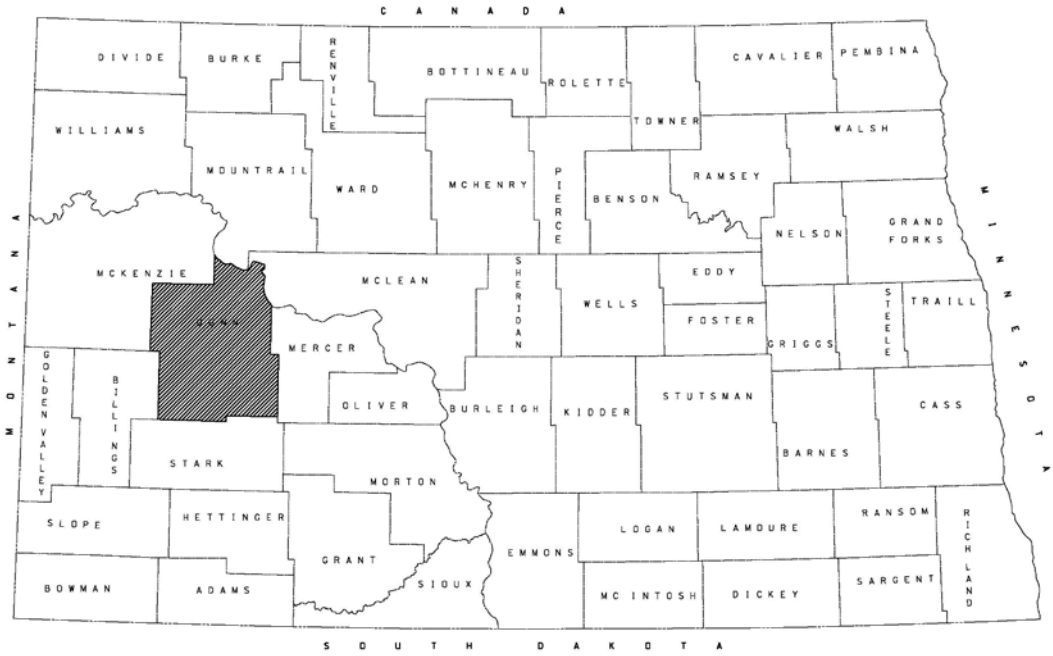
LINEAR SOILS SURVEY AND RECOMMENDATIONS

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, P.E.

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH DIVISION

MAY 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 5/25/16 and the original document is stored at the North Dakota Department of Transportation.

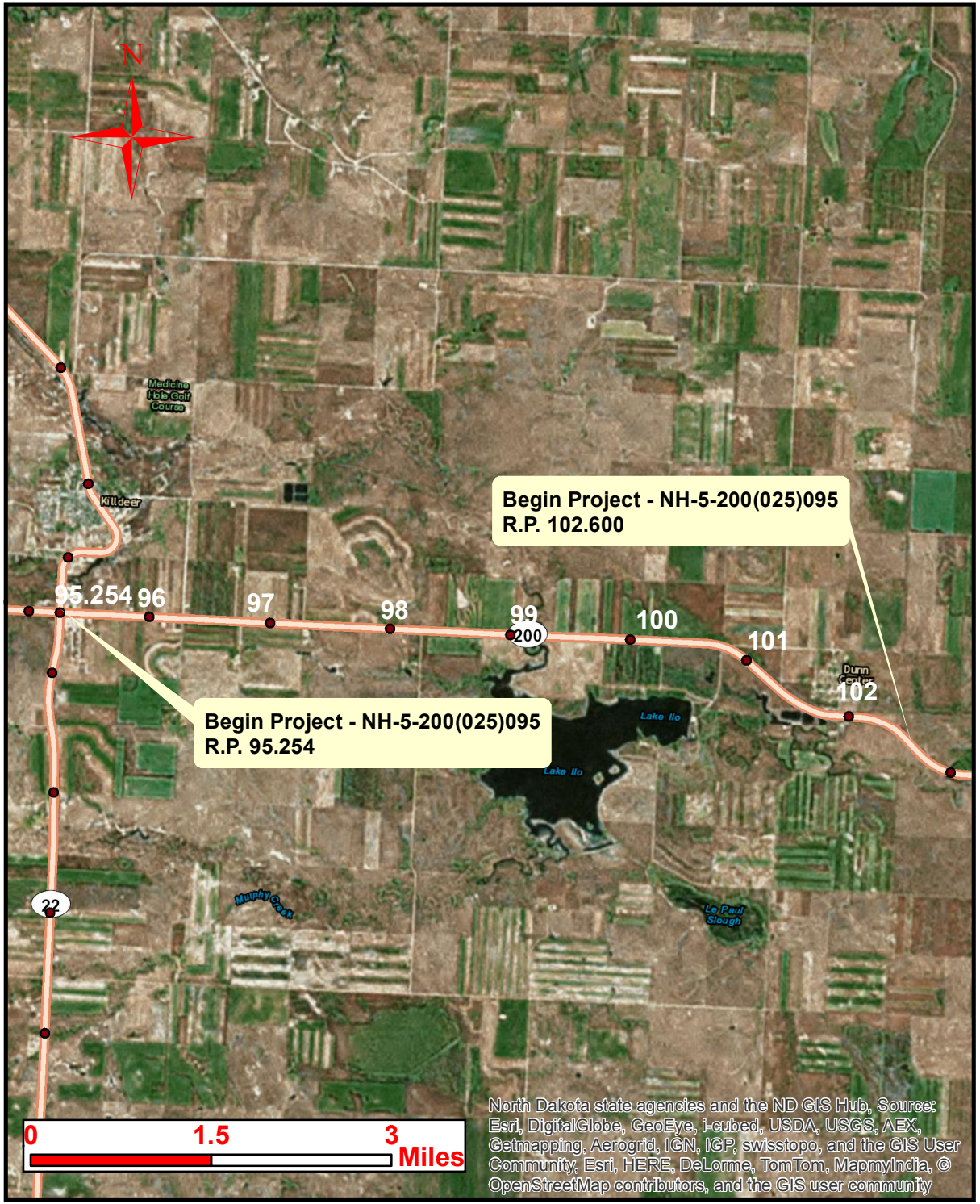
REGISTERED PROFESSIONAL ENGINEER
MATTHEW C. KURLE
PE-8777
DATE 5-25-2016
NORTH DAKOTA

Matthew C. Kurle, P.E.

25 MAY 2016
Date

Linear Soils Report and Recommendation

Project: NH-5-200(025)095
PCN: 19734
Scope: FDR, HBP, Culvert Rehab, Selective Gradeing
Length: 7.35 Miles
Location: JCT HWY 22 Killdeer to E of Dunn Center



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Introduction

Location: Junction Highway 22 in Killdeer to East of Dunn Center
Reference Points: 95.254 to 102.600
Project Length: 7.35 Miles
Proposed Project Scope: Full Depth Reclamation, Hot Bituminous Pavement, Culvert Rehabilitation, Selective Grading
Investigation Scope: 1000' Intervals and Identified Maintenance Areas

Existing Roadway Section

Construction History

Table 1 - Construction History – R.P. 95.254 to R.P. 102.600

Construction History				
Year	Construction	Depth (in)	Width (ft)	Oil
1958	Grade		38.0	
1958	Traffic Service Gravel	3.0	22.0	
1960	Aggregate Base	3.5	36.0	
1960	Emulsified Base	3.5	34.0	SS-1
1960	Hot Bituminous Pavement	2.0	24.0	150-200
1985	Drive Slope Flattening			
1985	Hot Bituminous Pavement	2.0	28.0	120-150
1986	Contract Sand Seal		28.0	AE-150S
2001	Federal Aid Chip Seal		26.0	HFMS-2
2009	Hot Bituminous Pavement	2.0	24.0	PG 58-28

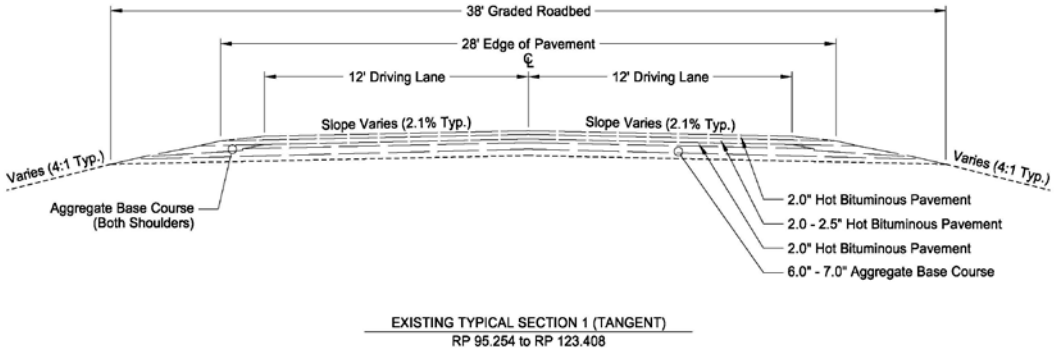

Figure 1 – Existing Typical Section

Existing Roadway Condition

Distress Data

Table 2 – Distress Data, Ride and Average Rut RP 95.0 to RP 102.0

Year	Distress Score	Ride	PRPI	IRI	Average Rut
2015	85	2.43	Fair	136	0.22
2014	85	2.97	Fair	109	0.20
2013	82	3.30	Excl	93	0.10
2012	86	3.52	Good	83	0.18
2011	88	4.05	Good	59	0.10
2010	97	4.19	Good	53	0.09
2009	98	4.32	Good	47	0.07
2008	77	2.47	Fair	134	0.26
2007	75	2.71	Good	122	0.21
2006	76	2.43	Good	136	0.24
2005	79	2.43	Fair	136	0.22

Maintenance Review

Date of Maintenance Review(s): 2/22/2016
Materials and Research Person Conducting the Review: Jamie Naumann
District Maintenance Person Conducting Review: Dave Kuntz, Killdeer Section

The summary of the identified maintenance areas are shown in the following table. This table also includes areas indicated by district personnel that were not identified during the maintenance review. The pavement evaluation log can be found in Appendix B (Subsurface Investigation Scope).

Table 3 - Identified Maintenance Areas

Location RP + Feet	Distress Identified	Drilling Required (Yes or No)
95+1966 to 102+0000	Transverse Cracks	Yes
95+1980 to 96+1590	Rutting – WB Lane	Yes
97+3160 to 98+3700	Rutting – WB Lane	Yes
98+1448 to 98+1513	Rutting – WB Lane	Yes
Lake IIO Bridge 99+1210	Soft Area off of Bridge Ends	Yes
99+5220	Frost Heave	Yes

Summary of Soil Analysis

Soil Sample Distribution

Not all of the soils samples taken during the investigation had laboratory analysis performed. Samples that appeared to be visually and texturally comparable to an adjacent sample location were excluded from laboratory analysis.

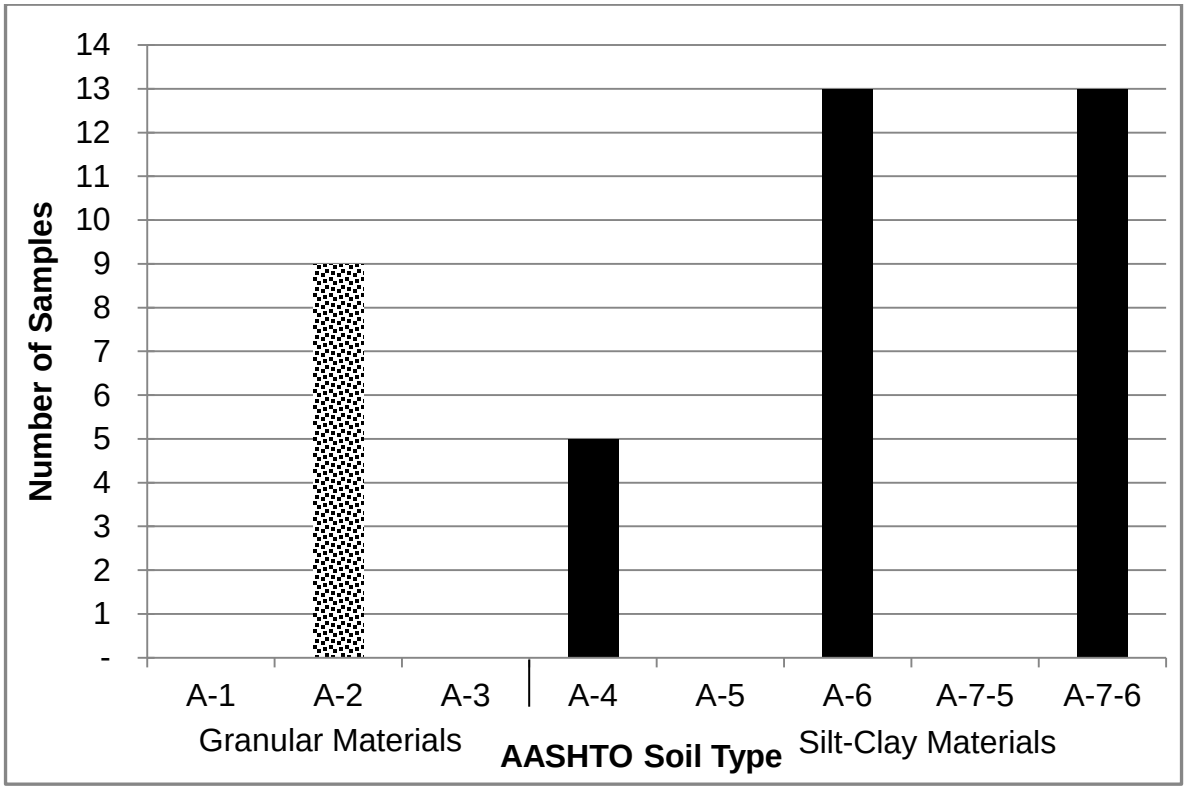

Figure 2 - Soil Sample Distribution

Moisture

The moisture contents provided in this report and summarized below have been obtained from samples taken between 4/12/16 & 4/13/16.

Table 4 - Summary of In-Place and Optimum Moisture Contents

Quantity	AASHTO Classification	In-Place Moisture Range (%)	In-Place Moisture Average (%)	Optimum Moisture Average (%)	Difference Between Average In-Place and Optimum Moistures (%)
9	A-2-4	7.4-22.4	10.3	9.4	0.9
5	A-4	13.4-17.3	14.8	9.2	5.6
13	A-6	12.9-28.6	20.3	11.0	9.3
13	A-7-6	17.9-40.9	24.2	13.6	10.6
12	Unclassified	11.4-26.8	19.6	NA	NA

Table 5 - Summary of In-Place versus Optimum Moisture Content

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)
9	A-2-4	67%	22%	0%	11%	0%
5	A-4	0%	60%	40%	0%	0%
13	A-6	0%	15%	46%	31%	8%
13	A-7-6	0%	23%	15%	54%	8%

Atterberg Limits

Table 6 - 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-4	21-28	23	15-18	17	4-10	7
A-6	31-40	35	16-20	17	13-25	18
A-7-6	41-58	48	17-28	21	22-32	27

Swell Potential

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

Table 7 - Swell Potential

Low (Plasticity Index < 25)	Marginal (25 ≤ Plasticity Index ≤ 35)	High (Plasticity Index > 35)
77%	23%	0%

Frost Susceptibility

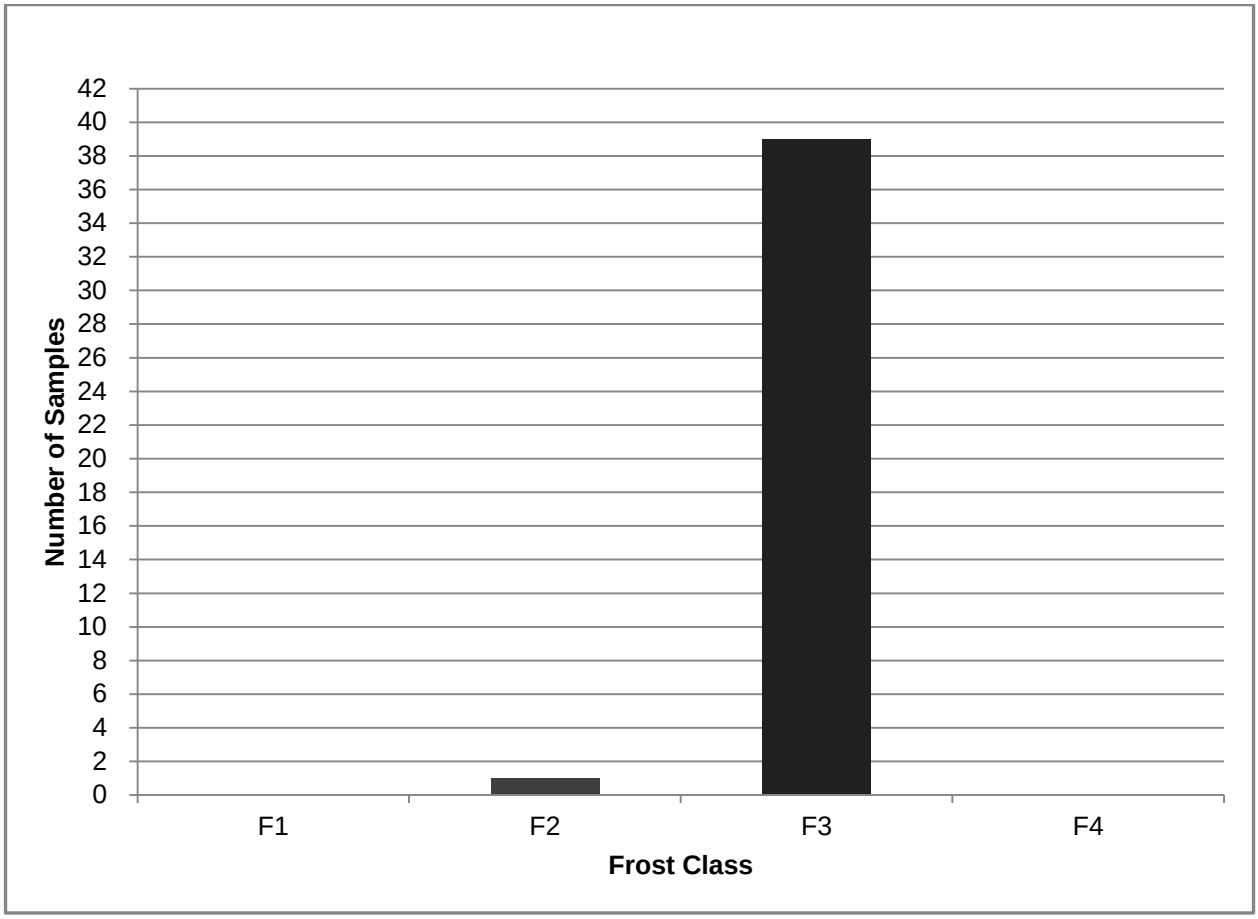

Figure 3 - Frost Susceptibility Distribution

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 8 - Group Indices

AASHTO Classification	Group Index Range	Group Index Average
A-4	0-1	0
A-6	4-16	7
A-7-6	13-31	22

Existing Surface and Base Section at the Boring Locations

The soil borings were performed on 4/12/16 & 4/13/16 using a 6 inch solid flight auger. The following table represents the pavement section as reported in the field log at the boring locations.

Table 9 - Surface and Base Section at the Boring Locations

RP + Feet	Offset	Asphalt Thickness (ft)	Base Thickness (ft)	RP + Feet	Offset	Asphalt Thickness (ft)	Base Thickness (ft)
95+3000	Rt 7 WB	0.9	0.4	99+1312	Rt 9 WB	1.1	0.3
95+4000	Rt 7 WB	0.8	0.5	99+1470	Rt 9 WB	0.8	0.6
96+0000	Rt 7 WB	0.8	0.4	99+1570	Rt 9 WB	0.8	0.6
96+1000	Rt 7 WB	0.8	0.5	99+2000	Rt 9 WB	0.9	0.6
96+2000	Rt 7 WB	0.8	0.5	99+3000	Rt 9 WB	0.8	0.5
96+3000	Rt 7 WB	0.9	0.4	99+4000	Rt 9 WB	0.9	0.4
96+4000	Rt 7 WB	0.8	1.2	99+5096	Rt 9 WB	1.1	0.4
97+0000	Rt 7 WB	0.9	0.5	99+5164	Rt 9 WB	0.9	0.4
97+1000	Rt 7 WB	0.8	0.6	99+5208	Rt 9 WB	0.9	0.6
97+2000	Rt 7 WB	0.8	0.6	99+5243	Rt 9 WB	0.8	0.6
97+3000	Rt 7 WB	0.9	0.5	100+0000	Rt 9 WB	0.8	0.5
97+3400	Rt 7 WB	0.9	0.5	100+1000	Rt 9 WB	0.8	0.5
97+4000	Rt 7 WB	0.9	0.5	100+2000	Rt 9 WB	0.9	1.4
98+0000	Rt 7 WB	1.2	0.3	100+3000	Rt 9 WB	0.8	1.6
98+1000	Rt 7 WB	0.9	0.6	100+4000	Rt 9 WB	1.0	1.3
98+1509	Rt 7 WB	NA	NA	100+5266	Rt 9 WB	0.9	0.9
98+2000	Rt 7 WB	1.1	0.5	101+1000	Rt 9 WB	1.0	0.7
98+3000	Rt 7 WB	0.9	0.5	101+2000	Rt 9 WB	1.0	1.3
98+4000	Rt 7 WB	0.9	0.5	101+3000	Rt 9 WB	1.0	0.8
99+0000	Rt 7 WB	0.9	0.4	101+4000	Rt 9 WB	0.9	0.5
99+0940	Rt 7 WB	1.0	0.5	102+0000	Rt 9 WB	0.8	0.5
99+1048	Rt 7 WB	1.0	0.3	102+1000	Rt 9 WB	0.9	0.4
99+1158	Rt 7 WB	1.2	0.2	102+2000	Rt 9 WB	0.7	0.6
99+1219	Rt 7 WB	1.2	0.3	102+3200	Rt 9 WB	0.8	0.5

*Asphalt and Base thicknesses reported may vary due to the presence of bitumen treated base in the existing pavement/base section.

Design Recommendations

Table 10 – Design Recommendations

Location RP + Feet	Distress Identified	Recommendation*	Justification
95+1966 to 102+0000	Transverse Cracks	Do Nothing	• The transverse cracking is not indicative of any specific subgrade related issues. • Borings were performed at 1000' intervals through entire project.
95+1980 to 96+1590	Rutting – WB Lane	Do Nothing	• Soils consist of granular material (A-2-4) with low moisture content.
97+3160 to 98+3700	Rutting – WB Lane	Do Nothing	• Low group indices and low swell potential in the soils. • Elevated moisture contents in this area. • Project scope of Full Depth Reclamation should correct the problem.
98+1448 to 98+1513	Rutting – WB Lane	Do Nothing	• Clayey type soils (A-7-6) with high group indices with moderate swell potential present. • Project scope of Full Depth Reclamation should correct the problem.
Lake IIO Bridge 99+1210	Soft Area off of Bridge Ends	Do Nothing	• Soils in this area have low group indices and swell potentials. • Distress appears to be typical of bridge ends where the bridge transitions to the pavement section. The subgrade does not appear to be the cause of the distress. • Project scope of Full Depth Reclamation should correct the problem.
99+5220	Frost Heave	Subcut	• Clayey type soils (A-7-6) with high group indices with moderate swell potential present. • Elevated water content in relation to optimum moistures indicate a higher potential for frost lenses to form. • Subcut to 2/3 of extreme frost depth below top of pavement (Extreme Frost Depth = 69" per NOAA). • Subcut depth = 46" Below the top of existing pavement.

*See Design Information Below

Design Information

Compaction Method: T-180

Subgrade Prep: None

Subcut:

Table 11 – Subcut Recommendations

Location RP + Feet	Length	Depth
99+5100 To 100+0000	≈175’	46”

Subcut:
This subcut quantity shall be calculated based on the lengths and depths as shown in Table 13 above and adhere to the guidelines stated below.

Remarks:
Subcut 46” below the top of the existing pavement. Place geogrid (Type G) at the bottom of all subcut excavations and backfill with Class 3 or Class 5 aggregate. Place 12” of aggregate on the geogrid prior to compacting. Do not scarify the bottom of the subcut.

Drainage: None

Plan Notes

None

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

Subsurface Investigation Scope

LINEAR SOILS SURVEY FIELD INVESTIGATION SCOPE

TO:	**File**
FROM:	**Matt Kurle – Materials and Research (Geotechnical)**
DATE:	**3/3/2016**
HIGHWAY:	**200.254**
PROJECT NUMBER:	**NH-5-200(025)095**
PCN:	**19734**
LOCATION:	**ND Hwy 22 in Killdeer (RP 95.254) to east of Dunn Center (RP 102.600)**
IMPROVEMENT SCOPE:	**Mine & Blend/FDR and Widening**
SUBJECT:	**Linear Soils Survey Subsurface Investigation Scope**

We have completed the Maintenance Review of the roadway (attached to this memo) and have circulated it to the Dickinson District for comments. The linear soils survey field investigation scope is based on the improvement strategy for the roadway as per Chapter 7 of the NDDOT Design Manual.

Improvement Strategy: Major Rehabilitation
Investigation Scope: 1000' Intervals and Identified Areas

The Dickinson District provided additional maintenance problem areas during the review phase of the maintenance review. These locations have been added to the proposed subsurface investigation.

The following table shows the proposed subsurface investigation scope.

Boring Location	Justification for Boring	Boring Depth	Location
95+1300 to 102+3200	Major Rehabilitation project	5 feet	Conduct 1 boring every 1000' along Highway 200
95+1980 to 96+1590	District Identified Rutting in WB Lanes Beginning at the Roundabout	5 feet	Conduct additional borings in the rutted areas of the **WB** lanes (4 borings spaced through this area in the ruts) Identify these areas in the boring log.
97+3160 to 98+3700	District Identified Rutting in WB Lanes	5 feet	Conduct additional borings in the rutted areas of the **WB** lanes (4 borings spaced through this area in the ruts) Identify these areas in the boring log.
98+1448 to 98+1513	Maintenance Identified Rutting in WB Lane	5 feet	Conduct 1 boring within this identified rutted area.
Lake Ilo Bridge 99+1210	District Identified Soft Area off both Ends of Bridge	10 feet	Conduct 3 borings off each end of the bridge. One boring directly off the bridge end and two additional spaced at 100' intervals. A total number of **six** borings
99+5220	District Identified Depression and Frost Heave	10 Feet	Conduct 3 borings within the frost heave area and one boring on either side approximately 50 feet away. A total number of **five** borings.

The following are the associated tasks and dates for the completion of the Linear Soils Survey and Recommendations for this project.

Task	**Completion (*Anticipated*) Date**
Maintenance Review with District Maintenance Forces	2/20/2016
District Review of Findings from Previous Task	3/2/2016
Linear Soils Survey Field Work Complete	*4/6/2016*
Linear Soils Survey Lab Work	*4/18/2016*
Linear Soils Survey Report	*5/1/2016**
*Milestone Task	

PAVEMENT EVALUATION LOG FOR LINEAR SOIL SURVEY

North Dakota Department of Transportation, Materials & Research
SFN 60472 (9-2013)

Sheet 1 of 1

Project Number	PCN	Date of Survey
NH-5-200(025)095	19734	2/22/2016

Section Maintenance Contact	Completed By
Dave Kuntz	Jamie Naumann

Highway Reference Points	Surface Type
95+1966 to 102+0000	Asphalt

Location	Pavement Distress	Description	Maintenance Comment	Picture Number	Drilling Required
95+1966 to 102+0000	Transv. Cracks	Depressed, Rutting in west bound lane only, Longitudinal cracking-wheel path-minimal	Last crack seal-2012		No
98+1448 to 98+1513	Rutting	1.0" deep rutting and pushing in west bound lane wheel track.	Hand patch done in 2015	1,2	No
99+1070 to 99+1298	Other	Blade patch over bridge.	Blade patch done 25 years ago. Concrete bridge deck deteriorating.		No
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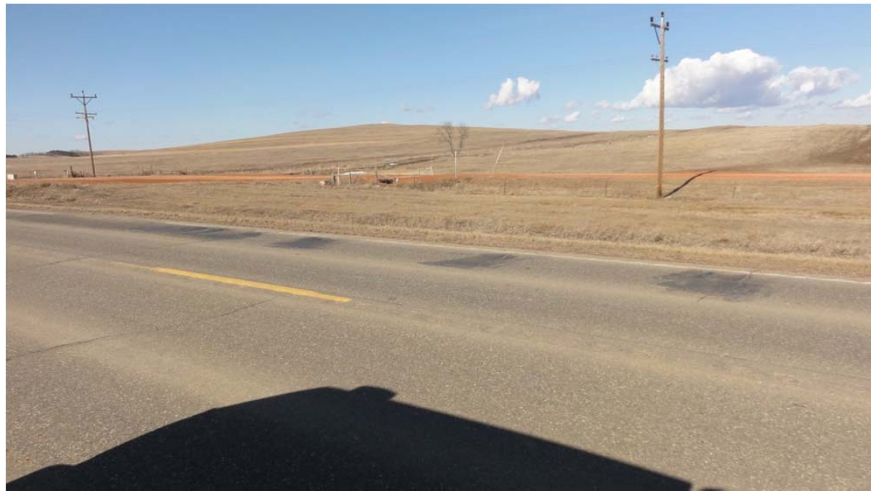
	Select One				Select One
	Select One				Select One
	Select One				Select One
	Select One				Select One
	Select One				Select One

Comments



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DSC00002

APPENDIX C

Boring Locations

Legend

- Boring Locations
- Reference Points

NH-5-200(025)095

Legend

- Boring Locations
- Reference Points

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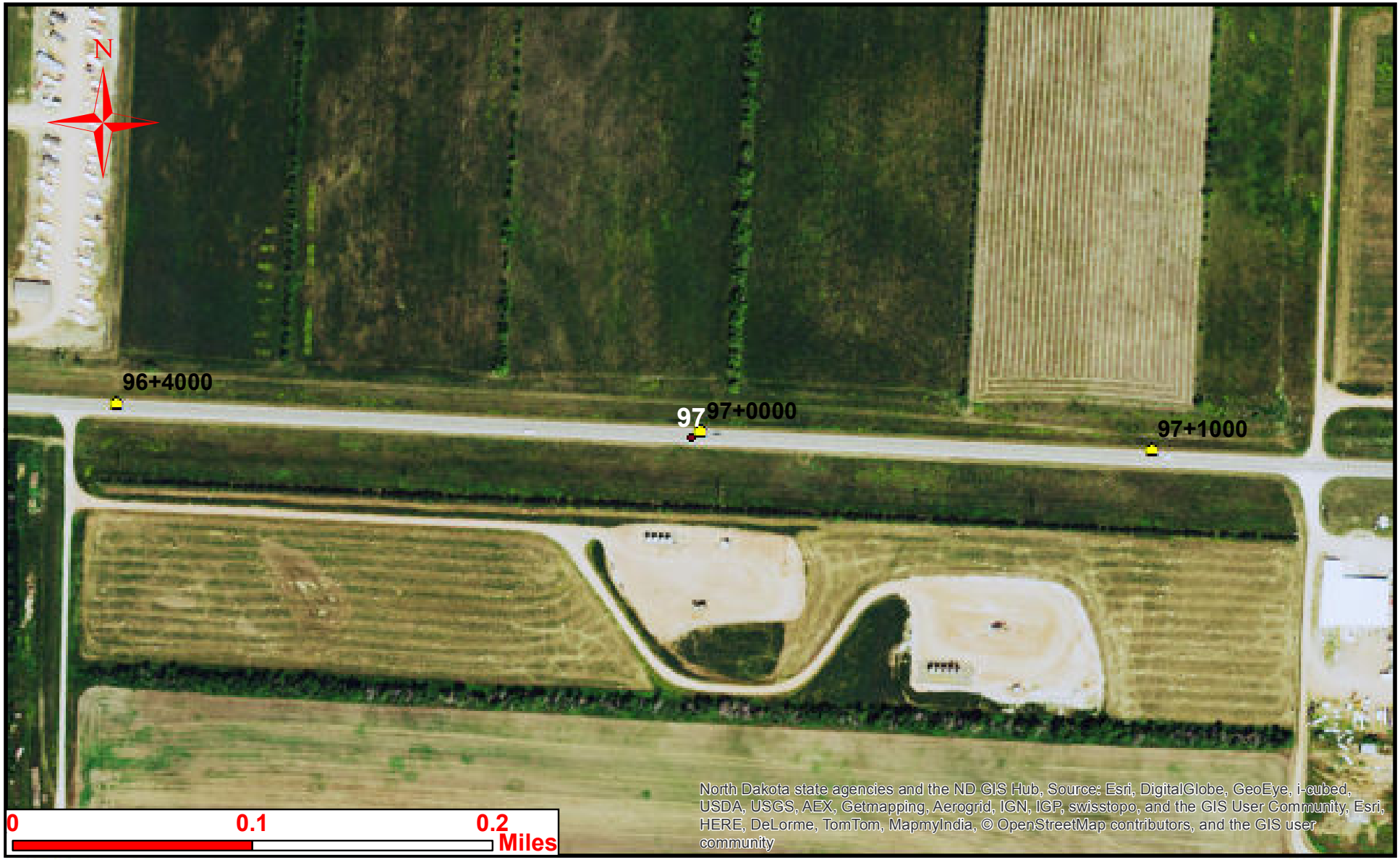

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- Boring Locations
- Reference Points

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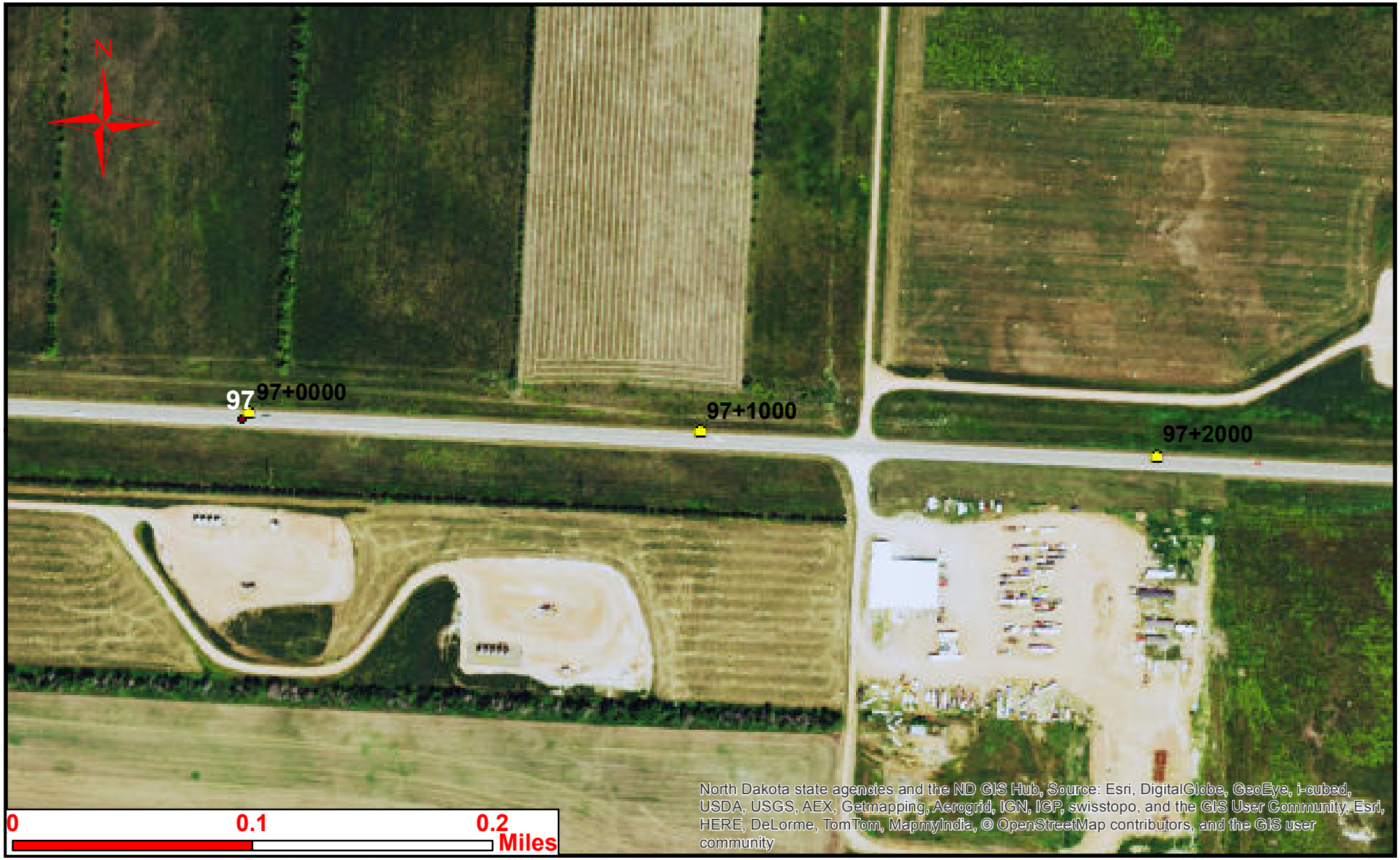

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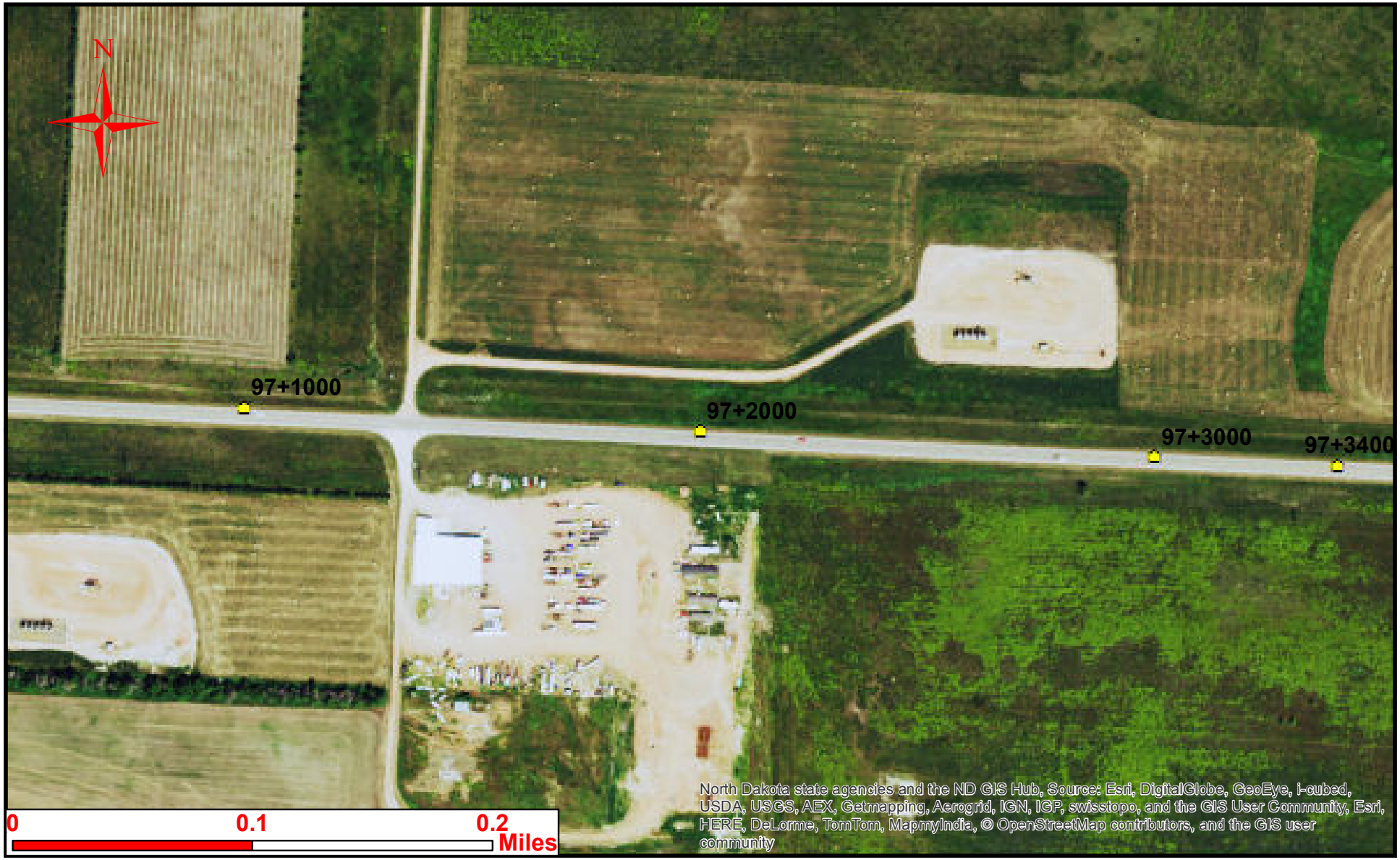

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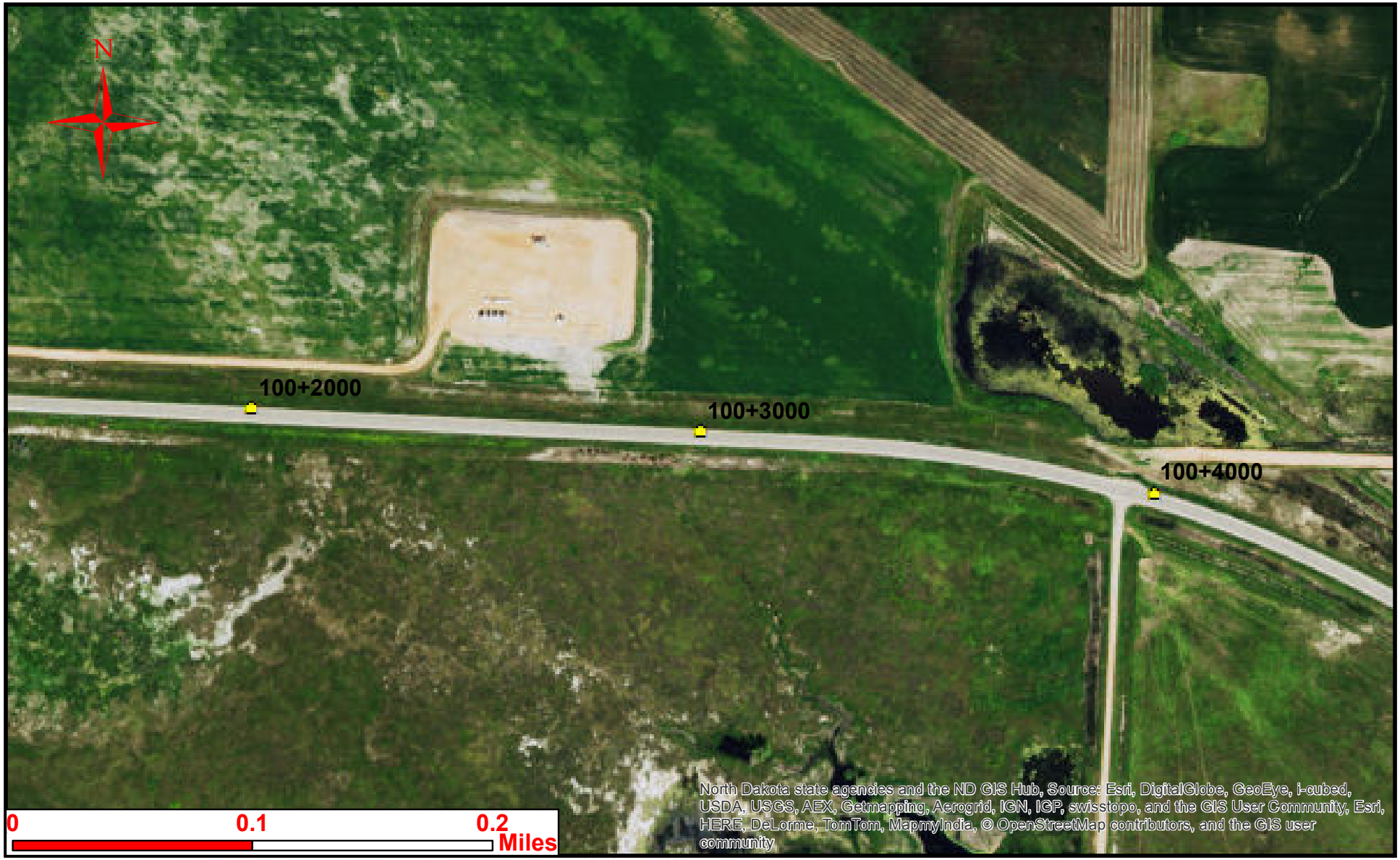

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- Reference Points

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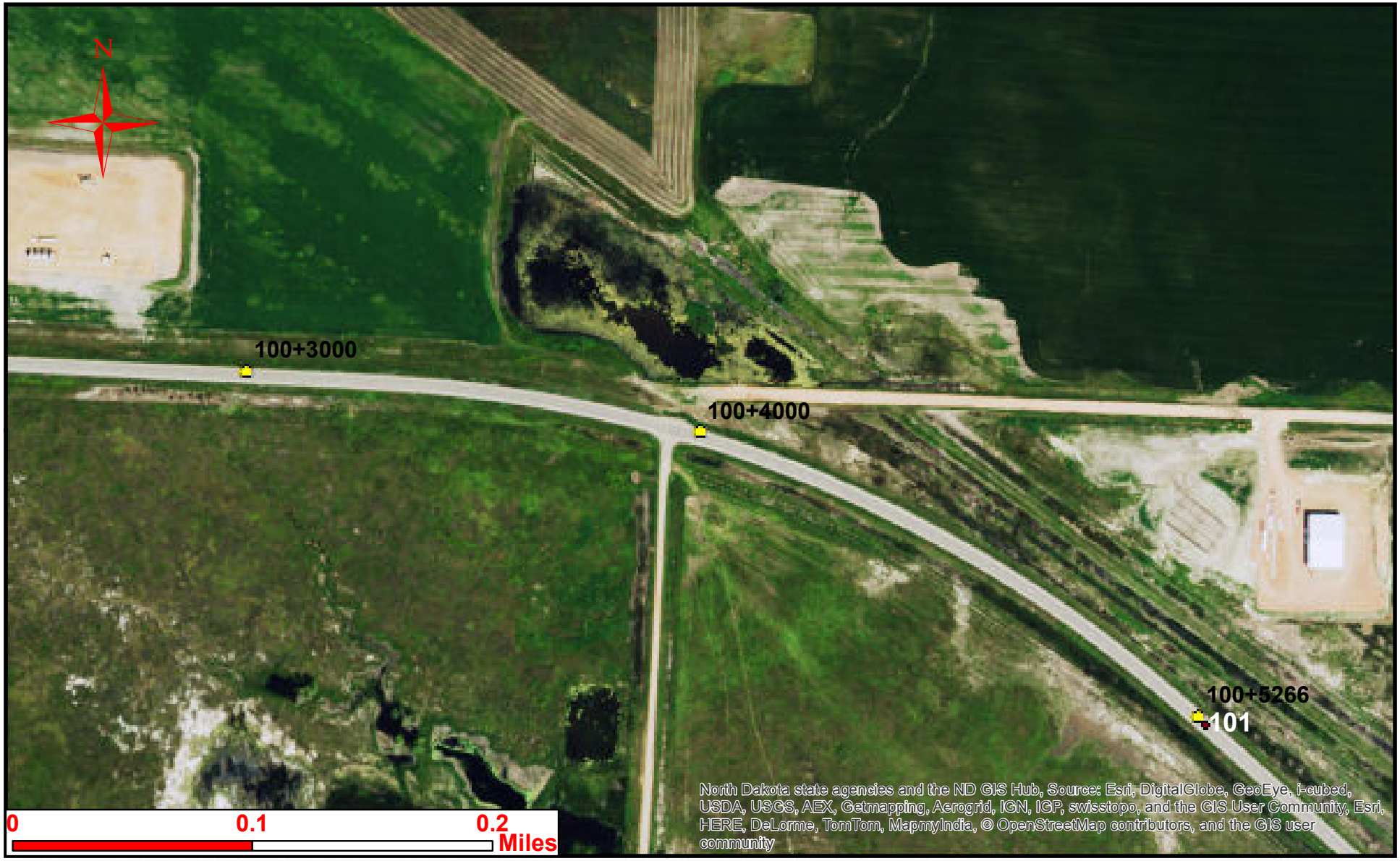

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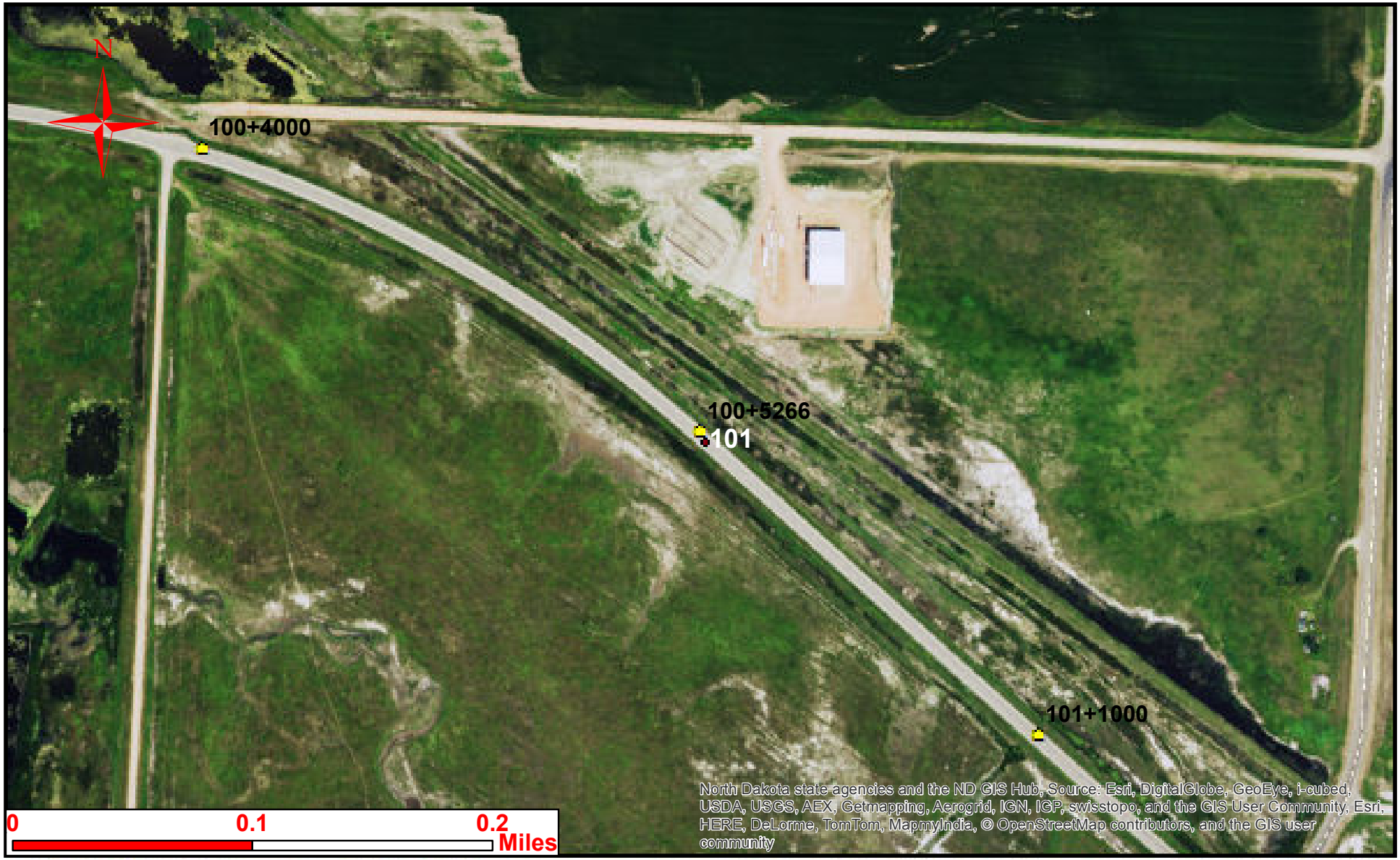
- Reference Points

NH-5-200(025)095



Legend

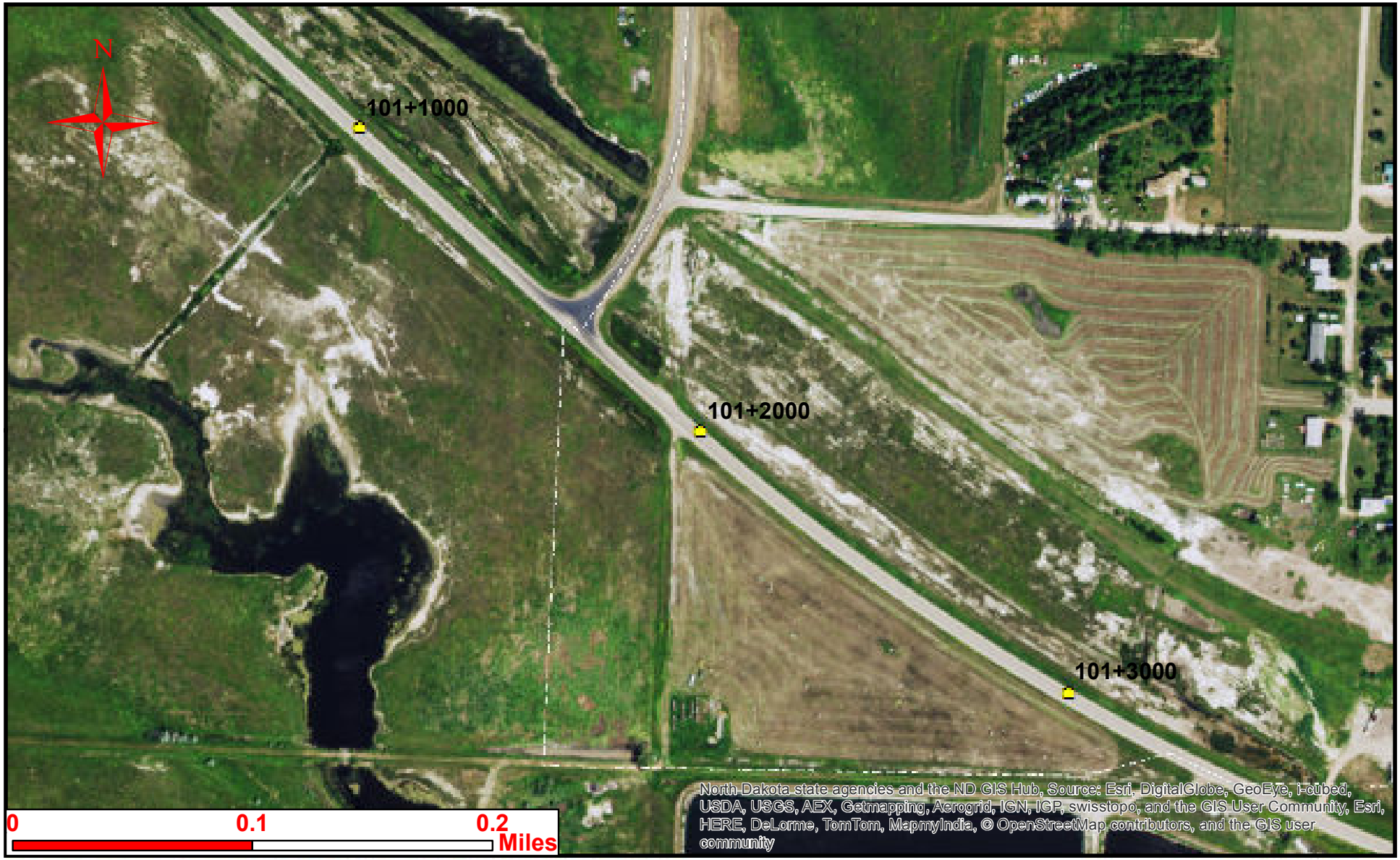
- Boring Locations
- Reference Points

NH-5-200(025)095

Legend

- Boring Locations
- Reference Points

NH-5-200(025)095



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- Boring Locations
- Reference Points

NH-5-200(025)095

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- Boring Locations
- Reference Points

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- Boring Locations
- Reference Points

NH-5-200(025)095

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- Boring Locations
- Reference Points

NH-5-200(025)095

APPENDIX D

SUMMARY OF SOILS ANALYSIS

NH-5-200(025)095																			
					GI < 20		Low Swell	Below Opt.	Below PL										
								0% to 6% Over Opt.											
							Moderate Swell	6% to 10% Over Opt.	PL to 5% Above										
					GI > 20			10% to 16% Over Opt.											
							High Swell	More than 16% Over Opt.	More Than 5% Above										
STA	Offset	Depth of Sample (ft)	Plastic Limit	AASHTO	Group Index	Optimum Moisture	Swell Potential (PI)	Average In-Place Moisture Content of Sample Depth	Plastic Limit vs. Moisture Content									F4 Soil
									2 foot	3 foot	4 foot	5 foot	6 foot	7 foot	8 foot	9 foot	10 foot	
95+3000	Rt 7 WB	0.9-5.0	NP	A-2-4(0)	0	9.7	0	8.2	7.8	10.5	7.6	7.0						
95+4000	Rt 7 WB	0.8-5.0	NP	A-2-4(0)	0	9.1	0	7.4	7.5	8.3	8.0	6.0						
96+0000	Rt 7 WB	0.8-5.0	NP	A-2-4(0)	0	10	0	9.4	10.8	9.2	9.3	8.2						
96+1000	Rt 7 WB	0.8-5.0	NP	A-2-4(0)	0	9.7	0	8.8	7.4	9.7	8.1	10.0						
96+2000	Rt 7 WB	0.8-4.5	NA	NA	NA	NA	NA	17.6	16.3	15.8	20.7	12.5						
96+3000	Rt 7 WB	0.9-5.0	14.2	A-6(5)	5	11.6	14	23	28.1	19.7	21.1	23.0						
96+4000	Rt 7 WB	0.8-5.0	NP	A-2-4(0)	0	8.5	0	8.9	9.8	10.0	7.9	7.9						
97+0000	Rt 7 WB	0.9-5.0	NA	NA	NA	8.5	NA	11.4	10.9	9.8	11.8	13.4						
97+1000	Rt 7 WB	0.8-5.0	NP	A-2-4(0)	0	10.6	0	7.8	10.3	5.4	10.6	5.1						
97+2000	Rt 7 WB	0.8-5.0	10	A-4(1)	1	9.1	10	17.3	14.8	16.9	18.7	18.6						
97+3000	Rt 7 WB	0.9-5.0	5.4	A-4(0)	0	9.7	5	13.4	15.0	16.8	13.2	8.4						
97+3400	Rt 7 WB	0.9-5.0	NA	NA	NA	NA	NA	22.3	20.2	18.9	24.9	25.5						
97+4000	Rt 7 WB	0.9-5.0	13.3	A-6(4)	4	10.4	13	16.1	19.9	13.6	12.8	18.4						
98+0000	Rt 7 WB	1.2-5.0	25.8	A-7-6(22)	22	12	26	22.3	24.9	24.0	23.0	17.3						
98+1000	Rt 7 WB	0.9-5.0	25.8	A-7-6(22)	22	15.3	26	24.7	18.1	27.5	25.1	28.0						
98+1509	Rt 7 WB	1.4-5.0	23.9	A-7-6(21)	21	12	24	22.5	25.8	12.4	25.9	26.0						
98+2000	Rt 7 WB	1.1-5.0	NA	NA	NA	NA	NA	24.2	24.4	22.5	25.9	24.2						
98+3000	Rt 7 WB	0.9-5.0	NA	NA	NA	NA	NA	20.2	21.3	22.9	22.6	13.9						
98+4000	Rt 7 WB	0.9-5.0	22	A-7-6(13)	13	11.1	22	20.4	21.0	22.4	20.7	17.3						
99+0000	Rt 7 WB	0.9-5.0	4.2	A-4(0)	0	9.5	4	15.8	18.1	14.0	12.8	18.4						
99+0940	Rt 7 WB	1.0-6.5	NA	NA	NA	NA	NA	17.3	21.2	15.8	16.7	17.8	15.1					
99+0940	Rt 7 WB	6.5-10.0	16.4	A-6(10)	10	11.5	16	28.6						21.0	24.4	32.2	36.8	
99+1048	Rt 7 WB	1.0-7.5	NA	NA	NA	NA	NA	15.9	11.1	13.6	15.8	18.6	16.8	19.5				
99+1048	Rt 7 WB	7.5-10.0	NP	A-2-4(0)	0	9.1	3	22.4							21.2	22.8	23.1	
99+1158	Rt 7 WB	1.2-10.0	14.9	A-6(4)	4	10.5	15	19.7	18.2	15.4	16.7	18.2	14.9	22.3	22.6	24.8	24.9	
99+1219	Rt 7 WB	1.2-10.0	21.5	A-6(10)	10	12	22	24.5	20.4	18.6	21.3	21.2	23.7	25.2	29.1	26.9	34.0	
99+1312	Rt 9 WB	1.1-7.0	24.8	A-7-6(16)	16	12	25	25	28.1	26.1	28.0	24.3	17.9	25.8				
99+1312	Rt 9 WB	7.0-10.0	22.2	A-7-6(21)	21	11.8	22	25.4							23.4	27.0	25.7	
99+1470	Rt 9 WB	0.8-6.5	20.3	A-6(10)	10	10.6	20	18.1	25.8	19.5	12.9	16.8	15.8					
99+1470	Rt 9 WB	6.5-10.0	14.4	A-6(4)	4	10	14	21.9						19.9	21.6	21.1	24.9	
99+1570	Rt 9 WB	0.8-10.0	17.8	A-6(7)	7	10.1	18	17.7	26.4	25.8	12.7	17.2	12.8	15.1	16.6	16.9	15.3	
99+2000	Rt 9 WB	0.9-5.0	NA	NA	NA	NA	NA	23	26.3	17.2	26.9	21.8						
99+3000	Rt 9 WB	0.8-5.0	30.7	A-7-6(31)	31	12.8	31	23.4	23.4	24.4	22.7	23.1						
99+4000	Rt 9 WB	0.9-5.0	30.8	A-7-6(30)	30	13	31	24.1	24.5	24.6	23.1	24.1						
99+5096	Rt 9 WB	1.1-6.5	NA	NA	NA	NA	NA	26.3	22.3	29.4	26.5	18.1	35.4	99.0	88.1	115.1	226.4	
99+5164	Rt 9 WB	1.0-6.5	28.4	A-7-6(21)	21	16.1	28	40.9	23.1	21.1	31.7	34.1	94.6	97.9	69.6	100.0	98.0	
99+5208	Rt 9 WB	0.9-6.5	NA	NA	NA	NA	NA	26.8	25.5	18.6	25.5	29.1	35.3	47.5	89.3	103.7	93.4	
99+5243	Rt 9 WB	0.8-4.5	27.5	A-7-6(17)	17	14	28	26.8	20.9	26.0	33.5	83.9	80.0	94.2	78.2	90.0	95.0	
100+0000	Rt 9 WB	0.8-4.5	29.9	A-7-6(24)	24	16.5	30	18.8	1.4	23.3	31.8	91.2	87.5	104.1	101.6	89.3	59.7	
100+1000	Rt 9 WB	0.8-5.0	NP	A-2-4(0)	0	8.7	0	12.6	30.4	7.3	6.3	6.2						
100+2000	Rt 9 WB	0.9-5.0	18.3	A-6(7)	7	12.6	18	19.5	17.3	16.1	23.7	21.0						
100+3000	Rt 9 WB	0.8-5.0	28	A-7-6(22)	22	13.2	28	17.9	14.6	12.8	23.3	20.9						
100+4000	Rt 9 WB	1.0-5.0	18	A-6(4)	4	10.8	18	12.9	14.2	10.3	15.6	11.4						
100+5266	Rt 9 WB	0.9-5.0	32.2	A-7-6(28)	28	16.5	32	21.8	16.4	18.8	27.5	24.3						
101+1000	Rt 9 WB	1.0-5.0	18.9	A-6(6)	6	11.1	19	19	14.1	20.0	25.1	17.0						
101+2000	Rt 9 WB	1.0-5.0	NA	NA	NA	NA	NA	14.6	12.1	9.9	14.4	22.0						
101+3000	Rt 9 WB	1.0-5.0	24.6	A-6(16)	16	11.2	25	19.6	17.9	14.2	19.2	27.0						
101+4000	Rt 9 WB	0.9-5.0	5.5	A-4(0)	0	9.1	6	14.3	14.8	16.0	12.7	13.9						
102+0000	Rt 9 WB	0.8-5.0	7.6	A-4(1)	1	8.6	8	13.4	18.7	14.6	10.5	9.6						
102+1000	Rt 9 WB	0.9-5.0	NP	A-2-4(0)	0	9.4	0	7.4	6.9	8.3	7.2	7.3						
102+2000	Rt 9 WB	0.7-5.0	NA	NA	NA	NA	NA	16.4	13.2	16.7	13.0	22.5						
102+3200	Rt 9 WB	0.8-5.0	15.4	A-6(9)	9	10.8	15	23.1	20.6	20.9	24.4	26.6						

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-9-2016	**Date Reported**	4/21/2016	**District**	Dickinson
County	DUNN	**Submitted By**	Naumann	**Project Number**	NH-5-200(025)095
		AASHTO Test Method	T-180 Mold Size 4 inch	**PCN**	19734

Comments

Lab Number	298	297	296	295
Reference Pt + Feet	100+0000	100+1000	100+2000	100+3000
Distance From CenterLine (Ft.)	Rt 9 WB	Rt 9 WB	Rt 9 WB	Rt 9 WB
Depth, Ft.	0.8 - 4.5	0.8 - 5.0	0.9 - 5.0	0.8 - 5.0
Field Sample No.	298	297	296	295
% Pass. 3/8" Sieve	100	100	99	100
% Pass. No. 4 Sieve	99	100	97	100
% Pass. No. 10 Sieve	94	100	94	99
% Coarse Sand (-No. 10 + No. 40)	5	3	9	3
% Fine Sand (-No. 40 + No. 200)	13	71	30	17
% Silt (0.074 - 0.005 mm)	16	19	25	38
% Clay (-0.005 mm)	60	8	30	41
Liquid Limit (-No. 40)	58	0	38	46
Plasticity Index (-No. 40)	30	NP	18	28
Plastic Limit	28	0	20	18
Soil Color	BRN/GRY/BLK	GRY	BRN/GRY/BLK	BRN/GRY
Textural Class	CLY	SNDY LM	CLY LM	CLY
Soil Class (AASHTO M-145)	A-7-6(24)	A-2-4(0)	A-6(7)	A-7-6(22)
Frost Class	F3	F3	F3	F3
Optimum Moisture (%)	16.5	8.7	12.6	13.2
Maximum Dry Density (pcf)	110.3	125.0	119.2	120.8
% Organic Content				

Depth (Ft.)	**Moisture (%)**											
	2	1.4	2	30.4	2	17.3	2	14.6
	3	23.3	3	7.3	3	16.1	3	12.8
	4	31.8	4	6.3	4	23.7	4	23.3
	5	91.2	5	6.2	5	21.0	5	20.9
	6	87.5	12.6		19.5		17.9	
	7	104.1						
	8	101.6						
	9	89.3						
	10	59.7						
Avg. Moisture of Sample Depth	18.8							

Scott W. Wutzke, Testing Lab Supervisor
Date Printed: 5/23/2016

Linear Laboratory Analysis

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

Report Number	SS-9-2016	**Date Reported**	4/21/2016	**District**	Dickinson
County	DUNN	**Submitted By**	Naumann	**Project Number**	NH-5-200(025)095
		AASHTO Test Method	T-180 Mold Size 4 inch	**PCN**	19734

Comments

Lab Number	294	293	292	291
Reference Pt + Feet	100+4000	100+5266	101+1000	101+2000
Distance From CenterLine (Ft.)	Rt 9 WB	Rt 9 WB	Rt 9 WB	Rt 9 WB
Depth, Ft.	1.0 - 5.0	0.9 - 5.0	1.0 - 5.0	1.0 - 5.0
Field Sample No.	294	293	292	291
% Pass. 3/8" Sieve	100	100	97	
% Pass. No. 4 Sieve	98	99	96	
% Pass. No. 10 Sieve	94	98	92	
% Coarse Sand (-No. 10 + No. 40)	10	3	9	
% Fine Sand (-No. 40 + No. 200)	39	13	32	
% Silt (0.074 - 0.005 mm)	19	31	26	
% Clay (-0.005 mm)	25	51	26	
Liquid Limit (-No. 40)	34	55	34	
Plasticity Index (-No. 40)	18	32	19	
Plastic Limit	16	23	16	
Soil Color	BRN/GRY/BLK	BRN/BLK	BRN/GRY/BLK	BRN/BLK
Textural Class	SNDY CLY LM	CLY	CLY LM	
Soil Class (AASHTO M-145)	A-6(4)	A-7-6(28)	A-6(6)	
Frost Class	F3	F3	F3	
Optimum Moisture (%)	10.8	16.5	11.1	
Maximum Dry Density (pcf)	125.7	110.9	123.4	
% Organic Content				
Depth (Ft.) | Moisture (%)	2 | 14.2	2 | 16.4	2 | 14.1	2 | 12.1
	3 | 10.3	3 | 18.8	3 | 20.0	3 | 9.9
	4 | 15.6	4 | 27.5	4 | 25.1	4 | 14.4
	5 | 11.4	5 | 24.3	5 | 17.0	5 | 22.0
Avg. Moisture of Sample Depth	12.9	21.8	19.0	14.6

Scott W. Wutzke, Testing Lab Supervisor
Date Printed: 5/23/2016

Linear Laboratory Analysis

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

Report Number	SS-9-2016	**Date Reported**	4/21/2016	**District**	Dickinson
County	DUNN	**Submitted By**	Naumann	**Project Number**	NH-5-200(025)095
		AASHTO Test Method	T-180 Mold Size 4 inch	**PCN**	19734

Comments

Lab Number	290	289	288	287
Reference Pt + Feet	101+3000	101+4000	102+0000	102+1000
Distance From CenterLine (Ft.)	Rt 9 WB	Rt 9 WB	Rt 9 WB	Rt 9 WB
Depth, Ft.	1.0 - 5.0	0.9 - 5.0	0.8 - 5.0	0.9 - 5.0
Field Sample No.	290	289	288	287
% Pass. 3/8" Sieve	100	97	96	99
% Pass. No. 4 Sieve	99	96	93	97
% Pass. No. 10 Sieve	95	93	89	95
% Coarse Sand (-No. 10 + No. 40)	4	9	9	11
% Fine Sand (-No. 40 + No. 200)	18	44	33	64
% Silt (0.074 - 0.005 mm)	35	26	33	12
% Clay (-0.005 mm)	38	14	15	8
Liquid Limit (-No. 40)	40	21	23	0
Plasticity Index (-No. 40)	25	6	8	NP
Plastic Limit	16	16	15	0
Soil Color	BRN/GRY/BLK	BRN/BLK	BRN	BRN
Textural Class	CLY	SNDY LM	SNDY LM	SNDY LM
Soil Class (AASHTO M-145)	A-6(16)	A-4(0)	A-4(1)	A-2-4(0)
Frost Class	F3	F3	F3	F2
Optimum Moisture (%)	11.2	9.1	8.6	9.4
Maximum Dry Density (pcf)	124.5	129.8	133.1	125.3
% Organic Content				
Depth (Ft.) | Moisture (%)	2 | 17.9	2 | 14.8	2 | 18.7	2 | 6.9
	3 | 14.2	3 | 16.0	3 | 14.6	3 | 8.3
	4 | 19.2	4 | 12.7	4 | 10.5	4 | 7.2
	5 | 27.0	5 | 13.9	5 | 9.6	5 | 7.3
Avg. Moisture of Sample Depth	19.6	14.3	13.4	7.4

Scott W. Wutzke, Testing Lab Supervisor
Date Printed: 5/23/2016

Linear Laboratory Analysis

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

Report Number	SS-9-2016	**Date Reported**	4/21/2016	**District**	Dickinson
County	DUNN	**Submitted By**	Naumann	**Project Number**	NH-5-200(025)095
		AASHTO Test Method	T-180 Mold Size 4 inch	**PCN**	19734

Comments

Lab Number	286	285	336	335
Reference Pt + Feet	102+2000	102+3200	95+3000	95+4000
Distance From CenterLine (Ft.)	Rt 9 WB	Rt 9 WB	Rt 7 WB	Rt 7 WB
Depth, Ft.	0.7 - 5.0	0.8 - 5.0	0.9 - 5.0	0.8 - 5.0
Field Sample No.	286	285	336	335
% Pass. 3/8" Sieve		100	96	100
% Pass. No. 4 Sieve		100	95	100
% Pass. No. 10 Sieve		99	95	99
% Coarse Sand (-No. 10 + No. 40)		2	3	3
% Fine Sand (-No. 40 + No. 200)		27	60	63
% Silt (0.074 - 0.005 mm)		37	25	26
% Clay (-0.005 mm)		32	7	8
Liquid Limit (-No. 40)		34	0	0
Plasticity Index (-No. 40)		15	NP	NP
Plastic Limit		19	0	0
Soil Color	BRN/GRY	BRN/GRY/BLK	BRN	BRN
Textural Class		CLY	SNDY LM	SNDY LM
Soil Class (AASHTO M-145)		A-6(9)	A-2-4(0)	A-2-4(0)
Frost Class		F3	F3	F3
Optimum Moisture (%)		10.8	9.7	9.1
Maximum Dry Density (pcf)		124.0	126.8	127.1
% Organic Content				
Depth (Ft.) | Moisture (%)	2 | 13.2	2 | 20.6	2 | 7.8	2 | 7.5
	3 | 16.7	3 | 20.9	3 | 10.5	3 | 8.3
	4 | 13.0	4 | 24.4	4 | 7.6	4 | 8.0
	5 | 22.5	5 | 26.6	5 | 7.0	5 | 6.0
Avg. Moisture of Sample Depth	16.4	23.1	8.2	7.4

Scott W. Wutzke, Testing Lab Supervisor
Date Printed: 5/23/2016

Linear Laboratory Analysis

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

Report Number	SS-9-2016	**Date Reported**	4/21/2016	**District**	Dickinson
County	DUNN	**Submitted By**	Naumann	**Project Number**	NH-5-200(025)095
		AASHTO Test Method	T-180 Mold Size 4 inch	**PCN**	19734

Comments

Lab Number	334	333	332	331
Reference Pt + Feet	96+0000	96+1000	96+2000	96+3000
Distance From CenterLine (Ft.)	Rt 7 WB	Rt 7 WB	Rt 7 WB	Rt 7 WB
Depth, Ft.	0.8 - 5.0	0.8 - 5.0	0.8 - 4.5	0.9 - 5.0
Field Sample No.	334	333	332	331
% Pass. 3/8" Sieve	98	99		99
% Pass. No. 4 Sieve	97	99		97
% Pass. No. 10 Sieve	96	99		93
% Coarse Sand (-No. 10 + No. 40)	2	1		4
% Fine Sand (-No. 40 + No. 200)	63	68		34
% Silt (0.074 - 0.005 mm)	24	25		29
% Clay (-0.005 mm)	7	5		26
Liquid Limit (-No. 40)	0	0		32
Plasticity Index (-No. 40)	NP	NP		14
Plastic Limit	0	0		17
Soil Color	BRN	BRN	BRN	BRN
Textural Class	SNDY LM	SNDY LM		CLY LM
Soil Class (AASHTO M-145)	A-2-4(0)	A-2-4(0)		A-6(5)
Frost Class	F3	F3		F3
Optimum Moisture (%)	10.0	9.7		11.6
Maximum Dry Density (pcf)	125.0	124.9		122.1
% Organic Content				
Depth (Ft.) | Moisture (%)	2 | 10.8	2 | 7.4	2 | 16.3	2 | 28.1
	3 | 9.2	3 | 9.7	3 | 15.8	3 | 19.7
	4 | 9.3	4 | 8.1	4 | 20.7	4 | 21.1
	5 | 8.2	5 | 10.0	5 | 12.5	5 | 23.0
Avg. Moisture of Sample Depth	9.4	8.8	17.6	23.0

Scott W. Wutzke, Testing Lab Supervisor
Date Printed: 5/23/2016

Linear Laboratory Analysis

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

Report Number	SS-9-2016	**Date Reported**	4/21/2016	**District**	Dickinson
County	DUNN	**Submitted By**	Naumann	**Project Number**	NH-5-200(025)095
		AASHTO Test Method	T-180 Mold Size 4 inch	**PCN**	19734

Comments

Lab Number	330	329	328	327
Reference Pt + Feet	96+4000	97+0000	97+1000	97+2000
Distance From CenterLine (Ft.)	Rt 7 WB	Rt 7 WB	Rt 7 WB	Rt 7 WB
Depth, Ft.	0.8 - 5.0	0.9 - 5.0	0.8 - 5.0	0.8 - 5.0
Field Sample No.	330	329	328	327
% Pass. 3/8" Sieve	100		99	100
% Pass. No. 4 Sieve	99		98	99
% Pass. No. 10 Sieve	99		97	97
% Coarse Sand (-No. 10 + No. 40)	3		5	3
% Fine Sand (-No. 40 + No. 200)	66		64	51
% Silt (0.074 - 0.005 mm)	22		23	29
% Clay (-0.005 mm)	8		6	15
Liquid Limit (-No. 40)	0		0	28
Plasticity Index (-No. 40)	NP		NP	10
Plastic Limit	0		0	18
Soil Color	BRN	BRN	BRN	BRN
Textural Class	SNDY LM		SNDY LM	SNDY LM
Soil Class (AASHTO M-145)	A-2-4(0)		A-2-4(0)	A-4(1)
Frost Class	F3		F3	F3
Optimum Moisture (%)	8.5	8.5	10.6	9.1
Maximum Dry Density (pcf)	128.5	128.5	124.6	127.1
% Organic Content				
Depth (Ft.) | Moisture (%)	2 | 9.8	2 | 10.9	2 | 10.3	2 | 14.8
	3 | 10.0	3 | 9.8	3 | 5.4	3 | 16.9
	4 | 7.9	4 | 11.8	4 | 10.6	4 | 18.7
	5 | 7.9	5 | 13.4	5 | 5.1	5 | 18.6
Avg. Moisture of Sample Depth	8.9	11.4	7.8	17.3

Scott W. Wutzke, Testing Lab Supervisor
Date Printed: 5/23/2016

Linear Laboratory Analysis

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

Report Number	SS-9-2016	**Date Reported**	4/21/2016	**District**	Dickinson
County	DUNN	**Submitted By**	Naumann	**Project Number**	NH-5-200(025)095
		AASHTO Test Method	T-180 Mold Size 4 inch	**PCN**	19734

Comments

Lab Number	326	325	324	323
Reference Pt + Feet	97+3000	97+3400	97+4000	98+0000
Distance From CenterLine (Ft.)	Rt 7 WB	Rt 7 WB	Rt 7 WB	Rt 7 WB
Depth, Ft.	0.9 - 5.0	0.9 - 5.0	0.9 - 5.0	1.2 - 5.0
Field Sample No.	326	325	324	323
% Pass. 3/8" Sieve	98		98	100
% Pass. No. 4 Sieve	97		95	99
% Pass. No. 10 Sieve	95		93	98
% Coarse Sand (-No. 10 + No. 40)	5		4	2
% Fine Sand (-No. 40 + No. 200)	49		35	11
% Silt (0.074 - 0.005 mm)	30		37	52
% Clay (-0.005 mm)	10		17	33
Liquid Limit (-No. 40)	23		31	46
Plasticity Index (-No. 40)	5		13	26
Plastic Limit	18		18	20
Soil Color	BRN	BRN	BRN	BRN/GRY/BLK
Textural Class	SNDY LM		LM	CLY
Soil Class (AASHTO M-145)	A-4(0)		A-6(4)	A-7-6(22)
Frost Class	F3		F3	F3
Optimum Moisture (%)	9.7		10.4	12.0
Maximum Dry Density (pcf)	127.5		126.4	120.7
% Organic Content				
Depth (Ft.) | Moisture (%)	2 | 15.0	2 | 20.2	2 | 19.9	2 | 24.9
	3 | 16.8	3 | 18.9	3 | 13.6	3 | 24.0
	4 | 13.2	4 | 24.9	4 | 12.8	4 | 23.0
	5 | 8.4	5 | 25.5	5 | 18.4	5 | 17.3
Avg. Moisture of Sample Depth	13.4	22.3	16.1	22.3

Scott W. Wutzke, Testing Lab Supervisor
Date Printed: 5/23/2016

Linear Laboratory Analysis

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

Report Number	SS-9-2016	**Date Reported**	4/21/2016	**District**	Dickinson
County	DUNN	**Submitted By**	Naumann	**Project Number**	NH-5-200(025)095
		AASHTO Test Method	T-180 Mold Size 4 inch	**PCN**	19734

Comments

Lab Number	322	321	320	319
Reference Pt + Feet	98+1000	98+1509	98+2000	98+3000
Distance From CenterLine (Ft.)	Rt 7 WB	Rt 7 WB	Rt 7 WB	Rt 7 WB
Depth, Ft.	0.9 - 5.0	1.4 - 5.0	1.1 - 5.0	0.9 - 5.0
Field Sample No.	322	321	320	319
% Pass. 3/8" Sieve	100	100		
% Pass. No. 4 Sieve	99	99		
% Pass. No. 10 Sieve	97	97		
% Coarse Sand (-No. 10 + No. 40)	3	4		
% Fine Sand (-No. 40 + No. 200)	13	9		
% Silt (0.074 - 0.005 mm)	45	54		
% Clay (-0.005 mm)	36	29		
Liquid Limit (-No. 40)	50	46		
Plasticity Index (-No. 40)	26	24		
Plastic Limit	24	22		
Soil Color	BRN/GRY/BLK	BRN	BRN/GRY/BLK	BRN/GRY/BLK
Textural Class	CLY	SLTY CLY LM		
Soil Class (AASHTO M-145)	A-7-6(22)	A-7-6(21)		
Frost Class	F3	F3		
Optimum Moisture (%)	15.3	12.0		
Maximum Dry Density (pcf)	114.2	119.7		
% Organic Content				
Depth (Ft.) | Moisture (%)	2 | 18.1	2 | 25.8	2 | 24.4	2 | 21.3
	3 | 27.5	3 | 12.4	3 | 22.5	3 | 22.9
	4 | 25.1	4 | 25.9	4 | 25.9	4 | 22.6
	5 | 28.0	5 | 26.0	5 | 24.2	5 | 13.9
Avg. Moisture of Sample Depth	24.7	22.5	24.2	20.2

Scott W. Wutzke, Testing Lab Supervisor
Date Printed: 5/23/2016

Linear Laboratory Analysis

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

Report Number	SS-9-2016	**Date Reported**	4/21/2016	**District**	Dickinson
County	DUNN	**Submitted By**	Naumann	**Project Number**	NH-5-200(025)095
		AASHTO Test Method	T-180 Mold Size 4 inch	**PCN**	19734

Comments

Lab Number	318	317	315	316
Reference Pt + Feet	98+4000	99+0000	99+0940	99+0940
Distance From CenterLine (Ft.)	Rt 7 WB	Rt 7 WB	Rt 7 WB	Rt 7 WB
Depth, Ft.	0.9 - 5.0	0.9 - 5.0	1.0 - 6.5	6.5 - 10.0
Field Sample No.	318	317	315	316
% Pass. 3/8" Sieve	100	94		100
% Pass. No. 4 Sieve	100	91		100
% Pass. No. 10 Sieve	98	87		100
% Coarse Sand (-No. 10 + No. 40)	2	7		1
% Fine Sand (-No. 40 + No. 200)	28	44		27
% Silt (0.074 - 0.005 mm)	40	23		48
% Clay (-0.005 mm)	29	14		23
Liquid Limit (-No. 40)	41	22		36
Plasticity Index (-No. 40)	22	4		16
Plastic Limit	19	18		19
Soil Color	BRN/GRY	BRN	BRN/GRY/BLK	BLK/GRY
Textural Class	CLY LM	SNDY LM		CLY LM
Soil Class (AASHTO M-145)	A-7-6(13)	A-4(0)		A-6(10)
Frost Class	F3	F3		F3
Optimum Moisture (%)	11.1	9.5		11.5
Maximum Dry Density (pcf)	124.8	128.9		121.9
% Organic Content				
Depth (Ft.) | Moisture (%)	2 | 21.0	2 | 18.1	2 | 21.2	7 | 21.0
	3 | 22.4	3 | 14.0	3 | 15.8	8 | 24.4
	4 | 20.7	4 | 12.8	4 | 16.7	9 | 32.2
	5 | 17.3	5 | 18.4	5 | 17.8	10 | 36.8
Avg. Moisture of Sample Depth	20.4	15.8	6 | 15.1	28.6
			17.3	

Scott W. Wutzke, Testing Lab Supervisor
Date Printed: 5/23/2016

Linear Laboratory Analysis

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

Report Number	SS-9-2016	**Date Reported**	4/21/2016	**District**	Dickinson
County	DUNN	**Submitted By**	Naumann	**Project Number**	NH-5-200(025)095
		AASHTO Test Method	T-180 Mold Size 4 inch	**PCN**	19734

Comments

Lab Number	313	314	312	311
Reference Pt + Feet	99+1048	99+1048	99+1158	99+1219
Distance From CenterLine (Ft.)	Rt 7 WB	Rt 7 WB	Rt 7 WB	Rt 7 WB
Depth, Ft.	1.0 - 7.5	7.5 - 10.0	1.2 - 10.0	1.2 - 10.0
Field Sample No.	313	314	312	311
% Pass. 3/8" Sieve		100	100	100
% Pass. No. 4 Sieve		100	98	99
% Pass. No. 10 Sieve		100	92	95
% Coarse Sand (-No. 10 + No. 40)		2	6	4
% Fine Sand (-No. 40 + No. 200)		66	35	30
% Silt (0.074 - 0.005 mm)		21	29	28
% Clay (-0.005 mm)		11	23	33
Liquid Limit (-No. 40)		21	31	39
Plasticity Index (-No. 40)		3	15	22
Plastic Limit		18	16	18
Soil Color	BRN/GRY/BLK	BRN/TAN	BRN/GRY/BLK	BRN/GRY/BLK
Textural Class		SNDY LM	CLY LM	CLY
Soil Class (AASHTO M-145)		A-2-4(0)	A-6(4)	A-6(10)
Frost Class		F3	F3	F3
Optimum Moisture (%)		9.1	10.5	12.0
Maximum Dry Density (pcf)		129.1	125.0	120.7
% Organic Content				

Depth (Ft.)	**Moisture (%)**											
	2	11.1	8	21.2	2	18.2	2	20.4
	3	13.6	9	22.8	3	15.4	3	18.6
	4	15.8	10	23.1	4	16.7	4	21.3
	5	18.6	22.4		5	18.2	5	21.2
	6	16.8			6	14.9	6	23.7
	7	19.5			7	22.3	7	25.2
Avg. Moisture of Sample Depth	15.9				8	22.6	8	29.1
					9	24.8	9	26.9
					10	24.9	10	34.0
					19.7		24.5	

Scott W. Wutzke, Testing Lab Supervisor
Date Printed: 5/23/2016

Linear Laboratory Analysis

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

Report Number	SS-9-2016	**Date Reported**	4/21/2016	**District**	Dickinson
County	DUNN	**Submitted By**	Naumann	**Project Number**	NH-5-200(025)095
		AASHTO Test Method	T-180 Mold Size 4 inch	**PCN**	19734

Comments

Lab Number	309	310	307	308
Reference Pt + Feet	99+1312	99+1312	99+1470	99+1470
Distance From CenterLine (Ft.)	Rt 9 WB	Rt 9 WB	Rt 9 WB	Rt 9 WB
Depth, Ft.	1.1 - 7.0	7.0 - 10.0	0.8 - 6.5	6.5 - 10.0
Field Sample No.	309	310	307	308
% Pass. 3/8" Sieve	100	100	100	100
% Pass. No. 4 Sieve	100	100	99	100
% Pass. No. 10 Sieve	98	100	97	100
% Coarse Sand (-No. 10 + No. 40)	3	0	5	1
% Fine Sand (-No. 40 + No. 200)	24	10	29	49
% Silt (0.074 - 0.005 mm)	37	59	33	28
% Clay (-0.005 mm)	35	31	31	22
Liquid Limit (-No. 40)	42	42	36	33
Plasticity Index (-No. 40)	25	22	20	14
Plastic Limit	17	20	16	18
Soil Color	BRN/GRY/BLK	GRN/GRY	BRN/GRY/BLK	GRN/GRY
Textural Class	CLY	SLTY CLY	CLY	CLY LM
Soil Class (AASHTO M-145)	A-7-6(16)	A-7-6(21)	A-6(10)	A-6(4)
Frost Class	F3	F3	F3	F3
Optimum Moisture (%)	12.0	11.8	10.6	10.0
Maximum Dry Density (pcf)	122.9	122.4	125.9	128.1
% Organic Content				
Depth (Ft.) | Moisture (%)	2 | 28.1	8 | 23.4	2 | 25.8	7 | 19.9
	3 | 26.1	9 | 27.0	3 | 19.5	8 | 21.6
	4 | 28.0	10 | 25.7	4 | 12.9	9 | 21.1
	5 | 24.3	25.4	5 | 16.8	10 | 24.9
	6 | 17.9		6 | 15.8	21.9
	7 | 25.8		18.1	
Avg. Moisture of Sample Depth	25.0			

Scott W. Wutzke, Testing Lab Supervisor
Date Printed: 5/23/2016

Linear Laboratory Analysis

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

Report Number	SS-9-2016	**Date Reported**	4/21/2016	**District**	Dickinson
County	DUNN	**Submitted By**	Naumann	**Project Number**	NH-5-200(025)095
		AASHTO Test Method	T-180 Mold Size 4 inch	**PCN**	19734

Comments

Lab Number	306	305	304	303
Reference Pt + Feet	99+1570	99+2000	99+3000	99+4000
Distance From CenterLine (Ft.)	Rt 9 WB	Rt 9 WB	Rt 9 WB	Rt 9 WB
Depth, Ft.	0.8 - 10.0	0.9 - 5.0	0.8 - 5.0	0.9 - 5.0
Field Sample No.	306	305	304	303
% Pass. 3/8" Sieve	100		100	100
% Pass. No. 4 Sieve	99		99	99
% Pass. No. 10 Sieve	98		98	97
% Coarse Sand (-No. 10 + No. 40)	3		1	2
% Fine Sand (-No. 40 + No. 200)	39		2	4
% Silt (0.074 - 0.005 mm)	27		53	53
% Clay (-0.005 mm)	29		42	39
Liquid Limit (-No. 40)	34		49	50
Plasticity Index (-No. 40)	18		31	31
Plastic Limit	16		19	20
Soil Color	BRN/GRY	BRN/TAN	BRN/TAN	BRN/TAN
Textural Class	CLY LM		CLY	CLY
Soil Class (AASHTO M-145)	A-6(7)		A-7-6(31)	A-7-6(30)
Frost Class	F3		F3	F3
Optimum Moisture (%)	10.1		12.8	13.0
Maximum Dry Density (pcf)	126.9		120.2	120.9
% Organic Content				
Depth (Ft.) | Moisture (%)	2 | 26.4	2 | 26.3	2 | 23.4	2 | 24.5
	3 | 25.8	3 | 17.2	3 | 24.4	3 | 24.6
	4 | 12.7	4 | 26.9	4 | 22.7	4 | 23.1
	5 | 17.2	5 | 21.8	5 | 23.1	5 | 24.1
	6 | 12.8	23.0	23.4	24.1
	7 | 15.1			
	8 | 16.6			
	9 | 16.9			
	10 | 15.3			
Avg. Moisture of Sample Depth	17.7			

Scott W. Wutzke, Testing Lab Supervisor
Date Printed: 5/23/2016

Linear Laboratory Analysis

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

Report Number	SS-9-2016	**Date Reported**	4/21/2016	**District**	Dickinson
County	DUNN	**Submitted By**	Naumann	**Project Number**	NH-5-200(025)095
		AASHTO Test Method	T-180 Mold Size 4 inch	**PCN**	19734

Comments

Lab Number	302	301	300	299
Reference Pt + Feet	99+5096	99+5164	99+5208	99+5243
Distance From CenterLine (Ft.)	Rt 9 WB	Rt 9 WB	Rt 9 WB	Rt 9 WB
Depth, Ft.	1.1 - 6.5	1.0 - 6.5	0.9 - 6.5	0.8 - 4.5
Field Sample No.	302	301	300	299
% Pass. 3/8" Sieve		100		99
% Pass. No. 4 Sieve		99		98
% Pass. No. 10 Sieve		94		92
% Coarse Sand (-No. 10 + No. 40)		6		6
% Fine Sand (-No. 40 + No. 200)		14		18
% Silt (0.074 - 0.005 mm)		20		20
% Clay (-0.005 mm)		53		48
Liquid Limit (-No. 40)		53		49
Plasticity Index (-No. 40)		28		28
Plastic Limit		24		21
Soil Color	BRN/GRY/BLK	BRN/GRY/BLK	BRN/GRY/BLK	BRN/GRY/BLK
Textural Class		CLY		CLY
Soil Class (AASHTO M-145)		A-7-6(21)		A-7-6(17)
Frost Class		F3		F3
Optimum Moisture (%)		16.1		14.0
Maximum Dry Density (pcf)		109.8		116.5
% Organic Content				
Depth (Ft.) | Moisture (%)	2 | 22.3	2 | 23.1	2 | 25.5	2 | 20.9
	3 | 29.4	3 | 21.1	3 | 18.6	3 | 26.0
	4 | 26.5	4 | 31.7	4 | 25.5	4 | 33.5
	5 | 18.1	5 | 34.1	5 | 29.1	5 | 83.9
	6 | 35.4	6 | 94.6	6 | 35.3	6 | 80.0
	7 | 99.0	7 | 97.9	7 | 47.5	7 | 94.2
	8 | 88.1	8 | 69.6	8 | 89.3	8 | 78.2
	9 | 115.1	9 | 100.0	9 | 103.7	9 | 90.0
	10 | 226.4	10 | 98.0	10 | 93.4	10 | 95.0
Avg. Moisture of Sample Depth	26.3	40.9	26.8	26.8

Scott W. Wutzke, Testing Lab Supervisor
Date Printed: 5/23/2016

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
NH-5-200(025)095			
Offset From Centerline		Type of Soil	
AASTHO Designation	Date		
T-180	**4/26/2016**		**285**

Density

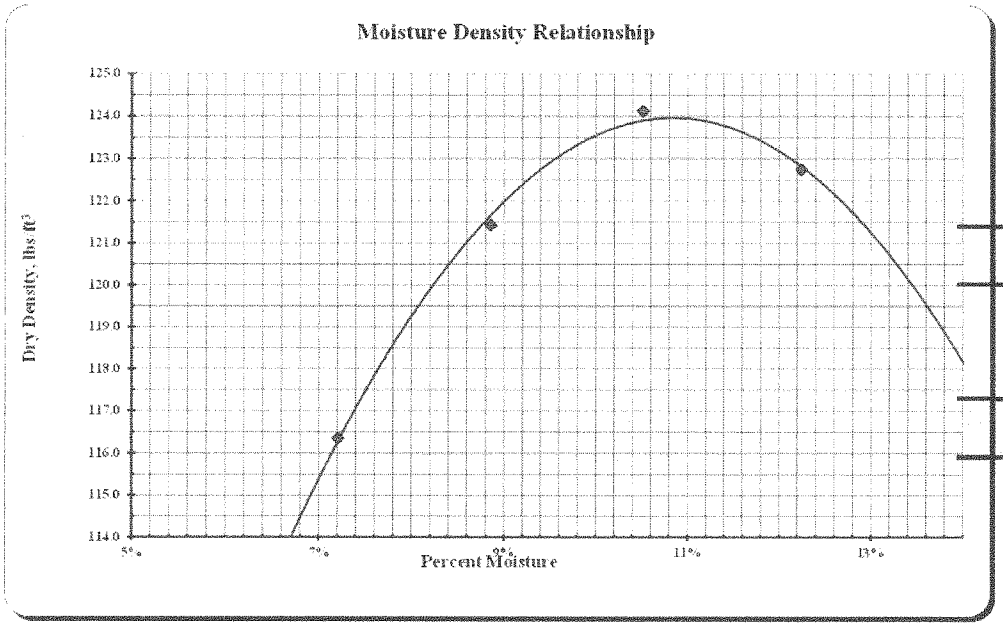
			Test Count	4				
	Determination No.		1	2	3	4	5	6
A	Volume of Mold	cu. ft.	0.0333	0.0333	0.0333	0.0333	0.0333	0.0333
		lbs.	8.59	8.83	9.00	9.02		
C	Weight of Mold	lbs.	4.43	4.43	4.43	4.43	4.43	4.43
D	Weight of Compacted Soil = B - C	lbs.	4.15	4.40	4.57	4.59		
E	Wet Density = D / A	lbs./cu.ft.	124.7	132.2	137.2	137.8		
F	Dry Density = (E x 100) / (100 + L)	lbs./cu.ft.	**116.4**	**121.4**	**124.1**	**122.7**	**#VALUE!**	**#VALUE!**

Moisture Content

AASHTO T99 or T180 Tested by:

	Container No.		23	24	25	26		
G	Wet Weight / Container	grams	143.0	142.9	142.3	146.9		
H	Dry Weight / Container	grams	135.9	134.3	132.3	134.9		
I	Moisture Loss = G - H	grams	7.1	8.6	10.0	12.0		
J	Tare Weight of Container	grams	37.4	37.2	37.2	36.9		
K	Dry Soil = H - J	grams	98.5	97.1	95.1	98.0		
L	%Moisture = (I / K) x 100	%	**7.2%**	**8.9%**	**10.5%**	**12.2%**		

ASTM D4643 AASHTO T217 or T265 Tested by: ml



Max Dry Density

124.0 lbs./cu.ft.

Optimum Moisture

10.8%

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
NH-5-200(025)095			
Offset From Centerline		Type of Soil	
AASTHO Designation **T-180**	Date **4/26/2016**		**287**

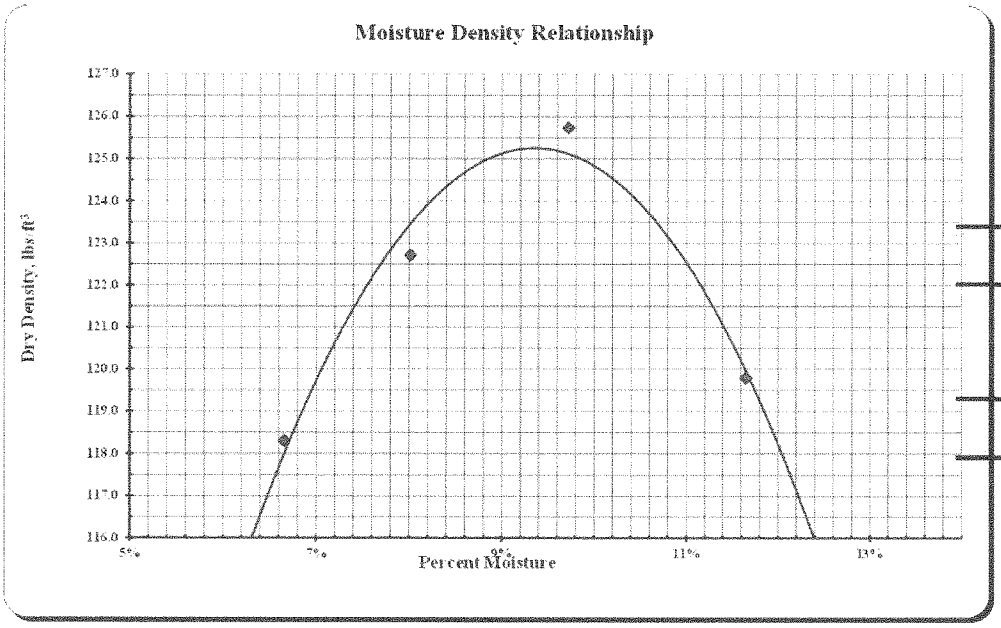
Density		Test Count	4				
Determination No.		1	2	3	4	5	6
A Volume of Mold	cu. ft.	0.0333	0.0333	0.0333	0.0333	0.0333	0.0333
	lbs.	8.64	8.85	9.03	8.89		
C Weight of Mold	lbs.	4.44	4.44	4.44	4.44	4.44	4.44
D Weight of Compacted Soil = B - C	lbs.	4.20	4.41	4.59	4.45		
E Wet Density = D / A	lbs./cu.ft.	126.2	132.6	138.0	133.8		
F Dry Density = (E x 100) / (100 + L)	lbs./cu.ft.	**118.3**	**122.7**	**125.7**	**119.8**	**#VALUE!**	**#VALUE!**

Moisture Content

AASHTO T99 or T180 Tested by:

Container No.		97	98	99	100		
G Wet Weight / Container	grams	151.4	149.4	147.1	157.0		
H Dry Weight / Container	grams	144.3	141.1	137.4	144.5		
I Moisture Loss = G - H	grams	7.1	8.3	9.7	12.5		
J Tare Weight of Container	grams	37.7	37.5	37.6	37.2		
K Dry Soil = H - J	grams	106.6	103.6	99.8	107.3		
L %Moisture = (I / K) x 100	%	**6.7%**	**8.0%**	**9.7%**	**11.6%**		

ASTM D4643 AASHTO T217 or T265 Tested by: ml



Max Dry Density

125.3 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
NH-5-200(025)095			
Offset From Centerline		Type of Soil	
AASTHO Designation **T-180**	Date **4/26/2016**		**288**

Density

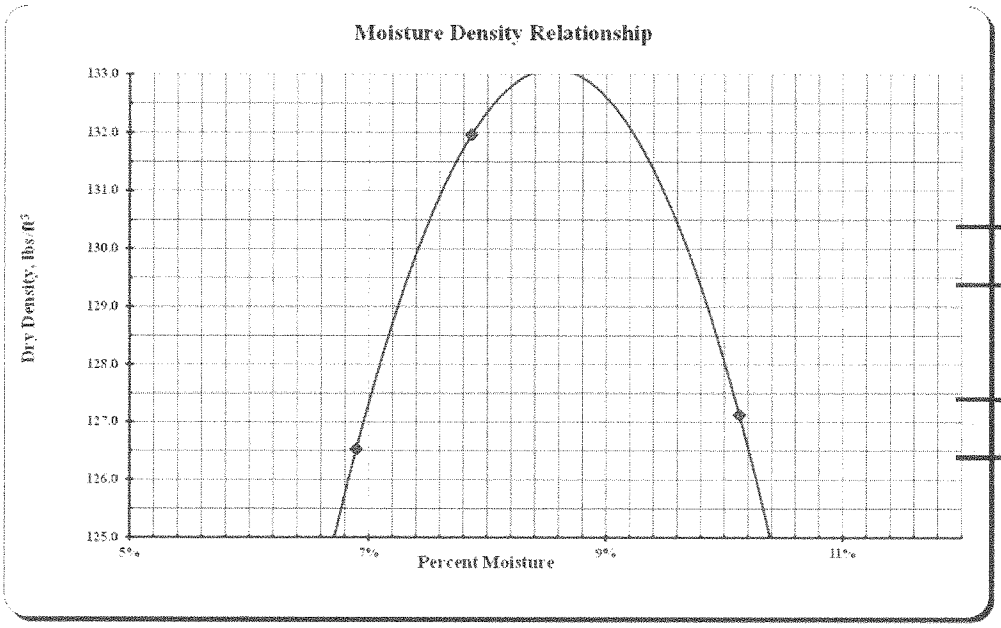
			Test Count	3				
	Determination No.		1	2	3	4	5	6
A	Volume of Mold	cu. ft.	0.0333	0.0333	0.0333	0.0333	0.0333	0.0333
		lbs.	8.94	9.17	9.10			
C	Weight of Mold	lbs.	4.43	4.43	4.43	4.43	4.43	4.43
D	Weight of Compacted Soil = B - C	lbs.	4.50	4.74	4.66			
E	Wet Density = D / A	lbs./cu.ft.	135.3	142.3	140.0			
F	Dry Density = (E x 100) / (100 + L)	lbs./cu.ft.	**126.5**	**132.0**	**127.1**	**#VALUE!**	**#VALUE!**	**#VALUE!**

Moisture Content

AASHTO T99 or T180 Tested by:

	Container No.		27	28	29			
G	Wet Weight / Container	grams	163.8	162.0	149.2			
H	Dry Weight / Container	grams	155.6	152.9	138.9			
I	Moisture Loss = G - H	grams	8.2	9.1	10.3			
J	Tare Weight of Container	grams	36.7	37.2	37.2			
K	Dry Soil = H - J	grams	118.9	115.7	101.7			
L	%Moisture = (I / K) x 100	%	**6.9%**	**7.9%**	**10.1%**			

ASTM D4643 AASHTO T217 or T265 Tested by: ml



Max Dry Density

133.1 lbs./cu.ft.

Optimum Moisture

8.6%

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
NH-5-200(025)095			
Offset From Centerline		Type of Soil	
AASTHO Designation **T-180**	Date **4/26/2016**		**289**

Density

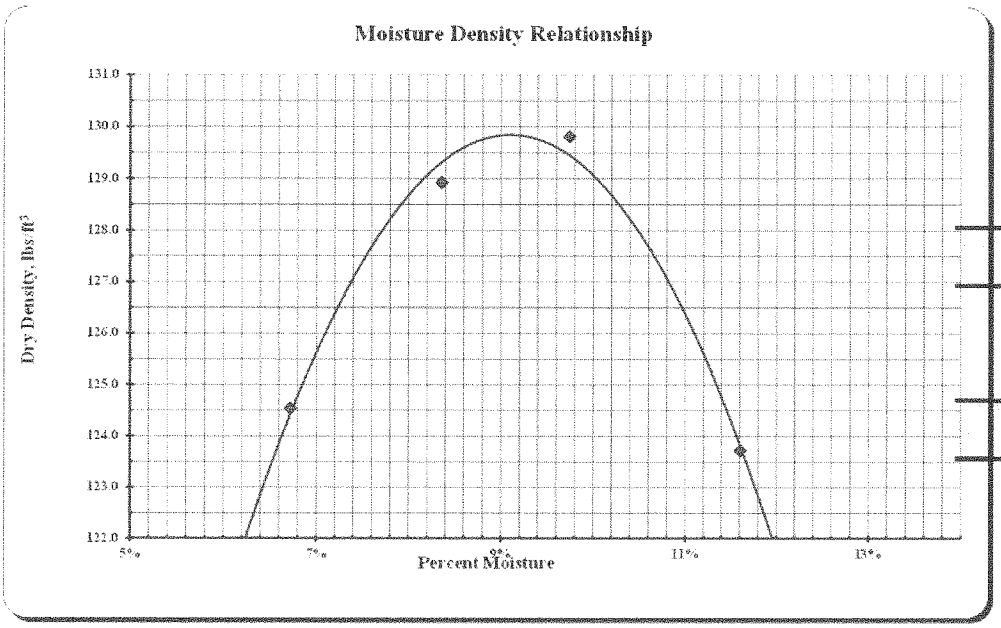
			Test Count	4				
	Determination No.		1	2	3	4	5	6
A	Volume of Mold	cu. ft.	0.0333	0.0333	0.0333	0.0333	0.0333	0.0333
		lbs.	8.87	9.09	9.18	9.04		
C	Weight of Mold	lbs.	4.44	4.44	4.44	4.44	4.44	4.44
D	Weight of Compacted Soil = B - C	lbs.	4.43	4.65	4.74	4.60		
E	Wet Density = D / A	lbs./cu.ft.	132.9	139.7	142.5	138.1		
F	Dry Density = (E x 100) / (100 + L)	lbs./cu.ft.	**124.5**	**128.9**	**129.8**	**123.7**	**#VALUE!**	**#VALUE!**

Moisture Content

AASHTO T99 or T180 Tested by:

	Container No.		101	102	103	104		
G	Wet Weight / Container	grams	151.9	154.4	156.6	152.6		
H	Dry Weight / Container	grams	144.7	145.4	146.0	140.6		
I	Moisture Loss = G - H	grams	7.2	9.0	10.6	12.0		
J	Tare Weight of Container	grams	37.6	37.7	37.2	37.2		
K	Dry Soil = H - J	grams	107.1	107.7	108.8	103.4		
L	%Moisture = (I / K) x 100	%	**6.7%**	**8.4%**	**9.7%**	**11.6%**		

ASTM D4643 AASHTO T217 or T265 Tested by: ml



Max Dry Density

129.8 lbs./cu.ft.

Optimum Moisture

9.1%

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
NH-5-200(025)095			
Offset From Centerline		Type of Soil	
AASTHO Designation	Date		
T-180	**4/26/2016**		**290**

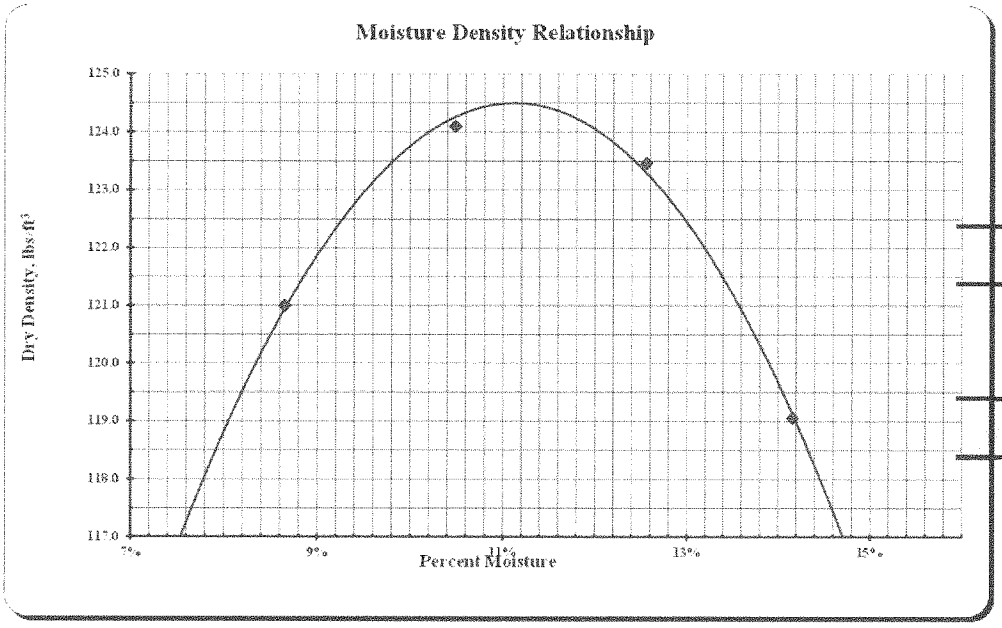
Density		Test Count	4				
Determination No.		1	2	3	4	5	6
A Volume of Mold	cu. ft.	0.0333	0.0333	0.0333	0.0333	0.0333	0.0333
	lbs.	8.81	9.00	9.06	8.96		
C Weight of Mold	lbs.	4.43	4.43	4.43	4.43	4.43	4.43
D Weight of Compacted Soil = B - C	lbs.	4.38	4.57	4.63	4.53		
E Wet Density = D / A	lbs./cu.ft.	131.5	137.1	139.0	135.9		
F Dry Density = (E x 100) / (100 + L)	lbs./cu.ft.	**121.0**	**124.1**	**123.5**	**119.1**	**#VALUE!**	**#VALUE!**

Moisture Content

AASHTO T99 or T180 Tested by:

Container No.		30	31	32	33		
G Wet Weight / Container	grams	150.1	155.0	151.6	166.1		
H Dry Weight / Container	grams	141.1	143.8	138.8	150.1		
I Moisture Loss = G - H	grams	9.0	11.2	12.8	16.0		
J Tare Weight of Container	grams	37.1	37.0	36.9	37.1		
K Dry Soil = H - J	grams	104.0	106.8	101.9	113.0		
L %Moisture = (I / K) x 100	%	**8.7%**	**10.5%**	**12.6%**	**14.2%**		

ASTM D4643 AASHTO T217 or T265 Tested by: ml



Max Dry Density

124.5 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
NH-5-200(025)095			
Offset From Centerline		Type of Soil	
AASTHO Designation **T-180**	Date **4/26/2016**		**292**

Density

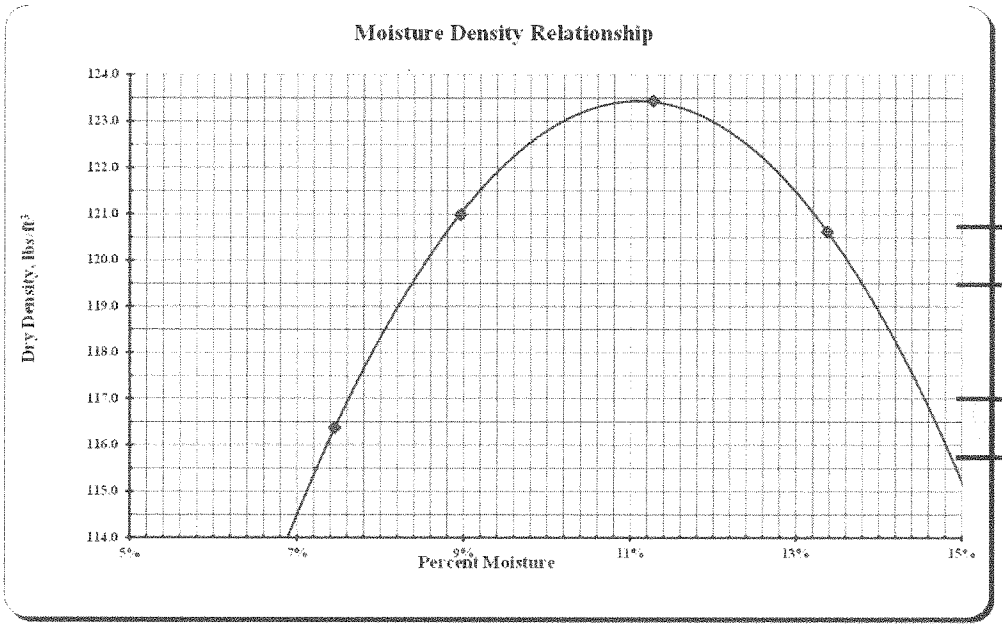
			Test Count	4				
	Determination No.		1	2	3	4	5	6
A	Volume of Mold	cu. ft.	0.0333	0.0333	0.0333	0.0333	0.0333	0.0333
		lbs.	8.60	8.83	9.01	8.99		
C	Weight of Mold	lbs.	4.44	4.44	4.44	4.44	4.44	4.44
D	Weight of Compacted Soil = B - C	lbs.	4.16	4.39	4.57	4.55		
E	Wet Density = D / A	lbs./cu.ft.	125.0	131.8	137.4	136.8		
F	Dry Density = (E x 100) / (100 + L)	lbs./cu.ft.	**116.4**	**121.0**	**123.4**	**120.6**	**#VALUE!**	**#VALUE!**

Moisture Content

AASHTO T99 or T180 Tested by:

	Container No.		105	106	107	108		
G	Wet Weight / Container	grams	174.5	174.9	145.7	152.4		
H	Dry Weight / Container	grams	165.0	163.6	134.7	138.8		
I	Moisture Loss = G - H	grams	9.5	11.3	11.0	13.6		
J	Tare Weight of Container	grams	37.5	37.5	37.1	37.1		
K	Dry Soil = H - J	grams	127.5	126.1	97.6	101.7		
L	%Moisture = (I / K) x 100	%	**7.5%**	**9.0%**	**11.3%**	**13.4%**		

ASTM D4643 AASHTO T217 or T265 Tested by: ml



Max Dry Density

123.4 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
NH-5-200(025)095			
Offset From Centerline		Type of Soil	
AASTHO Designation	Date		
T-180	**4/26/2016**		**293**

Density — Test Count: 4

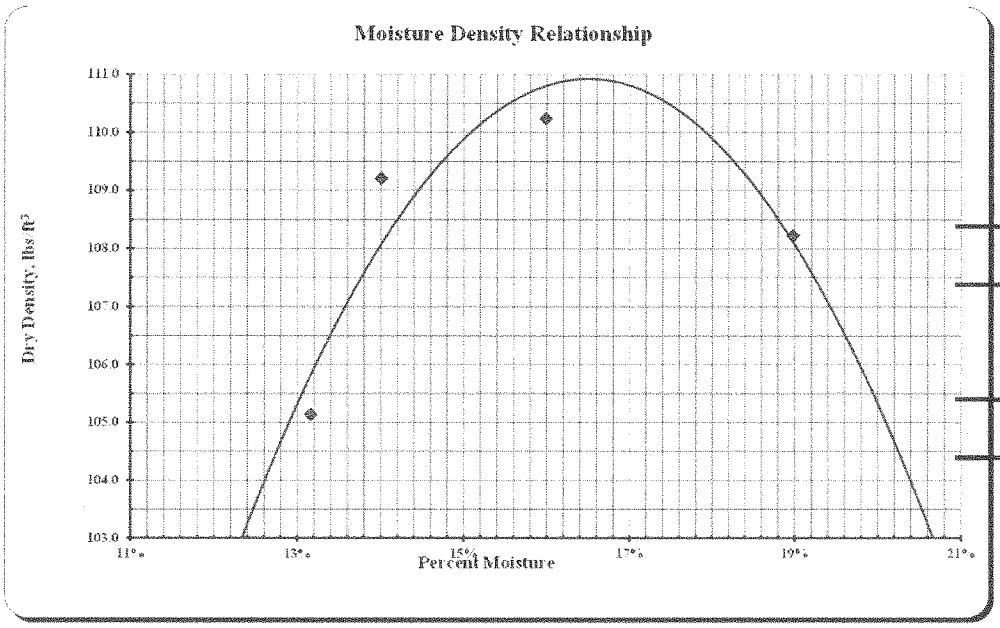
	Determination No.		1	2	3	4	5	6
A	Volume of Mold	cu. ft.	0.0333	0.0333	0.0333	0.0333	0.0333	0.0333
		lbs.	8.40	8.58	8.69	8.72		
C	Weight of Mold	lbs.	4.43	4.43	4.43	4.43	4.43	4.43
D	Weight of Compacted Soil = B - C	lbs.	3.96	4.15	4.26	4.29		
E	Wet Density = D / A	lbs./cu.ft.	119.0	124.5	127.9	128.8		
F	Dry Density = (E x 100) / (100 + L)	lbs./cu.ft.	**105.1**	**109.2**	**110.2**	**108.2**	**#VALUE!**	**#VALUE!**

Moisture Content

AASHTO T99 or T180 Tested by:

	Container No.		34	35	36	37		
G	Wet Weight / Container	grams	147.2	153.1	156.9	151.4		
H	Dry Weight / Container	grams	134.5	138.9	140.4	133.2		
I	Moisture Loss = G - H	grams	12.7	14.2	16.5	18.2		
J	Tare Weight of Container	grams	38.0	37.5	37.2	37.3		
K	Dry Soil = H - J	grams	96.5	101.4	103.2	95.9		
L	%Moisture = (I / K) x 100	%	**13.2%**	**14.0%**	**16.0%**	**19.0%**		

ASTM D4643 AASHTO T217 or T265 Tested by: ml



Max Dry Density

110.9 lbs./cu.ft.

Optimum Moisture

16.5%

MOISTURE-DENSITY RELATIONS OF SOILS

North Dakota Department Of Transportation, Materials & Research Division

SFN 10063 (Rev. 03-2006)

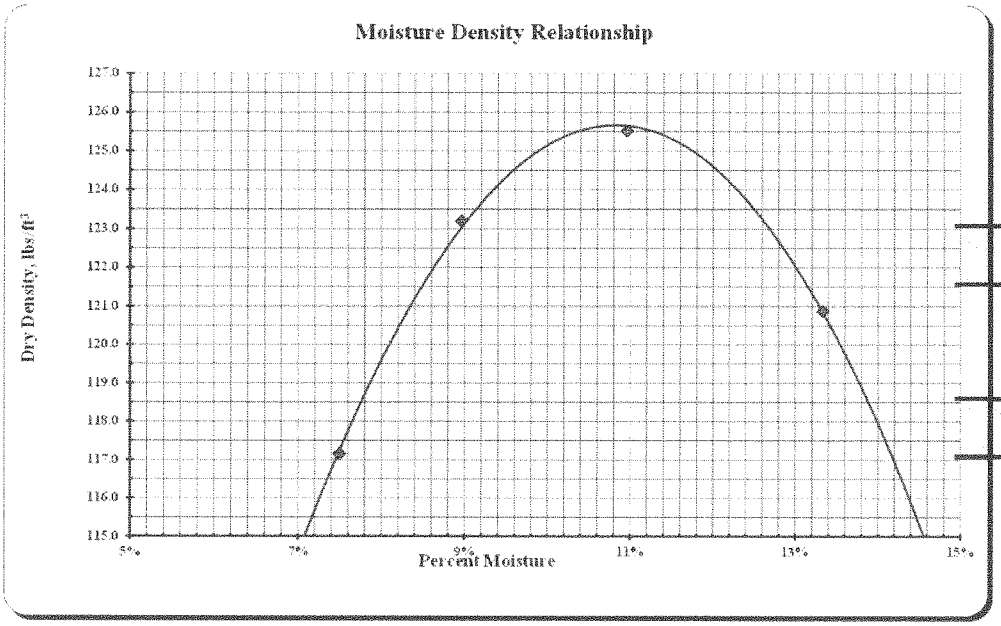
Project No.	PCN	Station	Depth Below Grade
NH-5-200(025)095			
Offset From Centerline		Type of Soil	
AASTHO Designation	Date		
T-180	**4/26/2016**		**294**

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	8.91	9.08	9.00		
C Weight of Mold	lbs.	4.44	4.44	4.44	4.44	4.44	4.44
D Weight of Compacted Soil = B - C	lbs.	4.19	4.47	4.64	4.56		
E Wet Density = D / A	lbs./cu.ft.	125.9	134.2	139.3	137.0		
F Dry Density = (E x 100) / (100 + L)	lbs./cu.ft.	**117.2**	**123.2**	**125.5**	**120.9**	**#VALUE!**	**#VALUE!**

Moisture Content AASHTO T99 or T180 Tested by:

Container No.		109	110	111	112		
G Wet Weight / Container	grams	155.4	150.2	144.2	159.9		
H Dry Weight / Container	grams	147.2	140.9	133.7	145.5		
I Moisture Loss = G - H	grams	8.2	9.3	10.5	14.4		
J Tare Weight of Container	grams	37.8	37.1	37.9	37.5		
K Dry Soil = H - J	grams	109.4	103.8	95.8	108.0		
L %Moisture = (I / K) x 100	%	**7.5%**	**9.0%**	**11.0%**	**13.3%**		

ASTM D4643 AASHTO T217 or T265 Tested by: ml



Max Dry Density

125.7 lbs./cu.ft.

Optimum Moisture

10.8%

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
NH-5-200(025)095			
Offset From Centerline		Type of Soil	
AASTHO Designation **T-180**	Date **4/26/2016**		**295**

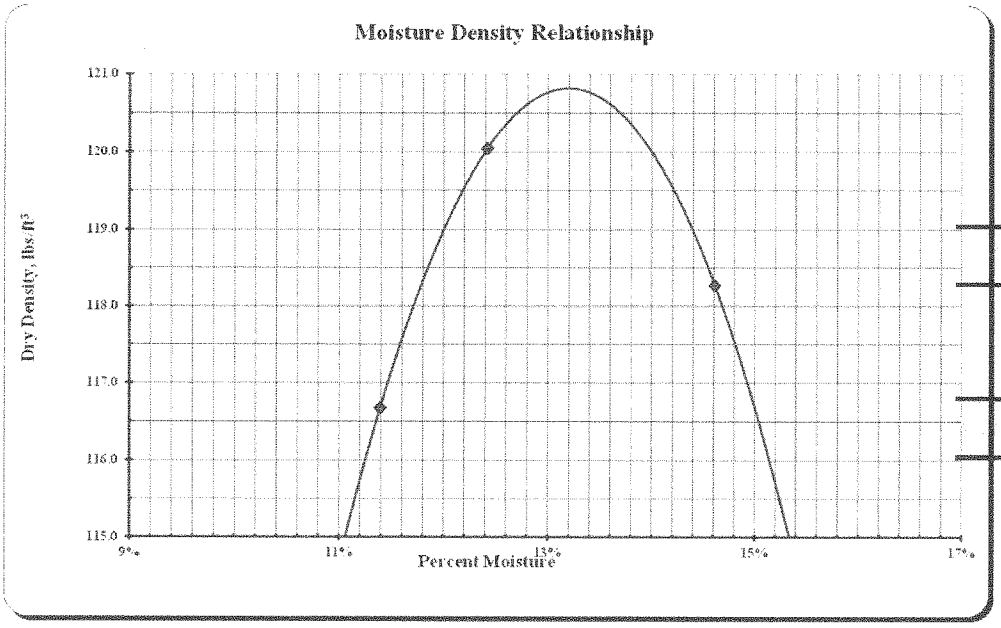
Density		Test Count	3				
Determination No.		1	2	3	4	5	6
A Volume of Mold	cu. ft.	0.0333	0.0333	0.0333	0.0333	0.0333	0.0333
	lbs.	8.76	8.92	8.95			
C Weight of Mold	lbs.	4.43	4.43	4.43	4.43	4.43	4.43
D Weight of Compacted Soil = B - C	lbs.	4.33	4.49	4.51			
E Wet Density = D / A	lbs./cu.ft.	130.0	135.0	135.6			
F Dry Density = (E x 100) / (100 + L)	lbs./cu.ft.	**116.7**	**120.0**	**118.3**	**#VALUE!**	**#VALUE!**	**#VALUE!**

Moisture Content

AASHTO T99 or T180 Tested by:

Container No.		38	39	40			
G Wet Weight / Container	grams	146.4	158.8	147.7			
H Dry Weight / Container	grams	135.2	145.4	133.6			
I Moisture Loss = G - H	grams	11.2	13.4	14.1			
J Tare Weight of Container	grams	36.9	37.5	37.1			
K Dry Soil = H - J	grams	98.3	107.9	96.5			
L %Moisture = (I / K) x 100	%	**11.4%**	**12.4%**	**14.6%**			

ASTM D4643 AASHTO T217 or T265 Tested by: ml



Max Dry Density

120.8 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
NH-5-200(025)095			
Offset From Centerline		Type of Soil	
AASTHO Designation **T-180**	Date **4/26/2016**		**296**

Density

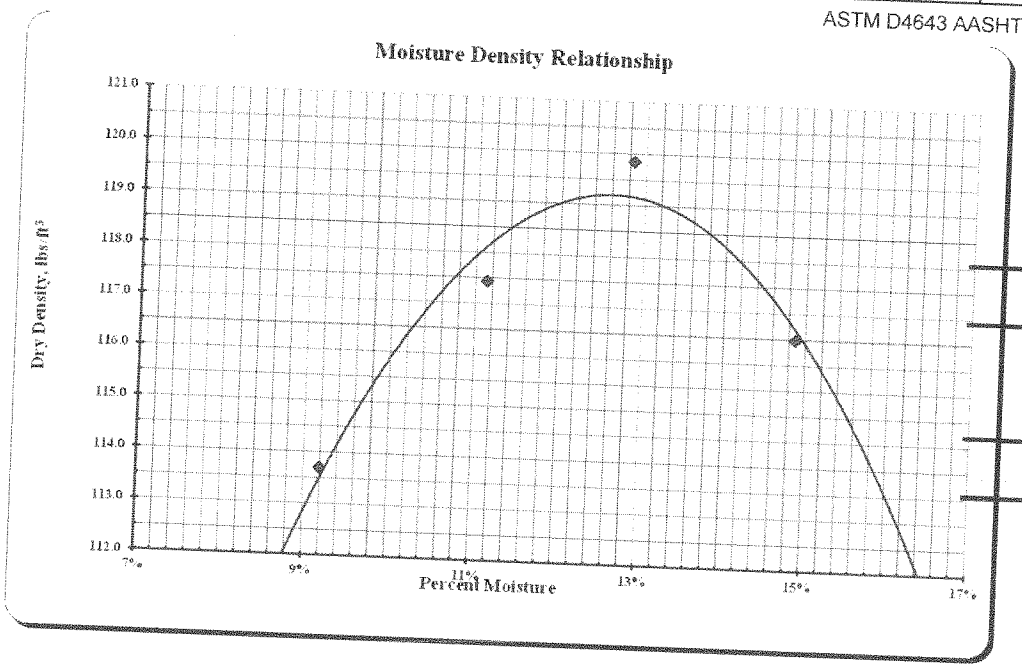
		Test Count	4				
Determination No.		1	2	3	4	5	6
A Volume of Mold	cu. ft.	0.0333	0.0333	0.0333	0.0333	0.0333	0.0333
	lbs.	8.57	8.79	8.94	8.90		
C Weight of Mold	lbs.	4.44	4.44	4.44	4.44	4.44	4.44
D Weight of Compacted Soil = B - C	lbs.	4.13	4.35	4.50	4.46		
E Wet Density = D / A	lbs./cu.ft.	124.1	130.5	135.3	133.8		
F Dry Density = (E x 100) / (100 + L)	lbs./cu.ft.	**113.7**	**117.4**	**119.9**	**116.5**	**#VALUE!**	**#VALUE!**

Moisture Content

AASHTO T99 or T180 Tested by:

Container No.		113	114	115	116		
G Wet Weight / Container	grams	155.6	151.2	160.5	151.7		
H Dry Weight / Container	grams	145.7	139.8	146.4	136.9		
I Moisture Loss = G - H	grams	9.9	11.4	14.1	14.8		
J Tare Weight of Container	grams	38.0	37.4	36.7	37.4		
K Dry Soil = H - J	grams	107.7	102.4	109.7	99.5		
L %Moisture = (I / K) x 100	%	**9.2%**	**11.1%**	**12.9%**	**14.9%**		

ASTM D4643 AASHTO T217 or T265 Tested by: ml



Max Dry Density

119.2 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
NH-5-200(025)095			
Offset From Centerline		Type of Soil	
AASTHO Designation	Date		
T-180	**4/26/2016**		**297**

Density

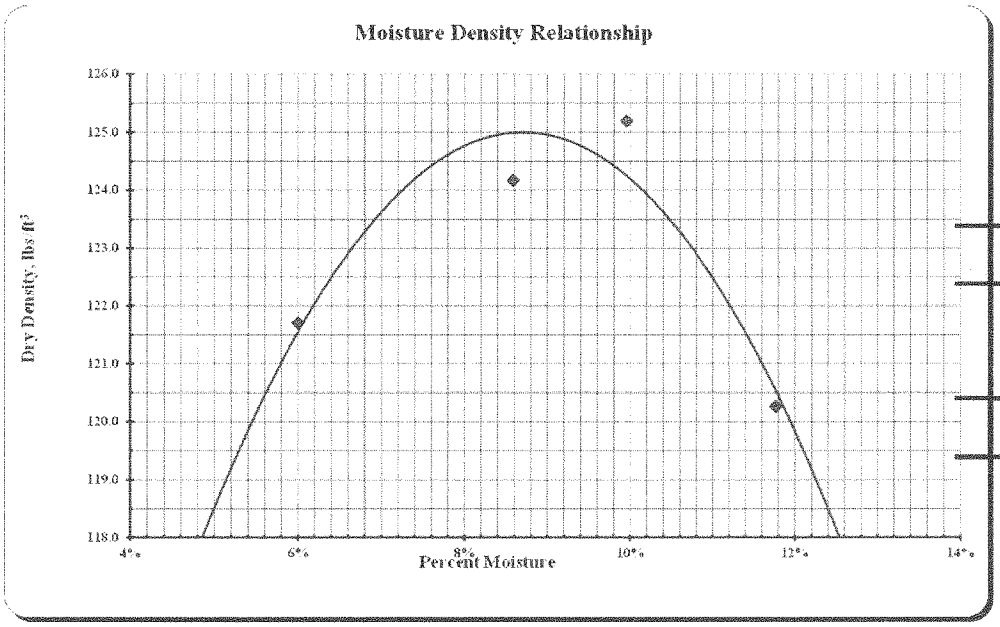
			Test Count	4				
	Determination No.		1	2	3	4	5	6
A	Volume of Mold	cu. ft.	0.0333	0.0333	0.0333	0.0333	0.0333	0.0333
		lbs.	8.73	8.92	9.02	8.91		
C	Weight of Mold	lbs.	4.43	4.43	4.43	4.43	4.43	4.43
D	Weight of Compacted Soil = B - C	lbs.	4.30	4.49	4.58	4.48		
E	Wet Density = D / A	lbs./cu.ft.	129.0	134.8	137.7	134.4		
F	Dry Density = (E x 100) / (100 + L)	lbs./cu.ft.	**121.7**	**124.2**	**125.2**	**120.3**	**#VALUE!**	**#VALUE!**

Moisture Content

AASHTO T99 or T180 Tested by:

	Container No.		41	42	43	44		
G	Wet Weight / Container	grams	148.5	148.0	154.1	154.8		
H	Dry Weight / Container	grams	142.2	139.2	143.5	142.4		
I	Moisture Loss = G - H	grams	6.3	8.8	10.6	12.4		
J	Tare Weight of Container	grams	37.2	36.7	37.0	37.0		
K	Dry Soil = H - J	grams	105.0	102.5	106.5	105.4		
L	%Moisture = (I / K) x 100	%	**6.0%**	**8.6%**	**10.0%**	**11.8%**		

ASTM D4643 AASHTO T217 or T265 Tested by: ml



Max Dry Density

125.0 lbs./cu.ft.

Optimum Moisture

8.7%

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
NH-5-200(025)095			
Offset From Centerline		Type of Soil	
AASTHO Designation **T-180**	Date **4/26/2016**		**298**

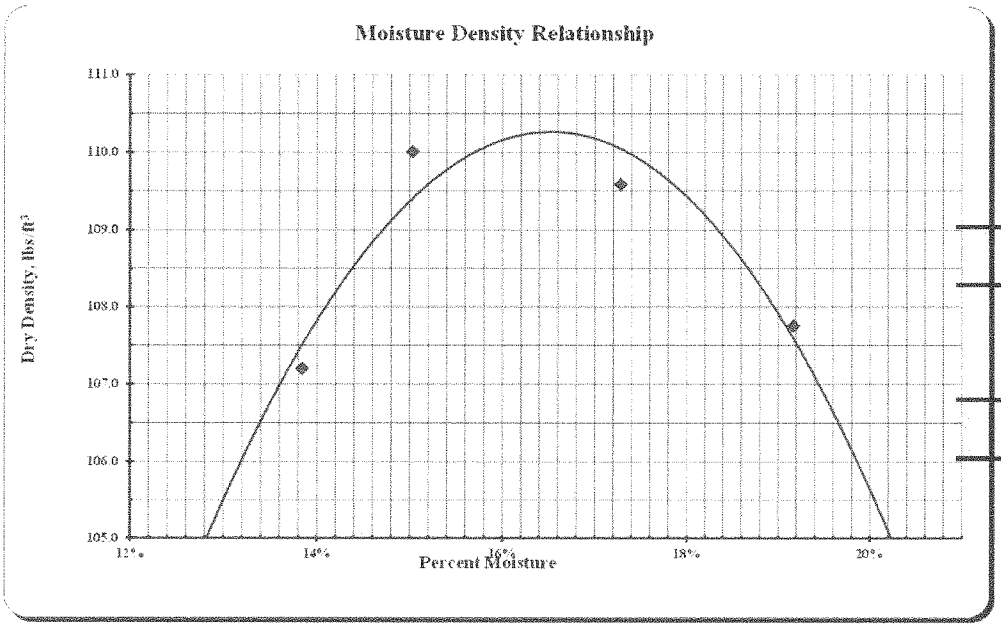
Density		Test Count	4				
Determination No.		1	2	3	4	5	6
A Volume of Mold	cu. ft.	0.0333	0.0333	0.0333	0.0333	0.0333	0.0333
	lbs.	8.50	8.65	8.72	8.72		
C Weight of Mold	lbs.	4.44	4.44	4.44	4.44	4.44	4.44
D Weight of Compacted Soil = B - C	lbs.	4.06	4.21	4.28	4.28		
E Wet Density = D / A	lbs./cu.ft.	122.0	126.5	128.5	128.4		
F Dry Density = (E x 100) / (100 + L)	lbs./cu.ft.	**107.2**	**110.0**	**109.6**	**107.8**	**#VALUE!**	**#VALUE!**

Moisture Content

AASHTO T99 or T180 Tested by:

Container No.		117	118	119	120		
G Wet Weight / Container	grams	151.6	152.7	154.5	146.1		
H Dry Weight / Container	grams	137.7	137.7	137.2	128.6		
I Moisture Loss = G - H	grams	13.9	15.0	17.3	17.5		
J Tare Weight of Container	grams	37.3	37.9	37.1	37.3		
K Dry Soil = H - J	grams	100.4	99.8	100.1	91.3		
L %Moisture = (I / K) x 100	%	**13.8%**	**15.0%**	**17.3%**	**19.2%**		

ASTM D4643 AASHTO T217 or T265 Tested by: ml



Max Dry Density

110.3 lbs./cu.ft.

Optimum Moisture

16.5%

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
NH-5-200(025)095			
Offset From Centerline		Type of Soil	
AASTHO Designation **T-180**	Date **4/26/2016**		**299**

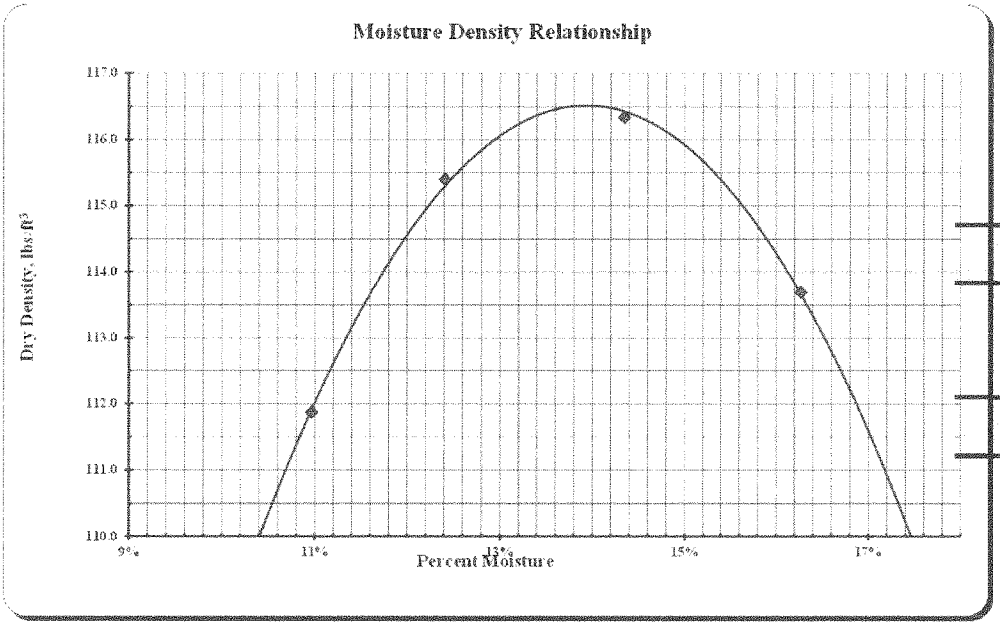
Density		Test Count	4				
	Determination No.	1	2	3	4	5	6
A Volume of Mold	cu. ft.	0.0333	0.0333	0.0333	0.0333	0.0333	0.0333
	lbs.	8.57	8.76	8.86	8.83		
C Weight of Mold	lbs.	4.43	4.44	4.43	4.43	4.43	4.43
D Weight of Compacted Soil = B - C	lbs.	4.13	4.32	4.43	4.40		
E Wet Density = D / A	lbs./cu.ft.	124.1	129.7	133.0	132.2		
F Dry Density = (E x 100) / (100 + L)	lbs./cu.ft.	**111.9**	**115.4**	**116.3**	**113.7**	**#VALUE!**	**#VALUE!**

Moisture Content

AASHTO T99 or T180 Tested by:

Container No.		45	46	47	48		
G Wet Weight / Container	grams	149.9	146.7	143.0	153.6		
H Dry Weight / Container	grams	138.8	134.6	129.7	137.3		
I Moisture Loss = G - H	grams	11.1	12.1	13.3	16.3		
J Tare Weight of Container	grams	37.6	37.1	37.0	37.1		
K Dry Soil = H - J	grams	101.2	97.5	92.7	100.2		
L %Moisture = (I / K) x 100	%	**11.0%**	**12.4%**	**14.3%**	**16.3%**		

ASTM D4643 AASHTO T217 or T265 Tested by: ml



Max Dry Density

116.5 lbs./cu.ft.

Optimum Moisture

14.0%

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
NH-5-200(025)095			
Offset From Centerline		Type of Soil	
AASTHO Designation **T-180**	Date **4/26/2016**		**301**

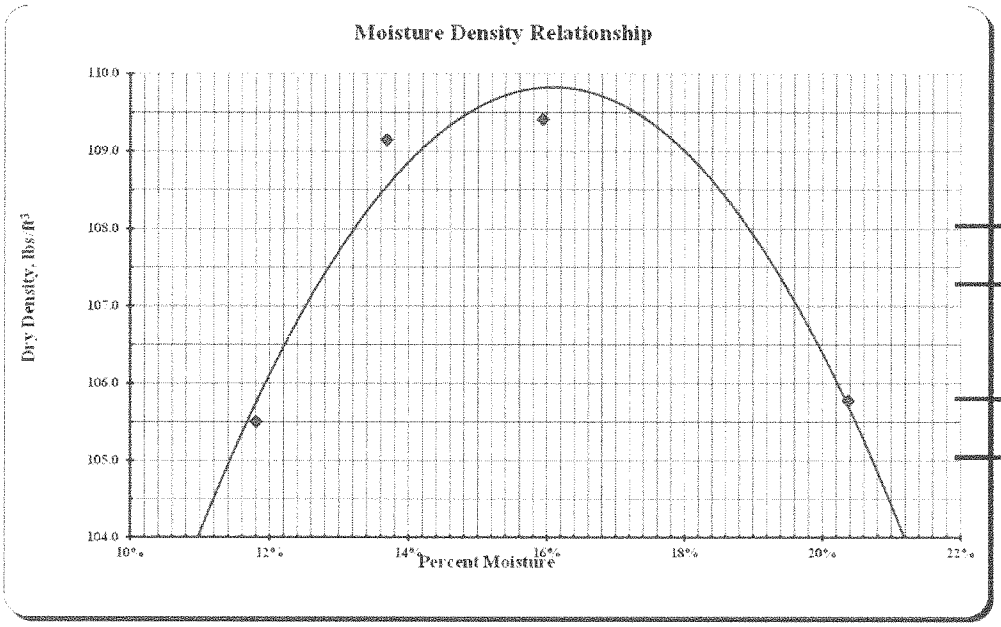
Density		Test Count	4				
Determination No.		1	2	3	4	5	6
A Volume of Mold	cu. ft.	0.0333	0.0333	0.0333	0.0333	0.0333	0.0333
	lbs.	8.37	8.57	8.66	8.68		
C Weight of Mold	lbs.	4.44	4.44	4.44	4.44	4.44	4.44
D Weight of Compacted Soil = B - C	lbs.	3.93	4.13	4.22	4.24		
E Wet Density = D / A	lbs./cu.ft.	118.0	124.1	126.8	127.3		
F Dry Density = (E x 100) / (100 + L)	lbs./cu.ft.	**105.5**	**109.1**	**109.4**	**105.8**	**#VALUE!**	**#VALUE!**

Moisture Content

AASHTO T99 or T180 Tested by:

Container No.		1	2	3	4		
G Wet Weight / Container	grams	145.5	145.3	153.5	152.5		
H Dry Weight / Container	grams	134.0	132.3	137.5	132.9		
I Moisture Loss = G - H	grams	11.5	13.0	16.0	19.6		
J Tare Weight of Container	grams	36.6	37.3	37.1	36.7		
K Dry Soil = H - J	grams	97.4	95.0	100.4	96.2		
L %Moisture = (I / K) x 100	%	**11.8%**	**13.7%**	**15.9%**	**20.4%**		

ASTM D4643 AASHTO T217 or T265 Tested by: mi



Max Dry Density

109.8 lbs./cu.ft.

Optimum Moisture

16.1%

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
NH-5-200(025)095			
Offset From Centerline		Type of Soil	
AASTHO Designation	Date		
T-180	**4/27/2016**		**303**

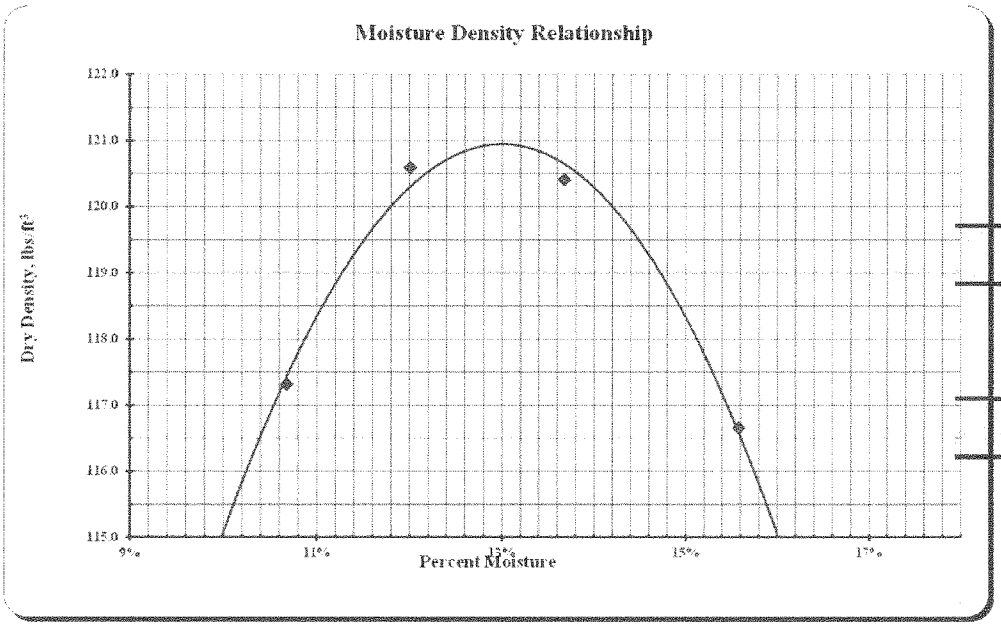
Density — Test Count: 4

	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	8.93	8.99	8.92		
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.	4.32	4.50	4.56	4.49		
E	Wet Density = D / A	lbs./cu.ft.	129.8	135.1	136.9	134.8		
F	Dry Density = (E x 100) / (100 + L)	lbs./cu.ft.	**117.3**	**120.6**	**120.4**	**116.7**	**#VALUE!**	**#VALUE!**

Moisture Content — AASHTO T99 or T180 Tested by:

	Container No.		1	2	3	4		
G	Wet Weight / Container	grams	142.3	148.3	151.8	146.5		
H	Dry Weight / Container	grams	132.1	136.4	138.0	131.7		
I	Moisture Loss = G - H	grams	10.2	11.9	13.8	14.8		
J	Tare Weight of Container	grams	36.6	37.3	37.1	36.7		
K	Dry Soil = H - J	grams	95.5	99.1	100.9	95.0		
L	%Moisture = (I / K) x 100	%	**10.7%**	**12.0%**	**13.7%**	**15.6%**		

ASTM D4643 AASHTO T217 or T265 Tested by: ml



Max Dry Density

120.9 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
NH-5-200(025)095			
Offset From Centerline		Type of Soil	
AASTHO Designation **T-180**	Date **4/27/2016**		**304**

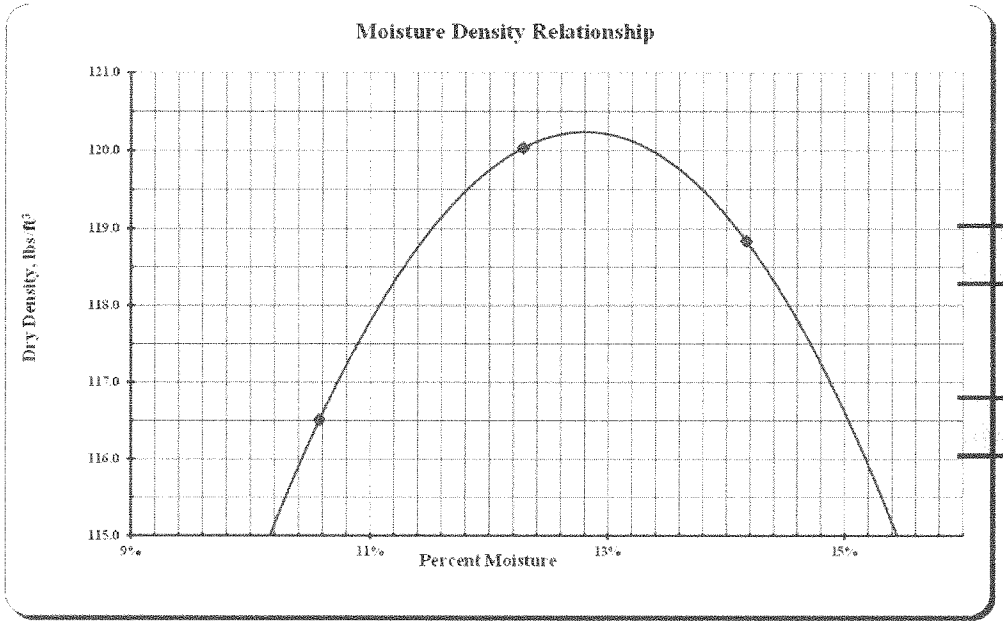
Density		Test Count	3				
	Determination No.	1	2	3	4	5	6
A Volume of Mold	cu. ft.	0.0333	0.0333	0.0333	0.0333	0.0333	0.0333
	lbs.	8.73	8.92	8.96			
C Weight of Mold	lbs.	4.44	4.43	4.44	4.44	4.44	4.44
D Weight of Compacted Soil = B - C	lbs.	4.29	4.49	4.52			
E Wet Density = D / A	lbs./cu.ft.	128.8	134.8	135.7			
F Dry Density = (E x 100) / (100 + L)	lbs./cu.ft.	**116.5**	**120.0**	**118.8**	**#VALUE!**	**#VALUE!**	**#VALUE!**

Moisture Content

AASHTO T99 or T180 Tested by:

Container No.		61	62	63			
G Wet Weight / Container	grams	145.0	146.4	148.5			
H Dry Weight / Container	grams	134.7	134.5	134.7			
I Moisture Loss = G - H	grams	10.3	11.9	13.8			
J Tare Weight of Container	grams	37.3	37.6	37.3			
K Dry Soil = H - J	grams	97.4	96.9	97.4			
L %Moisture = (I / K) x 100	%	**10.6%**	**12.3%**	**14.2%**			

ASTM D4643 AASHTO T217 or T265 Tested by: ml



Max Dry Density

120.2 lbs./cu.ft.

Optimum Moisture

12.8%

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
NH-5-200(025)095			
Offset From Centerline		Type of Soil	
AASTHO Designation **T-180**	Date **4/27/2016**		**306**

Density

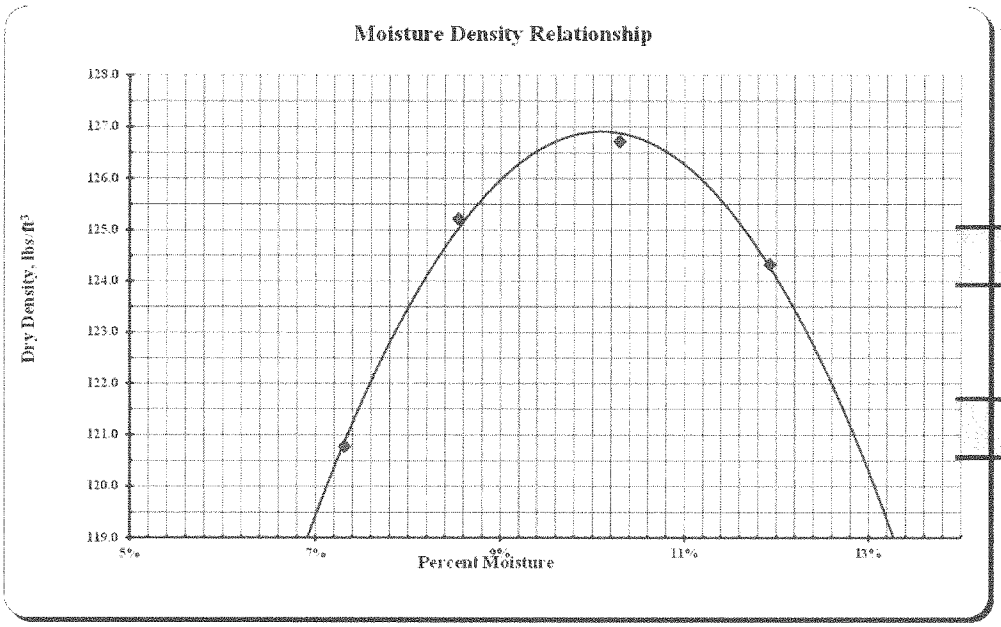
			Test Count	4				
	Determination No.		1	2	3	4	5	6
A	Volume of Mold	cu. ft.	0.0333	0.0333	0.0333	0.0333	0.0333	0.0333
		lbs.	8.75	8.96	9.09	9.07		
C	Weight of Mold	lbs.	4.44	4.43	4.44	4.44	4.44	4.44
D	Weight of Compacted Soil = B - C	lbs.	4.32	4.53	4.65	4.63		
E	Wet Density = D / A	lbs./cu.ft.	129.6	135.9	139.8	139.2		
F	Dry Density = (E x 100) / (100 + L)	lbs./cu.ft.	**120.8**	**125.2**	**126.7**	**124.3**	**#VALUE!**	**#VALUE!**

Moisture Content

AASHTO T99 or T180 Tested by:

	Container No.		64	65	66	67		
G	Wet Weight / Container	grams	159.1	145.8	147.0	145.1		
H	Dry Weight / Container	grams	150.8	137.3	136.8	133.6		
I	Moisture Loss = G - H	grams	8.3	8.5	10.2	11.5		
J	Tare Weight of Container	grams	37.3	37.8	37.7	37.2		
K	Dry Soil = H - J	grams	113.5	99.5	99.1	96.4		
L	%Moisture = (I / K) x 100	%	**7.3%**	**8.5%**	**10.3%**	**11.9%**		

ASTM D4643 AASHTO T217 or T265 Tested by: ml



Max Dry Density

126.9 lbs./cu.ft.

Optimum Moisture

10.1%

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
NH-5-200(025)095			
Offset From Centerline		Type of Soil	
AASTHO Designation **T-180**	Date **4/27/2016**		**307**

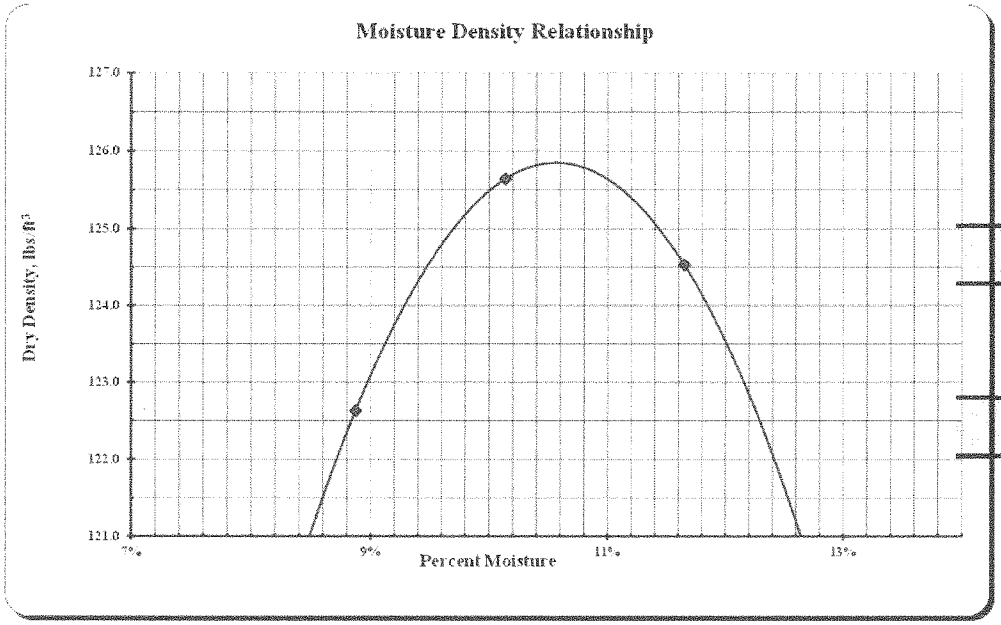
Density		Test Count	3				
	Determination No.	1	2	3	4	5	6
A Volume of Mold	cu. ft.	0.0333	0.0333	0.0333	0.0333	0.0333	0.0333
	lbs.	8.88	9.04	9.06			
C Weight of Mold	lbs.	4.43	4.43	4.43	4.43	4.43	4.43
D Weight of Compacted Soil = B - C	lbs.	4.45	4.61	4.63			
E Wet Density = D / A	lbs./cu.ft.	133.5	138.4	139.0			
F Dry Density = (E x 100) / (100 + L)	lbs./cu.ft.	**122.6**	**125.6**	**124.5**	**#VALUE!**	**#VALUE!**	**#VALUE!**

Moisture Content

AASHTO T99 or T180 Tested by:

Container No.		5	6	7			
G Wet Weight / Container	grams	151.2	150.1	149.4			
H Dry Weight / Container	grams	141.9	139.7	137.6			
I Moisture Loss = G - H	grams	9.3	10.4	11.8			
J Tare Weight of Container	grams	37.1	37.1	36.3			
K Dry Soil = H - J	grams	104.8	102.6	101.3			
L %Moisture = (I / K) x 100	%	**8.9%**	**10.1%**	**11.6%**			

ASTM D4643 AASHTO T217 or T265 Tested by: ml



Max Dry Density

125.9 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
NH-5-200(025)095			
Offset From Centerline		Type of Soil	
AASTHO Designation **T-180**	Date **4/27/2016**		**308**

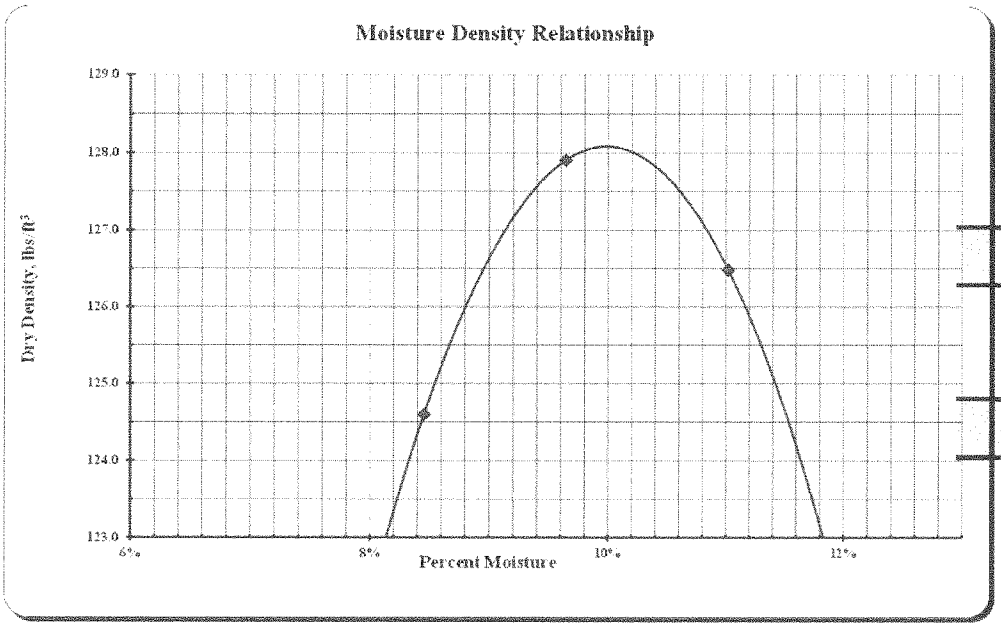
Density		Test Count	3				
	Determination No.	1	2	3	4	5	6
A Volume of Mold	cu. ft.	0.0333	0.0333	0.0333	0.0333	0.0333	0.0333
	lbs.	8.93	9.10	9.11			
C Weight of Mold	lbs.	4.43	4.43	4.43	4.43	4.43	4.43
D Weight of Compacted Soil = B - C	lbs.	4.50	4.67	4.68			
E Wet Density = D / A	lbs./cu.ft.	135.1	140.2	140.4			
F Dry Density = (E x 100) / (100 + L)	lbs./cu.ft.	**124.6**	**127.9**	**126.5**	**#VALUE!**	**#VALUE!**	**#VALUE!**

Moisture Content

AASHTO T99 or T180 Tested by:

Container No.		8	9	10			
G Wet Weight / Container	grams	140.9	156.6	146.5			
H Dry Weight / Container	grams	132.8	146.1	135.6			
I Moisture Loss = G - H	grams	8.1	10.5	10.9			
J Tare Weight of Container	grams	37.0	37.2	36.7			
K Dry Soil = H - J	grams	95.8	108.9	98.9			
L %Moisture = (I / K) x 100	%	**8.5%**	**9.6%**	**11.0%**			

ASTM D4643 AASHTO T217 or T265 Tested by: mi



Max Dry Density

128.1 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
NH-5-200(025)095			
Offset From Centerline		Type of Soil	
AASTHO Designation **T-180**	Date **4/27/2016**		**309**

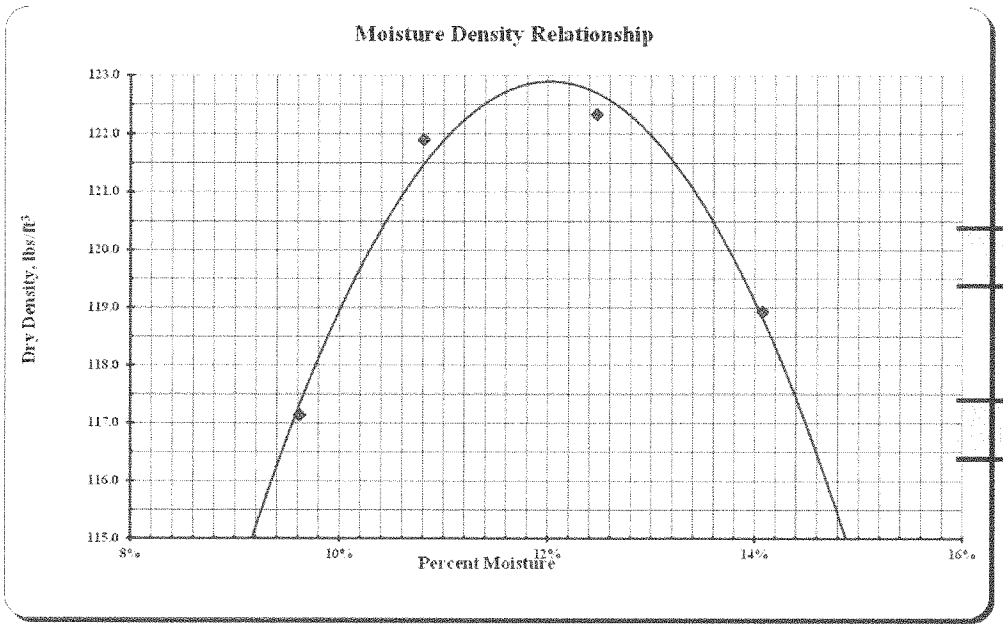
Density		Test Count	4				
	Determination No.	1	2	3	4	5	6
A Volume of Mold	cu. ft.	0.0333	0.0333	0.0333	0.0333	0.0333	0.0333
	lbs.	8.71	8.94	9.02	8.96		
C Weight of Mold	lbs.	4.44	4.44	4.44	4.44	4.44	4.44
D Weight of Compacted Soil = B - C	lbs.	4.28	4.50	4.58	4.52		
E Wet Density = D / A	lbs./cu.ft.	128.4	135.1	137.6	135.7		
F Dry Density = (E x 100) / (100 + L)	lbs./cu.ft.	**117.1**	**121.9**	**122.3**	**118.9**	**#VALUE!**	**#VALUE!**

Moisture Content

AASHTO T99 or T180 Tested by:

Container No.		68	69	70	71		
G Wet Weight / Container	grams	140.7	159.7	147.6	153.9		
H Dry Weight / Container	grams	131.6	147.8	135.4	139.5		
I Moisture Loss = G - H	grams	9.1	11.9	12.2	14.4		
J Tare Weight of Container	grams	37.0	37.7	37.6	37.2		
K Dry Soil = H - J	grams	94.6	110.1	97.8	102.3		
L %Moisture = (I / K) x 100	%	**9.6%**	**10.8%**	**12.5%**	**14.1%**		

ASTM D4643 AASHTO T217 or T265 Tested by: ml



Max Dry Density

122.9 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
NH-5-200(025)095			
Offset From Centerline		Type of Soil	
AASTHO Designation **T-180**	Date **4/27/2016**		**310**

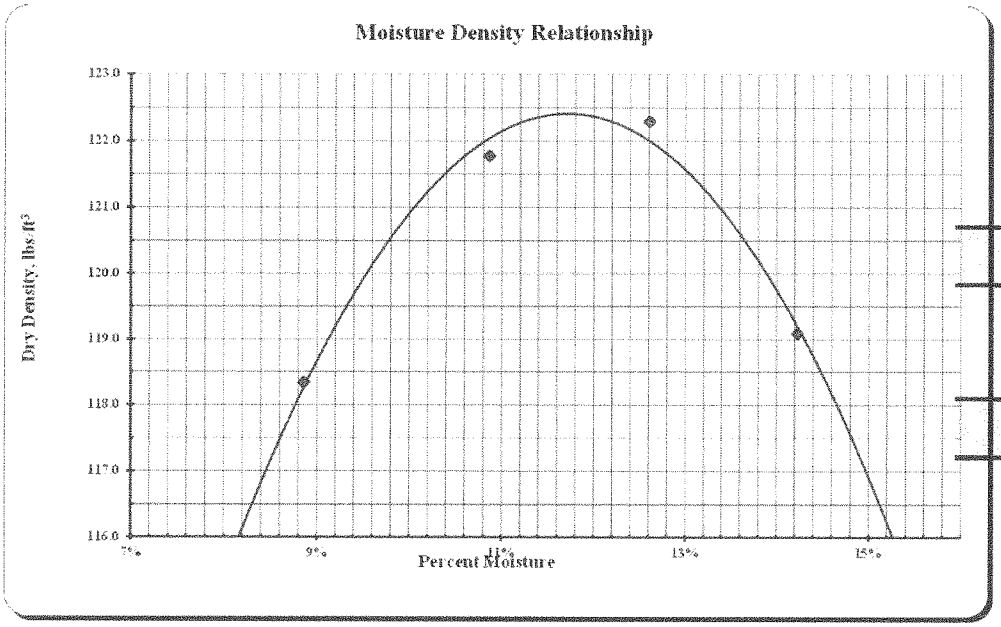
Density		Test Count	4				
Determination No.		1	2	3	4	5	6
A Volume of Mold	cu. ft.	0.0333	0.0333	0.0333	0.0333	0.0333	0.0333
	lbs.	8.72	8.93	9.02	8.96		
C Weight of Mold	lbs.	4.43	4.43	4.43	4.43	4.43	4.43
D Weight of Compacted Soil = B - C	lbs.	4.29	4.50	4.59	4.53		
E Wet Density = D / A	lbs./cu.ft.	128.8	135.0	137.7	136.0		
F Dry Density = (E x 100) / (100 + L)	lbs./cu.ft.	**118.3**	**121.8**	**122.3**	**119.1**	**#VALUE!**	**#VALUE!**

Moisture Content

AASHTO T99 or T180 Tested by:

Container No.		11	12	13	14		
G Wet Weight / Container	grams	140.4	148.1	153.2	151.9		
H Dry Weight / Container	grams	132.0	137.2	140.2	137.7		
I Moisture Loss = G - H	grams	8.4	10.9	13.0	14.2		
J Tare Weight of Container	grams	37.2	36.9	37.1	37.9		
K Dry Soil = H - J	grams	94.8	100.3	103.1	99.8		
L %Moisture = (I / K) x 100	%	**8.9%**	**10.9%**	**12.6%**	**14.2%**		

ASTM D4643 AASHTO T217 or T265 Tested by: ml



Max Dry Density

122.4 lbs./cu.ft.

Optimum Moisture

11.8%

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
NH-5-200(025)095			
Offset From Centerline		Type of Soil	
AASTHO Designation **T-180**	Date **4/27/2016**		**311**

Density

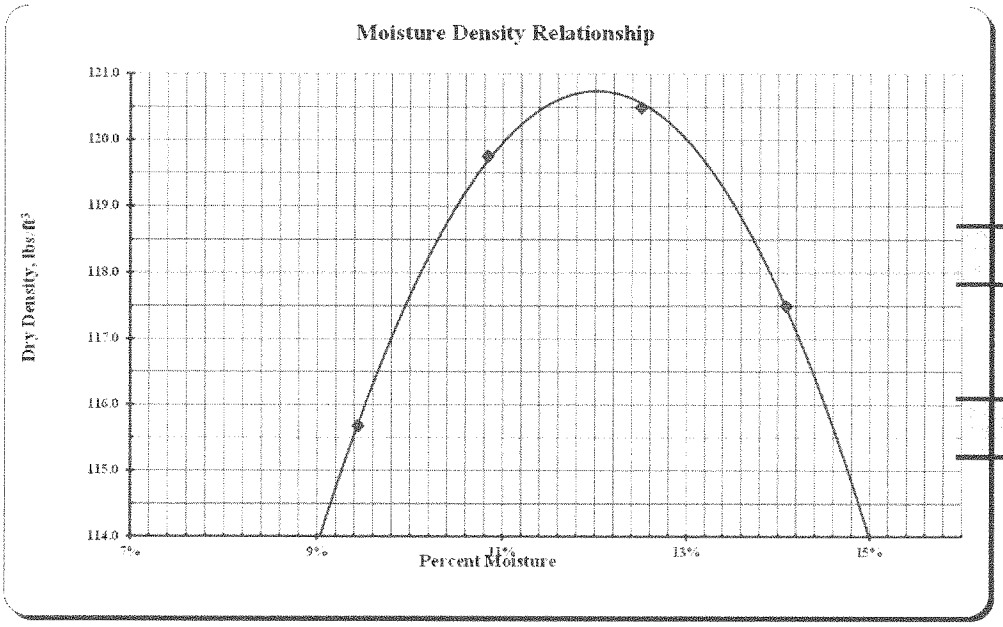
		Test Count	4				
	Determination No.	1	2	3	4	5	6
A Volume of Mold	cu. ft.	0.0333	0.0333	0.0333	0.0333	0.0333	0.0333
	lbs.	8.65	8.86	8.95	8.90		
C Weight of Mold	lbs.	4.44	4.44	4.44	4.44	4.44	4.44
D Weight of Compacted Soil = B - C	lbs.	4.22	4.42	4.51	4.46		
E Wet Density = D / A	lbs./cu.ft.	126.6	132.7	135.6	134.1		
F Dry Density = (E x 100) / (100 + L)	lbs./cu.ft.	**115.7**	**119.8**	**120.5**	**117.5**	**#VALUE!**	**#VALUE!**

Moisture Content

AASHTO T99 or T180 Tested by:

Container No.		72	73	74	75		
G Wet Weight / Container	grams	150.3	148.9	148.1	144.2		
H Dry Weight / Container	grams	140.5	138.0	135.8	131.0		
I Moisture Loss = G - H	grams	9.8	10.9	12.3	13.2		
J Tare Weight of Container	grams	36.7	37.4	37.4	37.3		
K Dry Soil = H - J	grams	103.8	100.6	98.4	93.7		
L %Moisture = (I / K) x 100	%	**9.4%**	**10.8%**	**12.5%**	**14.1%**		

ASTM D4643 AASHTO T217 or T265 Tested by: ml



Max Dry Density

120.7 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
NH-5-200(025)095			
Offset From Centerline		Type of Soil	
AASTHO Designation **T-180**	Date **4/27/2016**		**312**

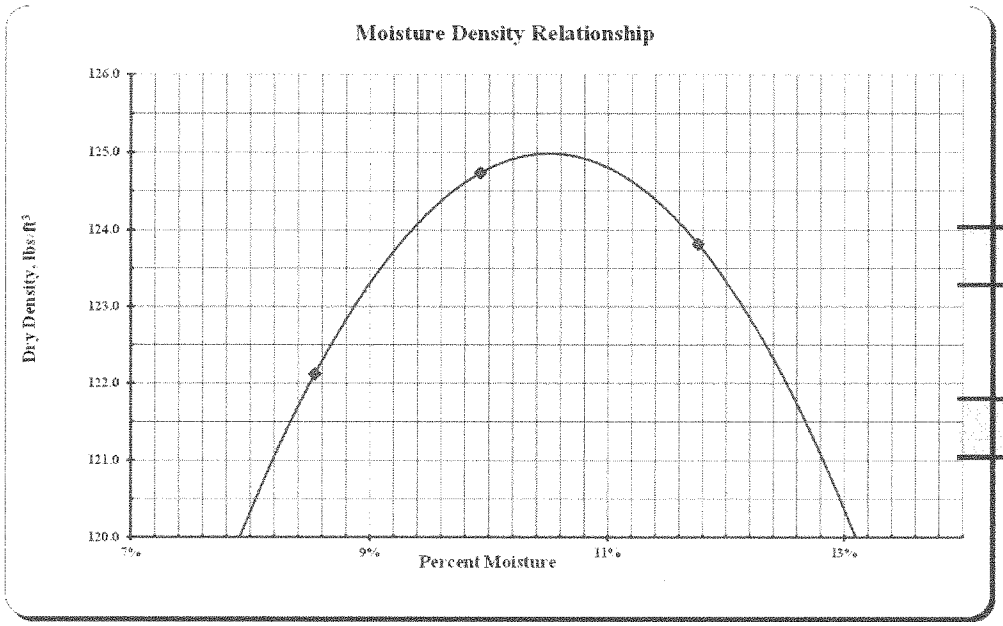
Density		Test Count	3				
	Determination No.	1	2	3	4	5	6
A Volume of Mold	cu. ft.	0.0333	0.0333	0.0333	0.0333	0.0333	0.0333
	lbs.	8.85	9.00	9.04			
C Weight of Mold	lbs.	4.43	4.43	4.43	4.43	4.43	4.43
D Weight of Compacted Soil = B - C	lbs.	4.41	4.57	4.61			
E Wet Density = D / A	lbs./cu.ft.	132.6	137.1	138.4			
F Dry Density = (E x 100) / (100 + L)	lbs./cu.ft.	**122.1**	**124.7**	**123.8**	**#VALUE!**	**#VALUE!**	**#VALUE!**

Moisture Content

AASHTO T99 or T180 Tested by:

Container No.		15	16	17			
G Wet Weight / Container	grams	146.6	155.7	146.1			
H Dry Weight / Container	grams	138.0	145.0	134.6			
I Moisture Loss = G - H	grams	8.6	10.7	11.5			
J Tare Weight of Container	grams	37.3	37.2	36.8			
K Dry Soil = H - J	grams	100.7	107.8	97.8			
L %Moisture = (I / K) x 100	%	**8.5%**	**9.9%**	**11.8%**			

ASTM D4643 AASHTO T217 or T265 Tested by: ml



Max Dry Density

125.0 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
NH-5-200(025)095			
Offset From Centerline		Type of Soil	
AASTHO Designation **T-180**	Date **4/27/2016**		**314**

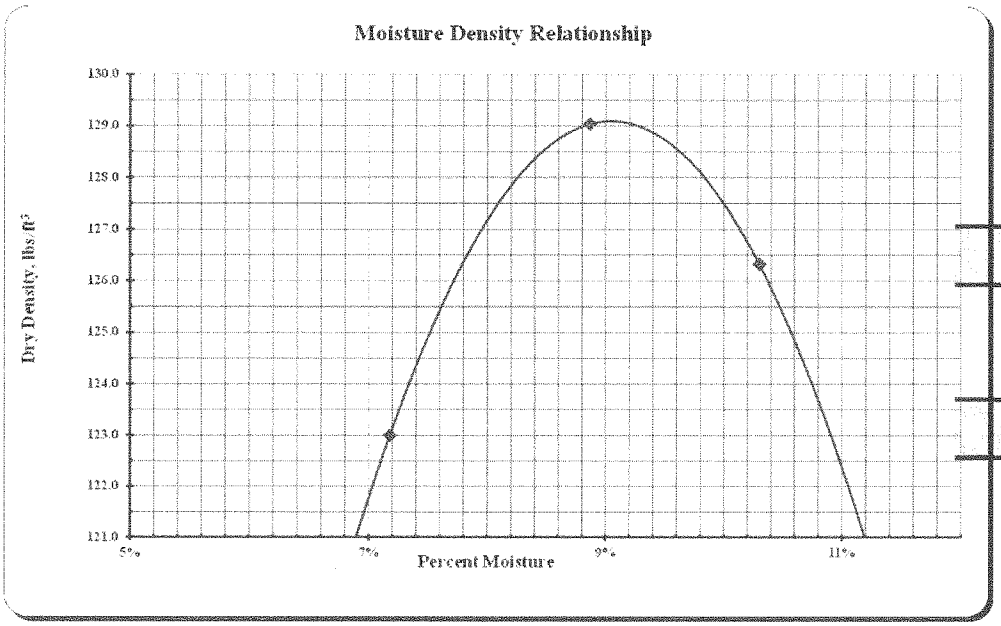
Density		Test Count	3				
	Determination No.	1	2	3	4	5	6
A Volume of Mold	cu. ft.	0.0333	0.0333	0.0333	0.0333	0.0333	0.0333
	lbs.	8.83	9.12	9.08			
C Weight of Mold	lbs.	4.44	4.44	4.44	4.44	4.44	4.44
D Weight of Compacted Soil = B - C	lbs.	4.39	4.68	4.64			
E Wet Density = D / A	lbs./cu.ft.	131.8	140.5	139.3			
F Dry Density = (E x 100) / (100 + L)	lbs./cu.ft.	**123.0**	**129.0**	**126.3**	**#VALUE!**	**#VALUE!**	**#VALUE!**

Moisture Content

AASHTO T99 or T180 Tested by:

Container No.		76	77	78			
G Wet Weight / Container	grams	141.0	142.4	147.5			
H Dry Weight / Container	grams	134.1	133.8	137.2			
I Moisture Loss = G - H	grams	6.9	8.6	10.3			
J Tare Weight of Container	grams	38.0	36.8	37.2			
K Dry Soil = H - J	grams	96.1	97.0	100.0			
L %Moisture = (I / K) x 100	%	**7.2%**	**8.9%**	**10.3%**			

ASTM D4643 AASHTO T217 or T265 Tested by: ml



Max Dry Density

129.1 lbs./cu.ft.

Optimum Moisture

9.1%

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
NH-5-200(025)095			
Offset From Centerline		Type of Soil	
AASTHO Designation **T-180**	Date **4/27/2016**		**316**

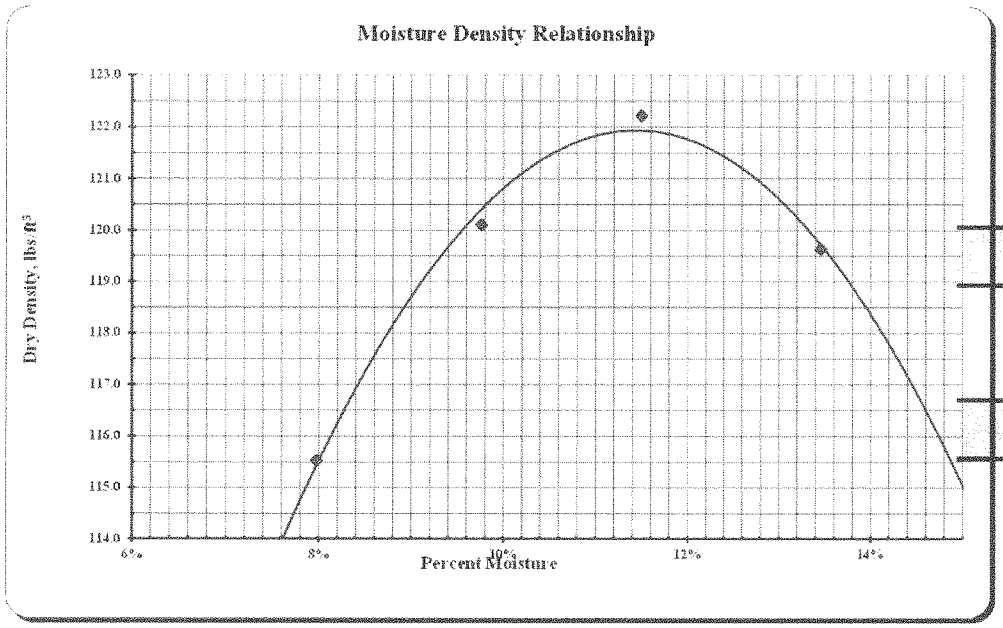
Density		Test Count	4				
	Determination No.	1	2	3	4	5	6
A Volume of Mold	cu. ft.	0.0333	0.0333	0.0333	0.0333	0.0333	0.0333
	lbs.	8.59	8.82	8.97	8.95		
C Weight of Mold	lbs.	4.43	4.43	4.43	4.43	4.43	4.43
D Weight of Compacted Soil = B - C	lbs.	4.15	4.39	4.54	4.52		
E Wet Density = D / A	lbs./cu.ft.	124.7	131.8	136.3	135.7		
F Dry Density = (E x 100) / (100 + L)	lbs./cu.ft.	**115.5**	**120.1**	**122.2**	**119.6**	**#VALUE!**	**#VALUE!**

Moisture Content

AASHTO T99 or T180 Tested by:

Container No.		18	19	20	21		
G Wet Weight / Container	grams	145.4	147.3	149.0	142.5		
H Dry Weight / Container	grams	137.4	137.5	137.4	130.0		
I Moisture Loss = G - H	grams	8.0	9.8	11.6	12.5		
J Tare Weight of Container	grams	37.1	37.1	36.5	37.1		
K Dry Soil = H - J	grams	100.3	100.4	100.9	92.9		
L %Moisture = (I / K) x 100	%	**8.0%**	**9.8%**	**11.5%**	**13.5%**		

ASTM D4643 AASHTO T217 or T265 Tested by: ml



Max Dry Density

121.9 lbs./cu.ft.

Optimum Moisture

11.5%

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
NH-5-200(025)095			
Offset From Centerline		Type of Soil	
AASTHO Designation **T-180**	Date **4/27/2016**		**317**

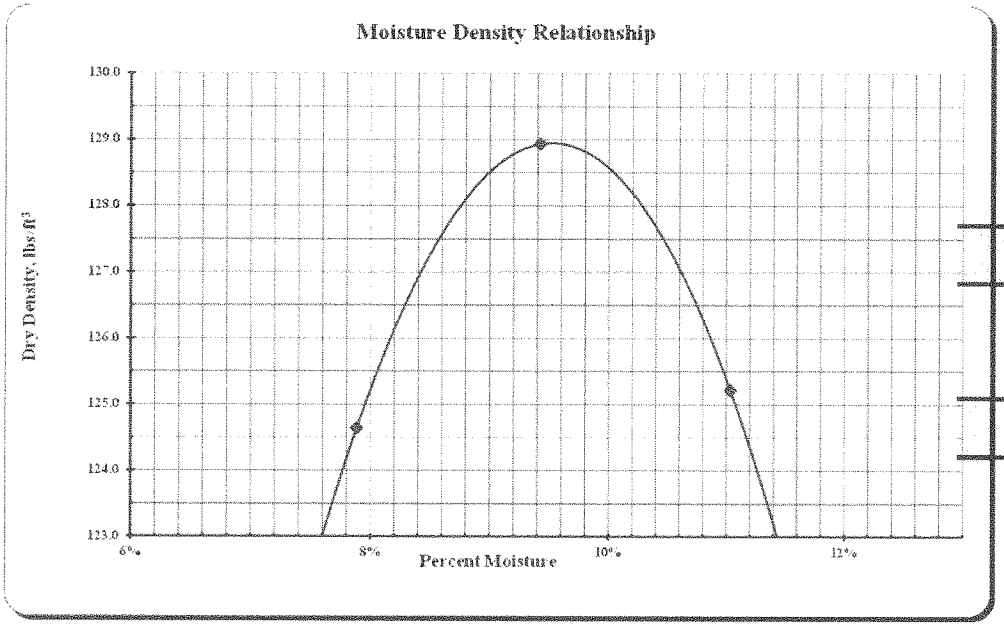
Density		Test Count	3				
	Determination No.	1	2	3	4	5	6
A Volume of Mold	cu. ft.	0.0333	0.0333	0.0333	0.0333	0.0333	0.0333
	lbs.	8.92	9.14	9.07			
C Weight of Mold	lbs.	4.44	4.44	4.44	4.44	4.44	4.44
D Weight of Compacted Soil = B - C	lbs.	4.48	4.70	4.63			
E Wet Density = D / A	lbs./cu.ft.	134.5	141.1	139.0			
F Dry Density = (E x 100) / (100 + L)	lbs./cu.ft.	**124.6**	**128.9**	**125.2**	**#VALUE!**	**#VALUE!**	**#VALUE!**

Moisture Content

AASHTO T99 or T180 Tested by:

Container No.		79	80	81			
G Wet Weight / Container	grams	147.9	148.6	150.5			
H Dry Weight / Container	grams	139.8	139.0	139.3			
I Moisture Loss = G - H	grams	8.1	9.6	11.2			
J Tare Weight of Container	grams	37.1	37.1	37.8			
K Dry Soil = H - J	grams	102.7	101.9	101.5			
L %Moisture = (I / K) x 100	%	**7.9%**	**9.4%**	**11.0%**			

ASTM D4643 AASHTO T217 or T265 Tested by: ml



Max Dry Density

128.9 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
NH-5-200(025)095			
Offset From Centerline		Type of Soil	
AASTHO Designation	Date		
T-180	**4/28/2016**		**318**

Density

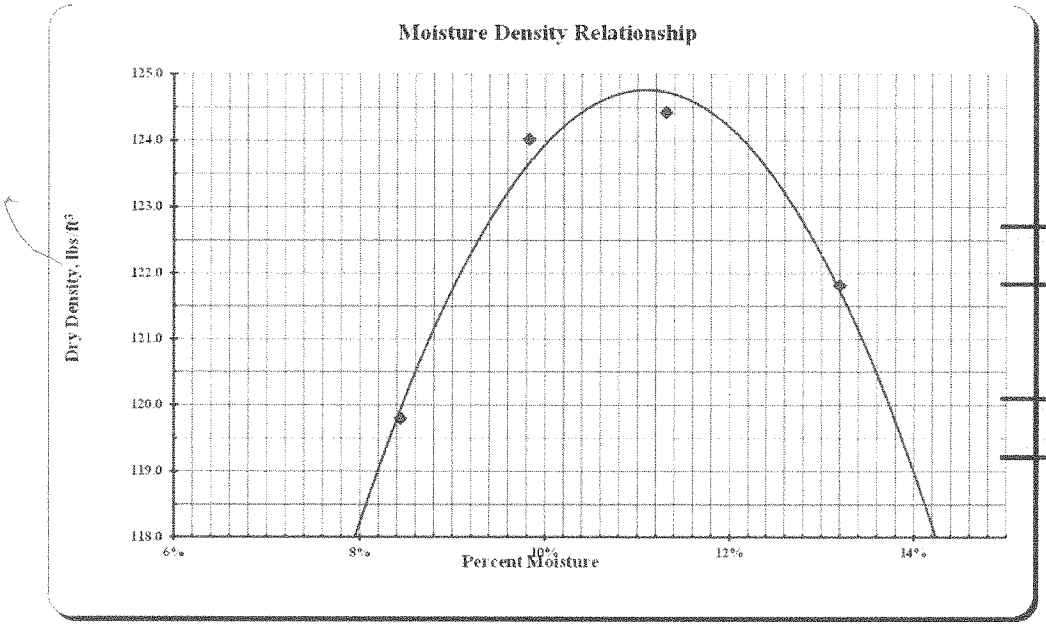
			Test Count	4				
	Determination No.		1	2	3	4	5	6
A	Volume of Mold	cu. ft.	0.0333	0.0333	0.0333	0.0333	0.0333	0.0333
		lbs.	8.76	8.97	9.04	9.02		
C	Weight of Mold	lbs.	4.43	4.44	4.43	4.43	4.43	4.43
D	Weight of Compacted Soil = B - C	lbs.	4.33	4.54	4.61	4.59		
E	Wet Density = D / A	lbs./cu.ft.	129.9	136.2	138.5	137.9		
F	Dry Density = (E x 100) / (100 + L)	lbs./cu.ft.	**119.8**	**124.0**	**124.4**	**121.8**	**#VALUE!**	**#VALUE!**

Moisture Content

AASHTO T99 or T180 Tested by:

	Container No.		1	2	3	4		
G	Wet Weight / Container	grams	158.7	147.9	147.3	160.2		
H	Dry Weight / Container	grams	149.2	138.0	136.1	145.8		
I	Moisture Loss = G - H	grams	9.5	9.9	11.2	14.4		
J	Tare Weight of Container	grams	36.6	37.3	37.1	36.7		
K	Dry Soil = H - J	grams	112.6	100.7	99.0	109.1		
L	%Moisture = (I / K) x 100	%	**8.4%**	**9.8%**	**11.3%**	**13.2%**		

ASTM D4643 AASHTO T217 or T265 Tested by: ml



Max Dry Density

124.8 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
NH-5-200(025)095			
Offset From Centerline		Type of Soil	
AASTHO Designation **T-180**	Date **4/28/2016**		**321**

Density

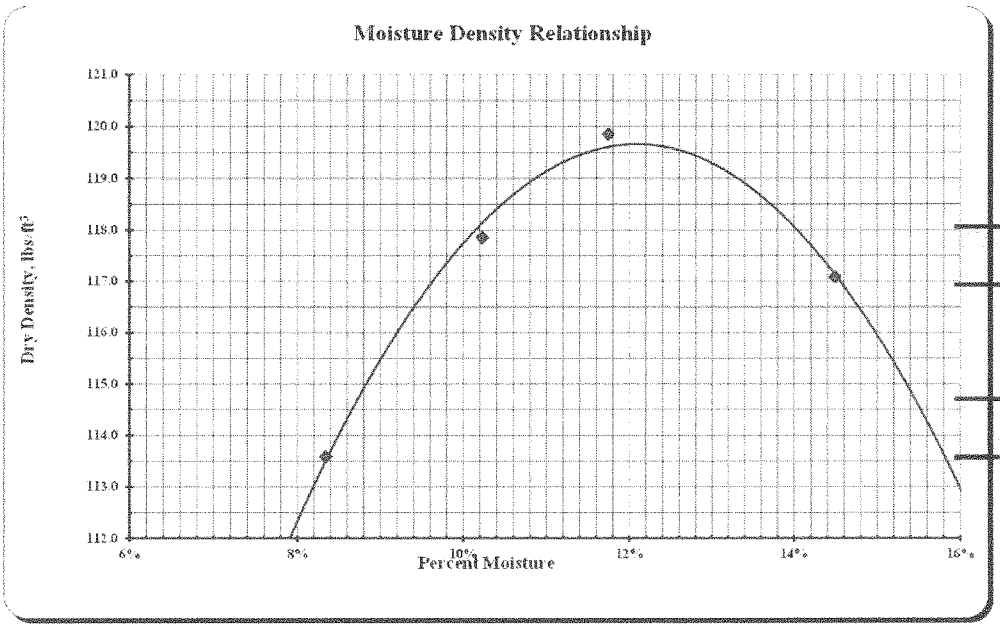
			Test Count	4				
	Determination No.		1	2	3	4	5	6
A	Volume of Mold	cu. ft.	0.0333	0.0333	0.0333	0.0333	0.0333	0.0333
		lbs.	8.54	8.77	8.90	8.90		
C	Weight of Mold	lbs.	4.44	4.44	4.44	4.44	4.44	4.44
D	Weight of Compacted Soil = B - C	lbs.	4.10	4.33	4.46	4.46		
E	Wet Density = D / A	lbs./cu.ft.	123.1	129.9	133.9	134.1		
F	Dry Density = (E x 100) / (100 + L)	lbs./cu.ft.	**113.6**	**117.9**	**119.9**	**117.1**	**#VALUE!**	**#VALUE!**

Moisture Content

AASHTO T99 or T180 Tested by:

	Container No.		61	62	63	64		
G	Wet Weight / Container	grams	154.2	154.0	150.5	157.4		
H	Dry Weight / Container	grams	145.2	143.2	138.6	142.2		
I	Moisture Loss = G - H	grams	9.0	10.8	11.9	15.2		
J	Tare Weight of Container	grams	37.3	37.6	37.3	37.3		
K	Dry Soil = H - J	grams	107.9	105.6	101.3	104.9		
L	%Moisture = (I / K) x 100	%	**8.3%**	**10.2%**	**11.7%**	**14.5%**		

ASTM D4643 AASHTO T217 or T265 Tested by: ml



Max Dry Density

119.7 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
NH-5-200(025)095			
Offset From Centerline		Type of Soil	
AASTHO Designation **T-180**	Date **4/28/2016**		**322**

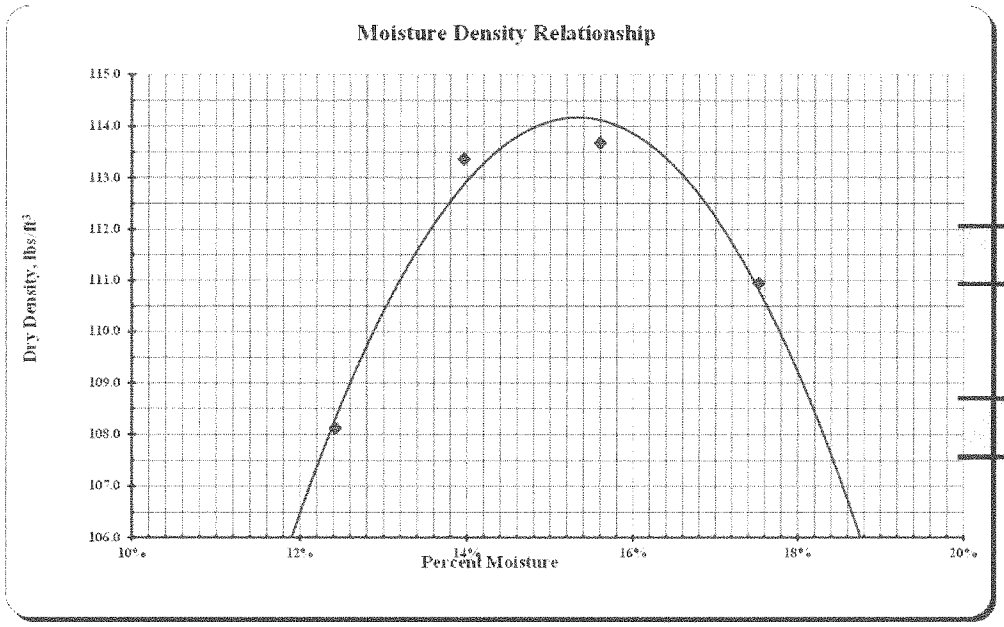
Density		Test Count	4				
	Determination No.	1	2	3	4	5	6
A Volume of Mold	cu. ft.	0.0333	0.0333	0.0333	0.0333	0.0333	0.0333
	lbs.	8.48	8.73	8.81	8.77		
C Weight of Mold	lbs.	4.43	4.43	4.43	4.43	4.43	4.43
D Weight of Compacted Soil = B - C	lbs.	4.05	4.30	4.38	4.34		
E Wet Density = D / A	lbs./cu.ft.	121.6	129.2	131.4	130.4		
F Dry Density = (E x 100) / (100 + L)	lbs./cu.ft.	**108.1**	**113.4**	**113.7**	**110.9**	**#VALUE!**	**#VALUE!**

Moisture Content

AASHTO T99 or T180 Tested by:

Container No.		5	6	7	8		
G Wet Weight / Container	grams	146.6	157.1	149.7	144.3		
H Dry Weight / Container	grams	134.5	142.4	134.4	128.3		
I Moisture Loss = G - H	grams	12.1	14.7	15.3	16.0		
J Tare Weight of Container	grams	37.1	37.1	36.3	37.0		
K Dry Soil = H - J	grams	97.4	105.3	98.1	91.3		
L %Moisture = (I / K) x 100	%	**12.4%**	**14.0%**	**15.6%**	**17.5%**		

ASTM D4643 AASHTO T217 or T265 Tested by: ml



Max Dry Density

114.2 lbs./cu.ft.

Optimum Moisture

15.3%

MOISTURE-DENSITY RELATIONS OF SOILS

North Dakota Department Of Transportation, Materials & Research Division

SFN 10063 (Rev. 03-2006)

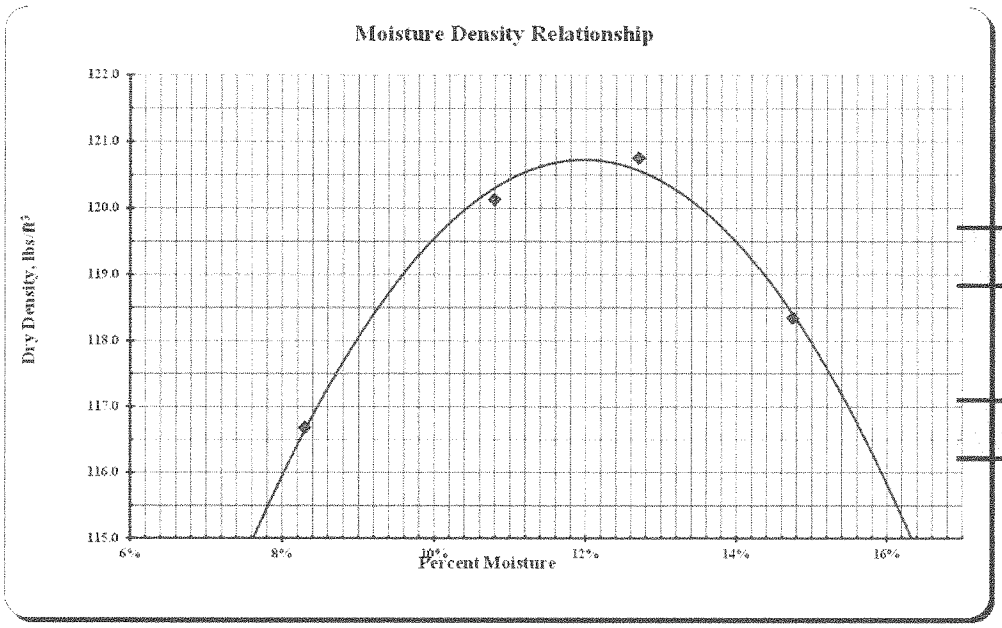
Project No.	PCN	Station	Depth Below Grade
NH-5-200(025)095			
Offset From Centerline		Type of Soil	
AASTHO Designation **T-180**	Date **4/28/2016**		**323**

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.	8.65	8.87	8.97	8.96		
C Weight of Mold	lbs.	4.44	4.44	4.44	4.44	4.44	4.44
D Weight of Compacted Soil = B - C	lbs.	4.21	4.43	4.53	4.52		
E Wet Density = D / A	lbs./cu.ft.	126.4	133.1	136.1	135.8		
F Dry Density = (E x 100) / (100 + L)	lbs./cu.ft.	**116.7**	**120.1**	**120.8**	**118.3**	**#VALUE!**	**#VALUE!**

Moisture Content AASHTO T99 or T180 Tested by:

Container No.		65	66	67	68		
G Wet Weight / Container	grams	159.2	148.6	149.9	158.4		
H Dry Weight / Container	grams	149.9	137.8	137.2	142.8		
I Moisture Loss = G - H	grams	9.3	10.8	12.7	15.6		
J Tare Weight of Container	grams	37.8	37.7	37.2	37.0		
K Dry Soil = H - J	grams	112.1	100.1	100.0	105.8		
L %Moisture = (I / K) x 100	%	**8.3%**	**10.8%**	**12.7%**	**14.7%**		

ASTM D4643 AASHTO T217 or T265 Tested by: ml



Max Dry Density

120.7 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
NH-5-200(025)095			
Offset From Centerline		Type of Soil	
AASTHO Designation **T-180**	Date **4/28/2016**		**324**

Density

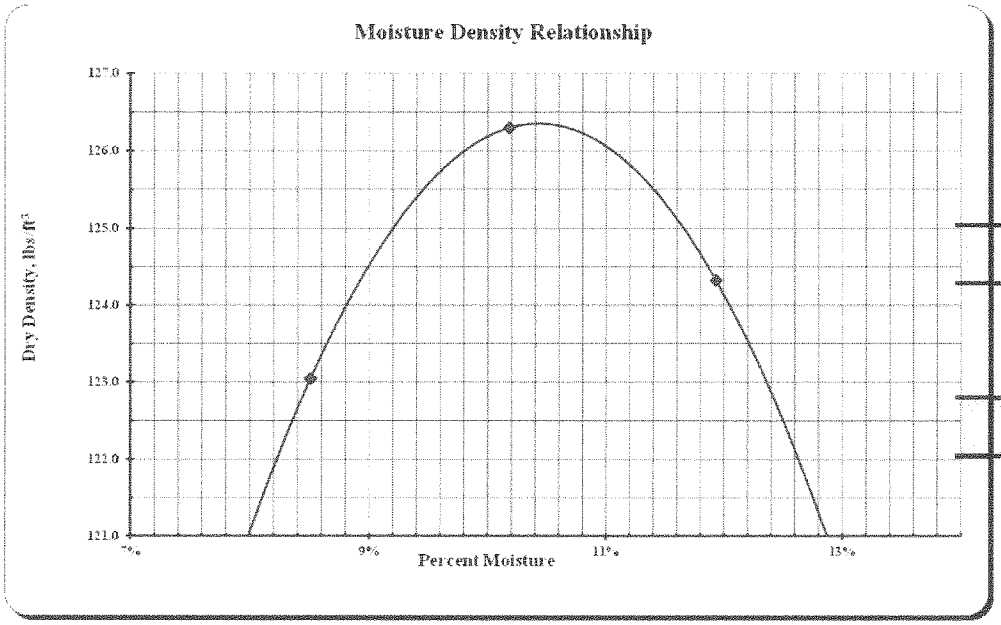
			Test Count	3				
	Determination No.		1	2	3	4	5	6
A	Volume of Mold	cu. ft.	0.0333	0.0333	0.0333	0.0333	0.0333	0.0333
		lbs.	8.88	9.07	9.07			
C	Weight of Mold	lbs.	4.43	4.43	4.43	4.43	4.43	4.43
D	Weight of Compacted Soil = B - C	lbs.	4.45	4.63	4.63			
E	Wet Density = D / A	lbs./cu.ft.	133.5	139.2	139.2			
F	Dry Density = (E x 100) / (100 + L)	lbs./cu.ft.	**123.0**	**126.3**	**124.3**	**#VALUE!**	**#VALUE!**	**#VALUE!**

Moisture Content

AASHTO T99 or T180 Tested by:

	Container No.		9	10	11			
G	Wet Weight / Container	grams	145.6	151.4	143.2			
H	Dry Weight / Container	grams	137.1	140.8	131.9			
I	Moisture Loss = G - H	grams	8.5	10.6	11.3			
J	Tare Weight of Container	grams	37.2	36.7	37.2			
K	Dry Soil = H - J	grams	99.9	104.1	94.7			
L	%Moisture = (I / K) x 100	%	**8.5%**	**10.2%**	**11.9%**			

ASTM D4643 AASHTO T217 or T265 Tested by: ml



Max Dry Density

126.4 lbs./cu.ft.

Optimum Moisture

10.4%

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
NH-5-200(025)095			
Offset From Centerline		Type of Soil	
AASTHO Designation **T-180**	Date **4/28/2016**		**326**

Density

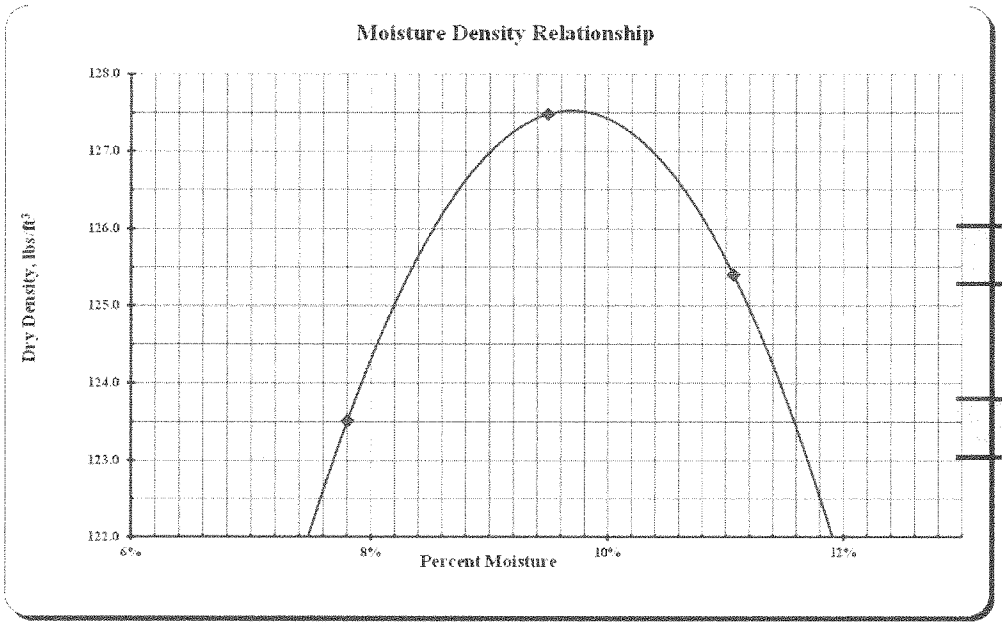
			Test Count	3				
	Determination No.		1	2	3	4	5	6
A	Volume of Mold	cu. ft.	0.0333	0.0333	0.0333	0.0333	0.0333	0.0333
		lbs.	8.87	9.09	9.08			
C	Weight of Mold	lbs.	4.44	4.44	4.44	4.44	4.44	4.44
D	Weight of Compacted Soil = B - C	lbs.	4.43	4.65	4.64			
E	Wet Density = D / A	lbs./cu.ft.	133.2	139.6	139.3			
F	Dry Density = (E x 100) / (100 + L)	lbs./cu.ft.	**123.5**	**127.5**	**125.4**	**#VALUE!**	**#VALUE!**	**#VALUE!**

Moisture Content

AASHTO T99 or T180 Tested by:

	Container No.		69	70	71			
G	Wet Weight / Container	grams	156.5	144.9	144.6			
H	Dry Weight / Container	grams	147.9	135.6	133.9			
I	Moisture Loss = G - H	grams	8.6	9.3	10.7			
J	Tare Weight of Container	grams	37.7	37.6	37.2			
K	Dry Soil = H - J	grams	110.2	98.0	96.7			
L	%Moisture = (I / K) x 100	%	**7.8%**	**9.5%**	**11.1%**			

ASTM D4643 AASHTO T217 or T265 Tested by: ml



Max Dry Density

127.5 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)

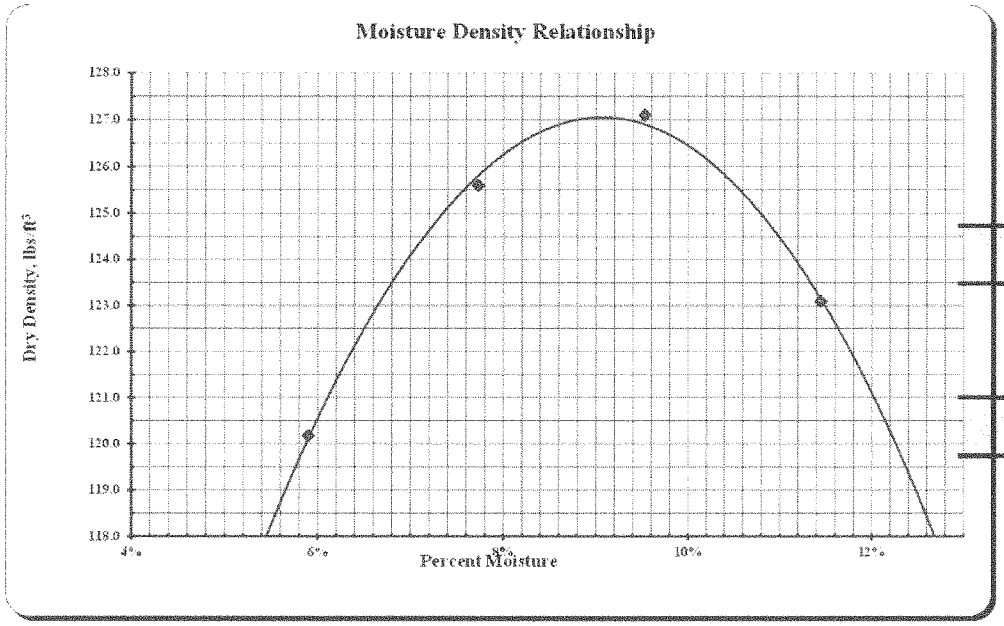
Project No.	PCN	Station	Depth Below Grade
NH-5-200(025)095			
Offset From Centerline		Type of Soil	
AASTHO Designation **T-180**	Date **4/28/2016**		**327**

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	8.94	9.07	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.	4.24	4.51	4.64	4.57		
E Wet Density = D / A	lbs./cu.ft.	127.3	135.3	139.2	137.2		
F Dry Density = (E x 100) / (100 + L)	lbs./cu.ft.	**120.2**	**125.6**	**127.1**	**123.1**	**#VALUE!**	**#VALUE!**

Moisture Content AASHTO T99 or T180 Tested by:

Container No.		12	13	14	15		
G Wet Weight / Container	grams	148.2	151.4	154.0	149.3		
H Dry Weight / Container	grams	142.0	143.2	143.9	137.8		
I Moisture Loss = G - H	grams	6.2	8.2	10.1	11.5		
J Tare Weight of Container	grams	36.9	37.1	37.9	37.3		
K Dry Soil = H - J	grams	105.1	106.1	106.0	100.5		
L %Moisture = (I / K) x 100	%	**5.9%**	**7.7%**	**9.5%**	**11.4%**		

ASTM D4643 AASHTO T217 or T265 Tested by: ml



Max Dry Density

127.1 lbs./cu.ft.

Optimum Moisture

9.1%

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
NH-5-200(025)095			
Offset From Centerline		Type of Soil	
AASTHO Designation	Date		
T-180	**4/28/2016**		**328**

Density

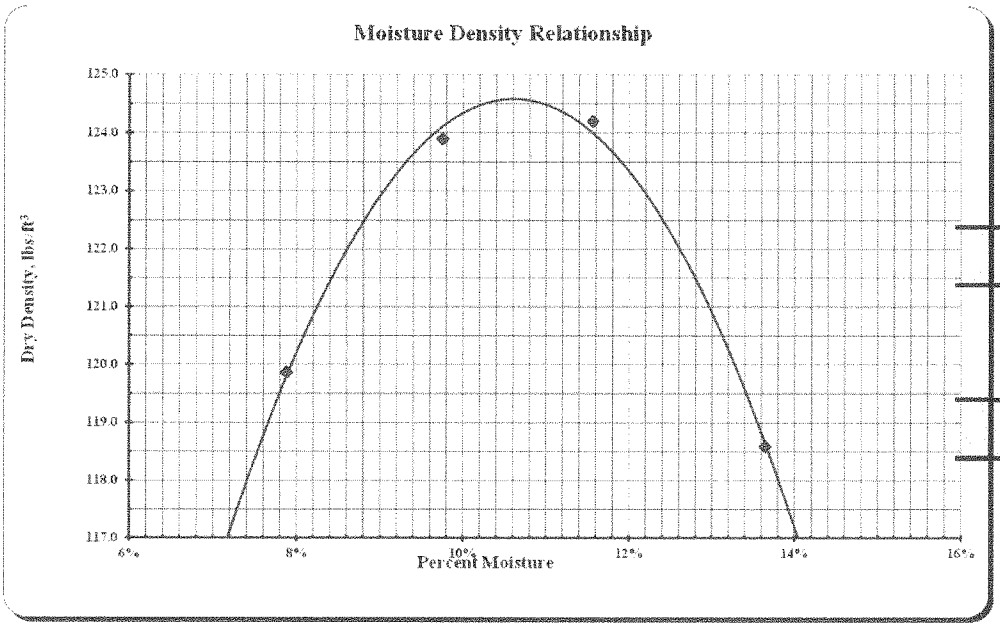
			Test Count	4				
	Determination No.		1	2	3	4	5	6
A	Volume of Mold	cu. ft.	0.0333	0.0333	0.0333	0.0333	0.0333	0.0333
		lbs.	8.74	8.97	9.05	8.93		
C	Weight of Mold	lbs.	4.44	4.44	4.44	4.44	4.44	4.44
D	Weight of Compacted Soil = B - C	lbs.	4.31	4.53	4.61	4.49		
E	Wet Density = D / A	lbs./cu.ft.	129.3	136.0	138.6	134.8		
F	Dry Density = (E x 100) / (100 + L)	lbs./cu.ft.	**119.9**	**123.9**	**124.2**	**118.6**	**#VALUE!**	**#VALUE!**

Moisture Content

AASHTO T99 or T180 Tested by:

	Container No.		72	73	74	75		
G	Wet Weight / Container	grams	147.6	142.1	147.4	151.4		
H	Dry Weight / Container	grams	139.5	132.8	136.0	137.7		
I	Moisture Loss = G - H	grams	8.1	9.3	11.4	13.7		
J	Tare Weight of Container	grams	36.7	37.4	37.4	37.3		
K	Dry Soil = H - J	grams	102.8	95.4	98.6	100.4		
L	%Moisture = (I / K) x 100	%	**7.9%**	**9.7%**	**11.6%**	**13.6%**		

ASTM D4643 AASHTO T217 or T265 Tested by: ml



Max Dry Density

124.6 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
NH-5-200(025)095			
Offset From Centerline		Type of Soil	
AASTHO Designation **T-180**	Date **4/28/2016**		**330**

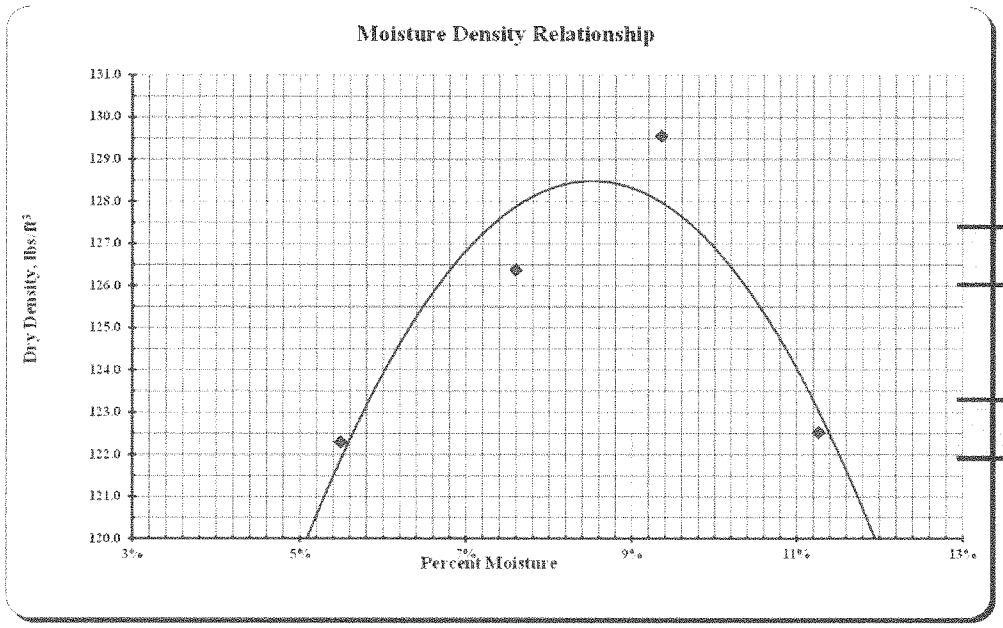
Density		Test Count	4				
	Determination No.	1	2	3	4	5	6
A Volume of Mold	cu. ft.	0.0333	0.0333	0.0333	0.0333	0.0333	0.0333
	lbs.	8.73	8.96	9.15	8.97		
C Weight of Mold	lbs.	4.43	4.43	4.43	4.43	4.43	4.43
D Weight of Compacted Soil = B - C	lbs.	4.30	4.53	4.72	4.54		
E Wet Density = D / A	lbs./cu.ft.	129.0	136.0	141.7	136.3		
F Dry Density = (E x 100) / (100 + L)	lbs./cu.ft.	**122.3**	**126.4**	**129.6**	**122.5**	**#VALUE!**	**#VALUE!**

Moisture Content

AASHTO T99 or T180 Tested by:

Container No.		16	17	18	19		
G Wet Weight / Container	grams	152.6	157.2	150.5	156.6		
H Dry Weight / Container	grams	146.6	148.7	140.8	144.5		
I Moisture Loss = G - H	grams	6.0	8.5	9.7	12.1		
J Tare Weight of Container	grams	37.2	36.8	37.1	37.1		
K Dry Soil = H - J	grams	109.4	111.9	103.7	107.4		
L %Moisture = (I / K) x 100	%	**5.5%**	**7.6%**	**9.4%**	**11.3%**		

ASTM D4643 AASHTO T217 or T265 Tested by: ml



Max Dry Density

128.5 lbs./cu.ft.

Optimum Moisture

8.5%

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
NH-5-200(025)095			
Offset From Centerline		Type of Soil	
AASTHO Designation **T-180**	Date **4/28/2016**		**331**

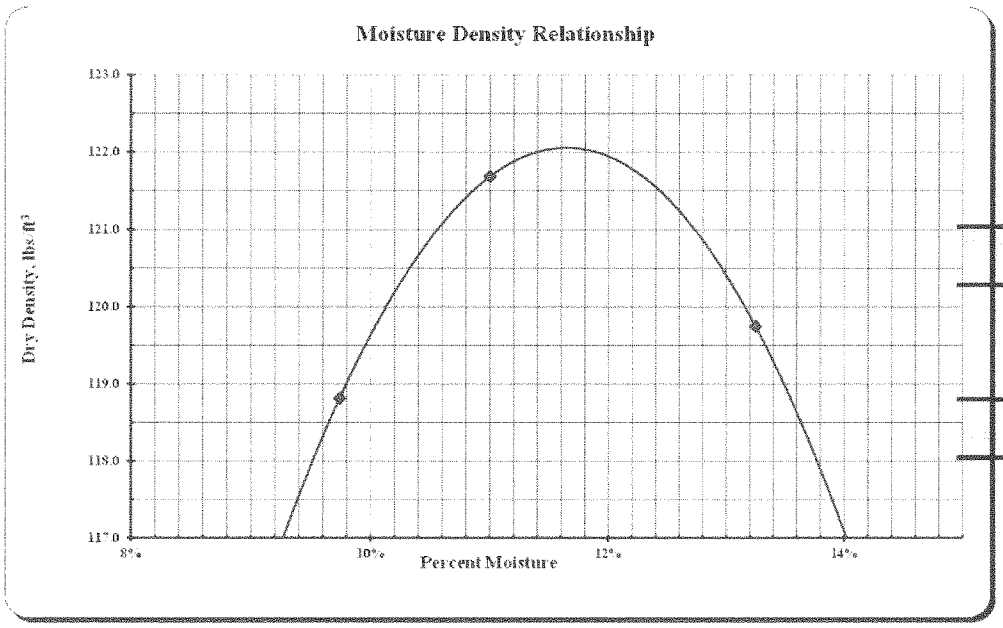
Density		Test Count	3				
	Determination No.	1	2	3	4	5	6
A Volume of Mold	cu. ft.	0.0333	0.0333	0.0333	0.0333	0.0333	0.0333
	lbs.	8.78	8.94	8.95			
C Weight of Mold	lbs.	4.44	4.44	4.44	4.44	4.44	4.44
D Weight of Compacted Soil = B - C	lbs.	4.34	4.50	4.52			
E Wet Density = D / A	lbs./cu.ft.	130.4	135.1	135.6			
F Dry Density = (E x 100) / (100 + L)	lbs./cu.ft.	**118.8**	**121.7**	**119.7**	**#VALUE!**	**#VALUE!**	**#VALUE!**

Moisture Content

AASHTO T99 or T180 Tested by:

Container No.		76	77	78			
G Wet Weight / Container	grams	148.4	148.8	154.3			
H Dry Weight / Container	grams	138.6	137.7	140.6			
I Moisture Loss = G - H	grams	9.8	11.1	13.7			
J Tare Weight of Container	grams	38.0	36.8	37.2			
K Dry Soil = H - J	grams	100.6	100.9	103.4			
L %Moisture = (I / K) x 100	%	**9.7%**	**11.0%**	**13.2%**			

ASTM D4643 AASHTO T217 or T265 Tested by: ml



Max Dry Density

122.1 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)

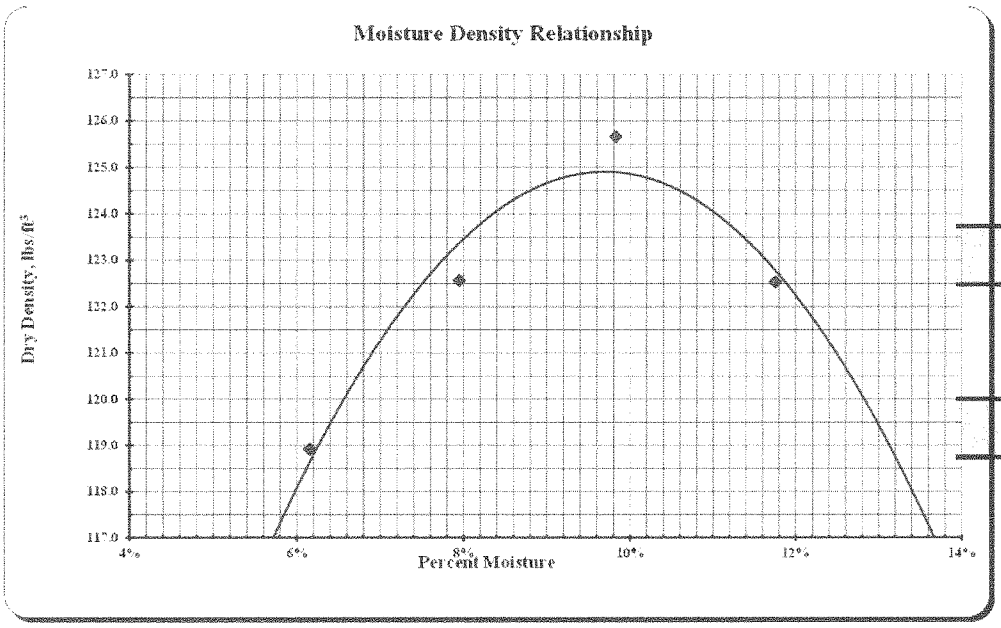
Project No.	PCN	Station	Depth Below Grade
NH-5-200(025)095			
Offset From Centerline		Type of Soil	
AASTHO Designation **T-180**	Date **4/28/2016**		**333**

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.	8.64	8.85	9.03	9.00		
C Weight of Mold	lbs.	4.44	4.44	4.44	4.44	4.44	4.44
D Weight of Compacted Soil = B - C	lbs.	4.20	4.41	4.60	4.56		
E Wet Density = D / A	lbs./cu.ft.	126.2	132.3	138.0	136.9		
F Dry Density = (E x 100) / (100 + L)	lbs./cu.ft.	**118.9**	**122.6**	**125.7**	**122.5**	**#VALUE!**	**#VALUE!**

Moisture Content AASHTO T99 or T180 Tested by:

Container No.		79	80	81	82		
G Wet Weight / Container	grams	157.8	155.3	150.7	153.4		
H Dry Weight / Container	grams	150.8	146.6	140.6	141.2		
I Moisture Loss = G - H	grams	7.0	8.7	10.1	12.2		
J Tare Weight of Container	grams	37.1	37.1	37.8	37.4		
K Dry Soil = H - J	grams	113.7	109.5	102.8	103.8		
L %Moisture = (I / K) x 100	%	**6.2%**	**7.9%**	**9.8%**	**11.8%**		

ASTM D4643 AASHTO T217 or T265 Tested by: ml



Max Dry Density

124.9 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
NH-5-200(025)095			
Offset From Centerline		Type of Soil	
AASTHO Designation **T-180**	Date **4/28/2016**		**334**

Density

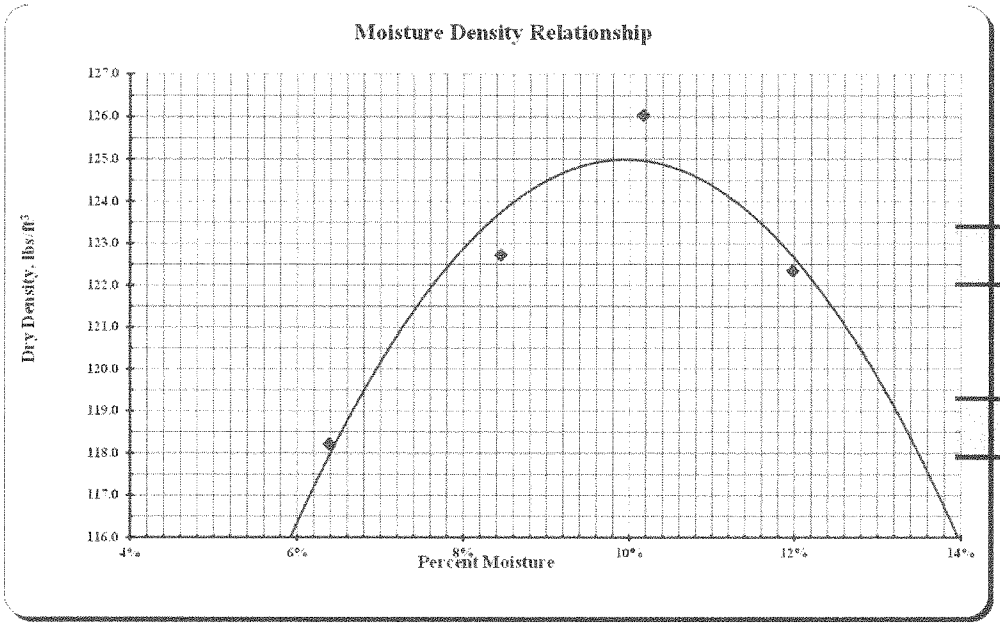
			Test Count	4				
	Determination No.		1	2	3	4	5	6
A	Volume of Mold	cu. ft.	0.0333	0.0333	0.0333	0.0333	0.0333	0.0333
		lbs.	8.62	8.86	9.06	8.99		
C	Weight of Mold	lbs.	4.43	4.43	4.43	4.43	4.43	4.43
D	Weight of Compacted Soil = B - C	lbs.	4.19	4.43	4.62	4.56		
E	Wet Density = D / A	lbs./cu.ft.	125.8	133.1	138.9	137.0		
F	Dry Density = (E x 100) / (100 + L)	lbs./cu.ft.	**118.2**	**122.7**	**126.0**	**122.3**	**#VALUE!**	**#VALUE!**

Moisture Content

AASHTO T99 or T180 Tested by:

	Container No.		20	21	22	23		
G	Wet Weight / Container	grams	153.2	150.1	149.7	157.1		
H	Dry Weight / Container	grams	146.2	141.3	139.3	144.3		
I	Moisture Loss = G - H	grams	7.0	8.8	10.4	12.8		
J	Tare Weight of Container	grams	36.5	37.1	37.0	37.4		
K	Dry Soil = H - J	grams	109.7	104.2	102.3	106.9		
L	%Moisture = (I / K) x 100	%	**6.4%**	**8.4%**	**10.2%**	**12.0%**		

ASTM D4643 AASHTO T217 or T265 Tested by: ml



Max Dry Density

125.0 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)

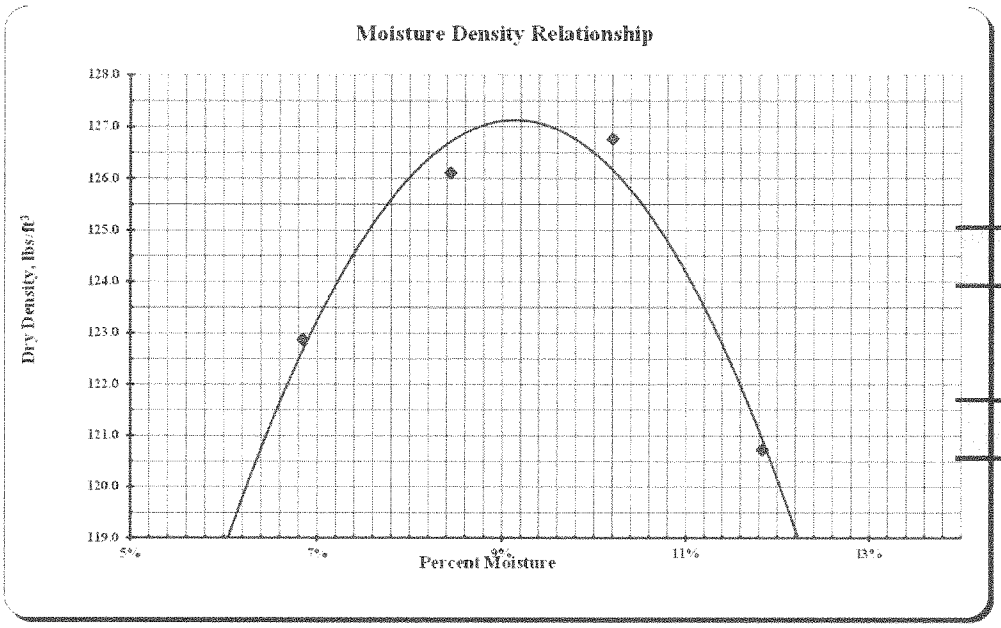
Project No.	PCN	Station	Depth Below Grade
NH-5-200(025)095			
Offset From Centerline		Type of Soil	
AASTHO Designation **T-180**	Date **4/28/2016**		**335**

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.	8.80	8.99	9.08	8.93		
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.	4.37	4.55	4.65	4.50		
E Wet Density = D / A	lbs./cu.ft.	131.3	136.8	139.7	135.0		
F Dry Density = (E x 100) / (100 + L)	lbs./cu.ft.	**122.9**	**126.1**	**126.8**	**120.7**	**#VALUE!**	**#VALUE!**

Moisture Content AASHTO T99 or T180 Tested by:

Container No.		24	25	26	27		
G Wet Weight / Container	grams	148.0	154.1	147.1	146.3		
H Dry Weight / Container	grams	140.9	145.0	136.9	134.7		
I Moisture Loss = G - H	grams	7.1	9.1	10.2	11.6		
J Tare Weight of Container	grams	37.2	37.2	36.9	36.7		
K Dry Soil = H - J	grams	103.7	107.8	100.0	98.0		
L %Moisture = (I / K) x 100	%	**6.8%**	**8.4%**	**10.2%**	**11.8%**		

ASTM D4643 AASHTO T217 or T265 Tested by: ml



Max Dry Density

127.1 lbs./cu.ft.

Optimum Moisture

9.1%

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
NH-5-200(025)095			
Offset From Centerline		Type of Soil	
AASTHO Designation **T-180**	Date **4/28/2016**		**336**

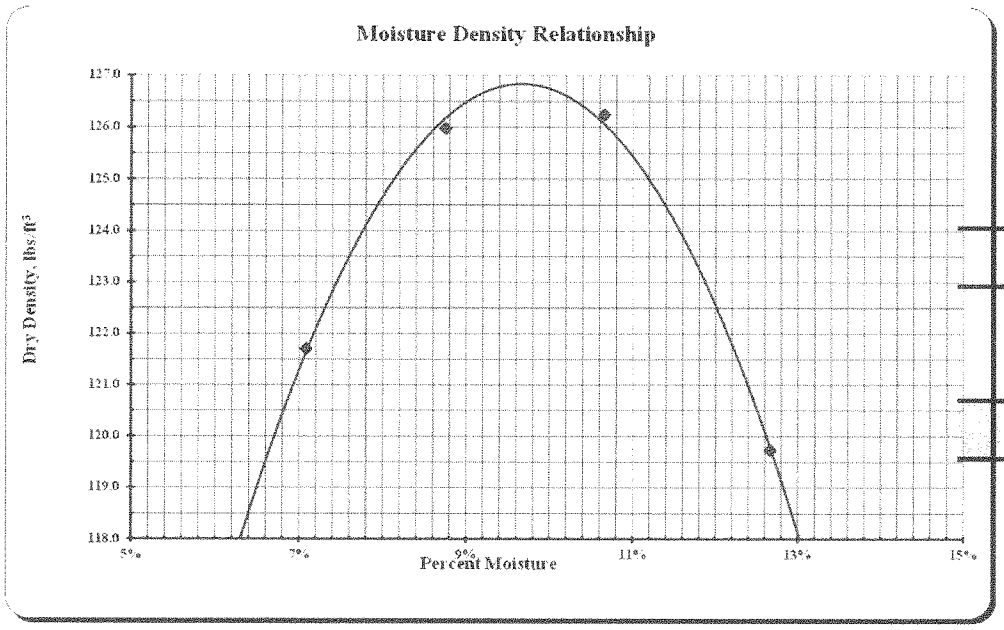
Density		Test Count	4				
Determination No.		1	2	3	4	5	6
A Volume of Mold	cu. ft.	0.0333	0.0333	0.0333	0.0333	0.0333	0.0333
	lbs.	8.78	8.99	9.09	8.93		
C Weight of Mold	lbs.	4.44	4.43	4.44	4.44	4.44	4.44
D Weight of Compacted Soil = B - C	lbs.	4.34	4.56	4.65	4.49		
E Wet Density = D / A	lbs./cu.ft.	130.3	137.0	139.7	134.9		
F Dry Density = (E x 100) / (100 + L)	lbs./cu.ft.	**121.7**	**126.0**	**126.2**	**119.7**	**#VALUE!**	**#VALUE!**

Moisture Content

AASHTO T99 or T180 Tested by:

Container No.		83	84	85	86		
G Wet Weight / Container	grams	180.8	152.5	140.6	148.8		
H Dry Weight / Container	grams	171.3	143.2	130.7	136.3		
I Moisture Loss = G - H	grams	9.5	9.3	9.9	12.5		
J Tare Weight of Container	grams	37.2	36.9	37.8	37.6		
K Dry Soil = H - J	grams	134.1	106.3	92.9	98.7		
L %Moisture = (I / K) x 100	%	**7.1%**	**8.7%**	**10.7%**	**12.7%**		

ASTM D4643 AASHTO T217 or T265 Tested by: ml



Max Dry Density

126.8 lbs./cu.ft.

Optimum Moisture

9.7%