Express Oil Change

Geotechnical Engineering Report

July 3, 2024 | Terracon Project No. EH245089

Baton Rouge, LA

Prepared for:

Express Oil Change, LLC.
1880 Southpark Drive
Birmingham, AL 35244

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July 3, 2024

Express Oil Change, LLC.
1880 Southpark Drive
Birmingham, AL 35244

Attn: Justin Duck
P: (205) 397-1142
E: Justin.duck@expressoil.com

Re: Geotechnical Engineering Report
Express Oil Change
9340 Old Hammond Hwy
Baton Rouge, Louisiana
Terracon Project No. EH245089

Dear Mr. Duck:

We have completed the scope of Geotechnical Engineering services for the above referenced project in general accordance with Terracon Proposal No. PEH245089 dated May 21, 2024. This report presents the findings of the subsurface exploration and provides geotechnical recommendations concerning earthwork and the design and construction of foundations, floor slabs and pavements for the proposed project.

We appreciate the opportunity to be of service to you on this project. If you have any questions concerning this report or if we may be of further service, please contact us.

Sincerely,

Terracon

STATE OF LOUISIANA
JOHN M. VOELKER
License No. 43451
PROFESSIONAL ENGINEER
07/03/2024

John M. Voelker, P.E.
Project Engineer

Lynne E. Roussel, P.E.
Principal

Table of Contents

Figures

Attachments

Note: This report was originally delivered in a web-based format. **Blue Bold** text in the report indicates a referenced section heading. The PDF version also includes hyperlinks which direct the reader to that section and clicking on the Terracon logo will bring you back to this page. For more interactive features, please view your project online at **client.terracon.com**.

Refer to each individual Attachment for a listing of contents.

Introduction

This report presents the results of our subsurface exploration and Geotechnical Engineering services performed for the proposed building and pavement to be located at 9340 Old Hammond Hwy in Baton Rouge, Louisiana. The purpose of these services was to provide information and geotechnical engineering recommendations relative to:

- Subsurface soil conditions
- Groundwater conditions
- Seismic site classification per IBC
- Site preparation and earthwork
- Foundation design and construction
- Floor slab design and construction
- Lateral earth pressure
- Pavement design and construction

The geotechnical engineering Scope of Services for this project included the advancement of test borings, laboratory testing, engineering analysis, and preparation of this report.

Drawings showing the site and boring locations are shown on the **Site Location** and **Exploration Plan**, respectively. The results of the laboratory testing performed on soil samples obtained from the site during our field exploration are included on the boring logs and as separate graphs in the **Exploration Results** section.

Project Description

Our initial understanding of the project was provided in our proposal and was discussed during project planning. A period of collaboration has transpired since the project was initiated, and our final understanding of the project conditions is as follows:

Item	Description
Information Provided	An email request for proposal was provided by Justin Duck on May 14, 2024. The request included a preliminary site plan with proposed borings and draft resubdivision drawing.
Project Description	The project includes construction of an Express Oil Change building and parking lot.

Item	Description
Proposed Structure	Structures associated with the project include a single-story building with an estimated footprint area of 5,600 square feet, mostly used for automotive maintenance and repair services.
Building Construction	We anticipate that the structure will consist of load-bearing masonry walls, steel frame, shallow foundations, and slab-on-grade.
Finished Floor Elevation	We have assumed that finished floor is not more than 2 feet above existing grade.
Maximum Loads	Anticipated structural loads not provided. In the absence of information provided by the design team, we will use the following loads in estimating settlement based on our experience with similar projects. ▪ Columns: 50 kips ▪ Walls: 2 kips per linear foot (klf) ▪ Slabs: 100 pounds per square foot (psf)
Grading/Slopes	Proposed finished grade elevation for the building pad is estimated to be less than 2 feet above current grades. Final slopes are planned with a maximum height of 5 feet and an inclination of 3H:1V (Horizontal: Vertical) or flatter.
Below-Grade Structures	The structure will include subsurface pits constructed of cast in place concrete retaining walls and sublevel slabs estimated to extend about 6 feet below the finished floor elevation.
Pavements	Paved driveway and parking will be constructed around the building. A preferred pavement surfacing has not been identified to us as part of the preliminary information. However, concrete surfacing is common for this client and is the assumed preference. Unless information is provided prior to the report, the anticipated ACI traffic categories and daily truck traffic will be assumed to consist of: ▪ Category A: Car parking areas and access lanes, 10 trucks per week, less than 1,000 vehicles per day ▪ Category B: Entrance and truck service lanes, 20 trucks per week ▪ Category D: Heavy duty trucks, 1 truck per week ▪ Category E: Garbage or fire truck lanes The pavement design period is 20 years.

Terracon should be notified if any of the above information is inconsistent with the planned construction, especially the grading limits, as modifications to our recommendations may be necessary.

Site Conditions

The following description of site conditions is derived from our site visit in association with the field exploration and our review of publicly available geologic and topographic maps.

Item	Description
Parcel Information	The project is located at 9340 Old Hammond Hwy in Baton Rouge, Louisiana. Approximately 1.14 acres Latitude/Longitude (approximate): 30.4305° N, 91.0849° W. See **Site Location**
Existing Improvements	Based on historical satellite imagery, a formerly developed strip mall and gas station car wash that was demolished in 2014 and 2019. The paved areas and adjacent gas station was removed between 2017 and 2019. Grading for the adjacent new construction extended into the property since 2023 to present. West side adjacent to an empty lot and substation.
Current Ground Cover	Site graded with bare soil to grass and also debris and material stockpiles.
Existing Topography	Relatively flat, with an average elevation of +41 feet, MSL.

Geotechnical Characterization

Surface Geology

The west portion of the site is mapped within an area of undifferentiated alluvium of small upland streams (Hua). These Holocene age alluvial deposits of minor streams and creeks filled valleys cut into older deposits. The lithology of these alluvial deposits reflects the reworked lithology of their adjacent source. The majority of the property is mapped within an area of the Hammond alloformation (Pph). These Pleistocene Age deposits of middle to late Wisconsin Coastal Plain streams include flood-plain deposits of the late Pleistocene Mississippi River, exposed in the eastern valley wall of the modern Mississippi River alluvial valley. The unit is blanketed by Peoria Loess, which in places is underlain by Sicily Island Loess. The deposits typically consist of upper very silty clay or silt overlying medium stiff to very stiff tan and light gray silty clays and clays with silt and sand layering. The soils within the Prairie Terrace typically provide good foundation support for relatively light to moderately loaded structures, are overconsolidated, and normally only marginally compressible. In some areas that are very dry and desiccated, the potential for expansive properties exists, but these conditions are not typical of the Prairie Terrace deposits.

Baton Rouge 30x60 Minute Geologic Quadrangle (Louisiana Geological Survey, 2000)

Subsurface Conditions

We have developed a general characterization of the subsurface conditions based upon our review of the subsurface exploration, laboratory data, geologic setting and our understanding of the project. This characterization, termed GeoModel, forms the basis of our geotechnical calculations and evaluation of the site. Conditions observed at each exploration point are indicated on the individual logs. The individual logs can be found in the **Exploration Results** and the GeoModel can be found in the **Figures** attachment of this report.

As part of our analyses, we identified the following model layers within the subsurface profile. For a more detailed view of the model layer depths at each boring location, refer to the GeoModel.

Model Layer	Layer Name	General Description
1	Soil with Debris	Brown to tan, lean clay with rubble debris to 2 to 4 feet

2	**Dry Subgrade**	Brown and gray, stiff to very stiff, lean clay, with gravel to 1 foot, dry moisture condition in the top 4 to 6 feet
3	**Typical Clays**	Tan and gray, stiff to very stiff, lean clay, lean clay with sand to fat clay

The borings were advanced using a flight auger drilling technique that allow short term groundwater observations to be made while drilling. Groundwater was initially encountered in boring B-01 during drilling at a depth of approximately 18 feet below the existing ground surface. After 15 minutes, the water was measured at about 16 feet below existing grade. Groundwater conditions may be different at the time of construction. conditions may change because of seasonal variations in rainfall, runoff, river levels and other conditions not apparent at the time of drilling. Long-term groundwater monitoring was outside the scope of services for this project.

Geologic Hazards

The site is mapped approximately 5.5 miles south from the Denham Springs-Scotlandville faults and approximately 1 mile north from the Baton Rouge fault. These faults of East Baton Rouge Parish are active but have not been demonstrated to be seismic (they do not generate detectable earthquakes). Rather, the faults have been shown to cause damage to road, pavement, and building structures in the immediate vicinity of the faults gradually, over periods of decades. Due to the low seismicity in the region and absence of soils prone to liquefaction, such as loose sands, the soils at the site are not considered a risk for liquefaction.

Seismic Site Class

The seismic design requirements for buildings and other structures are based on Seismic Design Category. Site Classification is required to determine the Seismic Design Category for a structure. The Site Classification is based on the upper 100 feet of the site profile defined by a weighted average value of either shear wave velocity, standard penetration resistance, or undrained shear strength in accordance with Section 20.4 of ASCE 7 and the International Building Code (IBC). Based on the soil properties observed at the site and as described on the exploration logs and results, our professional opinion is that a **Seismic Site Classification of D** be considered for the project. Subsurface explorations at this site were extended to a maximum depth of 20 feet. The site properties below the boring depth to 100 feet were estimated based on our experience and knowledge of geologic conditions of the general area. Although not considered essential, additional deeper borings or geophysical testing may be performed to confirm the conditions below the current boring depth.

Geotechnical Overview

The subsurface materials generally consisted of stiff to very stiff lean clays that were dry relative to the tested plastic limit. The borings also appeared to include gravel or the presence of debris or rubble. At greater depth the soils had similar stiff to very stiff consistency. Strength lab test results in sandy soils of boring B-01 can be misleading and the dry unit weight result indicates that the soil sample is relatively compact. Groundwater was encountered at 16 feet during drilling.

The surficial soils in the top 2 feet are recommended to be moisture conditioned at the time construction. During site stripping and moisture conditioning, the presence of further debris or old fills are expected to be encountered and should be investigated further. It is difficult with small diameter boreholes to identify and determine the extent of debris across the site. Existing debris could be minimal or also include dump pits. Support of foundations and pavements on or above existing debris, there is an inherent risk for the owner that compressible fill or unsuitable material, within or buried will not be discovered. This risk of unforeseen conditions cannot be eliminated without completely removing the existing debris. To take advantage of the cost benefit of not removing the entire amount of debris, the owner must be willing to accept the risk of increased differential performance which can result in increased cracking and abrupt differential settlement.

The surface soils appeared relatively stable at the time of the exploration with how dry the conditions were. However, the clays could become unstable with typical earthwork and construction traffic, especially after stripping the site and in times of higher precipitation events. Effective drainage should be completed early in the construction sequence and maintained after construction to reduce potential issues. At project sites with minimal grade change and with developments and roads surrounding the construction area it can be difficult to maintain positive drainage throughout the construction phase. The construction phase drainage should be considered in the development of the project overall grading and drainage plan. The possible poor drainage conditions can lead to instability in the areas around the site and hamper construction progress. A temporary dewatering system of sumps and pumps could be necessary to remove ponding water where positive drainage is not feasible.

If possible, the grading should be performed during the warmer and drier times of the year. If grading is performed during the winter months, an increased risk for possible further undercutting and replacement of unstable subgrade will persist. Initial processing of the surface soils is recommended to achieve suitable stability for subsequent fill placement. If construction is performed during a wet season, it can be prudent to consider specifying chemical treatment of critical project access roads and construction laydown areas as part of the construction package to reduce potential weather related delays. Additional site preparation recommendations, including proofrolling, subgrade improvement and fill placement, are provided in the **Earthwork** section.

Based on the conditions encountered and estimated load-settlement relationships, the proposed structures can be supported on conventional continuous or spread footings. The soils which form the bearing stratum for shallow foundations are medium plasticity lean clays, with pockets of high plasticity fat clay encountered in pavement borings B-05 and B-06. In general, lean clays are considered to exhibit low to moderate potential while fat clays are considered to exhibit a moderate to high potential for shrink-swell movements with changes in moisture. Maintaining a minimum dead load pressure on footings should reduce the anticipated swell movements to tolerable levels. Moisture condition as described should be performed to reduce the floor slab heave potential. The **Shallow Foundations** section addresses support of the building directly bearing on native stiff to very stiff lean/fat clay or structural fill. The **Floor Slabs** section addresses slab-on-grade support of the building.

Our opinion of pavement section thickness design has been developed based on our understanding of the intended use, assumed traffic, and subgrade preparation recommended herein using methodology contained in ACI 330 "Guide to Design and Construction of Concrete Parking Lots" and adjusted with consideration to LADOTD Louisiana State Specification for Roads and Bridges (LSSRB 2016). The **Pavements** section includes minimum pavement component thickness.

The recommendations contained in this report are based upon the results of field and laboratory testing (presented in the **Exploration Results**), engineering analyses, and our current understanding of the proposed project. The **General Comments** section provides an understanding of the report limitations.

Earthwork

Earthwork is anticipated to include clearing and grubbing, removing debris, moisture conditioning, excavations, and structural fill placement. The following sections provide recommendations for use in the preparation of specifications for the work. Recommendations include critical quality criteria, as necessary, to render the site in the state considered in our geotechnical engineering evaluation for foundations, floor slabs, and pavements.

Site Preparation

Prior to placing fill, the existing debris, vegetation, topsoil, root mats, and loose, soft or otherwise unsuitable material should be removed. Complete stripping of the topsoil should be performed in the proposed building and parking/driveway areas. Topsoil measurements were made at the boring locations; however, stripping depths between our boring locations and across the site could vary considerably. As such we recommend actual stripping depths be evaluated by a representative of Terracon during construction to aid in preventing removal of excess material.

Evidence of debris was observed on the previously developed/cleared site. Additional debris, buried foundations, old fills or underground facilities (such as septic tanks, utilities) could be encountered during construction clearing and should be further investigated. Such features should be removed, and the excavation thoroughly cleaned prior to backfill placement and construction.

Subgrade Preparation

After stripping the site, moisture conditioning should be performed in structural areas in the top 2 feet. These soils should moisture conditioned, compacted in lifts with density testing. Where fat clay soils are encountered they should be removed and replaced with structural fill. Areas not moisture conditioned, the subgrade should be proofrolled with an adequately loaded rubber tire vehicle such as a partially-loaded tandem-axle dump truck or loaded scraper. The vehicle should weigh between 15 and 20 Tons (total vehicle weight). The proofrolling should be performed under the observation of the Geotechnical Engineer or representative. Areas excessively deflecting under the proofroll should be delineated and subsequently addressed by the Geotechnical Engineer. If unstable subgrade is encountered after initial topsoil stripping, mitigation should be performed as described in the **Soil Stabilization** section. Unstable, isolated areas could either be removed or modified by treating with lime or cement as specified by the Geotechnical Engineer at the time of construction. Excessively wet or dry material should either be removed or moisture conditioned and recompacted.

Soil Stabilization

Construction performed during wet seasons may require stabilization. Methods of subgrade improvement, as described below, could include scarification, drying and recompaction, chemical stabilization or removal of unstable materials and replacement with structural fill. The appropriate method of improvement, if required, would be dependent on factors such as schedule, weather, availability and costs of materials, the size of area to be stabilized, and the nature of the instability. More detailed recommendations can be provided during construction as the need for subgrade stabilization occurs. Performing site grading operations during warm seasons and dry periods would help reduce the amount of subgrade stabilization required.

If the exposed subgrade is unstable during proofrolling operations, it could be stabilized using one of the methods outlined below.

- **Scarification and Recompaction** - It may be feasible to scarify, dry, and recompact the exposed lean clay soils in unstable areas that were observed during proofrolling. The upper maximum 12 inches of native subgrade should be processed by frequent windrowing with a dozer or plowing with a set of heavy duty disc harrows for at least three working days to achieve stable conditions for fill placement before consideration of other mitigation approaches. The windrowing and drying effort should be performed during a period with at least two days forecasted to be dry. The processed areas should be sealed with the dozer at the end of the day in case of overnight rain. Stabilizing subgrades by drying likely would not be achievable if the thickness of the unstable soil is greater than about 1 to 2 feet, if the unstable soil is at groundwater levels, or if construction is performed during a period of wet or cool weather when drying is difficult.

- **Chemical Treatment** – For higher plasticity or wet, unstable surficial soils, it may be prudent to consider specifying chemical treatment of critical project access roads, building pads and construction laydown areas as part of the construction package to reduce potential weather-related delays. For the typical near surface lean clay soils at this site, treatment of the subgrade with minimum 3% quick lime or 6% hydrated lime by volume to a depth of 12 inches should provide for a more weather resistant subgrade of these critical areas during the construction phase. The hazards of airborne particles during mixing blowing across the site or onto adjacent property should be considered. Additional testing could be needed to develop specific recommendations on determining the most suitable stabilizing agent and optimum amounts required to improve subgrade stability by blending with the site soils.
- **Undercut and Replacement** – Small soft areas, debris or debris dump pits could be removed and replaced with structural fill. If excavation to remove weak soils becomes excessive (more than 4-5 feet) in pavement areas, placement of a high performance woven geotextile fabric (Mirafi RS380i woven fabric, or equivalent) is recommended to assist in bridging over areas of soft subgrade. The geotextile should be placed with a minimum overlap of 24 inches at all joints with the overlap placed in the intended direction of fill placement. The fill should be spread onto the geotextile with a small dozer to limit the disturbance of underlying clay soil. A clean sand (maximum 10% passing the No. 200 sieve) is recommended for the initial minimum 3 feet of fill placement to facilitate compaction and dewatering efforts. A lean clay fill can be used to cap out the fill placement. The initial lift of fill material should be placed and compacted to achieve at least 92 percent of the standard Proctor maximum dry density. Some slight pumping may be observed in this initial lift. Subsequent lifts of fill material should be placed as recommended in the Compaction Requirements table.

Further evaluation of the need and recommendations for subgrade stabilization can be provided during construction as the geotechnical conditions are exposed.

Fill Material Types

Fill required to achieve design grade should be classified as structural fill and general fill. Structural fill is material used below, or within 10 feet of structures, pavements or constructed slopes and other structural areas. General fill is material used to achieve grade outside of these areas, such as landscaped areas.

Reuse of On-Site Soil: Excavated on-site lean clay soil may be selectively reused as structural fill below foundations, pavements and landscaping areas. Excavated on-site fat clay soil is not suitable for reuse as Structural Fill without lime treatment due to difficult compaction characteristics, stability issues at higher moistures and shrink/swell potential. It can be used as backfill in the landscape areas without lime treatment. CH soils should not be used within 3 feet of finished grade in building areas and 1 foot below finished grade in other structural fill areas.

Material property requirements for on-site lean clay soil for use as general fill and structural fill are noted in the table below:

Property	General Fill	Structural Fill
Composition	Free of deleterious material	Free of deleterious material
Sand content	Not limited	Maximum 25% retained on No. 200 sieve
Plasticity	Liquid Limit less than 50, Plasticity index greater than 10 and less than 30	
GeoModel Layer Expected to be Suitable [1]	2, 3	2 (after moisture conditioning) or 3

1. Based on subsurface exploration. Actual material suitability should be determined in the field at time of construction.

Imported Fill Materials: Imported fill materials should meet the following material property requirements. Regardless of its source, compacted fill should consist of approved materials that are free of organic matter and debris.

Soil Type [1]	USCS Classification	Acceptable Parameters (for Structural Fill)
Low Plasticity Soil	CL, SC	Liquid Limit less than 45, Plasticity index greater than 10 and less than 25
Imported Sand	SP, SP-SM	Less than 10% Passing No. 200 sieve

Soil Type [1]	USCS Classification	Acceptable Parameters (for Structural Fill)
Aggregate Base	GP, GM	LADOTD No. 610 Crushed Limestone or similarly graded crushed recycled concrete. [2]

1. Structural and general fill should consist of approved materials free of organic matter and debris. A sample of each material type should be submitted to the Geotechnical Engineer for evaluation prior to use on this site. Additional geotechnical consultation should be provided prior to use of uniformly graded gravel on the site.
2. Materials should meet the requirements of LSSRB Section 1033.03.

Fill Placement and Compaction Requirements

Structural and general fill should meet the following compaction requirements.

Item	Structural Fill	General Fill
Maximum Lift Thickness	9 inches or less in loose thickness when heavy, self-propelled compaction equipment is used. 4 to 6 inches in loose thickness when hand-guided equipment (i.e. jumping jack or plate compactor) is used.	Same as structural fill
Minimum Compaction Requirements [1,2,3]	95% of max. below foundations, floor slabs, and finished pavement subgrade. 100% of maximum dry density for aggregate base beneath pavement.	92% of max.
Water Content Range [1]	Low plasticity cohesive: 0% to +3% of optimum High plasticity cohesive: 0 to +4% of optimum Granular: 0% to +3% of optimum	As required to achieve min. compaction requirements.

1. Maximum density and optimum water content as determined by the standard Proctor test (ASTM D 698).
2. High plasticity cohesive fill should not be compacted to more than 100% of standard Proctor maximum dry density.
3. If the granular material is a coarse sand or gravel, or of a uniform size, or has a low fines content, compaction comparison to relative density may be more appropriate. In this case, granular materials should be compacted to at least 70% relative density (ASTM D 4253 and D 4254). Materials not amenable to density testing should be placed, compacted and conditioned at workable moisture levels to a stable condition observed without pumping when proofrolling by the Geotechnical Engineer or representative.

Utility Trench Backfill

Any soft or unsuitable materials encountered at the bottom of utility trench excavations should be removed and replaced with structural fill or bedding material in accordance with LADOTD or local public works specifications for the utility to be supported. This recommendation is particularly applicable to utility work requiring grade control and/or in areas where subsequent grade raising could cause settlement in the subgrade supporting the utility. Trench excavation should not be conducted below a downward 1:1 projection from existing foundations without engineering review of shoring requirements and geotechnical observation during construction.

On-site materials are considered suitable for backfill cover of utility and pipe trenches, provided the material is free of organic matter and deleterious substances.

Trench backfill should be mechanically placed and compacted as discussed earlier in this report. Compaction of initial lifts should be accomplished with hand-operated tampers or other lightweight compactors. Where trenches are placed beneath slabs or footings, the backfill should satisfy the gradation and expansion index requirements of structural fill discussed in this report. Flooding or jetting for placement and compaction of backfill is not recommended.

Grading and Drainage

All grades must provide effective drainage away from the building during and after construction and should be maintained throughout the life of the structure. Water retained next to the building can result in soil movements greater than those discussed in this report. Greater movements can result in unacceptable differential floor slab and/or foundation movements, cracked slabs and walls, and roof leaks. The roof should have gutters/drains with downspouts that discharge onto splash blocks at a distance of at least 10 feet from the building.

At project sites with minimal grade change and with developments and roads surrounding the construction area, it can be difficult to maintain positive drainage throughout the construction phase. The construction phase drainage should be considered in the development of the project overall grading and drainage plan. The possible poor drainage conditions can lead to instability in the areas around the building and hamper construction progress. The site grading and general contractor should consider their means and methods to maintain drainage during the construction phase. It is sometimes prudent to consider specifying chemical treatment of critical project access roads and construction laydown areas as part of the construction package to reduce potential weather-related delays as described above.

Exposed ground should be sloped and maintained at a minimum 5% away from the building for at least 10 feet beyond the perimeter of the building. Locally, flatter grades may be necessary to transition ADA access requirements for flatwork. After building construction and landscaping have been completed, final grades should be verified to document effective drainage has been achieved. Grades around the structure should also be periodically inspected and adjusted, as necessary, as part of the structure's maintenance program. Where paving or flatwork abuts the structure, a maintenance program should be established to effectively seal and maintain joints and prevent surface water infiltration.

Trees or other vegetation whose root systems can remove excessive moisture from the subgrade and foundation soils should not be planted next to the structure. Trees and shrubbery should be kept away from the exterior edges of the foundation element a distance at least equal to 1.5 times their expected mature height.

Earthwork Construction Considerations

Shallow excavations for the proposed structure are anticipated to be accomplished with conventional construction equipment. Upon completion of filling and grading, care should be taken to maintain the subgrade water content prior to construction of grade-supported improvements such as floor slabs and pavements. Construction traffic over the completed subgrades should be avoided. The site should also be graded to prevent ponding of surface water on the prepared subgrades or in excavations. Water collecting over or adjacent to construction areas should be removed. If the subgrade desiccates, saturates, or is disturbed, the affected material should be removed, or the materials should be scarified, moisture conditioned, and recompacted prior to floor slab construction.

The groundwater table could rise and affect overexcavation efforts, especially for overexcavation and replacement of lower strength soils. A temporary dewatering system consisting of sumps with pumps may be necessary to achieve the recommended depth of overexcavation depending on groundwater conditions at the time of construction.

As a minimum, excavations should be performed in accordance with OSHA 29 CFR, Part 1926, Subpart P, "Excavations" and its appendices, and in accordance with any applicable local and/or state regulations.

Construction site safety is the sole responsibility of the contractor who controls the means, methods, and sequencing of construction operations. Under no circumstances shall the information provided herein be interpreted to mean Terracon is assuming responsibility for construction site safety or the contractor's activities; such responsibility shall neither be implied nor inferred.

Excavations or other activities resulting in ground disturbance have the potential to affect adjoining properties and structures. Our scope of services does not include review of available final grading information or consider potential temporary grading performed by the contractor for possible effects such as ground movement beyond the project limits. A preconstruction/ precondition survey should be conducted to document nearby property/infrastructure prior to any site development activity. Excavation or ground disturbance activities adjacent property lines should be monitored or instrumented for potential ground movements that could negatively affect adjoining property and/or structures.

Construction Observation and Testing

The earthwork efforts should be observed by the Geotechnical Engineer (or others under their direction). Observation should include documentation of adequate removal of surficial materials (vegetation, topsoil, and pavements), evaluation and remediation of existing debris materials, moisture conditioning, as well as proofrolling and mitigation of unsuitable areas delineated by the proofroll.

Each lift of compacted fill should be tested, evaluated, and reworked, as necessary, as recommended by the Geotechnical Engineer prior to placement of additional lifts. Each lift of fill should be tested for density and water content at a frequency of at least one test for every 2,500 square feet of compacted fill in the building areas and 5,000 square feet in pavement areas. Where not specified by local ordinance, one density and water content test should be performed for every 100 linear feet of compacted utility trench backfill and a minimum of one test performed for every 12 vertical inches of compacted backfill.

In areas of foundation excavations, the bearing subgrade should be evaluated by the Geotechnical Engineer. If unanticipated conditions are observed, the Geotechnical Engineer should prescribe mitigation options.

In addition to the documentation of the essential parameters necessary for construction, the continuation of the Geotechnical Engineer into the construction phase of the project provides the continuity to maintain the Geotechnical Engineer's evaluation of subsurface conditions, including assessing variations and associated design changes.

Shallow Foundations

If the site has been prepared in accordance with the requirements noted in **Earthwork**, the following design parameters are applicable for shallow foundations.

Design Parameters – Compressive Loads

Item	Description
Maximum Net Allowable Bearing Pressure [1, 2]	1,500 psf - (Isolated columns and continuous footings)
Required Bearing Stratum [3]	GeoModel Layer 2 after moisture conditioning, 3 or undisturbed native soils or structural fill
Minimum Foundation Dimensions	Per IBC 1809.7
Ultimate Passive Resistance[4] **(equivalent fluid pressures)**	250 pcf (cohesive backfill) 350 pcf (granular backfill)
Sliding Resistance [5]	250 psf allowable cohesion (native/structural fill clay) 0.25 allowable coefficient of friction (granular material)
Minimum Embedment below Finished Grade [6]	Exterior footings: 18 inches Interior footings: 12 inches
Estimated Total Settlement from Structural Loads [2]	Less than about 1 inch
Estimated Differential Settlement [2, 7]	About 1/2 of total settlement

1. The maximum net allowable bearing pressure is the pressure in excess of the minimum surrounding overburden pressure at the footing base elevation. Values assume that exterior grades are no steeper than 20% within 10 feet of structure.
2. Values provided are for maximum loads noted in **Project Description**. Settlement is for structural loads and up to 2 feet of structural fill. Additional geotechnical consultation will be necessary if higher loads or fill heights are anticipated.
3. Unsuitable or soft soils should be overexcavated and replaced per the recommendations presented in **Earthwork**.
4. Use of passive earth pressures require the sides of the excavation for the spread footing foundation to be nearly vertical and the concrete placed neat against these vertical faces or that the footing forms be removed and compacted structural fill be placed against the vertical footing face. Assumes no hydrostatic pressure.
5. Can be used to compute sliding resistance where foundations are placed on suitable soil/materials. Frictional resistance for granular materials is dependent on the bearing pressure which may vary due to load combinations. A factor of safety of 1.5 was applied to this value. For fine-grained materials, lateral resistance using cohesion should not exceed ½ the dead load.
6. Embedment necessary to minimize the effects of seasonal water content variations. For sloping ground, maintain depth below the lowest adjacent exterior grade within 5 horizontal feet of the structure.
7. Differential settlements are noted for equivalent-loaded foundations and bearing elevation as measured over a span of 50 feet.

Design Parameters – Overturning and Uplift Loads

Shallow foundations subjected to overturning loads should be proportioned such that the resultant eccentricity is maintained in the center-third of the foundation (e.g., e < b/6, where b is the foundation width). This recommendation is intended to keep the entire foundation area in compression during the extreme lateral/overturning load event. Foundation oversizing may be required to satisfy this condition.

Uplift resistance of spread footings can be developed from the effective weight of the footing and the overlying soils with consideration to the IBC basic load combinations.

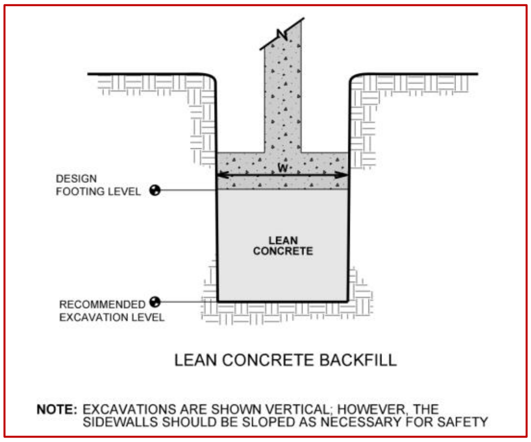
Item	Description
Soil Moist Unit Weight	115 pcf
Soil Effective Unit Weight [1]	53 pcf
Soil weight included in uplift resistance	Soil included within the prism extending up from the top perimeter of the footing at an angle of 20 degrees from vertical to ground surface

1. Effective (or buoyant) unit weight should be used for soil above the foundation level and below a water level. The high groundwater level should be used in uplift design as applicable.

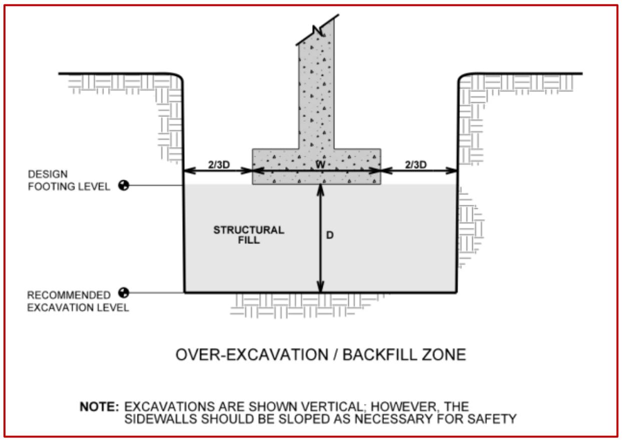
Foundation Construction Considerations

As noted in **Earthwork**, the footing excavations should be evaluated under the observation of the Geotechnical Engineer. The base of all foundation excavations should be free of water and loose soil, prior to placing concrete. Concrete should be placed soon after excavating to reduce bearing soil disturbance. Care should be taken to prevent wetting or drying of the bearing materials during construction. Excessively wet or dry material or any loose/disturbed material in the bottom of the footing excavations should be removed/reconditioned before foundation concrete is placed.

If unsuitable bearing soils are observed at the base of the planned footing excavation, the excavation should be extended deeper to suitable soils, and the footings could bear directly on these soils at the lower level or on lean concrete backfill placed in the excavations. The lean concrete replacement zone is illustrated on the sketch below.



Overexcavation for structural fill placement below footings should be conducted as shown below. The overexcavation should be backfilled up to the footing base elevation, with structural soil fill or crushed stone wrapped in non-woven geotextile fabric placed, as recommended in the **Earthwork** section.



Floor Slabs

Design parameters for floor slabs assume the requirements for **Earthwork** have been followed. Specific attention should be given to positive drainage away from the structure and positive drainage of the aggregate base beneath the floor slab.

Existing debris materials were observed. As previously described, any existing debris present beneath floor slabs should be completely removed. The final subgrade should be moisture conditioned as described previously.

Floor Slab Design Parameters

Item	Description
Floor Slab Support[1]	Use around 4 inches base course meeting material specifications of ACI 302 Subgrade grubbed, moisture conditioned and compacted to recommendations in **Earthwork**
Estimated Modulus of Subgrade Reaction [2]	125 pounds per square inch per inch (psi/in) for point loads

1. Floor slabs should be structurally independent of building footings or walls to reduce the possibility of floor slab cracking caused by differential movements between the slab and foundation.
2. Modulus of subgrade reaction is an estimated value based upon our experience with the subgrade condition, the requirements noted in **Earthwork**, and the floor slab support as noted in this table. It is provided for point loads. For large area loads the modulus of subgrade reaction would be lower.

The use of a vapor retarder should be considered beneath concrete slabs on grade covered with wood, tile, carpet, or other moisture sensitive or impervious coverings, when the project includes humidity-controlled areas, or when the slab will support equipment sensitive to moisture. When conditions warrant the use of a vapor retarder, the slab designer should refer to ACI 302 and/or ACI 360 for procedures and cautions regarding the use and placement of a vapor retarder.

Saw-cut contraction joints should be placed in the slab to help control the location and extent of cracking. For additional recommendations, refer to the ACI Design Manual. Joints or cracks should be sealed with a waterproof, non-extruding compressible compound specifically recommended for heavy duty concrete pavement and wet environments.

Where floor slabs are tied to perimeter walls or turn-down slabs to meet structural or other construction objectives, our experience indicates differential movement between the walls and slabs will likely be observed in adjacent slab expansion joints or floor slab cracks beyond the length of the structural dowels. The Structural Engineer should account for potential differential settlement through use of sufficient control joints, appropriate reinforcing or other means.

Floor Slab Construction Considerations

Finished subgrade, within and for at least 10 feet beyond the floor slab, should be protected from traffic, rutting, or other disturbance and maintained in a relatively moist condition until floor slabs are constructed. If the subgrade should become damaged or desiccated prior to construction of floor slabs, the affected material should be removed, and structural fill should be added to replace the resulting excavation. Final conditioning of the finished subgrade should be performed immediately prior to placement of the floor slab support course.

The Geotechnical Engineer should observe the condition of the floor slab subgrades immediately prior to placement of the floor slab support course, reinforcing steel, and concrete. Attention should be paid to high traffic areas that were rutted and disturbed earlier, and to areas where backfilled trenches are located.

Lateral Earth Pressures

Design Parameters

Earth pressures will be influenced by structural design of the walls, conditions of wall restraint, methods of construction, and/or compaction and the strength of the materials being restrained. Active earth pressure is commonly used for design of free-standing cantilever retaining walls and assumes wall movement. The "at-rest" condition assumes no wall movement and is commonly used for basement walls, loading dock walls, or other walls restrained at the top. The recommended design lateral earth pressures do not include a factor of safety and do not provide for possible hydrostatic pressure on the walls (unless stated).

Lateral Earth Pressure Design Parameters

Earth Pressure Condition [1]	Coefficient for Backfill Type [2]	Surcharge Pressure [3] p_1 (psf)	Equivalent Fluid Pressures (psf) [2,4]	
			Unsaturated [5]	Submerged [5]
Active (Ka)	Granular - 0.31 Fine Grained - 0.41	(0.31)S (0.41)S	(40)H (50)H	(80)H (85)H
At-Rest (Ko)	Granular - 0.47 Fine Grained - 0.58	(0.47)S (0.58)S	(55)H (70)H	(90)H (95)H

1. For active earth pressure, wall must rotate about base, with top lateral movements 0.002 H to 0.004 H, where H is wall height. For passive earth pressure, wall must move horizontally to mobilize resistance. Fat clay or other expansive soils should not be used as backfill behind the wall.
2. Uniform, horizontal backfill, with a maximum unit weight of 120 pcf for cohesive soils and 125 pcf for granular soils.
3. Uniform surcharge, where S is surcharge pressure.
4. Loading from heavy compaction equipment is not included.

Lateral Earth Pressure Design Parameters

Earth Pressure Condition [1]	Coefficient for Backfill Type [2]	Surcharge Pressure [3] p_1 (psf)	Equivalent Fluid Pressures (psf) [2,4]	
			Unsaturated [5]	Submerged [5]

5. To achieve "Unsaturated" conditions, follow guidelines in **Subsurface Drainage for Below-Grade Walls** below. "Submerged" conditions are recommended when drainage behind walls is not incorporated into the design.

Backfill placed against structures should consist of granular soils or low plasticity cohesive soils. For the granular values to be valid, the granular backfill must extend out and up from the base of the wall at an angle of at least 45 degrees from vertical for the active case.

Footings, floor slabs or other loads bearing on backfill behind walls may have a significant influence on the lateral earth pressure. Placing footings within wall backfill and in the zone of active soil influence on the wall should be avoided unless structural analyses indicate the wall can safely withstand the increased pressure.

The lateral earth pressure recommendations given in this section are applicable to the design of rigid retaining walls subject to slight rotation, such as cantilever, or gravity type concrete walls. These recommendations are not applicable to the design of modular block - geogrid reinforced backfill walls (also termed MSE walls). Recommendations covering these types of wall systems are beyond the scope of services for this assignment. However, we would be pleased to develop a proposal for evaluation and design of such wall systems upon request.

Subsurface Drainage for Below-Grade Walls

A perforated rigid plastic drain line installed behind the base of walls and extends below adjacent grade is recommended to prevent hydrostatic loading on the walls. The invert of a drain line around a below-grade building area or exterior retaining wall should be placed near foundation bearing level. The drain line should be sloped to provide positive gravity drainage to daylight or to a sump pit and pump. The drain line should be surrounded by clean, free-draining granular material having less than 5% passing the No. 200 sieve, such as No. 57 aggregate. The free-draining aggregate should be encapsulated in a filter fabric. The granular fill should extend to within 2 feet of final grade, where it should be capped with compacted cohesive fill to reduce infiltration of surface water into the drain system.

As an alternative to free-draining granular fill, a prefabricated drainage structure may be used. A prefabricated drainage structure is a plastic drainage core or mesh which is covered with filter fabric to prevent soil intrusion and is fastened to the wall prior to placing backfill.

Pavements

General Pavement Comments

Pavement designs are provided for the traffic conditions and pavement life conditions as noted in **Project Description** and in the following sections of this report. A critical aspect of pavement performance is site preparation. Pavement designs noted in this section must be applied to the site which has been prepared as recommended in the **Earthwork** section.

Support characteristics of subgrade for pavement design do not account for shrink/swell movements of an expansive clay subgrade. Thus, the pavement may be adequate from a structural standpoint, yet still experience cracking and deformation due to shrink/swell related movement of the subgrade without conditioning.

Pavement Design Parameters

An estimated California Bearing Ratio (CBR) of 3 and a modulus of subgrade reaction of 100 pci was used for the portland cement concrete (PCC) pavement designs. The value was empirically derived based upon our experience with the Lean Clay subgrade soils and our expectation of the quality of the subgrade as prescribed by the **Site Preparation** conditions as outlined in **Earthwork**. A modulus of rupture of 550 psi was used in design for the concrete (based on correlations with a minimum 28-day compressive strength of 4,000 psi).

Pavement Section Thicknesses

The following table provides our estimated minimum thickness of PCC pavements.

Portland Cement Concrete Design

Layer	Thickness (inches)			
	Traffic Category A [1]	Traffic Category B [1]	Traffic Category D [1]	Traffic Category E [1]
PCC [2]	5	6	7	8
Aggregate Base [2]	4	4	4	4

1. See **Project Description** for more specifics regarding traffic classifications.
2. All materials should meet the current Louisiana Department of Transportation Specifications for Roads and Bridges (LSSRB).

Portland Cement Concrete Design

Layer	Thickness (inches)			
	Traffic Category A [1]	Traffic Category B [1]	Traffic Category D [1]	Traffic Category E [1]

- Concrete Pavement - LSSRB 2016: Section 601
- Aggregate base - LSSRB 2016 No. 610 limestone or similarly graded recycled crushed concrete: Section 1033.03

Areas for parking of heavy vehicles, concentrated turn areas, and start/stop maneuvers could require thicker pavement sections. Edge restraints (i.e. concrete curbs or aggregate shoulders) should be planned along curves and areas of maneuvering vehicles.

Although not required for structural support, a minimum 4-inch thick dense graded base course layer is recommended to help reduce potential for slab curl, shrinkage cracking, and subgrade pumping through joints. Proper joint spacing will also be required to prevent excessive slab curling and shrinkage cracking. Joints should be sealed to prevent entry of foreign material and doweled where necessary for load transfer. PCC pavement details for joint spacing, joint reinforcement, and joint sealing should be prepared in accordance with ACI 330 and ACI 325.

Where practical, we recommend early-entry cutting of crack-control joints in PCC pavements. Cutting of the concrete in its "green" state typically reduces the potential for micro-cracking of the pavements prior to the crack control joints being formed, compared to cutting the joints after the concrete has fully set. Micro-cracking of pavements may lead to crack formation in locations other than the sawed joints, and/or reduction of fatigue life of the pavement.

Openings in pavements, such as decorative landscaped areas, are sources for water infiltration into surrounding pavement systems. Water can collect in the islands and migrate into the surrounding subgrade soils thereby degrading support of the pavement. Islands with raised concrete curbs, irrigated foliage, and low permeability near-surface soils are particular areas of concern. The civil design for the pavements with these conditions should include features to restrict or collect and discharge excess water from the islands. Examples of features are edge drains connected to the stormwater collection system, longitudinal subdrains, or other suitable outlets and impermeable barriers preventing lateral migration of water such as a cutoff wall installed to a depth below the pavement structure.

Pavement Drainage

Pavements should be sloped to provide rapid drainage of surface water. Water allowed to pond on or adjacent to the pavements could saturate the subgrade and contribute to premature pavement deterioration. In addition, the pavement subgrade should be graded to provide positive drainage within the granular base section.

Pavement Maintenance

The pavement sections represent minimum recommended thicknesses and, as such, periodic upkeep should be anticipated. Preventive maintenance should be planned and provided for through an on-going pavement management program. Maintenance activities are intended to slow the rate of pavement deterioration and to preserve the pavement investment. Pavement care consists of both localized (e.g., crack and joint sealing and patching) and global maintenance (e.g., surface sealing). Additional engineering consultation is recommended to determine the type and extent of a cost-effective program. Even with periodic maintenance, some movements and related cracking may still occur, and repairs may be required.

Pavement performance is affected by its surroundings. In addition to providing preventive maintenance, the civil engineer should consider the following recommendations in the design and layout of pavements:

- Final grade adjacent to paved areas should slope down from the edges at a minimum 2%.
- Subgrade and pavement surfaces should have a minimum 2% slope to promote proper surface drainage.
- Install pavement drainage systems surrounding areas anticipated for frequent wetting.
- Place 8 inches of compacted dense graded crushed stone around drop inlet basins extending at least 8 inches from the perimeter to reduce settlement at pavement interface
- Install joint sealant and seal cracks immediately.
- Seal all landscaped areas in or adjacent to pavements to reduce moisture migration to subgrade soils.
- Place compacted, low permeability backfill against the exterior side of curb and gutter.
- Place curb, gutter and/or sidewalk directly on clay subgrade soils rather than on unbound granular base course materials.

General Comments

Our analysis and opinions are based upon our understanding of the project, the geotechnical conditions in the area, and the data obtained from our site exploration. Variations will occur between exploration point locations or due to the modifying effects of construction or weather. The nature and extent of such variations may not become evident until during or after construction. Terracon should be retained as the Geotechnical Engineer, where noted in this report, to provide observation and testing services during pertinent construction phases. If variations appear, we can provide further evaluation and supplemental recommendations. If variations are noted in the absence of our observation and testing services on-site, we should be immediately notified so that we can provide evaluation and supplemental recommendations.

Our Scope of Services does not include either specifically or by implication any environmental or biological (e.g., mold, fungi, bacteria) assessment of the site or identification or prevention of pollutants, hazardous materials or conditions. If the owner is concerned about the potential for such contamination or pollution, other studies should be undertaken.

Our services and any correspondence are intended for the sole benefit and exclusive use of our client for specific application to the project discussed and are accomplished in accordance with generally accepted geotechnical engineering practices with no third-party beneficiaries intended. Any third-party access to services or correspondence is solely for information purposes to support the services provided by Terracon to our client. Reliance upon the services and any work product is limited to our client and is not intended for third parties. Any use or reliance of the provided information by third parties is done solely at their own risk. No warranties, either express or implied, are intended or made.

Site characteristics as provided are for design purposes and not to estimate excavation cost. Any use of our report in that regard is done at the sole risk of the excavating cost estimator as there may be variations on the site that are not apparent in the data that could significantly effect excavation cost. Any parties charged with estimating excavation costs should seek their own site characterization for specific purposes to obtain the specific level of detail necessary for costing. Site safety and cost estimating including excavation support and dewatering requirements/design are the responsibility of others. Construction and site development have the potential to affect adjacent properties. Such impacts can include damages due to vibration, modification of groundwater/surface water flow during construction, foundation movement due to undermining or subsidence from excavation, as well as noise or air quality concerns. Evaluation of these items on nearby properties are commonly associated with contractor means and methods and are not addressed in this report. The owner and contractor should consider a preconstruction/precondition survey of surrounding development. If changes in the nature, design, or location of the project are planned, our conclusions and recommendations shall not be considered valid unless we review the changes and either verify or modify our conclusions in writing.

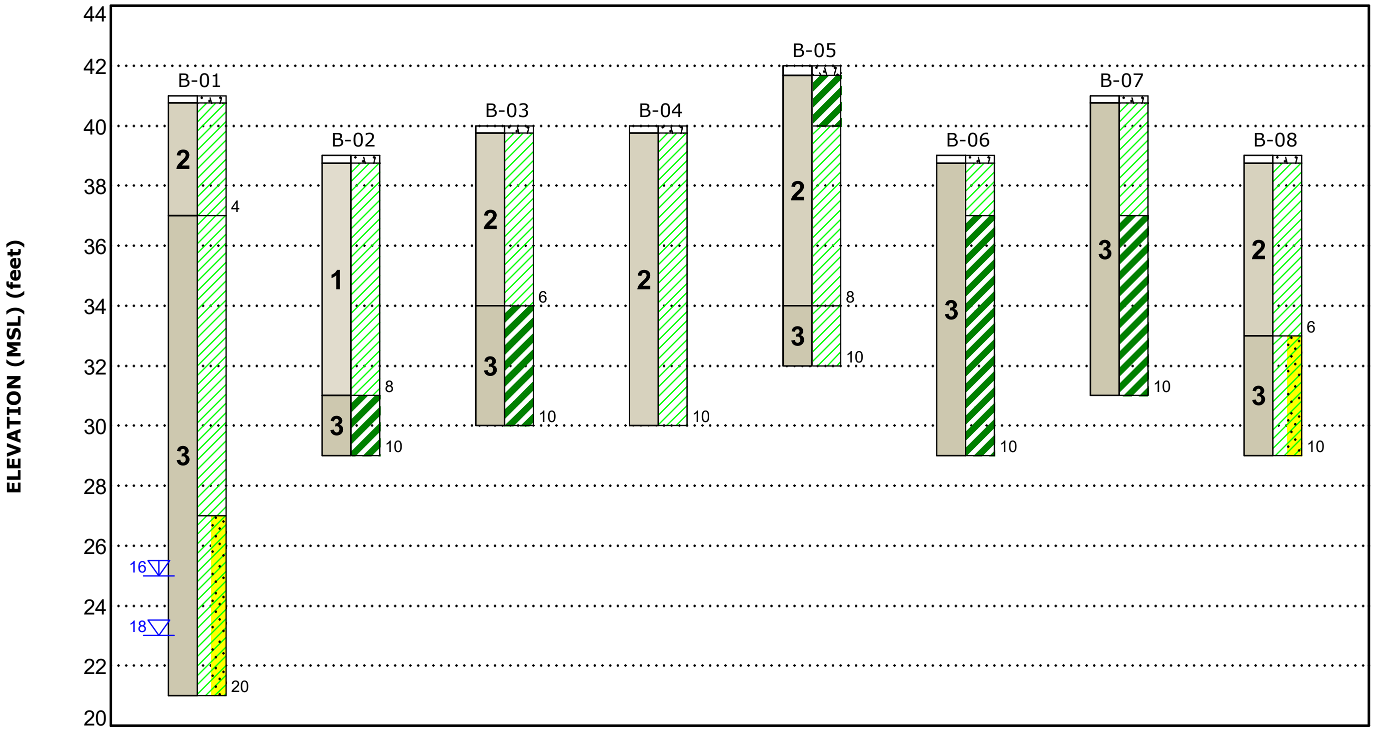
Figures

Contents:

Note: All attachments are one page unless noted above.

Terracon
2822 O'Neal Ln, Bldg B
Baton Rouge, LA

GeoModel



This is not a cross section. This is intended to display the Geotechnical Model only. See individual logs for more detailed conditions.

Model Layer	Layer Name	General Description
1	**Soil with Debris**	Brown to tan, lean clay with rubble debris to 2 to 4 feet
2	**Dry Subgrade**	Brown and gray, stiff to very stiff, lean clay, with gravel to 1 foot, dry moisture condition in the top 4 to 6 feet
3	**Typical Clays**	Tan and gray, stiff to very stiff, lean clay, lean clay with sand to fat clay

Legend

Topsoil | Lean Clay | Lean Clay with Sand | Fat Clay

First Water Observation
Second Water Observation

Groundwater levels are temporal. The levels shown are representative of the date and time of our exploration. Significant changes are possible over time.
Water levels shown are as measured during and/or after drilling. In some cases, boring advancement methods mask the presence/absence of groundwater. See individual logs for details.

NOTES:
Layering shown on this figure has been developed by the geotechnical engineer for purposes of modeling the subsurface conditions as required for the subsequent geotechnical engineering for this project.
Numbers adjacent to soil column indicate depth below ground surface.

Attachments

Exploration and Testing Procedures

Field Exploration

Number of Locations	Type of Exploration	Planned Termination Depth (feet)	Planned Location
1	Soil Boring	20	Building area
1	Soil Boring	10	Building area
6	Soil Boring	10	Parking area

Boring Layout and Elevations: Terracon personnel provided the boring layout using handheld GPS equipment (estimated horizontal accuracy of about ±10 feet) and referencing existing site features. Approximate ground surface elevations were estimated using Google Earth imagery. If elevations and a more precise boring layout are desired, we recommend borings be surveyed.

Subsurface Exploration Procedures: We advanced the borings with a track-mounted rotary drill rig using continuous flight augers (solid stem) to a depth of around 20 feet. Five samples were obtained in the upper 10 feet of each boring and at intervals of 5 feet thereafter. In the thin-walled tube sampling procedure, a thin-walled, seamless steel tube with a sharp cutting edge was pushed hydraulically into the soil to obtain a relatively undisturbed sample. We observed and recorded groundwater levels during drilling and sampling. For safety purposes, all borings were backfilled with auger cuttings after their completion, consistent with state regulations.

The sampling depths, penetration distances, and other sampling information was recorded on the field boring logs. The samples were placed in appropriate containers and taken to our soil laboratory for testing and classification by a Geotechnical Engineer. Our exploration team prepared field boring logs as part of the drilling operations. These field logs included visual classifications of the materials observed during drilling and our interpretation of the subsurface conditions between samples. Final boring logs were prepared from the field logs. The final boring logs represent the Geotechnical Engineer's interpretation of the field logs and include modifications based on observations and tests of the samples in our laboratory.

Laboratory Testing

The project engineer reviewed the field data and assigned laboratory tests. The laboratory testing program included the following types of tests:

- Moisture Content

- Atterberg Limits
- Dry Unit Weight
- Unconfined Compression
- Grain size analysis

The laboratory testing program often included examination of soil samples by an engineer. Based on the results of our field and laboratory programs, we described and classified the soil samples in accordance with the Unified Soil Classification System.

Site Location and Exploration Plans

Contents:

Note: All attachments are one page unless noted above.

Site Location

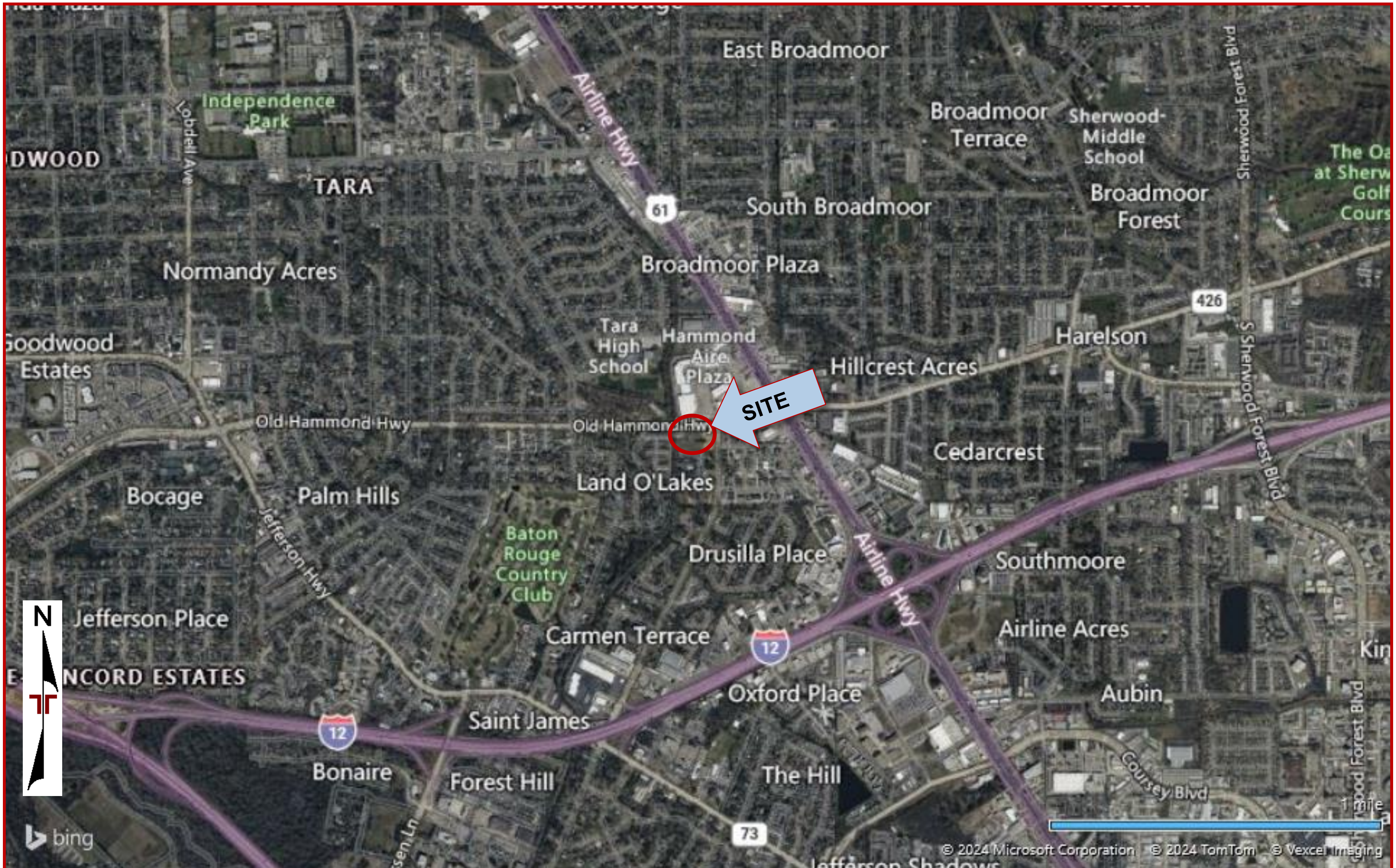


DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

MAP PROVIDED BY MICROSOFT BING MAPS

Exploration Plan

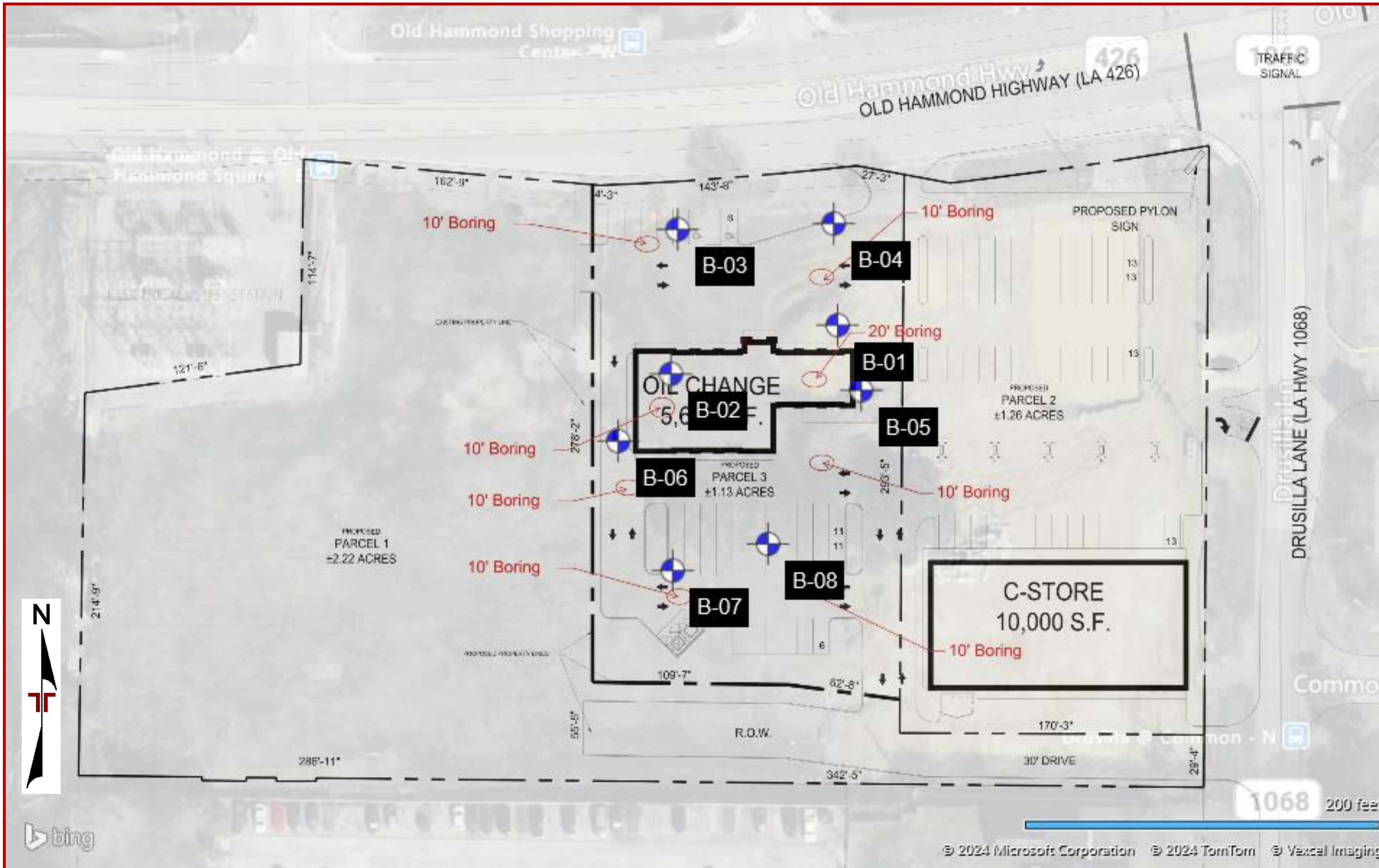


DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

MAP PROVIDED BY MICROSOFT BING MAPS

Exploration and Laboratory Results

Contents:

Note: All attachments are one page unless noted above.

Terracon
2822 O'Neal Ln, Bldg B
Baton Rouge, LA

Boring Log No. B-01

Location: See Exploration Plan

Latitude: 30.4306° Longitude: -91.0848°

Depth (Ft.) Elevation: 41 (Ft.) +/-

Model Layer	Depth (Ft.)	Material Description	Elevation	Sample Depth Interval (Ft.)	Water Level Observations	Field Test Results	Test Type	Compressive Strength (tsf)	Strain (%)	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits LL-PL-PI	Percent Fines
	0.3	**3" TOPSOIL**	40.75	0-1		--							
2		**LEAN CLAY (CL)**, brown and gray, dry, very stiff - with gravel to 1 foot - becoming tan below 2 feet		1-2		--				12.5		45-21-24	
	4.0		37	2-4		4.00 (HP)	UC	2.41	9.7	19.3	102		
3		**LEAN CLAY (CL)**, tan and gray, stiff to very stiff		4-6		3.00 (HP)	UC	1.02	8.8	25.7	95		
				6-8		4.00 (HP)							
				8-10		2.75 (HP)	UC	1.73	15	24.2	100		
				11-13		2.75 (HP)							
	14.0		27										
		LEAN CLAY WITH SAND (CL), gray and tan, soft to medium stiff		14-16	∇ While drilling (16 ft)	3.00 (HP)				19.4			
					∇ After 15 minutes (18 ft)								
	20.0		21	18-20		3.50 (HP)	UC	0.43	9.5	29.8	100	31-18-13	73

Boring Terminated at 20 Feet

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).
See Supporting Information for explanation of symbols and abbreviations.
Elevation Reference: Elevation determined from Google Earth.

Water Level Observations
∇ While drilling
∇ After 15 minutes

Drill Rig
GP385

Driller
G. Triplette

Notes

Advancement Method
0'-20' Continuous Flight Auger

Abandonment Method
Boring backfilled with soil cuttings upon completion.

Logged by
K. Sylve

Boring Started
05-30-2024

Boring Completed
05-30-2024

Terracon
2822 O'Neal Ln, Bldg B
Baton Rouge, LA

Boring Log No. B-02

Location: See Exploration Plan

Latitude: 30.4305° Longitude: -91.0851°

Model Layer	Graphic Log	Depth (Ft.) / Description / Elevation: 39 (Ft.) +/-	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	Strength Test: Test Type	Strength Test: Compressive Strength (tsf)	Strength Test: Strain (%)	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits LL-PL-PI	Percent Fines
		0.3 **3" TOPSOIL** 38.75											
1		**LEAN CLAY (CL)**, brown and tan, stiff to very stiff - with rubble to 2 feet				4.00 (HP)	UC	1.97	8.8	11.5	113	33-18-15	
						4.00 (HP)				16.3			
						3.00 (HP)				24.6			
			5			1.50 (HP)	UC	2.09	15	19.8	110	39-19-20	
		8.0 31				2.75 (HP)							
3		**FAT CLAY (CH)**, brown and gray, medium stiff to stiff - low strain failure at 8 to 10 feet 10.0 29				2.25 (HP)	UC	0.96	2.3	32.6	90		
		Boring Terminated at 10 Feet	10										

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).
See Supporting Information for explanation of symbols and abbreviations.
Elevation Reference: Elevation determined from Google Earth.

Notes

Water Level Observations
Groundwater not encountered

Advancement Method
0'-10' Continuous Flight Auger

Abandonment Method
Boring backfilled with soil cuttings upon completion.

Drill Rig
GP385

Driller
G. Triplette

Logged by
K. Sylve

Boring Started
05-30-2024

Boring Completed
05-30-2024

Terracon
2822 O'Neal Ln, Bldg B
Baton Rouge, LA

Boring Log No. B-03

Location: See Exploration Plan

Latitude: 30.4307° Longitude: -91.0851°

Model Layer	Graphic Log	Depth (Ft.)	Material Description	Elevation: 40 (Ft.) +/-	Water Level Observations	Sample Type	Field Test Results	Strength Test: Test Type	Strength Test: Compressive Strength (tsf)	Strength Test: Strain (%)	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits LL-PL-PI	Percent Fines
		0.3	**3" TOPSOIL**	39.75			--				12.6			
2			**LEAN CLAY (CL)**, tan, dry, with rubble				--				19.7		43-20-23	
							--				8.6			
		6.0		34			--				16.1			
3			**FAT CLAY (CH)**, tan and gray, stiff				1.75 (HP)							
		10.0		30			2.50 (HP)				33.5			
			Boring Terminated at 10 Feet											

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).
See Supporting Information for explanation of symbols and abbreviations.
Elevation Reference: Elevation determined from Google Earth.

Water Level Observations
Groundwater not encountered

Drill Rig
GP385

Driller
G. Triplette

Notes

Advancement Method
0'-10' Continuous Flight Auger

Abandonment Method
Boring backfilled with soil cuttings upon completion.

Logged by
K. Sylve

Boring Started
05-30-2024

Boring Completed
05-30-2024

Terracon
2822 O'Neal Ln, Bldg B
Baton Rouge, LA

Boring Log No. B-04

Location: See Exploration Plan

Latitude: 30.4308° Longitude: -91.0848°

Model Layer	Graphic Log	Depth (Ft.) / Description / Elevation: 40 (Ft.) +/-	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	Strength Test: Test Type	Strength Test: Compressive Strength (tsf)	Strength Test: Strain (%)	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits LL-PL-PI	Percent Fines
		0.3 **3" TOPSOIL** 39.75				4.00 (HP)				11.5		28-13-15	
2		**LEAN CLAY (CL)**, tan, brown, and gray, stiff to very stiff - dry, with gravel to 1 foot				4.00 (HP)				18.6			
						4.00 (HP)							
			5			3.00 (HP)				25.5			
						2.50 (HP)							
		10.0 30	10			4.00 (HP)				26.1			

Boring Terminated at 10 Feet

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).
See Supporting Information for explanation of symbols and abbreviations.
Elevation Reference: Elevation determined from Google Earth.

Water Level Observations
Groundwater not encountered

Drill Rig
GP385

Driller
G. Triplette

Notes

Advancement Method
0'-10' Continuous Flight Auger

Abandonment Method
Boring backfilled with soil cuttings upon completion.

Logged by
K. Sylve

Boring Started
05-30-2024

Boring Completed
05-30-2024

Express Oil Change
Old Hammond Highway | Baton Rouge, LA
Terracon Project No. EH245089

Terracon
2822 O'Neal Ln, Bldg B
Baton Rouge, LA

Boring Log No. B-05

Location: See Exploration Plan

Latitude: 30.4305° Longitude: -91.0848°

Elevation: 42 (Ft.) +/-

Model Layer	Graphic Log	Depth (Ft.)	Material Description	Elevation (Ft.)	Water Level Observations	Sample Type	Field Test Results	Test Type	Compressive Strength (tsf)	Strain (%)	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits LL-PL-PI	Percent Fines
		0.3	**4" TOPSOIL**	41.67										
2			**FAT CLAY (CH)**, tan, gray, and brown, dry, very stiff to hard				4.50 (HP)				10.6		50-24-26	
							4.00 (HP)	UC	3.72	8.3	11.1	100		
		2.0		40										
			LEAN CLAY (CL), tan, gray, and brown, dry, hard				4.50 (HP)							
		5					4.50 (HP)	UC	5.20	4.6	11.1	119	47-15-32	
							4.50 (HP)							
		8.0		34										
3			**LEAN CLAY (CL)**, gray, medium stiff to stiff				2.25 (HP)	UC	0.81	14.9	20.6	105		
		10.0		32										

Boring Terminated at 10 Feet

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).
See Supporting Information for explanation of symbols and abbreviations.
Elevation Reference: Elevation determined from Google Earth.

Notes

Water Level Observations
Groundwater not encountered

Advancement Method
0'-10' Continuous Flight Auger

Abandonment Method
Boring backfilled with soil cuttings upon completion.

Drill Rig
GP385

Driller
G. Triplette

Logged by
K. Sylve

Boring Started
05-30-2024

Boring Completed
05-30-2024

Terracon
2822 O'Neal Ln, Bldg B
Baton Rouge, LA

Boring Log No. B-06

Location: See Exploration Plan

Latitude: 30.4304° Longitude: -91.0852°

Depth (Ft.) Elevation: 39 (Ft.) +/-

Model Layer	Graphic Log	Material Description	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	Strength Test: Test Type	Strength Test: Compressive Strength (tsf)	Strength Test: Strain (%)	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits LL-PL-PI	Percent Fines
		0.3 **3" TOPSOIL** 38.75											
3		**LEAN CLAY (CL)**, tan and gray - trace gravel to 1 foot				--				17.2		37-18-19	
		2.0 37				1.25 (HP)				29.1			
		FAT CLAY (CH), tan and gray, stiff to very stiff				2.00 (HP)							
			5			1.75 (HP)				25.6			
						2.00 (HP)							
		10.0 29	10			1.75 (HP)				32.6			
		Boring Terminated at 10 Feet											

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).
See Supporting Information for explanation of symbols and abbreviations.
Elevation Reference: Elevation determined from Google Earth.

Water Level Observations
Groundwater not encountered

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Notes

Advancement Method
0'-10' Continuous Flight Auger

Abandonment Method
Boring backfilled with soil cuttings upon completion.

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Terracon
2822 O'Neal Ln, Bldg B
Baton Rouge, LA

Boring Log No. B-07

Location: See Exploration Plan

Latitude: 30.4302° Longitude: -91.0851°

Model Layer	Graphic Log	Depth (Ft.) / Material Description / Elevation: 41 (Ft.) +/-	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	Strength Test: Test Type	Strength Test: Compressive Strength (tsf)	Strength Test: Strain (%)	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits LL-PL-PI	Percent Fines
3		0.3 **3" TOPSOIL** 40.75											
		LEAN CLAY (CL), brown and gray, very stiff - with gravel to 1 foot				4.00 (HP)				19.8			
						2.75 (HP)				21.6		38-21-17	
						2.75 (HP)							
		4.0 37											
		FAT CLAY (CH), brown and gray, stiff to very stiff	5			2.75 (HP)				28.9			
						2.75 (HP)							
						2.75 (HP)				33.3			
		10.0 31	10										
		Boring Terminated at 10 Feet											

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).
See Supporting Information for explanation of symbols and abbreviations.
Elevation Reference: Elevation determined from Google Earth.

Water Level Observations
Groundwater not encountered

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Notes

Advancement Method
0'-10' Continuous Flight Auger

Abandonment Method
Boring backfilled with soil cuttings upon completion.

Logged by
K. Sylve

Boring Started
05-30-2024

Boring Completed
05-30-2024

Terracon
2822 O'Neal Ln, Bldg B
Baton Rouge, LA

Boring Log No. B-08

Location: See Exploration Plan

Latitude: 30.4303° Longitude: -91.0849°

Elevation: 39 (Ft.) +/-

Model Layer	Depth (Ft.)	Material Description	Elevation (Ft.)	Sample Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	Test Type	Compressive Strength (tsf)	Strain (%)	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits LL-PL-PI	Percent Fines
	0.3	**3" TOPSOIL**	38.75											
2		**LEAN CLAY (CL)**, tan, gray, and brown, dry, stiff to very stiff		0-1			4.50 (HP)				10.1		35-21-14	
				1-2			4.50 (HP)				12.7			
				2-4			4.50 (HP)							
	6.0		33	4-6			3.00 (HP)				14.9			
3		**LEAN CLAY WITH SAND (CL)**, gray, stiff to very stiff		6-8			2.50 (HP)							
	10.0		29	8-10			1.75 (HP)				22.8			
		Boring Terminated at 10 Feet												

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).
See Supporting Information for explanation of symbols and abbreviations.
Elevation Reference: Elevation determined from Google Earth.

Water Level Observations
Groundwater not encountered

Drill Rig
GP385

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Notes

Advancement Method
0'-10' Continuous Flight Auger

Abandonment Method
Boring backfilled with soil cuttings upon completion.

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05-30-2024

Boring Completed
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Supporting Information

Contents:

Note: All attachments are one page unless noted above.

Terracon
2822 O'Neal Ln, Bldg B
Baton Rouge, LA

General Notes

Sampling	Water Level	Field Tests
Auger Cuttings; Shelby Tube	Water Initially Encountered Water Level After a Specified Period of Time Water Level After a Specified Period of Time Cave In Encountered Water levels indicated on the soil boring logs are the levels measured in the borehole at the times indicated. Groundwater level variations will occur over time. In low permeability soils, accurate determination of groundwater levels is not possible with short term water level observations.	(HP) Hand Penetrometer (tsf) UC Unconfined Compressive Strength

Descriptive Soil Classification

Soil classification as noted on the soil boring logs is based Unified Soil Classification System. Where sufficient laboratory data exist to classify the soils consistent with ASTM D2487 "Classification of Soils for Engineering Purposes" this procedure is used. ASTM D2488 "Description and Identification of Soils (Visual-Manual Procedure)" is also used to classify the soils, particularly where insufficient laboratory data exist to classify the soils in accordance with ASTM D2487. In addition to USCS classification, coarse grained soils are classified on the basis of their in-place relative density, and fine-grained soils are classified on the basis of their consistency. See "Strength Terms" table below for details. The ASTM standards noted above are for reference to methodology in general. In some cases, variations to methods are applied as a result of local practice or professional judgment.

Location And Elevation Notes

Exploration point locations as shown on the Exploration Plan and as noted on the soil boring logs in the form of Latitude and Longitude are approximate. See Exploration and Testing Procedures in the report for the methods used to locate the exploration points for this project. Surface elevation data annotated with +/- indicates that no actual topographical survey was conducted to confirm the surface elevation. Instead, the surface elevation was approximately determined from topographic maps of the area.

Strength Terms

Relative Density of Coarse-Grained Soils (More than 50% retained on No. 200 sieve.) Density determined by Standard Penetration Resistance		**Consistency of Fine-Grained Soils** (50% or more passing the No. 200 sieve.) Consistency determined by laboratory shear strength testing, field visual-manual procedures or standard penetration resistance		
Relative Density	**Standard Penetration or N-Value (Blows/Ft.)**	**Consistency**	**Unconfined Compressive Strength Qu (tsf)**	**Standard Penetration or N-Value (Blows/Ft.)**
Very Loose	0 - 3	Very Soft	less than 0.25	0 - 1
Loose	4 - 9	Soft	0.25 to 0.50	2 - 4
Medium Dense	10 - 29	Medium Stiff	0.50 to 1.00	4 - 8
Dense	30 - 50	Stiff	1.00 to 2.00	8 - 15
Very Dense	> 50	Very Stiff	2.00 to 4.00	15 - 30
		Hard	> 4.00	> 30

Relevance of Exploration and Laboratory Test Results

Exploration/field results and/or laboratory test data contained within this document are intended for application to the project as described in this document. Use of such exploration/field results and/or laboratory test data should not be used independently of this document.

Unified Soil Classification System

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests [A]				Soil Classification	
				Group Symbol	**Group Name** [B]
Coarse-Grained Soils: More than 50% retained on No. 200 sieve	**Gravels:** More than 50% of coarse fraction retained on No. 4 sieve	**Clean Gravels:** Less than 5% fines [C]	$Cu \geq 4$ and $1 \leq Cc \leq 3$ [E]	GW	Well-graded gravel [F]
			$Cu < 4$ and/or $[Cc < 1$ or $Cc > 3.0]$ [E]	GP	Poorly graded gravel [F]
		Gravels with Fines: More than 12% fines [C]	Fines classify as ML or MH	GM	Silty gravel [F, G, H]
			Fines classify as CL or CH	GC	Clayey gravel [F, G, H]
	Sands: 50% or more of coarse fraction passes No. 4 sieve	**Clean Sands:** Less than 5% fines [D]	$Cu \geq 6$ and $1 \leq Cc \leq 3$ [E]	SW	Well-graded sand [I]
			$Cu < 6$ and/or $[Cc < 1$ or $Cc > 3.0]$ [E]	SP	Poorly graded sand [I]
		Sands with Fines: More than 12% fines [D]	Fines classify as ML or MH	SM	Silty sand [G, H, I]
			Fines classify as CL or CH	SC	Clayey sand [G, H, I]
Fine-Grained Soils: 50% or more passes the No. 200 sieve	**Silts and Clays:** Liquid limit less than 50	**Inorganic:**	PI > 7 and plots above "A" line [J]	CL	Lean clay [K, L, M]
			PI < 4 or plots below "A" line [J]	ML	Silt [K, L, M]
		Organic:	$\frac{LL\ oven\ dried}{LL\ not\ dried} < 0.75$	OL	Organic clay [K, L, M, N]
					Organic silt [K, L, M, O]
	Silts and Clays: Liquid limit 50 or more	**Inorganic:**	PI plots on or above "A" line	CH	Fat clay [K, L, M]
			PI plots below "A" line	MH	Elastic silt [K, L, M]
		Organic:	$\frac{LL\ oven\ dried}{LL\ not\ dried} < 0.75$	OH	Organic clay [K, L, M, P]
					Organic silt [K, L, M, Q]
Highly organic soils:	Primarily organic matter, dark in color, and organic odor			PT	Peat

[A] Based on the material passing the 3-inch (75-mm) sieve.
[B] If field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.
[C] Gravels with 5 to 12% fines require dual symbols: GW-GM well-graded gravel with silt, GW-GC well-graded gravel with clay, GP-GM poorly graded gravel with silt, GP-GC poorly graded gravel with clay.
[D] Sands with 5 to 12% fines require dual symbols: SW-SM well-graded sand with silt, SW-SC well-graded sand with clay, SP-SM poorly graded sand with silt, SP-SC poorly graded sand with clay.
[E] $Cu = D_{60}/D_{10}$ $\quad Cc = \frac{(D_{30})^2}{D_{10} \times D_{60}}$
[F] If soil contains ≥ 15% sand, add "with sand" to group name.
[G] If fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.
[H] If fines are organic, add "with organic fines" to group name.
[I] If soil contains ≥ 15% gravel, add "with gravel" to group name.
[J] If Atterberg limits plot in shaded area, soil is a CL-ML, silty clay.
[K] If soil contains 15 to 29% plus No. 200, add "with sand" or "with gravel," whichever is predominant.
[L] If soil contains ≥ 30% plus No. 200 predominantly sand, add "sandy" to group name.
[M] If soil contains ≥ 30% plus No. 200, predominantly gravel, add "gravelly" to group name.
[N] PI ≥ 4 and plots on or above "A" line.
[O] PI < 4 or plots below "A" line.
[P] PI plots on or above "A" line.
[Q] PI plots below "A" line.