REPORT OF SUBSURFACE EXPLORATION AND GEOTECHNICAL ENGINEERING EVALUATION

BEACON HILL SOUTHWEST QUADRANT
KANSAS CITY, MISSOURI
TSI PROJECT NUMBER 20162042

TALIAFERRO & BROWNE, INC.
1020 East 8th Street
Kansas City, Missouri 64106

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geotechnical, inc

8248 NW 101st Terrace #5
Kansas City, Missouri 64153

July 27, 2017

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PROFESSIONAL SERVICE SINCE 1989

July 27, 2017

Kurt Mitscher
TALIFERRO & BROWNE, INC.
1020 East 8th Street
Kansas City, Missouri 64106

Re: **Report of Subsurface Exploration and**
Geotechnical Engineering Services
Beacon Hill Southwest Quadrant
Kansas City, Missouri
TSi Project No. 20162042

Dear Mr. Mitscher:

TSi Geotechnical Inc. (TSi) has completed the authorized subsurface exploration and geotechnical engineering evaluation for the referenced project and is pleased to submit this report of our findings to the Taliaferro & Browne (T&B). The purpose of our services was to determine subsurface conditions at specific exploration locations and to gather data on which to prepare geotechnical recommendations for the design and construction of the proposed Beacon Hill Southwest Quadrant. This report describes the exploration procedures used, exhibits the data obtained, and presents our evaluations and recommendations relative to the geotechnical engineering aspects of the project.

We appreciate the opportunity to assist you with this project. If you have any questions, or if we may be of further service to you, please call us.

Respectfully submitted,
TSI GEOTECHNICAL, INC.

Wilson Smith

Wilson Smith, PE
Staff Engineer

Denise B. Hervey, PE
for: Principal

Brian Robben, PE, RG
Geotechnical Department Manager

STATE OF MISSOURI
BRIAN WILLIAM ROBBEN
NUMBER PE-2004017235
7/27/17
PROFESSIONAL ENGINEER

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REPORT OF SUBSURFACE EXPLORATION AND
GEOTECHNICAL ENGINEERING EVALUATION
BEACON HILL SOUTHWEST QUADRANT
KANSAS CITY, MISSOURI

1.0 SCOPE OF SERVICES

This report summarizes the results of a geotechnical study performed for the proposed new pavements and pavement rehabilitations in Beacon Hill Southwest Quadrant in Kansas City, Missouri. The study was performed in general accordance with TSi's proposal to the T&B, dated November 2, 2015. Based on TSi's understanding of the project, the following items have been identified for inclusion in this study report:

- Subsurface conditions at the boring locations;
- Laboratory test results;
- Influence of groundwater on the project;
- Pavement recommendations;
- Subgrade modulus for soils below asphalt and concrete pavements,
- General construction considerations; and
- Recommendations for fill and backfill materials, placement, and compaction.

2.0 SITE AND PROJECT DESCRIPTIONS

The site is located in the Beacon Hill neighborhood of Kansas City, Missouri and is bound by Troost Avenue and Tracy Avenue on the west and east, respectively. The site is also bound by 25th Street and 27th Street on the north and south, respectively. The project will consist of a 2-inch mill and overlay of two existing streets: Forest Avenue between 25th and 27th Streets, and 26th Street between Troost Avenue and Tracy Avenue. The project will also consist of new concrete alley pavements; one between Troost Avenue and Forest Avenue, connecting 25th and 26th Streets, and the other between Forest Avenue and Tracy Avenue, connecting 26th and 27th Streets. The project also includes several new asphalt pavements. The existing 25th Terrace will be extended from Tracy Avenue to Troost Avenue, and a new 26th Terrace will be constructed between Forest Avenue and Tracy Avenue. New asphalt pavements will also be constructed parallel to and just east of Forest Avenue, between 25th and 27th Streets. The project will also include new sidewalks constructed along the existing and new streets at the site.

3.0 FIELD EXPLORATION AND LABORATORY TESTING

3.1 FIELD EXPLORATION

On December 5, 7, and 8, 2016, TSi conducted an exploration program at the project site consisting of 15 soil borings, designated as Borings B-01 to B-15 and 5 pavement cores, designated as C-01 to C-05. Borings that encountered bedrock were stopped prior to their planned depths at auger refusal. The logs from this exploration are included in Appendix B. The approximate locations of the borings are indicated on the Site and Boring Location Plan, Figure 1 in Appendix A. The boring locations were selected by Taliaferro & Browne, Inc. and located in the field by TSi.

The borings were drilled using a CME-550X all-terrain drill rig to advance flight auger drilling tools. Split-spoon and Shelby tube samples were recovered from the borings. Split-spoon samples were recovered using a 2-inch outside-diameter, split-barrel sampler, driven by an automatic hammer, in accordance with ASTM D 1586. The split-spoon samples were placed in plastic bags for later testing in the laboratory. Three-inch diameter Shelby tube samples were obtained in accordance with ASTM D 1587. The Shelby tube samples were preserved by sealing the entire sample in the tube.

The results of the field tests and measurements were recorded on field logs and appropriate data sheets by the field engineer. Those data sheets and logs contain information concerning the exploration methods, samples attempted and recovered, indications of the presence of various subsurface materials, and the observation of groundwater if encountered. The field logs and data sheets contain the field engineer's interpretations of the conditions between samples, based on the performance of the exploration equipment and the cuttings brought to the surface. The final logs included in this report were based on the field logs, modified as appropriate based on the results of laboratory testing of soil samples.

3.2 LABORATORY TESTING

A laboratory testing program was conducted by TSi to determine selected engineering properties of the obtained soil samples. The following laboratory tests were performed on the samples recovered from the borings:

- visual descriptions by color and texture of each sample (ASTM 2488);
- natural moisture content of selected samples (ASTM D 2216);
- Atterberg limits on selected cohesive samples (ASTM D 4318);
- unit weight of selected undisturbed samples (ASTM D 7263);
- unconfined compression tests on selected cohesive samples (ASTM D 2166);
- Standard Proctor (ASTM D 698); and
- California Bearing Ratio (CBR) (ASTM D 1883).

The results of the laboratory tests are summarized on the boring logs. The analyses and conclusions contained in this report are based on field and laboratory test results and on the interpretations of the subsurface conditions as reported on the logs. Only data pertinent to the objectives of this report have been included on the logs; therefore, these logs should not be used for other purposes.

4.0 SUBSURFACE CONDITIONS

Details of the subsurface conditions encountered at the boring locations are shown on the logs in Appendix B. The general subsurface conditions encountered and their pertinent engineering characteristics are described in the following paragraphs. Conditions represented by the borings should be considered applicable only at these locations on the dates shown; the reported conditions may be different at other locations or at other times.

4.1 GENERALIZED SUBSURFACE PROFILE

Surficial soils across most of the project site consisted of approximately 6.0 to 8.5 inches of clay with roots. At Boring B-08, surface material was composed of approximately 2.0 inches of Portland cement concrete.

The surficial materials were underlain by existing fill at Borings B-01, -02, -04, -06, -07, -09, -12, and -15. Fill primarily consisted of lean clay with trace cobbles, mulch, brick fragments and wood pieces extending 2.5 to 7.0 feet below the ground surface. At B-12, a 6.0-inch layer of limestone cobble fill was encountered below ground surface. Poorly-graded sand with trace clay and brick fragments was encountered at Boring B-15 extending to a depth of approximately 6.0 feet where it was underlain by lean clay fill with trace gravel. The fill at B-15 continued to the boring termination depth. Standard penetration tests (N-values) varied significantly across the project site ranging from 5 blows per foot (bpf) to 50 blows for zero inches. Moisture contents ranged from 5% to 25%. Unconfined compressive strength tests were performed on the cohesive soil samples in the fill resulting in undrained shear and dry density values ranging from 0.64 to 1.08 tons per square foot (tsf) and 95 to 97 pounds per cubic foot (pcf), respectively. An Atterberg limits tests was performed resulting in a liquid limit of 40 and a plasticity index of 19.

The surficial materials and existing fill were underlain by natural cohesive soils consisting of lean and fat clay (CL and CH, in accordance with the Unified Soil Classification System). The natural clay continued to the boring termination depths across the project site except at Boring B-11 where the clay was underlain by weathered limestone and B-15 where natural soil was not encountered. Moisture contents and N-values within the soil ranged from 18% to 29% and 4 to 13 bpf, respectively. Atterberg limits tests performed on select samples and resulted in liquid limits ranging from 34 to 55 and plasticity indices ranging from 10 to 27. Unconfined compressive strength tests were performed on clay samples resulting in undrained shear and dry density values ranging from 0.65 to 1.57 tsf and 94 to 100 pcf, respectively.

Limestone bedrock was encountered at Boring B-11 approximately 8.0 feet below the ground surface. The limestone was weathered with shale seams and exhibited an N value of 50 blows for two inches. A moisture content of 15% was measured.

4.2 GROUNDWATER

Groundwater was not encountered in any of the borings with the exception of Boring B-04 where groundwater was encountered at a depth of 8.5 feet. The presence or absence of groundwater at a particular location does not necessarily mean that groundwater will be present or absent at that location at other times. Seasonal variations and other unknown considerations could cause fluctuations in water levels and the presence of water in the soils. Groundwater may be perched on top of the limestone bedrock during rainy seasons. Groundwater may also be perched within joints in bedrock during periods of rainy weather.

5.0 ENGINEERING ASSESSMENTS AND RECOMMENDATIONS

5.1 SWELLING CLAY CONSIDERATIONS

High plasticity (fat) clay soils will be exposed during excavation for portions of the pavement areas at the site. The fat clay is of concern with regard to their potential for volume change. This concern applies to these materials whether in their natural condition or used as fill material. These materials tend to swell when they absorb water and to shrink when they dry out. Some relatively simple design and construction considerations are recommended that will help to maintain the natural moisture content of the fat clay. Avoiding conditions that could result in excessive wetting or drying of the fat clay will reduce their potential for volume change. The following design and construction precautions are recommended:

1. Fat clays should not be used as backfill material within 2 feet of pavement structures.
2. Fat clay used as fill should be placed and compacted wet of its optimum moisture content, as discussed in Section 6.5 of this report.
3. Positive surface drainage should be provided during and after construction to prevent ponding of water in and around any excavations or the exposed subgrade.
4. Manholes and concrete boxes should be backfilled with lean clay to avoid collecting water in crushed limestone backfill.

5.2 PAVEMENT DESIGN

TSi understands that the roadway pavement will be based on the City of Kansas City standard pavement section. TSi recommends a well-graded aggregate base, such as MoDOT Type 5 or equivalent, directly underlying the pavements with a minimum thickness of 6 inches. Fill material below the pavements should consist of minimum of 24 inches of low volume change (LVC) material consistent with requirements outlined in Section 6.3 of this report.

A standard Proctor test was conducted on composite soil sample of clay obtained from 0 to 5 feet in depth at several boring locations. The test yielded a maximum dry density of 101.4 pounds per square foot (psf) and an optimum moisture content of 20.8%. A California Bearing Ratio (CBR) test of the native soil was also conducted on the composite sample of subgrade soil from the boring locations. This test resulted in a CBR of 1.7. The standard proctor and CBR test results are included in Appendix C of this report. Based on the general character of the on-site subsurface conditions and assuming a properly prepared subgrade the measured CBR value of 1.7 is considered appropriate for use in designing the flexible pavement sections for the site.

Rigid pavement design can be based on a modulus-of-subgrade reaction (k) of 50 pounds per cubic inch (pci) for the subgrade. These values for rigid and flexible pavement design are based on the requirement that the pavement subgrade is prepared in accordance with the recommendations provided in Sections 6.1, 6.3, 6.4 and 6.5 in this report.

Stabilization of the subgrade will provide a stiffer, more durable subgrade, which will improve the durability of the pavements. It will also provide a subgrade that is less prone to disturbance under construction traffic, especially during rainy weather. If the design team desires to increase the CBR value of the subgrade, subgrade stabilization with fly ash or lime is recommended. Our experience indicates that CBR values of up to 15 to 20 can be achieved with fly ash-treated subgrade. The CBR value for lime treated soils will be greater than the CBR values measured in the native clay. The stabilized soils should be compacted as recommended in Section 6.4 of this report.

A lime- or fly ash-treated Proctor and CBR testing was not included in the scope of this exploration. The exact amount of lime or fly ash application should be determined in the laboratory before construction begins. If requested, TSi can perform additional services to determine the optimal percentage of fly ash or lime application in the laboratory using additional soil samples from the site to perform standard Proctor and CBR tests at varying fly ash or lime percentages.

5.3 PAVEMENT DRAINAGE

Water circulation was used during pavement coring operations to cool the core barrel while cutting through the pavement structure. Pavements should be properly graded to shed stormwater runoff. Pooling of water below pavement structures can cause subgrade conditions to deteriorate. We recommend the pavements be properly "crowned" such that stormwater runoff is directed laterally towards the curbs. This will help reduce subgrade deterioration and pavement distress.

6.0 SITE PREPARATION AND EXCAVATION CONSIDERATIONS

6.1 SUBGRADE PREPARATION

Construction areas should be stripped of vegetation, root mass, organic soil, buried structures, pavements, and any deleterious materials prior to site excavation and grading. Care should be taken during stripping to prevent excessive disturbance of the underlying soil. After the removal of these materials, and where further excavation is not required, the exposed subgrade should be proofrolled. Proofrolling is accomplished by passing over the subgrade with proper equipment such as a loaded tandem-axle dump truck or scraper and observing the subgrade for pockets of excessively soft, wet, disturbed, or otherwise unsuitable soils. Any unacceptable materials thus found should be excavated and either recompacted or replaced with new structural fill.

Prior to placing fill in any area, the subgrade should be scarified to a depth of about 6 inches, the moisture content adjusted to near its optimum moisture content, and the subgrade recompacted in accordance with recommendations made in subsequent sections of this report. The recommended proofrolling and/or scarification and recompaction may be waived if, in the opinion of a geotechnical engineer, this procedure would be detrimental or unnecessary. Following the satisfactory preparation of the subgrade, controlled fill material may be placed.

6.2 EXCAVATIONS

Trenching, excavating, and bracing should be performed in accordance with OSHA (Occupational Safety and Health Administration) regulations and other applicable regulatory agencies. In accordance with the OSHA excavation standards, the clay soils at the site are considered Type C, which requires a side slope for excavations of not steeper than 1.5 Horizontal to 1.0 Vertical (1.0H:1.0V). However, worker safety and classification of the excavation soil is the responsibility of the contractor. Also according to OSHA requirements, any excavation extending to a depth of more than 20 feet must be designed by a registered professional engineer.

6.3 SUBGRADE PROTECTION

Construction areas should be properly drained in order to reduce or prevent surface runoff from collecting on the exposed subgrade in excavations. Any ponded water on the exposed subgrade or trench bottom should be removed immediately. Temporary storm-water swales and collection areas may be required to control surface water flow into low areas of the site or into trench excavations.

Excavations should be kept dry, and foot traffic on the subgrade should be kept to a minimum. Any disturbed, loose, or soft material that is encountered or develops in the footing excavations should be removed prior to the placement of concrete.

6.4 FILL AND BACKFILL MATERIALS

Structural fill should consist of approved soils or crushed limestone material, free of organic matter and debris. Fill material placed within 18 inches of pavement structures should consist of select LVC fill material. LVC fill should consist of approved, well-graded granular materials or low to moderate plasticity cohesive soil. Low to moderate plasticity cohesive materials used as LVC fill should consist of inorganic clay with a liquid limit less than 45 and a plasticity index of less than 25. Based on laboratory tests performed, the granular fill should have a maximum particle size of 1.0 inch. The lean clay soils present on this site could be used as either structural fill or LVC fill. Fill materials from off-site sources should be approved prior to their use. Soil with decayable material such as wood, metal, or vegetation is not acceptable.

Some of the soil on the site will require the addition of moisture prior to compaction. This should be performed in a controlled manner using a tank truck with a spray bar, and the moistened soil should be thoroughly blended with a disk or pulverizer to produce a uniform moisture content. Repeated passages of the equipment may be required to achieve a uniform moisture content. Fat clays should be compacted wet of their optimum moisture content. If the pavements are constructed during the winter season, fill materials should be carefully observed to see that no ice or frozen soils are placed as fill or remain in the base materials upon which fill is placed.

Some of the on-site soil may require moisture reduction prior to compaction. During warm weather, moisture reduction can generally be accomplished by disking, or otherwise aerating the soil. When air-drying is not possible, a moisture-reducing chemical additive, such as lime or Class C fly ash, could be used as a drying agent.

6.5 FILL AND BACKFILL PLACEMENT

Cohesive fill placed for pavement support should be compacted to a dry density of at least 95% of the standard Proctor maximum dry density (ASTM D 698) of the soil. Granular material, such as crushed limestone, placed for structure or pavement support, should be compacted to at least 100% of the standard Proctor maximum dry density. The moisture content of lean clay or granular fill at the time of compaction should generally be from $^{+}/\text{-}$ 2% of the optimum moisture content of the material as determined by the standard Proctor compaction test. Fill should be placed in loose lifts not in excess of 8.0 inches thick, and compacted to the aforementioned criterion. However, it may be necessary to place fill in thinner lifts to achieve the recommended compaction when using small hand-operated equipment.

7.0 CONSTRUCTION OBSERVATION AND TESTING

It is recommended that TSi be retained during construction to perform testing and observation services for the following items:

- removal of soils with grass and roots, pavements, and any other deleterious material;
- proofrolling, recompaction, and preparation of the soil subgrade that will support new fill or structural elements;
- placement and compaction of fill and backfill;
- quality assurance testing for pavement materials.

These Quality Assurance services should help to verify the design assumptions and maintain construction procedures in accordance with the project plans, specifications, and good engineering practice.

8.0 REPORT LIMITATIONS

This geotechnical report has been prepared for the exclusive use of **TALIAFERRO & BROWNE, INC.** for the specific application to the subject project. The information and recommendations contained in this report have been made in accordance with generally accepted geotechnical and foundation engineering practices; no other warranties are implied or expressed.

The assessments and recommendations submitted in this report are based in part upon the data obtained from the borings. The nature and extent of variations between the borings may not be evident at this time. If variations appear evident at a later date, it may be necessary to re-evaluate the recommendations of this report.

We emphasize that this report was prepared for design purposes only and may not be sufficient to prepare an accurate construction bid. Contractors reviewing this report should acknowledge that the information and recommendations contained herein are for design purposes.

If conditions at the site have changed due to natural causes or other operations, this report should be reviewed by TSi to determine the applicability of the analyses and recommendations considering the changed conditions. The report should also be reviewed by TSi if changes occur in the structure location, size, and type, in the planned loads, elevations, grading and site development plans or the project concepts.

TSi requests the opportunity to review the final plans and specifications for the project prior to construction to verify that the recommendations in this report are properly interpreted and incorporated in the design and construction documents. If TSi is not accorded the opportunity to make this recommended review, we can assume no responsibility for the misinterpretation of our recommendations.

APPENDIX A

Site and Boring Location Plan

Legend

● Boring Location B- Boring C- Coring

Figure 1: Site, Boring and Coring Location Plan

Project No. 20162042

Beacon Hill Southwest Quadrant
Kansas City, Missouri

Not to Scale

Approved by: BWR

APPENDIX B

Logs of Boring
General Notes
Unified Soil Classification System

LOG OF BORING NO. B-01

Project Description: **Beacon Hill SW Quadrant Infrastructure**
Kansas City, MO

TSi Geotechnical
8248 NW 101st Terrace, #5
Kansas City, MO 64153
(816) 599-7965

Surface El.:
Location: **See Site and Boring Location Plan**

Depth, feet	Samples	Sample #	Graphic Log	MATERIAL DESCRIPTION	Recovery %	RQD	Penetration Blows Per 6 inches	Hand Penetrometer TSF	Undrained Shear Strength, TSF	Unit Dry Weight, lb/cu ft.	Water Content, %	Liquid Limit	Plastic Limit	Plasticity Index
				Brown, CLAY with roots and organics										
	⧗	SS-1	▩	Brown, lean CLAY (FILL), with brick fragments	39		5 5 5				17			
			▨	Brown, lean CLAY (CL)										
	■	ST-2	▨		63			>4.5	1.31	105	20	39	25	14
5														
	⧗	SS-3	▨		100		5 5 5				24			
10				Boring termination at 10.0 ft.										
15														
20														
25														
30														

Completion Depth:	10.00
Date Boring Started:	12/5/16
Date Boring Completed:	12/5/16
Engineer/Geologist:	TW
Project No.:	20162042

Remarks: Boring drilled with CME 550, using FA and auto SPT. Groundwater not encountered during drilling.

The stratification lines represent approximate strata boundaries.
In situations, the transition may be gradual.

LOG OF BORING NO. B-02

Project Description: **Beacon Hill SW Quadrant Infrastructure**
Kansas City, MO

TSi Geotechnical
8248 NW 101st Terrace, #5
Kansas City, MO 64153
(816) 599-7965

Surface El.:
Location: **See Site and Boring Location Plan**

Depth, feet	Samples	Sample #	Graphic Log	MATERIAL DESCRIPTION	Recovery %	RQD	Penetration Blows Per 6 inches	Hand Penetrometer TSF	Undrained Shear Strength, TSF	Unit Dry Weight, lb/cu ft.	Water Content, %	Liquid Limit	Plastic Limit	Plasticity Index
				Brown, CLAY with roots and organics										
	⧗	SS-1	☒	Brown, lean CLAY (FILL) with cobbles	33		39 50/0"				5			
5	⧗	SS-2	▨	Brown, lean CLAY (CL)	61		4 3 4				23	42	25	17
	■	ST-3	▨		100			3.50	0.85	98	24			
10				Boring termination at 10.0 ft.										
15														
20														
25														
30														

Completion Depth: 10.00
Date Boring Started: 12/5/16
Date Boring Completed: 12/5/16
Engineer/Geologist: TW
Project No.: 20162042

Remarks: Boring drilled with CME 550, using FA and auto SPT. Groundwater not encountered during drilling.

The stratification lines represent approximate strata boundaries.
In situations, the transition may be gradual.

KC LOG WITH LAB BEACON HILL SW QUAD.GPJ 7/27/17

LOG OF BORING NO. B-03

Project Description: **Beacon Hill SW Quadrant Infrastructure**
Kansas City, MO

TSi Geotechnical
8248 NW 101st Terrace, #5
Kansas City, MO 64153
(816) 599-7965

Surface El.:
Location: **See Site and Boring Location Plan**

Depth, feet	Samples	Sample #	Graphic Log	MATERIAL DESCRIPTION	Recovery %	RQD	Penetration Blows Per 6 inches	Hand Penetrometer TSF	Undrained Shear Strength, TSF	Unit Dry Weight, lb/cu ft.	Water Content, %	Liquid Limit	Plastic Limit	Plasticity Index
				Brown, CLAY with roots and organics										
				Brown, lean CLAY (CL)										
		ST-1			63			3.75	1.01	99	21			
		SS-2			44		3 3 3				24			
5														
		SS-3			72		4 5 8				24			
10				Boring termination at 10.0 ft.										
15														
20														
25														
30														

Completion Depth:	10.00
Date Boring Started:	12/5/16
Date Boring Completed:	12/5/16
Engineer/Geologist:	TW
Project No.:	20162042

Remarks: Boring drilled with CME 550, using FA and auto SPT. Groundwater not encountered during drilling.

The stratification lines represent approximate strata boundaries.
In situations, the transition may be gradual.

LOG OF BORING NO. B-04

Project Description: **Beacon Hill SW Quadrant Infrastructure**
Kansas City, MO

TSi Geotechnical
8248 NW 101st Terrace, #5
Kansas City, MO 64153
(816) 599-7965

Surface El.:
Location: **See Site and Boring Location Plan**

Depth, feet	Samples	Sample #	Graphic Log	MATERIAL DESCRIPTION	Recovery %	RQD	Penetration Blows Per 6 inches	Hand Penetrometer TSF	Undrained Shear Strength, TSF	Unit Dry Weight, lb/cu ft.	Water Content, %	Liquid Limit	Plastic Limit	Plasticity Index
				Brown, CLAY with roots and organics										
		SS-1		Brown, lean CLAY (FILL) trace sandstone cobbles	28		3 5 5				25			
		ST-2			42				1.08	97	22			
5				Brown, lean clay (CL)										
				▽										
		SS-3			100		2 2 2				27	31	22	9
10				Boring termination at 10.0 ft.										
15														
20														
25														
30														

Completion Depth: 10.00
Date Boring Started: 12/5/16
Date Boring Completed: 12/5/16
Engineer/Geologist: TW
Project No.: 20162042

Remarks: Boring drilled with CME 550, using FA and auto SPT. Groundwater was encountered during drilling at 8.5 feet.

The stratification lines represent approximate strata boundaries. In situations, the transition may be gradual.

LOG OF BORING NO. B-05

Project Description: **Beacon Hill SW Quadrant Infrastructure**
Kansas City, MO

TSi Geotechnical
8248 NW 101st Terrace, #5
Kansas City, MO 64153
(816) 599-7965

Surface El.:
Location: **See Site and Boring Location Plan**

Depth, feet	Samples	Sample #	Graphic Log	MATERIAL DESCRIPTION	Recovery %	RQD	Penetration Blows Per 6 inches	Hand Penetrometer TSF	Undrained Shear Strength, TSF	Unit Dry Weight, lb/cu ft.	Water Content, %	Liquid Limit	Plastic Limit	Plasticity Index
				Brown, CLAY with roots and organics										
	⧗	SS-1	▨	Gray brown, lean CLAY (CL), trace roots	89		3 3 4				29			
5	⧗	SS-2	▨		100		3 4 6				28			
	■	ST-3	▨	- with limestone gravel below 8.5 ft.	100				1.01	99	25			
10				Boring termination at 9.3 ft.										
15														
20														
25														
30														

Completion Depth: 9.30
Date Boring Started: 12/7/16
Date Boring Completed: 12/7/16
Engineer/Geologist: TW
Project No.: 20162042

Remarks: Boring drilled with CME 550, using FA and auto SPT. Groundwater not encountered during drilling. Sampler refusal at 9.3 feet.

The stratification lines represent approximate strata boundaries.
In situations, the transition may be gradual.

LOG OF BORING NO. B-06

Project Description: **Beacon Hill SW Quadrant Infrastructure**
Kansas City, MO

TSi Geotechnical
8248 NW 101st Terrace, #5
Kansas City, MO 64153
(816) 599-7965

Surface El.:
Location: **See Site and Boring Location Plan**

Depth, feet	Samples	Sample #	Graphic Log	MATERIAL DESCRIPTION	Recovery %	RQD	Penetration Blows Per 6 inches	Hand Penetrometer TSF	Undrained Shear Strength, TSF	Unit Dry Weight, lb/cu ft.	Water Content, %	Liquid Limit	Plastic Limit	Plasticity Index
				Brown, CLAY with roots and organics										
	■	ST-1	▩	Brown, lean CLAY (FILL) with mulch	75				0.64	95	21			
5	⧗	SS-2	▩	-brick fragments encountered below 3.5 ft.	0		5 3 3							
			▨	Gray, lean CLAY (CL)										
10	⧗	SS-3	▨		100		4 4 5				24	34	24	10
				Boring termination at 10.0 ft.										
15														
20														
25														
30														

Completion Depth:	10.00
Date Boring Started:	12/7/16
Date Boring Completed:	12/7/16
Engineer/Geologist:	TW
Project No.:	20162042

Remarks: Boring drilled with CME 550, using FA and auto SPT. Groundwater not encountered during drilling.

The stratification lines represent approximate strata boundaries.
In situations, the transition may be gradual.

LOG OF BORING NO. B-07

Project Description: **Beacon Hill SW Quadrant Infrastructure**
Kansas City, MO

TSi Geotechnical
8248 NW 101st Terrace, #5
Kansas City, MO 64153
(816) 599-7965

Surface El.:
Location: **See Site and Boring Location Plan**

Depth, feet	Samples	Sample #	Graphic Log	MATERIAL DESCRIPTION	Recovery %	RQD	Penetration Blows Per 6 inches	Hand Penetrometer TSF	Undrained Shear Strength, TSF	Unit Dry Weight, lb/cu ft.	Water Content, %	Liquid Limit	Plastic Limit	Plasticity Index
				Brown, CLAY with roots and organics										
	⧗	SS-1	▩	Brown, lean CLAY (FILL), trace wood and gravel	11		2 3 2				29			
	■	ST-2	▩	- with brick fragments encountered below 3.0 ft.	50									
5														
			▨	Gray brown, lean CLAY (CL)										
	■	ST-3	▨		54			2.50			24	48	26	22
10				Boring termination at 10.0 ft.										
15														
20														
25														
30														

Completion Depth:	10.00
Date Boring Started:	12/8/16
Date Boring Completed:	12/8/16
Engineer/Geologist:	TW
Project No.:	20162042

Remarks: Boring drilled with CME 550, using FA and auto SPT. Groundwater not encountered during drilling. Samples ST-2 and ST-3 were pushed but samples were plugged by brick fragment

The stratification lines represent approximate strata boundaries.
In situations, the transition may be gradual.

LOG OF BORING NO. B-08

Project Description: **Beacon Hill SW Quadrant Infrastructure**
Kansas City, MO

TSi Geotechnical
8248 NW 101st Terrace, #5
Kansas City, MO 64153
(816) 599-7965

Surface El.:
Location: **See Site and Boring Location Plan**

Depth, feet	Samples	Sample #	Graphic Log	MATERIAL DESCRIPTION	Recovery %	RQD	Penetration Blows Per 6 inches	Hand Penetrometer TSF	Undrained Shear Strength, TSF	Unit Dry Weight, lb/cu ft.	Water Content, %	Liquid Limit	Plastic Limit	Plasticity Index
				Portland cement concrete (2.0")										
			▨	Brown, lean CLAY (CL)										
	⧗	SS-1	▨		100		3 4 5				27			
5	⧗	SS-2	▨		100		4 4 5				25	38	25	13
	■	ST-3	▨		42			2.00	0.93	94	28			
10				Boring termination at 10.0 ft.										
15														
20														
25														
30														

Completion Depth:	10.00
Date Boring Started:	12/8/16
Date Boring Completed:	12/8/16
Engineer/Geologist:	TW
Project No.:	20162042

Remarks: Boring drilled with CME 550, using FA and auto SPT. Groundwater not encountered during drilling.

The stratification lines represent approximate strata boundaries.
In situations, the transition may be gradual.

LOG OF BORING NO. B-09

Project Description: **Beacon Hill SW Quadrant Infrastructure**
Kansas City, MO

TSi Geotechnical
8248 NW 101st Terrace, #5
Kansas City, MO 64153
(816) 599-7965

Surface El.:
Location: **See Site and Boring Location Plan**

Depth, feet	Samples	Sample #	Graphic Log	MATERIAL DESCRIPTION	Recovery %	RQD	Penetration Blows Per 6 inches	Hand Penetrometer TSF	Undrained Shear Strength, TSF	Unit Dry Weight, lb/cu ft.	Water Content, %	Liquid Limit	Plastic Limit	Plasticity Index
				Brown, CLAY with roots and organics										
	■	ST-1		Brown, lean CLAY (FILL) with gravel and trace brick fragments	25						11			
5	⧗	SS-2			61		4 4 4				22	40	21	19
				Dark brown, lean CLAY (CL)										
10	⧗	SS-3			100		2 4 4	2.00			27			
				Boring termination at 10.0 ft.										
15														
20														
25														
30														

Completion Depth:	10.00
Date Boring Started:	12/8/16
Date Boring Completed:	12/8/16
Engineer/Geologist:	TW
Project No.:	20162042

Remarks: Boring drilled with CME 550, using FA and auto SPT. Groundwater not encountered during drilling.

The stratification lines represent approximate strata boundaries.
In situations, the transition may be gradual.

LOG OF BORING NO. B-10

Project Description: **Beacon Hill SW Quadrant Infrastructure**
Kansas City, MO

TSi Geotechnical
8248 NW 101st Terrace, #5
Kansas City, MO 64153
(816) 599-7965

Surface El.:
Location: **See Site and Boring Location Plan**

Depth, feet	Samples	Sample #	Graphic Log	MATERIAL DESCRIPTION	Recovery %	RQD	Penetration Blows Per 6 inches	Hand Penetrometer TSF	Undrained Shear Strength, TSF	Unit Dry Weight, lb/cu ft.	Water Content, %	Liquid Limit	Plastic Limit	Plasticity Index
				Brown, CLAY with roots and organics										
		SS-1		Brown, fat CLAY (CH)	44		4 5 6				24	51	30	21
		ST-2			75			3.25	1.57	100	24			
5														
		SS-3			100		4 4 5				23			
10				Boring termination at 10.0 ft.										
15														
20														
25														
30														

Completion Depth: 10.00
Date Boring Started: 12/8/16
Date Boring Completed: 12/8/16
Engineer/Geologist: TW
Project No.: 20162042

Remarks: Boring drilled with CME 550, using FA and auto SPT. Groundwater not encountered during drilling.

The stratification lines represent approximate strata boundaries. In situations, the transition may be gradual.

LOG OF BORING NO. B-11

Project Description: **Beacon Hill SW Quadrant Infrastructure**
Kansas City, MO

TSi Geotechnical
8248 NW 101st Terrace, #5
Kansas City, MO 64153
(816) 599-7965

Surface El.:
Location: **See Site and Boring Location Plan**

Depth, feet	Samples	Sample #	Graphic Log	MATERIAL DESCRIPTION	Recovery %	RQD	Penetration Blows Per 6 inches	Hand Penetrometer TSF	Undrained Shear Strength, TSF	Unit Dry Weight, lb/cu ft.	Water Content, %	Liquid Limit	Plastic Limit	Plasticity Index
				Brown, CLAY with roots and organics										
	⧗	SS-1	▨	Brown, lean CLAY (CL)	44		4 4 6				24			
5	⧗	SS-2	▨		100		4 5 5	1.50			22	40	24	16
	⧗	SS-3		LIMESTONE, gray, weathered with shale seams			11 50/2"				15			
10				Boring termination at 9.2 ft.										

Completion Depth:	9.20
Date Boring Started:	12/8/16
Date Boring Completed:	12/8/16
Engineer/Geologist:	TW
Project No.:	20162042

Remarks: Boring drilled with CME 550, using FA and auto SPT. Groundwater not encountered during drilling.

The stratification lines represent approximate strata boundaries.
In situations, the transition may be gradual.

LOG OF BORING NO. B-12

Project Description: **Beacon Hill SW Quadrant Infrastructure**
Kansas City, MO

TSi Geotechnical
8248 NW 101st Terrace, #5
Kansas City, MO 64153
(816) 599-7965

Surface El.:
Location: **See Site and Boring Location Plan**

Depth, feet	Samples	Sample #	Graphic Log	MATERIAL DESCRIPTION	Recovery %	RQD	Penetration Blows Per 6 inches	Hand Penetrometer TSF	Undrained Shear Strength, TSF	Unit Dry Weight, lb/cu ft.	Water Content, %	Liquid Limit	Plastic Limit	Plasticity Index
				Brown, CLAY with roots and organics										
				Limestone cobbles, gray										
		SS-1		Brown to light brown, lean CLAY (CL), trace fine sand	61		4 5 5				18			
		ST-2			100			2.00	1.01	99	24			
5														
		SS-3			100		3 3 5				20			
10				Boring termination at 10.0 ft.										
15														
20														
25														
30														

Completion Depth: 10.00
Date Boring Started: 12/8/16
Date Boring Completed: 12/8/16
Engineer/Geologist: TW
Project No.: 20162042

Remarks: Boring drilled with CME 550, using FA and auto SPT. Groundwater not encountered during drilling.

The stratification lines represent approximate strata boundaries.
In situations, the transition may be gradual.

LOG OF BORING NO. B-13

Project Description: **Beacon Hill SW Quadrant Infrastructure**
Kansas City, MO

TSi Geotechnical
8248 NW 101st Terrace, #5
Kansas City, MO 64153
(816) 599-7965

Surface El.:
Location: **See Site and Boring Location Plan**

Depth, feet	Samples	Sample #	Graphic Log	MATERIAL DESCRIPTION	Recovery %	RQD	Penetration Blows Per 6 inches	Hand Penetrometer TSF	Undrained Shear Strength, TSF	Unit Dry Weight, lb/cu ft.	Water Content, %	Liquid Limit	Plastic Limit	Plasticity Index
				Brown, CLAY with roots and organics										
		SS-1		Brown, fat CLAY (CH) trace gravel	61		5 4 4				21			
		ST-2		- no gravel below 3.0 ft.	67			2.75	1.34	96	27	55	28	27
5														
		SS-3			89		3 4 4				24			
10				Boring termination at 10.0 ft.										
15														
20														
25														
30														

Completion Depth: 10.00
Date Boring Started: 12/8/16
Date Boring Completed: 12/8/16
Engineer/Geologist: TW
Project No.: 20162042

Remarks: Boring drilled with CME 550, using FA and auto SPT. Groundwater not encountered during drilling.

The stratification lines represent approximate strata boundaries.
In situations, the transition may be gradual.

LOG OF BORING NO. B-14

Project Description: **Beacon Hill SW Quadrant Infrastructure**
Kansas City, MO

TSi Geotechnical
8248 NW 101st Terrace, #5
Kansas City, MO 64153
(816) 599-7965

Surface El.:
Location: **See Site and Boring Location Plan**

Depth, feet	Samples	Sample #	Graphic Log	MATERIAL DESCRIPTION	Recovery %	RQD	Penetration Blows Per 6 inches	Hand Penetrometer TSF	Undrained Shear Strength, TSF	Unit Dry Weight, lb/cu ft.	Water Content, %	Liquid Limit	Plastic Limit	Plasticity Index
0				Brown, CLAY with root and organics										
	⧗	SS-1	▨	Brown, lean CLAY (CL), trace gravel	67		6 6 6				18			
5	⧗	SS-2	▨		100		3 4 9				23			
	■	ST-3	▨	- no gravel below 8.0 ft.	100			3.00	0.65	95	27			
10				Boring termination at 10.0 ft.										
15														
20														
25														
30														

Completion Depth: 10.00
Date Boring Started: 12/8/16
Date Boring Completed: 12/8/16
Engineer/Geologist: TW
Project No.: 20162042

Remarks: Boring drilled with CME 550, using FA and auto SPT. Groundwater not encountered during drilling.

The stratification lines represent approximate strata boundaries.
In situations, the transition may be gradual.

LOG OF BORING NO. B-15

Project Description: **Beacon Hill SW Quadrant Infrastructure**
Kansas City, MO

TSi Geotechnical
8248 NW 101st Terrace, #5
Kansas City, MO 64153
(816) 599-7965

Surface El.:
Location: **See Site and Boring Location Plan**

Depth, feet	Samples	Sample #	Graphic Log	MATERIAL DESCRIPTION	Recovery %	RQD	Penetration Blows Per 6 inches	Hand Penetrometer TSF	Undrained Shear Strength, TSF	Unit Dry Weight, lb/cu ft.	Water Content, %	Liquid Limit	Plastic Limit	Plasticity Index
				Brown, CLAY with gravel, roots and organics										
				Light brown, poorly-graded SAND (FILL) trace clay and brick fragments										
	⧗	SS-1			28		5 4 4							
5	⧗	SS-2			33		2 3 4				25			
				Light brown, lean CLAY (FILL) trace gravel										
10	⧗	SS-3			89		3 3 4				20			
				Boring termination at 10.0 ft.										
15														
20														
25														
30														

Completion Depth: 10.00
Date Boring Started: 12/5/16
Date Boring Completed: 12/5/16
Engineer/Geologist: TW
Project No.: 20162042

Remarks: Boring drilled with CME 550, using FA and auto SPT. Groundwater not encountered during drilling. Sampler refusal at 1.0 foot.

The stratification lines represent approximate strata boundaries.
In situations, the transition may be gradual.

GENERAL NOTES

The number of borings is based on: topographic and geologic factors; the magnitude of structure loading; the size, shape, and value of the structure; consequences of failure; and other factors. The type and sequence of sampling are selected to reduce the possibility of undiscovered anomalies and maintain drilling efficiency. Attempts are made to detect and/or identify occurrences during drilling and sampling such as the presence of water, boulders, gas, zones of lost circulation, relative ease or resistance to drilling progress, unusual sample recovery, variation in resistance to driving split-spoon samplers, unusual odors, etc. However, lack of notation regarding these occurrences does not preclude their presence.

Although attempts are made to obtain stabilized groundwater levels, the levels shown on the Logs of Boring may not have stabilized, particularly in more impermeable cohesive soils. Consequently, the indicated groundwater levels may not represent present or future levels. Groundwater levels may vary significantly over time due to the effects of precipitation, infiltration, or other factors not evident at the time indicated.

Unless otherwise noted, soil classifications indicated on the Logs of Boring are based on visual observations and are not the result of classification tests. Although visual classifications are performed by experienced technicians or engineers, classifications so made may not be conclusive.

Generally, variations in texture less than one foot in thickness are described as layers within a stratum, while thicker zones are logged as individual strata. However, minor anomalies and changes of questionable lateral extent may appear only in the verbal description. The lines indicating changes in strata on the Logs of Borings are approximate boundaries only, as the actual material change may be between samples or may be a gradual transition.

Samples chosen for laboratory testing are selected in such a manner as to measure selected physical characteristics of each material encountered. However, as samples are recovered only intermittently and not all samples undergo a complete series of tests, the results of such tests may not conclusively represent the characteristics of all subsurface materials present.

NOTATION USED ON BORING LOGS

APPROXIMATE PROPORTIONS

TRACE	<15%
WITH	15-30%
MODIFIER	>30%

Clay or clayey may be used as major material or modifier, regardless of relative proportions, if the clay content is sufficient to dominate the soil properties.

PARTICLE SIZE

BOULDERS		>12 Inches
COBBLES		12 Inches – 3 Inches
GRAVEL		
	Coarse	3 Inches – ¾ Inch
	Fine	¾ Inch – No. 4 Sieve (4.750 mm)
SAND		
	Coarse	No. 4 – No. 10 Sieve (2.000 mm)
	Medium	No. 10 – No. 40 Sieve (0.420 mm)
	Fine	No. 40 – No. 200 Sieve (0.074 mm)
SILT		No. 200 Sieve - 0.002 mm
CLAY		< 0.002 mm

PENETRATION – BLOWS

Number of impacts of a 140-pound hammer falling a distance of 30 inches to cause a standard split-barrel sampler, 1 3/8 inches I.D., to penetrate a distance of 6 inches. The number of impacts for the first 6 inches of penetration is known as the seating drive. The sum of the impacts for the last 12 inches of penetration is the Standard Penetration Test Resistance or “N” value, blows per foot. For example, if blows = 6-8-9, “N” = 8+9 or 17.

OTHER NOTATIONS

Recovery % – length of recovered soil divided by length of sample attempted.

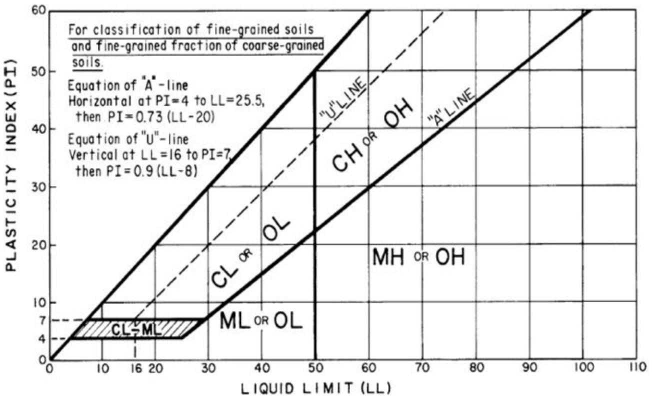
50/2”	Impacts of hammer to cause sampler to penetrate the indicated number of inches
WR	Sampler penetrated under the static loading of the weight of the drill rods
WH	Sampler penetrated under the static loading the weight of the hammer and drill rods
HSA	Hollow stem auger drilling method
FA	Flight auger drilling method
RW	Rotary wash drilling methods with drilling mud
AH	Automatic hammer used for Standard Penetration Test sample
SH	Safety hammer with rope and cathead used for Standard Penetration Test sample

GRAPHIC SYMBOLS

∇	Depth at which groundwater was encountered during drilling
▼	Depth at which groundwater was measured after drilling
⧗	Standard Penetration Test Sample, ASTM D1586
▮	3-inch diameter Shelby Tube Sample, ASTM D1587
G	Sample grabbed from auger
❚❚	NX Size rock core sample

TSi
geotechnical

UNIFIED SOIL CLASSIFICATION SYSTEM, (ASTM D-2487)

Major Divisions			*Group Symbols*		*Typical Names*	*Laboratory Classification Criteria*		
Coarse-grained soils (More than half of materials is larger than No. 200 sieve size)	Gravels (More than half 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	Determine percentages of sand and gravel from grain-size curve. Depending on percentage of fines (fraction smaller than No. 200 sieve size), coarse-Grained soils are classified as follows: Less than 5 per cent GW, GP, SW, SP More than 12 per cent GM, GC, SM, SC 5 to 12 per cent Borderline cases requiring dual symbols[b]	$C_u = \frac{D_{60}}{D_{10}}$ greater than 4; $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ between 1 and 3	
			GP		Poorly graded gravels, gravel-sand mixtures, little or no fines		Not meeting all gradation requirements for GW	
		Gravels with fines (Appreciable amount of fines)	GM[a]	d	Silty gravels, gravel-sand-silt mixtures		Atterberg limits below "A" line or P.1. less than 4	Above "A" line with P.1. between 4 and 7 are *borderline* cases requiring use of dual symbols
				u				
			GC		Clayey gravels, gravel-sand-clay mixtures		Atterberg limits below "A" line with P.1. greater than 7	
	Sands (More than half 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		$C_u = \frac{D_{60}}{D_{10}}$ greater than 6; $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ between 1 and 3	
			SP		Poorly graded sands, gravelly sands, little or no fines		Not meeting all gradation requirements for SW	
		Sands with fines (Appreciable amount of fines)	SM[a]	d	Silty sands, sand-mix mixtures		Atterberg limits about "A" line or P.I. less than 4	Limits plotting in hatched zone with P.I. between 4 and 7 are *borderline* cases requiring use of dual symbols
				u				
			SC		Clayey sands, sand-clay mixtures		Atterberg limits about "A" line with P.I. greater than 7	
Fine-grained soils (More than half of materials 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 clayey fine sands, or clayey silts with slight plasticity			
			CL		Inorganic clays 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 medium to high plasticity, organic silts			
			OH		Organic clays of medium to high plasticity, organic silts			
	Highly organic soils		Pt		Peat and other highly organic soils			

[a] Division of GM and SM groups into subdivisions of d and u are for roads and airfields only. Subdivision is based on Atterberg limits; suffix d used when L.L. is 26 or less and the P.1. is 6 or less; the suffix u used when L.L. is greater than 28.

[b] Borderline classifications, used for soils possessing characteristics of two groups, are designated by combinations of group symbols. For example: GW-GC, well-graded gravel-sand mixture with clay binder.

T:\Geotechnical Group\Notes for Geotech Reports\Unified Soil Classifications System2.doc

APPENDIX C

Laboratory Test Results

PROCTOR TEST

PROJECT NAME: **Beacon Hill SW Quadrant**

PROJECT No.: 20162042

SAMPLE NUMBER: **A**
SAMPLE LOCATION: **Composite bulk sample from Borings B-05, B-10, B-12, B-14**
DEPTH:
VISUAL CLASS. (USCS): **Brown lean clay**

TYPE OF COMPACTION	**Std.**	**D698**		
SIEVE ANALYSIS RESULTS	0.75	0.375	No. 4	**PROCEDURE**
% Retained(cummulative)				**A**

SOIL WEIGHT DATA					
Determination Number	1	2	3	4	5
Weight- Soil + Mold (wet),g	3690.0	3787.6	3842.2	3837.5	
Weight of Mold,g	1988.3	1988.3	1988.3	1988.3	
Weight Wet Soil,g	**1701.7**	**1799.3**	**1853.9**	**1849.2**	
Volume of Mold (ft^3)	**0.0333**	**0.0333**	**0.0333**	**0.0333**	
MOISTURE DATA					
Weight- Soil + Tare (wet),g	292.0	307.9	365.5	343.5	
Weight- Soil + Tare (dry),g	251.9	260.2	303.1	279.6	
Weight- Tare,g	6.8	6.8	6.8	6.9	
COMPUTED DATA					
Wet unit weight (pcf)	**112.7**	**119.1**	**122.7**	**122.4**	
Moisture content (%)	**16.4**	**18.8**	**21.1**	**23.4**	
Dry unit weight (pcf)	**96.8**	**100.2**	**101.4**	**99.2**	

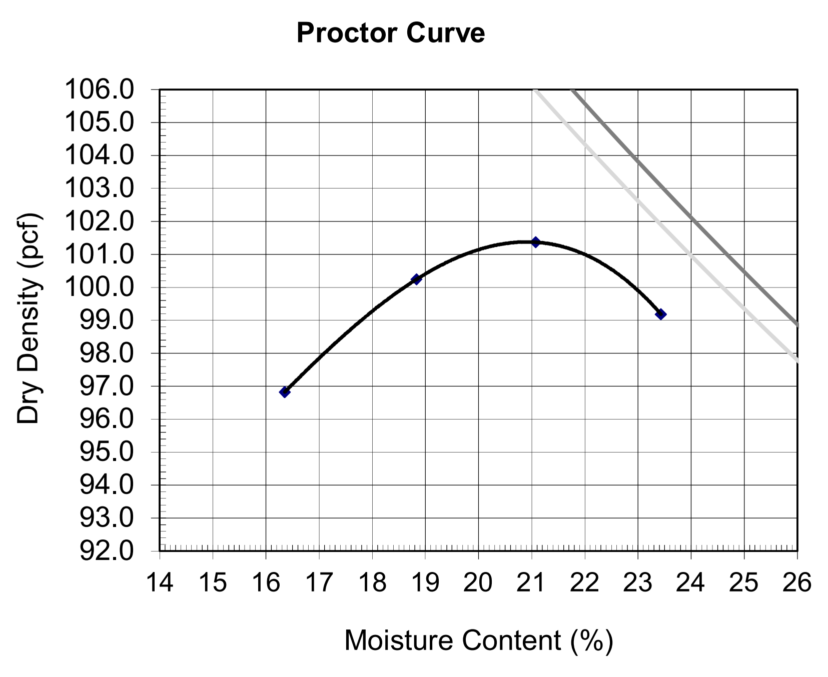
Maximum Dry Density (pcf)	**101.4**
Optimum Moisture Content (%)	**20.8**
Natural Moisture Content (%)*	

Liquid Limit	40
Plastic Limit	21
Plasticity Index	19
CLASSIFICATION. (USCS)*	**CL**

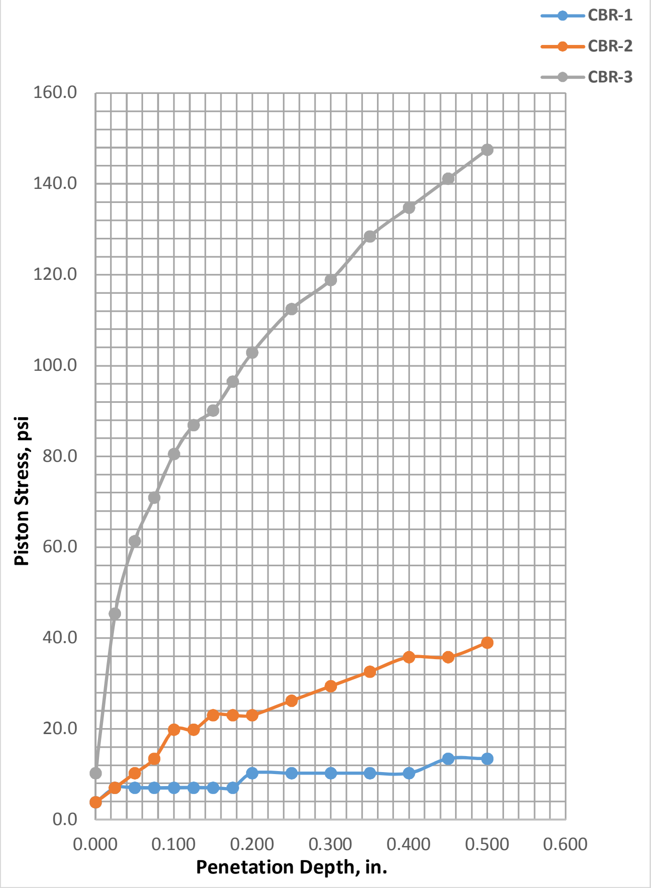
*** with additive**

	Date
Tested by: MC	12/21/2016
Calculated by: AWR	12/22/2016
Checked by: AWR	12/22/2016
Entered Into Excel by: AWR	12/22/2016

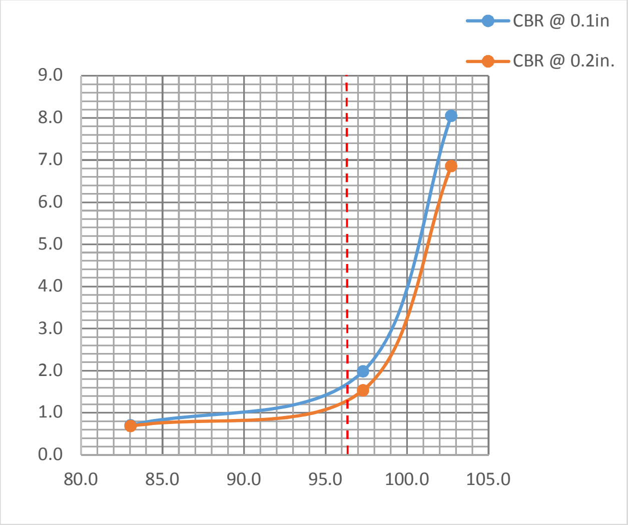
NOTE:

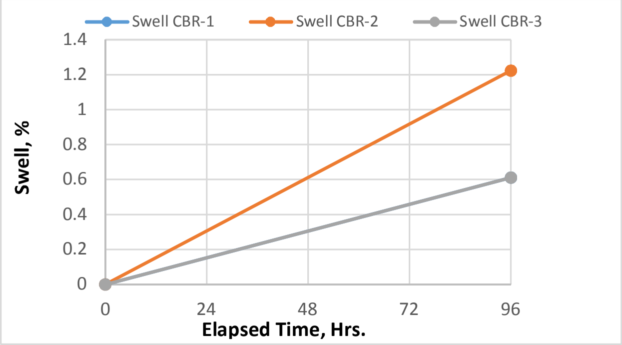


CALIFORNIA BEARING RATIO TEST REPORT
ASTM D 1883-07



% CBR Value @ 95% Compaction = 1.7 @ 0.1 in. penetration
% CBR Value @ 95% Compaction = 1.3 @ 0.2 in. penetration





	Molded			Soaked			CBR%				
Specimen ID	Density, pcf	Percent of Max. Density	Moisture, %	Density, pcf	Percent of Max. Density	Moisture, %	0.1 in.	0.2 in	Moisture of Top 1" Layer, %	Surcharge lbs	Max Swell, %
CBR-1	83.0	81.9	21.0	79.6	78.5	26.2	0.7	0.7	36.9	10	0.6
CBR-2	97.3	96.0	21.1	94.8	93.5	24.3	2.0	1.5	31.2	10	1.2
CBR-3	102.7	101.3	20.8	101.8	100.4	21.9	8.1	6.9	23.9	10	0.6

Material Description	USCS	MAX DENSITY, pcf	OPTIMUM MOISTURE, %	LL	PI
	CL	101.4	20.8	40	19

Remarks:

Compaction Method: ASTM D 698

Project: Beacon Hill SW Quadrant
Location: Kansas City, Missouri
Client: Taliaferro & Browne
Sample No.: 1
Boring: Bulk Sample **Project No.: 20162042**
Depth: na **Date:**

TSi geotechnical, inc.

8248 NW 101st Terrace, #5
Kansas City, Missouri 66214
p| 816.599.7965
f| 816.599.7967

APPENDIX D

Pavement Core Photographs

C-01 **Beacon Hill Southwest Quadrant** **20162042**

Pavement Type.	Thickness (in)
Asphaltic concrete	3.5

C-02 **Beacon Hill Southwest Quadrant** **20162042**

Pavement Type	Thickness (in)
Asphaltic concrete	4.5

C-03 **Beacon Hill Southwest Quadrant** **20162042**

Pavement Type	Thickness (in)
Asphaltic Concrete	4.0

C-04 **Beacon Hill Southwest Quadrant** **20162042**

Pavement Type.	Thickness (in)
Asphaltic concrete	5.5

C-05 **Beacon Hill Southwest Quadrant** **20162042**

Pavement Type.	Thickness (in)
Asphaltic concrete	3.0