Attachment 17 – Geotechnical Study

Natchitoches Parish Port
NorthPort Tract

GeoConsultants, LLC of Louisiana
226 Parkwood Drive
Alexandria, Louisiana 71301

GeoConsultants, LLC of Louisiana

Geotechnical and Forensic Engineering Services

March 21, 2011

Mr. Robert Breedlove, Executive Director
Natchitoches Parish Port
P.O. Box 2215
Natchitoches, Louisiana 71457

RE: Preliminary Geotechnical Investigation
Site Verification
Natchitoches Parish Port Property
Campti, Louisiana
Report No. 03-11-030

Dear Mr. Breedlove:

GeoConsultants, LLC of Louisiana 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,
GeoConsultants, LLC of Louisiana

N. J. Gorsha, P.E.

NJG/krg

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

Distribution: (3) Addressee

GEOTECHNICAL INVESTIGATION
FOR
SITE VERIFICATION
NATCHITOCHES PARISH PORT PROPERTY
CAMPTI, LOUISIANA
REPORT NO. 03-11-030

Prepared For:

Natchitoches Parish Port
P.O. Box 2215
Natchitoches, Louisiana 71457

Prepared By:

Geo*Consultants*, LLC of Louisiana
226 Parkwood Drive
Alexandria, Louisiana 71301

TABLE OF CONTENTS

APPENDIX

GEOTECHNICAL INVESTIGATION
FOR
SITE VERIFICATION
NATCHITOCHES PARISH PORT PROPERTY
CAMPTI, LOUISIANA
REPORT NO. 03-11-030

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 immediate vicinity of a proposed new port facility. 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, architect, civil engineer, and other design team professionals with recommendations 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. Robert Breedlove, Executive Director for the Natchitoches Parish Port (client), by accepting our August 10, 2010 written proposal. Authorization to proceed was provided on January 24, 2011. Field procedures were conducted between March 1 and 5, 2011. To accomplish the intended purposes, a three-phase study program was conducted which included:

- a field investigation consisting of six 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 is not available. The proposed buildings should consist of either steel or wood framing and may 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 purposes 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 area investigated is an approximately 134 acre tract of land located on the west frontage of U.S. Highway 84 and extends to State Highway 486 in Natchitoches Parish, Campti, Louisiana. The site was noted to slope downward to the southwest with estimated maximum elevation differences of between approximately seven (7) to eight (8) feet. The site was vegetated with weeds, grass, and scattered timber at the time of drilling. The drilling rig experienced moderate difficulty moving about the site.

Subsurface Stratigraphy:

In accordance with your request, subsurface conditions at the anticipated building sites were explored by drilling a total of six (6) borings to depths between approximately 70 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: sandy silt to silty sand (ML/SM), silty lean clay (CL), fat clay (CH), silt (ML), lean to fat clay (CL/CH), silty sand to sandy silt (SM/ML), poorly graded sand (SP-SM), and silty sand (SM).

Groundwater Conditions:

Seepage was observed at depths of 14.5 to 18.5 feet during advancement of the test borings. Groundwater was measured at depths of 10 to 19 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 GeoConsultants 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.

Based on the size and type of anticipated structures, as well as the findings from this investigation, a system of shallow footings with an on-grade 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.

Potential Vertical Rise (PVR) values were estimated to vary between less than one inch and approximately 3.25 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. The surficial soils encountered by the borings are considered to be moderately to highly expansive.

Shallow Foundations:

To remediate variable soil conditions in the surficial zone, provide a consistent subgrade for slab support, and reduce the potential for active soils to affect the foundations where active clays are present at the surface, GeoConsultants recommends that a uniform layer of density-approved select fill be provided beneath the 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	< 1.0	1.0
2	3.25	5.0
3	2.75	3.0
4	2.5	3.0
5	2.25	2.0
6	2.0	2.0

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.

Shallow foundations may utilize individual or continuous footings bearing within the upper five (5) feet of the surficial zone. The provision of at least one (1) to two (2) feet of select fill should be anticipated to be necessary to provide a suitable subgrade for the structures. 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.

Fill areas may be required to provide a level building pad for the proposed structures. These fill areas should be composed of density controlled select fill (compacted to 95% Standard Proctor ASTM D-698). These constructed fills, even though placed in a density controlled and monitored manner, can be expected to settle between 1% and 2% throughout the fill thickness. This contribution to settlement can be significant on sites with constructed fill depths exceeding three (3) or four (4) feet, and should be accounted for in the design of the building. Usually the most effective means to minimize deleterious effects of this settlement is to simply provide a relatively constant fill thickness, or accommodate a gradual transition from cut to fill.

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:

The design charts below present preliminary estimates for drilled, cast-in-place concrete shafts and driven timber and concrete piles. 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.

The actual building configurations and loads were not estimated at the time this report was prepared. The chart below represents the design curves for a single size drilled shaft having a diameter of 18 inches. The driven piles were assumed to be a class B creosote treated timber pile and the concrete pile dimensions were limited to a 12 inch square pre-cast, pre-stressed concrete pile. Once the final site investigations are performed, the estimated values for other diameters of deep foundations may be provided at that time.

We understand that deep foundations may be considered for use at this site due to special equipment or building loads. Shafts should be founded at a minimum estimated depth of 30 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 30 and 50 feet below present ground surface.

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

The factor of safety for these calculations is estimated to be 2.0. 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

The bearing capacity of the naturally occurring soil was evaluated from the results of the Standard Penetration Tests (SPT) and the Unified Soil Classifications. These test results indicate that the existing soil has a range from low to moderate bearing capacity with respect to shear strength. The superstructure loads for the office building may be supported on Class B creosote treated timber piles founded at a minimum depth of 35 feet below the existing ground surface in the underlying silty sand stratum. 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	25
40	30
45	35
50	40

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	40
45	50
50	55

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, 1993 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 300 blows per foot. 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 2.5 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 0.144 g. The project also has a mapped 1.0 second spectral response acceleration (S_1) of 0.066. Based on Section 1615.1.1 of the IBC2003, a Site Class of D has been estimated for this site due to the lack of subsurface information to a depth of 100 feet. 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 1.4, respectively. The design spectral response accelerations, S_{DS} and S_{D1}, were determined to be 0.154 g and 0.106 g, respectively.

Pavements:

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 Ratios (CBR) of between 2.0 and 5.0.

The satisfactory performance of pavements for parking and drive areas depends upon several factors including (1) the characteristics of the supporting soil; (2) the magnitude and frequency of wheel load applications; (3) quality of construction materials; (4) the contractor's placement and workmanship abilities, (5) good drainage, and (6) the desired period of design life.

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.

Subgrade may be, or become, wet and unstable under paving areas, depending on several factors, including construction season, groundwater fluctuations, contractor's maintenance of positive drainage, routing of equipment, weather, and scheduling constraints. Flexible base and concrete should be placed only on subgrade that has passed both stability and compaction requirements. Also, it is prudent for contract documents to accommodate over-excavation and replacement as needed or, more typically, to anticipate such remedial activity through the change order process. In any event, the owner should be advised that this risk is inherent in practically every construction project that involves site work.

Lime Treatment:

A review of the boring logs indicates that the subgrade below many 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 surficial clays 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.

If dusting of dry hydrated lime is anticipated to be problematic, whether due to loss of lime or due to local air emissions restrictions, the lime may be slurried with water and applied, if soil conditions are dry. In wet weather, pelletized quick lime may be used, if appropriate worker safety precautions are followed. The use of quick lime will reduce the amount of lime required by about 20% on a weight basis, as compared to hydrated lime.

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:

A bulk sample of the sandy silt to silty sand subgrade was submitted to the laboratory to determine its suitability for use for cement treatment. The results of those tests indicate that the subgrade 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.

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.)

Proper finishing of concrete pavement requires appropriate construction joints to reduce the potential for cracking. Construction joints ("weakened planes") should be designed in accordance with current Portland Cement Association guidelines. It is recommended that such "weakened plane" joints be spaced no more than 15' c-c, or as specified by the structural engineer. Depth of such joints should be 1/3 of the pavement thickness. These joints should be cut as soon as the concrete will support the machinery. Joints should be sealed to reduce the potential for water infiltration into pavement joints and subsequent infiltration into the supporting soils.

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 Lot Entries & Drives)**	**Heavy Duty (Truck Entries & Drives)**
Portland Cement Concrete	6.0" Portland Cement Concrete 8.0" Lime Treated Subgrade or Density Controlled Select Fill	7.0" Portland Cement Concrete 8.0" Lime Treated Subgrade or Density Controlled Select Fill
Asphalt Over Crushed Stone Base	3.0" Item 501 Type 3 Surface 7.0" Item 1003.03 (b) Base 8.0" Lime Treated Subgrade or Density Controlled Select Fill	4.0" Item 501 Type 3 Surface 11.0" Item 1003.03 (b) Base 8.0" Lime Treated Subgrade or Density Controlled Select Fill
*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.

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 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 GeoConsultants 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. GeoConsultants 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
ATTERBERG LIMITS RESULTS
UNCONFINED COMPRESSIVE STRENGTH CURVES
HYDROMETER RESULTS
LIME TREATMENT RESULTS

FIELD AND LABORATORY PROCEDURES
FOR
SITE VERIFICATION
NATCHITOCHES PARISH PORT PORPERTY
CAMPTI, LOUISIANA
GTL REPORT NO. 03-11-030

I. FIELD OPERATIONS:

Subsurface conditions were defined by six (6) intermittent soil borings drilled from March 1 to March 5, 2011 within the project area. Boring locations were selected and staked in the field by representatives of GeoConsultants, LLC of Louisiana. An illustration of the approximate boring locations 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. Surface elevations at the boreholes were not provided at the time of our investigation.

A truck-mounted rotary drill rig designed specifically for our purposes was used to make the test borings. Each boring was advanced 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. 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). Depths at which split-spoon samples were taken are indicated by two crossed lines in the "Samples" column on the Log of Boring. 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 at 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 Borings. 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 in the following table:

TABLE 1

Test	ASTM Designations
Atterberg Limits	D4318
Moisture Content	D2216
Partial Gradation	D1140
Unconfined Compression (Soil)	D2166
Hydrometer Analysis	D422
Lime Series	D6276-99a

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 ***GeoConsultants LLC of Louisiana.***

Plan of Borings

(Approximate Scale: 1" = 3,551')

PROJECT		
Site Verification, Natchitoches Parish Port Property, Campti, Louisiana		
DATE	FILE NUMBER	
3/11/2011	03-11-030	***GEOCONSULTANTS, LLC of Louisiana***

N

Plan of Borings

(Approximate Scale: 1" = 3,551')

PROJECT		
Site Verification, Natchitoches Parish Port Property, Campti, Louisiana		
DATE	FILE NUMBER	
3/11/2011	03-11-030	***GEOCONSULTANTS, LLC of Louisiana***

N

LOG OF BORING

PROJECT : Natchitoches Parish Port Property
BORING No. : B- 1
LOCATION: Campti, Louisiana
FILE No. : 03-11-030
CLIENT : Natchitoches Parish Port
DATE : 3/1/11

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.)
			3		Loose to Medium Dense Brownish Red SANDY SILT TO SILTY SAND (ML/SM)	11		NP	NP	NP	52	
			10		3.0'	6						
			12		Stiff Brownish Red Silty LEAN CLAY (CL)	12						
5			9			10		30	21	9	98	
			7		- firm @ 7.0 feet	23						
					8.5'							
			9		Stiff Brownish Red & Gray FAT CLAY (CH)	28		70	25	45	99	
10		1.75	Push			30	93					2416
					13.0'							
			3		Loose Brownish Red SILT (ML) w/sand & clayey silt (CL-ML) traces	19						
15												
			3			29		NP	NP	NP	85	
20												
			3		- w/lean clay (CL) layer @ 24.0 feet	28						
25												
					27.0'							
					Stiff Brownish Red FAT CLAY (CH)							
		1.75	Push			35	88	62	24	38	99	2483
30					31.5'							
					Firm Brownish Red LEAN TO FAT CLAY (CL/CH)							
		1.090	Push			27	95					1229
35												
		2.00	Push		- stiff @ 39.0 feet	25	99	48	22	26	97	2331
40												
					43.0'							
			3		Loose Brownish Red SILTY SAND TO SANDY SILT (SM/ML)	26						
45												
			2		- very loose @ 48.5 feet	26		NP	NP	NP	49	
50												

Continued Next Page

COMPLETION DEPTH, FEET:
70.0

WATER OBSERVATIONS, FEET:
10.0 @ 36 Hours

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

LOG OF BORING

PROJECT : Natchitoches Parish Port Property
BORING No. : B- 1
LOCATION: Campti, Louisiana
FILE No. : 03-11-030
CLIENT : Natchitoches Parish Port
DATE : 3/1/11

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							
55	X		5		Very Loose Brownish Red SILTY SAND TO SANDY SILT (SM/ML)	26						
					57.0'							
60	X		7		Loose Brownish Red SILTY SAND (SM)	26		NP	NP	NP	31	
65	X		7		- w/clayey sand traces (SC) @ 64.0 feet	37						
70	X		7		- brownish red @ 68.5 feet 70.0'	24						
					Water Seepage Observed @ 17.5 Feet While Drilling							
75												
80												
85												
90												
95												
100												

COMPLETION DEPTH, FEET:
70.0

WATER OBSERVATIONS, FEET:
10.0 @ 36 Hours

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

GEOTECHNICAL TESTING LABORATORY, INC.

LOG OF BORING

PROJECT : Natchitoches Parish Port Property
BORING No. : **B- 2**
LOCATION: Campti, Louisiana
FILE No. : 03-11-030
CLIENT : Natchitoches Parish Port
DATE : 3/2/11

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.)
		1.25	Push		Firm Reddish Brown FAT CLAY (CH)	35	85					1200
		2.00	Push		- stiff, brown @ 3.0 feet	30	90	71	25	46	99	2220
5		1.25	Push		- firm, brownish red below 5.0 feet	37	82					1415
		1.25	Push			30	92	78	27	51	99	1928
		1.50	Push			32	90					1865
10												
		0.50	Push		- soft @ 14.0 feet	28	93					635
15					17.5'							
			7		Firm Brownish Red Silty LEAN CLAY (CL) w/occasional sandy silt (ML) layers	26		38	22	16	97	
20												
			7			24						
25					27.0'							
			8		Stiff Red FAT CLAY (CH)	31		67	25	42	99	
30												
			10			26						
35					37.5'							
			10		Medium Dense Red, Poorly Graded, SAND (SP-SM) w/silt	23						
40												
			61		- very dense @ 44.0 feet	23		NP	NP	NP	10	
45												
			20		- medium dense, brown @ 48.0 feet	19						
50					*Continued Next Page*							

COMPLETION DEPTH, FEET:
70.0

WATER OBSERVATIONS, FEET:
10.0 @ 24 Hours

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

LOG OF BORING

PROJECT : Natchitoches Parish Port Property
BORING No. : **B- 2**
LOCATION: Campti, Louisiana
FILE No. : 03-11-030
CLIENT : Natchitoches Parish Port
DATE : 3/2/11

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.)
					Medium Dense Brown, Poorly Graded, SAND (SP-SM) w/silt							
55	X		14		- dense @ 54.0 feet	17						
60	X		49		- very dense @ 59.0 feet	19		NP	NP	NP	9	
65	X		57			16						
70	X		64		70.0'	17						
					Water Seepage Observed @ 18.5 Feet While Drilling							
75												
80												
85												
90												
95												
100												

Split Spoon Shelby Tube No Recovery

COMPLETION DEPTH, FEET:
70.0

WATER OBSERVATIONS, FEET:
10.0 @ 24 Hours

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

GEOTECHNICAL TESTING LABORATORY, INC.

LOG OF BORING

PROJECT : Natchitoches Parish Port Property
LOCATION: Campti, Louisiana
CLIENT : Natchitoches Parish Port

BORING No. : B- 3
FILE No. : 03-11-030
DATE : 3/2/11

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 Brownish Red FAT CLAY (CH)	33	84	71	27	44	99	1127
		1.25	Push			35	83					1187
5		2.50	Push		- stiff, brown @ 5.0 feet	30	90	68	24	44	99	2806
		1.25	Push		- firm @ 7.0 feet	30	92					1508
					8.0'							
		1.00	Push		Soft Brownish Red Silty LEAN CLAY (CH)	29	93					975
10												
			7		- firm @ 14.0 feet	23		43	22	21	96	
15												
					17.0'							
					Firm Brownish Red FAT CLAY (CH)	31						
			7									
20						31	89	69	26	43	99	857
		0.75	Push		- soft w/silty sand (SM) layer @ 21.0 feet							
			7		- firm, brownish red & gray @ 24.0 feet	38						
25												
						34	88	74	27	47	99	1255
		0.75	Push									
30												
						31	91					852
		0.50	Push		- soft, brownish red & gray @ 34.0 feet							
35												
					37.5'							
			5		Firm Brownish Red LEAN TO FAT CLAY (CL/CH)	27		46	22	24	99	
40												
					42.0'							
					Loose Brownish Red SILT (ML) w/sand	23						
			4									
45												
						31		NP	NP	NP	79	
50			3									

Continued Next Page

COMPLETION DEPTH, FEET:
70.0

WATER OBSERVATIONS, FEET:
13.0 @ 6 Hours

NOTES:
See Plan of Borings for Location
ND = Not Determined

Strata Boundaries May Not Be Exact

LOG OF BORING

PROJECT : Natchitoches Parish Port Property
LOCATION: Campti, Louisiana
CLIENT : Natchitoches Parish Port

BORING No. : B- 3
FILE No. : 03-11-030
DATE : 3/2/11

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							
55	X		14		Loose Brownish Red SILT (ML) w/sand - medium dense @ 54.0 feet 57.0'	37						
60	X		22		Medium Dense Brown SILTY SAND (SM)	22		NP	NP	NP	19	
65	X		30		- dense below 64.0 feet	20						
70	X		34		70.0'	19						
					Water Seepage Observed @ 18.5 Feet While Drilling							
75												
80												
85												
90												
95												
100												

COMPLETION DEPTH, FEET:
70.0

WATER OBSERVATIONS, FEET:
13.0 @ 6 Hours

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

GEOTECHNICAL TESTING LABORATORY, INC.

LOG OF BORING

PROJECT : Natchitoches Parish Port Property
BORING No. : **B- 4**
LOCATION: Campti, Louisiana
FILE No. : 03-11-030
CLIENT : Natchitoches Parish Port
DATE : 3/3/11

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 Brownish Red FAT CLAY (CH)	33	87					1072
		2.25	Push		- stiff, brown @ 3.0 feet	35	89	74	27	47	99	2890
5		3.75	Push		- very stiff, brown @ 5.0 feet	30	89					4623
		2.25	Push		- stiff, brownish red below 7.0 feet	30	93					3004
		2.50	Push			29	92	56	23	33	99	2701
10					12.0'							
		0.25	Push		Soft Brownish Red LEAN TO FAT CLAY (CL/CH)	24	99	50	22	28	98	621
15												
			1		- very soft @ 19.0 feet	33						
20					22.5'							
			11		Medium Dense Brownish Red SILTY SAND (SM)	25		NP	NP	NP	16	
25												
			5		- loose, brown & gray @ 29.0 feet	32						
30												
			16		- medium dense, brown @ 34.0 feet	31		NP	NP	NP	19	
35												
			5		- loose w/lean clay (CL) layer @ 39.0 feet	35						
40												
			4		- loose @ 44.0 feet	29						
45					47.0'							
			4		Firm Brown & Gray FAT CLAY (CH)	58						
50												
		2.00	Push			61	67	91	30	61	99	1973
55												
					- stiff @ 58.0 feet	44	74					2242
60		2.25	Push									

Continued Next Page

COMPLETION DEPTH, FEET:
100.0

WATER OBSERVATIONS, FEET:
14.0 @ 12 Hours

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

LOG OF BORING

PROJECT : Natchitoches Parish Port Property
LOCATION: Campti, Louisiana
CLIENT : Natchitoches Parish Port

BORING No. : B- 4
FILE No. : 03-11-030
DATE : 3/3/11

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							
					Stiff Brown & Gray FAT CLAY (CH)							
65		1.50	Push		- firm @ 64.0 feet	26	98					1415
					66.5'							
					Medium Dense Brown SILTY SAND (SM)							
70			23			21		NP	NP	NP	16	
					72.5'							
					Very Dense Brown, Poorly Graded, SAND (SP-SM) w/silt	14						
75			53									
					- w/gravel below 79.0 feet	15		NP	NP	NP	7	
80			51									
					- dense @ 84.0 feet	17						
85			36									
					- very dense below 89.0 feet	10						
90			66									
						11					6	
95			51									
					100.0'	11						
100			65		Water Seepage Observed @ 18.5 Feet While Drilling							
105												
110												
115												
120												

COMPLETION DEPTH, FEET:
100.0

WATER OBSERVATIONS, FEET:
14.0 @ 12 Hours

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

GEOTECHNICAL TESTING LABORATORY, INC.

LOG OF BORING

PROJECT : Natchitoches Parish Port Property
LOCATION: Campti, Louisiana
CLIENT : Natchitoches Parish Port

BORING No. : B- 5
FILE No. : 03-11-030
DATE : 3/4/11

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.)
		1.75	Push		Stiff Brownish Red FAT CLAY (CH)	29	87	69	26	43	98	2034
		2.00	Push			28	91					2346
5		3.50	Push		- very stiff @ 4.0 feet 6.0'	25	97	68	25	43	99	4561
			5		Firm Brownish Red Silty LEAN CLAY (CL) w/silt (ML) layers	24						
10			7			27		33	21	12	97	
					13.0'							
			4		Loose Brownish Red SILT (ML) w/sand	27		NP	NP	NP	85	
15												
20			2		- very loose @ 19.0 feet 22.0'	27						
		0.50	Push		Soft Brownish Red FAT CLAY (CH)	32	88	78	26	52	98	877
25												
30		1.00	Push		- firm @ 29.0 feet 32.5'	30	89					1641
			2		Very Soft Red Silty LEAN CLAY (CL)	24						
35												
					38.0'							
			1		Very Loose Brownish Red SANDY SILT TO SILTY SAND (ML/SM)	26		NP	NP	NP	51	
40												
45			18		- medium dense @ 44.0 feet 46.5'	25						
			11		Medium Dense Brownish Red SILTY SAND (SM)	27		NP	NP	NP	40	
50												

Continued Next Page

COMPLETION DEPTH, FEET:
70.0

WATER OBSERVATIONS, FEET:
19.0 @ 10 Minutes

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

LOG OF BORING

PROJECT : Natchitoches Parish Port Property
BORING No. : **B- 5**
LOCATION: Campti, Louisiana
FILE No. : 03-11-030
CLIENT : Natchitoches Parish Port
DATE : 3/4/11

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 (Continued)	Moisture Content (%)	Unit Dry Weight (Lbs./Cu. Ft.)	Liquid Limit	Plastic Limit	Plasticity Index	% Passing No. 200 Sieve	Unconfied Compression (Lbs./Sq. Ft.)
55	☒		20		Medium Dense Brownish Red SILTY SAND (SM)	24						
60	☒		27		61.5'	21						
65	☒		53		Very Dense Brown, Poorly Graded, SAND (SP-SM) w/silt	20		NP	NP	NP	8	
70	☒		58		70.0'	17						
					Water Seepage Observed @ 14.5 Feet While Drilling							
75												
80												
85												
90												
95												
100												

COMPLETION DEPTH, FEET:
70.0

WATER OBSERVATIONS, FEET:
19.0 @ 10 Minutes

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

GEOTECHNICAL TESTING LABORATORY, INC.

LOG OF BORING

PROJECT : Natchitoches Parish Port Property
LOCATION: Campti, Louisiana
CLIENT : Natchitoches Parish Port

BORING No. : B- 6
FILE No. : 03-11-030
DATE : 3/5/11

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.)
		1.50	Push		Stiff Brownish Red FAT CLAY (CH)	29	89					2186
		1.75	Push			27	92	54	23	31	98	2529
5		1.00	Push		- firm, brown @ 5.0 feet	27	91					1166
		1.25	Push		- firm below 7.0 feet	23	94	55	23	32	99	1704
10			7		12.0'	22						
			8		Stiff Brownish Red FAT CLAY (CH)	33		77	25	52	99	
15		2.50	Push			34	86					2572
20		1.00	Push		- firm, brownish red & gray @ 19.0 feet	25	97					1561
					22.5'							
25			2		Very Soft Brownish Red Silty LEAN CLAY (CL)	34		33	21	12	95	
30			2			33						
35			1			32						
					37.0'							
40		1.25	Push		Firm Brown FAT CLAY (CH)	58	69	83	27	56	99	1171
					41.5'							
45			12		Medium Dense Brown SILTY SAND (SM)	25		NP	NP	NP	26	
50			14			24						

Continued Next Page

COMPLETION DEPTH, FEET:
70.0

WATER OBSERVATIONS, FEET:
17.0 @ 10 Minutes

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

GEOTECHNICAL TESTING LABORATORY, INC.

LOG OF BORING

PROJECT : Natchitoches Parish Port Property
LOCATION: Campti, Louisiana
CLIENT : Natchitoches Parish Port

BORING No. : B- 6
FILE No. : 03-11-030
DATE : 3/5/11

Split Spoon | Shelby Tube | No Recovery

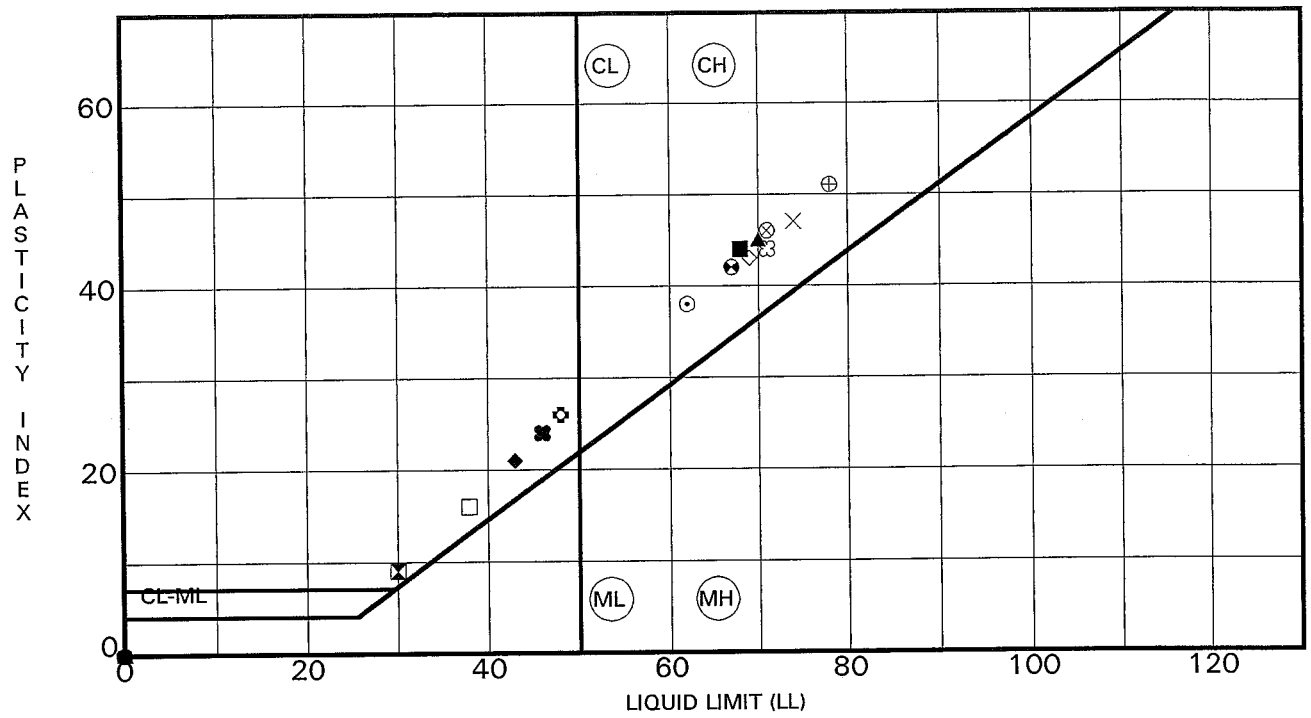
Depth (Feet)	Samples	Hand Penetrometer (Tons/Sq. Ft.)	Standard Penetration (Blows/Foot)	Graphic Log	STRATUM DESCRIPTION (Continued)	Moisture Content (%)	Unit Dry Weight (Lbs./Cu. Ft.)	Liquid Limit	Plastic Limit	Plasticity Index	% Passing No. 200 Sieve	Unconfied Compression (Lbs./Sq. Ft.)
55	X		19		Medium Dense Brown SILTY SAND (SM)	23						
					57.0'							
60	X		5		Firm Brown FAT CLAY (CH)	55		84	27	57	99	
65	■	1.00	Push		65.0'	35	84					1749
	X		19		Medium Dense Brown, Poorly Graded, SAND (SP-SM) w/silt	24		NP	NP	NP	6	
70					70.0'							
					Water Seepage Observed @ 17.5 Feet While Drilling							
75												
80												
85												
90												
95												
100												

COMPLETION DEPTH, FEET:
70.0

WATER OBSERVATIONS, FEET:
17.0 @ 10 Minutes

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

GEOTECHNICAL TESTING LABORATORY, INC.



Specimen Identification			LL	PL	PI	Fines	Classification
●	B- 1	1.0	NP	NP	NP	52.0	SANDY SILT ML
⊠	B- 1	6.0	30	21	9	98.0	LEAN CLAY CL
▲	B- 1	9.5	70	25	45	99.0	FAT CLAY CH
★	B- 1	19.5	NP	NP	NP	85.0	SILT with SAND ML
⊙	B- 1	29.0	62	24	38	99.0	FAT CLAY CH
✿	B- 1	39.0	48	22	26	97.0	LEAN CLAY CL
○	B- 1	49.5	NP	NP	NP	49.0	SILTY SAND SM
△	B- 1	59.5	NP	NP	NP	31.0	SILTY SAND SM
⊗	B- 2	3.0	71	25	46	99.0	FAT CLAY CH
⊕	B- 2	7.0	78	27	51	99.0	FAT CLAY CH
□	B- 2	19.5	38	22	16	97.0	LEAN CLAY CL
⊖	B- 2	29.5	67	25	42	99.0	FAT CLAY CH
◔	B- 2	44.5	NP	NP	NP	10.0	POORLY GRADED SAND with SILT SP-SM
☆	B- 2	59.5	NP	NP	NP	9.0	POORLY GRADED SAND with SILT SP-SM
⊠	B- 3	1.0	71	27	44	99.0	FAT CLAY CH
■	B- 3	5.0	68	24	44	99.0	FAT CLAY CH
◆	B- 3	14.5	43	22	21	96.0	LEAN CLAY CL
◇	B- 3	21.0	69	26	43	99.0	FAT CLAY CH
×	B- 3	29.0	74	27	47	99.0	FAT CLAY CH
✖	B- 3	39.5	46	22	24	99.0	LEAN CLAY CL

PROJECT Natchitoches Parish Port Property - Campti, Louisiana

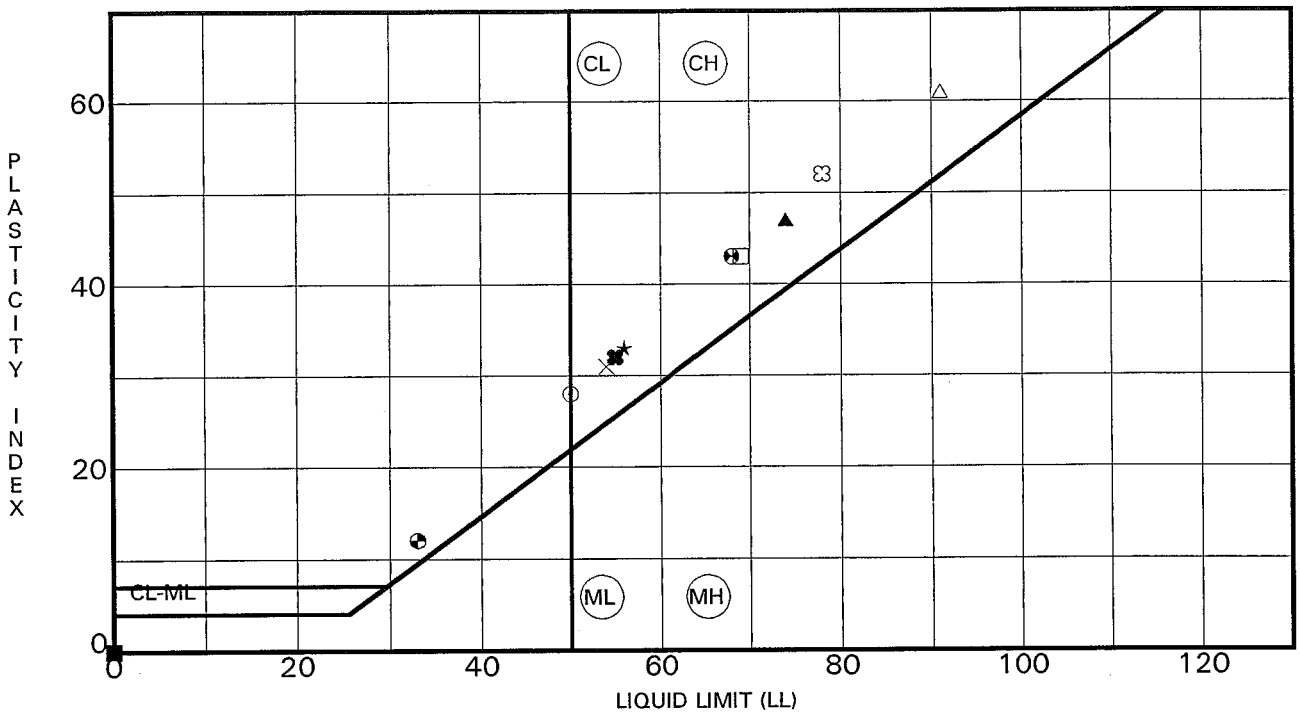
JOB NO. 03-11-030

DATE 3/14/11

ATTERBERG LIMITS' RESULTS

Geotechnical Testing Laboratory, Inc.

226 Parkwood Drive



Specimen Identification			LL	PL	PI	Fines	Classification
●	B- 3	49.5	NP	NP	NP	79.0	SILT with SAND ML
⊠	B- 3	59.5	NP	NP	NP	19.0	SILTY SAND SM
▲	B- 4	3.0	74	27	47	99.0	FAT CLAY CH
★	B- 4	9.0	56	23	33	99.0	FAT CLAY CH
⊙	B- 4	14.0	50	22	28	98.0	FAT CLAY CH
✿	B- 4	24.5	NP	NP	NP	16.0	SILTY SAND SM
○	B- 4	34.5	NP	NP	NP	19.0	SILTY SAND SM
△	B- 4	54.0	91	30	61	99.0	FAT CLAY CH
⊗	B- 4	69.5	NP	NP	NP	16.0	SILTY SAND SM
⊕	B- 4	79.5	NP	NP	NP	7.0	POORLY GRADED SAND with SILT SP-SM
□	B- 5	1.0	69	26	43	98.0	FAT CLAY CH
⊖	B- 5	5.0	68	25	43	99.0	FAT CLAY CH
◕	B- 5	9.0	33	21	12	97.0	LEAN CLAY CL
☆	B- 5	14.5	NP	NP	NP	85.0	SILT with SAND ML
⊠	B- 5	24.0	78	26	52	98.0	FAT CLAY CH
■	B- 5	39.5	NP	NP	NP	51.0	SANDY SILT ML
◆	B- 5	49.5	NP	NP	NP	40.0	SILTY SAND SM
◇	B- 5	64.5	NP	NP	NP	8.0	POORLY GRADED SAND with SILT SP-SM
×	B- 6	3.0	54	23	31	98.0	FAT CLAY CH
✖	B- 6	7.0	55	23	32	99.0	FAT CLAY CH

PROJECT Natchitoches Parish Port Property - Campti, Louisiana

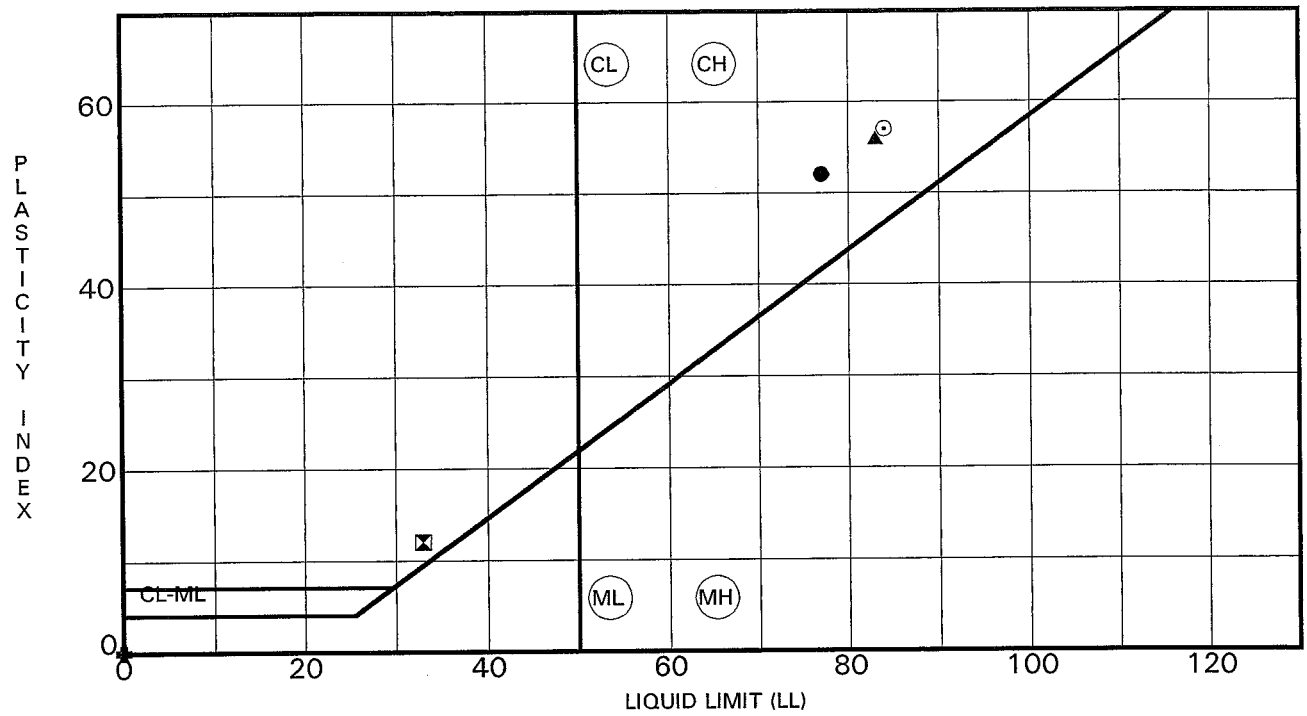
JOB NO. 03-11-030

DATE 3/14/11

ATTERBERG LIMITS' RESULTS

Geotechnical Testing Laboratory, Inc.

226 Parkwood Drive



Specimen Identification			LL	PL	PI	Fines	Classification
●	B- 6	14.5	77	25	52	99.0	FAT CLAY CH
⊠	B- 6	24.5	33	21	12	95.0	LEAN CLAY CL
▲	B- 6	39.0	83	27	56	99.0	FAT CLAY CH
★	B- 6	44.5	NP	NP	NP	26.0	SILTY SAND SM
⊙	B- 6	59.5	84	27	57	99.0	FAT CLAY CH
✡	B- 6	69.5	NP	NP	NP	6.0	POORLY GRADED SAND with SILT SP-SM

PROJECT Natchitoches Parish Port Property - Campti, Louisiana

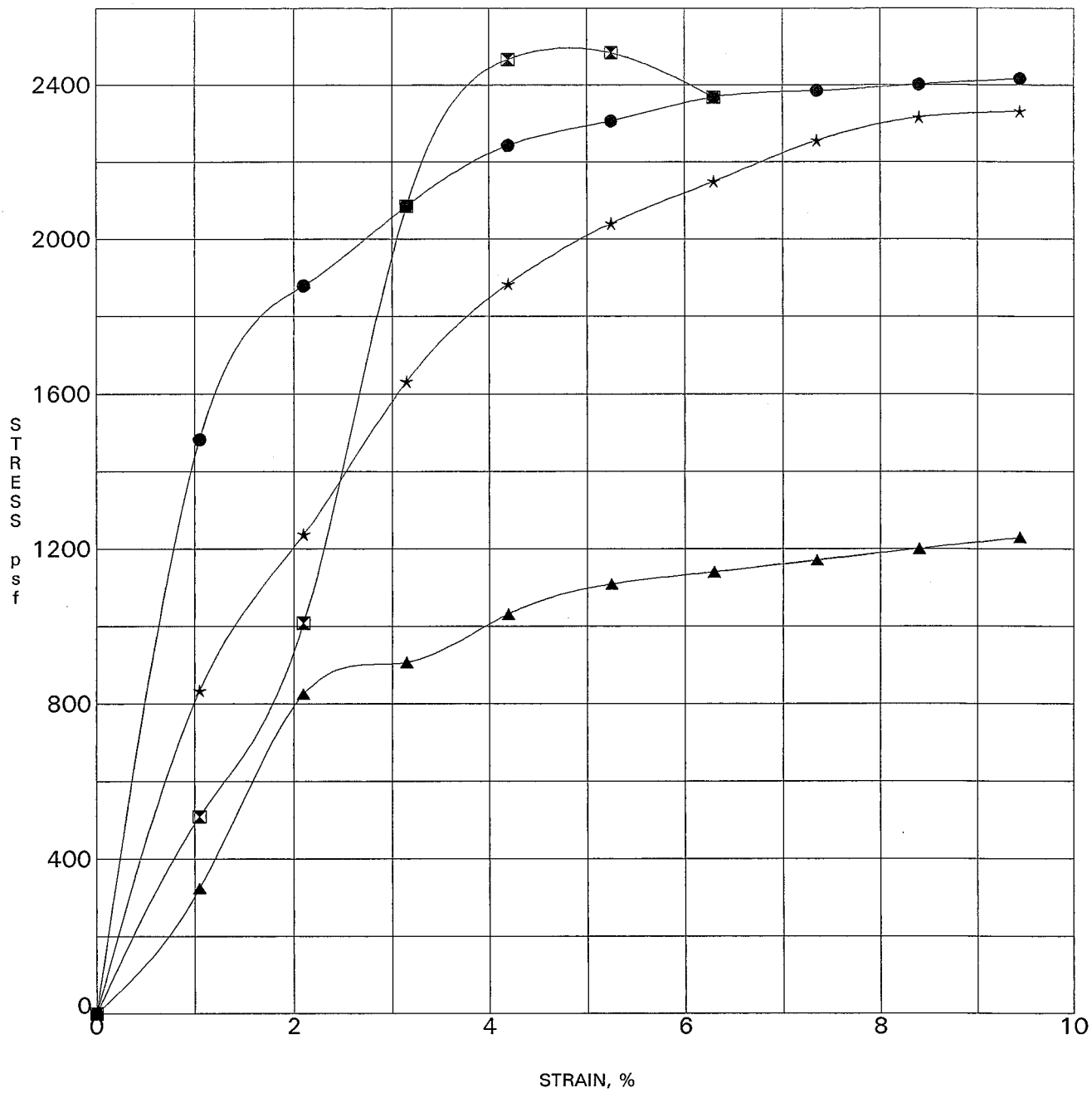
JOB NO. 03-11-030

DATE 3/14/11

ATTERBERG LIMITS' RESULTS

Geotechnical Testing Laboratory, Inc.

226 Parkwood Drive



Specimen Identification			Classification	DD	MC%
●	B- 1	11.0	FAT CLAY CH	93	30
⊠	B- 1	29.0	FAT CLAY CH	88	35
▲	B- 1	34.0	LEAN CLAY CL	95	27
★	B- 1	39.0	LEAN CLAY CL	99	25

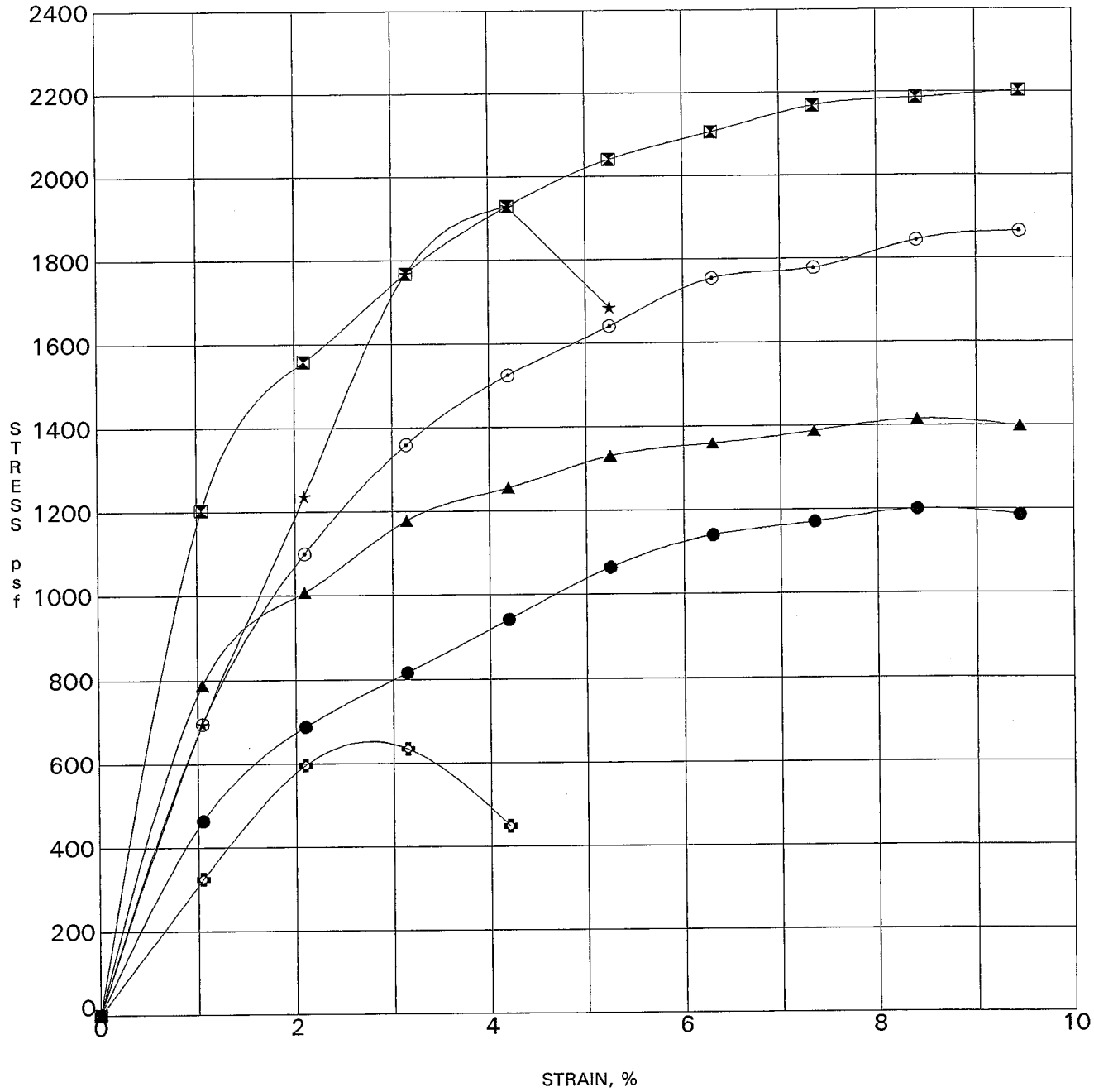
PROJECT Natchitoches Parish Port Property - Campti, Louisiana

JOB NO. 03-11-030

DATE 3/11/11

UNCONFINED COMPRESSION TEST

Geotechnical Testing Laboratory, Inc.
226 Parkwood Drive



Specimen Identification			Classification	DD	MC%
●	B- 2	1.0	FAT CLAY CH	85	35
⊠	B- 2	3.0	FAT CLAY CH	90	30
▲	B- 2	5.0	FAT CLAY CH	82	37
★	B- 2	7.0	FAT CLAY CH	92	30
⊙	B- 2	9.0	FAT CLAY CH	90	32
✡	B- 2	14.0	FAT CLAY CH	93	28

PROJECT Natchitoches Parish Port Property - Campti, Louisiana

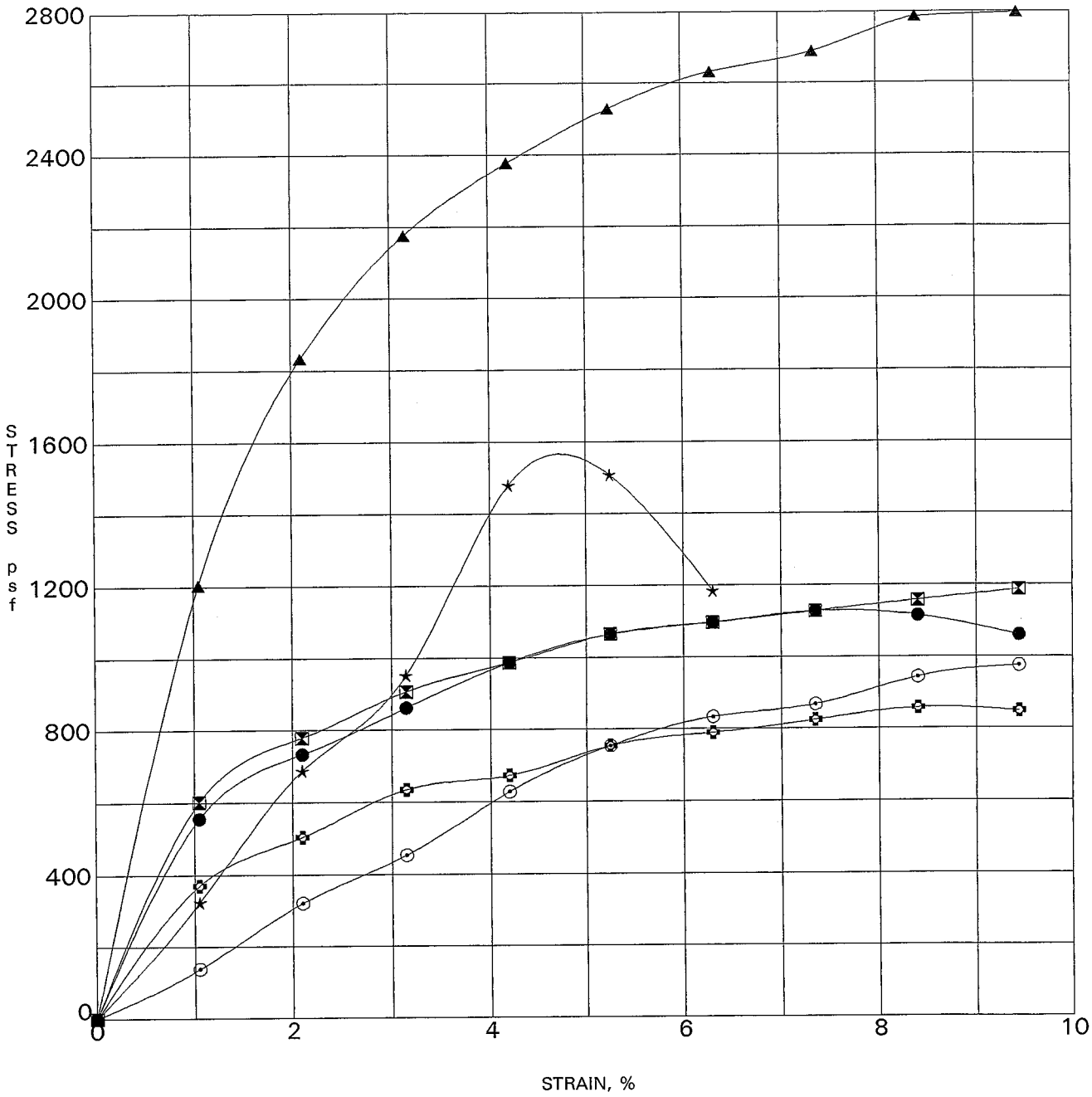
JOB NO. 03-11-030

DATE 3/11/11

UNCONFINED COMPRESSION TEST

Geotechnical Testing Laboratory, Inc.

226 Parkwood Drive



Specimen Identification			Classification	DD	MC%
●	B- 3	1.0	FAT CLAY CH	84	33
⊠	B- 3	3.0	FAT CLAY CH	83	35
▲	B- 3	5.0	FAT CLAY CH	90	30
★	B- 3	7.0	FAT CLAY CH	92	30
⊙	B- 3	9.0	LEAN CLAY CL	93	29
✿	B- 3	21.0	FAT CLAY CH	89	31

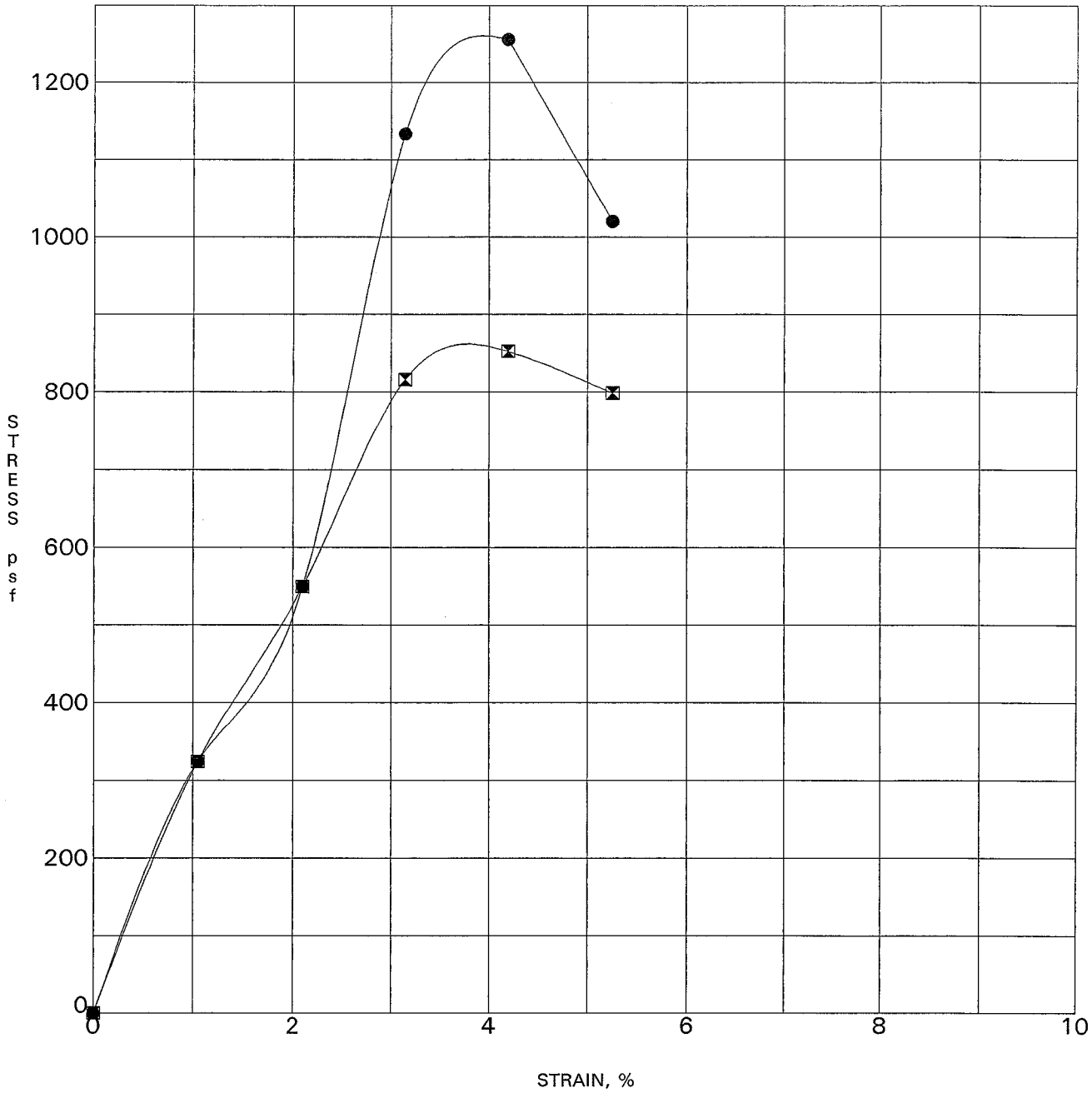
PROJECT Natchitoches Parish Port Property - Campti, Louisiana

JOB NO. 03-11-030

DATE 3/14/11

UNCONFINED COMPRESSION TEST

Geotechnical Testing Laboratory, Inc.
226 Parkwood Drive



Specimen Identification			Classification	DD	MC%
●	B- 3	29.0	FAT CLAY CH	88	34
⊠	B- 3	34.0	FAT CLAY CH	91	31

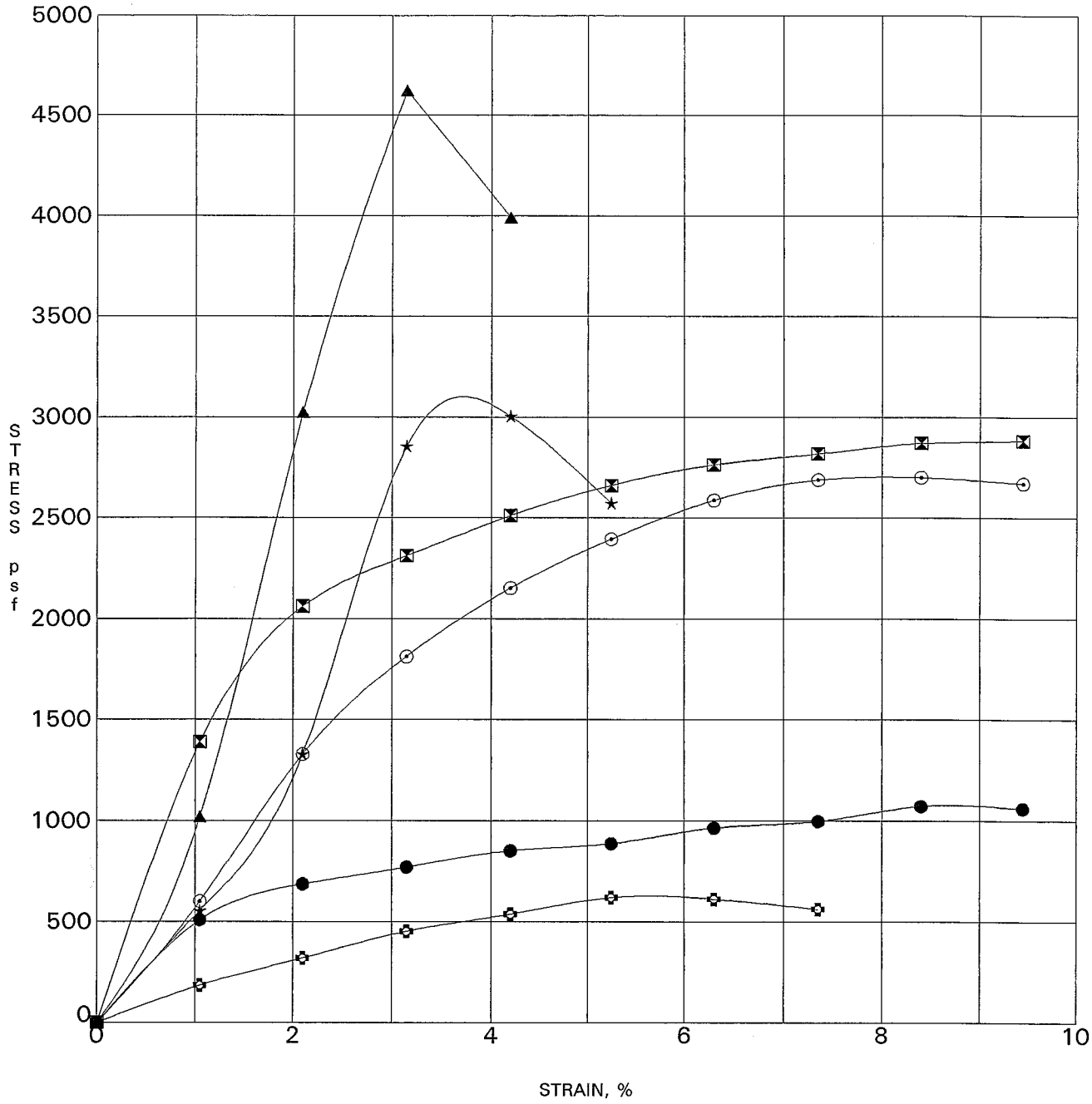
PROJECT **Natchitoches Parish Port Property - Campti, Louisiana**

JOB NO. **03-11-030**

DATE **3/14/11**

UNCONFINED COMPRESSION TEST

Geotechnical Testing Laboratory, Inc.
226 Parkwood Drive



Specimen Identification			Classification	DD	MC%
●	B- 4	1.0	FAT CLAY CH	87	33
⊠	B- 4	3.0	FAT CLAY CH	89	35
▲	B- 4	5.0	FAT CLAY CH	89	30
★	B- 4	7.0	FAT CLAY CH	93	30
⊙	B- 4	9.0	FAT CLAY CH	92	29
✿	B- 4	14.0	FAT CLAY CH	99	24

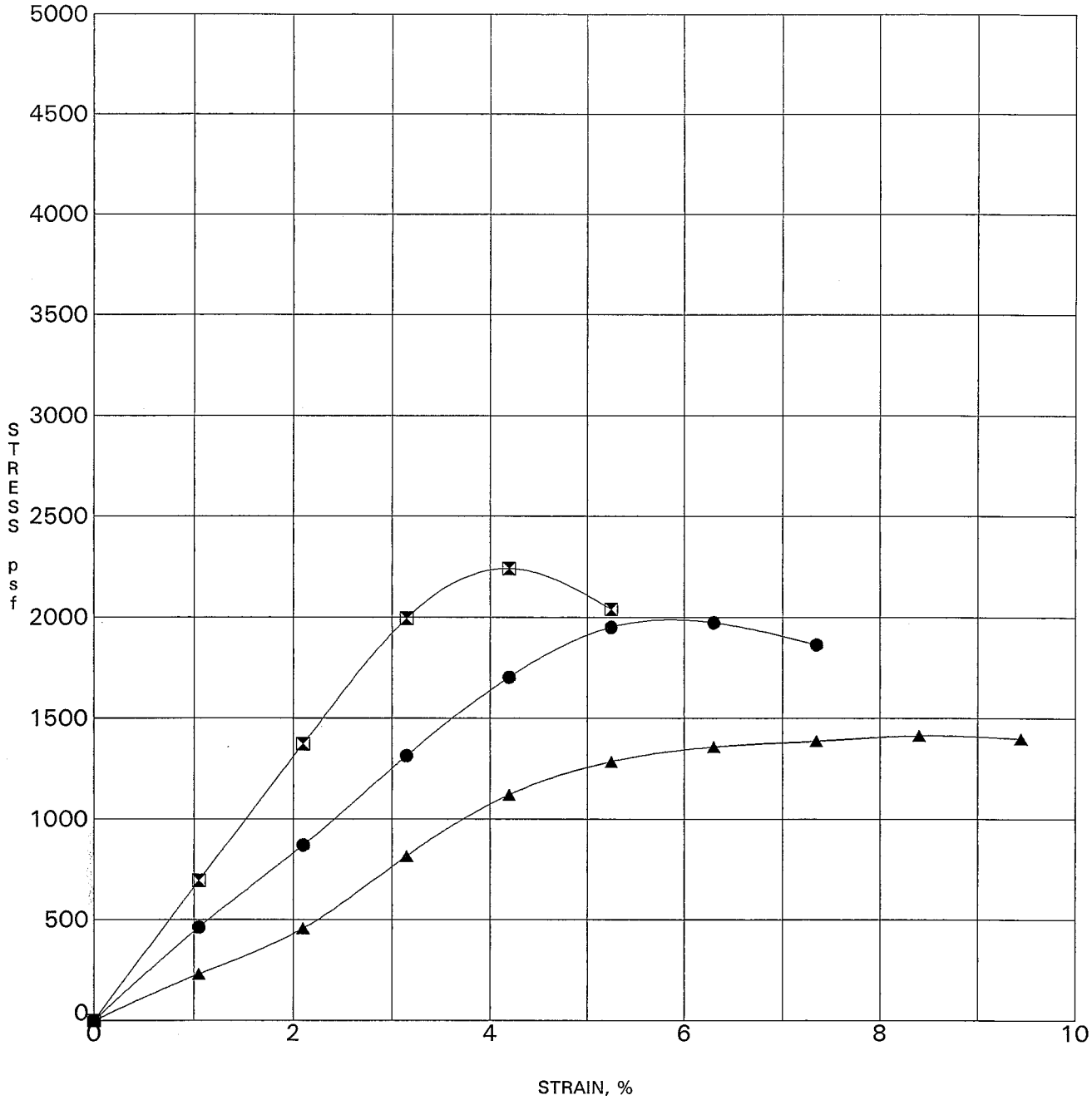
PROJECT Natchitoches Parish Port Property - Campti, Louisiana

JOB NO. 03-11-030

DATE 3/14/11

UNCONFINED COMPRESSION TEST

Geotechnical Testing Laboratory, Inc.
226 Parkwood Drive



Specimen Identification			Classification	DD	MC%
●	B- 4	54.0	FAT CLAY CH	67	61
⊠	B- 4	59.0	FAT CLAY CH	74	44
▲	B- 4	64.0	FAT CLAY CH	98	26

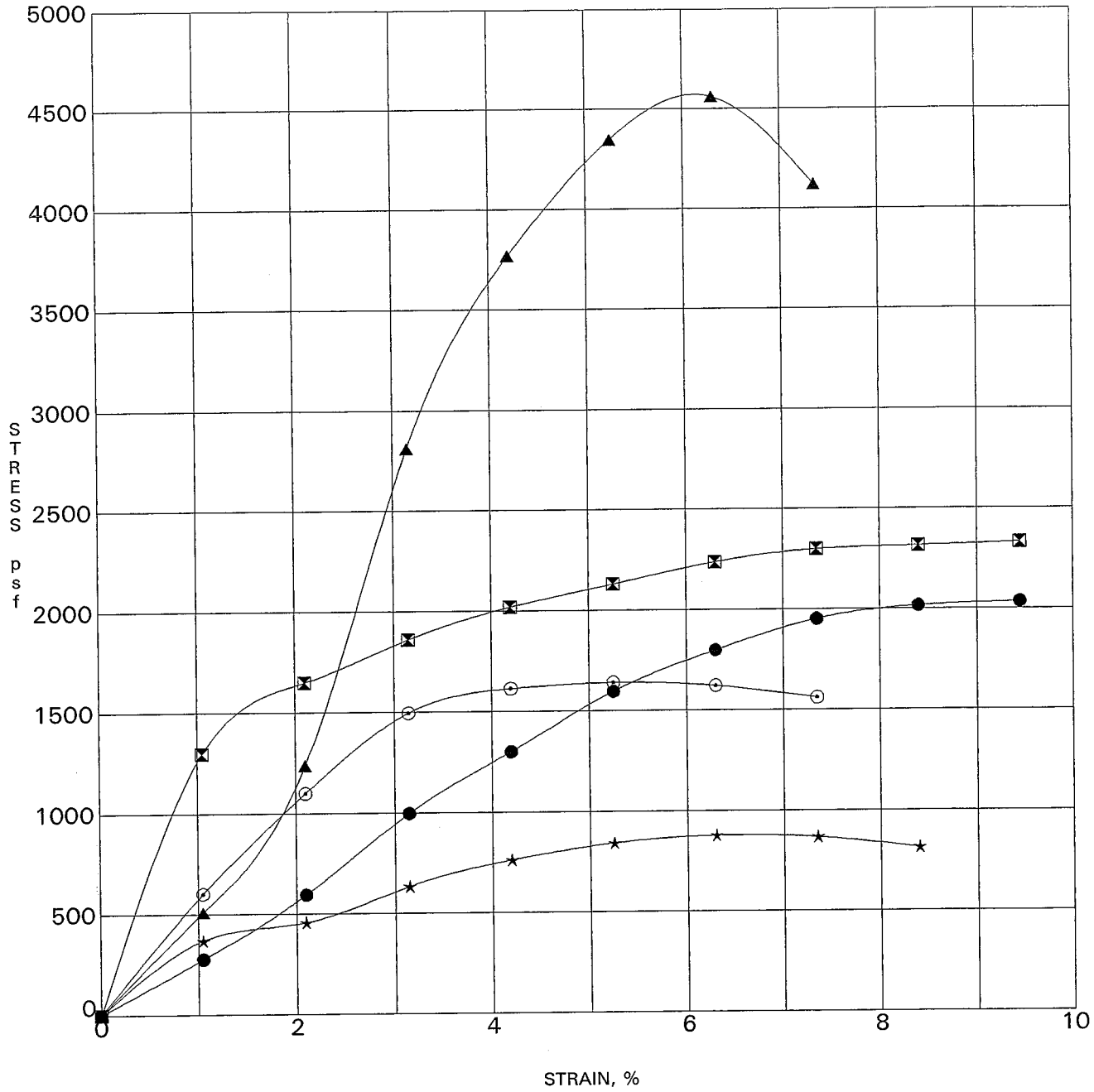
PROJECT **Natchitoches Parish Port Property - Campti, Louisiana**

JOB NO. **03-11-030**

DATE **3/14/11**

UNCONFINED COMPRESSION TEST

Geotechnical Testing Laboratory, Inc.
226 Parkwood Drive



Specimen Identification			Classification	DD	MC%
●	B- 5	1.0	FAT CLAY CH	87	29
⊠	B- 5	3.0	FAT CLAY CH	91	28
▲	B- 5	5.0	FAT CLAY CH	97	25
★	B- 5	24.0	FAT CLAY CH	88	32
⊙	B- 5	29.0	FAT CLAY CH	89	30

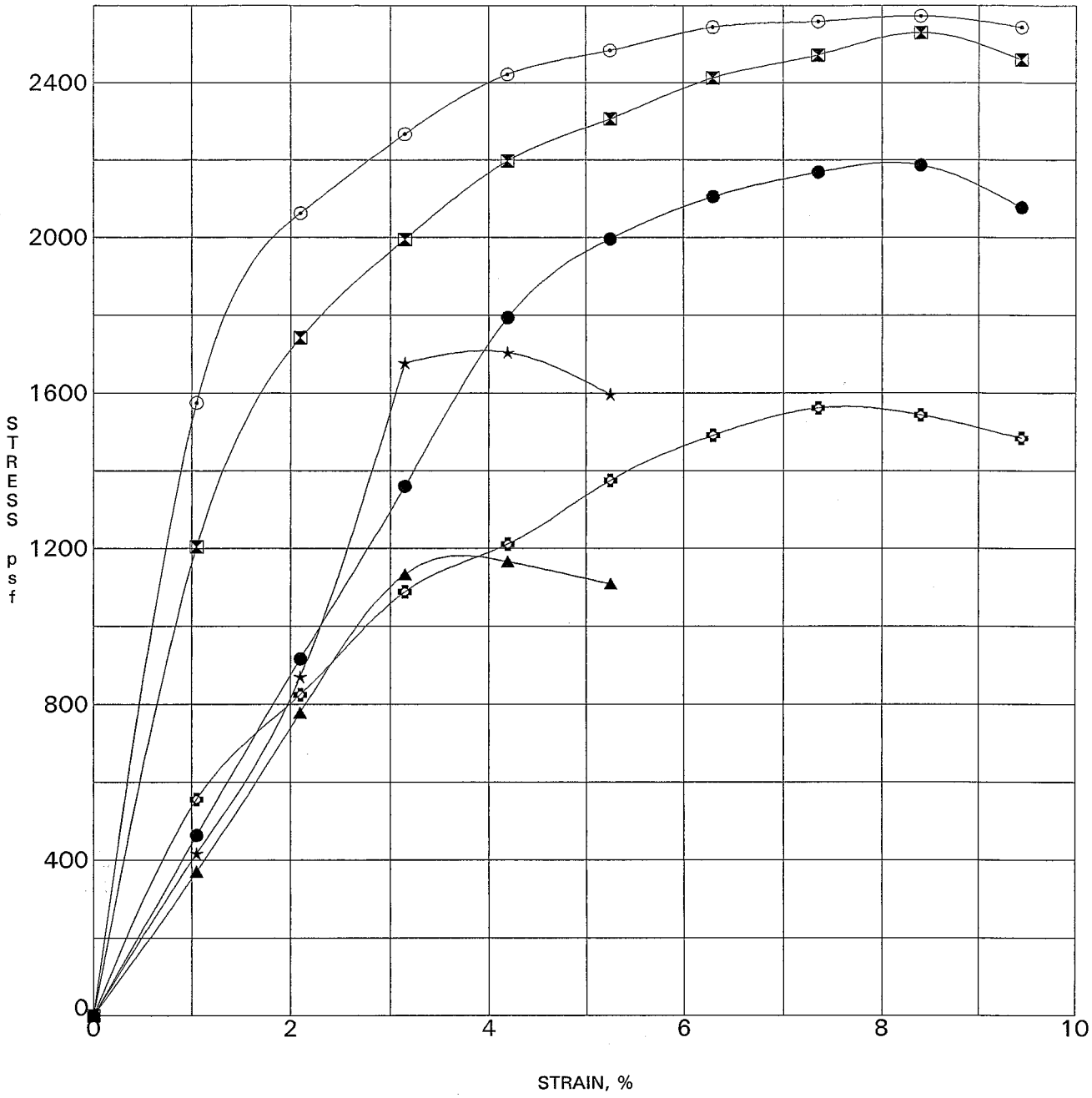
PROJECT Natchitoches Parish Port Property - Campti, Louisiana

JOB NO. 03-11-030

DATE 3/14/11

UNCONFINED COMPRESSION TEST

Geotechnical Testing Laboratory, Inc.
226 Parkwood Drive



Specimen Identification			Classification	DD	MC%
●	B- 6	1.0	FAT CLAY CH	89	29
⊠	B- 6	3.0	FAT CLAY CH	92	27
▲	B- 6	5.0	FAT CLAY CH	91	27
★	B- 6	7.0	FAT CLAY CH	94	23
⊙	B- 6	16.0	FAT CLAY CH	86	34
✿	B- 6	19.0	FAT CLAY CH	97	25

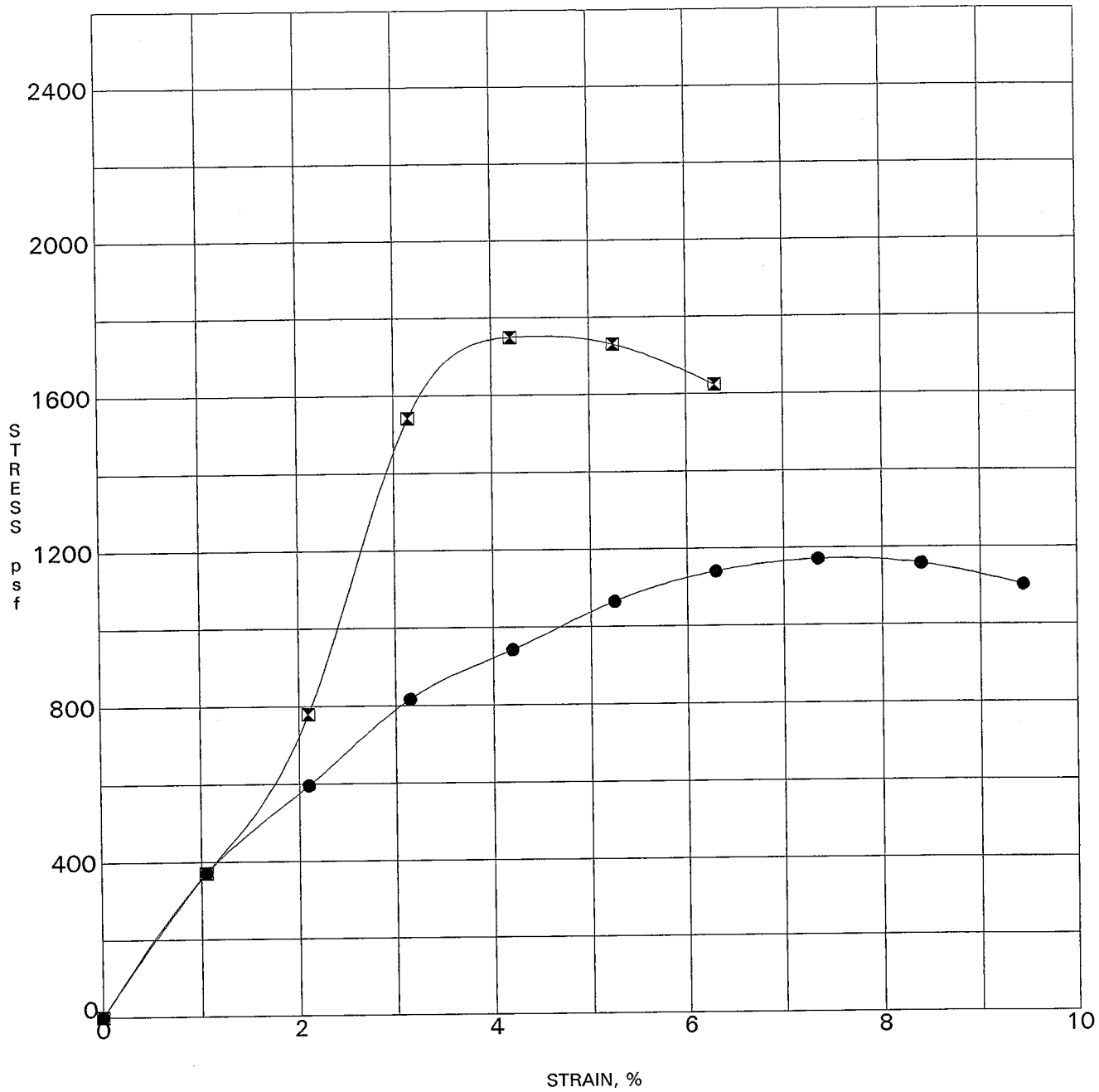
PROJECT Natchitoches Parish Port Property - Campti, Louisiana

JOB NO. 03-11-030

DATE 3/14/11

UNCONFINED COMPRESSION TEST

Geotechnical Testing Laboratory, Inc.
226 Parkwood Drive



Specimen Identification			Classification	DD	MC%
●	B- 6	39.0	FAT CLAY CH	69	58
⊠	B- 6	64.0	FAT CLAY CH	84	35

PROJECT Natchitoches Parish Port Property - Campti, Louisiana

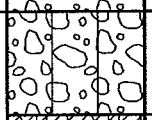
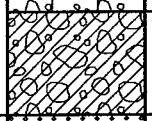
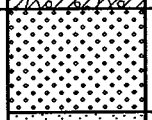
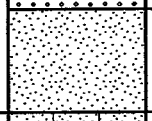
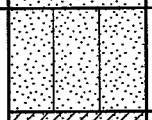
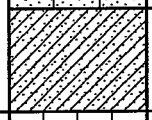
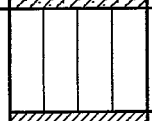
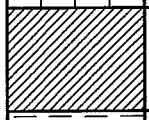
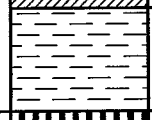
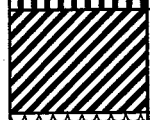
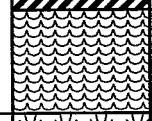
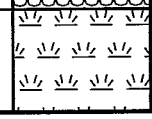
JOB NO. 03-11-030

DATE 3/14/11

UNCONFINED COMPRESSION TEST

Geotechnical Testing Laboratory, Inc.
226 Parkwood Drive

SOIL CLASSIFICATION CHART

MAJOR DIVISIONS			SYMBOLS: GRAPH	SYMBOLS: LETTER	TYPICAL DESCRIPTIONS
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

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

Report Date: 3/11/2011 **Sample Date:** 3/3/2011 **Project No:** 03-11-030

Client: Natchitoches Parish Port
P.O. Box 2215
Natchitoches, Louisiana 71457
Attn: Mr. Robert Breedlove, Executive Director

Project: Site Verification, Natchitoches Parish Port Property, Campti, 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	Pavement Subgrade, Boring B-2				
Material Description	Fat Clay (CH) (A-7-6)				
Average Liquid Limit (LL)	71				
Average Plasticity Index (PI)	46				
Lime Quantity	**2.0%**	**3.0%**	**4.0%**	**5.0%**	**6.0%**
pH Readings	10.16	10.88	11.22	12.40	12.49

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.

Laboratory Analysis of Soils For Soil-Cement Treatment

Report Date: 3/11/2011 **Sample Date:** 3/3/2011 **Project No:** 03-11-030

Client: Natchitoches Parish Port
P.O. Box 2215
Natchitoches, Louisiana 71457
Attn: Mr. Robert Breedlove, Executive Director

Project: Site Verification, Natchitoches Parish Port Property, Campti, Louisiana

Test Methods: DOTD TR407, TR413, TR423, TR428

Laboratory Results:

Test	Pavement Subgrade @ Boring B-1	Cement Treatment Specifications
Silt, %	40	65% Max.
Sand, %	48	79% Max.
Clay, %	12	
Liquid Limit (LL)	Non Plastic	
Plasticity Index (PI)	Non Plastic	22 Max.
Organic Content, %	0.9	2.0 Max.
Soil Group	A-4	A-6 or Better
Soil Classification	Sandy Silt to Silty Sand	
Results	Unusable	

GEOTECHNICAL TESTING LABORATORY, INC.