L-2

Memo: Milwaukee Estuary DMMF Geotechnical Laboratory Data

Foth Infrastructure & Environment, LLC
Memorandum to File

July 20, 2020

TO: Memo to File

CC: DMMF DTWG

FR: Timothy Wagner, P.E. (Foth)
Brian Sperrazza, P.G., P.E. (Foth)

RE: Milwauke Estuary Dredged Material Management Facility Geotechnical Laboratory Data

A geotechnical investigation and evaluation were performed as described in Appendix L of the *90% Design Report* (Foth 2020b). A portion of the geotechnical laboratory data had not been received at the time of publishing the *90% Design Report*. This memorandum provides the data from those laboratory tests.

Geotechnical sediment samples were collected according the *Pre-Design Investigation Work Plan* (Foth, 2020a), and a subset were submitted to Soil Engineering and Testing in Minneapolis, Minneapolis, for analysis. Laboratory testing was completed according to the testing schedule presented in Table 1. Results for each test are organized by boring in Table 2, and the laboratory data sheets are included as Attachment 2. The geotechnical laboratory strength test result values were generally consistent with the strength values used for geotechnical and structural modeling, as provided in Appendix L of the *90% Design Report.*

References:

Foth Infrastructure & Environment, LLC, 2020a. *Pre-Design Investigation Work Plan* – Milwaukee Estuary DMMF. June 2, 2020.

Foth Infrastructure & Environment, LLC, 2020b. *90% Design Report* – Milwaukee Estuary DMMF. June 2020.

Attachments:
Attachment 1: Tables
Attachment 2: Geotechnical Laboratory Testing Data Sheets

Attachment 1

Tables

Table 1

Geotechnical Laboratory Test Schedule

ASTM No. Sample ID	Sample Type	Sample Depth	D422 Grain Size Analysis	D4318 Atterberg Limits	D7263 Dry Density	D2216 Water Content	D854 Specific Gravity	Calculations Saturation, Porosity, etc	D5084 Permeability Falling Head	D2435 One-Dimensional Consolidation	D4767/D2850 Triaxial Shear
SB-4	Shelby Tube	28.5-30.5	X	X			X	X		X	CU
SB-7	Shelby Tube	17.5-20	X	X			X	X		X	CU
ST-11	Shelby Tube	30-32	X	X			X	X		X	CU
SB-8	Shelby Tube	2.5-5	X	X	X				X	X	
ST-10	Shelby Tube	15-17	X	X	X				X	X	
ST-11	Shelby Tube	10-12	X	X	X		X	X	X	X	
ST-13	Shelby Tube	3-5	X	X	X		X	X	X	X	
ST-15	Shelby Tube	15-18.5	X	X	X		X	X	X	X	
SB-1	Split Spoon	18-20	X			X					UU
SB-2	Split Spoon	13.5-25	X			X					UU
SB-3	Split Spoon	8.5-10	X			X					UU
SB-5	Split Spoon	18.5-20	X			X					UU
SB-6	Split Spoon	13.5-15	X			X					UU
SB-7	Split Spoon	8.5-10	X			X					UU
SB-8	Split Spoon	18.5-20	X			X					UU

Notes:

CU = Consolidated Undrained Triaxial Compression Test

UU = Unconsolidated Undrained Triaxial Compression Test

Prepared by: BMS2

Checked by: TSW1

Table 2

Geotechnical Soil Borings Investigation

Summary of Geotechnical Laboratory Testing Results

			ASTM Procedure	D4767(CU)/ D2850(UU)					D2435												D5084	CALCULATIONS		D854	D7263/ D2216		D4318			D2487	D422-16																			
			ASTM Description	Triaxial Shear					One-Dimensional Consolidation												Hydraulic Conductivity	Porosity	Saturation	Specific Gravity	Dry Density	Water Content	Atterberg Limits			USCS	Grain Size Analysis																			
			ASTM Parameter	ϕ'	c'	γ_d	W.C	P_c	P_c	OCR	OCR	C_c	C_{cr}	e_o	S_G	WC	γ_d	γ_w	γ_{sat}	γ_b	γ_{sub}	k @ 20 deg C	n	S		γ_d	WC	Liquid Limit	Plastic Limit	Plasticity Index	Symbol	Sieve Size Passing												Diameter						
Boring ID	Depth[1]	Elevation[2]	Description	(°)	(psf)	(pcf)	(%)	(tsf)	(ksf)	(current)	(future)					(%)	(pcf)	(pcf)	(pcf)	(pcf)	(pcf)	(cm/sec)		(%)		(pcf)	(%)					1" (%)	3/4" (%)	3/8" (%)	#4 (%)	#10 (%)	#20 (%)	#40 (%)	#100 (%)	#200 (%)	0.03 (mm)	0.02 (mm)	0.011 (mm)	0.008 (mm)	0.005 (mm)	0.003 (mm)	0.001 (mm)
SB-4	28.5-30.5	-51.2 -53.2	DF	30.7[a]	240	-	-	3.3	6.6	2.4	0.6	0.07	0.01	0.45	2.79	16.1	120	62	139	77	87	-	0.30	91.6	2.79	120.1	16.1	20.0	12.0	8.0	CL	-	-	-	100.0	100.0	99.8	99.5	95.9	89.1	69.2	58.4	46.0	38.0	32.4	24.1	19.2
SB-7	17.5-20	-35.2 -37.7	DF	26.0[a]	360	-	-	0.37	0.74	0.5	0.1	0.41	0.07	1.57	2.79	57.7	66	62	106	43	79	-	0.38	88.8	2.79			35.0	13.0	22.0	CL	-	-	100.0	99.7	99.3	98.7	98.0	94.3	91.0	79.9	74.7	67.3	61.7	55.7	45.6	36.6
ST-11	30-32	-42.5 -44.5	DF	30.1[a]	400	-	-	1.4	2.8	1.0	0.3	0.07	0.01	0.43	2.81	16.4	120	62	141	79	89	-	0.32	89.2	2.81	122.8	15.7	21.0	12.0	9.0	CL	-	-	-	100.0	99.9	99.4	98.4	93.2	87.6	69.9	62.3	51.8	43.2	36.9	27.1	20.8
SB-8	2.5-5	-15.1 -17.6	NF	-	-	-	-	1.5	3	7.5	0.3	0.15	0.02	0.63	2.73	22.3	107	62	128	66	80	5.30E-08	-	-	2.65	66.6	55.3	51.0	28.0	23.0	CH/OH	-	-	-	100.0	99.9	99.7	99.1	96.8	95.5	86.4	71.8	58.0	47.2	37.4	26.9	17.1
ST-10	15-17	-26.8 -28.8	DF	-	-	-	-	0.95	1.9	1.3	0.2	0.09	0.01	0.43	2.79	15.1	121	62	140	78	87	2.40E-08	-	-	2.79	121.4	15.1	23.0	12.0	11.0	CL	100.0	94.0	91.9	89.5	85.7	83.8	82.2	76.0	69.2	51.4	45.3	39.7	34.1	30.6	22.2	18.7
ST-11	10-12	-22.5 -24.5	NF	-	-	-	-	8.8	17.6	16.9	1.6	0.01	0.01	0.45	2.79	15.7	123	62	139	77	87	1.40E-08	0.33	82.4	2.79	120.1	16.4	24.0	12.0	12.0	CL	-	-	-	100.0	99.9	99.4	98.7	93.9	87.8	70.4	62.9	54.0	45.4	39.3	30.1	23.1
ST-13	3-5	-19.6 -21.6	NF	-	-	-	-	6.2	12.4	28.5	1.2	0.14	0.01	0.42	2.77	14.6	122	62	140	78	87	3.90E-08	0.28	100.7	2.77	124.8	14.0	21.0	11.0	10.0	CL	-	-	-	100.0	99.5	98.7	96.9	87.1	78.1	60.0	52.9	46.3	39.8	35.6	27.8	21.8
ST-15	15-18.5	-31.2 -34.7	DF	-	-	-	-	10	20	12.5	1.9	0.16	0.01	0.51	2.85	16.4	118	62	139	77	87	3.30E-08	0.33	91.5	2.85	118	16.4	25.0	12.0	13.0	CL	-	-	100.0	99.9	99.4	98.9	98.2	94.8	90.3	68.4	58.6	49.2	43.2	37.5	29.7	23.2
SB-1	18-20	-37.9 -39.9	DF	0	1570	121	12.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.79	-	-	-	-	-	CL	-	-	-	100.0	99.7	99.1	98.3	90.6	82.0	62.3	53.4	44.8	39.3	34.2	27.0	21.0
SB-2	13.5-15	-31.1 -32.6	DF	0	870	115	16.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.79	-	-	-	-	-	CL	-	-	100.0	99.9	99.6	99.2	98.8	96.9	94.6	83.4	75.0	61.4	52.2	44.4	32.8	24.7
SB-3	8.5-10	-31.7 -33.2	NF	0	910	111	18.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.79	-	-	-	-	-	CL	-	-	-	-	100.0	99.9	99.7	98.8	97.1	87.3	81.0	71.1	63.8	56.6	44.9	34.6
SB-5	18.5-20	-40.7 -42.2	DF	0	330	112	18.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.79	-	-	-	-	-	CL	-	-	-	-	100.0	99.9	99.6	97.6	85.4	54.8	45.3	35.6	32.7	28.8	21.9	16.9
SB-6	13.5-15	-33.1 -34.6	NF	0	160	80.7	37.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.65	-	42.1[b]	-	-	-	CL/OL	-	-	-	100.0	97.4	93.2	89.8	78.6	72.4	62.8	54.0	43.7	37.8	33.3	24.5	17.9
SB-7	8.5-10	-26.2 -27.7	NF	0	680	94.4	27.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.68	-	33.4[b]	-	-	-	CL	-	-	-	100.0	99.8	99.3	98.3	92.8	89.0	82.0	75.1	66.5	60.9	54.9	45.8	35.7
SB-8	18.5-20	-31.1 -32.6	DF	0	330	95.4	27.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.68	-	28.1[b]	-	-	-	CL	-	-	100.0	99.9	99.5	98.9	98.2	94.6	90.6	79.3	72.1	62.8	56.8	51.5	42.2	33.1

Notes:

Prepared by: BMS2
Checked by: TSW1

ASTM = American Society of Testing and Materials.

1 = Depth measured as feet below mudline.

2 = Elevation measured as feet below Low Water Datum (LWD).

CU = Consolidated-Undrained Triaxial Compression Test, estimating long-term strength conditions.

UU = Unconsolidated-Undrained Triaxial Compression Test, estimating short-term strength conditions.

f' = phi, the effective friction angle at failure, measured in degrees.

c' = cohesion, the effective cohesion at failure, mesured in pounds per square foot.

gd = dry density, measured in pounds per cubic foot.

WC = water content, measured as a percentage.

P_c = Preconsolidation pressure, which estimates prehistoric loading, measured in tons per square foot.

Pp= anticipated loading pressure desnity of material multiply height material

C_c = Compression index, representing the, unitless.

C_{cr} = Recompression index,unitless,

e_o = initial void ratio, prior to consolidation, unitless.

k = hydraulic conductivity, using falling head methodology, meaured in centimeters per second.

n = porosity, unitless.

S = degree of saturation, measured as a percentage.

USCS = Unified Soil Classification System

Grain Size Analysis = Grain size diameter measured as percent passing numbered sieves, and grain size diameter in millimeters.

DF = Deep Foundation, as identified in stability modeling.

NF = Native Foundation (shallow), as identified in stability modeling.

a = Shear Strength measured using ASTM D4767 Conolidated-Undrained Test; reported lowest measured value.

b = Water content measured using ASTM D2216.

- = sample not collected or parameter not measured.

Attachment 2

Geotechnical Laboratory Testing Data Sheets

Hydraulic Conductivity Test Data ASTM D5084

Project: DMMF - MKE Harbor, WI Date: 6/29/2020

Client: Foth Infrastructure & Environment, LLC Job No.: 12596

Boring No.:	SB-8	ST-10	ST-11	ST-13	ST-15		
Sample No.:							
Depth (ft):	2.5-5	15-17	10-12	3-5	15-18.5		
Location:							
Sample Type:	TWT	TWT	TWT	TWT	TWT		
Soil Classification:	Fat Clay, slightly organic (CH/OH)	Sandy Lean Clay w/a little gravel (CL)	Lean Clay (CL)	Lean Clay w/sand (CL)	Lean Clay (CL)		
Atterberg Limits Liquid Limit:	51	23	24	21	25		
Atterberg Limits Plastic Limit:	28	12	12	11	12		
Atterberg Limits Plasticity Index:	23	11	12	10	13		
Permeability Test	Intact	Intact	Intact	Intact	Intact		
Before Test Conditions Saturation %:							
Before Test Conditions Porosity:			0.33	0.28	0.33		
Before Test Conditions Height (in):	2.91	2.96	2.20	2.89	2.90		
Before Test Conditions Diameter (in):	2.82	2.87	2.86	2.86	2.88		
Before Test Conditions Dry Density (pcf):	66.6	120.6	116.1	124.8	119.6		
Before Test Conditions Water Content:	55.3%	15.2%	14.8%	14.0%	15.7%		
Test Conditions Test Type:	Falling	Falling	Falling	Falling	Falling		
Test Conditions Max Head (ft):	5.0	5.0	5.0	5.0	5.0		
Test Conditions Confining press. (Effective-psi):	2.0	2.0	2.0	2.0	2.0		
Test Conditions Trial Numbers:	9-13	9-13	9-13	9-13	9-13		
Test Conditions Water Temp ℃:	22.0	22.0	22.0	22.0	22.0		
Test Conditions Compaction:							
Test Conditions Saturation %:	99.6%	98.3%	95.5%	96.2%	95.1%		
Coefficient of Permeability							
K @ 20 ℃ (cm/sec)	**5.3×10^{-8}**	**2.4×10^{-8}**	**1.4×10^{-8}**	**3.9×10^{-8}**	**3.3×10^{-8}**		
K @ 20 ℃ (ft/min)	**1.0×10^{-7}**	**4.7×10^{-8}**	**2.8×10^{-8}**	**7.7×10^{-8}**	**6.5×10^{-8}**		
Notes:							

9530 James Ave South

SOIL ENGINEERING TESTING, INC.

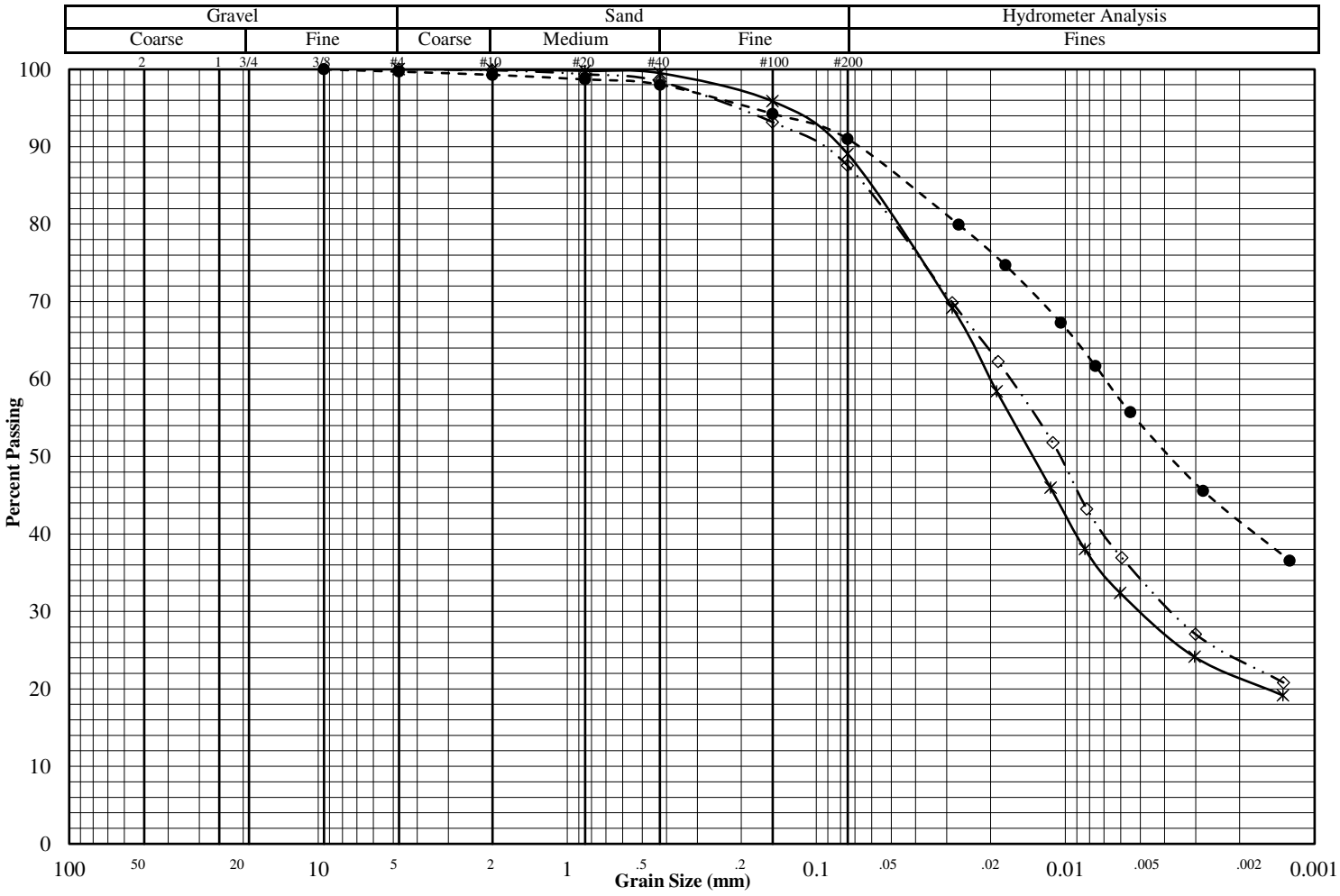
Bloomington, MN 55431

Grain Size Distribution ASTM D422-16

Job No. : **12596**

Project:	DMMF - MKE Harbor, WI	Test Date:	6/18/20
Reported To:	Foth Infrastructure & Environment, LLC	Report Date:	6/28/20

	Location / Boring No.	Sample No.	Depth (ft)	Sample Type	Soil Classification
*	SB-4		28.5-30.5	TWT	Lean Clay (CL)
●	SB-7		17.5-20	TWT	Lean Clay (CL)
◇	ST-11		30-32	TWT	Lean Clay (CL)



Additional Results	*	●	◇
Liquid Limit	20	35	21
Plastic Limit	12	13	12
Plasticity Index ASTM:D4316	8	22	9
Water Content ASTM:D2216			
Dry Density (pcf) ASTM:D7263			
Specific Gravity ASTM:D854	2.79	2.79	2.81
Porosity			
Organic Content ASTM:D2974			
pH ASTM:D4972 Method B			

(* = assumed)

Percent Passing

	*	●	◇
Mass (g)	189.3	251.9	284.4
2"			
1.5"			
1"			
3/4"			
3/8"		100.0	
#4	100.0	99.7	100.0
#10	100.0	99.3	99.9
#20	99.8	98.7	99.4
#40	99.5	98.0	98.4
#100	95.9	94.3	93.2
#200	89.1	91.0	87.6

	*	●	◇
D_{60}			
D_{30}			
D_{10}			
C_U			
C_C			

Remarks:

9530 James Ave South

SOIL ENGINEERING TESTING, INC.

Bloomington, MN 55431

Grain Size Distribution ASTM D422-16

Job No. : **12596**

Project:	DMMF - MKE Harbor, WI	Test Date:	6/18/20
Reported To:	Foth Infrastructure & Environment, LLC	Report Date:	6/28/20

	Location / Boring No.	Sample No.	Depth (ft)	Sample Type	Soil Classification
Spec 1	SB-4		28.5-30.5	TWT	Lean Clay (CL)
Spec 2	SB-7		17.5-20	TWT	Lean Clay (CL)
Spec 3	ST-11		30-32	TWT	Lean Clay (CL)

Sieve Data

Specimen 1		Specimen 2		Specimen 3	
Sieve	% Passing	Sieve	% Passing	Sieve	% Passing
2"		2"		2"	
1.5"		1.5"		1.5"	
1"		1"		1"	
3/4"		3/4"		3/4"	
3/8"		3/8"	100.0	3/8"	
#4	100.0	#4	99.7	#4	100.0
#10	100.0	#10	99.3	#10	99.9
#20	99.8	#20	98.7	#20	99.4
#40	99.5	#40	98.0	#40	98.4
#100	95.9	#100	94.3	#100	93.2
#200	89.1	#200	91.0	#200	87.6

Hydrometer Data

Specimen 1		Specimen 2		Specimen 3	
Diameter (mm)	% Passing	Diameter	% Passing	Diameter	% Passing
0.028	69.2	0.027	79.9	0.028	69.9
0.019	58.4	0.017	74.7	0.019	62.3
0.011	46.0	0.010	67.3	0.011	51.8
0.008	38.0	0.008	61.7	0.008	43.2
0.006	32.4	0.005	55.7	0.006	36.9
0.003	24.1	0.003	45.6	0.003	27.1
0.001	19.2	0.001	36.6	0.001	20.8

Remarks

Specimen 1	Specimen 2	Specimen 3

9530 James Ave South

SOIL ENGINEERING TESTING, INC.

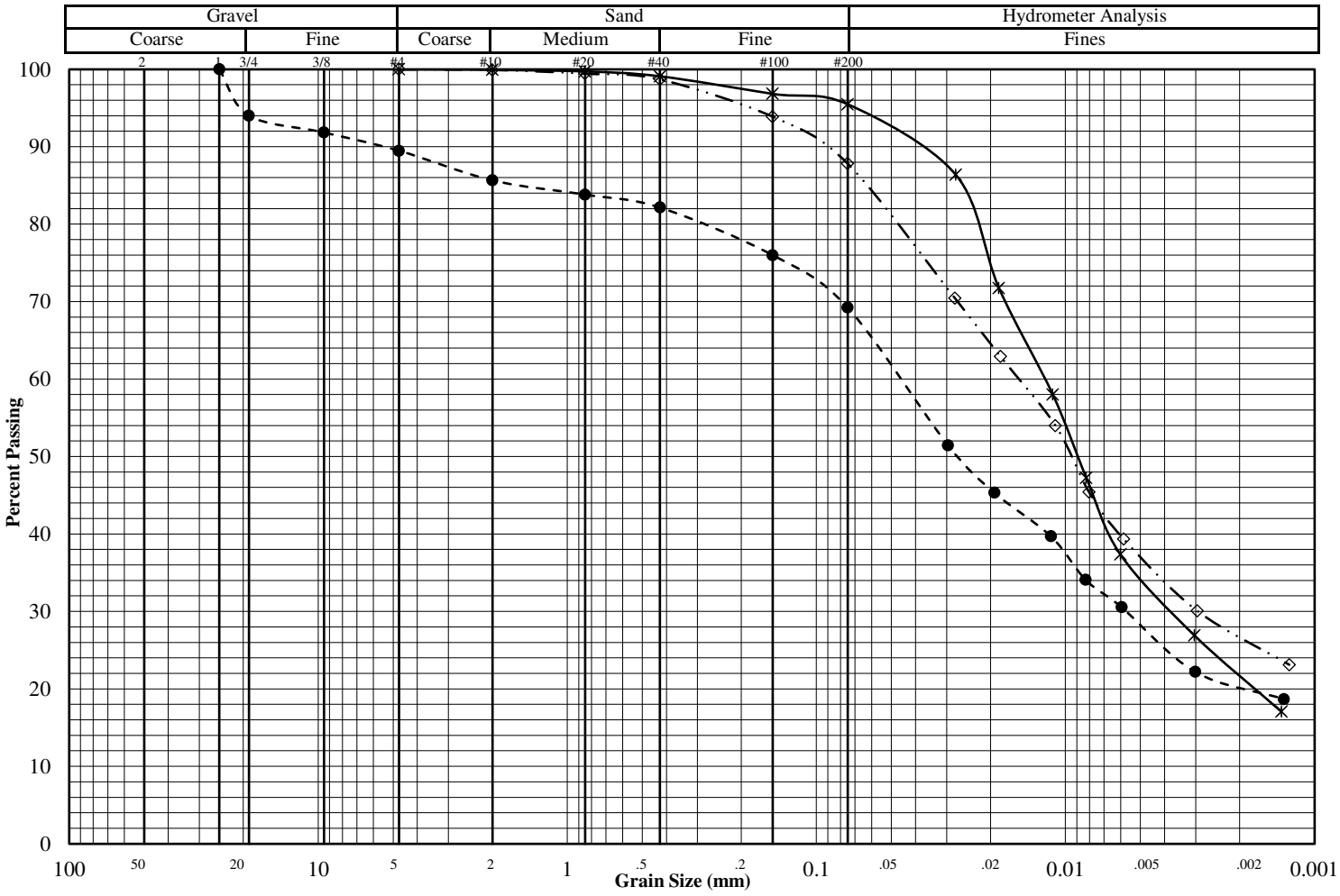
Bloomington, MN 55431

Grain Size Distribution ASTM D422-16

Job No. : **12596**

Project:	DMMF - MKE Harbor, WI	Test Date:	6/18/20
Reported To:	Foth Infrastructure & Environment, LLC	Report Date:	6/28/20

	Location / Boring No.	Sample No.	Depth (ft)	Sample Type	Soil Classification
*	SB-8		2.5-5	TWT	Fat Clay, slightly organic (CH/OH)
●	ST-10		15-17	TWT	Sandy Lean Clay w/a little gravel (CL)
◇	ST-11		10-12	TWT	Lean Clay (CL)



Additional Results	*	●	◇
Liquid Limit	51	23	24
Plastic Limit	28	12	12
Plasticity Index ASTM:D4316	23	11	12
Water Content ASTM:D2216			
Dry Density (pcf) ASTM:D7263			
Specific Gravity ASTM:D854	2.65*	2.79*	2.79
Porosity			
Organic Content ASTM:D2974			
pH ASTM:D4972 Method B			

Percent Passing

	*	●	◇
Mass (g)	134.2	342.8	274.8
2"			
1.5"			
1"		100.0	
3/4"		94.0	
3/8"		91.9	
#4	100.0	89.5	100.0
#10	99.9	85.7	99.9
#20	99.7	83.8	99.4
#40	99.1	82.2	98.7
#100	96.8	76.0	93.9
#200	95.5	69.2	87.8

	*	●	◇
D_{60}			
D_{30}			
D_{10}			
C_U			
C_C			

Remarks:

(* = assumed)

9530 James Ave South

SOIL ENGINEERING TESTING, INC.

Bloomington, MN 55431

Grain Size Distribution ASTM D422-16

Job No. : **12596**

Project:	DMMF - MKE Harbor, WI	Test Date:	6/18/20
Reported To:	Foth Infrastructure & Environment, LLC	Report Date:	6/28/20

	Location / Boring No.	Sample No.	Depth (ft)	Sample Type	Soil Classification
Spec 1	SB-8		2.5-5	TWT	Fat Clay, slightly organic (CH/OH)
Spec 2	ST-10		15-17	TWT	Sandy Lean Clay w/a little gravel (CL)
Spec 3	ST-11		10-12	TWT	Lean Clay (CL)

Sieve Data

Specimen 1		Specimen 2		Specimen 3	
Sieve	% Passing	Sieve	% Passing	Sieve	% Passing
2"		2"		2"	
1.5"		1.5"		1.5"	
1"		1"	100.0	1"	
3/4"		3/4"	94.0	3/4"	
3/8"		3/8"	91.9	3/8"	
#4	100.0	#4	89.5	#4	100.0
#10	99.9	#10	85.7	#10	99.9
#20	99.7	#20	83.8	#20	99.4
#40	99.1	#40	82.2	#40	98.7
#100	96.8	#100	76.0	#100	93.9
#200	95.5	#200	69.2	#200	87.8

Hydrometer Data

Specimen 1		Specimen 2		Specimen 3	
Diameter (mm)	% Passing	Diameter	% Passing	Diameter	% Passing
0.028	86.4	0.030	51.4	0.028	70.4
0.019	71.8	0.019	45.3	0.018	62.9
0.011	58.0	0.011	39.7	0.011	54.0
0.008	47.2	0.008	34.1	0.008	45.4
0.006	37.4	0.006	30.6	0.006	39.3
0.003	26.9	0.003	22.2	0.003	30.1
0.001	17.1	0.001	18.7	0.001	23.1

Remarks

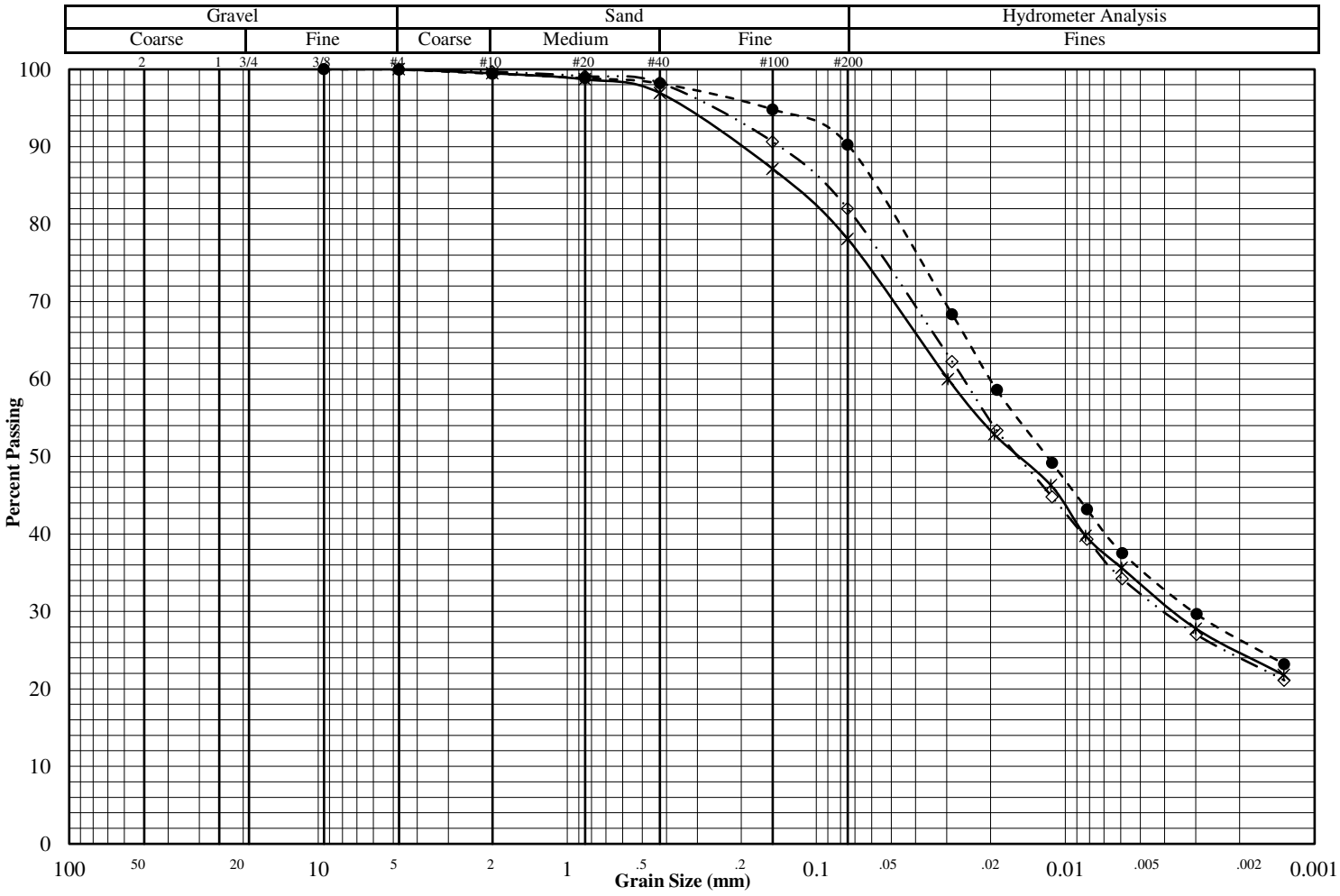
Specimen 1	Specimen 2	Specimen 3

Grain Size Distribution ASTM D422-16

Job No. : **12596**

Project:	DMMF - MKE Harbor, WI	Test Date:	6/18/20
Reported To:	Foth Infrastructure & Environment, LLC	Report Date:	6/28/20

	Location / Boring No.	Sample No.	Depth (ft)	Sample Type	Soil Classification
*	ST-13		3-5	TWT	Lean Clay w/sand (CL)
●	ST-15		15-18.5	TWT	Lean Clay (CL)
◇	SB-1		18-20	Bag	Lean Clay w/sand (CL)



Additional Results	*	●	◇
Liquid Limit	21	25	
Plastic Limit	11	12	
Plasticity Index ASTM:D4316	10	13	
Water Content ASTM:D2216			
Dry Density (pcf) ASTM:D7263			
Specific Gravity ASTM:D854	2.77	2.85	2.79*
Porosity			
Organic Content ASTM:D2974			
pH ASTM:D4972 Method B			

Percent Passing

	*	●	◇
Mass (g)	229.1	245.0	1177.1
2"			
1.5"			
1"			
3/4"			
3/8"		100.0	
#4	100.0	99.9	100.0
#10	99.5	99.4	99.7
#20	98.7	98.9	99.1
#40	96.9	98.2	98.3
#100	87.1	94.8	90.6
#200	78.1	90.3	82.0

	*	●	◇
D_{60}			
D_{30}			
D_{10}			
C_U			
C_C			

Remarks:

(* = assumed)

9530 James Ave South

SOIL ENGINEERING TESTING, INC.

Bloomington, MN 55431

Grain Size Distribution ASTM D422-16

Job No. : **12596**

Project:	DMMF - MKE Harbor, WI	Test Date:	6/18/20
Reported To:	Foth Infrastructure & Environment, LLC	Report Date:	6/28/20

	Location / Boring No.	Sample No.	Depth (ft)	Sample Type	Soil Classification
Spec 1	ST-13		3-5	TWT	Lean Clay w/sand (CL)
Spec 2	ST-15		15-18.5	TWT	Lean Clay (CL)
Spec 3	SB-1		18-20	Bag	Lean Clay w/sand (CL)

Sieve Data

Specimen 1		Specimen 2		Specimen 3	
Sieve	% Passing	Sieve	% Passing	Sieve	% Passing
2"		2"		2"	
1.5"		1.5"		1.5"	
1"		1"		1"	
3/4"		3/4"		3/4"	
3/8"		3/8"	100.0	3/8"	
#4	100.0	#4	99.9	#4	100.0
#10	99.5	#10	99.4	#10	99.7
#20	98.7	#20	98.9	#20	99.1
#40	96.9	#40	98.2	#40	98.3
#100	87.1	#100	94.8	#100	90.6
#200	78.1	#200	90.3	#200	82.0

Hydrometer Data

Specimen 1		Specimen 2		Specimen 3	
Diameter (mm)	% Passing	Diameter	% Passing	Diameter	% Passing
0.030	60.0	0.029	68.4	0.029	62.3
0.019	52.9	0.019	58.6	0.019	53.4
0.011	46.3	0.011	49.2	0.011	44.8
0.008	39.8	0.008	43.2	0.008	39.3
0.006	35.6	0.006	37.5	0.006	34.2
0.003	27.8	0.003	29.7	0.003	27.0
0.001	21.8	0.001	23.2	0.001	21.1

Remarks

Specimen 1	Specimen 2	Specimen 3

9530 James Ave South

SOIL ENGINEERING TESTING, INC.

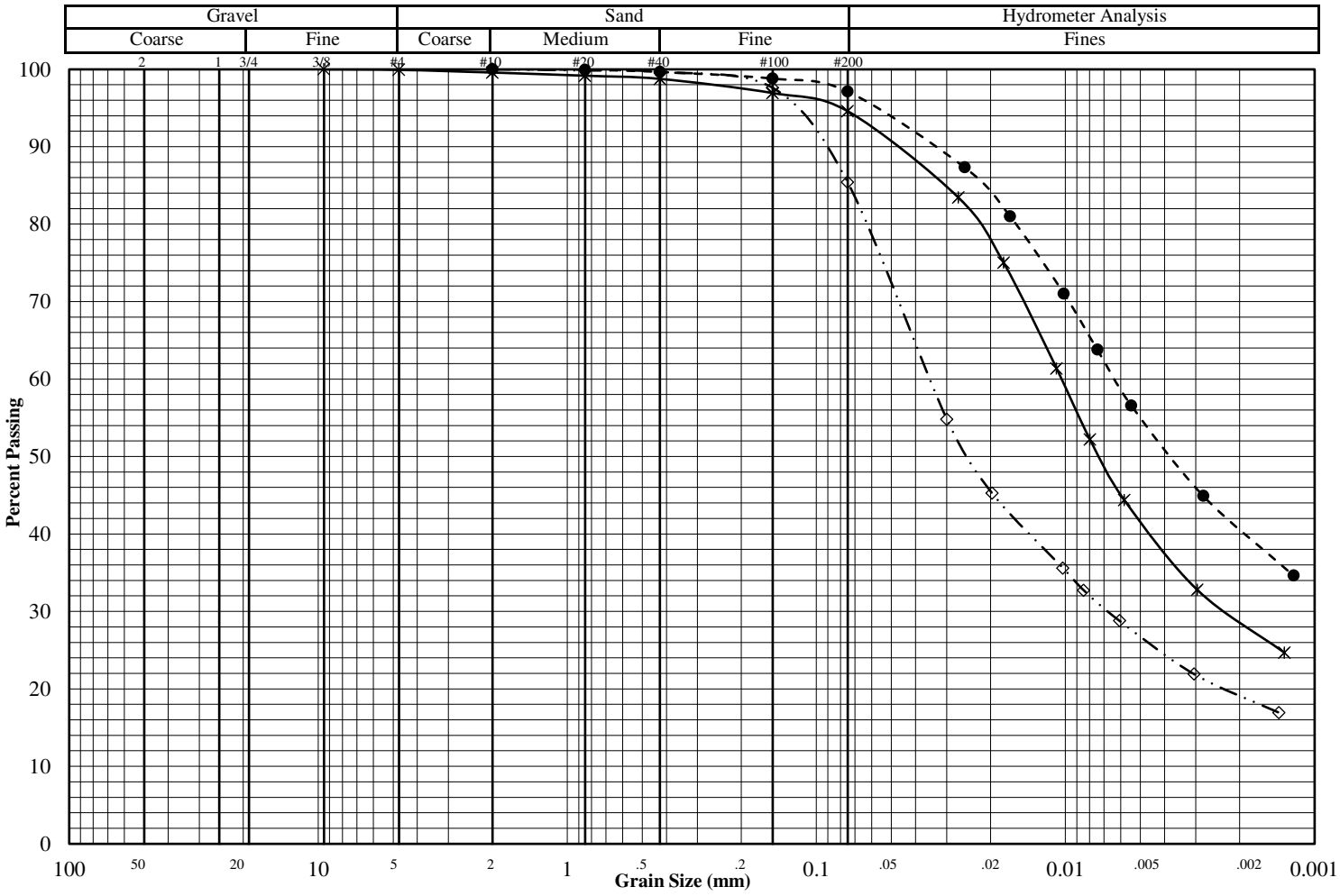
Bloomington, MN 55431

Grain Size Distribution ASTM D422-16

Job No. : **12596**

Project:	DMMF - MKE Harbor, WI	Test Date:	6/18/20
Reported To:	Foth Infrastructure & Environment, LLC	Report Date:	6/28/20

	Location / Boring No.	Sample No.	Depth (ft)	Sample Type	Soil Classification
*	SB-2		13.5-15	Bag	Lean Clay (CL)
●	SB-3		8.5-10	Bag	Lean Clay (CL)
◇	SB-5		18.5-20	Bag	Lean Clay (CL)



Additional Results	*	●	◇
Liquid Limit			
Plastic Limit			
Plasticity Index ASTM:D4316			
Water Content ASTM:D2216			
Dry Density (pcf) ASTM:D7263			
Specific Gravity ASTM:D854	2.79*	2.79*	2.79*
Porosity			
Organic Content ASTM:D2974			
pH ASTM:D4972 Method B			

Percent Passing

	*	●	◇
Mass (g)	910.1	850.0	646.3
2"			
1.5"			
1"			
3/4"			
3/8"	100.0		
#4	99.9		
#10	99.6	100.0	100.0
#20	99.2	99.9	99.9
#40	98.8	99.7	99.6
#100	96.9	98.8	97.6
#200	94.6	97.1	85.4

	*	●	◇
D_{60}			
D_{30}			
D_{10}			
C_U			
C_C			

Remarks:

(* = assumed)

9530 James Ave South

SOIL ENGINEERING TESTING, INC.

Bloomington, MN 55431

Grain Size Distribution ASTM D422-16

Job No. : **12596**

Project:	DMMF - MKE Harbor, WI	Test Date:	6/18/20
Reported To:	Foth Infrastructure & Environment, LLC	Report Date:	6/28/20

	Location / Boring No.	Sample No.	Depth (ft)	Sample Type	Soil Classification
Spec 1	SB-2		13.5-15	Bag	Lean Clay (CL)
Spec 2	SB-3		8.5-10	Bag	Lean Clay (CL)
Spec 3	SB-5		18.5-20	Bag	Lean Clay (CL)

Sieve Data

Specimen 1		Specimen 2		Specimen 3	
Sieve	% Passing	Sieve	% Passing	Sieve	% Passing
2"		2"		2"	
1.5"		1.5"		1.5"	
1"		1"		1"	
3/4"		3/4"		3/4"	
3/8"	100.0	3/8"		3/8"	
#4	99.9	#4		#4	
#10	99.6	#10	100.0	#10	100.0
#20	99.2	#20	99.9	#20	99.9
#40	98.8	#40	99.7	#40	99.6
#100	96.9	#100	98.8	#100	97.6
#200	94.6	#200	97.1	#200	85.4

Hydrometer Data

Specimen 1		Specimen 2		Specimen 3	
Diameter (mm)	% Passing	Diameter	% Passing	Diameter	% Passing
0.027	83.4	0.025	87.3	0.030	54.8
0.018	75.0	0.017	81.0	0.020	45.3
0.011	61.4	0.010	71.1	0.010	35.6
0.008	52.2	0.007	63.8	0.008	32.7
0.006	44.4	0.005	56.6	0.006	28.8
0.003	32.8	0.003	44.9	0.003	21.9
0.001	24.7	0.001	34.6	0.001	16.9

Remarks

Specimen 1	Specimen 2	Specimen 3

9530 James Ave South

SOIL ENGINEERING TESTING, INC.

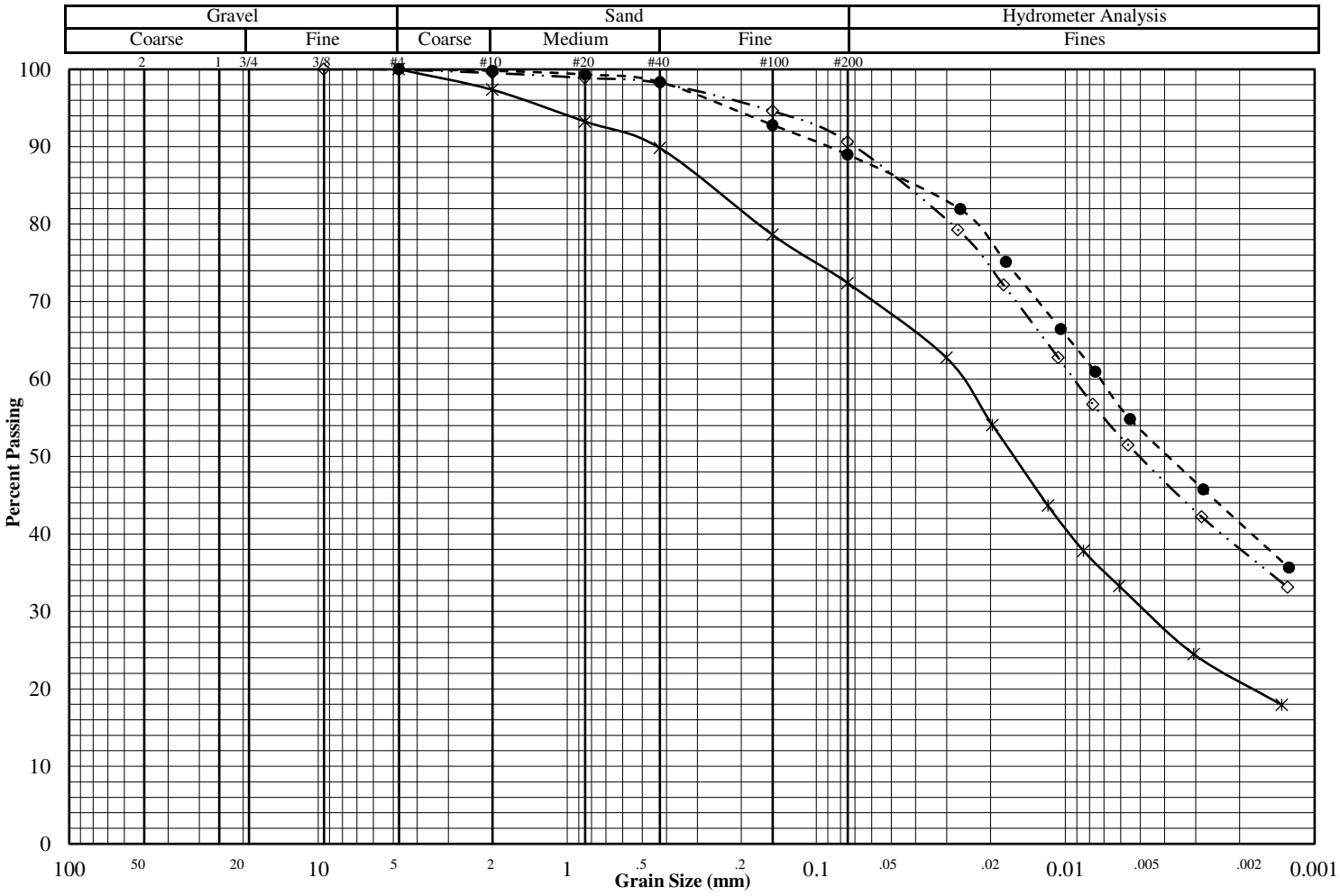
Bloomington, MN 55431

Grain Size Distribution ASTM D422-16

Job No. : **12596**

Project:	DMMF - MKE Harbor, WI	Test Date:	6/18/20
Reported To:	Foth Infrastructure & Environment, LLC	Report Date:	6/28/20

	Location / Boring No.	Sample No.	Depth (ft)	Sample Type	Soil Classification
*	SB-6		13.5-15	Bag	Lean Clay w/sand and shell fragments, slightly organic (CL/OL)
●	SB-7		8.5-10	Bag	Lean Clay, slightly organic (CL)
◇	SB-8		18.5-20	Bag	Lean Clay (CL)



Additional Results	*	●	◇
Liquid Limit			
Plastic Limit			
Plasticity Index ASTM:D4316			
Water Content ASTM:D2216	42.1	33.4	28.1
Dry Density (pcf) ASTM:D7263			
Specific Gravity ASTM:D854	2.65*	2.68*	2.68*
Porosity			
Organic Content ASTM:D2974			
pH ASTM:D4972 Method B			

Percent Passing

	*	●	◇
Mass (g)	581.3	445.3	22.4
2"			
1.5"			
1"			
3/4"			
3/8"			100.0
#4	100.0	100.0	99.9
#10	97.4	99.8	99.5
#20	93.2	99.3	98.9
#40	89.8	98.3	98.2
#100	78.6	92.8	94.6
#200	72.4	89.0	90.6

	*	●	◇
D_{60}			
D_{30}			
D_{10}			
C_U			
C_C			

Remarks:

(* = assumed)

9530 James Ave South

SOIL ENGINEERING TESTING, INC.

Bloomington, MN 55431

Grain Size Distribution ASTM D422-16

Job No. : **12596**

Project:	DMMF - MKE Harbor, WI	Test Date:	6/18/20
Reported To:	Foth Infrastructure & Environment, LLC	Report Date:	6/28/20

	Location / Boring No.	Sample No.	Depth (ft)	Sample Type	Soil Classification
Spec 1	SB-6		13.5-15	Bag	Lean Clay w/sand and shell fragments, slightly organic (CL/OL)
Spec 2	SB-7		8.5-10	Bag	Lean Clay, slightly organic (CL)
Spec 3	SB-8		18.5-20	Bag	Lean Clay (CL)

Sieve Data

Specimen 1		Specimen 2		Specimen 3	
Sieve	% Passing	Sieve	% Passing	Sieve	% Passing
2"		2"		2"	
1.5"		1.5"		1.5"	
1"		1"		1"	
3/4"		3/4"		3/4"	
3/8"		3/8"		3/8"	100.0
#4	100.0	#4	100.0	#4	99.9
#10	97.4	#10	99.8	#10	99.5
#20	93.2	#20	99.3	#20	98.9
#40	89.8	#40	98.3	#40	98.2
#100	78.6	#100	92.8	#100	94.6
#200	72.4	#200	89.0	#200	90.6

Hydrometer Data

Specimen 1		Specimen 2		Specimen 3	
Diameter (mm)	% Passing	Diameter	% Passing	Diameter	% Passing
0.030	62.8	0.026	82.0	0.027	79.3
0.020	54.0	0.017	75.1	0.018	72.1
0.012	43.7	0.010	66.5	0.011	62.8
0.008	37.8	0.008	60.9	0.008	56.8
0.006	33.3	0.006	54.9	0.006	51.5
0.003	24.5	0.003	45.8	0.003	42.2
0.001	17.9	0.001	35.7	0.001	33.1

Remarks

Specimen 1	Specimen 2	Specimen 3

9530 James Ave South

SOIL ENGINEERING TESTING, INC.

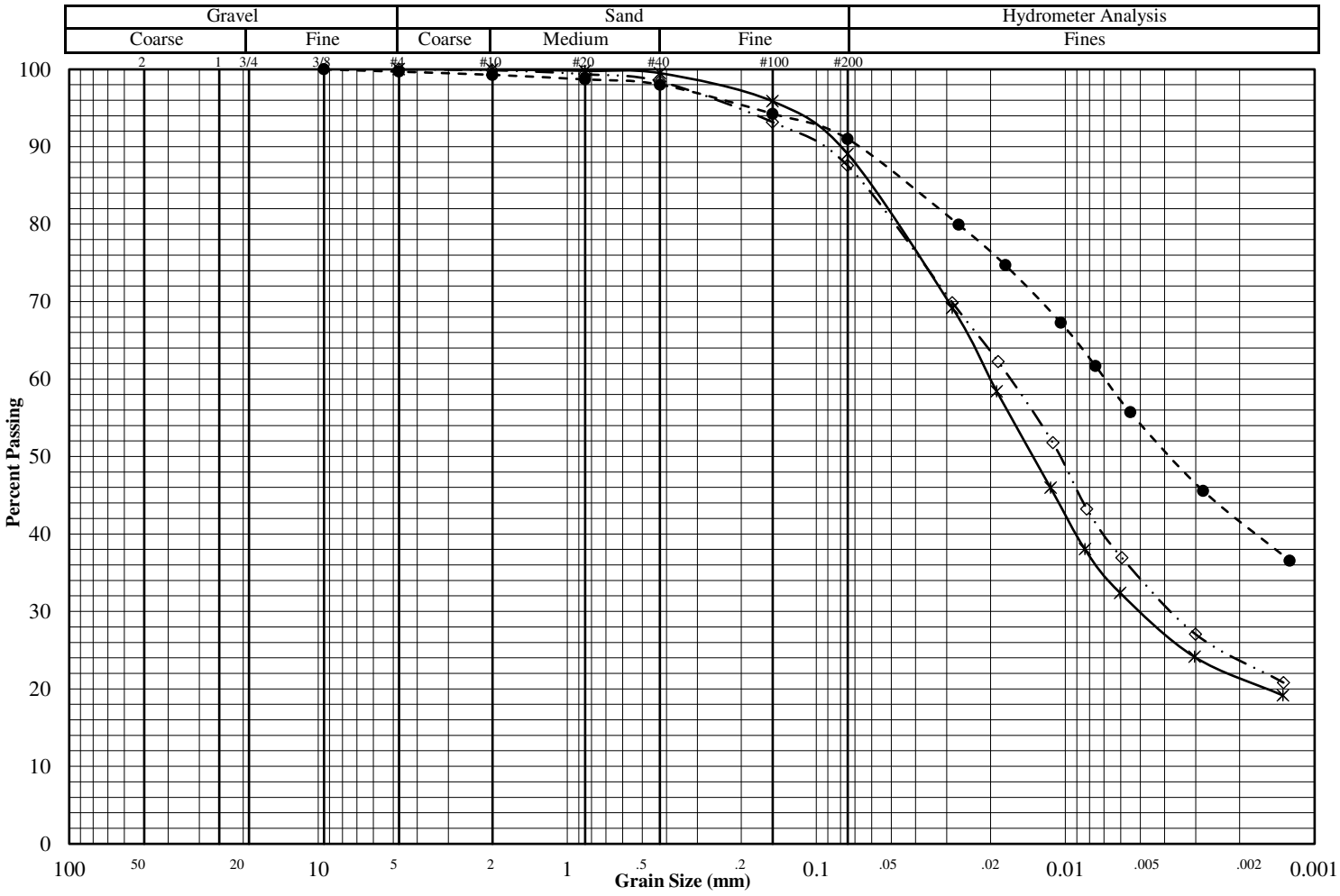
Bloomington, MN 55431

Grain Size Distribution ASTM D422-16

Job No. : **12596**

Project:	DMMF - MKE Harbor, WI	Test Date:	6/18/20
Reported To:	Foth Infrastructure & Environment, LLC	Report Date:	6/28/20

	Location / Boring No.	Sample No.	Depth (ft)	Sample Type	Soil Classification
*	SB-4		28.5-30.5	TWT	Lean Clay (CL)
●	SB-7		17.5-20	TWT	Lean Clay (CL)
◇	ST-11		30-32	TWT	Lean Clay (CL)



Additional Results	*	●	◇
Liquid Limit	20	35	21
Plastic Limit	12	13	12
Plasticity Index ASTM:D4316	8	22	9
Water Content ASTM:D2216			
Dry Density (pcf) ASTM:D7263			
Specific Gravity ASTM:D854	2.79	2.79	2.81
Porosity			
Organic Content ASTM:D2974			
pH ASTM:D4972 Method B			

(* = assumed)

Percent Passing

	*	●	◇
Mass (g)	189.3	251.9	284.4
2"			
1.5"			
1"			
3/4"			
3/8"		100.0	
#4	100.0	99.7	100.0
#10	100.0	99.3	99.9
#20	99.8	98.7	99.4
#40	99.5	98.0	98.4
#100	95.9	94.3	93.2
#200	89.1	91.0	87.6

	*	●	◇
D_{60}			
D_{30}			
D_{10}			
C_U			
C_C			

Remarks:

9530 James Ave South

SOIL ENGINEERING TESTING, INC.

Bloomington, MN 55431

Grain Size Distribution ASTM D422-16

Job No. : **12596**

Project:	DMMF - MKE Harbor, WI	Test Date:	6/18/20
Reported To:	Foth Infrastructure & Environment, LLC	Report Date:	6/28/20

	Location / Boring No.	Sample No.	Depth (ft)	Sample Type	Soil Classification
Spec 1	SB-4		28.5-30.5	TWT	Lean Clay (CL)
Spec 2	SB-7		17.5-20	TWT	Lean Clay (CL)
Spec 3	ST-11		30-32	TWT	Lean Clay (CL)

Sieve Data

Specimen 1		Specimen 2		Specimen 3	
Sieve	% Passing	Sieve	% Passing	Sieve	% Passing
2"		2"		2"	
1.5"		1.5"		1.5"	
1"		1"		1"	
3/4"		3/4"		3/4"	
3/8"		3/8"	100.0	3/8"	
#4	100.0	#4	99.7	#4	100.0
#10	100.0	#10	99.3	#10	99.9
#20	99.8	#20	98.7	#20	99.4
#40	99.5	#40	98.0	#40	98.4
#100	95.9	#100	94.3	#100	93.2
#200	89.1	#200	91.0	#200	87.6

Hydrometer Data

Specimen 1		Specimen 2		Specimen 3	
Diameter (mm)	% Passing	Diameter	% Passing	Diameter	% Passing
0.028	69.2	0.027	79.9	0.028	69.9
0.019	58.4	0.017	74.7	0.019	62.3
0.011	46.0	0.010	67.3	0.011	51.8
0.008	38.0	0.008	61.7	0.008	43.2
0.006	32.4	0.005	55.7	0.006	36.9
0.003	24.1	0.003	45.6	0.003	27.1
0.001	19.2	0.001	36.6	0.001	20.8

Remarks

Specimen 1	Specimen 2	Specimen 3

9530 James Ave South

SOIL ENGINEERING TESTING, INC.

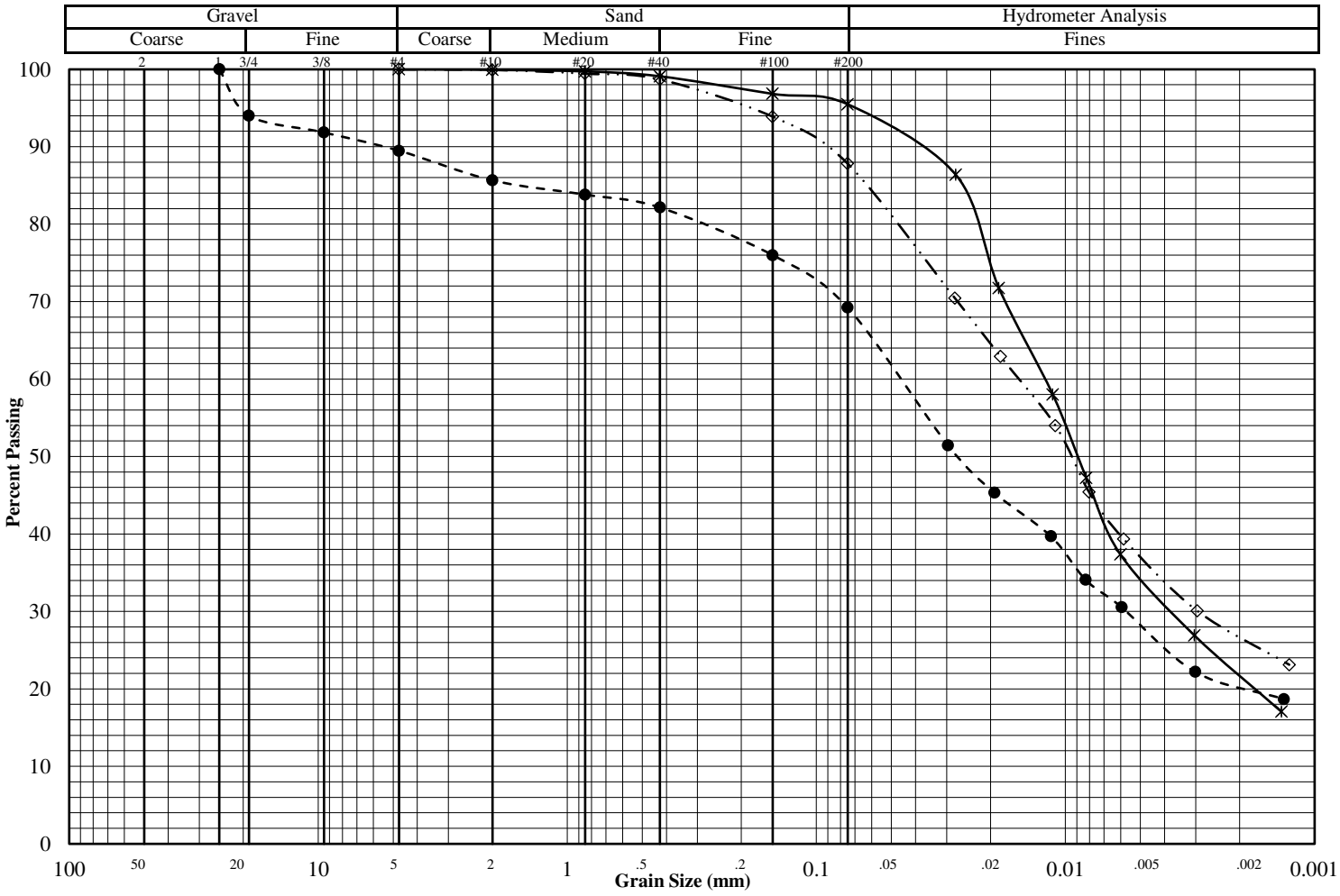
Bloomington, MN 55431

Grain Size Distribution ASTM D422-16

Job No. : **12596**

Project:	DMMF - MKE Harbor, WI	Test Date:	6/18/20
Reported To:	Foth Infrastructure & Environment, LLC	Report Date:	6/28/20

	Location / Boring No.	Sample No.	Depth (ft)	Sample Type	Soil Classification
*	SB-8		2.5-5	TWT	Fat Clay, slightly organic (CH/OH)
●	ST-10		15-17	TWT	Sandy Lean Clay w/a little gravel (CL)
◇	ST-11		10-12	TWT	Lean Clay (CL)



Additional Results	*	●	◇
Liquid Limit	51	23	24
Plastic Limit	28	12	12
Plasticity Index ASTM:D4316	23	11	12
Water Content ASTM:D2216			
Dry Density (pcf) ASTM:D7263			
Specific Gravity ASTM:D854	2.65*	2.79*	2.79
Porosity			
Organic Content ASTM:D2974			
pH ASTM:D4972 Method B			

Percent Passing

	*	●	◇
Mass (g)	134.2	342.8	274.8
2"			
1.5"			
1"		100.0	
3/4"		94.0	
3/8"		91.9	
#4	100.0	89.5	100.0
#10	99.9	85.7	99.9
#20	99.7	83.8	99.4
#40	99.1	82.2	98.7
#100	96.8	76.0	93.9
#200	95.5	69.2	87.8

	*	●	◇
D_{60}			
D_{30}			
D_{10}			
C_U			
C_C			

Remarks:

(* = assumed)

9530 James Ave South

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Bloomington, MN 55431

Grain Size Distribution ASTM D422-16

Job No. : **12596**

Project:	DMMF - MKE Harbor, WI	Test Date:	6/18/20
Reported To:	Foth Infrastructure & Environment, LLC	Report Date:	6/28/20

	Location / Boring No.	Sample No.	Depth (ft)	Sample Type	Soil Classification
Spec 1	SB-8		2.5-5	TWT	Fat Clay, slightly organic (CH/OH)
Spec 2	ST-10		15-17	TWT	Sandy Lean Clay w/a little gravel (CL)
Spec 3	ST-11		10-12	TWT	Lean Clay (CL)

Sieve Data

Specimen 1		Specimen 2		Specimen 3	
Sieve	% Passing	Sieve	% Passing	Sieve	% Passing
2"		2"		2"	
1.5"		1.5"		1.5"	
1"		1"	100.0	1"	
3/4"		3/4"	94.0	3/4"	
3/8"		3/8"	91.9	3/8"	
#4	100.0	#4	89.5	#4	100.0
#10	99.9	#10	85.7	#10	99.9
#20	99.7	#20	83.8	#20	99.4
#40	99.1	#40	82.2	#40	98.7
#100	96.8	#100	76.0	#100	93.9
#200	95.5	#200	69.2	#200	87.8

Hydrometer Data

Specimen 1		Specimen 2		Specimen 3	
Diameter (mm)	% Passing	Diameter	% Passing	Diameter	% Passing
0.028	86.4	0.030	51.4	0.028	70.4
0.019	71.8	0.019	45.3	0.018	62.9
0.011	58.0	0.011	39.7	0.011	54.0
0.008	47.2	0.008	34.1	0.008	45.4
0.006	37.4	0.006	30.6	0.006	39.3
0.003	26.9	0.003	22.2	0.003	30.1
0.001	17.1	0.001	18.7	0.001	23.1

Remarks

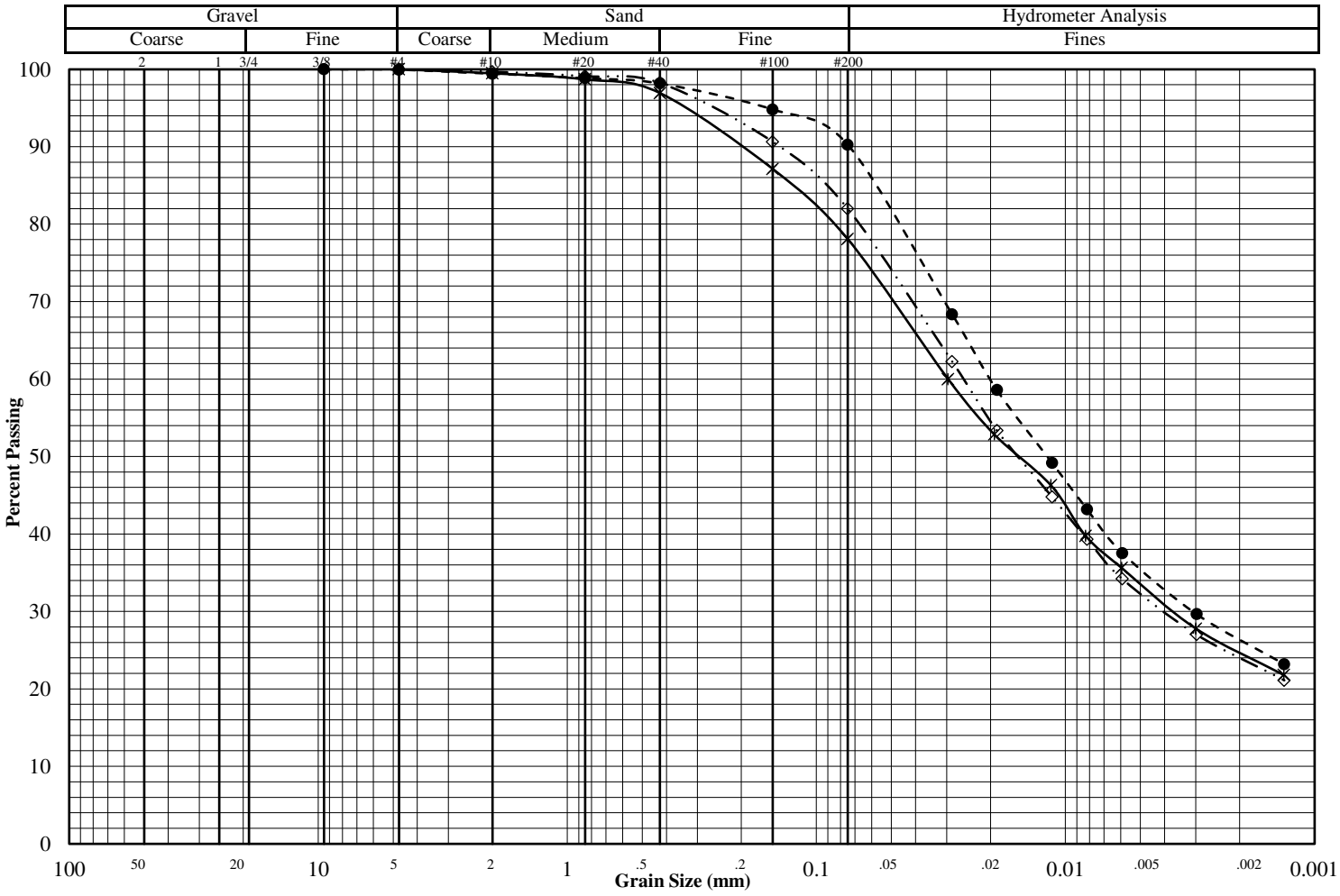
Specimen 1	Specimen 2	Specimen 3

Grain Size Distribution ASTM D422-16

Job No. : **12596**

Project:	DMMF - MKE Harbor, WI	Test Date:	6/18/20
Reported To:	Foth Infrastructure & Environment, LLC	Report Date:	6/28/20

	Location / Boring No.	Sample No.	Depth (ft)	Sample Type	Soil Classification
*	ST-13		3-5	TWT	Lean Clay w/sand (CL)
●	ST-15		15-18.5	TWT	Lean Clay (CL)
◇	SB-1		18-20	Bag	Lean Clay w/sand (CL)



Additional Results	*	●	◇
Liquid Limit	21	25	
Plastic Limit	11	12	
Plasticity Index ASTM:D4316	10	13	
Water Content ASTM:D2216			
Dry Density (pcf) ASTM:D7263			
Specific Gravity ASTM:D854	2.77	2.85	2.79*
Porosity			
Organic Content ASTM:D2974			
pH ASTM:D4972 Method B			

Percent Passing

	*	●	◇
Mass (g)	229.1	245.0	1177.1
2"			
1.5"			
1"			
3/4"			
3/8"		100.0	
#4	100.0	99.9	100.0
#10	99.5	99.4	99.7
#20	98.7	98.9	99.1
#40	96.9	98.2	98.3
#100	87.1	94.8	90.6
#200	78.1	90.3	82.0

	*	●	◇
D_{60}			
D_{30}			
D_{10}			
C_U			
C_C			

Remarks:

(* = assumed)

9530 James Ave South

SOIL ENGINEERING TESTING, INC.

Bloomington, MN 55431

Grain Size Distribution ASTM D422-16

Job No. : **12596**

Project:	DMMF - MKE Harbor, WI	Test Date:	6/18/20
Reported To:	Foth Infrastructure & Environment, LLC	Report Date:	6/28/20

	Location / Boring No.	Sample No.	Depth (ft)	Sample Type	Soil Classification
Spec 1	ST-13		3-5	TWT	Lean Clay w/sand (CL)
Spec 2	ST-15		15-18.5	TWT	Lean Clay (CL)
Spec 3	SB-1		18-20	Bag	Lean Clay w/sand (CL)

Sieve Data

Specimen 1		Specimen 2		Specimen 3	
Sieve	% Passing	Sieve	% Passing	Sieve	% Passing
2"		2"		2"	
1.5"		1.5"		1.5"	
1"		1"		1"	
3/4"		3/4"		3/4"	
3/8"		3/8"	100.0	3/8"	
#4	100.0	#4	99.9	#4	100.0
#10	99.5	#10	99.4	#10	99.7
#20	98.7	#20	98.9	#20	99.1
#40	96.9	#40	98.2	#40	98.3
#100	87.1	#100	94.8	#100	90.6
#200	78.1	#200	90.3	#200	82.0

Hydrometer Data

Specimen 1		Specimen 2		Specimen 3	
Diameter (mm)	% Passing	Diameter	% Passing	Diameter	% Passing
0.030	60.0	0.029	68.4	0.029	62.3
0.019	52.9	0.019	58.6	0.019	53.4
0.011	46.3	0.011	49.2	0.011	44.8
0.008	39.8	0.008	43.2	0.008	39.3
0.006	35.6	0.006	37.5	0.006	34.2
0.003	27.8	0.003	29.7	0.003	27.0
0.001	21.8	0.001	23.2	0.001	21.1

Remarks

Specimen 1	Specimen 2	Specimen 3

9530 James Ave South

SOIL ENGINEERING TESTING, INC.

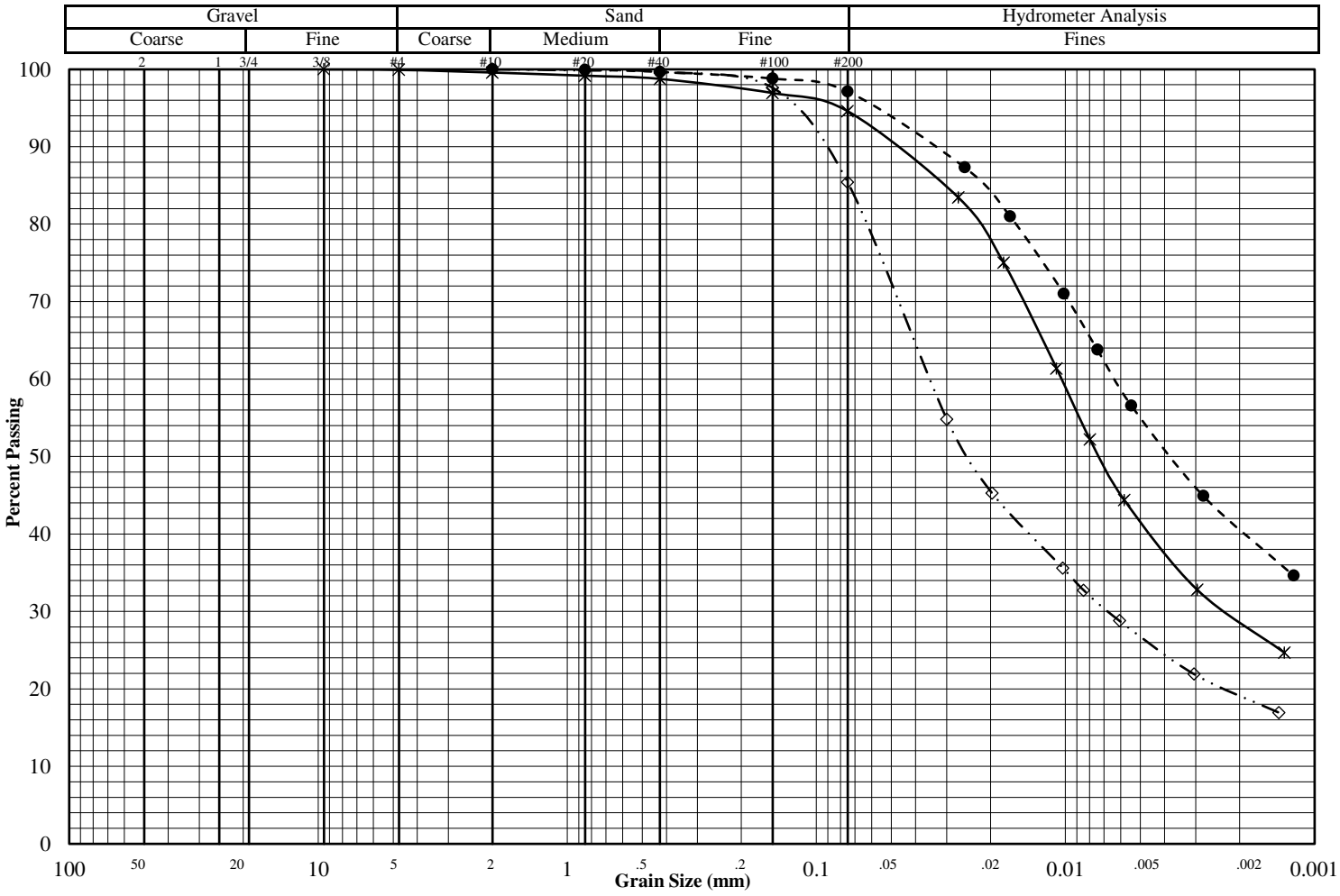
Bloomington, MN 55431

Grain Size Distribution ASTM D422-16

Job No. : **12596**

Project:	DMMF - MKE Harbor, WI	Test Date:	6/18/20
Reported To:	Foth Infrastructure & Environment, LLC	Report Date:	6/28/20

	Location / Boring No.	Sample No.	Depth (ft)	Sample Type	Soil Classification
*	SB-2		13.5-15	Bag	Lean Clay (CL)
●	SB-3		8.5-10	Bag	Lean Clay (CL)
◇	SB-5		18.5-20	Bag	Lean Clay (CL)



Additional Results	*	●	◇
Liquid Limit			
Plastic Limit			
Plasticity Index ASTM:D4316			
Water Content ASTM:D2216			
Dry Density (pcf) ASTM:D7263			
Specific Gravity ASTM:D854	2.79*	2.79*	2.79*
Porosity			
Organic Content ASTM:D2974			
pH ASTM:D4972 Method B			

Percent Passing

	*	●	◇
Mass (g)	910.1	850.0	646.3
2"			
1.5"			
1"			
3/4"			
3/8"	100.0		
#4	99.9		
#10	99.6	100.0	100.0
#20	99.2	99.9	99.9
#40	98.8	99.7	99.6
#100	96.9	98.8	97.6
#200	94.6	97.1	85.4

	*	●	◇
D_{60}			
D_{30}			
D_{10}			
C_U			
C_C			

Remarks:

(* = assumed)

9530 James Ave South

SOIL ENGINEERING TESTING, INC.

Bloomington, MN 55431

Grain Size Distribution ASTM D422-16

Job No. : **12596**

Project:	DMMF - MKE Harbor, WI	Test Date:	6/18/20
Reported To:	Foth Infrastructure & Environment, LLC	Report Date:	6/28/20

	Location / Boring No.	Sample No.	Depth (ft)	Sample Type	Soil Classification
Spec 1	SB-2		13.5-15	Bag	Lean Clay (CL)
Spec 2	SB-3		8.5-10	Bag	Lean Clay (CL)
Spec 3	SB-5		18.5-20	Bag	Lean Clay (CL)

Sieve Data

Specimen 1		Specimen 2		Specimen 3	
Sieve	% Passing	Sieve	% Passing	Sieve	% Passing
2"		2"		2"	
1.5"		1.5"		1.5"	
1"		1"		1"	
3/4"		3/4"		3/4"	
3/8"	100.0	3/8"		3/8"	
#4	99.9	#4		#4	
#10	99.6	#10	100.0	#10	100.0
#20	99.2	#20	99.9	#20	99.9
#40	98.8	#40	99.7	#40	99.6
#100	96.9	#100	98.8	#100	97.6
#200	94.6	#200	97.1	#200	85.4

Hydrometer Data

Specimen 1		Specimen 2		Specimen 3	
Diameter (mm)	% Passing	Diameter	% Passing	Diameter	% Passing
0.027	83.4	0.025	87.3	0.030	54.8
0.018	75.0	0.017	81.0	0.020	45.3
0.011	61.4	0.010	71.1	0.010	35.6
0.008	52.2	0.007	63.8	0.008	32.7
0.006	44.4	0.005	56.6	0.006	28.8
0.003	32.8	0.003	44.9	0.003	21.9
0.001	24.7	0.001	34.6	0.001	16.9

Remarks

Specimen 1	Specimen 2	Specimen 3

9530 James Ave South

SOIL ENGINEERING TESTING, INC.

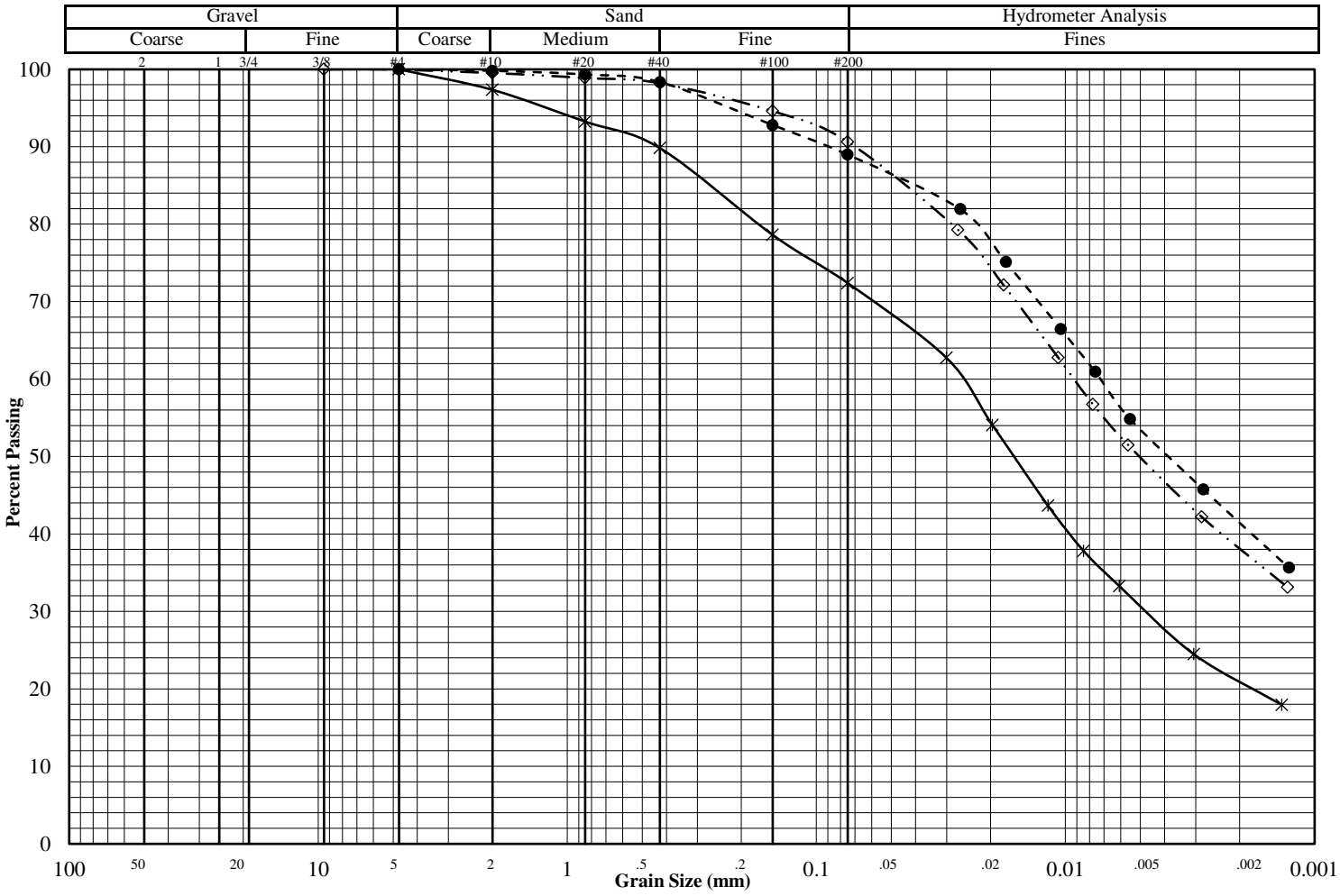
Bloomington, MN 55431

Grain Size Distribution ASTM D422-16

Job No. : **12596**

Project:	DMMF - MKE Harbor, WI	Test Date:	6/18/20
Reported To:	Foth Infrastructure & Environment, LLC	Report Date:	6/28/20

	Location / Boring No.	Sample No.	Depth (ft)	Sample Type	Soil Classification
*	SB-6		13.5-15	Bag	Lean w/sand and shell fragments, slightly organic (CL/OL)
●	SB-7		8.5-10	Bag	Lean Clay, slightly organic (CL)
◇	SB-8		18.5-20	Bag	Lean Clay (CL)



Additional Results	*	●	◇
Liquid Limit			
Plastic Limit			
Plasticity Index ASTM:D4316			
Water Content ASTM:D2216	42.1	33.4	28.1
Dry Density (pcf) ASTM:D7263			
Specific Gravity ASTM:D854	2.65*	2.68*	2.68*
Porosity			
Organic Content ASTM:D2974			
pH ASTM:D4972 Method B			

Percent Passing

	*	●	◇
Mass (g)	581.3	445.3	22.4
2"			
1.5"			
1"			
3/4"			
3/8"			100.0
#4	100.0	100.0	99.9
#10	97.4	99.8	99.5
#20	93.2	99.3	98.9
#40	89.8	98.3	98.2
#100	78.6	92.8	94.6
#200	72.4	89.0	90.6

	*	●	◇
D_{60}			
D_{30}			
D_{10}			
C_U			
C_C			

Remarks:

(* = assumed)

9530 James Ave South

SOIL ENGINEERING TESTING, INC.

Bloomington, MN 55431

Grain Size Distribution ASTM D422-16

Job No. : **12596**

Project:	DMMF - MKE Harbor, WI	Test Date:	6/18/20
Reported To:	Foth Infrastructure & Environment, LLC	Report Date:	6/28/20

	Location / Boring No.	Sample No.	Depth (ft)	Sample Type	Soil Classification
Spec 1	SB-6		13.5-15	Bag	Lean w/sand and shell fragments, slightly organic (CL/OL)
Spec 2	SB-7		8.5-10	Bag	Lean Clay, slightly organic (CL)
Spec 3	SB-8		18.5-20	Bag	Lean Clay (CL)

Sieve Data

Specimen 1		Specimen 2		Specimen 3	
Sieve	% Passing	Sieve	% Passing	Sieve	% Passing
2"		2"		2"	
1.5"		1.5"		1.5"	
1"		1"		1"	
3/4"		3/4"		3/4"	
3/8"		3/8"		3/8"	100.0
#4	100.0	#4	100.0	#4	99.9
#10	97.4	#10	99.8	#10	99.5
#20	93.2	#20	99.3	#20	98.9
#40	89.8	#40	98.3	#40	98.2
#100	78.6	#100	92.8	#100	94.6
#200	72.4	#200	89.0	#200	90.6

Hydrometer Data

Specimen 1		Specimen 2		Specimen 3	
Diameter (mm)	% Passing	Diameter	% Passing	Diameter	% Passing
0.030	62.8	0.026	82.0	0.027	79.3
0.020	54.0	0.017	75.1	0.018	72.1
0.012	43.7	0.010	66.5	0.011	62.8
0.008	37.8	0.008	60.9	0.008	56.8
0.006	33.3	0.006	54.9	0.006	51.5
0.003	24.5	0.003	45.8	0.003	42.2
0.001	17.9	0.001	35.7	0.001	33.1

Remarks

Specimen 1	Specimen 2	Specimen 3

9530 James Ave South

SOIL ENGINEERING TESTING, INC.

Bloomington, MN 55431

Laboratory Test Summary

Project: DMMF - MKE Harbor, WI **Job:** 12596

Client: Foth Infrastructure & Environment, LLC **Date:** 7/20/20

Sample Information & Classification

Boring #							
Sample #	SB-4	SB-7	ST-11	ST-11	ST-13	ST-15	
Depth (ft)	28.5-30.5	17.5-20	30-32	10-12	3-5	15-18.5	
Type or BPF	TWT	TWT	TWT	TWT	TWT	TWT	
Classification	Lean Clay (CL)	Lean Clay (CL)	Lean Clay (CL)	Lean Clay (CL)	Lean Clay w/sand (CL)	Lean Clay (CL)	

Porosity & Degree of Saturation

Porosity	0.30	0.38	0.32	0.33	0.28	0.33	
Saturation	91.6%	88.8%	89.2%	82.4%	100.7%	91.5%	

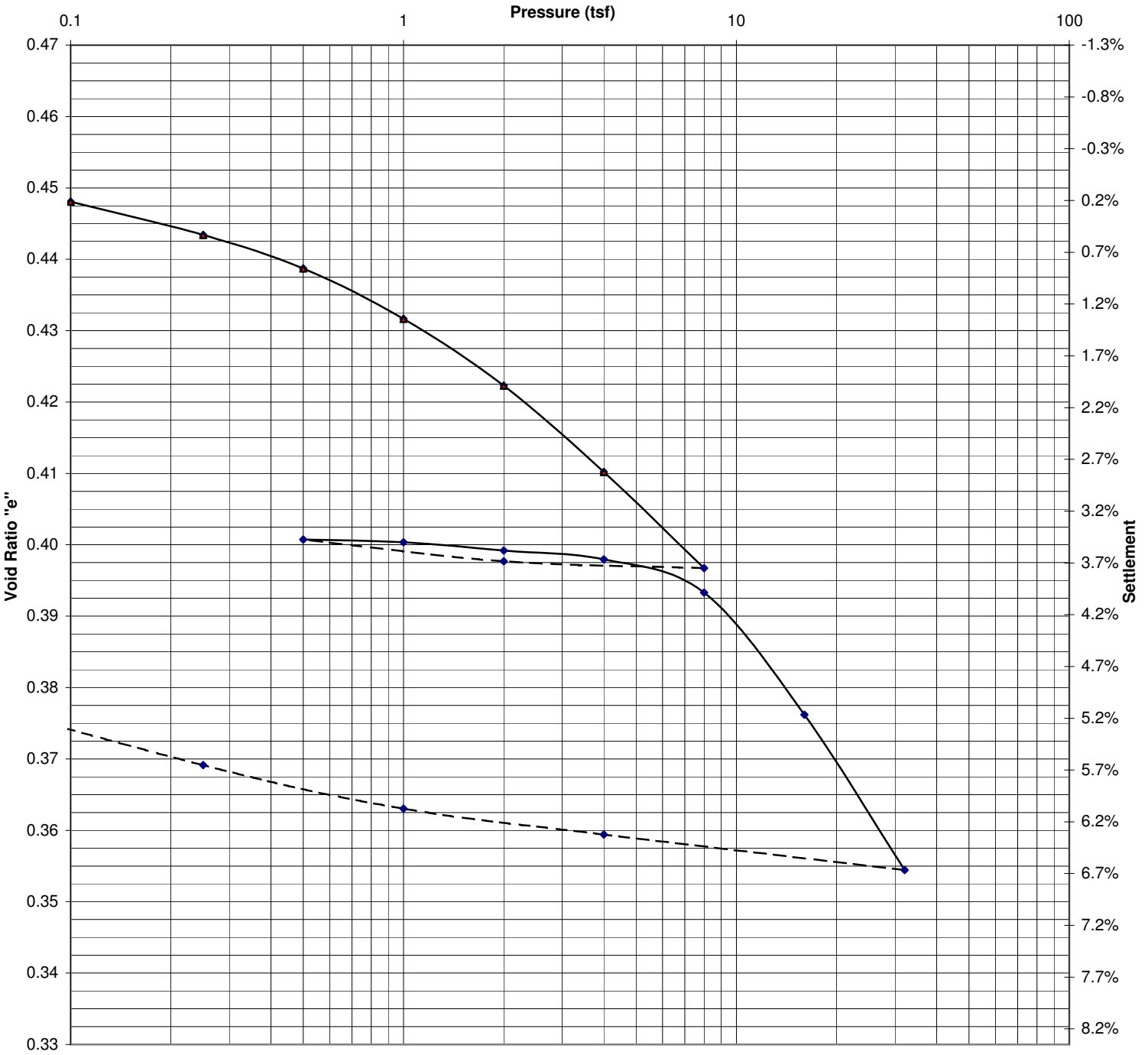
Notes: The reported results for SB-4, SB-7, and ST-11 (30') are averages of the three CU points at each location.

Boring #							
Sample #							
Depth (ft)							
Type or BPF							
Classification							
Porosity							
Saturation							

Sample Information & Classification

Boring #							
Sample #							
Depth (ft)							
Type or BPF							
Classification							
Porosity							
Saturation							

Void Ratio and % Settlement vs. Log of Pressure



Project: DMMF - MKE Harbor, WI / Foth Infrastructure & Environment, LLC			Date: 6/30/20
Sample #:	Boring #: SB-4	Depth ft: 28.5-30.5	Job #: 12596
Soil Type: Lean Clay w/laminations of silty sand (CL)			
Initial W/C (%): 16.1	Dry Density (pcf): 120.1	LL: 20 PL: 12 PI: 8	Gs: 2.79
Organic Content (%):	Initial Height (in.): 0.760	Diameter (in.): 2.500	e_o= 0.451
Preconsolidation Pressure (Pc): 3.3 tsf	Compression Index (Cc): 0.07	Recompression Index (Cr): 0.01	

Remarks: Testing performed in general accordance with ASTM:D2435

9530 James Avenue South

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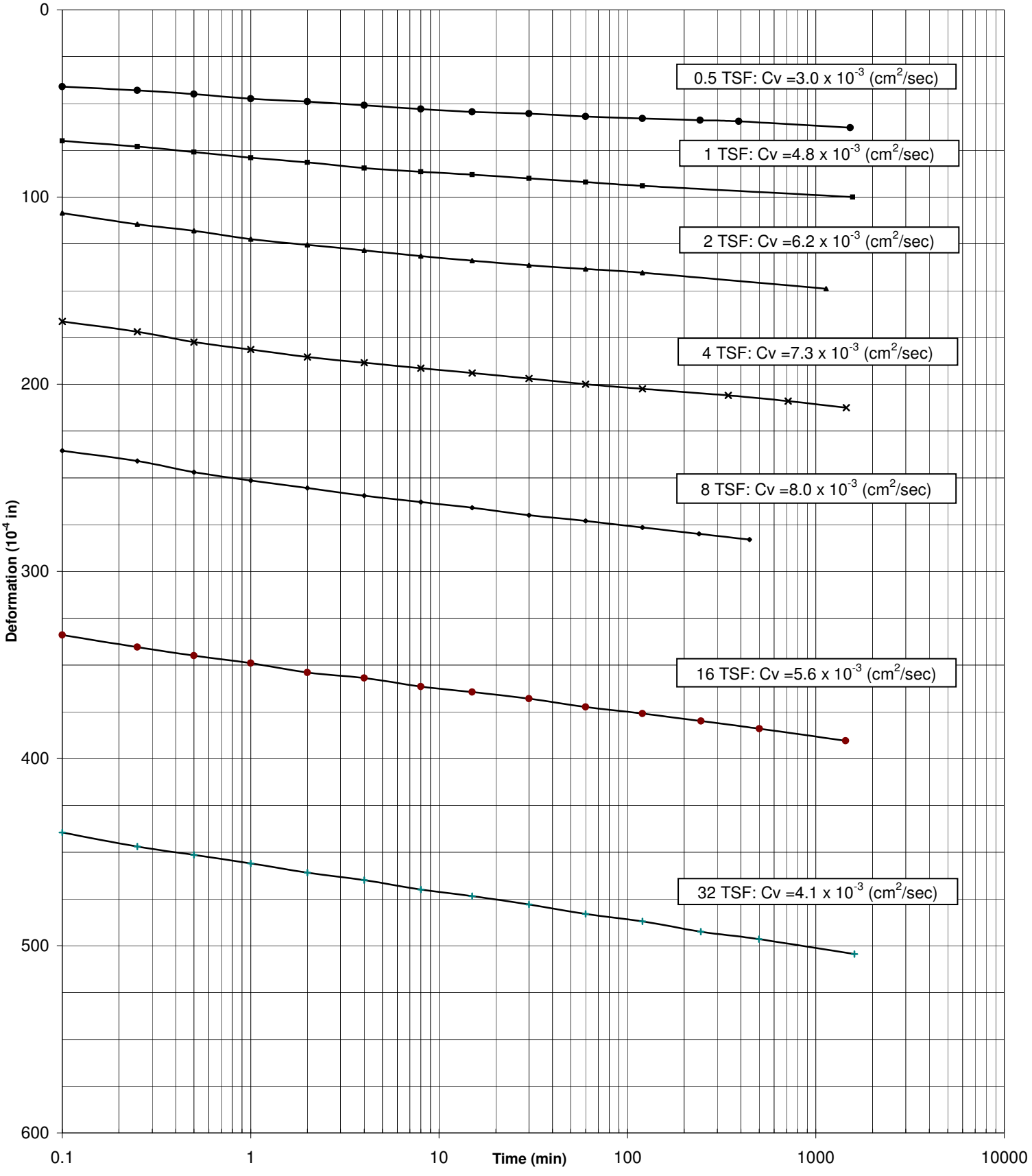
Bloomington, Minnesota 55431

Consolidation Log of Time Curves



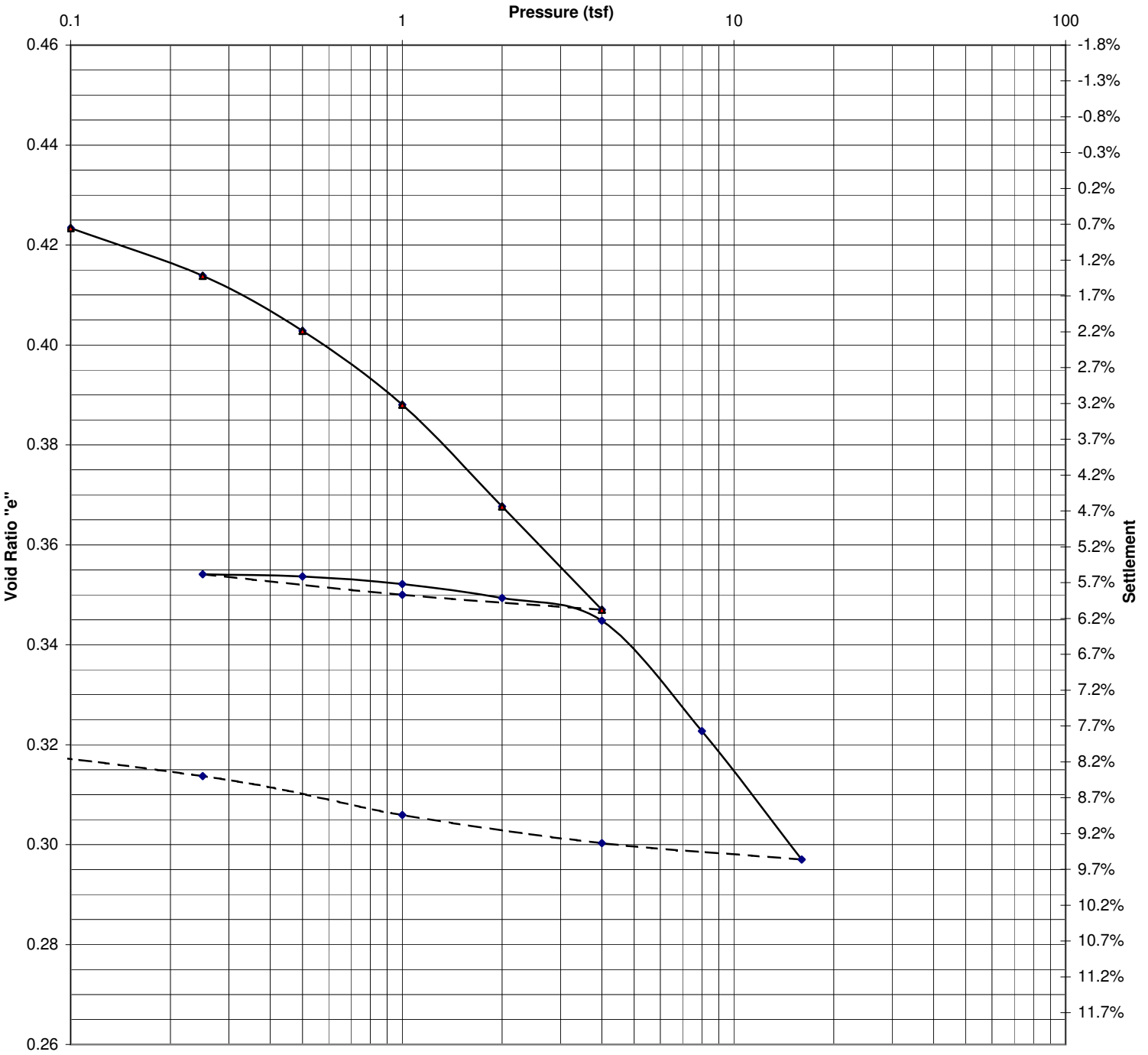
Project: DMMF - MKE Harbor, WI / Foth Infrastructure & Environment, LLC			Date: 6/30/20
Sample #:	Boring #: SB-4	Depth ft: 28.5-30.5	Job #: 12596

9530 James Avenue South

SOIL ENGINEERING TESTING, INC.

Bloomington, Minnesota 55431

Void Ratio and % Settlement vs. Log of Pressure



Project: DMMF - MKE Harbor, WI / Foth Infrastructure & Environment, LLC				Date: 6/30/20
Sample #:	Boring #: ST-10	Depth ft: 15-17		Job #: 12596
Soil Type: Sandy Lean Clay w/a little gravel (CL)				
Initial W/C (%): 15.1	Dry Density (pcf): 121.4	LL: 23	PL: 12	PI: 11	Gs: 2.79 (Assumed)
Organic Content (%):	Initial Height (in.): 0.995	Diameter (in.): 2.506	e_o= 0.434	
Preconsolidation Pressure (Pc): 0.95 tsf	Compression Index (Cc): 0.09	Recompression Index (Cr): 0.01		
Remarks: Testing performed in general accordance with ASTM:D2435				

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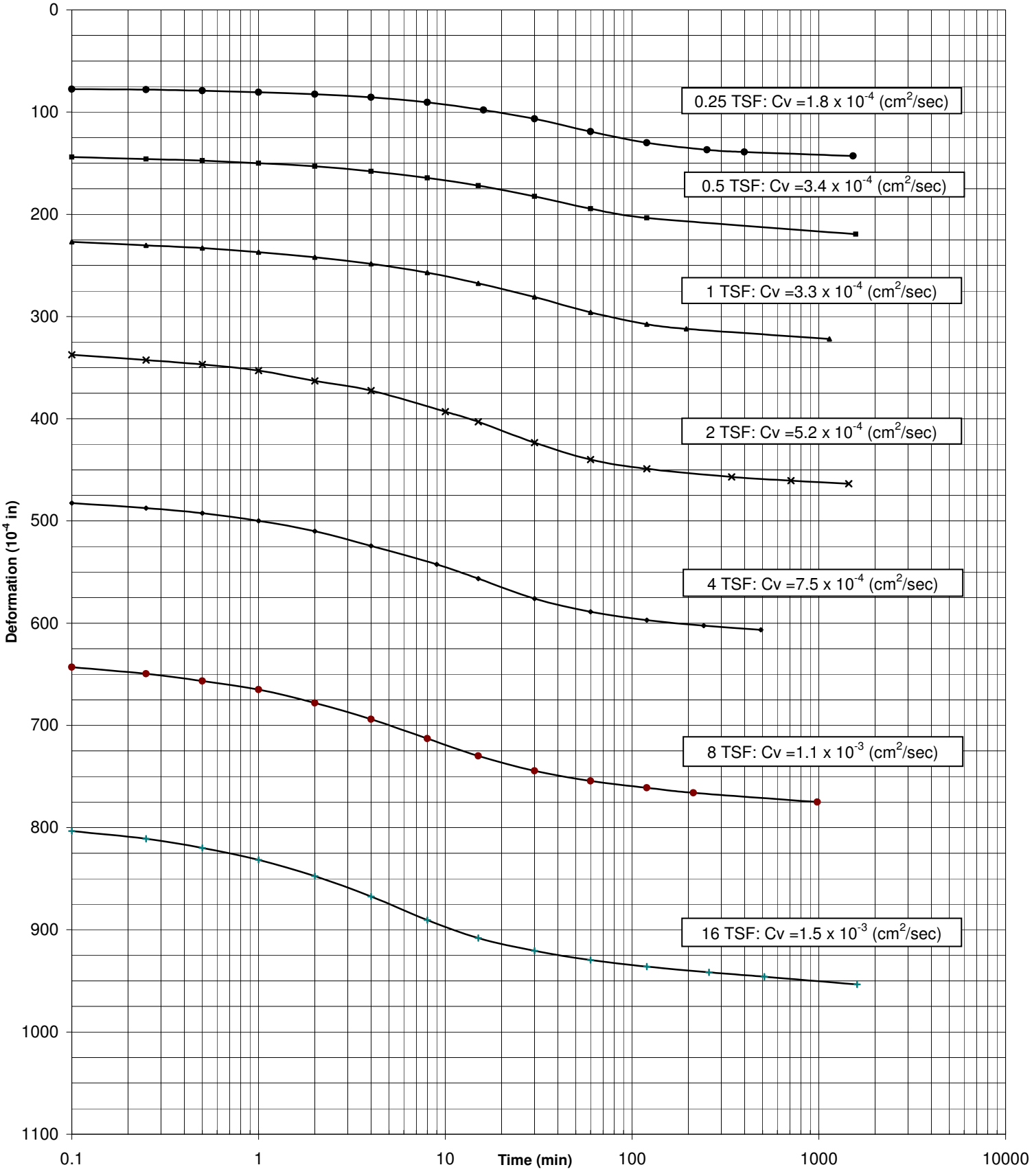
Bloomington, Minnesota 55431

Consolidation Log of Time Curves



Project: DMMF - MKE Harbor, WI / Foth Infrastructure & Environment, LLC			Date: 6/30/20
Sample #:	Boring #: ST-10	Depth ft: 15-17	Job #: 12596

9530 James Avenue South

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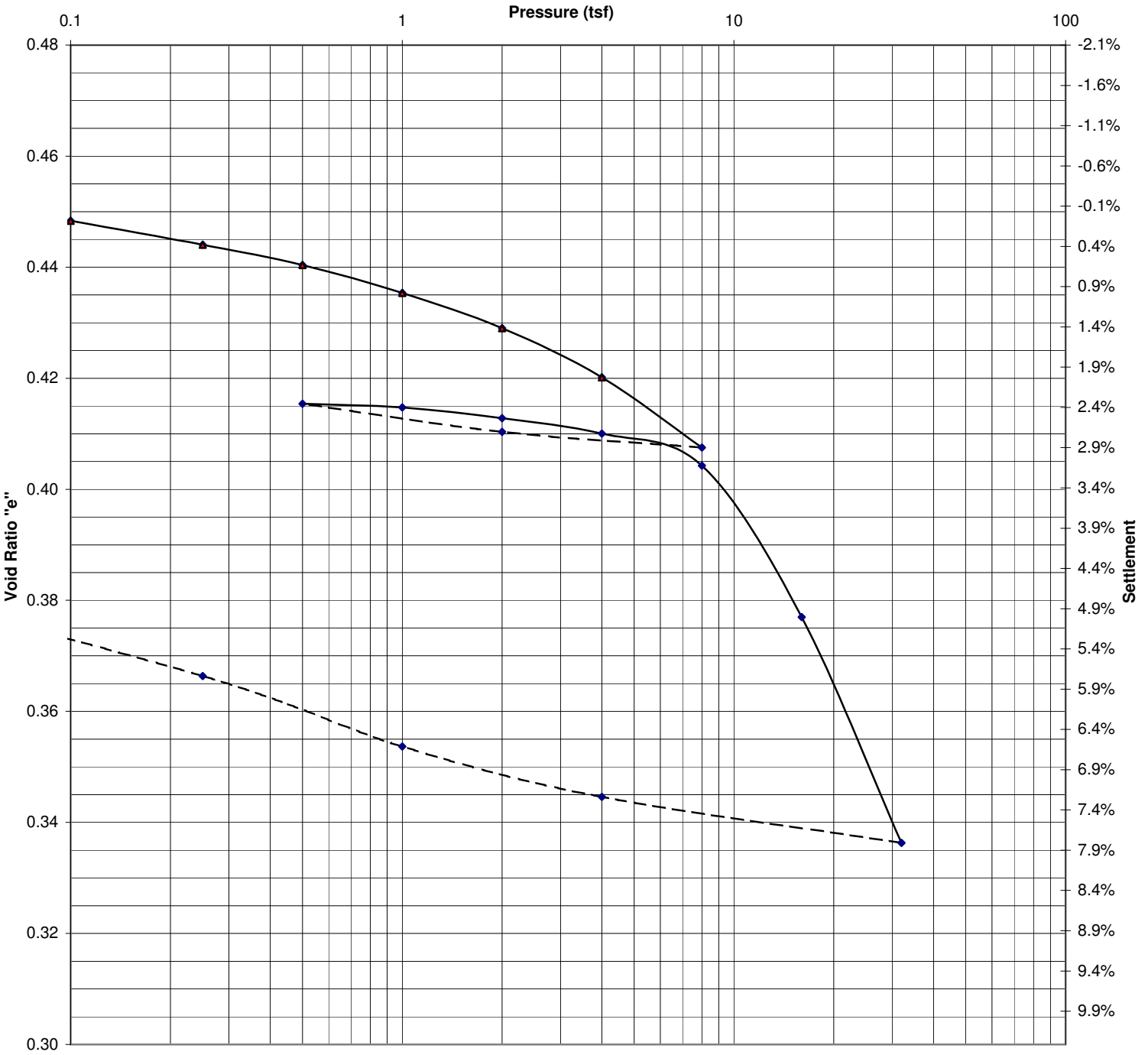
Bloomington, Minnesota 55431

Void Ratio and % Settlement vs. Log of Pressure



Project: DMMF - MKE Harbor, WI / Foth Infrastructure & Environment, LLC				Date: 6/30/20
Sample #:	Boring #: ST-11	Depth ft: 10-12		Job #: 12596
Soil Type: Lean Clay (CL)				
Initial W/C (%): 16.4	Dry Density (pcf): 120.1	LL: 24	PL: 12 PI: 12	Gs: 2.79
Organic Content (%):	Initial Height (in.): 0.753	Diameter (in.): 2.503	e_o= 0.450	
Preconsolidation Pressure (Pc): 8.8 tsf	Compression Index (Cc): 0.13	Recompression Index (Cr): 0.01		

Remarks: Testing performed in general accordance with ASTM:D2435

9530 James Avenue South

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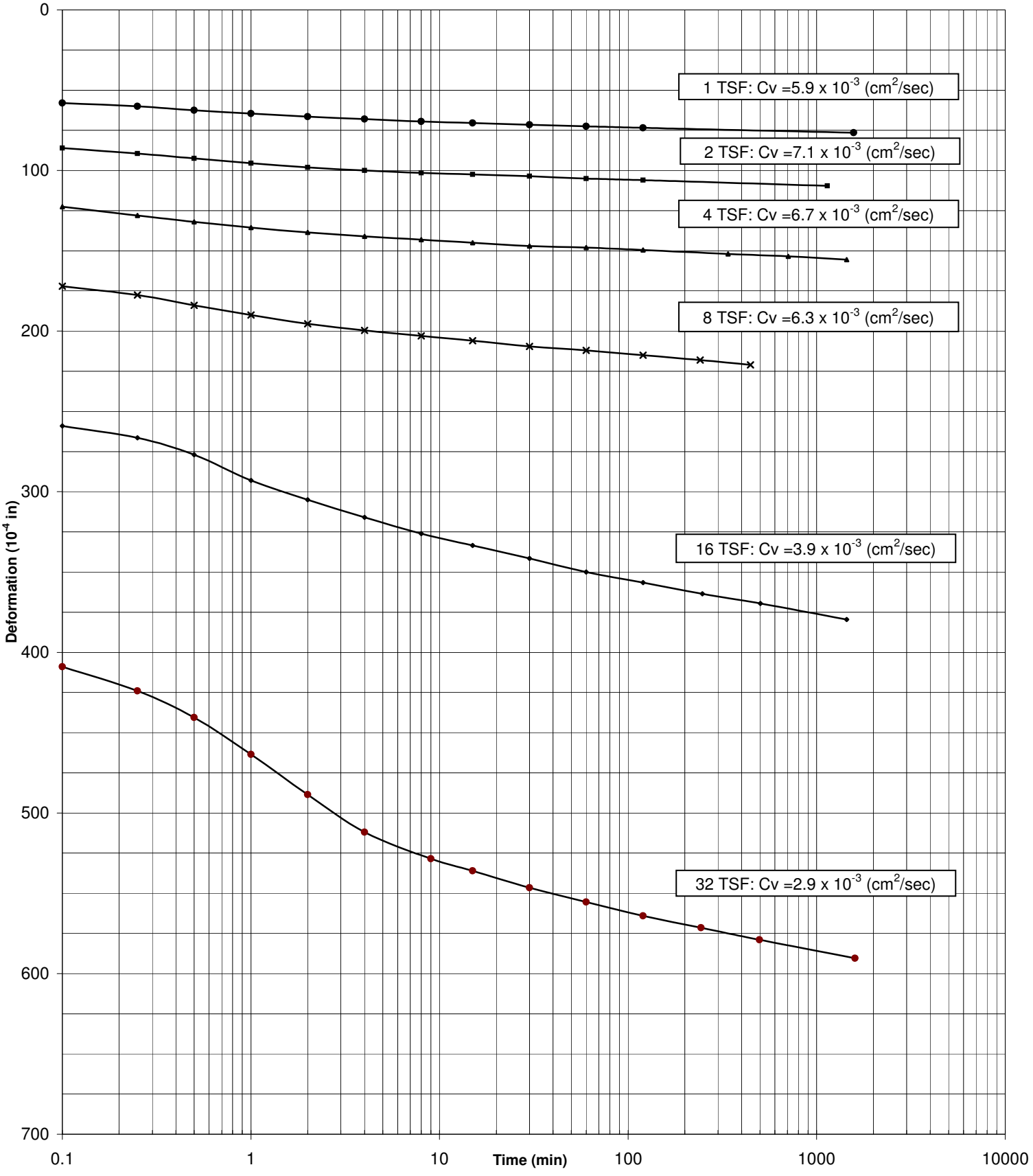
Bloomington, Minnesota 55431

Consolidation Log of Time Curves



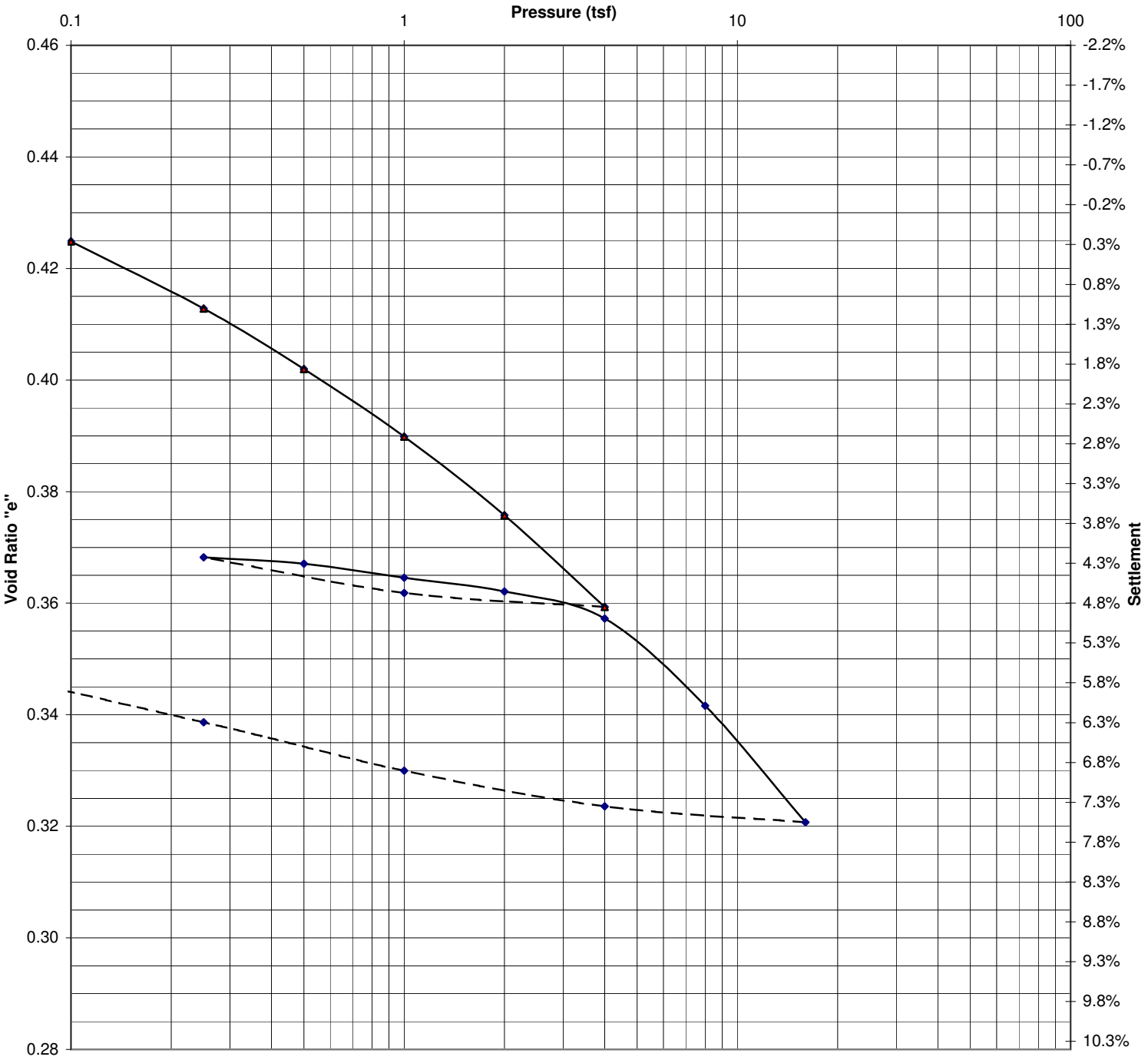
Project: DMMF - MKE Harbor, WI / Foth Infrastructure & Environment, LLC			Date: 6/30/20
Sample #:	Boring #: ST-11	Depth ft: 10-12	Job #: 12596

9530 James Avenue South

SOIL ENGINEERING TESTING, INC.

Bloomington, Minnesota 55431

Void Ratio and % Settlement vs. Log of Pressure



Project: DMMF - MKE Harbor, WI / Foth Infrastructure & Environment, LLC			Date: 6/30/20
Sample #:	Boring #: ST-11	Depth ft: 30-32	Job #: 12596
Soil Type: Lean Clay (CL)			
Initial W/C (%): 15.7	Dry Density (pcf): 122.8	LL: 21 PL: 12 PI: 9	Gs: 2.81
Organic Content (%):	Initial Height (in.): 0.749	Diameter (in.): 2.494	e_o= 0.428
Preconsolidation Pressure (Pc): 1.4 tsf	Compression Index (Cc): 0.07	Recompression Index (Cr): 0.01	

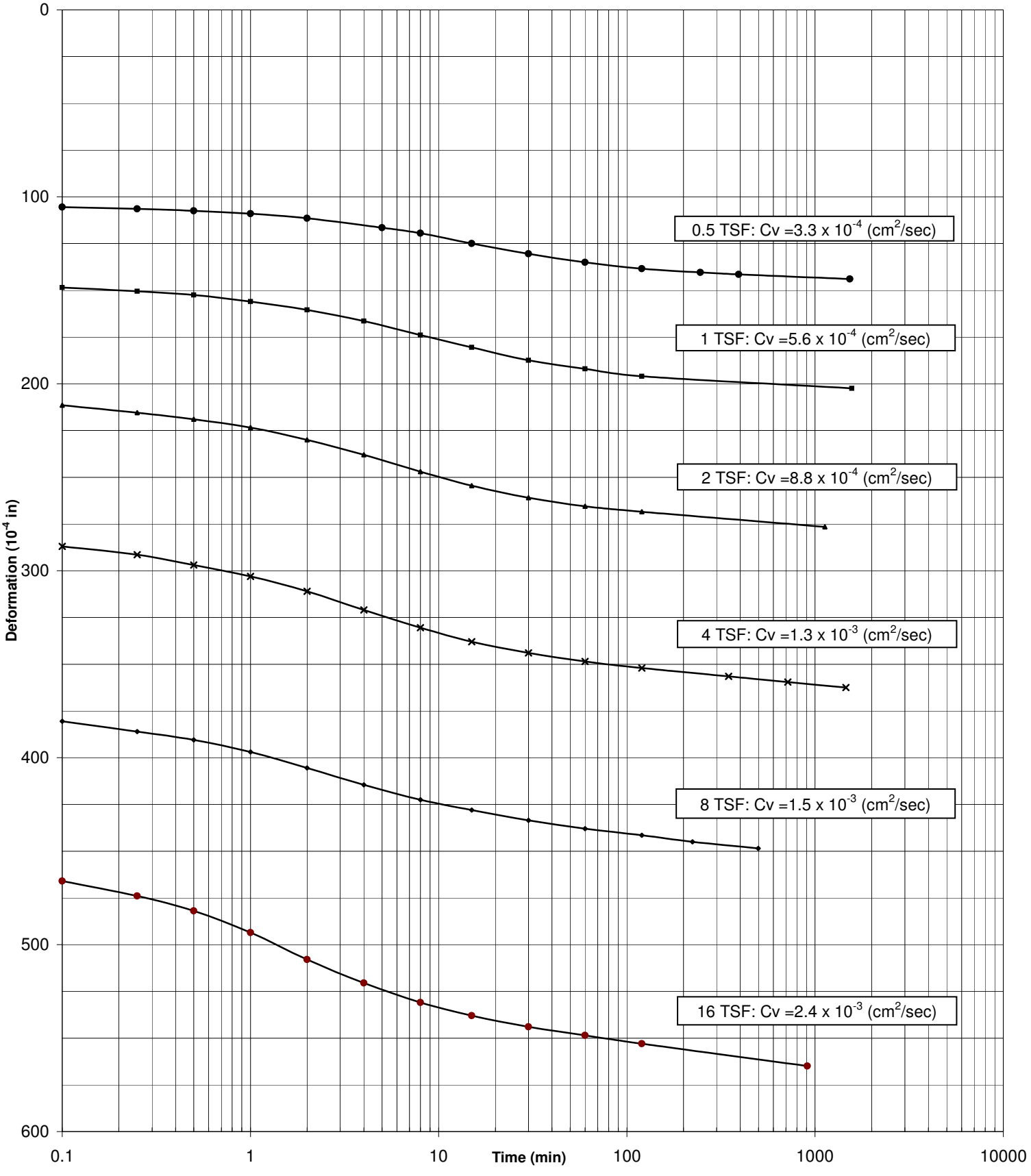
Remarks: Testing performed in general accordance with ASTM:D2435

9530 James Avenue South

SOIL ENGINEERING TESTING, INC.

Bloomington, Minnesota 55431

Consolidation Log of Time Curves



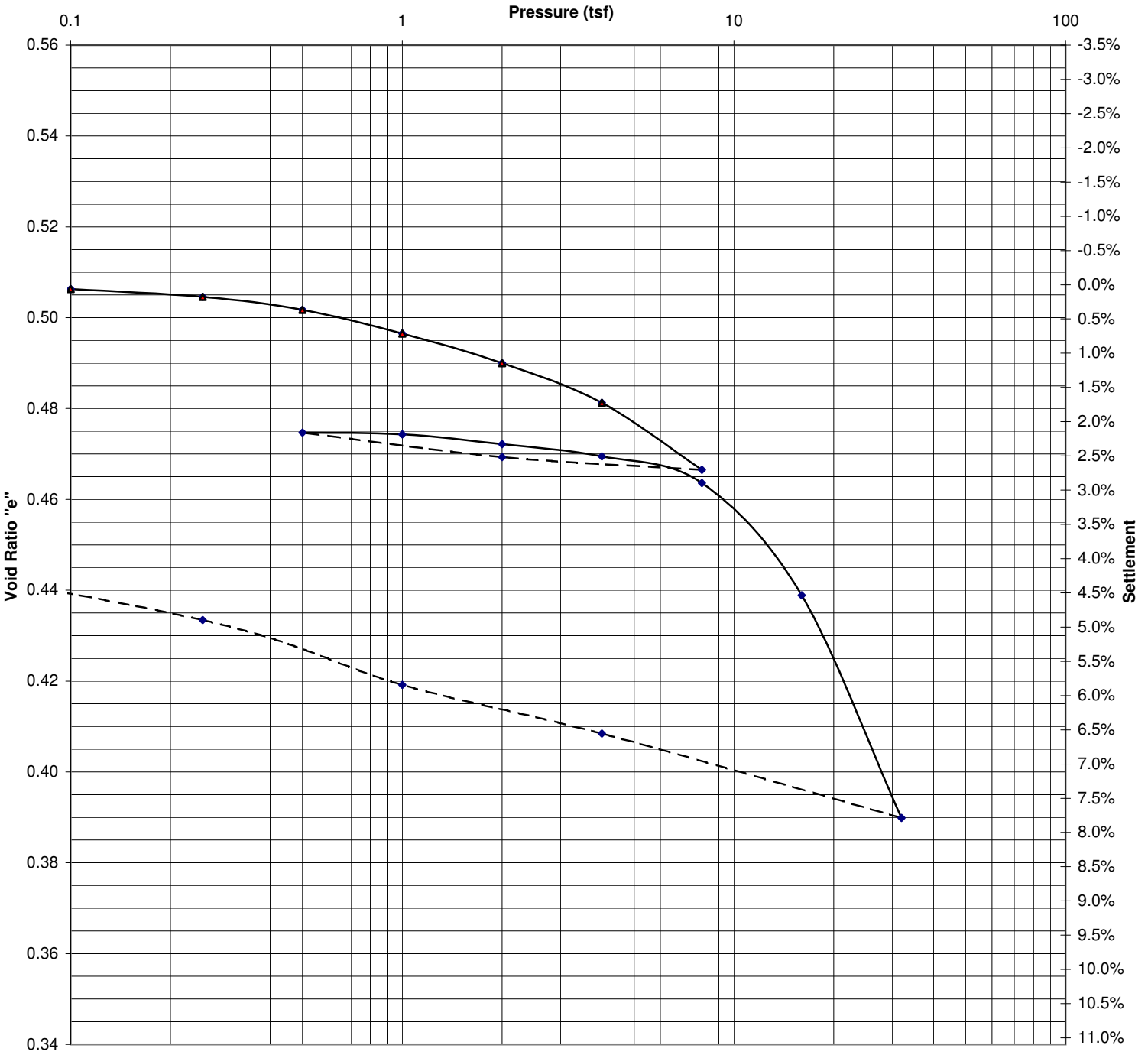
Project: DMMF - MKE Harbor, WI / Foth Infrastructure & Environment, LLC			Date: 6/30/20
Sample #:	Boring #: ST-11	Depth ft: 30-32	Job #: 12596

9530 James Avenue South

SOIL ENGINEERING TESTING, INC.

Bloomington, Minnesota 55431

Void Ratio and % Settlement vs. Log of Pressure



Project: DMMF - MKE Harbor, WI / Foth Infrastructure & Environment, LLC			Date: 6/30/20
Sample #:	Boring #: ST-15	Depth ft: 15-18.5	Job #: 12596
Soil Type: Lean Clay (CL)			
Initial W/C (%): 16.4	Dry Density (pcf): 118.0	LL: 25 PL: 12 PI: 13	Gs: 2.85
Organic Content (%):	Initial Height (in.): 0.998	Diameter (in.): 2.507	e_o= 0.507
Preconsolidation Pressure (Pc): 10 tsf	Compression Index (Cc): 0.16	Recompression Index (Cr): 0.01	

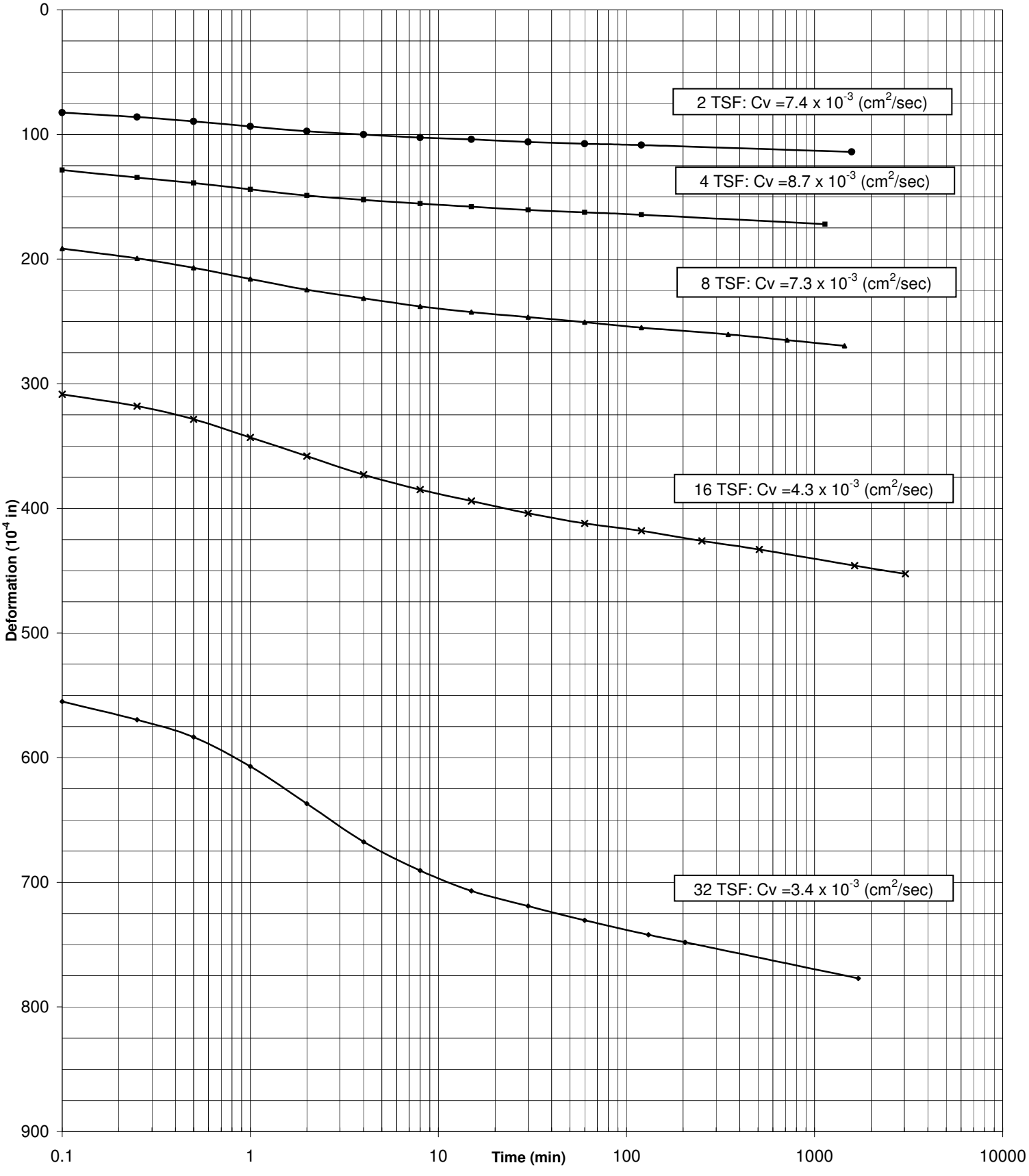
Remarks: Testing performed in general accordance with ASTM:D2435

9530 James Avenue South

SOIL ENGINEERING TESTING, INC.

Bloomington, Minnesota 55431

Consolidation Log of Time Curves



Project: DMMF - MKE Harbor, WI / Foth Infrastructure & Environment, LLC			Date: 6/30/20
Sample #:	Boring #: ST-15	Depth ft: 15-18.5	Job #: 12596

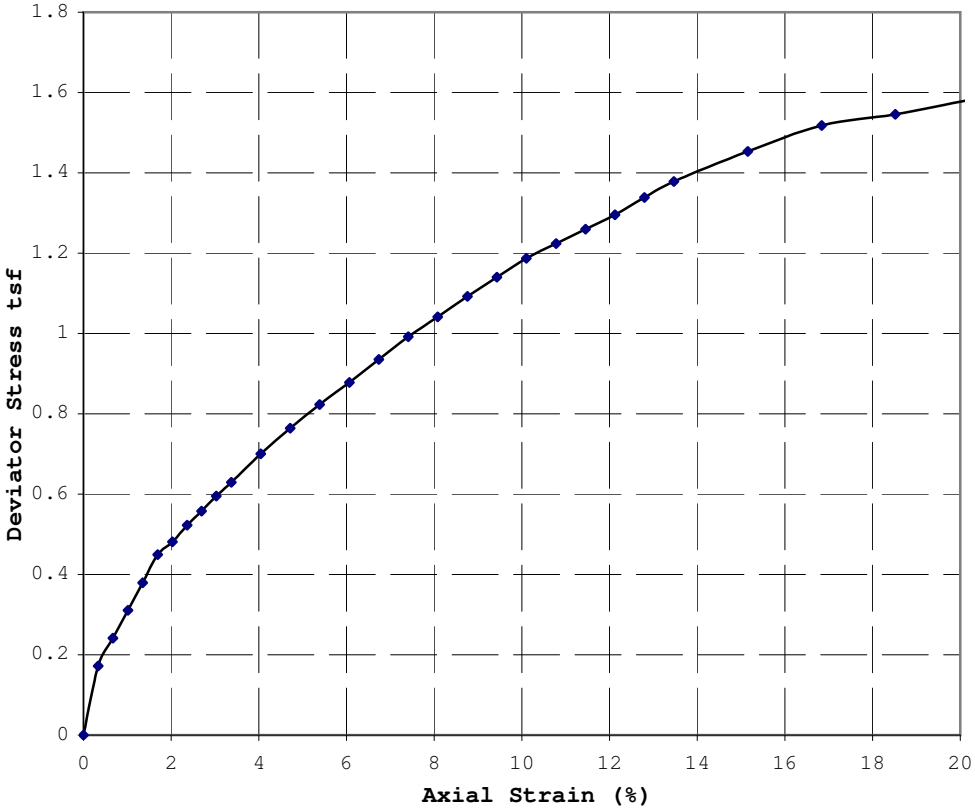
9530 James Avenue South

SOIL ENGINEERING TESTING, INC.

Bloomington, Minnesota 55431

Triaxial U-U Stress/Strain Curves (ASTM:D2850)

Project: DMMF - MKE Harbor, WI | Job: 12596
Client: Foth Infrastructure & Environment, LLC | Date: 6/30/20
Remarks: Specimens trimmed to given sizes; Allowed to adjust under applied confining pressures for about 10 minutes.



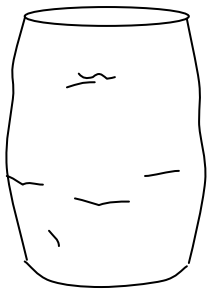
Boring: SB-1 Depth: 18-20
Sample #:
Soil Type: Lean Clay w/sand (CL)

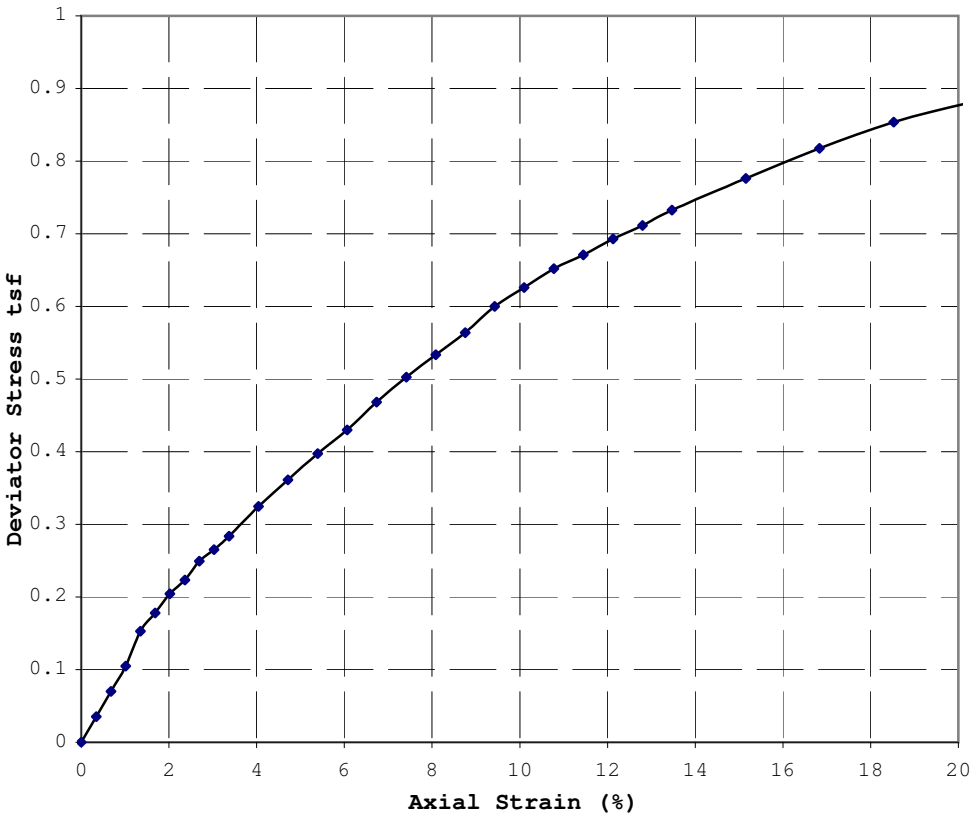
Strain Rate (in/min): 0.030
Sample Type: Bag
Dia. (in) 1.44 Ht. (in) 2.97
Height to Diameter Ratio: 2.06

Max Deviator Stress: 1.57 tsf
Strain at Failure (%): 20.0
Confining Pressure: 3.0 tsf

W.C. (%) 12.7
Yd (pcf): 120.5

Sketch of Specimen After Failure





Boring: SB-2 Depth: 13.5-15
Sample #:
Soil Type: Lean Clay (CL)

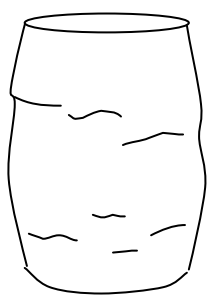
Strain Rate (in/min): 0.030
Sample Type: Bag

Dia. (in): 1.44 Ht. (in): 2.97
Height to Diameter Ratio: 2.06

Max Deviator Stress: 0.87 tsf
Strain at Failure (%): 20.0
Confining Pressure: 4.0 tsf

W.C. (%): 16.4
Yd (pcf): 114.5

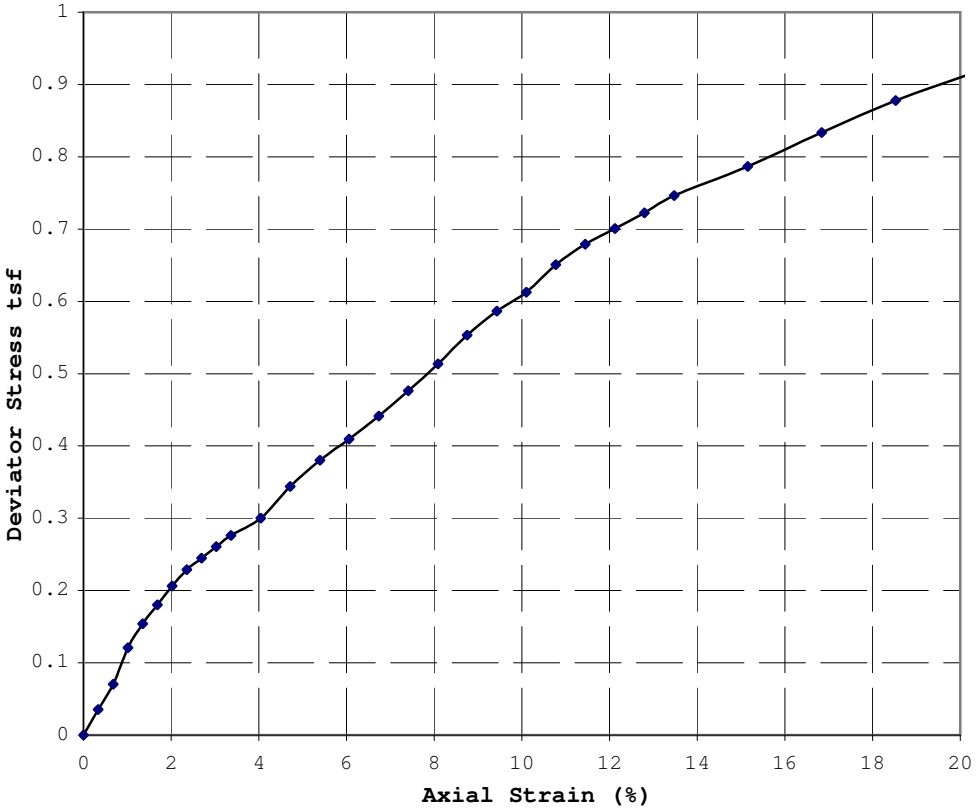
Sketch of Specimen After Failure



9530 James Ave South
SOIL ENGINEERING TESTING, INC.
Bloomington, MN 55431

Triaxial U-U Stress/Strain Curves (ASTM:D2850)

Project: DMMF - MKE Harbor, WI | Job: 12596
Client: Foth Infrastructure & Environment, LLC | Date: 6/30/20
Remarks: Specimens trimmed to given sizes; Allowed to adjust under applied confining pressures for about 10 minutes.



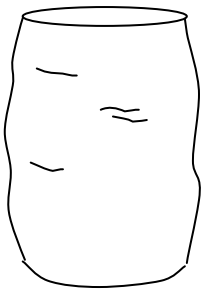
Boring: SB-3 | Depth: 8.5-10
Sample #:
Soil Type: Lean Clay (CL)

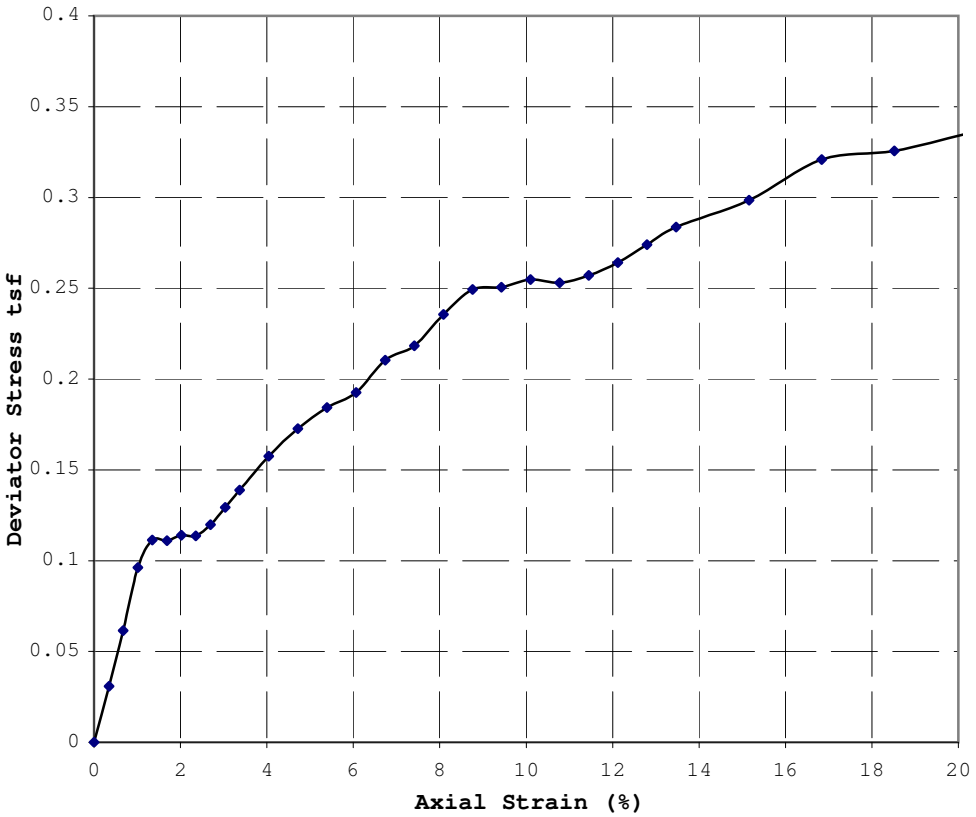
Strain Rate (in/min): 0.030
Sample Type: Bag
Dia. (in) 1.44 | Ht. (in) 2.97
Height to Diameter Ratio: 2.06

Max Deviator Stress: 0.91 tsf
Strain at Failure (%): 20.0
Confining Pressure: 3.0 tsf

W.C. (%) 18.9
Yd (pcf): 110.9

Sketch of Specimen After Failure





Boring: SB-5 | Depth: 18.5-20
Sample #:
Soil Type: Lean Clay (CL)

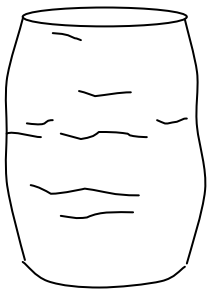
Strain Rate (in/min): 0.030
Sample Type: Bag

Dia. (in): 1.44 | Ht. (in): 2.97
Height to Diameter Ratio: 2.06

Max Deviator Stress: 0.33 tsf
Strain at Failure (%): 20.0
Confining Pressure: 5.0 tsf

W.C. (%): 18.2
Yd (pcf): 111.6

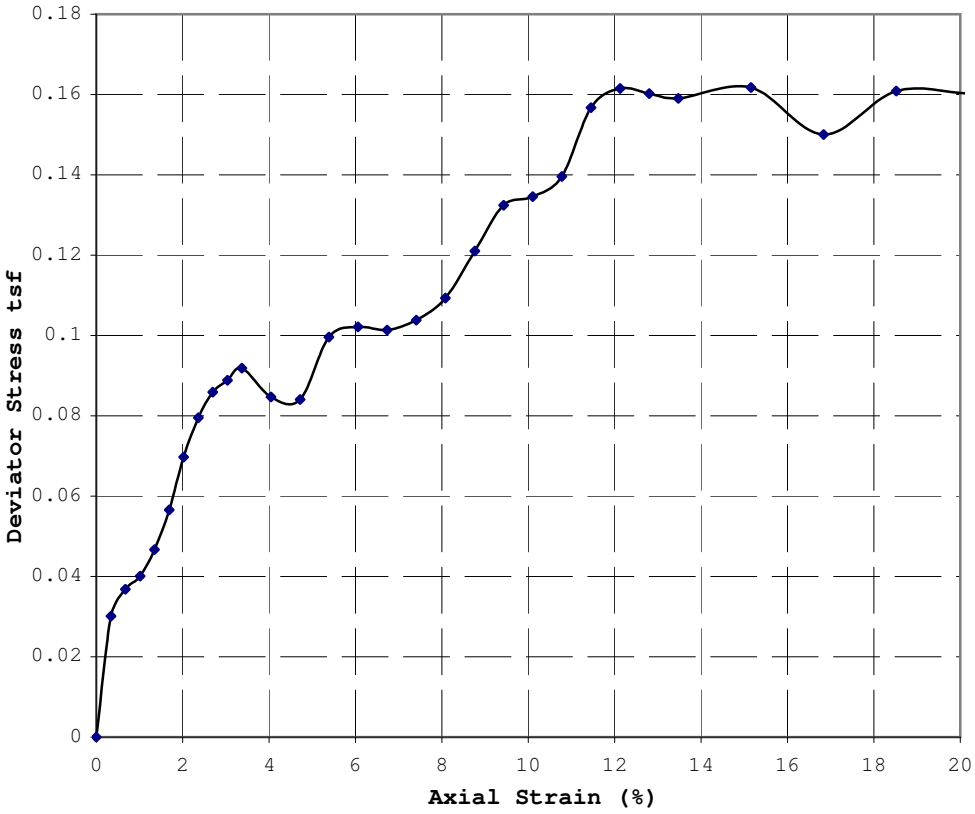
Sketch of Specimen After Failure



9530 James Ave South | SOIL ENGINEERING TESTING, INC. | Bloomington, MN 55431

Triaxial U-U Stress/Strain Curves (ASTM:D2850)

Project: DMMF - MKE Harbor, WI | Job: 12596
Client: Foth Infrastructure & Environment, LLC | Date: 6/30/20
Remarks: Specimens trimmed to given sizes; Allowed to adjust under applied confining pressures for about 10 minutes.



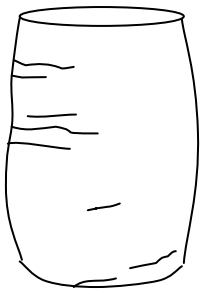
Boring: SB-6 | Depth: 13.5-15
Sample #:
Soil Type: Lean Clay w/sand and shell fragments (CL/OL)

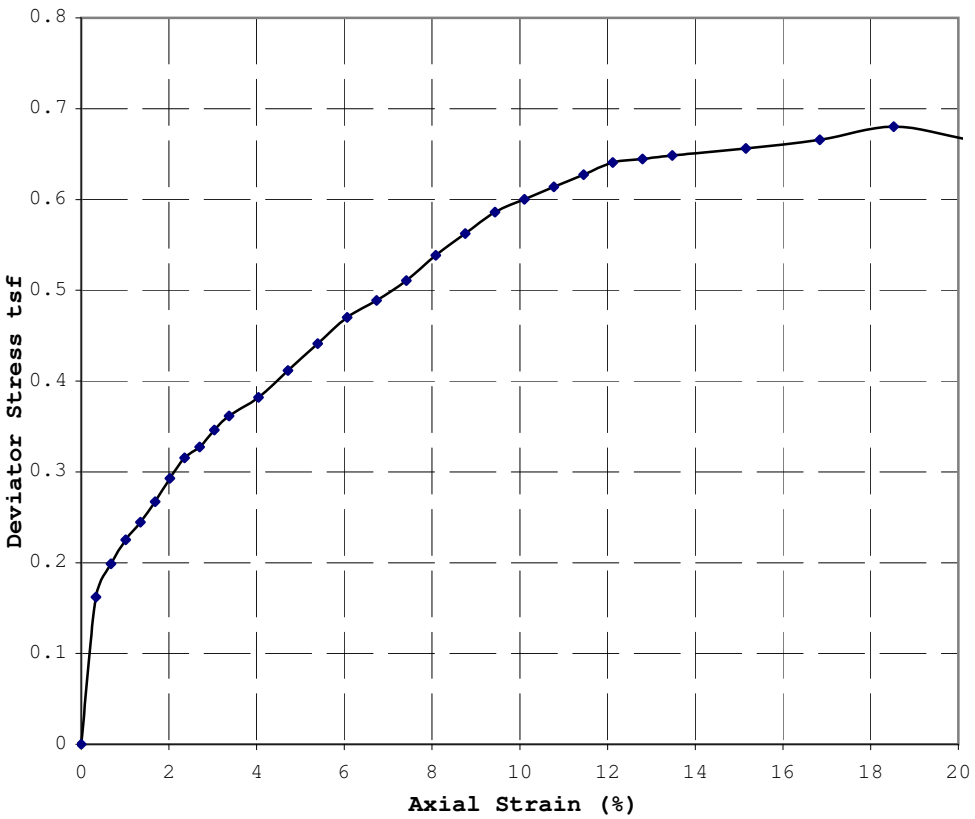
Strain Rate (in/min): 0.030
Sample Type: Bag
Dia. (in) 1.44 | Ht. (in) 2.97
Height to Diameter Ratio: 2.06

Max Deviator Stress: 0.16 tsf
Strain at Failure (%): 15.2
Confining Pressure: 4.0 tsf

W.C. (%) 37.5
Yd (pcf): 80.7

Sketch of Specimen After Failure





Boring: SB-7 | Depth: 8.5-10
Sample #:
Soil Type: Lean Clay, slightly organic (CL)

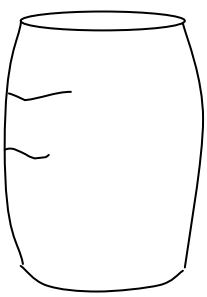
Strain Rate (in/min): 0.030
Sample Type: Bag

Dia. (in): 1.44 | Ht. (in): 2.97
Height to Diameter Ratio: 2.06

Max Deviator Stress: 0.68 tsf
Strain at Failure (%): 18.5
Confining Pressure: 3.0 tsf

W.C. (%): 27.9
Yd (pcf): 94.4

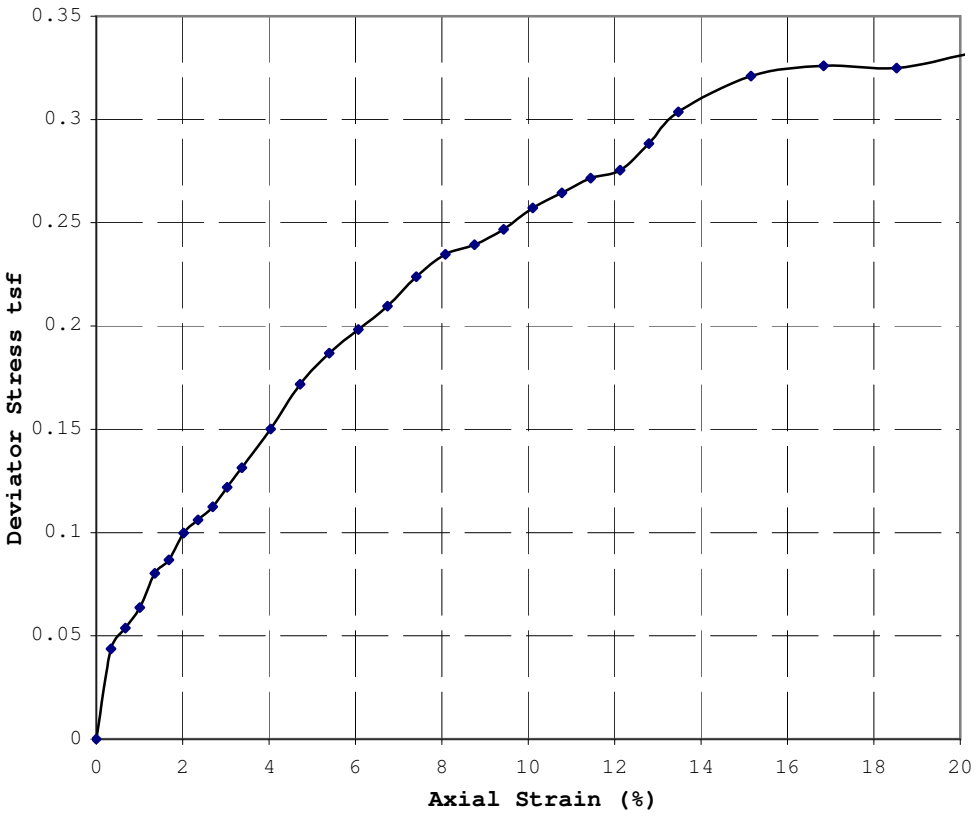
Sketch of Specimen After Failure



9530 James Ave South | SOIL ENGINEERING TESTING, INC. | Bloomington, MN 55431

Triaxial U-U Stress/Strain Curves (ASTM:D2850)

Project: DMMF - MKE Harbor, WI | Job: 12596
Client: Foth Infrastructure & Environment, LLC | Date: 6/30/20
Remarks: Specimens trimmed to given sizes; Allowed to adjust under applied confining pressures for about 10 minutes.



Boring: SB-8 | Depth: 18.5-20
Sample #:

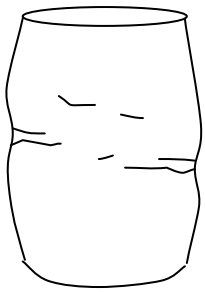
Soil Type: Lean Clay (CL)

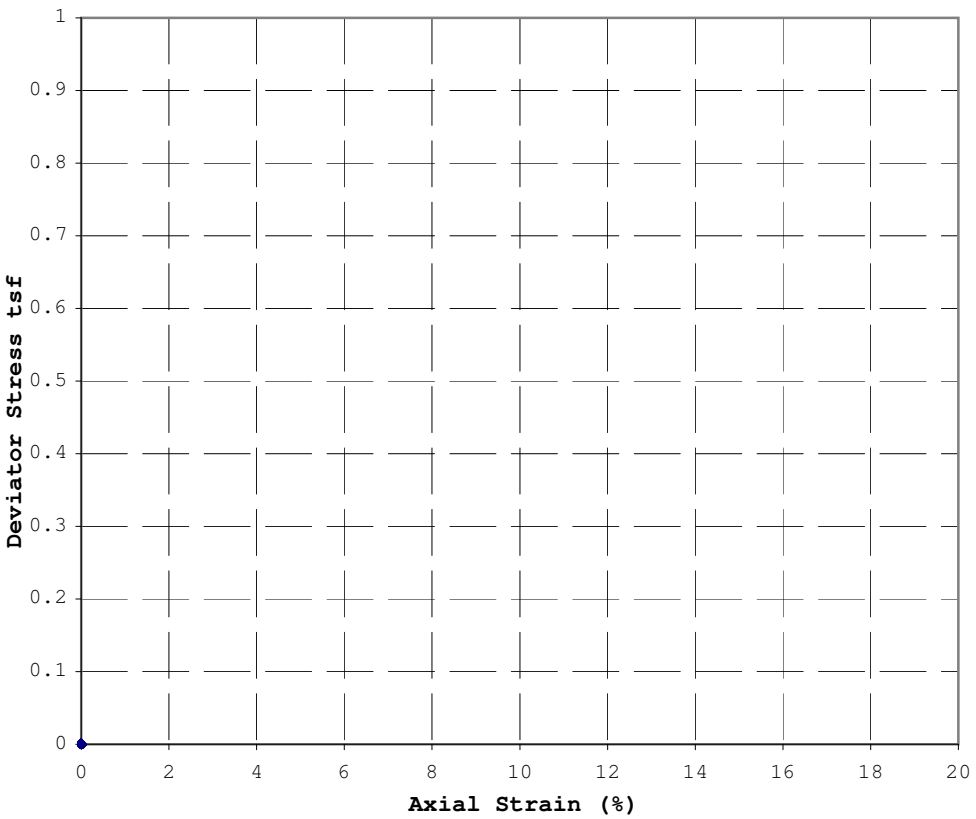
Strain Rate (in/min): 0.030
Sample Type: Bag
Dia. (in) 1.44 | Ht. (in) 2.97
Height to Diameter Ratio: 2.06

Max Deviator Stress: 0.33 tsf
Strain at Failure (%): 20.0
Confining Pressure: 4.0 tsf

W.C. (%) 27.3
Yd (pcf): 95.4

Sketch of Specimen After Failure





Boring: | Depth:
Sample #:

Soil Type:

Strain Rate (in/min):
Sample Type:

Dia. (in): | Ht. (in):
Height to Diameter Ratio:

Max Deviator Stress: tsf
Strain at Failure (%):
Confining Pressure: tsf

W.C. (%):
Yd (pcf):

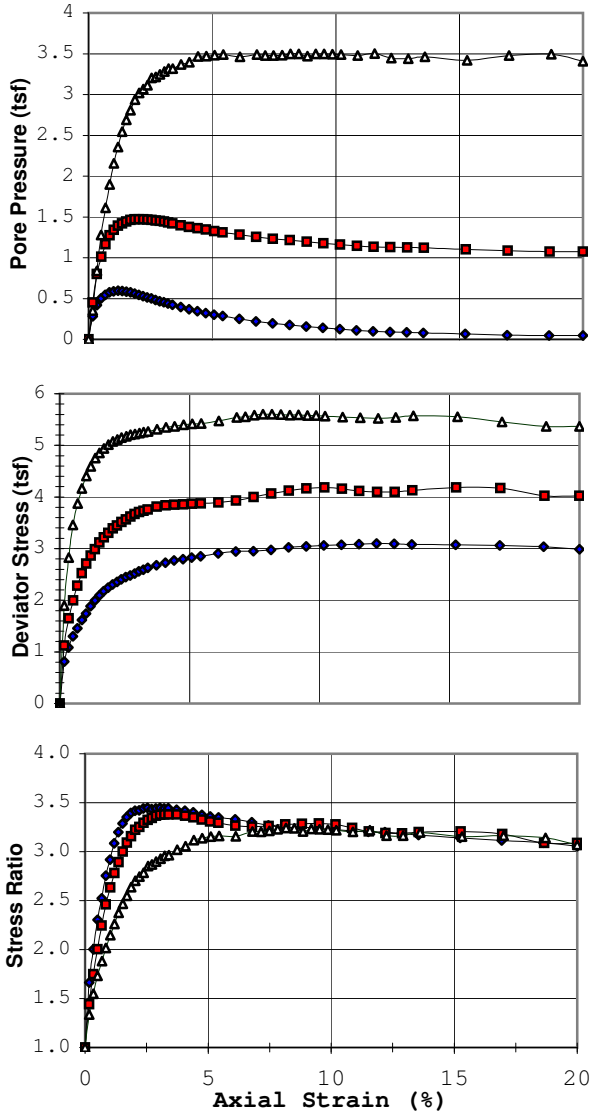
Sketch of Specimen After Failure

9530 James Ave South | SOIL ENGINEERING TESTING, INC. | Bloomington, MN 55431

TRIAXIAL TEST ASTM: D 4767

Job No. **12596**
Date: **7/14/20**

Project: **DMMF - MKE Harbor, WI / Foth Infrastructure & Environment, LLC**
Boring #: **SB-4** Sample #: Type: **3T** Depth (ft): **28.5-30.5**
Soil Type: **Lean Clay (CL)**



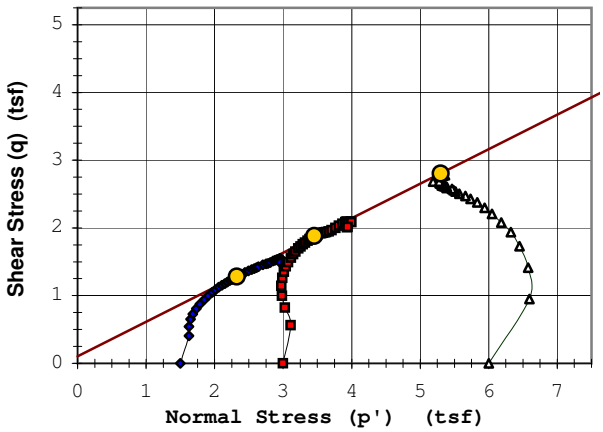
Failure Criterion: **Max. Stress Ratio**
Angle of internal friction, **ϕ' =** **30.7 °**
Apparent Cohesion, **c' =** **0.12 (tsf)**

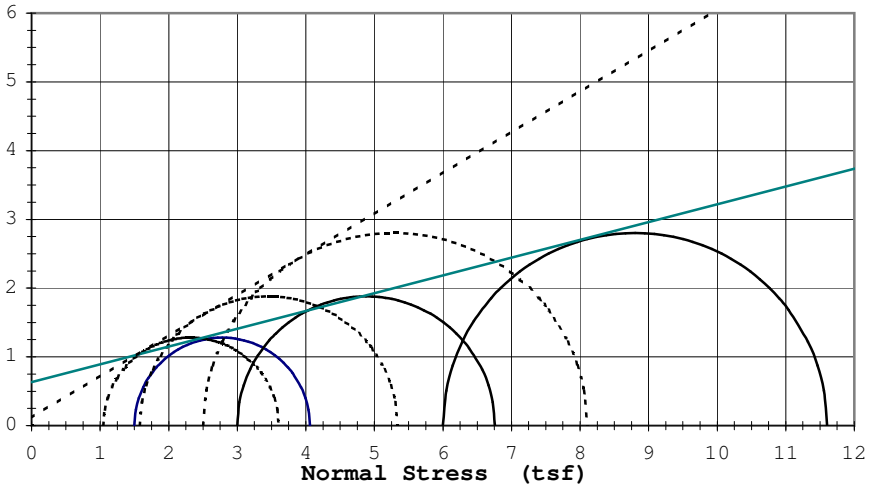
Test Date:	6/29/20		Liquid Limit:		20
Test Type:	CU w/pp		Plastic Limit:		12
Strain Rate (in/min):	0.000737		Plasticity Index:		8
Strain Rate (%/min):	0.025		Spec. Gravity :		2.79

Before Consolidation	A	B	C	D	E
Diameter (in)	1.44	1.44	1.44		
Height (in)	2.97	2.97	2.97		
Water Content (%)	14.8	14.7	14.9		
Dry Density (pcf)	120.4	121.1	120.4		
Void Ratio	0.45	0.44	0.45		
After Consolidation					
Diameter (in)	1.43	1.43	1.41		
Height (in)	2.95	2.95	2.94		
Water Content (%)	14.9	14.7	13.5		
Dry Density (pcf)	123.0	123.5	126.4		
Void Ratio	0.42	0.41	0.38		
Back Pressure (tsf)	4.8	6.4	6.0		
Minor Principal Stress (tsf)	1.50	3.00	6.00		
Max. Deviator Stress (tsf)	3.10	4.19	5.61		
Ultimate Deviator Stress (tsf)	2.99	4.03	5.37		
Deviator Stress at Failure (tsf)	2.56	3.76	5.60		
Max. Pore Pressure Buildup (tsf)	0.60	1.47	3.50		
Pore Pressure Parameter "B"	0.95	0.95	0.95		
Pct. Axial Strain at Failure	3.0	3.4	8.2		

"These test results are for informational purposes only and must be reviewed by a qualified professional engineer to verify that the test parameters shown are appropriate for any particular design"

Remarks: Radial drainage strips applied to trimmed specimen; Saturated, backpressured until "B" response was 0.95 to 1.00; Consolidated; All Drainage valves closed and immediately sheared.
A correction for membrane stiffness was applied to the deviator stress.





Rupture Envelope at Failure
α = 27.0 ° a = 0.1 (tsf)

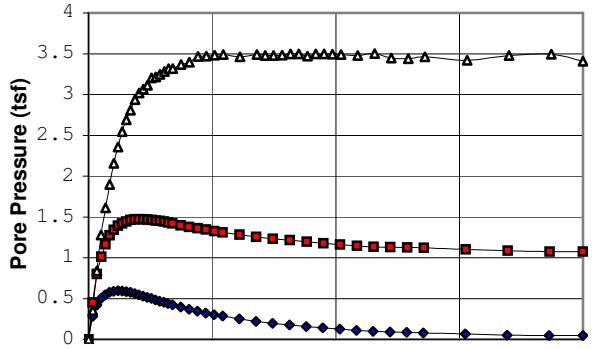
---------- Effective ϕ': 30.7 ° c'= 0.12 (tsf)
_____ Total ϕ: 14.5 ° c= 0.63 (tsf)

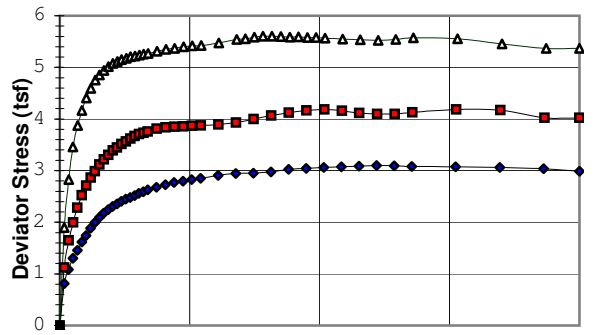
9530 James Avenue South
SOIL ENGINEERING TESTING, INC.
Bloomington, Minnesota 55431

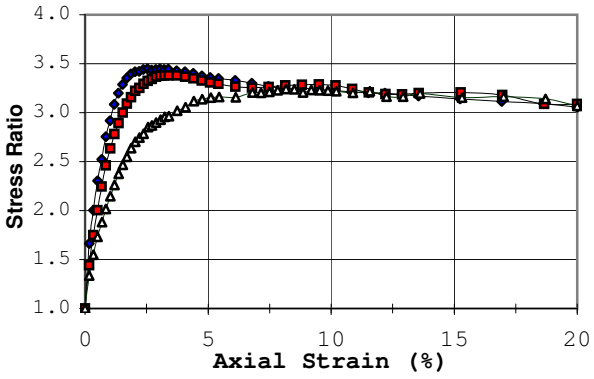
TRIAXIAL TEST ASTM: D 4767

Job No. **12596**
Date: **7/14/20**

Project: **DMMF - MKE Harbor, WI / Foth Infrastructure & Environment, LLC**
Boring #: **SB-4** Sample #: Type: **3T** Depth (ft): **28.5-30.5**
Soil Type: **Lean Clay (CL)**



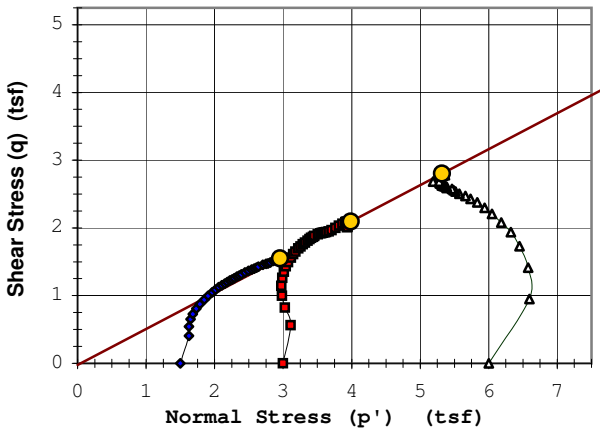


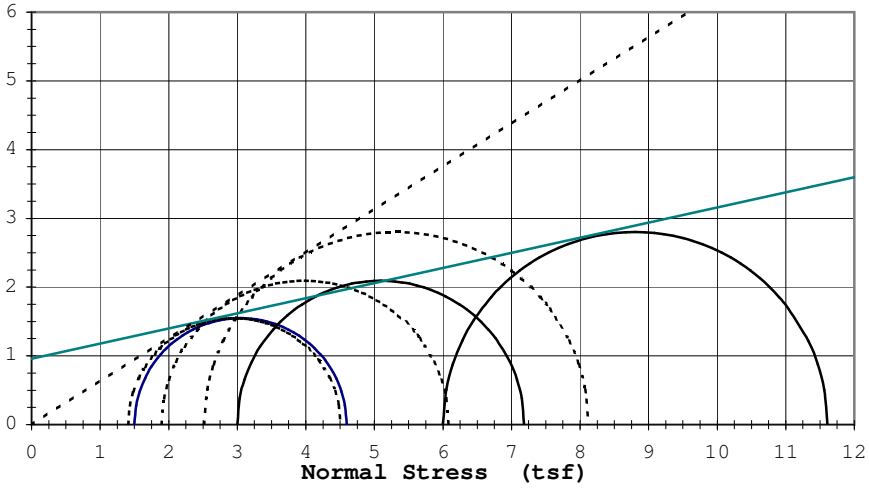


Failure Criterion:	Max. Deviator Stress				
Angle of internal friction, ϕ' =	32.1 °				
Apparent Cohesion, c' =	0.00 (tsf)				
Test Date: 6/29/20	Liquid Limit: 20				
Test Type: CU w/pp	Plastic Limit: 12				
Strain Rate (in/min): 0.000737	Plasticity Index: 8				
Strain Rate (%/min): 0.025	Spec. Gravity : 2.79				
Before Consolidation	**A**	**B**	**C**	**D**	**E**
Diameter (in)	1.44	1.44	1.44		
Height (in)	2.97	2.97	2.97		
Water Content (%)	14.8	14.7	14.9		
Dry Density (pcf)	120.4	121.1	120.4		
Void Ratio	0.45	0.44	0.45		
After Consolidation					
Diameter (in)	1.43	1.43	1.41		
Height (in)	2.95	2.95	2.94		
Water Content (%)	14.9	14.7	13.5		
Dry Density (pcf)	123.0	123.5	126.4		
Void Ratio	0.42	0.41	0.38		
Back Pressure (tsf)	4.8	6.4	6.0		
Minor Principal Stress (tsf)	1.50	3.00	6.00		
Max. Deviator Stress (tsf)	3.10	4.19	5.61		
Ultimate Deviator Stress (tsf)	2.99	4.03	5.37		
Deviator Stress at Failure (tsf)	3.10	4.19	5.61		
Max. Pore Pressure Buildup (tsf)	0.60	1.47	3.50		
Pore Pressure Parameter "B"	0.95	0.95	0.95		
Pct. Axial Strain at Failure	12.2	15.3	7.8		

"These test results are for informational purposes only and must be reviewed by a qualified professional engineer to verify that the test parameters shown are appropriate for any particular design"

Remarks: Radial drainage strips applied to trimmed specimen; Saturated, backpressured until "B" response was 0.95 to 1.00; Consolidated; All Drainage valves closed and immediately sheared.
A correction for membrane stiffness was applied to the deviator stress.





Rupture Envelope at Failure
α = 28.0 ° a = 0.0 (tsf)

---------- Effective ϕ': 32.1 ° c'= 0.00 (tsf)
_____ Total ϕ: 12.4 ° c= 0.96 (tsf)

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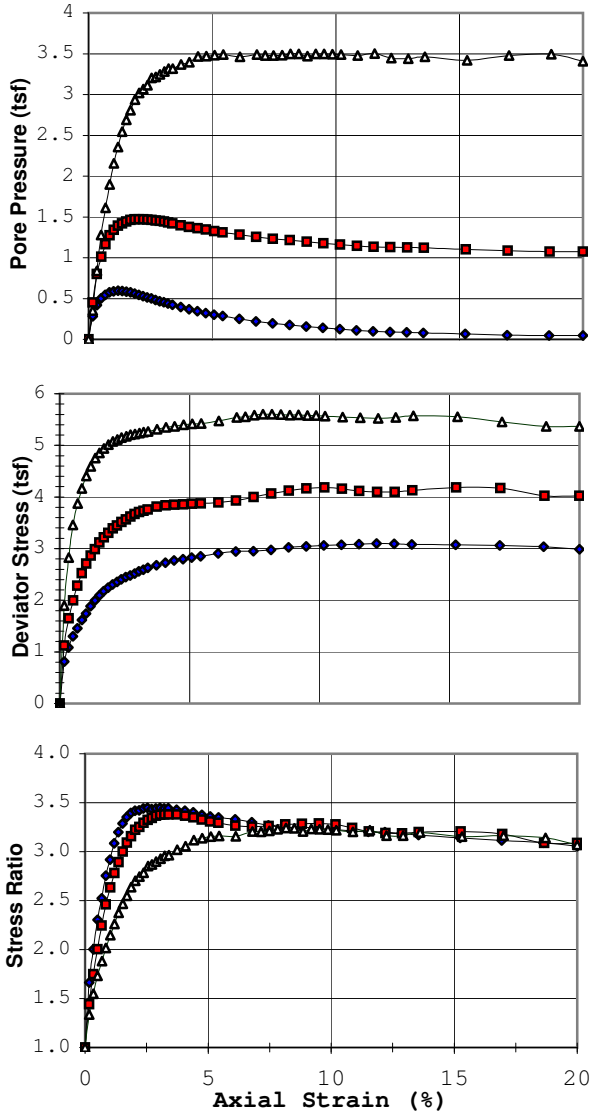
Bloomington, Minnesota 55431

TRIAXIAL TEST ASTM: D 4767

Job No. **12596**
Date: **7/14/20**

Project: **DMMF - MKE Harbor, WI / Foth Infrastructure & Environment, LLC**
Boring #: **SB-4** Sample #: Type: **3T** Depth (ft): **28.5-30.5**
Soil Type: **Lean Clay (CL)**



Failure Criterion: **Given Strain of: 15%**

Angle of internal friction, **ϕ' =** **31.8 °**

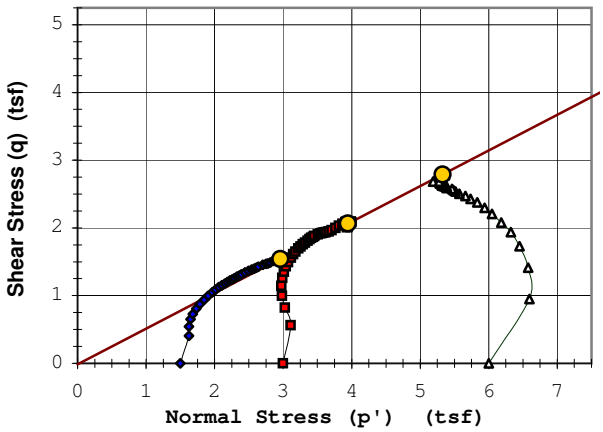
Apparent Cohesion, **c' =** **0.00 (tsf)**

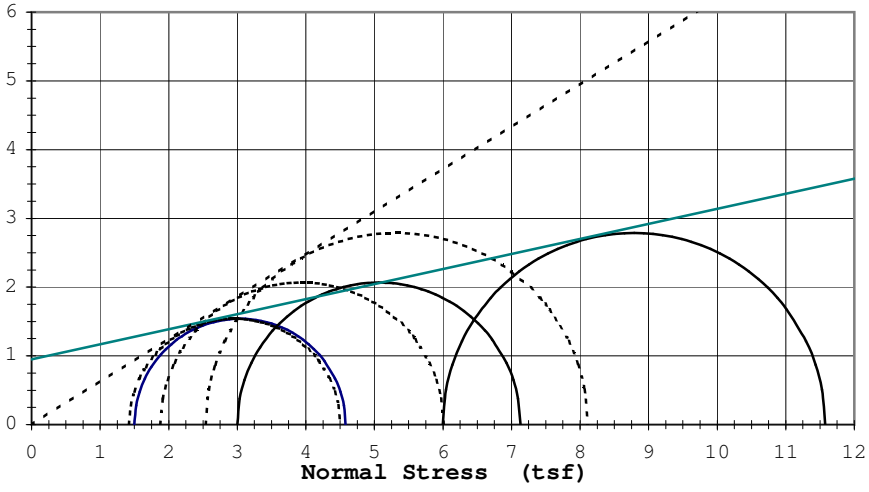
Test Date:	6/29/20		Liquid Limit:		20
Test Type:	CU w/pp		Plastic Limit:		12
Strain Rate (in/min):	0.000737		Plasticity Index:		8
Strain Rate (%/min):	0.025		Spec. Gravity :		2.79

Before Consolidation	A	B	C	D	E
Diameter (in)	1.44	1.44	1.44		
Height (in)	2.97	2.97	2.97		
Water Content (%)	14.8	14.7	14.9		
Dry Density (pcf)	120.4	121.1	120.4		
Void Ratio	0.45	0.44	0.45		
After Consolidation					
Diameter (in)	1.43	1.43	1.41		
Height (in)	2.95	2.95	2.94		
Water Content (%)	14.9	14.7	13.5		
Dry Density (pcf)	123.0	123.5	126.4		
Void Ratio	0.42	0.41	0.38		
Back Pressure (tsf)	4.8	6.4	6.0		
Minor Principal Stress (tsf)	1.50	3.00	6.00		
Max. Deviator Stress (tsf)	3.10	4.19	5.61		
Ultimate Deviator Stress (tsf)	2.99	4.03	5.37		
Deviator Stress at Failure (tsf)	3.08	4.13	5.57		
Max. Pore Pressure Buildup (tsf)	0.60	1.47	3.50		
Pore Pressure Parameter "B"	0.95	0.95	0.95		
Pct. Axial Strain at Failure	15.0	15.0	15.0		

"These test results are for informational purposes only and must be reviewed by a qualified professional engineer to verify that the test parameters shown are appropriate for any particular design"

Remarks: Radial drainage strips applied to trimmed specimen; Saturated, backpressured until "B" response was 0.95 to 1.00; Consolidated; All Drainage valves closed and immediately sheared.
A correction for membrane stiffness was applied to the deviator stress.





Rupture Envelope at Failure
α = 27.8 ° a = 0.0 (tsf)

---------- Effective ϕ': 31.8 ° c'= 0.00 (tsf)
_____ Total ϕ: 12.4 ° c= 0.95 (tsf)

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Bloomington, Minnesota 55431

Triaxial Data

Job: **12596**

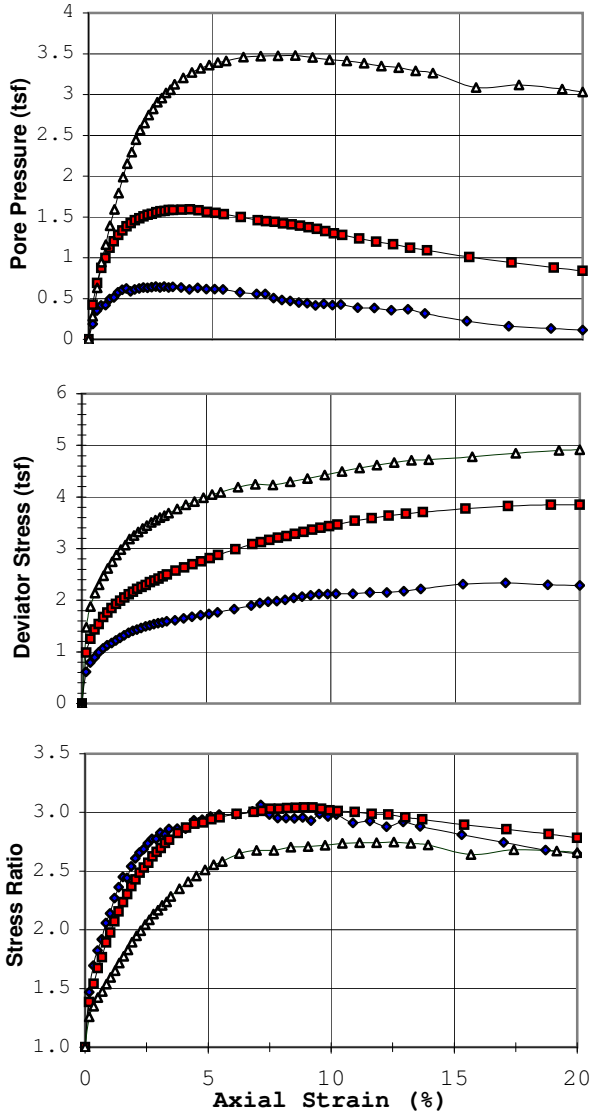
Boring: SB-4 Sample: Depth: 28.5-30.5 Date: 7/14/20

1.5 tsf			3.0 tsf			6.0 tsf			Sample 4			Sample 5		
Strain (%)	Deviator Stress (tsf)	Pore Pressure (tsf)	Strain (%)	Deviator Stress (tsf)	Pore Pressure (tsf)	Strain (%)	Deviator Stress (tsf)	Pore Pressure (tsf)	Strain (%)	Deviator Stress (tsf)	Pore Pressure (tsf)	Strain (%)	Deviator Stress (tsf)	Pore Pressure (tsf)
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00						
0.17	0.81	0.28	0.17	1.12	0.45	0.17	1.90	0.35						
0.34	1.09	0.42	0.34	1.65	0.80	0.34	2.83	0.84						
0.51	1.30	0.50	0.51	1.99	1.01	0.51	3.46	1.28						
0.68	1.45	0.54	0.68	2.28	1.17	0.68	3.87	1.61						
0.85	1.62	0.58	0.85	2.52	1.27	0.85	4.16	1.90						
1.02	1.74	0.59	1.02	2.71	1.34	1.02	4.41	2.16						
1.19	1.89	0.60	1.19	2.86	1.39	1.19	4.59	2.36						
1.35	1.99	0.59	1.36	2.99	1.42	1.36	4.75	2.54						
1.52	2.10	0.58	1.53	3.12	1.44	1.53	4.86	2.69						
1.69	2.18	0.58	1.70	3.22	1.46	1.70	4.94	2.81						
1.86	2.25	0.56	1.87	3.30	1.47	1.87	5.01	2.94						
2.03	2.30	0.55	2.04	3.39	1.47	2.04	5.07	3.02						
2.20	2.35	0.53	2.21	3.45	1.47	2.21	5.11	3.07						
2.37	2.40	0.52	2.38	3.51	1.47	2.38	5.15	3.11						
2.54	2.45	0.50	2.55	3.57	1.46	2.56	5.18	3.20						
2.71	2.48	0.48	2.72	3.62	1.46	2.72	5.20	3.21						
2.88	2.52	0.47	2.89	3.67	1.45	2.89	5.22	3.25						
3.05	2.56	0.45	3.06	3.70	1.44	3.06	5.24	3.28						
3.22	2.59	0.44	3.22	3.73	1.43	3.23	5.26	3.32						
3.39	2.63	0.42	3.39	3.76	1.42	3.40	5.27	3.32						
3.72	2.68	0.40	3.73	3.81	1.40	3.74	5.31	3.37						
4.06	2.73	0.37	4.07	3.84	1.38	4.08	5.35	3.40						
4.40	2.77	0.35	4.41	3.85	1.36	4.43	5.37	3.47						
4.74	2.80	0.32	4.75	3.85	1.34	4.76	5.40	3.47						
5.08	2.82	0.30	5.09	3.86	1.33	5.10	5.41	3.48						
5.42	2.85	0.29	5.43	3.88	1.31	5.44	5.42	3.49						
6.09	2.91	0.25	6.11	3.89	1.28	6.12	5.47	3.46						
6.77	2.94	0.22	6.78	3.93	1.26	6.81	5.54	3.49						
7.45	2.95	0.20	7.46	4.00	1.23	7.15	5.56	3.48						
8.13	2.98	0.18	8.14	4.06	1.22	7.49	5.58	3.48						
8.80	3.02	0.16	8.82	4.12	1.20	7.83	5.61	3.48						
9.48	3.04	0.14	9.50	4.17	1.18	8.17	5.60	3.50						
10.16	3.06	0.13	10.18	4.18	1.16	8.51	5.59	3.50						
10.83	3.08	0.11	10.86	4.16	1.15	8.85	5.59	3.47						
11.51	3.09	0.10	11.53	4.12	1.13	9.19	5.59	3.50						
12.19	3.10	0.09	12.21	4.10	1.13	9.53	5.58	3.50						
12.87	3.09	0.09	12.89	4.10	1.12	9.87	5.58	3.49						
13.54	3.08	0.08	13.57	4.13	1.12	10.21	5.57	3.49						
15.24	3.07	0.06	15.26	4.19	1.10	10.89	5.55	3.48						
16.93	3.06	0.05	16.96	4.17	1.09	11.57	5.54	3.50						
18.62	3.04	0.05	18.66	4.02	1.08	12.25	5.52	3.45						
20.00	2.99	0.05	20.00	4.03	1.07	12.93	5.54	3.44						
						13.61	5.57	3.46						
						15.31	5.56	3.42						
						17.01	5.46	3.48						
						18.72	5.37	3.49						
						20.00	5.37	3.41						

TRIAXIAL TEST ASTM: D 4767

Job No. **12596**
Date: **7/14/20**

Project: **DMMF - MKE Harbor, WI / Foth Infrastructure & Environment, LLC**
Boring #: **SB-7** Sample #: Type: **3T** Depth (ft): **17.5-20**
Soil Type: **Lean Clay (CL)**



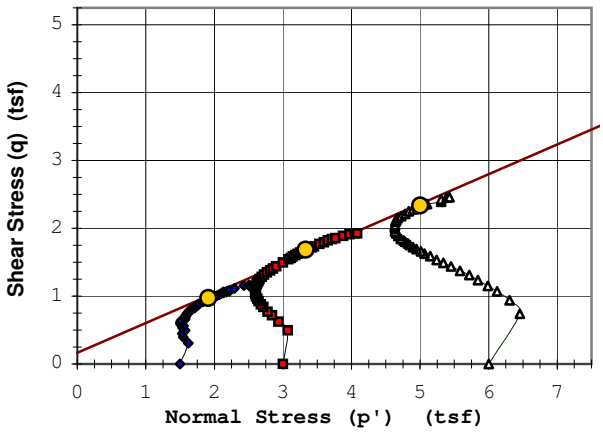
Failure Criterion: **Max. Stress Ratio**
Angle of internal friction, **ϕ' =** **26.0 °**
Apparent Cohesion, **c' =** **0.18 (tsf)**

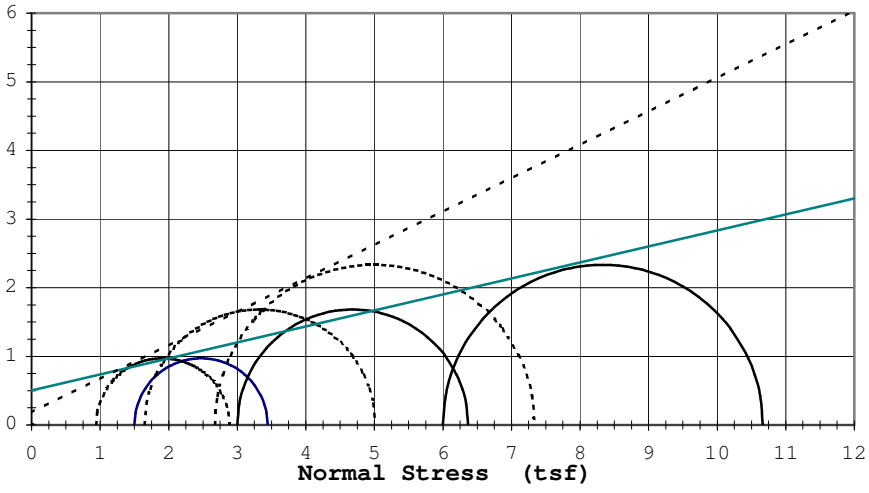
Test Date:	6/24/20		Liquid Limit:		35
Test Type:	CU w/pp		Plastic Limit:		13
Strain Rate (in/min):	0.000323		Plasticity Index:		22
Strain Rate (%/min):	0.011		Spec. Gravity :		2.79

Before Consolidation	A	B	C	D	E
Diameter (in)	1.44	1.44	1.44		
Height (in)	2.97	2.97	2.98		
Water Content (%)	21.2	20.6	22.6		
Dry Density (pcf)	107.7	108.8	105.3		
Void Ratio	0.62	0.60	0.65		
After Consolidation					
Diameter (in)	1.42	1.41	1.41		
Height (in)	2.94	2.92	2.87		
Water Content (%)	19.8	18.1	19.3		
Dry Density (pcf)	112.1	115.8	113.2		
Void Ratio	0.55	0.50	0.54		
Back Pressure (tsf)	5.3	4.6	4.6		
Minor Principal Stress (tsf)	1.50	3.00	6.00		
Max. Deviator Stress (tsf)	2.33	3.85	4.92		
Ultimate Deviator Stress (tsf)	2.28	3.85	4.92		
Deviator Stress at Failure (tsf)	1.94	3.36	4.67		
Max. Pore Pressure Buildup (tsf)	0.65	1.59	3.48		
Pore Pressure Parameter "B"	0.95	0.95	0.95		
Pct. Axial Strain at Failure	7.1	9.2	12.5		

"These test results are for informational purposes only and must be reviewed by a qualified professional engineer to verify that the test parameters shown are appropriate for any particular design"

Remarks: Radial drainage strips applied to trimmed specimen; Saturated, backpressured until "B" response was 0.95 to 1.00; Consolidated; All Drainage valves closed and immediately sheared.
A correction for membrane stiffness was applied to the deviator stress.





Rupture Envelope at Failure
α = 23.7 ° a = 0.2 (tsf)

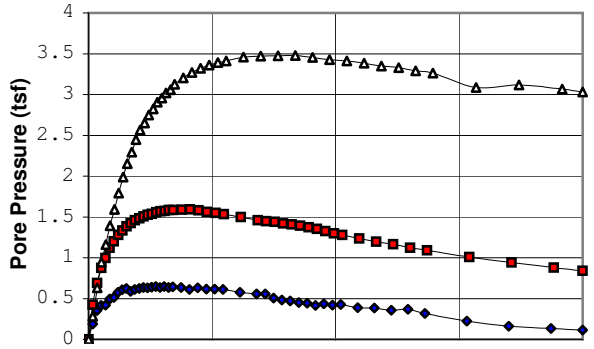
----------	Effective ϕ':	26.0 °	c'= 0.18 (tsf)
_____	Total ϕ:	13.1 °	c= 0.50 (tsf)

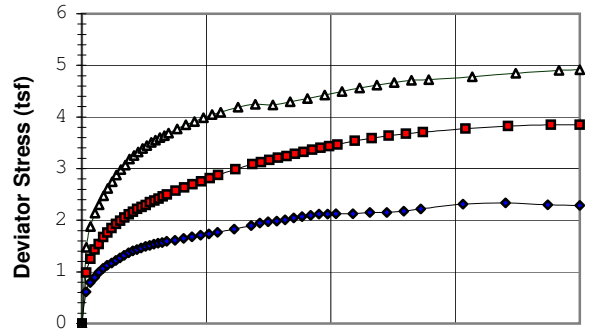
9530 James Avenue South
FOIL ENGINEERING TESTING, INC.
Bloomington, Minnesota 55431

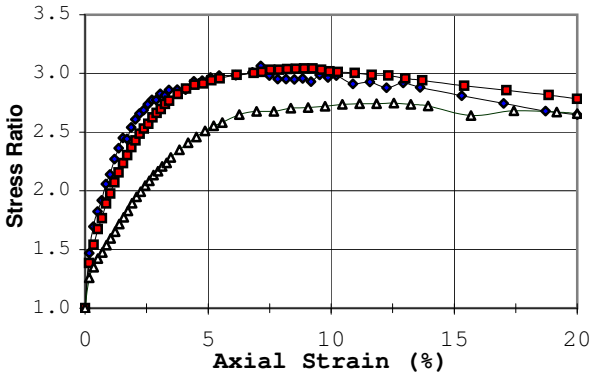
TRIAXIAL TEST ASTM: D 4767

Job No. **12596**
Date: **7/14/20**

Project: **DMMF - MKE Harbor, WI / Foth Infrastructure & Environment, LLC**
Boring #: **SB-7** Sample #: Type: **3T** Depth (ft): **17.5-20**
Soil Type: **Lean Clay (CL)**







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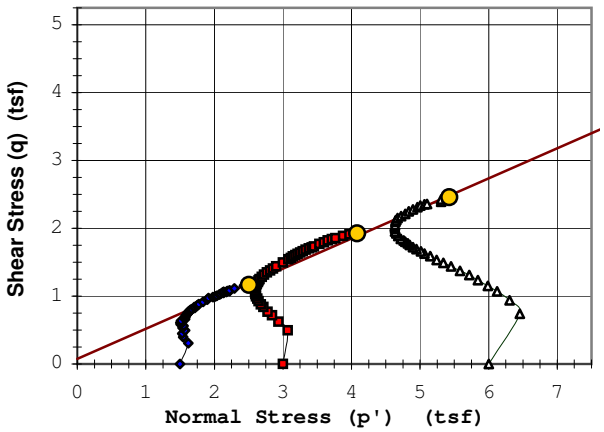
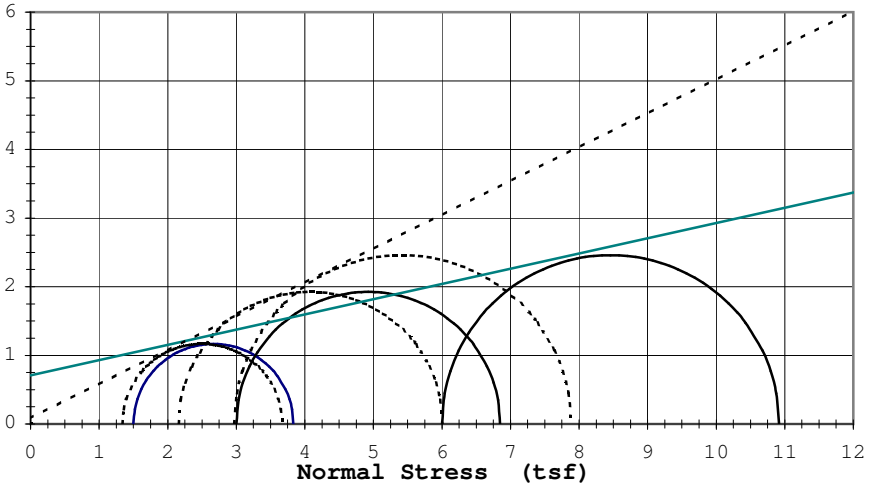
X

Failure Criterion:	Max. Deviator Stress				
Angle of internal friction, ϕ' =	26.3 °				
Apparent Cohesion, c' =	0.08 (tsf)				
Test Date: 6/24/20		Liquid Limit:	35		
Test Type: CU w/pp		Plastic Limit:	13		
Strain Rate (in/min): 0.000323		Plasticity Index:	22		
Strain Rate (%/min): 0.011		Spec. Gravity :	2.79		
Before Consolidation	**A**	**B**	**C**	**D**	**E**
Diameter (in)	1.44	1.44	1.44		
Height (in)	2.97	2.97	2.98		
Water Content (%)	21.2	20.6	22.6		
Dry Density (pcf)	107.7	108.8	105.3		
Void Ratio	0.62	0.60	0.65		
After Consolidation					
Diameter (in)	1.42	1.41	1.41		
Height (in)	2.94	2.92	2.87		
Water Content (%)	19.8	18.1	19.3		
Dry Density (pcf)	112.1	115.8	113.2		
Void Ratio	0.55	0.50	0.54		
Back Pressure (tsf)	5.3	4.6	4.6		
Minor Principal Stress (tsf)	1.50	3.00	6.00		
Max. Deviator Stress (tsf)	2.33	3.85	4.92		
Ultimate Deviator Stress (tsf)	2.28	3.85	4.92		
Deviator Stress at Failure (tsf)	2.33	3.85	4.92		
Max. Pore Pressure Buildup (tsf)	0.65	1.59	3.48		
Pore Pressure Parameter "B"	0.95	0.95	0.95		
Pct. Axial Strain at Failure	17.0	20.0	20.0		

"These test results are for informational purposes only and must be reviewed by a qualified professional engineer to verify that the test parameters shown are appropriate for any particular design"

Remarks: Radial drainage strips applied to trimmed specimen; Saturated, backpressured until "B" response was 0.95 to 1.00; Consolidated; All Drainage valves closed and immediately sheared.
A correction for membrane stiffness was applied to the deviator stress.





Rupture Envelope at Failure
α = 23.9 ° a = 0.1 (tsf)

---------- Effective ϕ': 26.3 ° c'= 0.08 (tsf)
_____ Total ϕ: 12.5 ° c= 0.71 (tsf)

9530 James Avenue South

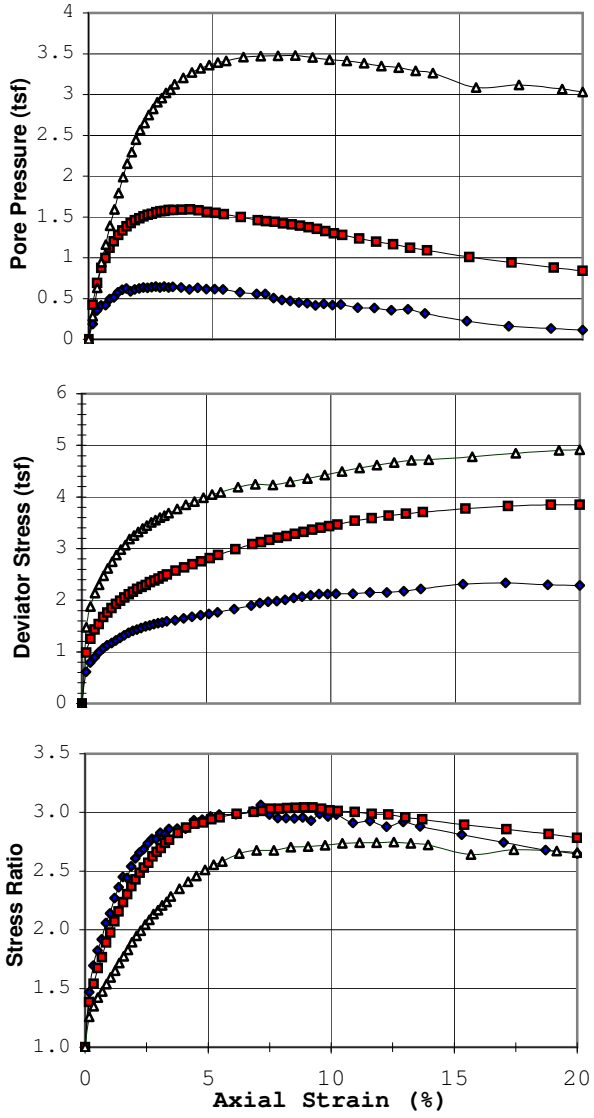
SOIL ENGINEERING TESTING, INC.

Bloomington, Minnesota 55431

TRIAXIAL TEST ASTM: D 4767

Job No. **12596**
Date: **7/14/20**

Project: **DMMF - MKE Harbor, WI / Foth Infrastructure & Environment, LLC**
Boring #: **SB-7** Sample #: Type: **3T** Depth (ft): **17.5-20**
Soil Type: **Lean Clay (CL)**



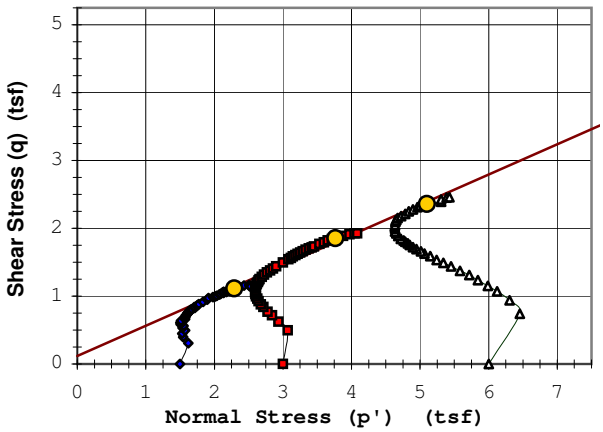
Failure Criterion: **Given Strain of: 15%**
Angle of internal friction, **ϕ' =** **26.5 °**
Apparent Cohesion, **c' =** **0.13 (tsf)**

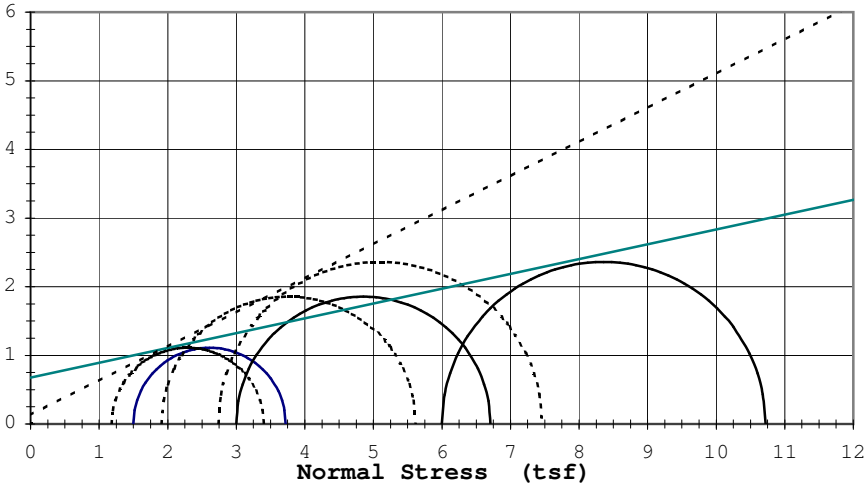
Test Date:	6/24/20		Liquid Limit:	35	
Test Type:	CU w/pp		Plastic Limit:	13	
Strain Rate (in/min):	0.000323		Plasticity Index:	22	
Strain Rate (%/min):	0.011		Spec. Gravity :	2.79	

Before Consolidation	A	B	C	D	E
Diameter (in)	1.44	1.44	1.44		
Height (in)	2.97	2.97	2.98		
Water Content (%)	21.2	20.6	22.6		
Dry Density (pcf)	107.7	108.8	105.3		
Void Ratio	0.62	0.60	0.65		
After Consolidation					
Diameter (in)	1.42	1.41	1.41		
Height (in)	2.94	2.92	2.87		
Water Content (%)	19.8	18.1	19.3		
Dry Density (pcf)	112.1	115.8	113.2		
Void Ratio	0.55	0.50	0.54		
Back Pressure (tsf)	5.3	4.6	4.6		
Minor Principal Stress (tsf)	1.50	3.00	6.00		
Max. Deviator Stress (tsf)	2.33	3.85	4.92		
Ultimate Deviator Stress (tsf)	2.28	3.85	4.92		
Deviator Stress at Failure (tsf)	2.22	3.71	4.72		
Max. Pore Pressure Buildup (tsf)	0.65	1.59	3.48		
Pore Pressure Parameter "B"	0.95	0.95	0.95		
Pct. Axial Strain at Failure	15.0	15.0	15.0		

"These test results are for informational purposes only and must be reviewed by a qualified professional engineer to verify that the test parameters shown are appropriate for any particular design"

Remarks: Radial drainage strips applied to trimmed specimen; Saturated, backpressured until "B" response was 0.95 to 1.00; Consolidated; All Drainage valves closed and immediately sheared.
A correction for membrane stiffness was applied to the deviator stress.





Rupture Envelope at Failure
α = 24.0 ° a = 0.1 (tsf)

----------	Effective ϕ':	26.5 °	c'= 0.13 (tsf)
_____	Total ϕ:	12.2 °	c= 0.68 (tsf)

9530 James Avenue South
FOTH ENGINEERING TESTING, INC.
Bloomington, Minnesota 55431

Triaxial Data

Job: **12596**

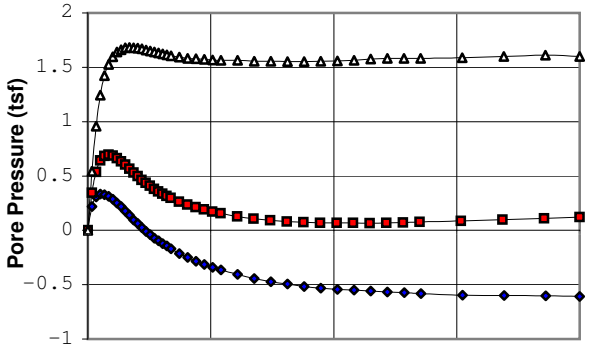
Boring: SB-7 Sample: Depth: 17.5-20 Date: 7/14/20

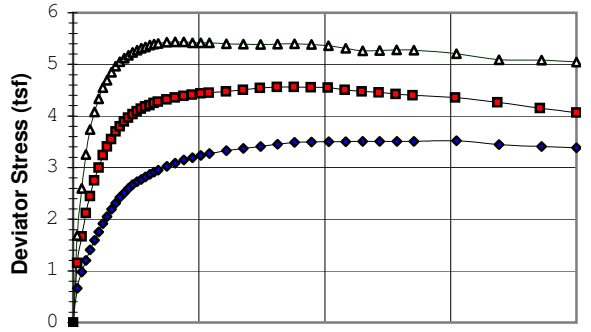
1.5 tsf			3.0 tsf			6.0 tsf			Sample 4			Sample 5		
Strain (%)	Deviator Stress (tsf)	Pore Pressure (tsf)	Strain (%)	Deviator Stress (tsf)	Pore Pressure (tsf)	Strain (%)	Deviator Stress (tsf)	Pore Pressure (tsf)	Strain (%)	Deviator Stress (tsf)	Pore Pressure (tsf)	Strain (%)	Deviator Stress (tsf)	Pore Pressure (tsf)
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00						
0.17	0.61	0.19	0.17	0.99	0.42	0.17	1.48	0.28						
0.34	0.80	0.35	0.35	1.25	0.69	0.35	1.88	0.63						
0.51	0.89	0.42	0.51	1.43	0.87	0.52	2.14	0.95						
0.68	0.99	0.42	0.69	1.54	0.99	0.70	2.30	1.16						
0.85	1.06	0.49	0.86	1.67	1.12	0.87	2.47	1.39						
1.02	1.13	0.51	1.03	1.76	1.20	1.05	2.62	1.59						
1.19	1.17	0.58	1.20	1.85	1.28	1.22	2.75	1.79						
1.36	1.22	0.61	1.37	1.93	1.33	1.39	2.88	1.99						
1.53	1.27	0.62	1.54	1.99	1.39	1.57	2.98	2.15						
1.70	1.32	0.59	1.71	2.05	1.42	1.74	3.07	2.29						
1.87	1.37	0.61	1.88	2.11	1.46	1.92	3.18	2.45						
2.04	1.41	0.62	2.06	2.16	1.48	2.09	3.26	2.56						
2.21	1.43	0.64	2.23	2.22	1.51	2.27	3.32	2.65						
2.38	1.47	0.63	2.40	2.25	1.53	2.44	3.39	2.75						
2.55	1.50	0.64	2.57	2.30	1.54	2.61	3.45	2.83						
2.72	1.51	0.65	2.74	2.35	1.56	2.79	3.51	2.90						
2.89	1.54	0.63	2.91	2.38	1.57	2.96	3.55	2.96						
3.06	1.56	0.65	3.08	2.42	1.57	3.14	3.60	3.02						
3.23	1.57	0.64	3.25	2.46	1.58	3.31	3.64	3.06						
3.40	1.59	0.64	3.43	2.50	1.59	3.49	3.69	3.12						
3.74	1.61	0.63	3.77	2.57	1.59	3.83	3.77	3.20						
4.08	1.65	0.61	4.11	2.64	1.59	4.18	3.85	3.27						
4.42	1.68	0.63	4.45	2.70	1.58	4.53	3.91	3.32						
4.76	1.71	0.62	4.80	2.75	1.56	4.88	3.99	3.36						
5.10	1.74	0.62	5.14	2.81	1.55	5.23	4.05	3.39						
5.44	1.76	0.61	5.48	2.87	1.53	5.58	4.09	3.41						
6.12	1.83	0.58	6.17	2.99	1.50	6.27	4.19	3.46						
6.81	1.90	0.56	6.85	3.08	1.46	6.97	4.24	3.47						
7.15	1.94	0.56	7.19	3.13	1.45	7.67	4.23	3.47						
7.49	1.97	0.51	7.54	3.17	1.44	8.36	4.30	3.48						
7.83	1.99	0.48	7.88	3.21	1.42	9.06	4.36	3.45						
8.17	2.01	0.47	8.22	3.24	1.41	9.76	4.43	3.43						
8.51	2.05	0.45	8.56	3.28	1.39	10.46	4.50	3.41						
8.85	2.07	0.44	8.91	3.32	1.37	11.15	4.56	3.38						
9.19	2.09	0.42	9.25	3.36	1.35	11.85	4.62	3.35						
9.53	2.12	0.44	9.59	3.40	1.32	12.55	4.67	3.33						
9.87	2.12	0.42	9.93	3.43	1.30	13.24	4.71	3.29						
10.21	2.12	0.43	10.28	3.47	1.28	13.94	4.72	3.26						
10.89	2.12	0.39	10.96	3.54	1.24	15.68	4.78	3.09						
11.57	2.15	0.38	11.65	3.59	1.20	17.42	4.85	3.12						
12.25	2.15	0.36	12.33	3.64	1.16	19.17	4.90	3.07						
12.93	2.17	0.37	13.02	3.68	1.12	20.00	4.92	3.03						
13.61	2.22	0.32	13.70	3.71	1.09									
15.31	2.31	0.22	15.41	3.78	1.01									
17.01	2.33	0.16	17.13	3.82	0.94									
18.71	2.30	0.13	18.84	3.85	0.88									
20.00	2.28	0.11	20.00	3.85	0.84									

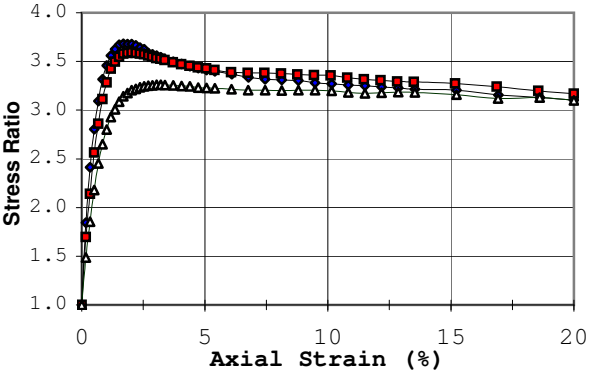
TRIAXIAL TEST ASTM: D 4767

Job No. **12596**
Date: **7/13/20**

Project: **DMMF - MKE Harbor, WI / Foth Infrastructure & Environment, LLC**
Boring #: **ST-11** Sample #: Type: **3T** Depth (ft): **30-32**
Soil Type: **Lean Clay (CL)**







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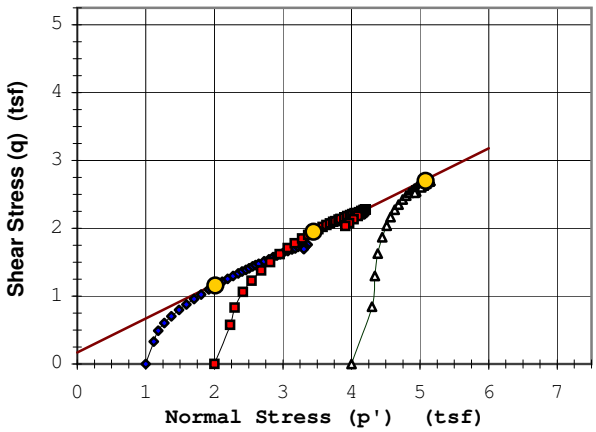
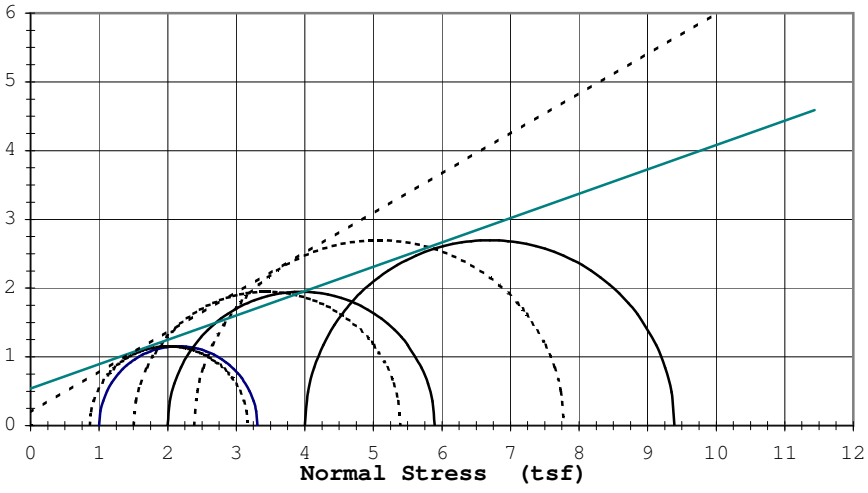
Failure Criterion:	Max. Stress Ratio				
Angle of internal friction, ϕ' =	30.1 °				
Apparent Cohesion, c' =	0.20 (tsf)				
Test Date: 6/24/20		Liquid Limit:	21		
Test Type: CU w/pp		Plastic Limit:	12		
Strain Rate (in/min): 0.00074		Plasticity Index:	9		
Strain Rate (%/min): 0.025		Spec. Gravity :	2.81		
Before Consolidation	**A**	**B**	**C**	**D**	**E**
Diameter (in)	1.44	1.44	1.44		
Height (in)	2.97	2.98	2.98		
Water Content (%)	15.5	15.1	15.8		
Dry Density (pcf)	119.0	119.8	117.7		
Void Ratio	0.47	0.46	0.49		
After Consolidation					
Diameter (in)	1.43	1.42	1.42		
Height (in)	2.95	2.96	2.96		
Water Content (%)	16.0	15.4	16.2		
Dry Density (pcf)	121.1	122.4	120.6		
Void Ratio	0.45	0.43	0.45		
Back Pressure (tsf)	5.5	5.6	6.4		
Minor Principal Stress (tsf)	1.00	2.00	4.00		
Max. Deviator Stress (tsf)	3.52	4.56	5.44		
Ultimate Deviator Stress (tsf)	3.39	4.07	5.05		
Deviator Stress at Failure (tsf)	2.31	3.89	5.39		
Max. Pore Pressure Buildup (tsf)	0.33	0.70	1.68		
Pore Pressure Parameter "B"	0.95	0.95	0.95		
Pct. Axial Strain at Failure	1.7	2.0	3.2		

"These test results are for informational purposes only and must be reviewed by a qualified professional engineer to verify that the test parameters shown are appropriate for any particular design"

Remarks: Radial drainage strips applied to trimmed specimen; Saturated, backpressured until "B" response was 0.95 to 1.00; Consolidated; All Drainage valves closed and immediately sheared.
A correction for membrane stiffness was applied to the deviator stress.





Rupture Envelope at Failure	
α = 26.6 °	a = 0.2 (tsf)

----------	Effective ϕ': 30.1 °	c'=	0.20 (tsf)
_____	Total ϕ: 19.5 °	c=	0.54 (tsf)

9530 James Avenue South

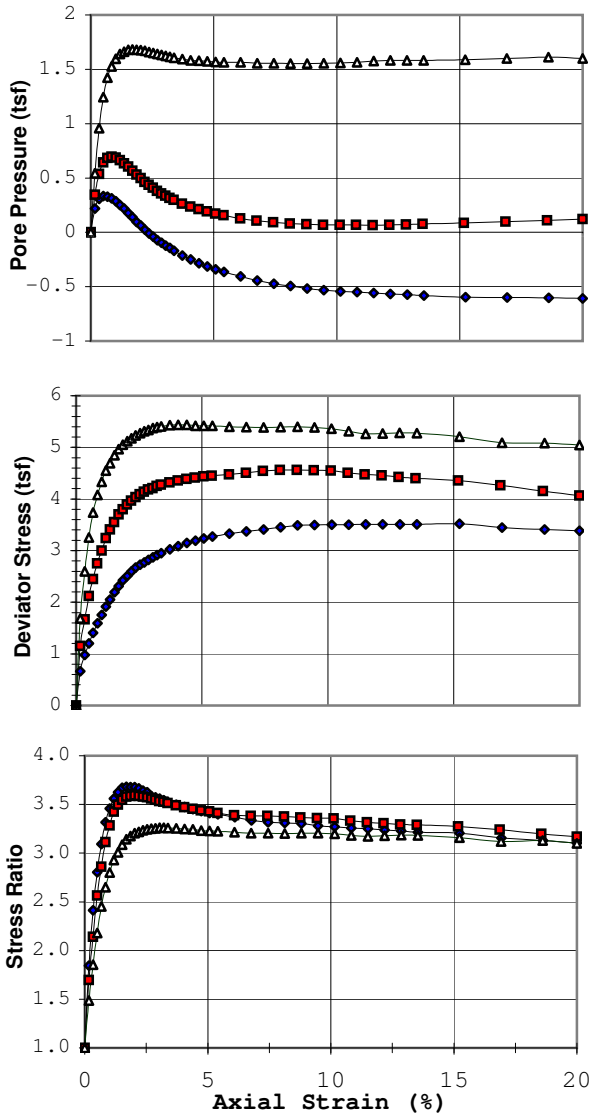
SOIL ENGINEERING TESTING, INC.

Bloomington, Minnesota 55431

TRIAXIAL TEST ASTM: D 4767

Job No. **12596**
Date: **7/13/20**

Project: **DMMF - MKE Harbor, WI / Foth Infrastructure & Environment, LLC**
Boring #: **ST-11** Sample #: Type: **3T** Depth (ft): **30-32**
Soil Type: **Lean Clay (CL)**



Failure Criterion: **Max. Deviator Stress**

Angle of internal friction, **ϕ' =** **32.5 °**

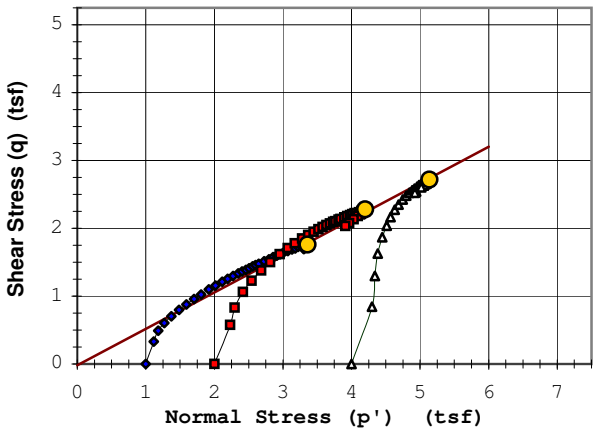
Apparent Cohesion, **c' =** **0.00 (tsf)**

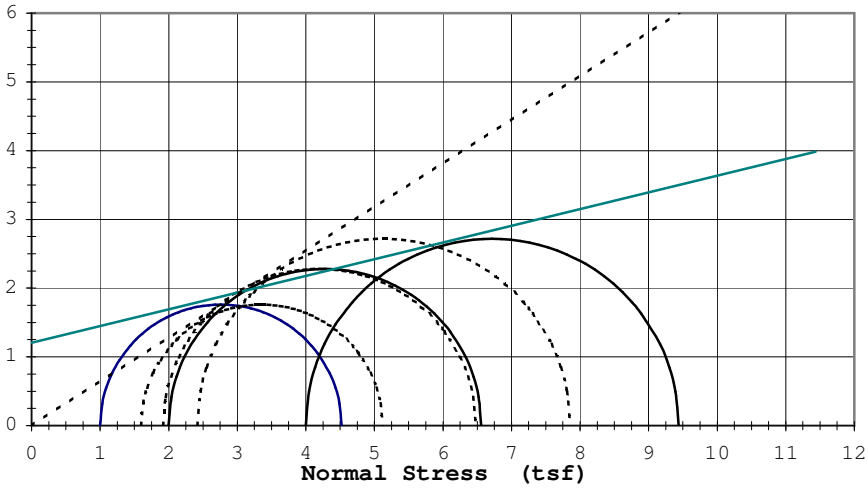
Test Date:	6/24/20		Liquid Limit:		21
Test Type:	CU w/pp		Plastic Limit:		12
Strain Rate (in/min):	0.00074		Plasticity Index:		9
Strain Rate (%/min):	0.025		Spec. Gravity :		2.81

Before Consolidation	A	B	C	D	E
Diameter (in)	1.44	1.44	1.44		
Height (in)	2.97	2.98	2.98		
Water Content (%)	15.5	15.1	15.8		
Dry Density (pcf)	119.0	119.8	117.7		
Void Ratio	0.47	0.46	0.49		
After Consolidation					
Diameter (in)	1.43	1.42	1.42		
Height (in)	2.95	2.96	2.96		
Water Content (%)	16.0	15.4	16.2		
Dry Density (pcf)	121.1	122.4	120.6		
Void Ratio	0.45	0.43	0.45		
Back Pressure (tsf)	5.5	5.6	6.4		
Minor Principal Stress (tsf)	1.00	2.00	4.00		
Max. Deviator Stress (tsf)	3.52	4.56	5.44		
Ultimate Deviator Stress (tsf)	3.39	4.07	5.05		
Deviator Stress at Failure (tsf)	3.52	4.56	5.44		
Max. Pore Pressure Buildup (tsf)	0.33	0.70	1.68		
Pore Pressure Parameter "B"	0.95	0.95	0.95		
Pct. Axial Strain at Failure	15.2	8.1	4.1		

"These test results are for informational purposes only and must be reviewed by a qualified professional engineer to verify that the test parameters shown are appropriate for any particular design"

Remarks: Radial drainage strips applied to trimmed specimen; Saturated, backpressured until "B" response was 0.95 to 1.00; Consolidated; All Drainage valves closed and immediately sheared.
A correction for membrane stiffness was applied to the deviator stress.





Rupture Envelope at Failure
α = 28.2 ° a = 0.0 (tsf)

---------- Effective ϕ': 32.5 ° c'= 0.00 (tsf)
_____ Total ϕ: 13.7 ° c= 1.20 (tsf)

9530 James Avenue South

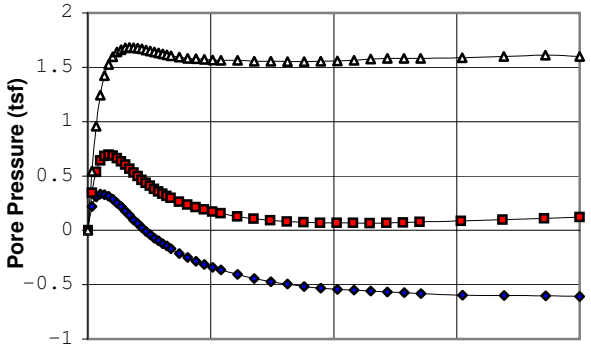
SOIL ENGINEERING TESTING, INC.

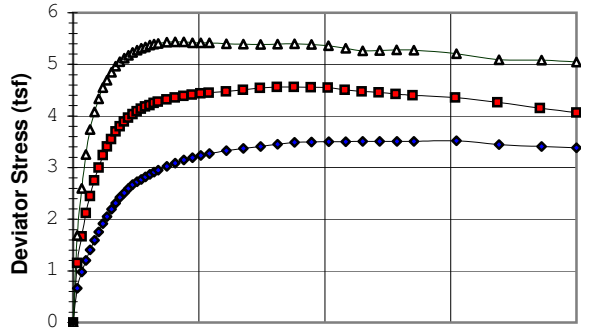
Bloomington, Minnesota 55431

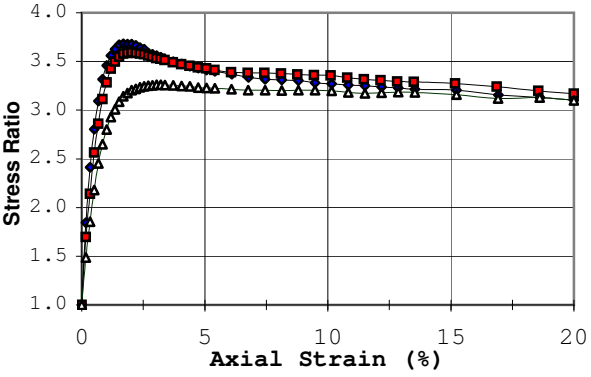
TRIAXIAL TEST ASTM: D 4767

Job No. **12596**
Date: **7/13/20**

Project: **DMMF - MKE Harbor, WI / Foth Infrastructure & Environment, LLC**
Boring #: **ST-11** Sample #: Type: **3T** Depth (ft): **30-32**
Soil Type: **Lean Clay (CL)**





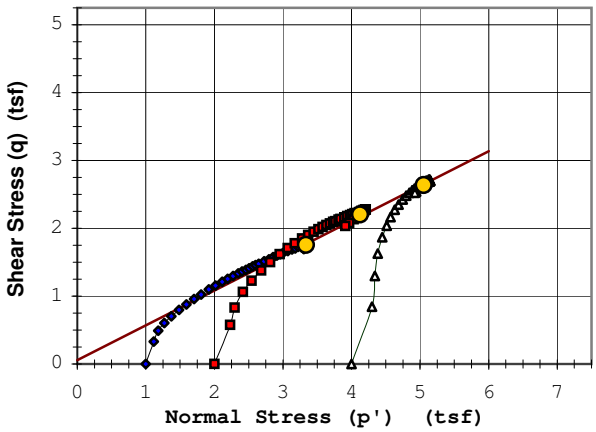


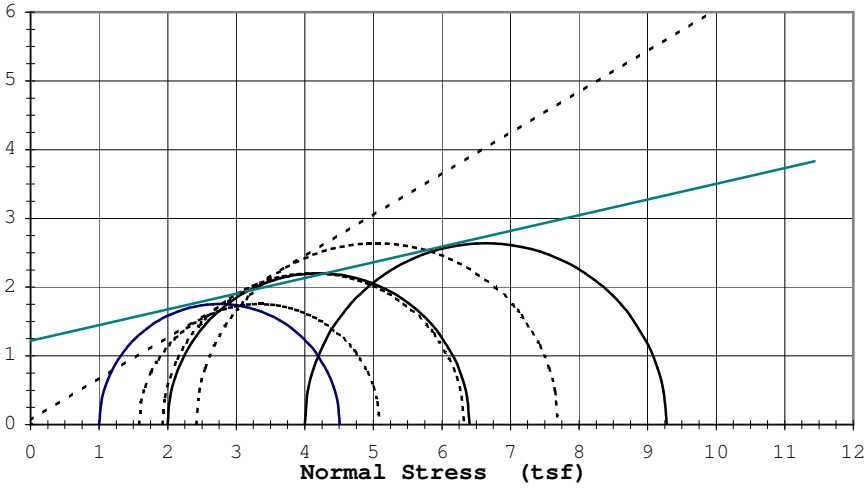
Failure Criterion:	Given Strain of: 15%				
Angle of internal friction, ϕ' =	30.9 °				
Apparent Cohesion, c' =	0.07 (tsf)				
Test Date: 6/24/20		Liquid Limit:	21		
Test Type: CU w/pp		Plastic Limit:	12		
Strain Rate (in/min): 0.00074		Plasticity Index:	9		
Strain Rate (%/min): 0.025		Spec. Gravity :	2.81		

Before Consolidation	A	B	C	D	E
Diameter (in)	1.44	1.44	1.44		
Height (in)	2.97	2.98	2.98		
Water Content (%)	15.5	15.1	15.8		
Dry Density (pcf)	119.0	119.8	117.7		
Void Ratio	0.47	0.46	0.49		
After Consolidation					
Diameter (in)	1.43	1.42	1.42		
Height (in)	2.95	2.96	2.96		
Water Content (%)	16.0	15.4	16.2		
Dry Density (pcf)	121.1	122.4	120.6		
Void Ratio	0.45	0.43	0.45		
Back Pressure (tsf)	5.5	5.6	6.4		
Minor Principal Stress (tsf)	1.00	2.00	4.00		
Max. Deviator Stress (tsf)	3.52	4.56	5.44		
Ultimate Deviator Stress (tsf)	3.39	4.07	5.05		
Deviator Stress at Failure (tsf)	3.51	4.40	5.28		
Max. Pore Pressure Buildup (tsf)	0.33	0.70	1.68		
Pore Pressure Parameter "B"	0.95	0.95	0.95		
Pct. Axial Strain at Failure	15.0	15.0	15.0		

"These test results are for informational purposes only and must be reviewed by a qualified professional engineer to verify that the test parameters shown are appropriate for any particular design"

Remarks: Radial drainage strips applied to trimmed specimen; Saturated, backpressured until "B" response was 0.95 to 1.00; Consolidated; All Drainage valves closed and immediately sheared.
A correction for membrane stiffness was applied to the deviator stress.





Rupture Envelope at Failure	
α = 27.2 °	a = 0.1 (tsf)

----------	Effective ϕ': 30.9 °	c'=	0.07 (tsf)
_____	Total ϕ: 12.9 °	c=	1.22 (tsf)

9530 James Avenue South

SOIL ENGINEERING TESTING, INC.

Bloomington, Minnesota 55431

Triaxial Data

Job: **12596**

Boring: ST-11 Sample: Depth: 30-32 Date: 7/13/20

1 tsf			2 tsf			4 tsf			Sample 4			Sample 5		
Strain (%)	Deviator Stress (tsf)	Pore Pressure (tsf)	Strain (%)	Deviator Stress (tsf)	Pore Pressure (tsf)	Strain (%)	Deviator Stress (tsf)	Pore Pressure (tsf)	Strain (%)	Deviator Stress (tsf)	Pore Pressure (tsf)	Strain (%)	Deviator Stress (tsf)	Pore Pressure (tsf)
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00						
0.17	0.66	0.22	0.17	1.15	0.35	0.17	1.69	0.54						
0.34	0.98	0.31	0.34	1.66	0.54	0.34	2.60	0.96						
0.51	1.20	0.33	0.51	2.12	0.64	0.51	3.25	1.24						
0.68	1.41	0.33	0.67	2.45	0.68	0.68	3.74	1.42						
0.85	1.59	0.31	0.84	2.75	0.70	0.85	4.08	1.53						
1.02	1.75	0.29	1.01	3.00	0.69	1.02	4.33	1.60						
1.18	1.91	0.25	1.18	3.24	0.66	1.18	4.55	1.64						
1.35	2.05	0.22	1.35	3.41	0.63	1.35	4.69	1.66						
1.52	2.19	0.18	1.52	3.55	0.60	1.52	4.85	1.68						
1.69	2.31	0.14	1.69	3.70	0.57	1.69	4.96	1.68						
1.86	2.42	0.10	1.86	3.80	0.53	1.86	5.05	1.68						
2.03	2.51	0.06	2.02	3.89	0.50	2.03	5.12	1.68						
2.20	2.60	0.02	2.19	3.97	0.46	2.20	5.17	1.67						
2.37	2.67	-0.01	2.36	4.03	0.44	2.37	5.23	1.66						
2.54	2.73	-0.04	2.53	4.09	0.41	2.54	5.27	1.65						
2.71	2.77	-0.07	2.70	4.14	0.38	2.71	5.31	1.64						
2.88	2.82	-0.10	2.87	4.19	0.36	2.88	5.34	1.63						
3.05	2.87	-0.12	3.04	4.21	0.34	3.05	5.37	1.62						
3.22	2.91	-0.14	3.20	4.26	0.32	3.21	5.39	1.61						
3.39	2.95	-0.17	3.37	4.28	0.30	3.38	5.41	1.60						
3.72	3.03	-0.21	3.71	4.32	0.26	3.72	5.43	1.59						
4.06	3.09	-0.25	4.05	4.36	0.24	4.06	5.44	1.58						
4.40	3.15	-0.28	4.38	4.39	0.21	4.40	5.44	1.58						
4.74	3.19	-0.31	4.72	4.41	0.19	4.74	5.42	1.57						
5.08	3.23	-0.34	5.06	4.44	0.17	5.08	5.42	1.57						
5.42	3.27	-0.36	5.40	4.45	0.16	5.41	5.42	1.57						
6.09	3.33	-0.41	6.07	4.48	0.13	6.09	5.40	1.56						
6.77	3.37	-0.44	6.75	4.51	0.11	6.77	5.39	1.55						
7.45	3.41	-0.47	7.42	4.54	0.09	7.45	5.39	1.55						
8.12	3.45	-0.49	8.09	4.56	0.08	8.12	5.39	1.55						
8.80	3.49	-0.52	8.77	4.56	0.07	8.80	5.40	1.55						
9.48	3.50	-0.53	9.44	4.56	0.07	9.48	5.39	1.55						
10.16	3.50	-0.54	10.12	4.55	0.07	10.15	5.36	1.56						
10.83	3.50	-0.55	10.79	4.51	0.07	10.83	5.31	1.57						
11.51	3.51	-0.56	11.47	4.48	0.07	11.51	5.26	1.58						
12.19	3.51	-0.57	12.14	4.45	0.07	12.18	5.27	1.58						
12.86	3.51	-0.57	12.82	4.42	0.07	12.86	5.28	1.58						
13.54	3.51	-0.58	13.49	4.40	0.08	13.54	5.28	1.58						
15.23	3.52	-0.60	15.18	4.36	0.09	15.23	5.21	1.59						
16.93	3.45	-0.60	16.86	4.26	0.10	16.92	5.09	1.60						
18.62	3.41	-0.60	18.55	4.15	0.11	18.61	5.09	1.61						
20.00	3.39	-0.61	20.00	4.07	0.12	20.00	5.05	1.60						