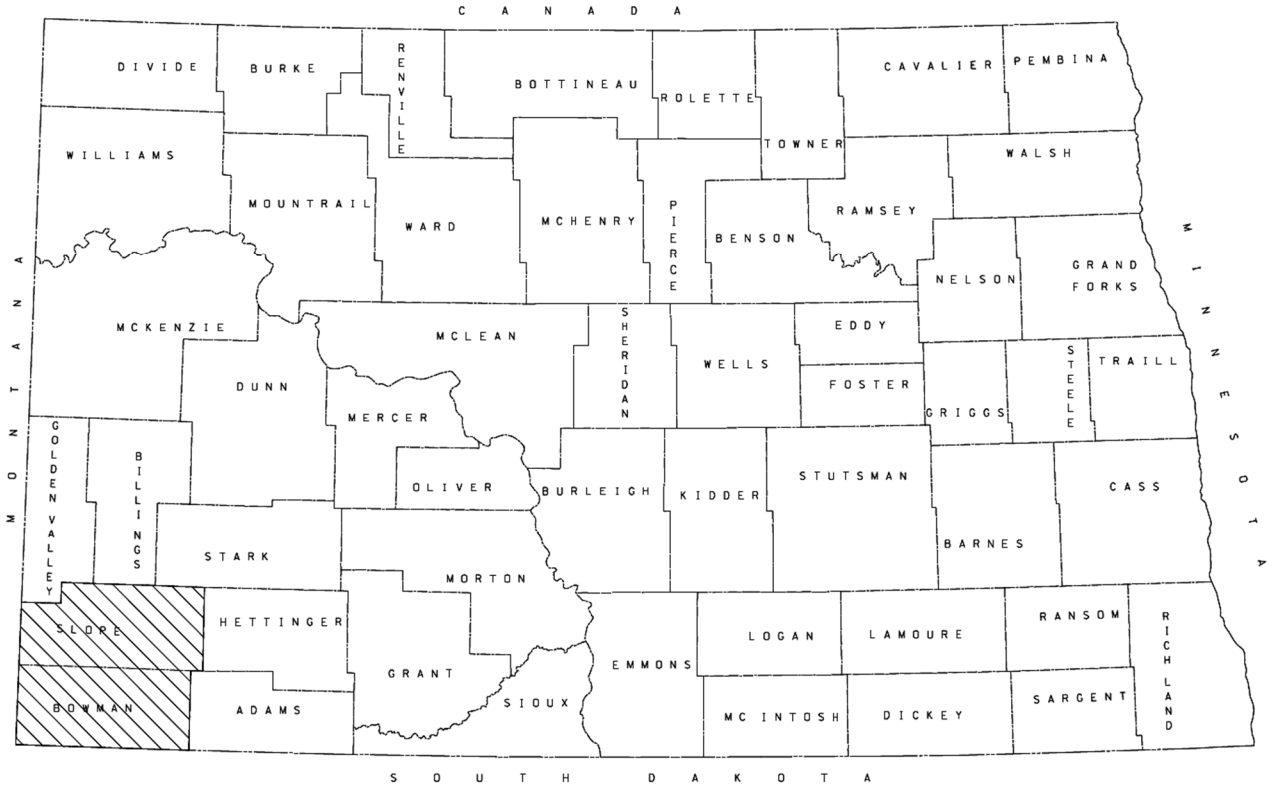
LINEAR SOILS SURVEY AND RECOMMENDATIONS

PROJECT NO. SS-5-067(014)000

PCN 22940

COUNTY Bowman/Slope

ND 67, RP 0.000 to 16.144



PREPARED BY: Jared Loegering

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH DIVISION

April 2019

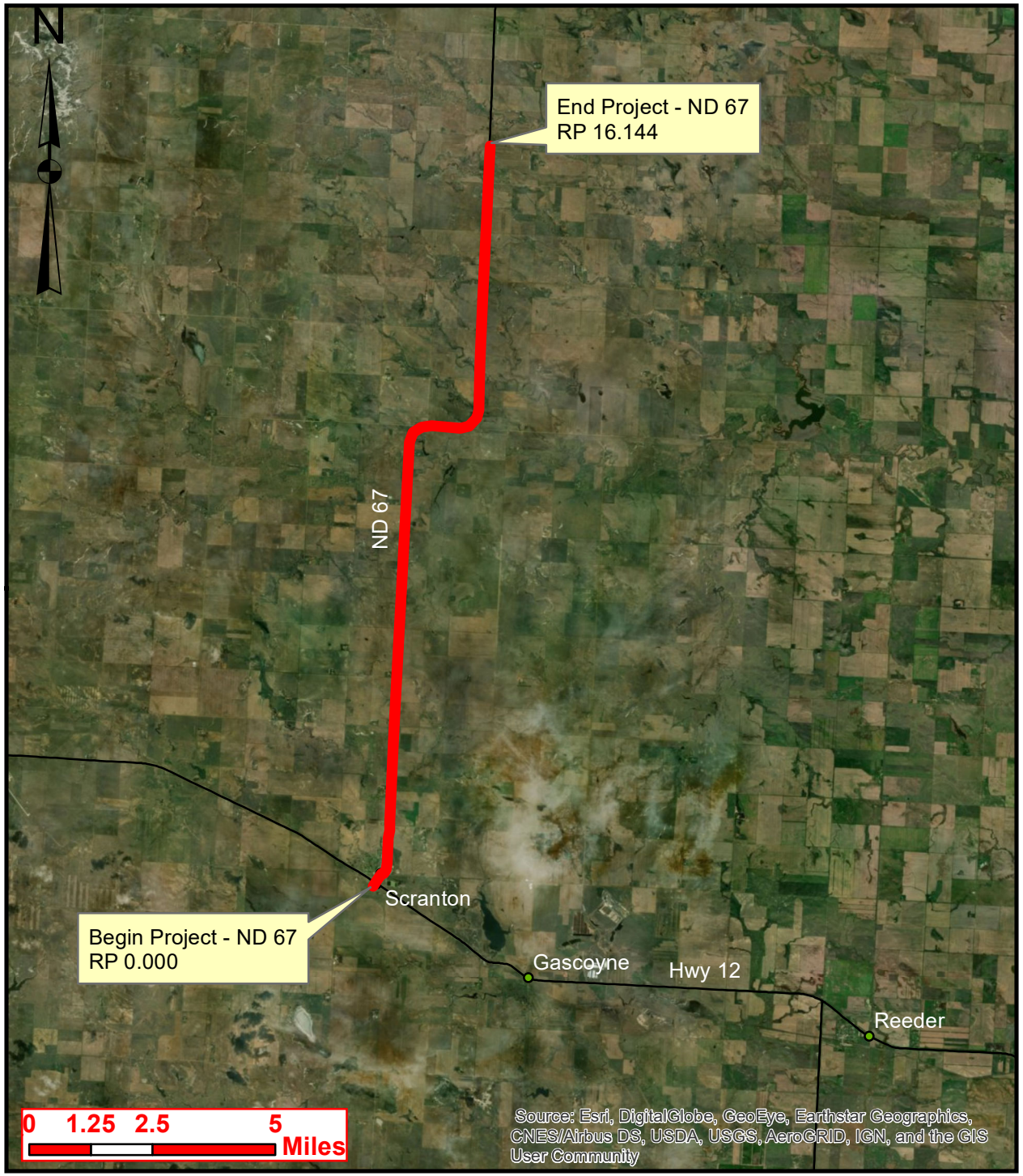
ND 67, Jct. 12 at Scranton N Approx. 15 Miles

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 Jared J. Loegering, Registration number PE-10931 on 04/29/2019 and the original document is stored at the North Dakota Department of Transportation.

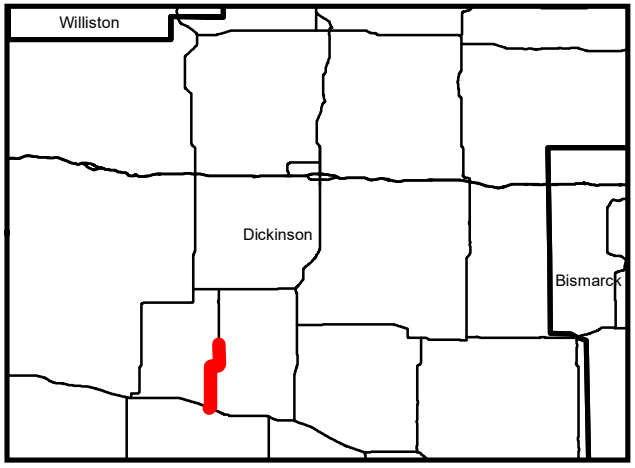
Jared J. Loegering, P.E.

04-29-2019
Date



Linear Soils Survey and Recommendations

Project: SS-5-067(014)000
PCN: 22940
Scope: Preventative Maintenance Mill & HBP Overlay
Length: 16.144 Miles
Location: ND 67, Jct 12 at Scranton N Approx. 15 Miles



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Introduction

Location: ND 67, Jct. 12 at Scranton N Approx. 15 Miles
Reference Points: 0.000 to 16.144
Project Length: 16.144
Proposed Project Scope: Preventative Maintenance Mill & HBP Overlay
Investigation Scope: Identified Maintenance Locations

Maintenance Review

No maintenance review was completed for this project.

Field Review

Date of Field Review: 08/29/2018
Materials and Research Person Conducting the Review: Matt Kurle/Seung Baek

Materials and Research personnel met with Rob Rayhorn from the Dickinson District in Scranton, ND to discuss the severe roadway distress near the grain elevator on ND 67 from approximately RP 0.235 to 0.675. This section of roadway receives a high amount of truck traffic due to the grain elevator. The other portions of the roadway within the City of Scranton also show medium to high severity of pavement distress. After review of the existing information, it was found that approximately 6” of the 10” of base is made up of scoria. From the observations made in the field, the pavement distress identified was believed to be caused by the scoria used as a base material and the truck traffic. It is also believed that the subgrade is not a contributing factor due to the roadway not showing typical subgrade-related distresses.

At the field review it was decided that Materials & Research would drill the city section and determine approximate asphalt, aggregate, and scoria depths as well as obtain subgrade information. Falling weight Deflectometer (FWD) testing was also going to be used to find the strength of the pavement and subgrade. See Appendix B for more information on the field review.

Summary of Soil Investigation

The investigation consisted of borings spaced at 250’ intervals within the City of Scranton.

Table 1 – Boring Locations Summary

Boring Location	Justification for Boring	Boring depth	Location
0+0775 to 0+4500	Roadway Distress	5'	1 boring every 250' along the roadway within the City of Scranton. A total number of 16 borings.

Maps of the boring locations are shown in Appendix C. The lab results are included in Appendix E.

Summary of Soil/FWD Analysis

The majority of the soils are clayey sands and sandy lean clays with AASHTO classifications of A-4 and A-6. These soils have on average a maximum dry density of approximately 126.5 lb/ft^3 and an optimum water content of approximately 10%. The in-place moistures of the soils are on average 0% to 16% over optimum.

The FWD data showed that the subgrade had above average strengths through the City of Scranton while the pavement section indicated poor strengths. Results of the FWD testing can be seen below:

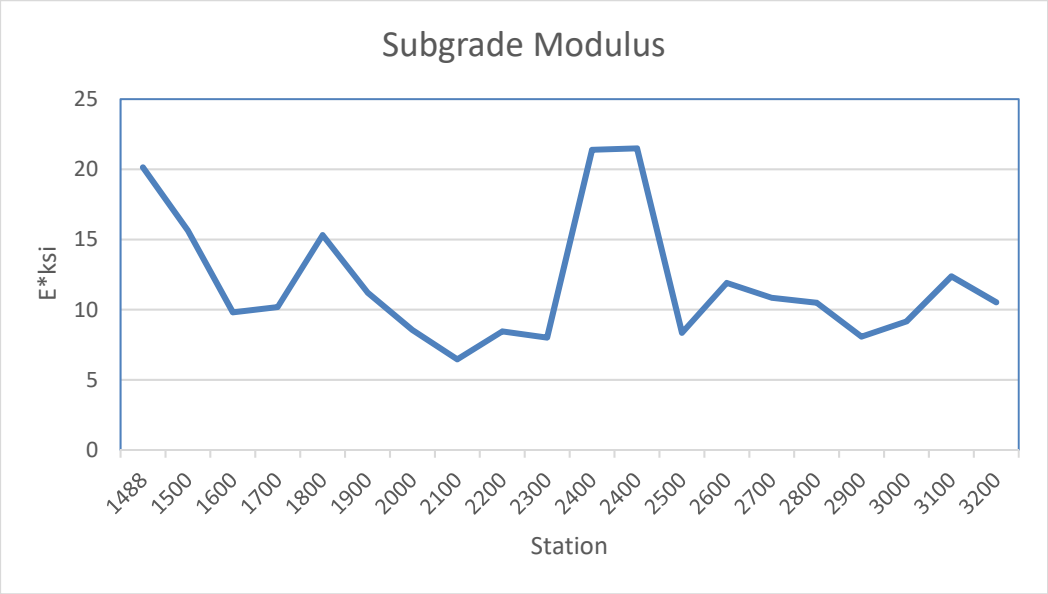


Figure 1 - Subgrade Modulus Results - FWD Testing

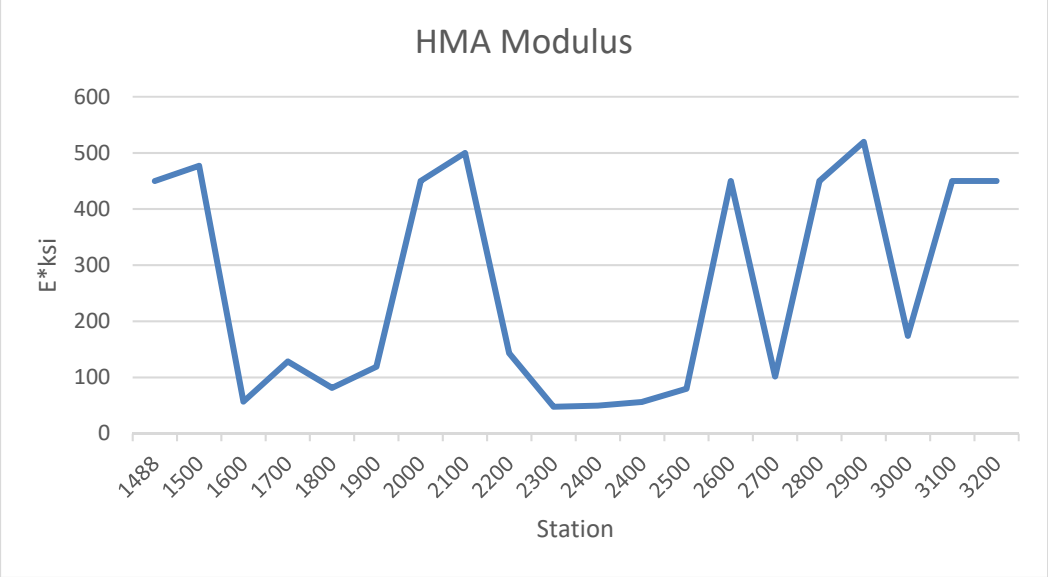


Figure 2 – Pavement Modulus Results - FWD Testing

Soil Sample Distribution

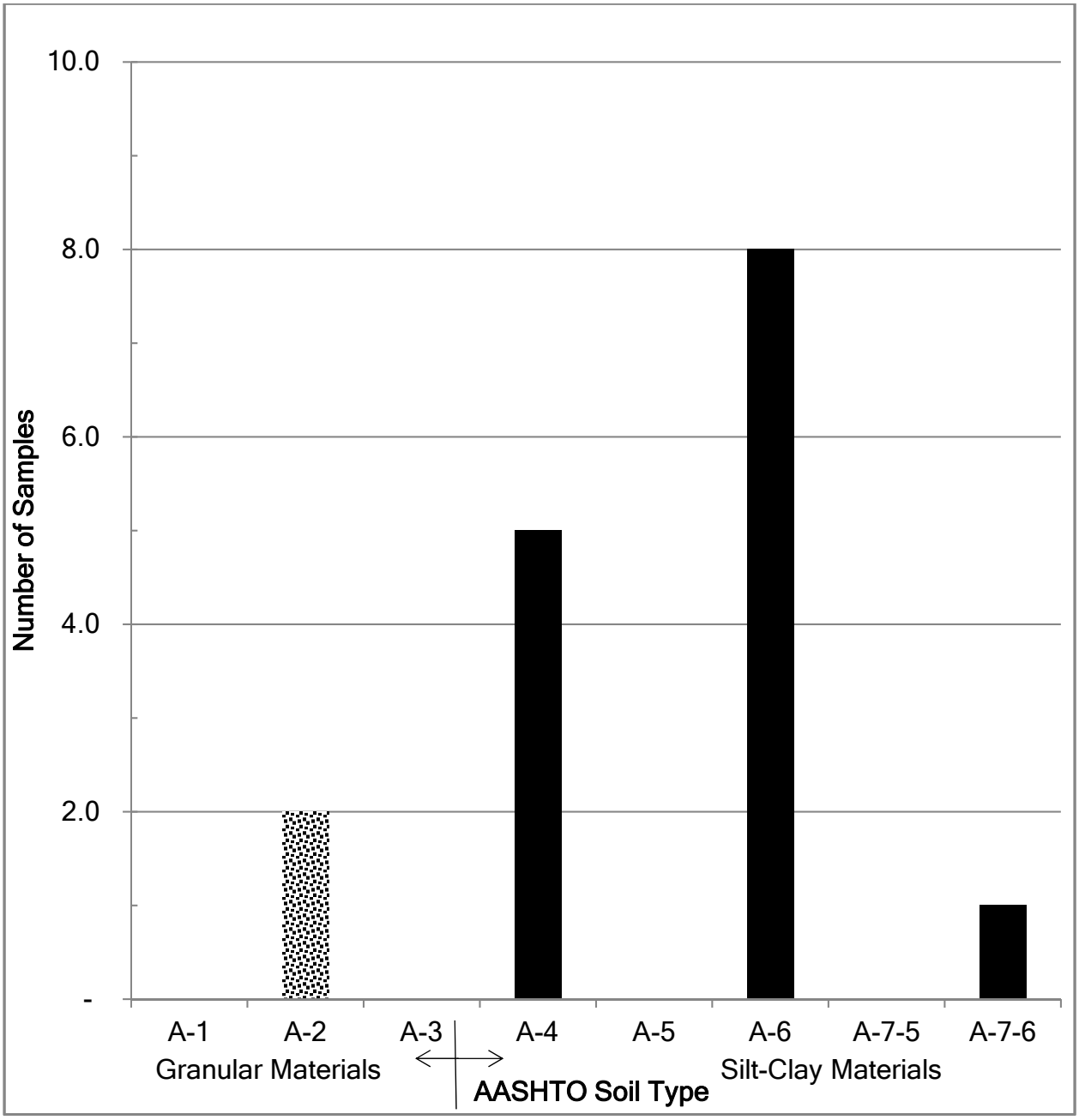


Figure 3 - Soil Sample Distribution

Design Recommendations

City of Scranton Limits – 0+1050 to 0+3500: Based on the subgrade information obtained from drilling and the FWD testing, the subgrade is adequate through this roadway section. The roadway distress appears to be from the pavement and base sections. It is recommended to subcut 24" from the top of existing pavement to remove all of the existing pavement, base and scoria. If the proposed pavement design section is greater than 24", use the recommended pavement design for the subcut section.

Design Information

Pipe Replacement: Pipe replacements on this project may require a non-standard pipe backfill detail. Contact the Materials and Research Geotechnical Section prior to the PS&E if any pipes are being installed or replaced on this project. Please include any pertinent information such as location, size, depth to inlet, etc.

Compaction Method: T-180

Subgrade Prep: None

Subcut:
Table 2 – Subcut Location

Location RP + Feet	Length	Depth
0+1050 to 0+3500	2450'	24"

Calculate the subcut quantity based on the lengths and depths as shown in Table 4 above and adhere to the guidelines stated below.

Remarks: Subcut 24” from the top of proposed pavement. If the proposed pavement design section is greater than 24”, use the recommended pavement design for the subcut section. Place geogrid (Type) G at the bottom of all subcut excavations and backfill with Class 5 Aggregate. Place 10” of aggregate on the geogrid prior to compacting. Do not scarify the bottom of the subcut.

Drainage: None

Plan Notes

None

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

APPENDIX A

SOIL CLASSIFICATION

AASHTO 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%)

Unified Soil Classification System, USCS

Table 5.2 Unified Soil Classification System (Based on Material Passing 76.2-mm Sieve)

Criteria for assigning group symbols				Group symbol
Coarse-grained soils More than 50% of retained on No. 200 sieve	Gravels More than 50% of coarse fraction retained on No. 4 sieve	Clean Gravels Less than 5% fines[a]	$C_u \geq 4$ and $1 \leq C_c \leq 3$[c]	GW
			$C_u < 4$ and/or $1 > C_c > 3$[c]	GP
		Gravels with Fines More than 12% fines[a,d]	$PI < 4$ or plots below "A" line (Figure 5.3)	GM
			$PI > 7$ and plots on or above "A" line (Figure 5.3)	GC
	Sands 50% or more of coarse fraction passes No. 4 sieve	Clean Sands Less than 5% fines[b]	$C_u \geq 6$ and $1 \leq C_c \leq 3$[c]	SW
			$C_u < 6$ and/or $1 > C_c > 3$[c]	SP
		Sands with Fines More than 12% fines[b,d]	$PI < 4$ or plots below "A" line (Figure 5.3)	SM
			$PI > 7$ and plots on or above "A" line (Figure 5.3)	SC
Fine-grained soils 50% or more passes No. 200 sieve	Silts and clays Liquid limit less than 50	Inorganic	$PI > 7$ and plots on or above "A" line (Figure 5.3)[e]	CL
			$PI < 4$ or plots below "A" line (Figure 5.3)[e]	ML
		Organic	$\frac{\text{Liquid limit — oven dried}}{\text{Liquid limit — not dried}} < 0.75$; see Figure 5.3; OL zone	OL
	Silts and clays Liquid limit 50 or more	Inorganic	PI plots on or above "A" line (Figure 5.3)	CH
			PI plots below "A" line (Figure 5.3)	MH
		Organic	$\frac{\text{Liquid limit — oven dried}}{\text{Liquid limit — not dried}} < 0.75$; see Figure 5.3; OH zone	OH
Highly Organic Soils	Primarily organic matter, dark in color, and organic odor			Pt

[a] Gravels with 5 to 12% fine require dual symbols: GW-GM, GW-GC, GP-GM, GP-GC.

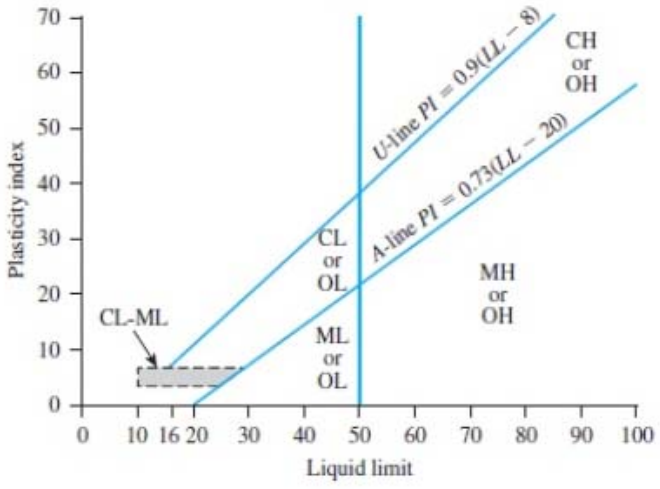
[b] Sands with 5 to 12% fines require dual symbols: SW-SM, SW-SC, SP-SM, SP-SC.

[c] $C_u = \frac{D_{60}}{D_{10}}$; $C_c = \frac{(D_{30})^2}{D_{60} \times D_{10}}$

[d] If $4 \leq PI \leq 7$ and plots in the hatched area in Figure 5.3, use dual symbol GC-GM or SC-SM.

[e] If $4 \leq PI \leq 7$ and plots in the hatched area in Figure 5.3, use dual symbol CL-ML.

Plasticity Chart :



APPENDIX B

Field Review

FIELD INSPECTION MEMO

TO:	**File**	
FROM:	**Matt Kurle/Seung Baek – Materials and Research**	
DATE:	**9/18/2018**	
HIGHWAY:	**ND 67**	
PROJECT NUMBER:	**No current project number assigned**	
PCN:	**No current PCN assigned**	
LOCATION:	**ND 67 Scranton City Section (RP 0.235 to RP 0.675)**	
SUBJECT:	**Discussion of the geotechnical data needed for the Environmental Document**	
DATE MEETING:	**8/29/2018**	
ATTENDEES:	**Materials & Research**	**Dickinson District**
	Matt Kurle	**Rob Rayhorn**
	Seung Il Baek	

Materials and Research personnel met with Rob Rayhorn (Dickinson District) in Scranton, ND on 8/29/2018 to discuss severe roadway distress near the grain elevator on ND 67 (see project map attached below). Approximately 1/8th mile of the roadway section is severely distressed. It is indicated that this section of roadway receives a high amount of truck traffic due to the grain elevator. The other portions of the city section also show medium to high severity pavement distress.

Review of information indicates that the existing pavement section is 5.5” of HMA on 10” of base. During the site visit and review of previous project plans, it was found that the base is made up of approximately 6 inches of scoria. Scoria does not function well as a base material and is not a substitute for aggregate.

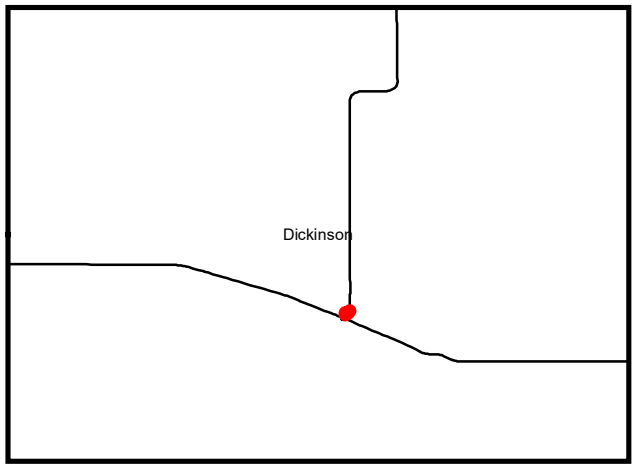
Initial observations by Materials & Research indicates that the pavement distress identified in the area is caused by scoria in the base section as well as unaccounted for heavy truck traffic. It is believed that the subgrade is not a contributing factor to the distresses as subgrade materials in this part of the state are generally considered suitable and the adjacent roadways are not showing the signs of pavement distress typically associated with poor subgrade. The city section will be drilled by Materials & Research staff to determine the depth of the existing pavement section, depth to the bottom of the scoria and to gather subgrade information. It is important to note that the thickness of the pavement will not be as accurate compared to completing the drilling with a coring machine. A final recommendation for the repair of the pavement distress will be provided during project development.


2018/08/29


2018/08/29

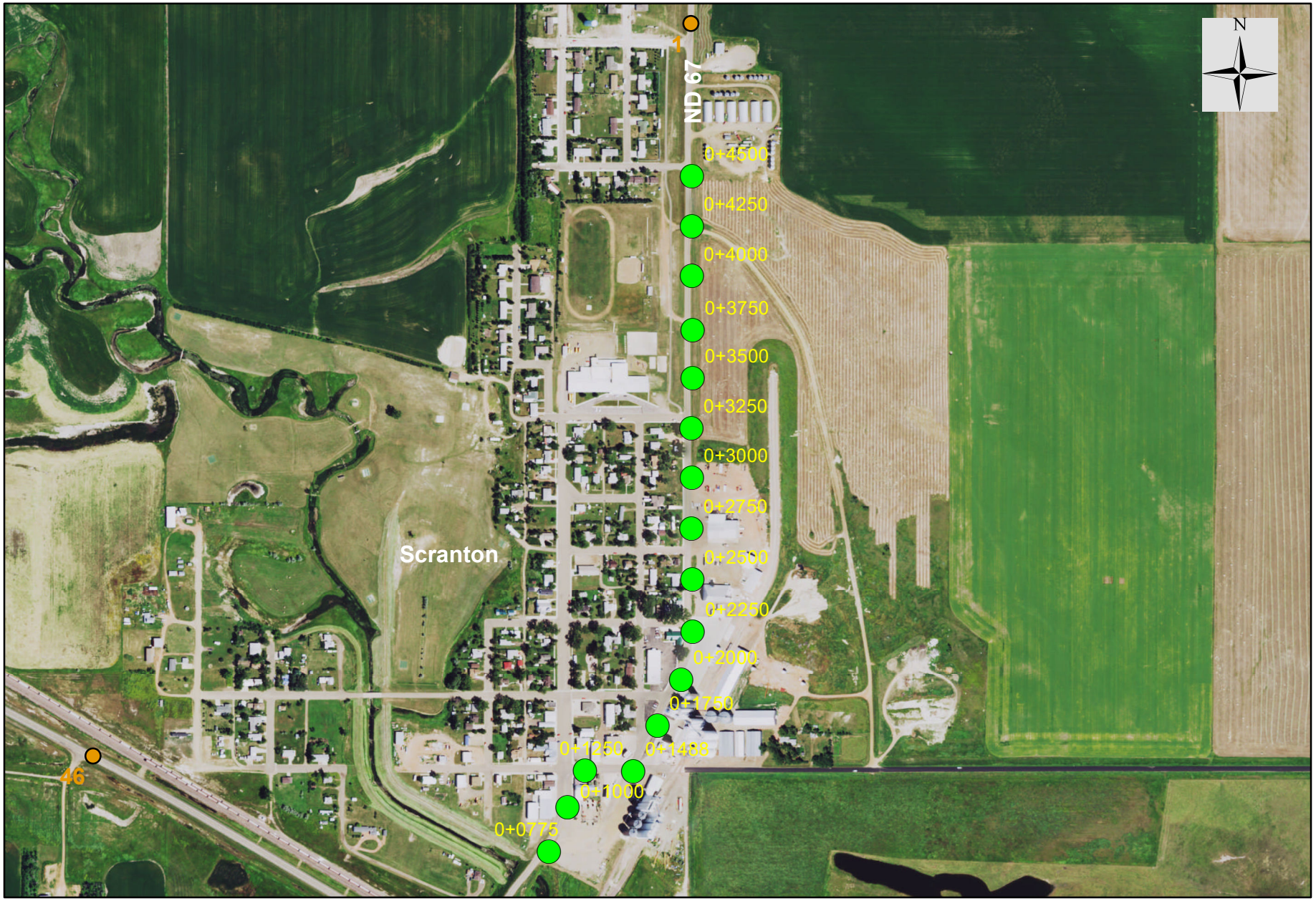
Field Review Location

Length: 0.44 Miles
Location: ND 67 Scranton City Section, RP 0.235 to 0.675



APPENDIX C

BORING LOCATIONS



Legend

- Reference Point
- Boring Locations

ND 67, Jct. 12 at Scranton N Approx. 15 Miles

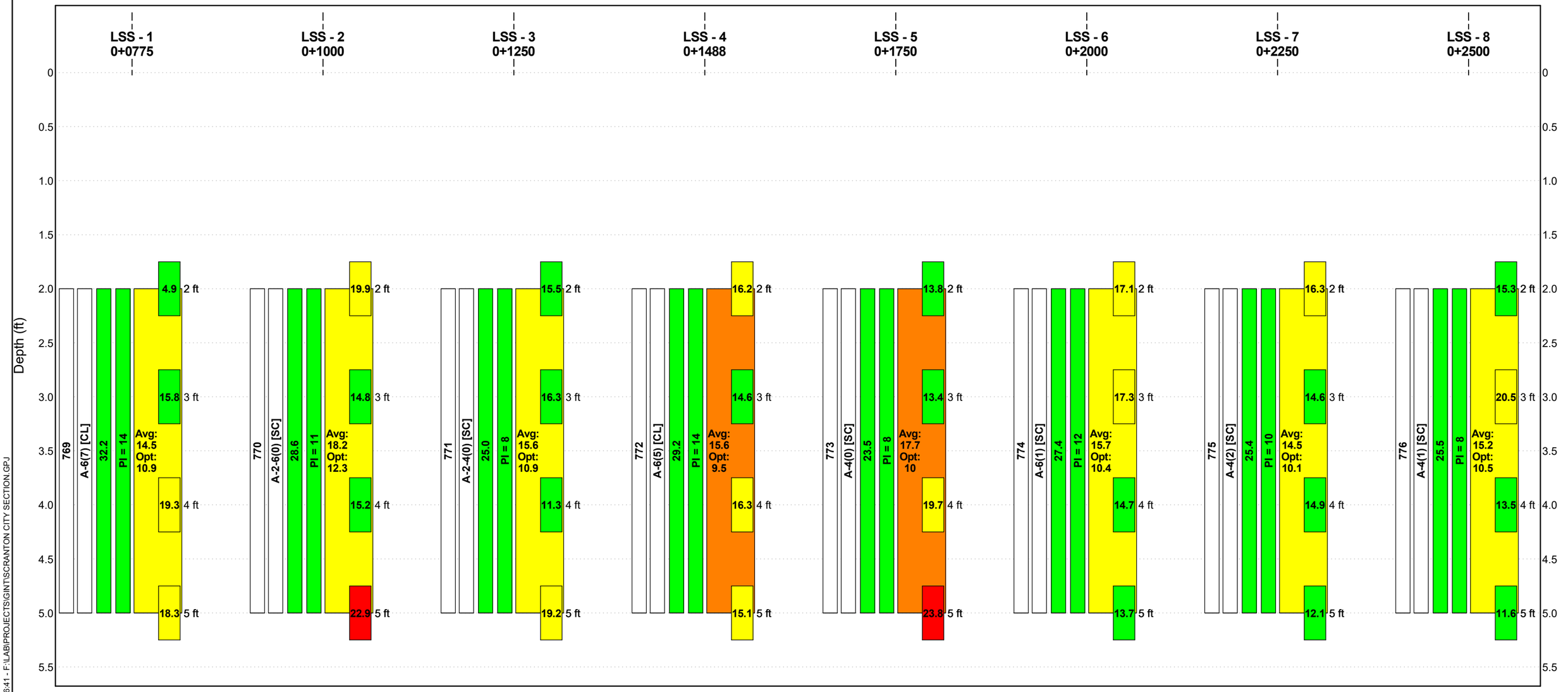
APPENDIX D

SUMMARY OF SOILS ANALYSIS

NORTH DAKOTA DEPARTMENT OF TRANSPORATION
300 AIRPORT ROAD
BISMARCK, ND 58504

PROJECT NUMBER Scranton City Section **PCN**

LOCATION Bowman County



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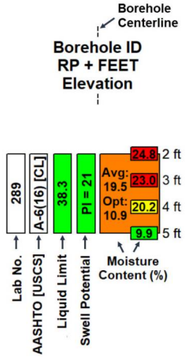
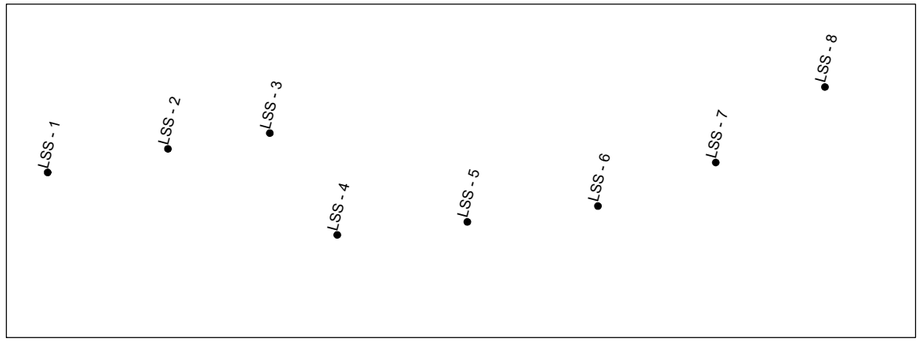


Liquid Limit	LL<50	50<=LL<60	LL>=60	
Swell Potential	Low	Marginal	High	
Moisture Content	Below PL	0-5% Over PL	>5% Over PL	Non-Plastic
Avg. In-Place Moisture Content	MC < Opt	0<=MC<6% Over Opt	6<=MC<10% Over Opt	10<=MC<16% Over Opt	MC>16% Over Opt

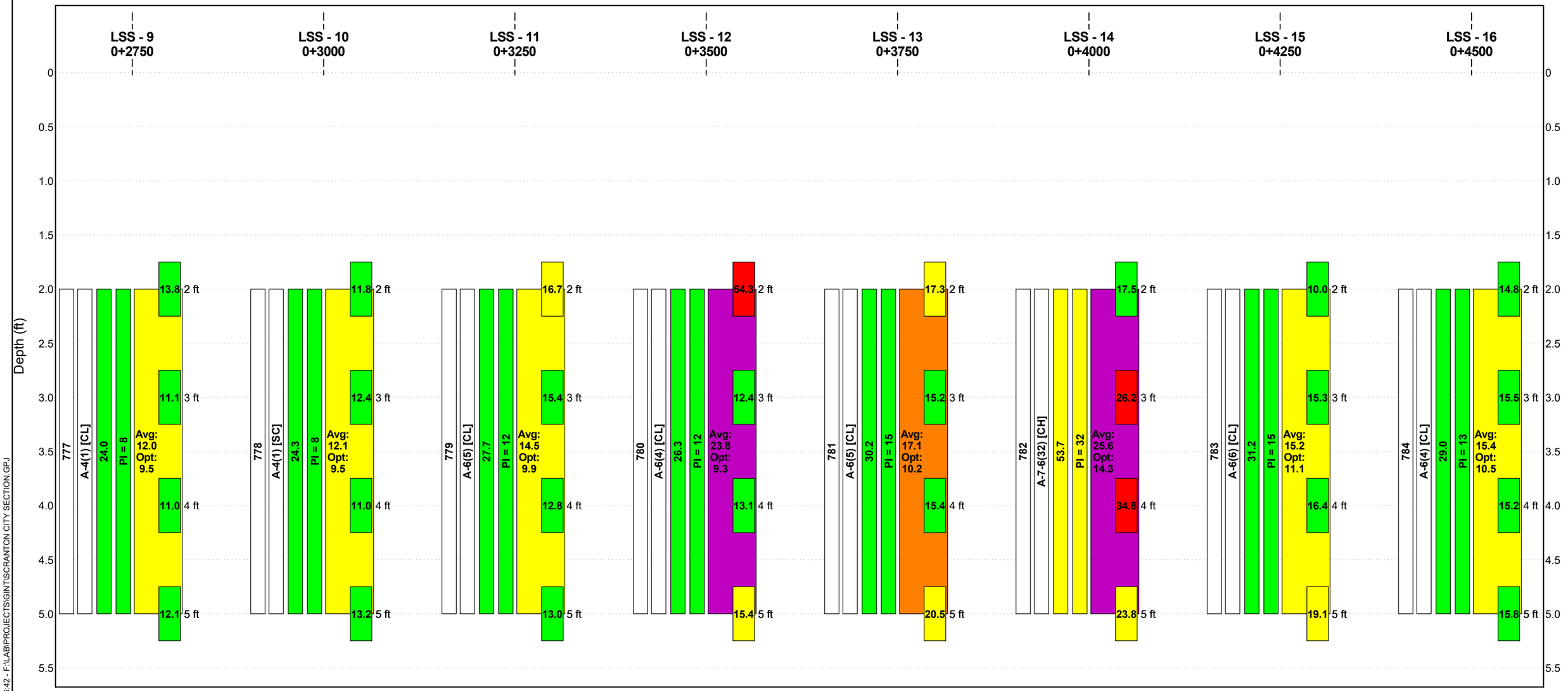
Boreholes Equally Spaced (0 to 500 ft)



NORTH DAKOTA DEPARTMENT OF TRANSPORATION
300 AIRPORT ROAD
BISMARCK, ND 58504

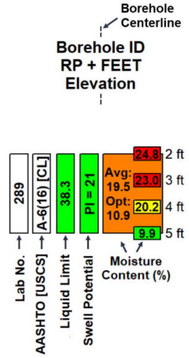
PROJECT NUMBER Scranton City Section **PCN**

LOCATION Bowman County

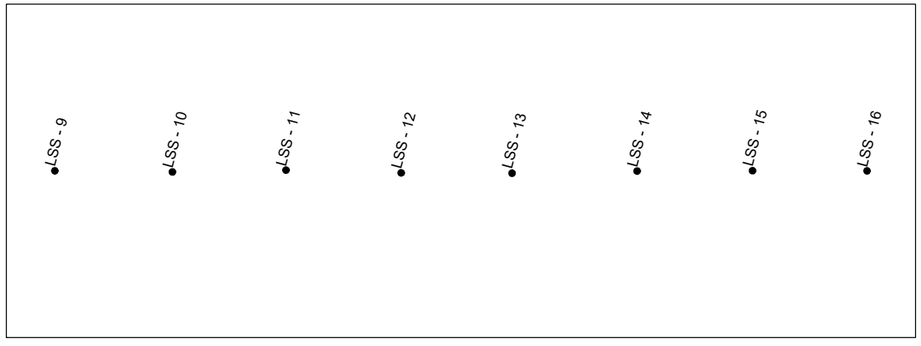


Boreholes Equally Spaced (0 to 550 ft)

LEGEND



Liquid Limit	LL<50	50<=LL<60	LL>=60	
Swell Potential	Low	Marginal	High	
Moisture Content	Below PL	0-5% Over PL	>5% Over PL	Non-Plastic
Avg. In-Place Moisture Content	MC < Opt	0<=MC<6% Over Opt	6<=MC<10% Over Opt	10<=MC<16% Over Opt	MC>16% Over Opt



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APPENDIX E

LAB RESULTS

SUMMARY OF LABORATORY RESULTS

NORTH DAKOTA DEPARTMENT OF TRANSPORATION
300 AIRPORT ROAD
BISMARCK, ND 58504

PROJECT NUMBER Scranton City Section **LOCATION** Bowman County

PCN

Borehole	Depth	Liquid Limit	Plastic Limit	Plasticity Index	Maximum Size (mm)	%<#200 Sieve	AASHTO Classification	USCS Class-ification	Water Content (%)	Avg. Water Content (%)	Dry Density (pcf)	Satur-ation (%)	Void Ratio
LSS - 1	2.0	32	18	14	9.5	68	A-6 (7)	CL	4.9	14.5			
LSS - 1	3.0								15.8	14.5			
LSS - 1	4.0								19.3	14.5			
LSS - 1	5.0								18.3	14.5			
LSS - 2	2.0	29	17	12	25	33	A-2-6 (0)	SC	19.9	18.2			
LSS - 2	3.0								14.8	18.2			
LSS - 2	4.0								15.2	18.2			
LSS - 2	5.0								22.9	18.2			
LSS - 3	2.0	25	17	8	25	33	A-2-4 (0)	SC	15.5	15.6			
LSS - 3	3.0								16.3	15.6			
LSS - 3	4.0								11.3	15.6			
LSS - 3	5.0								19.2	15.6			
LSS - 4	2.0	29	15	14	25	55	A-6 (5)	CL	16.2	15.6			
LSS - 4	3.0								14.6	15.6			
LSS - 4	4.0								16.3	15.6			
LSS - 4	5.0								15.1	15.6			
LSS - 5	2.0	23	15	8	25	39	A-4 (0)	SC	13.8	17.7			
LSS - 5	3.0								13.4	17.7			
LSS - 5	4.0								19.7	17.7			
LSS - 5	5.0								23.8	17.7			
LSS - 6	2.0	27	16	11	25	42	A-6 (1)	SC	17.1	15.7			
LSS - 6	3.0								17.3	15.7			
LSS - 6	4.0								14.7	15.7			
LSS - 6	5.0								13.7	15.7			
LSS - 7	2.0	25	15	10	25	48	A-4 (2)	SC	16.3	14.5			
LSS - 7	3.0								14.6	14.5			
LSS - 7	4.0								14.9	14.5			
LSS - 7	5.0								12.1	14.5			
LSS - 8	2.0	26	18	8	25	48	A-4 (1)	SC	15.3	15.2			
LSS - 8	3.0								20.5	15.2			
LSS - 8	4.0								13.5	15.2			
LSS - 8	5.0								11.6	15.2			
LSS - 9	2.0	24	16	8	9.5	53	A-4 (1)	CL	13.8	12.0			
LSS - 9	3.0								11.1	12.0			
LSS - 9	4.0								11.0	12.0			
LSS - 9	5.0								12.1	12.0			
LSS - 10	2.0	24	16	8	25	46	A-4 (1)	SC	11.8	12.1			
LSS - 10	3.0								12.4	12.1			
LSS - 10	4.0								11.0	12.1			
LSS - 10	5.0								13.2	12.1			
LSS - 11	2.0	28	16	12	9.5	65	A-6 (5)	CL	16.7	14.5			
LSS - 11	3.0								15.4	14.5			
LSS - 11	4.0								12.8	14.5			

SUMMARY OF LABORATORY RESULTS

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION
300 AIRPORT ROAD
BISMARCK, ND 58504

PROJECT NUMBER Scranton City Section **LOCATION** Bowman County

PCN

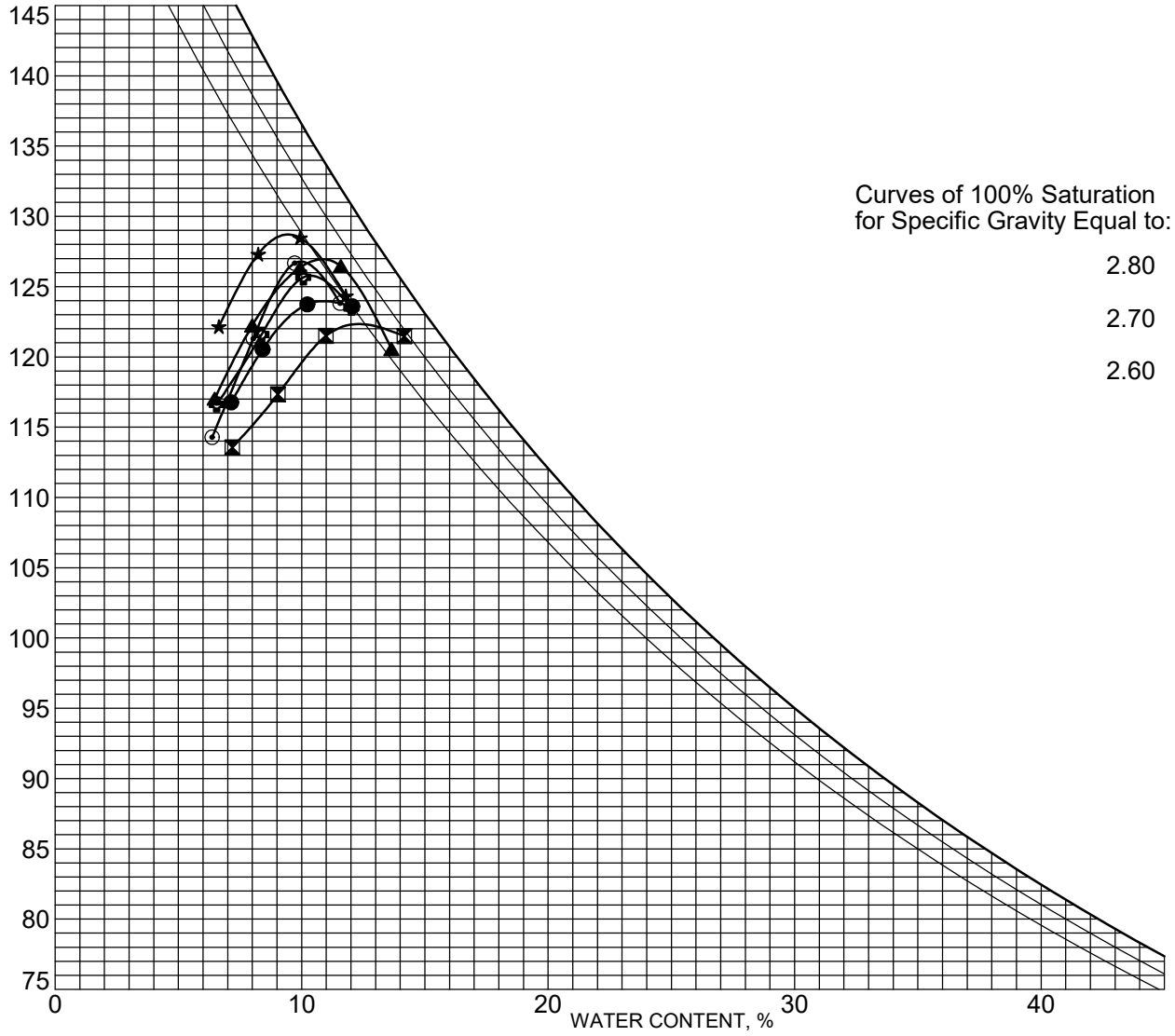
Borehole	Depth	Liquid Limit	Plastic Limit	Plasticity Index	Maximum Size (mm)	%<#200 Sieve	AASHTO Classification	USCS Class-ification	Water Content (%)	Avg. Water Content (%)	Dry Density (pcf)	Satur-ation (%)	Void Ratio
LSS - 11	5.0								13.0	14.5			
LSS - 12	2.0	26	14	12	9.5	61	A-6 (4)	CL	54.3	23.8			
LSS - 12	3.0								12.4	23.8			
LSS - 12	4.0								13.1	23.8			
LSS - 12	5.0								15.4	23.8			
LSS - 13	2.0	30	16	14	25	56	A-6 (5)	CL	17.3	17.1			
LSS - 13	3.0								15.2	17.1			
LSS - 13	4.0								15.4	17.1			
LSS - 13	5.0								20.5	17.1			
LSS - 14	2.0	54	21	33	25	90	A-7-6 (32)	CH	17.5	25.6			
LSS - 14	3.0								26.2	25.6			
LSS - 14	4.0								34.8	25.6			
LSS - 14	5.0								23.8	25.6			
LSS - 15	2.0	31	17	14	9.5	62	A-6 (6)	CL	10.0	15.2			
LSS - 15	3.0								15.3	15.2			
LSS - 15	4.0								16.4	15.2			
LSS - 15	5.0								19.1	15.2			
LSS - 16	2.0	29	16	13	25	55	A-6 (4)	CL	14.8	15.4			
LSS - 16	3.0								15.5	15.4			
LSS - 16	4.0								15.2	15.4			
LSS - 16	5.0								15.8	15.4			

MOISTURE-DENSITY RELATIONSHIP

NORTH DAKOTA DEPARTMENT OF TRANSPORATION
300 AIRPORT ROAD
BISMARCK, ND 58504

PROJECT NUMBER Scranton City Section **LOCATION** Bowman County

PCN



BOREHOLE		DEPTH	AASHTO Classification	USCS Description
●	**LSS - 1**	**2.0**	**A-6 (7)**	**SANDY LEAN CLAY(CL)**
⊠	**LSS - 2**	**2.0**	**A-2-6 (0)**	**CLAYEY SAND(SC)**
▲	**LSS - 3**	**2.0**	**A-2-4 (0)**	**CLAYEY SAND(SC)**
★	**LSS - 4**	**2.0**	**A-6 (5)**	**SANDY LEAN CLAY(CL)**
⊙	**LSS - 5**	**2.0**	**A-4 (0)**	**CLAYEY SAND(SC)**
✿	**LSS - 6**	**2.0**	**A-6 (1)**	**CLAYEY SAND(SC)**

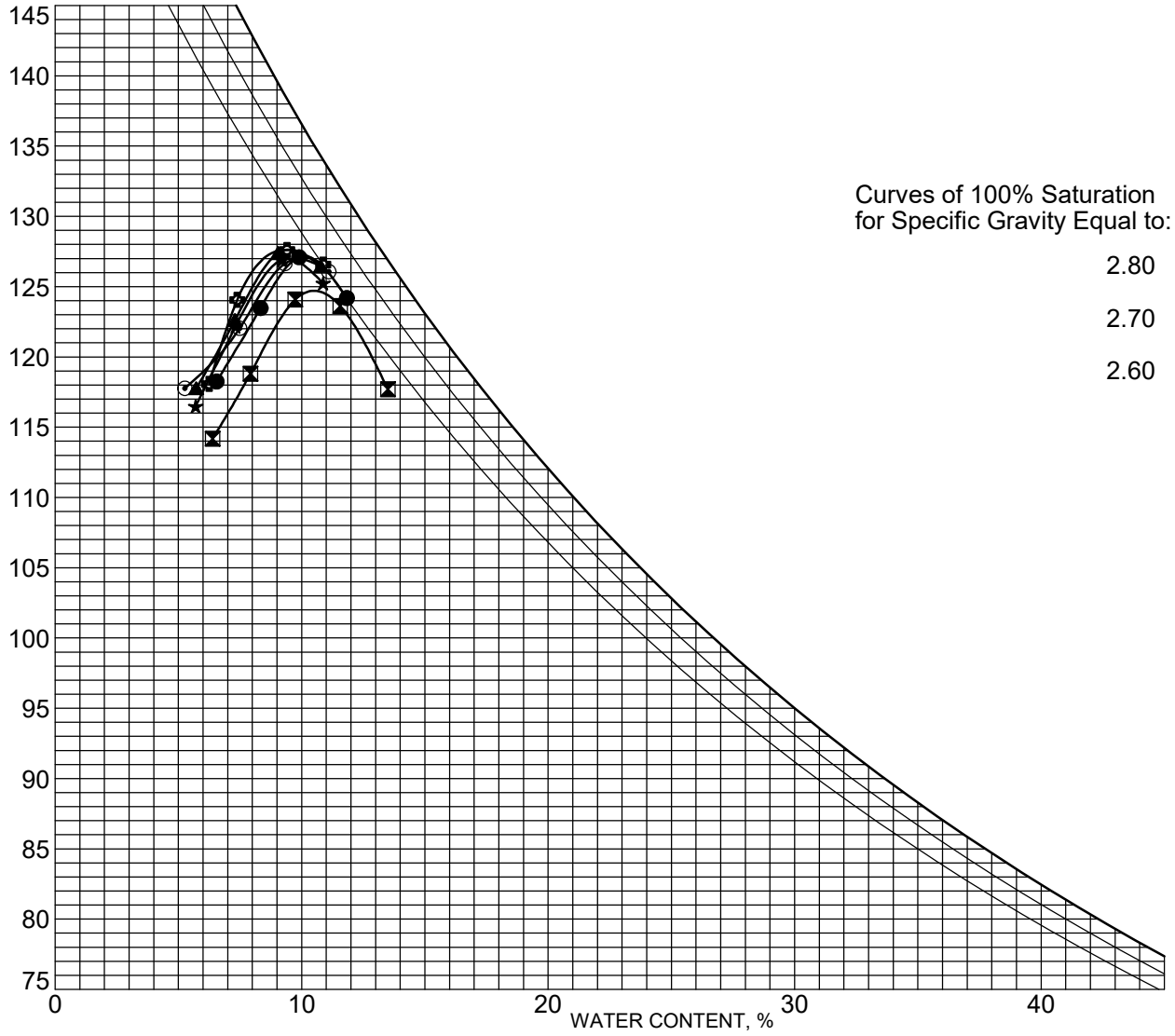
BOREHOLE		DEPTH	Test Method	LL	PL	PI	Max DD	Optimum WC
●	**LSS - 1**	**2.0**	**AASHTO T-180 Method A**	**32**	**18**	**14**	**124.0 PCF**	**10.9 %**
⊠	**LSS - 2**	**2.0**	**AASHTO T-180 Method A**	**29**	**17**	**12**	**122.3 PCF**	**12.3 %**
▲	**LSS - 3**	**2.0**	**AASHTO T-180 Method A**	**25**	**17**	**8**	**126.9 PCF**	**10.9 %**
★	**LSS - 4**	**2.0**	**AASHTO T-180 Method A**	**29**	**15**	**14**	**128.7 PCF**	**9.5 %**
⊙	**LSS - 5**	**2.0**	**AASHTO T-180 Method A**	**23**	**15**	**8**	**126.8 PCF**	**10.0 %**
✿	**LSS - 6**	**2.0**	**AASHTO T-180 Method A**	**27**	**16**	**11**	**125.8 PCF**	**10.4 %**

MOISTURE-DENSITY RELATIONSHIP

NORTH DAKOTA DEPARTMENT OF TRANSPORATION
300 AIRPORT ROAD
BISMARCK, ND 58504

PROJECT NUMBER Scranton City Section **LOCATION** Bowman County

PCN



BOREHOLE		DEPTH	AASHTO Classification	USCS Description
●	LSS - 7	2.0	A-4 (2)	CLAYEY SAND(SC)
⊠	LSS - 8	2.0	A-4 (1)	CLAYEY SAND(SC)
▲	LSS - 9	2.0	A-4 (1)	SANDY LEAN CLAY(CL)
★	LSS - 10	2.0	A-4 (1)	CLAYEY SAND(SC)
⊙	LSS - 11	2.0	A-6 (5)	SANDY LEAN CLAY(CL)
✿	LSS - 12	2.0	A-6 (4)	SANDY LEAN CLAY(CL)

BOREHOLE		DEPTH	Test Method	LL	PL	PI	Max DD	Optimum WC
●	LSS - 7	2.0	AASHTO T-180 Method A	25	15	10	127.2 PCF	10.1 %
⊠	LSS - 8	2.0	AASHTO T-180 Method A	26	18	8	124.7 PCF	10.5 %
▲	LSS - 9	2.0	AASHTO T-180 Method A	24	16	8	127.6 PCF	9.5 %
★	LSS - 10	2.0	AASHTO T-180 Method A	24	16	8	127.0 PCF	9.5 %
⊙	LSS - 11	2.0	AASHTO T-180 Method A	28	16	12	127.0 PCF	9.9 %
✿	LSS - 12	2.0	AASHTO T-180 Method A	26	14	12	127.6 PCF	9.3 %

MOISTURE-DENSITY RELATIONSHIP

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BISMARCK, ND 58504

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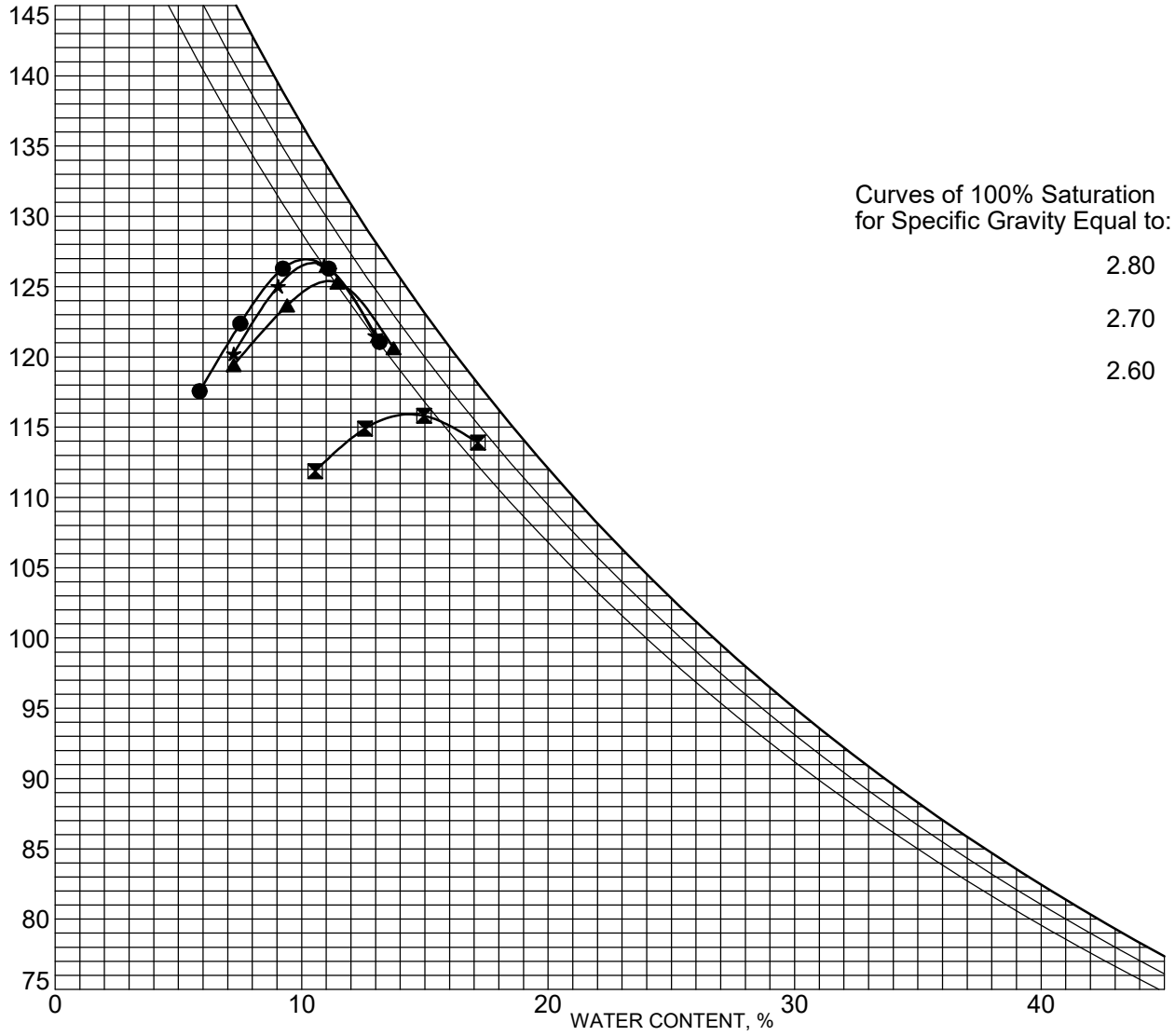


	BOREHOLE	DEPTH	AASHTO Classification	USCS Description
●	**LSS - 13**	**2.0**	**A-6 (5)**	**SANDY LEAN CLAY(CL)**
⊠	**LSS - 14**	**2.0**	**A-7-6 (32)**	**FAT CLAY(CH)**
▲	**LSS - 15**	**2.0**	**A-6 (6)**	**SANDY LEAN CLAY(CL)**
★	**LSS - 16**	**2.0**	**A-6 (4)**	**SANDY LEAN CLAY(CL)**

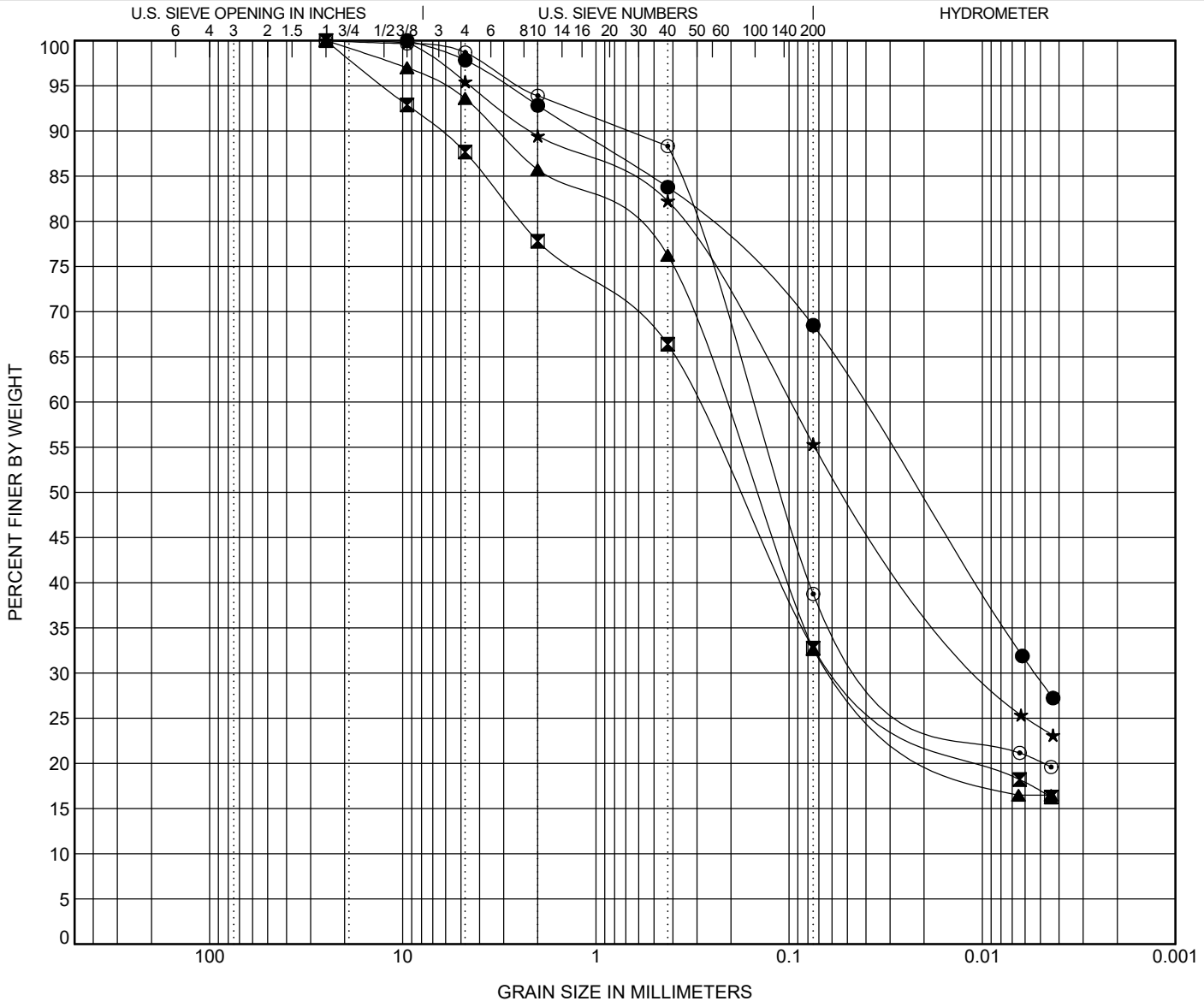
	BOREHOLE	DEPTH	Test Method	LL	PL	PI	Max DD	Optimum WC
●	**LSS - 13**	**2.0**	**AASHTO T-180 Method A**	**30**	**16**	**14**	**126.9 PCF**	**10.2 %**
⊠	**LSS - 14**	**2.0**	**AASHTO T-180 Method A**	**54**	**21**	**33**	**115.9 PCF**	**14.3 %**
▲	**LSS - 15**	**2.0**	**AASHTO T-180 Method A**	**31**	**17**	**14**	**125.4 PCF**	**11.1 %**
★	**LSS - 16**	**2.0**	**AASHTO T-180 Method A**	**29**	**16**	**13**	**126.7 PCF**	**10.5 %**

GRAIN SIZE DISTRIBUTION

NORTH DAKOTA DEPARTMENT OF TRANSPORATION
300 AIRPORT ROAD
BISMARCK, ND 58504

PROJECT NUMBER Scranton City Section **LOCATION** Bowman County

PCN



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

BOREHOLE	DEPTH	AASHTO Classification	USCS Classification	LL	PL	PI	Cc	Cu
● LSS - 1	2.0	A-6 (7)	CL	32	18	14		
⊠ LSS - 2	2.0	A-2-6 (0)	SC	29	17	12		
▲ LSS - 3	2.0	A-2-4 (0)	SC	25	17	8		
★ LSS - 4	2.0	A-6 (5)	CL	29	15	14		
⊙ LSS - 5	2.0	A-4 (0)	SC	23	15	8		

BOREHOLE	DEPTH	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
● LSS - 1	2.0	9.5	0.042	0.005		2.2	29.4	39.3	29.1
⊠ LSS - 2	2.0	25	0.306	0.047		12.3	54.9	15.8	16.9
▲ LSS - 3	2.0	25	0.223	0.051		6.4	61.0	16.1	16.5
★ LSS - 4	2.0	25	0.101	0.009		4.5	40.1	31.3	24.0
⊙ LSS - 5	2.0	25	0.158	0.022		1.3	59.9	18.6	20.1

GRAIN SIZE DISTRIBUTION

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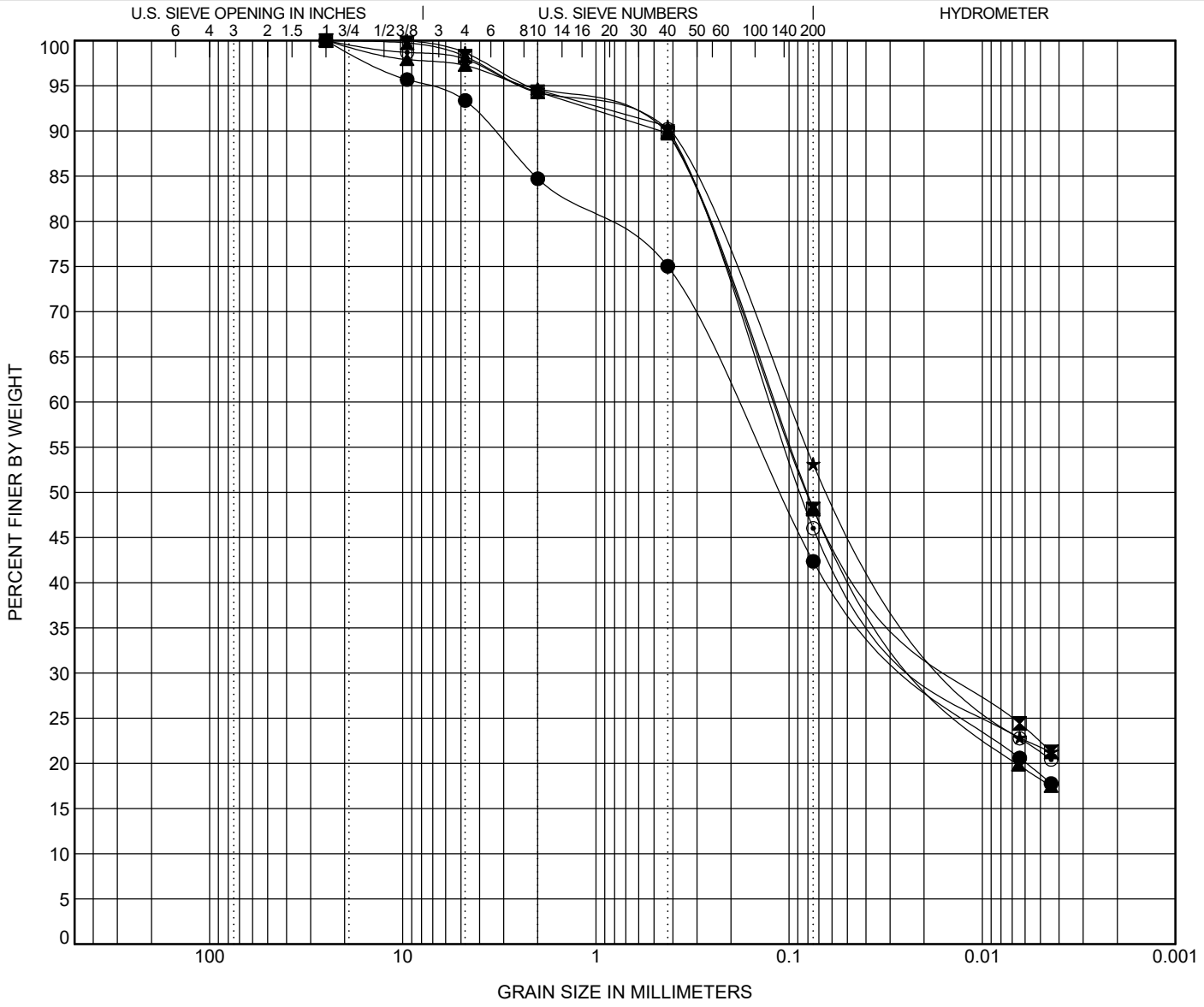

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	BOREHOLE	DEPTH	AASHTO Classification	USCS Classification	LL	PL	PI	Cc	Cu
●	**LSS - 6**	**2.0**	**A-6 (1)**	**SC**	**27**	**16**	**11**		
⊠	**LSS - 7**	**2.0**	**A-4 (2)**	**SC**	**25**	**15**	**10**		
▲	**LSS - 8**	**2.0**	**A-4 (1)**	**SC**	**26**	**18**	**8**		
★	**LSS - 9**	**2.0**	**A-4 (1)**	**CL**	**24**	**16**	**8**		
⊙	**LSS - 10**	**2.0**	**A-4 (1)**	**SC**	**24**	**16**	**8**		

	BOREHOLE	DEPTH	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**LSS - 6**	**2.0**	**25**	**0.191**	**0.019**		**6.6**	**51.0**	**23.6**	**18.7**
⊠	**LSS - 7**	**2.0**	**25**	**0.123**	**0.011**		**1.7**	**50.1**	**25.8**	**22.4**
▲	**LSS - 8**	**2.0**	**25**	**0.122**	**0.016**		**2.7**	**49.0**	**30.0**	**18.2**
★	**LSS - 9**	**2.0**	**9.5**	**0.103**	**0.011**		**1.3**	**45.5**	**31.3**	**21.8**
⊙	**LSS - 10**	**2.0**	**25**	**0.13**	**0.014**		**2.0**	**51.9**	**24.8**	**21.2**

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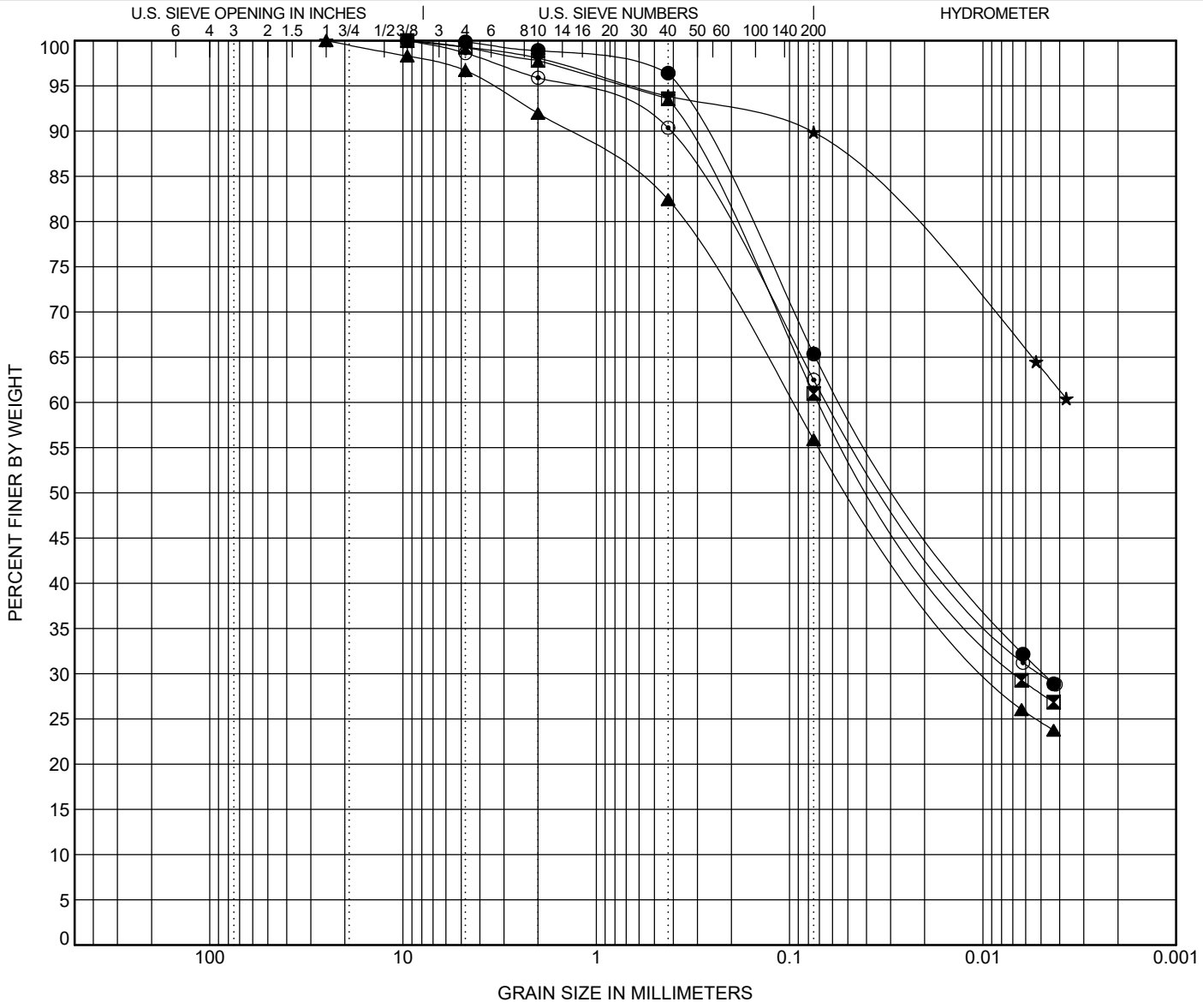

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

BOREHOLE	DEPTH	AASHTO Classification	USCS Classification	LL	PL	PI	Cc	Cu
● LSS - 11	2.0	A-6 (5)	CL	28	16	12		
⊠ LSS - 12	2.0	A-6 (4)	CL	26	14	12		
▲ LSS - 13	2.0	A-6 (5)	CL	30	16	14		
★ LSS - 14	2.0	A-7-6 (32)	CH	54	21	33		
⊙ LSS - 15	2.0	A-6 (6)	CL	31	17	14		

BOREHOLE	DEPTH	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
● LSS - 11	2.0	9.5	0.05	0.005		0.1	34.5	35.1	30.2
⊠ LSS - 12	2.0	9.5	0.07	0.007		0.7	38.3	33.2	27.8
▲ LSS - 13	2.0	25	0.098	0.009		3.3	40.8	31.2	24.7
★ LSS - 14	2.0	25				0.7	9.4	26.1	63.8
⊙ LSS - 15	2.0	9.5	0.062	0.005		1.4	36.1	32.6	29.9

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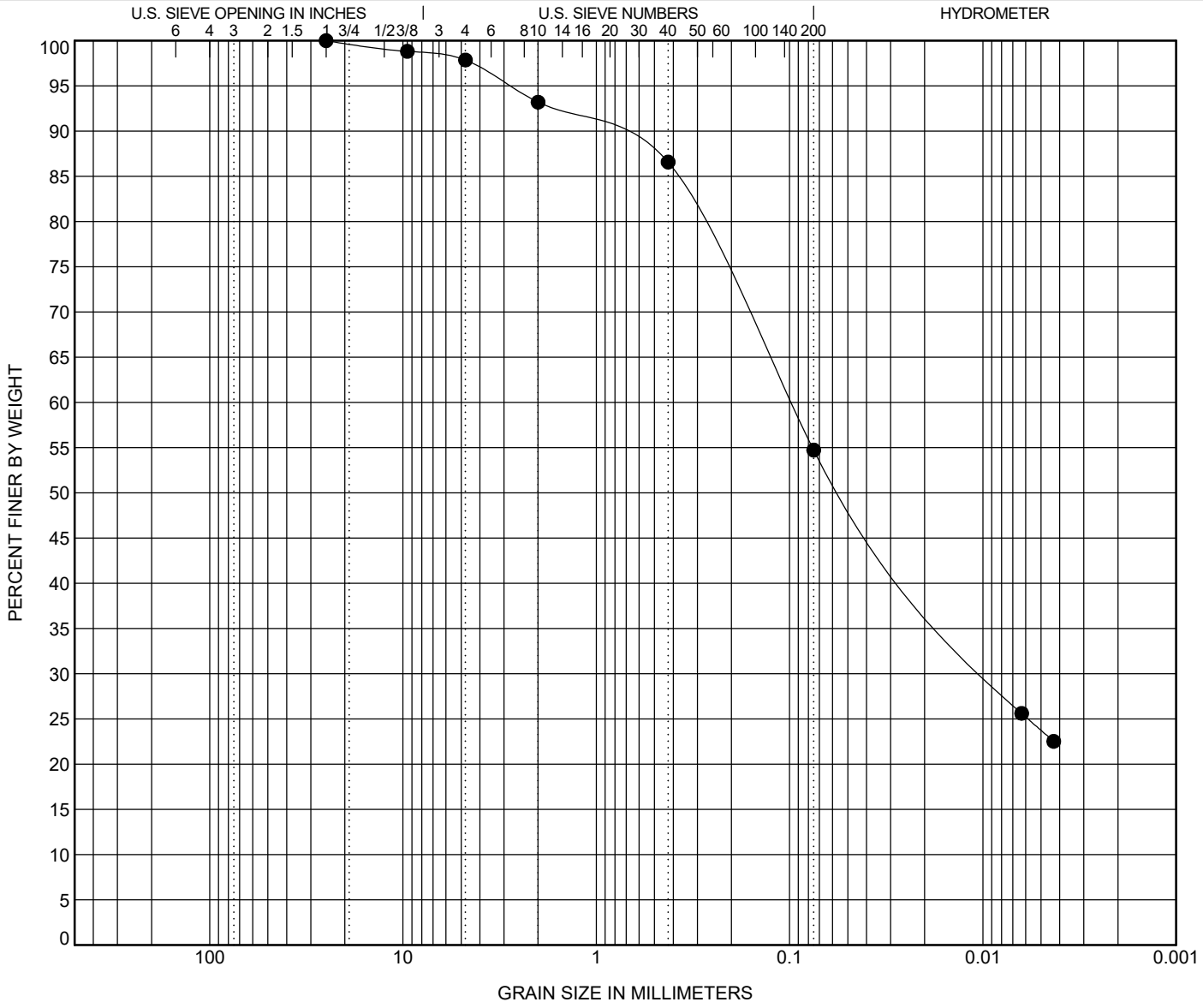

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	BOREHOLE	DEPTH	AASHTO Classification	USCS Classification	LL	PL	PI	Cc	Cu
●	**LSS - 16**	**2.0**	**A-6 (4)**	**CL**	**29**	**16**	**13**		

	BOREHOLE	DEPTH	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**LSS - 16**	**2.0**	**25**	**0.1**	**0.009**		**2.1**	**43.1**	**31.0**	**23.7**

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