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December 12, 2022

Paravel Capital LLC
1509 Old W 38th Street, Suite 3
Austin, Texas 78731

Attention: Mr. Garrison Welch

SUBJECT: **SUBSURFACE EXPLORATION, LABORATORY TESTING PROGRAM, AND FOUNDATION AND PAVEMENT RECOMMENDATIONS FOR THE PROPOSED BANDERA RANCH RETAIL DEVELOPMENT 15030 BANDERA ROAD HELOTES, TEXAS RETL Project Number: G222839**

Dear Mr. Welch,

In accordance with our agreement, Rock Engineering & Testing Laboratory, LLC (RETL) performed a subsurface exploration and foundation and pavement evaluation for the referenced project. The results of this exploration, together with our recommendations, are presented in the accompanying report, an electronic copy of which is being transmitted herewith. RETL will provide up to two (2) hard copies of this report upon your request.

Often, because of design and construction details that occur on a project, questions arise concerning soil conditions. RETL would be pleased to continue its role as the Geotechnical Engineer during project implementation.

RETL also has great interest in providing materials testing services and special inspections during the construction phase of this project. If you will advise us of the appropriate time to discuss these engineering services, we will be pleased to meet with you at your convenience.

Sincerely,

Kyle D. Hammock, P.E.
Vice President – San Antonio

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SUBSURFACE EXPLORATION, LABORATORY TESTING PROGRAM, AND FOUNDATION AND PAVEMENT RECOMMENDATIONS FOR THE PROPOSED BANDERA RANCH RETAIL DEVELOPMENT 15030 BANDERA ROAD HELOTES, TEXAS

RETL PROJECT NUMBER: G222839

PREPARED FOR:

PARAVEL CAPITAL LLC
1509 OLD W 38TH STREET, SUITE 3
AUSTIN, TEXAS 78731

DECEMBER 12, 2022

PREPARED BY:

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ENGINEERING AND TESTING ROCK LABORATORY LLC
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INTRODUCTION

This report presents the results of a subsurface exploration and foundation and pavement evaluation for the proposed Bandera Ranch Retail Development to be constructed at 15030 Bandera Road in Helotes, Texas. This study was conducted for Paravel Capital LLC.

Authorization

The work for this project was performed in accordance with RETL Proposal No. SGP102722B dated October 27, 2022. The proposal contained a scope of work, fee, and limitations. The proposal was approved and signed by Mr. Curtis Thigpen on October 28, 2022 and returned to RETL via email.

Purpose and Scope

The purpose of this study was to determine applicable foundation and pavement design recommendations for the proposed project. The scope of this study included the subsurface exploration, field and laboratory testing, engineering analysis and evaluation of the subsurface soils, development of foundation and pavement design recommendations suitable for the proposed project, and preparation of this report.

The scope of services did not include an environmental assessment. Any statements in this report, or on the Logs of Boring, regarding odors, colors, unusual or suspicious items or conditions are strictly for the information of the client. In addition, our scope of services did not include a geologic assessment or detailed fault study.

General

The exploration and analysis of the subsurface conditions reported herein are considered sufficient in detail and scope to form a reasonable basis for foundation and pavement designs. The recommendations submitted for the proposed project are based on the available soil information and the preliminary design details provided to RETL by Paravel Capital LLC. If other design criteria are required for the structural and civil engineers to complete the foundation and pavement designs, and the requested information can be obtained from the agreed upon scope of work, RETL will provide the requested information as a supplement to this report.

The Geotechnical Engineer states that the findings, recommendations, specifications or professional advice contained herein, have been presented after being prepared in a manner consistent with the level of care and skill ordinarily exercised by reputable members of the Geotechnical Engineer's profession practicing contemporaneously under similar conditions in the locality of the project.

RETL operates in accordance with "*Standard Practice for Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction*", (ASTM D3740). No other representations are expressed or implied, and no warranty or guarantee is included or intended.

FIELD EXPLORATION

Scope

The field exploration, completed in order to evaluate the engineering characteristics of the subsurface conditions, included a reconnaissance of the project site, drilling test borings and recovering disturbed samples of soil and rock at the test boring locations. RETL performed a total of six (6) borings at the site. Each boring was drilled to a depth of approximately 20-feet.

During the sample recovery operations, the soil and rock encountered were classified and recorded on Logs of Boring in accordance with "*Standard Guide for Field Logging of Subsurface Exploration of Soil and Rock*", (ASTM D5434). Upon completion of the drilling operations and obtaining the groundwater observations, the drill holes were backfilled with excavated soil and rock.

RETL determined the number, location, and depth of the borings. The borings were located in the field by RETL personnel by measuring distances from reference points on the site and using a hand-held commercially available GPS unit. RETL personnel performed the boring operations. A Boring Location Plan is provided in the Appendix of this report.

Drilling and Sampling Procedures

The test borings were performed using a drilling rig equipped with a rotary head and solid flight auger and air rotary drilling methods were used to advance the boreholes to the termination depths. Disturbed samples were obtained employing split-barrel sampling procedures in general accordance with the procedures for "*Penetration Test and Split-Barrel Sampling of Soils*" (ASTM D1586).

The samples obtained from the test borings were classified in the field, placed in plastic bags, marked according to boring number, depth and any other pertinent field data, and stored in special containers. The samples were delivered to the laboratory for testing at the completion of the drilling operations.

Field Tests and Measurements

Penetration Tests - During the sampling procedures, standard penetration tests (SPTs) were performed to obtain the standard penetration value of the soil and rock. The standard penetration value (N) is defined as the number of blows of a 140-pound hammer, falling 30-inches, required to advance the split-barrel sampler 1-foot into the soil or rock. The sampler is lowered to the bottom of the previously cleaned drill hole and advanced by blows from the hammer. The number of blows is recorded for each of three successive 6-inch penetrations. The "N" value is obtained by adding the second and third 6-inch increment number of blows from the hammer. The results of standard penetration tests indicate the relative density of cohesionless soil and rock, and comparative consistency of cohesive soil, thereby providing a basis for estimating the relative strength and compressibility of the soil and rock profile components.

Water Level Measurements - Water level measurements were obtained during the test boring operations and are noted on the Logs of Boring provided in the Appendix. The amount of water in an open borehole largely depends on the permeability of the soils encountered at the boring location. In relatively pervious soils, such as sandy soils, the indicated depths are usually reliable groundwater levels. In relatively impervious soils, such as clayey soils, a suitable estimate of the groundwater depth may not be possible, even after several days of observation. Seasonal variations, temperature, land-use, proximity to a creek, river or lake and recent rainfall conditions may influence the depth to the groundwater.

Ground Surface Elevations - The ground surface elevations at the test boring locations were not provided or surveyed. The depths referred to in this report are reported from the actual ground surface elevations at the boring locations during the time of our field investigation. Existing grade information and plan Finished Floor Elevations (FFEs) are critical in the development of proper geotechnical recommendations. Accordingly, a Grading Plan with Finished Floor Elevations should be provided to RETL for review prior to design finalization so that we can review the information and provide additional or revised recommendations as necessary.

LABORATORY TESTING PROGRAM

A laboratory-testing program was conducted to supplement the information obtained during the field investigation. The results of the laboratory-testing program provided additional pertinent engineering characteristics of the subsurface materials necessary in analyzing the behavior of the foundation and pavement systems for the proposed project.

The laboratory-testing program included performing supplementary visual classification (ASTM D2487) and moisture content tests (ASTM D2216). In addition, selected samples were subjected to Atterberg limits tests (ASTM D4318) and percent material finer than the #200 sieve tests (ASTM D1140).

The laboratory-testing program was conducted in general accordance with applicable ASTM Specifications. The results of these tests are presented on the accompanying Logs of Boring provided in the Appendix.

SUBSURFACE CONDITIONS

General

The types of materials encountered in the test borings have been visually classified and are described in detail on the Logs of Boring. The results of the standard penetration tests, water level observations and other laboratory tests are presented on the Logs of Boring in numerical form. Representative samples of the soil and rock were placed in polyethylene bags and are now stored in the laboratory for further analysis, if desired. Unless notified to the contrary, the samples will be disposed of three months after issuance of this report.

The stratification of the soil and rock, as shown on the Logs of Boring, represents the conditions at the actual boring locations. Variations may occur between, or beyond, the boring locations. Lines of demarcation represent the approximate boundary between different soil types, but the transition may be gradual, or not clearly defined.

It should be noted that, whereas the test borings were drilled and sampled by experienced drillers, it is sometimes difficult to record changes in stratification within narrow limits. In the absence of foreign substances, it is also difficult to distinguish between discolored soils and clean soil fill.

Soil and Rock Conditions

The generalized soil and rock conditions encountered in the borings performed at the site consist of a relatively thin upper stratum of clayey soils that range in thickness from a couple of inches to approximately 2-feet, underlain by weathered limestone rock that extends to the boring termination depths of approximately 20-feet. The surficial clayey soils are low in expansive potential with tested plasticity indices (PI) of 5 and 11. The weathered limestone is very hard, contains clay seams and layers, and is non-expansive.

Exceptions to the above generalized soil and rock conditions do exist. Most notable is the presence of an approximate 2½-feet thick sandy fat clay layer in Boring B-1 and the presence of an approximate 3-foot thick sandy lean clay layer in Boring B-7. These identified clay layers contain weathered limestone and appeared to be thicker than the typical clay seams and layers that are typical and were present with the weathered limestone materials. Detailed descriptions of the soil and rock materials encountered at the boring locations are provided on the Logs of Boring included in the Appendix.

Seismic Site Class

The field investigation did not include a 100-foot deep boring, therefore, the soil properties are not known in sufficient detail to determine the Site Class per ASCE 7 Chapter 20. This section states that where site-specific data are not available to a depth of 100-feet, appropriate soil properties are permitted to be estimated by the registered design professional preparing the soil investigation report based on known geologic conditions. This site has a very thin layer of clayey soils underlain by very hard weathered limestone extending to the 20-foot depth.

Table 20.3-1 Site Class Definitions of ASCE 7 Chapter 20, indicates that Site Class C materials should have soil undrained shear strengths greater than 2,000 psf and standard penetration resistances greater than 50 blows per foot. The on-site soils and rock extending to the 20-foot depth have strengths similar to Site Class C materials; therefore, RETL recommends that Site Class C, “dense soil and soft rock profile” be assumed.

Groundwater Observations

Groundwater was not encountered during the drilling operations and the borings were dry upon completion of the drilling operations. It should be noted that water levels in open boreholes may require several hours to several days to stabilize depending on the permeability of the subsurface materials. In addition, groundwater levels or zones of seepage may be subject to seasonal conditions, recent rainfall, drought or temperature effects.

FOUNDATION DISCUSSION AND RECOMMENDATIONS

Project Description

Based on the information provided to RETL, it is understood that the 8.48-acre site is being developed to accommodate six (6) single-story buildings including a 19,950 square-foot Retail Building, a 17,600 square-foot Grocery Building, a 7,300 square-foot Restaurant Building and three Quick Service Restaurant (QSR) buildings with individual footprints of about 2,000 square-feet or less. Approximately 43,000 square feet of new pavements, including 221 automobile parking spaces and associated driveways, will also be constructed as part of the project.

Detailed information regarding the type of building construction and estimated structural loading conditions has not been provided. Maximum point loads are assumed to be less than 50 kips and wall loads are assumed to be in the range of 1 to 2-kips per foot. In addition, it is anticipated that shallow foundation systems will be used for all of the planned building structures.

As previously discussed, grading plans were not available or provided for our review. Site grading information is critical to the proper development of geotechnical recommendations. Therefore, RETL should be provided a grading plan for review prior to design finalization. At that point, supplemental and/or revised recommendations can be provided as appropriate.

PVR Discussion

The clayey soils present at the surface at this site generally tested to be low plasticity. These surficial clayey soils are typically highly variable in composition and clay content and also contain various percentages of gravel and/or organics and overlay non-expansive weathered limestone. **The calculated total potential vertical rise (PVR) for slab-on-grade construction at this site is ½-inch or less in the present condition.** The PVR was calculated using the Texas Department of Transportation Method TEX-124E.

As the PVR in the proposed building areas is ½-inch or less in the current condition, site mitigation to reduce the PVR value is not necessary. However, the building pads should be constructed as recommended herein in order to maintain a PVR value of ½-inch or less and to provide uniform and proper support of the shallow foundations and floor slab systems.

Shallow Foundation Recommendations

Unstiffened monolithic slab-on-grade foundations or conventional spread and strip footing foundations used with grade-supported floor slab systems may be used for support of the structures provided the building pads are prepared as recommended in the "**Site Preparation**" section of this report which includes the removal of all surficial clayey soils in the building areas, and replacement with select fill to achieve a "Not Considered Expansive" condition as per IBC. *All grade beams and footings within an individual building structure shall be founded either entirely on or within the natural weathered limestone materials or should be founded entirely within properly compacted select fill building pad materials.* All grade beams and footings should have a minimum depth of 2-feet below the finished floor slab elevation and perimeter grade beams and footings should have a minimum final embedment depth of 2-feet below the final surface grades surrounding the foundations.

Grade beams and footings founded on or within natural limestone materials may be designed for an allowable unit bearing pressure of 4,000 psf. Grade beams and footings founded within properly compacted select fill may be designed for an allowable unit bearing pressure of 2,500 psf. These values incorporate a design safety factor of at least 3.0. Grade beams and strip footings should be a minimum of 12-inches wide to reduce the potential for localized shear failure.

Shallow foundations and soil supported floor slabs may be subject to slight vertical movements, as discussed earlier in this report. Even slight differential movements may cause distress to interior wall partitions and rigid exterior facades supported by a shallow slab-on-grade foundation resulting in cosmetic damage. The potential for movement should be understood and addressed during the design phase of the proposed structures planned for construction at this site.

The foundation excavations should be observed by a representative of RETL prior to steel and concrete placement to assess that the foundation materials are capable of supporting the design loads and to identify the acceptability of the bearing materials.

Soft or loose zones encountered at the bottom of footing excavations should be removed to the level of competent materials as directed by the Geotechnical Engineer. Cavities formed as a result of excavation of soft or loose zones should be backfilled with compacted select fill.

After opening, grade beam and footing excavations should be observed, and concrete placed as quickly as possible. Surface run-off water should be drained away from the excavations and not be allowed to pond.

Floor Slabs

If conventional spread and continuous footing foundations are used, it is feasible to use grade-supported concrete floor slabs in conjunction with the footings supporting the building structures. It is recommended that the building pads be prepared in accordance with the site preparation recommendations provided in this report. Soil supported floor slabs are subject to vertical movements. It should be understood that grade-supported floor slabs and shallow foundations are subject to differential movements resulting in potential distress and cosmetic damage to rigid interior walls, floor coverings and partitions.

Potential foundation movements and the likelihood that cosmetic damage could occur should be understood and addressed during the design phase of this project. Interior wall partitions should be allowed to move freely with movements of the floating floor slab.

Grade supported floor slabs may be separated from the footing supported foundation elements by a permanent expansion joint that allows free vertical movement of the slab. If the floor slabs are separated from the footing supported foundation elements, differential vertical movements may cause problems at critical points such as doors and where interior walls are supported by the interior floor slab and connected to footing supported building components.

The floor slabs could alternatively be attached to the footing supported foundation elements. If the floor slabs or interior walls or partitions that are supported on a floating floor slab are connected to footing supported foundation elements, a plastic hinge crack may develop approximately 3 to 10 feet away from and parallel to the foundation elements. Installing a joint parallel to the footing supported foundation element can assist with controlling the location of the plastic hinge crack. Typically, the joint should be constructed 5 to 7 feet away from the foundation elements.

PAVEMENT CONSIDERATIONS

In designing the proposed parking areas and driveways, the existing subgrade conditions must be considered together with the expected traffic use and loading conditions. The conditions that influence pavement design can be summarized as follows:

1. Bearing values of the subgrade. These values can be represented by a California Bearing Ratio (CBR) for the design of flexible asphalt pavements, or a Modulus of Subgrade Reaction (K) for rigid concrete pavements.
2. Vehicular traffic, in terms of the number and frequency of vehicles and their range of axle loads.
3. Probable increase in vehicular use over the life of the pavement.
4. The availability of suitable materials to be used in the construction of the pavement and their relative costs.

Specific laboratory testing to define the subgrade strength (i.e. CBR/K values) have not been performed for this analysis. Based upon local experience, the plasticity indices of the natural subgrade clayey materials and to account for potential required general fill to raise pavement area grades, the governing CBR and K value have been selected as 3 and 100 pci, respectively.

Since traffic counts and design vehicles have not been provided, it is possible to provide a non-engineered pavement section suitable for light and heavy-duty service based on pavement sections that have provided adequate serviceability for similar type applications. Allowances for proper drainage and proper material selection of base materials are most important for performance of asphaltic pavements. Ruts and birdbaths in asphalt pavements allow for quick deterioration of the pavement primarily due to saturation of the underlying base materials and subgrade soils.

Automobile parking areas and the driveways and can be designed with either a flexible or rigid pavement. It is important that the exposed subgrade is properly prepared prior to pavement installation.

Flexible Asphalt Pavements

The recommended light and heavy-duty flexible pavement section options, using the locally available base material, are provided in the following tables. **In areas where the final pavement subgrade consists of cut native limestone rock, the light-duty section can be used for both light and heavy-duty service and the geogrid can be omitted from the pavement section.**

Light Duty Flexible Pavement (Automobile Parking Areas)	
HMAC Type D	2"
Crushed Limestone Base Material	8"
TENSAR Geogrid	TX-5
Compacted Subgrade	6"

Heavy Duty Flexible Pavement (Driveways)	
HMAC Type D	2"
Crushed Limestone Base Material	10"
TENSAR Geogrid	TX-5
Compacted Subgrade	6"

Allowances for proper drainage and proper material selection of base materials are most important for performance of asphaltic pavements. Ruts and birdbaths in asphalt pavements allow for quick deterioration of the pavement primarily due to saturation of the underlying base materials and subgrade soils.

Rigid Concrete Pavements

The use of concrete for paving has become more prevalent in recent years due to the long-term maintenance cost benefits of concrete pavement compared to asphalt pavements. Concrete pavement is recommended in areas that receive continuous repetitive traffic such as the main entrances, loading areas and trash dump approach areas. The recommended light and heavy-duty rigid concrete pavement sections are provided in the following table. **In areas where the final pavement subgrade consists of cut native limestone rock, a minimum 2-inch thick sand or fine limestone millings layer is recommended between the rock subgrade and concrete pavement to serve as a cushion and level-up surface.**

Rigid Pavement	Light Duty	Heavy Duty
Reinforced Concrete	5½"	6"
Compacted Subgrade	6"	6"

The heavy-duty concrete at the location of the trash dumpster should be 8-inches in thickness and be large enough to accommodate both the front and rear wheels of the vehicles used to pick up the trash dumpsters. Maintenance or operations managers need to stress the importance of placing the trash dumpsters in their proper locations to reduce the distress trash pickup operations place on the pavement.

Pavement Material Recommendations

Compacted Subgrade - The upper 6-inches of exposed subgrade soils should be compacted to at least 95-percent of the maximum dry density as determined by the modified Proctor test (ASTM D1557). The moisture content of the subgrade soils should be maintained at or above the optimum moisture content. Where limestone represents the final subgrade, compaction and compaction testing will not be required unless it is disturbed during grading operations.

General Fill - After subgrade preparation is complete, the placement of properly compacted general fill soils may begin in the paved areas to raise the grades, where required. General fill soils could consist of clean on-site clayey soil or cut limestone materials free, organics and other deleterious materials or imported soils with a maximum plasticity index of 25. The fill used to raise the grade where required in the proposed parking and drive areas should be placed in no greater than 8-inch thick loose lifts. Each lift should be compacted to at least 95-percent of the maximum dry density as determined by the modified Proctor test (ASTM D1557). The moisture content of the general fill soils should be maintained within at or above the optimum moisture content value.

Geogrid - It is recommended that geogrid be placed beneath the base material and on top of the compacted subgrade. Geogrid should be Tensar TX-5 and should be placed and overlapped in accordance with the manufacturer's recommendations. Geogrid will significantly improve the long-term performance of the pavements and reduce cracking. Where the final subgrade consists of cut limestone rock, the geogrid can be omitted.

Base Material - Base materials should meet the requirements set forth in the Texas Department of Transportation (TxDOT) 2014 Standard Specifications for Construction of Highways, Streets and Bridges; Item 247, Type A, Grade 1-2. The base material should be placed in maximum 8-inch thick loose lifts and compacted to a minimum density of 95-percent of the maximum dry density as determined by the modified Proctor test (ASTM D1557). The moisture content of the base materials should be maintained within 2-percentage points of the optimum moisture content.

Hot Mix Asphaltic Concrete - Hot mix asphaltic concrete should meet the requirements set forth in TxDOT Item 340 or 341; Type D surface course. The asphaltic concrete should be compacted to between 91.5 and 96.3-percent of the laboratory density.

Rigid Concrete - The concrete pavement should be properly reinforced and jointed, as per ACI, and should have a minimum 28-day compressive strength of 3,000 psi. Expansion joints should be spaced no greater than 60-feet and should be sealed with an appropriate sealant so that moisture infiltration into the subgrade soils and resultant concrete deterioration at the joints is minimized. Control joint spacing should not exceed 15-feet and preferably less to adequately control cracking. The joints should be thoroughly cleaned, and sealant should be installed without overfilling before the pavement is opened to traffic.

Based on past experience with concrete pavements supported on similar subgrade soils, RETL recommends that reinforcement for concrete pavement consist of #4 bars (1/2–inch diameter) spaced at 18-inches on center each way. The splice length for #4 bars should not be less than 20-inches.

SITE IMPROVEMENT METHODS

General Considerations

A majority of foundation related problems are attributable, at least in part, to poor drainage. A number of measures may be used to improve drainage and attain a reduction in subsoil moisture content variations. Some of these are outlined below:

- During construction, a positive drainage scheme should be implemented to prevent ponding of water on the subgrade in the foundation areas.
- Positive drainage should be maintained around the structures through a roof/gutter system connected to piping or directed to paved surfaces, transmitting water away from the foundation perimeters.
- Positive grades sloping away from the foundations should be designed and implemented for the area extending at least 10-feet away from the foundation perimeters.
- Utility trenches can serve as aqueducts that transport water beneath the structures and into foundation excavations causing foundation and floor slab distress and/or moisture transmission related problems. Clay plugs or collars should be installed in trenches just outside the building footprints to prevent horizontal migration of groundwater through trenches into the building pads.
- A minimum 12-inch clay cap should be installed around the perimeter of the foundation in areas not receiving concrete flatwork.

- Vegetation placed in landscape beds that are adjacent to the structures should be limited to plants and shrubs that will not exceed a mature height of 3-feet. Large bushes and trees should be planted away from the foundations at a distance that will exceed their full mature height and canopy width.

Project features beyond the scope of those discussed above should be planned and designed similarly to attain good drainage and relatively uniform moisture content within the foundation areas. Poor drainage schemes are generally the primary cause of slab-on-grade foundation problems.

Concrete Flatwork

Concrete flatwork such as sidewalks and patio areas adjacent to the buildings may be subject to soil-related movements. Individual concrete panels of concrete flatwork should be dowelled together to minimize trip hazards as a result of differential movements within the flatwork. All efforts should be made to avoid having situations where site flatwork panels are partially supported on compacted select fill soils and partially supported on natural in-situ or general fill soils which will result in differential movement between surrounding flatwork and building structures.

If it is desired to increase the performance level and reduce the total and differential movements for concrete flatwork adjacent to the buildings, the select fill building pads should be extended to a distance of 2-feet beyond the edge of all movement sensitive perimeter flatwork.

CONSTRUCTION CONSIDERATIONS

Site Preparation

Within the areas of the subject site where engineered improvements are planned, vegetation, roots, objectionable materials, and topsoil should be stripped from the surface. The stripped material should either be stockpiled for use in non-structural and landscaped areas or removed from the site. A stripping depth of at least 6-inches is recommended.

In the building areas, all of the upper clayey soils should be undercut to expose weathered limestone rock. Where the foundations will bear entirely on or within native limestone materials, additional excavation of the weathered limestone rock should be performed as required to provide a minimum of 6-inches of select fill beneath the building floor slabs. Although not required, it may be desirable to further over-excavate the limestone sufficient to provide 18 to 24-inch or thicker select fill building pads in order to allow foundation and utility excavations to occur mostly within the select fill building pads.

In the building areas where the foundations will bear within compacted fill materials, additional excavation of the limestone rock should be performed as necessary in order to allow for a minimum of 1-foot of compacted select fill beneath all grade beams and footings and as necessary to limit the differential fill thickness beneath each structure to the lesser of 5-feet or 50-percent of the maximum fill thickness. Where applicable, the exposed rock surface should then be properly benched into the slope such that select fill can be placed in uniform horizontal lifts and keyed into the native cut limestone.

The excavations should extend a minimum of 5-feet beyond the foundation perimeters prior to sloping, and also a minimum of 2-feet outside any movement sensitive appurtenances including ramps, stoops, patios and sidewalks constructed adjacent to the buildings.

Upon completion of the stripping and excavation operations, the exposed subgrade should be proof-rolled with a minimum 15-ton rubber tire dump truck or loader under the supervision of RETL to detect any soft areas or yielding clay pockets between limestone outcrops prior to fill placement. If any soft pockets, pumping areas or unstable rock are identified, the objectionable materials should be removed to expose firm materials and the excavation replaced with compacted select fill.

In areas within the footprint of any structures planned where trees were previously located, the entire tree root ball should also be excavated, and the excavation backfilled with properly compacted engineered fill.

Subgrade Preparation

After stripping, undercutting, proofrolling operations, and any necessary remediation are completed, the exposed subgrade soils should be scarified to a depth of 6-inches, moisture conditioned if necessary, and compacted to at least 95-percent of the maximum dry density as determined by the modified Proctor (ASTM D1557). The moisture content of the subgrade soils should be maintained at or above the optimum moisture content. Weathered limestone rock, which should represent the subgrade in the building and movement sensitive flatwork areas, will not require compaction or compaction testing.

Engineered Fill Materials

After subgrade preparation is complete, properly compacted fill soils should be used to the raise the site to the design subgrade elevations where engineered improvements are planned. Fill soils placed to raise the site to the design subgrade elevations should consist of select fill for the building structures and general fill soils for the remainder of the site.

Select Fill (Building Areas) - Select fill material used at this site for the building pads shall consist of crushed limestone meeting the plasticity and gradation requirements set forth in Texas Department of Transportation (TxDOT) Standard Specifications 2014; Item 247, Type A, Grade 1-2. The limestone can be imported from a local quarry or can be processed from on-site or off-site locations provided that it is crushed, screened and/or milled to meet the TxDOT Item 247, Grade 1-2 specification.

Where the foundations will bear entirely within select fill rather than entirely within native limestone, a minimum of 12-inches of select fill should be maintained below all grade beams and footings.

Select fill should be placed in no greater than 8-inch thick loose lifts and shall be compacted to at least 98-percent of the maximum dry density as determined by the modified proctor (ASTM D1557). The moisture content of the select fill should be maintain within -2 to +2 percentage points of the optimum moisture content. Each lift of select fill should be horizontally placed and where applicable, the select fill should be keyed into the properly benched limestone slope in a stairstep fashion. The Geotechnical Engineer shall approve select fill utilized at this site.

General Fill - On-site excavated soils free of organics and deleterious materials or imported soils can be used to raise the site grades as necessary. Imported general fill soils should have a maximum plasticity index (PI) of 25.

General fill soils should be compacted to at least 95-percent of the maximum dry density as determined by the modified Proctor (ASTM D1557). The moisture content of the general fill soils should be maintained at or above the optimum moisture content.

Earthwork and Foundation Acceptance

Exposure to the environment may weaken the soils at the foundation bearing levels if excavations remain open for long periods of time. Therefore, it is recommended that the foundation excavations be extended to the design elevations and the foundations be constructed as soon as possible to minimize potential damage to the bearing soils.

The foundation bearing levels should be free of loose or soft soil, ponded water or debris and should be observed prior to concreting by the Geotechnical Engineer, or his designated representative. Foundation concrete should not be placed on materials that have been disturbed by seepage. If the bearing soils are softened by water intrusion, the unsuitable soils must be removed from the foundation excavations and be replaced with properly compacted select fill prior to placement of concrete.

The Geotechnical Engineer, or his designated representative, should approve the condition of the exposed subgrade and monitor the placement of all select fill and general fill. As a guideline, a minimum of one in-place density test should be performed on the subgrade and each lift of select fill in the building areas for each 5,000 square feet or a minimum of three in-place densities per testing interval. The test frequency can be increased to 10,000 SF in the paving areas. Any areas not meeting the required compaction should be recompacted and retested until compliance is met.

Vapor Retarder

Polyolefin vapor retarders with a permeance of less than 0.1 US perms (ASTM E96) and Class A strength should be placed under the concrete floor slabs on the select fill building pads to reduce the transmission of water vapor from the supporting soil through the concrete slabs and to function as a slip sheet to reduce subgrade drag friction. A film thickness of 10 mils (0.25 mm) is typically used for reduced vapor transmission and durability during and after its installation. The vapor retarder should be installed according to ASTM E1643, “Standard Practice for Installation of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs.”

All penetrations through the vapor retarders should be sealed to ensure its integrity. The vapor retarders should be taped around all openings to ensure the effectiveness of the barrier. Grade stakes should not be driven through the barrier and care should be taken to avoid punctures during reinforcement and concrete placement. Placement of slab concrete directly on the vapor retarder increases the risks of surface dusting, blistering and slab curling making good concrete practice critical. A low water to cement ratio concrete mix design combined with proper and adequate curing procedures will help ensure a good quality slab.

Expansion Joints

Expansion or control joints should be designed and placed in various portions of the structures especially rigid masonry walls. Properly planned placement of these joints will assist in controlling the degree and location of material cracking that normally occurs due to material shrinkage, thermal affects, soil movements and other related structural conditions.

Rock Excavation

Very hard limestone rock was encountered at this. Therefore, high powered rock excavation and rock hammer/sawing/milling equipment will be required at this site to perform grading, foundation and utility excavations. As previously stated, it may be desirable to over-excavate the limestone as necessary to provide sufficient thickness select fill building pads in order for foundation and utility excavations to occur within the select fill building pads without the need to utilize “rock excavation” techniques.

Utilities

Utilities that project through the slab-on-grade floor or walls should be designed with either some degree of flexibility, or with sleeves, in order to prevent damage to these lines should movement occur.

GENERAL COMMENTS

If significant changes are made in the character or location of the proposed project, a consultation should be arranged to review any changes with respect to the prevailing soil conditions. At that time, it may be necessary to submit supplementary recommendations.

It is recommended that the services of RETL be engaged to test and evaluate the subgrade materials prior to placing select and general fill, and in the foundation excavations prior to concreting in order to verify that the bearing materials are consistent with those encountered in the borings. RETL cannot accept any responsibility for any conditions that deviate from those described in this report, nor for the performance of the foundations and pavements if not engaged to also provide construction observation and testing for this project. If it is required for RETL to accept any liability, then RETL must agree with the plans and perform such observation during construction as we recommend.

Sheeting, shoring and bracing of trenches, pits and excavations should be made the responsibility of the contractor and should comply with all current and applicable local, state and federal safety codes, regulations and practices, including the Occupational Safety and Health Administration.

APPENDIX

BORING LOCATION PLAN

NO SCALE
LOCATIONS ARE APPROXIMATE

December 12, 2022
Paravel Capital
RETL Project No.: G222839

BANDERA RANCH RETAIL DEVELOPMENT
15030 Bandera Road
Helotes, Texas

ROCK ENGINEERING AND TESTING LABORATORY, LLC
10856 VANDALE STREET
SAN ANTONIO, TEXAS 78216
(210) 495-8000

ENGINEERING AND TESTING ROCK LABORATORY LLC
A UES COMPANY

LOG OF BORING B-1

Rock Engineering & Testing Laboratory LLC
10856 Vandale Street
San Antonio, Texas 78216
Telephone: 210-495-8000
Fax: 210-495-8015

CLIENT: Paravel Capital
PROJECT: Bandera Ranch Retail Development
LOCATION: 15030 Bandera Rd; Helotes, TX
NUMBER: G222839
DATE(S) DRILLED: 11/16/2022

DRILLING METHOD(S):
Solid Flight Auger

GROUNDWATER INFORMATION:
Groundwater was not encountered during the drilling operations and the boring was dry upon completion of the drilling operations.

SURFACE ELEVATION: N/A

SOIL SYMBOL	DEPTH (FT)	SAMPLE NUMBER	SAMPLES	N: BLOWS/FT P: TONS/SQ FT T: TONS/SQ FT Qc: TONS/SQ FT	MOISTURE CONTENT (%)	ATTERBERG LIMITS LIQUID LIMIT LL	ATTERBERG LIMITS PLASTIC LIMIT PL	ATTERBERG LIMITS PLASTICITY INDEX PI	DRY DENSITY POUNDS/CU.FT	COMPRESSIVE STRENGTH (TONS/SQ FT)	MINUS NO. 200 SIEVE (%)	DESCRIPTION OF STRATUM
		SPT S-1		N=41-50/4"	8	31	30	1			26	**WEATHERED LIMESTONE**, with clay seams and layers, light brown to tan, dry, very hard.
		SPT S-2		N=50/2"	4							Same as above.
	5	SPT S-3		N=50/4"	3							Same as above.
		SPT S-4		N=79	14	50	19	31			60	**SANDY FAT CLAY**, with weathered limestone and chert gravel, light reddish-brown, moist, hard. (CH)
		SPT S-5		N=20-50/2"	9							**WEATHERED LIMESTONE**, with clay seams and layers, with chert, dry, very hard.
	10											
		SPT S-6		N=50/4"	6							Same as above, sans chert.
	15											
		SPT S-7		N=49	4							Same as above, with calcareous clay seams.
	20											Boring terminated at a depth of 20-feet.

N - STANDARD PENETRATION TEST RESISTANCE
Qc - STATIC CONE PENETROMETER TEST INDEX
P - POCKET PENETROMETER RESISTANCE

REMARKS:
Boring location determined by RETL. Drilling operations performed by RETL.
GPS Coordinates: N 29.58467°, W -98.69384°

LOG OF BORING B-2

Rock Engineering & Testing Laboratory LLC
10856 Vandale Street
San Antonio, Texas 78216
Telephone: 210-495-8000
Fax: 210-495-8015

CLIENT: Paravel Capital
PROJECT: Bandera Ranch Retail Development
LOCATION: 15030 Bandera Rd; Helotes, TX
NUMBER: G222839
DATE(S) DRILLED: 11/15/2022

DRILLING METHOD(S):
Solid Flight Auger and Air Rotary

GROUNDWATER INFORMATION:
Groundwater was not encountered during the drilling operations and the boring was dry upon completion of the drilling operations.

SURFACE ELEVATION: N/A

SOIL SYMBOL	DEPTH (FT)	SAMPLE NUMBER	SAMPLES	N: BLOWS/FT P: TONS/SQ FT T: TONS/SQ FT Qc: TONS/SQ FT	MOISTURE CONTENT (%)	ATTERBERG LIMITS LIQUID LIMIT LL	ATTERBERG LIMITS PLASTIC LIMIT PL	ATTERBERG LIMITS PLASTICITY INDEX PI	DRY DENSITY POUNDS/CU.FT	COMPRESSIVE STRENGTH (TONS/SQ FT)	MINUS NO. 200 SIEVE (%)	DESCRIPTION OF STRATUM
		SPT S-1		N=50/3"	15						44	**CLAYEY SAND**, brown, moist, hard.
		SPT S-2		N=50/1"	3							**WEATHERED LIMESTONE**, with clay seams and layers, light brown to tan, dry, very hard.
	5	SPT S-3		N=50/2"	3							Same as above.
		SPT S-4		N=50/2"	9							Same as above.
		SPT S-5		N=50/1"	6							Same as above.
	10											
		SPT S-6		N=50/1"	7							Same as above.
	15											
		SPT S-7		N=50/1"	6							Same as above.
	20											Boring terminated at a depth of 20-feet.

N - STANDARD PENETRATION TEST RESISTANCE
Qc - STATIC CONE PENETROMETER TEST INDEX
P - POCKET PENETROMETER RESISTANCE

REMARKS:
Boring location determined by RETL. Drilling operations performed by RETL.
GPS Coordinates: N 29.58435°, W -98.69369°

LOG OF BORING B-3

Rock Engineering & Testing Laboratory LLC
10856 Vandale Street
San Antonio, Texas 78216
Telephone: 210-495-8000
Fax: 210-495-8015

CLIENT: Paravel Capital
PROJECT: Bandera Ranch Retail Development
LOCATION: 15030 Bandera Rd; Helotes, TX
NUMBER: G222839
DATE(S) DRILLED: 11/14/2022

DRILLING METHOD(S):
Air Rotary

GROUNDWATER INFORMATION:
Groundwater was not encountered during the drilling operations and the boring was dry upon completion of the drilling operations.

SURFACE ELEVATION: N/A

SOIL SYMBOL	DEPTH (FT)	SAMPLE NUMBER	SAMPLES	N: BLOWS/FT P: TONS/SQ FT T: TONS/SQ FT Qc: TONS/SQ FT	MOISTURE CONTENT (%)	ATTERBERG LIMITS LIQUID LIMIT LL	ATTERBERG LIMITS PLASTIC LIMIT PL	ATTERBERG LIMITS PLASTICITY INDEX PI	DRY DENSITY POUNDS/CU.FT	COMPRESSIVE STRENGTH (TONS/SQ FT)	MINUS NO. 200 SIEVE (%)	DESCRIPTION OF STRATUM
		SPT S-1		N=38-50/3"	8	28	20	8			55	**SANDY LEAN CLAY**, with gravel, brown, moist, hard.
												WEATHERED LIMESTONE, with clay seams and layers, light brown to tan, dry, very hard.
		SPT S-2		N=50/4"	4							Same as above.
	5	SPT S-3		N=50/1"	5							Same as above.
		SPT S-4		N=50/1"	5							Same as above.
		SPT S-5		N=50/5"	8							Same as above.
	10											
		SPT S-6		N=50/3"	7							Same as above.
	15											
		SPT S-7		N=50/2"	10							Same as above.
	20											Boring terminated at a depth of 20-feet.

N - STANDARD PENETRATION TEST RESISTANCE
Qc - STATIC CONE PENETROMETER TEST INDEX
P - POCKET PENETROMETER RESISTANCE

REMARKS:
Boring location determined by RETL. Drilling operations performed by RETL.
GPS Coordinates: N 29.58400°, W -98.69337°

LOG OF BORING B-4

Rock Engineering & Testing Laboratory LLC
10856 Vandale Street
San Antonio, Texas 78216
Telephone: 210-495-8000
Fax: 210-495-8015

CLIENT: Paravel Capital
PROJECT: Bandera Ranch Retail Development
LOCATION: 15030 Bandera Rd; Helotes, TX
NUMBER: G222839
DATE(S) DRILLED: 11/14/2022

DRILLING METHOD(S):
Solid Flight Auger

GROUNDWATER INFORMATION:
Groundwater was not encountered during the drilling operations and the boring was dry upon completion of the drilling operations.

SURFACE ELEVATION: N/A

SOIL SYMBOL	DEPTH (FT)	SAMPLE NUMBER	SAMPLES	N: BLOWS/FT P: TONS/SQ FT T: TONS/SQ FT Qc: TONS/SQ FT	MOISTURE CONTENT (%)	ATTERBERG LIMITS LIQUID LIMIT LL	ATTERBERG LIMITS PLASTIC LIMIT PL	ATTERBERG LIMITS PLASTICITY INDEX PI	DRY DENSITY POUNDS/CU.FT	COMPRESSIVE STRENGTH (TONS/SQ FT)	MINUS NO. 200 SIEVE (%)	DESCRIPTION OF STRATUM
		SPT S-1		N=10-50/5"	14							**SANDY LEAN CLAY WITH GRAVEL**, brown, moist, hard.
		SPT S-2		N=30-50/4"	2	19	16	3			25	**WEATHERED LIMESTONE**, with clay seams and layers, light brown to tan, dry, very hard.
	5	SPT S-3		N=50/1"	5							Same as above.
		SPT S-4		N=50/2"	5							Same as above.
		SPT S-5		N=50/1"	11							Same as above.
	10											
		SPT S-6		N=30-50/3"	13	26	13	13			90	Same as above.
	15											
		SPT S-7		N=50/2"	8							Same as above.
	20											Boring terminated at a depth of 20-feet.

N - STANDARD PENETRATION TEST RESISTANCE
Qc - STATIC CONE PENETROMETER TEST INDEX
P - POCKET PENETROMETER RESISTANCE

REMARKS:
Boring location determined by RETL. Drilling operations performed by RETL.
GPS Coordinates: N 29.58341°, W -98.69317°

LOG OF BORING B-5

Rock Engineering & Testing Laboratory LLC
10856 Vandale Street
San Antonio, Texas 78216
Telephone: 210-495-8000
Fax: 210-495-8015

CLIENT: Paravel Capital
PROJECT: Bandera Ranch Retail Development
LOCATION: 15030 Bandera Rd; Helotes, TX
NUMBER: G222839
DATE(S) DRILLED: 11/14/2022

DRILLING METHOD(S):
Solid Flight Auger

GROUNDWATER INFORMATION:
Groundwater was not encountered during the drilling operations and the boring was dry upon completion of the drilling operations.

SURFACE ELEVATION: N/A

SOIL SYMBOL	DEPTH (FT)	SAMPLE NUMBER	SAMPLES	N: BLOWS/FT P: TONS/SQ FT T: TONS/SQ FT Qc: TONS/SQ FT	MOISTURE CONTENT (%)	ATTERBERG LIMITS LIQUID LIMIT LL	ATTERBERG LIMITS PLASTIC LIMIT PL	ATTERBERG LIMITS PLASTICITY INDEX PI	DRY DENSITY POUNDS/CU.FT	COMPRESSIVE STRENGTH (TONS/SQ FT)	MINUS NO. 200 SIEVE (%)	DESCRIPTION OF STRATUM
		SPT S-1		N=38-50/2"	4							**SANDY LEAN CLAY WITH GRAVEL**, brown, moist, hard.
		SPT S-2		N=50/1"	4							**WEATHERED LIMESTONE**, with clay seams and layers, some chert, light brown to tan, dry, very hard.
	5	SPT S-3		N=50/3"	3							Same as above.
		SPT S-4		N=50/2"	6							Same as above.
		SPT S-5		N=50/2"	13							Same as above.
	10											
		SPT S-6		N=50/2"	9							Same as above.
	15											
		SPT S-7		N=61	12	20	13	7			72	Same as above, with increased clay layers.
	20											Boring terminated at a depth of 20-feet.

N - STANDARD PENETRATION TEST RESISTANCE
Qc - STATIC CONE PENETROMETER TEST INDEX
P - POCKET PENETROMETER RESISTANCE

REMARKS:
Boring location determined by RETL. Drilling operations performed by RETL.
GPS Coordinates: N 29.58331°, W -98.69265°

LOG OF BORING B-6

Rock Engineering & Testing Laboratory LLC
10856 Vandale Street
San Antonio, Texas 78216
Telephone: 210-495-8000
Fax: 210-495-8015

CLIENT: Paravel Capital
PROJECT: Bandera Ranch Retail Development
LOCATION: 15030 Bandera Rd; Helotes, TX
NUMBER: G222839
DATE(S) DRILLED: 11/14/2022

DRILLING METHOD(S):
Solid Flight Auger

GROUNDWATER INFORMATION:
Groundwater was not encountered during the drilling operations and the boring was dry upon completion of the drilling operations.

SURFACE ELEVATION: N/A

SOIL SYMBOL	DEPTH (FT)	SAMPLE NUMBER	SAMPLES	N: BLOWS/FT P: TONS/SQ FT T: TONS/SQ FT Qc: TONS/SQ FT	MOISTURE CONTENT (%)	ATTERBERG LIMITS LIQUID LIMIT LL	ATTERBERG LIMITS PLASTIC LIMIT PL	ATTERBERG LIMITS PLASTICITY INDEX PI	DRY DENSITY POUNDS/CU.FT	COMPRESSIVE STRENGTH (TONS/SQ FT)	MINUS NO. 200 SIEVE (%)	DESCRIPTION OF STRATUM
		SPT S-1		N=44	8	28	17	11			48	**CLAYEY SAND WITH GRAVEL**, brown, moist, hard. (SC)
		SPT S-2		N=50/3"	8							**WEATHERED LIMESTONE**, with clay seams and layers, moist, very hard.
	5	SPT S-3		N=50/3"	3							Same as above, dry.
		SPT S-4		N=50/2"	5							Same as above.
		SPT S-5		N=50/2"	7							Same as above.
	10											
		SPT S-6		N=50/1"	9							Same as above.
	15											
		SPT S-7		N=50/1"	6							Same as above.
	20											Boring terminated at a depth of 20-feet.

N - STANDARD PENETRATION TEST RESISTANCE
Qc - STATIC CONE PENETROMETER TEST INDEX
P - POCKET PENETROMETER RESISTANCE

REMARKS:
Boring location determined by RETL. Drilling operations performed by RETL.
GPS Coordinates: N 29.58274°, W -98.69203°

LOG OF BORING B-7

Rock Engineering & Testing Laboratory LLC
10856 Vandale Street
San Antonio, Texas 78216
Telephone: 210-495-8000
Fax: 210-495-8015

CLIENT: Paravel Capital
PROJECT: Bandera Ranch Retail Development
LOCATION: 15030 Bandera Rd; Helotes, TX
NUMBER: G222839
DATE(S) DRILLED: 11/14/2022

DRILLING METHOD(S):
Solid Flight Auger

GROUNDWATER INFORMATION:
Groundwater was not encountered during the drilling operations and the boring was dry upon completion of the drilling operations.

SURFACE ELEVATION: N/A

SOIL SYMBOL	DEPTH (FT)	SAMPLE NUMBER	SAMPLES	N: BLOWS/FT P: TONS/SQ FT T: TONS/SQ FT Qc: TONS/SQ FT	MOISTURE CONTENT (%)	ATTERBERG LIMITS LIQUID LIMIT LL	ATTERBERG LIMITS PLASTIC LIMIT PL	ATTERBERG LIMITS PLASTICITY INDEX PI	DRY DENSITY POUNDS/CU.FT	COMPRESSIVE STRENGTH (TONS/SQ FT)	MINUS NO. 200 SIEVE (%)	DESCRIPTION OF STRATUM
					19	25	20	5			71	**SILTY CLAY WITH GRAVEL**, brown, moist, hard.
		SPT S-1		N=30-50/1"								
		SPT S-2		N=50/1"	5							**WEATHERED LIMESTONE**, with clay seams, light brown to tan, dry, very hard.
	5	SPT S-3		N=54	6	29	15	14			59	**SANDY LEAN CLAY**, with gravel, light and reddish-brown, dry, hard.
		SPT S-4		N=30-50/5"	4							**WEATHERED LIMESTONE**, with clay seams and layers, light brown to tan, dry, very hard.
		SPT S-5		N=50/2"	6							Same as above.
	10											
		SPT S-6		N=50/1"	6							Same as above.
	15											
		SPT S-7		N=50/3"	5							Same as above.
	20											Boring terminated at a depth of 20-feet.

N - STANDARD PENETRATION TEST RESISTANCE
Qc - STATIC CONE PENETROMETER TEST INDEX
P - POCKET PENETROMETER RESISTANCE

REMARKS:
Boring location determined by RETL. Drilling operations performed by RETL.
GPS Coordinates: N 29.58218°, W -98.69200°

LOG OF BORING B-8

Rock Engineering & Testing Laboratory LLC
10856 Vandale Street
San Antonio, Texas 78216
Telephone: 210-495-8000
Fax: 210-495-8015

CLIENT: Paravel Capital
PROJECT: Bandera Ranch Retail Development
LOCATION: 15030 Bandera Rd; Helotes, TX
NUMBER: G222839
DATE(S) DRILLED: 11/14/2022

DRILLING METHOD(S):
Solid Flight Auger

GROUNDWATER INFORMATION:
Groundwater was not encountered during the drilling operations and the boring was dry upon completion of the drilling operations.

SURFACE ELEVATION: N/A

SOIL SYMBOL	DEPTH (FT)	SAMPLE NUMBER	SAMPLES	N: BLOWS/FT P: TONS/SQ FT T: TONS/SQ FT Qc: TONS/SQ FT	MOISTURE CONTENT (%)	ATTERBERG LIMITS LIQUID LIMIT LL	ATTERBERG LIMITS PLASTIC LIMIT PL	ATTERBERG LIMITS PLASTICITY INDEX PI	DRY DENSITY POUNDS/CU.FT	COMPRESSIVE STRENGTH (TONS/SQ FT)	MINUS NO. 200 SIEVE (%)	DESCRIPTION OF STRATUM
		SPT S-1		N=50/3"	2						15	**WEATHERED LIMESTONE**, with clay seams and layers, light brown to tan, dry, very hard.
		SPT S-2		N=50/1"	8							Same as above.
	5	SPT S-3		N=50/5"	5							Same as above.
		SPT S-4		N=50/2"	3							Same as above.
		SPT S-5		N=50/1"	7							Same as above.
	10											
		SPT S-6		N=50/3"	5							Same as above.
	15											
		SPT S-7		N=50/1"	7							Same as above.
	20											Boring terminated at a depth of 20-feet.

N - STANDARD PENETRATION TEST RESISTANCE
Qc - STATIC CONE PENETROMETER TEST INDEX
P - POCKET PENETROMETER RESISTANCE

REMARKS:
Boring location determined by RETL. Drilling operations performed by RETL.
GPS Coordinates: N 29.58215°, W -98.69170°

Rock Engineering & Testing Laboratory, LLC
10856 Vandale Street
San Antonio, TX 78216
Telephone: 210-495-8000

KEY TO SOIL CLASSIFICATION AND SYMBOLS

UNIFIED SOIL CLASSIFICATION SYSTEM

MAJOR DIVISIONS		SYMBOL	NAME
COARSE GRAINED SOILS	GRAVEL AND GRAVELLY SOILS	GW	Well Graded Gravels or Gravel-Sand mixtures, little or no fines
		GP	Poorly Graded Gravels or Gravel-Sand mixtures, little or no fines
		GM	Silty Gravels, Gravel-Sand-Silt mixtures
		GC	Clayey Gravels, Gravel-Sand-Clay Mixtures
	SAND AND SANDY SOILS	SW	Well Graded Sands or Gravelly Sands, little or no fines
		SP	Poorly Graded Sands or Gravelly Sands, little or no fines
		SM	Silty Sands, Sand-Silt Mixtures
		SC	Clayey Sands, Sand-Clay mixtures
	SILTS AND CLAYS LL < 50	ML	Inorganic Silts and very fine Sands, Rock Flour, Silty or Clayey fine Sands or Clayey Silts
		CL	Inorganic Clays of low to medium plasticity, Gravelly Clays, Sandy Clays, Silty Clays, Lean Clays
		OL	Organic Silts and Organic Silt-Clays of low plasticity
	SILTS AND CLAYS LL > 50	MH	Inorganic Silts, Micaceous or Diatomaceous fine Sandy or Silty soils, Elastic Silts
		CH	Inorganic Clays of high plasticity, Fat Clays
		OH	Organic Clays of medium to high plasticity, Organic Silts
NON USCS MATERIALS			Limestone
			Marl/Claystone
			Sandstone

TERMS CHARACTERIZING SOIL STRUCTURE

SLICKENSIDED - having inclined planes of weakness that are slick and glossy in appearance

FISSURED - containing shrinkage cracks, frequently filled with fine sand or silt; usually more or less vertical

LAMINATED (VARVED) - composed of thin layers of varying color and texture, usually grading from sand or silt at the bottom to clay at the top

CRUMBLY - cohesive soils which break into small blocks or crumbs on drying

CALCAREOUS - containing appreciable quantities of calcium carbonate, generally nodular

WELL GRADED - having wide range in grain sizes and substantial amounts of all intermediate particle sizes

POORLY GRADED - predominantly of one grain size uniformly graded) or having a range of sizes with some intermediate size missing (gap or skip graded)

SYMBOLS FOR TEST DATA

- Groundwater Level (Initial Reading)
- Groundwater Level (Final Reading)
- Shelby Tube Sample
- SPT Samples
- Auger Sample
- Rock Core
- Texas Cone Penetrometer
- Grab Sample

TERMS DESCRIBING CONSISTENCY OF SOIL

COARSE GRAINED SOILS		FINE GRAINED SOILS		
DESCRIPTIVE TERM	NO. BLOWS/FT. STANDARD PEN. TEST	DESCRIPTIVE TERM	NO. BLOWS/FT. STANDARD PEN. TEST	UNCONFINED COMPRESSION TONS PER SQ. FT.
Very Loose	0 - 4	Very Soft	< 2	< 0.25
Loose	4 - 10	Soft	2 - 4	0.25 - 0.50
Medium	10 - 30	Firm	4 - 8	0.50 - 1.00
Dense	30 - 50	Stiff	8 - 15	1.00 - 2.00
Very Dense	over 50	Very Stiff	15 - 30	2.00 - 4.00
		Hard	over 30	over 4.00

Field Classification for "Consistency" of Fine Grained Soils is determined with a 0.25" diameter penetrometer