

LINEAR SOILS SURVEY AND RECOMMENDATIONS

PROJECT NO. NH-NHU-7-002(156)022

PCN 20845

COUNTY Williams

U.S. Highway 2 From RP 22.386 to RP 31.954



PREPARED BY: Jordan M. Nehls, P.E.

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH DIVISION

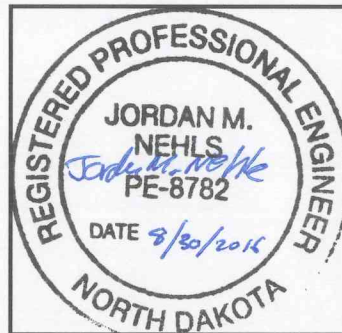
AUGUST 2016

NH-NHU-7-002(156)022

U.S. Highway 2 From 2 Miles North of Williston North to 63rd St NW - EB

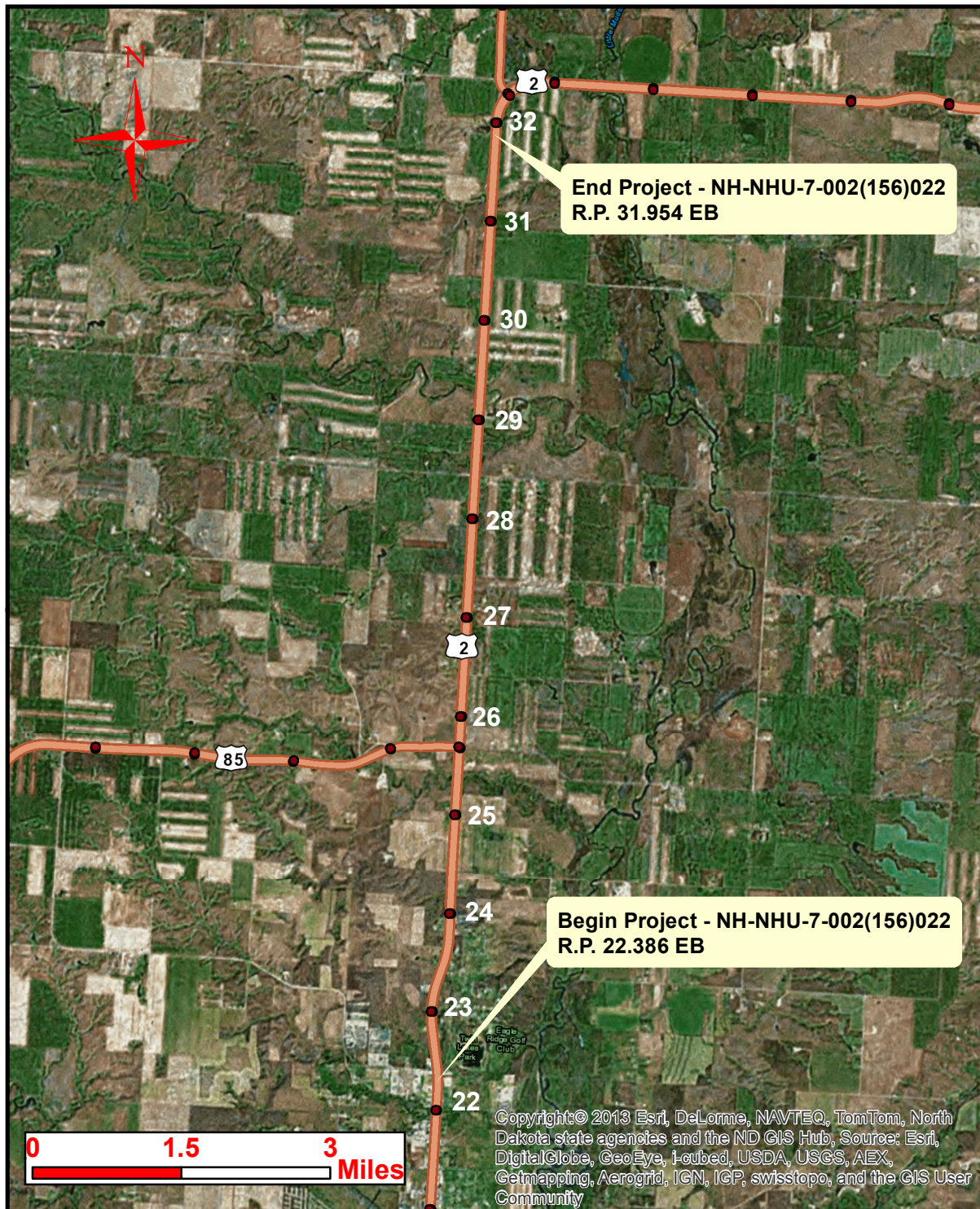
CERTIFICATION

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 Jordan M. Nehls, Registration number PE-8782 on 8/30/16 and the original document is stored at the North Dakota Department of Transportation.



Jordan M. Nehls
Jordan M. Nehls, P.E.

8/30/2016
Date



Linear Soils Report and Recommendation

Project: NH-NHU-7-002(156)022

PCN: 20845

Scope: Concrete Overlay

Length: 9.6 Miles

Location: US 2 From 2 Miles North of Williston
North to 63rd St NW - EB



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Introduction

Location: U.S. Highway 2 From 2 Miles North of Williston North to 63rd St NW - EB

Reference Points: 22.386 to 31.954

Project Length: 9.568 Miles

Proposed Project Scope: Concrete Overlay

Investigation Scope: Boring every 1000' along U.S. Highway 2 from 2 Miles North of Williston North to 63rd St NW - EB

Existing Roadway Section

Construction History

Table 1 - Construction History – R.P. 22.386 to R.P. 31.954

Construction History				
Year	Construction	Depth (in)	Width (ft)	Oil
1978	Grade	---	48.0	---
1979	Aggregate Base	8.0	42.0	---
1979	Hot Bituminous Pavement	2.0	40.0	---
1979	Hot Bituminous Pavement	2.0	27.0	---
1990	Safety Enhancements 90-1	---	---	---
1990	Contract Chip Seal	---	24.0	HFMS-2
1998	Contract Chip Seal	---	24.0	HFMS-2
2006	HBP – Superpave – FAA 45	2.5	36.0	PG 58-28
2006	HBP – Superpave – FAA 45	2.0	36.0	PG 64-28
2009	Slurry Seal	---	24.0	CRS2P

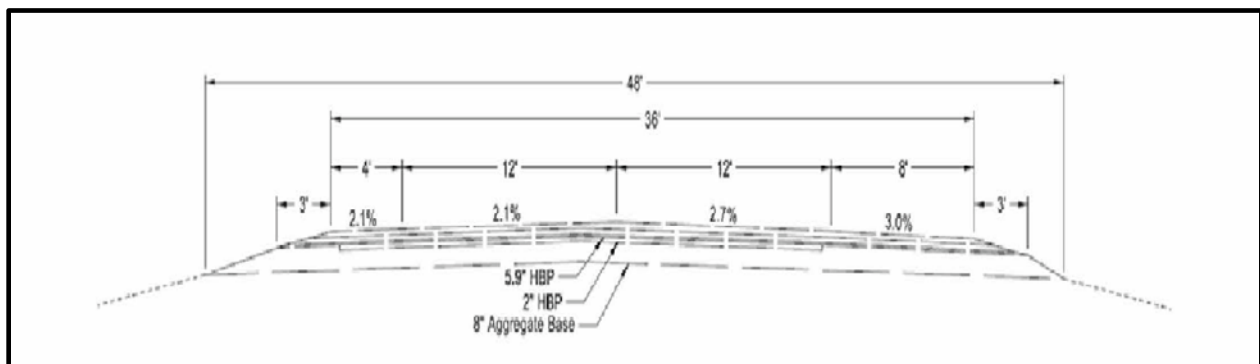


Figure 1 – Typical Section R.P. 22.386 to R.P. 31.954

Existing Roadway Condition

Distress Data

Table 2 – 2015 Distress Data

Reference Point	Alligator Cracking	Longitudinal Cracking	Transverse Cracking	Block Cracking	Bituminous Patching	Rutting
	(0-27)	(0-9)	(0-9)	(0-9)	(0-18)	(0-27)
22	3	4	7	0	0	27
23	3	7	7	0	0	14
24	3	1	7	0	0	27
25	3	1	7	0	0	27
26	3	0	7	0	0	27
27	3	4	7	0	0	27
28	3	4	7	0	0	27
29	3	4	7	0	0	27
30	3	4	7	0	0	27
31	3	7	7	0	2	14
Average	3	4	7	0	0	24

Ride Data

Table 3 – 2015 Ride Data

Reference Point	Distress Score		Rut (inches)		International Roughness	
					Index (inches/mile)	
	Excellent	≥ 98	Excellent	< 0.25	Excellent	< 61
	Good	88 - 97	Good	0.25 - 0.375	Good	61 - 99
	Fair	77 - 87	Fair	0.376 - 0.50	Fair	100 - 145
	Poor	≤ 76	Poor	> 0.50	Poor	>145
22	58		0.46		77	
23	68		0.44		61	
24	61		0.60		56	
25	61		0.46		98	
26	62		0.56		66	
27	58		0.53		62	
28	58		0.52		61	
29	58		0.51		58	
30	58		0.49		58	
31	66		0.32		62	
Average	61		0.49		66	

Maintenance Review

Date of Maintenance Review(s): 5/2/2016

Materials and Research Person Conducting the Review: Jamie Naumann

District Maintenance Person Conducting Review: Rick Sigvaldsen, Williston District,
Maintenance Superintendent

The summary of the identified maintenance areas are shown in the following table.
The pavement evaluation log can be found in Appendix B.

Table 4 - Identified Maintenance Areas

Location RP + Feet	Distress Identified	Drilling Required (Yes or No)
22+2038 To 31+5037	Rutting (Approx. 0.25")	No

Summary of Soil Analysis

Soil Sample Distribution

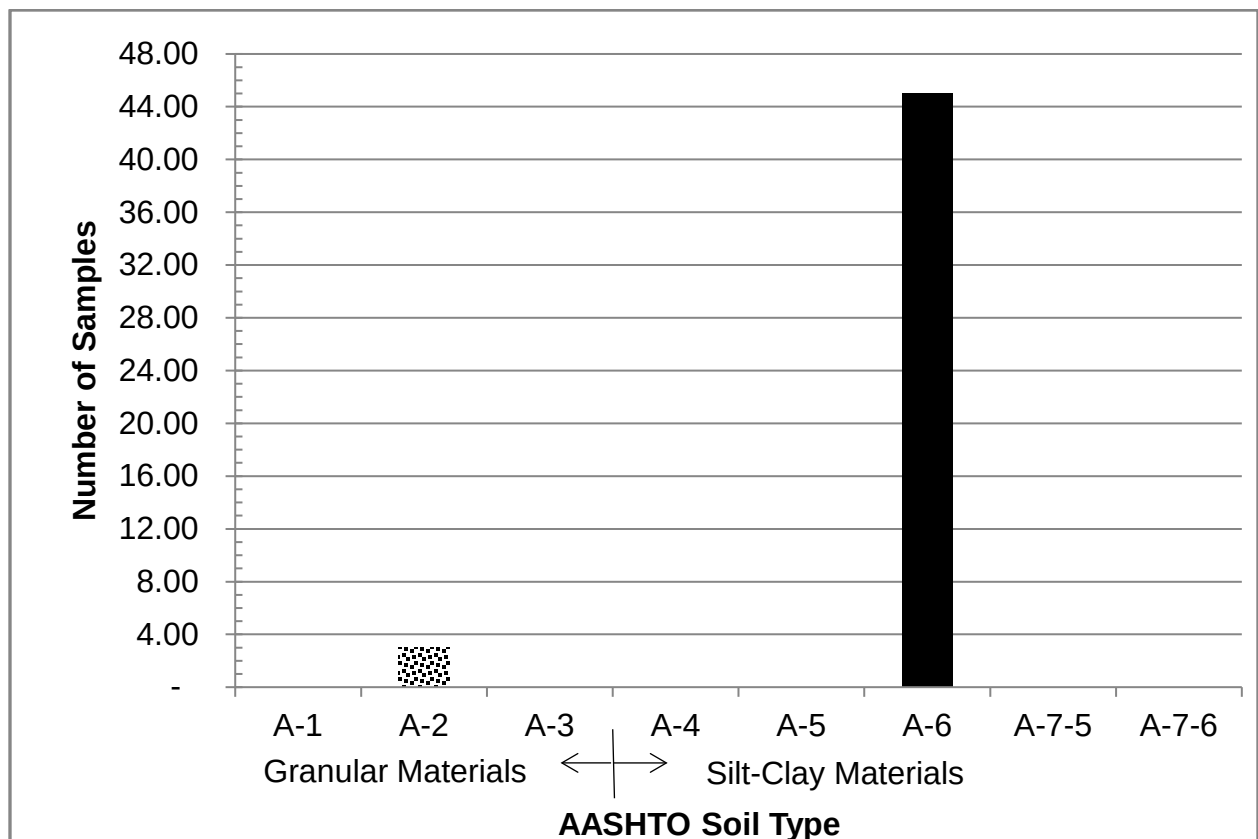


Figure 2 - Soil Sample Distribution

Moisture

The moisture contents provided in this report and summarized below have been obtained from samples taken between 5/31/16 & 6/1/16.

Table 5 - 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 (%)
3	A-2-4	8-10	9.3	8.4	0.9
45	A-6	8.7-27.2	14.1	9.3	4.8

Table 6 - 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)
3	A-2-4	33%	67%	0%	0%	0%
45	A-6	2%	79%	14%	2%	2%

Atterberg Limits

Table 7 - Summary of Atterberg Limits

AASHTO Classification	Liquid Limit Range (%)	Liquid Limit Average (%)	Plastic Limit Range (%)	Plastic Limit Average (%)	Plasticity Index Range (%)	Plasticity Index Average (%)
A-2-4	0-22	15	NP-16	10	NP-10	5
A-6	24-38	34	11-18	15	12-24	19

Swell Potential

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

Table 8 - Swell Potential

Low (Plasticity Index < 25)	Marginal (25 ≤ Plasticity Index ≤ 35)	High (Plasticity Index > 35)
100%	0%	0%

Frost Susceptibility

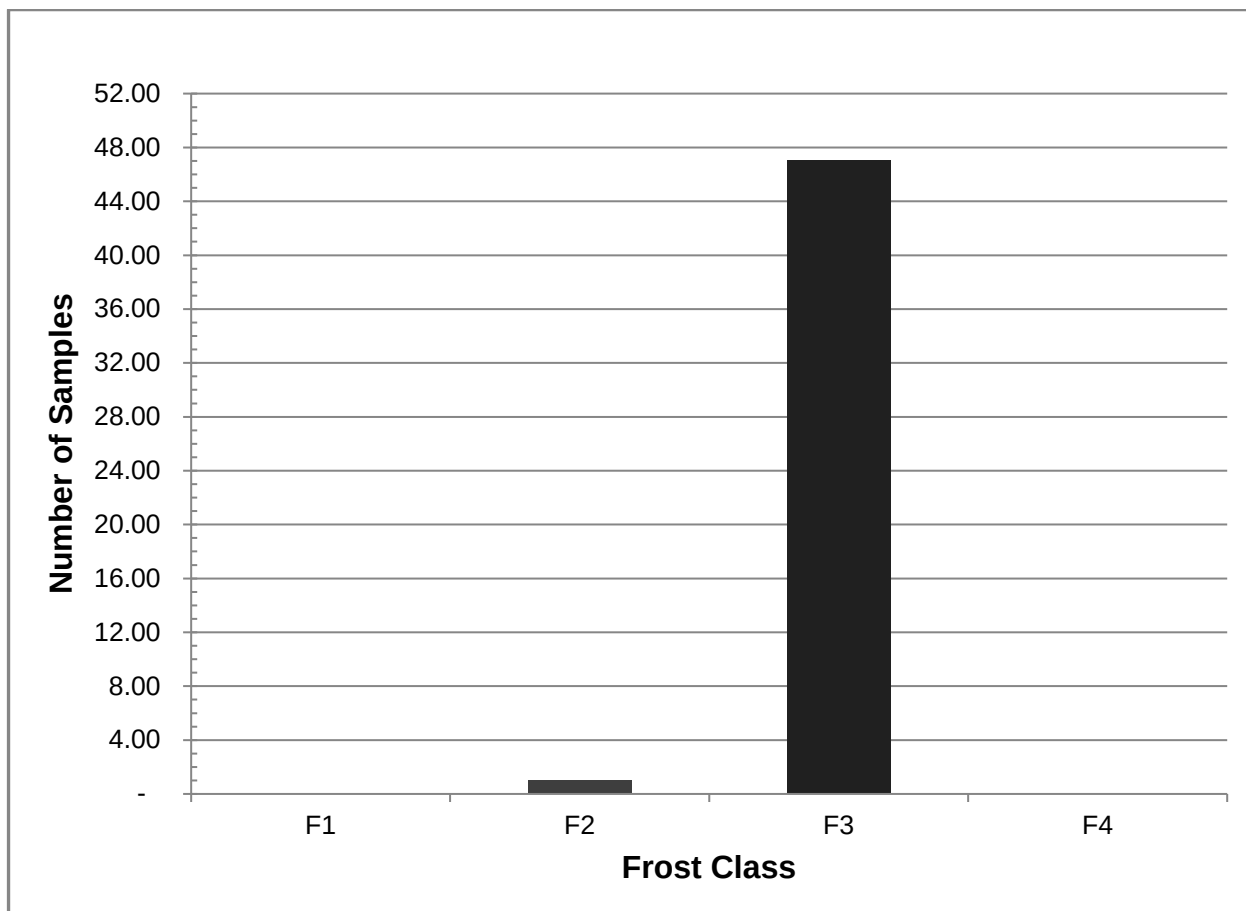


Figure 3 - Frost Susceptibility Distribution

Group Index

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

Table 9 - Group Indices

AASHTO Classification	Group Index Range	Group Index Average
A-2-4	0-0	0
A-6	3-13	8

Existing Surface and Base Section at the Boring Locations

The soil borings were performed on 5/31/16 & 6/1/16 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 10 - Surface and Base Section at the Boring Locations

RP + Feet	Offset	Asphalt Thickness (ft)	Base Thickness (ft)
22+2000	Rt 7 EB	0.8	0.9
22+3000	Rt 7 EB	1.4	0.8
22+4000	Rt 7 EB	0.8	0.5
23+0000	Rt 7 EB	0.9	0.5
23+1000	Rt 7 EB	1.0	0.4
23+2000	Rt 7 EB	0.8	0.4
23+3000	Rt 7 EB	0.8	0.7
23+4000	Rt 7 EB	0.9	0.5
24+0000	Rt 7 EB	0.9	0.4
24+1000	Rt 7 EB	0.9	0.4
24+2000	Rt 7 EB	0.7	0.6
24+3000	Rt 7 EB	0.8	0.5
24+4000	Rt 7 EB	0.7	0.4
25+0000	Rt 8 EB	0.9	0.5
25+1000	Rt 8 EB	0.9	0.5
25+2000	Rt 8 EB	0.8	0.5
25+2931	Rt 8 EB	1.6	0.4
25+4000	Rt 8 EB	1.0	0.7
26+0000	Rt 8 EB	0.7	0.5
26+1000	Rt 8 EB	0.7	0.5
26+2000	Rt 8 EB	0.7	0.4
26+3000	Rt 8 EB	0.7	0.5
26+4000	Rt 8 EB	0.8	0.6
27+0000	Rt 8 EB	0.8	0.6
27+1000	Rt 8 EB	0.7	0.6
27+2040	Rt 7 EB	0.8	0.7
27+3000	Rt 7 EB	0.8	0.6
27+4000	Rt 7 EB	0.7	0.5
28+0000	Rt 7 EB	0.8	0.7
28+1000	Rt 7 EB	0.8	0.5
28+2000	Rt 7 EB	0.8	0.5
28+3000	Rt 7 EB	0.9	0.4
28+4000	Rt 7 EB	0.8	0.5
29+0000	Rt 8 EB	0.7	0.7
29+1000	Rt 8 EB	0.8	0.5
29+2000	Rt 8 EB	0.9	0.7
29+3000	Rt 8 EB	0.9	0.6
29+4000	Rt 8 EB	1.0	0.5
30+0000	Rt 8 EB	0.8	0.5

RP + Feet	Offset	Asphalt Thickness (ft)	Base Thickness (ft)
30+1000	Rt 8 EB	0.9	0.5
30+2000	Rt 8 EB	0.7	0.5
30+3000	Rt 8 EB	0.9	0.3
30+4000	Rt 8 EB	0.9	0.3
31+0000	Rt 8 EB	0.7	0.3
31+1000	Rt 8 EB	0.9	0.6
31+2000	Rt 8 EB	0.7	0.6
31+3000	Rt 8 EB	0.8	0.6
31+4207	Rt 8 EB	1.1	0.5

Design Recommendations

Table 11 – Design Recommendations

Location RP + Feet	Distress Identified	Recommendation	Justification
22+2038 To 31+5037	Rutting (Approx. 0.25")	No subgrade work required	• The rutting is a pavement distress that is not related to the subgrade • No borings required

Design Information

Based on the scope of work and condition of the existing soils no subgrade design recommendations are required.

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	• Gravely Soils • Sands, except very fine silty sands • Clays, PI > 12	Greater than 20 Greater than 15 ---
F4	Very High	• All Silts • Very Fine Silty Sands • Clays, PI > 12 • Varved Clays and other fine-grained banded sediments	--- Greater than 15 --- ---

APPENDIX B

PAVEMENT EVALUATION LOG AND SUBSURFACE INVESTIGATION SCOPE

PAVEMENT EVALUATION LOG FOR LINEAR SOIL SURVEY

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

Project Number NH-NHU-7-002(156)022	PCN 20845	Date of Survey 5/2/2016
Section Maintenance Contact Rick Sigvaldsen		Completed By Jamie Naumann
Highway Reference Points 22+2038 to 31+5037	Surface Type Asphalt	

Location	Pavement Distress	Description	Maintenance Comment	Picture Number	Drilling Required
22+2038 to 31+5037	Rutting	Minimal rutting (0.25"), Transverse cracks	No tenting or depressed cracks		No
	Select One				Select One
	Select One				Select One
	Select One				Select One
	Select One				Select One
	Select One				Select One
	Select One				Select One
	Select One				Select One
	Select One				Select One
	Select One				Select One

Comments

I met with Rick Sigvaldsen on 5/2/2016 and he indicated the road was in good condition. Crack spaces 50.0', and Last chip seal in approximately 2000.

LINEAR SOILS SURVEY FIELD INVESTIGATION SCOPE

TO:	File
FROM:	Jordan Nehls – Materials and Research (Geotechnical)
DATE:	5/11/2016
HIGHWAY:	002.022
PROJECT NUMBER:	NH-NHU-7-002(156)022
PCN:	20845
LOCATION:	2 Miles North Williston North to 63 rd St NW - EB
IMPROVEMENT SCOPE:	Concrete Overlay
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 Williston 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: U.S. Highway 2 From 2 Miles North of Williston North to 63rd St NW - EB

The following table shows the proposed subsurface investigation scope.

Boring Location	Justification for Boring	Boring Depth	Location
22+2000 To 31+5000	Major Rehabilitation of Roadway	5 feet	Conduct 1 boring every 1000' along the existing roadway. A total number of approximately 48 borings.

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

Task	Completion (<i>Anticipated</i>) Date
Maintenance Review with District Maintenance Forces	5/2/2016
District Review of Findings from Previous Task	5/13/2016
Linear Soils Survey Field Work Complete	5/17/2016
Linear Soils Survey Lab Work	7/15/2016
Linear Soils Survey Report	8/30/2016*
*Milestone Task	

APPENDIX C

Boring Locations

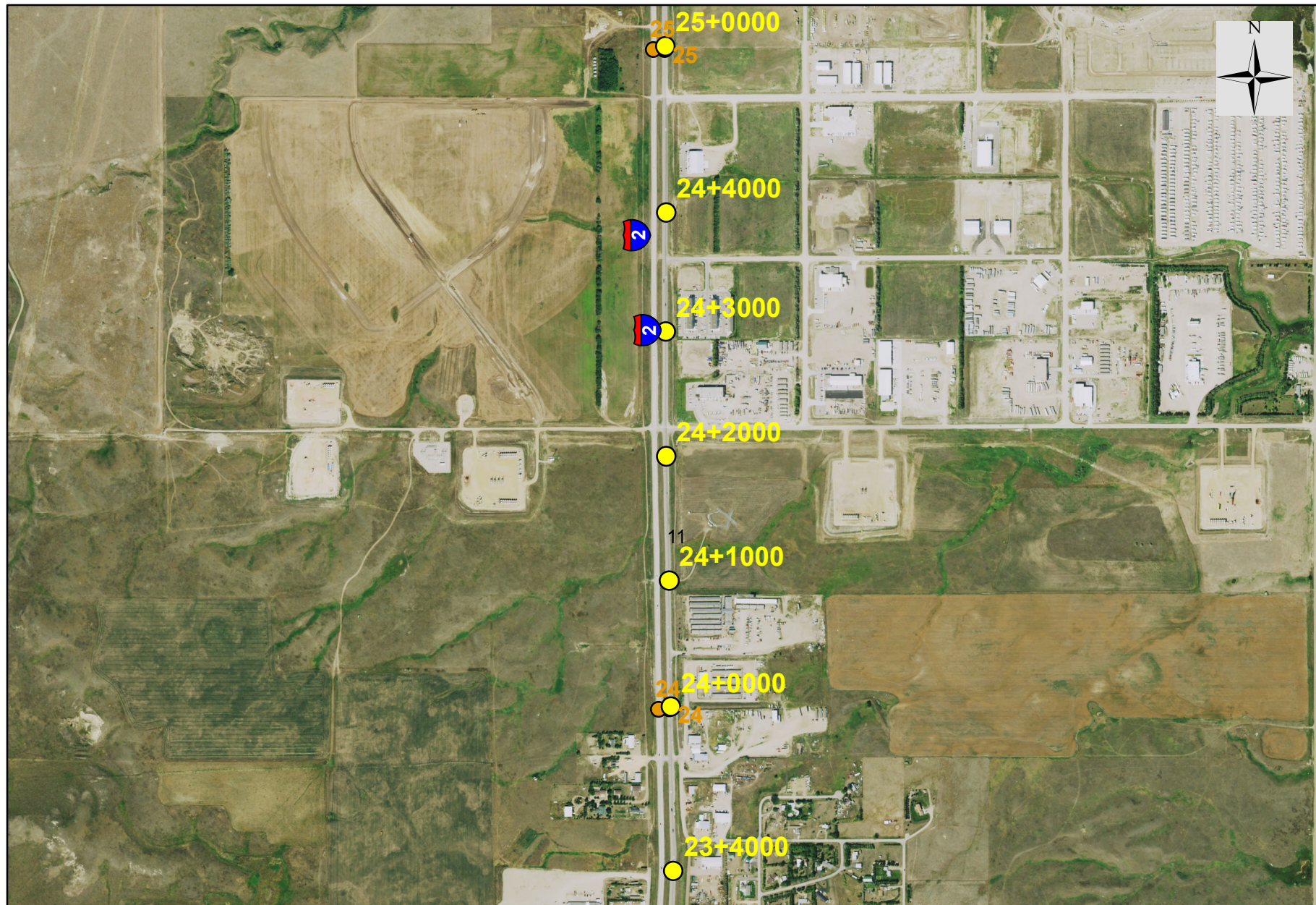


Legend

- Reference Point
- Boring Locations

0 1,250 2,500 5,000 Feet

Project Number: NH-NHU-7-002(156)022



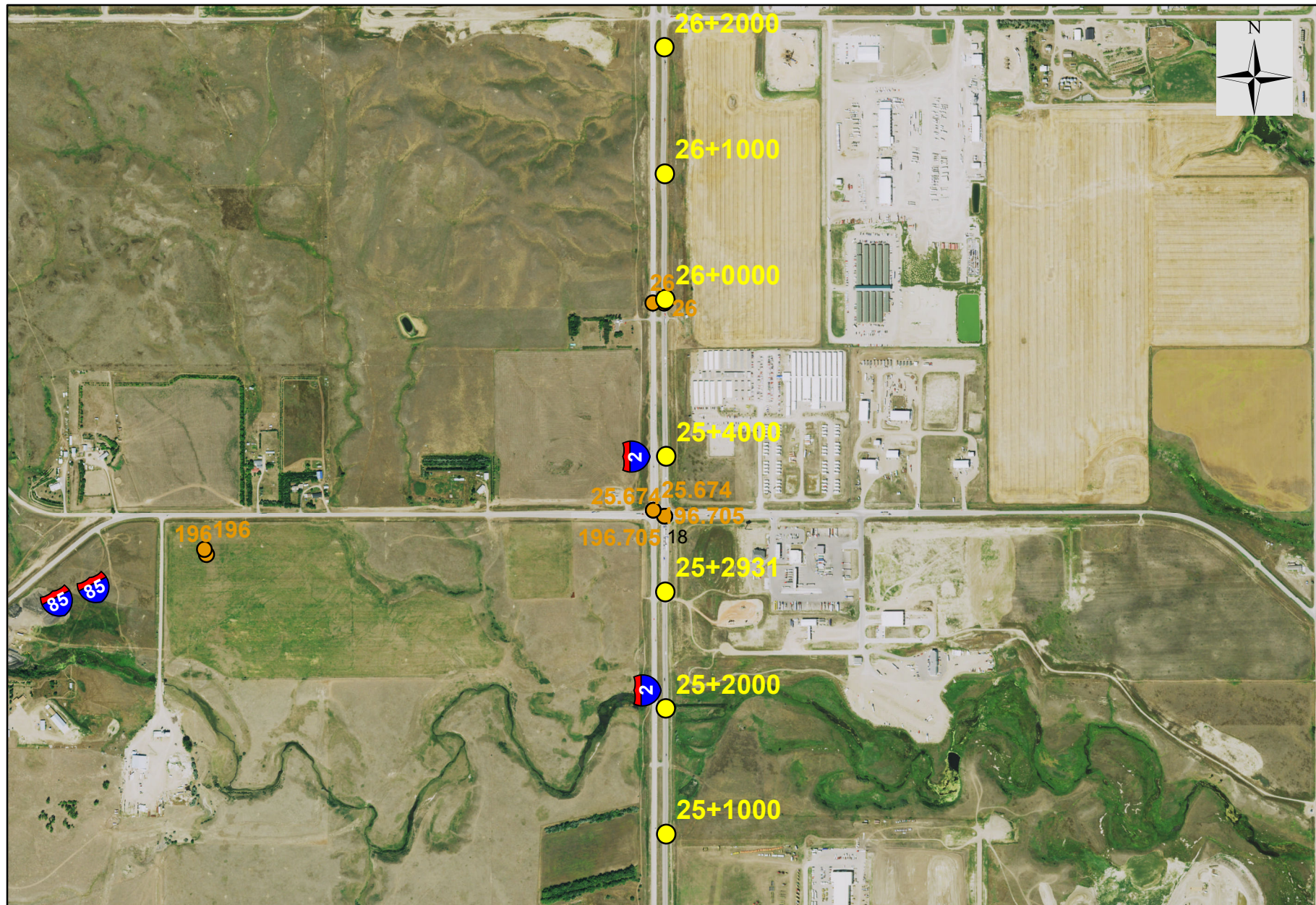
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Reference Point

Boring Locations



Project Number: NH-NHU-7-002(156)022

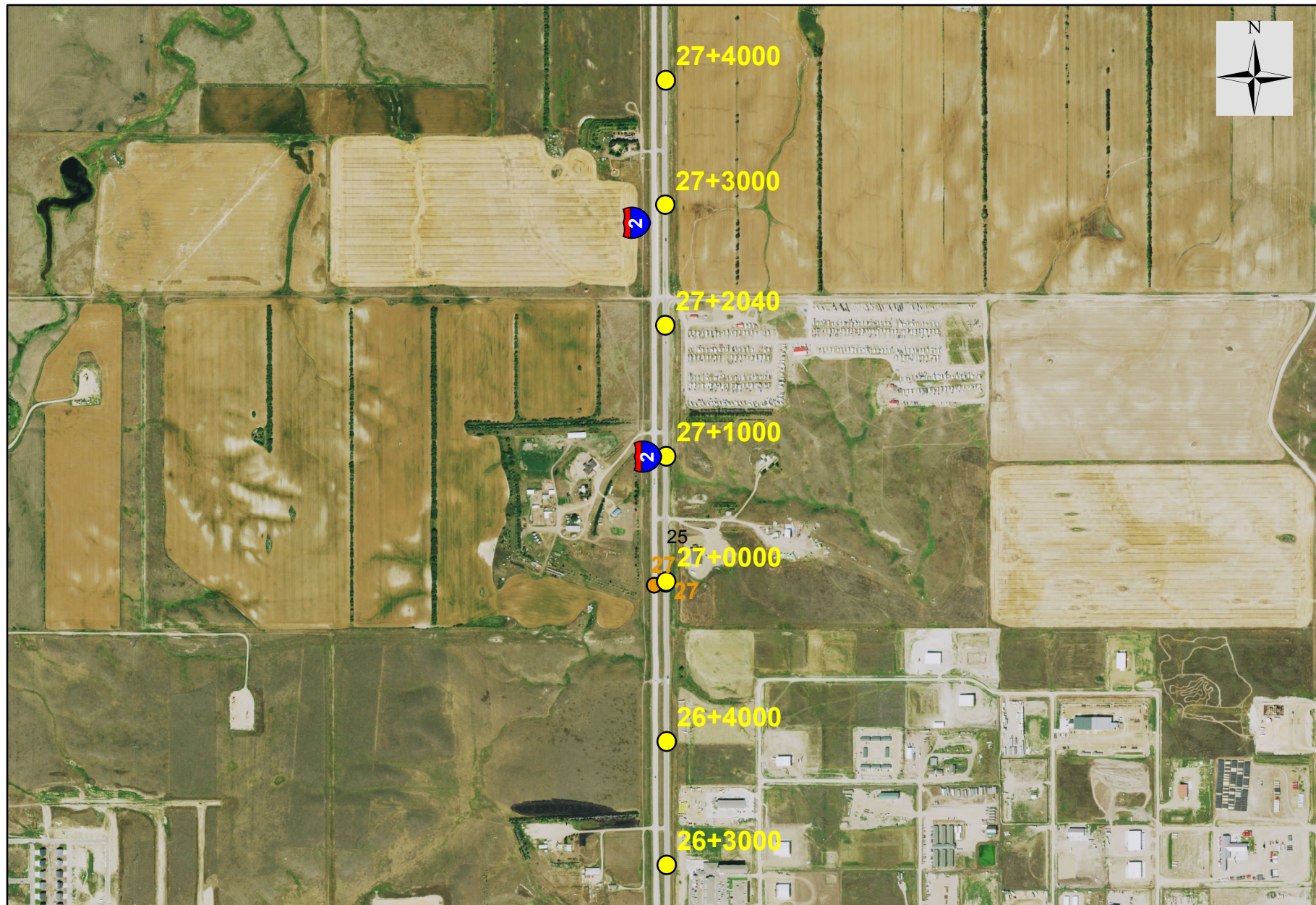


Legend

- Reference Point
- Boring Locations



Project Number: NH-NHU-7-002(156)022

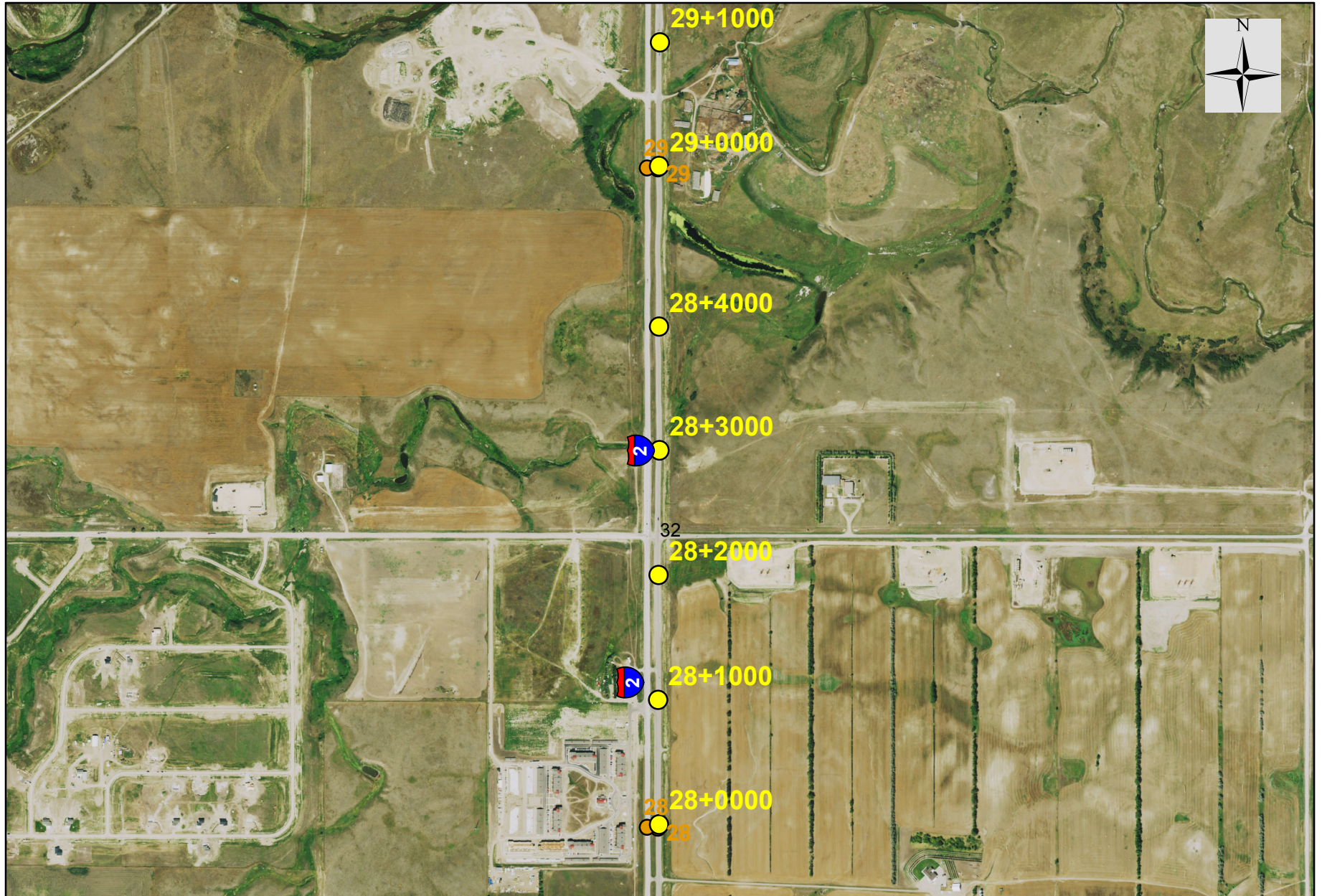


Legend

- Reference Point
- Boring Locations

0 1,250 2,500 5,000 Feet

Project Number: NH-NHU-7-002(156)022

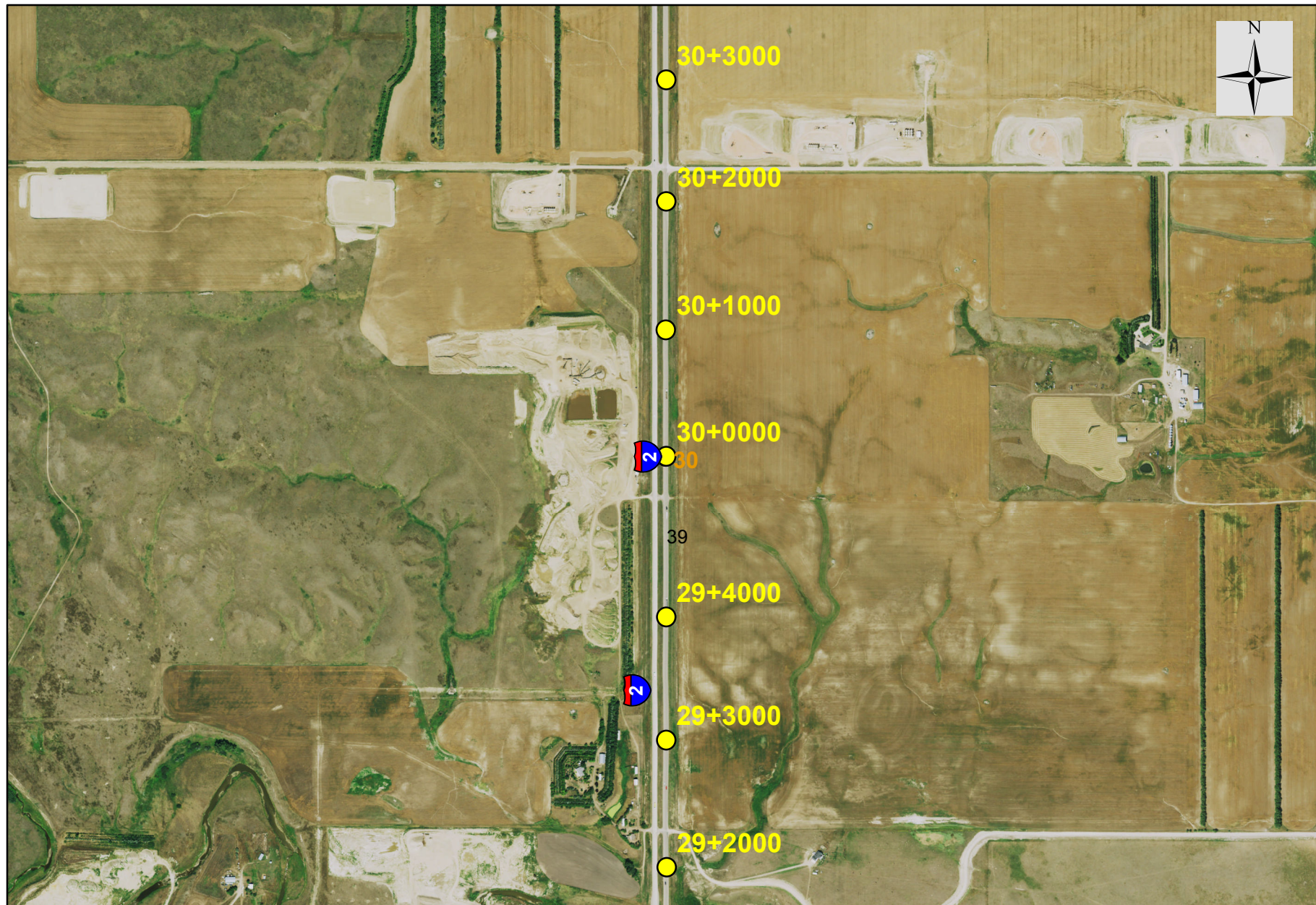


Legend

- Reference Point
- Boring Locations



Project Number: NH-NHU-7-002(156)022



Legend

- Reference Point
- Boring Locations



Project Number: NH-NHU-7-002(156)022



Legend

- Reference Point
- Boring Locations

0 1,250 2,500 5,000 Feet

Project Number: NH-NHU-7-002(156)022

APPENDIX D

SUMMARY OF SOILS ANALYSIS

Project No.: NH-7-002(156)022

PCN: 20845

Swell Potential: Low Marginal High

Moisture Content: Below PL 0-5% Over PL >5% Over PL

Color Key

Group Index: GI≤20 GI>20

Ave. In-Place: MC < 0 ≤ MC < 6% 6 ≤ MC < 10% 10 ≤ MC < 16% MC > 16%
Moisture Content Opt. Over opt. Over opt. Over opt. Over opt.

Lab No.	STA	Offset	Depth of Sample (ft)	Plastic Limit (PL)	AASHTO Class	Group Index	Optimum Moisture	Swell Potential (PI)	Ave. In-Place Moisture	Moisture Content @ Depth (ft)																							Frost Class
										2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
476	22+2000	Rt 7 NB	0.8-5	13.6	A-6(9)	9	9.5	20	14.7	14.7	15.3	14.2	14.6																				F3
477	22+3000	Rt 7 NB	1.4-5	12.8	A-6(8)	8	8.8	20	22.1	46.0	11.9	13.3	17.1																				F3
478	22+4000	Rt 7 NB	0.8-5	13.4	A-6(10)	10	9.8	22	15.5	14.7	16.8	16.4	14.0																				F3
479	23+0000	Rt 7 NB	0.9-5	13.6	A-6(13)	13	10.2	24	15.4	15.1	13.4	16.0	16.9																				F3
481	23+2000	Rt 7 NB	0.8-5	14.8	A-6(9)	9	9.6	18	14.7	14.7	17.1	15.2	11.8																				F3
482	23+3000	Rt 7 NB	0.8-5	14.3	A-6(8)	8	9.3	18	13.9	16.0	13.4	14.6	11.7																				F3
483	23+4000	Rt 7 NB	0.9-5	13.7	A-6(10)	10	9.2	21	12.6	13.9	13.0	11.7	11.8																				F3
484	24+0000	Rt 7 NB	0.9-5	13.7	A-6(9)	9	9.0	21	12.4	11.1	13.5	9.5	15.7																				F3
485	24+1000	Rt 7 NB	0.9-5	12.5	A-6(6)	6	8.4	19	11.8	13.0	12.1	10.5	11.7																				F3
486	24+2000	Rt 7 NB	0.7-5	13.0	A-6(7)	7	9.3	20	12.0	10.4	12.6	14.8	10.3																				F3
487	24+3000	Rt 7 NB	0.8-5	16.1	A-2-4(0)	0	7.3	6	10.0	12.1	13.4	5.7	8.7																				F3
488	24+4000	Rt 7 NB	0.7-4	16.1	A-6(8)	8	9.6	21	9.6	15.5	8.6	11.3	2.8																				F3
489	25+0000	Rt 8 NB	0.9-5	13.7	A-6(9)	9	9.9	21	14.8	12.1	13.6	16.0	17.4																				F3

Project No.: NH-7-002(156)022

PCN: 20845

Swell Potential: Low Marginal High

Moisture Content: Below PL 0-5% Over PL >5% Over PL

Color Key

Group Index: GI≤20 GI>20

Ave. In-Place: MC < Opt. 0 ≤ MC < 6% 6 ≤ MC < 10% 10 ≤ MC < 16% MC > 16%
Moisture Content Over opt. Over opt. Over opt. Over opt.

Lab No.	STA	Offset	Depth of Sample (ft)	Plastic Limit (PL)	AASHTO Class	Group Index	Optimum Moisture	Swell Potential (PI)	Ave. In-Place Moisture	Moisture Content @ Depth (ft)																							Frost Class
										2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
490	25+1000	Rt 8 NB	0.9-5	0.0	A-2-4(0)	0	10.2	0	8.0	9.3	7.0	9.3	6.6																				F2
491	25+2000	Rt 8 NB	0.8-5	13.3	A-6(6)	6	8.2	20	12.3	15.3	7.7	11.7	14.5																				F3
492	25+2931	Rt 8 NB	1.6-5	13.3	A-6(7)	7	9.7	19	13.4	5.0	13.8	17.1	17.6																				F3
493	25+4000	Rt 8 NB	1-5	15.9	A-6(10)	10	10.4	21	14.8	9.9	13.9	15.4	20.2																				F3
494	26+0000	Rt 8 NB	0.7-5	14.5	A-6(6)	6	9.3	16	10.5	10.9	13.4	10.2	7.4																				F3
495	26+1000	Rt 8 NB	0.7-4	14.8	A-6(6)	6	9.9	18	13.1	16.5	15.9	16.1	3.9																				F3
496	26+2000	Rt 8 NB	0.7-5	17.6	A-6(10)	10	11.1	19	16.1	9.9	15.8	22.3	16.4																				F3
497	26+3000	Rt 8 NB	0.7-5	14.8	A-6(9)	9	10.2	19	14.9	14.3	17.2	12.8	15.4																				F3
498	26+4000	Rt 8 NB	0.8-5	16.0	A-6(10)	10	9.7	22	15.9	15.0	14.2	16.7	17.8																				F3
499	27+0000	Rt 8 NB	0.8-5	14.4	A-6(7)	7	9.9	17	14.5	14.3	17.8	12.9	13.1																				F3
500	27+1000	Rt 8 NB	0.7-5	15.9	A-6(10)	10	9.4	21	13.8	9.1	15.7	15.6	14.7																				F3
501	27+2040	Rt 7 NB	0.8-5	14.9	A-6(12)	12	10.3	23	14.2	13.5	12.2	16.8	14.4																				F3
502	27+3000	Rt 7 NB	0.8-5	13.1	A-6(4)	4	8.8	15	13.4	14.3	13.6	11.6	13.9																				F3

Project No.: NH-7-002(156)022

PCN: 20845

Swell Potential: Low Marginal High

Moisture Content: Below PL 0-5% Over PL >5% Over PL

Color Key

Group Index: GI≤20 GI>20

Ave. In-Place: MC < Opt. 0 ≤ MC < 6% 6 ≤ MC < 10% 10 ≤ MC < 16% MC > 16%
Moisture Content Over opt. Over opt. Over opt. Over opt.

Lab No.	STA	Offset	Depth of Sample (ft)	Plastic Limit (PL)	AASHTO Class	Group Index	Optimum Moisture	Swell Potential (PI)	Ave. In-Place Moisture	Moisture Content @ Depth (ft)																							Frost Class
										2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
503	27+4000	Rt 7 NB	0.7-5	16.2	A-6(8)	8	9.7	20	13.3	10.9	14.1	12.6	15.7																				F3
504	28+0000	Rt 7 NB	0.8-5	16.4	A-6(7)	7	9.7	19	17.7	13.5	18.3	16.7	22.3																				F3
505	28+1000	Rt 7 NB	0.8-5	16.0	A-6(3)	3	8.2	15	10.8	12.1	11.4	3.4	16.2																				F3
506	28+2000	Rt 7 NB	0.8-5	17.3	A-6(8)	8	10.2	20	18.3	17.1	14.4	16.2	25.4																				F3
507	28+3000	Rt 7 NB	0.9-5	14.5	A-6(5)	5	9.3	15	27.2	14.5	12.9	15.0	66.5																				F3
508	28+4000	Rt 7 NB	0.8-3.7	15.9	A-6(10)	10	10.1	22	10.5	18.8	13.4	5.6	4.0																				F3
510	29+1000	Rt 8 NB	0.8-5	16.6	A-6(7)	7	10.1	18	17.9	15.8	14.5	22.7	18.6																				F3
511	29+2000	Rt 8 NB	0.9-4.5	12.4	A-2-4(0)	0	7.6	10	9.8	10.4	10.9	5.8	12.1																				F3
512	29+3000	Rt 8 NB	0.9-5	14.2	A-6(7)	7	8.9	22	11.9	10.0	11.7	12.7	13.2																				F3
513	29+4000	Rt 8 NB	1-5	15.6	A-6(7)	7	9.9	18	13.7	13.4	13.5	14.8	13.1																				F3
514	30+0000	Rt 8 NB	0.8-5	15.8	A-6(10)	10	9.8	21	15.1	13.8	14.1	16.6	15.9																				F3
515	30+1000	Rt 8 NB	0.9-5	15.7	A-6(8)	8	9.2	19	16.9	12.9	14.6	19.4	20.8																				F3
516	30+2000	Rt 8 NB	0.7-5	13.3	A-6(4)	4	8.5	16	13.4	13.1	15.8	10.4	14.4																				F3

Project No.: NH-7-002(156)022

PCN: 20845

Swell Potential: Low Marginal High

Moisture Content: Below PL 0-5% Over PL >5% Over PL

Color Key

Group Index: GI≤20 GI>20

Ave. In-Place: MC < 0 ≤ MC < 6% 6 ≤ MC < 10% 10 ≤ MC < 16% MC > 16%
Moisture Content Opt. Over opt. Over opt. Over opt. Over opt.

Lab No.	STA	Offset	Depth of Sample (ft)	Plastic Limit (PL)	AASHTO Class	Group Index	Optimum Moisture	Swell Potential (PI)	Ave. In-Place Moisture	Moisture Content @ Depth (ft)																							Frost Class
										2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
517	30+3000	Rt 8 NB	0.9-5	13.8	A-6(4)	4	7.9	15	12.2	9.7	11.9	14.5	12.6																				F3
518	30+4000	Rt 8 NB	0.9-5	15.0	A-6(7)	7	7.8	21	9.9	8.2	8.5	8.9	14.1																				F3
519	31+0000	Rt 8 NB	0.7-5	11.3	A-6(3)	3	6.5	12	8.7	8.7	9.3	8.3	8.4																				F3
520	31+1000	Rt 8 NB	0.9-5	12.6	A-6(8)	8	8.6	21	16.0	16.5	13.2	14.6	19.5																				F3
521	31+2000	Rt 8 NB	0.7-5	13.0	A-6(9)	9	8.5	21	12.9	11.2	13.6	13.7	13.2																				F3
522	31+3000	Rt 8 NB	0.8-5	15.3	A-6(8)	8	9.0	18	13.1	14.2	13.9	13.0	11.4																				F3
523	31+4207	Rt 8 NB	1.1-5	13.1	A-6(6)	6	8.7	17	10.9	4.0	13.2	14.4	11.9																				F3

APPENDIX E

LAB RESULTS

Linear Laboratory Analysis

Department of Transportation, Materials and Research Division

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

Report Number	SS-26-2016	Date Reported	6/17/2016	District	Bismarck
County	WILLIAMS	Submitted By	Naumann	Project Number	NH-7-002(156)022
AASHTO Test Method			T-180	PCN	20845

Comments

Lab Number	476	477	478	479
Reference Pt + Feet	22+2000	22+3000	22+4000	23+0000
Distance From CenterLine (Ft.)	Rt 7 NB	Rt 7 NB	Rt 7 NB	Rt 7 NB
Depth, Ft.	0.8 - 5.0	1.4 - 5.0	0.8 - 5.0	0.9 - 5.0
Field Sample No.	476	477	478	479
% Pass. 3/8" Sieve	100	99	98	97
% Pass. No. 4 Sieve	97	98	96	96
% Pass. No. 10 Sieve	94	94	93	94
% Coarse Sand (-No. 10 + No. 40)	11	12	10	8
% Fine Sand (-No. 40 + No. 200)	23	24	22	20
% Silt (0.074 - 0.005 mm)	31	31	30	33
% Clay (-0.005 mm)	29	27	31	32
Liquid Limit (-No. 40)	34	32	35	38
Plasticity Index (-No. 40)	20	20	22	24
Plastic Limit	14	13	13	14
Soil Color	BRN	BRN	BRN	BRN
Textural Class	CLY LM	CLY LM	CLY	CLY
Soil Class (AASHTO M-145)	A-6(9)	A-6(8)	A-6(10)	A-6(13)
Frost Class	F3	F3	F3	F3
Optimum Moisture (%)	9.5	8.8	9.8	10.2
Maximum Dry Density (pcf)	130.5	130.7	129.2	126.8
% Organic Content				
Depth (Ft.) Moisture (%)	2 14.7	2 46.0	2 14.7	2 15.1
	3 15.3	3 11.9	3 16.8	3 13.4
	4 14.2	4 13.3	4 16.4	4 16.0
	5 14.6	5 17.1	5 14.0	5 16.9
Avg. Moisture of Sample Depth	14.7	22.0	15.4	15.3

Linear Laboratory Analysis

Department of Transportation, Materials and Research Division

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

Report Number	SS-26-2016	Date Reported	6/17/2016	District	Bismarck
County	WILLIAMS	Submitted By	Naumann	Project Number	NH-7-002(156)022
		AASHTO Test Method	T-180	PCN	20845

Comments

Lab Number	480	481	482	483
Reference Pt + Feet	23+1000	23+2000	23+3000	23+4000
Distance From CenterLine (Ft.)	Rt 7 NB	Rt 7 NB	Rt 7 NB	Rt 7 NB
Depth, Ft.	1.0 - 5.0	0.8 - 5.0	0.8 - 5.0	0.9 - 5.0
Field Sample No.	480	481	482	483
% Pass. 3/8" Sieve	100	99	100	98
% Pass. No. 4 Sieve	98	99	100	96
% Pass. No. 10 Sieve	94	96	95	91
% Coarse Sand (-No. 10 + No. 40)	10	10	11	10
% Fine Sand (-No. 40 + No. 200)	19	23	23	21
% Silt (0.074 - 0.005 mm)	44	33	36	31
% Clay (-0.005 mm)	22	30	25	29
Liquid Limit (-No. 40)	30	33	33	35
Plasticity Index (-No. 40)	14	18	18	21
Plastic Limit	16	15	14	14
Soil Color	BRN	BRN/GRY	BRN	BRN
Textural Class	CLY LM	CLY	CLY LM	CLY LM
Soil Class (AASHTO M-145)	A-6(7)	A-6(9)	A-6(8)	A-6(10)
Frost Class	F3	F3	F3	F3
Optimum Moisture (%)	10.6	9.6	9.3	9.2
Maximum Dry Density (pcf)	127.0	127.8	129.5	129.8
% Organic Content				
Depth (Ft.) Moisture (%)	2 13.8	2 14.7	2 16.0	2 13.9
	3 -139.1	3 17.1	3 13.4	3 13.0
	4 18.0	4 15.2	4 14.6	4 11.7
	5 12.7	5 11.8	5 11.7	5 11.8
Avg. Moisture of Sample Depth	-23.6	14.7	13.9	12.6

Linear Laboratory Analysis

Department of Transportation, Materials and Research Division

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

Report Number	SS-26-2016	Date Reported	6/17/2016	District	Bismarck
County	WILLIAMS	Submitted By	Naumann	Project Number	NH-7-002(156)022
		AASHTO Test Method	T-180	PCN	20845

Comments

Lab Number	484	485	486	487
Reference Pt + Feet	24+0000	24+1000	24+2000	24+3000
Distance From CenterLine (Ft.)	Rt 7 NB	Rt 7 NB	Rt 7 NB	Rt 7 NB
Depth, Ft.	0.9 - 5.0	0.9 - 5.0	0.7 - 5.0	0.8 - 5.0
Field Sample No.	484	485	486	487
% Pass. 3/8" Sieve	99	100	97	92
% Pass. No. 4 Sieve	98	98	95	84
% Pass. No. 10 Sieve	93	92	90	76
% Coarse Sand (-No. 10 + No. 40)	11	14	13	18
% Fine Sand (-No. 40 + No. 200)	23	25	24	30
% Silt (0.074 - 0.005 mm)	31	27	28	17
% Clay (-0.005 mm)	28	26	25	11
Liquid Limit (-No. 40)	34	32	33	22
Plasticity Index (-No. 40)	21	19	20	6
Plastic Limit	14	13	13	16
Soil Color	BRN	BRN	BRN	BRN
Textural Class	CLY LM	CLY LM	CLY LM	SNDY LM
Soil Class (AASHTO M-145)	A-6(9)	A-6(6)	A-6(7)	A-2-4(0)
Frost Class	F3	F3	F3	F3
Optimum Moisture (%)	9.0	8.4	9.3	7.3
Maximum Dry Density (pcf)	129.3	131.3	130.1	133.4
% Organic Content				
Depth (Ft.) Moisture (%)	2 11.1	2 13.0	2 10.4	2 12.1
	3 13.5	3 12.1	3 12.6	3 13.4
	4 9.5	4 10.5	4 14.8	4 5.7
	5 15.7	5 11.7	5 10.3	5 8.7
Avg. Moisture of Sample Depth	12.5	11.8	12.0	10.0

Linear Laboratory Analysis

Department of Transportation, Materials and Research Division

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

Report Number	SS-26-2016	Date Reported	6/17/2016	District	Bismarck
County	WILLIAMS	Submitted By	Naumann	Project Number	NH-7-002(156)022
		AASHTO Test Method	T-180	PCN	20845

Comments

Lab Number	488	489	490	491
Reference Pt + Feet	24+4000	25+0000	25+1000	25+2000
Distance From CenterLine (Ft.)	Rt 7 NB	Rt 8 NB	Rt 8 NB	Rt 8 NB
Depth, Ft.	0.7 - 4.0	0.9 - 5.0	0.9 - 5.0	0.8 - 5.0
Field Sample No.	488	489	490	491
% Pass. 3/8" Sieve	95	98	97	100
% Pass. No. 4 Sieve	92	96	95	98
% Pass. No. 10 Sieve	87	93	93	92
% Coarse Sand (-No. 10 + No. 40)	12	12	23	17
% Fine Sand (-No. 40 + No. 200)	22	22	51	26
% Silt (0.074 - 0.005 mm)	26	29	11	27
% Clay (-0.005 mm)	28	31	8	23
Liquid Limit (-No. 40)	37	35	0	33
Plasticity Index (-No. 40)	21	21	NP	20
Plastic Limit	16	14	0	13
Soil Color	BRN	BRN	BRN	BRN
Textural Class	CLY LM	CLY	SND	SNDY CLY LM
Soil Class (AASHTO M-145)	A-6(8)	A-6(9)	A-2-4(0)	A-6(6)
Frost Class	F3	F3	F2	F3
Optimum Moisture (%)	9.6	9.9	10.2	8.2
Maximum Dry Density (pcf)	130.4	128.3	123.1	131.3
% Organic Content				
Depth (Ft.) Moisture (%)	2 15.5	2 12.1	2 9.3	2 15.3
	3 8.6	3 13.6	3 7.0	3 7.7
	4 11.3	4 16.0	4 9.3	4 11.7
	5 2.8	5 17.4	5 6.6	5 14.5
Avg. Moisture of Sample Depth	11.8	14.8	8.1	12.3

Linear Laboratory Analysis

Department of Transportation, Materials and Research Division

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

Report Number	SS-26-2016	Date Reported	6/17/2016	District	Bismarck
County	WILLIAMS	Submitted By	Naumann	Project Number	NH-7-002(156)022
AASHTO Test Method			T-180	PCN	20845

Comments

Lab Number	492	493	494	495
Reference Pt + Feet	25+2931	25+4000	26+0000	26+1000
Distance From CenterLine (Ft.)	Rt 8 NB	Rt 8 NB	Rt 8 NB	Rt 8 NB
Depth, Ft.	1.6 - 5.0	1.0 - 5.0	0.7 - 5.0	0.7 - 4.0
Field Sample No.	492	493	494	495
% Pass. 3/8" Sieve	99	100	100	98
% Pass. No. 4 Sieve	97	98	99	96
% Pass. No. 10 Sieve	94	95	95	89
% Coarse Sand (-No. 10 + No. 40)	13	10	10	12
% Fine Sand (-No. 40 + No. 200)	23	23	28	23
% Silt (0.074 - 0.005 mm)	29	33	32	29
% Clay (-0.005 mm)	28	29	26	26
Liquid Limit (-No. 40)	32	37	30	33
Plasticity Index (-No. 40)	19	21	16	18
Plastic Limit	13	16	15	15
Soil Color	BRN	BRN/GRY	BRN	BRN
Textural Class	CLY LM	CLY LM	CLY LM	CLY LM
Soil Class (AASHTO M-145)	A-6(7)	A-6(10)	A-6(6)	A-6(6)
Frost Class	F3	F3	F3	F3
Optimum Moisture (%)	9.7	10.4	9.3	9.9
Maximum Dry Density (pcf)	129.2	126.4	129.7	128.4
% Organic Content				
Depth (Ft.) Moisture (%)	2 5.0	2 9.9	2 10.9	2 16.5
	3 13.8	3 13.9	3 13.4	3 15.9
	4 17.1	4 15.4	4 10.2	4 16.1
	5 17.6	5 20.2	5 7.4	5 3.9
Avg. Moisture of Sample Depth	13.4	14.9	10.5	16.2

Linear Laboratory Analysis

Department of Transportation, Materials and Research Division

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

Report Number	SS-26-2016	Date Reported	6/17/2016	District	Bismarck
County	WILLIAMS	Submitted By	Naumann	Project Number	NH-7-002(156)022
		AASHTO Test Method	T-180	PCN	20845

Comments

Lab Number	496	497	498	499
Reference Pt + Feet	26+2000	26+3000	26+4000	27+0000
Distance From CenterLine (Ft.)	Rt 8 NB	Rt 8 NB	Rt 8 NB	Rt 8 NB
Depth, Ft.	0.7 - 5.0	0.7 - 5.0	0.8 - 5.0	0.8 - 5.0
Field Sample No.	496	497	498	499
% Pass. 3/8" Sieve	97	97	97	100
% Pass. No. 4 Sieve	96	93	95	98
% Pass. No. 10 Sieve	94	90	92	96
% Coarse Sand (-No. 10 + No. 40)	10	9	9	11
% Fine Sand (-No. 40 + No. 200)	20	21	22	24
% Silt (0.074 - 0.005 mm)	33	29	28	32
% Clay (-0.005 mm)	30	32	32	30
Liquid Limit (-No. 40)	37	34	38	31
Plasticity Index (-No. 40)	19	19	22	17
Plastic Limit	18	15	16	14
Soil Color	BRN	BRN	BRN	BRN
Textural Class	CLY	CLY	CLY	CLY LM
Soil Class (AASHTO M-145)	A-6(10)	A-6(9)	A-6(10)	A-6(7)
Frost Class	F3	F3	F3	F3
Optimum Moisture (%)	11.1	10.2	9.7	9.9
Maximum Dry Density (pcf)	125.7	127.6	127.3	127.9
% Organic Content				
Depth (Ft.) Moisture (%)	2 9.9	2 14.3	2 15.0	2 14.3
	3 15.8	3 17.2	3 14.2	3 17.8
	4 22.3	4 12.8	4 16.7	4 12.9
	5 16.4	5 15.4	5 17.8	5 13.1
Avg. Moisture of Sample Depth	16.1	14.9	15.9	14.5

Linear Laboratory Analysis

Department of Transportation, Materials and Research Division

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

Report Number	SS-26-2016	Date Reported	6/17/2016	District	Bismarck
County	WILLIAMS	Submitted By	Naumann	Project Number	NH-7-002(156)022
		AASHTO Test Method	T-180	PCN	20845

Comments

Lab Number	500	501	502	503
Reference Pt + Feet	27+1000	27+2040	27+3000	27+4000
Distance From CenterLine (Ft.)	Rt 8 NB	Rt 7 NB	Rt 7 NB	Rt 7 NB
Depth, Ft.	0.7 - 5.0	0.8 - 5.0	0.8 - 5.0	0.7 - 5.0
Field Sample No.	500	501	502	503
% Pass. 3/8" Sieve	94	98	98	96
% Pass. No. 4 Sieve	93	97	97	94
% Pass. No. 10 Sieve	90	95	93	91
% Coarse Sand (-No. 10 + No. 40)	9	9	14	11
% Fine Sand (-No. 40 + No. 200)	21	23	27	23
% Silt (0.074 - 0.005 mm)	32	32	31	29
% Clay (-0.005 mm)	29	31	22	28
Liquid Limit (-No. 40)	37	38	28	36
Plasticity Index (-No. 40)	21	23	15	20
Plastic Limit	16	15	13	16
Soil Color	BRN	BRN	BRN	BRN
Textural Class	CLY LM	CLY	CLY LM	CLY LM
Soil Class (AASHTO M-145)	A-6(10)	A-6(12)	A-6(4)	A-6(8)
Frost Class	F3	F3	F3	F3
Optimum Moisture (%)	9.4	10.3	8.8	9.7
Maximum Dry Density (pcf)	128.7	128.2	132.1	128.9
% Organic Content				
Depth (Ft.) Moisture (%)	2 9.1	2 13.5	2 14.3	2 10.9
	3 15.7	3 12.2	3 13.6	3 14.1
	4 15.6	4 16.8	4 11.6	4 12.6
	5 14.7	5 14.4	5 13.9	5 15.7
Avg. Moisture of Sample Depth	13.8	14.3	13.3	13.3

Linear Laboratory Analysis

Department of Transportation, Materials and Research Division

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

Report Number	SS-26-2016	Date Reported	6/17/2016	District	Bismarck
County	WILLIAMS	Submitted By	Naumann	Project Number	NH-7-002(156)022
		AASHTO Test Method	T-180	PCN	20845

Comments

Lab Number	504	505	506	507
Reference Pt + Feet	28+0000	28+1000	28+2000	28+3000
Distance From CenterLine (Ft.)	Rt 7 NB	Rt 7 NB	Rt 7 NB	Rt 7 NB
Depth, Ft.	0.8 - 5.0	0.8 - 5.0	0.8 - 5.0	0.9 - 5.0
Field Sample No.	504	505	506	507
% Pass. 3/8" Sieve	97	93	95	97
% Pass. No. 4 Sieve	95	89	92	94
% Pass. No. 10 Sieve	91	85	88	92
% Coarse Sand (-No. 10 + No. 40)	12	19	10	9
% Fine Sand (-No. 40 + No. 200)	25	24	23	29
% Silt (0.074 - 0.005 mm)	28	23	29	35
% Clay (-0.005 mm)	27	20	26	19
Liquid Limit (-No. 40)	35	31	37	29
Plasticity Index (-No. 40)	19	15	20	15
Plastic Limit	16	16	17	15
Soil Color	BRN/GRY	BRN	BRN/GRY/BLK	BRN/BLK
Textural Class	CLY LM	SNDY LM	CLY LM	LM
Soil Class (AASHTO M-145)	A-6(7)	A-6(3)	A-6(8)	A-6(5)
Frost Class	F3	F3	F3	F3
Optimum Moisture (%)	9.7	8.2	10.2	9.3
Maximum Dry Density (pcf)	127.6	132.1	127.3	128.9
% Organic Content				
Depth (Ft.) Moisture (%)	2 13.5	2 12.1	2 17.1	2 14.5
	3 18.3	3 11.4	3 14.4	3 12.9
	4 16.7	4 3.4	4 16.2	4 15.0
	5 22.3	5 16.2	5 25.4	5 66.5
Avg. Moisture of Sample Depth	17.7	10.8	18.3	27.2

Linear Laboratory Analysis

Department of Transportation, Materials and Research Division

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

Report Number	SS-26-2016	Date Reported	6/17/2016	District	Bismarck
County	WILLIAMS	Submitted By	Naumann	Project Number	NH-7-002(156)022
		AASHTO Test Method	T-180	PCN	20845

Comments

Lab Number	508	509	510	511
Reference Pt + Feet	28+4000	29+0000	29+1000	29+2000
Distance From CenterLine (Ft.)	Rt 7 NB	Rt 8 NB	Rt 8 NB	Rt 8 NB
Depth, Ft.	0.8 - 3.7	0.7 - 5.0	0.8 - 5.0	0.9 - 4.5
Field Sample No.	508	509	510	511
% Pass. 3/8" Sieve	99	98	95	94
% Pass. No. 4 Sieve	97	95	92	92
% Pass. No. 10 Sieve	90	92	88	85
% Coarse Sand (-No. 10 + No. 40)	10	8	10	17
% Fine Sand (-No. 40 + No. 200)	21	20	22	35
% Silt (0.074 - 0.005 mm)	29	30	29	16
% Clay (-0.005 mm)	31	33	26	16
Liquid Limit (-No. 40)	38	38	35	22
Plasticity Index (-No. 40)	22	23	18	10
Plastic Limit	16	15	17	12
Soil Color	BRN	BRN	BRN/GRY/BLK	BRN/GRY
Textural Class	CLY	CLY	CLY LM	SNDY LM
Soil Class (AASHTO M-145)	A-6(10)	A-6(12)	A-6(7)	A-2-4(0)
Frost Class	F3	F3	F3	F3
Optimum Moisture (%)	10.1	10.2	10.1	7.6
Maximum Dry Density (pcf)	127.3	127.0	127.3	133.5
% Organic Content				
Depth (Ft.) Moisture (%)	2 18.8	2 14.5	2 15.8	2 10.4
	3 13.4	3 17.0	3 14.5	3 10.9
	4 5.6	4 -143.8	4 22.7	4 5.8
	5 4.0	5 15.9	5 18.6	5 12.1
Avg. Moisture of Sample Depth	16.1	-24.1	17.9	9.1

Linear Laboratory Analysis

Department of Transportation, Materials and Research Division

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

Report Number	SS-26-2016	Date Reported	6/17/2016	District	Bismarck
County	WILLIAMS	Submitted By	Naumann	Project Number	NH-7-002(156)022
		AASHTO Test Method	T-180	PCN	20845

Comments

Lab Number	512	513	514	515
Reference Pt + Feet	29+3000	29+4000	30+0000	30+1000
Distance From CenterLine (Ft.)	Rt 8 NB	Rt 8 NB	Rt 8 NB	Rt 8 NB
Depth, Ft.	0.9 - 5.0	1.0 - 5.0	0.8 - 5.0	0.9 - 5.0
Field Sample No.	512	513	514	515
% Pass. 3/8" Sieve	98	100	100	100
% Pass. No. 4 Sieve	95	98	98	97
% Pass. No. 10 Sieve	87	93	94	94
% Coarse Sand (-No. 10 + No. 40)	14	11	10	12
% Fine Sand (-No. 40 + No. 200)	21	25	24	25
% Silt (0.074 - 0.005 mm)	26	28	29	28
% Clay (-0.005 mm)	26	30	31	29
Liquid Limit (-No. 40)	36	34	37	35
Plasticity Index (-No. 40)	22	18	21	19
Plastic Limit	14	16	16	16
Soil Color	BRN/GRY/BLK	BRN	BRN	BRN/BLK
Textural Class	CLY LM	CLY LM	CLY	CLY LM
Soil Class (AASHTO M-145)	A-6(7)	A-6(7)	A-6(10)	A-6(8)
Frost Class	F3	F3	F3	F3
Optimum Moisture (%)	8.9	9.9	9.8	9.2
Maximum Dry Density (pcf)	131.6	127.2	129.2	129.0
% Organic Content				
Depth (Ft.) Moisture (%)	2 10.0	2 13.4	2 13.8	2 12.9
	3 11.7	3 13.5	3 14.1	3 14.6
	4 12.7	4 14.8	4 16.6	4 19.4
	5 13.2	5 13.1	5 15.9	5 20.8
Avg. Moisture of Sample Depth	11.9	13.7	15.1	16.9

Linear Laboratory Analysis

Department of Transportation, Materials and Research Division

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

Report Number	SS-26-2016	Date Reported	6/17/2016	District	Bismarck
County	WILLIAMS	Submitted By	Naumann	Project Number	NH-7-002(156)022
		AASHTO Test Method	T-180	PCN	20845

Comments

Lab Number	516	517	518	519
Reference Pt + Feet	30+2000	30+3000	30+4000	31+0000
Distance From CenterLine (Ft.)	Rt 8 NB	Rt 8 NB	Rt 8 NB	Rt 8 NB
Depth, Ft.	0.7 - 5.0	0.9 - 5.0	0.9 - 5.0	0.7 - 5.0
Field Sample No.	516	517	518	519
% Pass. 3/8" Sieve	98	95	98	98
% Pass. No. 4 Sieve	96	93	95	96
% Pass. No. 10 Sieve	93	89	91	91
% Coarse Sand (-No. 10 + No. 40)	11	14	13	13
% Fine Sand (-No. 40 + No. 200)	35	26	26	26
% Silt (0.074 - 0.005 mm)	24	28	32	32
% Clay (-0.005 mm)	23	21	20	20
Liquid Limit (-No. 40)	29	29	36	24
Plasticity Index (-No. 40)	16	15	21	13
Plastic Limit	13	14	15	11
Soil Color	BRN	BRN/GRY	BRN	BRN
Textural Class	SNDY CLY LM	SNDY CLY LM	LM	CLY LM
Soil Class (AASHTO M-145)	A-6(4)	A-6(4)	A-6(7)	A-6(3)
Frost Class	F3	F3	F3	F3
Optimum Moisture (%)	8.5	7.9	7.8	6.5
Maximum Dry Density (pcf)	130.2	131.4	133.0	138.9
% Organic Content				
Depth (Ft.) Moisture (%)	2 13.1	2 9.7	2 8.2	2 8.7
	3 15.8	3 11.9	3 8.5	3 9.3
	4 10.4	4 14.5	4 8.9	4 8.3
	5 14.4	5 12.6	5 14.1	5 8.4
Avg. Moisture of Sample Depth	13.4	12.2	10.0	8.7

Linear Laboratory Analysis

Department of Transportation, Materials and Research Division

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

Report Number	SS-26-2016	Date Reported	6/17/2016	District	Bismarck
County	WILLIAMS	Submitted By	Naumann	Project Number	NH-7-002(156)022
		AASHTO Test Method	T-180	PCN	20845

Comments

Lab Number	520	521	522	523
Reference Pt + Feet	31+1000	31+2000	31+3000	31+4207
Distance From CenterLine (Ft.)	Rt 8 NB	Rt 8 NB	Rt 8 NB	Rt 8 NB
Depth, Ft.	0.9 - 5.0	0.7 - 5.0	0.8 - 5.0	1.1 - 5.0
Field Sample No.	520	521	522	523
% Pass. 3/8" Sieve	98	99	100	100
% Pass. No. 4 Sieve	96	97	98	98
% Pass. No. 10 Sieve	92	94	94	91
% Coarse Sand (-No. 10 + No. 40)	11	10	10	11
% Fine Sand (-No. 40 + No. 200)	23	23	24	23
% Silt (0.074 - 0.005 mm)	30	32	33	32
% Clay (-0.005 mm)	27	29	28	25
Liquid Limit (-No. 40)	33	34	34	30
Plasticity Index (-No. 40)	21	21	18	17
Plastic Limit	13	13	15	13
Soil Color	BRN/GRY	BRN	BRN	BRN
Textural Class	CLY LM	CLY LM	CLY LM	CLY LM
Soil Class (AASHTO M-145)	A-6(8)	A-6(9)	A-6(8)	A-6(6)
Frost Class	F3	F3	F3	F3
Optimum Moisture (%)	8.6	8.5	9.0	8.7
Maximum Dry Density (pcf)	129.5	131.2	129.8	130.3
% Organic Content				
Depth (Ft.) Moisture (%)	2 16.5	2 11.2	2 14.2	2 4.0
	3 13.2	3 13.6	3 13.9	3 13.2
	4 14.6	4 13.7	4 13.0	4 14.4
	5 19.5	5 13.2	5 11.4	5 11.9
Avg. Moisture of Sample Depth	16.0	12.9	13.1	10.8

MOISTURE-DENSITY RELATIONS OF SOILS

North Dakota Department Of Transportation, Materials & Research Division

SFN 10063 (Rev. 03-2006)

Project No. NH-7-002(156)022	PCN	Station	Depth Below Grade
Offset From Centerline		Type of Soil	
AASHTO Designation T-180	Date 8/9/2016	476	

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
		lbs.	9.01	9.09	9.18	9.19	
C	Weight of Mold	lbs.	4.43	4.43	4.43	4.43	4.43
D	Weight of Compacted Soil = B - C	lbs.	4.58	4.66	4.75	4.76	
E	Wet Density = D / A	lbs./cu.ft.	137.4	139.9	142.7	142.9	
F	Dry Density = (E x 100) / (100 + L)	lbs./cu.ft.	128.2	129.2	131.0	130.3	#VALUE!

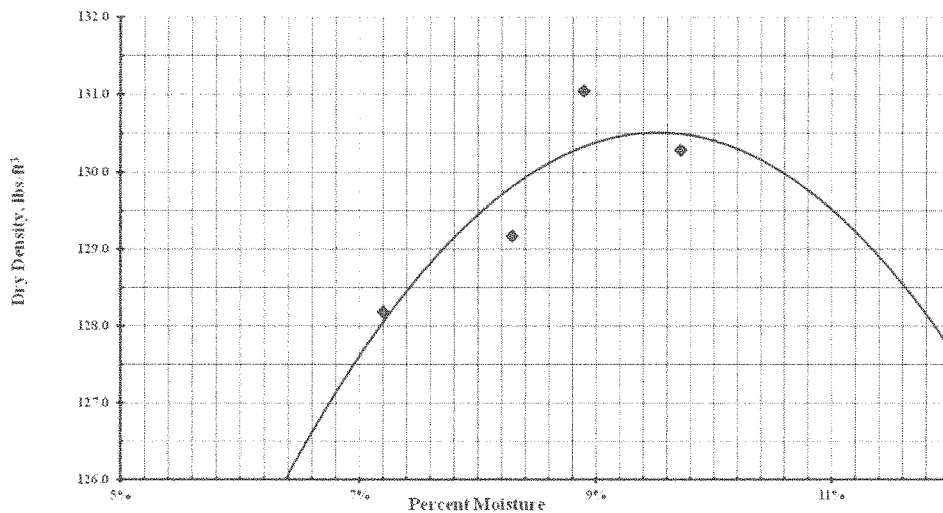
Moisture Content

AASHTO T99 or T180 Tested by:

Container No.		1	2	3	4		
G	Wet Weight / Container	grams	152.7	158.8	158.3	163.2	
H	Dry Weight / Container	grams	144.9	149.5	148.4	152.0	
I	Moisture Loss = G - H	grams	7.8	9.3	9.9	11.2	
J	Tare Weight of Container	grams	36.6	37.3	37.1	36.7	
K	Dry Soil = H - J	grams	108.3	112.2	111.3	115.3	
L	%Moisture = (I / K) x 100	%	7.2%	8.3%	8.9%	9.7%	

ASTM D4643 AASHTO T217 or T265 Tested by: dt

Moisture Density Relationship



Max Dry Density

130.5 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. NH-7-002(156)022	PCN	Station	Depth Below Grade
Offset From Centerline		Type of Soil	
AASHTO Designation T-180	Date 8/9/2016	477	

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
		lbs.	8.96	9.17	9.16		
C	Weight of Mold	lbs.	4.43	4.43	4.43	4.43	4.43
D	Weight of Compacted Soil = B - C	lbs.	4.53	4.74	4.73		
E	Wet Density = D / A	lbs./cu.ft.	136.0	142.4	142.1		
F	Dry Density = (E x 100) / (100 + L)	lbs./cu.ft.	127.5	130.7	128.3	#VALUE!	#VALUE!

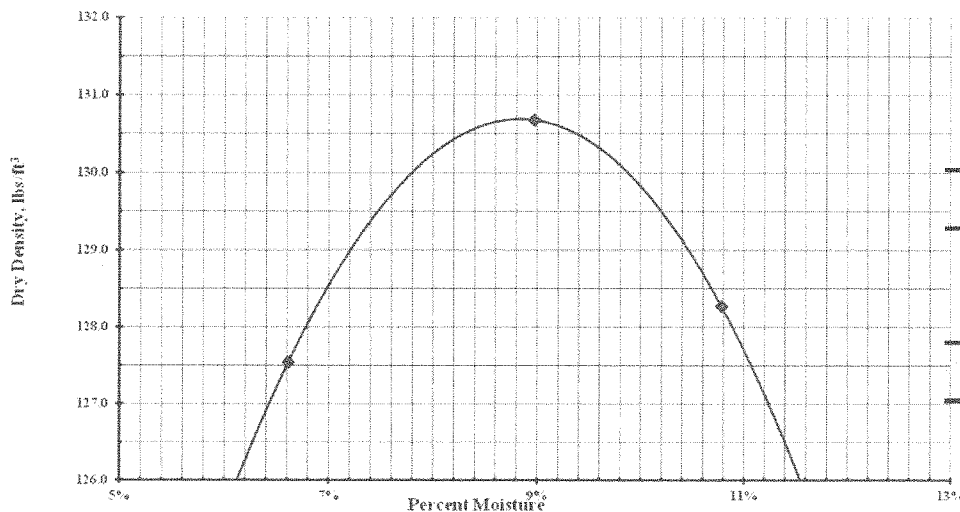
Moisture Content

AASHTO T99 or T180 Tested by:

Container No.		5	6	7			
G	Wet Weight / Container	grams	156.4	154.9	175.0		
H	Dry Weight / Container	grams	149.0	145.2	161.5		
I	Moisture Loss = G - H	grams	7.4	9.7	13.5		
J	Tare Weight of Container	grams	37.1	37.1	36.3		
K	Dry Soil = H - J	grams	111.9	108.1	125.2		
L	%Moisture = (I / K) x 100	%	6.6%	9.0%	10.8%		

ASTM D4643 AASHTO T217 or T265 Tested by: dt

Moisture Density Relationship



Max Dry Density

130.7 lbs./cu.ft.

Optimum Moisture

8.8%

MOISTURE-DENSITY RELATIONS OF SOILS

North Dakota Department Of Transportation, Materials & Research Division

SFN 10063 (Rev. 03-2006)

Project No. NH-7-002(156)022	PCN	Station	Depth Below Grade
Offset From Centerline	Type of Soil		
AASHTO Designation T-180	Date 8/9/2016	478	

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	8.98	9.17	9.13	
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	4.55	4.74	4.69		
E Wet Density = D / A lbs./cu.ft.	128.9	136.5	142.3	141.0		
F Dry Density = (E x 100) / (100 + L) lbs./cu.ft.	121.0	126.3	129.8	126.2	#VALUE!	#VALUE!

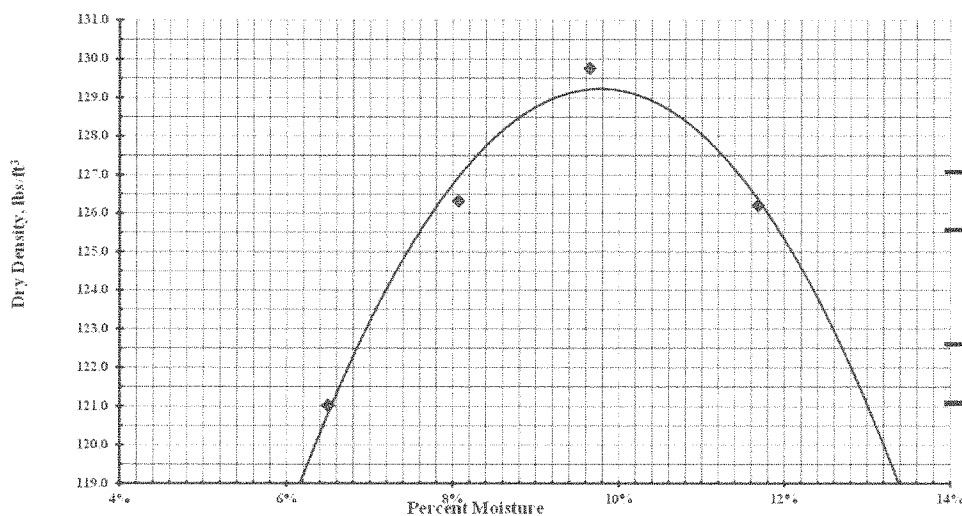
Moisture Content

AASHTO T99 or T180 Tested by:

Container No.	8	9	10	11		
G Wet Weight / Container grams	158.3	168.5	176.5	134.7		
H Dry Weight / Container grams	150.9	158.7	164.2	124.5		
I Moisture Loss = G - H grams	7.4	9.8	12.3	10.2		
J Tare Weight of Container grams	37.0	37.2	36.7	37.2		
K Dry Soil = H - J grams	113.9	121.5	127.5	87.3		
L %Moisture = (I / K) x 100	6.5%	8.1%	9.6%	11.7%		

ASTM D4643 AASHTO T217 or T265 Tested by: dt

Moisture Density Relationship



Max Dry Density

129.2 lbs./cu.ft.

Optimum Moisture

9.8%

MOISTURE-DENSITY RELATIONS OF SOILS

North Dakota Department Of Transportation, Materials & Research Division

SFN 10063 (Rev. 03-2006)

Project No. NH-7-002(156)022	PCN	Station	Depth Below Grade
Offset From Centerline		Type of Soil	
AASHTO Designation T-180	Date 8/9/2016	479	

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
		lbs.	8.74	8.97	9.14	9.07	
C	Weight of Mold	lbs.	4.43	4.43	4.43	4.43	4.43
D	Weight of Compacted Soil = B - C	lbs.	4.31	4.54	4.70	4.64	
E	Wet Density = D / A	lbs./cu.ft.	129.4	136.4	141.3	139.4	
F	Dry Density = (E x 100) / (100 + L)	lbs./cu.ft.	121.2	125.2	127.6	124.0	#VALUE!

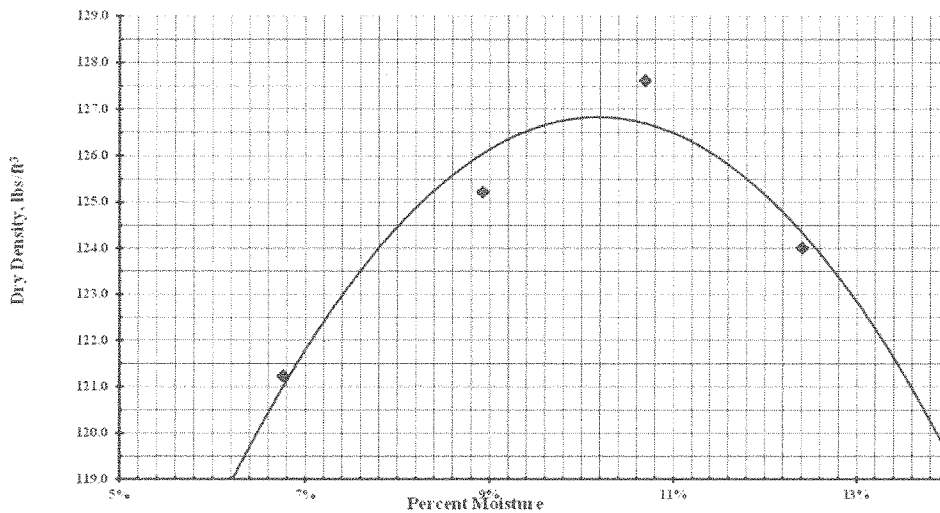
Moisture Content

AASHTO T99 or T180 Tested by:

Container No.		12	13	14	15		
G	Wet Weight / Container	grams	164.8	166.5	161.1	161.4	
H	Dry Weight / Container	grams	156.7	155.9	149.2	147.7	
I	Moisture Loss = G - H	grams	8.1	10.6	11.9	13.7	
J	Tare Weight of Container	grams	36.9	37.1	37.9	37.3	
K	Dry Soil = H - J	grams	119.8	118.8	111.3	110.4	
L	%Moisture = (I / K) x 100	%	6.8%	8.9%	10.7%	12.4%	

ASTM D4643 AASHTO T217 or T265 Tested by: dt

Moisture Density Relationship



Max Dry Density

126.8 lbs./cu. ft.

Optimum Moisture

10.2%

MOISTURE-DENSITY RELATIONS OF SOILS

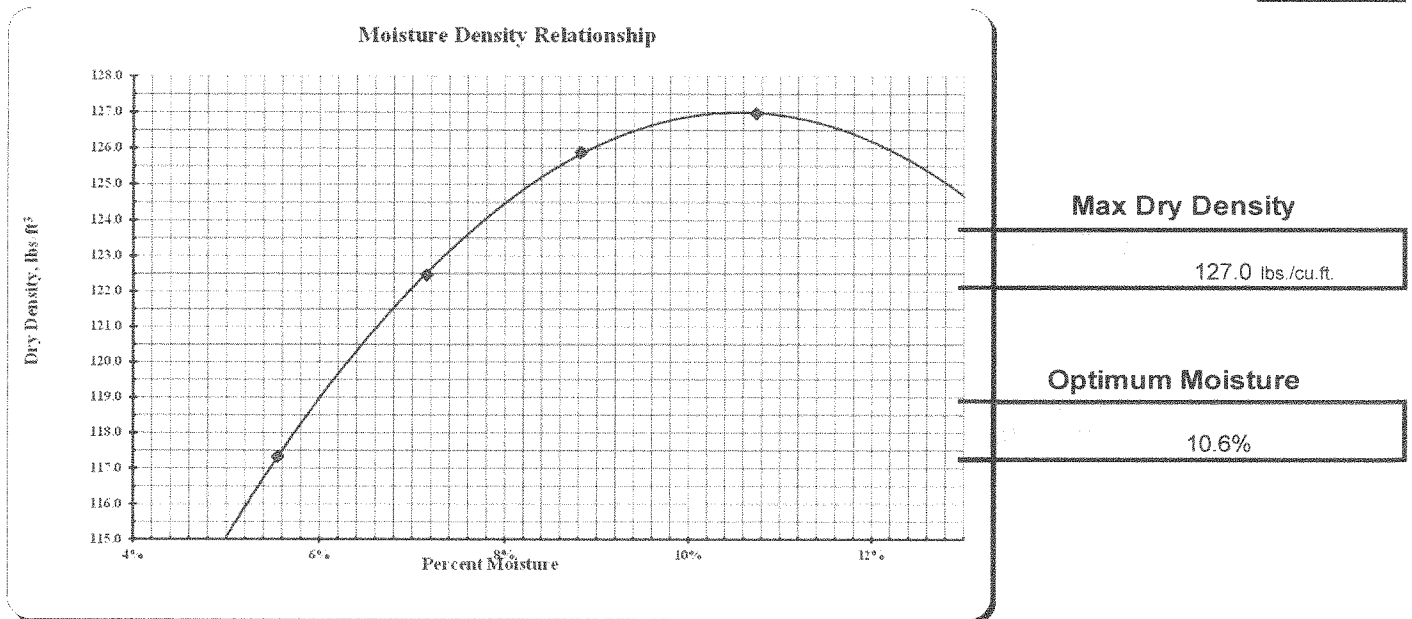
North Dakota Department Of Transportation, Materials & Research Division

SFN 10063 (Rev. 03-2006)

Project No. NH-7-002(156)022		PCN		Station		Depth Below Grade	
Offset From Centerline				Type of Soil			
AASHTO Designation T-180		Date 8/9/2016				480	
Density		Test Count		4			
Determination No.		1		2		3	
A Volume of Mold		cu. ft.		0.0333		0.0333	
		lbs.		8.56		8.80	
C Weight of Mold		lbs.		4.43		4.43	
D Weight of Compacted Soil = B - C		lbs.		4.12		4.37	
E Wet Density = D / A		lbs./cu.ft.		123.8		131.2	
F Dry Density = (E x 100) / (100 + L)		lbs./cu.ft.		117.3		122.5	

Moisture Content		AASHTO T99 or T180 Tested by: dt					
Container No.		16	17	18	19		
G Wet Weight / Container	grams	147.5	179.1	167.8	166.0		
H Dry Weight / Container	grams	141.7	169.6	157.2	153.5		
I Moisture Loss = G - H	grams	5.8	9.5	10.6	12.5		
J Tare Weight of Container	grams	37.2	36.8	37.1	37.1		
K Dry Soil = H - J	grams	104.5	132.8	120.1	116.4		
L %Moisture = (I / K) x 100	%	5.6%	7.2%	8.8%	10.7%		

ASTM D4643 AASHTO T217 or T265 Tested by: dt



MOISTURE-DENSITY RELATIONS OF SOILS

North Dakota Department Of Transportation, Materials & Research Division

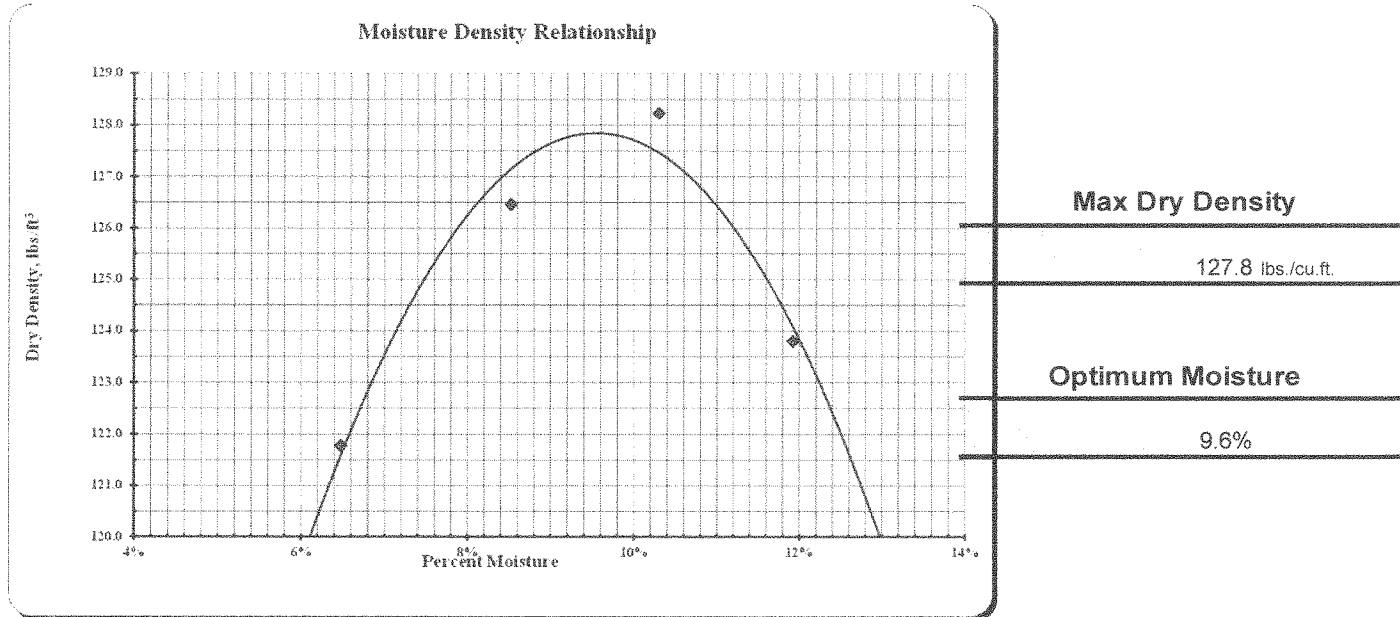
SFN 10063 (Rev. 03-2006)

Project No. NH-7-002(156)022	PCN	Station	Depth Below Grade
Offset From Centerline		Type of Soil	
AASHTO Designation T-180	Date 8/9/2016	481	

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
		lbs.	8.75	9.00	9.14	9.05	
C	Weight of Mold	lbs.	4.43	4.43	4.43	4.43	4.43
D	Weight of Compacted Soil = B - C	lbs.	4.32	4.57	4.71	4.61	
E	Wet Density = D / A	lbs./cu.ft.	129.7	137.2	141.4	138.6	
F	Dry Density = (E x 100) / (100 + L)	lbs./cu.ft.	121.8	126.5	128.2	123.8	#VALUE!

Moisture Content		AASHTO T99 or T180 Tested by:					
Container No.		20	21	22	23		
G	Wet Weight / Container	grams	148.3	158.1	147.3	155.7	
H	Dry Weight / Container	grams	141.5	148.6	137.0	143.1	
I	Moisture Loss = G - H	grams	6.8	9.5	10.3	12.6	
J	Tare Weight of Container	grams	36.5	37.1	37.0	37.4	
K	Dry Soil = H - J	grams	105.0	111.5	100.0	105.7	
L	%Moisture = (I / K) x 100	%	6.5%	8.5%	10.3%	11.9%	

ASTM D4643 AASHTO T217 or T265 Tested by: dt



MOISTURE-DENSITY RELATIONS OF SOILS

North Dakota Department Of Transportation, Materials & Research Division

SFN 10063 (Rev. 03-2006)

Project No. NH-7-002(156)022	PCN	Station	Depth Below Grade
Offset From Centerline		Type of Soil	
AASHTO Designation T-180	Date 8/9/2016	482	

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
		lbs.	8.71	8.95	9.14	9.11	
C	Weight of Mold	lbs.	4.43	4.43	4.43	4.43	4.43
D	Weight of Compacted Soil = B - C	lbs.	4.28	4.52	4.70	4.67	
E	Wet Density = D / A	lbs./cu.ft.	128.6	135.9	141.3	140.4	
F	Dry Density = (E x 100) / (100 + L)	lbs./cu.ft.	120.8	126.4	129.2	126.3	#VALUE!

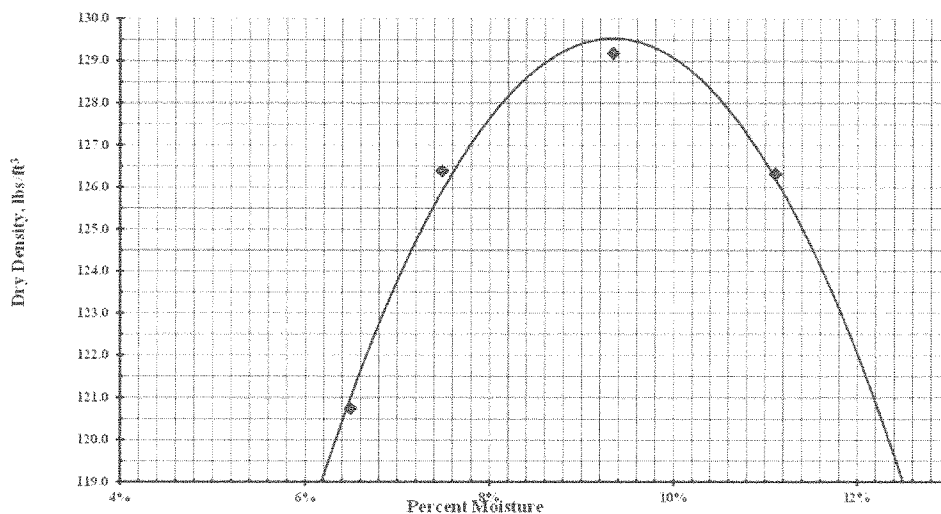
Moisture Content

AASHTO T99 or T180 Tested by:

Container No.		24	25	26	27		
G	Wet Weight / Container	grams	166.8	152.1	143.4	142.7	
H	Dry Weight / Container	grams	158.9	144.1	134.3	132.1	
I	Moisture Loss = G - H	grams	7.9	8.0	9.1	10.6	
J	Tare Weight of Container	grams	37.2	37.2	36.9	36.7	
K	Dry Soil = H - J	grams	121.7	106.9	97.4	95.4	
L	%Moisture = (I / K) x 100	%	6.5%	7.5%	9.3%	11.1%	

ASTM D4643 AASHTO T217 or T265 Tested by: dt

Moisture Density Relationship



Max Dry Density

129.5 lbs./cu.ft.

Optimum Moisture

9.3%

MOISTURE-DENSITY RELATIONS OF SOILS

North Dakota Department Of Transportation, Materials & Research Division

SFN 10063 (Rev. 03-2006)

Project No. NH-7-002(156)022	PCN	Station	Depth Below Grade
Offset From Centerline	Type of Soil		
AASHTO Designation T-180	Date 8/10/2016	483	

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	9.12	9.16	8.98	
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.	4.44	4.69	4.73	4.54		
E Wet Density = D / A lbs./cu.ft.	133.3	140.8	142.0	136.5		
F Dry Density = (E x 100) / (100 + L) lbs./cu.ft.	124.9	129.6	128.5	121.3	#VALUE!	#VALUE!

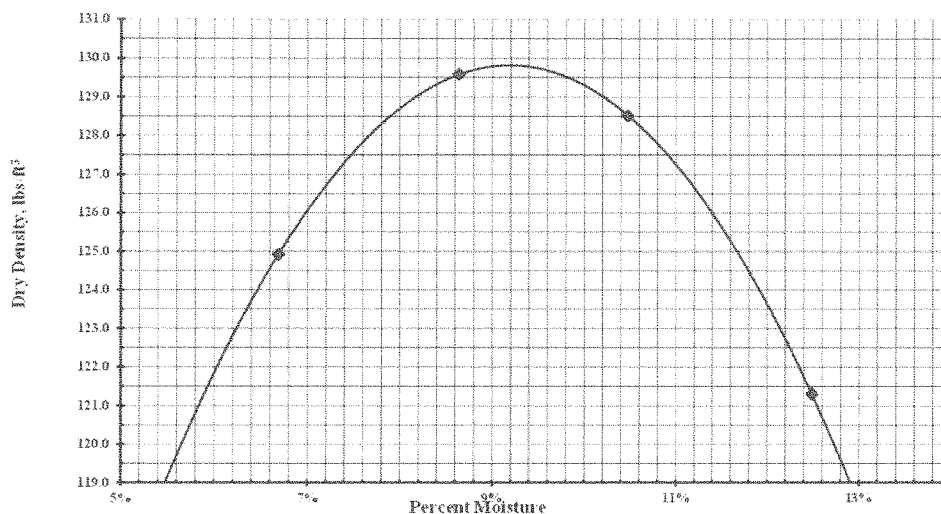
Moisture Content

AASHTO T99 or T180 Tested by:

Container No.	28	29	30	31		
G Wet Weight / Container grams	161.6	155.4	162.6	151.4		
H Dry Weight / Container grams	153.8	146.0	150.7	138.7		
I Moisture Loss = G - H grams	7.8	9.4	11.9	12.7		
J Tare Weight of Container grams	37.2	37.2	37.1	37.0		
K Dry Soil = H - J grams	116.6	108.8	113.6	101.7		
L %Moisture = (I / K) x 100	6.7%	8.6%	10.5%	12.5%		

ASTM D4643 AASHTO T217 or T265 Tested by: dt

Moisture Density Relationship



Max Dry Density

129.8 lbs./cu. ft.

Optimum Moisture

9.2%

MOISTURE-DENSITY RELATIONS OF SOILS

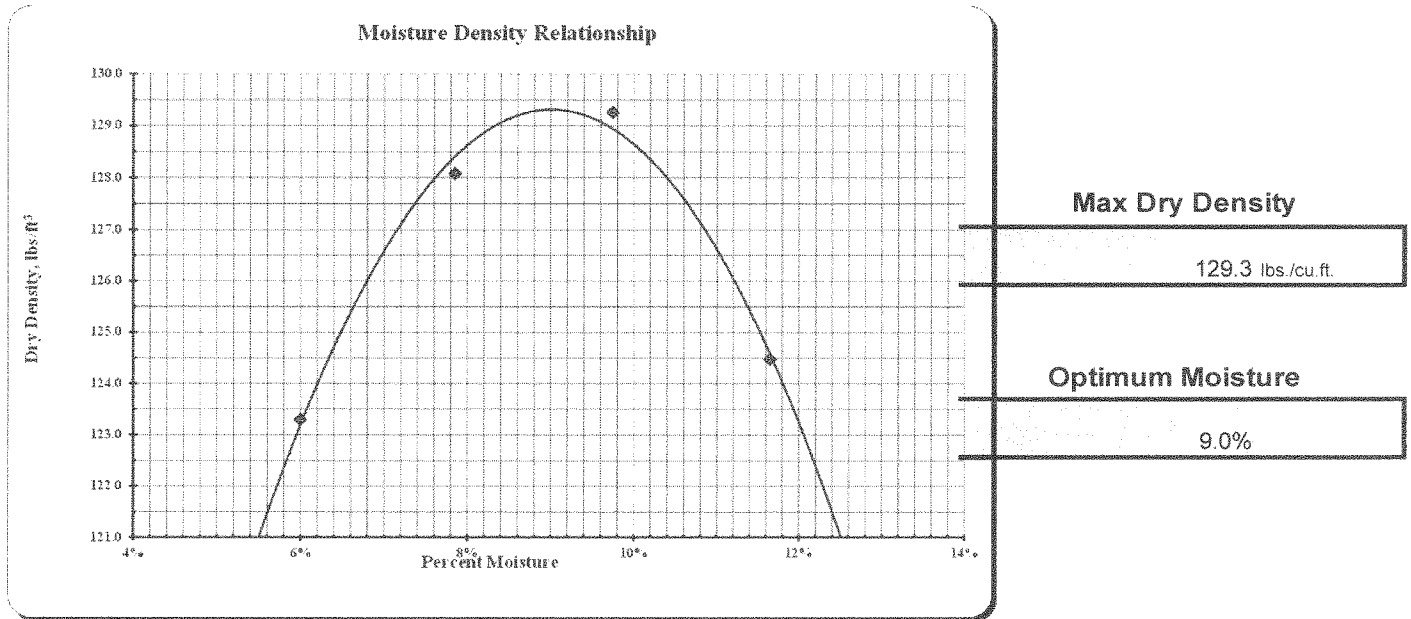
North Dakota Department Of Transportation, Materials & Research Division

SFN 10063 (Rev. 03-2006)

Project No. NH-7-002(156)022		PCN		Station		Depth Below Grade	
Offset From Centerline				Type of Soil			
AASHTO Designation T-180		Date 8/10/2016				484	
Density		Test Count		4			
Determination No.		1		2		3	
A Volume of Mold		cu. ft.		0.0333		0.0333	
		lbs.		8.78		9.03	
C Weight of Mold		lbs.		4.43		4.43	
D Weight of Compacted Soil = B - C		lbs.		4.35		4.60	
E Wet Density = D / A		lbs./cu.ft.		130.7		138.1	
F Dry Density = (E x 100) / (100 + L)		lbs./cu.ft.		123.3		128.1	

Moisture Content		AASHTO T99 or T180 Tested by: dt					
Container No.		32	33	34	35		
G Wet Weight / Container	grams	150.0	164.9	150.6	145.8		
H Dry Weight / Container	grams	143.6	155.6	140.6	134.5		
I Moisture Loss = G - H	grams	6.4	9.3	10.0	11.3		
J Tare Weight of Container	grams	36.9	37.1	38.0	37.5		
K Dry Soil = H - J	grams	106.7	118.5	102.6	97.0		
L %Moisture = (I / K) x 100	%	6.0%	7.8%	9.7%	11.6%		

ASTM D4643 AASHTO T217 or T265 Tested by: dt



MOISTURE-DENSITY RELATIONS OF SOILS

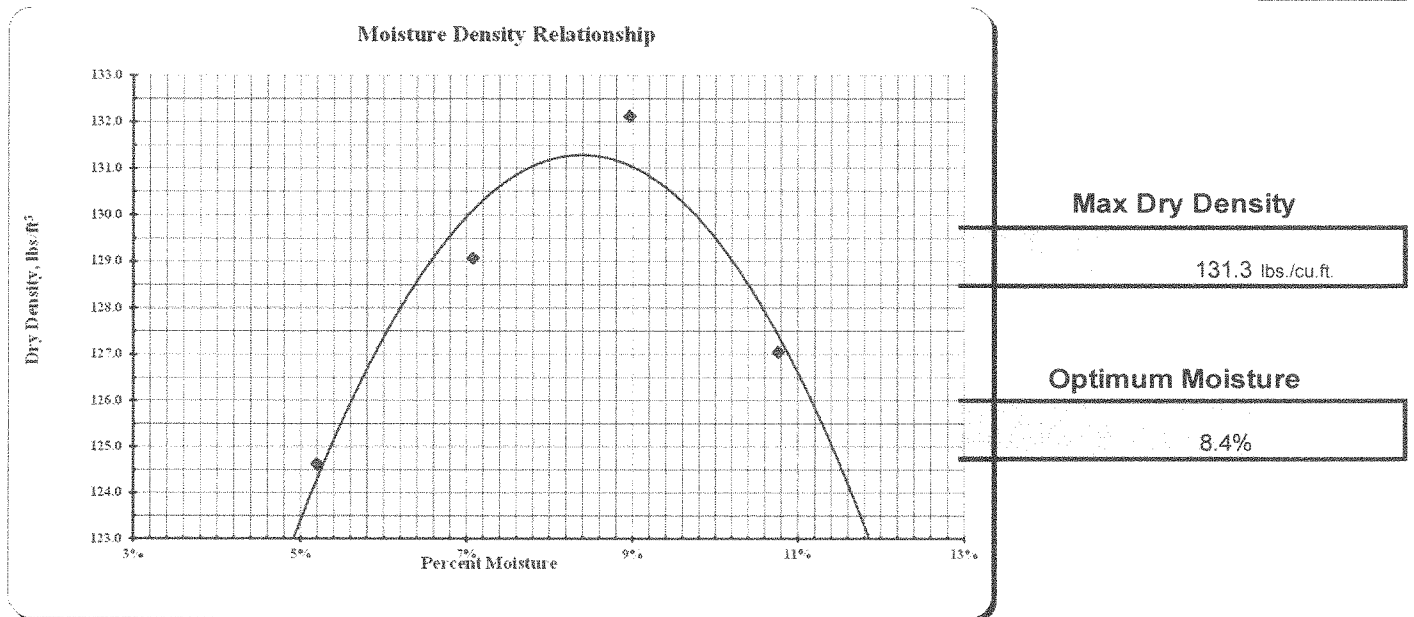
North Dakota Department Of Transportation, Materials & Research Division

SFN 10063 (Rev. 03-2006)

Project No. NH-7-002(156)022		PCN		Station		Depth Below Grade	
Offset From Centerline				Type of Soil			
AASHTO Designation T-180		Date 8/10/2016				485	
Density		Test Count		4			
Determination No.		1		2		3	
A Volume of Mold		cu. ft.		0.0333		0.0333	
		lbs.		8.80		9.03	
C Weight of Mold		lbs.		4.43		4.43	
D Weight of Compacted Soil = B - C		lbs.		4.37		4.60	
E Wet Density = D / A		lbs./cu.ft.		131.1		138.2	
F Dry Density = (E x 100) / (100 + L)		lbs./cu.ft.		124.6		129.1	

Moisture Content		AASHTO T99 or T180 Tested by:					
Container No.		36		37		38	
G Wet Weight / Container		grams		152.6		162.9	
H Dry Weight / Container		grams		146.9		154.6	
I Moisture Loss = G - H		grams		5.7		8.3	
J Tare Weight of Container		grams		37.2		37.3	
K Dry Soil = H - J		grams		109.7		117.3	
L %Moisture = (I / K) x 100		%		5.2%		7.1%	

ASTM D4643 AASHTO T217 or T265 Tested by: dt



MOISTURE-DENSITY RELATIONS OF SOILS

North Dakota Department Of Transportation, Materials & Research Division

SFN 10063 (Rev. 03-2006)

Project No. NH-7-002(156)022	PCN	Station	Depth Below Grade			
Offset From Centerline		Type of Soil				
AASHTO Designation T-180	Date 8/10/2016			486		
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.	8.83	9.12	9.19	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.	4.40	4.69	4.75	4.61		
E Wet Density = D / A lbs./cu.ft.	132.1	140.7	142.8	138.4		
F Dry Density = (E x 100) / (100 + L) lbs./cu.ft.	124.0	129.6	129.7	123.4	#VALUE!	#VALUE!

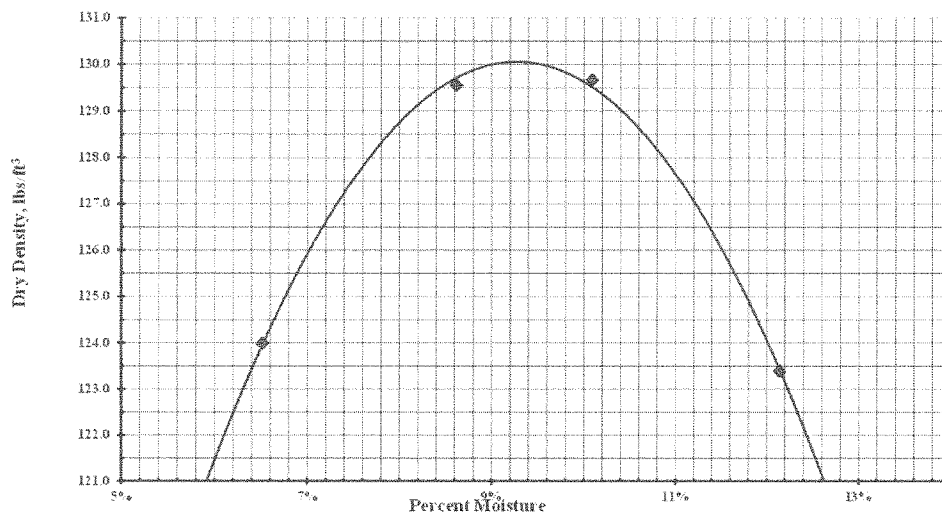
Moisture Content

AASHTO T99 or T180 Tested by:

Container No.	40	41	42	43		
G Wet Weight / Container grams	167.9	168.3	145.8	153.4		
H Dry Weight / Container grams	159.9	157.9	135.8	140.8		
I Moisture Loss = G - H grams	8.0	10.4	10.0	12.6		
J Tare Weight of Container grams	37.1	37.2	36.7	37.0		
K Dry Soil = H - J grams	122.8	120.7	99.1	103.8		
L %Moisture = (I / K) x 100	6.5%	8.6%	10.1%	12.1%		

ASTM D4643 AASHTO T217 or T265 Tested by: dt

Moisture Density Relationship



Max Dry Density

130.1 lbs./cu.ft.

Optimum Moisture

9.3%

MOISTURE-DENSITY RELATIONS OF SOILS

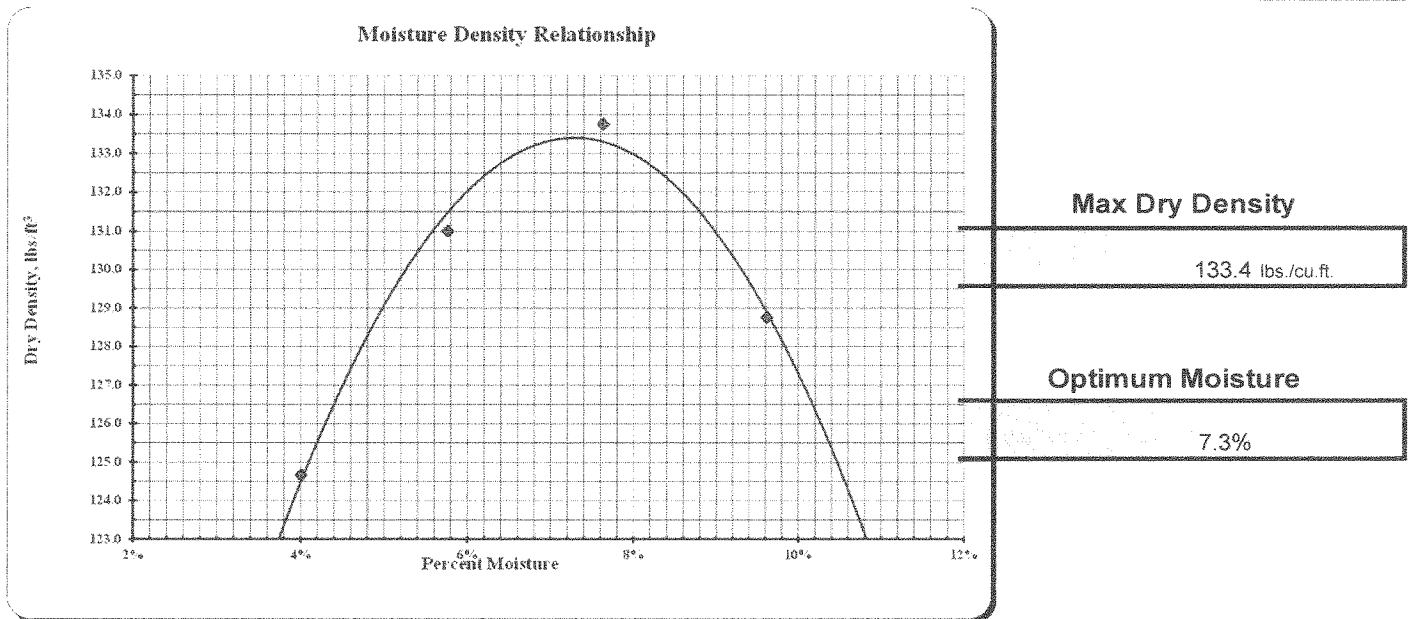
North Dakota Department Of Transportation, Materials & Research Division

SFN 10063 (Rev. 03-2006)

Project No. NH-7-002(156)022	PCN	Station	Depth Below Grade			
Offset From Centerline		Type of Soil				
AASHTO Designation T-180	Date 8/10/2016				487	
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
	lbs.	8.75	9.04	9.23	9.13	
C Weight of Mold	lbs.	4.43	4.43	4.43	4.43	4.43
D Weight of Compacted Soil = B - C	lbs.	4.32	4.61	4.79	4.70	
E Wet Density = D / A	lbs./cu.ft.	129.7	138.6	144.0	141.1	
F Dry Density = (E x 100) / (100 + L)	lbs./cu.ft.	124.7	131.0	133.8	128.8	#VALUE!

Moisture Content		AASHTO T99 or T180 Tested by:				
Container No.		44	45	46	47	
G Wet Weight / Container	grams	164.2	169.7	159.8	153.4	
H Dry Weight / Container	grams	159.3	162.5	151.1	143.2	
I Moisture Loss = G - H	grams	4.9	7.2	8.7	10.2	
J Tare Weight of Container	grams	37.0	37.6	37.1	37.0	
K Dry Soil = H - J	grams	122.3	124.9	114.0	106.2	
L %Moisture = (I / K) x 100	%	4.0%	5.8%	7.6%	9.6%	

ASTM D4643 AASHTO T217 or T265 Tested by: dt



MOISTURE-DENSITY RELATIONS OF SOILS

North Dakota Department Of Transportation, Materials & Research Division

SFN 10063 (Rev. 03-2006)

Project No. NH-7-002(156)022	PCN	Station	Depth Below Grade
Offset From Centerline		Type of Soil	
AASHTO Designation T-180	Date 8/10/2016	488	

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.	9.03	9.20	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.	4.59	4.77	4.64			
E Wet Density = D / A lbs./cu.ft.	138.0	143.1	139.3			
F Dry Density = (E x 100) / (100 + L) lbs./cu.ft.	127.7	130.2	124.8	#VALUE!	#VALUE!	#VALUE!

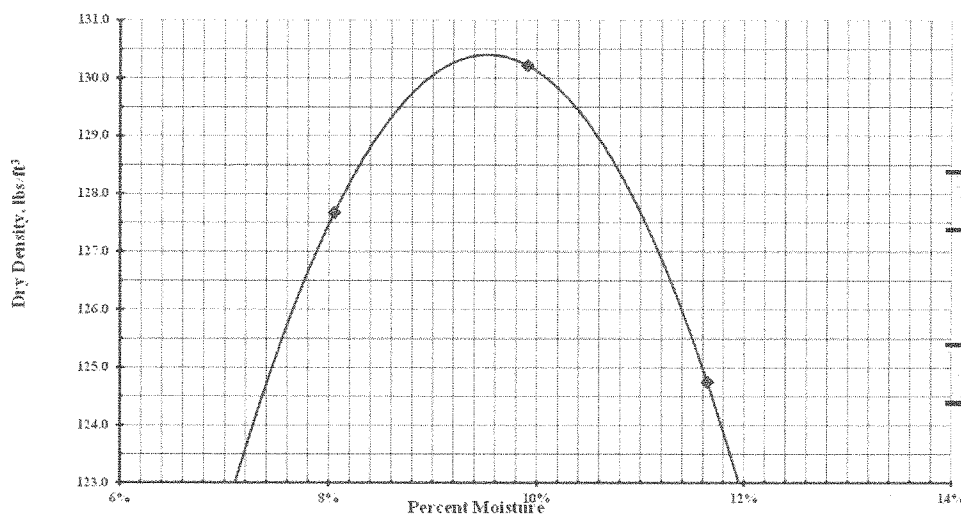
Moisture Content

AASHTO T99 or T180 Tested by:

Container No.	48	49	50			
G Wet Weight / Container grams	165.9	158.3	141.5			
H Dry Weight / Container grams	156.3	147.4	130.6			
I Moisture Loss = G - H grams	9.6	10.9	10.9			
J Tare Weight of Container grams	37.1	37.3	37.0			
K Dry Soil = H - J grams	119.2	110.1	93.6			
L %Moisture = (I / K) x 100	8.1%	9.9%	11.6%			

ASTM D4643 AASHTO T217 or T265 Tested by: dt

Moisture Density Relationship



Max Dry Density

130.4 lbs./cu.ft.

Optimum Moisture

9.6%

MOISTURE-DENSITY RELATIONS OF SOILS

North Dakota Department Of Transportation, Materials & Research Division

SFN 10063 (Rev. 03-2006)

Project No. NH-7-002(156)022	PCN	Station	Depth Below Grade
Offset From Centerline		Type of Soil	
AASHTO Designation T-180	Date 8/11/2016	489	

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
		lbs.	8.81	9.06	9.16	9.01	
C	Weight of Mold	lbs.	4.43	4.43	4.43	4.43	4.43
D	Weight of Compacted Soil = B - C	lbs.	4.38	4.63	4.73	4.58	
E	Wet Density = D / A	lbs./cu.ft.	131.5	139.2	141.9	137.6	
F	Dry Density = (E x 100) / (100 + L)	lbs./cu.ft.	122.8	127.6	127.8	121.6	#VALUE!

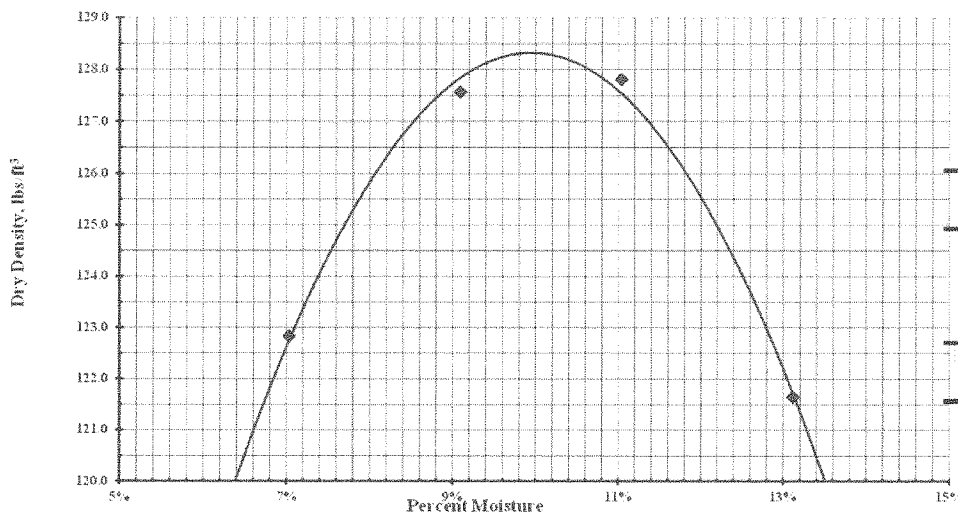
Moisture Content

AASHTO T99 or T180 Tested by:

Container No.		51	52	53	54		
G	Wet Weight / Container	grams	190.0	164.9	156.8	156.9	
H	Dry Weight / Container	grams	180.0	154.3	144.9	143.0	
I	Moisture Loss = G - H	grams	10.0	10.6	11.9	13.9	
J	Tare Weight of Container	grams	37.2	37.3	37.1	37.0	
K	Dry Soil = H - J	grams	142.8	117.0	107.8	106.0	
L	%Moisture = (I / K) x 100	%	7.0%	9.1%	11.0%	13.1%	

ASTM D4643 AASHTO T217 or T265 Tested by: dt

Moisture Density Relationship



Max Dry Density

128.3 lbs./cu.ft.

Optimum Moisture

9.9%

MOISTURE-DENSITY RELATIONS OF SOILS

North Dakota Department Of Transportation, Materials & Research Division

SFN 10063 (Rev. 03-2006)

Project No. NH-7-002(156)022	PCN	Station	Depth Below Grade
Offset From Centerline	Type of Soil		
AASHTO Designation T-180	Date 8/11/2016	490	

Density	Test Count	5				
Determination No.	1	2	3	4	5	6
A Volume of Mold cu. ft.	0.0333	0.0333	0.0333	0.0333	0.0333	0.0333
	lbs.	8.44	8.63	8.80	8.93	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.	4.01	4.20	4.37	4.50	4.56	
E Wet Density = D / A lbs./cu.ft.	120.4	126.2	131.2	135.1	136.9	
F Dry Density = (E x 100) / (100 + L) lbs./cu.ft.	115.7	119.2	121.9	123.1	122.8	#VALUE!

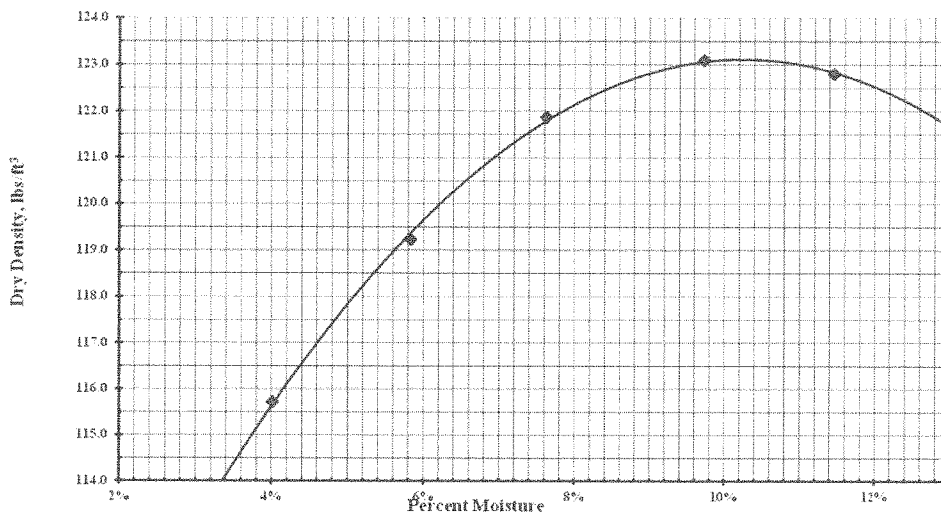
Moisture Content

AASHTO T99 or T180 Tested by:

Container No.	55	56	57	58	59	
G Wet Weight / Container grams	155.3	145.8	159.1	168.4	189.5	
H Dry Weight / Container grams	150.7	139.8	150.5	156.7	173.8	
I Moisture Loss = G - H grams	4.6	6.0	8.6	11.7	15.7	
J Tare Weight of Container grams	36.6	37.3	37.3	36.8	37.2	
K Dry Soil = H - J grams	114.1	102.5	113.2	119.9	136.6	
L %Moisture = (I / K) x 100 %	4.0%	5.8%	7.6%	9.7%	11.5%	

ASTM D4643 AASHTO T217 or T265 Tested by: dt

Moisture Density Relationship



Max Dry Density

123.1 lbs./cu.ft.

Optimum Moisture

10.2%

MOISTURE-DENSITY RELATIONS OF SOILS

North Dakota Department Of Transportation, Materials & Research Division

SFN 10063 (Rev. 03-2006)

Project No. NH-7-002(156)022	PCN	Station	Depth Below Grade			
Offset From Centerline		Type of Soil				
AASHTO Designation T-180	Date 8/11/2016				491	
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	9.02	9.21	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.	4.33	4.59	4.77	4.67		
E Wet Density = D / A lbs./cu.ft.	130.1	137.7	143.4	140.4		
F Dry Density = (E x 100) / (100 + L) lbs./cu.ft.	123.9	129.0	131.6	127.0	#VALUE!	#VALUE!

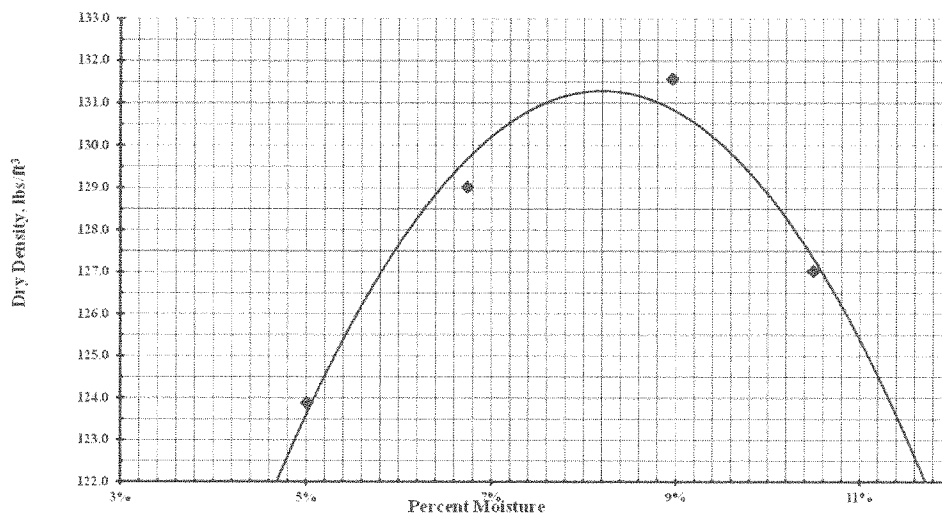
Moisture Content

AASHTO T99 or T180 Tested by:

Container No.	60	61	62	63		
G Wet Weight / Container grams	158.8	170.3	167.7	146.9		
H Dry Weight / Container grams	153.0	161.9	157.0	136.5		
I Moisture Loss = G - H grams	5.8	8.4	10.7	10.4		
J Tare Weight of Container grams	37.4	37.3	37.6	37.3		
K Dry Soil = H - J grams	115.6	124.6	119.4	99.2		
L %Moisture = (I / K) x 100 %	5.0%	6.7%	9.0%	10.5%		

ASTM D4643 AASHTO T217 or T265 Tested by: dt

Moisture Density Relationship



Max Dry Density

131.3 lbs./cu.ft.

Optimum Moisture

8.2%

MOISTURE-DENSITY RELATIONS OF SOILS

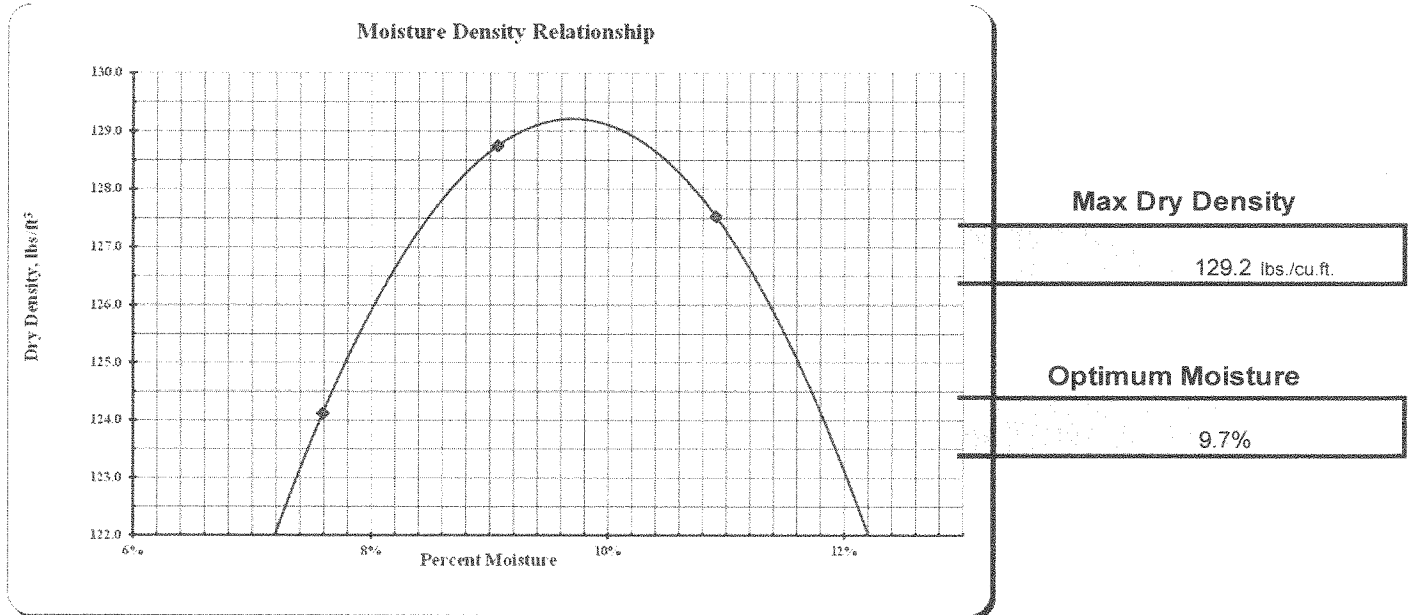
North Dakota Department Of Transportation, Materials & Research Division

SFN 10063 (Rev. 03-2006)

Project No. NH-7-002(156)022		PCN		Station		Depth Below Grade	
Offset From Centerline				Type of Soil			
AASHTO Designation T-180		Date 8/11/2016		492			
Density		Test Count		3			
Determination No.		1		2		3	
A Volume of Mold		cu. ft.		0.0333		0.0333	
		lbs.		8.88		9.11	
C Weight of Mold		lbs.		4.43		4.43	
D Weight of Compacted Soil = B - C		lbs.		4.45		4.68	
E Wet Density = D / A		lbs./cu.ft.		133.5		140.4	
F Dry Density = (E x 100) / (100 + L)		lbs./cu.ft.		124.1		128.8	

Moisture Content		AASHTO T99 or T180 Tested by: dt					
Container No.		64		65		66	
G Wet Weight / Container		grams		167.7		166.8	
H Dry Weight / Container		grams		158.5		156.1	
I Moisture Loss = G - H		grams		9.2		10.7	
J Tare Weight of Container		grams		37.3		37.8	
K Dry Soil = H - J		grams		121.2		118.3	
L %Moisture = (I / K) x 100		%		7.6%		9.1%	

ASTM D4643 AASHTO T217 or T265 Tested by: dt



MOISTURE-DENSITY RELATIONS OF SOILS

North Dakota Department Of Transportation, Materials & Research Division

SFN 10063 (Rev. 03-2006)

Project No. NH-7-002(156)022	PCN	Station	Depth Below Grade
Offset From Centerline		Type of Soil	
AASHTO Designation T-180	Date 8/15/2016	493	

Density		Test Count					
		4					
Determination No.		1	2	3	4	5	6
A	Volume of Mold	0.0333	0.0333	0.0333	0.0333	0.0333	0.0333
	cu. ft.						
C	Weight of Mold	8.78	9.00	9.10	8.99		
	lbs.						
D	Weight of Compacted Soil = B - C	4.43	4.43	4.43	4.43	4.43	4.43
	lbs.						
E	Wet Density = D / A	4.35	4.57	4.66	4.56		
	lbs./cu.ft.						
F	Dry Density = (E x 100) / (100 + L)	130.6	137.4	140.1	136.9		
	lbs./cu.ft.						
		121.4	125.7	125.8	120.8	#VALUE!	#VALUE!

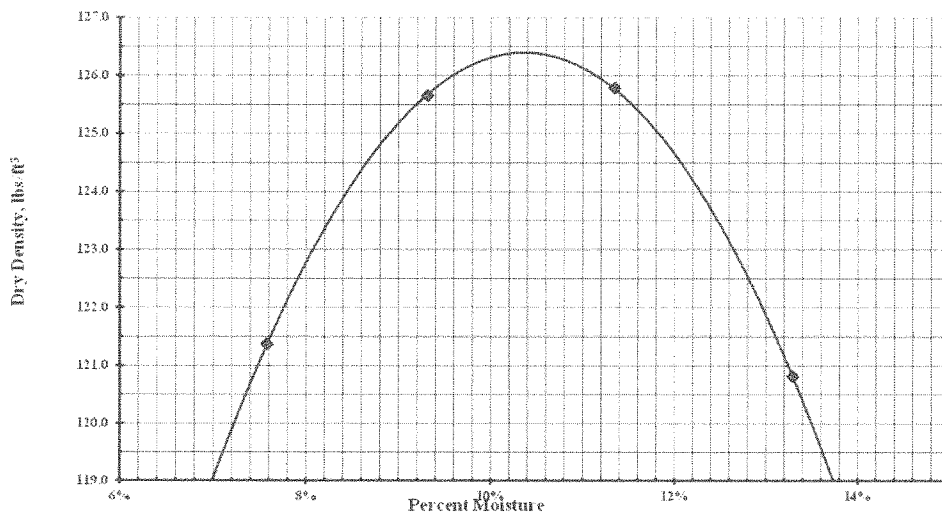
Moisture Content

AASHTO T99 or T180 Tested by:

Container No.		67	68	69	70		
G	Wet Weight / Container	177.0	167.9	169.8	141.0		
	grams						
H	Dry Weight / Container	167.2	156.8	156.3	128.9		
	grams						
I	Moisture Loss = G - H	9.8	11.2	13.5	12.1		
	grams						
J	Tare Weight of Container	37.2	37.0	37.7	37.6		
	grams						
K	Dry Soil = H - J	130.0	119.8	118.6	91.3		
	grams						
L	%Moisture = (I / K) x 100	7.6%	9.3%	11.3%	13.3%		
	%						

ASTM D4643 AASHTO T217 or T265 Tested by: dt

Moisture Density Relationship



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. NH-7-002(156)022	PCN	Station	Depth Below Grade				
Offset From Centerline		Type of Soil					
AASHTO Designation T-180	Date 8/15/2016					494	
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.	8.96	9.15	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.	4.52	4.72	4.67				
E Wet Density = D / A lbs./cu.ft.	135.9	141.7	140.1				
F Dry Density = (E x 100) / (100 + L) lbs./cu.ft.	126.4	129.7	126.0	#VALUE!	#VALUE!	#VALUE!	

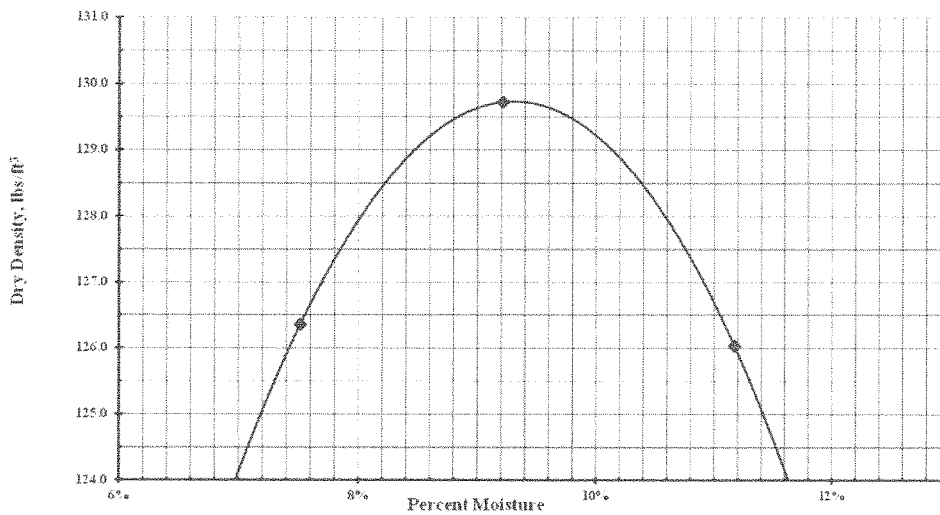
Moisture Content

AASHTO T99 or T180 Tested by:

Container No.	71	72	73			
G Wet Weight / Container grams	166.8	151.2	157.8			
H Dry Weight / Container grams	157.7	141.5	145.7			
I Moisture Loss = G - H grams	9.1	9.7	12.1			
J Tare Weight of Container grams	37.2	36.7	37.4			
K Dry Soil = H - J grams	120.5	104.8	108.3			
L %Moisture = (I / K) x 100	7.5%	9.2%	11.2%			

ASTM D4643 AASHTO T217 or T265 Tested by: dt

Moisture Density Relationship



Max Dry Density

129.7 lbs./cu.ft.

Optimum Moisture

9.3%

MOISTURE-DENSITY RELATIONS OF SOILS

North Dakota Department Of Transportation, Materials & Research Division

SFN 10063 (Rev. 03-2006)

Project No. NH-7-002(156)022	PCN	Station	Depth Below Grade			
Offset From Centerline		Type of Soil				
AASHTO Designation T-180	Date 8/15/2016	495				
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.	8.69	8.96	9.14	9.08		
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.	4.26	4.53	4.71	4.65		
E Wet Density = D / A lbs./cu.ft.	128.0	136.0	141.4	139.7		
F Dry Density = (E x 100) / (100 + L) lbs./cu.ft.	119.9	125.7	128.6	124.8	#VALUE!	#VALUE!

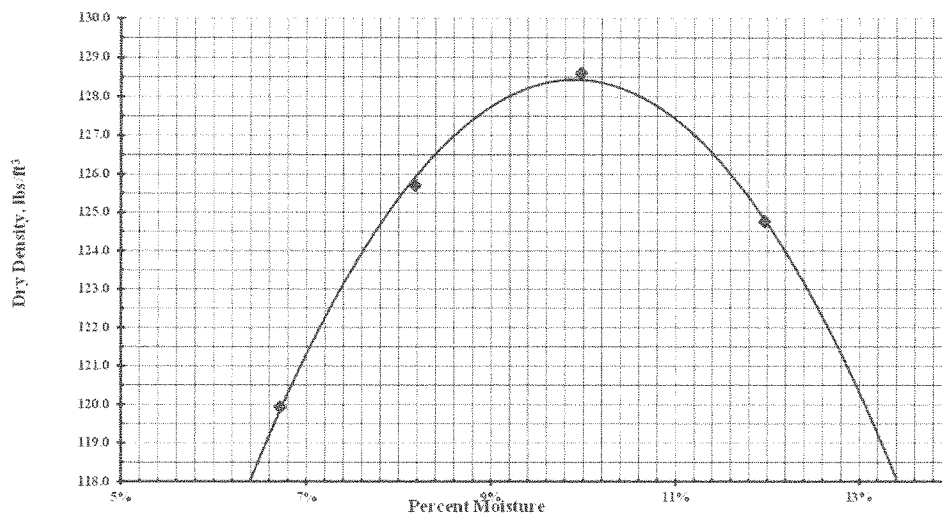
Moisture Content

AASHTO T99 or T180 Tested by:

Container No.	74	75	76	77		
G Wet Weight / Container grams	158.3	166.7	155.3	162.9		
H Dry Weight / Container grams	150.7	156.9	144.7	149.4		
I Moisture Loss = G - H grams	7.6	9.8	10.6	13.5		
J Tare Weight of Container grams	37.4	37.3	38.0	36.8		
K Dry Soil = H - J grams	113.3	119.6	106.7	112.6		
L %Moisture = (I / K) x 100 %	6.7%	8.2%	10.0%	12.0%		

ASTM D4643 AASHTO T217 or T265 Tested by: dt

Moisture Density Relationship



Max Dry Density

128.4 lbs./cu.ft.

Optimum Moisture

9.9%

MOISTURE-DENSITY RELATIONS OF SOILS

North Dakota Department Of Transportation, Materials & Research Division

SFN 10063 (Rev. 03-2006)

Project No. NH-7-002(156)022	PCN	Station	Depth Below Grade
Offset From Centerline		Type of Soil	
ASTHO Designation T-180	Date 8/15/2016	496	

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	8.79	9.00	9.09	
C Weight of Mold lbs.	4.43	4.43	4.43	4.43	4.43	4.43
D Weight of Compacted Soil = B - C lbs.	4.16	4.36	4.57	4.66		
E Wet Density = D / A lbs./cu.ft.	125.0	131.0	137.3	139.8		
F Dry Density = (E x 100) / (100 + L) lbs./cu.ft.	117.6	121.4	125.4	125.5	#VALUE!	#VALUE!

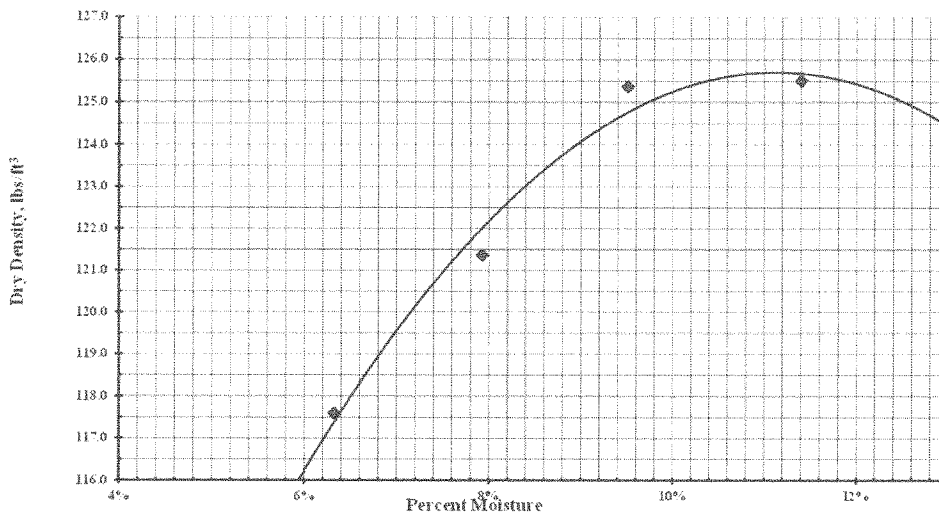
Moisture Content

AASHTO T99 or T180 Tested by:

Container No.	78	79	80	81		
G Wet Weight / Container grams	138.9	176.6	177.7	156.3		
H Dry Weight / Container grams	132.9	166.4	165.5	144.2		
I Moisture Loss = G - H grams	6.1	10.3	12.2	12.1		
J Tare Weight of Container grams	37.2	37.1	37.1	37.8		
K Dry Soil = H - J grams	95.7	129.3	128.4	106.4		
L %Moisture = (I / K) x 100	6.3%	7.9%	9.5%	11.4%		

ASTM D4643 AASHTO T217 or T265 Tested by: dt

Moisture Density Relationship



Max Dry Density

125.7 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. NH-7-002(156)022	PCN	Station	Depth Below Grade
Offset From Centerline		Type of Soil	
AASHTO Designation T-180	Date 8/15/2016	497	

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
		lbs.	8.82	9.05	9.14	8.99	
C	Weight of Mold	lbs.	4.43	4.43	4.43	4.43	4.43
D	Weight of Compacted Soil = B - C	lbs.	4.39	4.62	4.70	4.56	
E	Wet Density = D / A	lbs./cu.ft.	131.8	138.7	141.3	136.9	
F	Dry Density = (E x 100) / (100 + L)	lbs./cu.ft.	122.5	126.8	127.0	121.2	#VALUE!

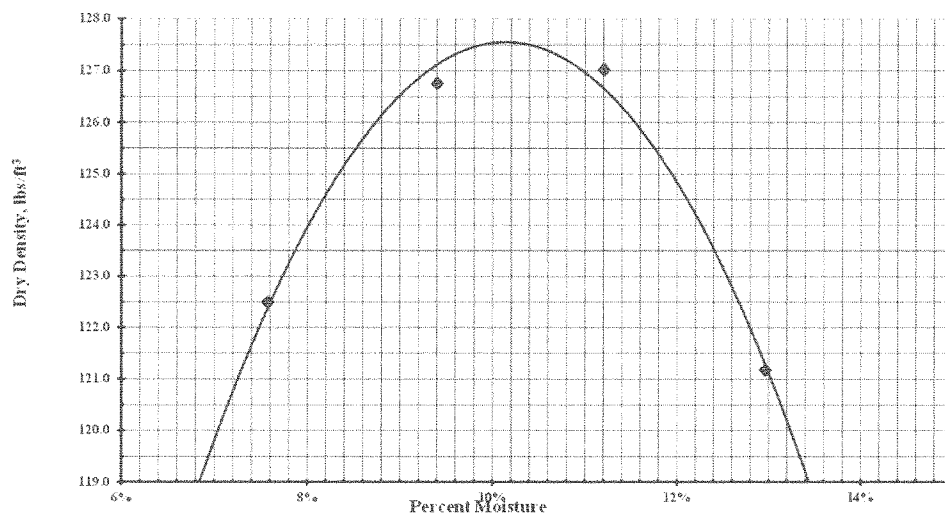
Moisture Content

AASHTO T99 or T180 Tested by:

Container No.		82	83	84	85		
G	Wet Weight / Container	grams	168.5	161.6	151.5	142.3	
H	Dry Weight / Container	grams	159.3	150.9	140.0	130.3	
I	Moisture Loss = G - H	grams	9.2	10.7	11.6	12.0	
J	Tare Weight of Container	grams	37.4	37.2	36.9	37.8	
K	Dry Soil = H - J	grams	121.9	113.7	103.1	92.5	
L	%Moisture = (I / K) x 100	%	7.6%	9.4%	11.2%	13.0%	

ASTM D4643 AASHTO T217 or T265 Tested by: dt

Moisture Density Relationship



Max Dry Density

127.6 lbs./cu.ft.

Optimum Moisture

10.2%

MOISTURE-DENSITY RELATIONS OF SOILS

North Dakota Department Of Transportation, Materials & Research Division

SFN 10063 (Rev. 03-2006)

Project No. NH-7-002(156)022	PCN	Station	Depth Below Grade
Offset From Centerline		Type of Soil	
AASHTO Designation T-180	Date 8/15/2016	498	

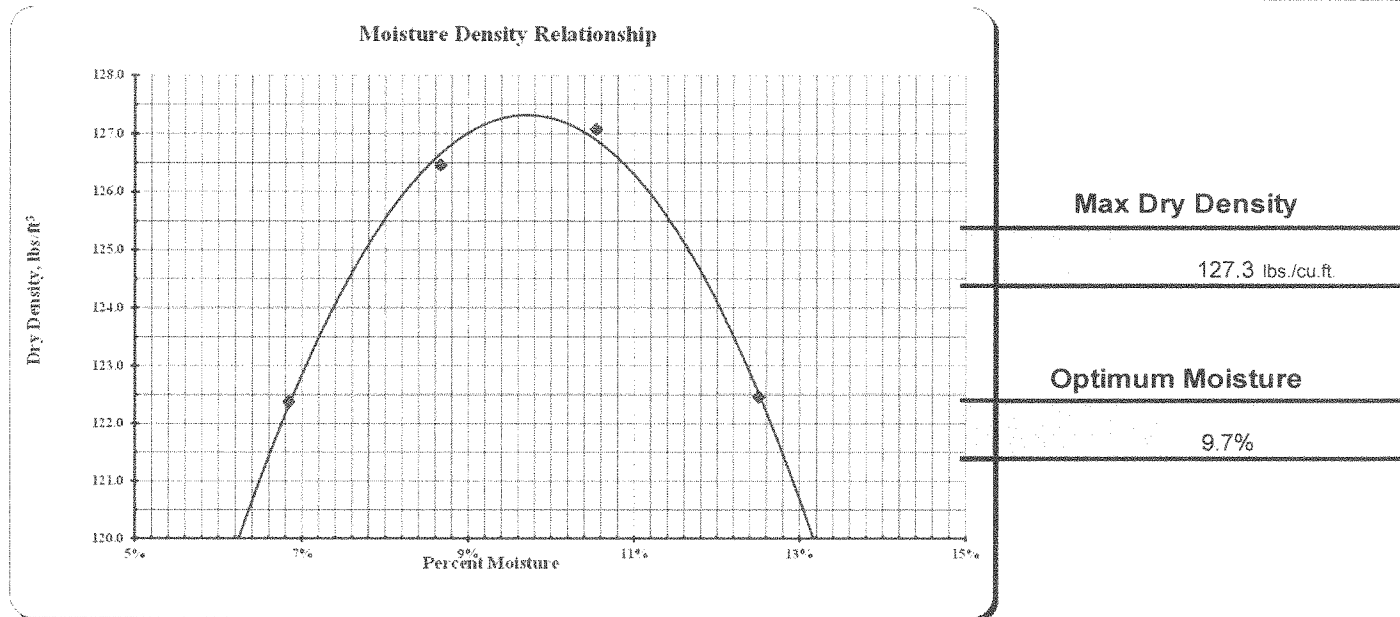
Density		Test Count					
		4					
Determination No.		1	2	3	4	5	6
A	Volume of Mold	cu. ft.	0.0333	0.0333	0.0333	0.0333	0.0333
		lbs.	8.79	9.01	9.11	9.02	
C	Weight of Mold	lbs.	4.43	4.43	4.43	4.43	4.43
D	Weight of Compacted Soil = B - C	lbs.	4.35	4.58	4.68	4.59	
E	Wet Density = D / A	lbs./cu.ft.	130.8	137.4	140.5	137.8	
F	Dry Density = (E x 100) / (100 + L)	lbs./cu.ft.	122.4	126.5	127.1	122.5	#VALUE!

Moisture Content

AASHTO T99 or T180 Tested by:

Container No.		86	87	88	89		
G	Wet Weight / Container	grams	175.5	160.3	161.2	154.9	
H	Dry Weight / Container	grams	166.7	150.5	149.4	141.9	
I	Moisture Loss = G - H	grams	8.8	9.8	11.8	13.0	
J	Tare Weight of Container	grams	37.6	37.5	37.8	37.6	
K	Dry Soil = H - J	grams	129.1	113.0	111.6	104.3	
L	%Moisture = (I / K) x 100	%	6.8%	8.7%	10.5%	12.5%	

ASTM D4643 AASHTO T217 or T265 Tested by: dt



MOISTURE-DENSITY RELATIONS OF SOILS

North Dakota Department Of Transportation, Materials & Research Division

SFN 10063 (Rev. 03-2006)

Project No. NH-7-002(156)022	PCN	Station	Depth Below Grade
Offset From Centerline		Type of Soil	
AASHTO Designation T-180	Date 8/15/2016	499	

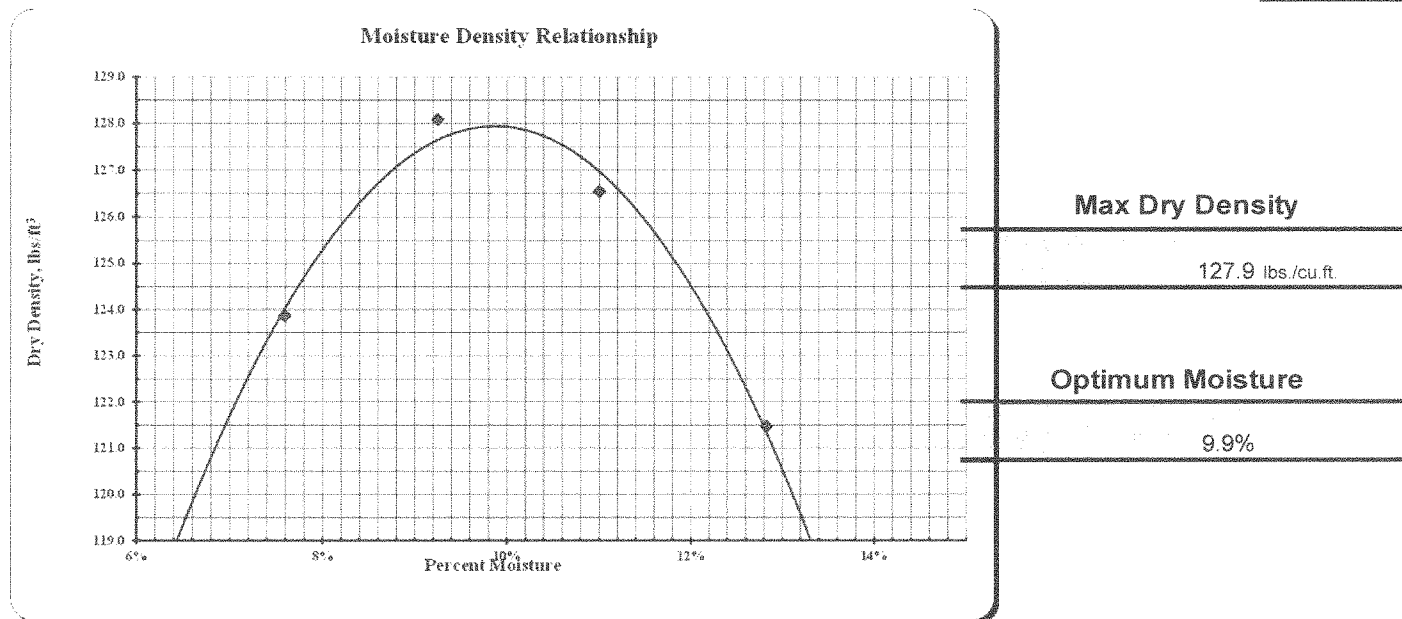
Density		Test Count					
		4					
Determination No.		1	2	3	4	5	6
A	Volume of Mold	cu. ft.	0.0333	0.0333	0.0333	0.0333	0.0333
		lbs.	8.87	9.09	9.11	9.00	
C	Weight of Mold	lbs.	4.43	4.43	4.43	4.43	4.43
D	Weight of Compacted Soil = B - C	lbs.	4.44	4.66	4.68	4.56	
E	Wet Density = D / A	lbs./cu.ft.	133.3	139.9	140.5	137.1	
F	Dry Density = (E x 100) / (100 + L)	lbs./cu.ft.	123.9	128.1	126.6	121.5	#VALUE!

Moisture Content

AASHTO T99 or T180 Tested by:

Container No.		90	91	92	93		
G	Wet Weight / Container	grams	166.4	179.8	153.2	153.7	
H	Dry Weight / Container	grams	157.3	167.8	141.7	140.5	
I	Moisture Loss = G - H	grams	9.1	12.0	11.5	13.2	
J	Tare Weight of Container	grams	37.9	37.6	37.4	37.6	
K	Dry Soil = H - J	grams	119.4	130.2	104.3	102.9	
L	%Moisture = (I / K) x 100	%	7.6%	9.3%	11.0%	12.8%	

ASTM D4643 AASHTO T217 or T265 Tested by: dt



MOISTURE-DENSITY RELATIONS OF SOILS

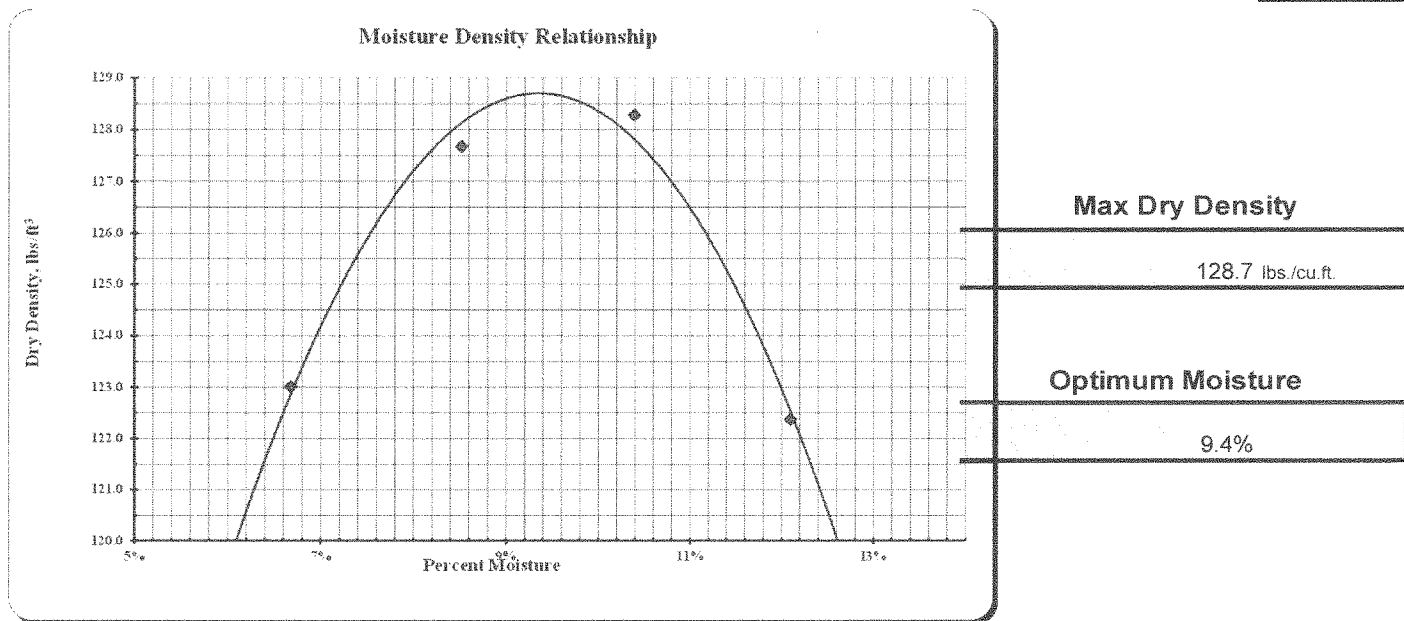
North Dakota Department Of Transportation, Materials & Research Division

SFN 10063 (Rev. 03-2006)

Project No. NH-7-002(156)022		PCN		Station		Depth Below Grade	
Offset From Centerline				Type of Soil			
AASHTO Designation T-180		Date 8/15/2016				500	
Density		Test Count		4			
Determination No.		1		2		3	
A Volume of Mold		cu. ft.		0.0333		0.0333	
		lbs.		8.80		9.04	
C Weight of Mold		lbs.		4.43		4.43	
D Weight of Compacted Soil = B - C		lbs.		4.37		4.61	
E Wet Density = D / A		lbs./cu.ft.		131.2		138.6	
F Dry Density = (E x 100) / (100 + L)		lbs./cu.ft.		123.0		127.7	

Moisture Content		AASHTO T99 or T180 Tested by: dt					
Container No.		94	95	96	97		
G Wet Weight / Container	grams	170.4	162.2	163.6	156.6		
H Dry Weight / Container	grams	162.1	152.4	151.7	143.8		
I Moisture Loss = G - H	grams	8.3	9.8	11.9	12.8		
J Tare Weight of Container	grams	37.7	37.5	37.2	37.7		
K Dry Soil = H - J	grams	124.4	114.9	114.5	106.1		
L %Moisture = (I / K) x 100	%	6.7%	8.5%	10.4%	12.1%		

ASTM D4643 AASHTO T217 or T265 Tested by: dt



MOISTURE-DENSITY RELATIONS OF SOILS

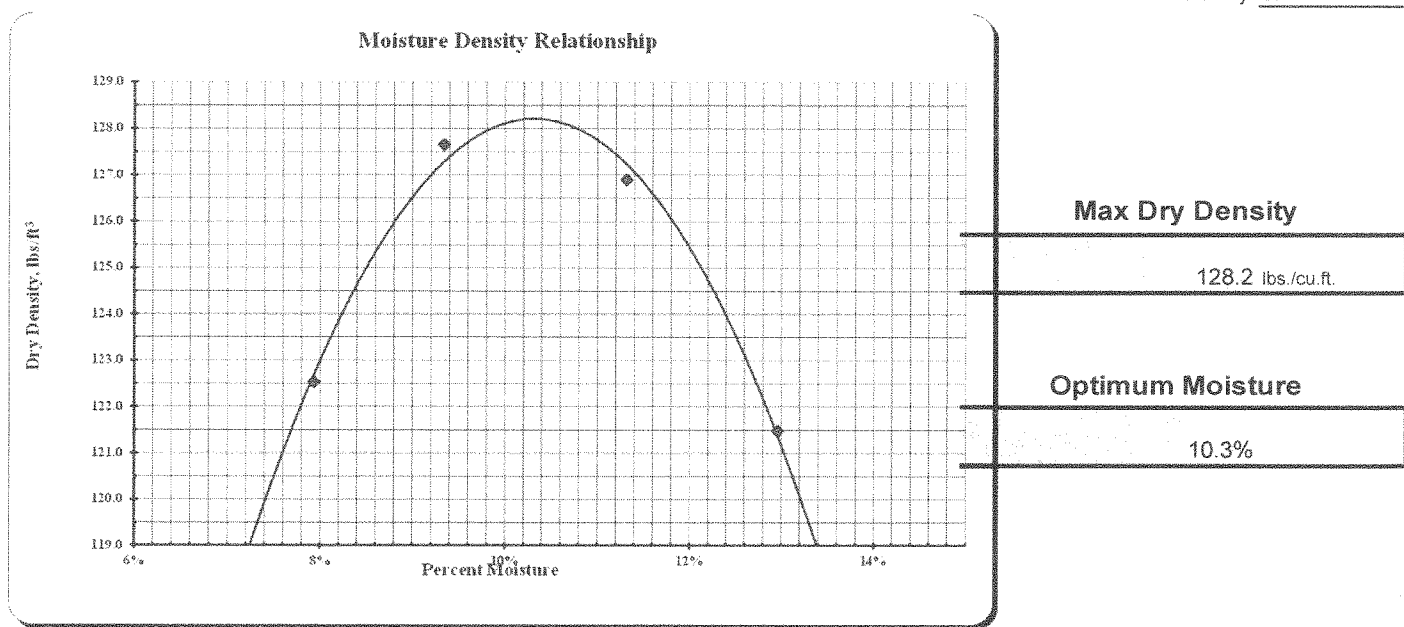
North Dakota Department Of Transportation, Materials & Research Division

SFN 10063 (Rev. 03-2006)

Project No. NH-7-002(156)022		PCN		Station		Depth Below Grade	
Offset From Centerline				Type of Soil			
AASHTO Designation T-180		Date 8/15/2016				501	
Density		Test Count		4			
Determination No.		1		2		3	
A Volume of Mold		cu. ft.		0.0333		0.0333	
		lbs.		8.84		9.08	
C Weight of Mold		lbs.		4.43		4.43	
D Weight of Compacted Soil = B - C		lbs.		4.40		4.65	
E Wet Density = D / A		lbs./cu.ft.		132.3		139.6	
F Dry Density = (E x 100) / (100 + L)		lbs./cu.ft.		122.5		127.7	

Moisture Content		AASHTO T99 or T180 Tested by: dt					
Container No.		98	99	100	101		
G Wet Weight / Container	grams	160.2	173.4	146.5	135.2		
H Dry Weight / Container	grams	151.2	161.8	135.4	124.0		
I Moisture Loss = G - H	grams	9.0	11.6	11.1	11.2		
J Tare Weight of Container	grams	37.5	37.6	37.2	37.6		
K Dry Soil = H - J	grams	113.7	124.2	98.2	86.4		
L %Moisture = (I / K) x 100	%	7.9%	9.3%	11.3%	13.0%		

ASTM D4643 AASHTO T217 or T265 Tested by: dt



MOISTURE-DENSITY RELATIONS OF SOILS

North Dakota Department Of Transportation, Materials & Research Division

SFN 10063 (Rev. 03-2006)

Project No. NH-7-002(156)022	PCN	Station	Depth Below Grade
Offset From Centerline		Type of Soil	
AASHTO Designation T-180	Date 8/15/2016	502	

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
		lbs.	9.04	9.22	9.11		
C	Weight of Mold	lbs.	4.43	4.43	4.43	4.43	4.43
D	Weight of Compacted Soil = B - C	lbs.	4.61	4.79	4.67		
E	Wet Density = D / A	lbs./cu.ft.	138.5	143.9	140.4		
F	Dry Density = (E x 100) / (100 + L)	lbs./cu.ft.	129.0	132.1	126.5	#VALUE!	#VALUE!

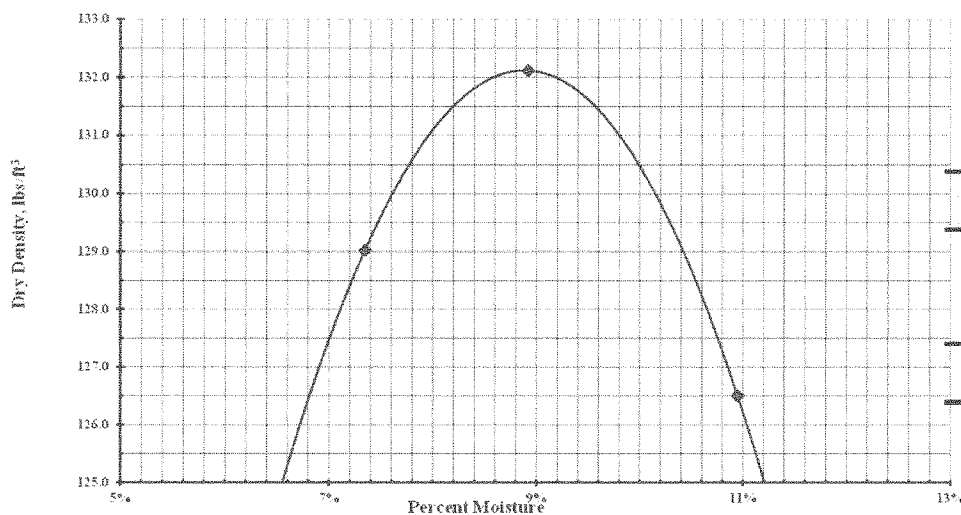
Moisture Content

AASHTO T99 or T180 Tested by:

Container No.		102	103	104			
G	Wet Weight / Container	grams	170.4	159.2	151.0		
H	Dry Weight / Container	grams	161.3	149.2	139.8		
I	Moisture Loss = G - H	grams	9.1	10.0	11.2		
J	Tare Weight of Container	grams	37.7	37.2	37.2		
K	Dry Soil = H - J	grams	123.6	112.0	102.6		
L	%Moisture = (I / K) x 100	%	7.3%	8.9%	10.9%		

ASTM D4643 AASHTO T217 or T265 Tested by: dt

Moisture Density Relationship



Max Dry Density

132.1 lbs./cu.ft.

Optimum Moisture

8.8%

MOISTURE-DENSITY RELATIONS OF SOILS

North Dakota Department Of Transportation, Materials & Research Division

SFN 10063 (Rev. 03-2006)

Project No. NH-7-002(156)022	PCN	Station	Depth Below Grade			
Offset From Centerline		Type of Soil				
AASHTO Designation T-180	Date 8/15/2016			503		
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	9.04	9.16	9.05		
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	4.61	4.72	4.62		
E Wet Density = D / A lbs./cu.ft.	131.4	138.6	141.9	138.7		
F Dry Density = (E x 100) / (100 + L) lbs./cu.ft.	122.8	127.7	128.6	123.5	#VALUE!	#VALUE!

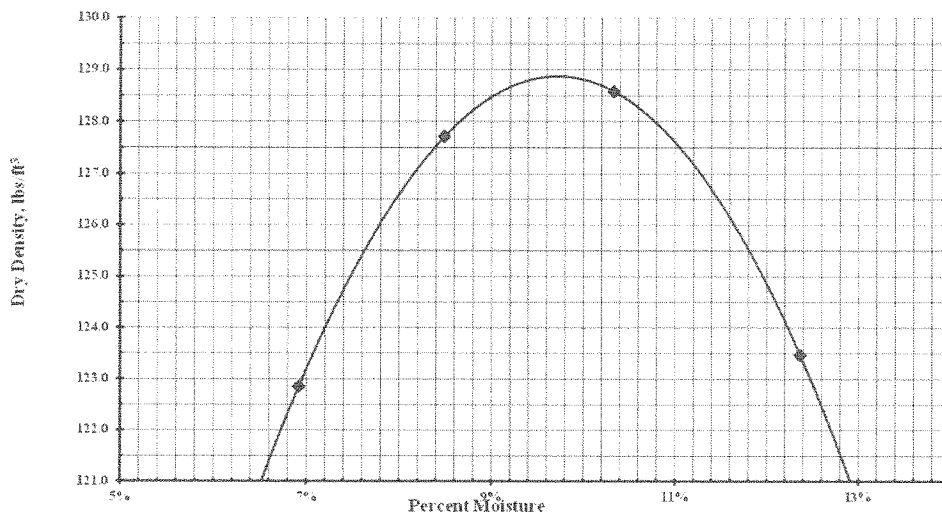
Moisture Content

AASHTO T99 or T180 Tested by:

Container No.	105	106	107	108		
G Wet Weight / Container grams	159.7	175.0	144.1	146.4		
H Dry Weight / Container grams	151.8	164.2	134.1	134.4		
I Moisture Loss = G - H grams	7.9	10.8	10.0	12.0		
J Tare Weight of Container grams	37.5	37.5	37.1	37.1		
K Dry Soil = H - J grams	114.3	126.7	97.0	97.3		
L %Moisture = (I / K) x 100 %	6.9%	8.5%	10.3%	12.4%		

ASTM D4643 AASHTO T217 or T265 Tested by: dt

Moisture Density Relationship



Max Dry Density

128.9 lbs./cu.ft.

Optimum Moisture

9.7%

MOISTURE-DENSITY RELATIONS OF SOILS

North Dakota Department Of Transportation, Materials & Research Division

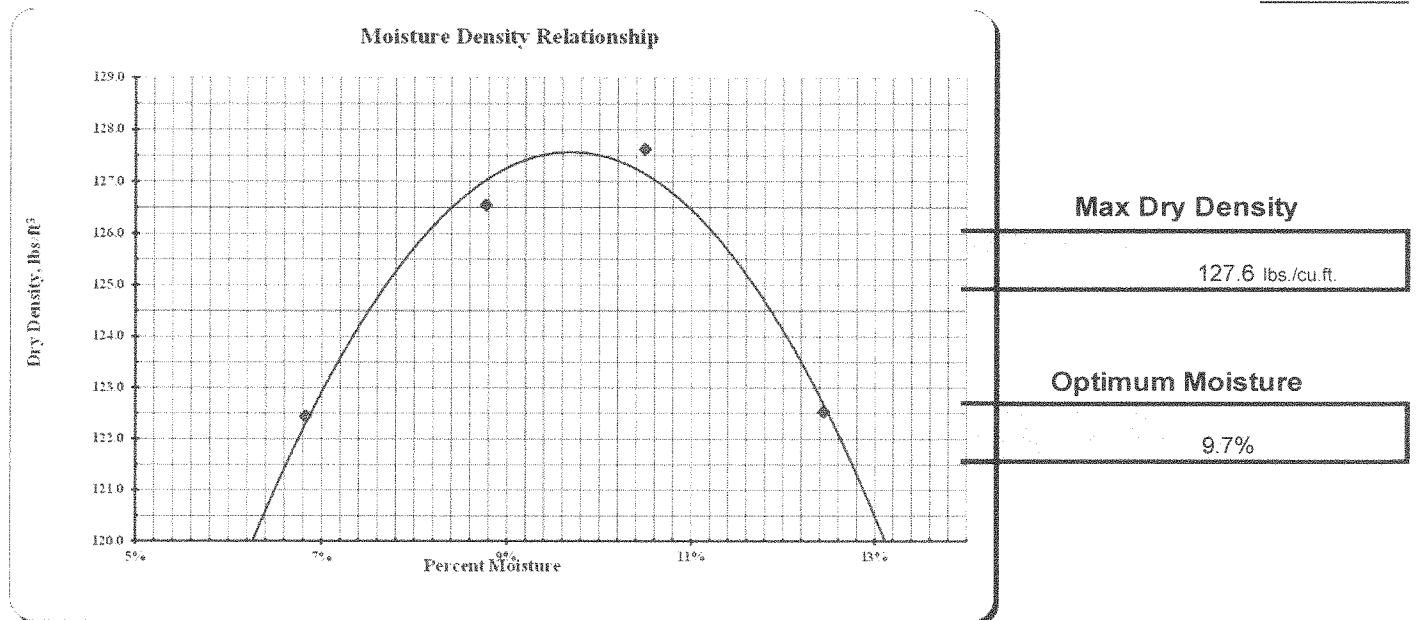
SFN 10063 (Rev. 03-2006)

Project No. NH-7-002(156)022	PCN	Station	Depth Below Grade
Offset From Centerline		Type of Soil	
AASHTO Designation T-180	Date 8/15/2016	504	

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
		lbs.	8.79	9.01	9.13	9.02	
C	Weight of Mold	lbs.	4.43	4.43	4.43	4.43	4.43
D	Weight of Compacted Soil = B - C	lbs.	4.36	4.58	4.70	4.59	
E	Wet Density = D / A	lbs./cu.ft.	130.8	137.7	141.0	137.8	
F	Dry Density = (E x 100) / (100 + L)	lbs./cu.ft.	122.4	126.6	127.6	122.5	#VALUE!

Moisture Content		AASHTO T99 or T180 Tested by:					
Container No.		109	110	111	112		
G	Wet Weight / Container	grams	173.4	163.3	153.8	152.1	
H	Dry Weight / Container	grams	164.7	153.1	142.8	139.4	
I	Moisture Loss = G - H	grams	8.7	10.2	11.0	12.7	
J	Tare Weight of Container	grams	37.8	37.1	37.9	37.5	
K	Dry Soil = H - J	grams	126.9	116.0	104.9	101.9	
L	%Moisture = (I / K) x 100	%	6.8%	8.8%	10.5%	12.4%	

ASTM D4643 AASHTO T217 or T265 Tested by: dt



MOISTURE-DENSITY RELATIONS OF SOILS

North Dakota Department Of Transportation, Materials & Research Division

SFN 10063 (Rev. 03-2006)

Project No. NH-7-002(156)022	PCN	Station	Depth Below Grade			
Offset From Centerline		Type of Soil				
AASTHO Designation T-180	Date 8/15/2016	505				
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	9.09	9.20	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.	4.38	4.66	4.77	4.61		
E Wet Density = D / A lbs./cu.ft.	131.5	139.8	143.1	138.3		
F Dry Density = (E x 100) / (100 + L) lbs./cu.ft.	124.8	130.9	131.6	124.5	#VALUE!	#VALUE!

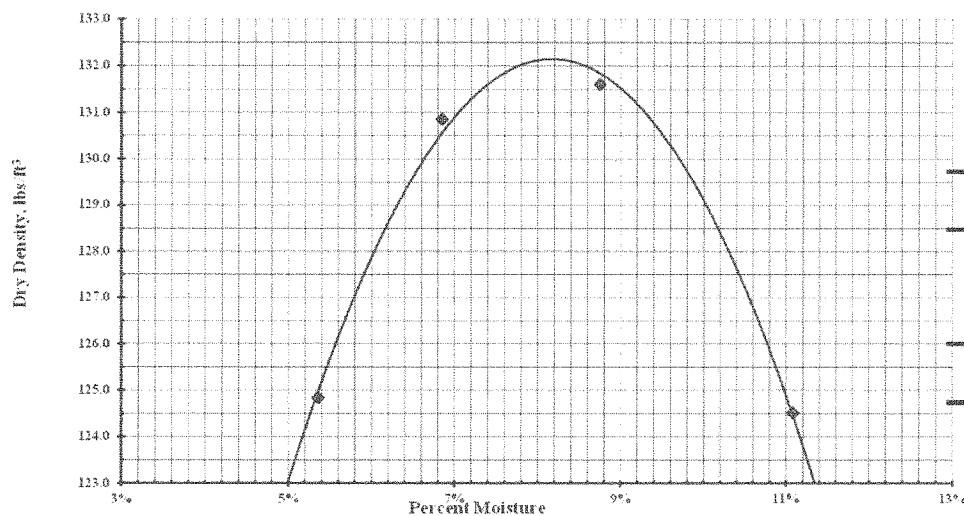
Moisture Content

AASHTO T99 or T180 Tested by:

Container No.	113	114	115	116		
G Wet Weight / Container grams	187.1	153.5	162.0	166.5		
H Dry Weight / Container grams	179.5	146.1	151.9	153.6		
I Moisture Loss = G - H grams	7.6	7.4	10.1	12.9		
J Tare Weight of Container grams	38.0	37.4	36.7	37.4		
K Dry Soil = H - J grams	141.5	108.7	115.2	116.2		
L %Moisture = (I / K) x 100 %	5.4%	6.8%	8.7%	11.1%		

ASTM D4643 AASHTO T217 or T265 Tested by: dt

Moisture Density Relationship



Max Dry Density

132.1 lbs./cu.ft.

Optimum Moisture

8.2%

MOISTURE-DENSITY RELATIONS OF SOILS

North Dakota Department Of Transportation, Materials & Research Division

SFN 10063 (Rev. 03-2006)

Project No. NH-7-002(156)022	PCN	Station	Depth Below Grade
Offset From Centerline		Type of Soil	
AASHTO Designation T-180	Date 8/15/2016	506	

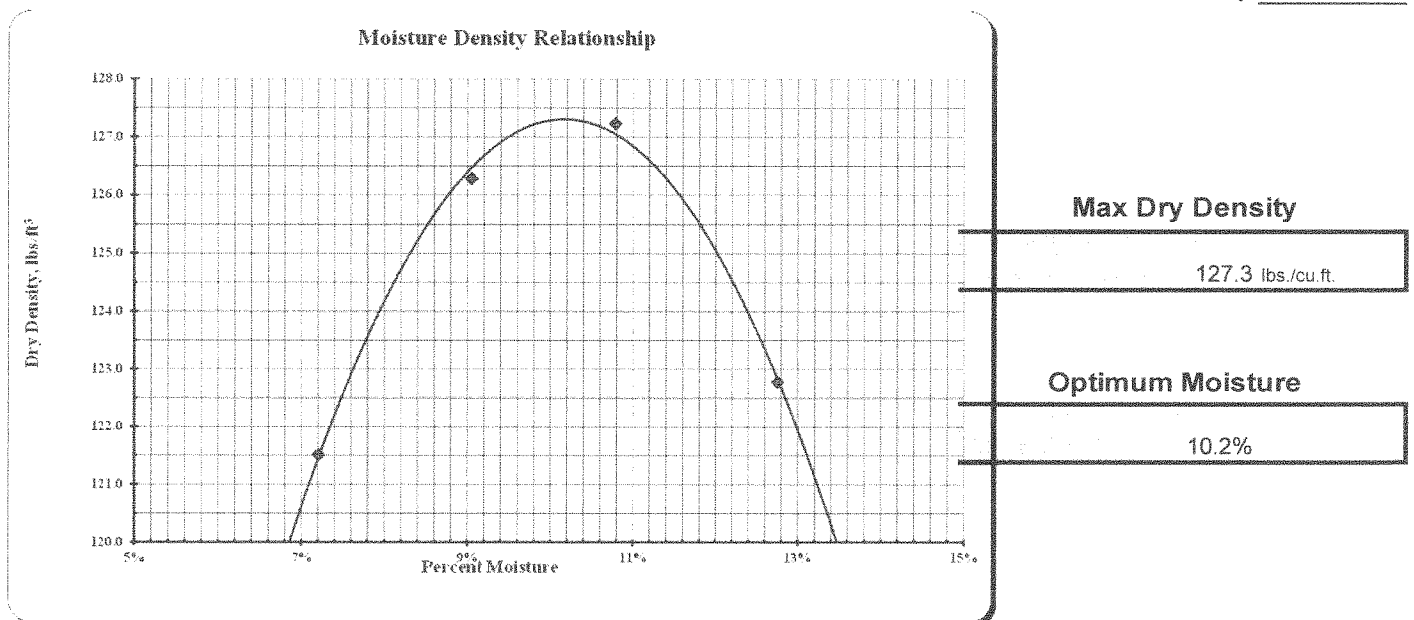
Density		Test Count	4				
Determination No.		1	2	3	4	5	6
A	Volume of Mold	cu. ft.	0.0333	0.0333	0.0333	0.0333	0.0333
		lbs.	8.77	9.02	9.13	9.04	
C	Weight of Mold	lbs.	4.43	4.43	4.43	4.43	4.43
D	Weight of Compacted Soil = B - C	lbs.	4.34	4.59	4.69	4.61	
E	Wet Density = D / A	lbs./cu.ft.	130.3	137.7	141.0	138.4	
F	Dry Density = (E x 100) / (100 + L)	lbs./cu.ft.	121.5	126.3	127.2	122.8	#VALUE!

Moisture Content

AASHTO T99 or T180 Tested by:

Container No.	117	118	119	120		
G Wet Weight / Container	grams	160.5	145.5	150.6	128.1	
H Dry Weight / Container	grams	152.2	136.6	139.6	117.8	
I Moisture Loss = G - H	grams	8.3	8.9	11.1	10.3	
J Tare Weight of Container	grams	37.3	37.9	37.1	37.3	
K Dry Soil = H - J	grams	114.9	98.7	102.5	80.5	
L %Moisture = (I / K) x 100	%	7.2%	9.1%	10.8%	12.8%	

ASTM D4643 AASHTO T217 or T265 Tested by: dt



MOISTURE-DENSITY RELATIONS OF SOILS

North Dakota Department Of Transportation, Materials & Research Division

SFN 10063 (Rev. 03-2006)

Project No. NH-7-002(156)022	PCN	Station	Depth Below Grade
Offset From Centerline		Type of Soil	
AASHTO Designation T-180	Date 8/15/2016	507	

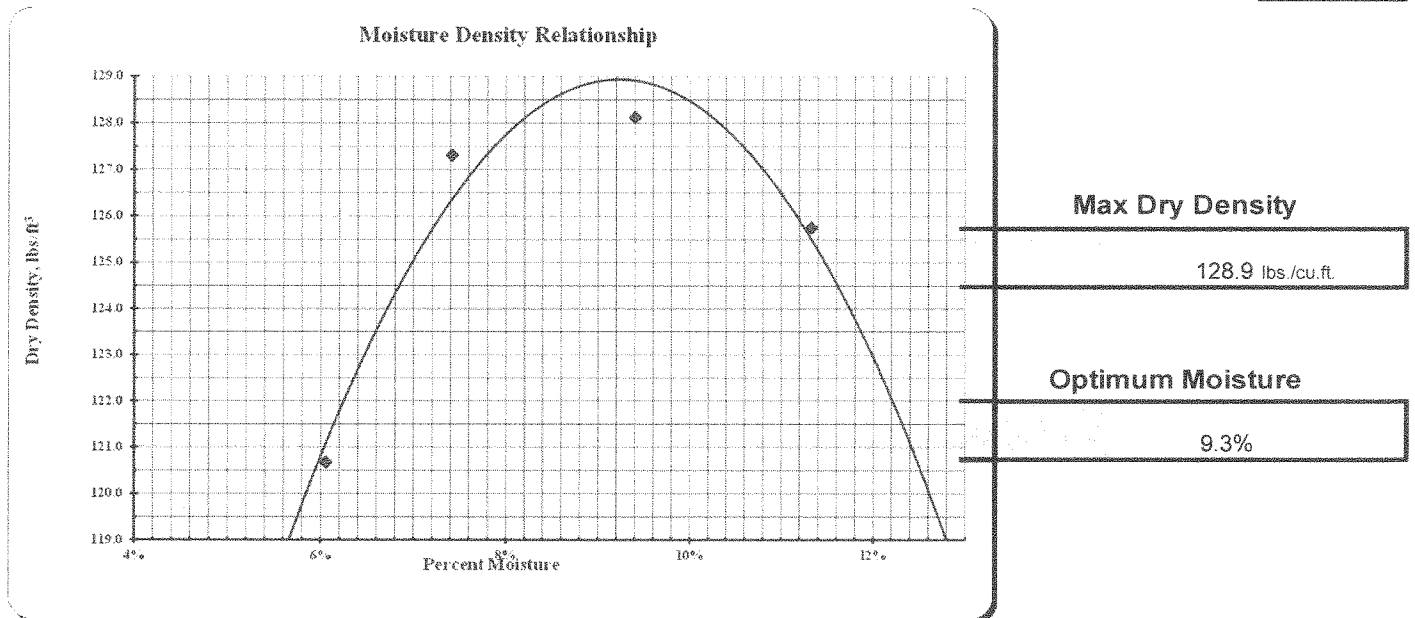
Density		Test Count					
		4					
Determination No.		1	2	3	4	5	6
A	Volume of Mold	cu. ft.	0.0333	0.0333	0.0333	0.0333	0.0333
		lbs.	8.69	8.98	9.10	9.09	
C	Weight of Mold	lbs.	4.43	4.43	4.43	4.43	4.43
D	Weight of Compacted Soil = B - C	lbs.	4.26	4.55	4.67	4.66	
E	Wet Density = D / A	lbs./cu.ft.	128.0	136.8	140.2	140.0	
F	Dry Density = (E x 100) / (100 + L)	lbs./cu.ft.	120.7	127.3	128.1	125.8	#VALUE!

Moisture Content

AASHTO T99 or T180 Tested by:

Container No.		57	58	59	60		
G	Wet Weight / Container	grams	167.7	152.1	150.4	151.1	
H	Dry Weight / Container	grams	160.3	144.1	140.7	139.5	
I	Moisture Loss = G - H	grams	7.4	8.0	9.7	11.6	
J	Tare Weight of Container	grams	37.3	36.8	37.2	37.4	
K	Dry Soil = H - J	grams	123.0	107.3	103.5	102.1	
L	%Moisture = (I / K) x 100	%	6.1%	7.4%	9.4%	11.3%	

ASTM D4643 AASHTO T217 or T265 Tested by: dt



MOISTURE-DENSITY RELATIONS OF SOILS

North Dakota Department Of Transportation, Materials & Research Division

SFN 10063 (Rev. 03-2006)

Project No. NH-7-002(156)022	PCN	Station	Depth Below Grade
Offset From Centerline		Type of Soil	
AASHTO Designation T-180	Date 8/18/2016	508	

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
		lbs.	8.76	8.98	9.13	9.05	
C	Weight of Mold	lbs.	4.43	4.43	4.43	4.43	4.43
D	Weight of Compacted Soil = B - C	lbs.	4.32	4.55	4.70	4.62	
E	Wet Density = D / A	lbs./cu.ft.	129.8	136.6	141.1	138.6	
F	Dry Density = (E x 100) / (100 + L)	lbs./cu.ft.	121.4	125.7	127.5	123.2	#VALUE!

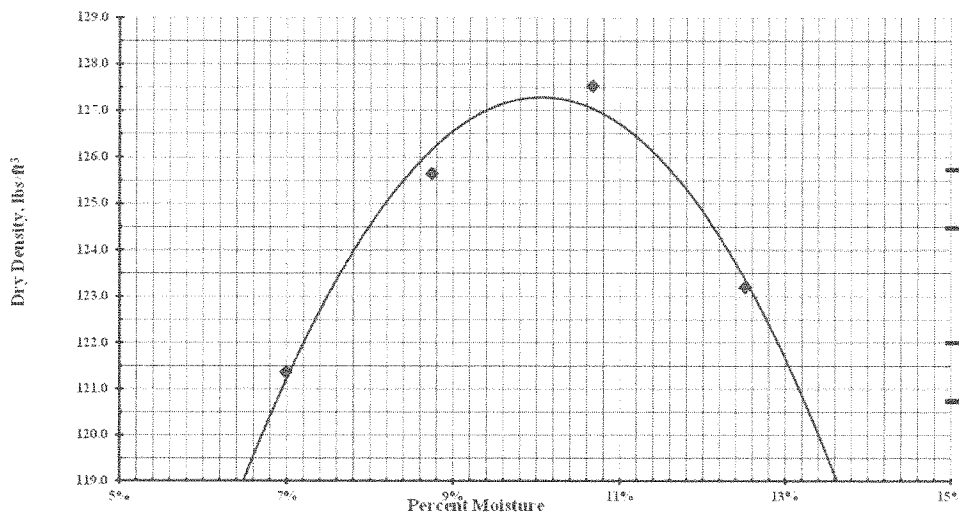
Moisture Content

AASHTO T99 or T180 Tested by:

Container No.		1	2	3	4		
G	Wet Weight / Container	grams	166.7	158.0	151.2	144.6	
H	Dry Weight / Container	grams	158.2	148.3	140.2	132.6	
I	Moisture Loss = G - H	grams	8.5	9.7	11.0	12.0	
J	Tare Weight of Container	grams	36.6	37.3	37.1	36.7	
K	Dry Soil = H - J	grams	121.6	111.0	103.1	95.9	
L	%Moisture = (I / K) x 100	%	7.0%	8.7%	10.7%	12.5%	

ASTM D4643 AASHTO T217 or T265 Tested by: dt

Moisture Density Relationship



Max Dry Density

127.3 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. NH-7-002(156)022	PCN	Station	Depth Below Grade
Offset From Centerline		Type of Soil	
AASTHO Designation T-180	Date 8/18/2016	509	

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
		lbs.	8.79	8.99	9.13	9.02	
C	Weight of Mold	lbs.	4.43	4.43	4.43	4.43	4.43
D	Weight of Compacted Soil = B - C	lbs.	4.35	4.56	4.70	4.59	
E	Wet Density = D / A	lbs./cu.ft.	130.8	136.9	141.2	137.7	
F	Dry Density = (E x 100) / (100 + L)	lbs./cu.ft.	121.9	125.5	127.3	121.8	#VALUE!

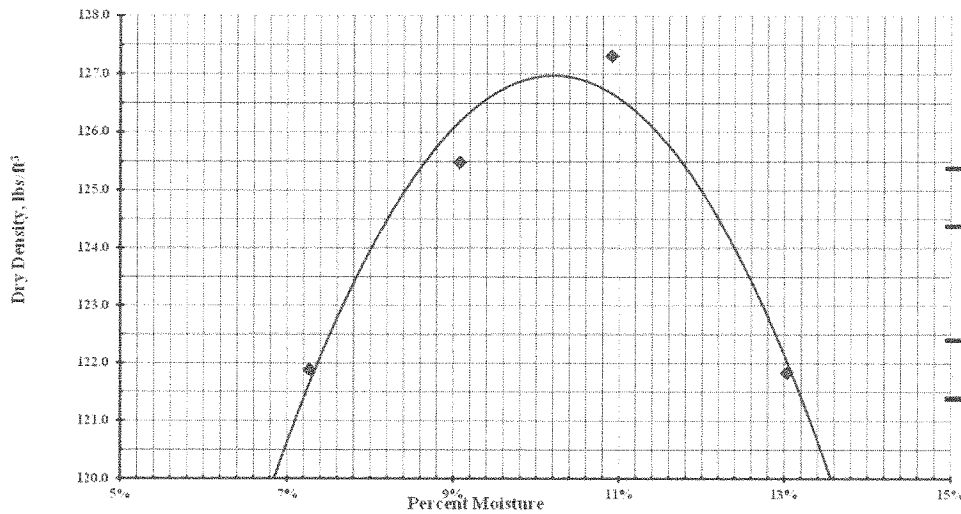
Moisture Content

AASTHO T99 or T180 Tested by:

Container No.	5	6	7	8		
G Wet Weight / Container	grams	169.9	163.3	163.4	127.2	
H Dry Weight / Container	grams	160.9	152.8	150.9	116.8	
I Moisture Loss = G - H	grams	9.0	10.5	12.5	10.4	
J Tare Weight of Container	grams	37.1	37.1	36.3	37.0	
K Dry Soil = H - J	grams	123.8	115.7	114.6	79.8	
L %Moisture = (I / K) x 100	%	7.3%	9.1%	10.9%	13.0%	

ASTM D4643 AASHTO T217 or T265 Tested by: dt

Moisture Density Relationship



Max Dry Density

127.0 lbs./cu.ft.

Optimum Moisture

10.2%

MOISTURE-DENSITY RELATIONS OF SOILS

North Dakota Department Of Transportation, Materials & Research Division

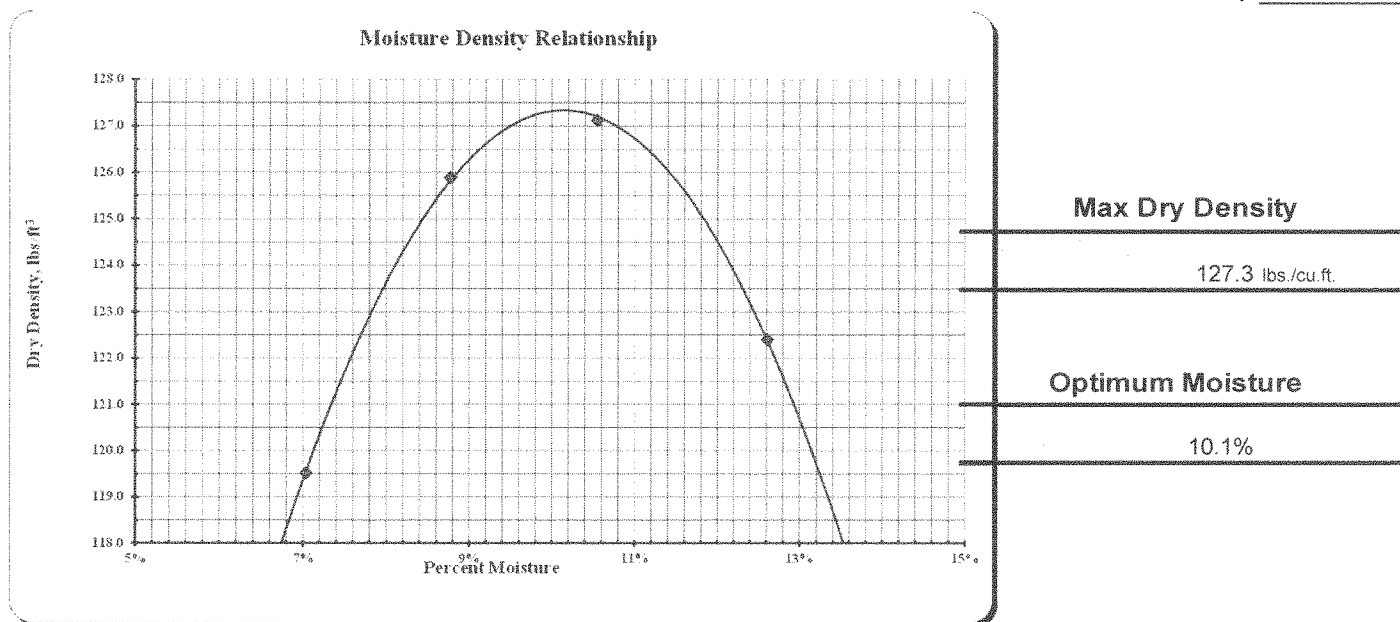
SFN 10063 (Rev. 03-2006)

Project No. NH-7-002(156)022	PCN	Station	Depth Below Grade
Offset From Centerline		Type of Soil	
AASHTO Designation T-180	Date 8/18/2016	510	

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
		lbs.	8.69	8.99	9.11	9.02	
C	Weight of Mold	lbs.	4.43	4.43	4.43	4.43	4.43
D	Weight of Compacted Soil = B - C	lbs.	4.26	4.56	4.68	4.59	
E	Wet Density = D / A	lbs./cu.ft.	127.9	136.9	140.5	137.8	
F	Dry Density = (E x 100) / (100 + L)	lbs./cu.ft.	119.5	125.9	127.1	122.4	#VALUE!

Moisture Content		AASHTO T99 or T180 Tested by:					
Container No.		9	10	11	12		
G	Wet Weight / Container	grams	195.4	171.9	153.5	165.5	
H	Dry Weight / Container	grams	185.0	161.0	142.4	151.1	
I	Moisture Loss = G - H	grams	10.4	10.9	11.1	14.4	
J	Tare Weight of Container	grams	37.2	36.7	37.2	36.9	
K	Dry Soil = H - J	grams	147.8	124.3	105.2	114.2	
L	%Moisture = (I / K) x 100	%	7.0%	8.8%	10.6%	12.6%	

ASTM D4643 AASHTO T217 or T265 Tested by: ml



MOISTURE-DENSITY RELATIONS OF SOILS

North Dakota Department Of Transportation, Materials & Research Division

SFN 10063 (Rev. 03-2006)

Project No. NH-7-002(156)022	PCN	Station	Depth Below Grade
Offset From Centerline	Type of Soil		
AASHTO Designation T-180	Date 8/18/2016	511	

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	9.07	9.25	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.	4.32	4.64	4.82	4.67		
E Wet Density = D / A lbs./cu.ft.	129.7	139.3	144.7	140.4		
F Dry Density = (E x 100) / (100 + L) lbs./cu.ft.	124.4	131.1	134.1	127.4	#VALUE!	#VALUE!

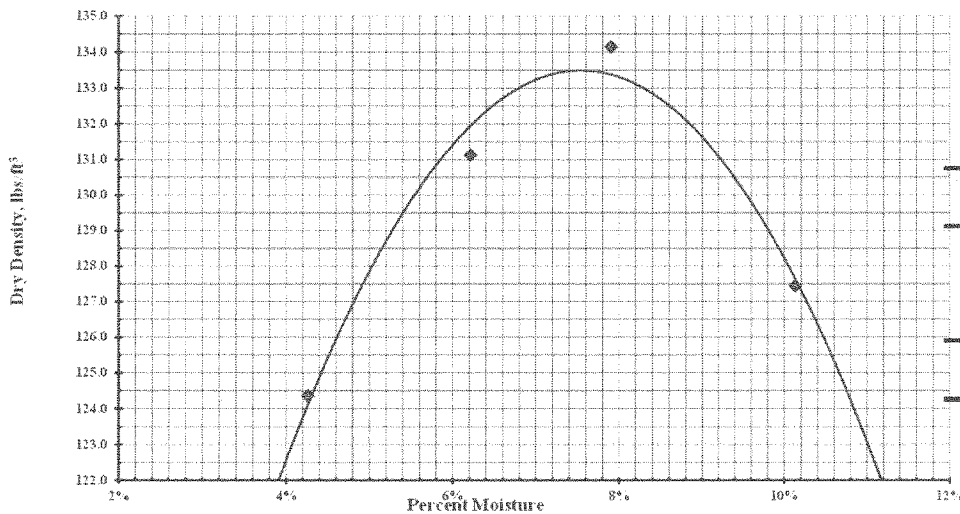
Moisture Content

AASHTO T99 or T180 Tested by:

Container No.	13	14	15	16		
G Wet Weight / Container grams	159.4	157.6	168.4	147.0		
H Dry Weight / Container grams	154.4	150.6	158.8	136.9		
I Moisture Loss = G - H grams	5.0	7.0	9.6	10.1		
J Tare Weight of Container grams	37.1	37.9	37.3	37.2		
K Dry Soil = H - J grams	117.3	112.7	121.5	99.7		
L %Moisture = (I / K) x 100 %	4.3%	6.2%	7.9%	10.1%		

ASTM D4643 AASHTO T217 or T265 Tested by: dt

Moisture Density Relationship



Max Dry Density

133.5 lbs./cu.ft.

Optimum Moisture

7.6%

MOISTURE-DENSITY RELATIONS OF SOILS

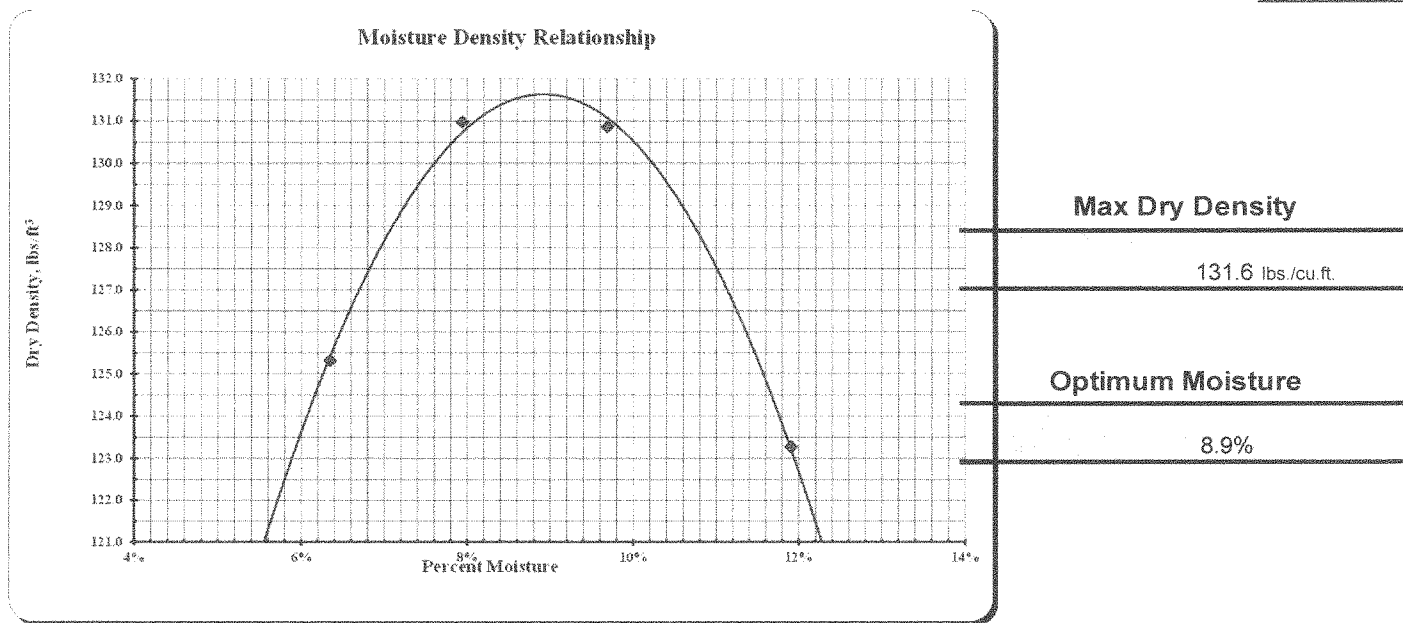
North Dakota Department Of Transportation, Materials & Research Division

SFN 10063 (Rev. 03-2006)

Project No. NH-7-002(156)022		PCN		Station		Depth Below Grade	
Offset From Centerline				Type of Soil			
AASHTO Designation T-180		Date 8/18/2016				512	
Density		Test Count		4			
Determination No.		1		2		3	
A Volume of Mold		cu. ft.		0.0333		0.0333	
		lbs.		8.87		9.14	
C Weight of Mold		lbs.		4.43		4.43	
D Weight of Compacted Soil = B - C		lbs.		4.44		4.71	
E Wet Density = D / A		lbs./cu.ft.		133.3		141.4	
F Dry Density = (E x 100) / (100 + L)		lbs./cu.ft.		125.3		131.0	

Moisture Content		AASHTO T99 or T180 Tested by:					
Container No.		17		18		19	
G Wet Weight / Container		grams		162.5		164.9	
H Dry Weight / Container		grams		155.0		155.5	
I Moisture Loss = G - H		grams		7.5		9.4	
J Tare Weight of Container		grams		36.8		37.1	
K Dry Soil = H - J		grams		118.2		118.4	
L %Moisture = (I / K) x 100		%		6.3%		7.9%	

ASTM D4643 AASHTO T217 or T265 Tested by: dt



MOISTURE-DENSITY RELATIONS OF SOILS

North Dakota Department Of Transportation, Materials & Research Division

SFN 10063 (Rev. 03-2006)

Project No. NH-7-002(156)022	PCN	Station	Depth Below Grade
Offset From Centerline		Type of Soil	
AASHTO Designation T-180	Date 8/18/2016	513	

Density		Test Count					
		1	2	3	4	5	6
Determination No.		1	2	3	4	5	6
A	Volume of Mold	cu. ft.	0.0333	0.0333	0.0333	0.0333	0.0333
		lbs.	8.74	9.00	9.11	9.03	
C	Weight of Mold	lbs.	4.43	4.43	4.43	4.43	4.43
D	Weight of Compacted Soil = B - C	lbs.	4.31	4.57	4.68	4.60	
E	Wet Density = D / A	lbs./cu.ft.	129.3	137.1	140.4	138.1	
F	Dry Density = (E x 100) / (100 + L)	lbs./cu.ft.	121.0	126.2	126.9	122.8	#VALUE!

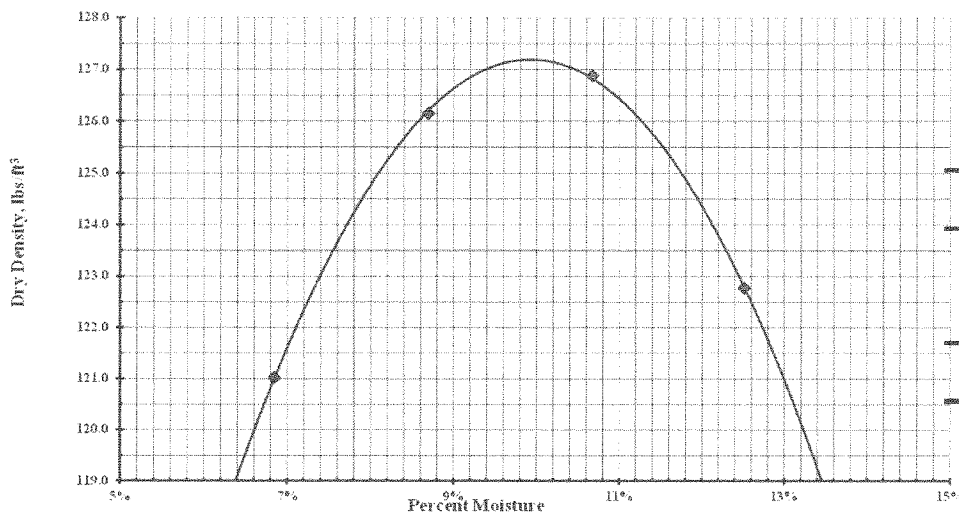
Moisture Content

AASHTO T99 or T180 Tested by:

Container No.		21	22	23	24		
G	Wet Weight / Container	grams	176.0	180.8	149.4	146.0	
H	Dry Weight / Container	grams	167.1	169.3	138.6	133.9	
I	Moisture Loss = G - H	grams	8.9	11.5	10.8	12.1	
J	Tare Weight of Container	grams	37.1	37.0	37.4	37.2	
K	Dry Soil = H - J	grams	130.0	132.3	101.2	96.7	
L	%Moisture = (I / K) x 100	%	6.8%	8.7%	10.7%	12.5%	

ASTM D4643 AASHTO T217 or T265 Tested by: dt

Moisture Density Relationship



Max Dry Density

127.2 lbs./cu. ft.

Optimum Moisture

9.9%

MOISTURE-DENSITY RELATIONS OF SOILS

North Dakota Department Of Transportation, Materials & Research Division

SFN 10063 (Rev. 03-2006)

Project No. NH-7-002(156)022	PCN	Station	Depth Below Grade
Offset From Centerline		Type of Soil	
AASHTO Designation T-180	Date 8/22/2016	514	

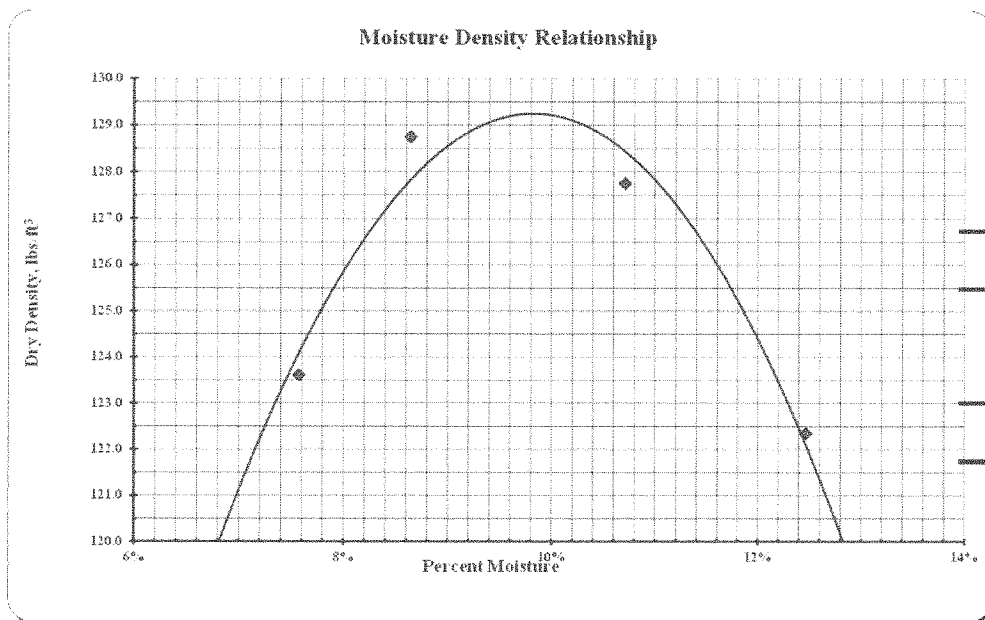
Density		Test Count	4				
Determination No.		1	2	3	4	5	6
A	Volume of Mold	cu. ft.	0.0333	0.0333	0.0333	0.0333	0.0333
		lbs.	8.85	9.09	9.14	9.01	
C	Weight of Mold	lbs.	4.43	4.43	4.43	4.43	4.43
D	Weight of Compacted Soil = B - C	lbs.	4.43	4.66	4.71	4.58	
E	Wet Density = D / A	lbs./cu.ft.	133.0	139.9	141.4	137.6	
F	Dry Density = (E x 100) / (100 + L)	lbs./cu.ft.	123.6	128.8	127.8	122.3	#VALUE!

Moisture Content

AASHTO T99 or T180 Tested by:

Container No.		1	2	3	4		
G	Wet Weight / Container	grams	161.6	147.9	147.7	154.0	
H	Dry Weight / Container	grams	152.8	139.1	137.0	141.0	
I	Moisture Loss = G - H	grams	8.8	8.8	10.7	13.0	
J	Tare Weight of Container	grams	36.6	37.3	37.1	36.7	
K	Dry Soil = H - J	grams	116.2	101.8	99.9	104.3	
L	%Moisture = (I / K) x 100	%	7.6%	8.6%	10.7%	12.5%	

ASTM D4643 AASHTO T217 or T265 Tested by: ml



Max Dry Density

129.2 lbs./cu. ft.

Optimum Moisture

9.8%

MOISTURE-DENSITY RELATIONS OF SOILS

North Dakota Department Of Transportation, Materials & Research Division

SFN 10063 (Rev. 03-2006)

Project No. NH-7-002(156)022	PCN	Station	Depth Below Grade
Offset From Centerline		Type of Soil	
ASTHO Designation T-180	Date 8/22/2016	515	

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.	8.82	9.08	9.14	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.	4.39	4.65	4.71	4.57		
E Wet Density = D / A lbs./cu.ft.	132.0	139.8	141.4	137.3		
F Dry Density = (E x 100) / (100 + L) lbs./cu.ft.	124.0	128.8	128.2	122.0	#VALUE!	#VALUE!

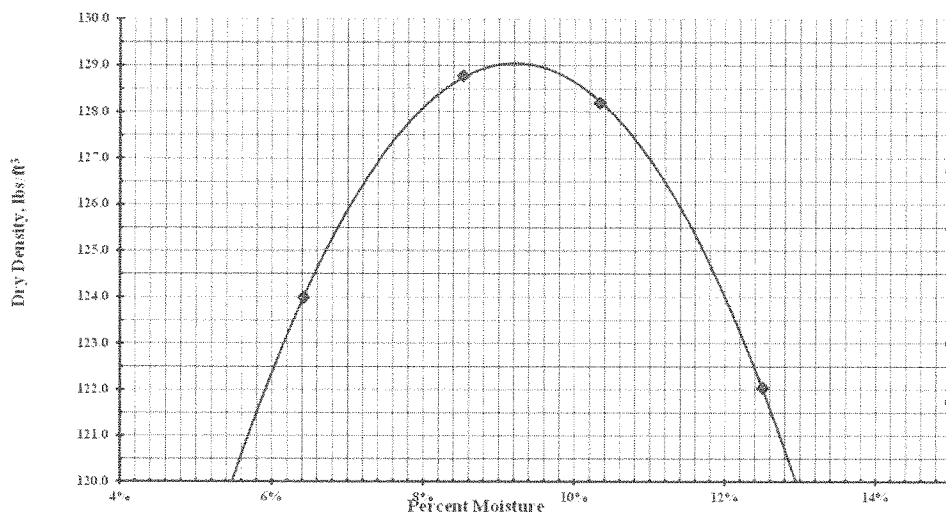
Moisture Content

AASHTO T99 or T180 Tested by:

Container No.	5	6	7	8		
G Wet Weight / Container grams	146.5	145.3	143.1	143.2		
H Dry Weight / Container grams	139.9	136.8	133.1	131.4		
I Moisture Loss = G - H grams	6.6	8.5	10.0	11.8		
J Tare Weight of Container grams	37.1	37.1	36.3	37.0		
K Dry Soil = H - J grams	102.8	99.7	96.8	94.4		
L %Moisture = (I / K) x 100	6.4%	8.5%	10.3%	12.5%		

ASTM D4643 AASHTO T217 or T265 Tested by: ml

Moisture Density Relationship



Max Dry Density

129.0 lbs./cu.ft.

Optimum Moisture

9.2%

MOISTURE-DENSITY RELATIONS OF SOILS

North Dakota Department Of Transportation, Materials & Research Division

SFN 10063 (Rev. 03-2006)

Project No. NH-7-002(156)022	PCN	Station	Depth Below Grade
Offset From Centerline		Type of Soil	
AASHTO Designation T-180	Date 8/22/2016	516	

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
		lbs.	8.78	9.07	9.15	9.04	
C	Weight of Mold	lbs.	4.43	4.43	4.43	4.43	4.43
D	Weight of Compacted Soil = B - C	lbs.	4.35	4.64	4.73	4.62	
E	Wet Density = D / A	lbs./cu.ft.	130.6	139.3	142.0	138.6	
F	Dry Density = (E x 100) / (100 + L)	lbs./cu.ft.	123.8	129.4	129.6	124.5	#VALUE!

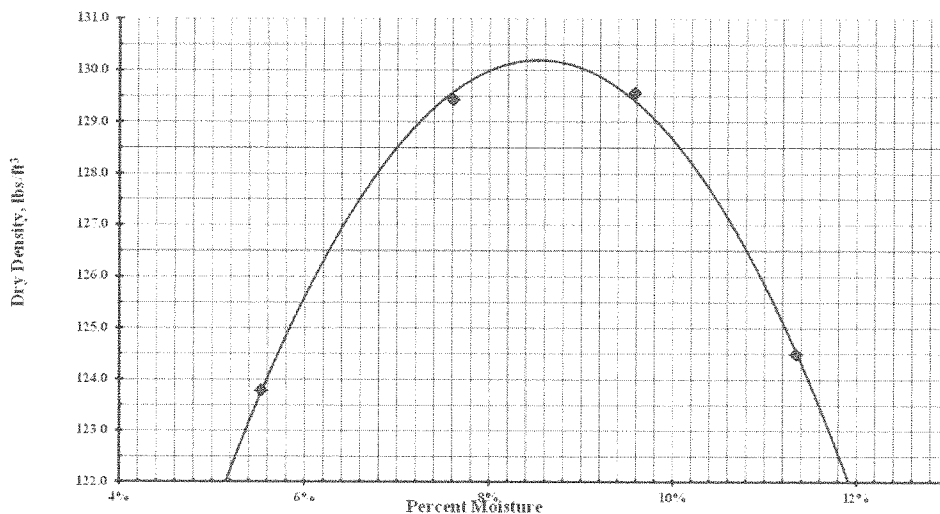
Moisture Content

AASHTO T99 or T180 Tested by:

Container No.		9	10	11	12		
G	Wet Weight / Container	grams	157.4	140.0	144.7	149.8	
H	Dry Weight / Container	grams	151.1	132.7	135.3	138.3	
I	Moisture Loss = G - H	grams	6.3	7.3	9.4	11.5	
J	Tare Weight of Container	grams	37.2	36.7	37.2	36.9	
K	Dry Soil = H - J	grams	113.9	96.0	98.1	101.4	
L	%Moisture = (I / K) x 100	%	5.5%	7.6%	9.6%	11.3%	

ASTM D4643 AASHTO T217 or T265 Tested by: ml

Moisture Density Relationship



Max Dry Density

130.2 lbs./cu.ft

Optimum Moisture

8.5%

MOISTURE-DENSITY RELATIONS OF SOILS

North Dakota Department Of Transportation, Materials & Research Division

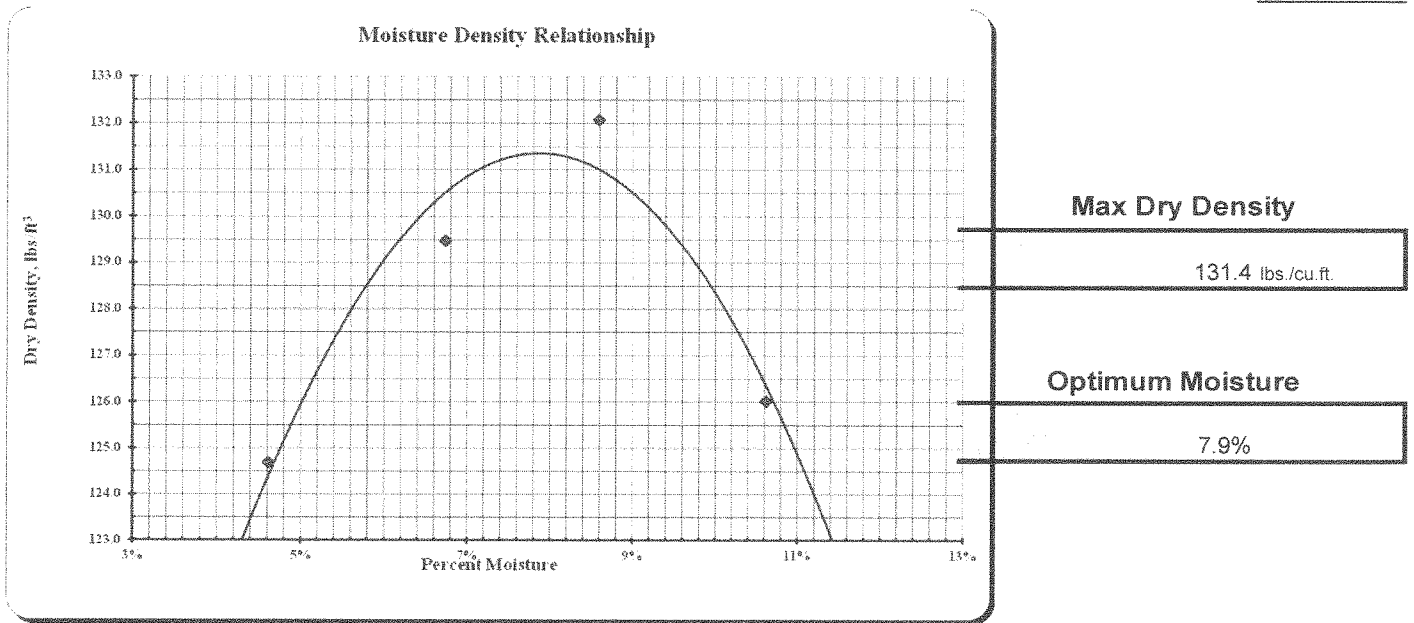
SFN 10063 (Rev. 03-2006)

Project No. NH-7-002(156)022	PCN	Station	Depth Below Grade
Offset From Centerline		Type of Soil	
AASHTO Designation T-180	Date 8/22/2016	517	

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.	8.77	9.03	9.20	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.	4.34	4.60	4.78	4.64		
E Wet Density = D / A lbs./cu.ft.	130.5	138.2	143.4	139.4		
F Dry Density = (E x 100) / (100 + L) lbs./cu.ft.	124.7	129.5	132.1	126.0	#VALUE!	#VALUE!

Moisture Content		AASHTO T99 or T180 Tested by:					
Container No.		13	14	15	16		
G Wet Weight / Container grams		155.0	150.4	149.8	154.9		
H Dry Weight / Container grams		149.8	143.3	140.9	143.6		
I Moisture Loss = G - H grams		5.2	7.1	8.9	11.3		
J Tare Weight of Container grams		37.1	37.9	37.3	37.2		
K Dry Soil = H - J grams		112.7	105.4	103.6	106.4		
L %Moisture = (I / K) x 100	%	4.6%	6.7%	8.6%	10.6%		

ASTM D4643 AASHTO T217 or T265 Tested by: ml



MOISTURE-DENSITY RELATIONS OF SOILS

North Dakota Department Of Transportation, Materials & Research Division

SFN 10063 (Rev. 03-2006)

Project No. NH-7-002(156)022		PCN		Station		Depth Below Grade	
Offset From Centerline				Type of Soil			
AASHTO Designation T-180		Date 8/23/2016				518	
Density		Test Count		3			
Determination No.		1		2		3	
A Volume of Mold		cu. ft.		0.0333		0.0333	
		lbs.		8.91		9.19	
C Weight of Mold		lbs.		4.43		4.43	
D Weight of Compacted Soil = B - C		lbs.		4.48		4.76	
E Wet Density = D / A		lbs./cu.ft.		134.7		142.9	
F Dry Density = (E x 100) / (100 + L)		lbs./cu.ft.		127.3		132.9	

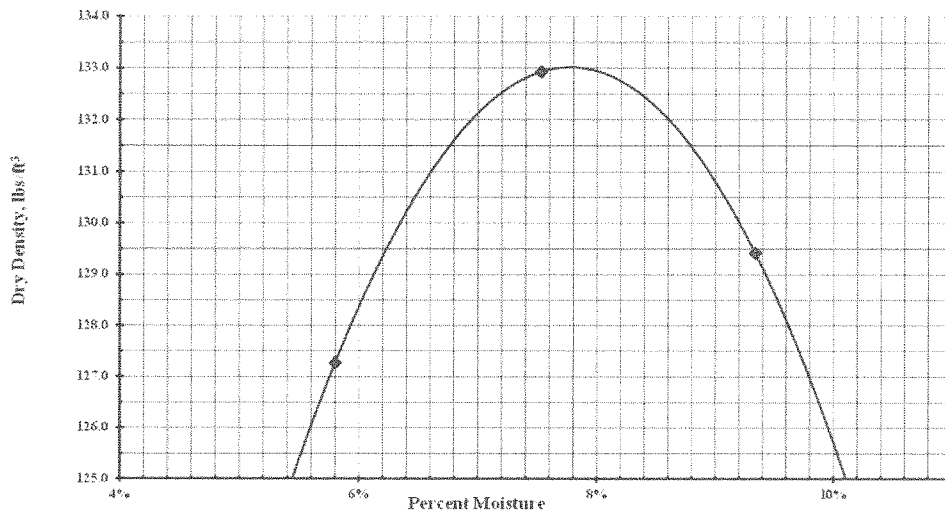
Moisture Content

AASHTO T99 or T180 Tested by:

Container No.	17	18	19			
G Wet Weight / Container	grams	159.0	149.9	146.0		
H Dry Weight / Container	grams	152.3	142.0	136.7		
I Moisture Loss = G - H	grams	6.7	7.9	9.3		
J Tare Weight of Container	grams	36.8	37.1	37.1		
K Dry Soil = H - J	grams	115.5	104.9	99.6		
L %Moisture = (I / K) x 100	%	5.8%	7.5%	9.3%		

ASTM D4643 AASHTO T217 or T265 Tested by: ml

Moisture Density Relationship



Max Dry Density

133.0 lbs./cu.ft.

Optimum Moisture

7.8%

MOISTURE-DENSITY RELATIONS OF SOILS

North Dakota Department Of Transportation, Materials & Research Division

SFN 10063 (Rev. 03-2006)

Project No. NH-7-002(156)022	PCN	Station	Depth Below Grade
Offset From Centerline		Type of Soil	
AASHTO Designation T-180	Date 8/23/2016	519	

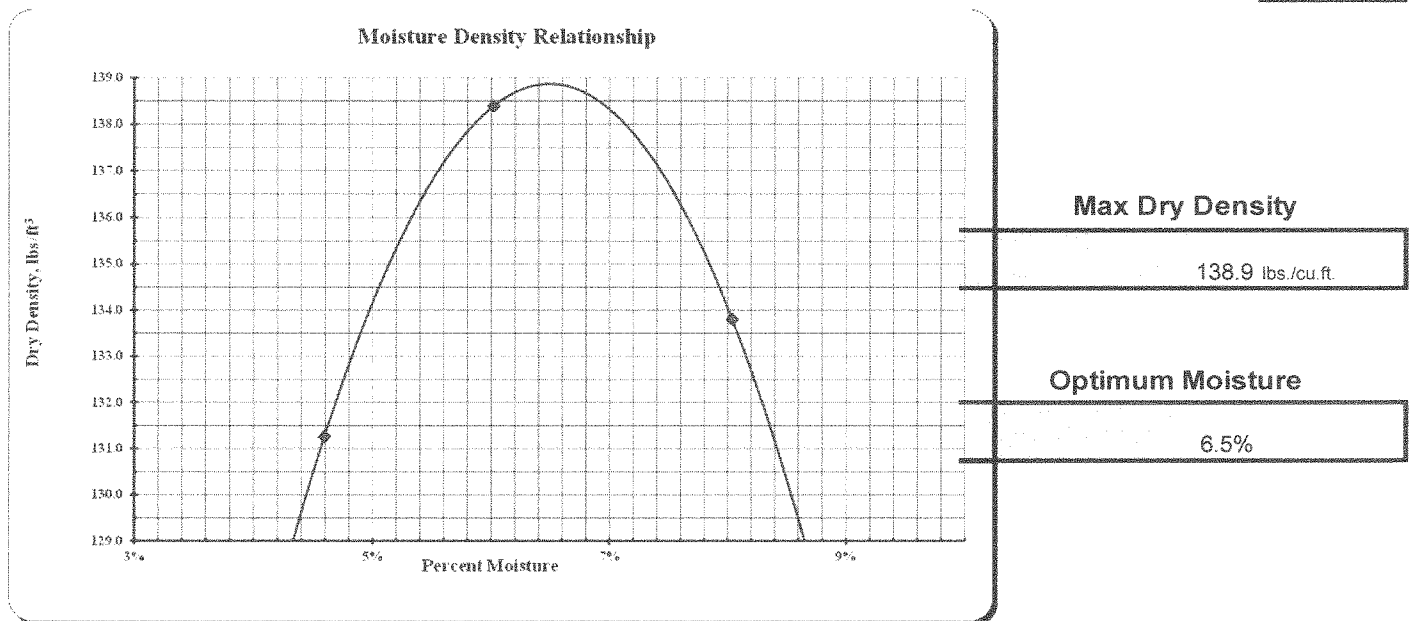
Density		Test Count					
		3					
Determination No.		1	2	3	4	5	6
A	Volume of Mold	cu. ft.	0.0333	0.0333	0.0333	0.0333	0.0333
		lbs.	9.00	9.32	9.24		
C	Weight of Mold	lbs.	4.43	4.43	4.43	4.43	4.43
D	Weight of Compacted Soil = B - C	lbs.	4.57	4.89	4.81		
E	Wet Density = D / A	lbs./cu.ft.	137.3	146.7	144.6		
F	Dry Density = (E x 100) / (100 + L)	lbs./cu.ft.	131.3	138.4	133.8	#VALUE!	#VALUE!

Moisture Content

AASHTO T99 or T180 Tested by:

Container No.		20	21	22			
G	Wet Weight / Container	grams	150.3	146.3	156.6		
H	Dry Weight / Container	grams	145.3	140.1	147.7		
I	Moisture Loss = G - H	grams	5.0	6.2	8.9		
J	Tare Weight of Container	grams	36.5	37.1	37.0		
K	Dry Soil = H - J	grams	108.8	103.0	110.7		
L	%Moisture = (I / K) x 100	%	4.6%	6.0%	8.0%		

ASTM D4643 AASHTO T217 or T265 Tested by: ml



MOISTURE-DENSITY RELATIONS OF SOILS

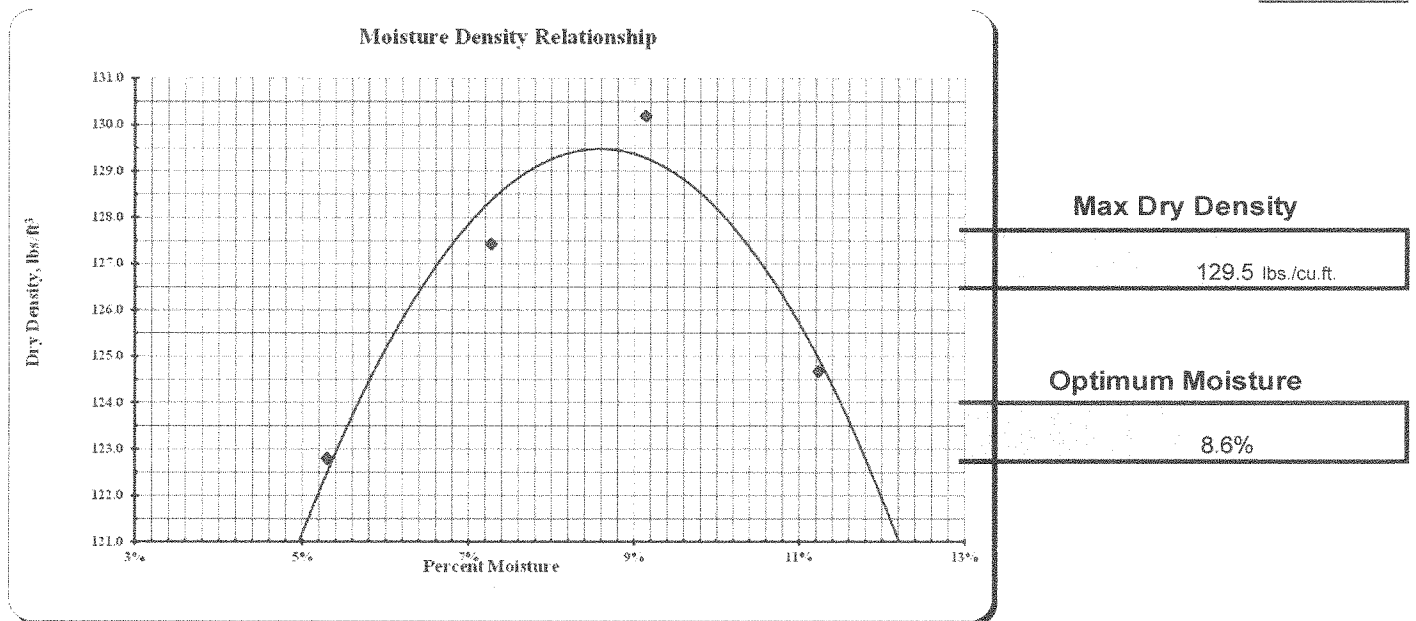
North Dakota Department Of Transportation, Materials & Research Division

SFN 10063 (Rev. 03-2006)

Project No. NH-7-002(156)022		PCN		Station		Depth Below Grade	
Offset From Centerline				Type of Soil			
AASHTO Designation T-180		Date 8/23/2016				520	
Density		Test Count		4			
Determination No.		1		2		3	
A Volume of Mold		cu. ft.		0.0333		0.0333	
		lbs.		8.73		8.98	
C Weight of Mold		lbs.		4.43		4.43	
D Weight of Compacted Soil = B - C		lbs.		4.31		4.55	
E Wet Density = D / A		lbs./cu.ft.		129.3		136.7	
F Dry Density = (E x 100) / (100 + L)		lbs./cu.ft.		122.8		127.4	

Moisture Content		AASHTO T99 or T180 Tested by:					
Container No.		23		24		25	
G Wet Weight / Container		grams		150.7		144.9	
H Dry Weight / Container		grams		145.0		137.6	
I Moisture Loss = G - H		grams		5.7		7.3	
J Tare Weight of Container		grams		37.4		37.2	
K Dry Soil = H - J		grams		107.6		100.4	
L %Moisture = (I / K) x 100		%		5.3%		7.3%	

ASTM D4643 AASHTO T217 or T265 Tested by: ml



MOISTURE-DENSITY RELATIONS OF SOILS

North Dakota Department Of Transportation, Materials & Research Division

SFN 10063 (Rev. 03-2006)

Project No. NH-7-002(156)022	PCN	Station	Depth Below Grade			
Offset From Centerline		Type of Soil				
AASHTO Designation T-180	Date 8/23/2016			521		
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.	8.86	9.13	9.17			
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.	4.44	4.70	4.74			
E Wet Density = D / A lbs./cu.ft.	133.2	141.3	142.5			
F Dry Density = (E x 100) / (100 + L) lbs./cu.ft.	125.6	130.9	130.2	#VALUE!	#VALUE!	#VALUE!

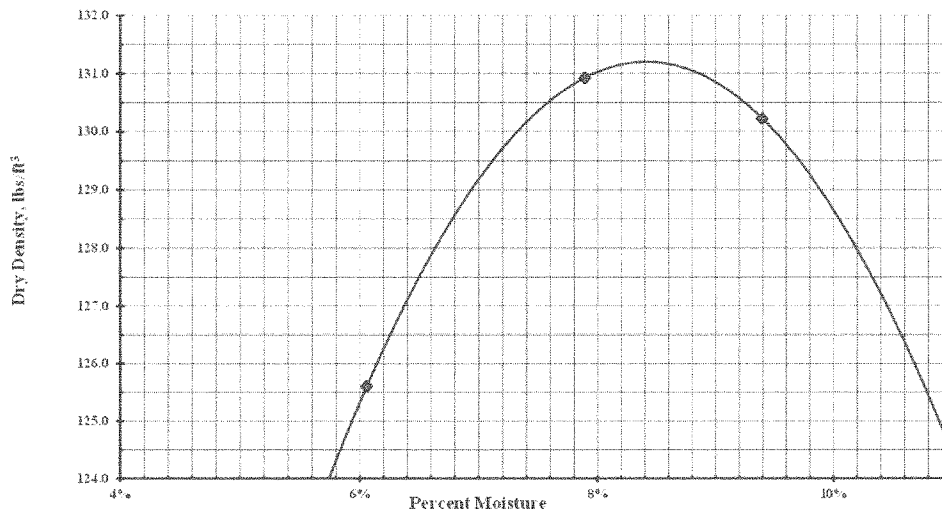
Moisture Content

AASHTO T99 or T180 Tested by:

Container No.	27	28	29			
G Wet Weight / Container grams	154.0	149.3	142.0			
H Dry Weight / Container grams	147.3	141.1	133.0			
I Moisture Loss = G - H grams	6.7	8.2	9.0			
J Tare Weight of Container grams	36.7	37.2	37.2			
K Dry Soil = H - J grams	110.6	103.9	95.8			
L %Moisture = (I / K) x 100	6.1%	7.9%	9.4%			

ASTM D4643 AASHTO T217 or T265 Tested by: ml

Moisture Density Relationship



Max Dry Density

131.2 lbs./cu.ft.

Optimum Moisture

8.5%

MOISTURE-DENSITY RELATIONS OF SOILS

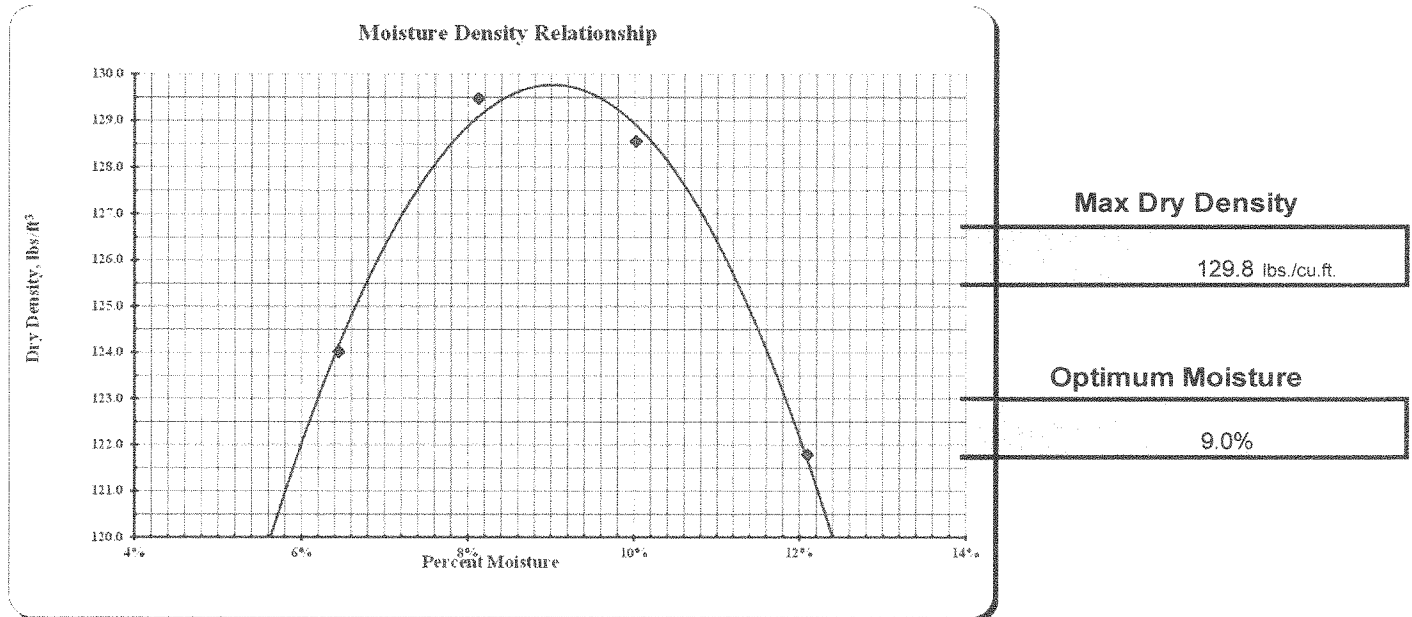
North Dakota Department Of Transportation, Materials & Research Division

SFN 10063 (Rev. 03-2006)

Project No. NH-7-002(156)022		PCN		Station		Depth Below Grade	
Offset From Centerline				Type of Soil			
AASHTO Designation T-180		Date 8/23/2016				522	
Density		Test Count		4			
Determination No.		1		2		3	
A Volume of Mold		cu. ft.		0.0333		0.0333	
		lbs.		8.82		9.09	
C Weight of Mold		lbs.		4.43		4.43	
D Weight of Compacted Soil = B - C		lbs.		4.40		4.66	
E Wet Density = D / A		lbs./cu.ft.		132.0		140.0	
F Dry Density = (E x 100) / (100 + L)		lbs./cu.ft.		124.0		129.5	

Moisture Content		AASHTO T99 or T180 Tested by:					
Container No.		30		31		32	
G Wet Weight / Container		grams		157.6		148.8	
H Dry Weight / Container		grams		150.3		140.4	
I Moisture Loss = G - H		grams		7.3		8.4	
J Tare Weight of Container		grams		37.1		37.0	
K Dry Soil = H - J		grams		113.2		103.4	
L %Moisture = (I / K) x 100		%		6.4%		8.1%	

ASTM D4643 AASHTO T217 or T265 Tested by: ml



MOISTURE-DENSITY RELATIONS OF SOILS

North Dakota Department Of Transportation, Materials & Research Division

SFN 10063 (Rev. 03-2006)

Project No. NH-7-002(156)022		PCN		Station		Depth Below Grade	
Offset From Centerline				Type of Soil			
AASHTO Designation T-180		Date 8/23/2016				523	
Density		Test Count		4			
Determination No.		1		2		3	
A Volume of Mold		cu. ft.		0.0333		0.0333	
		lbs.		8.82		9.07	
C Weight of Mold		lbs.		4.43		4.43	
D Weight of Compacted Soil = B - C		lbs.		4.40		4.64	
E Wet Density = D / A		lbs./cu.ft.		132.1		139.5	
F Dry Density = (E x 100) / (100 + L)		lbs./cu.ft.		124.7		129.4	

Moisture Content

AASHTO T99 or T180 Tested by:

Container No.		34	35	36	37		
G Wet Weight / Container	grams	155.0	158.6	148.0	148.6		
H Dry Weight / Container	grams	148.5	149.9	138.2	137.0		
I Moisture Loss = G - H	grams	6.5	8.7	9.8	11.6		
J Tare Weight of Container	grams	38.0	37.5	37.2	37.3		
K Dry Soil = H - J	grams	110.5	112.4	101.0	99.7		
L %Moisture = (I / K) x 100	%	5.9%	7.7%	9.7%	11.6%		

ASTM D4643 AASHTO T217 or T265 Tested by: ml

