ENTECH
ENGINEERING, INC.

505 ELKTON DRIVE
COLORADO SPRINGS, CO 80907
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August 18, 2022
Revised August 19, 2022
Revised August 24, 2022

Classic Communities
2138 Flying Horse Club Drive
Colorado Springs, Colorado 80921

Attn: Adam Doyle

Re: Pavement Recommendations - Revised
Aspen Valley Road and Falcon Nest Court
Retreat at TimberRidge, Filing No. 2
El Paso County, Colorado
Entech Job No. 221486

Dear Mr. Doyle:

As requested, Entech Engineering, Inc. obtained samples of the pavement subgrade soils from the proposed roadways at the above referenced site. Laboratory testing was performed in order to determine the pavement support characteristics of the soil. This letter presents the results of the laboratory testing and pavement recommendations for the roadways.

Project Description

The project will consist of paving of the proposed Falcon Nest Court and a portion of Aspen Valley Road in the Retreat at TimberRidge, Filing No. 2 subdivision in El Paso County, Colorado. A Subsurface Soil Investigation and laboratory testing were performed to determine the pavement support characteristics on the soils. The general layout of the site is presented in the Test Boring Location Map in Figure 1.

Subgrade Conditions

A total of five test borings were drilled along the roadways to depths of approximately 5 and 10 feet below the existing subgrade surface at the required sample frequency. The boring locations are shown from Figure No. 1.

The soils at the roadway subgrade depth consisted of clayey sand fill (Soil Type 1), silty to clean sand (Soil Type 2), very sandy clay (Soil Type 3), and slightly silty to silty sandstone. The Test Boring Logs are presented in Appendix A. Soil Type 3 was encountered beneath the subgrade influence zone at a depth of 4 feet and is not expected to affect the asphalt performance. Due to the similarities of the Type 1, Type 2, and Type 4 samples of the pavement sections were determined using the Type 1 soil data. Sieve Analyses and Atterberg Limit testing were performed on subgrade soil samples obtained from the test borings for the purpose of classification. The percent passing the No. 200 sieve ranged from approximately 4 to 23 percent.

The Type 1, Type 2, and Type 4 soils classified as A-2-6 and A-1-b soils and A-2-4 soils which commonly exhibits good pavement support characteristics. Groundwater was not encountered in the test borings. Sulfate testing resulted in 0.00 to less than 0.01 percent soluble sulfate by weight, indicating a negligible potential for below grade concrete degradation due to sulfate attack.

The Type 1, 2, and 4 soils are anticipated to have low swell potentials. A Swell/Consolidation Test on a sample the Type 3 soils resulted in volume change of 1.1 percent. Mitigation for expansive soils is not required on this site.

California Bearing Ratio (CBR) testing was performed on a representative subgrade sample of the Type 1 materials to determine the support characteristics of the subgrade soils for the roadway sections. The results of the CBR testing, are presented in Appendix B and summarized as follows:

Soil Type 1 – Silty Sand
CBR 1
R @ 95% = 65.0
R @ 90% = 30.0
Use R = 50.0 for design

Classification Testing	
Liquid Limit	33
Plasticity Index	20
Percent Passing 200	18.8
AASHTO Classification	A-2-6
Group Index	0
Unified Soils Classification	SC

Pavement Design

CBR testing was used to determine pavement sections for the roadways. Pavement sections were determined utilizing El Paso County Engineering Criteria Manual. Both Aspen Valley Road and Falcon Nest Court classify as Rural Local Roads, which use an 18K ESAL value of 36,500 for design purposes. Pavement sections were determined for asphalt on basecourse or asphalt on cement stabilized subgrade.

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

Reliability	75%
Δpsi	2.0
"R" Value Subgrade (Soil Type 1)	50.0
Resilient Modulus (Soil Type 1)	13,168 psi
Structural Coefficients	
Hot Bituminous Pavement	0.44
Aggregate Basecourse	0.11
Cement Stabilized Subgrade	0.11

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

Pavement Sections – Rural Local
ESAL = 36,500
Soil Type 1

Alternative	Asphalt (in)	Basecourse (in)	Cement Stabilized Subgrade (in)
1. Asphalt Over Basecourse	3.0*	6.0	-
2. Asphalt Over Cement Stabilized Subgrade	3.0*	-	8.0

* Minimum sections required per El Paso County Criteria.
The calculations have full-depth sections provided. Full depth sections are currently not allowed by El Paso County.

Roadway Construction - Asphalt on Aggregate Basecourse Alternatives

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

Roadway Construction – Cement Stabilized Subgrade

Prior to placement of the asphalt, the subgrade may be stabilized by addition of cement to a depth of at least 8 inches. The amount of cement applied shall be 2.0 percent (by weight) of the subgrade's maximum dry density as determined by the Modified Proctor Test (ASTM D-1557) and based on laboratory cement stabilization testing. The cement should be spread evenly on the subgrade surface and be thoroughly mixed into the subgrade over an 8-inch depth such that a uniform blend of soil and cement is achieved. Prior to application or mixing of the cement, the upper 8 inches of subgrade should be thoroughly moisture conditioned to the soil's optimum water content or as much as 2 percent more than the optimum water content as necessary to provide a compactable soil condition. Densification of the cement-stabilized subgrade should be completed to obtain a compaction of at least 95 percent of the subgrade maximum dry density as determined by the Modified Proctor Test (ASTM D-1557). Satisfactory compaction of the subgrade shall occur within 90 minutes from the time of mixing the cement into the subgrade.

The following conditions shall be observed as part of the subgrade stabilization:

- Type I/II cement as supplied; a local supplier shall be used. All cement used for stabilization should come from the same source. If cement sources are changed a new laboratory mix design should be completed.

- Moisture conditioning of the subgrade and/or mixing of the cement into the subgrade shall not occur when soil temperatures are below 40° F. Cement treated subgrades should be maintained at a temperature of 40° F or greater until the subgrade has been compacted as required.

- Cement placement, cement mixing and compaction of the cement treated subgrade should be observed by a Soils Engineer. The Soils Engineer should complete in situ compaction tests and construct representative compacted specimens of the treated subgrade material for subsequent laboratory quality assurance testing.

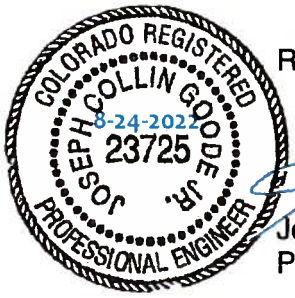
If significant grading is performed, the soils at subgrade may change. Modification to the pavement sections should be evaluated after site grading is completed.

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

We trust that this has provided you with the information you required. The pavement sections provided are based on general site soil types. If you have any questions or need additional information, please do not hesitate to contact us.

Respectfully Submitted,

ENTECH ENGINEERING, INC.



Reviewed by:

Daniel P. Stegman

Joseph C. Goode, Jr., P.E.
President

DPS/jr

Encl.
AAprojects/2022/221486 pr-Rev2

TABLE

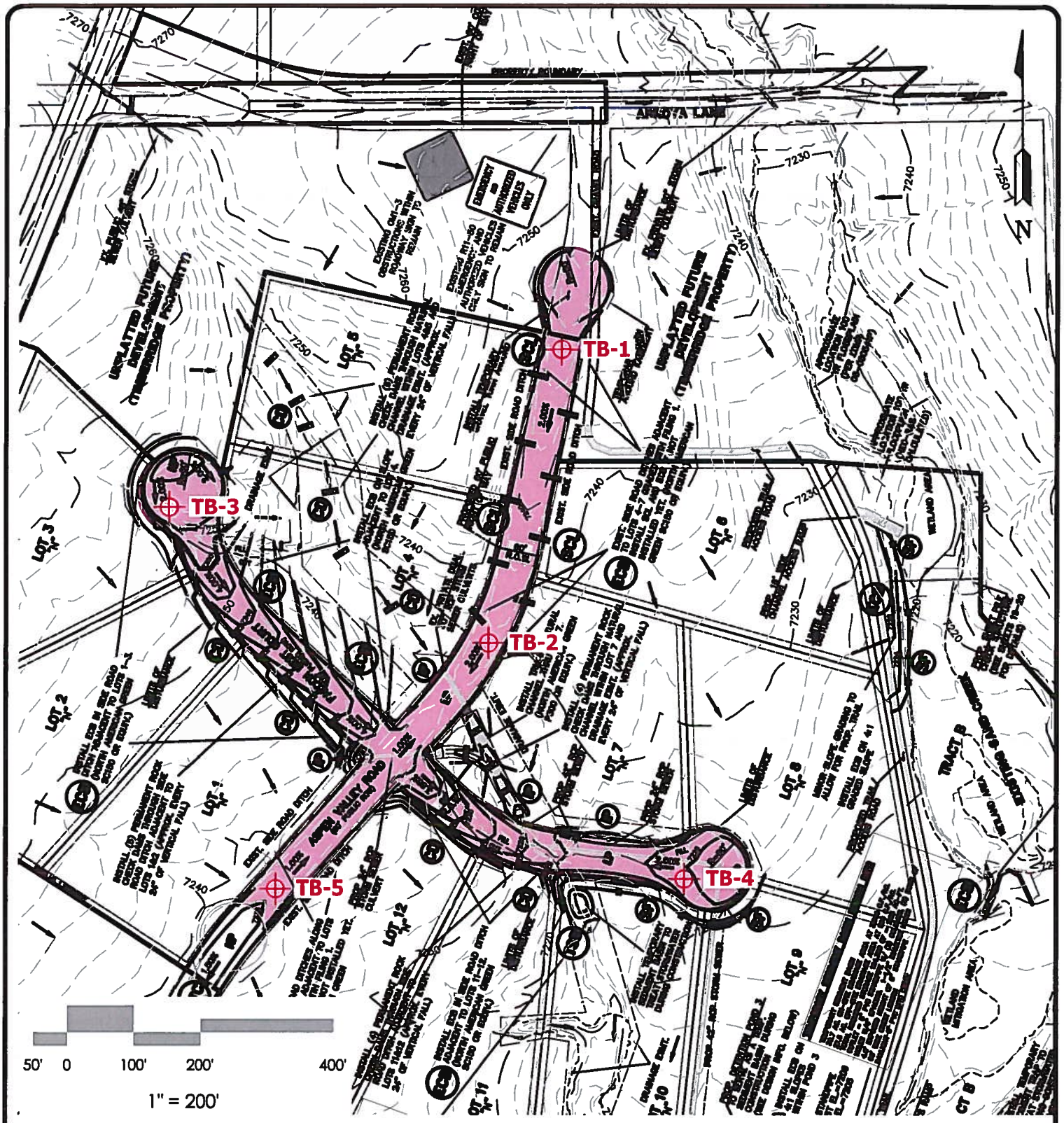
TABLE 1

SUMMARY OF LABORATORY TEST RESULTS

CLIENT CLASSIC COMMUNITIES
PROJECT TIMBERRIDGE, FILING 2
JOB NO. 221486

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
1, CBR	4	0-3			18.8	33	20		A-2-6		SC	FILL, SAND, CLAYEY
1	4	1-2			22.6	37	20	<0.01	A-2-6		SC	FILL, SAND, CLAYEY
2	1	1-2			10.2	NV	NP		A-1-b		SM-SW	SAND, SLIGHTLY SILTY
2	2	1-2			3.9	NV	NP	0.00	A-1-b		SW	SAND
2	5	1-2			21.6	NV	NP		A-1-b		SM	SAND, SILTY
3	1	5	21.2	106.9	51.3	49	25	0.00	A-7-6	1.1	CL	CLAY, VERY SANDY
4	3	1-2			10.6	NV	NP		A-1-b		SM-SW	SANDSTONE, SLIGHTLY SILTY
4	4	10			12.3	NV	NP	<0.01	A-2-4		SM	SANDSTONE, SILTY
4	5	5			12.3	NV	NP		A-1-b		SM	SANDSTONE, SILTY

FIGURES



-SEE REPORT FOR COMPOSITE SECTIONS

SOIL TYPE:

ESAL = 36,500 (RURAL LOCAL)
3" ASPHALT OVER 8" OF CTS

TB- APPROXIMATE TEST BORING LOCATION AND NUMBER

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TEST BORING LOCATION MAP
RETREAT AT TIMBERRIDGE, F2
EL PASO COUNTY, CO
FOR: CLASSIC COMMUNITIES

DRAWN:	DATE:	CHECKED:	DATE:
JHR	8/11/22	DPS	8/24/22

JOB NO.: 221486

FIG NO.: 1

APPENDIX A: Test Boring Logs

TEST BORING NO. 1
DATE DRILLED 7/26/2022
Job # 221486

REMARKS

DRY TO 5', 7/26/22

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
SAND, SLIGHTLY SILTY, FINE TO COARSE GRAINED, BROWN, MEDIUM DENSE, DRY			24	2.4	2
CLAY, VERY SANDY, GRAY BROWN, FIRM, MOIST	5		10	15.3	3
	10				
	15				
	20				

TEST BORING NO. 2
DATE DRILLED 7/26/2022
CLIENT CLASSIC COMMUNITIES
LOCATION TIMBERRIDGE, FILING 2

REMARKS

DRY TO 5', 7/26/22

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
SAND, FINE TO COARSE GRAINED, TAN, MEDIUM DENSE TO DENSE, MOIST			16	4.8	2
	5		37	5.9	2
	10				
	15				
	20				

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TEST BORING LOG

DRAWN:	DATE:	CHECKED: JHR	DATE: 8-11-22

JOB NO.: 221486
FIG NO.: A- 1

TEST BORING NO. 3
DATE DRILLED 7/26/2022
Job # 221486

REMARKS

DRY TO 5', 7/26/22

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type	
					2	SAND, SILTY, TAN
			50/11"	7.2	4	SANDSTONE, SLIGHTLY SILTY, FINE TO COARSE GRAINED, TAN, VERY DENSE, MOIST
5			50	9.8	4	
10						
15						
20						

TEST BORING NO. 4
DATE DRILLED 7/26/2022
CLIENT CLASSIC COMMUNITIES
LOCATION TIMBERRIDGE, FILING 2

REMARKS

DRY TO 10', 7/26/22

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type	
			20	9.7	1	FILL 0-9', SAND, CLAYEY, FINE TO MEDIUM GRAINED, GRAY BROWN, MEDIUM DENSE, MOIST
5			22	10.3	1	
10			50/11"	7.8	4	SANDSTONE, SILTY, FINE TO COARSE GRAINED, TAN, VERY DENSE, MOIST
15						
20						

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TEST BORING LOG

DRAWN:	DATE:	CHECKED: JHR	DATE: 8-11-22

JOB NO.: 221486
FIG NO.: A- 2

TEST BORING NO. 5
DATE DRILLED 7/26/2022
Job # 221486

TEST BORING NO.
DATE DRILLED
CLIENT CLASSIC COMMUNITIES
LOCATION TIMBERRIDGE, FILING 2

REMARKS

DRY TO 5', 7/26/22

REMARKS

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type	Description
			37	6.3	2	SAND, SILTY, FINE TO COARSE GRAINED, TAN, DENSE, MOIST
5			50/6"	7.0	4	SANDSTONE, SILTY, FINE TO COARSE GRAINED, TAN, VERY DENSE, MOIST
10						
15						
20						

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
5					
10					
15					
20					

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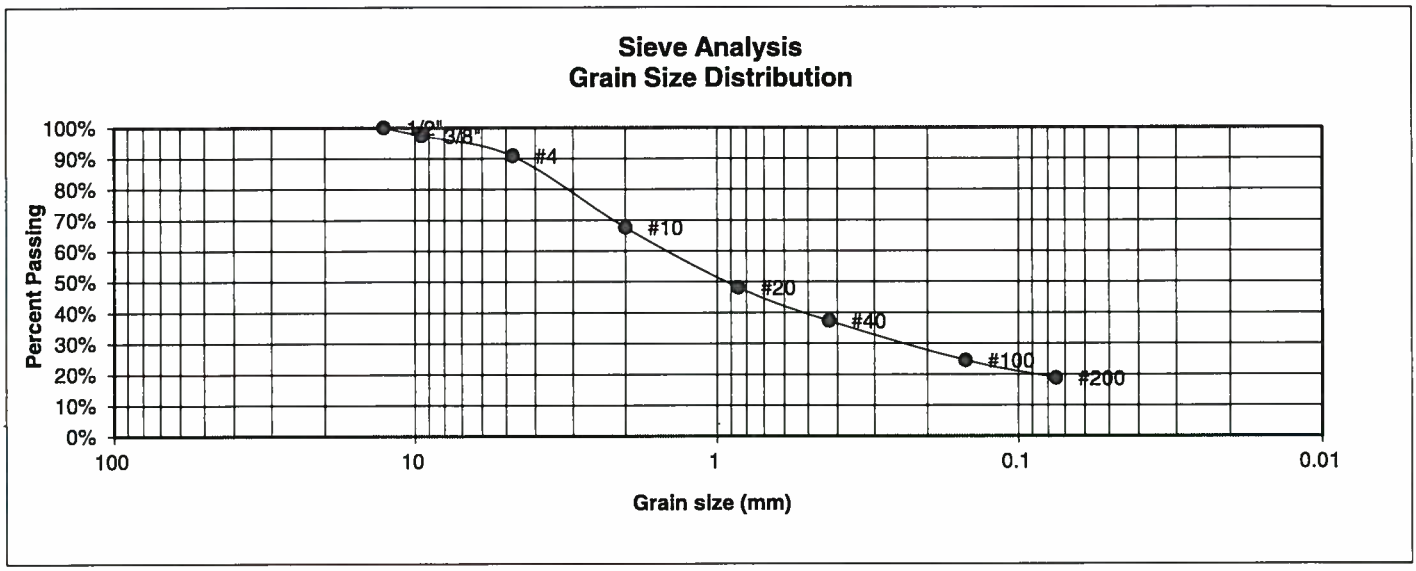
TEST BORING LOG

DRAWN:	DATE:	CHECKED:	DATE:
		JHR	8-11-22

JOB NO.: 221486
FIG NO.: A- 3

APPENDIX B: Laboratory Testing Results

UNIFIED CLASSIFICATION	SC	CLIENT	CLASSIC COMMUNITIES
SOIL TYPE #	1, CBR	PROJECT	TIMBERRIDGE, FILING 2
TEST BORING #	4	JOB NO.	221486
DEPTH (FT)	0-3	TEST BY	BL
AASHTO CLASSIFICATION	A-2-6	GROUP INDEX	0



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	100.0%
3/8"	97.4%
4	90.9%
10	67.6%
20	48.1%
40	37.3%
100	24.5%
200	18.8%

Atterberg Limits

Plastic Limit	13
Liquid Limit	33
Plastic Index	20

Swell

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

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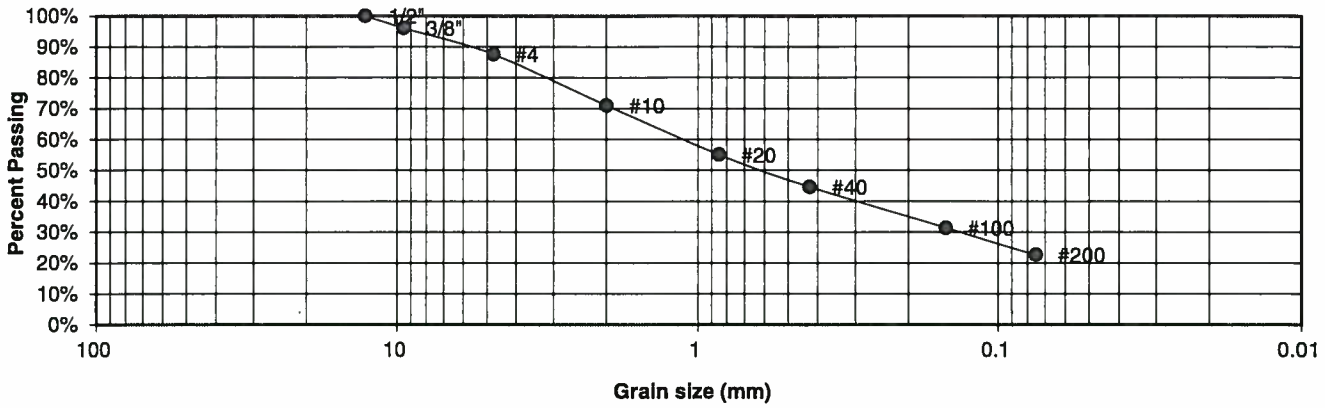
LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
		JHR	8-11-22

JOB NO.: 221486
FIG NO.: B-1

UNIFIED CLASSIFICATION	SC	CLIENT	CLASSIC COMMUNITIES
SOIL TYPE #	1	PROJECT	TIMBERRIDGE, FILING 2
TEST BORING #	4	JOB NO.	221486
DEPTH (FT)	1-2	TEST BY	BL
AASHTO CLASSIFICATION	A-2-6	GROUP INDEX	-2

Sieve Analysis
Grain Size Distribution



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	100.0%
3/8"	96.0%
4	87.6%
10	71.0%
20	55.0%
40	44.6%
100	31.3%
200	22.6%

Atterberg Limits	
Plastic Limit	17
Liquid Limit	37
Plastic Index	20

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

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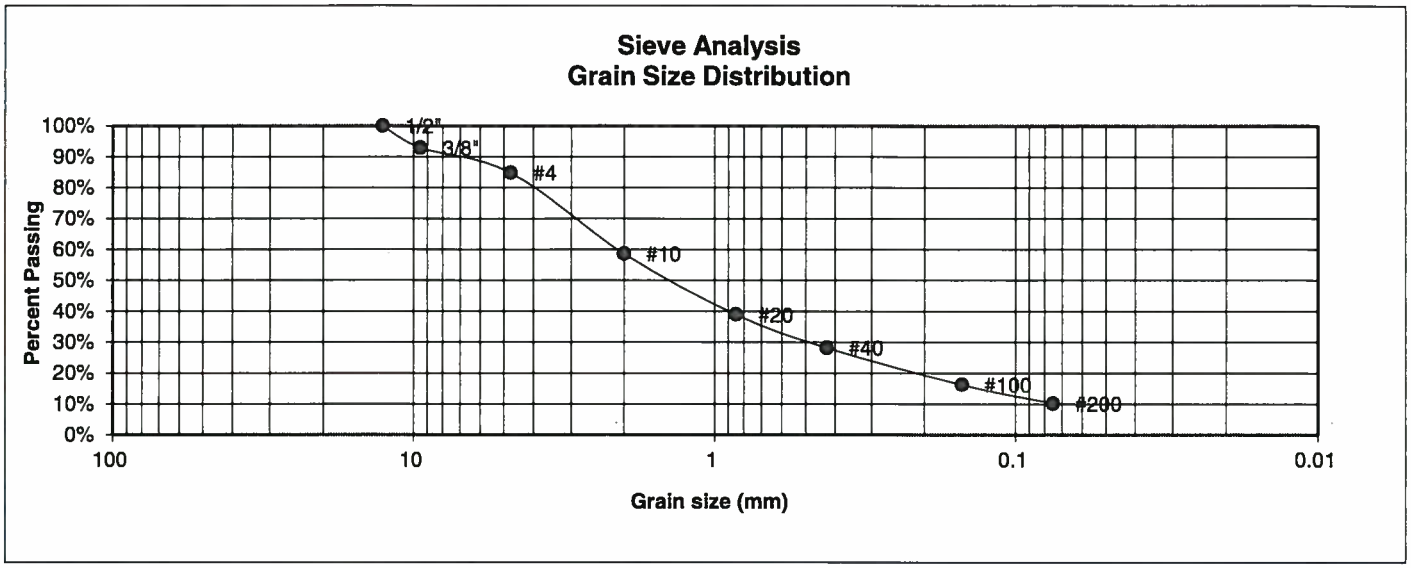
LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
		JHR	8-11-22

JOB NO.: 221486
FIG NO.: B-2

UNIFIED CLASSIFICATION	SM-SW	CLIENT	CLASSIC COMMUNITIES
SOIL TYPE #	2	PROJECT	TIMBERRIDGE, FILING 2
TEST BORING #	1	JOB NO.	221486
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"	92.9%
4	84.9%
10	58.6%
20	38.9%
40	28.2%
100	16.2%
200	10.2%

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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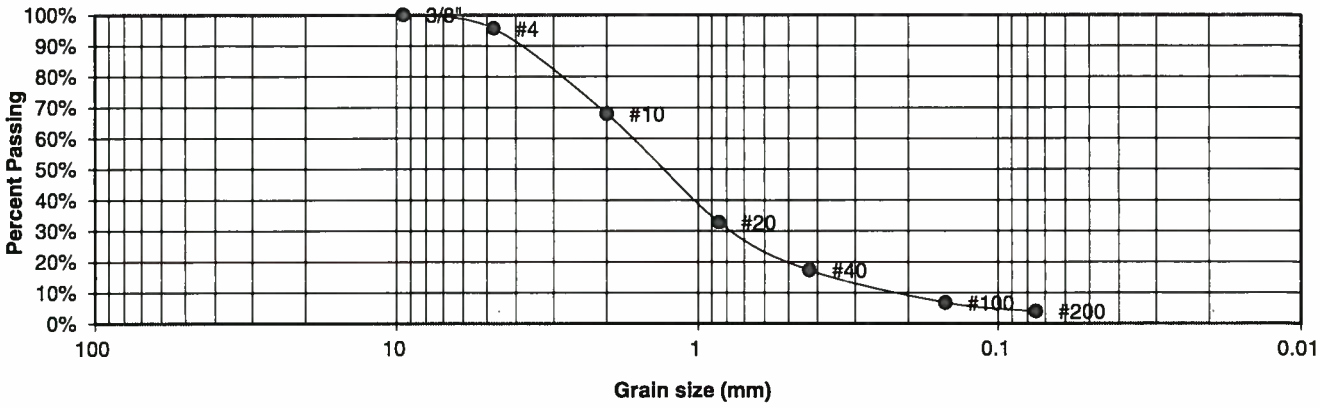
LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
		JHR	8-11-22

JOB NO.: 221486
FIG NO.: B-3

UNIFIED CLASSIFICATION	SW	CLIENT	CLASSIC COMMUNITIES
SOIL TYPE #	2	PROJECT	TIMBERRIDGE, FILING 2
TEST BORING #	2	JOB NO.	221486
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	95.6%
10	68.0%
20	32.8%
40	17.3%
100	6.8%
200	3.9%

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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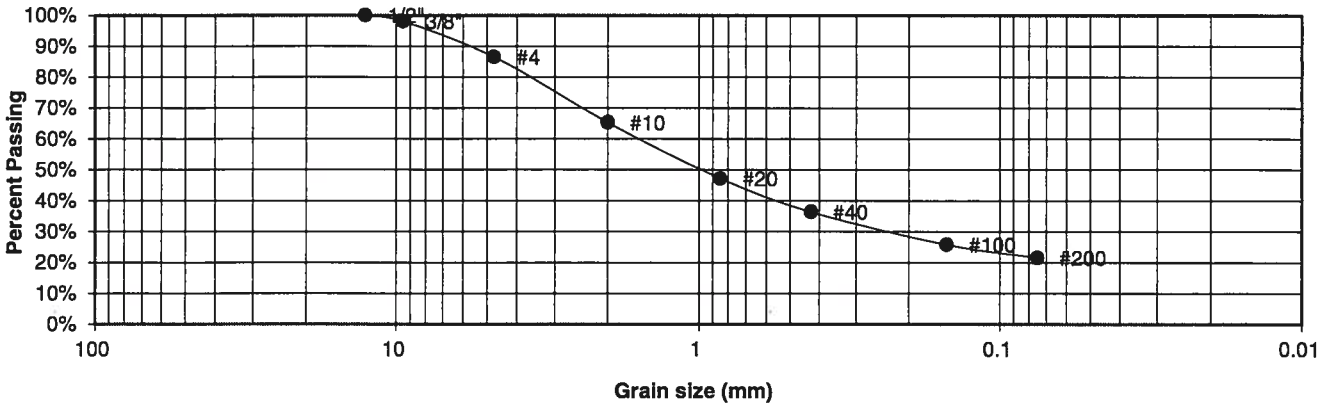
LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
		JHR	8-18-22

JOB NO.: 221486
FIG NO.: B-4

UNIFIED CLASSIFICATION	SM	CLIENT	CLASSIC COMMUNITIES
SOIL TYPE #	2	PROJECT	TIMBERRIDGE, FILING 2
TEST BORING #	5	JOB NO.	221486
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"	100.0%
3/8"	98.0%
4	86.5%
10	65.3%
20	47.2%
40	36.4%
100	25.8%
200	21.6%

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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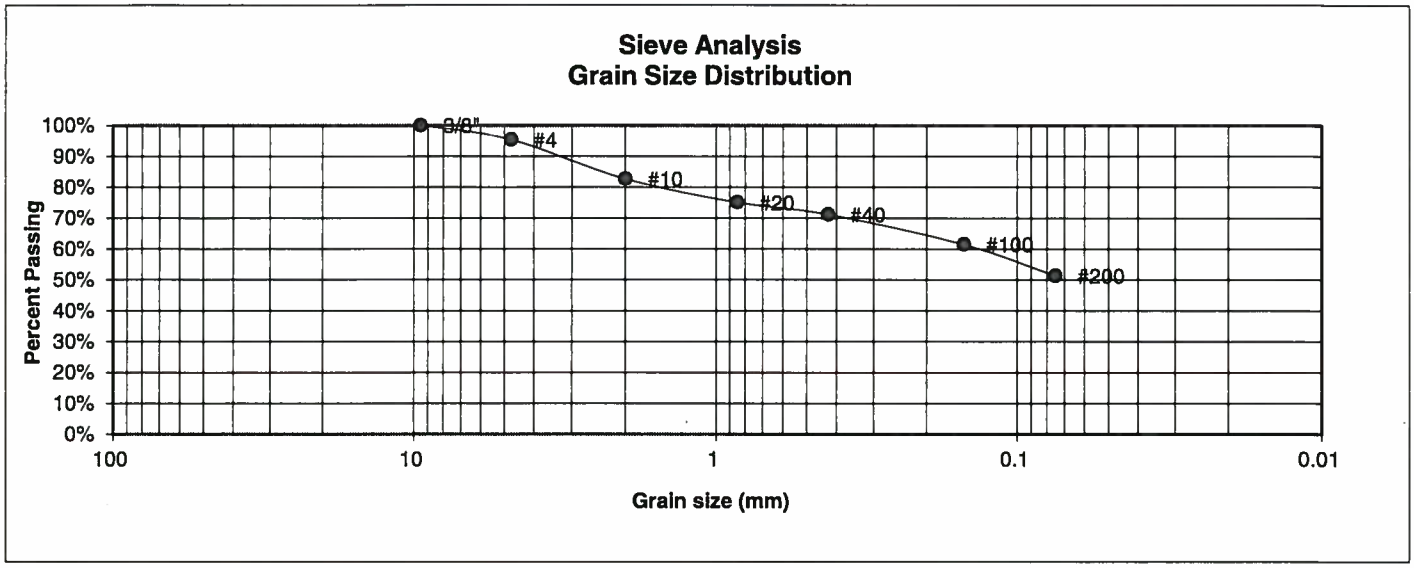
LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
		JHR	8-11-22

JOB NO.: 221486
FIG NO.: B-5

UNIFIED CLASSIFICATION	CL	CLIENT	CLASSIC COMMUNITIES
SOIL TYPE #	3	PROJECT	TIMBERRIDGE, FILING 2
TEST BORING #	1	JOB NO.	221486
DEPTH (FT)	5	TEST BY	BL
AASHTO CLASSIFICATION	A-7-6	GROUP INDEX	9



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	95.4%
10	82.7%
20	75.1%
40	71.2%
100	61.5%
200	51.3%

Atterberg Limits	
Plastic Limit	24
Liquid Limit	49
Plastic Index	25

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

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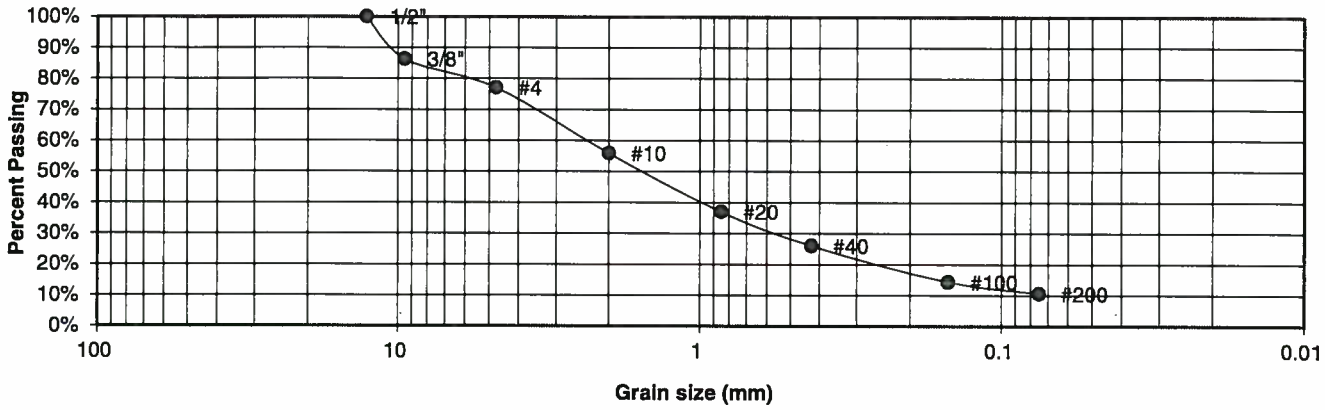
LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
		JHR	8-11-22

JOB NO.: 221486
FIG NO.: B-6

UNIFIED CLASSIFICATION	SM-SW	CLIENT	CLASSIC COMMUNITIES
SOIL TYPE #	4	PROJECT	TIMBERRIDGE, FILING 2
TEST BORING #	3	JOB NO.	221486
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"	100.0%
3/8"	86.3%
4	77.1%
10	55.9%
20	37.0%
40	26.0%
100	14.3%
200	10.6%

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

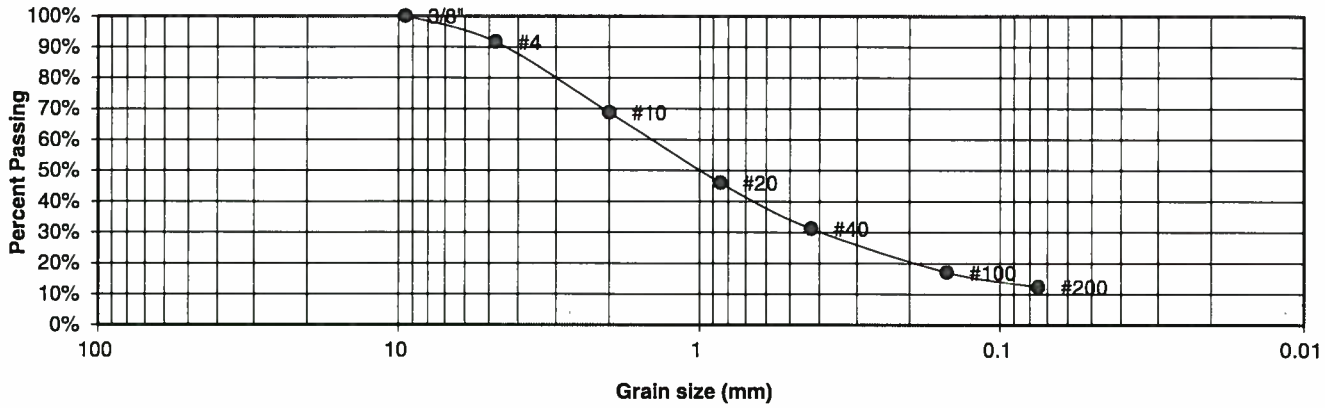
LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
		JLR	8-11-22

JOB NO.: 221486
FIG NO.: 7

UNIFIED CLASSIFICATION	SM	CLIENT	CLASSIC COMMUNITIES
SOIL TYPE #	4	PROJECT	TIMBERRIDGE, FILING 2
TEST BORING #	4	JOB NO.	221486
DEPTH (FT)	10	TEST BY	BL
AASHTO CLASSIFICATION	A-2-4	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	91.7%
10	68.7%
20	46.0%
40	31.2%
100	17.1%
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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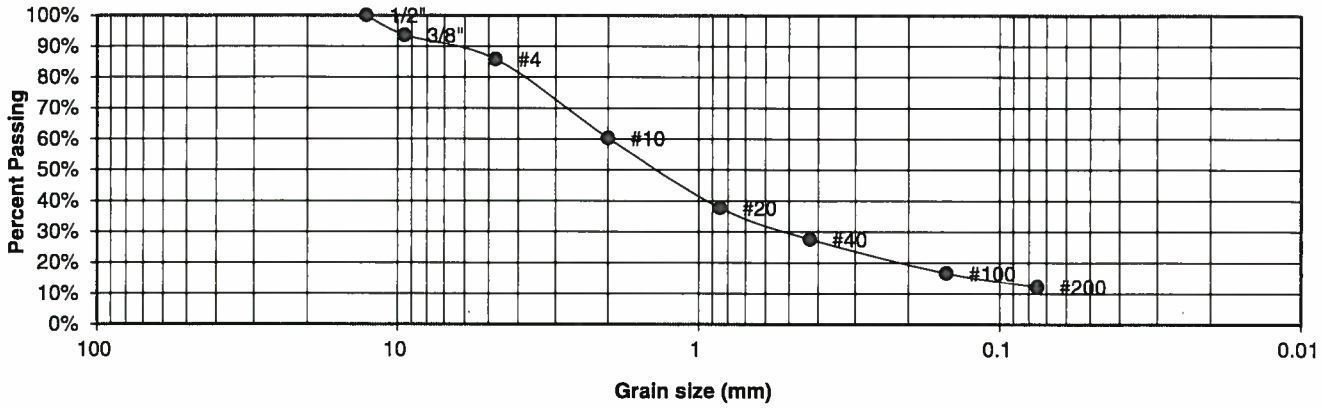
LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
		JHR	8-11-22

JOB NO.: 221486
FIG NO.: B-8

UNIFIED CLASSIFICATION	SM	CLIENT	CLASSIC COMMUNITIES
SOIL TYPE #	4	PROJECT	TIMBERRIDGE, FILING 2
TEST BORING #	5	JOB NO.	221486
DEPTH (FT)	5	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"	100.0%
3/8"	93.6%
4	85.8%
10	60.3%
20	37.8%
40	27.6%
100	16.6%
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

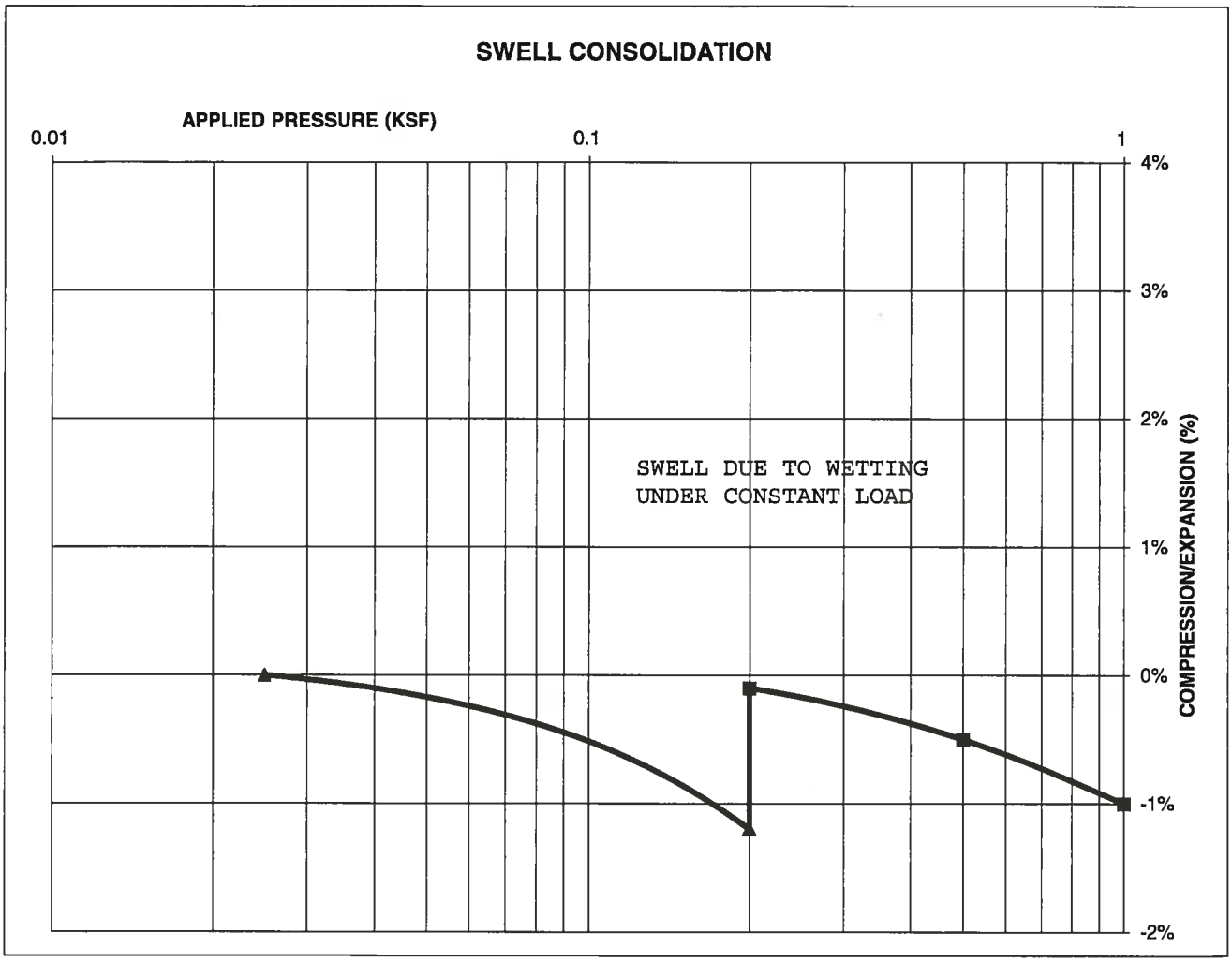
DRAWN:	DATE:	CHECKED:	DATE:
		JHR	8-11-22

JOB NO.: 221486
FIG NO.: B-9

CONSOLIDATION TEST RESULTS

TEST BORING #	1	DEPTH(ft)	5
DESCRIPTION	CL	SOIL TYPE	3
NATURAL UNIT DRY WEIGHT (PCF)			107
NATURAL MOISTURE CONTENT			21.2%
SWELL/CONSOLIDATION (%)			1.1%

JOB NO. 221486
CLIENT CLASSIC COMMUNITIES
PROJECT TIMBERRIDGE, FILING 2



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SWELL CONSOLIDATION
TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
		JHR	8-11-22

JOB NO.: 221486
FIG NO.: 8-16

CLIENT	CLASSIC COMMUNITIES	JOB NO.	221486
PROJECT	TIMBERRIDGE, FILING 2	DATE	8/4/2022
LOCATION	TIMBERRIDGE, FILING 2	TEST BY	BL

BORING NUMBER	DEPTH, (ft)	SOIL TYPE NUMBER	UNIFIED CLASSIFICATION	WATER SOLUBLE SULFATE, (wt%)
TB-1	5	2	CL	0.00
TB-2	1-2	1	SW	0.00
TB-4	1-2	1	SC	<0.01
TB-4	10	2	SM	<0.01

QC BLANK PASS

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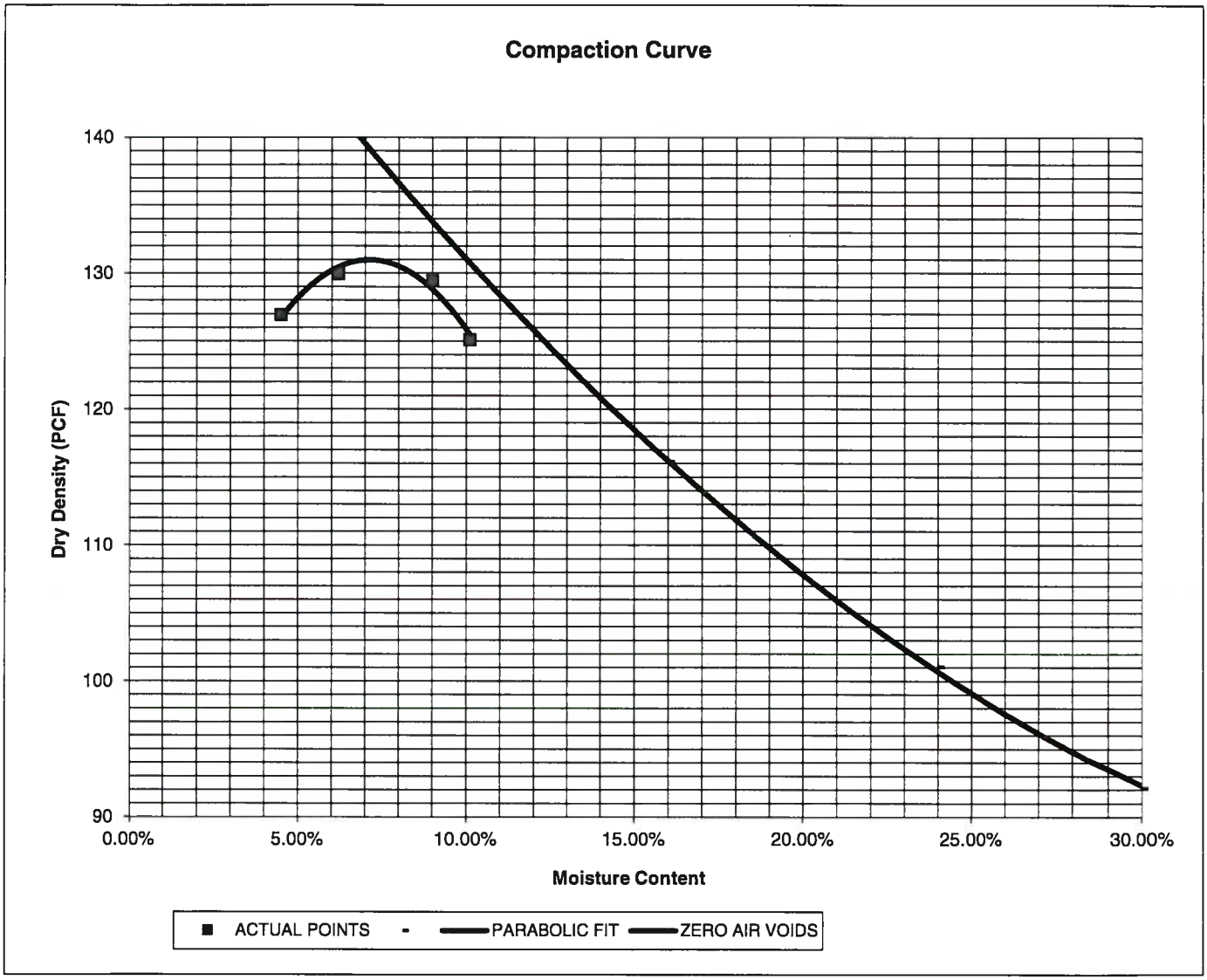
LABORATORY TEST SULFATE RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
		JHR	8-11-22

JOB NO.: 221486
FIG NO.:

PROJECT	TIMBERRIDGE, FILING 2	CLIENT	CLASSIC COMMUNITIES
SAMPLE LOCATION	TB-4 @ 0-3'	JOB NO.	221486
SOIL DESCRIPTION	FILL, SAND, CLAYEY, BROWN	DATE	07/28/22

IDENTIFICATION	SC	COMPACTION TEST #	1
TEST DESIGNATION / METHOD	ASTM D-1557-A	TEST BY	AL
MAXIMUM DRY DENSITY (PCF)	130.9	OPTIMUM MOISTURE	7.1%



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MOISTURE DENSITY RELATION

DRAWN:	DATE:	CHECKED:	DATE:
		JHR	8-11-22

JOB NO.: 221486
FIG NO.: B-12

CBR TEST LOAD DATA

JOB NO: 221486
CLIENT: CLASSIC COMMUNITIES
PROJECT: TIMBERRIDGE, FILING 2
SOIL TYPE: 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	125	41.77	254	84.88	371	123.98
0.050	188	62.82	370	123.64	483	161.40
0.075	203	67.84	405	135.34	503	168.09
0.100	259	86.55	517	172.76	847	283.04
0.125	268	89.56	533	178.11	894	298.75
0.150	291	97.24	580	193.82	1180	394.32
0.175	329	109.94	658	219.88	1326	443.11
0.200	385	128.65	768	256.64	1825	609.86
0.300	468	156.39	935	312.45	2596	867.50
0.400	555	185.46	1108	370.26	3255	1087.72
0.500	632	211.19	1278	427.07	4043	1351.04

FINAL MOISTURE CONTENT

	MOLD # 1	MOLD # 2	MOLD # 3
CAN #	317	342	350
WT. CAN	8.63	8.66	7.78
WT. CAN+WET	202.18	230.33	193.5
WT. CAN+DRY	183.21	205.26	177.19
WT. H20	18.97	25.07	16.31
WT. DRY SOIL	174.58	196.6	169.41
MOISTURE CONTENT	10.87%	12.75%	9.63%

WET DENSITY (PCF)	124.8	132.0	141.0
DRY DENSITY (PCF)	116.5	123.2	131.7

BEARING RATIO	8.65	17.28	28.30

90% OF DRY DENSITY	117.8
95% OF DRY DENSITY	124.4

BEARING RATIO AT 90% OF MAX	10.32	~ R VALUE	30
BEARING RATIO AT 95% OF MAX	18.74	~ R VALUE	65

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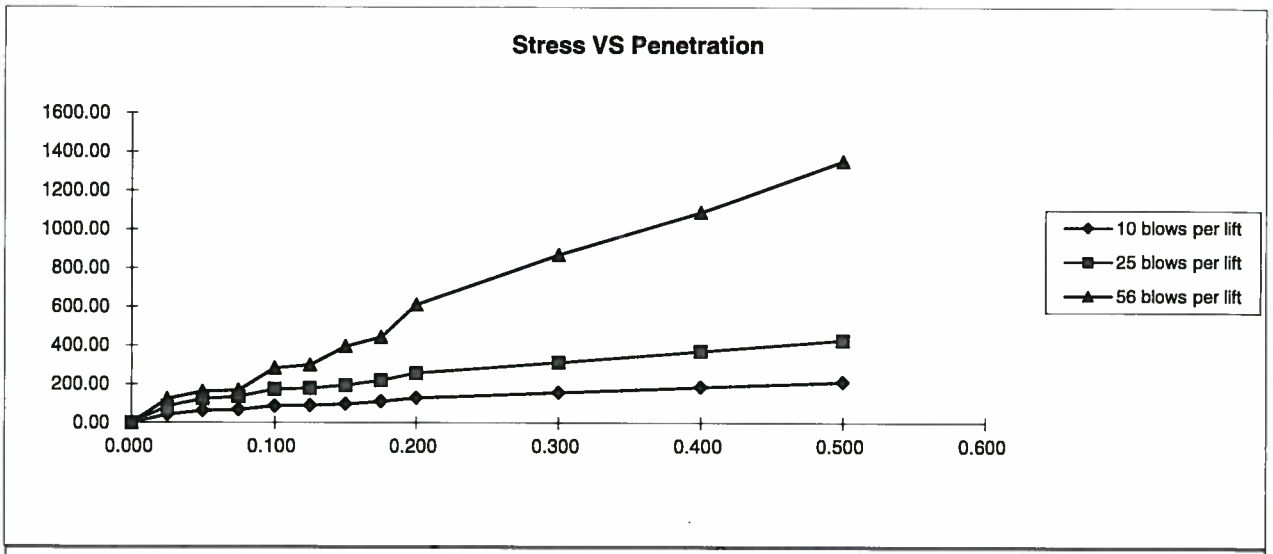
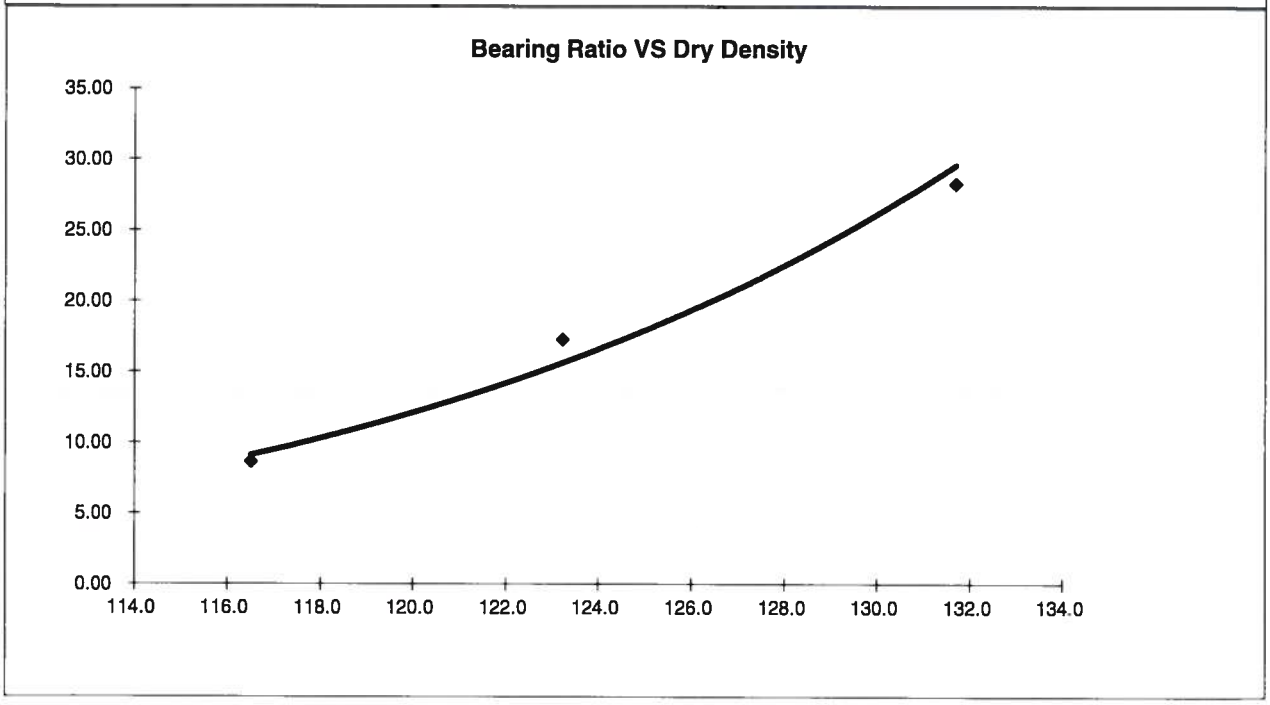
CBR TEST DATA

DRAWN:	DATE:	CHECKED:	DATE:
		SHR	8-11-22

JOB NO.: 221486
FIG NO.: B-13





BEARING RATIO AT 90% OF MAX	10.32	~ R VALUE	30.00
BEARING RATIO AT 95% OF MAX	18.74	~ R VALUE	65.00

JOB NO: 221486
SOIL TYPE: 1

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CALIFORNIA BEARING RATIO

DRAWN:	DATE:	CHECKED:	DATE:
		JHL	8-11-22

JOB NO.: 221486
FIG.NO.: B-14

APPENDIX C: Pavement Design Calculations

FLEXIBLE PAVEMENT DESIGN

DESIGN DATA — Classic Communitites
Retreat at TimberRidge, Filing No. 2 - Rural Local - Soil Type 1

Equivalent (18 kip) Single Axle Load Applications (ESAL):	ESAL (W_{18}) =	36,500
Hveem Stabilometer (R Value) Results:	R =	50
Standard Deviation	S_o =	0.45
Loss in Serviceability	Δpsi =	2.0
Reliability	Reliability =	75
Reliability (z-statistic)	Z_R =	-0.674
Soil Resilient Modulus	M_R =	13168

Weighted Structural Number (WSN): → WSN = 1.42

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)
50	0
60	-0.253
70	-0.524
75	-0.674
80	-0.841
90	-1.282
95	-1.65
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
4.56	4.56	0.0

Job No. 221486
Fig. No. C-1

DESIGN CALCULATIONS

AGGREGATE BASECOURSE SECTIONS

DESIGN DATA Classic Communities
Retreat at TimberRidge, Filing No. 2 Rural Local - Soil Type 1

Equivalent (18 kip) Single Axle Load Applications (ESAL):	ESAL =	36,500
Hveem Stabilometer (R Value) Results:	R =	50
Weighted Structural Number (WSN):	WSN =	1.42

DESIGN EQUATION

$$WSN = C_1D_1 + C_2D_2$$

C_1 = 0.44 Strength Coefficient - Hot Bituminous Asphalt
C_2 = 0.11 Strength Coefficient - Aggregate Base Course

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

FOR FULL DEPTH ASPHALT SECTION (CURRENTLY NOT ALLOWED)

$D_1 = (WSN)/C_1$ = 3.2 inches of Full Depth Asphalt
Use 5.0 inches Full Depth

FOR ASPHALT + AGGREGATE BASE COURSE SECTION

Asphalt Thickness (t) = [3] inches
$D_2 = ((WSN) - (t)(C_1))/C_2$ = 0.9 inches of Aggregate
Base Course, use 6.0 inches

RECOMMENDED ALTERNATIVES

1. 3.0 inches of Asphalt + 6.0 inches of Aggregate Base Course, or
2. 5.0 inches of Full Depth Asphalt

Job No. 221486
Fig. No. C-2

DESIGN CALCULATIONS

CEMENT TREATED SECTIONS

DESIGN DATA Classic Communitites
Retreat at TimberRidge, Filing No. 2 - Rural Local - Soil Type 1

Equivalent (18 kip) Single Axle Load Applications (ESAL):	ESAL =	36,500
Hveem Stabilometer (R Value) Results:	R =	50
Weighted Structural Number (WSN):	WSN =	1.42

DESIGN EQUATION

$$WSN = C_1D_1 + C_2D_2$$

C_1 = 0.44 Strength Coefficient - Hot Bituminous Asphalt
C_2 = 0.11 Strength Coefficient - Cement Stabilized Subgrade

D_1 = Depth of Asphalt (inches)
D_2 = Depth of Cement Stabilized Subgrade(inches)

FOR FULL DEPTH ASPHALT SECTION(CURRENTLY NOT ALLOWED)

$D_1 = (WSN)/C_1$ = 3.2 inches of Full Depth Asphalt
Use 5.0 inches Full Depth

FOR ASPHALT + CEMENT STABILIZED SUBGRADE SECTION

Asphalt Thickness (t) = [3] inches
$D_2 = ((WSN) - (t)(C_1))/C_2$ = 0.9 inches of Cement Stabilized Subgrade,
use 8.0 inches

RECOMMENDED ALTERNATIVES

1. 3.0 inches of Asphalt + 8.0 inches of Cement Stabilized Subgrade, or
2. 5.0 inches of Full-Depth Asphalt

Job No. 221486
Fig. No. C-3