- GEOTECHNICAL ENGINEERING
- CONSTRUCTION MATERIALS ENGINEERING & TESTING
- SOILS • ASPHALT • CONCRETE

August 24, 2022

El Rancho Sonrisa, LLC
8626 Jodhpur Dr.
Boerne, Texas 78015

Attention: Chris Weigand

SUBJECT: **SUBSURFACE EXPLORATION, LABORATORY TESTING PROGRAM AND PAVEMENT EVALUATION**
FOR THE PROPOSED SMILEY TRACT ROADWAYS PHASES 1 TO 4
SW LOOP 410 AND ZARZAMORA ST
SAN ANTONIO, TEXAS
RETL Project No.: G222544

Dear Mr. Weigand,

In accordance with our agreement, Rock Engineering and Testing Laboratory, LLC (RETL) has conducted a subsurface exploration and pavement evaluation for the above referenced project. The results of this exploration, together with our recommendations, are to be found in the accompanying report, an electronic copy of which is being transmitted herewith. RETL will provide up to two (2) versions of this report in hard copy at the request of the client.

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 and observation services 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

ROCK ENGINEERING & TESTING LABORATORY, LLC

Corpus Christi
Office: 361.883.4555
Fax: 361.883.4711
6817 Leopard St.
Corpus Christi, TX 78409

San Antonio
Office: 210.495.8000
Fax: 210.495.8015
10856 Vandale
San Antonio, TX 78216

Round Rock
Office: 512.284.8022
Fax: 512.284.7764
7 Roundville Ln.
Round Rock, TX 78664

www.rocktesting.com

SUBSURFACE EXPLORATION, LABORATORY TESTING PROGRAM,
AND PAVEMENT EVALUATION
FOR THE PROPOSED
SMILEY TRACT ROADWAYS PHASES 1 TO 4
SW LOOP 410 AND ZARZAMORA ST
SAN ANTONIO, TEXAS

RETL PROJECT NUMBER: G222544

PREPARED FOR:

EL RANCHO SONRISA, LLC
8626 JODHPUR DR.
BOERNE, TEXAS 78015

AUGUST 24, 2022

PREPARED BY:

ROCK ENGINEERING AND TESTING LABORATORY, LLC
10856 VANDALE ST.
SAN ANTONIO, TEXAS 78216
PHONE: (210) 495-8000; FAX: (210) 495-8015

TEXAS BOARD OF PROFESSIONAL ENGINEERS
FIRM REGISTRATION NUMBER 2101

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

TABLE OF CONTENTS

INTRODUCTION

This report presents the results of a subsurface exploration and pavement evaluation for the proposed Smiley Tract Roadways Phases 1 to 4 to be constructed in San Antonio, Texas. This study was conducted for El Rancho Sonrisa, LLC and CCE Development.

Authorization

The work for this project was performed in accordance with RETL Proposal Number SGP062722B dated June 28, 2022. The proposal contained a scope of work, lump sum fee and limitations. The proposal was approved and signed by Chris Weigand, Manager of El Rancho Sonrisa, LLC on July 6, 2022 and returned to RETL via email.

Purpose and Scope

The purpose of this exploration was to evaluate the soil conditions at the site and to provide pavement recommendations suitable for the proposed subdivision roadways.

The scope of the exploration and evaluation included the subsurface exploration, field and laboratory testing, engineering analysis and evaluation of the subsurface soils, provision of pavement recommendations, and preparation of this report.

The scope of services did not include an environmental assessment. Any statements in this report, or on the boring logs, regarding odors, colors, unusual or suspicious items or conditions are strictly for the information of the client.

General

The exploration and analysis of the subsurface conditions reported herein are considered sufficient in detail and scope to form a reasonable basis for the pavement design. The recommendations submitted for the proposed project are based on the available soil information and the preliminary design details provided by Kevin Denson, P.E. If the civil engineer requires additional soil parameters to complete the pavement design, 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 general 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 pavement materials included a reconnaissance of the project site, drilling the test borings, and recovering disturbed split spoon samples.

A total of 13 borings were performed at the site and were each drilled to a depth of 10-feet within the proposed new subdivision roadways. RETL determined the number, depth and general location of the borings and staked the borings in the field. RETL performed the boring operations. Bulk samples of subgrade were also collected at boring locations B-1, B-5, B-10 and B-13. Upon completion of the drilling operations and obtaining the groundwater observations, the bore holes were backfilled with excavated soil and the site cleaned as required. A Boring Location Plan is provided in the Appendix of this report.

Drilling and Sampling Procedures

The borings were performed using a drilling rig equipped with a rotary head and solid stem auger drilling methods were used to advance the boreholes to their desired 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 were classified in the field, placed in plastic bags, marked according to their boring number, depth and any other pertinent field data, stored in special containers and delivered to the laboratory for testing.

Field Tests and Measurements

Penetration Tests - During the sampling procedures, standard penetration tests (SPT) were performed to obtain the standard penetration value of the soil. 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. 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. The results of standard penetration tests indicate the relative density of cohesionless soils and comparative consistency of cohesive soils, thereby providing a basis for estimating the relative strength and compressibility of the soil profile components.

Water Level Observations - Water level observations were obtained during the test boring operations and are noted on the boring logs provided in the Appendix. The amount of water in open boreholes largely depends on the permeability of the soils encountered at the boring locations. In relatively pervious soils, such as sandy soils, the indicated depths are usually reliable groundwater levels. In relatively impervious 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 body of water, and recent rainfall conditions may influence the depth to the groundwater.

Ground Surface Elevations - Ground surface elevations were not provided at the boring locations. All 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.

LABORATORY TESTING PROGRAM

In addition to the field investigation, a laboratory-testing program was conducted to determine additional pertinent engineering characteristics of the subgrade materials necessary in developing the pavement recommendations for the roadways.

The laboratory-testing program included supplementary visual classification (ASTM D2487) on all samples. In addition, selected samples were subjected water content tests (ASTM D2216), Atterberg limits tests (ASTM D4318), percent material finer than the #200 sieve tests (ASTM D1140), moisture density relationship tests (ASTM D698), California Bearing Ratio (CBR) tests (ASTM D1883), pH tests (ASTM D5464), lime series (TEX Method 121E), and sulfate content determinations (TEX Method 145E).

All phases of the laboratory-testing program were conducted in general accordance with applicable ASTM or TxDOT Specifications. The results of these tests are to be found in this report or on the accompanying boring logs provided in the Appendix.

SUBSURFACE CONDITIONS

General

The types of subsurface materials encountered in the test borings have been visually classified and are described in detail on the boring logs. The results of the standard penetration tests, water level observations and laboratory tests are presented on the boring logs in numerical form.

Representative samples of the soils were placed in polyethylene bags and are now stored in the laboratory for further analysis, if desired. Unless notified to the contrary, all samples will be disposed of 3 months after issuance of this report.

The stratification of the soil, as shown on the boring logs, represents the soil 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, whereby the test borings were drilled and sampled by experienced technicians, 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.

Seismic Site Class

The field investigation did not include a 100-footdeep 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 stiff to hard clay soils and medium dense to very dense sand and gravel soils extending to the 10-foot depth. Table 20.3-1 Site Class Definitions of ASCE 7 Chapter 20, indicates that Site Class D materials should have soil undrained shear strengths between 1,000 and 2,000 psf and standard penetration resistances between 15 and 50 blows per foot. The on-site soils extending to the 10-foot depth have strengths similar to Site Class D materials; therefore, RETL recommends that Site Class D, “stiff soil profile” be assumed.

Generalized Soil Conditions

The soil conditions at the project site generally consist of fat clays (CH), lean clays (CL), clayey sands (SC) and clayey gravels (GC) which extend to the boring termination depths of 10-feet. The fat clay soils are high to very high in plasticity with tested plasticity indices (PI) ranging from 32 to 41 and the lean clay soils are moderate to high in plasticity with tested plasticity indices (PI) ranging from 21 to 32. The sand and gravel soils are low to high in plasticity with tested plasticity indices (PI) ranging from 3 to 33. Standard Penetration tests (N values) performed on the soils ranged from 15 blows per foot to 50 blows for 2 inches of penetration indicating the clay soils are stiff to hard in consistency and the sand and gravel soils are medium dense to very dense.

Sulfate Test Results

The sulfate test results on representative subgrade samples are provided in the following table:

SUBGRADE SOILS SULFATE TEST RESULTS	
Boring No.	**Sulfate (ppm)**
B-1	80
B-5	<10
B-10	<10
B-13	<10

The TxDOT Technical Memorandum for treatment of soils containing sulfates with lime indicates the following risk levels:

SULFATE RISK LEVELS	
Sulfate (ppm)	**Risk**
<3,000	Low
3,000-5,000	Moderate
5,000-8,000	Moderate to High
>8,000	High and Unacceptable

The sulfate concentrations indicate the subgrade soils at the site are in a low risk level of using lime as a treatment method.

Lime Series and pH Test Results

The lime series and pH test results on the bulk subgrade samples are provided in the following tables:

BORING B-1 BULK SUBGRADE SAMPLE LIME SERIES AND pH TEST RESULTS		
% Lime	**LL / PI**	**pH**
0	65/47	7.0
2	65/33	12.3
4	63/22	12.4
6	61/20	12.5
8	59/18	12.6
10	59/18	12.6

BORING B-5 BULK SUBGRADE SAMPLE LIME SERIES AND pH TEST RESULTS		
% Lime	**LL / PI**	**pH**
0	33/19	6.7
2	33/10	12.3
4	33/9	12.4
6	34/9	12.5
8	36/10	12.6
10	36/9	12.6

BORING B-10 BULK SUBGRADE SAMPLE LIME SERIES AND pH TEST RESULTS		
% Lime	**LL / PI**	**pH**
0	38/24	7.3
2	38/12	12.4
4	38/12	12.5
6	38/10	12.6
8	38/8	12.6
10	39/11	12.7

BORING B-13 BULK SUBGRADE SAMPLE LIME SERIES AND pH TEST RESULTS		
% Lime	**LL / PI**	**pH**
0	33/18	7.4
2	34/11	12.3
4	33/9	12.4
6	33/9	12.6
8	34/10	12.6
10	34/10	12.6

Where: LL = Liquid Limit (%)
PI = Plasticity Index

Based on the test results indicated above, we recommend that subgrade soils with a PI of 20 or more be treated with 5-percent lime to consistently reduce the plasticity index (PI) and pH to acceptable levels.

Groundwater Observations

Groundwater was not encountered in the borings during the drilling operations and the borings were dry upon completion of the drilling. It should be noted that water levels in open boreholes may require anywhere from several hours to several days to stabilize depending on the permeability of the soils and that groundwater levels at this site may be subject to seasonal conditions, recent rainfall, drought or temperature effects.

PAVEMENT RECOMMENDATIONS

It is understood that new roadways utilizing flexible pavements will be constructed for the Smiley Tract. In designing the proposed pavements, 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.
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) has been performed for this analysis. **Based upon the CBR test results and the plasticity indices and strengths of the natural subgrade soils, a CBR value of 4 has been selected for Phases 1, 2 and 3 and a CBR value of 6 has been selected for the Phase 4.**

We have evaluated the proposed new subdivision roadways as City of San Antonio "Local A Without Bus Traffic" and "Local B" streets. **The required AASHTO 18-kip ESAL for a "Local A Without Bus Traffic" street is 100,000 and the required AASHTO 18-kip ESAL for a "Local B" street is 2,000,000.**

RETL used the following pavement design parameters for the flexible pavement design:

AASHTO PAVEMENT DESIGN PARAMETER	DESIGN VALUE
Local A Reliability (R)	70%
Local B Reliability (R)	90%
Overall Deviation	0.45
Initial/Terminal Serviceability	4.2 / 2.0
Subgrade Design CBR Phases 1 to 3	4
Subgrade Design CBR Phase 4	6
Design Life	20 years

The following lime treated subgrade, limestone base, and hot mix asphaltic concrete layer coefficients were selected for the pavement design:

PAVEMENT CONSTITUENT	LAYER COEFFICIENT (α)
New Crushed Limestone Base (TxDOT Item 247 Type A, Grade 1-2)	0.14
Type B HMAC	0.38
Type C or D HMAC	0.44

The recommended hot mixed asphaltic concrete (HMAC) pavement sections are provided in the following tables:

LOCAL TYPE A STREET WITHOUT BUS TRAFFIC COSA MINIMUM 18-kip ESAL VALUE = 100,000 AASHTO STRUCTURAL NUMBER RANGE = 2.02 to 3.18		
Pavement Constituent	Phases 1 to 3	Phase 4
HMAC Type C or D	2”	2”
Crushed Limestone Base	11”	10”
Compacted Subgrade	6”	6”
AASHTO Structural No.	2.42	2.28
Calculated 18-kip ESAL	109,000	142,000

LOCAL TYPE B STREET COSA MINIMUM 18-kip ESAL VALUE = 2,000,000 AASHTO STRUCTURAL NUMBER RANGE = 2.92 to 5.08				
Pavement Constituent	Phases 1 to 3	Phases 1 to 3	Phase 4	Phase 4
HMAC Type C or D	4”	1.5”	4”	1.5”
HMAC Type B	---	9.5”	---	8.5”
Crushed Limestone Base	18”	---	15”	---
Compacted Subgrade	6”	6”	6”	6”
AASHTO Structural No.	4.28	4.27	3.86	4.89
Calculated 18-kip ESAL	2,249,000	2,212,000	2,075,000	2,189,000

Subgrade and Embankment

Subgrade preparation and embankment construction should be performed in accordance with COSA ITEM 107 *“EMBANKMENT”.* After all surface organics and deleterious materials have been removed and the desired subgrade elevation has been achieved, the upper 6-inches of exposed subgrade soils should be compacted to a minimum density of 95 or 98-percent of the maximum dry unit weight of the subgrade soils as determined by TEX 114E and at or above the optimum moisture content. Any embankment fill required to achieve the final subgrade elevation shall be placed in maximum 8-inch loose lifts and compacted as specified above.

Lime Treated Subgrade

Roadbed soil having a plasticity index (PI) greater than 20 should be treated with lime. Lime placement and mixing operations should be performed in accordance with COSA ITEM 108 *"LIME TREATES SUBGRADE"***.** Lime treatment of the subgrade soils is recommended to reduce the effect of soil heave on the pavements. Lime shall be properly mixed with the upper 6-inches of subgrade at a minimum rate of 5-percent of the maximum dry unit weight of the raw subgrade soils as determined by TEX 114-E. This percentage equates to approximately 27 pounds per square yard per 6-inch treatment depth. Treated soils shall obtain a minimum pH of 12.4, a plasticity index (PI) less than 20 and a minimum unconfined compressive strength of 50 psi.

After proper curing time, usually 48 to 72 hours, the lime treated soils should be remixed and compacted to a minimum density of 95-percent of the maximum dry unit weight of the lime stabilized subgrade soils as determined by TEX 114-E and at, or above, the optimum moisture content.

Limestone Base

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 or COSA ITEM 200 *"FLEXIBLE BASE"*. The base material should be placed in maximum 8-inch loose lifts and compacted to a minimum density of 95-percent of the maximum dry density as determined by TEX 113E. The moisture content of the base materials should be maintained within 2-percent of the optimum moisture content.

Hot Mix Asphalt

Asphalt concrete should meet the requirements set forth in TxDOT Item 340 or 341, or COSA Item 205; Type B, C or D. The asphaltic concrete should be compacted to 91.5 to 96.3-percent of the maximum theoretical specific gravity of the mixture determined according to test method TEX 227-F. Pavement cores should be tested for density according to test method TEX 207-F.

Drainage

Proper drainage is very important to achieve the desired performance from flexible asphaltic concrete pavements. RETL has assumed that good drainage will be incorporated into the project and the pavements will be fast draining and puddle free. Low or flat areas in asphalt pavements allow standing water and quick deterioration of the pavement primarily due to saturation of the underlying pavement materials and subgrade soils.

It should be noted that groundwater and/or saturated soils with free water may be encountered during construction. These areas will have to be remediated on a case by case basis with the installation of drain systems and piping to collect and remove the water from the pavement areas. A minimum of 1-percent cross-slope in the pavement surface is recommended.

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.

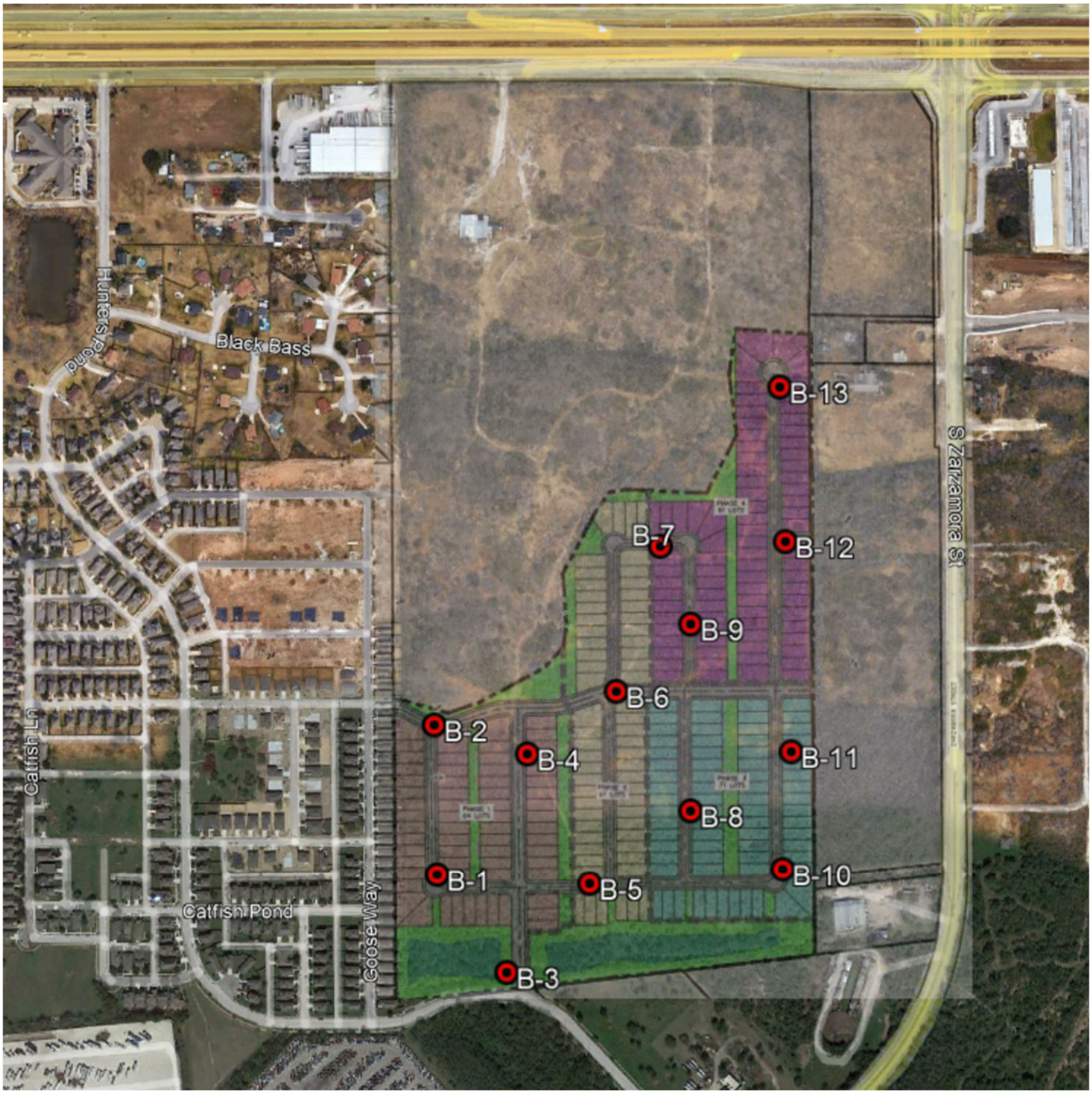
It is recommended that the services of RETL be engaged to test and evaluate the subgrade soils in the pavement areas prior to placing pavement constituents in order to verify that the bearing soils are consistent with those encountered in the borings. RETL cannot accept any responsibility for any conditions that deviate from those described in this report, nor for the performance of the 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.

All 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



August 24, 2022
El Rancho Sonrisa, LLC
RETL Project No.: G222544

SMILEY TRACT ROADWAYS PHASES 1 TO 4
SW Loop 410 and Zarzamora St
San Antonio, Texas

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

LOG OF BORING 01

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

CLIENT: El Rancho Sonrisa, LLC
PROJECT: Smiley Tract Roadways; Phases 1-4
LOCATION: SW Loop 410 & S. Zarzamora; SA, TX
NUMBER: G222544
DATE(S) DRILLED: 7/30/2022

DRILLING METHOD(S):
Solid Flight Auger

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

SURFACE ELEVATION: N/A

FIELD DATA					LABORATORY DATA							
						ATTERBERG LIMITS						
SOIL SYMBOL	DEPTH (FT)	SAMPLE NUMBER	SAMPLES	N: BLOWS/FT P: TONS/SQ FT T: TONS/SQ FT Qc: TONS/SQ FT	MOISTURE CONTENT (%)	LIQUID LIMIT LL	PLASTIC LIMIT PL	PLASTICITY INDEX PI	DRY DENSITY POUNDS/CU.FT	COMPRESSIVE STRENGTH (TONS/SQ FT)	MINUS NO. 200 SIEVE (%)	DESCRIPTION OF STRATUM
	1	SPT S-1		N= 52	4						21	**SILTY CLAYEY GRAVEL**, brown and gray, dry, dense. (55% gravel)
	2											
	3	SPT S-2		N= 36	3							Same as above.
	4											
	5	SPT S-3		N= 30	11	46	16	30			89	**LEAN CLAY**, light red-brown, dry, hard. (CL)
	6											
	7	SPT S-4		N= 48	11							Same as above.
	8											
	9	SPT S-5		N= 52	7							Same as above.
	10											Boring terminated at a depth of 10-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 a subcontractor to RETL.
GPS Coordinates: N 29.31125°, W -98.53895°

LOG OF BORING 02

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

CLIENT: El Rancho Sonrisa, LLC
PROJECT: Smiley Tract Roadways; Phases 1-4
LOCATION: SW Loop 410 & S. Zarzamora; SA, TX
NUMBER: G222544
DATE(S) DRILLED: 7/28/2022

DRILLING METHOD(S):
Solid Flight Auger

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

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 LL	ATTERBERG LIMITS PL	ATTERBERG LIMITS PI	DRY DENSITY POUNDS/CU.FT	COMPRESSIVE STRENGTH (TONS/SQ FT)	MINUS NO. 200 SIEVE (%)	DESCRIPTION OF STRATUM
	1	SPT S-1		N= 19	11	57	17	40			54	**SANDY FAT CLAY**, light red-brown, dry, very stiff. (CH)
	2											
	3	SPT S-2		N= 24	14							Same as above.
	4											
	5	SPT S-3		N= 41	13							Same as above, hard.
	6											
	7	SPT S-4		N= 33	8	43	17	26			56	**SANDY LEAN CLAY**, light red-brown, dry, hard. (CL)
	8											
	9	SPT S-5		N= 52	7							**SANDY SILTY CLAY**, tan, dry, hard.
	10											Boring terminated at a depth of 10-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 a subcontractor to RETL.
GPS Coordinates: N 29.31286°, W -98.53898°

LOG OF BORING 03

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

CLIENT: El Rancho Sonrisa, LLC
PROJECT: Smiley Tract Roadways; Phases 1-4
LOCATION: SW Loop 410 & S. Zarzamora; SA, TX
NUMBER: G222544
DATE(S) DRILLED: 7/30/2022

DRILLING METHOD(S):
Solid Flight Auger

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

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
	1	SPT S-1		N= 17	11							**SANDY LEAN CLAY**, gray, dry, very stiff.
	2											
	3	SPT S-2		N= 27	7	44	12	32			65	Same as above. (CL)
	4											
	5	SPT S-3		N= 18	9							**SANDY LEAN CLAY**, light brown, dry, very stiff.
	6											
	7	SPT S-4		N= 28	7	32	11	21			62	Same as above. (CL)
	8											
	9	SPT S-5		N= 53	3						14	**SILTY GRAVEL**, brown, dry, dense.
	10											Boring terminated at a depth of 10-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 a subcontractor to RETL.
GPS Coordinates: N 29.31020°, W -98.53810°

LOG OF BORING 04

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

CLIENT: El Rancho Sonrisa, LLC
PROJECT: Smiley Tract Roadways; Phases 1-4
LOCATION: SW Loop 410 & S. Zarzamora; SA, TX
NUMBER: G222544
DATE(S) DRILLED: 7/28/2022

DRILLING METHOD(S):
Solid Flight Auger

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

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 LL	ATTERBERG LIMITS PL	ATTERBERG LIMITS PI	DRY DENSITY POUNDS/CU.FT	COMPRESSIVE STRENGTH (TONS/SQ FT)	MINUS NO. 200 SIEVE (%)	DESCRIPTION OF STRATUM
	1	SPT S-1		N= 35	3	25	14	11			37	**CLAYEY SAND WITH GRAVEL**, gray, dry, dense. (SC)
	2											
	3	SPT S-2		N= 39	8							Same as above.
	4											
	5	SPT S-3		N= 34-50/3"	7							Same as above, very dense.
	6											
	7	SPT S-4		N= 37	12	40	19	21			63	**SANDY LEAN CLAY**, brown, dry, hard. (CL)
	8											
	9	SPT S-5		N= 49	8							Same as above.
	10											Boring terminated at a depth of 10-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 a subcontractor to RETL.
GPS Coordinates: N 29.31255°, W -98.53784°

LOG OF BORING 05

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

CLIENT: El Rancho Sonrisa, LLC
PROJECT: Smiley Tract Roadways; Phases 1-4
LOCATION: SW Loop 410 & S. Zarzamora; SA, TX
NUMBER: G222544
DATE(S) DRILLED: 7/30/2022

DRILLING METHOD(S):
Solid Flight Auger

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

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
	1	SPT S-1		N= 18	7	60	19	41			60	**SANDY FAT CLAY**, gray, dry, very stiff. (CH)
	2											
	3	SPT S-2		N= 11-50/3"	4							**CLAYEY GRAVEL**, gray, dry, very dense.
	4											
	5	SPT S-3		N=21	4	54	21	33			45	**CLAYEY SAND**, tan, dry, very stiff. (SC)
	6											
	7	SPT S-4		N= 27	4							Same as above, gray and brown.
	8											
	9	SPT S-5		N= 36	14							Same as above, hard, with calcareous material.
	10											Boring terminated at a depth of 10-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 a subcontractor to RETL.
GPS Coordinates: N 29.31115°, W -98.53708°

LOG OF BORING 06

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

CLIENT: El Rancho Sonrisa, LLC
PROJECT: Smiley Tract Roadways; Phases 1-4
LOCATION: SW Loop 410 & S. Zarzamora; SA, TX
NUMBER: G222544
DATE(S) DRILLED: 8/5/2022

DRILLING METHOD(S):
Solid Flight Auger

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

SURFACE ELEVATION: N/A

FIELD DATA				LABORATORY DATA								
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
	1	SPT S-1		N= 40	1						32	**SILTY CLAYEY GRAVEL**, gray and brown, dry, dense.
	2											
	3	SPT S-2		N= 71	2							Same as above, very dense.
	4											
	5	SPT S-3		N= 60	3							Same as above.
	6											
	7	SPT S-4		N= 30	12	50	18	32			55	**SANDY FAT CLAY**, light red-brown, dry, hard. (CH)
	8											
	9	SPT S-5		N= 40	10							Same as above.
	10											Boring terminated at a depth of 10-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 a subcontractor to RETL.
GPS Coordinates: N 29.31322°, W -98.53675°

LOG OF BORING 07

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

CLIENT: El Rancho Sonrisa, LLC
PROJECT: Smiley Tract Roadways; Phases 1-4
LOCATION: SW Loop 410 & S. Zarzamora; SA, TX
NUMBER: G222544
DATE(S) DRILLED: 7/28/2022

DRILLING METHOD(S):
Solid Flight Auger

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

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
	1	SPT S-1		N= 21	6						47	**SILTY CLAYEY GRAVEL**, brown and gray, dry, medium dense.
	2											
	3	SPT S-2		N= 44	7	24	18	6			45	Same as above, dense. (GM-GC)
	4											
	5	SPT S-3		N= 41	3							**SILTY CLAYEY SAND**, light red-brown, dry, dense.
	6											
	7	SPT S-4		N= 77	4						44	Same as above, very dense.
	8											
	9	SPT S-5		N= 50/4"	7							Same as above.
	10											Boring terminated at a depth of 10-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 a subcontractor to RETL.
GPS Coordinates: N 29.31477°, W -98.53621°

LOG OF BORING 08

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

CLIENT: El Rancho Sonrisa, LLC
PROJECT: Smiley Tract Roadways; Phases 1-4
LOCATION: SW Loop 410 & S. Zarzamora; SA, TX
NUMBER: G222544
DATE(S) DRILLED: 7/30/2022

DRILLING METHOD(S):
Solid Flight Auger

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

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
		FIELD DATA			LABORATORY DATA							
	1	SPT S-1		N= 15	7	39	16	23			53	**SANDY LEAN CLAY**, dark brown, dry, stiff. (CL)
	2											
	3	SPT S-2		N= 30	7	50	18	32			60	**SANDY FAT CLAY**, brown and tan, dry, hard. (CH)
	4											
	5	SPT S-3		N= 28	7							Same as above, very stiff.
	6											
	7	SPT S-4		N= 35	6							**GRAVELLY LEAN CLAY**, brown, dry, hard.
	8											
	9	SPT S-5		N= 54	5							Same as above.
	10											Boring terminated at a depth of 10-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 a subcontractor to RETL.
GPS Coordinates: N 29.31194°, W -98.53584°

LOG OF BORING 09

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

CLIENT: El Rancho Sonrisa, LLC
PROJECT: Smiley Tract Roadways; Phases 1-4
LOCATION: SW Loop 410 & S. Zarzamora; SA, TX
NUMBER: G222544
DATE(S) DRILLED: 8/5/2022

DRILLING METHOD(S):
Solid Flight Auger

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

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 LL	ATTERBERG LIMITS PL	ATTERBERG LIMITS PI	DRY DENSITY POUNDS/CU.FT	COMPRESSIVE STRENGTH (TONS/SQ FT)	MINUS NO. 200 SIEVE (%)	DESCRIPTION OF STRATUM
	1	SPT S-1		N= 25	5	36	22	14			36	**CLAYEY GRAVEL**, brown, dry, medium dense. (GC)
	2											
	3	SPT S-2		N= 24	7							Same as above.
	4											
	5	SPT S-3		N= 24	7						73	**LEAN CLAY**, with gravel, brown, dry, very stiff.
	6											
	7	SPT S-4		N= 29	6							Same as above.
	8											
	9	SPT S-5		N= 38	3							**SANDY SILTY CLAY**, light red-brown, dry, hard.
	10											Boring terminated at a depth of 10-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 a subcontractor to RETL.
GPS Coordinates: N 29.31394°, W -98.53584°

LOG OF BORING 10

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

CLIENT: El Rancho Sonrisa, LLC
PROJECT: Smiley Tract Roadways; Phases 1-4
LOCATION: SW Loop 410 & S. Zarzamora; SA, TX
NUMBER: G222544
DATE(S) DRILLED: 7/30/2022

DRILLING METHOD(S):
Solid Flight Auger

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

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
	1	SPT S-1		N= 19	7	39	16	23			64	**SANDY LEAN CLAY**, dark brown, dry, very stiff. (CL)
	2											
	3	SPT S-2		N= 15-50/3"	4							Same as above, with gravel, very hard.
	4											
	5	SPT S-3		N= 71	5	25	13	12			35	**CLAYEY GRAVEL**, brown, dry, very dense. (GC)
	6											
	7	SPT S-4		N= 50/2"	8							**SANDY SILTY CLAY**, with gravel, light brown, dry, very hard.
	8											
	9	SPT S-5		N= 28	7							Same as above, sans gravel, very stiff.
	10											Boring terminated at a depth of 10-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 a subcontractor to RETL.
GPS Coordinates: N 29.31131°, W -98.53471°

LOG OF BORING 11

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

CLIENT: El Rancho Sonrisa, LLC
PROJECT: Smiley Tract Roadways; Phases 1-4
LOCATION: SW Loop 410 & S. Zarzamora; SA, TX
NUMBER: G222544
DATE(S) DRILLED: 7/30/2022

DRILLING METHOD(S):
Solid Flight Auger

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

SURFACE ELEVATION: N/A

FIELD DATA					LABORATORY DATA								DESCRIPTION OF STRATUM
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 (%)		
	1	SPT S-1		N= 58	1						16		**SILTY CLAYEY GRAVEL**, gray and brown, dry, dense.
	3	SPT S-2		N= 30-50/4"	1						17		Same as above, very dense. (35% gravel)
	5	SPT S-3		N= 24-50/4"	1						6		Same as above.
	7	SPT S-4		N= 66	1								**SILTY CLAYEY GRAVEL**, gray, dry, dense.
	9	SPT S-5		N= 38-50/3"	4						36		Same as above, very dense.
	10												Boring terminated at a depth of 10-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 a subcontractor to RETL.
GPS Coordinates: N 29.31251°, W -98.53439°

LOG OF BORING 12

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

CLIENT: El Rancho Sonrisa, LLC
PROJECT: Smiley Tract Roadways; Phases 1-4
LOCATION: SW Loop 410 & S. Zarzamora; SA, TX
NUMBER: G222544
DATE(S) DRILLED: 7/30/2022

DRILLING METHOD(S):
Solid Flight Auger

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

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
	1	SPT S-1		N= 36	1	19	16	3			15	**SILTY GRAVEL**, gray and brown, dry, dense. (GM)
	2											
	3	SPT S-2		N= 61	1							Same as above.
	4											
	5	SPT S-3		N= 44	1							Same as above.
	6											
	7	SPT S-4		N= 71	5	29	18	11			28	**CLAYEY SAND**, light red-brown, dry, hard. (SC)
	8											
	9	SPT S-5		N= 48	5							Same as above.
	10											Boring terminated at a depth of 10-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 a subcontractor to RETL.
GPS Coordinates: N 29.31477°, W -98.53441°

LOG OF BORING 13

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

CLIENT: El Rancho Sonrisa, LLC
PROJECT: Smiley Tract Roadways; Phases 1-4
LOCATION: SW Loop 410 & S. Zarzamora; SA, TX
NUMBER: G222544
DATE(S) DRILLED: 7/30/2022

DRILLING METHOD(S):
Solid Flight Auger

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

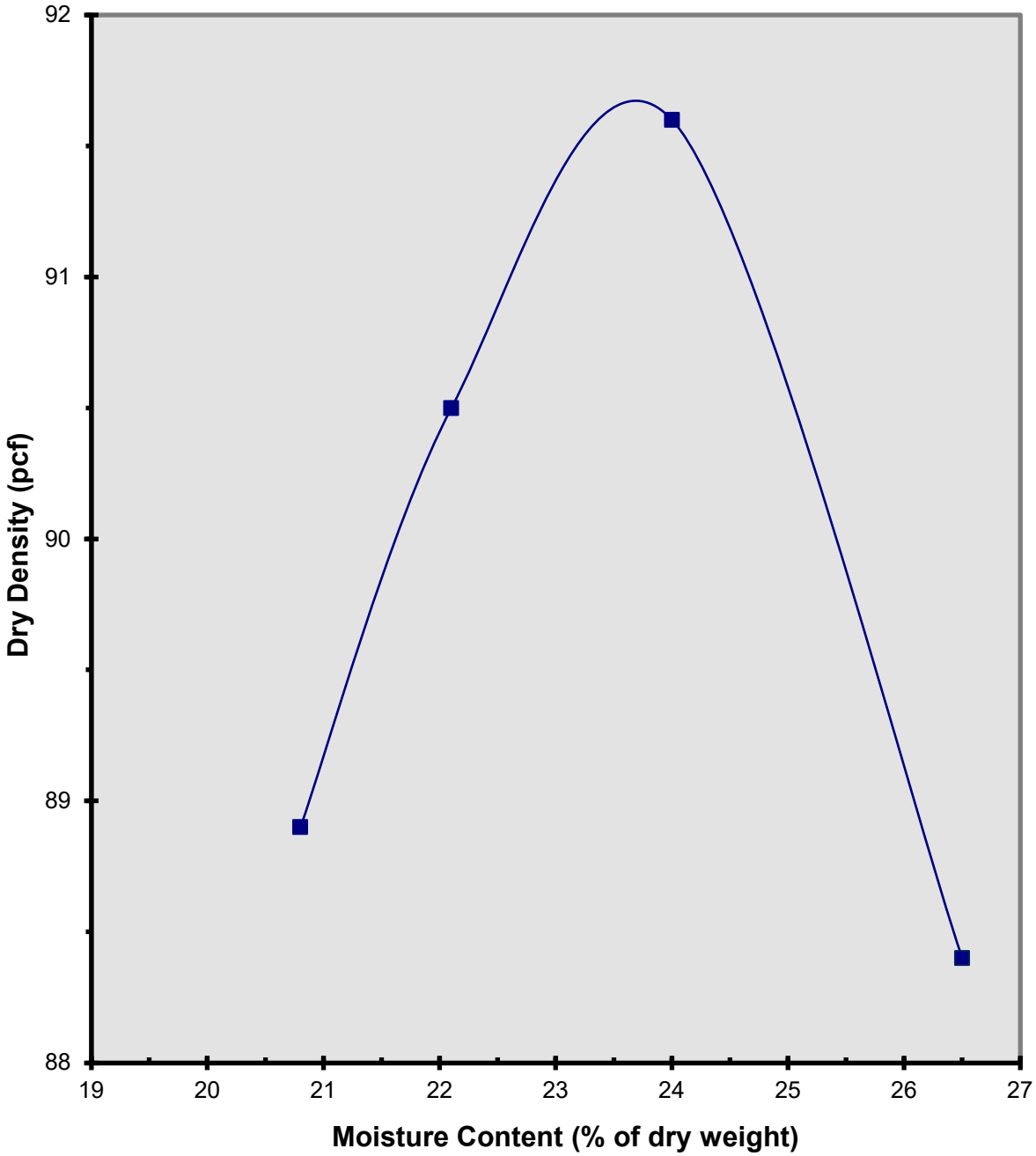
SURFACE ELEVATION: N/A

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
	1	SPT S-1		N= 28	4							**CLAYEY GRAVEL**, gray and brown, dry, medium dense.
	2											
	3	SPT S-2		N= 55	3	33	16	17			21	Same as above, dense. (GC)
	4											
	5	SPT S-3		N= 37-50/3"	4							Same as above.
	6											
	7	SPT S-4		N= 65	5	48	18	30			23	**CLAYEY GRAVEL**, gray and brown, dry, dense. (GC)
	8											
	9	SPT S-5		N= 55	5							**CLAYEY SAND**, light red-brown, dry, dense.
	10											Boring terminated at a depth of 10-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 a subcontractor to RETL.
GPS Coordinates: N 29.31647°, W -98.53475°

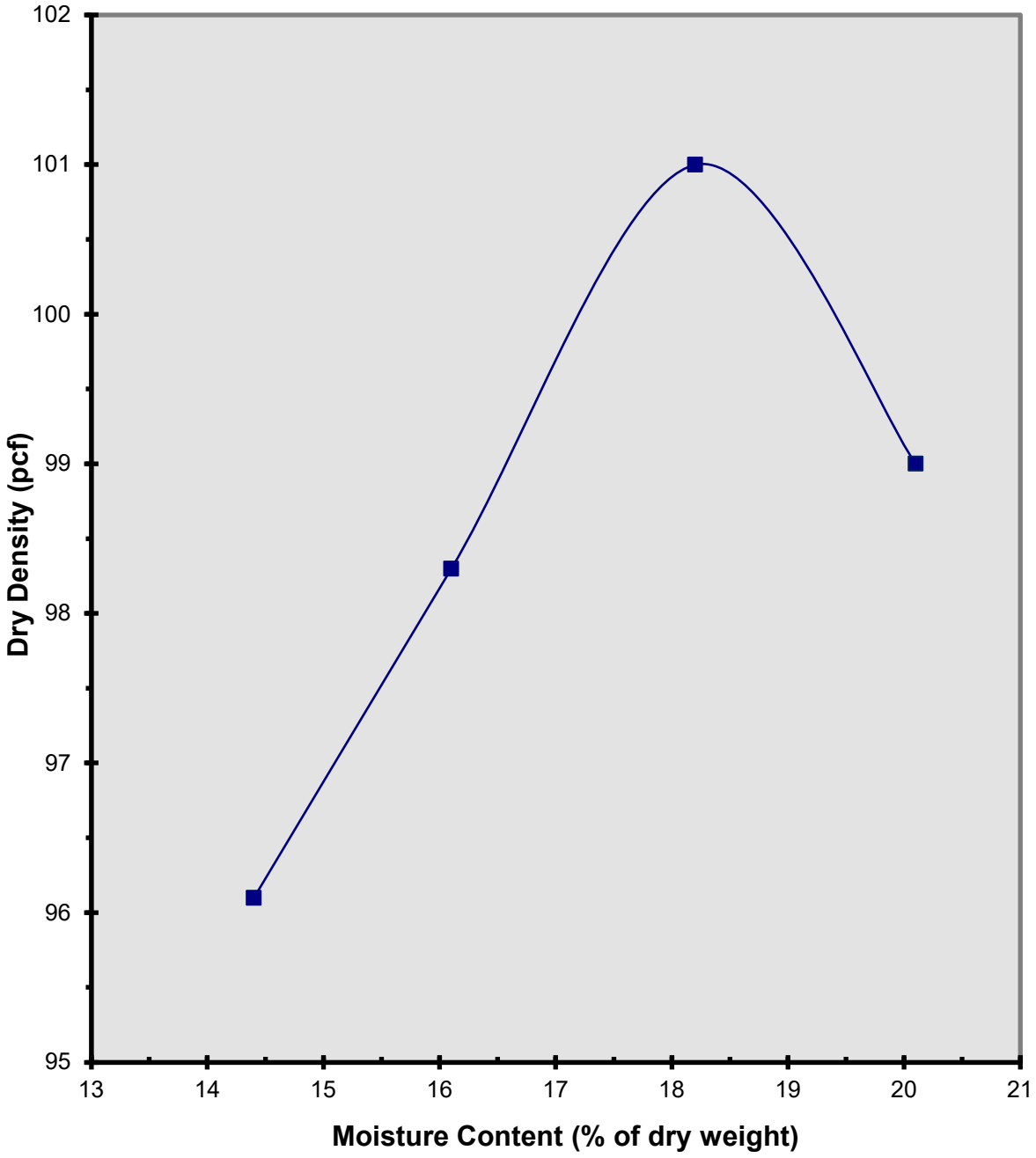
DENSITY VERSUS MOISTURE CURVE
(ASTM D698)



PROJECT	MAXIMUM LAB DENSITY	LAB DATA
Weston Homeplace Kerrville, Texas	91.6 pcf ASTM D698	LL = 63 PI = 41 Minus #200 = 84%
SAMPLE DESCRIPTION	**OPTIMUM MOISTURE**	**RETL PROJ. NO.**
Bulk Sample B-1 Dark Brown Fat Clay with Gravel (CH)	24.0%	G222575

ROCK ENGINEERING AND TESTING LABORATORY, LLC

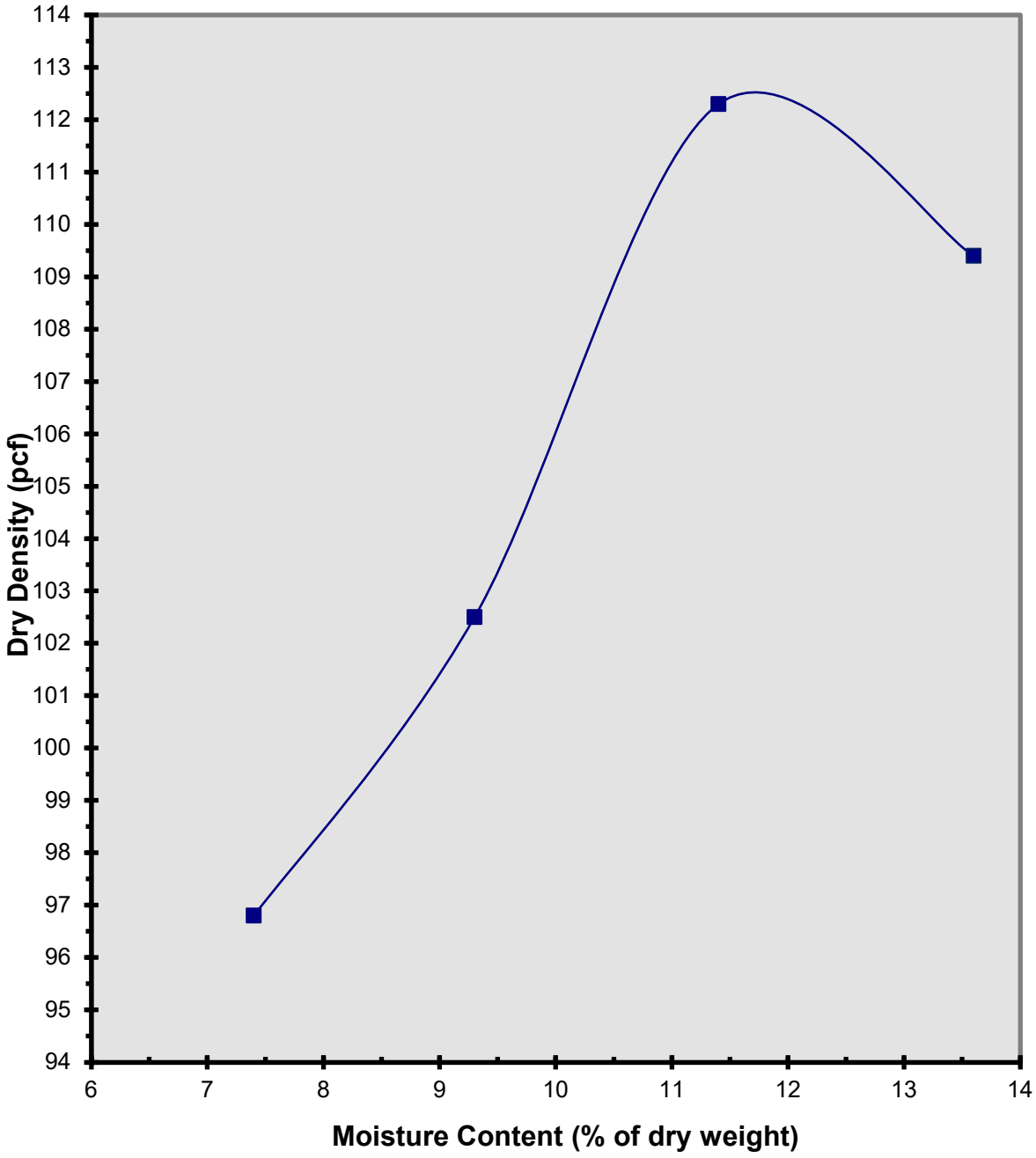
DENSITY VERSUS MOISTURE CURVE
(ASTM D698)



PROJECT	MAXIMUM LAB DENSITY	LAB DATA
Smiley Tract San Antonio, Texas	101.4 pcf ASTM D698	LL = 46 PI = 28 Minus #200 = 62%
SAMPLE DESCRIPTION	**OPTIMUM MOISTURE**	**RETL PROJ. NO.**
Bulk Sample B-5 Brown Gravelly Lean Clay (CL)	18.6%	G222544

ROCK ENGINEERING AND TESTING LABORATORY, LLC

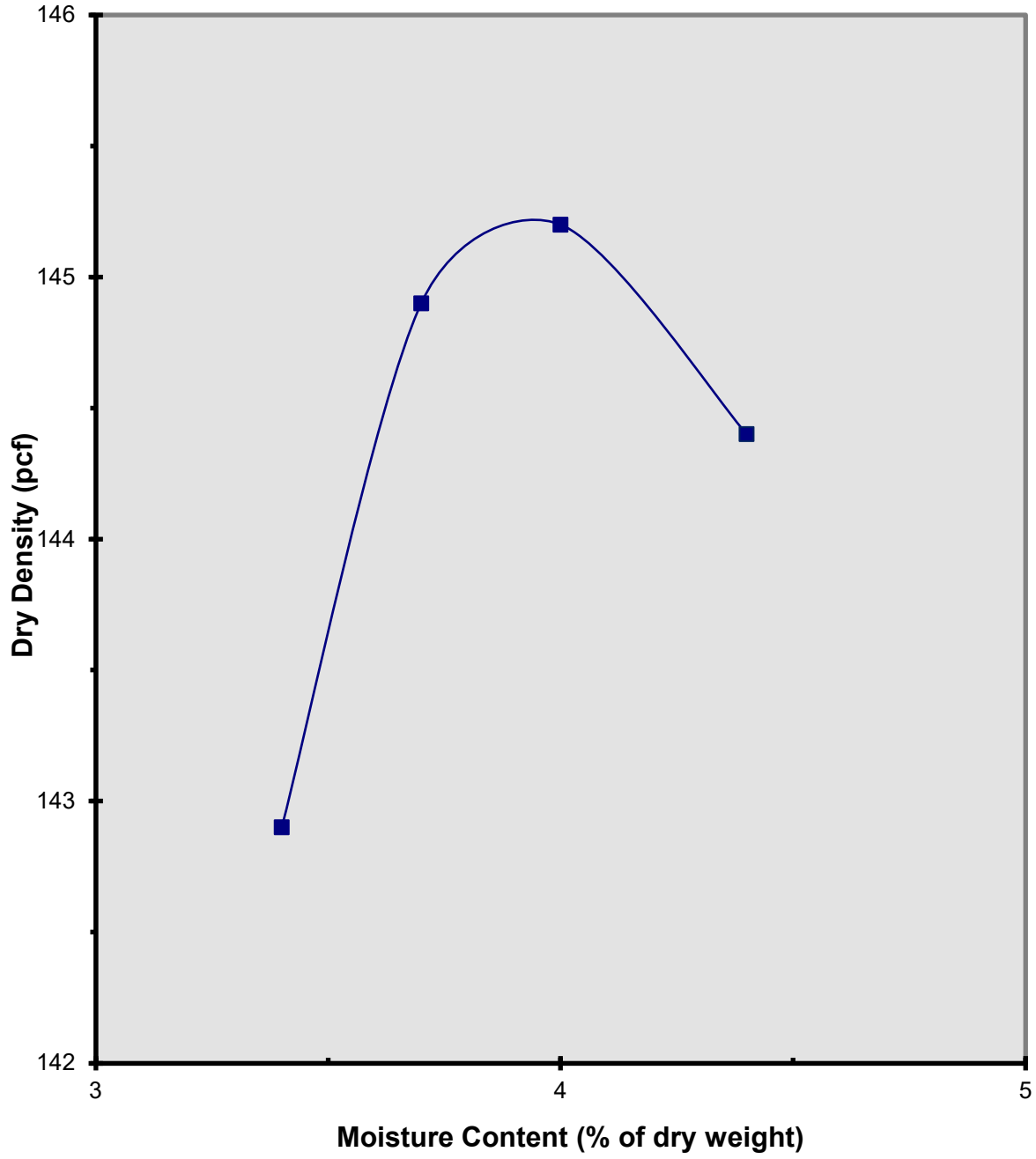
DENSITY VERSUS MOISTURE CURVE
(ASTM D698)



PROJECT	MAXIMUM LAB DENSITY	LAB DATA
Smiley Tract San Antonio, Texas	112.7 pcf ASTM D698	LL = 43 PI = 28 Minus #200 = 30%
SAMPLE DESCRIPTION	**OPTIMUM MOISTURE**	**RETL PROJ. NO.**
Bulk Sample B-10 Brown Clayey Gravel (GC)	11.8%	G222544

ROCK ENGINEERING AND TESTING LABORATORY, LLC

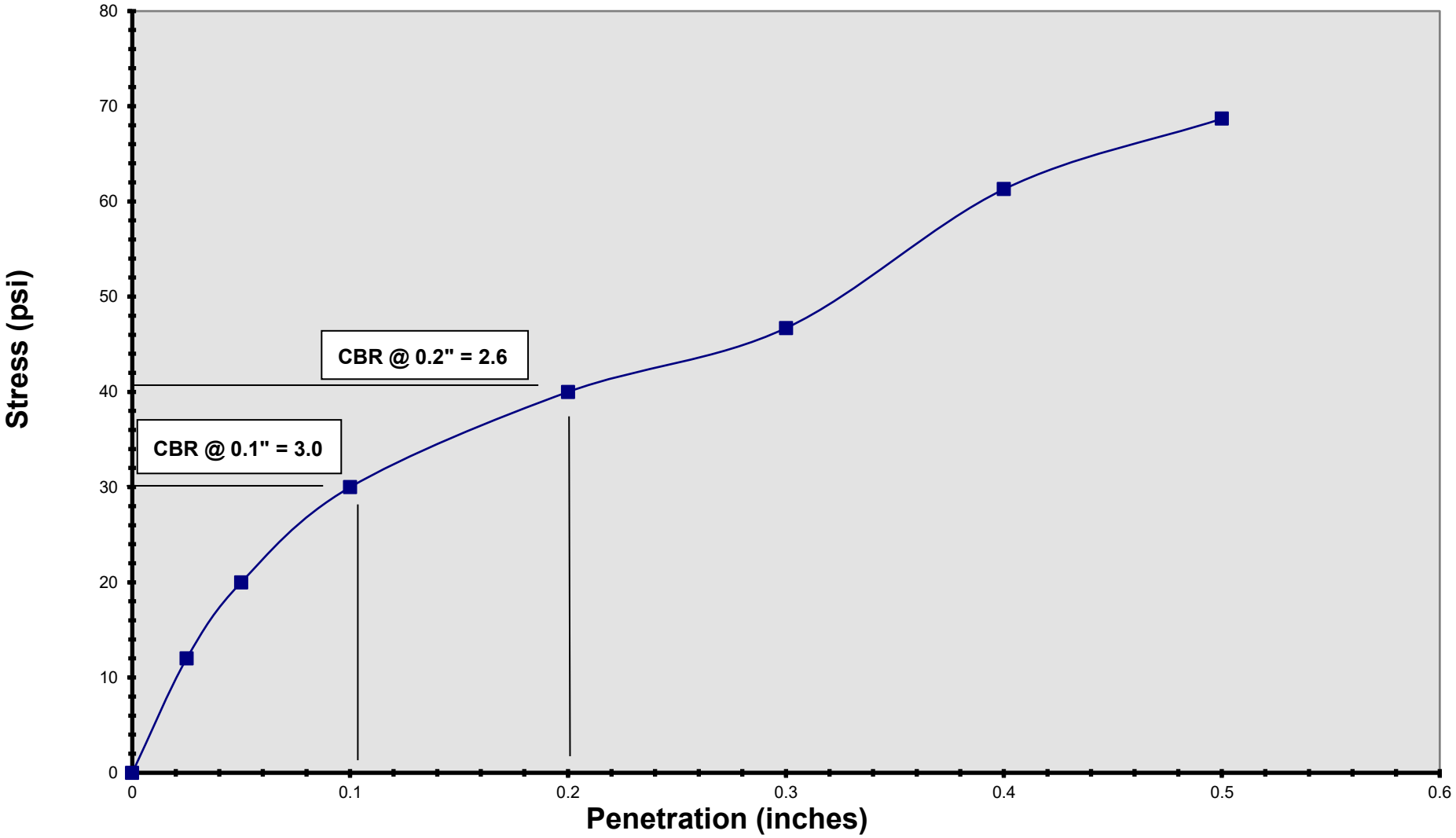
DENSITY VERSUS MOISTURE CURVE
(ASTM D698)



PROJECT	MAXIMUM LAB DENSITY	LAB DATA
Smiley Tract San Antonio, Texas	145.3 pcf ASTM D698	LL = 40 PI = 26 Minus #200 = 24%
SAMPLE DESCRIPTION	**OPTIMUM MOISTURE**	**RETL PROJ. NO.**
Bulk Sample B-13 Brown Clayey Gravel (GC)	3.9%	G222544

ROCK ENGINEERING AND TESTING LABORATORY, LLC

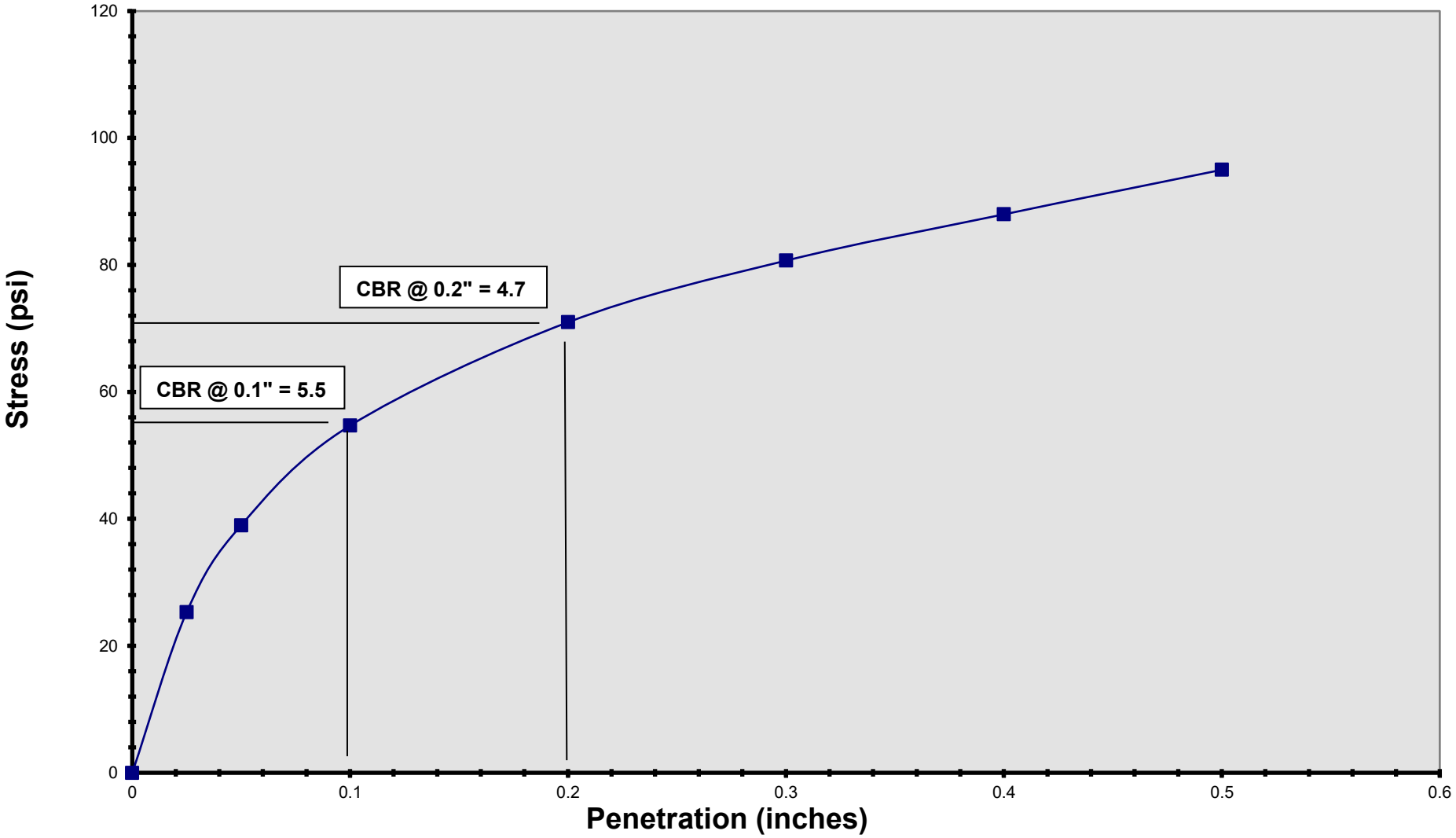
CBR - Stress versus Penetration Curve
(ASTM D1883)



PROJECT DESCRIPTION	MOLDED DRY DENSITY	CBR @ 0.1 INCH PENETRATION	TEST DATE
Smiley Tract San Antonio, Texas	122.03 pcf (94.6% of max density)	3.0	August 2022
SAMPLE DESCRIPTION	**MOLDED MOISTURE CONT.**	**CBR @ 0.2 INCHES PENETRATION**	**RETL PROJ. NO.**
Bulk Sample B-1 Brown Clayey Gravel (GC)	8.0%	2.6	G222544

ROCK ENGINEERING AND TESTING LABORATORY, LLC

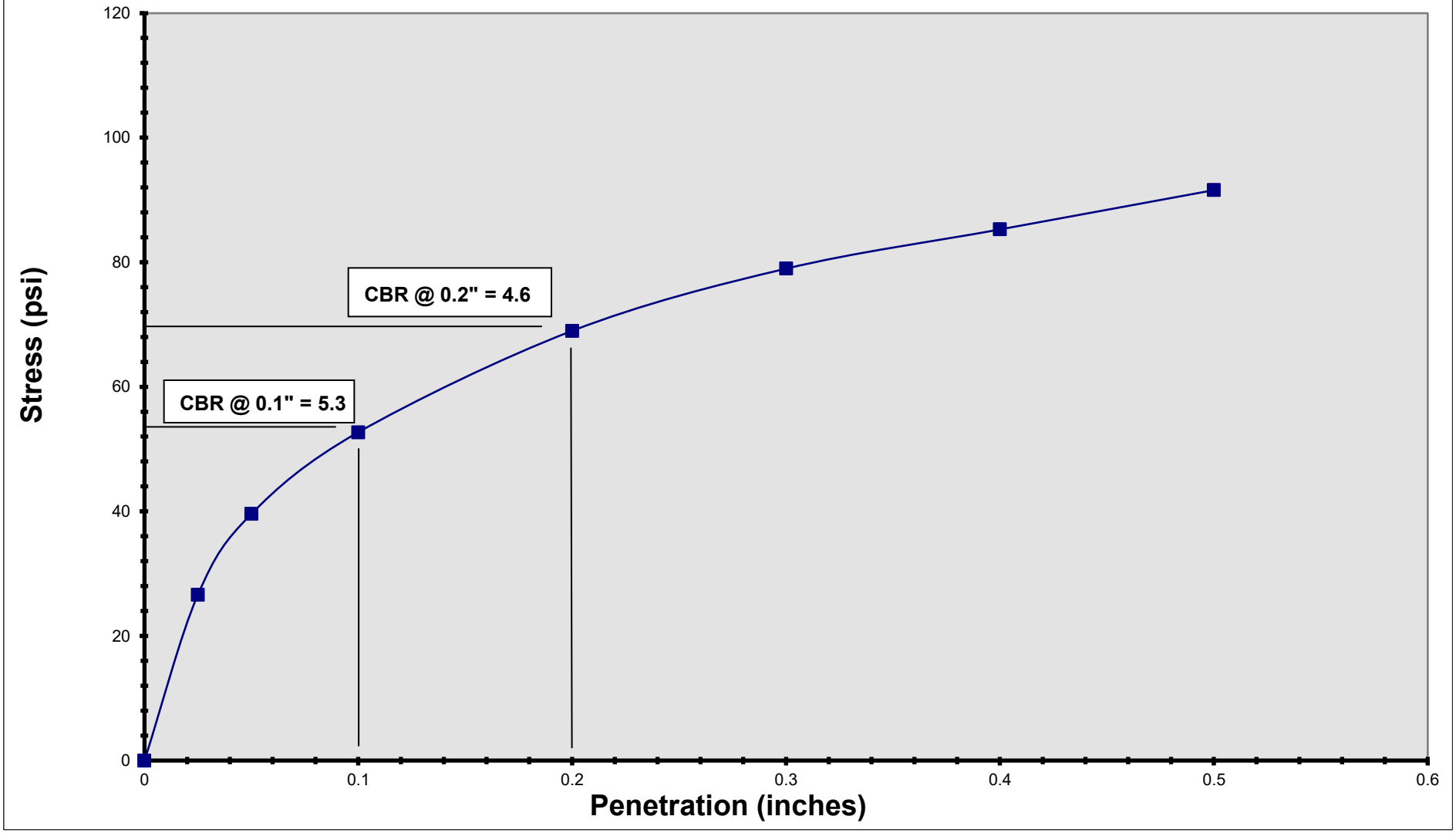
CBR - Stress versus Penetration Curve
(ASTM D1883)



PROJECT DESCRIPTION	MOLDED DRY DENSITY	CBR @ 0.1 INCH PENETRATION	TEST DATE
Smiley Tract San Antonio, Texas	101.4 pcf (100% of max density)	5.5	August 2022
SAMPLE DESCRIPTION	**MOLDED MOISTURE CONT.**	**CBR @ 0.2 INCHES PENETRATION**	**RETL PROJ. NO.**
Bulk Sample B-5 Brown Gravelly Lean Clay (CL)	18.6%	4.7	G222544

ROCK ENGINEERING AND TESTING LABORATORY, LLC

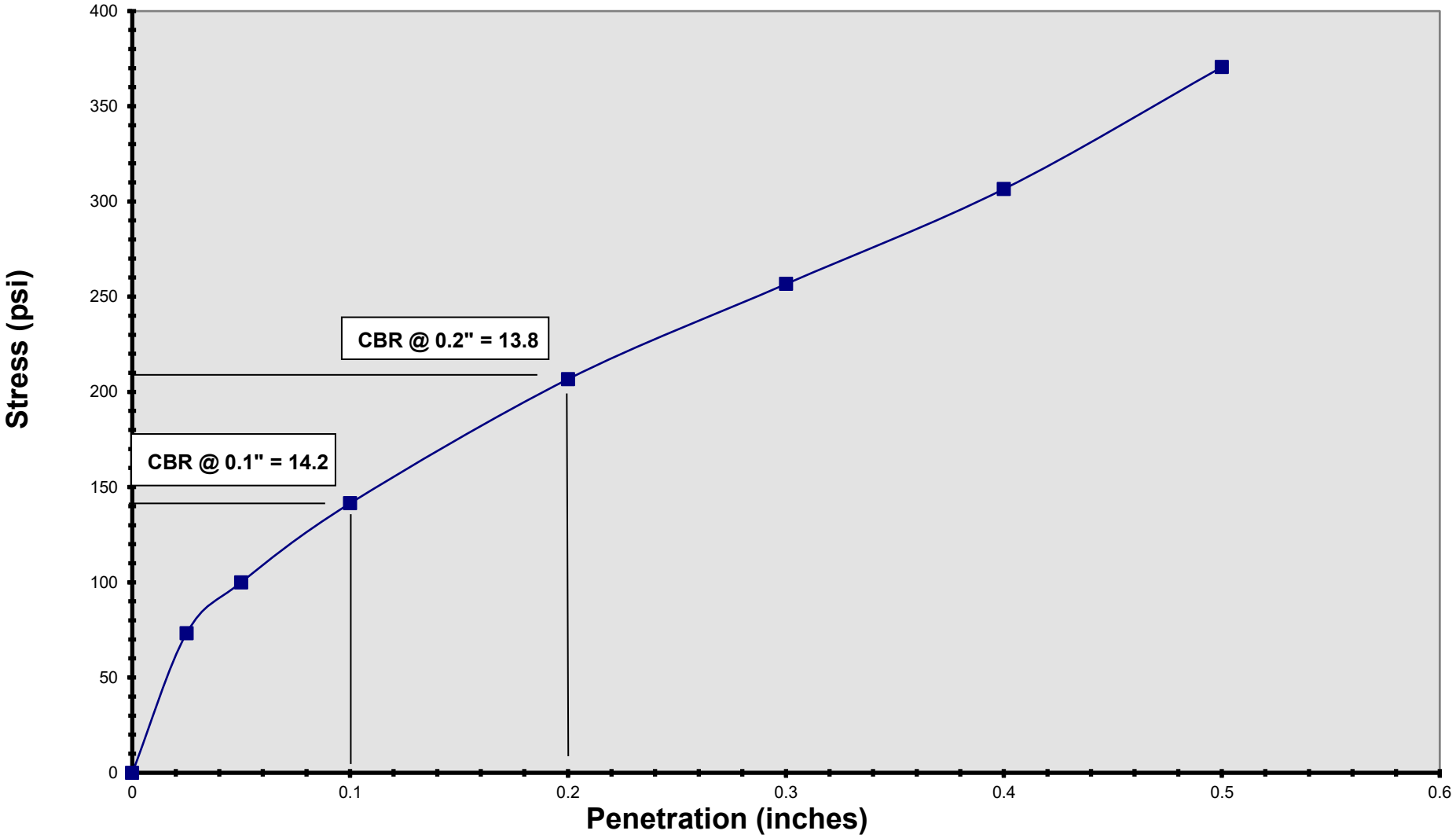
CBR - Stress versus Penetration Curve
(ASTM D1883)



PROJECT DESCRIPTION	MOLDED DRY DENSITY	CBR @ 0.1 INCH PENETRATION	TEST DATE
Smiley Tract San Antonio, Texas	109.1 pcf (96.8% of max density)	5.3	August 2022
SAMPLE DESCRIPTION	**MOLDED MOISTURE CONT.**	**CBR @ 0.2 INCHES PENETRATION**	**RETL PROJ. NO.**
Bulk Sample B-10 Brown Clayey Gravel (GC)	11.5%	4.6	G222544

ROCK ENGINEERING AND TESTING LABORATORY, LLC

CBR - Stress versus Penetration Curve
(ASTM D1883)



PROJECT DESCRIPTION	MOLDED DRY DENSITY	CBR @ 0.1 INCH PENETRATION	TEST DATE
Smiley Tract San Antonio, Texas	116.0 pcf (97.2% of max density)	14.2	August 2022
SAMPLE DESCRIPTION	**MOLDED MOISTURE CONT.**	**CBR @ 0.2 INCHES PENETRATION**	**RETL PROJ. NO.**
Bulk Sample B-13 Brown Clayey Gravel (GC)	9.8%	13.8	G222544

ROCK ENGINEERING AND TESTING LABORATORY, LLC

Engineering & Testing
Laboratory, Inc.

Rock Engineering & Testing Laboratory
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