AMERICAN ENGINEERING TESTING, INC.

CONSULTANTS
· ENVIRONMENTAL
· GEOTECHNICAL
· MATERIALS
· FORENSICS

March 19, 2020

Mr. Tony Rotchadl, PE
Bolton & Menk, Inc.
1960 Premier Drive
Mankato, MN 56001
Anthony.Rotchadl@bolton-menk.com

RE: Geotechnical Exploration and Review
TH 60
Madison Lake to Waterville, Minnesota
AET #08-20562

Dear Mr. Rotchadl:

This letter report presents the results of the seismic CPTu soundings, hand auger borings, and standard penetration test borings conducted between February 3, 2020 to March 5, 2020; along State Highway 60 between Madison Lake and Waterville, Minnesota. The work was performed under our proposal dated January 9, 2020 which your authorized-on January 13, 2020. The scope of work authorized included the following:

- Two (2) standard penetration test borings to a depth of 30 feet.
- Push fourteen (14) seismic CPTu sounding to a depth of 30 feet.
- Four (4) hand auger borings to a depth of 10 inches.
- Soil laboratory testing (Unconfined compressive strength, water content, moisture density).
- Preparation of this letter report

We have included one electronic and hard copies of our report.

1.0 Project Information
The CPTu soundings, SPT soil borings, and hand auger soil borings were advanced at the locations provided by MnDOT. Proposed locations 5, 14, and 15 were either eliminated or not accessible to our equipment. Location 13 had only the SPT soil boring performed. The CPT rig got stuck trying to access location 13 and had to be towed from the ditch.

2.0 Site Exploration
Logs of the test borings are attached. The logs contain information concerning soil layering, soil classification, geologic description, and moisture condition. Relatively density or consistency is also noted, which is based on the standard penetration resistance (N-value).

We refer you to the standard sheet entitled "Exploration/Classification Methods" for details on the drilling and the sampling methods, and the water level measurement methods. Data sheets concerning the Unified Soils Classification System, the descriptive terminology, and the symbols used on the boring logs are also attached.

The hand auger test boring locations are shown on Figure 2. The CPTu and SPT boring locations and surface elevations were recorded by MnDOT and are included on the boring logs. The coordinates and elevations of the hand auger borings were not recorded.

3.0 Conditions Encountered

3.1 Hand Auger Boring Soils

The hand auger borings were advanced to document the existing aggregate base thickness on two gravel surfaced roads adjacent to Minnesota State Highway 60 near Elysian, Minnesota. Hand auger borings 1A and 1B were performed on Warner Lane and hand augers 2A and 2 B were performed on 516th Street as shown on Figure 2.

Hand auger borings 1A and 1B encountered 4¼ inches of brown loamy sand with gravel at the surface underlain by dark brown and black, sandy clay. Hand auger borings 2A and 2B encountered 4½ inches of brown loamy sand with gravel at the surface underlain by slightly organic, brown and black, sandy clay. Based on our experience we estimate a conservative MnDOT Soil Factor value of 130 for the softer sandy clay subgrade soils encountered.

3.2 Groundwater

The depth or lack of subsurface water noted at the boring locations should not be taken as an accurate representation of the actual subsurface water levels. A long period of time is generally required for groundwater to stabilize in the impermeable soils generally present at the site; this period of time is generally not available during a typical subsurface exploration program.

4.0 Additional Exploration and Review

We have not been authorized at this time to provide specific pavement or earthwork recommendations. As additional project details become available, please contact us for specific design recommendations.

5.0 Limitations

Within the limitations of scope, budget, and schedule, our services have been conducted according to generally accepted geotechnical engineering practices at this time and location. Other than this, no warranty, either expressed or implied, is intended.

Important information regarding risk management and proper use of this report is given in the attached sheet entitled "Geotechnical Report Limitations and Guidelines for Use".

6.0 Remarks

We appreciate being giving the opportunity to work with you on your project. If you have any questions regarding the work reported herein, please do not hesitate to contact us at (507) 387-2222 or gguyer@amengtest.com.

Sincerely,
American Engineering Testing, Inc.

Gregory A. Guyer, PE
Manager – Mankato
MN Reg. No. 44618
gguyer@amengtest.com

Report Reviewed By:
American Engineering Testing, Inc.

Steven J. Ruesink, PE
Regional Manager
MN Reg. No. 19431
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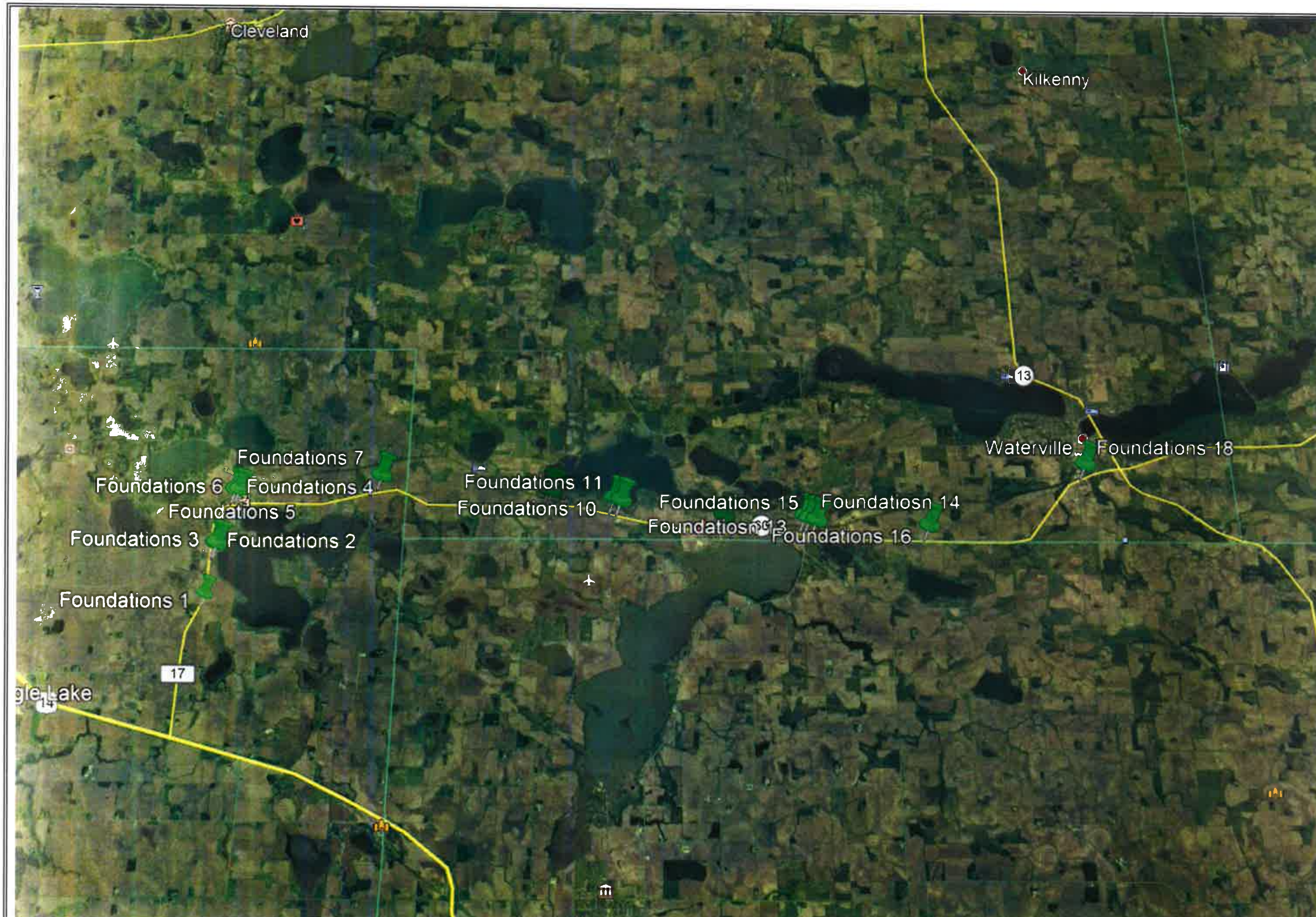
GAG/SJR/lmh

Attachments

- Figure 1 – Site Location
- Figure 2 – Hand Auger Boring Locations
- Subsurface SPT Boring Logs
- Subsurface CPT Boring Logs
- Lab Test Results
- Exploration/Classification Methods
- Boring Log Notes
- Unified Soil Classification System
- Geotechnical Report Limitations and Guidelines For Use



AMERICAN ENGINEERING TESTING, INC.

Project	Highway 60 Elysian, MN	Subject:	Site Location	AET Job No:	08-20562	Date:	March 17, 2020
Scale:	NTS	Drawn By:	GG	Checked By:	SR	Figure 1	

AMERICAN ENGINEERING TESTING, INC.	Project	Highway 60 (Warren Ln) Elysian, MN	Subject:	Boring Locations	AET Job No:	08-20562	Date:	March 17, 2020
	Scale:	NTS	Drawn By:	GG	Checked By:	SR	Figure 2	

AMERICAN ENGINEERING TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **08-20562** LOG OF BORING NO. **1A (p. 1 of 1)**

PROJECT: **Trunk Highway 60; Madison Lake to Waterville, MN**

DEPTH IN FEET	SURFACE ELEVATION: MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	WC	DEN	LL	PL	qp
	4.25" FILL, loamy sand w/gravel, brown and dark brown (LS)	FILL		M	HA						
	5.75" FILL, sandy clay, a little gravel, dark brown and black (SC)			M	HA		17				
	END OF BORING										

DEPTH:	DRILLING METHOD	DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
0-10"	**4" HA**							
Centerline		**3/5/20**		**10"**	**None**	**10"**	**None**	**None**
BORING COMPLETED: **3/5/20**								
DR: **SS** LG: **BB** Rig:								

WATER LEVEL MEASUREMENTS

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

AET_CORP 08-20562 TRUNK HIGHWAY 60.GPJ AET+CPT+WELL.GDT 3/19/20

AMERICAN ENGINEERING TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **08-20562** LOG OF BORING NO. **1B (p. 1 of 1)**

PROJECT: **Trunk Highway 60; Madison Lake to Waterville, MN**

DEPTH IN FEET	SURFACE ELEVATION: MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	WC	DEN	LL	PL	qp
	4.25" FILL, sand w/gravel, brown (S)	FILL		M	HA						
	5.75" FILL, sandy clay, brown and black (SC)			M	HA		20				
	END OF BORING										

DEPTH:	DRILLING METHOD	DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
0-10"	**4" HA**							
Shoulder PI		**3/5/20**		**10"**	**None**	**10"**	**None**	**None**
BORING COMPLETED: **3/5/20**								
DR: **SS** LG: **BB** Rig:								

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

AET_CORP 08-20562 TRUNK HIGHWAY 60.GPJ AET+CPT+WELL.GDT 3/19/20

AMERICAN ENGINEERING TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **08-20562** LOG OF BORING NO. **2A (p. 1 of 1)**

PROJECT: **Trunk Highway 60; Madison Lake to Waterville, MN**

DEPTH IN FEET	SURFACE ELEVATION: MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS: WC	DEN	LL	PL	qp
	4.5" FILL, sand w/gravel, brown (S)	FILL		M	HA						
	5.5" FILL, sandy clay, slightly organic, black and brown (SC)			M	HA		21				
	END OF BORING										

DEPTH:	DRILLING METHOD	DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
0-10"	**4" HA**							
Centerline		**3/5/20**		**10"**	**None**	**10"**	**None**	**None**

BORING COMPLETED: **3/5/20**

DR: **SS** LG: **BB** Rig:

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

AET_CORP 08-20562 TRUNK HIGHWAY 60.GPJ AET+CPT+WELL.GDT 3/19/20

AMERICAN ENGINEERING TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **08-20562** LOG OF BORING NO. **2B (p. 1 of 1)**

PROJECT: **Trunk Highway 60; Madison Lake to Waterville, MN**

DEPTH IN FEET	SURFACE ELEVATION: MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	WC	DEN	LL	PL	qp
	4.5" FILL, sand w/gravel, brown (S)	FILL		M	HA						
	5.5" FILL, sandy clay, slightly organic, black and brown (SC)			M	HA		22				
	END OF BORING										

DEPTH: DRILLING METHOD	WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
0-10" **4" HA**	DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
Shoulder PI	**3/5/20**		**10"**	**None**	**10"**	**None**	**None**	
BORING COMPLETED: **3/5/20**								
DR: **SS** LG: **BB** Rig:								

AET_CORP 08-20562 TRUNK HIGHWAY 60.GPJ AET+CPT+WELL.GDT 3/19/20

AMERICAN ENGINEERING TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **08-20562** LOG OF BORING NO. **B-13 (p. 1 of 1)**

PROJECT: **Trunk Highway 60; Madison Lake to Waterville, MN**

SURFACE ELEVATION: **1018.850'** Co. Coordinates: N **101599.94** E **363633.978**

DEPTH IN FEET	ELEV. FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	WC	DEN	LL	PL	qp
0–2		ORGANIC CLAY LOAM, black (C)	SWAMP DEPOSIT		W	SU		80				
2–7		HIGHLY ORGANIC CLAY LOAM, black (C)		WH	M	SS	14	211				
				WH	M	SS	0					
7–9.5		ORGANIC CLAY LOAM, black (C)		WH	M	SS	19	74				
9.5–14.5		LOAMY SAND, gray (LS)	COARSE ALLUVIUM		W	TW	0					
				2	W	SS	4					
14.5–31		SAND, gray (S)		13	W	SS	18					
				8	W	SS	14					
				17	W	SS	16					
				11	W	SS	16					
				12	W	SS	8					
				14	W	SS	18					
				13	W	SS	17					
31		**END OF BORING**										

DEPTH:	DRILLING METHOD	WATER LEVEL MEASUREMENTS						
		DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
0-29½'	**3.25" HSA**	**2/25/20**	**2:30**	**31'**	**29.5'**	**29'**	**None**	**12.1'**
		2/25/20	**2:45**	**31'**	**29.5'**	**28.5'**	**None**	**11.7'**

BORING COMPLETED: **2/25/20**

DR: **GH** LG: **SB** Rig: **27R**

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

AET_CORP W-ELEV AND COORD 08-20562 TRUNK HIGHWAY 60.GPJ AET+CPT+WELL.GDT 3/19/20

AMERICAN ENGINEERING TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **08-20562** LOG OF BORING NO. **B-4 (p. 1 of 1)**

PROJECT: **Trunk Highway 60; Madison Lake to Waterville, MN**

SURFACE ELEVATION: **1023.976'** Co. Coordinates: N **103748.117** E **320127.957**

DEPTH IN FEET	ELEV. FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS WC	DEN	LL	PL	qp
0–2		FILL, organic clay loam, dark brown and black (CL)	FILL		W	SU		94				
2–4		Fill, sandy clay loam, brown and gray (SCL)		2	W	SS	18	28				
4–10		PEAT, black (PT)	SWAMP DEPOSIT	2	M	SS	10	370				
				WH	M	SS	8	205				
10–14		MARL TEXTURAL CLASSICATION: CLAY, gray w/white shells (C)			M	TW	14	48	68			
				WH	M	SS	24	61				
14–19		CLAY, gray, lenses of sand (C)	FINE ALLUVIUM		M	TW	20	35	86			
				6	M	SS	10	31				
19–33		SANDY CLAY LOAM, gray (SCL)	TILL		M	TW	20	25	99			
				8	M	SS	24	22				
					M	TW	22	24	103			
				7	▼	SS	18					
					▽ M	TW	24	24	102			
				11	M	SS	18					
33		**END OF BORING**										

DEPTH:	DRILLING METHOD	WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
0-29½'	**3.25" HSA**	DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
		2/25/20	**12:50**	**33'**	**29.5'**	**31.5'**	**None**	**30.5'**	
		2/25/20	**1:05**	**33'**	**29.5'**	**31.5'**	**None**	**28.3'**	
BORING COMPLETED: **2/25/20**									
DR: **GH** LG: **SB** Rig: **27R**									

AET_CORP W-ELEV AND COORD 08-20562 TRUNK HIGHWAY 60.GPJ AET+CPT+WELL.GDT 3/19/20

MINNESOTA DEPARTMENT OF TRANSPORTATION - GEOTECHNICAL SECTION

AMERICAN ENGINEERING TESTING, INC.

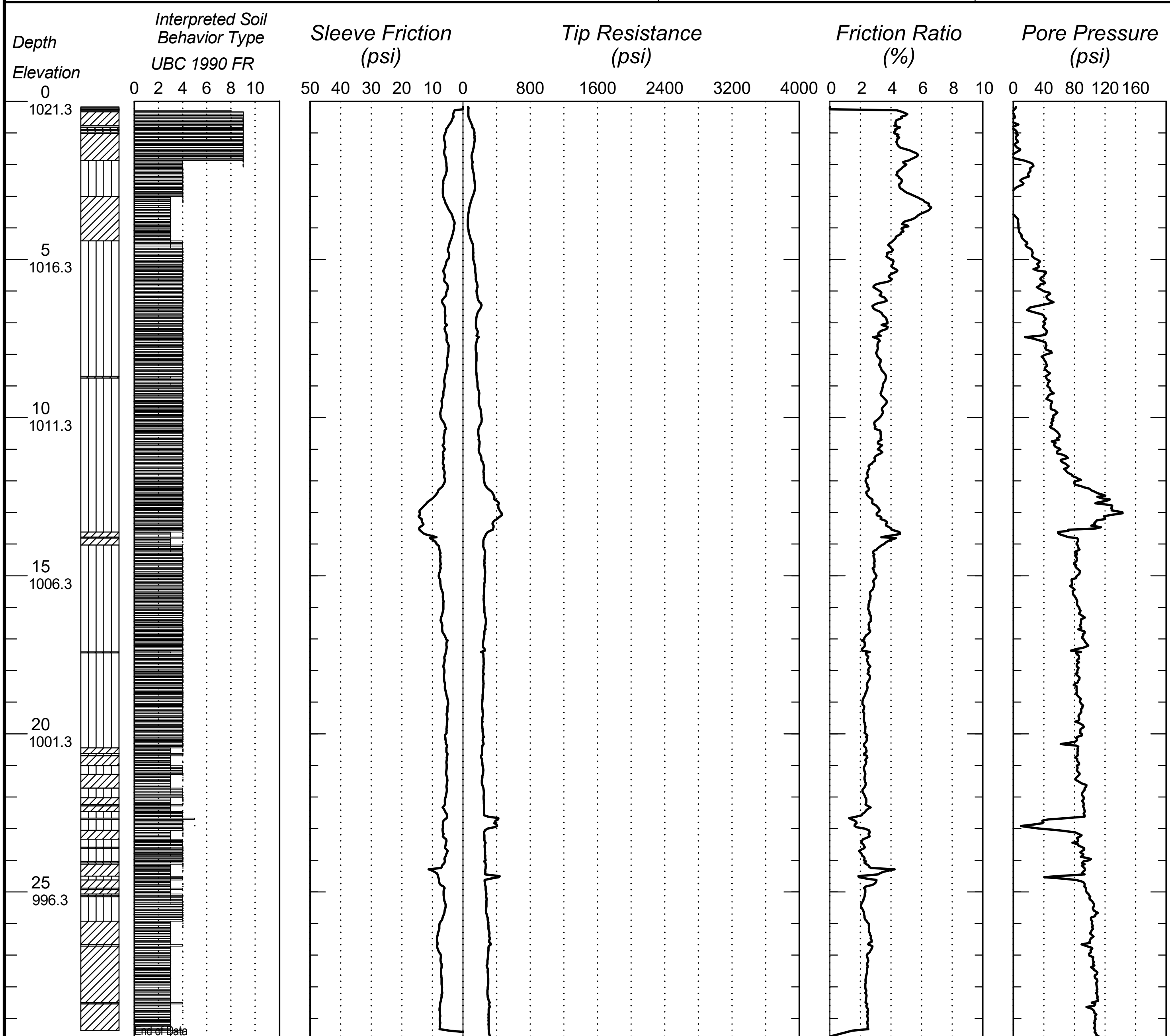
This sounding was taken by American Engineering Testing.

CONE PENETRATION TEST RESULTS

UNIQUE NUMBER

State Project	Bridge No. or Job Desc.	Trunk Highway/Location	Sounding No.	Ground Elevation
4006-35		**60**	**C-01**	**1021.3** *(Surveyed)*

Location Le Sueur County Coordinate System **X=318700 Y=95727**	*CPT Machine* **21**	*SHEET 1 of 1*
	CPT Operator **Adams**	*Date Completed* **2/3/20**
Latitude (North)= *Longitude (West)=*	*Hole Type* **CPT-STD**	



Bottom of Hole 29.72

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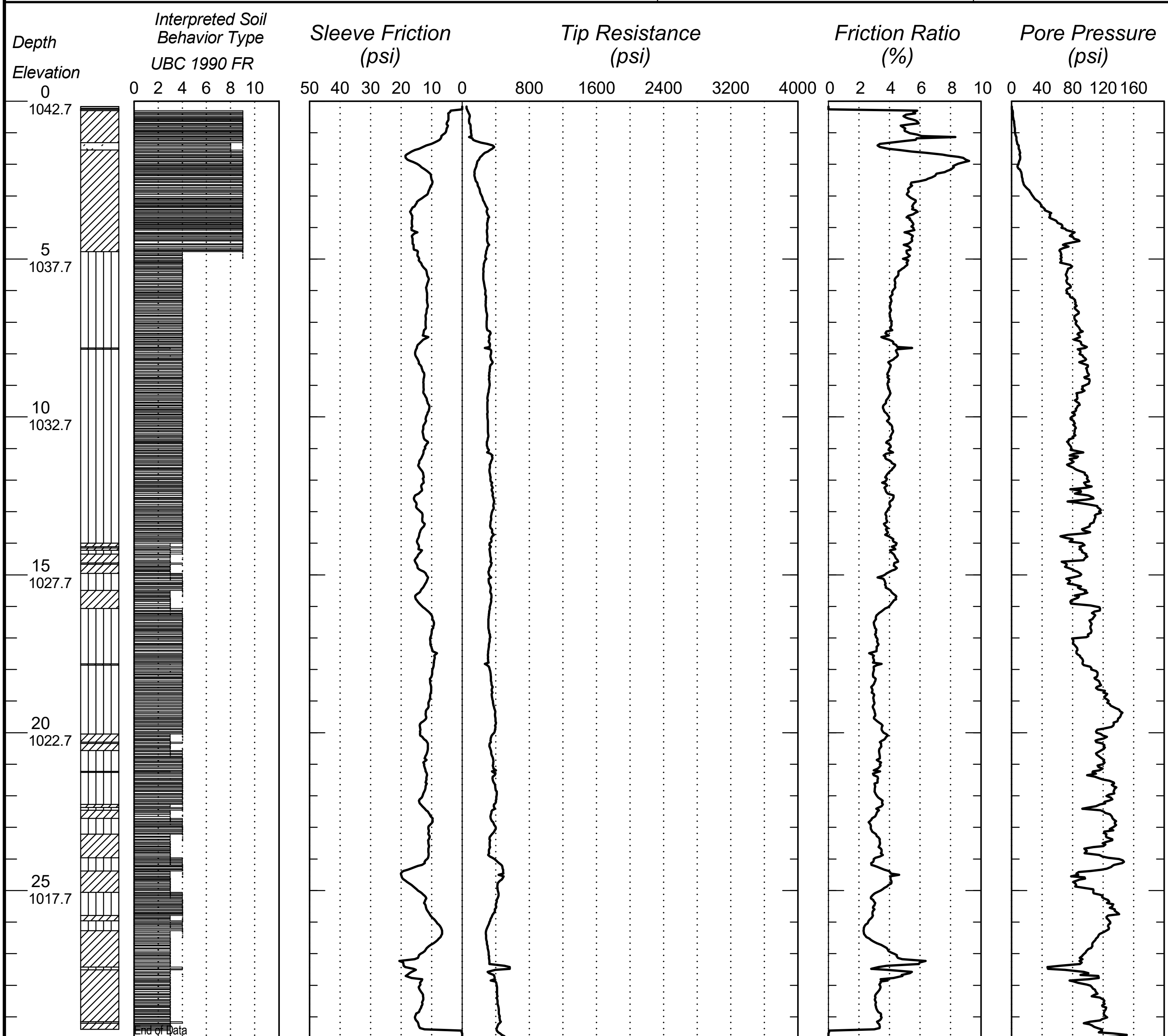
CONE PENETRATION TEST RESULTS

UNIQUE NUMBER

State Project	Bridge No. or Job Desc.	Trunk Highway/Location	Sounding No.	Ground Elevation
4006-35		**60**	**C-02**	**1042.7** *(Surveyed)*

Location Le Sueur County Coordinate System	*CPT Machine* **21**	*SHEET 1 of 1*
X=319060 Y=99390	*CPT Operator* **Adams**	*Date Completed*
Latitude (North)= *Longitude (West)=*	*Hole Type* **CPT-STD**	**2/3/20**



Bottom of Hole 29.74

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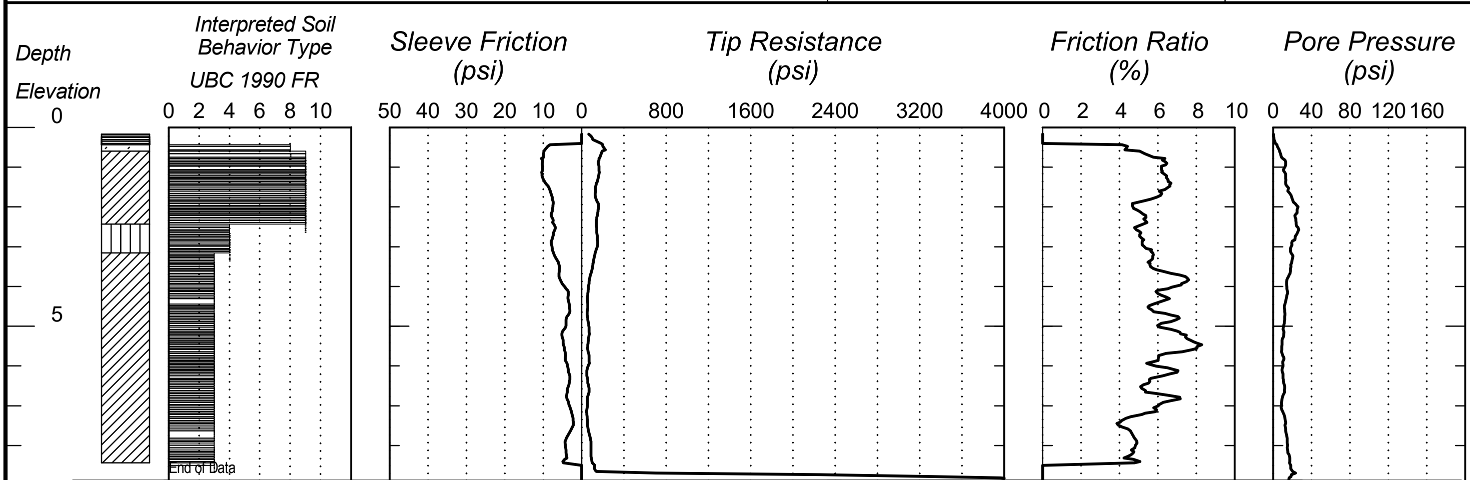
UNIQUE NUMBER

State Project	Bridge No. or Job Desc.	Trunk Highway/Location	Sounding No.	Ground Elevation
4006-35		**60**	**C-03**	(from Plan)

Location: Le Sueur County Coordinate System **X=319195 Y=99379**	CPT Machine **21**	SHEET 1 of 1
Latitude (North)= Longitude (West)=	CPT Operator **Adams**	Date Completed
	Hole Type **CPT-STD**	**2/3/20**



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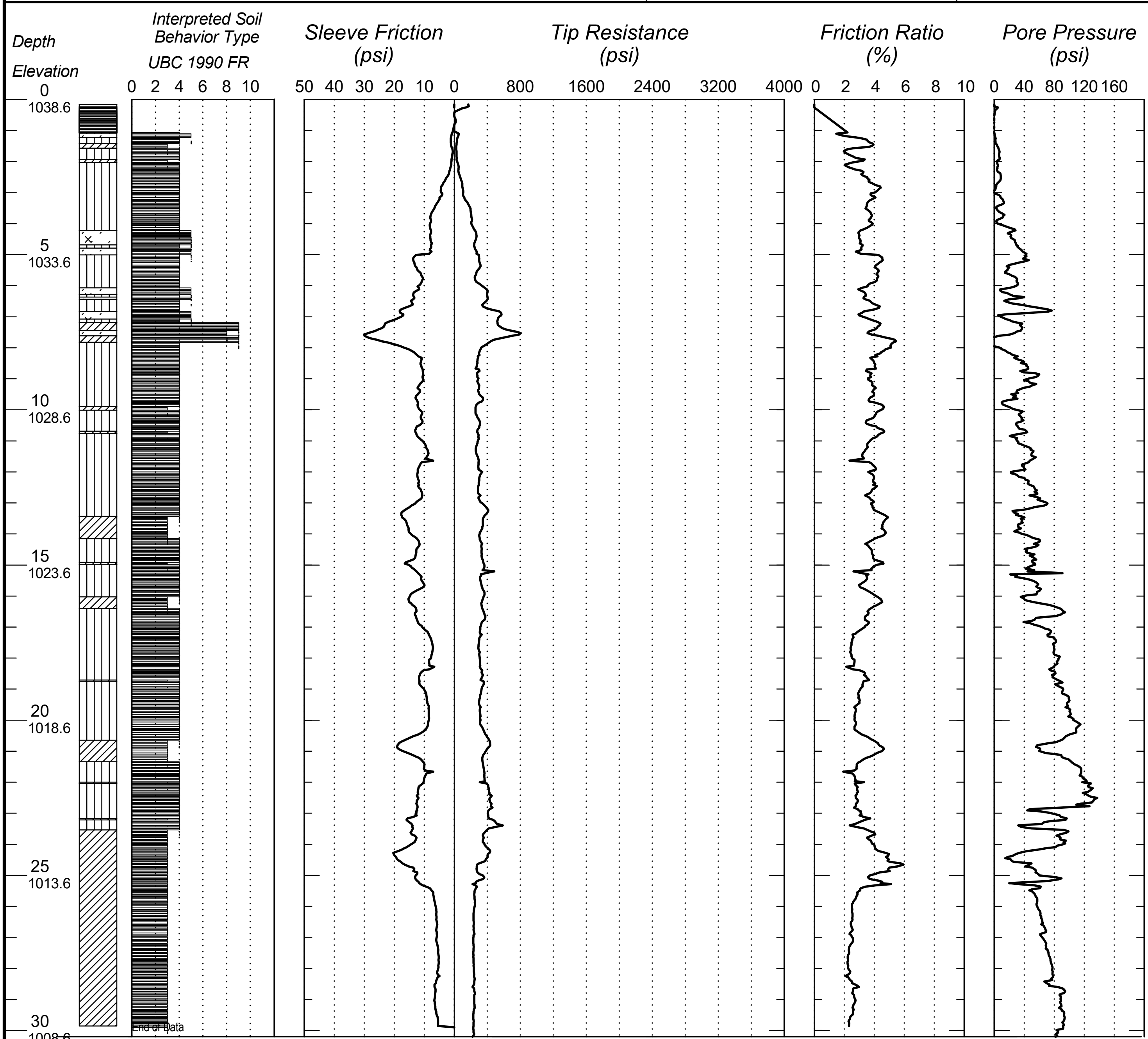
UNIQUE NUMBER

State Project	Bridge No. or Job Desc.	Trunk Highway/Location	Sounding No.	Ground Elevation
4006-35		**60**	**C-03A**	**1038.6** *(Surveyed)*

Location Le Sueur County Coordinate System **X=319194 Y=99365**	*CPT Machine* **21**	*SHEET 1 of 1*
Latitude (North)= *Longitude (West)=*	*CPT Operator* **Adams**	*Date Completed* **2/6/20**
	Hole Type **CPT-STD**	



Bottom of Hole 30.2

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UNIQUE NUMBER

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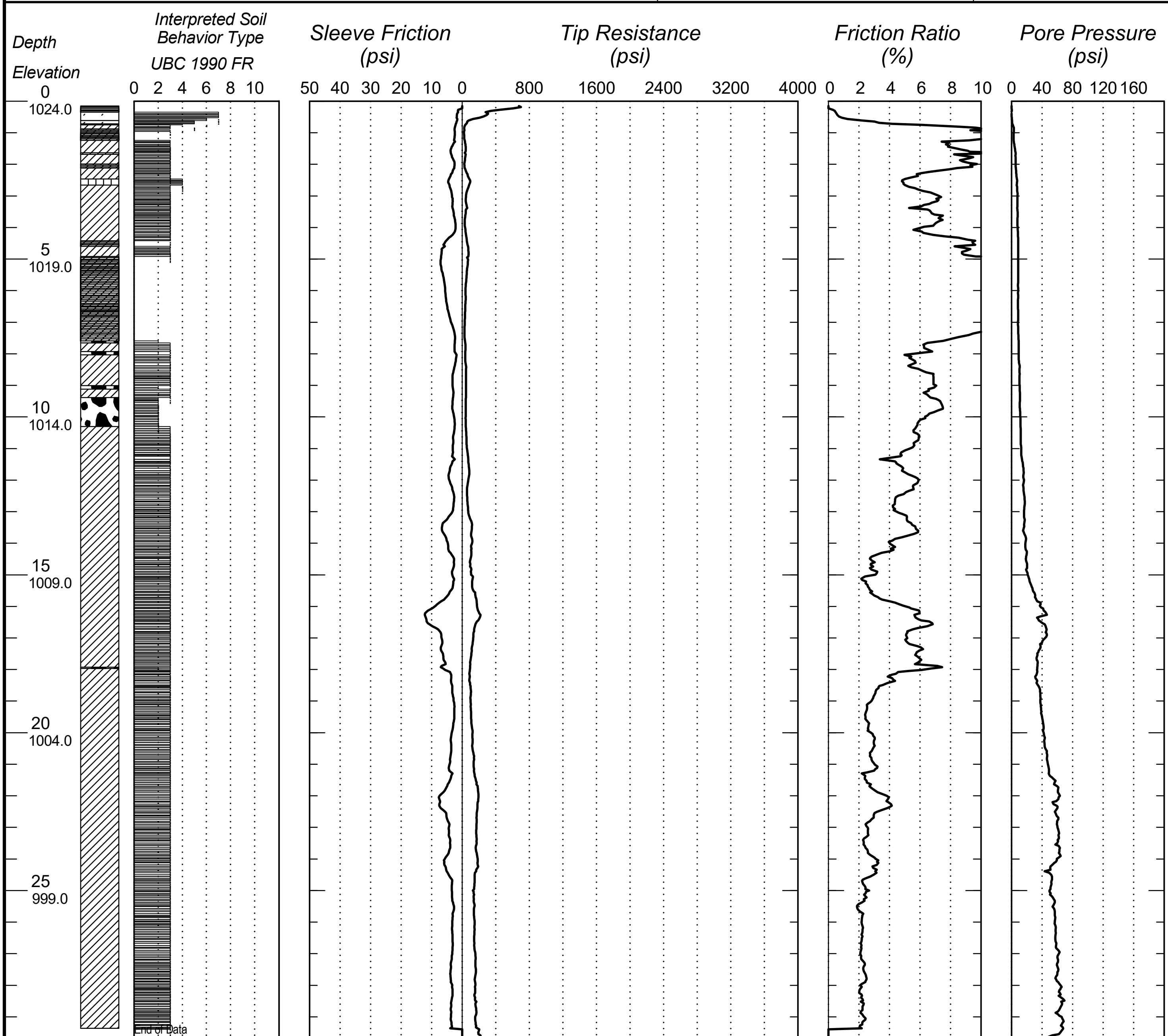
State Project	Bridge No. or Job Desc.	Trunk Highway/Location	Sounding No.	Ground Elevation
4006-35		**60**	**C-04**	**1024.0** (Surveyed)

Location Le Sueur County Coordinate System	CPT Machine **21**	SHEET 1 of 1
X=320128 Y=103748	CPT Operator **Adams**	Date Completed
Latitude (North)= Longitude (West)=	Hole Type **CPT-STD**	**2/3/20**



Bottom of Hole 29.72

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CONE PENETRATION TEST RESULTS

UNIQUE NUMBER

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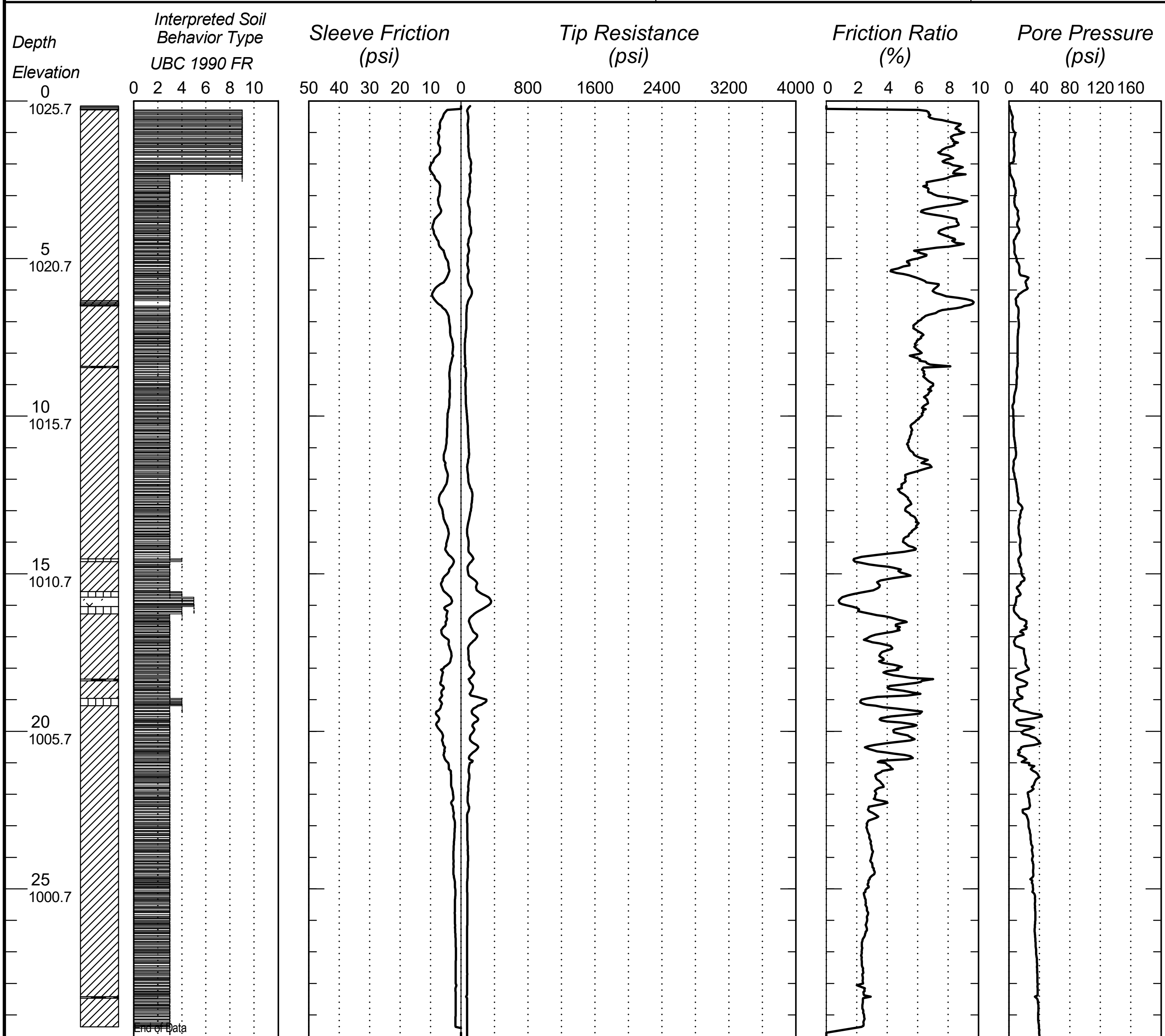
State Project	Bridge No. or Job Desc.	Trunk Highway/Location	Sounding No.	Ground Elevation
4006-35		**60**	**C-06**	**1025.7** (Surveyed)

Location Le Sueur County Coordinate System **X=320479 Y=103847**	CPT Machine **21**	SHEET 1 of 1
	CPT Operator **Adams**	Date Completed
Latitude (North)= Longitude (West)=	Hole Type **CPT-STD**	**2/3/20**



Bottom of Hole 29.73

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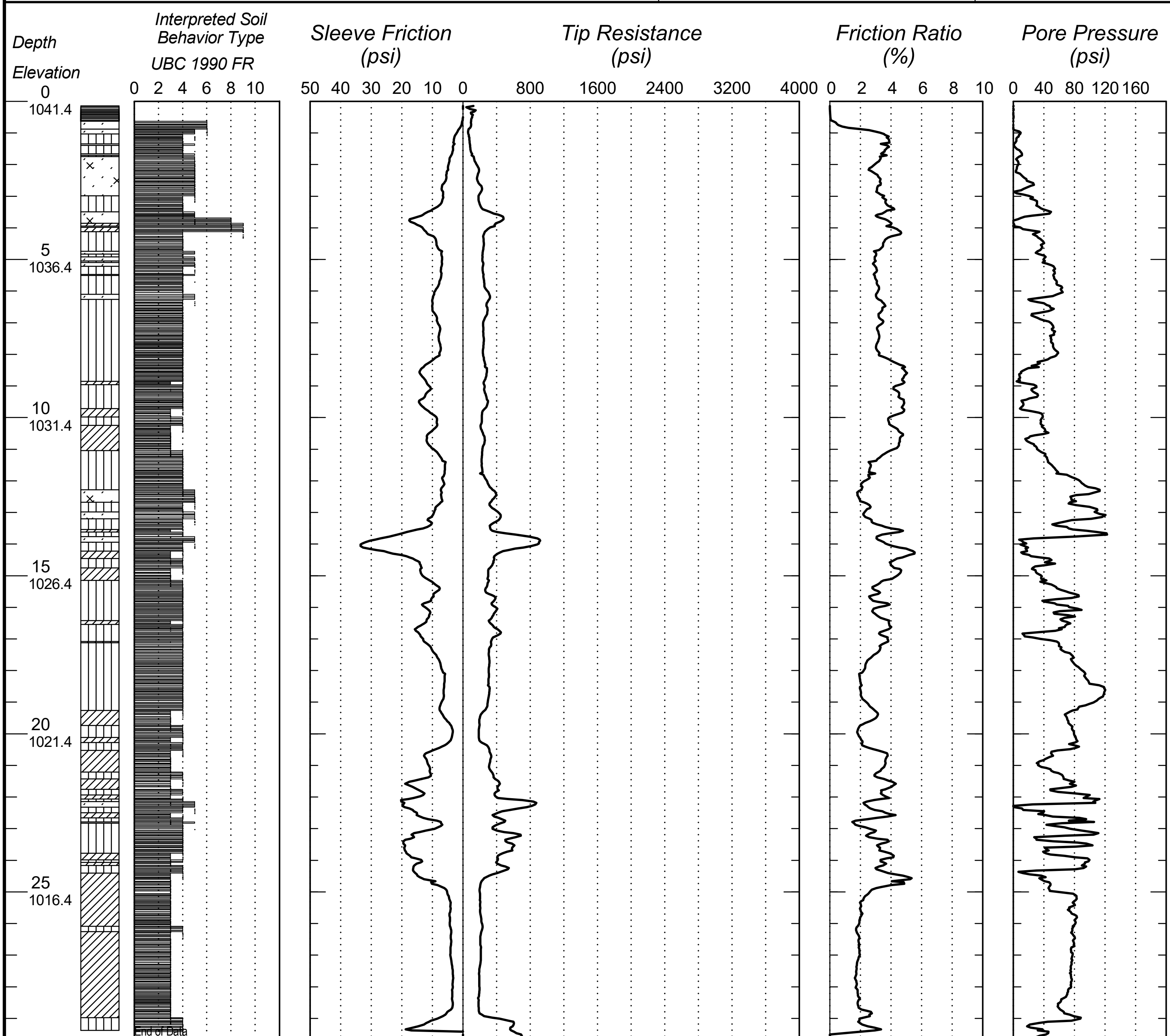
CONE PENETRATION TEST RESULTS

UNIQUE NUMBER

State Project	Bridge No. or Job Desc.	Trunk Highway/Location	Sounding No.	Ground Elevation
4006-35		**60**	**C-07**	**1041.4** (Surveyed)

Location: Le Sueur County Coordinate System	CPT Machine **21**	SHEET 1 of 1
X=331286 Y=104916	CPT Operator **Adams**	Date Completed
Latitude (North)= Longitude (West)=	Hole Type **CPT-STD**	**2/4/20**



Bottom of Hole 29.73

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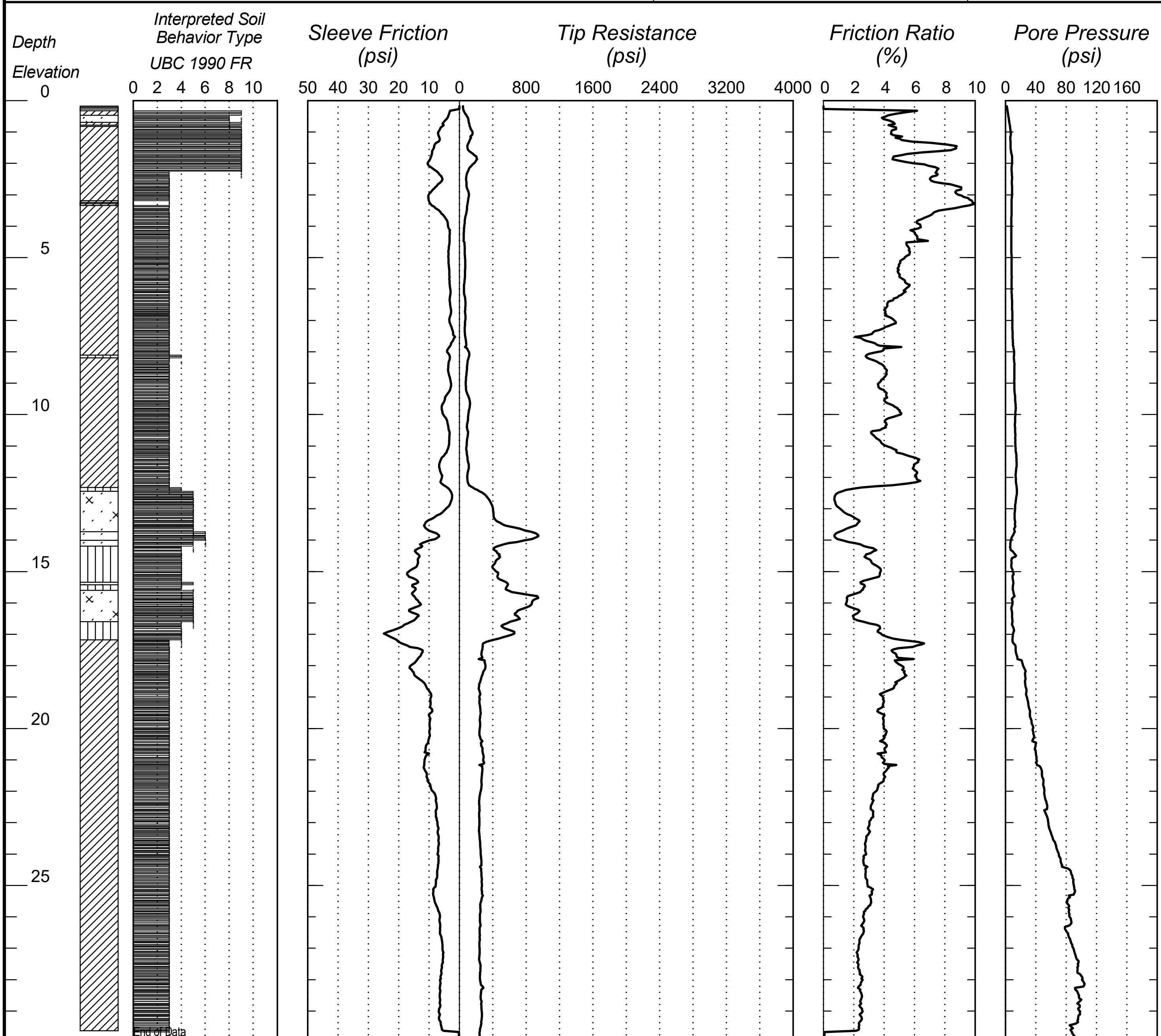
CONE PENETRATION TEST RESULTS

UNIQUE NUMBER

State Project	Bridge No. or Job Desc.	Trunk Highway/Location	Sounding No.	Ground Elevation
4006-35		60	C-08	(from Plan)

Location		
Le Sueur County Coordinate System X=344086 Y=103686 Latitude (North)= Longitude (West)=	CPT Machine 21 CPT Operator Adams Hole Type CPT-STD	SHEET 1 of 1 Date Completed 2/4/20



Bottom of Hole 29.98

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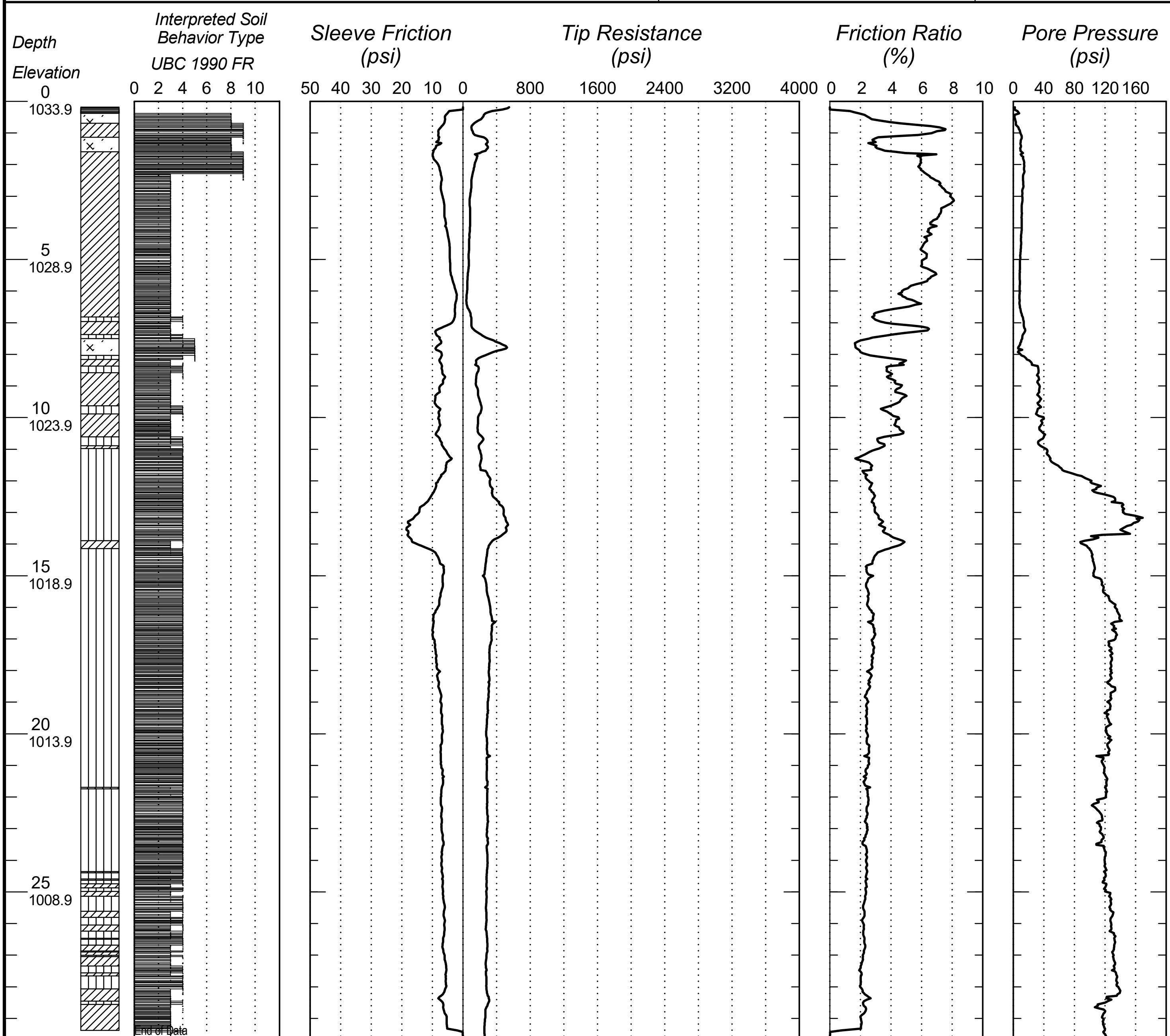
MINNESOTA DEPARTMENT OF TRANSPORTATION - GEOTECHNICAL SECTION

CONE PENETRATION TEST RESULTS

UNIQUE NUMBER

State Project	Bridge No. or Job Desc.	Trunk Highway/Location	Sounding No.	Ground Elevation
4006-35		**60**	**C-09**	**1033.9** *(Surveyed)*

Location Le Sueur County Coordinate System **X=344388 Y=103660** *Latitude (North)=* *Longitude (West)=*	*CPT Machine* **21** *CPT Operator* **Adams** *Hole Type* **CPT-STD**	*SHEET 1 of 1* *Date Completed* **2/4/20**



Bottom of Hole 29.7

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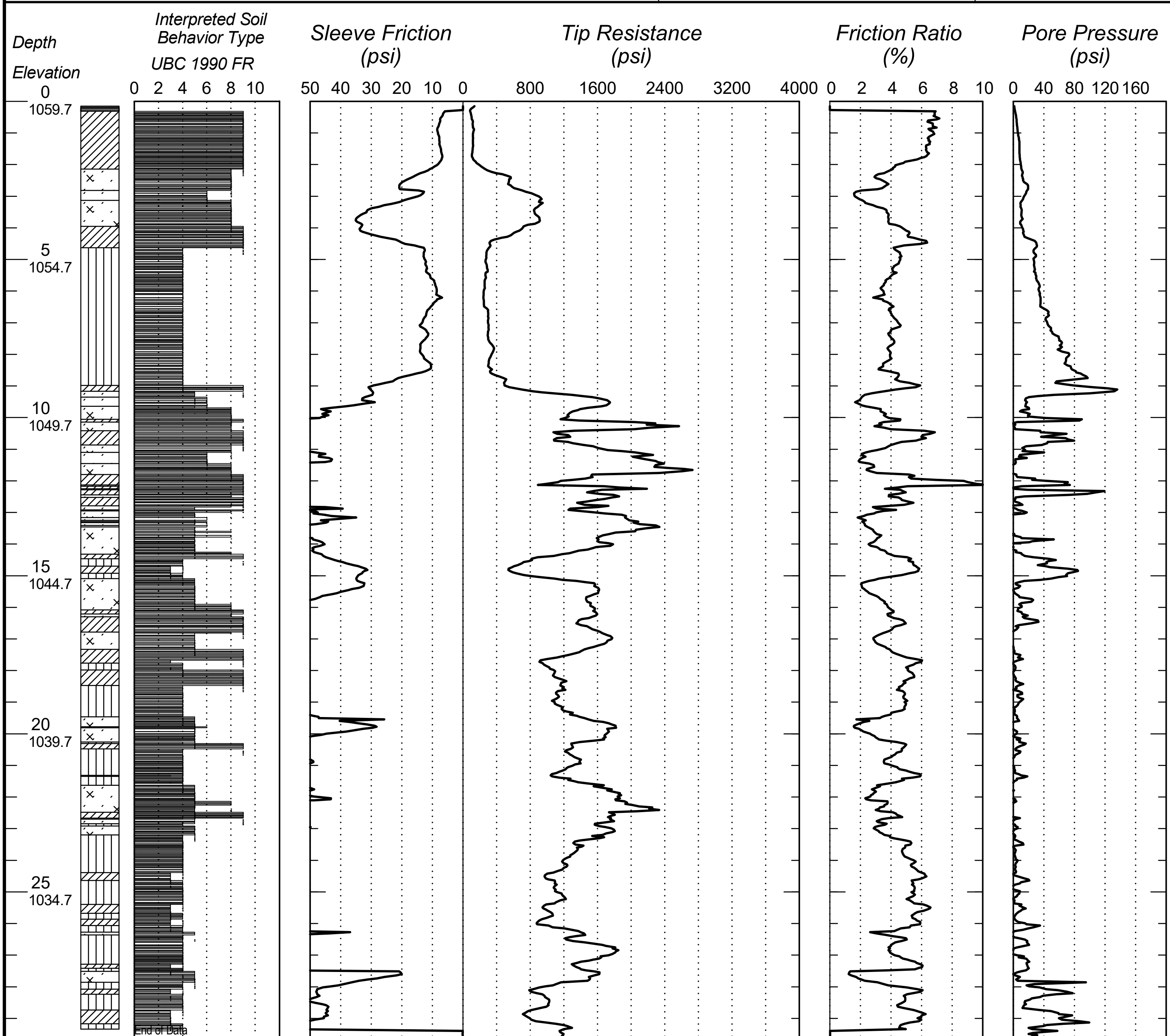
CONE PENETRATION TEST RESULTS

UNIQUE NUMBER

This sounding was taken by American Engineering Testing.

State Project	Bridge No. or Job Desc.	Trunk Highway/Location	Sounding No.	Ground Elevation
4006-35		60	C-10	1059.7 (Surveyed)

Location Le Sueur County Coordinate System X=349168 Y=103066	CPT Machine 21	SHEET 1 of 1
	CPT Operator Adams	Date Completed
Latitude (North)= Longitude (West)=	Hole Type CPT-STD	2/4/20



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DEPARTMENT OF TRANSPORTATION

MINNESOTA DEPARTMENT OF TRANSPORTATION - GEOTECHNICAL SECTION

AMERICAN ENGINEERING TESTING, INC.

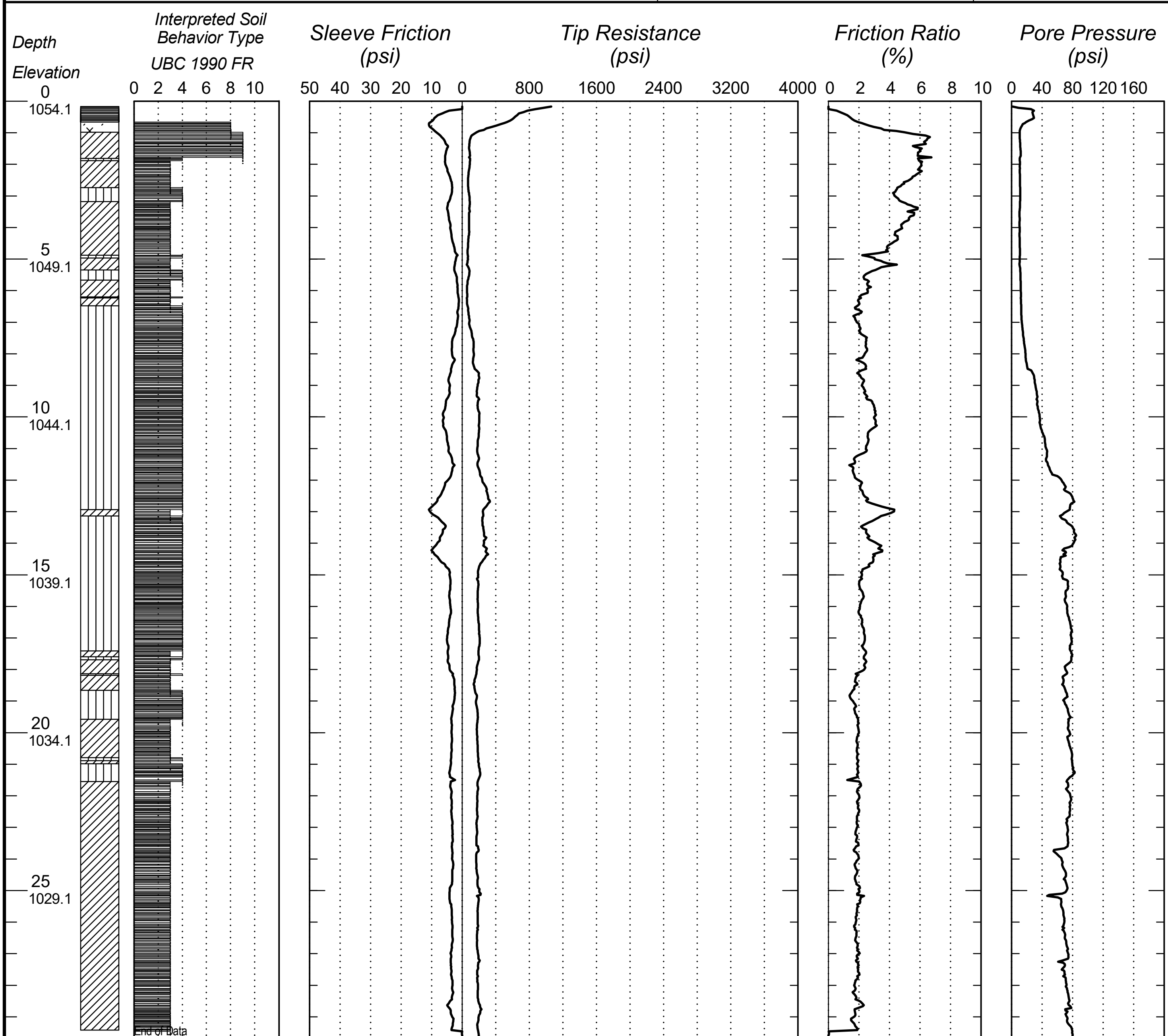
This sounding was taken by American Engineering Testing.

CONE PENETRATION TEST RESULTS

UNIQUE NUMBER

State Project	Bridge No. or Job Desc.	Trunk Highway/Location	Sounding No.	Ground Elevation
4006-35		**60**	**C-11**	**1054.1** *(Surveyed)*

Location Le Sueur County Coordinate System **X=349682 Y=102904**	*CPT Machine* **21**	*SHEET 1 of 1*
	CPT Operator **Adams**	*Date Completed* **2/4/20**
Latitude (North)= *Longitude (West)=*	*Hole Type* **CPT-STD**	



Bottom of Hole 29.77

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DEPARTMENT OF TRANSPORTATION

MINNESOTA DEPARTMENT OF TRANSPORTATION - GEOTECHNICAL SECTION

AMERICAN ENGINEERING TESTING, INC.

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CONE PENETRATION TEST RESULTS

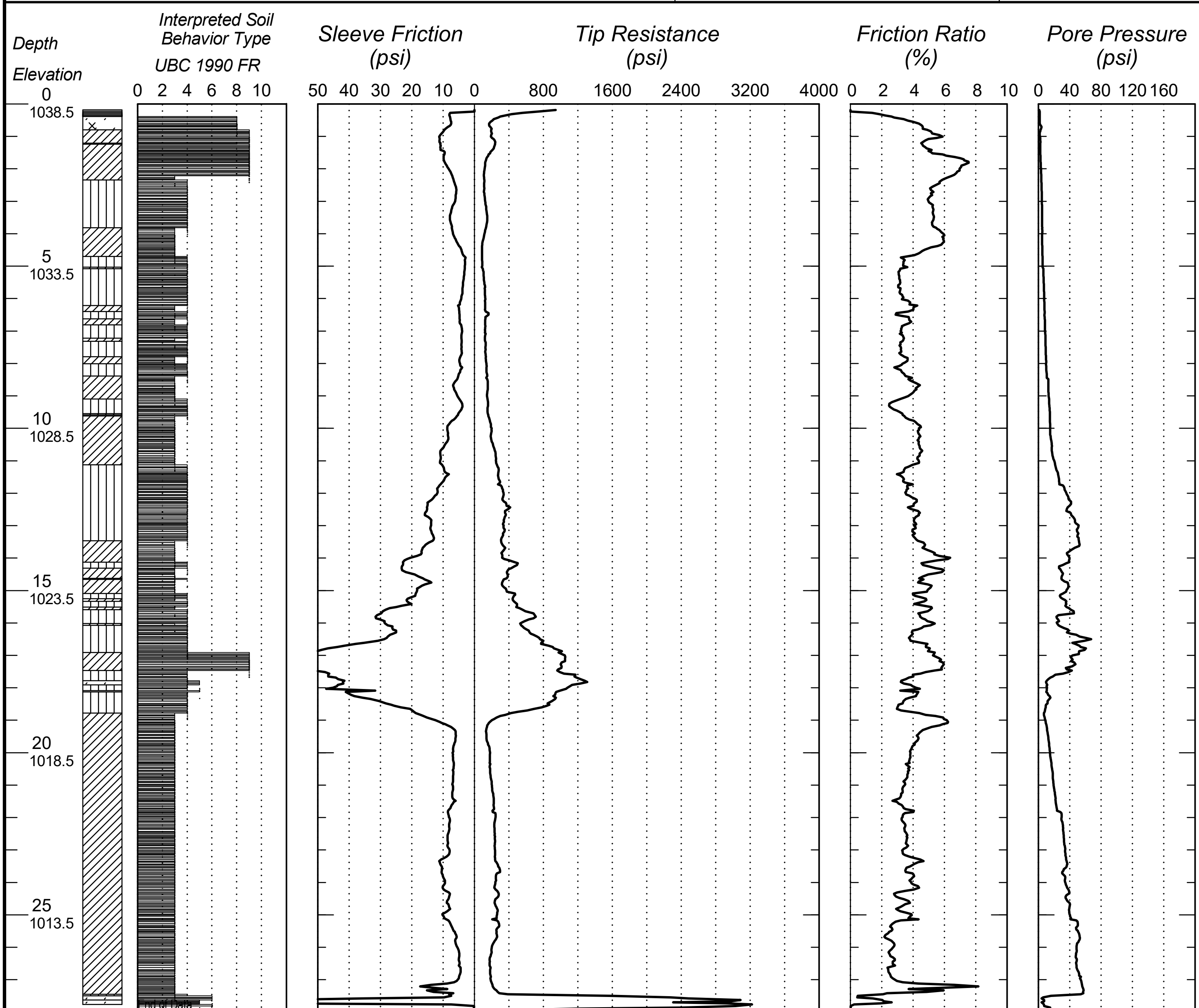
UNIQUE NUMBER

State Project	Bridge No. or Job Desc.	Trunk Highway/Location	Sounding No.	Ground Elevation
4006-35		**60**	**C-12**	**1038.5** *(Surveyed)*

Location Le Sueur County Coordinate System
X=357636 Y=101530
Latitude (North)= *Longitude (West)=*

CPT Machine **21**
CPT Operator **Adams**
Hole Type **CPT-STD**

SHEET 1 of 1
Date Completed **2/4/20**



Bottom of Hole 28.08

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MINNESOTA DEPARTMENT OF TRANSPORTATION - GEOTECHNICAL SECTION

AMERICAN ENGINEERING TESTING, INC.

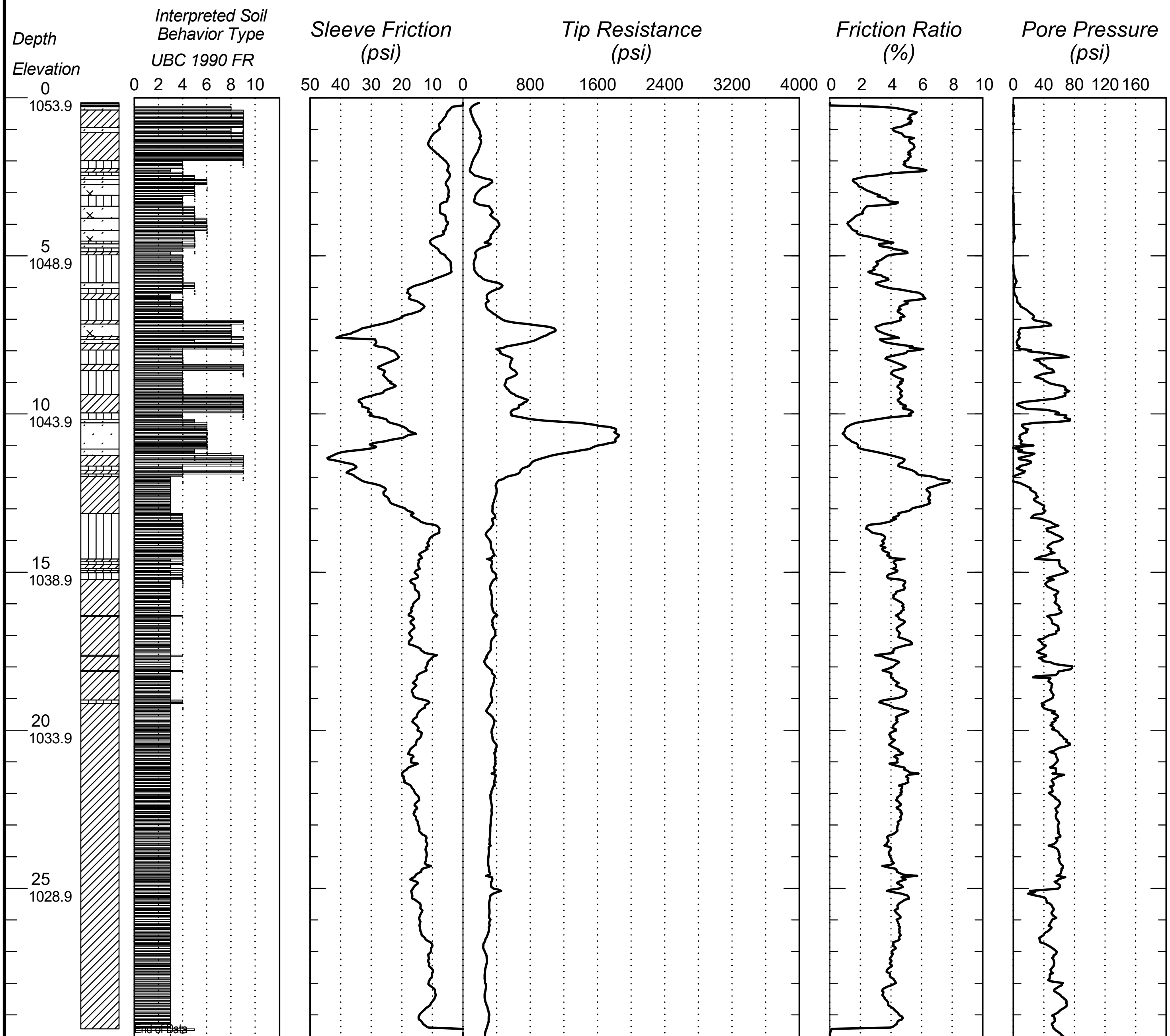
CONE PENETRATION TEST RESULTS

UNIQUE NUMBER

This sounding was taken by American Engineering Testing.

State Project	Bridge No. or Job Desc.	Trunk Highway/Location	Sounding No.	Ground Elevation
4006-35		**60**	**C-16**	**1053.9** *(Surveyed)*

Location Le Sueur County Coordinate System **X=373039 Y=100833**	*CPT Machine* **21**	*SHEET 1 of 1*
Latitude (North)= *Longitude (West)=*	*CPT Operator* **Adams**	*Date Completed* **2/5/20**
	Hole Type **CPT-STD**	



Bottom of Hole 29.75

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DEPARTMENT OF TRANSPORTATION

MINNESOTA DEPARTMENT OF TRANSPORTATION - GEOTECHNICAL SECTION

AMERICAN ENGINEERING TESTING, INC.

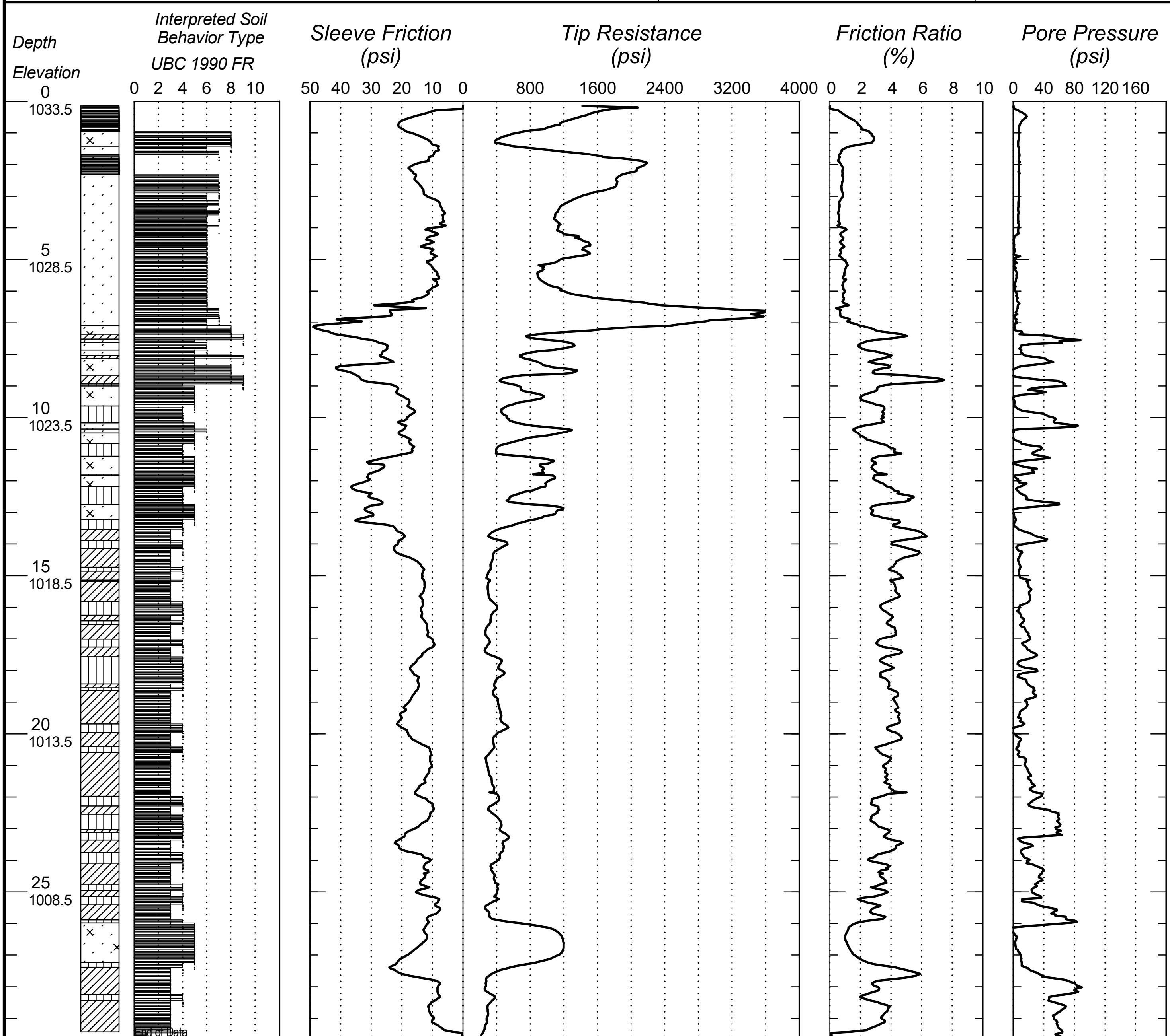
This sounding was taken by American Engineering Testing.

CONE PENETRATION TEST RESULTS

UNIQUE NUMBER

State Project	Bridge No. or Job Desc.	Trunk Highway/Location	Sounding No.	Ground Elevation
4006-35		**60**	**C-18**	**1033.5** (Surveyed)

Location Le Sueur County Coordinate System **X=385476 Y=105892**	CPT Machine **21**	SHEET 1 of 1
	CPT Operator **Adams**	Date Completed
Latitude (North)= Longitude (West)=	Hole Type **CPT-STD**	**2/5/20**



Bottom of Hole 29.75

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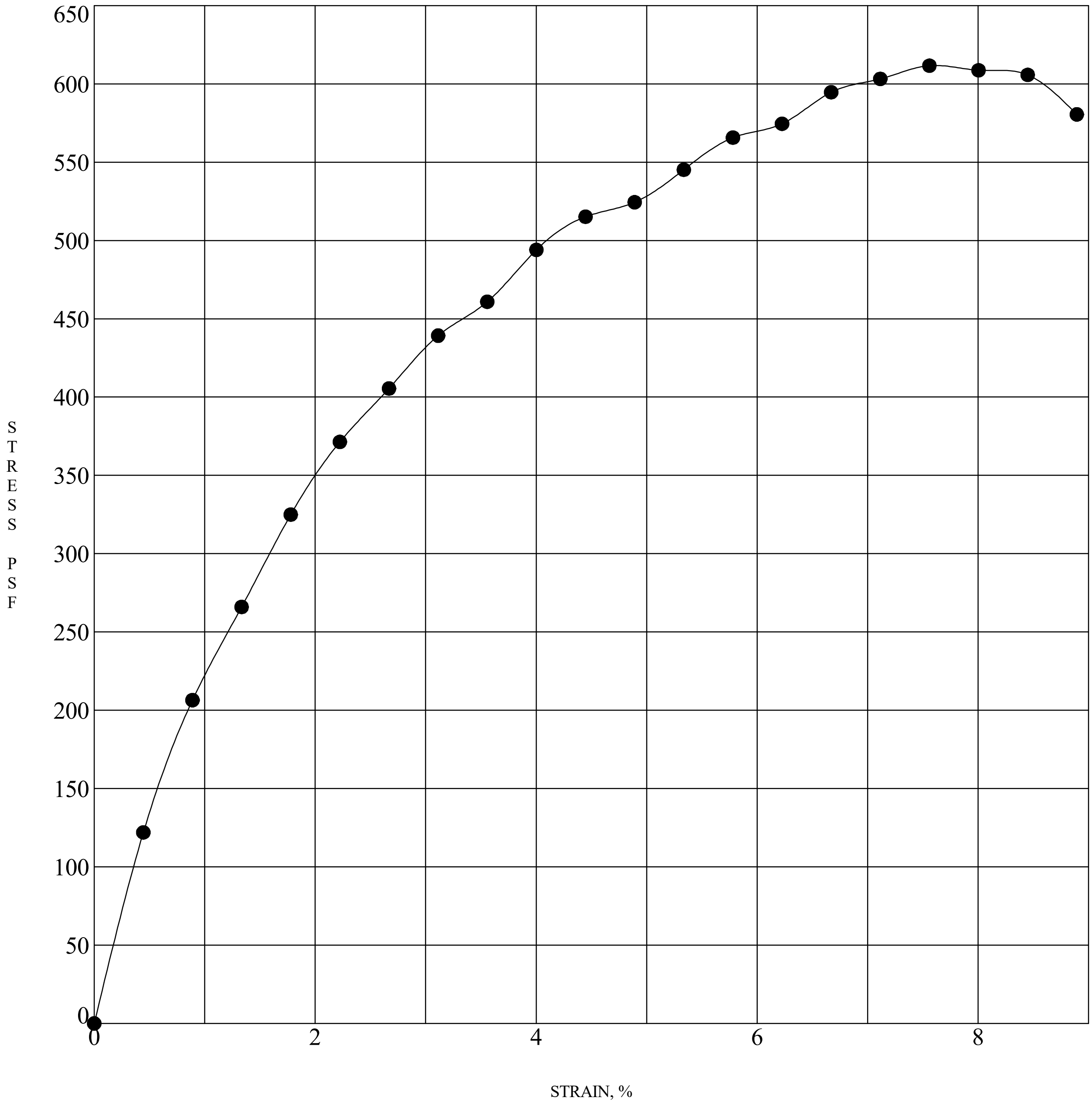


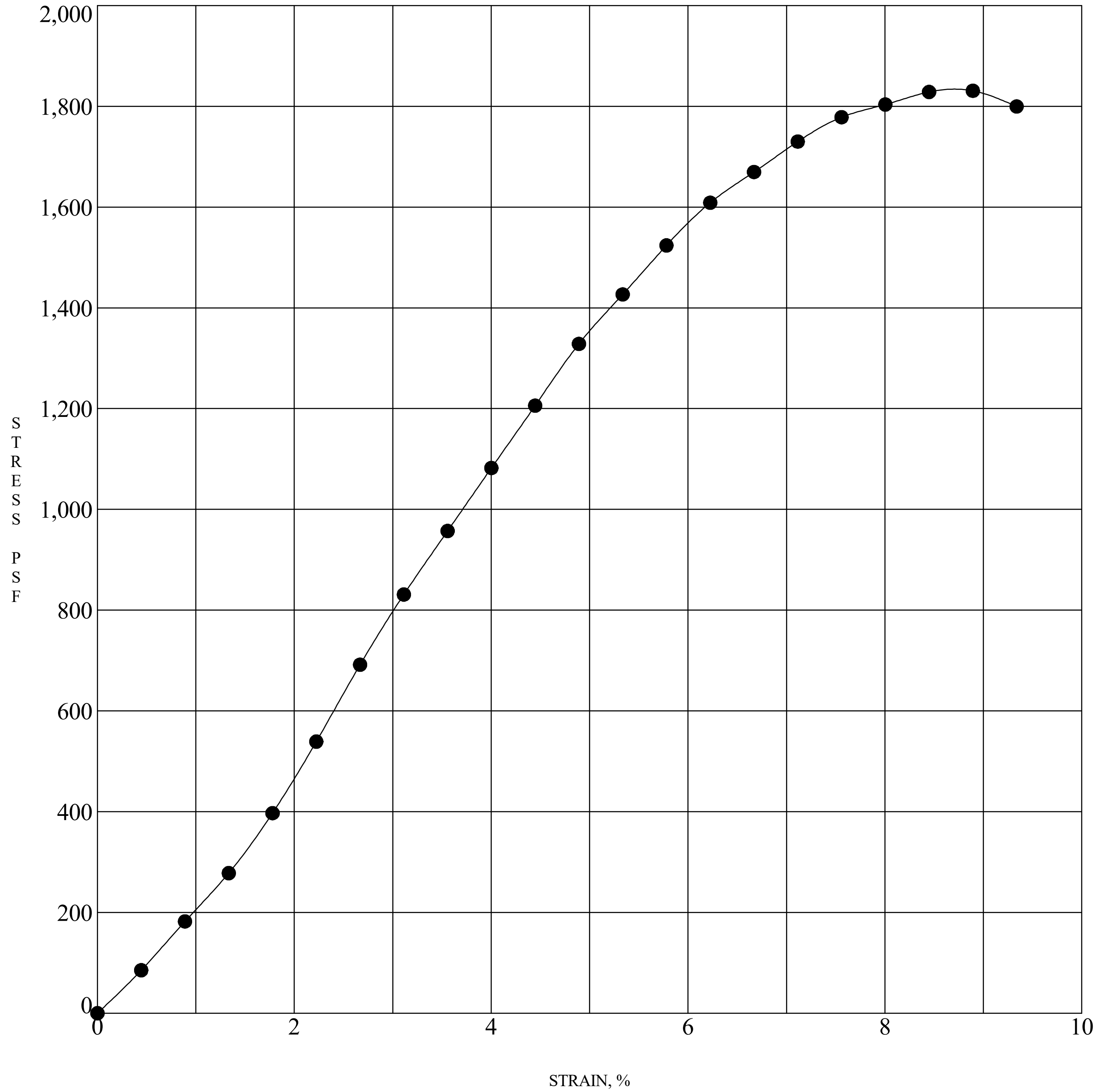
	Specimen Identification		Classification	DD	MC%
●	**#B-4**	**9.5'**		**68**	**48**

PROJECT **Trunk Highway 60; Madison Lake to Waterville, MN**

AET JOB NO. **08-20562**
DATE **2/25/20**

AMERICAN ENGINEERING TESTING, INC.

UNCONFINED COMPRESSION TEST



	Specimen Identification		Classification	DD	MC%
●	#B-4	14.5'		86	35

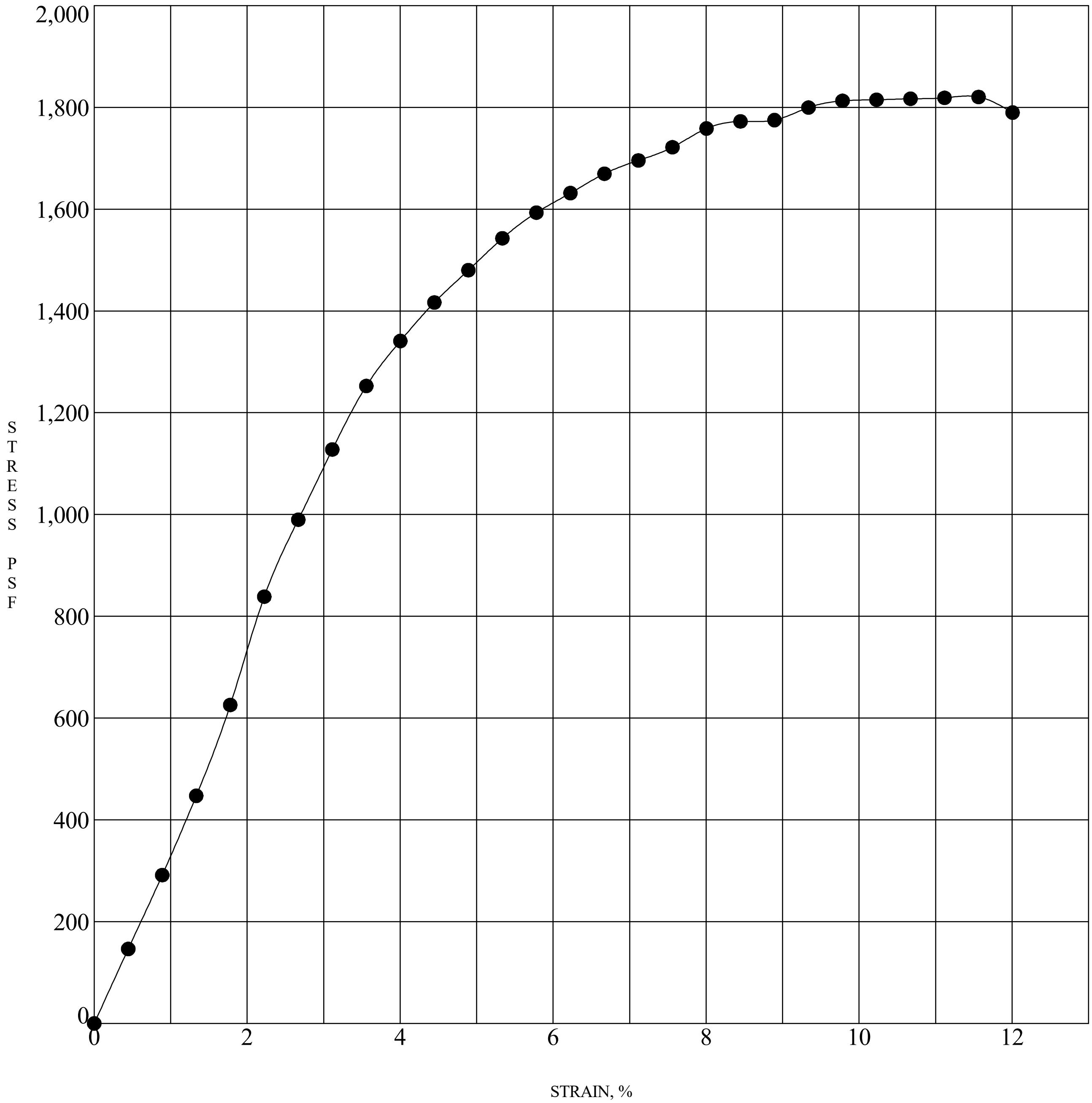
PROJECT **Trunk Highway 60; Madison Lake to Waterville, MN**

AET JOB NO. **08-20562**

DATE **2/25/20**

AMERICAN ENGINEERING TESTING, INC.

UNCONFINED COMPRESSION TEST



	Specimen Identification		Classification	DD	MC%
●	**#B-4**	**19.5'**		**99**	**25**

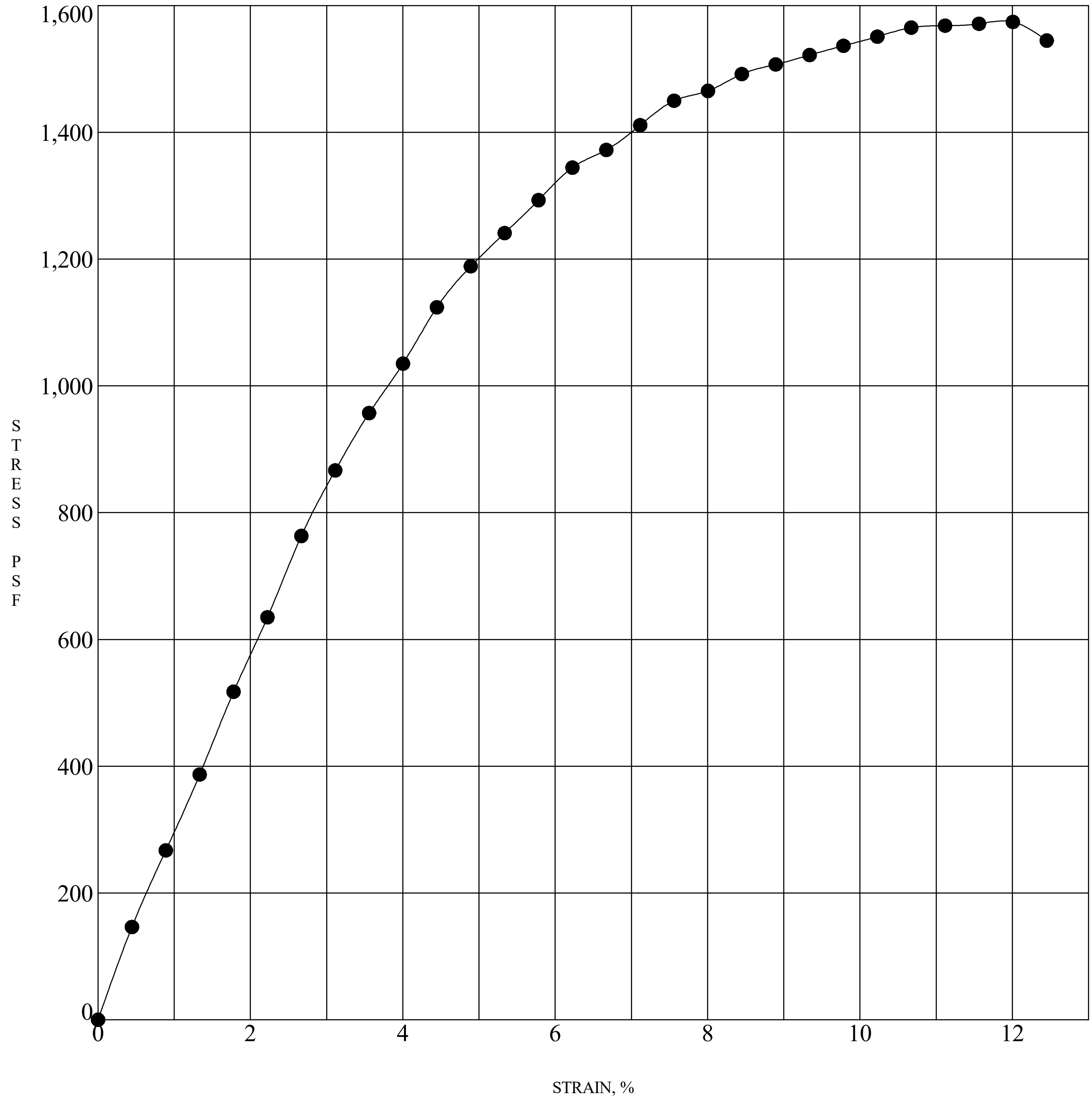
PROJECT **Trunk Highway 60; Madison Lake to Waterville, MN**

AET JOB NO. **08-20562**

DATE **2/25/20**

AMERICAN ENGINEERING TESTING, INC.

UNCONFINED COMPRESSION TEST



	Specimen Identification	Classification	DD	MC%
●	**#B-4 24.5'**		**103**	**24**

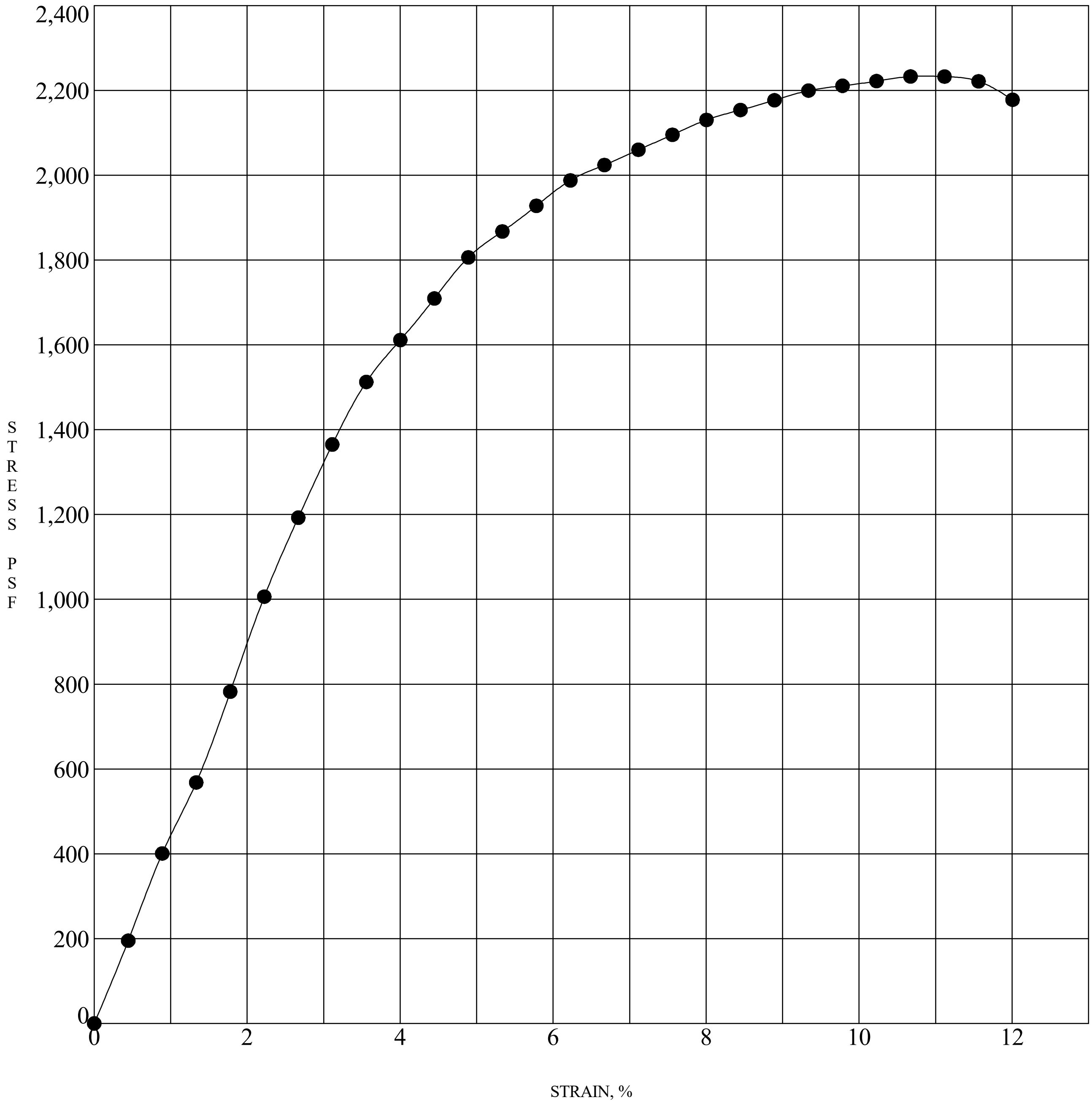
PROJECT **Trunk Highway 60; Madison Lake to Waterville, MN**

AET JOB NO. **08-20562**

DATE **2/25/20**

AMERICAN ENGINEERING TESTING, INC.

UNCONFINED COMPRESSION TEST



	Specimen Identification		Classification	DD	MC%
●	#B-4	29.5'		102	24

PROJECT **Trunk Highway 60; Madison Lake to Waterville, MN**

AET JOB NO. **08-20562**

DATE **2/25/20**

AMERICAN ENGINEERING TESTING, INC.

UNCONFINED COMPRESSION TEST

EXPLORATION/CLASSIFICATION METHODS

SAMPLING METHODS

Split-Spoon Samples (SS)

Standard penetration (split-spoon) samples were collected in general accordance with ASTM:D1586. This method consists of driving a 2" O.D. split barrel sampler into the in-situ soil with a 140-pound hammer dropped from a height of 30". The sampler is driven a total of 18" into the soil. After an initial set of 6", the number of hammer blows to drive the sampler the final 12" is known as the standard penetration resistance or N-value.

Disturbed Samples (DS)/Spin-up Samples (SU)

Sample types described as "DS" or "SU" on the boring logs are disturbed samples, which are taken from the flights of the auger. Because the auger disturbs the samples, possible soil layering and contact depths should be considered approximate.

Sampling Limitations

Unless actually observed in a sample, contacts between soil layers are estimated based on the spacing of samples and the action of drilling tools. Cobbles, boulders, and other large objects generally cannot be recovered from test borings, and they may be present in the ground even if they are not noted on the boring logs.

CLASSIFICATION METHODS

Soil classifications shown on the boring logs are based on the Unified Soil Classification (USC) system. The USC system is described in ASTM:D2487 and D2488. Where laboratory classification tests (sieve analysis or Atterberg Limits) have been performed, accurate classifications per ASTM: D2487 are possible. Otherwise, soil classifications shown on the boring logs are visual-manual judgments. Charts are attached which provide information on the USC system, the descriptive terminology, and the symbols used on the boring logs.

The boring logs include descriptions of apparent geology. The geologic depositional origin of each soil layer is interpreted primarily by observation of the soil samples, which can be limited. Observations of the surrounding topography, vegetation, and development can sometimes aid this judgment.

WATER LEVEL MEASUREMENTS

The ground water level measurements are shown at the bottom of the boring logs. The following information appears under "Water Level Measurements" on the logs:

- Date and Time of measurement
- Sampled Depth: lowest depth of soil sampling at the time of measurement
- Casing Depth: depth to bottom of casing or hollow-stem auger at time of measurement
- Cave-in Depth: depth at which measuring tape stops in the borehole
- Water Level: depth in the borehole where free water is encountered
- Drilling Fluid Level: same as Water Level, except that the liquid in the borehole is drilling fluid

The true location of the water table at the boring locations may be different than the water levels measured in the boreholes. This is possible because there are several factors that can affect the water level measurements in the borehole. Some of these factors include: permeability of each soil layer in profile, presence of perched water, amount of time between water level readings, presence of drilling fluid, weather conditions, and use of borehole casing.

SAMPLE STORAGE

Unless notified to do otherwise, we routinely retain representative samples of the soils recovered from the borings for a period of 30 days.

BORING LOG NOTES

DRILLING AND SAMPLING SYMBOLS

Symbol	Definition
AR:	Sample of material obtained from cuttings blown out the top of the borehole during air rotary procedure.
B, H, N:	Size of flush-joint casing
CAS:	Pipe casing, number indicates nominal diameter in inches
COT:	Clean-out tube
DC:	Drive casing; number indicates diameter in inches
DM:	Drilling mud or bentonite slurry
DR:	Driller (initials)
DS:	Disturbed sample from auger flights
DP:	Direct push drilling; a 2.125 inch OD outer casing with an inner 1½ inch ID plastic tube is driven continuously into the ground.
FA:	Flight auger; number indicates outside diameter in inches
HA:	Hand auger; number indicates outside diameter
HSA:	Hollow stem auger; number indicates inside diameter in inches
LG:	Field logger (initials)
MC:	Column used to describe moisture condition of samples and for the ground water level symbols
N (BPF):	Standard penetration resistance (N-value) in blows per foot (see notes)
NQ:	NQ wireline core barrel
PQ:	PQ wireline core barrel
RDA:	Rotary drilling with compressed air and roller or drag bit.
RDF:	Rotary drilling with drilling fluid and roller or drag bit
REC:	In split-spoon (see notes), direct push and thin-walled tube sampling, the recovered length (in inches) of sample. In rock coring, the length of core recovered (expressed as percent of the total core run). Zero indicates no sample recovered.
SS:	Standard split-spoon sampler (steel; 1.5" is inside diameter; 2" outside diameter); unless indicated otherwise
SU	Spin-up sample from hollow stem auger
TW:	Thin-walled tube; number indicates inside diameter in inches
WASH:	Sample of material obtained by screening returning rotary drilling fluid or by which has collected inside the borehole after "falling" through drilling fluid
WH:	Sampler advanced by static weight of drill rod and hammer
WR:	Sampler advanced by static weight of drill rod
94mm:	94 millimeter wireline core barrel
▼:	Water level directly measured in boring
▽:	Estimated water level based solely on sample appearance

TEST SYMBOLS

Symbol	Definition
CONS:	One-dimensional consolidation test
DEN:	Dry density, pcf
DST:	Direct shear test
E:	Pressuremeter Modulus, tsf
HYD:	Hydrometer analysis
LL:	Liquid Limit, %
LP:	Pressuremeter Limit Pressure, tsf
OC:	Organic Content, %
PERM:	Coefficient of permeability (K) test; F - Field; L - Laboratory
PL:	Plastic Limit, %
q_p:	Pocket Penetrometer strength, tsf (approximate)
q_c:	Static cone bearing pressure, tsf
q_u:	Unconfined compressive strength, psf
R:	Electrical Resistivity, ohm-cms
RQD:	Rock Quality Designation of Rock Core, in percent (aggregate length of core pieces 4" or more in length as a percent of total core run)
SA:	Sieve analysis
TRX:	Triaxial compression test
VSR:	Vane shear strength, remolded (field), psf
VSU:	Vane shear strength, undisturbed (field), psf
WC:	Water content, as percent of dry weight
%-200:	Percent of material finer than #200 sieve

STANDARD PENETRATION TEST NOTES
(Calibrated Hammer Weight)

The standard penetration test consists of driving a split-spoon sampler with a drop hammer (calibrated weight varies to provide N_{60} values) and counting the number of blows applied in each of three 6" increments of penetration. If the sampler is driven less than 18" (usually in highly resistant material), permitted in ASTM: D1586, the blows for each complete 6" increment and for each partial increment is on the boring log. For partial increments, the number of blows is shown to the nearest 0.1' below the slash.

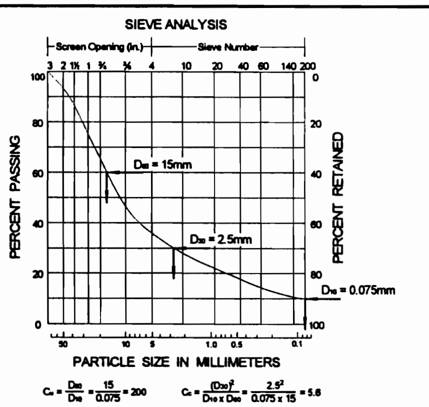
The length of sample recovered, as shown on the "REC" column, may be greater than the distance indicated in the N column. The disparity is because the N-value is recorded below the initial 6" set (unless partial penetration defined in ASTM: D1586 is encountered) whereas the length of sample recovered is for the entire sampler drive (which may even extend more than 18").

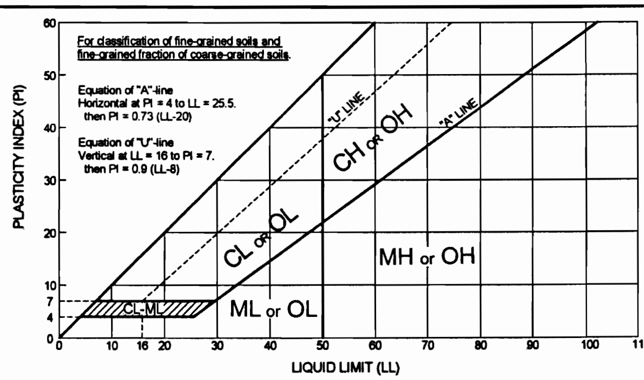
UNIFIED SOIL CLASSIFICATION SYSTEM
ASTM Designations: D 2487, D2488

AMERICAN ENGINEERING TESTING, INC.

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests[A]

				Soil Classification: Group Symbol	Soil Classification: Group Name[B]
Coarse-Grained Soils More than 50% retained on No. 200 sieve	Gravels More than 50% coarse fraction retained on No. 4 sieve	Clean Gravels Less than 5% fines[C]	$Cu \geq 4$ and $1 \leq Cc \leq 3$[E]	GW	Well graded gravel[F]
			$Cu<4$ and/or $1>Cc>3$[E]	GP	Poorly graded gravel[F]
		Gravels with Fines more than 12% fines [C]	Fines classify as ML or MH	GM	Silty gravel[F.G.H]
			Fines classify as CL or CH	GC	Clayey gravel[F.G.H]
	Sands 50% or more of coarse fraction passes No. 4 sieve	Clean Sands Less than 5% fines[D]	$Cu \geq 6$ and $1 \leq Cc \leq 3$[E]	SW	Well-graded sand[I]
			$Cu<6$ and/or $1>Cc>3$[E]	SP	Poorly-graded sand[I]
		Sands with Fines more than 12% fines [D]	Fines classify as ML or MH	SM	Silty sand[G.H.I]
			Fines classify as CL or CH	SC	Clayey sand[G.H.I]
Fine-Grained Soils 50% or more passes the No. 200 sieve (see Plasticity Chart below)	Silts and Clays Liquid limit less than 50	inorganic	PI>7 and plots on or above "A" line[J]	CL	Lean clay[K.L.M]
			PI<4 or plots below "A" line[J]	ML	Silt[K.L.M]
		organic	Liquid limit–oven dried / Liquid limit – not dried <0.75	OL	Organic clay[K.L.M.N] Organic silt[K.L.M.O]
	Silts and Clays Liquid limit 50 or more	inorganic	PI plots on or above "A" line	CH	Fat clay[K.L.M]
			PI plots below "A" line	MH	Elastic silt[K.L.M]
		organic	Liquid limit–oven dried / Liquid limit – not dried <0.75	OH	Organic clay[K.L.M.P] Organic silt[K.L.M.Q]
Highly organic soil			Primarily organic matter, dark in color, and organic in odor	PT	Peat[R]





Plasticity Chart

Notes

[A]Based on the material passing the 3-in (75-mm) sieve.

[B]If field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.

[C]Gravels with 5 to 12% fines require dual symbols:
- GW-GM well-graded gravel with silt
- GW-GC well-graded gravel with clay
- GP-GM poorly graded gravel with silt
- GP-GC poorly graded gravel with clay

[D]Sands with 5 to 12% fines require dual symbols:
- SW-SM well-graded sand with silt
- SW-SC well-graded sand with clay
- SP-SM poorly graded sand with silt
- SP-SC poorly graded sand with clay

[E]$Cu = D_{60}/D_{10}$, $Cc = \frac{(D_{30})^2}{D_{10} \times D_{60}}$

[F]If soil contains ≥15% sand, add "with sand" to group name.

[G]If fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.

[H]If fines are organic, add "with organic fines" to group name.

[I]If soil contains ≥15% gravel, add "with gravel" to group name.

[J]If Atterberg limits plot is hatched area, soils is a CL-ML silty clay.

[K]If soil contains 15 to 29% plus No. 200 add "with sand" or "with gravel", whichever is predominant.

[L]If soil contains ≥30% plus No. 200, predominantly sand, add "sandy" to group name.

[M]If soil contains ≥30% plus No. 200, predominantly gravel, add "gravelly" to group name.

[N]PI≥4 and plots on or above "A" line.

[O]PI<4 or plots below "A" line.

[P]PI plots on or above "A" line.

[Q]PI plots below "A" line.

[R]Fiber Content description shown below.

ADDITIONAL TERMINOLOGY NOTES USED BY AET FOR SOIL IDENTIFICATION AND DESCRIPTION

Grain Size

Term	Particle Size
Boulders	Over 12"
Cobbles	3" to 12"
Gravel	#4 sieve to 3"
Sand	#200 to #4 sieve
Fines (silt & clay)	Pass #200 sieve

Gravel Percentages

Term	Percent
A Little Gravel	3% - 14%
With Gravel	15% - 29%
Gravelly	30% - 50%

Consistency of Plastic Soils

Term	N-Value, BPF
Very Soft	less than 2
Soft	2 - 4
Firm	5 - 8
Stiff	9 - 15
Very Stiff	16 - 30
Hard	Greater than 30

Relative Density of Non-Plastic Soils

Term	N-Value, BPF
Very Loose	0 - 4
Loose	5 - 10
Medium Dense	11 - 30
Dense	31 - 50
Very Dense	Greater than 50

Moisture/Frost Condition (MC Column)

D (Dry):	Absense of moisture, dusty, dry to touch.
M (Moist):	Damp, although free water not visible. Soil may still have a high water content (over "optimum").
W (Wet/ Waterbearing):	Free water visible intended to describe non-plastic soils. Waterbearing usually relates to sands and sand with silt.
F (Frozen):	Soil frozen

Layering Notes

Laminations:	Layers less than ½" thick of differing material or color.
Lenses:	Pockets or layers greater than ½" thick of differing material or color.

Peat Description

Term	Fiber Content (Visual Estimate)
Fibric Peat:	Greater than 67%
Hemic Peat:	33 – 67%
Sapric Peat:	Less than 33%

Organic Description (if no lab tests)

Soils are described as *organic*, if soil is not peat and is judged to have sufficient organic fines content to influence the Liquid Limit properties. *Slightly organic* used for borderline cases.

Root Inclusions

With roots:	Judged to have sufficient quantity of roots to influence the soil properties.
Trace roots:	Small roots present, but not judged to be in sufficient quantity to significantly affect soil properties.

B.1 REFERENCE

This appendix provides information to help you manage your risks relating to subsurface problems which are caused by construction delays, cost overruns, claims, and disputes. This information was developed and provided by ASFE[1], of which, we are a member firm.

B.2 RISK MANAGEMENT INFORMATION

B.2.1 Geotechnical Services are Performed for Specific Purposes, Persons, and Projects

Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical engineering study conducted for a civil engineer may not fulfill the needs of a construction contractor or even another civil engineer. Because each geotechnical engineering study is unique, each geotechnical engineering report is unique, prepared solely for the client. No one except you should rely on your geotechnical engineering report without first conferring with the geotechnical engineer who prepared it. And no one, not even you, should apply the report for any purpose or project except the one originally contemplated.

B.2.2 Read the Full Report

Serious problems have occurred because those relying on a geotechnical engineering report did not read it all. Do not rely on an executive summary. Do not read selected elements only.

B.2.3 A Geotechnical Engineering Report is Based on A Unique Set of Project-Specific Factors

Geotechnical engineers consider a number of unique, project-specific factors when establishing the scope of a study. Typically factors include: the client's goals, objectives, and risk management preferences; the general nature of the structure involved, its size, and configuration; the location of the structure on the site; and other planned or existing site improvements, such as access roads, parking lots, and underground utilities. Unless the geotechnical engineer who conducted the study specifically indicates otherwise, do not rely on a geotechnical engineering report that was:

- not prepared for you,
- not prepared for your project,
- not prepared for the specific site explored, or
- completed before important project changes were made.

Typical changes that can erode the reliability of an existing geotechnical engineering report include those that affect:

- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from a light industrial plant to a refrigerated warehouse,
- elevation, configuration, location, orientation, or weight of the proposed structure,
- composition of the design team, or
- project ownership.

As a general rule, always inform your geotechnical engineer of project changes, even minor ones, and request an assessment of their impact. Geotechnical engineers cannot accept responsibility or liability for problems that occur because their reports do not consider developments of which they were not informed.

B.2.4 Subsurface Conditions Can Change

A geotechnical engineering report is based on conditions that existed at the time the study was performed. Do not rely on a geotechnical engineering report whose adequacy may have been affected by: the passage of time; by man-made events, such as construction on or adjacent to the site; or by natural events, such as floods, earthquakes, or groundwater fluctuations. Always contact the geotechnical engineer before applying the report to determine if it is still reliable. A minor amount of additional testing or analysis could prevent major problems.

1 ASFE, 8811 Colesville Road/Suite G106, Silver Spring, MD 20910
Telephone: 301/565-2733: www.asfe.org

B.2.5 Most Geotechnical Findings Are Professional Opinions
Site exploration identified subsurface conditions only at those points where subsurface tests are conducted or samples are taken. Geotechnical engineers review field and laboratory data and then apply their professional judgment to render an opinion about subsurface conditions throughout the site. Actual subsurface conditions may differ, sometimes significantly, from those indicated in your report. Retaining the geotechnical engineer who developed your report to provide construction observation is the most effective method of managing the risks associated with unanticipated conditions.

B.2.6 A Report's Recommendations Are Not Final
Do not overrely on the construction recommendations included in your report. Those recommendations are not final, because geotechnical engineers develop them principally from judgment and opinion. Geotechnical engineers can finalize their recommendations only by observing actual subsurface conditions revealed during construction. The geotechnical engineer who developed your report cannot assume responsibility or liability for the report's recommendations if that engineer does not perform construction observation.

B.2.7 A Geotechnical Engineering Report Is Subject to Misinterpretation
Other design team members' misinterpretation of geotechnical engineering reports has resulted in costly problems. Lower that risk by having your geotechnical engineer confer with appropriate members of the design team after submitting the report. Also retain your geotechnical engineer to review pertinent elements of the design team's plans and specifications. Contractors can also misinterpret a geotechnical engineering report. Reduce that risk by having your geotechnical engineer participate in prebid and preconstruction conferences, and by providing construction observation.

B.2.8 Do Not Redraw the Engineer's Logs
Geotechnical engineers prepare final boring and testing logs based upon their interpretation of field logs and laboratory data. To prevent errors or omissions, the logs included in a geotechnical engineering report should never be redrawn for inclusion in architectural or other design drawings. Only photographic or electronic reproduction is acceptable, but recognizes that separating logs from the report can elevate risk.

B.2.9 Give Contractors a Complete Report and Guidance
Some owners and design professionals mistakenly believe they can make contractors liable for unanticipated subsurface conditions by limiting what they provide for bid preparation. To help prevent costly problems, give contractors the complete geotechnical engineering report, but preface it with a clearly written letter of transmittal. In the letter, advise contractors that the report was not prepared for purposes of bid development and that the report's accuracy is limited; encourage them to confer with the geotechnical engineer who prepared the report (a modest fee may be required) and/or to conduct additional study to obtain the specific types of information they need or prefer. A prebid conference can also be valuable. Be sure contractors have sufficient time to perform additional study. Only then might you be in a position to give contractors the best information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions.

B.2.10 Read Responsibility Provisions Closely
Some clients, design professionals, and contractors do not recognize that geotechnical engineering is far less exact than other engineering disciplines. This lack of understanding has created unrealistic expectations that have led to disappointments, claims, and disputes. To help reduce the risk of such outcomes, geotechnical engineers commonly include a variety of explanatory provisions in their report. Sometimes labeled "limitations" many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. Read these provisions closely. Ask questions. Your geotechnical engineer should respond fully and frankly.

B.2.11 Geoenvironmental Concerns Are Not Covered
The equipment, techniques, and personnel used to perform a geoenvironmental study differ significantly from those used to perform a geotechnical study. For that reason, a geotechnical engineering report does not usually relate any geoenvironmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. Unanticipated environmental problems have led to numerous project failures. If you have not yet obtained your own geoenvironmental information, ask your geotechnical consultant for risk management guidance. Do not rely on an environmental report prepared for someone else