TO: Roger Weigel
Design Division

ATTN: Justin Schlosser
Design Division

FROM: /s/Ron Horner
Materials and Research Engineer
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Geotechnical Section

PROJECT: IM-8-029(132)078
Major Rehabilitation - Reconstruction

PCN: 18984

LOCATION: South Argusville North to South Hunter Separation - Northbound

LENGTH: 8.847 Miles

DATE: July 9, 2012

SUBJECT: Linear Soils Report and Recommendations

Attached is the Linear Soils Report and Recommendation for the above referenced project. If there are any changes made to the project after the report is issued that may require alteration to this recommendation or if you have any questions please contact Jeff Jirava at 328-6908 or jjirava@nd.gov.

IM-8-029(132)078

S Argusville N to S Hunter Sep - NB

CERTIFICATION

I hereby certify that this report was prepared by me or under my direct supervision and that I am a duly registered professional engineer under the laws of the State of North Dakota. This document was originally issued and sealed by Jeff Jirava, Registration number PE-5950 on 7/9/12 and the original document is stored at the North Dakota Department of Transportation.

_____ _____

Jeff Jirava, P.E. Date

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Linear Soils Report and Recommendations

Project: IM-8-029(132)078

PCN: 18984

Scope: Major Rehabilitation - Reconstruction

Location: S Argusville N to S Hunter Sep - NB

Length: 8.847 Miles

Project Limits: RP 79.153 to RP 88.00

Date: July 9, 2012

Introduction

This report will provide recommendations for the reconstruction of I-29 (Northbound) from RP 79.153 to RP 88.0. The pavement design recommendation is 12.0” of doweled jointed PCC on 8.0” of dense graded base. The project location is shown on Figure 1.

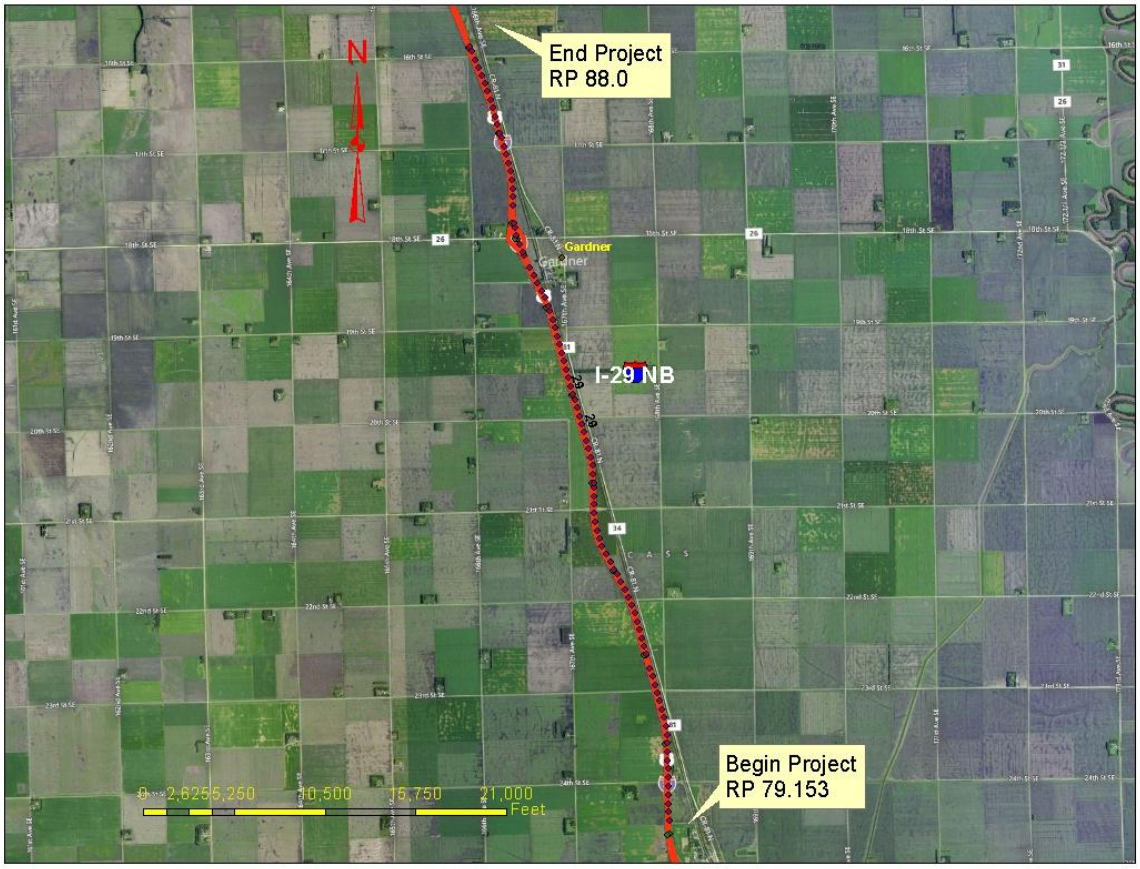

Figure 1 - Project Location Map

Existing Pavement Section

The roadway for this project consists of two segments.

RP 79.153 to RP 85.71 Northbound

Table 1 - Construction History (RP 79.153 to RP 85.71)

Construction History			
Year	Construction	Depth (in)	Width (ft)
1968	Grade	-	48
1968	C-C 104 Feet	-	-
1968	Lime Treated Subgrade	6.0	48
1970	Plant Mix Bit Base	2.0	48
1970	Cont – Reinf PCC	8.0	24
1970	Plant Mix Bit Base	5.8	4.9, 0, 11.2
1970	Hot Bit Pavement	2.0	3.0, 0, 10.0
1982	Contract Sand Seal	-	3.0, 0, 10.0
1986	Concrete Pavement Repair	-	-
1997	Int Cont Patch – 1.5”	-	37
1998	Concrete Pavement Repair	-	24
1998	HBP – Variable Depth	4.5	24
1998	HBP – Variable Depth	3.5	3.0, 0, 10.0
2008	Microsurfacing	-	24.5

RP 85.71 to RP 88.00 Northbound

Table 2 - Construction History (RP 85.71 to RP 88.00)

Construction History			
Year	Construction	Depth (in)	Width (ft)
1968	Grade	-	48
1968	C-C 104 Feet	-	-
1968	Lime Treated Subgrade	6.0	48
1970	Plant Mix Bit Base	2.0	28
1970	Cont – Reinf PCC	8.0	24
1970	Plant Mix Bit Base	6.5	4.6, 0, 11.6
1970	Hot Bit Pavement	2.0	3.0, 0, 10.0
1982	Contract Sand Seal	-	3.0, 0, 10.0
1986	Concrete Pavement Repair	-	-
1997	Int Cont Patch – 1.5”	-	37
1998	Concrete Pavement Repair	-	24
1998	HBP – Variable Depth	4.5	24
1998	HBP – Variable Depth	3.5	3.0, 0, 10.0
2008	Microsurfacing	-	24.5

Existing Pavement Section (Cont.)

The existing typical section for both segments is shown in Figure 2.

Existing Typical Section:

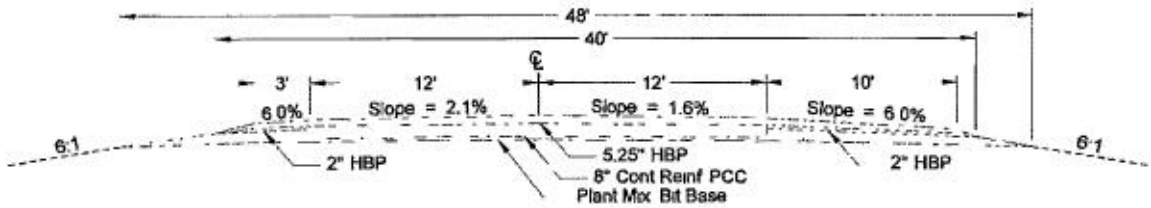

Figure 2 - Existing Typical Section

Maintenance Review

On 8/3/10, Jamie Naumann, Drill Crew Chief, spoke with Gary Heisler, Fargo District, to discuss any maintenance areas within the project limits. Gary indicated that there were no specific problem areas that needed to be investigated.

Existing Roadway Condition

Distress Data

Table 3 - Distress Data - RP 0.000 to RP 11.000

Reference Point	Alligator Cracking (0-18)	Longitudinal Cracking (0-9)	Transverse Cracking (0-9)	Block Cracking (0-9)	Bituminous Patching (0-18)	Rutting (0-12)
79	0	0	0	0	0	0
80	0	1	1	0	0	4
81	0	1	4	0	0	4
82	0	1	1	0	0	9
83	0	1	1	0	0	9
84	0	1	1	0	0	4
85	0	1	7	0	0	4
86	0	4	7	0	0	4
87	0	1	7	0	0	9
88	0	1	4	0	0	4

Existing Roadway Condition (Cont.)

Ride Data

Table 4 - Ride Data

Location	Ride Score	Distress Score		Rut (inches)		Public Ride Perception Index	International Roughness Index (inches/mile)	
		Excellent	≥ 98	Excellent	< 0.25		Excellent	< 61
		Good	88 - 97	Good	0.25 - 0.375		Good	61 - 99
		Fair	77 - 87	Fair	0.376 - 0.50		Fair	100 - 145
		Poor	≤ 76	Poor	> 0.50		Poor	>145
RP 79.153 to RP 85.71 NB	3.96	89		0.16		Good	57	
RP 85.71 to RP 88.00 NB	3.76	90		0.14		Good	62	

Boring Information

The soil borings were performed on 8/2/10 to 8/4/10 using a 6 inch solid flight auger. A total of 97 samples were taken at approximately 500' intervals along the entire length of the project. The borings extended to depths of up to 5.0 feet below the existing pavement surface.

Summary of Soil Analysis

Previous Linear Soils Report

The Soils Report dated August 4, 1997, states that the soils encountered during that investigation were "extremely" uniform.

Soil Descriptions

All of the samples that were collected were classified as AASHTO A-7-6. The AASHTO A-7-6 soil is a silt-clay material. These soils have high liquid limits and may be elastic as well as subject to extremely high volume changes. The plasticity index in these soils is high in relation to liquid limit.

Summary of Soil Analysis (Cont.)

Moisture

The moisture contents provided in this report and summarized below have been obtained from samples taken on 8/2/10 and 8/4/10.

Table 5 - Summary of In-Place and Optimum Moisture Contents

Quantity	AASHTO Classification	In-Place Moisture Range (%)	In-Place Moisture Average (%)	T-99 Optimum Moisture Average (%)	Difference Between Average In-Place and T-99 Optimum Moistures (%)
97	A-7-6	27.4-48.4	32.0	23.0	9.0

Table 6 - Summary of In-Place versus Optimum Moisture Contents

In-Place Moisture vs. Optimum Moisture						
Quantity	**AASHTO Classification**	**Below Optimum**	**Optimum to Moderate** (0 to 6% over optimum)	**Moderate to High** (6 to 10% over optimum)	**High** (10 to 16% over optimum)	**Very High** (> 16% over optimum)
97	A-7-6	0%	29%	23%	45%	3%

Atterberg Limits

Table 7 - Summary of Atterberg Limits

AASHTO Classification	Liquid Limit Range (%)	Liquid Limit Average (%)	Plastic Limit Range (%)	Plastic Limit Average (%)	Plasticity Index Range (%)	Plasticity Index Average (%)
A-7-6	48-79	68	18-43	26	29-51	42

Swell Potential

The swell potential, which is based on the Plasticity Index (PI), is shown in the following table.

Table 8 - Swell Potential

Low (Plasticity Index < 25)	**Marginal** (25 ≤ Plasticity Index ≤ 35)	**High** (Plasticity Index > 35)
0%	7%	93%

Summary of Soil Analysis (Cont.)

Frost Susceptibility

Lab Number 1195 was classified as an F4 soil. The F4 designation indicates that under the right conditions these soils have a higher probability of heaving during freeze/thaw cycles.

Group Index

All of the samples were classified as A-7-6. The Group Indexes from the samples ranged from a low of 18 to a high of 54 with an average of 40. A group index of 20 or greater indicates a “very poor” subgrade material.

Design Recommendations

The analysis of the soils shows that the moisture contents were high and were, on average, 9.0% above the T-99 optimum moisture contents. The majority of the samples have high swell potential. These high swell potentials are common in the Red River Valley. The Geotechnical Section Recommends that 500 feet of 18 inch subcut be provided for use at the discretion of the project engineer.

We recommend placing geotextile reinforcement fabric R1 directly on the proposed subgrade across the entire pavement section for the total length of the project in lieu of subgrade prep. This will reduce the amount of disturbance to the subgrade, which will allow the soil to remain at its natural moisture content and thus limit any future movement.

Design Information

Depth = 18 inches

- The subcut should be cut to a depth of 18 inches below the top of the proposed subgrade elevation. The construction requirements are in 302.02 C.

Area = 500 feet as to be determined by the engineer

- This 500 feet is to be used at the discretion of the project engineer

Transitioning = 20:1

- This subcut will require a 20:1 transition until it ties into the subgrade on the adjacent legs of the intersection.

Plan Notes

None

The recommendations in this report are based on the Reconstruction option. If the scope of work, vertical profile or horizontal alignment is changed, in either the conceptual phase or the design phase, Materials and Research must be notified as soon as possible to ensure that there is adequate geotechnical information addressing these areas.

APPENDIX A

SUMMARY OF SOIL ANALYSIS

PROJECT NO. IM-8-029(132)078
PCN 18984
DESCRIPTION Reconstruction

	GI ≤ 20	Low Swell	Below Opt.
			0% to 6% Over Opt.
		Marginal Swell	6% to 10% Over Opt.
	GI > 20		10% to 16% Over Opt
		High Swell	More than 16% Over

Moisture Cont. Below PL	
Moisture Cont. 0% to 5% Over PL	
Moisture Cont. More Than 5% Above PL	

Lab No.	STA	Offset	Depth of Sample (ft)	Plastic Limit (PL)	AASHTO	Group Index	Optimum Moisture	Swell Potential (PI)	Average In-Place Moisture Content of	Moisture Content @ Certain Depths 2 foot	3 foot	4 foot	5 foot	F4 Soil
1187	79+0807	Rt 13 NB	1 - 5	25.3	A-7-6(48)	48	19.2	47	33.9	44.7	30.9	30.2	29.6	
1188	79+1307	Rt 14 NB	1.4 - 5	24.2	A-7-6(37)	37	25.2	41	33	33.1	30.9	33.5	34.6	
1189	79+1807	Rt 14 NB	1.3 - 5	27.6	A-7-6(47)	47	20.3	46	34	34.2	33.6	35.7	32.6	
1190	79+2307	Rt 14 NB	1.3 - 5	26.8	A-7-6(47)	47	26	44	30.4	31.5	28.4	30.5	31.4	
1191	79+2807	Rt 14 NB	1.3 - 5	27.1	A-7-6(34)	34	20	37	31.9	30.3	31.2	34.8	31.4	
1192	79+3307	Rt 14 NB	1.2 - 5	24.9	A-7-6(46)	46	26.3	45	32.7	32.2	31.5	32.1	34.9	
1193	79+3807	Rt 14 NB	1.2 - 5	23.8	A-7-6(45)	45	19.3	47	31.9	31	32.1	30.8	33.9	
1194	79+4307	Rt 14 NB	1.1 - 5	27.9	A-7-6(34)	34	25.8	33	32	32.2	31.2	30.8	33.9	
1195	79+4807	Rt 14 NB	1.1 - 5	42.6	A-7-5(39)	39	19.3	36	33.6	38.7	31.5	32.6	31.7	
720	80+0000	Rt 13 NB	1.3 - 5	24	A-7-6(40)	40	22.2	42	32.1	35	30.3	31.6	31.6	
721	80+0500	Rt 13 NB	1.1 - 5	25.8	A-7-6(40)	40	18.8	41	31.2	28.4	31.9	30.3	34.2	
722	80+1000	Rt 14 NB	1 - 5	24.5	A-7-6(31)	31	22.7	38	30.3	33.8	29	29.5	28.8	
723	80+1500	Rt 13 NB	1.1 - 5	24.4	A-7-6(38)	38	18	41	27.4	27.9	28.2	24	29.3	
724	80+2000	Rt 13 NB	1.2 - 5	25.7	A-7-6(48)	48	25.9	45	30.2	29	31	29.1	31.7	
725	80+2500	Rt 13 NB	1.1 - 5	26.2	A-7-6(46)	46	19.3	44	30.3	30.4	27.9	31.2	31.7	
726	80+3000	Rt 13 NB	1.2 - 5	25	A-7-6(43)	43	24.4	45	30.7	33	30.9	28.6	29.9	
727	80+3500	Rt 13 NB	1.1 - 5	24.3	A-7-6(23)	23	18.7	34	30.1	33.1	28.6	28.1	30.8	
728	80+4000	Rt 13 NB	1.1 - 5	25.2	A-7-6(36)	36	23.7	40	30	31	28.8	29.6	30.5	
729	80+4500	Rt 13 NB	1.3 - 5	24.6	A-7-6(38)	38	18	40	35.5	32.5	30.9	47.5	30.9	
730	80+5000	Rt 13 NB	1.5 - 5	25.5	A-7-6(45)	45	19.9	48	30.4	31.7	30	30.2	29.6	
731	81+0000	Rt 13 NB	1.4 - 5	24.4	A-7-6(33)	33	18.8	37	32	29.6	32.1	31.5	34.7	
732	81+0500	Rt 13 NB	1.4 - 5	25.8	A-7-6(27)	27	24.6	35	31	27.7	30.8	32.6	32.9	
733	81+1000	Rt 13 NB	1.1 - 5	18.4	A-7-6(24)	24	19.4	29	31.1	32	30.5	30.9	30.9	
734	81+1500	Rt 13 NB	1.2 - 5	24.8	A-7-6(35)	35	26	40	32.2	33.2	31	30.3	34.1	
735	81+2000	Rt 13 NB	1.2 - 5	25	A-7-6(35)	35	19	39	31.4	30.5	34.2	31.4	29.8	
736	81+2500	Rt 13 NB	1.1 - 5	23.3	A-7-6(18)	18	24.2	35	48.4	43.4	88.2	32.2	29.7	
737	81+3000	Rt 13 NB	1.1 - 5	24.9	A-7-6(32)	32	17.9	41	33.6	32.8	31.9	32.9	36.7	
738	81+3500	Rt 13 NB	1.1 - 5	25.3	A-7-6(33)	33	23.9	39	34	31.7	31.6	38.5	34.4	
739	81+4000	Rt 13 NB	1.2 - 5	26	A-7-6(41)	41	19.2	43	30.7	28.8	31.1	30.7	32.3	
740	81+4500	Rt 13 NB	1.2 - 5	27.2	A-7-6(34)	34	18.6	39	32.7	33.1	32.8	31.9	32.8	
741	81+5000	Rt 13 NB	1.2 - 5	25.3	A-7-6(35)	35	25.3	40	34	36.3	33.3	32.7	33.7	
742	82+0000	Rt 13 NB	1.3 - 5	26.7	A-7-6(49)	49	20.3	49	34.1	34.6	36.8	31.1	34	
743	82+0500	Rt 13 NB	1.3 - 5	26.6	A-7-6(42)	42	26.6	43	29.5	28.3	27.8	32.2	29.7	
744	82+1000	Rt 13 NB	1.1 - 5	25.4	A-7-6(32)	32	18.5	37	30.1	32.1	26.1	29.7	32.5	
745	82+1500	Rt 13 NB	1.4 - 5	25.6	A-7-6(34)	34	24.9	40	30.8	30.9	33.2	31.6	27.7	
746	82+2000	Rt 13 NB	1.1 - 5	26.9	A-7-6(36)	36	20.1	39	30.6	30.3	28.9	33.5	29.8	
747	82+2500	Rt 13 NB	1.2 - 5	24.7	A-7-6(34)	34	26.3	36	33.1	29.2	36.4	39.8	27.2	
748	82+3000	Rt 13 NB	1.2 - 5	26.4	A-7-6(44)	44	19.1	46	33.4	32.6	34.6	32.9	33.5	
749	82+3500	Rt 13 NB	1.2 - 5	27	A-7-6(42)	42	26.1	43	29.9	26.9	28.7	31.9	32.1	
750	82+4000	Rt 13 NB	1.5 - 5	22.5	A-7-6(38)	38	18.1	47	29.9	30.7	29.5	30.6	28.8	
751	82+4500	Rt 13 NB	1.3 - 5	26	A-7-6(39)	39	23.7	41	29.6	28.6	30.6	31.1	28.1	
752	82+5000	Rt 13 NB	1.3 - 5	26.2	A-7-6(48)	48	23.6	48	30.6	31.1	32.3	30	29	
753	83+0000	Rt 13 NB	1.1 - 5	23.7	A-7-6(39)	39	19.6	40	31.3	29.3	30.4	30.6	34.9	
754	83+0500	Rt 13 NB	1.2 - 5	25.4	A-7-6(38)	38	25.9	39	28.9	26.5	29.1	29.7	30.3	
755	83+1000	Rt 13 NB	1.2 - 5	23.8	A-7-6(28)	28	18.2	37	30	28.6	30	30.1	31.2	
756	83+1500	Rt 13 NB	1.4 - 5	23.4	A-7-6(43)	43	27	46	29.9	30.4	31.2	29.3	28.6	
757	83+2000	Rt 13 NB	1.3 - 5	22.3	A-7-6(44)	44	19.7	45	30.4	29.6	30.7	30.3	31	
758	83+2500	Rt 13 NB	1.3 - 5	25.1	A-7-6(38)	38	28.6	42	30.6	28.4	32	30.5	31.4	
759	83+3000	Rt 13 NB	1.3 - 5	23.8	A-7-6(47)	47	19.2	48	29.8	27.4	31.5	30.8	29.6	
760	83+3500	Rt 13 NB	1.1 - 5	24.5	A-7-6(40)	40	27	40	31.2	33.3	32.5	30.4	28.6	
761	83+4000	Rt 13 NB	1.2 - 5	23	A-7-6(41)	41	18.6	43	33	31.2	31.1	36.6	33.1	
762	83+4500	Rt 13 NB	1.2 - 5	28.2	A-7-6(41)	41	28.5	39	31.5	31	32.4	31.2	31	
763	83+5000	Rt 13 NB	1 - 5	24.6	A-7-6(42)	42	19.8	42	30.7	32.1	29.8	33	27.8	
764	84+0000	Rt 13 NB	1 - 5	26.2	A-7-6(43)	43	27.5	44	32.2	30.1	29.7	34.6	34.2	
765	84+0500	Rt 13 NB	1 - 5	26.7	A-7-6(48)	48	19.8	45	31.1	33.2	32.2	29.4	29.5	
766	84+1000	Rt 13 NB	1 - 5	25.1	A-7-6(50)	50	26	45	28.3	27.4	27.7	30	28.5	
767	84+1500	Rt 13 NB	1 - 5	25.7	A-7-6(39)	39	19	37	30.2	30.8	28.1	31.9	30.3	
768	84+2000	Rt 13 NB	1.2 - 5	26.1	A-7-6(41)	41	27.9	40	28	28	28.6	23.6	31.9	
769	84+2500	Rt 13 NB	1.1 - 5	26.4	A-7-6(38)	38	18.9	39	29	28	26.7	29.1	32.2	
770	84+3000	Rt 13 NB	1 - 5	26.4	A-7-6(46)	46	26.9	42	30.5	29.1	30.9	31.7	30.2	
771	84+3500	Rt 13 NB	1.2 - 5	26.2	A-7-6(34)	34	19.9	36	30.4	27.4	28.1	32.4	33.7	
772	84+4000	Rt 13 NB	1.1 - 5	28.5	A-7-6(49)	49	26	49	30.4	29.5	24.7	38.5	28.9	
773	84+4500	Rt 13 NB	1.1 - 5	26.7	A-7-6(52)	52	19.6	49	29.2	33.7	22.6	30.4	30.2	
774	84+5000	Rt 13 NB	1.2 - 5	27.2	A-7-6(46)	46	27.8	46	32.4	39	30	30.2	30.3	
1196	85+0000	Rt 14 NB	1.5 - 5	28.2	A-7-6(50)	50	27.1	47	36.1	45.4	31.4	34.1	33.5	
1197	85+0500	Rt 14 NB	1.5 - 5	26.3	A-7-6(43)	43	20.1	43	36.2	47.6	31	34.1	31.8	
1198	85+1000	Rt 14 NB	1.1 - 5	26.3	A-7-6(54)	54	27.2	50	35.4	43.8	31.2	34.9	31.7	
1199	85+1500	Rt 14 NB	1.2 - 5	28.5	A-7-6(41)	41	20.5	38	32.2	33.6	32.2	31.4	31.5	
1200	85+2000	Rt 14 NB	1.1 - 5	25.8	A-7-6(43)	43	26.3	43	30.4	33.7	29.5	28.1		
1201	85+2500	Rt 14 NB	1.1 - 5	26.8	A-7-6(50)	50	20.3	48	32.4	33.3	30.8	32.9	32.5	
1202	85+3280	Rt 14 NB	1 - 5	26.8	A-7-6(41)	41	27.2	42	30	31.9	29.5	29.9	28.9	
1203	85+3500	Rt 14 NB	1.1 - 5	25.1	A-7-6(47)	47	20	46	29.4	32.1	25	28.9	31.7	
1204	85+4000	Rt 14 NB	1.2 - 5	29.5	A-7-6(47)	47	29.5	45	30.3	33.1	30.4		27.3	
1205	85+4500	Rt 14 NB	1.1 - 5	25.6	A-7-6(47)	47	20.3	48	35.1	31.1	30.2	32	47.2	
1206	85+5000	Rt 14 NB	1.3 - 5	27.9	A-7-6(42)	42	28.4	43	32	33.6	29.4	32	33	
1207	86+0000	Rt 14 NB	1.4 - 5	26.4	A-7-6(48)	48	20.3	45	31.5	31.9	32.6	30.1	31.5	
1208	86+1000	Rt 14 NB	1 - 5	27	A-7-6(43)	43	27.8	46	34	33.7	35.8	34.1	32.4	
1209	86+1500	Rt 14 NB	1.2 - 5	27.4	A-7-6(40)	40	20.7	39	33	32.9	31.2	34.6	33.2	
1210	86+2000	Rt 14 NB	1.4 - 5	27.4	A-7-6(42)	42	28.3	43	35.5	44.3	32.5	32.1	33	
1211	86+2500	Rt 14 NB	1.4 - 5	25.3	A-7-6(44)	44	19.3	42	32.6	37.3	28.7	31.8	32.7	
1212	86+3000	Rt 14 NB	1.5 - 5	26	A-7-6(44)	44	29.5	42	32.2	31.8	30.6	35.8	30.9	
1213	86+3500	Rt 14 NB	1.5 - 5	26.8	A-7-6(43)	43	19.9	44	32.9	33.8	30.6	32.3	35.1	
1214	86+4000	Rt 14 NB	1.2 - 5	26.7	A-7-6(44)	44	26.9	41	33.7	35.5	30.4	33.9	34.8	
1215	86+4500	Rt 14 NB	1 - 5	27.2	A-7-6(48)	48	21.1	46	34.1	32	31.9	34.1	38.2	
1216	86+5000	Rt 14 NB	1.2 - 5	28.8	A-7-6(44)	44	27.8	43	35.5	35.9	31.8	40.2	34.1	
1217	87+0000	Rt 14 NB	1.2 - 5	26.4	A-7-6(37)	37	20.8	37	33.1	33.5	33.3	35.7	29.9	
1218	87+0500	Rt 14 NB	1 - 5	28.7	A-7-6(45)	45	30.2	42	32.9	33.5	33.9	34	30.4	
1219	87+1000	Rt 14 NB	1.2 - 5	27.6	A-7-6(39)	39	20.3	42	33.1	30	33.2	35.1	33.8	
1220	87+1500	Rt 14 NB	1.2 - 5	25.4	A-7-6(38)	38	28	41	32	30.9	33.1	31	33.1	
1221	87+2000	Rt 14 NB	1.2 - 5	27.5	A-7-6(38)	38	18.8	38	30.2	30.4	26.5	29.5	34.5	
1222	87+2500	Rt 14 NB	1.2 - 5	25.9	A-7-6(51)	51	28.3	51	33.8	34.2	34.1	34.2	32.8	
1223	87+3000	Rt 14 NB	1.3 - 5	25.7	A-7-6(40)	40	19.5	41	31.6	32.9	31	31.1	31.8	
1224	87+3500	Rt 14 NB	1.2 - 5	26.4	A-7-6(35)	35	26.8	40	33.2	30.5	33.7	33.1	35.7	
1225	87+4000	Rt 14 NB	1.2 - 5	27.7	A-7-6(31)	31	20.5	37	34.5	36.4	33.8	34.7	33	
1226	87+4500	Rt 14 NB	1.1 - 5	26.1	A-7-6(28)	28	27	34	32.2	26.9	31.7	34	36.1	
1227	87+5000	Rt 14 NB	1.2 - 5	25.5	A-7-6(41)	41	20	41	33	37.7	30.7	32.2	31.6	
1228	88+0000	Rt 14 NB	1.2 - 5	26.3	A-7-6(30)	30	28.9	34	32.9	30.3	32.2	34.2	34.9	

APPENDIX B

LAB RESULTS

Linear Laboratory Analysis

Department of Transportation, Materials and Research Division
300 Airport Road, Bismarck ND 58504 (701) 328-6900

Report Number	SS-53-2010	**Date Reported**	12/13/2010	**District**	Bismarck
County	CASS	**Submitted By**	Naumann	**Project Number**	IM-8-029(132)078
		AASHTO Test Method		**PCN**	18984

Comments

Lab Number	1187	1188	1189	1190
Reference Pt + Feet	79+0807	79+1307	79+1807	79+2307
Distance From CenterLine (Ft.)	Rt 13 NB	Rt 14 NB	Rt 14 NB	Rt 14 NB
Depth, Ft.	1.3 - 5.0	1.3 - 5.0	1.1 - 5.0	1.2 - 5.0
Field Sample No.	1187	1188	1189	1190
% Pass. 3/8" Sieve	100	100	100	100
% Pass. No. 4 Sieve	100	98	99	100
% Pass. No. 10 Sieve	97	95	97	98
% Coarse Sand (-No. 10 + No. 40)	3	5	3	2
% Fine Sand (-No. 40 + No. 200)	3	6	4	3
% Silt (0.074 - 0.005 mm)	26	26	27	29
% Clay (-0.005 mm)	65	59	63	64
Liquid Limit (-No. 40)	72	65	73	71
Plasticity Index (-No. 40)	47	41	46	44
Plastic Limit	25	24	28	27
Soil Color	BRN/GRY/BLK	BRN/GRY/BLK	BRN/GRY/BLK	BRN/GRY/BLK
Textural Class	CLY	CLY	CLY	CLY
Soil Class (AASHTO M-145)	A-7-6(48)	A-7-6(37)	A-7-6(47)	A-7-6(47)
Frost Class	F3	F3	F3	F3
Optimum Moisture (%)	19.2	25.2	20.3	26.0
Maximum Dry Density (pcf)	109.5	93.0	105.0	91.8
% Organic Content				
Depth (Ft.) | Moisture (%)	2 | 44.7	2 | 33.1	2 | 34.2	2 | 31.5
	3 | 30.9	3 | 30.9	3 | 33.6	3 | 28.4
	4 | 30.2	4 | 33.5	4 | 35.7	4 | 30.5
	5 | 29.6	5 | 34.6	5 | 32.6	5 | 31.4
Avg. Moisture of Sample Depth	33.9	33.0	34.0	30.4

Scott W. Wutzke, Testing Lab Supervisor
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Linear Laboratory Analysis

Department of Transportation, Materials and Research Division
300 Airport Road, Bismarck ND 58504 (701) 328-6900

Report Number	SS-53-2010	**Date Reported**	12/13/2010	**District**	Bismarck
County	CASS	**Submitted By**	Naumann	**Project Number**	IM-8-029(132)078
		AASHTO Test Method		**PCN**	18984

Comments

Lab Number	1191	1192	1193	1194
Reference Pt + Feet	79+2807	79+3307	79+3807	79+4307
Distance From CenterLine (Ft.)	Rt 14 NB	Rt 14 NB	Rt 14 NB	Rt 14 NB
Depth, Ft.	1.2 - 5.0	1.2 - 50.3	1.1 - 5.0	1.1 - 5.0
Field Sample No.	1191	1192	1193	1194
% Pass. 3/8" Sieve	100	100	100	100
% Pass. No. 4 Sieve	99	100	99	99
% Pass. No. 10 Sieve	95	97	97	98
% Coarse Sand (-No. 10 + No. 40)	5	3	4	3
% Fine Sand (-No. 40 + No. 200)	5	3	5	4
% Silt (0.074 - 0.005 mm)	27	19	20	24
% Clay (-0.005 mm)	57	72	68	67
Liquid Limit (-No. 40)	64	70	71	61
Plasticity Index (-No. 40)	37	45	47	33
Plastic Limit	27	25	24	28
Soil Color	BRN/GRY/BLK	BRN/GRY/BLK	BRN/GRY/BLK	BRN/GRY/BLK
Textural Class	CLY	CLY	CLY	CLY
Soil Class (AASHTO M-145)	A-7-6(34)	A-7-6(46)	A-7-6(45)	A-7-6(34)
Frost Class	F3	F3	F3	F3
Optimum Moisture (%)	20.0	26.3	19.3	25.8
Maximum Dry Density (pcf)	105.7	91.0	107.1	93.9
% Organic Content				
Depth (Ft.) | Moisture (%)	2 | 30.3	2 | 32.2	2 | 31.0	2 | 32.2
	3 | 31.2	3 | 31.5	3 | 32.1	3 | 31.2
	4 | 34.8	4 | 32.1	4 | 30.8	4 | 30.8
	5 | 31.4	5 | 34.9	5 | 33.9	5 | 33.9
Avg. Moisture of Sample Depth	31.9	32.7	31.9	32.0

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Linear Laboratory Analysis

Department of Transportation, Materials and Research Division
300 Airport Road, Bismarck ND 58504 (701) 328-6900

Report Number	SS-53-2010	**Date Reported**	12/13/2010	**District**	Bismarck
County	CASS	**Submitted By**	Naumann	**Project Number**	IM-8-029(132)078
		AASHTO Test Method		**PCN**	18984

Comments

Lab Number	1195	720	721	722
Reference Pt + Feet	79+4807	80+0000	80+0500	80+1000
Distance From CenterLine (Ft.)	Rt 14 NB	Rt 13 NB	Rt 13 NB	Rt 14 NB
Depth, Ft.	1.2 - 5.0	1.4 - 5.0	1.3 - 5.0	1.3 - 5.0
Field Sample No.	1195	720	721	722
% Pass. 3/8" Sieve	100	100	100	100
% Pass. No. 4 Sieve	99	99	100	97
% Pass. No. 10 Sieve	97	97	97	90
% Coarse Sand (-No. 10 + No. 40)	5	5	5	6
% Fine Sand (-No. 40 + No. 200)	5	5	5	7
% Silt (0.074 - 0.005 mm)	18	24	21	20
% Clay (-0.005 mm)	69	63	67	57
Liquid Limit (-No. 40)	79	66	67	63
Plasticity Index (-No. 40)	36	42	41	38
Plastic Limit	43	24	26	25
Soil Color	BRN/GRY/BLK	BLK/GRY	BRN/GRY	BRN/GRY
Textural Class	CLY	CLY	CLY	CLY
Soil Class (AASHTO M-145)	A-7-5(39)	A-7-6(40)	A-7-6(40)	A-7-6(31)
Frost Class	F4	F3	F3	F3
Optimum Moisture (%)	19.3	22.2	18.8	22.7
Maximum Dry Density (pcf)	108.2	90.4	110.1	92.7
% Organic Content				
Depth (Ft.) | Moisture (%)	2 | 38.7	2 | 35.0	2 | 28.4	2 | 33.8
	3 | 31.5	3 | 30.3	3 | 31.9	3 | 29.0
	4 | 32.6	4 | 31.6	4 | 30.3	4 | 29.5
	5 | 31.7	5 | 31.6	5 | 34.2	5 | 28.8
Avg. Moisture of Sample Depth	33.6	32.1	31.2	30.3

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Linear Laboratory Analysis

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County	CASS	**Submitted By**	Naumann	**Project Number**	IM-8-029(132)078
		AASHTO Test Method		**PCN**	18984

Comments

Lab Number	723	724	725	726
Reference Pt + Feet	80+1500	80+2000	80+2500	80+3000
Distance From CenterLine (Ft.)	Rt 13 NB	Rt 13 NB	Rt 13 NB	Rt 13 NB
Depth, Ft.	1.3 - 5.0	1.1 - 5.0	1.2 - 5.0	1.2 - 5.0
Field Sample No.	723	724	725	726
% Pass. 3/8" Sieve	100	100	100	100
% Pass. No. 4 Sieve	99	100	100	99
% Pass. No. 10 Sieve	95	98	98	96
% Coarse Sand (-No. 10 + No. 40)	5	2	3	4
% Fine Sand (-No. 40 + No. 200)	5	3	4	6
% Silt (0.074 - 0.005 mm)	19	24	23	20
% Clay (-0.005 mm)	65	70	68	67
Liquid Limit (-No. 40)	66	71	70	70
Plasticity Index (-No. 40)	41	45	44	45
Plastic Limit	24	26	26	25
Soil Color	BRN/GRY/BLK	BLK/GRY	BLK/GRY	BRN/GRY/BLK
Textural Class	CLY	CLY	CLY	CLY
Soil Class (AASHTO M-145)	A-7-6(38)	A-7-6(48)	A-7-6(46)	A-7-6(43)
Frost Class	F3	F3	F3	F3
Optimum Moisture (%)	18.0	25.9	19.3	24.4
Maximum Dry Density (pcf)	110.0	91.5	108.7	93.2
% Organic Content				
Depth (Ft.) | Moisture (%)	2 | 27.9	2 | 29.0	2 | 30.4	2 | 33.0
	3 | 28.2	3 | 31.0	3 | 27.9	3 | 30.9
	4 | 24.0	4 | 29.1	4 | 31.2	4 | 28.6
	5 | 29.3	5 | 31.7	5 | 31.7	5 | 29.9
Avg. Moisture of Sample Depth	27.4	30.2	30.3	30.7

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Linear Laboratory Analysis

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Report Number	SS-53-2010	**Date Reported**	12/13/2010	**District**	Bismarck
County	CASS	**Submitted By**	Naumann	**Project Number**	IM-8-029(132)078
		AASHTO Test Method		**PCN**	18984

Comments

Lab Number	727	728	729	730
Reference Pt + Feet	80+3500	80+4000	80+4500	80+5000
Distance From CenterLine (Ft.)	Rt 13 NB	Rt 13 NB	Rt 13 NB	Rt 13 NB
Depth, Ft.	1.0 - 5.0	1.0 - 5.0	1.0 - 5.0	1.0 - 5.0
Field Sample No.	727	728	729	730
% Pass. 3/8" Sieve	100	100	100	100
% Pass. No. 4 Sieve	92	98	99	98
% Pass. No. 10 Sieve	86	96	96	95
% Coarse Sand (-No. 10 + No. 40)	9	6	4	4
% Fine Sand (-No. 40 + No. 200)	9	7	6	6
% Silt (0.074 - 0.005 mm)	21	25	24	23
% Clay (-0.005 mm)	47	58	63	62
Liquid Limit (-No. 40)	58	66	65	73
Plasticity Index (-No. 40)	34	40	40	48
Plastic Limit	24	25	25	26
Soil Color	BRN/GRY/BLK	BLK/GRY	BLK/GRY	BLK/GRY
Textural Class	CLY	CLY	CLY	CLY
Soil Class (AASHTO M-145)	A-7-6(23)	A-7-6(36)	A-7-6(38)	A-7-6(45)
Frost Class	F3	F3	F3	F3
Optimum Moisture (%)	18.7	23.7	18.0	19.9
Maximum Dry Density (pcf)	108.4	94.9	110.2	106.5
% Organic Content				
Depth (Ft.) | Moisture (%)	2 | 33.1	2 | 31.0	2 | 32.5	2 | 31.7
	3 | 28.6	3 | 28.8	3 | 30.9	3 | 30.0
	4 | 28.1	4 | 29.6	4 | 47.5	4 | 30.2
	5 | 30.8	5 | 30.5	5 | 30.9	5 | 29.6
Avg. Moisture of Sample Depth	30.1	30.0	35.5	30.4

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Linear Laboratory Analysis

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Report Number	SS-53-2010	**Date Reported**	12/13/2010	**District**	Bismarck
County	CASS	**Submitted By**	Naumann	**Project Number**	IM-8-029(132)078
		AASHTO Test Method		**PCN**	18984

Comments

Lab Number	731	732	733	734
Reference Pt + Feet	81+0000	81+0500	81+1000	81+1500
Distance From CenterLine (Ft.)	Rt 13 NB	Rt 13 NB	Rt 13 NB	Rt 13 NB
Depth, Ft.	1.0 - 5.0	1.2 - 5.0	1.1 - 5.0	1.0 - 5.0
Field Sample No.	731	732	733	734
% Pass. 3/8" Sieve	100	100	100	100
% Pass. No. 4 Sieve	99	95	98	97
% Pass. No. 10 Sieve	95	91	94	92
% Coarse Sand (-No. 10 + No. 40)	5	8	6	5
% Fine Sand (-No. 40 + No. 200)	6	7	7	6
% Silt (0.074 - 0.005 mm)	24	23	27	25
% Clay (-0.005 mm)	59	53	55	57
Liquid Limit (-No. 40)	61	60	48	65
Plasticity Index (-No. 40)	37	35	29	40
Plastic Limit	24	26	18	25
Soil Color	BLK/GRY	BLK/GRY	BLK/GRY	BLK/GRY
Textural Class	CLY	CLY	CLY	CLY
Soil Class (AASHTO M-145)	A-7-6(33)	A-7-6(27)	A-7-6(24)	A-7-6(35)
Frost Class	F3	F3	F3	F3
Optimum Moisture (%)	18.8	24.6	19.4	26.0
Maximum Dry Density (pcf)	107.6	91.6	107.4	91.1
% Organic Content				
Depth (Ft.) | Moisture (%)	2 | 29.6	2 | 27.7	2 | 32.0	2 | 33.2
	3 | 32.1	3 | 30.8	3 | 30.5	3 | 31.0
	4 | 31.5	4 | 32.6	4 | 30.9	4 | 30.3
	5 | 34.7	5 | 32.9	5 | 30.9	5 | 34.1
Avg. Moisture of Sample Depth	32.0	31.0	31.1	32.2

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Linear Laboratory Analysis

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Report Number	SS-53-2010	**Date Reported**	12/13/2010	**District**	Bismarck
County	CASS	**Submitted By**	Naumann	**Project Number**	IM-8-029(132)078
		AASHTO Test Method		**PCN**	18984

Comments

Lab Number	735	736	737	738
Reference Pt + Feet	81+2000	81+2500	81+3000	81+3500
Distance From CenterLine (Ft.)	Rt 13 NB	Rt 13 NB	Rt 13 NB	Rt 13 NB
Depth, Ft.	1.0 - 5.0	1.4 - 5.0	1.3 - 5.0	1.3 - 5.0
Field Sample No.	735	736	737	738
% Pass. 3/8" Sieve	100	100	100	100
% Pass. No. 4 Sieve	98	96	96	98
% Pass. No. 10 Sieve	94	88	92	94
% Coarse Sand (-No. 10 + No. 40)	5	18	9	7
% Fine Sand (-No. 40 + No. 200)	6	11	8	8
% Silt (0.074 - 0.005 mm)	22	16	18	21
% Clay (-0.005 mm)	61	43	58	57
Liquid Limit (-No. 40)	64	58	66	65
Plasticity Index (-No. 40)	39	35	41	39
Plastic Limit	25	23	25	25
Soil Color	BLK/GRY	BLK/GRY	BLK/GRY	BLK/GRY
Textural Class	CLY	CLY	CLY	CLY
Soil Class (AASHTO M-145)	A-7-6(35)	A-7-6(18)	A-7-6(32)	A-7-6(33)
Frost Class	F3	F3	F3	F3
Optimum Moisture (%)	19.0	24.2	17.9	23.9
Maximum Dry Density (pcf)	109.0	95.1	110.7	92.7
% Organic Content				
Depth (Ft.) | Moisture (%)	2 | 30.5	2 | 43.4	2 | 32.8	2 | 31.7
	3 | 34.2	3 | 88.2	3 | 31.9	3 | 31.6
	4 | 31.4	4 | 32.2	4 | 32.9	4 | 38.5
	5 | 29.8	5 | 29.7	5 | 36.7	5 | 34.4
Avg. Moisture of Sample Depth	31.4	48.4	33.6	34.0

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County	CASS	**Submitted By**	Naumann	**Project Number**	IM-8-029(132)078
		AASHTO Test Method		**PCN**	18984

Comments

Lab Number	739	740	741	742
Reference Pt + Feet	81+4000	81+4500	81+5000	82+0000
Distance From CenterLine (Ft.)	Rt 13 NB	Rt 13 NB	Rt 13 NB	Rt 13 NB
Depth, Ft.	1.3 - 5.0	1.2 - 5.0	1.2 - 5.0	1.1 - 5.0
Field Sample No.	739	740	741	742
% Pass. 3/8" Sieve	100	100	100	100
% Pass. No. 4 Sieve	99	98	98	99
% Pass. No. 10 Sieve	97	94	94	97
% Coarse Sand (-No. 10 + No. 40)	6	7	6	4
% Fine Sand (-No. 40 + No. 200)	7	8	8	5
% Silt (0.074 - 0.005 mm)	18	24	23	19
% Clay (-0.005 mm)	67	56	58	69
Liquid Limit (-No. 40)	69	66	65	76
Plasticity Index (-No. 40)	43	39	40	49
Plastic Limit	26	27	25	27
Soil Color	BRN/GRY/BLK	BRN/GRY/BLK	BRN/GRY/BLK	BRN/GRY/BLK
Textural Class	CLY	CLY	CLY	CLY
Soil Class (AASHTO M-145)	A-7-6(41)	A-7-6(34)	A-7-6(35)	A-7-6(49)
Frost Class	F3	F3	F3	F3
Optimum Moisture (%)	19.2	18.6	25.3	20.3
Maximum Dry Density (pcf)	107.7	107.8	89.9	105.9
% Organic Content				
Depth (Ft.) | Moisture (%)	2 | 28.8	2 | -355.8	2 | 36.3	2 | 34.6
	3 | 31.1	3 | 32.8	3 | 33.3	3 | 36.8
	4 | 30.7	4 | 31.9	4 | 32.7	4 | 31.1
	5 | 32.3	5 | 32.8	5 | 33.7	5 | 34.0
Avg. Moisture of Sample Depth	30.7	-64.5	34.0	34.1

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County	CASS	**Submitted By**	Naumann	**Project Number**	IM-8-029(132)078
		AASHTO Test Method		**PCN**	18984

Comments

Lab Number	743	744	745	746
Reference Pt + Feet	82+0500	82+1000	82+1500	82+2000
Distance From CenterLine (Ft.)	Rt 13 NB	Rt 13 NB	Rt 13 NB	Rt 13 NB
Depth, Ft.	1.1 - 5.0	1.3 - 5.0	1.1 - 5.0	1.0 - 5.0
Field Sample No.	743	744	745	746
% Pass. 3/8" Sieve	100	99	99	99
% Pass. No. 4 Sieve	99	96	96	98
% Pass. No. 10 Sieve	97	92	94	95
% Coarse Sand (-No. 10 + No. 40)	4	5	6	4
% Fine Sand (-No. 40 + No. 200)	5	7	8	5
% Silt (0.074 - 0.005 mm)	23	24	27	28
% Clay (-0.005 mm)	65	56	53	57
Liquid Limit (-No. 40)	69	63	66	66
Plasticity Index (-No. 40)	43	37	40	39
Plastic Limit	27	25	26	27
Soil Color	BLK/GRY	BLK/GRY	BLK/GRY	BLK/GRY
Textural Class	CLY	CLY	CLY	CLY
Soil Class (AASHTO M-145)	A-7-6(42)	A-7-6(32)	A-7-6(34)	A-7-6(36)
Frost Class	F3	F3	F3	F3
Optimum Moisture (%)	26.6	18.5	24.9	20.1
Maximum Dry Density (pcf)	89.4	108.4	93.6	106.1
% Organic Content				
Depth (Ft.) | Moisture (%)	2 | 28.3	2 | 32.1	2 | 30.9	2 | 30.3
	3 | 27.8	3 | 26.1	3 | 33.2	3 | 28.9
	4 | 32.2	4 | 29.7	4 | 31.6	4 | 33.5
	5 | 29.7	5 | 32.5	5 | 27.7	5 | 29.8
Avg. Moisture of Sample Depth	29.5	30.1	30.8	30.6

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Linear Laboratory Analysis

Department of Transportation, Materials and Research Division
300 Airport Road, Bismarck ND 58504 (701) 328-6900

Report Number	SS-53-2010	**Date Reported**	12/13/2010	**District**	Bismarck
County	CASS	**Submitted By**	Naumann	**Project Number**	IM-8-029(132)078
		AASHTO Test Method		**PCN**	18984

Comments

Lab Number	747	748	749	750
Reference Pt + Feet	82+2500	82+3000	82+3500	82+4000
Distance From CenterLine (Ft.)	Rt 13 NB	Rt 13 NB	Rt 13 NB	Rt 13 NB
Depth, Ft.	1.1 - 5.0	1.2 - 5.0	1.1 - 5.0	1.2 - 5.0
Field Sample No.	747	748	749	750
% Pass. 3/8" Sieve	100	99	99	99
% Pass. No. 4 Sieve	99	98	98	96
% Pass. No. 10 Sieve	97	96	96	93
% Coarse Sand (-No. 10 + No. 40)	5	5	4	8
% Fine Sand (-No. 40 + No. 200)	6	5	5	7
% Silt (0.074 - 0.005 mm)	27	22	21	17
% Clay (-0.005 mm)	58	64	65	62
Liquid Limit (-No. 40)	61	73	70	69
Plasticity Index (-No. 40)	36	46	43	47
Plastic Limit	25	26	27	23
Soil Color	BRN/GRY/BLK	BRN/GRY/BLK	BRN/GRY/BLK	BRN/GRY/BLK
Textural Class	CLY	CLY	CLY	CLY
Soil Class (AASHTO M-145)	A-7-6(34)	A-7-6(44)	A-7-6(42)	A-7-6(38)
Frost Class	F3	F3	F3	F3
Optimum Moisture (%)	26.3	19.1	26.1	18.1
Maximum Dry Density (pcf)	91.7	107.2	92.6	107.9
% Organic Content				
Depth (Ft.) | Moisture (%)	2 | 29.2	2 | 32.6	2 | 26.9	2 | 30.7
	3 | 36.4	3 | 34.6	3 | 28.7	3 | 29.5
	4 | 39.8	4 | 32.9	4 | 31.9	4 | 30.6
	5 | 27.2	5 | 33.5	5 | 32.1	5 | 28.8
Avg. Moisture of Sample Depth	33.1	33.4	29.9	29.9

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Linear Laboratory Analysis

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300 Airport Road, Bismarck ND 58504 (701) 328-6900

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County	CASS	**Submitted By**	Naumann	**Project Number**	IM-8-029(132)078
		AASHTO Test Method		**PCN**	18984

Comments

Lab Number	751	752	753	754
Reference Pt + Feet	82+4500	82+5000	83+0000	83+0500
Distance From CenterLine (Ft.)	Rt 13 NB	Rt 13 NB	Rt 13 NB	Rt 13 NB
Depth, Ft.	1.1 - 5.0	1.1 - 5.0	1.3 - 5.0	1.5 - 5.0
Field Sample No.	751	752	753	754
% Pass. 3/8" Sieve	100	100	100	100
% Pass. No. 4 Sieve	99	99	99	99
% Pass. No. 10 Sieve	96	97	97	98
% Coarse Sand (-No. 10 + No. 40)	4	4	3	4
% Fine Sand (-No. 40 + No. 200)	6	5	5	6
% Silt (0.074 - 0.005 mm)	24	18	26	24
% Clay (-0.005 mm)	63	71	63	64
Liquid Limit (-No. 40)	67	75	64	64
Plasticity Index (-No. 40)	41	48	40	39
Plastic Limit	26	26	24	25
Soil Color	BLK/GRY	BRN/LT GRY	BRN/GRY/BLK	BLK/GRY
Textural Class	CLY	CLY	CLY	CLY
Soil Class (AASHTO M-145)	A-7-6(39)	A-7-6(48)	A-7-6(39)	A-7-6(38)
Frost Class	F3	F3	F3	F3
Optimum Moisture (%)	23.7	23.6	19.6	25.9
Maximum Dry Density (pcf)	92.2	90.2	106.9	90.9
% Organic Content				
Depth (Ft.) | Moisture (%)	2 | 28.6	2 | 31.1	2 | 29.3	2 | 26.5
	3 | 30.6	3 | 32.3	3 | 30.4	3 | 29.1
	4 | 31.1	4 | 30.0	4 | 30.6	4 | 29.7
	5 | 28.1	5 | 29.0	5 | 34.9	5 | 30.3
Avg. Moisture of Sample Depth	29.6	30.6	31.3	28.9

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Report Number	SS-53-2010	**Date Reported**	12/13/2010	**District**	Bismarck
County	CASS	**Submitted By**	Naumann	**Project Number**	IM-8-029(132)078
		AASHTO Test Method		**PCN**	18984

Comments

Lab Number	755	756	757	758
Reference Pt + Feet	83+1000	83+1500	83+2000	83+2500
Distance From CenterLine (Ft.)	Rt 13 NB	Rt 13 NB	Rt 13 NB	Rt 13 NB
Depth, Ft.	1.4 - 5.0	1.4 - 5.0	1.1 - 5.0	1.2 - 5.0
Field Sample No.	755	756	757	758
% Pass. 3/8" Sieve	100	100	100	100
% Pass. No. 4 Sieve	97	99	99	97
% Pass. No. 10 Sieve	92	96	97	94
% Coarse Sand (-No. 10 + No. 40)	10	4	3	5
% Fine Sand (-No. 40 + No. 200)	8	6	5	5
% Silt (0.074 - 0.005 mm)	23	21	20	21
% Clay (-0.005 mm)	52	65	69	64
Liquid Limit (-No. 40)	61	70	68	67
Plasticity Index (-No. 40)	37	46	45	42
Plastic Limit	24	23	22	25
Soil Color	BLK/GRY	BLK/GRY	BLK/GRY	BLK/GRY
Textural Class	CLY	CLY	CLY	CLY
Soil Class (AASHTO M-145)	A-7-6(28)	A-7-6(43)	A-7-6(44)	A-7-6(38)
Frost Class	F3	F3	F3	F3
Optimum Moisture (%)	18.2	27.0	19.7	28.6
Maximum Dry Density (pcf)	109.2	91.6	106.8	89.4
% Organic Content				
Depth (Ft.) | Moisture (%)	2 | 28.6	2 | 30.4	2 | 29.6	2 | 28.4
	3 | 30.0	3 | 31.2	3 | 30.7	3 | 32.0
	4 | 30.1	4 | 29.3	4 | 30.3	4 | 30.5
	5 | 31.2	5 | 28.6	5 | 31.0	5 | 31.4
Avg. Moisture of Sample Depth	30.0	29.9	30.4	30.6

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Linear Laboratory Analysis

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		AASHTO Test Method		**PCN**	18984

Comments

Lab Number	759	760	761	762
Reference Pt + Feet	83+3000	83+3500	83+4000	83+4500
Distance From CenterLine (Ft.)	Rt 13 NB	Rt 13 NB	Rt 13 NB	Rt 13 NB
Depth, Ft.	1.2 - 5.0	1.1 - 5.0	1.1 - 5.0	1.1 - 5.0
Field Sample No.	759	760	761	762
% Pass. 3/8" Sieve	100	100	100	100
% Pass. No. 4 Sieve	99	99	99	100
% Pass. No. 10 Sieve	97	97	96	98
% Coarse Sand (-No. 10 + No. 40)	3	3	4	3
% Fine Sand (-No. 40 + No. 200)	5	4	5	4
% Silt (0.074 - 0.005 mm)	22	25	26	26
% Clay (-0.005 mm)	67	65	61	65
Liquid Limit (-No. 40)	71	65	66	67
Plasticity Index (-No. 40)	48	40	43	39
Plastic Limit	24	25	23	28
Soil Color	BLK/GRY	BLK/GRY	BLK/GRY	DRK GRY
Textural Class	CLY	CLY	CLY	CLY
Soil Class (AASHTO M-145)	A-7-6(47)	A-7-6(40)	A-7-6(41)	A-7-6(41)
Frost Class	F3	F3	F3	F3
Optimum Moisture (%)	19.2	27.0	18.6	28.5
Maximum Dry Density (pcf)	107.5	88.7	105.7	86.7
% Organic Content				
Depth (Ft.) | Moisture (%)	2 | 27.4	2 | 33.3	2 | 31.2	2 | 31.0
	3 | 31.5	3 | 32.5	3 | 31.1	3 | 32.4
	4 | 30.8	4 | 30.4	4 | 36.6	4 | 31.2
	5 | 29.6	5 | 28.6	5 | 33.1	5 | 31.0
Avg. Moisture of Sample Depth	29.8	31.2	33.0	31.5

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		AASHTO Test Method		**PCN**	18984

Comments

Lab Number	763	764	765	766
Reference Pt + Feet	83+5000	84+0000	84+0500	84+1000
Distance From CenterLine (Ft.)	Rt 13 NB	Rt 13 NB	Rt 13 NB	Rt 13 NB
Depth, Ft.	1.2 - 5.0	1.2 - 5.0	1.2 - 5.0	1.3 - 5.0
Field Sample No.	763	764	765	766
% Pass. 3/8" Sieve	100	100	100	100
% Pass. No. 4 Sieve	99	100	100	99
% Pass. No. 10 Sieve	97	96	98	97
% Coarse Sand (-No. 10 + No. 40)	3	3	2	4
% Fine Sand (-No. 40 + No. 200)	5	4	4	5
% Silt (0.074 - 0.005 mm)	27	22	24	23
% Clay (-0.005 mm)	62	66	69	65
Liquid Limit (-No. 40)	67	70	72	71
Plasticity Index (-No. 40)	42	44	45	45
Plastic Limit	25	26	27	25
Soil Color	BLK/GRY	BLK/GRY	DRK GRY	BLK/GRY
Textural Class	CLY	CLY	CLY	CLY
Soil Class (AASHTO M-145)	A-7-6(42)	A-7-6(43)	A-7-6(48)	A-7-6(50)
Frost Class	F3	F3	F3	F3
Optimum Moisture (%)	19.8	27.5	19.8	26.0
Maximum Dry Density (pcf)	104.5	87.0	104.8	88.9
% Organic Content				
Depth (Ft.) | Moisture (%)	2 | 32.1	2 | 30.1	2 | 33.2	2 | 27.4
	3 | 29.8	3 | 29.7	3 | 32.2	3 | 27.7
	4 | 33.0	4 | 34.6	4 | 29.4	4 | 30.0
	5 | 27.8	5 | 34.2	5 | 29.5	5 | 28.5
Avg. Moisture of Sample Depth	30.7	32.2	31.1	28.3

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County	CASS	**Submitted By**	Naumann	**Project Number**	IM-8-029(132)078
		AASHTO Test Method		**PCN**	18984

Comments

Lab Number	767	768	769	770
Reference Pt + Feet	84+1500	84+2000	84+2500	84+3000
Distance From CenterLine (Ft.)	Rt 13 NB	Rt 13 NB	Rt 13 NB	Rt 13 NB
Depth, Ft.	1.3 - 5.0	1.1 - 5.0	1.4 - 5.0	1.1 - 5.0
Field Sample No.	767	768	769	770
% Pass. 3/8" Sieve	100	100	100	100
% Pass. No. 4 Sieve	100	99	100	100
% Pass. No. 10 Sieve	98	98	97	99
% Coarse Sand (-No. 10 + No. 40)	3	3	4	2
% Fine Sand (-No. 40 + No. 200)	4	5	5	4
% Silt (0.074 - 0.005 mm)	32	28	27	29
% Clay (-0.005 mm)	59	62	61	65
Liquid Limit (-No. 40)	63	66	65	69
Plasticity Index (-No. 40)	37	40	39	42
Plastic Limit	26	26	26	26
Soil Color	BLK/GRY	BLK/GRY	BLK/GRY	BLK/GRY
Textural Class	CLY	CLY	CLY	CLY
Soil Class (AASHTO M-145)	A-7-6(39)	A-7-6(41)	A-7-6(38)	A-7-6(46)
Frost Class	F3	F3	F3	F3
Optimum Moisture (%)	19.0	27.9	18.9	26.9
Maximum Dry Density (pcf)	108.8	90.2	107.4	89.0
% Organic Content				
Depth (Ft.) | Moisture (%)	2 | 30.8	2 | 28.0	2 | 28.0	2 | 29.1
	3 | 28.1	3 | 28.6	3 | 26.7	3 | 30.9
	4 | 31.9	4 | 23.6	4 | 29.1	4 | 31.7
	5 | 30.3	5 | 31.9	5 | 32.2	5 | 30.2
Avg. Moisture of Sample Depth	30.2	28.0	29.0	30.5

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County	CASS	**Submitted By**	Naumann	**Project Number**	IM-8-029(132)078
		AASHTO Test Method		**PCN**	18984

Comments

Lab Number	771	772	773	774
Reference Pt + Feet	84+3500	84+4000	84+4500	84+5000
Distance From CenterLine (Ft.)	Rt 13 NB	Rt 13 NB	Rt 13 NB	Rt 13 NB
Depth, Ft.	1.2 - 5.0	1.2 - 5.0	1.2 - 5.0	1.5 - 5.0
Field Sample No.	771	772	773	774
% Pass. 3/8" Sieve	100	100	100	100
% Pass. No. 4 Sieve	99	99	100	99
% Pass. No. 10 Sieve	96	97	99	98
% Coarse Sand (-No. 10 + No. 40)	4	4	2	4
% Fine Sand (-No. 40 + No. 200)	6	5	3	5
% Silt (0.074 - 0.005 mm)	31	19	24	23
% Clay (-0.005 mm)	55	70	69	66
Liquid Limit (-No. 40)	62	77	75	73
Plasticity Index (-No. 40)	36	49	49	46
Plastic Limit	26	29	27	27
Soil Color	BLK/GRY	BRN/GRY/BLK	BLK/GRY	BLK/GRY
Textural Class	CLY	CLY	CLY	CLY
Soil Class (AASHTO M-145)	A-7-6(34)	A-7-6(49)	A-7-6(52)	A-7-6(46)
Frost Class	F3	F3	F3	F3
Optimum Moisture (%)	19.9	26.0	19.6	27.8
Maximum Dry Density (pcf)	107.5	90.0	107.2	87.7
% Organic Content				
Depth (Ft.) | Moisture (%)	2 | 27.4	2 | 29.5	2 | 33.7	2 | 39.0
	3 | 28.1	3 | 24.7	3 | 22.6	3 | 30.0
	4 | 32.4	4 | 38.5	4 | 30.4	4 | 30.2
	5 | 33.7	5 | 28.9	5 | 30.2	5 | 30.3
Avg. Moisture of Sample Depth	30.4	30.4	29.2	32.4

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Comments

Lab Number	1196	1197	1198	1199
Reference Pt + Feet	85+0000	85+0500	85+1000	85+1500
Distance From CenterLine (Ft.)	Rt 14 NB	Rt 14 NB	Rt 14 NB	Rt 14 NB
Depth, Ft.	1.5 - 5.0	1.5 - 5.0	1.1 - 5.0	1.2 - 5.0
Field Sample No.	1196	1197	1198	1199
% Pass. 3/8" Sieve	100	100	100	100
% Pass. No. 4 Sieve	99	99	100	100
% Pass. No. 10 Sieve	98	97	99	99
% Coarse Sand (-No. 10 + No. 40)	3	4	2	3
% Fine Sand (-No. 40 + No. 200)	4	4	3	4
% Silt (0.074 - 0.005 mm)	19	19	22	30
% Clay (-0.005 mm)	72	70	73	62
Liquid Limit (-No. 40)	75	69	76	67
Plasticity Index (-No. 40)	47	43	50	38
Plastic Limit	28	26	26	29
Soil Color	BLK/GRY	BLK/GRY	BLK/GRY	BLK/GRY
Textural Class	CLY	CLY	CLY	CLY
Soil Class (AASHTO M-145)	A-7-6(50)	A-7-6(43)	A-7-6(54)	A-7-6(41)
Frost Class	F3	F3	F3	F3
Optimum Moisture (%)	27.1	20.1	27.2	20.5
Maximum Dry Density (pcf)	89.1	104.8	86.8	104.3
% Organic Content				
Depth (Ft.) | Moisture (%)	2 | 45.4	2 | 47.6	2 | 43.8	2 | 33.6
	3 | 31.4	3 | 31.0	3 | 31.2	3 | 32.2
	4 | 34.1	4 | 34.1	4 | 34.9	4 | 31.4
	5 | 33.5	5 | 31.8	5 | 31.7	5 | 31.5
Avg. Moisture of Sample Depth	36.1	36.2	35.4	32.2

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Comments

Lab Number	1200	1201	1202	1203
Reference Pt + Feet	85+2000	85+2500	85+3280	85+3500
Distance From CenterLine (Ft.)	Rt 14 NB	Rt 14 NB	Rt 14 NB	Rt 14 NB
Depth, Ft.	1.1 - 5.0	1.1 - 5.0	1.0 - 5.0	1.1 - 5.0
Field Sample No.	1200	1201	1202	1203
% Pass. 3/8" Sieve	100	100	100	100
% Pass. No. 4 Sieve	100	99	100	100
% Pass. No. 10 Sieve	98	98	98	98
% Coarse Sand (-No. 10 + No. 40)	4	3	5	3
% Fine Sand (-No. 40 + No. 200)	5	4	6	5
% Silt (0.074 - 0.005 mm)	28	25	27	27
% Clay (-0.005 mm)	62	66	60	64
Liquid Limit (-No. 40)	68	75	69	71
Plasticity Index (-No. 40)	43	48	42	46
Plastic Limit	26	27	27	25
Soil Color	BLK/GRY	BLK/GRY	BLK/GRY	BLK/GRY
Textural Class	CLY	CLY	CLY	CLY
Soil Class (AASHTO M-145)	A-7-6(43)	A-7-6(50)	A-7-6(41)	A-7-6(47)
Frost Class	F3	F3	F3	F3
Optimum Moisture (%)	26.3	20.3	27.2	20.0
Maximum Dry Density (pcf)	91.0	105.7	89.7	105.8
% Organic Content				
Depth (Ft.) | Moisture (%)	2 | 33.7	2 | 33.3	2 | 31.9	2 | 32.1
	3 | 29.5	3 | 30.8	3 | 29.5	3 | 25.0
	4 | 28.1	4 | 32.9	4 | 29.9	4 | 28.9
	5 | -4.5	5 | 32.5	5 | 28.9	5 | 31.7
Avg. Moisture of Sample Depth	21.7	32.4	30.0	29.4

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Comments

Lab Number	1204	1205	1206	1207
Reference Pt + Feet	85+4000	85+4500	85+5000	86+0000
Distance From CenterLine (Ft.)	Rt 14 NB	Rt 14 NB	Rt 14 NB	Rt 14 NB
Depth, Ft.	1.2 - 5.0	1.1 - 5.0	1.3 - 5.0	1.4 - 5.0
Field Sample No.	1204	1205	1206	1207
% Pass. 3/8" Sieve	100	100	100	100
% Pass. No. 4 Sieve	99	100	99	100
% Pass. No. 10 Sieve	97	97	97	98
% Coarse Sand (-No. 10 + No. 40)	3	4	4	3
% Fine Sand (-No. 40 + No. 200)	4	5	6	4
% Silt (0.074 - 0.005 mm)	23	23	22	26
% Clay (-0.005 mm)	67	65	65	66
Liquid Limit (-No. 40)	74	74	71	72
Plasticity Index (-No. 40)	45	48	43	45
Plastic Limit	30	26	28	26
Soil Color	BLK/GRY	BRN/GRY/BLK	BRN/GRY/BLK	BRN/GRY/BLK
Textural Class	CLY	CLY	CLY	CLY
Soil Class (AASHTO M-145)	A-7-6(47)	A-7-6(47)	A-7-6(42)	A-7-6(48)
Frost Class	F3	F3	F3	F3
Optimum Moisture (%)	29.5	20.3	28.4	20.3
Maximum Dry Density (pcf)	86.7	105.0	87.3	105.0
% Organic Content				
Depth (Ft.) | Moisture (%)	2 | 33.1	2 | 31.1	2 | 33.6	2 | 31.9
	3 | 30.4	3 | 30.2	3 | 29.4	3 | 32.6
	4 | -9.4	4 | 32.0	4 | 32.0	4 | 30.1
	5 | 27.3	5 | 47.2	5 | 33.0	5 | 31.5
Avg. Moisture of Sample Depth	20.3	35.1	32.0	31.5

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Comments

Lab Number	1208	1209	1210	1211
Reference Pt + Feet	86+1000	86+1500	86+2000	86+2500
Distance From CenterLine (Ft.)	Rt 14 NB	Rt 14 NB	Rt 14 NB	Rt 14 NB
Depth, Ft.	1.0 - 5.0	1.2 - 5.0	1.4 - 5.0	1.4 - 5.0
Field Sample No.	1208	1209	1210	1211
% Pass. 3/8" Sieve	100	100	100	100
% Pass. No. 4 Sieve	99	99	99	100
% Pass. No. 10 Sieve	96	97	97	98
% Coarse Sand (-No. 10 + No. 40)	5	3	5	3
% Fine Sand (-No. 40 + No. 200)	6	4	6	4
% Silt (0.074 - 0.005 mm)	19	27	21	28
% Clay (-0.005 mm)	66	62	65	64
Liquid Limit (-No. 40)	73	67	71	68
Plasticity Index (-No. 40)	46	39	43	42
Plastic Limit	27	27	27	25
Soil Color	BRN/GRY/BLK	BRN/GRY/BLK	BRN/GRY/BLK	BRN/GRY/BLK
Textural Class	CLY	CLY	CLY	CLY
Soil Class (AASHTO M-145)	A-7-6(43)	A-7-6(40)	A-7-6(42)	A-7-6(44)
Frost Class	F3	F3	F3	F3
Optimum Moisture (%)	27.8	20.7	28.3	19.3
Maximum Dry Density (pcf)	88.4	104.3	87.7	106.7
% Organic Content				
Depth (Ft.) | Moisture (%)	2 | 33.7	2 | 32.9	2 | 44.3	2 | 37.3
	3 | 35.8	3 | 31.2	3 | 32.5	3 | 28.7
	4 | 34.1	4 | 34.6	4 | 32.1	4 | 31.8
	5 | 32.4	5 | 33.2	5 | 33.0	5 | 32.7
Avg. Moisture of Sample Depth	34.0	33.0	35.5	32.6

Scott W. Wutzke, Testing Lab Supervisor
Date Printed: 6/4/2012

Linear Laboratory Analysis

Department of Transportation, Materials and Research Division
300 Airport Road, Bismarck ND 58504 (701) 328-6900

Report Number	SS-53-2010	**Date Reported**	12/13/2010	**District**	Bismarck
County	CASS	**Submitted By**	Naumann	**Project Number**	IM-8-029(132)078
		AASHTO Test Method		**PCN**	18984

Comments

Lab Number	1212	1213	1214	1215
Reference Pt + Feet	86+3000	86+3500	86+4000	86+4500
Distance From CenterLine (Ft.)	Rt 14 NB	Rt 14 NB	Rt 14 NB	Rt 14 NB
Depth, Ft.	1.5 - 5.0	1.5 - 5.0	1.2 - 5.0	1.0 - 5.0
Field Sample No.	1212	1213	1214	1215
% Pass. 3/8" Sieve	100	100	100	100
% Pass. No. 4 Sieve	100	99	99	99
% Pass. No. 10 Sieve	98	97	98	97
% Coarse Sand (-No. 10 + No. 40)	3	4	2	3
% Fine Sand (-No. 40 + No. 200)	4	5	3	4
% Silt (0.074 - 0.005 mm)	25	23	23	23
% Clay (-0.005 mm)	66	65	70	68
Liquid Limit (-No. 40)	68	70	68	73
Plasticity Index (-No. 40)	42	44	41	46
Plastic Limit	26	27	27	27
Soil Color	BRN/GRY/BLK	BRN/GRY/BLK	BRN/GRY/BLK	BRN/GRY/BLK
Textural Class	CLY	CLY	CLY	CLY
Soil Class (AASHTO M-145)	A-7-6(44)	A-7-6(43)	A-7-6(44)	A-7-6(48)
Frost Class	F3	F3	F3	F3
Optimum Moisture (%)	29.5	19.9	26.9	21.1
Maximum Dry Density (pcf)	88.0	106.4	86.0	103.1
% Organic Content				
Depth (Ft.) | Moisture (%)	2 | 31.8	2 | 33.8	2 | 35.5	2 | 32.0
	3 | 30.6	3 | 30.6	3 | 30.4	3 | 31.9
	4 | 35.8	4 | 32.3	4 | 33.9	4 | 34.1
	5 | 30.9	5 | 35.1	5 | 34.8	5 | 38.2
Avg. Moisture of Sample Depth	32.2	32.9	33.7	34.1

Scott W. Wutzke, Testing Lab Supervisor
Date Printed: 6/4/2012

Linear Laboratory Analysis

Department of Transportation, Materials and Research Division
300 Airport Road, Bismarck ND 58504 (701) 328-6900

Report Number	SS-53-2010	**Date Reported**	12/13/2010	**District**	Bismarck
County	CASS	**Submitted By**	Naumann	**Project Number**	IM-8-029(132)078
		AASHTO Test Method		**PCN**	18984

Comments

Lab Number	1216	1217	1218	1219
Reference Pt + Feet	86+5000	87+0000	87+0500	87+1000
Distance From CenterLine (Ft.)	Rt 14 NB	Rt 14 NB	Rt 14 NB	Rt 14 NB
Depth, Ft.	1.2 - 5.0	1.2 - 5.0	1.0 - 5.0	1.2 - 5.0
Field Sample No.	1216	1217	1218	1219
% Pass. 3/8" Sieve	100	100	100	100
% Pass. No. 4 Sieve	100	99	99	100
% Pass. No. 10 Sieve	99	98	99	94
% Coarse Sand (-No. 10 + No. 40)	4	5	2	5
% Fine Sand (-No. 40 + No. 200)	5	5	4	6
% Silt (0.074 - 0.005 mm)	16	19	26	24
% Clay (-0.005 mm)	73	70	68	59
Liquid Limit (-No. 40)	72	64	71	70
Plasticity Index (-No. 40)	43	37	42	42
Plastic Limit	29	26	29	28
Soil Color	BRN/GRY/BLK	BRN/GRY/BLK	BRN/GRY/BLK	BRN/GRY/BLK
Textural Class	CLY	CLY	CLY	CLY
Soil Class (AASHTO M-145)	A-7-6(44)	A-7-6(37)	A-7-6(45)	A-7-6(39)
Frost Class	F3	F3	F3	F3
Optimum Moisture (%)	27.8	20.8	30.2	20.3
Maximum Dry Density (pcf)	83.4	103.4	84.6	104.1
% Organic Content				
Depth (Ft.) | Moisture (%)	2 | 35.9	2 | 33.5	2 | 33.5	2 | 30.0
	3 | 31.8	3 | 33.3	3 | 33.9	3 | 33.2
	4 | 40.2	4 | 35.7	4 | 34.0	4 | 35.1
	5 | 34.1	5 | 29.9	5 | 30.4	5 | 33.8
Avg. Moisture of Sample Depth	35.5	33.1	32.9	33.1

Scott W. Wutzke, Testing Lab Supervisor
Date Printed: 6/4/2012

Linear Laboratory Analysis

Department of Transportation, Materials and Research Division
300 Airport Road, Bismarck ND 58504 (701) 328-6900

Report Number	SS-53-2010	**Date Reported**	12/13/2010	**District**	Bismarck
County	CASS	**Submitted By**	Naumann	**Project Number**	IM-8-029(132)078
		AASHTO Test Method		**PCN**	18984

Comments

Lab Number	1220	1221	1222	1223
Reference Pt + Feet	87+1500	87+2000	87+2500	87+3000
Distance From CenterLine (Ft.)	Rt 14 NB	Rt 14 NB	Rt 14 NB	Rt 14 NB
Depth, Ft.	1.2 - 5.0	1.2 - 5.0	1.2 - 5.0	1.3 - 5.0
Field Sample No.	1220	1221	1222	1223
% Pass. 3/8" Sieve	100	100	100	100
% Pass. No. 4 Sieve	99	99	99	99
% Pass. No. 10 Sieve	97	97	96	98
% Coarse Sand (-No. 10 + No. 40)	6	4	3	5
% Fine Sand (-No. 40 + No. 200)	6	5	5	6
% Silt (0.074 - 0.005 mm)	25	29	20	27
% Clay (-0.005 mm)	59	59	68	60
Liquid Limit (-No. 40)	66	66	77	67
Plasticity Index (-No. 40)	41	38	51	41
Plastic Limit	25	28	26	26
Soil Color	BRN/GRY/BLK	BRN/GRY/BLK	BRN/DRK GRY	BRN/GRY/BLK
Textural Class	CLY	CLY	CLY	CLY
Soil Class (AASHTO M-145)	A-7-6(38)	A-7-6(38)	A-7-6(51)	A-7-6(40)
Frost Class	F3	F3	F3	F3
Optimum Moisture (%)	28.0	18.8	28.3	19.5
Maximum Dry Density (pcf)	88.6	105.3	89.6	106.4
% Organic Content				
Depth (Ft.) | Moisture (%)	2 | 30.9	2 | 30.4	2 | 34.2	2 | 32.9
	3 | 33.1	3 | 26.5	3 | 34.1	3 | 31.0
	4 | 31.0	4 | 29.5	4 | 34.2	4 | 31.1
	5 | 33.1	5 | 34.5	5 | 32.8	5 | 31.8
Avg. Moisture of Sample Depth	32.0	30.2	33.8	31.6

Scott W. Wutzke, Testing Lab Supervisor
Date Printed: 6/4/2012

Linear Laboratory Analysis

Department of Transportation, Materials and Research Division
300 Airport Road, Bismarck ND 58504 (701) 328-6900

Report Number	SS-53-2010	**Date Reported**	12/13/2010	**District**	Bismarck
County	CASS	**Submitted By**	Naumann	**Project Number**	IM-8-029(132)078
		AASHTO Test Method		**PCN**	18984

Comments

Lab Number	1224	1225	1226	1227
Reference Pt + Feet	87+3500	87+4000	87+4500	87+5000
Distance From CenterLine (Ft.)	Rt 14 NB	Rt 14 NB	Rt 14 NB	Rt 14 NB
Depth, Ft.	1.2 - 5.0	1.2 - 5.0	1.1 - 5.0	1.2 - 5.0
Field Sample No.	1224	1225	1226	1227
% Pass. 3/8" Sieve	97	100	100	100
% Pass. No. 4 Sieve	96	97	99	99
% Pass. No. 10 Sieve	94	91	94	96
% Coarse Sand (-No. 10 + No. 40)	6	6	7	3
% Fine Sand (-No. 40 + No. 200)	7	7	8	5
% Silt (0.074 - 0.005 mm)	25	23	27	28
% Clay (-0.005 mm)	56	55	51	60
Liquid Limit (-No. 40)	66	65	60	67
Plasticity Index (-No. 40)	40	37	34	41
Plastic Limit	26	28	26	26
Soil Color	BRN/GRY/BLK	BRN/GRY	BRN/GRY/BLK	BRN/GRY/BLK
Textural Class	CLY	CLY	CLY	CLY
Soil Class (AASHTO M-145)	A-7-6(35)	A-7-6(31)	A-7-6(28)	A-7-6(41)
Frost Class	F3	F3	F3	F3
Optimum Moisture (%)	26.8	20.5	27.0	20.0
Maximum Dry Density (pcf)	88.9	104.2	90.1	104.3
% Organic Content				
Depth (Ft.) | Moisture (%)	2 | 30.5	2 | 36.4	2 | 26.9	2 | 37.7
	3 | 33.7	3 | 33.8	3 | 31.7	3 | 30.7
	4 | 33.1	4 | 34.7	4 | 34.0	4 | 32.2
	5 | 35.7	5 | 33.0	5 | 36.1	5 | 31.6
Avg. Moisture of Sample Depth	33.2	34.5	32.2	33.0

Scott W. Wutzke, Testing Lab Supervisor
Date Printed: 6/4/2012

Linear Laboratory Analysis

Department of Transportation, Materials and Research Division
300 Airport Road, Bismarck ND 58504 (701) 328-6900

Report Number	SS-53-2010	**Date Reported**	12/13/2010	**District**	Bismarck
County	CASS	**Submitted By**	Naumann	**Project Number**	IM-8-029(132)078
		AASHTO Test Method		**PCN**	18984

Comments

Lab Number	1228		
Reference Pt + Feet	88+0000		
Distance From CenterLine (Ft.)	Rt 14 NB		
Depth, Ft.	1.2 - 5.0		
Field Sample No.	1228		
% Pass. 3/8" Sieve	100		
% Pass. No. 4 Sieve	99		
% Pass. No. 10 Sieve	93		
% Coarse Sand (-No. 10 + No. 40)	5		
% Fine Sand (-No. 40 + No. 200)	7		
% Silt (0.074 - 0.005 mm)	28		
% Clay (-0.005 mm)	53		
Liquid Limit (-No. 40)	61		
Plasticity Index (-No. 40)	34		
Plastic Limit	26		
Soil Color	BRN/GRY/BLK		
Textural Class	CLY		
Soil Class (AASHTO M-145)	A-7-6(30)		
Frost Class	F3		
Optimum Moisture (%)	28.9		
Maximum Dry Density (pcf)	88.5		
% Organic Content			
Depth (Ft.) | Moisture (%)	2	|	30.3
	3	|	32.2
	4	|	34.2
	5	|	34.9
Avg. Moisture of Sample Depth	32.9		

Scott W. Wutzke, Testing Lab Supervisor
Date Printed: 6/4/2012

1997 Linear Soils Report

MEMORANDUM

☐ Div	☒ Proj	☐ City	☐ Hwy
PROJECT TIED TO	IM-8-029(028)078		
ORIGIN	Materials	DATE	8-6-97
ITEM #	Soils Recommendation		

TO: Ken Birst
Design Engineer

FROM: Darcy R. Rosendahl RH DRR
Geotechnical & Research Engineer

DATE: August 4, 1997

SUBJECT: Soils Report for Project IM-8-029(028)078
Argusville Intersection North to Hunter - Northbound

Attached is the soils report for the above referenced project. The soils are very uniform through this area. The in place moisture contents are also very uniform. No subcuts are recommended but provisions are given in case soft areas are encountered.

If you have any questions please call Blane Hoesel at 328-6907.

c: Dennis Jacobson, East Region
Grant Levi, Fargo District
David K. O. Leer, Infrastructure Support
FHWA

Linear Soil Survey Report and Recommendations

Project IM-8-029(028)078

Station 710+00± to 1195+00±
Argusville Intersection North to Hunter-**North Bound**
Cass County
July 28, 1997

SOIL CLASSIFICATIONS AND COMMENTS

Twenty seven samples were analyzed on this project at depths of 0.8 to 5.0 feet below the pavement surface and four samples extended beyond 5.0 feet but less than 8.0 feet. The results are as follows:

Quant.	AASHTO Class	Field Moisture Range (%)	Field Moisture Average (%)	Optimum Moisture Range (%)	Plastic Limit Range (%)	Plastic Limit Average (%)	Plastic Index Average (%)
31	A-7-6	26.0-32.8	29.7	20.9-24.2	22.2-25.8	24.1	49.3

All of the samples were in the plastic range, and none of the samples were classified as F-4 soil.

All of the samples exhibited plastic index values greater than 40, which indicates that they have a very high expansion potential.

Organic contents were checked on selected samples and ranged from 3.4% to 4.6%.

Moisture-only samples were also taken at the following depths:

Depth	Field Moisture Range (%)	Field Moisture Average (%)
1'	18.8-34.1	28.3
2'	20.7-37.9	29.9
3'	24.9-35.4	29.4
4'	24.2-37.9	30.1

SOIL DESCRIPTIONS

Silt-Clay Soils:

The **A-7-6** soils typically consist of plastic clays. They usually have high volume change between wet and dry states. These soils have dry strength but lose much of this strength upon absorbing water. The A-7-6 soils will compress when wet and shrink and swell with changes in moisture content. They do not drain readily and may absorb water by capillarity with resulting loss in strength. These soils can also be highly frost susceptible although they will perform well when moisture is kept near the optimum value. They have high liquid limits and may be elastic.

DETAILED DESIGN RECOMMENDATIONS

Station	to	Station	Remarks
710+00±		1195+00±	Remove and salvage the existing pavement and base. Excavate to a depth which will allow for the designed base and pavement section and waste the excavated material outside of the inslope. Subgrade preparation is recommended to a depth of 12" below the bottom elevation of the designed base course. In areas that are too wet or unstable for scarification and compaction., the subgrade should be subcut to a depth of 12" and the excavated material shall be wasted outside of the inslope. Place separation fabric (S2) at the bottom of the subcut and backfill with a granular material to allow for the designed base and pavement. A transition of 20:1 is recommended when changing cut elevations to reduce differential heave.

Note: It is estimated that less than 10% of the project will require subcut and fabric.

SUBGRADE PREPARATION: Compliance of Standard Specification 230.02 B.5, Subgrade Preparation Type C(12"), is recommended throughout this project. Maximum dry density and optimum moisture should be determined in accordance with AASHTO T-99. It is not necessary to apply compaction efforts to the subgrade where fabric will be used.

We are not recommending specific subcut sections on this project due to the extremely uniform soils in this area. If you have any questions please call me at 328-6907.

Blane Hoesel

Blane Hoesel, Geotechnical Coordinator