March 5, 2020
Revised March 19, 2020

ENTECH
ENGINEERING, INC.

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

Approved
By: Elizabeth Nijkamp
Date:03/23/2020
El Paso County Planning & Community Development

Tech Contractors
3575 Kenyon Street, Suite 200
San Diego, California 92110

Attn: Raul Guzman

Re: Pavement Recommendations
PCD File No. SF1822
Winding Walk, Filing 2, Phase 2
El Paso County, Colorado

Dear Mr. Guzman:

As requested, Entech Engineering, Inc. has obtained samples of the subgrade soils from sections of the roadways in the Winding Walk Subdivision, Filing 2, Phase 2, in El Paso County, Colorado. Laboratory testing to determine the pavement support characteristics of the soils was performed. This letter presents the results of the laboratory testing and pavement recommendations for the roadways.

Project Description

The project lies north and east of the initial phase of the development. The extent of the roadway construction is conceptually shown in Figure 1.

The roadways in this project consist of Quiet Walk Lane, Winding Bend Lane, and sections of Winding Walk Drive and Morning Creek Lane. The site layout and the locations of the test borings, drilled at approximate 500-foot intervals, are shown on the Test Boring Location Plan, Figure 1.

Subgrade Conditions

Three exploratory test borings were drilled in the roadways to depths of approximately 5 to 10 feet. The Boring Logs are presented in Appendix A. Sieve Analysis and Atterberg Limit testing were performed on soil samples obtained from the test borings for the purpose of classification. Sieve analyses performed indicated the percent passing the No. 200 sieve for the roadway subgrade soils ranged from approximately 18 to 28 percent. Atterberg Limit Tests performed on the samples resulted in Liquid Limits ranging from 27 to 32 and Plastic Indexes of 9 to 14. One general soil type was encountered at the subgrade depth (Soil Type 1). Soil Type 1 consisted of clayey sand which classified as A-2-4 and A-2-6 soils based on the AASHTO classification system. The Type 1 soils have good pavement support characteristics. Sulfate testing of the subgrade indicated that the soils exhibit a negligible potential for sulfate attack. Ground water was not encountered in the test borings.

Swell testing was not required on the Soil Type 1 soils based on their AASHTO classifications. Mitigation 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 sample of Soil Type 1 to determine the support characteristic of the subgrade soils for the roadway sections. The results of the CBR testing, are presented in Appendix B and summarized as follows:

Soil Type1 – Clayey Sand

R @ 90% = 71.0
R @ 95% = 75.0
Use R = 50.0 for design*

Classification Testing

Liquid Limit	27
Plasticity Index	11
Percent Passing 200	28.2
AASHTO Classification	A-2-6
Group Index	0
Unified Soils Classification	SC

* An R Value of 50 is used for design calculations due to slight variability of the soils between borings and it results in minimum sections for the roadways.

Pavement Design

The CBR testing was used to determine pavement sections for this site. The pavement sections were determined utilizing the El Paso County "Pavement Design Criteria and Report". The following classifications and ESAL values were used for this portion of the filing. All of the roadways in this phase classify as urban local roads which uses an 18K ESAL value of 292,000 for design. Pavement alternatives for asphalt over aggregate basecourse and cement stabilized subgrade sections are provided. Design parameters used in the pavement analysis are as follows:

Reliability (Local Roads)	80%
Serviceability Index Urban Local	2.2
Resilient Modulus	13,168 psi
"R" Value Subgrade – ST 1	50.0
Structural Coefficients:	
Hot Bituminous Pavement	0.44
Aggregate Base Course	0.11
Cement Stabilized Subgrade	0.12

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

Pavement Sections – Soil Type 1

Urban Local – ESAL = 292,000 – All Roadways

Alternative	Asphalt (in)	Base Course (in)	Cement Stabilized Subgrade (in.)
1. Asphalt Over Base Course	3.0*	8.0*	--
2. Cement Stabilized Subgrade	4.0*	--	8.0*

[1] Full depth sections are only allowed over chemically treated or suitable subgrade.
* Minimum sections required by the El Paso County Pavement Design Criteria and Report.

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. Due to the AASHTO classifications, mitigation for expansive soils will not be required.

Roadway Construction - Full Depth Asphalt and Asphalt on Aggregate Base Course Alternatives

Prior to placement of the asphalt, the subgrade should be proofrolled and compacted to a minimum of 95 percent of its maximum Standard Proctor Dry Density, ASTM D-698 at 0 to +3 percent of optimum moisture content or 95 percent of its maximum Modified Proctor Dry Density, ASTM D-1557 at ±2 percent of optimum moisture content. Any loose or soft areas should be removed and replaced with suitable materials. Base course materials should be compacted to a minimum of 95 percent of its maximum Modified Proctor Dry Density, ASTM D-1557 at ± 2 percent of optimum moisture content. Special attention should be given to areas adjacent to manholes, inlet structures and valves.

Roadway Construction – Cement Stabilized Subgrade Alternative

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

compaction of at least 95 percent of the subgrade maximum dry density as determined by the Modified Proctor Test (ASTM D-1557). Satisfactory compaction of the subgrade shall occur within 90 minutes from the time of mixing the cement into the subgrade.

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

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

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

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

- Microfracturing of the stabilized subgrade is recommended.

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/ao

Encl.

Reviewed by:

Mark H. Hauschild, P.E.
Senior Engineer

Entech Job No. 200190
AAprojects/2020/200190/200190 pr-Rev

TABLE

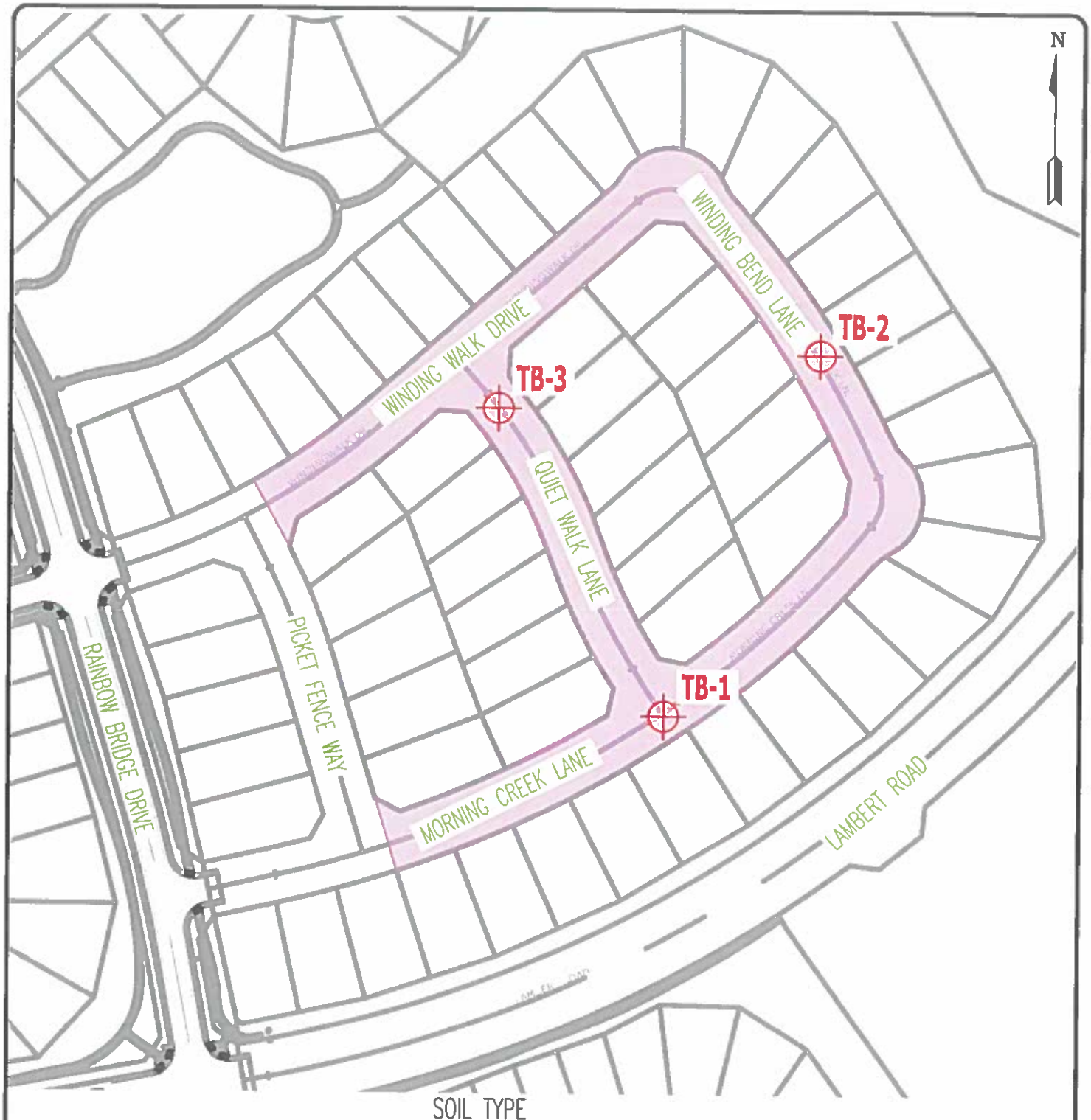
TABLE 1

SUMMARY OF LABORATORY TEST RESULTS

CLIENT TECH CONTRACTORS
PROJECT WINDING WALK, F-2
JOB NO. 200190

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			28.2	27	11		A-2-6		SC	SAND, CLAYEY
1	1	1-2			22.4	32	12		A-2-6		SC	SAND, CLAYEY
1	2	1-2			17.9	28	9	<0.01	A-2-4		SC	SAND, CLAYEY
1	3	1-2			26.0	32	14		A-2-6		SC	SAND, CLAYEY
2	1	10			16.8	34	15	<0.01	A-2-6		SC	SANDSTONE, CLAYEY

FIGURE



SOIL TYPE

NOTES:

: URBAN LOCAL – (292,000) – 3.0" ASPHALT OVER 8.0" BASECOURSE, OR 4.0" ASPHALT OVER 8.0" OF CEMENT-TREATED SUBGRADE.

TB-2 - APPROXIMATE TEST BORING LOCATION AND NUMBER

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

TEST BORING LOCATION PLAN
WINDING WALK, F2, PHASE 2
EL PASO COUNTY, CO
FOR: TECH CONTRACTORS

DRAWN BY:	DATE DRAWN:	DESIGNED BY:	CHECKED:
SC	06/24/19	SC	SC

JOB NO.: 200190

FIG. NO.: 1

APPENDIX A: Test Boring Logs

TEST BORING NO. 1
DATE DRILLED 1/30/2020
Job # 200190

REMARKS

DRY TO 10', 1/30/20

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type	
			21	7.2	1	SAND, CLAYEY, FINE TO COARSE GRAINED, BROWN, MEDIUM DENSE, MOIST
5			11	6.3	1	
10			50/10"	9.0	2	SANDSTONE, CLAYEY, FINE TO COARSE GRAINED, GRAY BROWN, VERY DENSE, MOIST
15						
20						

TEST BORING NO. 2
DATE DRILLED 1/30/2020
CLIENT TECH CONTRACTORS
LOCATION WINDING WALK, F-2

REMARKS

DRY TO 5', 1/30/20

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type	
			11	7.3	1	SAND, CLAYEY, FINE TO COARSE GRAINED, BROWN, MEDIUM DENSE TO LOOSE, MOIST
5			8	7.2	1	
10						
15						
20						

ENTECH
ENGINEERING, INC.
505 ELKTON DRIVE
COLORADO SPRINGS, COLORADO 80907

TEST BORING LOG

DRAWN:	DATE:	CHECKED:	DATE: 2/25/20

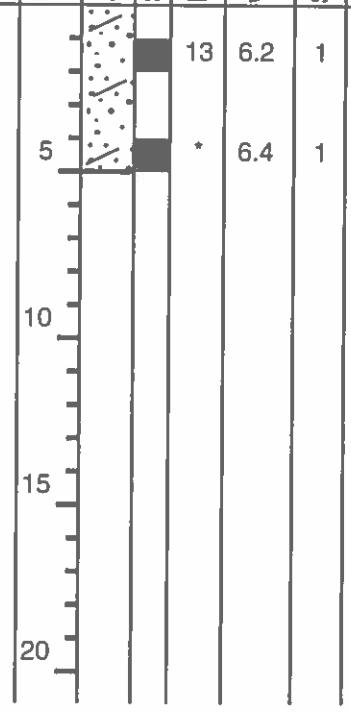
JOB NO. 200190
FIG NO. A- 1

TEST BORING NO. 3
DATE DRILLED 1/30/2020
Job # 200190

REMARKS

DRY TO 5', 1/30/20

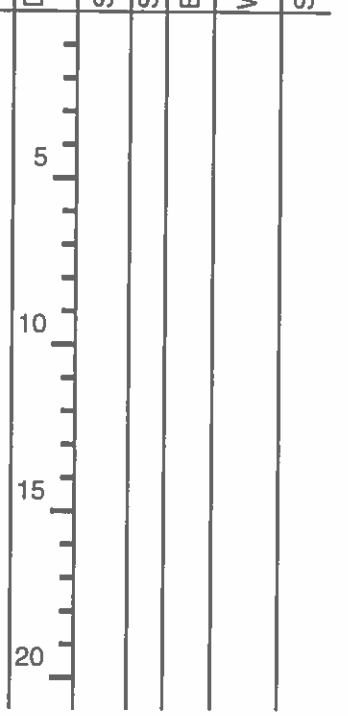
Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
SAND, CLAYEY, FINE TO COARSE GRAINED, BROWN, MEDIUM DENSE, MOIST			13	6.2	1
* - BULK SAMPLE TAKEN	5		*	6.4	1
	10				
	15				
	20				



TEST BORING NO.
DATE DRILLED 1/30/2020
CLIENT TECH CONTRACTORS
LOCATION WINDING WALK, F-2

REMARKS

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



ENTECH
ENGINEERING, INC.
505 ELKTON DRIVE
COLORADO SPRINGS, COLORADO 80907

TEST BORING LOG

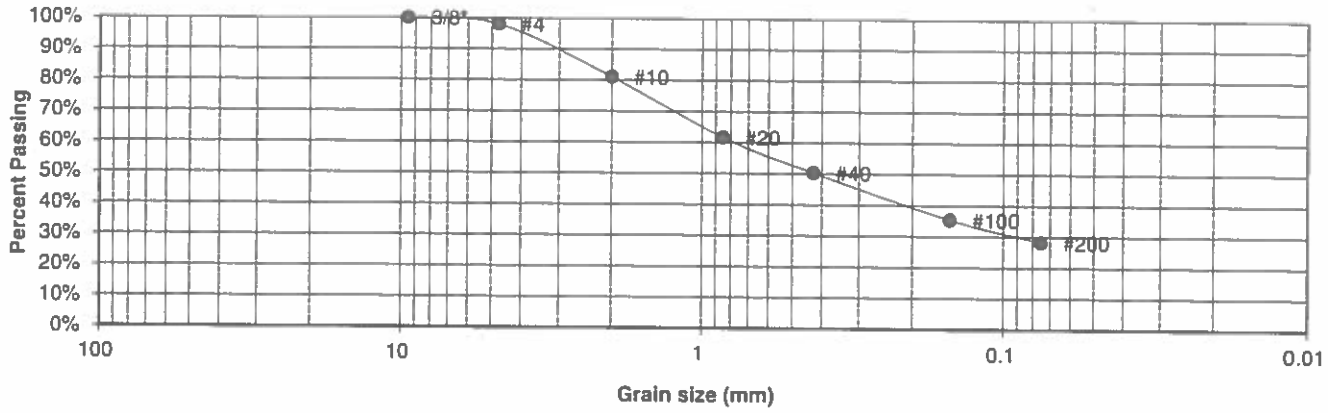
DRAWN:	DATE:	CHECKED:	DATE: 2/24/20

JOB NO. 200190
FIG NO A- 2

APPENDIX B: Laboratory Test Results

UNIFIED CLASSIFICATION	SC	CLIENT	TECH CONTRACTORS
SOIL TYPE #	1, CBR	PROJECT	WINDING WALK, F-2
TEST BORING #	1	JOB NO.	200190
DEPTH (FT)	0-3	TEST BY	BL
AASHTO CLASSIFICATION	A-2-6	GROUP INDEX	0

Sieve Analysis
Grain Size Distribution



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	98.0%
10	81.0%
20	61.6%
40	50.3%
100	35.4%
200	28.2%

Atterberg Limits

Plastic Limit	16
Liquid Limit	27
Plastic Index	11

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

ENTECH ENGINEERING, INC.
505 ELKTON DRIVE
COLORADO SPRINGS, COLORADO 80907

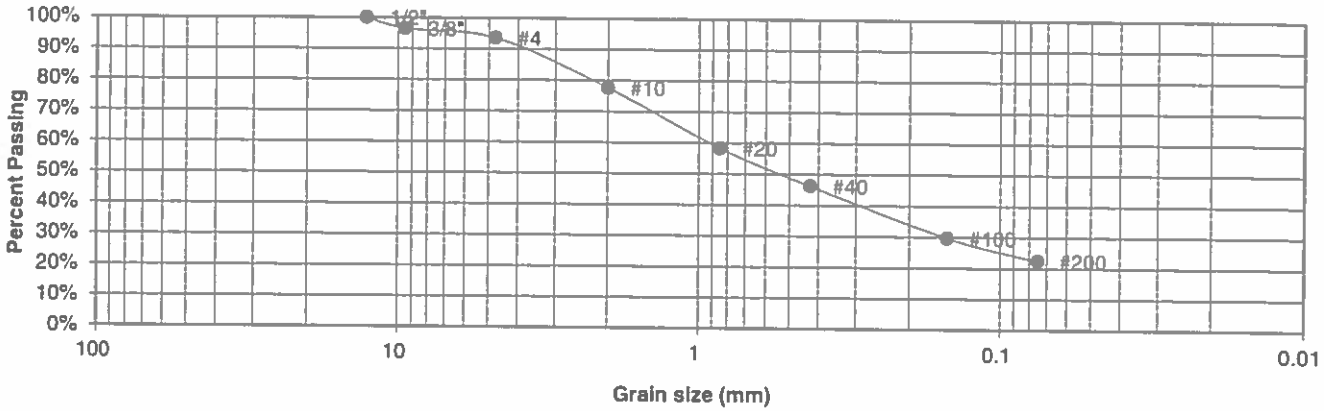
LABORATORY TEST RESULTS

DRAWN	DATE	CHECKED:	DATE:
			2/24/20

JOB NO. 200190
FIG NO. B-1

UNIFIED CLASSIFICATION	SC	CLIENT	TECH CONTRACTORS
SOIL TYPE #	1	PROJECT	WINDING WALK, F-2
TEST BORING #	1	JOB NO.	200190
DEPTH (FT)	1-2	TEST BY	BL
AASHTO CLASSIFICATION	A-2-6	GROUP INDEX	0

Sieve Analysis
Grain Size Distribution



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	100.0%
3/8"	96.5%
4	93.5%
10	77.6%
20	58.3%
40	46.2%
100	29.7%
200	22.4%

Atterberg Limits	
Plastic Limit	20
Liquid Limit	32
Plastic Index	12

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

ENTECH
ENGINEERING, INC.
505 ELKTON DRIVE
COLORADO SPRINGS, COLORADO 80907

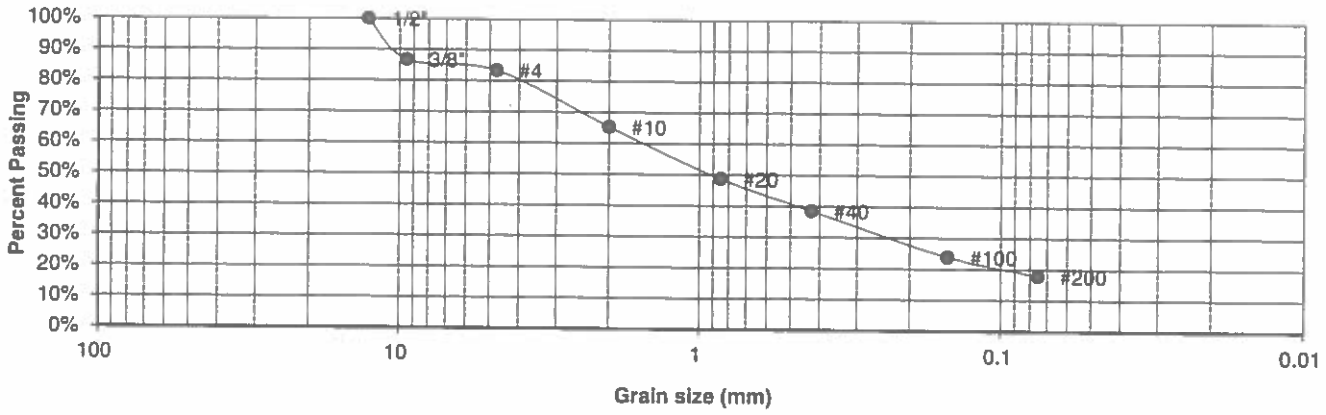
LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
			2/25/20

JOB NO.: 200190
FIG NO.: B-2

UNIFIED CLASSIFICATION	SC	CLIENT	TECH CONTRACTORS
SOIL TYPE #	1	PROJECT	WINDING WALK, F-2
TEST BORING #	2	JOB NO.	200190
DEPTH (FT)	1-2	TEST BY	BL
AASHTO CLASSIFICATION	A-2-4	GROUP INDEX	0

Sieve Analysis
Grain Size Distribution



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	100.0%
3/8"	86.7%
4	83.3%
10	65.3%
20	48.7%
40	38.5%
100	23.9%
200	17.9%

Atterberg Limits

Plastic Limit	19
Liquid Limit	28
Plastic Index	9

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

ENTECH ENGINEERING, INC.
505 ELKTON DRIVE
COLORADO SPRINGS, COLORADO 80907

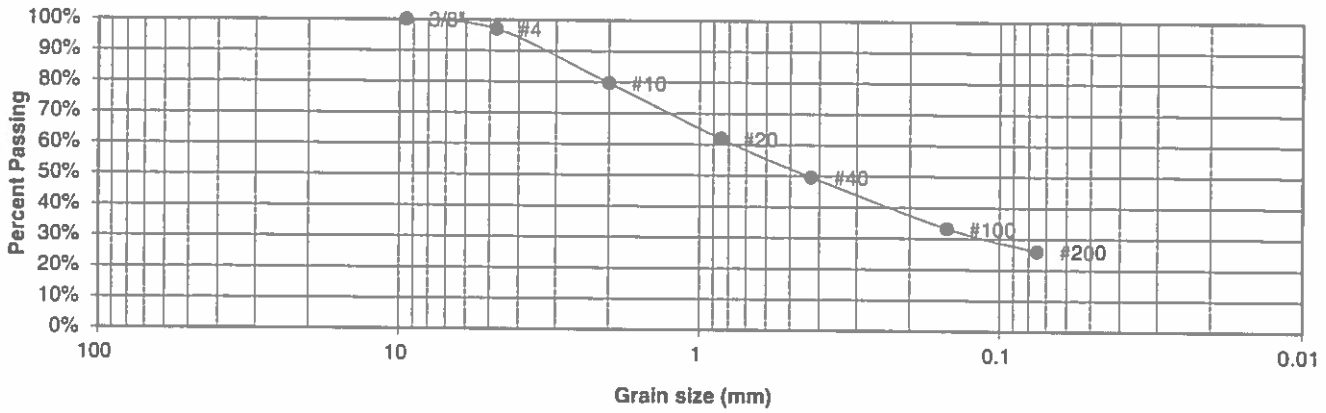
LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE: 2/25/20

JOB NO.: 200190
FIG NO.: B-3

UNIFIED CLASSIFICATION	SC	CLIENT	TECH CONTRACTORS
SOIL TYPE #	1	PROJECT	WINDING WALK, F-2
TEST BORING #	3	JOB NO.	200190
DEPTH (FT)	1-2	TEST BY	BL
AASHTO CLASSIFICATION	A-2-6	GROUP INDEX	0

Sieve Analysis
Grain Size Distribution



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	97.0%
10	79.7%
20	61.9%
40	49.6%
100	33.2%
200	26.0%

Atterberg Limits	
Plastic Limit	18
Liquid Limit	32
Plastic Index	14

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

ENTECH
ENGINEERING, INC.
505 ELKTON DRIVE
COLORADO SPRINGS, COLORADO 80907

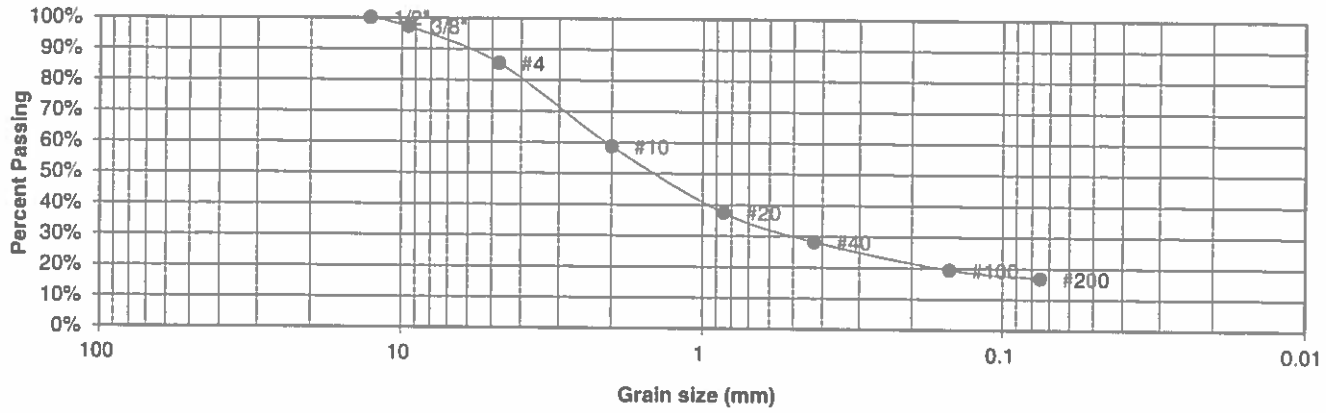
LABORATORY TEST RESULTS

DRAWN	DATE	CHECKED	DATE
			2/25/20

JOB NO. 200190
FIG NO. B-4

UNIFIED CLASSIFICATION	SC	CLIENT	TECH CONTRACTORS
SOIL TYPE #	2	PROJECT	WINDING WALK, F-2
TEST BORING #	1	JOB NO.	200190
DEPTH (FT)	10	TEST BY	BL
AASHTO CLASSIFICATION	A-2-6	GROUP INDEX	0

Sieve Analysis
Grain Size Distribution



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	100.0%
3/8"	97.2%
4	85.5%
10	58.7%
20	37.5%
40	28.2%
100	19.4%
200	16.8%

Atterberg Limits

Plastic Limit	19
Liquid Limit	34
Plastic Index	15

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

ENTECH ENGINEERING, INC.
505 ELKTON DRIVE
COLORADO SPRINGS, COLORADO 80907

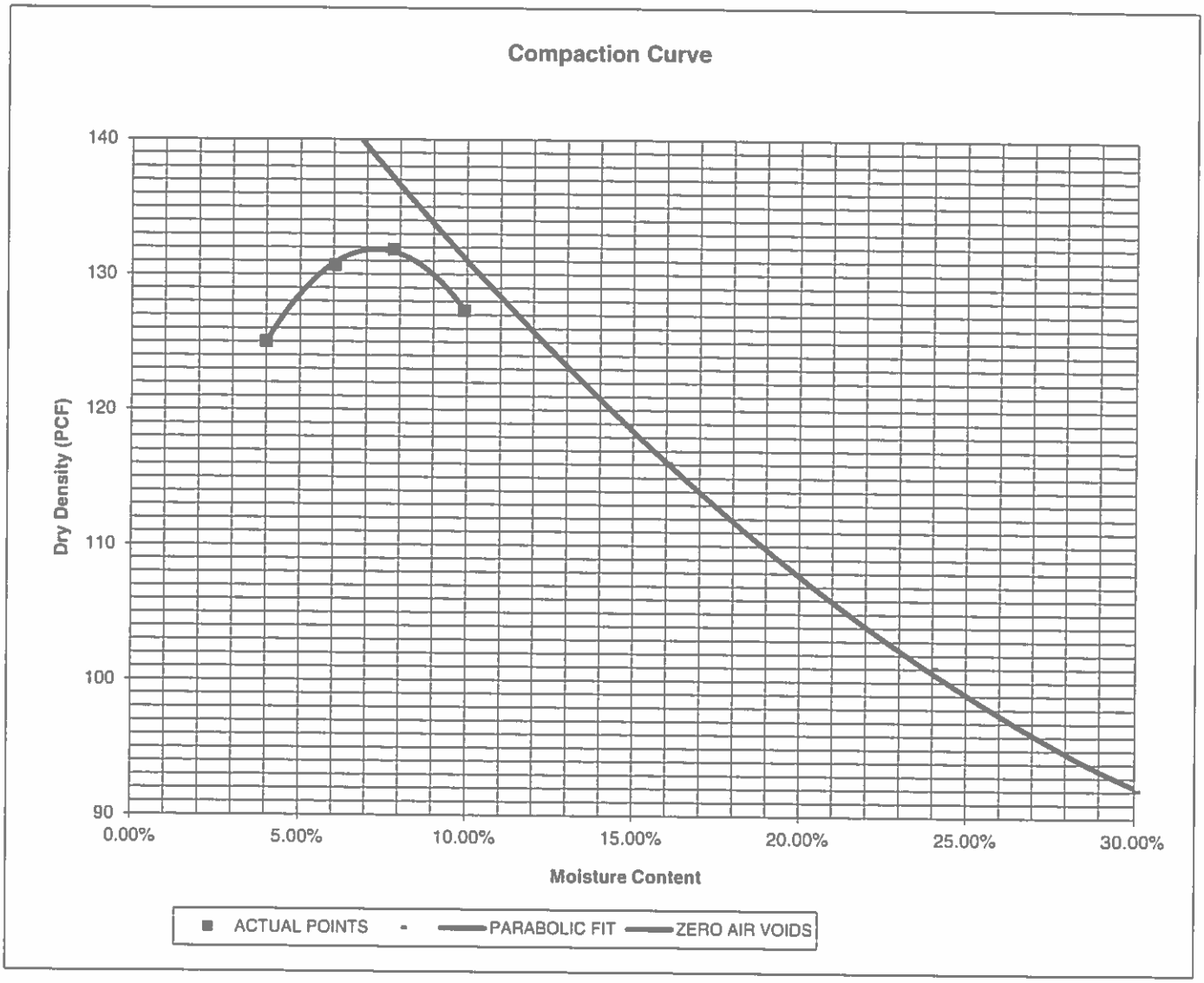
LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE: 2/25/20

JOB NO.: 200190
FIG NO.: B-5

PROJECT	WINDING WALK, F-2	CLIENT	TECH CONTRACTORS
SAMPLE LOCATION	TB-1 @ 0-3'	JOB NO.	200190
SOIL DESCRIPTION	SAND, CLAYEY, BROWN	DATE	02/03/20

IDENTIFICATION	SC	COMPACTION TEST #	1
TEST DESIGNATION / METHOD	ASTM D-1557-A	TEST BY	KW
MAXIMUM DRY DENSITY (PCF)	131.8	OPTIMUM MOISTURE	7.2%



ENTECH
ENGINEERING, INC.
505 ELKTON DRIVE
COLORADO SPRINGS, COLORADO 80907

MOISTURE DENSITY RELATION

DRAWN:	DATE:	CHECKED	DATE
			2/24/20

JOB NO.: 200190
FIG NO.: B-6

CBR TEST LOAD DATA

JOB NO: 200190
CLIENT: TECH CONTRACTORS
PROJECT: WINDING WALK, F-2
SOIL TYPE: 1

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 # 2 LOAD(LBS) (LBS)	STRESS (PSI)	*56 BLOWS* MOLD # 3 LOAD(LBS) (LBS)	STRESS (PSI)
0.000	0	0.00	0	0.00	0	0.00
0.025	138	46.12	224	74.85	416	139.01
0.050	211	70.51	539	180.12	743	248.29
0.075	265	88.55	843	281.70	1086	362.91
0.100	324	108.27	1020	340.85	1707	570.42
0.125	364	121.64	1324	442.44	2603	869.84
0.150	396	132.33	1470	491.23	3348	1118.79
0.175	436	145.70	1749	584.46	3998	1336.00
0.200	464	155.05	2120	708.44	4572	1527.81
0.300	587	196.16	2762	922.97	5133	1715.28
0.400	712	237.93	3262	1090.06	6000	2005.01
0.500	826	276.02	3669	1226.06		

FINAL MOISTURE CONTENT

	MOLD # 1	MOLD # 2	MOLD # 3
CAN #	313	310	307
WT. CAN	6.55	6.67	6.58
WT. CAN+WET	320.38	290.22	323.45
WT. CAN+DRY	286.05	264.38	298.73
WT. H20	34.33	25.84	24.72
WT. DRY SOIL	279.5	257.71	292.15
MOISTURE CONTENT	12.28%	10.03%	8.46%
WET DENSITY (PCF)	123.2	131.7	136.4
DRY DENSITY (PCF)	114.9	122.9	127.3
BEARING RATIO	10.83	34.09	57.04

90% OF DRY DENSITY	118.6
95% OF DRY DENSITY	125.2

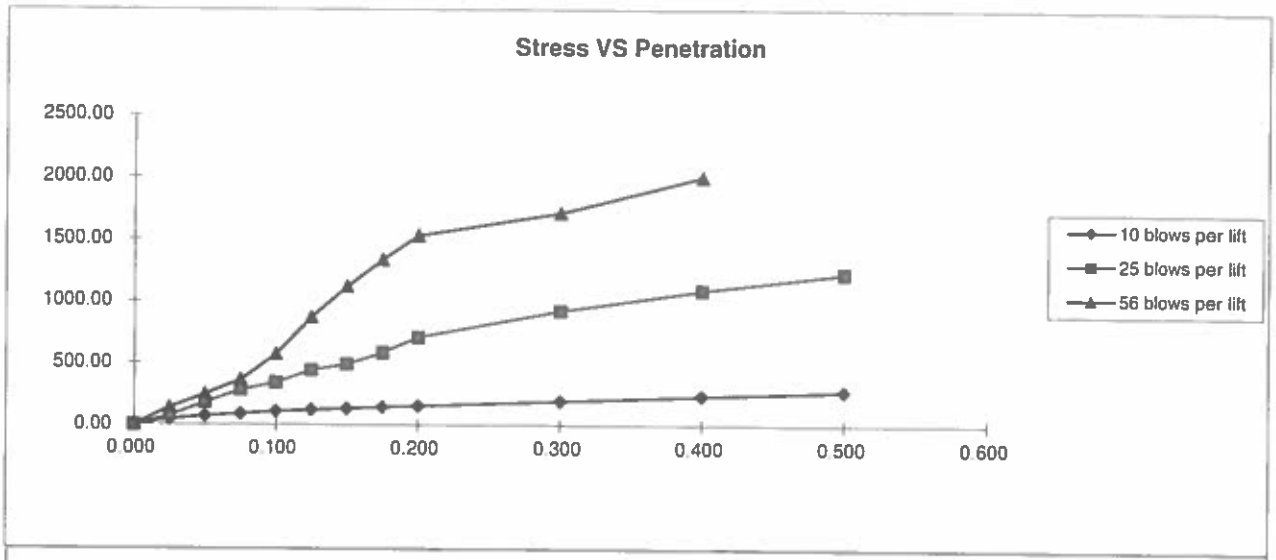
BEARING RATIO AT 90% OF MAX	21.62 ~ R VALUE	71
BEARING RATIO AT 95% OF MAX	46.27 ~ R VALUE	75

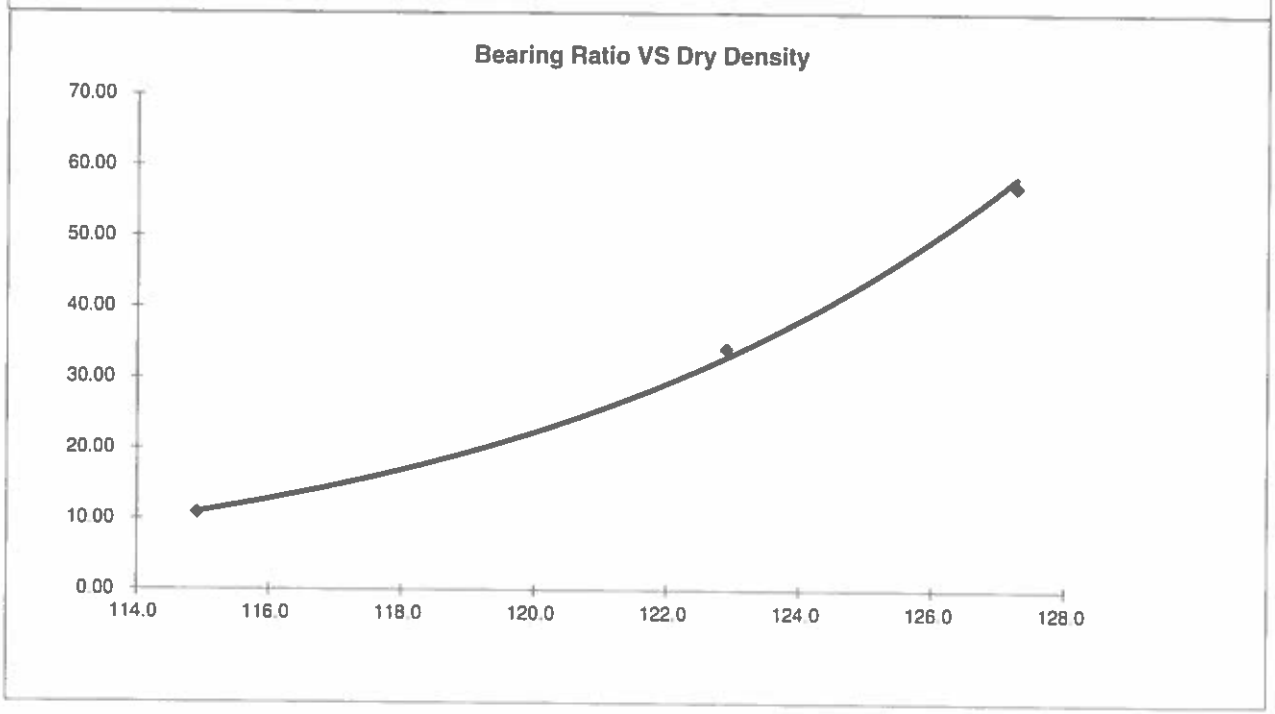
ENTECH
ENGINEERING, INC.
505 ELKTON DRIVE
COLORADO SPRINGS, COLORADO 80907

CBR TEST DATA

DRAWN:	DATE:	CHECKED:	DATE: 2/24/26

JOB NO: 200190
FIG NO: B-7





BEARING RATIO AT 90% OF MAX	21.62	~ R VALUE	71.00
BEARING RATIO AT 95% OF MAX	46.27	~ R VALUE	75.00

JOB NO: 200190
SOIL TYPE: 1

ENTECH
ENGINEERING, INC.
505 ELKTON DRIVE
COLORADO SPRINGS, COLORADO 80907

CALIFORNIA BEARING RATIO

DRAWN:	DATE:	CHECKED:	DATE: 2/24/20

JOB NO. 200190
FIG NO. B-6

CLIENT	TECH CONTRACTORS	JOB NO.	200190
PROJECT	WINDING WALK, F-2	DATE	2/25/2020
LOCATION	WINDING WALK, F-2	TEST BY	BL

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

QC BLANK PASS

ENTECH
ENGINEERING, INC.
505 ELKTON DRIVE
COLORADO SPRINGS, COLORADO 80907

LABORATORY TEST
SULFATE RESULTS

DRAWN:	DATE:	CHECKED:	DATE: 2/24/20

JOB NO. 200190
FIG NO. B-9

APPENDIX C: Pavement Design Calculations

FLEXIBLE PAVEMENT DESIGN

DESIGN DATA WINDINGWALK, F2, PH 2 - URBAN LOCAL - ESAL = 292,000

SOIL TYPE 1, CBR # 1

Equivalent (18 kip) Single Axle Load Applications (ESAL):	ESAL (W_{18}) =	292,000
Hveem Stabilometer (R Value) Results:	R =	50
Standard Deviation	S_o =	0.45
Loss in Serviceability	Δpsi =	2.2
Reliability	Reliability =	80
Reliability (z-statistic)	Z_R =	-0.84
Soil Resilient Modulus	M_R =	13168

Weighted Structural Number (WSN): → WSN = 2.09

DESIGN TABLES AND EQUATIONS

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

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

$k = M_R / 19.4$

Where:

M_R = resilient modulus (psi)

S_1 = the soil support value

R = R-value obtained from the Hveem stabilometer

CBR = California Bearing Ratio

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

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

Left	Right	Difference
5.47	5.47	0.0

Job No. 200190
Fig. No. C-1

DESIGN CALCULATIONS

CEMENT TREATED SECTIONS

DESIGN DATA: WINDINGWALK, F2, PH 2 - URBAN LOCAL - ESAL = 292K

SOIL TYPE 1, CBR # 1

Equivalent (18 kip) Single Axle Load Applications (ESAL):	ESAL =	292,000
Hveem Stabilometer (R Value) Results:	R =	50
Weighted Structural Number (WSN):	WSN =	2.09

DESIGN EQUATION

$$WSN = C_1D_1 + C_2D_2$$

C_1 = 0.44 Strength Coefficient - Hot Bituminous Asphalt

C_2 = 0.11 Strength Coefficient - Cement Treated Subgrade.

D_1 = Depth of Asphalt (inches)

D_2 = Depth of Cement Treated Subgrade (inches)

FOR FULL DEPTH ASPHALT SECTION - (CURRENTLY NOT ALLOWED)

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

Use 5.0 inches Full Depth

FOR ASPHALT + CEMENT TREATED SUBGRADE SECTION

Asphalt Thickness (t) = 4 inches

$D_2 = ((WSN) - (t)(C_1))/C_2$ = 3.0 inches

Use 8.0 inches of Cement Treated Subgrade.

RECOMMENDED ALTERNATIVES

1. 4.0 inches of Asphalt + 8 inches of Cement Treated Subgrade.
2. 5.0 inches of Full Depth Asphalt

Job No. 200190
Fig. No. C-3

DESIGN CALCULATIONS

DESIGN DATA WINDINGWALK, F2, PH 2 - URBAN LOCAL - ESAL = 292,000

SOIL TYPE 1, CBR # 1

Equivalent (18 kip) Single Axle Load Applications (ESAL):	ESAL =	292,000
Hveem Stabilometer (R Value) Results:	R =	50
Weighted Structural Number (WSN):	WSN =	2.09

DESIGN EQUATION

$$WSN = C_1D_1 + C_2D_2$$

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

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

FOR FULL DEPTH ASPHALT SECTION (CURRENTLY NOT ALLOWED)

$D_1 = (WSN)/C_1$ = 4.7 inches of Full Depth Asphalt
Use 5.0 inches Full Depth

FOR ASPHALT + AGGREGATE BASE COURSE SECTION

Asphalt Thickness (t) = [3] inches
$D_2 = ((WSN) - (t)(C_1))/C_2$ = 7.0 inches of Aggregate
Base Course, use 8.0 inches

RECOMMENDED ALTERNATIVES

1. 3.0 inches of Asphalt + 8.0 inches of Aggregate Base Course, or
2. 5.0 inches of Full Depth Asphalt

Job No. 200190
Fig. No. C-2