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

SF197

July 6, 2020

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

Approved
By: Elizabeth Nijkamp
Date:09/02/2020
El Paso County Planning & Community Development

Attn: Bill Ritchie

Re: Pavement Recommendations
Sun Chaser Heights and Jazzy Lady Court
Midtown at Hannah Ridge, Filing No.1
El Paso County, Colorado

Dear Mr. Ritchie:

As requested, Entech Engineering, Inc. has obtained samples of the pavement subgrade soils from portions of Sunchaser Heights and Jazzy Lady Court in the Midtown at Hannah Ridge, Filing No. 1 subdivision in Colorado Springs, Colorado. This letter presents the results of the laboratory testing and pavement recommendations for the roadway.

Project Description

The roadways for this project consist of Sunchaser Heights and Jazzy Lady Court. A Subsurface Soil Investigation and laboratory testing was performed in order to determine the pavement support characteristics of the soils. The general location of the site is shown on the Vicinity Map, Figure 1. The general layout of the site is presented in the Test Boring Location Plan in Figure 2.

Subgrade Conditions

Three test borings were drilled along the roadways to depths of approximately 5 and 10 feet below the existing subgrade surface. The soils at the roadway subgrade depth consisted of clayey sand fill (Soil Type 1) overlying native silty sand (Soil Type 2). The Test Boring Logs are presented in Appendix A. Sieve Analyses and Atterberg Limit testing were performed on soil samples obtained from the test borings for the purpose of classification. The percent passing the No. 200 sieve for the Type 1 soils ranged from approximately 30 to 35 percent. One subgrade soil type was determined for pavement evaluation based on the laboratory testing (Type 1). The Type 1 subgrade soils classified as A-2-4 and A-2-6 soils, using the AASHTO classification system. Groundwater was not encountered in the test borings. Water-soluble sulfate tests results indicated that the soils exhibit a negligible potential for sulfate attack.

Swell/Consolidation Testing was performed on three samples of the subgrade soils. Samples of the subgrade soils tested resulted in volume changes of 0.1 to 1.3 percent, indicating a low swell potential. Based on the swell test results, mitigation of expansive soils on this site is not required. Laboratory test results are presented in Appendix B and are summarized on Table 1.

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

Soil Type 1 – Clayey Sand Fill
CBR 1
R @ 90% = 1.0
R @ 95% = 22.0
Use R = 22.0 for design

Classification Testing	
Liquid Limit	33
Plasticity Index	16
Percent Passing 200	33.5
AASHTO Classification	A-2-6
Group Index	1
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. Sun Chaser Heights and Jazzy Lady Court classify as urban local low volume roadways, which used an 18k ESAL value of 36,500 for design purposes. Alternative pavement sections were determined for asphalt supported on aggregate basecourse, and asphalt on cement stabilized subgrade.

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

Reliability	
Urban Local (Low Volume)	80%
Standard Deviation	0.45
Δpsi	2.2
"R" Value Subgrade (Soil Type 1: A-2-6)	22
Resilient Modulus (Soil Type 1: A-2-6)	5,273 psi
Hot Bituminous Pavement	0.44
Aggregate Basecourse	0.11
Cement Stabilized Subgrade	0.12

The pavement design calculations are presented in Appendix C. Pavement section alternatives for the roadway sections are presented as follows. 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 – Soil Type 1

Alternative	Urban Local Low Volume – ESAL = 36,500 Asphalt** (in)	Basecourse (in)	Cement Stabilized Subgrade (in.)
1. Asphalt Over Basecourse	3.0*	7.5	--
2. Cement Stabilized Subgrade	3.0*	--	10.0

*Minimum sections required per the El Paso County Engineering Criteria Manual.

Roadway Construction - Full Depth Asphalt and 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 the soils 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. Basecourse 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 Alternative

Prior to placement of the asphalt, the subgrade shall be stabilized by addition of cement to a depth of at least 10 inches for Soil Type 1 areas. The amount of cement applied shall be 2.0 percent (by weight) of the subgrade's maximum dry density as determined by the Standard Proctor Test (ASTM D-698) based on laboratory cement stabilization testing. The cement should be spread evenly on the subgrade surface and be thoroughly mixed into the subgrade over a 10 inches depth such that a uniform blend of soil and cement is achieved. Prior to application or mixing of the cement, the upper 10 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 Standard Proctor Test (ASTM D-698). 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. If you have any questions or need additional information, please do not hesitate to contact us.

Respectfully Submitted,

ENTECH ENGINEERING, INC.

Daniel P. Stegman

DPS/bs

Entech Job No. 200511
AAprojects/2020/200511 - pr

COLORADO LICENSED
MARK HOWARD HAUSCHILD
35140
7/8/2020
PROFESSIONAL ENGINEER

Reviewed by:

Mark H. Hauschild, P.E.
Senior Engineer

TABLE

TABLE 1

SUMMARY OF LABORATORY TEST RESULTS

CLIENT CLASSIC COMMUNITIES
PROJECT MIDTOWN, HANNAH RIDGE, F1
JOB NO. 200511

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	1	0-3			33.5	33	16		A-2-6		SC	FILL, SAND, CLAYEY
1	1	1-2	11.7	103.5	30.3	30	14	<0.01	A-2-6	0.2	SC	FILL, SAND, CLAYEY
1	2	1-2	10.3	115.9	34.6	29	10		A-2-4	0.1	SC	FILL, SAND, CLAYEY
1	3	1-2	11.4	106.8	34.9	31	12		A-2-6	1.3	SC	FILL, SAND, CLAYEY
2	1	10			17.2	NV	NP	<0.01	A-2-4		SM	SAND, SILTY

FIGURES

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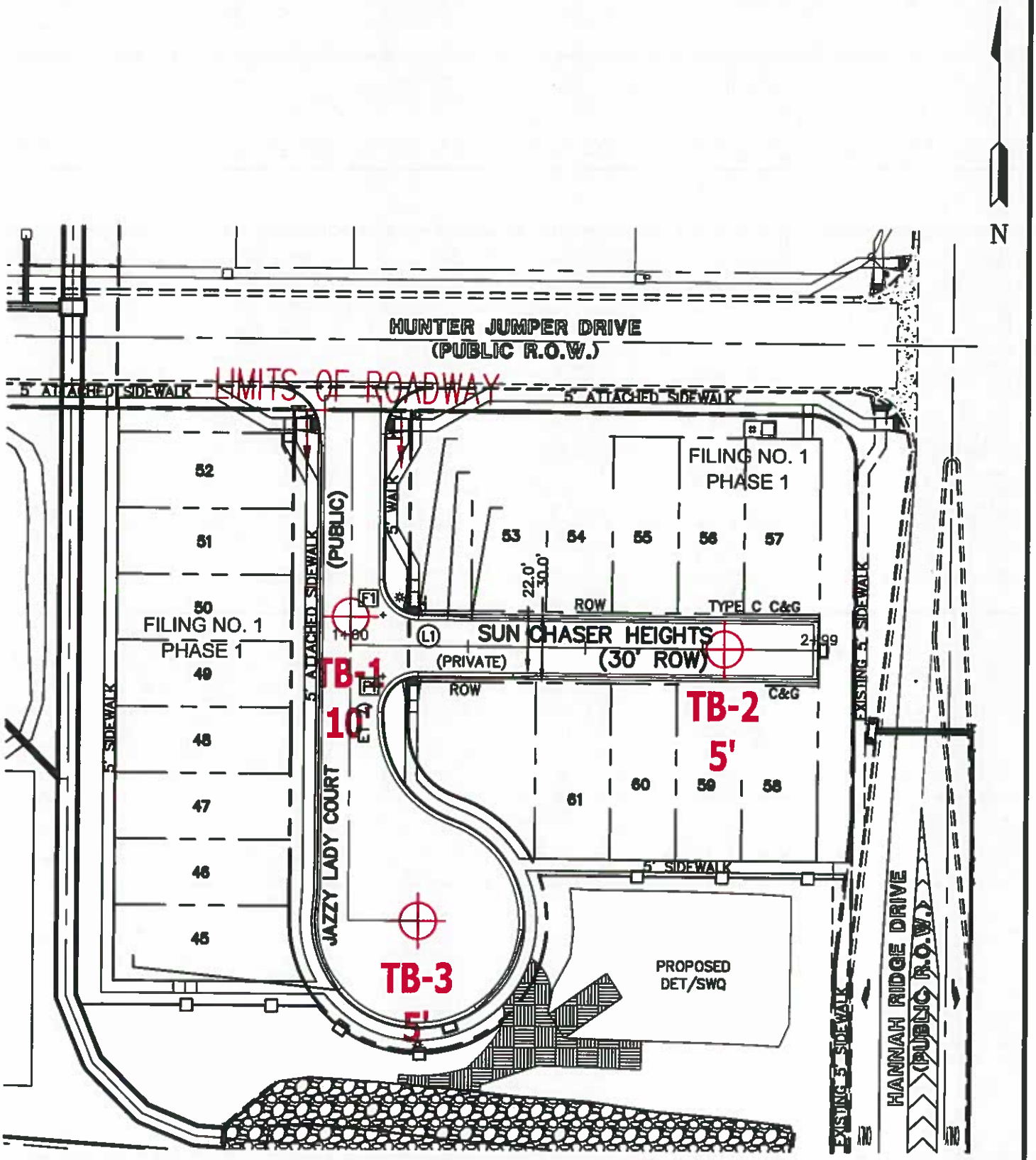
VICINITY MAP
MIDTOWN HANNAH RIDGE, FILING No.1
COLORADO SPRINGS, COLORADO
FOR: CLASSIC COMMUNITIES

DRAWN BY:	DATE DRAWN:	DESIGNED BY:	CHECKED:
RPJ	06/25/2020	RPJ	DPS

JOB NO.: 200511
FIG. NO.: 1



TB-2- APPROXIMATE TEST BORING LOCATION, NUMBER, AND DEPTH

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TEST BORING LOCATION PLAN
MIDTOWN HANNAH RIDGE, FILING No.1
COLORADO SPRINGS, COLORADO
FOR: CLASSIC COMMUNITIES

DRAWN BY:	DATE DRAWN:	DESIGNED BY:	CHECKED:
RPJ	06/17/2020	RPJ	DPS

JOB NO.: 200511
FIG. NO.: 2

APPENDIX A: Test Boring Logs

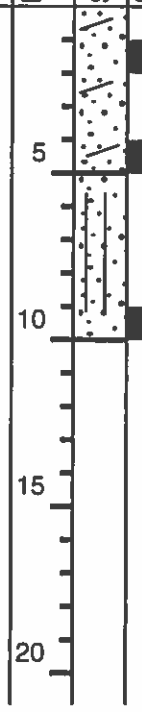
TEST BORING NO. 1
DATE DRILLED 5/18/2020
Job # 200511

REMARKS

DRY TO 10', 5/18/20

FILL 0-5', SAND, CLAYEY, FINE TO MEDIUM GRAINED, BROWN, LOOSE, MOIST

SAND, SILTY, FINE TO MEDIUM GRAINED, BROWN, MEDIUM DENSE, MOIST



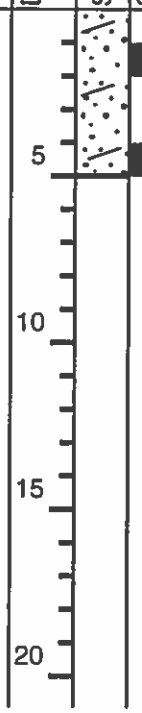
Blows per foot	Watercontent %	Soil Type
4	10.9	1
9	11.3	1
11	8.1	2

TEST BORING NO. 2
DATE DRILLED 5/18/2020
CLIENT CLASSIC COMMUNITIES
LOCATION MIDTOWN, HANNAH RIDGE, F1

REMARKS

DRY TO 5', 5/18/20

FILL 0-5', SAND, CLAYEY, FINE TO MEDIUM GRAINED, BROWN, MEDIUM DENSE, MOIST



Blows per foot	Watercontent %	Soil Type
16	7.9	1
18	8.4	1

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TEST BORING LOG

DRAWN:	DATE:	CHECKED:	DATE:
			6/2/20

JOB NO.: 200511
FIG NO.: A-1

TEST BORING NO. 3
DATE DRILLED 5/18/2020
Job # 200511

REMARKS

DRY TO 5', 5/18/20

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type	
						FILL 0-5', SAND, CLAYEY, FINE TO MEDIUM GRAINED, BROWN, MEDIUM DENSE TO LOOSE, MOIST
			20	9.6	1	
5			6	13.2	1	
10						
15						
20						

TEST BORING NO.
DATE DRILLED
CLIENT CLASSIC COMMUNITIES
LOCATION MIDTOWN, HANNAH RIDGE, F1

REMARKS

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

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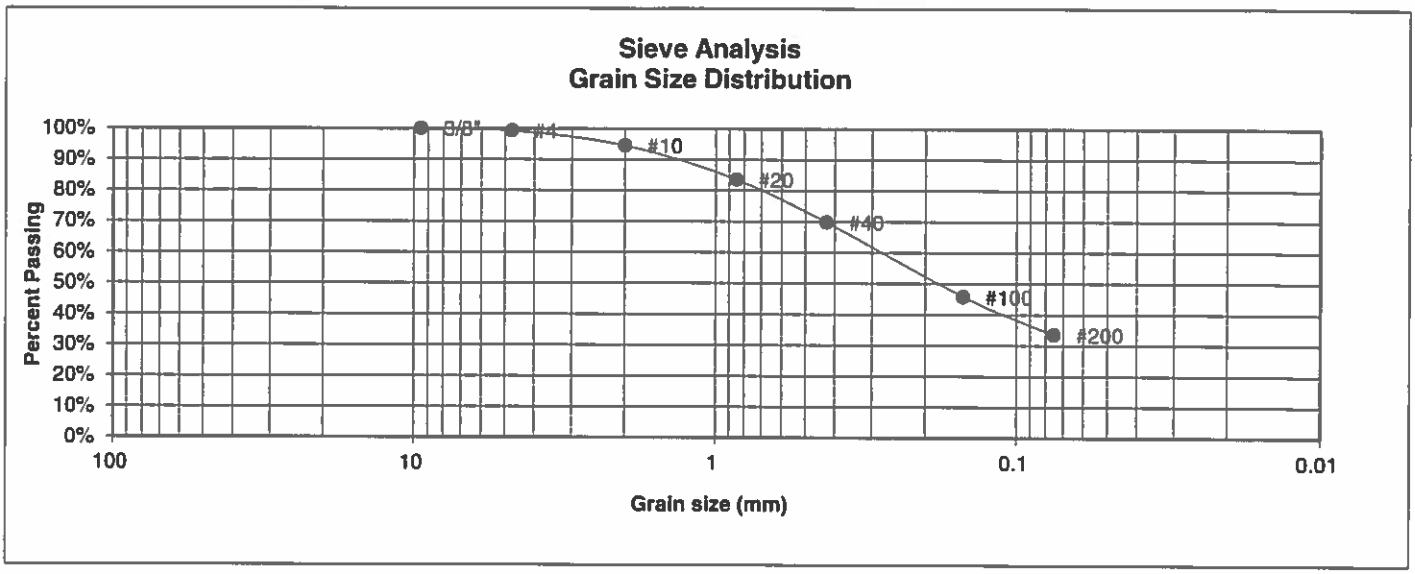
TEST BORING LOG

DRAWN:	DATE:	CHECKED:	DATE:
			6/22/20

JOB NO.: 200511
FIG NO.: A-2

APPENDIX B: Laboratory Testing Results

UNIFIED CLASSIFICATION	SC	CLIENT	CLASSIC COMMUNITIES
SOIL TYPE #	1, CBR	PROJECT	MIDTOWN, HANNAH RIDGE, F1
TEST BORING #	1	JOB NO.	200511
DEPTH (FT)	0-3	TEST BY	BL
AASHTO CLASSIFICATION	A-2-6	GROUP INDEX	1



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	99.3%
10	94.6%
20	83.6%
40	69.8%
100	45.7%
200	33.5%

Atterberg Limits	
Plastic Limit	17
Liquid Limit	33
Plastic Index	16

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

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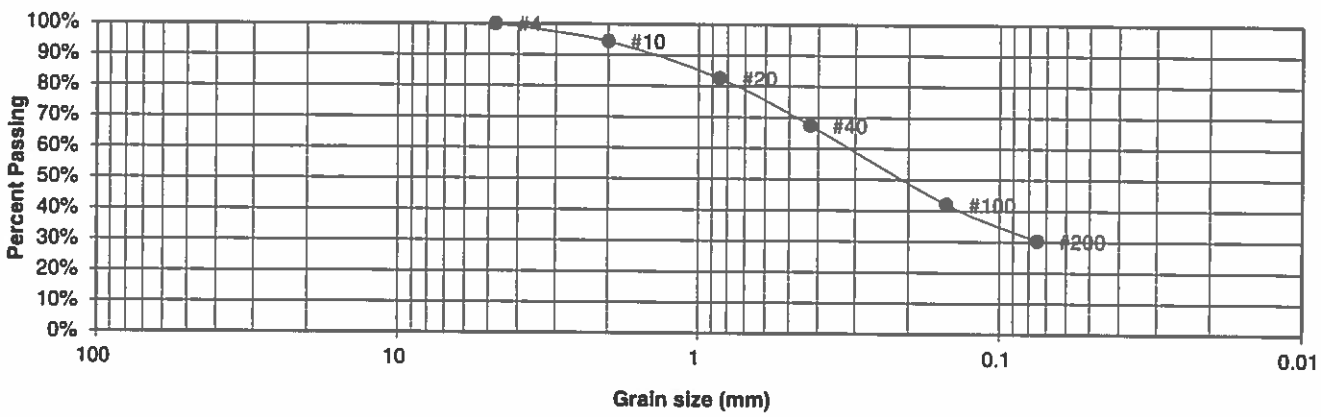
LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
			6/22/20

JOB NO.: 200511
FIG NO.: B-1

UNIFIED CLASSIFICATION	SC	CLIENT	CLASSIC COMMUNITIES
SOIL TYPE #	1	PROJECT	MIDTOWN, HANNAH RIDGE, F1
TEST BORING #	1	JOB NO.	200511
DEPTH (FT)	1-2	TEST BY	BL
AASHTO CLASSIFICATION	A-2-6	GROUP INDEX	1



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	
4	100.0%
10	94.4%
20	82.6%
40	67.4%
100	42.0%
200	30.3%

Atterberg Limits	
Plastic Limit	16
Liquid Limit	30
Plastic Index	14

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

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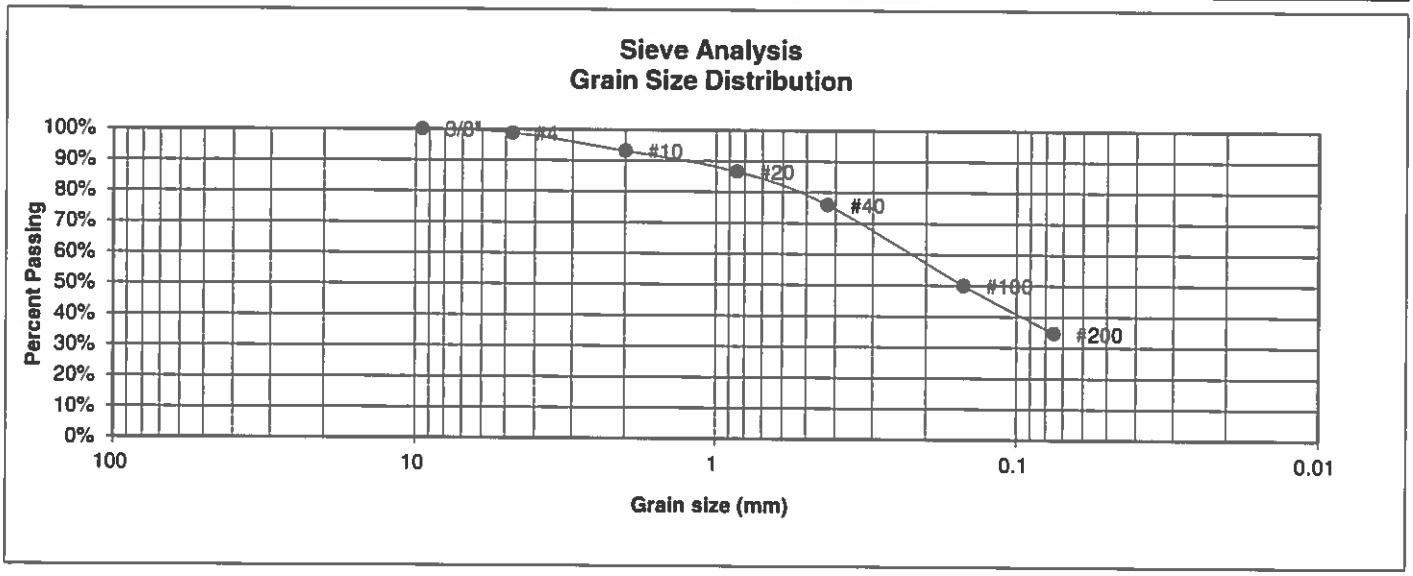
LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
			1/2/20

JOB NO.: 200511
FIG NO.: B-2

UNIFIED CLASSIFICATION	SC	CLIENT	CLASSIC COMMUNITIES
SOIL TYPE #	1	PROJECT	MIDTOWN, HANNAH RIDGE, F1
TEST BORING #	2	JOB NO.	200511
DEPTH (FT)	1-2	TEST BY	BL
AASHTO CLASSIFICATION	A-2-4	GROUP INDEX	0



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	98.8%
10	93.2%
20	86.6%
40	76.0%
100	50.0%
200	34.6%

Atterberg Limits

Plastic Limit	19
Liquid Limit	29
Plastic Index	10

Swell

Moisture at start

Moisture at finish

Moisture increase

Initial dry density (pcf)

Swell (psf)

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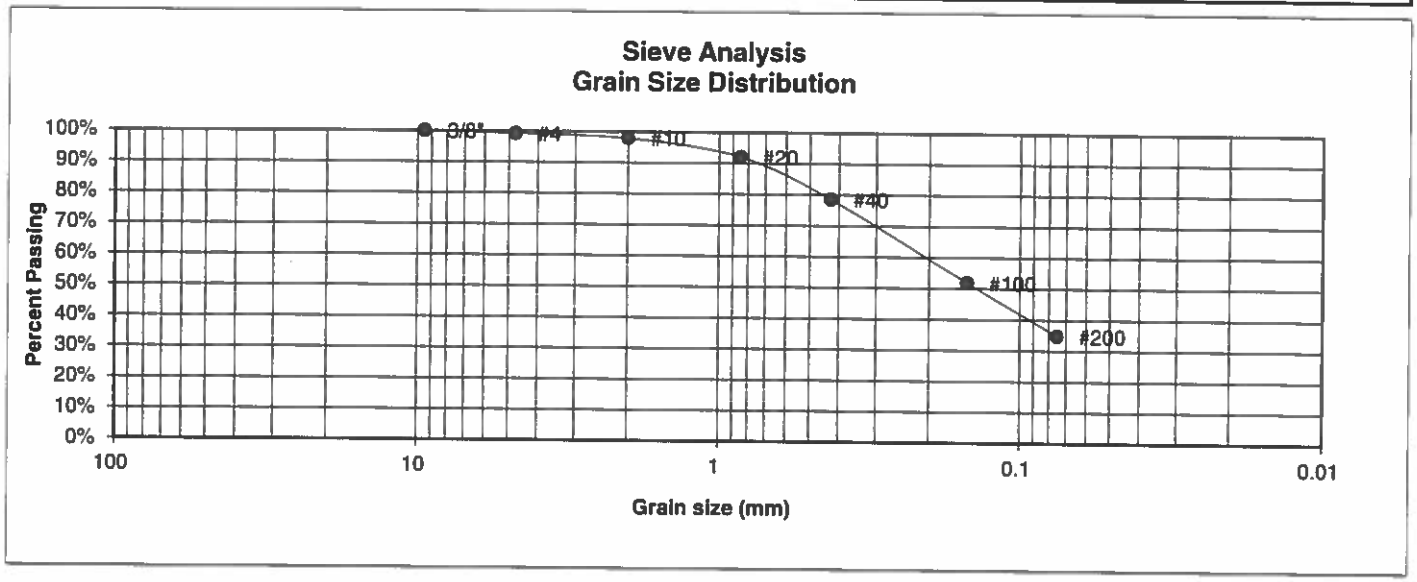
LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
			6/4/20

JOB NO.: 200511
FIG NO.: B-3

UNIFIED CLASSIFICATION	SC	CLIENT	CLASSIC COMMUNITIES
SOIL TYPE #	1	PROJECT	MIDTOWN, HANNAH RIDGE, FI
TEST BORING #	3	JOB NO.	200511
DEPTH (FT)	1-2	TEST BY	BL
AASHTO CLASSIFICATION	A-2-6	GROUP INDEX	0



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	99.2%
10	97.9%
20	92.0%
40	78.5%
100	51.9%
200	34.9%

Atterberg Limits	
Plastic Limit	19
Liquid Limit	31
Plastic Index	12

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

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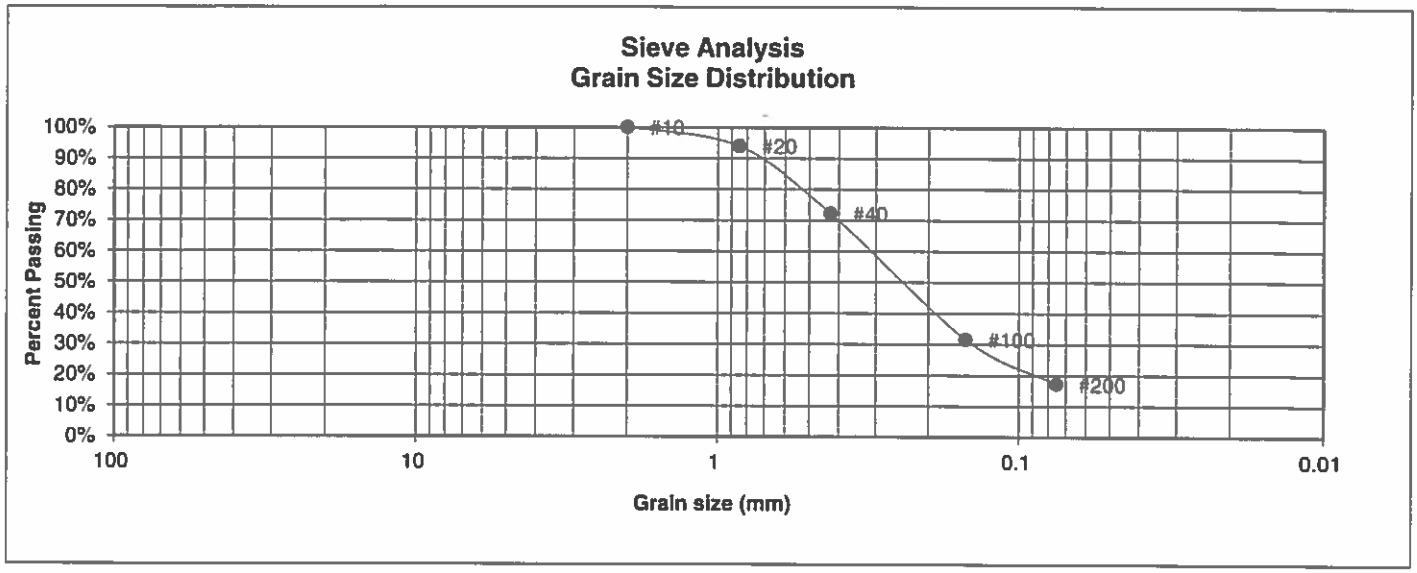
LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
			6/2/20

JOB NO.: 200511
FIG NO.: B-4

UNIFIED CLASSIFICATION	SM	CLIENT	CLASSIC COMMUNITIES
SOIL TYPE #	2	PROJECT	MIDTOWN, HANNAH RIDGE, F1
TEST BORING #	1	JOB NO.	200511
DEPTH (FT)	10	TEST BY	BL
AASHTO CLASSIFICATION	A-2-4	GROUP INDEX	0



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	
4	
10	100.0%
20	94.0%
40	72.2%
100	31.6%
200	17.2%

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

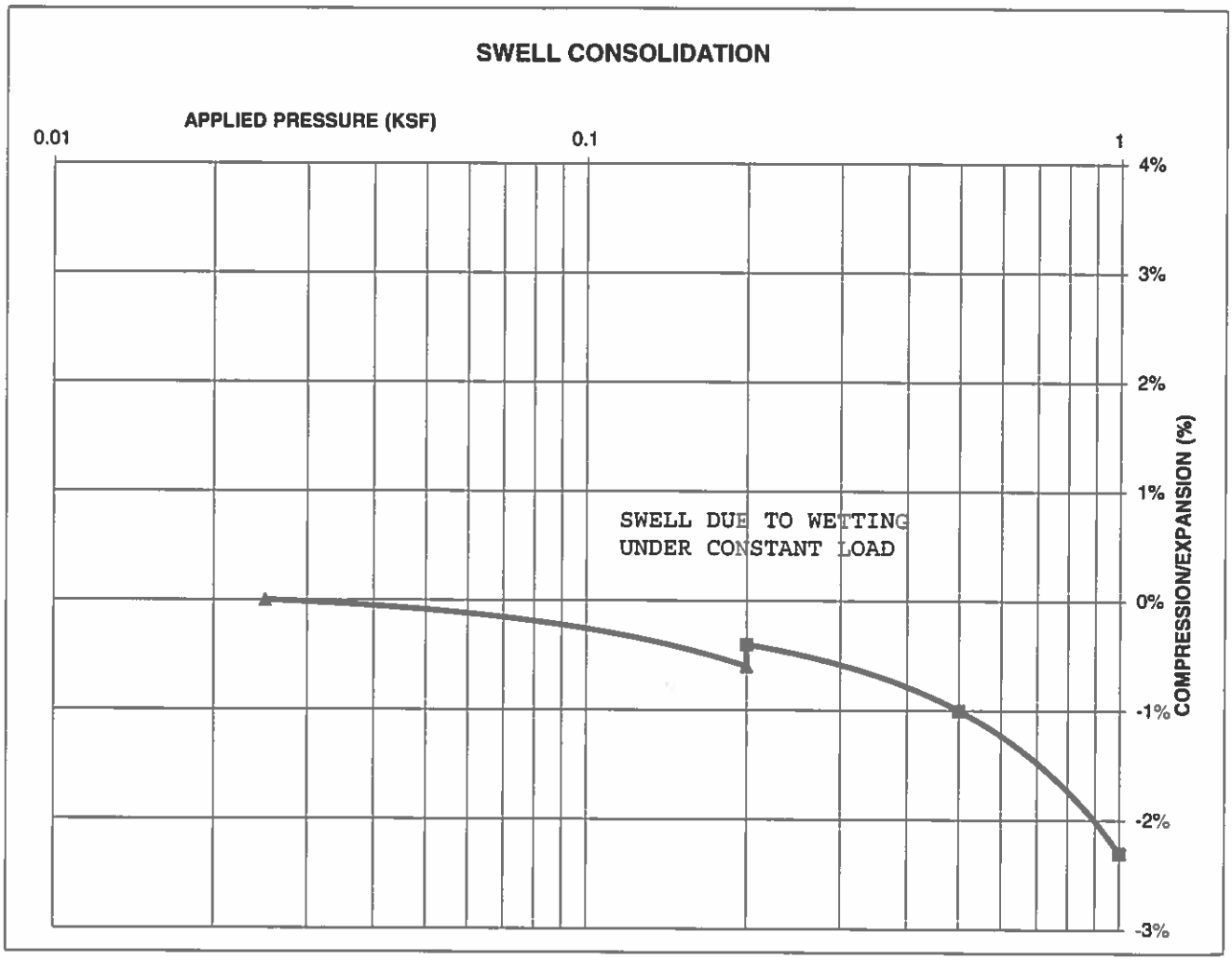
DRAWN:	DATE:	CHECKED:	DATE:
			6/24/20

JOB NO.: 200511
FIG NO.: B-5

CONSOLIDATION TEST RESULTS

TEST BORING #	1	DEPTH(ft)	1-2
DESCRIPTION	SC	SOIL TYPE	1
NATURAL UNIT DRY WEIGHT (PCF)			104
NATURAL MOISTURE CONTENT			11.7%
SWELL/CONSOLIDATION (%)			0.2%

JOB NO. 200511
CLIENT CLASSIC COMMUNITIES
PROJECT MIDTOWN, HANNAH RIDGE, F1



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SWELL CONSOLIDATION
TEST RESULTS

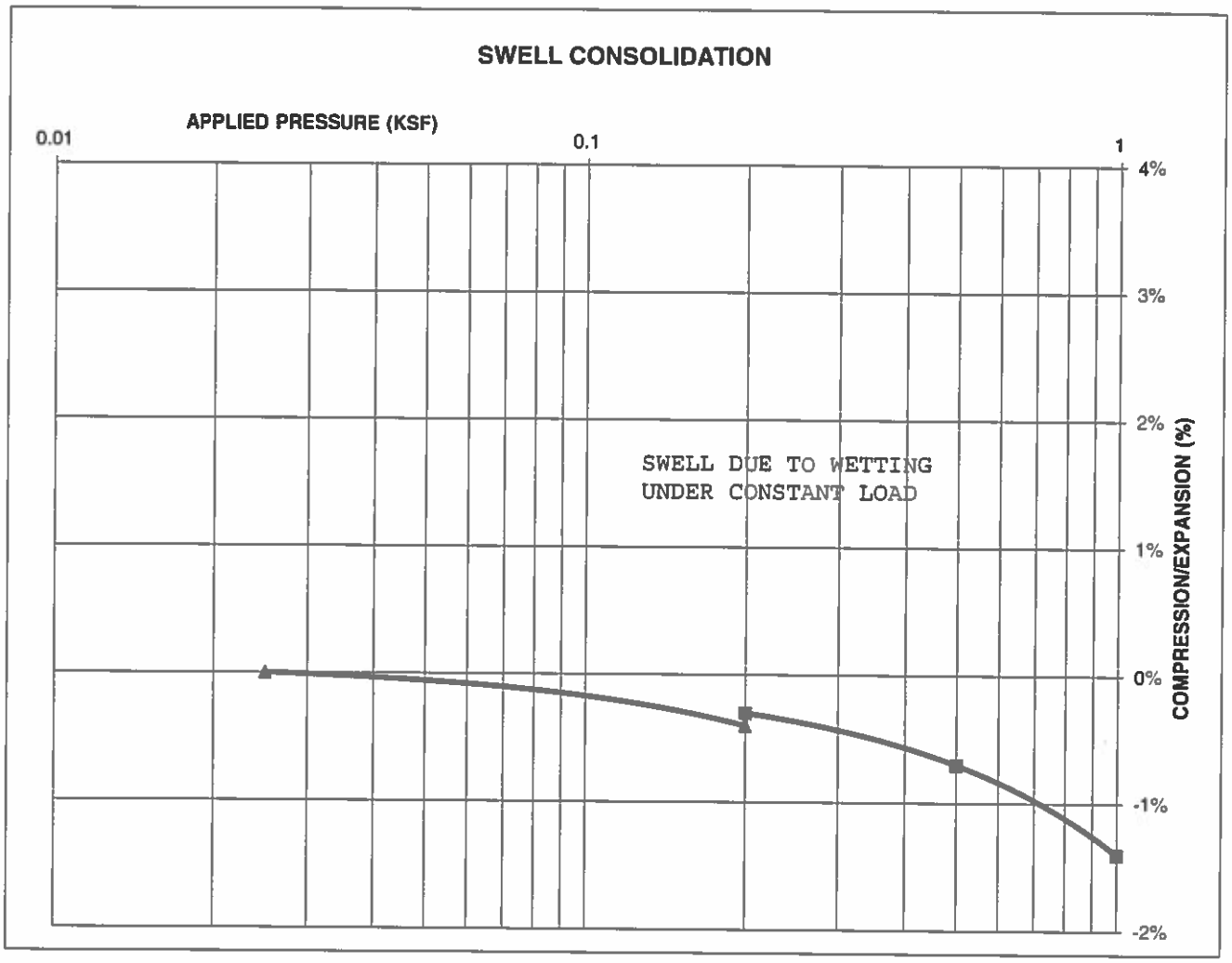
DRAWN:	DATE:	CHECKED: M	DATE: 6/12/20

JOB NO.: 200511
FIG NO.: B-6

CONSOLIDATION TEST RESULTS

TEST BORING #	2	DEPTH(ft)	1-2
DESCRIPTION	SC	SOIL TYPE	1
NATURAL UNIT DRY WEIGHT (PCF)			116
NATURAL MOISTURE CONTENT			10.3%
SWELL/CONSOLIDATION (%)			0.1%

JOB NO. 200511
CLIENT CLASSIC COMMUNITIES
PROJECT MIDTOWN, HANNAH RIDGE, F1



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SWELL CONSOLIDATION
TEST RESULTS

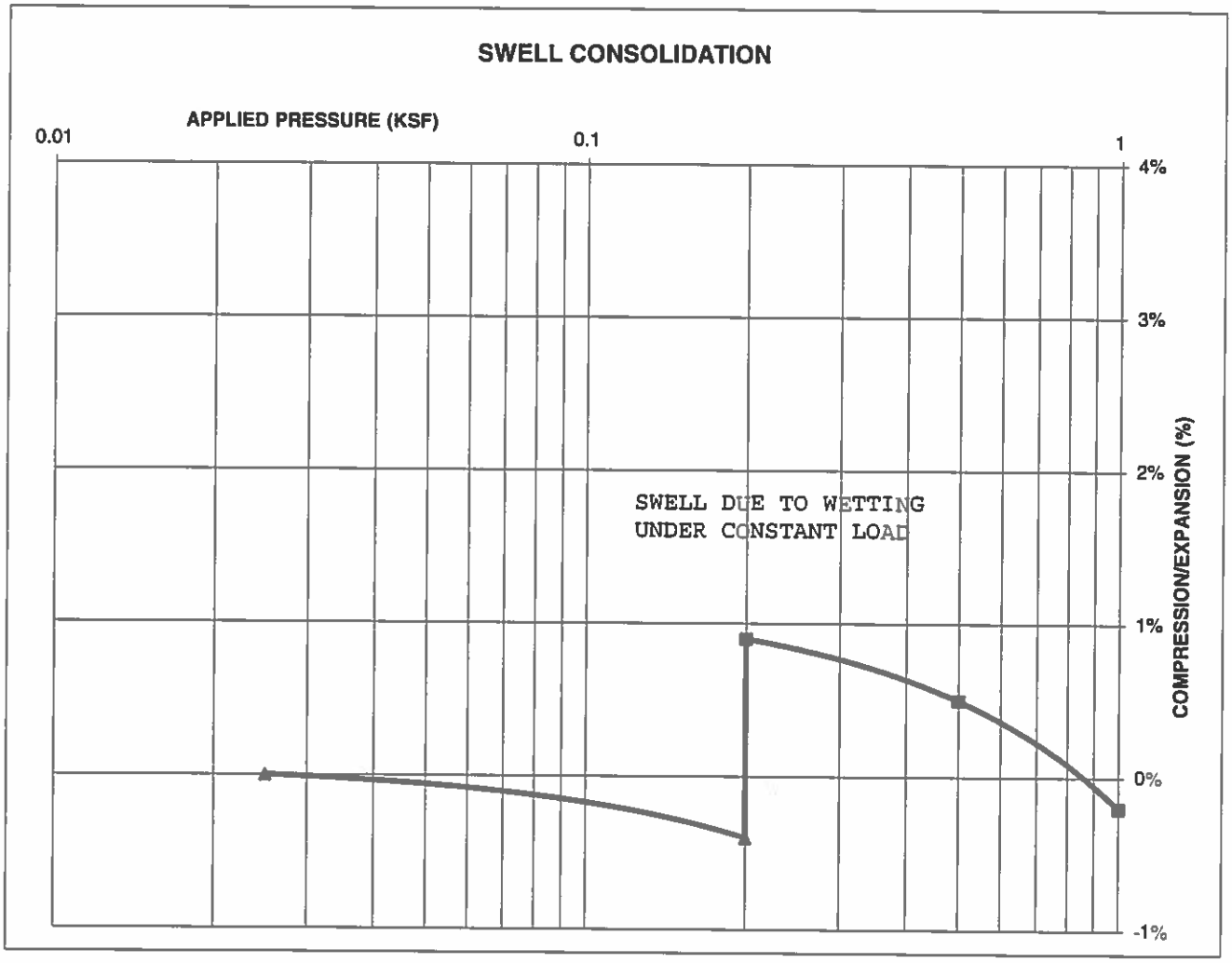
DRAWN:	DATE:	CHECKED:	DATE:
			6/2/20

JOB NO.: 200511
FIG NO.: B-7

CONSOLIDATION TEST RESULTS

TEST BORING #	3	DEPTH(ft)	1-2
DESCRIPTION	SC	SOIL TYPE	1
NATURAL UNIT DRY WEIGHT (PCF)			107
NATURAL MOISTURE CONTENT			11.4%
SWELL/CONSOLIDATION (%)			1.3%

JOB NO. 200511
CLIENT CLASSIC COMMUNITIES
PROJECT MIDTOWN, HANNAH RIDGE, F1



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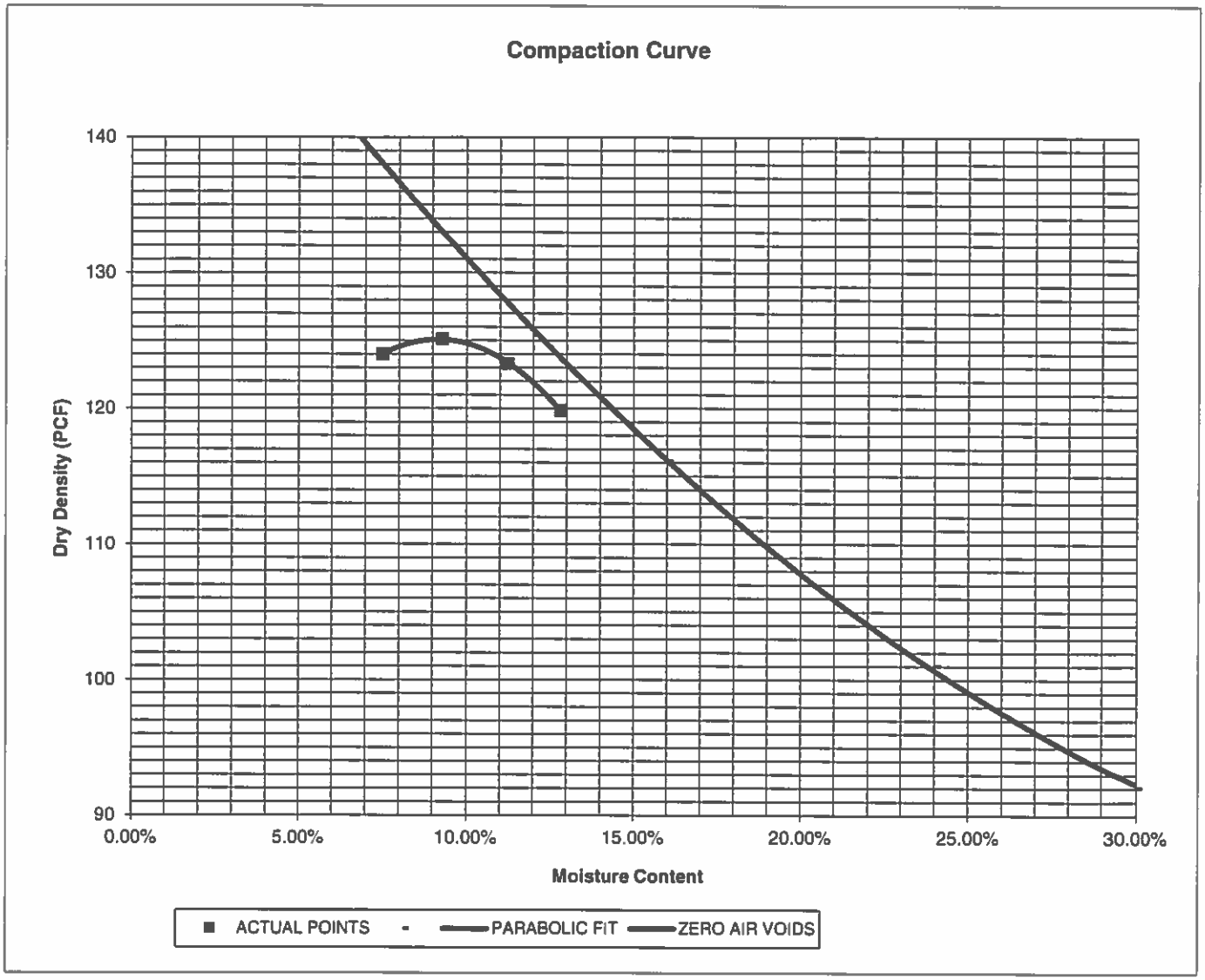
SWELL CONSOLIDATION
TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE: 6/2/20

JOB NO.: 200511
FIG NO.: B-8

PROJECT	MIDTOWN, HANNAH RIDGE, F1	CLIENT	CLASSIC COMMUNITIES
SAMPLE LOCATION	TB-1 @ 0-3'	JOB NO.	200511
SOIL DESCRIPTION	FILL, SAND, CLAYEY, BROWN	DATE	05/20/20

IDENTIFICATION	SC	COMPACTION TEST #	1
TEST DESIGNATION / METHOD	ASTM D-1557-A	TEST BY	AL
MAXIMUM DRY DENSITY (PCF)	125.1	OPTIMUM MOISTURE	9.3%



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MOISTURE DENSITY RELATION

DRAWN:	DATE:	CHECKED:	DATE:
			6/12/20

JOB NO.: 200511
FIG NO.: B-9

CBR TEST LOAD DATA

JOB NO: 200511
CLIENT: CLASSIC COMMUNITIES
PROJECT: MIDTOWN, HANNAH RIDGE, FI
SOIL TYPE: I

PISTON DIAMETER (cm)	PISTON AREA (in^2)
4.958	2.99250919

PENETRATION DEPTH (INCHES)	*10 BLOWS* MOLD # 1 LOAD(LBS) (LBS)	STRESS (PSI)	*25 BLOWS* MOLD # 3 LOAD(LBS) (LBS)	STRESS (PSI)	*56 BLOWS* MOLD # 5 LOAD(LBS) (LBS)	STRESS (PSI)
0.000	0	0.00	0	0.00	0	0.00
0.025	45	15.04	91	30.41	137	45.78
0.050	58	19.38	115	38.43	195	65.16
0.075	68	22.72	137	45.78	255	85.21
0.100	81	27.07	163	54.47	316	105.60
0.125	89	29.74	174	58.15	347	115.96
0.150	93	31.08	185	61.82	369	123.31
0.175	101	33.75	204	68.17	404	135.00
0.200	105	35.09	223	74.52	435	145.36
0.300	123	41.10	246	82.21	472	157.73
0.400	135	45.11	272	90.89	532	177.78
0.500	151	50.46	295	98.58	548	183.12

FINAL MOISTURE CONTENT

	MOLD # 1	MOLD # 3	MOLD # 5
CAN #	303	106	307
WT. CAN	8.34	8.42	8.35
WT. CAN+WET	245.21	259.75	240.08
WT. CAN+DRY	208.41	221.45	205.47
WT. H20	36.8	38.3	34.61
WT. DRY SOIL	200.07	213.03	197.12
MOISTURE CONTENT	18.39%	17.98%	17.56%
WET DENSITY (PCF)	124.2	127.1	132.0
DRY DENSITY (PCF)	113.7	116.3	120.8
BEARING RATIO	2.71	5.45	10.56

90% OF DRY DENSITY	112.6
95% OF DRY DENSITY	118.8

BEARING RATIO AT 90% OF MAX	1.61 ~ R VALUE	1
BEARING RATIO AT 95% OF MAX	8.35 ~ R VALUE	22

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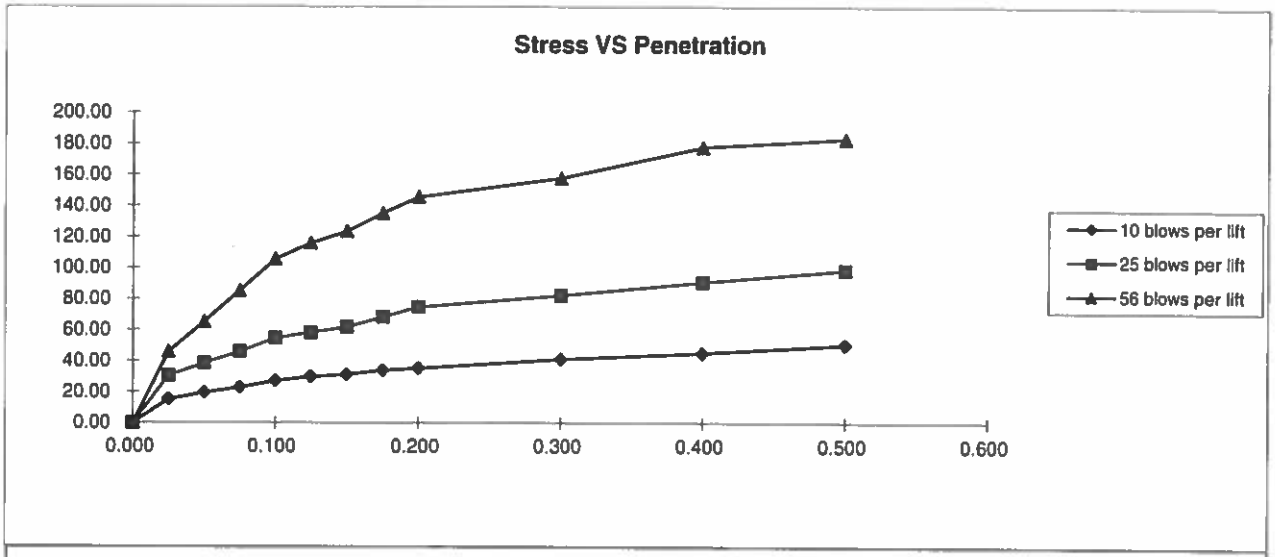
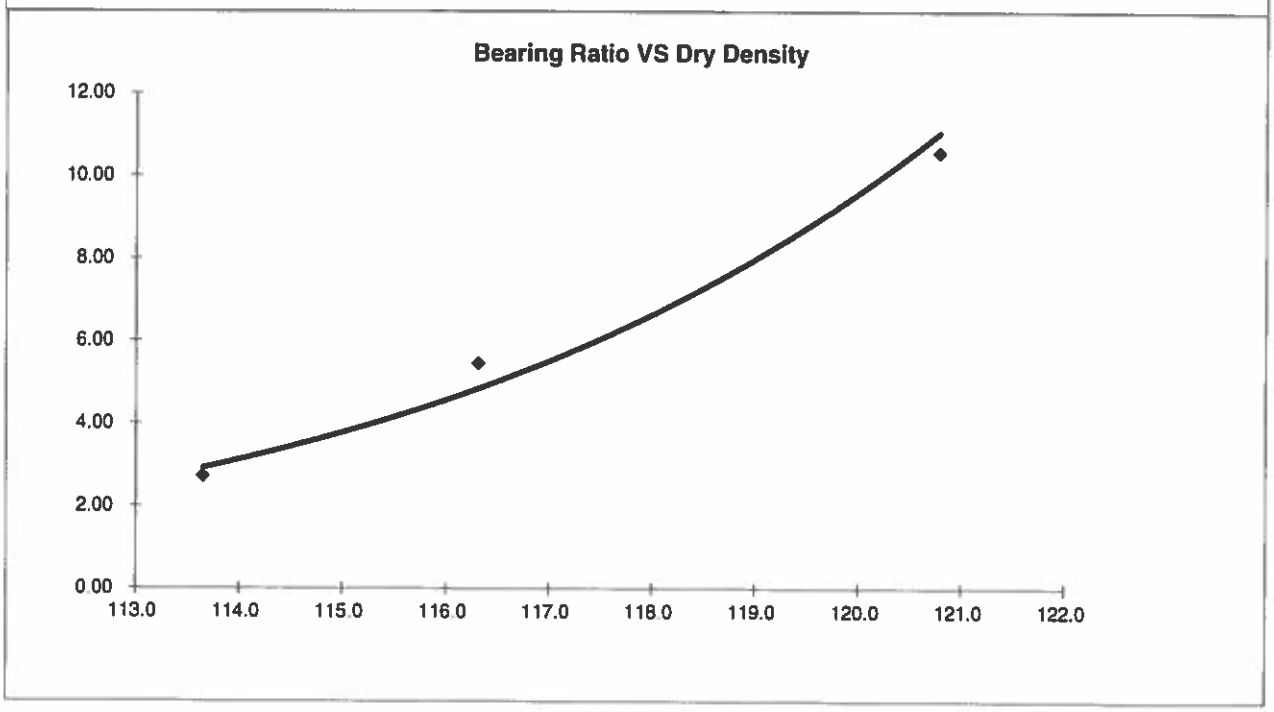
CBR TEST DATA

DRAWN:	DATE:	CHECKED:	DATE:
			1/21/20

JOB NO.: 200511
FIG NO.: B-10





BEARING RATIO AT 90% OF MAX	1.61 ~ R VALUE	1.00
BEARING RATIO AT 95% OF MAX	8.35 ~ R VALUE	22.00

JOB NO: 200511
SOIL TYPE: 1

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CALIFORNIA BEARING RATIO

DRAWN:	DATE:	CHECKED:	DATE:
			6/2/20

JOB NO.: 200511
FIG NO.: B-11

CLIENT	CLASSIC COMMUNITIES	JOB NO.	200511
PROJECT	MIDTOWN, HANNAH RIDGE, F1	DATE	5/29/2020
LOCATION	MIDTOWN, HANNAH RIDGE, F1	TEST BY	BL

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

QC BLANK PASS

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COLORADO SPRINGS, COLORADO 80907

LABORATORY TEST
SULFATE RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
		h	6/2/20

JOB NO.: 200511
FIG NO.: B-12

APPENDIX C: Pavement Design Calculations

DESIGN CALCULATIONS

DESIGN DATA — CLASSIC COMMUNITIES - MIDTOWN AT HANNAH RIDGE, F1
URBAN LOCAL LOW VOLUME ROADS - SOIL TYPE 1
SUNCHASER HEIGHTS AND JAZZY LADY COURT

Equivalent (18 kip) Single Axle Load Applications (ESAL):	ESAL =	36,500
Hveem Stabilometer (R Value) Results:	R =	22
Weighted Structural Number (WSN):	WSN =	2.10

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

$D_1 = (WSN)/C_1$ = 4.8 inches of Full Depth Asphalt
Use 5.0 inches Full Depth

FOR ASPHALT + AGGREGATE BASE COURSE SECTION

Asphalt Thickness (t) = 3 inches
$D_2 = ((WSN) - (t)(C_1))/C_2$ = 7.1 inches of Aggregate
Base Course, use 7.5 inches

RECOMMENDED ALTERNATIVES

1. 3.0 inches of Asphalt + 7.5 inches of Aggregate Base Course, or
2. 5.0 inches of Asphalt

Job No. 200511
Fig. No. C-1

FLEXIBLE PAVEMENT DESIGN

DESIGN DATA — CLASSIC COMMUNITIES - MIDTOWN AT HANNAH RIDGE, FL
URBAN LOCAL LOW VOLUME ROADS - SOIL TYPE 1
SUNCHASER HEIGHTS AND JAZZY LADY COURT

Equivalent (18 kip) Single Axle Load Applications (ESAL):	ESAL (W_{18}) =	36,500
Hveem Stabilometer (R Value) Results:	R =	22
Standard Deviation	S_o =	0.45
Loss in Serviceability	Δpsi =	2.2
Reliability	Reliability =	80
Reliability (z-statistic)	Z_R =	-0.841
Soil Resilient Modulus	M_R =	5273

Weighted Structural Number (WSN): → WSN = 2.10

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)
60	-0.253
70	-0.524
75	-0.674
80	-0.841
85	-1.036
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. 200511
Fig. No. C-2

DESIGN CALCULATIONS

DESIGN DATA CLASSIC COMMUNITIES - MIDTOWN AT HANNAH RIDGE, F1
URBAN LOCAL LOW VOLUME ROADS - SOIL TYPE 1
SUNCHASER HEIGHTS AND JAZZY LADY COURT

Equivalent (18 kip) Single Axle Load Applications (ESAL):	ESAL =	36,500
Hveem Stabilometer (R Value) Results:	R =	22
Weighted Structural Number (WSN):	WSN =	2.10

DESIGN EQUATION

$$WSN = C_1D_1 + C_2D_2$$

C_1 = 0.44 Strength Coefficient - Hot Bituminous Asphalt
C_2 = 0.12 Strength Coefficient - Cement Stabilized Subgrade

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

FOR FULL DEPTH ASPHALT SECTION

$D_1 = (WSN)/C_1$ = 4.8 inches of Full Depth Asphalt
Use [5.0] inches Full Depth

FOR ASPHALT + CEMENT STABILIZED SUBGRADE SECTION

Asphalt Thickness (t) = [3] inches
$D_2 = ((WSN) - (t)(C_1))/C_2$ = 6.5 inches of Cement Stabilized Subgrade
Use [10.0] inches

RECOMMENDED ALTERNATIVES

1. 3.0 inches of Asphalt + 10.0 inches of Cement Stabilized Subgrade, or
2. 5.0 inches of Asphalt

Job No. 200511
Fig. No. C-3

FLEXIBLE PAVEMENT DESIGN

DESIGN DATA — CLASSIC COMMUNITIES - MIDTOWN AT HANNAH RIDGE, FI
URBAN LOCAL LOW VOLUME ROADS - SOIL TYPE I
SUNCHASER HEIGHTS AND JAZZY LADY COURT

Equivalent (18 kip) Single Axle Load Applications (ESAL):	ESAL (W_{18}) =	36,500
Hveem Stabilometer (R Value) Results:	R =	22
Standard Deviation	S_o =	0.45
Loss in Serviceability	Δpsi =	2.2
Reliability	Reliability =	80
Reliability (z-statistic)	Z_R =	-0.841
Soil Resilient Modulus	M_R =	5273

Weighted Structural Number (WSN): → WSN = 2.10

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)
60	-0.253
70	-0.524
75	-0.674
80	-0.841
85	-1.036
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. 200511
Fig. No. C-4