GEOTECHNICAL STUDY
FOR THE
PROPOSED NEW BUILDING AT
FM 646 AND I-45
LEAGUE CITY, TEXAS

PREPARED FOR

MS. SOONHEE AHN
HOUSTON, TEXAS

PREPARED BY

A.R.M. SOIL TESTING
HOUSTON, TEXAS

PROJECT NO: G10-173

May 21, 2010

ARM SOIL TESTING
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May 21, 2010
Project Number: G10-173

Ms. Soonhee Ahn
14914 Limber Oak
Houston, Texas 77082

Reference: GEOTECHNICAL INVESTIGATIONS FOR THE PROPOSED NEW BUILDING AT FM 646 AND I-45 IN LEAGUE CITY, TEXAS

Dear Ms. Ahn:

ARM Soil Testing is pleased to submit the results of the geotechnical exploration study for the above-referenced project. This report briefly presents the findings of the study along with our conclusions and recommendations for the design of the foundation for the proposed new building at FM 646 and I-45 in League City, Texas.

We appreciate the opportunity to serve you and look forward to working with you in other future projects. We also look forward to providing you again on future environmental consulting needs.

Should you have any questions regarding this report or any questions pertaining to soils engineering, please do not hesitate to call me at (832) 593-7510 at any time.

Respectfully submitted,

A.R.M. SOIL TESTING

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INTRODUCTION

Planning is underway for construction of a new building at FM 646 and I-45 in League City, Texas. Information on this project was supplied by the client. The project consists of a new (50'X60') building. Structural details such as column and wall loads are not known at this time but are not expected to exceed 50 kips and 2.0 kips per foot.

PURPOSE AND SCOPE

A geotechnical study was performed for the purposes of (1) exploring the subsurface conditions of the site (2) evaluating the pertinent engineering properties of the subsurface materials (3) providing recommendations concerning suitable types of foundation systems for support of the planned structure and (4) providing geotechnical construction guidelines.

<u>Analyses of slope stability, bulkhead or any other features at the site is not within the scope of this investigation and, therefore, ARM is not responsible for any problems caused by these features. The settlement analysis was not within the scope of this study.</u>

Narrative descriptions of our findings and recommendations are contained in the body of the report. A Boring Location Plan and the boring logs are included in Plates 1 through 3 of the report.

SUBSURFACE EXPLORATION

Conditions at this site were explored with two (2) borings located approximately as shown on the Location of Borings plan found in the Plate 1 of this report. The borings were drilled to the depths of 20 and 15 feet each below existing site grades on May 19, 2010. After the soil samples were obtained and the borings completed, final groundwater levels were measured in the boreholes and they were backfilled with soil cuttings prior to leaving the site.

Undisturbed and disturbed sampling procedures were performed at selected depths during the field exploration phase to obtain samples for laboratory testing and stratigraphy identification. Three-inch diameter thin-wall tube samplers for cohesive materials and two-inch diameter split samplers for cohensionless soils were utilized to obtain undisturbed samples. Thin-wall tube samples were mechanically extruded in the field, visually classified, labeled according to boring number and depth, then packaged in protective boxes for transport back to the laboratory.

LABORATORY TESTING

Upon completion of drilling operations, the soil samples were transported to the laboratory for testing and further study. The laboratory testing was performed in order to evaluate the strengths, classifications and volume change characteristics of the major soil strata. Atterberg limits tests and minus 200 sieve analyses were performed using selected soil samples to determine the index properties of the subsurface materials. Results of laboratory classification tests, in-situ moisture contents and strength tests are presented on the boring log included in the Appendix of the report.

SITE CONDITIONS

Site Description

The project site is relatively flat. The site is vacant and covered with grass. All trees and root system within the building and pavement area should be removed and the soils compacted as specified in the report.

Soil Stratigraphy

The subsurface conditions present at the boring location are presented on the Log of Borings. A summary of the various strata and their approximate depths and thicknesses which were encountered in the borings are presented on the following TABLE 1. SUMMARY OF SUBSURFACE CONDITIONS. Note that depths on the log and in the following table are referenced from the ground surface, which existed at the time of the field exploration.

TABLE 1 SUMMARY OF SUBSURFACE CONDITIONS			
Stratum	Description	First Encountered (ft)	Bottom of Stratum (ft)
CLAY (CH)	Stiff to very stiff dark gray to light gray and tan to reddish brown and light gray clays	Ground Surface	13
SILTY SAND (SM)	Loose (saturated) tan silty sand	13	20

The clays of stratum I are considered fat clays. The clays are highly plastic with plasticity indices of 35 to 46. **These soils are considered expansive** and have very high potential for shrink and swell movements that are usually associated with changes in soil moisture content. The clays are stiff to very stiff in consistency.

The silty sands of stratum II are loose. The Standard Penetration Test (SPT) counts range from 4 to 6 blows per foot.

The above subsurface description is of a generalized nature to highlight the major subsurface stratification features and materials characteristics. The boring logs included in Plates 2 through 4 should be reviewed for specific information at the boring locations. These records include soil /rock descriptions, stratifications, penetration resistances, and locations of the samples and laboratory test data. The stratifications shown on the boring logs represent the conditions only at the actual boring location.

Groundwater Conditions

The borings were monitored at the time of drilling for evidence of groundwater. At the time of drilling, groundwater was encountered at 13 feet and final reading of 10 feet. Excavations for footings may encounter some water at some locations. For best results, any standing water should be pumped out and footings poured immediately after the excavation has been made.

Water traveling through the soil (subsurface water) is often unpredictable and may be present at other locations and depths at the site. Due to the seasonal changes in groundwater and the unpredictable nature of groundwater paths, groundwater levels will also fluctuate. Therefore, it is necessary during construction to be aware of groundwater in excavations in order to determine if any changes are necessary in the construction procedures due to the presence of the water.

ANALYSIS AND RECOMMENDATIONS

Suitable Building Foundation

The foundation for the proposed structure must satisfy two independent criteria. First, the maximum design pressure exerted at the foundation level should not exceed the allowable bearing pressure based on an adequate factor of safety with respect to soil shear strength. Secondly, the magnitude of slab-on-grade and foundation movement due to soil volume changes or settlement must be such that structural movement is within tolerable limits. Considering the subsurface conditions encountered at the boring locations, the proposed building structure may be supported on drilled and underreamed foundation.

Drilled and Underreamed Piers

The structural loads for the proposed building may be supported on drilled and underreamed piers founded at a depth of ten (10) feet below the existing grades in the competent clayey soils. The piers should be designed for net allowable bearing pressures of 2,500 pounds per square feet (psf) for sustained dead loads plus live loads and 3,750 psf for total loads, respectively. The drilled piers should not be placed closer than three diameters, center to center.

The ultimate capacity of under reamed footings to resist uplift loads can be determined from the following equation provided the ratio of footing depth to bell diameter is greater than 1.5:

$$Q_u = 5.8\ c\ (D^2 - d^2)$$

where: Q_u= ultimate uplift capacity, pounds
c= Average shear strength above the footing grade, pounds per square foot. (use c = 800 PSF)
D= underream diameter, feet.
d= shaft diameter, feet.

A minimum factor of safety of 2.0 is recommended for final design.

The settlement analysis was not within the scope of this study.

Floor Slabs

The surficial soils within the proposed building lines consist of highly expansive clays. Based on existing soil conditions, the estimated potential vertical rise (PVR) using TEX-124E method is approximately 3.4 inches. Any grade-supported floor slab for this project constructed over expansive clays will incur some level of risk associated with expansion or shrinkage of the moisture-sensitive soils.

A structurally supported floor slab with a six-inch void space would be most suitable floor system for the proposed construction. However, a grade-supported floor system may also used using either of the two options to reduce the PVR to one-inch- (1):

- Undercut upper 3.5 feet of existing high plasticity expansive clays and replace with compacted low plasticity structural fill or top the existing soils with 3.5 feet of compacted low plasticity structural fill.

- Excavate the upper 3.5 feet of existing high plasticity clays and thoroughly mix the clays with 8% of lime (dry weight) under proper moisture control. Then place the lime-stabilized clays in 8-inch loose lifts and compact each lift to at least 95% of the maximum dry density as specified by ASTM D-698.

Grade Beams

Grade beams used in conjunction with drilled piers should be placed beneath all load bearing walls. Grade beams should be founded at a depth of 24 inches below the final grades and should be designed to support the imposed loads.

Maintenance Considerations

The site should be graded in such a manner to shed all rainwater away from the structure. Water should not be allowed to pond around the structure. Positive site drainage will reduce the exposure of the on-site clays to a moisture source thus eliminating swelling of the on-site clays.

Due to the presence of sandy clay soils, it is imperative to install a watertight plumbing system. Water leakage due to poor plumbing will have detrimental effects on the performance of the structure.

Roof gutters should be utilized to direct roof runoff away from the structure. Downspouts should not be allowed to discharge near the structure. Downspout extensions should be used to facilitate rapid rainwater drainage away from the structure.

Trees should be planted at a distance equaling the anticipated height of the mature tree. If trees are planted in close proximity to the structure, the roots will extend below the slab area causing distress to the slab. Root barriers should be constructed around the perimeter of the building in the event that trees are located less than the maximum anticipated height of the mature tree. Root barrier should extend at least four feet below grade.

The floor slabs should be provided with a moisture barrier to prevent migration of the capillary moisture through the slab. Six-mill Visqueen can be used. In addition, a two-inch layer of sand can be used for leveling purposes.

Pavement Recommendations

General

We were not provided with traffic type nor with traffic frequency for the drives and parking areas associated with this facility. As a result, we have provided general guidelines for pavement thicknesses.

Flexible asphaltic concrete pavement or rigid Portland cement pavement can be used at this site for automobile traffic use. Pavement subject to light truck traffic can also be rigid or flexible pavement. However, pavement design recommendations presented herein are not applicable for streets or major thoroughfares.

Pavement Sections

The following pavement sections are recommended for the project site. In parking lots and drives servicing only automobile traffic, 5 inches of asphalt concrete should provide adequate service. It is recommended that this be increased to a minimum of 6 inches in main drives and any areas subject to occasional light truck traffic. The section should consist of a 2-inch surface course meeting the requirements of THD Type D with a base course meeting the requirements of THD Type A or B. The coarse aggregate in the surface layer should be crushed limestone rather than gravel.

Portland Cement concrete pavements are recommended in areas subject to any heavy truck traffic such as garbage pickup and/or dumpster trucks and any heavy delivery trucks. We recommend the use of 5 inches of Portland Cement Concrete for general area pavements, which are not subject to truck traffic. A minimum 6-inch thick section is recommended in areas subject to truck traffic. The required thickness will depend on the number of truck passes per day. A minimum 7-inch thick Portland cement pavement thickness is recommended in areas subject to loading of dumpster type garbage trucks. We recommend that the Portland cement concrete in light duty pavement areas should have a minimum 28-day compressive strength of 3,500 pounds per square inch and in heavy duty pavement areas, a 28 day compressive strength of 4,000 psi.

Subgrade Stabilization

Based on the results of laboratory testing, the subgrade performance of the on-site soils can be improved by stabilization with hydrated lime. Stabilization is recommended below both pavement systems. It is estimated that the near surface expansive clayey soils below the future pavements will require 7 percent hydrated lime by dry unit weight. This assumes soil properties of the subgrade soils will be similar to the soils existing in the areas where the borings were drilled. The stabilized clays should be compacted to a minimum of ninety-five (95) percent of the maximum density in a moisture content range of -1% to +4% of the soil/lime mixture's optimum moisture content as determined by ASTM D-698.

A minimum stabilized subgrade depth of 6 inches is recommended below the bottom of the proposed pavement. We recommend that the depth of stabilized subgrade be increased to 8-inch for heavy traffic areas. It is to be noted that the actual amount of lime required be determined after stripping of the subgrade.

The prepared subgrade should be protected and moist cured or sealed with a bituminous material until the pavement materials are placed. Finished pavement subgrade areas should be graded at all times to prevent ponding and infiltration of excessive moisture on or adjacent to the pavement subgrade surface.

It is recommended to extend the pavement stabilization five feet beyond the perimeter of the pavement in order to preclude edge failure. It is also highly recommended to maintain positive drainage away from the pavement throughout the life of the pavement.

Hot Mixed Asphaltic Concrete (HMAC)

All hot mix asphaltic concrete used on this project for new construction shall comply in all respects to Item 340 of the current edition of the Texas Department of Highways and Public Transportation's Standard Specifications (TSDHPT) except as modified for this project. The paving mixture for the wearing surface for new pavement for this project is recommended to be a Fine Graded Surface Course (Type D). The paving mixture for the HMAC base course for this project should be a coarse graded or fine graded Base Course (Type A or Type B). The coarse aggregate in the surface layer should be a crushed limestone rather than gravel.

Portland Cement (Rigid) Concrete

The Portland cement concrete (PCC) used on this project should comply in all respects with Item 360 of the current edition of the TSDHPT Standard Specifications except as may be modified for this project. Type I cement is recommended for use in the concrete pavement.

The concrete in light duty pavement areas should have a minimum 28 day compressive strength of 3,500 pounds per square inch and in heavy duty pavement areas, a 28 day compressive strength of 4,000 psi is recommended. Assuming a nominal maximum aggregate size of 1 to 1 1/2 inches, it is recommended that the concrete have entrained air of 5 percent ($\pm$1%) with a maximum water cement ratio of 0.50.

Portland cement concrete pavement types for standard or heavy duty traffic pavements in this area are generally jointed reinforced concrete pavements (JRCP). Due to construction over swelling clays, unreinforced pavement is not recommended. Reinforcing steel and joint systems for the pavement should be properly designed.

CONSTRUCTION GUIDELINES

Site Preparation

Soft soils should be removed until firm soil is reached. The soft soils can be aerated and placed back in eight-inch loose lifts and compacted to 95% as specified by ASTM D-698. Tree stumps, tree roots, old slabs, old foundations and existing pavements should be removed from the structure area. If the tree stumps and roots are left in place, settlement and termite infestation may occur. Once a root system is removed, a void is created in the subsoil. It is recommended to fill these voids with structural fill or cement-stabilized sand and compact to 95% as specified by ASTM D-698.

Any low-lying areas including ravines, ditches, swamps, etc. should be filled with structural fill and placed in eight-inch lifts. Each lift should be compacted to 95% of the maximum dry density as specified by ASTM D-698.

The exposed subgrade should be scarified to a minimum depth of six (6) inches in the driveway and slab areas. The subgrade should then be compacted to 95% of the maximum density as determined by the Standard Moisture Density Relationship (ASTM D-698). In the event that the upper six (6) inches cannot be compacted due to excessive moisture, we recommend that these soils be excavated and removed or chemically stabilized to provide a firm base for fill placement. Proof rolling should be performed using a heavy tired loaded truck or pneumatic rubber-tired weighting about 15 to 20 tons equipment.

The fill soils should extend at least five feet beyond the perimeter of the structure. In addition, the floor slab should be placed as soon as possible after the building pad is prepared. If the building pad is left exposed to rainfall, perched groundwater conditions may develop which will undermine the integrity of the floor slab. All trenches (water, cable, electrical) should be properly backfilled and compacted to 95% of the maximum dry densities. Sand or permeable materials should not be used as backfill. Improperly backfilled and improperly compacted trench, if left exposed will also be another source for perched groundwater conditions. In general perched water tends to be trapped within the fill. The trapped groundwater tends to soften the subgrade. Positive drainage should be maintained across the entire building pad.

A qualified soil technician should monitor all earthwork operations. Field density tests should be conducted on each lift using a nuclear density gauge. The gauge should be calibrated every day. Prior to field density tests, a 50-pound sample from the subgrade soils should be obtained. A similar sample should be obtained from the fill soils. A Standard Moisture Density Relationship (ASTM D-698) should be performed on each sample in order to obtain an optimum moisture content and a maximum dry density. The field density tests should be compared to these results every time the soils are tested in the field.

The above recommendations are applicable to slabs, driveways, pavements and any structures that are supported directly on-grade.

Low Swell Potential Structural Fill

Low swell potential select fill should consist of cohesive soils free of organics or other deleterious materials and should have a maximum liquid limit of 35, a plasticity index not less than 10 or more than 20, 20 percent should pass the No. 200 sieve and a maximum particle size of 2 inches. Sandy clays and clayey sands are recommended for use.

The low swell potential select fill should be cleaned and free of organic matter or other deleterious material. The fill should be placed in maximum 9-inch loose lifts and compacted to a minimum of 95 percent of the maximum dry density as determined by ASTM D 698 (Standard Proctor). The moisture content at the time of compaction should be at, or above the optimum value as defined by ASTM D 698. The referenced moisture content and density should be maintained until construction is complete.

Drainage

Roof drainage should be collected by a system of gutters and down spouts and transmitted to a paved surface where water can drain rapidly away from the structure. Sidewalks, parking areas, building access drives, and the general ground surface should be sloped so that water will drain away from the structure. Water should not be allowed to pond near the building foundations.

Footing Construction

Concrete should be placed in underreamed piers immediately following drilling and inspection. Significant seepage into excavations from groundwater is anticipated if excavations remain too long. If water collects in excess of 1-inch depth at the bottom of the footing excavations, it should be pumped out prior to concrete placement or the concrete should be tremied in place. We recommend that footing installations be monitored by the testing laboratory.

Groundwater Control

In general, the highest groundwater level during construction should be at least three (3) feet below the bottom of the excavation to ensure excavation stability. Presence of groundwater above the excavation depths may require de-watering. However, it is the contractor’s responsibility to select the proper de-watering systems for the proposed constructions.

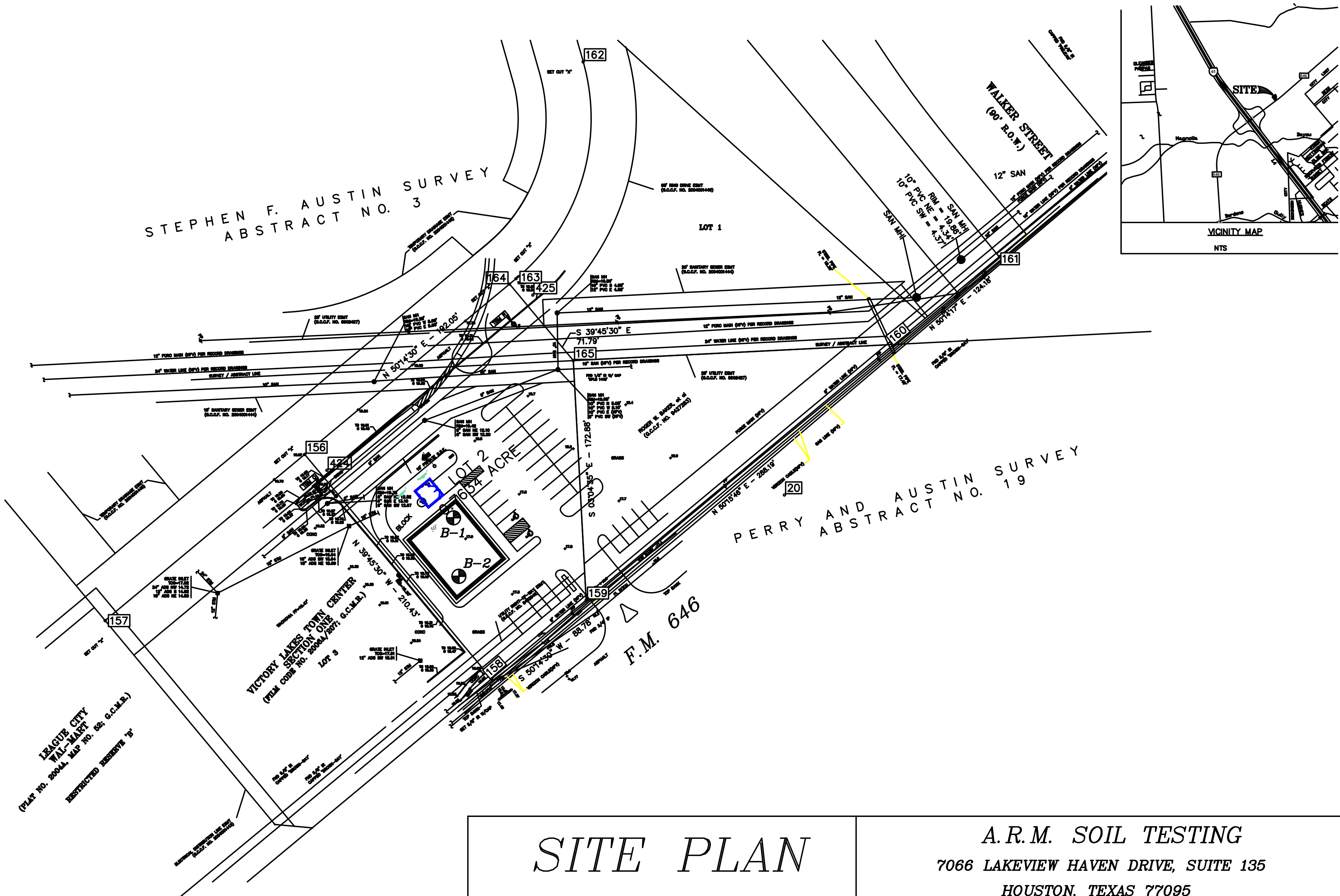
LIMITATIONS

The conclusions reached in this report are based on the conditions at the boring location. In any subsurface exploration, it is necessary to assume that the subsoil conditions between exploratory borings do not change significantly. Therefore, careful observations must be made during excavation to detect significant deviations from conditions encountered in the test borings. If such deviations are detected, this office should be contacted immediately.

In the event that any changes in the nature, design or location of the structures are planned, the conclusions and recommendations contained in this report shall not be considered valid unless the changes are reviewed and conclusions of this report are modified and verified in writing.

We have conducted this geotechnical study using the standard of care and diligence normally practiced by recognized engineering firms now performing services of a similar nature under similar circumstances. Unless specifically stated otherwise, any environmental or contaminant assessment efforts are beyond the scope of work for this report. We intend for this report, including all illustrations, to be used in its entirety. If this report is made available to potential contractors, it should be for information only and not as a warranty of subsurface conditions.

This report has been prepared for the specific application to the proposed new building at building at FM 646 and I-45 in League City, Texas.



SITE PLAN	A.R.M. SOIL TESTING 7066 LAKEVIEW HAVEN DRIVE, SUITE 135 HOUSTON, TEXAS 77095	
PROPOSED NEW BUILDING AT NEC I-45 & FM 646 LEAGUE CITY, TEXAS	SCALE: N.T.S.	DRWN BY: SM
	PROJECT NO. G10-173	PLATE NO. 1

LOG OF BORING B- 1

PROJECT NAME: PROPOSED NEW BUILDING | **PROJECT NUMBER: G10-173**

PROJECT LOCATION: FM 646 AND I-45 IN LEAGUE CITY, TEXAS | **DATE DRILLED: 05/19/2010**

Type of Boring: Auger

Boring Location: See Plan of Borings

Surface Elevation: Existing

DEPTH, FT.	SAMPLE TYPE	STANDARD PENETRATION TEST	LEGEND	POCKET PENETROMETER (tsf)	UNCONFINED COMP. (tsf)	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	LIQUID LIMIT (%)	PLASTIC LIMIT	PLASTICITY INDEX	#200 SIEVE (%)	MATERIAL DESCRIPTION	GROUP SYMBOL
												Very stiff dark gray **CLAY** with roots	**CH**
				3.50		21							
2.0				3.00	1.45	23	107	54	19	35			
4.0				2.00		24						.. stiff light gray and tan below 4 feet	
6.0				2.00		26						.. light gray and reddish brown below 6 feet	
8.0				2.25	1.20	28	102	68	22	46		.. with calcareous nodules below 8 feet	
10.0													
												Loose tan **SILTY SAND** (saturated)	**SM**
		5				25							
15.0													
		4				27						.. light tan (saturated) below 18 feet	
20.0													
												Boring Was Terminated at 20 feet	

Water Level Measurements:

Initial Reading: 13'

Final Reading: 10'

Drilled by: JR DRILLING

Logged by: JH

LOG OF BORING B- 2

PROJECT NAME: PROPOSED NEW BUILDING	PROJECT NUMBER: G10-173
PROJECT LOCATION: FM 646 AND I-45 IN LEAGUE CITY, TEXAS	DATE DRILLED: 05/19/2010

Type of Boring: Auger
Boring Location: See Plan of Borings
Surface Elevation: Existing

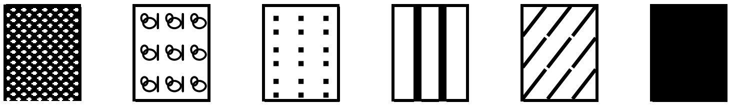
DEPTH, FT.	SAMPLE TYPE	STANDARD PENETRATION TEST	LEGEND	POCKET PENETROMETER (tsf)	UNCONFINED COMP. (tsf)	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	LIQUID LIMIT (%)	PLASTIC LIMIT	PLASTICITY INDEX	#200 SIEVE (%)	MATERIAL DESCRIPTION	GROUP SYMBOL
				3.00		19						Very stiff dark gray **CLAY** with roots	CH
2.0				2.50	1.35	22	105	57	20	37		.. stiff with sand seams below 2 feet	
4.0				2.50		25						.. light gray and tan below 4 feet	
6.0				2.50		24		65	21	44		.. light gray and reddish brown with calcareous nodules below 6 feet	
8.0				2.50	1.50	27	104					.. with calcareous nodules below 8 feet	
10.0													
		6				24						Loose tan **SILTY SAND** (saturated)	SM
15.0												Boring Was Terminated at 15 feet	
20.0													

Water Level Measurements:
Initial Reading: 13'
Final Reading: 8'

Drilled by: JR DRILLING
Logged by: JH

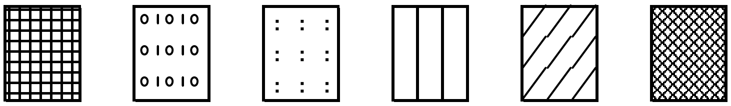
KEY TO LOG TERMS AND SYMBOLS

SOIL TYPE



ROCK GRAVEL SAND SILT CLAY PEAT

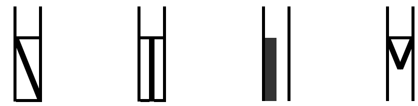
MODIFIERS



STONE GRAVELY SANDY SILTY CLAYEY FILL

SAMPLER TYPE

NO SAMPLE | AUGER SAMPLE | SHELBY TUBE | SPLIT SPOON



NO RECOVERY | ROCK CORE | 2" SHELBY TUBE | TXDOT CONE

UNIFIED SOIL CLASSIFICATION SYSTEM - ASTM D 2487

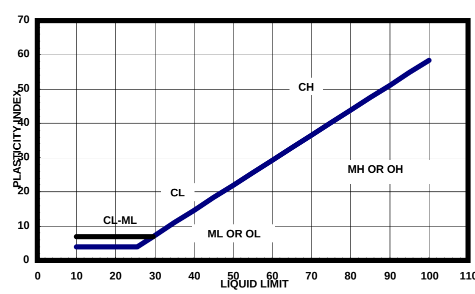
MAJOR DIVISIONS			LETTER SYMBOL	TYPICAL DESCRIPTIONS
COARSE GRAINED SOILS LESS THAN 50% PASSING NO. 200 SIEVE	GRAVEL & GRAVELY SOILS LESS THAN 50% PASSING NO. 4 SIEVE	CLEAN GRAVELS (LITTLE OR NO FINES	GW	WELL GRADED GRAVELS, GRAVEL-SAND MIXTURES WITH LITTLE OR NO FINES
			GP	POORLY GRADED GRAVELS, GRAVEL-SAND MIXTURES WITH LITTLE OR NO FINES
		W/ APPRECIATE-BLE FINES	GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES
			GC	CLAYEY GRAVELS,GRAVEL-SAND-CLAY MIXTURES
	SANDS MORE THAN 50% PASSING NO. 4 SIEVE	CLEAN SANDS LITTLE FINES	SW	WELL GRADED SAND, GRAVELY SAND (LITTLE FINES)
			SP	POORLY GRADED SANDS, GRAVELY SAND (L.FINES)
		SANDS WITH APPREA. FINES	SM	SILTY SANDS, SAND-SILT MIXTURES
			SC	CLAYEY SANDS,SAND-CLAY MIXTURES
FINE GRAINED SOILS LESS THAN 50% PASSING NO. 200 SIEVE	SILTS AND CLAYS LIQUID LIMIT LESS THAN 50		ML	INORGANIC SILTS & VERY FINE SANDS,ROCK FLOUR SILTY OR CLAYEY FINE SANDS OR CLAYEY SILT W/PI
			CL	INORGANIC CLAY OF LOW TO MEDIUM PI LEAN CLAY GRAVELY CLAYS, SANDY CLAYS, SILTY CLAYS
			OL	ORGANIC SILTS & ORGANIC SILTY CLAYS OF LOW PI
	SILTS AND CLAYS LIQUID LIMIT GREATER THAN 50		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SANDY OR SILTY SOILS, ELASTIC SILTS
			CH	INORGANIC CLAYS OF HIGH PLASTICITY FAT CLAYS
			OH	ORGANIC CLAYS OF MED TO HIGH PI, ORGANIC SILT
HIGHLY ORGANIC SOIL			PT	PEAT AND OTHER HIGHLY ORGANIC SOILS
UNCLASSIFIED FILL MATERIALS			ARTIFICIALLY DEPOSITED AND OTHER UNCLASSIFIED SOILS FILL MATERIALS	

CONSISTENCY OF COHESIVE SOILS

CONSISTENCY	UNCONIFINED COMP. STRENGTH IN TSF
VERY SOFT	0 TO 0.25
SOFT	0.25 TO 0.5
FIRM	0.5 TO 1.5
STIFF	1.75 TO 2.75
VERY STIFF	3.0 TO 4.5
HARD	4.5+

RELATIVE DENSITY - GRANULAR SOILS

CONSISTENCY	N-VALUE (BLOWS PER FT)
VERY LOOSE	0-4
LOOSE	4-9
MEDIUM DENSE	10-29
DENSE	30-49
VERY DENSE	> 50 OR 50+



CLASSIFICATION OF GRANULAR SOILS

U.S. STANDARD SIEVE SIZE(S)

6"	3"	3/4"	4	10	40	200		
BOUL- -DERS	COBBLES	GRAVEL COARSE	GRAVEL FINE	SAND COARSE	SAND MEDIUM	SAND FINE	SILT OR CLAY	CLAY
152	76.2	19.1	4.76	2.0	0.42	0.074	0.002	

GRAIN SIZE IN MM