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PAVEMENT DESIGN REPORT
RETREAT AT PRAIRIE RIDGE, FILING NO. 2
DINES BOULEVARD – NORTH
EL PASO COUNTY, COLORADO

PCD File No. SF259 and PAV267

Prepared for:
Classic Communities
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Attn: Austin Lenz

July 10, 2026

Respectfully Submitted,

ENTECH ENGINEERING, INC.

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Entech Job No. 241932

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1 Introduction

Entech Engineering, Inc. (Entech) completed this pavement design report for the northern section of Dines Boulevard roadway within the Retreat at Prairie Ridge, Filing No. 2. This report describes the subsurface exploration program and laboratory testing program conducted for the proposed roadway improvements and provides pavement section alternatives and construction recommendations. Entech participated in this project as a subconsultant to Classic Communities. The contents of this report, including the pavement design recommendations, are subject to the limitations and assumptions presented in Section 7.

2 Project Description

The site is located northwest of the intersection of Vollmer Road and Briargate Parkway within the Retreat at Prairie Ridge, Filing No. 2, in El Paso County, Colorado (Figure 1). The proposed improvements include paving a portion of Dines Boulevard that begins at the future Briargate Parkway to the southwest and extends northeast to Vollmer Road within the Retreat at Prairie Ridge, Filing No. 2. The extent of our investigation is shown in Figure 2.

At the time of our subsurface exploration program, the existing roadway was rough-graded, and utilities were being installed. Surrounding properties comprise vacant land, land being developed for future residential lots, and an existing subdivision. Based on the development plans, Dines Boulevard is designated as an urban residential collector roadway.

3 Subsurface Explorations and Laboratory Testing

3.1 Subsurface Exploration Program

Subsurface conditions within the project site were explored by six test borings, designated TB-1 through TB-6, drilled on April 10, 2026. The locations of the test borings are shown on the Site and Exploration Plan (Figure 2). The borings were drilled to depths of 5 to 10 feet below the existing ground surface (bgs). The drilling was performed using a truck-mounted, continuous flight auger drill rig supplied and operated by Entech. Descriptive boring logs providing the lithologies of the subsurface conditions encountered during drilling are presented in Appendix A. Groundwater levels were measured in each of the open boreholes at the conclusion of drilling.

Soil samples were obtained from the borings utilizing the Standard Penetration Test (ASTM D1586) using a 2-inch outside diameter split spoon or a 2½-inch modified California sampler.

Results of the Standard Penetration Test (SPT) are included on the boring logs in terms of N-values expressed in blows per foot (bpf). Soil samples recovered from the borings were visually classified and recorded on the boring logs. The soil classifications were later verified utilizing laboratory testing and grouped by soil type. The soil type numbers are included on the boring logs. It should be understood that the soil descriptions shown on the boring logs may vary between boring locations and sample depths. It should also be noted that the lines of stratigraphic separation shown on the boring logs represent approximate boundaries between soil types, and the actual stratigraphic transitions may be more gradual or variable with location.

3.2 Geotechnical Index and Engineering Property Testing

Water content testing (ASTM D2216) was performed on the samples recovered from the borings, and the results are shown on the boring logs. Grain-size analysis (ASTM D6913) and Atterberg limits testing (ASTM D4318) were performed on selected samples to assist in classifying the materials encountered in the borings.

For pavement design, a Modified Proctor (ASTM D1557) and a California Bearing Ratio (CBR) test (ASTM D1883) were completed. Soluble sulfate testing was performed on select soil samples to evaluate the potential for below-grade degradation of concrete due to sulfate attack. The laboratory testing results are presented in Appendix B and summarized in Table B-1.

Compressive strength testing of cement-treated soil was conducted on a representative soil sample collected from boring TB-3 and is presented in Section 5.2. A summary of the testing results is attached in Appendix B, Table B-2.

4 Subgrade Conditions

One primary soil type and one bedrock type were encountered in the test borings drilled for the subsurface investigation. Each soil type was classified in accordance with the Unified Soil Classification System (USCS) and the American Association of State Highway and Transportation Officials (AASHTO) soil classification system using the laboratory testing results and the observations made during drilling.

4.1 Subsurface Conditions

Subsurface conditions along the proposed roadways generally consisted of medium dense silty sand fill (Soil Type 1, AASHTO A-1-b, A-2-6) in borings TB-1 through TB-3. Sandstone bedrock,

or very dense silty sand when classified as a soil (Soil Type 2, AASHTO A-2-4, A-4, A-7-6, A-1-b), was encountered underlying Soil Type 1 in boring TB-3 and at the existing ground surface in borings TB-4 through TB-6 and extended to the termination depth of those borings.

Laboratory test results are presented in Appendix B and are summarized in Table B-1.

4.2 Groundwater

Groundwater was not encountered in the test borings. Groundwater fluctuations are possible and will depend on seasonal variations, local precipitation, runoff, and other factors; however, we do not anticipate that groundwater will affect the proposed roadway construction.

5 Pavement Design Recommendations

Pavement design recommendations were made in accordance with the *El Paso County Engineering Criteria Manual (ECM).*

5.1 Subgrade Conditions

California Bearing Ratio (CBR) testing was performed on a representative sample of the Soil Type 1 silty sand fill from TB-3 to determine the support characteristics of the subgrade soils. The results of the CBR testing are presented in Appendix B and summarized in Exhibit 1.

Exhibit 1: Subsurface Laboratory Testing Summary

Design Parameter	Value
Soil Type	1 – Silty Sand
CBR at 95%	65.8
Design CBR	10
Liquid Limit	NV
Plasticity Index	NP
Percent Passing 200	14.4
AASHTO Classification	A-1-b
Unified Soils Classification	SM

5.2 Cement-Treated Subgrade Design

Strength testing for the site subgrade soils was performed on a set of soil-cement samples from boring TB-3 (Soil Type 1). Testing was performed on soil-cement samples prepared with 2% and 4% Portland Cement Type 1L. A compressive strength of 160 pounds per square inch (psi) is recommended for cement-stabilized subgrade. The results of the strength testing and Modified Proctor (ASTM D1557) maximum dry density are presented in Appendix B and summarized in

Exhibit 2. To account for waste and construction variability, we recommend that the design mix be increased by 1% in the field. A **3% mix is recommended** for Soil Type 1 based on the laboratory test results.

Exhibit 2: Subsurface Laboratory Testing Summary

Design Parameter	Value
Soil Type	1 – Clayey Sand Fill
Design CBR	10
Average Compressive Strength for 2% Mix (psi)	298
Average Compressive Strength for 4% Mix (psi)	390
Optimum Moisture Content (%)	7.3
Maximum Dry Density (pcf)	130.4

The amount of cement applied shall be a minimum of 3% (by weight) of the subgrade's maximum dry density as determined by the Modified Proctor (ASTM D1557) for granular soils.

5.3 Swell Mitigation

El Paso County requires swell mitigation for soils with swell testing results greater than 2% under a surcharge of 150 pounds per square foot (psf). Due to the granular nature of the soil samples collected during our subsurface investigation swell testing was not feasible. Based on the classification of the subgrade soils, mitigation for expansive soils is not required on this site.

5.4 Traffic Loading

Traffic data is not available for the proposed roadways within the Retreat at Prairie Ridge, Filing No. 2; however, Dines Boulevard is designated as an urban residential collector roadway based on current development plans. The *El Paso County Engineering Criteria Manual* provides default 18-kip equivalent single axle loadings (ESAL) based on the street classification. For design, a default ESAL value of 821,000 was used for the urban residential collector roadway designation.

5.5 Pavement Design

The pavement sections were determined utilizing the *El Paso County Engineering Criteria Manual*, the CBR testing, and the default ESAL. Design parameters used in the pavement analysis are presented in Exhibit 3.

Exhibit 3: Pavement Design Parameters

Design Parameter	Value
Reliability	85%
Standard Deviation	0.45
Serviceability Loss (Δ psi)	2.0
Design CBR	10
Resilient Modulus	15,000 psi
Structural Coefficients	
Hot Bituminous Pavement	0.44
Aggregate Base Course	0.11
Recycled Concrete Base	0.11
Cement-Treated Soil	0.11

Pavement section alternatives recommended for the proposed roadways are summarized in Exhibit 4. The pavement design calculations are presented in Appendix C.

Exhibit 4: Recommended Pavement Sections

Pavement Area	Roadway Designation	Design ESAL	Alternative [1]
Dines Boulevard (North)	Residential Collector	821,000	1. 4.0 inches HMA over 8.0 inches ABC/RCB
			2. 4.0 inches HMA over 8.0 inches CTS [2]

ABC = Aggregate Base Course; CTS = Cement-Treated Soil; ESAL = Equivalent Single Axle Loads; HMA = Hot Mix Asphalt; RCB = Recycled Concrete Base

Notes:

1. All pavement alternatives meet the minimum sections required per the *El Paso County Engineering Criteria Manual.*
2. The use of CTS will require a deviation request approval.

6 Construction Recommendations

Pavement design recommendations provided herein are contingent on good construction practices, and poor construction techniques may result in poor performance. Our analyses assumed that this project would be constructed according to the *El Paso County Engineering Criteria Manual* and the *Pikes Peak Region Asphalt Paving Specifications*.

6.1 Earthwork Recommendations for Pavement Subgrade

Proper subgrade preparation is required for adequate pavement performance. Paving areas should be cleared of all deleterious materials, including but not limited to existing pavements, utility poles, and fence poles. Surface vegetation, if any, should be removed by stripping, with the depth to be field-determined.

6.1.1 Subgrade Preparation – Unbound Base Alternatives

If pavement section alternatives are selected utilizing aggregate base course (ABC) or recycled concrete base (RCB), the final subgrade surface should be scarified to a depth of 8 inches, moisture conditioned within +/- 2% of the optimum water content, and recompacted to 95% of the Modified Proctor (ASTM D1557) maximum dry density.

The compacted surface below pavements should be proof rolled with a fully loaded, tandem-axle, 10-yard dump truck or equivalent. Any areas that are delineated to be soft, loose, or yielding during proof rolling should be removed and reconditioned, or replaced.

6.1.2 Subgrade Preparation – Cement-Treated Base

If pavement section alternatives are selected utilizing cement-treated soil (CTS), a preliminary proof roll should be completed with a fully loaded, tandem-axle, 10-yard dump truck or equivalent prior to placement of cement stabilization. Any areas that are delineated to be soft, loose, or yielding during proof rolling should be removed and reconditioned, or replaced.

Following the preliminary proof roll, the subgrade shall be stabilized by the addition of cement. The amount of cement applied shall be a minimum of 3% (by weight) of the subgrade's maximum dry density as determined by the Modified Proctor (ASTM D1557) for granular soils or by the Standard Proctor (ASTM D698) for cohesive soils. The cement should be spread evenly on the subgrade surface and thoroughly mixed into the subgrade such that a uniform blend of soil and cement is achieved to the CTS design depth. Densification of the cement-stabilized subgrade should be completed to obtain a compaction of at least 95% of the subgrade's maximum dry density as determined by the Modified Proctor (ASTM D1557) or by the Standard Proctor (ASTM D698). 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 followed as part of the subgrade stabilization:

- Type 1L 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 degrees F. Cement-treated subgrades should be maintained at a temperature of 40 degrees 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 Entech Engineering. Testing should include in-situ compaction tests and representative compacted specimens of the treated subgrade material for subsequent laboratory quality assurance testing. Testing reports will be provided to El Paso County as construction progresses.
- A minimum 7-day CTS compressive strength of 125 psi must be achieved.
- Soil strengths in excess of 275 psi will require microfracturing. Microfracturing will be completed using the Standard Method as defined by the *City of Colorado Springs Draft Standard Specification,* Section 305 – Chemically-Treated Subgrade. Microfracturing will be performed with the same (or equivalent tonnage) steel drum vibratory roller used for compaction of the CTS. A minimum 12-ton roller shall be used. Three full passes with the roller operating at maximum amplitude and traveling at 2- 3 mph shall be applied. If the treated material breaks up excessively at the surface, the vibration amplitude shall be decreased or eliminated.

6.1.3 Fill Placement and Compaction

Granular fill placed as part of the pavement subgrade shall consist of nonexpansive, granular soil, free of organic matter, unsuitable materials, debris, and cobbles greater than 3 inches in diameter. Additionally, any granular fill placed as part of the roadway subgrade should have a minimum CBR of 10. All granular fill placed within the pavement subgrade should be compacted to a minimum of 95% of the Modified Proctor (ASTM D1557) maximum dry density at +/-2% of optimum moisture content. Fill material should be placed in horizontal lifts such that each finished lift has a compacted thickness of 6 inches or less. Entech should approve any imported fill to be used within the pavement subgrade area prior to delivery to the site.

6.1.4 Aggregate Base Course and Recycled Concrete Base

ABC or RCB materials shall conform to the *El Paso County Standard Specifications Manual*, Appendix D, Table D-6. ABC or RCB materials should be compacted to a minimum of 95% of the Modified Proctor (ASTM D1557) maximum dry density within +/-2% of optimum moisture content.

6.2 Concrete Degradation Due to Sulfate Attack

Sulfate solubility testing was conducted on several samples recovered from the test borings to evaluate the potential for sulfate attack on concrete. The test results indicated less than 0.01% soluble sulfate (by weight) as presented in Appendix B. The test results indicate the sulfate component of the in-place soils presents a negligible to severe exposure threat to concrete placed below the site grade.

As presented in the *Evaluation of Selected Pavement Specifications and Responses to Questions Relevant to Design and Construction of Cement-Treated Soil and Aggregate Layers in El Paso County, Colorado*, by Spencer Gutherie and Robert Stevens, dated March 13, 2024, soils with less than 3,000 ppm (0.3%) do not require special construction practices.

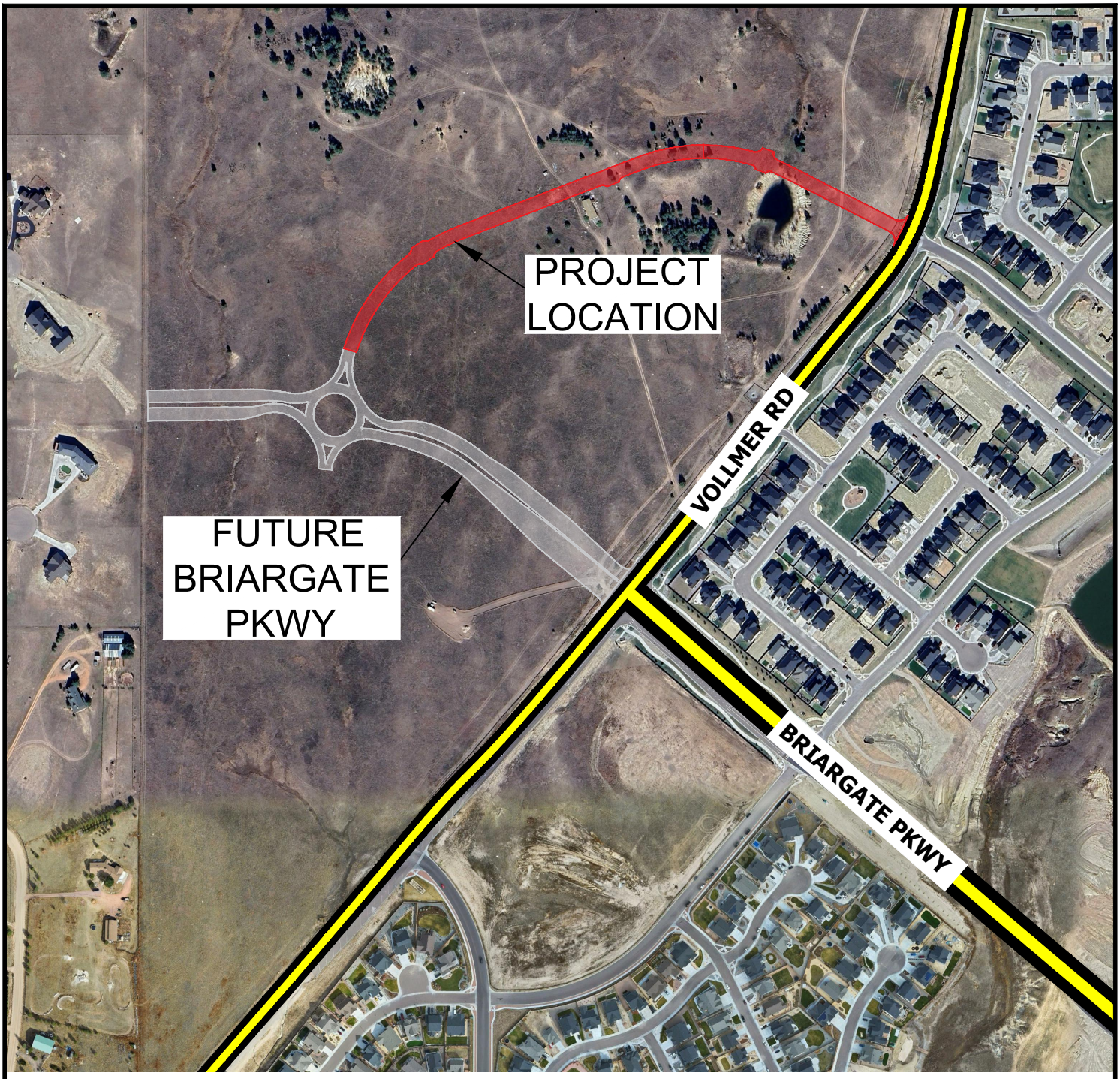
6.3 Construction Observation

Subgrade preparation for pavement structures should be observed by Entech in order to verify that (1) no anomalies are present, (2) materials similar to those described in this report have been encountered or placed, and (3) no soft spots, expansive or organic soil, or debris are present in the pavement subgrade prior to paving. Construction observation requirements, as presented in the Use of CTS for Paving Season Memorandum, should be followed.

7 Closure

The subsurface investigation, geotechnical evaluation, and recommendations presented in this report are intended for use by Classic Communities with application to the paving of the northern section of Dines Boulevard within the Retreat at Prairie Ridge, Filing No. 2, in El Paso County, Colorado. In conducting the subsurface investigation, laboratory testing, engineering evaluation, and reporting, Entech Engineering, Inc. endeavored to work in accordance with generally accepted professional geotechnical and geologic practices and principles consistent with the level of care and skill ordinarily exercised by members of the geotechnical profession currently practicing in the same locality and under similar conditions. No other warranty, expressed or implied, is made. During final design and/or construction, if conditions are encountered that appear different from those described in this report, Entech Engineering, Inc. requests to be notified so that the evaluation and recommendations presented herein can be reviewed and modified as appropriate.

If there are any questions regarding the information provided herein, or if Entech Engineering, Inc. can be of further assistance, please do not hesitate to contact us.



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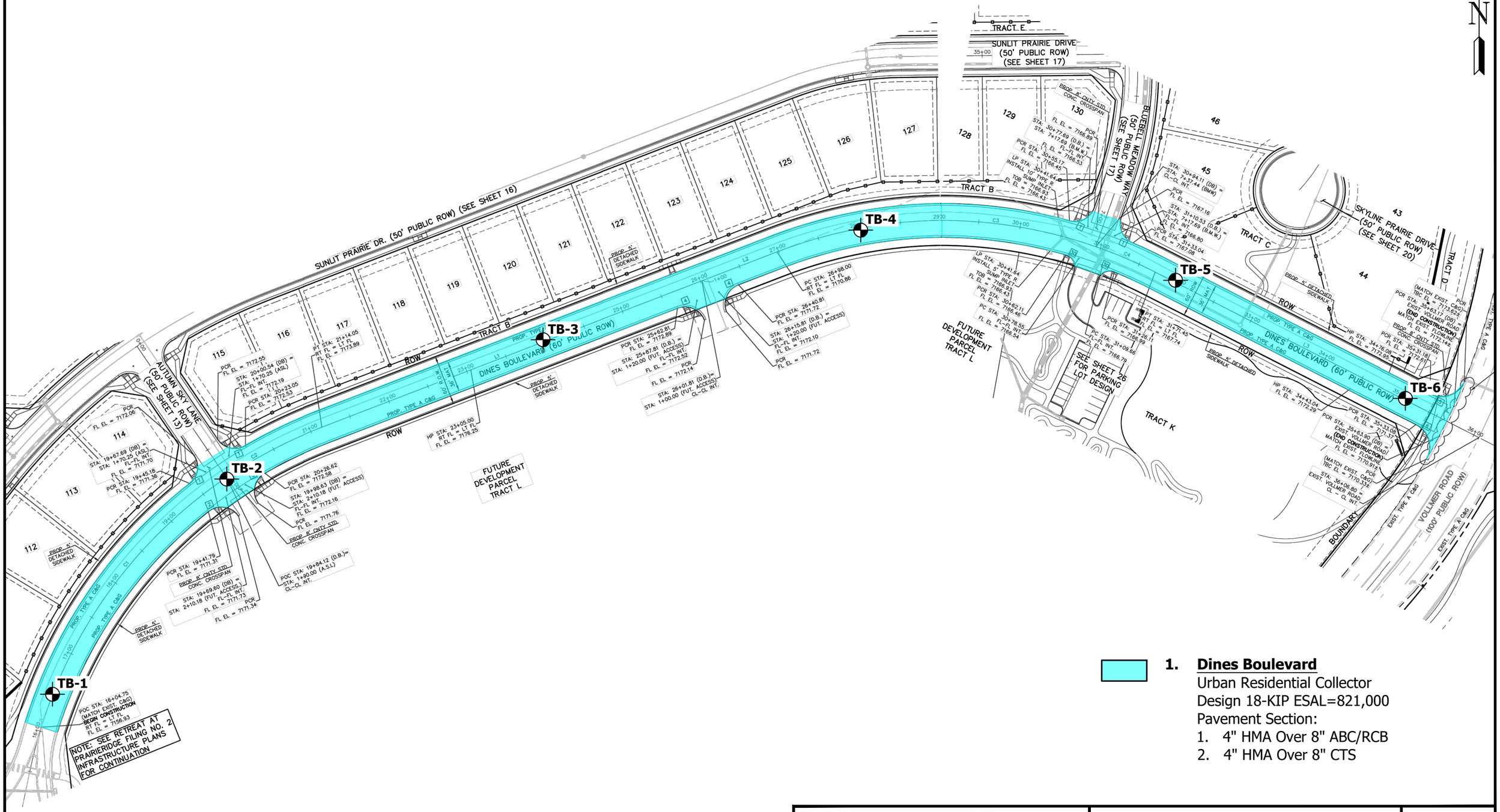
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VICINITY MAP

RETREAT AT PRAIRIE RIDGE F2 DINES BLVD N
CLASSIC COMMUNITIES

JOB NO.
241932

FIG. 1



TB- APPROXIMATE TEST BORING LOCATION AND NUMBER

SCALE: 0 50 100

1. **Dines Boulevard**
   Urban Residential Collector
   Design 18-KIP ESAL=821,000
   Pavement Section:
   1. 4" HMA Over 8" ABC/RCB
   2. 4" HMA Over 8" CTS

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SITE AND EXPLORATION PLAN

RETREAT AT PRAIRIE RIDGE F2 DINES BLVD N
CLASSIC COMMUNITIES

JOB NO. 241932

FIG. 2

APPENDIX A: Test Boring Logs

TEST BORING 1
DATE DRILLED 4/10/2026

REMARKS

DRY TO 5', 4/10/26

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
FILL 0-5', SAND, SILTY, TAN to BROWN, MEDIUM DENSE, MOIST			10	7.0	1
5			20	7.1	1
10					
15					
20					

TEST BORING 2
DATE DRILLED 4/10/2026

REMARKS

DRY TO 5', 4/10/26

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
FILL 0-5', SAND, SILTY, TAN to BROWN, MEDIUM DENSE, MOIST			29	7.6	1
5			27	8.4	1
10					
15					
20					

ENTECH ENGINEERING, INC.

TEST BORING LOGS

RETREAT AT PRAIRIE RIDGE F2 DINES BLVD N
CLASSIC COMMUNITIES

JOB NO. 241932

FIG. A-1

TEST BORING 3
DATE DRILLED 4/10/2026

REMARKS

DRY TO 10', 4/10/26

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
			10	2.4	1
5			23	8.6	1
10			50/8"	11.6	2
15					
20					

FILL 0-5', SAND, SILTY, TAN to BROWN, MEDIUM DENSE, DRY to MOIST

SANDSTONE, VERY WEAK, LIGHT BROWN, WEATHERED (SAND, SILTY, VERY DENSE, MOIST)

TEST BORING 4
DATE DRILLED 4/10/2026

REMARKS

DRY TO 5', 4/10/26

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
			50/8"	8.8	2
5			50/7"	9.8	2
10					
15					
20					

SANDSTONE, VERY WEAK, TAN, EXTREMELY WEATHERED (SAND, WITH SILT, VERY DENSE, MOIST)

ENTECH ENGINEERING, INC.

TEST BORING LOGS

RETREAT AT PRAIRIE RIDGE F2 DINES BLVD N
CLASSIC COMMUNITIES

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FIG. A-2

TEST BORING 5
DATE DRILLED 4/10/2026

REMARKS

DRY TO 5', 4/10/26

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
SANDSTONE, VERY WEAK, TAN, MODERATELY WEATHERED (SAND, SILTY, VERY DENSE, MOIST)			50/9"	12.9	2
5			50/5"	10.3	2
10					
15					
20					

TEST BORING 6
DATE DRILLED 4/10/2026

REMARKS

DRY TO 5', 4/10/26

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
SANDSTONE, VERY WEAK, TAN, MODERATELY WEATHERED (SAND, SILTY, VERY DENSE, MOIST)			50/8"	6.6	2
5			50/5"	9.7	2
10					
15					
20					

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TEST BORING LOGS

RETREAT AT PRAIRIE RIDGE F2 DINES BLVD N
CLASSIC COMMUNITIES

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FIG. A-3

APPENDIX B: Laboratory Test Results

TABLE B-1
SUMMARY OF LABORATORY TEST RESULTS

SOIL TYPE	TEST BORING NO.	DEPTH (FT)	WATER (%)	PASSING NO. 200 SIEVE (%)	LIQUID LIMIT	PLASTIC LIMIT	PLASTIC INDEX	SULFATE (WT %)	AASHTO CLASS. (GROUP INDEX)	USCS	SOIL DESCRIPTION
1, CBR	3	0-3	3.9	14.4	NV	NP	NP		A-1-b (0)	SM	FILL, SAND, SILTY
1	1	1-2	7.7	14.5	40	27	13	<0.01	A-2-6 (0)	SM	FILL, SAND, SILTY
1	2	1-2	8.3	28.3	38	25	13		A-2-6 (0)	SM	FILL, SAND, SILTY
1	3	1-2	2.9	6.3	NV	NP	NP		A-1-b (0)	SW-SM	FILL, SAND, WITH SILT
2	4	1-2	5.6	5.9	NV	NP	NP		A-1-b (0)	SW-SM	SANDSTONE (SAND, WITH SILT)
2	5	1-2	38.9	45.2	46	30	16	<0.01	A-7-6 (4)	SM	SANDSTONE (SAND, SILTY)
2	6	1-2	9.9	16.3	36	28	8		A-2-4 (0)	SM	SANDSTONE (SAND, SILTY)
2	3	10	12.1	42.7	36	27	9		A-4 (1)	SM	SANDSTONE (SAND, SILTY)

Project: Retreat at Prairie Ridge, F2, N Dines Blvd
Client: Classic SRJ
Job No: 241932

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TABLE B-2

SUMMARY OF CTS TEST RESULTS

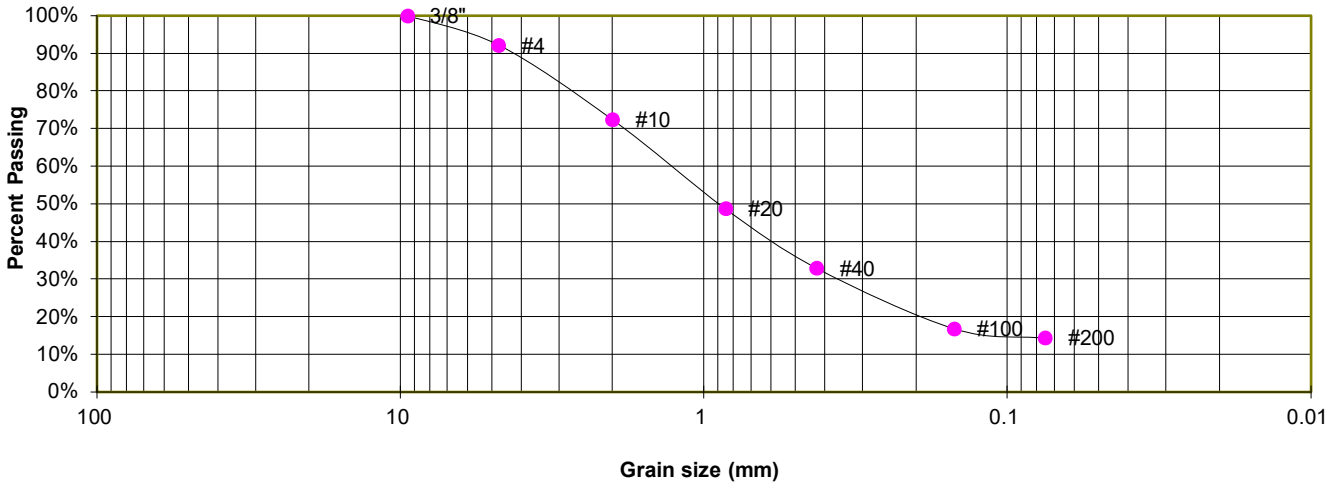
FIELD SAMPLE ID	*SOIL ADDITIVE*	*ADDITIVE PERCENTAGE (%)*	*WATER CONTENT (%)*	*DENSITY (dry)*	*AGE (days)*	*STRENGTH (psi)*
TB-3 @ 0-3'	TYPE IL CEMENT	2	7.3	123.3	7	315
				123.0		280
				123.1		299
					AVERAGE:	**298**
TB-3 @ 0-3'	TYPE IL CEMENT	4	7.3	122.3	7	310
				123.1		430*
				123.3		430*
					AVERAGE:	**390**

Notes:

1. CURING METHOD: Ambient Temperature Oven

* - Low-capacity break machine was utilized for strength testing; however, the samples exceeded the machine's maximum capacity.

TEST BORING	3	SOIL DESCRIPTION	FILL, SAND, SILTY
DEPTH (FT)	0-3	SOIL TYPE	1, CBR



GRAIN SIZE ANALYSIS

U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	92.2%
10	72.4%
20	48.8%
40	32.9%
100	16.8%
200	14.4%

ATTERBERG LIMITS

Plastic Limit	NP
Liquid Limit	NV
Plastic Index	NP

SOIL CLASSIFICATION

USCS CLASSIFICATION:	SM
AASHTO CLASSIFICATION:	A-1-b
AASHTO GROUP INDEX:	0

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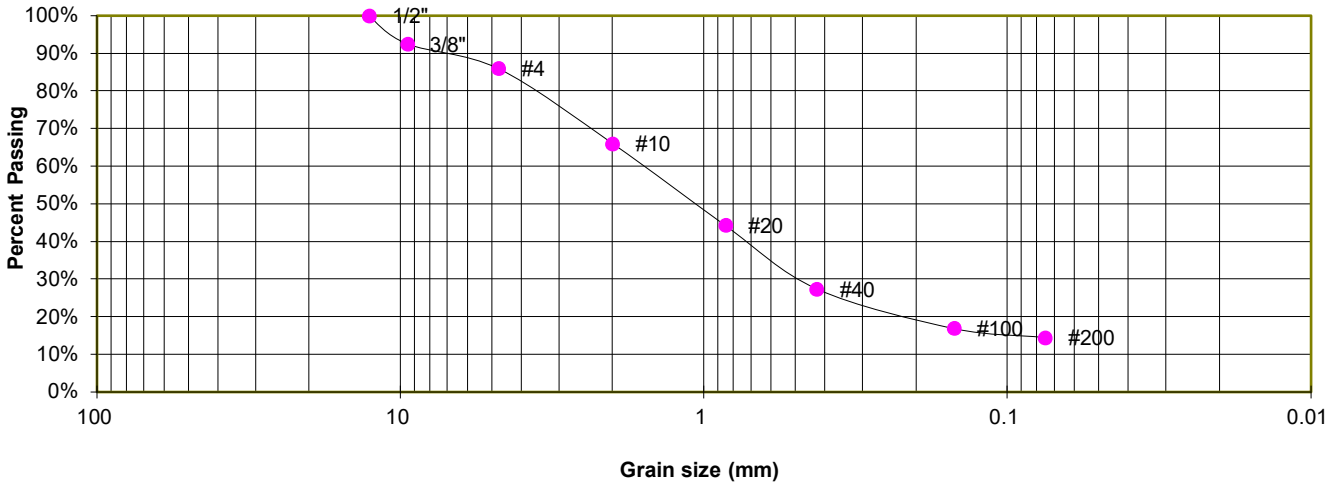
LABORATORY TEST RESULTS

RETREAT AT PRAIRIE RIDGE F2 DINES BLVD N
CLASSIC COMMUNITIES

JOB NO. 241932

FIG. B-1

TEST BORING	1	SOIL DESCRIPTION	FILL, SAND, SILTY
DEPTH (FT)	1-2	SOIL TYPE	1



GRAIN SIZE ANALYSIS

U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	100.0%
3/8"	92.5%
4	86.0%
10	66.0%
20	44.3%
40	27.4%
100	16.9%
200	14.5%

ATTERBERG LIMITS

Plastic Limit	27
Liquid Limit	40
Plastic Index	13

SOIL CLASSIFICATION

USCS CLASSIFICATION:	SM
AASHTO CLASSIFICATION:	A-2-6
AASHTO GROUP INDEX:	0

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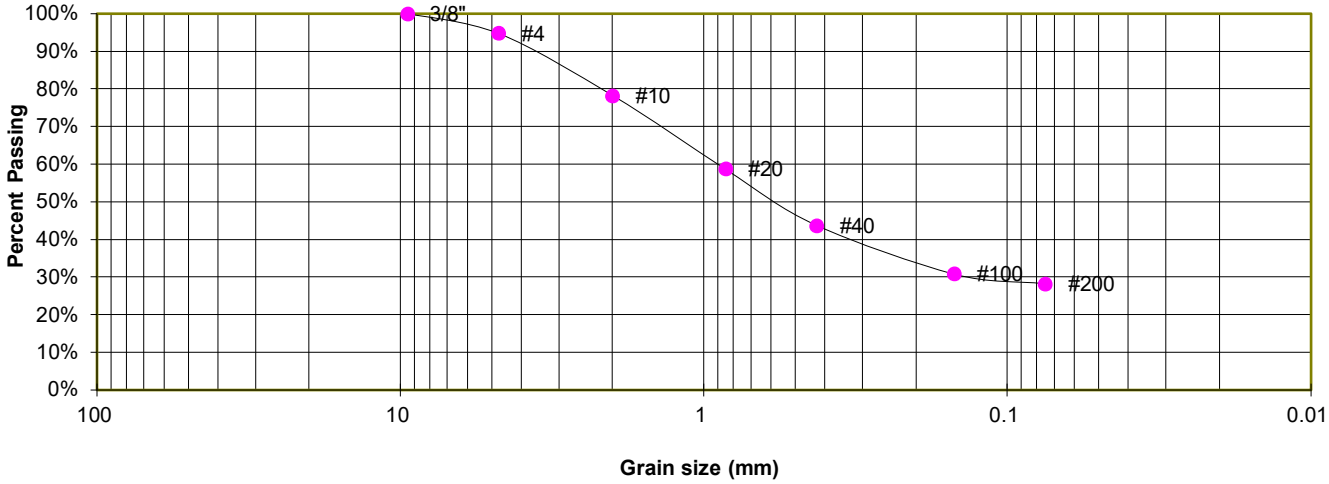
LABORATORY TEST RESULTS

RETREAT AT PRAIRIE RIDGE F2 DINES BLVD N
CLASSIC COMMUNITIES

JOB NO. 241932

FIG. B-2

TEST BORING	2	SOIL DESCRIPTION	FILL, SAND, SILTY
DEPTH (FT)	1-2	SOIL TYPE	1



GRAIN SIZE ANALYSIS

U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	94.8%
10	78.3%
20	58.7%
40	43.7%
100	30.9%
200	28.3%

ATTERBERG LIMITS

Plastic Limit	25
Liquid Limit	38
Plastic Index	13

SOIL CLASSIFICATION

USCS CLASSIFICATION:	SM
AASHTO CLASSIFICATION:	A-2-6
AASHTO GROUP INDEX:	0

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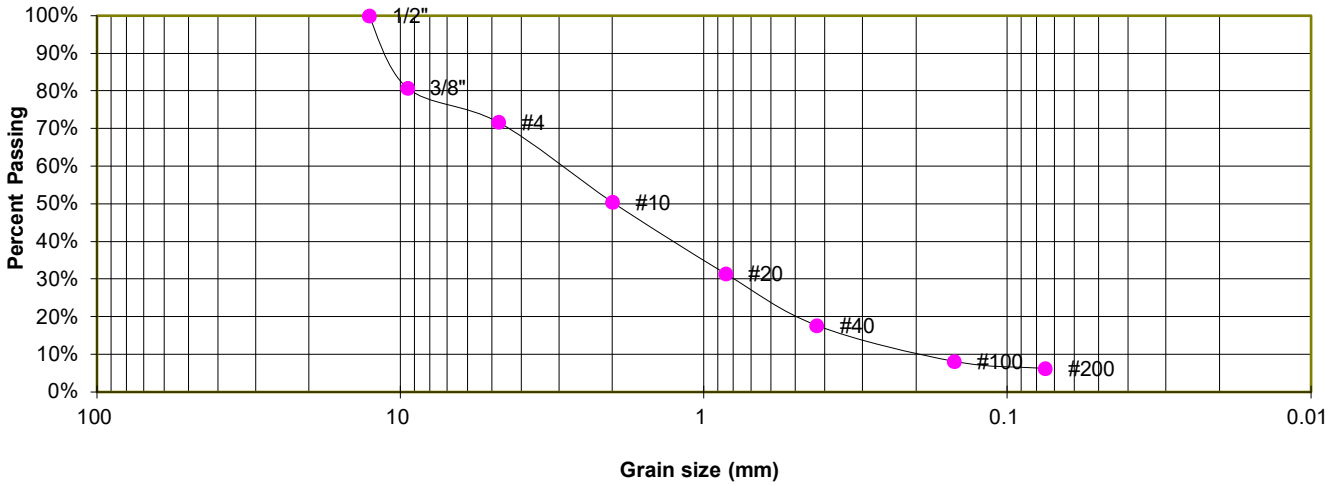
LABORATORY TEST RESULTS

RETREAT AT PRAIRIE RIDGE F2 DINES BLVD N
CLASSIC COMMUNITIES

JOB NO. 241932

FIG. B-3

TEST BORING	3	SOIL DESCRIPTION	FILL, SAND, WITH SILT
DEPTH (FT)	1-2	SOIL TYPE	1



GRAIN SIZE ANALYSIS

U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	100.0%
3/8"	80.8%
4	71.7%
10	50.5%
20	31.5%
40	17.7%
100	8.2%
200	6.3%

ATTERBERG LIMITS

Plastic Limit	NP
Liquid Limit	NV
Plastic Index	NP

SOIL CLASSIFICATION

USCS CLASSIFICATION: SW-SM
AASHTO CLASSIFICATION: A-1-b
AASHTO GROUP INDEX: 0

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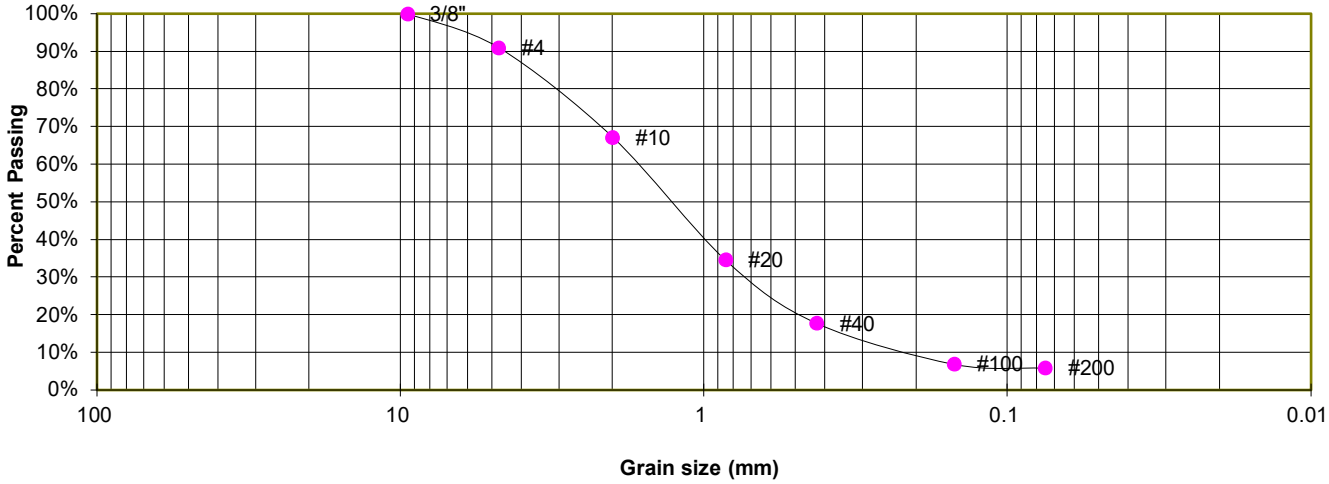
LABORATORY TEST RESULTS

RETREAT AT PRAIRIE RIDGE F2 DINES BLVD N
CLASSIC COMMUNITIES

JOB NO. 241932

FIG. B-4

TEST BORING	4	SOIL DESCRIPTION	SANDSTONE (SAND, WITH SILT)
DEPTH (FT)	1-2	SOIL TYPE	2



GRAIN SIZE ANALYSIS

U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	91.0%
10	67.2%
20	34.6%
40	17.8%
100	6.9%
200	5.9%

ATTERBERG LIMITS

Plastic Limit	NP
Liquid Limit	NV
Plastic Index	NP

SOIL CLASSIFICATION

USCS CLASSIFICATION: SW-SM
AASHTO CLASSIFICATION: A-1-b
AASHTO GROUP INDEX: 0

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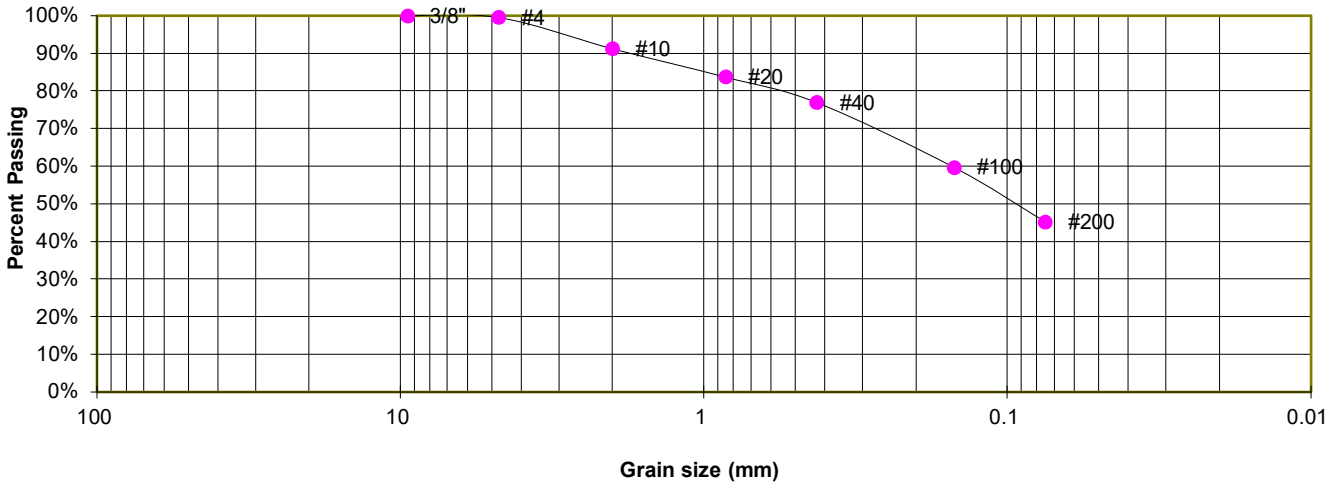
LABORATORY TEST RESULTS

RETREAT AT PRAIRIE RIDGE F2 DINES BLVD N
CLASSIC COMMUNITIES

JOB NO. 241932

FIG. B-5

TEST BORING	5	SOIL DESCRIPTION	SANDSTONE (SAND, SILTY)
DEPTH (FT)	1-2	SOIL TYPE	2



GRAIN SIZE ANALYSIS

U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	99.6%
10	91.3%
20	83.8%
40	77.0%
100	59.8%
200	45.2%

ATTERBERG LIMITS

Plastic Limit	30
Liquid Limit	46
Plastic Index	16

SOIL CLASSIFICATION

USCS CLASSIFICATION:	SM
AASHTO CLASSIFICATION:	A-7-6
AASHTO GROUP INDEX:	4

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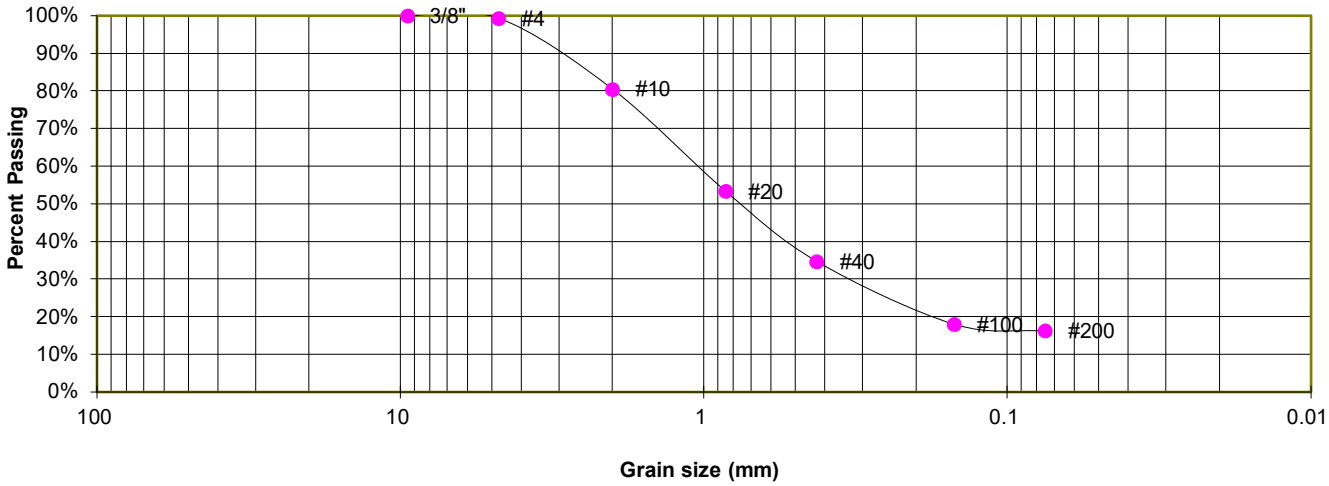
LABORATORY TEST RESULTS

RETREAT AT PRAIRIE RIDGE F2 DINES BLVD N
CLASSIC COMMUNITIES

JOB NO. 241932

FIG. B-6

TEST BORING	6	SOIL DESCRIPTION	SANDSTONE (SAND, SILTY)
DEPTH (FT)	1-2	SOIL TYPE	2



GRAIN SIZE ANALYSIS

U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	99.3%
10	80.5%
20	53.4%
40	34.7%
100	18.0%
200	16.3%

ATTERBERG LIMITS

Plastic Limit	28
Liquid Limit	36
Plastic Index	8

SOIL CLASSIFICATION

USCS CLASSIFICATION:	SM
AASHTO CLASSIFICATION:	A-2-4
AASHTO GROUP INDEX:	0

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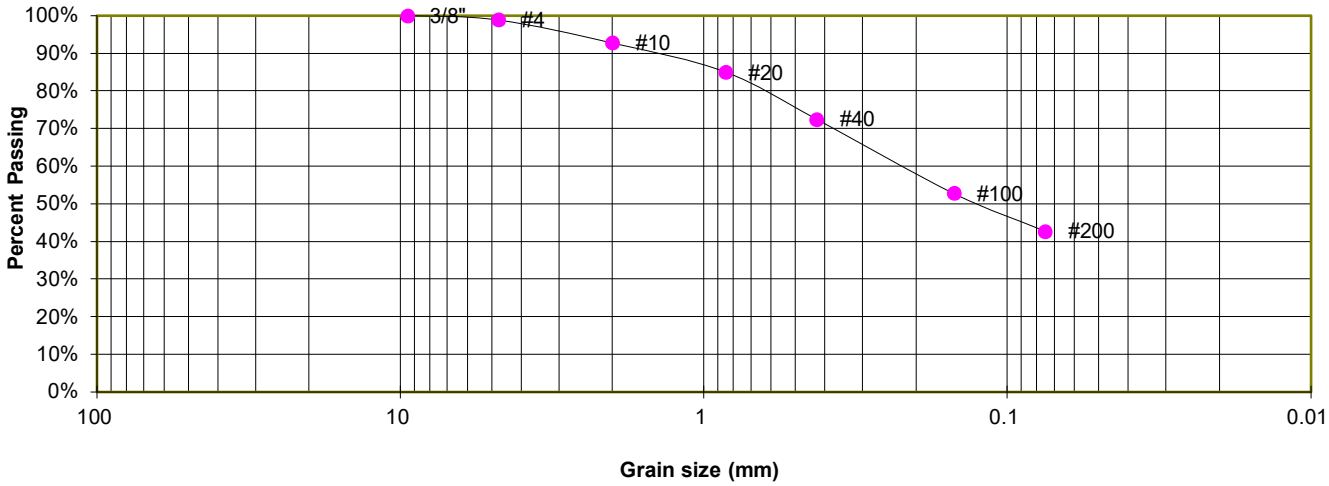
LABORATORY TEST RESULTS

RETREAT AT PRAIRIE RIDGE F2 DINES BLVD N
CLASSIC COMMUNITIES

JOB NO. 241932

FIG. B-7

TEST BORING	3	SOIL DESCRIPTION	SANDSTONE (SAND, SILTY)
DEPTH (FT)	10	SOIL TYPE	2



GRAIN SIZE ANALYSIS

U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	98.9%
10	92.8%
20	85.0%
40	72.5%
100	52.8%
200	42.7%

ATTERBERG LIMITS

Plastic Limit	27
Liquid Limit	36
Plastic Index	9

SOIL CLASSIFICATION

USCS CLASSIFICATION:	SM
AASHTO CLASSIFICATION:	A-4
AASHTO GROUP INDEX:	1

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LABORATORY TEST RESULTS

RETREAT AT PRAIRIE RIDGE F2 DINES BLVD N
CLASSIC COMMUNITIES

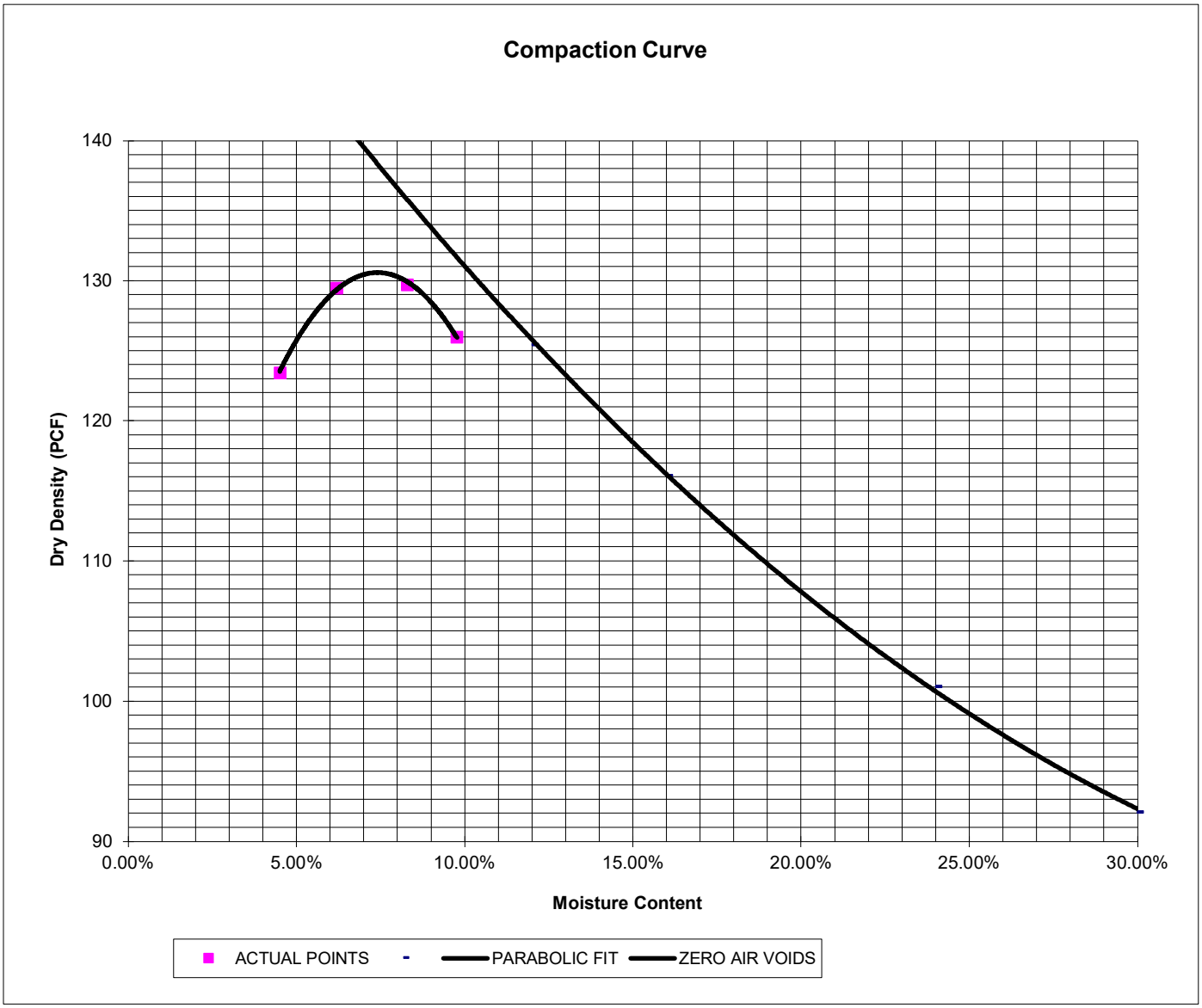
JOB NO. 241932

FIG. B-8

SAMPLE LOCATION TB-3 @ 0-3'	SOIL DESCRIPTION FILL, SAND, SILTY, GRAY
	SOIL TYPE 1

PROCTOR DATA

IDENTIFICATION:	SM
PROCTOR TEST #:	1
TEST BY:	DK
TEST DESIGNATION:	ASTM-1557-A
MAXIMUM DRY DENSITY (PCF):	130.4
OPTIMUM MOISTURE:	7.3



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LABORATORY TEST RESULTS

RETREAT AT PRAIRIE RIDGE F2 DINES BLVD N
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FIG. B-9

SAMPLE LOCATION TB-3 @ 0-3' SOIL DESCRIPTION FILL, SAND, SILTY, GRAY
SOIL TYPE 1

CBR TEST LOAD DATA

Piston Diameter (cm): 4.958
Piston Area (in^2): 2.993

Penetration Depth (inches)	*10 BLOWS* Mold # 1 Load (lbs)	Stress (psi)	*25 BLOWS* Mold # 2 Load (lbs)	Stress (psi)	*56 BLOWS* Mold # 3 Load (lbs)	Stress (psi)
0.000	0	0.00	0	0.00	0	0.00
0.025	521	174.10	811	271.01	1439	480.87
0.050	718	239.93	1067	356.56	2068	691.06
0.075	840	280.70	1411	471.51	2683	896.57
0.100	1008	336.84	1795	599.83	3214	1074.02
0.125	1126	376.27	1998	667.67	3780	1263.15
0.150	1215	406.01	2239	748.20	4228	1412.86
0.175	1283	428.74	2456	820.72	4701	1570.92
0.200	1350	451.13	2680	895.57	5453	1822.22
0.300	1695	566.41	3460	1156.22	6000	2005.01
0.400	1934	646.28	4014	1341.35		
0.500	2216	740.52	4716	1575.94		

MOISTURE AND DENSITY DATA

	Mold # 1	Mold # 2	Mold # 3
Can #	500	501	502
Wt. Can	8.38	8.33	8.33
Wt. Can+Wet	294.45	267.93	234.91
Wt. Can+Dry	267.17	246.98	217.62
Wt. H20	27.28	20.95	17.29
Wt. Dry Soil	258.79	238.65	209.29
Moisture Content	10.54%	8.78%	8.26%
Wet Density (PCF)	127.2	132.3	137.4
Dry Density (PCF)	118.5	123.3	128.0
% Compaction	91%	95%	98%
CBR	33.68	59.98	107.40

PROCTOR DATA

Maximum Dry Density (pcf)	130.4
Optimum Moisture	7.3
90% of Max. Dry Density (pcf)	117.4
95% of Max. Dry Density (pcf)	123.9

CBR at 90% of Max. Density = 27.2 ~ R VALUE 73
CBR at 95% of Max. Density = 65.8 ~ R VALUE 81

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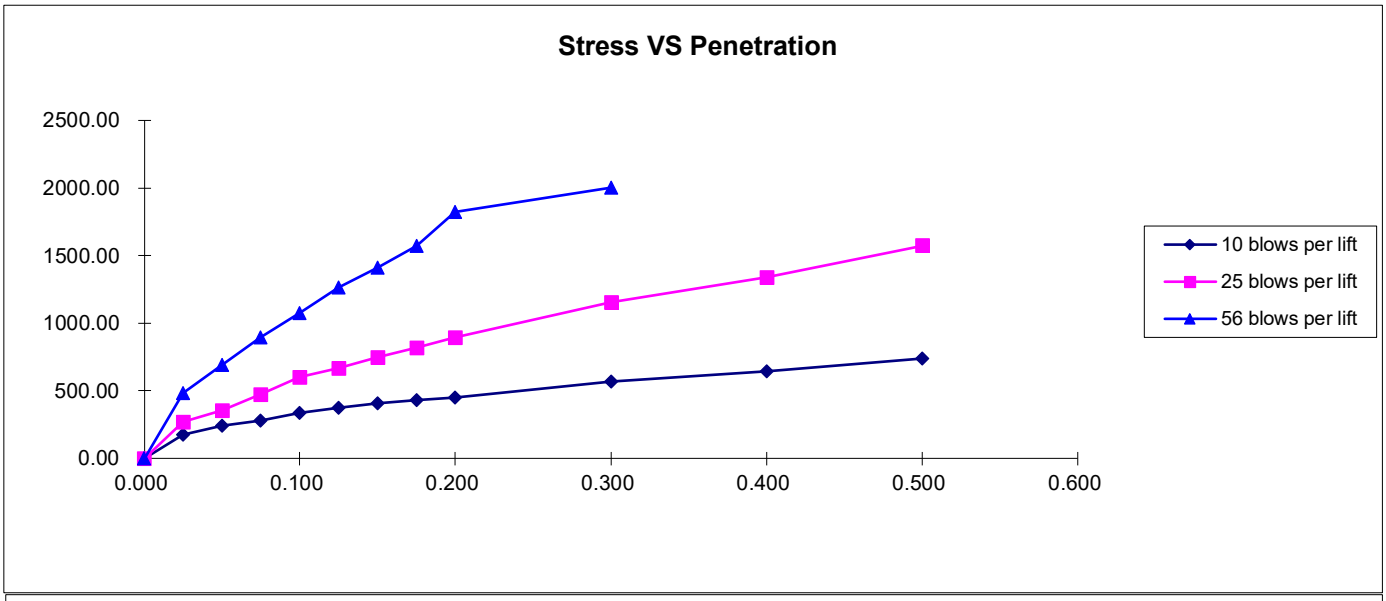
LABORATORY TEST RESULTS

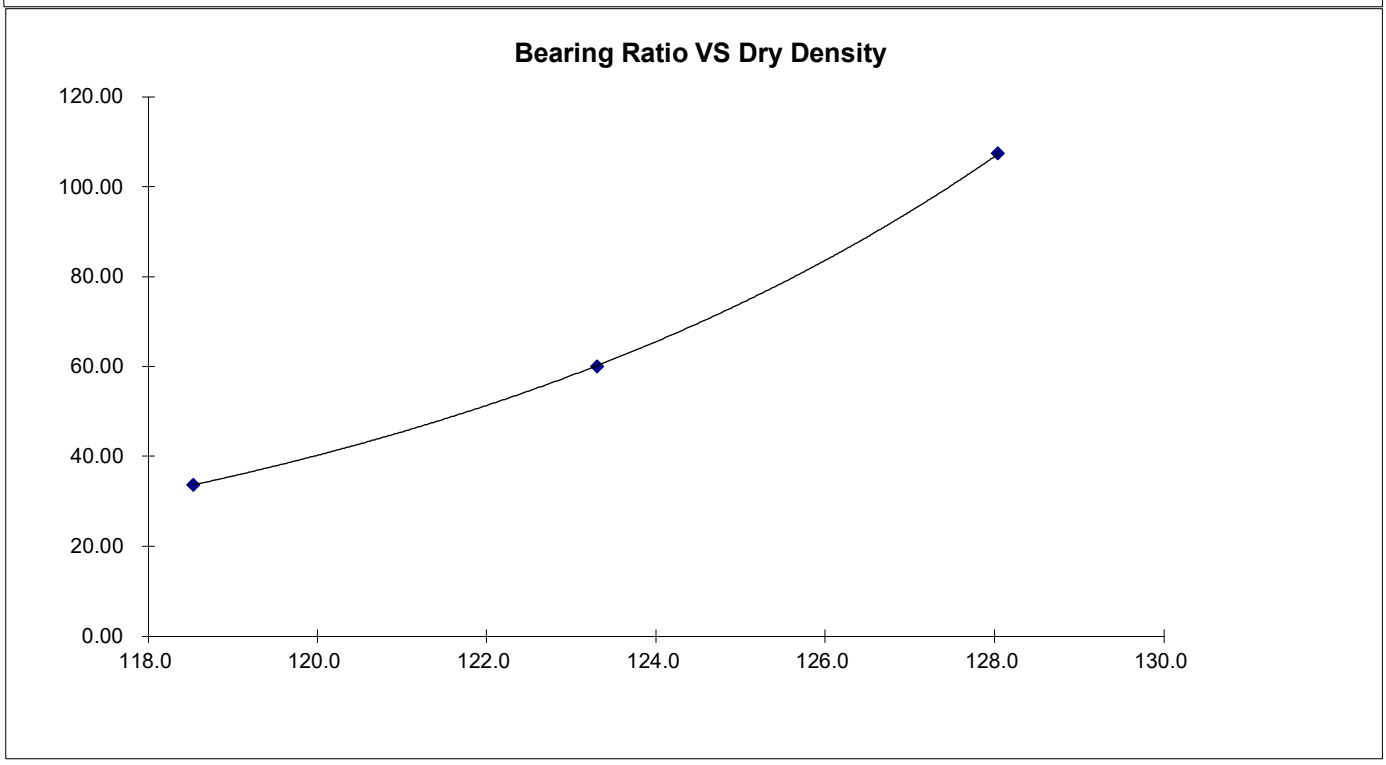
RETREAT AT PRAIRIE RIDGE F2 DINES BLVD N
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FIG. B-10

SAMPLE LOCATION TB-3 @ 0-3'	SOIL DESCRIPTION FILL, SAND, SILTY, GRAY
	SOIL TYPE 1





ENTECH ENGINEERING, INC.

LABORATORY TEST RESULTS

RETREAT AT PRAIRIE RIDGE F2 DINES BLVD N
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FIG. B-11

APPENDIX C: Pavement Design Calculations

FLEXIBLE PAVEMENT DESIGN

PROJECT DATA

Project Location: Retreat at Prairie Ridge, Filing No. 2

Job Number: 241932

DESIGN DATA

Equivalent (18-kip) Single Axle Load Applications (ESAL):	ESAL (W_{18}) =	821,000
Design CBR	CBR =	10
Standard Deviation	S_o =	0.45
Loss in Serviceability	Δpsi =	2.0
Reliability	Reliability =	85
Reliability (z-statistic)	Z_R =	-1.04
Soil Resilient Modulus	M_R =	15,000 psi

Required Structural Number (SN): → SN = 2.44

DESIGN EQUATIONS

Resilient Modulus

If using CBR:

$M_R = (CBR) \times 1{,}500$

If using R-Value:

$M_R = 10^{[(S_1 + 18.72) / 6.24]}$ where: $S_1 = [(R\text{-value} - 5) / 11.29] + 3$

Required Structural Number

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

Pavement Section Thickness

$SN^* = C_1D_1 + C_2D_2$ where:

C_1 = Strength Coefficient - HMA

C_2 = Strength Coefficient - ABC/RCB

D_1 = Depth of HMA (inches)

D_2 = Depth of ABC/RCB (inches)

RECOMMENED THICKNESSES

Layer	Material	Structural Layer	Thickness (D^*_i)	SN^*_i	SN
1	HMA	C_1 = 0.44	4.0 inches	1.760	-
2	ABC/RCB	C_2 = 0.11	8.0 inches	0.880	
			SN* =	2.640	2.44

Pavement SN > Required SN, Design is Acceptable

FIG. C-1

FLEXIBLE PAVEMENT DESIGN

PROJECT DATA

Project Location: Retreat at Prairie Ridge, Filing No. 2

Job Number: 241932

DESIGN DATA

Equivalent (18-kip) Single Axle Load Applications (ESAL):	ESAL (W_{18}) =	821,000
Design CBR	CBR =	10
Standard Deviation	S_o =	0.45
Loss in Serviceability	Δpsi =	2.0
Reliability	Reliability =	85
Reliability (z-statistic)	Z_R =	-1.04
Soil Resilient Modulus	M_R =	15,000 psi

Required Structural Number (SN): → SN = 2.44

DESIGN EQUATIONS

Resilient Modulus

If using CBR: $M_R = (CBR) \times 1{,}500$

If using R-Value: $M_R = 10^{[(S_1 + 18.72) / 6.24]}$ where: $S_1 = [(\text{R-value} - 5) / 11.29] + 3$

Required Structural Number

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

Pavement Section Thickness

$SN^* = C_1D_1 + C_2D_2$ where: C_1 = Strength Coefficient - HMA

C_2 = Strength Coefficient - CTS

D_1 = Depth of HMA (inches)

D_2 = Depth of CTS (inches)

RECOMMENED THICKNESSES

Layer	Material	Structural Layer	Thickness (D^*_i)	SN^*_i	SN
1	HMA	C_1 = 0.44	4.0 inches	1.760	-
2	CTS	C_2 = 0.11	8.0 inches	0.880	
			SN* =	2.640	2.44

Pavement SN > Required SN, Design is Acceptable

FIG. C-2