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Approved
By: Elizabeth Nijkamp, PE
Date:05/26/2023
El Paso County Department of Public Works

PAVEMENT DESIGN REPORT

The Ridge at Lorson Ranch – Filing No. 3
El Paso County, Colorado

PREPARED FOR:

Landhuis Company
212 N. Wahsatch Ave. Ste 301
Colorado Springs, CO

JOB NO. 186386-3

October 20, 2022
Revised May 2, 2023

Respectfully Submitted,

RMG – Rocky Mountain Group

Jared McElmeel, E.I.
Geotechnical Staff Engineer

Reviewed by,

RMG – Rocky Mountain Group

COLORADO REGISTERED
ANTHONY P. MUNGER
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39818
PROFESSIONAL ENGINEER

Tony Munger, P.E.
Sr. Geotechnical Project Manager

SF Number 22-007

TABLE OF CONTENTS

GENERAL SITE AND PROJECT DESCTIPTION

Location

The Ridge at Lorson Ranch, Filing No. 3 is generally located in the southeastern portion of El Paso County, Colorado, east of the intersection of Fontaine Boulevard and Marksheffel Road. The location of the site is shown on the Site Vicinity Map, Figure 1.

Existing Conditions

At the time of our field investigation, the proposed streets were close to grade and utility mains and services had been installed. Curb and gutter had not been installed.

Project Description

This Pavement Design Report was performed to determine the subsurface conditions present along the roadway alignments and to develop recommendations for the design and construction of the proposed flexible pavements.

The proposed streets included in this investigation are shown on Figures 2.1 and 2.2. The streets considered below are classified as Urban Local. The roads classified as Urban Local are Reagan Ridge Drive, Logans Ridge Drive, Rikers Ridge Lane, Cody Ridge Drive, Scrub Jay Trail, Broken Top Drive, Alpine Ridge Drive, and Walleye Drive.

FIELDNVESTIGATION AND SUBSURFACE CONDITIONS

Drilling

The subsurface conditions on the site were investigated by drilling thirteen exploratory test borings. The approximate locations of the test borings are presented in the Test Boring Location Plan, Figure 2.1.

The test borings were advanced with a power-driven, continuous-flight auger drill rig to depths of about 5 to 10 feet below the existing ground surface. Samples were obtained in general accordance with ASTM D-1586 utilizing a 2-inch OD split-barrel sampler. Representative bulk samples of subsurface materials were obtained from each boring at a depth of approximately 0 to 2 feet below the existing ground surface. An Explanation of Test Boring Logs is presented in Figure 3. The Test Boring Logs are presented in Figures 4 through 10.

Subsurface Materials

The subsurface materials encountered in the test borings consisted of sandy clay fill, native sandy clay, and sandy claystone. Combined bulk samples of the material classified as CL according to the Unified Classification System. For pavement design purposes, the combined bulk soil samples classified as A-6 with a group index of 18, and A-7-6 with group indices ranging from 20 to 30 in

accordance with the American Association of State Highway and Transportation Officials (AASHTO) classification system. This soil classification is considered "poor" as subgrade material.

Groundwater

Groundwater was not encountered in the test borings at the time of drilling. Groundwater is not expected to affect the construction of the pavements. Fluctuations in groundwater and subsurface moisture conditions may occur due to variations in precipitation and other factors not readily apparent at this time. Development of the property and adjacent properties may also affect groundwater levels.

LABORATORY TESTING

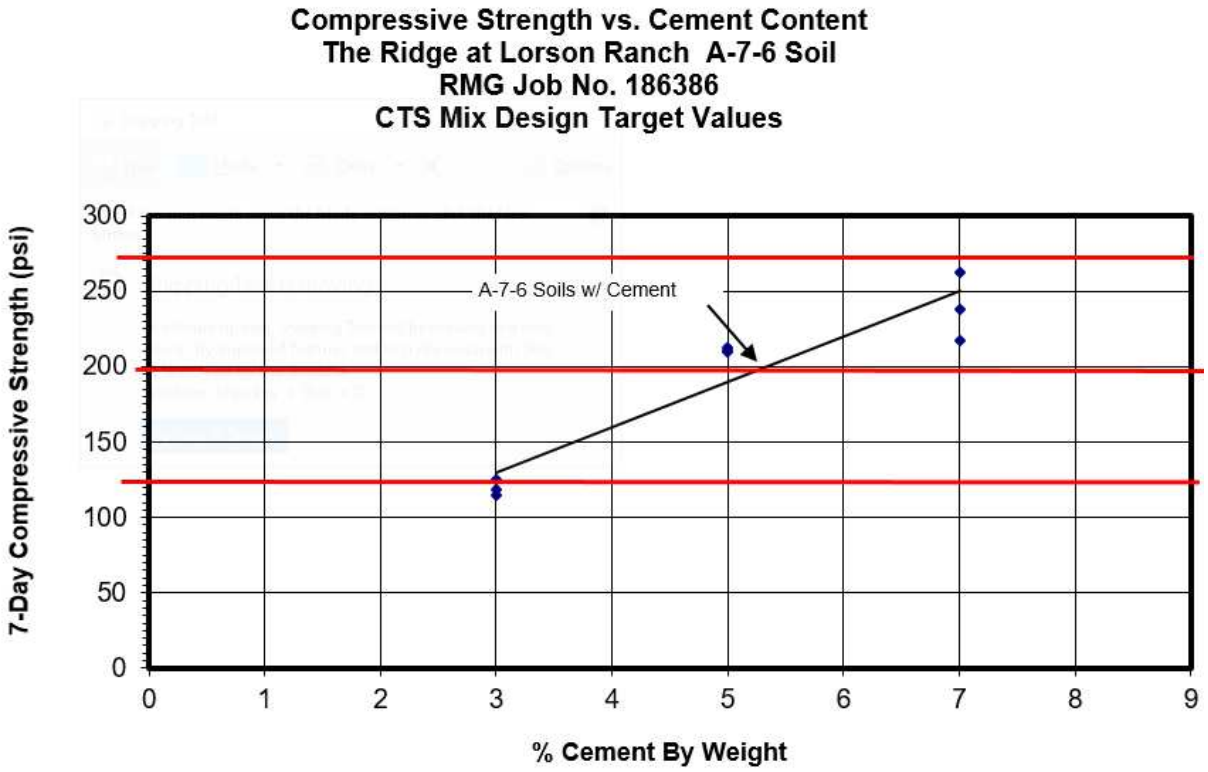
Laboratory Testing

The moisture content for the recovered samples was obtained in the laboratory. Grain-size analysis, Atterberg Limits tests, and Denver Swell/Consolidation tests were performed on selected samples for purposes of classification and to develop pertinent engineering properties. A Summary of Laboratory Test Results is presented in Figure 11. Soil Classification Data are presented in Figures 12 through 14. Denver Swell/Consolidation Test Results are presented in Figure 15 through 17.

A combined bulk sample of A-7-6 soil (using materials with group indices ranging from 25 to 30) was tested to determine the optimum moisture-density relationship in accordance with ASTM D698 (Standard Proctor compaction test). California Bearing Ratio, CBR tests were performed at varying densities with moisture content near optimum. At 95% of the maximum Standard Proctor density, the CBR of the bulk sample was determined to be 1.6. The Moisture-Density Relation Curves are presented in Figure 18. The CBR Test Results are presented in Figures 19 and 20.

Representative specimens of soil composed of the on-site subgrade materials and Portland Cement were prepared by varying the “percent cement by weight” at target values of 3, 5, and 7 percent cement. Three specimens (pucks) were prepared for each target cement value, compacted to 95% of the maximum Standard Proctor density and cured in a saturated condition for 7-days. The compressive strength of each specimen was then determined upon completion of the 7-day curing process.

The data values were then plotted as a function of “7-day Compressive Strength versus Percent Cement by Weight”, shown below. In accordance with the El Paso County Engineering Criteria Manual, the target “percent cement by weight” was selected to obtain strengths in the lower Strength Coefficient (SC) categories (SC = 0.11, 125-200 psi; SC = 0.12, 200-275 psi). A target SC = 0.11 is used for CTS soil in the pavement design procedure presented below. Based upon an evaluation of the test data, a target range of 6.25 percent cement is recommended in all roadway sections. Microfracturing will be required for strengths above the 275-psi threshold stipulated in the Engineering Criteria Manual.



PAVEMENT DESIGN

The discussion presented below is based on the subsurface conditions encountered in the test borings, laboratory test results and the project characteristics previously described. If the subsurface conditions are different from those described in this report or the project characteristics change, RMG should be retained to review our recommendations and modify them, if necessary. The conclusions and recommendations presented in this report should be verified by RMG during construction.

The pavement design was performed using the El Paso County Engineering Criteria Manual, Appendix D. The pavement design parameters and design calculations are presented below.

Street Classification – Urban Local

1) Reagan Ridge Drive, Logans Ridge Drive, Rikers Ridge Lane, Cody Ridge Drive, Scrub Jay Trail, Broken Top Drive, Alpine Ridge Drive, and Walleye Drive

ESAL = 292,000 (Table D-2)
Serviceability Index = 2.0 (Table D-1)

2) Strength coefficients (Table D-3)

Asphalt (HMA): $a_1 = 0.44$
Cement-Treated Subgrade (CTS): $a_2 = 0.11$

3) Subgrade
M_r = CBR x 1500 = 1.6 x 1500 = 2,400 psi

4) Structural number (SN) = 3.73 (per 1993 AASHTO Empirical Equation for Flexible Pavements)

5) Composite asphalt/CTS section
Minimum HMA thickness = D_1 = 3 inches (Table D-2)
CTS thickness = D_2 = {SN – (D_1 x a_1)} / a_2 = {3.73 – (3 x 0.44)} / 0.11 = 22.0 inches
SN = (5.25 x 0.44) + (13 x 0.11) = 3.74 > 3.73 (Min. SN required)
Use HMA thickness = 5.25 inches over CTS thickness = 13.0 inches

6) Optional composite asphalt/ABC section
The strength coefficient of ABC is the same as the strength coefficient of our CTS design (0.11). Therefore, the design thicknesses of HMA and ABC will remain the same.

Pavement Thickness

Based on the design calculations, the recommended pavement section is presented below and on Figure 2.2.

Recommended Pavement Sections

Option 1 – HMA Over ABC Reagan Ridge Drive, Logans Ridge Drive, Rikers Ridge Lane, Cody Ridge Drive, Scrub Jay Trail, Broken Top Drive, Alpine Ridge Drive, and Walleye Drive	5.25" HMA	13.0" ABC
Option 2 – HMA Over CTS Reagan Ridge Drive, Logans Ridge Drive, Rikers Ridge Lane, Cody Ridge Drive, Scrub Jay Trail, Broken Top Drive, Alpine Ridge Drive, and Walleye Drive	5.25" HMA	13.0" CTS
Optimal CTS Percent Cement by Weight = 6.25%		

Pavement Materials

Pavement materials should be selected, prepared, and placed in accordance with El Paso County specifications and the *Pikes Peak Region Asphalt Paving Specifications*. Tests should be performed in accordance with the applicable procedures presented in the specifications.

Soil Mitigation

The PDCM notes that mitigation measures may be required for expansive soils, shallow ground water, subgrade instability, etc. Based on the AASHTO classification of for the soils in the subdivision, the subgrade soils evaluated for this pavement design exhibited a swell of less than 2.0%. Groundwater or wet and unstable soils were not encountered in the borings. Therefore, special mitigation measures do not appear to be necessary for subgrade preparation.

Subgrade Preparation

All fill placed below pavements should be moisture conditioned and compacted in accordance with El Paso County *Standard Specifications Manual*. Prior to placement of the pavement section, the final subgrade should be scarified to a depth of 12 inches, adjusted to within 2 percent of the optimum moisture content and compacted to El Paso County specifications. The subgrade should then be proofrolled with a heavy, pneumatic tired vehicle. Areas which deform under wheel loads should be removed and replaced. Base course placed atop prepared subgrade should be compacted to at least 95 percent of the maximum modified Proctor density (ASTM D1557).

Sulfate Content

Sulfate testing was performed on selected samples based on ASTM C1580. Test results showed up to 0.98% by weight, indicating the soils present Class II (severe) sulfate exposure. Based on these results, high sulfate resistant Type V cement or a Type V equivalent mixture according to ACI 201.2R-10 is generally suggested for concrete in contact with the subsurface materials. However, based on the use of CTS as roadway subgrade throughout the Lorson Ranch area for over a decade with no apparent signs that cement-sulfate reaction is adversely affecting performance of the roadways, it is our opinion that Type I/II cement is suitable for use in the CTS.

Surface Drainage

Surface drainage is important for the satisfactory performance of pavement. Wetting of the subgrade soils or base course will cause a loss of strength which can result in pavement distress. Surface drainage should provide for efficient removal of storm-water runoff. Water should not be allowed to pond on the pavement or at the edges of the pavement.

Subgrade Observations and Testing

The pavement thicknesses presented above assume pavement construction is completed in accordance with El Paso County specifications and the *Pikes Peak Region Asphalt Paving Specifications*. RMG should be present at the site during subgrade preparation, placement of fill, and construction of pavements to perform site observations and testing.

CLOSING

This report has been prepared for the exclusive purpose of providing geotechnical engineering information and recommendations for development described in this report. RMG should be retained to review the final construction documents prior to construction to verify our findings, conclusions and recommendations have been appropriately implemented.

This report has been prepared for the exclusive use by the **Landhuis Company** for application as an aid in the design and construction of the proposed development in accordance with generally accepted geotechnical engineering practices. The analyses and recommendations in this report are based in part upon data obtained from test borings, site observations and the information presented in referenced reports. The nature and extent of variations may not become evident until construction. If variations then become evident, RMG should be retained to review the recommendations presented in this report considering the varied condition, and either verify or modify them in writing.

Our professional services were performed using that degree of care and skill ordinarily exercised, under similar circumstances, by geotechnical engineers practicing in this or similar localities. RMG does not warrant the work of regulatory agencies or other third parties supplying information which may have been used during the preparation of this report. No warranty, express or implied is made by the preparation of this report. Third parties reviewing this report should draw their own conclusions regarding site conditions and specific construction techniques to be used on this project.

The scope of services for this project does not include, either specifically or by implication, environmental assessment of the site or identification of contaminated or hazardous materials or conditions. Development of recommendations for the mitigation of environmentally related conditions, including but not limited to biological or toxicological issues, are beyond the scope of this report. If the Client desires investigation into the potential for such contamination or conditions, other studies should be undertaken.

If we can be of further assistance in discussing the contents of this report or analysis of the proposed development, from a geotechnical engineering point-of-view, please feel free to contact us.

FIGURES

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SITE VICINITY MAP

THE RIDGE AT LORSON RANCH
PAVEMENT DESIGN
EL PASO COUNTY, COLORADO
LANDHUIS COMPANY

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FIG No. 1

DATE 10-20-2022

DENOTES APPROXIMATE LOCATION OF TEST BORINGS

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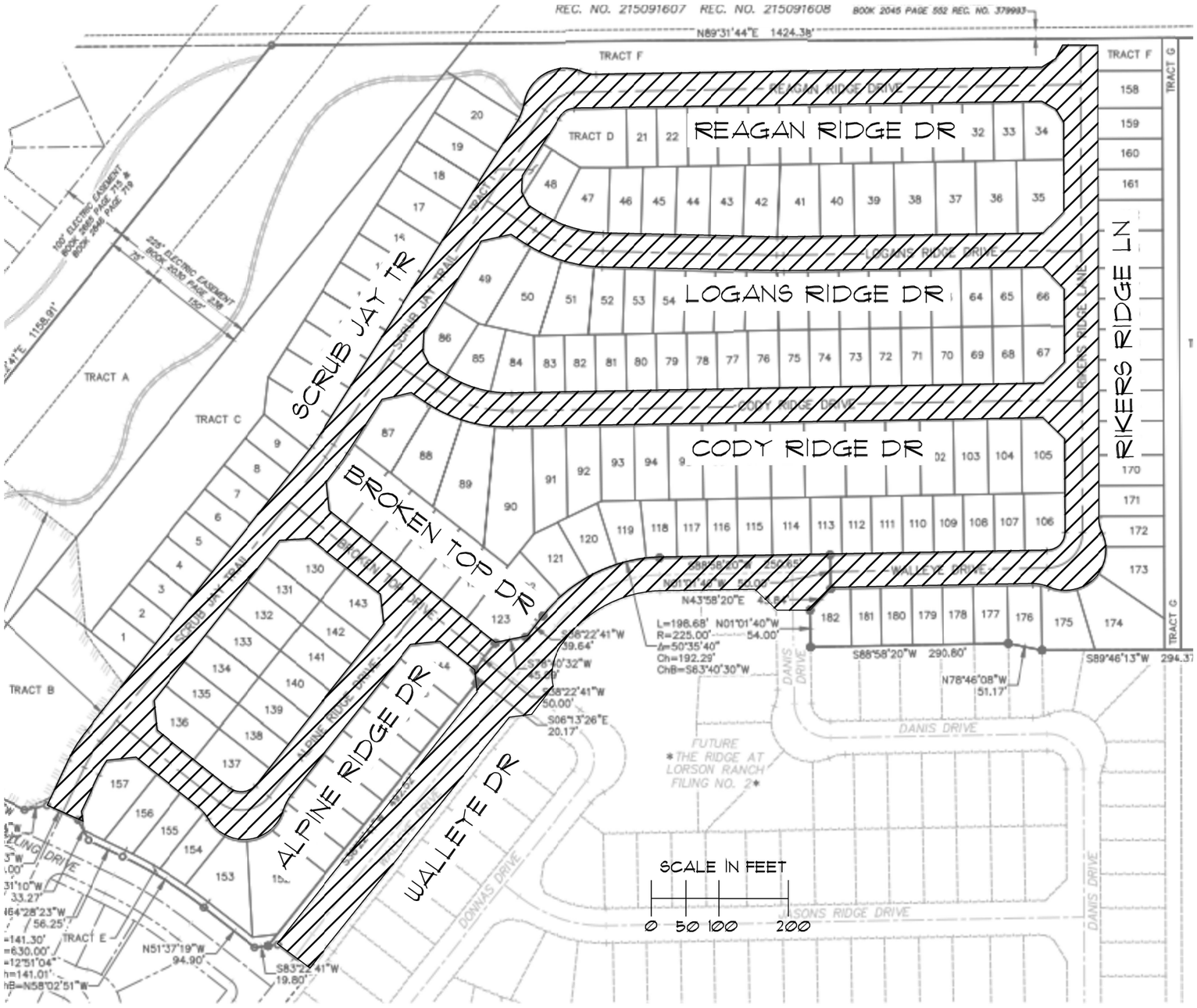
EL PASO COUNTY, COLORADO
LANDHUIS COMPANY

ENGINEER:	TM
DRAWN BY:	NM
CHECKED BY:	TM
ISSUED:	10-20-2022

TEST BORING LAYOUT PLAN

SHEET No.
FIG-2.1



5.25" HMA
OVER
13" ABC

OR

5.25" HMA
OVER
13" CTS

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ISSUED:	10-20-2022
ALTERNATE OPTIONS	4-26-23
	186386

PAVEMENT RECOMMENDATIONS

SHEET No.
FIG-2.2

SOILS DESCRIPTION


CLAYSTONE


FILL: CLAY, SANDY


SANDY CLAY

UNLESS NOTED OTHERWISE, ALL LABORATORY
TESTS PRESENTED HEREIN WERE PERFORMED BY:
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2910 AUSTIN BLUFFS PARKWAY
COLORADO SPRINGS, COLORADO

SYMBOLS AND NOTES


XX — STANDARD PENETRATION TEST - MADE BY DRIVING A SPLIT-BARREL SAMPLER INTO THE SOIL BY DROPPING A 140 LB. HAMMER 30", IN GENERAL ACCORDANCE WITH ASTM D-1586. NUMBER INDICATES NUMBER OF HAMMER BLOWS PER FOOT (UNLESS OTHERWISE INDICATED).


XX — UNDISTURBED CALIFORNIA SAMPLE - MADE BY DRIVING A RING-LINED SAMPLER INTO THE SOIL BY DROPPING A 140 LB. HAMMER 30", IN GENERAL ACCORDANCE WITH ASTM D-3550. NUMBER INDICATES NUMBER OF HAMMER BLOWS PER FOOT (UNLESS OTHERWISE INDICATED).


FREE WATER TABLE


DEPTH AT WHICH BORING CAVED


BULK — DISTURBED BULK SAMPLE


AUG — AUGER "CUTTINGS"

4.5 — WATER CONTENT (%)

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EXPLANATION OF TEST BORING LOGS

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FIGURE No. 3

DATE Oct/20/2022

TEST BORING: **40** DATE DRILLED: 9/28/22 NO GROUNDWATER ON 9/28/22	DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
FILL: CLAY, SANDY, brown, stiff to very stiff, moist	2.5			16	12.5
				15	13.6
	5.0				

TEST BORING: **41** DATE DRILLED: 9/28/22 NO GROUNDWATER ON 9/28/22	DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
FILL: CLAY, SANDY, brown, stiff to very stiff, moist	2.5			15	11.5
				16	14.3
	5.0				

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TEST BORING LOG

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FIGURE No. 4

DATE Oct/20/2022

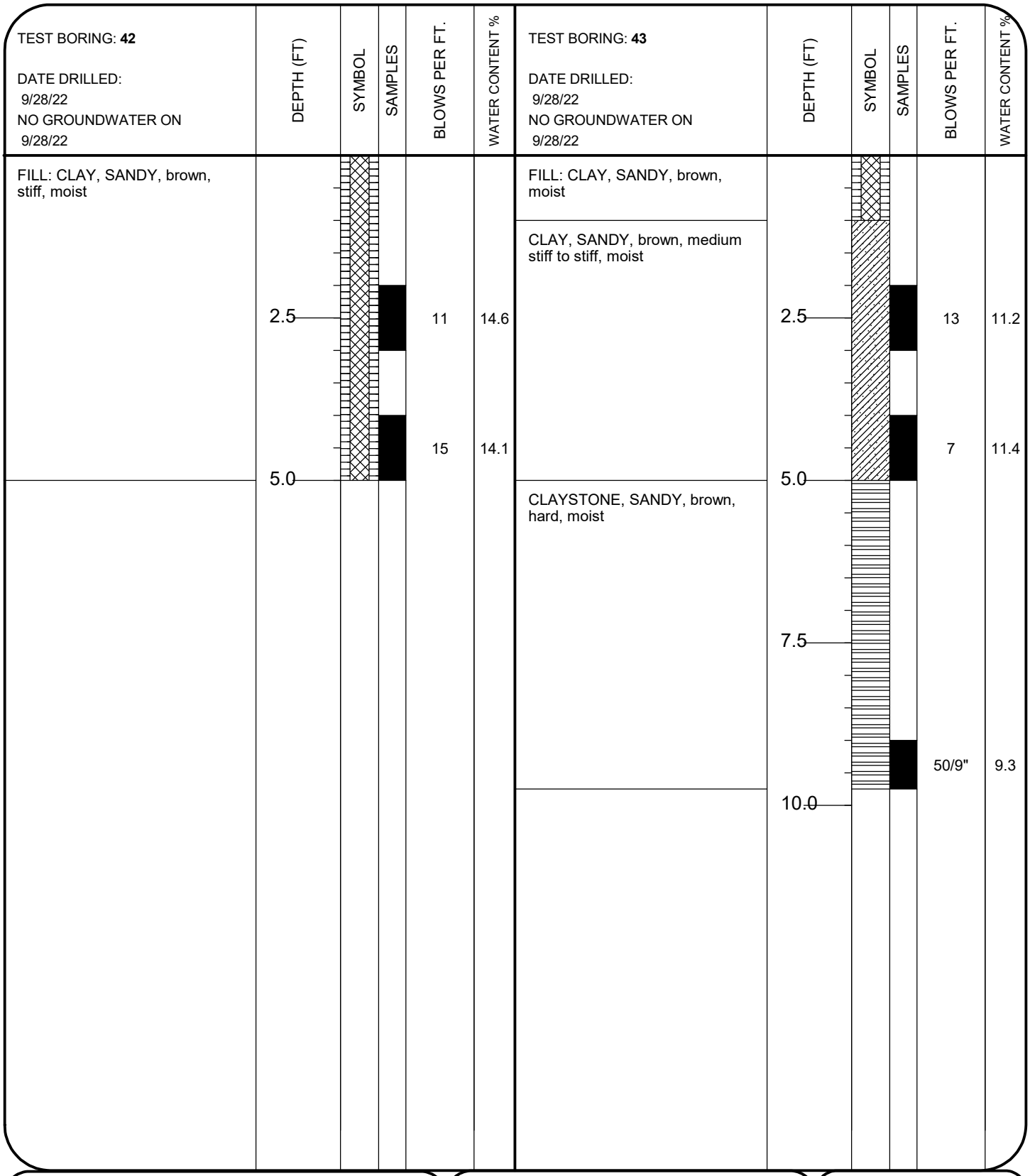

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FIGURE No. 5

DATE Oct/20/2022

TEST BORING: **44** DATE DRILLED: 9/28/22 NO GROUNDWATER ON 9/28/22	DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
FILL: CLAY, SANDY, brown, stiff, moist	2.5			9	15.7
CLAY, SANDY, brown, very stiff, moist				28	11.7
CLAYSTONE, SANDY, dark brown, medium hard, moist	5.0				

TEST BORING: **45** DATE DRILLED: 9/28/22 NO GROUNDWATER ON 9/28/22	DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
FILL: CLAY, SANDY, brown, stiff, moist	2.5			9	16.3
				10	16.2
	5.0				

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TEST BORING LOG

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FIGURE No. 6

DATE Oct/20/2022

TEST BORING: **46** DATE DRILLED: 9/28/22 NO GROUNDWATER ON 9/28/22	DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
FILL: CLAY, SANDY, brown, soft to stiff, moist	2.5			9	15.2
				4	15.5
	5.0				

TEST BORING: **47** DATE DRILLED: 9/28/22 NO GROUNDWATER ON 9/28/22	DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
FILL: CLAY, SANDY, brown, moist	2.5			40	10.4
CLAYSTONE, SANDY, dark brown, medium hard to hard, moist				50/11"	9.4
	5.0				

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TEST BORING LOG

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FIGURE No. 7

DATE Oct/20/2022

TEST BORING: **48** DATE DRILLED: 9/28/22 NO GROUNDWATER ON 9/28/22	DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
FILL: CLAY, SANDY, brown, stiff to very stiff, moist	2.5			10	17.0
				19	13.4
	5.0				

TEST BORING: **49** DATE DRILLED: 9/28/22 NO GROUNDWATER ON 9/28/22	DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
FILL: CLAY, SANDY, brown, stiff, moist	2.5			9	13.8
	5.0			13	13.1
	7.5				
				14	22.1
	10.0				

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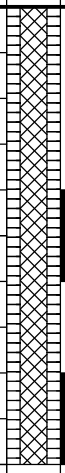
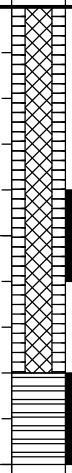
TEST BORING LOG

JOB No. 186386

FIGURE No. 8

DATE Oct/20/2022

TEST BORING: **50** DATE DRILLED: 9/28/22 NO GROUNDWATER ON 9/28/22	DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
FILL: CLAY, SANDY, brown, medium stiff to stiff, moist	2.5			13	16.6
				6	16.5
	5.0				

TEST BORING: **51** DATE DRILLED: 9/28/22 NO GROUNDWATER ON 9/28/22	DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
FILL: CLAY, SANDY, brown, stiff, moist	2.5			15	15.1
CLAYSTONE, SANDY, dark brown, firm, moist				21	19.3
	5.0				

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TEST BORING LOG

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FIGURE No. 9

DATE Oct/20/2022

TEST BORING: **52**

DATE DRILLED:
9/28/22
NO GROUNDWATER ON
9/28/22

DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
FILL: CLAY, SANDY, brown, medium stiff to very stiff, moist				
2.5			20	18.8
			8	12.2
5.0				

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FIGURE No. 10

DATE Oct/20/2022

Test Boring No.	Depth	Water Content (%)	Dry Density (pcf)	Liquid Limit	Plasticity Index	% Retained No.10 Sieve	% Retained No.40 Sieve	% Passing No. 200 Sieve	% Swell @ 100 psf	AASHTO Classification
40	2.0	12.5	101.7	41	26	1.9	3.8	81.2	- 0.1	A-7-6 (20)
40	4.0	13.6								
41	2.0	11.5		42	25	0.4	3.6	82.3		A-7-6 (20)
41	4.0	14.3								
42	2.0	14.6		46	31	1.5	4.0	82.9		A-7-6 (25)
42	4.0	14.1								
43	2.0	11.2	103.9	39	24	1.7	3.5	79.5	0.0	A-6 (18)
43	4.0	11.4								
43	9.0	9.3								
44	2.0	15.7		45	30	0.4	3.5	84.4		A-7-6 (25)
44	4.0	11.7								
45	2.0	16.3	95.7	43	29	1.5	4.4	79.4	0.0	A-7-6 (22)
45	4.0	16.2								
46	2.0	15.2		45	32	1.1	3.5	76.9		A-7-6 (23)
46	4.0	15.5								
47	2.0	10.4	104.7	43	30	1.6	3.5	81.2	- 0.1	A-7-6 (23)
47	4.0	9.4								
48	2.0	17.0	94.5	49	34	2.3	8.6	71.6	- 0.6	A-7-6 (23)
48	4.0	13.4								
49	2.0	13.8		47	32	0.8	3.7	80.7		A-7-6 (25)
49	4.0	13.1								
49	9.0	22.1								
50	2.0	16.6		49	34	2.8	4.5	82.5		A-7-6 (28)
50	4.0	16.5								
51	2.0	15.1	99.7	44	31	2.1	11.9	75.7	0.1	A-7-6 (22)
51	4.0	19.3								
52	2.0	18.8		54	36	1.6	5.7	80.9		A-7-6 (30)
52	4.0	12.2								

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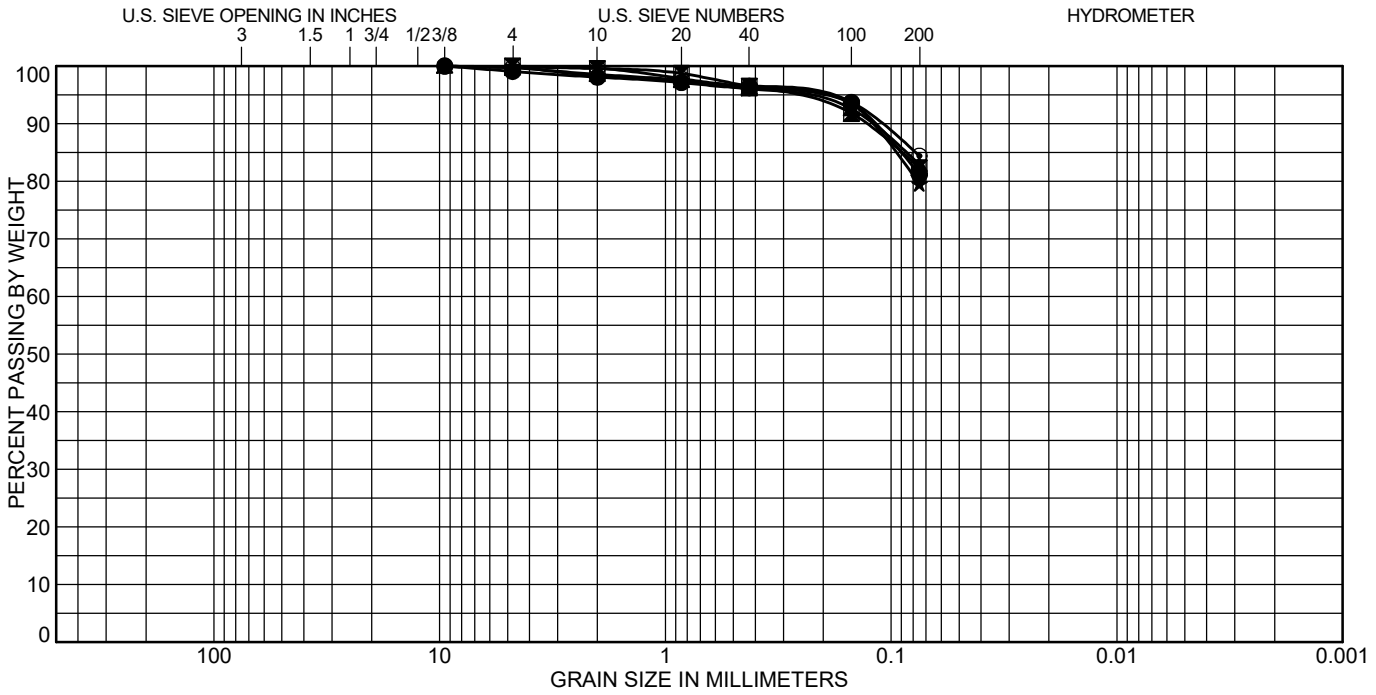
SUMMARY OF LABORATORY TEST RESULTS

JOB No. 186386
FIGURE No. 11
PAGE 1 OF 1
DATE Oct/20/2022



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Test Boring	Depth (ft)	Classification	LL	PL	PI
●	40	2.0	LEAN CLAY with SAND(CL)	41	15	26
⧓	41	2.0	LEAN CLAY with SAND(CL)	42	17	25
▲	42	2.0	LEAN CLAY with SAND(CL)	46	15	31
★	43	2.0	LEAN CLAY with SAND(CL)	39	15	24
⊙	44	2.0	LEAN CLAY with SAND(CL)	45	15	30

	Test Boring	Depth (ft)	%Gravel	%Sand	%Silt	%Clay
●	40	2.0	0.9	17.9	81.2	
⧓	41	2.0	0.0	17.7	82.3	
▲	42	2.0	0.3	16.8	82.9	
★	43	2.0	0.0	20.5	79.5	
⊙	44	2.0	0.2	15.4	84.4	

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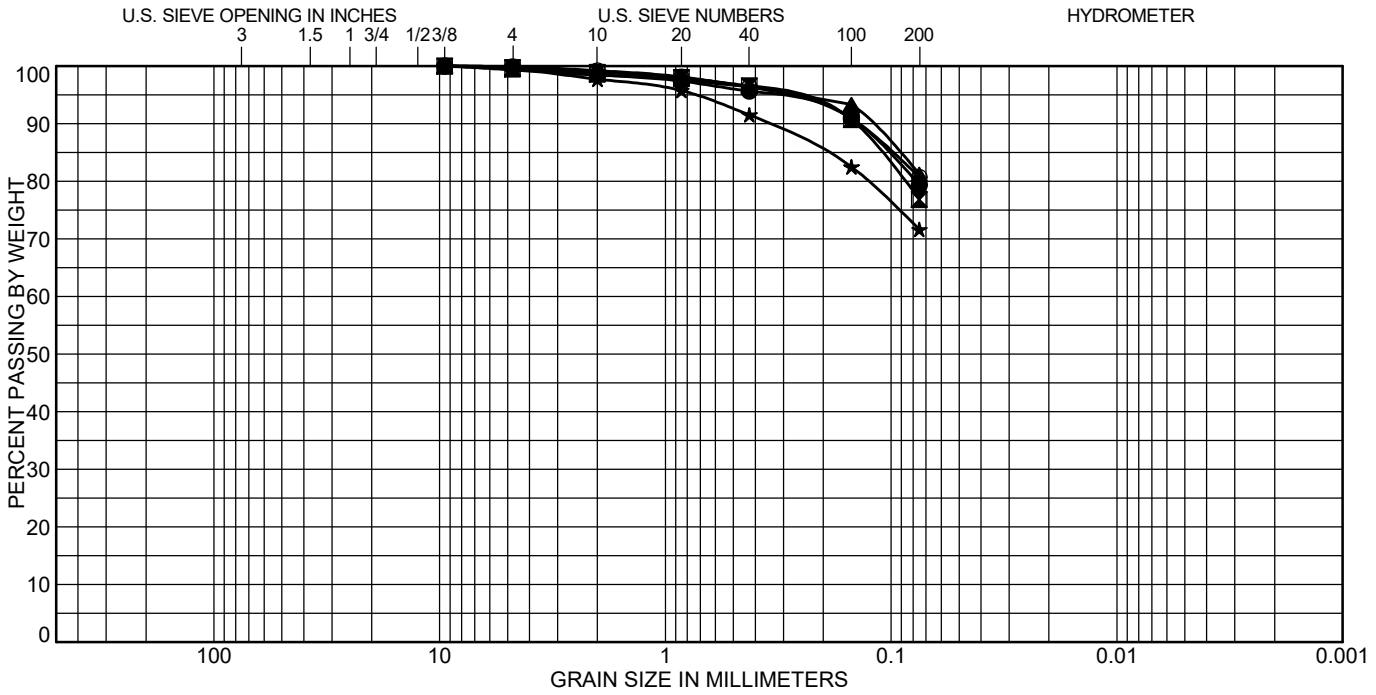
SOIL CLASSIFICATION DATA

JOB No. 186386

FIGURE No. 12

DATE Oct/20/2022



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Test Boring	Depth (ft)	Classification	LL	PL	PI
●	45	2.0	LEAN CLAY with SAND(CL)	43	14	29
⧓	46	2.0	LEAN CLAY with SAND(CL)	45	13	32
▲	47	2.0	LEAN CLAY with SAND(CL)	43	13	30
★	48	2.0	LEAN CLAY with SAND(CL)	49	15	34
⊙	49	2.0	LEAN CLAY with SAND(CL)	47	15	32

	Test Boring	Depth (ft)	%Gravel	%Sand	%Silt	%Clay
●	45	2.0	0.3	20.3	79.4	
⧓	46	2.0	0.3	22.9	76.9	
▲	47	2.0	0.7	18.1	81.2	
★	48	2.0	0.4	27.9	71.6	
⊙	49	2.0	0.1	19.2	80.7	

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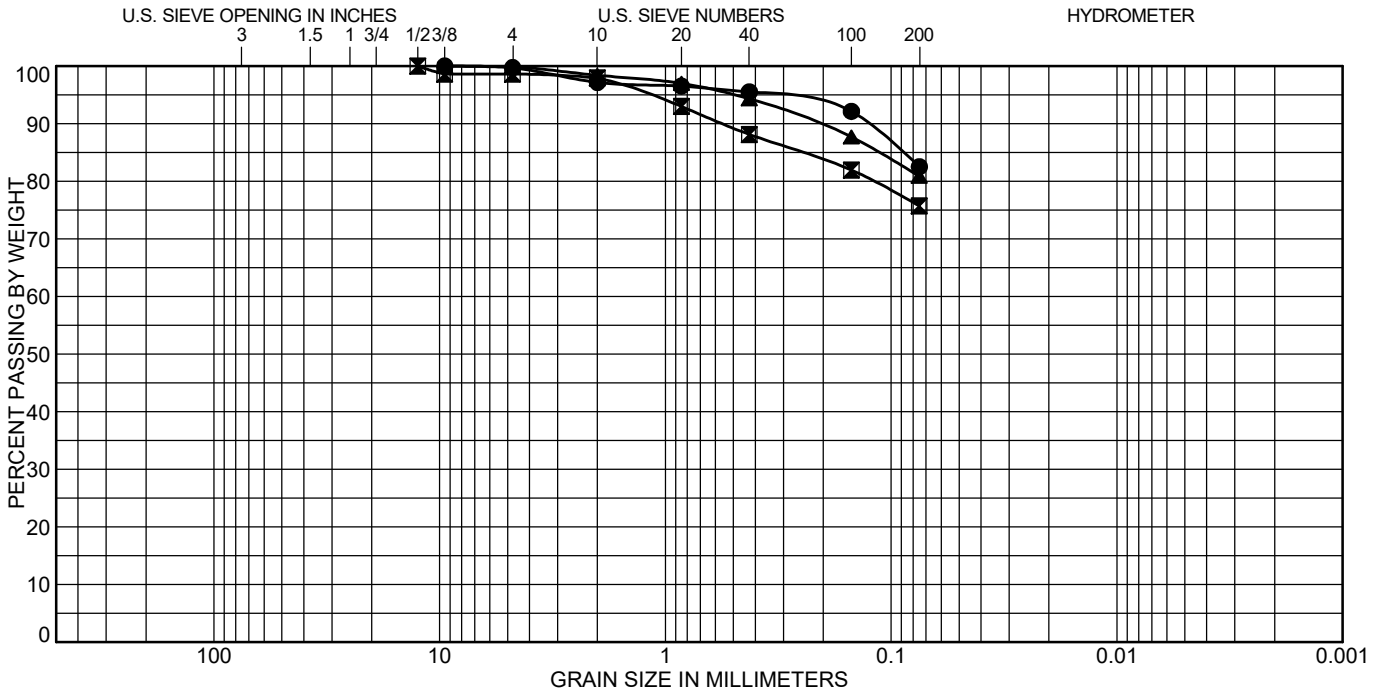
SOIL CLASSIFICATION DATA

JOB No. 186386

FIGURE No. 13

DATE Oct/20/2022



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Test Boring	Depth (ft)	Classification	LL	PL	PI
●	**50**	**2.0**	**LEAN CLAY with SAND(CL)**	**49**	**15**	**34**
⧓	**51**	**2.0**	**LEAN CLAY with SAND(CL)**	**44**	**13**	**31**
▲	**52**	**2.0**	**FAT CLAY with SAND(CH)**	**54**	**18**	**36**

	Test Boring	Depth (ft)	%Gravel	%Sand	%Silt	%Clay
●	**50**	**2.0**	**0.3**	**17.2**	**82.5**	
⧓	**51**	**2.0**	**1.4**	**22.9**	**75.7**	
▲	**52**	**2.0**	**0.1**	**19.0**	**80.9**	

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SOIL CLASSIFICATION DATA

JOB No. 186386

FIGURE No. 14

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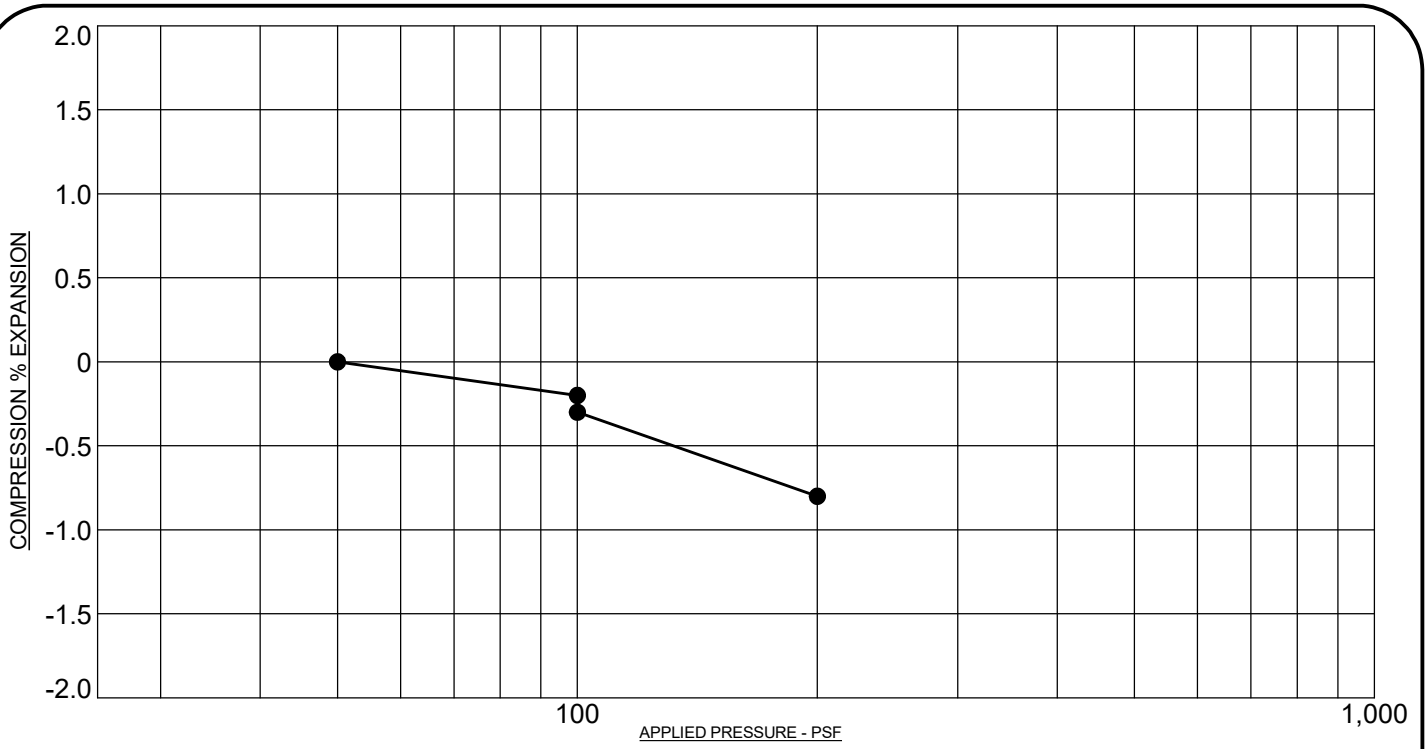
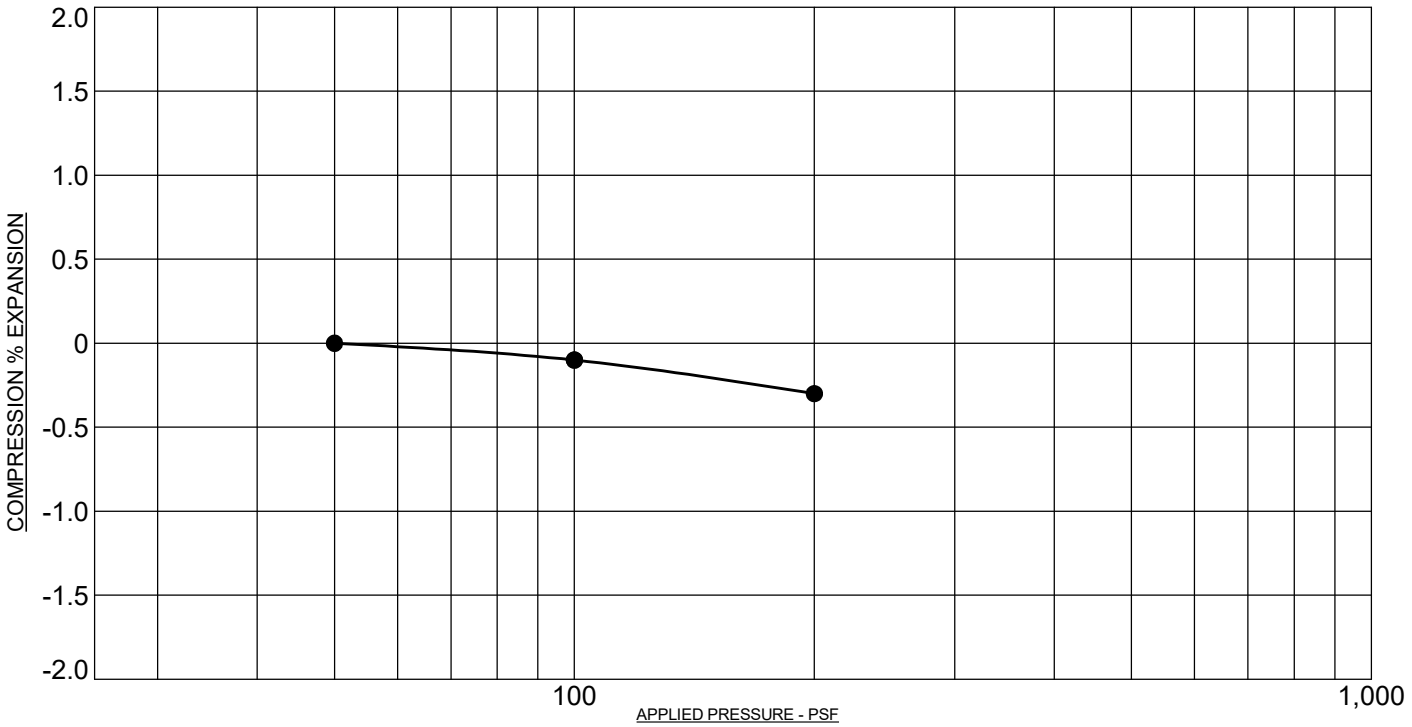


PROJECT: **The Ridge at Lorson Ranch El Paso County, Colorado**
SAMPLE DESCRIPTION: **FILL: CLAY, SANDY**
NOTE: SAMPLE WAS INUNDATED WITH WATER AT 100 PSF

SAMPLE LOCATION: **40 @ 2 FT**
NATURAL DRY UNIT WEIGHT: **101.7 PCF**
NATURAL MOISTURE CONTENT: **12.5%**
PERCENT SWELL/COMPRESSION: **- 0.1**



PROJECT: **The Ridge at Lorson Ranch El Paso County, Colorado**
SAMPLE DESCRIPTION: **CLAY, SANDY**
NOTE: SAMPLE WAS INUNDATED WITH WATER AT 100 PSF

SAMPLE LOCATION: **43 @ 2 FT**
NATURAL DRY UNIT WEIGHT: **103.9 PCF**
NATURAL MOISTURE CONTENT: **11.2%**
PERCENT SWELL/COMPRESSION: **0.0**

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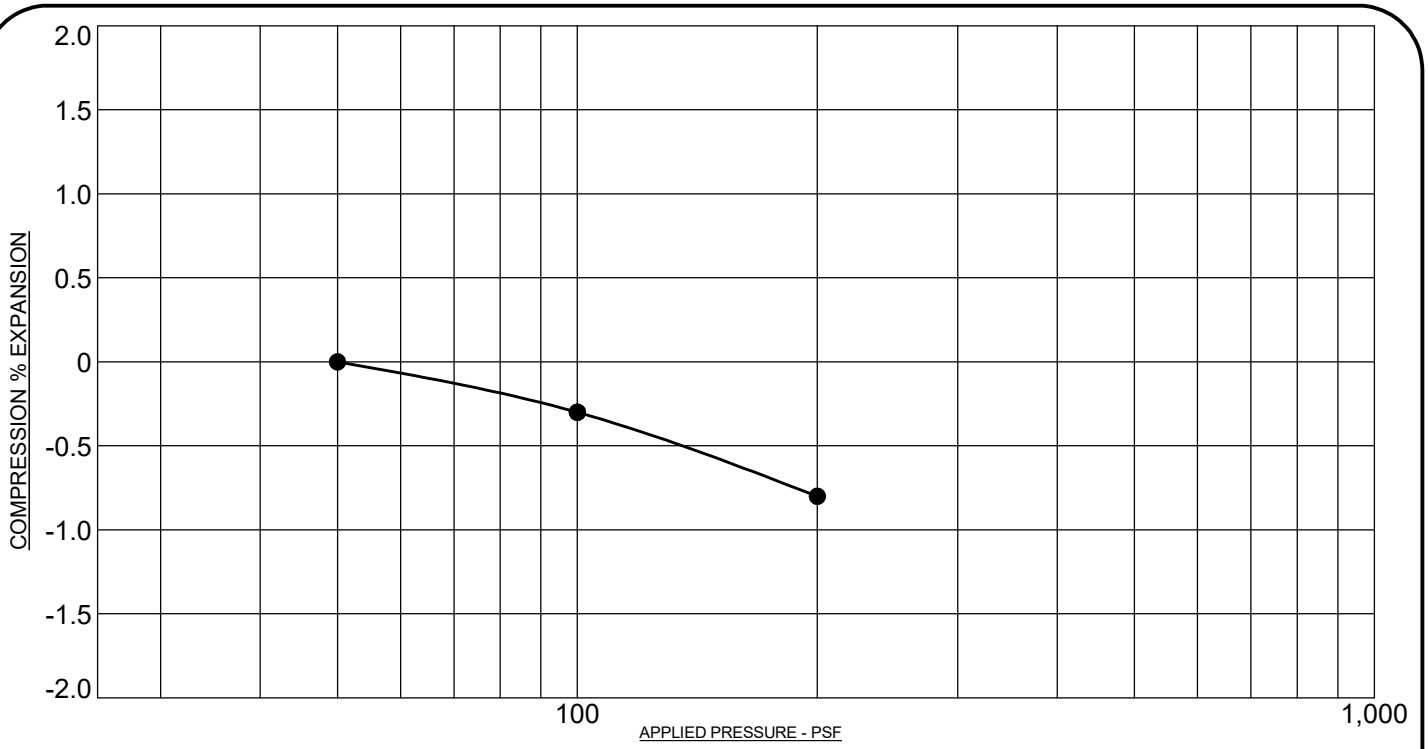
SWELL/CONSOLIDATION TEST RESULTS

JOB No. 186386

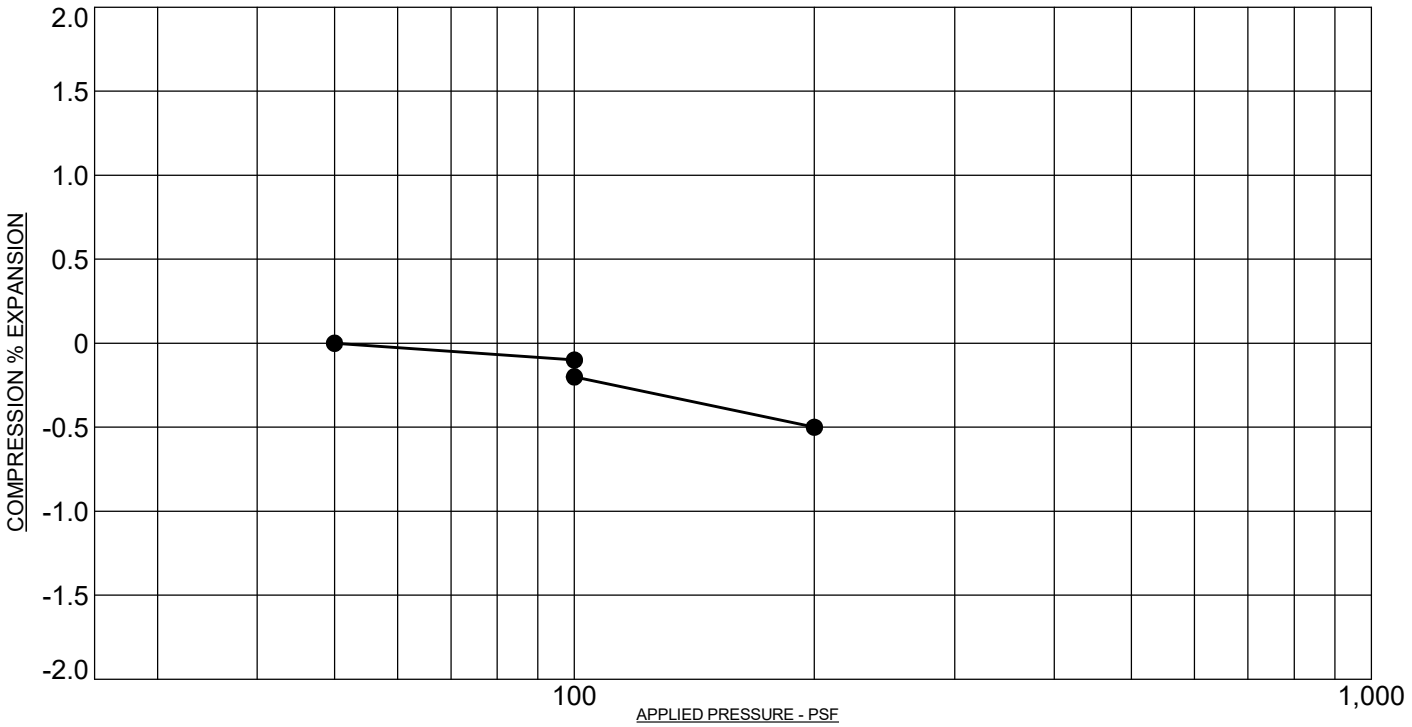
FIGURE No. 15

DATE Oct/20/2022



PROJECT: **The Ridge at Lorson Ranch El Paso County, Colorado**
SAMPLE DESCRIPTION: **FILL: CLAY, SANDY**
NOTE: SAMPLE WAS INUNDATED WITH WATER AT 100 PSF

SAMPLE LOCATION: **45 @ 2 FT**
NATURAL DRY UNIT WEIGHT: **95.7 PCF**
NATURAL MOISTURE CONTENT: **16.3%**
PERCENT SWELL/COMPRESSION: **0.0**



PROJECT: **The Ridge at Lorson Ranch El Paso County, Colorado**
SAMPLE DESCRIPTION: **CLAYSTONE, SANDY**
NOTE: SAMPLE WAS INUNDATED WITH WATER AT 100 PSF

SAMPLE LOCATION: **47 @ 2 FT**
NATURAL DRY UNIT WEIGHT: **104.7 PCF**
NATURAL MOISTURE CONTENT: **10.4%**
PERCENT SWELL/COMPRESSION: **- 0.1**

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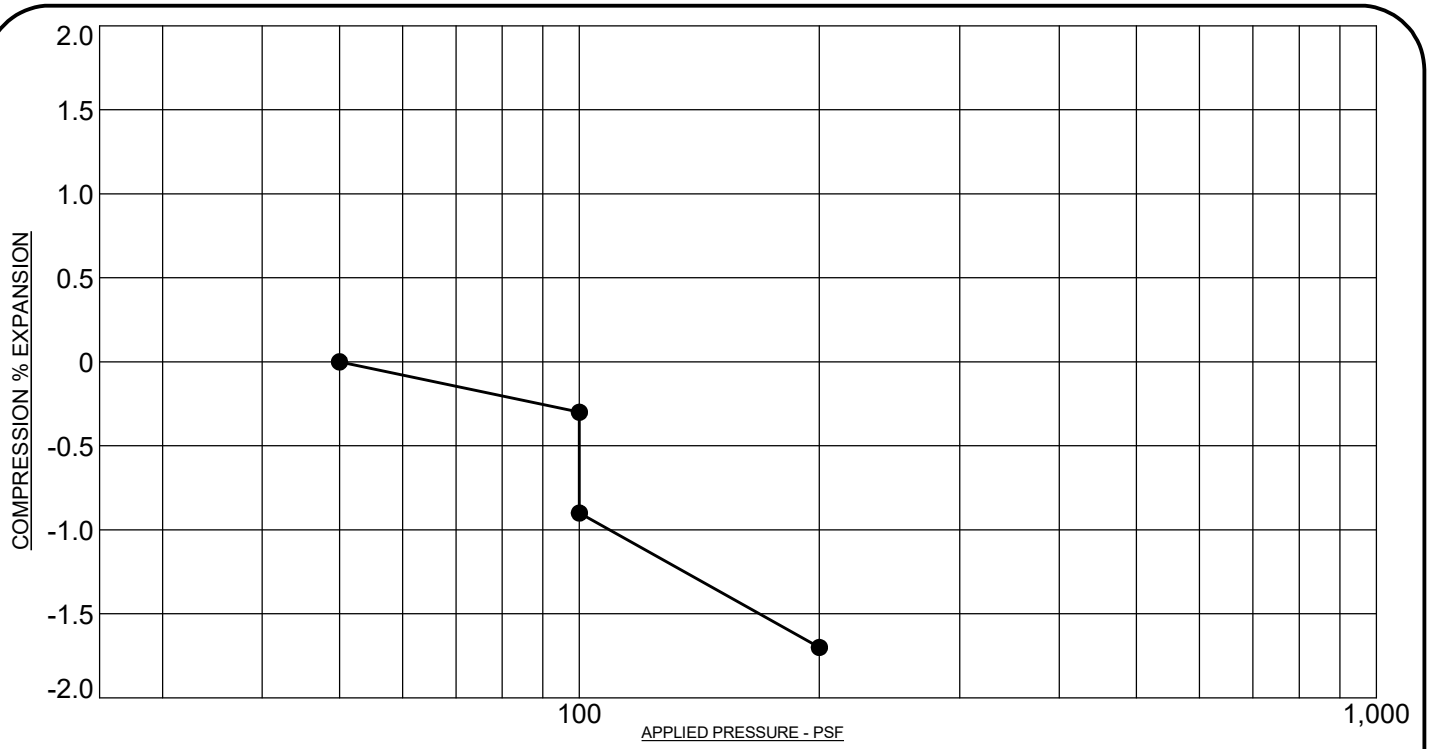
SWELL/CONSOLIDATION TEST RESULTS

JOB No. 186386

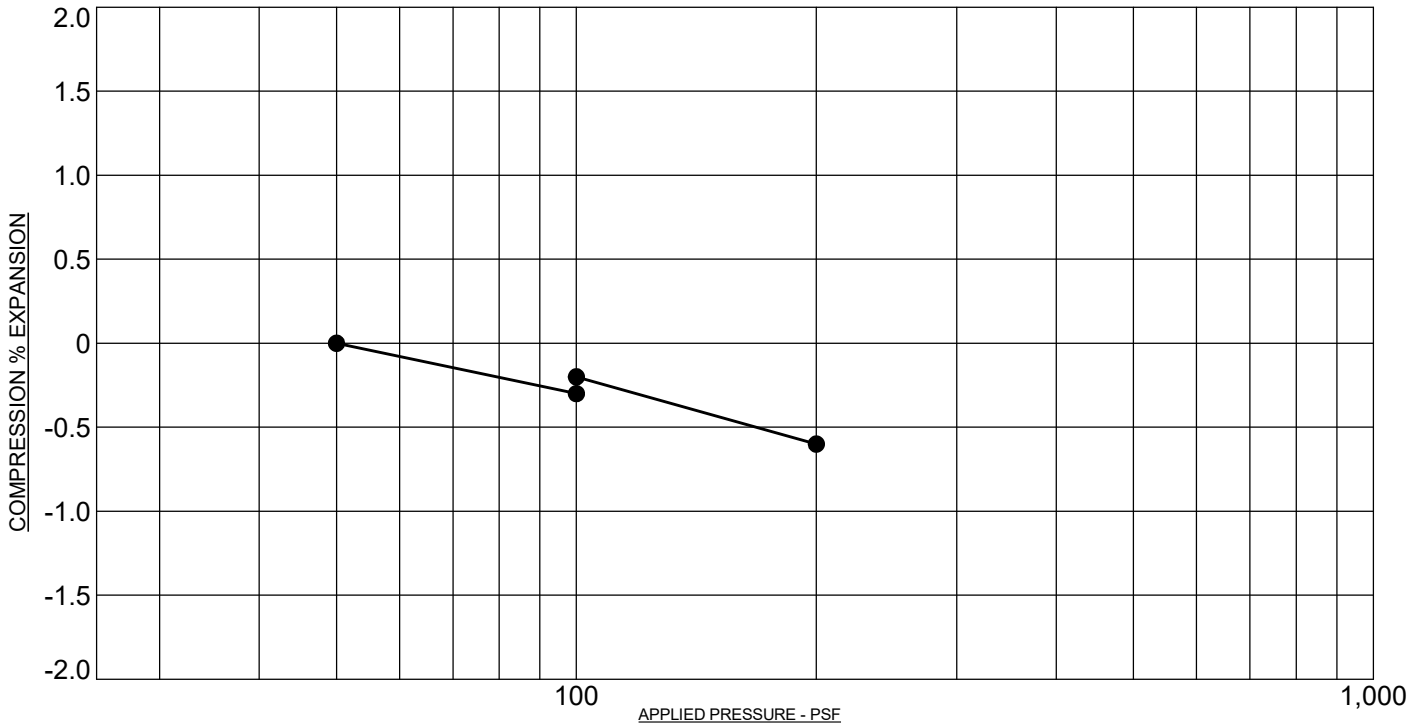
FIGURE No. 16

DATE Oct/20/2022



PROJECT: **The Ridge at Lorson Ranch El Paso County, Colorado**
SAMPLE DESCRIPTION: **FILL: CLAY, SANDY**
NOTE: SAMPLE WAS INUNDATED WITH WATER AT 100 PSF

SAMPLE LOCATION: **48 @ 2 FT**
NATURAL DRY UNIT WEIGHT: **94.5 PCF**
NATURAL MOISTURE CONTENT: **17.0%**
PERCENT SWELL/COMPRESSION: **- 0.6**



PROJECT: **The Ridge at Lorson Ranch El Paso County, Colorado**
SAMPLE DESCRIPTION: **FILL: CLAY, SANDY**
NOTE: SAMPLE WAS INUNDATED WITH WATER AT 100 PSF

SAMPLE LOCATION: **51 @ 2 FT**
NATURAL DRY UNIT WEIGHT: **99.7 PCF**
NATURAL MOISTURE CONTENT: **15.1%**
PERCENT SWELL/COMPRESSION: **0.1**

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SWELL/CONSOLIDATION TEST RESULTS

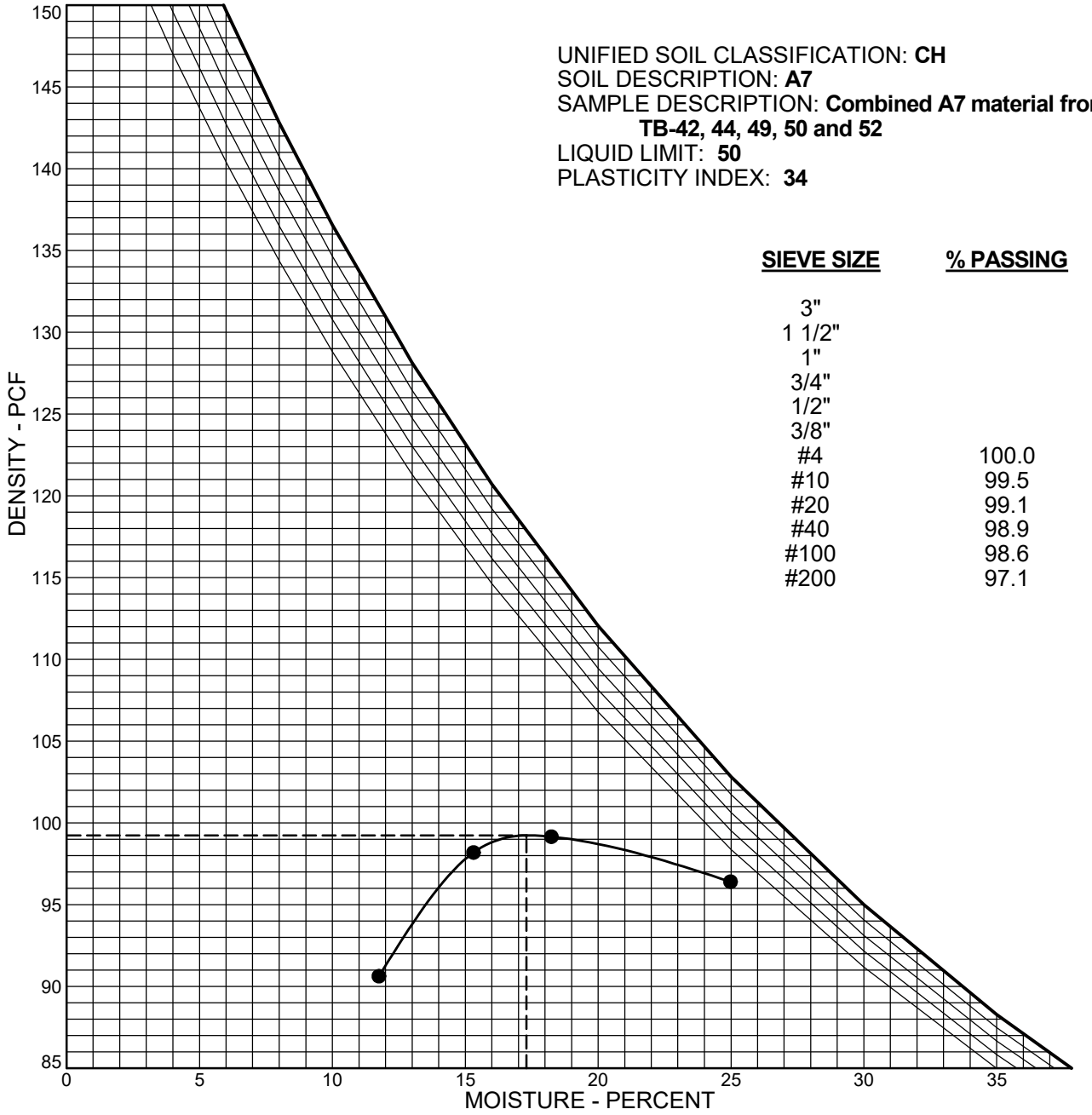
JOB No. 186386

FIGURE No. 17

DATE Oct/20/2022

CLIENT: Landhuis Company **SAMPLE NUMBER:** CBR Proctor

PROJECT: **The Ridge at Lorson Ranch El Paso County, Colorado**



UNIFIED SOIL CLASSIFICATION: **CH**
SOIL DESCRIPTION: **A7**
SAMPLE DESCRIPTION: **Combined A7 material from TB-42, 44, 49, 50 and 52**
LIQUID LIMIT: **50**
PLASTICITY INDEX: **34**

SIEVE SIZE	% PASSING
3"	
1 1/2"	
1"	
3/4"	
1/2"	
3/8"	
#4	100.0
#10	99.5
#20	99.1
#40	98.9
#100	98.6
#200	97.1

DESIGNATION **ASTM D-1557A**
MAX. DRY DENSITY **99.5 pcf**
OPTIMUM MOISTURE **17.3 %**
FRACTION USED **-4**
MOLD VOLUME **0.0333 cu.ft.**

NOTE: ZERO AIR VOIDS CURVES PLOTTED FOR:
Gs = 2.60
Gs = 2.65
Gs = 2.70
Gs = 2.75
Gs = 2.80

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MOISTURE-DENSITY RELATION CURVE

JOB No. 186386

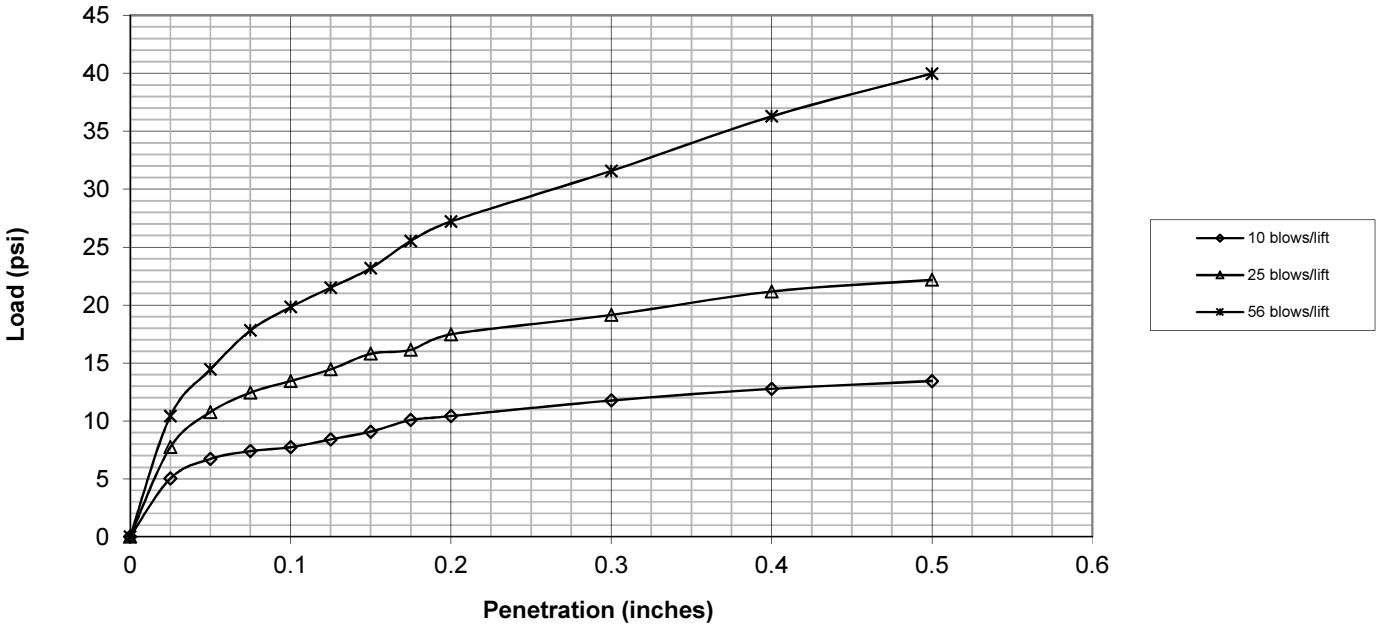
FIGURE No. 18

DATE Oct/20/2022

CALIFORNIA BEARING RATIO TEST RESULTS

Project: The Ridge at Lorson Ranch
Job No.: 186386
AASHTO Classification" A-7
Sample Number: CBR
Sample Location: Combined Bulk Sample
Soil Description: Sandy Clay

Penetration (in)	10 blows/lift Load (psi)	25 blows/lift Load (psi)	56 blows/lift Load (psi)
0.000	0.0	0.0	0.0
0.025	5.0	7.7	10.4
0.050	6.7	10.7	14.4
0.075	7.4	12.4	17.8
0.100	7.7	13.4	19.8
0.125	8.4	14.4	21.5
0.150	9.1	15.8	23.2
0.175	10.1	16.1	25.5
0.200	10.4	17.5	27.2
0.300	11.8	19.1	31.6
0.400	12.8	21.2	36.3
0.500	13.4	22.2	40.0



	Corrected Penetration (in)	Corrected Load (psi)
10 blows/lift	0.100	0.8
25 blows/lift	0.100	1.3
56 blows/lift	0.100	2.0

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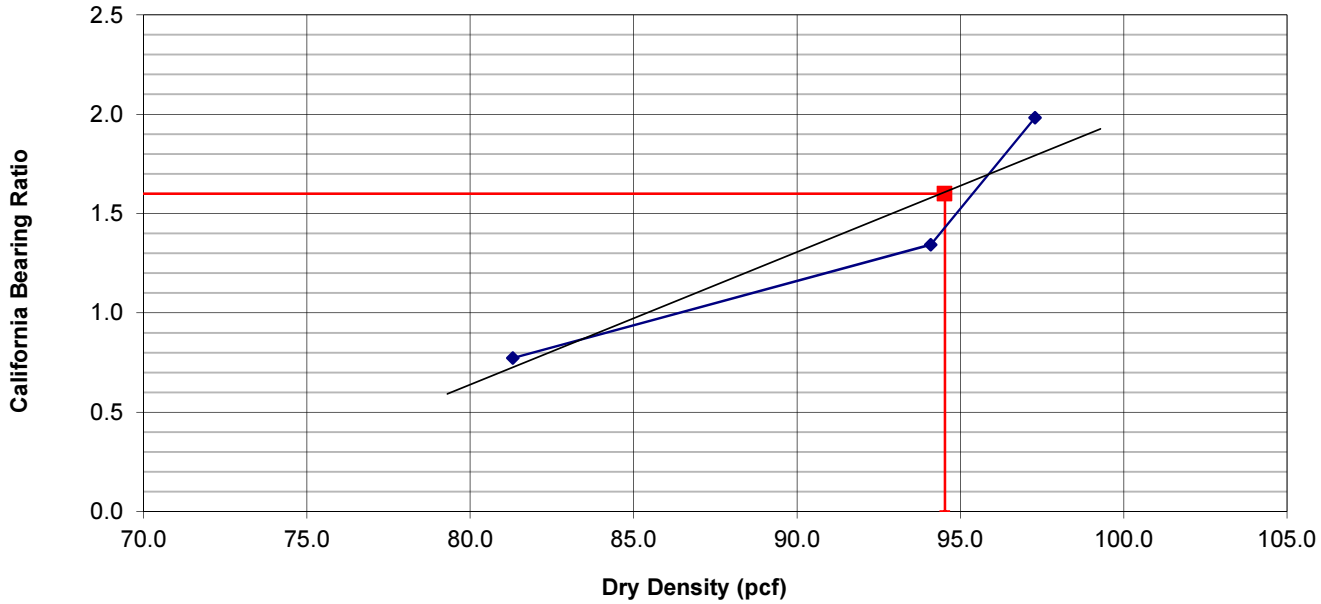
Figure No. 19

CALIFORNIA BEARING RATIO TEST RESULTS

Project: The Ridge at Lorson Ranch
Job No.: 186386
AASHTO Classification" A-7
Sample Number: CBR
Sample Location: Combined Bulk Sample
Soil Description: Sandy Clay

	10 blows/lift	25 blows/lift	56 blows/lift
Corrected California Bearing Ratio	0.8	1.3	2.0
Dry Density (pcf)	81.3	94.1	97.3
Percent Compaction	82	95	98
Percent Moisture After Soaking	40.5	38.6	34.2
Percent Expansion (+) / Compression (-)	3.3%	3.9%	3.7%
Surcharge Weight (lbs)	12.60	12.60	12.60



California Bearing Ratio	**1.6**
Dry Density (pcf)	99.5
Percent Compaction	95%
Target Dry Density	94.5
Compaction Test Method	ASTM D-698
Condition of sample	Soaked

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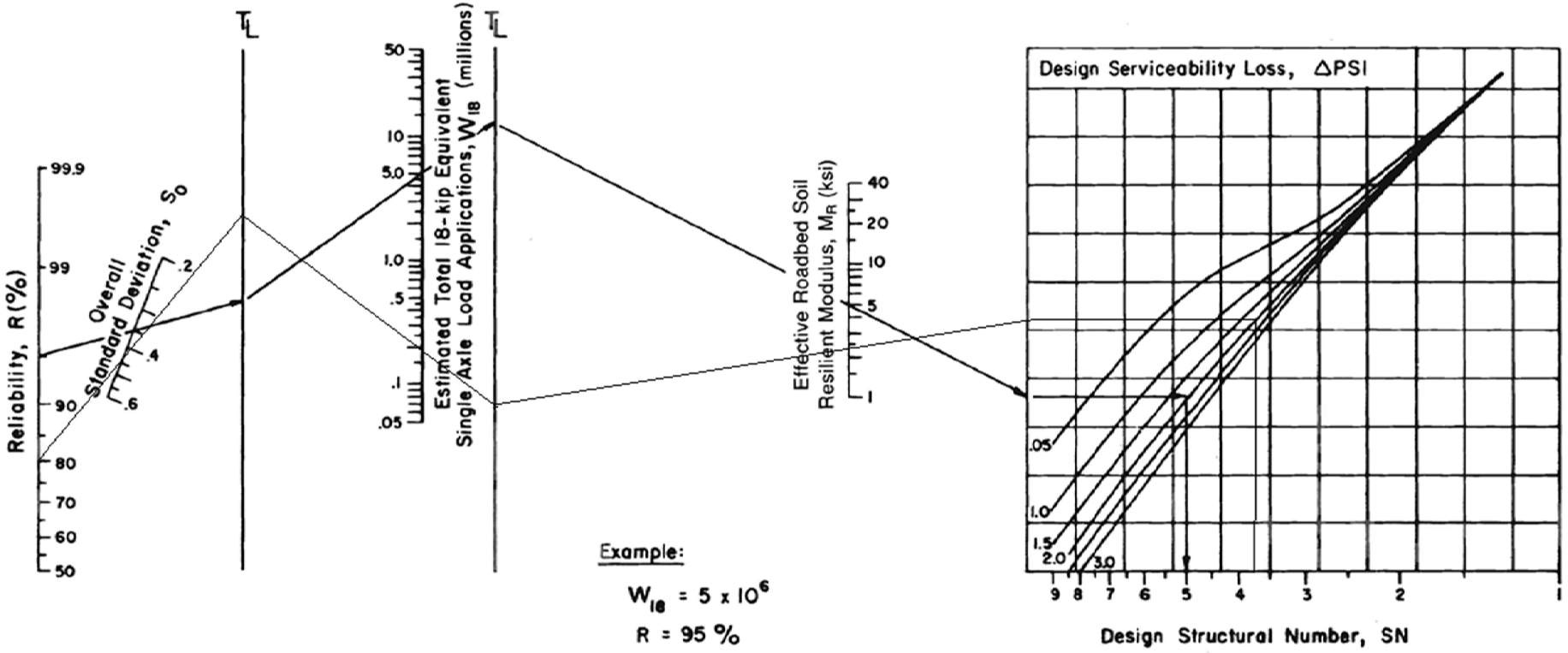
Figure No. 20

APPENDIX A

NOMOGRAPH SOLVES:

$$\log_{10} W_{18} = Z_R * S_o + 9.36 * \log_{10}(SN+1) - 0.20 + \frac{\log_{10}\left[\frac{\Delta PSI}{4.2 - 1.5}\right]}{0.40 + \frac{1094}{(SN+1)^{5.19}}} + 2.32 * \log_{10} M_R - 8.07$$



Example:

$W_{18} = 5 \times 10^6$

R = 95 %

$S_o = 0.35$

$M_R = 5000$ psi

ΔPSI = 1.9

Solution: SN = 5.0