



ECS Southeast, LLP

Geotechnical Engineering Report

Express Oil Change – Juban Crossing

Juban Road
Denham Springs, Louisiana

ECS Project No. 65:1437

September 7, 2023





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ECS Project No. 65:1437

Reference: Geotechnical Engineering Report
Express Oil Change – Juban Crossing
Juban Road
Denham Springs, Louisiana

Ms. Bernatski:

ECS Southeast, LLP (ECS) has completed the subsurface exploration, laboratory testing, and geotechnical engineering analyses for the Express Oil Change – Juban Crossing project in Denham Springs, LA. Our services were performed in accordance with our agreed to scope of work. This report presents our geotechnical analysis of the project along with the results of the field exploration and laboratory testing conducted, and our design and construction recommendations.

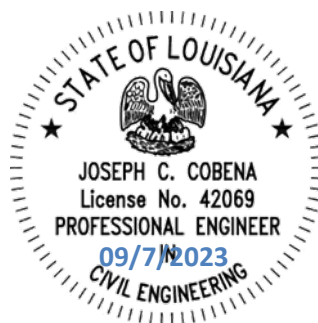
It has been our pleasure to be of service to Express Oil Change & Tire Engineers during the design phase of this project. We would appreciate the opportunity to remain involved during the continuation of the design phase, and we would like to provide our services during construction phase operations as well to evaluate subsurface conditions assumed for this report. Should you have any questions concerning the information contained in this report, or if we can be of further assistance to you, please feel free to contact us.

Respectfully submitted,

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Appendix A – Drawings & Reports

- Site Location Diagram
- Boring Location Diagram

Appendix B – Field Operations

- Reference Notes for Boring Logs
- Boring Logs B-1 to B-2, P-1 to P-6

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- Laboratory Testing Results Summary

EXECUTIVE SUMMARY

The following summarizes the main findings of the exploration, particularly those that may have a cost impact on the planned development. Further, our principal foundation recommendations are summarized. Information gleaned from the Executive Summary should not be utilized in lieu of reading the entire geotechnical report.

SUBSURFACE CONDITIONS:

- Surface Material: Silt and wood debris from recent clearing operations.
- Probable Fill: Not encountered.
- Expected Undercut: Up to 12 Inches to remove surficial silt soils and up to 2 feet to remove tree root balls after clearing of existing tree cover.
- Natural Material: Gray and Tan Lean Clay (CL)
- Swell Potential (PVR): Low
- Groundwater: Encountered at depths of approximately 15 and 23 feet in borings B-1 and B-2, respectively, during drilling operations. The 48-hour water level Performed at boring B-2 reading was recorded as 6.5 feet below grade.

DESIGN & CONSTRUCTION RECOMMENDATIONS:

- Shallow foundations
 - Max. Net Allow. Bearing Pressure
 - 2,000 psf for spread footings
 - Min. Exterior Footing Depth = 24 inches
 - Min. Interior Footing Depth = Per structural design
- Slab-on-Grade: Modulus of Subgrade Reaction of 125 pci
- Seismic Design: IBC Site Class “D”

ECS should be retained to review all project documents to confirm conformance with our recommendations, and to perform CMT testing for earthwork and foundation construction activities to document that our recommendations are strictly followed. This also allows us to quickly provide recommendations for remedial activities, where necessary.

1.0 INTRODUCTION

The purpose of this study was to provide geotechnical information for the design of a new Express Oil Change: a 1-story, slab-on-grade building and pit design with associated parking and drive areas. We anticipate the plan area of the building to encompass approximately 4,500 square feet. The recommendations developed for this report are based on project information supplied by the client.

ECS's services were provided in accordance with Proposal No. 1966P, dated July 6, 2023, as authorized by Ms. Ashley Bernatski on July 6, 2023, which includes our Terms and Conditions of Service.

This report contains the procedures and results of our subsurface exploration and laboratory testing programs, review of existing site conditions, engineering analyses, and recommendations for the design and construction of the project.

The report includes the following items:

- Observations from our site reconnaissance including location diagram, current site conditions, surface topographic conditions, and encountered groundwater.
- Description of the field exploration and laboratory tests performed.
- Final logs of soil test borings, records of the field exploration, and laboratory tests in accordance with the standard practice of geotechnical engineers.
- Recommendations for allowable bearing pressure for conventional shallow foundation systems and estimates of total and differential foundation settlement based on specific project information and design loads assumed by ECS.
- Recommendations for below grade wall design.
- Recommendations for floor slab and pavement construction, including recommendations for subgrade modulus and subgrade improvements.
- Evaluation of the on-site soil characteristics encountered in the soil boring including the suitability of the on-site materials for reuse as engineered fill to support ground slabs and potential groundwater impact on structures and project construction.
- Recommendations regarding site preparation and construction observations and testing.

2.0 PROJECT INFORMATION

2.1 PROJECT LOCATION/CURRENT SITE USE/PAST SITE USE

The project is located on Juban Road in Denham Springs, LA, Figure 1. The site is undeveloped and is currently wooded. The topography of the site is relatively flat with surface elevations ranging from +37 feet MSL to +38 feet MSL. The elevations and topographic variations were estimated from Google Earth.



Figure 1: General Site Location Outlined in Red

2.2 PROPOSED CONSTRUCTION

Table 1 outlines the understanding of the planned development including proposed buildings and related infrastructure.

Table 1: Project Design Information

SUBJECT	DESIGN INFORMATION / ASSUMPTIONS
Building Footprint	Approximately 4,500 Square Feet
Number of Stories	Single-Story
Usage	Automotive Maintenance
Framing	Steel
Assumed Column Loads	25 kips Maximum
Assumed Wall Loads	2 Kips Per Linear Foot (klf) Maximum
Lowest Finish Floor Elevation	EL. 41 ft MSL (Estimated to be approximately 4 feet above present site grades)

Pavement: It is anticipated the proposed site grading will require minor excavation ('cut') and 'fill' thicknesses. The planned traffic loading was not provided to ECS. Therefore, it was necessary for us to estimate design traffic volumes. Based on similar type developments we assumed a maximum daily traffic volume of 500 automobiles and 12 delivery trucks for medium-duty pavement areas, and a maximum daily traffic volume of 250 automobiles, and three delivery trucks for light-duty pavement areas.

If ECS's understanding of the project is not correct, especially if the structural loads or elevations are different, please contact ECS so that we may review these changes and revise our recommendations, as appropriate.

3.0 FIELD EXPLORATION AND LABORATORY TESTING

3.1 FIELD EXPLORATION PROGRAM

The field exploration was planned with the objective of characterizing the project site in general geotechnical and geological terms and to evaluate subsequent field and laboratory data to assist in the determination of geotechnical recommendations.

3.1.1 Test Borings

Our scope of work included drilling a total of eight (8) soil test borings. One (1) test boring was located in the area of the proposed pit footprint and was advanced to a depth of approximately 25 feet below the existing site grades. One (1) test boring was located in the area of the proposed building footprint and was advanced to a depth of approximately 25 feet below the existing site grades. Six (6) test borings were drilled for the parking and drive pavements to a depth of approximately 6 feet below the existing site grades. Our borings were located with a handheld GPS unit, and their approximate locations are shown on the Boring Location Diagram in Appendix A. The approximate ground surface elevations noted in this report were estimated from Google Earth.

Representative soil samples were obtained by means of Standard Penetration Test (SPT) procedures in accordance with ASTM Specifications D-1586 in granular soils and by means of Shelby tube sampling

procedures in accordance with ASTM Specifications D-1587 in cohesive soils. SPT sampling is performed by driving a split-barrel sampler into the soil in 1.5-foot intervals with a 140-lb hammer and measures the resistance of the soil to penetration of the 2-inch diameter sampler. In the Shelby tube sampling procedure, a thin walled, steel, seamless tube with sharp cutting edges is pushed hydraulically into the soil, and a relatively undisturbed sample is obtained.

Field logs of the soils encountered in the borings were maintained by the drill crew. After recovery, each geotechnical soil sample was removed for the sampler and visually classified. Representative portions of each soil sample were then wrapped in plastic and transported to our laboratory for further visual examination and laboratory testing. After completion of the drilling operations, the boreholes were backfilled with cuttings to the existing ground surface.

3.2 SUBSURFACE CHARACTERIZATION

Table 2 provides generalized characterizations of the soil strata encountered during our subsurface exploration. For specific subsurface information including encountered groundwater levels and soil stratification, please refer to the Appendix B Field Operations.

Table 2: GENERALIZED SUBSURFACE CONDITIONS

Approximate Depth (ft)	Elevation ⁽¹⁾ (Ft, MSL)	Stratum No.	Soil Description
0 – 0.5 ft	EL. +37.0 to +37.5	-	SILT AND WOOD DEBRIS
0.5 – 25.0 ft	EL. +37.5 to +12.0	I	LEAN CLAY (CL) , Stiff to Very Stiff, Gray and Tan

Notes:

- (1) Please note that the ground surface elevations were surveyed by a licensed surveyor; these elevations are approximate based on Google-Earth®.
- (2) Soil descriptions show generalized strata to 25'. Strata in the borings vary with depth, please see attached Boring Logs in Appendix B.

3.3 GROUNDWATER OBSERVATIONS

Groundwater measurements were made in the borings during and shortly after drilling operations. In auger drilling operations, water is not introduced into the borehole and the groundwater position can often be evaluated by observing water flowing into and out of the excavation. Furthermore, visual observation of soil samples retrieved were used in refining the groundwater conditions.

Groundwater was encountered at depths of approximately 15 feet and 23 feet in borings B-1 and B-2, respectively, at the time of drilling. A 48-hour delayed water level reading was performed at boring B-2. The water level at that time was approximately 6.5 feet below the ground surface. Given the shallow static groundwater level and typically shallow local groundwater conditions, dewatering methods should be implemented for the pit portion of the structure and for construction of deep utilities.

The highest groundwater observations are normally encountered in the late winter or early spring or following seasonal heavy rainfall events. Fluctuations in the location of the long-term water table may

occur due to changes in precipitation, evaporation, surface water runoff and other factors not immediately apparent at the time of his investigation. Therefore, the groundwater conditions at this site are expected to be significantly influenced by surface water runoff and seasonal rainfall.

3.4 LABORATORY TESTING

The laboratory testing consisted of selected tests performed on samples obtained during our field exploration operations. Classification and index property tests were performed on representative soil samples. The soil samples were tested for moisture content, Atterberg Limits, and percent passing standard No. 200 sieve, and Unconfined Compression.

Each sample was visually classified based on texture and plasticity in accordance with ASTM D2488 Standard Practice for Description and Identification of Soils (Visual-Manual Procedures) and including USCS classification symbols. After classification, the samples were grouped in the major zones noted on the boring logs in Appendix B: Field Operations. The group symbols for each soil type are indicated in parentheses along with the soil descriptions. The stratification lines between strata on the logs are approximate; the in situ transitions may be gradual.

The soil samples will be retained in our laboratory for a period of 60 days, after which, they will be discarded unless other instructions are received as to their disposition.

4.0 DESIGN RECOMMENDATIONS

The following recommendations have been developed based on Sections 2 and 3. If there are any changes to the project characteristics or if different subsurface conditions are encountered during construction, ECS should be consulted so that the recommendations of this report can be reviewed. Site grading information was not provided during this report; however, we have assumed that the foundation elevation will be approximately 4 feet above existing site elevations. If the finished floor elevation deviates from this assumed site grades, the recommendations provided below should be evaluated by our office.

4.1 GEOTECHNICAL CONSIDERATIONS

Based on the subsurface conditions encountered in the borings, the anticipated loading conditions and the lowest level bearing elevation, the site appears suited for the proposed development provided the recommendations herein are strictly adhered to. The following sections detail our recommendations for the proposed development regarding foundation and below grade work.

4.1.1 Presence of Expansive Soils

Based on the laboratory test results, the subsurface soils encountered within the building pad and pavement areas generally have a low swelling potential. Soils with swelling potential located above the water table and within depths that are subject to changes in moisture are expected to experience volume change and were considered in our potential vertical rise (PVR) estimation. **The potential vertical rise (PVR) is estimated to be less than 1 inch using an applied load of 1.0 psi.**

Generally, one (1) inch of PVR is acceptable as the maximum allowable value used for design and construction. However, the structural engineer must confirm if these PVR values are within acceptable

limits for the specific project. These PVR estimations assume that the soils are allowed to increase/decrease in moisture content from a relatively dry condition to a relatively wet condition over a depth of approximately 10 feet from the existing ground surface at the time of field exploration.

4.1.2 Moisture Sensitive Soils

Based on the laboratory test results, fine grained soils were disclosed directly beneath the surface layer across the site. These soils are moisture sensitive, subject to volume changes and will become inadequate when wet of their optimum moisture content as evaluated by ASTM D698. Effective site drainage should be implemented at the onset of construction and maintained throughout the construction process. Care should be taken to keep construction traffic to a minimum across the site during wet periods. Water should not be allowed to pond on construction areas (building pads or pavement subgrade).

4.1.3 Perimeter Conditions

Positive drainage away from the structure should be provided during construction and maintained throughout the life of the proposed project. Water should not be allowed to infiltrate into the excavations during construction. Foundation soils should not be allowed to become wet. Grades must be sloped to provide effective drainage away from the building during and after construction. Adjacent concrete sidewalks and pavements should be sloped to provide drainage away from the building, and joints should be sealed; close attention should be paid to those directly abutting the building.

Roof runoff and surface drainage should be collected and discharged away from the structure to prevent wetting of the foundation soils. Roof gutters should be installed and connected to downspouts and pipes directing roof runoff into stormwater collection systems or discharged onto positively sloped pavements.

4.2 FOUNDATIONS

Using the design parameter recommendations, for structures with maximum column loads of 25 kips or less, and provided subgrades and structural fills given in Table 3, the proposed structure can be supported by shallow foundations. For column loads greater than 25 kips, ECS should be consulted to provide additional recommendations.

Table 3: Recommended Shallow Foundation Design Parameters

Design Parameter	Column Footing	Wall Footing
Net Allowable Bearing Pressure ⁽¹⁾	2,000 psf	
Acceptable Bearing Soil Material	Compacted Engineered Fill or Stiff Native Soil	
Minimum Width	24 inches	18 inches
Minimum Footing Embedment Depth (below slab or finished grade) ⁽²⁾	24 inches	18 inches
Estimated Total Settlement ⁽³⁾	Less than 1- inch	Less than 1- inch
Estimated Differential Settlement ⁽⁴⁾	Less than 1/2 inches between columns	Less than 1/2 inches

Notes:

- (1) Net allowable bearing pressure is the applied pressure in excess of the surrounding overburden soils above the base of the foundation.
- (2) For bearing considerations and expansive soil concerns.
- (3) The estimated total settlement is for a 4 ft x 4 ft square footing with an imposed bearing pressure of 2000 psf. If final loads (bearing pressure) or the footing sizes are greater, ECS must be contacted to update foundation recommendations and settlement calculations.
- (4) Based on maximum column/wall loads and variability in borings. Differential settlement can be re-evaluated once the foundation plans are more complete.

Potential Undercuts: Most of the soils at the foundation bearing elevation are anticipated to be adequate for support of the proposed structure without remediation. If soft or loose soils are observed during footing observations, the footings should be extended to adequate bearing soils. Undercut areas should be backfilled with compacted engineered fill or lean concrete ($f'c \geq 1,000$ psi at 28 days) to the original design bottom of footing elevation; the original footing should be constructed on top of the hardened lean concrete or engineered fill, seen in Figure 2. If engineered fill is used to backfill the undercut footing, the over-excavated footings should be widened accordingly on all sides for each one (1) foot of over excavation in Figure 2. If lean concrete is used for backfill, the over-excavation does not require widening.

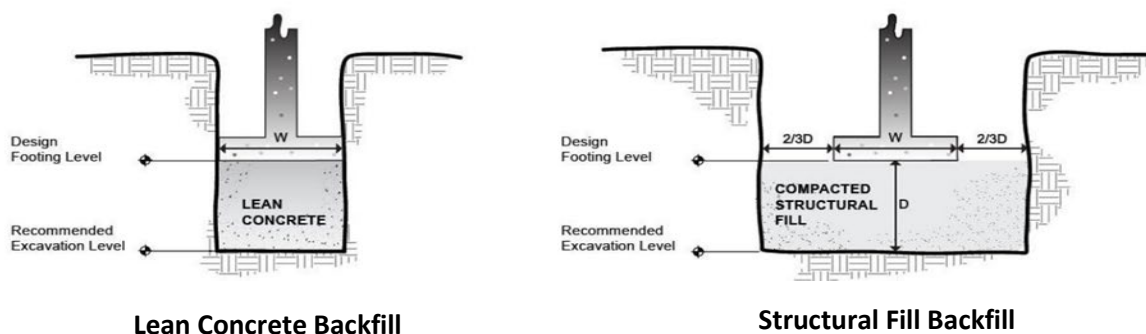


Figure 2: Undercut backfill schematic.

The net allowable soil bearing pressure refers to that pressure which may be transmitted to the foundation bearing soils in excess of the final minimum surrounding overburden pressure. The final

footing elevation should be evaluated by ECS's geotechnical engineering personnel to evaluate that the bearing soils can support the recommended net allowable bearing pressure and adequate for foundation construction. These evaluations should include visual observations using a T-probe or static cone penetrometer, or with the use of a Dynamic Cone Penetrometer (DCP), if necessary. Evaluations should be performed within each column footing excavation (minimum of 2 tests per column footing) and at intervals not greater than 25 feet in continuous footings. The DCP testing should extend at least 2 feet below the final foundation subgrade. A minimum DCP value of 10 blows should be used for the evaluation of the foundations.

The settlement of a structure is a function of the compressibility of the bearing materials, bearing pressure, actual structural loads, fill depths, and the bearing elevation of footings with respect to the final ground surface elevation. Estimates of settlement for foundations bearing on engineered or non-engineered fills are strongly dependent on the quality of fill placed. Factors that may affect the quality of fill include maximum loose lift thickness of the fills placed and the amount of compactive effort placed on each lift. If the recommendations outlined in this report are followed, we expect total settlements for the proposed construction to be in the range of 1 inch or less, while the differential settlement will be approximately half of the anticipated total settlement. This evaluation is based on our engineering experience and the anticipated loadings for this type of structure and is intended to aid the structural engineer with the design.

Exposure to the environment may weaken the soils at the foundation bearing level if the foundation excavations remain exposed during periods of inclement weather. Therefore, foundation concrete should be placed the same day that final excavation is achieved, and the design bearing pressure verified. If the bearing soils are softened by surface water absorption or exposure to the environment, the softened soils must be removed from the foundation excavation bottom immediately prior to placement of concrete. If the foundation excavation must remain open overnight, or if rainfall is apparent while the bearing soils are exposed, we recommend that a 1 to 3-inch thick "mud mat" of "lean" concrete be placed over the exposed bearing soils before the placement of reinforcing steel.

4.3 BELOW GRADE WALLS

ECS recommends that below grade walls be designed to withstand at-rest lateral earth pressures and surcharge loads from adjacent building foundations, and/or streets. These recommendations apply to a "drained" condition which is where there is drainage material behind below grade walls that prevents hydrostatic water pressures on the back of the below grade wall.

To accomplish a drained condition, drainage materials such as a free draining gravel, geocomposite drainage panels, weep holes, and an underslab drainage system should be used.

ECS recommends that walls that are restrained from movement at the top be designed for a linearly increasing lateral earth pressure. Figure 3 depicts our recommended at-rest lateral earth pressure condition for a "drained below-grade wall" with restrained wall top.

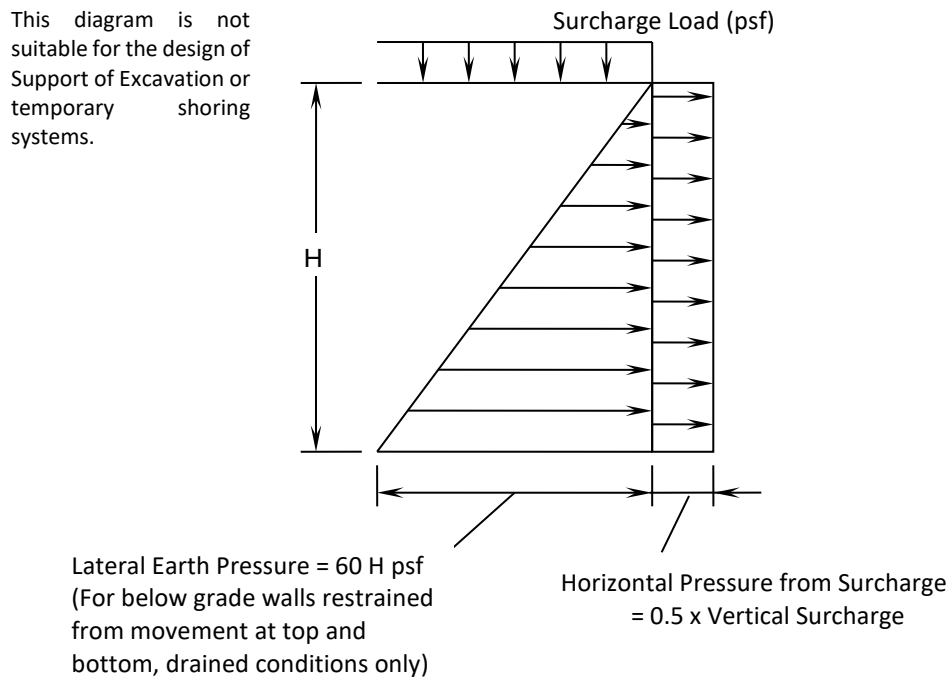


Figure 3: Lateral earth pressure diagram for below grade walls.

Surcharge loads imposed within a 45-degree slope from the base of the restrained wall should be considered in the below grade wall design. These surcharge loads should be based on an at-rest pressure coefficient, k_0 , of 0.5. Care should be used to avoid the operation of heavy equipment to compact the wall backfill since it may overload and damage the wall; in addition, such loads are not typically considered in the design of below grade walls.

4.4 UNDERSLAB SUBDRAINAGE

We recommend that the below grade areas be provided with a perimeter and underslab subdrainage system.

The system may consist of perforated wall, closed joint drain tiles located around the interior perimeter of the below grade areas, as close as feasible to the exterior wall, slightly below the finished floor level. Weep holes (which convey drainage from behind the walls to the underslab subdrainage system) should be a minimum of 4 inches in diameter and should be placed at a spacing of no greater than 8 feet on center. The weep holes should drain freely from the exterior drainage materials and be connected to the interior (could be exterior and thus eliminate the weep hole needs) perimeter drain line. The interior drain lines should be surrounded by coarse-grained material having a gradation compatible with the size of the openings in the drain lines and subgrade soils.

We recommend at least 1 permanent sump pit, typically equally spaced, in the lowest floor level. An interior pipe network should be designed to convey water to the sump pits. We recommend that each sump be designed with a full duplex capability (i.e., two pumps per pit), with each individual pump rated

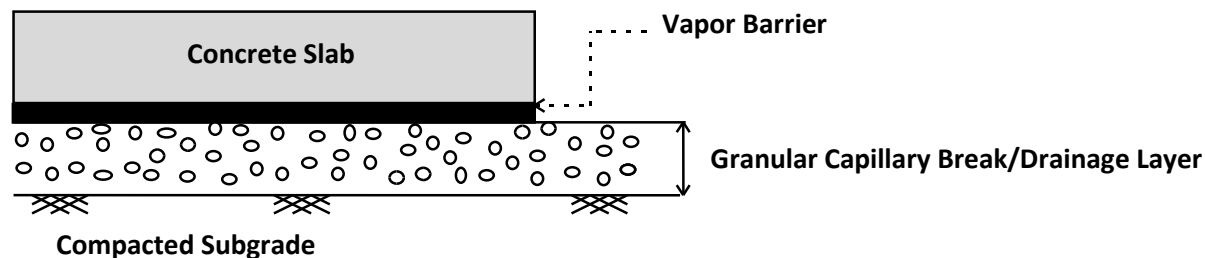
at a capacity of at least 10 gpm with a duplex capacity of 20 gpm. With two sumps, a total pumping capacity of 40 gpm should be achieved.

The contractor should monitor the pumping rate of the construction dewatering system in order to verify that the permanent sump pumps have been adequately sized. The permanent pumps should be sized for the larger of the construction dewatering rates observed, or as recommended below. Once the plans are further developed, please contact ECS so that we can refine our pumping estimates.

Perimeter and lateral drain lines should be wrapped with a non-woven product such as Mirafi 140N with an AOS of 70 (U.S. Sieve). Clean outs should be installed at all sharp bends and at approximately every 100 feet for straight runs. A grit collection chamber should be installed upstream of the sump to reduce the granular material reaching the pumps.

4.5 SLABS ON GRADE

Provided subgrades and structural fills are prepared as discussed herein, the proposed floor slabs can be constructed as Ground Supported Slabs (or Slab-On-Grade) on lean natural soils, newly placed fill soils or lime treated soils. Based on the assumed finished floor elevation, it appears that the slabs will bear on native clay material or newly placed structural fill. The following graphic depicts our soil-supported slab recommendations:



1. Drainage Layer Thickness: 4 inches
2. Drainage Layer Material: GRAVEL (GP, GW), SAND (SP, SW)

Figure 4: Slab on grade schematic.

Soft or yielding soils may be encountered in some areas. Those soils should be removed and replaced with compacted Structural Fill in accordance with the recommendations included in this report.

Subgrade Modulus: Provided the structural fill and granular drainage layer are constructed in accordance with our recommendations, the slab may be designed assuming a modulus of subgrade reaction, **k_1 of 125 pci (lbs./cu. inch)**. The modulus of subgrade reaction value is based on a 1 ft by 1 ft plate load test basis.

Vapor Barrier: Before the placement of concrete, a vapor barrier may be placed on top of the granular drainage layer to provide additional protection against moisture penetration through the floor slab. When a vapor barrier is used, special attention should be given to surface curing of the slab to reduce the potential for uneven drying, curling and/or cracking of the slab. Depending on proposed flooring material types, the structural engineer and/or the architect may choose to eliminate the vapor barrier.

Slab Isolation: Soil-supported slabs should be isolated from the foundations and foundation-supported elements of the structure so that differential movement between the foundations and slab will not induce excessive shear and bending stresses in the floor slab. Where the structural configuration prevents the use of a free-floating slab such as in a drop-down footing/monolithic slab configuration, the slab should be designed with adequate reinforcement and load transfer devices to reduce risk of overstressing of the slab.

4.6 SEISMIC DESIGN CONSIDERATIONS

Seismic Site Classification: The International Building Code (IBC) 2015/2018 requires site classification for seismic design based on the upper 100 feet of a soil profile. The methods are utilized in classifying sites, namely the shear wave velocity (v_s) method; the unconfined compressive strength (s_u) method; and the Standard Penetration Resistance (N-value) method. The unconfined compressive strength (s_u) method was used in classifying this site.

Table 4: Seismic Site Classification

Site Class	Soil Profile Name	Shear Wave Velocity, V_s , (ft./s)	Soil Undrained Shear Strength (psf)
A	Hard Rock	$V_s > 5,000$ fps	N/A
B	Rock	$2,500 < V_s \leq 5,000$ fps	N/A
C	Very dense soil and soft rock	$1,200 < V_s \leq 2,500$ fps	≥ 2000
D	Stiff Soil Profile	$600 \leq V_s \leq 1,200$ fps	$1000 \leq S_u \leq 2000$
E	Soft Soil Profile	$V_s < 600$ fps	< 1000

Based upon our interpretation of the subsurface conditions, the appropriate **Seismic Site Classification** is “D”, Table 4.

The Site Class definition should not be confused with the Seismic Design Category designation which the Structural Engineer typically assesses. If a higher site classification is beneficial to the project, we can provide additional testing methods that may yield more favorable results.

4.7 PAVEMENTS

Subgrade Characteristics: Based on the results of our borings, it appears that the pavement subgrade will consist mainly of lean clay soils. The soils across the site are moisture sensitive and will become difficult to work with when wet. Care should be taken if construction is performed during wet weather periods.

California Bearing Ratio [CBR] testing was not performed as part of this study. Therefore, ECS has assumed a CBR value of the onsite subsoil to be 3 for preliminary design purposes.

ECS was not provided traffic loading information, so we have assumed loadings typical of this type of project. We assumed a maximum daily traffic volume of 500 automobiles and 12 delivery trucks for medium duty pavement areas, and a maximum daily traffic volume of 250 automobiles, and three delivery trucks for light duty pavement areas. Our pavement section recommendations for medium duty (drives) pavements should accommodate occasional heavier loadings due to trash trucks, delivery vehicles and light truck traffic and may be considered for main drives. Typical pavement sections are presented below. Actual pavements sections and joint spacing, if applicable, should be designed based on specific traffic loads.

Table 5: Proposed Pavement Sections

MATERIAL	FLEXIBLE PAVEMENT		RIGID PAVEMENT		
	Medium Duty	Light Duty	Heavy ⁽²⁾ Duty	Medium Duty	Light Duty
Portland Cement Concrete ($f'_c = 4000$ psi)	-	-	8 in.	6 in.	5 in.
Asphaltic Concrete Surface Course	2 inches	1 ½ inches	-		-
Asphaltic Concrete Binder Course	2 inches	1 ½ inches	-		-
Graded Aggregate Base Course ⁽¹⁾	6 inches	6 inches	4 inches	4 inches	4 inches
Proofrolled In-Situ lean Clay or Compacted Engineered Fill (Min. Thickness)	12 inches	12 inches	12 inches	12 inches	12 inches

Notes:

- (1) Lime treated fill for rigid pavement and cement treated fill for flexible pavement may be used as an alternative to aggregate base course. Review Section 5.1.5 for additional information.
- (2) Large, front loading garbage trucks frequently impose concentrated front wheel loads on pavements during loading. This type of loading typically results in rutting of asphalt pavement and ultimately pavement failures. For preliminary design purposes, we recommend that the pavement in trash pickup areas consist of an 8-inch thick, 4,000 psi, reinforced concrete slab over at least 12 inches of properly compacted engineered fill material.

Pavement Considerations: In regions of improper surface and/or subsurface drainage, a softening of the subgrade and other problems related to the deterioration of the pavement can be expected. Esurance of positive drainage will reduce the possibility of the subgrade materials becoming saturated during the normal service period of the pavement.

The reinforced pavement in the trash pick-up area should extend to a minimum of 5 feet past the location of the expected wheel loads. When traffic loading becomes available, ECS or the Civil Engineer can design the pavements. Appropriate jointing should also be incorporated into the design of the PCC pavement which should be specified, constructed, and tested to meet the following requirements:

1. Proper pavement joint spacing and saw-cutting will be required to prevent excessive slab curling and shrinkage cracking. Joints should be sealed to prevent entry of foreign material and dowelled where necessary for load transfer and saw cutting should be performed while the concrete is in its “green” state. The design engineer should refer to ACI330R-08 for more detailed for the design of rigid pavement.
2. Portland Cement Concrete: Minimum compressive strength of 4,000 psi at 28 days.
3. Hot Mix asphaltic concrete should conform to the latest edition of the LSSRB Section 502. Structural fill should meet the criteria for material properties and compaction recommended in Section 5.1 of this report.
4. Crushed aggregate base should be compacted to maximum lift height of eight inches to a minimum of 95 percent of the Standard Proctor (ASTM D698) maximum dry density. Aggregate should conform to the latest edition of the Louisiana Standard Specifications for Roads and Bridges (LSSRB) Section 1003.03.

Representative soil samples should be collected from the upper 2 feet of the final pavement subgrade to assess the suitability of the in-situ CBR values, prior to implementation of the pavement sections provided

herein. Often during construction and preparation of the roadway subgrade, the soil materials may be improved and can sometimes yield reduced pavement sections based on the actual CBR values and traffic loads.

5.0 SITE CONSTRUCTION RECOMMENDATIONS

5.1 SUBGRADE PREPARATION

The existing soils are moisture sensitive and will become inadequate when above their optimum moisture content as evaluated by ASTM D698. Effective site drainage should be implemented at the beginning of and maintained throughout construction activities. Care should be taken to keep construction traffic to a minimum during and immediately after times of inclement weather.

ECS should be on-site full-time during earthwork and foundation construction activities to document that our recommendations are strictly followed and to provide recommendations for remedial activities, if necessary.

5.1.1 Stripping and Grubbing

The subgrade preparation should consist of clearing remaining trees and vegetation and stripping up to 12 inches of surficial silt soils, existing fill, construction debris, existing foundation elements and utilities and soft or yielding materials from the 10-foot expanded building limits, and 5 feet beyond the toe of structural fills.

Note: Following stripping and grubbing the entire construction area should be proofrolled as outlined in Section 5.1.2 of this report. Soils observed to rut or deflect greater than an inch in depth should be undercut and replaced or otherwise mitigated.

Deeper topsoil or organic laden soils may be present in wet, low-lying, and poorly drained areas. In wooded areas, the root balls may extend as deep as about 2 feet and will require additional localized stripping depth to completely remove the organics. ECS should be retained to evaluate that topsoil and poor surficial materials have been removed prior to the placement of structural fill or construction of structures.

5.1.2 Proofrolling

Following clearing activities and prior to fill placement or other construction on subgrades, the subgrades should be evaluated by an ECS field technician. The exposed subgrade should be thoroughly proofrolled with a half loaded tandem-axle dump truck or similar construction equipment weighing a minimum of 15 tons. Proofrolling should be traversed in two perpendicular directions with overlapping passes of the vehicle under the observation of an ECS technician to assist in identifying localized yielding materials.

Where proofrolling identifies areas of yielding or “pumping” subgrade those areas should be repaired prior to the placement of subsequent structural fill or other construction materials. Observations of yielding or “pumping” should be addressed with ECS to establish the appropriate remediation as outlined in Section 5.1.3.

5.1.3 Subgrade Stabilization

Methods of stabilization include undercutting, moisture conditioning, or chemical stabilization. Test pits may be excavated to explore the shallow subsurface materials to help in determining the cause of the observed inadequate materials, and to assist in the evaluation of appropriate remedial actions to stabilize the subgrade. Anticipated methods of subgrade stabilization of the near surface soils are provided below:

Moisture Conditioning: If it is established that high moisture content is the cause of the inadequate subgrade, the geotechnical engineer may require the earthwork contractor process the upper 12 to 18 inches of in-situ subgrade by windrowing with a dozer or plowing with a set of heavy-duty disk harrows until soil moisture is observed to be within 2 percent of its optimum moisture content as evaluated by ASTM D698 to improve subgrade conditions before consideration other mitigation approaches. The drying effort should begin after the exposed subgrade is free of standing water and the windrowing/disking should be continuous during a period of dry weather. ECS should be onsite to periodically perform soil moisture testing. The processed areas should be sealed with compaction equipment and a flat drum roller or dozer blade at the end of the day in case of overnight rain. If weather conditions do not allow appropriate time to dry the native subgrade, the geotechnical engineer may recommend chemical treatment with lime or cement in order to provide an adequate working surface for fill placement.

Undercut and Replace: Where proofrolling identifies areas of yielding or “pumping” subgrade those areas can be repaired by undercut of the yielding or ‘pumping’ soils. The undercut areas should be backfilled with compacted structural fill. Undercut should extend to adequate subgrade soils as observed by the geotechnical engineer or their qualified representative.

Lime Stabilization: Lime stabilization may be used to modify onsite clay soils to achieve an adequate working surface and achieve PIs between 10 and 25 for reuse as structural fill. The amount of lime necessary to achieve lime stabilization will vary depending on the clay mineral, plasticity and type of lime used for stabilization. For estimating purposes 4 to 6% percent of lime by volume should be used; however, a laboratory lime series should be performed at the time of construction to establish the optimum lime content. Surficial samples should be collected from across the site and testing should be conducted on the composite sample. The subgrade soils should meet the requirements of Section 305.4, and lime treatment of the subbase should meet the requirements of Section 304 - Type B, of the latest edition of the LSSRB. An ECS Field Engineer or Senior Technician should be present during lime treatment activities to observe lime quantities and document that treated areas are in conformance with the project requirements. Please note that caution should be used when powdered lime is used in closely populated areas. To control dust, a lime slurry or pelletized lime may be used where dust must be controlled. In addition, pelletized lime will generally require 2 to 3 times the effort to properly pulverize and mix into the clay soils than a powder or slurry.

Cement Stabilization: When soils have PI values of 15 or below, cement stabilization should be used in lieu of lime treatment. Additionally, 12 inches of cement stabilized soil can be used as an alternative to aggregate base course for light and medium duty flexible pavement. A minimum of 10% by volume of cement is recommended to use for a cement stabilized base course and should be prepared in general accordance with LSSRB, Section 303-04. Note that the cement treatment of the roadways should be conducted in general accordance with LSSRB, Section 303. Cement stabilized base course should yield a compressive strength of at least 250 psi at 7 days as evaluated by a mix design in accordance with DOTD TR 432 Standard Procedure. The treated soil should be compacted at least 95% of maximum dry density +/-3% the optimum moisture content in accordance with the Sub-section 303.11 of LSSRB.

5.2 EARTHWORK OPERATIONS

5.2.1 Structural Fill

Prior to placement of structural fill, representative bulk samples (approximately 50 pounds) of on-site and/or off-site borrow should be submitted to ECS for laboratory testing, which will typically include Atterberg limits, natural moisture content, grain-size distribution, and moisture-density relationships (i.e., Proctors) for compaction. Import materials should be tested prior to being hauled to the site to evaluate if they meet project specifications. Alternatively, Proctor data from other accredited laboratories can be submitted if the test results are within the last 90 days.

Satisfactory Structural Fill Materials: Materials satisfactory for use as Structural Fill should consist of inorganic soils with the following engineering properties and compaction requirements outlined in Tables 6 and 7.

Table 6: Structural Fill Index Properties

Soil Type	USCS Classification	Property
Imported Clay Fill	CL, SC	LL < 45, 10<PI<25
Imported Sand Fill	SP, SP-SM	Less than 10% passing #200 sieve
Aggregate Base	GP	LADOTD 610 crushed limestone or similarly graded recycled aggregate
On-Site Soils	CL	The native lean clay soils in the top 4 feet appear to meet the requirements for reuse as structural fill.

Table 7: Structural Fill Compaction Requirements

Subject	Requirement
Compaction Standard	Standard Proctor, ASTM D698
Required Compaction	95% of Max. Dry Density
Moisture Content	Optimum to +3 % Points of the Soil's Optimum Value
Loose Thickness	8 Inches Prior to Compaction

Fill Placement: Excessively wet fill soils or aggregates should be scarified, aerated, and moisture conditioned prior to compaction.

On-Site Borrow Suitability: Natural deposits of soils that meet the definition above may be used as structural fill on the site.

5.3 FOUNDATION AND SLAB OBSERVATIONS

Protection of Foundation Excavations: Exposure to the environment may weaken the soils at the footing bearing level if the foundation excavations remain open; therefore, foundation concrete should be placed the same day that excavations are made. Bearing soils that are weakened by surface water intrusion or exposure must be removed from the foundation excavation bottom immediately prior to placement of concrete. If the excavation must remain open overnight, or if rainfall becomes imminent while the bearing

soils are exposed, a 1 to 3-inch thick “mud mat” of “lean” concrete should be placed on the bearing soils before the placement of reinforcing steel.

Footing Subgrade Observations: Most of the soils at the foundation bearing elevation are anticipated to be adequate for support of the proposed structure. ECS should observe the foundation subgrade prior to placing foundation concrete, to confirm the bearing soils are as recommended.

Slab Subgrade Verification: Prior to placement of a drainage layer, the subgrade should be prepared in accordance with the recommendations found in Section 5.1.2.

5.4 UTILITY INSTALLATIONS

Utility Subgrades: The soils encountered in our exploration are expected to be generally adequate for support of utility pipes. The pipe subgrades should be observed and probed for stability by ECS. Loose or inadequate materials encountered should be removed and replaced with adequate compacted Structural Fill, or pipe stone bedding material.

Utility Backfilling: The granular bedding material (often AASHTO #57 stone) should be at least 4 inches thick, but not less than that specified by the civil engineer’s project drawings and specifications. We recommend that the bedding materials be placed up to the springline of the pipe. Fill placed for support of the utilities, as well as backfill over the utilities, should conform to Section 5.2.

Excavation Safety: Excavations and slopes should be constructed and maintained in accordance with OSHA excavation safety standards. The contractor is solely responsible for designing, constructing, and maintaining adequate excavations and slopes. The contractor’s responsible person, as defined in 29 CFR Part 1926, should evaluate the soil exposed in the excavations as part of the contractor’s safety procedures. In no case should slope height, slope inclination, or excavation depth, including utility trench excavation depth, exceed those specified in local, state, and federal safety regulations. ECS is providing this information solely as a service to our client. ECS is not assuming responsibility for construction site safety or the contractor’s activities; such responsibility is not being implied and should not be inferred.

6.0 CLOSING

ECS has prepared this report to guide the geotechnical-related design and construction aspects of the project. We performed these services in accordance with the standard of care expected of professionals in the industry performing similar services on projects of like size and complexity at this time in the region. No other representation expressed or implied, and no warranty or guarantee is included or intended in this report.

The description of the proposed project is based on information provided to ECS by Express Oil Change & Tire Engineers. If any of this information is inaccurate or changes, either because of our interpretation of the documents provided or site or design changes that may occur later, ECS should be contacted so we can review our recommendations and provide additional or alternate recommendations that reflect the proposed construction.

We recommend that ECS review the project plans and specifications so we can confirm that those plans/specifications are in accordance with the recommendations of this geotechnical report.

Field observations, and quality assurance testing during earthwork and foundation installation are an extension of, and integral to, the geotechnical design. We recommend that ECS be retained to apply our expertise throughout the geotechnical phases of construction, and to provide consultation and recommendation should issues arise.

ECS is not responsible for the conclusions, opinions, or recommendations of others based on the data in this report.

Appendix A - Drawings and Reports

Site Location Diagram

Boring Location Diagram(s)



SITE LOCATION DIAGRAM EXPRESS OIL CHANGE - JUBAN CROSSING

JUBAN ROAD, DENHAM SPRINGS, LOUISIANA
EXPRESS OIL CHANGE, LLC



ENGINEER JCC3
SCALE AS NOTED
PROJECT NO. 65:1437
FIGURE 1 OF 1
DATE 8/29/2023



BORING LOCATION DIAGRAM EXPRESS OIL CHANGE - JUBAN CROSSING

JUBAN ROAD, DENHAM SPRINGS, LOUISIANA
EXPRESS OIL CHANGE, LLC



ENGINEER JCC3
SCALE AS NOTED
PROJECT NO. 65:1437
FIGURE 1 OF 1
DATE 8/29/2023

Appendix B – Field Operations

Reference Notes

Boring Logs



ECS Southeast, LLP

REFERENCE NOTES FOR BORING LOGS

CLIENT Express Oil Change, LLC

PROJECT NAME EOC - Juban Crossing

PROJECT NUMBER 65-1437

MATERIAL^{1,2,3}CL: LEAN CLAY
low to medium plasticity

DRILLING SAMPLING SYMBOLS & ABBREVIATIONS

SS	Split Spoon Sampler	PM	Pressuremeter Test
ST	Shelby Tube Sampler	RD	Rock Bit Drilling
WS	Wash Sample	RC	Rock Core, NX, BX, AX
BS	Bulk Sample of Cuttings	REC	Rock Sample Recovery %
PA	Power Auger (no sample)	RQD	Rock Quality Designation %
HSA	Hollow Stem Auger		

PARTICLE SIZE IDENTIFICATION

DESIGNATION	PARTICLE SIZES
Boulders	12 inches (300 mm) or larger
Cobbles	3 inches to 12 inches (75 mm to 300 mm)
Gravel: Coarse	3/4 inch to 3 inches (19 mm to 75 mm)
Fine	4.75 mm to 19 mm (No. 4 sieve to 3/4 inch)
Sand: Coarse	2.00 mm to 4.75 mm (No. 10 to No. 4 sieve)
Medium	0.425 mm to 2.00 mm (No. 40 to No. 10 sieve)
Fine	0.074 mm to 0.425 mm (No. 200 to No. 40 sieve)
Silt & Clay ("Fines")	<0.074 mm (smaller than a No. 200 sieve)

COHESIVE SILTS & CLAYS

UNCONFINED COMPRESSIVE STRENGTH, QP ⁴	SPT ⁵ (BPF)	CONSISTENCY ⁷ (COHESIVE)
<0.25	<2	Very Soft
0.25 - <0.50	3 - 4	Soft
0.50 - <1.00	5 - 8	Firm
1.00 - <2.00	9 - 15	Stiff
2.00 - <4.00	16 - 30	Very Stiff
4.00 - 8.00	31 - 50	Hard
>8.00	>50	Very Hard

RELATIVE
AMOUNT⁷COARSE
GRAINED
(%)⁸FINE
GRAINED
(%)⁸

Trace	≤ 5	≤ 5
With	10 - 20	10 - 25
Adjective (ex: "Silty")	25 - 45	30 - 45

GRAVELS, SANDS & NON-COHESIVE SILTS

SPT ⁵	DENSITY
<5	Very Loose
5 - 10	Loose
11 - 30	Medium Dense
31 - 50	Dense
>50	Very Dense

WATER LEVELS⁶

▽	WL (First Encountered)
▼	WL (Completion)
▽	WL (Seasonal High Water)
▽	WL (Stabilized)

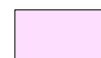
FILL AND ROCK



FILL



POSSIBLE FILL



PROBABLE FILL





ROCK

¹Classifications and symbols per ASTM D 2488-17 (Visual-Manual Procedure) unless noted otherwise.²To be consistent with general practice, "POORLY GRADED" has been removed from GP, GP-GM, GP-GC, SP, SP-SM, SP-SC soil types on the boring logs.³Non-ASTM designations are included in soil descriptions and symbols along with ASTM symbol [Ex: (SM-FILL)].⁴Typically estimated via pocket penetrometer or Torvane shear test and expressed in tons per square foot (tsf).⁵Standard Penetration Test (SPT) refers to the number of hammer blows (blow count) of a 140 lb. hammer falling 30 inches on a 2 inch OD split spoon sampler required to drive the sampler 12 inches (ASTM D 1586). "N-value" is another term for "blow count" and is expressed in blows per foot (bpf). SPT correlations per 7.4.2 Method B and need to be corrected if using an auto hammer.⁶The water levels are those levels actually measured in the borehole at the times indicated by the symbol. The measurements are relatively reliable when augering, without adding fluids, in granular soils. In clay and cohesive silts, the determination of water levels may require several days for the water level to stabilize. In such cases, additional methods of measurement are generally employed.⁷Minor deviation from ASTM D 2488-17 Note 14.⁸Percentages are estimated to the nearest 5% per ASTM D 2488-17.


DEPTH, FT	WATER LEVEL	SYMBOL	SAMPLES	BLOWS PER 6 INCHES	BORING NO. B-1 LAT: 30.472087° LONG: -90.919529° SURFACE EL.: 37.0'	STRATUM DEPTH, FT	CLASSIFICATION					SHEAR STRENGTH						
							UNIT DRY WT, PCF	PASSING NO. 200 SIEVE, %	WATER CONTENT, %	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX (PI)	KSF					
STRATUM DESCRIPTION																		
					Light gray and tan lean clay, very stiff (CL)				17									3.5
					---stiff													
5							107		20	31	18	13						
							109		21	30	17	13						
							109		19	31	15	16						
10									19									4.0
15									21									
20					---very stiff				21									3.3
25					Bottom Depth of Borehole = 25 Feet	25.0			20									4.5
30																		
35																		


NOTES: 1. ▽: Water First Noticed. 2. Terms and symbols defined on reference notes.		START DATE: July 19, 2023 COMPLETION DATE: July 19, 2023 TOTAL DEPTH: 25.0' CAVED DEPTH: Not Applicable DRY AUGER: Y WET ROTARY: N BACKFILL: Y LOGGER: NB DRILL RIG: ATV HAMMER TYPE: Manual	
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	Client: Express Oil Change, LLC		LOG OF BORING NO. B-1	
	Project Name: EOC - Juban Crossing			
	Site Location: Denham Springs, Louisiana	Project No. 65-1437	PM/PE	NB/JC


DEPTH, FT	WATER LEVEL	SYMBOL	SAMPLES	BLOWS PER 6 INCHES	BORING NO. B-2 LAT: 30.471908° LONG: -90.919584° SURFACE EL.: 38.0'	STRATUM DEPTH, FT	CLASSIFICATION						SHEAR STRENGTH					
							UNIT DRY WT, PCF	PASSING NO. 200 SIEVE, %	WATER CONTENT, %	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX (PI)	KSF					
STRATUM DESCRIPTION																		
					Light gray and tan lean clay, very stiff (CL)				19	33	23	10						
5					---stiff				18									
					---very stiff				18									
					---stiff				20									
10						114	83	19	26	13	13							
15									23									
20					---very stiff	106		22	41	17	24							
25									21									
Bottom Depth of Borehole = 25 Feet						25.0												
30																		
35																		
NOTES: 1. ▽: Water First Noticed. ▼: Depth To Water after 48 Hr 2. Terms and symbols defined on reference notes.									START DATE: July 19, 2023 COMPLETION DATE: July 19, 2023 TOTAL DEPTH: 25.0' CAVED DEPTH: Not Applicable DRY AUGER: Y WET ROTARY: N BACKFILL: Y LOGGER: NB DRILL RIG: ATV HAMMER TYPE: Manual									
						Client: Express Oil Change, LLC												
						Project Name: EOC - Juban Crossing												
						Site Location: Denham Springs, Louisiana						Project No. 65-1437			PM/PE NB/JC			

LOG OF BORING NO. B-2

DEPTH, FT	WATER LEVEL	SYMBOL	SAMPLES	BLOWS PER 6 INCHES	BORING NO. P-1 LAT: 30.472113° LONG: -90.919849° SURFACE EL.: 38.0'	STRATUM DEPTH, FT	CLASSIFICATION						SHEAR STRENGTH					
					UNIT DRY WT, PCF		PASSING NO. 200 SIEVE, %	WATER CONTENT, %	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX (PI)	KSF 0.5 1.0 1.5 2.0 2.5						
					Tan lean clay, stiff (CL) ---very stiff			93	21	35	23	12						
5									21									
									20									
					Bottom Depth of Borehole = 6 Feet	6.0												
10																		
15																		
20																		
25																		
30																		
35																		
NOTES: 1. Terms and symbols defined on reference notes.							START DATE: July 19, 2023 COMPLETION DATE: July 19, 2023 TOTAL DEPTH: 6.0' CAVED DEPTH: Not Applicable DRY AUGER: Y WET ROTARY: N BACKFILL: Y LOGGER: NB DRILL RIG: ATV HAMMER TYPE: Manual											
						LOG OF BORING NO. P-1 Client: Express Oil Change, LLC												
						Project Name: EOC - Juban Crossing												
						Site Location: Denham Springs, Louisiana						Project No. 65-1437			PM/PE NB/JC			

DEPTH, FT	WATER LEVEL	SYMBOL	SAMPLES	BLOWS PER 6 INCHES	BORING NO. P-3 LAT: 30.471745° LONG: -90.919545° SURFACE EL.: 38.0'	STRATUM DEPTH, FT	CLASSIFICATION						SHEAR STRENGTH				
					UNIT DRY WT, PCF		PASSING NO. 200 SIEVE, %	WATER CONTENT, %	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX (PI)	KSF					
					STRATUM DESCRIPTION												
													0.5	1.0	1.5	2.0	2.5
					Tan lean clay trace sand, very stiff (CL)			13									3.5
								17									3.5
5								14									4.5
					Bottom Depth of Borehole = 6 Feet	6.0											
10																	
15																	
20																	
25																	
30																	
35																	
NOTES: 1. Terms and symbols defined on reference notes.							START DATE: July 19, 2023 COMPLETION DATE: July 19, 2023 TOTAL DEPTH: 6.0' CAVED DEPTH: Not Applicable DRY AUGER: Y WET ROTARY: N BACKFILL: Y LOGGER: NB DRILL RIG: ATV HAMMER TYPE: Manual										
		Client: Express Oil Change, LLC					LOG OF BORING NO. P-3										
		Project Name: EOC - Juban Crossing															
		Site Location: Denham Springs, Louisiana					Project No. 65-1437			PM/PE NB/JC							

DEPTH, FT	WATER LEVEL	SYMBOL	SAMPLES	BLOWS PER 6 INCHES	BORING NO. P-5 LAT: 30.471979° LONG: -90.919311° SURFACE EL.: 37.0'	STRATUM DEPTH, FT	CLASSIFICATION						SHEAR STRENGTH				
					UNIT DRY WT, PCF		PASSING NO. 200 SIEVE, %	WATER CONTENT, %	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX (PI)	KSF					
					STRATUM DESCRIPTION						□ Penetrometer Unconfined ▼ ◇ Torvane Triaxial ● △ Hand Vane Miniature Vane ▲						
											0.5	1.0	1.5	2.0	2.5		
					Gray and tan lean clay, firm (CL)			27									
					---stiff			21									
5								22									
					Bottom Depth of Borehole = 6 Feet	6.0											
10																	
15																	
20																	
25																	
30																	
35																	
NOTES: 1. Terms and symbols defined on reference notes.											START DATE: July 19, 2023 COMPLETION DATE: July 19, 2023 TOTAL DEPTH: 6.0' CAVED DEPTH: Not Applicable DRY AUGER: Y WET ROTARY: N BACKFILL: Y LOGGER: NB DRILL RIG: ATV HAMMER TYPE: Manual						
		Client: Express Oil Change, LLC					LOG OF BORING NO. P-5										
		Project Name: EOC - Juban Crossing															
		Site Location: Denham Springs, Louisiana					Project No. 65-1437		PM/PE NB/JC								

DEPTH, FT	WATER LEVEL	SYMBOL	SAMPLES	BLOWS PER 6 INCHES	BORING NO. P-6 LAT: 30.472121° LONG: -90.919336° SURFACE EL.: 37.0'	STRATUM DEPTH, FT	CLASSIFICATION						SHEAR STRENGTH									
					UNIT DRY WT, PCF		PASSING NO. 200 SIEVE, %	WATER CONTENT, %	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX (PI)	KSF										
					STRATUM DESCRIPTION							0.5	1.0	1.5	2.0	2.5						
					Gray and tan lean clay, very stiff (CL)				10								3.0					
									15								3.3					
5					---trace sand, soft (CL)				16													
					Bottom Depth of Borehole = 6 Feet	6.0																
10																						
15																						
20																						
25																						
30																						
35																						
NOTES: 1. Terms and symbols defined on reference notes.										START DATE: July 19, 2023 COMPLETION DATE: July 19, 2023 TOTAL DEPTH: 6.0' CAVED DEPTH: Not Applicable DRY AUGER: Y WET ROTARY: N BACKFILL: Y LOGGER: NB DRILL RIG: ATV HAMMER TYPE: Manual												
						Client: Express Oil Change, LLC												LOG OF BORING NO. P-6				
						Project Name: EOC - Juban Crossing																
						Site Location: Denham Springs, Louisiana										Project No. 65-1437			PM/PE NB/JC			

Appendix C – Laboratory Testing

Laboratory Testing Summary

Soil Boring ID	Depth Interval (ft)	D2488	D2216	D2166/D2850		D4318			D422/D1140 /D6913	D2166/D2850					D4648	D2974	Comments
		Visual Description	Moisture (%)	Unit Weight (PCF)		Atterberg Limits				Shear Strength (KSF)	Remolded Strength (KSF)	Failure Strain (%)	Confining Pressure (PSI)	Failure Type	Mini Vane Shear Strength (KSF)	Organic Content (%)	
				Wet	Dry	LL	PL	PI									
B-1	0.5 - 2.0	Light gray and tan fat clay with ferrous nodules (CH)	17.1														
B-1	2.0 - 4.0	Stiff light gray and reddish tan lean clay with silt lenses and ferrous nodules (CL)	20.0	129.0	107.4	31	18	13		1.987		12.4		B			
B-1	4.0 - 6.0	Stiff light gray and tan lean clay with silt lenses and ferrous nodules (CL)	20.8	132.2	109.4	30	17	13		1.211		15.0		B			
B-1	6.0 - 8.0	Stiff light gray and tan lean clay with silt lenses and ferrous nodules (CL)	19.5	130.6	109.3	31	15	16		1.326		15.0		B			
B-1	8.0 - 10.0	Light gray and tan lean clay with ferrous nodules (CL)	19.0														PP = 1.75
B-1	13.0 - 15.0	Light gray and tan lean clay with ferrous nodules (CL)	20.7														PP = 2.0
B-1	18.0 - 20.0	Light gray and tan lean clay with ferrous nodules (CL)	20.6														PP = 1.5
B-1	23.0 - 25.0	Light gray and tan fat clay with ferrous nodules (CH)	20.2														PP = 4.0+

*The classification symbol and name are based on visual-manual procedures.

Multiple Shear = MS Vertical Shear = VS Angle Shear = AS
Slickensided = SLS Bulge = B Crumble = C

Technical Responsibility: Stephannie Campbell

Title: Lead Lab Technician

Date: 8/29/2023

Summary of Lab Results

Project No.: 65-1437



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11211 Industriplex Blvd. Ste. 300
Baton Rouge, LA 70809
Telephone: 225.224.2583

EOC - Juban Crossing
Denham Springs, Louisiana



ECS Limited
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Baton Rouge, LA 70809
Telephone: 225.224.2583

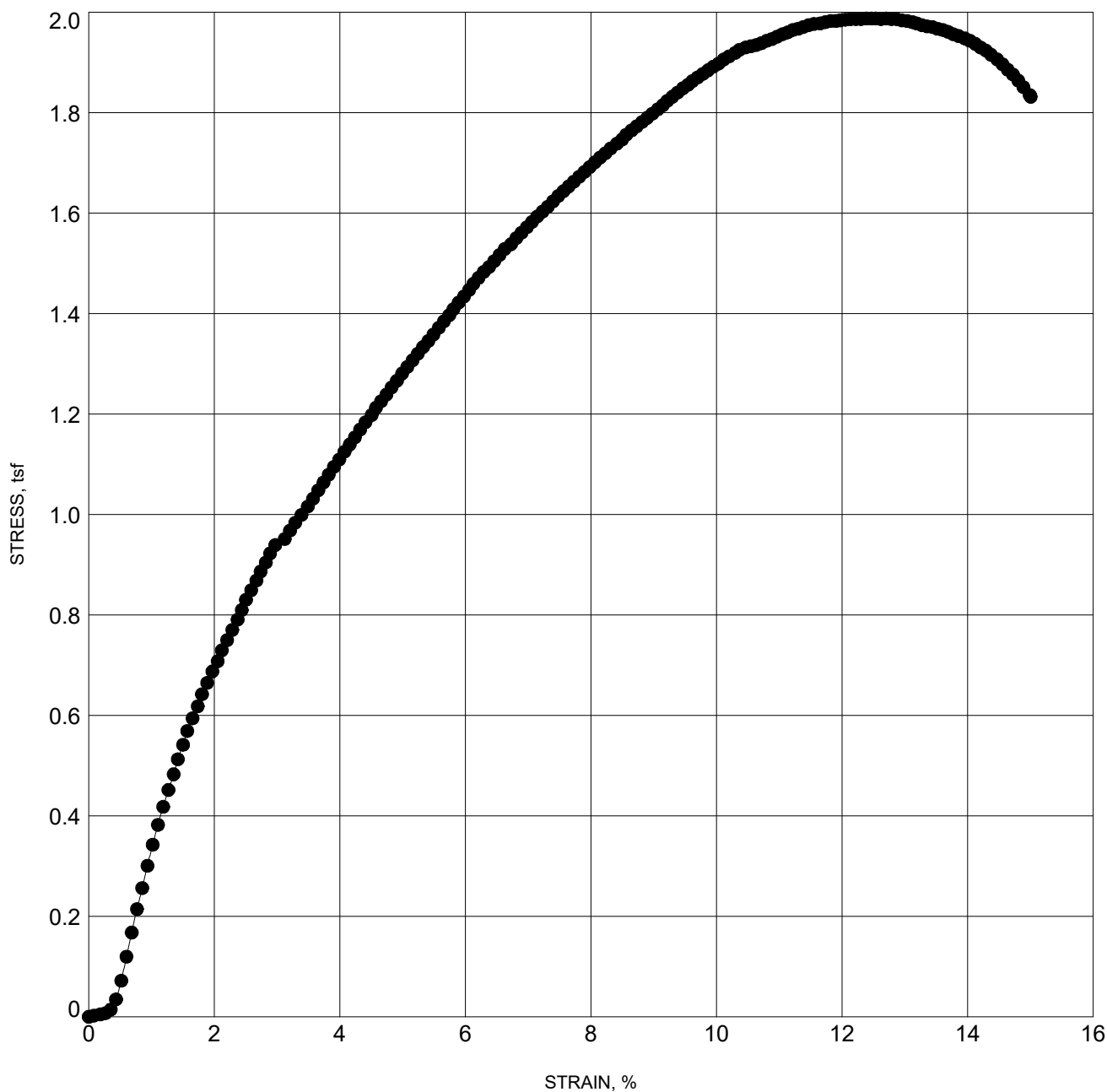
UNCONFINED COMPRESSION TEST

CLIENT Express Oil Change, LLC

PROJECT NAME EOC - Juban Crossing

PROJECT NUMBER 65-1437

PROJECT LOCATION Denham Springs, Louisiana



Boring ID	B-1	Depth(ft)	2.0 - 4.0	
Water Content, %	20.0	Specimen Diameter	2.767	LL = 31
Wet Density, pcf	129.0	Specimen Height	5.991	PL = 18
Dry Density, pcf	107.4	Height/diameter ratio	2.17	PL = 13
Saturation, %	92.9	Failure Stress, tsf	1.987	%200=
Void Ratio	0.59	Strain, %	12.4	Organic=Not Applicable
Description: Stiff light gray and reddish tan lean clay with silt lenses and ferrous nodules (CL)				
Tested By:	S. Campbell	Date Tested:	8/11/2023	Reviewed By: Wendy Allen
				Date Reviewed: 8/25/2023



ECS Limited
11211 Industriplex Blvd. Ste. 300
Baton Rouge, LA 70809
Telephone: 225.224.2583

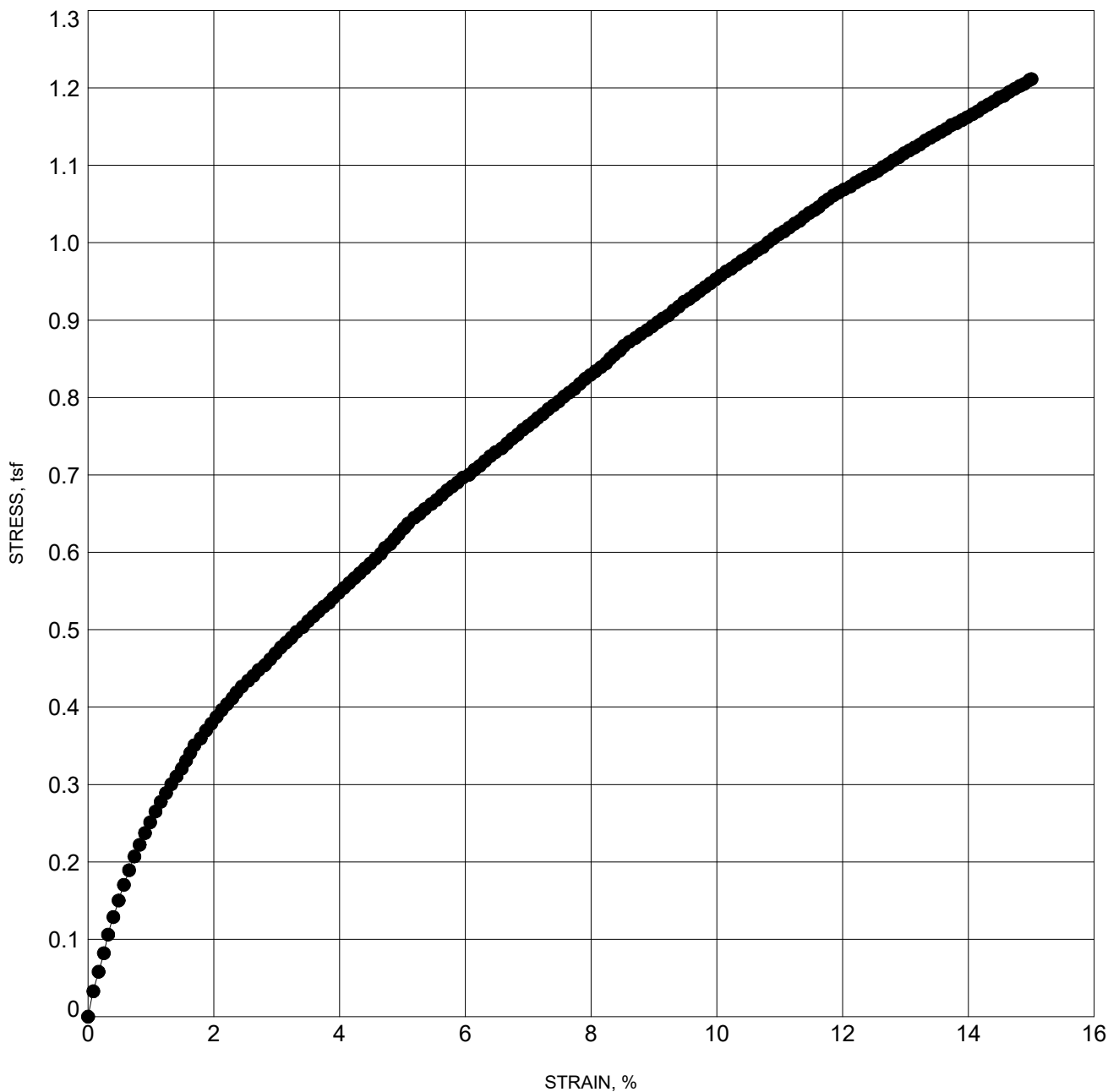
UNCONFINED COMPRESSION TEST

CLIENT Express Oil Change, LLC

PROJECT NAME EOC - Juban Crossing

PROJECT NUMBER 65-1437

PROJECT LOCATION Denham Springs, Louisiana



Boring ID		B-1	Depth(ft)		4.0 - 6.0
Water Content, %	20.8		Specimen Diameter	2.696	LL =30
Wet Density, pcf	132.2		Specimen Height	5.972	PL =17
Dry Density, pcf	109.4		Height/diameter ratio	2.22	PL = 13
Saturation, %	101.2		Failure Stress, tsf	1.211	%200=
Void Ratio	0.56		Strain, %	15.0	Organic=Not Applicable
Description: Stiff light gray and tan lean clay with silt lenses and ferrous nodules (CL)					
Tested By: S. Campbell		Date Tested: 8/11/2023		Reviewed By: Wendy Allen	
				Date Reviewed: 8/29/2023	



ECS Limited
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Baton Rouge, LA 70809
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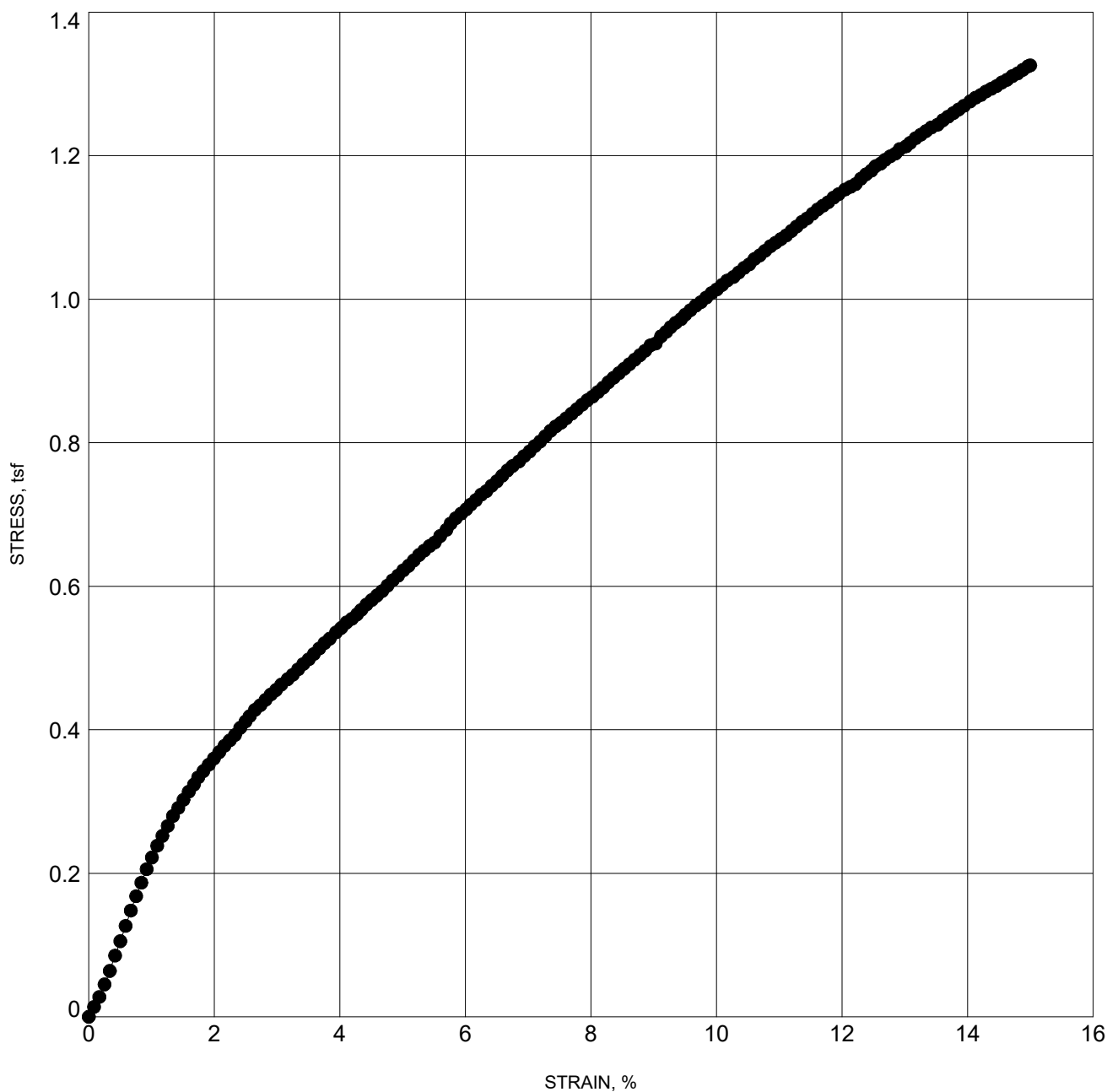
UNCONFINED COMPRESSION TEST

CLIENT Express Oil Change, LLC

PROJECT NAME EOC - Juban Crossing

PROJECT NUMBER 65-1437

PROJECT LOCATION Denham Springs, Louisiana



Boring ID	B-1	Depth(ft)	6.0 - 8.0	
Water Content, %	19.5	Specimen Diameter	2.704	LL =31
Wet Density, pcf	130.6	Specimen Height	5.968	PL =15
Dry Density, pcf	109.3	Height/diameter ratio	2.21	PL = 16
Saturation, %	94.5	Failure Stress, tsf	1.326	%200=
Void Ratio	0.56	Strain, %	15.0	Organic=Not Applicable
Description: Stiff light gray and tan lean clay with silt lenses and ferrous nodules (CL)				
Tested By:	S. Campbell	Date Tested:	8/11/2023	Reviewed By: Wendy Allen
				Date Reviewed: 8/29/2023

Soil Boring ID	Depth Interval (ft)	D2488	D2216	D2166/D2850		D4318			D422/D1140 /D6913	D2166/D2850					D4648	D2974	Comments	
		Visual Description	Moisture (%)	Unit Weight (PCF)		Atterberg Limits				%<#200 Sieve	Shear Strength (KSF)	Remolded Strength (KSF)	Failure Strain (%)	Confining Pressure (PSI)	Failure Type	Mini Vane Shear Strength (KSF)		Organic Content (%)
				Wet	Dry	LL	PL	PI										
B-2	0.5 - 2.0	Light gray and tan lean clay with roots (CL)	18.9			33	23	10										
B-2	2.0 - 4.0	Tan, brown, and light gray lean clay with ferrous nodules (CL)	18.1														PP=2.25	
B-2	4.0 - 6.0	Tan and light gray lean clay with ferrous stains (CL)	17.8														PP=1.25	
B-2	6.0 - 8.0	Tan and light gray lean clay with ferrous stains (CL)	19.8														PP=3.25	
B-2	8.0 - 10.0	Stiff tan and light gray lean clay with ferrous nodules (CL)	18.5	134.9	113.8	26	13	13	82.8	1.503		15.0		B			PP=0.5	
B-2	13.0 - 15.0	Light gray and tan lean clay with ferrous stains (CL)	22.6														PP=2.0	
B-2	18.0 - 20.0	Very stiff light gray and tan lean clay with ferrous nodules (CL)	21.6	128.6	105.8	41	17	24		2.003		8.9		MS			PP=2.5	
B-2	23.0 - 25.0	Light gray and tan lean clay with ferrous stains (CL)	21.0														PP=4.0+	

*The classification symbol and name are based on visual-manual procedures.

Multiple Shear = MS Vertical Shear = VS Angle Shear = AS
Slickensided = SLS Bulge = B Crumble = C

Technical Responsibility: Stephannie Campbell

Title: Lead Lab Technician

Date: 8/29/2023

Summary of Lab Results

Project No.: 65-1437



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EOC - Juban Crossing
Denham Springs, Louisiana



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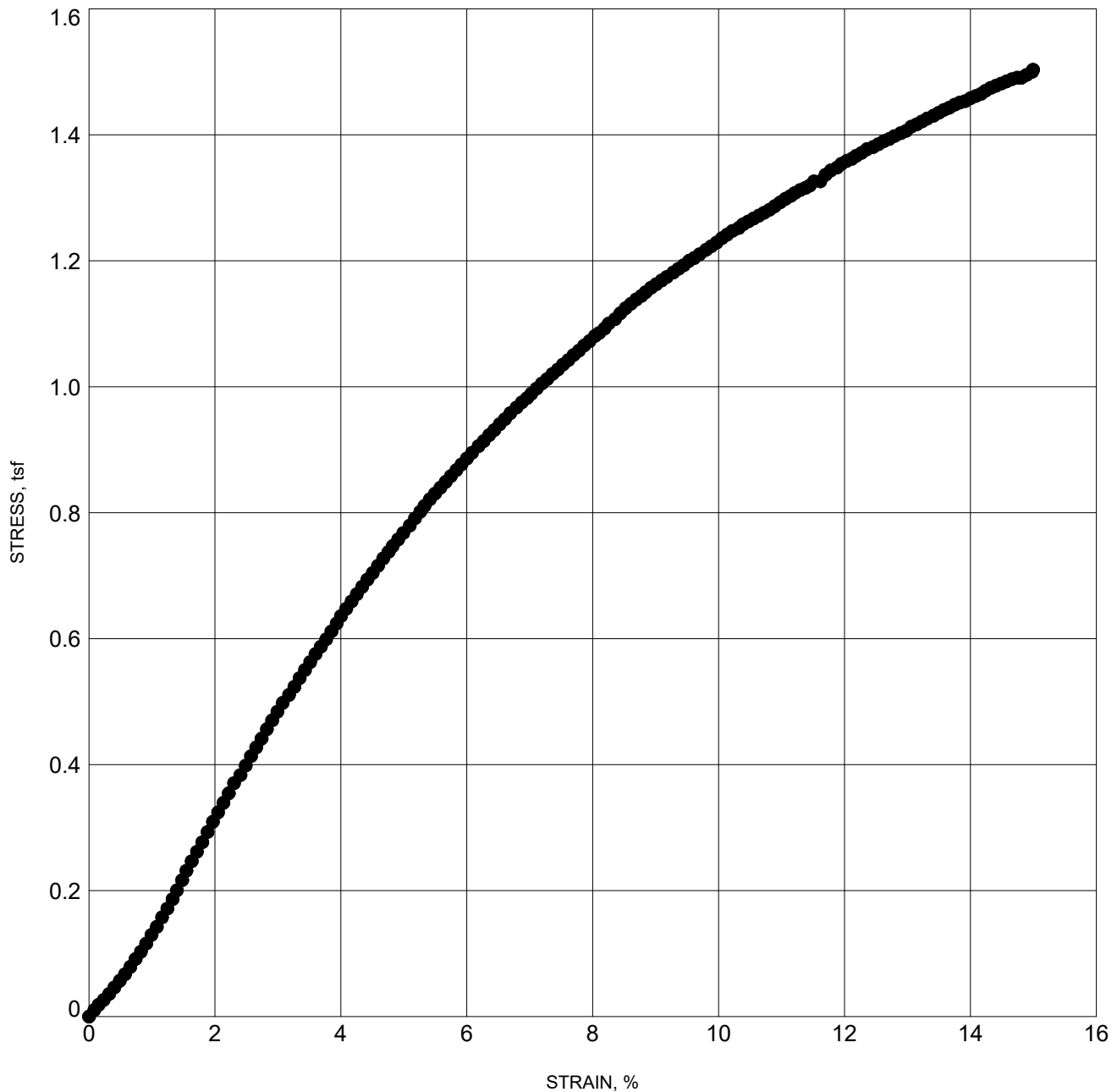
UNCONFINED COMPRESSION TEST

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PROJECT NAME EOC - Juban Crossing

PROJECT NUMBER 65-1437

PROJECT LOCATION Denham Springs, Louisiana



Boring ID		B-2	Depth(ft)		8.0 - 10.0	
Water Content, %	18.5		Specimen Diameter	2.814	LL =26	
Wet Density, pcf	134.9		Specimen Height	5.949	PL =13	
Dry Density, pcf	113.8		Height/diameter ratio	2.11	PL = 13	
Saturation, %	101.1		Failure Stress, tsf	1.503	%200=83	
Void Ratio	0.50		Strain, %	15.0	Organic=Not Applicable	
Description: Stiff tan and light gray lean clay with ferrous nodules (CL)						
Tested By: S. Campbell		Date Tested: 8/11/2023		Reviewed By: Wendy Allen		Date Reviewed: 8/29/2023



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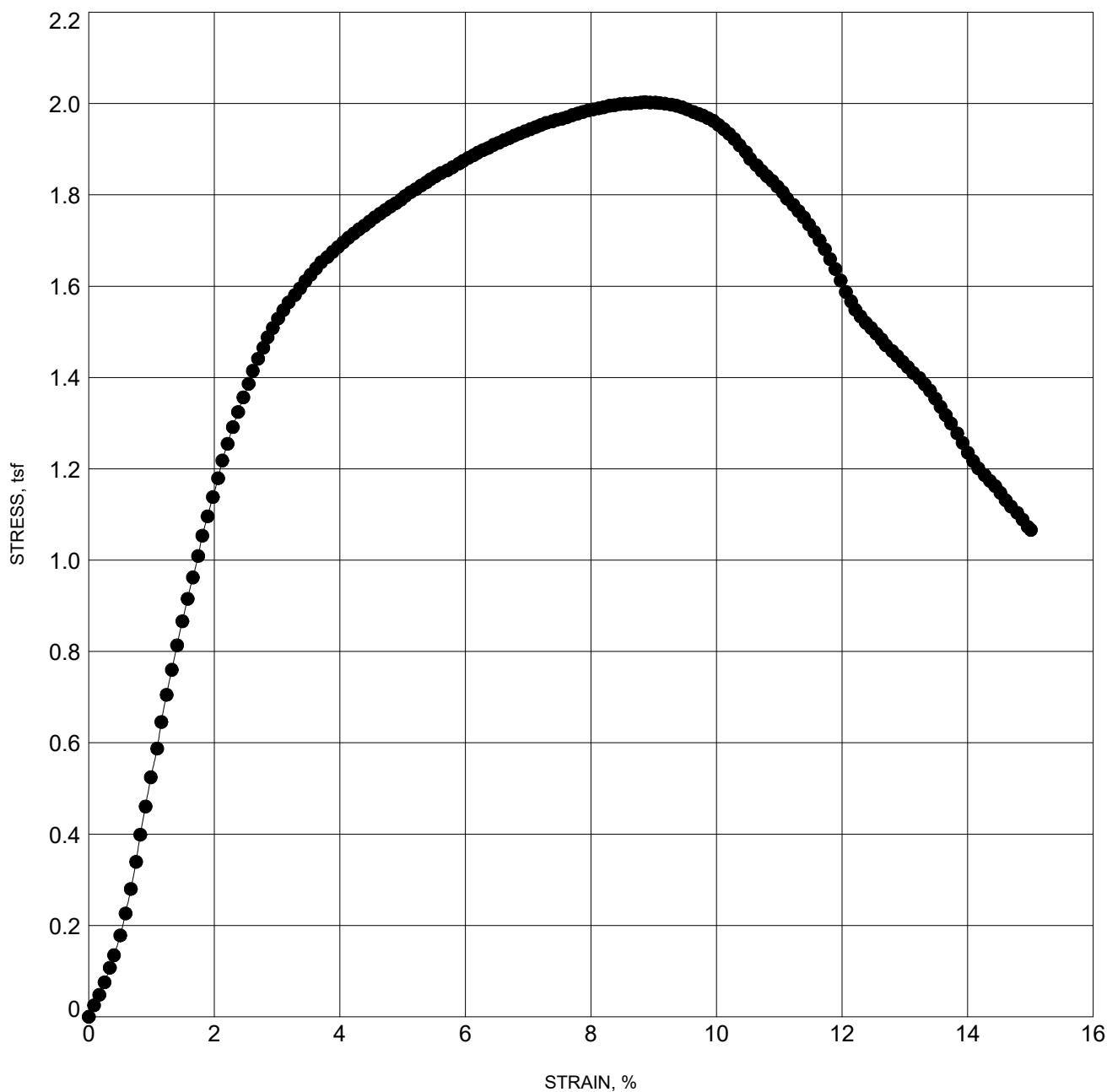
UNCONFINED COMPRESSION TEST

CLIENT Express Oil Change, LLC

PROJECT NAME EOC - Juban Crossing

PROJECT NUMBER 65-1437

PROJECT LOCATION Denham Springs, Louisiana




Boring ID		B-2		Depth(ft) 18.0 - 20.0	
Water Content, %	21.6	Specimen Diameter	2.833	LL =41	
Wet Density, pcf	128.6	Specimen Height	5.970	PL =17	
Dry Density, pcf	105.8	Height/diameter ratio	2.11	PL = 24	
Saturation, %	96.0	Failure Stress, tsf	2.003	%200=	
Void Ratio	0.62	Strain, %	8.9	Organic=Not Applicable	
Description: Very stiff light gray and tan lean clay with ferrous nodules (CL)					
Tested By: S. Campbell		Date Tested: 8/11/2023		Reviewed By: Wendy Allen	
				Date Reviewed: 8/29/2023	

Soil Boring ID	Depth Interval (ft)	D2488	D2216	D2166/D2850		D4318			D422/D1140/D6913	D2166/D2850					D4648	D2974	Comments
		Visual Description	Moisture (%)	Unit Weight (PCF)		Atterberg Limits			%<#200 Sieve	Shear Strength (KSF)	Remolded Strength (KSF)	Failure Strain (%)	Confining Pressure (PSI)	Failure Type	Mini Vane Shear Strength (KSF)	Organic Content (%)	
				Wet	Dry	LL	PL	PI									
P-1	0.5 - 2.0	Tan lean clay with roots (CL)	20.8			35	23	12	92.6								
P-1	2.5 - 4.0	Light gray and tan fat clay with ferrous nodules (CH)	21.5														
P-1	4.0 - 6.0	Light gray and tan lean clay with ferrous nodules (CL)	20.4														

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Technical Responsibility: <u>Stephannie Campbell</u> Title: <u>Lead Lab Technician</u> Date: <u>8/29/2023</u>	Summary of Lab Results Project No.: 65-1437	EOC - Juban Crossing Denham Springs, Louisiana  ECS Limited 11211 Industriplex Blvd. Ste. 300 Baton Rouge, LA 70809 Telephone: 225.224.2583
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Soil Boring ID	Depth Interval (ft)	D2488	D2216	D2166/D2850		D4318			D422/D1140 /D6913	D2166/D2850					D4648	D2974	Comments
		Visual Description	Moisture (%)	Unit Weight (PCF)		Atterberg Limits			%<#200 Sieve	Shear Strength (KSF)	Remolded Strength (KSF)	Failure Strain (%)	Confining Pressure (PSI)	Failure Type	Mini Vane Shear Strength (KSF)	Organic Content (%)	
				Wet	Dry	LL	PL	PI									
P-2	0.5 - 2.0	Light gray fat clay with ferrous nodules (CH)	19.6														
P-2	2.5 - 4.0	Light gray fat clay with silt lenses, calcareous nodules, and ferrous stains (CH)	24.3														
P-2	4.5 - 6.0	Tan and light gray lean clay with ferrous nodules (CL)	20.2														

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Technical Responsibility: Stephannie Campbell

Title: Lead Lab Technician

Date: 8/29/2023

Summary of Lab Results

Project No.: 65-1437




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Denham Springs, Louisiana

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		Visual Description	Moisture (%)	Unit Weight (PCF)		Atterberg Limits			%<#200 Sieve	Shear Strength (KSF)	Remolded Strength (KSF)	Failure Strain (%)	Confining Pressure (PSI)	Failure Type	Mini Vane Shear Strength (KSF)	Organic Content (%)	
				Wet	Dry	LL	PL	PI									
P-3	0.5 - 2.0	Tan sandy lean clay with ferrous nodules and roots (CL)	12.8														
P-3	2.5 - 4.0	Tan and light gray lean clay with ferrous stains (CL)	17.2														
P-3	4.5 - 6.0	Tan sandy lean clay (CL)	14.3														

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Soil Boring ID	Depth Interval (ft)	D2488	D2216	D2166/D2850		D4318			D422/D1140/D6913	D2166/D2850					D4648	D2974	Comments
		Visual Description	Moisture (%)	Unit Weight (PCF)		Atterberg Limits			%<#200 Sieve	Shear Strength (KSF)	Remolded Strength (KSF)	Failure Strain (%)	Confining Pressure (PSI)	Failure Type	Mini Vane Shear Strength (KSF)	Organic Content (%)	
				Wet	Dry	LL	PL	PI									
P-4	0.5 - 2.0	Light gray lean clay with roots (CL)	9.4														
P-4	2.0 - 4.0	Light gray and brown lean clay with ferrous nodules (CL)	23.3														
P-4	4.0 - 6.0	Light gray and tan lean clay with ferrous nodules (CL)	20.8														

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		Visual Description	Moisture (%)	Unit Weight (PCF)		Atterberg Limits				%<#200 Sieve	Shear Strength (KSF)	Remolded Strength (KSF)	Failure Strain (%)	Confining Pressure (PSI)	Failure Type	Mini Vane Shear Strength (KSF)	
				Wet	Dry	LL	PL	PI									
P-5	0.0 - 2.0	Light gray and tan lean clay with ferrous nodules (CL)	26.9														PP=0.75
P-5	2.0 - 4.0	Light gray and tan lean clay with ferrous nodules and calcareous nodules (CL)	21.1														PP=2.0
P-5	4.0 - 6.0	Light gray and tan lean clay with ferrous nodules (CL)	22.3														PP=0.75

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Soil Boring ID	Depth Interval (ft)	D2488	D2216	D2166/D2850		D4318			D422/D1140 /D6913	D2166/D2850					D4648	D2974	Comments
		Visual Description	Moisture (%)	Unit Weight (PCF)		Atterberg Limits				%<#200 Sieve	Shear Strength (KSF)	Remolded Strength (KSF)	Failure Strain (%)	Confining Pressure (PSI)	Failure Type	Mini Vane Shear Strength (KSF)	
				Wet	Dry	LL	PL	PI									
P-6	0.5 - 2.0	Light gray and tan fat clay with roots (CH)	10.0														
P-6	2.5 - 4.0	Tan sandy lean clay with ferrous nodules (CL)	14.8														
P-6	4.5 - 6.0	Tan and light gray lean clay with ferrous nodules (CL)	16.0														

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Important Information about This Geotechnical-Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.

While you cannot eliminate all such risks, you can manage them. The following information is provided to help.

The Geoprofessional Business Association (GBA) has prepared this advisory to help you – assumedly a client representative – interpret and apply this geotechnical-engineering report as effectively as possible. In that way, clients can benefit from a lowered exposure to the subsurface problems that, for decades, have been a principal cause of construction delays, cost overruns, claims, and disputes. If you have questions or want more information about any of the issues discussed below, contact your GBA-member geotechnical engineer. Active involvement in the Geoprofessional Business Association exposes geotechnical engineers to a wide array of risk-confrontation techniques that can be of genuine benefit for everyone involved with a construction project.

Geotechnical-Engineering Services Are Performed for Specific Purposes, Persons, and Projects

Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical-engineering study conducted for a given civil engineer will not likely meet the needs of a civil-works constructor or even a different civil engineer. Because each geotechnical-engineering study is unique, each geotechnical-engineering report is unique, prepared *solely* for the client. *Those who rely on a geotechnical-engineering report prepared for a different client can be seriously misled.* No one except authorized client representatives should rely on this geotechnical-engineering report without first conferring with the geotechnical engineer who prepared it. *And no one – not even you – should apply this report for any purpose or project except the one originally contemplated.*

Read this Report in Full

Costly problems have occurred because those relying on a geotechnical-engineering report did not read it *in its entirety*. Do not rely on an executive summary. Do not read selected elements only. *Read this report in full.*

You Need to Inform Your Geotechnical Engineer about Change

Your geotechnical engineer considered unique, project-specific factors when designing the study behind this report and developing the confirmation-dependent recommendations the report conveys. A few typical factors include:

- the client's goals, objectives, budget, schedule, and risk-management preferences;
- the general nature of the structure involved, its size, configuration, and performance criteria;
- the structure's location and orientation on the site; and
- other planned or existing site improvements, such as retaining walls, access roads, parking lots, and underground utilities.

Typical changes that could erode the reliability of this report include those that affect:

- the site's size or shape;
- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from a light-industrial plant to a refrigerated warehouse;
- the elevation, configuration, location, orientation, or weight of the proposed structure;
- the composition of the design team; or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project changes – even minor ones – and request an assessment of their impact. *The geotechnical engineer who prepared this report cannot accept responsibility or liability for problems that arise because the geotechnical engineer was not informed about developments the engineer otherwise would have considered.*

This Report May Not Be Reliable

Do not rely on this report if your geotechnical engineer prepared it:

- for a different client;
- for a different project;
- for a different site (that may or may not include all or a portion of the original site); or
- before important events occurred at the site or adjacent to it; e.g., man-made events like construction or environmental remediation, or natural events like floods, droughts, earthquakes, or groundwater fluctuations.

Note, too, that it could be unwise to rely on a geotechnical-engineering report whose reliability may have been affected by the passage of time, because of factors like changed subsurface conditions; new or modified codes, standards, or regulations; or new techniques or tools. *If your geotechnical engineer has not indicated an "apply-by" date on the report, ask what it should be, and, in general, if you are the least bit uncertain about the continued reliability of this report, contact your geotechnical engineer before applying it.* A minor amount of additional testing or analysis – if any is required at all – could prevent major problems.

Most of the "Findings" Related in This Report Are Professional Opinions

Before construction begins, geotechnical engineers explore a site's subsurface through various sampling and testing procedures. *Geotechnical engineers can observe actual subsurface conditions only at those specific locations where sampling and testing were performed.* The data derived from that sampling and testing were reviewed by your geotechnical engineer, who then applied professional judgment to form opinions about subsurface conditions throughout the site. Actual sitewide-subsurface conditions may differ – maybe significantly – from those indicated in this report. Confront that risk by retaining your geotechnical engineer to serve on the design team from project start to project finish, so the individual can provide informed guidance quickly, whenever needed.

This Report's Recommendations Are Confirmation-Dependent

The recommendations included in this report – including any options or alternatives – are confirmation-dependent. In other words, *they are not final*, because the geotechnical engineer who developed them relied heavily on judgment and opinion to do so. Your geotechnical engineer can finalize the recommendations *only after observing actual subsurface conditions* revealed during construction. If through observation your geotechnical engineer confirms that the conditions assumed to exist actually do exist, the recommendations can be relied upon, assuming no other changes have occurred. *The geotechnical engineer who prepared this report cannot assume responsibility or liability for confirmation-dependent recommendations if you fail to retain that engineer to perform construction observation.*

This Report Could Be Misinterpreted

Other design professionals' misinterpretation of geotechnical-engineering reports has resulted in costly problems. Confront that risk by having your geotechnical engineer serve as a full-time member of the design team, to:

- confer with other design-team members,
- help develop specifications,
- review pertinent elements of other design professionals' plans and specifications, and
- be on hand quickly whenever geotechnical-engineering guidance is needed.

You should also confront the risk of constructors misinterpreting this report. Do so by retaining your geotechnical engineer to participate in prebid and preconstruction conferences and to perform construction observation.

Give Constructors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can shift unanticipated-subsurface-conditions liability to constructors by limiting the information they provide for bid preparation. To help prevent the costly, contentious problems this practice has caused, include the complete geotechnical-engineering report, along with any attachments or appendices, with your contract documents, *but be certain to note conspicuously that you've included the material for informational purposes only*. To avoid misunderstanding, you may also want to note that "informational purposes" means constructors have no right to rely on the interpretations, opinions, conclusions, or recommendations in the report, but they may rely on the factual data relative to the specific times, locations, and depths/elevations referenced. Be certain that constructors know they may learn about specific project requirements, including options selected from the report, *only* from the design drawings and specifications. Remind constructors that they may

perform their own studies if they want to, and *be sure to allow enough time* to permit them to do so. Only then might you be in a position to give constructors the information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions. Conducting prebid and preconstruction conferences can also be valuable in this respect.

Read Responsibility Provisions Closely

Some client representatives, design professionals, and constructors do not realize that geotechnical engineering is far less exact than other engineering disciplines. That lack of understanding has nurtured unrealistic expectations that have resulted in disappointments, delays, cost overruns, claims, and disputes. To confront that risk, geotechnical engineers commonly include explanatory provisions in their reports. Sometimes labeled "limitations," many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely*. Ask questions. Your geotechnical engineer should respond fully and frankly.

Geoenvironmental Concerns Are Not Covered

The personnel, equipment, and techniques used to perform an environmental study – e.g., a "phase-one" or "phase-two" environmental site assessment – differ significantly from those used to perform a geotechnical-engineering study. For that reason, a geotechnical-engineering report does not usually relate any environmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated subsurface environmental problems have led to project failures*. If you have not yet obtained your own environmental information, ask your geotechnical consultant for risk-management guidance. As a general rule, *do not rely on an environmental report prepared for a different client, site, or project, or that is more than six months old*.

Obtain Professional Assistance to Deal with Moisture Infiltration and Mold

While your geotechnical engineer may have addressed groundwater, water infiltration, or similar issues in this report, none of the engineer's services were designed, conducted, or intended to prevent uncontrolled migration of moisture – including water vapor – from the soil through building slabs and walls and into the building interior, where it can cause mold growth and material-performance deficiencies. Accordingly, *proper implementation of the geotechnical engineer's recommendations will not of itself be sufficient to prevent moisture infiltration*. Confront the risk of moisture infiltration by including building-envelope or mold specialists on the design team. *Geotechnical engineers are not building-envelope or mold specialists*.



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