GEOTECHNICAL EVALUATION
HCC SOUTHWEST COLLEGE BRAYS OAKS CAMPUS – ADDITIONAL PARKING LOT
8855 WEST BELLFORT BOULEVARD
HOUSTON, TEXAS

ALLIANCE LABORATORIES PROJECT NO.: AE19-187 Rev 1

Submitted to:

Houston Community College
3100 Main St #12C13
Houston, TX 77002

Submitted by:

ALLIANCE LABORATORIES, INC.

Houston, Texas

April 10, 2019

ALLIANCE LABORATORIES, INC.

Consulting Engineers · Geotechnical Engineering · Construction Materials Testing

April 10, 2019

Mr. Gregory Kieschnick
Senior Project Manager
Houston Community College
3100 Main Street, # 12C13
Houston, TX 77002

Re: Geotechnical Evaluation
HCC Southwest College Brays Oaks Campus – Additional Parking Lot
8855 West Bellfort Boulevard
Houston, Texas

Alliance Laboratories Project No.: AE19-187 Rev 1

Dear Mr. Kieschnick:

We are pleased to submit the attached geotechnical report for the above referenced project. The geotechnical evaluation was performed in accordance with our proposal no. APE18-711 dated July 24, 2018.

Presented are recommendations for design of pavement. Also included are results of the field exploration program and laboratory test results.

We trust that the study results will lead to economical design and construction of the proposed facilities. If we can be of further assistance, please do not hesitate to contact us.

We appreciate the opportunity to provide these services.

Sincerely,

ALLIANCE LABORATORIES, INC.
Firm Registration No. F-5407

Raghunath Dass

STATE OF TEXAS
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GEOTECHNICAL EVALUATION
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8855 WEST BELLFORT BOULEVARD
HOUSTON, TEXAS

1. INTRODUCTION

1.1 PROJECT DESCRIPTION

The proposed project consists of construction of additional concrete parking lot in Houston Community College Brays Oaks Campus at 8855 West Bellfort Boulevard in Houston, Texas.

1.2 PURPOSE AND SCOPE

The purpose of this study is to evaluate the existing subsurface conditions encountered in the area and develop engineering recommendations for the design of pavements. Our scope of work included:

1. Drilling and sampling (2) geotechnical borings to a depth of 10 feet each for the evaluation of subsurface conditions.
2. Visually classifying samples obtained from the field and conducting laboratory tests to determine their engineering properties, and
3. Recommended pavement sections for additional parking areas.

2. FIELD EXPLORATION

Subsurface conditions were evaluated by two exploratory borings drilled at the approximate locations shown on the Plan of Borings, Figure 1. The soil was sampled continuously from the ground surface to a depth of 10 feet.

Relatively undisturbed samples of cohesive soils were obtained by hydraulically pushing three-inch outside diameter (O.D.) thin-walled, seamless tube samplers (Shelby tube) into the ground. The tube samples were extruded in the field, sealed with foil, and placed into airtight plastic bags. Estimates of the undrained shear strength of the cohesive soils were obtained using pocket penetrometer tests.

The soil samples obtained from the borings were tagged for identification and transported to Alliance Laboratories where representative samples were selected for laboratory testing and classification. Sample depths, soil descriptions and classifications ([based on Unified Soil Classification System (USCS) in accordance with ASTM D 2487] are shown on the Boring Logs provided in the Appendix. The description for the boring log terms and symbols is provided in the Appendix.

Water level observations during drilling are approximately 24 hours after the completion of drilling are recorded on the Boring Logs as shown in the Appendix, and described in Section 4.3 of this report.

3. LABORATORY TESTING

Laboratory tests were performed on representative soil samples to evaluate their engineering properties and aid in soil classification. The following laboratory tests were performed:

- Moisture content determinations (ASTM D 2216);
- Unconfined compression test (ASTM D 2166);
- Atterberg limits (ASTM D 4318);
- Pocket Penetrometer; and
- Percent passing # 200 Sieve (ASTM D 1140).

4. SITE AND SUBSURFACE CONDITIONS

4.1 SITE CONDITIONS

At the time of our evaluation the site was a grassy field. The borings were drilled with conventional auger using truck mounted drilling equipment.

4.2 SUBSURFACE SOIL STRATIGRAPHY

The subsurface soil stratigraphies at the location of Borings B-1 and B-2 are described on the Boring Logs. Data from these borings suggest that the upper 10 feet of the overburden soils are composed primarily of 2 feet of sandy lean clay fill underlain by natural sandy lean clay and high plasticity clays.

It should be noted that depths on the Boring Logs refer to the depths from the existing ground surface at the time of the geotechnical evaluation. The stratification lines shown on the boring logs represent the approximate boundaries between the various soil types and the transition between soil types may be gradual.

4.3 GROUNDWATER

Groundwater was not encountered during drilling in Borings B-1 and B-2.

Fluctuations in the long-term ground water level should be expected throughout the years depending upon variations in hydrological conditions and other factors not apparent at the time the borings were drilled. It is not possible to accurately predict the magnitude of subsurface ground water fluctuations that might occur based upon short-term observations. The subsurface water conditions are subject to change with variations in climatic conditions. An accurate determination of the actual ground water level fluctuations requires long term monitoring using an observation well that is sealed from the influence of surface water.

5. PAVEMENT RECOMMENDATIONS

5.1 STABILIZATION OF SUBGRADE SOILS

Based on the proposed grading requirements and the results of our field and laboratory studies, exposed subgrade soils will consist of sandy lean clay fill to a depth of 2. Deeper excavation may encounter high plasticity clays.

Lime stabilization of the subgrade soils is recommended to improve the bearing value and provide a uniform pavement subgrade soil condition. Lime stabilization to a depth of 6-inches is recommended.

Stabilization-series tests should be performed on soil samples obtained from the upper 8-in. of the final grade, during construction, to determine the optimum stabilization concentration. For estimating purposes only, 5 percent lime by dry weight is recommended at 25 lbs lime per square yard area.

5.2 SUBGRADE PREPARATION – PAVEMENT AREAS

Recommended soil preparation for the proposed pavement is provided as follows:

1. Site drainage should be established and maintained at all times. Storm drainage structures should be installed if required.
2. Areas of weakness identified by proofrolling should be undercut to firm soil and compacted in lifts with a maximum loose thickness of 8-in as outlined in Item 5.5 below. The proofrolling operation should be observed by the geotechnical engineer or a representative.
3. After proofrolling, the upper 8" should be compacted as specified below.
4. In fill areas, suitable earth fill should be placed to the top of the proposed subgrade elevation. Suitable earth fill should be placed in lifts with a maximum loose thickness of 8-in. The suitable earth fill should consist of the excavated on-site clays, which are free from debris and organic matter, or similar imported materials. On-site clay fill should be compacted from -2% to + 2% of the optimum moisture content to a minimum of 95 percent of the maximum Standard Proctor dry density (ASTM D 698).
5. The subgrade material should be stabilized with hydrated lime. Until PI tests are performed, the estimated amount of hydrated lime for stabilization (25 lbs lime per square yard area a treated depth of 6-in). Actual stabilization requirements should be evaluated during construction after final grading.
6. Stabilization procedures should be in accordance with the most recent revision of the Harris County Engineering Department Specifications entitled "Specifications for the Construction of Roads and Bridges Within Harris County, Texas" or equivalent specifications.

7. The lime stabilized soil should be compacted from 2 percent below to 2 percent above the optimum moisture content to a minimum dry density of 95 percent of the maximum Standard Proctor dry density (ASTM D 698).

The moisture content and dry density of the lime stabilized subgrade should be maintained until the paving is completed.

5.3 TRAFFIC LOADING

The proposed parking lot is anticipated to passenger cars, passenger trucks (pickup trucks) and medium trucks, such as delivery trucks. It is also anticipated that tractor trailer trucks may use the lot. We have used the about 400,000 ESAL for design. If traffic data is different than the provided, we should be notified.

5.4 PAVEMENT SECTION

The subgrade will be suitable for support of rigid pavement provided the subgrade is prepared as described above in Sections 5.1 and 5.2.

The data presented in this report have been used for analysis of pavement design requirements in accordance with the "*AASHTO Guide for Design of Pavement Structures – 1993*" prepared by the American Association of State Highway and Transportation Officials (AASHTO). The design approach includes certain modifications to the "AASHTO Interim Guide for Design of Pavement Structures, 1981" which was developed as a result of the AASHTO Road Test program and based on road user definition of failure. The primary basis for the AASHTO pavement prediction method is cumulative heavy axle load applications. A mixed traffic stream of different axle loads and configurations is converted into an equivalent number of heavy load applications, termed 18-kip Equivalent Single Axle Loads (18-kip ESAL), using load equivalency factors determined at the AASHTO Road Test. The general methodology in the *AASHTO Guide for Design of Pavement Structures, 1993* (AASHTO Design Guide) relates the total number of 18-kip ESAL's to the service life of the pavement structure. The proposed access roadways and parking appear to have a low to medium traffic volume. The recommended pavement type and thickness as a function of the estimated wheel loads are as follows:

TABLE 2 – RIGID PAVEMENT SECTION

Description	Pavement Section
Surface:	6"- 3000 psi concrete
Subbase:	6" Lime stabilized subgrade
Traffic Loading:	400,000 ESAL

The pavement should be adequately reinforced with steel, and all construction joints should be provided with load transfer dowels. The reinforcement steel should be No. 4 bars or greater conforming to ASTM Designation A-615. All concrete for the paving should be air entrained with a total air content of 4 to 6 percent. Air entraining admixtures should conform to ASTM Designation C-260. All joints, including sawed joints, should be sealed immediately following the cleaning of joints, and prior to opening the pavement to any traffic. Adequate pavement drainage is essential to pavement performance in accordance with design criteria.

It is essential to maintain the pavement to prevent infiltration of water into the subgrade soils. Allowing water into the subgrade will accelerate pavement failure and maintenance requirements. Periodic maintenance must be performed on the pavement sections to seal any surface cracks and prevent infiltration of water. In addition, the pavement should be graded to prevent water from ponding against the edge of the pavement and to promote rapid surface drainage away from the pavement. Adequate pavement drainage is essential to provide satisfactory pavement performance in accordance with design criteria. All grading should provide positive drainage away from the construction areas and should prevent water from ponding within the construction limits during or after construction. Unpaved areas and permeable surfaces should be provided with steeper gradients than paved areas.

5.5 PROOFROLLING

Site preparation within the construction limits should include removing removing of any identified organic soils and soft natural soils. We recommend that the subgrade soils exposed after stripping be closely observed by the geotechnical engineer or his representative to evaluate their stability and suitability for placing new fill or supporting pavements.

Following proper site stripping, the exposed subgrade should be proofrolled. Proofrolling aids in providing a firm base for compaction and in delineating if soft or disturbed areas may exist below subgrade level. Proofrolling may be accomplished with a fully loaded tandem-axle dump truck or other equipment providing an equivalent subgrade loading. A minimum gross weight of 20 tons is recommended for the proofrolling equipment. Proofrolling should be performed under the direct supervision of the geotechnical engineer or a representative. Soft or unstable areas detected during proofrolling should be removed, adjusted in moisture content and recompacted, replaced with select fill if they cannot be densified in-place or chemically stabilized. The weak soils should be over-excavated to a maximum depth of 2-feet or until a firm subgrade is encountered, whichever is shallower.

5.6 DRAINAGE

In order to minimize surface runoff infiltration through the pavement surface, all cracks and joints in the pavement should be sealed on a routine basis after construction. In addition, the pavement should be graded to prevent water from ponding against the edge of the pavement and to promote rapid surface drainage away from the pavement. Adequate pavement drainage is essential to provide satisfactory pavement performance in accordance with design criteria. All grading should provide positive drainage away from the construction areas and should prevent water from ponding within the construction limits during or after construction. Unpaved areas and permeable surfaces should be provided with steeper gradients than paved areas.

6. CONSTRUCTION INSPECTION

Construction inspection is necessary to ensure that the proposed pavement sections are constructed according to the specifications developed by the civil engineer. Alliance Laboratories, Inc. has a well trained and experienced staff for providing these services. We would be pleased to assist in materials testing and inspection during the course of construction.

7. LIMITATIONS

Recommendations provided in this report have been developed from information provided by a limited number of test borings. These test borings depict subsurface conditions only at the specific boring locations and at the particular dates designated on the logs. Subsurface conditions may vary between boring locations. The nature and extent of variations between borings may not become evident until construction begins. If subsurface conditions encountered during construction differ from what we have obtained from test borings, our office should be notified immediately so that the effects of these conditions on design and construction can be addressed.

Professional services provided in this geotechnical exploration have been performed, findings obtained, and recommendations prepared in accordance with generally accepted geotechnical engineering principles and practices. The scope of services provided herein does not include an environmental assessment of the site or evaluation for the presence or absence of hazardous materials in the soil, surface water, and ground water, or identification of faults.

The reproduction of this report or any part thereof, in plans or other documents supplied to persons other than the owner, should bear language indicating that the information contained therein is for the purpose of providing guidance for pavement design only. All contractors referring to this geotechnical report should draw their own conclusions regarding excavations, trafficability, etc., for bidding purposes. Alliance Laboratories, Inc. is not responsible for conclusions, opinions, or recommendations made by others based on this data.

APPENDIX

PLAN OF BORINGS

BORING LOGS

(Borings B-1 and B-2)

Description of Boring Log Terms and Symbols

HCC Brays Oaks
Approximate Topo Lilmits
Legend
HCC Brays Oak Campus
Westbrae Pkwy
W Bellfort Ave
HCC Brays Oak Campus
B-1
B-2
N
500 ft
Google Earth
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LOG OF BORING B-1

Project: **HCC SW College Brays Oaks Campus - Additional Parking Lot** Project No.: **AE19-187**
Date Drilled: **3/20/19**
Location: **See Plan of Boring**

Client: **Houston Community College**

Depth to water ecountered during drilling: **Groundwater was not encountered during drilling.**

ELEVATION/ DEPTH (feet)	SOIL SYMBOLS SAMPLER SYMBOLS & FIELD TEST DATA	DESCRIPTION	MC %	LL %	PL %	PI	-200 %	D.D. pcf	UNCON. tsf	Strain %	P.PEN tsf
0		FILL: very stiff, dark gray and light gray sandy lean clay	16				61				3.0
		FILL									
		Stiff, dark gray and brown SANDY LEAN CLAY (CL)	21	50	16	34	61				1.5
		fat clay 2'-4'									
5			16								3.25
			19	47	12	35	62				1.25
			18								1.75
		CL									
10		Boring terminated @ 10 feet ft									
15											
20											
25											
30											

Notes:

LOG OF BORING B-2

Project: **HCC SW College Brays Oaks Campus - Additional Parking Lot**
Project No.: **AE19-187**
Date Drilled: **3/20/19**
Location: **See Plan of Borings**

Client: **Houston Community College**

Depth to water ecountered during drilling: **Groundwater was not encountered during drilling.**

ELEVATION/ DEPTH (feet)	DESCRIPTION	MC %	LL %	PL %	PI	-200 %	D.D. pcf	UNCON. tsf	Strain %	P.PEN tsf
0	FILL: very stiff, dark gray and tan sandy lean clay (FILL)	12	36	11	25	57				4.5
	Very stiff, light gray and tan SANDY LEAN CLAY (CL)	19								2.25
5		18					111	1.87	8.5	2.0
		18				66				2.25
	(CL)	17								3.5
10	Boring terminated @ 10 feet ft									
15										
20										
25										
30										

Notes:

ALLIANCE LABORATORIES, INC.

SYMBOLS AND TERMS USED ON BORING LOGS

Unified Soil Classifications System Symbols

GW	Well-graded Gravel
GP	Poorly-graded Gravel
GM	Silty Gravel
GC	Clayey Gravel
SC	Clayey Sand
SW	Well-graded Sand
SP	Poorly-graded Sand
SM	Silty Sand
ML	Sandy Silt
ML	Clayey Silt
OL	Organic Silt
MH	Elastic Silt
CH	Fat Clay
CL	Lean Clay
CL	Sandy Lean Clay
CL-ML	Silty Clay
OH	Organic Clay
FILL	Fill
	Concrete
	Asphalt
	Pavement

Sampler Symbols	Meaning
	Depth of thin - walled tube sample
	Depth of Standard Penetration Test (SPT)
	Depth of auger sample
	Depth of sampling attempt with no recovery
	TxDOT Cone Penetrometer Test
Field Test Data	
2.50	Pocket penetrometer reading in tons per square foot
8/6	Blow count per 6 - in. interval of the Standard Penetration Test
	Observed free water during drilling
	Observed static water level
Laboratory Test Data	
Wc (%)	Moisture content in percent
Dens. (pcf)	Dry unit weight in pounds per cubic foot
Qu (tsf)	Unconfined compressive strength in tons per square foot
UU (tsf)	Compressive strength under confining pressure in tons per square foot.
Str. (%)	Strain at failure in percent
LL	Liquid limit in percent
PI	Plasticity index in percent
#200 (%)	Percent passing the No. 200 mesh sieve
( )	Confining pressure in pounds per square inch
*	Slickensided failure
**	Did not fail

RELATIVE DENSITY OF COHESIONLESS & SEMI-COHESIVE SOILS

The following descriptive terms for relative density apply to cohesionless soils such as gravels, silty fine sands, and fine sands as well as semi-cohesive and semi-cohesive soils such as sandy silts, clayey silts, and clayey sands.

Relative Density	Typical SPT "N" Value Range*
Very Loose	0-4
Loose	5-10
Medium Dense	11-30
Dense	31-50
Very Dense	Over 50

* "N" is the number of blows from a 140-lb weight having a free fall of 30-in. required to penetrate the final 12-in. of an 18-in. sample interval. The density designations correspond to a SPT "N" value range based on an effective overburden pressure of 1 tsf. Density descriptors may be modified because of variations in the effective overburden pressure.

CONSISTENCY OF COHESIVE SOILS

The following descriptive terms for consistency apply to cohesive soils such as clays, sandy clays, and silty clays.

Typical Unconfined Compressive Strength (tsf)	Consistency	Typical SPT "N" Value Range**
qu < 0.25	Very soft	≤ 2
0.25 ≤ qu < 0.50	Soft	3-4
0.50 ≤ qu < 1.00	Firm	5-8
1.00 ≤ qu < 2.00	Stiff	9-15
2.00 ≤ qu < 4.00	Very Stiff	16-30
qu ≥ 4.00	Very Stiff - Hard	≥ 31

** An "N" value of 31 or greater corresponds to a hard consistency. The correlation of consistency with a typical SPT "N" value range is approximate.

ALLIANCE LABORATORIES, INC.