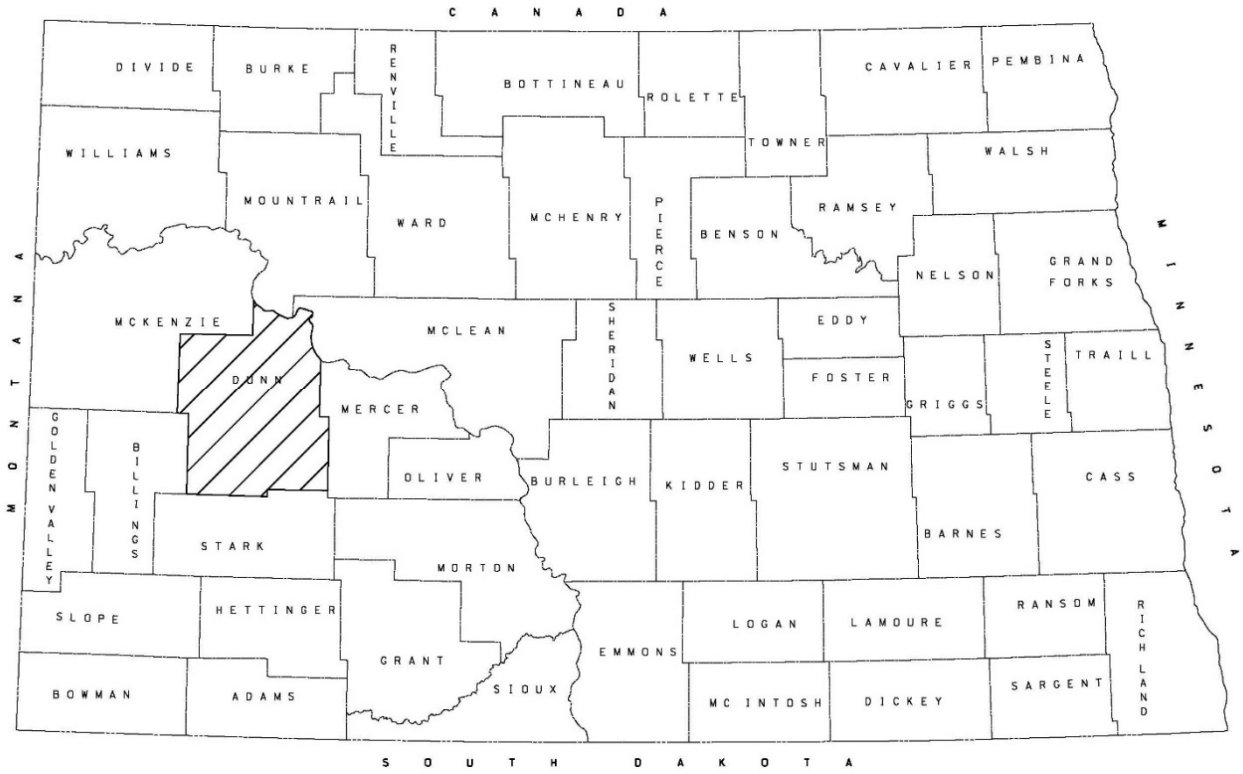
Borrow Site Report

PROJECT NO. NH-5-200(025)095

PCN 19734

COUNTY Dunn

Junction Highway 200 from RP 95.254 to RP 102.600



PREPARED BY: Matthew C. Kurle

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH DIVISION

August 2016

NH-5-200(025)095

Junction ND Highway 22 in Killdeer (RP 95.254) to East of Dunn Center (RP 102.600)

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 Matthew C. Kurle, Registration number PE-8777 on 8/18/2016 and the original document is stored at the North Dakota Department of Transportation.

REGISTERED PROFESSIONAL ENGINEER
MATTHEW C. KURLE
PE-8777
DATE 8-18-2016
NORTH DAKOTA

Matthew C. Kurle, P.E.

18 AUGUST 2016
Date

Borrow Site Investigation

Project: NH-5-200(025)095

PCN: 19734

Scope: Full Depth Reclamation,
Selective Grading
Culvert Rehabilitation,
Hot Bituminous Surfacing

Length: 7.35 Miles

Location: Junction 22 in Killdeer to East of Dunn Center

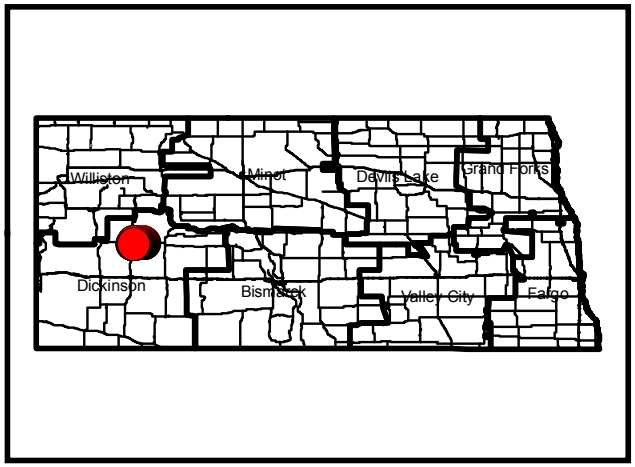


Table of Contents

Introduction 1
Sampling and Testing Procedures: 1
Borrow Site B-1 1
Summary and Recommendations 2
Borrow Site B-1 Recommendation 2
Moisture and Density Controls 2

List of Tables

Table 1 - Summary of Borrow Site B-1 1

Appendix

Appendix A – Map of Boring Locations
Appendix B – Summary and Lab Results for Borrow Site B1
Appendix C – Borrow Site B-1 NDDOT Material Source Certificate of Approval
Appendix D – Proctor Results

Introduction

This report includes the investigation of the borrow site on project NH-5-200(025)095. The field and subsurface investigation was conducted on 7/18/2016 and 7/19/2016 in order to develop this report.

Sampling and Testing Procedures:

Borings were conducted with a six inch solid flight auger. Soil samples were taken at each boring location. Borings that had significant changes in soil type were split into separate samples. Moisture content samples were taken at 1 foot intervals.

The samples were submitted to the laboratory for determination of AASHTO classification, moisture content, dry density, sieve analysis, and Atterberg limits.

Borrow Site B-1

This borrow site was drilled on 7/18/2016 and 7/19/2016. A total of 24 borings were conducted at this location. Additional testing was run on the borings listed below. A summary of the boring data is shown in Table 1. Detailed data is in Appendix B.

Table 1 - Summary of Borrow Site B-1

Boring Number	Lab Number	NDDOT Textural Class	AASHTO Class	Depth of Sample	Average In Place Moisture Content	Optimum Moisture Content T-180	Max Dry Density
				feet	%	%	lb/ft^3
49	704	CLY	A-7-5(52)	1.0-5.0	29.8	18.2	106.5
50	705	CLY	A-7-6(31)	0.0-5.0	23.9	15.7	110.1
51	706	CLY	A-7-6(27)	0.8-5.0	17.4	13.5	118.9
52	707	CLY	A-7-6(23)	0.5-3.9	19.8	16.2	111.8
53	708	SLTY CLY	A-7-6(29)	0.5-5.0	23.1	13.2	119.7
54	709	CLY	A-7-6(29)	0.5-5.0	15.9	13.7	117.4
55	710	CLY	A-6(6)	0.8-5.0	9.2	10.5	123.8
56	711	CLY	A-7-6(48)	0.8-8.2	16.3	15.1	115.1
57	712	CLY	A-7-6(24)	0.7-10.0	13.3	12.5	120.5
58	713	CLY	A-7-6(23)	0.9-5.0	13.7	13.3	117.8
59	714	CLY	A-7-6(49)	0.5-15.0	21.5	14.1	117.9
60	715	CLY	A-6(11)	0.7-9.0	11.0	10.5	126.7
	716	CLY	A-6(14)	9.0-15.0	22.3	13.8	117.1
61	717	CLY	A-6(4)	0.7-15.0	10.0	9.4	128.7
62	718	CLY	A-6(15)	0.7-10.0	11.1	12.4	121.2
63	719	CLY	A-7-6(36)	0.8-5.0	13.9	12.4	120.1
64	720	CLY	A-7-6(31)	1.1-5.0	11.6	13.9	115.9

Boring Number	Lab Number	NDDOT Textural Class	AASHTO Class	Depth of Sample	Average In Place Moisture Content	Optimum Moisture Content T-180	Max Dry Density
				feet	%	%	lb/ft^3
65	721	CLY	A-7-6(29)	1.0-10.0	16.9	12.5	120.4
66	722	CLY	A-6(11)	1.0-10.0	10.9	11.7	122.3
67	723	CLY	A-6(15)	0.7-10.0	13.0	11.6	123.0
68	724	CLY	A-7-6(35)	0.7-10.0	14.7	5.4	115.0
69	725	CLY	A-7-6(28)	1.3-10.0	13.1	13.1	121.0
70	726	CLY	A-7-6(35)	0.6-10.0	14.9	12.6	121.2
71	727	CLY	A-7-6(34)	0.6-10.0	18.8	13.0	119.8
72	728	CLY	A-7-6(25)	2.5-5.0	14.8	13.3	117.5

Summary and Recommendations

The majority of the soils encountered in Borrow Site B-1 were A-7-6 soils with high group indices and moderate swell potential indicating a potential for these soils to be susceptible to seasonal movement. Boring 56 was drilled to a depth of 10 feet and coal was encountered from 8.2 feet to 10.0 feet. It can be expected that additional coal layers may be encountered within this site. The soils encountered in boring 61 were classified as F4 soils which are highly susceptible to frost action. See Appendix B for the moisture contents and other detailed data at the specific sample depths.

Borrow Site B-1 Recommendation

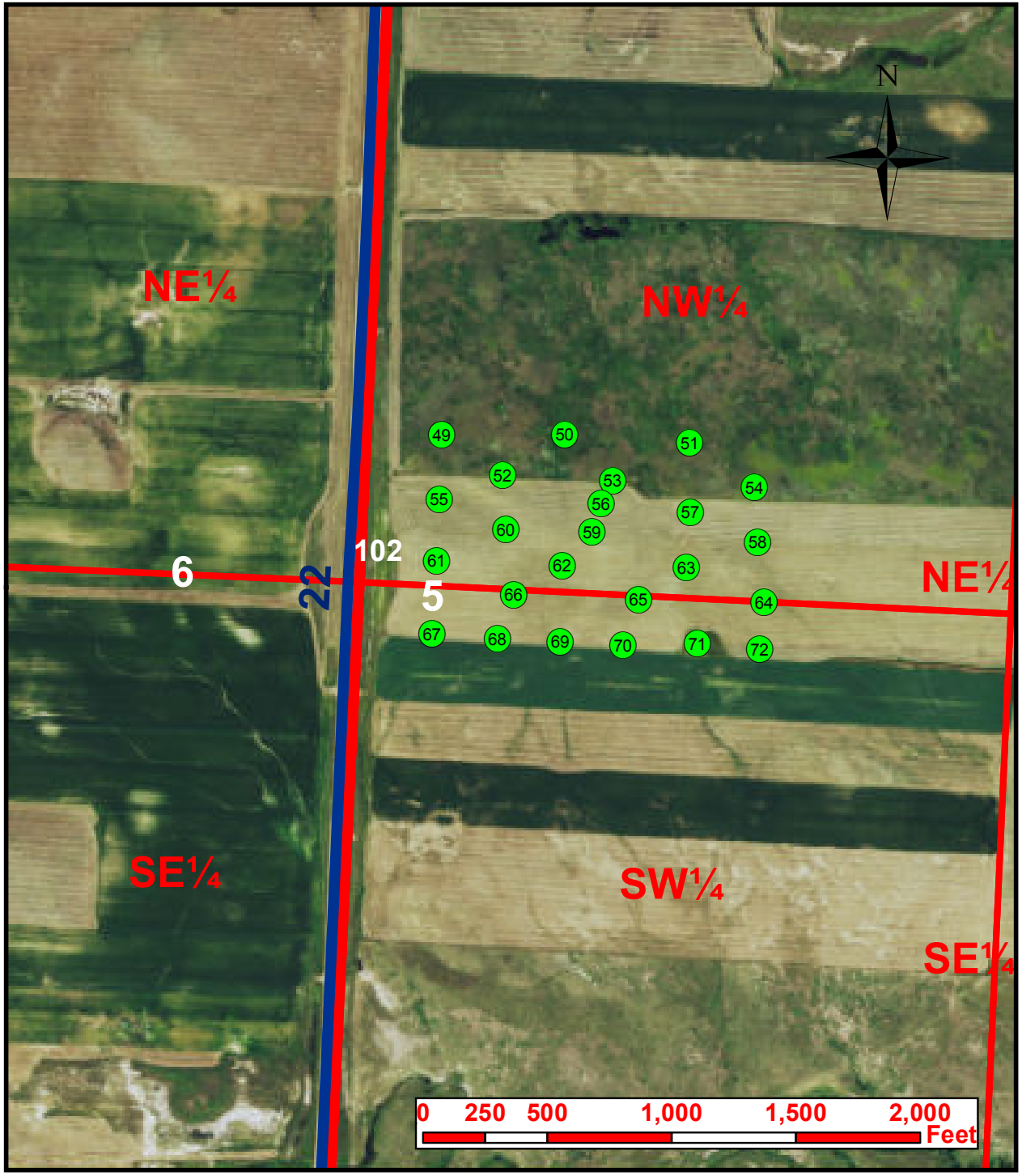
The material properties of the soil encountered in the investigation indicate that these soils may be susceptible to seasonal movement given conditions such as elevated moisture contents are present. To minimize the potential for differential seasonal movement of these soils and ensure they perform adequately, mix and blend the materials well to create a uniform embankment section.

Moisture and Density Controls

Moisture and Density for all borrow material shall be in accordance with AASHTO T-180.

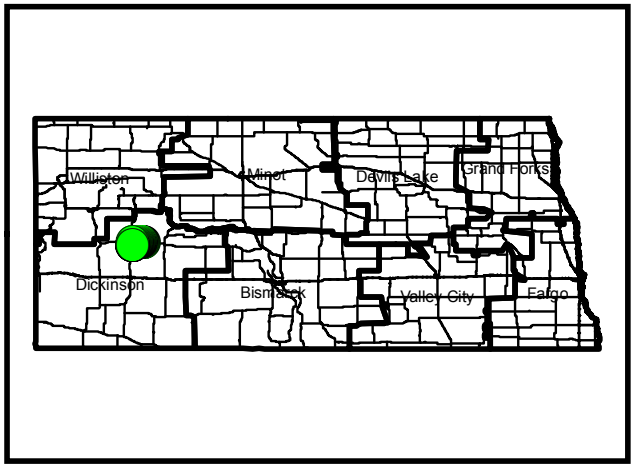
APPENDIX A

Map of Boring Locations



Borrow Site - B-1

Project:NH-5-200(025)095
PCN: 19734
Location: SW1/4NW1/4, N1/2NW1/4SW1/4
S 5 T144N R95W



APPENDIX B

Summary and Lab Results for Borrow Site B1

Project No.: NHU-5-200(025)095

PCN: 19734

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
723	101+5110	Rt 300 EB	0.7-10	19.8	A-6(15)	15	11.6	20	13.0	7.7	12.3	10.1	9.9	10.9	12.0	15.4	16.2	18.3																F3
724	101+5110	Rt 550 EB	0.7-10	23.3	A-7-6(35)	35	15.4	32	14.7	20.0	12.2	10.7	8.6	10.1	12.3	14.2	23.4	24.6																F3
725	101+5110	Rt 800 EB	1.3-10	18.2	A-7-6(28)	28	13.1	30	13.9	11.9	11.4	14.5	13.1	10.0	16.1	12.5	13.8	15.0																F3
726	101+5110	Rt 1050 EB	0.6-10	17.7	A-7-6(35)	35	12.6	34	15.0	12.4	11.3	11.4	12.8	21.1	15.6	16.4	13.4	15.9																F3
727	101+5110	Rt 1340 EB	0.6-10	19.3	A-7-6(34)	34	13.0	32	18.8	21.4	14.9	15.8	18.0	16.3	14.9	21.0	19.0	20.7																F3
728	101+5110	Rt 1600 EB	2.5-5	20.5	A-7-6(25)	25	13.3	27	17.4	20.5	15.5	15.5	13.5																					F3
720	101+5235	Rt 1600 WB	1.1-5	21.2	A-7-6(31)	31	13.9	31	13.6	10.7	10.3	11.4	13.8																					F3
721	101+5235	Rt 1100 WB	1-10	18.3	A-7-6(29)	29	12.5	29	16.8	10.6	10.0	15.1	15.3	16.7	21.3	20.0	15.2	15.7																F3
722	101+5235	Rt 600 WB	1-10	17.6	A-6(11)	11	11.7	18	10.9	8.2	7.7	8.8	10.5	10.5	11.5	12.1	11.1	11.4																F3
717	102+0070	Rt 300 EB	0.7-13.5	15.6	A-6(4)	4	9.4	11	10.0	7.1	7.1	6.7	6.1	7.3	8.1	10.5	7.1	6.6	7.4	5.7	6.8	24.8	25.8											F4
718	102+0070	Rt 800 EB	0.7-10	16.6	A-6(15)	15	12.4	23	11.1	6.6	5.3	6.6	10.6	11.1	13.2	14.2	15.2	14.9																F3
719	102+0070	Rt 1300 EB	0.8-5	20.1	A-7-6(36)	36	12.4	33	13.8	10.7	15.3	17.0	16.2																					F3
713	102+0189	Rt 1300 WB	0.9-5	19.4	A-7-6(23)	23	13.3	27	13.7	14.7	11.6	8.7	10.1																					F3

Project No.: NHU-5-200(025)095

PCN: 19734

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
714	102+0189	Rt 900 WB	0.5-15	20.1	A-7-6(49)	49	14.1	45	21.5	18.5	19.8	19.5	21.7	20.9	19.9	21.4	22.0	22.2	22.5	23.2	24.5	27.6	23.0											F3
715	102+0189	Rt 550 WB	0.7-9	17.1	A-6(11)	11	10.5	18	18.8	8.8	9.5	9.7	9.2	10.0	80.6	10.1	16.2																	F3
716	102+0189	Rt 550 WB	0.7-9	15.7	A-6(14)	14	13.8	20	22.3									16.9	23.1	24.9	21.7	21.7	25.5											F3
710	102+0314	Rt 300 EB	0.8-5	18.1	A-6(6)	6	10.5	14	9.2	7.3	7.6	7.8	7.9																					F3
711	102+0314	Rt 940 EB	0.8-8.2	22.6	A-7-6(48)	48	15.1	43	21.9	15.3	15.6	15.6	15.1	16.4	15.6	22.0	63.0	25.6																F3
712	102+0314	Rt 1300 EB	0.7-10	18.8	A-7-6(24)	24	12.5	26	13.4	10.3	11.1	8.6	12.0	14.3	12.1	13.9	14.2	16.1																F3
707	102+0439	Rt 550 EB	0.5-3.9	22.0	A-7-6(23)	23	16.2	38	39.9	15.9	17.2	50.8	89.5																					F3
708	102+0439	Rt 1050 EB	0.5-5	20.1	A-7-6(29)	29	13.2	30	23.1	21.3	22.3	20.3	17.7																					F3
709	102+0439	Rt 1600 EB	0.5-5	20.6	A-7-6(29)	29	13.7	29	15.9	14.1	11.8	15.5	19.7																					F3
704	102+0564	Rt 300 EB	1-5	32.1	A-7-5(52)	52	18.2	44	29.8	24.1	19.7	55.3	28.0																					F3
705	102+0564	Rt 800 EB	0-5	24.7	A-7-6(31)	31	15.7	30	23.8	29.2	24.2	19.0	18.5																					F3
706	102+0564	Rt 1300 EB	0.8-5	19.3	A-7-6(27)	27	13.5	29	17.4	12.3	14.7	21.1	16.5																					F3

Borrow Area Laboratory Analysis

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

Report Number	SS-32-2016	**Date Reported**	7/20/2016	**District**	Bismarck
County	DUNN	**Submitted By**	Naumann	**Project Number**	NHU-5-200(025)095
		AASHTO Test Method		**PCN**	19734

Comments

Lab Number	723	724	725	726
Reference Pt + Feet	101+5110	101+5110	101+5110	101+5110
Distance From CenterLine (Ft.)	Rt 300 EB	Rt 550 EB	Rt 800 EB	Rt 1050 EB
Depth, Ft.	0.7 - 10.0	0.7 - 10.0	1.3 - 10.0	0.6 - 10.0
Field Sample No.	723	724	725	726
% Pass. 3/8" Sieve	100	100	100	100
% Pass. No. 4 Sieve	100	100	100	100
% Pass. No. 10 Sieve	100	100	99	100
% Coarse Sand (-No. 10 + No. 40)	0	1	1	0
% Fine Sand (-No. 40 + No. 200)	21	3	8	4
% Silt (0.074 - 0.005 mm)	24	23	34	40
% Clay (-0.005 mm)	55	74	56	56
Liquid Limit (-No. 40)	40	55	48	52
Plasticity Index (-No. 40)	20	32	30	34
Plastic Limit	20	23	18	18
Soil Color	BRN/TAN	BRN/GRY	BRN/TAN	BRN/TAN
Textural Class	CLY	CLY	CLY	CLY
Soil Class (AASHTO M-145)	A-6(15)	A-7-6(35)	A-7-6(28)	A-7-6(35)
Frost Class	F3	F3	F3	F3
Optimum Moisture (%)	11.6	15.4	13.1	12.6
Maximum Dry Density (pcf)	123.0	115.0	121.0	121.2
% Organic Content				

Depth (Ft.)	**Moisture (%)**											
1	17.2	1	11.3	1	20.3	1	19.6
2	7.7	2	20.0	2	11.9	2	12.4
3	12.3	3	12.2	3	11.4	3	11.3
4	10.1	4	10.7	4	14.5	4	11.4
5	9.9	5	8.6	5	13.1	5	12.8
6	10.9	6	10.1	6	10.0	6	21.1
7	12.0	7	12.3	7	16.1	7	15.6
8	15.4	8	14.2	8	12.5	8	16.4
9	16.2	9	23.4	9	13.8	9	13.4
10	18.3	10	24.6	10	15.0	10	15.9
Avg. Moisture of Sample Depth	13.0		14.7		13.1		14.9

Scott W. Wutzke, Testing Lab Supervisor
Date Printed: 8/16/2016

Borrow Area Laboratory Analysis

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

Report Number	SS-32-2016	**Date Reported**	7/20/2016	**District**	Bismarck
County	DUNN	**Submitted By**	Naumann	**Project Number**	NHU-5-200(025)095
		AASHTO Test Method		**PCN**	19734

Comments

Lab Number	727	728	720	721
Reference Pt + Feet	101+5110	101+5110	101+5235	101+5235
Distance From CenterLine (Ft.)	Rt 1340 EB	Rt 1600 EB	Rt 1600 WB	Rt 1100 WB
Depth, Ft.	0.6 - 10.0	2.5 - 5.0	1.1 - 5.0	1.0 - 10.0
Field Sample No.	727	728	720	721
% Pass. 3/8" Sieve	100	100	100	100
% Pass. No. 4 Sieve	100	100	100	100
% Pass. No. 10 Sieve	100	99	99	100
% Coarse Sand (-No. 10 + No. 40)	1	1	1	0
% Fine Sand (-No. 40 + No. 200)	2	10	7	6
% Silt (0.074 - 0.005 mm)	44	26	41	33
% Clay (-0.005 mm)	53	63	50	61
Liquid Limit (-No. 40)	52	47	52	48
Plasticity Index (-No. 40)	32	27	31	29
Plastic Limit	19	21	21	18
Soil Color	BRN/TAN	BRN/BLK	BRN/BLK	BRN/TAN
Textural Class	CLY	CLY	CLY	CLY
Soil Class (AASHTO M-145)	A-7-6(34)	A-7-6(25)	A-7-6(31)	A-7-6(29)
Frost Class	F3	F3	F3	F3
Optimum Moisture (%)	13.0	13.3	13.9	12.5
Maximum Dry Density (pcf)	119.8	117.5	115.9	120.4
% Organic Content				
Depth (Ft.) | Moisture (%)	1 | 26.1	1 | 22.1	1 | 22.0	1 | 28.6
	2 | 21.4	2 | 20.5	2 | 10.7	2 | 10.6
	3 | 14.9	3 | 15.5	3 | 10.3	3 | 10.0
	4 | 15.8	4 | 15.5	4 | 11.4	4 | 15.1
	5 | 18.0	5 | 13.5	5 | 13.8	5 | 15.3
	6 | 16.3	14.8	11.6	6 | 16.7
	7 | 14.9			7 | 21.3
	8 | 21.0			8 | 20.0
	9 | 19.0			9 | 15.2
	10 | 20.7			10 | 15.7
Avg. Moisture of Sample Depth	18.8			16.9

Scott W. Wutzke, Testing Lab Supervisor
Date Printed: 8/16/2016

Borrow Area Laboratory Analysis

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

Report Number	SS-32-2016	**Date Reported**	7/20/2016	**District**	Bismarck
County	DUNN	**Submitted By**	Naumann	**Project Number**	NHU-5-200(025)095
		AASHTO Test Method		**PCN**	19734

Comments

Lab Number	722	717	717.1	718
Reference Pt + Feet	101+5235	102+0070	102+0070	102+0070
Distance From CenterLine (Ft.)	Rt 600 WB	Rt 300 EB	Rt 300 EB	Rt 800 EB
Depth, Ft.	1.0 - 10.0	0.7 - 13.5	0.7 - 13.5	0.7 - 10.0
Field Sample No.	722	717	717.1	718
% Pass. 3/8" Sieve	100	100		100
% Pass. No. 4 Sieve	100	100		99
% Pass. No. 10 Sieve	100	100		99
% Coarse Sand (-No. 10 + No. 40)	1	1		1
% Fine Sand (-No. 40 + No. 200)	25	35		25
% Silt (0.074 - 0.005 mm)	19	1		0
% Clay (-0.005 mm)	55	63		73
Liquid Limit (-No. 40)	35	27		40
Plasticity Index (-No. 40)	18	11		23
Plastic Limit	18	16		17
Soil Color	BRN/TAN	BRN/TAN	BRN/TAN	BRN/TAN
Textural Class	CLY	CLY		CLY
Soil Class (AASHTO M-145)	A-6(11)	A-6(4)		A-6(15)
Frost Class	F3	F4		F3
Optimum Moisture (%)	11.7	9.4		12.4
Maximum Dry Density (pcf)	122.3	128.7		121.2
% Organic Content				

Depth (Ft.)	**Moisture (%)**								
1	17.4	1	12.9	13	6.8	1	13.0
2	8.2	2	7.1	14	24.8	2	6.6
3	7.7	3	7.1	15	25.8	3	5.3
4	8.8	4	6.7	6.8		4	6.6
5	10.5	5	6.1			5	10.6
6	10.5	6	7.3			6	11.1
7	11.5	7	8.1			7	13.2
8	12.1	8	10.5			8	14.2
9	11.1	9	7.1			9	15.2
10	11.4	10	6.6			10	14.9
Avg. Moisture of Sample Depth	10.9	11	7.4			11.1	
		12	5.7				
		7.7					

Scott W. Wutzke, Testing Lab Supervisor
Date Printed: 8/16/2016

Borrow Area Laboratory Analysis

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

Report Number	SS-32-2016	**Date Reported**	7/20/2016	**District**	Bismarck
County	DUNN	**Submitted By**	Naumann	**Project Number**	NHU-5-200(025)095
		AASHTO Test Method		**PCN**	19734

Comments

Lab Number	719	713	714	714.1
Reference Pt + Feet	102+0070	102+0189	102+0189	102+0189
Distance From CenterLine (Ft.)	Rt 1300 EB	Rt 1300 WB	Rt 900 WB	Rt 900 WB
Depth, Ft.	0.8 - 5.0	0.9 - 5.0	0.5 - 15.0	0.5 - 15.0
Field Sample No.	719	713	714	714.1
% Pass. 3/8" Sieve	100	100	100	
% Pass. No. 4 Sieve	100	100	99	
% Pass. No. 10 Sieve	100	99	98	
% Coarse Sand (-No. 10 + No. 40)	0	1	0	
% Fine Sand (-No. 40 + No. 200)	1	13	2	
% Silt (0.074 - 0.005 mm)	28	16	20	
% Clay (-0.005 mm)	71	69	77	
Liquid Limit (-No. 40)	53	46	66	
Plasticity Index (-No. 40)	33	27	45	
Plastic Limit	20	19	20	
Soil Color	BRN/TAN	BRN	BRN/GRY/BLK	BRN/GRY/BLK
Textural Class	CLY	CLY	CLY	
Soil Class (AASHTO M-145)	A-7-6(36)	A-7-6(23)	A-7-6(49)	
Frost Class	F3	F3	F3	
Optimum Moisture (%)	12.4	13.3	14.1	
Maximum Dry Density (pcf)	120.1	117.8	117.9	
% Organic Content				

Depth (Ft.)	**Moisture (%)**											
1	9.9	1	23.4	1	16.3	13	24.5
2	10.7	2	14.7	2	18.5	14	27.6
3	15.3	3	11.6	3	19.8	15	23.0
4	17.0	4	8.7	4	19.5	25.0	
5	16.2	5	10.1	5	21.7		
Avg. Moisture of Sample Depth	13.9		13.7	6	20.9		
				7	19.9		
				8	21.4		
				9	22.0		
				10	22.2		
				11	22.5		
				12	23.2		
				20.6			

Scott W. Wutzke, Testing Lab Supervisor
Date Printed: 8/16/2016

Borrow Area Laboratory Analysis

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

Report Number	SS-32-2016	**Date Reported**	7/20/2016	**District**	Bismarck
County	DUNN	**Submitted By**	Naumann	**Project Number**	NHU-5-200(025)095
		AASHTO Test Method		**PCN**	19734

Comments

Lab Number	715	716	716.1	710
Reference Pt + Feet	102+0189	102+0189	102+0189	102+0314
Distance From CenterLine (Ft.)	Rt 550 WB	Rt 550 WB	Rt 550 WB	Rt 300 EB
Depth, Ft.	0.7 - 9.0	0.7 - 9.0	0.7 - 9.0	0.8 - 5.0
Field Sample No.	715	716	716.1	710
% Pass. 3/8" Sieve	100	100		100
% Pass. No. 4 Sieve	100	100		100
% Pass. No. 10 Sieve	100	100		100
% Coarse Sand (-No. 10 + No. 40)	2	1		1
% Fine Sand (-No. 40 + No. 200)	25	19		40
% Silt (0.074 - 0.005 mm)	5	3		1
% Clay (-0.005 mm)	67	78		59
Liquid Limit (-No. 40)	35	36		33
Plasticity Index (-No. 40)	18	20		14
Plastic Limit	17	16		18
Soil Color	BRN/TAN	BRN/GRY	BRN/GRY	BRN
Textural Class	CLY	CLY		CLY
Soil Class (AASHTO M-145)	A-6(11)	A-6(14)		A-6(6)
Frost Class	F3	F3		F3
Optimum Moisture (%)	10.5	13.8		10.5
Maximum Dry Density (pcf)	126.7	117.1		123.8
% Organic Content				

Depth (Ft.) | Moisture (%)											
	1	15.0	10	16.9	13	21.7	1	15.3
	2	8.8	11	23.1	14	21.7	2	7.3
	3	9.5	12	24.9	15	25.5	3	7.6
	4	9.7	0.0		0.0		4	7.8
	5	9.2					5	7.9
	6	10.0					9.2	
	7	10.9						
	8	10.1						
	9	16.2						
Avg. Moisture of Sample Depth	11.0							

Scott W. Wutzke, Testing Lab Supervisor
Date Printed: 8/16/2016

Borrow Area Laboratory Analysis

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

Report Number	SS-32-2016	**Date Reported**	7/20/2016	**District**	Bismarck
County	DUNN	**Submitted By**	Naumann	**Project Number**	NHU-5-200(025)095
		AASHTO Test Method		**PCN**	19734

Comments

Lab Number	711	712	707	708
Reference Pt + Feet	102+0314	102+0314	102+0439	102+0439
Distance From CenterLine (Ft.)	Rt 940 EB	Rt 1300 EB	Rt 550 EB	Rt 1050 EB
Depth, Ft.	0.8 - 8.2	0.7 - 10.0	0.5 - 3.9	0.5 - 5.0
Field Sample No.	711	712	707	708
% Pass. 3/8" Sieve	100	100	100	100
% Pass. No. 4 Sieve	100	100	100	100
% Pass. No. 10 Sieve	100	99	99	100
% Coarse Sand (-No. 10 + No. 40)	0	1	11	2
% Fine Sand (-No. 40 + No. 200)	1	10	24	7
% Silt (0.074 - 0.005 mm)	9	23	25	55
% Clay (-0.005 mm)	90	65	40	35
Liquid Limit (-No. 40)	65	45	60	50
Plasticity Index (-No. 40)	43	27	38	30
Plastic Limit	23	19	22	20
Soil Color	BRN/TAN	BRN/TAN	BRN	BRN
Textural Class	CLY	CLY	CLY	SLTY CLY
Soil Class (AASHTO M-145)	A-7-6(48)	A-7-6(24)	A-7-6(23)	A-7-6(29)
Frost Class	F3	F3	F3	F3
Optimum Moisture (%)	15.1	12.5	16.2	13.2
Maximum Dry Density (pcf)	115.1	120.5	111.8	119.7
% Organic Content				

Depth (Ft.)	**Moisture (%)**								
1	14.9	1	21.0	1	26.2	1	33.7
2	15.3	2	10.3	2	15.9	2	21.3
3	15.6	3	11.1	3	17.2	3	22.3
4	15.6	4	8.6	4	50.8	4	20.3
5	15.1	5	12.0	5	89.5	5	17.7
6	16.4	6	14.3		19.8		23.1
7	15.6	7	12.1				
8	22.0	8	13.9				
9	63.0	9	14.2				
10	25.6	10	16.1				
Avg. Moisture of Sample Depth	16.3		13.3				

Scott W. Wutzke, Testing Lab Supervisor
Date Printed: 8/16/2016

Borrow Area Laboratory Analysis

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

Report Number	SS-32-2016	**Date Reported**	7/20/2016	**District**	Bismarck
County	DUNN	**Submitted By**	Naumann	**Project Number**	NHU-5-200(025)095
		AASHTO Test Method		**PCN**	19734

Comments

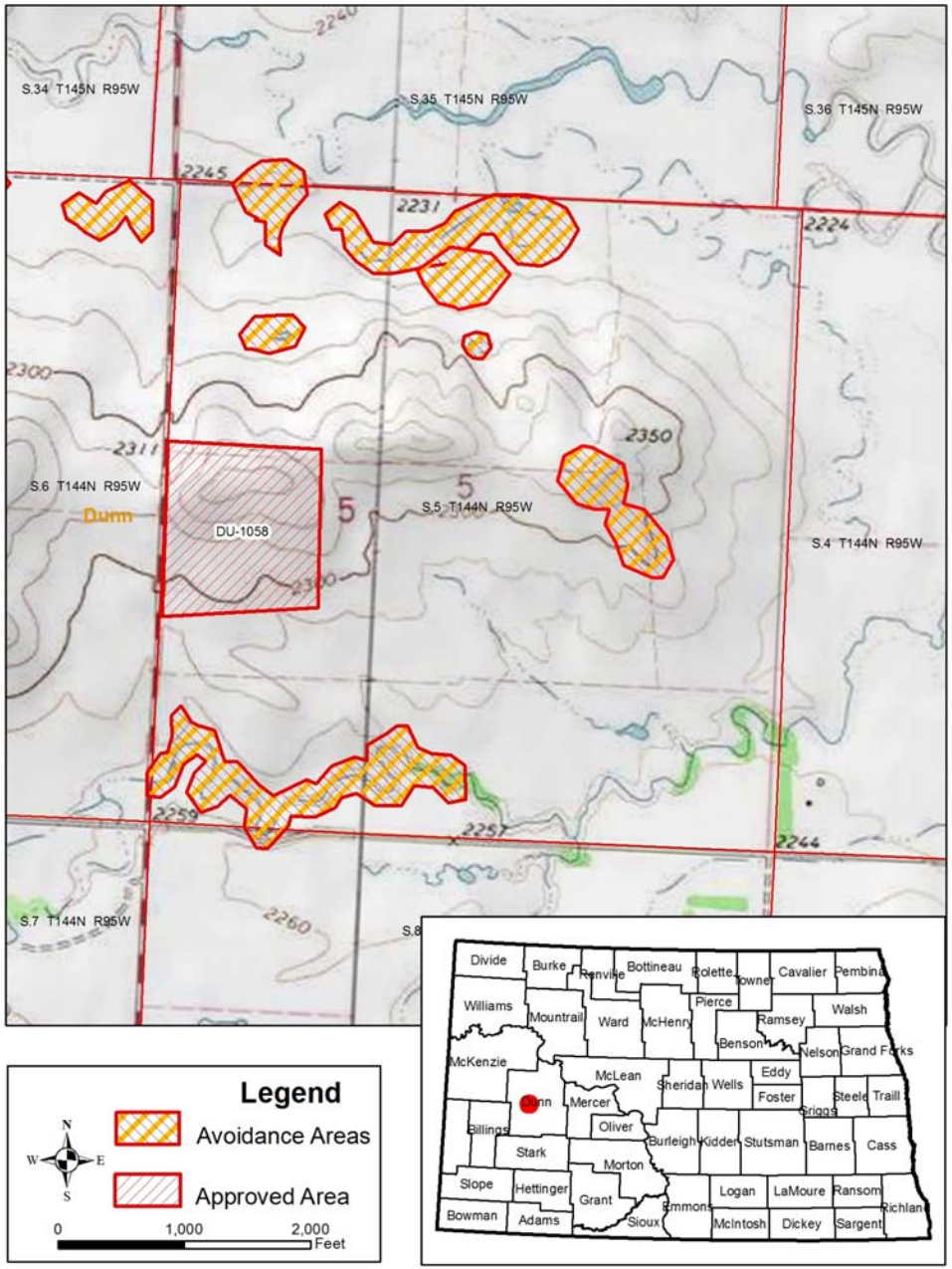
Lab Number	709	704	705	706
Reference Pt + Feet	102+0439	102+0564	102+0564	102+0564
Distance From CenterLine (Ft.)	Rt 1600 EB	Rt 300 EB	Rt 800 EB	Rt 1300 EB
Depth, Ft.	0.5 - 5.0	1.0 - 5.0	0.0 - 5.0	0.8 - 5.0
Field Sample No.	709	704	705	706
% Pass. 3/8" Sieve	100	100	100	100
% Pass. No. 4 Sieve	100	100	100	99
% Pass. No. 10 Sieve	100	100	99	98
% Coarse Sand (-No. 10 + No. 40)	0	1	1	1
% Fine Sand (-No. 40 + No. 200)	8	2	6	9
% Silt (0.074 - 0.005 mm)	27	28	53	53
% Clay (-0.005 mm)	65	69	40	35
Liquid Limit (-No. 40)	50	77	55	48
Plasticity Index (-No. 40)	29	45	30	29
Plastic Limit	21	32	25	19
Soil Color	BRN/TAN	BRN/BLK	BRN/BLK	BRN
Textural Class	CLY	CLY	CLY	CLY
Soil Class (AASHTO M-145)	A-7-6(29)	A-7-5(52)	A-7-6(31)	A-7-6(27)
Frost Class	F3	F3	F3	F3
Optimum Moisture (%)	13.7	18.2	15.7	13.5
Maximum Dry Density (pcf)	117.4	106.5	110.1	118.9
% Organic Content				
Depth (Ft.) | Moisture (%)	1 | 18.5	1 | 21.7	1 | 28.3	1 | 22.2
	2 | 14.1	2 | 24.1	2 | 29.2	2 | 12.3
	3 | 11.8	3 | 19.7	3 | 24.2	3 | 14.7
	4 | 15.5	4 | 55.3	4 | 19.0	4 | 21.1
	5 | 19.7	5 | 28.0	5 | 18.5	5 | 16.5
Avg. Moisture of Sample Depth	15.9	29.8	23.9	17.4

Scott W. Wutzke, Testing Lab Supervisor
Date Printed: 8/16/2016

APPENDIX C

NDDOT Material Source Certificate of Approval

NDDOT Material Source Certificate of Approval



Expires December 31st

2019

DU-1058

Pit Name: Kukla

SW1/4NW1/4, N1/2NW1/4SW1/4	S. 5	T. 144 N,	R 95 W

County: Dunn

Conditions:

This location is approved for use, provided all avoidance areas shown on the map are avoided and all Conditions listed above and below are complied with.

NDDOT advises that all applicants (contractors or their representatives) may be subject to meeting certain legal responsibilities pursuant to one or more of the following authorities administered by the USFWS: Migratory Bird Treaty Act (MBTA) (16 U.S.C. 703 et seq.); Endangered Species Act (ESA) (16 U.S.C. 1531 et seq.); and Bald and Golden Eagle Protection Act (BGEPA) (16 U.S.C. 668-668d, 54 Stat. 250). It is the responsibility of the applicants and/or any individual conducting activities at any approved site to fulfill the requirements of these Acts. The contractor will be responsible obtaining all applicable permits outlined in Section 107 of the Standard Specifications for Road and Bridge Construction (SSRBC). Additionally, contractor will be responsible for any impacts to wetlands, including permitting those impacts and mitigating the loss of the wetlands. As with all projects, if cultural artifacts and/or features (e.g., stone tools, fire hearths, stone circles, burials) are encountered, provisions outlined in Section 107.06 of SSRBC shall be followed.

This approval does not imply landowner permission to acquire material at this location. An agreement with the landowner is still necessary. If you have any questions regarding material sources please email materialsource@nd.gov

APPENDIX D

Proctor Results

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
NHU-5-200(025)095			
Offset From Centerline		Type of Soil	
AASTHO Designation	Date		
T-180	**8/1/2016**		**704**

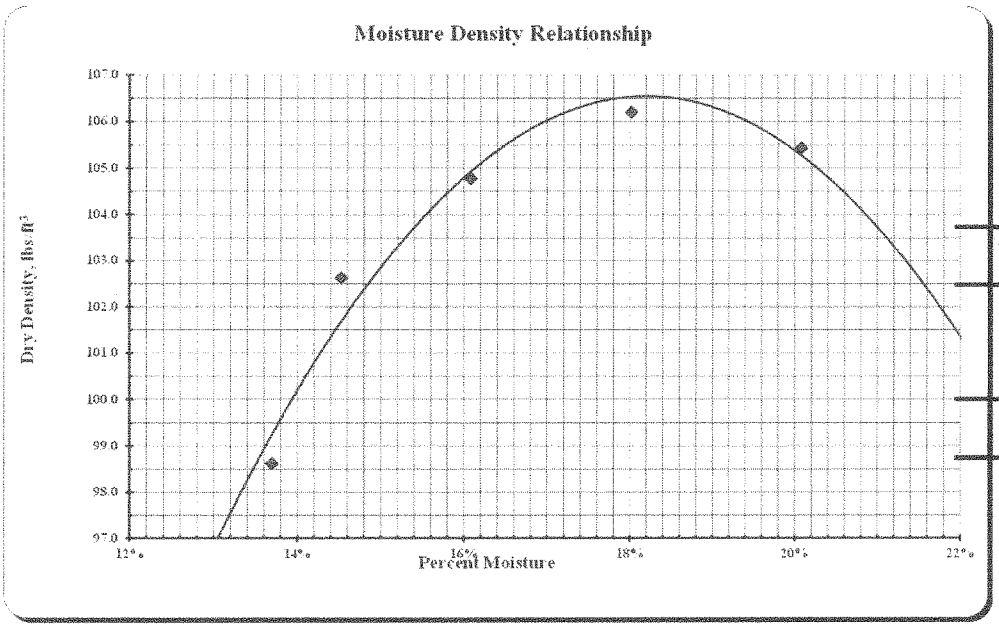
Density		Test Count	5				
Determination No.		1	2	3	4	5	6
A Volume of Mold	cu. ft.	0.0333	0.0333	0.0333	0.0333	0.0333	0.0333
	lbs.	8.17	8.34	8.48	8.61	8.65	
C Weight of Mold	lbs.	4.43	4.43	4.43	4.43	4.43	4.43
D Weight of Compacted Soil = B - C	lbs.	3.73	3.91	4.05	4.17	4.22	
E Wet Density = D / A	lbs./cu.ft.	112.1	117.5	121.6	125.3	126.6	
F Dry Density = (E x 100) / (100 + L)	lbs./cu.ft.	**98.6**	**102.6**	**104.8**	**106.2**	**105.4**	**#VALUE!**

Moisture Content

AASHTO T99 or T180 Tested by:

Container No.		1	2	3	4	5	
G Wet Weight / Container	grams	144.5	174.5	149.0	174.9	160.9	
H Dry Weight / Container	grams	131.5	157.1	133.5	153.8	140.2	
I Moisture Loss = G - H	grams	13.0	17.4	15.5	21.1	20.7	
J Tare Weight of Container	grams	36.6	37.3	37.1	36.7	37.1	
K Dry Soil = H - J	grams	94.9	119.8	96.4	117.1	103.1	
L %Moisture = (I / K) x 100	%	**13.7%**	**14.5%**	**16.1%**	**18.0%**	**20.1%**	

ASTM D4643 AASHTO T217 or T265 Tested by: dt



Max Dry Density

106.5 lbs./cu.ft.

Optimum Moisture

18.2%

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
NHU-5-200(025)095			
Offset From Centerline		Type of Soil	
AASTHO Designation **T-180**	Date **8/1/2016**		**705**

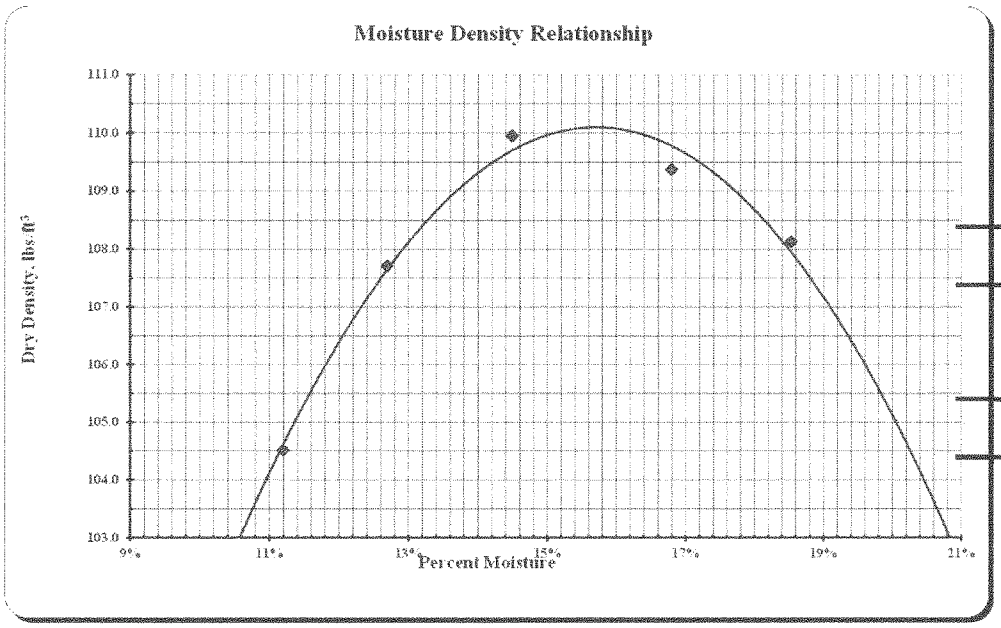
Density		Test Count	5				
Determination No.		1	2	3	4	5	6
A Volume of Mold	cu. ft.	0.0333	0.0333	0.0333	0.0333	0.0333	0.0333
	lbs.	8.30	8.47	8.62	8.69	8.70	
C Weight of Mold	lbs.	4.43	4.43	4.43	4.43	4.43	4.43
D Weight of Compacted Soil = B - C	lbs.	3.87	4.04	4.19	4.25	4.27	
E Wet Density = D / A	lbs./cu.ft.	116.2	121.4	125.9	127.7	128.2	
F Dry Density = (E x 100) / (100 + L)	lbs./cu.ft.	**104.5**	**107.7**	**110.0**	**109.4**	**108.1**	**#VALUE!**

Moisture Content

AASHTO T99 or T180 Tested by:

Container No.		6	7	8	9	10	
G Wet Weight / Container	grams	155.3	154.4	157.9	160.3	149.3	
H Dry Weight / Container	grams	143.4	141.1	142.6	142.6	131.7	
I Moisture Loss = G - H	grams	11.9	13.3	15.3	17.7	17.6	
J Tare Weight of Container	grams	37.1	36.3	37.0	37.2	36.7	
K Dry Soil = H - J	grams	106.3	104.8	105.6	105.4	95.0	
L %Moisture = (I / K) x 100	%	**11.2%**	**12.7%**	**14.5%**	**16.8%**	**18.5%**	

ASTM D4643 AASHTO T217 or T265 Tested by: dt



Max Dry Density

110.1 lbs./cu.ft.

Optimum Moisture

15.7%

MOISTURE-DENSITY RELATIONS OF SOILS

North Dakota Department Of Transportation, Materials & Research Division

SFN 10063 (Rev. 03-2006)

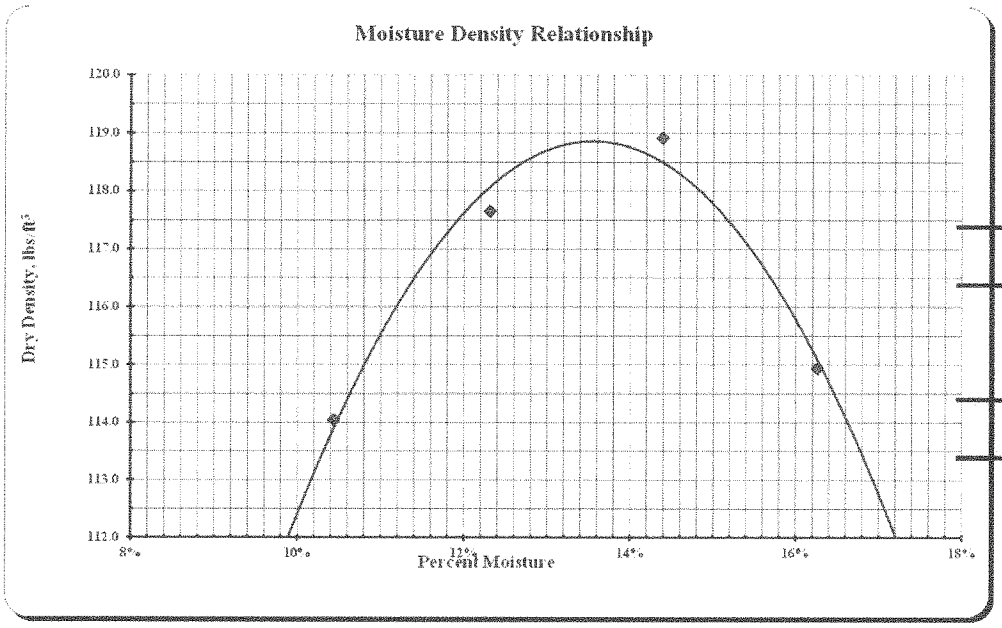
Project No.	PCN	Station	Depth Below Grade
NHU-5-200(025)095			
Offset From Centerline		Type of Soil	
AASTHO Designation **T-180**	Date **8/1/2016**		**706**

Density		Test Count	4				
Determination No.		1	2	3	4	5	6
A Volume of Mold	cu. ft.	0.0333	0.0333	0.0333	0.0333	0.0333	0.0333
	lbs.	8.63	8.83	8.96	8.88		
C Weight of Mold	lbs.	4.43	4.43	4.43	4.43	4.43	4.43
D Weight of Compacted Soil = B - C	lbs.	4.19	4.40	4.53	4.45		
E Wet Density = D / A	lbs./cu.ft.	125.9	132.1	136.0	133.6		
F Dry Density = (E x 100) / (100 + L)	lbs./cu.ft.	**114.0**	**117.7**	**118.9**	**114.9**	**#VALUE!**	**#VALUE!**

Moisture Content AASHTO T99 or T180 Tested by:

Container No.		11	12	13	14		
G Wet Weight / Container	grams	158.9	161.0	160.3	148.0		
H Dry Weight / Container	grams	147.4	147.4	144.8	132.6		
I Moisture Loss = G - H	grams	11.5	13.6	15.5	15.4		
J Tare Weight of Container	grams	37.2	36.9	37.1	37.9		
K Dry Soil = H - J	grams	110.2	110.5	107.7	94.7		
L %Moisture = (I / K) x 100	%	**10.4%**	**12.3%**	**14.4%**	**16.3%**		

ASTM D4643 AASHTO T217 or T265 Tested by: dt



Max Dry Density

118.9 lbs./cu.ft.

Optimum Moisture

13.5%

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
NHU-5-200(025)095			
Offset From Centerline		Type of Soil	
AASTHO Designation **T-180**	Date **8/1/2016**		**707**

Density

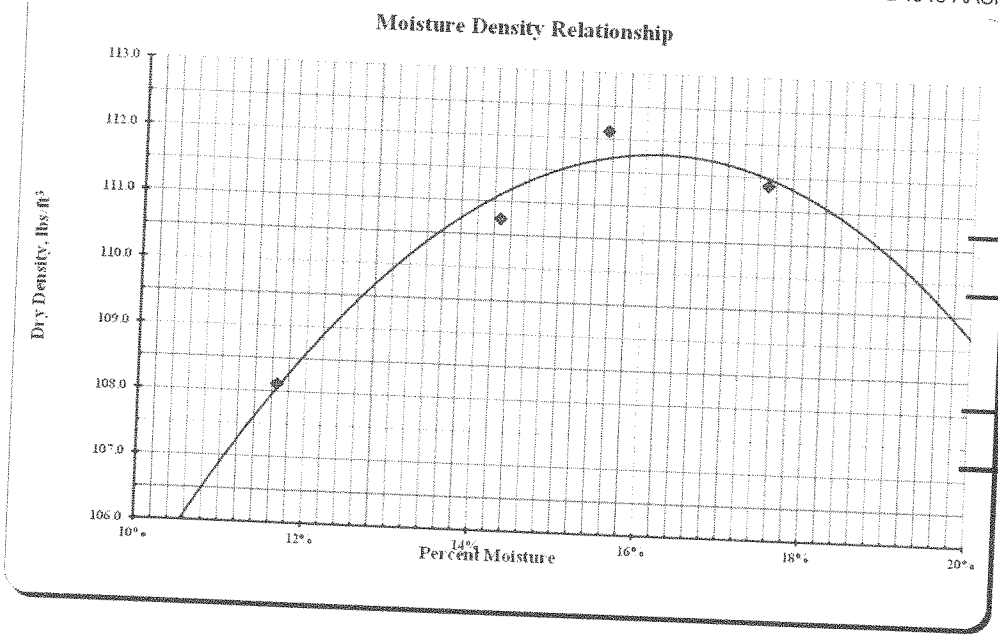
	Test Count	4					
	Determination No.	1	2	3	4	5	6
A Volume of Mold	cu. ft.	0.0333	0.0333	0.0333	0.0333	0.0333	0.0333
	lbs.	8.45	8.64	8.75	8.79		
C Weight of Mold	lbs.	4.43	4.43	4.43	4.43	4.43	4.43
D Weight of Compacted Soil = B - C	lbs.	4.02	4.21	4.31	4.36		
E Wet Density = D / A	lbs./cu.ft.	120.7	126.5	129.5	130.9		
F Dry Density = (E x 100) / (100 + L)	lbs./cu.ft.	**108.1**	**110.7**	**112.1**	**111.4**	**#VALUE!**	**#VALUE!**

Moisture Content

AASHTO T99 or T180 Tested by:

	Container No.	15	16	17	18		
G Wet Weight / Container	grams	138.8	154.9	152.0	164.0		
H Dry Weight / Container	grams	128.2	140.2	136.5	145.1		
I Moisture Loss = G - H	grams	10.6	14.7	15.5	18.9		
J Tare Weight of Container	grams	37.3	37.2	36.8	37.1		
K Dry Soil = H - J	grams	90.9	103.0	99.7	108.0		
L %Moisture = (I / K) x 100	%	**11.7%**	**14.3%**	**15.5%**	**17.5%**		

ASTM D4643 AASHTO T217 or T265 Tested by: dt



Max Dry Density

111.8 lbs./cu ft.

Optimum Moisture

16.2%

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
NHU-5-200(025)095			
Offset From Centerline		Type of Soil	
AASTHO Designation **T-180**	Date **8/1/2016**		**708**

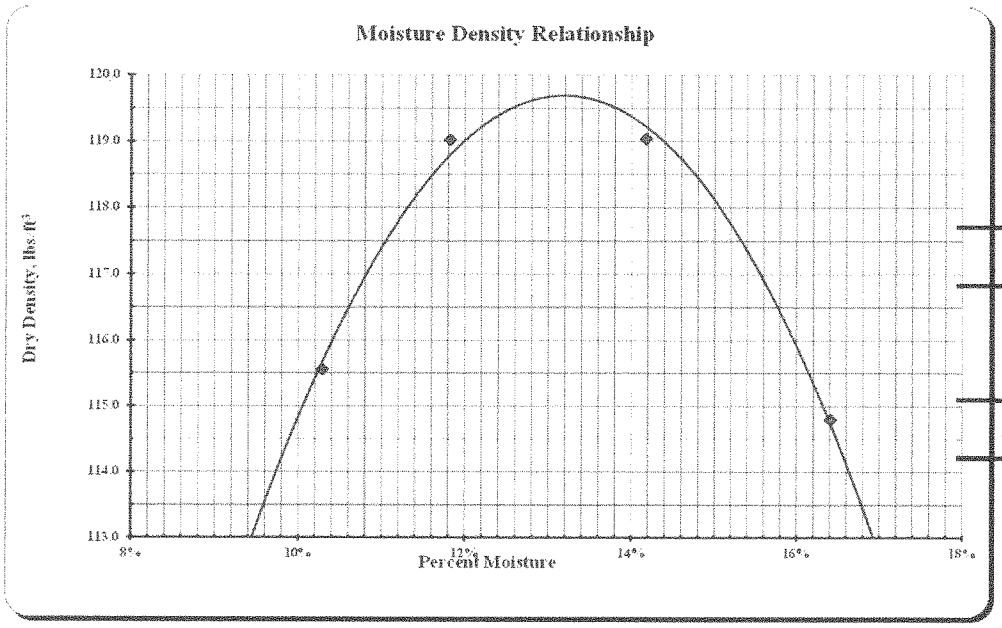
Density		Test Count	4				
Determination No.		1	2	3	4	5	6
A Volume of Mold	cu. ft.	0.0333	0.0333	0.0333	0.0333	0.0333	0.0333
	lbs.	8.68	8.86	8.96	8.88		
C Weight of Mold	lbs.	4.43	4.43	4.43	4.43	4.43	4.43
D Weight of Compacted Soil = B - C	lbs.	4.24	4.43	4.53	4.45		
E Wet Density = D / A	lbs./cu.ft.	127.4	133.1	135.9	133.6		
F Dry Density = (E x 100) / (100 + L)	lbs./cu.ft.	**115.6**	**119.0**	**119.0**	**114.8**	**#VALUE!**	**#VALUE!**

Moisture Content

AASHTO T99 or T180 Tested by:

Container No.		19	20	21	22		
G Wet Weight / Container	grams	164.7	166.1	171.6	149.8		
H Dry Weight / Container	grams	152.8	152.4	154.9	133.9		
I Moisture Loss = G - H	grams	11.9	13.7	16.7	15.9		
J Tare Weight of Container	grams	37.1	36.5	37.1	37.0		
K Dry Soil = H - J	grams	115.7	115.9	117.8	96.9		
L %Moisture = (I / K) x 100	%	**10.3%**	**11.8%**	**14.2%**	**16.4%**		

ASTM D4643 AASHTO T217 or T265 Tested by: dt



Max Dry Density

119.7 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
NHU-5-200(025)095			
Offset From Centerline		Type of Soil	
AASTHO Designation **T-180**	Date **8/1/2016**		**709**

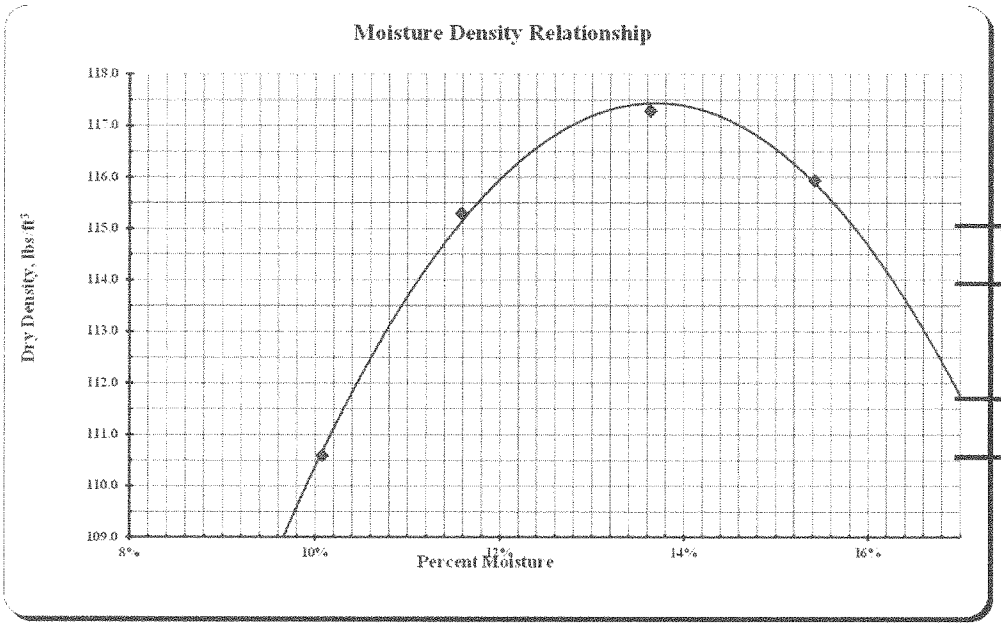
Density		Test Count	4				
Determination No.		1	2	3	4	5	6
A Volume of Mold	cu. ft.	0.0333	0.0333	0.0333	0.0333	0.0333	0.0333
	lbs.	8.49	8.71	8.87	8.89		
C Weight of Mold	lbs.	4.43	4.43	4.43	4.43	4.43	4.43
D Weight of Compacted Soil = B - C	lbs.	4.05	4.28	4.44	4.46		
E Wet Density = D / A	lbs./cu.ft.	121.7	128.6	133.3	133.8		
F Dry Density = (E x 100) / (100 + L)	lbs./cu.ft.	**110.6**	**115.3**	**117.3**	**115.9**	**#VALUE!**	**#VALUE!**

Moisture Content

AASHTO T99 or T180 Tested by:

Container No.		23	24	25	26		
G Wet Weight / Container	grams	151.0	148.0	153.9	138.7		
H Dry Weight / Container	grams	140.6	136.5	139.9	125.1		
I Moisture Loss = G - H	grams	10.4	11.5	14.0	13.6		
J Tare Weight of Container	grams	37.4	37.2	37.2	36.9		
K Dry Soil = H - J	grams	103.2	99.3	102.7	88.2		
L %Moisture = (I / K) x 100	%	**10.1%**	**11.6%**	**13.6%**	**15.4%**		

ASTM D4643 AASHTO T217 or T265 Tested by: dt



Max Dry Density

117.4 lbs./cu.ft.

Optimum Moisture

13.7%

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
NHU-5-200(025)095			
Offset From Centerline		Type of Soil	
AASTHO Designation **T-180**	Date **8/1/2016**		**710**

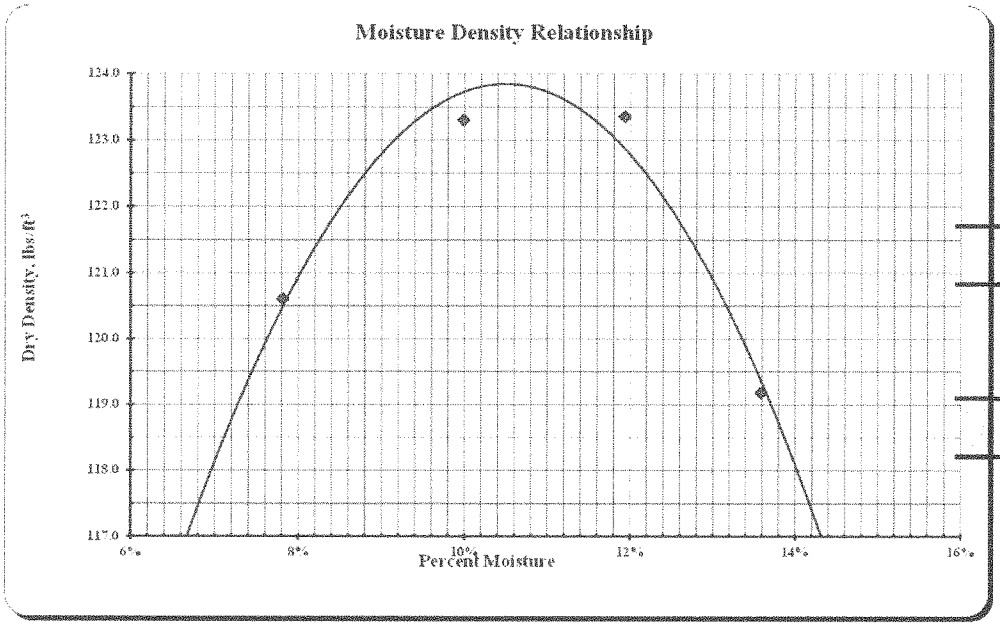
Density		Test Count	4				
Determination No.		1	2	3	4	5	6
A Volume of Mold	cu. ft.	0.0333	0.0333	0.0333	0.0333	0.0333	0.0333
	lbs.	8.76	8.95	9.03	8.94		
C Weight of Mold	lbs.	4.43	4.43	4.43	4.43	4.43	4.43
D Weight of Compacted Soil = B - C	lbs.	4.33	4.52	4.60	4.51		
E Wet Density = D / A	lbs./cu.ft.	130.0	135.6	138.1	135.4		
F Dry Density = (E x 100) / (100 + L)	lbs./cu.ft.	**120.6**	**123.3**	**123.4**	**119.2**	**#VALUE!**	**#VALUE!**

Moisture Content

AASHTO T99 or T180 Tested by:

Container No.		27	28	29	30		
G Wet Weight / Container	grams	160.9	168.3	158.2	157.5		
H Dry Weight / Container	grams	151.9	156.4	145.3	143.1		
I Moisture Loss = G - H	grams	9.0	11.9	12.9	14.4		
J Tare Weight of Container	grams	36.7	37.2	37.2	37.1		
K Dry Soil = H - J	grams	115.2	119.2	108.1	106.0		
L %Moisture = (I / K) x 100	%	**7.8%**	**10.0%**	**11.9%**	**13.6%**		

ASTM D4643 AASHTO T217 or T265 Tested by: dt



Max Dry Density

123.8 lbs./cu.ft.

Optimum Moisture

10.5%

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
NHU-5-200(025)095			
Offset From Centerline		Type of Soil	
AASTHO Designation **T-180**	Date **8/2/2016**		**711**

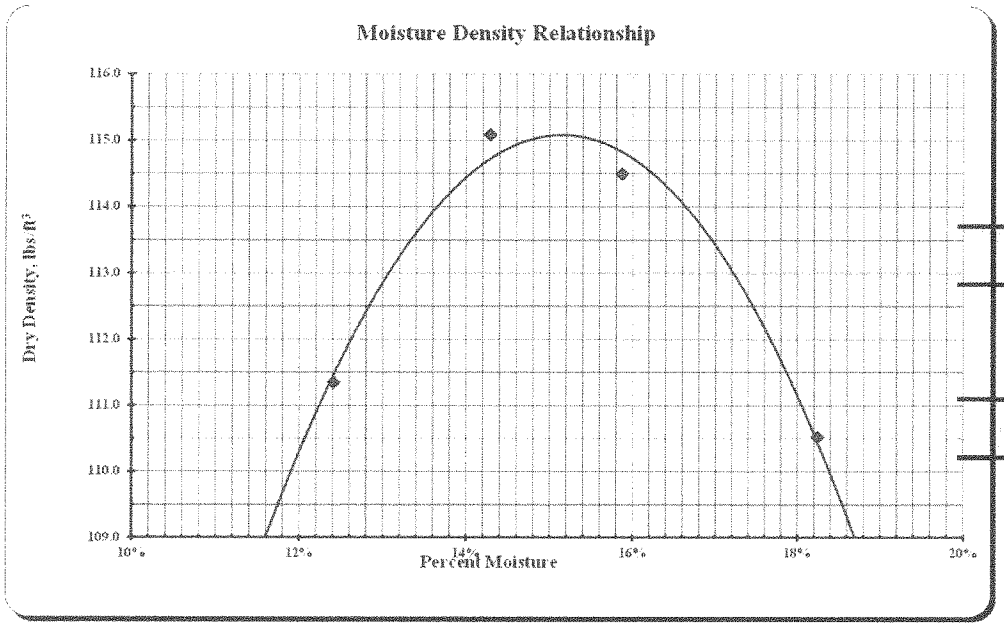
Density		Test Count	4				
Determination No.		1	2	3	4	5	6
A Volume of Mold	cu. ft.	0.0333	0.0333	0.0333	0.0333	0.0333	0.0333
	lbs	8.60	8.81	8.85	8.78		
C Weight of Mold	lbs.	4.43	4.43	4.43	4.43	4.43	4.43
D Weight of Compacted Soil = B - C	lbs.	4.17	4.38	4.42	4.35		
E Wet Density = D / A	lbs./cu.ft.	125.2	131.5	132.7	130.7		
F Dry Density = (E x 100) / (100 + L)	lbs./cu.ft.	**111.3**	**115.1**	**114.5**	**110.5**	**#VALUE!**	**#VALUE!**

Moisture Content

AASHTO T99 or T180 Tested by:

Container No.		31	32	33	34		
G Wet Weight / Container	grams	144.8	162.5	168.5	141.7		
H Dry Weight / Container	grams	132.9	146.8	150.5	125.7		
I Moisture Loss = G - H	grams	11.9	15.7	18.0	16.0		
J Tare Weight of Container	grams	37.0	36.9	37.1	38.0		
K Dry Soil = H - J	grams	95.9	109.9	113.4	87.7		
L %Moisture = (I / K) x 100	%	**12.4%**	**14.3%**	**15.9%**	**18.2%**		

ASTM D4643 AASHTO T217 or T265 Tested by: dt



Max Dry Density

115.1 lbs./cu.ft.

Optimum Moisture

15.1%

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
NHU-5-200(025)095			
Offset From Centerline		Type of Soil	
AASTHO Designation	Date		
T-180	**8/2/2016**		**712**

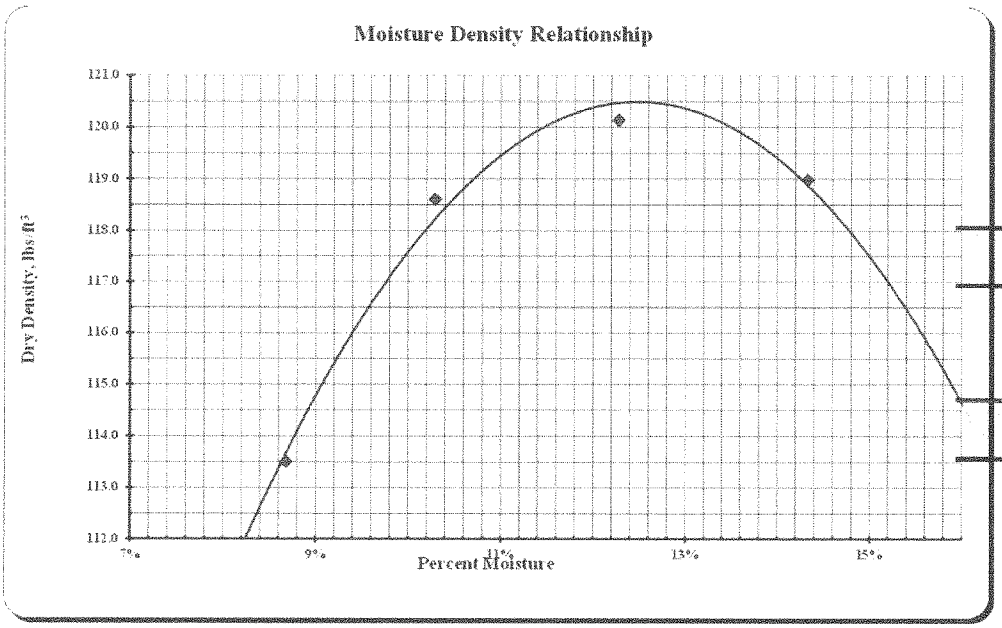
Density		Test Count	4				
	Determination No.	1	2	3	4	5	6
A Volume of Mold	cu. ft.	0.0333	0.0333	0.0333	0.0333	0.0333	0.0333
	lbs.	8.54	8.79	8.92	8.96		
C Weight of Mold	lbs.	4.43	4.43	4.43	4.43	4.43	4.43
D Weight of Compacted Soil = B - C	lbs.	4.11	4.36	4.49	4.53		
E Wet Density = D / A	lbs./cu.ft.	123.4	130.8	134.9	136.0		
F Dry Density = (E x 100) / (100 + L)	lbs./cu.ft.	**113.5**	**118.6**	**120.1**	**119.0**	**#VALUE!**	**#VALUE!**

Moisture Content

AASHTO T99 or T180 Tested by:

Container No.		35	36	37	38		
G Wet Weight / Container	grams	152.7	165.8	152.5	144.6		
H Dry Weight / Container	grams	143.5	153.8	139.9	131.1		
I Moisture Loss = G - H	grams	9.2	12.0	12.6	13.5		
J Tare Weight of Container	grams	37.5	37.2	37.3	36.9		
K Dry Soil = H - J	grams	106.0	116.6	102.6	94.2		
L %Moisture = (I / K) x 100	%	**8.7%**	**10.3%**	**12.3%**	**14.3%**		

ASTM D4643 AASHTO T217 or T265 Tested by: dt



Max Dry Density

120.5 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
NHU-5-200(025)095			
Offset From Centerline		Type of Soil	
AASTHO Designation	Date		
T-180	**8/2/2016**		**713**

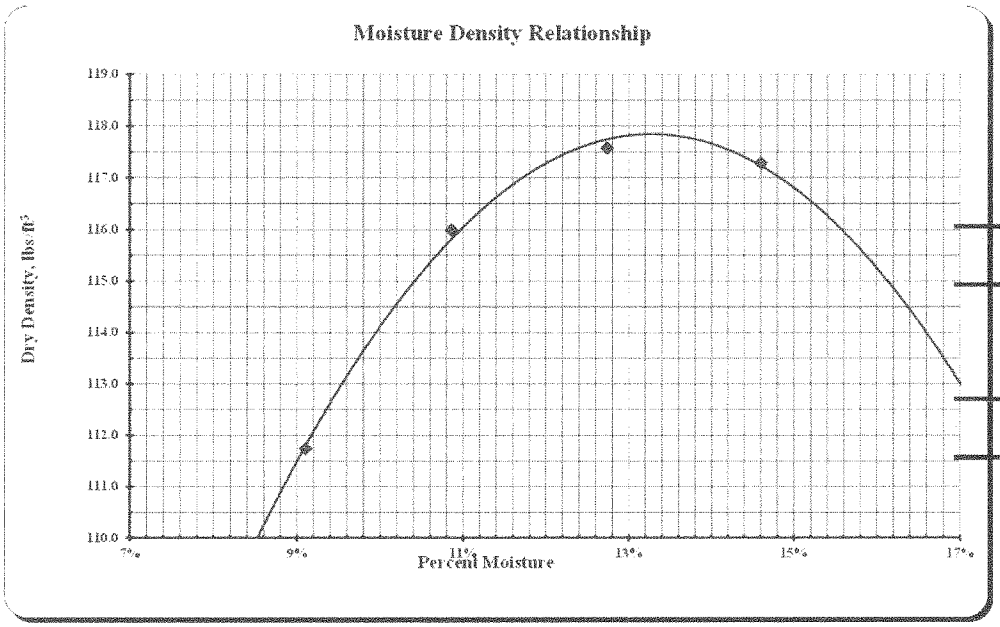
Density		Test Count	4				
	Determination No.	1	2	3	4	5	6
A Volume of Mold	cu. ft.	0.0333	0.0333	0.0333	0.0333	0.0333	0.0333
	lbs.	8.49	8.71	8.85	8.91		
C Weight of Mold	lbs.	4.43	4.43	4.43	4.43	4.43	4.43
D Weight of Compacted Soil = B - C	lbs.	4.06	4.28	4.41	4.48		
E Wet Density = D / A	lbs./cu.ft.	121.9	128.6	132.6	134.4		
F Dry Density = (E x 100) / (100 + L)	lbs./cu.ft.	**111.7**	**116.0**	**117.6**	**117.3**	**#VALUE!**	**#VALUE!**

Moisture Content

AASHTO T99 or T180 Tested by:

Container No.		39	40	41	42		
G Wet Weight / Container	grams	154.9	168.8	162.0	145.0		
H Dry Weight / Container	grams	145.1	155.9	147.9	131.2		
I Moisture Loss = G - H	grams	9.8	12.9	14.1	13.8		
J Tare Weight of Container	grams	37.5	37.1	37.2	36.7		
K Dry Soil = H - J	grams	107.6	118.8	110.7	94.5		
L %Moisture = (I / K) x 100	%	**9.1%**	**10.9%**	**12.7%**	**14.6%**		

ASTM D4643 AASHTO T217 or T265 Tested by: dt



Max Dry Density

117.8 lbs./cu.ft.

Optimum Moisture

13.3%

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
NHU-5-200(025)095			
Offset From Centerline		Type of Soil	
AASTHO Designation	Date		
T-180	**8/2/2016**		**714**

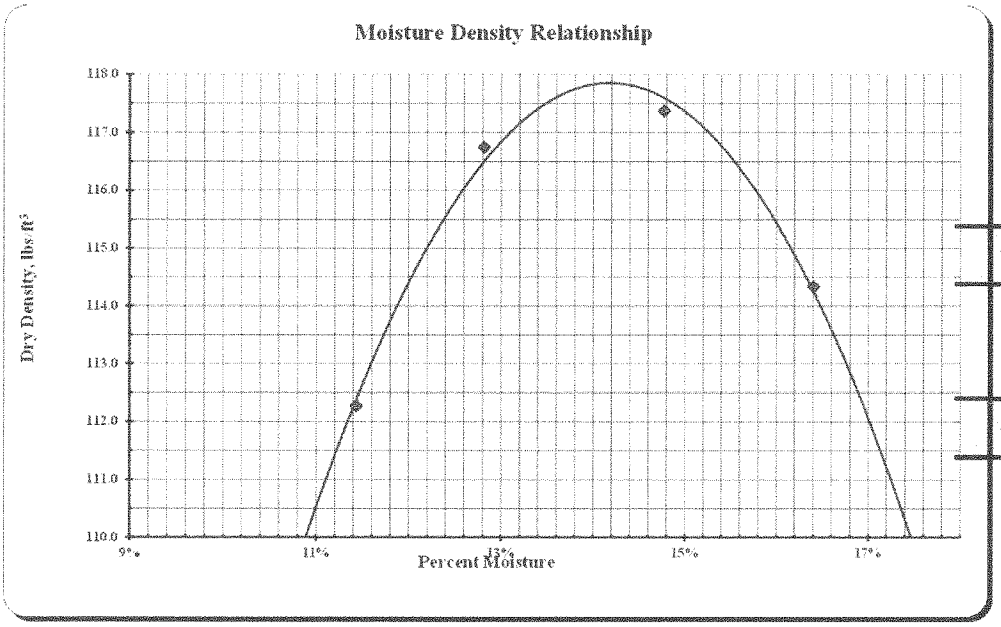
Density		Test Count	4				
Determination No.		1	2	3	4	5	6
A Volume of Mold	cu. ft.	0.0333	0.0333	0.0333	0.0333	0.0333	0.0333
	lbs.	8.60	8.82	8.92	8.86		
C Weight of Mold	lbs.	4.43	4.43	4.43	4.43	4.43	4.43
D Weight of Compacted Soil = B - C	lbs.	4.17	4.39	4.49	4.43		
E Wet Density = D / A	lbs./cu.ft.	125.1	131.7	134.7	133.1		
F Dry Density = (E x 100) / (100 + L)	lbs./cu.ft.	**112.3**	**116.7**	**117.4**	**114.3**	**#VALUE!**	**#VALUE!**

Moisture Content

AASHTO T99 or T180 Tested by:

Container No.		43	44	45	46		
G Wet Weight / Container	grams	149.1	162.0	148.7	162.7		
H Dry Weight / Container	grams	137.6	147.8	134.4	145.0		
I Moisture Loss = G - H	grams	11.5	14.2	14.3	17.7		
J Tare Weight of Container	grams	37.0	37.0	37.6	37.1		
K Dry Soil = H - J	grams	100.6	110.8	96.8	107.9		
L %Moisture = (I / K) x 100	%	**11.4%**	**12.8%**	**14.8%**	**16.4%**		

ASTM D4643 AASHTO T217 or T265 Tested by: dt



Max Dry Density

117.9 lbs./cu.ft.

Optimum Moisture

14.1%

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
NHU-5-200(025)095			
Offset From Centerline		Type of Soil	
AASTHO Designation **T-180**	Date **8/2/2016**		**715**

Density

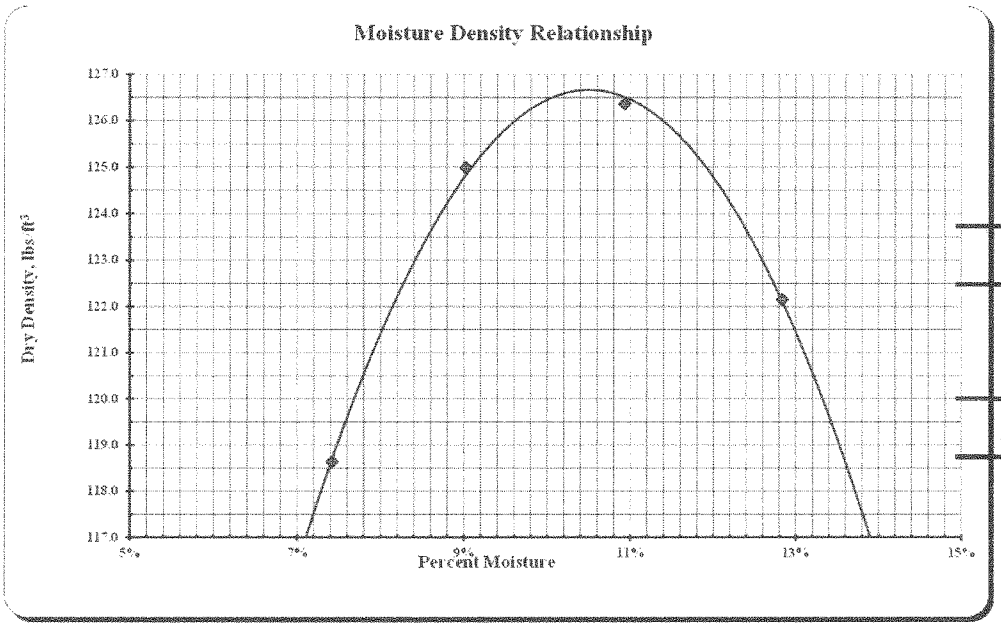
			Test Count	4				
	Determination No.		1	2	3	4	5	6
A	Volume of Mold	cu. ft.	0.0333	0.0333	0.0333	0.0333	0.0333	0.0333
		lbs.	8.68	8.97	9.10	9.02		
C	Weight of Mold	lbs.	4.43	4.43	4.43	4.43	4.43	4.43
D	Weight of Compacted Soil = B - C	lbs.	4.24	4.54	4.67	4.59		
E	Wet Density = D / A	lbs./cu.ft.	127.4	136.3	140.2	137.8		
F	Dry Density = (E x 100) / (100 + L)	lbs./cu.ft.	**118.6**	**125.0**	**126.4**	**122.2**	**#VALUE!**	**#VALUE!**

Moisture Content

AASHTO T99 or T180 Tested by:

	Container No.		47	48	49	50		
G	Wet Weight / Container	grams	155.7	126.5	168.2	150.4		
H	Dry Weight / Container	grams	147.5	119.1	155.3	137.5		
I	Moisture Loss = G - H	grams	8.2	7.4	12.9	12.9		
J	Tare Weight of Container	grams	37.0	37.1	37.3	37.0		
K	Dry Soil = H - J	grams	110.5	82.0	118.0	100.5		
L	%Moisture = (I / K) x 100	%	**7.4%**	**9.0%**	**10.9%**	**12.8%**		

ASTM D4643 AASHTO T217 or T265 Tested by: dt



Max Dry Density

126.7 lbs./cu.ft.

Optimum Moisture

10.5%

MOISTURE-DENSITY RELATIONS OF SOILS

North Dakota Department Of Transportation, Materials & Research Division

SFN 10063 (Rev. 03-2006)

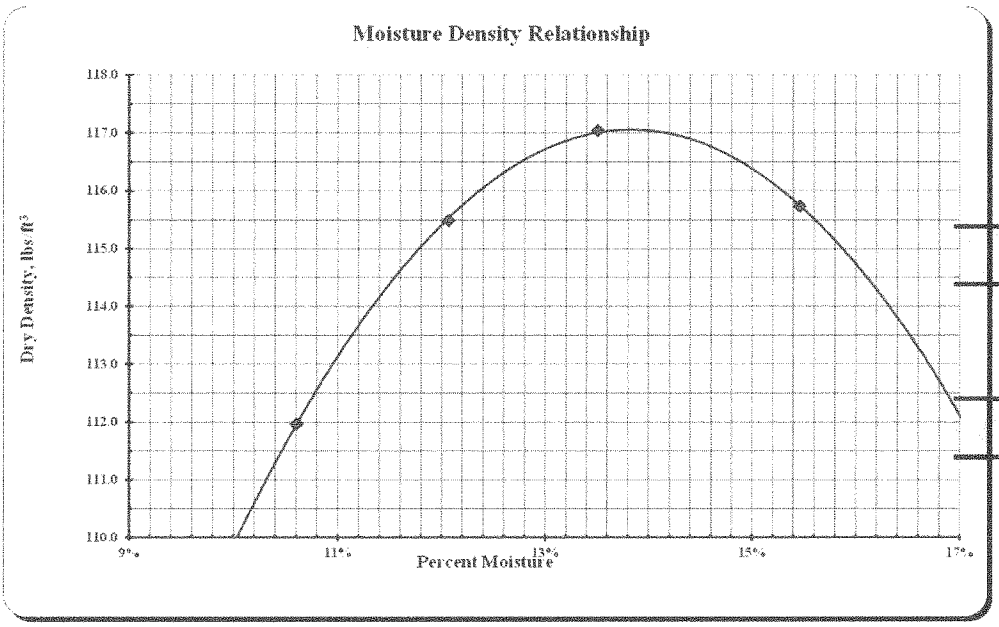
Project No.	PCN	Station	Depth Below Grade
NHU-5-200(025)095			
Offset From Centerline		Type of Soil	
AASTHO Designation **T-180**	Date **8/2/2016**		**716**

Density		Test Count	4				
	Determination No.	1	2	3	4	5	6
A Volume of Mold	cu. ft.	0.0333	0.0333	0.0333	0.0333	0.0333	0.0333
	lbs.	8.56	8.74	8.86	8.88		
C Weight of Mold	lbs.	4.43	4.43	4.43	4.43	4.43	4.43
D Weight of Compacted Soil = B - C	lbs.	4.12	4.31	4.42	4.45		
E Wet Density = D / A	lbs./cu.ft.	123.8	129.4	132.9	133.6		
F Dry Density = (E x 100) / (100 + L)	lbs./cu.ft.	**112.0**	**115.5**	**117.0**	**115.7**	**#VALUE!**	**#VALUE!**

Moisture Content AASHTO T99 or T180 Tested by:

Container No.		51	52	53	54		
G Wet Weight / Container	grams	141.5	153.4	162.3	164.7		
H Dry Weight / Container	grams	131.5	140.9	147.4	147.6		
I Moisture Loss = G - H	grams	10.0	12.5	14.9	17.1		
J Tare Weight of Container	grams	37.2	37.3	37.1	37.0		
K Dry Soil = H - J	grams	94.3	103.6	110.3	110.6		
L %Moisture = (I / K) x 100	%	**10.6%**	**12.1%**	**13.5%**	**15.5%**		

ASTM D4643 AASHTO T217 or T265 Tested by: dt



Max Dry Density

117.1 lbs./cu.ft.

Optimum Moisture

13.8%

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
NHU-5-200(025)095			
Offset From Centerline		Type of Soil	
AASTHO Designation **T-180**	Date **8/2/2016**		**717**

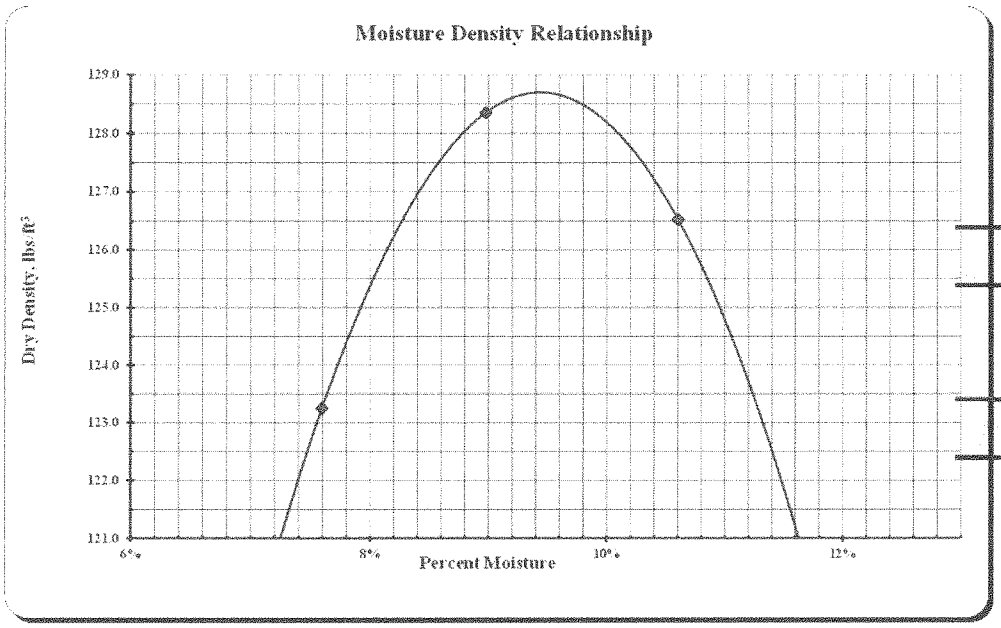
Density		Test Count	3				
	Determination No.	1	2	3	4	5	6
A Volume of Mold	cu. ft.	0.0333	0.0333	0.0333	0.0333	0.0333	0.0333
	lbs.	8.85	9.09	9.09			
C Weight of Mold	lbs.	4.43	4.43	4.43	4.43	4.43	4.43
D Weight of Compacted Soil = B - C	lbs.	4.42	4.66	4.66			
E Wet Density = D / A	lbs./cu.ft.	132.6	139.9	139.9			
F Dry Density = (E x 100) / (100 + L)	lbs./cu.ft.	**123.3**	**128.4**	**126.5**	**#VALUE!**	**#VALUE!**	**#VALUE!**

Moisture Content

AASHTO T99 or T180 Tested by:

Container No.		55	56	57			
G Wet Weight / Container	grams	148.5	150.2	158.3			
H Dry Weight / Container	grams	140.6	140.9	146.7			
I Moisture Loss = G - H	grams	7.9	9.3	11.6			
J Tare Weight of Container	grams	36.6	37.3	37.3			
K Dry Soil = H - J	grams	104.0	103.6	109.4			
L %Moisture = (I / K) x 100	%	**7.6%**	**9.0%**	**10.6%**			

ASTM D4643 AASHTO T217 or T265 Tested by: dt



Max Dry Density

128.7 lbs./cu.ft.

Optimum Moisture

9.4%

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
NHU-5-200(025)095			
Offset From Centerline		Type of Soil	
AASTHO Designation **T-180**	Date **8/2/2016**		**718**

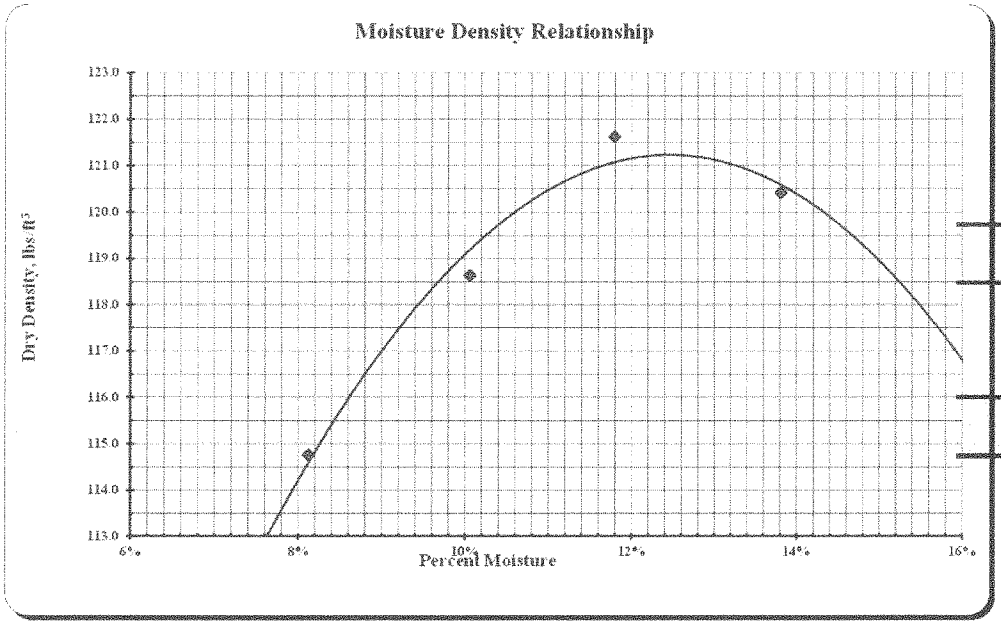
Density		Test Count	4				
Determination No.		1	2	3	4	5	6
A Volume of Mold	cu. ft.	0.0333	0.0333	0.0333	0.0333	0.0333	0.0333
	lbs.	8.56	8.78	8.96	9.00		
C Weight of Mold	lbs.	4.43	4.43	4.43	4.43	4.43	4.43
D Weight of Compacted Soil = B - C	lbs.	4.13	4.35	4.53	4.56		
E Wet Density = D / A	lbs./cu.ft.	124.1	130.6	136.0	137.1		
F Dry Density = (E x 100) / (100 + L)	lbs./cu.ft.	**114.8**	**118.6**	**121.6**	**120.4**	**#VALUE!**	**#VALUE!**

Moisture Content

AASHTO T99 or T180 Tested by:

Container No.		58	59	60	61		
G Wet Weight / Container	grams	160.6	165.2	160.6	160.9		
H Dry Weight / Container	grams	151.3	153.5	147.6	145.9		
I Moisture Loss = G - H	grams	9.3	11.7	13.0	15.0		
J Tare Weight of Container	grams	36.8	37.2	37.4	37.3		
K Dry Soil = H - J	grams	114.5	116.3	110.2	108.6		
L %Moisture = (I / K) x 100	%	**8.1%**	**10.1%**	**11.8%**	**13.8%**		

ASTM D4643 AASHTO T217 or T265 Tested by: dt



Max Dry Density

121.2 lbs./cu.ft.

Optimum Moisture

12.4%

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
NHU-5-200(025)095			
Offset From Centerline		Type of Soil	
AASTHO Designation **T-180**	Date **8/2/2016**		**719**

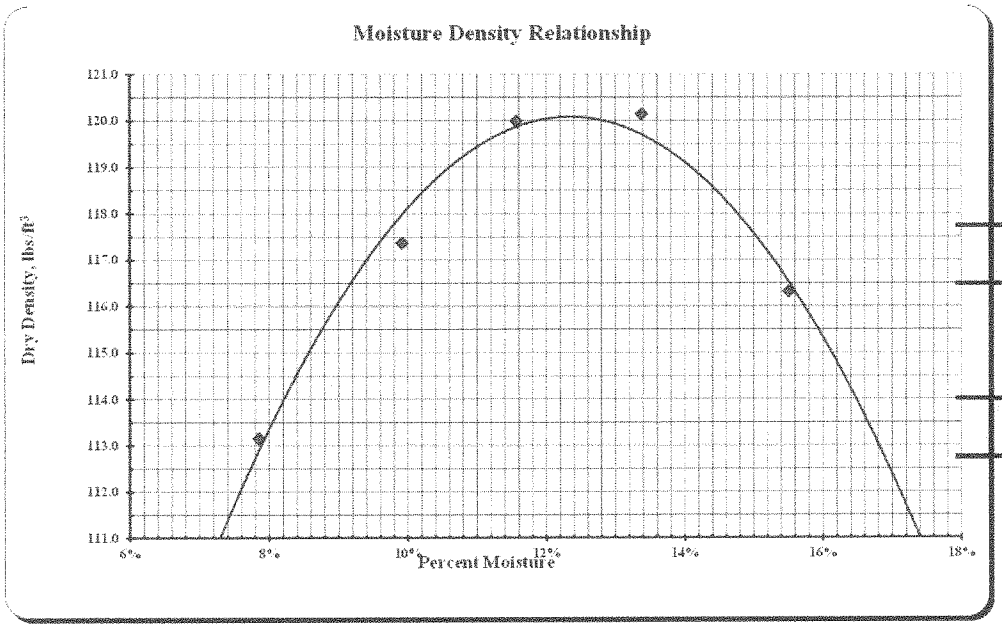
Density		Test Count	5				
Determination No.		1	2	3	4	5	6
A Volume of Mold	cu. ft.	0.0333	0.0333	0.0333	0.0333	0.0333	0.0333
	lbs.	8.50	8.73	8.89	8.97	8.91	
C Weight of Mold	lbs.	4.43	4.43	4.43	4.43	4.43	4.43
D Weight of Compacted Soil = B - C	lbs.	4.06	4.30	4.46	4.54	4.47	
E Wet Density = D / A	lbs./cu.ft.	122.0	129.0	133.9	136.2	134.4	
F Dry Density = (E x 100) / (100 + L)	lbs./cu.ft.	**113.2**	**117.4**	**120.0**	**120.1**	**116.3**	**#VALUE!**

Moisture Content

AASHTO T99 or T180 Tested by:

Container No.		62	63	64	65	66	
G Wet Weight / Container	grams	166.7	167.0	132.8	168.3	167.3	
H Dry Weight / Container	grams	157.3	155.3	122.9	152.9	149.9	
I Moisture Loss = G - H	grams	9.4	11.7	9.9	15.4	17.4	
J Tare Weight of Container	grams	37.6	37.3	37.3	37.8	37.7	
K Dry Soil = H - J	grams	119.7	118.0	85.6	115.1	112.2	
L %Moisture = (I / K) x 100	%	**7.9%**	**9.9%**	**11.6%**	**13.4%**	**15.5%**	

ASTM D4643 AASHTO T217 or T265 Tested by: dt



Max Dry Density

120.1 lbs./cu.ft.

Optimum Moisture

12.4%

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
NHU-5-200(025)095			
Offset From Centerline		Type of Soil	
AASTHO Designation **T-180**	Date **8/2/2016**		**720**

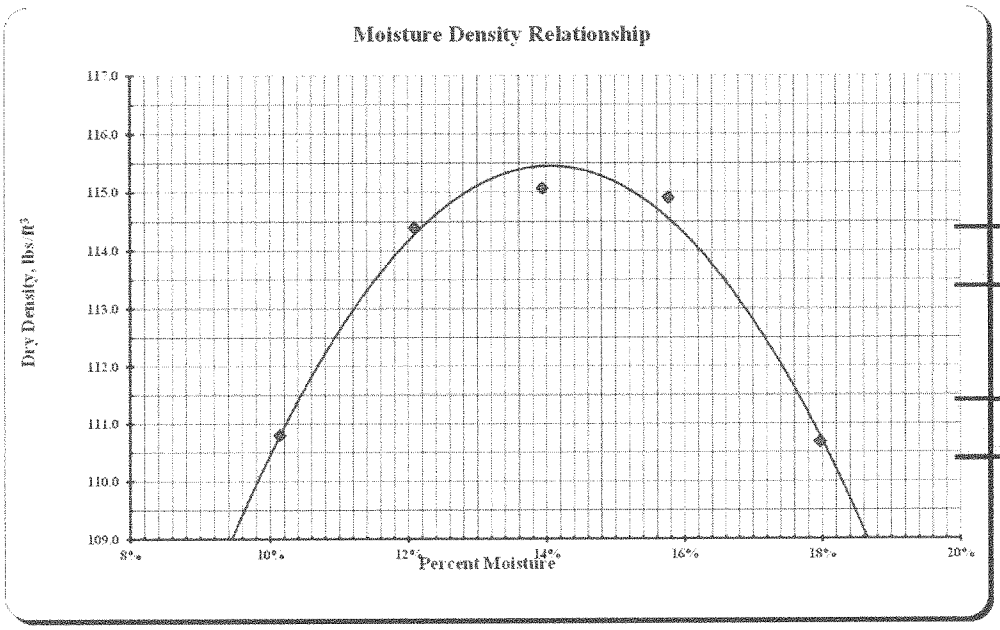
Density — Test Count: 5

	Determination No.		1	2	3	4	5	6
A	Volume of Mold	cu. ft.	0.0333	0.0333	0.0333	0.0333	0.0333	0.0333
		lbs.	8.50	8.70	8.80	8.86	8.78	
C	Weight of Mold	lbs.	4.43	4.43	4.43	4.43	4.43	4.43
D	Weight of Compacted Soil = B - C	lbs.	4.06	4.27	4.37	4.43	4.35	
E	Wet Density = D / A	lbs./cu.ft.	122.0	128.2	131.1	133.0	130.6	
F	Dry Density = (E x 100) / (100 + L)	lbs./cu.ft.	**110.8**	**114.4**	**115.1**	**114.9**	**110.7**	**#VALUE!**

Moisture Content — AASHTO T99 or T180 Tested by:

	Container No.		67	68	69	70	71	
G	Wet Weight / Container	grams	145.8	160.3	155.4	134.5	146.2	
H	Dry Weight / Container	grams	135.8	147.0	141.0	121.3	129.6	
I	Moisture Loss = G - H	grams	10.0	13.3	14.4	13.2	16.6	
J	Tare Weight of Container	grams	37.2	37.0	37.7	37.6	37.2	
K	Dry Soil = H - J	grams	98.6	110.0	103.3	83.7	92.4	
L	%Moisture = (I / K) x 100	%	**10.1%**	**12.1%**	**13.9%**	**15.8%**	**18.0%**	

ASTM D4643 AASHTO T217 or T265 Tested by: dt



Max Dry Density

115.9 lbs./cu.ft.

Optimum Moisture

13.9%

MOISTURE-DENSITY RELATIONS OF SOILS

North Dakota Department Of Transportation, Materials & Research Division

SFN 10063 (Rev. 03-2006)

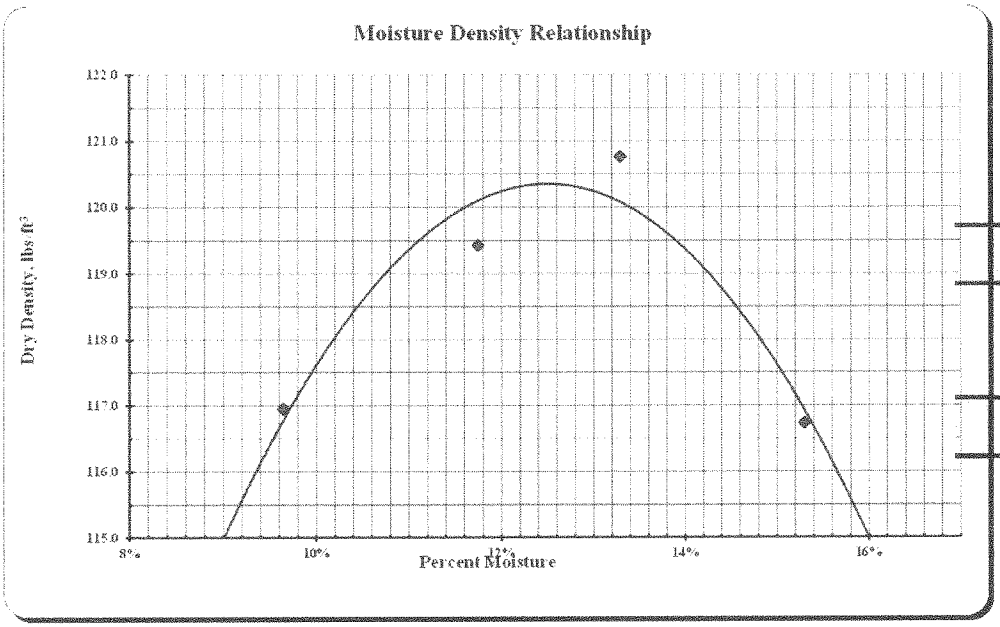
Project No.	PCN	Station	Depth Below Grade
NHU-5-200(025)095			
Offset From Centerline		Type of Soil	
AASTHO Designation **T-180**	Date **8/2/2016**		**721**

Density		Test Count	4				
Determination No.		1	2	3	4	5	6
A Volume of Mold	cu. ft.	0.0333	0.0333	0.0333	0.0333	0.0333	0.0333
	lbs.	8.70	8.87	8.99	8.91		
C Weight of Mold	lbs.	4.43	4.43	4.43	4.43	4.43	4.43
D Weight of Compacted Soil = B - C	lbs.	4.27	4.44	4.56	4.48		
E Wet Density = D / A	lbs./cu.ft.	128.2	133.5	136.8	134.6		
F Dry Density = (E x 100) / (100 + L)	lbs./cu.ft.	**117.0**	**119.4**	**120.8**	**116.7**	**#VALUE!**	**#VALUE!**

Moisture Content AASHTO T99 or T180 Tested by:

Container No.		72	73	74	75		
G Wet Weight / Container	grams	159.5	153.5	164.4	160.9		
H Dry Weight / Container	grams	148.7	141.3	149.5	144.5		
I Moisture Loss = G - H	grams	10.8	12.2	14.9	16.4		
J Tare Weight of Container	grams	36.7	37.4	37.4	37.3		
K Dry Soil = H - J	grams	112.0	103.9	112.1	107.2		
L %Moisture = (I / K) x 100	%	**9.6%**	**11.7%**	**13.3%**	**15.3%**		

ASTM D4643 AASHTO T217 or T265 Tested by: dt



Max Dry Density

120.4 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
NHU-5-200(025)095			
Offset From Centerline		Type of Soil	
AASTHO Designation **T-180**	Date **8/2/2016**		**722**

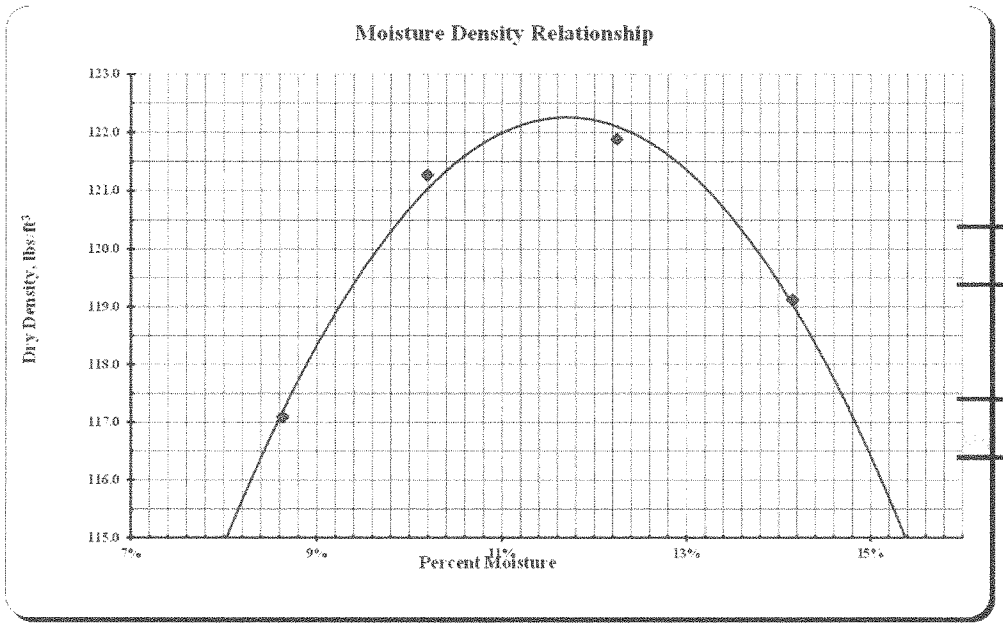
Density		Test Count	4				
Determination No.		1	2	3	4	5	6
A Volume of Mold	cu. ft.	0.0333	0.0333	0.0333	0.0333	0.0333	0.0333
	lbs.	8.67	8.88	8.99	8.96		
C Weight of Mold	lbs.	4.43	4.43	4.43	4.43	4.43	4.43
D Weight of Compacted Soil = B - C	lbs.	4.24	4.45	4.56	4.53		
E Wet Density = D / A	lbs./cu.ft.	127.2	133.6	136.8	136.0		
F Dry Density = (E x 100) / (100 + L)	lbs./cu.ft.	**117.1**	**121.3**	**121.9**	**119.1**	**#VALUE!**	**#VALUE!**

Moisture Content

AASHTO T99 or T180 Tested by:

Container No.		76	77	78	79		
G Wet Weight / Container	grams	148.7	173.0	175.6	168.6		
H Dry Weight / Container	grams	139.9	160.4	160.5	152.3		
I Moisture Loss = G - H	grams	8.8	12.6	15.1	16.3		
J Tare Weight of Container	grams	38.0	36.8	37.2	37.1		
K Dry Soil = H - J	grams	101.9	123.6	123.3	115.2		
L %Moisture = (I / K) x 100	%	**8.6%**	**10.2%**	**12.2%**	**14.1%**		

ASTM D4643 AASHTO T217 or T265 Tested by: dt



Max Dry Density

122.3 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
NHU-5-200(025)095			
Offset From Centerline		Type of Soil	
AASTHO Designation **T-180**	Date **8/2/2016**		**723**

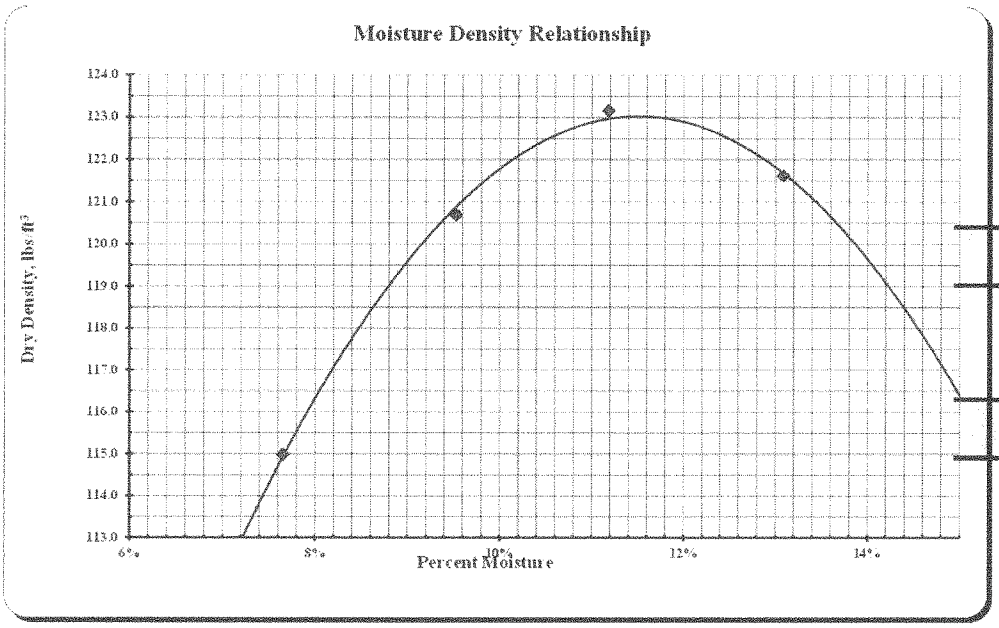
Density		Test Count	4				
Determination No.		1	2	3	4	5	6
A Volume of Mold	cu. ft.	0.0333	0.0333	0.0333	0.0333	0.0333	0.0333
	lbs.	8.55	8.83	8.99	9.01		
C Weight of Mold	lbs.	4.43	4.43	4.43	4.43	4.43	4.43
D Weight of Compacted Soil = B - C	lbs.	4.12	4.40	4.56	4.58		
E Wet Density = D / A	lbs./cu.ft.	123.8	132.2	136.9	137.5		
F Dry Density = (E x 100) / (100 + L)	lbs./cu.ft.	**115.0**	**120.7**	**123.2**	**121.6**	**#VALUE!**	**#VALUE!**

Moisture Content

AASHTO T99 or T180 Tested by:

Container No.		80	81	82	83		
G Wet Weight / Container	grams	162.3	174.6	157.7	158.2		
H Dry Weight / Container	grams	153.4	162.7	145.6	144.2		
I Moisture Loss = G - H	grams	8.9	11.9	12.1	14.0		
J Tare Weight of Container	grams	37.1	37.8	37.4	37.2		
K Dry Soil = H - J	grams	116.3	124.9	108.2	107.0		
L %Moisture = (I / K) x 100	%	**7.7%**	**9.5%**	**11.2%**	**13.1%**		

ASTM D4643 AASHTO T217 or T265 Tested by: dt



Max Dry Density

123.0 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
NHU-5-200(025)095			
Offset From Centerline		Type of Soil	
AASTHO Designation **T-180**	Date **8/2/2016**		**724**

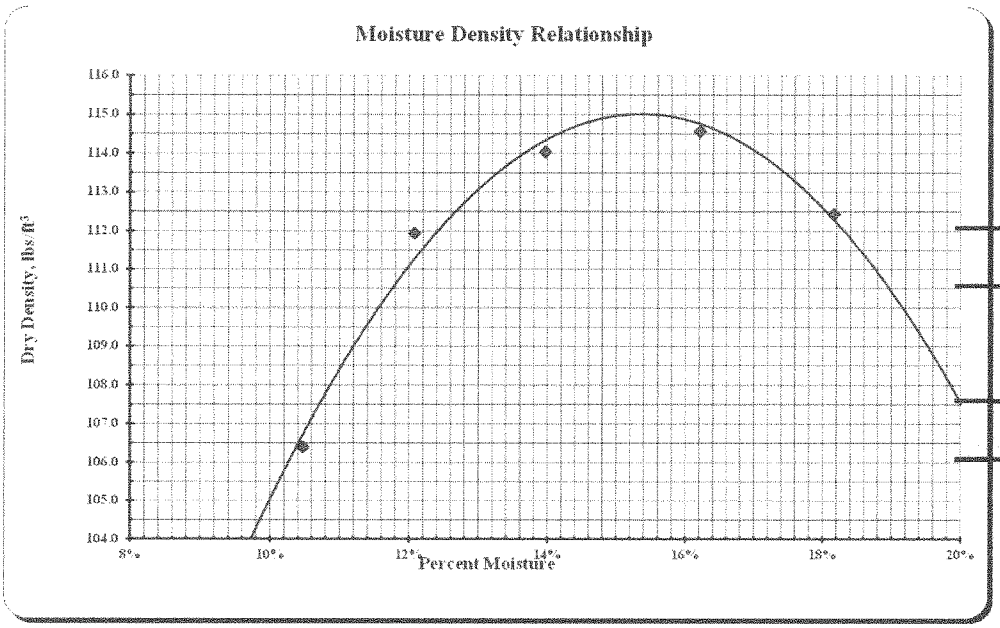
Density		Test Count	5				
Determination No.		1	2	3	4	5	6
A Volume of Mold	cu. ft.	0.0333	0.0333	0.0333	0.0333	0.0333	0.0333
	lbs.	8.35	8.61	8.76	8.87	8.86	
C Weight of Mold	lbs.	4.43	4.43	4.43	4.43	4.43	4.43
D Weight of Compacted Soil = B - C	lbs.	3.91	4.18	4.33	4.43	4.42	
E Wet Density = D / A	lbs./cu.ft.	117.5	125.5	130.0	133.2	132.9	
F Dry Density = (E x 100) / (100 + L)	lbs./cu.ft.	**106.4**	**111.9**	**114.0**	**114.6**	**112.4**	**#VALUE!**

Moisture Content

AASHTO T99 or T180 Tested by:

Container No.		84	85	86	87	88	
G Wet Weight / Container	grams	151.9	164.0	166.5	157.2	160.1	
H Dry Weight / Container	grams	141.0	150.4	150.7	140.5	141.3	
I Moisture Loss = G - H	grams	10.9	13.6	15.8	16.7	18.8	
J Tare Weight of Container	grams	36.9	37.8	37.6	37.5	37.8	
K Dry Soil = H - J	grams	104.1	112.6	113.1	103.0	103.5	
L %Moisture = (I / K) x 100	%	**10.5%**	**12.1%**	**14.0%**	**16.2%**	**18.2%**	

ASTM D4643 AASHTO T217 or T265 Tested by: dt



Max Dry Density

115.0 lbs./cu.ft.

Optimum Moisture

15.4%

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
NHU-5-200(025)095			
Offset From Centerline		Type of Soil	
AASTHO Designation **T-180**	Date **8/2/2016**		**725**

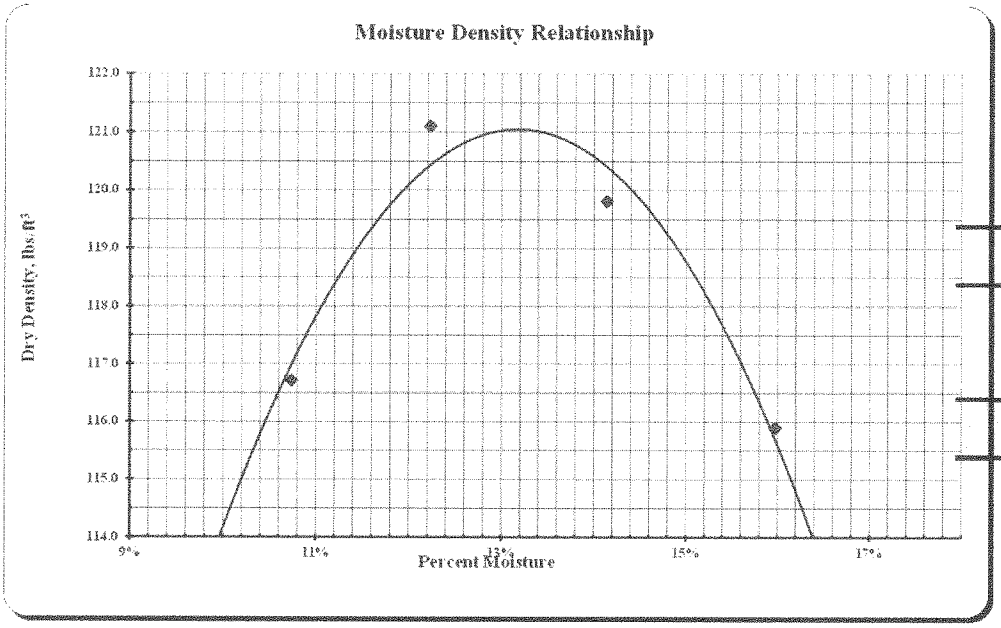
Density		Test Count	4				
Determination No.		1	2	3	4	5	6
A Volume of Mold	cu. ft.	0.0333	0.0333	0.0333	0.0333	0.0333	0.0333
	lbs.	8.74	8.96	8.99	8.91		
C Weight of Mold	lbs.	4.43	4.43	4.43	4.43	4.43	4.43
D Weight of Compacted Soil = B - C	lbs.	4.30	4.53	4.55	4.48		
E Wet Density = D / A	lbs./cu.ft.	129.2	135.9	136.8	134.4		
F Dry Density = (E x 100) / (100 + L)	lbs./cu.ft.	**116.7**	**121.1**	**119.8**	**115.9**	**#VALUE!**	**#VALUE!**

Moisture Content

AASHTO T99 or T180 Tested by:

Container No.		89	90	91	92		
G Wet Weight / Container	grams	145.9	151.7	139.3	160.1		
H Dry Weight / Container	grams	135.4	139.3	126.7	143.2		
I Moisture Loss = G - H	grams	10.5	12.4	12.6	16.9		
J Tare Weight of Container	grams	37.6	37.9	37.6	37.4		
K Dry Soil = H - J	grams	97.8	101.4	89.1	105.8		
L %Moisture = (I / K) x 100	%	**10.7%**	**12.2%**	**14.1%**	**16.0%**		

ASTM D4643 AASHTO T217 or T265 Tested by: dt



Max Dry Density

121.0 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
NHU-5-200(025)095			
Offset From Centerline		Type of Soil	
AASTHO Designation **T-180**	Date **8/2/2016**		**726**

Density — Test Count: 4

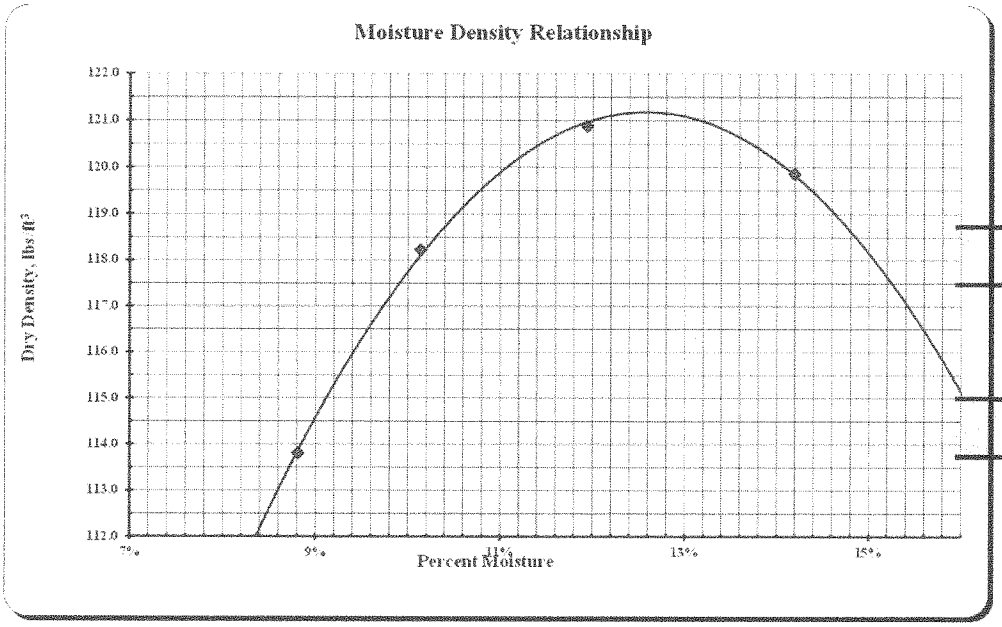
Determination No.		1	2	3	4	5	6
A Volume of Mold	cu. ft.	0.0333	0.0333	0.0333	0.0333	0.0333	0.0333
	lbs.	8.56	8.77	8.94	8.99		
C Weight of Mold	lbs.	4.43	4.43	4.43	4.43	4.43	4.43
D Weight of Compacted Soil = B - C	lbs.	4.12	4.34	4.51	4.56		
E Wet Density = D / A	lbs./cu.ft.	123.8	130.2	135.3	136.9		
F Dry Density = (E x 100) / (100 + L)	lbs./cu.ft.	**113.8**	**118.2**	**120.9**	**119.9**	**#VALUE!**	**#VALUE!**

Moisture Content

AASHTO T99 or T180 Tested by:

Container No.		93	94	95	96		
G Wet Weight / Container	grams	133.9	150.7	152.8	157.9		
H Dry Weight / Container	grams	126.1	140.3	140.5	142.9		
I Moisture Loss = G - H	grams	7.8	10.4	12.3	15.0		
J Tare Weight of Container	grams	37.6	37.7	37.5	37.2		
K Dry Soil = H - J	grams	88.5	102.6	103.0	105.7		
L %Moisture = (I / K) x 100	%	**8.8%**	**10.1%**	**11.9%**	**14.2%**		

ASTM D4643 AASHTO T217 or T265 Tested by: dt



Max Dry Density

121.2 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
NHU-5-200(025)095			
Offset From Centerline		Type of Soil	
AASTHO Designation **T-180**	Date **8/2/2016**		**727**

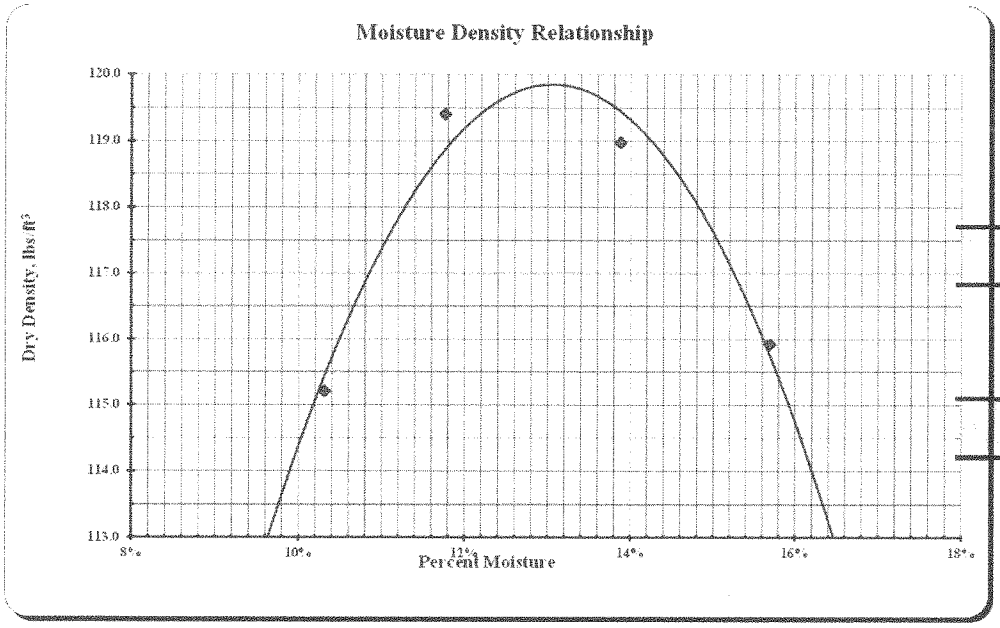
Density		Test Count	4				
Determination No.		1	2	3	4	5	6
A Volume of Mold	cu. ft.	0.0333	0.0333	0.0333	0.0333	0.0333	0.0333
	lbs.	8.66	8.87	8.94	8.90		
C Weight of Mold	lbs.	4.43	4.43	4.43	4.43	4.43	4.43
D Weight of Compacted Soil = B - C	lbs.	4.23	4.44	4.51	4.47		
E Wet Density = D / A	lbs./cu.ft.	127.1	133.5	135.5	134.1		
F Dry Density = (E x 100) / (100 + L)	lbs./cu.ft.	**115.2**	**119.4**	**119.0**	**115.9**	**#VALUE!**	**#VALUE!**

Moisture Content

AASHTO T99 or T180 Tested by:

Container No.		97	98	99	100		
G Wet Weight / Container	grams	144.7	142.0	177.1	147.8		
H Dry Weight / Container	grams	134.7	131.0	160.1	132.8		
I Moisture Loss = G - H	grams	10.0	11.0	17.0	15.0		
J Tare Weight of Container	grams	37.7	37.5	37.6	37.2		
K Dry Soil = H - J	grams	97.0	93.5	122.5	95.6		
L %Moisture = (I / K) x 100	%	**10.3%**	**11.8%**	**13.9%**	**15.7%**		

ASTM D4643 AASHTO T217 or T265 Tested by: dt



Max Dry Density

119.8 lbs./cu.ft.

Optimum Moisture

13.0%

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
NHU-5-200(025)095			
Offset From Centerline		Type of Soil	
AASTHO Designation **T-180**	Date **8/2/2016**		**728**

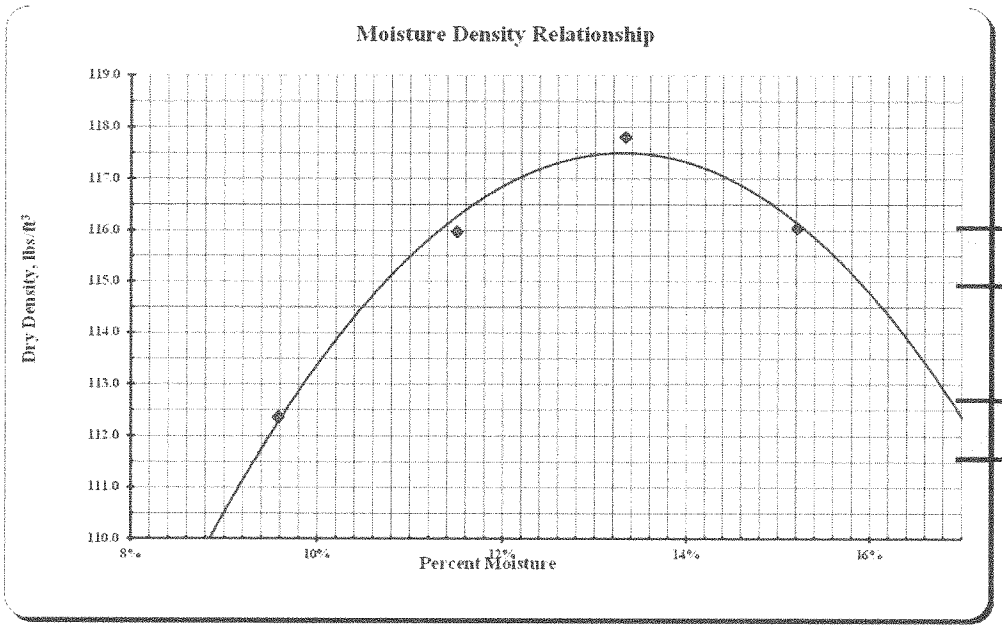
Density		Test Count	4				
Determination No.		1	2	3	4	5	6
A Volume of Mold	cu. ft.	0.0333	0.0333	0.0333	0.0333	0.0333	0.0333
	lbs.	8.53	8.74	8.88	8.88		
C Weight of Mold	lbs.	4.43	4.43	4.43	4.43	4.43	4.43
D Weight of Compacted Soil = B - C	lbs.	4.10	4.31	4.45	4.45		
E Wet Density = D / A	lbs./cu.ft.	123.1	129.3	133.5	133.7		
F Dry Density = (E x 100) / (100 + L)	lbs./cu.ft.	**112.4**	**116.0**	**117.8**	**116.0**	**#VALUE!**	**#VALUE!**

Moisture Content

AASHTO T99 or T180 Tested by:

Container No.		101	102	103	104		
G Wet Weight / Container	grams	168.0	145.3	163.0	142.5		
H Dry Weight / Container	grams	156.6	134.2	148.2	128.6		
I Moisture Loss = G - H	grams	11.4	11.1	14.8	13.9		
J Tare Weight of Container	grams	37.6	37.7	37.2	37.2		
K Dry Soil = H - J	grams	119.0	96.5	111.0	91.4		
L %Moisture = (I / K) x 100	%	**9.6%**	**11.5%**	**13.3%**	**15.2%**		

ASTM D4643 AASHTO T217 or T265 Tested by: dt



Max Dry Density

117.5 lbs./cu.ft.

Optimum Moisture

13.3%