August 1, 2023

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

Eagle Forest Development
4920 Northpark Loop
Colorado Springs, CO 80918

Attn: Andy Mohr

Re: Pavement Recommendations
Eagle Forest Subdivision – Eagle Forest Drive
El Paso County, Colorado
Entech Job No. 221784

Dear Mr. Mohr:

As requested, Entech Engineering, Inc. (Entech) obtained samples of the subgrade soils from Eagle Forest Drive to provide pavement recommendations. The site is located in the subdivision called Eagle Forest Subdivision north of Shoup Road in El Paso County, Colorado. This letter presents the results of our Subsurface Soil Investigation, laboratory testing, and provides pavement recommendations for the roadway.

Project Description

The new roadway to be paved is an approximately 3,000-foot-long section of Eagle Forest Drive extending north from Shoup Road and bending westward to form a cul-de-sac.

Subsurface Explorations and Laboratory Testing

Subsurface conditions at the project site were explored by drilling eight test borings on July 12, 2023. The site layout and the locations of the test borings are shown on the Site and Exploration Plan, Figure 1. 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 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 and bedrock samples were obtained from the borings utilizing the Standard Penetration Test (ASTM D-1586) using a split-barrel 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 and bedrock samples recovered from the borings were visually classified and recorded on the boring logs. The soil and bedrock classifications were later verified utilizing laboratory testing and grouped by soil type. The soil and bedrock type numbers are included on the boring logs. It should be understood that the soil and bedrock descriptions shown on the boring logs may vary between boring location and sample depths. It should also be noted that the lines of stratigraphic separation shown on the boring logs represent approximate boundaries between soil and bedrock types and the actual stratigraphic transitions may be more gradual or variable with location.

Water content testing (ASTM D-2216) was performed on the samples recovered from the borings, and the results are shown on the boring logs. Grain-Size Analysis (ASTM D-422) and Atterberg Limits testing (ASTM D-4318) were performed on selected samples to assist in classifying the

materials encountered in the borings. Swell/Consolidation testing (ASTM D-4546) was performed to evaluate the expansive/compressive characteristics of select soil and bedrock samples. 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 summarized on Table B-1.

Subgrade Conditions

The test borings were completed along the proposed roadway alignment. The soils encountered in the test borings consisted of four general soil types; Type 1; silty to clayey sand fill, Type 2; native silty to clayey sand with silt, Type 3; weathered sandstone bedrock (silty to clayey sand when classified as a soil), and Type 4; claystone (sandy clay when classified as a soil). The Type 1 subgrade soils classified as A-2-4, the Type 2 soils classified as A-1-b, A-2-4, A-6 and A-4 and the Type 3 Soils classified as A-1-b, A-2-6 and A-2-4 soils, based on the AASHTO classification system. The Type 4 claystone was generally encountered only in TB-7 below the subgrade influence zone. Sulfate testing indicated that the soils exhibit a negligible potential for sulfate attack. Groundwater was not encountered in the test borings.

Swell/Consolidation testing was performed on several samples of the subgrade and underlying soils which indicated volume changes of 0.1 to 0.9 percent, which indicates low swell potentials. A Swell Test on the claystone resulted in volume change of 3.5 percent, which indicates a high swell potential. Due to its depth, the claystone will likely not affect the pavement subgrade. Laboratory test results are presented in Appendix B and are summarized on Table B-1.

California Bearing Ratio (CBR) testing was performed on a representative sample of Soil Type 3 to determine the support characteristics of the subgrade soil for the roadway sections. The Type 3 soils generally exhibit good subgrade support characteristics. The results of the CBR testing, are presented in Appendix B and summarized as follows:

Exhibit 1: Subsurface Laboratory Testing Summary

Design Parameter	Value
Soil Type	1 – Sandstone (Clayey Sand)
CBR at 95%	7.22
Design CBR	7.22
Liquid Limit	32
Plasticity Index	17
Percent Passing 200	28.9
AASHTO Classification	A-2-6
Group Index	1
Unified Soils Classification	SC

Pavement Design

The CBR testing was used to determine the design subgrade modulus for the roadway. The pavement sections were determined utilizing the El Paso County "Pavement Design Criteria and Report." ESAL values were obtained from the Traffic Impact Study performed by LSC Transportation Consultants, LLC dated January 13, 2021, LSC Job No. S204230, PCD File No. PUDSP206. The new asphalt portion of Eagle Forest Road classifies as a rural local residential road with an 18-kip equivalent single axle load (ESAL) value of 36,500.

Pavement alternatives for asphalt over aggregate base course and for are provided. Design parameters used in the pavement analysis are as follows:

Exhibit 2: Pavement Design Parameters

Design Parameter	Value
Reliability (Local Roadway)	75%
Standard Deviation	0.45
Serviceability Loss (Δ psi)	2.0
Design CBR	7.22
Resilient Modulus	10,830 psi
Structural Coefficients	
Hot Bituminous Pavement	0.44
Aggregate Basecourse	0.11

Pavement calculations are attached in Appendix C. Pavement sections recommended for this phase of the filing are summarized as follows:

Recommended Pavement Sections

Pavement Area	Design ESAL	Alternative
Eagle Forest Road (New Asphalt)	36,500	1. 3.0 inches HMA over 4.0 inches ABC

ABC = Aggregate Base Course; ESAL = equivalent single axle loads; HMA = Hot Mix Asphalt;

Note:

1. Full depth sections are not allowed.

Swelling Soils Mitigation

El Paso County criteria requires mitigation of expansive soils for roadway subgrade that have a swell of 2 percent or greater with a 150 pound per square foot surcharge. Based on the swell testing, mitigation for expansive soils is not anticipated to be required for the subgrade soils on this site, considering that the AASHTO A-6 soils were encountered at depths below the subgrade influence zone.

Roadway Subgrade Preparation

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 identified during proofrolling 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.

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

Based on the soils encountered, subgrade soil problem areas, if any, will be identified at proof roll. We do not anticipate issues with the subgrade in regards to shallow water, frost susceptible soils, groundwater or drainage conditions, soluble sulfates, or cold weather construction.

In addition to the above guidance, the asphalt, 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:JCG/dps

Encl.

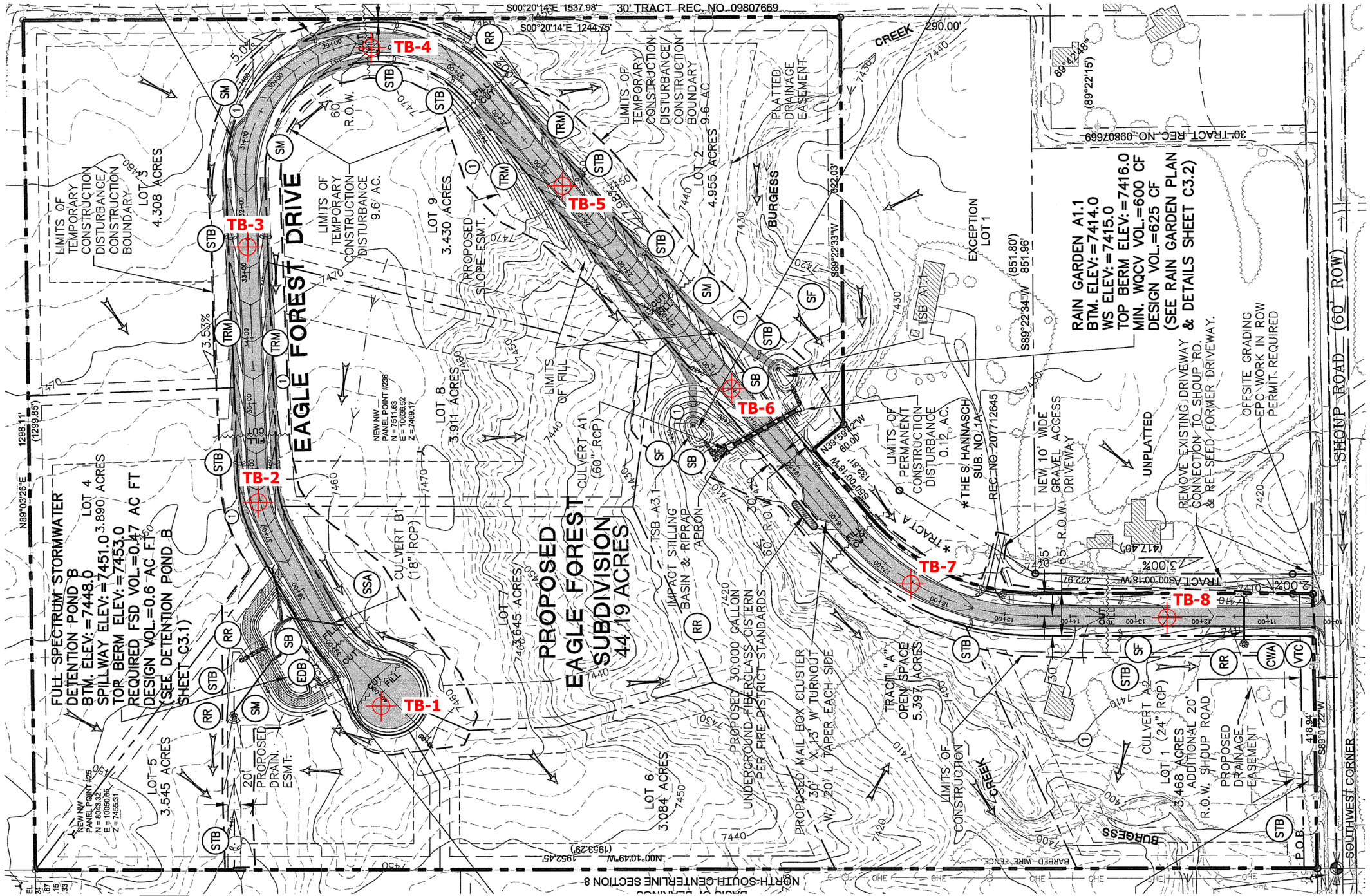
Reviewed by:

Digitally signed by Austin M Nossokoff
Date: 2023.08.01 09:26:23 -06'00'

COLORADO LICENSED
AUSTIN M NOSSOKOFF
53477
PROFESSIONAL ENGINEER

Austin M. Nossokoff, P.E.
Project Engineer

EPC Project No. SF2131



TB- APPROXIMATE TEST BORING LOCATION AND NUMBER

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SITE AND EXPLORATION PLAN
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JOB NO. 221784

FIG. 1

APPENDIX A: Test Boring Logs

TABLE A-1

DEPTH TO BEDROCK

TEST BORING	DEPTH TO BEDROCK (ft.)
1	4
2	4
3	1
4	4
5	1
6	>10
7	1
8	1

TEST BORING 1
DATE DRILLED 7/12/2023

REMARKS

DRY TO 5', 7/12/23

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
			17	8.8	2
5			50/11"	10.6	3
10					
15					
20					

SAND, WITH SILT, BROWN, MEDIUM DENSE, MOIST

SANDSTONE, WEAK, BROWN, HIGHLY WEATHERED. (SAND, CLAYEY, VERY DENSE, MOIST)

TEST BORING 2
DATE DRILLED 7/12/2023

REMARKS

DRY TO 5', 7/12/23

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
			12	10.4	1
5			50/11"	9.9	3
10					
15					
20					

FILL 0-4', SAND, SILTY, BROWN, MEDIUM DENSE, MOIST

SANDSTONE, VERY WEAK, BROWN, COMPLETELY WEATHERED. (SAND, WITH SILT, VERY DENSE, MOIST)

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TEST BORING LOGS

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FIG. A-1

TEST BORING 3
DATE DRILLED 7/12/2023

REMARKS

DRY TO 10', 7/12/23

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
					2
			50/10"	8.8	3
5			50/7"	8.0	3
10			50/8"	9.7	3
15					
20					

SAND, CLAYEY, BROWN SANDSTONE, WEAK to VERY WEAK, BROWN, HIGHLY WEATHERED. (SAND, CLAYEY, VERY DENSE, MOIST)

TEST BORING 4
DATE DRILLED 7/12/2023

REMARKS

DRY TO 5', 7/12/23

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
			20	10.7	2
5			50/11"	9.2	3
10					
15					
20					

SAND, SILTY, BROWN, MEDIUM DENSE, MOIST

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

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TEST BORING LOGS

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FIG. A-2

TEST BORING 5
DATE DRILLED 7/12/2023

REMARKS

DRY TO 5', 7/12/23

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
					2
			50	15.8	3
			9"		
5			50	14.6	3
			10"		
10					
15					
20					

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

TEST BORING 6
DATE DRILLED 7/12/2023

REMARKS

DRY TO 10', 7/12/23

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
			18	10.9	1
5			19	11.8	2
10			20	7.1	2
15					
20					

FILL 0-3', SAND, SILTY, BROWN, MEDIUM DENSE, MOIST

SAND, CLAYEY, BROWN to BLACK, MEDIUM DENSE, MOIST

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TEST BORING LOGS

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FIG. A-3

TEST BORING 7
DATE DRILLED 7/12/2023

REMARKS

DRY TO 5', 7/12/23

SAND, CLAYEY
SANDSTONE, WEAK, BROWN, HIGHLY WEATHERED, (SAND, CLAYEY, VERY DENSE, MOIST)
CLAYSTONE, WEAK, GRAY, MODERATELY WEATHERED, WITH IRON OXIDATION. (CLAY, SANDY, HARD, MOIST

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
			50/10"	6.2	3
5			50/8"	16.8	4
10					
15					
20					

TEST BORING 8
DATE DRILLED 7/12/2023

REMARKS

DRY TO 5', 7/12/23

FILL 0-1', SAND, CLAYEY, BROWN
SANDSTONE, VERY WEAK, BROWN, HIGHLY WEATHERED. (SAND, CLAYEY, DENSE to VERY DENSE, MOIST)

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
					1
			39	14.5	3
5			50/9"	10.1	3
10					
15					
20					

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TEST BORING LOGS

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FIG. A-4

APPENDIX B: Laboratory Test Results

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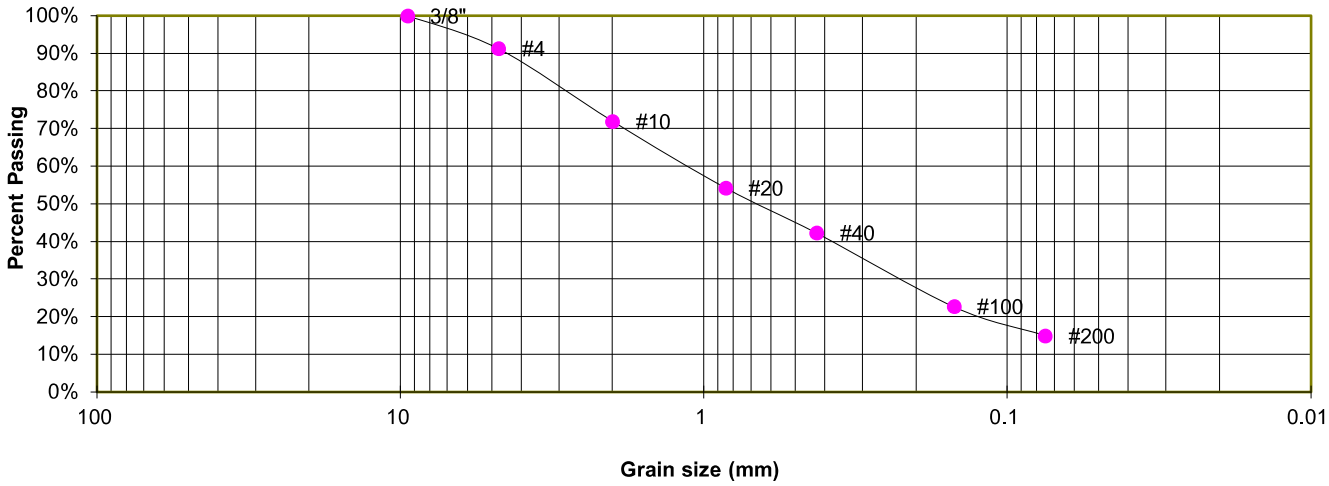
TABLE B-1
SUMMARY OF LABORATORY TEST RESULTS

SOIL TYPE	TEST BORING NO.	DEPTH (FT)	WATER (%)	DRY DENSITY (PCF)	PASSING NO. 200 SIEVE (%)	LIQUID LIMIT	PLASTIC LIMIT	PLASTIC INDEX	SULFATE (WT %)	SWELL/ CONSOL (%)	AASHTO CLASS.	USCS	SOIL DESCRIPTION
1	2	1-2			14.9	NV	NP	NP	<0.01		A-2-4	SM	FILL, SAND, SILTY
1	6	1-2			25.9	NV	NP	NP	<0.01		A-2-4	SM	FILL, SAND, SILTY
2	1	1-2			10.4	NV	NP	NP			A-1-b	SW-SM	SAND, WITH SILT
2	4	1-2			18.7	NV	NP	NP			A-2-4	SM	SAND, SILTY
2	6	5	15.0	112.2	36.5	34	18	16	<0.01	0.8	A-6	SC	SAND, CLAYEY
2	6	10			21.9	29	19	10			A-4	SC	SAND, CLAYEY
2	6	0-3			65.7							SM	SAND, SILTY
3, CBR	3	1-3	9.9	115.9	28.9	32	15	17		0.4	A-2-6	SC	SANDSTONE. (SAND, CLAYEY)
3	3	1-2	14.6	112.6	23.1	36	20	16		0.3	A-2-6	SC	SANDSTONE. (SAND, CLAYEY)
3	5	1-2			21.9	NV	NP	NP			A-2-4	SM	SANDSTONE. (SAND, SILTY)
3	7	1-2	14.8	111.7	26.1	29	15	14		0.9	A-2-6	SC	SANDSTONE. (SAND, CLAYEY)
3	8	1-2	13.5	111.3	34.9	32	18	14		0.5	A-2-6	SC	SANDSTONE. (SAND, CLAYEY)
3	1	5	14.8	111.2	24.6	37	18	19		0.1	A-2-6	SC	SANDSTONE. (SAND, CLAYEY)
3	2	5			10.9	NV	NP	NP	<0.01		A-1-b	SW-SM	SANDSTONE. (SAND, WITH SILT)
3	4	5			18.2	NV	NP	NP			A-2-4	SM	SANDSTONE. (SAND, SILTY)
4	7	5	17.3	110.0	65.7	40	20	20	<0.01	3.5	A-6	CL	CLAYSTONE. (CLAY, SANDY)

Project: Eagle Forest Drive
Client: Eagle Forest Development
Job No: 221784

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	91.2%
10	71.9%
20	54.3%
40	42.3%
100	22.7%
200	14.9%

ATTERBERG LIMITS

Plastic Limit	NP
Liquid Limit	NV
Plastic Index	NP

SOIL CLASSIFICATION

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

ENTECH ENGINEERING, INC.

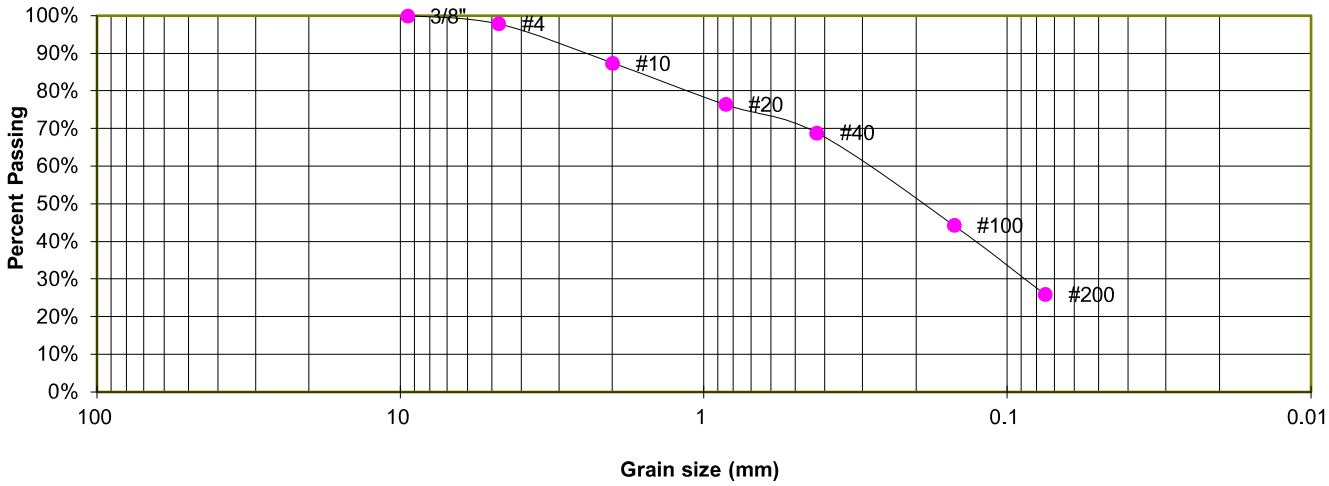
LABORATORY TEST RESULTS

EAGLE FOREST DRIVE
EAGLE FOREST DEVELOPMENT

JOB NO. 221784

FIG. B-1

TEST BORING	6	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	97.9%
10	87.4%
20	76.4%
40	68.9%
100	44.3%
200	25.9%

ATTERBERG LIMITS

Plastic Limit	NP
Liquid Limit	NV
Plastic Index	NP

SOIL CLASSIFICATION

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

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LABORATORY TEST RESULTS

EAGLE FOREST DRIVE
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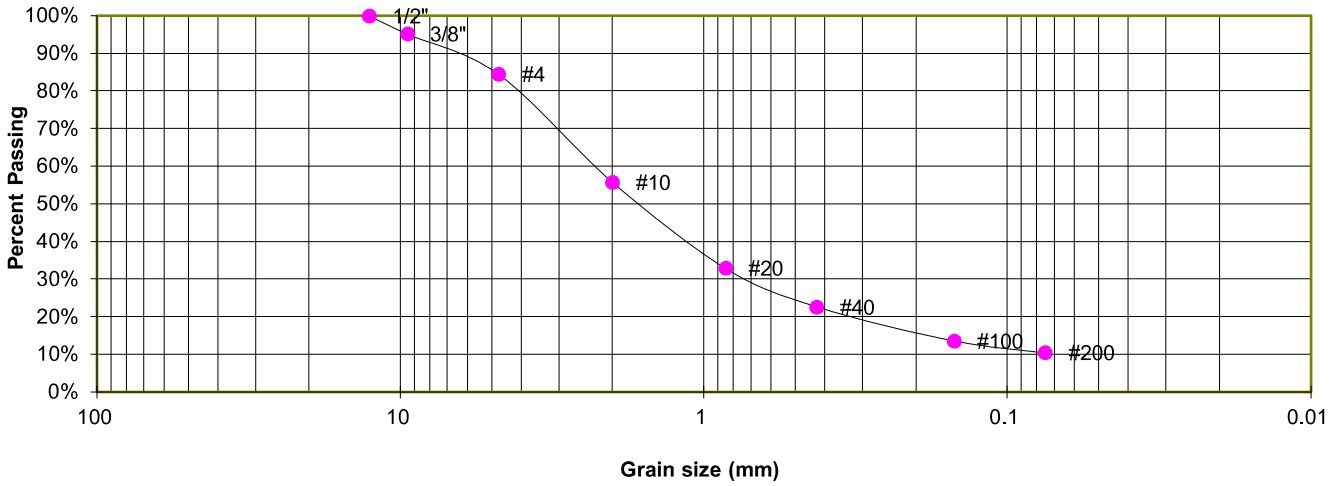
JOB NO. 221784

FIG. B-2

TEST BORING	1	SOIL DESCRIPTION	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"	100.0%
3/8"	95.2%
4	84.5%
10	55.7%
20	32.9%
40	22.6%
100	13.6%
200	10.4%

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

EAGLE FOREST DRIVE
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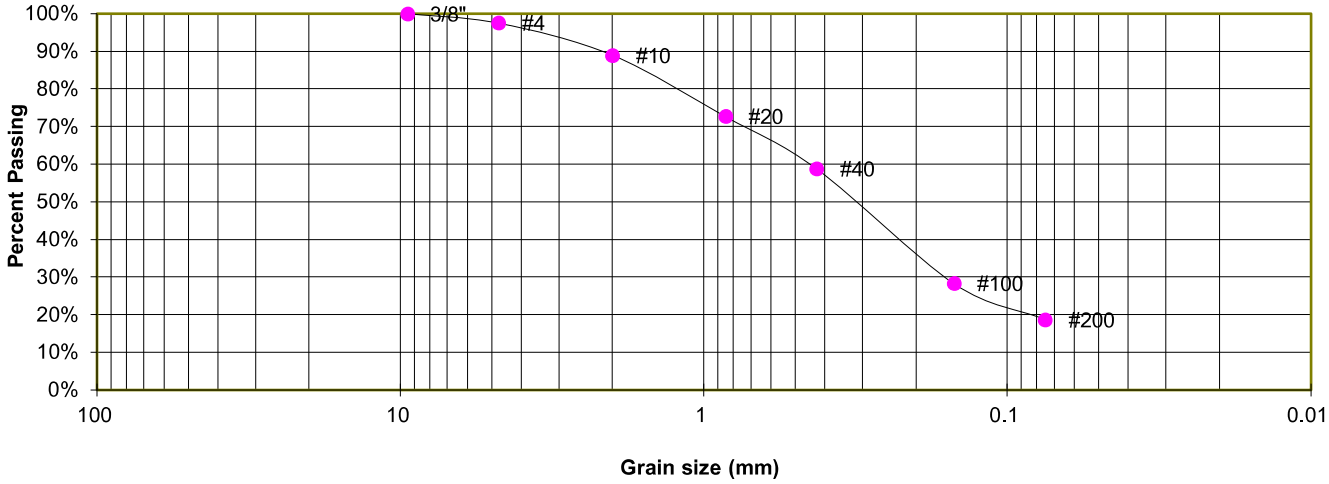
JOB NO. 221784

FIG. B-3

TEST BORING	4	SOIL DESCRIPTION	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	97.6%
10	88.9%
20	72.7%
40	58.8%
100	28.3%
200	18.7%

ATTERBERG LIMITS

Plastic Limit	NP
Liquid Limit	NV
Plastic Index	NP

SOIL CLASSIFICATION

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

ENTECH ENGINEERING, INC.

LABORATORY TEST RESULTS

EAGLE FOREST DRIVE
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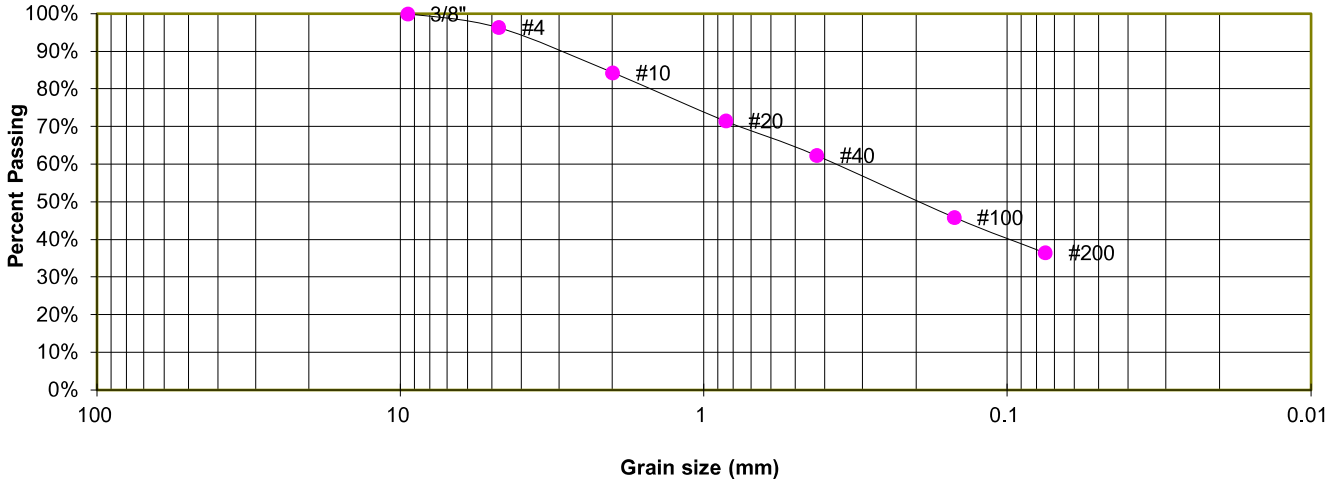
FIG. B-4

TEST BORING	6	SOIL DESCRIPTION	SAND, CLAYEY
DEPTH (FT)	5	SOIL TYPE	2



GRAIN SIZE ANALYSIS

U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	96.4%
10	84.4%
20	71.5%
40	62.4%
100	45.9%
200	36.5%

ATTERBERG LIMITS

Plastic Limit	18
Liquid Limit	34
Plastic Index	16

SOIL CLASSIFICATION

USCS CLASSIFICATION:	SC
AASHTO CLASSIFICATION:	A-6
AASHTO GROUP INDEX:	1

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LABORATORY TEST RESULTS

EAGLE FOREST DRIVE
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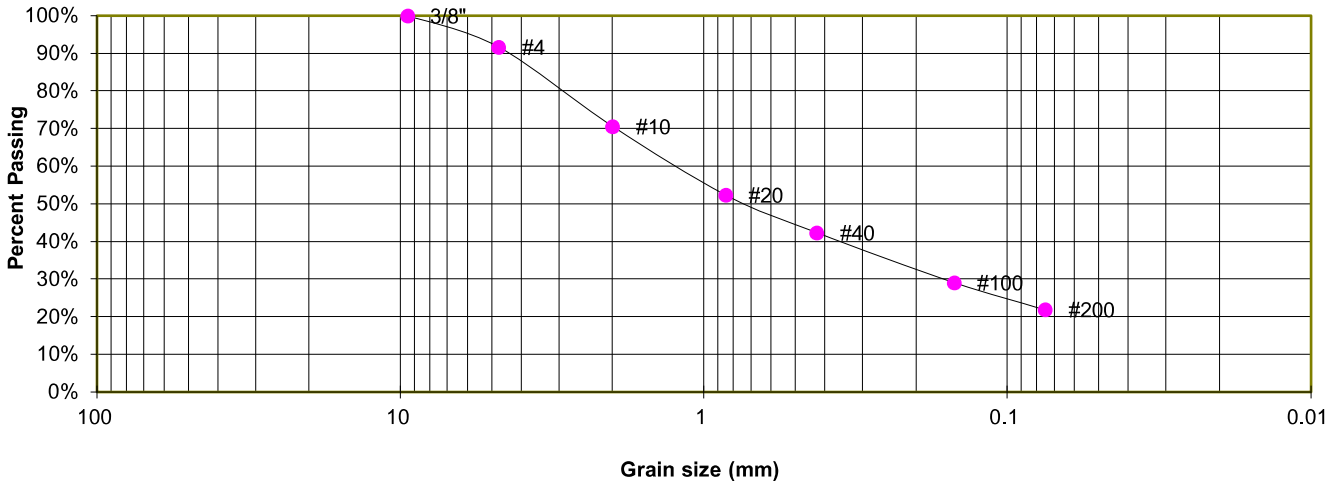
FIG. B-5

TEST BORING	6	SOIL DESCRIPTION	SAND, CLAYEY
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	91.7%
10	70.6%
20	52.4%
40	42.3%
100	29.1%
200	21.9%

ATTERBERG LIMITS

Plastic Limit	19
Liquid Limit	29
Plastic Index	10

SOIL CLASSIFICATION

USCS CLASSIFICATION:	SC
AASHTO CLASSIFICATION:	A-4
AASHTO GROUP INDEX:	0

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LABORATORY TEST RESULTS

EAGLE FOREST DRIVE
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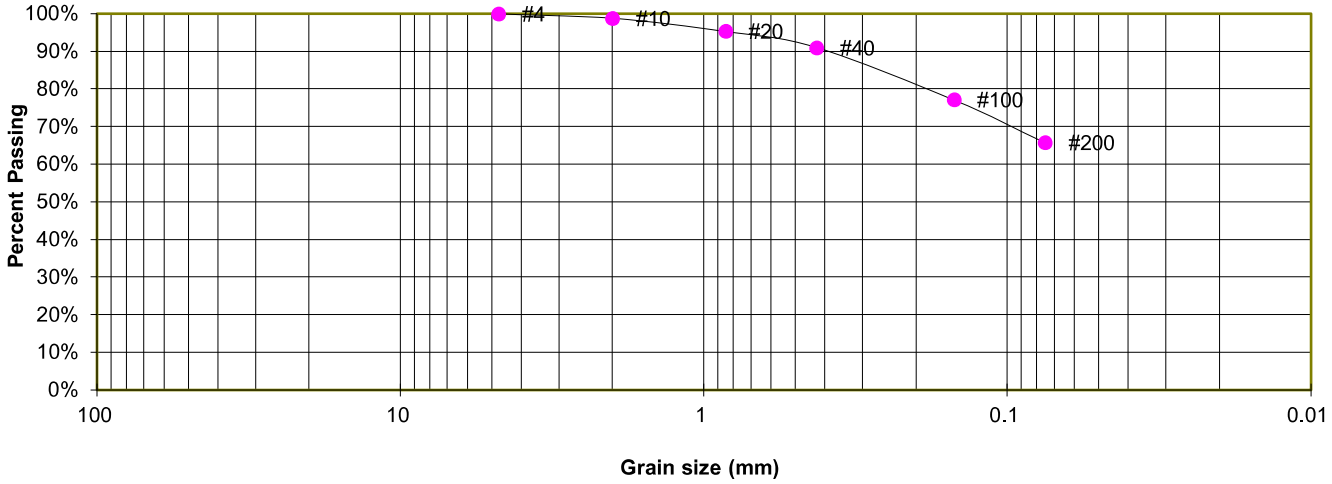
JOB NO. 221784

FIG. B-6

TEST BORING	6	SOIL DESCRIPTION	SAND, SILTY
DEPTH (FT)	0-3	SOIL TYPE	2



GRAIN SIZE ANALYSIS

U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	
4	100.0%
10	98.8%
20	95.3%
40	91.0%
100	77.2%
200	65.7%

SOIL CLASSIFICATION

USCS CLASSIFICATION: SM
AASHTO CLASSIFICATION:
AASHTO GROUP INDEX:

ENTECH ENGINEERING, INC.

LABORATORY TEST RESULTS

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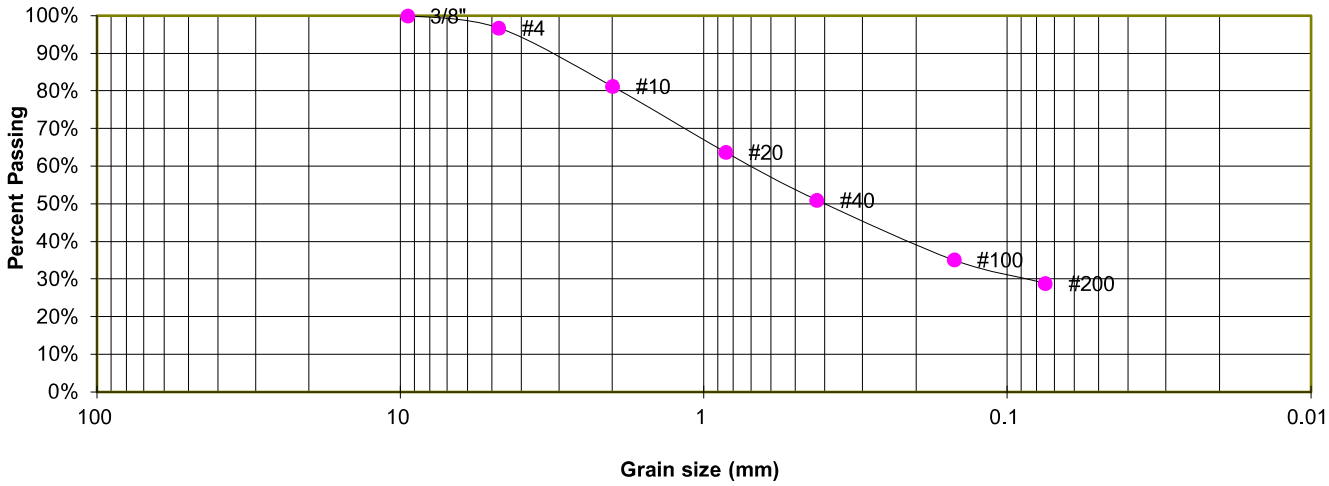
FIG. B-7

TEST BORING 3	SOIL DESCRIPTION SANDSTONE. (SAND, CLAYEY)
DEPTH (FT) 1-3	SOIL TYPE 3, CBR



GRAIN SIZE ANALYSIS

U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	96.8%
10	81.2%
20	63.8%
40	51.0%
100	35.2%
200	28.9%

ATTERBERG LIMITS

Plastic Limit	15
Liquid Limit	32
Plastic Index	17

SOIL CLASSIFICATION

USCS CLASSIFICATION:	SC
AASHTO CLASSIFICATION:	A-2-6
AASHTO GROUP INDEX:	1

ENTECH ENGINEERING, INC.

LABORATORY TEST RESULTS

EAGLE FOREST DRIVE
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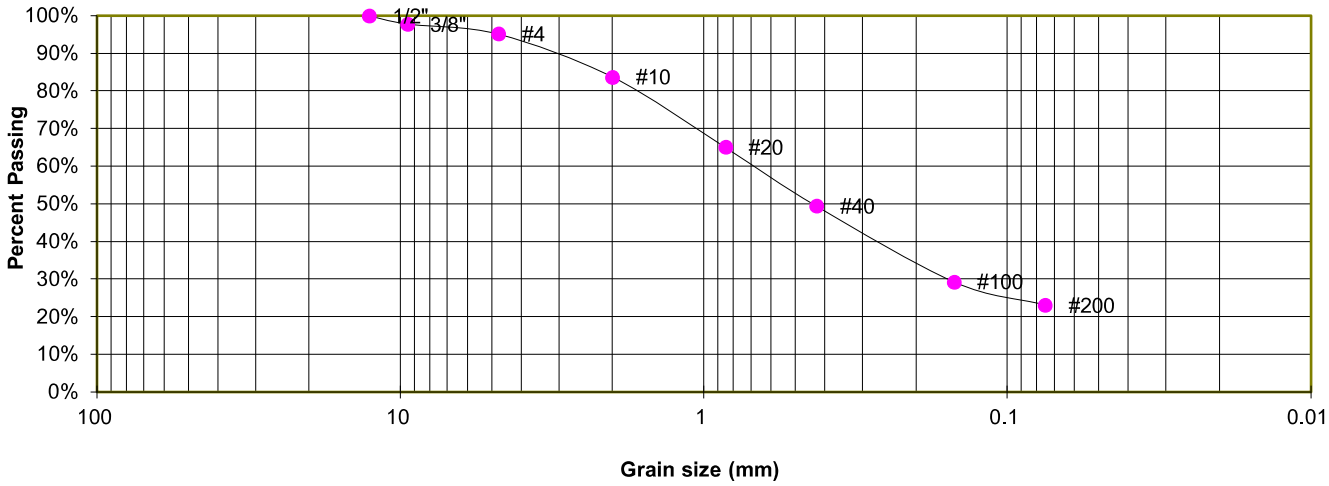
JOB NO. 221784

FIG. B-8

TEST BORING	3	SOIL DESCRIPTION	SANDSTONE. (SAND, CLAYEY)
DEPTH (FT)	1-2	SOIL TYPE	3



GRAIN SIZE ANALYSIS

U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	100.0%
3/8"	97.8%
4	95.1%
10	83.7%
20	65.0%
40	49.4%
100	29.3%
200	23.1%

ATTERBERG LIMITS

Plastic Limit	20
Liquid Limit	36
Plastic Index	16

SOIL CLASSIFICATION

USCS CLASSIFICATION:	SC
AASHTO CLASSIFICATION:	A-2-6
AASHTO GROUP INDEX:	1

ENTECH ENGINEERING, INC.

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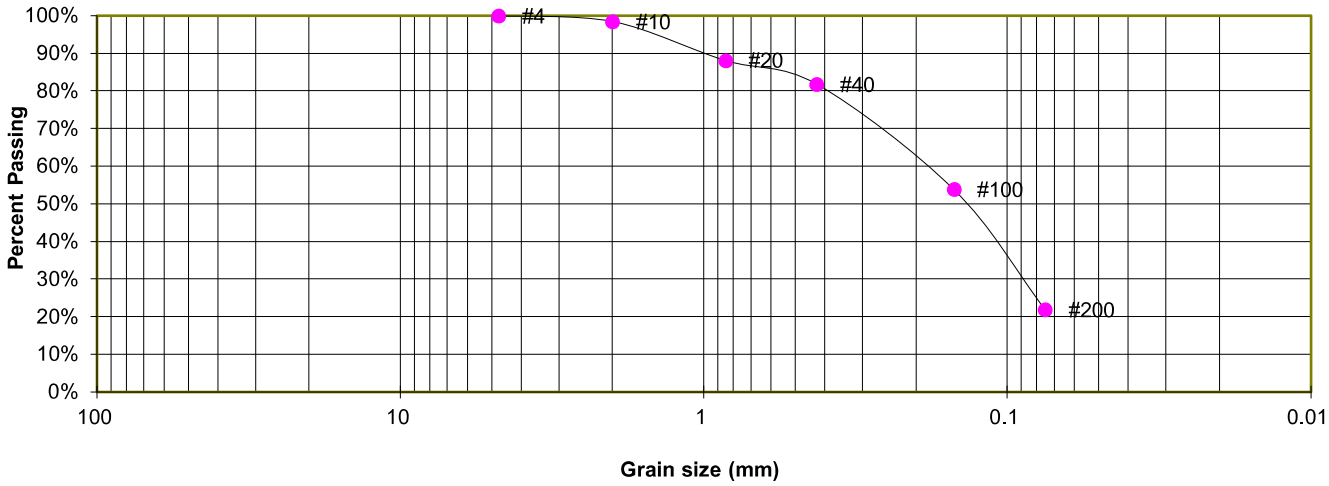
FIG. B-9

TEST BORING	5	SOIL DESCRIPTION	SANDSTONE. (SAND, SILTY)
DEPTH (FT)	1-2	SOIL TYPE	3



GRAIN SIZE ANALYSIS

U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	
4	100.0%
10	98.5%
20	88.2%
40	81.8%
100	53.9%
200	21.9%

ATTERBERG LIMITS

Plastic Limit	NP
Liquid Limit	NV
Plastic Index	NP

SOIL CLASSIFICATION

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

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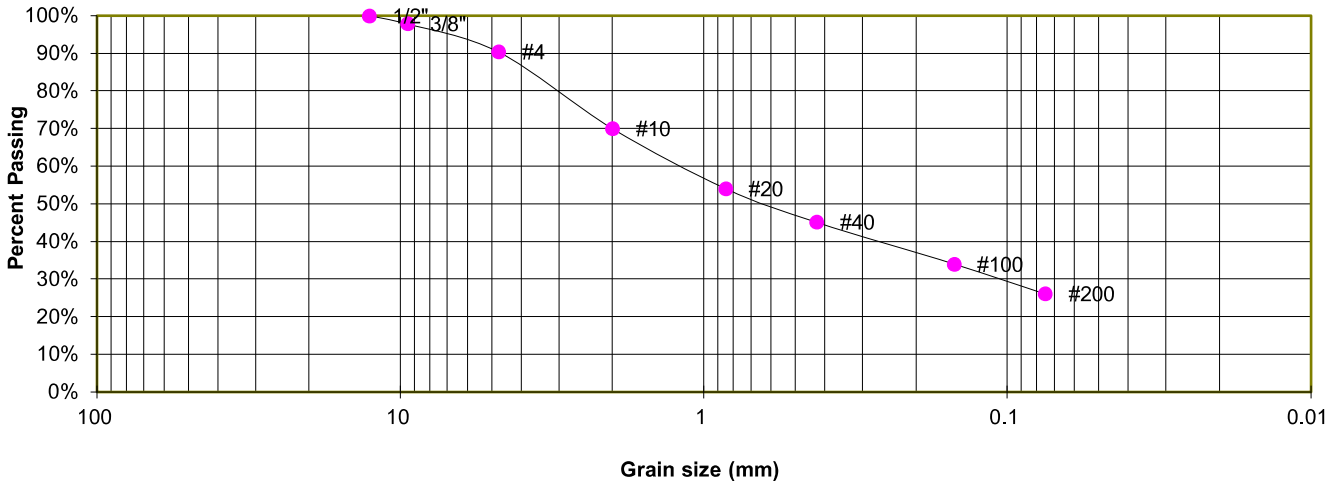
FIG. B-10

TEST BORING	7	SOIL DESCRIPTION	SANDSTONE. (SAND, CLAYEY)
DEPTH (FT)	1-2	SOIL TYPE	3



GRAIN SIZE ANALYSIS

U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	100.0%
3/8"	97.9%
4	90.4%
10	70.0%
20	54.1%
40	45.1%
100	34.0%
200	26.1%

ATTERBERG LIMITS

Plastic Limit	15
Liquid Limit	29
Plastic Index	14

SOIL CLASSIFICATION

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

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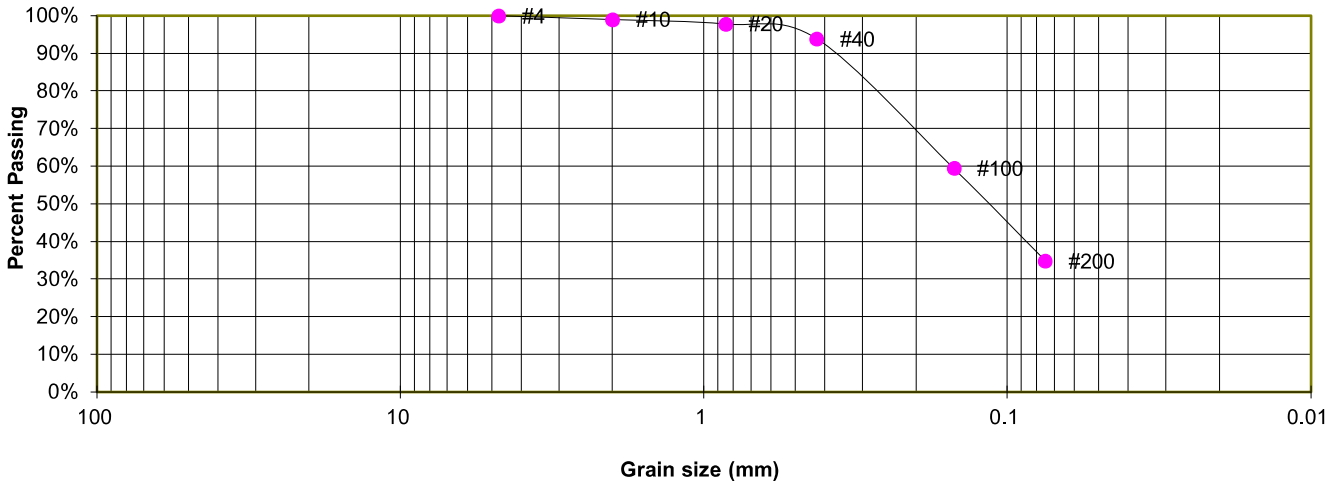
FIG. B-11

TEST BORING	8	SOIL DESCRIPTION	SANDSTONE. (SAND, CLAYEY)
DEPTH (FT)	1-2	SOIL TYPE	3



GRAIN SIZE ANALYSIS

U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	
4	100.0%
10	99.0%
20	97.8%
40	93.9%
100	59.5%
200	34.9%

ATTERBERG LIMITS

Plastic Limit	18
Liquid Limit	32
Plastic Index	14

SOIL CLASSIFICATION

USCS CLASSIFICATION:	SC
AASHTO CLASSIFICATION:	A-2-6
AASHTO GROUP INDEX:	1

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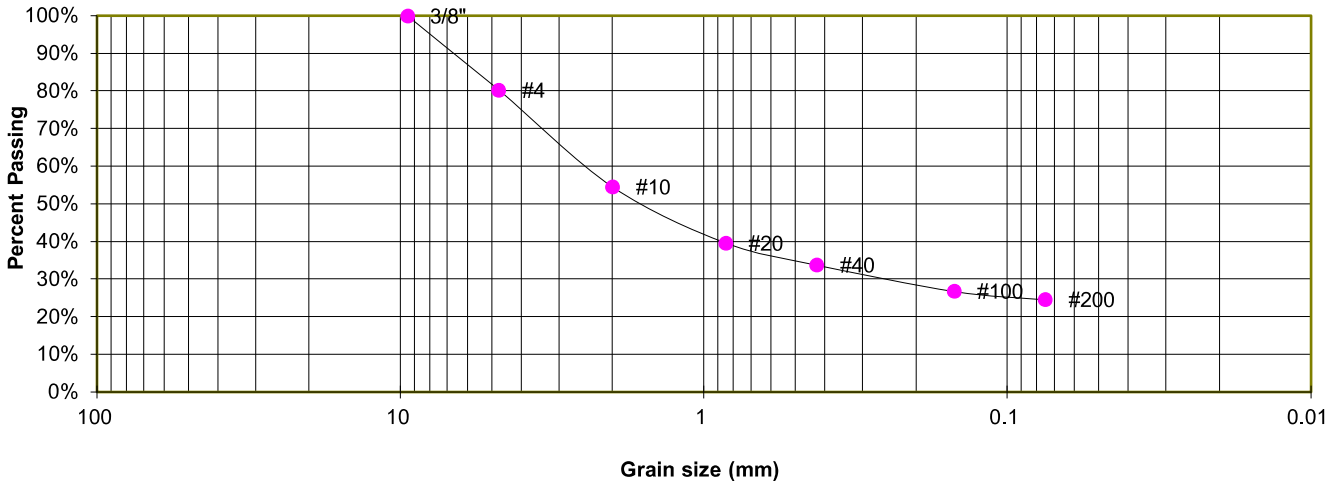
FIG. B-12

TEST BORING	1	SOIL DESCRIPTION	SANDSTONE. (SAND, CLAYEY)
DEPTH (FT)	5	SOIL TYPE	3



GRAIN SIZE ANALYSIS

U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	80.2%
10	54.5%
20	39.7%
40	33.8%
100	26.8%
200	24.6%

ATTERBERG LIMITS

Plastic Limit	18
Liquid Limit	37
Plastic Index	19

SOIL CLASSIFICATION

USCS CLASSIFICATION:	SC
AASHTO CLASSIFICATION:	A-2-6
AASHTO GROUP INDEX:	1

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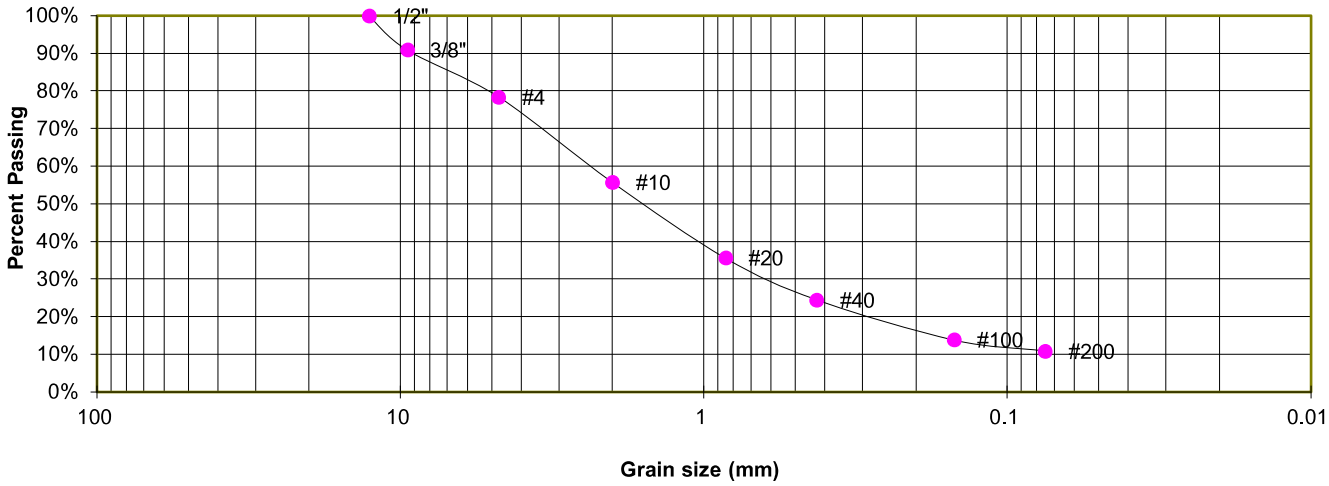
FIG. B-13

TEST BORING	2	SOIL DESCRIPTION	SANDSTONE. (SAND, WITH SILT)
DEPTH (FT)	5	SOIL TYPE	3



GRAIN SIZE ANALYSIS

U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	100.0%
3/8"	90.9%
4	78.4%
10	55.7%
20	35.7%
40	24.5%
100	13.9%
200	10.9%

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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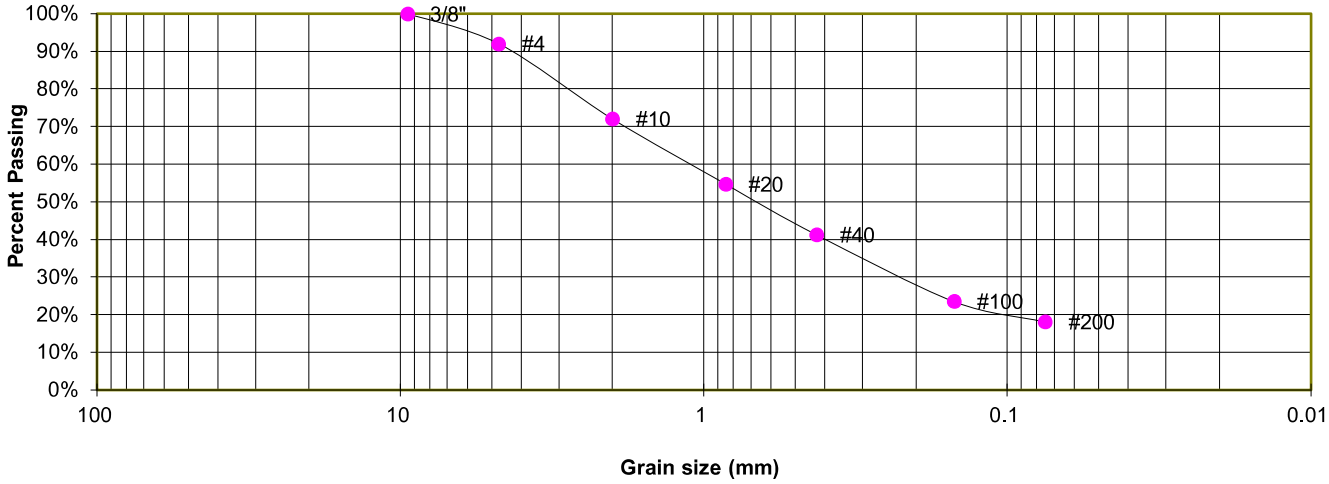
FIG. B-14

TEST BORING	4	SOIL DESCRIPTION	SANDSTONE. (SAND, SILTY)
DEPTH (FT)	5	SOIL TYPE	3



GRAIN SIZE ANALYSIS

U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	92.0%
10	72.1%
20	54.8%
40	41.3%
100	23.6%
200	18.2%

ATTERBERG LIMITS

Plastic Limit	NP
Liquid Limit	NV
Plastic Index	NP

SOIL CLASSIFICATION

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

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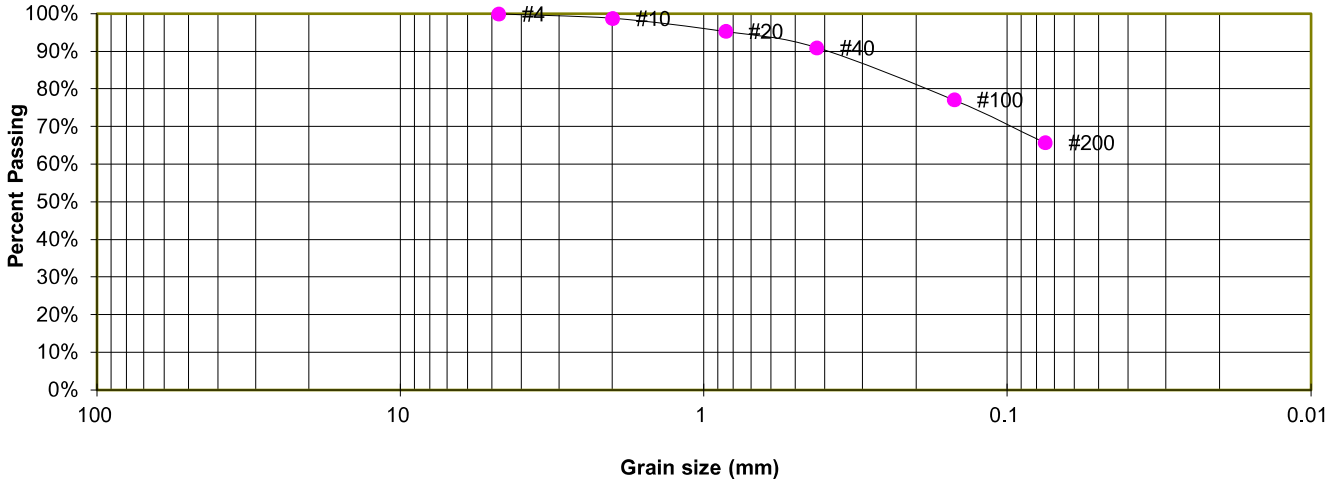
FIG. B-15

TEST BORING	7	SOIL DESCRIPTION	CLAYSTONE. (CLAY, SANDY)
DEPTH (FT)	5	SOIL TYPE	4



GRAIN SIZE ANALYSIS

U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	
4	100.0%
10	98.8%
20	95.3%
40	91.0%
100	77.2%
200	65.7%

ATTERBERG LIMITS

Plastic Limit	20
Liquid Limit	40
Plastic Index	20

SOIL CLASSIFICATION

USCS CLASSIFICATION:	CL
AASHTO CLASSIFICATION:	A-6
AASHTO GROUP INDEX:	11

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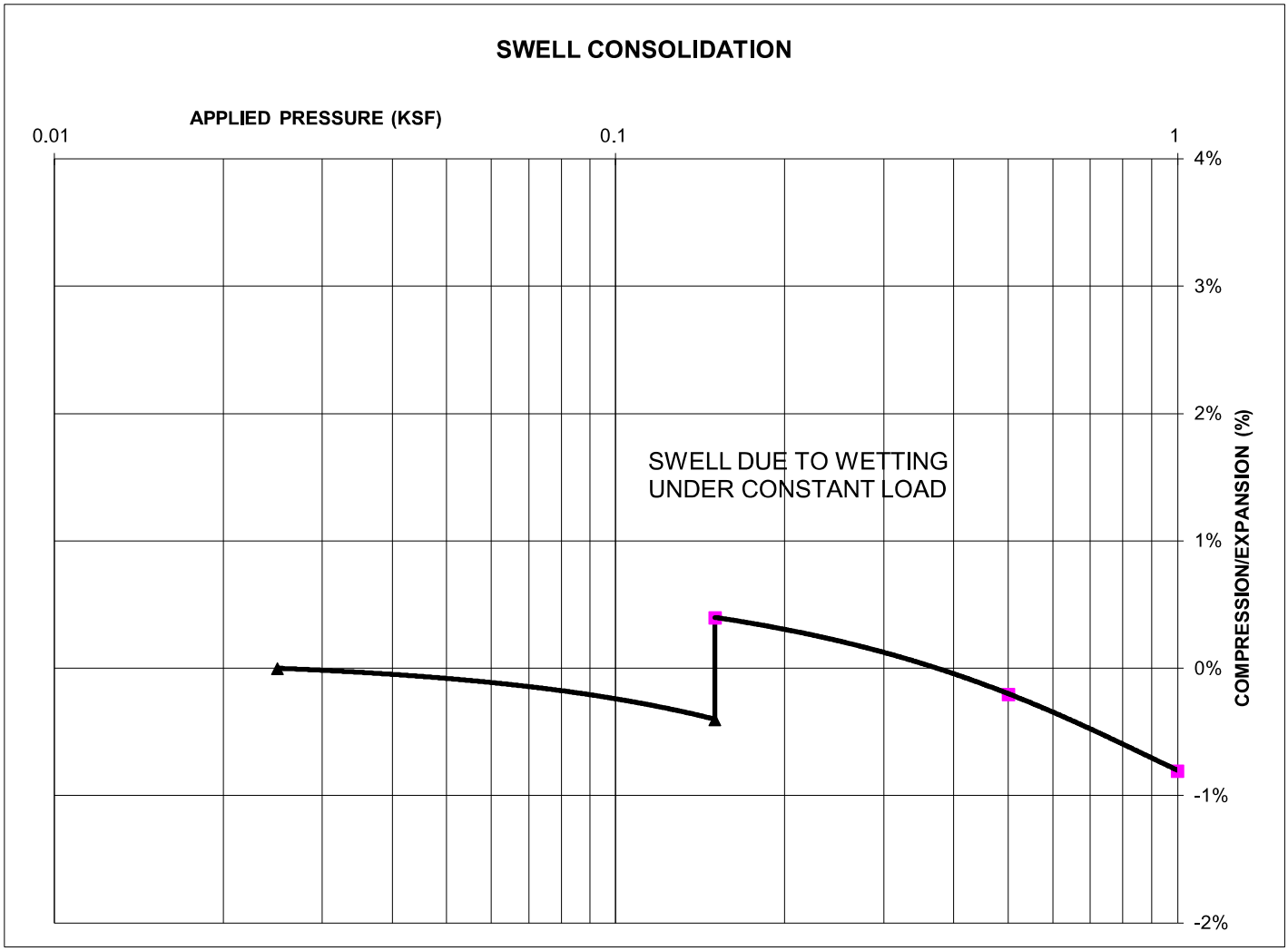
FIG. B-16

TEST BORING	6	SOIL DESCRIPTION	SAND, CLAYEY
DEPTH (FT)	5	SOIL TYPE	2



SWELL/CONSOLIDATION TEST RESULTS

NATURAL UNIT DRY WEIGHT (PCF): 112
NATURAL MOISTURE CONTENT: 15.0%
SWELL/CONSOLIDATION (%): 0.8%

ENTECH ENGINEERING, INC.

SWELL/CONSOLIDATION TEST RESULTS

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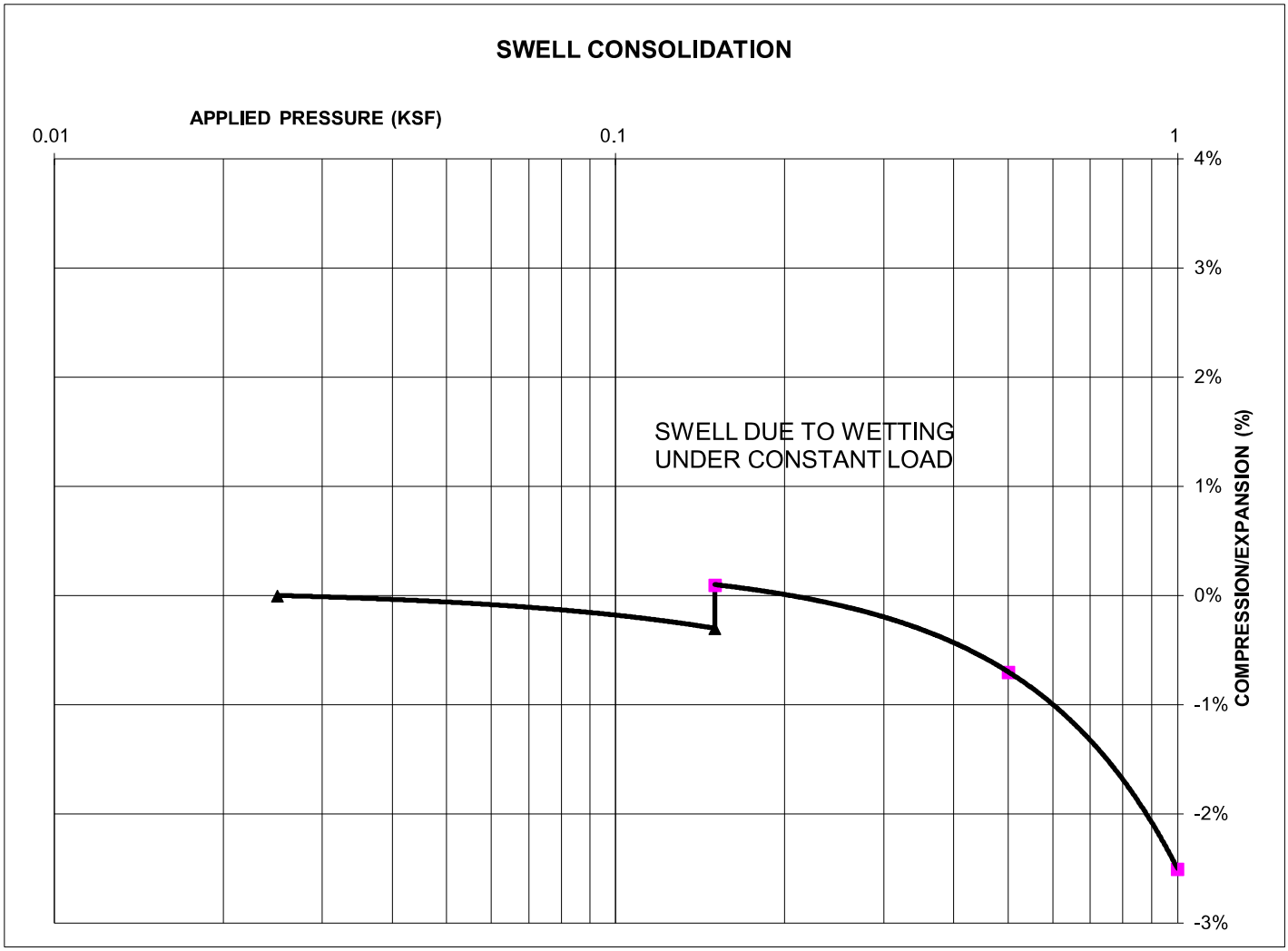
FIG. B-17

TEST BORING	3	SOIL DESCRIPTION	SANDSTONE. (SAND, CLAYEY)
DEPTH (FT)	1-3	SOIL TYPE	3



SWELL/CONSOLIDATION TEST RESULTS

NATURAL UNIT DRY WEIGHT (PCF):	116
NATURAL MOISTURE CONTENT:	9.9%
SWELL/CONSOLIDATION (%):	0.4%

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SWELL/CONSOLIDATION TEST RESULTS

EAGLE FOREST DRIVE
EAGLE FOREST DEVELOPMENT

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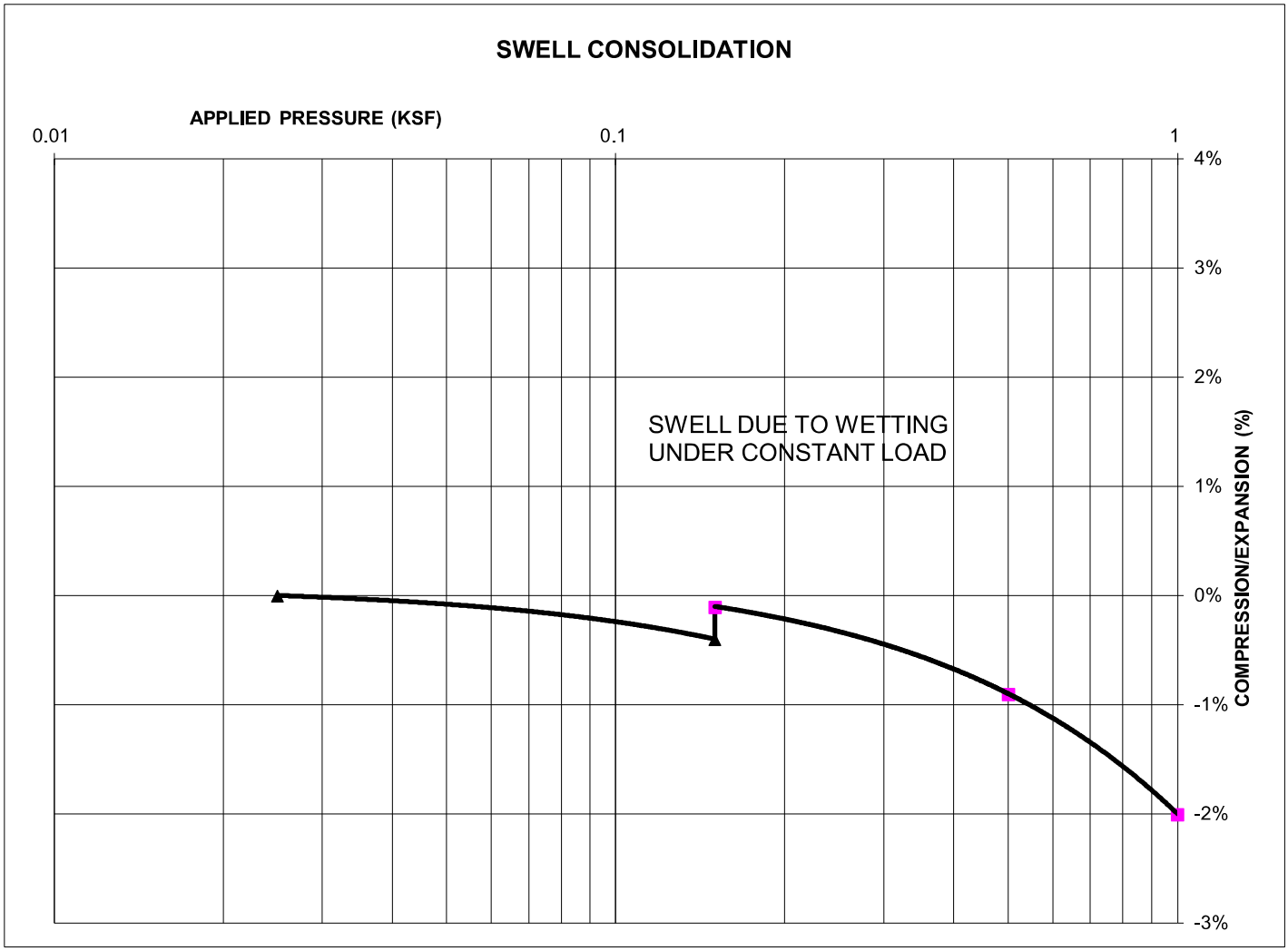
FIG. B-18

TEST BORING	3	SOIL DESCRIPTION	SANDSTONE. (SAND, CLAYEY)
DEPTH (FT)	1-2	SOIL TYPE	3



SWELL/CONSOLIDATION TEST RESULTS

NATURAL UNIT DRY WEIGHT (PCF): 113
NATURAL MOISTURE CONTENT: 14.6%
SWELL/CONSOLIDATION (%): 0.3%

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SWELL/CONSOLIDATION TEST RESULTS

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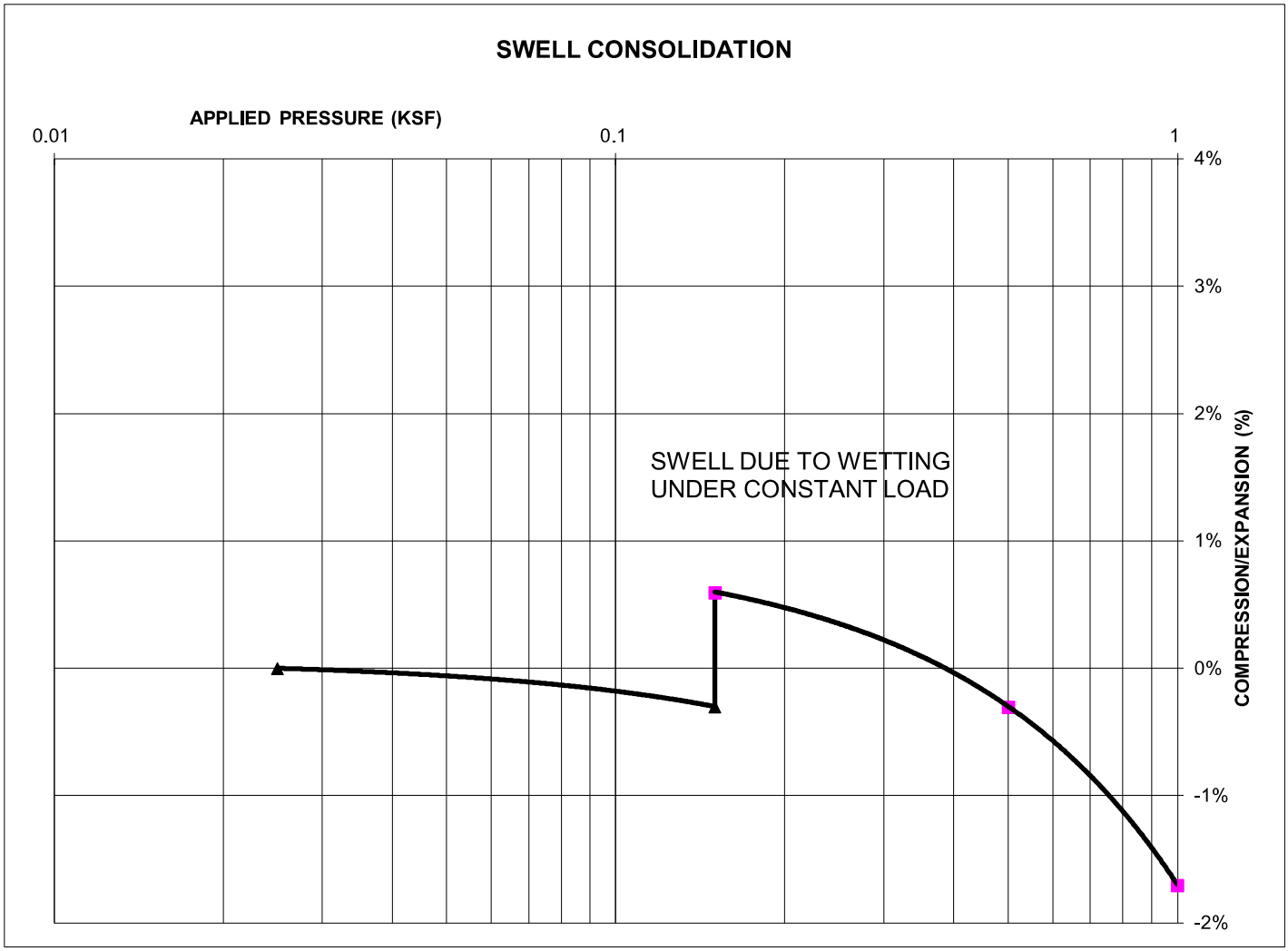
FIG. B-19

TEST BORING	7	SOIL DESCRIPTION	SANDSTONE. (SAND, CLAYEY)
DEPTH (FT)	1-2	SOIL TYPE	3



SWELL/CONSOLIDATION TEST RESULTS

NATURAL UNIT DRY WEIGHT (PCF):	112
NATURAL MOISTURE CONTENT:	14.8%
SWELL/CONSOLIDATION (%):	0.9%

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SWELL/CONSOLIDATION TEST RESULTS

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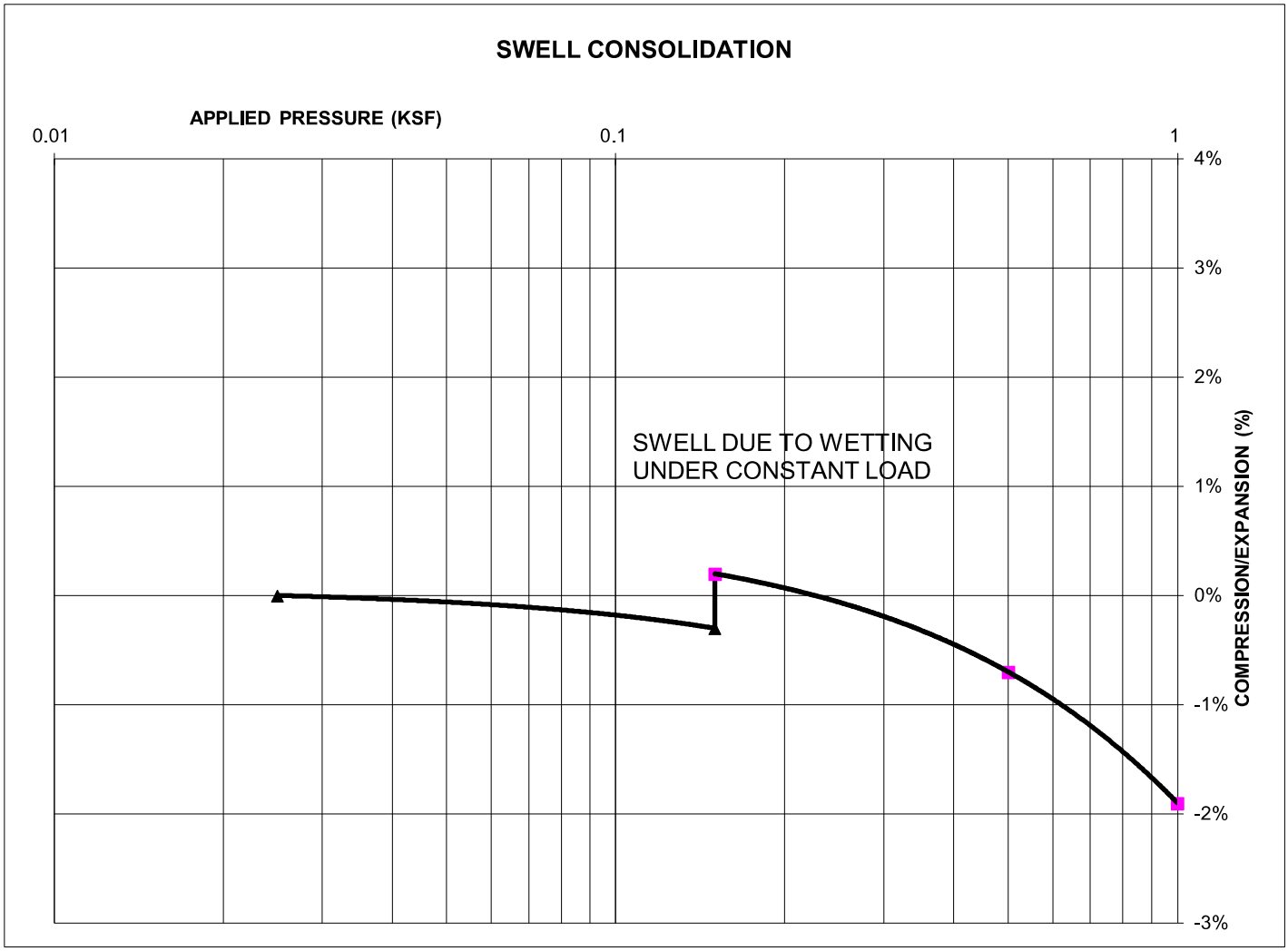
FIG. B-20

TEST BORING	8	SOIL DESCRIPTION	SANDSTONE. (SAND, CLAYEY)
DEPTH (FT)	1-2	SOIL TYPE	3



SWELL/CONSOLIDATION TEST RESULTS

NATURAL UNIT DRY WEIGHT (PCF):	111
NATURAL MOISTURE CONTENT:	13.5%
SWELL/CONSOLIDATION (%):	0.5%

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SWELL/CONSOLIDATION TEST RESULTS

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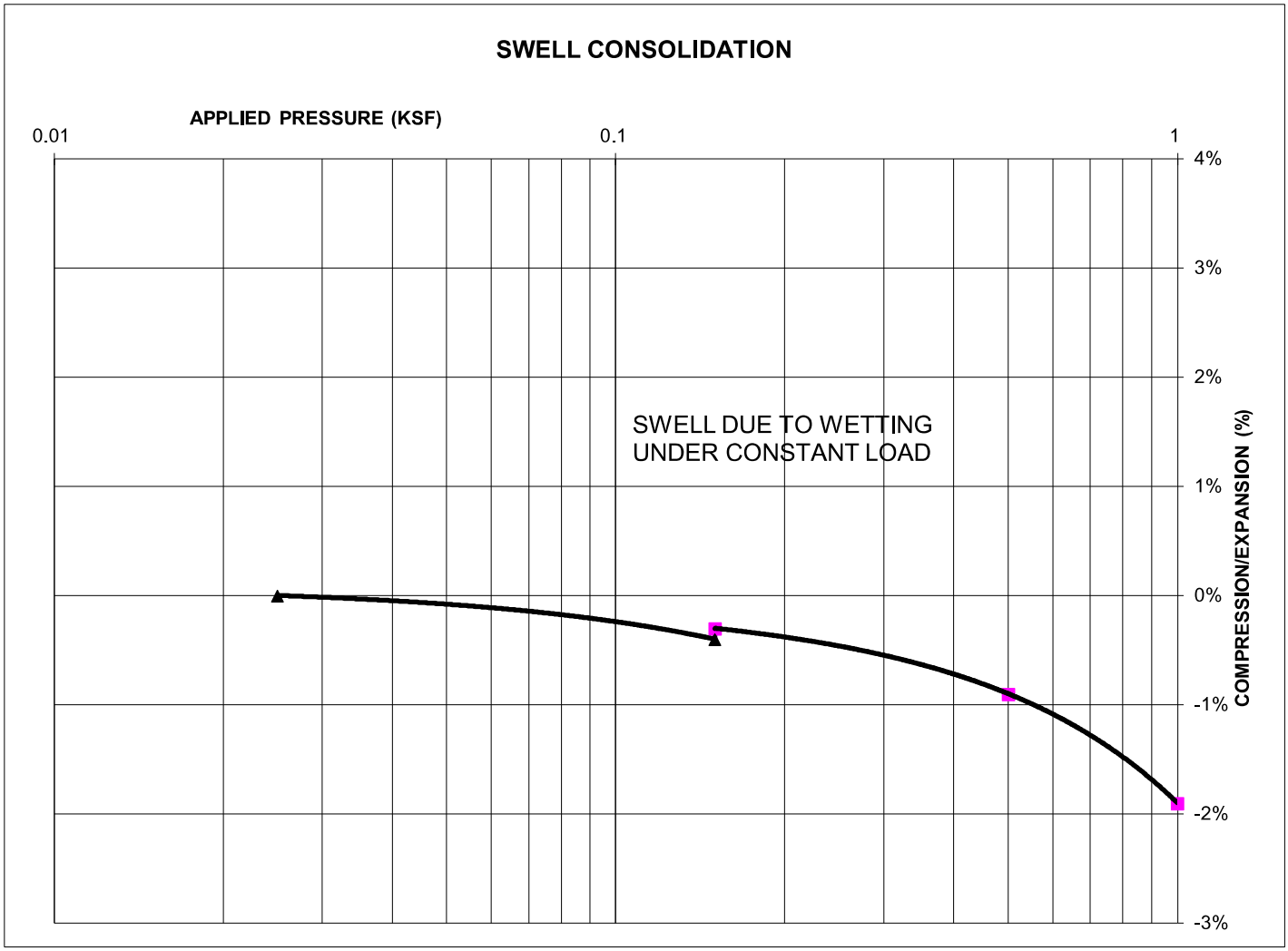
FIG. B-21

TEST BORING	1	SOIL DESCRIPTION	SANDSTONE. (SAND, CLAYEY)
DEPTH (FT)	1-2	SOIL TYPE	3



SWELL/CONSOLIDATION TEST RESULTS

NATURAL UNIT DRY WEIGHT (PCF): 111
NATURAL MOISTURE CONTENT: 14.8%
SWELL/CONSOLIDATION (%): 0.1%

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SWELL/CONSOLIDATION TEST RESULTS

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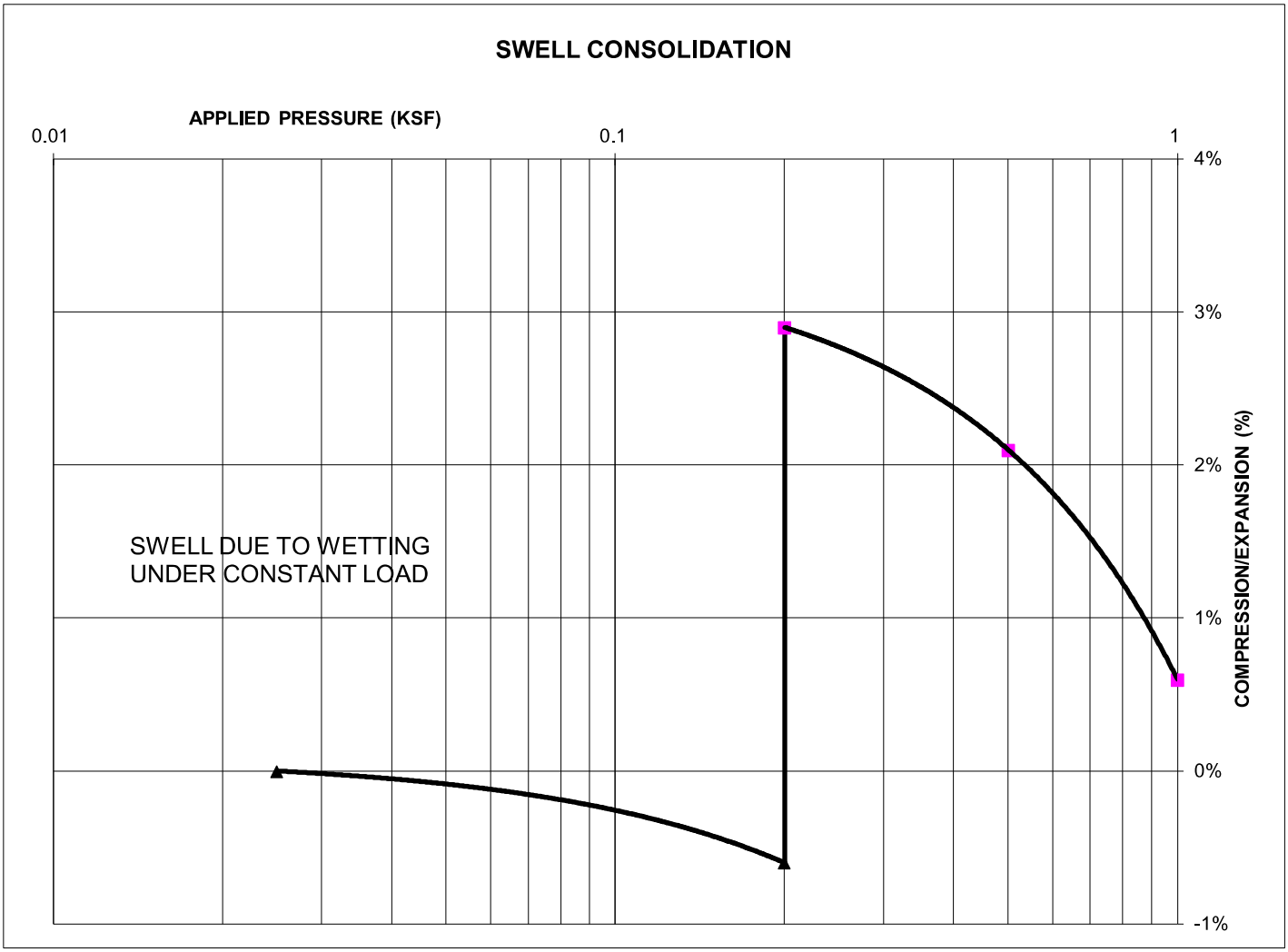
FIG. B-22

TEST BORING	7	SOIL DESCRIPTION	CLAYSTONE. (CLAY, SANDY)
DEPTH (FT)	5	SOIL TYPE	4



SWELL/CONSOLIDATION TEST RESULTS

NATURAL UNIT DRY WEIGHT (PCF): 110
NATURAL MOISTURE CONTENT: 17.3%
SWELL/CONSOLIDATION (%): 3.5%

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SWELL/CONSOLIDATION TEST RESULTS

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FIG. B-23

SAMPLE LOCATION TB-3 @ 1-3'	SOIL DESCRIPTION SANDSTONE. (SAND, CLAYEY) SOIL TYPE 3

PROCTOR DATA

IDENTIFICATION:	CL
PROCTOR TEST #:	1
TEST BY:	AL
TEST DESIGNATION:	ASTM-1557-A
MAXIMUM DRY DENSITY (PCF):	125.1
OPTIMUM MOISTURE:	8.2

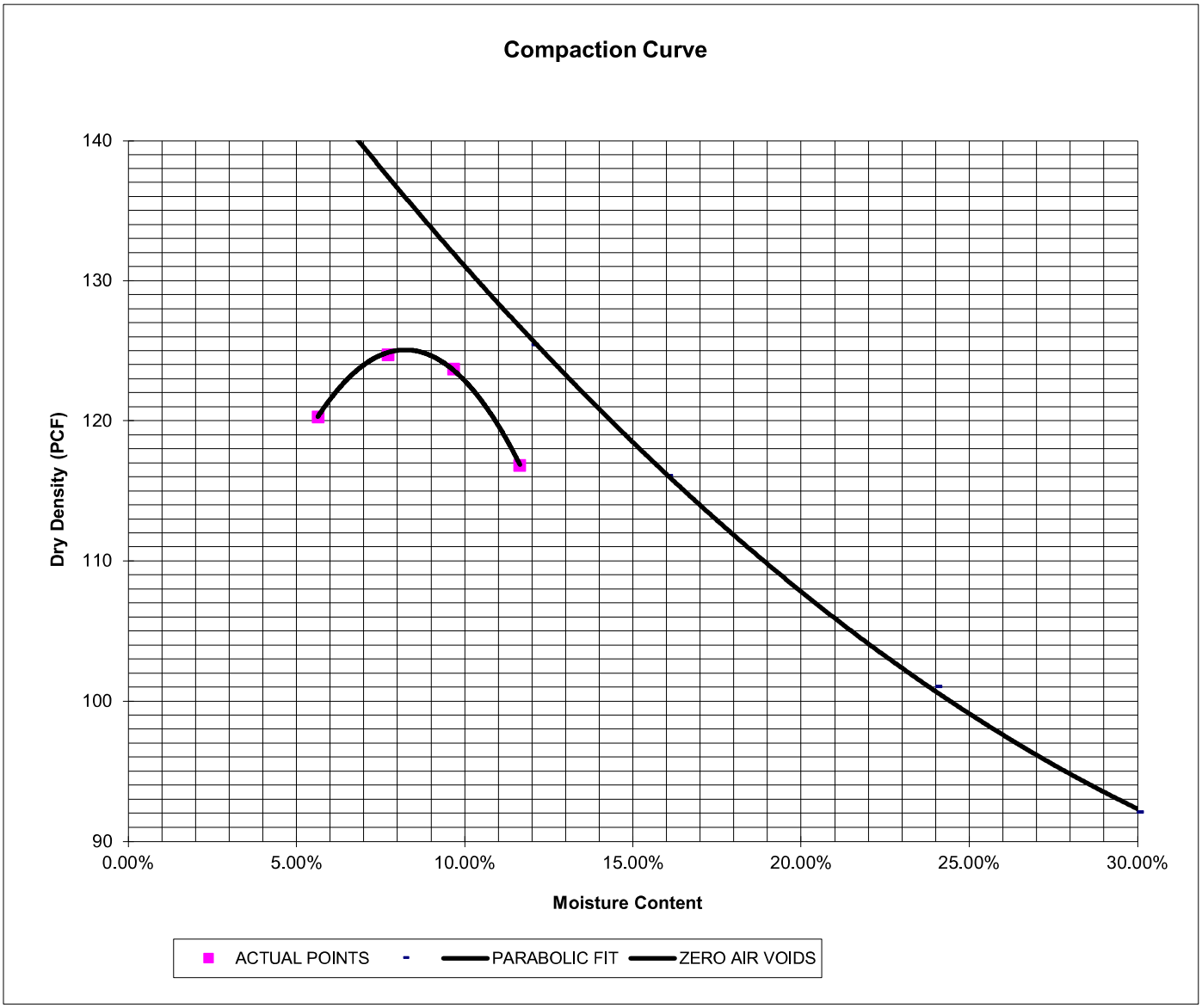

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FIG. 24

SAMPLE LOCATION TB-3	SOIL DESCRIPTION SANDSTONE. (SAND, CLAYEY)
DEPTH (FT) 44929	SOIL TYPE 3

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	33	11.03	71	23.73	129	43.11
0.050	60	20.05	124	41.44	257	85.88
0.075	72	24.06	146	48.79	312	104.26
0.100	104	34.75	207	69.17	432	144.36
0.125	125	41.77	246	82.21	462	154.39
0.150	141	47.12	287	95.91	517	172.76
0.175	158	52.80	310	103.59	600	200.50
0.200	185	61.82	365	121.97	688	229.91
0.300	278	92.90	548	183.12	940	314.12
0.400	368	122.97	726	242.61	1122	374.94
0.500	422	141.02	882	294.74	1319	440.77

MOISTURE AND DENSITY DATA

	Mold # 1	Mold # 2	Mold # 3
Can #	342	343	361
Wt. Can	8.51	8.5	8.57
Wt. Can+Wet	234.79	257.81	234.78
Wt. Can+Dry	205.99	226.67	212.35
Wt. H20	28.8	31.14	22.43
Wt. Dry Soil	197.48	218.17	203.78
Moisture Content	14.58%	14.27%	11.01%
Wet Density (PCF)	122.3	128.4	133.9
Dry Density (PCF)	113.0	118.6	123.7
% Compaction	90%	95%	99%
CBR	3.48	6.92	14.44

PROCTOR DATA

Maximum Dry Density (pcf)	125.1
Optimum Moisture	8.2
90% of Max. Dry Density (pcf)	112.6
95% of Max. Dry Density (pcf)	118.8

CBR at 90% of Max. Density = 3.20	~ R VALUE 8
CBR at 95% of Max. Density = 7.22	~ R VALUE 17

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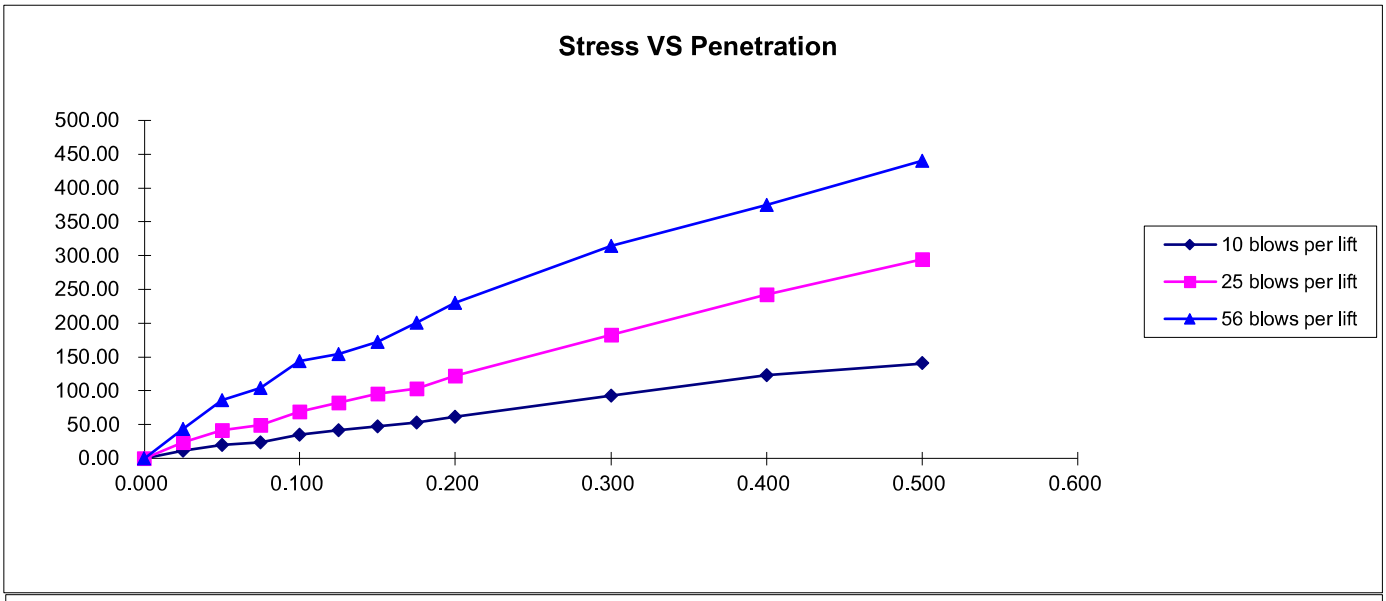
FIG. B-25

SAMPLE LOCATION TB-3	SOIL DESCRIPTION SANDSTONE. (SAND, CLAYEY)
DEPTH (FT) 44929	SOIL TYPE 3



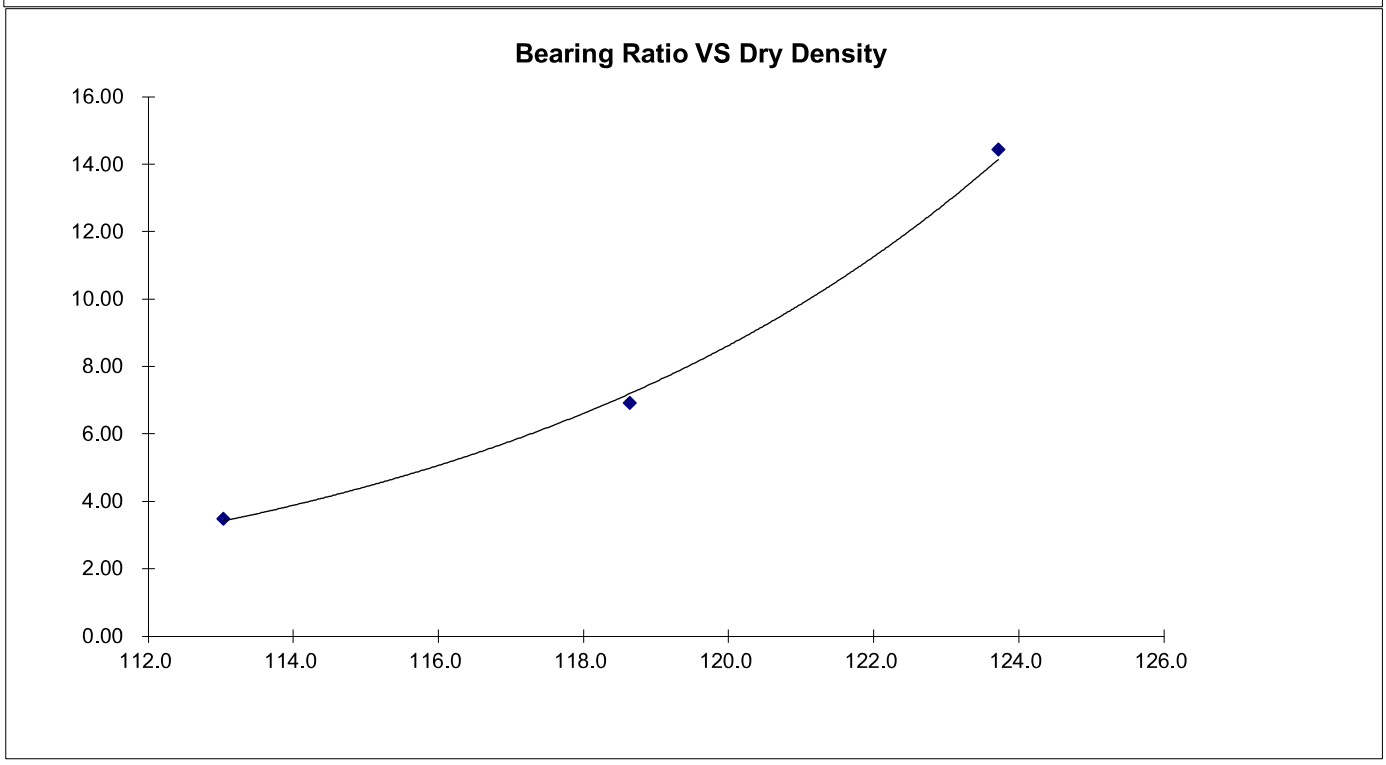


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FIG. B-26

APPENDIX C: Pavement Design Calculations

FLEXIBLE PAVEMENT DESIGN

PROJECT DATA

Project Location EAGLE FOREST DRIVE AT EAGLE FOREST SUBDIVISION

Job Number: 221784

DESIGN DATA

Equivalent (18-kip) Single Axle Load Applications (ESAL):	ESAL (W_{18}) =	36,500
Design CBR	CBR =	7.22
Standard Deviation	S_o =	0.45
Loss in Serviceability	Δpsi =	2.5
Reliability	Reliability =	75
Reliability (z-statistic)	Z_R =	-0.67
Soil Resilient Modulus	M_R =	10,830 psi

Required Structural Number (SN): → SN = 1.53

DESIGN EQUATIONS

Resilient Modulus

If using CBR:

M_R = (CBR) x 1,500

If using R-Value:

$M_R = 10^{[(S_1 + 18.72) / 6.24]}$ where: S_1 = [(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 - Hot Bituminous Asphalt

C_2 = Strength Coefficient - Aggregate Base Course

D_1 = Depth of Asphalt (inches)

D_2 = Depth of Base Course (inches)

RECOMMENED THICKNESSES

Layer	Material	Structural Layer	Thickness (D^*_i)	SN^*_i	SN
1	HMA	C_1 = 0.44	3.0 inches	1.320	-
2	ABC	C_2 = 0.11	4.0 inches	0.440	
			SN*=	1.760	1.53

Pavement SN > Required SN, Design is Acceptable

Fig. No. C-1