% Standard Proctor)	9 inches

Concrete Pavements The following minimum section is provided for regular duty concrete paving (automobiles only):

Portland cement concrete:	4 inches
Dense graded aggregate: (95% Standard Proctor)	5 inches
Compacted fill or subgrade: (95% Standard Proctor)	9 inches

In areas to be frequented by trucks and designated for heavier traffic (including trucks), the regular duty concrete section above should be increased to:

Portland cement concrete:	6 inches
Dense graded aggregate: (95% Standard Proctor)	6 inches
Compacted fill or subgrade: (95% Standard Proctor)	9 inches

Pedestrian walks can be constructed as shown:

Portland cement concrete:	4 inches
Compacted subgrade (95% Standard Proctor)	9 inches

Design and Construction All paving, regardless of asphalt or concrete should conform to applicable sections of the *Kentucky Standard Specifications for Road and Bridge Construction*. Dense Graded Aggregate (DGA) as defined by Section 805 of the *Kentucky Standard Specifications for Road and Bridge Construction* may be used as aggregate base course.

Only asphalt with Kentucky Department of Transportation approved mix designs should be utilized. These typically include the following properties:

Wearing Surface		Asphalt Binder	
Marshall Stability:	1,200 lb.	Marshall Stability:	1,000 lb.
Percent Asphalt:	4-8 percent	Percent Asphalt:	3-7 percent
Voids Total Mix:	3-5 percent	Voids Total Mix:	3-7 percent

Concrete paving should be designed to attain a minimum compressive strength of 4000 psi at 28 days and be air entrained sufficiently (usually 4 to 6 percent) to improve durability. Concrete should be placed at slumps that will allow it to attain the recommended minimum strength. Additionally, concrete pavements should be designed with adequate reinforcing steel and joint spacing to prevent potential cracking and provide proper load distribution. As a minimum, wire mesh or fiber mesh should be utilized. In areas where heavy traffic is expected and other areas where trucks will turn sharply back and forth (such as loading docks and dumpster pads), reinforcement consisting of No. 4 bars on 14 inches centers should be used as reinforcement.

Proper drainage to eliminate water ponding in the pavement area is essential to long term pavement performance. Both the pavement surface and soil subgrade should be adequately sloped to prevent water from ponding on the pavement or ponding on the soil subgrade beneath the subgrade. Adequate drainage relief should be incorporated into the design to remove water from beneath the pavement area. In some cases, subsurface drains may be necessary.

The provided asphalt and concrete sections are minimums derived from a subgrade California Bearing Ratio (CBR) assumed from similar projects and past experience. Additionally, pavement loading information has been assumed from similar projects. Regular duty traffic area loading has been assumed to be 500 automobiles per day and daily heavy duty traffic has been assumed as 4 (16 kips) five axle trucks, 12 (16 kips) two axle vans, and 30 automobiles.

Thicker pavement sections would reduce the potential for pavement cracking and deformation and may be required depending on the actual traffic loading conditions (or local building code requirements).

Closure The findings presented in this report are derived from the soils encountered in the borings and information provided by representatives of J. Clark Architecture & Design. Should conditions during site development and construction activities differ from those discussed in this report, ESE should be contacted so that our recommendations can be reviewed and revised, if necessary.

All reports, drawings, specifications, computer files, field data, notes, and other documents and instruments prepared by ESE in the performance of this study are considered as instruments of service and remain the property of ESE. ESE retains all common law, statutory, and other reserved rights, including the copyright thereto.

ESE's scope of services did not include any environmental assessment for the presence or absence of hazardous or toxic materials in the soil or groundwater at or adjacent to the site studied. Additionally, ESE's services did not include the verification or delineation of any potential wetlands at the site. Any statements in this report or on the subsurface exploration logs concerning soil odors, colors, or other unusual conditions are strictly for the information of the client. Prior to purchase or development of this site, a thorough environmental assessment is recommended. ESE is available to assist with these services if desired.

This report may be distributed and relied upon by the Client. Reliance on the information and conclusions in this report by any other person or entity is not authorized without the written consent of Earth Science Engineering, LLC. Thank you for this opportunity to assist you with this project.

If you have any questions concerning this report or if ESE may be of further service in any manner, please do not hesitate to call 931-645-8008 or e-mail alice@eseng.us.

Respectfully submitted,

EARTH SCIENCE ENGINEERING, LLC

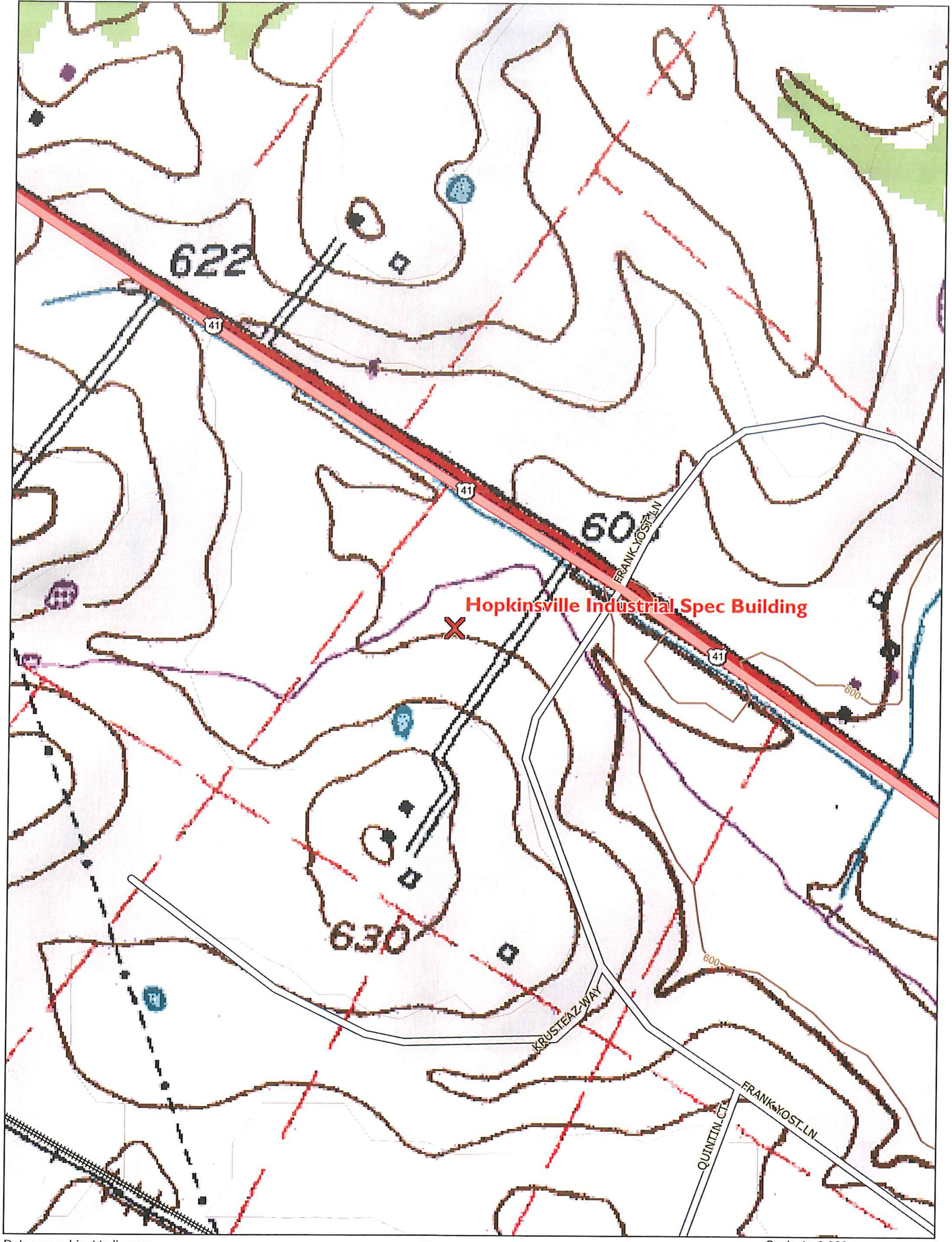
Shannon L. Medina

Christopher K. Casteel, P.E.

SLM/CKC/af

Attachments: USGS Topographical Map (1 page)
Aerial Photograph (1 page)
ReMi Shear Wave Results (1 page)
Boring Location Plan (1 page)
Boring GPS Coordinates (1 page)
Subsurface Exploration Log Key (1 page)
Subsurface Exploration Logs (6 pages)

DeLORME



TN
MN (3.7°W)

Scale 1 : 6,000

1" = 500.0 ft

Data Zoom 15-0


Frank Yost Ln
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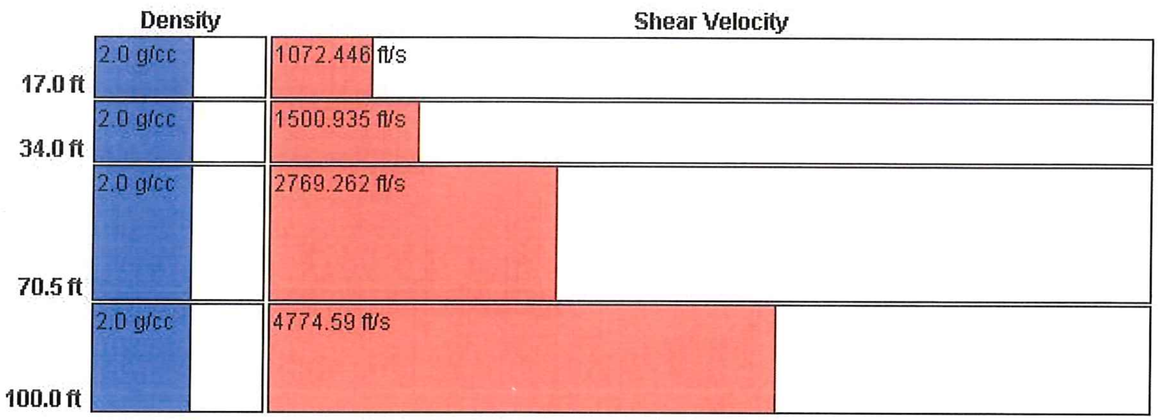
41

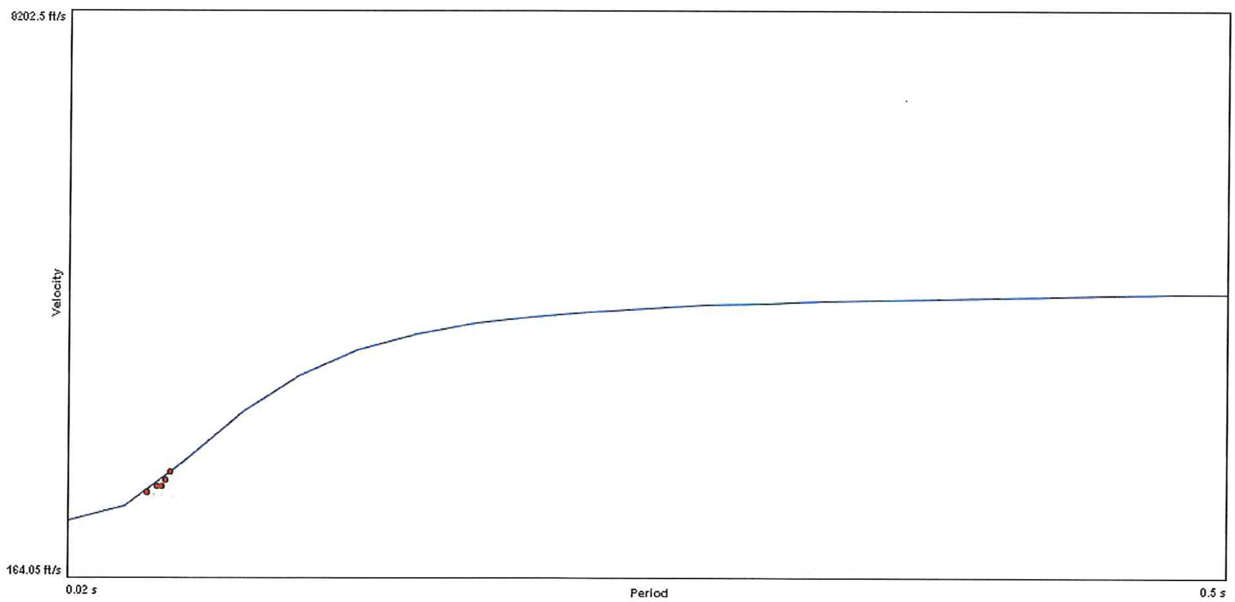
ReMi Testing Results

Project:	Hopkinsville Industrial Spec Building	Date:	August 2020
Client:	J Clark Architecture Desgin	Project no.:	‘08416
Weather:	Sunny, 82°	ESE Personnel:	SLM

Shear Velocity vs. Depth



Dispersion Curve



RMS Error: 31.571 ft/s
Vs = 2148.836 IBC Site Class C (IBC 2000 1615.1.1)

Calculated Avg. Shear Wave Velocity (feet/second):	2,148	Site Class (IBC):	C

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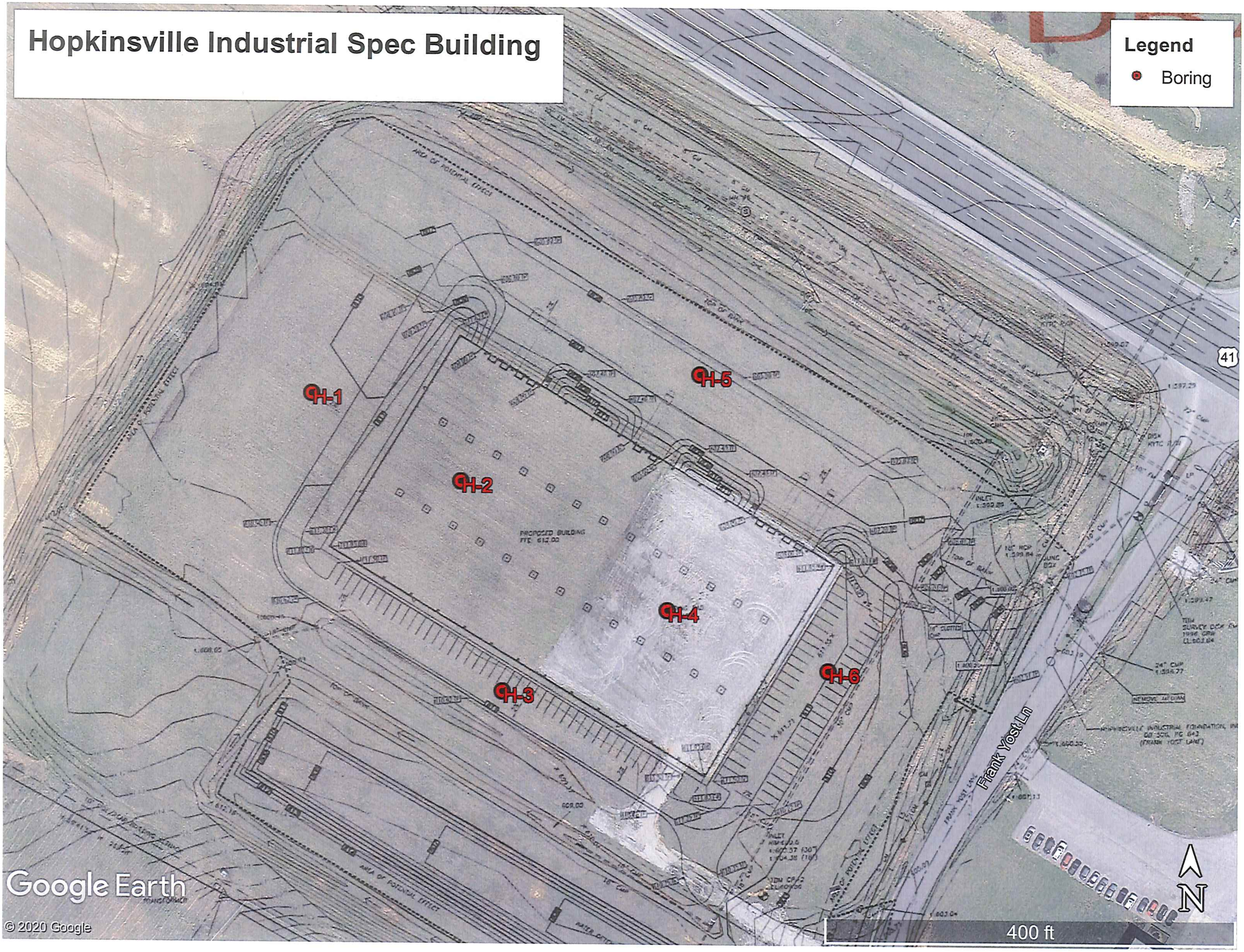
Hopkinsville Industrial Spec Building



Hopkinsville Industrial Spec Building

Boring	GPS Coordinates
H-1	36.802609°N, -87.392413°W
H-2	36.802375°N, -87.391917°W
H-3	36.801812°N, -87.391778°W
H-4	36.802031°N, -87.391230°W
H-5	36.802665°N, -87.391125°W
H-6	36.801871°N, -87.390695°W

KEY TO SUBSURFACE EXPLORATION LOG SYMBOLS

DRILLING AND SAMPLING SYMBOLS

SS: Split-spoon; 1 3/8" I.D., 2" O.D.

ST: Shelby tube; 3" O.D.

AU: Auger bag sample

DB: Diamond bit (rock coring)

SOIL PROPERTY SYMBOLS

Qp: Unconfined compressive strength, hand penetrometer, tsf

N: Blows per foot of a 140 lb hammer falling 30 inches on a 2" O.D. split spoon

mc: Percent of water in sample, %

Dd: Sample dry density, pcf

-#200: Percent of sample passing a #200 sieve

Qu: Unconfined compressive strength, Shelby tube sample

QR: Unconfined compressive strength, RIMAC® field test device, tsf

LL: Liquid limit, %

PI: Plasticity Index

-#4: Percent of sample passing a #4 sieve

RELATIVE DENSITY AND CONSISTENCY

COHESIVE SOILS (clays & silts)

N	Consistency	Qu (tsf)
0 - 2	Very soft	0 - 0.25
3 - 4	Soft	0.25 - 0.50
5 - 8	Firm	0.50 - 1.00
9 - 15	Stiff	1.00 - 2.00
16 - 30	Very stiff	2.00 - 4.00
> 30	Hard	> 4.00

NON-COHESIVE SOILS (sands & gravels)

N	Relative Density
0 - 4	Very loose
5 - 10	Loose
11 - 30	Medium Dense
31 - 50	Dense
> 50	Very Dense

PARTICLE SIZE

Boulders	> 8"
Cobbles	3" - 8"
Gravel	5mm - 3"
Coarse sand	0.6mm - 5mm
Medium sand	0.2mm - 0.6mm
Fine sand	0.074mm - 0.2mm
Silt	0.005mm - 0.074mm
Clay	< 0.005mm

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LOG OF BORING H-1

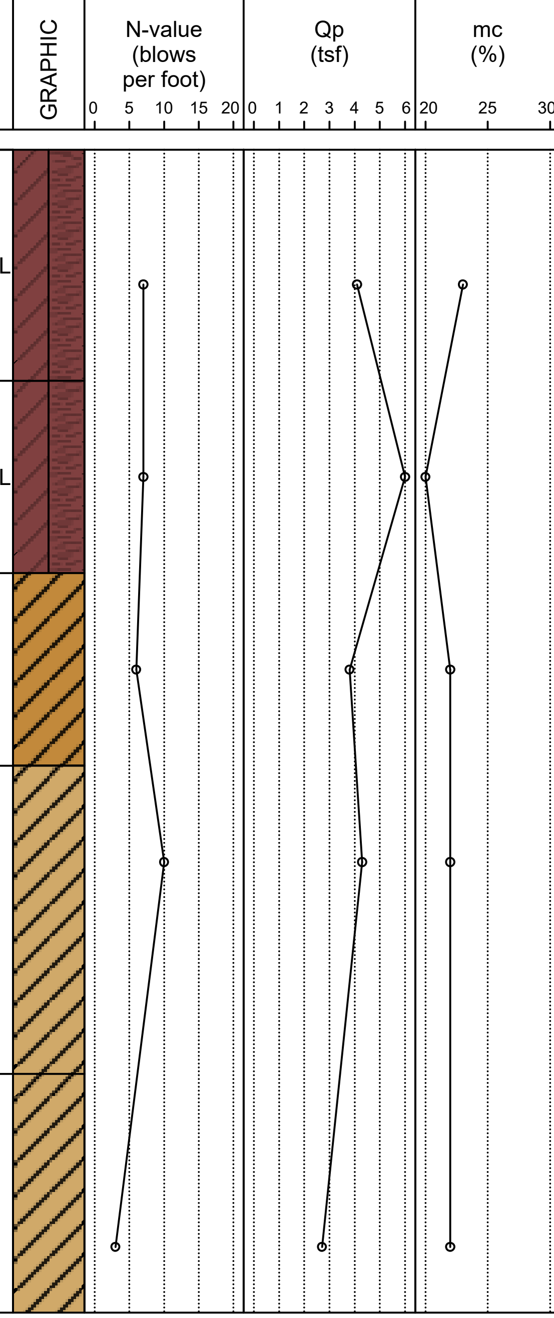
Hopkinsville Industrial Spec Building
Hopkinsville, Christian County, Kentucky
J. Clark Architecture Design

ESE Project no: 08416

Date Started	: 07/27/2020	Driller	: D. Hendrix
Date Completed	: 07/27/2020	Helper	: R. Moore
Hole Diameter	: 2.25 in.	Drill Equipment	: 6620DT
Drilling Method	: Hollow Stem Auger	Est. surface material	: 8" topsoil
Sampling Method	: SPT; automatic hammer	Surface elevations not provided	

Sample Condition: Split Spoon; Shelby Tube; Auger Cuttings; Rock Core

Depth in Feet	Surf. Elev.	Samples	DESCRIPTION	USCS	Qr (tsf)	Dd (pcf)
0–3		Split Spoon	Firm, brownish red with tan with trace yellow and black, silty CLAY (possible fill)	CL-FL	5.8	109
3–5.5		Split Spoon	Firm, brownish red with tan, silty CLAY (possible fill)	CL-FL	5.8	113
5.5–8		Split Spoon	LL = 51 PI = 30 at 6'. Firm, tan with red and gray, CLAY (possible fill)	CH	3.2	105
8–12		Split Spoon	Stiff, tan with gray and black, CLAY	CH		
12–15.1		Split Spoon	SOFT, tan with gray and black, CLAY	CH		



Boring was terminated at (-)15.1' due to auger refusal.

During drilling, no free water was encountered and the boring was dry at completion.

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LOG OF BORING H-2

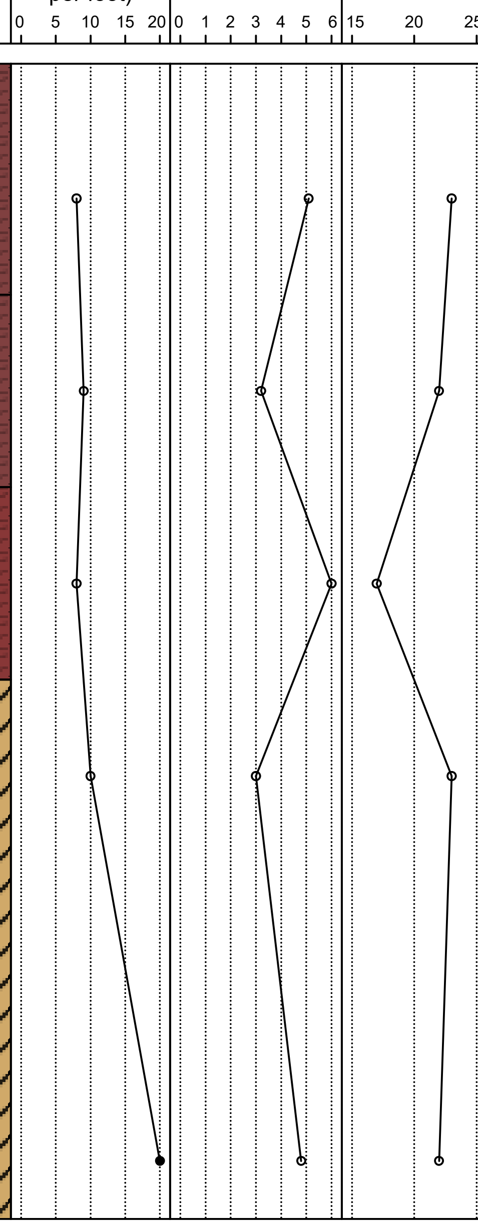
Hopkinsville Industrial Spec Building
Hopkinsville, Christian County, Kentucky
J. Clark Architecture Design

ESE Project no: 08416

Date Started	: 07/24/2020	Driller	: D. Hendrix
Date Completed	: 07/24/2020	Helper	: R. Moore
Hole Diameter	: 2.25 in.	Drill Equipment	: 6620DT
Drilling Method	: Hollow Stem Auger	Est. surface material	: 8" topsoil
Sampling Method	: SPT; automatic hammer	Surface elevations not provided	

Sample Condition: Split Spoon; Shelby Tube; Auger Cuttings; Rock Core

Depth in Feet	Surf. Elev.	Samples	DESCRIPTION	USCS	GRAPHIC	N-value (blows per foot)	Qp (tsf)	mc (%)	Qr (tsf)	Dd (pcf)
0–3		Split Spoon	Firm brownish red with orange, tan, and yellow with trace gray CLAY (fill) with chert fragments	FL					2.7	96
3–5.5		Split Spoon	Stiff brownish red with tan with trace black CLAY (fill)	FL					4.4	92
5.5–8		Split Spoon	LL = 46 PI = 25 at 6' Firm reddish brown with tan silty CLAY (fill)	FL					2.9	109
8–15		Split Spoon (2)	Stiff to Hard tan with gray with trace black CLAY N = 50/4"	CH						



Boring was terminated at (-)15' due to auger refusal.

During drilling, no free water was encountered and the boring was dry at completion.

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LOG OF BORING H-3

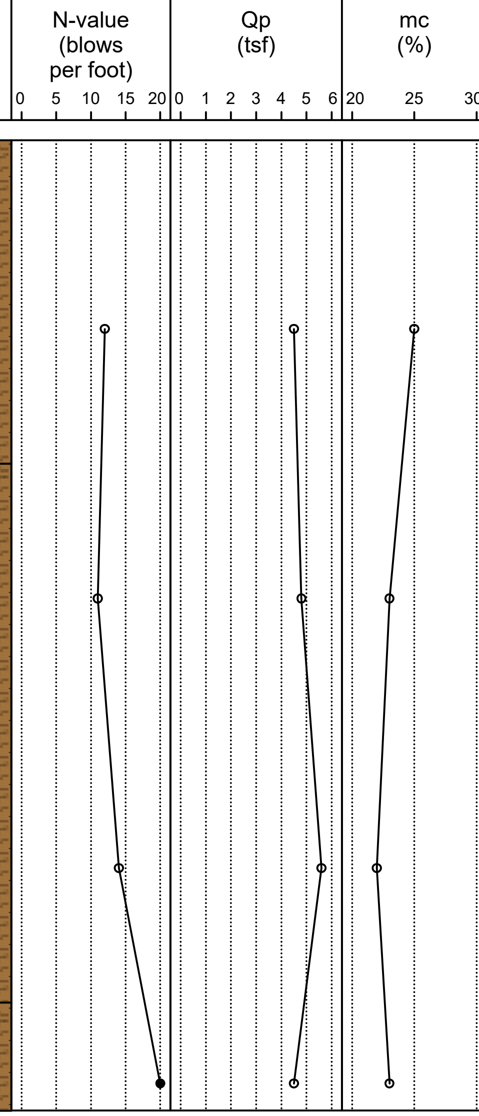
Hopkinsville Industrial Spec Building
Hopkinsville, Christian County, Kentucky
J. Clark Architecture Design

ESE Project no: 08416

Date Started	: 07/24/2020	Driller	: D. Hendrix
Date Completed	: 07/24/2020	Helper	: R. Moore
Hole Diameter	: 2.25 in.	Drill Equipment	: 6620DT
Drilling Method	: Hollow Stem Auger	Est. surface material	: 8" topsoil
Sampling Method	: SPT; automatic hammer	Surface elevations not provided	

Sample Condition: Split Spoon; Shelby Tube; Auger Cuttings; Rock Core

Depth in Feet	Surf. Elev.	Samples	DESCRIPTION	USCS	Qr (tsf)	Dd (pcf)
0–3		Split Spoon	Stiff brown with tan silty CLAY (possible fill)	CL-FL	4.9	104
3–8		Split Spoon	Stiff brown with tan and red silty CLAY (possible fill)	CL-FL	3.8	101
		Split Spoon			3.4	104
8–9		Split Spoon	Hard brown with tan and red silty CLAY with chert fragments and chunks N = 50/2"	CL-FL		



Boring was terminated at (-)9' due to auger refusal.

During drilling, no free water was encountered and the boring was dry at completion.

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LOG OF BORING H-4

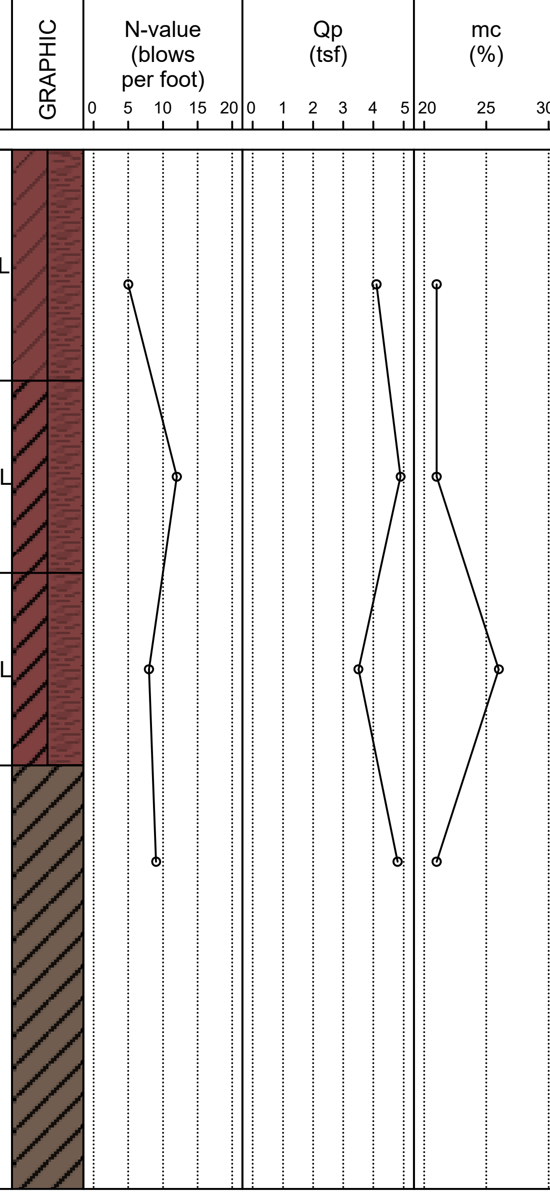
Hopkinsville Industrial Spec Building
Hopkinsville, Christian County, Kentucky
J. Clark Architecture Design

ESE Project no: 08416

Date Started	: 07/24/2020	Driller	: D. Hendrix
Date Completed	: 07/24/2020	Helper	: R. Moore
Hole Diameter	: 2.25 in.	Drill Equipment	: 6620DT
Drilling Method	: Hollow Stem Auger	Est. surface material	: 3" gravel & 7" topsoil
Sampling Method	: SPT; automatic hammer	Surface elevations not provided	

Sample Condition: Split Spoon; Shelby Tube; Auger Cuttings; Rock Core

Depth in Feet	Surf. Elev.	Samples	DESCRIPTION	USCS	Qr (tsf)	Dd (pcf)
0 – 6		Split Spoon	Firm brownish red with tan silty CLAY (possible fill)	CL-FL	2.0	108
6 – 11		Split Spoon	Stiff brownish red with tan CLAY (possible fill) LL = 50 PI = 30 at 5'	CH-FL	3.7	
11 – 16		Split Spoon	Firm brownish red with tan CLAY (possible fill)	CH-FL	3.5	106
16 – 13.5		Split Spoon	Stiff brown with gray CLAY	CH		



Boring was terminated at (-)13.5' due to auger refusal.

During drilling, no free water was encountered and the boring was dry at completion.

LOG OF BORING H-5

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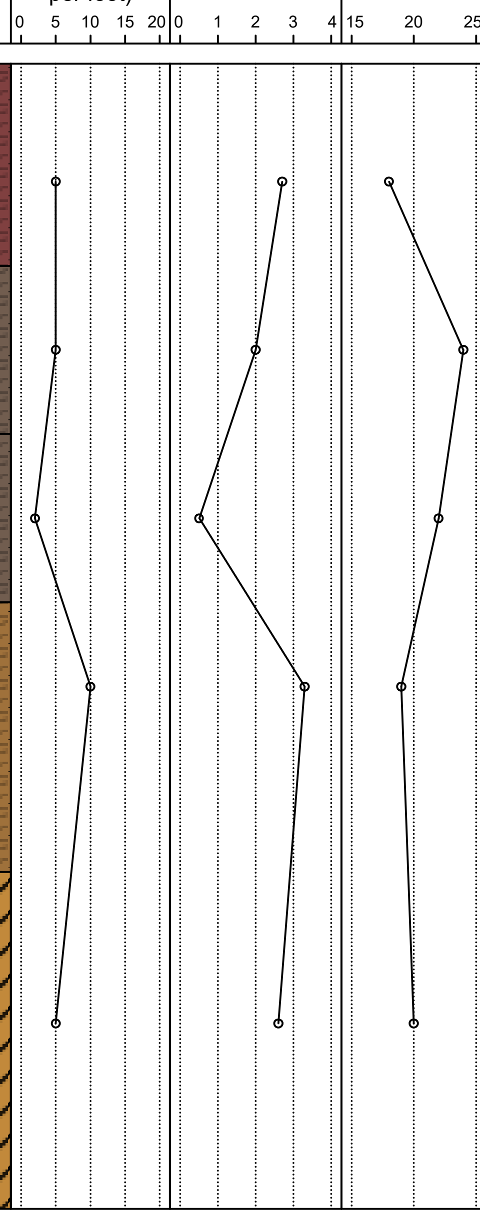
Hopkinsville Industrial Spec Building
Hopkinsville, Christian County, Kentucky
J. Clark Architecture Design

ESE Project no: 08416

Date Started	: 07/24/2020	Driller	: D. Hendrix
Date Completed	: 07/24/2020	Helper	: R. Moore
Hole Diameter	: 2.25 in.	Drill Equipment	: 6620DT
Drilling Method	: Hollow Stem Auger	Est. surface material	: 8" topsoil
Sampling Method	: SPT; automatic hammer	Surface elevations not provided	

Sample Condition: Split Spoon; Shelby Tube; Auger Cuttings; Rock Core

Depth in Feet	Surf. Elev.	Samples	DESCRIPTION	USCS	GRAPHIC	N-value (blows per foot)	Qp (tsf)	mc (%)	Qr (tsf)	Dd (pcf)
0–4		Split Spoon	Firm brownish red with tan silty CLAY (fill)	FL					3.3	105
4–6.5		Split Spoon	LL = 30 PI = 10 at 3.5' Firm brown with gray silty CLAY (fill)	FL					1.6	104
6.5–9		Split Spoon	VERY SOFT brownish gray silty CLAY (fill; slightly moist)	FL						
9–12		Split Spoon	Stiff brown with tan and gray silty CLAY (fill) with limestone fragments and chunks	FL						
12–17		Split Spoon	Firm tan with orange with trace gray CLAY with chert fragments and chunks	CH						



Boring was terminated at (-)17' due to auger refusal.

During drilling, no free water was encountered and the boring was dry at completion.

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LOG OF BORING H-6

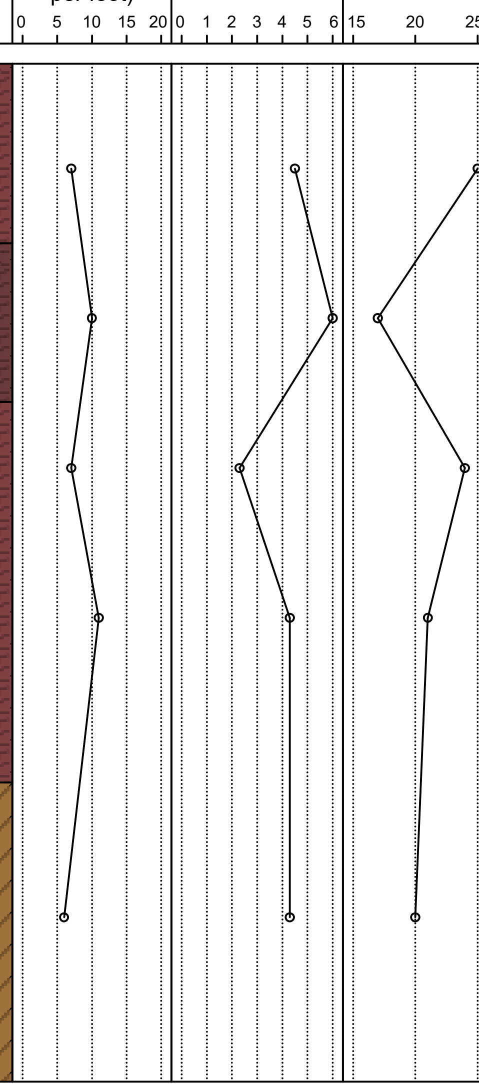
Hopkinsville Industrial Spec Building
Hopkinsville, Christian County, Kentucky
J. Clark Architecture Design

ESE Project no: 08416

Date Started	: 07/27/2020	Driller	: D. Hendrix
Date Completed	: 07/27/2020	Helper	: R. Moore
Hole Diameter	: 2.25 in.	Drill Equipment	: 6620DT
Drilling Method	: Hollow Stem Auger	Est. surface material	: 8" topsoil
Sampling Method	: SPT; automatic hammer	Surface elevations not provided	

Sample Condition: Split Spoon; Shelby Tube; Auger Cuttings; Rock Core

Depth in Feet	Surf. Elev.	Samples	DESCRIPTION	USCS	GRAPHIC	N-value (blows per foot)	Qp (tsf)	mc (%)	Qr (tsf)	Dd (pcf)
0		Split Spoon	Firm brownish red with tan and black CLAY (fill)	FL					4.0	100
5		Split Spoon	Stiff brown and red silty CLAY (fill)	FL					3.3	108
10		Split Spoon, Split Spoon	Firm to Stiff brownish red with tan and orange CLAY (possible fill)	FL					2.9	98
15		Split Spoon	Firm brown with tan and black silty CLAY	CL						



Boring was terminated at (-)17' due to auger refusal.

During drilling, no free water was encountered and the boring was dry at completion.

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