

## PAVEMENT DESIGN REPORT

**Falcon Meadows at Bent Grass, Filing No. 4  
El Paso County, Colorado**

### PREPARED FOR:

**Challenger Communities  
8605 Explorer Drive, Suite 250  
Colorado Springs, CO 80920**

**JOB NO. 195345**

**July 26, 2024**

Respectfully Submitted,

RMG – Rocky Mountain Group

A handwritten signature in blue ink, appearing to read 'J McElmeel', is written over the printed name.

**Jared McElmeel, E.I.  
Geotechnical Staff Engineer**

Reviewed by,

RMG – Rocky Mountain Group

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



# TABLE OF CONTENTS

---

GENERAL SITE AND PROJECT DESCRIPTION.....	3
Location.....	3
Existing Site Conditions.....	3
Project Description.....	3
Previous Studies and Field Investigation.....	3
FIELD INVESTIGATION AND SUBSURFACE CONDITIONS.....	3
Drilling.....	3
Subsurface Materials.....	4
Groundwater.....	4
LABORATORY TESTING.....	4
Laboratory Testing.....	4
PAVEMENT DESIGN.....	5
Pavement Design.....	5
Pavement Thickness.....	6
Pavement Materials.....	7
Foundation Recommendations.....	7
Expansive Soil Mitigation.....	7
Subgrade Preparation.....	7
Surface Drainage.....	7
Subgrade Observations and Testing.....	7
CLOSING.....	7
FIGURES	
Site Vicinity Map.....	1
Test Boring Location Plan .....	2.1
Pavement Recommendations .....	2.2
Explanation of Test Boring Logs.....	3
Test Boring Logs.....	4-5
Summary of Laboratory Test Results.....	6
Soil Classification Data.....	7-8
Swell/Consolidation Test Results.....	9
Moisture-Density Relationship Curve.....	10
California Bearing Ratio Test Results.....	11-12

## APPENDIX A

1993 AASHTO Empirical Equation for Flexible Pavements

# GENERAL SITE AND PROJECT DESCRIPTION

---

## Location

Falcon Meadows at Bent Grass, Filing No. 4 is generally located north of E Woodman Road and west of Meridian Rd in the northeastern portion of El Paso County, Colorado. The location of the site is shown on the Site Vicinity Map, Figure 1.

## Existing Site Conditions

At the time of our investigation the project site was overlot graded, the roadways were rough graded and utilities 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 within the proposed development, and to develop recommendations for the design and construction of the proposed flexible pavements.

The proposed streets included in this investigation are shown on Figure 2.1 and 2.2. The streets considered herein are classified as Urban Local and Urban Local Low Volume.

## Previous Studies and Field Investigation

Reports of previous geotechnical engineering/geologic investigations for this site were available for our review and are listed below:

1. *Pavement Design Report, Falcon Meadows at Bent Grass, Filing No. 3, El Paso County, Colorado, Rocky Mountain Group, Job No. 195343, June 14, 2024.*
2. *Pavement Study, Falcon Meadows at Bent Grass, Filing No. 1, El Paso County, Colorado, A. G. Wassenaar, Project No. 214061-P2, Last dated: October 1, 2021*

The findings, conclusions and recommendations contained in those reports were considered during the preparation of this report.

# FIELD INVESTIGATION AND SUBSURFACE CONDITIONS

---

## Drilling

The subsurface conditions on the site were investigated by drilling six 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-3550 utilizing a 2½-inch OD modified California 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 6.

### Subsurface Materials

The subsurface materials encountered in the test borings consisted of silty to clayey sand, sandy clay, sandy claystone, and clayey sandstone. Combined bulk samples of the material classified as SM according to the Unified Classification System. For pavement design purposes the combined bulk soil samples classified as A-6 in accordance with the American Association of State Highway and Transportation Officials (AASHTO) classification system. This soil classification is considered “Fair to Poor” as subgrade material.

A composite bulk sample from the TB-2 and TB-4 Test Borings, A-6 soil, was tested to determine its moisture-density relationship curve in accordance with ASTM D698 (Standard Proctor compaction test). Maximum Dry Density proved to be 114.3 pcf at 12.5 percent moisture. A CBR test was performed at varying densities at moisture content near optimum. At 95% of the maximum Modified Proctor density, 108.6 pcf, the CBR of the bulk sample was 2.9.

Composite Sample Derived From	Composite Sample Classification	% Passing #200 Sieve	LL	PI	Maximum Dry Density (pcf)	Optimum Moisture (%)	Resulting CBR
TB-2 and TB-4	A-6	44.5	33	17	114.3	12.5	2.9

### Groundwater

Groundwater was not encountered in the test borings during field exploration. While groundwater is not expected to be a factor in pavement construction on this site, fluctuations in groundwater and subsurface moisture conditions may occur due to variations in rainfall 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 and Atterberg Limits 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 7. Soil Classification Data are presented in Figures 8 and 9.



A combined bulk sample of A-6 soil was tested to determine the optimum moisture-density relationship in accordance with ASTM D-698 (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 2.9. The Moisture-Density Relation Curve is presented in Figure 10. The CBR Test Results are presented in Figures 11 and 12.

The developer intends to install a composite roadway section consisting of Hot Mix Asphalt over Aggregate Base Course (ABC).

## PAVEMENT DESIGN

---

The following pavement design is based on the subsurface conditions encountered in the test borings and on the project characteristics previously described. If conditions are different from those described in this report or the project characteristics change, RMG should be retained to review our recommendations and adjust them, if necessary.

### **Pavement Design**

This pavement design was prepared in accordance with the El Paso County Pavement Design Criteria Manual.

### **Street Classification – Urban Local**

- 1) Lemon Grass Road south end  
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 Stabilized Subgrade:  $a_2 = 0.11$
- 3) Subgrade  
 $M_r = \text{CBR} \times 1500 = 2.9 \times 1500 = 4,350 \text{ psi}$
- 4) Structural number (SN) = 3.07 (per 1993 AASHTO Empirical Equation for Flexible Pavements, presented in Appendix A)
- 5) Composite asphalt/base course section  
Minimum HMA thickness =  $D_1 = 3 \text{ inches}$  (Table D-2)  
Use HMA thickness =  $D_1 = 4.5 \text{ inches}$   
ABC thickness =  $D_2 = \{\text{SN} - (D_1 \times a_1)\} / a_2 = \{3.07 - (4.5 \times 0.44)\} / 0.11 = 9.91 \text{ inches}$   
Minimum ABC thickness = 8 inches (Table D-2)

$SN = (4.5 \times 0.44) + (10 \times 0.11) = 3.08 > 3.07$  (Min. SN required)  
 Use minimum HMA thickness of 4.5" and minimum ABC thickness of 10"

**Street Classification – Urban Local-Low Volume**

- 1) Lemon Grass Road north end  
 ESAL = 36,500 (Table D-2)  
 Serviceability Index = 2.0 (Table D-1)
- 2) Strength coefficients (Table 6)  
 Asphalt (HMA):  $a_1 = 0.44$   
 Cement Stabilized Subgrade:  $a_2 = 0.11$
- 3) Subgrade  
 $M_r = CBR \times 1500 = 2.9 \times 1500 = 4,350$  psi
- 4) Structural number (SN) = 2.24 (per 1993 AASHTO Empirical Equation for Flexible Pavements, presented in Appendix A)
- 5) Composite asphalt/base course section  
 Minimum HMA thickness =  $D_1 = 3$  inches (Table D-2)  
 Use HMA thickness =  $D_1 = 3.5$  inches  
 $ABC \text{ thickness} = D_2 = \{SN - (D_1 \times a_1)\} / a_2 = \{2.24 - (3.5 \times 0.44)\} / 0.11 = 6.36$  inches  
 Minimum ABC thickness = 4 inches (Table D-2)  
 $SN = (3.5 \times 0.44) + (6.5 \times 0.11) = 2.26 > 2.24$  (Min. SN required)  
 Use minimum HMA thickness of 3.5" and minimum ABC thickness of 6.5"

**Pavement Thickness**

Based on the design calculations, the recommended pavement sections are presented below and on Figure 2.

Street	Sample	Required SN	HMA (in.)	ABC (in.)	CTS (in.)	Calculated SN	OK
Lemon Grass Road (north end)	CBR-Proctor	2.24	3.5	6.5	0	2.26	Y
Lemon Grass Road (south end)	CBR-Proctor	3.07	4.5	10	0	3.08	Y

## **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.

## **Expansive 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 for the soils in this subdivision, the subgrade soils evaluated for this pavement design can be expected to be non-expansive. 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 the 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 City 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).

## **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 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**

---

Our field exploration was conducted to provide geotechnical information for pavement thickness design. Variations in subsurface conditions not indicated by the borings may be encountered. This report has been prepared for **Challenger Communities** for application as an aid in the design 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 exploratory borings and test pits, 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 re-evaluate the recommendations of this report, if necessary.

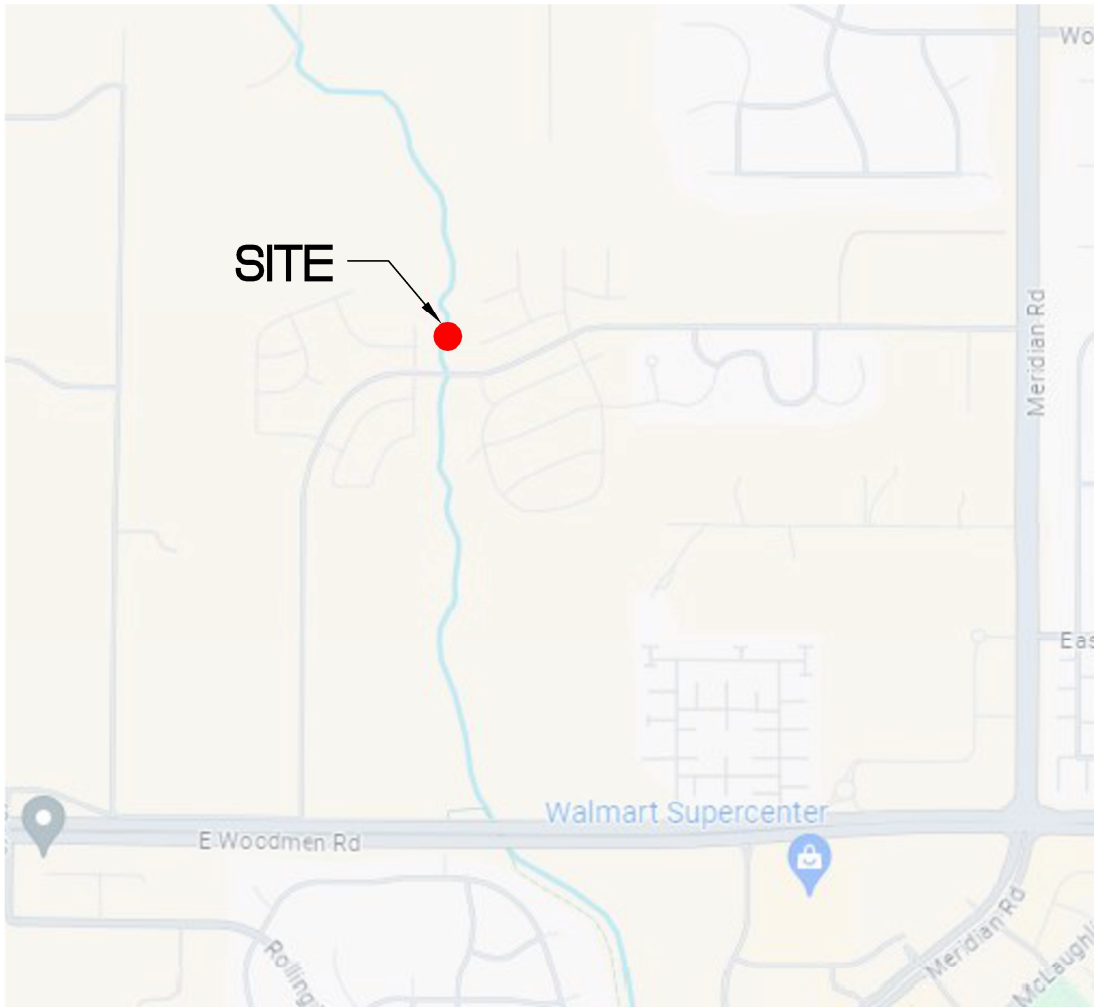
Our professional services were performed using that degree of care and skill ordinarily exercised, under similar circumstances, by geotechnical engineers practicing in this or similar localities. RMG Engineers does not warrant the work of regulatory agencies or other third parties supplying information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

This report is for the exclusive purpose of providing geotechnical information and pavement thickness design recommendations. 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



NOT TO SCALE

Architecture  
Structural  
Geotechnical



**Engineers / Architects**

SOUTHERN COLORADO OFFICE  
2910 AUSTIN BLUFFS PKWY, SUITE 100,  
COLORADO SPRINGS, CO 80918  
(719) 548-0600 ~ WWW.RMGENGINEERS.COM

SOUTHERN COLORADO, DENVER METRO, NORTHERN COLORADO

Materials Testing  
Forensics  
Civil / Planning

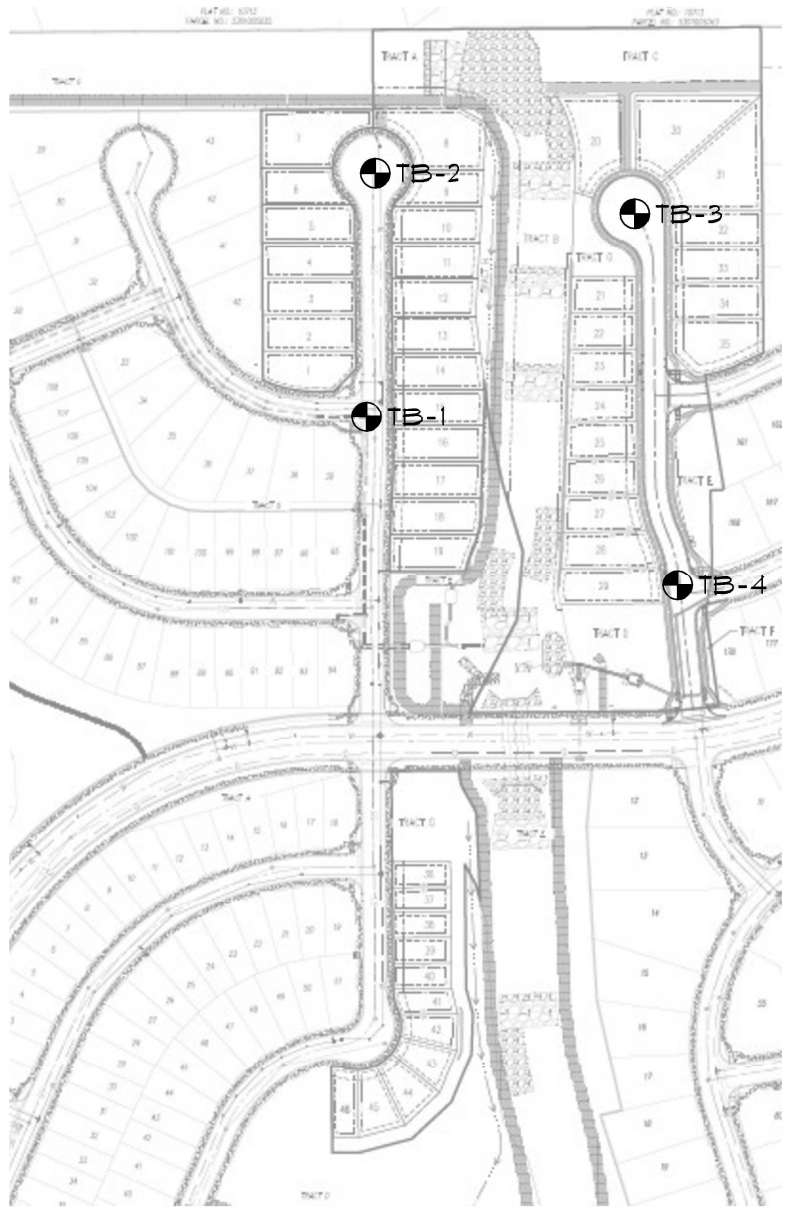
## SITE VICINITY MAP

FALCON MEADOWS AT BENT GRASS  
FILING NO. 4  
EL PASO COUNTY, COLORADO  
CHALLENGER COMMUNITIES

JOB No. 195345

FIG No. 1

DATE 7-26-2024



NOT TO SCALE

⊕ DENOTES APPROXIMATE LOCATION OF TEST BORINGS

Architecture  
Structural  
Geotechnical



Materials Testing  
Forensics  
Civil / Planning

**Engineers / Architects**

SOUTHERN COLORADO OFFICE  
2910 AUSTIN BLUFFS PKWY, SUITE 100,  
COLORADO SPRINGS, CO 80918  
(719) 548-0600 ~ WWW.RMGENGINEERS.COM

SOUTHERN COLORADO, DENVER METRO, NORTHERN COLORADO

## TEST BORING LOCATION PLAN

FALCON MEADOWS AT BENT GRASS  
FILING NO. 4  
EL PASO COUNTY, COLORADO  
CHALLENGER COMMUNITIES

JOB No. 195345

FIG No. 2.1


DATE 7-26-2024






 Urban Local low volume: 3" HMA over 4" ABC

 Urban Local: 3.5" HMA over 8" ABC

 Areas previously designed as part of Filing No. 3. See Pavement Design Report by RMG, Job No. 195343, last dated June 14, 2024

 Areas previously designed as part of Filing No. 1. See Pavement Study by A. G. Wassenaar, Project No. 214061-P2, last dated October 1, 2021



NOT TO SCALE

Architecture  
Structural  
Geotechnical



**Engineers / Architects**

SOUTHERN COLORADO OFFICE  
2910 AUSTIN BLUFFS PKWY, SUITE 100,  
COLORADO SPRINGS, CO 80918  
(719) 548-0600 ~ WWW.RMGENGINEERS.COM

SOUTHERN COLORADO, DENVER METRO, NORTHERN COLORADO

Materials Testing  
Forensics  
Civil / Planning

## PAVEMENT RECOMMENDATIONS

FALCON MEADOWS AT BENT GRASS  
FILING NO. 4  
EL PASO COUNTY, COLORADO  
CHALLENGER COMMUNITIES

JOB No. 195345

FIG No. 2.2

DATE 7-26-2024

# SOILS DESCRIPTION



CLAYSTONE



FILL: SAND, SILTY TO CLAYEY



SILTY TO CLAYEY SAND

UNLESS NOTED OTHERWISE, ALL LABORATORY TESTS PRESENTED HEREIN WERE PERFORMED BY:  
 RMG - ROCKY MOUNTAIN GROUP  
 5085 LIST DRIVE, SUITE 200  
 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 (%)

ROCKY MOUNTAIN GROUP

Structural  
Forensics



Geotechnical  
Materials Testing

Colorado Springs, (Corporate Office)  
 5085 List Drive, Suite 200  
 Colorado Springs, CO 80918  
 (719) 548-0600








SOUTHERN COLORADO, DENVER METRO, NORTHERN COLORADO

## EXPLANATION OF TEST BORING LOGS

JOB No. 195345

FIGURE No. 3

DATE Jul/26/2024

LOT No.: 1 DATE DRILLED: 6/10/24 REMARKS: NO GROUNDWATER ON 6/10/24	DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %	SOIL TYPE	DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %	SOIL TYPE
SAND, SILTY TO CLAYEY, with gravel, tan to gray, medium dense, moist	2.5			24	11.0	SANDSTONE, SILTY TO CLAYEY, light brown to gray, medium hard, moist	2.5			50/8"	10.1	
	5.0			47	10.3		5.0			50/9"	14.2	

ROCKY MOUNTAIN GROUP

Structural  
Forensics



Geotechnical  
Materials Testing

Colorado Springs - (Corporate Office)  
5085 List Drive, Suite 200  
Colorado Springs, CO 80918  
(719) 548-0600












SOUTHERN COLORADO, DENVER METRO, NORTHERN COLORADO

## TEST BORING LOGS

JOB No. 195345

FIGURE No. 4

DATE Jul/26/2024

LOT No.: <b>3</b> DATE DRILLED: 6/10/24 REMARKS: NO GROUNDWATER ON 6/10/24	DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %	SOIL TYPE	DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %	SOIL TYPE
SAND, SILTY TO CLAYEY, with gravel, tan to dark brown, loose to medium dense, moist	2.5			11	3.6	FILL: SAND, SILTY TO CLAYEY, with gravel, tan to brown, loose to medium dense, moist	2.5			19	8.9	
	5.0			19	5.1		5.0			11	6.6	
						SANDSTONE, SILTY, tan, medium dense, moist	7.5					
							10.0			50/8"	8.4	

ROCKY MOUNTAIN GROUP

Structural  
Forensics



Geotechnical  
Materials Testing

Colorado Springs - Corporate Office  
5085 List Drive, Suite 200  
Colorado Springs, CO 80918  
(719) 548-0600

SOUTHERN COLORADO, DENVER METRO, NORTHERN COLORADO

## TEST BORING LOGS

JOB No. 195345

FIGURE No. 5

DATE Jul/26/2024

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
1	0.0			27	11	22.8	52.4	25.5		A-2-6 (0)
1	2.0	11.0	101.1	29	12	17.4	40.3	18.5	0.0	A-2-6 (0)
1	4.0	10.3								
2	0.0			28	13	11.9	29.3	39.2		A-6 (1)
2	2.0	10.1								
2	4.0	14.2								
3	0.0			NP	NP	28.8	62.9	14.3		A-1-b (0)
3	2.0	3.6								
3	4.0	5.1								
4	0.0			34	18	13.3	27.8	44.5		A-6 (4)
4	2.0	8.9		NP	NP	11.6	43.8	23.3		A-2-4 (0)
4	4.0	6.6								
4	9.0	8.4								

ROCKY MOUNTAIN GROUP

Structural  
Forensics



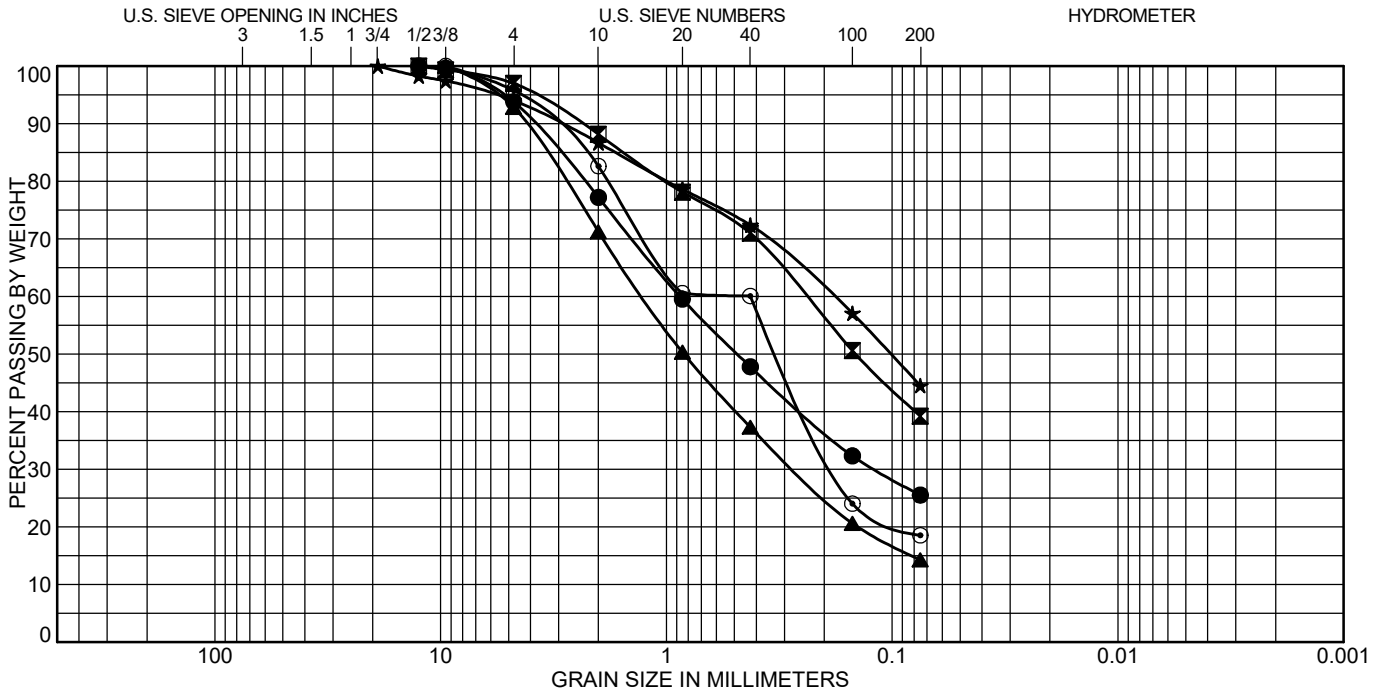
Geotechnical  
Materials Testing

Colorado Springs, (Corporate Office)  
5085 List Drive, Suite 200  
Colorado Springs, CO 80918  
(719) 548-0600

SOUTHERN COLORADO, DENVER METRO, NORTHERN COLORADO

## SUMMARY OF LABORATORY TEST RESULTS

JOB No. 195345  
FIGURE No. 6  
PAGE 1 OF 1  
DATE Jul/26/2024



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Test Boring	Depth (ft)	Classification	LL	PL	PI
● 1	0.0	CLAYEY SAND(SC)	27	16	11
☒ 2	0.0	CLAYEY SAND(SC)	28	15	13
▲ 3	0.0	SILTY SAND(SM)	NP	NP	NP
★ 4	0.0	CLAYEY SAND(SC)	34	16	18
⊙ 1	2.0	CLAYEY SAND(SC)	29	17	12

Test Boring	Depth (ft)	%Gravel	%Sand	%Silt	%Clay
● 1	0.0	6.2	68.3	25.5	
☒ 2	0.0	3.0	57.8	39.2	
▲ 3	0.0	7.2	78.6	14.3	
★ 4	0.0	6.0	49.5	44.5	
⊙ 1	2.0	4.2	77.3	18.5	

ROCKY MOUNTAIN GROUP

Structural  
Forensics



Geotechnical  
Materials Testing

Colorado Springs: (Corporate Office)  
5085 List Drive, Suite 200  
Colorado Springs, CO 80918  
(719) 548-0600

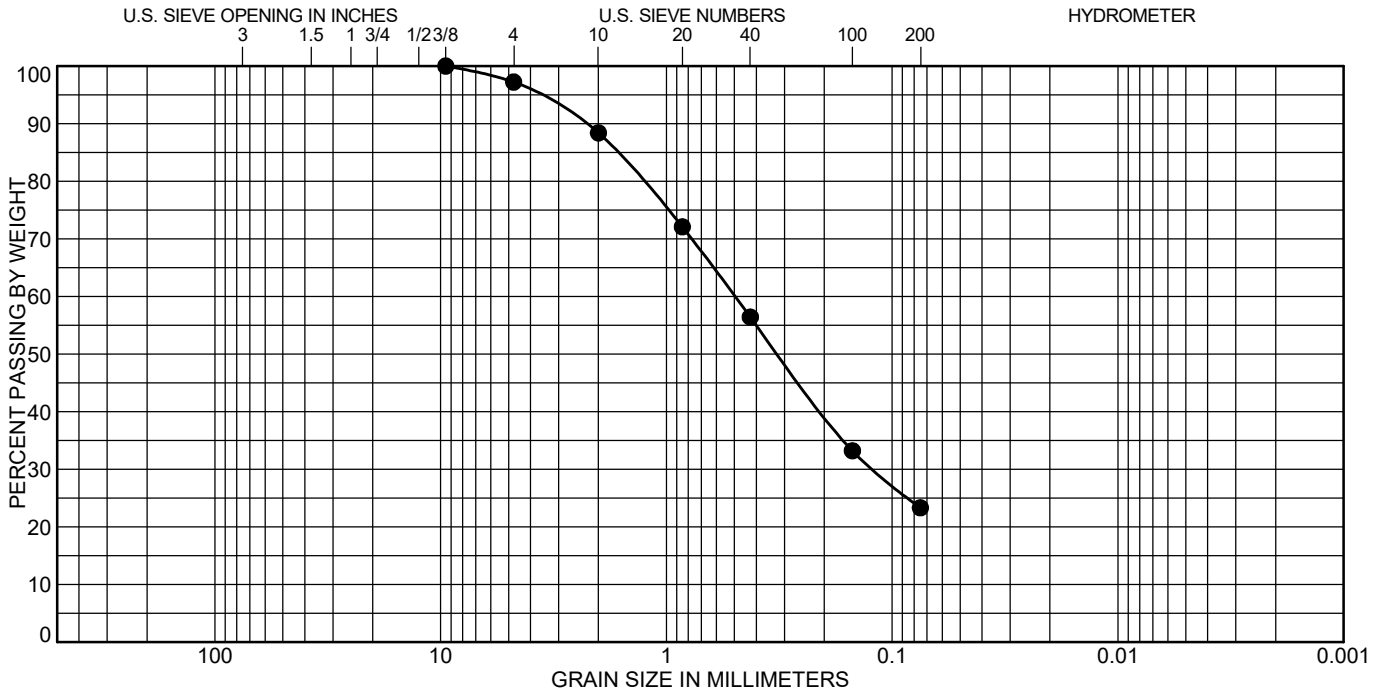
SOUTHERN COLORADO, DENVER METRO, NORTHERN COLORADO

## SOIL CLASSIFICATION DATA

JOB No. 195345

FIGURE No. 7

DATE Jul/26/2024



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Test Boring	Depth (ft)	Classification	LL	PL	PI
● 4	2.0	SILTY SAND(SM)	NP	NP	NP

Test Boring	Depth (ft)	%Gravel	%Sand	%Silt	%Clay
● 4	2.0	2.8	73.9	23.3	

ROCKY MOUNTAIN GROUP

Structural Forensics



Geotechnical Materials Testing

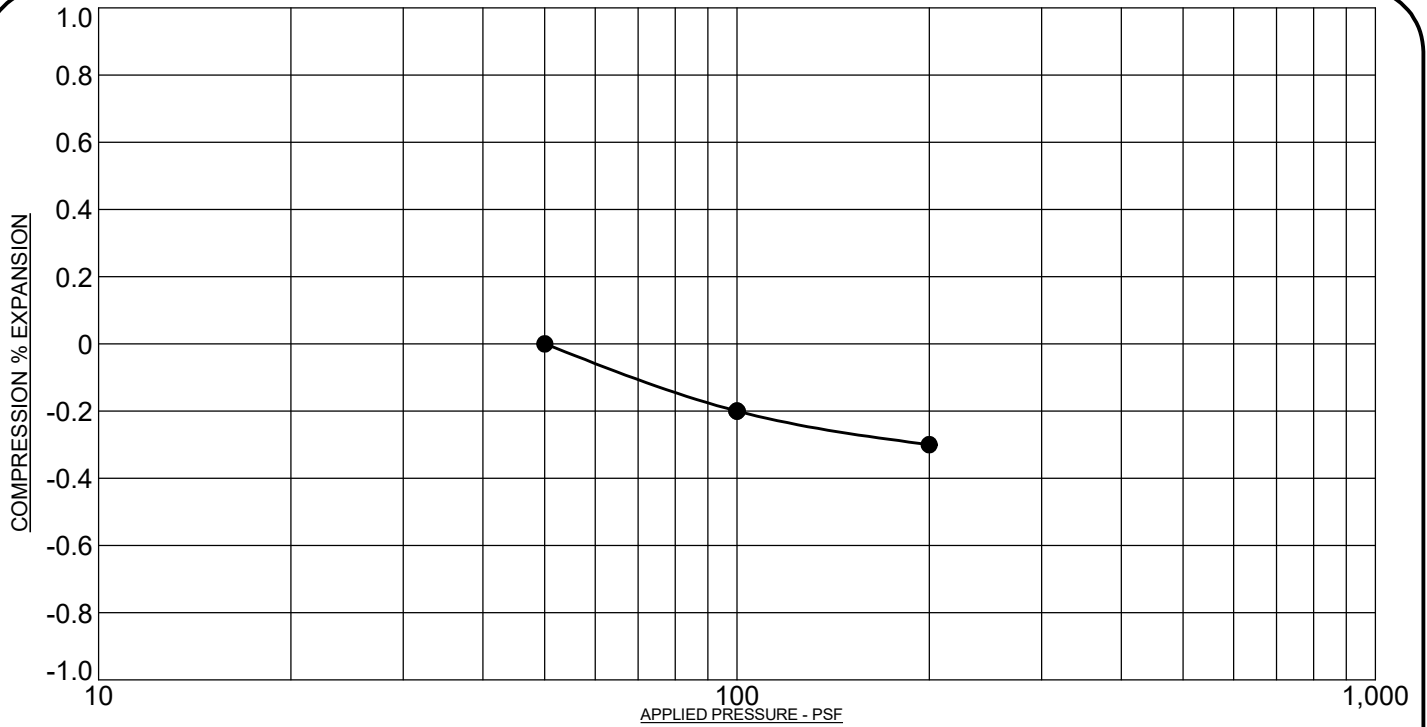
Colorado Springs: (Corporate Office)  
5085 List Drive, Suite 200  
Colorado Springs, CO 80918  
(719) 548-0600  
SOUTHERN COLORADO, DENVER METRO, NORTHERN COLORADO

# SOIL CLASSIFICATION DATA

JOB No. 195345

FIGURE No. 8

DATE Jul/26/2024



PROJECT: **Falcon Meadows at Bent Grass, Filing No. 4 El Paso County, Colorado**  
 SAMPLE DESCRIPTION: **SAND, SILTY TO CLAYEY**  
 NOTE: **SAMPLE WAS INUNDATED WITH WATER AT 100 PSF**

SAMPLE LOCATION: **1 @ 2 FT**  
 NATURAL DRY UNIT WEIGHT: **101.1 PCF**  
 NATURAL MOISTURE CONTENT: **11.0%**  
 PERCENT SWELL/COMPRESSION: **0.0**

ROCKY MOUNTAIN GROUP

Structural  
Forensics



*Colorado Springs, (Corporate Office)*  
 5085 List Drive, Suite 200  
 Colorado Springs, CO 80918  
 (719) 548-0600

SOUTHERN COLORADO, DENVER METRO, NORTHERN COLORADO

Geotechnical  
Materials Testing

## SWELL/CONSOLIDATION TEST RESULTS

JOB No. 195345

FIGURE No. 9

DATE Jul/26/2024

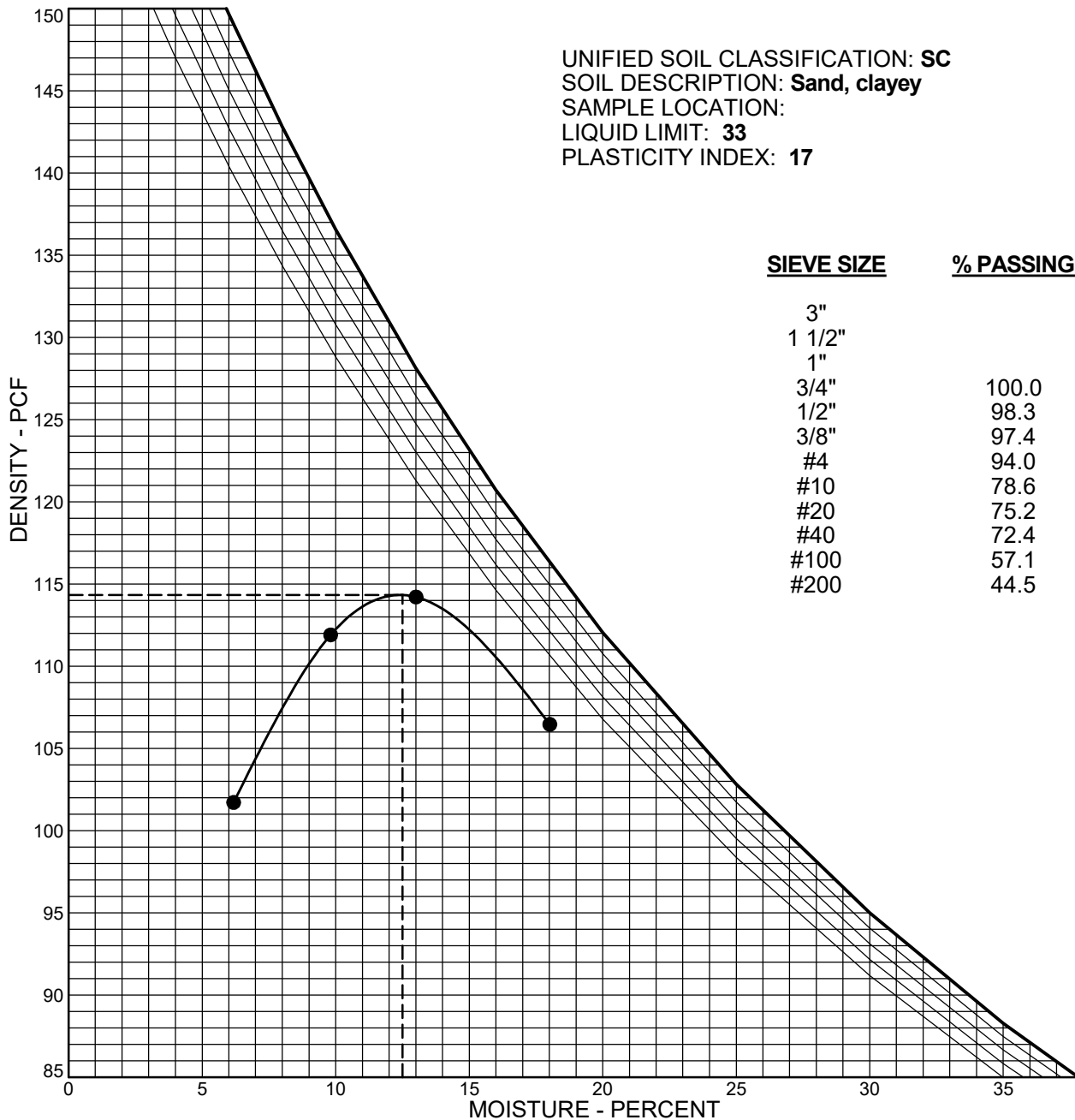


CLIENT: Challenger Communities

SAMPLE NUMBER: 4

PROJECT: Falcon Meadows at Bent Grass, Filing No. 4 El Paso County, Colorado

UNIFIED SOIL CLASSIFICATION: SC  
SOIL DESCRIPTION: Sand, clayey  
SAMPLE LOCATION:  
LIQUID LIMIT: 33  
PLASTICITY INDEX: 17



DESIGNATION **ASTM D-698A**  
MAX. DRY DENSITY **114.3 pcf**  
OPTIMUM MOISTURE **12.5 %**  
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

ROCKY MOUNTAIN GROUP

Structural  
Forensics



Geotechnical  
Materials Testing

Colorado Springs: (Corporate Office)  
5085 List Drive, Suite 200  
Colorado Springs, CO 80918  
(719) 548-0600

SOUTHERN COLORADO, DENVER METRO, NORTHERN COLORADO

# MOISTURE-DENSITY RELATION CURVE

JOB No. 195345

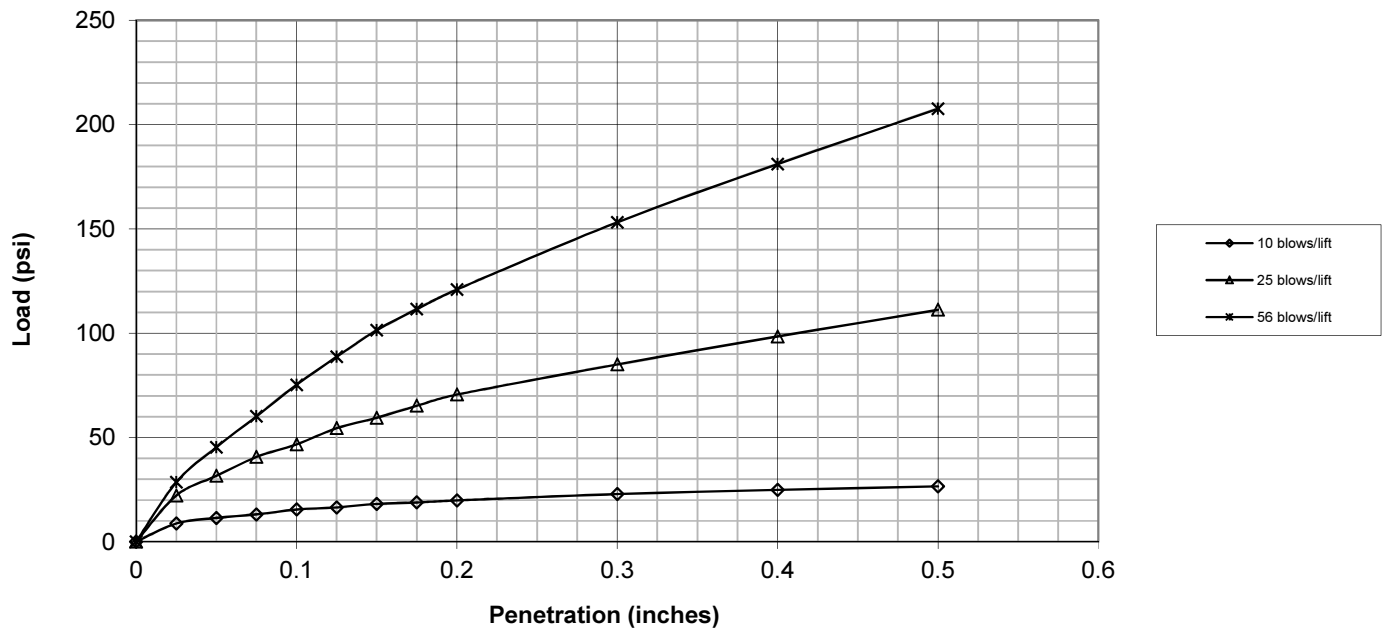
FIGURE No. 10

DATE Jul/26/2024

# CALIFORNIA BEARING RATIO TEST RESULTS

Project: Falcon Meadows at Bent Grass, Filing No. 4  
 Job No.: 195345  
 AASHTO Classification: A-6  
 Sample Number: CBR  
 Sample Location: Combined Bulk Sample  
 Soil Description: Clayey Sand

	10 blows/lift	25 blows/lift	56 blows/lift
Penetration (in)	Load (psi)	Load (psi)	Load (psi)
0.000	0.0	0.0	0.0
0.025	8.7	22.2	28.6
0.050	11.4	31.6	45.4
0.075	13.1	40.6	60.1
0.100	15.5	46.7	75.2
0.125	16.5	54.4	88.7
0.150	18.1	59.5	101.5
0.175	18.8	65.2	111.5
0.200	19.8	70.5	120.9
0.300	22.8	85.0	153.2
0.400	24.9	98.4	181.1
0.500	26.5	111.2	207.6



	Corrected Penetration (in)	Corrected Load (psi)
10 blows/lift	0.100	1.5
25 blows/lift	0.100	4.7
56 blows/lift	0.100	7.5

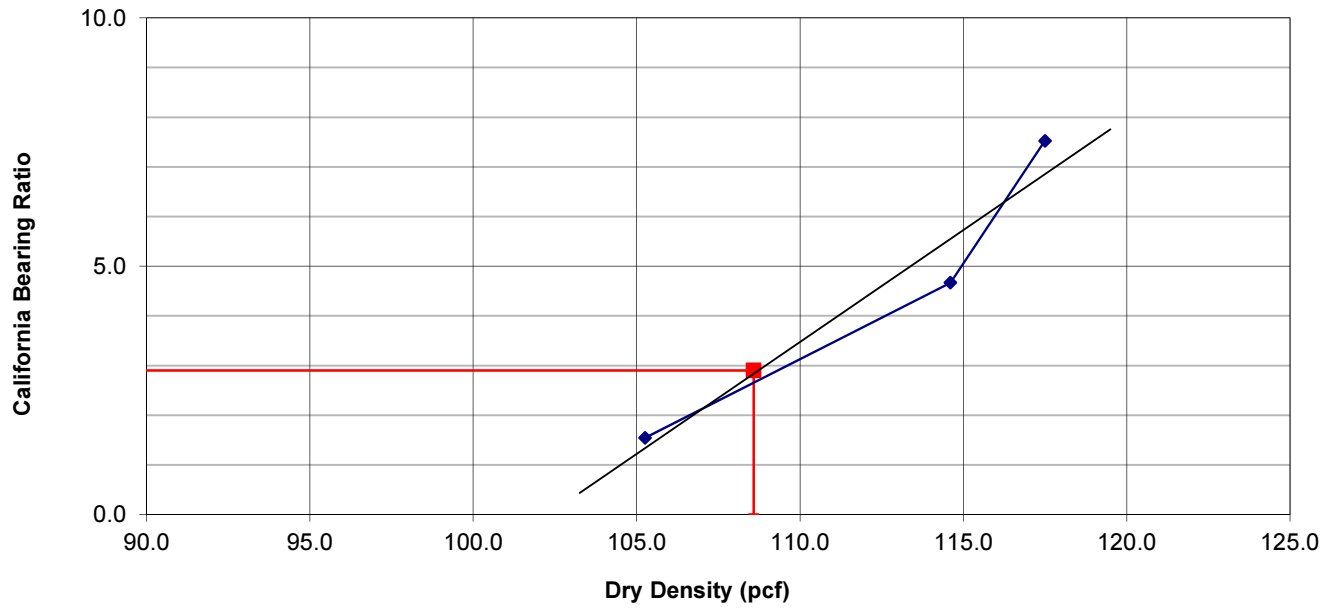


Figure No. 11

# CALIFORNIA BEARING RATIO TEST RESULTS

Project: Falcon Meadows at Bent Grass, Filing No. 4  
 Job No.: 195345  
 AASHTO Classification" A-6  
 Sample Number: CBR  
 Sample Location: Combined Bulk Sample  
 Soil Description: Clayey Sand

	10 blows/lift	25 blows/lift	56 blows/lift
Corrected California Bearing Ratio	1.5	4.7	7.5
Dry Density (pcf)	105.3	114.6	117.5
Percent Compaction	92	100	103
Percent Moisture After Soaking	27.1	26.0	29.6
Percent Expansion (+) / Compression (-)	-0.7%	-0.5%	-0.9%
Surcharge Weight (lbs)	12.60	12.60	12.60



<b>California Bearing Ratio</b>	<b>2.9</b>
Dry Density (pcf)	114.3
Percent Compaction	95%
Target Dry Density	108.6
Compaction Test Method	ASTM D-698
Condition of sample	Soaked

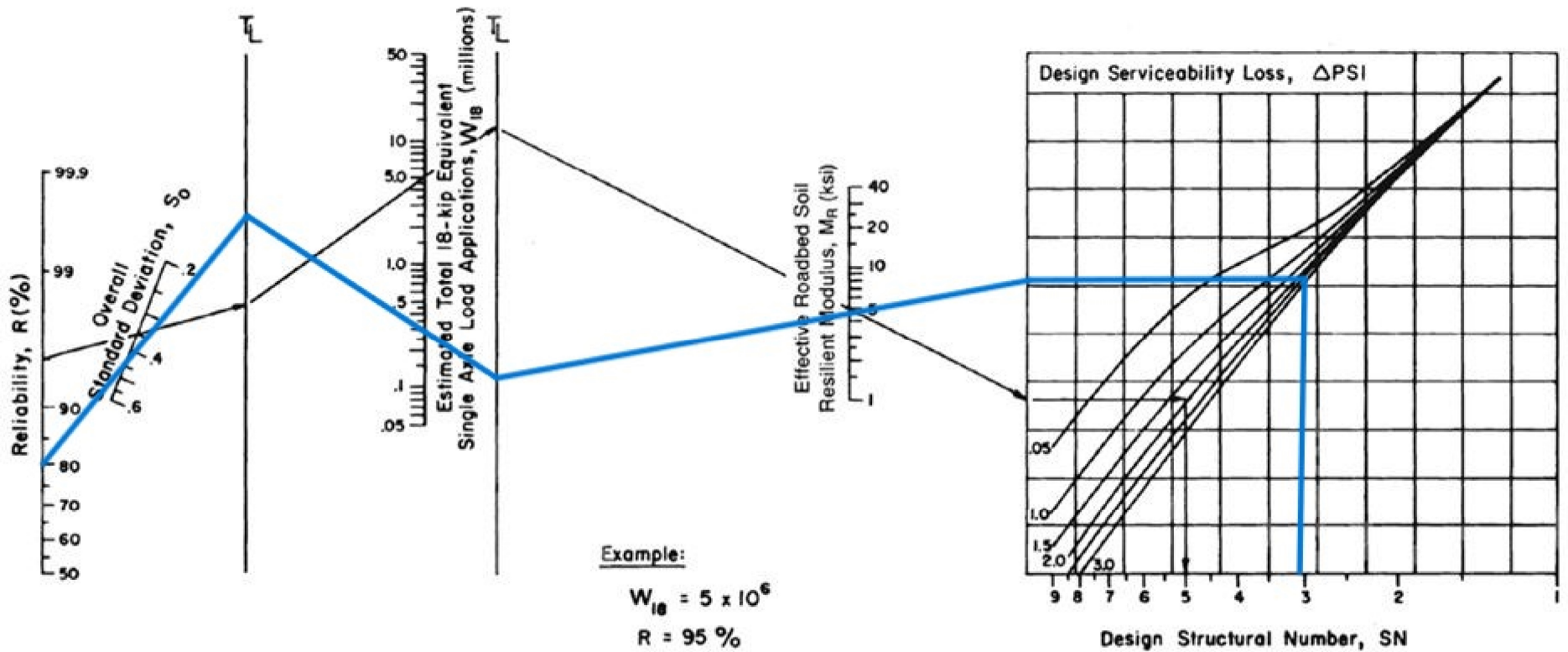


Figure No. 12

Figure D-1. Flexible Pavement Nomograph

NOMOGRAPH SOLVES:

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

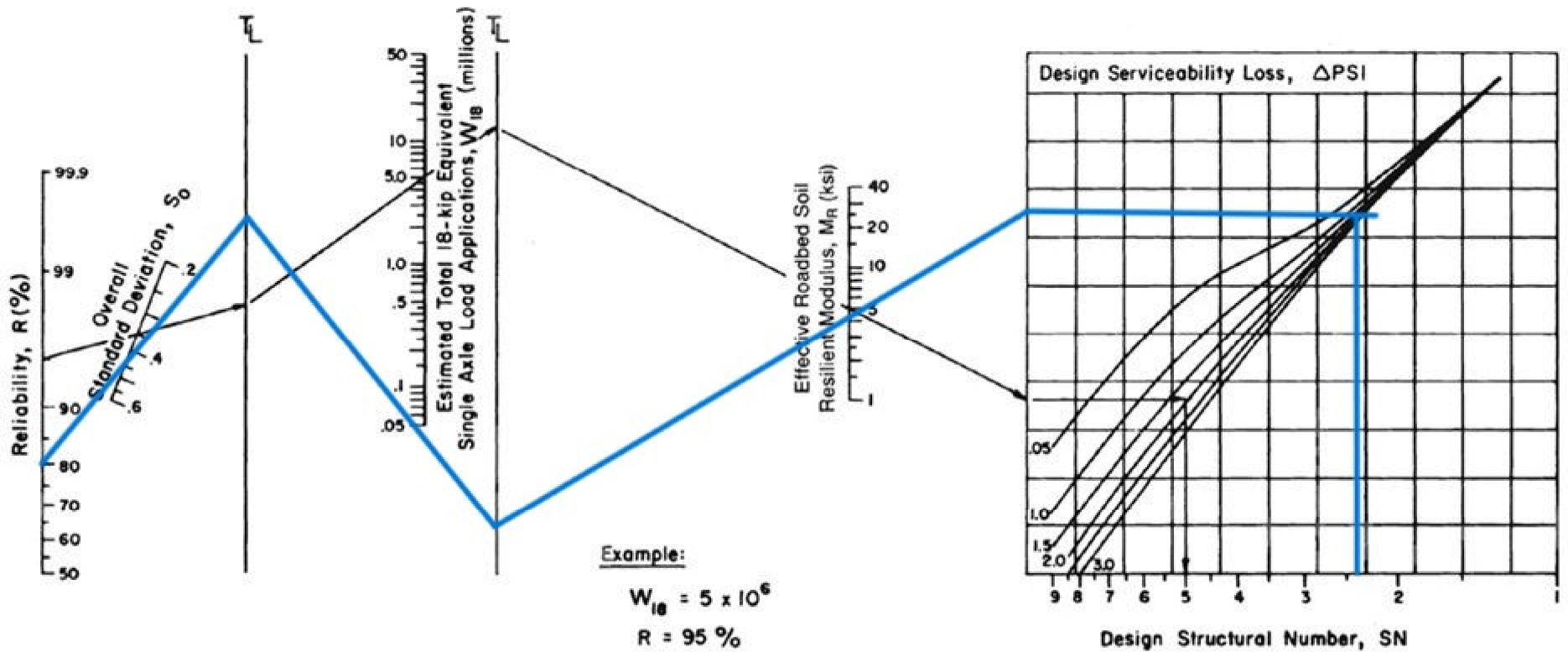


**Example:**  
 $W_{18} = 5 \times 10^6$   
 $R = 95 \%$   
 $S_o = 0.35$   
 $M_R = 5000 \text{ psi}$   
 $\Delta \text{PSI} = 1.9$   
**Solution: SN = 5.0**

Figure D-1. Flexible Pavement Nomograph

NOMOGRAPH SOLVES:

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



**Example:**  
 $W_{18} = 5 \times 10^6$   
 $R = 95 \%$   
 $S_o = 0.35$   
 $M_R = 5000 \text{ psi}$   
 $\Delta \text{PSI} = 1.9$   
**Solution: SN = 5.0**