Deep Foundation Report and Analysis

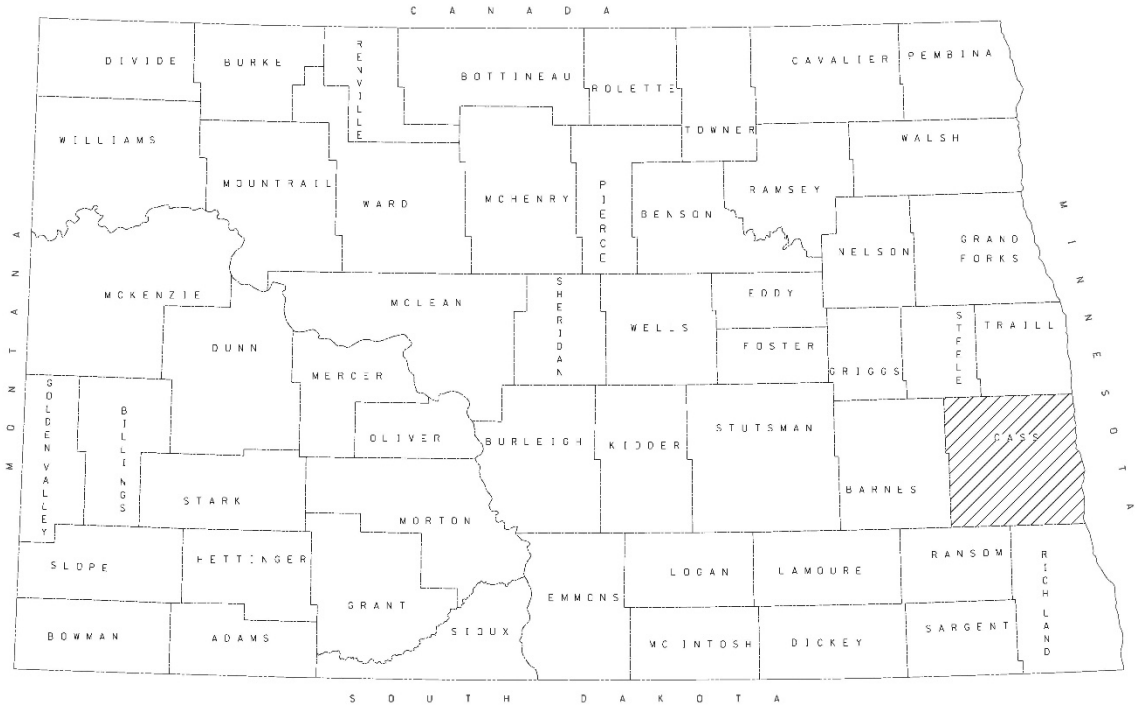
PROJECT NO. IM-8-094(092)346

PCN 21570

COUNTY Cass

Bridge #:0094-346.396L
0094-346.400R

West Fargo Horace Interchange (I-94 & Sheyenne Street)



PREPARED BY: Jordan M. Nehls, PE

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH DIVISION

DECEMBER 2017

IM-8-094(092)346

West Fargo Horace Interchange (I-94 & Sheyenne Street)

Bridge #0094-346.396L
Bridge #0094-346.400R

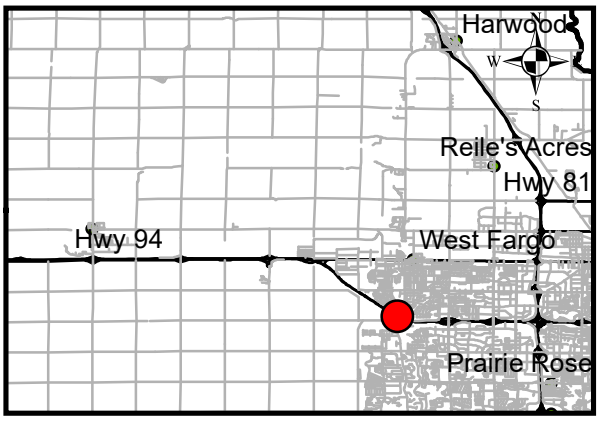
CERTIFICATION

I hereby certify that this report was prepared by me or under my direct supervision and that I am a duly registered professional engineer under the laws of the State of North Dakota. This document was originally issued and sealed by Jordan M. Nehls, Registration number PE-8782 on 12/19/2017 and the original document is stored at the North Dakota Department of Transportation.

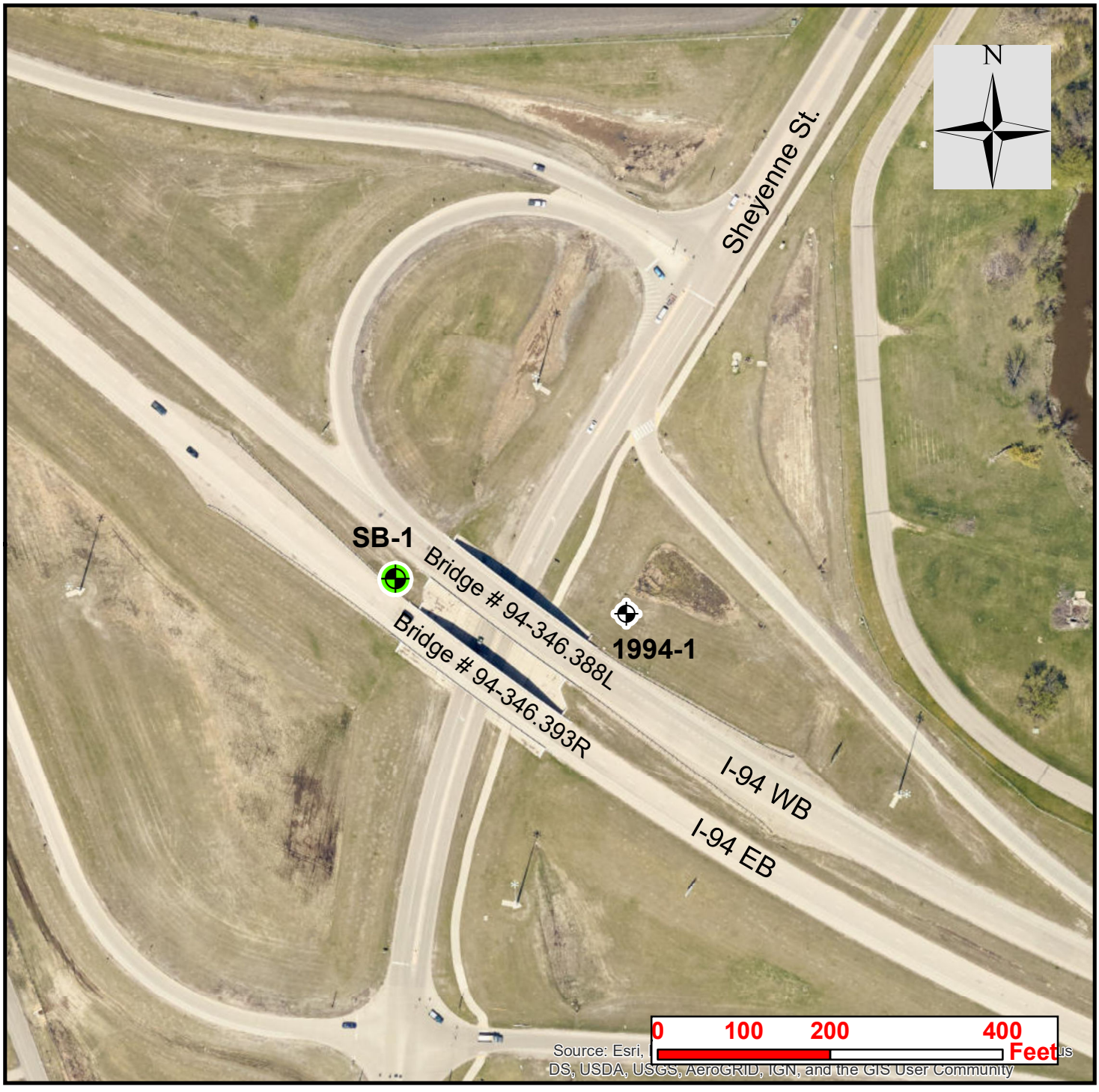
Jordan M. Nehls
Jordan M. Nehls, P.E.

12/19/2017
Date

Bridge Replacements



Project: IM-8-094(092)346
PCN: 21570
Scope: Structure Replacements
Location: West Fargo Horace Interchange
(I-94 & Sheyenne St)
Bridge: 0094-346.388L
0094-346.393R



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Appendix

Introduction

This report will provide embankment and foundation recommendations for the construction of the proposed structures and ramps referred to as the West Fargo Horace Interchange - I-94 & Sheyenne Street (NDDOT Bridges 0094-346.396L & 0094-346.400R).

Existing Structures Information

Bridge # 94-346.388L

Year Constructed: 1995
Main Structure Type: Prestressed Concrete Continuous – Spread Box Beam
Length: 197 feet total length (3 spans)
Foundation Type: Steel H-Piles (HP 12x53, HP 14x73)
End Slopes: 10:1 – Pedestrian Underpass – 3:1 w/ Concrete Slope Protection

Bridge # 94-346.393R

Year Constructed: 1996
Main Structure Type: Prestressed Concrete Continuous – Spread Box Beam
Length: 208 feet total length (3 spans)
Foundation Type: Steel H-Piles (HP 12x53, HP 14x73)
End Slopes: 10:1 – Pedestrian Underpass – 3:1 w/ Concrete Slope Protection

Subsurface Investigation

Based on site conditions, access, and available data only one deep foundation soil boring was conducted for this project. The soil boring (SB-1) was conducted on the west side of the structures near the existing abutments. The boring was conducted in the median of Interstate 94 from 6/5/2017 to 6/8/2017. The boring log can be found in **Appendix A**.

Historical data also shows that a soil boring (1994-1) was conducted in April of 1994 on the northeast side of the structure. The boring was conducted for the original construction of the existing bridges. The soils information from this boring was used for comparison when analyzing the most recent soils investigation. The boring log has also been included in **Appendix A**.

Sampling and Testing Procedures:

Shelby tube sampling and split spoon sampling were used to extract the samples from a hollow stem auger.

Shelby tube sampling provides an “undisturbed” sample of fine grained soils for laboratory testing via a thin wall tube that is slowly pushed into the soils to be sampled. Triaxial testing equipment was used to determine shear strengths. Densities were calculated according to AASHTO test method T-296.

Split spoon samplers are utilized during advancement of the boring to perform the Standard Penetration Test (SPT). The samples are considered “disturbed”, due to the driving nature in which they are obtained. The SPT results in an N-value, or number of blows required to drive the split spoon sampler 1 foot. This N-value is used to estimate the shear strength and friction angle of the soil, define the consistency of cohesive soils and also the relative density of non-cohesive soils.

The samples from the split spoon and Shelby tubes are submitted to the laboratory for determination of AASHTO classification, moisture content, dry density, sieve analysis, Atterberg limits, and strength parameters.

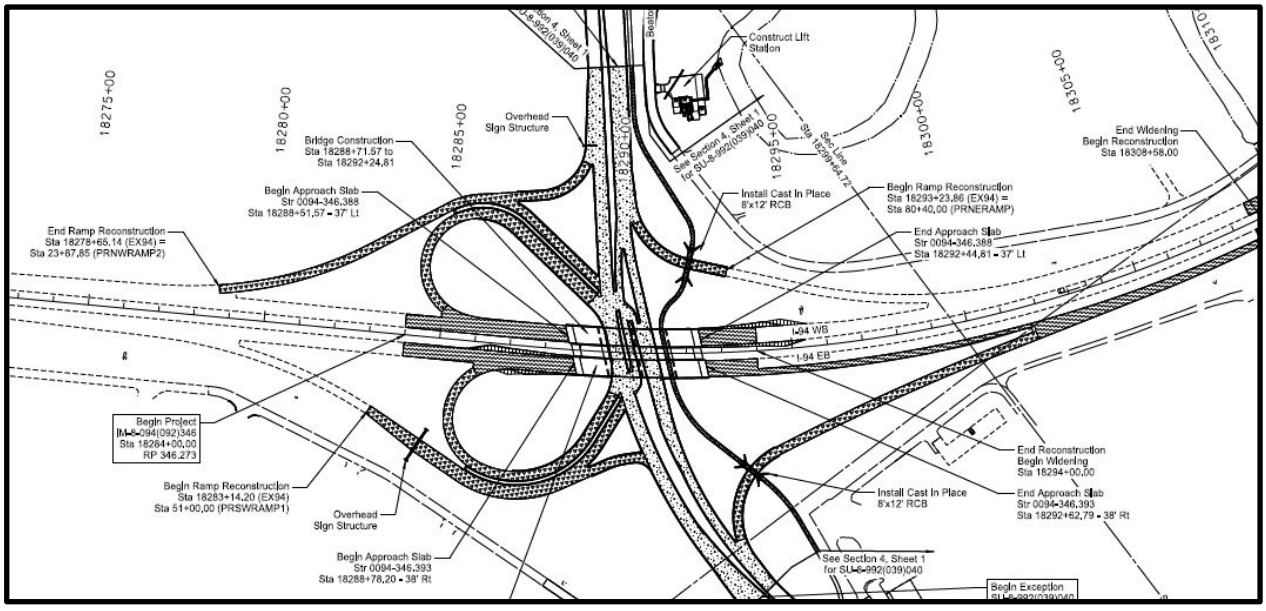
Test Results

A summary of the lab analysis has been included in the **Appendix B**.

Proposed Structure

Bridge # 94-346.396L
Main Structure Type: 4 Span
Foundation Type: Steel H-Piles (HP 14x73)

Bridge # 94-346.400R
Main Structure Type: 4 Span
Foundation Type: Steel H-Piles (HP 14x73)



Bridge # 94-346.396L & 94-346.400R Proposed Ramp Layouts

Foundation Recommendation

Steel Piling

Pile recommendations are given as termination elevations. The pile sizes that have been analyzed are HP10x42, HP12x53, HP14x73, and HP14x102.

The software “APile” (v2014) was used in conjunction with engineering judgment and past experience in pile driving in these types of soils to estimate the pile lengths. The output from this analysis is available upon request from the NDDOT Geotechnical Section.

Below is a simplified soil profile for boring SB-1 that was used to predict the unfactored geotechnical resistance. The unfactored geotechnical resistance is used to predict the pile termination elevations.

Table 1 – SB-1 Simplified Soil Profile (Total Stress Analysis – TSA)

Layer	Elevation	Depth	Cohesion (lb/ft^2)	Friction Angle	Unit Weight (lb/ft^3)
Clay Fill	910.7-890.7	0.0-20.0	1000	0	120
Clay	890.7-839.7	20.0-71.0	500	0	103
Sandy Clay	839.7-826.7	71.0-84.0	1000	0	135
Sandy Clay	826.7-804.7	84.0-106.0	4000	0	140

Based on the soils information that was obtained from boring SB-1 the pile will not reach the required bearing at the bottom of the boring for all pile sizes. However, based on soil boring 1994-1 and historical data from the adjacent 9th St Interchange it is reasonable to assume that the pile will obtain bearing in the glacial till layer which is generally near an elevation of 800 feet.

It is recommended that pile length estimations be based on the piles terminating at an elevation of 800 feet.

Pile Tips

It is not anticipated that pile tips will not be required for either of the structures.

Downdrag

Downdrag is caused by settlement occurring in the soil in which a pile is already in place. Based on little to no fill being placed at the bridge ends downdrag is not a concern for either of the structures.

Scour

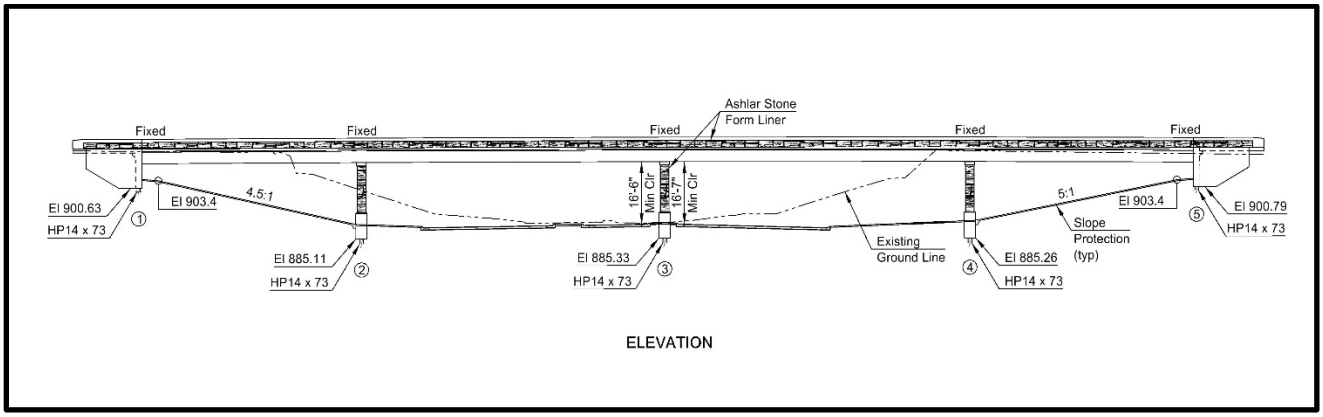
This is not a water crossing so scour will not be an issue at these structures.

Compaction Recommendations

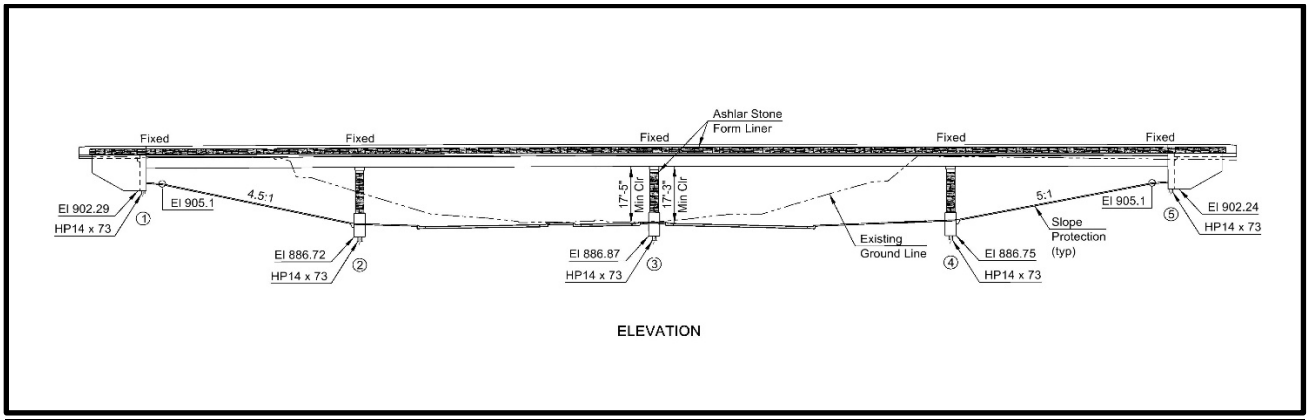
Compact all embankment material used for the construction of the ramps per Section 203.04.E.2 AASHTO T-99.

End Slope Recommendation

The stability analysis was conducted with Slope/W developed by Geo-Slope International. The analysis was a two-dimensional limit equilibrium method. The proposed bridge layouts were provided by the Bridge Division and were used in the analysis. Based on the structures having similar geometries the stability analysis was only conducted for one structure. The proposed structure layouts are shown in the figures below.



Bridge # 94-346.396L Proposed Layout



Bridge # 94-346.400R Proposed Layout

An effective stress (long term stability) analysis was performed. For the effective stress analysis, the soil parameters were based on the soil laboratory results. A correlation between the liquid limit and clay size fraction to the drained residual strength of cohesive soils was used. This correlation is based on a paper titled "Drained Residual Strength of Cohesive Soils" written by Timothy Stark and Hisham Eid, 1994.

Based on the slope stability analysis the proposed slopes for both of the structures are sufficient. The stability analysis outputs can be found in Appendix C.

Settlement

Settlement Analysis

Based on little to no fill being placed to construct the proposed bridges settlement is not a concern for either of the structure embankments.

Based on proposed cross sections and profiles provided by the Local Government Division, the construction of the new ramps will require fills up to approximately 7-11 feet in some locations. Those locations are summarized in the table below.

Table 2 – Ramp Fill Locations

Location	Critical Station	Elevation Existing Ground	Elevation Proposed Pavement	Total Fill
Northwest Ramp 2	17+50	895	902	7'
Northwest Loop	32+00	898	907	9'
Southwest Loop	48+00	897	908	11'

*The proposed ramp locations are shown in the Proposed Structure section above

A settlement analysis was completed based on a one-dimensional consolidation test performed on soil samples that were collected from boring SB-1. Although the samples are currently under an existing fill it was conservatively assumed for this analysis that the soils are normally consolidated (present overburden pressure is equal to the preconsolidation pressure). The following parameters were used for each of the analysis.

Fill Height: 7' – 11'
Unit Weight Fill, γ_{Fill} = 120 lb/ft^3 (Assumed)
Unit Weight of Existing Material, γ = 103 lb/ft^3 (Lab Data)
Effective Unit Weight of Existing Material, γ' = 40.6 lb/ft^3
Water Table Depth = 0 (At Surface - Assumed)
Bousinesq Factor, I = Varies
(Values of Influence Factor I for Vertical Stress Under an Infinitely Long Embankment, NAVFAC, 1982)
Compression Index, C_c = 0.43 – 0.56 (Lab Data)
Recompression Index, C_r = N/A (Assumed Normally Consolidated)
Coefficient of Consolidation, Cv = 0.02 – 0.05 ft^2/day (Lab Data)

The settlement calculations show that there is going to be significant consolidation of the foundation soils from placing the fill needed to construct the ramps. Based on the best available information and conservative assumptions the total settlement is estimated to be in the range of 3' – 5' in the locations evaluated above. However, it is estimated that this settlement will occur over many decades.

Settlement Recommendations

Based on the large amount of settlement and the long duration over which that settlement is expected to occur, it is believed that the settlement will have long term effects at the deeper fill locations of the proposed ramps. We do not believe that any additional measures to help minimize or speed up consolidation are feasible and/or will produce the desired results. Because this will cause long lasting effects on the ramps we recommend using an asphalt pavement surface so that any uneven pavement caused by the settlement can be maintained when needed.

We also recommend that a monitoring program be included in the plans. This is necessary so the Geotechnical Section can monitor the settlement and pore pressure at the fill locations during and after construction to get a better understanding of the effects of placing fill on the soft cohesive soils in this part of the state. The Geotechnical Section will work with the designer to incorporate the monitoring program in the plans and will work with the Fargo District and the contractor when installing and collecting the data.

Pre-Boring

No pre-boring is necessary for either of the structures.

Design Recommendations

Any proposed slopes steeper than 4:1 will need to be evaluated by the Geotechnical Section.

Compact all embankment material per Section 203.04E.2.b – Compaction Control Type A, ND T-99, of the Standard Specifications.

APPENDIX A

Boring Logs

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

LOG OF BORING SB - 1

PROJECT NUMBER IM-8-094(092)346 **DATE STARTED** 6/7/17 **COMPLETED** 6/7/17

PCN 21570 **ELEVATION** 910.7 ft

LOCATION Cass County **RP+FEET** 346+1959 **OFFSET** 7 **DIR** Rt

DRILLED BY Dallan **LOGGED BY** Jamie **DRILLING METHOD** Hollow Stem Auger

ENGINEER

NOTES

ELEVATION (ft)	DEPTH (ft)	MATERIAL DESCRIPTION	GRAPHIC LOG	AASHTO	USCS	SAMPLE TYPE & NUMBER	RECOVERY (%)	SPT N VALUE (20 40 60 80)	MC / PL / LL (30 60 90 120); CLAY FRACTION (%) (20 40 60 80)	TESTS & REMARKS
910	0	Fill Black / Gray High Plasticity Fat Clay Firm to Stiff Consistency		A-7-6	CH	SS 490	10	6	MC 28, LL 80	
				A-7-6	CH	SS 491	40	8	MC 26, LL 77	
905	5			A-7-6	CH	3TW 492	75		MC 29, LL 79	
				A-7-6	CH	SS 493	75	9	MC 26, LL 78	
900	10			A-7-5	MH	3TW 494	65		MC 37, LL 79	
				A-7-6	CH	SS 495	75	9	MC 27, LL 79	
895	15			A-7-6	CH	3TW 496	85		MC 23, LL 65	
				A-7-6	CH	SS 497	75	11	MC 25, LL 74	
	20	890.7 ft 20.0 ft		A-7-6	CH	3TW 498	100		MC 23, LL 59	
890		Dark Gray Very High Plasticity Fat Clay Soft Consistency		A-7-5	CH	SS 499	100	4	MC 36, LL 104	
	25			A-7-5	CH	3TW 500	100		MC 36, LL 108	
885				A-7-5	CH	SS 501	100	4	MC 31, LL 97	
						3TW			MC 37, LL 91	

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PROJECT NUMBER IM-8-094(092)346 **LOCATION** Cass County

PCN 21570

ELEVATION (ft)	DEPTH (ft)	MATERIAL DESCRIPTION	GRAPHIC LOG	AASHTO	USCS	SAMPLE TYPE & NUMBER	RECOVERY (%)	SPT N VALUE	MC / PL / LL / CLAY FRACTION (%)	TESTS & REMARKS
880	30	Dark Gray Very High Plasticity Fat Clay Soft Consistency *(continued from previous page)*		A-7-5	CH	502	100		37 91	
				A-7-6	CH	SS 503	100	5	29 90	
				A-7-5	CH	3TW 504	100		30 91	
875	35			A-7-5	CH	SS 505	100	4	31 94	
						3TW 506	100			
870	40			A-7-6	CH	SS 507	100	5	28 78	
				A-7-5	CH	3TW 508	100		31 96	
865	45			A-7-5	CH	SS 509	100	3	30 82	
				A-7-5	CH	3TW 510	100		32 93	
860	50			A-7-6	CH	SS 511	100	3	29 87	
						3TW 512	100		32 92	
855	55			A-7-6	CH	SS 513	100	4	28 79	
				A-7-6	CH	3TW 514	100		29 77	
850	60			A-7-6	CH	SS 515	100	5	26 69	

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NDDOT North Dakota Department of Transportation
NORTH DAKOTA DEPARTMENT OF TRANSPORATION
300 AIRPORT ROAD
BISMARCK, ND 58504

LOG OF BORING SB - 1

PROJECT NUMBER IM-8-094(092)346 **LOCATION** Cass County

PCN 21570

ELEVATION (ft)	DEPTH (ft)	MATERIAL DESCRIPTION	GRAPHIC LOG	AASHTO	USCS	SAMPLE TYPE & NUMBER	RECOVERY (%)	SPT N VALUE	MC / PL / LL / CLAY FRACTION (%)	TESTS & REMARKS
845	65	Dark Gray Very High Plasticity Fat Clay Soft Consistency *(continued from previous page)*		A-7-6	CH	3TW 516	100		MC 25, CLAY FRACTION 65	
				A-7-6	CH	SS 517	100	5	MC 24, CLAY FRACTION 70	
840	70	839.7 ft 71.0 ft		A-7-6	CH	3TW 518	100		MC 21, CLAY FRACTION 60	
		Dark Gray Low Plasticity Sandy Lean Clay Gravel Mix Stiff to Very Stiff Consistency		A-6		SS 519	100	8	MC 17, CLAY FRACTION 32	
835	75			A-6	SC	3TW 520	100		MC 16, CLAY FRACTION 32	
				A-6	CL	SS 521	100	7	MC 17, CLAY FRACTION 32	
830	80			A-6	GC	3TW 522	100		MC 17, CLAY FRACTION 31	
				A-6	CL	SS 523	100	25	MC 16, CLAY FRACTION 29	
		826.7 ft 84.0 ft								
825	85	Dark Gray Low Plasticity Sandy Lean Clay Gravel Mix Stiff to Very Stiff Consistency				SS 524	10	56	MC	
820	90			A-6	CL	SS 525	100	64	MC 16, CLAY FRACTION 29	
815	95			A-6	SC	SS 526	100	88	MC 17, CLAY FRACTION 25	

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300 AIRPORT ROAD
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LOG OF BORING SB - 1

PROJECT NUMBER IM-8-094(092)346 **LOCATION** Cass County

PCN 21570

ELEVATION (ft)	DEPTH (ft)	MATERIAL DESCRIPTION	GRAPHIC LOG	AASHTO	USCS	SAMPLE TYPE & NUMBER	RECOVERY (%)	SPT N VALUE (20 40 60 80)	MC / PL LL (30 60 90 120) / CLAY FRACTION (%) (20 40 60 80)	TESTS & REMARKS
810	100	Dark Gray Low Plasticity Sandy Lean Clay Gravel Mix Stiff to Very Stiff Consistency *(continued from previous page)*		A-6	CL	SS 527	100	77	1.25	
805	105	804.7 ft 106.0 ft Bottom of borehole at 106.0 ft		A-6	CL	SS 528	100	63	1.26	

SITE SOIL SURVEY

Department of Transportation, Materials & Research
SFN 10077 (Rev. 2-92)
Part 1 of 2

PROJECT	STRUCTURE NO.	COUNTY
IM-8-094 (009) 345		Cass

LOCATION	BORING NO.	STATION	OFFSET
Drain #21 E to 1.0 Mi W. 45 Th	1	402+44	Lt. 100'

DATE DRILLING STARTED	DATE DRILLING FINISHED	FINAL WATER LEVEL	AVERAGE SEEPAGE RATE (FT. RISE/MIN)
4-4-94	4-15-94	N/A (see note)	N/A

DEPTH 1" - 5"	ELEV.	PROFILE	CORE NO.	CLASSIFICATION	COLOR OF MATERIAL	CHARACTERISTICS	SOIL GROUP	REMARKS
	904.4							
1.0'	903.4			(3)	(2)	Topsoil (4)	(1)	
5	N = 11		C-1 94M-74 Shelby 1 C-2 94M-75 Jar 1	Clay	Dk. Brn.	Stiff Impervious Plastic	A-7-5	$\phi = 0°$ $C = 1{,}638^{\#}$ $W = 35\%$ $Y_d = 85^{\#}$
10	893.9		C-3 94M-76 Shelby 2	Clay	Gray	Amorphous - Med. stiff - Imperv. with perm. lenses	A-7-5	$\phi = 0°$ $C = 1{,}026^{\#}$ $W = 31\%$ $Y_d = 91^{\#}$
	N = 5		C-4 94M-77 Jar 2	Clay	Gray	Amorphous - Med. stiff - Imperv. with Perm. lenses	A-7-6	
	890.9							
15	N = 4		C-5 94M-78 Shelby 3 C-6 94M-79 Jar 3	Clay	Gray	Very Soft - Imperv. - Sand pockets - Plastic	A-7-5	$\phi = 0°$ $C = 540^{\#}$ $W = 58\%$ $Y_d = 68^{\#}$
20	N = 5		C-7 94M-80 Shelby 4 C-8 94M-81 Jar 4					$\phi = 0°$ $C = 702^{\#}$ $W = 58\%$ $Y_d = 66^{\#}$
25	N = 4		C-9 94M-82 Shel. 5 C-10 Jar 5	Clay	Gray	Very Soft - Imper. with Perm. lenses - water bearing - PL	A-7-5	$\phi = 0°$ $C = 890^{\#}$ $W = 55\%$ $Y_d = 68^{\#}$
30	N = 4		C-11 94M-83 Shel. 6 C-12 Jar 6 C-13 94M-84			Very Soft - Imperv. - Plastic		$\phi = 0°$ $C = 972^{\#}$ $W = 53\%$ $Y_d = 70^{\#}$

35 N=4		Shel. 7 C-14	Clay	Gray	non-water bearing	A-7-5	
40 N=4		Jar 7 C-15 94M-85 Shel. 8 C-16 Jar 8					
45 N=4		C-17 94M-86 Shel. 9 C-18 94M-87 Jar 9	Clay	Gray	Very soft - Imperv. with perm. lenses - water bearing - PL	A-7-5	$\phi = 0°$ C = 788# W = 53% Yd = 70#
50 N=4 55		C-19 94M-88 Shel. 10 C-20 Jar 10 C-21 94M-89 Shel. 11	Clay	Gray	Very soft - Impervious - Plastic - Non-water bearing	A-7-5	$\phi = 0°$ C = 1,080# W = 52% Yd = 71#
N=4 60 N=4 65 N=4 836.9		C-22 Jar 11 C-23 94M-90 Shel. 12 C-24 Jar 12 C-25 Jar 13	Clay	Gray	Very soft - Impervious - Plastic - Non-water bearing	A-7-5	
70 833.9		C-26 94M-91 Shel. 13	Clay Lm.	Gray	Stiff - imperv. with perm. Strata water bearing	A-6	$\phi = 10°$ C = 1,013# W = 21% Yd = 110#
N=9 75 N=7 825.9		C-27 94M-92 Jar 14 C-28 Jar 15	Clay Lm.	Gray	Stiff - imperv. with perm. strata water bearing Plastic	A-4	
80 N=25 820.9		C-30 94M-93 Jar 16	Sandy Lm.	Gray	Very stiff - Imperv. with perm. strata - water bearing - non-plastic -	A-2-4	
85 N=42		C-31 94M-94 Jar 17			cobbles		

90	N = 38	C-32 Jar 18	Clay Lm.	Gray	Hard - Imperv. with perm. strata - water bearing - non-plastic - Laminated - cobbles	A-6	
95	N = 42	C-33 Jar 19					
	805.9						
100	N = 96	C-34 Jar 20	Sandy Lm.	Gray	Very hard - Imperv. with perm. strata - non-water bearing - non-plastic - cobbles	A-4	
105	N = 102	C-35 94M-95 Jar 21					
110	N = 102 793.9	C-36 Jar 22					
115							

Note: Water level after 15 hrs. was at elevation 808.3 ft. - hole wall is suspected to be sealed.

APPENDIX B

Lab Results

SUMMARY OF LABORATORY RESULTS

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

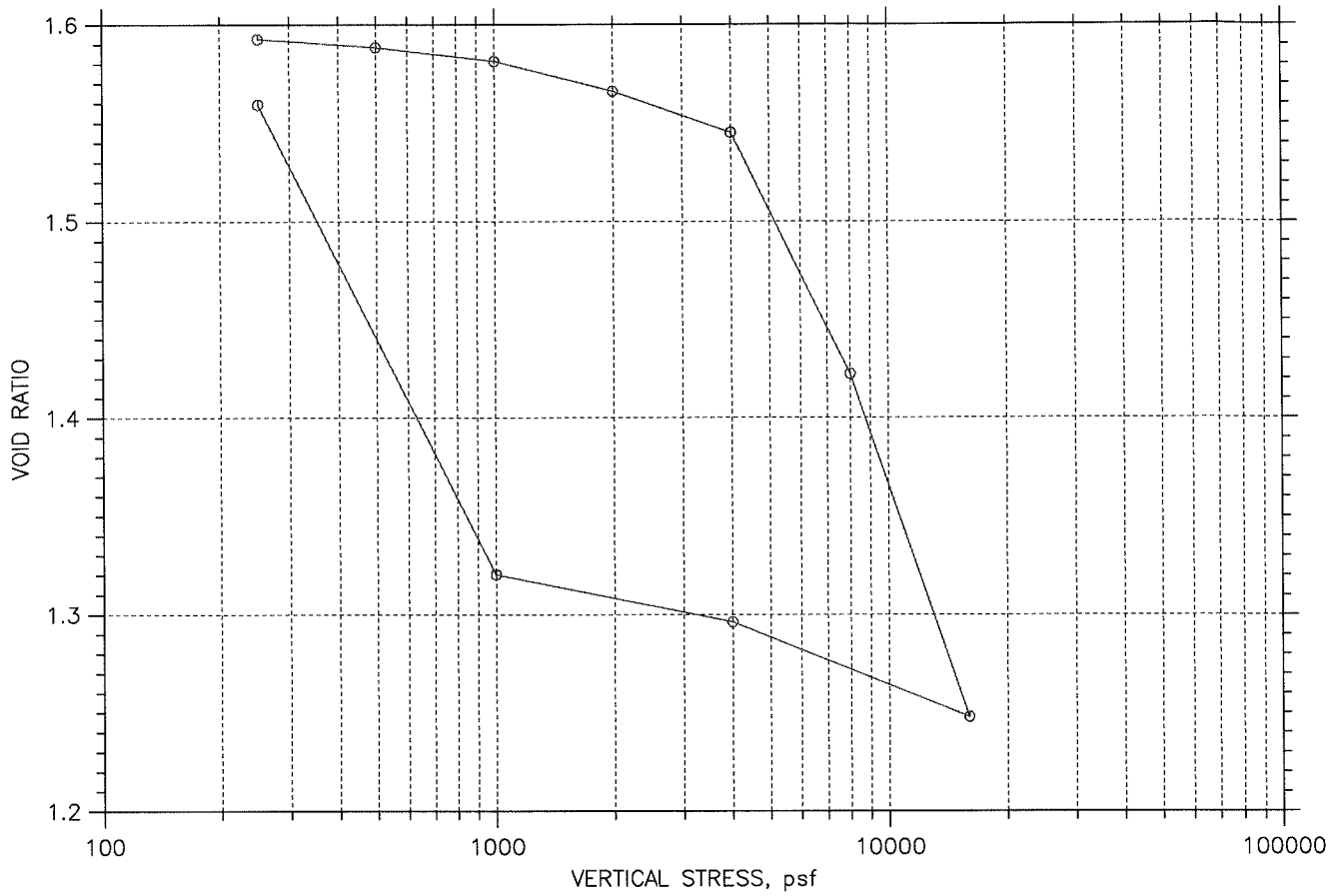
PROJECT NUMBER IM-8-094(092)346 **LOCATION** Cass County

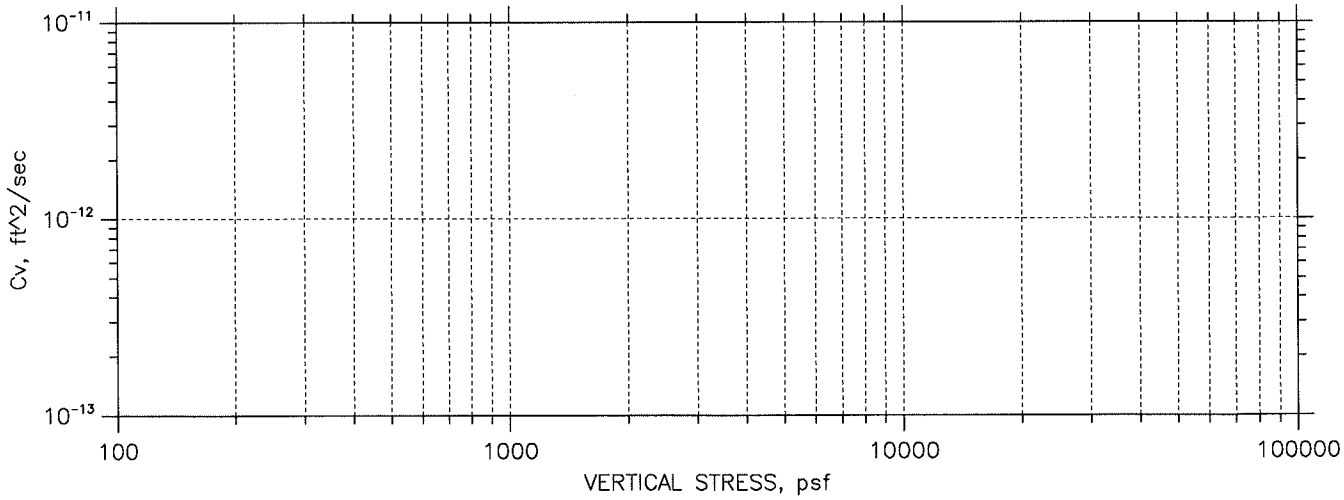
PCN 21570

Borehole	Depth	Liquid Limit	Plastic Limit	Plasticity Index	Maximum Size (mm)	%<#200 Sieve	AASHTO Classification	USCS Class-ification	Water Content (%)	Avg. Water Content (%)	Dry Density (pcf)	Satur-ation (%)	Void Ratio
SB - 1	0.0	80	28	52	4.75	96	A-7-6 (58)	CH	22.3	38.2			
SB - 1	2.0	77	26	51	4.75	98	A-7-6 (58)	CH	34.2	38.2			
SB - 1	4.0	79	29	50	2	97	A-7-6 (57)	CH	37.5	38.2			
SB - 1	6.0	78	26	52	9.5	97	A-7-6 (59)	CH	36.1	38.2			
SB - 1	9.0	79	37	42	9.5	98	A-7-5 (51)	MH	36.3	38.2			
SB - 1	11.0	79	27	52	4.75	97	A-7-6 (59)	CH	34.5	38.2			
SB - 1	14.0	65	23	42	9.5	96	A-7-6 (46)	CH	27.2	38.2			
SB - 1	16.0	74	25	49	4.75	99	A-7-6 (56)	CH	34.0	38.2			
SB - 1	19.0	59	23	36	2	99	A-7-6 (41)	CH	38.5	38.2			
SB - 1	21.0	104	36	68	2	100	A-7-5 (83)	CH	56.8	38.2			
SB - 1	24.0	108	36	72	9.5	100	A-7-5 (88)	CH	59.1	38.2			
SB - 1	26.0	97	31	66	2	99	A-7-5 (78)	CH	58.5	38.2			
SB - 1	29.0	91	37	54	2	99	A-7-5 (66)	CH	58.3	38.2			
SB - 1	31.0	90	29	61	2	100	A-7-6 (73)	CH	52.3	38.2			
SB - 1	34.0	91	30	61	2	100	A-7-5 (73)	CH	54.7	38.2			
SB - 1	36.0	94	31	63	2	99	A-7-5 (75)	CH	57.8	38.2			
SB - 1	39.0								52.6	38.2			
SB - 1	41.0	78	28	50	4.75	99	A-7-6 (59)	CH	51.8	38.2			
SB - 1	44.0	96	31	65	4.75	99	A-7-5 (77)	CH	65.4	38.2			
SB - 1	46.0	82	30	52	4.75	100	A-7-5 (62)	CH	49.4	38.2			
SB - 1	49.0	93	32	61	9.5	99	A-7-5 (73)	CH	54.2	38.2			
SB - 1	51.0	87	29	58	2	99	A-7-6 (68)	CH	54.9	38.2			
SB - 1	54.0	92	32	60					60.1	38.2			
SB - 1	56.0	79	28	51	4.75	97	A-7-6 (58)	CH	50.5	38.2			
SB - 1	59.0	77	29	48	4.75	98	A-7-6 (56)	CH	52.6	38.2			
SB - 1	61.0	69	26	43	9.5	96	A-7-6 (48)	CH	46.5	38.2			
SB - 1	64.0	65	25	40	25	92	A-7-6 (42)	CH	45.5	38.2			
SB - 1	66.0	70	24	46	4.75	94	A-7-6 (49)	CH	17.9	38.2			
SB - 1	69.0	60	21	39	25	83	A-7-6 (34)	CH	41.8	38.2			
SB - 1	71.0	32	17	15	25	56	A-6 (15)		19.9	38.2			
SB - 1	74.0	32	16	16	25	50	A-6 (5)	SC	19.9	38.2			
SB - 1	76.0	32	17	15	9.5	61	A-6 (6)	CL	20.1	38.2			
SB - 1	79.0	31	17	14	25	41	A-6 (2)	GC	19.0	38.2			
SB - 1	81.0	29	16	13	9.5	57	A-6 (4)	CL	17.6	38.2			
SB - 1	84.0								11.1	38.2			
SB - 1	89.0	29	15	14	25	52	A-6 (4)	CL	11.2	38.2			
SB - 1	94.0	25	14	11	25	48	A-6 (2)	SC	9.3	38.2			
SB - 1	99.0	25	14	11	25	57	A-6 (3)	CL	10.2	38.2			
SB - 1	104.0	26	14	12	9.5	54	A-6 (3)	CL	10.6	38.2			

CONSOLIDATION TEST DATA

SUMMARY REPORT

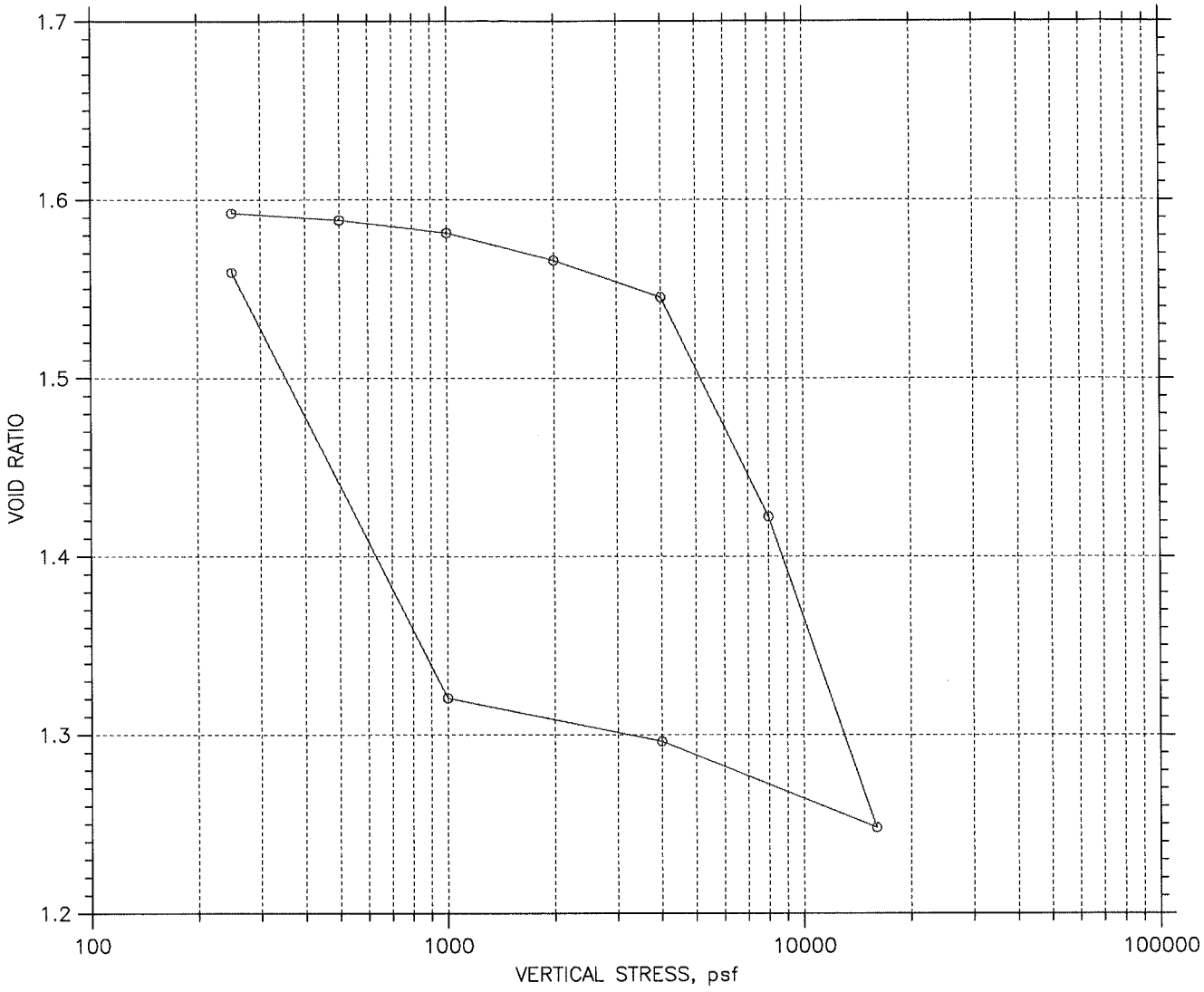




Project: IM-8-094(092)346	Location:	Project No.:
Boring No.: 1	Tested By: Traeholt	Checked By: Dietrich
Sample No.: SS-500-17	Test Date: 9/28/2016	Depth: 24.6-24.7
Test No.: CON-1-17	Sample Type: Shelby Tube	Elevation:
Description: Total length 27 1/2" Brn Cly with White Silt Deposits		
Remarks:		

CONSOLIDATION TEST DATA

SUMMARY REPORT



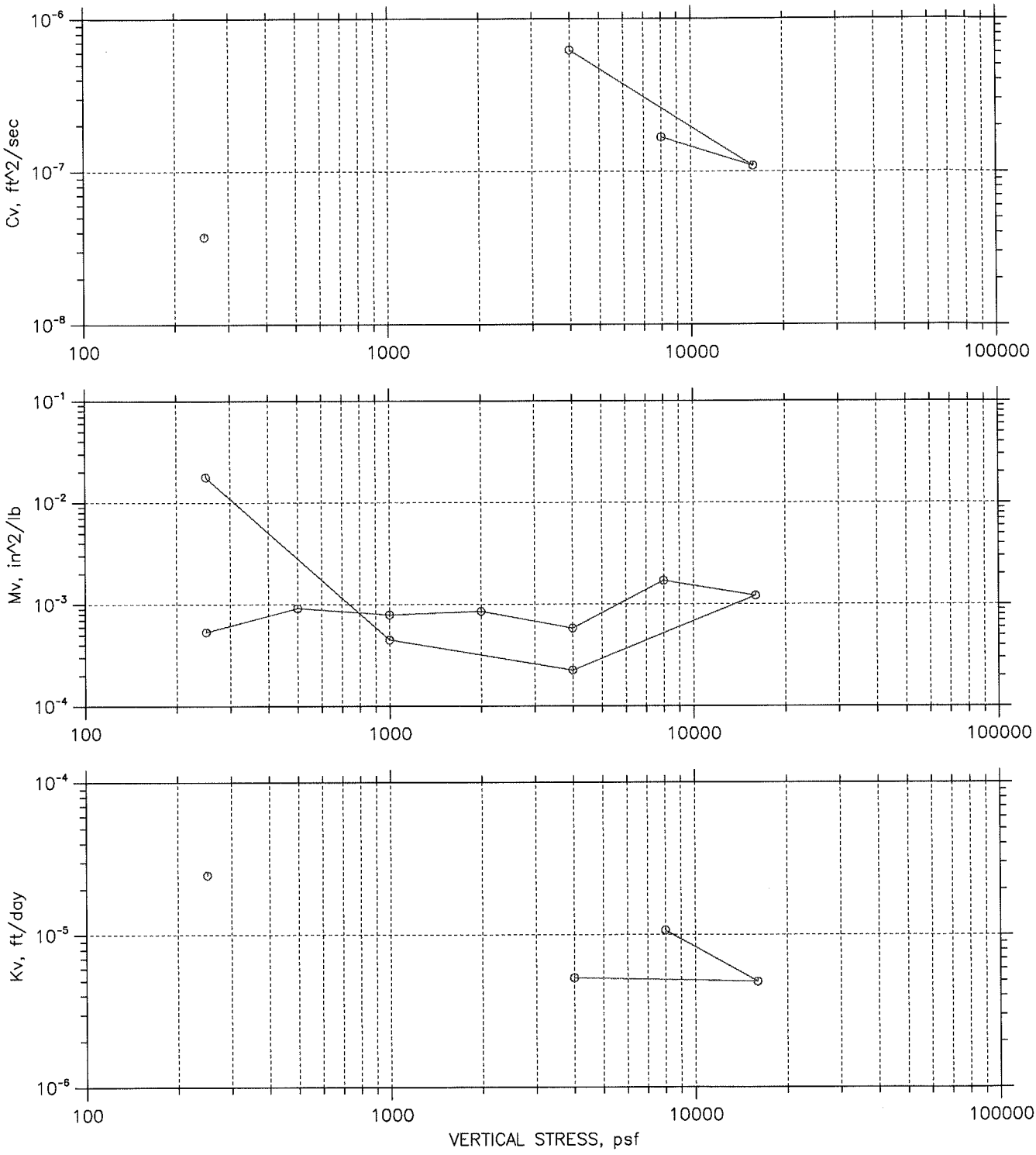
					Before Test	After Test
Overburden Pressure, psf:				Water Content, %	61.15	62.30
Preconsolidation Pressure, psf:				Dry Unit Weight, pcf	63.778	64.668
Compression Index:				Saturation, %	101.64	105.93
Diameter: 2.5 in		Height: 1 in		Void Ratio	1.59	1.56
LL: ---	PL: ---	PI: ---	GS: 2.65	Back Pressure, psf	0	0

Project: IM-8-094(092)346	Location:	Project No.:
Boring No.: 1	Tested By: Traeholt	Checked By: Dietrich
Sample No.: SS-500-17	Test Date: 9/28/2016	Depth: 24.6-24.7
Test No.: CON-1-17	Sample Type: Shelby Tube	Elevation:
Description: Total length 27 1/2" Brn Cly with White Silt Deposits		
Remarks:		

Tue, 05-DEC-2017 13:41:00

CONSOLIDATION TEST DATA

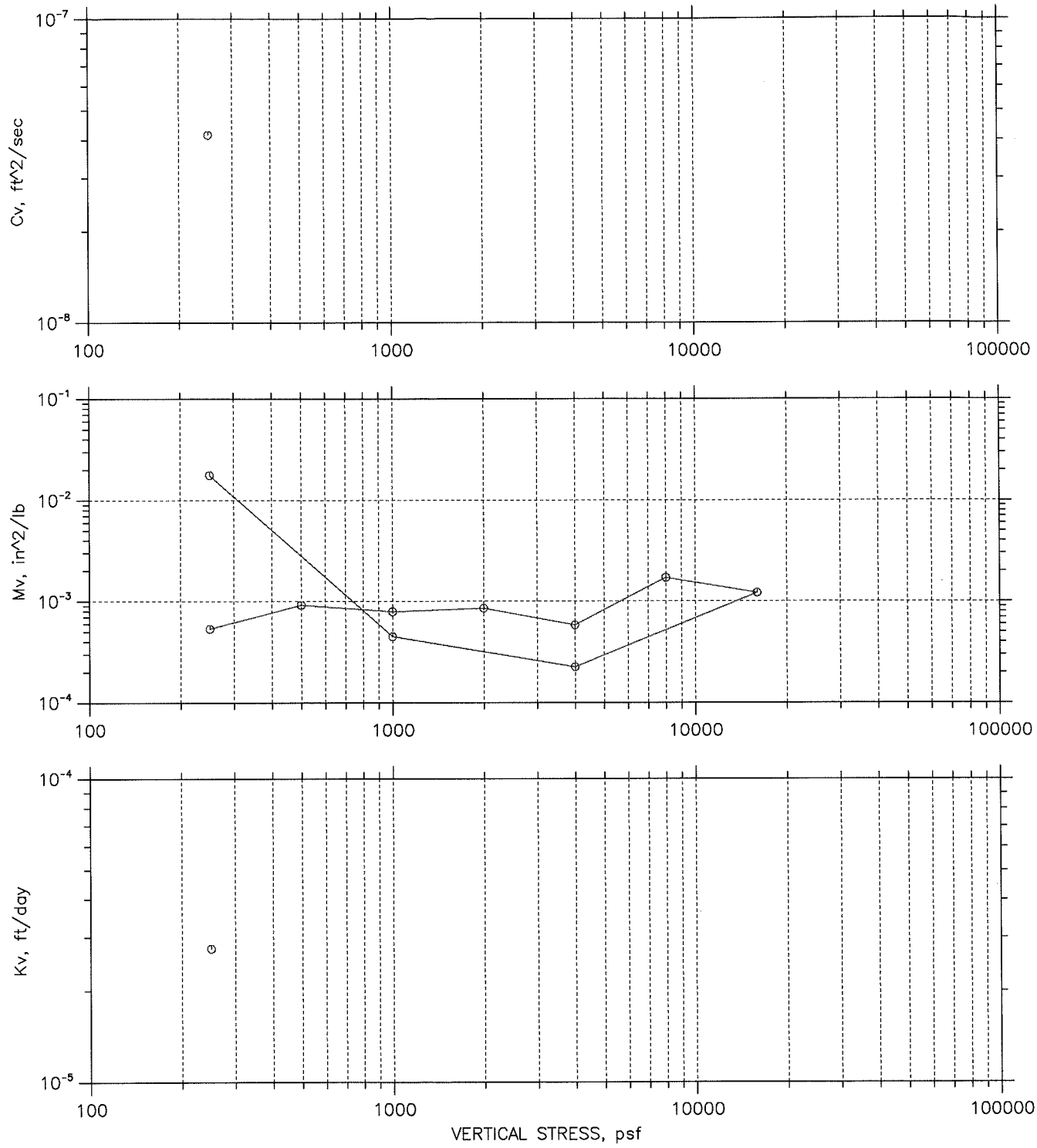
ROOT of TIME COEFFICIENTS



Project: IM-8-094(092)346	Location:	Project No.:
Boring No.: 1	Tested By: Traeholt	Checked By: Dietrich
Sample No.: SS-500-17	Test Date: 9/28/2016	Depth: 24.6-24.7
Test No.: CON-1-17	Sample Type: Shelby Tube	Elevation:
Description: Total length 27 1/2" Brn Cly with White Silt Deposits		
Remarks:		

CONSOLIDATION TEST DATA

LOG of TIME COEFFICIENTS



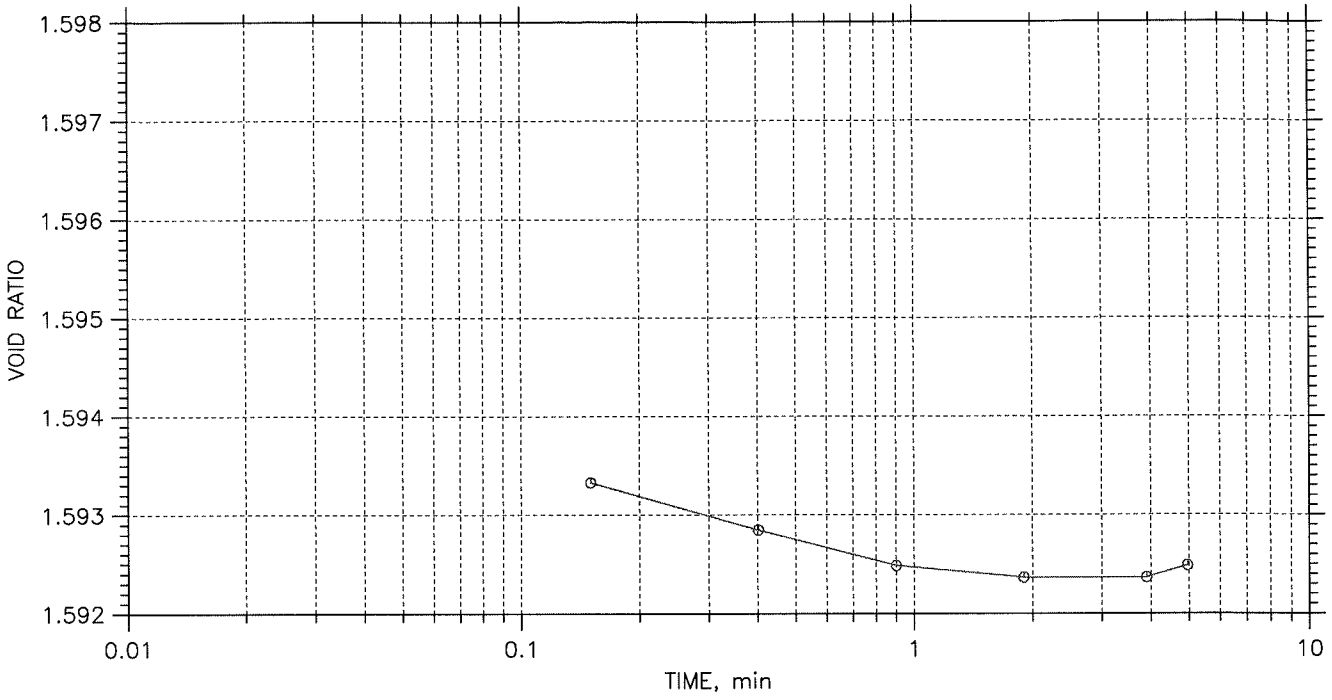
Project: IM-8-094(092)346	Location:	Project No.:
Boring No.: 1	Tested By: Traeholt	Checked By: Dietrich
Sample No.: SS-500-17	Test Date: 9/28/2016	Depth: 24.6-24.7
Test No.: CON-1-17	Sample Type: Shelby Tube	Elevation:
Description: Total length 27 1/2" Brn Cly with White Silt Deposits		
Remarks:		

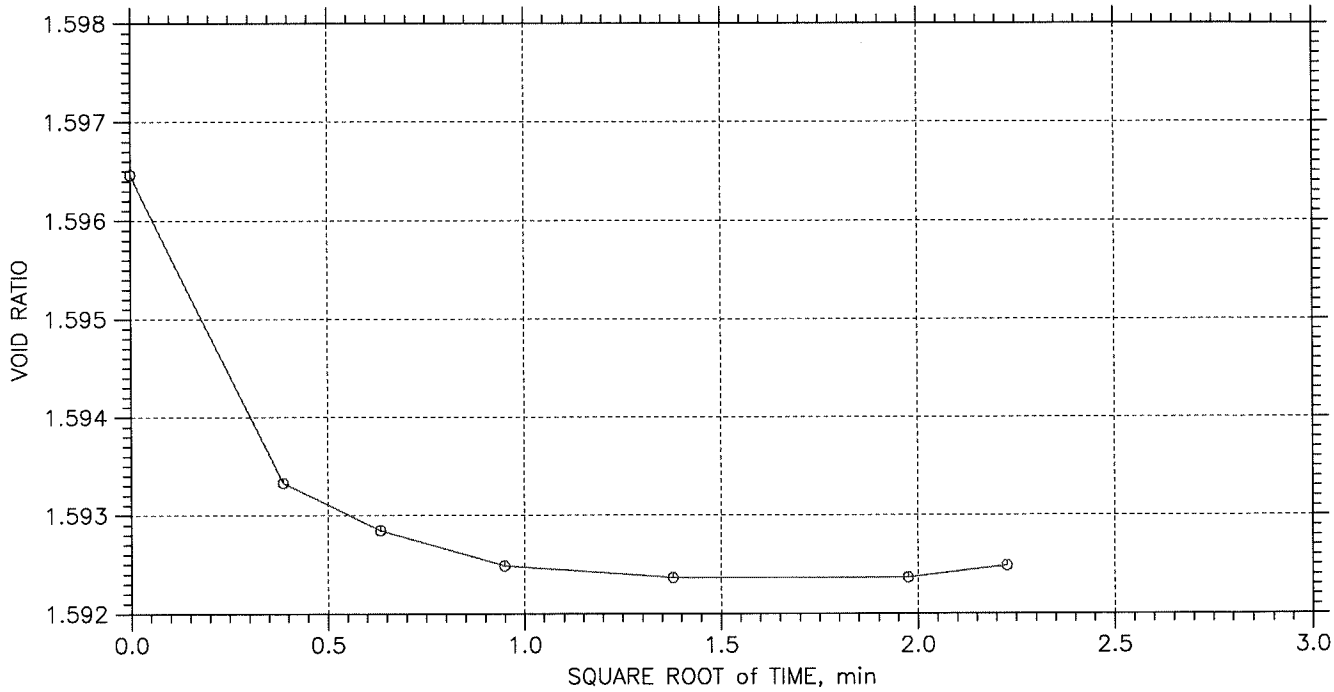
CONSOLIDATION TEST DATA

TIME CURVES

Step: 1 of 10

Stress: 250. psf





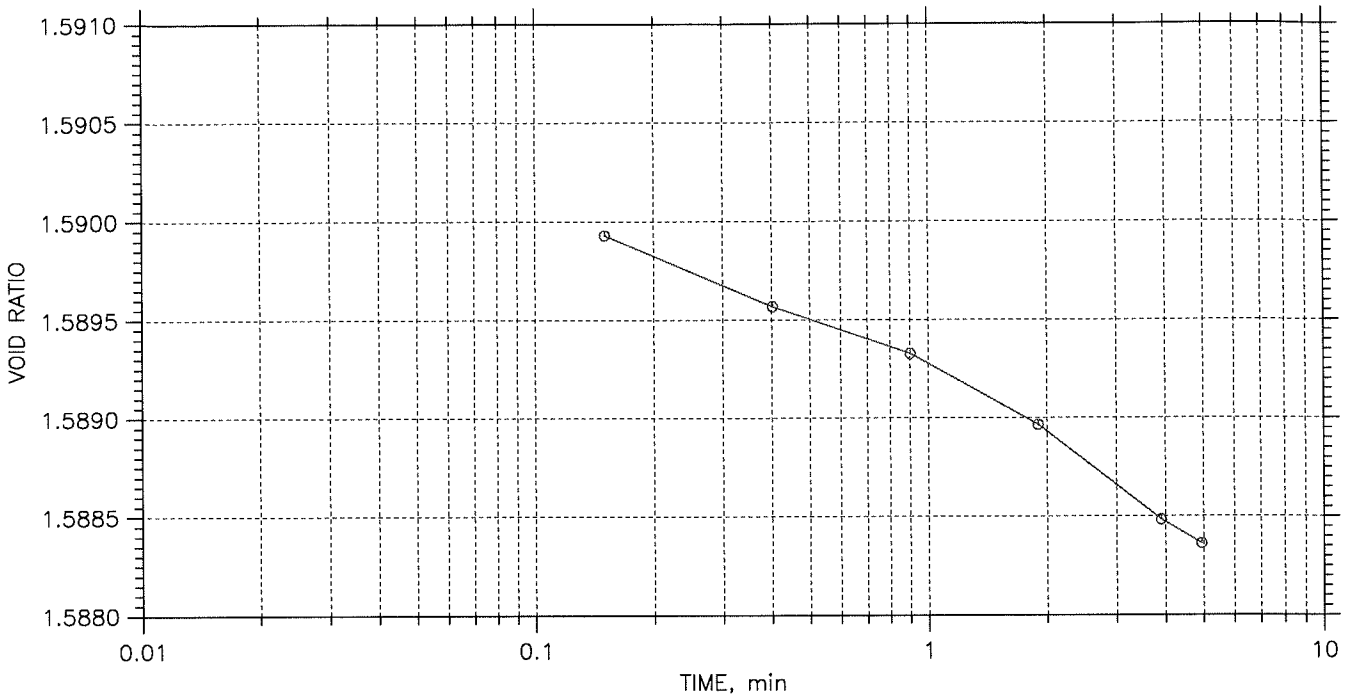
Project: IM-8-094(092)346	Location:	Project No.:
Boring No.: 1	Tested By: Traeholt	Checked By: Dietrich
Sample No.: SS-500-17	Test Date: 9/28/2016	Depth: 24.6-24.7
Test No.: CON-1-17	Sample Type: Shelby Tube	Elevation:
Description: Total length 27 1/2" Brn Cly with White Silt Deposits		
Remarks:		

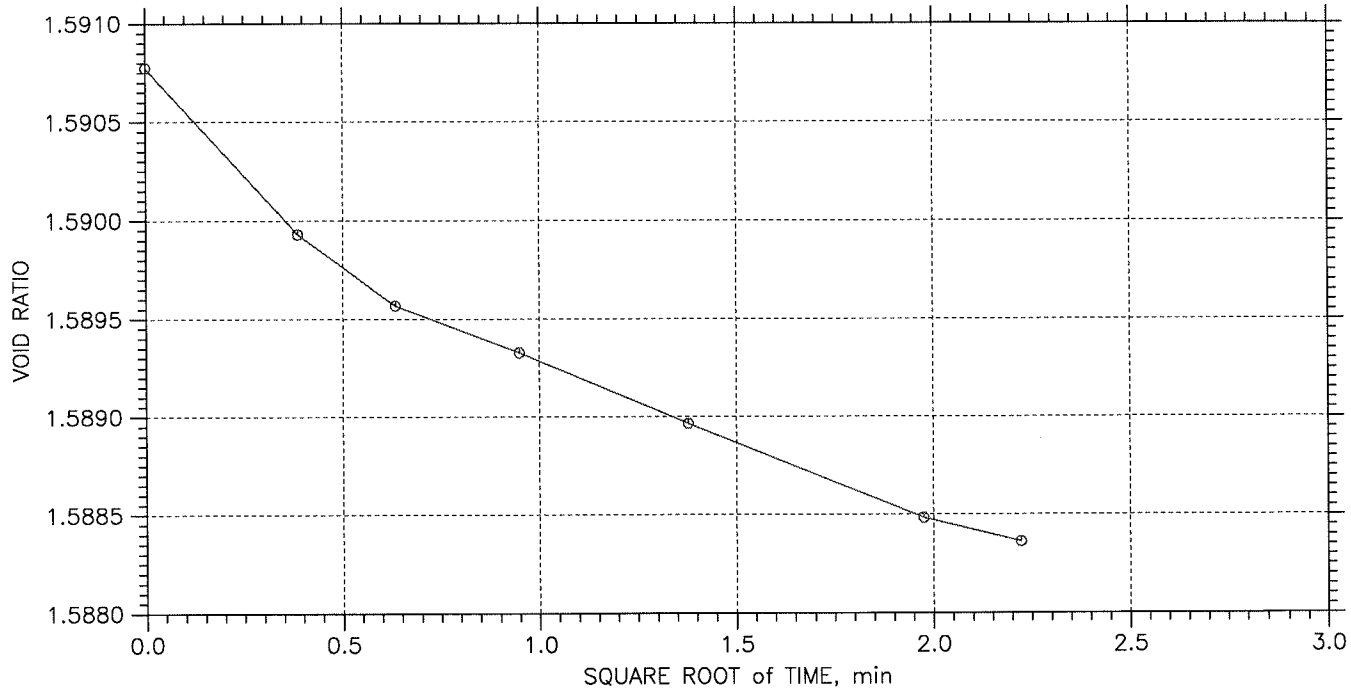
CONSOLIDATION TEST DATA

TIME CURVES

Step: 2 of 10

Stress: 500. psf





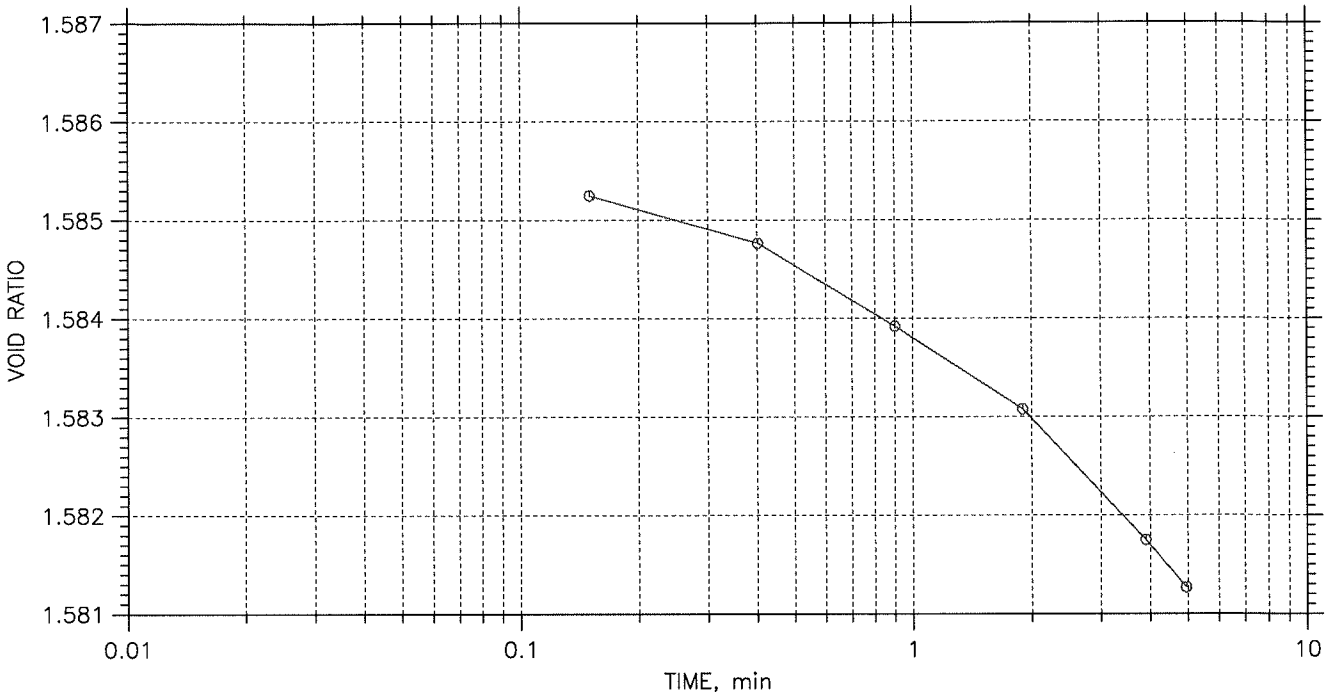
Project: IM-8-094(092)346	Location:	Project No.:
Boring No.: 1	Tested By: Traeholt	Checked By: Dietrich
Sample No.: SS-500-17	Test Date: 9/28/2016	Depth: 24.6-24.7
Test No.: CON-1-17	Sample Type: Shelby Tube	Elevation:
Description: Total length 27 1/2" Brn Cly with White Silt Deposits		
Remarks:		

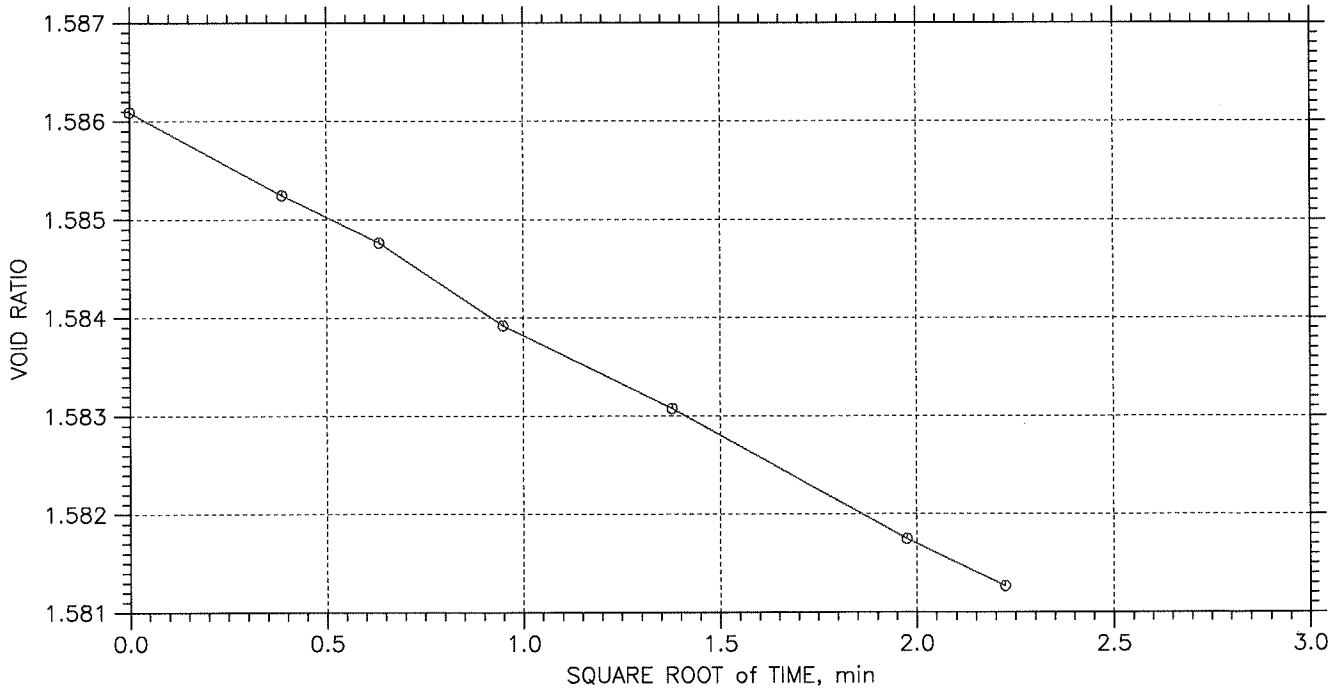
CONSOLIDATION TEST DATA

TIME CURVES

Step: 3 of 10

Stress: 1000. psf





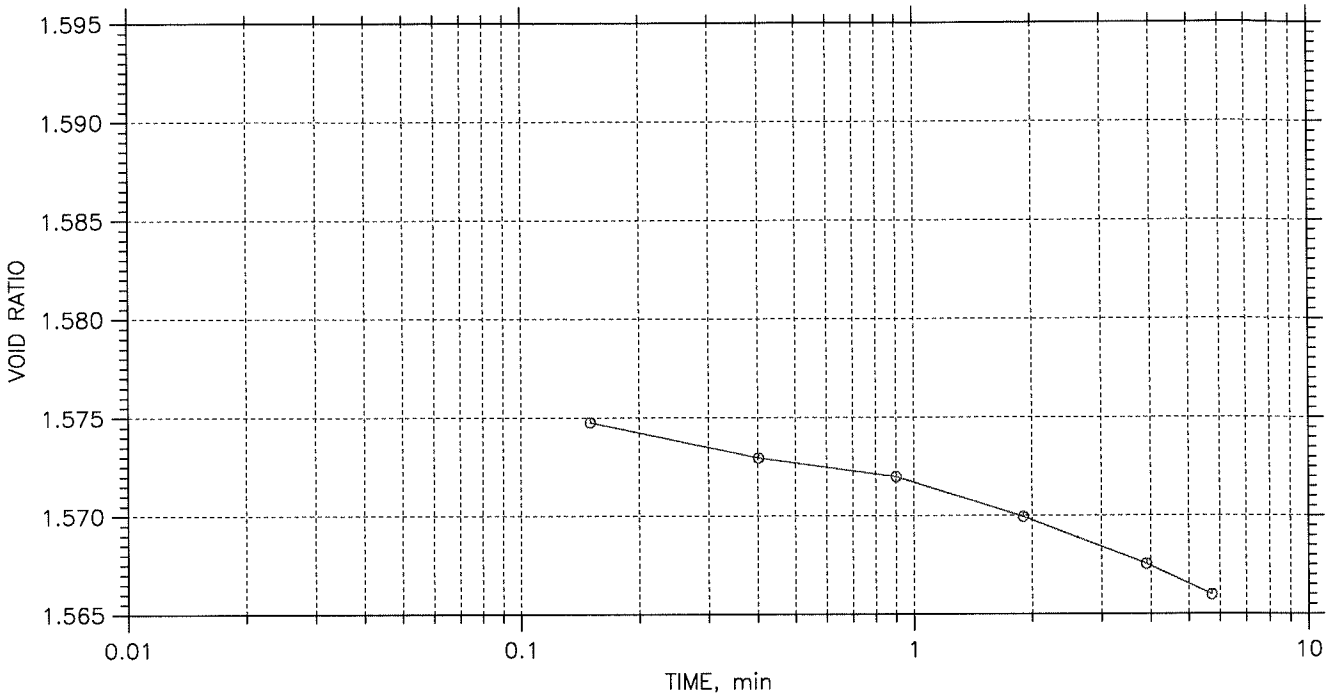
Project: IM-8-094(092)346	Location:	Project No.:
Boring No.: 1	Tested By: Traeholt	Checked By: Dietrich
Sample No.: SS-500-17	Test Date: 9/28/2016	Depth: 24.6-24.7
Test No.: CON-1-17	Sample Type: Shelby Tube	Elevation:
Description: Total length 27 1/2" Brn Cly with White Silt Deposits		
Remarks:		

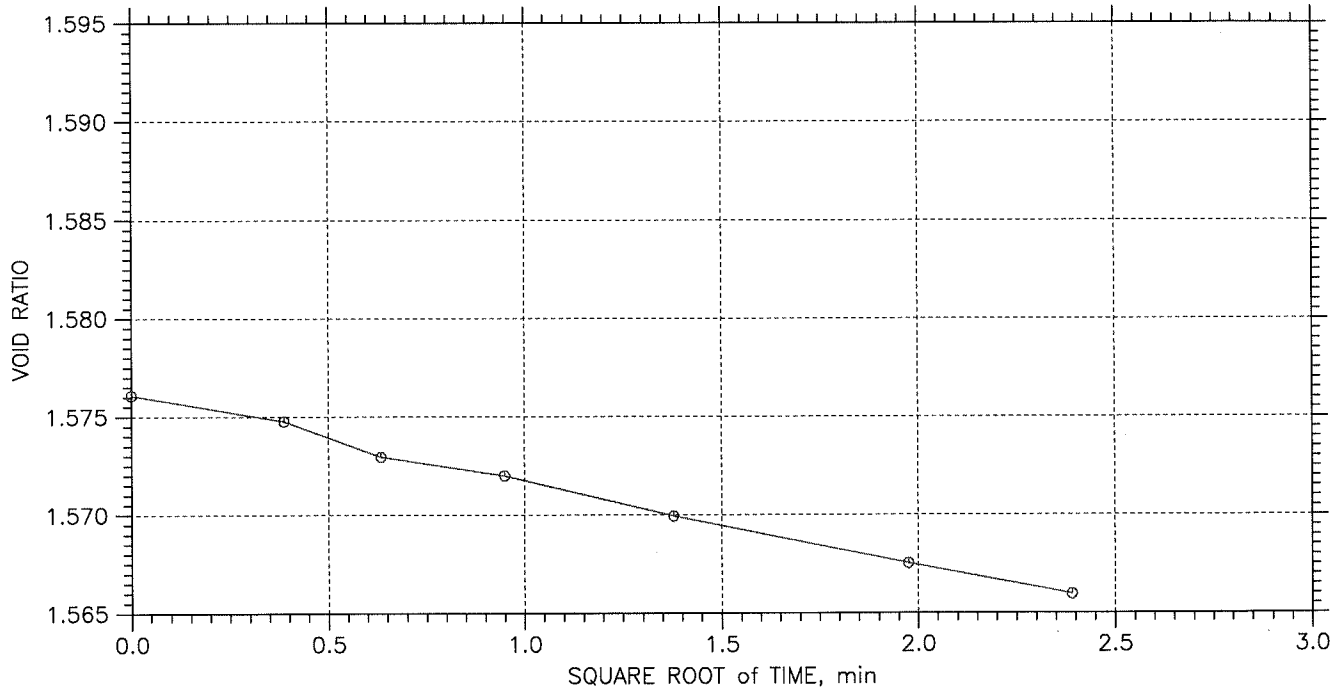
CONSOLIDATION TEST DATA

TIME CURVES

Step: 4 of 10

Stress: 2000. psf





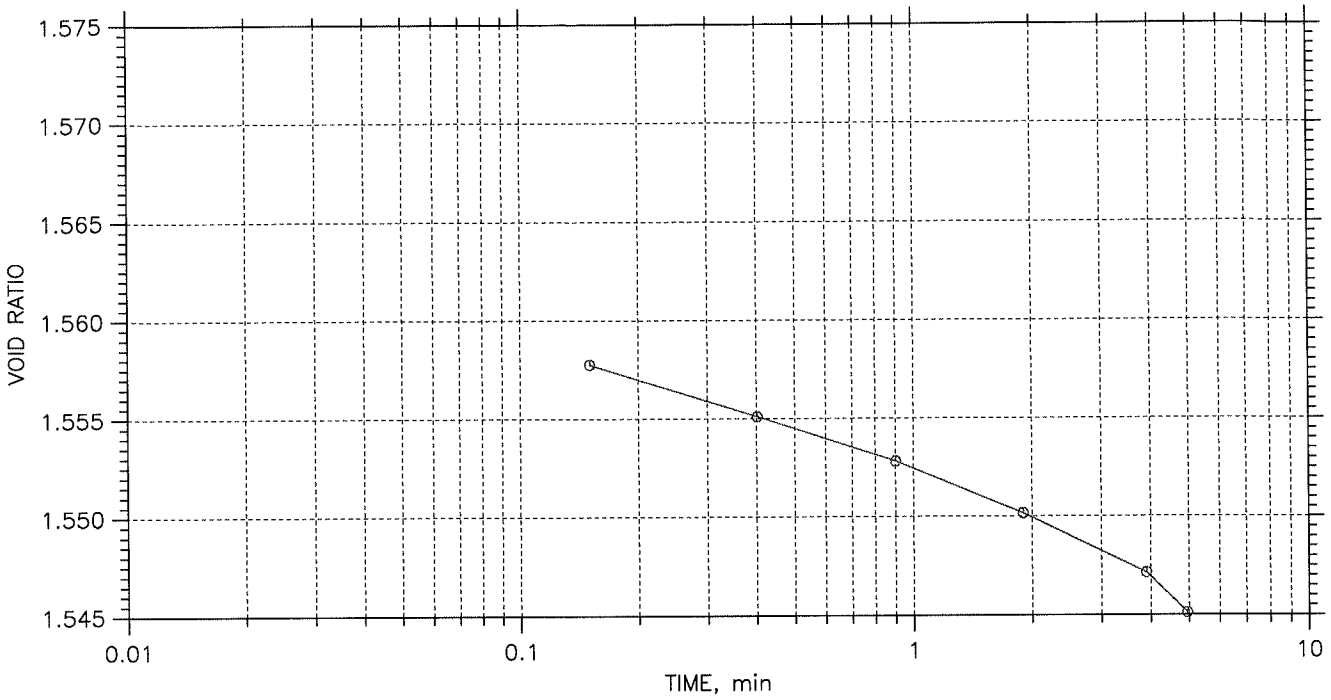
Project: IM-8-094(092)346	Location:	Project No.:
Boring No.: 1	Tested By: Traeholt	Checked By: Dietrich
Sample No.: SS-500-17	Test Date: 9/28/2016	Depth: 24.6-24.7
Test No.: CON-1-17	Sample Type: Shelby Tube	Elevation:
Description: Total length 27 1/2" Brn Cly with White Silt Deposits		
Remarks:		

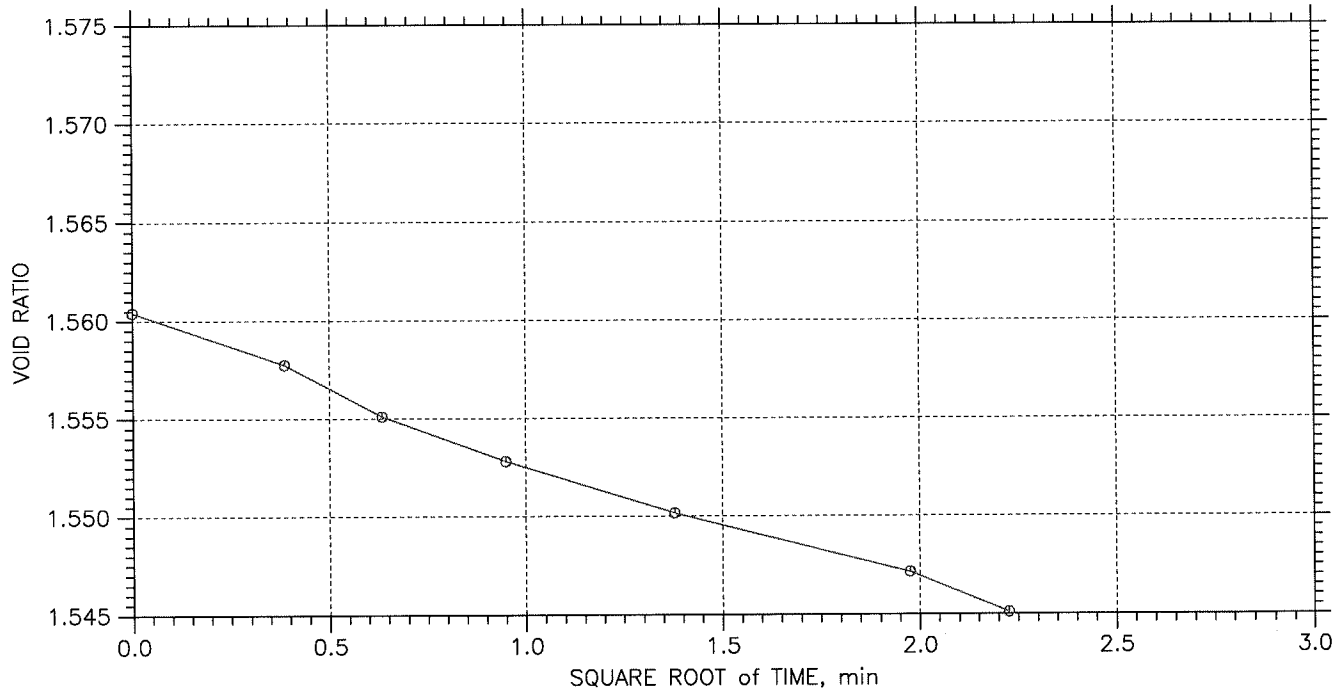
CONSOLIDATION TEST DATA

TIME CURVES

Step: 5 of 10

Stress: 4000. psf





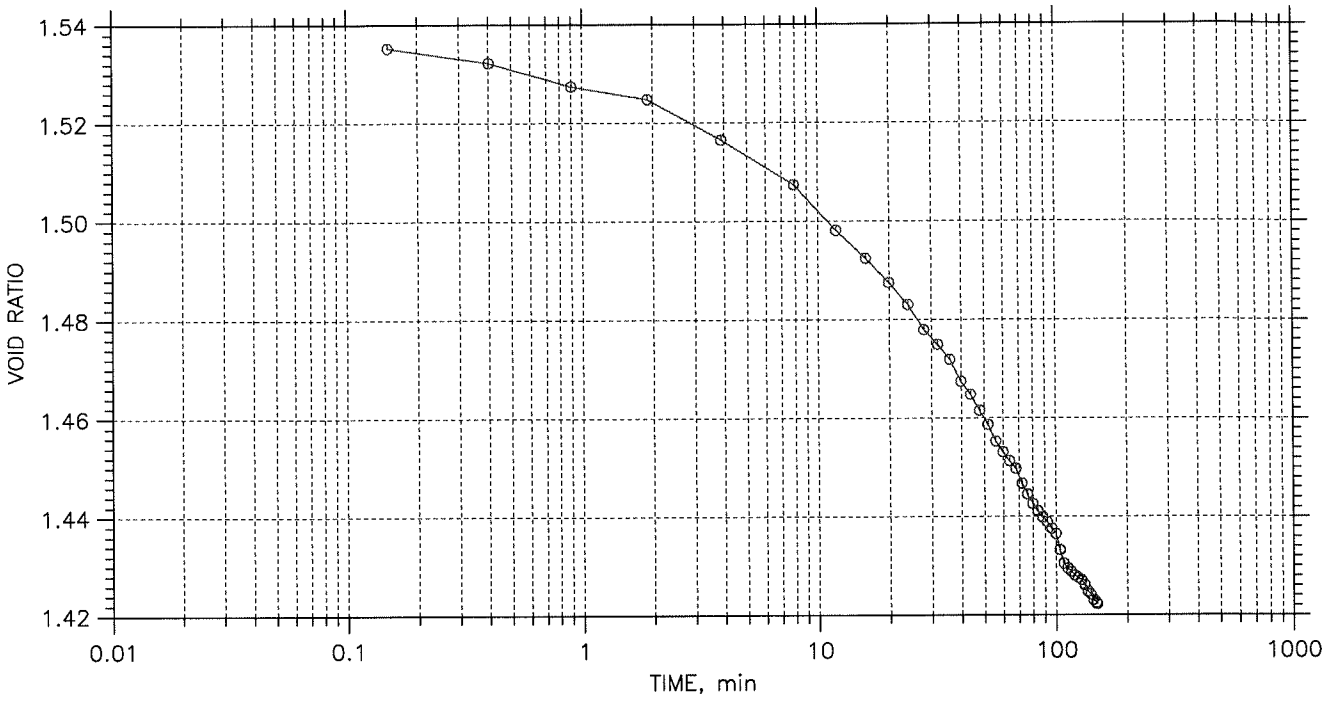
Project: IM-8-094(092)346	Location:	Project No.:
Boring No.: 1	Tested By: Traeholt	Checked By: Dietrich
Sample No.: SS-500-17	Test Date: 9/28/2016	Depth: 24.6-24.7
Test No.: CON-1-17	Sample Type: Shelby Tube	Elevation:
Description: Total length 27 1/2" Brn Cly with White Silt Deposits		
Remarks:		

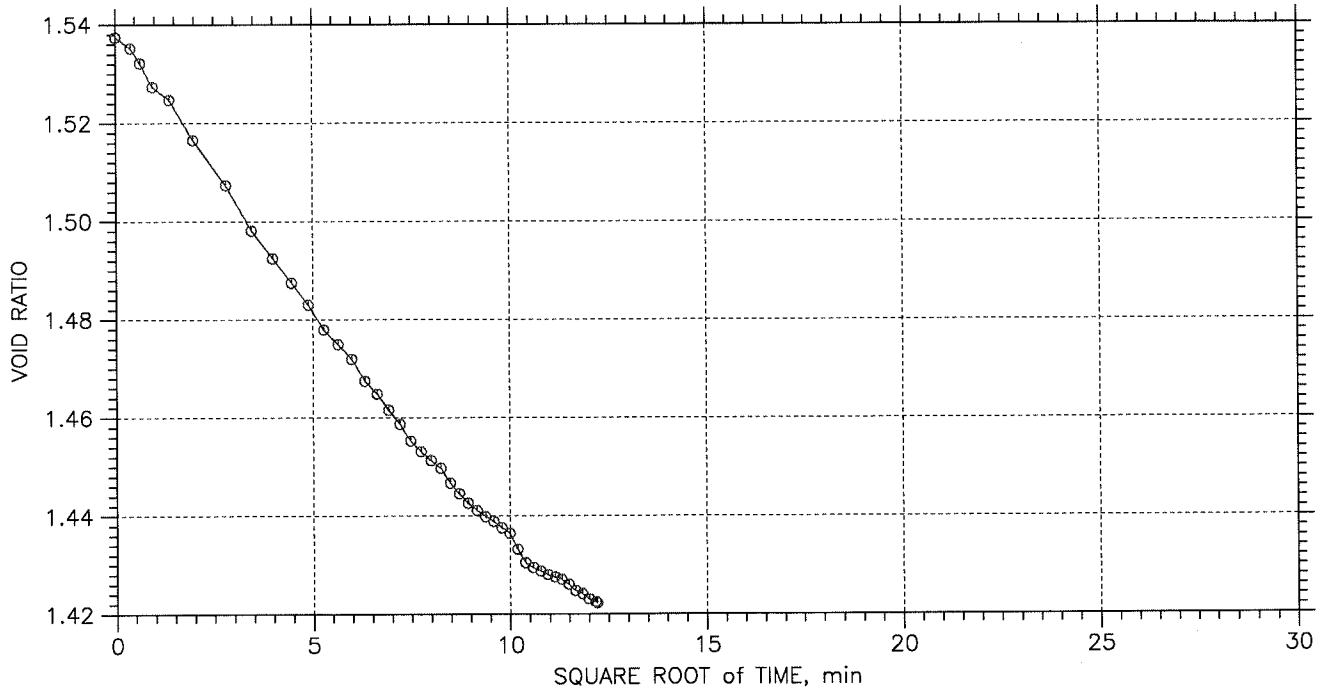
CONSOLIDATION TEST DATA

TIME CURVES

Step: 6 of 10

Stress: 8000. psf





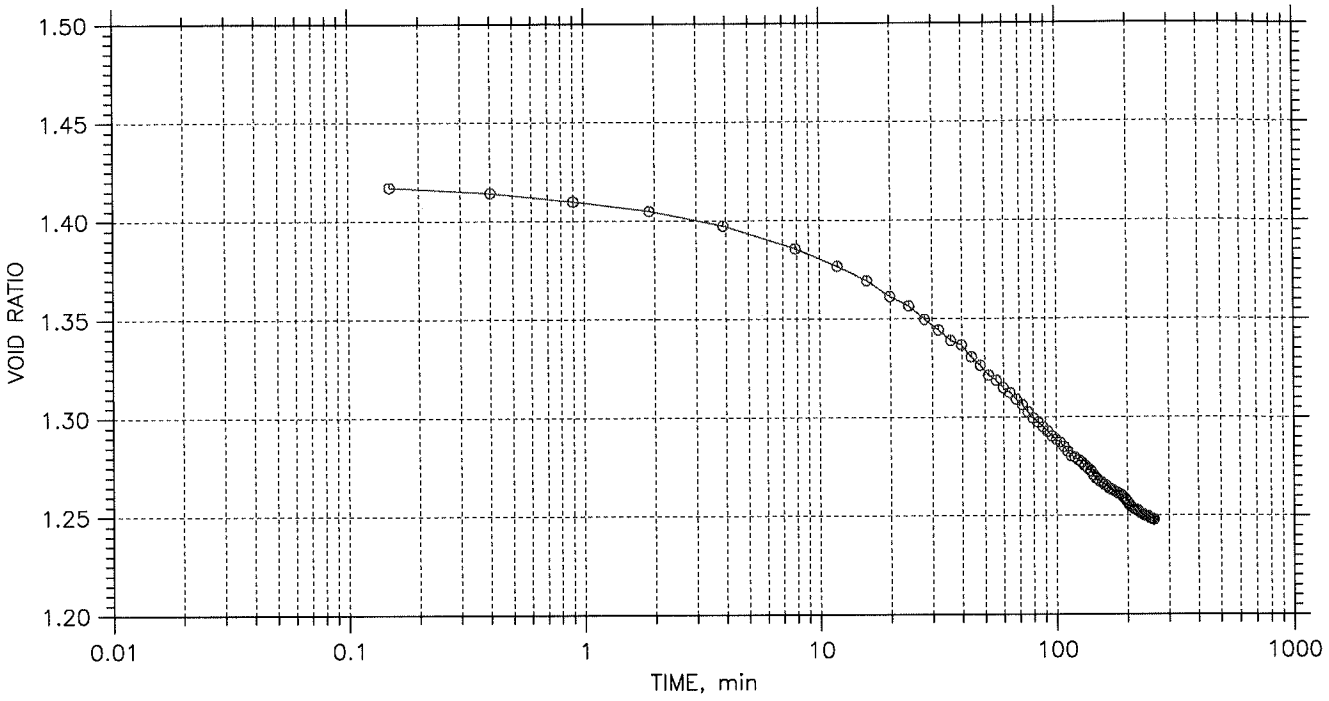
Project: IM-8-094(092)346	Location:	Project No.:
Boring No.: 1	Tested By: Traeholt	Checked By: Dietrich
Sample No.: SS-500-17	Test Date: 9/28/2016	Depth: 24.6-24.7
Test No.: CON-1-17	Sample Type: Shelby Tube	Elevation:
Description: Total length 27 1/2" Brn Cly with White Silt Deposits		
Remarks:		

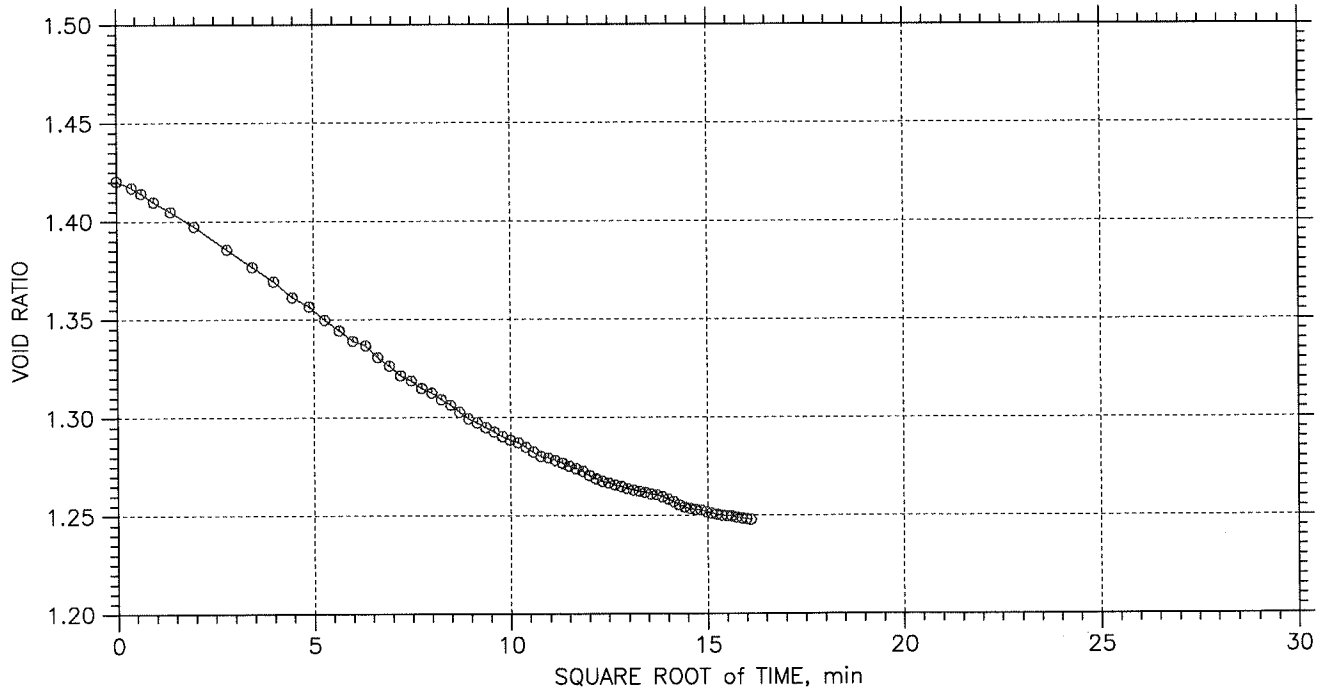
CONSOLIDATION TEST DATA

TIME CURVES

Step: 7 of 10

Stress: 16000 psf





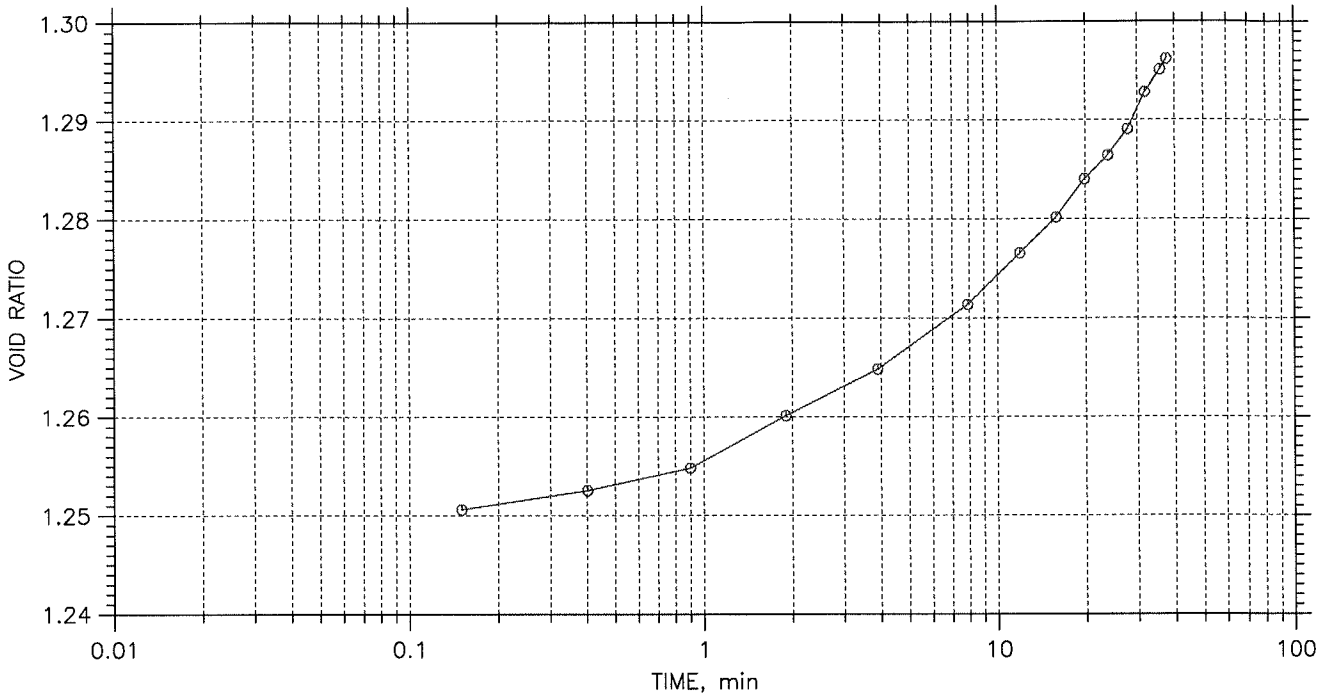
Project: IM-8-094(092)346	Location:	Project No.:
Boring No.: 1	Tested By: Traeholt	Checked By: Dietrich
Sample No.: SS-500-17	Test Date: 9/28/2016	Depth: 24.6-24.7
Test No.: CON-1-17	Sample Type: Shelby Tube	Elevation:
Description: Total length 27 1/2" Brn Cly with White Silt Deposits		
Remarks:		

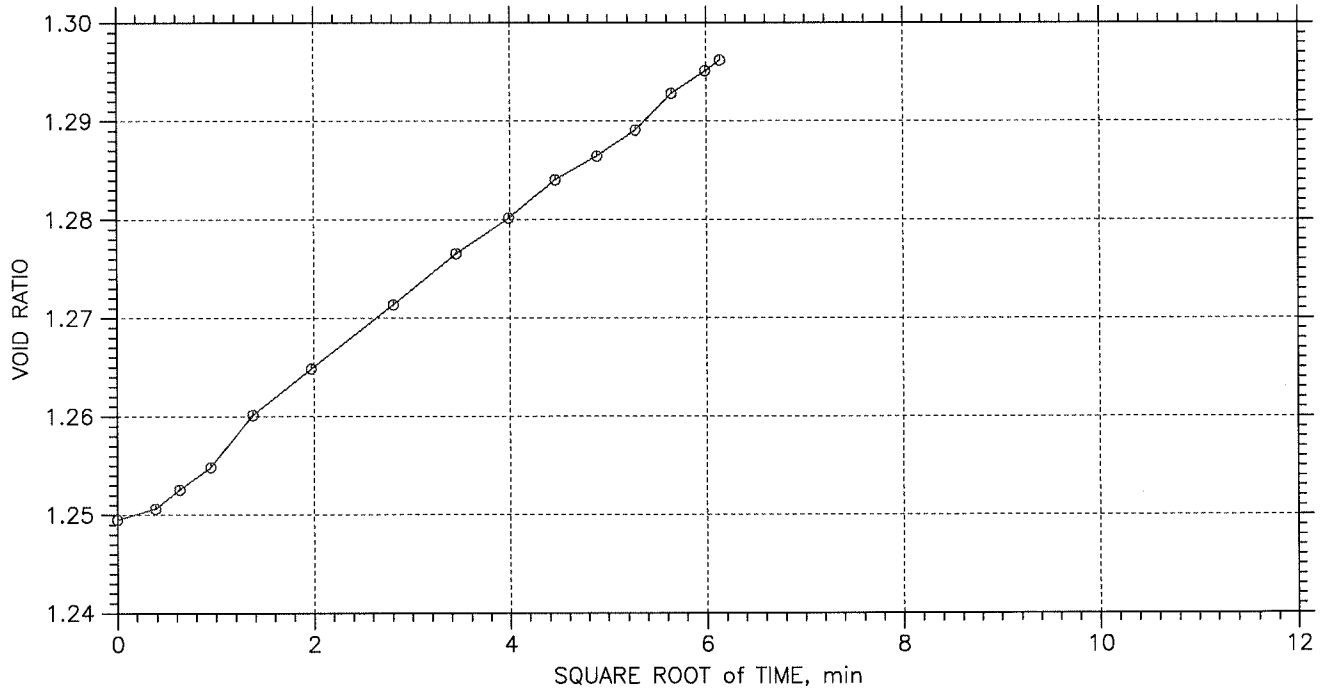
CONSOLIDATION TEST DATA

TIME CURVES

Step: 8 of 10

Stress: 4000. psf





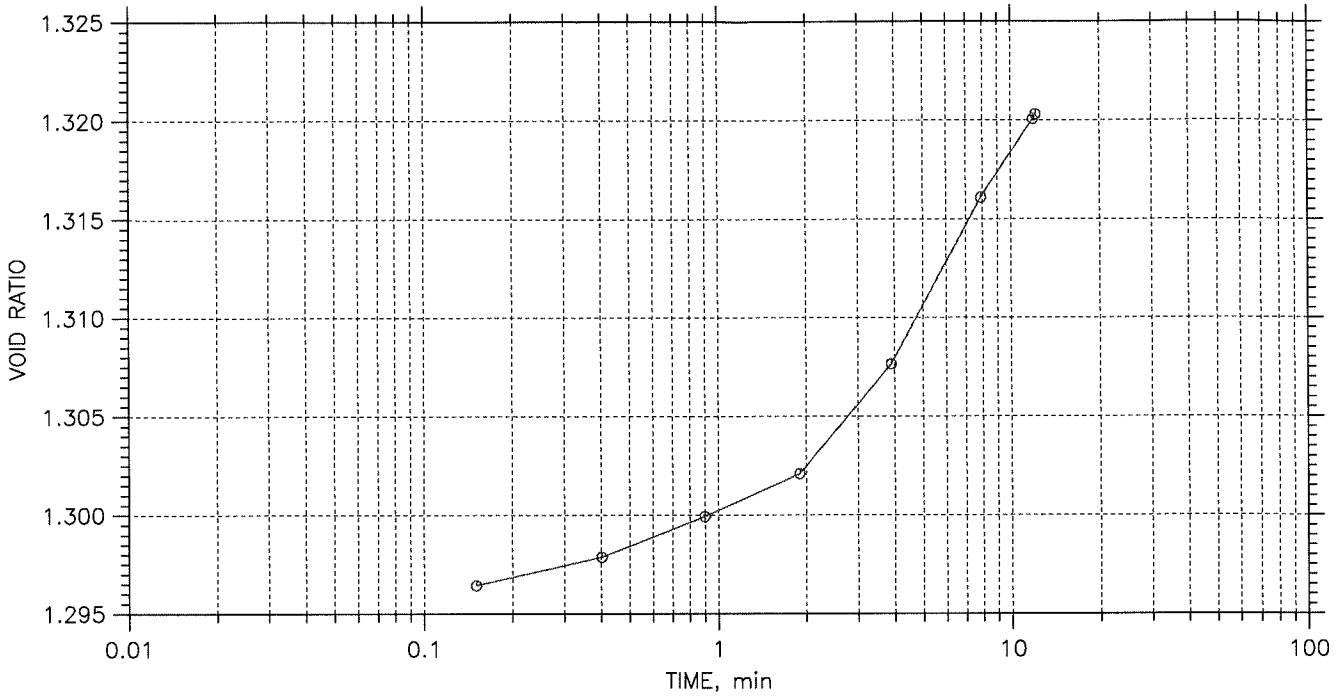
Project: IM-8-094(092)346	Location:	Project No.:
Boring No.: 1	Tested By: Traeholt	Checked By: Dietrich
Sample No.: SS-500-17	Test Date: 9/28/2016	Depth: 24.6-24.7
Test No.: CON-1-17	Sample Type: Shelby Tube	Elevation:
Description: Total length 27 1/2" Brn Cly with White Silt Deposits		
Remarks:		

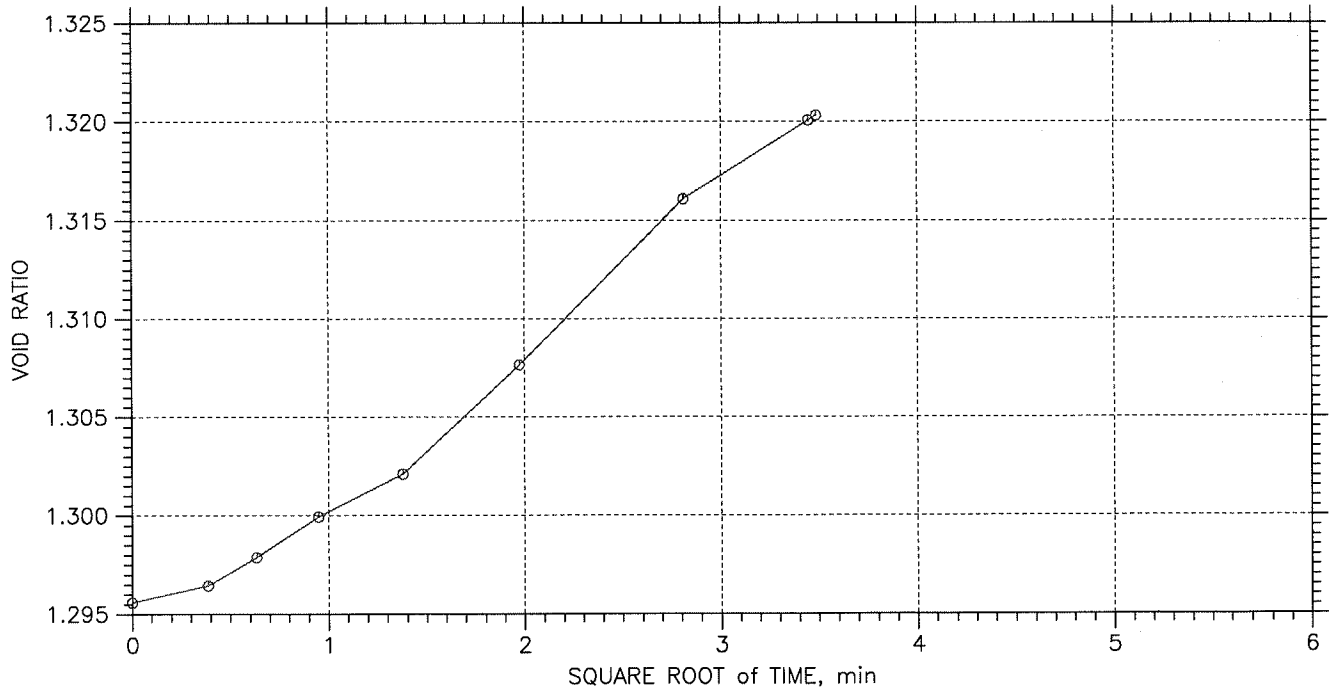
CONSOLIDATION TEST DATA

TIME CURVES

Step: 9 of 10

Stress: 1000. psf





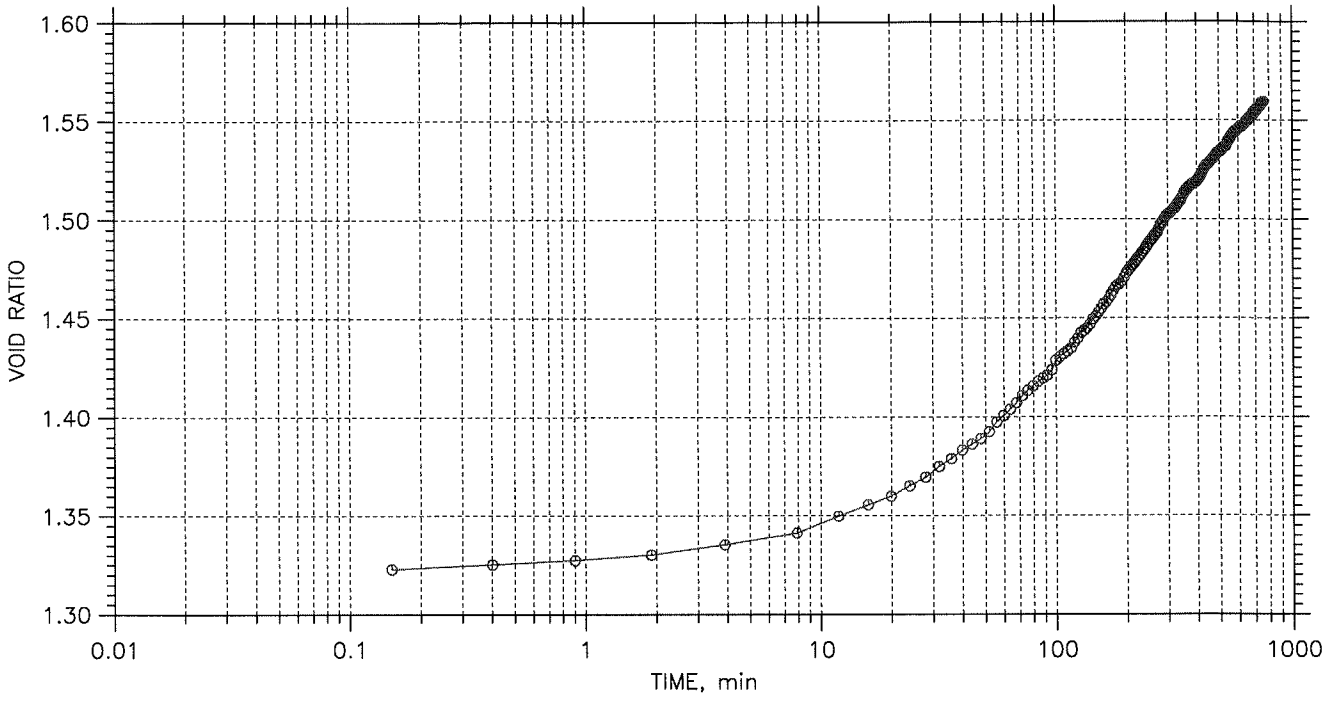
Project: IM-8-094(092)346	Location:	Project No.:
Boring No.: 1	Tested By: Traeholt	Checked By: Dietrich
Sample No.: SS-500-17	Test Date: 9/28/2016	Depth: 24.6-24.7
Test No.: CON-1-17	Sample Type: Shelby Tube	Elevation:
Description: Total length 27 1/2" Brn Cly with White Silt Deposits		
Remarks:		

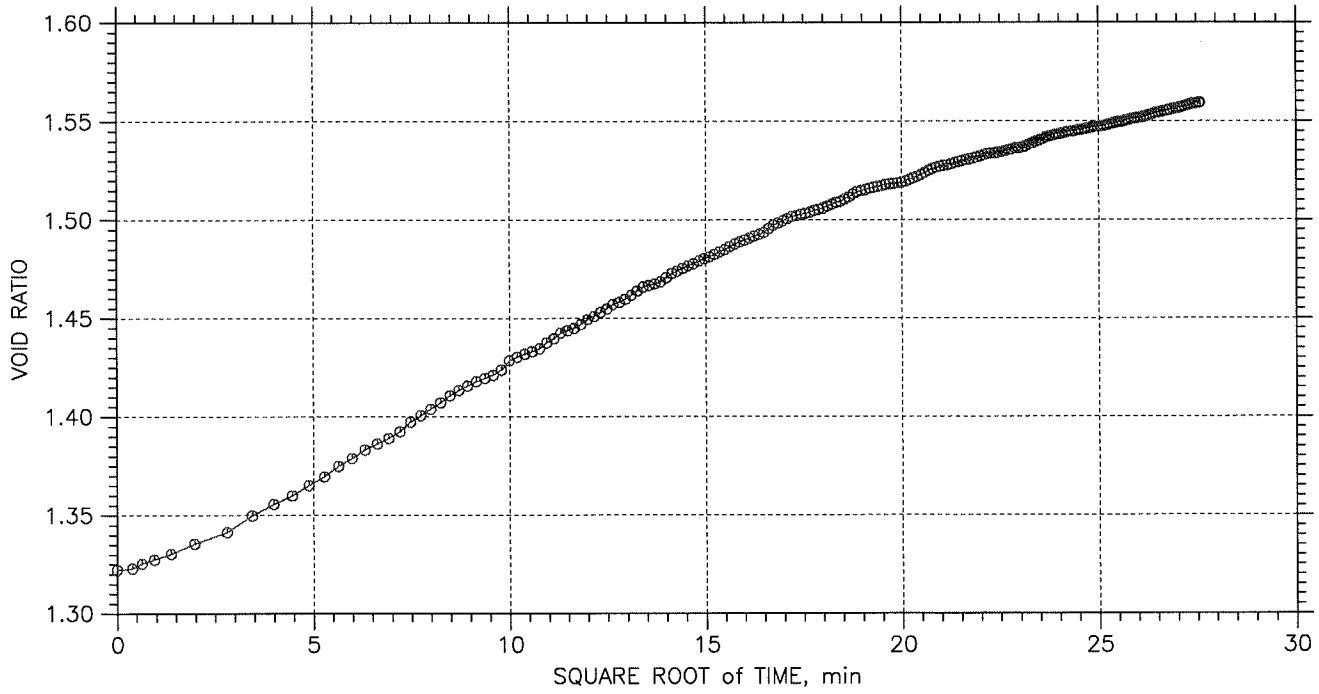
CONSOLIDATION TEST DATA

TIME CURVES

Step: 10 of 10

Stress: 250. psf





Project: IM-8-094(092)346	Location:	Project No.:
Boring No.: 1	Tested By: Traeholt	Checked By: Dietrich
Sample No.: SS-500-17	Test Date: 9/28/2016	Depth: 24.6-24.7
Test No.: CON-1-17	Sample Type: Shelby Tube	Elevation:
Description: Total length 27 1/2" Brn Cly with White Silt Deposits		
Remarks:		

CONSOLIDATION TEST DATA

Project: IM-8-094(092)346
Boring No.: 1
Sample No.: SS-500-17
Test No.: CON-1-17

Location:
Tested By: Traeholt
Test Date: 9/28/2016
Sample Type: Shelby Tube

Project No.:
Checked By: Dietrich
Depth: 24.6-24.7
Elevation:

Soil Description: Total length 27 1/2" Brn Cly with White Silt Deposits
Remarks:

Estimated Specific Gravity: 2.65
Initial Void Ratio: 1.59
Final Void Ratio: 1.56

Liquid Limit: ---
Plastic Limit: ---
Plasticity Index: ---

Initial Height: 1.00 in
Specimen Diameter: 2.50 in

	Before Consolidation		After Consolidation	
	Trimmings	Specimen+Ring	Specimen+Ring	Trimmings
Container ID	S 72	RING		s7
Wt. Container + Wet Soil, gm	84.1	241.07	242.02	163.44
Wt. Container + Dry Soil, gm	58.57	190.82	190.82	112.32
Wt. Container, gm	15.4	108.64	108.64	30.27
Wt. Dry Soil, gm	43.17	82.179	82.179	82.05
Water Content, %	59.14	61.15	62.30	62.30
Void Ratio	---	1.59	1.56	---
Degree of Saturation, %	---	101.64	105.93	---
Dry Unit Weight, pcf	---	63.778	64.668	---

CONSOLIDATION TEST DATA

Project: IM-8-094(092)346
Boring No.: 1
Sample No.: SS-500-17
Test No.: CON-1-17

Location:
Tested By: Traeholt
Test Date: 9/28/2016
Sample Type: Shelby Tube

Project No.:
Checked By: Dietrich
Depth: 24.6-24.7
Elevation:

Soil Description: Total length 27 1/2" Brn Cly with White Silt Deposits
Remarks:

	Applied Stress psf	Final Displacement in	Void Ratio	Strain at End %	Sq.Rt. T90 min	Cv ft^2/sec	Mv 1/psf	k ft/day
1	250	0.0009249	1.592	0.09	0.0	0.00e+000	3.70e-006	0.00e+000
2	500	0.002513	1.588	0.25	0.0	0.00e+000	6.35e-006	0.00e+000
3	1e+003	0.005248	1.581	0.52	0.0	0.00e+000	5.47e-006	0.00e+000
4	2e+003	0.01115	1.566	1.11	0.0	0.00e+000	5.90e-006	0.00e+000
5	4e+003	0.01919	1.545	1.92	0.0	0.00e+000	4.02e-006	0.00e+000
6	8e+003	0.06655	1.422	6.65	134.6	1.67e-007	1.18e-005	1.07e-005
7	1.6e+004	0.1338	1.248	13.38	183.1	1.09e-007	8.40e-006	4.92e-006
8	4e+003	0.1151	1.296	11.51	30.3	6.21e-007	1.55e-006	5.20e-006
9	1e+003	0.1058	1.320	10.58	0.0	0.00e+000	3.10e-006	0.00e+000
10	250	0.01376	1.559	1.38	582.3	3.72e-008	1.23e-004	2.47e-005

	Applied Stress psf	Final Displacement in	Void Ratio	Strain at End %	Log. T50 min	Cv ft^2/sec	Mv 1/psf	k ft/day	Ca %
1	250	0.0009249	1.592	0.09	0.0	0.00e+000	3.70e-006	0.00e+000	0.00e+000
2	500	0.002513	1.588	0.25	0.0	0.00e+000	6.35e-006	0.00e+000	0.00e+000
3	1e+003	0.005248	1.581	0.52	0.0	0.00e+000	5.47e-006	0.00e+000	0.00e+000
4	2e+003	0.01115	1.566	1.11	0.0	0.00e+000	5.90e-006	0.00e+000	0.00e+000
5	4e+003	0.01919	1.545	1.92	0.0	0.00e+000	4.02e-006	0.00e+000	0.00e+000
6	8e+003	0.06655	1.422	6.65	0.0	0.00e+000	1.18e-005	0.00e+000	0.00e+000
7	1.6e+004	0.1338	1.248	13.38	0.0	0.00e+000	8.40e-006	0.00e+000	0.00e+000
8	4e+003	0.1151	1.296	11.51	0.0	0.00e+000	1.55e-006	0.00e+000	0.00e+000
9	1e+003	0.1058	1.320	10.58	0.0	0.00e+000	3.10e-006	0.00e+000	0.00e+000
10	250	0.01376	1.559	1.38	121.4	4.15e-008	1.23e-004	2.75e-005	0.00e+000

CONSOLIDATION TEST DATA

Project: IM-8-094(092)346
Boring No.: 1
Sample No.: SS-500-17
Test No.: CON-1-17

Location:
Tested By: Traeholt
Test Date: 9/28/2016
Sample Type: Shelby Tube

Project No.:
Checked By: Dietrich
Depth: 24.6-24.7
Elevation:

Soil Description: Total length 27 1/2" Brn Cly with White Silt Deposits
Remarks:

Load Increment: 1 of 10
Applied Stress: 250 psf

	Elapsed Time min	Sq.Rt. of Time min	Displacement in	Strain %	Void Ratio
1	0.00	0.00	-0.0006088	-0.06	1.596
2	0.15	0.39	0.0005996	0.06	1.593
3	0.40	0.63	0.0007855	0.08	1.593
4	0.90	0.95	0.0009249	0.09	1.592
5	1.90	1.38	0.0009714	0.10	1.592
6	3.90	1.98	0.0009714	0.10	1.592
7	4.96	2.23	0.0009249	0.09	1.592

CONSOLIDATION TEST DATA

Project: IM-8-094(092)346
Boring No.: 1
Sample No.: SS-500-17
Test No.: CON-1-17

Location:
Tested By: Traeholt
Test Date: 9/28/2016
Sample Type: Shelby Tube

Project No.:
Checked By: Dietrich
Depth: 24.6-24.7
Elevation:

Soil Description: Total length 27 1/2" Brn Cly with White Silt Deposits
Remarks:

Load Increment: 2 of 10
Applied Stress: 500 psf

	Elapsed Time min	Sq.Rt. of Time min	Displacement in	Strain %	Void Ratio
1	0.00	0.00	0.001584	0.16	1.591
2	0.15	0.39	0.001909	0.19	1.590
3	0.40	0.63	0.002049	0.20	1.590
4	0.90	0.95	0.002142	0.21	1.589
5	1.90	1.38	0.002281	0.23	1.589
6	3.90	1.98	0.002467	0.25	1.588
7	4.94	2.22	0.002513	0.25	1.588

CONSOLIDATION TEST DATA

Project: IM-8-094(092)346
Boring No.: 1
Sample No.: SS-500-17
Test No.: CON-1-17

Location:
Tested By: Traeholt
Test Date: 9/28/2016
Sample Type: Shelby Tube

Project No.:
Checked By: Dietrich
Depth: 24.6-24.7
Elevation:

Soil Description: Total length 27 1/2" Brn Cly with White Silt Deposits
Remarks:

Load Increment: 3 of 10
Applied Stress: 1e+003 psf

	Elapsed Time min	Sq.Rt. of Time min	Displacement in	Strain %	Void Ratio
1	0.00	0.00	0.003389	0.34	1.586
2	0.15	0.39	0.003715	0.37	1.585
3	0.40	0.63	0.0039	0.39	1.585
4	0.90	0.95	0.004226	0.42	1.584
5	1.90	1.38	0.004551	0.46	1.583
6	3.90	1.98	0.005062	0.51	1.582
7	4.95	2.22	0.005248	0.52	1.581

CONSOLIDATION TEST DATA

Project: IM-8-094(092)346
Boring No.: 1
Sample No.: SS-500-17
Test No.: CON-1-17

Location:
Tested By: Traeholt
Test Date: 9/28/2016
Sample Type: Shelby Tube

Project No.:
Checked By: Dietrich
Depth: 24.6-24.7
Elevation:

Soil Description: Total length 27 1/2" Brn Cly with White Silt Deposits
Remarks:

Load Increment: 4 of 10
Applied Stress: 2e+003 psf

	Elapsed Time min	Sq.Rt. of Time min	Displacement in	Strain %	Void Ratio
1	0.00	0.00	0.007246	0.72	1.576
2	0.15	0.39	0.007757	0.78	1.575
3	0.40	0.63	0.008454	0.85	1.573
4	0.90	0.95	0.008826	0.88	1.572
5	1.90	1.38	0.009616	0.96	1.570
6	3.90	1.98	0.01055	1.05	1.568
7	5.72	2.39	0.01115	1.11	1.566

CONSOLIDATION TEST DATA

Project: IM-8-094(092)346
Boring No.: 1
Sample No.: SS-500-17
Test No.: CON-1-17

Location:
Tested By: Traeholt
Test Date: 9/28/2016
Sample Type: Shelby Tube

Project No.:
Checked By: Dietrich
Depth: 24.6-24.7
Elevation:

Soil Description: Total length 27 1/2" Brn Cly with White Silt Deposits
Remarks:

Load Increment: 5 of 10
Applied Stress: 4e+003 psf

	Elapsed Time min	Sq.Rt. of Time min	Displacement in	Strain %	Void Ratio
1	0.00	0.00	0.01329	1.33	1.560
2	0.15	0.39	0.01431	1.43	1.558
3	0.40	0.63	0.01533	1.53	1.555
4	0.90	0.95	0.01622	1.62	1.553
5	1.90	1.38	0.01724	1.72	1.550
6	3.90	1.98	0.0184	1.84	1.547
7	4.95	2.23	0.01919	1.92	1.545

CONSOLIDATION TEST DATA

Project: IM-8-094(092)346
Boring No.: 1
Sample No.: SS-500-17
Test No.: CON-1-17

Location:
Tested By: Traeholt
Test Date: 9/28/2016
Sample Type: Shelby Tube

Project No.:
Checked By: Dietrich
Depth: 24.6-24.7
Elevation:

Soil Description: Total length 27 1/2" Brn Cly with White Silt Deposits
Remarks:

Load Increment: 6 of 10
Applied Stress: 8e+003 psf

	Elapsed Time min	Sq.Rt. of Time min	Displacement in	Strain %	Void Ratio
1	0.00	0.00	0.02216	2.22	1.537
2	0.15	0.39	0.023	2.30	1.535
3	0.40	0.63	0.02416	2.42	1.532
4	0.90	0.95	0.02602	2.60	1.527
5	1.90	1.38	0.02704	2.70	1.525
6	3.90	1.98	0.0302	3.02	1.517
7	7.90	2.81	0.03374	3.37	1.507
8	11.90	3.45	0.03731	3.73	1.498
9	15.90	3.99	0.0395	3.95	1.492
10	19.90	4.46	0.0414	4.14	1.487
11	23.90	4.89	0.04312	4.31	1.483
12	27.90	5.28	0.04508	4.51	1.478
13	31.90	5.65	0.04624	4.62	1.475
14	35.90	5.99	0.0474	4.74	1.472
15	39.90	6.32	0.04912	4.91	1.467
16	43.90	6.63	0.05014	5.01	1.465
17	47.90	6.92	0.0514	5.14	1.462
18	51.90	7.20	0.05251	5.25	1.459
19	55.90	7.48	0.05381	5.38	1.455
20	59.90	7.74	0.05465	5.46	1.453
21	63.90	7.99	0.05535	5.53	1.451
22	67.90	8.24	0.05595	5.60	1.450
23	71.90	8.48	0.05711	5.71	1.447
24	75.90	8.71	0.05795	5.79	1.445
25	79.90	8.94	0.05869	5.87	1.443
26	83.90	9.16	0.05925	5.93	1.441
27	87.90	9.38	0.05976	5.98	1.440
28	91.90	9.59	0.06013	6.01	1.439
29	95.90	9.79	0.06065	6.06	1.438
30	99.90	10.00	0.06106	6.11	1.436
31	103.90	10.19	0.06232	6.23	1.433
32	107.90	10.39	0.06339	6.34	1.430
33	111.90	10.58	0.06376	6.38	1.429
34	115.90	10.77	0.06404	6.40	1.429
35	119.90	10.95	0.06432	6.43	1.428
36	123.90	11.13	0.0645	6.45	1.428
37	127.90	11.31	0.06469	6.47	1.427
38	131.90	11.48	0.06506	6.51	1.426
39	135.90	11.66	0.06557	6.56	1.425
40	139.90	11.83	0.0658	6.58	1.424
41	143.90	12.00	0.06622	6.62	1.423
42	147.90	12.16	0.06645	6.65	1.422
43	148.86	12.20	0.06655	6.65	1.422

CONSOLIDATION TEST DATA

Project: IM-8-094(092)346
Boring No.: 1
Sample No.: SS-500-17
Test No.: CON-1-17

Location:
Tested By: Traeholt
Test Date: 9/28/2016
Sample Type: Shelby Tube

Project No.:
Checked By: Dietrich
Depth: 24.6-24.7
Elevation:

Soil Description: Total length 27 1/2" Brn Cly with White Silt Deposits
Remarks:

Load Increment: 7 of 10
Applied Stress: 1.6e+004 psf

	Elapsed Time min	Sq.Rt. of Time min	Displacement in	Strain %	Void Ratio
1	0.00	0.00	0.06725	6.72	1.420
2	0.15	0.39	0.06855	6.85	1.417
3	0.40	0.63	0.06966	6.97	1.414
4	0.90	0.95	0.07134	7.13	1.410
5	1.90	1.38	0.07324	7.32	1.405
6	3.90	1.98	0.07617	7.62	1.397
7	7.90	2.81	0.08068	8.07	1.386
8	11.90	3.45	0.08412	8.41	1.377
9	15.90	3.99	0.08695	8.70	1.369
10	19.90	4.46	0.09007	9.01	1.361
11	23.90	4.89	0.09188	9.19	1.356
12	27.90	5.28	0.09453	9.45	1.350
13	31.90	5.65	0.09662	9.66	1.344
14	35.90	5.99	0.09866	9.87	1.339
15	39.90	6.32	0.09955	9.95	1.337
16	43.90	6.63	0.1019	10.19	1.331
17	47.90	6.92	0.1035	10.35	1.326
18	51.90	7.20	0.1054	10.54	1.321
19	55.90	7.48	0.1065	10.65	1.319
20	59.90	7.74	0.108	10.80	1.315
21	63.90	7.99	0.1089	10.89	1.312
22	67.90	8.24	0.1102	11.02	1.309
23	71.90	8.48	0.1113	11.13	1.306
24	75.90	8.71	0.1127	11.27	1.303
25	79.90	8.94	0.1139	11.39	1.299
26	83.90	9.16	0.1147	11.47	1.297
27	87.90	9.38	0.1156	11.56	1.295
28	91.90	9.59	0.1165	11.65	1.293
29	95.90	9.79	0.1174	11.74	1.290
30	99.90	10.00	0.1181	11.81	1.288
31	103.90	10.19	0.1186	11.86	1.287
32	107.90	10.39	0.1195	11.95	1.285
33	111.90	10.58	0.1204	12.04	1.282
34	115.90	10.77	0.1213	12.13	1.280
35	119.90	10.95	0.1216	12.16	1.279
36	123.90	11.13	0.1221	12.21	1.278
37	127.90	11.31	0.1226	12.26	1.277
38	131.90	11.48	0.1232	12.32	1.275
39	135.90	11.66	0.1237	12.37	1.274
40	139.90	11.83	0.1242	12.42	1.273
41	143.90	12.00	0.1251	12.51	1.270
42	147.90	12.16	0.1257	12.57	1.269
43	151.90	12.32	0.1262	12.62	1.267
44	155.90	12.49	0.1265	12.65	1.267
45	159.90	12.65	0.1269	12.69	1.266
46	163.90	12.80	0.1272	12.72	1.265
47	167.90	12.96	0.1277	12.77	1.264
48	171.90	13.11	0.1279	12.79	1.263
49	175.90	13.26	0.1282	12.82	1.262
50	179.90	13.41	0.1284	12.84	1.262
51	183.90	13.56	0.1287	12.87	1.261
52	187.90	13.71	0.1289	12.89	1.260
53	191.90	13.85	0.1293	12.93	1.259
54	195.90	14.00	0.1298	12.98	1.258
55	199.90	14.14	0.1303	13.03	1.257
56	203.90	14.28	0.1309	13.09	1.255
57	207.90	14.42	0.1313	13.13	1.254
58	211.90	14.56	0.1316	13.16	1.253
59	215.90	14.69	0.1318	13.18	1.253
60	219.90	14.83	0.1319	13.19	1.253
61	223.90	14.96	0.1322	13.22	1.252
62	227.90	15.10	0.1325	13.25	1.251
63	231.90	15.23	0.1327	13.27	1.251
64	235.90	15.36	0.1329	13.29	1.250
65	239.90	15.49	0.133	13.30	1.250
66	243.90	15.62	0.1331	13.31	1.250
67	247.90	15.74	0.1333	13.33	1.249
68	251.90	15.87	0.1335	13.35	1.249
69	255.90	16.00	0.1336	13.36	1.248
70	259.43	16.11	0.1338	13.38	1.248

CONSOLIDATION TEST DATA

Project: IM-8-094(092)346
Boring No.: 1
Sample No.: SS-500-17
Test No.: CON-1-17

Location:
Tested By: Traeholt
Test Date: 9/28/2016
Sample Type: Shelby Tube

Project No.:
Checked By: Dietrich
Depth: 24.6-24.7
Elevation:

Soil Description: Total length 27 1/2" Brn Cly with White Silt Deposits
Remarks:

Load Increment: 8 of 10
Applied Stress: 4e+003 psf

	Elapsed Time min	Sq.Rt. of Time min	Displacement in	Strain %	Void Ratio
1	0.00	0.00	0.1331	13.31	1.249
2	0.15	0.39	0.1327	13.27	1.251
3	0.40	0.63	0.1319	13.19	1.253
4	0.90	0.95	0.1311	13.11	1.255
5	1.90	1.38	0.129	12.90	1.260
6	3.90	1.98	0.1272	12.72	1.265
7	7.90	2.81	0.1247	12.47	1.271
8	11.90	3.45	0.1227	12.27	1.277
9	15.90	3.99	0.1213	12.13	1.280
10	19.90	4.46	0.1198	11.98	1.284
11	23.90	4.89	0.1189	11.89	1.286
12	27.90	5.28	0.1179	11.79	1.289
13	31.90	5.65	0.1164	11.64	1.293
14	35.90	5.99	0.1155	11.55	1.295
15	37.71	6.14	0.1151	11.51	1.296

CONSOLIDATION TEST DATA

Project: IM-8-094(092)346
Boring No.: 1
Sample No.: SS-500-17
Test No.: CON-1-17

Location:
Tested By: Traeholt
Test Date: 9/28/2016
Sample Type: Shelby Tube

Project No.:
Checked By: Dietrich
Depth: 24.6-24.7
Elevation:

Soil Description: Total length 27 1/2" Brn Cly with White Silt Deposits
Remarks:

Load Increment: 9 of 10
Applied Stress: 1e+003 psf

	Elapsed Time min	Sq.Rt. of Time min	Displacement in	Strain %	Void Ratio
1	0.00	0.00	0.1153	11.53	1.296
2	0.15	0.39	0.115	11.50	1.296
3	0.40	0.63	0.1145	11.45	1.298
4	0.90	0.95	0.1137	11.37	1.300
5	1.90	1.38	0.1128	11.28	1.302
6	3.90	1.98	0.1107	11.07	1.308
7	7.90	2.81	0.1074	10.74	1.316
8	11.90	3.45	0.1059	10.59	1.320
9	12.18	3.49	0.1058	10.58	1.320

CONSOLIDATION TEST DATA

Project: IM-8-094(092)346
Boring No.: 1
Sample No.: SS-500-17
Test No.: CON-1-17

Location:
Tested By: Traeholt
Test Date: 9/28/2016
Sample Type: Shelby Tube

Project No.:
Checked By: Dietrich
Depth: 24.6-24.7
Elevation:

Soil Description: Total length 27 1/2" Brn Cly with White Silt Deposits
Remarks:

Load Increment: 10 of 10
Applied Stress: 250 psf

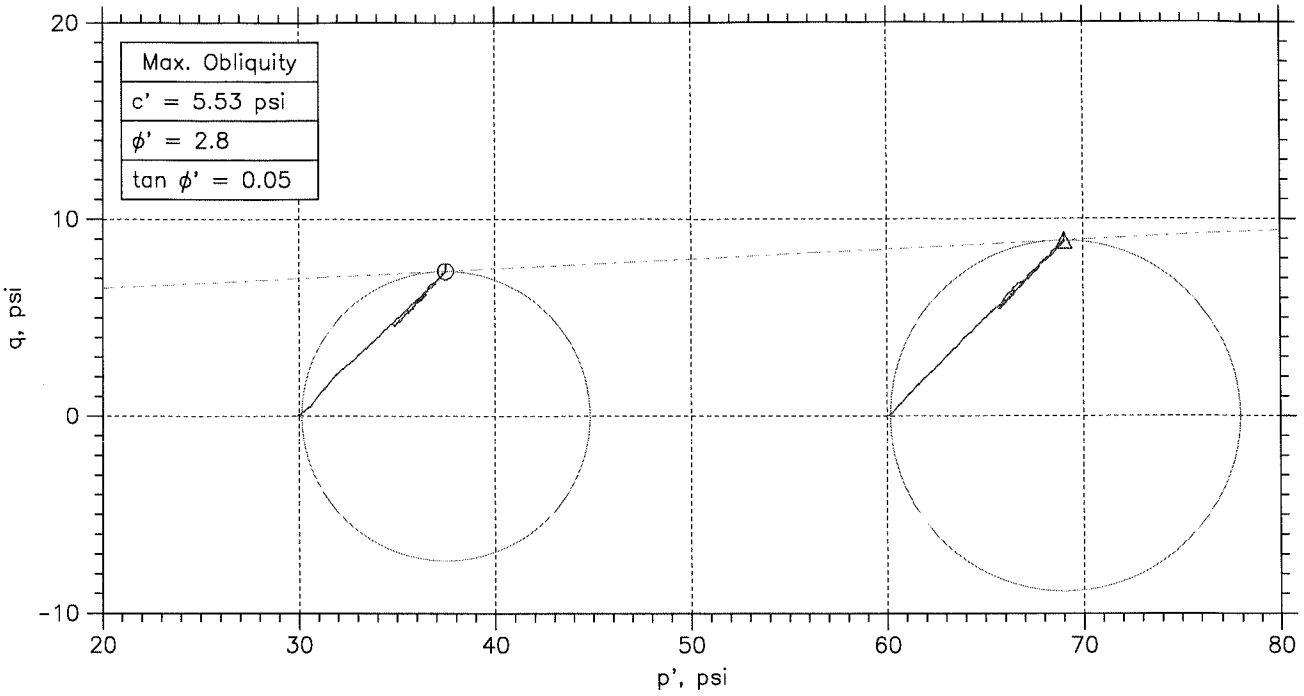
	Elapsed Time min	Sq.Rt. of Time min	Displacement in	Strain %	Void Ratio
1	0.00	0.00	0.1051	10.51	1.322
2	0.15	0.39	0.1048	10.48	1.323
3	0.40	0.63	0.1039	10.39	1.325
4	0.90	0.95	0.1031	10.31	1.327
5	1.90	1.38	0.102	10.20	1.330
6	3.90	1.98	0.1	10.00	1.335
7	7.90	2.81	0.09774	9.77	1.341
8	11.90	3.45	0.09448	9.45	1.350
9	15.90	3.99	0.09225	9.23	1.356
10	19.90	4.46	0.09058	9.06	1.360
11	23.90	4.89	0.08858	8.86	1.365
12	27.90	5.28	0.08686	8.69	1.369
13	31.90	5.65	0.08482	8.48	1.375
14	35.90	5.99	0.08328	8.33	1.379
15	39.90	6.32	0.08161	8.16	1.383
16	43.90	6.63	0.08045	8.04	1.386
17	47.90	6.92	0.07938	7.94	1.389
18	51.90	7.20	0.07803	7.80	1.392
19	55.90	7.48	0.07617	7.62	1.397
20	59.90	7.74	0.07492	7.49	1.400
21	63.90	7.99	0.07366	7.37	1.404
22	67.90	8.24	0.07241	7.24	1.407
23	71.90	8.48	0.07101	7.10	1.411
24	75.90	8.71	0.06999	7.00	1.413
25	79.90	8.94	0.06911	6.91	1.416
26	83.90	9.16	0.06822	6.82	1.418
27	87.90	9.38	0.06762	6.76	1.419
28	91.90	9.59	0.06702	6.70	1.421
29	95.90	9.79	0.06599	6.60	1.424
30	99.90	10.00	0.06413	6.41	1.428
31	103.90	10.19	0.06348	6.35	1.430
32	107.90	10.39	0.06288	6.29	1.432
33	111.90	10.58	0.06237	6.24	1.433
34	115.90	10.77	0.06181	6.18	1.434
35	119.90	10.95	0.06065	6.06	1.438
36	123.90	11.13	0.05986	5.99	1.440
37	127.90	11.31	0.05874	5.87	1.442
38	131.90	11.48	0.05828	5.83	1.444
39	135.90	11.66	0.05781	5.78	1.445
40	139.90	11.83	0.05707	5.71	1.447
41	143.90	12.00	0.05609	5.61	1.449
42	147.90	12.16	0.05554	5.55	1.451
43	151.90	12.32	0.0547	5.47	1.453
44	155.90	12.49	0.05405	5.40	1.455
45	159.90	12.65	0.05317	5.32	1.457
46	163.90	12.80	0.05275	5.27	1.458
47	167.90	12.96	0.05214	5.21	1.460
48	171.90	13.11	0.05135	5.14	1.462
49	175.90	13.26	0.05052	5.05	1.464
50	179.90	13.41	0.04973	4.97	1.466
51	183.90	13.56	0.04945	4.94	1.467
52	187.90	13.71	0.04912	4.91	1.467
53	191.90	13.85	0.04875	4.88	1.468
54	195.90	14.00	0.04791	4.79	1.471
55	199.90	14.14	0.04708	4.71	1.473
56	203.90	14.28	0.04661	4.66	1.474
57	207.90	14.42	0.0461	4.61	1.475
58	211.90	14.56	0.04559	4.56	1.477
59	215.90	14.69	0.04522	4.52	1.478
60	219.90	14.83	0.04466	4.47	1.479
61	223.90	14.96	0.0442	4.42	1.480
62	227.90	15.10	0.04383	4.38	1.481
63	231.90	15.23	0.04336	4.34	1.482
64	235.90	15.36	0.0429	4.29	1.484
65	239.90	15.49	0.04243	4.24	1.485
66	243.90	15.62	0.04187	4.19	1.486
67	247.90	15.74	0.04136	4.14	1.488
68	251.90	15.87	0.04094	4.09	1.489
69	255.90	16.00	0.04057	4.06	1.490
70	259.90	16.12	0.0402	4.02	1.491
71	263.90	16.25	0.03978	3.98	1.492
72	267.90	16.37	0.03946	3.95	1.492
73	271.90	16.49	0.03908	3.91	1.493
74	275.90	16.61	0.03834	3.83	1.495
75	279.90	16.73	0.03764	3.76	1.497
76	283.90	16.85	0.03727	3.73	1.498
77	287.90	16.97	0.03685	3.69	1.499
78	291.90	17.09	0.03639	3.64	1.500
79	295.90	17.20	0.03597	3.60	1.502
80	299.90	17.32	0.03579	3.58	1.502
81	303.90	17.43	0.03555	3.56	1.503

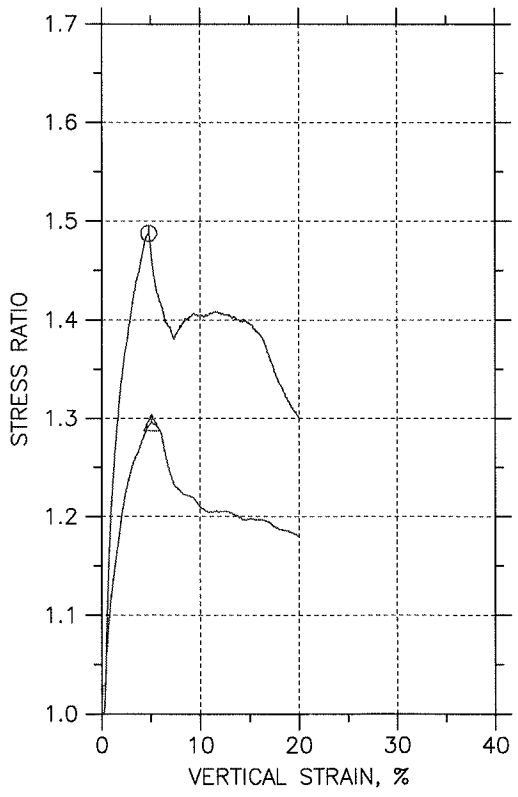
180	699.90	26.46	0.01571	1.57	1.554
181	703.90	26.53	0.01562	1.56	1.554
182	707.90	26.61	0.01552	1.55	1.555
183	711.90	26.68	0.01534	1.53	1.555
184	715.90	26.76	0.01524	1.52	1.555
185	719.90	26.83	0.0151	1.51	1.556
186	723.90	26.91	0.01496	1.50	1.556
187	727.90	26.98	0.01483	1.48	1.556
188	731.90	27.05	0.01473	1.47	1.557
189	735.90	27.13	0.01464	1.46	1.557
190	739.90	27.20	0.01445	1.45	1.557
191	743.90	27.27	0.01427	1.43	1.558
192	747.90	27.35	0.01408	1.41	1.558
193	751.90	27.42	0.0139	1.39	1.559
194	755.90	27.49	0.01385	1.38	1.559
195	759.90	27.57	0.01376	1.38	1.559
196	761.29	27.59	0.01376	1.38	1.559

82	307.90	17.55	0.03537	3.54	1.503
83	311.90	17.66	0.03513	3.51	1.504
84	315.90	17.77	0.03481	3.48	1.505
85	319.90	17.89	0.03458	3.46	1.505
86	323.90	18.00	0.03434	3.43	1.506
87	327.90	18.11	0.03393	3.39	1.507
88	331.90	18.22	0.03355	3.36	1.508
89	335.90	18.33	0.03323	3.32	1.509
90	339.90	18.44	0.03304	3.30	1.509
91	343.90	18.54	0.03258	3.26	1.510
92	347.90	18.65	0.03216	3.22	1.511
93	351.90	18.76	0.03165	3.16	1.513
94	355.90	18.87	0.03114	3.11	1.514
95	359.90	18.97	0.03091	3.09	1.515
96	363.90	19.08	0.03077	3.08	1.515
97	367.90	19.18	0.03044	3.04	1.516
98	371.90	19.28	0.03025	3.03	1.516
99	375.90	19.39	0.03012	3.01	1.517
100	379.90	19.49	0.02993	2.99	1.517
101	383.90	19.59	0.0297	2.97	1.518
102	387.90	19.70	0.0296	2.96	1.518
103	391.90	19.80	0.02951	2.95	1.518
104	395.90	19.90	0.02942	2.94	1.519
105	399.90	20.00	0.02928	2.93	1.519
106	403.90	20.10	0.02909	2.91	1.519
107	407.90	20.20	0.02877	2.88	1.520
108	411.90	20.30	0.02844	2.84	1.521
109	415.90	20.39	0.02816	2.82	1.522
110	419.90	20.49	0.02779	2.78	1.523
111	423.90	20.59	0.02742	2.74	1.524
112	427.90	20.69	0.027	2.70	1.525
113	431.90	20.78	0.02663	2.66	1.526
114	435.90	20.88	0.0264	2.64	1.526
115	439.90	20.97	0.02617	2.62	1.527
116	443.90	21.07	0.02598	2.60	1.527
117	447.90	21.16	0.02593	2.59	1.528
118	451.90	21.26	0.0257	2.57	1.528
119	455.90	21.35	0.02542	2.54	1.529
120	459.90	21.45	0.02528	2.53	1.529
121	463.90	21.54	0.0251	2.51	1.530
122	467.90	21.63	0.02486	2.49	1.530
123	471.90	21.72	0.02472	2.47	1.531
124	475.90	21.82	0.02458	2.46	1.531
125	479.90	21.91	0.0244	2.44	1.532
126	483.90	22.00	0.02417	2.42	1.532
127	487.90	22.09	0.02389	2.39	1.533
128	491.90	22.18	0.0237	2.37	1.533
129	495.90	22.27	0.02361	2.36	1.534
130	499.90	22.36	0.02356	2.36	1.534
131	503.90	22.45	0.02342	2.34	1.534
132	507.90	22.54	0.02333	2.33	1.534
133	511.90	22.63	0.02314	2.31	1.535
134	515.90	22.71	0.02296	2.30	1.535
135	519.90	22.80	0.02282	2.28	1.536
136	523.90	22.89	0.02259	2.26	1.536
137	527.90	22.98	0.02259	2.26	1.536
138	531.90	23.06	0.02245	2.24	1.537
139	535.90	23.15	0.02221	2.22	1.537
140	539.90	23.24	0.02184	2.18	1.538
141	543.90	23.32	0.02161	2.16	1.539
142	547.90	23.41	0.02133	2.13	1.540
143	551.90	23.49	0.0211	2.11	1.540
144	555.90	23.58	0.02087	2.09	1.541
145	559.90	23.66	0.0205	2.05	1.542
146	563.90	23.75	0.02031	2.03	1.542
147	567.90	23.83	0.02012	2.01	1.543
148	571.90	23.91	0.01989	1.99	1.543
149	575.90	24.00	0.0198	1.98	1.544
150	579.90	24.08	0.01966	1.97	1.544
151	583.90	24.16	0.01952	1.95	1.544
152	587.90	24.25	0.01938	1.94	1.545
153	591.90	24.33	0.01929	1.93	1.545
154	595.90	24.41	0.01919	1.92	1.545
155	599.90	24.49	0.01905	1.91	1.545
156	603.90	24.57	0.01896	1.90	1.546
157	607.90	24.66	0.01882	1.88	1.546
158	611.90	24.74	0.01873	1.87	1.546
159	615.90	24.82	0.01859	1.86	1.547
160	619.90	24.90	0.0184	1.84	1.547
161	623.90	24.98	0.01836	1.84	1.547
162	627.90	25.06	0.01831	1.83	1.547
163	631.90	25.14	0.01822	1.82	1.548
164	635.90	25.22	0.01808	1.81	1.548
165	639.90	25.30	0.01789	1.79	1.548
166	643.90	25.38	0.01771	1.77	1.549
167	647.90	25.45	0.01757	1.76	1.549
168	651.90	25.53	0.01743	1.74	1.550
169	655.90	25.61	0.01738	1.74	1.550
170	659.90	25.69	0.0172	1.72	1.550
171	663.90	25.77	0.01706	1.71	1.551
172	667.90	25.84	0.01687	1.69	1.551
173	671.90	25.92	0.01678	1.68	1.551
174	675.90	26.00	0.01668	1.67	1.552
175	679.90	26.07	0.01659	1.66	1.552
176	683.90	26.15	0.01645	1.65	1.552
177	687.90	26.23	0.01631	1.63	1.553
178	691.90	26.30	0.01613	1.61	1.553
179	695.90	26.38	0.01599	1.60	1.553

SS-504-17

Test File

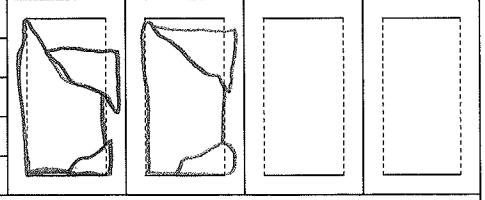




Symbol		⏀	△		
Sample No.		SS-504-17	SS-504-17		
Test No.		UU-23-17	UU-24-17		
Depth		36.0	36.0		
Initial	Diameter, in	2.798	2.796		
	Height, in	5.734	5.734		
	Water Content, %	54.7	57.5		
	Dry Density, pcf	68.46	67.51		
	Saturation, %	102.4	105.1		
	Void Ratio	1.42	1.45		
Before Shear	Water Content, %	53.3	54.4		
	Dry Density, pcf	68.56	67.76		
	Saturation*, %	100.0	100.0		
	Void Ratio	1.41	1.44		
	Back Press., psi	.0	.0		
Ver. Eff. Cons. Stress, psi		29.95	59.96		
Shear Strength, psi		7.345	8.879		
Strain at Failure, %		4.8	5.1		
Strain Rate, %/min		1	1		
B-Value		---	---		
Estimated Specific Gravity		2.65	2.65		
Liquid Limit		---	---		
Plastic Limit		---	---		

NDDOT
North Dakota Department of Transportation

Project: IM-8-094(092)346
Location:
Project No.:
Boring No.: 1
Sample Type:
Description: T.L. 28" Gry Cly, Slicken Sided
Remarks: 34.4-34.9



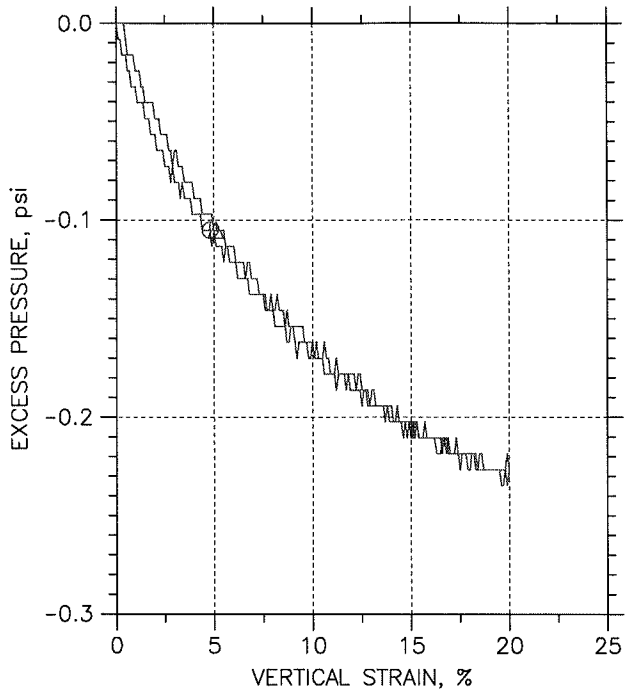
Phase calculations based on start and end of test.

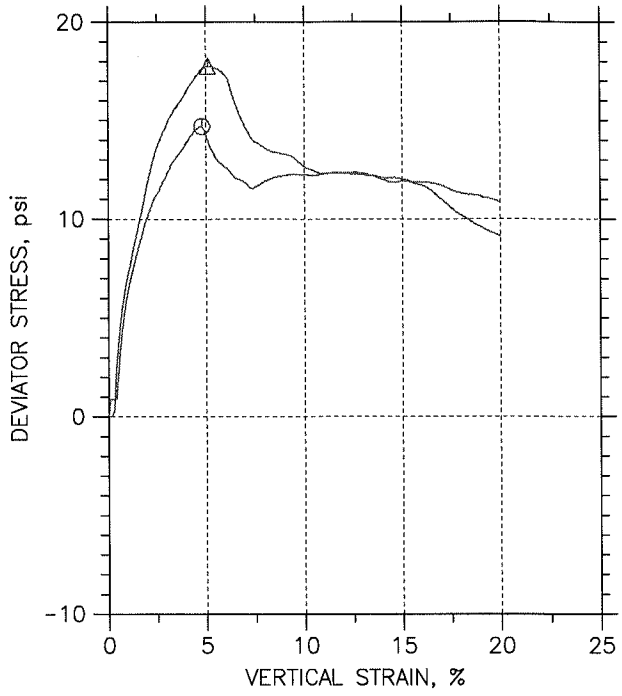
Tue, 17-OCT-2017 08:14:26

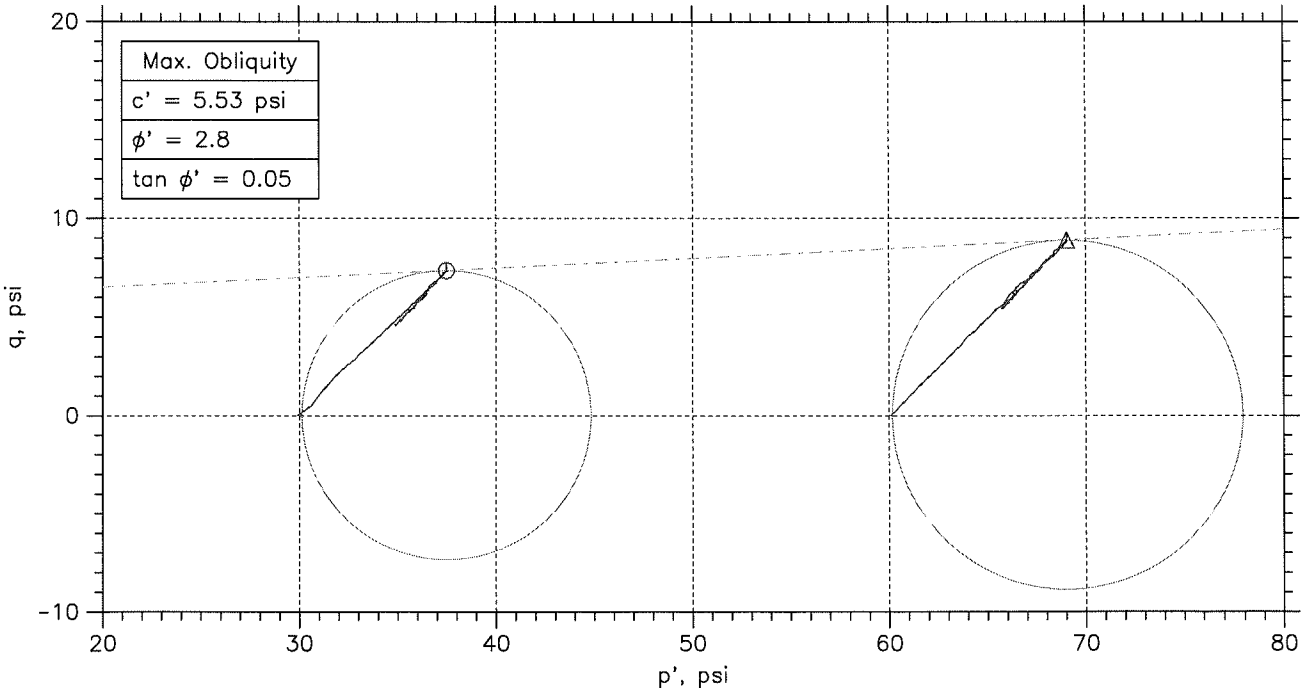
* Saturation is set to 100% for phase calculations.

SS-504-17

Test File







	Sample No.	Test No.	Depth	Tested By	Test Date	Checked By	Check Date	Test File
⊙	SS-504-17	UU-23-17	36.0	DT	10/4/2017	MD		UU-23-2017.dat
△	SS-504-17	UU-24-17	36.0	DT	10/4/2017	MD		UU-24-2017.dat

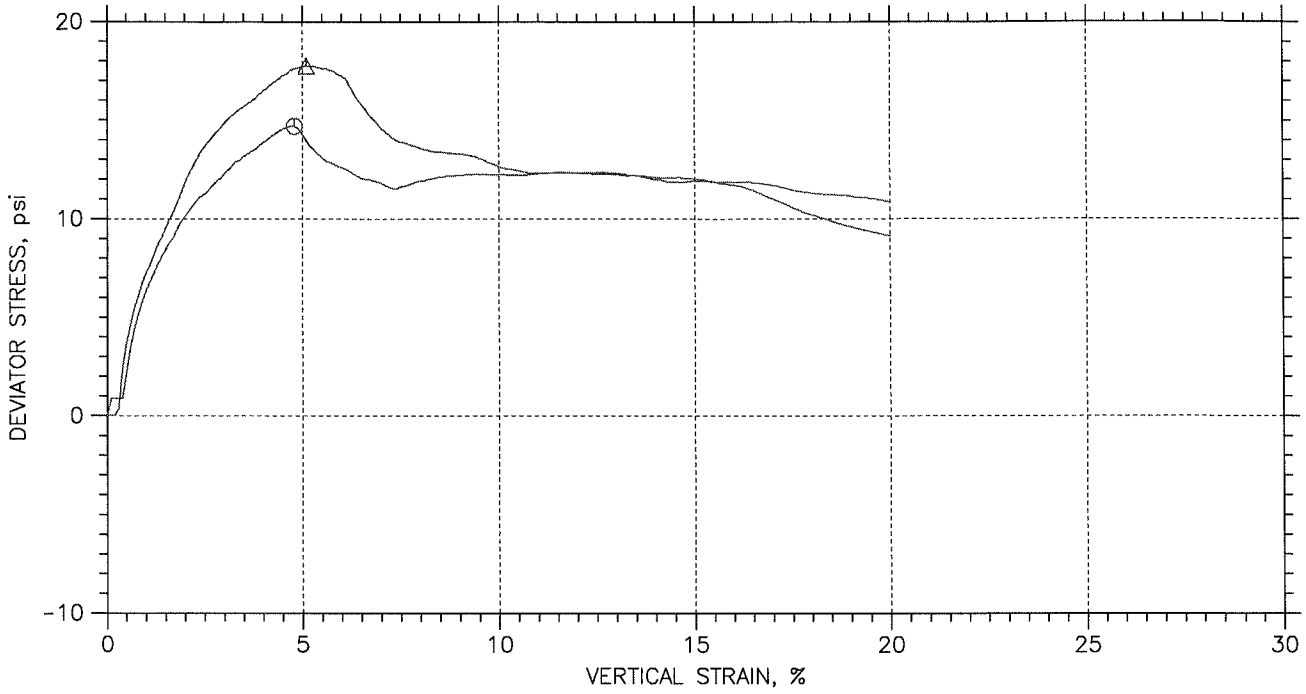
NDDOT
North Dakota Department of Transportation

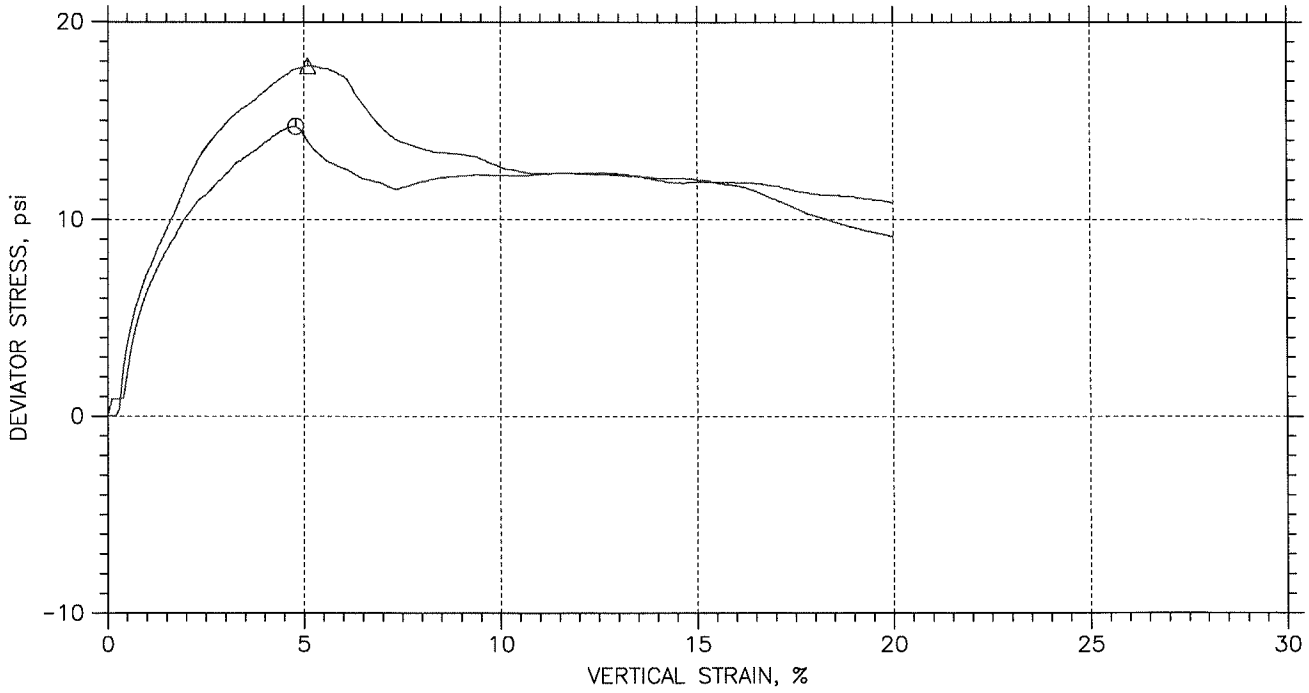
Project: IM-8-094(092)346	Location:	Project No.:
Boring No.: 1	Sample Type:	
Description: T.L. 28" Gry Cly, Slicken Sided		
Remarks: 34.4-34.9		

Tue, 17-OCT-2017 08:14:26

55-504-17

Test File





	Sample No.	Test No.	Depth	Tested By	Test Date	Checked By	Check Date	Test File
⊙	SS-504-17	UU-23-17	36.0	DT	10/4/2017	MD		UU-23-2017.dat
△	SS-504-17	UU-24-17	36.0	DT	10/4/2017	MD		UU-24-2017.dat

NDDOT North Dakota Department of Transportation

Project: IM-8-094(092)346	Location:	Project No.:
Boring No.: 1	Sample Type:	
Description: T.L. 28" Gry Cly, Slicken Sided		
Remarks: 34.4-34.9		

Tue, 17-OCT-2017 08:14:26

TRIAXIAL TEST

Project: IM-8-094(092)346
Boring No.: 1
Sample No.: SS-504-17
Test No.: UU-23-17

Location:
Tested By: DT
Test Date: 10/4/2017
Sample Type:

Project No.:
Checked By: MD
Depth: 36.0
Elevation:

Soil Description: T.L. 28" Gry Cly, Slicken Sided
Remarks: 34.4-34.9

Specimen Height: 5.73 in
Specimen Area: 6.15 in^2
Specimen Volume: 577.76 cc

Piston Area: 0.21 in^2
Piston Friction: 0.00 lb
Piston Weight: 0.00 lb

Filter Strip Correction: 0.00 psi
Membrane Correction: 4.20 lb/in
Correction Type: Uniform

Liquid Limit: ---

Plastic Limit: ---

Estimated Specific Gravity: 2.65

	Before Test Trimmings	Before Test Specimen	After Test Specimen	After Test Trimmings
Container ID	S 2	---		
Wt. Container + Wet Soil, gm	73.52	---	---	0
Wt. Container + Dry Soil, gm	53.62	---	---	0
Wt. Container, gm	17.27	---	---	0
Wt. Wet Soil, gm	56.25	980.47	633.6	0
Wt. Dry Soil, gm	36.35	633.6	633.6	0
Wt. Water, gm	19.9	346.87	0	0
Water Content, %	54.75	54.75	0.00	0.00
Void Ratio	---	1.42	1.41	---
Degree of Saturation, %	---	102.42	0.00	---
Dry Unit Weight, pcf	---	68.462	68.559	---

Initial

Height: 5.734 in
Area: 6.1487 in^2
Volume: 577.76 cc

Moisture: 54.75 %
Void Ratio: 1.42
Dry Unit Weight: 68.462 pcf
Saturation: 102.42 %

End of Initialization
Time: 11.063 min
Total Vertical Stress: 29.946 psi
Total Horizontal Stress: 29.979 psi
Pore Pressure: 0 psi
Effective Vertical Stress: 29.946 psi
Effective Horizontal Stress: 29.979 psi

Height Change: 0.0026955 in
Area Change: 0 in^2
Volume Change: 0.81479 cc
Water Change: -0.29604 cc
Correction: 9.3187 cc

Height: 5.7313 in
Area: 6.1487 in^2
Volume: 576.94 cc

Moisture: 53.32 %
Void Ratio: 1.41
Dry Unit Weight: 68.559 pcf
Saturation: 100.00 %

End of Consolidation/A
Time: 11.063 min
Total Vertical Stress: 29.946 psi
Total Horizontal Stress: 29.979 psi
Pore Pressure: 0 psi
Effective Vertical Stress: 29.946 psi
Effective Horizontal Stress: 29.979 psi

Height Change: 0.0026955 in
Area Change: 0 in^2
Volume Change: 0.81479 cc
Water Change: -0.29604 cc
Correction: 9.3187 cc

Height: 5.7313 in
Area: 6.1487 in^2
Volume: 576.94 cc

Moisture: 53.32 %
Void Ratio: 1.41
Dry Unit Weight: 68.559 pcf
Saturation: 100.00 %

End of Saturation
Time: 11.063 min
Total Vertical Stress: 29.946 psi
Total Horizontal Stress: 29.979 psi
Pore Pressure: 0 psi
Effective Vertical Stress: 29.946 psi
Effective Horizontal Stress: 29.979 psi

Height Change: 0.0026955 in
Area Change: 0 in^2
Volume Change: 0.81479 cc
Water Change: -0.29604 cc
Correction: 9.3187 cc

Height: 5.7313 in
Area: 6.1487 in^2
Volume: 576.94 cc

Moisture: 53.32 %
Void Ratio: 1.41
Dry Unit Weight: 68.559 pcf
Saturation: 100.00 %

End of Consolidation/B
Time: 11.063 min
Total Vertical Stress: 29.946 psi
Total Horizontal Stress: 29.979 psi
Pore Pressure: 0 psi
Effective Vertical Stress: 29.946 psi
Effective Horizontal Stress: 29.979 psi

Height Change: 0.0026955 in
Area Change: 0 in^2
Volume Change: 0.81479 cc
Water Change: -0.29604 cc
Correction: 9.3187 cc

Height: 5.7313 in
Area: 6.1487 in^2
Volume: 576.94 cc

Moisture: 53.32 %
Void Ratio: 1.41
Dry Unit Weight: 68.559 pcf
Saturation: 100.00 %

End of Shear
Time: 31.298 min
Total Vertical Stress: 39.236 psi
Total Horizontal Stress: 30.092 psi
Pore Pressure: -0.22671 psi
Effective Vertical Stress: 39.462 psi
Effective Horizontal Stress: 30.319 psi

Height Change: 1.1491 in
Area Change: -1.5302 in^2
Volume Change: 0.81479 cc
Water Change: -0.29604 cc
Correction: 347.16 cc

Height: 4.5849 in
Area: 7.6789 in^2
Volume: 576.94 cc

Moisture: 0.00 %
Void Ratio: 1.41
Dry Unit Weight: 68.559 pcf
Saturation: 0.00 %

At Failure
Time: 15.952 min
Total Vertical Stress: 44.726 psi
Total Horizontal Stress: 30.036 psi
Pore Pressure: -0.10526 psi
Effective Vertical Stress: 44.831 psi
Effective Horizontal Stress: 30.141 psi

Height Change: 0.27796 in
Area Change: -0.31656 in^2
Volume Change: 0.81479 cc
Water Change: -0.29604 cc
Correction: 0 cc

Height: 5.456 in
Area: 6.4653 in^2
Volume: 576.94 cc

Moisture: 53.32 %
Void Ratio: 1.41
Dry Unit Weight: 68.559 pcf
Saturation: 100.00 %

SS-504-17

TRIAXIAL TEST

Project: IM-8-094(092)346
Boring No.: 1
Sample No.: SS-504-17
Test No.: UU-24-17

Location:
Tested By: DT
Test Date: 10/4/2017
Sample Type:

Project No.:
Checked By: MD
Depth: 36.0
Elevation:

Soil Description: T.L. 28" Gry Cly, Slicken Sided
Remarks: 34.9-35.4

Specimen Height: 5.73 in
Specimen Area: 6.14 in^2
Specimen Volume: 576.93 cc

Piston Area: 0.21 in^2
Piston Friction: 0.00 lb
Piston Weight: 0.00 lb

Filter Strip Correction: 0.00 psi
Membrane Correction: 4.20 lb/in
Correction Type: Uniform

Liquid Limit: ---

Plastic Limit: ---

Estimated Specific Gravity: 2.65

	Before Test Trimmings	Before Test Specimen	After Test Specimen	After Test Trimmings
Container ID	S 24	---		
Wt. Container + Wet Soil, gm	75.61	---	---	0
Wt. Container + Dry Soil, gm	54.15	---	---	0
Wt. Container, gm	16.84	---	---	0
Wt. Wet Soil, gm	58.77	982.71	623.87	0
Wt. Dry Soil, gm	37.31	623.87	623.87	0
Wt. Water, gm	21.46	358.84	0	0
Water Content, %	57.52	57.52	0.00	0.00
Void Ratio	---	1.45	1.44	---
Degree of Saturation, %	---	105.08	0.00	---
Dry Unit Weight, pcf	---	67.507	67.763	---

Initial

Height: 5.734 in
Area: 6.1399 in^2
Volume: 576.93 cc

Moisture: 57.52 %
Void Ratio: 1.45
Dry Unit Weight: 67.507 pcf
Saturation: 105.08 %

End of Initialization
Time: 11.085 min
Total Vertical Stress: 59.961 psi
Total Horizontal Stress: 59.966 psi
Pore Pressure: 0 psi
Effective Vertical Stress: 59.961 psi
Effective Horizontal Stress: 59.966 psi

Height Change: 0.0072035 in
Area Change: 0 in^2
Volume Change: 2.1744 cc
Water Change: -0.31803 cc
Correction: 19.824 cc

Height: 5.7268 in
Area: 6.1399 in^2
Volume: 574.76 cc

Moisture: 54.39 %
Void Ratio: 1.44
Dry Unit Weight: 67.763 pcf
Saturation: 100.00 %

End of Consolidation/A
Time: 11.085 min
Total Vertical Stress: 59.961 psi
Total Horizontal Stress: 59.966 psi
Pore Pressure: 0 psi
Effective Vertical Stress: 59.961 psi
Effective Horizontal Stress: 59.966 psi

Height Change: 0.0072035 in
Area Change: 0 in^2
Volume Change: 2.1744 cc
Water Change: -0.31803 cc
Correction: 19.824 cc

Height: 5.7268 in
Area: 6.1399 in^2
Volume: 574.76 cc

Moisture: 54.39 %
Void Ratio: 1.44
Dry Unit Weight: 67.763 pcf
Saturation: 100.00 %

End of Saturation
Time: 11.085 min
Total Vertical Stress: 59.961 psi
Total Horizontal Stress: 59.966 psi
Pore Pressure: 0 psi
Effective Vertical Stress: 59.961 psi
Effective Horizontal Stress: 59.966 psi

Height Change: 0.0072035 in
Area Change: 0 in^2
Volume Change: 2.1744 cc
Water Change: -0.31803 cc
Correction: 19.824 cc

Height: 5.7268 in
Area: 6.1399 in^2
Volume: 574.76 cc

Moisture: 54.39 %
Void Ratio: 1.44
Dry Unit Weight: 67.763 pcf
Saturation: 100.00 %

End of Consolidation/B
Time: 11.085 min
Total Vertical Stress: 59.961 psi
Total Horizontal Stress: 59.966 psi
Pore Pressure: 0 psi
Effective Vertical Stress: 59.961 psi
Effective Horizontal Stress: 59.966 psi

Height Change: 0.0072035 in
Area Change: 0 in^2
Volume Change: 2.1744 cc
Water Change: -0.31803 cc
Correction: 19.824 cc

Height: 5.7268 in
Area: 6.1399 in^2
Volume: 574.76 cc

Moisture: 54.39 %
Void Ratio: 1.44
Dry Unit Weight: 67.763 pcf
Saturation: 100.00 %

End of Shear
Time: 31.299 min
Total Vertical Stress: 70.971 psi
Total Horizontal Stress: 60.072 psi
Pore Pressure: -0.2348 psi
Effective Vertical Stress: 71.205 psi
Effective Horizontal Stress: 60.306 psi

Height Change: 1.1526 in
Area Change: -1.5158 in^2
Volume Change: 2.1744 cc
Water Change: -0.31803 cc
Correction: 359.16 cc

Height: 4.5814 in
Area: 7.6557 in^2
Volume: 574.76 cc

Moisture: 0.00 %
Void Ratio: 1.44
Dry Unit Weight: 67.763 pcf
Saturation: 0.00 %

At Failure
Time: 16.267 min
Total Vertical Stress: 77.813 psi
Total Horizontal Stress: 60.055 psi
Pore Pressure: -0.11335 psi
Effective Vertical Stress: 77.926 psi
Effective Horizontal Stress: 60.169 psi

Height Change: 0.29953 in
Area Change: -0.34198 in^2
Volume Change: 2.1744 cc
Water Change: -0.31803 cc
Correction: 0 cc

Height: 5.4345 in
Area: 6.4819 in^2
Volume: 574.76 cc

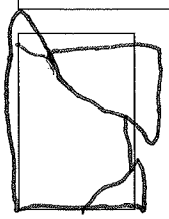
Moisture: 54.39 %
Void Ratio: 1.44
Dry Unit Weight: 67.763 pcf
Saturation: 100.00 %

TRIAXIAL UU(Q) CCU(R) CD(S)

North Dakota Department of Transportation, Materials & Research
SFN 50459 (10-2016)

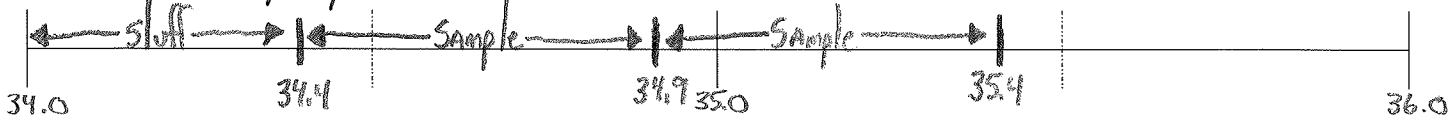
Project Number	
IM-8-094(090)346	
Boring Number	
1	

Field Sample Number			Lab Number		Depth	
SS-504-17			UU-23-17		34.4 to 34.9	
Weight of Sample	After Test Weight		Confining Pressure		Test Number	of
980.47			30.0		1	2
Diameter			Height		Moisture Can Number	After Moisture Can Number
	2.768	2.818		5.735	S2	
	2.781	2.821		5.730	Wet Wt + Can 73.52	Wet Wt + Can
	2.789	2.809		5.736	Dry Wt + Can 53.62	Dry Wt + Can
	Average 2.798		Average 5.734		Wt of Can 17.27	Wt of Can

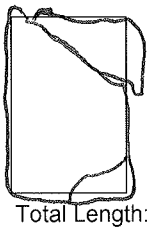


Total Length:

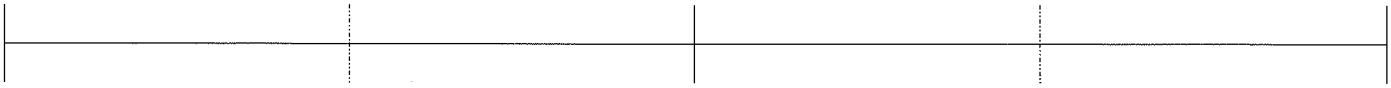
28" Gray Cly, slickensided



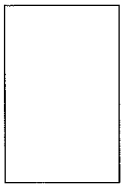
Field Sample Number			Lab Number		Depth	
SS-504-17			UU-24-17		34.9 to 35.4	
Weight of Sample	After Test Weight		Confining Pressure		Test Number	of
982.71			60.0		2	2
Diameter			Height		Moisture Can Number	After Moisture Can Number
	2.774	2.827		5.734	S24	
	2.774	2.826		5.734	Wet Wt + Can 75.61	Wet Wt + Can
	2.761	2.813		5.735	Dry Wt + Can 54.15	Dry Wt + Can
	Average 2.796		Average 5.734		Wt of Can 16.84	Wt of Can



Total Length:



Field Sample Number			Lab Number		Depth	
Weight of Sample	After Test Weight		Confining Pressure		Test Number	of
Diameter			Height		Moisture Can Number	After Moisture Can Number
					Wet Wt + Can	Wet Wt + Can
					Dry Wt + Can	Dry Wt + Can
	Average		Average		Wt of Can	Wt of Can

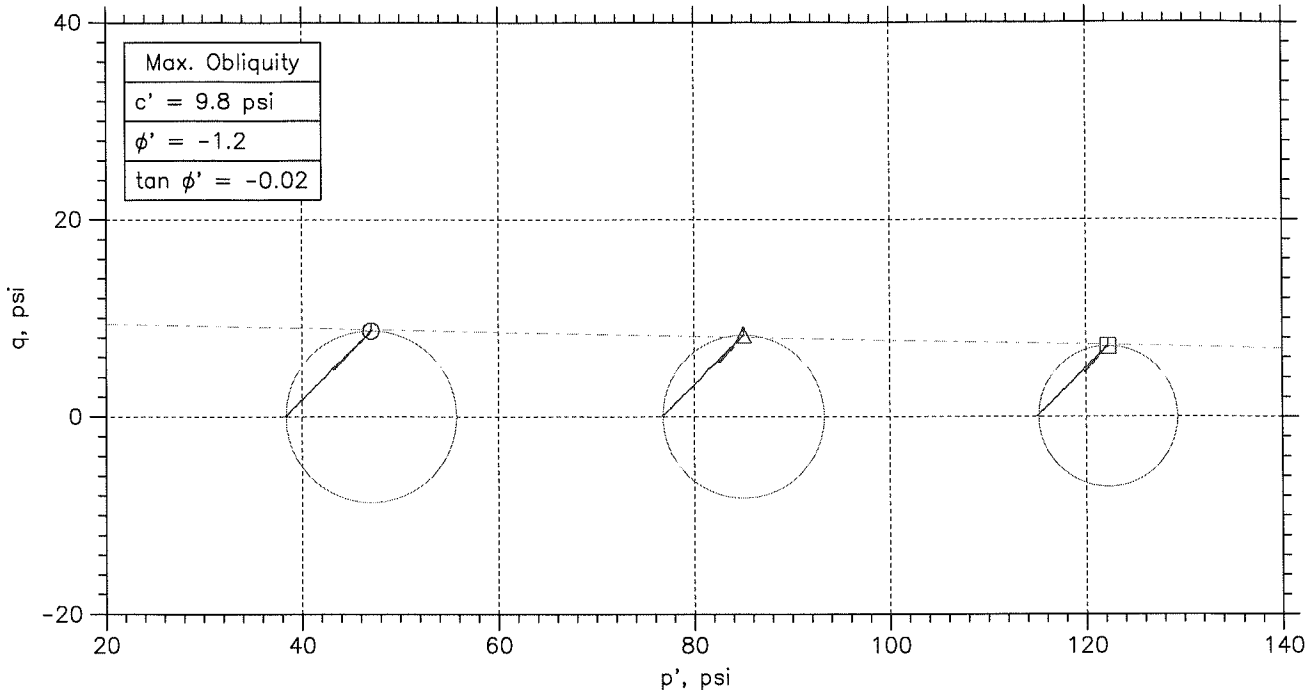


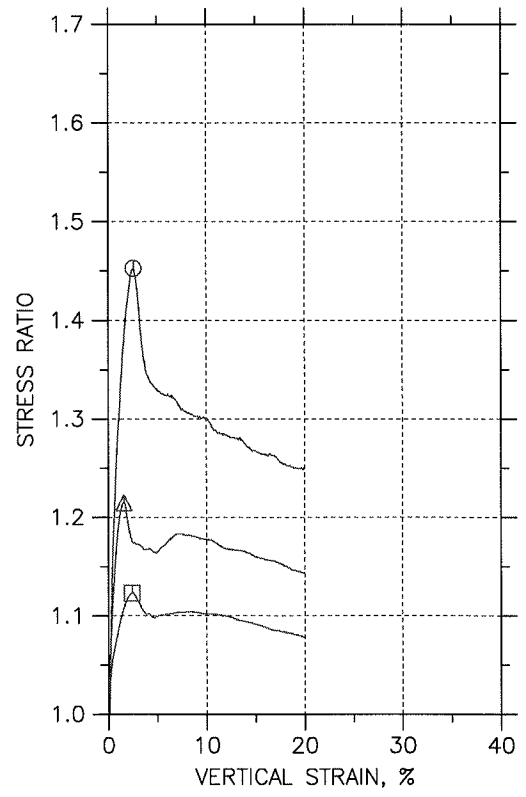
Total Length:

AASHTO T-234 Tested By:

SS-508-17

Test File





Symbol		⏲	△	⏍	
Sample No.		SS-508-17	SS-508-17	SS-508-17	
Test No.		UU-25-17	UU-26-17	UU-27-17	
Depth		46.0	46.0	46.0	
Initial	Diameter, in	2.854	2.848	2.843	
	Height, in	5.736	5.746	5.748	
	Water Content, %	65.4	57.8	59.0	
	Dry Density, pcf	62.62	66.49	66.88	
	Saturation, %	105.6	102.9	106.0	
	Void Ratio	1.64	1.49	1.47	
Before Shear	Water Content, %	61.9	56.1	55.4	
	Dry Density, pcf	62.67	66.52	67.03	
	Saturation*, %	100.0	100.0	100.0	
	Void Ratio	1.64	1.49	1.47	
	Back Press., psi	.0	.0	-.008097	
Ver. Eff. Cons. Stress, psi		38.27	76.66	115.	
Shear Strength, psi		8.683	8.242	7.096	
Strain at Failure, %		2.6	1.6	2.4	
Strain Rate, %/min		1	1	1	
B-Value		---	---	---	
Estimated Specific Gravity		2.65	2.65	2.65	
Liquid Limit		---	---	---	
Plastic Limit		---	---	---	

NDDOT North Dakota Department of Transportation

Project: IM-8-094(092)346

Location:

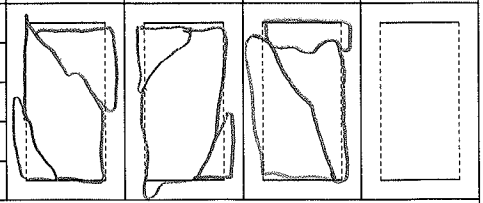
Project No.:

Boring No.: 1

Sample Type:

Description: T.L. 25 3/4" Brn Cly,SLICKEN SIDED

Remarks: 44.3-44.8



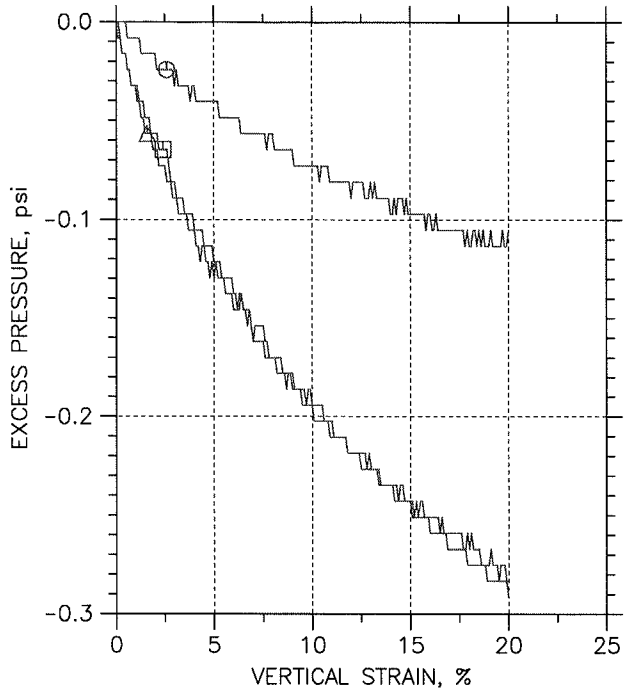
Phase calculations based on start and end of test.

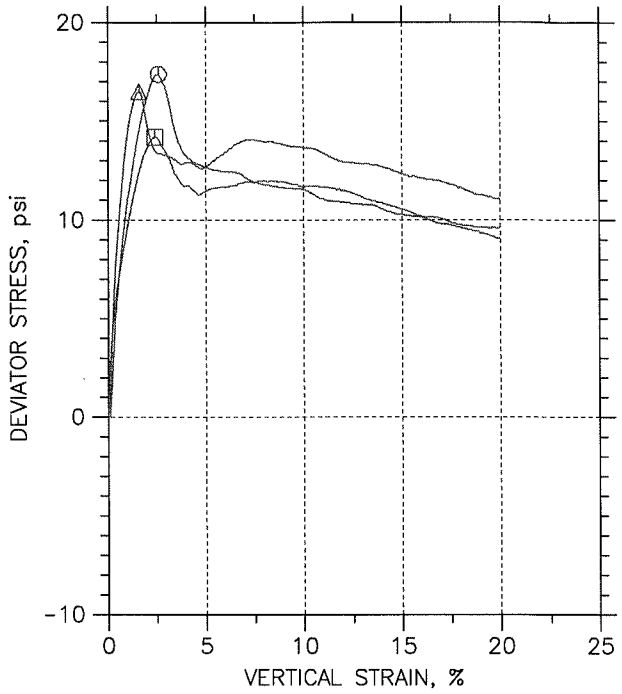
* Saturation is set to 100% for phase calculations.

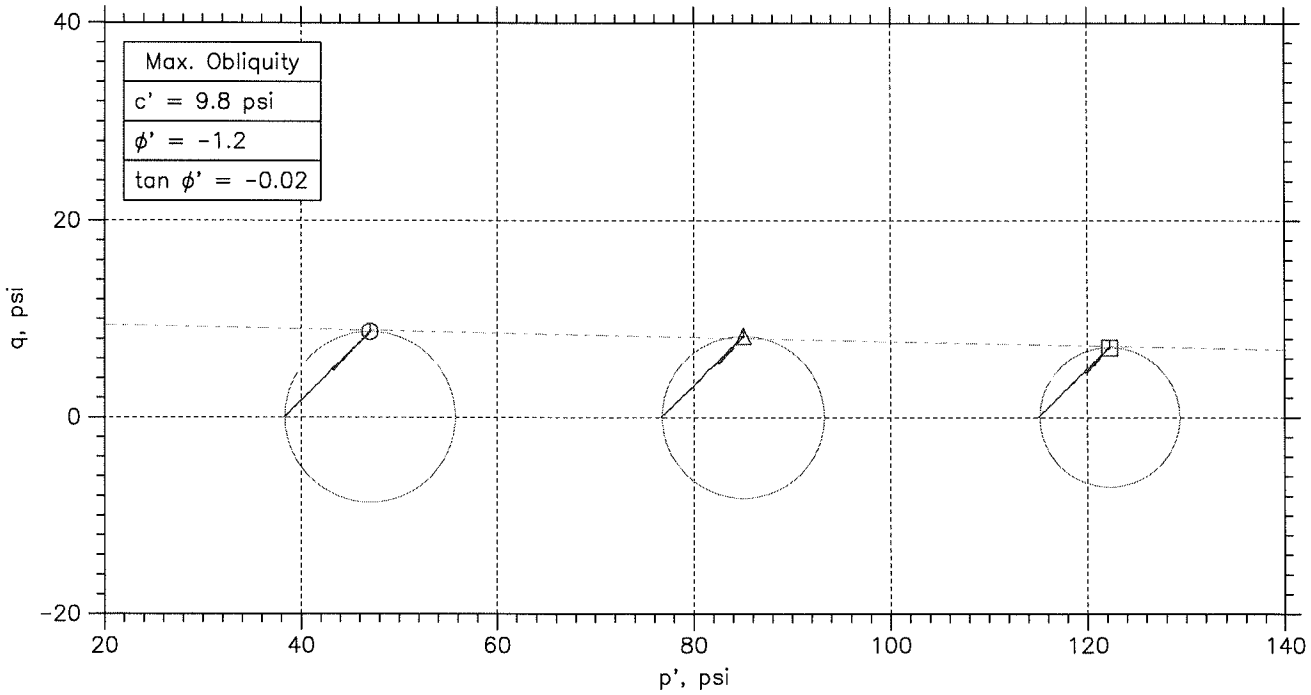
Tue, 17-OCT-2017 08:20:30

55-508-17

Test File







	Sample No.	Test No.	Depth	Tested By	Test Date	Checked By	Check Date	Test File
⊙	SS-508-17	UU-25-17	46.0	DT	10/12/2017	MD		UU-25-2017.dat
△	SS-508-17	UU-26-17	46.0	DT	10/12/2017	MD		UU-26-2017.dat
⊡	SS-508-17	UU-27-17	46.0	DT	10/12/2017	MD		UU-27-2017.dat

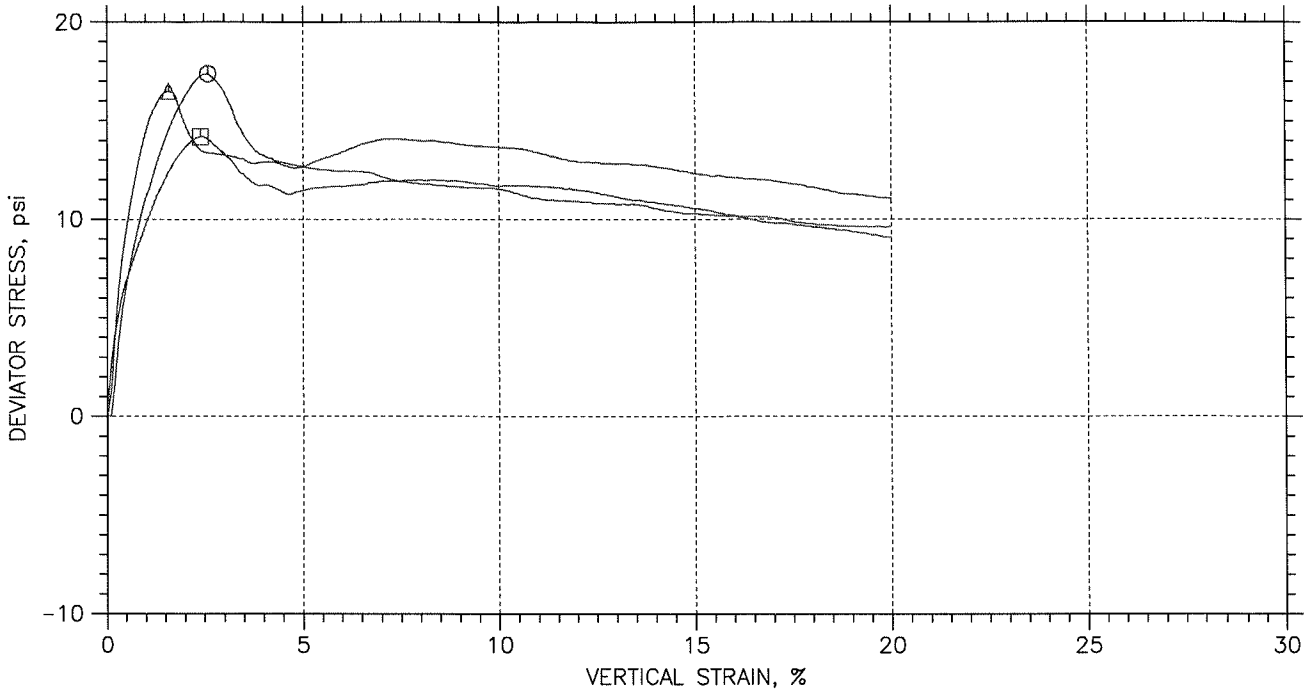
NDDOT
North Dakota Department of Transportation

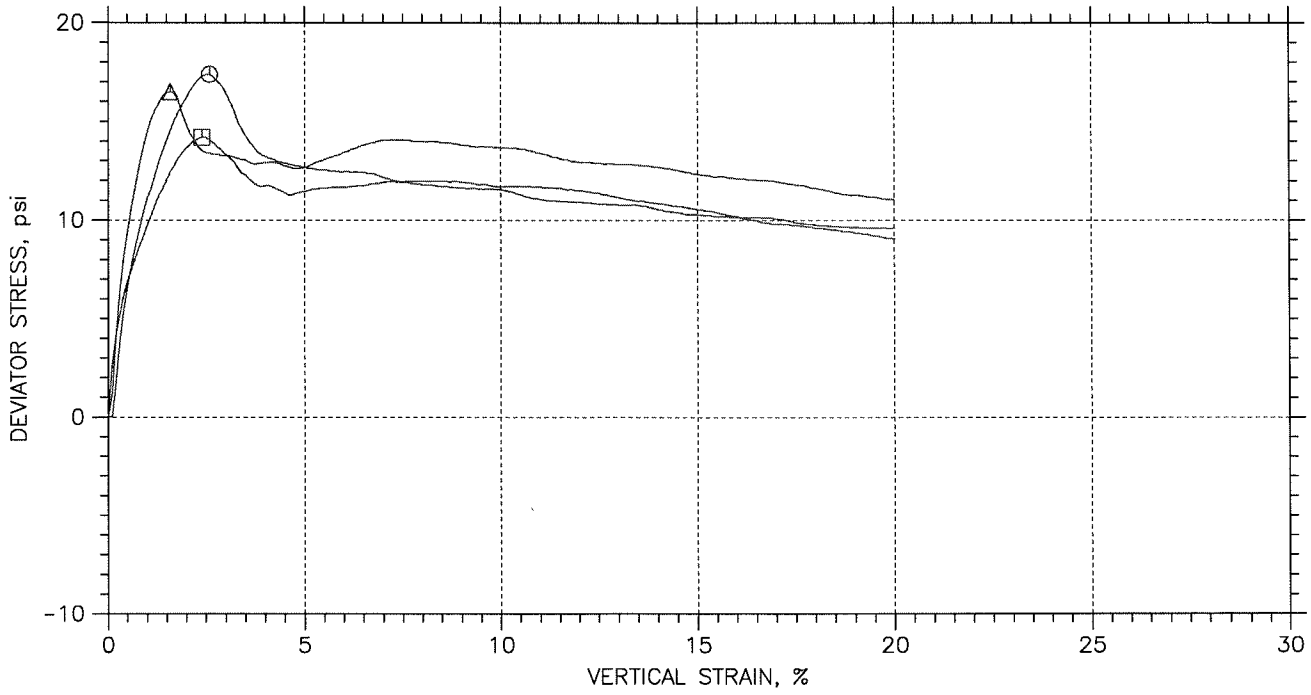
Project: IM-8-094(092)346	Location:	Project No.:
Boring No.: 1	Sample Type:	
Description: T.L. 25 3/4" Brn Cly,SLICKEN SIDED		
Remarks: 44.3-44.8		

Tue, 17-OCT-2017 08:20:30

SS-508-17

Test File





	Sample No.	Test No.	Depth	Tested By	Test Date	Checked By	Check Date	Test File
⊙	SS-508-17	UU-25-17	46.0	DT	10/12/2017	MD		UU-25-2017.dat
△	SS-508-17	UU-26-17	46.0	DT	10/12/2017	MD		UU-26-2017.dat
⊡	SS-508-17	UU-27-17	46.0	DT	10/12/2017	MD		UU-27-2017.dat

NDDOT
North Dakota Department of Transportation

Project: IM-8-094(092)346	Location:	Project No.:
Boring No.: 1	Sample Type:	
Description: T.L. 25 3/4" Brn Cly,SLICKEN SIDED		
Remarks: 44.3-44.8		

Tue, 17-OCT-2017 08:20:30

TRIAXIAL TEST

Project: IM-8-094(092)346
Boring No.: 1
Sample No.: SS-508-17
Test No.: UU-25-17

Location:
Tested By: DT
Test Date: 10/12/2017
Sample Type:

Project No.:
Checked By: MD
Depth: 46.0
Elevation:

Soil Description: T.L. 25 3/4" Brn Cly,SLICKEN SIDED
Remarks: 44.3-44.8

Specimen Height: 5.74 in
Specimen Area: 6.40 in^2
Specimen Volume: 601.32 cc

Piston Area: 0.21 in^2
Piston Friction: 0.00 lb
Piston Weight: 0.00 lb

Filter Strip Correction: 0.00 psi
Membrane Correction: 4.20 lb/in
Correction Type: Uniform

Liquid Limit: ---

Plastic Limit: ---

Estimated Specific Gravity: 2.65

	Before Test Trimmings	Before Test Specimen	After Test Specimen	After Test Trimmings
Container ID	S 23	---		
Wt. Container + Wet Soil, gm	84.26	---	---	0
Wt. Container + Dry Soil, gm	57.68	---	---	0
Wt. Container, gm	17.05	---	---	0
Wt. Wet Soil, gm	67.21	997.77	603.18	0
Wt. Dry Soil, gm	40.63	603.18	603.18	0
Wt. Water, gm	26.58	394.59	0	0
Water Content, %	65.42	65.42	0.00	0.00
Void Ratio	---	1.64	1.64	---
Degree of Saturation, %	---	105.59	0.00	---
Dry Unit Weight, pcf	---	62.62	62.669	---

Initial

Height: 5.736 in
Area: 6.3973 in^2
Volume: 601.32 cc

Moisture: 65.42 %
Void Ratio: 1.64
Dry Unit Weight: 62.62 pcf
Saturation: 105.59 %

End of Initialization
Time: 11.099 min
Total Vertical Stress: 38.27 psi
Total Horizontal Stress: 38.267 psi
Pore Pressure: 0 psi
Effective Vertical Stress: 38.27 psi
Effective Horizontal Stress: 38.267 psi

Height Change: 0.0014872 in
Area Change: 0 in^2
Volume Change: 0.46772 cc
Water Change: -0.192 cc
Correction: 21.544 cc

Height: 5.7345 in
Area: 6.3973 in^2
Volume: 600.86 cc

Moisture: 61.88 %
Void Ratio: 1.64
Dry Unit Weight: 62.669 pcf
Saturation: 100.00 %

End of Consolidation/A
Time: 11.099 min
Total Vertical Stress: 38.27 psi
Total Horizontal Stress: 38.267 psi
Pore Pressure: 0 psi
Effective Vertical Stress: 38.27 psi
Effective Horizontal Stress: 38.267 psi

Height Change: 0.0014872 in
Area Change: 0 in^2
Volume Change: 0.46772 cc
Water Change: -0.192 cc
Correction: 21.544 cc

Height: 5.7345 in
Area: 6.3973 in^2
Volume: 600.86 cc

Moisture: 61.88 %
Void Ratio: 1.64
Dry Unit Weight: 62.669 pcf
Saturation: 100.00 %

End of Saturation
Time: 11.099 min
Total Vertical Stress: 38.27 psi
Total Horizontal Stress: 38.267 psi
Pore Pressure: 0 psi
Effective Vertical Stress: 38.27 psi
Effective Horizontal Stress: 38.267 psi

Height Change: 0.0014872 in
Area Change: 0 in^2
Volume Change: 0.46772 cc
Water Change: -0.192 cc
Correction: 21.544 cc

Height: 5.7345 in
Area: 6.3973 in^2
Volume: 600.86 cc

Moisture: 61.88 %
Void Ratio: 1.64
Dry Unit Weight: 62.669 pcf
Saturation: 100.00 %

End of Consolidation/B
Time: 11.099 min
Total Vertical Stress: 38.27 psi
Total Horizontal Stress: 38.267 psi
Pore Pressure: 0 psi
Effective Vertical Stress: 38.27 psi
Effective Horizontal Stress: 38.267 psi

Height Change: 0.0014872 in
Area Change: 0 in^2
Volume Change: 0.46772 cc
Water Change: -0.192 cc
Correction: 21.544 cc

Height: 5.7345 in
Area: 6.3973 in^2
Volume: 600.86 cc

Moisture: 61.88 %
Void Ratio: 1.64
Dry Unit Weight: 62.669 pcf
Saturation: 100.00 %

End of Shear
Time: 31.278 min
Total Vertical Stress: 47.901 psi
Total Horizontal Stress: 38.275 psi
Pore Pressure: -0.10526 psi
Effective Vertical Stress: 48.006 psi
Effective Horizontal Stress: 38.38 psi

Height Change: 1.1488 in
Area Change: -1.5958 in^2
Volume Change: 0.46772 cc
Water Change: -0.192 cc
Correction: 394.79 cc

Height: 4.5872 in
Area: 7.9931 in^2
Volume: 600.86 cc

Moisture: 0.00 %
Void Ratio: 1.64
Dry Unit Weight: 62.669 pcf
Saturation: 0.00 %

At Failure
Time: 13.712 min
Total Vertical Stress: 55.714 psi
Total Horizontal Stress: 38.348 psi
Pore Pressure: -0.02429 psi
Effective Vertical Stress: 55.738 psi
Effective Horizontal Stress: 38.372 psi

Height Change: 0.15062 in
Area Change: -0.17462 in^2
Volume Change: 0.46772 cc
Water Change: -0.192 cc
Correction: 0 cc

Height: 5.5854 in
Area: 6.5719 in^2
Volume: 600.86 cc

Moisture: 61.88 %
Void Ratio: 1.64
Dry Unit Weight: 62.669 pcf
Saturation: 100.00 %

TRIAXIAL TEST

Project: IM-8-094(092)346
Boring No.: 1
Sample No.: SS-508-17
Test No.: UU-26-17

Location:
Tested By: DT
Test Date: 10/12/2017
Sample Type:

Project No.:
Checked By: MD
Depth: 46.0
Elevation:

Soil Description: T.L. 25 3/4" Brn Cly,SLICKEN SIDED
Remarks: 44.8-45.3

Specimen Height: 5.75 in
Specimen Area: 6.37 in^2
Specimen Volume: 599.84 cc

Piston Area: 0.21 in^2
Piston Friction: 0.00 lb
Piston Weight: 0.00 lb

Filter Strip Correction: 0.00 psi
Membrane Correction: 4.20 lb/in
Correction Type: Uniform

Liquid Limit: ---

Plastic Limit: ---

Estimated Specific Gravity: 2.65

	Before Test Trimmings	Before Test Specimen	After Test Specimen	After Test Trimmings
Container ID	S 32	---		
Wt. Container + Wet Soil, gm	65.08	---	---	0
Wt. Container + Dry Soil, gm	47.38	---	---	0
Wt. Container, gm	16.76	---	---	0
Wt. Wet Soil, gm	48.32	1008.1	638.84	0
Wt. Dry Soil, gm	30.62	638.84	638.84	0
Wt. Water, gm	17.7	369.29	0	0
Water Content, %	57.81	57.81	0.00	0.00
Void Ratio	---	1.49	1.49	---
Degree of Saturation, %	---	102.93	0.00	---
Dry Unit Weight, pcf	---	66.487	66.523	---

Initial

Height: 5.746 in
Area: 6.3704 in^2
Volume: 599.84 cc

Moisture: 57.81 %
Void Ratio: 1.49
Dry Unit Weight: 66.487 pcf
Saturation: 102.93 %

End of Initialization
Time: 11.063 min
Total Vertical Stress: 76.659 psi
Total Horizontal Stress: 76.68 psi
Pore Pressure: 0 psi
Effective Vertical Stress: 76.659 psi
Effective Horizontal Stress: 76.68 psi

Height Change: 0.0010224 in
Area Change: 0 in^2
Volume Change: 0.3202 cc
Water Change: -0.27083 cc
Correction: 11.109 cc

Height: 5.745 in
Area: 6.3704 in^2
Volume: 599.52 cc

Moisture: 56.11 %
Void Ratio: 1.49
Dry Unit Weight: 66.523 pcf
Saturation: 100.00 %

End of Consolidation/A
Time: 11.063 min
Total Vertical Stress: 76.659 psi
Total Horizontal Stress: 76.68 psi
Pore Pressure: 0 psi
Effective Vertical Stress: 76.659 psi
Effective Horizontal Stress: 76.68 psi

Height Change: 0.0010224 in
Area Change: 0 in^2
Volume Change: 0.3202 cc
Water Change: -0.27083 cc
Correction: 11.109 cc

Height: 5.745 in
Area: 6.3704 in^2
Volume: 599.52 cc

Moisture: 56.11 %
Void Ratio: 1.49
Dry Unit Weight: 66.523 pcf
Saturation: 100.00 %

End of Saturation
Time: 11.063 min
Total Vertical Stress: 76.659 psi
Total Horizontal Stress: 76.68 psi
Pore Pressure: 0 psi
Effective Vertical Stress: 76.659 psi
Effective Horizontal Stress: 76.68 psi

Height Change: 0.0010224 in
Area Change: 0 in^2
Volume Change: 0.3202 cc
Water Change: -0.27083 cc
Correction: 11.109 cc

Height: 5.745 in
Area: 6.3704 in^2
Volume: 599.52 cc

Moisture: 56.11 %
Void Ratio: 1.49
Dry Unit Weight: 66.523 pcf
Saturation: 100.00 %

End of Consolidation/B
Time: 11.063 min
Total Vertical Stress: 76.659 psi
Total Horizontal Stress: 76.68 psi
Pore Pressure: 0 psi
Effective Vertical Stress: 76.659 psi
Effective Horizontal Stress: 76.68 psi

Height Change: 0.0010224 in
Area Change: 0 in^2
Volume Change: 0.3202 cc
Water Change: -0.27083 cc
Correction: 11.109 cc

Height: 5.745 in
Area: 6.3704 in^2
Volume: 599.52 cc

Moisture: 56.11 %
Void Ratio: 1.49
Dry Unit Weight: 66.523 pcf
Saturation: 100.00 %

End of Shear
Time: 31.246 min
Total Vertical Stress: 87.884 psi
Total Horizontal Stress: 76.834 psi
Pore Pressure: -0.28339 psi
Effective Vertical Stress: 88.168 psi
Effective Horizontal Stress: 77.117 psi

Height Change: 1.1502 in
Area Change: -1.5901 in^2
Volume Change: 0.3202 cc
Water Change: -0.27083 cc
Correction: 369.56 cc

Height: 4.5958 in
Area: 7.9605 in^2
Volume: 599.52 cc

Moisture: 0.00 %
Void Ratio: 1.49
Dry Unit Weight: 66.523 pcf
Saturation: 0.00 %

At Failure
Time: 12.704 min
Total Vertical Stress: 93.237 psi
Total Horizontal Stress: 76.753 psi
Pore Pressure: -0.056677 psi
Effective Vertical Stress: 93.294 psi
Effective Horizontal Stress: 76.809 psi

Height Change: 0.092949 in
Area Change: -0.10767 in^2
Volume Change: 0.3202 cc
Water Change: -0.27083 cc
Correction: 0 cc

Height: 5.6531 in
Area: 6.4781 in^2
Volume: 599.52 cc

Moisture: 56.11 %
Void Ratio: 1.49
Dry Unit Weight: 66.523 pcf
Saturation: 100.00 %

SS-508-17

TRIAXIAL TEST

Project: IM-8-094(092)346
Boring No.: 1
Sample No.: SS-508-17
Test No.: UU-27-17

Location:
Tested By: DT
Test Date: 10/12/2017
Sample Type:

Project No.:
Checked By: MD
Depth: 46.0
Elevation:

Soil Description: T.L. 25 3/4" Brn Cly,SLICKEN SIDED
Remarks: 45.4-45.9

Specimen Height: 5.75 in
Specimen Area: 6.35 in^2
Specimen Volume: 597.95 cc

Piston Area: 0.21 in^2
Piston Friction: 0.00 lb
Piston Weight: 0.00 lb

Filter Strip Correction: 0.00 psi
Membrane Correction: 4.20 lb/in
Correction Type: Uniform

Liquid Limit: ---

Plastic Limit: ---

Estimated Specific Gravity: 2.65

	Before Test Trimmings	Before Test Specimen	After Test Specimen	After Test Trimmings
Container ID	S 33	---		
Wt. Container + Wet Soil, gm	68.41	---	---	0
Wt. Container + Dry Soil, gm	49.43	---	---	0
Wt. Container, gm	17.24	---	---	0
Wt. Wet Soil, gm	51.17	1018.2	640.54	0
Wt. Dry Soil, gm	32.19	640.54	640.54	0
Wt. Water, gm	18.98	377.68	0	0
Water Content, %	58.96	58.96	0.00	0.00
Void Ratio	---	1.47	1.47	---
Degree of Saturation, %	---	106.02	0.00	---
Dry Unit Weight, pcf	---	66.875	67.028	---

Initial

Height: 5.748 in
Area: 6.3481 in^2
Volume: 597.95 cc

Moisture: 58.96 %
Void Ratio: 1.47
Dry Unit Weight: 66.875 pcf
Saturation: 106.02 %

End of Initialization
Time: 11.072 min
Total Vertical Stress: 115.01 psi
Total Horizontal Stress: 114.98 psi
Pore Pressure: -0.0080967 psi
Effective Vertical Stress: 115.02 psi
Effective Horizontal Stress: 114.99 psi

Height Change: 0.0043686 in
Area Change: 0 in^2
Volume Change: 1.3633 cc
Water Change: -0.29979 cc
Correction: 23.11 cc

Height: 5.7436 in
Area: 6.3481 in^2
Volume: 596.58 cc

Moisture: 55.40 %
Void Ratio: 1.47
Dry Unit Weight: 67.028 pcf
Saturation: 100.00 %

End of Consolidation/A
Time: 11.072 min
Total Vertical Stress: 115.01 psi
Total Horizontal Stress: 114.98 psi
Pore Pressure: -0.0080967 psi
Effective Vertical Stress: 115.02 psi
Effective Horizontal Stress: 114.99 psi

Height Change: 0.0043686 in
Area Change: 0 in^2
Volume Change: 1.3633 cc
Water Change: -0.29979 cc
Correction: 23.11 cc

Height: 5.7436 in
Area: 6.3481 in^2
Volume: 596.58 cc

Moisture: 55.40 %
Void Ratio: 1.47
Dry Unit Weight: 67.028 pcf
Saturation: 100.00 %

End of Saturation
Time: 11.072 min
Total Vertical Stress: 115.01 psi
Total Horizontal Stress: 114.98 psi
Pore Pressure: -0.0080967 psi
Effective Vertical Stress: 115.02 psi
Effective Horizontal Stress: 114.99 psi

Height Change: 0.0043686 in
Area Change: 0 in^2
Volume Change: 1.3633 cc
Water Change: -0.29979 cc
Correction: 23.11 cc

Height: 5.7436 in
Area: 6.3481 in^2
Volume: 596.58 cc

Moisture: 55.40 %
Void Ratio: 1.47
Dry Unit Weight: 67.028 pcf
Saturation: 100.00 %

End of Consolidation/B
Time: 11.072 min
Total Vertical Stress: 115.01 psi
Total Horizontal Stress: 114.98 psi
Pore Pressure: -0.0080967 psi
Effective Vertical Stress: 115.02 psi
Effective Horizontal Stress: 114.99 psi

Height Change: 0.0043686 in
Area Change: 0 in^2
Volume Change: 1.3633 cc
Water Change: -0.29979 cc
Correction: 23.11 cc

Height: 5.7436 in
Area: 6.3481 in^2
Volume: 596.58 cc

Moisture: 55.40 %
Void Ratio: 1.47
Dry Unit Weight: 67.028 pcf
Saturation: 100.00 %

End of Shear
Time: 31.277 min
Total Vertical Stress: 124.15 psi
Total Horizontal Stress: 115.08 psi
Pore Pressure: -0.29148 psi
Effective Vertical Stress: 124.44 psi
Effective Horizontal Stress: 115.37 psi

Height Change: 1.1534 in
Area Change: -1.5754 in^2
Volume Change: 1.3633 cc
Water Change: -0.29979 cc
Correction: 377.98 cc

Height: 4.5946 in
Area: 7.9235 in^2
Volume: 596.58 cc

Moisture: 0.00 %
Void Ratio: 1.47
Dry Unit Weight: 67.028 pcf
Saturation: 0.00 %

At Failure
Time: 13.499 min
Total Vertical Stress: 129.31 psi
Total Horizontal Stress: 115.12 psi
Pore Pressure: -0.064774 psi
Effective Vertical Stress: 129.37 psi
Effective Horizontal Stress: 115.18 psi

Height Change: 0.14244 in
Area Change: -0.16458 in^2
Volume Change: 1.3633 cc
Water Change: -0.29979 cc
Correction: 0 cc

Height: 5.6056 in
Area: 6.5127 in^2
Volume: 596.58 cc

Moisture: 55.40 %
Void Ratio: 1.47
Dry Unit Weight: 67.028 pcf
Saturation: 100.00 %

TRIAXIAL UU(Q) CCU(R) CD(S)

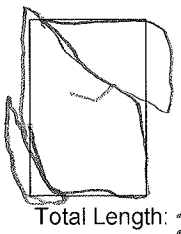
North Dakota Department of Transportation, Materials & Research
SFN 50459 (10-2016)

Project Number	
IM-8-094(092)346	
Boring Number	
1	

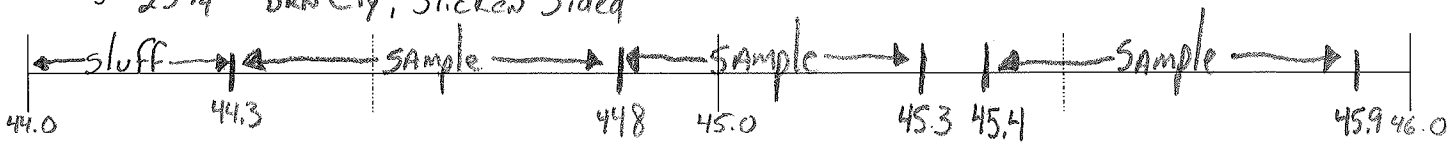
Field Sample Number	Lab Number	Depth
SS-508-17	UU-25-17	44.3 to 44.8

Weight of Sample	After Test Weight	Confining Pressure	Test Number	of
997.77		38.3	1	2

Diameter		Height		Moisture Can Number	After Moisture Can Number
2.866	2.856	5.735		S23	
2.866	2.843	5.736		Wet Wt + Can 84.26	Wet Wt + Can
2.855	2.836	5.736		Dry Wt + Can 57.68	Dry Wt + Can
Average 2.854		Average 5.736		Wt of Can 17.05	Wt of Can



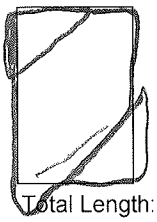
Total Length: 25 3/4" Brn Cly, Slicken Sided



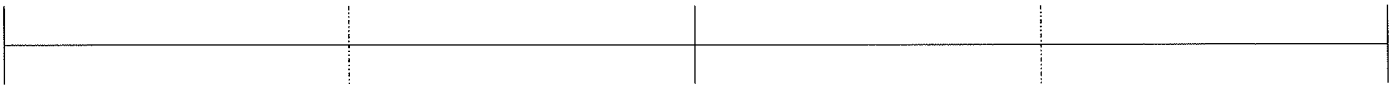
Field Sample Number	Lab Number	Depth
SS-508-17	UU-26-17	44.8 to 45.3

Weight of Sample	After Test Weight	Confining Pressure	Test Number	of
1008.13		76.7	2	2

Diameter		Height		Moisture Can Number	After Moisture Can Number
2.846	2.862	5.745		S32	
2.838	2.859	5.747		Wet Wt + Can 65.08	Wet Wt + Can
2.838	2.842	5.745		Dry Wt + Can 47.38	Dry Wt + Can
Average 2.848		Average 5.746		Wt of Can 16.76	Wt of Can



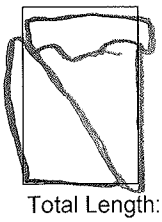
Total Length:



Field Sample Number	Lab Number	Depth
SS-508-17	UU-27-17	44.5 to 45.9

Weight of Sample	After Test Weight	Confining Pressure	Test Number	of
1018.22		115.0	3	3

Diameter		Height		Moisture Can Number	After Moisture Can Number
2.850	2.851	5.748		S33	
2.836	2.850	5.746		Wet Wt + Can 68.41	Wet Wt + Can
2.826	2.845	5.749		Dry Wt + Can 49.43	Dry Wt + Can
Average 2.843		Average 5.748		Wt of Can 17.24	Wt of Can

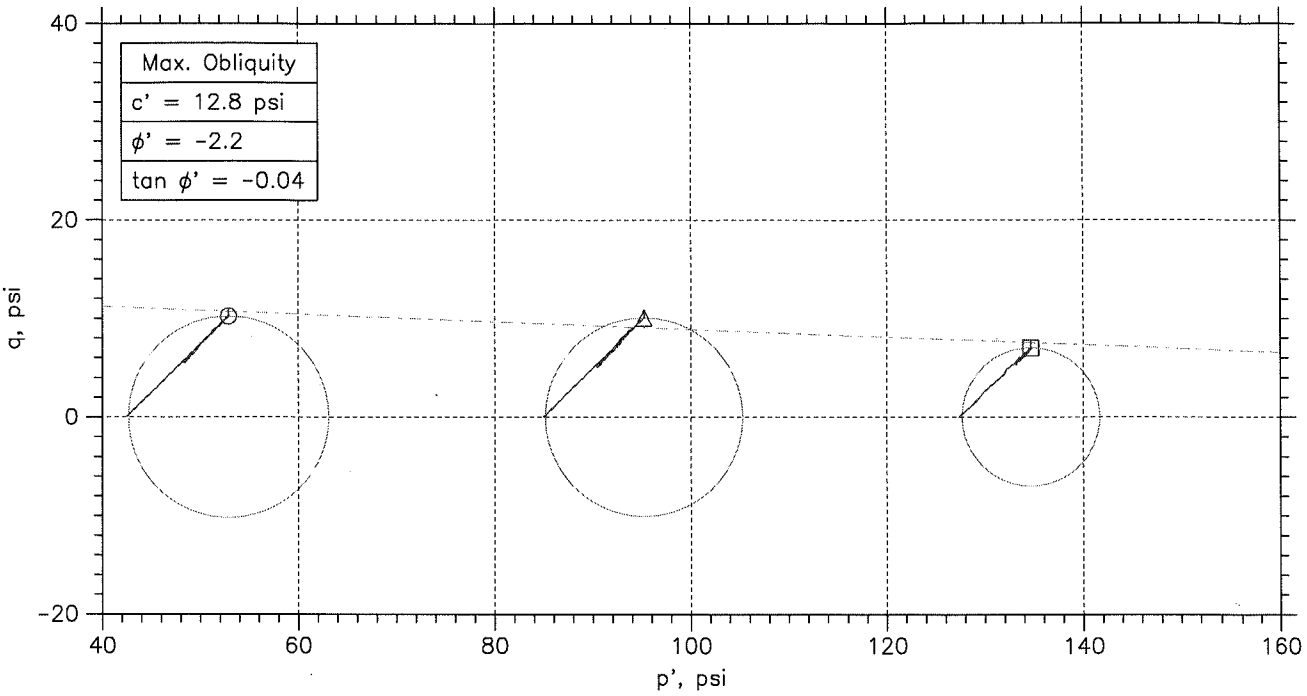


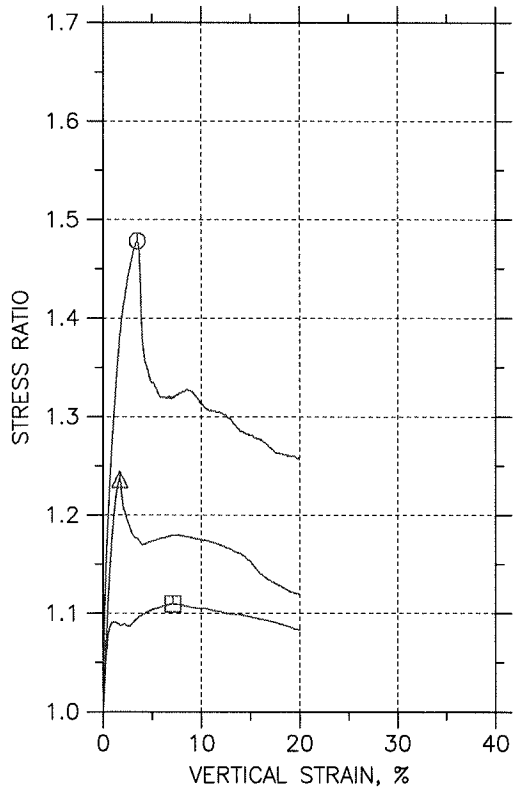
Total Length:

AASHTO T-234 Tested By:

55-510-17

Test File





Symbol		⏲	△	⏍	
Sample No.		SS-510-17	SS-510-17	SS-510-17	
Test No.		UU-28-17	UU-29-17	UU-30-17	
Depth		51.0	51.0	51.0	
Initial	Diameter, in	2.855	2.846	2.834	
	Height, in	5.748	5.748	5.75	
	Water Content, %	54.2	64.4	68.6	
	Dry Density, pcf	69.07	63.97	61.19	
	Saturation, %	102.9	107.6	106.8	
	Void Ratio	1.4	1.59	1.7	
Before Shear	Water Content, %	52.3	59.9	64.0	
	Dry Density, pcf	69.34	63.92	61.34	
	Saturation*, %	100.0	100.0	100.0	
	Void Ratio	1.39	1.59	1.7	
	Back Press., psi	.0	.0	.0	
Ver. Eff. Cons. Stress, psi		42.47	85.	127.5	
Shear Strength, psi		10.2	10.06	6.99	
Strain at Failure, %		3.5	1.7	7.1	
Strain Rate, %/min		1	1	1	
B-Value		---	---	---	
Estimated Specific Gravity		2.65	2.65	2.65	
Liquid Limit		---	---	---	
Plastic Limit		---	---	---	

NDDOT North Dakota Department of Transportation

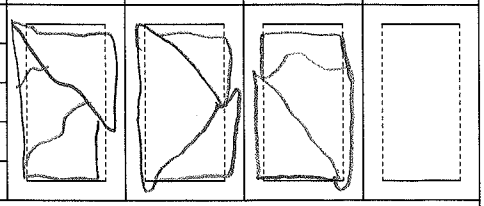
Project: IM-8-094(092)346

Location:

Project No.:

Boring No.: 1

Sample Type:



Description: T.L. 25 1/2" Brn Cly with silt deposits,SLICKEN SIDED

Remarks: 49.3-49.8

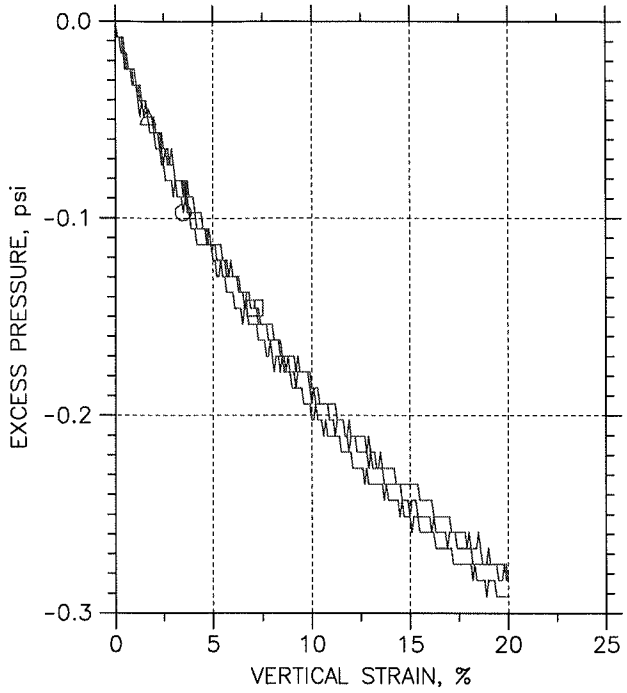
Phase calculations based on start and end of test.

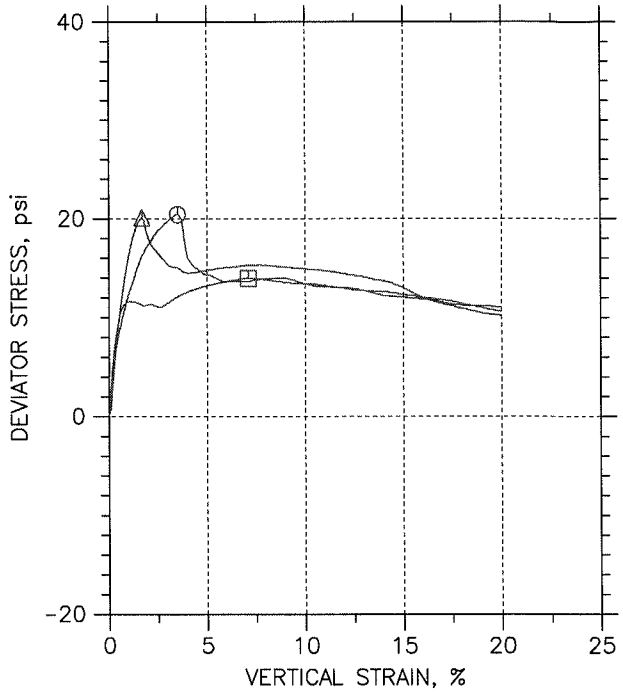
* Saturation is set to 100% for phase calculations.

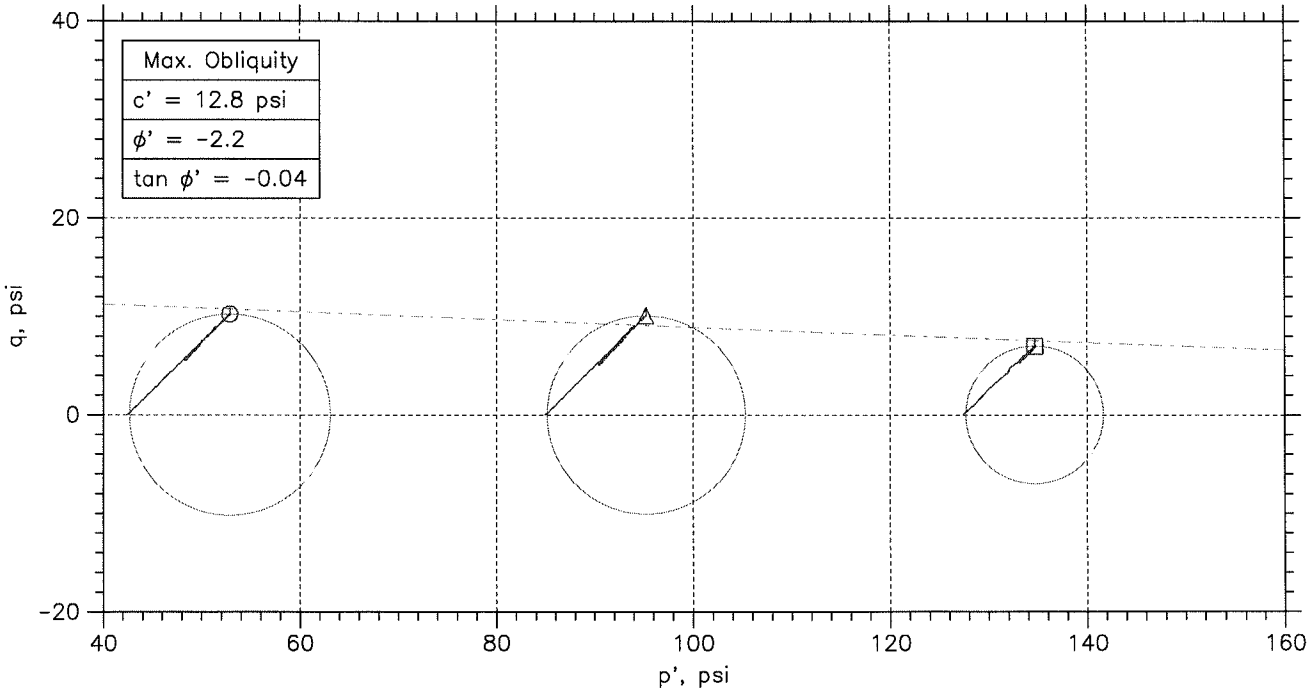
Tue, 17-OCT-2017 08:26:02

SS-510-17

Test File







	Sample No.	Test No.	Depth	Tested By	Test Date	Checked By	Check Date	Test File
⊙	SS-510-17	UU-28-17	51.0	DT	10/12/2017	MD		UU-28-2017.dat
△	SS-510-17	UU-29-17	51.0	DT	10/12/2017	MD		UU-29-2017.dat
□	SS-510-17	UU-30-17	51.0	DT	10/12/2017	MD		UU-30-2017.dat

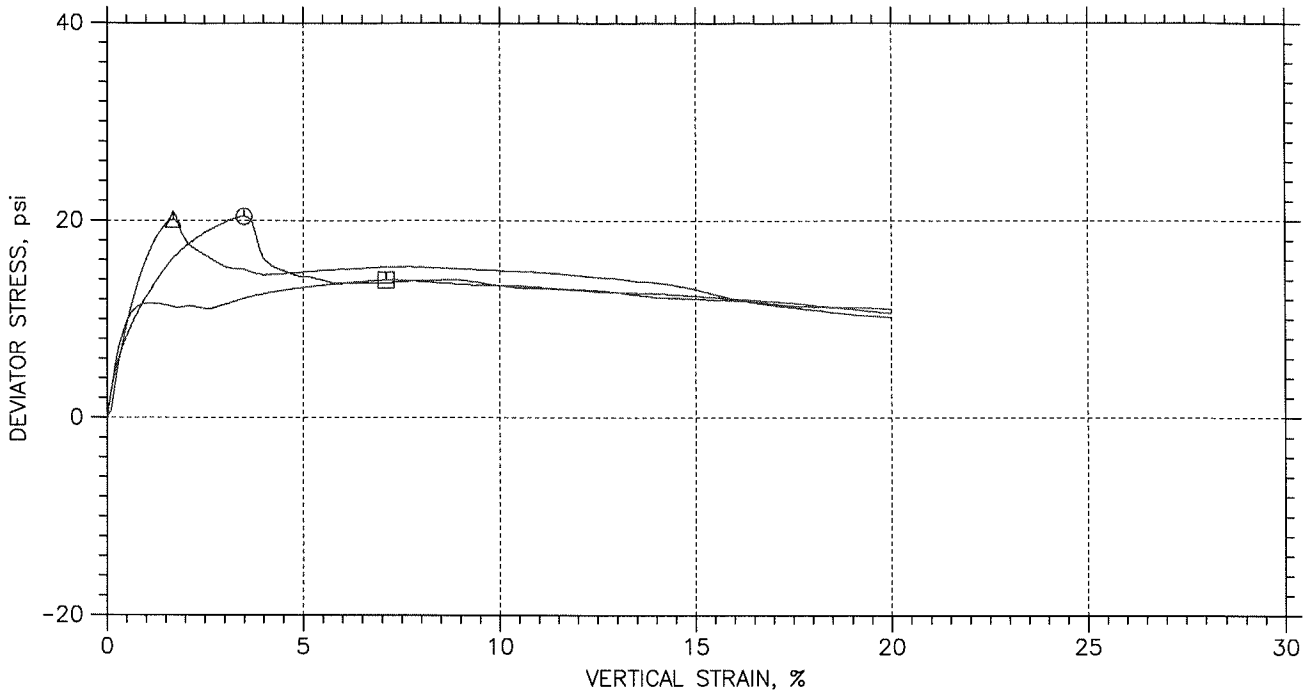
NDDOT
North Dakota Department of Transportation

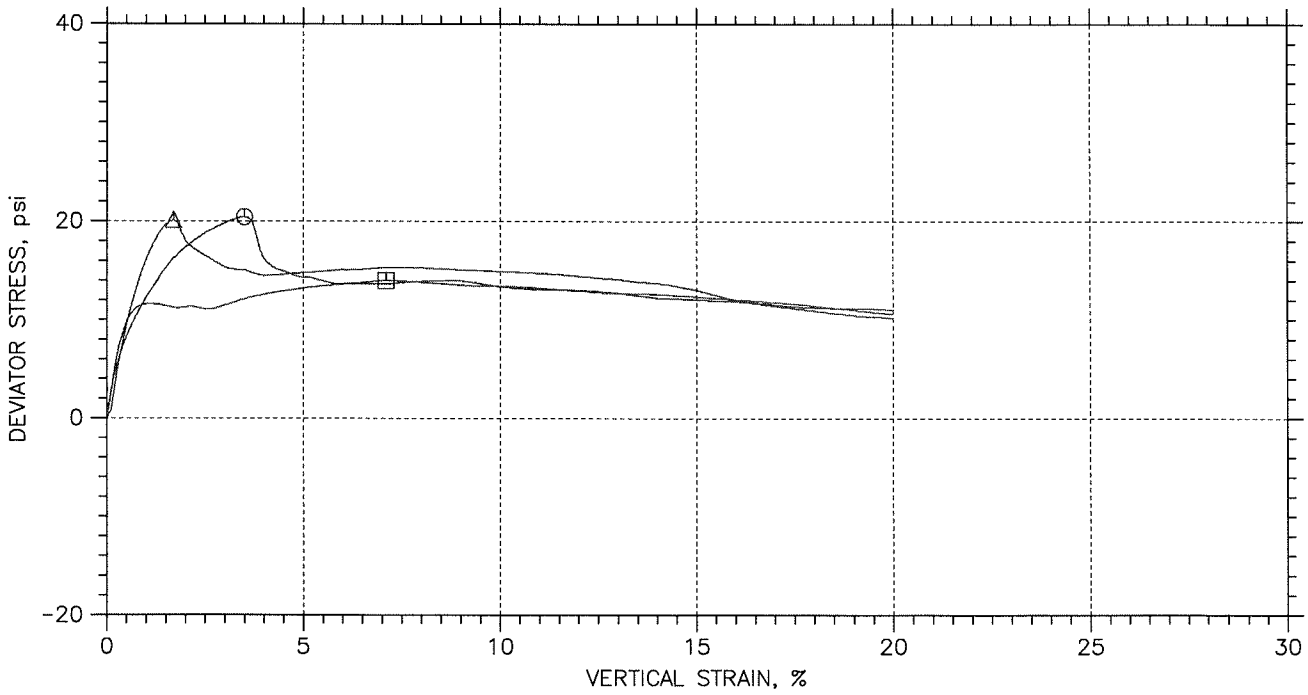
Project: IM-8-094(092)346	Location:	Project No.:
Boring No.: 1	Sample Type:	
Description: T.L. 25 1/2" Brn Cly with silt deposits,SLICKEN SIDED		
Remarks: 49.3-49.8		

Tue, 17-OCT-2017 08:26:02

55-510-17

Test File





	Sample No.	Test No.	Depth	Tested By	Test Date	Checked By	Check Date	Test File
⊙	SS-510-17	UU-28-17	51.0	DT	10/12/2017	MD		UU-28-2017.dat
△	SS-510-17	UU-29-17	51.0	DT	10/12/2017	MD		UU-29-2017.dat
⊟	SS-510-17	UU-30-17	51.0	DT	10/12/2017	MD		UU-30-2017.dat

NDDOT North Dakota Department of Transportation

Project: IM-8-094(092)346	Location:	Project No.:
Boring No.: 1	Sample Type:	
Description: T.L. 25 1/2" Brn Cly with silt deposits,SLICKEN SIDED		
Remarks: 49.3-49.8		

Tue, 17-OCT-2017 08:26:02

TRIAXIAL TEST

Project: IM-8-094(092)346
Boring No.: 1
Sample No.: SS-510-17
Test No.: UU-28-17

Location:
Tested By: DT
Test Date: 10/12/2017
Sample Type:

Project No.:
Checked By: MD
Depth: 51.0
Elevation:

Soil Description: T.L. 25 1/2" Brn Cly with silt deposits,SLICKEN SIDED
Remarks: 49.3-49.8

Specimen Height: 5.75 in
Specimen Area: 6.40 in^2
Specimen Volume: 603.00 cc

Piston Area: 0.21 in^2
Piston Friction: 0.00 lb
Piston Weight: 0.00 lb

Filter Strip Correction: 0.00 psi
Membrane Correction: 4.20 lb/in
Correction Type: Uniform

Liquid Limit: ---

Plastic Limit: ---

Estimated Specific Gravity: 2.65

	Before Test Trimmings	Before Test Specimen	After Test Specimen	After Test Trimmings
Container ID	S 8	---		
Wt. Container + Wet Soil, gm	54.4	---	---	0
Wt. Container + Dry Soil, gm	41.22	---	---	0
Wt. Container, gm	16.89	---	---	0
Wt. Wet Soil, gm	37.51	1028.5	667.12	0
Wt. Dry Soil, gm	24.33	667.12	667.12	0
Wt. Water, gm	13.18	361.39	0	0
Water Content, %	54.17	54.17	0.00	0.00
Void Ratio	---	1.40	1.39	---
Degree of Saturation, %	---	102.88	0.00	---
Dry Unit Weight, pcf	---	69.066	69.34	---

Initial

Height: 5.748 in
Area: 6.4018 in^2
Volume: 603 cc

Moisture: 54.17 %
Void Ratio: 1.40
Dry Unit Weight: 69.066 pcf
Saturation: 102.88 %

End of Initialization
Time: 11.081 min
Total Vertical Stress: 42.465 psi
Total Horizontal Stress: 42.484 psi
Pore Pressure: 0 psi
Effective Vertical Stress: 42.465 psi
Effective Horizontal Stress: 42.484 psi

Height Change: 0.0075753 in
Area Change: 0 in^2
Volume Change: 2.3841 cc
Water Change: -0.30515 cc
Correction: 12.819 cc

Height: 5.7404 in
Area: 6.4018 in^2
Volume: 600.62 cc

Moisture: 52.30 %
Void Ratio: 1.39
Dry Unit Weight: 69.34 pcf
Saturation: 100.00 %

End of Consolidation/A
Time: 11.081 min
Total Vertical Stress: 42.465 psi
Total Horizontal Stress: 42.484 psi
Pore Pressure: 0 psi
Effective Vertical Stress: 42.465 psi
Effective Horizontal Stress: 42.484 psi

Height Change: 0.0075753 in
Area Change: 0 in^2
Volume Change: 2.3841 cc
Water Change: -0.30515 cc
Correction: 12.819 cc

Height: 5.7404 in
Area: 6.4018 in^2
Volume: 600.62 cc

Moisture: 52.30 %
Void Ratio: 1.39
Dry Unit Weight: 69.34 pcf
Saturation: 100.00 %

End of Saturation
Time: 11.081 min
Total Vertical Stress: 42.465 psi
Total Horizontal Stress: 42.484 psi
Pore Pressure: 0 psi
Effective Vertical Stress: 42.465 psi
Effective Horizontal Stress: 42.484 psi

Height Change: 0.0075753 in
Area Change: 0 in^2
Volume Change: 2.3841 cc
Water Change: -0.30515 cc
Correction: 12.819 cc

Height: 5.7404 in
Area: 6.4018 in^2
Volume: 600.62 cc

Moisture: 52.30 %
Void Ratio: 1.39
Dry Unit Weight: 69.34 pcf
Saturation: 100.00 %

End of Consolidation/B
Time: 11.081 min
Total Vertical Stress: 42.465 psi
Total Horizontal Stress: 42.484 psi
Pore Pressure: 0 psi
Effective Vertical Stress: 42.465 psi
Effective Horizontal Stress: 42.484 psi

Height Change: 0.0075753 in
Area Change: 0 in^2
Volume Change: 2.3841 cc
Water Change: -0.30515 cc
Correction: 12.819 cc

Height: 5.7404 in
Area: 6.4018 in^2
Volume: 600.62 cc

Moisture: 52.30 %
Void Ratio: 1.39
Dry Unit Weight: 69.34 pcf
Saturation: 100.00 %

End of Shear
Time: 31.251 min
Total Vertical Stress: 53.599 psi
Total Horizontal Stress: 42.557 psi
Pore Pressure: -0.29148 psi
Effective Vertical Stress: 53.89 psi
Effective Horizontal Stress: 42.848 psi

Height Change: 1.1563 in
Area Change: -1.5804 in^2
Volume Change: 2.3841 cc
Water Change: -0.30515 cc
Correction: 361.7 cc

Height: 4.5917 in
Area: 7.9822 in^2
Volume: 600.62 cc

Moisture: 0.00 %
Void Ratio: 1.39
Dry Unit Weight: 69.34 pcf
Saturation: 0.00 %

At Failure
Time: 14.614 min
Total Vertical Stress: 63.006 psi
Total Horizontal Stress: 42.597 psi
Pore Pressure: -0.097161 psi
Effective Vertical Stress: 63.103 psi
Effective Horizontal Stress: 42.694 psi

Height Change: 0.20862 in
Area Change: -0.24447 in^2
Volume Change: 2.3841 cc
Water Change: -0.30515 cc
Correction: 0 cc

Height: 5.5394 in
Area: 6.6463 in^2
Volume: 600.62 cc

Moisture: 52.30 %
Void Ratio: 1.39
Dry Unit Weight: 69.34 pcf
Saturation: 100.00 %

TRIAXIAL TEST

Project: IM-8-094(092)346
Boring No.: 1
Sample No.: SS-510-17
Test No.: UU-29-17

Location:
Tested By: DT
Test Date: 10/12/2017
Sample Type:

Project No.:
Checked By: MD
Depth: 51.0
Elevation:

Soil Description: T.L. 25 1/2" Brn Cly with silt deposits,SLICKEN SIDED
Remarks: 49.8-50.3

Specimen Height: 5.75 in
Specimen Area: 6.36 in^2
Specimen Volume: 599.21 cc

Piston Area: 0.21 in^2
Piston Friction: 0.00 lb
Piston Weight: 0.00 lb

Filter Strip Correction: 0.00 psi
Membrane Correction: 4.20 lb/in
Correction Type: Uniform

Liquid Limit: ---

Plastic Limit: ---

Estimated Specific Gravity: 2.65

	Before Test Trimmings	Before Test Specimen	After Test Specimen	After Test Trimmings
Container ID	S 48	---		
Wt. Container + Wet Soil, gm	66.59	---	---	0
Wt. Container + Dry Soil, gm	47.17	---	---	0
Wt. Container, gm	17.01	---	---	0
Wt. Wet Soil, gm	49.58	1009.4	614	0
Wt. Dry Soil, gm	30.16	614	614	0
Wt. Water, gm	19.42	395.36	1.1642e-013	0
Water Content, %	64.39	64.39	0.00	0.00
Void Ratio	---	1.59	1.59	---
Degree of Saturation, %	---	107.58	0.00	---
Dry Unit Weight, pcf	---	63.969	63.924	---

Initial

Height: 5.748 in
Area: 6.3615 in^2
Volume: 599.21 cc

Moisture: 64.39 %
Void Ratio: 1.59
Dry Unit Weight: 63.969 pcf
Saturation: 107.58 %

End of Initialization
Time: 11.152 min
Total Vertical Stress: 84.998 psi
Total Horizontal Stress: 85.033 psi
Pore Pressure: 0 psi
Effective Vertical Stress: 84.998 psi
Effective Horizontal Stress: 85.033 psi

Height Change: -0.0013478 in
Area Change: 0 in^2
Volume Change: -0.4215 cc
Water Change: -0.32393 cc
Correction: 27.75 cc

Height: 5.7493 in
Area: 6.3615 in^2
Volume: 599.63 cc

Moisture: 59.92 %
Void Ratio: 1.59
Dry Unit Weight: 63.924 pcf
Saturation: 100.00 %

End of Consolidation/A
Time: 11.152 min
Total Vertical Stress: 84.998 psi
Total Horizontal Stress: 85.033 psi
Pore Pressure: 0 psi
Effective Vertical Stress: 84.998 psi
Effective Horizontal Stress: 85.033 psi

Height Change: -0.0013478 in
Area Change: 0 in^2
Volume Change: -0.4215 cc
Water Change: -0.32393 cc
Correction: 27.75 cc

Height: 5.7493 in
Area: 6.3615 in^2
Volume: 599.63 cc

Moisture: 59.92 %
Void Ratio: 1.59
Dry Unit Weight: 63.924 pcf
Saturation: 100.00 %

End of Saturation
Time: 11.152 min
Total Vertical Stress: 84.998 psi
Total Horizontal Stress: 85.033 psi
Pore Pressure: 0 psi
Effective Vertical Stress: 84.998 psi
Effective Horizontal Stress: 85.033 psi

Height Change: -0.0013478 in
Area Change: 0 in^2
Volume Change: -0.4215 cc
Water Change: -0.32393 cc
Correction: 27.75 cc

Height: 5.7493 in
Area: 6.3615 in^2
Volume: 599.63 cc

Moisture: 59.92 %
Void Ratio: 1.59
Dry Unit Weight: 63.924 pcf
Saturation: 100.00 %

End of Consolidation/B
Time: 11.152 min
Total Vertical Stress: 84.998 psi
Total Horizontal Stress: 85.033 psi
Pore Pressure: 0 psi
Effective Vertical Stress: 84.998 psi
Effective Horizontal Stress: 85.033 psi

Height Change: -0.0013478 in
Area Change: 0 in^2
Volume Change: -0.4215 cc
Water Change: -0.32393 cc
Correction: 27.75 cc

Height: 5.7493 in
Area: 6.3615 in^2
Volume: 599.63 cc

Moisture: 59.92 %
Void Ratio: 1.59
Dry Unit Weight: 63.924 pcf
Saturation: 100.00 %

End of Shear
Time: 31.357 min
Total Vertical Stress: 95.221 psi
Total Horizontal Stress: 85.065 psi
Pore Pressure: -0.28339 psi
Effective Vertical Stress: 95.504 psi
Effective Horizontal Stress: 85.348 psi

Height Change: 1.1488 in
Area Change: -1.5946 in^2
Volume Change: -0.4215 cc
Water Change: -0.32393 cc
Correction: 395.68 cc

Height: 4.5992 in
Area: 7.9561 in^2
Volume: 599.63 cc

Moisture: 0.00 %
Void Ratio: 1.59
Dry Unit Weight: 63.924 pcf
Saturation: 0.00 %

At Failure
Time: 12.899 min
Total Vertical Stress: 105.24 psi
Total Horizontal Stress: 85.13 psi
Pore Pressure: -0.04858 psi
Effective Vertical Stress: 105.29 psi
Effective Horizontal Stress: 85.178 psi

Height Change: 0.096481 in
Area Change: -0.1121 in^2
Volume Change: -0.4215 cc
Water Change: -0.32393 cc
Correction: 0 cc

Height: 5.6515 in
Area: 6.4736 in^2
Volume: 599.63 cc

Moisture: 59.92 %
Void Ratio: 1.59
Dry Unit Weight: 63.924 pcf
Saturation: 100.00 %

55-510-17

TRIAXIAL TEST

Project: IM-8-094(092)346
Boring No.: 1
Sample No.: SS-510-17
Test No.: UU-30-17

Location:
Tested By: DT
Test Date: 10/12/2017
Sample Type:

Project No.:
Checked By: MD
Depth: 51.0
Elevation:

Soil Description: T.L. 25 1/2" Brn Cly with silt deposits,SLICKEN SIDED
Remarks: 50.3-50.8

Specimen Height: 5.75 in
Specimen Area: 6.31 in^2
Specimen Volume: 594.37 cc

Piston Area: 0.21 in^2
Piston Friction: 0.00 lb
Piston Weight: 0.00 lb

Filter Strip Correction: 0.00 psi
Membrane Correction: 4.20 lb/in
Correction Type: Uniform

Liquid Limit: ---

Plastic Limit: ---

Estimated Specific Gravity: 2.65

	Before Test Trimmings	Before Test Specimen	After Test Specimen	After Test Trimmings
Container ID	S 68	---		
Wt. Container + Wet Soil, gm	76.39	---	---	0
Wt. Container + Dry Soil, gm	51.59	---	---	0
Wt. Container, gm	15.46	---	---	0
Wt. Wet Soil, gm	60.93	982.52	582.61	0
Wt. Dry Soil, gm	36.13	582.61	582.61	0
Wt. Water, gm	24.8	399.91	0	0
Water Content, %	68.64	68.64	0.00	0.00
Void Ratio	---	1.70	1.70	---
Degree of Saturation, %	---	106.78	0.00	---
Dry Unit Weight, pcf	---	61.193	61.341	---

Initial

Height: 5.75 in
Area: 6.308 in^2
Volume: 594.37 cc

Moisture: 68.64 %
Void Ratio: 1.70
Dry Unit Weight: 61.193 pcf
Saturation: 106.78 %

End of Initialization
Time: 11.112 min
Total Vertical Stress: 127.47 psi
Total Horizontal Stress: 127.47 psi
Pore Pressure: 0 psi
Effective Vertical Stress: 127.47 psi
Effective Horizontal Stress: 127.47 psi

Height Change: 0.0046474 in
Area Change: 0 in^2
Volume Change: 1.4412 cc
Water Change: -0.30891 cc
Correction: 27.14 cc

Height: 5.7454 in
Area: 6.308 in^2
Volume: 592.93 cc

Moisture: 64.04 %
Void Ratio: 1.70
Dry Unit Weight: 61.341 pcf
Saturation: 100.00 %

End of Consolidation/A
Time: 11.112 min
Total Vertical Stress: 127.47 psi
Total Horizontal Stress: 127.47 psi
Pore Pressure: 0 psi
Effective Vertical Stress: 127.47 psi
Effective Horizontal Stress: 127.47 psi

Height Change: 0.0046474 in
Area Change: 0 in^2
Volume Change: 1.4412 cc
Water Change: -0.30891 cc
Correction: 27.14 cc

Height: 5.7454 in
Area: 6.308 in^2
Volume: 592.93 cc

Moisture: 64.04 %
Void Ratio: 1.70
Dry Unit Weight: 61.341 pcf
Saturation: 100.00 %

End of Saturation
Time: 11.112 min
Total Vertical Stress: 127.47 psi
Total Horizontal Stress: 127.47 psi
Pore Pressure: 0 psi
Effective Vertical Stress: 127.47 psi
Effective Horizontal Stress: 127.47 psi

Height Change: 0.0046474 in
Area Change: 0 in^2
Volume Change: 1.4412 cc
Water Change: -0.30891 cc
Correction: 27.14 cc

Height: 5.7454 in
Area: 6.308 in^2
Volume: 592.93 cc

Moisture: 64.04 %
Void Ratio: 1.70
Dry Unit Weight: 61.341 pcf
Saturation: 100.00 %

End of Consolidation/B
Time: 11.112 min
Total Vertical Stress: 127.47 psi
Total Horizontal Stress: 127.47 psi
Pore Pressure: 0 psi
Effective Vertical Stress: 127.47 psi
Effective Horizontal Stress: 127.47 psi

Height Change: 0.0046474 in
Area Change: 0 in^2
Volume Change: 1.4412 cc
Water Change: -0.30891 cc
Correction: 27.14 cc

Height: 5.7454 in
Area: 6.308 in^2
Volume: 592.93 cc

Moisture: 64.04 %
Void Ratio: 1.70
Dry Unit Weight: 61.341 pcf
Saturation: 100.00 %

End of Shear
Time: 31.304 min
Total Vertical Stress: 138.19 psi
Total Horizontal Stress: 127.54 psi
Pore Pressure: -0.28339 psi
Effective Vertical Stress: 138.47 psi
Effective Horizontal Stress: 127.82 psi

Height Change: 1.1537 in
Area Change: -1.5642 in^2
Volume Change: 1.4412 cc
Water Change: -0.30891 cc
Correction: 400.22 cc

Height: 4.5963 in
Area: 7.8722 in^2
Volume: 592.93 cc

Moisture: 0.00 %
Void Ratio: 1.70
Dry Unit Weight: 61.341 pcf
Saturation: 0.00 %

At Failure
Time: 18.282 min
Total Vertical Stress: 141.54 psi
Total Horizontal Stress: 127.56 psi
Pore Pressure: -0.14574 psi
Effective Vertical Stress: 141.68 psi
Effective Horizontal Stress: 127.7 psi

Height Change: 0.4126 in
Area Change: -0.49116 in^2
Volume Change: 1.4412 cc
Water Change: -0.30891 cc
Correction: 0 cc

Height: 5.3374 in
Area: 6.7991 in^2
Volume: 592.93 cc

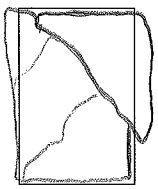
Moisture: 64.04 %
Void Ratio: 1.70
Dry Unit Weight: 61.341 pcf
Saturation: 100.00 %

TRIAXIAL UU(Q) CCU(R) CD(S)

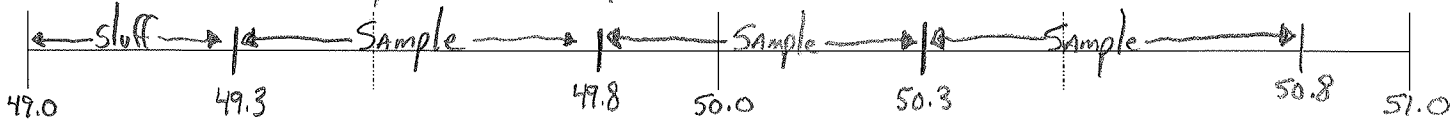
North Dakota Department of Transportation, Materials & Research
SFN 50459 (10-2016)

Project Number	
IM-8-094(092)346	
Boring Number	
1	

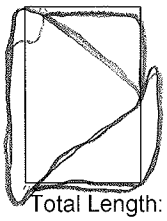
Field Sample Number			Lab Number		Depth	
SS-510-17			UU-28-17		49.3 to 49.8	
Weight of Sample	After Test Weight		Confining Pressure		Test Number	of
1028.57			42.5		1	3
Diameter	2.866	2.847	Height	5.748	Moisture Can Number	After Moisture Can Number
	2.866	2.849		5.750	S8	
	2.866	2.836		5.746	Wet Wt + Can	Wet Wt + Can
					54.40	
					Dry Wt + Can	Dry Wt + Can
					41.22	
	Average		Average		Wt of Can	Wt of Can
	2.855		5.748		16.89	



Total Length: 25½" Brn Cly with silt Deposits

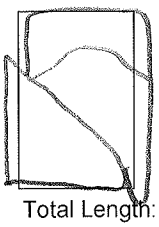


Field Sample Number			Lab Number		Depth	
SS-510-17			UU-29-17		49.8 to 50.3	
Weight of Sample	After Test Weight		Confining Pressure		Test Number	of
1009.36			85.0		2	3
Diameter	2.843	2.856	Height	5.748	Moisture Can Number	After Moisture Can Number
	2.840	2.852		5.748	S48	
	2.839	2.848		5.747	Wet Wt + Can	Wet Wt + Can
					66.59	
					Dry Wt + Can	Dry Wt + Can
					47.17	
	Average		Average		Wt of Can	Wt of Can
	2.846		5.748		17.01	



Total Length:

Field Sample Number			Lab Number		Depth	
SS-510-17			UU-30-17		50.3 to 50.8	
Weight of Sample	After Test Weight		Confining Pressure		Test Number	of
982.52			127.5		3	3
Diameter	2.850	2.833	Height	5.749	Moisture Can Number	After Moisture Can Number
	2.839	2.832		5.749	S68	
	2.830	2.822		5.752	Wet Wt + Can	Wet Wt + Can
					76.39	
					Dry Wt + Can	Dry Wt + Can
					51.59	
	Average		Average		Wt of Can	Wt of Can
	2.834		5.750		15.46	

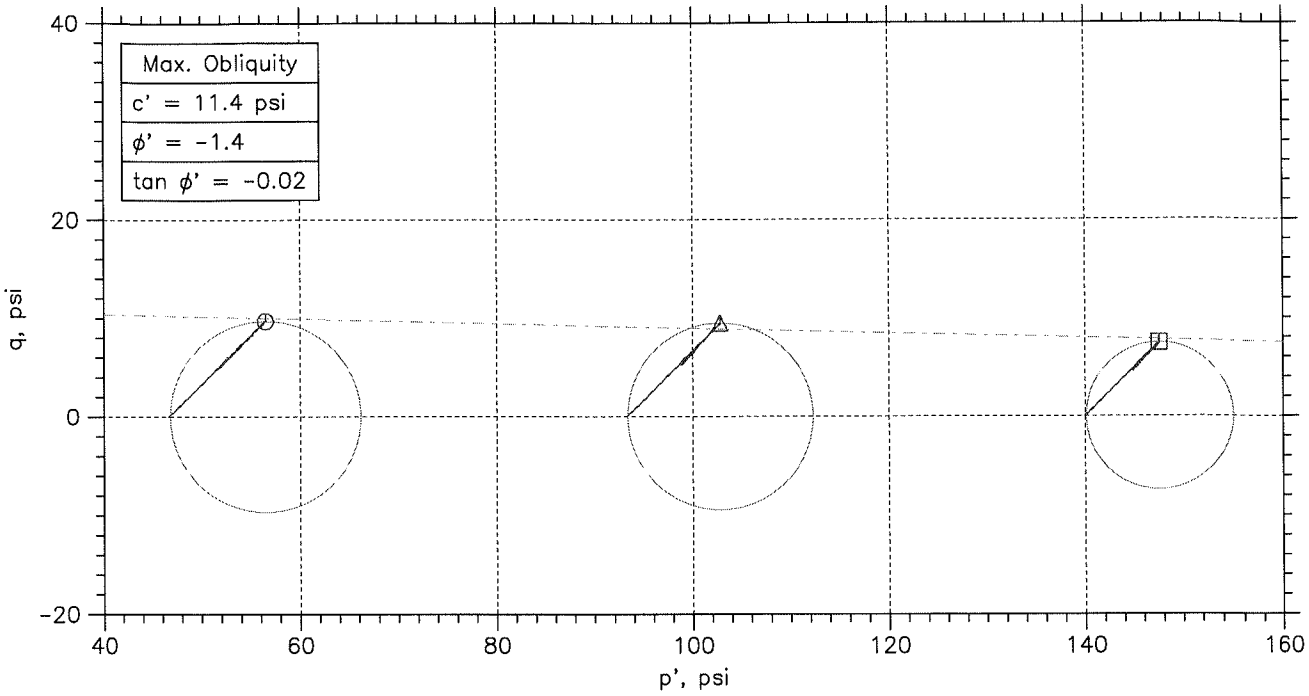


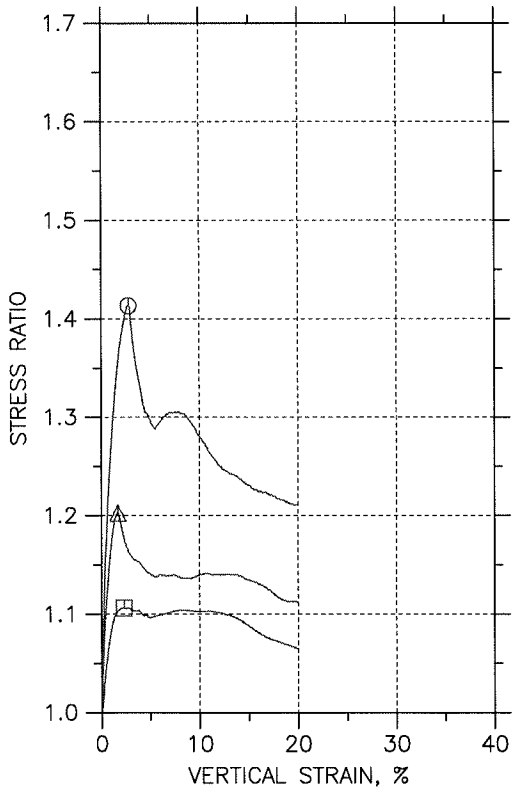
Total Length:

AASHTO T-234 Tested By:

SS-512-17

Test File





Symbol		⏀	△	⏍	
Sample No.		SS-512-17	SS-512-17	SS-512-17	
Test No.		UU-31-17	UU-32-17	UU-33-17	
Depth		56.0	56.0	56.0	
Initial	Diameter, in	2.849	2.845	2.848	
	Height, in	5.752	5.754	5.752	
	Water Content, %	60.1	58.2	56.1	
	Dry Density, pcf	65.04	66.35	67.52	
	Saturation, %	103.2	103.2	102.4	
	Void Ratio	1.54	1.49	1.45	
Before Shear	Water Content, %	58.1	56.0	54.8	
	Dry Density, pcf	65.17	66.59	67.47	
	Saturation*, %	100.0	100.0	100.0	
	Void Ratio	1.54	1.48	1.45	
	Back Press., psi	.0	.0	-.008097	
Ver. Eff. Cons. Stress, psi		46.65	93.28	140.	
Shear Strength, psi		9.674	9.443	7.429	
Strain at Failure, %		2.8	1.7	2.3	
Strain Rate, %/min		1	1	1	
B-Value		---	---	---	
Estimated Specific Gravity		2.65	2.65	2.65	
Liquid Limit		---	---	---	
Plastic Limit		---	---	---	

NDDOT North Dakota Department of Transportation

Project: IM-8-094(092)346

Location:

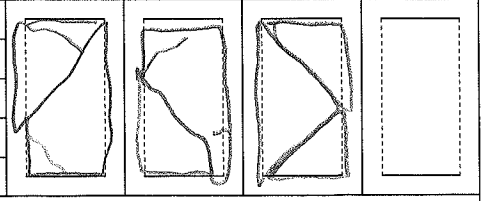
Project No.:

Boring No.: 1

Sample Type:

Description: T.L. 27 1/2" Brn Cly,SLICKEN SIDED

Remarks: 54.3-54.8



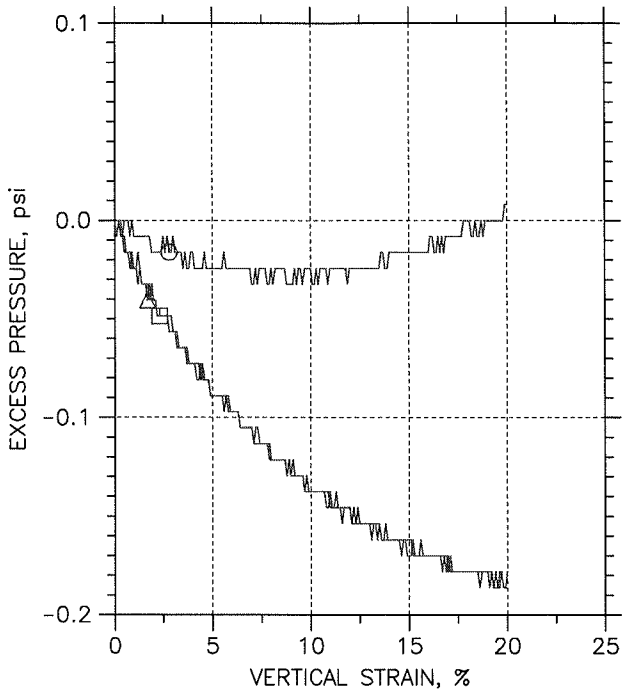
Phase calculations based on start and end of test.

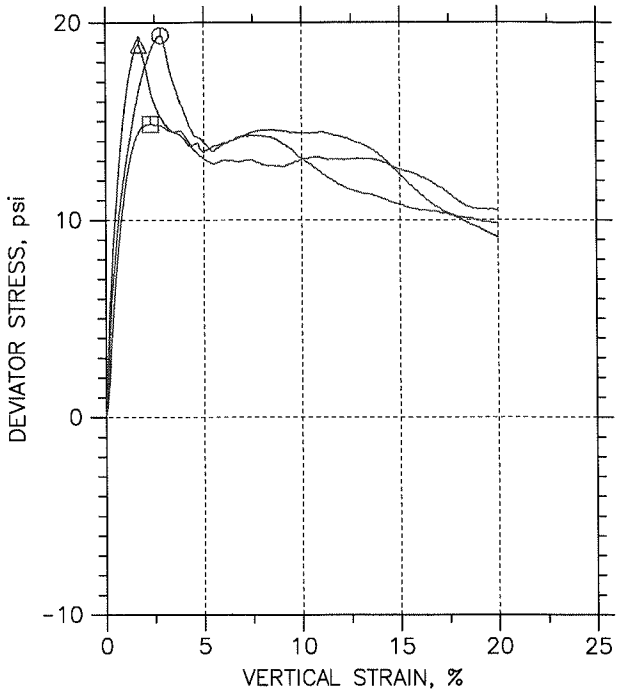
* Saturation is set to 100% for phase calculations.

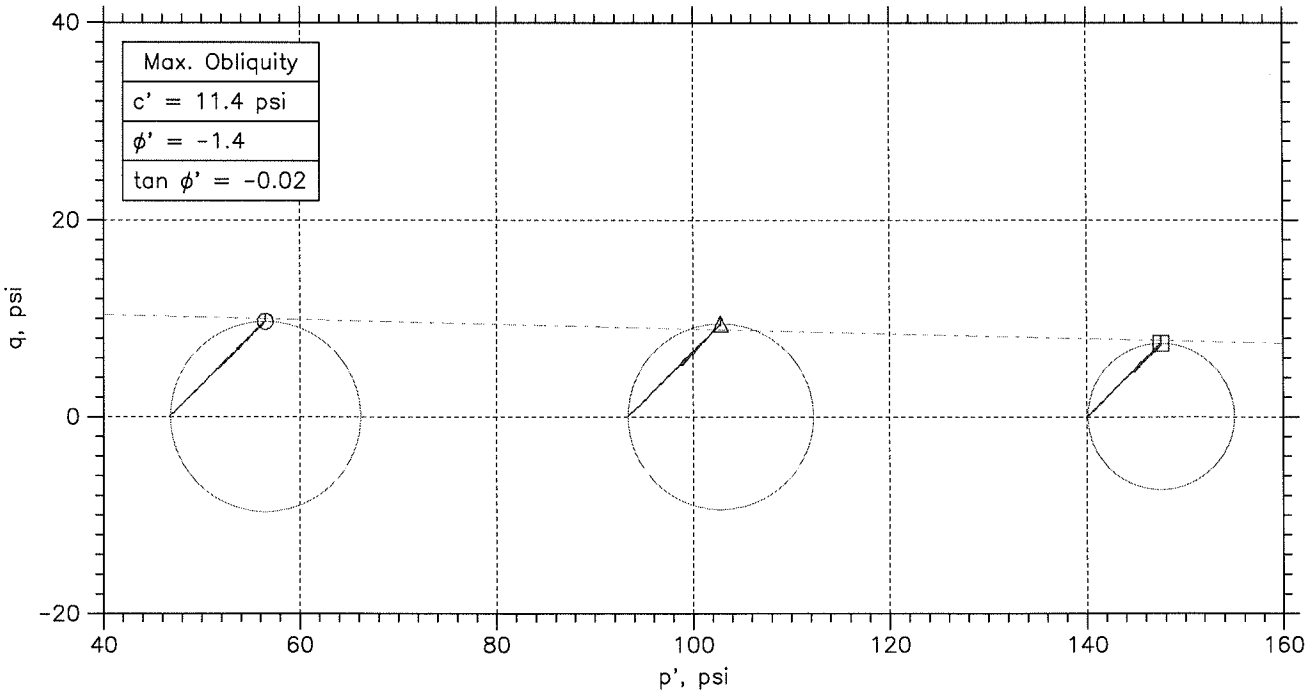
Tue, 17-OCT-2017 08:30:55

55-512-17

Test File







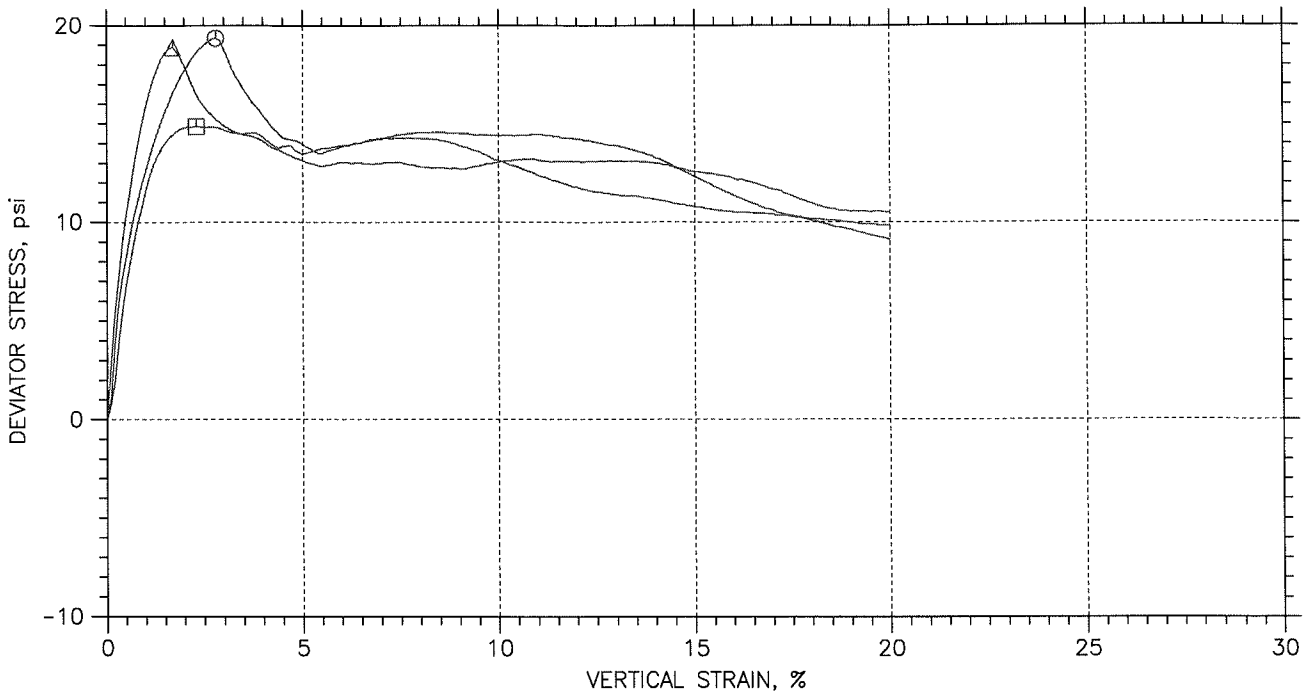
	Sample No.	Test No.	Depth	Tested By	Test Date	Checked By	Check Date	Test File
○	SS-512-17	UU-31-17	56.0	DT	10/16/2017	MD		UU-31-2017.dat
△	SS-512-17	UU-32-17	56.0	DT	10/16/2017	MD		UU-32-2017.dat
□	SS-512-17	UU-33-17	56.0	DT	10/16/2017	MD		UU-33-2017.dat

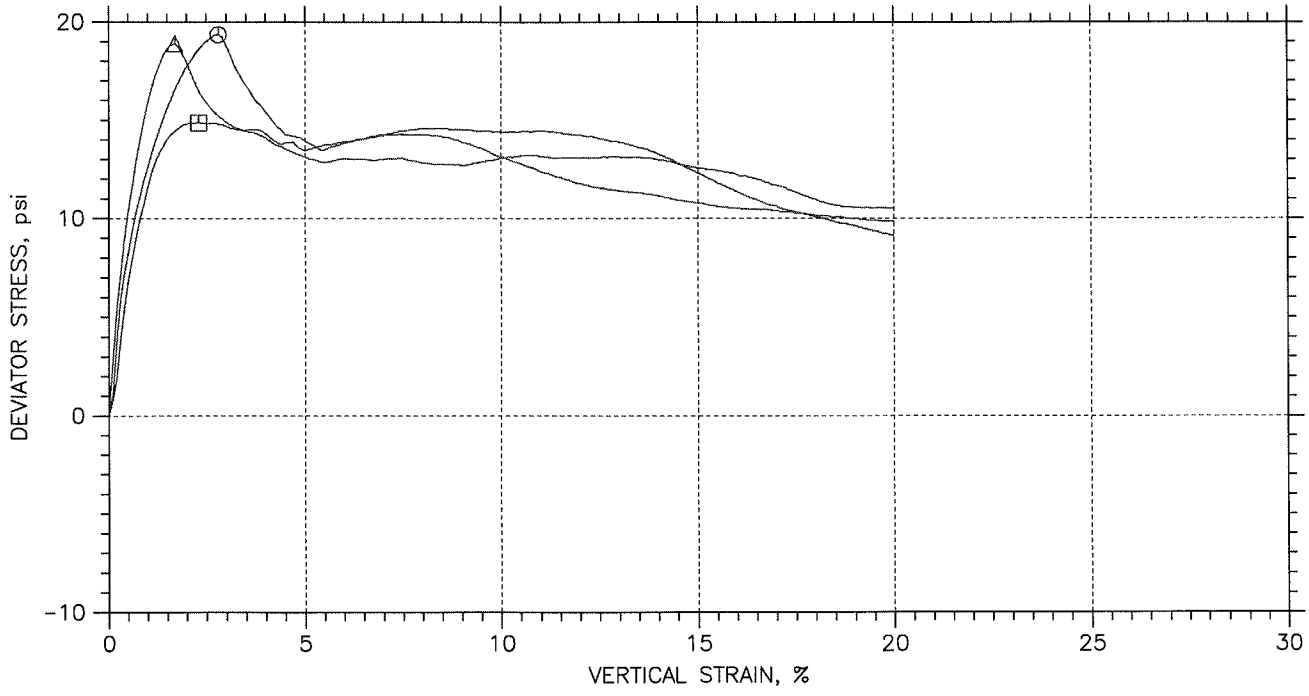
NDDOT
North Dakota Department of Transportation

Project: IM-8-094(092)346	Location:	Project No.:
Boring No.: 1	Sample Type:	
Description: T.L. 27 1/2" Brn Cly,SLICKEN SIDED		
Remarks: 54.3-54.8		

SS-512-17

Test File





	Sample No.	Test No.	Depth	Tested By	Test Date	Checked By	Check Date	Test File
⏲	SS-512-17	UU-31-17	56.0	DT	10/16/2017	MD		UU-31-2017.dat
△	SS-512-17	UU-32-17	56.0	DT	10/16/2017	MD		UU-32-2017.dat
⊡	SS-512-17	UU-33-17	56.0	DT	10/16/2017	MD		UU-33-2017.dat

NDDOT
North Dakota Department of Transportation

Project: IM-8-094(092)346	Location:	Project No.:
Boring No.: 1	Sample Type:	
Description: T.L. 27 1/2" Brn Cly,SLICKEN SIDED		
Remarks: 54.3-54.8		

Tue, 17-OCT-2017 08:30:55

TRIAXIAL TEST

Project: IM-8-094(092)346
Boring No.: 1
Sample No.: SS-512-17
Test No.: UU-31-17

Location:
Tested By: DT
Test Date: 10/16/2017
Sample Type:

Project No.:
Checked By: MD
Depth: 56.0
Elevation:

Soil Description: T.L. 27 1/2" Brn Cly,SLICKEN SIDED
Remarks: 54.3-54.8

Specimen Height: 5.75 in
Specimen Area: 6.37 in^2
Specimen Volume: 600.89 cc

Piston Area: 0.21 in^2
Piston Friction: 0.00 lb
Piston Weight: 0.00 lb

Filter Strip Correction: 0.00 psi
Membrane Correction: 4.20 lb/in
Correction Type: Uniform

Liquid Limit: ---

Plastic Limit: ---

Estimated Specific Gravity: 2.65

	Before Test Trimmings	Before Test Specimen	After Test Specimen	After Test Trimmings
Container ID	S 15	---		
Wt. Container + Wet Soil, gm	74.63	---	---	0
Wt. Container + Dry Soil, gm	53.03	---	---	0
Wt. Container, gm	17.09	---	---	0
Wt. Wet Soil, gm	57.54	1002.2	626.01	0
Wt. Dry Soil, gm	35.94	626.01	626.01	0
Wt. Water, gm	21.6	376.23	0	0
Water Content, %	60.10	60.10	0.00	0.00
Void Ratio	---	1.54	1.54	---
Degree of Saturation, %	---	103.17	0.00	---
Dry Unit Weight, pcf	---	65.038	65.166	---

Initial

Height: 5.752 in
Area: 6.3749 in^2
Volume: 600.89 cc

Moisture: 60.10 %
Void Ratio: 1.54
Dry Unit Weight: 65.038 pcf
Saturation: 103.17 %

End of Initialization
Time: 11.138 min
Total Vertical Stress: 46.646 psi
Total Horizontal Stress: 46.677 psi
Pore Pressure: 0 psi
Effective Vertical Stress: 46.646 psi
Effective Horizontal Stress: 46.677 psi

Height Change: 0.0037644 in
Area Change: 0 in^2
Volume Change: 1.1798 cc
Water Change: -0.1743 cc
Correction: 12.926 cc

Height: 5.7482 in
Area: 6.3749 in^2
Volume: 599.71 cc

Moisture: 58.06 %
Void Ratio: 1.54
Dry Unit Weight: 65.166 pcf
Saturation: 100.00 %

End of Consolidation/A
Time: 11.138 min
Total Vertical Stress: 46.646 psi
Total Horizontal Stress: 46.677 psi
Pore Pressure: 0 psi
Effective Vertical Stress: 46.646 psi
Effective Horizontal Stress: 46.677 psi

Height Change: 0.0037644 in
Area Change: 0 in^2
Volume Change: 1.1798 cc
Water Change: -0.1743 cc
Correction: 12.926 cc

Height: 5.7482 in
Area: 6.3749 in^2
Volume: 599.71 cc

Moisture: 58.06 %
Void Ratio: 1.54
Dry Unit Weight: 65.166 pcf
Saturation: 100.00 %

End of Saturation
Time: 11.138 min
Total Vertical Stress: 46.646 psi
Total Horizontal Stress: 46.677 psi
Pore Pressure: 0 psi
Effective Vertical Stress: 46.646 psi
Effective Horizontal Stress: 46.677 psi

Height Change: 0.0037644 in
Area Change: 0 in^2
Volume Change: 1.1798 cc
Water Change: -0.1743 cc
Correction: 12.926 cc

Height: 5.7482 in
Area: 6.3749 in^2
Volume: 599.71 cc

Moisture: 58.06 %
Void Ratio: 1.54
Dry Unit Weight: 65.166 pcf
Saturation: 100.00 %

End of Consolidation/B
Time: 11.138 min
Total Vertical Stress: 46.646 psi
Total Horizontal Stress: 46.677 psi
Pore Pressure: 0 psi
Effective Vertical Stress: 46.646 psi
Effective Horizontal Stress: 46.677 psi

Height Change: 0.0037644 in
Area Change: 0 in^2
Volume Change: 1.1798 cc
Water Change: -0.1743 cc
Correction: 12.926 cc

Height: 5.7482 in
Area: 6.3749 in^2
Volume: 599.71 cc

Moisture: 58.06 %
Void Ratio: 1.54
Dry Unit Weight: 65.166 pcf
Saturation: 100.00 %

End of Shear
Time: 31.362 min
Total Vertical Stress: 56.606 psi
Total Horizontal Stress: 46.741 psi
Pore Pressure: 0.0080967 psi
Effective Vertical Stress: 56.598 psi
Effective Horizontal Stress: 46.733 psi

Height Change: 1.1536 in
Area Change: -1.5836 in^2
Volume Change: 1.1798 cc
Water Change: -0.1743 cc
Correction: 376.41 cc

Height: 4.5984 in
Area: 7.9585 in^2
Volume: 599.71 cc

Moisture: 0.00 %
Void Ratio: 1.54
Dry Unit Weight: 65.166 pcf
Saturation: 0.00 %

At Failure
Time: 13.973 min
Total Vertical Stress: 66.171 psi
Total Horizontal Stress: 46.822 psi
Pore Pressure: -0.016193 psi
Effective Vertical Stress: 66.187 psi
Effective Horizontal Stress: 46.838 psi

Height Change: 0.16498 in
Area Change: -0.19015 in^2
Volume Change: 1.1798 cc
Water Change: -0.1743 cc
Correction: 0 cc

Height: 5.587 in
Area: 6.5651 in^2
Volume: 599.71 cc

Moisture: 58.06 %
Void Ratio: 1.54
Dry Unit Weight: 65.166 pcf
Saturation: 100.00 %

TRIAXIAL TEST

Project: IM-8-094(092)346
Boring No.: 1
Sample No.: SS-512-17
Test No.: UU-32-17

Location:
Tested By: DT
Test Date: 10/16/2017
Sample Type:

Project No.:
Checked By: MD
Depth: 56.0
Elevation:

Soil Description: T.L. 27 1/2" Brn Cly,SLICKEN SIDED
Remarks: 54.8-55.3

Specimen Height: 5.75 in
Specimen Area: 6.36 in^2
Specimen Volume: 599.41 cc

Piston Area: 0.21 in^2
Piston Friction: 0.00 lb
Piston Weight: 0.00 lb

Filter Strip Correction: 0.00 psi
Membrane Correction: 4.20 lb/in
Correction Type: Uniform

Liquid Limit: ---

Plastic Limit: ---

Estimated Specific Gravity: 2.65

	Before Test Trimmings	Before Test Specimen	After Test Specimen	After Test Trimmings
Container ID	S 58	---		
Wt. Container + Wet Soil, gm	85.98	---	---	0
Wt. Container + Dry Soil, gm	60.59	---	---	0
Wt. Container, gm	16.93	---	---	0
Wt. Wet Soil, gm	69.05	1007.6	637.11	0
Wt. Dry Soil, gm	43.66	637.11	637.11	0
Wt. Water, gm	25.39	370.51	-1.1642e-013	0
Water Content, %	58.15	58.15	-0.00	0.00
Void Ratio	---	1.49	1.48	---
Degree of Saturation, %	---	103.21	-0.00	---
Dry Unit Weight, pcf	---	66.355	66.592	---

Initial

Height: 5.754 in
Area: 6.357 in^2
Volume: 599.41 cc

Moisture: 58.15 %
Void Ratio: 1.49
Dry Unit Weight: 66.355 pcf
Saturation: 103.21 %

End of Initialization
Time: 11.107 min
Total Vertical Stress: 93.284 psi
Total Horizontal Stress: 93.28 psi
Pore Pressure: 0 psi
Effective Vertical Stress: 93.284 psi
Effective Horizontal Stress: 93.28 psi

Height Change: 0.0068317 in
Area Change: 0 in^2
Volume Change: 2.135 cc
Water Change: -0.27405 cc
Correction: 13.924 cc

Height: 5.7472 in
Area: 6.357 in^2
Volume: 597.28 cc

Moisture: 56.01 %
Void Ratio: 1.48
Dry Unit Weight: 66.592 pcf
Saturation: 100.00 %

End of Consolidation/A
Time: 11.107 min
Total Vertical Stress: 93.284 psi
Total Horizontal Stress: 93.28 psi
Pore Pressure: 0 psi
Effective Vertical Stress: 93.284 psi
Effective Horizontal Stress: 93.28 psi

Height Change: 0.0068317 in
Area Change: 0 in^2
Volume Change: 2.135 cc
Water Change: -0.27405 cc
Correction: 13.924 cc

Height: 5.7472 in
Area: 6.357 in^2
Volume: 597.28 cc

Moisture: 56.01 %
Void Ratio: 1.48
Dry Unit Weight: 66.592 pcf
Saturation: 100.00 %

End of Saturation
Time: 11.107 min
Total Vertical Stress: 93.284 psi
Total Horizontal Stress: 93.28 psi
Pore Pressure: 0 psi
Effective Vertical Stress: 93.284 psi
Effective Horizontal Stress: 93.28 psi

Height Change: 0.0068317 in
Area Change: 0 in^2
Volume Change: 2.135 cc
Water Change: -0.27405 cc
Correction: 13.924 cc

Height: 5.7472 in
Area: 6.357 in^2
Volume: 597.28 cc

Moisture: 56.01 %
Void Ratio: 1.48
Dry Unit Weight: 66.592 pcf
Saturation: 100.00 %

End of Consolidation/B
Time: 11.107 min
Total Vertical Stress: 93.284 psi
Total Horizontal Stress: 93.28 psi
Pore Pressure: 0 psi
Effective Vertical Stress: 93.284 psi
Effective Horizontal Stress: 93.28 psi

Height Change: 0.0068317 in
Area Change: 0 in^2
Volume Change: 2.135 cc
Water Change: -0.27405 cc
Correction: 13.924 cc

Height: 5.7472 in
Area: 6.357 in^2
Volume: 597.28 cc

Moisture: 56.01 %
Void Ratio: 1.48
Dry Unit Weight: 66.592 pcf
Saturation: 100.00 %

End of Shear
Time: 31.291 min
Total Vertical Stress: 103.91 psi
Total Horizontal Stress: 93.385 psi
Pore Pressure: -0.17813 psi
Effective Vertical Stress: 104.09 psi
Effective Horizontal Stress: 93.564 psi

Height Change: 1.1563 in
Area Change: -1.5705 in^2
Volume Change: 2.135 cc
Water Change: -0.27405 cc
Correction: 370.78 cc

Height: 4.5977 in
Area: 7.9275 in^2
Volume: 597.28 cc

Moisture: -0.00 %
Void Ratio: 1.48
Dry Unit Weight: 66.592 pcf
Saturation: -0.00 %

At Failure
Time: 12.846 min
Total Vertical Stress: 112.23 psi
Total Horizontal Stress: 93.345 psi
Pore Pressure: -0.040484 psi
Effective Vertical Stress: 112.27 psi
Effective Horizontal Stress: 93.385 psi

Height Change: 0.10471 in
Area Change: -0.12078 in^2
Volume Change: 2.135 cc
Water Change: -0.27405 cc
Correction: 0 cc

Height: 5.6493 in
Area: 6.4778 in^2
Volume: 597.28 cc

Moisture: 56.01 %
Void Ratio: 1.48
Dry Unit Weight: 66.592 pcf
Saturation: 100.00 %

SS-512-17

TRIAXIAL TEST

Project: IM-8-094(092)346
Boring No.: 1
Sample No.: SS-512-17
Test No.: UU-33-17

Location:
Tested By: DT
Test Date: 10/16/2017
Sample Type:

Project No.:
Checked By: MD
Depth: 56.0
Elevation:

Soil Description: T.L. 27 1/2" Brn Cly,SLICKEN SIDED
Remarks: 55.3-55.8

Specimen Height: 5.75 in
Specimen Area: 6.37 in^2
Specimen Volume: 600.47 cc

Piston Area: 0.21 in^2
Piston Friction: 0.00 lb
Piston Weight: 0.00 lb

Filter Strip Correction: 0.00 psi
Membrane Correction: 4.20 lb/in
Correction Type: Uniform

Liquid Limit: ---

Plastic Limit: ---

Estimated Specific Gravity: 2.65

	Before Test Trimmings	Before Test Specimen	After Test Specimen	After Test Trimmings
Container ID	S 17	---		
Wt. Container + Wet Soil, gm	82.38	---	---	0
Wt. Container + Dry Soil, gm	58.91	---	---	0
Wt. Container, gm	17.04	---	---	0
Wt. Wet Soil, gm	65.34	1013.5	649.43	0
Wt. Dry Soil, gm	41.87	649.43	649.43	0
Wt. Water, gm	23.47	364.04	0	0
Water Content, %	56.05	56.05	0.00	0.00
Void Ratio	---	1.45	1.45	---
Degree of Saturation, %	---	102.43	0.00	---
Dry Unit Weight, pcf	---	67.519	67.471	---

Initial

Height: 5.752 in
Area: 6.3704 in^2
Volume: 600.47 cc

Moisture: 56.05 %
Void Ratio: 1.45
Dry Unit Weight: 67.519 pcf
Saturation: 102.43 %

End of Initialization
Time: 11.116 min
Total Vertical Stress: 139.97 psi
Total Horizontal Stress: 139.97 psi
Pore Pressure: -0.0080967 psi
Effective Vertical Stress: 139.98 psi
Effective Horizontal Stress: 139.98 psi

Height Change: -0.0013478 in
Area Change: 0 in^2
Volume Change: -0.42209 cc
Water Change: -0.27405 cc
Correction: 8.4897 cc

Height: 5.7533 in
Area: 6.3704 in^2
Volume: 600.89 cc

Moisture: 54.79 %
Void Ratio: 1.45
Dry Unit Weight: 67.471 pcf
Saturation: 100.00 %

End of Consolidation/A
Time: 11.116 min
Total Vertical Stress: 139.97 psi
Total Horizontal Stress: 139.97 psi
Pore Pressure: -0.0080967 psi
Effective Vertical Stress: 139.98 psi
Effective Horizontal Stress: 139.98 psi

Height Change: -0.0013478 in
Area Change: 0 in^2
Volume Change: -0.42209 cc
Water Change: -0.27405 cc
Correction: 8.4897 cc

Height: 5.7533 in
Area: 6.3704 in^2
Volume: 600.89 cc

Moisture: 54.79 %
Void Ratio: 1.45
Dry Unit Weight: 67.471 pcf
Saturation: 100.00 %

End of Saturation
Time: 11.116 min
Total Vertical Stress: 139.97 psi
Total Horizontal Stress: 139.97 psi
Pore Pressure: -0.0080967 psi
Effective Vertical Stress: 139.98 psi
Effective Horizontal Stress: 139.98 psi

Height Change: -0.0013478 in
Area Change: 0 in^2
Volume Change: -0.42209 cc
Water Change: -0.27405 cc
Correction: 8.4897 cc

Height: 5.7533 in
Area: 6.3704 in^2
Volume: 600.89 cc

Moisture: 54.79 %
Void Ratio: 1.45
Dry Unit Weight: 67.471 pcf
Saturation: 100.00 %

End of Consolidation/B
Time: 11.116 min
Total Vertical Stress: 139.97 psi
Total Horizontal Stress: 139.97 psi
Pore Pressure: -0.0080967 psi
Effective Vertical Stress: 139.98 psi
Effective Horizontal Stress: 139.98 psi

Height Change: -0.0013478 in
Area Change: 0 in^2
Volume Change: -0.42209 cc
Water Change: -0.27405 cc
Correction: 8.4897 cc

Height: 5.7533 in
Area: 6.3704 in^2
Volume: 600.89 cc

Moisture: 54.79 %
Void Ratio: 1.45
Dry Unit Weight: 67.471 pcf
Saturation: 100.00 %

End of Shear
Time: 31.322 min
Total Vertical Stress: 149.21 psi
Total Horizontal Stress: 140.09 psi
Pore Pressure: -0.18622 psi
Effective Vertical Stress: 149.4 psi
Effective Horizontal Stress: 140.28 psi

Height Change: 1.1495 in
Area Change: -1.5966 in^2
Volume Change: -0.42209 cc
Water Change: -0.27405 cc
Correction: 364.31 cc

Height: 4.6025 in
Area: 7.9671 in^2
Volume: 600.89 cc

Moisture: 0.00 %
Void Ratio: 1.45
Dry Unit Weight: 67.471 pcf
Saturation: 0.00 %

At Failure
Time: 13.47 min
Total Vertical Stress: 154.94 psi
Total Horizontal Stress: 140.09 psi
Pore Pressure: -0.04858 psi
Effective Vertical Stress: 154.99 psi
Effective Horizontal Stress: 140.13 psi

Height Change: 0.1311 in
Area Change: -0.15156 in^2
Volume Change: -0.42209 cc
Water Change: -0.27405 cc
Correction: 0 cc

Height: 5.6209 in
Area: 6.522 in^2
Volume: 600.89 cc

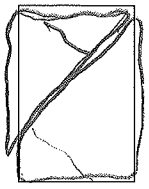
Moisture: 54.79 %
Void Ratio: 1.45
Dry Unit Weight: 67.471 pcf
Saturation: 100.00 %

TRIAXIAL UU(Q) CCU(R) CD(S)

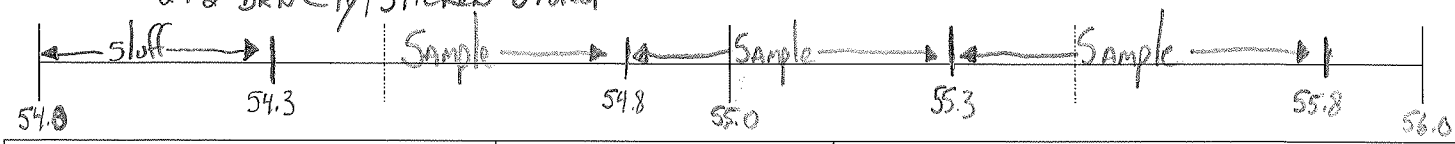
North Dakota Department of Transportation, Materials & Research
SFN 50459 (10-2016)

Project Number	
IM-8-094(092)346	
Boring Number	
1	

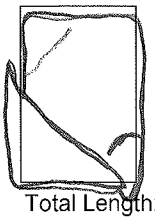
Field Sample Number			Lab Number		Depth	
SS-512-17			UU-31-17		54.3 to 54.8	
Weight of Sample	After Test Weight		Confining Pressure		Test Number	of
1002.24			46.7		1	3
Diameter	2.859	2.854	Height	5.754	Moisture Can Number	After Moisture Can Number
	2.858	2.839		5.754	Wet Wt + Can	Wet Wt + Can
	2.857	2.829		5.749	Dry Wt + Can	Dry Wt + Can
	Average		Average		Wt of Can	Wt of Can
	2.849		5.752		17.09	



Total Length: 27½" Brn Cly, Slicken Sided

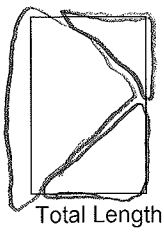


Field Sample Number			Lab Number		Depth	
SS-512-17			UU-32-17		54.8 to 55.3	
Weight of Sample	After Test Weight		Confining Pressure		Test Number	of
1007.62			93.3		2	3
Diameter	2.862	2.841	Height	5.756	Moisture Can Number	After Moisture Can Number
	2.858	2.836		5.754	Wet Wt + Can	Wet Wt + Can
	2.848	2.825		5.752	Dry Wt + Can	Dry Wt + Can
	Average		Average		Wt of Can	Wt of Can
	2.845		5.754		16.93	



Total Length:

Field Sample Number			Lab Number		Depth	
SS-512-17			UU-33-17		55.3 to 55.8	
Weight of Sample	After Test Weight		Confining Pressure		Test Number	of
1013.47			140.0		3	3
Diameter	2.854	2.862	Height	5.752	Moisture Can Number	After Moisture Can Number
	2.847	2.852		5.753	Wet Wt + Can	Wet Wt + Can
	2.838	2.836		5.750	Dry Wt + Can	Dry Wt + Can
	Average		Average		Wt of Can	Wt of Can
	2.848		5.752		17.04	

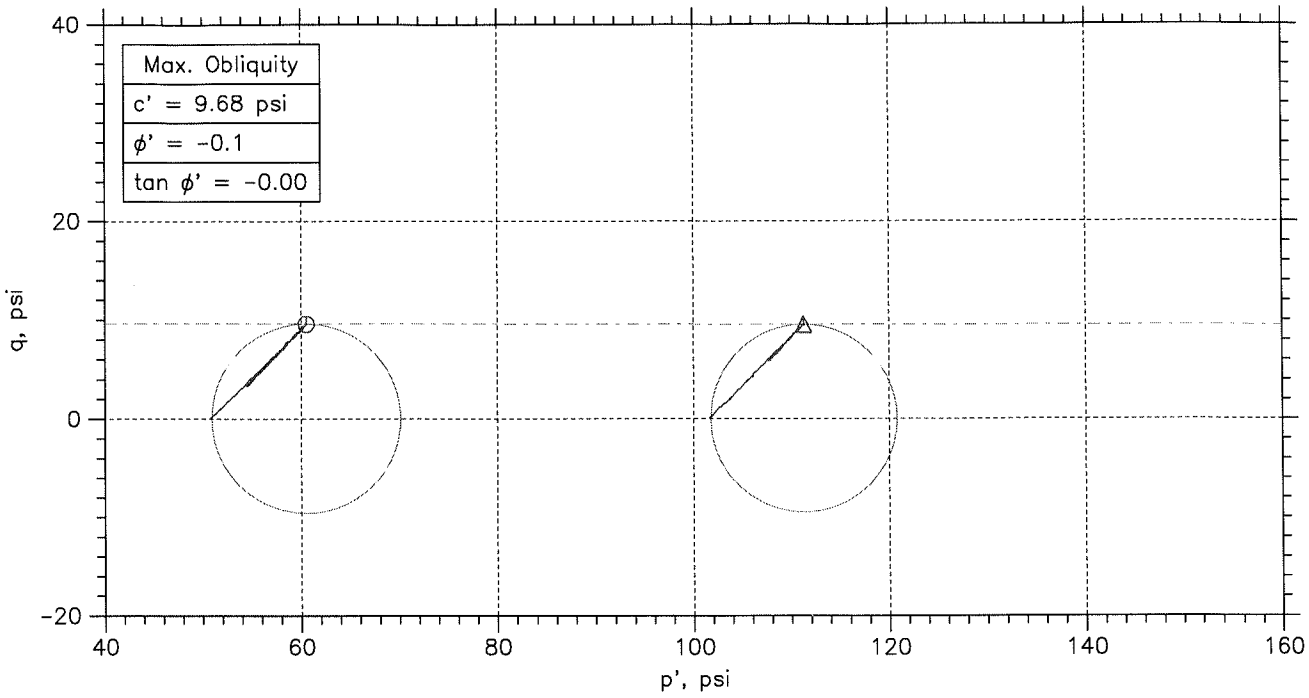


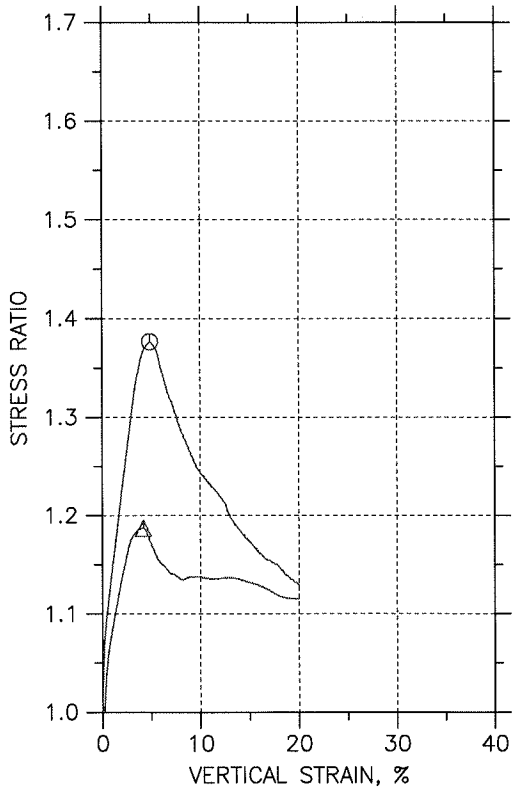
Total Length:

AASHTO T-234 Tested By:

SS-514-17

Test File





Symbol		⊙	△		
Sample No.		SS-514-17	SS-514-17		
Test No.		UU-34-17	UU-35-17		
Depth		61.0	61.0		
Initial	Diameter, in	2.821	2.818		
	Height, in	5.748	5.745		
	Water Content, %	52.6	53.6		
	Dry Density, pcf	71.37	70.31		
	Saturation, %	105.8	105.0		
	Void Ratio	1.32	1.35		
Before Shear	Water Content, %	49.7	51.0		
	Dry Density, pcf	71.37	70.33		
	Saturation*, %	100.0	100.0		
	Void Ratio	1.32	1.35		
	Back Press., psi	.0	.0		
Ver. Eff. Cons. Stress, psi		50.82	101.5		
Shear Strength, psi		9.586	9.511		
Strain at Failure, %		4.9	4.2		
Strain Rate, %/min		1	1		
B-Value		---	---		
Estimated Specific Gravity		2.65	2.65		
Liquid Limit		---	---		
Plastic Limit		---	---		

NDDOT North Dakota Department of Transportation

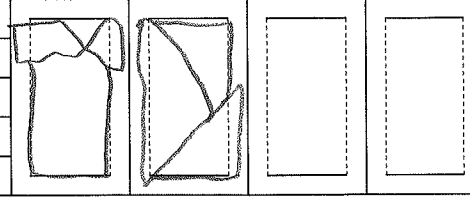
Project: IM-8-094(092)346

Location:

Project No.:

Boring No.: 1

Sample Type:



Description: T.L. 24 3/4" Brn Cly with Silt Deposits,SLICKEN SIDED

Remarks: 59.3-59.8

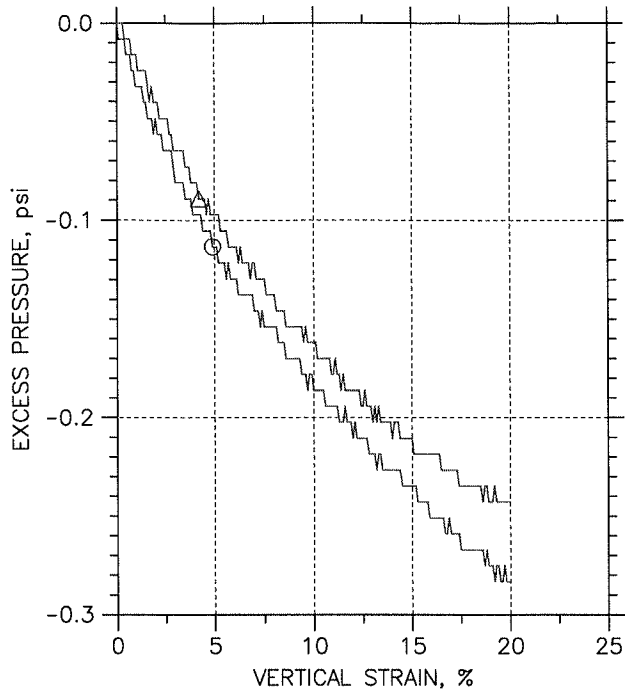
Phase calculations based on start and end of test.

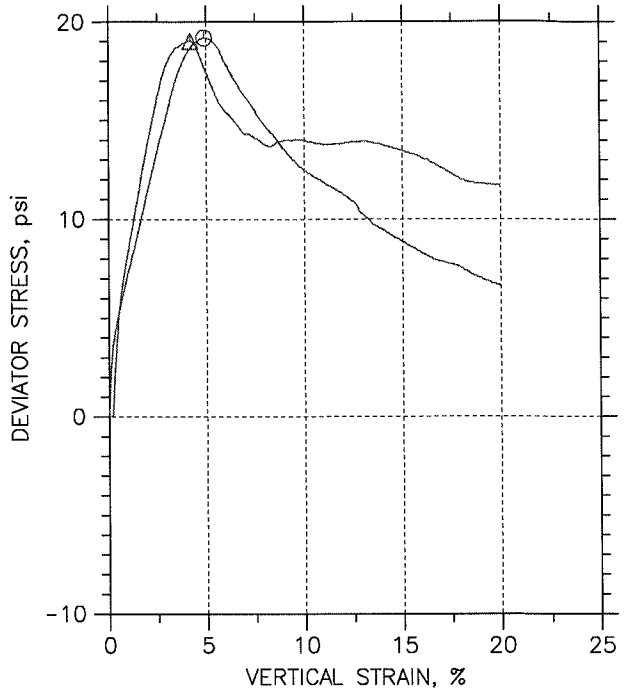
* Saturation is set to 100% for phase calculations.

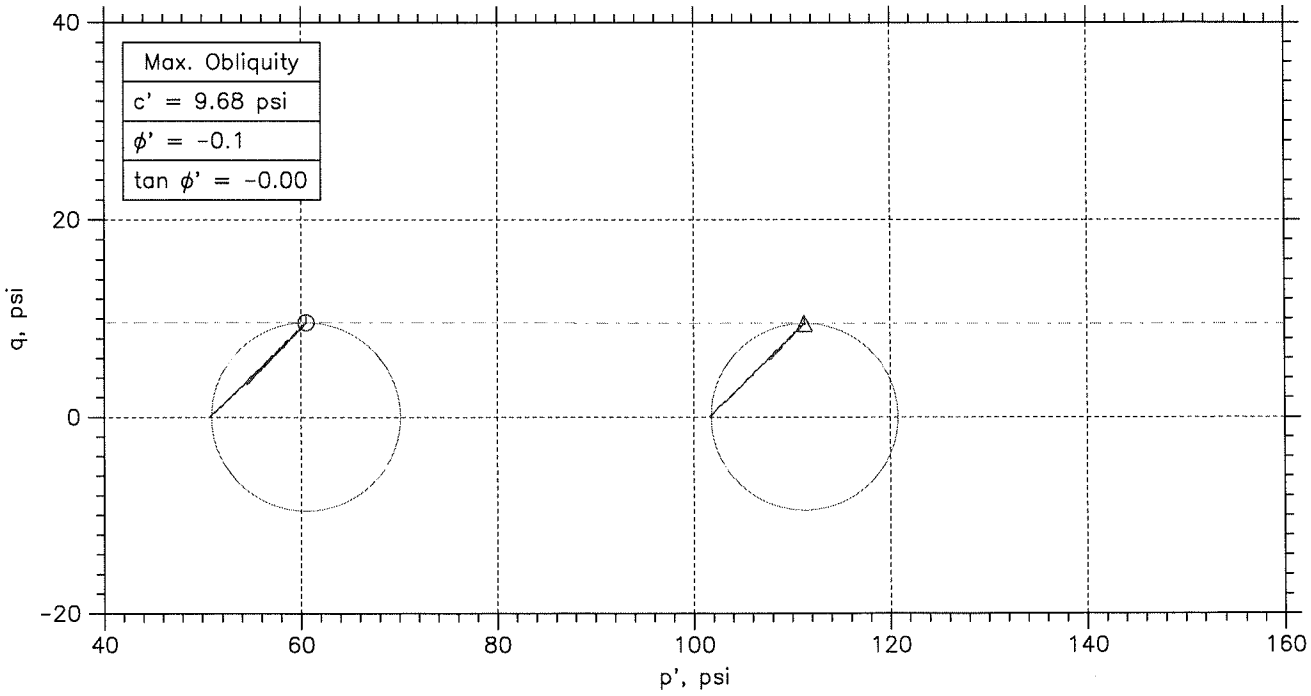
Tue, 17-OCT-2017 08:32:35

SS-514-17

Test File







	Sample No.	Test No.	Depth	Tested By	Test Date	Checked By	Check Date	Test File
⊙	SS-514-17	UU-34-17	61.0	DT	10/16/2017	MD		UU-34-2017.dat
△	SS-514-17	UU-35-17	61.0	DT	10/16/2017	MD		UU-35-2017.dat

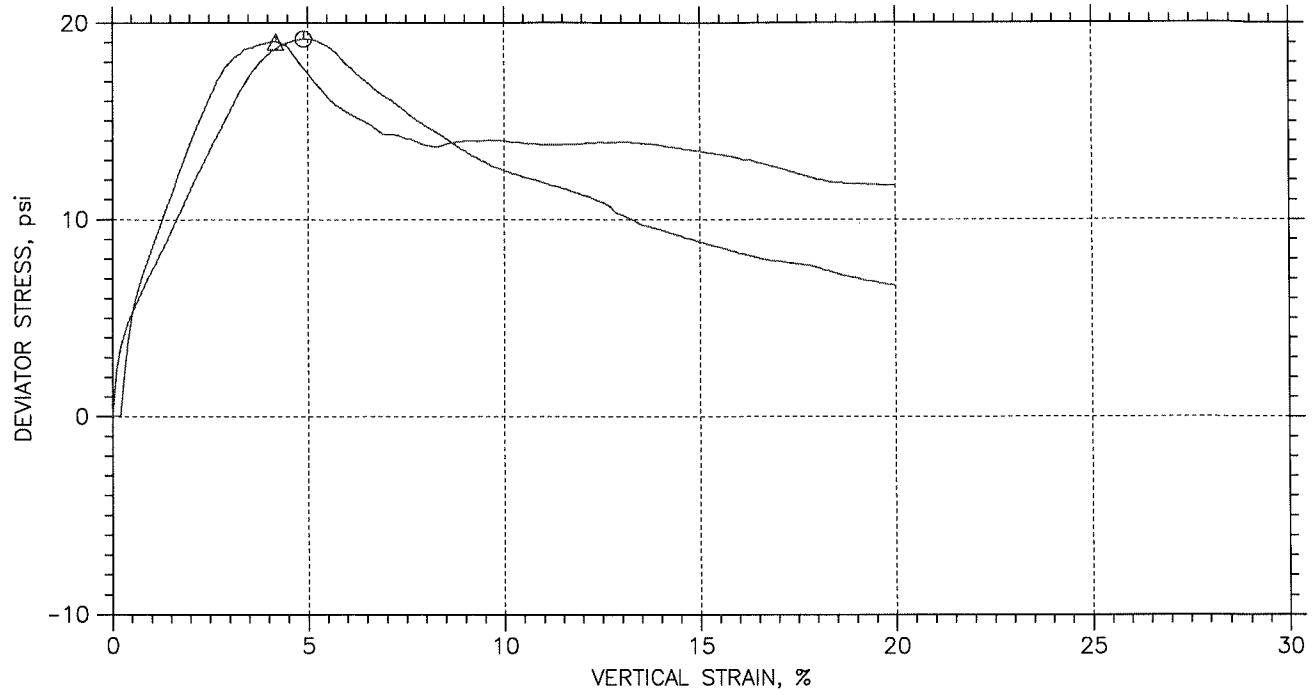
NDDOT
North Dakota Department of Transportation

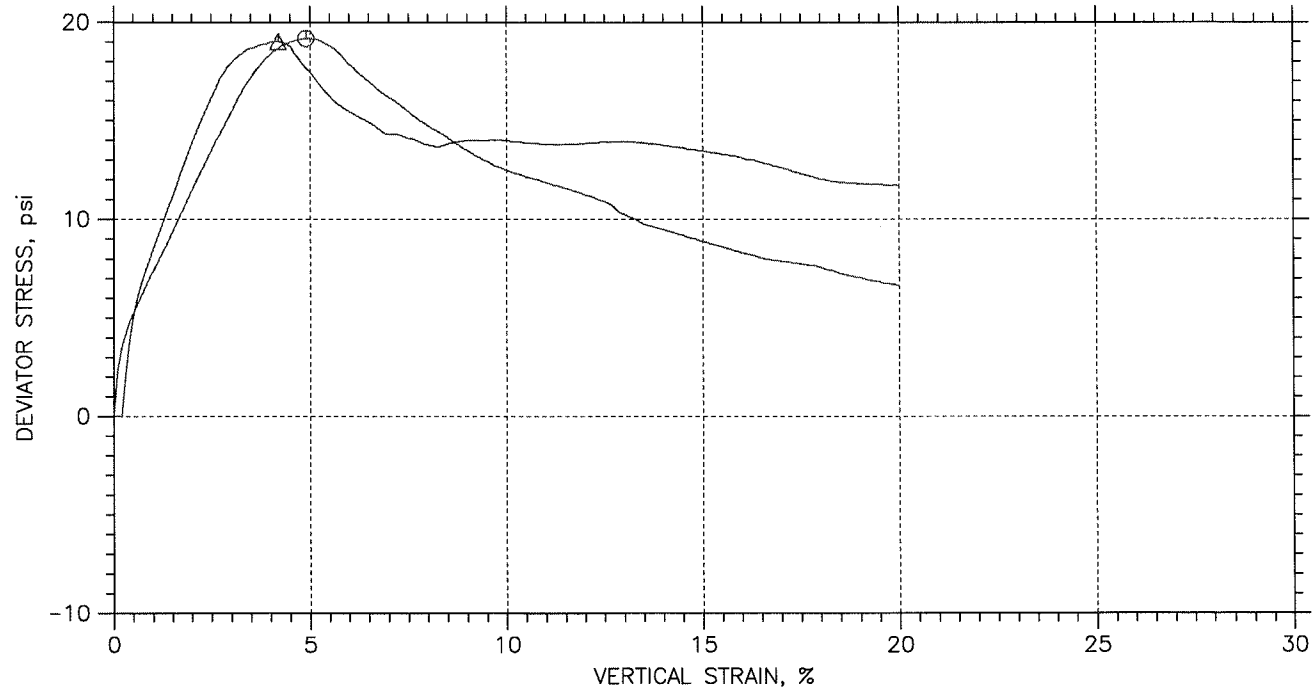
Project: IM-8-094(092)346	Location:	Project No.:
Boring No.: 1	Sample Type:	
Description: T.L. 24 3/4" Brn Cly with Silt Deposits,SLICKEN SIDED		
Remarks: 59.3-59.8		

Tue, 17-OCT-2017 08:32:35

SS-514-17

Test File





	Sample No.	Test No.	Depth	Tested By	Test Date	Checked By	Check Date	Test File
⏲	SS-514-17	UU-34-17	61.0	DT	10/16/2017	MD		UU-34-2017.dat
△	SS-514-17	UU-35-17	61.0	DT	10/16/2017	MD		UU-35-2017.dat

NDDOT North Dakota Department of Transportation

Project: IM-8-094(092)346	Location:	Project No.:
Boring No.: 1	Sample Type:	
Description: T.L. 24 3/4" Brn Cly with Silt Deposits,SLICKEN SIDED		
Remarks: 59.3-59.8		

Tue, 17-OCT-2017 08:32:35

TRIAXIAL TEST

Project: IM-8-094(092)346
Boring No.: 1
Sample No.: SS-514-17
Test No.: UU-34-17

Location:
Tested By: DT
Test Date: 10/16/2017
Sample Type:

Project No.:
Checked By: MD
Depth: 61.0
Elevation:

Soil Description: T.L. 24 3/4" Brn Cly with Silt Deposits,SLICKEN SIDED
Remarks: 59.3-59.8

Specimen Height: 5.75 in
Specimen Area: 6.25 in^2
Specimen Volume: 588.73 cc

Piston Area: 0.21 in^2
Piston Friction: 0.00 lb
Piston Weight: 0.00 lb

Filter Strip Correction: 0.00 psi
Membrane Correction: 4.20 lb/in
Correction Type: Uniform

Liquid Limit: ---

Plastic Limit: ---

Estimated Specific Gravity: 2.65

	Before Test Trimmings	Before Test Specimen	After Test Specimen	After Test Trimmings
Container ID	S 44	---		
Wt. Container + Wet Soil, gm	87.69	---	---	0
Wt. Container + Dry Soil, gm	63.34	---	---	0
Wt. Container, gm	17.04	---	---	0
Wt. Wet Soil, gm	70.65	1027.1	673.08	0
Wt. Dry Soil, gm	46.3	673.08	673.08	0
Wt. Water, gm	24.35	353.98	0	0
Water Content, %	52.59	52.59	0.00	0.00
Void Ratio	---	1.32	1.32	---
Degree of Saturation, %	---	105.75	0.00	---
Dry Unit Weight, pcf	---	71.372	71.374	---

Initial

Height: 5.748 in
Area: 6.2502 in^2
Volume: 588.73 cc

Moisture: 52.59 %
Void Ratio: 1.32
Dry Unit Weight: 71.372 pcf
Saturation: 105.75 %

End of Initialization
Time: 11.103 min
Total Vertical Stress: 50.823 psi
Total Horizontal Stress: 50.788 psi
Pore Pressure: 0 psi
Effective Vertical Stress: 50.823 psi
Effective Horizontal Stress: 50.788 psi

Height Change: 4.6474e-005 in
Area Change: 0 in^2
Volume Change: 0.01428 cc
Water Change: -0.27566 cc
Correction: 19.537 cc

Height: 5.748 in
Area: 6.2502 in^2
Volume: 588.71 cc

Moisture: 49.73 %
Void Ratio: 1.32
Dry Unit Weight: 71.374 pcf
Saturation: 100.00 %

End of Consolidation/A
Time: 11.103 min
Total Vertical Stress: 50.823 psi
Total Horizontal Stress: 50.788 psi
Pore Pressure: 0 psi
Effective Vertical Stress: 50.823 psi
Effective Horizontal Stress: 50.788 psi

Height Change: 4.6474e-005 in
Area Change: 0 in^2
Volume Change: 0.01428 cc
Water Change: -0.27566 cc
Correction: 19.537 cc

Height: 5.748 in
Area: 6.2502 in^2
Volume: 588.71 cc

Moisture: 49.73 %
Void Ratio: 1.32
Dry Unit Weight: 71.374 pcf
Saturation: 100.00 %

End of Saturation
Time: 11.103 min
Total Vertical Stress: 50.823 psi
Total Horizontal Stress: 50.788 psi
Pore Pressure: 0 psi
Effective Vertical Stress: 50.823 psi
Effective Horizontal Stress: 50.788 psi

Height Change: 4.6474e-005 in
Area Change: 0 in^2
Volume Change: 0.01428 cc
Water Change: -0.27566 cc
Correction: 19.537 cc

Height: 5.748 in
Area: 6.2502 in^2
Volume: 588.71 cc

Moisture: 49.73 %
Void Ratio: 1.32
Dry Unit Weight: 71.374 pcf
Saturation: 100.00 %

End of Consolidation/B
Time: 11.103 min
Total Vertical Stress: 50.823 psi
Total Horizontal Stress: 50.788 psi
Pore Pressure: 0 psi
Effective Vertical Stress: 50.823 psi
Effective Horizontal Stress: 50.788 psi

Height Change: 4.6474e-005 in
Area Change: 0 in^2
Volume Change: 0.01428 cc
Water Change: -0.27566 cc
Correction: 19.537 cc

Height: 5.748 in
Area: 6.2502 in^2
Volume: 588.71 cc

Moisture: 49.73 %
Void Ratio: 1.32
Dry Unit Weight: 71.374 pcf
Saturation: 100.00 %

End of Shear
Time: 31.308 min
Total Vertical Stress: 57.563 psi
Total Horizontal Stress: 50.934 psi
Pore Pressure: -0.28339 psi
Effective Vertical Stress: 57.846 psi
Effective Horizontal Stress: 51.217 psi

Height Change: 1.1501 in
Area Change: -1.5631 in^2
Volume Change: 0.01428 cc
Water Change: -0.27566 cc
Correction: 354.26 cc

Height: 4.5979 in
Area: 7.8134 in^2
Volume: 588.71 cc

Moisture: 0.00 %
Void Ratio: 1.32
Dry Unit Weight: 71.374 pcf
Saturation: 0.00 %

At Failure
Time: 16.067 min
Total Vertical Stress: 70.009 psi
Total Horizontal Stress: 50.837 psi
Pore Pressure: -0.11335 psi
Effective Vertical Stress: 70.122 psi
Effective Horizontal Stress: 50.95 psi

Height Change: 0.28173 in
Area Change: -0.32521 in^2
Volume Change: 0.01428 cc
Water Change: -0.27566 cc
Correction: 0 cc

Height: 5.4663 in
Area: 6.5754 in^2
Volume: 588.71 cc

Moisture: 49.73 %
Void Ratio: 1.32
Dry Unit Weight: 71.374 pcf
Saturation: 100.00 %

SS-514-17

TRIAXIAL TEST

Project: IM-8-094(092)346
Boring No.: 1
Sample No.: SS-514-17
Test No.: UU-35-17

Location:
Tested By: DT
Test Date: 10/16/2017
Sample Type:

Project No.:
Checked By: MD
Depth: 61.0
Elevation:

Soil Description: T.L. 24 3/4" Brn Cly with Silt Deposits,SLICKEN SIDED
Remarks: 59.8-60.3

Specimen Height: 5.75 in
Specimen Area: 6.24 in^2
Specimen Volume: 587.17 cc

Piston Area: 0.21 in^2
Piston Friction: 0.00 lb
Piston Weight: 0.00 lb

Filter Strip Correction: 0.00 psi
Membrane Correction: 4.20 lb/in
Correction Type: Uniform

Liquid Limit: ---

Plastic Limit: ---

Estimated Specific Gravity: 2.65

	Before Test Trimmings	Before Test Specimen	After Test Specimen	After Test Trimmings
Container ID	S 43	---		
Wt. Container + Wet Soil, gm	81.13	---	---	0
Wt. Container + Dry Soil, gm	58.74	---	---	0
Wt. Container, gm	16.98	---	---	0
Wt. Wet Soil, gm	64.15	1015.9	661.35	0
Wt. Dry Soil, gm	41.76	661.35	661.35	0
Wt. Water, gm	22.39	354.59	0	0
Water Content, %	53.62	53.62	0.00	0.00
Void Ratio	---	1.35	1.35	---
Degree of Saturation, %	---	105.03	0.00	---
Dry Unit Weight, pcf	---	70.315	70.325	---

Initial

Height: 5.745 in
Area: 6.2369 in^2
Volume: 587.17 cc

Moisture: 53.62 %
Void Ratio: 1.35
Dry Unit Weight: 70.315 pcf
Saturation: 105.03 %

End of Initialization
Time: 11.121 min
Total Vertical Stress: 101.53 psi
Total Horizontal Stress: 101.56 psi
Pore Pressure: 0 psi
Effective Vertical Stress: 101.53 psi
Effective Horizontal Stress: 101.56 psi

Height Change: 0.00027885 in
Area Change: 0 in^2
Volume Change: 0.085498 cc
Water Change: -0.29121 cc
Correction: 17.363 cc

Height: 5.7447 in
Area: 6.2369 in^2
Volume: 587.08 cc

Moisture: 51.03 %
Void Ratio: 1.35
Dry Unit Weight: 70.325 pcf
Saturation: 100.00 %

End of Consolidation/A
Time: 11.121 min
Total Vertical Stress: 101.53 psi
Total Horizontal Stress: 101.56 psi
Pore Pressure: 0 psi
Effective Vertical Stress: 101.53 psi
Effective Horizontal Stress: 101.56 psi

Height Change: 0.00027885 in
Area Change: 0 in^2
Volume Change: 0.085498 cc
Water Change: -0.29121 cc
Correction: 17.363 cc

Height: 5.7447 in
Area: 6.2369 in^2
Volume: 587.08 cc

Moisture: 51.03 %
Void Ratio: 1.35
Dry Unit Weight: 70.325 pcf
Saturation: 100.00 %

End of Saturation
Time: 11.121 min
Total Vertical Stress: 101.53 psi
Total Horizontal Stress: 101.56 psi
Pore Pressure: 0 psi
Effective Vertical Stress: 101.53 psi
Effective Horizontal Stress: 101.56 psi

Height Change: 0.00027885 in
Area Change: 0 in^2
Volume Change: 0.085498 cc
Water Change: -0.29121 cc
Correction: 17.363 cc

Height: 5.7447 in
Area: 6.2369 in^2
Volume: 587.08 cc

Moisture: 51.03 %
Void Ratio: 1.35
Dry Unit Weight: 70.325 pcf
Saturation: 100.00 %

End of Consolidation/B
Time: 11.121 min
Total Vertical Stress: 101.53 psi
Total Horizontal Stress: 101.56 psi
Pore Pressure: 0 psi
Effective Vertical Stress: 101.53 psi
Effective Horizontal Stress: 101.56 psi

Height Change: 0.00027885 in
Area Change: 0 in^2
Volume Change: 0.085498 cc
Water Change: -0.29121 cc
Correction: 17.363 cc

Height: 5.7447 in
Area: 6.2369 in^2
Volume: 587.08 cc

Moisture: 51.03 %
Void Ratio: 1.35
Dry Unit Weight: 70.325 pcf
Saturation: 100.00 %

End of Shear
Time: 31.304 min
Total Vertical Stress: 113.27 psi
Total Horizontal Stress: 101.58 psi
Pore Pressure: -0.251 psi
Effective Vertical Stress: 113.53 psi
Effective Horizontal Stress: 101.83 psi

Height Change: 1.1493 in
Area Change: -1.5586 in^2
Volume Change: 0.085498 cc
Water Change: -0.29121 cc
Correction: 354.88 cc

Height: 4.5957 in
Area: 7.7956 in^2
Volume: 587.08 cc

Moisture: 0.00 %
Void Ratio: 1.35
Dry Unit Weight: 70.325 pcf
Saturation: 0.00 %

At Failure
Time: 15.365 min
Total Vertical Stress: 120.69 psi
Total Horizontal Stress: 101.67 psi
Pore Pressure: -0.097161 psi
Effective Vertical Stress: 120.79 psi
Effective Horizontal Stress: 101.77 psi

Height Change: 0.24176 in
Area Change: -0.27722 in^2
Volume Change: 0.085498 cc
Water Change: -0.29121 cc
Correction: 0 cc

Height: 5.5032 in
Area: 6.5142 in^2
Volume: 587.08 cc

Moisture: 51.03 %
Void Ratio: 1.35
Dry Unit Weight: 70.325 pcf
Saturation: 100.00 %

TRIAXIAL UU(Q) CCU(R) CD(S)

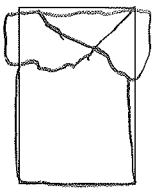
North Dakota Department of Transportation, Materials & Research
SFN 50459 (10-2016)

Project Number	
IM-8-094(092)346	
Boring Number	
1	

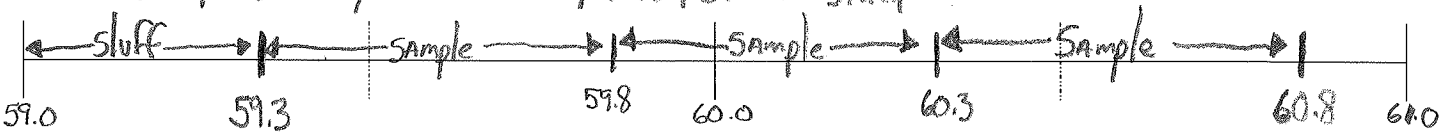
Field Sample Number	Lab Number	Depth
SS-514-17	UU-34-17	59.3 to 59.8

Weight of Sample	After Test Weight	Confining Pressure	Test Number	of
1027.06		50.8	1	3

Diameter			Height		Moisture Can Number	After Moisture Can Number
	2.845	2.808		5.747	S44	
	2.843	2.802		5.750	Wet Wt + Can 87.69	Wet Wt + Can
	2.827	2.802		5.747	Dry Wt + Can 63.34	Dry Wt + Can
	Average 2.821			Average 5.748	Wt of Can 17.04	Wt of Can



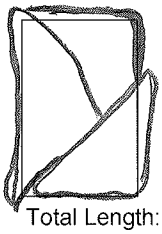
Total Length: 24 3/4" Brn Cly with silt Deposits, Slickensided



Field Sample Number	Lab Number	Depth
SS-514-17	UU-35-17	59.8 to 60.3

Weight of Sample	After Test Weight	Confining Pressure	Test Number	of
1015.94		101.6	2	3

Diameter			Height		Moisture Can Number	After Moisture Can Number
	2.802	2.841		5.746	S43	
	2.799	2.826		5.747	Wet Wt + Can 81.13	Wet Wt + Can
	2.802	2.837		5.743	Dry Wt + Can 58.74	Dry Wt + Can
	Average 2.818			Average 5.745	Wt of Can 16.98	Wt of Can

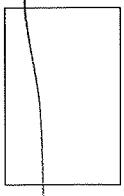


Total Length:

Field Sample Number	Lab Number	Depth
SS-514-17	UU-36-17	60.3 to 60.8

Weight of Sample	After Test Weight	Confining Pressure	Test Number	of
1024.75		127.1	3	3

Diameter			Height		Moisture Can Number	After Moisture Can Number
	2.846	2.813		5.753	S69	
	2.828	2.811		5.750	Wet Wt + Can 72.78	Wet Wt + Can
	2.821	2.799		5.751	Dry Wt + Can 54.06	Dry Wt + Can
	Average 2.819			Average 5.751	Wt of Can 15.36	Wt of Can



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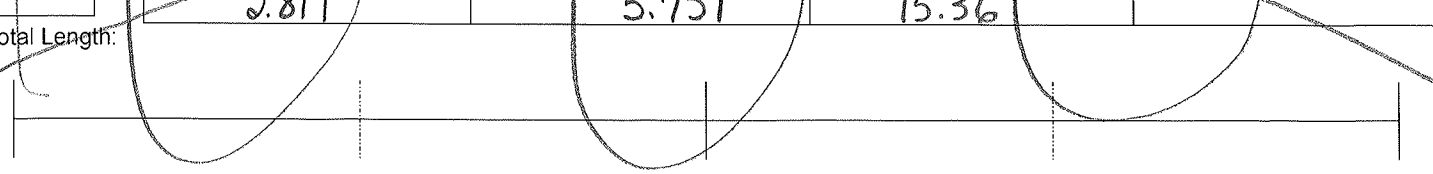
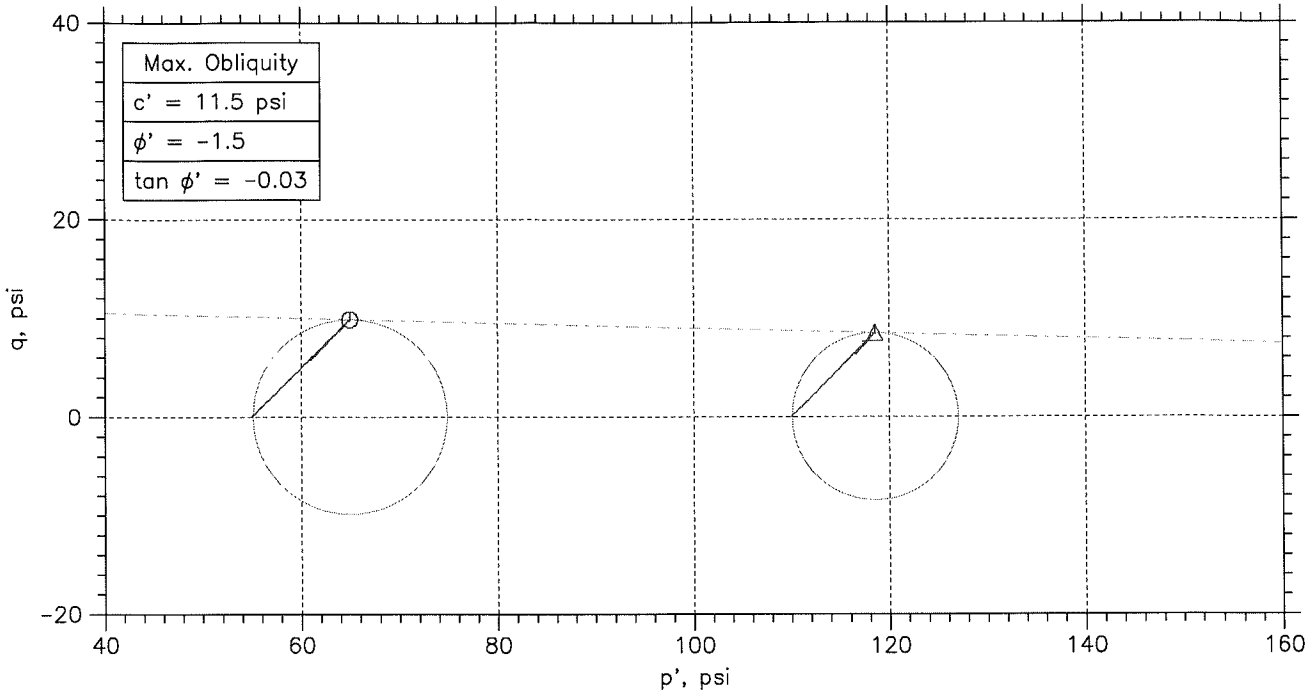
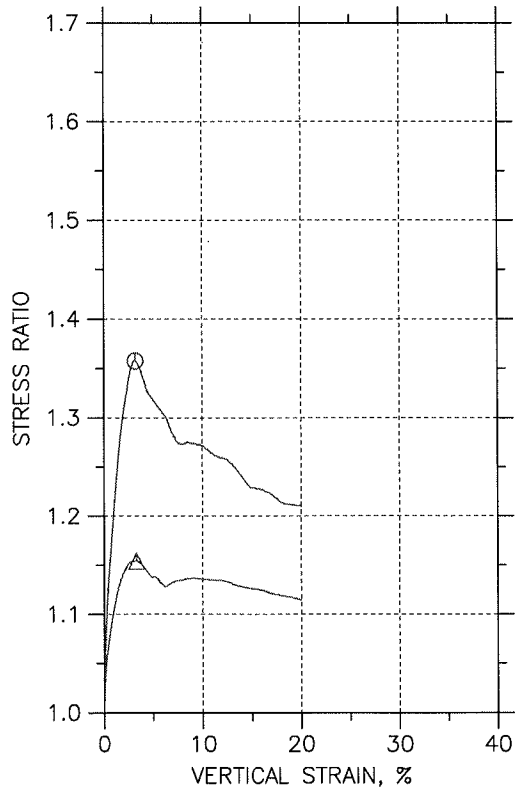


AASHTO T-234 Tested By:

SS-516-17

Test File





Symbol		⊙	△		
Sample No.		SS-516-17	SS-516-17		
Test No.		UU-36-17	UU-37-17		
Depth		66.0	66.0		
Initial	Diameter, in	2.847	2.832		
	Height, in	5.747	5.752		
	Water Content, %	45.5	45.4		
	Dry Density, pcf	75.21	76.39		
	Saturation, %	100.5	103.3		
	Void Ratio	1.2	1.17		
Before Shear	Water Content, %	44.9	43.6		
	Dry Density, pcf	75.56	76.75		
	Saturation*, %	100.0	100.0		
	Void Ratio	1.19	1.16		
	Back Press., psi	.0	.0		
Ver. Eff. Cons. Stress, psi		54.92	110.		
Shear Strength, psi		9.858	8.471		
Strain at Failure, %		3.2	3.3		
Strain Rate, %/min		1	1		
B-Value		---	---		
Estimated Specific Gravity		2.65	2.65		
Liquid Limit		---	---		
Plastic Limit		---	---		

NDDOT
North Dakota Department of Transportation

Project: IM-8-094(092)346

Location:

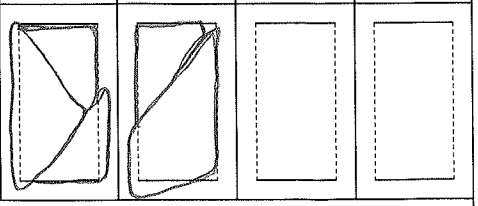
Project No.:

Boring No.: 1

Sample Type:

Description: T.L. 28" Brn Cly with Silt Deposits,Rock up to 1/4", SLICKEN SIDED

Remarks: 64.7-65.2



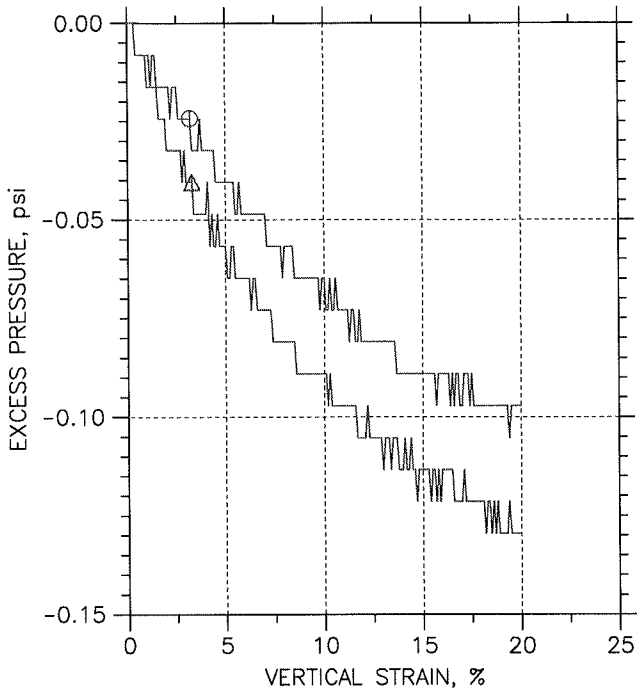
Phase calculations based on start and end of test.

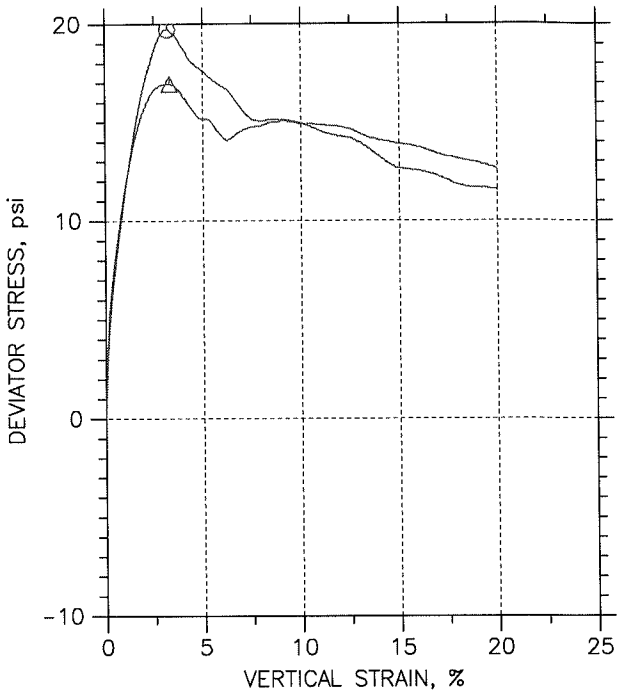
* Saturation is set to 100% for phase calculations.

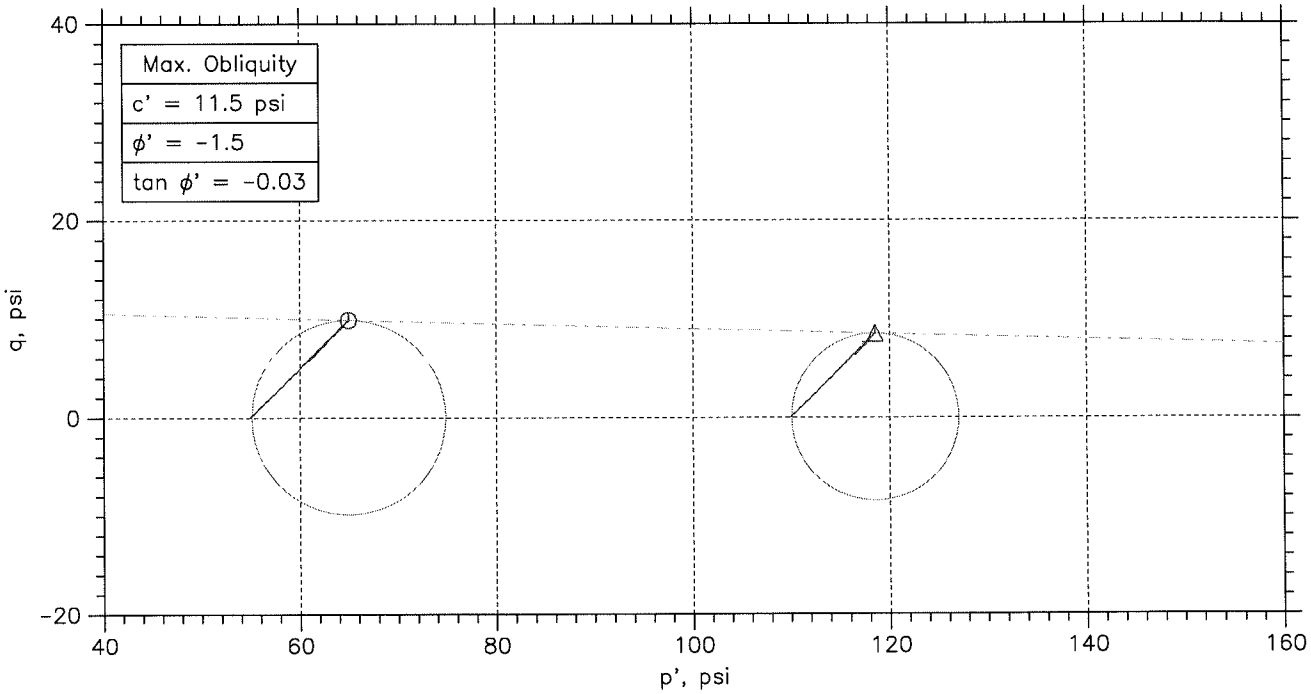
Wed, 18-OCT-2017 07:49:49

SS-516-17

Test File







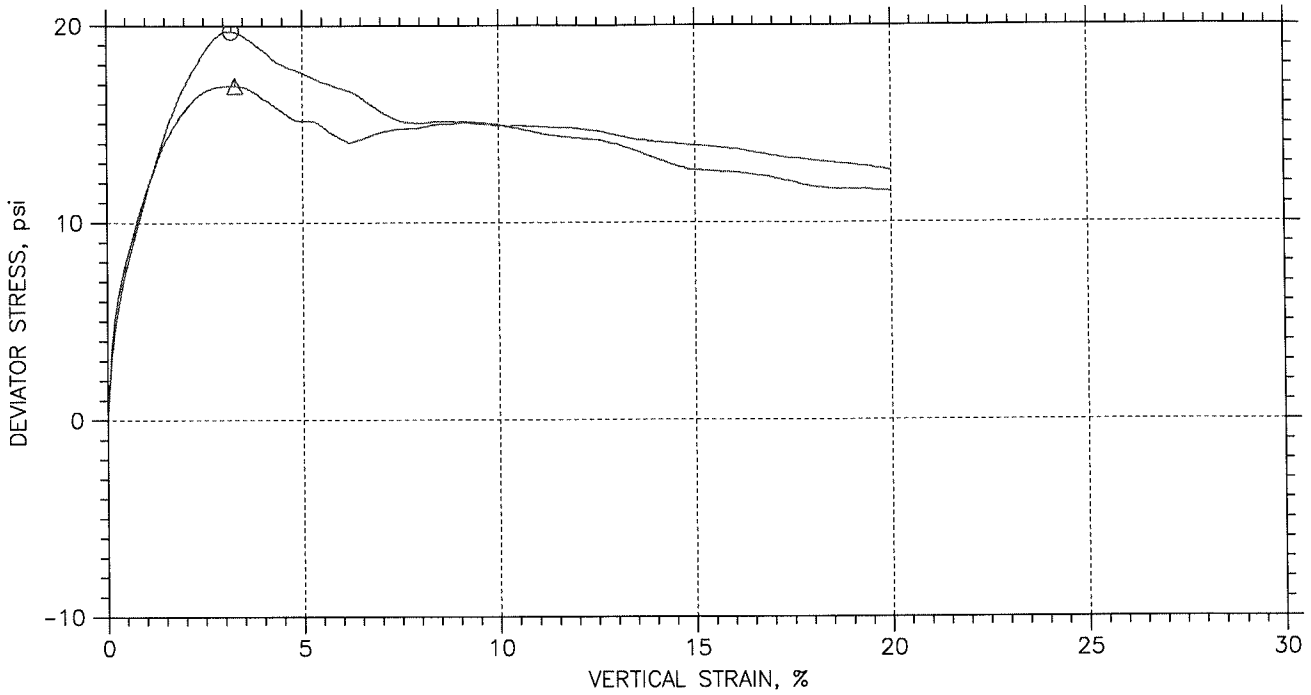
	Sample No.	Test No.	Depth	Tested By	Test Date	Checked By	Check Date	Test File
⊙	SS-516-17	UU-36-17	66.0	DT	10/17/2017	MD		UU-36-2017.dat
△	SS-516-17	UU-37-17	66.0	DT	10/17/2017	MD		UU-37-2017.dat

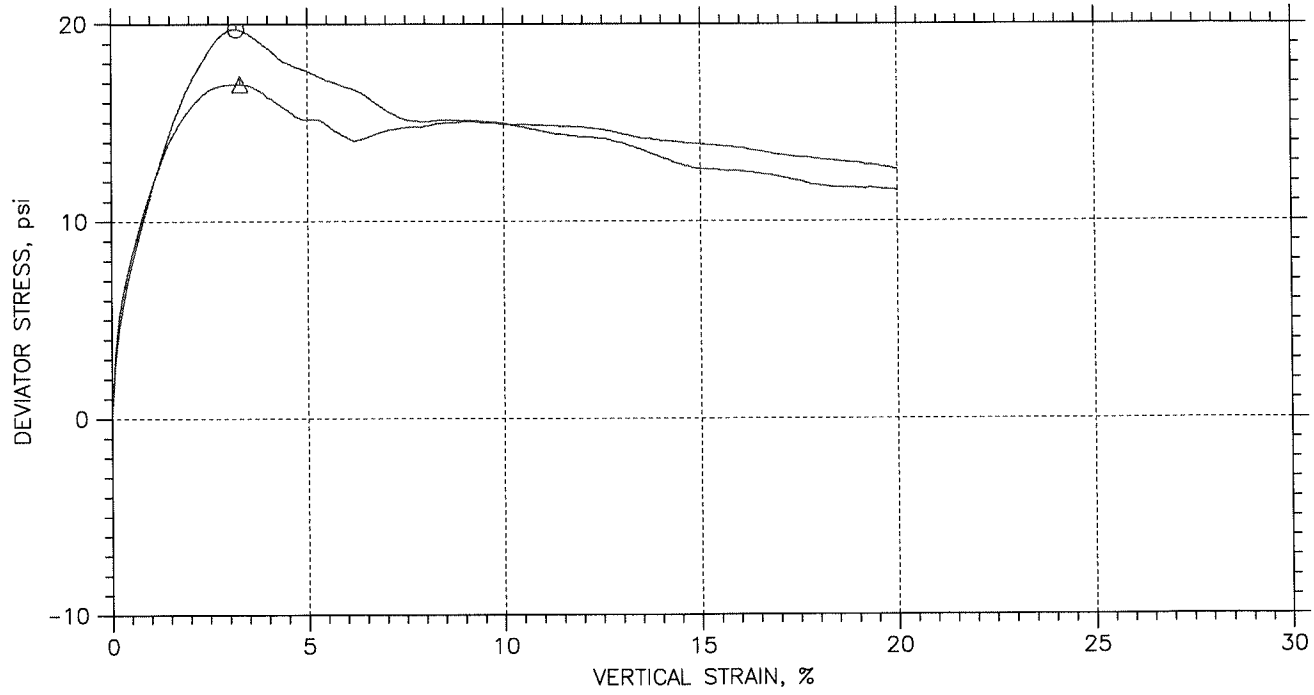
NDDOT North Dakota Department of Transportation

Project: IM-8-094(092)346	Location:	Project No.:
Boring No.: 1	Sample Type:	
Description: T.L. 28" Brn Cly with Silt Deposits,Rock up to 1/4", SLICKEN SIDED		
Remarks: 64.7-65.2		

SS-516-17

Test File





	Sample No.	Test No.	Depth	Tested By	Test Date	Checked By	Check Date	Test File
⏲	SS-516-17	UU-36-17	66.0	DT	10/17/2017	MD		UU-36-2017.dat
Δ	SS-516-17	UU-37-17	66.0	DT	10/17/2017	MD		UU-37-2017.dat

NDDOT
North Dakota Department of Transportation

Project: IM-8-094(092)346	Location:	Project No.:
Boring No.: 1	Sample Type:	
Description: T.L. 28" Brn Cly with Silt Deposits,Rock up to 1/4", SLICKEN SIDED		
Remarks: 64.7-65.2		

Wed, 18-OCT-2017 07:49:49

TRIAXIAL TEST

Project: IM-8-094(092)346
Boring No.: 1
Sample No.: SS-516-17
Test No.: UU-36-17

Location:
Tested By: DT
Test Date: 10/17/2017
Sample Type:

Project No.:
Checked By: MD
Depth: 66.0
Elevation:

Soil Description: T.L. 28" Brn Cly with Silt Deposits,Rock up to 1/4", SLICKEN SIDED
Remarks: 64.7-65.2

Specimen Height: 5.75 in
Specimen Area: 6.37 in^2
Specimen Volume: 599.52 cc

Piston Area: 0.21 in^2
Piston Friction: 0.00 lb
Piston Weight: 0.00 lb

Filter Strip Correction: 0.00 psi
Membrane Correction: 4.20 lb/in
Correction Type: Uniform

Liquid Limit: ---

Plastic Limit: ---

Estimated Specific Gravity: 2.65

	Before Test Trimmings	Before Test Specimen	After Test Specimen	After Test Trimmings
Container ID	S 41	---		
Wt. Container + Wet Soil, gm	84.54	---	---	0
Wt. Container + Dry Soil, gm	63.44	---	---	0
Wt. Container, gm	17.06	---	---	0
Wt. Wet Soil, gm	67.48	1050.8	722.26	0
Wt. Dry Soil, gm	46.38	722.26	722.26	0
Wt. Water, gm	21.1	328.58	-1.1642e-013	0
Water Content, %	45.49	45.49	-0.00	0.00
Void Ratio	---	1.20	1.19	---
Degree of Saturation, %	---	100.49	-0.00	---
Dry Unit Weight, pcf	---	75.208	75.56	---

Initial

Height: 5.747 in
Area: 6.366 in^2
Volume: 599.52 cc

Moisture: 45.49 %
Void Ratio: 1.20
Dry Unit Weight: 75.208 pcf
Saturation: 100.49 %

End of Initialization
Time: 11.032 min
Total Vertical Stress: 54.915 psi
Total Horizontal Stress: 54.94 psi
Pore Pressure: 0 psi
Effective Vertical Stress: 54.915 psi
Effective Horizontal Stress: 54.94 psi

Height Change: 0.0089231 in
Area Change: 0 in^2
Volume Change: 2.7925 cc
Water Change: -0.19897 cc
Correction: 4.599 cc

Height: 5.7381 in
Area: 6.366 in^2
Volume: 596.73 cc

Moisture: 44.88 %
Void Ratio: 1.19
Dry Unit Weight: 75.56 pcf
Saturation: 100.00 %

End of Consolidation/A
Time: 11.032 min
Total Vertical Stress: 54.915 psi
Total Horizontal Stress: 54.94 psi
Pore Pressure: 0 psi
Effective Vertical Stress: 54.915 psi
Effective Horizontal Stress: 54.94 psi

Height Change: 0.0089231 in
Area Change: 0 in^2
Volume Change: 2.7925 cc
Water Change: -0.19897 cc
Correction: 4.599 cc

Height: 5.7381 in
Area: 6.366 in^2
Volume: 596.73 cc

Moisture: 44.88 %
Void Ratio: 1.19
Dry Unit Weight: 75.56 pcf
Saturation: 100.00 %

End of Saturation
Time: 11.032 min
Total Vertical Stress: 54.915 psi
Total Horizontal Stress: 54.94 psi
Pore Pressure: 0 psi
Effective Vertical Stress: 54.915 psi
Effective Horizontal Stress: 54.94 psi

Height Change: 0.0089231 in
Area Change: 0 in^2
Volume Change: 2.7925 cc
Water Change: -0.19897 cc
Correction: 4.599 cc

Height: 5.7381 in
Area: 6.366 in^2
Volume: 596.73 cc

Moisture: 44.88 %
Void Ratio: 1.19
Dry Unit Weight: 75.56 pcf
Saturation: 100.00 %

End of Consolidation/B
Time: 11.032 min
Total Vertical Stress: 54.915 psi
Total Horizontal Stress: 54.94 psi
Pore Pressure: 0 psi
Effective Vertical Stress: 54.915 psi
Effective Horizontal Stress: 54.94 psi

Height Change: 0.0089231 in
Area Change: 0 in^2
Volume Change: 2.7925 cc
Water Change: -0.19897 cc
Correction: 4.599 cc

Height: 5.7381 in
Area: 6.366 in^2
Volume: 596.73 cc

Moisture: 44.88 %
Void Ratio: 1.19
Dry Unit Weight: 75.56 pcf
Saturation: 100.00 %

End of Shear
Time: 31.215 min
Total Vertical Stress: 66.638 psi
Total Horizontal Stress: 55.054 psi
Pore Pressure: -0.097161 psi
Effective Vertical Stress: 66.735 psi
Effective Horizontal Stress: 55.151 psi

Height Change: 1.1568 in
Area Change: -1.5672 in^2
Volume Change: 2.7925 cc
Water Change: -0.19897 cc
Correction: 328.78 cc

Height: 4.5902 in
Area: 7.9332 in^2
Volume: 596.73 cc

Moisture: -0.00 %
Void Ratio: 1.19
Dry Unit Weight: 75.56 pcf
Saturation: -0.00 %

At Failure
Time: 14.255 min
Total Vertical Stress: 74.874 psi
Total Horizontal Stress: 55.159 psi
Pore Pressure: -0.02429 psi
Effective Vertical Stress: 74.898 psi
Effective Horizontal Stress: 55.183 psi

Height Change: 0.19273 in
Area Change: -0.22308 in^2
Volume Change: 2.7925 cc
Water Change: -0.19897 cc
Correction: 0 cc

Height: 5.5543 in
Area: 6.5891 in^2
Volume: 596.73 cc

Moisture: 44.88 %
Void Ratio: 1.19
Dry Unit Weight: 75.56 pcf
Saturation: 100.00 %

55-516-17

TRIAXIAL TEST

Project: IM-8-094(092)346
Boring No.: 1
Sample No.: SS-516-17
Test No.: UU-37-17

Location:
Tested By: DT
Test Date: 10/17/2017
Sample Type:

Project No.:
Checked By: MD
Depth: 66.0
Elevation:

Soil Description: T.L. 28" Brn Cly with Silt Deposits,Rock up to 1/4", SLICKEN SIDED
Remarks: 65.2-65.7

Specimen Height: 5.75 in
Specimen Area: 6.30 in^2
Specimen Volume: 593.74 cc

Piston Area: 0.20 in^2
Piston Friction: 0.00 lb
Piston Weight: 0.00 lb

Filter Strip Correction: 0.00 psi
Membrane Correction: 4.20 lb/in
Correction Type: Uniform

Liquid Limit: ---

Plastic Limit: ---

Estimated Specific Gravity: 2.65

	Before Test Trimmings	Before Test Specimen	After Test Specimen	After Test Trimmings
Container ID	S 11	---		
Wt. Container + Wet Soil, gm	68.98	---	---	0
Wt. Container + Dry Soil, gm	52.71	---	---	0
Wt. Container, gm	16.89	---	---	0
Wt. Wet Soil, gm	52.09	1056.6	726.57	0
Wt. Dry Soil, gm	35.82	726.57	726.57	0
Wt. Water, gm	16.27	330.02	1.1642e-013	0
Water Content, %	45.42	45.42	0.00	0.00
Void Ratio	---	1.17	1.16	---
Degree of Saturation, %	---	103.27	0.00	---
Dry Unit Weight, pcf	---	76.394	76.753	---

Initial

Height: 5.752 in
Area: 6.2991 in^2
Volume: 593.74 cc

Moisture: 45.42 %
Void Ratio: 1.17
Dry Unit Weight: 76.394 pcf
Saturation: 103.27 %

End of Initialization
Time: 11.032 min
Total Vertical Stress: 109.96 psi
Total Horizontal Stress: 109.98 psi
Pore Pressure: 0 psi
Effective Vertical Stress: 109.96 psi
Effective Horizontal Stress: 109.98 psi

Height Change: 0.0089695 in
Area Change: 0 in^2
Volume Change: 2.7776 cc
Water Change: -0.2113 cc
Correction: 13.446 cc

Height: 5.743 in
Area: 6.2991 in^2
Volume: 590.96 cc

Moisture: 43.60 %
Void Ratio: 1.16
Dry Unit Weight: 76.753 pcf
Saturation: 100.00 %

End of Consolidation/A
Time: 11.032 min
Total Vertical Stress: 109.96 psi
Total Horizontal Stress: 109.98 psi
Pore Pressure: 0 psi
Effective Vertical Stress: 109.96 psi
Effective Horizontal Stress: 109.98 psi

Height Change: 0.0089695 in
Area Change: 0 in^2
Volume Change: 2.7776 cc
Water Change: -0.2113 cc
Correction: 13.446 cc

Height: 5.743 in
Area: 6.2991 in^2
Volume: 590.96 cc

Moisture: 43.60 %
Void Ratio: 1.16
Dry Unit Weight: 76.753 pcf
Saturation: 100.00 %

End of Saturation
Time: 11.032 min
Total Vertical Stress: 109.96 psi
Total Horizontal Stress: 109.98 psi
Pore Pressure: 0 psi
Effective Vertical Stress: 109.96 psi
Effective Horizontal Stress: 109.98 psi

Height Change: 0.0089695 in
Area Change: 0 in^2
Volume Change: 2.7776 cc
Water Change: -0.2113 cc
Correction: 13.446 cc

Height: 5.743 in
Area: 6.2991 in^2
Volume: 590.96 cc

Moisture: 43.60 %
Void Ratio: 1.16
Dry Unit Weight: 76.753 pcf
Saturation: 100.00 %

End of Consolidation/B
Time: 11.032 min
Total Vertical Stress: 109.96 psi
Total Horizontal Stress: 109.98 psi
Pore Pressure: 0 psi
Effective Vertical Stress: 109.96 psi
Effective Horizontal Stress: 109.98 psi

Height Change: 0.0089695 in
Area Change: 0 in^2
Volume Change: 2.7776 cc
Water Change: -0.2113 cc
Correction: 13.446 cc

Height: 5.743 in
Area: 6.2991 in^2
Volume: 590.96 cc

Moisture: 43.60 %
Void Ratio: 1.16
Dry Unit Weight: 76.753 pcf
Saturation: 100.00 %

End of Shear
Time: 31.241 min
Total Vertical Stress: 122.77 psi
Total Horizontal Stress: 110.12 psi
Pore Pressure: -0.12955 psi
Effective Vertical Stress: 122.9 psi
Effective Horizontal Stress: 110.24 psi

Height Change: 1.1577 in
Area Change: -1.5503 in^2
Volume Change: 2.7771 cc
Water Change: -0.21184 cc
Correction: 330.23 cc

Height: 4.5943 in
Area: 7.8494 in^2
Volume: 590.96 cc

Moisture: 0.00 %
Void Ratio: 1.16
Dry Unit Weight: 76.753 pcf
Saturation: 0.00 %

At Failure
Time: 14.392 min
Total Vertical Stress: 126.99 psi
Total Horizontal Stress: 110.05 psi
Pore Pressure: -0.040484 psi
Effective Vertical Stress: 127.03 psi
Effective Horizontal Stress: 110.09 psi

Height Change: 0.19849 in
Area Change: -0.22747 in^2
Volume Change: 2.7781 cc
Water Change: -0.21184 cc
Correction: 0 cc

Height: 5.5535 in
Area: 6.5265 in^2
Volume: 590.96 cc

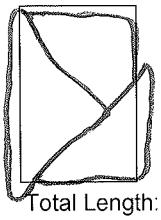
Moisture: 43.60 %
Void Ratio: 1.16
Dry Unit Weight: 76.753 pcf
Saturation: 100.00 %

TRIAXIAL UU(Q) CCU(R) CD(S)

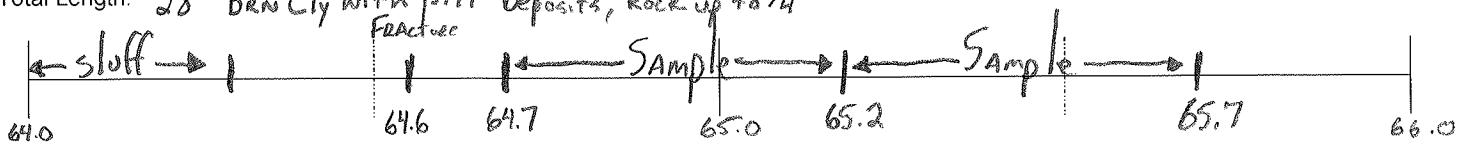
North Dakota Department of Transportation, Materials & Research
SFN 50459 (10-2016)

Project Number	IM-8-094(092)346
Boring Number	1

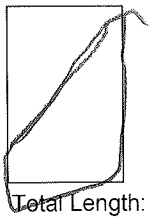
Field Sample Number	SS-516-17		Lab Number	UU-36-17	Depth	64.7 to 65.2	
Weight of Sample	1050.84	After Test Weight	Confining Pressure	55.0	Test Number	1 of 2	
Diameter	2.852	2.848	Height	5.746	Moisture Can Number	S41	After Moisture Can Number
	2.856	2.856		5.747	Wet Wt + Can	84.54	Wet Wt + Can
	2.832	2.838		5.748	Dry Wt + Can	63.44	Dry Wt + Can
	Average	2.847	Average	5.747	Wt of Can	17.06	Wt of Can



Total Length: 28" Brn Cly with silt Deposits, Rock up to 1/4"



Field Sample Number	SS-516-17		Lab Number	UU-37-17	Depth	65.2 to 65.7	
Weight of Sample	1056.59	After Test Weight	Confining Pressure	110.0	Test Number	2 of 2	
Diameter	2.837	2.836	Height	5.752	Moisture Can Number	S11	After Moisture Can Number
	2.827	2.834		5.752	Wet Wt + Can	68.98	Wet Wt + Can
	2.831	2.824		5.752	Dry Wt + Can	52.71	Dry Wt + Can
	Average	2.832	Average	5.752	Wt of Can	16.89	Wt of Can



Total Length:

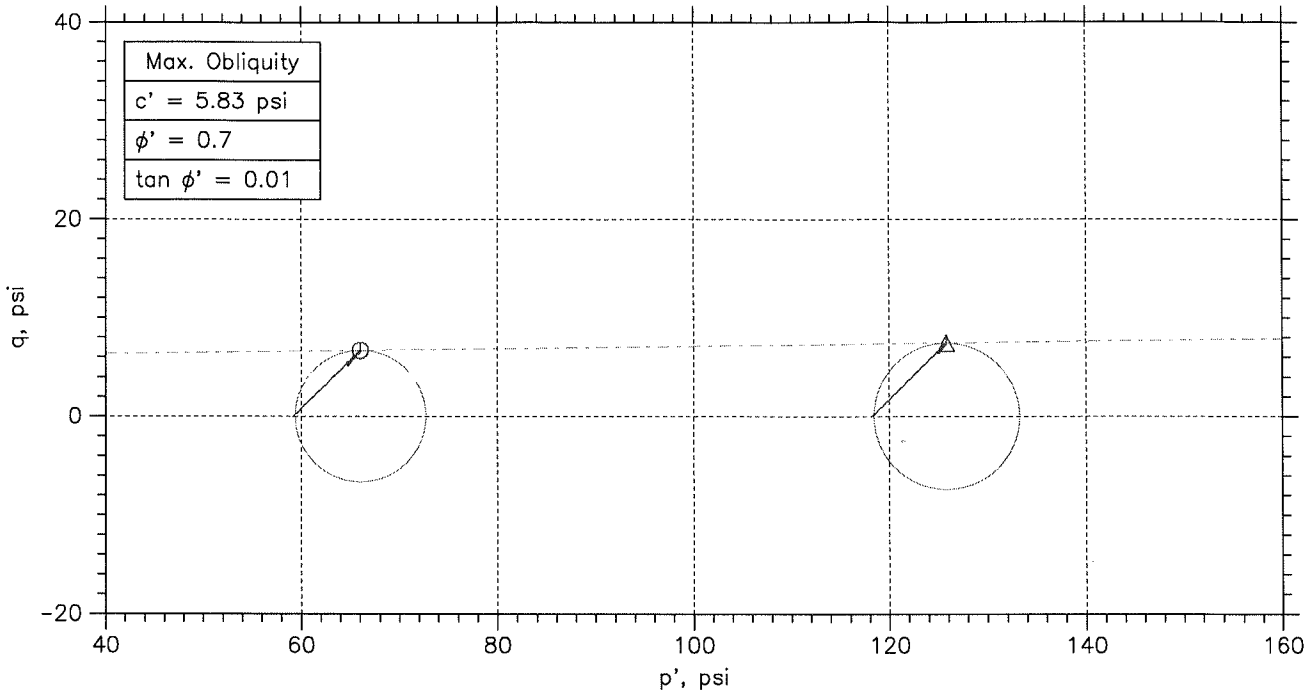
Field Sample Number			Lab Number		Depth		
Weight of Sample		After Test Weight	Confining Pressure		Test Number	of	
Diameter			Height		Moisture Can Number		After Moisture Can Number
					Wet Wt + Can		Wet Wt + Can
					Dry Wt + Can		Dry Wt + Can
	Average		Average		Wt of Can		Wt of Can

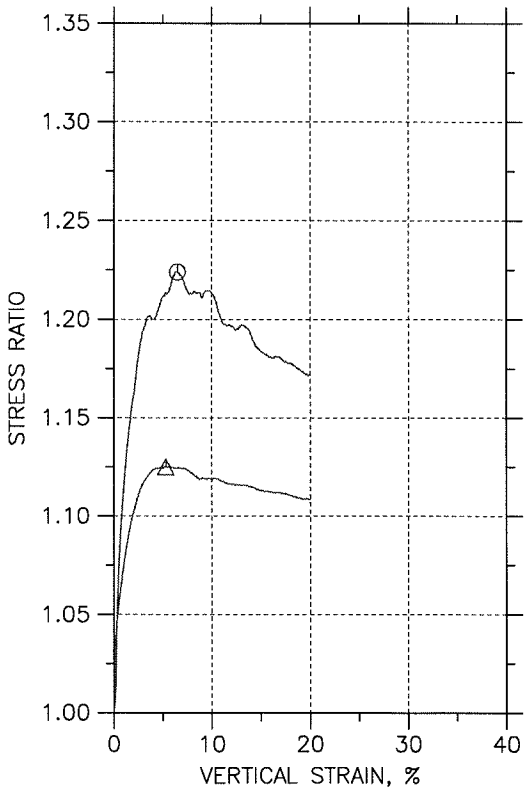
Total Length:

AASHTO T-234 Tested By:

SS-518-17

Test File





Symbol		⏲	△		
Sample No.		SS-518-17	SS-518-17		
Test No.		UU-38-17	UU-39-17		
Depth		71.0	71.0		
Initial	Diameter, in	2.843	2.832		
	Height, in	5.744	5.754		
	Water Content, %	42.4	33.6		
	Dry Density, pcf	78.36	90.98		
	Saturation, %	101.1	108.8		
	Void Ratio	1.11	0.818		
Before Shear	Water Content, %	41.9	30.5		
	Dry Density, pcf	78.44	91.48		
	Saturation*, %	100.0	100.0		
	Void Ratio	1.11	0.808		
	Back Press., psi	.0	.0		
Ver. Eff. Cons. Stress, psi		59.22	118.3		
Shear Strength, psi		6.653	7.401		
Strain at Failure, %		6.5	5.3		
Strain Rate, %/min		1	1		
B-Value		---	---		
Estimated Specific Gravity		2.65	2.65		
Liquid Limit		---	---		
Plastic Limit		---	---		

NDDOT North Dakota Department of Transportation

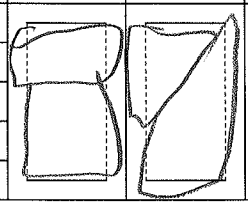
Project: IM-8-094(092)346

Location:

Project No.:

Boring No.: 1

Sample Type:



Description: T.L. 26" Brn Cly with Silt Deposits,Rock up to 1/4", SLICKEN SIDED

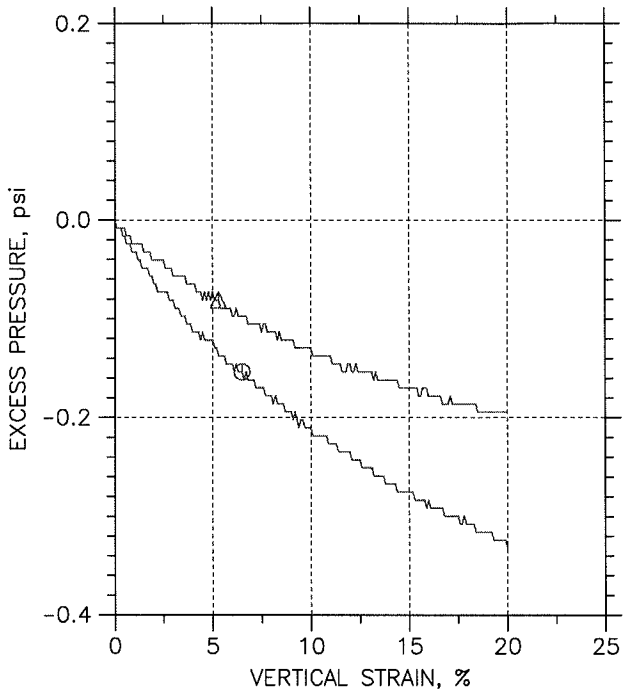
Remarks: 69.7-70.2

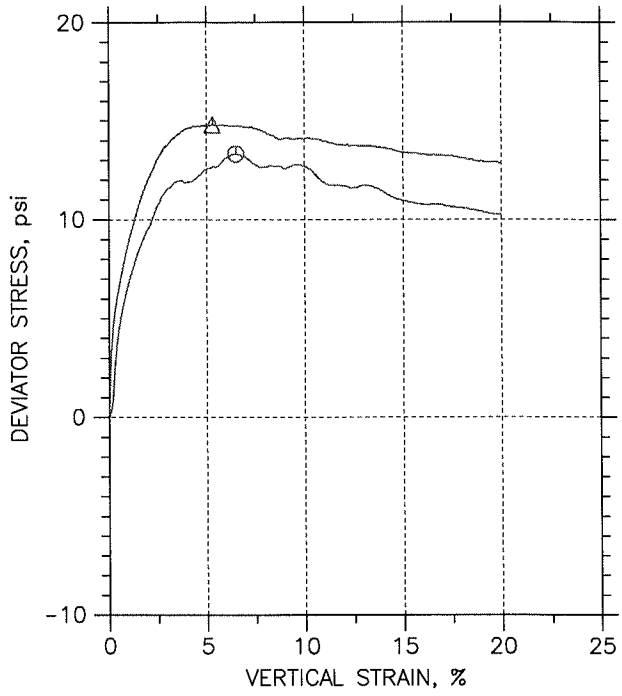
Phase calculations based on start and end of test.

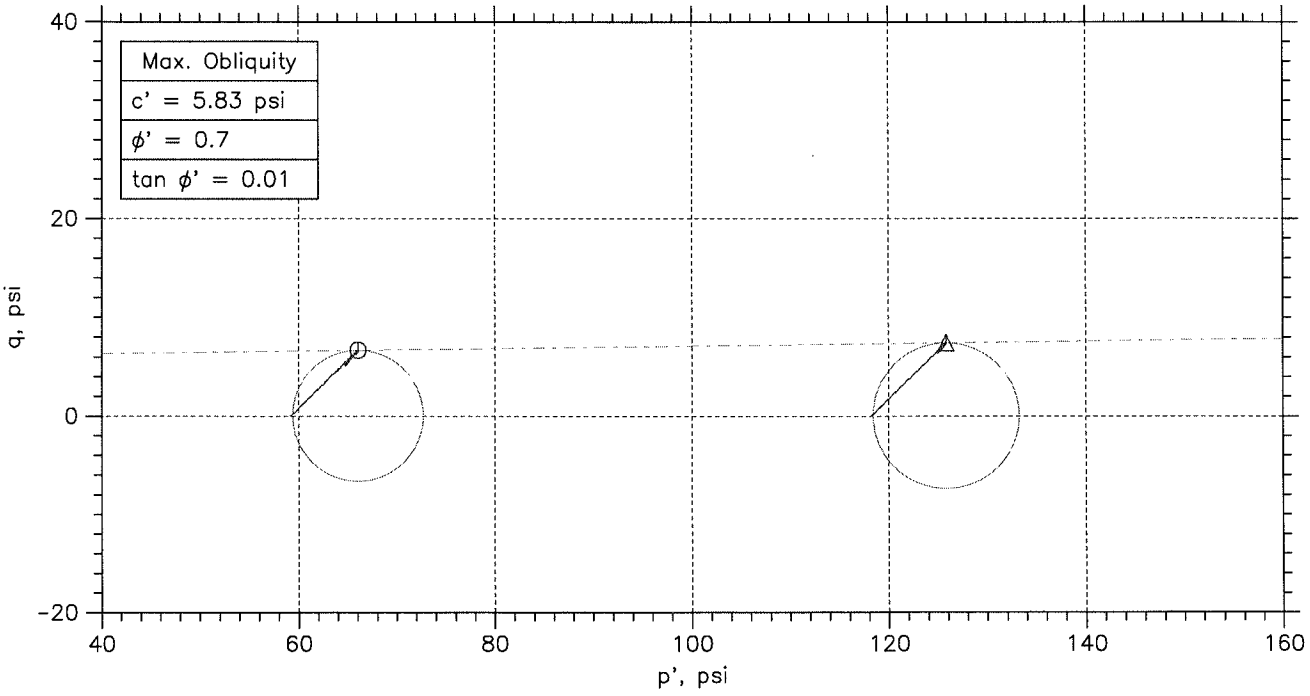
* Saturation is set to 100% for phase calculations.

Thu, 26-OCT-2017 12:42:57

Test File







	Sample No.	Test No.	Depth	Tested By	Test Date	Checked By	Check Date	Test File
ⓘ	SS-518-17	UU-38-17	71.0	DT	10/18/2017	MD		UU-38-2017.dat
△	SS-518-17	UU-39-17	71.0	DT	10/18/2017	MD		UU-39-2017.dat

NDDOT
North Dakota Department of Transportation

Project: IM-8-094(092)346	Location:	Project No.:
Boring No.: 1	Sample Type:	
Description: T.L. 26" Brn Cly with Silt Deposits,Rock up to 1/4", SLICKEN SIDED		
Remarks: 69.7-70.2		

TRIAXIAL TEST

Project: IM-8-094(092)346
Boring No.: 1
Sample No.: SS-518-17
Test No.: UU-38-17

Location:
Tested By: DT
Test Date: 10/18/2017
Sample Type:

Project No.:
Checked By: MD
Depth: 71.0
Elevation:

Soil Description: T.L. 26" Brn Cly with Silt Deposits,Rock up to 1/4", SLICKEN SIDED
Remarks: 69.7-70.2

Specimen Height: 5.74 in
Specimen Area: 6.35 in^2
Specimen Volume: 597.53 cc

Piston Area: 0.21 in^2
Piston Friction: 0.00 lb
Piston Weight: 0.00 lb

Filter Strip Correction: 0.00 psi
Membrane Correction: 4.20 lb/in
Correction Type: Uniform

Liquid Limit: ---

Plastic Limit: ---

Estimated Specific Gravity: 2.65

	Before Test Trimmings	Before Test Specimen	After Test Specimen	After Test Trimmings
Container ID	S 10	---		
Wt. Container + Wet Soil, gm	83.02	---	---	0
Wt. Container + Dry Soil, gm	63.35	---	---	0
Wt. Container, gm	16.93	---	---	0
Wt. Wet Soil, gm	66.09	1067.9	750.04	0
Wt. Dry Soil, gm	46.42	750.04	750.04	0
Wt. Water, gm	19.67	317.82	1.1642e-013	0
Water Content, %	42.37	42.37	0.00	0.00
Void Ratio	---	1.11	1.11	---
Degree of Saturation, %	---	101.06	0.00	---
Dry Unit Weight, pcf	---	78.362	78.438	---

Initial

Height: 5.744 in
Area: 6.3481 in^2
Volume: 597.53 cc

Moisture: 42.37 %
Void Ratio: 1.11
Dry Unit Weight: 78.362 pcf
Saturation: 101.06 %

End of Initialization
Time: 11.13 min
Total Vertical Stress: 59.22 psi
Total Horizontal Stress: 59.295 psi
Pore Pressure: 0 psi
Effective Vertical Stress: 59.22 psi
Effective Horizontal Stress: 59.295 psi

Height Change: 0.001859 in
Area Change: 0 in^2
Volume Change: 0.58015 cc
Water Change: -0.26654 cc
Correction: 4.1722 cc

Height: 5.7421 in
Area: 6.3481 in^2
Volume: 596.95 cc

Moisture: 41.85 %
Void Ratio: 1.11
Dry Unit Weight: 78.438 pcf
Saturation: 100.00 %

End of Consolidation/A
Time: 11.13 min
Total Vertical Stress: 59.22 psi
Total Horizontal Stress: 59.295 psi
Pore Pressure: 0 psi
Effective Vertical Stress: 59.22 psi
Effective Horizontal Stress: 59.295 psi

Height Change: 0.001859 in
Area Change: 0 in^2
Volume Change: 0.58015 cc
Water Change: -0.26654 cc
Correction: 4.1722 cc

Height: 5.7421 in
Area: 6.3481 in^2
Volume: 596.95 cc

Moisture: 41.85 %
Void Ratio: 1.11
Dry Unit Weight: 78.438 pcf
Saturation: 100.00 %

End of Saturation
Time: 11.13 min
Total Vertical Stress: 59.22 psi
Total Horizontal Stress: 59.295 psi
Pore Pressure: 0 psi
Effective Vertical Stress: 59.22 psi
Effective Horizontal Stress: 59.295 psi

Height Change: 0.001859 in
Area Change: 0 in^2
Volume Change: 0.58015 cc
Water Change: -0.26654 cc
Correction: 4.1722 cc

Height: 5.7421 in
Area: 6.3481 in^2
Volume: 596.95 cc

Moisture: 41.85 %
Void Ratio: 1.11
Dry Unit Weight: 78.438 pcf
Saturation: 100.00 %

End of Consolidation/B
Time: 11.13 min
Total Vertical Stress: 59.22 psi
Total Horizontal Stress: 59.295 psi
Pore Pressure: 0 psi
Effective Vertical Stress: 59.22 psi
Effective Horizontal Stress: 59.295 psi

Height Change: 0.001859 in
Area Change: 0 in^2
Volume Change: 0.58015 cc
Water Change: -0.26654 cc
Correction: 4.1722 cc

Height: 5.7421 in
Area: 6.3481 in^2
Volume: 596.95 cc

Moisture: 41.85 %
Void Ratio: 1.11
Dry Unit Weight: 78.438 pcf
Saturation: 100.00 %

End of Shear
Time: 31.349 min
Total Vertical Stress: 69.6 psi
Total Horizontal Stress: 59.335 psi
Pore Pressure: -0.33197 psi
Effective Vertical Stress: 69.932 psi
Effective Horizontal Stress: 59.667 psi

Height Change: 1.1507 in
Area Change: -1.5826 in^2
Volume Change: 0.57961 cc
Water Change: -0.26708 cc
Correction: 318.09 cc

Height: 4.5933 in
Area: 7.9307 in^2
Volume: 596.95 cc

Moisture: 0.00 %
Void Ratio: 1.11
Dry Unit Weight: 78.438 pcf
Saturation: 0.00 %

At Failure
Time: 17.73 min
Total Vertical Stress: 72.593 psi
Total Horizontal Stress: 59.287 psi
Pore Pressure: -0.15384 psi
Effective Vertical Stress: 72.747 psi
Effective Horizontal Stress: 59.44 psi

Height Change: 0.37533 in
Area Change: -0.44683 in^2
Volume Change: 0.58068 cc
Water Change: -0.26708 cc
Correction: 0 cc

Height: 5.3687 in
Area: 6.7949 in^2
Volume: 596.95 cc

Moisture: 41.85 %
Void Ratio: 1.11
Dry Unit Weight: 78.438 pcf
Saturation: 100.00 %

TRIAXIAL TEST

Project: IM-8-094(092)346
Boring No.: 1
Sample No.: SS-518-17
Test No.: UU-39-17

Location:
Tested By: DT
Test Date: 10/18/2017
Sample Type:

Project No.:
Checked By: MD
Depth: 71.0
Elevation:

Soil Description: T.L. 26" Brn Cly with Silt Deposits,Rock up to 1/4", SLICKEN SIDED
Remarks: 70.2-70.7

Specimen Height: 5.75 in
Specimen Area: 6.30 in^2
Specimen Volume: 593.95 cc

Piston Area: 0.21 in^2
Piston Friction: 0.00 lb
Piston Weight: 0.00 lb

Filter Strip Correction: 0.00 psi
Membrane Correction: 4.20 lb/in
Correction Type: Uniform

Liquid Limit: ---

Plastic Limit: ---

Estimated Specific Gravity: 2.65

	Before Test Trimmings	Before Test Specimen	After Test Specimen	After Test Trimmings
Container ID	S14	---		
Wt. Container + Wet Soil, gm	95.3	---	---	0
Wt. Container + Dry Soil, gm	75.59	---	---	0
Wt. Container, gm	16.92	---	---	0
Wt. Wet Soil, gm	78.38	1156.4	865.61	0
Wt. Dry Soil, gm	58.67	865.61	865.61	0
Wt. Water, gm	19.71	290.8	0	0
Water Content, %	33.59	33.59	0.00	0.00
Void Ratio	---	0.82	0.81	---
Degree of Saturation, %	---	108.79	0.00	---
Dry Unit Weight, pcf	---	90.982	91.476	---

Initial

Height: 5.754 in
Area: 6.2991 in^2
Volume: 593.95 cc

Moisture: 33.59 %
Void Ratio: 0.82
Dry Unit Weight: 90.982 pcf
Saturation: 108.79 %

End of Initialization
Time: 11.134 min
Total Vertical Stress: 118.25 psi
Total Horizontal Stress: 118.27 psi
Pore Pressure: 0 psi
Effective Vertical Stress: 118.25 psi
Effective Horizontal Stress: 118.27 psi

Height Change: 0.010364 in
Area Change: 0 in^2
Volume Change: 3.2093 cc
Water Change: -0.21023 cc
Correction: 26.918 cc

Height: 5.7436 in
Area: 6.2991 in^2
Volume: 590.74 cc

Moisture: 30.51 %
Void Ratio: 0.81
Dry Unit Weight: 91.476 pcf
Saturation: 100.00 %

End of Consolidation/A
Time: 11.134 min
Total Vertical Stress: 118.25 psi
Total Horizontal Stress: 118.27 psi
Pore Pressure: 0 psi
Effective Vertical Stress: 118.25 psi
Effective Horizontal Stress: 118.27 psi

Height Change: 0.010364 in
Area Change: 0 in^2
Volume Change: 3.2093 cc
Water Change: -0.21023 cc
Correction: 26.918 cc

Height: 5.7436 in
Area: 6.2991 in^2
Volume: 590.74 cc

Moisture: 30.51 %
Void Ratio: 0.81
Dry Unit Weight: 91.476 pcf
Saturation: 100.00 %

End of Saturation
Time: 11.134 min
Total Vertical Stress: 118.25 psi
Total Horizontal Stress: 118.27 psi
Pore Pressure: 0 psi
Effective Vertical Stress: 118.25 psi
Effective Horizontal Stress: 118.27 psi

Height Change: 0.010364 in
Area Change: 0 in^2
Volume Change: 3.2093 cc
Water Change: -0.21023 cc
Correction: 26.918 cc

Height: 5.7436 in
Area: 6.2991 in^2
Volume: 590.74 cc

Moisture: 30.51 %
Void Ratio: 0.81
Dry Unit Weight: 91.476 pcf
Saturation: 100.00 %

End of Consolidation/B
Time: 11.134 min
Total Vertical Stress: 118.25 psi
Total Horizontal Stress: 118.27 psi
Pore Pressure: 0 psi
Effective Vertical Stress: 118.25 psi
Effective Horizontal Stress: 118.27 psi

Height Change: 0.010364 in
Area Change: 0 in^2
Volume Change: 3.2093 cc
Water Change: -0.21023 cc
Correction: 26.918 cc

Height: 5.7436 in
Area: 6.2991 in^2
Volume: 590.74 cc

Moisture: 30.51 %
Void Ratio: 0.81
Dry Unit Weight: 91.476 pcf
Saturation: 100.00 %

End of Shear
Time: 31.33 min
Total Vertical Stress: 131.2 psi
Total Horizontal Stress: 118.29 psi
Pore Pressure: -0.19432 psi
Effective Vertical Stress: 131.4 psi
Effective Horizontal Stress: 118.48 psi

Height Change: 1.1592 in
Area Change: -1.5465 in^2
Volume Change: 3.2093 cc
Water Change: -0.21023 cc
Correction: 291.01 cc

Height: 4.5948 in
Area: 7.8455 in^2
Volume: 590.74 cc

Moisture: 0.00 %
Void Ratio: 0.81
Dry Unit Weight: 91.476 pcf
Saturation: 0.00 %

At Failure
Time: 16.51 min
Total Vertical Stress: 133.16 psi
Total Horizontal Stress: 118.36 psi
Pore Pressure: -0.080967 psi
Effective Vertical Stress: 133.24 psi
Effective Horizontal Stress: 118.44 psi

Height Change: 0.31496 in
Area Change: -0.36712 in^2
Volume Change: 3.2093 cc
Water Change: -0.21023 cc
Correction: 0 cc

Height: 5.439 in
Area: 6.6662 in^2
Volume: 590.74 cc

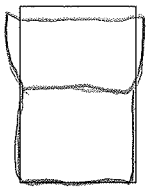
Moisture: 30.51 %
Void Ratio: 0.81
Dry Unit Weight: 91.476 pcf
Saturation: 100.00 %

TRIAXIAL UU(Q) CCU(R) CD(S)

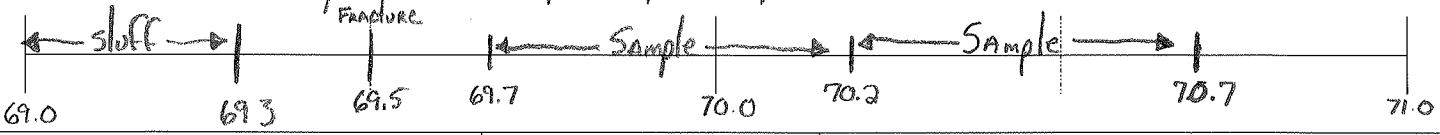
North Dakota Department of Transportation, Materials & Research
SFN 50459 (10-2016)

Project Number	
IM-8-094(092)346	
Boring Number	
1	

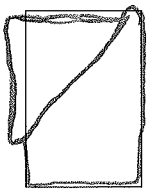
Field Sample Number			Lab Number		Depth	
SS-518-17			UU-38-17		69.7 to 70.2	
Weight of Sample	After Test Weight		Confining Pressure		Test Number	of
1067.86			59.2		1	2
Diameter	2.846	2.847	Height	5.744	Moisture Can Number	After Moisture Can Number
	2.839	2.842		5.744	S10	
	2.843	2.842		5.745	Wet Wt + Can 83.02	Wet Wt + Can
	Average 2.843		Average 5.744		Dry Wt + Can 63.35	Dry Wt + Can
					Wt of Can 16.93	Wt of Can



Total Length: 26" Brn Cly with silt Deposits, Rock up to 1/4"



Field Sample Number			Lab Number		Depth	
SS-518-17			UU-39-17		70.2 to 70.7	
Weight of Sample	After Test Weight		Confining Pressure		Test Number	of
1156.41			118.3		2	2
Diameter	2.857	2.821	Height	5.756	Moisture Can Number	After Moisture Can Number
	2.850	2.808		5.753	S14	
	2.837	2.817		5.752	Wet Wt + Can 95.30	Wet Wt + Can
	Average 2.832		Average 5.754		Dry Wt + Can 75.59	Dry Wt + Can
					Wt of Can 16.92	Wt of Can



Total Length:

Field Sample Number			Lab Number		Depth	
Weight of Sample	After Test Weight		Confining Pressure		Test Number	of
Diameter			Height		Moisture Can Number	After Moisture Can Number
					Wet Wt + Can	Wet Wt + Can
					Dry Wt + Can	Dry Wt + Can
	Average		Average		Wt of Can	Wt of Can

Total Length:

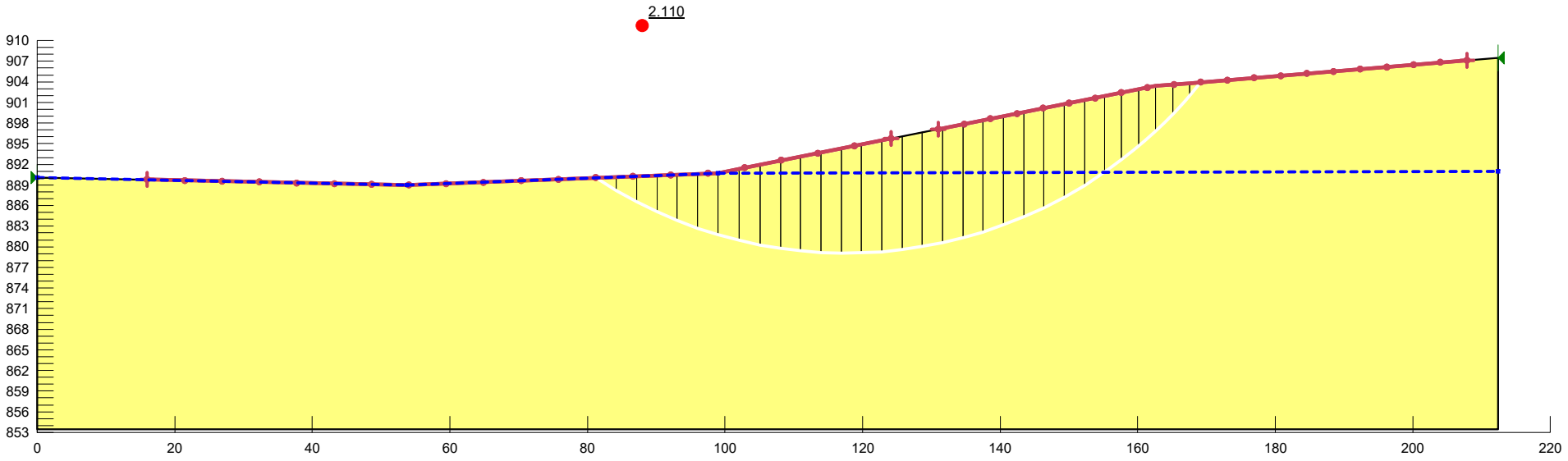
AASHTO T-234 Tested By:

APPENDIX C

Slope Stability Analysis

Project: IM-8-094(092)346
Bridge # 94-346.396L & 94-346.400R
Location: East Bridge End
Boring: SB-1
Analysis Name: Name: Effective Stress Analysis

Color	Name	Model	Unit Weight (pcf)	Strength Function	Piezometric Line
	Existing Material	Shear/Normal Fn.	105	Stark Correlation: LL = 93, CF = 89	1



Project: IM-8-094(092)346
Bridge #: 94-346.396L & 94-346.400R
Location: West Bridge End
Boring: SB-1
Analysis: Name: Effective Stress Analysis

Color	Name	Model	Unit Weight (pcf)	Strength Function	Piezometric Line
	Existing Material	Shear/Normal Fn.	105	Stark Correlation - CF = 89, LL = 93	1