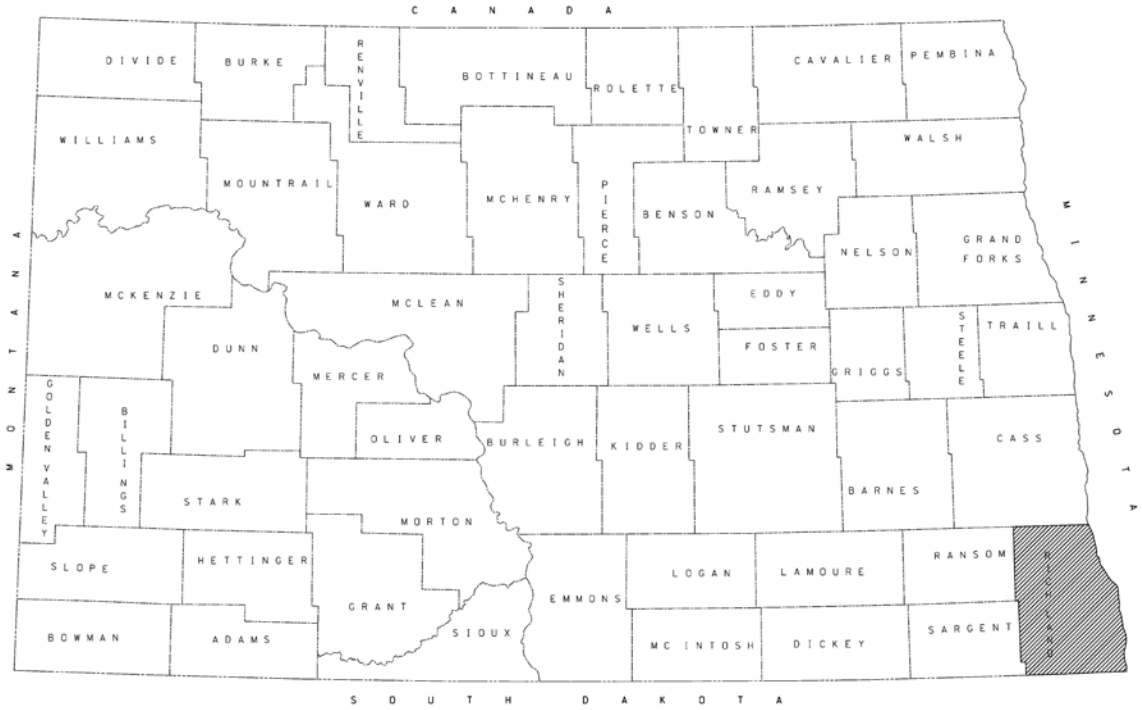
LINEAR SOILS SURVEY AND RECOMMENDATIONS

PROJECT NO. IM-8-029(151)000

PCN 19711

COUNTY Richland

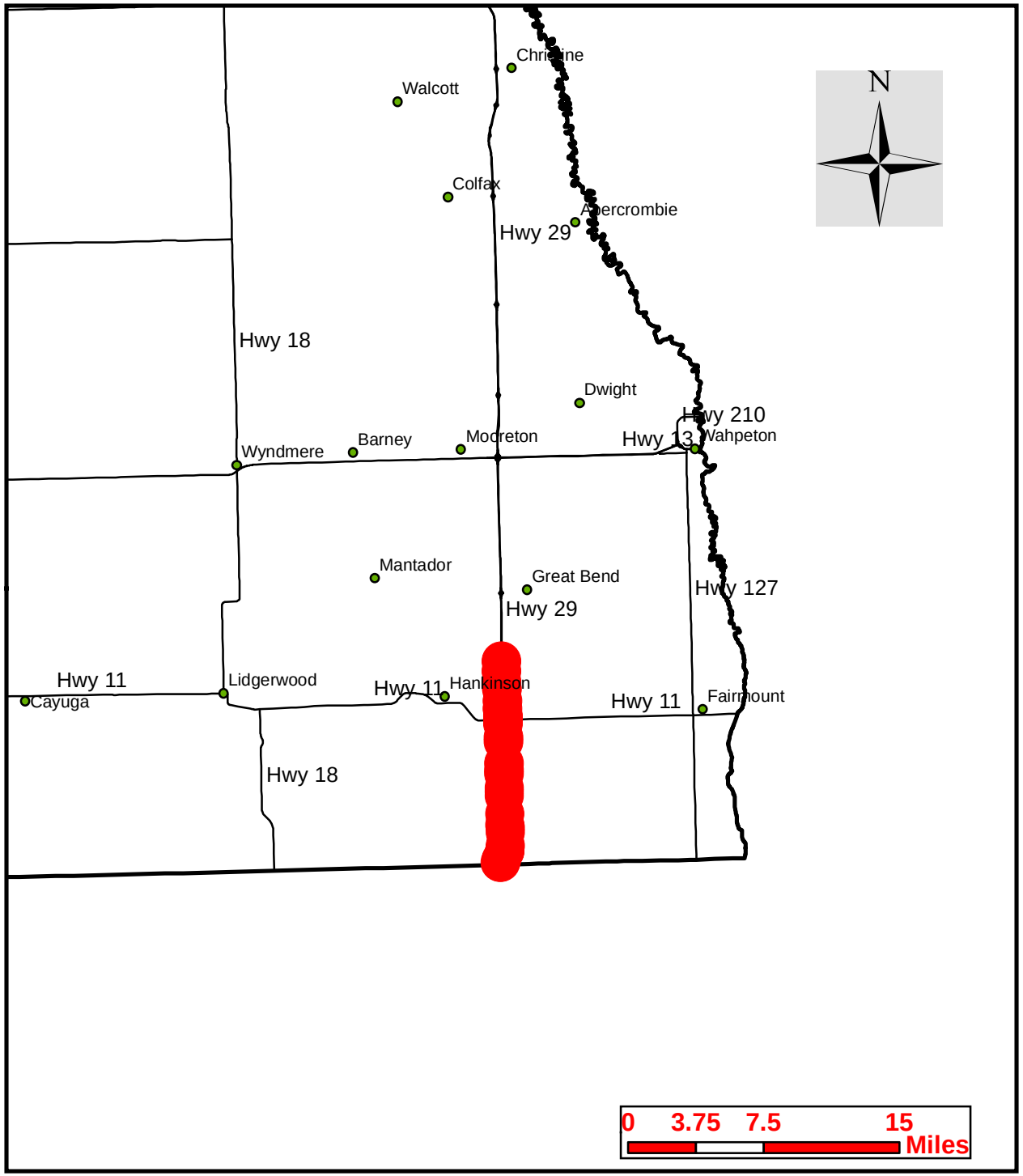
Interstate 29 SB RP 0.000 to RP 11.303



PREPARED BY: Jeff Jirava, P.E.

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH DIVISION

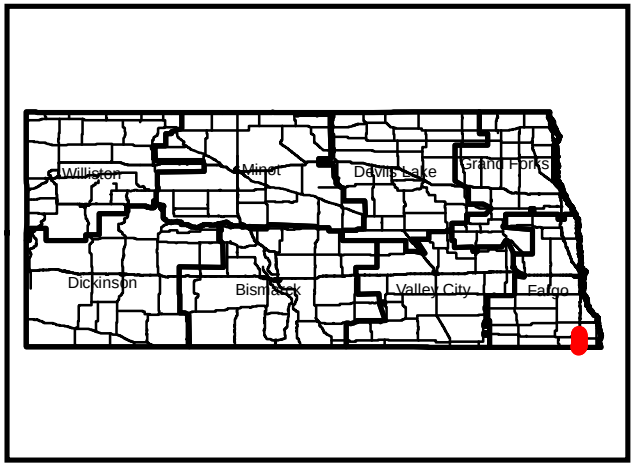
January 2016



Linear Soils Survey and Recommendations

Project: IM-8-029(151)000
PCN: 19711
Scope: Grade Lowering PCC Pavement Under Structures, Crack and Seat, Hot Mix Asphalt
Length: 11.303 Miles
Location: South State Line North 11.3 Miles SB

Drilled 1000' Interval and Identified Areas



IM-8-029(151)000

State Line North 11.3 Miles - Southbound

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 1/11/2016 and the original document is stored at the North Dakota Department of Transportation.

REGISTERED PROFESSIONAL ENGINEER
JEFF
JIRAVA
PE-5950
DATE 1/11/16
NORTH DAKOTA

Jeff Jirava, P.E.

11 JANUARY 2016
Date

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Appendix C – Boring Locations
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Introduction

Location: State Line North 11.3 Miles - Southbound
Reference Points: 0.000 to 11.303
Project Length: 11.303
Proposed Project Scope: Grade Lowering and PCC Pavement Reconstruction Under Structures, Crack and Seat, Hot Mix Asphalt
Investigation Scope: 1000' Interval and Identified Areas

Existing Roadway Section

Construction History

Table 1 - Construction History RP 0.000 to RP 11.300

Construction History				
Year	**Construction**	**Depth (in)**	**Width (ft)**	**Oil**
1975	Grade		48.0	
1975	C-C 104 Feet			
1976	Aggregate Base	2.0	43.0	
1976	Plant Mix Bit Base	2.0	41.0	85-100
1976	Non-Reinf PCC – Joint Space 16 ft	9.0	10.0/27.0/0.0	
1997	Concrete Pavement Rep		24.0	
1997	Grinding		18.0	

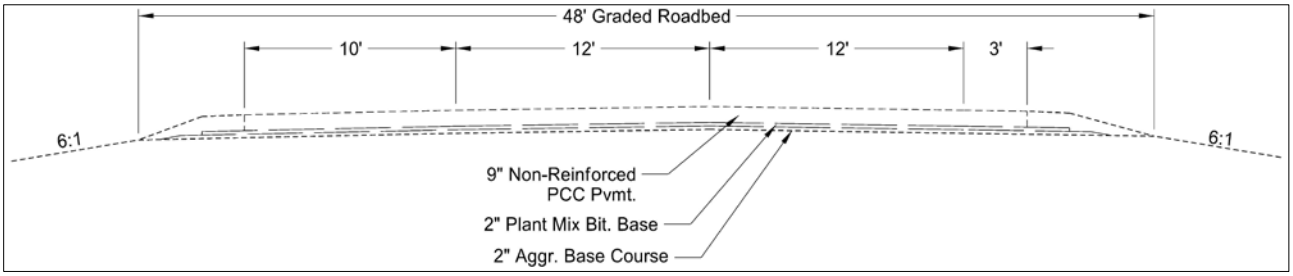

Figure 1 - Existing Typical Section 0.000 to 11.300

Existing Roadway Condition

Table 2 - Distress Data, Ride and Average Rut RP 0.000 to RP 11.300

Year	Distress Score	Ride	PRPI	IRI	Average Rut
2014	83	3.87	Good	67	NA
2013	84	3.80	Good	67	NA
2012	82	3.84	Good	68	NA
2011	83	3.85	Good	67	NA
2010	86	3.89	Good	65	NA
2009	89	3.93	Good	64	NA
2008	89	3.94	Good	63	NA
2007	93	4.03	Good	59	NA
2006	88	3.96	Good	62	NA
2005	86	3.96	Good	62	NA
2004	86	3.93	Good	63	NA

Maintenance Review

Date of Maintenance Review: 5/27/2015
Materials and Research Person Conducting the Review: Jamie Naumann
District Maintenance Person Conducting Review: Nathan Helmer

The summary of the identified maintenance areas that were drilled are shown in the following table. The evaluation log indicating all areas that were evaluated can be found in Appendix B.

Table 3 - Identified Maintenance Areas Drilled

Location RP + Feet	Distress Identified	Maintenance Comments
0+4290 to 0+4305	Frost Heave	

Summary of Soil Analysis

A summary of the locations that were drilled is shown in following table. A map of the boring locations is shown in Appendix C.

Table 4 - Boring Locations Summary

Location RP + Feet	Boring Interval, Depth and Method	Reason for Boring
0+0000 to 11+1586	Every 1000 feet, 5 feet deep using a solid flight auger.	Obtain subgrade information throughout the area
0+4290 to 0+4305	Frost Heave	Obtain subgrade information throughout the area

Soil Sample Distribution

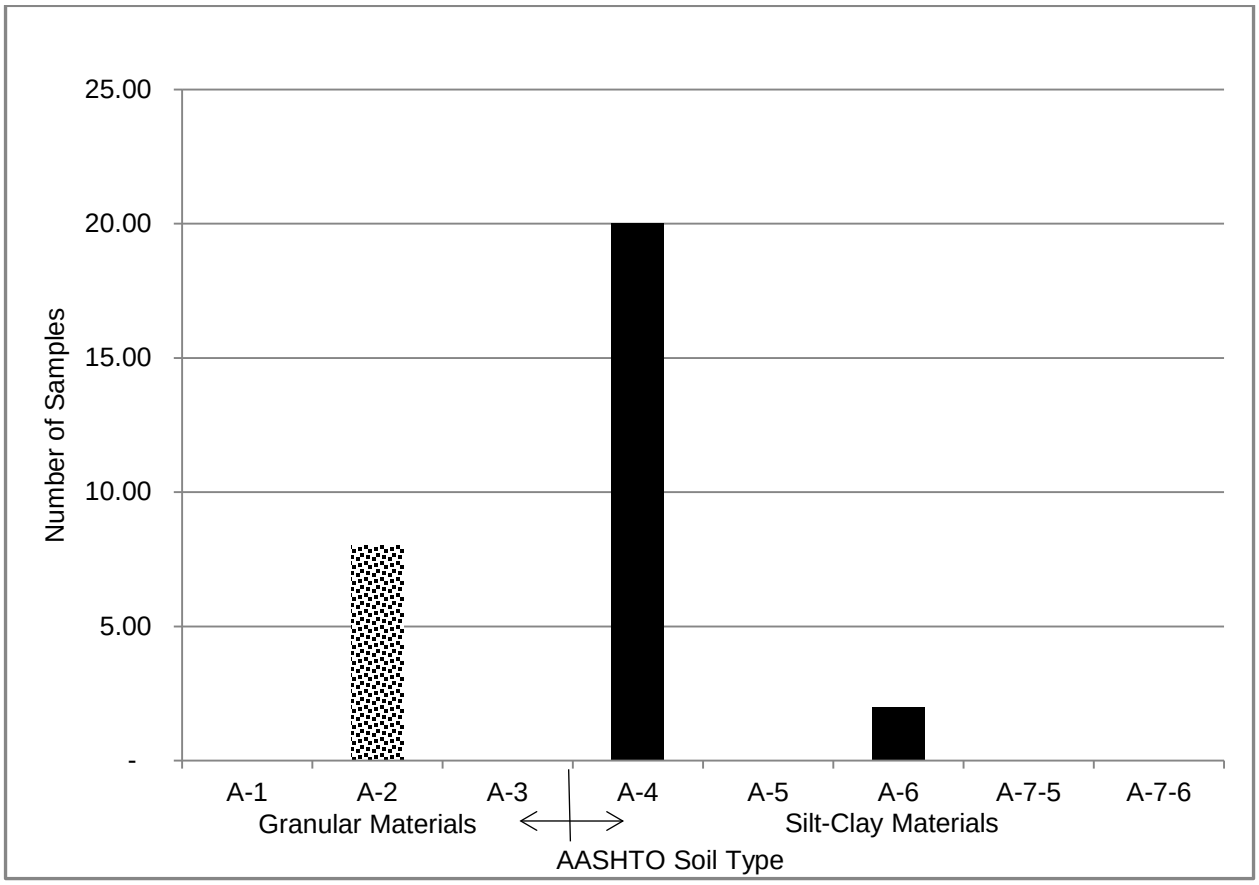

Figure 2 - Soil Sample Distribution

Moisture

The moisture contents provided in this report and summarized below have been obtained from samples taken on 9/16/15.

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

Quantity	AASHTO Classification	In-Place Moisture Range (%)	In-Place Moisture Average (%)	T-180 Optimum Moisture Average (%)	Difference Between Average In-Place and T-180 Optimum Moistures (%)
8	A-2-4	10.9-27.6	15.2	10.3	4.9
20	A-4	11.6-23.7	16.6	10.9	5.7
2	A-6	15.5-20.2	17.9	12.9	5.0

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

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)
8	A-2-4	0%	75%	12.5%	0%	12.5%
20	A-4	0%	60%	30%	10%	0%
2	A-6	0%	50%	50%	0%	0%

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-2-4	0	0	0	0	0	0
A-4	0-33.2	19.9	0-23.8	14.4	0-9.6	5.5
A-6	32.4-38.2	35.3	21-21.3	21.2	11.1-17.2	14.2

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)
100%	0%	0%

Frost Susceptibility

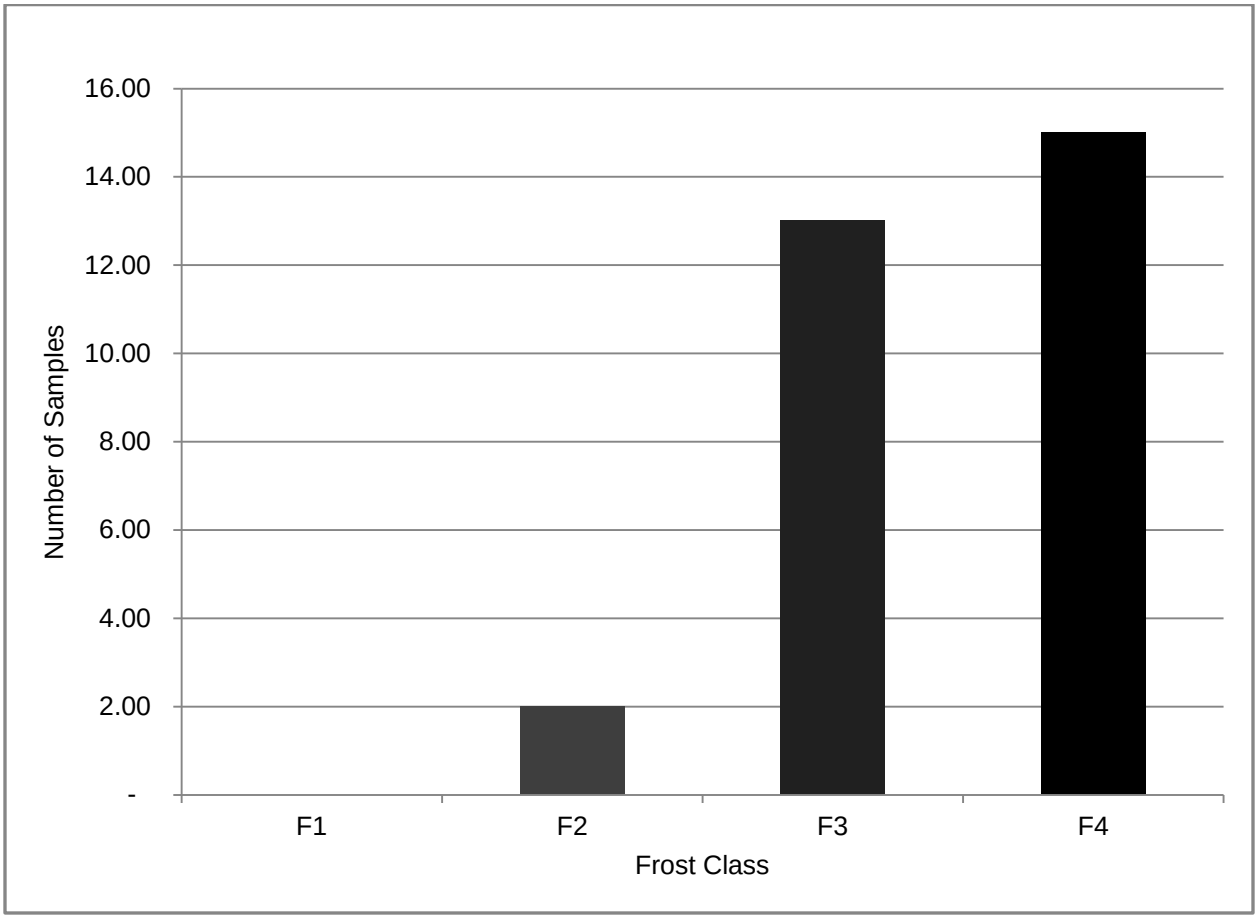

Figure 3 - Frost Susceptibility Distribution

Group Index

The Group Index is a parameter used to evaluate the quality of a soil as a subgrade material. The group index is always zero for A-1, A-2 and A-3 soils (Granular Soils). A group index of 20 or greater indicates a “very poor” subgrade material. The group indices are summarized in the following table.

Table 9 - Group Indices

AASHTO Classification	Group Index Range	Group Index Average
A-2-4	0	0
A-4	0-8	2.9
A-6	6-14	10.0

Design Recommendations

Table 10 - Design Recommendations Table

Location RP + Feet	Design Recommendation	Comment
0+0000 to 11+1586	Subgrade Prep 12 inch on reconstruction areas in the Grade Lowering Areas	
0+4290 to 0+4305	Do Nothing	The soils in this area are poor, but they are consistent with the majority of the rest of the project, considering the scope of crack and seat, corrective measure efforts and costs would outweigh the benefit.

Design Information

Subgrade Prep:

Table 11 – Subgrade Prep Recommendations

Location	Subgrade Prep Depth
Grade Lowering Areas	12 Inches below the proposed subgrade elevation.

Compaction Method: AASHTO T-180

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

APPENDIX A

SOIL CLASSIFICATION AND FROST SUSCEPTIBILITY

AASHTO Soil Classification System

Table 5.1. AASHTO Classification System

General Classification	*Granular materials (35% or less passing No. 200 Sieve (0.075 mm)*							*Silt-clay Materials More than 35% passing No. 200 Sieve (0.075 mm)*			
Group Classification	*A—1*		*A—3*	*A—2*				*A—4*	*A—5*	*A—6*	*A—7*
	A—1—a	*A—1—b*		*A—2—4*	*A—2—5*	*A—2—6*	*A—2—7*				*A—7—5* *A—7—6*
(*a*) Sieve Analysis: Percent Passing											
(*i*) 2.00 mm (No. 10)	50 max										
(*ii*) 0.425 mm (No. 40)	30 max	50 max	51 min								
(*iii*) 0.075 mm (No. 200)	15 max	25 max	10 max	35 max	35 max	35 max	35 max	36 min	36 min	36 min	36 min
(*b*) Characteristics of fraction passing 0.425 mm (No. 40)											
(*i*) Liquid limit				40 max	41 min	40 max	41 min	40 max	41 min	40 max	41 min
(*ii*) Plasticity index	6 max		N.P.	10 max	10 max	11 min	11 min	10 max	10 max	11 min	11 min*
(*c*) Usual types of significant Constituent materials	Stone Fragments Gravel and sand		Fine Sand	Silty or Clayey Gravel Sand				Silty Soils		Clayey Soils	
(*d*) General rating as subgrade.	Excellent to Good							Fair to Poor			

* If plasticity index is equal to or less than (liquid Limit—30), the soil is A—7—5 (*i.e.* PL > 30%)
If plasticity index is greater than (Liquid Limit—30), the soil is A—7—6 (*i.e.* PL < 30%)

Frost Susceptibility Index (Bases on US Army Corps of Engineers)

Frost Class	Frost Susceptibility	Soil Type	Percent Finer than 0.02 mm by weight %
F1	Negligible to Low	• Gravely Soils	3 – 10
F2	Low to Medium	• Gravely Soils • Sands	10 – 20 3 – 15
F3	High	• Gravelly Soils • Sands, except very fine silty sands • Clays, PI > 12	Greater than 20 Greater than 15 ----
F4	Very High	• All Silts • Very Fine Silty Sands • Clays, PI > 12 • Varved Clays and other fine-grained banded sediments	--- Greater than 15 --- ---

APPENDIX B

PAVEMENT EVALUATION

HH numbers for reference

Pavement Evaluation Sheet – Asphalt Surface

Project Number: IM-8-029(151)000 Date: 5-27-15

Section Contact: Nathan Helmer Initials: [illegible]

Location RP + Feet to RP + Feet	Distress Type (Low Severity)	Distress Type (Medium Severity)	Distress Type (High Severity)
11+1586 to 0+0000	TC-D pic 42-56	Spalling	
8+3500 to 7+760	BC-Rt side	pic 45-54 spalling	
7+4750 to 7+4850	Spalling Rt side	pic 55+56	
8+5280 to 11+0000	Spalling Rt side	pic 51-56	
	pic 1-11		
0+4305 & 0+4290	pic-1-11		(2) FH SBL

Distress Legend

Cracking:
Alligator Cracking (**AC**)
Block Cracking (**BC**)

Longitudinal Cracking:
- Wheel Path (**LC-WP**)
- Non-Wheel Path (**LC-NWP**)

Transverse Cracking:
- Depressed (**TC-D**)
- Tenting (**TC-T**)

Approx. Crack Spacing: 10'

Last Date of Crack Seal: 2015

Surface Deformation:
Bituminous Patching:
- Blade Patch (**BP-MBP**)
- Hand Patch (**BP-MHP**)
- Scotch Patch (**BP-MSP**)
- Paver-Laid Patch (**BP-PLP**)

Rutting (**RT**)
Approx. Depth: 0
Shoving (**SV**)

Miscellaneous Defects:
Water Pumping (**WP**)
Area of Greatest Distress (**AGD**)
- Location
- Possible Cause(s) of Distress(es)

Miscellaneous Defects:
Frost Heave (**FH**)
- Seasonal
- Centerline Pipe
- Previously Repaired
- Signed
- Evidence of Spring

Slough Area
- Water Present
- Spring
- Cattails
- Location of Slough Area
  - Right (**SA-R**)
  - Left (**SA-L**)

General Comments

What is the area of greatest distress on the project? Frost Heave

What is the location? 0+4382 - 0+

What are the causes contributing to the distress? Wet Soil under pavement

Is there a frost heave on the project? yes

Is it seasonal? yes

Is there a centerline pipe? no

Has it been previously repaired? no

Is it signed? no

Is there evidence of a spring? NO

I met with Nathan Helmer on 5-27-15. He indicated the worst area of concern was a frost heave at 0+4305 and @ 4290 SBL, the angle of Both NB & SB suggest Same FH. Both areas had tall weeds in ditch.

Spalling very sparatic throughout project. Areas of panel repair and several spalling repairs from asphalt patches to cut out and replace with concrete.

There is a bridge at mile 1+? that the panels underneith are sliding down and the soil underneith is being washed out onto the shoulder.

APPENDIX C

BORING LOCATIONS

Legend

- Boring Locations
- Reference Point

Project Number: IM-8-029(151)000

Legend

- Boring Locations
- Reference Point

Project Number: IM-8-029(151)000

Legend

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Legend

- Boring Locations
- Reference Point

Project Number: IM-8-029(151)000

APPENDIX D

SUMMARY OF SOILS ANALYSIS

Project No.: IM-8-029(159)000

PCN:

Color Key

Swell Potential:	Low	Marginal	High	Moisture Content:	Below PL	0-5% Over PL	>5% Over PL	
Group Index:	GI≤20	GI>20		Ave. In-Place: Moisture Content	MC < Opt.	0 ≤ MC < 6% Over opt.	6 ≤ MC < 10% Over opt.	10 ≤ MC < 16% Over opt.	MC >16% Over opt.

Lab No.	STA	Offset	Depth of Sample (ft)	Plastic Limit (PL)	AASHTO Class	Group Index	Optimum Moisture	Swell Potential (PI)	Ave. In-Place Moisture	Moisture Content @ Depth (ft) 2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	Frost Class
777	0+0500	Rt 24 SB	0.8-5	21.6	A-4(3)	3	11.2	7	19.0	18.0	22.3	22.8	23.6																					F4
776	0+1500	Rt 24 SB	0.8-5	21.3	A-6(6)	6	12.6	11	15.5	15.3	15.5	19.1	23.6																					F4
775	0+2500	Rt 24 SB	0.8-5	0.0		6		0	17.8	19.0	18.6	20.4	25.9																					
773	0+3500	Rt 24 SB	0.7-3	21.6	A-4(6)	6	12.2	9	17.1	18.5	26.7																							F4
772	0+4108	Rt 12 SB	0.8-5	20.2	A-4(3)	3	11.7	7	18.4	11.7	19.3	20.1	22.3																					F4
771	0+4305	Rt 12 SB	0.8-5	0.0	A-4(0)	0	11.6	0	20.0	22.4	21.8	18.3	17.4																					F4
770	0+4388	Rt 12 SB	0.7-5	21.4	A-4(4)	4	12.5	9	23.7	20.3	19.3	26.9	28.3																					F4
769	0+4500	Rt 12 SB	0.8-5	23.8	A-4(8)	8	13.4	8	18.5	14.6	16.9	19.7	22.7																					F4
			0-0						14.6	17.2	16.1	16.1	17.0																					
			0-0						13.5	22.1	13.1	14.2	14.3																					
			0-0						12.2	13.7	14.6	14.0	13.7																					
			0-0						15.4	17.7	15.2	18.6	18.9																					
			0-0						24.9	16.4	19.5	66.0	16.3																					

Project No.:

PCN:

Color Key

Swell Potential:	Low	Marginal	High	Moisture Content:	Below PL / 0-5% Over PL / >5% Over PL
Group Index:	GI≤20	GI>20		Ave. In-Place: Moisture Content	MC < Opt. / 0 ≤ MC < 6% Over opt. / 6 ≤ MC < 10% Over opt. / 10 ≤ MC < 16% Over opt. / MC >16% Over opt.

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			0-0						14.6	15.5	16.5	16.7	15.4																					
			0-0						22.6	43.5	21.6	19.0	18.6																					
			0-0						15.3	17.6	17.4	19.0	17.5																					
			0-0						14.1	9.8	12.0	25.1	19.5																					
			0-0						10.5	12.4	13.4	5.9	17.0																					
			0-0						13.0	13.8	13.4	15.3	14.8																					
			0-0						14.0	16.0	16.2	16.4	15.8																					
			0-0						14.5	13.9	15.1	16.9	21.2																					
			0-0						15.0	14.3	13.2	18.1	22.3																					
			0-0						17.3			13.2	21.4																					
			0-0						15.8	20.9	16.8	16.7	18.9																					
			0-0						15.5	13.2	15.8	18.0	24.2																					
			0-0						18.4	19.5	24.6	18.7	17.7																					

Project No.:

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Swell Potential:	Low	Marginal	High	Moisture Content:	Below PL / 0-5% Over PL / >5% Over PL
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			0-0						13.5	12.8	13.4	15.0	15.3																					
			0-0						15.6	12.9	12.9	21.4	24.7																					
			0-0						14.1	14.5	14.8	16.8	17.3																					
			0-0						16.0	17.2	16.0	21.5	19.1																					
			0-0						29.8			28.6	30.9																					
			0-0						19.9	25.6	23.7	21.2	20.3																					
			0-0						13.5	14.5	17.5	10.1	19.8																					
			0-0						18.9	20.9	22.5	22.8	20.7																					
			0-0						12.9	12.5	14.6	18.9	15.4																					
			0-0						19.8	25.0	23.0	24.1	20.8																					
768	1+0500	Rt 24 SB	0.8-5	21.1	A-4(1)	1	12.0	6	17.7	20.5	20.2	21.3	21.0																					F4
764	1+4500	Rt 39 SB	0.8-5	23.4	A-4(8)	8	13.1	8	16.2	18.0	18.6	20.4	18.9																					F4
763	2+0500	Rt 24 SB	0.7-5	21.0	A-6(14)	14	13.2	17	20.2	16.2	16.0	25.8	31.2																					F3

Project No.: IM-8-029(159)000

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Swell Potential:	Low	Marginal	High	Moisture Content:	Below PL	0-5% Over PL	>5% Over PL	
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762	2+1367	Rt 24 SB	0.8-5	19.6	A-4(6)	6	11.6	10	19.1	18.0	20.8	21.6	22.6																					F4
760	2+3500	Rt 24 SB	0.8-5	0.0		6		0	16.2	18.3	16.3	16.4	17.4																					
759	2+4500	Rt 24 SB	0.8-5	19.3	A-4(6)	6	11.6	9	14.9	17.0	17.7	16.4	15.7																					F4
758	3+0500	Rt 24 SB	0.6-5	0.0		6		0	37.3	20.2	20.4	117.7	20.7																					
754	3+4500	Rt 24 SB	0.8-5	0.0	A-2-4(0)	0	10.6	0	12.2	12.5	12.8	13.4	12.7																					F3
753	4+0470	Rt 24 SB	0.8-5	0.0	A-2-4(0)	0	11.1	0	11.7	18.5	11.3	10.3	11.2																					F3
752	4+1500	Rt 24 SB	0.8-5	19.7	A-4(1)	1	10.9	6	14.2	17.0	15.6	16.2	14.6																					F4
748	5+0500	Rt 24 SB	0.8-5	0.0	A-4(0)	0	11.2	0	14.9	13.9	19.2	20.8	15.6																					F3
746	5+2500	Rt 24 SB	0.8-5	0.0		0		0	13.1	16.3	11.9	12.3	13.0																					
745	5+3500	Rt 24 SB	0.7-5	19.7	A-4(4)	4	11.2	8	18.0	14.7	17.6	21.5	26.6																					F4
739	6+4500	Rt 24 SB	0.7-5	0.0	A-4(0)	0	10.0	0	14.8	17.1	14.8	12.7	15.1																					F3
738	7+0500	Rt 24 SB	0.7-5	23.6	A-4(7)	7	12.1	10	15.9	6.1	16.7	23.8	26.3																					F4
736	7+1500	Rt 24 SB	0.8-3.5	0.0	A-2-4(0)	0	9.6	0	11.0	12.6	13.6																							F3

Project No.: IM-8-029(159)000

PCN:

Color Key

Swell Potential:	Low	Marginal	High	Moisture Content:	Below PL	0-5% Over PL	>5% Over PL
Group Index:	GI≤20	GI>20		Ave. In-Place: Moisture Content	MC < Opt.	0 ≤ MC < 6% Over opt.	6 ≤ MC < 10% Over opt.	10 ≤ MC < 16% Over opt.	MC >16% Over opt.

Lab No.	STA	Offset	Depth of Sample (ft)	Plastic Limit (PL)	AASHTO Class	Group Index	Optimum Moisture	Swell Potential (PI)	Ave. In-Place Moisture	Moisture Content @ Depth (ft) 2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	Frost Class
733	7+4500	Rt 38 SB	0.9-5	15.7	A-4(1)	1	1.9	8	14.7	14.3	14.2	15.2	8.0																					F3
732	8+0500	Rt 24 SB	0.8-5	0.0	A-2-4(0)	0	9.7	0	13.5	19.2	14.4	14.0	14.7																					F3
731	8+1378	Rt 24 SB	0.8-5	0.0	A-4(0)	0	10.2	0	12.6	9.2	15.0	16.7	17.1																					F3
729	8+3500	Rt 24 SB	0.7-5	17.8	A-4(0)	0	9.9	4	14.7	14.3	15.9	16.6	19.1																					F4
727	9+0500	Rt 24 SB	0.6-5	0.0	A-2-4(0)	0	9.9	0	12.5	11.8	12.3	15.3	15.9																					F2
726	9+1500	Rt 24 SB	0.8-5	0.0		0		0	15.6	17.3	18.0	17.2	16.7																					
723	9+4000	Rt 24 SB	0.8-5	0.0	A-2-4(0)	0	9.9	0	27.7	70.0	18.3	20.4	23.4																					F3
722	10+0000	Rt 24 SB	0.8-5	0.0	A-4(0)	0	9.5	0	16.1	17.8	17.3	14.2	17.0																					F3
721	10+1000	Rt 24 SB	0.8-5	0.0	A-4(0)	0	9.8	0	11.7	13.6	14.4	5.2	17.8																					F3
718	10+4000	Rt 24 SB	0.8-5	0.0	A-2-4(0)	0	11.3	0	17.0	17.6	17.2	18.9	20.4																					F2
715	11+1586	Rt 24 SB	0.8-5	0.0	A-2-4(0)	0	10.2	0	16.3	15.4	18.4	21.4	16.7																					F3

APPENDIX E

LAB RESULTS

Linear Laboratory Analysis

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

Report Number	SS-22-2015	**Date Reported**	6/17/2015	**District**	Bismarck
County	RICHLAND	**Submitted By**	Naumann	**Project Number**	IM-8-029(159)000
		AASHTO Test Method		**PCN**	

Comments Sample 781 can be found in report # 21

Lab Number	777	776	775	773
Reference Pt + Feet	0+0500	0+1500	0+2500	0+3500
Distance From CenterLine (Ft.)	Rt 24 SB	Rt 24 SB	Rt 24 SB	Rt 24 SB
Depth, Ft.	0.8 - 5.0	0.8 - 5.0	0.8 - 5.0	0.7 - 3.0
Field Sample No.	777	776	775	773
% Pass. 3/8" Sieve	100	100		100
% Pass. No. 4 Sieve	99	100		99
% Pass. No. 10 Sieve	97	99	0	97
% Coarse Sand (-No. 10 + No. 40)	3	1		3
% Fine Sand (-No. 40 + No. 200)	22	32	0	13
% Silt (0.074 - 0.005 mm)	52	46	0	59
% Clay (-0.005 mm)	20	21	0	22
Liquid Limit (-No. 40)	28	32	0	31
Plasticity Index (-No. 40)	7	11	NP	9
Plastic Limit	22	21	0	22
Soil Color	BRN/BLK	BRN	BRN	BRN/GRY/BLK
Textural Class	SLTY CLY LM	CLY LM		SLTY CLY LM
Soil Class (AASHTO M-145)	A-4(3)	A-6(6)		A-4(6)
Frost Class	F4	F4		F4
Optimum Moisture (%)	11.2	12.6		12.2
Maximum Dry Density (pcf)	122.0	118.2		121.3
% Organic Content				
Depth (Ft.) | Moisture (%)	1 | 8.1	1 | 4.2	1 | 5.0	1 | 6.2
	2 | 18.0	2 | 15.3	2 | 19.0	2 | 18.5
	3 | 22.3	3 | 15.5	3 | 18.6	3 | 26.7
	4 | 22.8	4 | 19.1	4 | 20.4	17.2
	5 | 23.6	5 | 23.6	5 | 25.9	
Avg. Moisture of Sample Depth	19.0	15.5	17.8	

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Linear Laboratory Analysis

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Comments Sample 781 can be found in report # 21

Lab Number	774	772	771	770
Reference Pt + Feet	0+3500	0+4108	0+4305	0+4388
Distance From CenterLine (Ft.)	Rt 24 SB	Rt 12 SB	Rt 12 SB	Rt 12 SB
Depth, Ft.	3.0 - 5.0	0.8 - 5.0	0.8 - 5.0	0.7 - 5.0
Field Sample No.	774	772	771	770
% Pass. 3/8" Sieve		100	100	100
% Pass. No. 4 Sieve		99	100	100
% Pass. No. 10 Sieve		97	100	100
% Coarse Sand (-No. 10 + No. 40)		5	1	2
% Fine Sand (-No. 40 + No. 200)		24	43	32
% Silt (0.074 - 0.005 mm)		46	40	43
% Clay (-0.005 mm)		22	16	23
Liquid Limit (-No. 40)		27	0	31
Plasticity Index (-No. 40)		7	NP	9
Plastic Limit		20	0	21
Soil Color	BRN	BRN	BRN	BRN
Textural Class		CLY LM	LM	CLY LM
Soil Class (AASHTO M-145)		A-4(3)	A-4(0)	A-4(4)
Frost Class		F4	F4	F4
Optimum Moisture (%)		11.7	11.6	12.5
Maximum Dry Density (pcf)		121.9	119.1	119.8
% Organic Content				

Depth (Ft.)	**Moisture (%)**								
4	28.6	2	11.7	2	22.4	2	20.3
5	30.9	3	19.3	3	21.8	3	19.3
Avg. Moisture of Sample Depth	29.7	4	20.1	4	18.3	4	26.9
		5	22.3	5	17.4	5	28.3
		18.3		20.0		23.7	

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		AASHTO Test Method		**PCN**	

Comments Sample 781 can be found in report # 21

Lab Number	769	768	767	766
Reference Pt + Feet	0+4500	1+0500	1+1500	1+2500
Distance From CenterLine (Ft.)	Rt 12 SB	Rt 24 SB	Rt 24 SB	Rt 24 SB
Depth, Ft.	0.8 - 5.0	0.8 - 5.0	0.8 - 5.0	0.8 - 5.0
Field Sample No.	769	768	767	766
% Pass. 3/8" Sieve	100	100		
% Pass. No. 4 Sieve	100	100		
% Pass. No. 10 Sieve	99	98		
% Coarse Sand (-No. 10 + No. 40)	2	1		
% Fine Sand (-No. 40 + No. 200)	6	37		
% Silt (0.074 - 0.005 mm)	71	39		
% Clay (-0.005 mm)	21	21		
Liquid Limit (-No. 40)	32	27		
Plasticity Index (-No. 40)	8	6		
Plastic Limit	24	21		
Soil Color	BRN	BRN/BLK	BRN	BRN
Textural Class	SLTY CLY LM	CLY LM		
Soil Class (AASHTO M-145)	A-4(8)	A-4(1)		
Frost Class	F4	F4		
Optimum Moisture (%)	13.4	12.0		
Maximum Dry Density (pcf)	116.6	121.3		
% Organic Content				
Depth (Ft.) | Moisture (%)	2 | 14.6	1 | 5.4	1 | 8.8	1 | 7.5
	3 | 16.9	2 | 20.5	2 | 25.6	2 | 20.9
	4 | 19.7	3 | 20.2	3 | 23.7	3 | 22.5
	5 | 22.7	4 | 21.3	4 | 21.2	4 | 22.8
Avg. Moisture of Sample Depth	18.4	5 | 21.0	5 | 20.3	5 | 20.7
		17.7	19.9	18.9

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		AASHTO Test Method		**PCN**	

Comments Sample 781 can be found in report # 21

Lab Number	765	764	722	721
Reference Pt + Feet	1+3500	1+4500	10+0000	10+1000
Distance From CenterLine (Ft.)	Rt 24 SB	Rt 39 SB	Rt 24 SB	Rt 24 SB
Depth, Ft.	0.7 - 5.0	0.8 - 5.0	0.8 - 5.0	0.8 - 5.0
Field Sample No.	765	764	722	721
% Pass. 3/8" Sieve		100	100	100
% Pass. No. 4 Sieve		100	100	100
% Pass. No. 10 Sieve		99	100	100
% Coarse Sand (-No. 10 + No. 40)		1	1	1
% Fine Sand (-No. 40 + No. 200)		5	62	52
% Silt (0.074 - 0.005 mm)		70	19	30
% Clay (-0.005 mm)		23	19	17
Liquid Limit (-No. 40)		32	0	0
Plasticity Index (-No. 40)		8	NP	NP
Plastic Limit		23	0	0
Soil Color	BRN	BRN	BRN	BRN
Textural Class		SLTY CLY LM	SNDY LM	SNDY LM
Soil Class (AASHTO M-145)		A-4(8)	A-4(0)	A-4(0)
Frost Class		F4	F3	F3
Optimum Moisture (%)		13.1	9.5	9.8
Maximum Dry Density (pcf)		117.2	123.3	122.6
% Organic Content				
Depth (Ft.) | Moisture (%)	1 | 6.2	1 | 4.9	1 | 14.3	1 | 7.3
	2 | 25.0	2 | 18.0	2 | 17.8	2 | 13.6
	3 | 23.0	3 | 18.6	3 | 17.3	3 | 14.4
	4 | 24.1	4 | 20.4	4 | 14.2	4 | 5.2
	5 | 20.8	5 | 18.9	5 | 17.0	5 | 17.8
Avg. Moisture of Sample Depth	19.8	16.1	16.0	11.6

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Comments Sample 781 can be found in report # 21

Lab Number	720	719	718	717
Reference Pt + Feet	10+2000	10+3000	10+4000	11+0000
Distance From CenterLine (Ft.)	Rt 24 SB	Rt 24 SB	Rt 24 SB	Rt 24 SB
Depth, Ft.	0.8 - 5.0	0.8 - 5.0	0.8 - 5.0	0.9 - 5.0
Field Sample No.	720	719	718	717
% Pass. 3/8" Sieve			100	
% Pass. No. 4 Sieve			100	
% Pass. No. 10 Sieve			100	
% Coarse Sand (-No. 10 + No. 40)			0	
% Fine Sand (-No. 40 + No. 200)			87	
% Silt (0.074 - 0.005 mm)			6	
% Clay (-0.005 mm)			7	
Liquid Limit (-No. 40)			0	
Plasticity Index (-No. 40)			NP	
Plastic Limit			0	
Soil Color	BRN	BRN	BRN	BRN
Textural Class			SND	
Soil Class (AASHTO M-145)			A-2-4(0)	
Frost Class			F2	
Optimum Moisture (%)			11.3	
Maximum Dry Density (pcf)			108.6	
% Organic Content				
Depth (Ft.) | Moisture (%)	1 | 7.1	1 | 6.6	1 | 11.0	1 | 10.2
	2 | 14.3	2 | 17.2	2 | 17.6	2 | 43.5
	3 | 13.2	3 | 16.1	3 | 17.2	3 | 21.6
	4 | 18.1	4 | 16.1	4 | 18.9	4 | 19.0
	5 | 22.3	5 | 17.0	5 | 20.4	5 | 18.6
Avg. Moisture of Sample Depth	15.0	14.6	17.0	22.6

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		AASHTO Test Method		**PCN**	

Comments Sample 781 can be found in report # 21

Lab Number	716	715	763	762
Reference Pt + Feet	11+1000	11+1586	2+0500	2+1367
Distance From CenterLine (Ft.)	Rt 24 SB	Rt 24 SB	Rt 24 SB	Rt 24 SB
Depth, Ft.	0.9 - 5.0	0.8 - 5.0	0.7 - 5.0	0.8 - 5.0
Field Sample No.	716	715	763	762
% Pass. 3/8" Sieve		100	100	100
% Pass. No. 4 Sieve		100	100	100
% Pass. No. 10 Sieve		100	99	99
% Coarse Sand (-No. 10 + No. 40)		1	1	1
% Fine Sand (-No. 40 + No. 200)		73	15	20
% Silt (0.074 - 0.005 mm)		14	54	47
% Clay (-0.005 mm)		13	29	31
Liquid Limit (-No. 40)		0	38	29
Plasticity Index (-No. 40)		NP	17	10
Plastic Limit		0	21	20
Soil Color	BRN	BRN/BLK	BRN/BLK	BRN
Textural Class		SNDY LM	SLTY CLY LM	CLY
Soil Class (AASHTO M-145)		A-2-4(0)	A-6(14)	A-4(6)
Frost Class		F3	F3	F4
Optimum Moisture (%)		10.2	13.2	11.6
Maximum Dry Density (pcf)		121.2	117.3	122.7
% Organic Content				

Depth (Ft.)	**Moisture (%)**								
1	8.9	1	9.8	1	11.8	1	12.7
2	15.5	2	15.4	2	16.2	2	18.0
3	16.5	3	18.4	3	16.0	3	20.8
4	16.7	4	21.4	4	25.8	4	21.6
5	15.4	5	16.7	5	31.2	5	22.6
Avg. Moisture of Sample Depth	14.6		16.3		20.2		19.2

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Comments Sample 781 can be found in report # 21

Lab Number	761	760	759	758
Reference Pt + Feet	2+2500	2+3500	2+4500	3+0500
Distance From CenterLine (Ft.)	Rt 24 SB	Rt 24 SB	Rt 24 SB	Rt 24 SB
Depth, Ft.	0.8 - 5.0	0.8 - 5.0	0.8 - 5.0	0.6 - 5.0
Field Sample No.	761	760	759	758
% Pass. 3/8" Sieve			100	
% Pass. No. 4 Sieve			100	
% Pass. No. 10 Sieve		0	99	0
% Coarse Sand (-No. 10 + No. 40)			1	
% Fine Sand (-No. 40 + No. 200)		0	21	0
% Silt (0.074 - 0.005 mm)		0	54	0
% Clay (-0.005 mm)		0	23	0
Liquid Limit (-No. 40)		0	29	0
Plasticity Index (-No. 40)		NP	9	NP
Plastic Limit		0	19	0
Soil Color	BRN	BRN	BRN	BRN/GRY/BLK
Textural Class			SLTY CLY LM	
Soil Class (AASHTO M-145)			A-4(6)	
Frost Class			F4	
Optimum Moisture (%)			11.6	
Maximum Dry Density (pcf)			122.7	
% Organic Content				
Depth (Ft.) | Moisture (%)	1 | 11.3	1 | 12.5	1 | 7.9	1 | 7.3
	2 | 19.5	2 | 18.3	2 | 17.0	2 | 20.2
	3 | 24.6	3 | 16.3	3 | 17.7	3 | 20.4
	4 | 18.7	4 | 16.4	4 | 16.4	4 | 117.7
	5 | 17.7	5 | 17.4	5 | 15.7	5 | 20.7
Avg. Moisture of Sample Depth	18.4	16.2	14.9	37.3

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Comments Sample 781 can be found in report # 21

Lab Number	757	756	755	754
Reference Pt + Feet	3+1500	3+2500	3+3500	3+4500
Distance From CenterLine (Ft.)	Rt 24 SB	Rt 24 SB	Rt 24 SB	Rt 24 SB
Depth, Ft.	0.8 - 5.0	0.8 - 5.0	0.8 - 5.0	0.8 - 5.0
Field Sample No.	757	756	755	754
% Pass. 3/8" Sieve				100
% Pass. No. 4 Sieve				100
% Pass. No. 10 Sieve				100
% Coarse Sand (-No. 10 + No. 40)				0
% Fine Sand (-No. 40 + No. 200)				66
% Silt (0.074 - 0.005 mm)				19
% Clay (-0.005 mm)				15
Liquid Limit (-No. 40)				0
Plasticity Index (-No. 40)				NP
Plastic Limit				0
Soil Color	BRN	BRN	BRN	BRN
Textural Class				SNDY LM
Soil Class (AASHTO M-145)				A-2-4(0)
Frost Class				F3
Optimum Moisture (%)				10.6
Maximum Dry Density (pcf)				118.3
% Organic Content				
Depth (Ft.) | Moisture (%)	1 | 5.5	1 | 7.0	1 | 6.1	1 | 9.5
	2 | 13.9	2 | 14.5	2 | 17.2	2 | 12.5
	3 | 15.1	3 | 14.8	3 | 16.0	3 | 12.8
	4 | 16.9	4 | 16.8	4 | 21.5	4 | 13.4
	5 | 21.2	5 | 17.3	5 | 19.1	5 | 12.7
Avg. Moisture of Sample Depth	14.6	14.1	16.0	12.1

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Comments Sample 781 can be found in report # 21

Lab Number	753	752	751	750
Reference Pt + Feet	4+0470	4+1500	4+2500	4+3500
Distance From CenterLine (Ft.)	Rt 24 SB	Rt 24 SB	Rt 24 SB	Rt 24 SB
Depth, Ft.	0.8 - 5.0	0.8 - 5.0	0.8 - 5.0	0.8 - 5.0
Field Sample No.	753	752	751	750
% Pass. 3/8" Sieve	100	100		
% Pass. No. 4 Sieve	100	100		
% Pass. No. 10 Sieve	100	99		
% Coarse Sand (-No. 10 + No. 40)	0	1		
% Fine Sand (-No. 40 + No. 200)	70	38		
% Silt (0.074 - 0.005 mm)	16	38		
% Clay (-0.005 mm)	13	23		
Liquid Limit (-No. 40)	0	25		
Plasticity Index (-No. 40)	NP	6		
Plastic Limit	0	20		
Soil Color	BRN	BRN	BRN	BRN
Textural Class	SNDY LM	CLY LM		
Soil Class (AASHTO M-145)	A-2-4(0)	A-4(1)		
Frost Class	F3	F4		
Optimum Moisture (%)	11.1	10.9		
Maximum Dry Density (pcf)	114.8	124.3		
% Organic Content				
Depth (Ft.) | Moisture (%)	1 | 7.1	1 | 7.5	1 | 6.4	1 | 5.0
	2 | 18.5	2 | 17.0	2 | 16.4	2 | 17.6
	3 | 11.3	3 | 15.6	3 | 19.5	3 | 17.4
	4 | 10.3	4 | 16.2	4 | 66.0	4 | 19.0
	5 | 11.2	5 | 14.6	5 | 16.3	5 | 17.5
Avg. Moisture of Sample Depth	11.7	14.2	24.9	15.3

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Comments Sample 781 can be found in report # 21

Lab Number	749	748	747	746
Reference Pt + Feet	4+4500	5+0500	5+1500	5+2500
Distance From CenterLine (Ft.)	Rt 24 SB	Rt 24 SB	Rt 24 SB	Rt 24 SB
Depth, Ft.	0.1 - 5.0	0.8 - 5.0	0.9 - 5.0	0.8 - 5.0
Field Sample No.	749	748	747	746
% Pass. 3/8" Sieve		100		
% Pass. No. 4 Sieve		100		
% Pass. No. 10 Sieve		100		0
% Coarse Sand (-No. 10 + No. 40)		1		
% Fine Sand (-No. 40 + No. 200)		51		0
% Silt (0.074 - 0.005 mm)		33		0
% Clay (-0.005 mm)		15		0
Liquid Limit (-No. 40)		0		0
Plasticity Index (-No. 40)		NP		NP
Plastic Limit		0		0
Soil Color	BRN	BRN	BRN	BRN
Textural Class		SNDY LM		
Soil Class (AASHTO M-145)		A-4(0)		
Frost Class		F3		
Optimum Moisture (%)		11.2		
Maximum Dry Density (pcf)		119.7		
% Organic Content				
Depth (Ft.) | Moisture (%)	1 | 5.2	1 | 5.0	1 | 3.3	1 | 12.1
	2 | 13.7	2 | 13.9	2 | 12.5	2 | 16.3
	3 | 14.6	3 | 19.2	3 | 14.6	3 | 11.9
	4 | 14.0	4 | 20.8	4 | 18.9	4 | 12.3
	5 | 13.7	5 | 15.6	5 | 15.4	5 | 13.0
Avg. Moisture of Sample Depth	12.2	14.9	12.9	13.1

Scott W. Wutzke, Testing Lab Supervisor
Date Printed: 1/4/2016

Linear Laboratory Analysis

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

Report Number	SS-22-2015	**Date Reported**	6/17/2015	**District**	Bismarck
County	RICHLAND	**Submitted By**	Naumann	**Project Number**	IM-8-029(159)000
		AASHTO Test Method		**PCN**	

Comments Sample 781 can be found in report # 21

Lab Number	745	744	743	742
Reference Pt + Feet	5+3500	5+4500	6+0500	6+1500
Distance From CenterLine (Ft.)	Rt 24 SB	Rt 24 SB	Rt 24 SB	Rt 24 SB
Depth, Ft.	0.7 - 5.0	0.8 - 5.0	0.8 - 5.0	0.8 - 5.0
Field Sample No.	745	744	743	742
% Pass. 3/8" Sieve	100			
% Pass. No. 4 Sieve	100			
% Pass. No. 10 Sieve	100			
% Coarse Sand (-No. 10 + No. 40)	1			
% Fine Sand (-No. 40 + No. 200)	30			
% Silt (0.074 - 0.005 mm)	45			
% Clay (-0.005 mm)	24			
Liquid Limit (-No. 40)	28			
Plasticity Index (-No. 40)	8			
Plastic Limit	20			
Soil Color	BRN/GRY/BLK	BRN	BRN	BRN
Textural Class	CLY LM			
Soil Class (AASHTO M-145)	A-4(4)			
Frost Class	F4			
Optimum Moisture (%)	11.2			
Maximum Dry Density (pcf)	122.7			
% Organic Content				
Depth (Ft.) | Moisture (%)	1 | 9.7	1 | 3.8	1 | 4.0	1 | 3.7
	2 | 14.7	2 | 22.1	2 | 9.8	2 | 12.4
	3 | 17.6	3 | 13.1	3 | 12.0	3 | 13.4
	4 | 21.5	4 | 14.2	4 | 25.1	4 | 5.9
	5 | 26.6	5 | 14.3	5 | 19.5	5 | 17.0
Avg. Moisture of Sample Depth	18.0	13.5	14.1	10.4

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-22-2015	**Date Reported**	6/17/2015	**District**	Bismarck
County	RICHLAND	**Submitted By**	Naumann	**Project Number**	IM-8-029(159)000
		AASHTO Test Method		**PCN**	

Comments Sample 781 can be found in report # 21

Lab Number	741	740	739	738
Reference Pt + Feet	6+2500	6+3500	6+4500	7+0500
Distance From CenterLine (Ft.)	Rt 24 SB	Rt 24 SB	Rt 24 SB	Rt 24 SB
Depth, Ft.	0.8 - 5.0	0.8 - 5.0	0.7 - 5.0	0.7 - 5.0
Field Sample No.	741	740	739	738
% Pass. 3/8" Sieve			100	100
% Pass. No. 4 Sieve			100	99
% Pass. No. 10 Sieve			99	96
% Coarse Sand (-No. 10 + No. 40)			1	4
% Fine Sand (-No. 40 + No. 200)			56	11
% Silt (0.074 - 0.005 mm)			22	61
% Clay (-0.005 mm)			21	20
Liquid Limit (-No. 40)			0	33
Plasticity Index (-No. 40)			NP	10
Plastic Limit			0	24
Soil Color	BRN	BRN	BRN	BRN
Textural Class			SNDY CLY LM	SLTY CLY LM
Soil Class (AASHTO M-145)			A-4(0)	A-4(7)
Frost Class			F3	F4
Optimum Moisture (%)			10.0	12.1
Maximum Dry Density (pcf)			125.5	121.7
% Organic Content				
Depth (Ft.) | Moisture (%)	1 | 6.3	1 | 5.4	1 | 14.1	1 | 6.4
	2 | 13.2	2 | 16.0	2 | 17.1	2 | 6.1
	3 | 15.8	3 | 16.2	3 | 14.8	3 | 16.7
	4 | 18.0	4 | 16.4	4 | 12.7	4 | 23.8
	5 | 24.2	5 | 15.8	5 | 15.1	5 | 26.3
Avg. Moisture of Sample Depth	15.6	14.0	14.7	15.9

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-22-2015	**Date Reported**	6/17/2015	**District**	Bismarck
County	RICHLAND	**Submitted By**	Naumann	**Project Number**	IM-8-029(159)000
		AASHTO Test Method		**PCN**	

Comments Sample 781 can be found in report # 21

Lab Number	736	737	735	734
Reference Pt + Feet	7+1500	7+1500	7+2500	7+3500
Distance From CenterLine (Ft.)	Rt 24 SB	Rt 24 SB	Rt 24 SB	Rt 24 SB
Depth, Ft.	0.8 - 3.5	3.5 - 5.0	0.8 - 5.0	0.8 - 5.0
Field Sample No.	736	737	735	734
% Pass. 3/8" Sieve	100			
% Pass. No. 4 Sieve	99			
% Pass. No. 10 Sieve	98			
% Coarse Sand (-No. 10 + No. 40)	2			
% Fine Sand (-No. 40 + No. 200)	68			
% Silt (0.074 - 0.005 mm)	9			
% Clay (-0.005 mm)	19			
Liquid Limit (-No. 40)	0			
Plasticity Index (-No. 40)	NP			
Plastic Limit	0			
Soil Color	BRN	BRN/GRY/BLK	BRN	BRN
Textural Class	SNDY LM			
Soil Class (AASHTO M-145)	A-2-4(0)			
Frost Class	F3			
Optimum Moisture (%)	9.6			
Maximum Dry Density (pcf)	124.8			
% Organic Content				
Depth (Ft.) | Moisture (%)	1 | 6.7	4 | 13.2	1 | 6.2	1 | 6.5
	2 | 12.6	5 | 21.4	2 | 12.9	2 | 17.7
	3 | 13.6	17.3	3 | 12.9	3 | 15.2
Avg. Moisture of Sample Depth	10.9		4 | 21.4	4 | 18.6
			5 | 24.7	5 | 18.9
			15.6	15.4

Scott W. Wutzke, Testing Lab Supervisor
Date Printed: 1/4/2016

Linear Laboratory Analysis

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

Report Number	SS-22-2015	**Date Reported**	6/17/2015	**District**	Bismarck
County	RICHLAND	**Submitted By**	Naumann	**Project Number**	IM-8-029(159)000
		AASHTO Test Method		**PCN**	

Comments Sample 781 can be found in report # 21

Lab Number	733	732	731	730
Reference Pt + Feet	7+4500	8+0500	8+1378	8+2500
Distance From CenterLine (Ft.)	Rt 38 SB	Rt 24 SB	Rt 24 SB	Rt 24 SB
Depth, Ft.	0.9 - 5.0	0.8 - 5.0	0.8 - 5.0	0.7 - 5.0
Field Sample No.	733	732	731	730
% Pass. 3/8" Sieve	100	100	100	
% Pass. No. 4 Sieve	100	100	100	
% Pass. No. 10 Sieve	100	100	99	
% Coarse Sand (-No. 10 + No. 40)	2	1	1	
% Fine Sand (-No. 40 + No. 200)	48	68	61	
% Silt (0.074 - 0.005 mm)	24	15	17	
% Clay (-0.005 mm)	26	17	21	
Liquid Limit (-No. 40)	24	0	0	
Plasticity Index (-No. 40)	9	NP	NP	
Plastic Limit	16	0	0	
Soil Color	BRN	BRN	BRN	BRN
Textural Class	SNDY CLY LM	SNDY LM	SNDY CLY LM	
Soil Class (AASHTO M-145)	A-4(1)	A-2-4(0)	A-4(0)	
Frost Class	F3	F3	F3	
Optimum Moisture (%)	1.9	9.7	10.2	
Maximum Dry Density (pcf)	126.3	121.4	123.4	
% Organic Content				
Depth (Ft.) | Moisture (%)	1 | 21.8	1 | 5.4	1 | 5.1	1 | 5.8
	2 | 14.3	2 | 19.2	2 | 9.2	2 | 14.5
	3 | 14.2	3 | 14.4	3 | 15.0	3 | 17.5
	4 | 15.2	4 | 14.0	4 | 16.7	4 | 10.1
	5 | 8.0	5 | 14.7	5 | 17.1	5 | 19.8
Avg. Moisture of Sample Depth	14.7	13.6	12.6	13.6

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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-22-2015	**Date Reported**	6/17/2015	**District**	Bismarck
County	RICHLAND	**Submitted By**	Naumann	**Project Number**	IM-8-029(159)000
		AASHTO Test Method		**PCN**	

Comments Sample 781 can be found in report # 21

Lab Number	729	728	727	726
Reference Pt + Feet	8+3500	8+4500	9+0500	9+1500
Distance From CenterLine (Ft.)	Rt 24 SB	Rt 24 SB	Rt 24 SB	Rt 24 SB
Depth, Ft.	0.7 - 5.0	0.8 - 5.0	0.6 - 5.0	0.8 - 5.0
Field Sample No.	729	728	727	726
% Pass. 3/8" Sieve	100	0	100	
% Pass. No. 4 Sieve	100	0	99	
% Pass. No. 10 Sieve	100	0	99	0
% Coarse Sand (-No. 10 + No. 40)	1		1	
% Fine Sand (-No. 40 + No. 200)	39		80	0
% Silt (0.074 - 0.005 mm)	39		9	0
% Clay (-0.005 mm)	21		9	0
Liquid Limit (-No. 40)	22		0	0
Plasticity Index (-No. 40)	4		NP	NP
Plastic Limit	18		0	0
Soil Color	BRN	BRN	BRN	BRN
Textural Class	CLY LM		SND	
Soil Class (AASHTO M-145)	A-4(0)		A-2-4(0)	
Frost Class	F4		F2	
Optimum Moisture (%)	9.9		9.9	
Maximum Dry Density (pcf)	125.1		115.4	
% Organic Content				
Depth (Ft.) | Moisture (%)	1 | 7.4	1 | 10.9	1 | 7.0	1 | 8.8
	2 | 14.3	2 | 12.8	2 | 11.8	2 | 17.3
	3 | 15.9	3 | 13.4	3 | 12.3	3 | 18.0
	4 | 16.6	4 | 15.0	4 | 15.3	4 | 17.2
	5 | 19.1	5 | 15.3	5 | 15.9	5 | 16.7
Avg. Moisture of Sample Depth	14.6	13.5	12.5	15.6

Scott W. Wutzke, Testing Lab Supervisor
Date Printed: 1/4/2016

Linear Laboratory Analysis

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

Report Number	SS-22-2015	**Date Reported**	6/17/2015	**District**	Bismarck
County	RICHLAND	**Submitted By**	Naumann	**Project Number**	IM-8-029(159)000
		AASHTO Test Method		**PCN**	

Comments Sample 781 can be found in report # 21

Lab Number	725	724	723
Reference Pt + Feet	9+2500	9+3500	9+4000
Distance From CenterLine (Ft.)	Rt 24 SB	Rt 24 SB	Rt 24 SB
Depth, Ft.	0.8 - 5.0	0.8 - 5.0	0.8 - 5.0
Field Sample No.	725	724	723
% Pass. 3/8" Sieve			100
% Pass. No. 4 Sieve			100
% Pass. No. 10 Sieve			99
% Coarse Sand (-No. 10 + No. 40)			1
% Fine Sand (-No. 40 + No. 200)			65
% Silt (0.074 - 0.005 mm)			14
% Clay (-0.005 mm)			19
Liquid Limit (-No. 40)			0
Plasticity Index (-No. 40)			NP
Plastic Limit			0
Soil Color	BRN	BRN	BRN
Textural Class			SNDY LM
Soil Class (AASHTO M-145)			A-2-4(0)
Frost Class			F3
Optimum Moisture (%)			9.9
Maximum Dry Density (pcf)			122.3
% Organic Content			
Depth (Ft.) | Moisture (%)	1 | 7.6	1 | 5.6	1 | 6.2
	2 | 13.8	2 | 20.9	2 | 70.0
	3 | 13.4	3 | 16.8	3 | 18.3
	4 | 15.3	4 | 16.7	4 | 20.4
	5 | 14.8	5 | 18.9	5 | 23.4
Avg. Moisture of Sample Depth	13.0	15.8	27.6

Scott W. Wutzke, Testing Lab Supervisor
Date Printed: 1/4/2016

MOISTURE-DENSITY RELATIONS OF SOILS

North Dakota Department Of Transportation, Materials & Research Division

SFN 10063 (Rev. 03-2006)

Project No.	PCN	Station	Depth Below Grade
SIM-8-029(151)000			
Offset From Centerline		Type of Soil	
AASTHO Designation **T-180**	Date **12/21/2015**		**715**

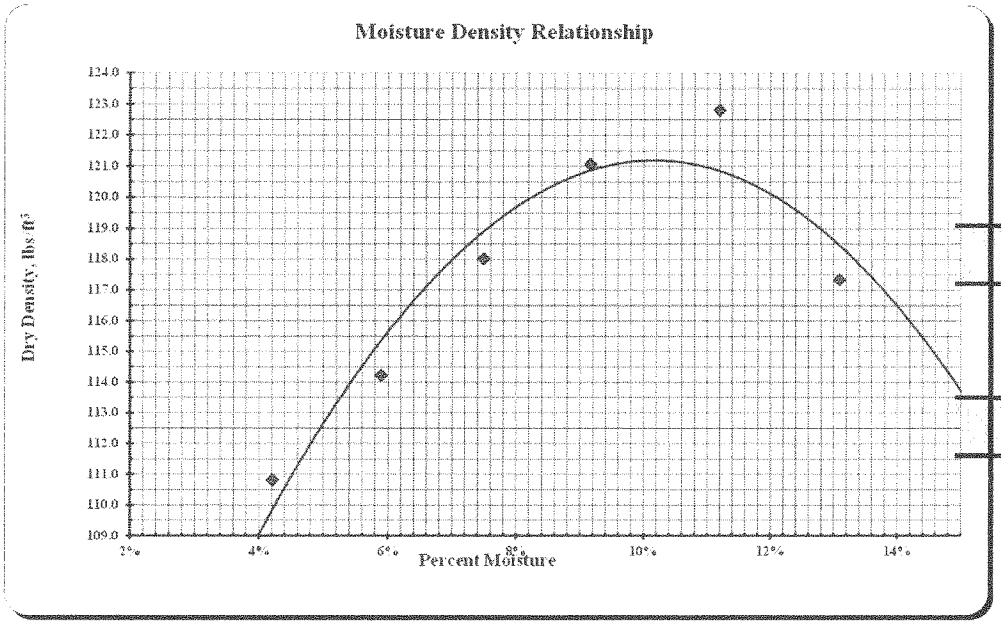
Density		Test Count	6				
	Determination No.	1	2	3	4	5	6
A Volume of Mold	cu. ft.	0.0332	0.0332	0.0332	0.0332	0.0332	0.0332
	lbs.	8.22	8.41	8.60	8.77	8.92	8.79
C Weight of Mold	lbs.	4.39	4.39	4.39	4.39	4.39	4.39
D Weight of Compacted Soil = B - C	lbs.	3.83	4.02	4.21	4.39	4.53	4.41
E Wet Density = D / A	lbs./cu.ft.	115.5	121.0	126.9	132.2	136.6	132.7
F Dry Density = (E x 100) / (100 + L)	lbs./cu.ft.	**110.8**	**114.2**	**118.0**	**121.1**	**122.8**	**117.3**

Moisture Content

AASHTO T99 or T180 Tested by:

Container No.		1	2	3	4	5	6
G Wet Weight / Container	grams	170.2	152.3	149.0	163.0	160.2	158.9
H Dry Weight / Container	grams	164.8	145.9	141.2	152.4	147.8	144.8
I Moisture Loss = G - H	grams	5.4	6.4	7.8	10.6	12.4	14.1
J Tare Weight of Container	grams	36.6	37.3	37.1	36.7	37.1	37.1
K Dry Soil = H - J	grams	128.2	108.6	104.1	115.7	110.7	107.7
L %Moisture = (I / K) x 100	%	**4.2%**	**5.9%**	**7.5%**	**9.2%**	**11.2%**	**13.1%**

ASTM D4643 AASHTO T217 or T265 Tested by: tv



Max Dry Density

121.2 lbs./cu.ft.

Optimum Moisture

10.2%

MOISTURE-DENSITY RELATIONS OF SOILS

North Dakota Department Of Transportation, Materials & Research Division

SFN 10063 (Rev. 03-2006)

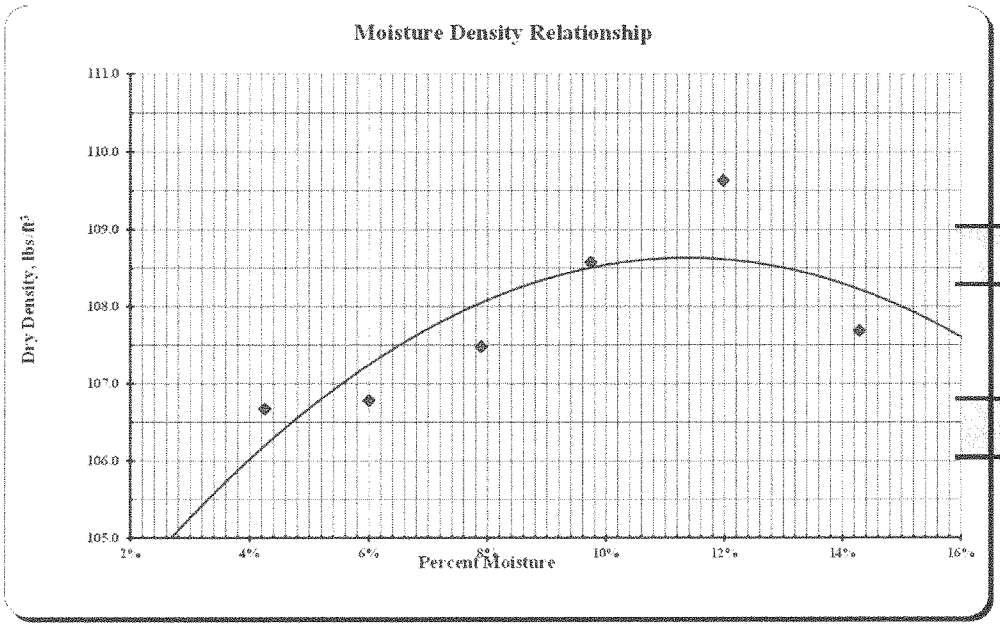
Project No.	PCN	Station	Depth Below Grade
SIM-8-029(151)000			
Offset From Centerline		Type of Soil	
AASTHO Designation **T-180**	Date **12/21/2015**		**718**

Density		Test Count	7				
	Determination No.	1	2	3	4	5	6
A Volume of Mold	cu. ft.	0.0332	0.0332	0.0332	0.0332	0.0332	0.0332
	lbs.	8.08	8.15	8.24	8.34	8.46	8.47
C Weight of Mold	lbs.	4.39	4.39	4.39	4.39	4.39	4.39
D Weight of Compacted Soil = B - C	lbs.	3.69	3.76	3.85	3.96	4.08	4.09
E Wet Density = D / A	lbs./cu.ft.	111.2	113.2	116.0	119.2	122.8	123.1
F Dry Density = (E x 100) / (100 + L)	lbs./cu.ft.	**106.7**	**106.8**	**107.5**	**108.6**	**109.6**	**107.7**

Moisture Content AASHTO T99 or T180 Tested by:

Container No.		8	9	10	11	12	13
G Wet Weight / Container	grams	157.2	157.3	165.2	169.0	166.8	178.7
H Dry Weight / Container	grams	152.3	150.5	155.8	157.3	152.9	161.0
I Moisture Loss = G - H	grams	4.9	6.8	9.4	11.7	13.9	17.7
J Tare Weight of Container	grams	37.0	37.2	36.7	37.2	36.9	37.1
K Dry Soil = H - J	grams	115.3	113.3	119.1	120.1	116.0	123.9
L %Moisture = (I / K) x 100	%	**4.2%**	**6.0%**	**7.9%**	**9.7%**	**12.0%**	**14.3%**

ASTM D4643 AASHTO T217 or T265 Tested by: tv



Max Dry Density

108.6 lbs./cu.ft.

Optimum Moisture

11.3%

MOISTURE-DENSITY RELATIONS OF SOILS

North Dakota Department Of Transportation, Materials & Research Division

SFN 10063 (Rev. 03-2006)

Project No.	PCN	Station	Depth Below Grade
SIM-8-029(151)000			
Offset From Centerline		Type of Soil	
AASTHO Designation **T-180**	Date **12/21/2015**		**721**

Density

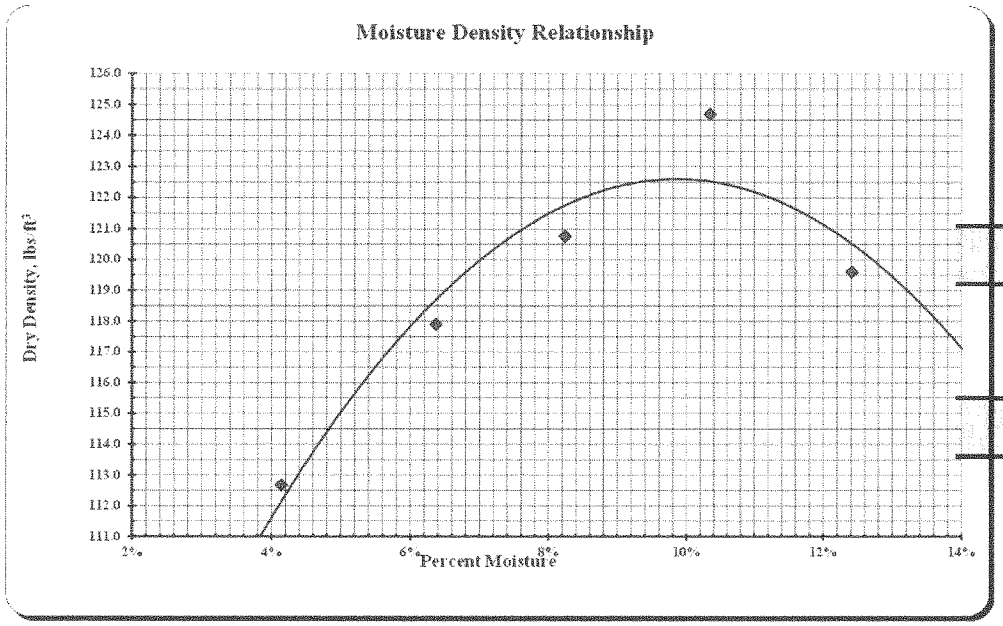
			Test Count	5				
	Determination No.		1	2	3	4	5	6
A	Volume of Mold	cu. ft.	0.0332	0.0332	0.0332	0.0332	0.0332	0.0332
		lbs.	8.28	8.55	8.73	8.95	8.85	
C	Weight of Mold	lbs.	4.39	4.39	4.39	4.39	4.39	4.39
D	Weight of Compacted Soil = B - C	lbs.	3.90	4.16	4.34	4.57	4.46	
E	Wet Density = D / A	lbs./cu.ft.	117.3	125.4	130.7	137.6	134.5	
F	Dry Density = (E x 100) / (100 + L)	lbs./cu.ft.	**112.7**	**117.9**	**120.8**	**124.7**	**119.6**	**#VALUE!**

Moisture Content

AASHTO T99 or T180 Tested by:

	Container No.		14	15	16	17	18	
G	Wet Weight / Container	grams	176.2	155.8	154.1	143.5	152.1	
H	Dry Weight / Container	grams	170.7	148.7	145.2	133.5	139.4	
I	Moisture Loss = G - H	grams	5.5	7.1	8.9	10.0	12.7	
J	Tare Weight of Container	grams	37.9	37.3	37.2	36.8	37.1	
K	Dry Soil = H - J	grams	132.8	111.4	108.0	96.7	102.3	
L	%Moisture = (I / K) x 100	%	**4.1%**	**6.4%**	**8.2%**	**10.3%**	**12.4%**	

ASTM D4643 AASHTO T217 or T265 Tested by: tv



Max Dry Density

122.6 lbs./cu.ft.

Optimum Moisture

9.8%

MOISTURE-DENSITY RELATIONS OF SOILS

North Dakota Department Of Transportation, Materials & Research Division

SFN 10063 (Rev. 03-2006)

Project No.	PCN	Station	Depth Below Grade
SIM-8-029(151)000			
Offset From Centerline		Type of Soil	
AASTHO Designation	Date		
T-180	**12/21/2015**		**722**

Density — Test Count: 5

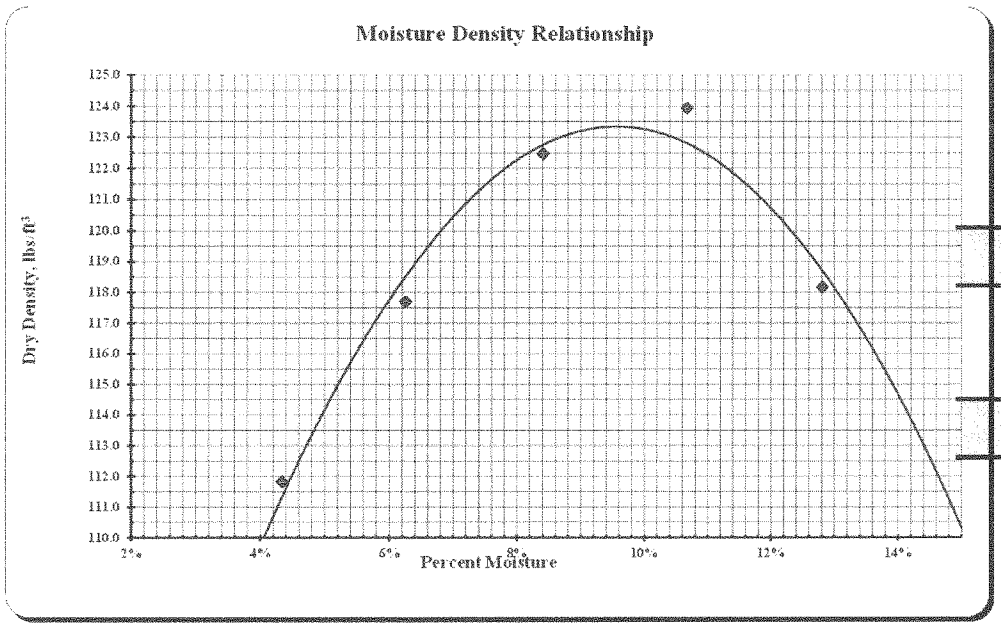
	Determination No.		1	2	3	4	5	6
A	Volume of Mold	cu. ft.	0.0332	0.0332	0.0332	0.0332	0.0332	0.0332
		lbs.	8.26	8.54	8.79	8.94	8.81	
C	Weight of Mold	lbs.	4.39	4.39	4.39	4.39	4.39	4.39
D	Weight of Compacted Soil = B - C	lbs.	3.87	4.15	4.41	4.55	4.43	
E	Wet Density = D / A	lbs./cu.ft.	116.7	125.1	132.8	137.2	133.3	
F	Dry Density = (E x 100) / (100 + L)	lbs./cu.ft.	**111.8**	**117.7**	**122.5**	**123.9**	**118.2**	**#VALUE!**

Moisture Content

AASHTO T99 or T180 Tested by:

	Container No.		19	20	21	22	23	
G	Wet Weight / Container	grams	171.7	162.3	154.4	149.0	169.5	
H	Dry Weight / Container	grams	166.1	154.9	145.3	138.2	154.5	
I	Moisture Loss = G - H	grams	5.6	7.4	9.1	10.8	15.0	
J	Tare Weight of Container	grams	37.1	36.5	37.1	37.0	37.4	
K	Dry Soil = H - J	grams	129.0	118.4	108.2	101.2	117.1	
L	%Moisture = (I / K) x 100	%	**4.3%**	**6.3%**	**8.4%**	**10.7%**	**12.8%**	

ASTM D4643 AASHTO T217 or T265 Tested by: tv



Max Dry Density

123.3 lbs./cu.ft.

Optimum Moisture

9.5%

MOISTURE-DENSITY RELATIONS OF SOILS

North Dakota Department Of Transportation, Materials & Research Division

SFN 10063 (Rev. 03-2006)

Project No.	PCN	Station	Depth Below Grade
SIM-8-029(151)000			
Offset From Centerline		Type of Soil	
AASTHO Designation **T-180**	Date **12/21/2015**		**723**

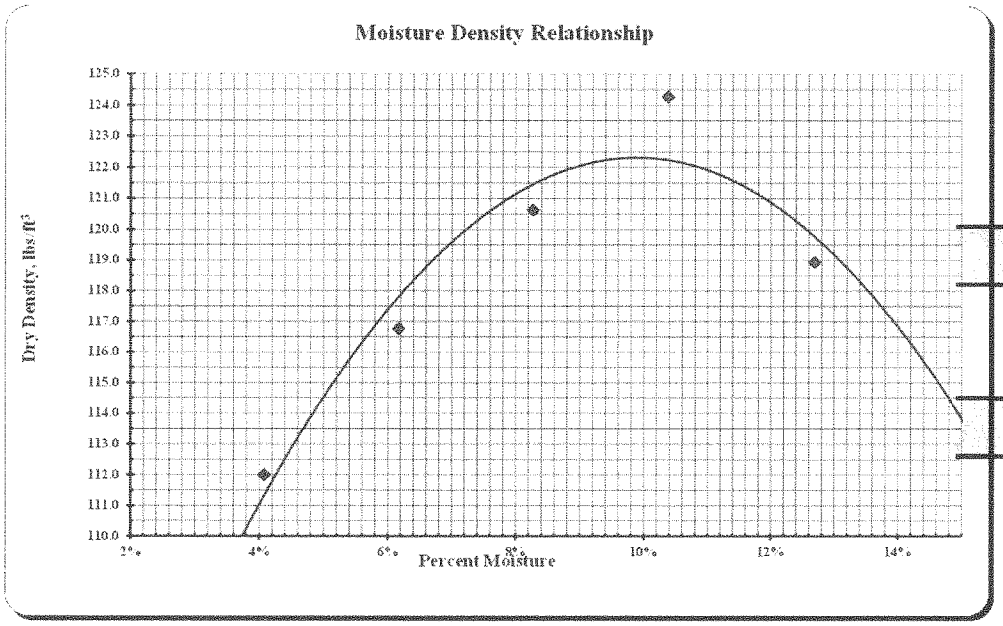
Density		Test Count	5				
	Determination No.	1	2	3	4	5	6
A Volume of Mold	cu. ft.	0.0332	0.0332	0.0332	0.0332	0.0332	0.0332
	lbs.	8.26	8.51	8.72	8.94	8.84	
C Weight of Mold	lbs.	4.39	4.39	4.39	4.39	4.39	4.39
D Weight of Compacted Soil = B - C	lbs.	3.87	4.12	4.34	4.55	4.45	
E Wet Density = D / A	lbs./cu.ft.	116.6	124.0	130.6	137.2	134.0	
F Dry Density = (E x 100) / (100 + L)	lbs./cu.ft.	**112.0**	**116.8**	**120.6**	**124.3**	**118.9**	**#VALUE!**

Moisture Content

AASHTO T99 or T180 Tested by:

	Container No.	24	25	26	27	28	
G Wet Weight / Container	grams	164.8	155.9	144.3	155.8	158.0	
H Dry Weight / Container	grams	159.8	149.0	136.1	144.6	144.4	
I Moisture Loss = G - H	grams	5.0	6.9	8.2	11.2	13.6	
J Tare Weight of Container	grams	37.2	37.2	36.9	36.7	37.2	
K Dry Soil = H - J	grams	122.6	111.8	99.2	107.9	107.2	
L %Moisture = (I / K) x 100	%	**4.1%**	**6.2%**	**8.3%**	**10.4%**	**12.7%**	

ASTM D4643 AASHTO T217 or T265 Tested by: tv



Max Dry Density

122.3 lbs./cu.ft.

Optimum Moisture

9.9%

MOISTURE-DENSITY RELATIONS OF SOILS

North Dakota Department Of Transportation, Materials & Research Division

SFN 10063 (Rev. 03-2006)

Project No.	PCN	Station	Depth Below Grade
SIM-8-029(151)000			
Offset From Centerline		Type of Soil	
AASTHO Designation **T-180**	Date **12/21/2015**		**727**

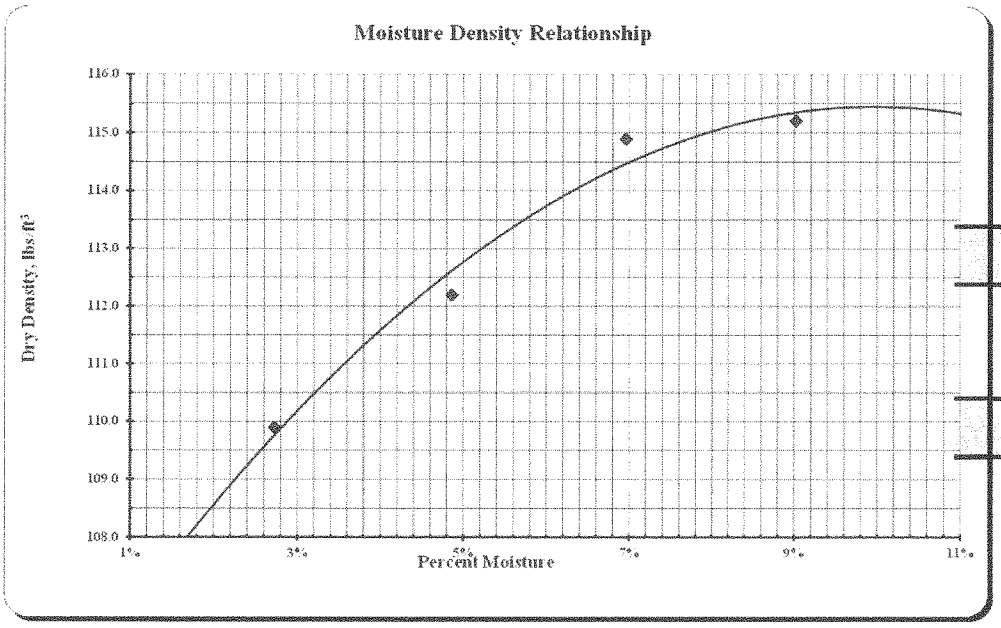
Density		Test Count	4				
	Determination No.	1	2	3	4	5	6
A Volume of Mold	cu. ft.	0.0332	0.0332	0.0332	0.0332	0.0332	0.0332
	lbs.	8.13	8.30	8.47	8.56		
C Weight of Mold	lbs.	4.39	4.39	4.39	4.39	4.39	4.39
D Weight of Compacted Soil = B - C	lbs.	3.75	3.91	4.08	4.17		
E Wet Density = D / A	lbs./cu.ft.	112.9	117.7	122.9	125.6		
F Dry Density = (E x 100) / (100 + L)	lbs./cu.ft.	**109.9**	**112.2**	**114.9**	**115.2**	**#VALUE!**	**#VALUE!**

Moisture Content

AASHTO T99 or T180 Tested by:

Container No.		29	30	31	32		
G Wet Weight / Container	grams	172.8	149.3	146.1	154.1		
H Dry Weight / Container	grams	169.2	144.1	139.0	144.4		
I Moisture Loss = G - H	grams	3.6	5.2	7.1	9.7		
J Tare Weight of Container	grams	37.2	37.1	37.0	36.9		
K Dry Soil = H - J	grams	132.0	107.0	102.0	107.5		
L %Moisture = (I / K) x 100	%	**2.7%**	**4.9%**	**7.0%**	**9.0%**		

ASTM D4643 AASHTO T217 or T265 Tested by: tv



Max Dry Density

115.4 lbs./cu.ft.

Optimum Moisture

9.9%

MOISTURE-DENSITY RELATIONS OF SOILS

North Dakota Department Of Transportation, Materials & Research Division

SFN 10063 (Rev. 03-2006)

Project No.	PCN	Station	Depth Below Grade
SIM-8-029(151)000			
Offset From Centerline		Type of Soil	
AASTHO Designation **T-180**	Date **12/21/2015**		**729**

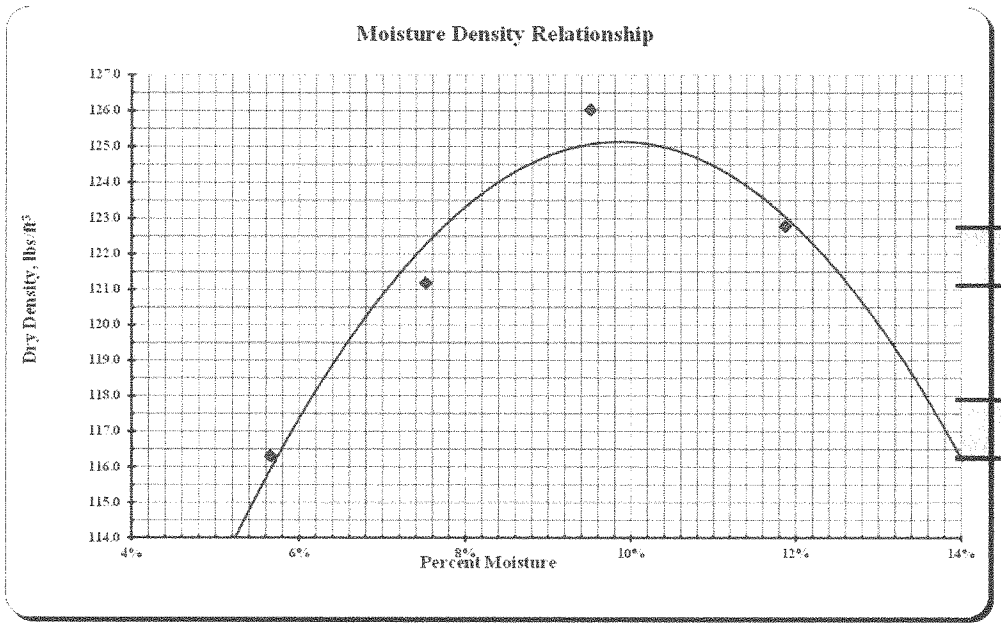
Density		Test Count	4				
	Determination No.	1	2	3	4	5	6
A Volume of Mold	cu. ft.	0.0332	0.0332	0.0332	0.0332	0.0332	0.0332
	lbs.	8.47	8.72	8.97	8.95		
C Weight of Mold	lbs.	4.39	4.39	4.39	4.39	4.39	4.39
D Weight of Compacted Soil = B - C	lbs.	4.08	4.33	4.58	4.56		
E Wet Density = D / A	lbs./cu.ft.	122.9	130.3	138.0	137.3		
F Dry Density = (E x 100) / (100 + L)	lbs./cu.ft.	**116.3**	**121.2**	**126.0**	**122.8**	**#VALUE!**	**#VALUE!**

Moisture Content

AASHTO T99 or T180 Tested by:

Container No.		33	34	35	36		
G Wet Weight / Container	grams	166.0	156.7	161.9	158.8		
H Dry Weight / Container	grams	159.1	148.4	151.1	145.9		
I Moisture Loss = G - H	grams	6.9	8.3	10.8	12.9		
J Tare Weight of Container	grams	37.1	38.0	37.5	37.2		
K Dry Soil = H - J	grams	122.0	110.4	113.6	108.7		
L %Moisture = (I / K) x 100	%	**5.7%**	**7.5%**	**9.5%**	**11.9%**		

ASTM D4643 AASHTO T217 or T265 Tested by: tv



Max Dry Density

125.1 lbs./cu.ft.

Optimum Moisture

9.9%

MOISTURE-DENSITY RELATIONS OF SOILS

North Dakota Department Of Transportation, Materials & Research Division

SFN 10063 (Rev. 03-2006)

Project No.	PCN	Station	Depth Below Grade
SIM-8-029(151)000			
Offset From Centerline		Type of Soil	
AASTHO Designation **T-180**	Date **12/22/2015**		**731**

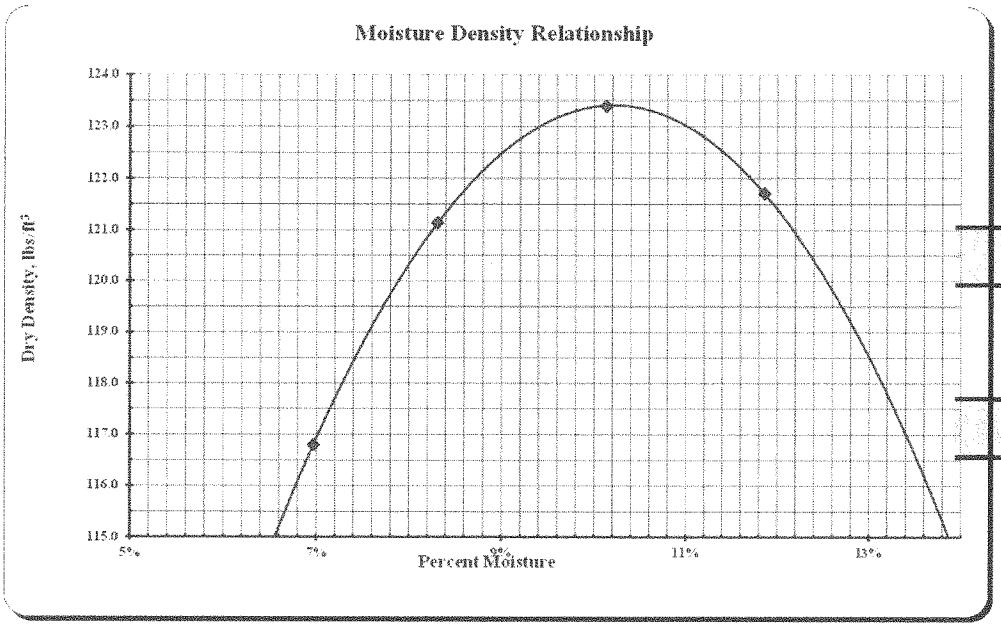
Density		Test Count	4				
	Determination No.	1	2	3	4	5	6
A Volume of Mold	cu. ft.	0.0332	0.0332	0.0332	0.0332	0.0332	0.0332
	lbs.	8.53	8.74	8.89	8.90		
C Weight of Mold	lbs.	4.38	4.38	4.38	4.38	4.38	4.38
D Weight of Compacted Soil = B - C	lbs.	4.15	4.36	4.51	4.52		
E Wet Density = D / A	lbs./cu.ft.	124.9	131.2	135.9	136.1		
F Dry Density = (E x 100) / (100 + L)	lbs./cu.ft.	**116.8**	**121.1**	**123.4**	**121.7**	**#VALUE!**	**#VALUE!**

Moisture Content

AASHTO T99 or T180 Tested by:

Container No.		37	38	39	40		
G Wet Weight / Container	grams	144.7	145.1	144.0	148.4		
H Dry Weight / Container	grams	137.7	136.8	134.2	136.6		
I Moisture Loss = G - H	grams	7.0	8.3	9.8	11.8		
J Tare Weight of Container	grams	37.3	36.9	37.5	37.1		
K Dry Soil = H - J	grams	100.4	99.9	96.7	99.5		
L %Moisture = (I / K) x 100	%	**7.0%**	**8.3%**	**10.1%**	**11.9%**		

ASTM D4643 AASHTO T217 or T265 Tested by: tv



Max Dry Density

123.4 lbs./cu.ft.

Optimum Moisture

10.2%

MOISTURE-DENSITY RELATIONS OF SOILS

North Dakota Department Of Transportation, Materials & Research Division

SFN 10063 (Rev. 03-2006)

Project No.	PCN	Station	Depth Below Grade
SIM-8-029(151)000			
Offset From Centerline		Type of Soil	
AASTHO Designation	Date		
T-180	**12/21/2015**		**732**

Density

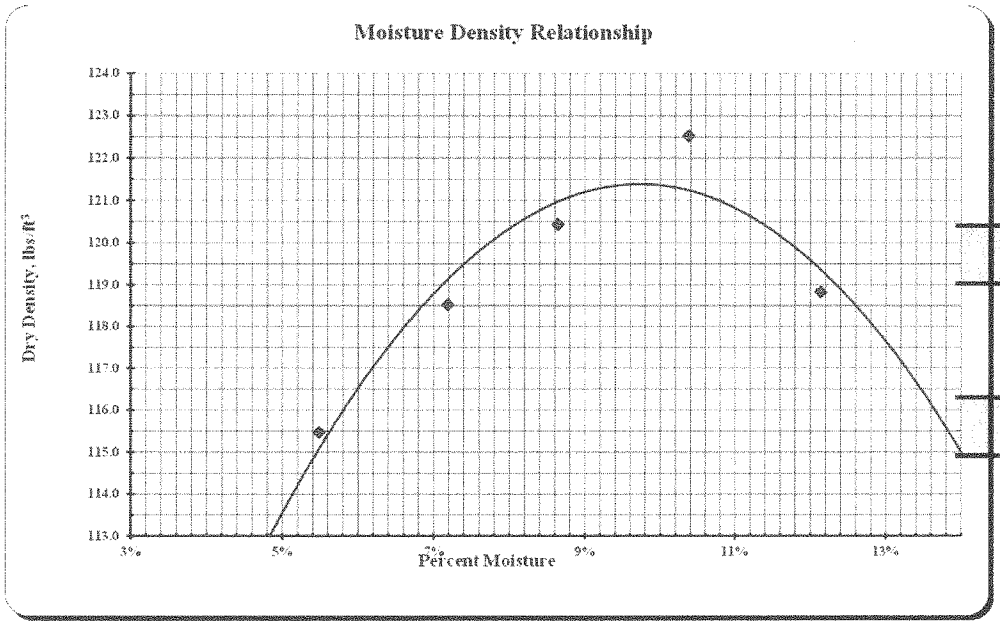
		Test Count	5				
	Determination No.	1	2	3	4	5	6
A	Volume of Mold cu. ft.	0.0332	0.0332	0.0332	0.0332	0.0332	0.0332
	lbs.	8.43	8.60	8.73	8.87	8.81	
C	Weight of Mold lbs.	4.38	4.38	4.38	4.38	4.38	4.38
D	Weight of Compacted Soil = B - C lbs.	4.04	4.22	4.34	4.49	4.42	
E	Wet Density = D / A lbs./cu.ft.	121.8	127.0	130.8	135.2	133.3	
F	Dry Density = (E x 100) / (100 + L) lbs./cu.ft.	**115.5**	**118.5**	**120.4**	**122.5**	**118.8**	**#VALUE!**

Moisture Content

AASHTO T99 or T180 Tested by:

	Container No.	41	42	43	44	45	
G	Wet Weight / Container grams	150.7	136.6	143.9	143.4	156.8	
H	Dry Weight / Container grams	144.8	129.9	135.4	133.4	143.9	
I	Moisture Loss = G - H grams	5.9	6.7	8.5	10.0	12.9	
J	Tare Weight of Container grams	37.2	36.7	37.0	37.0	37.6	
K	Dry Soil = H - J grams	107.6	93.2	98.4	96.4	106.3	
L	%Moisture = (I / K) x 100 %	**5.5%**	**7.2%**	**8.6%**	**10.4%**	**12.1%**	

ASTM D4643 AASHTO T217 or T265 Tested by: tv



Max Dry Density

121.4 lbs./cu.ft.

Optimum Moisture

9.7%

MOISTURE-DENSITY RELATIONS OF SOILS

North Dakota Department Of Transportation, Materials & Research Division

SFN 10063 (Rev. 03-2006)

Project No.	PCN	Station	Depth Below Grade
SIM-8-029(151)000			
Offset From Centerline		Type of Soil	
AASTHO Designation **T-180**	Date **12/21/2015**		**733**

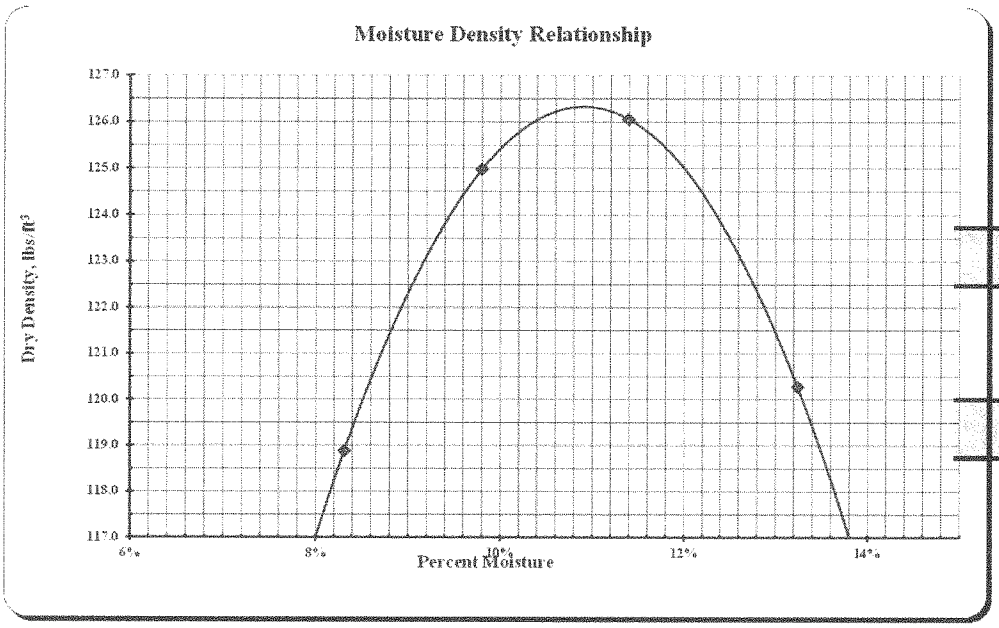
Density		Test Count	4				
	Determination No.	1	2	3	4	5	6
A Volume of Mold	cu. ft.	0.0332	0.0332	0.0332	0.0332	0.0332	0.0332
	lbs.	8.67	8.95	9.05	8.91		
C Weight of Mold	lbs.	4.39	4.39	4.39	4.39	4.39	4.39
D Weight of Compacted Soil = B - C	lbs.	4.28	4.56	4.66	4.52		
E Wet Density = D / A	lbs./cu.ft.	128.8	137.2	140.4	136.2		
F Dry Density = (E x 100) / (100 + L)	lbs./cu.ft.	**118.9**	**125.0**	**126.1**	**120.3**	**#VALUE!**	**#VALUE!**

Moisture Content

AASHTO T99 or T180 Tested by:

Container No.		46	47	48	49		
G Wet Weight / Container	grams	162.2	156.9	160.3	150.2		
H Dry Weight / Container	grams	152.6	146.2	147.7	137.0		
I Moisture Loss = G - H	grams	9.6	10.7	12.6	13.2		
J Tare Weight of Container	grams	37.1	37.0	37.1	37.3		
K Dry Soil = H - J	grams	115.5	109.2	110.6	99.7		
L %Moisture = (I / K) x 100	%	**8.3%**	**9.8%**	**11.4%**	**13.2%**		

ASTM D4643 AASHTO T217 or T265 Tested by: tv



Max Dry Density

126.3 lbs./cu.ft.

Optimum Moisture

10.9%

MOISTURE-DENSITY RELATIONS OF SOILS

North Dakota Department Of Transportation, Materials & Research Division

SFN 10063 (Rev. 03-2006)

Project No.	PCN	Station	Depth Below Grade
SIM-8-029(151)000			
Offset From Centerline		Type of Soil	
AASTHO Designation **T-180**	Date **12/22/2015**		**736**

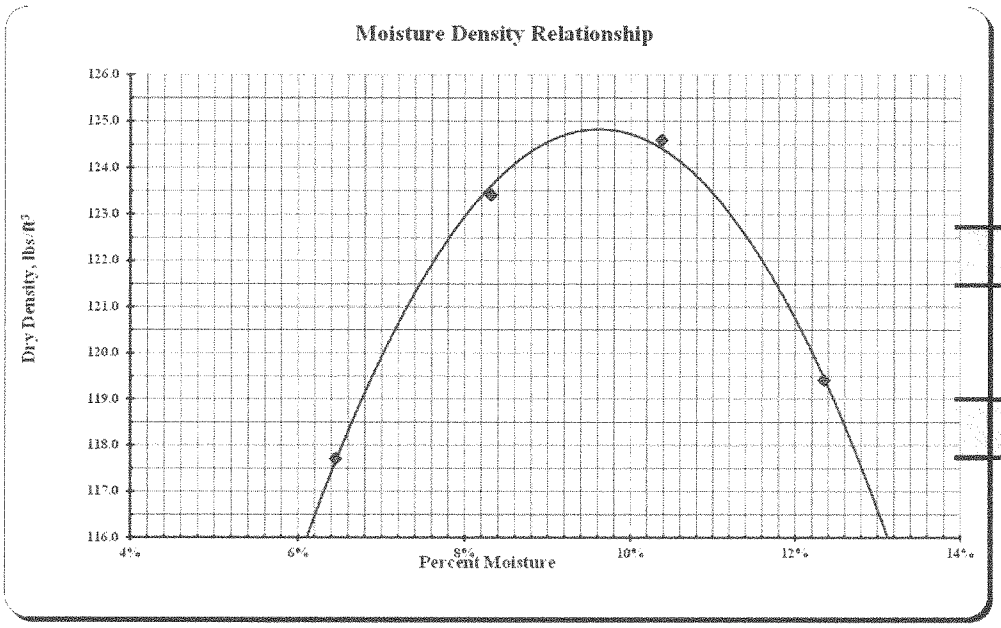
Density		Test Count	4				
	Determination No.	1	2	3	4	5	6
A Volume of Mold	cu. ft.	0.0332	0.0332	0.0332	0.0332	0.0332	0.0332
	lbs.	8.54	8.82	8.95	8.84		
C Weight of Mold	lbs.	4.38	4.38	4.38	4.38	4.38	4.38
D Weight of Compacted Soil = B - C	lbs.	4.16	4.44	4.57	4.45		
E Wet Density = D / A	lbs./cu.ft.	125.3	133.7	137.5	134.2		
F Dry Density = (E x 100) / (100 + L)	lbs./cu.ft.	**117.7**	**123.4**	**124.6**	**119.4**	**#VALUE!**	**#VALUE!**

Moisture Content

AASHTO T99 or T180 Tested by:

Container No.		50	51	52	53		
G Wet Weight / Container	grams	154.2	157.1	145.8	147.2		
H Dry Weight / Container	grams	147.1	147.9	135.6	135.1		
I Moisture Loss = G - H	grams	7.1	9.2	10.2	12.1		
J Tare Weight of Container	grams	37.0	37.2	37.3	37.1		
K Dry Soil = H - J	grams	110.1	110.7	98.3	98.0		
L %Moisture = (I / K) x 100	%	**6.4%**	**8.3%**	**10.4%**	**12.3%**		

ASTM D4643 AASHTO T217 or T265 Tested by: tv



Max Dry Density

124.8 lbs./cu.ft.

Optimum Moisture

9.6%

MOISTURE-DENSITY RELATIONS OF SOILS

North Dakota Department Of Transportation, Materials & Research Division

SFN 10063 (Rev. 03-2006)

Project No.	PCN	Station	Depth Below Grade
SIM-8-029(151)000			
Offset From Centerline		Type of Soil	
AASTHO Designation	Date		
T-180	**12/21/2015**		**738**

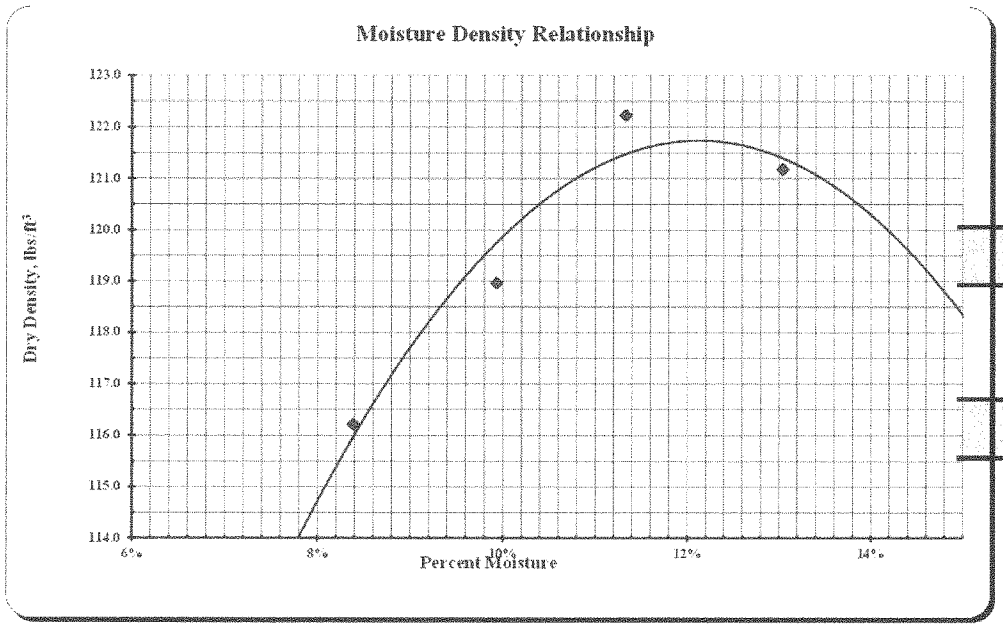
Density	Test Count	4				
Determination No.	1	2	3	4	5	6
A Volume of Mold cu. ft.	0.0332	0.0332	0.0332	0.0332	0.0332	0.0332
lbs.	8.57	8.72	8.90	8.93		
C Weight of Mold lbs.	4.38	4.38	4.38	4.38	4.38	4.38
D Weight of Compacted Soil = B - C lbs.	4.18	4.34	4.52	4.55		
E Wet Density = D / A lbs./cu.ft.	126.0	130.8	136.1	137.0		
F Dry Density = (E x 100) / (100 + L) lbs./cu.ft.	**116.2**	**119.0**	**122.2**	**121.2**	**#VALUE!**	**#VALUE!**

Moisture Content

AASHTO T99 or T180 Tested by:

Container No.	54	55	56	57		
G Wet Weight / Container grams	157.2	150.6	166.0	157.8		
H Dry Weight / Container grams	147.9	140.3	152.9	143.9		
I Moisture Loss = G - H grams	9.3	10.3	13.1	13.9		
J Tare Weight of Container grams	37.0	36.6	37.3	37.3		
K Dry Soil = H - J grams	110.9	103.7	115.6	106.6		
L %Moisture = (I / K) x 100 %	**8.4%**	**9.9%**	**11.3%**	**13.0%**		

ASTM D4643 AASHTO T217 or T265 Tested by: tv



Max Dry Density

121.7 lbs./cu.ft.

Optimum Moisture

12.1%

MOISTURE-DENSITY RELATIONS OF SOILS

North Dakota Department Of Transportation, Materials & Research Division

SFN 10063 (Rev. 03-2006)

Project No.	PCN	Station	Depth Below Grade
SIM-8-029(151)000			
Offset From Centerline		Type of Soil	
AASTHO Designation **T-180**	Date **12/21/2015**		**739**

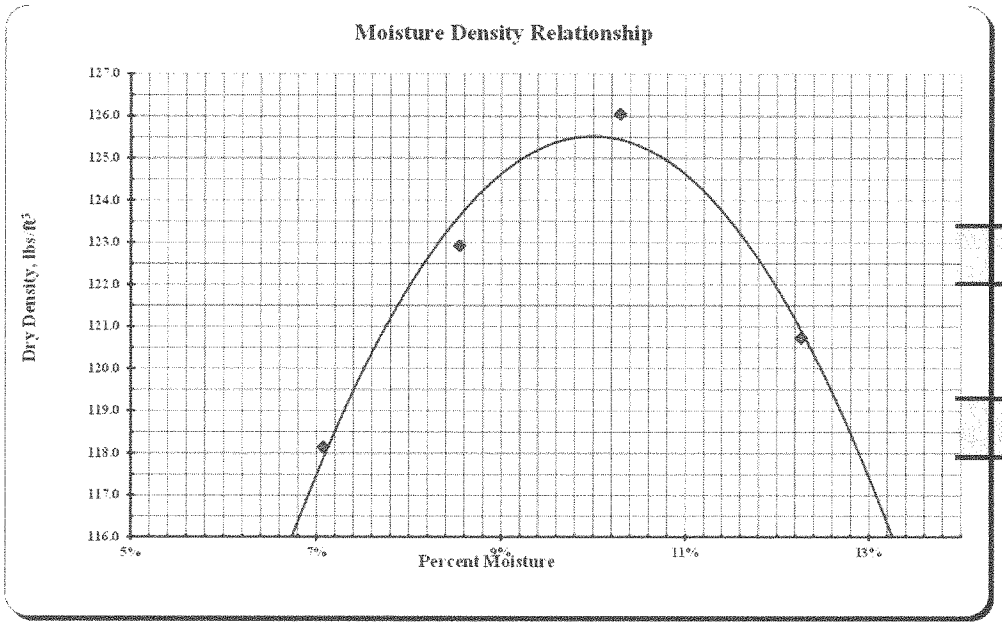
Density		Test Count	4				
	Determination No.	1	2	3	4	5	6
A Volume of Mold	cu. ft.	0.0332	0.0332	0.0332	0.0332	0.0332	0.0332
	lbs.	8.58	8.81	9.00	8.88		
C Weight of Mold	lbs.	4.38	4.38	4.38	4.38	4.38	4.38
D Weight of Compacted Soil = B - C	lbs.	4.20	4.43	4.62	4.50		
E Wet Density = D / A	lbs./cu.ft.	126.5	133.4	139.0	135.5		
F Dry Density = (E x 100) / (100 + L)	lbs./cu.ft.	**118.1**	**122.9**	**126.1**	**120.7**	**#VALUE!**	**#VALUE!**

Moisture Content

AASHTO T99 or T180 Tested by:

Container No.		58	59	60	61		
G Wet Weight / Container	grams	160.9	160.4	153.1	150.8		
H Dry Weight / Container	grams	152.7	150.7	142.3	138.4		
I Moisture Loss = G - H	grams	8.2	9.7	10.8	12.4		
J Tare Weight of Container	grams	36.8	37.2	37.4	37.3		
K Dry Soil = H - J	grams	115.9	113.5	104.9	101.1		
L %Moisture = (I / K) x 100	%	**7.1%**	**8.5%**	**10.3%**	**12.3%**		

ASTM D4643 AASHTO T217 or T265 Tested by: tv



Max Dry Density

125.5 lbs./cu.ft.

Optimum Moisture

10.0%

MOISTURE-DENSITY RELATIONS OF SOILS

North Dakota Department Of Transportation, Materials & Research Division

SFN 10063 (Rev. 03-2006)

Project No.	PCN	Station	Depth Below Grade
SIM-8-029(151)000			
Offset From Centerline		Type of Soil	
AASTHO Designation	Date		
T-180	**12/21/2015**		**745**

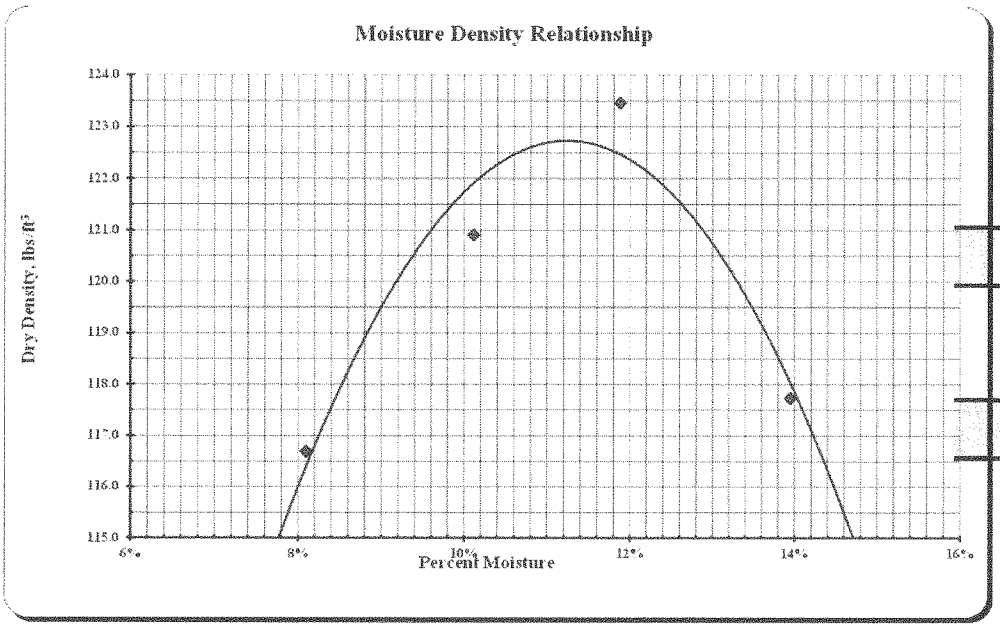
Density		Test Count	4				
Determination No.		1	2	3	4	5	6
A Volume of Mold	cu. ft.	0.0332	0.0332	0.0332	0.0332	0.0332	0.0332
	lbs.	8.57	8.80	8.97	8.84		
C Weight of Mold	lbs.	4.38	4.38	4.38	4.38	4.38	4.38
D Weight of Compacted Soil = B - C	lbs.	4.19	4.42	4.59	4.45		
E Wet Density = D / A	lbs./cu.ft.	126.1	133.1	138.1	134.2		
F Dry Density = (E x 100) / (100 + L)	lbs./cu.ft.	**116.7**	**120.9**	**123.5**	**117.7**	**#VALUE!**	**#VALUE!**

Moisture Content

AASHTO T99 or T180 Tested by:

Container No.		62	63	64	65		
G Wet Weight / Container	grams	167.1	154.9	168.2	158.7		
H Dry Weight / Container	grams	157.4	144.1	154.3	143.9		
I Moisture Loss = G - H	grams	9.7	10.8	13.9	14.8		
J Tare Weight of Container	grams	37.6	37.3	37.3	37.8		
K Dry Soil = H - J	grams	119.8	106.8	117.0	106.1		
L %Moisture = (I / K) x 100	%	**8.1%**	**10.1%**	**11.9%**	**13.9%**		

ASTM D4643 AASHTO T217 or T265 Tested by: tv



Max Dry Density

122.7 lbs./cu.ft.

Optimum Moisture

11.2%

MOISTURE-DENSITY RELATIONS OF SOILS

North Dakota Department Of Transportation, Materials & Research Division

SFN 10063 (Rev. 03-2006)

Project No.	PCN	Station	Depth Below Grade
SIM-8-029(151)000			
Offset From Centerline		Type of Soil	
AASTHO Designation	Date		
T-180	**12/21/2015**		**748**

Density

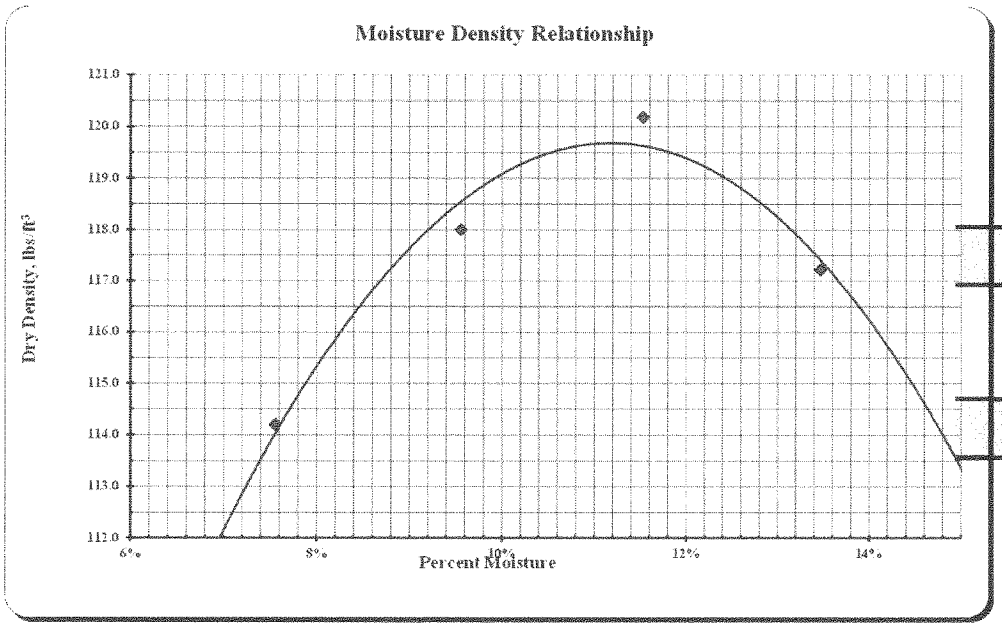
		Test Count	4				
	Determination No.		1	2	3	4	5	6
A	Volume of Mold	cu. ft.	0.0332	0.0332	0.0332	0.0332	0.0332	0.0332
		lbs.	8.46	8.67	8.83	8.80		
C	Weight of Mold	lbs.	4.38	4.38	4.38	4.38	4.38	4.38
D	Weight of Compacted Soil = B - C	lbs.	4.08	4.29	4.45	4.42		
E	Wet Density = D / A	lbs./cu.ft.	122.8	129.3	134.0	133.0		
F	Dry Density = (E x 100) / (100 + L)	lbs./cu.ft.	**114.2**	**118.0**	**120.2**	**117.2**	**#VALUE!**	**#VALUE!**

Moisture Content

AASHTO T99 or T180 Tested by:

	Container No.		66	67	68	69		
G	Wet Weight / Container	grams	147.3	140.4	147.3	148.9		
H	Dry Weight / Container	grams	139.6	131.4	135.9	135.7		
I	Moisture Loss = G - H	grams	7.7	9.0	11.4	13.2		
J	Tare Weight of Container	grams	37.7	37.2	37.0	37.7		
K	Dry Soil = H - J	grams	101.9	94.2	98.9	98.0		
L	%Moisture = (I / K) x 100	%	**7.6%**	**9.6%**	**11.5%**	**13.5%**		

ASTM D4643 AASHTO T217 or T265 Tested by: tv



Max Dry Density

119.7 lbs./cu.ft.

Optimum Moisture

11.2%

MOISTURE-DENSITY RELATIONS OF SOILS

North Dakota Department Of Transportation, Materials & Research Division

SFN 10063 (Rev. 03-2006)

Project No.	PCN	Station	Depth Below Grade
SIM-8-029(151)000			
Offset From Centerline		Type of Soil	
AASTHO Designation	Date		
T-180	**12/21/2015**		**752**

Density

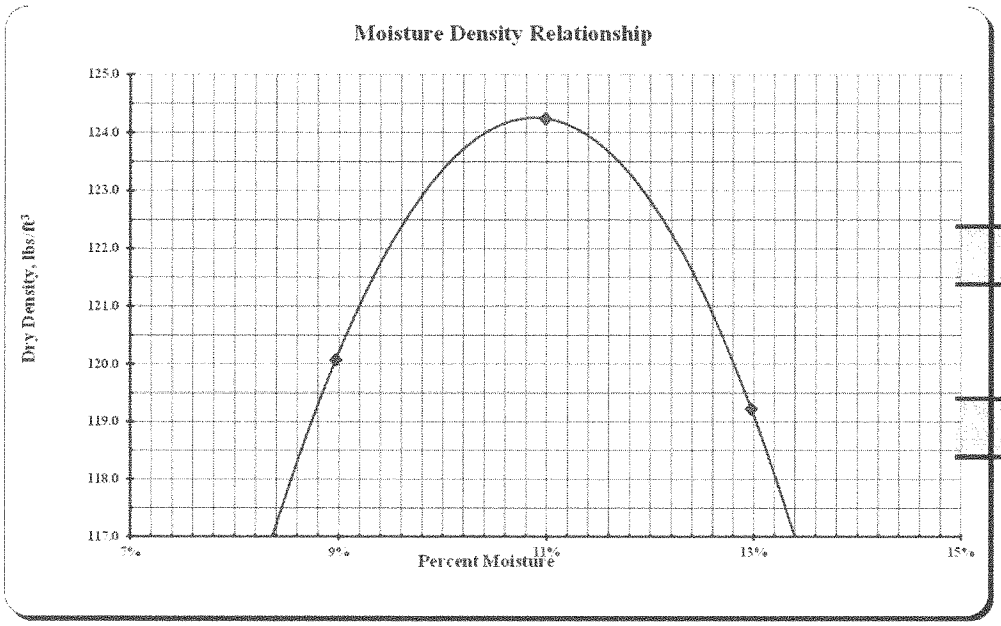
			Test Count	3				
	Determination No.		1	2	3	4	5	6
A	Volume of Mold	cu. ft.	0.0332	0.0332	0.0332	0.0332	0.0332	0.0332
		lbs.	8.73	8.96	8.86			
C	Weight of Mold	lbs.	4.38	4.38	4.38	4.38	4.38	4.38
D	Weight of Compacted Soil = B - C	lbs.	4.34	4.58	4.47			
E	Wet Density = D / A	lbs./cu.ft.	130.8	137.9	134.7			
F	Dry Density = (E x 100) / (100 + L)	lbs./cu.ft.	**120.1**	**124.2**	**119.2**	**#VALUE!**	**#VALUE!**	**#VALUE!**

Moisture Content

AASHTO T99 or T180 Tested by:

	Container No.		70	71	72			
G	Wet Weight / Container	grams	143.3	153.4	167.3			
H	Dry Weight / Container	grams	134.6	141.9	152.3			
I	Moisture Loss = G - H	grams	8.7	11.5	15.0			
J	Tare Weight of Container	grams	37.6	37.2	36.7			
K	Dry Soil = H - J	grams	97.0	104.7	115.6			
L	%Moisture = (I / K) x 100	%	**9.0%**	**11.0%**	**13.0%**			

ASTM D4643 AASHTO T217 or T265 Tested by: tv



Max Dry Density

124.3 lbs./cu.ft.

Optimum Moisture

10.9%

MOISTURE-DENSITY RELATIONS OF SOILS

North Dakota Department Of Transportation, Materials & Research Division

SFN 10063 (Rev. 03-2006)

Project No.	PCN	Station	Depth Below Grade
SIM-8-029(151)000			
Offset From Centerline		Type of Soil	
AASTHO Designation	Date		
T-180	**12/21/2015**		**753**

Density

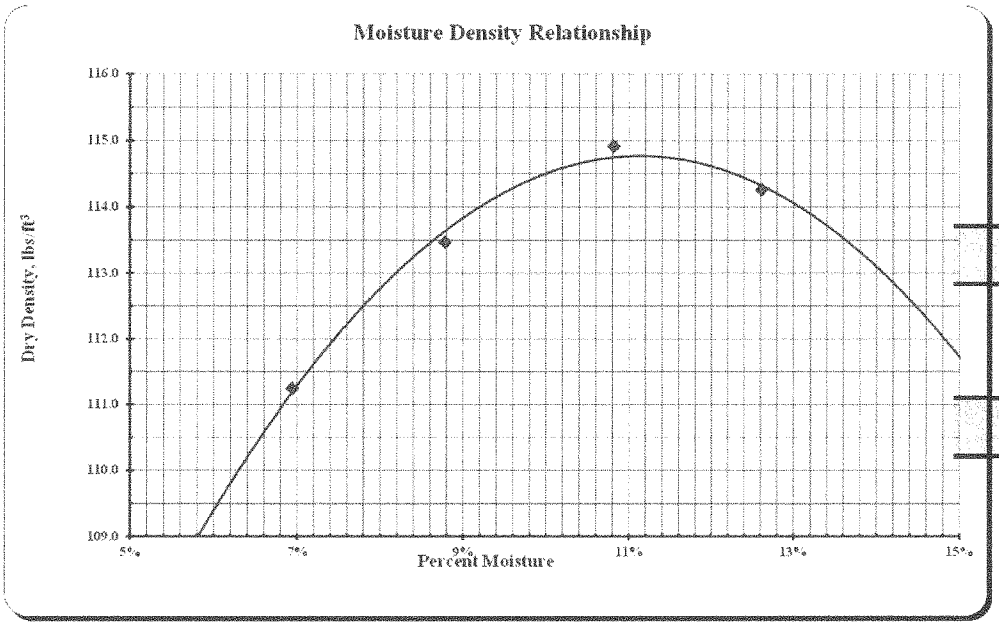
			Test Count	4				
	Determination No.		1	2	3	4	5	6
A	Volume of Mold	cu. ft.	0.0332	0.0332	0.0332	0.0332	0.0332	0.0332
		lbs.	8.33	8.48	8.61	8.66		
C	Weight of Mold	lbs.	4.38	4.38	4.38	4.38	4.38	4.38
D	Weight of Compacted Soil = B - C	lbs.	3.95	4.10	4.23	4.27		
E	Wet Density = D / A	lbs./cu.ft.	119.0	123.4	127.3	128.7		
F	Dry Density = (E x 100) / (100 + L)	lbs./cu.ft.	**111.3**	**113.5**	**114.9**	**114.3**	**#VALUE!**	**#VALUE!**

Moisture Content

AASHTO T99 or T180 Tested by:

	Container No.		73	74	75	76		
G	Wet Weight / Container	grams	137.5	139.0	137.7	164.8		
H	Dry Weight / Container	grams	131.0	130.8	127.9	150.6		
I	Moisture Loss = G - H	grams	6.5	8.2	9.8	14.2		
J	Tare Weight of Container	grams	37.4	37.4	37.3	38.0		
K	Dry Soil = H - J	grams	93.6	93.4	90.6	112.6		
L	%Moisture = (I / K) x 100	%	**6.9%**	**8.8%**	**10.8%**	**12.6%**		

ASTM D4643 AASHTO T217 or T265 Tested by: tv



Max Dry Density

114.8 lbs./cu.ft.

Optimum Moisture

11.1%

MOISTURE-DENSITY RELATIONS OF SOILS

North Dakota Department Of Transportation, Materials & Research Division

SFN 10063 (Rev. 03-2006)

Project No.	PCN	Station	Depth Below Grade
SIM-8-029(151)000			
Offset From Centerline		Type of Soil	
AASTHO Designation	Date		
T-180	**12/21/2015**		**754**

Density

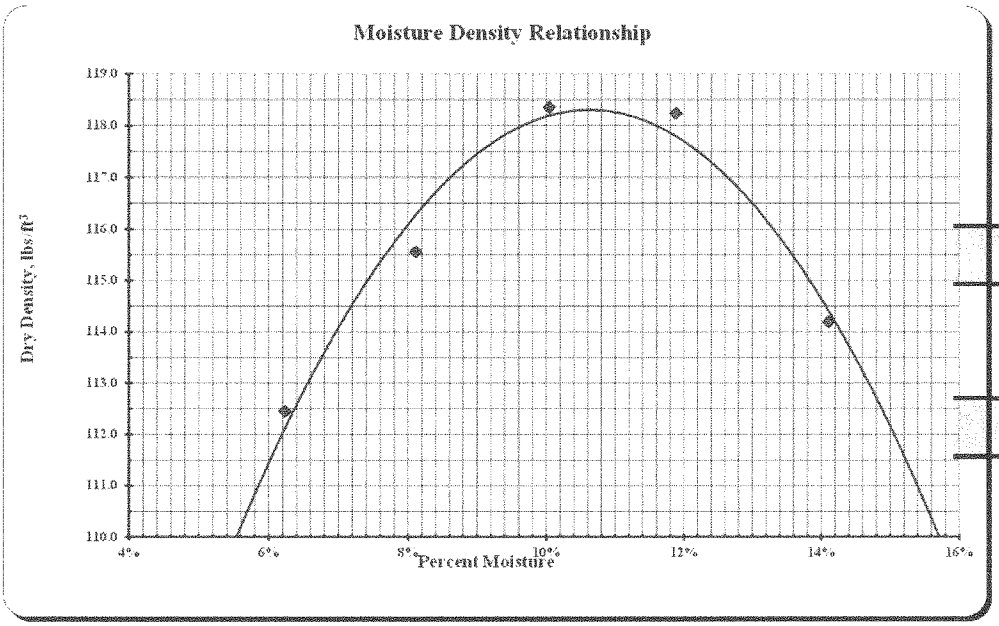
			Test Count	5				
	Determination No.		1	2	3	4	5	6
A	Volume of Mold	cu. ft.	0.0332	0.0332	0.0332	0.0332	0.0332	0.0332
		lbs.	8.35	8.53	8.71	8.78	8.71	
C	Weight of Mold	lbs.	4.38	4.38	4.38	4.38	4.38	4.38
D	Weight of Compacted Soil = B - C	lbs.	3.97	4.15	4.32	4.39	4.33	
E	Wet Density = D / A	lbs./cu.ft.	119.5	124.9	130.2	132.3	130.3	
F	Dry Density = (E x 100) / (100 + L)	lbs./cu.ft.	**112.4**	**115.6**	**118.4**	**118.2**	**114.2**	**#VALUE!**

Moisture Content

AASHTO T99 or T180 Tested by:

	Container No.		77	78	79	80	81	
G	Wet Weight / Container	grams	154.4	143.8	141.2	150.1	163.2	
H	Dry Weight / Container	grams	147.5	135.8	131.7	138.1	147.7	
I	Moisture Loss = G - H	grams	6.9	8.0	9.5	12.0	15.5	
J	Tare Weight of Container	grams	36.8	37.2	37.1	37.1	37.8	
K	Dry Soil = H - J	grams	110.7	98.6	94.6	101.0	109.9	
L	%Moisture = (I / K) x 100	%	**6.2%**	**8.1%**	**10.0%**	**11.9%**	**14.1%**	

ASTM D4643 AASHTO T217 or T265 Tested by: tv



Max Dry Density

118.3 lbs./cu.ft.

Optimum Moisture

10.6%

MOISTURE-DENSITY RELATIONS OF SOILS

North Dakota Department Of Transportation, Materials & Research Division

SFN 10063 (Rev. 03-2006)

Project No.	PCN	Station	Depth Below Grade
SIM-8-029(151)000			
Offset From Centerline		Type of Soil	
AASTHO Designation	Date		
T-180	**12/21/2015**		**759**

Density

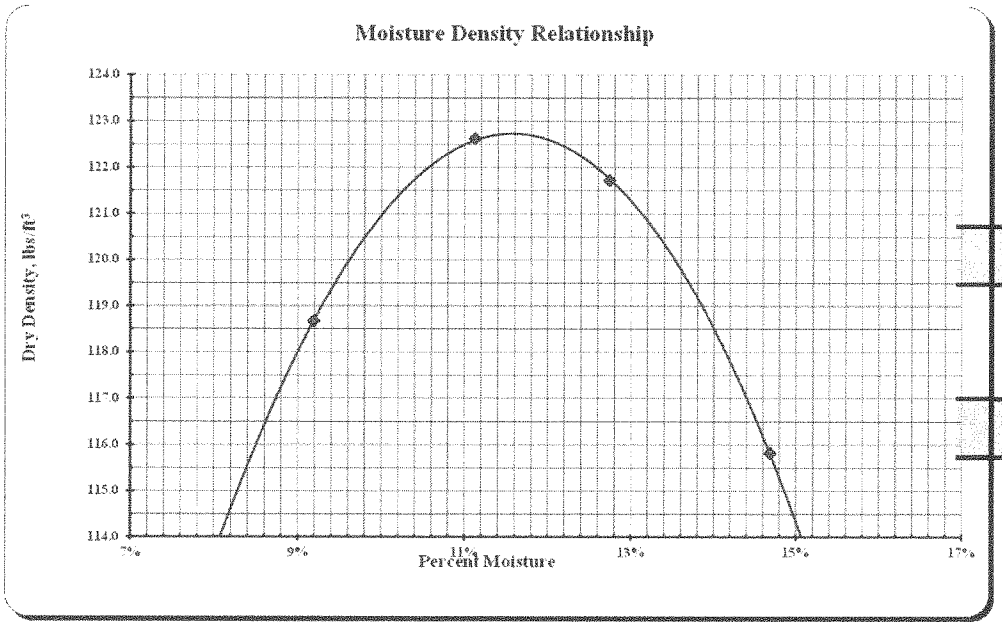
		Test Count	4				
	Determination No.	1	2	3	4	5	6
A Volume of Mold	cu. ft.	0.0332	0.0332	0.0332	0.0332	0.0332	0.0332
	lbs.	8.69	8.90	8.94	8.79		
C Weight of Mold	lbs.	4.38	4.38	4.38	4.38	4.38	4.38
D Weight of Compacted Soil = B - C	lbs.	4.30	4.52	4.56	4.41		
E Wet Density = D / A	lbs./cu.ft.	129.6	136.3	137.2	132.8		
F Dry Density = (E x 100) / (100 + L)	lbs./cu.ft.	**118.7**	**122.6**	**121.7**	**115.8**	**#VALUE!**	**#VALUE!**

Moisture Content

AASHTO T99 or T180 Tested by:

Container No.		82	85	83	84		
G Wet Weight / Container	grams	156.2	151.7	148.7	151.7		
H Dry Weight / Container	grams	146.2	140.3	136.1	137.0		
I Moisture Loss = G - H	grams	10.0	11.4	12.6	14.7		
J Tare Weight of Container	grams	37.4	37.8	37.2	36.9		
K Dry Soil = H - J	grams	108.8	102.5	98.9	100.1		
L %Moisture = (I / K) x 100	%	**9.2%**	**11.1%**	**12.7%**	**14.7%**		

ASTM D4643 AASHTO T217 or T265 Tested by: tv



Max Dry Density

122.7 lbs./cu.ft.

Optimum Moisture

11.6%

MOISTURE-DENSITY RELATIONS OF SOILS

North Dakota Department Of Transportation, Materials & Research Division

SFN 10063 (Rev. 03-2006)

Project No.	PCN	Station	Depth Below Grade
SIM-8-029(151)000			
Offset From Centerline		Type of Soil	
AASTHO Designation **T-180**	Date **12/21/2015**		**762**

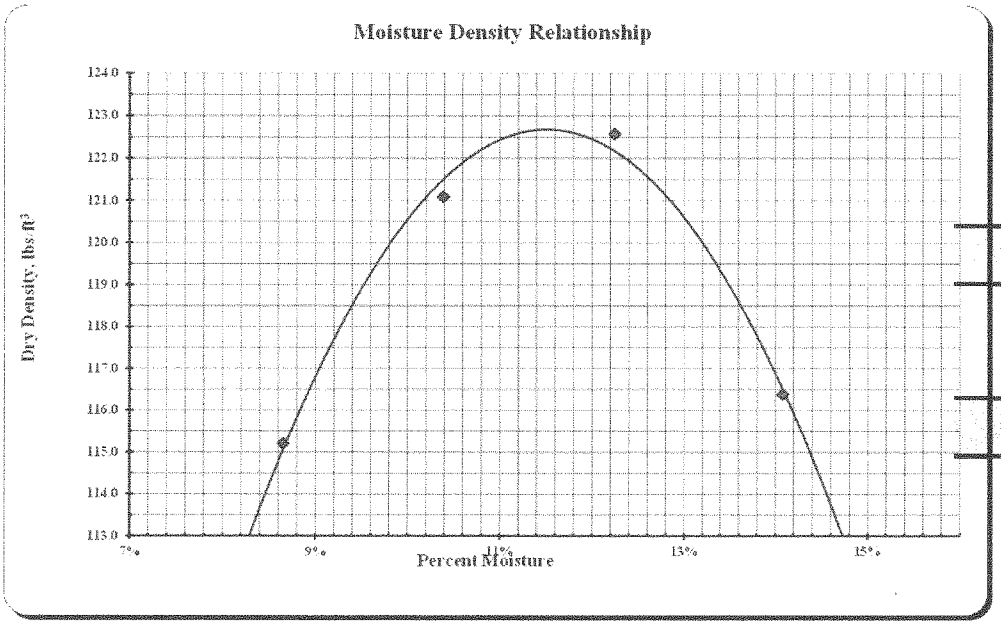
Density		Test Count	4				
	Determination No.	1	2	3	4	5	6
A Volume of Mold	cu. ft.	0.0332	0.0332	0.0332	0.0332	0.0332	0.0332
	lbs.	8.54	8.82	8.95	8.79		
C Weight of Mold	lbs.	4.38	4.38	4.38	4.38	4.38	4.38
D Weight of Compacted Soil = B - C	lbs.	4.16	4.44	4.57	4.41		
E Wet Density = D / A	lbs./cu.ft.	125.2	133.7	137.6	132.8		
F Dry Density = (E x 100) / (100 + L)	lbs./cu.ft.	**115.2**	**121.1**	**122.6**	**116.4**	**#VALUE!**	**#VALUE!**

Moisture Content

AASHTO T99 or T180 Tested by:

Container No.		1	2	3	4		
G Wet Weight / Container	grams	160.9	147.8	152.6	146.9		
H Dry Weight / Container	grams	151.0	137.4	140.0	133.3		
I Moisture Loss = G - H	grams	9.9	10.4	12.6	13.6		
J Tare Weight of Container	grams	36.6	37.3	37.1	36.7		
K Dry Soil = H - J	grams	114.4	100.1	102.9	96.6		
L %Moisture = (I / K) x 100	%	**8.7%**	**10.4%**	**12.2%**	**14.1%**		

ASTM D4643 AASHTO T217 or T265 Tested by: tv



Max Dry Density

122.7 lbs./cu.ft.

Optimum Moisture

11.6%

MOISTURE-DENSITY RELATIONS OF SOILS

North Dakota Department Of Transportation, Materials & Research Division

SFN 10063 (Rev. 03-2006)

Project No.	PCN	Station	Depth Below Grade
SIM-8-029(151)000			
Offset From Centerline		Type of Soil	
AASTHO Designation	Date		
T-180	**12/21/2015**		**763**

Density

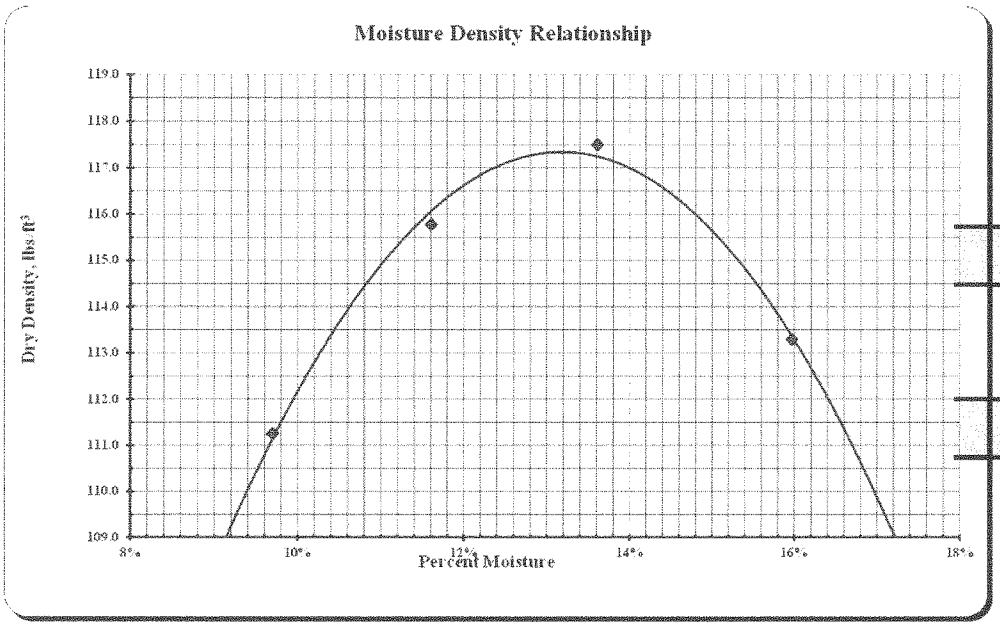
		Test Count	4					
	Determination No.		1	2	3	4	5	6
A	Volume of Mold	cu. ft.	0.0332	0.0332	0.0332	0.0332	0.0332	0.0332
		lbs.	8.44	8.68	8.82	8.75		
C	Weight of Mold	lbs.	4.39	4.39	4.39	4.39	4.39	4.39
D	Weight of Compacted Soil = B - C	lbs.	4.05	4.29	4.43	4.36		
E	Wet Density = D / A	lbs./cu.ft.	122.0	129.2	133.5	131.4		
F	Dry Density = (E x 100) / (100 + L)	lbs./cu.ft.	**111.3**	**115.8**	**117.5**	**113.3**	**#VALUE!**	**#VALUE!**

Moisture Content

AASHTO T99 or T180 Tested by:

	Container No.		85	86	87	88		
G	Wet Weight / Container	grams	152.0	158.8	166.9	154.0		
H	Dry Weight / Container	grams	141.9	146.2	151.4	138.0		
I	Moisture Loss = G - H	grams	10.1	12.6	15.5	16.0		
J	Tare Weight of Container	grams	37.8	37.6	37.5	37.8		
K	Dry Soil = H - J	grams	104.1	108.6	113.9	100.2		
L	%Moisture = (I / K) x 100	%	**9.7%**	**11.6%**	**13.6%**	**16.0%**		

ASTM D4643 AASHTO T217 or T265 Tested by: tv



Max Dry Density

117.3 lbs./cu.ft.

Optimum Moisture

13.2%

MOISTURE-DENSITY RELATIONS OF SOILS

North Dakota Department Of Transportation, Materials & Research Division

SFN 10063 (Rev. 03-2006)

Project No.	PCN	Station	Depth Below Grade
SIM-8-029(151)000			
Offset From Centerline		Type of Soil	
AASTHO Designation	Date		
T-180	**12/21/2015**		**764**

Density

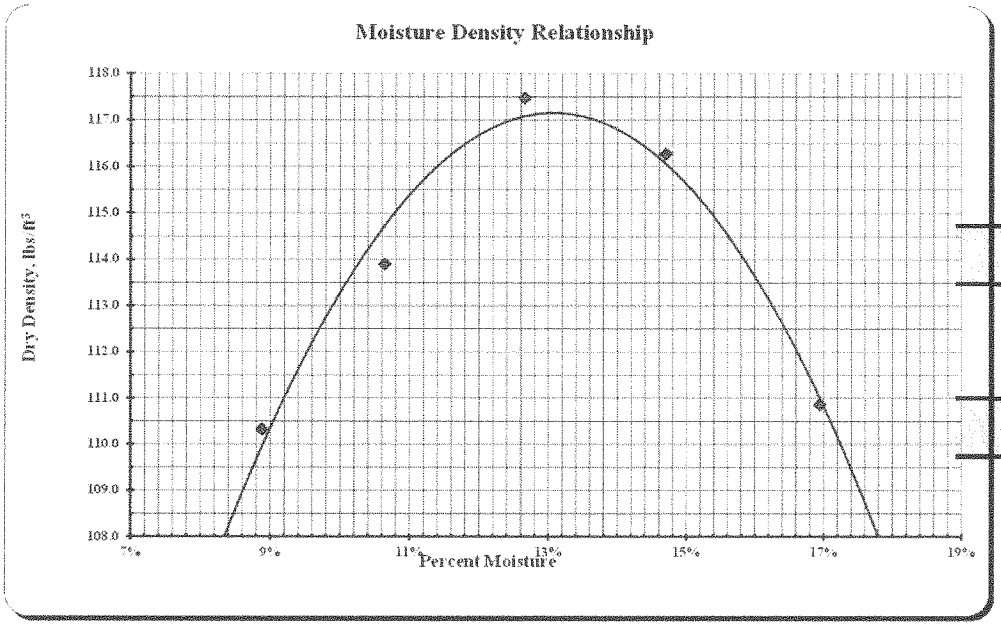
			Test Count	5				
	Determination No.		1	2	3	4	5	6
A	Volume of Mold	cu. ft.	0.0332	0.0332	0.0332	0.0332	0.0332	0.0332
		lbs.	8.38	8.57	8.78	8.82	8.69	
C	Weight of Mold	lbs.	4.39	4.39	4.39	4.39	4.39	4.39
D	Weight of Compacted Soil = B - C	lbs.	3.99	4.18	4.39	4.43	4.30	
E	Wet Density = D / A	lbs./cu.ft.	120.1	126.0	132.3	133.4	129.6	
F	Dry Density = (E x 100) / (100 + L)	lbs./cu.ft.	**110.3**	**113.9**	**117.5**	**116.3**	**110.9**	**#VALUE!**

Moisture Content

AASHTO T99 or T180 Tested by:

	Container No.		89	90	91	92	93	
G	Wet Weight / Container	grams	140.6	160.6	155.1	159.9	150.8	
H	Dry Weight / Container	grams	132.2	148.8	141.9	144.2	134.4	
I	Moisture Loss = G - H	grams	8.4	11.8	13.2	15.7	16.4	
J	Tare Weight of Container	grams	37.6	37.9	37.6	37.4	37.6	
K	Dry Soil = H - J	grams	94.6	110.9	104.3	106.8	96.8	
L	%Moisture = (I / K) x 100	%	**8.9%**	**10.6%**	**12.7%**	**14.7%**	**16.9%**	

ASTM D4643 AASHTO T217 or T265 Tested by: tv



Max Dry Density

117.2 lbs./cu.ft.

Optimum Moisture

13.1%

MOISTURE-DENSITY RELATIONS OF SOILS

North Dakota Department Of Transportation, Materials & Research Division

SFN 10063 (Rev. 03-2006)

Project No.	PCN	Station	Depth Below Grade
SIM-8-029(151)000			
Offset From Centerline		Type of Soil	
AASTHO Designation	Date		
T-180	**12/21/2015**		**768**

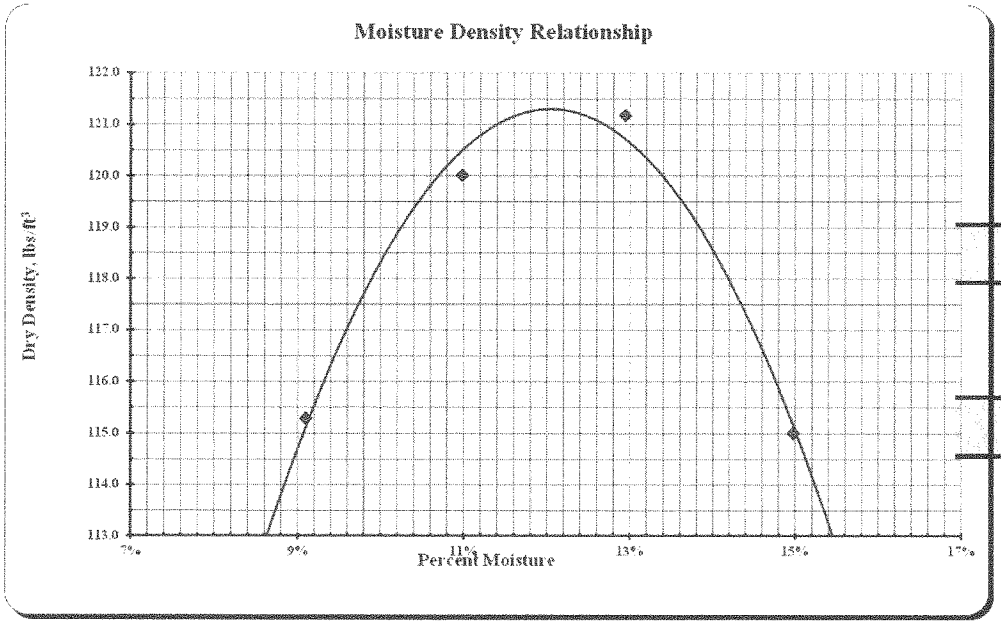
Density		Test Count	4				
	Determination No.	1	2	3	4	5	6
A Volume of Mold	cu. ft.	0.0332	0.0332	0.0332	0.0332	0.0332	0.0332
	lbs.	8.56	8.81	8.93	8.78		
C Weight of Mold	lbs.	4.39	4.39	4.39	4.39	4.39	4.39
D Weight of Compacted Soil = B - C	lbs.	4.18	4.42	4.54	4.39		
E Wet Density = D / A	lbs./cu.ft.	125.8	133.2	136.9	132.2		
F Dry Density = (E x 100) / (100 + L)	lbs./cu.ft.	**115.3**	**120.0**	**121.2**	**115.0**	**#VALUE!**	**#VALUE!**

Moisture Content

AASHTO T99 or T180 Tested by:

Container No.		94	95	96	97		
G Wet Weight / Container	grams	145.6	158.8	155.0	161.3		
H Dry Weight / Container	grams	136.6	146.8	141.5	145.2		
I Moisture Loss = G - H	grams	9.0	12.0	13.5	16.1		
J Tare Weight of Container	grams	37.7	37.5	37.2	37.7		
K Dry Soil = H - J	grams	98.9	109.3	104.3	107.5		
L %Moisture = (I / K) x 100	%	**9.1%**	**11.0%**	**12.9%**	**15.0%**		

ASTM D4643 AASHTO T217 or T265 Tested by: tv



Max Dry Density

121.3 lbs./cu.ft.

Optimum Moisture

12.0%

MOISTURE-DENSITY RELATIONS OF SOILS

North Dakota Department Of Transportation, Materials & Research Division

SFN 10063 (Rev. 03-2006)

Project No.	PCN	Station	Depth Below Grade
SIM-8-029(151)000			
Offset From Centerline		Type of Soil	
AASTHO Designation	Date		
T-180	**12/22/2015**		**769**

Density

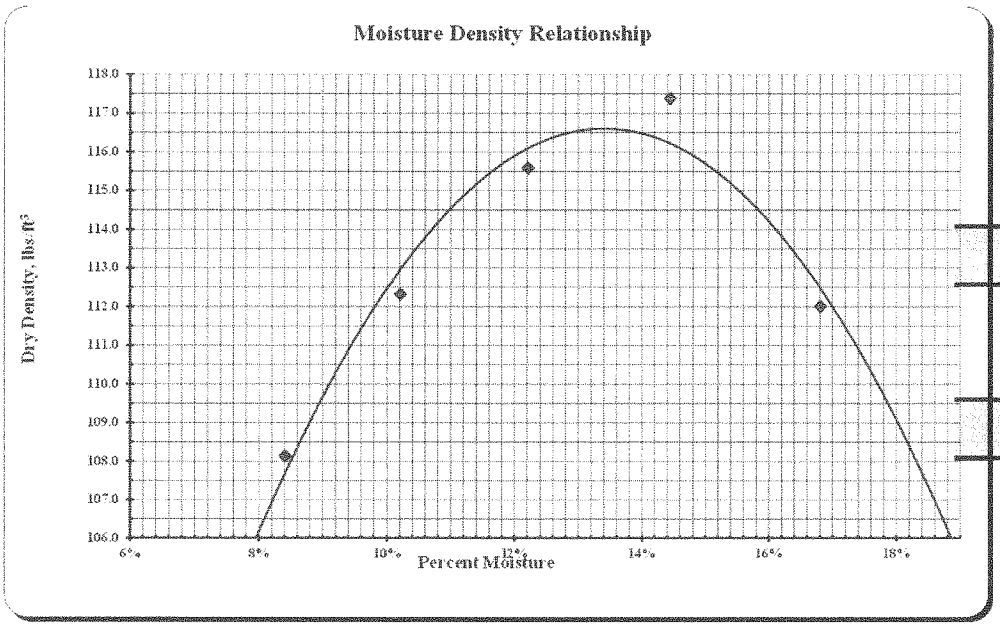
			Test Count	5				
	Determination No.		1	2	3	4	5	6
A	Volume of Mold	cu. ft.	0.0332	0.0332	0.0332	0.0332	0.0332	0.0332
		lbs.	8.28	8.50	8.69	8.85	8.73	
C	Weight of Mold	lbs.	4.39	4.39	4.39	4.39	4.39	4.39
D	Weight of Compacted Soil = B - C	lbs.	3.89	4.11	4.31	4.46	4.34	
E	Wet Density = D / A	lbs./cu.ft.	117.2	123.8	129.7	134.3	130.8	
F	Dry Density = (E x 100) / (100 + L)	lbs./cu.ft.	**108.1**	**112.3**	**115.6**	**117.4**	**112.0**	**#VALUE!**

Moisture Content

AASHTO T99 or T180 Tested by:

	Container No.		98	99	100	101	102	
G	Wet Weight / Container	grams	158.7	153.1	158.5	153.3	159.3	
H	Dry Weight / Container	grams	149.3	142.4	145.3	138.7	141.8	
I	Moisture Loss = G - H	grams	9.4	10.7	13.2	14.6	17.5	
J	Tare Weight of Container	grams	37.5	37.6	37.2	37.6	37.7	
K	Dry Soil = H - J	grams	111.8	104.8	108.1	101.1	104.1	
L	%Moisture = (I / K) x 100	%	**8.4%**	**10.2%**	**12.2%**	**14.4%**	**16.8%**	

ASTM D4643 AASHTO T217 or T265 Tested by: ss



Max Dry Density

116.6 lbs./cu.ft.

Optimum Moisture

13.4%

MOISTURE-DENSITY RELATIONS OF SOILS

North Dakota Department Of Transportation, Materials & Research Division

SFN 10063 (Rev. 03-2006)

Project No.	PCN	Station	Depth Below Grade
SIM-8-029(151)000			
Offset From Centerline		Type of Soil	
AASTHO Designation	Date		
T-180	**12/21/2015**		**770**

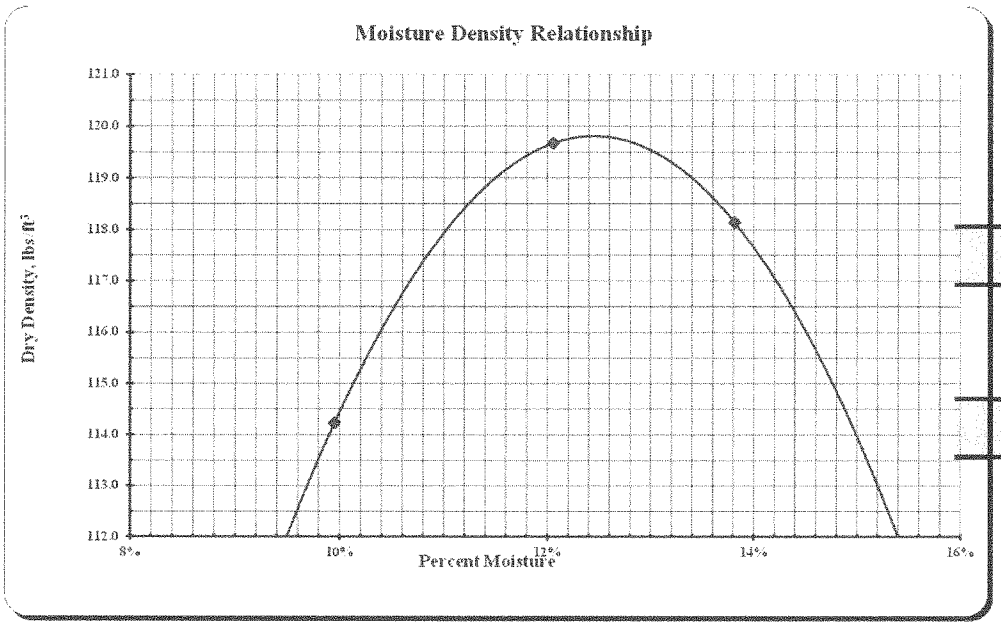
Density		Test Count	3				
	Determination No.	1	2	3	4	5	6
A Volume of Mold	cu. ft.	0.0332	0.0332	0.0332	0.0332	0.0332	0.0332
	lbs.	8.56	8.84	8.85			
C Weight of Mold	lbs.	4.39	4.39	4.39	4.39	4.39	4.39
D Weight of Compacted Soil = B - C	lbs.	4.17	4.45	4.46			
E Wet Density = D / A	lbs./cu.ft.	125.6	134.1	134.5			
F Dry Density = (E x 100) / (100 + L)	lbs./cu.ft.	**114.2**	**119.7**	**118.1**	**#VALUE!**	**#VALUE!**	**#VALUE!**

Moisture Content

AASHTO T99 or T180 Tested by:

Container No.		103	104	105			
G Wet Weight / Container	grams	153.2	156.2	154.5			
H Dry Weight / Container	grams	142.7	143.4	140.3			
I Moisture Loss = G - H	grams	10.5	12.8	14.2			
J Tare Weight of Container	grams	37.2	37.2	37.5			
K Dry Soil = H - J	grams	105.5	106.2	102.8			
L %Moisture = (I / K) x 100	%	**10.0%**	**12.1%**	**13.8%**			

ASTM D4643 AASHTO T217 or T265 Tested by: tv



Max Dry Density

119.8 lbs./cu.ft.

Optimum Moisture

12.5%

MOISTURE-DENSITY RELATIONS OF SOILS

North Dakota Department Of Transportation, Materials & Research Division

SFN 10063 (Rev. 03-2006)

Project No.	PCN	Station	Depth Below Grade
SIM-8-029(151)000			
Offset From Centerline		Type of Soil	
AASTHO Designation	Date		
T-180	**12/21/2015**		**771**

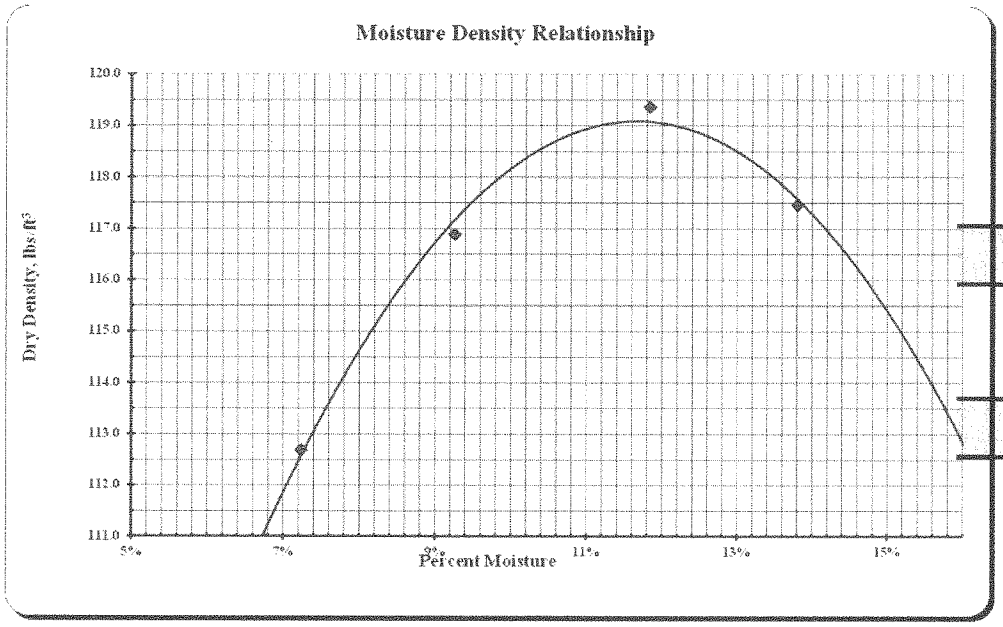
Density		Test Count	4				
Determination No.		1	2	3	4	5	6
A Volume of Mold	cu. ft.	0.0332	0.0332	0.0332	0.0332	0.0332	0.0332
	lbs.	8.40	8.63	8.82	8.83		
C Weight of Mold	lbs.	4.39	4.39	4.39	4.39	4.39	4.39
D Weight of Compacted Soil = B - C	lbs.	4.01	4.24	4.43	4.44		
E Wet Density = D / A	lbs./cu.ft.	120.8	127.7	133.5	133.7		
F Dry Density = (E x 100) / (100 + L)	lbs./cu.ft.	**112.7**	**116.9**	**119.4**	**117.5**	**#VALUE!**	**#VALUE!**

Moisture Content

AASHTO T99 or T180 Tested by:

Container No.		106	107	108	109		
G Wet Weight / Container	grams	159.0	153.9	148.6	172.2		
H Dry Weight / Container	grams	150.8	144.0	136.8	155.9		
I Moisture Loss = G - H	grams	8.2	9.9	11.8	16.3		
J Tare Weight of Container	grams	37.5	37.1	37.1	37.8		
K Dry Soil = H - J	grams	113.3	106.9	99.7	118.1		
L %Moisture = (I / K) x 100	%	**7.2%**	**9.3%**	**11.8%**	**13.8%**		

ASTM D4643 AASHTO T217 or T265 Tested by: tv



Max Dry Density

119.1 lbs./cu.ft.

Optimum Moisture

11.6%

MOISTURE-DENSITY RELATIONS OF SOILS

North Dakota Department Of Transportation, Materials & Research Division

SFN 10063 (Rev. 03-2006)

Project No.	PCN	Station	Depth Below Grade
SIM-8-029(151)000			
Offset From Centerline		Type of Soil	
AASTHO Designation	Date		
T-180	**12/21/2015**		**772**

Density

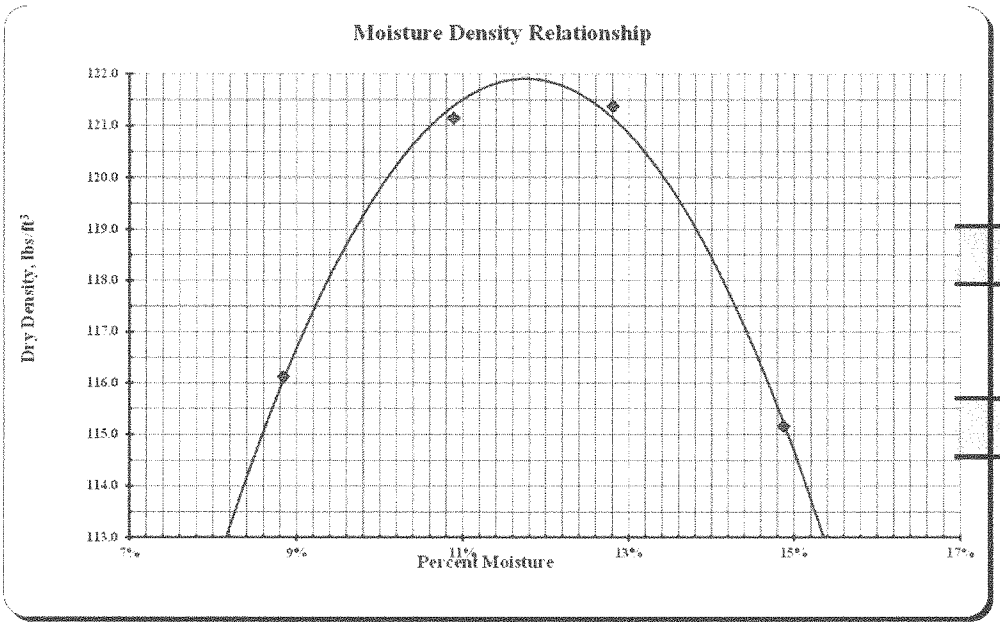
			Test Count	4				
	Determination No.		1	2	3	4	5	6
A	Volume of Mold	cu. ft.	0.0332	0.0332	0.0332	0.0332	0.0332	0.0332
		lbs.	8.58	8.84	8.93	8.78		
C	Weight of Mold	lbs.	4.38	4.38	4.38	4.38	4.38	4.38
D	Weight of Compacted Soil = B - C	lbs.	4.20	4.46	4.55	4.39		
E	Wet Density = D / A	lbs./cu.ft.	126.4	134.3	136.9	132.3		
F	Dry Density = (E x 100) / (100 + L)	lbs./cu.ft.	**116.1**	**121.1**	**121.4**	**115.2**	**#VALUE!**	**#VALUE!**

Moisture Content

AASHTO T99 or T180 Tested by:

	Container No.		14	15	16	17		
G	Wet Weight / Container	grams	159.8	163.6	155.2	157.3		
H	Dry Weight / Container	grams	149.9	151.2	141.8	141.7		
I	Moisture Loss = G - H	grams	9.9	12.4	13.4	15.6		
J	Tare Weight of Container	grams	37.9	37.3	37.2	36.8		
K	Dry Soil = H - J	grams	112.0	113.9	104.6	104.9		
L	%Moisture = (I / K) x 100	%	**8.8%**	**10.9%**	**12.8%**	**14.9%**		

ASTM D4643 AASHTO T217 or T265 Tested by: tv



Max Dry Density

121.9 lbs./cu.ft.

Optimum Moisture

11.7%

MOISTURE-DENSITY RELATIONS OF SOILS

North Dakota Department Of Transportation, Materials & Research Division

SFN 10063 (Rev. 03-2006)

Project No.	PCN	Station	Depth Below Grade
SIM-8-029(151)000			
Offset From Centerline		Type of Soil	
AASTHO Designation	Date		
T-180	**12/21/2015**		**773**

Density

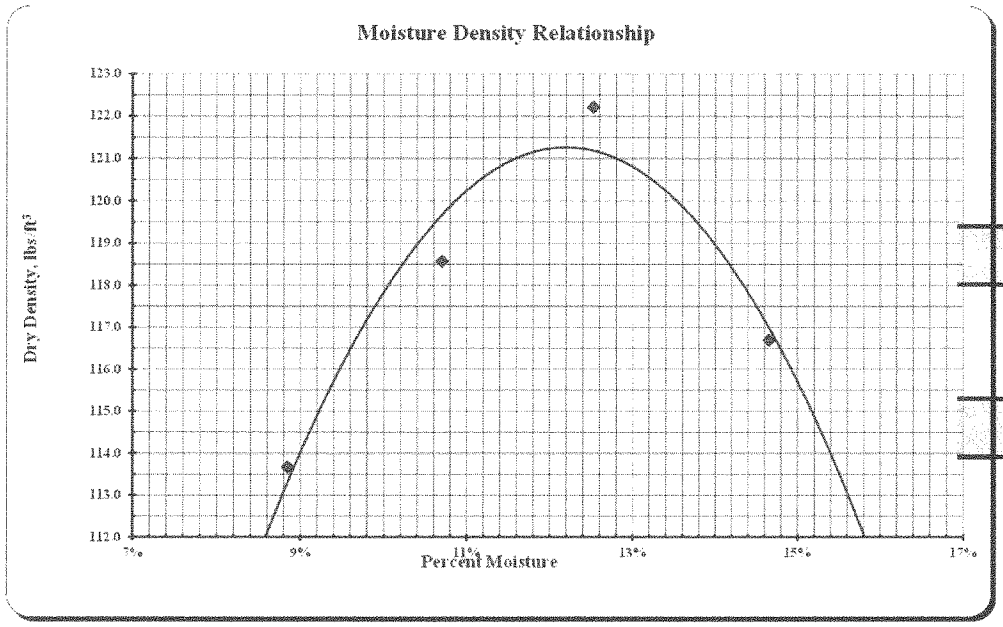
		Test Count	4				
	Determination No.	1	2	3	4	5	6
A	Volume of Mold cu. ft.	0.0332	0.0332	0.0332	0.0332	0.0332	0.0332
	lbs.	8.49	8.74	8.95	8.83		
C	Weight of Mold lbs.	4.38	4.38	4.38	4.38	4.38	4.38
D	Weight of Compacted Soil = B - C lbs.	4.11	4.36	4.57	4.44		
E	Wet Density = D / A lbs./cu.ft.	123.7	131.3	137.5	133.8		
F	Dry Density = (E x 100) / (100 + L) lbs./cu.ft.	**113.7**	**118.6**	**122.2**	**116.7**	**#VALUE!**	**#VALUE!**

Moisture Content

AASHTO T99 or T180 Tested by:

	Container No.	18	19	20	21		
G	Wet Weight / Container grams	158.9	147.8	148.8	157.6		
H	Dry Weight / Container grams	149.0	137.1	136.3	142.2		
I	Moisture Loss = G - H grams	9.9	10.7	12.5	15.4		
J	Tare Weight of Container grams	37.1	37.1	36.5	37.1		
K	Dry Soil = H - J grams	111.9	100.0	99.8	105.1		
L	%Moisture = (I / K) x 100 %	**8.8%**	**10.7%**	**12.5%**	**14.7%**		

ASTM D4643 AASHTO T217 or T265 Tested by: tv



Max Dry Density

121.3 lbs./cu.ft.

Optimum Moisture

12.2%

MOISTURE-DENSITY RELATIONS OF SOILS

North Dakota Department Of Transportation, Materials & Research Division

SFN 10063 (Rev. 03-2006)

Project No.	PCN	Station	Depth Below Grade
SIM-8-029(151)000			
Offset From Centerline		Type of Soil	
AASTHO Designation	Date		
T-180	**12/21/2015**		**776**

Density

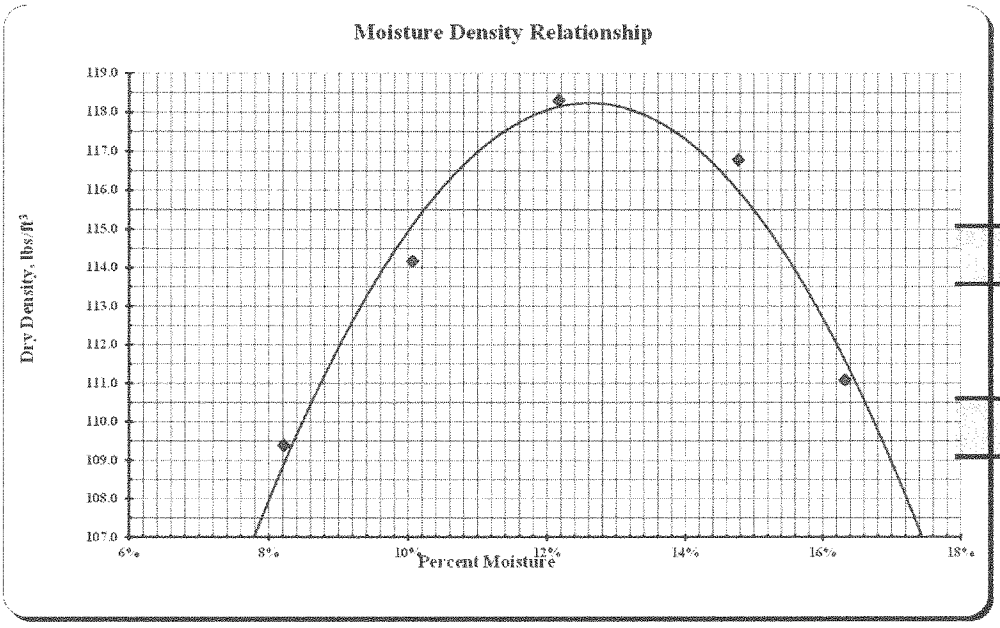
			Test Count	5				
	Determination No.		1	2	3	4	5	6
A	Volume of Mold	cu. ft.	0.0332	0.0332	0.0332	0.0332	0.0332	0.0332
		lbs.	8.31	8.55	8.79	8.83	8.67	
C	Weight of Mold	lbs.	4.38	4.38	4.38	4.38	4.38	4.38
D	Weight of Compacted Soil = B - C	lbs.	3.93	4.17	4.41	4.45	4.29	
E	Wet Density = D / A	lbs./cu.ft.	118.4	125.7	132.7	134.0	129.2	
F	Dry Density = (E x 100) / (100 + L)	lbs./cu.ft.	**109.4**	**114.2**	**118.3**	**116.8**	**111.1**	**#VALUE!**

Moisture Content

AASHTO T99 or T180 Tested by:

	Container No.		22	23	24	25	26	
G	Wet Weight / Container	grams	160.8	156.6	156.1	162.3	145.2	
H	Dry Weight / Container	grams	151.4	145.7	143.2	146.2	130.0	
I	Moisture Loss = G - H	grams	9.4	10.9	12.9	16.1	15.2	
J	Tare Weight of Container	grams	37.0	37.4	37.2	37.2	36.9	
K	Dry Soil = H - J	grams	114.4	108.3	106.0	109.0	93.1	
L	%Moisture = (I / K) x 100	%	**8.2%**	**10.1%**	**12.2%**	**14.8%**	**16.3%**	

ASTM D4643 AASHTO T217 or T265 Tested by: tv



Max Dry Density

118.2 lbs./cu.ft.

Optimum Moisture

12.6%

MOISTURE-DENSITY RELATIONS OF SOILS

North Dakota Department Of Transportation, Materials & Research Division

SFN 10063 (Rev. 03-2006)

Project No.	PCN	Station	Depth Below Grade
SIM-8-029(151)000			
Offset From Centerline		Type of Soil	
AASTHO Designation **T-180**	Date **12/21/2015**		**777**

Density

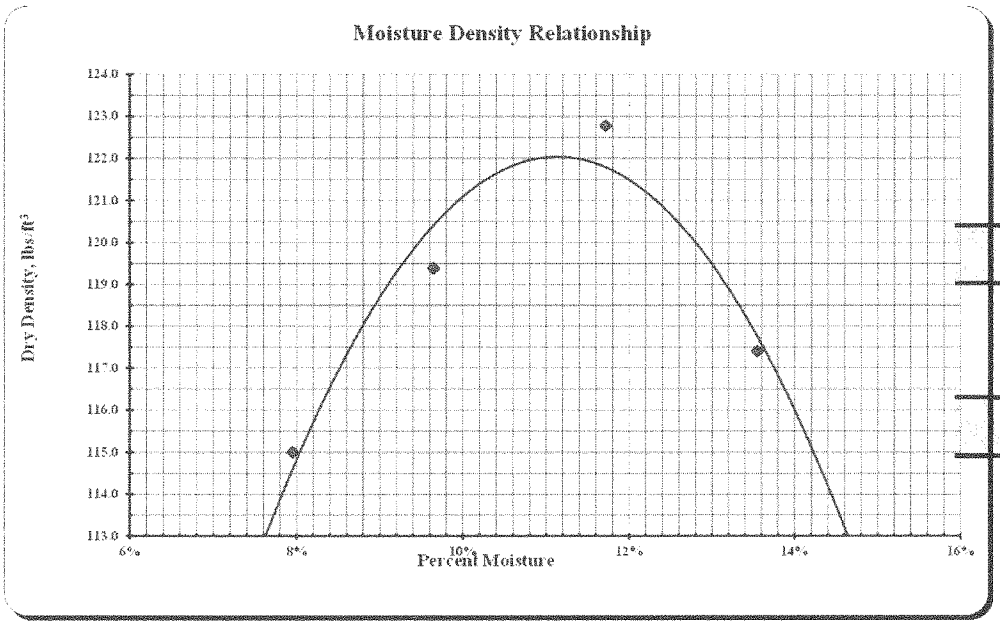
			Test Count	4				
	Determination No.		1	2	3	4	5	6
A	Volume of Mold	cu. ft.	0.0332	0.0332	0.0332	0.0332	0.0332	0.0332
		lbs.	8.51	8.73	8.94	8.81		
C	Weight of Mold	lbs.	4.38	4.38	4.38	4.38	4.38	4.38
D	Weight of Compacted Soil = B - C	lbs.	4.12	4.35	4.55	4.43		
E	Wet Density = D / A	lbs./cu.ft.	124.2	130.9	137.2	133.3		
F	Dry Density = (E x 100) / (100 + L)	lbs./cu.ft.	**115.0**	**119.4**	**122.8**	**117.4**	**#VALUE!**	**#VALUE!**

Moisture Content

AASHTO T99 or T180 Tested by:

	Container No.		5	6	7	8		
G	Wet Weight / Container	grams	151.1	142.8	157.4	160.2		
H	Dry Weight / Container	grams	142.7	133.5	144.7	145.5		
I	Moisture Loss = G - H	grams	8.4	9.3	12.7	14.7		
J	Tare Weight of Container	grams	37.1	37.1	36.3	37.0		
K	Dry Soil = H - J	grams	105.6	96.4	108.4	108.5		
L	%Moisture = (I / K) x 100	%	**8.0%**	**9.6%**	**11.7%**	**13.5%**		

ASTM D4643 AASHTO T217 or T265 Tested by: tv



Max Dry Density

122.0 lbs./cu.ft.

Optimum Moisture

11.2%

MOISTURE-DENSITY RELATIONS OF SOILS

North Dakota Department Of Transportation, Materials & Research Division

SFN 10063 (Rev. 03-2006)

Project No.	PCN	Station	Depth Below Grade
SIM-8-029(151)000			
Offset From Centerline		Type of Soil	
AASTHO Designation **T-180**	Date **12/21/2015**		**781**

Density — Test Count: 5

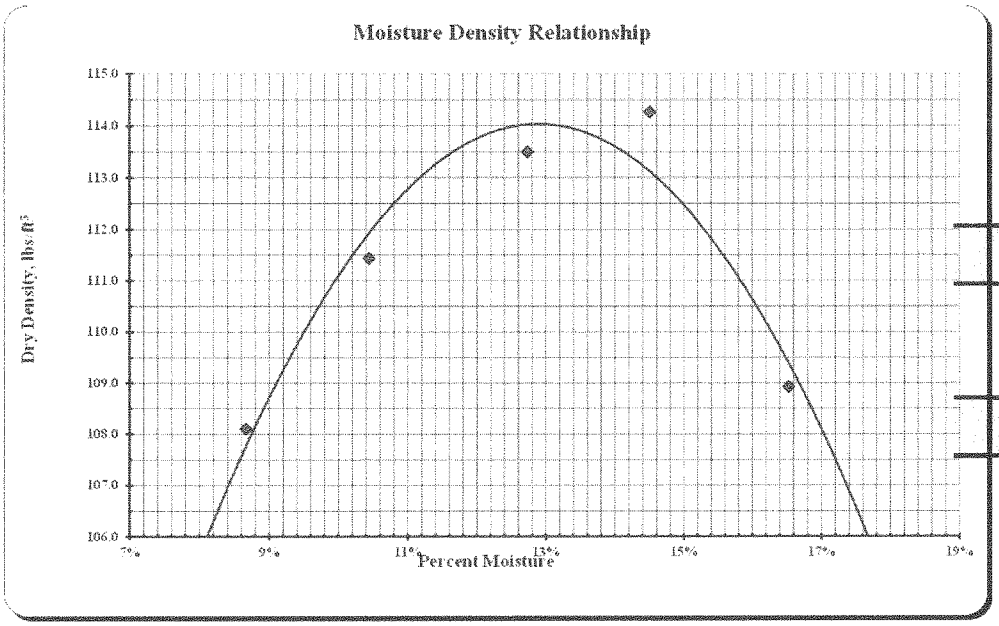
	Determination No.		1	2	3	4	5	6
A	Volume of Mold	cu. ft.	0.0332	0.0332	0.0332	0.0332	0.0332	0.0332
		lbs.	8.28	8.47	8.63	8.73	8.60	
C	Weight of Mold	lbs.	4.38	4.38	4.38	4.38	4.38	4.38
D	Weight of Compacted Soil = B - C	lbs.	3.90	4.09	4.25	4.34	4.21	
E	Wet Density = D / A	lbs./cu.ft.	117.5	123.1	128.0	130.8	126.9	
F	Dry Density = (E x 100) / (100 + L)	lbs./cu.ft.	**108.1**	**111.4**	**113.5**	**114.3**	**108.9**	**#VALUE!**

Moisture Content

AASHTO T99 or T180 Tested by:

	Container No.		9	10	11	12	13	
G	Wet Weight / Container	grams	143.8	139.3	151.4	155.3	161.2	
H	Dry Weight / Container	grams	135.3	129.6	138.5	140.3	143.6	
I	Moisture Loss = G - H	grams	8.5	9.7	12.9	15.0	17.6	
J	Tare Weight of Container	grams	37.2	36.7	37.2	36.9	37.1	
K	Dry Soil = H - J	grams	98.1	92.9	101.3	103.4	106.5	
L	%Moisture = (I / K) x 100	%	**8.7%**	**10.4%**	**12.7%**	**14.5%**	**16.5%**	

ASTM D4643 AASHTO T217 or T265 Tested by: tv



Max Dry Density

114.0 lbs./cu.ft.

Optimum Moisture

12.9%