April 8, 2022

ENTECH
ENGINEERING, INC.

505 ELKTON DRIVE
COLORADO SPRINGS, CO 80907
PHONE (719) 531-5599
FAX (719) 531-5238

SR Land, LLC
20 Boulder Crescent, 2nd Floor
Colorado Springs, CO 80903

Attn: Chaz Collins

Re: Pavement Recommendations
Sterling Ranch, Filing No. 2 - Marksheffel Road
Vollmer Road to approximately 250 feet East of Sterling Ranch Road
Colorado Springs, Colorado

Dear Mr. Collins:

As requested, Entech Engineering, Inc. has obtained samples of the pavement subgrade soils from portions of Marksheffel Road and Sterling Ranch Road in the Sterling Ranch Filing No. 2 subdivision. This letter presents the results of the laboratory testing and pavement recommendations for the roadway sections.

Project Description

The roadways for this project consist of a section of Marksheffel Road from Vollmer Road to approximately 250 feet East of Sterling Ranch Road in northeast Colorado Springs, Colorado. Subsurface Soil Investigation and laboratory testing was performed in order to determine the pavement support characteristics of the soils. The limits of this investigation and the approximate locations of the test borings are presented in the Site/Test Boring Location Map, Figure 1.

Subgrade Conditions

Four test borings were drilled along the above referenced roadways to depths of approximately 5 and 10 feet below the existing subgrade surface. The Test Boring Logs are presented in Appendix A. Sieve Analyses and Atterberg Limit testing were performed on the soil samples obtained from the test borings for the purpose of classification. The percent passing the No. 200 sieve for the soils at subgrade depth ranged from approximately 12 to 24 percent. The soils at the subgrade depth consisted of slightly silty sand fill and native slightly silty to silty sand. The subgrade soils are generally underlain with silty sand and sandy clay. The underlying Type 2 soils were encountered at depths below the subgrade influence zone. Based on the results of the laboratory testing, two general subgrade soil types were determined for the roadway sections at subgrade depths; silty sand fill (Soil Type 1A), and silty to slightly silty sand (Soil Type 1). The soils classify as A-1-b, based on the AASHTO Classification System. Based on the similar characteristics, Soil Types 1A and 1 were grouped together for laboratory testing. Groundwater was not encountered in any of the test borings.

The Type 2 (A-6) soils required Swell/Consolidation testing to determine their expansive characteristics. A Swell/Consolidation Test resulted in a volume change of 1.4 percent. The Swell Test results indicate mitigation of the expansive potential of the subgrade soils will not be required for this site.

California Bearing Ratio (CBR) testing was performed on a representative sample of the Type 1A and 1 subgrade soils. The results of the CBR and classification testing are presented as

follows and in Appendix B and on Table 1, attached. Based on the results of the classification and CBR testing, the soils on this site exhibit fair to good pavement support characteristics. The results of the CBR testing, classification testing, and Swell/Consolidation test are presented in Appendix B and are summarized as follows:

Soil Type 1 – Silty Sand

R @ 90% = 1.0
R @ 95% = 37.0
Use R = 35.0 for design*

Classification Testing

Liquid Limit	NV
Plasticity Index	NP
Percent Passing 200	24.1
AASHTO Classification	A-1-b
Group Index	0
Unified Soils Classification	SM

* The Type 1A silty sand fill and Type 1 slightly silty to silty sand will be grouped together into one category due to the similarity of the soils.

Pavement Design

CBR testing was used to determine pavement sections for the roadway sections. Pavement sections were determined utilizing Pavement Design Criteria Manual for the City of Colorado Springs. Marksheffel Road classifies as a major arterial, which used an 18K ESAL value of 4,500,000 for design purposes. Pavement sections were determined for asphalt supported on aggregate base course, asphalt millings, and on recycled concrete. City approval is required if asphalt millings or recycled concrete are to be utilized.

Design parameters used in the pavement analysis for the roadway section are as follows:

Reliability	
Major Arterial	95%
Standard Deviation	0.44
Resilient Modulus	8,065 psi
Δpsi	
Major Arterial	2.5
"R" Value Subgrade	35
Structural Coefficients:	
Hot Bituminous Pavement	0.44
Aggregate Basecourse	0.12
Asphalt Millings	0.07
Recycled Concrete	0.12

The pavement design calculations are presented in Appendix C. Pavement section alternatives for the roadway sections are presented below. Additional grading may result in subgrade soils with different support characteristics. The following pavement sections should be re-evaluated if additional grading is performed.

Marksheffel Road – Major Arterial
Soil Types 1 and 1A

Composite Section	Asphalt (in)	Basecourse (in)	Asphalt Millings (in)*	Recycled Concrete (in)*
1. Asphalt Over Basecourse	6.0	15.0	-	-
2. Asphalt Over Asphalt Millings	7.5	-	16.0	-
3. Asphalt Over Recycled Concrete	6.0	-	-	15.0

*City approval pending.

Roadway Construction

Prior to placement of the asphalt, the subgrade should be scarified, moisture-conditioned, compacted to a minimum of 95% of its maximum Modified Proctor Dry Density, ASTM D-1557 at ± 2 percent of optimum moisture content and proofrolled after properly compacted. Any loose or soft areas should be removed and replaced with suitable materials approved by Entech. Basecourse materials should be compacted to a minimum of 95% of its maximum Modified Proctor Dry Density, ASTM D-1557 at ± 2% of optimum moisture content. Special attention should be given to areas adjacent to manholes, inlet structures and valves.

In addition to the above guidance the asphalt, subgrade conditions, compaction of materials and roadway construction methods shall meet the City specifications.

We trust that this report contains the information you require. If you have questions or need additional information, please contact us.

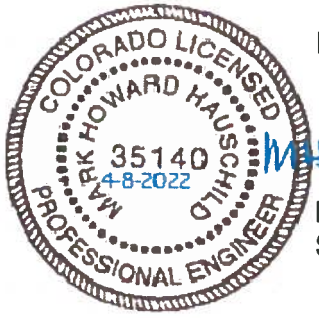
Respectfully Submitted,

ENTECH ENGINEERING, INC.

Daniel P. Stegman

DPS/drc

Entech Job No. 220394
AAprojects/2022/220397/220394 pr_Marksheffel



Reviewed by:

Mark Hauschild, P.E
Senior Engineer

TABLE

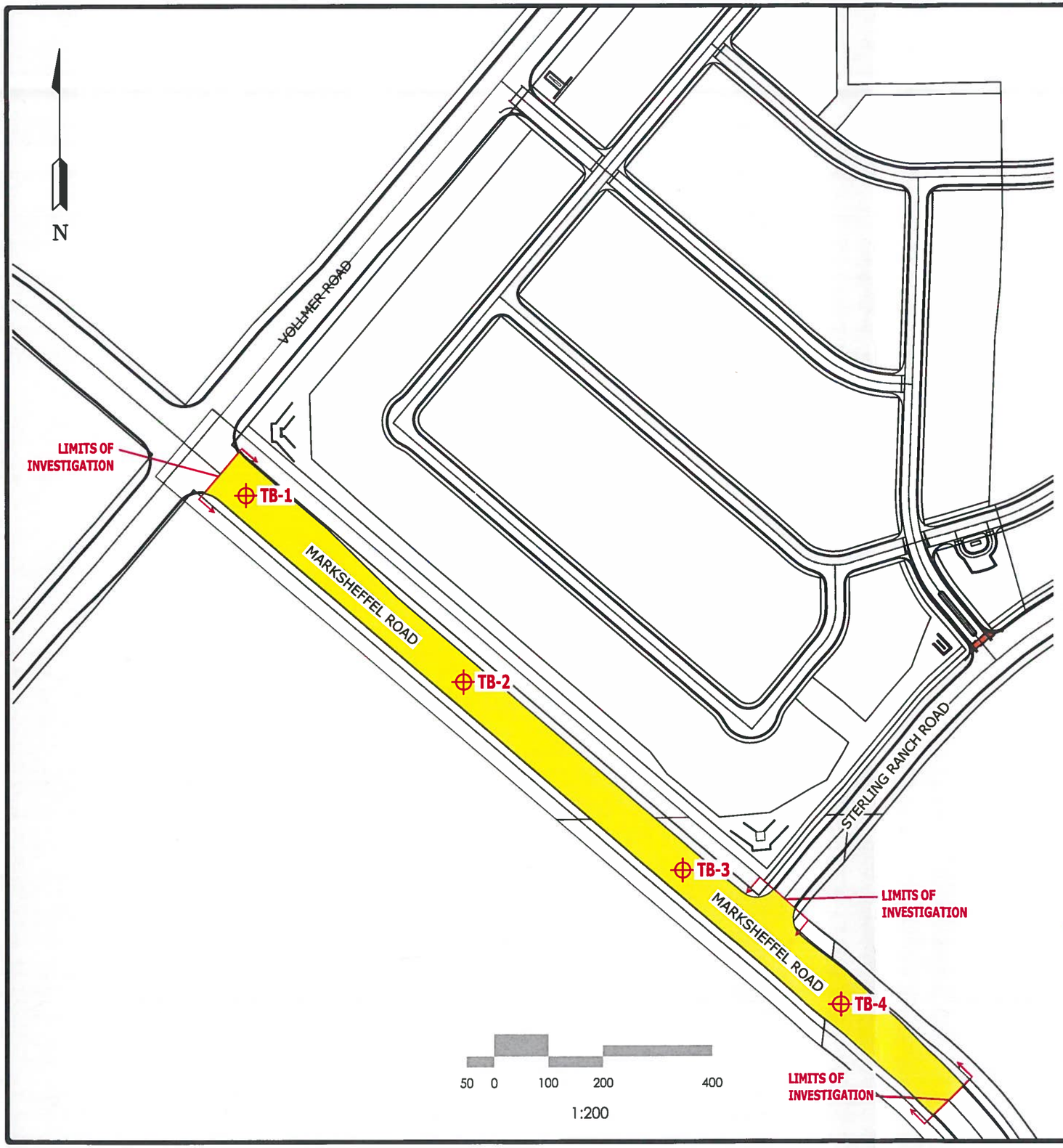
TABLE 1

SUMMARY OF LABORATORY TEST RESULTS

CLIENT SR LAND
PROJECT STERLING RANCH, F-2
JOB NO. 220394

SOIL TYPE	TEST BORING NO.	DEPTH (FT)	WATER (%)	DRY DENSITY (PCF)	PASSING NO. 200 SIEVE (%)	LIQUID LIMIT (%)	PLASTIC INDEX (%)	SULFATE (WT %)	AASHTO CLASS.	SWELL/ CONSOL (%)	UNIFIED CLASSIFICATION	SOIL DESCRIPTION
1A	1	1-2			13.1	NV	NP	0.01	A-1-b		SM	FILL, SAND, SLIGHTLY SILTY
1, CBR #1	1	0-3			24.1	NV	NP		A-1-b		SM	SAND, SILTY
1	2	1-2			12.3	NV	NP		A-1-b		SM	SAND, SLIGHTLY SILTY
1	3	1-2			16.0	NV	NP	<0.01	A-1-b		SM	SAND, SLIGHTLY SILTY
1	4	1-2			21.7	NV	NP		A-1-b		SM	SAND, SILTY
2	2	5	17.6	108.8	67.0	35	19		A-6	1.4	CL	CLAY, SANDY

FIGURE



TB-#- APPROXIMATE TEST BORING LOCATION AND NUMBER

SOIL TYPE 1/1A - PRINCIPAL ARTERIAL , 6" ASPHALT ON 15" OF BASE COURSE

**SECTION/SOIL TYPE TRANSITIONS ARE ESTIMATED AND MUST BE FIELD VERIFIED.

-SEE REPORT FOR ASPHALT MILLINGS OR RECYCLED CONCRETE SECTIONS

REVISION	BY

ENTECH ENGINEERING, INC.
505 ELKTON DRIVE COLORADO SPRINGS, CO. 80907 (719) 531-5599

SITE/TEST BORING LOCATION MAP
MARKSHEFFEL ROAD
COLORADO SPRINGS, CO.
FOR: SR LAND LLC

DRAWN	JAC
CHECKED	DPS
DATE	3/17/22
SCALE	1:200
JOB NO.	220394-B
FIGURE No.	1

APPENDIX A: Test Boring Logs

TEST BORING NO. 1
DATE DRILLED 8/24/2016
Job # 220394

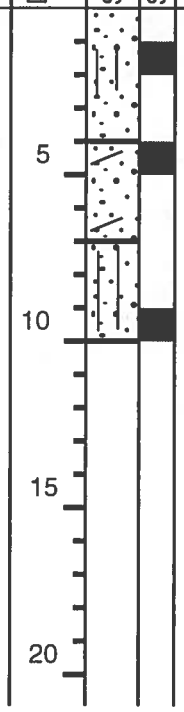
REMARKS

DRY TO 10', 8/24/16

FILL 0-4', POSS. FILL 4-7', SAND, SLIGHTLY SILTY, FINE TO COARSE GRAINED, BROWN, MEDIUM DENSE, MOIST

POSS. FILL, SAND, CLAYEY, FINE TO COARSE GRAINED, GRAY BROWN, MEDIUM DENSE, MOIST

SAND, SILTY, FINE TO COARSE GRAINED, TAN, MEDIUM DENSE, MOIST



Blows per foot	Watercontent %	Soil Type
16	6.9	1A
19	9.5	1A
26	3.3	1

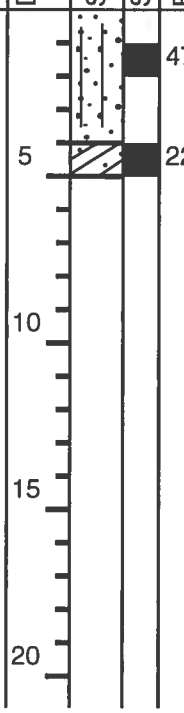
TEST BORING NO. 2
DATE DRILLED 8/24/2016
CLIENT SR LAND
LOCATION STERLING RANCH, F-2

REMARKS

DRY TO 5', 8/24/16

SAND, SILTY, FINE TO COARSE GRAINED, TAN, DENSE, MOIST

CLAY, SANDY, GRAY BROWN, STIFF, MOIST



Blows per foot	Watercontent %	Soil Type
47	5.8	1
22	12.1	2

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TEST BORING LOG

DRAWN:	DATE:	CHECKED: DS	DATE: 4/4/22

JOB NO.: 220394
FIG NO.: A- 1

TEST BORING NO. 3
DATE DRILLED 8/24/2016
Job # 220394

REMARKS

DRY TO 5', 8/24/16

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type	Description
			35	6.8	1	SAND, SILTY, FINE TO COARSE GRAINED, BROWN TO TAN,
5			31	4.4	1	DENSE, MOIST
10						
15						
20						

TEST BORING NO. 4
DATE DRILLED 8/24/2016
CLIENT SR LAND
LOCATION STERLING RANCH, F-2

REMARKS

DRY TO 5', 8/24/16

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type	Description
			31	5.0	1	SAND, SILTY, FINE TO COARSE GRAINED, GRAY BROWN,
5			20	9.2	1	DENSE TO MEDIUM DENSE, MOIST
10						
15						
20						

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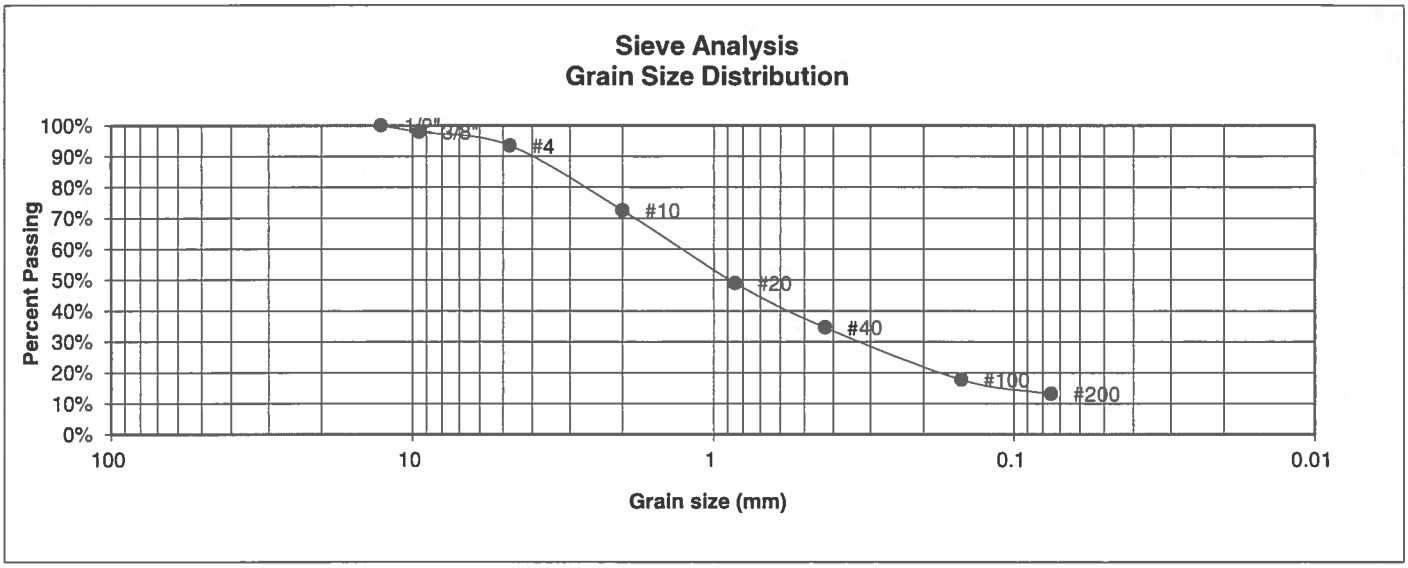
TEST BORING LOG

DRAWN:	DATE:	CHECKED:	DATE
		DS	4/12/22

JOB NO.: 220394
FIG NO.: A- 2

APPENDIX B: Laboratory Test Results

UNIFIED CLASSIFICATION	SM	CLIENT	SR LAND
SOIL TYPE #	1A	PROJECT	STERLING RANCH, F-2
TEST BORING #	1	JOB NO.	220394
DEPTH (FT)	1-2	TEST BY	BL
AASHTO CLASSIFICATION	A-1-b	GROUP INDEX	0



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	100.0%
3/8"	97.9%
4	93.5%
10	72.5%
20	49.0%
40	34.6%
100	17.7%
200	13.1%

Atterberg Limits

Plastic Limit	NP
Liquid Limit	NV
Plastic Index	NP

Swell

Moisture at start

Moisture at finish

Moisture increase

Initial dry density (pcf)

Swell (psf)

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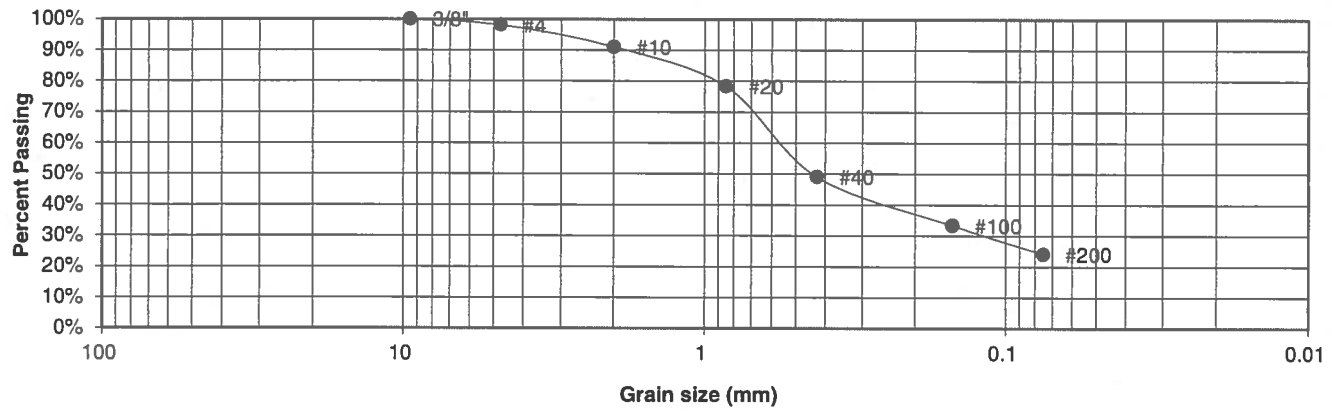
LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
		DS	4/4/22

JOB NO.: 220394
FIG NO.: B-1

UNIFIED CLASSIFICATION	SM	CLIENT	SR LAND
SOIL TYPE #	1, CBR #1	PROJECT	STERLING RANCH, F-2
TEST BORING #	1	JOB NO.	220394
DEPTH (FT)	0-3	TEST BY	BL
AASHTO CLASSIFICATION	A-1-b	GROUP INDEX	0

Sieve Analysis
Grain Size Distribution



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	98.1%
10	91.0%
20	78.3%
40	49.0%
100	33.3%
200	24.1%

Atterberg Limits

Plastic Limit	NP
Liquid Limit	NV
Plastic Index	NP

Swell

Moisture at start	
Moisture at finish	
Moisture increase	
Initial dry density (pcf)	
Swell (psf)	

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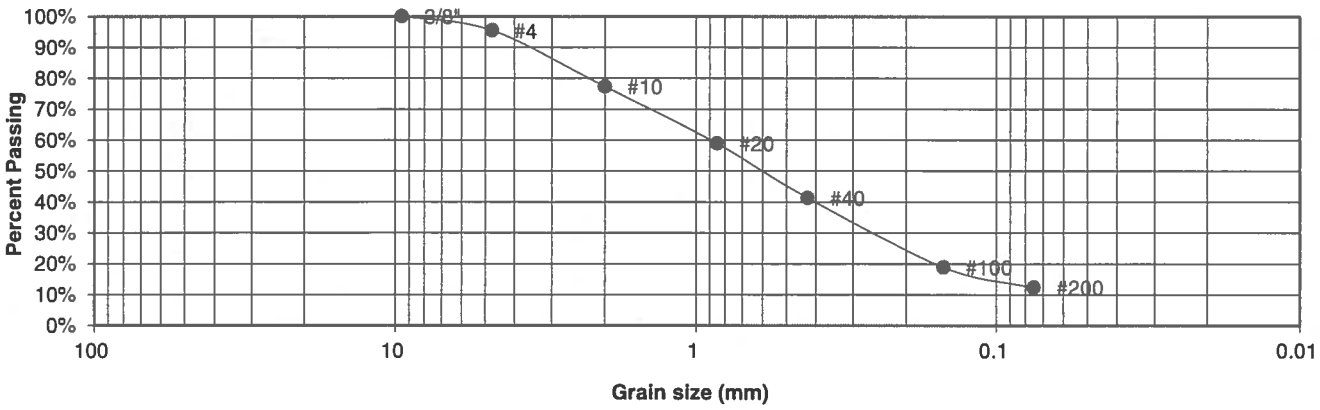
LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED: BS	DATE: 4/4/22

JOB NO.: 220394
FIG NO.: B-2

UNIFIED CLASSIFICATION	SM	CLIENT	SR LAND
SOIL TYPE #	1	PROJECT	STERLING RANCH, F-2
TEST BORING #	2	JOB NO.	220394
DEPTH (FT)	1-2	TEST BY	BL
AASHTO CLASSIFICATION	A-1-b	GROUP INDEX	0

Sieve Analysis
Grain Size Distribution



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	95.5%
10	77.3%
20	58.9%
40	41.3%
100	18.8%
200	12.3%

Atterberg Limits	
Plastic Limit	NP
Liquid Limit	NV
Plastic Index	NP

Swell	
Moisture at start	
Moisture at finish	
Moisture increase	
Initial dry density (pcf)	
Swell (psf)	

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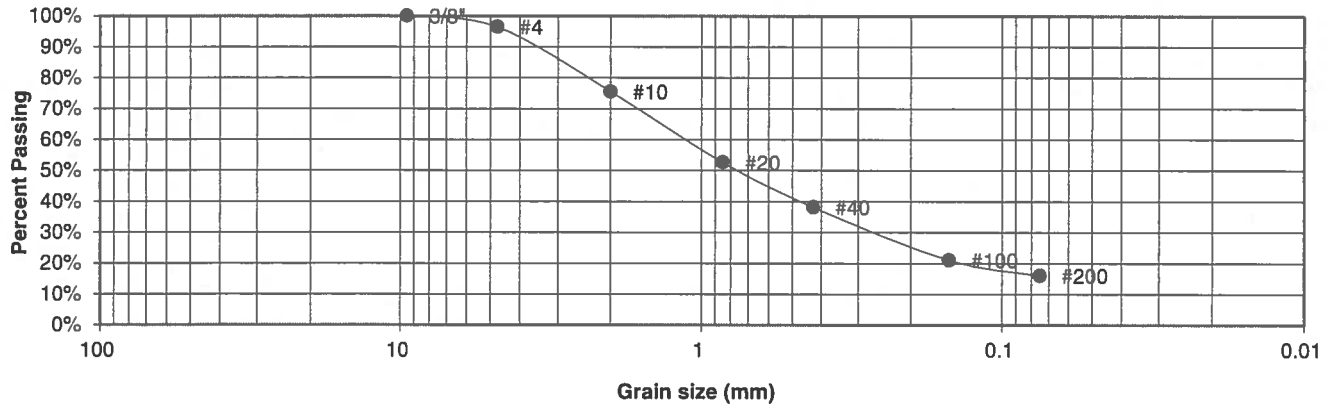
LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
		DS	4/4/22

JOB NO.: 220394
FIG NO.: B-3

UNIFIED CLASSIFICATION	SM	CLIENT	SR LAND
SOIL TYPE #	1	PROJECT	STERLING RANCH, F-2
TEST BORING #	3	JOB NO.	220394
DEPTH (FT)	1-2	TEST BY	BL
AASHTO CLASSIFICATION	A-1-b	GROUP INDEX	0

Sieve Analysis
Grain Size Distribution



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	96.5%
10	75.5%
20	52.6%
40	38.2%
100	21.1%
200	16.0%

Atterberg Limits

Plastic Limit	NP
Liquid Limit	NV
Plastic Index	NP

Swell

Moisture at start

Moisture at finish

Moisture increase

Initial dry density (pcf)

Swell (psf)

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COLORADO SPRINGS, COLORADO 80907

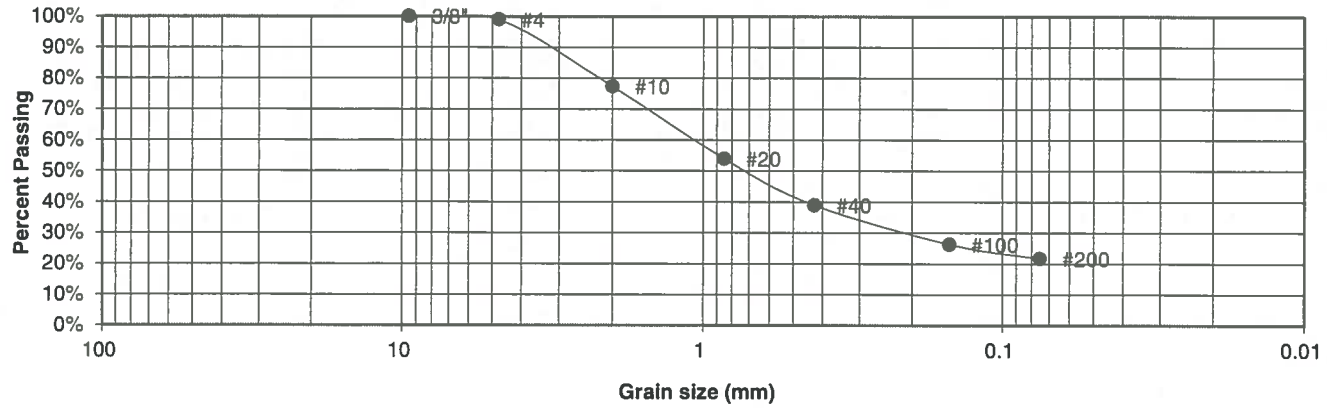
LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
		DS	4/4/22

JOB NO.: 220394
FIG NO.: B-4

UNIFIED CLASSIFICATION	SM	CLIENT	SR LAND
SOIL TYPE #	1	PROJECT	STERLING RANCH, F-2
TEST BORING #	4	JOB NO.	220394
DEPTH (FT)	1-2	TEST BY	BL
AASHTO CLASSIFICATION	A-1-b	GROUP INDEX	0

Sieve Analysis
Grain Size Distribution



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	98.9%
10	77.3%
20	53.9%
40	38.9%
100	26.3%
200	21.7%

Atterberg Limits

Plastic Limit	NP
Liquid Limit	NV
Plastic Index	NP

Swell

Moisture at start	
Moisture at finish	
Moisture increase	
Initial dry density (pcf)	
Swell (psf)	

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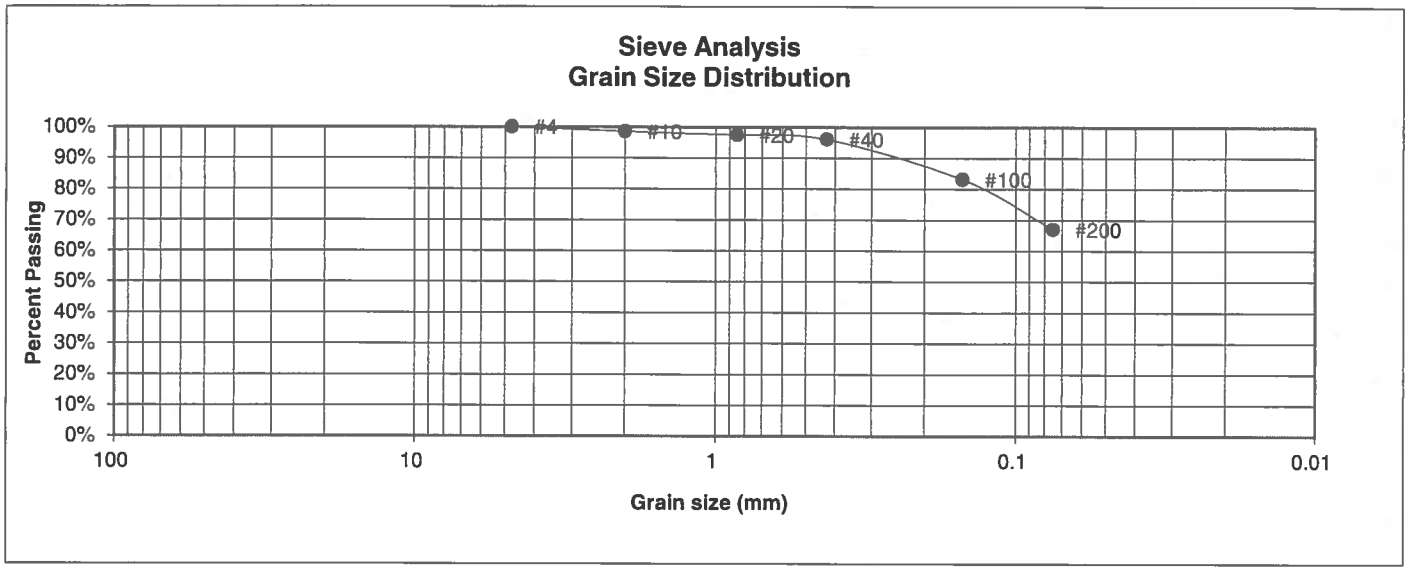
COLORADO SPRINGS, COLORADO 80907

LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
		DS	4/4/22

JOB NO.: 220394
FIG NO.: B-5

UNIFIED CLASSIFICATION	CL	CLIENT	SR LAND
SOIL TYPE #	2	PROJECT	STERLING RANCH, F-2
TEST BORING #	2	JOB NO.	220394
DEPTH (FT)	5	TEST BY	BL
AASHTO CLASSIFICATION	A-6	GROUP INDEX	10



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	
4	100.0%
10	98.6%
20	97.4%
40	96.1%
100	83.2%
200	67.0%

Atterberg Limits	
Plastic Limit	16
Liquid Limit	35
Plastic Index	19

Swell	
Moisture at start	
Moisture at finish	
Moisture increase	
Initial dry density (pcf)	
Swell (psf)	

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LABORATORY TEST RESULTS

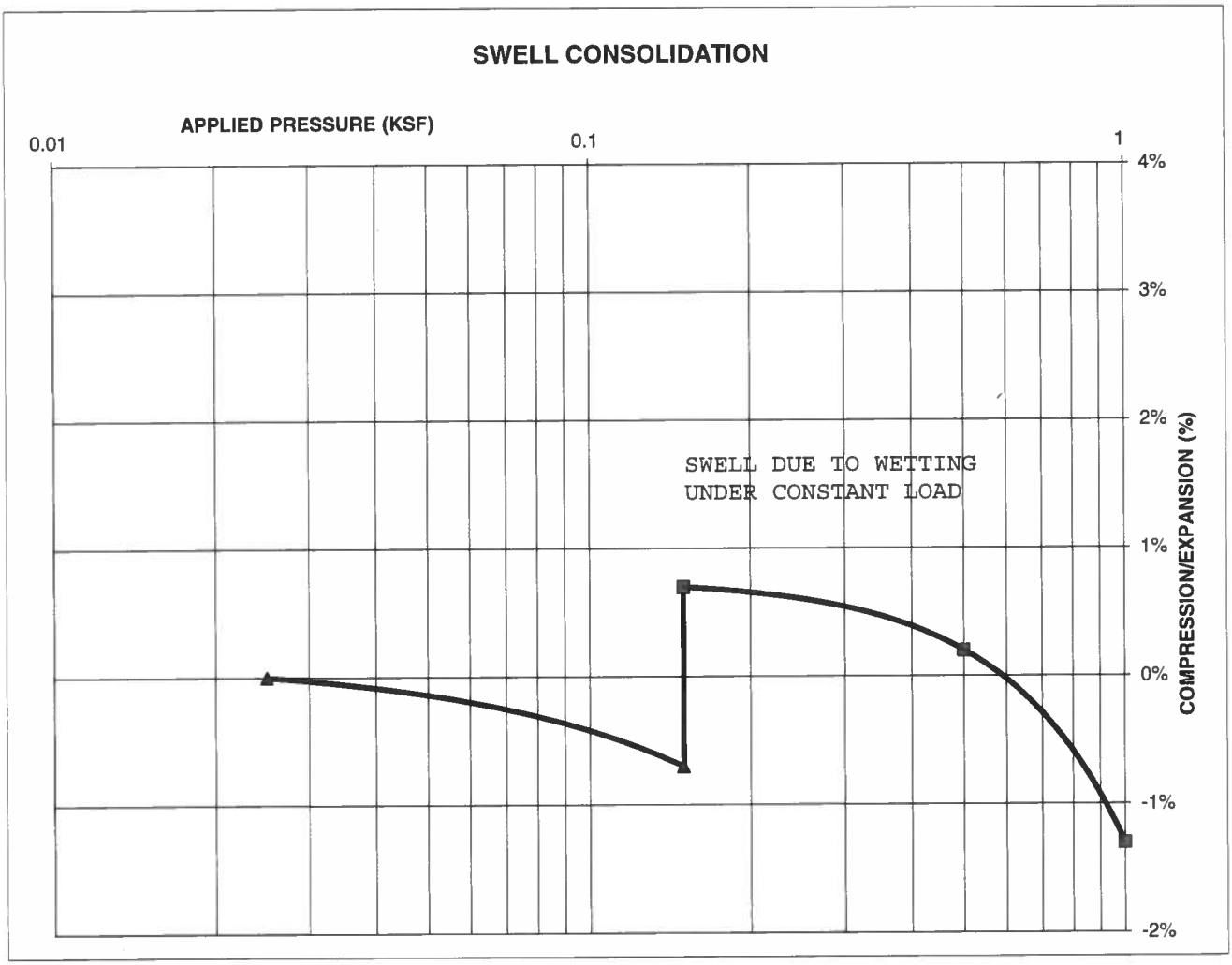
DRAWN:	DATE:	CHECKED:	DATE:
		DS	6/4/22

JOB NO.: 220394
FIG NO.: B-6

CONSOLIDATION TEST RESULTS

TEST BORING #	2	DEPTH(ft)	5
DESCRIPTION	CL	SOIL TYPE	3
NATURAL UNIT DRY WEIGHT (PCF)			109
NATURAL MOISTURE CONTENT			17.6%
SWELL/CONSOLIDATION (%)			1.4%

JOB NO. 220394
CLIENT SR LAND
PROJECT STERLING RANCH, F-2



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SWELL CONSOLIDATION
TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
		DS	4/14/22

JOB NO.: 220394
FIG NO.: B-7

CLIENT	SR LAND	JOB NO.	220394
PROJECT	STERLING RANCH, F-2	DATE	3/14/2022
LOCATION	STERLING RANCH, F-2	TEST BY	BL

BORING NUMBER	DEPTH, (ft)	SOIL TYPE NUMBER	UNIFIED CLASSIFICATION	WATER SOLUBLE SULFATE, (wt%)
TB-1	1-2	1A	SM	0.01
TB-3	1-2	1	SM	<0.01

QC BLANK PASS

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505 ELKTON DRIVE
COLORADO SPRINGS, COLORADO 80907

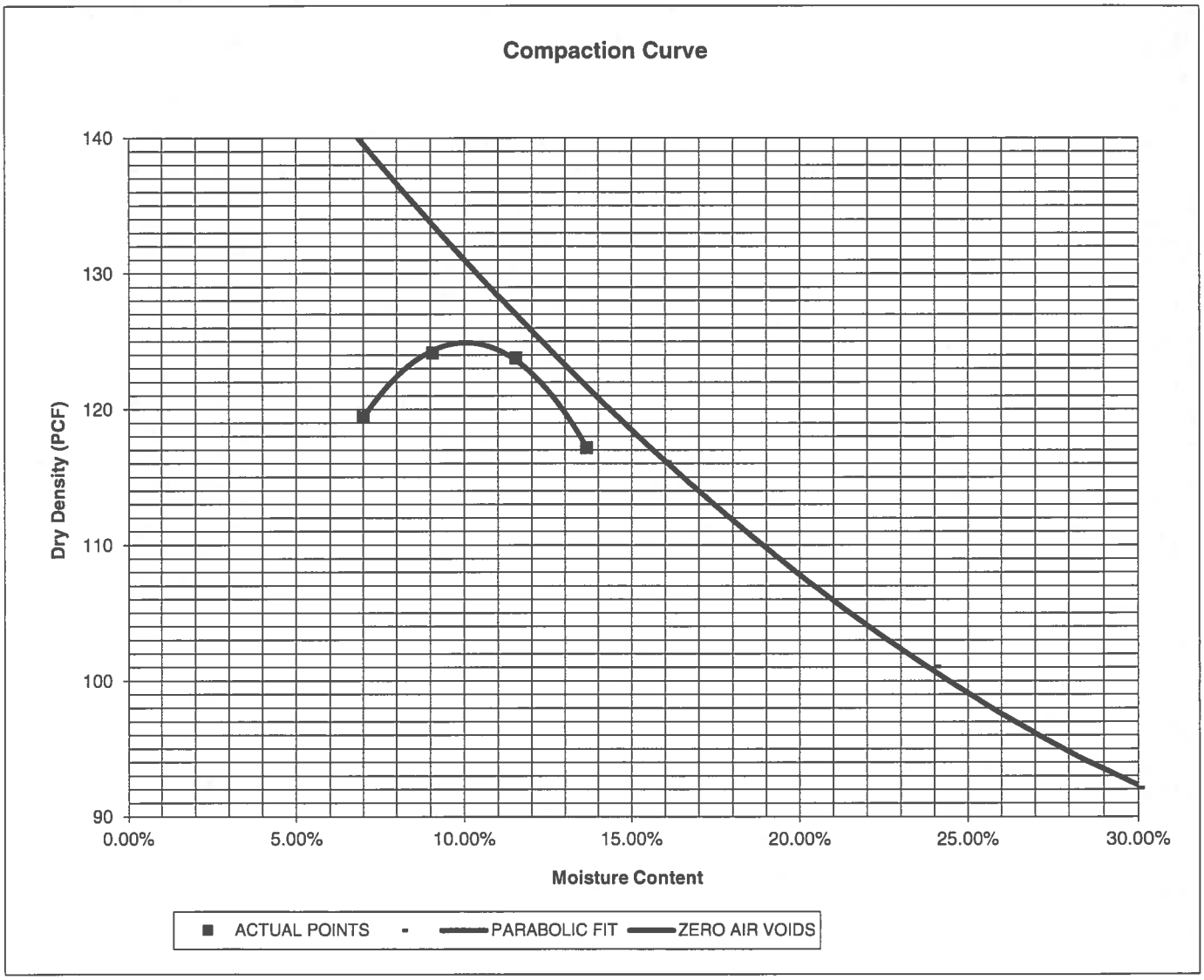
LABORATORY TEST
SULFATE RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
		DS	4/22/22

JOB NO.: 220394
FIG NO.: B-8

PROJECT	STERLING RANCH, F-2	CLIENT	SR LAND
SAMPLE LOCATION	TB-1 @ 0-3'	JOB NO.	220394
SOIL DESCRIPTION	SAND, SILTY, BROWN	DATE	08/27/16

IDENTIFICATION	SM	COMPACTION TEST #	1
TEST DESIGNATION / METHOD	ASTM D-1557-A	TEST BY	DC
MAXIMUM DRY DENSITY (PCF)	125	OPTIMUM MOISTURE	10.1%



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MOISTURE DENSITY RELATION

DRAWN:	DATE:	CHECKED:	DATE:
		DS	4/4/22

JOB NO.: 220394
FIG NO.: B-9

CBR TEST LOAD DATA

JOB NO: 220394
CLIENT: SR LAND
PROJECT: STERLING RANCH, F-2
SOIL TYPE: 1, CBR #1

PISTON DIAMETER (cm)	PISTON AREA (in^2)
4.958	2.993

PENETRATION DEPTH (INCHES)	*10 BLOWS* MOLD # 1 LOAD(LBS) (LBS)	STRESS (PSI)	*25 BLOWS* MOLD # 2 LOAD(LBS) (LBS)	STRESS (PSI)	*56 BLOWS* MOLD # 3 LOAD(LBS) (LBS)	STRESS (PSI)
0.000	0	0.00	0	0.00	0	0.00
0.025	86	28.74	108	36.09	211	70.51
0.050	120	40.10	316	105.60	336	112.28
0.075	165	55.14	452	151.04	500	167.08
0.100	226	75.52	480	160.40	645	215.54
0.125	291	97.24	678	226.57	827	276.36
0.150	371	123.98	823	275.02	1110	370.93
0.175	425	142.02	939	313.78	1420	474.52
0.200	691	230.91	1070	357.56	1663	555.72
0.300	1319	440.77	1450	484.54	2657	887.88
0.400	1806	603.51	2012	672.35	3506	1171.59
0.500	2093	699.41	2911	972.76	4311	1440.60

FINAL MOISTURE CONTENT

	MOLD #	1	MOLD #	2	MOLD #	3
CAN #		346		351		98
WT. CAN		6.89		6.84		6.98
WT. CAN+WET		116.98		121.64		82.66
WT. CAN+DRY		103.63		110.19		75.27
WT. H20		13.35		11.45		7.39
WT. DRY SOIL		96.74		103.35		68.29
MOISTURE CONTENT		13.80%		11.08%		10.82%

WET DENSITY (PCF)	127.8	133.3	136.7
DRY DENSITY (PCF)	116.1	121.1	124.1

BEARING RATIO		7.55	16.04	21.55
90% OF DRY DENSITY	112.5			
95% OF DRY DENSITY	118.8			

BEARING RATIO AT 90% OF MAX	1.49	~ R VALUE	1
BEARING RATIO AT 95% OF MAX	12.06	~ R VALUE	37

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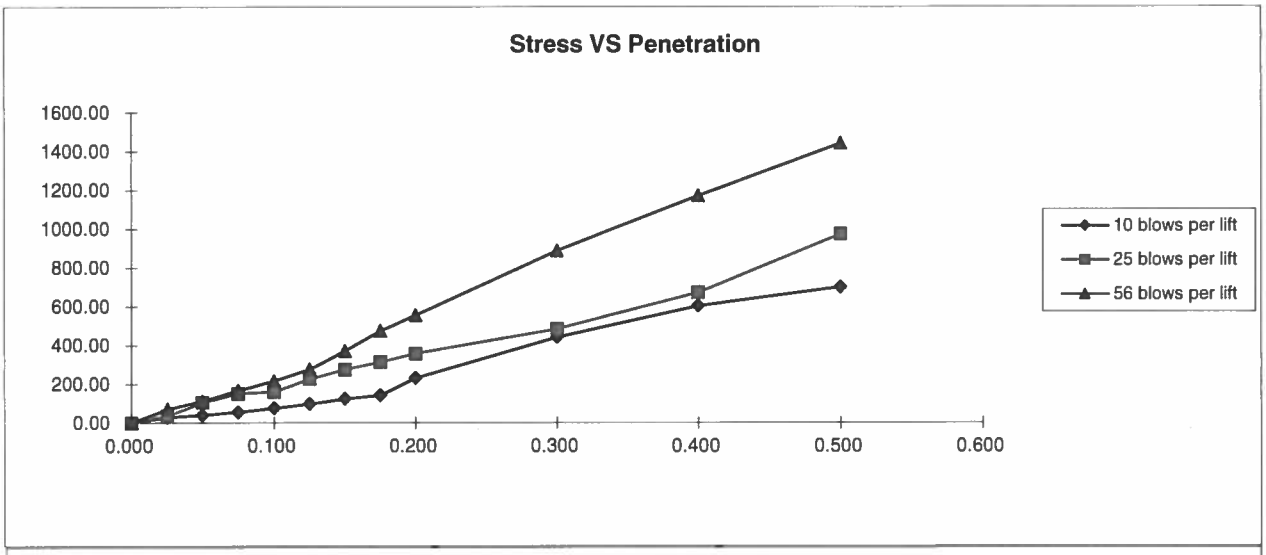
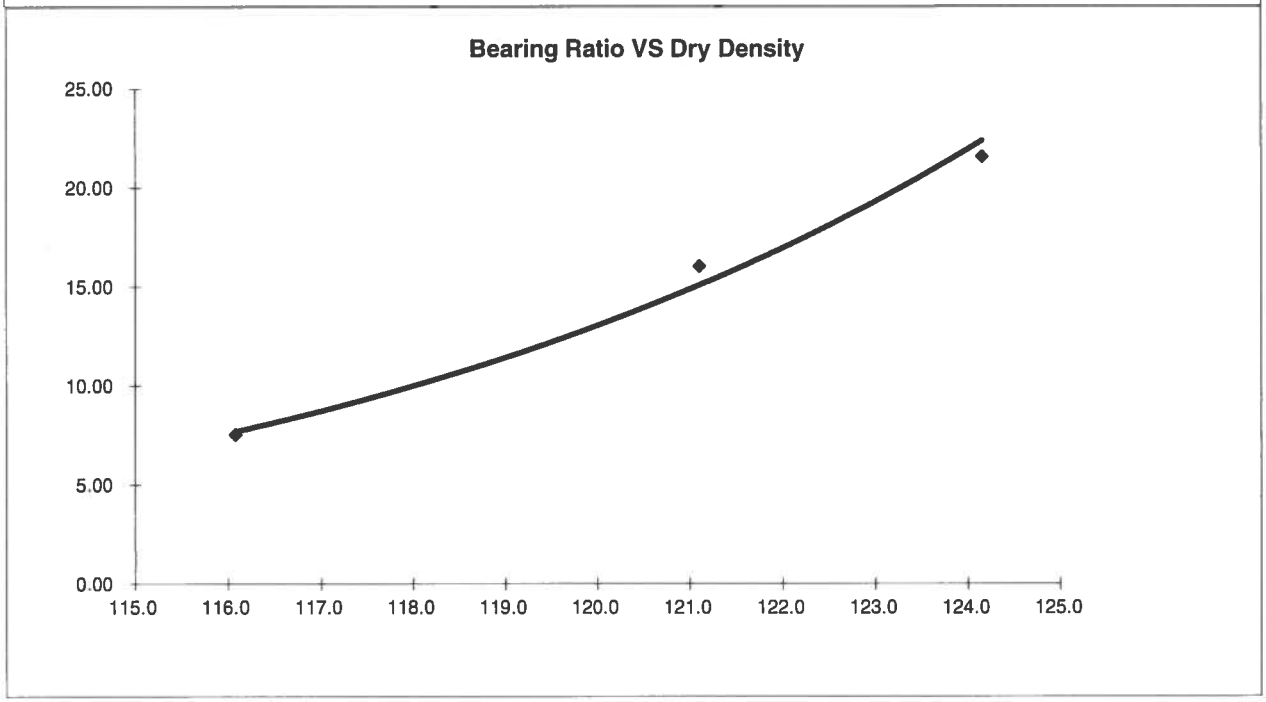
505 ELKTON DRIVE
COLORADO SPRINGS, COLORADO 80907

CBR TEST DATA

DRAWN:	DATE:	CHECKED:	DATE:
		DS	4/4/22

JOB NO.: 220394
FIG NO.: B-10





BEARING RATIO AT 90% OF MAX	1.49	~ R VALUE	1.00
BEARING RATIO AT 95% OF MAX	12.06	~ R VALUE	37.00

JOB NO: 220394
SOIL TYPE: 1, CBR #1

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CALIFORNIA BEARING RATIO

DRAWN:	DATE:	CHECKED:	DATE:
		DS	4/4/22

JOB NO.: 220394
FIG NO.: B-11

APPENDIX C: Pavement Design Calculations

FLEXIBLE PAVEMENT DESIGN

DESIGN DATA

SR LAND, LLC - MARKSHEFFEL ROAD - SOIL TYPES 1 AND 1A
MAJOR ARTERIAL

Equivalent (18 kip) Single Axle Load Applications (ESAL):	ESAL (W_{18}) =	4,500,000
Hveem Stabilometer (R Value) Results:	R =	35
Standard Deviation	S_o =	0.45
Loss in Serviceability	Δpsi =	2.0
Reliability	Reliability =	95
Reliability (z-statistic)	Z_R =	-1.65
Soil Resilient Modulus	M_R =	8065

Weighted Structural Number (WSN): → WSN = 4.36

DESIGN TABLES AND EQUATIONS

$S_1 = [(R - 5) / 11.29] + 3$

$M_R = 10^{[(S_1 + 18.72) / 6.24]}$

$k = M_R / 19.4$

Where:

M_R = resilient modulus (psi)

S_1 = the soil support value

R = R-value obtained from the Hveem stabilometer

CBR = California Bearing Ratio

Reliability (%)	Z_R (z-statistic)
80	-0.84
85	-1.04
90	-1.28
93	-1.48
94	-1.56
95	-1.65
96	-1.75
97	-1.88
98	-2.05
99	-2.33
99.9	-3.09
99.99	-3.75

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

Left	Right	Difference
6.65	6.65	0.0

Job No. 220394
Fig. No. C-1

DESIGN CALCULATIONS

AGGREGATE BASE COURSE

DESIGN DATA

SR LAND, LLC - MARKSHEFFEL ROAD - SOIL TYPES 1 AND 1A
MAJOR ARTERIAL

Equivalent (18 kip) Single Axle Load Applications (ESAL):	ESAL = 4,500,000
Hveem Stabilometer (R Value) Results:	R = 35
Weighted Structural Number (WSN):	WSN = 4.36

DESIGN EQUATION

$$WSN = C_1D_1 + C_2D_2$$

C_1 = 0.44 Strength Coefficient - Hot Bituminous Asphalt
C_2 = 0.12 Strength Coefficient - Aggregate Base Course

D_1 = Depth of Asphalt (inches)
D_2 = Depth of Base Course (inches)

FOR FULL DEPTH ASPHALT SECTION

$D_1 = (WSN)/C_1$ = 9.9 inches of Full Depth Asphalt
Use 10.0 inches Full Depth

FOR ASPHALT + AGGREGATE BASE COURSE SECTION

Asphalt Thickness (t) = [6] inches
$D_2 = ((WSN) - (t)(C_1))/C_2$ = 14.4 inches of Aggregate
Base Course, use 15.0 inches

RECOMMENDED ALTERNATIVES

1. 6.0 inches of Asphalt + 15.0 inches of Aggregate Base Course, or
2. 10.0 inches of Asphalt

Job No. 220394
Fig. No. C-2

DESIGN CALCULATIONS

ASPHALT MILLINGS

DESIGN DATA

SR LAND, LLC - MARKSHEFFEL ROAD - SOIL TYPES 1 AND 1A
MAJOR ARTERIAL

Equivalent (18 kip) Single Axle Load Applications (ESAL):	ESAL = 4,500,000
Hveem Stabilometer (R Value) Results:	R = 35
Weighted Structural Number (WSN):	WSN = 4.36

DESIGN EQUATION

$$WSN = C_1D_1 + C_2D_2$$

C_1 = 0.44 Strength Coefficient - Hot Bituminous Asphalt
C_2 = 0.07 Strength Coefficient - Asphalt Millings

D_1 = Depth of Asphalt (inches)
D_2 = Depth of Asphalt Millings (inches)

FOR FULL DEPTH ASPHALT SECTION

$D_1 = (WSN)/C_1$ = 9.9 inches of Full Depth Asphalt
Use 10.0 inches Full Depth

FOR ASPHALT + AGGREGATE BASE COURSE SECTION

Asphalt Thickness (t) = 7.5 inches
$D_2 = ((WSN) - (t)(C_1))/C_2$ = 15.1 inches of Asphalt Millings
Asphalt Millings, use 16.0 inches

RECOMMENDED ALTERNATIVES

1. 7.5 inches of Asphalt + 16.0 inches of Asphalt Millings, or
2. 10.0 inches of Asphalt

Job No. 220394
Fig. No. C-3

DESIGN CALCULATIONS

RECYCLED CONCRETE

DESIGN DATA

SR LAND, LLC - MARKSHEFFEL ROAD - SOIL TYPES 1 AND 1A
MAJOR ARTERIAL

Equivalent (18 kip) Single Axle Load Applications (ESAL):	ESAL = 4,500,000
Hveem Stabilometer (R Value) Results:	R = 35
Weighted Structural Number (WSN):	WSN = 4.36

DESIGN EQUATION

$$WSN = C_1D_1 + C_2D_2$$

C_1 = 0.44 Strength Coefficient - Hot Bituminous Asphalt
C_2 = 0.12 Strength Coefficient - Recycled Concrete

D_1 = Depth of Asphalt (inches)
D_2 = Depth of Recycled Concrete (inches)

FOR FULL DEPTH ASPHALT SECTION

$D_1 = (WSN)/C_1$ = 9.9 inches of Full Depth Asphalt
Use 10.0 inches Full Depth

FOR ASPHALT + AGGREGATE BASE COURSE SECTION

Asphalt Thickness (t) = [6] inches
$D_2 = ((WSN) - (t)(C_1))/C_2$ = 14.3 inches of Recycled Concrete
Recycled Concrete, use 15.0 inches

RECOMMENDED ALTERNATIVES

1. 6.0 inches of Asphalt + 15.0 inches of Recycled Concrete, or
2. 10.0 inches of Asphalt

Job No. 220394
Fig. No. C-4