



**GEOTEK ENGINEERING
& TESTING SERVICES, INC.**
909 East 50th Street North
Sioux Falls, South Dakota 57104
605-335-5512 Fax 605-335-0773

April 19, 2010

SHP Engineering and Architecture
301 W. Capitol Avenue
Pierre, SD 57501

Attn: Ed Jacobson, P.E., R.L.S.

Subj: Geotechnical Exploration
Proposed Pavement Improvements
Marty Indian School
Marty, South Dakota
GeoTek #10-275

Introduction

The purpose of this report is to provide our geotechnical engineering opinions and pavement recommendations for the referenced project. We performed our work in accordance with your authorization dated March 22, 2010.

Project Information

The project is located at the existing facility for the Marty Indian School in Marty, South Dakota. We understand that the project will consist of pavement improvements to the existing roads and parking areas.

Test Borings

We performed ten (10) test borings at the site on March 31, 2010. The subsurface conditions encountered at the boring locations are illustrated on the attached boring logs. The locations of the test borings are shown on the attached site map. The subsurface conditions at other times and locations at the site may differ from those found at our test boring locations. If different conditions are encountered during construction, it is necessary that you contact us so that our recommendations can be reviewed.

The subsurface conditions encountered at the test borings consist of 2 feet to 6 feet of existing fill materials at the surface overlying fat clay (fine alluvium), lean clay with sand (glacial till) and sandy lean clay (mixed alluvium) soils. The existing fill materials consisted of mostly clay soils.

The existing pavement conditions encountered at boring locations #1 through #7 consist of 2 ½ inches to 4 inches of asphalt pavement overlying 2 to 4 inches of gravel base. Test borings #8 through #10 encountered 6 inches to 7 inches of gravel surfacing.

Laboratory Tests

We performed laboratory tests on selected samples to aid in determining the index properties of the soils. The tests consisted of moisture content, dry density, Atterberg limits (liquid limit and plastic limit), standard Proctor and California Bearing Ratio. The laboratory tests were performed in accordance with the appropriate ASTM procedures. The results of the laboratory tests are shown on the boring logs opposite the samples upon which the tests were performed or on the attached data sheets.

A sample of the existing clay fill soils (boring #10) was selected for standard Proctor and California Bearing Ratio (CBR) testing. The CBR test samples were prepared at approximately 95 percent of standard Proctor density at water contents varying from 3 percent below the optimum water content up to 3 percent above the optimum water content. However, only 92 percent compaction was achievable at 3 percent above the optimum water content. Please refer to Tables 1 shown below that summarizes the results of the CBR tests.

Table 1. CBR Values at Varying Water Contents

Sample	Soil Type	3% Below Optimum	At Optimum Water Content	3% Above Optimum
Boring 10 1'-5'	Sandy Lean Clay, brown (CL)	3.7	3.2	2.8

The results of the field and lab tests indicate the clay subgrade soils have moderate moisture and density values in the upper 4 feet of the subgrade. We estimate California Bearing Ratio (CBR) values in the range of 2.5 to 4.0 for the clay soils encountered at the boring locations.

Recommendations

We understand the pavement improvements for the project have been divided into four areas. Our recommendations for the respective areas are discussed in the following sections.

Area 1 (Borings #6 and #7)

We understand the isolated areas of distressed pavement will be removed and patched, followed by placing an asphalt overlay for the entire area. In these cut-out areas, we recommend removing the existing materials to a depth that allows for the placement of at least 9 inches of new aggregate base course and at least 4 inches of new asphalt pavement. If soft/wet subgrade conditions are encountered, the depth of the removal/replacement may need to be increased. After the patching is complete, we recommend placing a 1 1/2-inch to 2-inch thick asphalt overlay for the entire area.

We recommend the aggregate base course materials meet the requirements of Sections 260 and 882 of the SDDOT Standard Specifications. We recommend the asphalt pavement materials meet the requirements of Section 320 of the SDDOT Standard Specifications.

Area 2 (Borings #8-#10)

We understand this existing gravel-surfaced area will receive new asphalt pavement. We recommend the area be graded to the design subgrade elevation. The subgrade soils should be moisture-conditioned to within +/- 2 percent of the optimum moisture content as determined by standard proctor. Once the soils have been moisture-conditioned to the recommended level, the soils should be compacted to a minimum of 95 percent of standard Proctor density (ASTM:D698). Areas of unstable subgrade may be encountered after stripping and removals. The soils within an unstable area should be removed, and either moisture-conditioned and recompacted, or replaced with suitable subgrade fill soils. If the unstable area will not stabilize using this method, alternate stabilization methods and/or materials may be required.

We recommend providing a minimum of at least 9 inches of aggregate base course and at least 4 inches of new asphalt pavement. We recommend the aggregate base course materials meet the requirements of Sections 260 and 882 of the SDDOT Standard Specifications. We recommend the asphalt pavement materials meet the requirements of Section 320 of the SDDOT Standard Specifications.

Area 3 (Borings #1-#3)

We understand the existing asphalt pavement section in the bus loop area will be removed and replaced with a new concrete pavement section.

We recommend the area be graded to the design subgrade elevation. The subgrade soils should be moisture-conditioned to within +/- 2 percent of the optimum moisture content as determined by standard proctor. Once the soils have been moisture-conditioned to the recommended level, the soils should be compacted to a minimum of 95 percent of standard Proctor density (ASTM:D698). Areas of unstable subgrade may be encountered after stripping and removals. The soils within an unstable area should be removed, and either moisture-conditioned and recompacted, or replaced with suitable subgrade fill soils. If the unstable area will not stabilize using this method, alternate stabilization methods and/or materials may be required.

We recommend providing a minimum of at least 8 inches of new aggregate base course and at least 6 inches of new concrete pavement. We recommend the aggregate base course materials meet the requirements of Sections 260 and 882 of the SDDOT Standard Specifications. We recommend the concrete pavement meet the requirements of ACI 330 and Section 380 of the SDDOT Standard Specifications.

Area 4 (Borings #4 and #5)

We understand the isolated areas of distressed pavement will be removed and patched, followed by placing an asphalt overlay for the entire area. In these cut-out areas, we recommend removing the existing materials to a depth that allows for the placement of at least 9 inches of new aggregate base course and at least 4 inches of new asphalt pavement. If soft/wet subgrade conditions are encountered, the depth of the removal/replacement may need to be increased.

After the patching is complete, we recommend placing a 1 ½-inch to 2-inch thick asphalt overlay for the entire area.

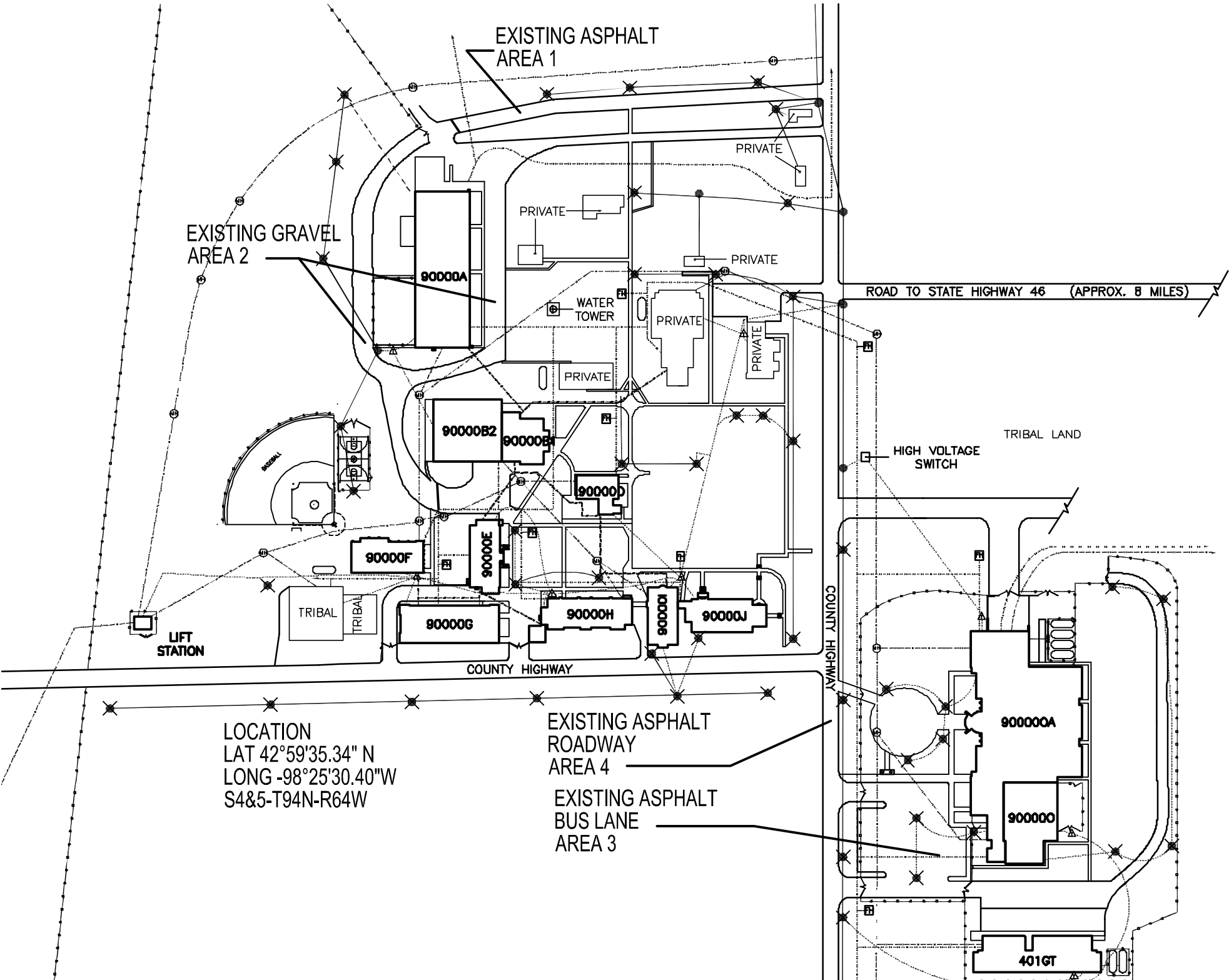
We recommend the aggregate base course materials meet the requirements of Sections 260 and 882 of the SDDOT Standard Specifications. We recommend the asphalt pavement materials meet the requirements of Section 320 of the SDDOT Standard Specifications.

Remarks

If you have any questions regarding this report, please contact our office at (605) 335-5512.

Respectfully Submitted,
GeoTek Engineering & Testing Services, Inc.

Jeff Christensen, PE
Geotechnical Manager



EXISTING ASPHALT
AREA 1

EXISTING GRAVEL
AREA 2

ROAD TO STATE HIGHWAY 46 (APPROX. 8 MILES)

TRIBAL LAND

HIGH VOLTAGE
SWITCH

LIFT
STATION

TRIBAL
TRIBAL

COUNTY HIGHWAY

COUNTY HIGHWAY

LOCATION
LAT 42°59'35.34" N
LONG -98°25'30.40"W
S4&5-T94N-R64W

EXISTING ASPHALT
ROADWAY
AREA 4

EXISTING ASPHALT
BUS LANE
AREA 3

90000A

90000B2

90000B

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GEOTECHNICAL TEST BORING LOG

GEOTEK # **10-275**

BORING NO. **1 (1 of 1)**

PROJECT **Proposed Pavement Improvements, Marty Indian School, Marty, SD**

DEPTH in FEET	DESCRIPTION OF MATERIAL	GEOLOGIC ORIGIN	N	WL	SAMPLE		LABORATORY TESTS					
					NO.	TYPE	WC	D	LL	PL	QU	
2	FILL, MIXTURE OF CLAY AND SAND: a little gravel, brown, moist, 4" of asphalt and 2" of gravel base at the surface	FILL	8		1	SPT	12					
	FAT CLAY: dark brownish gray, moist, stiff to firm, (CH)	FINE ALLUVIUM	11		2	SPT	23	104	50	20		
6			5		3	SPT						
	Bottom of borehole at 6 feet.											

WATER LEVEL MEASUREMENTS

START 3-31-10 COMPLETE 3-31-10 8:25 am

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	WATER LEVEL	METHOD
3-31-10	8:25 am	6	--	4	none	6" Flight Auger
--	--	--	--	--	--	
--	--	--	--	--	--	
--	--	--	--	--	--	CREW CHIEF Roy Hanson

GEOTECHNICAL TEST BORING 10-275.GPJ GEOTEKENG.GDT 4/19/10



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GEOTECHNICAL TEST BORING LOG

GEOTEK # **10-275**

BORING NO. **2 (1 of 1)**

PROJECT **Proposed Pavement Improvements, Marty Indian School, Marty, SD**

DEPTH in FEET	DESCRIPTION OF MATERIAL	GEOLOGIC ORIGIN	N	WL	SAMPLE		LABORATORY TESTS								
					NO.	TYPE	WC	D	LL	PL	QU				
	FILL, MOSTLY CLAY: a trace of gravel, brown and black, moist, 4" of asphalt and 2" of gravel base at the surface	FILL													
			4		1	SPT	22	107							
			8		2	SPT	25	96							
4½	FAT CLAY: dark brownish gray, moist, firm, (CH)	FINE ALLUVIUM													
			6		3	SPT	24								
6	Bottom of borehole at 6 feet.														

WATER LEVEL MEASUREMENTS

START 3-31-10 COMPLETE 3-31-10 8:40 am

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	WATER LEVEL	METHOD
3-31-10	8:40 am	6	--	4	none	6" Flight Auger
--	--	--	--	--	--	
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--	--	--	--	--	--	CREW CHIEF Roy Hanson

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GEOTECHNICAL TEST BORING LOG

GEOTEK # **10-275**

BORING NO. **3 (1 of 1)**

PROJECT **Proposed Pavement Improvements, Marty Indian School, Marty, SD**

DEPTH in FEET	DESCRIPTION OF MATERIAL	GEOLOGIC ORIGIN	N	WL	SAMPLE		LABORATORY TESTS								
					NO.	TYPE	WC	D	LL	PL	QU				
	FILL, MOSTLY CLAY: a trace of gravel, brown and black, moist, 3" of asphalt and 3" of gravel base at the surface	FILL													
			5		1	SPT	22	106							
			7		2	SPT	26	98							
4½	SANDY LEAN CLAY: brown and gray mottled, moist, firm, (CL)	MIXED ALLUVIUM													
			5		3	SPT	35								
6	Bottom of borehole at 6 feet.														

WATER LEVEL MEASUREMENTS

START 3-31-10 COMPLETE 3-31-10 9:00 am

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	WATER LEVEL	METHOD
3-31-10	9:00 am	6	--	4	none	6" Flight Auger
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GEOTECHNICAL TEST BORING LOG

GEOTEK # **10-275**

BORING NO. **4 (1 of 1)**

PROJECT **Proposed Pavement Improvements, Marty Indian School, Marty, SD**

DEPTH in FEET	DESCRIPTION OF MATERIAL	GEOLOGIC ORIGIN	N	WL	SAMPLE		LABORATORY TESTS								
					NO.	TYPE	WC	D	LL	PL	QU				
	FILL, MOSTLY CLAY: a trace of gravel, brown and black, moist, 2.5" of asphalt and 4" of gravel base at the surface	FILL													
			7		1	SPT	25								
			7		2	SPT	23	101							
4	FAT CLAY: dark brownish gray, moist, soft, (CH)	FINE ALLUVIUM													
			3		3	SPT	28								
6	Bottom of borehole at 6 feet.														

WATER LEVEL MEASUREMENTS

START 3-31-10 COMPLETE 3-31-10 9:25 am

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	WATER LEVEL	METHOD
3-31-10	9:25 am	6	--	4	none	6" Flight Auger
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--	--	--	--	--	--	CREW CHIEF Roy Hanson

GEOTECHNICAL TEST BORING 10-275.GPJ GEOTEKENG.GDT 4/19/10



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GEOTECHNICAL TEST BORING LOG

GEOTEK # **10-275**

BORING NO. **5 (1 of 1)**

PROJECT **Proposed Pavement Improvements, Marty Indian School, Marty, SD**

DEPTH in FEET	DESCRIPTION OF MATERIAL	GEOLOGIC ORIGIN	N	WL	SAMPLE		LABORATORY TESTS								
					NO.	TYPE	WC	D	LL	PL	QU				
0	FILL, MOSTLY CLAY: a trace of gravel, brown and black, moist, 3" of asphalt and 4" of gravel base at the surface	FILL													
9					1	SPT	14	119							
4					2	SPT	12	121							
4	LEAN CLAY WITH SAND: a little gravel, brown and gray mottled, moist, firm, (CL)														
7					3	SPT	28	93	47	20					
6	Bottom of borehole at 6 feet.														

WATER LEVEL MEASUREMENTS

START 3-31-10 COMPLETE 3-31-10 9:45 am

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	WATER LEVEL	METHOD
3-31-10	9:45 am	6	--	4	none	6" Flight Auger
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--	--	--	--	--	--	CREW CHIEF Roy Hanson

GEOTECHNICAL TEST BORING 10-275.GPJ GEOTEKENG.GDT 4/19/10



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GEOTECHNICAL TEST BORING LOG

GEOTEK # **10-275**

BORING NO. **6 (1 of 1)**

PROJECT **Proposed Pavement Improvements, Marty Indian School, Marty, SD**

DEPTH in FEET	DESCRIPTION OF MATERIAL	GEOLOGIC ORIGIN	N	WL	SAMPLE		LABORATORY TESTS								
					NO.	TYPE	WC	D	LL	PL	QU				
	FILL, MOSTLY CLAY: a trace of gravel, brown and black, moist, 4" of asphalt and 2" of gravel base at the surface	FILL													
			5		1	SPT	19	109							
			7		2	SPT	21	105							
			9		3	SPT	25								
6	Bottom of borehole at 6 feet.														

WATER LEVEL MEASUREMENTS

START 3-31-10 COMPLETE 3-31-10 10:05 am

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	WATER LEVEL	METHOD
3-31-10	10:05 am	6	--	4	none	6" Flight Auger
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--	--	--	--	--	--	CREW CHIEF Roy Hanson

GEOTECHNICAL TEST BORING 10-275.GPJ GEOTEKENG.GDT 4/19/10



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GEOTECHNICAL TEST BORING LOG

GEOTEK # **10-275**

BORING NO. **7 (1 of 1)**

PROJECT **Proposed Pavement Improvements, Marty Indian School, Marty, SD**

DEPTH in FEET	DESCRIPTION OF MATERIAL	GEOLOGIC ORIGIN	N	WL	SAMPLE		LABORATORY TESTS								
					NO.	TYPE	WC	D	LL	PL	QU				
	FILL, MOSTLY CLAY: a trace of gravel, brown and black, moist, 3.5" of asphalt and 2" of gravel base at the surface	FILL													
			6			1	SPT	13	115						
			10			2	SPT	19							
			11			3	SPT								
6	Bottom of borehole at 6 feet.														

WATER LEVEL MEASUREMENTS

START 3-31-10 COMPLETE 3-31-10 10:25 am

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	WATER LEVEL	METHOD
3-31-10	10:25 am	6	--	4	none	6" Flight Auger
--	--	--	--	--	--	
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GEOTECHNICAL TEST BORING 10-275.GPJ GEOTEKENG.GDT 4/19/10



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GEOTECHNICAL TEST BORING LOG

GEOTEK # **10-275**

BORING NO. **8 (1 of 1)**

PROJECT **Proposed Pavement Improvements, Marty Indian School, Marty, SD**

DEPTH in FEET	DESCRIPTION OF MATERIAL	GEOLOGIC ORIGIN	N	WL	SAMPLE		LABORATORY TESTS								
					NO.	TYPE	WC	D	LL	PL	QU				
	FILL, MOSTLY CLAY: a trace of gravel, brown and black, moist, 6" of gravel at the surface	FILL													
			15		1	SPT	17	114							
			5		2	SPT	21	97							
			5		3	SPT	26								
6	Bottom of borehole at 6 feet.														

WATER LEVEL MEASUREMENTS

START 3-31-10 COMPLETE 3-31-10 10:40 am

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	WATER LEVEL	METHOD
3-31-10	10:40 am	6	--	4	none	6" Flight Auger
--	--	--	--	--	--	
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--	--	--	--	--	--	CREW CHIEF Roy Hanson

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GEOTECHNICAL TEST BORING LOG

GEOTEK # **10-275**

BORING NO. **9 (1 of 1)**

PROJECT **Proposed Pavement Improvements, Marty Indian School, Marty, SD**

DEPTH in FEET	DESCRIPTION OF MATERIAL	GEOLOGIC ORIGIN	N	WL	SAMPLE		LABORATORY TESTS								
					NO.	TYPE	WC	D	LL	PL	QU				
	FILL, MOSTLY CLAY: a trace of gravel, brown and black, moist, 7" of gravel at the surface	FILL													
			9		1	SPT	16	112							
			7		2	SPT	18								
			4		3	SPT	31								
6	Bottom of borehole at 6 feet.														

WATER LEVEL MEASUREMENTS

START 3-31-10 COMPLETE 3-31-10 10:55 am

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	WATER LEVEL	METHOD
3-31-10	10:55 am	6	--	4	none	6" Flight Auger
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--	--	--	--	--	--	CREW CHIEF Roy Hanson

GEOTECHNICAL TEST BORING 10-275.GPJ GEOTEKENG.GDT 4/19/10



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GEOTECHNICAL TEST BORING LOG

GEOTEK # **10-275**

BORING NO. **10 (1 of 1)**

PROJECT **Proposed Pavement Improvements, Marty Indian School, Marty, SD**

DEPTH in FEET	DESCRIPTION OF MATERIAL	GEOLOGIC ORIGIN	N	WL	SAMPLE		LABORATORY TESTS								
					NO.	TYPE	WC	D	LL	PL	QU				
	FILL, MOSTLY CLAY: a trace of gravel, brown and black, moist, 6" of gravel at the surface	FILL													
			7		1	SPT	23	103							
			7		2	SPT	20	107							
					3	BAG									
			4		4	SPT	17	112							
6	Bottom of borehole at 6 feet.														

WATER LEVEL MEASUREMENTS

START 3-31-10 COMPLETE 3-31-10 11:25 am

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	WATER LEVEL	METHOD
3-31-10	11:25 am	6	--	4	none	6" Flight Auger
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GEOTECHNICAL TEST BORING 10-275.GPJ GEOTEKENG.GDT 4/19/10

SOIL CLASSIFICATION CHART

MAJOR DIVISIONS			SYMBOLS		TYPICAL DESCRIPTIONS	
			GRAPH	LETTER		
COARSE GRAINED SOILS MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	GRAVEL AND GRAVELLY SOILS MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	CLEAN GRAVELS (LITTLE OR NO FINES)		GW	WELL-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES	
		GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)		GP	POORLY-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES	
		GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)		GM	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES	
		GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)		GC	CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES	
	SAND AND SANDY SOILS MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE	CLEAN SANDS (LITTLE OR NO FINES)		SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES	
		CLEAN SANDS (LITTLE OR NO FINES)		SP	POORLY-GRADED SANDS, GRAVELLY SAND, LITTLE OR NO FINES	
		SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)		SM	SILTY SANDS, SAND - SILT MIXTURES	
		SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)		SC	CLAYEY SANDS, SAND - CLAY MIXTURES	
		SILTS AND CLAYS LIQUID LIMIT LESS THAN 50	SILTS AND CLAYS LIQUID LIMIT LESS THAN 50		ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
			SILTS AND CLAYS LIQUID LIMIT LESS THAN 50		CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
SILTS AND CLAYS LIQUID LIMIT LESS THAN 50			OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY		
SILTS AND CLAYS LIQUID LIMIT GREATER THAN 50	SILTS AND CLAYS LIQUID LIMIT GREATER THAN 50		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS		
			CH	INORGANIC CLAYS OF HIGH PLASTICITY		
			OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS		
HIGHLY ORGANIC SOILS				PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS	

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS

BORING LOG SYMBOLS AND DESCRIPTIVE TERMINOLOGY

SYMBOLS FOR DRILLING AND SAMPLING

<u>Symbol</u>	<u>Definition</u>
Bag	Bag sample
CS	Continuous split-spoon sampling
DM	Drilling mud
FA	Flight auger; number indicates outside diameter in inches
HA	Hand auger; number indicates outside diameter in inches
HSA	Hollow stem auger; number indicates inside diameter in inches
LS	Liner sample; number indicates outside diameter of liner sample
N	Standard penetration resistance (N-value) in blows per foot
NMR	No water level measurement recorded, primarily due to presence of drilling fluid
NSR	No sample retrieved; classification is based on action of drilling equipment and/or material noted in drilling fluid or on sampling bit
SH	Shelby tube sample; 3-inch outside diameter
SPT	Standard penetration test (N-value) using standard split-spoon sampler
SS	Split-spoon sample; 2-inch outside diameter unless otherwise noted
WL	Water level directly measured in boring
▼	Water level symbol

SYMBOLS FOR LABORATORY TESTS

<u>Symbol</u>	<u>Definition</u>
WC	Water content, percent of dry weight; ASTM:D2216
D	Dry density, pounds per cubic foot
LL	Liquid limit; ASTM:D4318
PL	Plastic limit; ASTM:D4318
QU	Unconfined compressive strength, pounds per square foot; ASTM:D2166

DENSITY/CONSISTENCY TERMINOLOGY

<u>Density</u>	<u>Consistency</u>	
<u>Term</u>	<u>Term</u>	
<u>N-Value</u>	<u>Term</u>	
Very Loose	0-4	Soft
Loose	5-8	Firm
Medium Dense	9-15	Stiff
Dense	16-30	Very Stiff
Very Dense	Over 30	Hard

PARTICLE SIZES

<u>Term</u>	<u>Particle Size</u>
Boulder	Over 12"
Cobble	3" – 12"
Gravel	#4 – 3"
Coarse Sand	#10 – #4
Medium Sand	#40 – #10
Fine Sand	#200 – #40
Silt and Clay	passes #200 sieve

DESCRIPTIVE TERMINOLOGY

<u>Term</u>	<u>Definition</u>
Dry	Absence of moisture, powdery
Frozen	Frozen soil
Moist	Damp, below saturation
Waterbearing	Pervious soil below water
Wet	Saturated, above liquid limit
Lamination	Up to ½" thick stratum
Layer	½" to 6" thick stratum
Lens	½" to 6" discontinuous stratum

GRAVEL PERCENTAGES

<u>Term</u>	<u>Range</u>
A trace of gravel	2-4%
A little gravel	5-15%
With gravel	16-50%

California Bearing Ratio ASTM:D1883

Project:	Proposed Pavement Improvements - Marty Indian School - #10-275	Job: 7417
Client:	Geotek Engineering & Testing Services, Inc.	Date: 4/15/10

Boring #: SB #10	Procedural Method:
Sample:	Specimens compacted to approximately 95% of maximum standard proctor density at 3% below, 3% above, and at optimum moisture content. Specimens soaked for a period of 4 days before CBR test was performed. Compaction of 95% was not achievable at 3% above optimum.
Depth (ft): 1-5' Type: Bulk	
Location:	
Classification: Lean Clay w/sand (CL)	

Laboratory Moisture-Density Values		Index Properties	
Method:	ASTM:D698 Method B	LL:	Gs:
Maximum Dry Density (PCF):	107.0	PL:	Organic Content:
Optimum Water Content:	20.0%	PI:	pH:

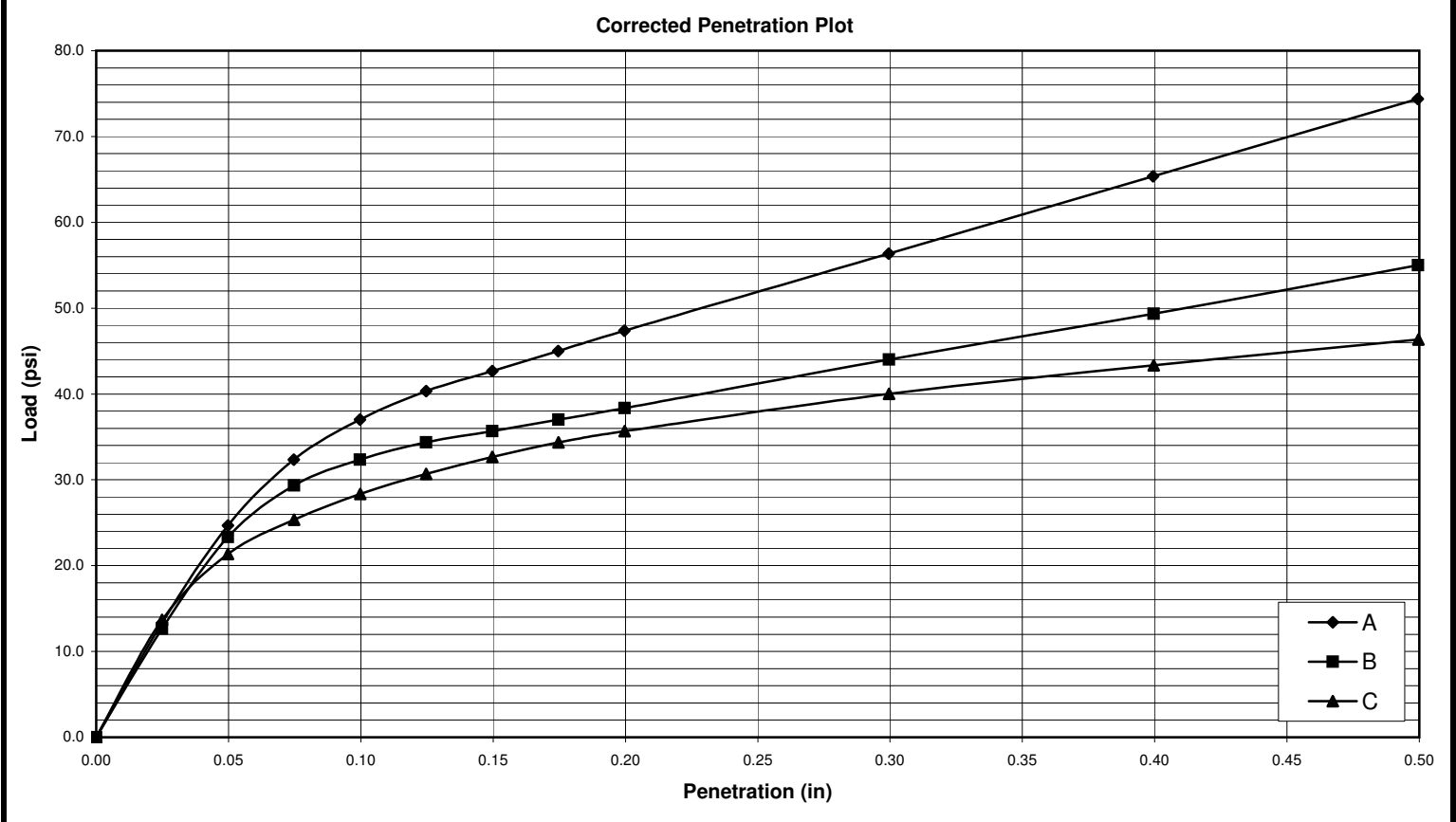
Initial Molding Conditions			
Specimen	A	B	C
Compaction Hammer:	5 lb	5 lb	5 lb
Number of Layers:	3	3	3
Blows per Layer:	NA	NA	NA
Initial Moisture Content:	17.0%	20.0%	23.0%
Initial Dry Density (PCF)	101.3	100.6	98.4
Relative Compaction	94.6%	94.1%	91.9%

Soaking Phase			
Days Soaked	4	4	4
Surcharge (psf)	50	50	50
Total Swell (%)	2.7%	1.4%	0.4%

Penetration Phase			
Surcharge (psf)	50	50	50
Corrected CBR Values			
at 0.1 inch (%)	3.7%	3.2%	2.8%
at 0.2 inch (%)	3.2%	2.6%	2.4%

Moisture Content After Penetration			
Top 1" of Specimen:	21.8%	23.3%	24.2%
Average of specimen:	20.2%	21.5%	23.6%

Stress vs. Penetration Graph



California Bearing Ratio ASTM:D1883

Project:	Proposed Pavement Improvements - Marty Indian School - #10-275	Job:	7417
Client:	Geotek Engineering & Testing Services, Inc.	Date:	4/15/10
Boring #: SB #10	Procedural Method:		
Sample:	Specimens compacted to approximately 95% of maximum standard proctor density at 3% below, 3% above, and at optimum moisture content. Specimens soaked for a period of 4 days before CBR test was performed.		
Depth (ft): 1-5'	Type: Bulk	Compaction of 95% was not achievable at 3% above optimum.	
Location:			
Classification:	Lean Clay w/sand (CL)		

Test Plot

Moisture Content vs CBR

