

Architectural  
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Materials Testing  
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**APPROVED**  
**Engineering Department**  
10/25/2022 7:42:57 AM  
dsdnijkamp  
EPC Planning & Community  
Development Department

## 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**

Respectfully Submitted,

RMG – Rocky Mountain Group

A handwritten signature in blue ink that reads 'Nathan Malefyt'.

**Nathan Malefyt  
Staff Geologist**

Reviewed by,

RMG – Rocky Mountain Group



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

SF Number 22-004

**Note:**  
- Full depth asphalt paving is  
not allowed by El Paso County.

**PCD File No. SF-22-007**

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### APPENDIX A

Design Chart for Flexible Pavements – Urban Local Roads

# GENERAL SITE AND PROJECT DESCRIPTION

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## **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.

# FIELD INVESTIGATION AND SUBSURFACE CONDITIONS

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## **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**

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## **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.

It's our understanding that the developer intends to install a composite roadway section consisting of Hot Mix Asphalt over Aggregate Base Course (ABC). The use of Cement-Treated Subgrade (CTS) was considered. However, based on information from personnel of El Paso County Planning & Community Development via electronic mail on September 19 and 20, 2022, our understanding is that the use of the on-site soils as a component of the CTS mixture has been deemed unsuitable for pavement construction. As such, a CTS option is not presented herein. If a CTS option is desired in the future, please contact personnel of RMG for more information.

# PAVEMENT DESIGN

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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):  $a_1 = 0.44$

Aggregate Base Course (ABC):  $a_2 = 0.11$

3) Subgrade

$M_r = \text{CBR} \times 1500 = 1.6 \times 1500 = 2,400$  psi

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

5) Composite asphalt/ABC section

Minimum HMA thickness =  $D_1 = 3$  inches (Table D-2)

ABC thickness =  $D_2 = \{\text{SN} - (D_1 \times a_1)\} / a_2 = \{3.73 - (3 \times 0.44)\} / 0.11 = 22.0$  inches

$\text{SN} = (5.25 \times 0.44) + (13 \times 0.11) = 3.74 > 3.73$  (Min. SN required)

Use HMA thickness = 5.25 inches over ABC thickness = 13.0 inches

## Pavement Thickness

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

**Recommended Pavement Sections**

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
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**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 place 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 suggested for concrete in contact with the subsurface materials. Cement type shall be designed and approved by a licensed Colorado Professional Engineer and Foundation Designer. Calcium chloride should not be used for the onsite soils. The concrete should not be placed on frozen ground. If placed during periods of cold temperatures, the concrete should be kept from freezing. This may require covering the concrete with insulated blankets and heating.

Concrete work should be completed in accordance with the latest applicable guidelines and standards published by ACI.

### **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**

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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

## APPENDIX A



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**Engineers / Architects**

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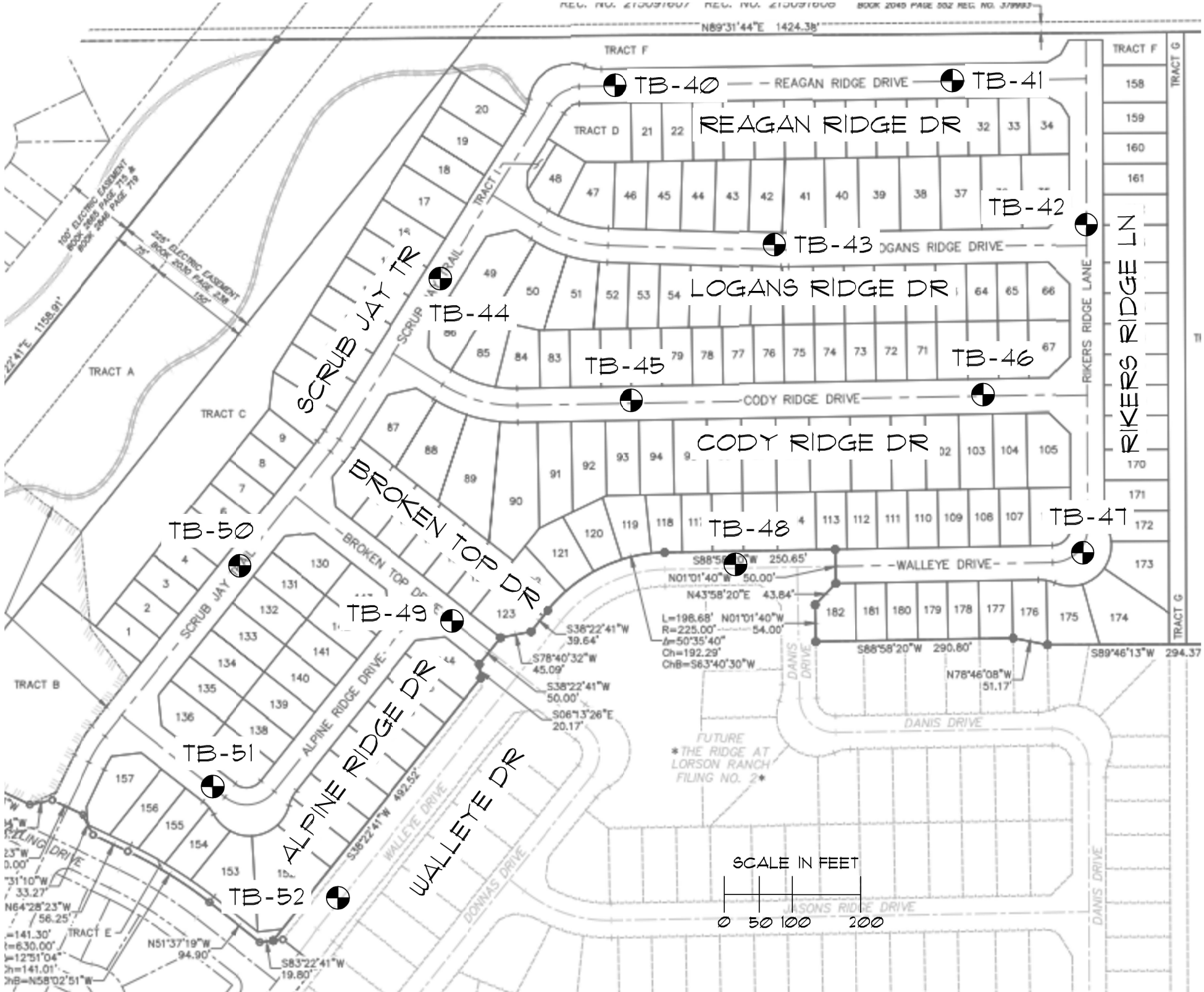
## SITE VICINITY MAP

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

JOB No. 186386

FIG No. 1

DATE 10-20-2022



● DENOTES APPROXIMATE LOCATION OF TEST BORINGS

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SOUTHERN COLORADO, DENVER METRO, NORTHERN COLORADO

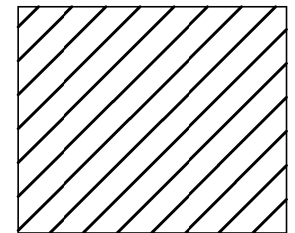
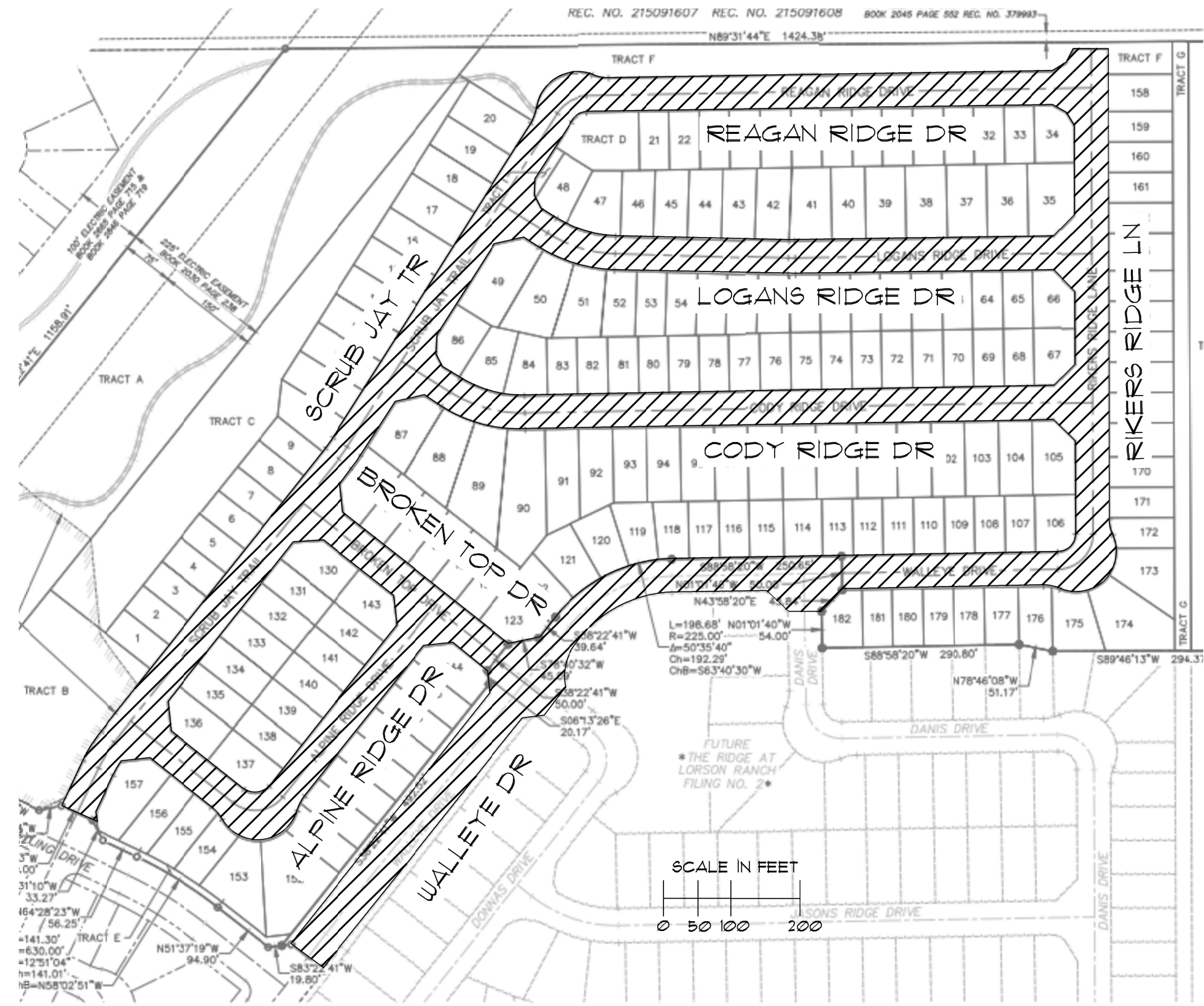
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Structural  
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THE RIDGE AT LORSON RANCH  
PAVEMENT DESIGN  
EL PASO COUNTY, COLORADO  
LANDHUIS COMPANY

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

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**RMG**

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

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

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:  
 RMG - ROCKY MOUNTAIN GROUP  
 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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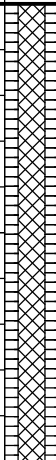

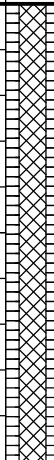

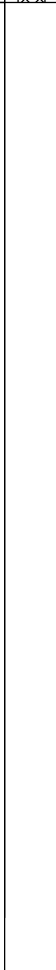

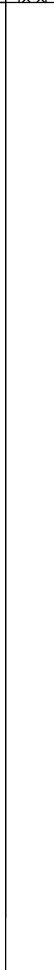

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Materials Testing  
Civil, Planning

## EXPLANATION OF TEST BORING LOGS

JOB No. 186386

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 %	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			16	12.5	FILL: CLAY, SANDY, brown, stiff to very stiff, moist	2.5			15	11.5
	5.0			15	13.6		5.0			16	14.3

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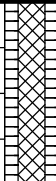

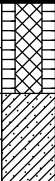

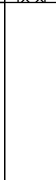







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## TEST BORING LOG

JOB No. 186386

FIGURE No. 4

DATE Oct/20/2022

TEST BORING: <b>42</b>  DATE DRILLED: 9/28/22 NO GROUNDWATER ON 9/28/22	DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %	TEST BORING: <b>43</b>  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			11	14.6	FILL: CLAY, SANDY, brown, moist	2.5			13	11.2
	5.0			15	14.1	CLAY, SANDY, brown, medium stiff to stiff, moist	5.0			7	11.4
						CLAYSTONE, SANDY, brown, hard, moist	7.5			50/9"	9.3
							10.0				

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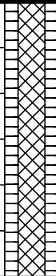

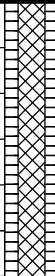

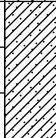
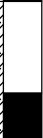
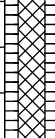

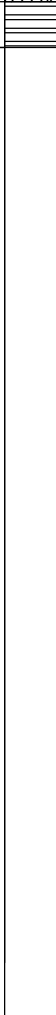

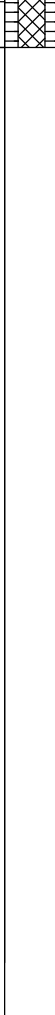

# TEST BORING LOG

JOB No. 186386

FIGURE No. 5

DATE Oct/20/2022



TEST BORING: <b>44</b>  DATE DRILLED: 9/28/22 NO GROUNDWATER ON 9/28/22	DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %	TEST BORING: <b>45</b>  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	FILL: CLAY, SANDY, brown, stiff, moist	2.5			9	16.3
CLAY, SANDY, brown, very stiff, moist				28	11.7					10	16.2
CLAYSTONE, SANDY, dark brown, medium hard, moist	5.0						5.0				

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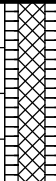



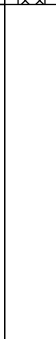



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## TEST BORING LOG

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FIGURE No. 6

DATE Oct/20/2022

TEST BORING: <b>46</b>  DATE DRILLED: 9/28/22 NO GROUNDWATER ON 9/28/22	DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %	TEST BORING: <b>47</b>  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	FILL: CLAY, SANDY, brown, moist	2.5			40	10.4
	5.0			4	15.5	CLAYSTONE, SANDY, dark brown, medium hard to hard, moist	5.0			50/11"	9.4

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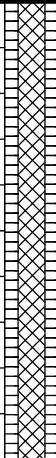

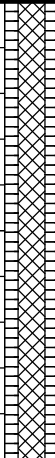

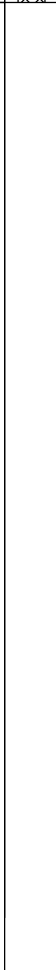






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## TEST BORING LOG

JOB No. 186386

FIGURE No. 7

DATE Oct/20/2022

TEST BORING: <b>48</b>  DATE DRILLED: 9/28/22 NO GROUNDWATER ON 9/28/22	DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %	TEST BORING: <b>49</b>  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	FILL: CLAY, SANDY, brown, stiff, moist	2.5			9	13.8
	5.0			19	13.4		5.0			13	13.1
							7.5				
							10.0			14	22.1

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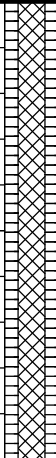

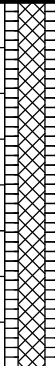

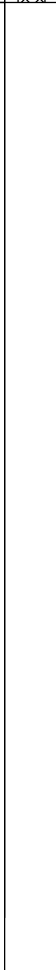

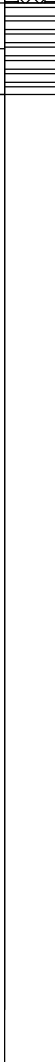

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# TEST BORING LOG

JOB No. 186386

FIGURE No. 8

DATE Oct/20/2022

TEST BORING: <b>50</b>  DATE DRILLED: 9/28/22 NO GROUNDWATER ON 9/28/22	DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %	TEST BORING: <b>51</b>  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	FILL: CLAY, SANDY, brown, stiff, moist	2.5			15	15.1
	5.0			6	16.5	CLAYSTONE, SANDY, dark brown, firm, moist	5.0			21	19.3

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## TEST BORING LOG

JOB No. 186386

FIGURE No. 9

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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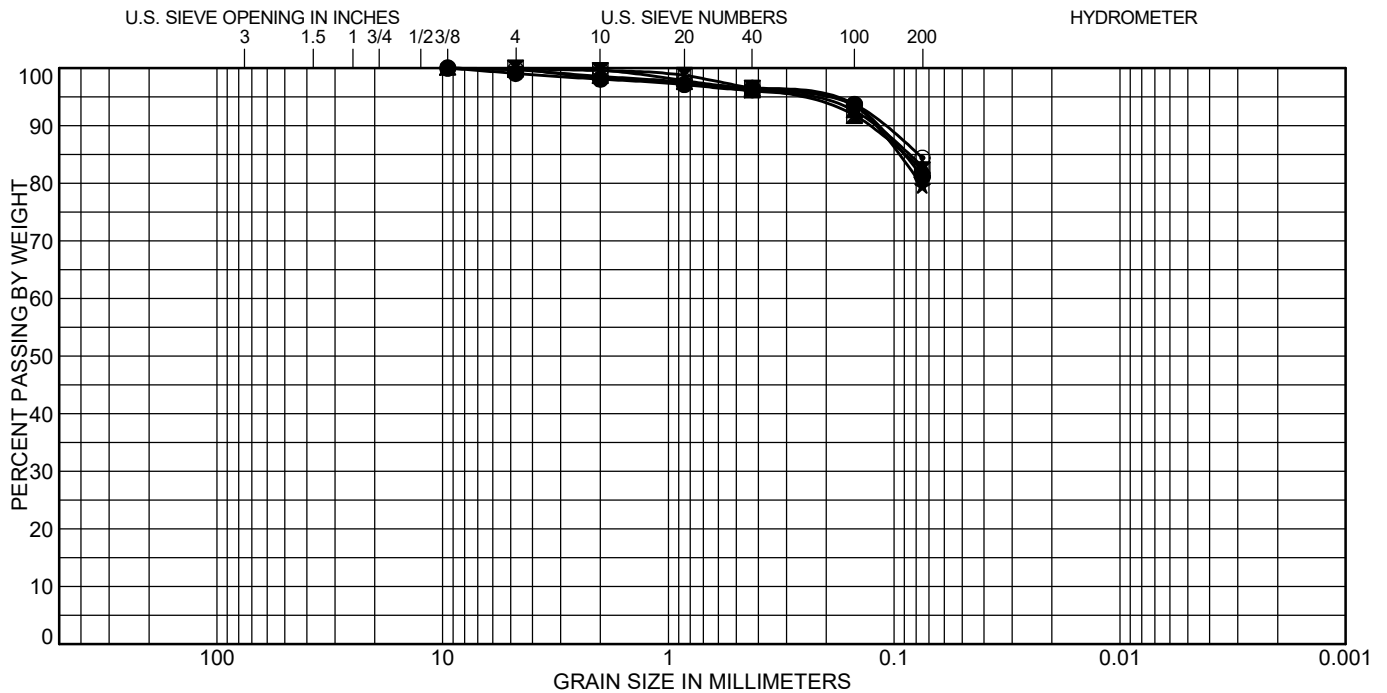
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**SUMMARY OF  
LABORATORY TEST  
RESULTS**

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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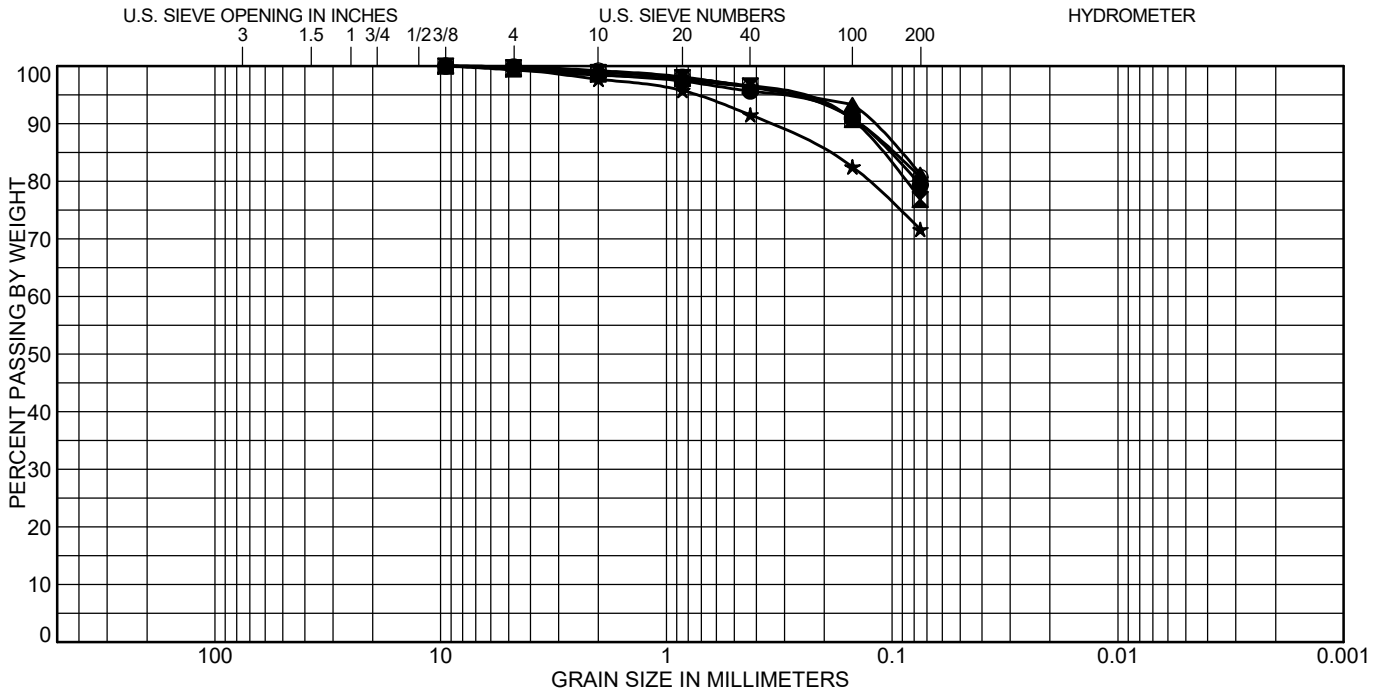
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## SOIL CLASSIFICATION DATA

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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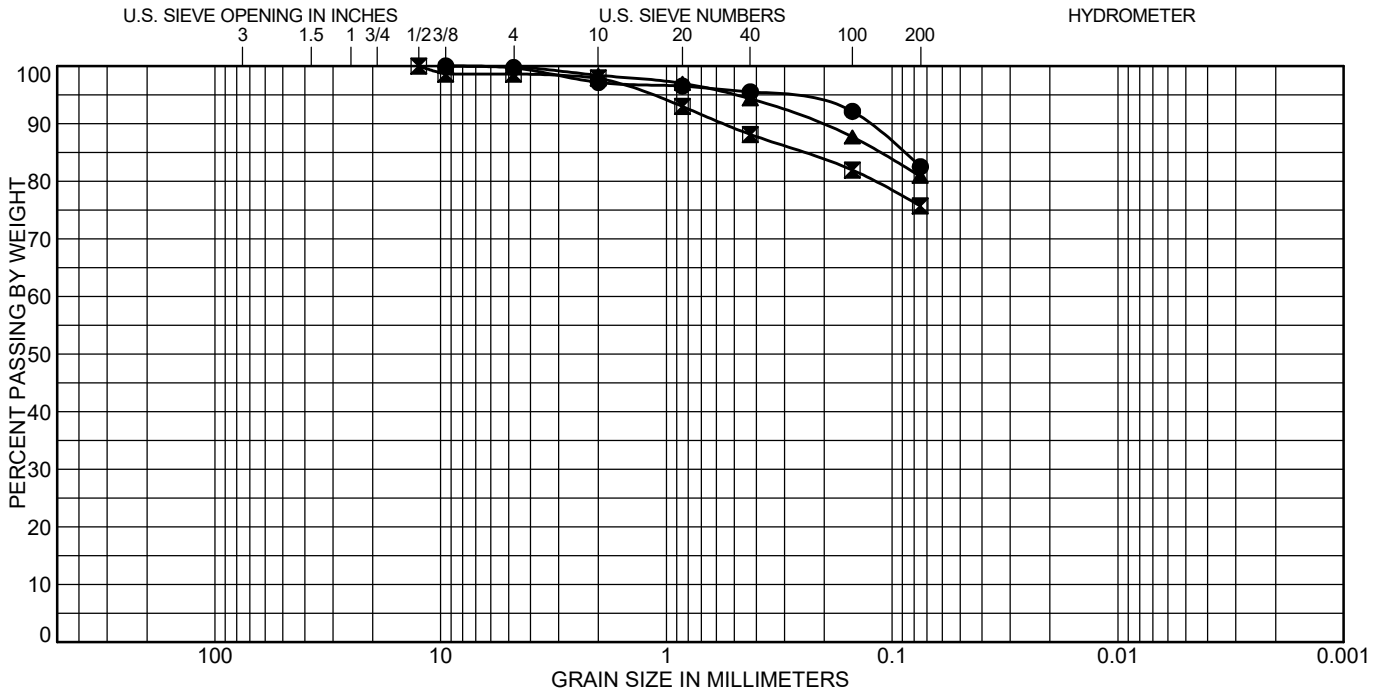
## SOIL CLASSIFICATION DATA

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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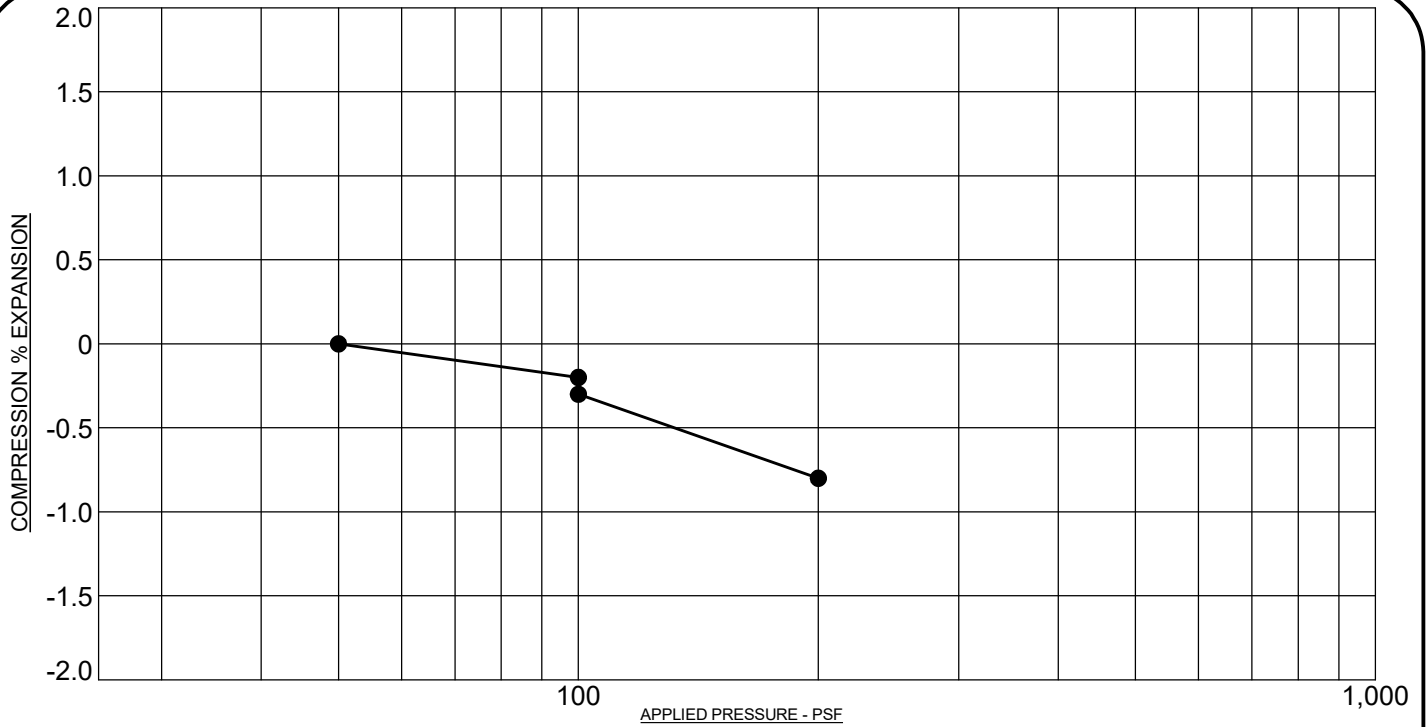
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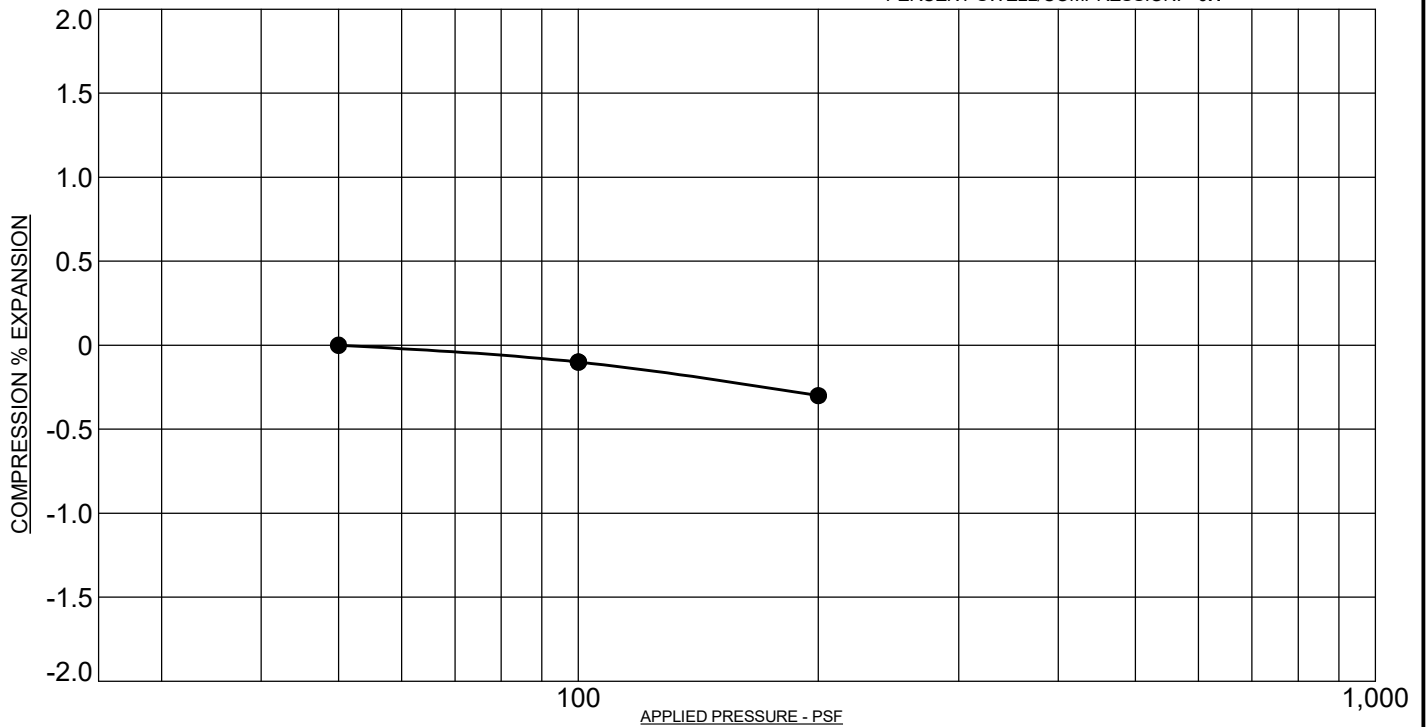
# SOIL CLASSIFICATION DATA

JOB No. 186386  
FIGURE No. 14  
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: **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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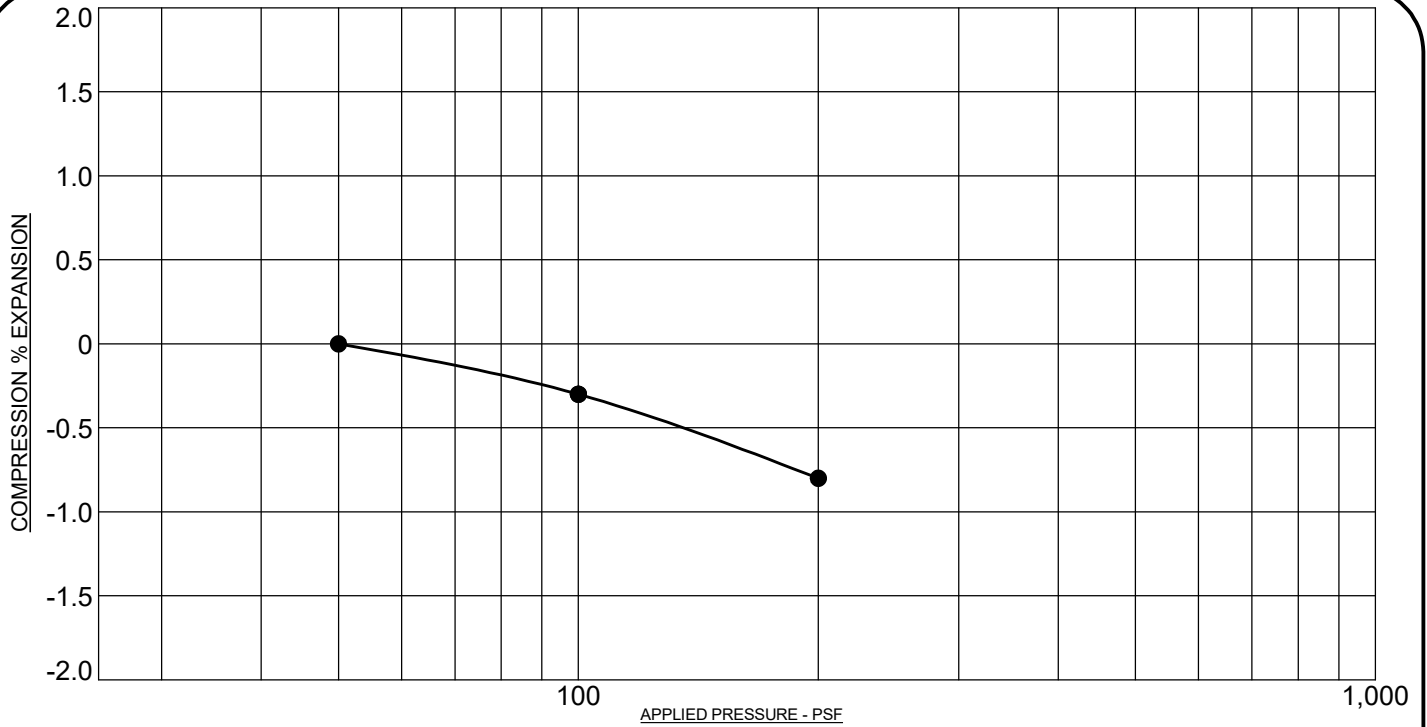
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## SWELL/CONSOLIDATION TEST RESULTS

JOB No. 186386

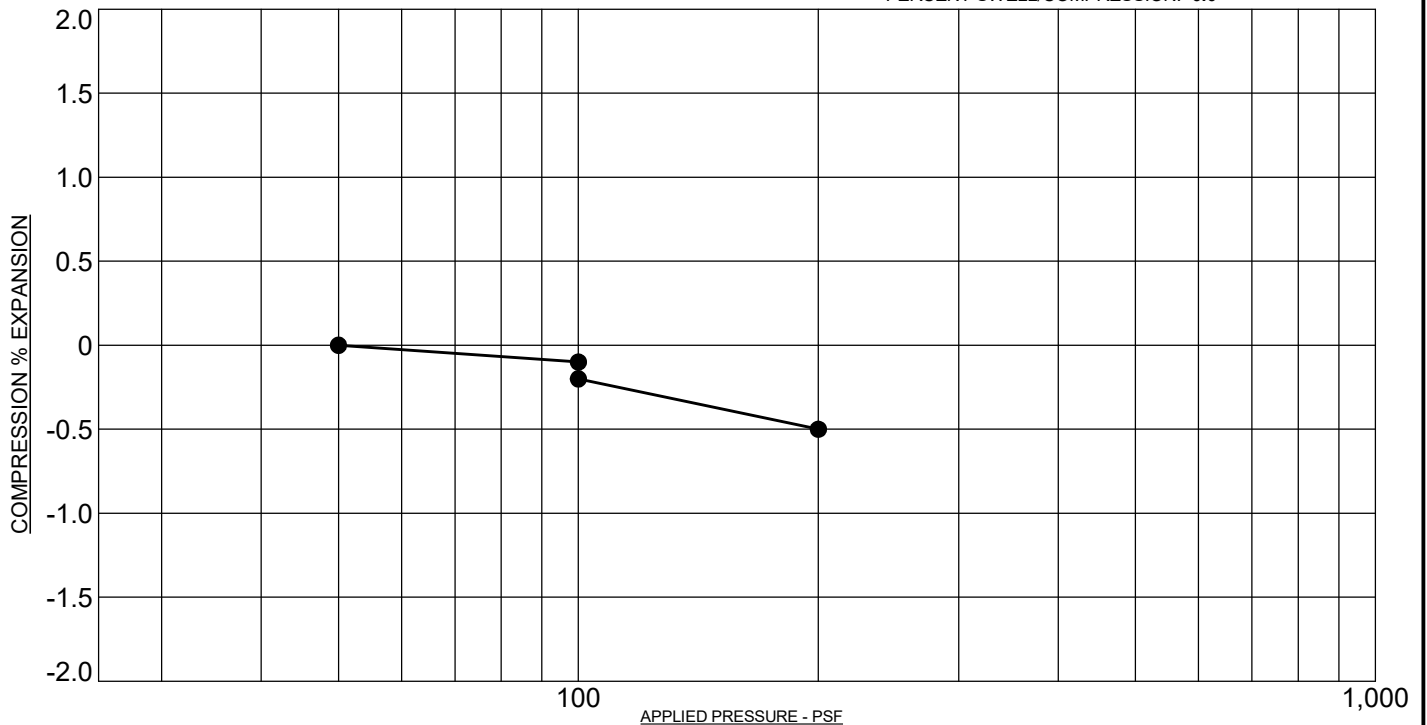
FIGURE No. 15

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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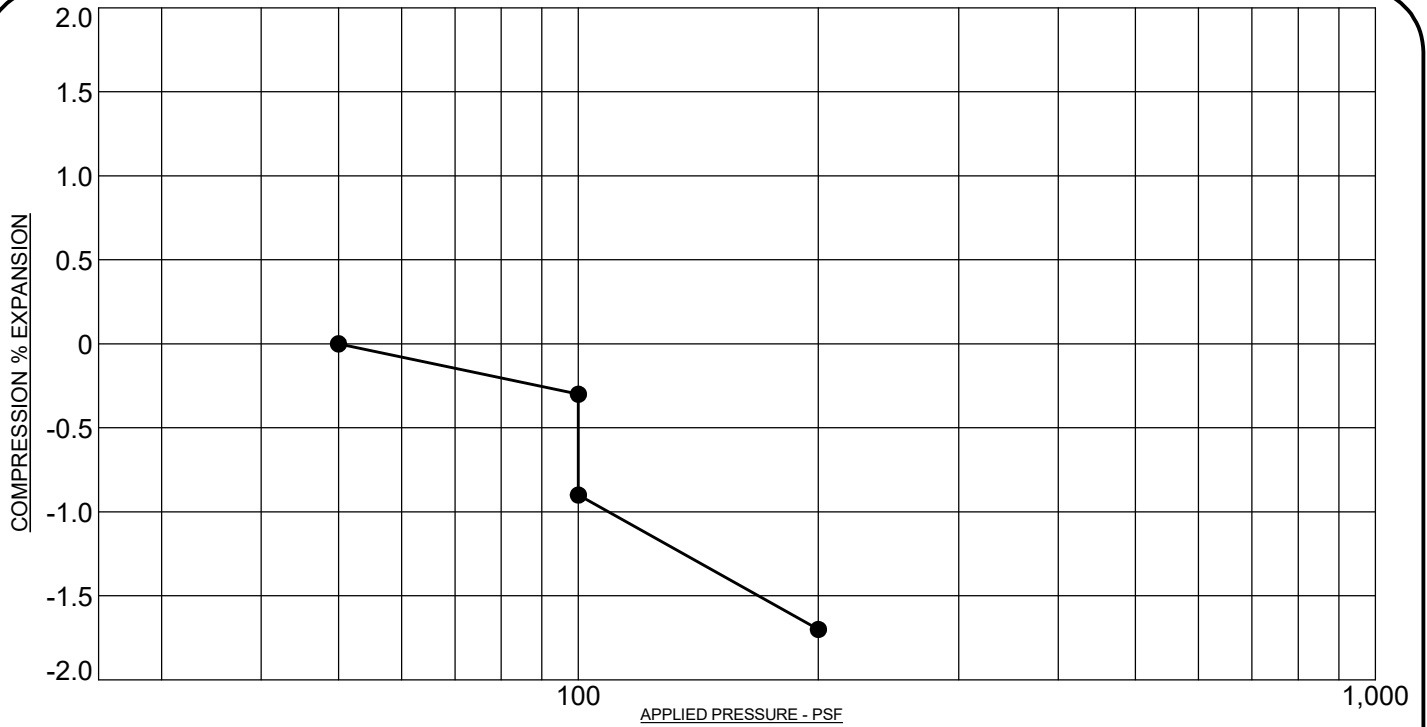
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## SWELL/CONSOLIDATION TEST RESULTS

JOB No. 186386

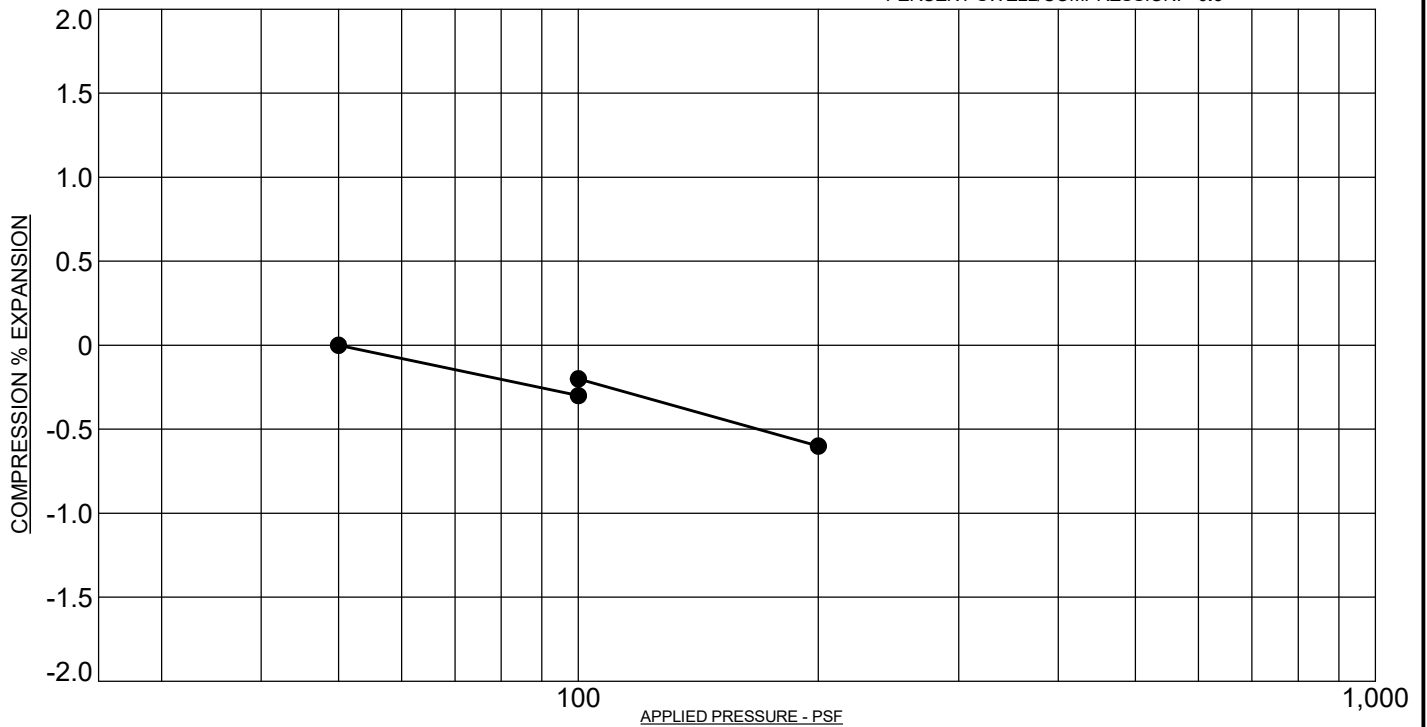
FIGURE No. 16

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

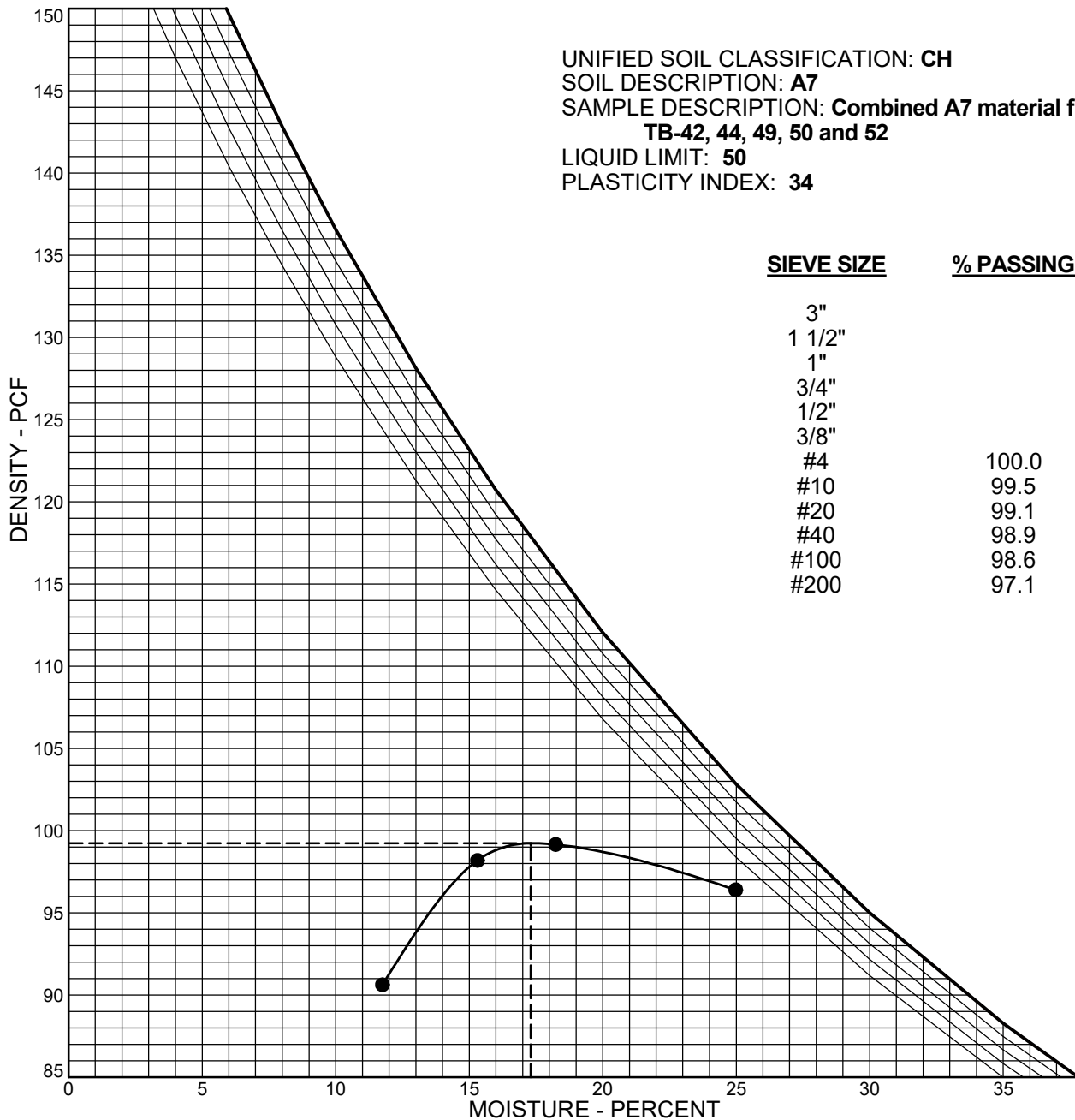
DATE Oct/20/2022

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



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

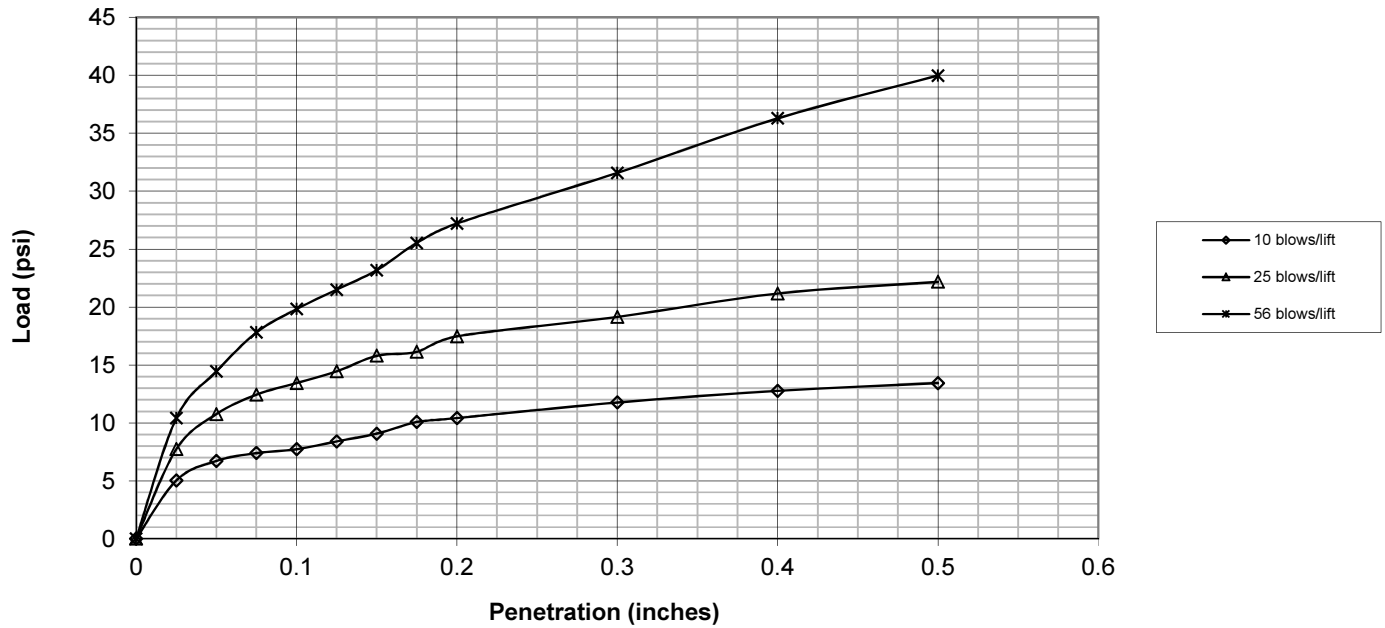
FIGURE No. 18

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	25 blows/lift	56 blows/lift
	Load (psi)	Load (psi)	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

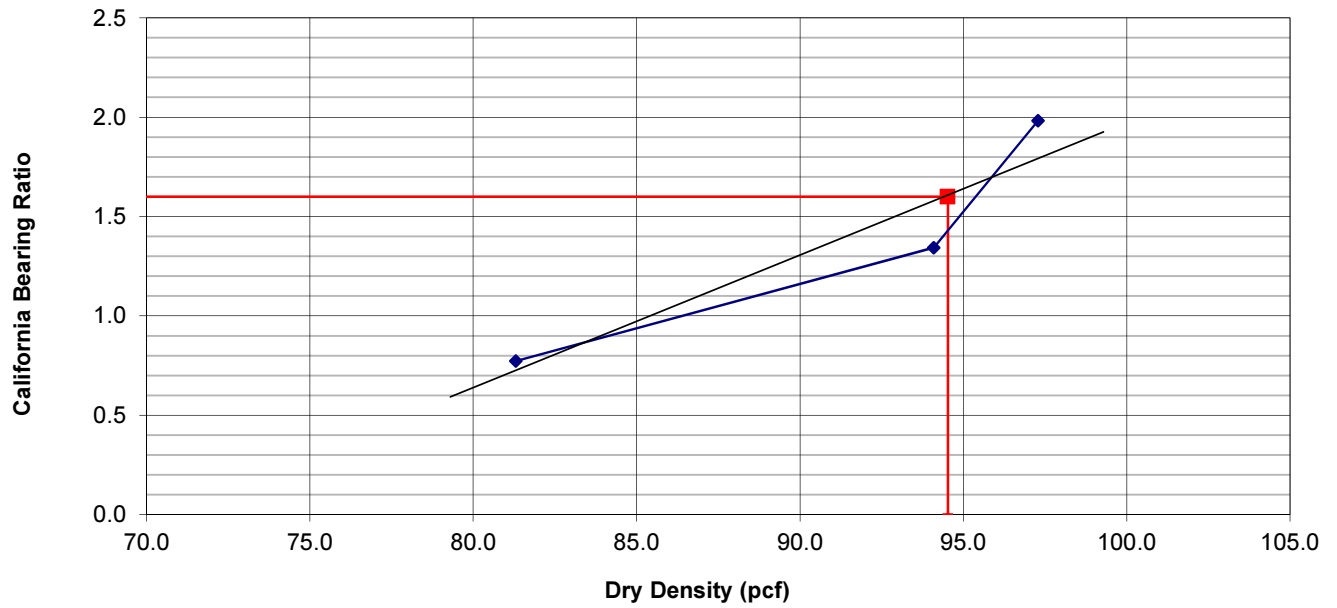


Figure No. 19

# 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



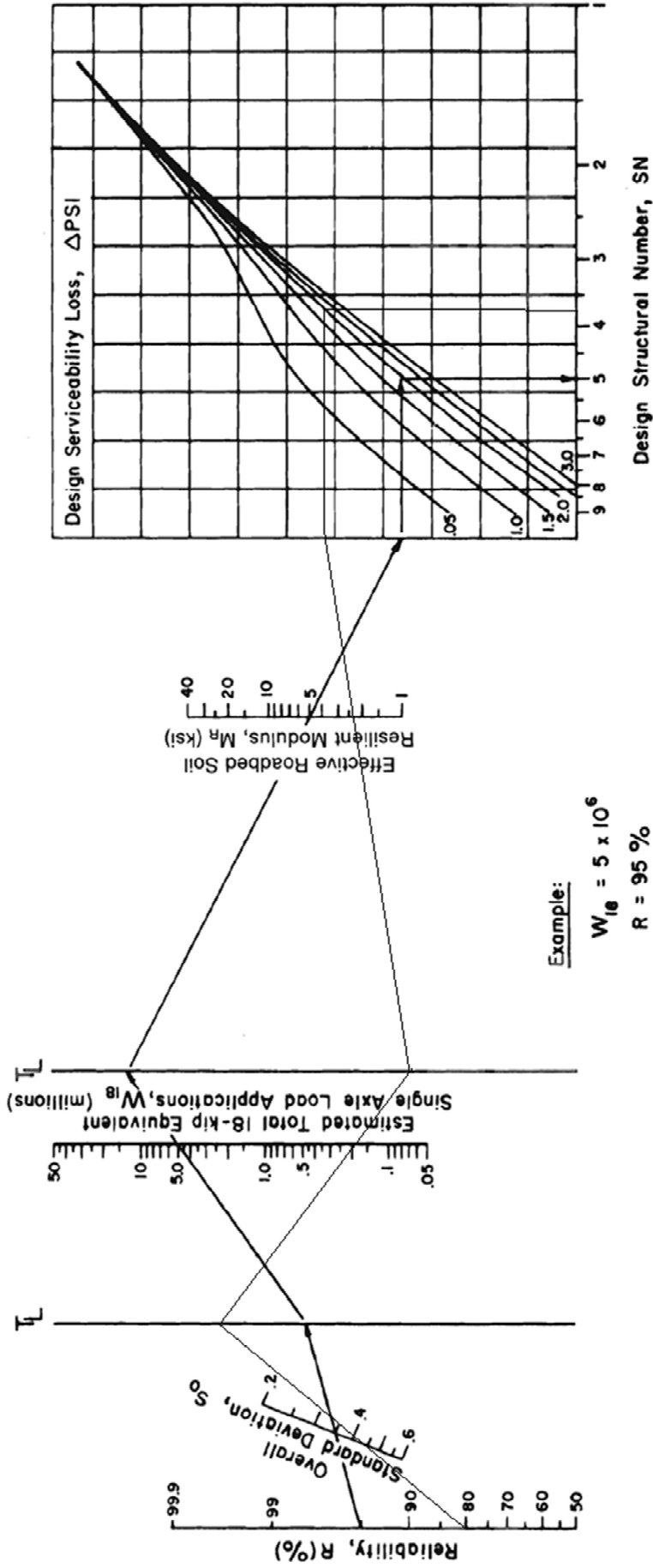
<b>California Bearing Ratio</b>	<b>1.6</b>
Dry Density (pcf)	99.5
Percent Compaction	95%
Target Dry Density	94.5
Compaction Test Method	ASTM D-698
Condition of sample	Soaked



Figure No. 20

NOMOGRAPH SOLVES:

$$\log_{10} W_{18} = Z_R \cdot S_0 + 9.36 \cdot \log_{10}(SN+1) - 0.20 + \frac{\log_{10} \left[ \frac{\Delta \text{PSI}}{4.2 - 1.5} \right]}{0.40 + \frac{1094}{(SN+1)^{5.19}}} + 2.32 \cdot \log_{10} M_R - 8.07$$



Example:

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

$$R = 95 \%$$

$$S_0 = 0.35$$

$$M_R = 5000 \text{ psi}$$

$$\Delta \text{PSI} = 1.9$$

$$\text{Solution: } SN = 5.0$$