LOUISIANA ECONOMIC DEVELOPMENT

ENGLAND INDUSTRIAL AIRPARK & COMMUNITY

EXHIBIT 18
PRELIMINARY GEOTECHNICAL ENGINEERING SERVICES REPORT

Geotechnical Testing Laboratory, Inc.

Engineering and Construction Materials Testing Services

November 14, 2012

Mr. David H. Broussard, Jr.
England Economic & Industrial Development District
1611 Arnold Avenue
Alexandria, Louisiana 71303

Mr. Kyle Randall
Pan American Engineers, Inc.
P.O. Box 89
Alexandria, Louisiana 71309-0089

RE: England Airpark Site W-1, Industrial Certification
Alexandria, Rapides Parish, Louisiana
GTL Report No. 10-12-168

Dear Mr. Broussard:

Geotechnical Testing Laboratory, Inc. is pleased to submit this preliminary report of subsurface exploration for the above referenced project. Included in the report are the results of the exploration and general recommendations concerning the potential design and construction of the foundations.

We appreciate the opportunity to have provided you with our geotechnical engineering services and look forward to assisting you by providing additional investigation services for individual projects during the development of the subject tract. If you have any questions concerning this report, or if we may be of further service, please contact our office.

Respectfully submitted,
Geotechnical Testing Laboratory, Inc.

N. J. Gorsha, P.E.

NJG/krg

11/14/12

STATE OF LOUISIANA
N.J. GORSHA
REG. No. 20082
REGISTERED
PROFESSIONAL ENGINEER
IN
CIVIL ENGINEERING

Distribution: (1) Mr. David Broussard, Jr.
(2) Mr. Kyle Randall

Preliminary Geotechnical Engineering Services Report
For
England Airpark Site W-1, Industrial Certification
Alexandria, Rapides Parish, Louisiana
GTL Report No. 10-12-168

Prepared For:

England Economic & Industrial Development District
1611 Arnold Avenue
Alexandria, Louisiana 71303

Pan American Engineers, Inc.
P.O. Box 89
Alexandria, Louisiana 71309-0089

Prepared By:

Geotechnical Testing Laboratory, Inc.
226 Parkwood Drive
Alexandria, Louisiana 71301

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APPENDIX

PRELIMINARY GEOTECHNICAL ENGINEERING SERVICES REPORT
FOR

England Airpark Site W-1, Industrial Certification
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Introduction:

This report transmits the findings of a geotechnical investigation performed for the above-referenced project. The purpose of this investigation was to define and evaluate the general subsurface conditions in the general vicinity of a planned new industrial development. Specifically, the study was planned to determine the following:

- Subsurface stratigraphy within the limits of our exploratory borings.
- Classification, strength, and compressibility characteristics of the foundation strata.
- Suitable foundation systems and allowable soil bearing pressures.

The purpose of this report is to provide the owner, structural engineer, civil engineer, and other design team professionals with preliminary recommendations to consider for the design and construction of the proposed project. This report should not be used by the contractor in lieu of project plans and specifications.

Project Authorization:

Formal authorization to perform the work was provided by Mr. Kyle Randall with Pan American Engineers, Inc. on behalf of the England Economic & Industrial Development District (client), by accepting our June 20, 2012 written proposal. Authorization to proceed was provided on September 28, 2012. Field procedures were conducted Between October 10 and November 5, 2012. To accomplish the intended purposes, a three-phase study program was conducted which included:

- a field investigation consisting of 14 exploratory test borings with samples obtained at selected intervals;
- a lab testing program designed to evaluate the expansive and strength characteristics of the subsurface soils; and,
- an engineering analysis of the field and laboratory test data for preliminary foundation design recommendations.

No additional analysis was requested. A brief description of the field and laboratory test procedures are provided in the Appendix.

Project Description:

The project will be the development of an industrial park site. We understand that the industrial park will consist of a number of structures varying from one (1) story to four (4) stories in height. Preliminary structural information was not available at the time this report was prepared. The proposed buildings should consist of either steel or wood framing and could be supported on either shallow foundations, or on drilled shafts bearing at depths sufficient to resist the anticipated loadings. The pavements will most likely consist of light duty pavements for passenger cars and pickup trucks and heavy duty pavements for tractor-trailer trucks.

For the purpose of this report, we have assumed that column loads could be between 25 and 150 kips, and that maximum continuous wall loads will be between one (1) and four (4) kips per

linear foot. Maximum uniform and isolated concentrated floor loads are expected to be 125 psf and five (5) kips, respectively. Grade changes are expected to be nominal with no more than two (2) to three (3) feet of cut or fill.

Information pertaining to anticipated traffic loads and volumes was not available. For the purpose of our pavement analysis of this report, we assume that the industrial traffic could consist of up to 500 repetitions of light passenger cars and pick-up trucks, 50 medium-sized delivery trucks and vans, and up to 50 heavy tractor-trailer trucks per day.

If any of this information should change significantly or be in error, it should be brought to our attention so that we may review recommendations made in this report.

Site and Subsurface Conditions:

The project site is a 700 acre tract of land bordered by State Highway 496 on the south, State Highway 1202 on the west and the Alexandria International Airport on the east and north. The site was noted to be relatively level with estimated maximum elevation differences of no more than one (1) to two (2) feet. The site was vegetated with weeds, grass and timber at the time of drilling. The drilling rig experienced moderate difficulty accessing the boreholes.

Subsurface Stratigraphy:

In accordance with your request, general subsurface conditions across the site were explored by drilling a total of 14 borings to depths between approximately 30 and 100 feet. The borings were located in the field by the drilling crew by measuring approximate distances from existing features as shown on the Plan of Borings included in the Appendix of this report.

The stratification of the soils encountered during field drilling operations is presented on the boring logs in the Appendix. The stratification of the subsurface materials shown on the boring logs represents the subsurface conditions encountered at the actual boring locations and variations may occur across the site. The lines of demarcation represent the approximate boundary between the soil types, but the actual transition may be gradual. The following subsurface descriptions are of a generalized nature to highlight the major stratification features. The boring logs should be reviewed for more detailed information.

In order of increasing depth, the borings generally encountered the following soil strata beneath the surface: silty lean clay (CL), silty sand (SM), silt (ML), fat clay (CH), lean to fat clay (CL/CH), slightly clayey silt (CL-ML), sandy silt (ML), and poorly graded sand (SP-SM), and poorly graded silty sand (SP-SM).

Groundwater Conditions:

Seepage was observed at depths of eight (8) to 18.5 feet during advancement of the test borings. Groundwater was measured at depths of 9.5 to 19 feet with cave-in depths between 12 and 42 feet below existing ground surface upon completion of the borings. The subsurface water regime is subject to change with variations in climatic conditions. Future construction activities may also alter the surface and/or subsurface drainage patterns of this site. Therefore, groundwater conditions should be explored at the start of construction by others. If there is a noticeable variance from the observations reported herein, then GTL should be notified immediately to review the effect, if any, such data may have on the design recommendations. It is not possible to predict future ground water conditions based upon short-term observations.

Foundation Recommendations:

The soil parameters presented below are based on single borings placed at irregular intervals across the site. The deviations between the boring locations indicate variable subsurface conditions across the site and should not be assumed as representative of the individual borings. Thus, the findings presented herein should be considered preliminary in nature and should be confirmed through further investigation prior to development of the subject parcel. Prior to developing any section of the tract, a specific subsurface investigation should be obtained and tailored to the individual project. This report should not be used in lieu of a final geotechnical investigation addressing site specific needs for the intended projects.

Detailed information on structural systems and planned grading was not available to us at the time this report was prepared. Based on the size and type of anticipated structures, as well as the findings from this investigation, systems of shallow footings with grade-supported floor slab, in conjunction with the recommended subgrade preparation is believed to be the most practical and economical means of support. However, heavier building loads could result in the use of deep foundations. Recommendations for both foundation types are discusses separately below.

Skin friction values for deep foundations will vary depending on the specific soils and their condition as encountered at the actual building locations. In addition to low skin friction values, the loose to very loose sandy silts and silty sands encountered below the water table in the southern portion of the site have a significant potential for liquefaction. Based on the boring profiles for the northern portion of the site, the potential for liquefaction appears to be moderate to low.

Due to the high potential for liquefaction across the southern portion of the site, we recommend that consideration be given to placing only lightly loaded structures across this area. Structures imposing heavy surface loads or requiring deep foundations should be located within the northern portion of the site after an adequate subsurface investigation has been performed.

The surficial site soils varied from moderately active to highly active, depending upon the location of the individual borings. Consequently, Potential Vertical Rise (PVR) values were estimated to vary between less than one (1) inch and approximately three (3) inches for this site. One (1) inch of PVR is generally accepted as the maximum allowable value for design and construction in the geographical area.

Trees or tree stumps located within any of the building limits should be grubbed and removed. The diameter of the excavation should be at least three (3) feet larger than the tree diameter and dry soils and roots 1/2 inch in diameter or greater should be grubbed to a minimum depth of four (4) feet below finished subgrade elevation. The resulting depression should be backfilled and compacted with select fill as discussed in a subsequent section of this report.

Shallow Foundations:

To provide a consistent subgrade for slab support and reduce the potential for active soils to affect the foundations where active clays are present, GTL recommends that a uniform layer of density-approved select fill be provided beneath grade-supported floor slabs. The select fill for the building pads should extend at least five (5) feet beyond the perimeter of the buildings. The table below indicates the estimated undercut and select fill pad thickness to limit the PVR to a value of one (1) inch or less for the individual building pads in the vicinity of the boring locations.

Boring No.	Estimated PVR (inches)	Estimated Thickness of Select Fill Pad (feet)
1	< 1	1.0
2	< 1	1.0
3	1.5	2.0
4	2.5	3.0
5	< 1	1.0
6	1.5	2.0
7	2.5	4.0
8	2.5	4.0
9	1.25	1.5
10	1.25	1.5
11	3.0	4.0
12	< 1	1.0
13	< 1	1.0
14	< 1	1.0

The fill should be used to elevate the building pads so that positive drainage is provided away from the buildings. Where feasible, elevating the building pads with fill is generally desirable because this aids in providing positive drainage away from the floor slabs and foundations and helps prevent water from collecting in the filled areas.

Excessive movement should not occur if careful measures are taken to minimize moisture variations beneath the structure to preclude loss of shear strength of foundation soils. It is not uncommon to assume differential movement as half of the PVR. However, it should be noted that for extreme conditions (i.e. soils dry and shrink in one area with soils in another area being exposed to water and swelling) differential movement can be equal to or even double the PVR.

For areas where a select fill pad of three (3) feet or greater is required to control the PVR, the plans should include a section illustrating the placement and compaction of at least 12 inches of fat clay below all landscaped areas and areas exposed to direct rainfall or runoff. The fat clay should act as a horizontal moisture barrier to inhibit moisture from infiltrating and saturating the select fill pad and thereby increasing the potential for swelling of the underlying fat clays. The fat clay layer should be placed and compacted to within six (6) inches of finished grade to allow the placement of a topsoil layer. The fat clay layer should extend at least five (5) feet beyond the perimeter of the structure.

Shallow foundations may utilize individual or continuous footings bearing within the upper five (5) feet of the surficial zone. Typical bearing capacity values for shallow spread footings may vary from between approximately 1,500 psf to 2,500 psf for soils with consistencies of medium dense or medium stiff. Strip footings for continuous wall loads may be estimated between 1,150 and 2,000 pounds per linear foot.

Construction of select fill as specified herein beneath the building should result in the development of a modulus of subgrade reaction (k_s) to range between 125 and 150 pounds per cubic inch based upon empirical equations that estimate the results of a plate load test. For warehouse slabs exposed to fork lift loads, the subgrade modulus may be increased to between 250 and 300 pci by placing eight (8) inches of crushed limestone base or equal below the slab.

Deep Foundations:

Deep foundations may be considered for use at this site, due to special equipment or building loads. Deep foundations extending to the loose or soft soils encountered in several areas will have relatively low allowable capacities, but other areas have moderate to fair allowable values. For example, an 18 inch diameter straight-sided shaft founded at a depth of 30 feet in the southern section of the site in the vicinity of Borings B-1 through B-3 and B-12 through B-13 would be capable of carrying a compressive axial load of no more than approximately 12 kips, whereas a shaft with the same dimensions placed within the northern area of the site would be capable of supporting between 25 and 50 kips. In addition to having low shearing strength, the potential for liquefaction in the southern portion of the site would require deep foundations to extend to depths of at least 50 feet or greater.

The design charts below present preliminary estimates for drilled, cast-in-place concrete shafts and driven timber and concrete piles placed across the northern portion of the site. These values are based on the average conditions encountered within the borings. Therefore, prior to developing any structure within this tract of land, we strongly recommend a specific site investigation to determine the actual soil parameters for deep foundations. Once the final site investigations are performed, the estimated values for other diameters of drilled shafts may be provided at that time.

Shafts should be founded at a minimum estimated depth of 20 feet below the existing ground surface. The table below presents the estimated allowable single shaft capacities for an 18 inch diameter shaft founded at depths between 20 and 50 feet below present ground surface.

Diameter of Shaft (inches)	Depth of Shaft (feet)	Allowable Compressive Single Shaft Capacity (kips)
18	20	15
	25	20
	30	25
	35	30
	40	35
	45	65
	50	85

The factor of safety for these calculations is estimated to be 2.0. All shafts should have a minimum diameter of 18 inches even if the actual bearing pressure is less than the design value. Groundwater will most likely be encountered in the drilled shafts. Casing for installing drilled shafts is always a possible necessity when dealing with the unknowns inherent with subsurface conditions. It is prudent for contract documents to include this option.

Drilled Shaft Considerations:

Due to the presence of a shallow groundwater table with a hydrostatic head, consideration should be given to installing the drilled shafts using a slurry method which maintains a constant slurry level equal to or slightly above the hydrostatic water level. If the shafts can be sealed from water intrusion using casing, the slurry option may be eliminated.

It is recommended that the design and construction of drilled piers should generally follow methods outlined in the manual titled Drilled Shafts: Construction Procedures and Design Methods (Publication No: FHWA-IF-99-025, August 1999).

We emphasize that close engineering supervision is essential during installation of the drilled pier foundations in order to assure that construction is performed in accordance with the plans and specifications. Also, to insure proper construction of the drilled piers at this site, close coordination between the drilling and concreting operations is considered to be of great importance. Detailed inspection of drilled shaft construction should be made to verify that the shafts are vertical and founded in the proper bearing stratum and to verify that all loose materials have been removed prior to concrete placement.

Driven Piles:

Due to the risk of liquefaction across the south end of the project, driven piles should not be considered as a means of support in this area. If piles are considered on any portion of the site, existing buildings should be surveyed and carefully monitored during all driving operations.

The superstructure loads for the northern portion of the site may be supported on Class B creosote treated timber piles founded at a minimum depth of 35 feet below the existing ground surface. The final depth of the piles may be selected from the following table after considering the estimated structural total loads.

Depth (feet)	Allowable Compressive Load (kips)
35	10
40	20
45	50
50	75

If the above allowable timber pile loads are found to be inadequate for the actual structural loads, consideration may be given to using 12-inch square per-cast, pre-stressed concrete piles. Such piles may be selected from the following table.

Depth (feet)	Allowable Compressive Load (kips)
35	30
40	60
45	80
50	100

The factor of safety for these calculations is at least 2.0. Total settlement is estimated to be on the order of one (1) inch or less for foundation units designed in accordance with recommendations provided herein. Differential settlements (between adjacent piles or clusters) are estimated to be on the order of 0.5 inch or less.

The recommended pile capacities are based on field and laboratory tests and/or empirical data. The magnitude of this project should include a pile testing program to determine if the pile capacities are adequate, or if shorter piles are warranted.

Driven Pile Considerations:

It is recommended that the installation of driven piles should generally follow methods outlined in Section 804 of the Louisiana Standard Specifications for Roads and Bridges, 2006 Edition. LaDOTD specifications may vary and clarifications may be necessary where this information conflicts with LaDOTD requirements.

Detailed inspection of driven pile construction should be made to verify that the piles are driven vertically and founded in the proper bearing stratum. The installation of all piling should be monitored by personnel familiar with the construction techniques required to install pre-cast, pre-stressed concrete piles.

Pre-drilling for the piles may be necessary to stabilize the driven piles to prevent lateral drifting of the piles prior to achieving their final depth. Pilot holes may extend to a depth no deeper than 10 feet. The piling should be driven below the depth of the pilot hole to depths shown on the final plans, but not less than the required bearing resistance shown on the plans. In any case, wood piling should not be driven beyond the point where the blow count exceeds 30 blows per foot. If damage to the pile is apparent, driving should cease.

All pile driving should be performed with power hammers. Approval of the contractor's pile driving equipment should be based on the wave equation analysis computer program FHWA-WEAP87 or newer version. A wave equation analysis should be performed for each pile type and size required in the plans. Approval of the pile driving system does not relinquish the contractor's responsibility from driving the piles to the required pile tip elevation without damage. The criteria the engineer should use to evaluate the pile driving equipment from the wave equation should be the pile driving resistance. The required number of hammer blows at the required end-of-driving pile capacity should be from 36 to 146 blows per foot. The pile driving resistance at any depth above the required pile tip elevation should be achieved with a reasonable driving resistance of less than 30 blows per foot for timber piles or 300 blows per foot for concrete piles. All piles, including test pile, should be driven with the same hammer.

If the piles are to be driven in clusters, they should be driven at a minimum center-to-center spacing of three (3) times the pile diameter. Piles driven at spacings greater than this should be designed to act as single piles.

Seismicity:

According to the USGS website for Seismic Hazard Design Parameters, the project site has a mapped 0.2 second spectral response acceleration (S_s) of 0.128 g. The project also has a mapped 1.0 second spectral response acceleration (S_1) of 0.060. Based on Section 1615.1.1 of the IBC2003, a Site Class of D has been designated for this site. Using Tables 1615.1.2(1) and 1615.1.2(2), the mapped spectral accelerations, and Site Class D; the site coefficients F_a and F_v have been determined to be 1.6 and 2.4, respectively. The design spectral response accelerations, S_{DS} and S_{D1}, were determined to be 0.137 g and 0.096 g, respectively.

OSHA Classification for Excavations:

For excavations deeper than four feet, the side slopes should conform to applicable federal, state and local regulations. The guidelines provided in the construction requirement section should be followed. A review of the boring logs and testing for the site indicates that the soils should be classified as a Type B Soil contingent on monitoring of the excavation to confirm the absence of free water seeping during the time the excavation is open. For this type of excavation, a slope of 1H:1V is allowed if the excavation is 20 feet or less in depth. Federal rules require daily inspection of excavations by a competent person when workers are present.

Underground Storage Tanks

The manufacturer's recommendations should be strictly followed for tank shipment, delivery, unloading and installation of tanks and piping, and in anchoring them against potential uplift forces. As a minimum, the installation should comply with published guidelines of the American Petroleum Institute (API) and the manufacturer's instructions.

We suggest that construction equipment and stockpiled materials should be kept away from the excavation at a minimum distance equal to the excavation depth to avoid surcharging of the excavation slopes. Also, the sequence of construction should be planned so that soil support under and beside foundation elements is not jeopardized by any tank excavations.

It is critical that consideration be given to the risk of floating the tank, both during installation and the service life. Such consequences include damage to the tank system and paving, loss of product and, if a product release occurs, related environmental impacts, including surface cleanup and remediation to soil and groundwater. The tank manufacturer should be contacted regarding proper anchoring, tank-hold fill specifications, and allowable fill and loads over the tanks. Control of runoff into the excavation during backfilling and paving over the tanks is also critically important to preventing flotation.

For flotation calculations, we recommend that the unit weight of the soil above the tank be assumed to be a maximum of 100 pounds per cubic foot. Groundwater was present in the borings, and it is anticipated that water may seep into open excavations during the construction at some locations. The excavations should be clean and free of loose soil or standing water. The tanks may continue to be susceptible to flotation even after the tank-hold is backfilled with granular materials, until it is ballasted internally by filling, and/or by external tie-down anchors.

Pavements:

In the absence of known traffic volumes, we assume that some areas of the plant will be paved for light vehicular traffic and other areas will receive heavier tractor-trailer loads. We assume that the pavements receiving light traffic could receive asphaltic concrete or Portland cement concrete surfacing. Heavier tractor-trailer traffic could use drives and parking areas surfaced with either crushed stone, asphaltic concrete or Portland cement concrete.

Information for this pavement analysis is inferred from the building borings. Our scope of services did not include extensive sampling and CBR testing of existing subgrade or potential sources of imported base material for the specific purpose of a detailed pavement analysis. Instead, we have assumed pavement related design parameters that are considered to be typical for the area soil types. It has been assumed that the constructed pavement subgrade will consist of well compacted soils. Based on experience, it is anticipated that the compacted native subgrade will yield a California Bearing Ratio (CBR) of between 2.0 and 5.0.

The general pavement design information presented in this report is based on subsurface conditions inferred by the test borings, information published by The Asphalt Institute, the Portland Cement Association, and past experience in the locale. The published information was utilized in conjunction with the available field and laboratory test data to develop general pavement designs based on the AASHTO structural numbering system.

Pavements to be utilized by light vehicular traffic may be either flexible or rigid pavement sections supported on well-compacted subgrade or select fill. However, Portland cement concrete pavements should be utilized where large loads (i.e. waste disposal containers, etc.) are located. Both flexible and rigid pavement sections have been designed using general engineering design criteria referenced above.

Subgrade:

It is paramount to the satisfactory performance of pavements that the subgrade be stable under loads and compacted prior to deployment of flexible base or concrete. All pavement subgrade should be proof rolled prior to beginning placement of pavement section materials. Stable subgrade is especially critical to the successful performance of flexible pavement sections. The

surficial soils within the proposed paving limits should be tested to determine the average plasticity index (PI) value. If the average PI of the subgrade is above a value of 20, the upper eight (8) inches of subgrade should be either removed and replaced with select fill, or treated with lime to reduce the PI to an acceptable limit.

Lime Treatment:

A review of the boring logs indicates that the subgrade below some areas of the pavements could consist of highly plastic clays. Normally, these materials are considered to have poor support characteristics for pavements unless they are chemically treated to improve their engineering properties. Generally, soils with a PI value greater than 20 should be either removed to a depth of eight (8) inches and replaced with density approved select fill, or lime-treated as discussed below.

Clayey soils with excessive plasticity are subject to loss in support value with increases in moisture, as well as volumetric changes (shrinking and swelling) accompanying moisture changes. They chemically react with hydrated lime, becoming more stable. Clayey soils should be free of organics and other deleterious materials. Lime treatment should be performed in accordance with the applicable provisions of Section 304 of the *Louisiana Standard Specifications for Roads and Bridges,* 2006 Edition.

A bulk sample of the typical fat clay subgrade was submitted to the laboratory for testing. Based on the results of our laboratory tests, it appears that the fat clay subgrade should be treated with a minimum of five (5) percent by dry weight of hydrated lime. Assuming an average dry unit soil weight of 95 pounds per cubic foot, the estimated weight of lime for field purposes should be 3.56 pounds per square yard per inch of compacted thickness. A copy of the Using pH to Estimate the Soil-Lime Proportion Requirement for Soil Stabilization is included in the Appendix of this report.

The lime-treated clay should be compacted at a moisture content not less than optimum, nor more than four (4) percent above the optimum as defined by ASTM D 698 (Standard Proctor). Compaction should be at least 95 percent of the maximum dry density defined by this standard. The required moisture content and density of the compacted material should be maintained until construction is complete.

Cement Treatment:

Bulk samples of the various other subgrades were submitted to the laboratory to determine their suitability for use for cement treatment. The results of those tests indicate that the subgrade some of the soils at this site are not suitable for use in cement treatment. A copy of the Determination of Usable Materials for Cement Treatment is included in the Appendix of this report. Prior to any pavement design, the subject area should have a subsurface investigation to determine the specific pavement subgrade(s) present.

Any cement-treated base should be compacted to at least 95 percent of Standard Proctor density at, or near the optimum moisture content as defined by ASTM D-698. As a guideline, it is recommended that field density tests be taken at a frequency of not less than one (1) test per 5,000 square feet of surface area of the pavements.

Shrinkage Cracks:

Performance evaluations of soil cement mixtures have repeatedly found that the major problem with the process is not strength or durability, but shrinkage cracking. The shrinkage of cement treated materials results from the loss of water by drying and from self-desiccation during the

hydration of the cement. The factors which influence the severity and amount of cracking may include the amount of cement used, the water content used in the field, the aggregate properties, the adequacy of the curing procedures, weather conditions, the degree of subgrade restraint on the base, and the type and time of placement of the final surfacing.

Shrinkage cracks can result in reflective cracks in the asphaltic wearing course relatively soon after installation since soil-cement mixtures typically generate tensile strengths equal to approximately 20 percent of the compressive strength of the mixture. Consequently, additional cracking may occur from subbase stresses, poor drainage or slope failures. These cracks are aesthetically unsightly and invariably permit water intrusion of the soil subgrade. This intrusion regularly results in higher maintenance costs and reduces overall pavement life if the cracks are not sealed once they appear and exceed approximately 1/8 inch in width.

Shrinkage cracks cannot be eliminated, but may be significantly reduced in the treated base by compacting the mixture at or below optimum moisture content, and be adequately cured. The extent and severity of reflective cracking in the asphalt surface may be reduced by delaying placement of the hot-mixed asphalt (HMA) surface. This concept could involve placing a chip seal on the cured section and the final HMA surface two to four months later.

Micro-cracking (or pre-cracking) of the treated mixture should be considered. This process consists of making a maximum of four passes of a steel wheel vibratory roller applied two to four days after finishing. The vibration will introduce a network of hairline cracks into the base early in its' life with the idea that these "micro-cracks" will minimize the major shrinkage cracks associated with soil-cement bases. Studies have been conducted on bases ranging in thickness from six to eight inches, and generating a minimum compressive strength of 500 psi in seven days.

The borings indicate the subgrade soils beneath some of the areas of treated roads could consist of high plasticity clays. The high PI's are indicative of a highly compressible and high shrink-swell susceptible material. Consequently, subgrade movements in the clays may cause tension cracking. This volume change by very high PI's will express itself also at the edge of the pavement where higher moisture contents and less density exist.

Traffic and Design Data:

Commercial pavement sections presented herein are based upon minimum material thickness as recommended by the Asphalt Institute and the Portland Cement Association. These sections are not based upon anticipated traffic loads as these were not available at the time this report was prepared. As previously discussed, we assume that the industrial traffic could consist of up to 500 repetitions of light passenger cars and pick-up trucks, 50 medium-sized delivery trucks and vans, and up to 50 heavy tractor-trailer trucks per day.

Asphaltic Pavement Materials:

Surface or wearing course asphaltic concrete should consist of Item 501, Type 3. Surface course asphalt should be compacted to a minimum of 95 percent of the density of the laboratory molded specimen, or a minimum of 92% of the maximum theoretical density. The placement temperature and compacted thickness of Hot Mix Asphaltic Concrete (HMAC) should be determined during placement. Samples for extraction and gradation analysis should be obtained at the rate of at least one sample for each day's operation, for each pavement course, with at least one sample for each 600 tons.

Granular base should be compacted to 95 percent of the maximum density defined by the Modified Proctor (ASTM D-1557). Cohesive (clay) subgrade soils should be compacted to a minimum of 95% of maximum density defined by the Standard Proctor (ASTM D-698). Non-cohesive (sand) subgrade soils should be compacted to 100% of maximum density defined by the Standard Proctor (ASTM D-698).

Portland Cement Concrete:

Concrete compressive strength should be a minimum of 3,000 psi at 28 days. The concrete should be designed with 5 percent (± 1 percent) entrained air to improve workability and durability. Subgrade (and subbase, if specified) should be compacted to a minimum of 95% of the maximum density defined by the Standard Proctor (ASTM D-698). The design of steel reinforcement, if advised by the structural engineer, should be in accordance with local or accepted codes. (Although reinforcement is not normally required by design, it is customary to provide minimum reinforcement of 6 x 6 x No. 6 welded wire flat mesh or No. 3 deformed steel bars spaced on 18-inch centers each way.)

Recommended Pavement Sections:

The table below presents a summary of both rigid and flexible pavement sections for standard and heavy duty applications. It should be noted that the pavement sections as presented below are minimums. If it is desired to reduce potential cracking, greater thickness of select fill and/or greater pavement section thickness could be utilized. In addition, long term pavement performance requires good drainage and performance of periodic maintenance activities. Refer to the text for qualification of the designs and further discussion and limitations.

MINIMUM PAVEMENT RECOMMENDATIONS *		
Pavement Type	**Light Duty (Parking Lots & Drives)**	**Heavy Duty (Truck Entries & Drives)**
Portland Cement Concrete	6.0" Portland Cement Concrete 8.0" Density-Approved Subgrade	7.0" Portland Cement Concrete 8.0" Density-Approved Subgrade
Asphalt Over Crushed Stone Base	2.0" Item 501 Type 3 Surface 8.0" Item 1003.03 (b) Base 8.0" Density-Approved Subgrade	3.0" Item 501 Type 3 Surface 12.0" Item 1003.03 (b) Base 8.0" Density-Approved Subgrade
Asphalt Over Cement Treated Subgrade	2.0" Item 501 Type 3 Surface 12.0" Density Approved Cement Treated Subgrade	3.0" Item 501 Type 3 Surface 12.0" Density Approved Cement Treated Subgrade
*Materials shall meet general requirements of the Louisiana DOTD Standard Specifications for Construction of Roads & Bridges, and specific requirements listed herein.		

The pavement section for the parking stalls may consist of either five (5) inches of Portland cement concrete, or two (2) inches of HMAC over six (6) inches of compacted stone base. Concrete thickness at trash receptacles should be a minimum of seven (7) inches. All paving recommendations are based on stable subgrade. Subgrade areas which are unstable should be over-excavated and replaced, or otherwise rendered stable prior to proceeding with base material placement.

Geotechnical Risk:

The concept of risk is an important aspect of the geotechnical evaluation. The primary reason for this is that the analytical methods used to develop geotechnical recommendations do not comprise an exact science. The analytical tools which geotechnical engineers use are generally empirical and must be used in conjunction with engineering judgment and experience. Therefore, the solutions and recommendations presented in the geotechnical evaluation should not be considered risk-free and, more importantly, are not a guarantee that the interaction between the

soils and the proposed structure will perform as planned. The engineering recommendations presented in the preceding sections constitutes GTL's professional estimate of those measures that are necessary for the proposed structure to perform according to the proposed design based on the information generated and referenced during this evaluation, and GTL's experience in working with these conditions.

Limitations:

The exploration and analysis of the site conditions reported herein are considered preliminary in detail and scope and are not intended to form a basis for pavement and foundation design. The information submitted is based on the available soil information only and not on design details for the intended projects.

The findings, recommendations or professional advice contained herein have been made after being prepared in accordance with generally accepted professional engineering practice in the fields of foundation engineering, soil mechanics, and engineering geology. No other warranties are implied or expressed.

The scope of services did not include any environmental assessment for the presence or absence of wetlands or hazardous or toxic materials in the soil, surface water, groundwater, or air, on or below or around this site. Any statements in this report or on the boring logs regarding odors, colors, or unusual or suspicious items or conditions are strictly for the information of the client. Prior to purchase or development of this site, an environmental assessment is advisable.

The scope of services did not include a geologic investigation to address any faults, large scale subsidence, or other macro geologic features not specifically addressed in this report or the agreement between GTL and the client.

After plans are more complete, it is recommended that the soils and foundation engineer be retained to provided a subsurface investigation tailored to meet the specific needs of the project.

This report has been prepared for the exclusive use of our client for the general application for the referenced project. GTL cannot be responsible for interpretations, opinions, or recommendations made by others based on the data contained in this report.

This report was prepared for general purposes only and should not be considered sufficient for purposes of preparing accurate plans for construction. Contractors reviewing this report are advised that the discussions and recommendations contained herein were provided exclusively to and for use by the project owner.

END OF REPORT TEXT

SEE FOLLOWING APPENDIX w/BORING LOGS & TEST RESULTS

APPENDIX

FIELD AND LABORATORY PROCEDURES
PLAN OF BORINGS
LOG OF BORINGS
CEMENT TREATMENT RESULTS
LIME TREATMENT RESULTS

Field And Laboratory Procedures
For
England Airpark Site W-1 Industrial Certification
Alexandria, Rapides Parish, Louisiana
GTL Report Number 10-12-168

I. FIELD OPERATIONS:

Subsurface conditions were defined by advancing fourteen (14) intermittent sample borings drilled between October 10, 2012 and November 5, 2012 within the project area. Boring locations were selected and staked in the field by representatives of Geotechnical Testing Laboratory, Inc. An illustration of the approximate boring locations with respect to the areas investigated is provided on the attached Plan of Borings. Descriptive terms and symbols used on the logs are in accordance with the Unified Soil Classification System (USCS). Surface elevations at the boreholes was not supplied prior to our field studies.

A truck-mounted rotary drill rig was used to make the test borings. Each boring was rotary washed using flight auger drilling techniques. Intermittent undisturbed samples were obtained in the following manner.

Standard penetration tests were performed in accordance with ASTM D-1586 procedures. This test is conducted by recording the number of blows required for a 140-pound hammer falling 30 inches to drive a split-spoon sampler eighteen inches into the substrata. Depths at which split-spoon samples were taken are indicated by two crossed lines in the "Samples" column on the Log of Boring. The number of blows required to drive the sampler for each 6-inch increment were recorded. The penetration resistance is the number of blows required to drive the split-spoon sampler the final 12-inches of penetration. Information related to the penetration resistance is presented under the "Field Data" heading of the Log of Boring as the Standard Penetration (Blows/Foot). These samples were visually examined, logged, and packaged for transport to our laboratory.

Cohesive strata were sampled in accordance with ASTM D-1587 procedures by means of pushing a thin walled Shelby tube a distance of two feet into the substrata. Consistency of the sample was measured in the field by means of a calibrated hand penetrometer. Such values, in tons per square foot, are provided under the "Field Data" heading on the Log of Boring. Depths which these undisturbed samples were obtained are indicated by a shaded portion in the "Samples" column of the Log of Boring. All samples were prudently extruded in the field were sealed to maintain "in-situ" conditions, labeled, and packaged for transport to our laboratory.

The presence of ground water was monitored during drilling operations. Initial water seepage readings are provided under "Stratum Description" at the bottom of the Log of Boring. After boring completion, water levels were allowed to rise and stabilize for several minutes prior to final water readings. These readings are found at the bottom of the Log of Boring under "Water Observations, Feet." Soil sloughing from the walls of the boring are also recorded here as depth of cave-in.

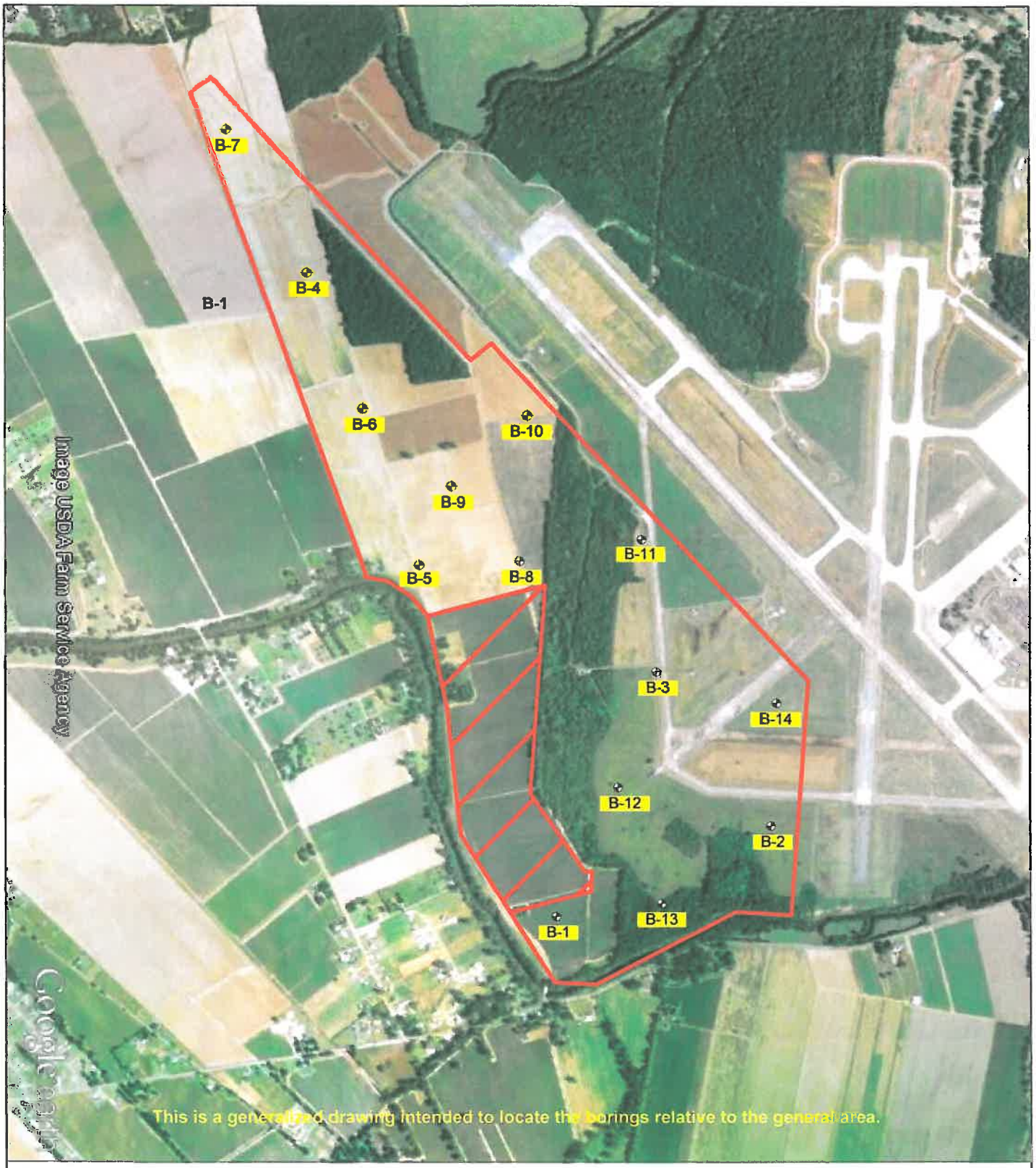
II. Laboratory Studies:

Upon return to the laboratory, all samples were visually examined and representative samples were selected for testing. Tests were performed on selected samples recovered from the test borings to verify classification and to determine pertinent engineering properties of the substrata. Individual test and ASTM designations are provided below:

Type of Test	Test Designations
Atterberg Limits	ASTM D 4318
Moisture Content	ASTM D 2216
Partial Gradation	ASTM D 1140
Unconfined Compression Tests	ASTM D 2166
Hydrometer Analysis	ASTM D 422
Lime Treatment	ASTM D6266-99a

Results for soil classifications are tabulated on the Log of Boring in their respective columns under "Laboratory Data."

Samples obtained during our field studies and not consumed by laboratory testing procedures will be retained free of charge for a period of 30 days. Arrangements for storage beyond that period of time must be made in writing to ***Geotechnical Testing Laboratory, Inc.***



Plan of Borings

1" = 2,939' (approximate)

PROJECT		
England Airpark Site W-1 Industrial Certification, Alexandria, Rapides Parish, Louisiana		
DATE	FILE NUMBER	
11/6/2012	10-12-168	***England Economic & Industrial Development District***

N

LOG OF BORING

PROJECT : England Airpark Site W-1 Industrial Certification **BORING No.** : **B- 1**

LOCATION: Alexandria, Louisiana **FILE No.** : 10-12-168

CLIENT : Pan American Engineers, Inc. **DATE** : 10/10/12 Sheet 1 of 1

Split Spoon | Shelby Tube | No Recovery

DRILL METHOD: Rotary Drill

SURFACE ELEVATION: ND

Depth (Feet)	Samples	Hand Penetrometer (Tons/Sq. Ft.)	Standard Penetration (Blows/Foot)	Graphic Log	STRATUM DESCRIPTION	Moisture Content (%)	Unit Dry Weight (Lbs./Cu. Ft.)	Liquid Limit	Plastic Limit	Plasticity Index	% Passing No. 200 Sieve	Unconfied Compression (Lbs./Sq. Ft.)
			9		Stiff Reddish Brown Silty LEAN CLAY (CL) w/occasional clayey silt (CL-ML) layers	14						
			5		- firm below 2.0 feet	22		37	22	15	96	
			5			21						
5			4			20						
			4			18						
					8.5'							
			2		Very Loose Reddish Brown Silty SAND (SM)	24		NP	NP	NP	44	
10					12.0'							
			1		Very Soft Reddish Brown Silty LEAN CLAY (CL)	31		36	23	13	93	
15					16.5'							
			1		Very Loose Reddish Brown Sandy SILT to Silty SAND (ML/SM)	27						
20												
			2			28		NP	NP	NP	55	
25												
			2			23						
30					30.0'							
					Water Seepage Noted @ 9.5 Feet While Drilling							
35												

COMPLETION DEPTH, FEET:
30.0

WATER OBSERVATIONS, FEET:
9.5' @ 10 Mins., Caved @ 17.0'

NOTES:
See Plan of Borings for Location
ND = Not Determined
Strata Boundaries May Not Be Exact

GEOTECHNICAL TESTING LABORATORY, INC.

LOG OF BORING

PROJECT : England Airpark Site W-1 Industrial Certification **BORING No.** : **B- 2**

LOCATION: Alexandria, Louisiana **FILE No.** : 10-12-168

CLIENT : Pan American Engineers, Inc. **DATE** : 10/10/12 Sheet 1 of 1

FIELD DATA				STRATUM DESCRIPTION	LABORATORY DATA						
Depth (Feet)	Samples	Hand Penetrometer (Tons/Sq. Ft.)	Standard Penetration (Blows/Foot)	Graphic Log	Split Spoon / Shelby Tube / No Recovery **DRILL METHOD:** Rotary Drill **SURFACE ELEVATION:** ND	Moisture Content (%)	Unit Dry Weight (Lbs./Cu. Ft.)	Liquid Limit	Plastic Limit	Plasticity Index	% Passing No. 200 Sieve	Unconfined Compression (Lbs./Sq. Ft.)
			23		Very Stiff Reddish Brown Silty LEAN CLAY (CL) w/occasional clayey silt (CL-ML) layers	20		31	22	9	94	
			11		- stiff @ 2.0 feet	28						
			3		- soft @ 3.5 feet	25						
5			2		- very soft @ 5.5 feet	31		31	21	10	88	
			3		- soft @ 7.0 feet	28						
					8.5'							
			5		Loose Reddish Brown, Slightly Clayey, SILT (CL-ML)	26						
10												
			1		- very loose @ 14.0 feet	28		28	22	6	92	
15												
			3		- loose @ 19.0 feet	26						
20												
			1		- very loose @ 24.0 feet	31						
25												
					27.0'							
			1		Very Loose Reddish Brown Sandy SILT (ML)	29		NP	NP	NP	56	
30					30.0'							
					Water Seepage Noted @ 10.0 Feet While Drilling							
35												

COMPLETION DEPTH, FEET:
30.0

WATER OBSERVATIONS, FEET:
10.0' @ 10 Mins., Caved @ 16.0'

NOTES:
See Plan of Borings for Location
ND = Not Determined
Strata Boundaries May Not Be Exact

GEOTECHNICAL TESTING LABORATORY, INC.

LOG OF BORING

PROJECT : England Airpark Site W-1 Industrial Certification **BORING No. :** B- 3

LOCATION: Alexandria, Louisiana **FILE No.** : 10-12-168

CLIENT : Pan American Engineers, Inc. **DATE** : 10/10/12 Sheet 1 of 1

Split Spoon | Shelby Tube | No Recovery

DRILL METHOD: Rotary Drill

SURFACE ELEVATION: ND

Depth (Feet)	Samples	Hand Penetrometer (Tons/Sq. Ft.)	Standard Penetration (Blows/Foot)	Graphic Log	STRATUM DESCRIPTION	Moisture Content (%)	Unit Dry Weight (Lbs./Cu. Ft.)	Liquid Limit	Plastic Limit	Plasticity Index	% Passing No. 200 Sieve	Unconfied Compression (Lbs./Sq. Ft.)
			7		Firm Reddish Brown Silty LEAN CLAY (CL) w/occasional clayey silt (CL-ML) layers	22		38	22	16	95	
			5			19						
			3		- soft @ 3.0 feet	23						
5					5.0'							
			8		Stiff Reddish Brown FAT CLAY (CH)	37		81	29	52	98	
		1.00	Push		- firm below 7.0 feet	39	79					1528
10		1.25	Push			31	90					1991
					11.5'							
			3		Loose Reddish Brown, Slightly Clayey, SILT (CL-ML) w/sand	30		27	22	5	80	
15					17.0'							
			1		Very Loose Reddish Brown Silty SAND to Sandy SILT (SM/ML)	31		NP	NP	NP	46	
20					22.5'							
			2		Very Soft Reddish Brown FAT CLAY (CH)	32						
25												
			2			34		62	27	35	99	
30					30.0'							
					Water Seepage Noted @ 10.5 Feet While Drilling							
35												

COMPLETION DEPTH, FEET:
30.0

WATER OBSERVATIONS, FEET:
10.5' @ 10 Mins., Caved @ 17.5'

NOTES:
See Plan of Borings for Location
ND = Not Determined
Strata Boundaries May Not Be Exact

GEOTECHNICAL TESTING LABORATORY, INC.

LOG OF BORING

PROJECT : England Airpark Site W-1 Industrial Certification **BORING No.** : **B- 4**

LOCATION: Alexandria, Louisiana **FILE No.** : 10-12-168

CLIENT : Pan American Engineers, Inc. **DATE** : 10/10/12 Sheet 1 of 1

Split Spoon | Shelby Tube | No Recovery

DRILL METHOD: Rotary Drill

SURFACE ELEVATION: ND

Depth (Feet)	Hand Penetrometer (Tons/Sq. Ft.)	Standard Penetration (Blows/Foot)	STRATUM DESCRIPTION	Moisture Content (%)	Unit Dry Weight (Lbs./Cu. Ft.)	Liquid Limit	Plastic Limit	Plasticity Index	% Passing No. 200 Sieve	Unconfied Compression (Lbs./Sq. Ft.)
	2.00	Push	Stiff Reddish Brown FAT CLAY (CH)	32	87	82	30	52	99	3242
	1.75	Push		27	94					3149
			- firm @ 4.0 feet							
5		5	5.5'	23						
		4	Firm Reddish Brown Silty LEAN CLAY (CL)	23		37	22	15	98	
			8.0'							
		3	Soft Reddish Brown FAT CLAY (CH)	27						
10	1.00	Push	- firm, reddish brown & gray @ 10.0 feet	34	86					1389
	1.25	Push	- reddish brown below 14.0 feet	34	88	75	28	47	99	1945
15										
	1.25	Push		30	89					1713
20										
	1.50	Push	- stiff @ 24.0 feet	24	102	81	29	52	99	2362
25										
	1.00	Push	- firm @ 29.0 feet	26	94					1436
30			30.0'							
			Water Seepage Noted @ 17.0 Feet While Drilling							
35										

COMPLETION DEPTH, FEET:
30.0

WATER OBSERVATIONS, FEET:
11.0' @ 15 Mins., Caved @ 20.0'

NOTES:
See Plan of Borings for Location
ND = Not Determined
Strata Boundaries May Not Be Exact

GEOTECHNICAL TESTING LABORATORY, INC.

LOG OF BORING

PROJECT : England Airpark Site W-1 Industrial Certification **BORING No.** : **B- 5**

LOCATION: Alexandria, Louisiana **FILE No.** : 10-12-168

CLIENT : Pan American Engineers, Inc. **DATE** : 10/10/12 Sheet 1 of 1

Split Spoon | Shelby Tube | No Recovery

DRILL METHOD: Rotary Drill

SURFACE ELEVATION: ND

Depth (Feet)	Samples	Hand Penetrometer (Tons/Sq. Ft.)	Standard Penetration (Blows/Foot)	Graphic Log	STRATUM DESCRIPTION	Moisture Content (%)	Unit Dry Weight (Lbs./Cu. Ft.)	Liquid Limit	Plastic Limit	Plasticity Index	% Passing No. 200 Sieve	Unconfied Compression (Lbs./Sq. Ft.)
			6		Loose Reddish Brown Silty SAND (SM)	10						
			7			8		NP	NP	NP	34	
5			5			13						
			3			23						
			8			24		NP	NP	NP	35	
10			2		- very loose @ 9.0 feet	30						
					12.0'							
		0.50	Push		Firm Reddish Brown FAT CLAY (CH)	30	91	69	27	42	99	1065
15												
20		0.75	Push		- reddish brown & gray @ 19.0 feet	33	90					1158
25		1.25	Push		- stiff, reddish brown & gray @ 24.0 feet	35	88					2269
30		1.25	Push		- firm reddish brown & gray below 29.0 feet	33	89	90	33	57	99	1528
35		1.00	Push			24	96					1297
40		1.00	Push			26	98					1158
					42.0'							
45			21		Medium Dense Reddish Brown Silty SAND (SM)	25		NP	NP	NP	16	
50			21		50.0'	22						
					Water Seepage Noted @ 8.0 Feet While Drilling							
55												

COMPLETION DEPTH, FEET:
50.0

WATER OBSERVATIONS, FEET:
10.0' @ 15 Mins., Caved @ 42.0'

NOTES:
See Plan of Borings for Location
ND = Not Determined
Strata Boundaries May Not Be Exact

GEOTECHNICAL TESTING LABORATORY, INC.

LOG OF BORING

PROJECT : England Airpark Site W-1 Industrial Certification — **BORING No.** : B- 6

LOCATION: Alexandria, Louisiana — **FILE No.** : 10-12-168

CLIENT : Pan American Engineers, Inc. — **DATE** : 10/18/12 — Sheet 1 of 2

Split Spoon | Shelby Tube | No Recovery

DRILL METHOD: Rotary/Wash

SURFACE ELEVATION: ND

Depth (Feet)	Samples	Hand Penetrometer (Tons/Sq. Ft.)	Standard Penetration (Blows/Foot)	Graphic Log	STRATUM DESCRIPTION	Moisture Content (%)	Unit Dry Weight (Lbs./Cu. Ft.)	Liquid Limit	Plastic Limit	Plasticity Index	% Passing No. 200 Sieve	Unconfied Compression (Lbs./Sq. Ft.)
			7		Firm to Stiff Reddish Brown FAT CLAY (CH)	20						
			9		3.0'	22		59	24	35	99	
5		0.75	Push		Firm to Stiff Reddish Brown LEAN TO FAT CLAY (CL/CH)	25	92					1343
		1.50	Push			24	98	47	23	24	99	2686
					8.0'							
10			6		Firm Reddish Brown Silty LEAN CLAY (CL) w/sand	26		31	18	13	83	
					12.0'							
15		1.50	Push		Stiff Red & Gray FAT CLAY (CH)	34	89					2732
20		1.25	Push		- firm, reddish brown & gray @ 19.0 feet	32	91	69	28	41	99	1899
25		1.00	Push			26	98					1621
30		1.00	Push			35	87					1899
35		1.50	Push		- stiff, reddish brown & gray @ 34.0 feet	29	94					2408
					37.5'							
40			16		Medium Dense Gray & Tan, Slightly Clayey, SILT (CL-ML) w/sand	23		28	21	7	76	
					43.0'							
45			44		Dense Tan Silty SAND (SM)	23						
50			44			27		NP	NP	NP	23	
55			45			20						
					57.0'							
60			72		Very Dense Tan, Poorly Graded, SAND (SP-SM) w/silt	21						

Continued Next Page

COMPLETION DEPTH, FEET:
100.0

WATER OBSERVATIONS, FEET:
16.0' @ 36 Hrs., Caved @ 17.0'

NOTES:
See Plan of Borings for Location
ND = Not Determined
Strata Boundaries May Not Be Exact

GEOTECHNICAL TESTING LABORATORY, INC.

LOG OF BORING

PROJECT : England Airpark Site W-1 Industrial Certification **BORING No.** : **B- 6**

LOCATION: Alexandria, Louisiana **FILE No.** : 10-12-168

CLIENT : Pan American Engineers, Inc. **DATE** : 10/18/12 Sheet 2 of 2

FIELD DATA				STRATUM DESCRIPTION	LABORATORY DATA						
Depth (Feet)	Samples	Hand Penetrometer (Tons/Sq. Ft.)	Standard Penetration (Blows/Foot)	Graphic Log	(Continued)	Moisture Content (%)	Unit Dry Weight (Lbs./Cu. Ft.)	Liquid Limit	Plastic Limit	Plasticity Index	% Passing No. 200 Sieve	Unconfied Compression (Lbs./Sq. Ft.)
					Split Spoon / Shelby Tube / No Recovery							
65	X		77		Very Dense Tan, Poorly Graded, SAND (SP-SM) w/silt	19		NP	NP	NP	8	
70	X		30		- dense below 69.0 feet	18						
75	X		35		78.5'	17						
80	X		82		Very Dense Tan & Gray, Poorly Graded, SAND (SP-SM) w/silt & gravel	19						
85	X		44		- dense @ 84.0 feet	18		NP	NP	NP	5	
90	X		30			15						
95	X		48			13						
100	X		55		- very dense @ 98.5 feet 100.0'	15						
105					Water Seepage Noted @ 16.0 Feet While Drilling							
110												
115												
120												

COMPLETION DEPTH, FEET:
100.0

WATER OBSERVATIONS, FEET:
16.0' @ 36 Hrs., Caved @ 17.0'

NOTES:
See Plan of Borings for Location
ND = Not Determined
Strata Boundaries May Not Be Exact

GEOTECHNICAL TESTING LABORATORY, INC.

LOG OF BORING

PROJECT : England Airpark Site W-1 Industrial Certification **BORING No. :** B- 7

LOCATION: Alexandria, Louisiana **FILE No.** : 10-12-168

CLIENT : Pan American Engineers, Inc. **DATE** : 10/22/12 Sheet 1 of 1

Split Spoon | Shelby Tube | No Recovery

DRILL METHOD: Rotary/Wash

SURFACE ELEVATION: ND

Depth (Feet)	Samples	Hand Penetrometer (Tons/Sq. Ft.)	Standard Penetration (Blows/Foot)	Graphic Log	STRATUM DESCRIPTION	Moisture Content (%)	Unit Dry Weight (Lbs./Cu. Ft.)	Liquid Limit	Plastic Limit	Plasticity Index	% Passing No. 200 Sieve	Unconfied Compression (Lbs./Sq. Ft.)
		1.00	Push		Firm Reddish Brown FAT CLAY (CH)	34	85					1528
		1.75	Push		- stiff @ 3.0 feet	29	92	60	26	34	98	2640
5		2.00	Push			27	98					3936
		1.00	Push		- firm @ 7.0 feet	25	97	74	29	45	99	1436
		1.50	Push		- stiff @ 9.0 feet	27	97					2825
10					12.0'							
			3		Soft Reddish Brown Silty LEAN CLAY (CL)	31		33	23	10	97	
15												
			3			26						
20												
			4		- firm @ 24.0 feet	29		39	22	17	99	
25					27.5'							
			5		Firm Reddish Brown FAT CLAY (CH)	33						
30												
			4			47		88	31	57	99	
35												
			16		- very stiff @ 39.0 feet	45						
40					41.0'							
			25		Medium Dense Reddish Brown, Poorly Graded, Silty SAND (SP-SM)	24		NP	NP	NP	8	
45												
			19		50.0'	22						
50					Water Seepage Noted @ 12.5 Feet While Drilling							
55												

COMPLETION DEPTH, FEET:
50.0

WATER OBSERVATIONS, FEET:
19.0' @ 10 Mins., Caved @ 24.0'

NOTES:
See Plan of Borings for Location
ND = Not Determined
Strata Boundaries May Not Be Exact

GEOTECHNICAL TESTING LABORATORY, INC.

LOG OF BORING

PROJECT : England Airpark Site W-1 Industrial Certification **BORING No.** : **B- 8**

LOCATION: Alexandria, Louisiana **FILE No.** : 10-12-168

CLIENT : Pan American Engineers, Inc. **DATE** : 10/25/12 Sheet 1 of 1

Split Spoon | Shelby Tube | No Recovery

DRILL METHOD: Rotary Drill

SURFACE ELEVATION: ND

Depth (Feet)	Samples	Hand Penetrometer (Tons/Sq. Ft.)	Standard Penetration (Blows/Foot)	Graphic Log	STRATUM DESCRIPTION	Moisture Content (%)	Unit Dry Weight (Lbs./Cu. Ft.)	Liquid Limit	Plastic Limit	Plasticity Index	% Passing No. 200 Sieve	Unconfied Compression (Lbs./Sq. Ft.)
	X		17		Very Stiff Reddish Brown FAT CLAY (CH)	28		66	24	42	97	
	X		9		- stiff @ 2.0 feet	30						
	■	1.50	Push			32	88					2917
5	X		4		- firm @ 5.5 feet	30		63	25	38	99	
	■	1.25	Push		- stiff @ 7.5 feet	35	85					2038
10	■	1.00	Push		- firm @ 9.5 feet	36	90	73	28	45	99	1760
	■	0.50	Push			35	87					1806
15												
	■	1.50	Push		- stiff @ 19.0 feet	38	86					2315
20												
	■	1.50	Push			42	81	105	34	71	99	2501
25												
	■	2.25	Push		- very stiff, reddish brown & gray @ 28.0 feet	39	93					4260
30					30.0'							
					Water Seepage Noted @ 12.5 Feet While Drilling							
35												

COMPLETION DEPTH, FEET:
30.0

WATER OBSERVATIONS, FEET:
10.5' @ 10 Mins., Caved @ 19.5'

NOTES:
See Plan of Borings for Location
ND = Not Determined
Strata Boundaries May Not Be Exact

GEOTECHNICAL TESTING LABORATORY, INC.

LOG OF BORING

PROJECT : England Airpark Site W-1 Industrial Certification **BORING No.** : **B- 9**

LOCATION: Alexandria, Louisiana **FILE No.** : 10-12-168

CLIENT : Pan American Engineers, Inc. **DATE** : 10/25/12 Sheet 1 of 1

Split Spoon | Shelby Tube | No Recovery

DRILL METHOD: Rotary Drill

SURFACE ELEVATION: ND

Depth (Feet)	Samples	Hand Penetrometer (Tons/Sq. Ft.)	Standard Penetration (Blows/Foot)	Graphic Log	STRATUM DESCRIPTION	Moisture Content (%)	Unit Dry Weight (Lbs./Cu. Ft.)	Liquid Limit	Plastic Limit	Plasticity Index	% Passing No. 200 Sieve	Unconfined Compression (Lbs./Sq. Ft.)
	X		6		Firm Reddish Brown LEAN TO FAT CLAY (CL/CH) 1.5'	28		52	24	28	98	
	X		4		Firm Reddish Brown Silty LEAN CLAY (CL)	22						
	X		4		4.0'	24		39	22	17	94	
5		1.50	Push		Stiff Reddish Brown FAT CLAY (CH)	34	85					2362
					7.0'							
		1.00	Push		Firm Reddish Brown Silty LEAN CLAY (CL)	29	92					1158
	X		6			28		29	20	9	95	
10					12.0'							
		2.00	Push		Stiff Reddish Brown FAT CLAY (CH)	35	92					3705
15												
		1.75	Push			38	86	65	27	38	99	2593
20												
		1.50	Push			36	88					2362
25												
					- firm @ 28.0 feet							
		1.00	Push			37	93					1204
30					30.0'							
					Water Seepage Noted @ 13.0 Feet While Drilling							
35												

COMPLETION DEPTH, FEET:
30.0

WATER OBSERVATIONS, FEET:
10.0' @ 10 Mins., Caved @ 15.5'

NOTES:
See Plan of Borings for Location
ND = Not Determined
Strata Boundaries May Not Be Exact

GEOTECHNICAL TESTING LABORATORY, INC.

LOG OF BORING

PROJECT : England Airpark Site W-1 Industrial Certification **BORING No.** : **B-10**

LOCATION: Alexandria, Louisiana **FILE No.** : 10-12-168

CLIENT : Pan American Engineers, Inc. **DATE** : 10/26/12 Sheet 1 of 1

Split Spoon | Shelby Tube | No Recovery

DRILL METHOD: Rotary/Wash

SURFACE ELEVATION: ND

Depth (Feet)	Samples	Hand Penetrometer (Tons/Sq. Ft.)	Standard Penetration (Blows/Foot)	Graphic Log	STRATUM DESCRIPTION	Moisture Content (%)	Unit Dry Weight (Lbs./Cu. Ft.)	Liquid Limit	Plastic Limit	Plasticity Index	% Passing No. 200 Sieve	Unconfied Compression (Lbs./Sq. Ft.)
		2.25	Push		Stiff Reddish Brown LEAN TO FAT CLAY (CL/CH)	24	93	52	24	28	98	3797
		3.25	Push		- very stiff @ 3.0 feet	27	93					5835
5		1.75	Push		- stiff @ 4.5 feet	22	102					3010
					6.0'							
		1.25	Push		Firm Reddish Brown Silty LEAN CLAY (CL)	24	101					1621
		0.50	Push		- soft @ 9.0 feet	24	96	35	22	13	96	787
10					12.0'							
		0.50	Push		Soft Reddish Brown FAT CLAY (CH)	37	86					787
15												
		1.00	Push		- firm @ 19.0 feet	38	79	71	28	43	99	1667
20												
		1.50	Push		- stiff @ 24.0 feet	33	84					2454
25												
					28.0'							
			4		Loose Reddish Brown & Gray CLAYEY SAND (SC)	24		28	17	11	22	
30					31.0'							
			5		Loose Reddish Brown Silty SAND (SM)	28		NP	NP	NP	19	
35					37.0'							
			4		Firm Reddish Brown Silty LEAN CLAY (CL) w/sand	29		32	19	13	84	
40					41.5'							
			16		Medium Dense Reddish Brown Silty SAND (SM)	24						
45												
			35		50.0'	27		NP	NP	NP	34	
50					Water Seepage Noted @ 11.5 Feet While Drilling							
55												

COMPLETION DEPTH, FEET:
50.0

WATER OBSERVATIONS, FEET:
12.5' @ 10 Minutes, Caved @ 33.0'

NOTES:
See Plan of Borings for Location
ND = Not Determined
Strata Boundaries May Not Be Exact

GEOTECHNICAL TESTING LABORATORY, INC.

LOG OF BORING

PROJECT : England Airpark Site W-1 Industrial Certification **BORING No.** : **B-11**

LOCATION: Alexandria, Louisiana **FILE No.** : 10-12-168

CLIENT : Pan American Engineers, Inc. **DATE** : 10/29/12 Sheet 1 of 1

Split Spoon | Shelby Tube | No Recovery

DRILL METHOD: Rotary/Wash

SURFACE ELEVATION: ND

Depth (Feet)	Samples	Hand Penetrometer (Tons/Sq. Ft.)	Standard Penetration (Blows/Foot)	Graphic Log	STRATUM DESCRIPTION	Moisture Content (%)	Unit Dry Weight (Lbs./Cu. Ft.)	Liquid Limit	Plastic Limit	Plasticity Index	% Passing No. 200 Sieve	Unconfied Compression (Lbs./Sq. Ft.)
		1.75	Push		Stiff Reddish Brown FAT CLAY (CH)	22	102					3056
			13			30		75	29	46	99	
5		1.25	Push		- firm @ 4.5 feet	38	83					1991
		1.00	Push			33	86					1482
		1.25	Push		- stiff @ 8.5 feet	30	91	69	27	42	98	2038
10												
15		0.50	Push		- firm @ 14.0 feet	25	94					1019
		1.25	Push			37	85	80	31	49	99	1945
20												
25		1.75	Push		- stiff @ 24.0 feet	35	84					2825
					27.0'							
30		0.75	Push		Firm Reddish Brown LEAN TO FAT CLAY (CL/CH)	25	92	48	22	26	86	1111
					32.0'							
35			28		Medium Dense Reddish Brown Silty SAND (SM)	22		NP	NP	NP	17	
40			26			23						
					43.0'							
45			30		Dense Reddish Brown, Poorly Graded, SAND (SP-SM) w/silt	22		NP	NP	NP	7	
50			38		50.0'	23						
					Water Seepage Noted @ 12.0 Feet While Drilling							
55												

COMPLETION DEPTH, FEET:
50.0

WATER OBSERVATIONS, FEET:
14.5' @ 10 Minutes, Caved @ 27.0'

NOTES:
See Plan of Borings for Location
ND = Not Determined
Strata Boundaries May Not Be Exact

GEOTECHNICAL TESTING LABORATORY, INC.

LOG OF BORING

PROJECT : England Airpark Site W-1 Industrial Certification **BORING No.** : **B-12**

LOCATION: Alexandria, Louisiana **FILE No.** : 10-12-168

CLIENT : Pan American Engineers, Inc. **DATE** : 10/10/12 Sheet 1 of 2

Split Spoon | Shelby Tube | No Recovery

DRILL METHOD: Rotary/Wash

SURFACE ELEVATION: ND

Depth (Feet)	Samples	Hand Penetrometer (Tons/Sq. Ft.)	Standard Penetration (Blows/Foot)	Graphic Log	STRATUM DESCRIPTION	Moisture Content (%)	Unit Dry Weight (Lbs./Cu. Ft.)	Liquid Limit	Plastic Limit	Plasticity Index	% Passing No. 200 Sieve	Unconfied Compression (Lbs./Sq. Ft.)
			9		Loose Reddish Brown SILT (ML)	18		NP	NP	NP	97	
			3		4.0'	16						
5			2		Very Soft Reddish Brown Silty LEAN CLAY (CL) - firm @ 5.5 feet	34		32	21	11	89	
			6		8.5'	27						
			4		Firm Reddish Brown FAT CLAY (CH)	42						
10		1.50	Push			37	83	72	29	43	99	1899
		1.50	Push		- stiff @ 14.0 feet	35	92					2130
15					17.5'							
			2		Very Loose Reddish Brown Sandy SILT (ML)	27		NP	NP	NP	56	
20												
			1			31						
25					28.0'							
			1		Very Loose Reddish Brown Silty SAND (SM)	25		NP	NP	NP	25	
30												
			8		- loose @ 34.0 feet	23						
35												
			12		- medium dense @ 39.0 feet	27						
40												
			21			23						
45												
			18			24		NP	NP	NP	15	
50												
			43		- dense @ 54.0 feet	24						
55												
			56		- very dense @ 58.5 feet	21						
60												

Continued Next Page

COMPLETION DEPTH, FEET:
100.0

WATER OBSERVATIONS, FEET:
12.0' @ 24 Hrs., Caved @ 16.0'

NOTES:
See Plan of Borings for Location
ND = Not Determined
Strata Boundaries May Not Be Exact

GEOTECHNICAL TESTING LABORATORY, INC.

LOG OF BORING

PROJECT : England Airpark Site W-1 Industrial Certification **BORING No.** : **B-12**

LOCATION: Alexandria, Louisiana **FILE No.** : 10-12-168

CLIENT : Pan American Engineers, Inc. **DATE** : 10/10/12 Sheet 2 of 2

Split Spoon | Shelby Tube | No Recovery

Depth (Feet)	Samples	Hand Penetrometer (Tons/Sq. Ft.)	Standard Penetration (Blows/Foot)	Graphic Log	STRATUM DESCRIPTION (Continued)	Moisture Content (%)	Unit Dry Weight (Lbs./Cu. Ft.)	Liquid Limit	Plastic Limit	Plasticity Index	% Passing No. 200 Sieve	Unconfied Compression (Lbs./Sq. Ft.)
65	X		19		Very Dense Reddish Brown Silty SAND (SM) - medium dense @ 64.0 feet 68.5'	21		NP	NP	NP	14	
70	X		33		Dense Reddish Brown, Poorly Graded, SAND (SP-SM) w/silt & gravel	23						
75	X		77		- very dense @ 74.0 feet	19						
80	X		82			20		NP	NP	NP	7	
85	X		52			18						
90	X		45		- dense below 89.0 feet	19						
95	X		46			15		NP	NP	NP	8	
100	X		46		100.0'	16						
105					Water Seepage Noted @ 18.5 Feet While Drilling							
110												
115												
120												

COMPLETION DEPTH, FEET:
100.0

WATER OBSERVATIONS, FEET:
12.0' @ 24 Hrs., Caved @ 16.0'

NOTES:
See Plan of Borings for Location
ND = Not Determined
Strata Boundaries May Not Be Exact

GEOTECHNICAL TESTING LABORATORY, INC.

LOG OF BORING

PROJECT : England Airpark Site W-1 Industrial Certification **BORING No.** : **B-13**

LOCATION: Alexandria, Louisiana **FILE No.** : 10-12-168

CLIENT : Pan American Engineers, Inc. **DATE** : 11/2/12 Sheet 1 of 1

Split Spoon | Shelby Tube | No Recovery

DRILL METHOD: Rotary/Wash

SURFACE ELEVATION: ND

Depth (Feet)	Samples	Hand Penetrometer (Tons/Sq. Ft.)	Standard Penetration (Blows/Foot)	Graphic Log	STRATUM DESCRIPTION	Moisture Content (%)	Unit Dry Weight (Lbs./Cu. Ft.)	Liquid Limit	Plastic Limit	Plasticity Index	% Passing No. 200 Sieve	Unconfied Compression (Lbs./Sq. Ft.)
			12		Medium Dense Reddish Brown, Slightly Clayey, SILT (CL-ML)	18		29	22	7	95	
			2		2.0'	27						
			3		Very Soft Reddish Brown Silty LEAN CLAY (CL)	33						
5					- soft @ 4.0 feet							
		1.00	Push			27	94	39	24	15	98	787
			2			26						
			1		- very soft @ 9.0 feet	30						
10					11.5'							
					Very Loose Reddish Brown Silty SAND (SM)							
			1			26		NP	NP	NP	17	
15					18.0'							
			2		Very Loose Reddish Brown, Slightly Clayey, Sandy SILT (CL-ML)	29						
20												
			2			27		26	21	5	60	
25					27.0'							
					Loose Reddish Brown Silty SAND (SM)							
			4			28						
30												
			2		- very loose @ 34.0 feet	29		NP	NP	NP	40	
35												
			3		- loose @ 39.0 feet	31						
40												
			6			26		NP	NP	NP	38	
45												
					- medium dense @ 48.5 feet							
			22		50.0'	25						
50					Water Seepage Noted @ 12.5 Feet While Drilling							
55												

COMPLETION DEPTH, FEET:
50.0

WATER OBSERVATIONS, FEET:
12.0' @ 72 Hrs., Caved @ 12.0'

NOTES:
See Plan of Borings for Location
ND = Not Determined
Strata Boundaries May Not Be Exact

GEOTECHNICAL TESTING LABORATORY, INC.

LOG OF BORING

PROJECT : England Airpark Site W-1 Industrial Certification **BORING No.** : **B-14**

LOCATION: Alexandria, Louisiana **FILE No.** : 10-12-168

CLIENT : Pan American Engineers, Inc. **DATE** : 11/5/12 Sheet 1 of 1

Split Spoon | Shelby Tube | No Recovery

DRILL METHOD: Rotary/Wash

SURFACE ELEVATION: ND

Depth (Feet)	Samples	Hand Penetrometer (Tons/Sq. Ft.)	Standard Penetration (Blows/Foot)	Graphic Log	STRATUM DESCRIPTION	Moisture Content (%)	Unit Dry Weight (Lbs./Cu. Ft.)	Liquid Limit	Plastic Limit	Plasticity Index	% Passing No. 200 Sieve	Unconfined Compression (Lbs./Sq. Ft.)
			8		Loose Reddish Brown SILT (ML) 2.0'	18						
			6		Firm Reddish Brown LEAN TO FAT CLAY (CL/CH)	29		51	23	28	99	
5		1.25	Push		6.0'	41	80					1852
		1.00	Push		Firm Reddish Brown Silty LEAN CLAY (CL) 8.0'	23	96	38	23	15	97	1204
10		2.00	Push		Stiff Reddish Brown FAT CLAY (CH) 12.5'	30	93					2686
15			4		Firm Reddish Brown Silty LEAN CLAY (CL)	32		30	21	9	95	
20			2		- soft @ 19.0 feet 21.5'	31						
		1.25	Push		Firm Reddish Brown FAT CLAY (CH)	36	91	64	26	38	99	1297
25												
30		1.75	Push		- stiff @ 29.0 feet 33.0'	23	90					2593
35			26		Medium Dense Reddish Brown Silty SAND (SM)	21						
40			45		- dense @ 39.0 feet	29		NP	NP	NP	47	
45			14		- medium dense below 44.0 feet	21						
50			13		50.0'	22		NP	NP	NP	13	
55					Water Seepage Noted @ 13.5 Feet While Drilling							

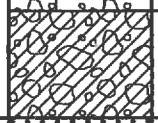
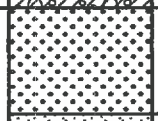
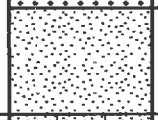
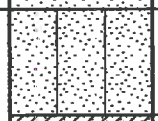
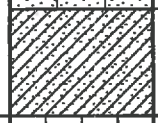
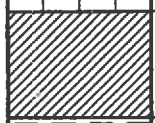
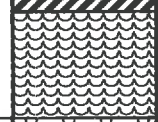
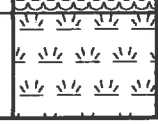
COMPLETION DEPTH, FEET:
50.0

WATER OBSERVATIONS, FEET:
17.0' @ 10 Mins., Caved @ 28.0'

NOTES:
See Plan of Borings for Location
ND = Not Determined
Strata Boundaries May Not Be Exact

GEOTECHNICAL TESTING LABORATORY, INC.

SOIL CLASSIFICATION CHART

MAJOR DIVISIONS			SYMBOLS		TYPICAL DESCRIPTIONS
			GRAPH	LETTER	
COARSE GRAINED SOILS MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	GRAVEL AND GRAVELLY SOILS MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	CLEAN GRAVELS (LITTLE OR NO FINES)		GW	WELL-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
				GP	POORLY-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
		GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)		GM	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES
				GC	CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES
	SAND AND SANDY SOILS MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE	CLEAN SANDS (LITTLE OR NO FINES)		SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
				SP	POORLY-GRADED SANDS, GRAVELLY SAND, LITTLE OR NO FINES
		SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)		SM	SILTY SANDS, SAND - SILT MIXTURES
				SC	CLAYEY SANDS, SAND - CLAY MIXTURES
FINE GRAINED SOILS MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	SILTS AND CLAYS	LIQUID LIMIT LESS THAN 50		ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR 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 SAND OR SILTY SOILS
				CH	INORGANIC CLAYS OF HIGH PLASTICITY
				OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS				PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS

Laboratory Analysis of Soils For Soil-Cement Treatment

Report Date: 11/6/2012 **Sample Date:** 10/10/2012 **Project No:** 10-12-168

Prepared For: England Economic and Industrial Development District
Economic Development Corporation
1611 Arnold Drive
Alexandria, Louisiana 71303

Pan American Engineers, Inc.
P.O. Box 89
Alexandria, Louisiana 71309-0089

Project: England Airpark Site W-1 Industrial Certification, Alexandria, Rapides Parish, Louisiana

Test Methods: DOTD TR407, TR413, TR423, TR428

Laboratory Results:

Test	Subgrade @ Boring B-1	Subgrade @ Boring B-5	Subgrade @ Boring B-12	Cement Treatment Specifications
Silt, %	73	25	85	65% Max.
Sand, %	4	66	3	79% Max.
Clay, %	23	9	12	
Liquid Limit (LL)	37	Non Plastic	Non Plastic	
Plasticity Index (PI)	22	Non Plastic	Non Plastic	22 Max.
Organic Content, %	0.9	0.5	0.7	2.0 Max.
Soil Group	A-6	A-4	A-4	A-6 or Better
Soil Classification	Silty Lean Clay	Silty Sand	Silt	
Results	Unusable	Usable	Unusable	

Geotechnical Testing Laboratory, Inc.

Using pH to Estimate the Soil-Lime Proportion Requirement for Soil Stabilization

Report Date: 11/6/2012 **Sample Date:** 10/25/2012 **Project No:** 10-12-168

Prepared For: England Economic and Industrial Development District
Economic Development Corporation
1611 Arnold Drive
Alexandria, Louisiana 71303

Pan American Engineers, Inc.
P.O. Box 89
Alexandria, Louisiana 71309-0089

Project: England Airpark Site W-1 Industrial Certification, Alexandria, Rapides Parish, Louisiana

Test Method: ASTM D4318; D6276-99a

Scope: This test method provides a means for estimating the soil-lime proportion requirements for stabilization of a soil. The optimum soil-lime proportion is selected by determining the lowest percentage of lime that results in a soil-lime pH of 12.4.

Laboratory Results:

Material Origin	Subgrade @ Boring B-8				
Material Description	Fat Clay (CH) (A-7-6)				
Liquid Limit (LL)	66				
Plasticity Index (PI)	42				
Lime Quantity	**2.0%**	**3.0%**	**4.0%**	**5.0%**	**6.0%**
pH Readings	10.65	11.44	12.02	12.45	12.62

Recommended, % by weight:	5.0
Spread Rate:	3.56 pounds per square yard per inch of compacted thickness

Comments: The spread rate is based off of an average dry unit soil weight of 95 pounds per cubic foot.

Geotechnical Testing Laboratory, Inc