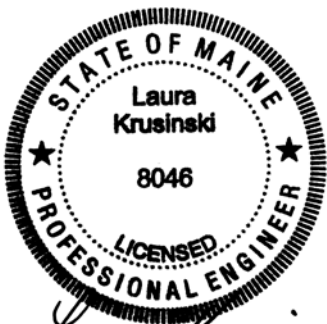


**MAINE DEPARTMENT OF TRANSPORTATION
BRIDGE PROGRAM
GEOTECHNICAL SECTION
AUGUSTA, MAINE**

GEOTECHNICAL DESIGN REPORT

For the Rehabilitation of:

**SECOND OTTER BRIDGE
COUNTY ROAD OVER OTTER STREAM
MILFORD, MAINE**



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Penobscot County
WIN 23466.00

Soils Report 2018-16
Bridge No. 2754

Fed No. STP-2346(600)
March 30, 2018

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1.0 INTRODUCTION

The purpose of this Geotechnical Design Report is to present subsurface information and provide geotechnical analyses for settlement mitigation of the east approach of Second Otter Bridge which carries County Road over Otter Stream in Milford, Maine. Five subsurface investigations have been completed at the site. This report presents the subsurface information obtained at the site during the subsurface investigations and settlement mitigation options for the east bridge approach.

The Second Otter Bridge was constructed in 2013 and consists of a 150-foot single span steel superstructure on integral abutments supported on five HP 14x117 piles. The west approach embankment is supported by a pile-supported load distribution platform, constructed in 2014 after the failure of the side slope on the northwest corner of the bridge.

The MaineDOT Bridge Program is proposing reconstruction of the east approach with the removal of the existing approach fill and replacement with lightweight material. The lightweight materials under consideration include: Expanded Polystyrene (EPS) Geofoam, Lightweight Foam Concrete Fill (LFCF) and Expanded Shale Aggregate (ESA).

2.0 GEOLOGIC SETTING

Second Otter Bridge in Milford carries County Road over Otter Stream 1.5 miles east of State Route 2 as shown on Sheet 1 - Location Map found at the end of this report.

According to the Surficial Geologic map entitled Orono Quadrangle, Maine Open File No. 81-6 (1981) published by the Maine Geological Survey the surficial soils in the vicinity of the site consist of glacial-marine deposits (Presumpscot Formation) comprised of mostly silt and clay with low permeability and poor drainage. These soils are typically deposited in flat to gently sloping topography except where dissected by streams.

According to the Bedrock Geologic Map of Maine (1985) published by the Maine Geologic Survey, the bedrock near the site consists of calcareous sandstone, interbedded sandstone and impure limestone of the Vassalboro Formation.

3.0 SUBSURFACE INVESTIGATION

Subsurface conditions at the project site were explored by drilling twelve test borings. Four borings were advanced to bedrock and were terminated with bedrock cores. The remaining eight borings were terminated either in the glaciomarine or glacial till deposit without encountering bedrock. The borings were drilled to depths ranging from approximately 12.5 to 69 feet below ground surface (bgs).

The 100-series borings were drilled in July 2010 to support the design of the new Second Otter Bridge, which was constructed in one construction season between 2013 and 2014. The 200-series and 400-series borings were drilled in 2014 to characterize subsurface conditions after a slope failure occurred in May 2014. The 300-series boring was drilled in 2014 to support the design of a pile-supported load distribution platform which constructed to support the west approach embankment after the slope failure. The 500-series boring was conducted in 2015 to investigate the cause of settlement observed at the west bridge approach and assist in the design of settlement mitigation options.

The boring locations are shown on Sheet 2 – Boring Location Plan, and an interpreted subsurface profile across the centerline of the site is shown on Sheet 3 – Interpretive Subsurface Profile.

Details and sampling methods used, field data obtained, and soil and groundwater conditions encountered are presented in the boring logs provided in Appendix A – Boring Logs and Sheets 4, 5 and 6– Boring Logs.

The borings were drilled using solid stem auger, cased wash boring and rock coring techniques. Soil samples were typically obtained at 5-foot intervals using Standard Penetration Test (SPT) methods. During SPT sampling, the sampler is driven 24 inches and the hammer blows for each 6-inch interval of penetration are recorded. The sum of the blows for the second and third intervals is the N-value, or standard penetration resistance. The MaineDOT and Maine Test Boring drill rigs used during the field investigations were equipped with either rope-and-cathead safety hammers or automatic hammers to drive the split spoon. No correction of N-values is required for the N-values obtained with the standard rope-and-cathead system where common practice assumes rope-and-cathead systems have a theoretical 60 percent hammer efficiency. Automatic hammers were calibrated per ASTM D4633-10 “Standard Test Method for Energy Measurement for Dynamic Penetrometers.” N-values obtained with automatic hammers are corrected by applying the corresponding average energy transfer factors to the raw field N-values. The hammer efficiency factors and both the raw field N-values and the corrected N-values (N_{60}) are shown on the boring logs.

Five undisturbed tube samples of glaciomarine clay were obtained in borings BB-MOS-301, BB-MOS-402 and BB-MOS-501.

In-situ vane shear tests were made at regular intervals in the soft soil deposits to measure the shear strength of the soft soils. In-situ vane shear tests were conducted with 55 millimeter (mm) by 110 mm Geonor rectangular vanes. The results of vane shear testing are summarized in Table 1 – Insitu Vane Shear Test Results, and are provided on the boring logs in Appendix A.

One inclinometer was installed in 2014 in completed borehole BB-MOS-301 to monitor ground movements below the west approach to the bridge.

Four borings were advanced approximately 10 feet into bedrock. The bedrock was cored in the borings using an NQ-2” core barrel and the Rock Quality Designation (RQD) of the core was calculated.

A MaineDOT geotechnical team member selected the boring locations and drilling methods, designated type and depth of sampling techniques and identified field and laboratory testing requirements. The subsurface conditions were logged in the field by a MaineDOT geotechnical engineer, a consultant engineer or a MaineDOT Northeast Transportation Technician Certifications Program (NETTCP) Certified Subsurface Inspector. The borings were located in the field by used of a tape after completion of the exploration programs.

4.0 LABORATORY TESTING

A laboratory testing program was conducted on selected soil samples recovered from test borings to assist in soil classification, evaluation of engineering properties of the soils, and geologic assessment of the project site.

Soil tests were performed at the MaineDOT Central Laboratory in Bangor, Maine and at GeoTesting Express, Inc. in Acton, Massachusetts.

The following soil laboratory tests (type and number of tests) were conducted:

- Standard grain size analyses - 24
- Grain size analyses with hydrometer - 15
- Natural water content tests - 37
- Atterberg limits - 15
- Incremental consolidation tests - 1
- Consolidated undrained triaxial tests - 2
- Loss on Ignition - 2

The results of soil laboratory tests are included as Appendix B – Laboratory Test Results. Laboratory test information is also shown on the boring logs provided in Appendix A – Boring Logs and on Sheets 4, 5 and 6 - Boring Logs.

5.0 SUBSURFACE CONDITIONS

Subsurface conditions encountered in the test borings consisted of fill soils, reworked stream alluvium, peat and glaciomarine deposits, underlain by glacial till and bedrock. The exploration locations are shown on Sheet 2 – Boring location Plan and a generalized subsurface profile along the bridge centerline is shown on Sheet 3 – Interpretive Subsurface Profile. The boring logs are provided in Appendix A – Boring Logs. The following paragraphs discuss the subsurface conditions encountered:

5.1 Fill

Fill soils, primarily consisting of sand with varying amount of silt, clay, gravel, cobbles and wood pieces were encountered in test borings drilled within the approaches to the prior bridge and the approaches to the existing Second Otter Bridge. The thickness of the fill layer encountered at the borings in the approaches ranged from approximately 11 to 17 feet.

The fill material in boring BB-MOS-301 included remnants of the old fill extension for the historical bridge pre-existing the 1950 bridge construction and included wood, cobbles and rubble from 15 to 17.3 feet below ground surface (bgs). The fill layer in boring BB-MOS-501 also included remnants of the old fill extension and included cobbles and rubble from 14 to 20 feet bgs. SPT N_{60} -values in the fill ranged from 7 to 42 blows per foot (bpf) indicating that the fill is loose to dense in consistency.

5.2 Organic Peat

Organic peat was encountered in borings BB-MOS-201 and BB-MOS-501 underlying the new approach fills. The thickness of the peat layer encountered was approximately 1 to 2 feet. One SPT N_{60} -value in the peat was 8 blows per foot (bpf) classifying the material as soft.

5.3 Alluvial Deposits

A thin, discontinuous layer of reworked stream alluvium was encountered beneath the fill in borings BB-MOS-101 and BB-MOS-401. The stream alluvium consisted of gravel or silt with varying amounts of sand, wood and peat. The thickness of the alluvium layer ranged from approximately 4.5 to 6.6 feet. SPT N_{60} -values in the alluvium range from 3 to 5 bpf indicating that the deposit is soft or loose in consistency.

5.4 Glaciomarine Deposit

A layer of glaciomarine silty clay and/or clayey silt were encountered in all of the borings with the exception of BB-MOS-103. The deposit encountered consists primarily of silty clay and clayey silt. The encountered thickness of the glaciomarine deposit ranged from approximately 10 to 19 feet in those borings where the lower boundary of the deposit was penetrated.

SPT N_{60} -values in the glaciomarine deposit generally ranged from weight-of-rod (WOR) to 21 bpf indicating the deposit is very soft to stiff in consistency.

In-situ vane shear tests were conducted with Geonor rectangular vanes in the glaciomarine deposits. A 55 x 110 mm or 16 x 32 mm vane was used. Occasionally vane shear tests could not be completed because the vane was unable to be pushed by hand to the test depth or the vane would not turn due to the presence of sand or gravel; this is noted on the boring logs. Thirty-three (33) successful vane shear tests conducted within the silty clay layers showed

measured undisturbed undrained shear strengths ranging from approximately 45 psf to 4087 psf, indicating that the glaciomarine deposit is very soft to soft in consistency. The remolded shear strengths at the test intervals ranged from approximately 22 to 393 psf. Based on the ratio of peak to remolded shear strength at all thirty-three (33) test intervals, the silty clay has a sensitivity ranging from 1.0 to 8.9 and is classified as insensitive to very sensitive.¹ The results of vane shear testing are summarized in Table 1 – In-situ Vane Shear Test Results and are provided on the boring logs in Appendix A - Boring Logs.

Atterberg limits tests were conducted on fifteen (15) samples of the glaciomarine deposit. Table 2 – Summary of Atterberg Limit Test Results summarizes the results of tests conducted on samples of the glaciomarine deposit. The plasticity indices of the samples indicate that the soils are classified as slightly plastic to medium plastic.² The natural water contents of the tested samples ranged from approximately 23 to 51 percent and liquid limits ranged from 27 to 37. The liquidity indices range from 0.2 to 3.1. Interpretation of these results indicates that the soils with liquidity indices of 1 or less are heavily overconsolidated while those with liquidity indices in excess of 1 are on the verge of being a viscous liquid as the natural water content exceeds the liquid limit. Soils with liquidity indices in excess of 1 have a high liquefaction or “quick” potential. It can be inferred that overburden pressure and interparticle cementation are providing stability for these soils. Under these conditions the slightest disturbance causing remolding has the potential to convert this type of deposit into a viscous liquid.

A one-dimensional consolidation test was conducted on an undisturbed tube taken from within the glaciomarine deposits. The results of the test are included in Appendix B – Laboratory Test Results. The results of the test were used to determine compression and recompression indexes for the silty clay and/or clayey silt deposit.

5.5 Glacial Till

A layer of glacial till was encountered in all of the test borings below the glaciomarine deposit, with the exception of boring BB-MOS-204 and BB-MOS-402, which were terminated in the glaciomarine soils. The glacial till encountered consisted of mixture of sand, silt and gravel and/or silt with lesser portions of sand and gravel.

The full thickness of the glacial till was penetrated in four of the twelve test borings and ranged from approximately 13.5 to 48 feet.

The glacial till was typically loose to very dense with N_{60} -values ranging from 7 to in excess of 50 bpf. Glacial till consisting of primarily of silt was typically stiff to hard with N_{60} values ranging from 8 to greater than 50 bpf.

¹ Foundation Engineering Handbook, 2nd Edition, 1991, Fang

² Principles of Geotechnical Engineering, 7th Edition, Das.

5.6 Bedrock

Bedrock was encountered and cored in borings BB-MOS-101, BB-MOS-102, BB-MOS-103 and BB-MOS-301. In those borings where bedrock was encountered, the depth to bedrock ranged from approximately 28 to 59 feet bgs (Elev. 51.3 to 58.4). The bedrock is identified as grey, fine grained, SANDSTONE, hard, fresh to slightly weathered, with joints close to moderately close, and tight fractures from horizontal to nearly vertical and minor silt infilling. The rock quality designation (RQD) of the bedrock was determined to range from 16 to 95 percent indicating a rock mass quality of very poor to excellent.

Table 3 summarizes approximate depths to bedrock, corresponding approximate top of bedrock elevations and RQD's.

5.7 Groundwater

Groundwater measurements in three borings showed groundwater levels at 2.6 to 13.0 feet below the ground surface. Groundwater levels were not observed in four borings drilled on land. Five borings were drilled from barge-mounted rigs or from a drill rig on the bridge deck where water levels were consistent with the river levels. In general, groundwater levels will fluctuate with precipitation, seasonal changes, runoff, and adjacent construction activities.

6.0 SETTLEMENT MITIGATION ALTERNATIVES

Settlement mitigation options under consideration consist of removal and replacement of the existing approach fill with lightweight material. The lightweight materials under consideration include: EPS Geofoam, Lightweight Foam Concrete Fill (LFCF) and Expanded Shale Aggregate (ESA).

7.0 GEOTECHNICAL EVALUATIONS AND RECOMMENDATIONS

S.W. Cole conducted geotechnical evaluations for the existing east approach and for the three lightweight fill options. Each lightweight fill option was modeled with layers of geotextile reinforcement to improve global stability.

Global stability evaluations for the existing east embankment and mitigated embankment were performed using SLOPE/W computer software. The objective of the three lightweight fill models with geotextile reinforcement (with an ultimate tensile strength of 4,800 lbs./ft.) was to provide a minimum factor of safety of 1.5 in accordance with AASHTO LRFD 11.6.2.3 and the guidance in C11.6.2.3.

Initial and detailed settlement models were developed for the existing conditions and proposed Geofoam, LFCF and ESA mitigation options to estimate the immediate,

consolidation and total settlement resulting from the placement of the roadway embankment. Settlement evaluations were completed using Settle3D software. Details and results of the initial detailed settlement evaluations are included in Appendix C – Geotechnical Evaluations.

Staged settlement evaluations were also completed to model the embankment using construction stages to simulate settlement after placement of the existing fill embankment (Stage 1) settlement of the existing embankment after 5 years (2018) and settlement of the lightweight fill options after an additional 10 years (2028). The results indicate that long-term settlement from the three lightweight fill options will be negligible.

Based on the initial, detailed and staged settlement evaluations and global stability evaluations, three settlement mitigations designs are recommended:

- Replace 8 feet of fill with Geofoam (2.0 pcf) and 2 layers of geosynthetic reinforcement;
- Replace 10 feet of fill with LFCF (36 pcf) and 2 layers of geosynthetic reinforcement;
- Replace 10 feet of fill with ESA (60 pcf) and 3 layers of geosynthetic reinforcement.

Details and results of the staged settlement evaluations are included in Appendix C – Geotechnical Evaluations.

8.0 CLOSURE

This report has been prepared for the use of the MaineDOT Bridge Program for specific application to the proposed reconstruction of the east approach embankment of Second Otter Bridge in Milford, Maine in accordance with generally accepted geotechnical and foundation engineering practices. No other intended use or warranty is expressed or implied.

In the event that any changes in the nature, design, or location of the proposed project are planned, this report should be reviewed by a geotechnical engineer to assess the appropriateness of the conclusions and recommendations and to modify the recommendations as appropriate to reflect the changes in design. These analyses and recommendations are based in part upon limited subsurface investigations at discrete exploratory locations completed at the site. If variations from the conditions encountered during the investigation appear evident during construction, it may also become necessary to re-evaluate the recommendations made in this report.

It is recommended that the geotechnical engineer be provided the opportunity for a review of the final design and specifications in order that the earthwork and foundation recommendations may be properly interpreted and implemented in the design and specifications.

Tables

Test Boring No.	Ground Surface Elev. (ft)	Vane Size (mm x mm)	Depth below ground surface (ft)	S _u (psf)	S _{u(remolded)} (psf)	Sensitivity
BB-MOS-101	110.4	55 x 110	25.6 - 26.0	402	67	6.0
		55 x 110	26.6 - 27.0	402	45	8.9
BB-MOS-102	86.9	55 x 110	5.6 - 6.0	45	45	1.0
		55 x 110	6.6 - 7.0	134	45	3.0
BB-MOS-201	98.7	55 x 110	12.6 - 13.0	536	89	6.0
BB-MOS-202	90.2	55 x 110	2.6 - 3.0	179	67	2.7
		55 x 110	3.6 - 4.0	179	67	2.7
		55 x 110	12.6 - 13.0	179	67	2.7
		55 x 110	13.6 - 14.0	268	89	3.0
BB-MOS-202A	90.5	55 x 110	5.1 - 5.5	223	45	5.0
		55 x 110	6.1 - 6.5	223	54	4.1
		55 x 110	8.6 - 9.0	179	67	2.7
		55 x 110	9.6 - 10.0	156	71	2.2
		55 x 110	12.1 - 12.5	246	54	4.6
		55 x 110	13.1 - 13.5	223	34	6.6
BB-MOS-203	87.9	55 x 110	6.1 - 6.5	89	45	2.0
		55 x 110	7.1 - 7.5	112	54	2.1
		55 x 110	9.6 - 10.0	143	49	2.9
		55 x 110	10.6 - 11.0	134	31	4.3
		55 x 110	13.1 - 13.5	223	121	1.8
BB-MOS-204	86	55 x 110	1.6 - 2.0	62	22	2.8
		55 x 110	2.6 - 3.0	134	31	4.3
		55 x 110	5.1 - 5.5	156	67	2.3
		55 x 110	6.1 - 6.5	134	27	5.0
		55 x 110	8.6 - 9.0	246	54	4.6
		55 x 110	9.6 - 10.0	179	67	2.7
BB-MOS-301	112.9	55 x 110	32.5-32.9	357	179	2.0
BB-MOS-402	48.5	16 x 32	8.2-8.3	4087	-	-
		16 x 32	10.7-10.8	1965	393	5.0
BB-MOS-501	113.5	55 x 110	26.5-26.9	674	89	7.6
		55 x 110	27.5-27.9	357	89	4.0
		55 x 110	29.6-30.0	223	45	5.0
		55 x 110	30.6-31.0	268	67	4.0

Table 1
In-situ Vane Shear Test Results
Milford, Second Otter Bridge
WINs 16667.00 and 23466.00

Test Boring No.	Sample No.	Soil Description	Water Content (%)	Liquid Limit	Plastic Limit	Plasticity Index	Liquidity Index
BB-MOS-101	5D	Silty CLAY, trace fine sand	28.9	32	22	10	0.7
	6D	Silty CLAY, trace fine sand	38.8	35	23	12	1.3
BB-MOS-102	2D	Silty CLAY, trace f-m sand	51.2	32	23	9	3.1
BB-MOS-103	2D/A	Clayey SILT, trace f-c sand	23.1	33	20	13	0.2
BB-MOS-201	3D	CLAY, some silt, little gravel, trace f. sand	36	33	24	9	1.3
BB-MOS-202A	1D	CLAY, some silt, trace f. sand	33.3	34	25	9	0.9
BB-MOS-203	1D	Silty CLAY, trace fine sand	46.1	37	24	13	1.7
BB-MOS-301	4D	Clayey SILT, trace fine sand	26.7	29	23	6	0.6
	1U	Clayey soils	29.2	30	19	11	0.9
	2U	Clayey soils	34.5	31	19	12	1.3
BB-MOS-401	3D	Silty CLAY, trace sand	24.9	31	22	9	0.3
BB-MOS-501	8D	Clayey SILT, trace fine sand	30.8	27	23	4	2.0
	9D	Silty CLAY, trace fine sand	39.4	37	23	14	1.2
	10D	Clayey SILT, trace fine sand	37.1	29	23	6	2.4
	1U	Clayey SILT, trace fine sand	35.5	30	20	10	1.6

Table 2
Summary of Atterberg Limits Test Results
Milford, Second Otter Bridge
WINs 16667.00 and 23466.00

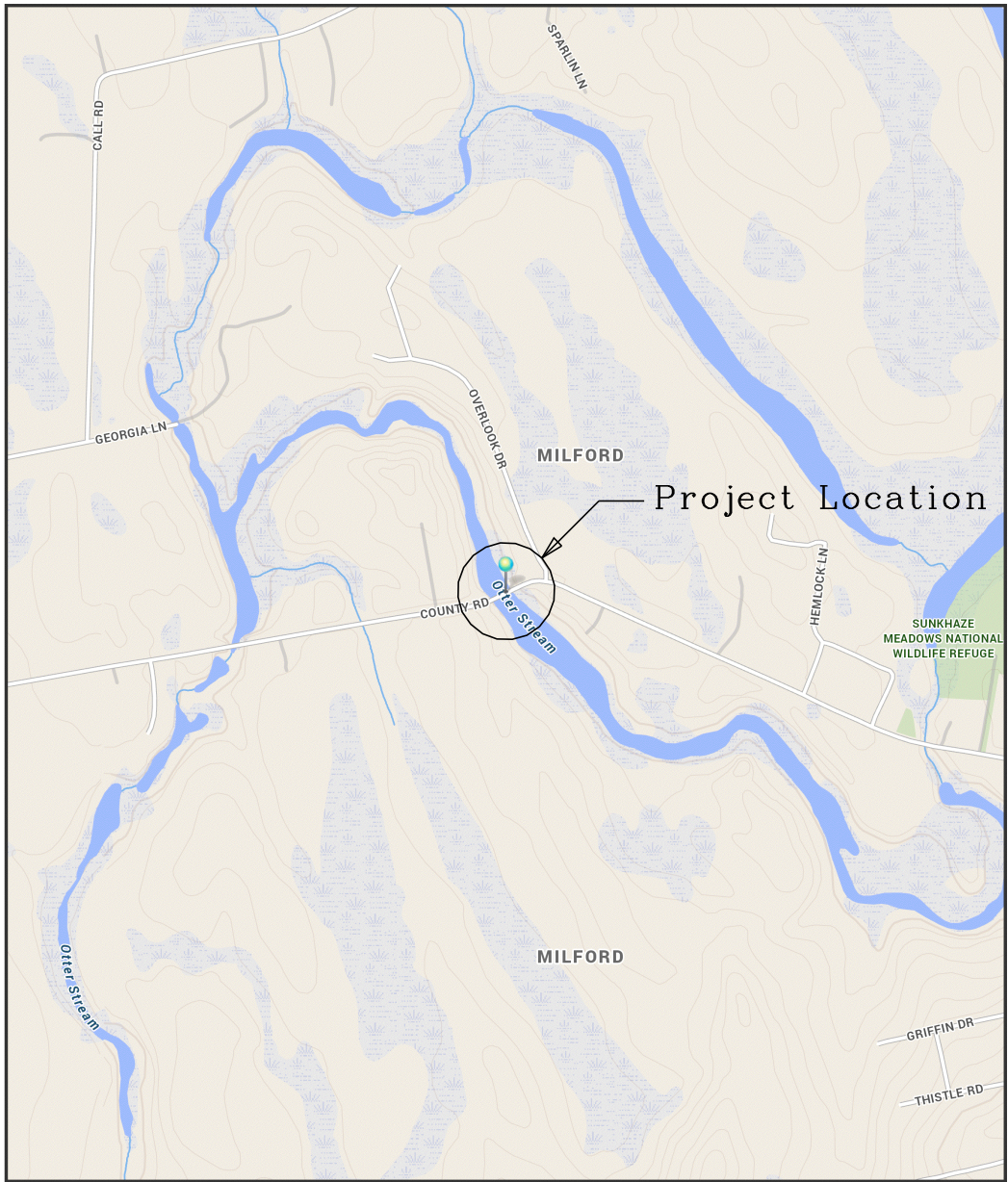
Boring No.	Approximate Depth to Bedrock (ft)	Approximate Top of Bedrock Elev. (ft)	RQD of bedrock cores in order of increasing depth
BB-MOS-101	52	58.4	16, 43%
BB-MOS-102	28.5	58.4	60, 67, 67%
BB-MOS-103	59.1	51.3	45, 35, 46%
BB-MOS-301	54.7	58.2	94, 95%

Table 3
Summary of Approximate
Bedrock Depths, Elevations and RQD
Milford, Second Otter Bridge
WINS 16667.00 and 23466.00

Sheets



MILFORD, MAINE



The Maine Department of Transportation provides this publication for information only. Reliance upon this information is at user risk. It is subject to revision and may be incomplete depending upon changing conditions. The Department assumes no liability if injuries or damages result from this information. This map is not intended to support emergency dispatch.

0.25 Miles
1 inch = 0.28 miles

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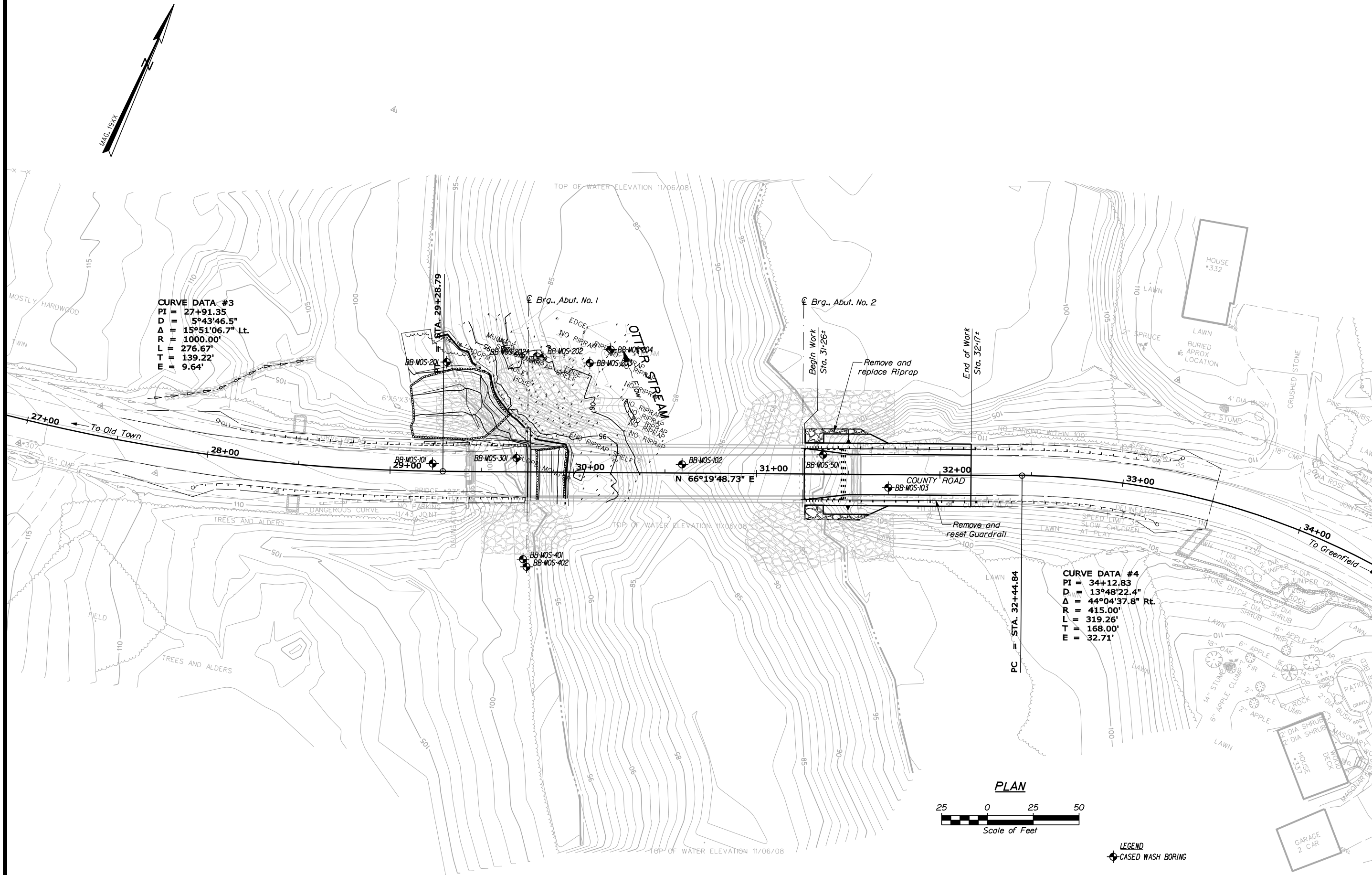
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Date: 3/30/2018

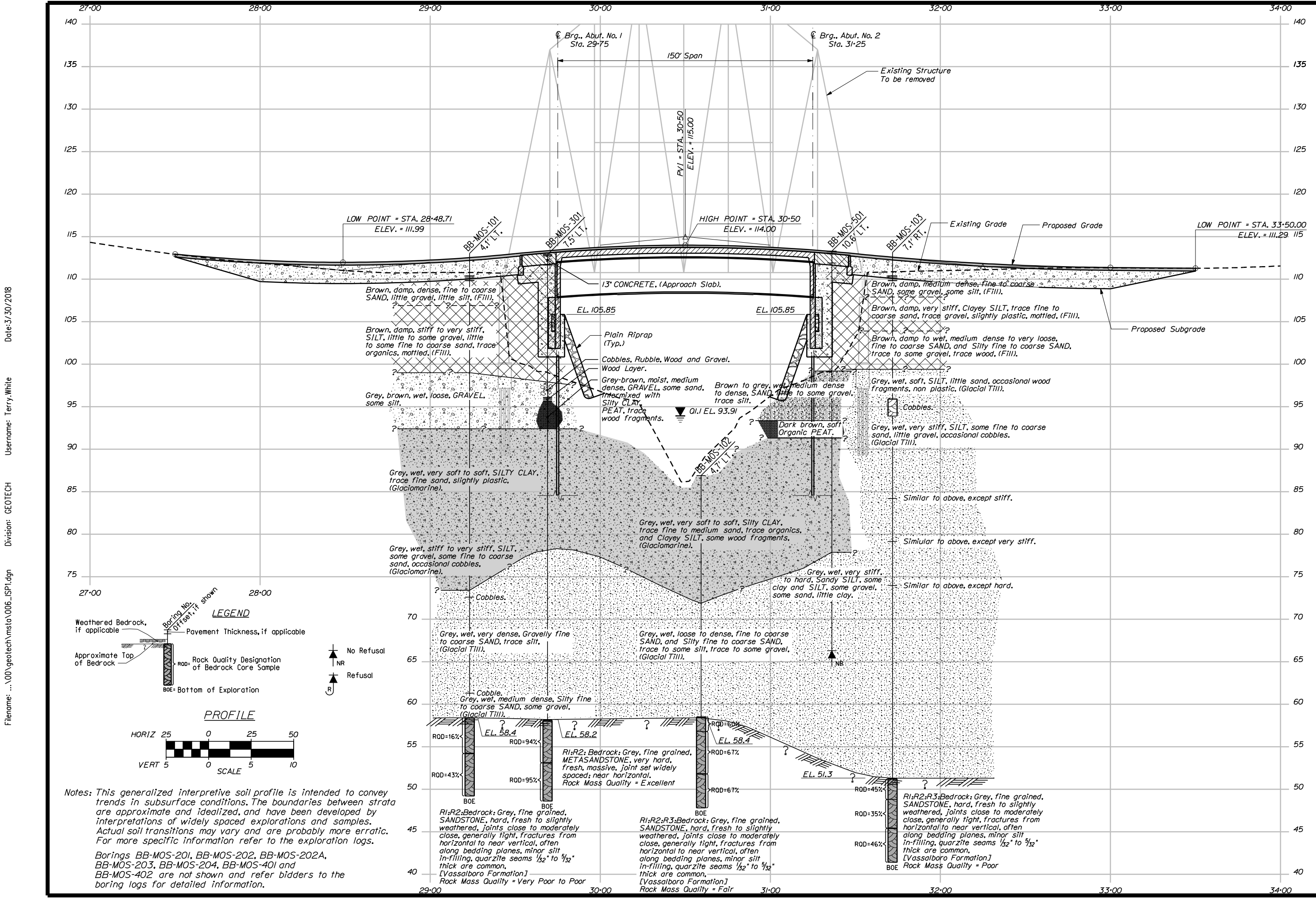
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DESIGN-DETAILED	LARUSINSKI, T. WHITE	JAN 2018	
CHECKED-REVIEWED			
DESIGNS-DETAILED			
DESIGNS-DETAILED			
REVISIONS 1			
REVISIONS 2			
REVISIONS 3			
REVISIONS 4			
FIELD CHANGES			
MILFORD		PENOBSCOT COUNTY	
SECOND OTTER BRIDGE		OTTER STREAM	
BORING LOCATION PLAN		SHEET NUMBER	
2		OF 6	



Date: 3/30/2018

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STATE OF MAINE	
DEPARTMENT OF TRANSPORTATION	
2346600	WIN
BRIDGE NO. 2754	BRIDGE PLANS

PROJ. MANAGER	DATE	BY	DATE
DESIGN-DETAILED	JAN 2018	L. KRUSINSKI	T. WHITE
CHECKED-REVIEWED			
DESIGNS-DETAILED			
DESIGNS-DETAILED			
REVISIONS 1			
REVISIONS 2			
REVISIONS 3			
REVISIONS 4			
FIELD CHANGES			

SECOND OTTER BRIDGE OTTER STREAM	PENOBSCOT COUNTY
MILFORD	INTERPRETIVE SUBSURFACE PROFILE
SHEET NUMBER	
3	
OF 6	

Appendix A

Boring Logs

UNIFIED SOIL CLASSIFICATION SYSTEM				MODIFIED BURMISTER SYSTEM																											
MAJOR DIVISIONS		GROUP SYMBOLS	TYPICAL NAMES	Descriptive Term	Portion of Total (%)																										
COARSE-GRAINED SOILS (more than half of material is larger than No. 200 sieve size)	GRAVELS (more than half of coarse fraction is larger than No. 4 sieve size)	CLEAN GRAVELS	GW Well-graded gravels, gravel-sand mixtures, little or no fines.	trace	0 - 10																										
		(little or no fines)	GP Poorly-graded gravels, gravel sand mixtures, little or no fines.	little	11 - 20																										
	SANDS (more than half of coarse fraction is smaller than No. 4 sieve size)	GRAVEL WITH FINES (Appreciable amount of fines)	GM Silty gravels, gravel-sand-silt mixtures.	some	21 - 35																										
		CLEAN SANDS	SW Well-graded sands, gravelly sands, little or no fines	adjective (e.g. sandy, clayey)	36 - 50																										
		(little or no fines)	SP Poorly-graded sands, gravelly sand, little or no fines.	TERMS DESCRIBING DENSITY/CONSISTENCY Coarse-grained soils (more than half of material is larger than No. 200 sieve): Includes (1) clean gravels; (2) silty or clayey gravels; and (3) silty, clayey or gravelly sands. Density is rated according to standard penetration resistance (N-value). <table border="1"> <thead> <tr> <th>Density of Cohesionless Soils</th> <th>Standard Penetration Resistance N-Value (blows per foot)</th> </tr> </thead> <tbody> <tr><td>Very loose</td><td>0 - 4</td></tr> <tr><td>Loose</td><td>5 - 10</td></tr> <tr><td>Medium Dense</td><td>11 - 30</td></tr> <tr><td>Dense</td><td>31 - 50</td></tr> <tr><td>Very Dense</td><td>> 50</td></tr> </tbody> </table>		Density of Cohesionless Soils	Standard Penetration Resistance N-Value (blows per foot)	Very loose	0 - 4	Loose	5 - 10	Medium Dense	11 - 30	Dense	31 - 50	Very Dense	> 50														
		Density of Cohesionless Soils	Standard Penetration Resistance N-Value (blows per foot)																												
Very loose	0 - 4																														
Loose	5 - 10																														
Medium Dense	11 - 30																														
Dense	31 - 50																														
Very Dense	> 50																														
SANDS WITH FINES (Appreciable amount of fines)	SM Silty sands, sand-silt mixtures	Fine-grained soils (more than half of material is smaller than No. 200 sieve): Includes (1) inorganic and organic silts and clays; (2) gravelly, sandy or silty clays; and (3) clayey silts. Consistency is rated according to undrained shear strength as indicated. <table border="1"> <thead> <tr> <th>Consistency of Cohesive soils</th> <th>SPT N-Value (blows per foot)</th> <th>Approximate Undrained Shear Strength (psf)</th> <th>Field Guidelines</th> </tr> </thead> <tbody> <tr><td>Very Soft</td><td>WOH, WOR, WOP, <2</td><td>0 - 250</td><td>Fist easily penetrates</td></tr> <tr><td>Soft</td><td>2 - 4</td><td>250 - 500</td><td>Thumb easily penetrates</td></tr> <tr><td>Medium Stiff</td><td>5 - 8</td><td>500 - 1000</td><td>Thumb penetrates with moderate effort</td></tr> <tr><td>Stiff</td><td>9 - 15</td><td>1000 - 2000</td><td>Indented by thumb with great effort</td></tr> <tr><td>Very Stiff</td><td>16 - 30</td><td>2000 - 4000</td><td>Indented by thumbnail</td></tr> <tr><td>Hard</td><td>>30</td><td>over 4000</td><td>Indented by thumbnail with difficulty</td></tr> </tbody> </table>		Consistency of Cohesive soils	SPT N-Value (blows per foot)	Approximate Undrained Shear Strength (psf)	Field Guidelines	Very Soft	WOH, WOR, WOP, <2	0 - 250	Fist easily penetrates	Soft	2 - 4	250 - 500	Thumb easily penetrates	Medium Stiff	5 - 8	500 - 1000	Thumb penetrates with moderate effort	Stiff	9 - 15	1000 - 2000	Indented by thumb with great effort	Very Stiff	16 - 30	2000 - 4000	Indented by thumbnail	Hard	>30	over 4000	Indented by thumbnail with difficulty
Consistency of Cohesive soils	SPT N-Value (blows per foot)			Approximate Undrained Shear Strength (psf)	Field Guidelines																										
Very Soft	WOH, WOR, WOP, <2	0 - 250	Fist easily penetrates																												
Soft	2 - 4	250 - 500	Thumb easily penetrates																												
Medium Stiff	5 - 8	500 - 1000	Thumb penetrates with moderate effort																												
Stiff	9 - 15	1000 - 2000	Indented by thumb with great effort																												
Very Stiff	16 - 30	2000 - 4000	Indented by thumbnail																												
Hard	>30	over 4000	Indented by thumbnail with difficulty																												
FINE-GRAINED SOILS (more than half of material is smaller than No. 200 sieve size)	SILTS AND CLAYS (liquid limit less than 50)	ML Inorganic silts and very fine sands, rock flour, silty or clayey fine sands, or clayey silts with slight plasticity.	Rock Quality Designation (RQD): RQD (%) = $\frac{\text{sum of the lengths of intact pieces of core} * > 4 \text{ inches}}{\text{length of core advance}}$ *Minimum NQ rock core (1.88 in. OD of core) Correlation of RQD to Rock Mass Quality <table border="1"> <thead> <tr> <th>Rock Mass Quality</th> <th>RQD (%)</th> </tr> </thead> <tbody> <tr><td>Very Poor</td><td>≤25</td></tr> <tr><td>Poor</td><td>26 - 50</td></tr> <tr><td>Fair</td><td>51 - 75</td></tr> <tr><td>Good</td><td>76 - 90</td></tr> <tr><td>Excellent</td><td>91 - 100</td></tr> </tbody> </table>			Rock Mass Quality	RQD (%)	Very Poor	≤25	Poor	26 - 50	Fair	51 - 75	Good	76 - 90	Excellent	91 - 100														
		Rock Mass Quality				RQD (%)																									
		Very Poor				≤25																									
	Poor	26 - 50																													
Fair	51 - 75																														
Good	76 - 90																														
Excellent	91 - 100																														
CL Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays.																															
OL Organic silts and organic silty clays of low plasticity.																															
SILTS AND CLAYS (liquid limit greater than 50)	MH Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts.	Desired Rock Observations (in this order, if applicable): Color (Munsell color chart) Texture (aphanitic, fine-grained, etc.) Rock Type (granite, schist, sandstone, etc.) Hardness (very hard, hard, mod. hard, etc.) Weathering (fresh, very slight, slight, moderate, mod. severe, severe, etc.) Geologic discontinuities/jointing: -dip (horiz - 0-5 deg., low angle - 5-35 deg., mod. dipping - 35-55 deg., steep - 55-85 deg., vertical - 85-90 deg.) -spacing (very close - <2 inch, close - 2-12 inch, mod. close - 1-3 feet, wide - 3-10 feet, very wide >10 feet) -tightness (tight, open, or healed) -infilling (grain size, color, etc.) Formation (Waterville, Ellsworth, Cape Elizabeth, etc.) RQD and correlation to rock mass quality (very poor, poor, etc.) ref: ASTM D6032 and AASHTO Standard Specification for Highway Bridges, 17th Ed. Table 4.4.8.1.2A Recovery (inch/inch and percentage) Rock Core Rate (X.X ft - Y.Y ft (min:sec))																													
	CH Inorganic clays of high plasticity, fat clays.																														
	OH Organic clays of medium to high plasticity, organic silts.																														
HIGHLY ORGANIC SOILS	Pt Peat and other highly organic soils.																														
Desired Soil Observations (in this order, if applicable): Color (Munsell color chart) Moisture (dry, damp, moist, wet) Density/Consistency (from above right hand side) Texture (fine, medium, coarse, etc.) Name (sand, silty sand, clay, etc., including portions - trace, little, etc.) Gradation (well-graded, poorly-graded, uniform, etc.) Plasticity (non-plastic, slightly plastic, moderately plastic, highly plastic) Structure (layering, fractures, cracks, etc.) Bonding (well, moderately, loosely, etc.,) Cementation (weak, moderate, or strong) Geologic Origin (till, marine clay, alluvium, etc.) Groundwater level				Sample Container Labeling Requirements: WIN Blow Counts Bridge Name / Town Sample Recovery Boring Number Date Sample Number Personnel Initials Sample Depth																											
Maine Department of Transportation Geotechnical Section Key to Soil and Rock Descriptions and Terms Field Identification Information																															

Driller: MaineDOT	Elevation (ft.): 110.4	Auger ID/OD: 5" Solid Stem
Operator: Giguere	Datum: NAVD88	Sampler: Standard Split Spoon
Logged By: M. Foley	Rig Type: CME 45C	Hammer Wt./Fall: 140#/30"
Date Start/Finish: 7/19/10-7/20/10	Drilling Method: Cased Wash Boring	Core Barrel: NQ-2"
Boring Location: 29+23.2, 4.1 ft Lt.	Casing ID/OD: HW & NW	Water Level*: 13.0' bgs

Definitions: D = Split Spoon Sample MD = Unsuccessful Split Spoon Sample attempt U = Thin Wall Tube Sample R = Rock Core Sample V = Insitu Vane Shear Test SSA = Solid Stem Auger	Definitions: S_u = Insitu Field Vane Shear Strength (psf) T_v = Pocket Torvane Shear Strength (psf) q_p = Unconfined Compressive Strength (ksf) $S_u(\text{lab})$ = Lab Vane Shear Strength (psf) WOH = weight of 140lb. hammer WOR = weight of rods WOC = weight of casing	Definitions: WC = water content, percent LL = Liquid Limit PL = Plastic Limit PI = Plasticity Index G = Grain Size Analysis C = Consolidation Test
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Sample Information											Visual Description and Remarks	Laboratory Testing Results/AASHTO and Unified Class.
Depth (ft.)	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (6 in.) Shear Strength (psf) or RQD (%)	N-value	Casing Blows	Elevation (ft.)	Graphic Log				
0						SSA	109.80		7" Pavement		0.60	
	1D	24/3	1.00 - 3.00	8/14/21/14	35				Brown, damp, dense, fine to coarse SAND, little gravel, little silt, (Fill).		G#239836 A-1-b, SM WC=3.8%	
							106.90		-----		3.50	
5	2D	24/6	5.00 - 7.00	6/3/4/5	7				Brown, damp, stiff, SILT, some gravel, some fine to coarse sand, (Fill).		G#239837 A-4, SM WC=9.2%	
10	3D	24/6	10.00 - 12.00	10/8/10/6	18	PUSH			Brown, damp, very stiff, SILT, little gravel, little fine to coarse sand, trace organics, mottled, (Fill).		G#239838 A-4, ML WC=19.7%	
							99.00		Based on survey, original ground is at approximately 11.4' bgs, at approximate elevation 99.0'.			
									Casing blows indicate a change at 13.0' bgs.			
15	4D	24/2	15.00 - 17.00	2/3/2/3	5	33			Grey brown, wet, loose, GRAVEL, some silt.			
									Small chunks of PEAT noted in wash water coming up at 17.0' bgs.			
							92.40		Wash water changes from brown to grey at 18.0' bgs.		18.00	
20	MV/5D	24/22	20.00 - 22.00	WOH/WOH/WOH/ WOH	---	62			Failed vane attempt at 20.0' bgs, would not push.		G#239839 A-4, CL WC=28.9% LL=32 PL=22 PI=10	
									Grey, wet, very soft, Silty CLAY, trace fine sand, slightly plastic, (Glaciomarine).			
25												

Remarks:
 Rock Coring Down Pressure 500 lbs.

Driller: MaineDOT	Elevation (ft.): 110.4	Auger ID/OD: 5" Solid Stem
Operator: Giguere	Datum: NAVD88	Sampler: Standard Split Spoon
Logged By: M. Foley	Rig Type: CME 45C	Hammer Wt./Fall: 140#/30"
Date Start/Finish: 7/19/10-7/20/10	Drilling Method: Cased Wash Boring	Core Barrel: NQ-2"
Boring Location: 29+23.2, 4.1 ft Lt.	Casing ID/OD: HW & NW	Water Level*: 13.0' bgs

Definitions: D = Split Spoon Sample MD = Unsuccessful Split Spoon Sample attempt U = Thin Wall Tube Sample R = Rock Core Sample V = Insitu Vane Shear Test SSA = Solid Stem Auger	Definitions: S_u = Insitu Field Vane Shear Strength (psf) T_v = Pocket Torvane Shear Strength (psf) q_p = Unconfined Compressive Strength (ksf) $S_u(\text{lab})$ = Lab Vane Shear Strength (psf) WOH = weight of 140lb. hammer WOR = weight of rods WOC = weight of casing	Definitions: WC = water content, percent LL = Liquid Limit PL = Plastic Limit PI = Plasticity Index G = Grain Size Analysis C = Consolidation Test
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Depth (ft.)	Sample Information								Elevation (ft.)	Graphic Log	Visual Description and Remarks	Laboratory Testing Results/AASHTO and Unified Class.
	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (6 in.) Shear Strength (psf) or RQD (%)	N-value	Casing Blows						
25	6D	24/24	25.00 - 27.00	push thru vane	---	58	81.40	29.00	29.00	Grey, wet, soft, Silty CLAY, trace fine sand, slightly plastic, (Glaciomarine).	G#239840 A-6, CL WC=38.8% LL=35 PL=23 PI=12	
	V2A		25.60 - 25.97	$S_u=402/67$ psf								
	V2B	26.60 - 26.97	$S_u=402/45$ psf									
30	7D/MU	24/12	30.00 - 32.00	3/3/5/6	8	52				Failed tube attempt, tube would not push. Grey, wet, stiff, SILT, some gravel, some fine to coarse sand, occasional cobbles, (Glaciomarine).		
						72						
							71					
							67					
							92					
35	8D	24/13	35.00 - 37.00	4/5/7/7	12	62				Grey, wet, very stiff, SILT, some gravel, some fine to coarse sand, occasional cobbles, (Glaciomarine).	G#239841 A-4, ML WC=12.0%	
						56						
							a67					
							OPEN					
40										Washed ahead to 45.0' bgs, then telescoped NW Casing down hole.		
							18					
							49					
							63					
45	9D	24/8	45.00 - 47.00	47/47/32/21	79	27				Grey, wet, very dense, Gravelly fine to coarse SAND, trace silt, (Glacial Till).		
							78					
							80					
							158					
50						64				Cored through 0.6' Quartzite Cobble at 49.1' bgs.		

Remarks:
 Rock Coring Down Pressure 500 lbs.

Maine Department of Transportation Soil/Rock Exploration Log US CUSTOMARY UNITS	Project: Second Otter Bridge #2754 carries County Road over Otter Stream Location: Milford, Maine	Boring No.: BB-MOS-101 PIN: 16667.00
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Driller: MaineDOT	Elevation (ft.): 110.4	Auger ID/OD: 5" Solid Stem
Operator: Giguere	Datum: NAVD88	Sampler: Standard Split Spoon
Logged By: M. Foley	Rig Type: CME 45C	Hammer Wt./Fall: 140#/30"
Date Start/Finish: 7/19/10-7/20/10	Drilling Method: Cased Wash Boring	Core Barrel: NQ-2"
Boring Location: 29+23.2, 4.1 ft Lt.	Casing ID/OD: HW & NW	Water Level*: 13.0' bgs

Definitions: D = Split Spoon Sample MD = Unsuccessful Split Spoon Sample attempt U = Thin Wall Tube Sample R = Rock Core Sample V = Insitu Vane Shear Test SSA = Solid Stem Auger	Definitions: S _u = Insitu Field Vane Shear Strength (psf) T _v = Pocket Torvane Shear Strength (psf) q _p = Unconfined Compressive Strength (ksf) S _u (lab) = Lab Vane Shear Strength (psf) WOH = weight of 140lb. hammer WOR = weight of rods WOC = weight of casing	Definitions: WC = water content, percent LL = Liquid Limit PL = Plastic Limit PI = Plasticity Index G = Grain Size Analysis C = Consolidation Test
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Depth (ft.)	Sample Information										Visual Description and Remarks	Laboratory Testing Results/AASHTO and Unified Class.
	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (6 in.) Shear Strength (psf) or RQD (%)	N-value	Casing Blows	Elevation (ft.)	Graphic Log				
50	10D	18/10	50.50 - 52.00	7/8/12	20	60	58.40				(50.8-52.0' bgs) Grey, wet, medium dense, Silty fine to coarse SAND, some gravel, (Glacial Till).	
	R1	50.4/50.4	52.00 - 56.20	RQD = 16%		NO-2 CORE						
55												
	R2	60/60	56.20 - 61.20	RQD = 43%								
60												
							49.20					
65												
70												
75												

Remarks:
Rock Coring Down Pressure 500 lbs.

Driller: MaineDOT	Elevation (ft.): 86.9	Auger ID/OD: 5" Solid Stem
Operator: Giguere	Datum: NAVD88	Sampler: Standard Split Spoon
Logged By: M. Foley	Rig Type: CME 45C	Hammer Wt./Fall: 140#/30"
Date Start/Finish: 7/21/10-7/22/10	Drilling Method: Cased Wash Boring	Core Barrel: NQ-2"
Boring Location: 30+59.3, 4.7 ft Lt.	Casing ID/OD: HW & NW	Water Level*: Water Boring

Definitions: D = Split Spoon Sample MD = Unsuccessful Split Spoon Sample attempt U = Thin Wall Tube Sample R = Rock Core Sample V = Insitu Vane Shear Test SSA = Solid Stem Auger	Definitions: S_u = Insitu Field Vane Shear Strength (psf) T_v = Pocket Torvane Shear Strength (psf) q_p = Unconfined Compressive Strength (ksf) $S_u(\text{lab})$ = Lab Vane Shear Strength (psf) WOH = weight of 140lb. hammer WOR = weight of rods WOC = weight of casing	Definitions: WC = water content, percent LL = Liquid Limit PL = Plastic Limit PI = Plasticity Index G = Grain Size Analysis C = Consolidation Test
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Sample Information											Visual Description and Remarks	Laboratory Testing Results/AASHTO and Unified Class.
Depth (ft.)	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (6 in.) Shear Strength (psf) or RQD (%)	N-value	Casing Blows	Elevation (ft.)	Graphic Log				
0	1D	24/a3	0.00 - 2.00	5/2/1-12"	3	HW PUSH					a3" recovery 1st attempt, sent spoon down a 2nd time 24" recovery. Grey, wet, soft, Silty CLAY, trace fine sand and organics, some wood fragments, (Glaciomarine).	
5	2D V1A V1B	24/12	5.00 - 7.00 5.60 - 5.97 6.60 - 6.97	push thru vane $S_u=45/45$ psf $S_u=134/45$ psf	---						Grey, wet, very soft, Silty CLAY, trace fine to medium sand. 55x110 mm raw torque readings: V1A: 1.0/1.0 ft-lbs V1B: 3.0/1.0 ft-lbs	G#239842 A-4, CL WC=51.2% LL=32 PL=23 PI=9
10	bMU										bPushed casing to 10.3' bgs on 21 July, had to push below bridge deck for overnight, missed shelly tube at 10.3'.	
15	3D MV	24/24	14.00 - 16.00 14.00 - 14.00	WOR/WOR/8/11	8		71.90				Telescoped NW Casing at 14.0' bgs. Grey, wet, stiff, Silty CLAY, trace fine to coarse sand, trace gravel, (Glaciomarine). Failed 55x110 mm vane attempt, would not push.	
											Grey, wet, medium dense, Silty fine to coarse SAND, little gravel, (Glacial Till).	
20	4D	24/10	20.60 - 22.60	38/13/21/17	34						Grey, wet, dense, fine to coarse SAND, some silt, some gravel, (Glacial Till).	G#239843 A-2-4, SM WC=8.7%
25						SUNK						

Remarks:
 13.6' from Bridge Deck to top of water.
 25.3' from Bridge Deck to Mudline. Mudline is 0 ft on this log.
 7" thick Bridge Deck.

* Water level readings have been made at times and under conditions stated. Groundwater fluctuations may occur due to conditions other than those present at the time measurements were made.

Driller: MaineDOT	Elevation (ft.): 86.9	Auger ID/OD: 5" Solid Stem
Operator: Giguere	Datum: NAVD88	Sampler: Standard Split Spoon
Logged By: M. Foley	Rig Type: CME 45C	Hammer Wt./Fall: 140#/30"
Date Start/Finish: 7/21/10-7/22/10	Drilling Method: Cased Wash Boring	Core Barrel: NQ-2"
Boring Location: 30+59.3, 4.7 ft Lt.	Casing ID/OD: HW & NW	Water Level*: Water Boring

Definitions: D = Split Spoon Sample MD = Unsuccessful Split Spoon Sample attempt U = Thin Wall Tube Sample R = Rock Core Sample V = Insitu Vane Shear Test SSA = Solid Stem Auger	Definitions: S_u = Insitu Field Vane Shear Strength (psf) T_v = Pocket Torvane Shear Strength (psf) q_p = Unconfined Compressive Strength (ksf) $S_u(\text{lab})$ = Lab Vane Shear Strength (psf) WOH = weight of 140lb. hammer WOR = weight of rods WOC = weight of casing	Definitions: WC = water content, percent LL = Liquid Limit PL = Plastic Limit PI = Plasticity Index G = Grain Size Analysis C = Consolidation Test
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Sample Information											Visual Description and Remarks	Laboratory Testing Results/AASHTO and Unified Class.
Depth (ft.)	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (6 in.) Shear Strength (psf) or RQD (%)	N-value	Casing Blows	Elevation (ft.)	Graphic Log				
25	5D	24/7	25.00 - 27.00	4/3/4/4	7	26	58.40		Grey, wet, loose, fine to coarse SAND, some gravel, some silt, (Glacial Till). Top of Bedrock at Elev. 58.4'. Bedrock: Grey, fine grained, SANDSTONE, hard, fresh to slightly weathered, joints close to moderately close, generally tight, fractures from horizontal to near vertical often along bedding planes, minor silt in-filling, quartzite seams 1/32" to 5/32" thick are common. (Vassalboro Formation). Rock Mass Quality = Fair. R1:Core Times (min:sec) 28.4-29.4' (4:18) 29.4-30.1' (6:00) 78% Recovery R2:Core Times (min:sec) 30.1-31.1' (3:00) 31.1-32.1' (3:00) 32.1-33.1' (5:30) 33.1-34.1' (4:45) 34.1-35.1' (3:45) 103% Recovery R3:Core Times (min:sec) 35.1-36.1' (5:00) 36.1-37.1' (4:30) 37.1-38.1' (3:45) 38.1-39.1' (3:18) 100% Recovery		28.50	
	R1	20.4/16	28.40 - 30.10	RQD = 60%		NQ-2						
30	R2	60/62	30.10 - 35.10	RQD = 67%		CORE						
35	R3	48/48	35.10 - 39.10	RQD = 67%			47.80		Bottom of Exploration at 39.10 feet below ground surface.		39.10	
40												
45												
50												

Remarks:
 13.6' from Bridge Deck to top of water.
 25.3' from Bridge Deck to Mudline. Mudline is 0 ft on this log.
 7" thick Bridge Deck.

* Water level readings have been made at times and under conditions stated. Groundwater fluctuations may occur due to conditions other than those present at the time measurements were made.

Driller: MaineDOT	Elevation (ft.): 110.4	Auger ID/OD: 5" Solid Stem
Operator: Giguere	Datum: NAVD88	Sampler: Standard Split Spoon
Logged By: M. Foley	Rig Type: CME 45C	Hammer Wt./Fall: 140#/30"
Date Start/Finish: 7/20/10-7/21/10	Drilling Method: Cased Wash Boring	Core Barrel: NQ-2"
Boring Location: 31+71.9, 7.1 ft Rt.	Casing ID/OD: HW & NW	Water Level*: 11.2' bgs.

Definitions: D = Split Spoon Sample MD = Unsuccessful Split Spoon Sample attempt U = Thin Wall Tube Sample R = Rock Core Sample V = Insitu Vane Shear Test SSA = Solid Stem Auger	Definitions: S_u = Insitu Field Vane Shear Strength (psf) T_v = Pocket Torvane Shear Strength (psf) q_p = Unconfined Compressive Strength (ksf) $S_u(\text{lab})$ = Lab Vane Shear Strength (psf) WOH = weight of 140lb. hammer WOR = weight of rods WOC = weight of casing	Definitions: WC = water content, percent LL = Liquid Limit PL = Plastic Limit PI = Plasticity Index G = Grain Size Analysis C = Consolidation Test
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Sample Information											Visual Description and Remarks	Laboratory Testing Results/AASHTO and Unified Class.
Depth (ft.)	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (6 in.) Shear Strength (psf) or RQD (%)	N-value	Casing Blows	Elevation (ft.)	Graphic Log				
0						aSHW	109.80		7" Pavement			
	1D	24/11	1.00 - 3.00	6/10/10/4	20		107.90		aSSA to 10.0' bgs, then pushed HW Casing to 10.0' bgs.			
									Brown, damp, medium dense, fine to coarse SAND, some gravel, some silt, (Fill).		G#239844 A-2-4, SM WC=7.3%	
5	2D/AB	24/19	5.00 - 7.00	2/4/5/12	9		103.90		Brown, damp, stiff, Clayey SILT, trace fine to coarse sand, trace gravel, slightly plastic, mottled, (Fill).		G#239845 A-6, CL WC=23.1% LL=33 PL=20 PI=13	
									2D/B (6.5-7.0') Brown, damp, medium dense, fine to coarse SAND, some gravel, trace silt, (Fill).			
10	3D/AB	24/14	10.00 - 12.00	2/1/1/1	2	65	99.40		3D/A (10.0-11.0') Brown, wet, very loose, Silty fine to coarse SAND, trace gravel, 2 inch wood chunk, with iron stained layers, (Fill).			
						21			3D/B (11.0-12.0') Grey, wet, soft, SILT, little sand, occasional wood fragments, non-plastic, (Glacial Till).			
						58			Based on survey, original ground is at approximately 12.4' bgs, at approximate elevation 98.0'.			
						219			Probable Cobble/Boulder at 14.5'bgs.			
15						104 347 NQ-2			Roller Coned ahead to 15.0' bgs, then began Core run at 15.0' to 16.5'bgs. 0.8' Cobble stacked on 0.3' Cobble with Till in Core Barrel.			
	4D	24/13	16.50 - 18.50	6/8/8/8	16	bWA			Grey, wet, very stiff, SILT, some fine to coarse sand, little gravel, occasional cobbles, (Glacial Till).		G#239846 A-4, CL WC=10.8%	
									bWashed ahead of Casing from 15.0-31.0' bgs.			
20	5D	24/16	20.00 - 22.00	4/11/6/9	17				Similar to above.			
25												

Remarks:
 Rock Coring Down Pressure 500 lbs.

Driller: MaineDOT	Elevation (ft.): 110.4	Auger ID/OD: 5" Solid Stem
Operator: Giguere	Datum: NAVD88	Sampler: Standard Split Spoon
Logged By: M. Foley	Rig Type: CME 45C	Hammer Wt./Fall: 140#/30"
Date Start/Finish: 7/20/10-7/21/10	Drilling Method: Cased Wash Boring	Core Barrel: NQ-2"
Boring Location: 31+71.9, 7.1 ft Rt.	Casing ID/OD: HW & NW	Water Level*: 11.2' bgs.

Definitions: D = Split Spoon Sample MD = Unsuccessful Split Spoon Sample attempt U = Thin Wall Tube Sample R = Rock Core Sample V = Insitu Vane Shear Test SSA = Solid Stem Auger	Definitions: S_u = Insitu Field Vane Shear Strength (psf) T_v = Pocket Torvane Shear Strength (psf) q_p = Unconfined Compressive Strength (ksf) $S_u(\text{lab})$ = Lab Vane Shear Strength (psf) WOH = weight of 140lb. hammer WOR = weight of rods WOC = weight of casing	Definitions: WC = water content, percent LL = Liquid Limit PL = Plastic Limit PI = Plasticity Index G = Grain Size Analysis C = Consolidation Test
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Depth (ft.)	Sample Information										Visual Description and Remarks	Laboratory Testing Results/AASHTO and Unified Class.
	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (6 in.) Shear Strength (psf) or RQD (%)	N-value	Casing Blows	Elevation (ft.)	Graphic Log				
25	6D	24/10	25.00 - 27.00	8/5/3/4	8						Grey, wet, stiff, SILT, some fine to coarse sand, little gravel, occasional cobbles, (Glacial Till).	G#239847 A-4, CL WC=11.0%
30	7D	24/13	30.00 - 32.00	5/6/11/9	17						Grey, wet, very stiff, SILT, some fine to coarse sand, little gravel, (Glacial Till). Telescoped NW Casing at 31.0' bgs.	
35	8D	24/10	35.00 - 37.00	16/12/18/24	30	94					Similar to above, hard.	
40	9D	24/13	40.00 - 42.00	8/13/12/14	25	130					Similar to above.	
45	10D	24/19	45.00 - 47.00	11/11/13/14	24	245					Grey, wet, hard, SILT, some fine to coarse sand, little gravel, (Glacial Till).	G#239848 A-4, CL WC=9.7%
50												

Remarks:
Rock Coring Down Pressure 500 lbs.

Driller: MaineDOT	Elevation (ft.): 110.4	Auger ID/OD: 5" Solid Stem
Operator: Giguere	Datum: NAVD88	Sampler: Standard Split Spoon
Logged By: M. Foley	Rig Type: CME 45C	Hammer Wt./Fall: 140#/30"
Date Start/Finish: 7/20/10-7/21/10	Drilling Method: Cased Wash Boring	Core Barrel: NQ-2"
Boring Location: 31+71.9, 7.1 ft Rt.	Casing ID/OD: HW & NW	Water Level*: 11.2' bgs.

Definitions: D = Split Spoon Sample MD = Unsuccessful Split Spoon Sample attempt U = Thin Wall Tube Sample R = Rock Core Sample V = Insitu Vane Shear Test SSA = Solid Stem Auger	Definitions: S _U = Insitu Field Vane Shear Strength (psf) T _V = Pocket Torvane Shear Strength (psf) q _p = Unconfined Compressive Strength (ksf) S _u (lab) = Lab Vane Shear Strength (psf) WOH = weight of 140lb. hammer WOR = weight of rods WOC = weight of casing	Definitions: WC = water content, percent LL = Liquid Limit PL = Plastic Limit PI = Plasticity Index G = Grain Size Analysis C = Consolidation Test
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Depth (ft.)	Sample Information							Elevation (ft.)	Graphic Log	Visual Description and Remarks	Laboratory Testing Results/AASHTO and Unified Class.
	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (6 in.) Shear Strength (psf) or RQD (%)	N-value	Casing Blows					
50	11D	24/10	50.00 - 52.00	15/24/15/8	39	bWA			Grey, wet, hard, SILT, some fine to coarse sand, little gravel, occasional cobbles, (Glacial Till).		
55	12D	24/14	55.00 - 57.00	11/18/32/25	50				Similar to above, with larger gravel pieces (Max Particle Size 1.75").		
60	R1	28.8/28.8	59.20 - 61.60	RQD = 45%		NQ-2 CORE	51.30		Top of Bedrock at Elev. 51.3'. Roller Coned ahead to 59.2' bgs. Bedrock: Grey, fine grained SANDSTONE, hard, fresh to slightly weathered, joints close to moderately close, generally tight, fractures from horizontal to near vertical often along bedding planes, minor silt in-filling, quartzite seams 1/32" to 5/32" thick are common. (Vassalboro Formation). Rock Mass Quality = Poor.		
65	R2	40.8/38	61.60 - 65.00	RQD = 35%					R1:Core Times (min:sec) 59.2-60.2' (3:45) 60.2-61.2' (4:00) 61.2-61.6' (1:00) 100% Recovery R2:Core Times (min:sec) 61.6-62.6' (3:45) 62.6-63.6' (4:18) 63.6-64.6' (5:00) 64.6-65.0' (4:30) 93% Recovery R3:Core Times (min:sec) 65.0-66.0' (5:30) 66.0-67.0' (3:18) 67.0-68.0' (3:00) 68.0-69.0' (3:30) 100% Recovery		
70							41.40		Bottom of Exploration at 69.00 feet below ground surface.		
75											

Remarks:
Rock Coring Down Pressure 500 lbs.

Driller: Maine Test Boring	Elevation (ft.): 98.7	Auger ID/OD: 5" Solid Stem
Operator: Mike/Mike	Datum: NAVD88	Sampler: Standard Split Spoon
Logged By: Krusinski	Rig Type: Mobile B-53 Tracked	Hammer Wt./Fall: 140#/30"
Date Start/Finish: 5/15/2014	Drilling Method: Cased Wash Boring	Core Barrel: NQ-2"
Boring Location: 29+30.4, 59.6 ft Lt.	Casing ID/OD: NW	Water Level*: 2.6 ft @ 07:30 AM

Definitions: D = Split Spoon Sample MD = Unsuccessful Split Spoon Sample attempt U = Thin Wall Tube Sample R = Rock Core Sample V = Insitu Vane Shear Test SSA = Solid Stem Auger	Definitions: S_u = Insitu Field Vane Shear Strength (psf) T_v = Pocket Torvane Shear Strength (psf) q_p = Unconfined Compressive Strength (ksf) $S_u(\text{lab})$ = Lab Vane Shear Strength (psf) WOH = weight of 140lb. hammer WOR = weight of rods WOC = weight of casing	Definitions: WC = water content, percent LL = Liquid Limit PL = Plastic Limit PI = Plasticity Index G = Grain Size Analysis C = Consolidation Test
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Depth (ft.)	Sample Information								Elevation (ft.)	Graphic Log	Visual Description and Remarks	Laboratory Testing Results/AASHTO and Unified Class.
	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (6 in.) Shear Strength (psf) or RQD (%)	N-value	Casing Blows						
0						SSA		96.70		Brown, moist, fine to coarse SAND, some gravel, occasional cobbles, (Fill).		
								96.00		Organic SILT layer.		
	MV		3.00 - 3.02	Would Not Push		aHP				Failed 55x110 mm vane attempt. aHP = Hydraulic Push		
5	1D/MV	24/13	5.00 - 7.00	3/10/10/14	20					Grey, wet, very stiff, Silty CLAY, trace fine sand. Failed 16x32 mm vane attempt, would not push.		
	2D/MV	24/12	8.00 - 10.00	9/9/12/12	21					Similar to above. Failed 16x32 mm vane attempt, would not push.		
10	3D/MV	24/14	10.00 - 12.00	5/4/4/3	8			88.20		Failed 16x32 mm vane attempt, would not push.		
	4D/A	18/18	12.00 - 13.50	WOH/WOH/50						Dark grey, wet, medium stiff, CLAY, some silt, little gravel, trace sand.	G#262825 A-4, ML WC=36.0% LL=33 PL=24 PI=9	
	V1		12.63 - 13.00	$S_u=536/89$ psf						4D (12.0-13.3 ft bgs) Similar to above. 55x110 mm vane raw torque readings: V1: 12/2 ft-lbs		
	MV			Would Not Push		NQ-2		85.40		Failed 55x110 mm vane attempt.		
15	5D	24/14	15.00 - 17.00	28/15/13/13	28	OPEN HOLE				4D/A (13.3-13.5 ft bgs) Grey, wet, clayey SILT, some fine sand, trace gravel. Cored COBBLE from 13.6-14.0 ft bgs. Cobble and Till from 13.6-14.6 ft bgs. Grey, wet, medium dense, fine to coarse SAND, some silt, little gravel, (Till). Roller Coned ahead to 20.0 ft bgs.		
20	6D		20.00 - 22.00	10/14/15/21	29					No description given.		
25								76.70		Bottom of Exploration at 22.00 feet below ground surface. NO REFUSAL		

Remarks:
 Emergency Boring for Slope Failure.
 Hydraulic pressure 250 ft-lbs to 5.0 ft bgs, 400-700 ft-lbs from 5.0-10.0 ft bgs.

Maine Department of Transportation Soil/Rock Exploration Log US CUSTOMARY UNITS	Project: Second Otter Bridge #2754 carries County Road over Otter Stream Location: Milford, Maine	Boring No.: BB-MOS-202 PIN: 16667.00
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Driller: Maine Test Boring	Elevation (ft.): 90.2	Auger ID/OD: N/A
Operator: Mike/Mike	Datum: NAVD88	Sampler: Standard Split Spoon
Logged By: Schonewald, Wilder	Rig Type: CME 45C	Hammer Wt./Fall: 140#/30"
Date Start/Finish: 5/15/2014-5/16/2014	Drilling Method: Cased Wash Boring	Core Barrel: NQ-2"
Boring Location:	Casing ID/OD: NW	Water Level*: Water Boring

Definitions: D = Split Spoon Sample MD = Unsuccessful Split Spoon Sample attempt U = Thin Wall Tube Sample R = Rock Core Sample V = Insitu Vane Shear Test SSA = Solid Stem Auger	Definitions: S_u = Insitu Field Vane Shear Strength (psf) T_v = Pocket Torvane Shear Strength (psf) q_p = Unconfined Compressive Strength (ksf) $S_{u(lab)}$ = Lab Vane Shear Strength (psf) WOH = weight of 140lb. hammer WOR = weight of rods WOC = weight of casing	Definitions: WC = water content, percent LL = Liquid Limit PL = Plastic Limit PI = Plasticity Index G = Grain Size Analysis C = Consolidation Test
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Depth (ft.)	Sample Information										Visual Description and Remarks	Laboratory Testing Results/AASHTO and Unified Class.
	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (6 in.) Shear Strength (psf) or RQD (%)	N-value	Casing Blows	Elevation (ft.)	Graphic Log				
0						2					1. See Remarks.	
						3					2. See Remarks.	
	V1		2.63 - 3.00	$S_u=179/67$ psf		DROP RODS					55x110 mm van raw torque readings: V1: 4.0/1.5 ft-lbs V2: 4.0/1.5 ft-lbs	
	V2		3.63 - 4.00	$S_u=179/67$ psf								
5												
10												
	V3		12.63 - 13.00	$S_u=179/67$ psf							55x110 mm van raw torque readings: V3: 4.0/1.5 ft-lbs V4: 6.0/2.0 ft-lbs	
	V4		13.63 - 14.00	$S_u=268/89$ psf								
15								75.80				14.40
	1D	24/4	15.00 - 17.00	45/34/34/40	68	WOC					Grey, wet, very dense, silty, fine to coarse SAND, some gravel, occasional cobbles, (Till). Roller Coned ahead to 20.0 ft bgs.	
						3						
						27						
						46						
						69						
20												
	2D	18/4	20.00 - 21.50	13/14/85-ROCK?	---						Similar to above.	
								68.70				21.50
											Bottom of Exploration at 21.50 feet below ground surface.	
25												

Remarks:

Emergency Boring for Slope Failure.

1. First location unable to penetrate Riprap below 4.0 ft bgs, relocated boring.
2. Rods slipped and sank to 10.5 ft bgs, casing to 9.0 ft bgs, clean out to 12.5 ft bgs.

Maine Department of Transportation Soil/Rock Exploration Log US CUSTOMARY UNITS	Project: Second Otter Bridge #2754 carries County Road over Otter Stream Location: Milford, Maine	Boring No.: BB-MOS-202A PIN: 16667.00
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Driller: Maine Test Boring	Elevation (ft.): 90.5	Auger ID/OD: N/A
Operator: Mike/Mike	Datum: NAVD88	Sampler: Standard Split Spoon
Logged By: Krusinski	Rig Type: CME 45C	Hammer Wt./Fall: 140#/30"
Date Start/Finish: 5/16/2014	Drilling Method: Cased Wash Boring	Core Barrel: NQ-2"
Boring Location: 29+79.6, 63.0 ft Lt.	Casing ID/OD: NW	Water Level*: Water Boring

Definitions: D = Split Spoon Sample MD = Unsuccessful Split Spoon Sample attempt U = Thin Wall Tube Sample R = Rock Core Sample V = Insitu Vane Shear Test SSA = Solid Stem Auger	Definitions: S_u = Insitu Field Vane Shear Strength (psf) T_v = Pocket Torvane Shear Strength (psf) q_p = Unconfined Compressive Strength (ksf) $S_u(\text{lab})$ = Lab Vane Shear Strength (psf) WOH = weight of 140lb. hammer WOR = weight of rods WOC = weight of casing	Definitions: WC = water content, percent LL = Liquid Limit PL = Plastic Limit PI = Plasticity Index G = Grain Size Analysis C = Consolidation Test
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Depth (ft.)	Sample Information										Visual Description and Remarks	Laboratory Testing Results/AASHTO and Unified Class.	
	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (6 in.) Shear Strength (psf) or RQD (%)	N-value	Casing Blows	Elevation (ft.)	Graphic Log					
0													
5	ID	24/24	4.50 - 6.50	WOR/WOR/WOR/WOR	---	aWOM							
	V1		5.13 - 5.50	$S_u=223/45$ psf		HOLE							
	V2		6.13 - 6.50	$S_u=223/54$ psf									
	V3		8.63 - 9.00	$S_u=179/67$ psf									
	V4		9.63 - 10.00	$S_u=156/71$ psf									
10													
	V5		12.13 - 12.50	$S_u=246/54$ psf									
	V6		13.13 - 13.50	$S_u=223/45$ psf	30								
	2D		13.90 - 15.90	$7/15/45/22$				76.80				13.70	
15													
25													

Remarks:
Emergency Boring for Slope Failure.

Driller: Maine Test Boring	Elevation (ft.): 87.9	Auger ID/OD: N/A
Operator: Mike/Mike	Datum: NAVD88	Sampler: Standard Split Spoon
Logged By: Krusinski/Wilder	Rig Type: CME 45C	Hammer Wt./Fall: 140#/30"
Date Start/Finish: 5/16/2014; 11:45-13:30	Drilling Method: Cased Wash Boring	Core Barrel: N/A
Boring Location: 30+08.5, 59.6 ft Lt.	Casing ID/OD: NW	Water Level*: River Boring

Definitions: D = Split Spoon Sample MD = Unsuccessful Split Spoon Sample attempt U = Thin Wall Tube Sample R = Rock Core Sample V = Insitu Vane Shear Test SSA = Solid Stem Auger	Definitions: S_u = Insitu Field Vane Shear Strength (psf) T_v = Pocket Torvane Shear Strength (psf) q_p = Unconfined Compressive Strength (ksf) $S_u(\text{lab})$ = Lab Vane Shear Strength (psf) WOH = weight of 140lb. hammer WOR = weight of rods WOC = weight of casing	Definitions: WC = water content, percent LL = Liquid Limit PL = Plastic Limit PI = Plasticity Index G = Grain Size Analysis C = Consolidation Test
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Depth (ft.)	Sample Information									Visual Description and Remarks	Laboratory Testing Results/AASHTO and Unified Class.
	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (6 in.) Shear Strength (psf) or RQD (%)	N-value	Casing Blows	Elevation (ft.)	Graphic Log			
0						WOC				aHP = Hydraulic Puch Light grey, moist, very soft, Silty CLAY, trace fine sand, changing to dark grey, moist, very soft, Silty CLAY; sand and gravel in top of spoon.	G#262808 A-6, CL WC=46.1% LL=37 PL=24 PI=13
						WOC					
						aHP					
	1D	24/24	3.00 - 5.00	WOR/WOR/WOR/WOR	---	OPEN HOLE					
5										55x110 mm vane raw torque readings: V1: 2.0/1.0 ft-lbs V2: 2.5/1.2 ft-lbs. Washed ahead to 9.0 ft bgs.	
	V1		6.13 - 6.50	$S_u=89/45$ psf							
	V2		7.13 - 7.50	$S_u=112/54$ psf							
										55x110 mm vane raw torque readings: V3: 3.2/1.1 ft-lbs V4: 3.0/0.7 ft-lbs	
10											
	V3		9.63 - 10.00	$S_u=143/49$ psf							
	V4		10.63 - 11.00	$S_u=134/31$ psf							
										Something stiff at 13.0 ft bgs. 55x110 mm vane raw torque readings: V5: 5.0/2.7 ft-lbs	
	V5		13.13 - 13.50	$S_u=223/121$ psf							
15	2D/MV	24/15	14.20 - 16.20	11/19/27/31	46		73.70			Failed vane attempt, could not push. Grey, damp, dense, fine to medium SAND, trace silt, trace of rounded gravel, (Till).	
							71.70			Bottom of Exploration at 16.20 feet below ground surface.	
20											
25											

Remarks:
 Emergency Boring for Slope Failure.
 11.4 ft from Raft Deck to Ground.

Driller: MaineDOT	Elevation (ft.): 112.9	Auger ID/OD: 5" Solid Stem
Operator: Giles/Daggett/Giles	Datum: NAVD88	Sampler: Standard Split Spoon
Logged By: B.Wilder/L. Krusinski	Rig Type: CME 45C	Hammer Wt./Fall: 140#/30"
Date Start/Finish: 6/6/14-6/9/14	Drilling Method: Cased Wash Boring	Core Barrel: NQ-2"
Boring Location: 29+69, 7.5 ft Lt.	Casing ID/OD: HW	Water Level*: None Observed

Hammer Efficiency Factor: 0.867 **Hammer Type:** Automatic Hydraulic Rope & Cathead

Definitions: R = Rock Core Sample S_u = Insitu Field Vane Shear Strength (psf) $S_{u(lab)}$ = Lab Vane Shear Strength (psf)
 D = Split Spoon Sample SSA = Solid Stem Auger T_v = Pocket Torvane Shear Strength (psf) WC = water content, percent
 MD = Unsuccessful Split Spoon Sample attempt HSA = Hollow Stem Auger q_p = Unconfined Compressive Strength (ksf) LL = Liquid Limit
 U = Thin Wall Tube Sample RC = Roller Cone N-uncorrected = Raw field SPT N-value PL = Plastic Limit
 MU = Unsuccessful Thin Wall Tube Sample attempt WOH = weight of 140lb. hammer Hammer Efficiency Factor = Annual Calibration Value PI = Plasticity Index
 V = Insitu Vane Shear Test, PP = Pocket Penetrometer WOR/C = weight of rods or casing N_{60} = SPT N-uncorrected corrected for hammer efficiency G = Grain Size Analysis
 MV = Unsuccessful Insitu Vane Shear Test attempt WO1P = Weight of one person N_{60} = (Hammer Efficiency Factor/60%)*N-uncorrected C = Consolidation Test

Depth (ft.)	Sample Information								Elevation (ft.)	Graphic Log	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.
	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-uncorrected	N_{60}	Casing Blows					
25	MV		25.50 - 25.50	Would not Push			48		78.30	Failed 55x110 mm vane attempt.		
							68					
							74					
	MU	24/0	28.50 - 30.50	Piston Sample			64				Failed Tube attempt, let set 20 minutes.	
							63					
30	2U	24/24	30.50 - 32.50	Piston Sample			42				Grey, wet, soft, silty CLAY with wood fragments, trace fine sand. (Wood fragments in top of tube).	
							53					
	V1		32.50 - 32.87	$S_u=357/179$ psf			58				55x110 mm vane raw torque readings: V1: 8.0/4.0 ft-lbs	
	MV		33.50 - 33.50	Would not Push			59				Failed 55x110 mm vane attempt.	
							173					
35	5D	24/11	35.00 - 37.00	61/8/9/11	17	25	32			Grey, moist, medium dense, silty, fine to coarse SAND, little gravel, (Glacial Till). Roller Coned ahead to 40.0 ft bgs.	G#245372 A-4, SM WC=10.1%	
							70					
							93					
							97					
							133					
40	6D	24/10	40.00 - 42.00	17/17/9/7	26	38	58			Grey, moist, dense, sandy SILT, little gravel, (Glacial Till). Roller Coned ahead to 45.0 ft bgs.	G#245373 A-4, SM WC=10.0%	
							65					
							81					
							82					
							97					
45	7D	24/5	45.00 - 47.00	4/10/6/9	16	23	61			Grey, moist, medium dense, silty SAND, some gravel, (Glacial Till). Roller Coned ahead to 50.0 ft bgs.	G#245374 A-4, SM WC=8.7%	
							58					
							58					
							91					
50							125					

Remarks:
 400# down pressure on Core Barrel.
 Installed Inclinator with inside base of inclinometer casing at 54.2' bgs.

Maine Department of Transportation Soil/Rock Exploration Log US CUSTOMARY UNITS				Project: Second Otter Bridge #2754 carries County Road over Otter Stream Location: Milford, Maine				Boring No.: BB-MOS-401 WIN: 16667.00							
Driller: Maine Test Boring, Inc.				Elevation (ft.): 98.58				Auger ID/OD: 5" Solid Stem							
Operator: Enos/Dube				Datum: NAVD88				Sampler: Standard Split Spoon							
Logged By: Be Schonewald				Rig Type: Mobile Drill B-53				Hammer Wt./Fall: 140#/30"							
Date Start/Finish: 8/13/2014; 08:00-14:00				Drilling Method: Cased Wash Boring				Core Barrel: N/A							
Boring Location: 29+72.9, 47.6 ft Rt.				Casing ID/OD: HW to 7.0 ft bgs.				Water Level*: None Observed							
Hammer Efficiency Factor: 0.60				Hammer Type: Automatic <input type="checkbox"/> Hydraulic <input type="checkbox"/> Rope & Cathead <input checked="" type="checkbox"/>											
Definitions: D = Split Spoon Sample MD = Unsuccessful Split Spoon Sample Attempt U = Thin Wall Tube Sample MU = Unsuccessful Thin Wall Tube Sample Attempt V = Field Vane Shear Test, PP = Pocket Penetrometer MV = Unsuccessful Field Vane Shear Test Attempt				R = Rock Core Sample SSA = Solid Stem Auger HSA = Hollow Stem Auger RC = Roller Cone WOH = Weight of 140lb. Hammer WOR/C = Weight of Rods or Casing WO1P = Weight of One Person				S _u = Peak/Remolded Field Vane Undrained Shear Strength (psf) S _{u(lab)} = Lab Vane Undrained Shear Strength (psf) q _p = Unconfined Compressive Strength (ksf) N-uncorrected = Raw Field SPT N-value Hammer Efficiency Factor = Rig Specific Annual Calibration Value N ₆₀ = SPT N-uncorrected Corrected for Hammer Efficiency N ₆₀ = (Hammer Efficiency Factor/60%)*N-uncorrected				T _v = Pocket Torvane Shear Strength (psf) WC = Water Content, percent LL = Liquid Limit PL = Plastic Limit PI = Plasticity Index G = Grain Size Analysis C = Consolidation Test			
Depth (ft.)	Sample Information								Elevation (ft.)	Graphic Log	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.			
	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (6 in. Shear Strength (psf) or RQD (%))	N-uncorrected	N ₆₀	Casing Blows								
0															
	1D	24/10	1.50 - 3.50	WOH/1/2/6	3	3	SSA HYD PUSH			Wood at 1.0 ft bgs. Dark greyish brown, wet, soft, fine sandy SILT with wood, roots and grass, (Recent Alluvium).					
5								94.08							
	2D/MV	24/13	5.00 - 7.00	2/3/4/5	7	7	WASH AHEAD			Failed 55x110 mm vane attempt, could not push. Dark grey, damp, medium stiff, SILT to Clayey SILT, with slight plasticity (ML).					
	MD/MV	24/0	8.00 - 10.00	4/7/8/10	15	15				Failed 55x110 mm vane attempt, could not push. (Resample) Dark grey, stiff, Clayey SILT with 2 pieces rounded gravel. Drilling behavior suggests gravel pieces are drop stones in silt-clay.					
10															
	3D/MV	24/19	10.00 - 12.00	2/4/4/5	8	8				Failed 55x110 mm vane attempt, could not push. Dark grey with black pockets, moist, medium stiff, Silty CLAY, trace sand (CL).	G#242677 A-4, CL WC=24.9% LL=31 PL=22 PI=9				
	4D/MV	24/19	13.00 - 15.00	2/8/13/13	21	21				Failed 55x110 mm vane attempt, could not push. 4D (13.0-14.4 ft) Dark grey, damp, very stiff, Clayey SILT, trace fine sand, (CL).; grading at 14.4 ft bgs to Till (4D/A below).					
15								84.18		4D/A (14.4-15.0 ft) Grey, damp, gravelly fine to medium SAND, some silt, trace coarse sand, (Till).					
	5D	24/10	17.00 - 19.00	15/9/13/11	22	22				Dark grey, damp, medium dense, fine to medium SAND, some gravel, little silt, trace coarse sand, (Till).					
20								79.58		Bottom of Exploration at 19.00 feet below ground surface. NO REFUSAL					
25															

Remarks:

Stratification lines represent approximate boundaries between soil types; transitions may be gradual.

* Water level readings have been made at times and under conditions stated. Groundwater fluctuations may occur due to conditions other than those present at the time measurements were made.

Maine Department of Transportation Soil/Rock Exploration Log US CUSTOMARY UNITS	Project: Second Otter Bridge #2754 carries County Road over Otter Stream Location: Milford, Maine	Boring No.: BB-MOS-402 WIN: 16667.00
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Driller: Maine Test Boring, Inc.	Elevation (ft.): 98.51	Auger ID/OD: N/A
Operator: Enos/Dube	Datum: NAVD88	Sampler: Thin Wall Tube
Logged By: Be Schonewald	Rig Type: Mobile Drill B-53	Hammer Wt./Fall: Hydraulic Push
Date Start/Finish: 8/13/2014; 14:15-16:15	Drilling Method: Cased Wash Boring	Core Barrel: N/A
Boring Location: 29+74.8, 51.8 ft Rt.	Casing ID/OD: HW	Water Level*: None Observed

Hammer Efficiency Factor: 0.60	Hammer Type: Automatic <input type="checkbox"/> Hydraulic <input type="checkbox"/> Rope & Cathead <input checked="" type="checkbox"/>	
<small> Definitions: D = Split Spoon Sample MD = Unsuccessful Split Spoon Sample Attempt U = Thin Wall Tube Sample MU = Unsuccessful Thin Wall Tube Sample Attempt V = Field Vane Shear Test, PP = Pocket Penetrometer MV = Unsuccessful Field Vane Shear Test Attempt R = Rock Core Sample SSA = Solid Stem Auger HSA = Hollow Stem Auger RC = Roller Cone WOH = Weight of 140lb. Hammer WOR/C = Weight of Rods or Casing WO1P = Weight of One Person S_u = Peak/Remolded Field Vane Undrained Shear Strength (psf) S_{u(lab)} = Lab Vane Undrained Shear Strength (psf) q_p = Unconfined Compressive Strength (ksf) N-uncorrected = Raw Field SPT N-value Hammer Efficiency Factor = Rig Specific Annual Calibration Value N₆₀ = SPT N-uncorrected Corrected for Hammer Efficiency N₆₀ = (Hammer Efficiency Factor/60%)*N-uncorrected T_v = Pocket Torvane Shear Strength (psf) WC = Water Content, percent LL = Liquid Limit PL = Plastic Limit PI = Plasticity Index G = Grain Size Analysis C = Consolidation Test </small>		

Depth (ft.)	Sample Information										Graphic Log	Visual Description and Remarks	Laboratory Testing Results/AASHTO and Unified Class.
	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-uncorrected	N ₆₀	Casing Blows	Elevation (ft.)					
0												No material description given.	
5												8.00 Grey, Clayey-SILT, stone in top of sample; portion of sample may be viable. 16x32 mm vane raw torque readings: V1: > 26 in-lbs	
	1U V1	24/17	8.00 - 10.00 8.20 - 8.31	Su = > 4087 psf									
10												86.01 Grey, Clayey-SILT. 16x32 mm vane raw torque readings: V2: 12.5/2.5 in-lbs	
	2U V2	24/24	10.50 - 12.50 10.70 - 10.81	Su = 1965/393 psf									
15												12.50 Bottom of Exploration at 12.50 feet below ground surface. NO REFUSAL	
20													
25													

Remarks:
 Top of tube samples packed with sand; top od silt-clay marked on tube.

Maine Department of Transportation Soil/Rock Exploration Log US CUSTOMARY UNITS				Project: Second Otter Bridge #2754 carries County Road over Otter Stream Location: Milford, Maine				Boring No.: BB-MOS-501 WIN: 16667.00							
Driller: MaineDOT		Elevation (ft.): 113.3		Auger ID/OD: 5" Solid Stem		Operator: Giles/Daggett/Giles		Datum: NAVD88		Sampler: Standard Split Spoon					
Logged By: B. Wilder		Rig Type: CME 45C		Hammer Wt./Fall: 140#/30"		Date Start/Finish: 7/13/2015		Drilling Method: Cased Wash Boring		Core Barrel: N/A					
Boring Location: 31+36.2, 10.6 ft Lt.		Casing ID/OD: HW		Water Level*: None Observed		Hammer Efficiency Factor: 0.908		Hammer Type: Automatic <input checked="" type="checkbox"/> Hydraulic <input type="checkbox"/> Rope & Cathead <input type="checkbox"/>							
Definitions: D = Split Spoon Sample MD = Unsuccessful Split Spoon Sample Attempt U = Thin Wall Tube Sample MU = Unsuccessful Thin Wall Tube Sample Attempt V = Field Vane Shear Test, PP = Pocket Penetrometer MV = Unsuccessful Field Vane Shear Test Attempt				R = Rock Core Sample SSA = Solid Stem Auger HSA = Hollow Stem Auger RC = Roller Cone WOH = Weight of 140lb. Hammer WOR/C = Weight of Rods or Casing WO1P = Weight of One Person				S _u = Peak/Remolded Field Vane Undrained Shear Strength (psf) S _{u(lab)} = Lab Vane Undrained Shear Strength (psf) q _p = Unconfined Compressive Strength (ksf) N-uncorrected = Raw Field SPT N-value Hammer Efficiency Factor = Rig Specific Annual Calibration Value N ₆₀ = SPT N-uncorrected Corrected for Hammer Efficiency N ₆₀ = (Hammer Efficiency Factor/60%)*N-uncorrected				T _v = Pocket Torvane Shear Strength (psf) WC = Water Content, percent LL = Liquid Limit PL = Plastic Limit PI = Plasticity Index G = Grain Size Analysis C = Consolidation Test			
Depth (ft.)	Sample Information								Elevation (ft.)	Graphic Log	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.			
	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-uncorrected	N ₆₀	Casing Blows								
0								SSA	112.97	4" Pavement					
									111.90	13" Concrete Approach Slab.	-0.33 -1.40				
	1D	24/14	3.00 - 5.00	3/4/5/5	9	14				Brown, dry, medium dense, fine to coarse SAND, some gravel, trace silt, (Fill).		G#263881 A-1-b, SW-SM WC=3.5%			
5	2D	24/12	5.00 - 7.00	6/8/8/8	16	24	32			Brown, damp, medium dense, fine to coarse SAND, little silt, little gravel, (Fill).		G#263882 A-1-b, SM WC=8.2%			
							58								
							55								
							55								
10	3D	24/6	10.00 - 12.00	6/7/9/11	16	24	42			Brown, wet, medium dense, fine to coarse SANDY GRAVEL, trace silt, (Fill).		G#263883 A-1-a, SW-SM WC=8.9%			
							143								
	4D	24/15	12.00 - 14.00	16/16/12/7	28	42	82			Brown, wet, dense, fine to coarse SAND, some gravel, little silt, (Fill).		G#263884 A-1-b, SW-SM WC=9.2%			
							78								
							107		99.30						
15	5D	15.6/12	15.00 - 16.30	3/4/60(3.6")	---		55			Brown, wet, dense, fine to coarse SAND, some gravel, trace silt, (Old fill extension.)		G#263885 A-1-b, SW-SM WC=13.7%			
							137			Roller Coned ahead through Cobble from 16.3-17.2 ft bgs.					
	6D	24/4	17.50 - 19.50	12/8/5/4	13	20	131			Similar to above, medium dense.					
							85		94.80						
							87			(6D) Grey, wet, medium dense, fine to coarse SAND, little gravel, trace silt.					
20	7D	24/4	20.00 - 22.00	2/2/3/3	5	8	68		93.30	Dark brown, soft, Organic PEAT.		#263886 Ignition Loss 14.6% H2O 90.6%			
							89								
	8D/MU	24/14	22.50 - 24.50	Hydraulic Push	---		95		91.30	Grey, wet, soft, Clayey SILT, trace fine sand, trace gravel, (Glaciomarine). Failed Tube attempt.		G#263887 A-4, ML WC=30.8% LL=27 PI=23 PI=4			
							77								
25	1U	24/18	24.50 - 26.50	Hydraulic Push	---		86			Grey, wet, soft, Clayey SILT, trace fine sand.					

Remarks:

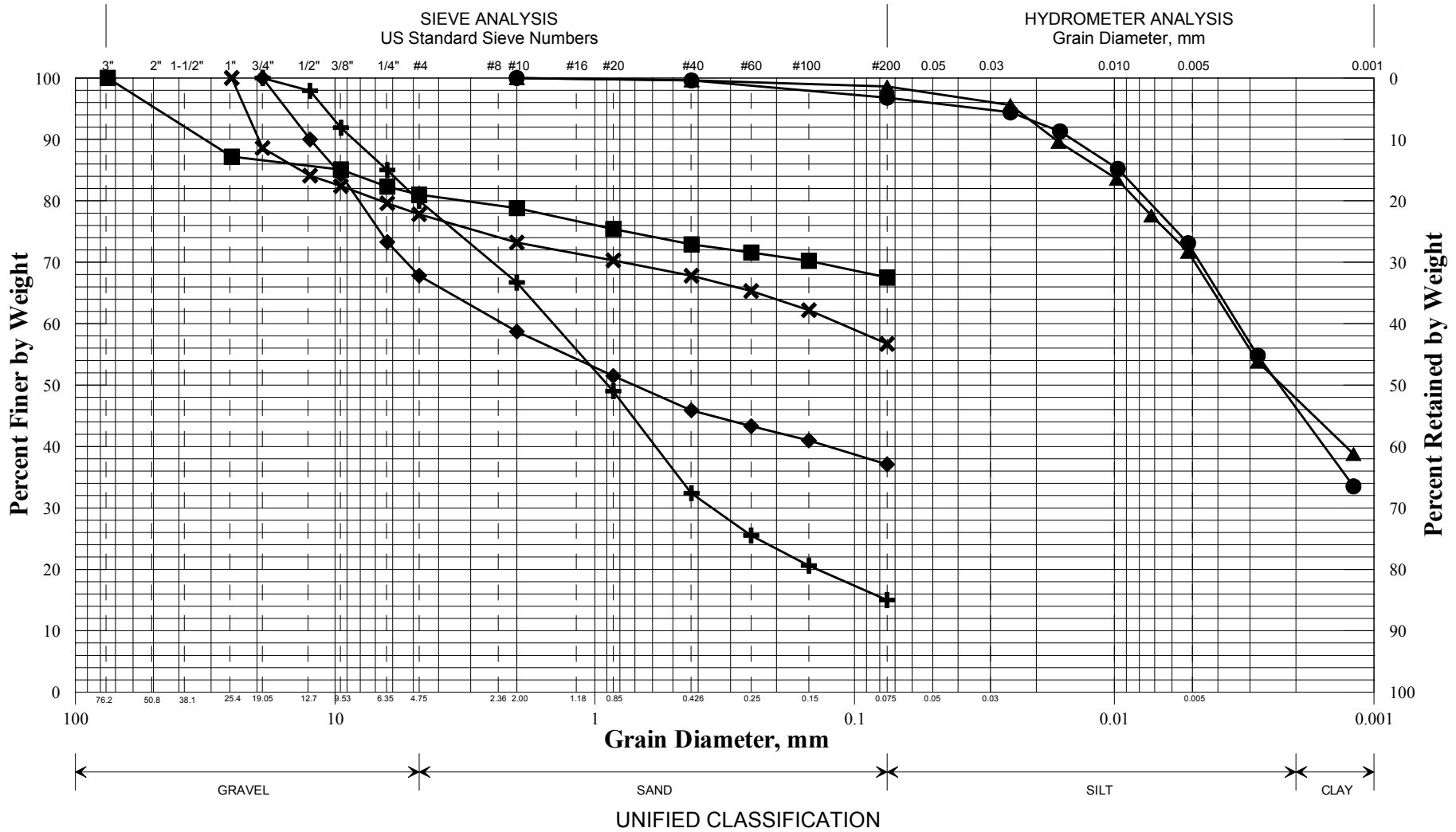
Stratification lines represent approximate boundaries between soil types; transitions may be gradual.

* Water level readings have been made at times and under conditions stated. Groundwater fluctuations may occur due to conditions other than those present at the time measurements were made.

Appendix B

Laboratory Test Results

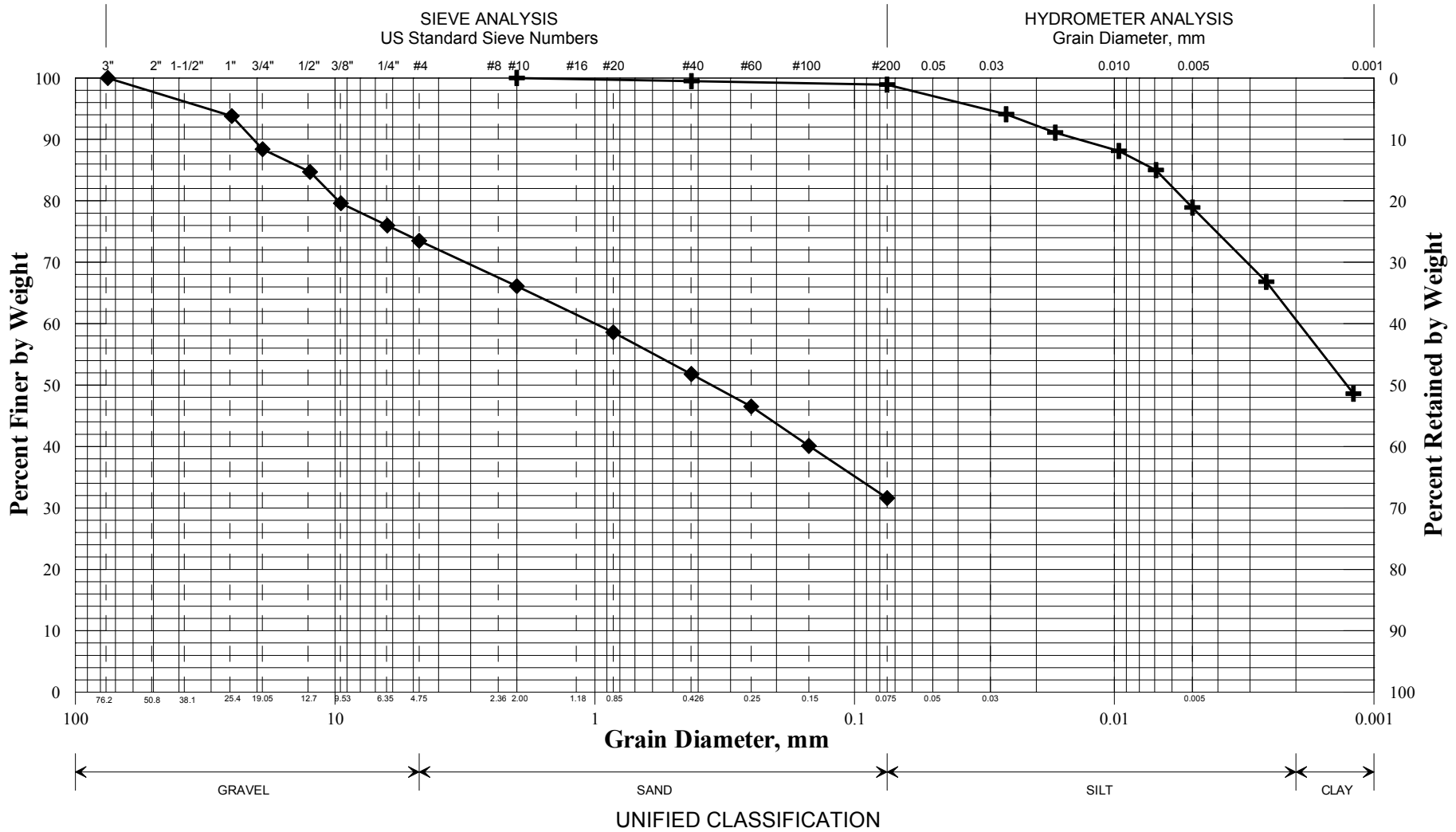
State of Maine Department of Transportation
GRAIN SIZE DISTRIBUTION CURVE



	Boring/Sample No.	Station	Offset, ft	Depth, ft	Description	W, %	LL	PL	PI
+	BB-MOS-101/1D	29+23.2	4.1 LT	1.0-3.0	SAND, little gravel, little silt.	3.8			
◆	BB-MOS-101/2D	29+23.2	4.1 LT	5.0-7.0	SILT, some gravel, some sand.	9.2			
■	BB-MOS-101/3D	29+23.2	4.1 LT	10.0-12.0	SILT, little gravel, little sand.	19.7			
●	BB-MOS-101/5D	29+23.2	4.1 LT	20.0-22.0	Silty CLAY, trace sand.	28.9	32	22	10
▲	BB-MOS-101/6D	29+23.2	4.1 LT	25.0-27.0	Silty CLAY, trace sand.	38.8	35	23	12
×	BB-MOS-101/8D	29+23.2	4.1 LT	35.0-37.0	SILT, some gravel, some sand.	12.0			

WIN
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Milford
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WHITE, TERRY A 11/9/2010

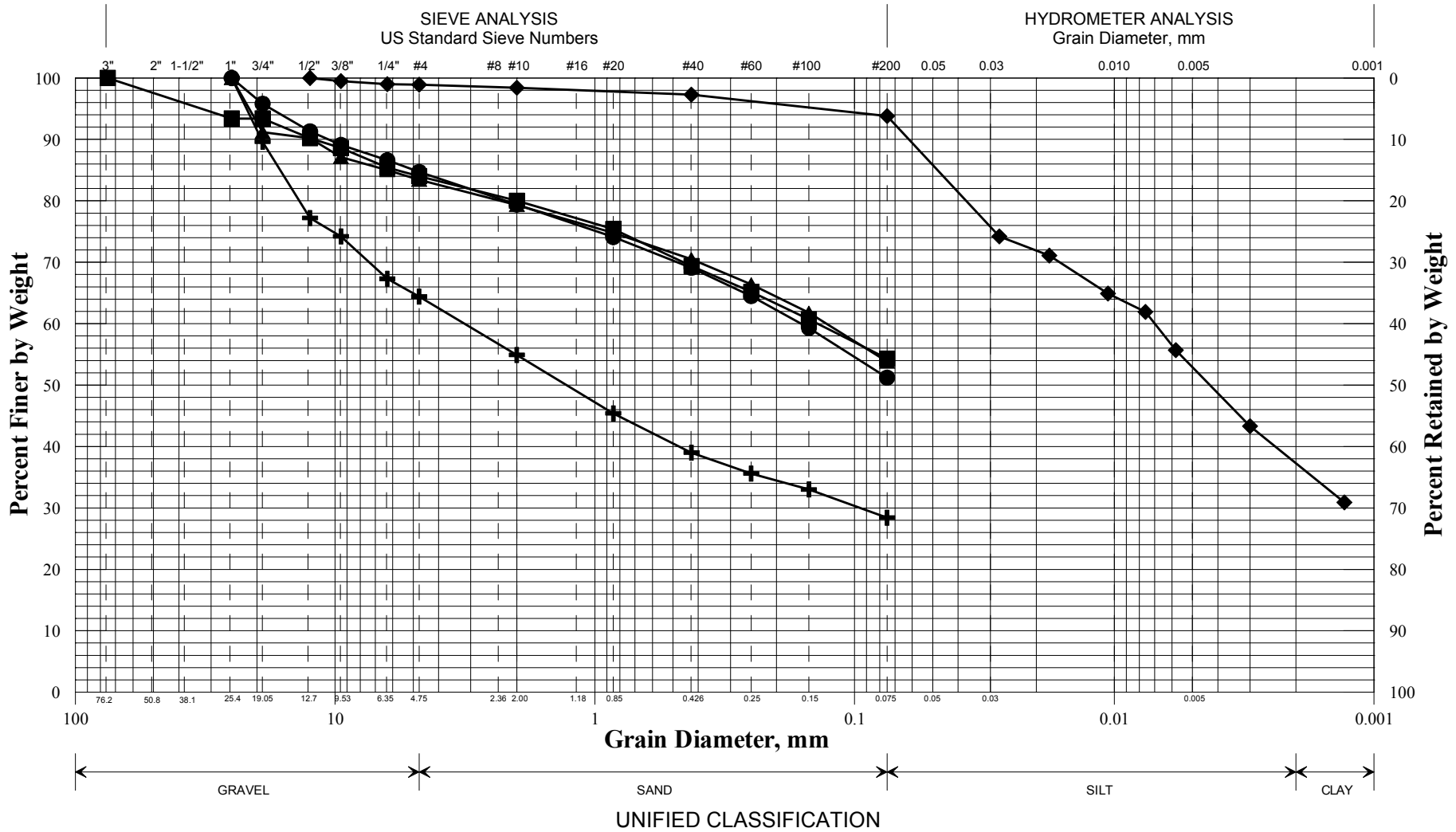
**State of Maine Department of Transportation
GRAIN SIZE DISTRIBUTION CURVE**



	Boring/Sample No.	Station	Offset, ft	Depth, ft	Description	W, %	LL	PL	PI
+	BB-MOS-102/2D	30+59.3	4.7 LT	5.0-7.0	Silty CLAY, trace sand.	51.2	32	23	9
◆	BB-MOS-102/4D	30+59.3	4.7 LT	20.6-22.6	SAND, some silt, some gravel.	8.7			
■									
●									
▲									
×									

WIN	
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WHITE, TERRY A	11/9/2010

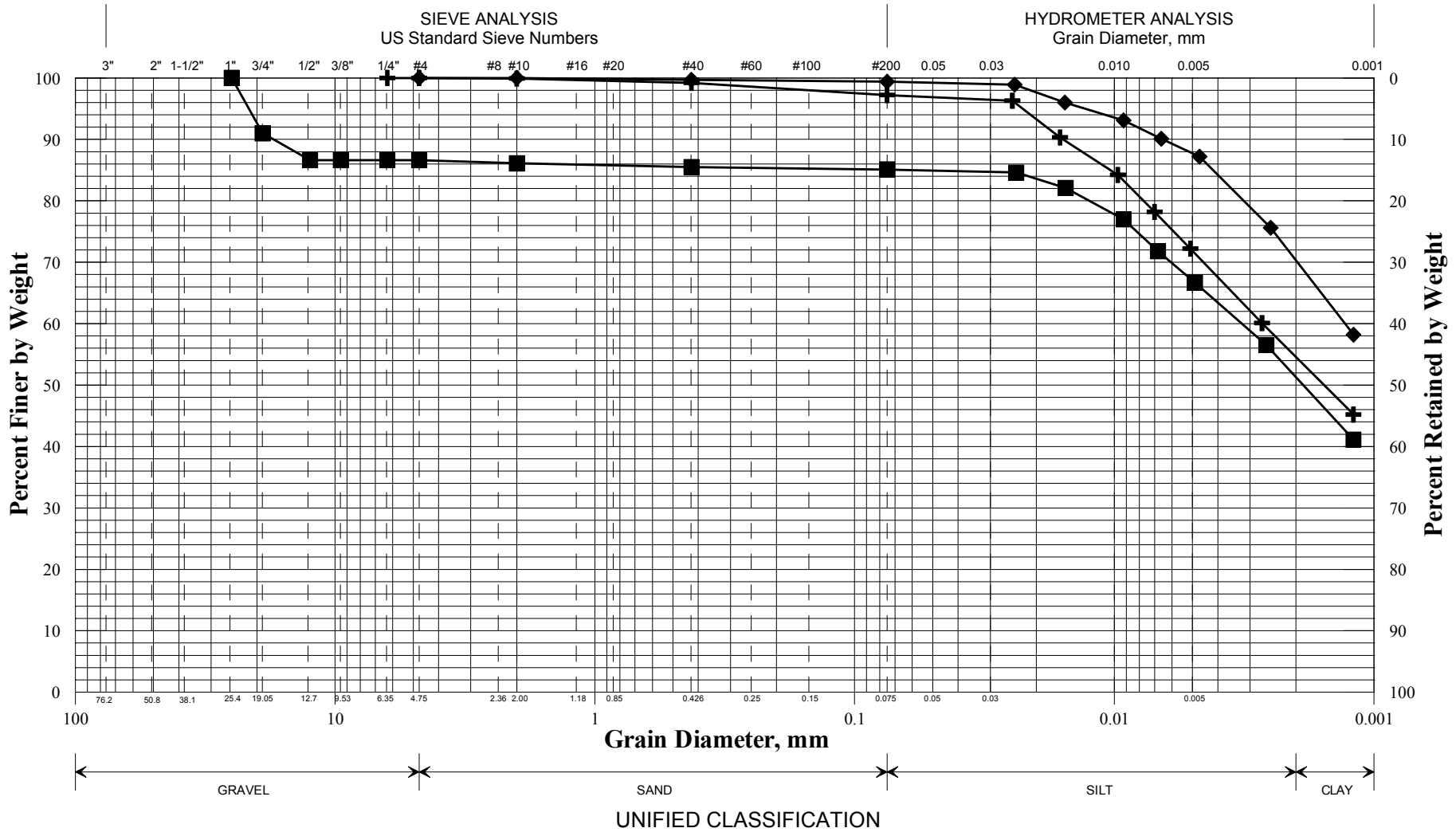
State of Maine Department of Transportation
GRAIN SIZE DISTRIBUTION CURVE



	Boring/Sample No.	Station	Offset, ft	Depth, ft	Description	W, %	LL	PL	PI
+	BB-MOS-103/1D	31+71.9	7.1 RT	1.0-3.0	SAND, some gravel, some silt.	7.3			
◆	BB-MOS-103/2DA	31+71.9	7.1 RT	5.0-6.5	Clayey SILT, trace sand, trace gravel.	23.1	33	20	13
■	BB-MOS-103/4D	31+71.9	7.1 RT	16.5-18.5	SILT, some sand, little gravel.	10.8			
●	BB-MOS-103/7D	31+71.9	7.1 RT	30.0-32.0	SILT, some sand, little gravel.	11.0			
▲	BB-MOS-103/10D	31+71.9	7.1 RT	45.0-47.0	SILT, some sand, little gravel.	9.7			
×									

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WHITE, TERRY A	11/9/2010

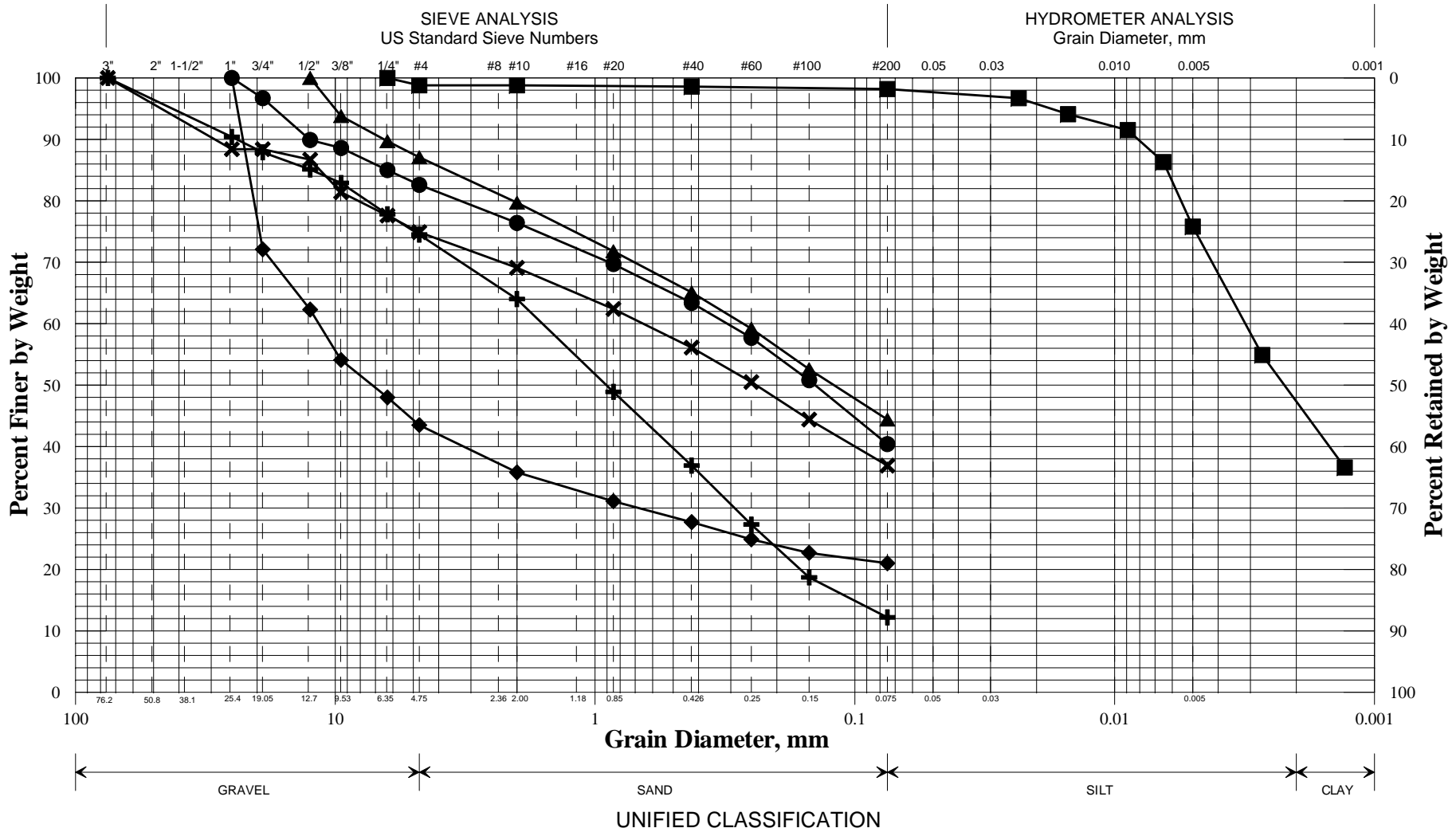
State of Maine Department of Transportation
GRAIN SIZE DISTRIBUTION CURVE



	Boring/Sample No.	Station	Offset, ft	Depth, ft	Description	W, %	LL	PL	PI
+	BB-MOS-203/1D	30+08.5	59.6 LT	3.0-5.5	Silty CLAY, trace sand.	46.1	37	24	13
◆	BB-MOS-202A/1D	29+79.6	63.0 LT	4.5-6.5	CLAY, some silt, trace sand.	33.3	34	25	9
■	BB-MOS-201/3D	29+30.4	59.6 LT	10.0-12.0	CLAY, some silt, little gravel, trace sand.	36.0	33	24	9
●									
▲									
×									

WIN
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Town
Milford
Reported by/Date
WHITE, TERRY A 5/29/2014

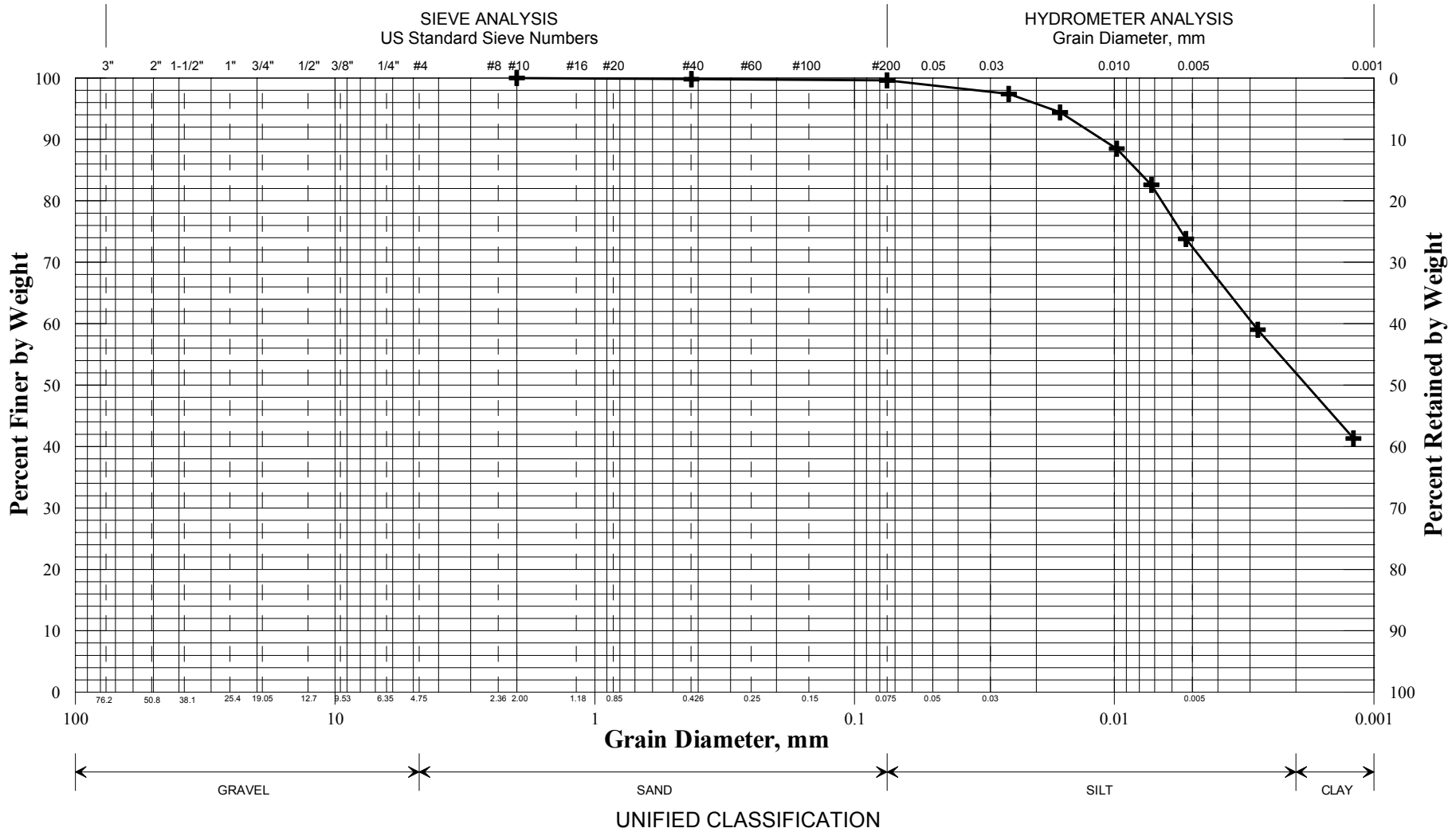
State of Maine Department of Transportation
GRAIN SIZE DISTRIBUTION CURVE



	Boring/Sample No.	Station	Offset, ft	Depth, ft	Description	W, %	LL	PL	PI
+	BB-MOS-301/2D	29+69	7.5 LT	5.0-7.0	SAND, some gravel, little silt.	4.4			
◆	BB-MOS-301/3D	29+69	7.5 LT	18.0-20.0	GRAVEL, some sand, some silt.	26.2			
■	BB-MOS-301/4D	29+69	7.5 LT	20.0-22.0	Clayey SILT, trace gravel, trace sand.	26.7	29	23	6
●	BB-MOS-301/5D	29+69	7.5 LT	35.0-37.0	Silty SAND, little gravel.	10.1			
▲	BB-MOS-301/6D	29+69	7.5 LT	40.0-42.0	Sandy SILT, little gravel.	10.0			
×	BB-MOS-301/7D	29+69	7.5 LT	45.0-47.0	Silty SAND, some gravel.	8.7			

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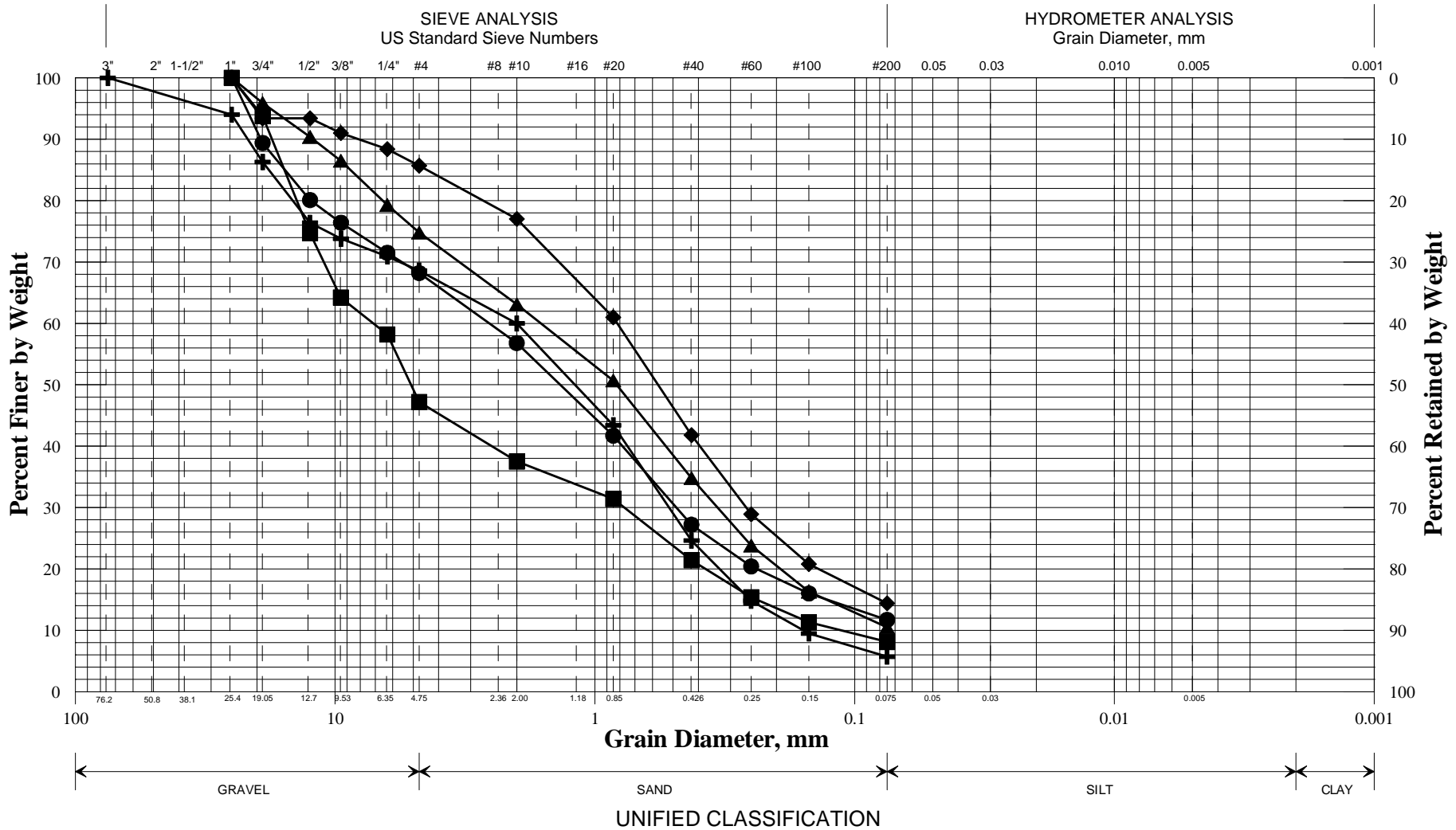
State of Maine Department of Transportation
GRAIN SIZE DISTRIBUTION CURVE



	Boring/Sample No.	Station	Offset, ft	Depth, ft	Description	W, %	LL	PL	PI
+	BB-MOS-401/3D	29+72.9	47.6 RT	10.0-12.0	Silty CLAY, trace sand.	24.9	31	22	9
◆									
■									
●									
▲									
×									

WIN	
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WHITE, TERRY A	8/20/2014

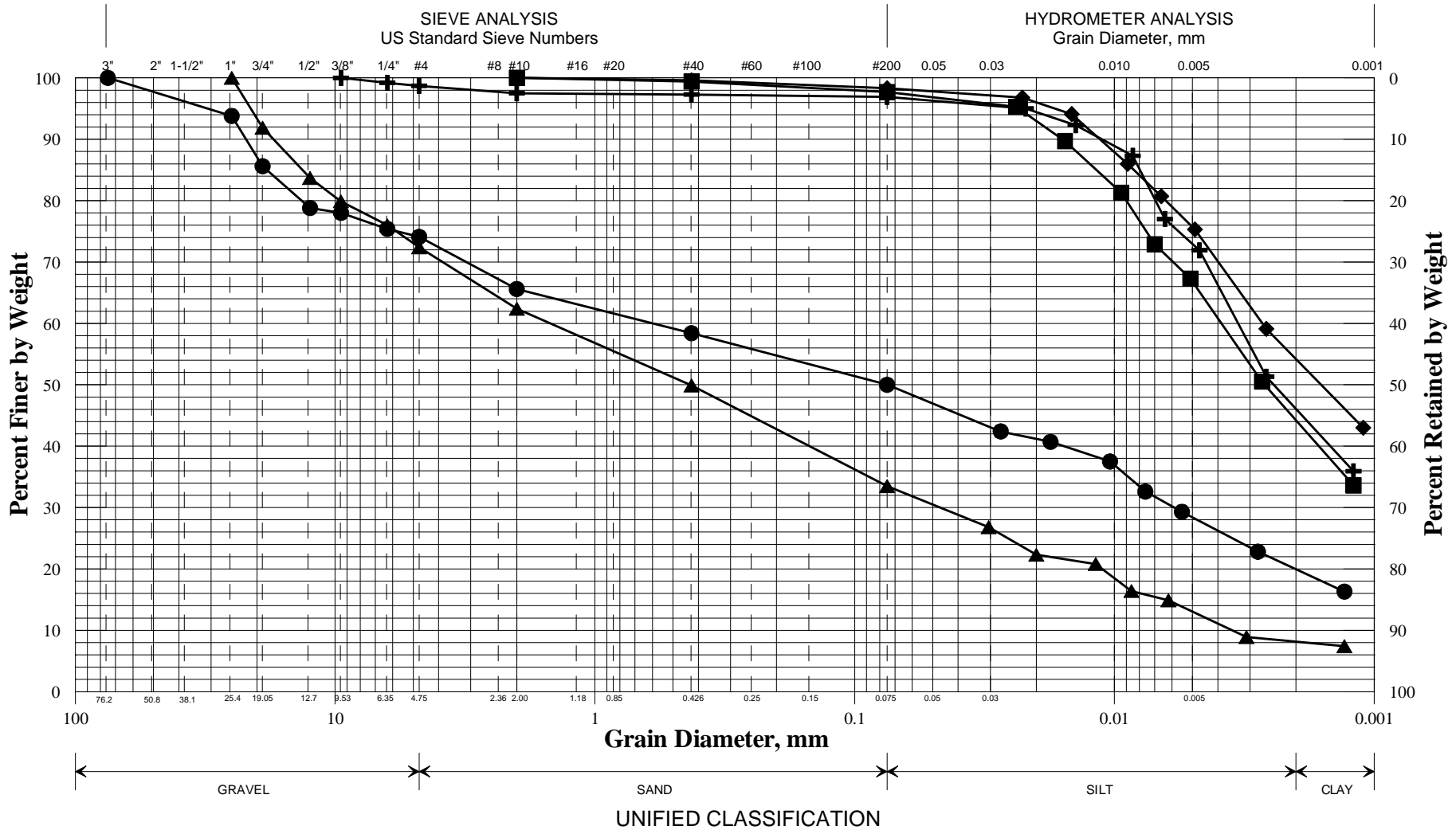
State of Maine Department of Transportation
GRAIN SIZE DISTRIBUTION CURVE



	Boring/Sample No.	Station	Offset, ft	Depth, ft	Description	W, %	LL	PL	PI
+	BB-MOS-501/1D	31+36.2	10.6 LT	3.0-5.0	SAND, some gravel, trace silt.	3.5			
◆	BB-MOS-501/2D	31+36.2	10.6	5.0-7.0	SAND, little silt, little gravel.	8.2			
■	BB-MOS-501/3D	31+36.2	10.6	10.0-12.0	Sandy GRAVEL, trace silt.	8.9			
●	BB-MOS-501/4D	31+36.2	10.6 LT	12.0-14.0	SAND, some gravel, little silt.	9.2			
▲	BB-MOS-501/5D	31+36.2	10.6 LT	15.0-16.3	SAND, some gravel, trace silt.	13.7			
×									

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WHITE, TERRY A	8/10/2015

State of Maine Department of Transportation
GRAIN SIZE DISTRIBUTION CURVE



	Boring/Sample No.	Station	Offset, ft	Depth, ft	Description	W, %	LL	PL	PI
+	BB-MOS-501/8D	31+36.2	10.6 LT	22.5-24.5	Clayey SILT, trace sand, trace gravel.	30.8	27	23	4
◆	BB-MOS-501/9D	31+36.2	10.6 LT	29.0-31.0	Silty CLAY, trace sand.	39.4	37	23	14
■	BB-MOS-501/10D	31+36.2	10.6 LT	32.0-34.0	Clayey SILT, trace sand.	37.1	29	23	6
●	BB-MOS-501/12D	31+36.2	10.6 LT	40.0-42.0	SILT, some gravel, some sand, little clay.	7.2			
▲	BB-MOS-501/13D	31+36.2	10.6 LT	45.0-47.0	SAND, some gravel, some silt, trace clay.	8.4			
×									

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WHITE, TERRY A	8/11/2015

Central Laboratory
Test Reports
100-series borings



GEOTECHNICAL TEST REPORT

Central Laboratory

SAMPLE INFORMATION

Reference No.	Boring No./Sample No.	Sample Description	Sampled	Received
239836	BB-MOS-101/1D	GEOTECHNICAL (DISTURBED)	7/19/2010	9/17/2010
Sample Type: GEOTECHNICAL		Location: OTHER	Station: 29+23.2 Offset, ft: 4.1 LT Dbfg, ft: 1.0-3.0	
WIN/Town 016667.00 - MILFORD			Sampler: REITER, MATTHEW	

TEST RESULTS

Sieve Analysis (T 27, T 11)	
Wash Method	
Procedure A	
SIEVE SIZE U.S. [SI]	% Passing
3 in. [75.0 mm]	
1 in. [25.0 mm]	
¾ in. [19.0 mm]	100.0
½ in. [12.5 mm]	97.9
⅜ in. [9.5 mm]	91.9
¼ in. [6.3 mm]	85.0
No. 4 [4.75 mm]	80.0
No. 10 [2.00 mm]	66.7
No. 20 [0.850 mm]	49.0
No. 40 [0.425 mm]	32.4
No. 60 [0.250 mm]	25.5
No. 100 [0.150 mm]	20.6
No. 200 [0.075 mm]	15.0

Direct Shear (T 236)			
Shear Angle, °			
Initial Water Content, %			
Normal Stress, psi			
Wet Density, lbs/ft³			
Dry Density, lbs/ft³			
Specimen Thickness, in			

Consolidation (T 216)					
Trimming, Water Content, %					
	Initial	Final		Void Ratio	% Strain
Water Content, %			Pmin		
Dry Density, lbs/ft³			Pp		
Void Ratio			Pmax		
Saturation, %			Cc/C'c		

Miscellaneous Tests	
<u>Liquid Limit @ 25 blows (T 89), %</u>	
<u>Plastic Limit (T 90), %</u>	
<u>Plasticity Index (T 90), %</u>	
<u>Specific Gravity, Corrected to 20°C (T 100)</u>	
<u>Loss on Ignition (T 267)</u>	
<u>Loss, %</u>	<u>H2O, %</u>
<u>Water Content (T 265), %</u>	
3.8	

Vane Shear Test on Shelby Tubes (Maine DOT)						
Depth taken in tube, ft	3 In.		6 In.		Water Content, %	Description of Material Sampled at the Various Tube Depths
	U. Shear	Remold	U. Shear	Remold		
	tons/ft²	tons/ft²	tons/ft²	tons/ft²		

Comments:

AUTHORIZATION AND DISTRIBUTION

Reported by: **FOGG, BRIAN**

Date Reported: **9/25/2010**



GEOTECHNICAL TEST REPORT

Central Laboratory

SAMPLE INFORMATION

Reference No.	Boring No./Sample No.	Sample Description	Sampled	Received
239837	BB-MOS-101/2D	GEOTECHNICAL (DISTURBED)	7/19/2010	9/17/2010
Sample Type: GEOTECHNICAL Location: OTHER		Station: 29+23.2 Offset, ft: 4.1 LT Dbfg, ft: 5.0-7.0	Sampler: REITER, MATTHEW	
WIN/Town 016667.00 - MILFORD				

TEST RESULTS

Sieve Analysis (T 27, T 11)	
Wash Method	
Procedure A	
SIEVE SIZE U.S. [SI]	% Passing
3 in. [75.0 mm]	
1 in. [25.0 mm]	
¾ in. [19.0 mm]	100.0
½ in. [12.5 mm]	90.0
⅜ in. [9.5 mm]	84.3
¼ in. [6.3 mm]	73.3
No. 4 [4.75 mm]	67.8
No. 10 [2.00 mm]	58.7
No. 20 [0.850 mm]	51.5
No. 40 [0.425 mm]	45.9
No. 60 [0.250 mm]	43.3
No. 100 [0.150 mm]	41.0
No. 200 [0.075 mm]	37.1

Direct Shear (T 236)			
Shear Angle, °			
Initial Water Content, %			
Normal Stress, psi			
Wet Density, lbs/ft³			
Dry Density, lbs/ft³			
Specimen Thickness, in			

Consolidation (T 216)					
Trimming, Water Content, %					
	Initial	Final		Void Ratio	% Strain
Water Content, %			Pmin		
Dry Density, lbs/ft³			Pp		
Void Ratio			Pmax		
Saturation, %			Cc/C'c		

Miscellaneous Tests	
Liquid Limit @ 25 blows (T 89), %	
Plastic Limit (T 90), %	
Plasticity Index (T 90), %	
Specific Gravity, Corrected to 20°C (T 100)	
Loss on Ignition (T 267)	
Loss, %	H2O, %
Water Content (T 265), %	
9.2	

Vane Shear Test on Shelby Tubes (Maine DOT)						
Depth taken in tube, ft	3 In.		6 In.		Water Content, %	Description of Material Sampled at the Various Tube Depths
	U. Shear	Remold	U. Shear	Remold		
	tons/ft²	tons/ft²	tons/ft²	tons/ft²		

Comments:

AUTHORIZATION AND DISTRIBUTION

Reported by: FOGG, BRIAN	Date Reported: 9/24/2010
Paper Copy: Lab File; Project File; Geotech File	



GEOTECHNICAL TEST REPORT

Central Laboratory

SAMPLE INFORMATION

Reference No.	Boring No./Sample No.	Sample Description	Sampled	Received
239838	BB-MOS-101/3D	GEOTECHNICAL (DISTURBED)	7/19/2010	9/17/2010
Sample Type: GEOTECHNICAL Location: OTHER		Station: 29+23.2 Offset, ft: 4.1 LT Dbfg, ft: 10.0-12.0	Sampler: REITER, MATTHEW	
WIN/Town 016667.00 - MILFORD				

TEST RESULTS

Sieve Analysis (T 27, T 11)	
Wash Method	
Procedure A	
SIEVE SIZE U.S. [SI]	% Passing
3 in. [75.0 mm]	100.0
1 in. [25.0 mm]	87.2
¾ in. [19.0 mm]	
½ in. [12.5 mm]	
⅜ in. [9.5 mm]	85.1
¼ in. [6.3 mm]	82.3
No. 4 [4.75 mm]	81.0
No. 10 [2.00 mm]	78.8
No. 20 [0.850 mm]	75.4
No. 40 [0.425 mm]	72.9
No. 60 [0.250 mm]	71.6
No. 100 [0.150 mm]	70.2
No. 200 [0.075 mm]	67.5

Direct Shear (T 236)			
Shear Angle, °			
Initial Water Content, %			
Normal Stress, psi			
Wet Density, lbs/ft³			
Dry Density, lbs/ft³			
Specimen Thickness, in			

Consolidation (T 216)					
Trimming, Water Content, %					
	Initial	Final		Void Ratio	% Strain
Water Content, %			Pmin		
Dry Density, lbs/ft³			Pp		
Void Ratio			Pmax		
Saturation, %			Cc/C'c		

Miscellaneous Tests	
Liquid Limit @ 25 blows (T 89), %	
Plastic Limit (T 90), %	
Plasticity Index (T 90), %	
Specific Gravity, Corrected to 20°C (T 100)	
Loss on Ignition (T 267)	
Loss, %	H2O, %
Water Content (T 265), %	
19.7	

Vane Shear Test on Shelby Tubes (Maine DOT)						
Depth taken in tube, ft	3 In.		6 In.		Water Content, %	Description of Material Sampled at the Various Tube Depths
	U. Shear	Remold	U. Shear	Remold		
	tons/ft²	tons/ft²	tons/ft²	tons/ft²		

Comments:
canceled liquid limit. Insufficient material.

AUTHORIZATION AND DISTRIBUTION

Reported by: **FOGG, BRIAN**

Date Reported: **10/29/2010**

Paper Copy: Lab File; Project File; Geotech File



GEOTECHNICAL TEST REPORT

Central Laboratory

SAMPLE INFORMATION

Reference No.	Boring No./Sample No.	Sample Description	Sampled	Received
239839	BB-MOS-101/5D	<u>GEOTECHNICAL (DISTURBED)</u>	7/19/2010	9/17/2010
Sample Type: GEOTECHNICAL Location: OTHER		Station: 29+23.2 Offset, ft: 4.1 LT Dbfg, ft: 20.0-22.0	Sampler: REITER, MATTHEW	
WIN/Town 016667.00 - MILFORD				

TEST RESULTS

Sieve Analysis (T 88)

Wash Method	
SIEVE SIZE U.S. [SI]	% Passing
3 in. [75.0 mm]	
1 in. [25.0 mm]	
¾ in. [19.0 mm]	
½ in. [12.5 mm]	
⅜ in. [9.5 mm]	
¼ in. [6.3 mm]	
No. 4 [4.75 mm]	
No. 10 [2.00 mm]	100.0
No. 20 [0.850 mm]	
No. 40 [0.425 mm]	99.6
No. 60 [0.250 mm]	
No. 100 [0.150 mm]	
No. 200 [0.075 mm]	96.8
[0.0251 mm]	94.4
[0.0162 mm]	91.3
[0.0097 mm]	85.2
[0.0052 mm]	73.1
[0.0028 mm]	54.8
[0.0012 mm]	33.5

Direct Shear (T 236)

Shear Angle, °			
Initial Water Content, %			
Normal Stress, psi			
Wet Density, lbs/ft³			
Dry Density, lbs/ft³			
Specimen Thickness, in			

Consolidation (T 216)

Trimmings, Water Content, %					
	Initial	Final		Void Ratio	% Strain
Water Content, %			Pmin		
Dry Density, lbs/ft³			Pp		
Void Ratio			Pmax		
Saturation, %			Cc/C'c		

Miscellaneous Tests

<u>Liquid Limit @ 25 blows (T 89), %</u>
32
<u>Plastic Limit (T 90), %</u>
22
<u>Plasticity Index (T 90), %</u>
10
<u>Specific Gravity, Corrected to 20°C (T 100)</u>
2.72
<u>Loss on Ignition (T 267)</u>
<u>Loss, %</u> <u>H2O, %</u>
<u>Water Content (T 265), %</u>
28.9

Vane Shear Test on Shelby Tubes (Maine DOT)

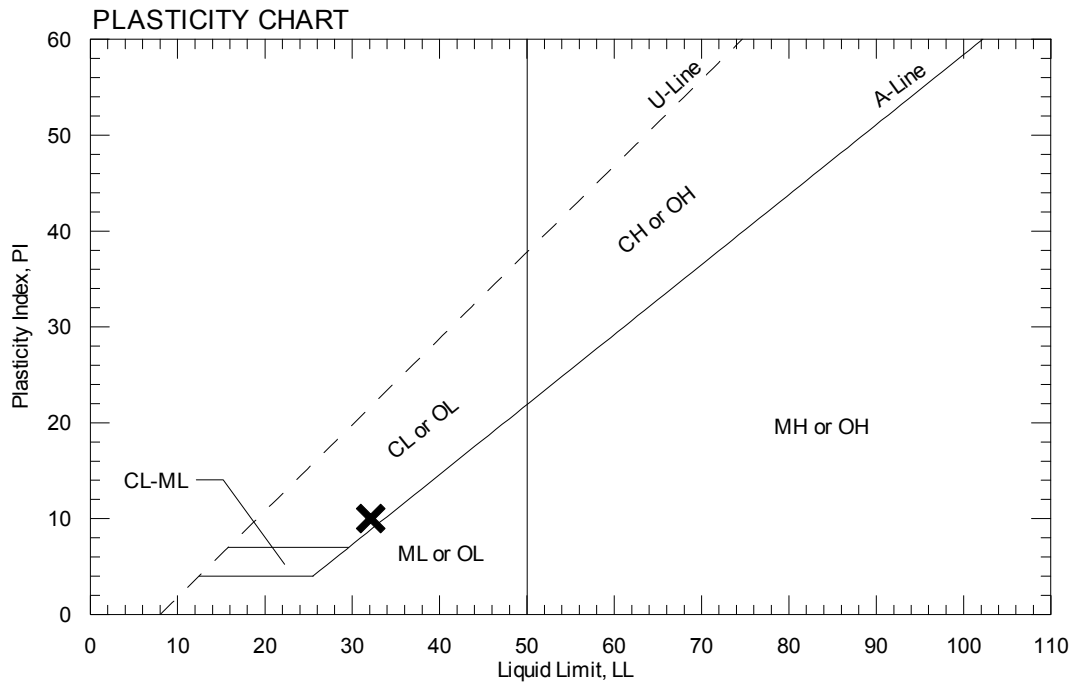
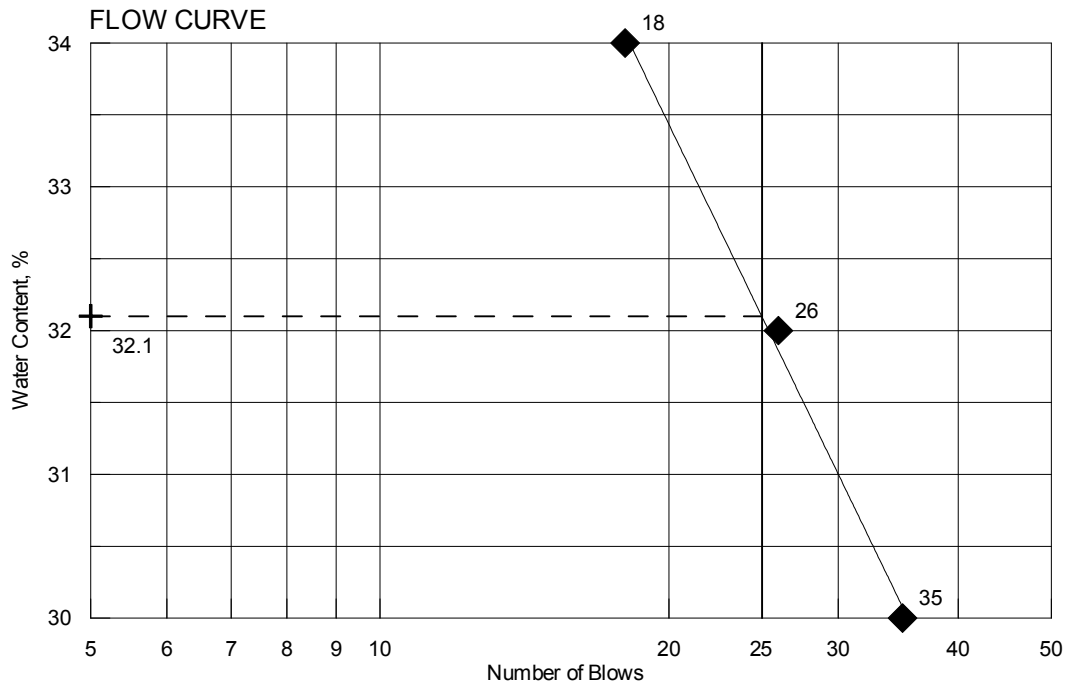
Depth taken in tube, ft	3 in.		6 in.		Water Content, %	Description of Material Sampled at the Various Tube Depths
	U. Shear	Remold	U. Shear	Remold		
	tons/ft²	tons/ft²	tons/ft²	tons/ft²		

Comments:

AUTHORIZATION AND DISTRIBUTION

Reported by: FOGG, BRIAN	Date Reported: 11/9/2010
Paper Copy: Lab File; Project File; Geotech File	

TOWN	Milford	Reference No.	239839
WIN	016667.00	Water Content, %	28.9
Sampled	7/19/2010	Liquid Limit @ 25 blows (T 89), %	32
Boring No./Sample No.	BB-MOS-101/5D	Plastic Limit (T 90), %	22
Station	29+23.2	Plasticity Index (T 90), %	10
Depth	20.0-22.0	Tested By	BBURR





GEOTECHNICAL TEST REPORT

Central Laboratory

SAMPLE INFORMATION

Reference No.	Boring No./Sample No.	Sample Description	Sampled	Received
239840	BB-MOS-101/6D	GEOTECHNICAL (DISTURBED)	7/19/2010	9/17/2010
Sample Type: GEOTECHNICAL		Location: OTHER	Station: 29+23.2 Offset, ft: 4.1 LT Dbfg, ft: 25.0-27.0	
WIN/Town 016667.00 - MILFORD		Sampler: REITER, MATTHEW		

TEST RESULTS

Sieve Analysis (T 88)	
Wash Method	
SIEVE SIZE U.S. [SI]	% Passing
3 in. [75.0 mm]	
1 in. [25.0 mm]	
¾ in. [19.0 mm]	
½ in. [12.5 mm]	
⅜ in. [9.5 mm]	
¼ in. [6.3 mm]	
No. 4 [4.75 mm]	
No. 10 [2.00 mm]	100.0
No. 20 [0.850 mm]	
No. 40 [0.425 mm]	99.6
No. 60 [0.250 mm]	
No. 100 [0.150 mm]	
No. 200 [0.075 mm]	98.6
[0.0251 mm]	95.6
[0.0164 mm]	89.6
[0.0098 mm]	83.6
[0.0072 mm]	77.6
[0.0052 mm]	71.7
[0.0028 mm]	53.8
[0.0012 mm]	38.8

Direct Shear (T 236)			
Shear Angle, °			
Initial Water Content, %			
Normal Stress, psi			
Wet Density, lbs/ft³			
Dry Density, lbs/ft³			
Specimen Thickness, in			

Consolidation (T 216)					
Trimmings, Water Content, %					
	Initial	Final		Void Ratio	% Strain
Water Content, %			Pmin		
Dry Density, lbs/ft³			Pp		
Void Ratio			Pmax		
Saturation, %			Cc/C'c		

Miscellaneous Tests	
<u>Liquid Limit @ 25 blows (T 89), %</u>	
35	
<u>Plastic Limit (T 90), %</u>	
23	
<u>Plasticity Index (T 90), %</u>	
12	
<u>Specific Gravity, Corrected to 20°C (T 100)</u>	
2.70	
<u>Loss on Ignition (T 267)</u>	
<u>Loss, %</u>	<u>H2O, %</u>
<u>Water Content (T 265), %</u>	
38.8	

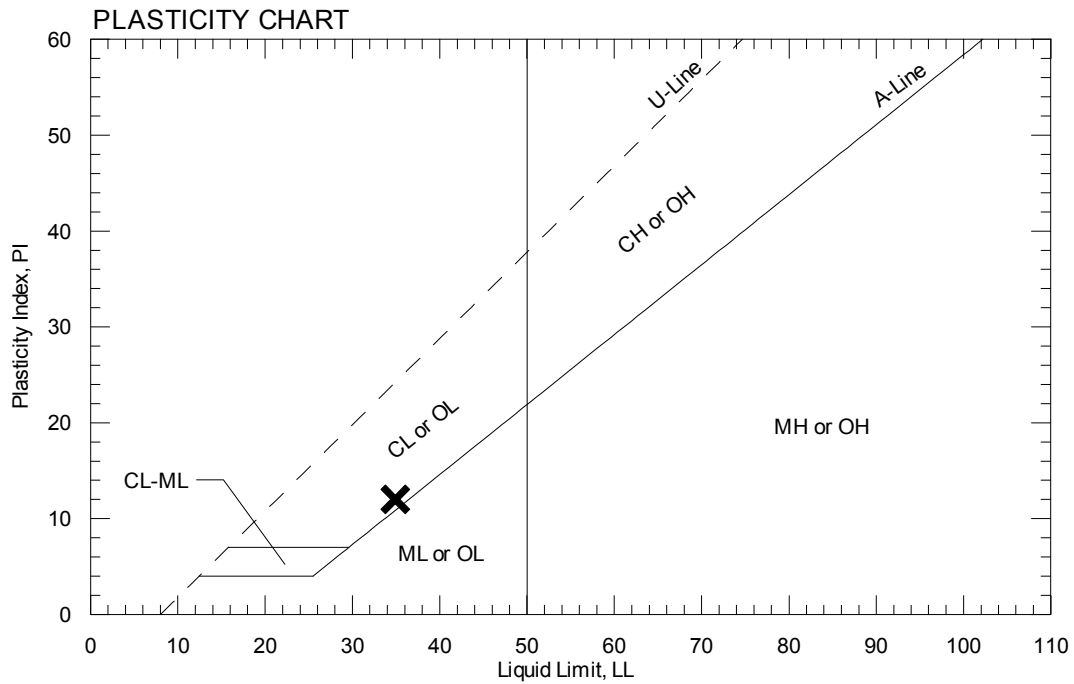
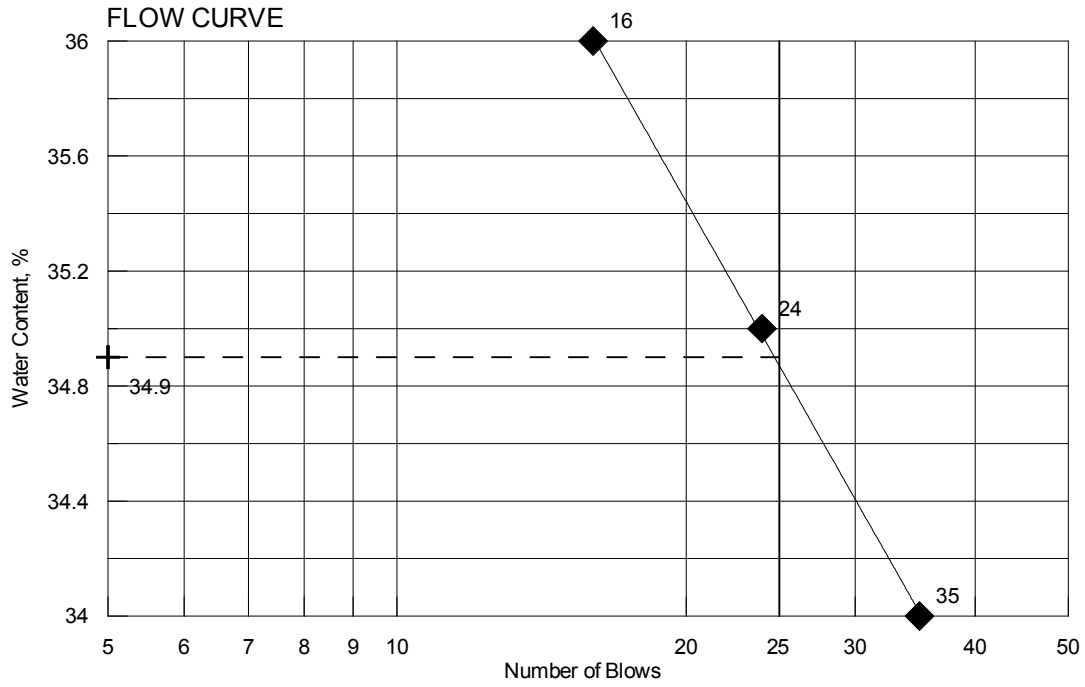
Vane Shear Test on Shelby Tubes (Maine DOT)						
Depth taken in tube, ft	3 In.		6 In.		Water Content, %	Description of Material Sampled at the Various Tube Depths
	U. Shear	Remold	U. Shear	Remold		
	tons/ft²	tons/ft²	tons/ft²	tons/ft²		

Comments:

AUTHORIZATION AND DISTRIBUTION

Reported by: **FOGG, BRIAN** Date Reported: **10/26/2010**

TOWN	Milford	Reference No.	239840
WIN	016667.00	Water Content, %	38.8
Sampled	7/19/2010	Liquid Limit @ 25 blows (T 89), %	35
Boring No./Sample No.	BB-MOS-101/6D	Plastic Limit (T 90), %	23
Station	29+23.2	Plasticity Index (T 90), %	12
Depth	25.0-27.0	Tested By	BBURR





GEOTECHNICAL TEST REPORT

Central Laboratory

SAMPLE INFORMATION

Reference No.	Boring No./Sample No.	Sample Description	Sampled	Received
239841	BB-MOS-101/8D	GEOTECHNICAL (DISTURBED)	7/19/2010	9/17/2010
Sample Type: GEOTECHNICAL		Location: OTHER	Station: 29+23.2 Offset, ft: 4.1 LT Dbfg, ft: 35.0-37.0	
WIN/Town 016667.00 - MILFORD		Sampler: REITER, MATTHEW		

TEST RESULTS

Sieve Analysis (T 27, T 11)	
Wash Method	
Procedure A	
SIEVE SIZE U.S. [SI]	% Passing
3 in. [75.0 mm]	
1 in. [25.0 mm]	100.0
¾ in. [19.0 mm]	88.6
½ in. [12.5 mm]	84.1
⅜ in. [9.5 mm]	82.4
¼ in. [6.3 mm]	79.6
No. 4 [4.75 mm]	77.8
No. 10 [2.00 mm]	73.2
No. 20 [0.850 mm]	70.3
No. 40 [0.425 mm]	67.8
No. 60 [0.250 mm]	65.3
No. 100 [0.150 mm]	62.2
No. 200 [0.075 mm]	56.7

Direct Shear (T 236)			
Shear Angle, °			
Initial Water Content, %			
Normal Stress, psi			
Wet Density, lbs/ft³			
Dry Density, lbs/ft³			
Specimen Thickness, in			

Consolidation (T 216)					
Trimblings, Water Content, %					
	Initial	Final		Void Ratio	% Strain
Water Content, %			Pmin		
Dry Density, lbs/ft³			Pp		
Void Ratio			Pmax		
Saturation, %			Cc/C'c		

Miscellaneous Tests
<u>Liquid Limit @ 25 blows (T 89), %</u>
<u>Plastic Limit (T 90), %</u>
<u>Plasticity Index (T 90), %</u>
<u>Specific Gravity, Corrected to 20°C (T 100)</u>
<u>Loss on Ignition (T 267)</u>
<u>Loss, %</u> <u>H2O, %</u>
<u>Water Content (T 265), %</u>
12.0

Vane Shear Test on Shelby Tubes (Maine DOT)						
Depth taken in tube, ft	3 In.		6 In.		Water Content, %	Description of Material Sampled at the Various Tube Depths
	U. Shear	Remold	U. Shear	Remold		
	tons/ft²	tons/ft²	tons/ft²	tons/ft²		

Comments:

AUTHORIZATION AND DISTRIBUTION

Reported by: **FOGG, BRIAN** Date Reported: **9/24/2010**



GEOTECHNICAL TEST REPORT

Central Laboratory

SAMPLE INFORMATION

Reference No.	Boring No./Sample No.	Sample Description	Sampled	Received
239842	BB-MOS-102/2D	GEOTECHNICAL (DISTURBED)	7/21/2010	9/17/2010
Sample Type: GEOTECHNICAL Location: OTHER		Station: 30+59.3 Offset, ft: 4.7 LT Dbfg, ft: 5.0-7.0	Sampler: REITER, MATTHEW	
WIN/Town 016667.00 - MILFORD				

TEST RESULTS

Sieve Analysis (T 88)	
Wash Method	
SIEVE SIZE U.S. [SI]	% Passing
3 in. [75.0 mm]	
1 in. [25.0 mm]	
¾ in. [19.0 mm]	
½ in. [12.5 mm]	
⅜ in. [9.5 mm]	
¼ in. [6.3 mm]	
No. 4 [4.75 mm]	
No. 10 [2.00 mm]	100.0
No. 20 [0.850 mm]	
No. 40 [0.425 mm]	99.5
No. 60 [0.250 mm]	
No. 100 [0.150 mm]	
No. 200 [0.075 mm]	98.9
[0.0261 mm]	94.1
[0.0169 mm]	91.1
[0.0096 mm]	88.1
[0.0069 mm]	85.0
[0.0050 mm]	78.9
[0.0026 mm]	66.8
[0.0012 mm]	48.6

Direct Shear (T 236)			
Shear Angle, °			
Initial Water Content, %			
Normal Stress, psi			
Wet Density, lbs/ft³			
Dry Density, lbs/ft³			
Specimen Thickness, in			

Consolidation (T 216)					
Trimmings, Water Content, %					
	Initial	Final		Void Ratio	% Strain
Water Content, %			Pmin		
Dry Density, lbs/ft³			Pp		
Void Ratio			Pmax		
Saturation, %			Cc/C'c		

Miscellaneous Tests	
<u>Liquid Limit @ 25 blows (T 89), %</u>	
32	
<u>Plastic Limit (T 90), %</u>	
23	
<u>Plasticity Index (T 90), %</u>	
9	
<u>Specific Gravity, Corrected to 20°C (T 100)</u>	
2.71	
<u>Loss on Ignition (T 267)</u>	
<u>Loss, %</u>	<u>H2O, %</u>
<u>Water Content (T 265), %</u>	
51.2	

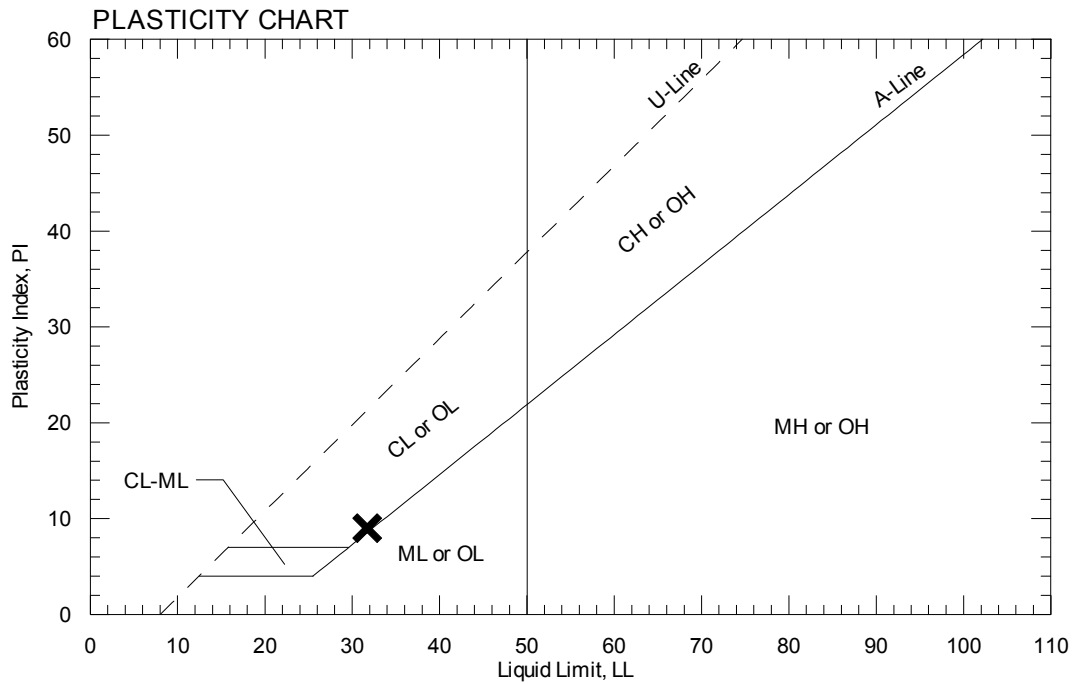
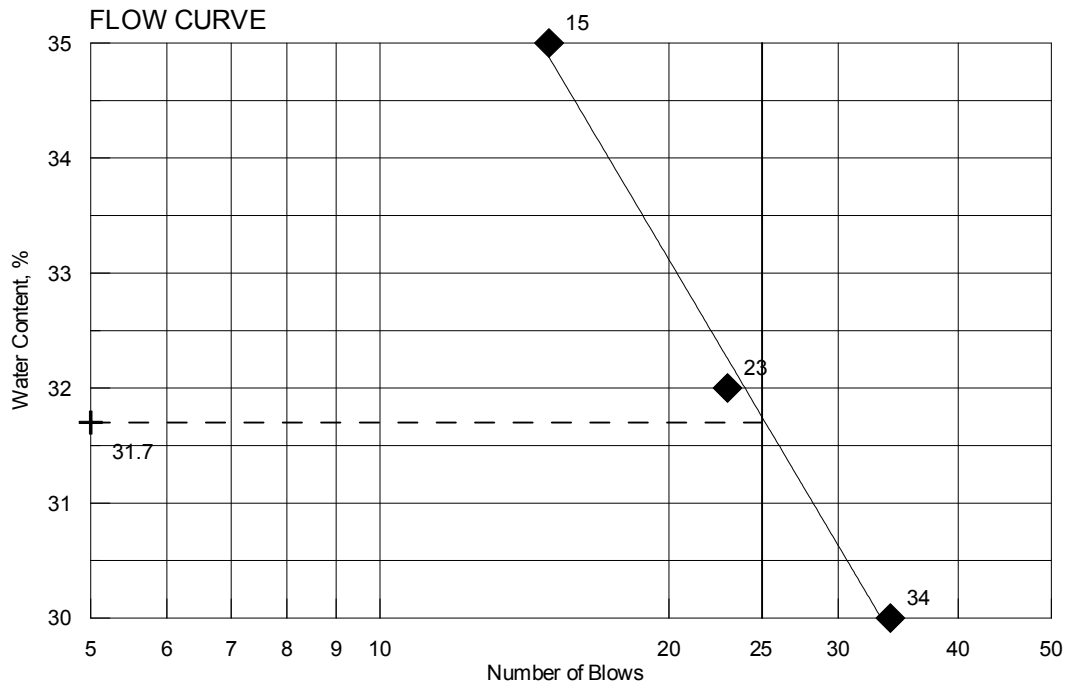
Vane Shear Test on Shelby Tubes (Maine DOT)						
Depth taken in tube, ft	3 In.		6 In.		Water Content, %	Description of Material Sampled at the Various Tube Depths
	U. Shear	Remold	U. Shear	Remold		
	tons/ft²	tons/ft²	tons/ft²	tons/ft²		

Comments:

AUTHORIZATION AND DISTRIBUTION

Reported by: FOGG, BRIAN	Date Reported: 11/9/2010
Paper Copy: Lab File; Project File; Geotech File	

TOWN	Milford	Reference No.	239842
WIN	016667.00	Water Content, %	51.2
Sampled	7/21/2010	Liquid Limit @ 25 blows (T 89), %	32
Boring No./Sample No.	BB-MOS-102/2D	Plastic Limit (T 90), %	23
Station	30+59.3	Plasticity Index (T 90), %	9
Depth	5.0-7.0	Tested By	BBURR





GEOTECHNICAL TEST REPORT

Central Laboratory

SAMPLE INFORMATION

Reference No.	Boring No./Sample No.	Sample Description	Sampled	Received
239843	BB-MOS-102/4D	GEOTECHNICAL (DISTURBED)	7/22/2010	9/17/2010
Sample Type: GEOTECHNICAL Location: OTHER		Station: 30+59.3 Offset, ft: 4.7 LT Dbfg, ft: 20.6-22.6	Sampler: REITER, MATTHEW	
WIN/Town 016667.00 - MILFORD				

TEST RESULTS

Sieve Analysis (T 27, T 11)	
Wash Method	
Procedure A	
SIEVE SIZE U.S. [SI]	% Passing
3 in. [75.0 mm]	100.0
1 in. [25.0 mm]	93.8
¾ in. [19.0 mm]	88.4
½ in. [12.5 mm]	84.7
⅜ in. [9.5 mm]	79.6
¼ in. [6.3 mm]	76.0
No. 4 [4.75 mm]	73.5
No. 10 [2.00 mm]	66.1
No. 20 [0.850 mm]	58.6
No. 40 [0.425 mm]	51.8
No. 60 [0.250 mm]	46.5
No. 100 [0.150 mm]	40.1
No. 200 [0.075 mm]	31.6

Direct Shear (T 236)			
Shear Angle, °			
Initial Water Content, %			
Normal Stress, psi			
Wet Density, lbs/ft³			
Dry Density, lbs/ft³			
Specimen Thickness, in			

Consolidation (T 216)					
Trimmings, Water Content, %					
	Initial	Final		Void Ratio	% Strain
Water Content, %			Pmin		
Dry Density, lbs/ft³			Pp		
Void Ratio			Pmax		
Saturation, %			Cc/C'c		

Miscellaneous Tests	
Liquid Limit @ 25 blows (T 89), %	
Plastic Limit (T 90), %	
Plasticity Index (T 90), %	
Specific Gravity, Corrected to 20°C (T 100)	
Loss on Ignition (T 267)	
Loss, %	H2O, %
Water Content (T 265), %	
8.7	

Vane Shear Test on Shelby Tubes (Maine DOT)						
Depth taken in tube, ft	3 In.		6 In.		Water Content, %	Description of Material Sampled at the Various Tube Depths
	U. Shear	Remold	U. Shear	Remold		
	tons/ft²	tons/ft²	tons/ft²	tons/ft²		

Comments:

AUTHORIZATION AND DISTRIBUTION

Reported by: **FOGG, BRIAN**

Date Reported: **9/25/2010**



GEOTECHNICAL TEST REPORT

Central Laboratory

SAMPLE INFORMATION

Reference No.	Boring No./Sample No.	Sample Description	Sampled	Received
239848	BB-MOS-103/10D	<u>GEOTECHNICAL (DISTURBED)</u>	7/21/2010	9/17/2010
Sample Type: GEOTECHNICAL Location: OTHER		Station: 31+71.9 Offset, ft: 7.1 RT Dbfg, ft: 45.0-47.0	Sampler: REITER, MATTHEW	
WIN/Town 016667.00 - MILFORD				

TEST RESULTS

Sieve Analysis (T 27, T 11)	
Wash Method	
Procedure A	
SIEVE SIZE U.S. [SI]	% Passing
3 in. [75.0 mm]	
1 in. [25.0 mm]	100.0
¾ in. [19.0 mm]	91.2
½ in. [12.5 mm]	90.2
⅜ in. [9.5 mm]	87.1
¼ in. [6.3 mm]	85.0
No. 4 [4.75 mm]	83.4
No. 10 [2.00 mm]	79.3
No. 20 [0.850 mm]	74.8
No. 40 [0.425 mm]	70.5
No. 60 [0.250 mm]	66.4
No. 100 [0.150 mm]	61.8
No. 200 [0.075 mm]	53.8

Direct Shear (T 236)			
Shear Angle, °			
Initial Water Content, %			
Normal Stress, psi			
Wet Density, lbs/ft³			
Dry Density, lbs/ft³			
Specimen Thickness, in			

Consolidation (T 216)					
Trimblings, Water Content, %					
	Initial	Final		Void Ratio	% Strain
Water Content, %			Pmin		
Dry Density, lbs/ft³			Pp		
Void Ratio			Pmax		
Saturation, %			Cc/C'c		

Miscellaneous Tests	
Liquid Limit @ 25 blows (T 89), %	
Plastic Limit (T 90), %	
Plasticity Index (T 90), %	
Specific Gravity, Corrected to 20°C (T 100)	
Loss on Ignition (T 267)	
Loss, %	H2O, %
Water Content (T 265), %	
9.7	

Vane Shear Test on Shelby Tubes (Maine DOT)						
Depth taken in tube, ft	3 In.		6 In.		Water Content, %	Description of Material Sampled at the Various Tube Depths
	U. Shear	Remold	U. Shear	Remold		
	tons/ft²	tons/ft²	tons/ft²	tons/ft²		

Comments:

AUTHORIZATION AND DISTRIBUTION

Reported by: **FOGG, BRIAN**

Date Reported: **9/24/2010**



GEOTECHNICAL TEST REPORT

Central Laboratory

SAMPLE INFORMATION

Reference No.	Boring No./Sample No.	Sample Description	Sampled	Received
239844	BB-MOS-103/1D	GEOTECHNICAL (DISTURBED)	7/20/2010	9/17/2010
Sample Type: GEOTECHNICAL Location: OTHER		Station: 31+71.9 Offset, ft: 7.1 RT Dbfg, ft: 1.0-3.0	Sampler: REITER, MATTHEW	
WIN/Town 016667.00 - MILFORD				

TEST RESULTS

Sieve Analysis (T 27, T 11)	
Wash Method	
Procedure A	
SIEVE SIZE U.S. [SI]	% Passing
3 in. [75.0 mm]	
1 in. [25.0 mm]	100.0
¾ in. [19.0 mm]	89.6
½ in. [12.5 mm]	77.2
⅜ in. [9.5 mm]	74.2
¼ in. [6.3 mm]	67.3
No. 4 [4.75 mm]	64.4
No. 10 [2.00 mm]	54.9
No. 20 [0.850 mm]	45.4
No. 40 [0.425 mm]	39.0
No. 60 [0.250 mm]	35.6
No. 100 [0.150 mm]	33.0
No. 200 [0.075 mm]	28.4

Direct Shear (T 236)			
Shear Angle, °			
Initial Water Content, %			
Normal Stress, psi			
Wet Density, lbs/ft³			
Dry Density, lbs/ft³			
Specimen Thickness, in			

Consolidation (T 216)					
Trimblings, Water Content, %					
	Initial	Final		Void Ratio	% Strain
Water Content, %			Pmin		
Dry Density, lbs/ft³			Pp		
Void Ratio			Pmax		
Saturation, %			Cc/C'c		

Miscellaneous Tests	
Liquid Limit @ 25 blows (T 89), %	
Plastic Limit (T 90), %	
Plasticity Index (T 90), %	
Specific Gravity, Corrected to 20°C (T 100)	
Loss on Ignition (T 267)	
Loss, %	H2O, %
Water Content (T 265), %	
7.3	

Vane Shear Test on Shelby Tubes (Maine DOT)						
Depth taken in tube, ft	3 In.		6 In.		Water Content, %	Description of Material Sampled at the Various Tube Depths
	U. Shear	Remold	U. Shear	Remold		
	tons/ft²	tons/ft²	tons/ft²	tons/ft²		

Comments:

AUTHORIZATION AND DISTRIBUTION

Reported by: FOGG, BRIAN	Date Reported: 9/24/2010
Paper Copy: Lab File; Project File; Geotech File	



GEOTECHNICAL TEST REPORT

Central Laboratory

SAMPLE INFORMATION

Reference No.	Boring No./Sample No.	Sample Description	Sampled	Received
239845	BB-MOS-103/2DA	GEOTECHNICAL (DISTURBED)	7/20/2010	9/17/2010
Sample Type: GEOTECHNICAL Location: OTHER		Station: 31+71.9 Offset, ft: 7.1 RT Dbfg, ft: 5.0-6.5	Sampler: REITER, MATTHEW	
WIN/Town 016667.00 - MILFORD				

TEST RESULTS

Sieve Analysis (T 88)	
Wash Method	
SIEVE SIZE U.S. [SI]	% Passing
3 in. [75.0 mm]	
1 in. [25.0 mm]	
¾ in. [19.0 mm]	
½ in. [12.5 mm]	100.0
⅜ in. [9.5 mm]	99.5
¼ in. [6.3 mm]	99.0
No. 4 [4.75 mm]	98.9
No. 10 [2.00 mm]	98.4
No. 20 [0.850 mm]	
No. 40 [0.425 mm]	97.3
No. 60 [0.250 mm]	
No. 100 [0.150 mm]	
No. 200 [0.075 mm]	93.8
[0.0277 mm]	74.2
[0.0178 mm]	71.1
[0.0106 mm]	64.9
[0.0076 mm]	61.9
[0.0058 mm]	55.7
[0.0030 mm]	43.3
[0.0013 mm]	30.9

Direct Shear (T 236)			
Shear Angle, °			
Initial Water Content, %			
Normal Stress, psi			
Wet Density, lbs/ft³			
Dry Density, lbs/ft³			
Specimen Thickness, in			

Consolidation (T 216)					
Trimmings, Water Content, %					
	Initial	Final		Void Ratio	% Strain
Water Content, %			Pmin		
Dry Density, lbs/ft³			Pp		
Void Ratio			Pmax		
Saturation, %			Cc/C'c		

Miscellaneous Tests	
Liquid Limit @ 25 blows (T 89), %	
33	
Plastic Limit (T 90), %	
20	
Plasticity Index (T 90), %	
13	
Specific Gravity, Corrected to 20°C (T 100)	
2.71	
Loss on Ignition (T 267)	
Loss, %	H2O, %
Water Content (T 265), %	
23.1	

Vane Shear Test on Shelby Tubes (Maine DOT)						
Depth taken in tube, ft	3 in.		6 in.		Water Content, %	Description of Material Sampled at the Various Tube Depths
	U. Shear	Remold	U. Shear	Remold		
	tons/ft²	tons/ft²	tons/ft²	tons/ft²		

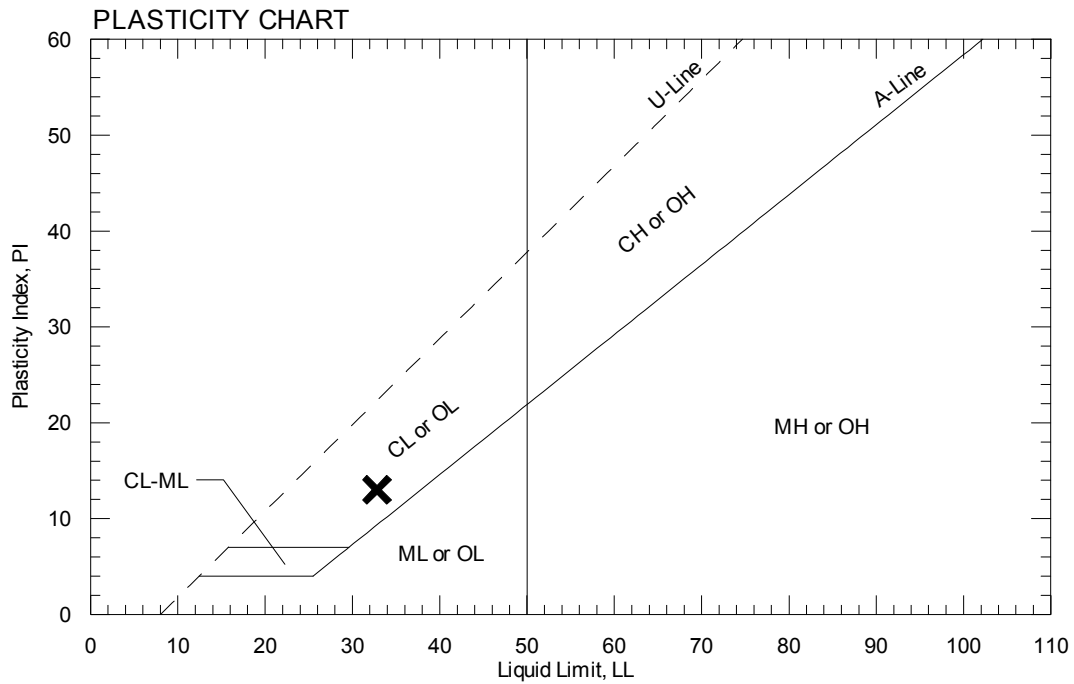
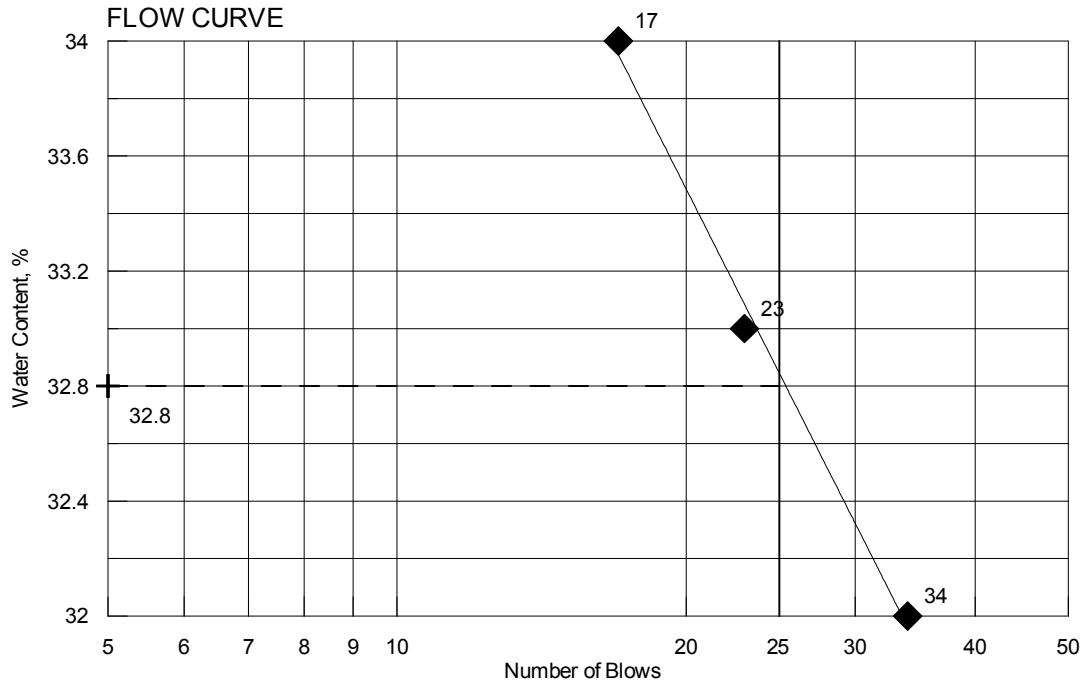
Comments:

AUTHORIZATION AND DISTRIBUTION

Reported by: **FOGG, BRIAN**
Date Reported: **11/3/2010**

Paper Copy: Lab File; Project File; Geotech File

TOWN	Milford	Reference No.	239845
WIN	016667.00	Water Content, %	23.1
Sampled	7/20/2010	Liquid Limit @ 25 blows (T 89), %	33
Boring No./Sample No.	BB-MOS-103/2DA	Plastic Limit (T 90), %	20
Station	31+71.9	Plasticity Index (T 90), %	13
Depth	5.0-6.5	Tested By	BBURR





GEOTECHNICAL TEST REPORT

Central Laboratory

SAMPLE INFORMATION

Reference No. **239846** Boring No./Sample No. **BB-MOS-103/4D** Sample Description **GEOTECHNICAL (DISTURBED)** Sampled **7/20/2010** Received **9/17/2010**

Sample Type: **GEOTECHNICAL** Location: **OTHER** Station: **31+71.9** Offset, ft: **7.1** RT Dbfg, ft: **16.5-18.5**

WIN/Town **016667.00 - MILFORD** Sampler: **REITER, MATTHEW**

TEST RESULTS

Sieve Analysis (T 27, T 11)

Wash Method	
Procedure A	
SIEVE SIZE U.S. [SI]	% Passing
3 in. [75.0 mm]	100.0
1 in. [25.0 mm]	93.4
¾ in. [19.0 mm]	93.4
½ in. [12.5 mm]	90.2
⅜ in. [9.5 mm]	88.6
¼ in. [6.3 mm]	85.4
No. 4 [4.75 mm]	84.0
No. 10 [2.00 mm]	80.0
No. 20 [0.850 mm]	75.4
No. 40 [0.425 mm]	69.4
No. 60 [0.250 mm]	65.2
No. 100 [0.150 mm]	60.7
No. 200 [0.075 mm]	54.3

Direct Shear (T 236)

Shear Angle, °			
Initial Water Content, %			
Normal Stress, psi			
Wet Density, lbs/ft³			
Dry Density, lbs/ft³			
Specimen Thickness, in			

Consolidation (T 216)

Trimblings, Water Content, %					
	Initial	Final		Void Ratio	% Strain
Water Content, %			Pmin		
Dry Density, lbs/ft³			Pp		
Void Ratio			Pmax		
Saturation, %			Cc/C'c		

Miscellaneous Tests

Liquid Limit @ 25 blows (T 89), %	
Plastic Limit (T 90), %	
Plasticity Index (T 90), %	
Specific Gravity, Corrected to 20°C (T 100)	
Loss on Ignition (T 267)	
Loss, %	H2O, %
Water Content (T 265), %	
10.8	

Vane Shear Test on Shelby Tubes (Maine DOT)

Depth taken in tube, ft	3 In.		6 In.		Water Content, %	Description of Material Sampled at the Various Tube Depths
	U. Shear	Remold	U. Shear	Remold		
	tons/ft²	tons/ft²	tons/ft²	tons/ft²		

Comments:

AUTHORIZATION AND DISTRIBUTION

Reported by: **FOGG, BRIAN**

Date Reported: **9/24/2010**

Paper Copy: Lab File; Project File; Geotech File



GEOTECHNICAL TEST REPORT

Central Laboratory

SAMPLE INFORMATION

Reference No.	Boring No./Sample No.	Sample Description	Sampled	Received
239847	BB-MOS-103/7D	GEOTECHNICAL (DISTURBED)	7/20/2010	9/17/2010
Sample Type: GEOTECHNICAL		Location: OTHER	Station: 31+71.9 Offset, ft: 7.1 RT Dbfg, ft: 30.0-32.0	
WIN/Town 016667.00 - MILFORD			Sampler: REITER, MATTHEW	

TEST RESULTS

Sieve Analysis (T 27, T 11)	
Wash Method	
Procedure A	
SIEVE SIZE U.S. [SI]	% Passing
3 in. [75.0 mm]	
1 in. [25.0 mm]	100.0
¾ in. [19.0 mm]	95.8
½ in. [12.5 mm]	91.3
⅜ in. [9.5 mm]	89.1
¼ in. [6.3 mm]	86.6
No. 4 [4.75 mm]	84.7
No. 10 [2.00 mm]	79.4
No. 20 [0.850 mm]	74.1
No. 40 [0.425 mm]	69.1
No. 60 [0.250 mm]	64.5
No. 100 [0.150 mm]	59.3
No. 200 [0.075 mm]	51.2

Direct Shear (T 236)			
Shear Angle, °			
Initial Water Content, %			
Normal Stress, psi			
Wet Density, lbs/ft³			
Dry Density, lbs/ft³			
Specimen Thickness, in			

Consolidation (T 216)					
Trimming, Water Content, %					
	Initial	Final		Void Ratio	% Strain
Water Content, %			Pmin		
Dry Density, lbs/ft³			Pp		
Void Ratio			Pmax		
Saturation, %			Cc/C'c		

Miscellaneous Tests	
Liquid Limit @ 25 blows (T 89), %	
Plastic Limit (T 90), %	
Plasticity Index (T 90), %	
Specific Gravity, Corrected to 20°C (T 100)	
Loss on Ignition (T 267)	
Loss, %	H2O, %
Water Content (T 265), %	
11.0	

Vane Shear Test on Shelby Tubes (Maine DOT)						
Depth taken in tube, ft	3 In.		6 In.		Water Content, %	Description of Material Sampled at the Various Tube Depths
	U. Shear	Remold	U. Shear	Remold		
	tons/ft²	tons/ft²	tons/ft²	tons/ft²		

Comments:

AUTHORIZATION AND DISTRIBUTION

Reported by: **FOGG, BRIAN**

Date Reported: **9/24/2010**

Central Laboratory
Test Reports
200-series borings



GEOTECHNICAL TEST REPORT

Central Laboratory

SAMPLE INFORMATION

Reference No. **262825** Boring No./Sample No. **BB-MOS-201/3D** Sample Description **GEOTECHNICAL (DISTURBED)** Sampled **5/16/2014** Received **5/22/2014**

Sample Type: **GEOTECHNICAL** Location: **OTHER** Station: **29+30.4** Offset, ft: **59.6** LT Dbfg, ft: **10.0-12.0**

WIN/Town **016667.00 - MILFORD** Sampler: **WILDER, BRUCE H**

TEST RESULTS

Sieve Analysis (T 88)	
Wash Method	
SIEVE SIZE U.S. [SI]	% Passing
3 in. [75.0 mm]	
1 in. [25.0 mm]	100.0
¾ in. [19.0 mm]	91.0
½ in. [12.5 mm]	86.6
⅜ in. [9.5 mm]	86.6
¼ in. [6.3 mm]	86.6
No. 4 [4.75 mm]	86.6
No. 10 [2.00 mm]	86.1
No. 20 [0.850 mm]	
No. 40 [0.425 mm]	85.5
No. 60 [0.250 mm]	
No. 100 [0.150 mm]	
No. 200 [0.075 mm]	85.1
[0.0239 mm]	84.6
[0.0154 mm]	82.1
[0.0092 mm]	77.0
[0.0068 mm]	71.8
[0.0049 mm]	66.7
[0.0026 mm]	56.5
[0.0012 mm]	41.1

Miscellaneous Tests	
Liquid Limit @ 25 blows (T 89), %	33
Plastic Limit (T 90), %	24
Plasticity Index (T 90), %	9
Specific Gravity, Corrected to 20°C (T 100)	2.78
Loss on Ignition (T 267)	
Loss, %	
H ₂ O, %	
Water Content (T 265), %	36.0

Consolidation (T 216)					
Trimming, Water Content, %					
	Initial	Final		Void Ratio	% Strain
Water Content, %			P _{min}		
Dry Density, lbs/ft ³			P _p		
Void Ratio			P _{max}		
Saturation, %			C _c /C _c		

Vane Shear Test on Shelby Tubes (Maine DOT)						
Depth taken in tube, ft	3 In.		6 In.		Water Content, %	Description of Material Sampled at the Various Tube Depths
	U. Shear tons/ft ²	Remold tons/ft ²	U. Shear tons/ft ²	Remold tons/ft ²		

Comments:

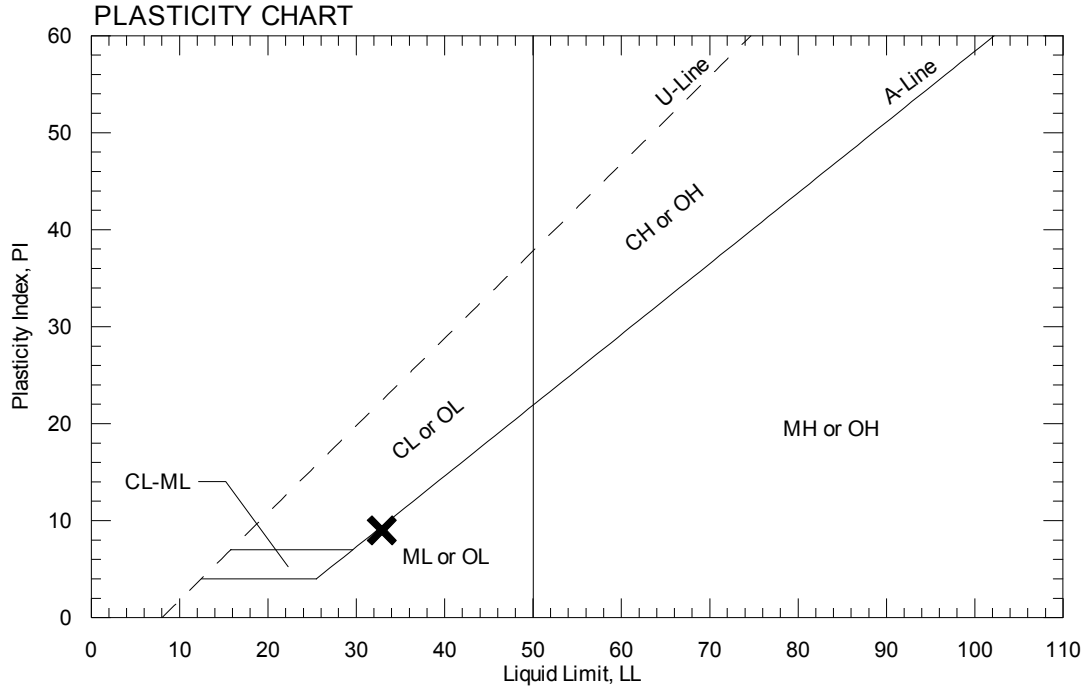
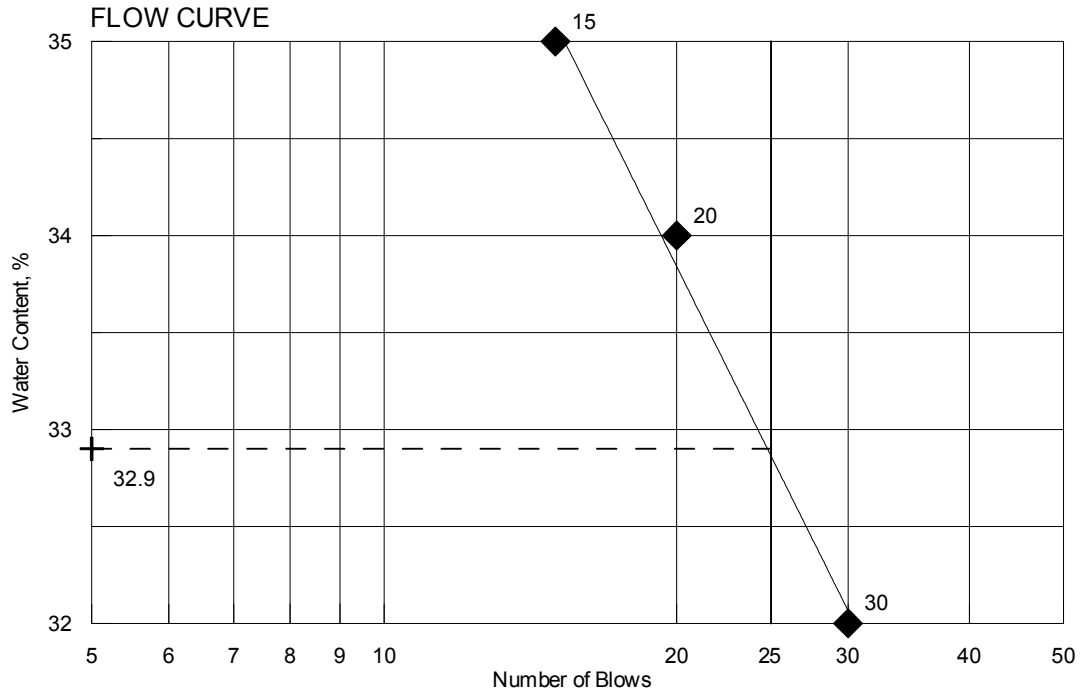
AUTHORIZATION AND DISTRIBUTION

Reported by: **FOGG, BRIAN**

Date Reported: **5/27/2014**

Paper Copy: Lab File; Project File; Geotech File

TOWN	Milford	Reference No.	262825
WIN	016667.00	Water Content, %	36
Sampled	5/16/2014	Liquid Limit @ 25 blows (T 89), %	33
Boring No./Sample No.	BB-MOS-201/3D	Plastic Limit (T 90), %	24
Station	29+30.4	Plasticity Index (T 90), %	9
Depth	10.0-12.0	Tested By	BBURR





GEOTECHNICAL TEST REPORT

Central Laboratory

SAMPLE INFORMATION

Reference No.	Boring No./Sample No.	Sample Description	Sampled	Received
262809	BB-MOS-202A/1D	GEOTECHNICAL (DISTURBED)	5/16/2014	5/22/2014
Sample Type: GEOTECHNICAL		Location: OTHER	Station: 29+79.6 Offset, ft: 63.0 LT Dbfg, ft: 4.5-6.5	
WIN/Town 016667.00 - MILFORD			Sampler: WILDER, BRUCE H	

TEST RESULTS

Sieve Analysis (T 88)	
Wash Method	
SIEVE SIZE U.S. [SI]	% Passing
3 in. [75.0 mm]	
1 in. [25.0 mm]	
¾ in. [19.0 mm]	
½ in. [12.5 mm]	
⅜ in. [9.5 mm]	
¼ in. [6.3 mm]	
No. 4 [4.75 mm]	100.0
No. 10 [2.00 mm]	100.0
No. 20 [0.850 mm]	
No. 40 [0.425 mm]	99.7
No. 60 [0.250 mm]	
No. 100 [0.150 mm]	
No. 200 [0.075 mm]	99.4
[0.0242 mm]	98.9
[0.0155 mm]	96.0
[0.0092 mm]	93.1
[0.0066 mm]	90.1
[0.0047 mm]	87.2
[0.0025 mm]	75.6
[0.0012 mm]	58.2

Miscellaneous Tests	
Liquid Limit @ 25 blows (T 89), %	34
Plastic Limit (T 90), %	25
Plasticity Index (T 90), %	9
Specific Gravity, Corrected to 20°C (T 100)	2.72
Loss on Ignition (T 267)	
Loss, %	
H2O, %	
Water Content (T 265), %	33.3

Consolidation (T 216)					
Trimmings, Water Content, %					
	Initial	Final		Void Ratio	% Strain
Water Content, %			Pmin		
Dry Density, lbs/ft³			Pp		
Void Ratio			Pmax		
Saturation, %			Cc/C'c		

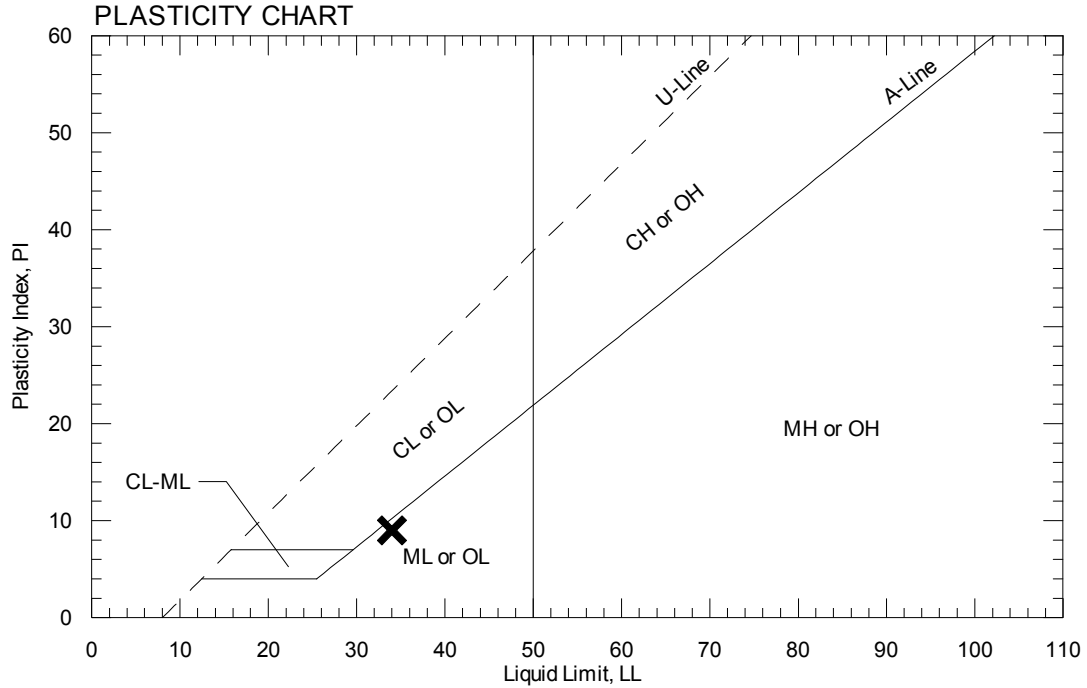
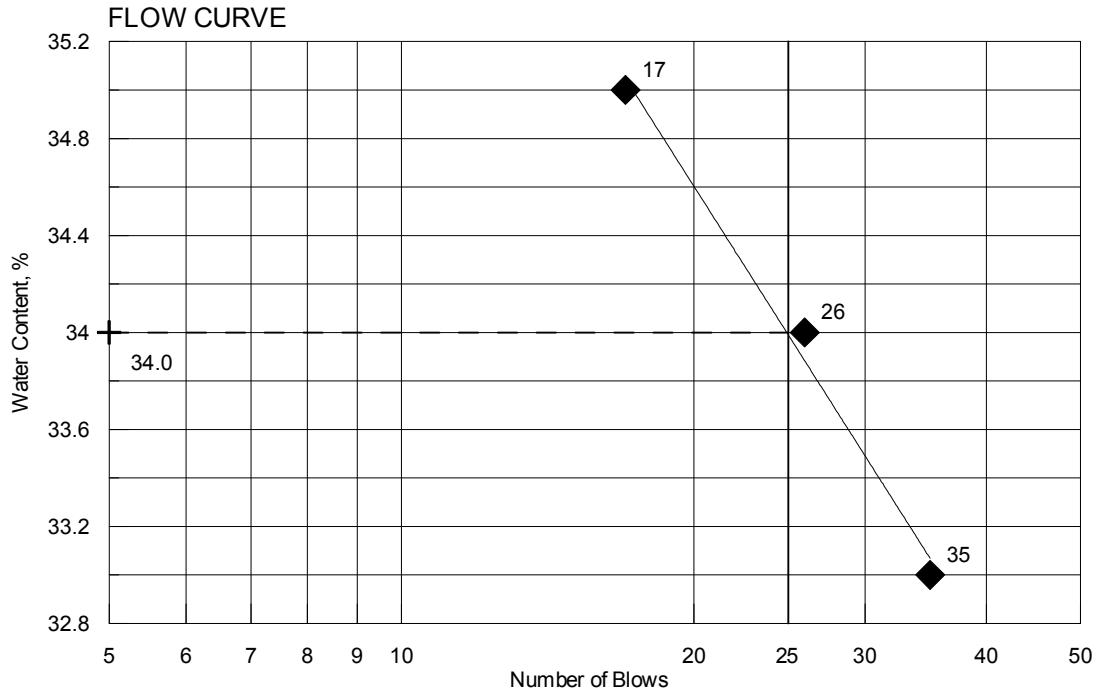
Vane Shear Test on Shelby Tubes (Maine DOT)						
Depth taken in tube, ft	3 In.		6 In.		Water Content, %	Description of Material Sampled at the Various Tube Depths
	U. Shear	Remold	U. Shear	Remold		
	tons/ft²	tons/ft²	tons/ft²	tons/ft²		

Comments:

AUTHORIZATION AND DISTRIBUTION

Reported by: **FOGG, BRIAN**
Date Reported: **5/28/2014**

TOWN	Milford	Reference No.	262809
WIN	016667.00	Water Content, %	33.3
Sampled	5/16/2014	Liquid Limit @ 25 blows (T 89), %	34
Boring No./Sample No.	BB-MOS-202A/1D	Plastic Limit (T 90), %	25
Station	29+79.6	Plasticity Index (T 90), %	9
Depth	4.5-6.5	Tested By	BBURR





GEOTECHNICAL TEST REPORT

Central Laboratory

S A M P L E I N F O R M A T I O N

Reference No.	Boring No./Sample No.	Sample Description	Sampled	Received
262808	BB-MOS-203/1D	GEOTECHNICAL (DISTURBED)	5/16/2014	5/22/2014
Sample Type: GEOTECHNICAL Location: OTHER		Station: 30+08.5 Offset, ft: 59.6 LT Dbfg, ft: 3.0-5.5		
WIN/Town 016667.00 - MILFORD		Sampler: WILDER, BRUCE H		

T E S T R E S U L T S

Sieve Analysis (T 88)

Wash Method

SIEVE SIZE U.S. [SI]	% Passing
3 in. [75.0 mm]	
1 in. [25.0 mm]	
¾ in. [19.0 mm]	
½ in. [12.5 mm]	
⅜ in. [9.5 mm]	
¼ in. [6.3 mm]	100.0
No. 4 [4.75 mm]	100.0
No. 10 [2.00 mm]	99.9
No. 20 [0.850 mm]	
No. 40 [0.425 mm]	99.2
No. 60 [0.250 mm]	
No. 100 [0.150 mm]	
No. 200 [0.075 mm]	97.2
[0.0247 mm]	96.3
[0.0162 mm]	90.3
[0.0097 mm]	84.2
[0.0070 mm]	78.2
[0.0051 mm]	72.2
[0.0027 mm]	60.1
[0.0012 mm]	45.2

Miscellaneous Tests

Liquid Limit @ 25 blows (T 89), %	37
Plastic Limit (T 90), %	24
Plasticity Index (T 90), %	13
Specific Gravity, Corrected to 20°C (T 100)	2.75
Loss on Ignition (T 267)	
Loss, %	
H ₂ O, %	
Water Content (T 265), %	46.1

Consolidation (T 216)

Trimmings, Water Content, %

	Initial	Final		Void Ratio	% Strain
Water Content, %			P _{min}		
Dry Density, lbs/ft ³			P _p		
Void Ratio			P _{max}		
Saturation, %			C _c /C' _c		

Vane Shear Test on Shelby Tubes (Maine DOT)

Depth taken in tube, ft	3 In.		6 In.		Water Content, %	Description of Material Sampled at the Various Tube Depths
	U. Shear tons/ft ²	Remold tons/ft ²	U. Shear tons/ft ²	Remold tons/ft ²		

Comments:

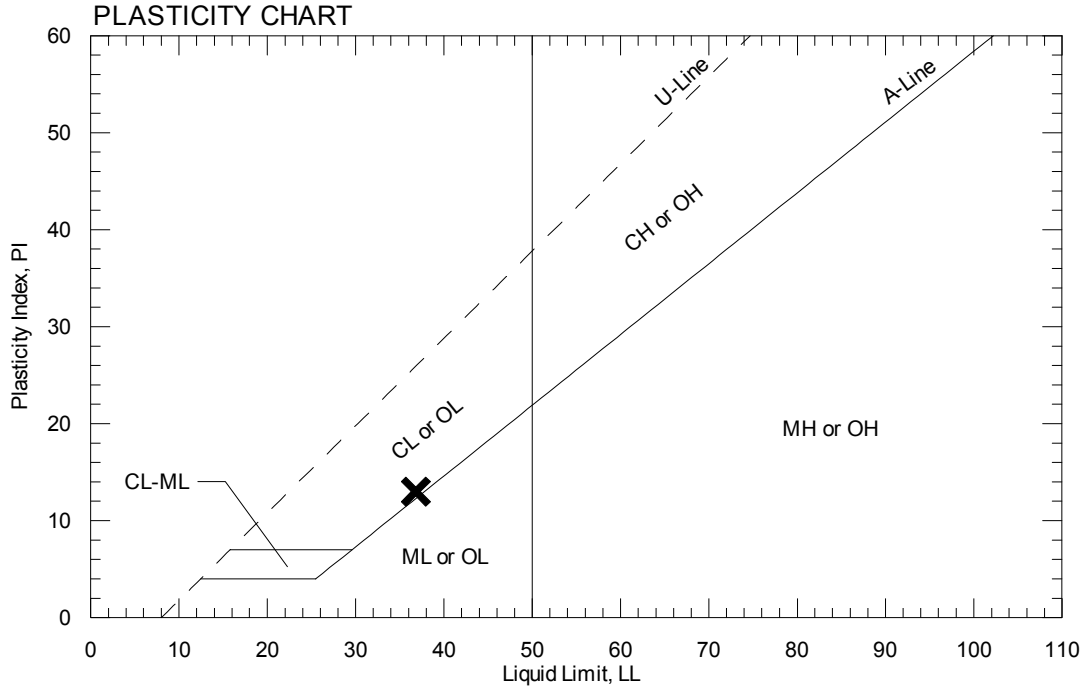
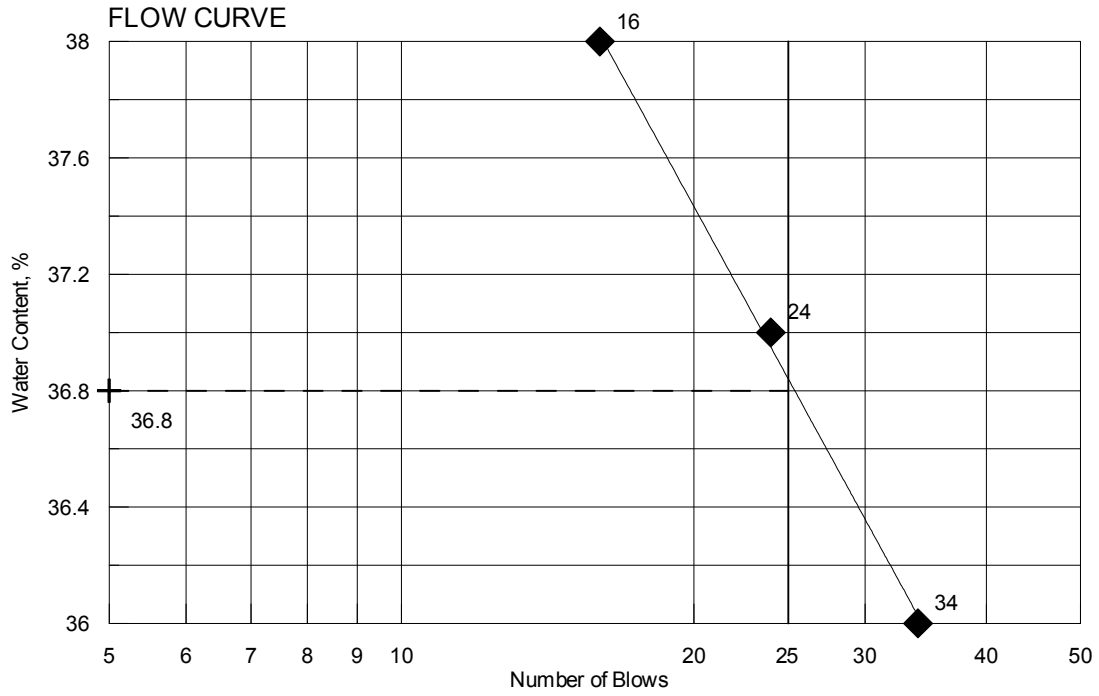
A U T H O R I Z A T I O N A N D D I S T R I B U T I O N

Reported by: **FOGG, BRIAN**

Date Reported: **5/27/2014**

Paper Copy: Lab File; Project File; Geotech File

TOWN	Milford	Reference No.	262808
WIN	016667.00	Water Content, %	46.1
Sampled	5/16/2014	Liquid Limit @ 25 blows (T 89), %	37
Boring No./Sample No.	BB-MOS-203/1D	Plastic Limit (T 90), %	24
Station	30+08.5	Plasticity Index (T 90), %	13
Depth	3.0-5.5	Tested By	BBURR



Central Laboratory
Test Reports
300-series borings



GEOTECHNICAL TEST REPORT

Central Laboratory

SAMPLE INFORMATION

Reference No.	Boring No./Sample No.	Sample Description	Sampled	Received
245369	BB-MOS-301/2D	GEOTECHNICAL (DISTURBED)	6/6/2014	6/16/2014
Sample Type: GEOTECHNICAL Location: OTHER		Station: 29+69 Offset, ft: 7.5 LT Dbfg, ft: 5.0-7.0	Sampler: WILDER, BRUCE H	
WIN/Town 016667.00 - MILFORD				

TEST RESULTS

Sieve Analysis (T 27, T 11)

Wash Method

Procedure A

SIEVE SIZE U.S. [SI]	% Passing
3 in. [75.0 mm]	100.0
1 in. [25.0 mm]	90.4
¾ in. [19.0 mm]	87.9
½ in. [12.5 mm]	85.1
⅜ in. [9.5 mm]	82.9
¼ in. [6.3 mm]	77.8
No. 4 [4.75 mm]	74.5
No. 10 [2.00 mm]	64.0
No. 20 [0.850 mm]	48.9
No. 40 [0.425 mm]	36.9
No. 60 [0.250 mm]	27.3
No. 100 [0.150 mm]	18.7
No. 200 [0.075 mm]	12.2

Miscellaneous Tests

Liquid Limit @ 25 blows (T 89), %	
Plastic Limit (T 90), %	
Plasticity Index (T 90), %	
Specific Gravity, Corrected to 20°C (T 100)	
Loss on Ignition (T 267)	
Loss, %	
H ₂ O, %	
Water Content (T 265), %	4.4

Consolidation (T 216)

Trimming, Water Content, %

	Initial	Final		Void Ratio	% Strain
Water Content, %			P _{min}		
Dry Density, lbs/ft ³			P _p		
Void Ratio			P _{max}		
Saturation, %			C _c /C _{c'}		

Vane Shear Test on Shelby Tubes (Maine DOT)

Depth taken in tube, ft	3 In.		6 In.		Water Content, %	Description of Material Sampled at the Various Tube Depths
	U. Shear	Remold	U. Shear	Remold		
	tons/ft ²	tons/ft ²	tons/ft ²	tons/ft ²		

Comments:

Performed ASTM D1140 method "B" and soaked for 24 hours. The dry mass was determined directly. The percent passing the No. 200 by washing was 11.6%.

AUTHORIZATION AND DISTRIBUTION

Reported by: **FOGG, BRIAN**Date Reported: **6/20/2014**

Paper Copy: Lab File; Project File; Geotech File



GEOTECHNICAL TEST REPORT

Central Laboratory

SAMPLE INFORMATION

Reference No.	Boring No./Sample No.	Sample Description	Sampled	Received
245370	BB-MOS-301/3D	GEOTECHNICAL (DISTURBED)	6/6/2014	6/16/2014
Sample Type: GEOTECHNICAL Location: OTHER		Station: 29+69 Offset, ft: 7.5 LT Dbfg, ft: 18.0-20.0	Sampler: WILDER, BRUCE H	
WIN/Town 016667.00 - MILFORD				

TEST RESULTS

Sieve Analysis (T 27, T 11)

Wash Method

Procedure A

SIEVE SIZE U.S. [SI]	% Passing
3 in. [75.0 mm]	
1 in. [25.0 mm]	100.0
¾ in. [19.0 mm]	72.1
½ in. [12.5 mm]	62.3
⅜ in. [9.5 mm]	54.1
¼ in. [6.3 mm]	48.0
No. 4 [4.75 mm]	43.5
No. 10 [2.00 mm]	35.8
No. 20 [0.850 mm]	31.1
No. 40 [0.425 mm]	27.7
No. 60 [0.250 mm]	24.9
No. 100 [0.150 mm]	22.7
No. 200 [0.075 mm]	21.0

Miscellaneous Tests

Liquid Limit @ 25 blows (T 89), %	
Plastic Limit (T 90), %	
Plasticity Index (T 90), %	
Specific Gravity, Corrected to 20°C (T 100)	
Loss on Ignition (T 267)	
Loss, %	17.4
H ₂ O, %	26.2
Water Content (T 265), %	26.2

Consolidation (T 216)

Trimming, Water Content, %

	Initial	Final		Void Ratio	% Strain
Water Content, %			P _{min}		
Dry Density, lbs/ft ³			P _p		
Void Ratio			P _{max}		
Saturation, %			C _c /C _c		

Vane Shear Test on Shelby Tubes (Maine DOT)

Depth taken in tube, ft	3 In.		6 In.		Water Content, %	Description of Material Sampled at the Various Tube Depths
	U. Shear	Remold	U. Shear	Remold		
	tons/ft ²	tons/ft ²	tons/ft ²	tons/ft ²		

Comments:

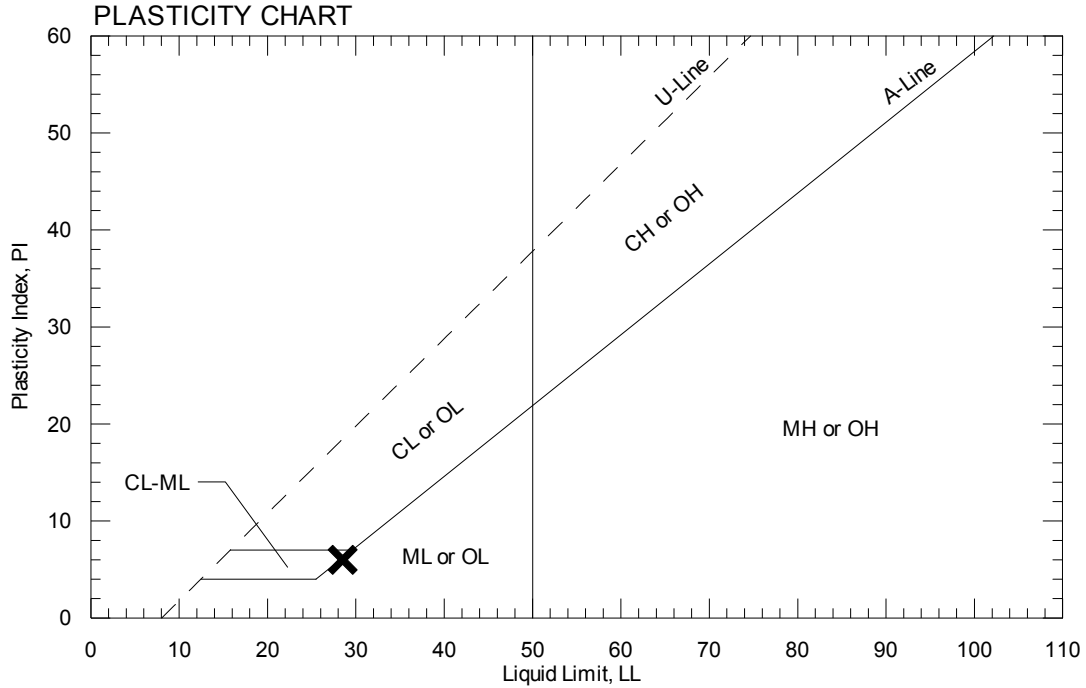
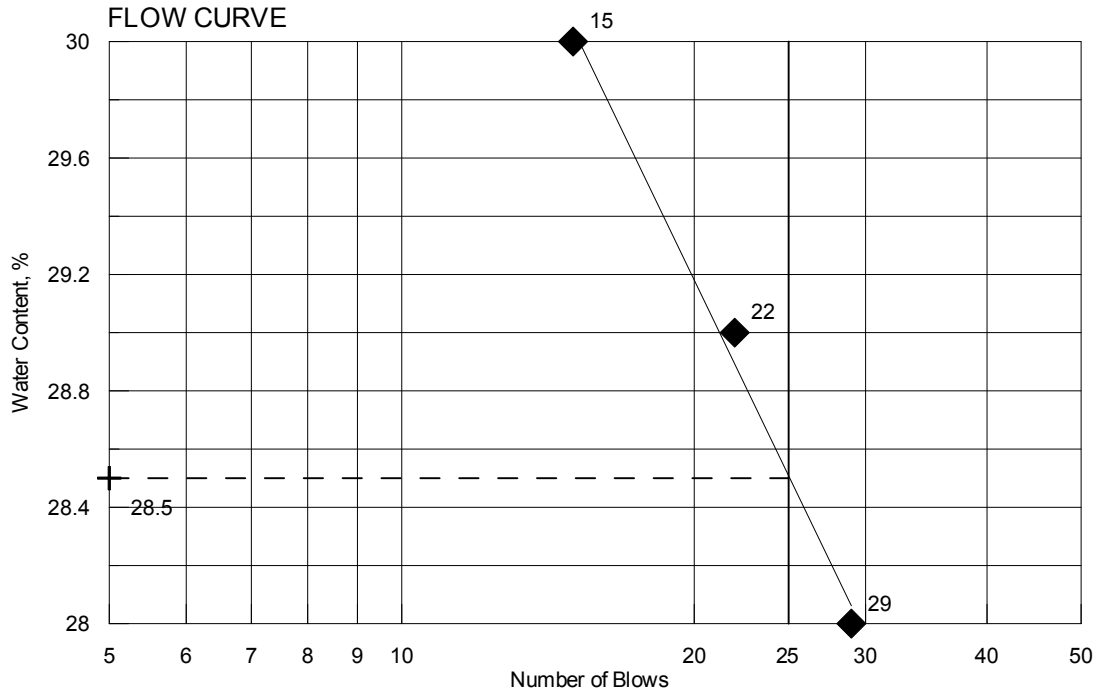
Performed ASTM D1140 method "B" and soaked for 24 hours. The dry mass was determined directly. The percent passing the No. 200 by washing was 20.8%.

AUTHORIZATION AND DISTRIBUTION

Reported by: **FOGG, BRIAN**Date Reported: **6/20/2014**

Paper Copy: Lab File; Project File; Geotech File

TOWN	Milford	Reference No.	245371
WIN	016667.00	Water Content, %	26.7
Sampled	6/6/2014	Liquid Limit @ 25 blows (T 89), %	29
Boring No./Sample No.	BB-MOS-301/4D	Plastic Limit (T 90), %	23
Station	29+69	Plasticity Index (T 90), %	6
Depth	20.0-22.0	Tested By	BBURR





GEOTECHNICAL TEST REPORT

Central Laboratory

SAMPLE INFORMATION

Reference No.	Boring No./Sample No.	Sample Description	Sampled	Received
245372	BB-MOS-301/5D	GEOTECHNICAL (DISTURBED)	6/9/2014	6/16/2014
Sample Type: GEOTECHNICAL Location: OTHER		Station: 29+69 Offset, ft: 7.5 LT Dbfg, ft: 35.0-37.0	Sampler: WILDER, BRUCE H	
WIN/Town 016667.00 - MILFORD				

TEST RESULTS

Sieve Analysis (T 27, T 11)

Wash Method

Procedure A

SIEVE SIZE U.S. [SI]	% Passing
3 in. [75.0 mm]	
1 in. [25.0 mm]	100.0
¾ in. [19.0 mm]	96.7
½ in. [12.5 mm]	89.9
⅜ in. [9.5 mm]	88.6
¼ in. [6.3 mm]	85.0
No. 4 [4.75 mm]	82.6
No. 10 [2.00 mm]	76.4
No. 20 [0.850 mm]	69.7
No. 40 [0.425 mm]	63.4
No. 60 [0.250 mm]	57.7
No. 100 [0.150 mm]	50.8
No. 200 [0.075 mm]	40.4

Miscellaneous Tests

Liquid Limit @ 25 blows (T 89), %	
Plastic Limit (T 90), %	
Plasticity Index (T 90), %	
Specific Gravity, Corrected to 20°C (T 100)	
Loss on Ignition (T 267)	
Loss, %	
H ₂ O, %	
Water Content (T 265), %	10.1

Consolidation (T 216)

Trimming, Water Content, %

	Initial	Final		Void Ratio	% Strain
Water Content, %			P _{min}		
Dry Density, lbs/ft ³			P _p		
Void Ratio			P _{max}		
Saturation, %			C _c /C _{c'}		

Vane Shear Test on Shelby Tubes (Maine DOT)

Depth taken in tube, ft	3 In.		6 In.		Water Content, %	Description of Material Sampled at the Various Tube Depths
	U. Shear	Remold	U. Shear	Remold		
	tons/ft ²	tons/ft ²	tons/ft ²	tons/ft ²		

Comments:

AUTHORIZATION AND DISTRIBUTION

Reported by: **FOGG, BRIAN**Date Reported: **6/20/2014**

Paper Copy: Lab File; Project File; Geotech File



GEOTECHNICAL TEST REPORT

Central Laboratory

SAMPLE INFORMATION

Reference No.	Boring No./Sample No.	Sample Description	Sampled	Received
245373	BB-MOS-301/6D	GEOTECHNICAL (DISTURBED)	6/9/2014	6/16/2014
Sample Type: GEOTECHNICAL Location:		Station: 29+69 Offset, ft: 7.5 LT Dbfg, ft: 40.0-42.0	Sampler: WILDER, BRUCE H	
WIN/Town 016667.00 - MILFORD				

TEST RESULTS

Sieve Analysis (T 27, T 11)

Wash Method	
Procedure A	
SIEVE SIZE U.S. [SI]	% Passing
3 in. [75.0 mm]	
1 in. [25.0 mm]	
¾ in. [19.0 mm]	
½ in. [12.5 mm]	100.0
⅜ in. [9.5 mm]	93.8
¼ in. [6.3 mm]	89.7
No. 4 [4.75 mm]	87.1
No. 10 [2.00 mm]	79.7
No. 20 [0.850 mm]	71.8
No. 40 [0.425 mm]	65.1
No. 60 [0.250 mm]	59.2
No. 100 [0.150 mm]	52.6
No. 200 [0.075 mm]	44.4

Miscellaneous Tests

Liquid Limit @ 25 blows (T 89), %	
Plastic Limit (T 90), %	
Plasticity Index (T 90), %	
Specific Gravity, Corrected to 20°C (T 100)	
Loss on Ignition (T 267)	
Loss, %	
H ₂ O, %	
Water Content (T 265), %	10.0

Consolidation (T 216)

Trimming, Water Content, %					
	Initial	Final		Void Ratio	% Strain
Water Content, %			P _{min}		
Dry Density, lbs/ft ³			P _p		
Void Ratio			P _{max}		
Saturation, %			C _c /C' _c		

Vane Shear Test on Shelby Tubes (Maine DOT)

Depth taken in tube, ft	3 In.		6 In.		Water Content, %	Description of Material Sampled at the Various Tube Depths
	U. Shear	Remold	U. Shear	Remold		
	tons/ft ²	tons/ft ²	tons/ft ²	tons/ft ²		

Comments:

AUTHORIZATION AND DISTRIBUTION

Reported by: **FOGG, BRIAN**

Date Reported: **6/20/2014**

Paper Copy: Lab File; Project File; Geotech File



GEOTECHNICAL TEST REPORT

Central Laboratory

SAMPLE INFORMATION

Reference No.	Boring No./Sample No.	Sample Description	Sampled	Received
245374	BB-MOS-301/7D	GEOTECHNICAL (DISTURBED)	6/9/2014	6/16/2014
Sample Type: GEOTECHNICAL Location: OTHER		Station: 29+69 Offset, ft: 7.5 LT Dbfg, ft: 45.0-47.0	Sampler: WILDER, BRUCE H	
WIN/Town 016667.00 - MILFORD				

TEST RESULTS

Sieve Analysis (T 27, T 11)

Wash Method	
Procedure A	
SIEVE SIZE U.S. [SI]	% Passing
3 in. [75.0 mm]	100.0
1 in. [25.0 mm]	88.4
¾ in. [19.0 mm]	88.4
½ in. [12.5 mm]	86.7
⅜ in. [9.5 mm]	81.4
¼ in. [6.3 mm]	77.6
No. 4 [4.75 mm]	74.9
No. 10 [2.00 mm]	69.1
No. 20 [0.850 mm]	62.4
No. 40 [0.425 mm]	56.1
No. 60 [0.250 mm]	50.5
No. 100 [0.150 mm]	44.4
No. 200 [0.075 mm]	36.9

Miscellaneous Tests

Liquid Limit @ 25 blows (T 89), %	
Plastic Limit (T 90), %	
Plasticity Index (T 90), %	
Specific Gravity, Corrected to 20°C (T 100)	
Loss on Ignition (T 267)	
Loss, %	
H ₂ O, %	
Water Content (T 265), %	8.7

Consolidation (T 216)

Trimmings, Water Content, %					
	Initial	Final		Void Ratio	% Strain
Water Content, %			P _{min}		
Dry Density, lbs/ft ³			P _p		
Void Ratio			P _{max}		
Saturation, %			C _c /C _c '		

Vane Shear Test on Shelby Tubes (Maine DOT)

Depth taken in tube, ft	3 In.		6 In.		Water Content, %	Description of Material Sampled at the Various Tube Depths
	U. Shear	Remold	U. Shear	Remold		
	tons/ft ²	tons/ft ²	tons/ft ²	tons/ft ²		

Comments:

AUTHORIZATION AND DISTRIBUTION

Reported by: **FOGG, BRIAN**

Date Reported: **6/20/2014**

Paper Copy: Lab File; Project File; Geotech File

GeoTesting Express
Test Reports
300-series borings



Client:	HNTB Corporation				
Project:	Milford Slope Repair				
Location:	Milford, ME	Project No:	GTX-301966		
Boring ID:	---	Sample Type:	---	Tested By:	md
Sample ID:	---	Test Date:	07/03/14	Checked By:	jdt
Depth :	---	Test Id:	299513		

Moisture Content of Soil and Rock - ASTM D2216

Boring ID	Sample ID	Depth	Description	Moisture Content, %
BB-MOS-301	1U	23.5-25.5 ft	Moist, very dark gray clay	29.2
BB-MOS-301	2U	30.5-32.5 ft	Moist, very dark gray clay	34.5

Notes: Temperature of Drying : 110° Celsius



Client:	HNTB Corporation		Project No:	GTX-301966
Project:	Milford Slope Repair			
Location:	Milford, ME			
Boring ID:	---	Sample Type:	---	Tested By: jek
Sample ID:	---	Test Date:	07/03/14	Checked By: jdt
Depth :	---	Test Id:	299515	

Moisture, Ash, and Organic Matter - ASTM D2974

Boring ID	Sample ID	Depth	Description	Moisture Content, %	Ash Content, %	Organic Matter, %
BB-MOS-301	1U	23.5-25.5 ft	Moist, very dark gray clay	29	98.5	1.5
BB-MOS-301	2U	30.5-32.5 ft	Moist, very dark gray clay	32	99.0	1.0

Notes: Moisture content determined by Method A and reported as a percentage of oven-dried mass; dried to a constant mass at temperature of 105° C
 Ash content and organic matter determined by Method C; dried to constant mass at temperature 440° C



Client:	HNTB Corporation		
Project:	Milford Slope Repair		
Location:	Milford, ME	Project No:	GTX-301966
Boring ID:	---	Sample Type:	---
Sample ID:	---	Test Date:	06/28/14
Depth :	---	Test Id:	299519

**Laboratory Determination of Density (Unit Weight)
of Soil Specimens by ASTM D7263**

Boring ID	Sample ID	Depth	Visual Description	Bulk Density pcf	Moisture Content %	Dry Density pcf	*
BB-MOS-301	1U	23.5-25.5 ft	Moist, very dark gray clay	117.4	30.38	90.05	(1)
BB-MOS-301	2U	30.5-32.5 ft	Moist, very dark gray clay	118.5	32.35	89.56	(2)

* Sample Comments

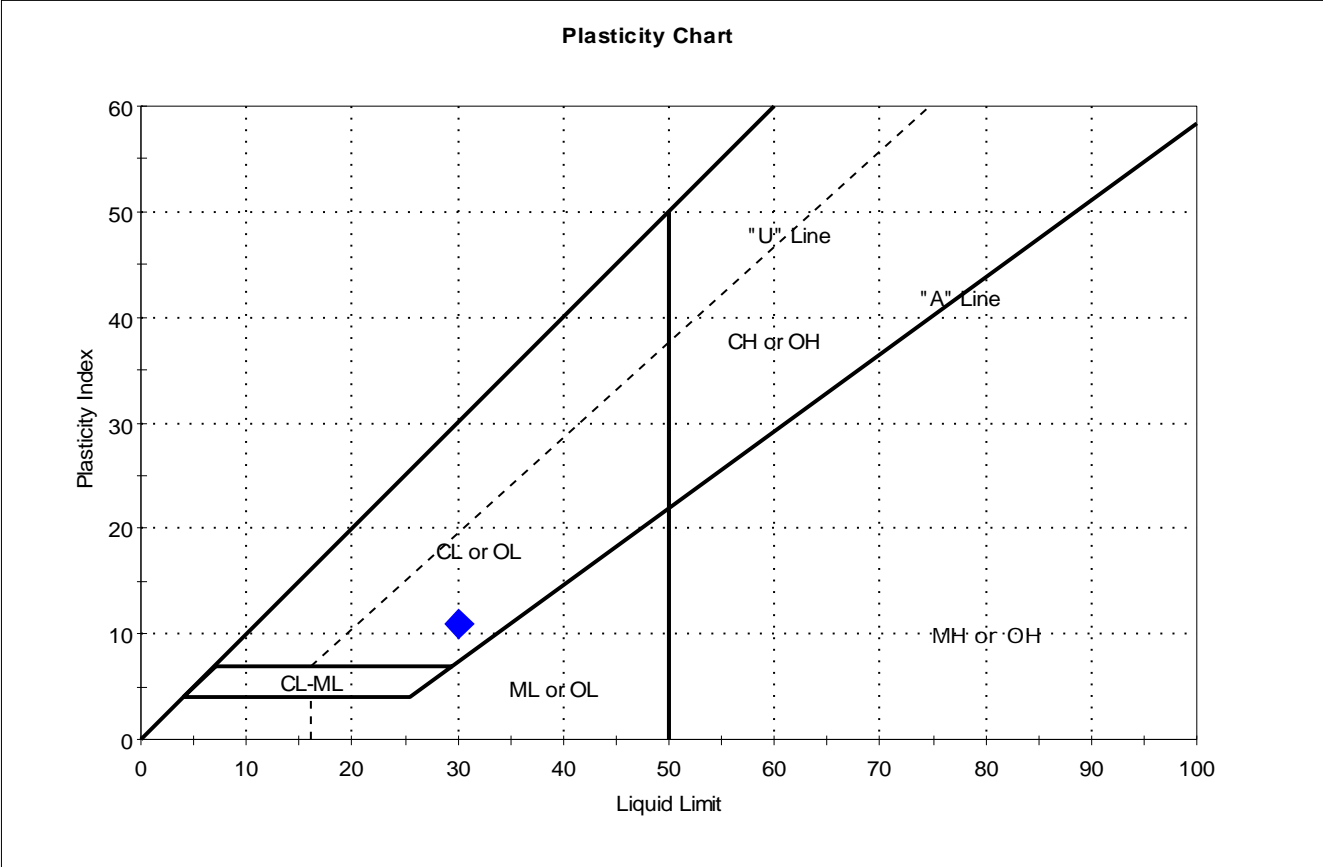
- (1): Method B-Cylinder, Intact
- (2): Method B-Cylinder, Intact

Notes: Moisture Content determined by ASTM D2216.



Client: HNTB Corporation	Project: Milford Slope Repair	Location: Milford, ME	Project No: GTX-301966
Boring ID: BB-MOS-301	Sample Type: tube	Tested By: cam	
Sample ID: 1U	Test Date: 07/03/14	Checked By: jdt	
Depth: 23.5-25.5 ft	Test Id: 299508		
Test Comment: ---			
Sample Description: Moist, very dark gray clay			
Sample Comment: ---			

Atterberg Limits - ASTM D4318



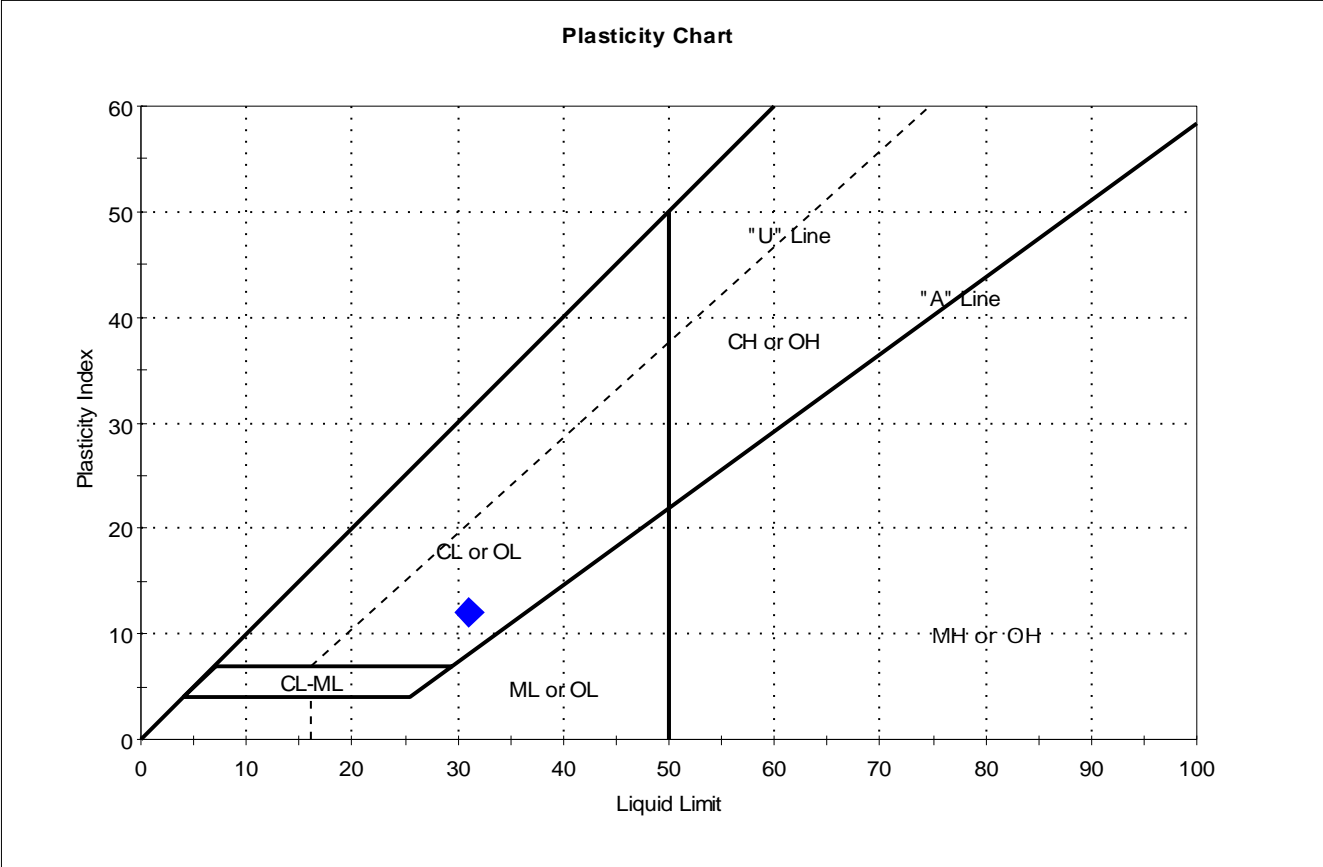
Symbol	Sample ID	Boring	Depth	Natural Moisture Content, %	Liquid Limit	Plastic Limit	Plasticity Index	Liquidity Index	Soil Classification
◆	1U	B-MOS-301	23.5-25.5 ft	29	30	19	11	0.9	Lean clay (CL)

Sample Prepared using the WET method
 0% Retained on #40 Sieve
 Dry Strength: VERY HIGH
 Dilatancy: RAPID
 Toughness: LOW



Client: HNTB Corporation	Project: Milford Slope Repair	Location: Milford, ME	Project No: GTX-301966
Boring ID: BB-MOS-301	Sample Type: tube	Tested By: cam	
Sample ID: 2U	Test Date: 07/03/14	Checked By: jdt	
Depth: 30.5-32.5 ft	Test Id: 299509		
Test Comment: ---			
Sample Description: Moist, very dark gray clay			
Sample Comment: ---			

Atterberg Limits - ASTM D4318



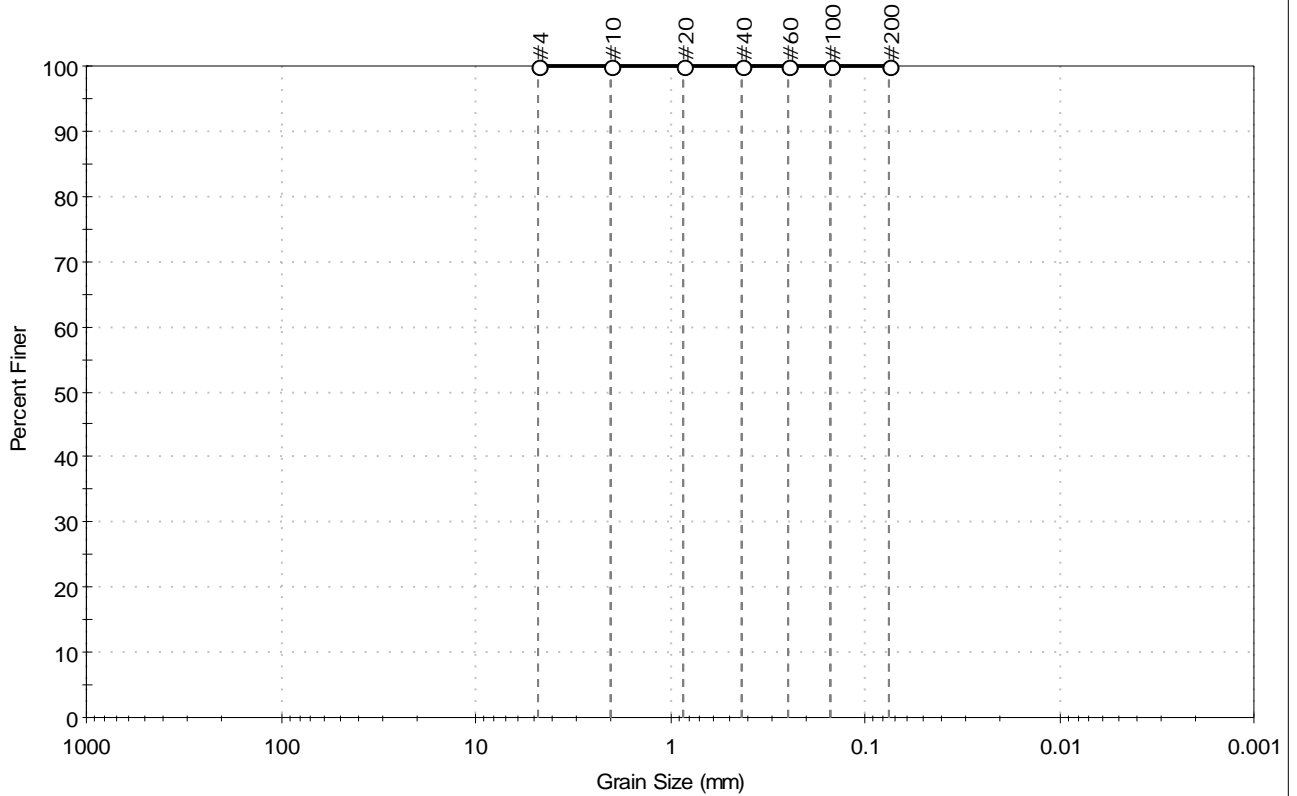
Symbol	Sample ID	Boring	Depth	Natural Moisture Content, %	Liquid Limit	Plastic Limit	Plasticity Index	Liquidity Index	Soil Classification
◆	2U	B-MOS-301	30.5-32.5 ft	34	31	19	12	1.3	Lean clay (CL)

Sample Prepared using the WET method
 0% Retained on #40 Sieve
 Dry Strength: VERY HIGH
 Dilatancy: SLOW
 Toughness: LOW



Client: HNTB Corporation	Project: Milford Slope Repair	Location: Milford, ME	Project No: GTX-301966
Boring ID: BB-MOS-301	Sample Type: tube	Tested By: jbr	Checked By: jdt
Sample ID: 1U	Test Date: 07/03/14	Test Id: 299510	
Depth: 23.5-25.5 ft			
Test Comment: ---	Sample Description: Moist, very dark gray clay		
Sample Comment: ---			

Particle Size Analysis - ASTM D422



% Cobble	% Gravel	% Sand	% Silt & Clay Size
---	0.0	0.1	99.9

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
#4	4.75	100		
#10	2.00	100		
#20	0.85	100		
#40	0.42	100		
#60	0.25	100		
#100	0.15	100		
#200	0.075	100		

<u>Coefficients</u>	
D ₈₅ = N/A	D ₃₀ = N/A
D ₆₀ = N/A	D ₁₅ = N/A
D ₅₀ = N/A	D ₁₀ = N/A
C _u = N/A	C _c = N/A

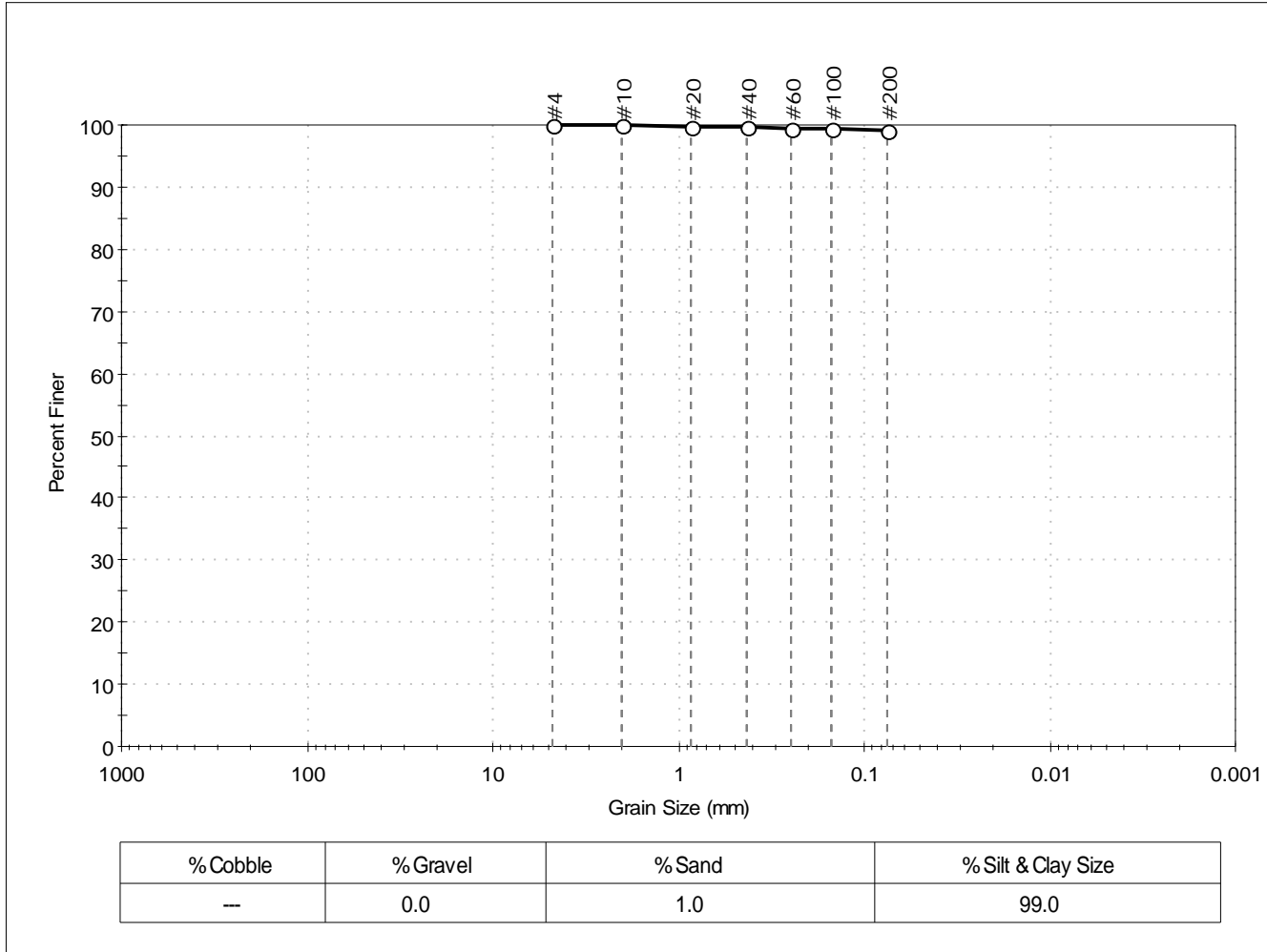
<u>Classification</u>	
<u>ASTM</u>	Lean clay (CL)
<u>AASHTO</u>	Clayey Soils (A-6 (11))

<u>Sample/Test Description</u>
Sand/Gravel Particle Shape : ---
Sand/Gravel Hardness : ---



Client: HNTB Corporation	Project: Milford Slope Repair	Location: Milford, ME	Project No: GTX-301966
Boring ID: BB-MOS-301	Sample Type: tube	Tested By: jbr	Checked By: jdt
Sample ID: 2U	Test Date: 07/03/14	Test Id: 299511	
Depth: 30.5-32.5 ft			
Test Comment: ---			
Sample Description: Moist, very dark gray clay			
Sample Comment: ---			

Particle Size Analysis - ASTM D422



Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
#4	4.75	100		
#10	2.00	100		
#20	0.85	100		
#40	0.42	100		
#60	0.25	100		
#100	0.15	99		
#200	0.075	99		

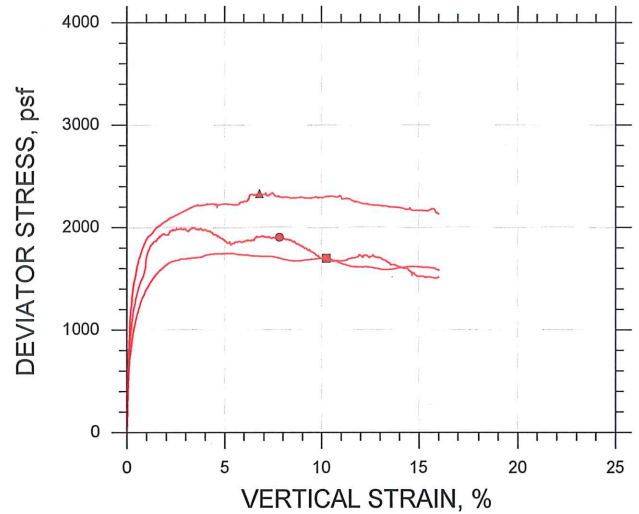
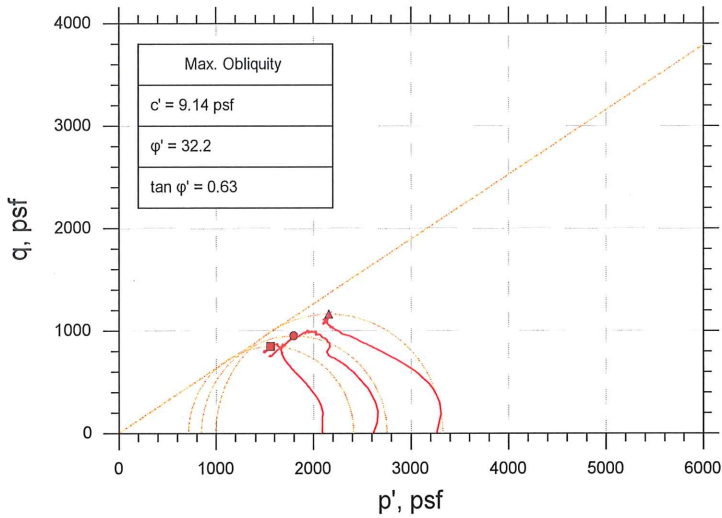
<u>Coefficients</u>	
D ₈₅ = N/A	D ₃₀ = N/A
D ₆₀ = N/A	D ₁₅ = N/A
D ₅₀ = N/A	D ₁₀ = N/A
C _u = N/A	C _c = N/A

<u>Classification</u>	
<u>ASTM</u>	Lean clay (CL)
<u>AASHTO</u>	Clayey Soils (A-6 (12))

<u>Sample/Test Description</u>	
Sand/Gravel Particle Shape :	---
Sand/Gravel Hardness :	---

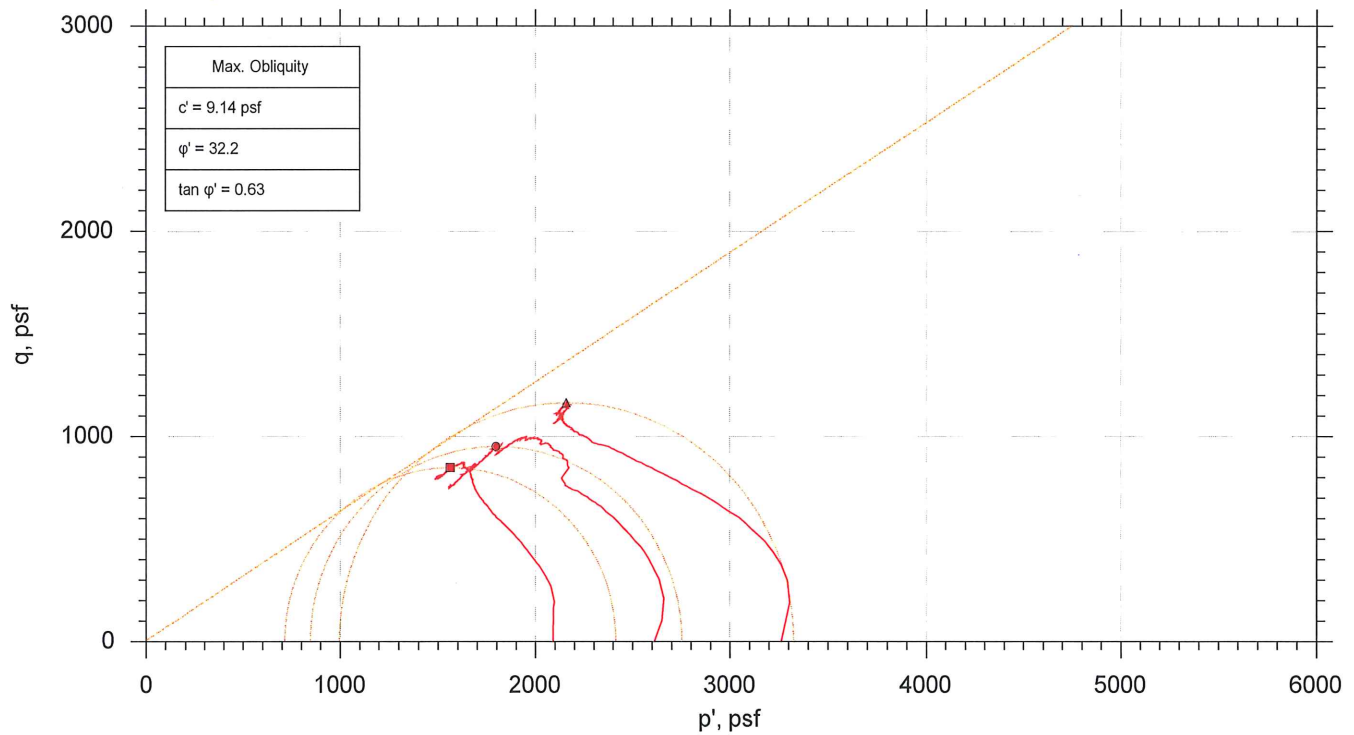
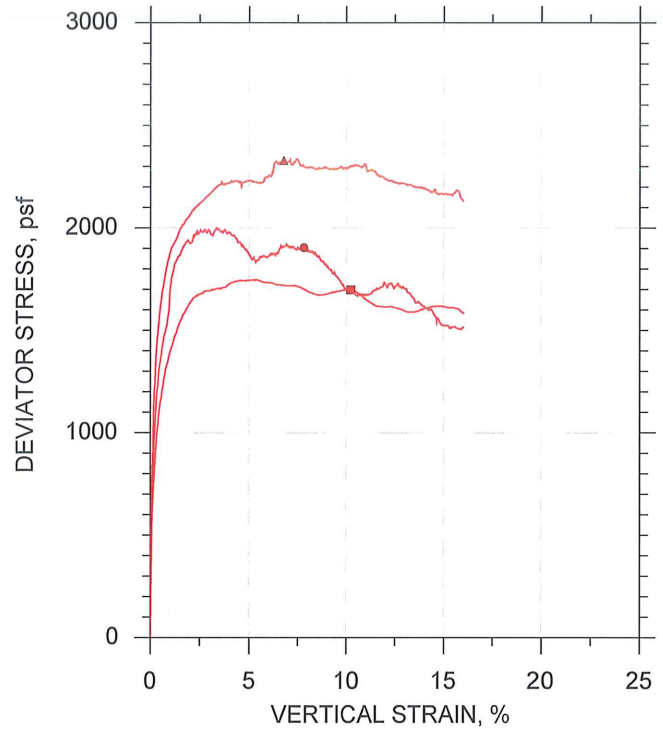
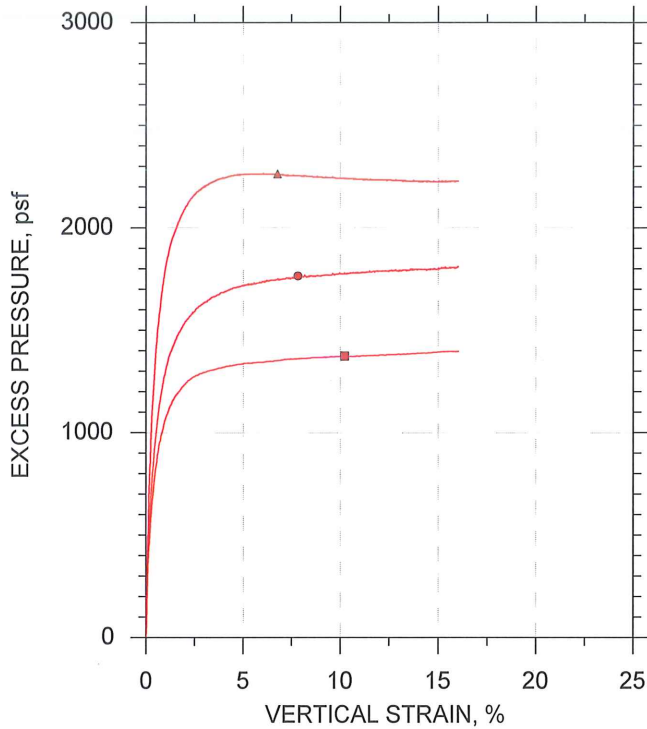
Client: HNTB Corporation	
Project Name: Milford Slope Repair	
Project Location: Milford, ME	
Project Number: GTX-301966	
Tested By: md	Checked By: jdt
Boring ID: BB-MOS-301	
Preparation: intact	
Description: Moist, very dark gray clay	
Classification: Lean Clay	
Group Symbol: CL	
Liquid Limit: 31	Plastic Limit: 19
Plasticity Index: 12	Estimated Specific Gravity: 2.7

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767




Symbol	■	●	▲	
Sample ID	2U	2U	2U	
Depth, ft	30.5-32.5 ft	30.5-32.5 ft	30.5-32.5 ft	
Test Number	CU-1-1	CU-1-2	CU-1-3	
Initial	Height, in	4.140	4.130	4.480
	Diameter, in	2.020	2.020	2.020
	Moisture Content (from Cuttings), %	31.9	33.8	32.3
	Dry Density, pcf	90.6	88.2	89.6
	Saturation (Wet Method), %	100.0	100.0	99.0
Before Shear	Void Ratio	0.861	0.912	0.882
	Moisture Content, %	30.2	30.2	28.7
	Dry Density, pcf	92.8	92.8	95.0
	Cross-sectional Area (Method A), in ²	3.151	3.087	3.071
	Saturation, %	100.0	100.0	100.0
	Void Ratio	0.816	0.817	0.774
Back Pressure, psf	1.996e+004	2.169e+004	2.140e+004	
Vertical Effective Consolidation Stress, psf	2079.	2594.	3243.	
Horizontal Effective Consolidation Stress, psf	2087.	2608.	3258.	
Vertical Strain after Consolidation, %	0.7402	1.264	1.306	
Volumetric Strain after Consolidation, %	2.383	4.753	4.757	
Time to 50% Consolidation, min	36.00	49.00	64.00	
Shear Strength, psf	849.1	952.4	1165.	
Strain at Failure, %	10.2	7.83	6.78	
Strain Rate, %/min	0.01600	0.01600	0.01600	
Deviator Stress at Failure, psf	1698.	1905.	2330.	
Effective Minor Principal Stress at Failure, psf	712.3	844.6	993.9	
Effective Major Principal Stress at Failure, psf	2411.	2749.	3323.	
B-Value	0.95	0.95	0.95	
Notes:				
<ul style="list-style-type: none"> - Before Shear Saturation set to 100% for phase calculation. - Moisture Content determined by ASTM D2216. - Atterberg Limits determined by ASTM D4318. - Deviator Stress includes membrane correction. - Values for c and ϕ determined from best-fit straight line for the specific test conditions. Actual strength parameters may vary and should be determined by an engineer for site conditions. 				
Remarks:				

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767



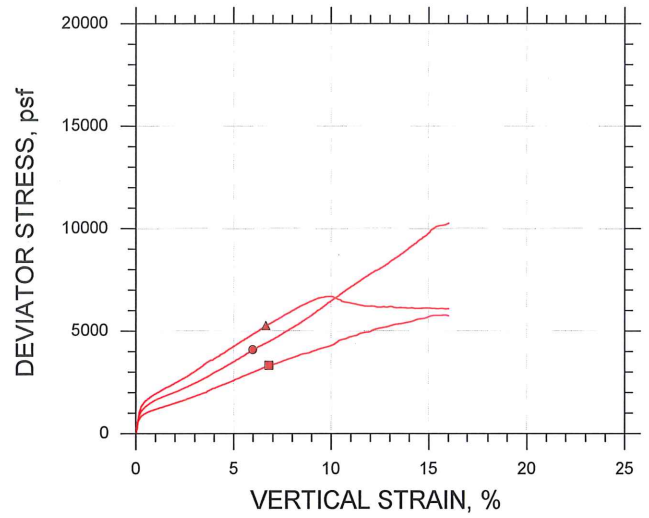
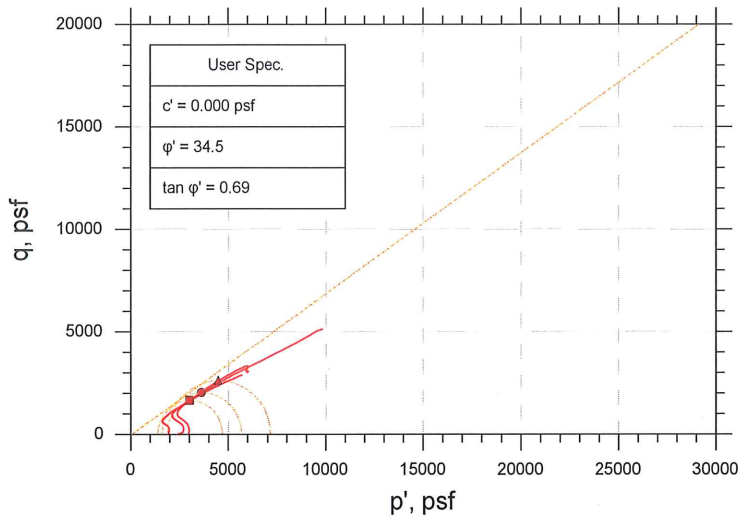
	Sample No.	Test No.	Depth	Tested By	Test Date	Checked By	Check Date	Test File
■	2U	CU-1-1	30.5-32.5 ft	md	06/26/14	jdt	7/1/14	301966-CU-1-1n.dat
●	2U	CU-1-2	30.5-32.5 ft	md	06/26/14	jdt	7/1/14	301966-CU-1-2n.dat
▲	2U	CU-1-3	30.5-32.5 ft	md	06/26/14	jdt	7/1/14	301966-CU-1-3n.dat

	Project: Milford Slope Repair		Location: Milford, ME		Project No.: GTX-301966	
	Boring No.: BB-MOS-301		Sample Type: intact			
	Description: Moist, very dark gray clay					
	Remarks: System S					



Client: HNTB Corporation	
Project Name: Milford Slope Repair	
Project Location: Milford, ME	
Project Number: GTX-301966	
Tested By: md	Checked By: jdt
Boring ID: BB-MOS-301	
Preparation: intact	
Description: Moist, very dark gray clay	
Classification: Lean Clay	
Group Symbol: CL	
Liquid Limit: 30	Plastic Limit: 19
Plasticity Index: 11	Estimated Specific Gravity: 2.7

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767



Symbol	■	●	▲	
Sample ID	1U	1U	1U	
Depth, ft	23.5-25.5 ft	23.5-25.5 ft	23.5-25.5 ft	
Test Number	CU-2-1	CU-2-2	CU-2-3	
Initial	Height, in	4.300	4.100	4.300
	Diameter, in	2.020	2.020	2.020
	Moisture Content (from Cuttings), %	27.7	28.1	30.4
	Dry Density, pcf	94.7	94.6	90.0
	Saturation (Wet Method), %	95.9	97.0	94.1
	Void Ratio	0.780	0.781	0.872
Before Shear	Moisture Content, %	25.5	27.1	26.8
	Dry Density, pcf	99.8	97.3	97.8
	Cross-sectional Area (Method A), in ²	3.092	3.158	3.012
	Saturation, %	100.0	100.0	100.0
	Void Ratio	0.690	0.731	0.723
	Back Pressure, psf	2.172e+004	2.024e+004	1.455e+004
Vertical Effective Consolidation Stress, psf	1864.	2329.	2913.	
Horizontal Effective Consolidation Stress, psf	1878.	2344.	2932.	
Vertical Strain after Consolidation, %	1.207	1.301	1.574	
Volumetric Strain after Consolidation, %	3.903	2.611	6.558	
Time to 50% Consolidation, min	100.0	100.0	174.0	
Shear Strength, psf	1666.	2045.	2631.	
Strain at Failure, %	6.80	5.98	6.65	
Strain Rate, %/min	0.01600	0.01600	0.01600	
Deviator Stress at Failure, psf	3333.	4091.	5262.	
Effective Minor Principal Stress at Failure, psf	1356.	1576.	1860.	
Effective Major Principal Stress at Failure, psf	4689.	5667.	7122.	
B-Value	0.95	0.94	0.98	

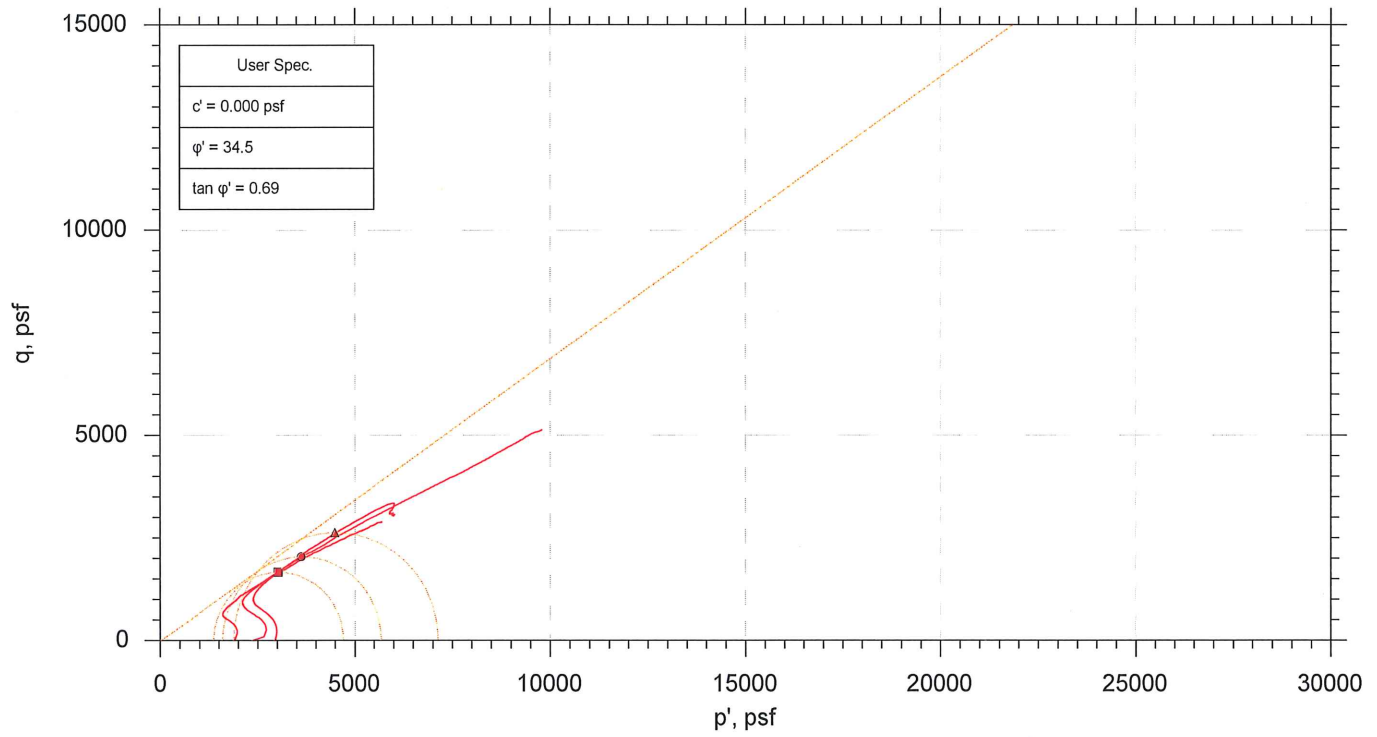
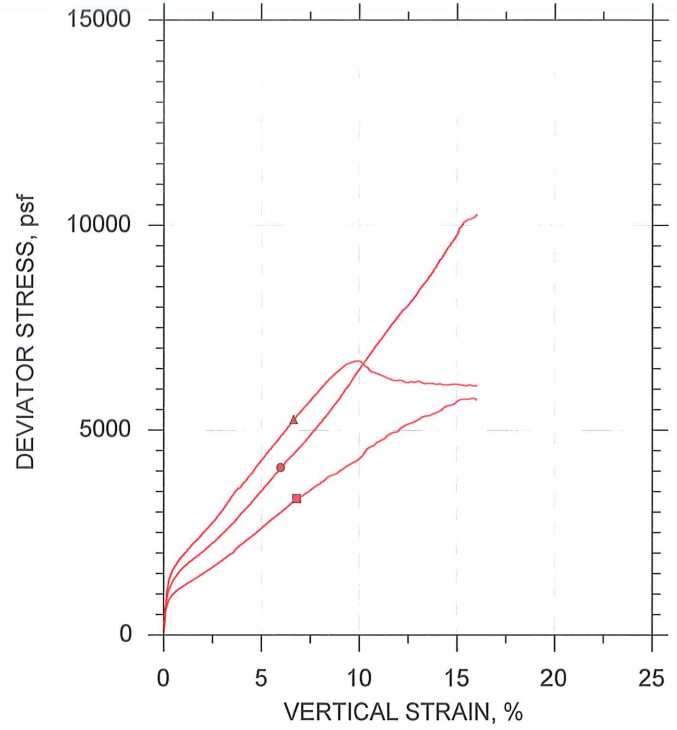
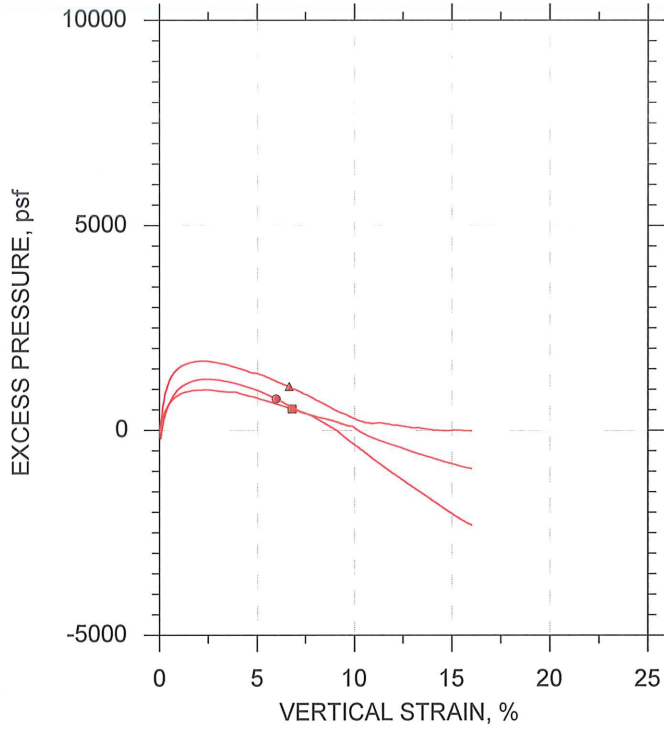
Notes:
 - Before Shear Saturation set to 100% for phase calculation.
 - Moisture Content determined by ASTM D2216.
 - Atterberg Limits determined by ASTM D4318.
 - Deviator Stress includes membrane correction.
 - Values for c and phi determined from best-fit straight line for the specific test conditions. Actual strength parameters may vary and should be determined by an engineer for site conditions.



Remarks:

System O

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767

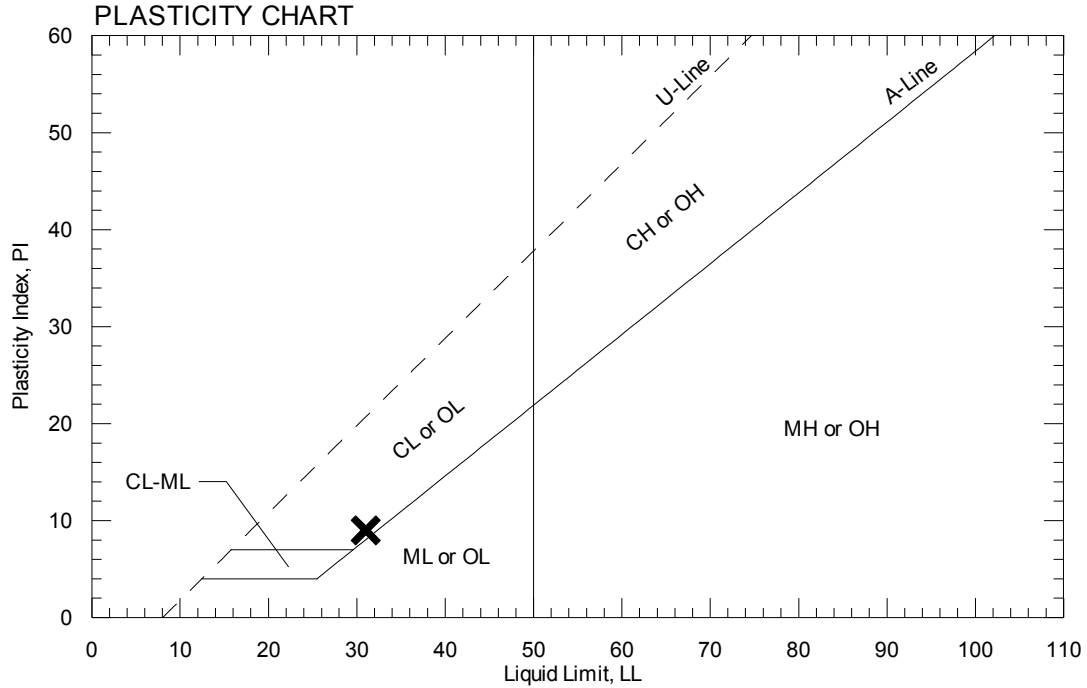
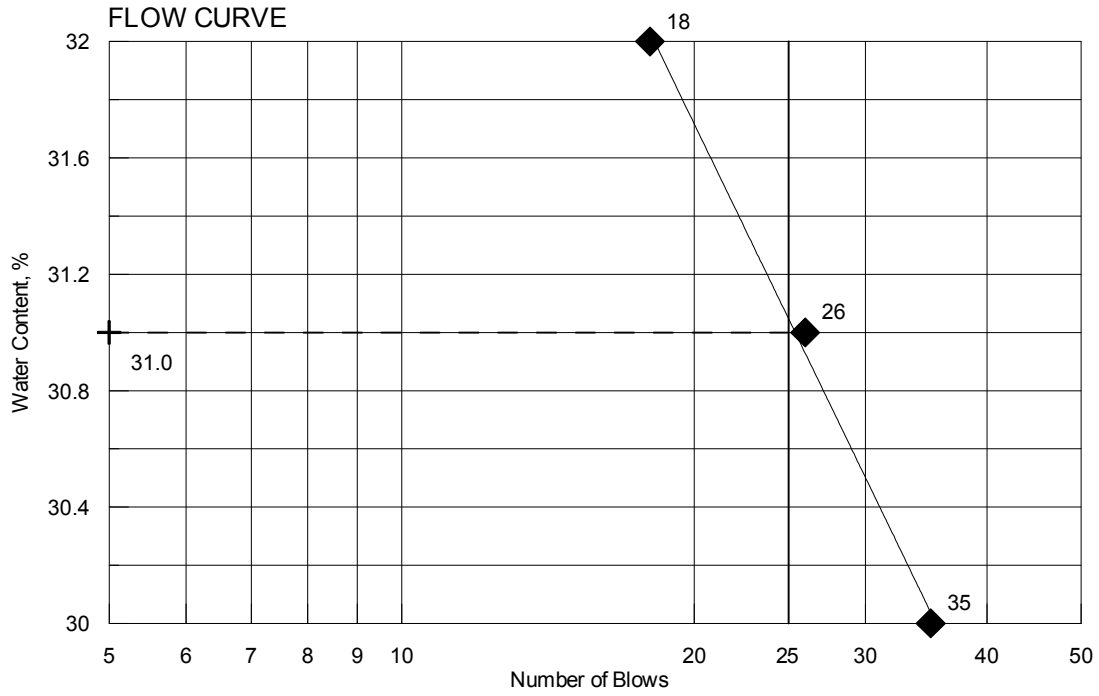


Sample No.	Test No.	Depth	Tested By	Test Date	Checked By	Check Date	Test File
■ 1U	CU-2-1	23.5-25.5 ft	md	06/28/14	jdt	7/2/14	301966-CU-2-1n.dat
● 1U	CU-2-2	23.5-25.5 ft	md	06/28/14	jdt	7/2/14	301966-CU-2-2n.dat
▲ 1U	CU-2-3	23.5-25.5 ft	md	06/26/14	jdt	7/2/14	301966-CU-2-3n.dat

	Project: Milford Slope Repair		Location: Milford, ME		Project No.: GTX-301966	
	Boring No.: BB-MOS-301		Sample Type: intact			
	Description: Moist, very dark gray clay					
	Remarks: System O					

Central Laboratory
Test Reports
400-series borings

TOWN	Milford	Reference No.	242677
WIN	016667.00	Water Content, %	24.9
Sampled	8/13/2014	Liquid Limit @ 25 blows (T 89), %	31
Boring No./Sample No.	BB-MOS-401/3D	Plastic Limit (T 90), %	22
Station	29+72.9	Plasticity Index (T 90), %	9
Depth	10.0-12.0	Tested By	BBURR



Central Laboratory
Test Reports
500-series borings



GEOTECHNICAL TEST REPORT

Central Laboratory

SAMPLE INFORMATION

Reference No.	Boring No./Sample No.	Sample Description	Sampled	Received
263881	BB-MOS-501/1D	GEOTECHNICAL (DISTURBED)	7/13/2015	7/29/2015
Sample Type: GEOTECHNICAL Location:		Station: 31+36.2 Offset, ft: 10.6 LT Dbfg, ft: 3.0-5.0	Sampler: BRUCE WILDER	
WIN/Town 016667.00 - MILFORD				

TEST RESULTS

Sieve Analysis (T 27, T 11)

Wash Method	
Procedure A	
SIEVE SIZE U.S. [SI]	% Passing
3 in. [75.0 mm]	100.0
1 in. [25.0 mm]	94.0
¾ in. [19.0 mm]	86.3
½ in. [12.5 mm]	76.4
⅜ in. [9.5 mm]	73.8
¼ in. [6.3 mm]	70.9
No. 4 [4.75 mm]	68.6
No. 10 [2.00 mm]	60.0
No. 20 [0.850 mm]	43.4
No. 40 [0.425 mm]	24.6
No. 60 [0.250 mm]	14.8
No. 100 [0.150 mm]	9.5
No. 200 [0.075 mm]	5.7

Miscellaneous Tests

Liquid Limit @ 25 blows (T 89), %	
Plastic Limit (T 90), %	
Plasticity Index (T 90), %	
Specific Gravity, Corrected to 20°C (T 100)	
Loss on Ignition (T 267)	
Loss, %	
H ₂ O, %	
Water Content (T 265), %	3.5

Consolidation (T 216)

Trimming, Water Content, %		
	Initial	Final
Water Content, %		P _{min}
Dry Density, lbs/ft ³		P _p
Void Ratio		P _{max}
Saturation, %		C _c /C _c

Vane Shear Test on Shelby Tubes (Maine DOT)

Depth taken in tube, ft	3 In.		6 In.		Water Content, %	Description of Material Sampled at the Various Tube Depths
	U. Shear	Remold	U. Shear	Remold		
	tons/ft ²	tons/ft ²	tons/ft ²	tons/ft ²		

Comments:

AUTHORIZATION AND DISTRIBUTION

Reported by: **GREGORY LIDSTONE**

Date Reported: **8/3/2015**



GEOTECHNICAL TEST REPORT

Central Laboratory

SAMPLE INFORMATION

Reference No.	Boring No./Sample No.	Sample Description	Sampled	Received
263882	BB-MOS-501/2D	GEOTECHNICAL (DISTURBED)	7/13/2015	7/29/2015
Sample Type: GEOTECHNICAL Location:		Station: 31+36.2 Offset, ft: 10.6 LT Dbfg, ft: 5.0-7.0		
WIN/Town 016667.00 - MILFORD		Sampler: BRUCE WILDER		

TEST RESULTS

Sieve Analysis (T 27, T 11)

Wash Method	
Procedure A	
SIEVE SIZE U.S. [SI]	% Passing
3 in. [75.0 mm]	
1 in. [25.0 mm]	100.0
¾ in. [19.0 mm]	93.4
½ in. [12.5 mm]	93.4
⅜ in. [9.5 mm]	91.0
¼ in. [6.3 mm]	88.4
No. 4 [4.75 mm]	85.7
No. 10 [2.00 mm]	77.0
No. 20 [0.850 mm]	61.0
No. 40 [0.425 mm]	41.8
No. 60 [0.250 mm]	28.9
No. 100 [0.150 mm]	20.8
No. 200 [0.075 mm]	14.4

Miscellaneous Tests

Liquid Limit @ 25 blows (T 89), %	
Plastic Limit (T 90), %	
Plasticity Index (T 90), %	
Specific Gravity, Corrected to 20°C (T 100)	
Loss on Ignition (T 267)	
Loss, %	
H ₂ O, %	
Water Content (T 265), %	8.2

Consolidation (T 216)

Trimming, Water Content, %				
	Initial	Final	Void Ratio	% Strain
Water Content, %			P _{min}	
Dry Density, lbs/ft ³			P _p	
Void Ratio			P _{max}	
Saturation, %			C _c /C _{c'}	

Vane Shear Test on Shelby Tubes (Maine DOT)

Depth taken in tube, ft	3 In.		6 In.		Water Content, %	Description of Material Sampled at the Various Tube Depths
	U. Shear	Remold	U. Shear	Remold		
	tons/ft ²	tons/ft ²	tons/ft ²	tons/ft ²		

Comments:

AUTHORIZATION AND DISTRIBUTION

Reported by: **GREGORY LIDSTONE**

Date Reported: **8/3/2015**



GEOTECHNICAL TEST REPORT

Central Laboratory

SAMPLE INFORMATION

Reference No.	Boring No./Sample No.	Sample Description	Sampled	Received
263883	BB-MOS-501/3D	GEOTECHNICAL (DISTURBED)	7/13/2015	7/29/2015
Sample Type: GEOTECHNICAL Location:		Station: 31+36.2 Offset, ft: 10.6 LT Dbfg, ft: 10.0-12.0	Sampler: BRUCE WILDER	
WIN/Town 016667.00 - MILFORD				

TEST RESULTS

Sieve Analysis (T 27, T 11)	
Wash Method	
Procedure A	
SIEVE SIZE U.S. [SI]	% Passing
3 in. [75.0 mm]	
1 in. [25.0 mm]	100.0
¾ in. [19.0 mm]	93.8
½ in. [12.5 mm]	74.7
⅜ in. [9.5 mm]	64.2
¼ in. [6.3 mm]	58.2
No. 4 [4.75 mm]	47.2
No. 10 [2.00 mm]	37.5
No. 20 [0.850 mm]	31.4
No. 40 [0.425 mm]	21.4
No. 60 [0.250 mm]	15.4
No. 100 [0.150 mm]	11.3
No. 200 [0.075 mm]	8.1

Miscellaneous Tests	
Liquid Limit @ 25 blows (T 89), %	
Plastic Limit (T 90), %	
Plasticity Index (T 90), %	
Specific Gravity, Corrected to 20°C (T 100)	
Loss on Ignition (T 267)	
Loss, %	
H ₂ O, %	
Water Content (T 265), %	8.9

Consolidation (T 216)					
Trimming, Water Content, %					
	Initial	Final		Void Ratio	% Strain
Water Content, %			P _{min}		
Dry Density, lbs/ft ³			P _p		
Void Ratio			P _{max}		
Saturation, %			C _c /C _c		

Vane Shear Test on Shelby Tubes (Maine DOT)						
Depth taken in tube, ft	3 In.		6 In.		Water Content, %	Description of Material Sampled at the Various Tube Depths
	U. Shear	Remold	U. Shear	Remold		
	tons/ft ²	tons/ft ²	tons/ft ²	tons/ft ²		

Comments:

AUTHORIZATION AND DISTRIBUTION

Reported by: **GREGORY LIDSTONE**

Date Reported: **8/4/2015**



GEOTECHNICAL TEST REPORT

Central Laboratory

SAMPLE INFORMATION

Reference No.	Boring No./Sample No.	Sample Description	Sampled	Received
263884	BB-MOS-501/4D	<u>GEOTECHNICAL (DISTURBED)</u>	7/13/2015	7/29/2015
Sample Type: GEOTECHNICAL Location:		Station: 31+36.2 Offset, ft: 10.6 LT Dbfg, ft: 12.0-14.0	Sampler: BRUCE WILDER	
WIN/Town 016667.00 - MILFORD				

TEST RESULTS

Sieve Analysis (T 27, T 11)	
Wash Method	
Procedure A	
SIEVE SIZE U.S. [SI]	% Passing
3 in. [75.0 mm]	
1 in. [25.0 mm]	100.0
¾ in. [19.0 mm]	89.4
½ in. [12.5 mm]	80.1
⅜ in. [9.5 mm]	76.4
¼ in. [6.3 mm]	71.5
No. 4 [4.75 mm]	68.2
No. 10 [2.00 mm]	56.8
No. 20 [0.850 mm]	41.7
No. 40 [0.425 mm]	27.2
No. 60 [0.250 mm]	20.4
No. 100 [0.150 mm]	16.0
No. 200 [0.075 mm]	11.7

Miscellaneous Tests	
Liquid Limit @ 25 blows (T 89), %	
Plastic Limit (T 90), %	
Plasticity Index (T 90), %	
Specific Gravity, Corrected to 20°C (T 100)	
Loss on Ignition (T 267)	
Loss, %	
H ₂ O, %	
Water Content (T 265), %	9.2

Consolidation (T 216)					
Trimming, Water Content, %					
	Initial	Final		Void Ratio	% Strain
Water Content, %			P _{min}		
Dry Density, lbs/ft ³			P _p		
Void Ratio			P _{max}		
Saturation, %			C _c /C _c '		

Vane Shear Test on Shelby Tubes (Maine DOT)						
Depth taken in tube, ft	3 In.		6 In.		Water Content, %	Description of Material Sampled at the Various Tube Depths
	U. Shear	Remold	U. Shear	Remold		
	tons/ft ²	tons/ft ²	tons/ft ²	tons/ft ²		

Comments:

AUTHORIZATION AND DISTRIBUTION

Reported by: **GREGORY LIDSTONE**

Date Reported: **8/3/2015**



GEOTECHNICAL TEST REPORT

Central Laboratory

SAMPLE INFORMATION

Reference No.	Boring No./Sample No.	Sample Description	Sampled	Received
263885	BB-MOS-501/5D	GEOTECHNICAL (DISTURBED)	7/13/2015	7/29/2015
Sample Type: GEOTECHNICAL Location:		Station: 31+36.2 Offset, ft: 10.6 LT Dbfg, ft: 15.0-16.3	Sampler: BRUCE WILDER	
WIN/Town 016667.00 - MILFORD				

TEST RESULTS

Sieve Analysis (T 27, T 11)	
Wash Method	
Procedure A	
SIEVE SIZE U.S. [SI]	% Passing
3 in. [75.0 mm]	
1 in. [25.0 mm]	100.0
¾ in. [19.0 mm]	95.9
½ in. [12.5 mm]	90.4
⅜ in. [9.5 mm]	86.5
¼ in. [6.3 mm]	79.3
No. 4 [4.75 mm]	74.8
No. 10 [2.00 mm]	63.1
No. 20 [0.850 mm]	50.7
No. 40 [0.425 mm]	34.8
No. 60 [0.250 mm]	23.8
No. 100 [0.150 mm]	16.3
No. 200 [0.075 mm]	10.5

Miscellaneous Tests	
Liquid Limit @ 25 blows (T 89), %	
Plastic Limit (T 90), %	
Plasticity Index (T 90), %	
Specific Gravity, Corrected to 20°C (T 100)	
Loss on Ignition (T 267)	
Loss, %	
H ₂ O, %	
Water Content (T 265), %	13.7

Consolidation (T 216)					
Trimming, Water Content, %					
	Initial	Final		Void Ratio	% Strain
Water Content, %			P _{min}		
Dry Density, lbs/ft ³			P _p		
Void Ratio			P _{max}		
Saturation, %			C _c /C _{c'}		

Vane Shear Test on Shelby Tubes (Maine DOT)

Depth taken in tube, ft	3 In.		6 In.		Water Content, %	Description of Material Sampled at the Various Tube Depths
	U. Shear	Remold	U. Shear	Remold		
	tons/ft ²	tons/ft ²	tons/ft ²	tons/ft ²		

Comments:

AUTHORIZATION AND DISTRIBUTION

Reported by: **GREGORY LIDSTONE**

Date Reported: **8/3/2015**

Paper Copy: Lab File; Project File; Geotech File



GEOTECHNICAL TEST REPORT

Central Laboratory

SAMPLE INFORMATION

Reference No.	Boring No./Sample No.	Sample Description	Sampled	Received
263886	BB-MOS-501/7D	GEOTECHNICAL (DISTURBED)	7/13/2015	7/29/2015
Sample Type: GEOTECHNICAL Location:		Station: 31+36.2 Offset, ft: 10.6 LT Dbfg, ft: 20.0-22.0	Sampler: BRUCE WILDER	
WIN/Town 016667.00 - MILFORD				

TEST RESULTS

Sieve Analysis (T 27)	
Wash Method	
SIEVE SIZE U.S. [SI]	% Passing
3 in. [75.0 mm]	
1 in. [25.0 mm]	
¾ in. [19.0 mm]	
½ in. [12.5 mm]	
⅜ in. [9.5 mm]	
¼ in. [6.3 mm]	
No. 4 [4.75 mm]	
No. 10 [2.00 mm]	
No. 20 [0.850 mm]	
No. 40 [0.425 mm]	
No. 60 [0.250 mm]	
No. 100 [0.150 mm]	
No. 200 [0.075 mm]	

Miscellaneous Tests	
Liquid Limit @ 25 blows (T 89), %	
Plastic Limit (T 90), %	
Plasticity Index (T 90), %	
Specific Gravity, Corrected to 20°C (T 100)	
Loss on Ignition (T 267)	
Loss, %	14.6
H2O, %	90.6
Water Content (T 265), %	

Consolidation (T 216)					
Trimming, Water Content, %					
	Initial	Final		Void Ratio	% Strain
Water Content, %			Pmin		
Dry Density, lbs/ft³			Pp		
Void Ratio			Pmax		
Saturation, %			Cc/C'c		

Vane Shear Test on Shelby Tubes (Maine DOT)						
Depth taken in tube, ft	3 In.		6 In.		Water Content, %	Description of Material Sampled at the Various Tube Depths
	U. Shear	Remold	U. Shear	Remold		
	tons/ft²	tons/ft²	tons/ft²	tons/ft²		

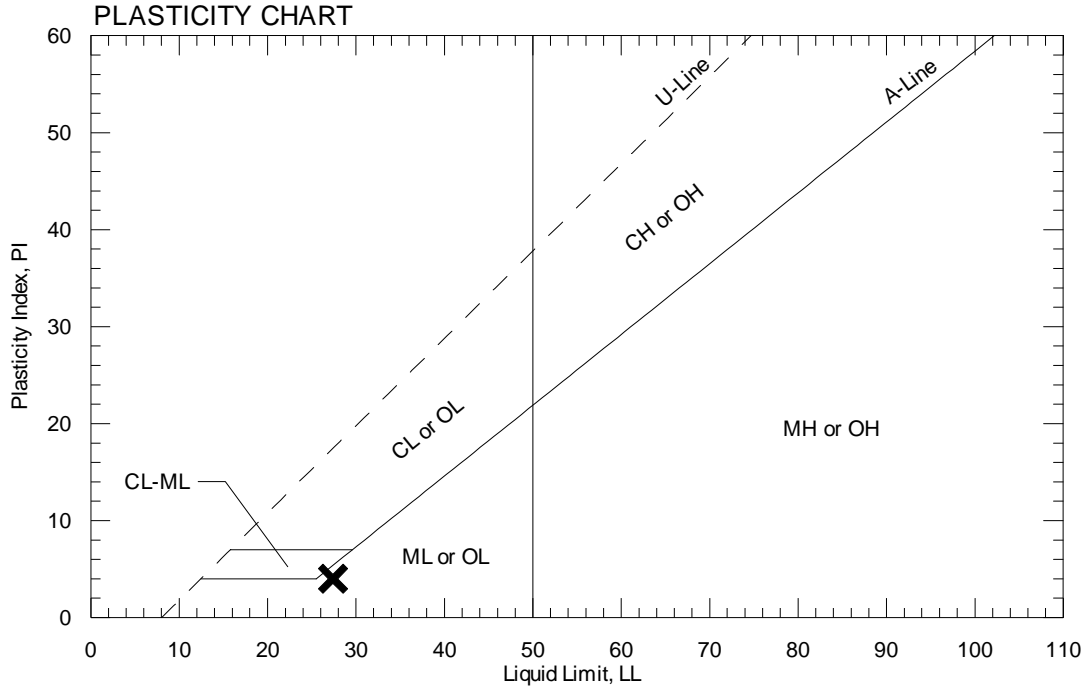
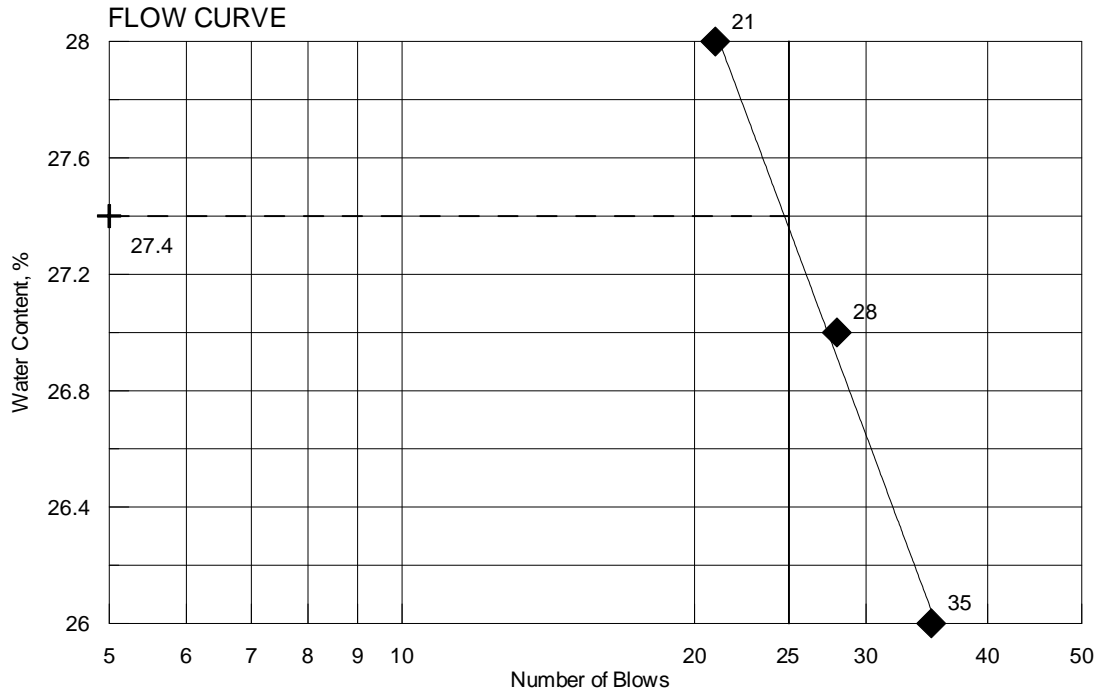
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AUTHORIZATION AND DISTRIBUTION

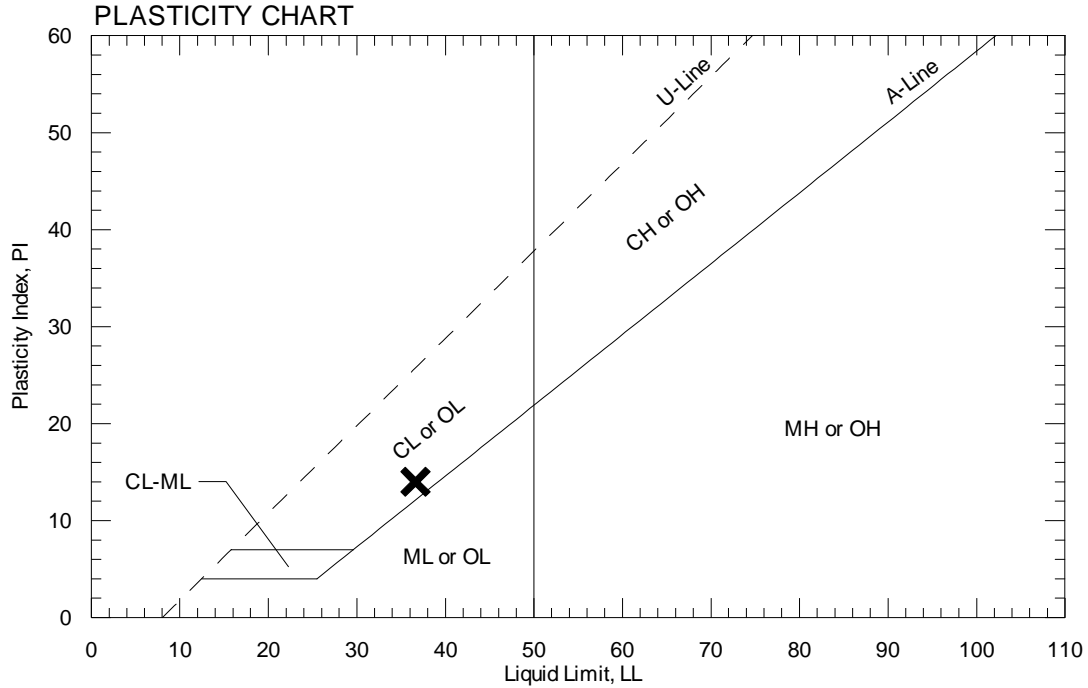
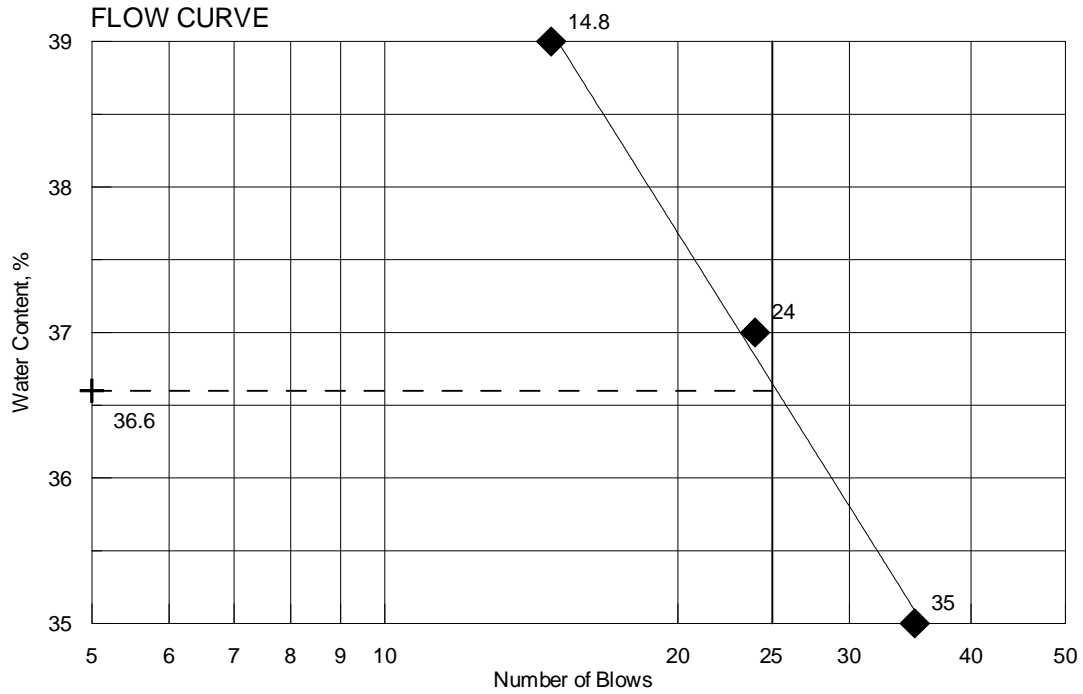
Reported by: **GREGORY LIDSTONE**

Date Reported: **8/1/2015**

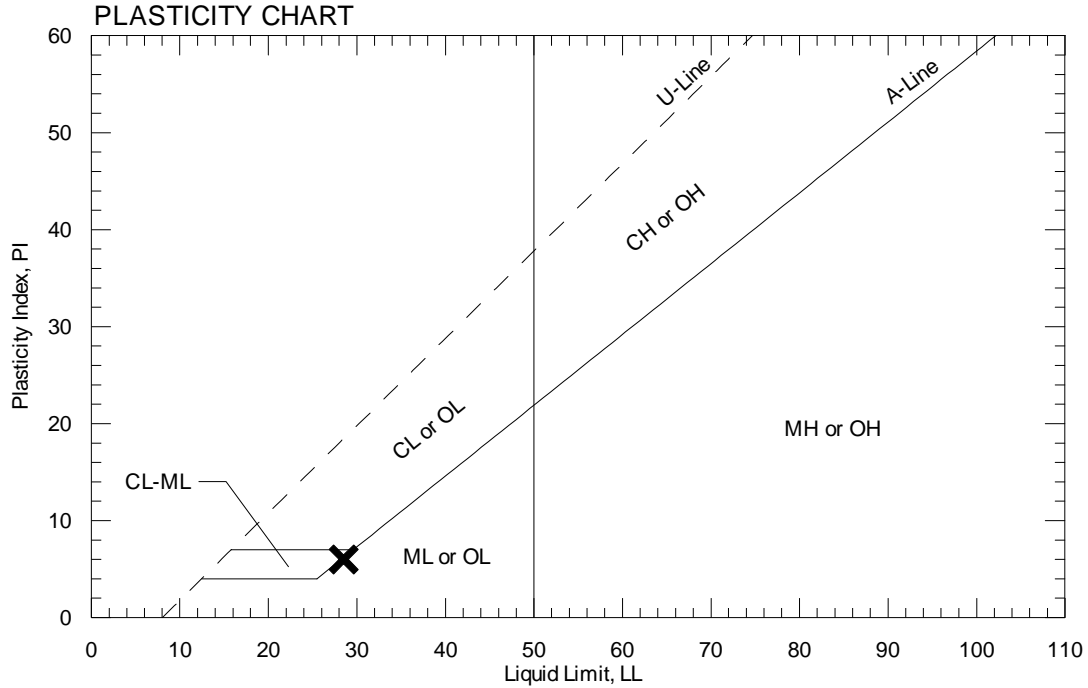
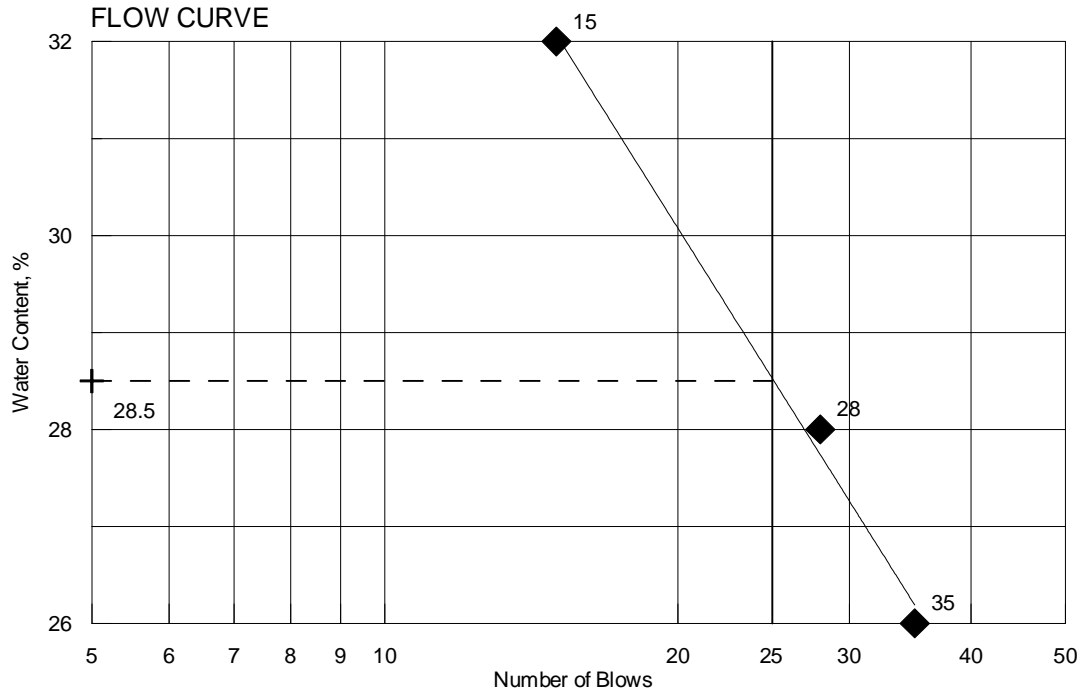
TOWN	Milford	Reference No.	263887
WIN	016667.00	Water Content, %	30.8
Sampled	7/13/2015	Liquid Limit @ 25 blows (T 89), %	27
Boring No./Sample No.	BB-MOS-501/8D	Plastic Limit (T 90), %	23
Station	31+36.2	Plasticity Index (T 90), %	4
Depth	22.5-24.5	Tested By	BBURR



TOWN	Milford	Reference No.	263888
WIN	016667.00	Water Content, %	39.4
Sampled	7/13/2015	Liquid Limit @ 25 blows (T 89), %	37
Boring No./Sample No.	BB-MOS-501/9D	Plastic Limit (T 90), %	23
Station	31+36.2	Plasticity Index (T 90), %	14
Depth	29.0-31.0	Tested By	BBURR



TOWN	Milford	Reference No.	263889
WIN	016667.00	Water Content, %	37.1
Sampled	7/13/2015	Liquid Limit @ 25 blows (T 89), %	29
Boring No./Sample No.	BB-MOS-501/10D	Plastic Limit (T 90), %	23
Station	31+36.2	Plasticity Index (T 90), %	6
Depth	32.0-34.0	Tested By	BBURR



GeoTesting Express
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Client:	Maine DOT		
Project:	Second Otter Bridge		
Location:	Milford, ME	Project No:	GTX-303508
Boring ID:	BB-MOS-501	Sample Type:	tube
Sample ID:	1U	Test Date:	08/03/15
Depth :	24.5-26.5 ft	Test Id:	340130
Tested By:	jbr		
Checked By:	jdt		
Test Comment:	---		
Visual Description:	Wet, very dark gray clay		
Sample Comment:	---		

Moisture Content of Soil and Rock - ASTM D2216

Boring ID	Sample ID	Depth	Description	Moisture Content, %
BB-MOS-501	1U	24.5-26.5 ft	Wet, very dark gray clay	35.5

Notes: Temperature of Drying : 110° Celsius



Client:	Maine DOT		
Project:	Second Otter Bridge		
Location:	Milford, ME	Project No:	GTX-303508
Boring ID:	BB-MOS-501	Sample Type:	tube
Sample ID:	1U	Test Date:	08/05/15
Depth :	24.5-26.5 ft	Test Id:	340123
Tested By:	cam		
Checked By:	jdt		
Test Comment:	---		
Visual Description:	Wet, very dark gray clay		
Sample Comment:	---		

USCS Classification - ASTM D2487

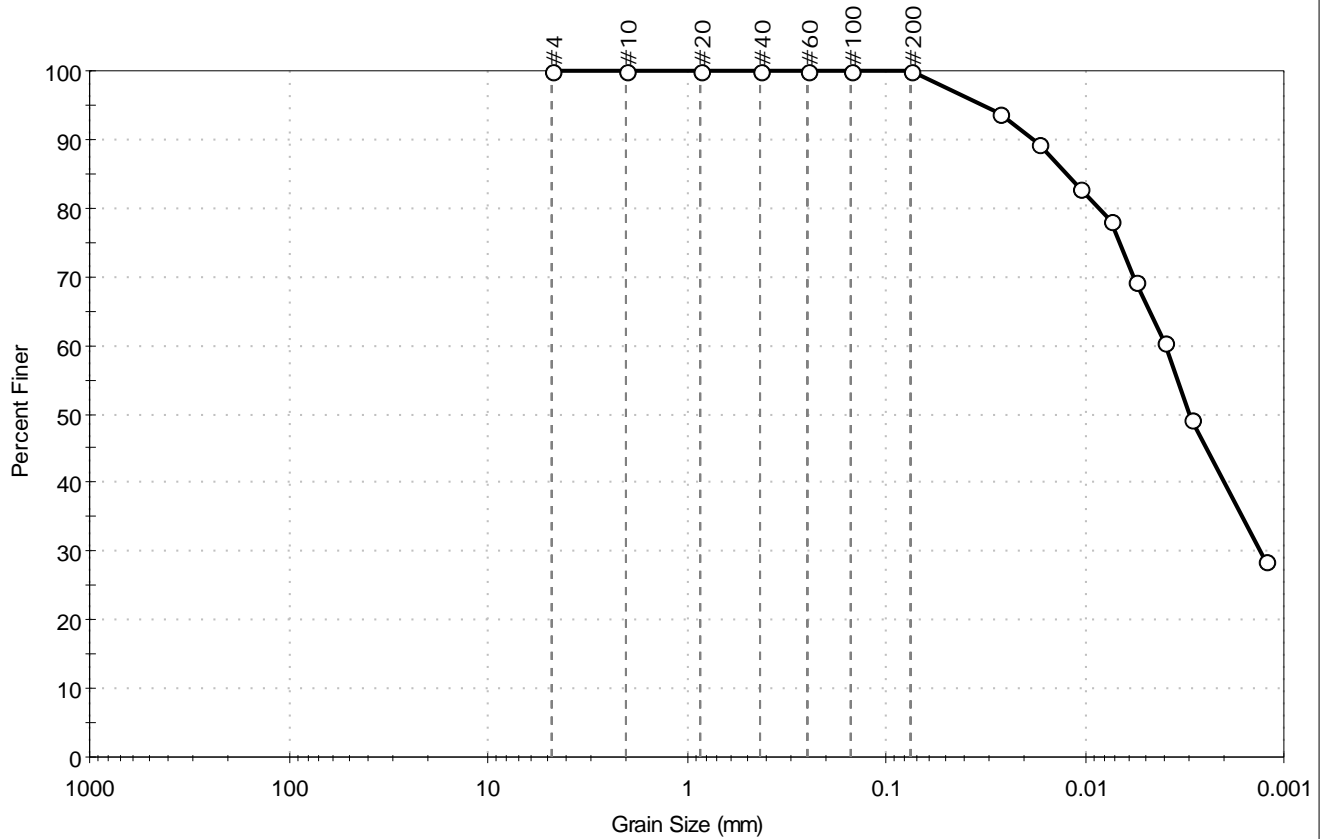
Boring ID	Sample ID	Depth	Group Name	Group Symbol	Gravel, %	Sand, %	Fines, %
BB-MOS-501	1U	24.5-26.5 ft	Lean clay	CL	0.0	0.1	99.9

Remarks: Grain Size analysis performed by ASTM D422 results enclosed
Atterberg Limits performed by ASTM D4318, results enclosed



Client: Maine DOT	Project: Second Otter Bridge	Location: Milford, ME	Project No: GTX-303508
Boring ID: BB-MOS-501	Sample Type: tube	Tested By: jbr	
Sample ID: 1U	Test Date: 08/03/15	Checked By: jdt	
Depth: 24.5-26.5 ft	Test Id: 340124		
Test Comment: ---			
Visual Description: Wet, very dark gray clay			
Sample Comment: ---			

Particle Size Analysis - ASTM D422



% Cobble	% Gravel	% Sand	% Silt & Clay Size
---	0.0	0.1	99.9

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
#4	4.75	100		
#10	2.00	100		
#20	0.85	100		
#40	0.42	100		
#60	0.25	100		
#100	0.15	100		
#200	0.075	100		
---	Particle Size (mm)	Percent Finer	Spec. Percent	Complies
---	0.0270	94		
---	0.0171	89		
---	0.0105	83		
---	0.0074	78		
---	0.0055	69		
---	0.0040	60		
---	0.0029	49		
---	0.0012	29		

<u>Coefficients</u>	
D ₈₅ = 0.0123 mm	D ₃₀ = 0.0013 mm
D ₆₀ = 0.0040 mm	D ₁₅ = N/A
D ₅₀ = 0.0030 mm	D ₁₀ = N/A
C _u = N/A	C _c = N/A

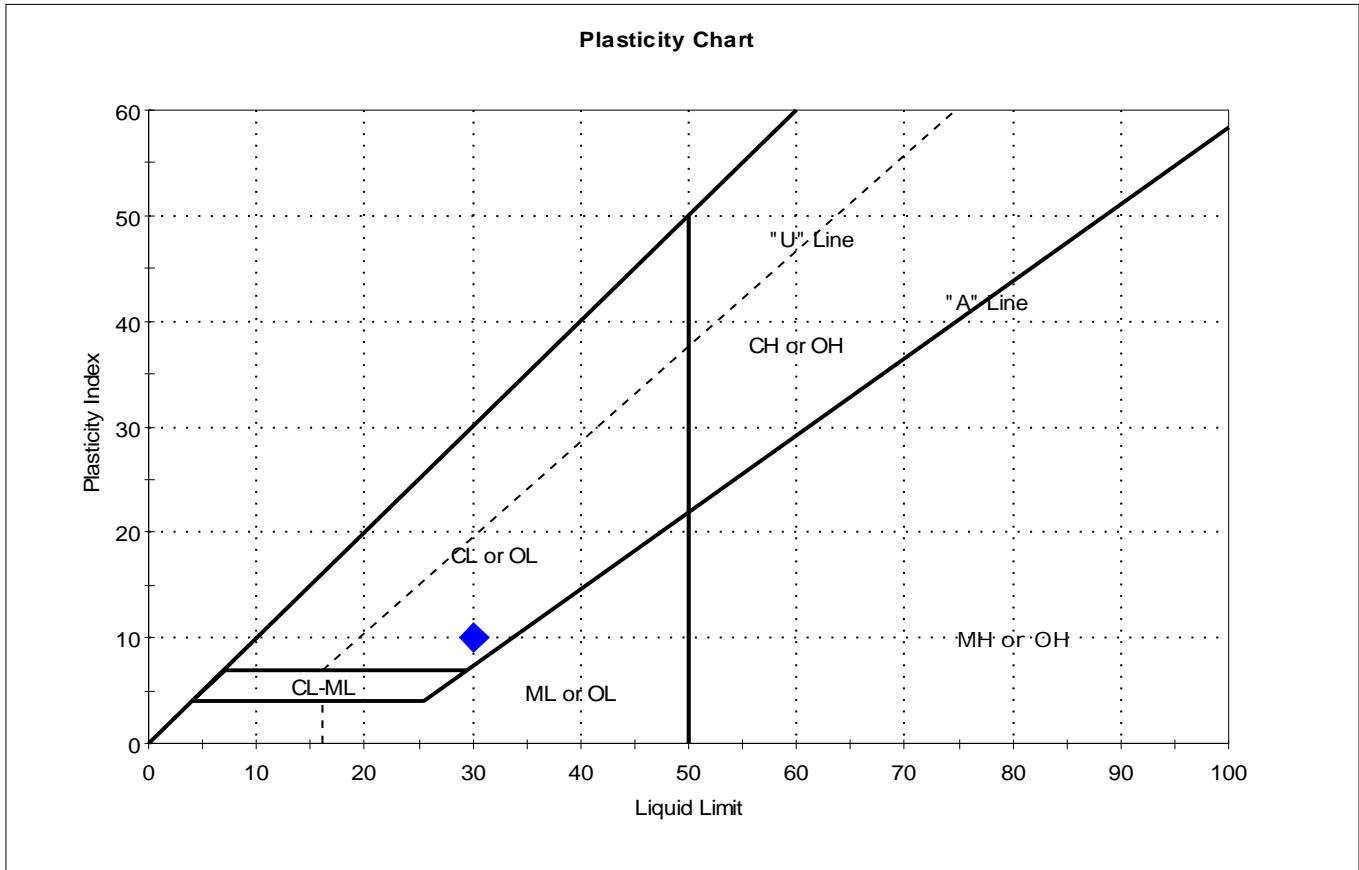
<u>Classification</u>	
<u>ASTM</u>	Lean clay (CL)
<u>AASHTO</u>	Silty Soils (A-4 (10))

<u>Sample/Test Description</u>
Sand/Gravel Particle Shape : ---
Sand/Gravel Hardness : ---
Dispersion Device : Apparatus A - Mech Mixer
Dispersion Period : 1 minute
Specific Gravity : 2.65
Separation of Sample: #200 Sieve



Client:	Maine DOT	Project No:	GTX-303508
Project:	Second Otter Bridge	Sample Type:	tube
Location:	Milford, ME	Tested By:	cam
Boring ID:	BB-MOS-501	Test Date:	08/05/15
Sample ID:	1U	Checked By:	jdt
Depth:	24.5-26.5 ft	Test Id:	340122
Test Comment:	---		
Visual Description:	Wet, very dark gray clay		
Sample Comment:	---		

Atterberg Limits - ASTM D4318

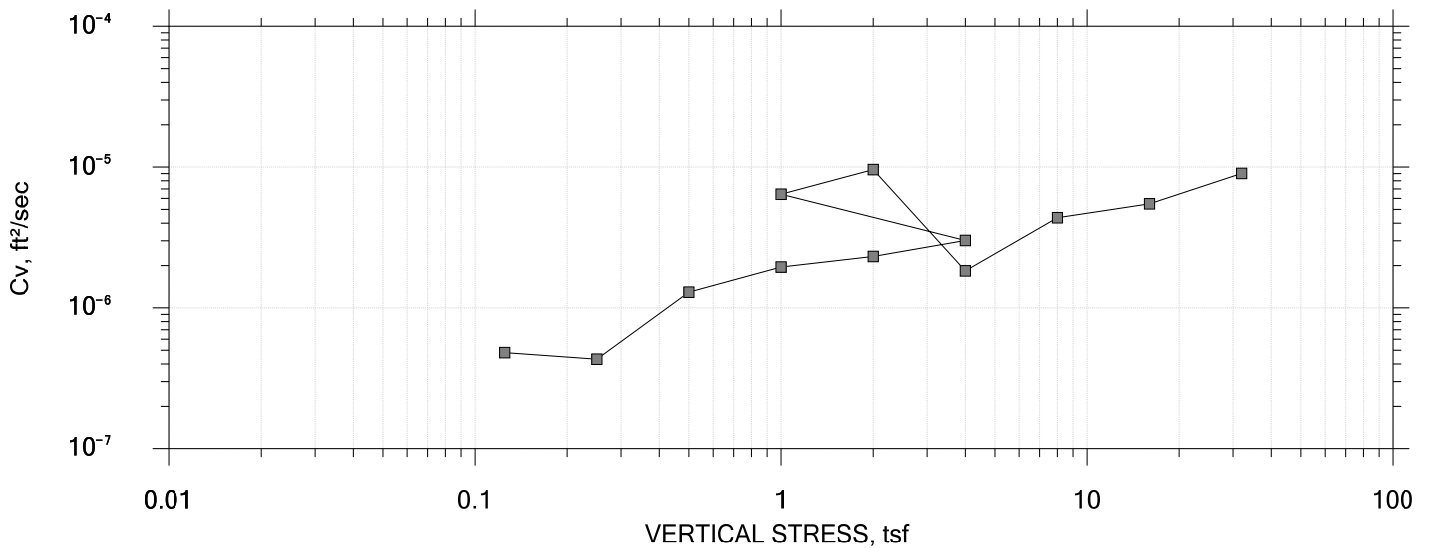
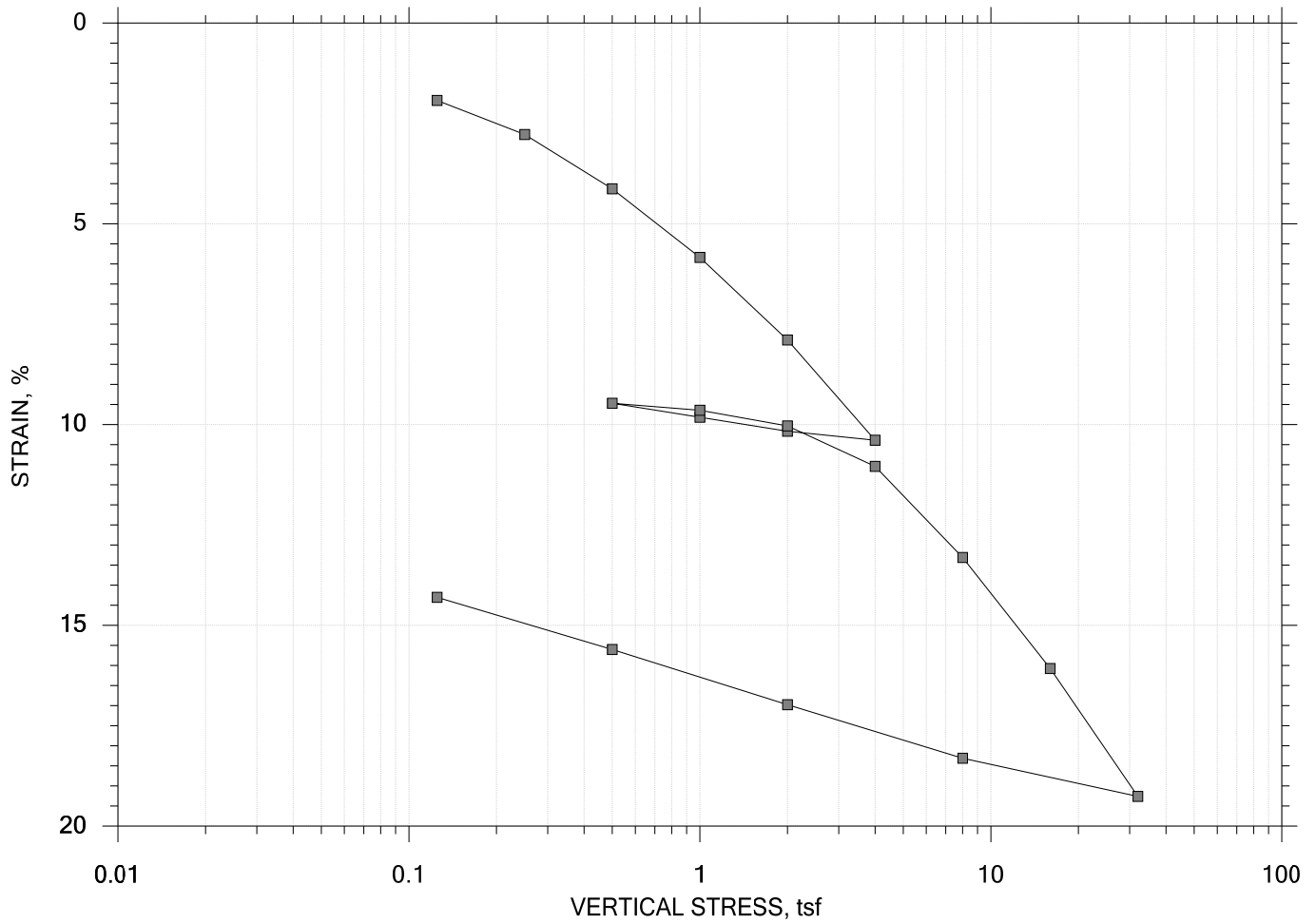



Symbol	Sample ID	Boring	Depth	Natural Moisture Content, %	Liquid Limit	Plastic Limit	Plasticity Index	Liquidity Index	Soil Classification
◆	1U	B-MOS-501	24.5-26.5 ft	36	30	20	10	1.6	Lean clay (CL)

Sample Prepared using the WET method
 0% Retained on #40 Sieve
 Dry Strength: VERY HIGH
 Dilatancy: SLOW
 Toughness: LOW

One-Dimensional Consolidation by ASTM D2435 - Method B

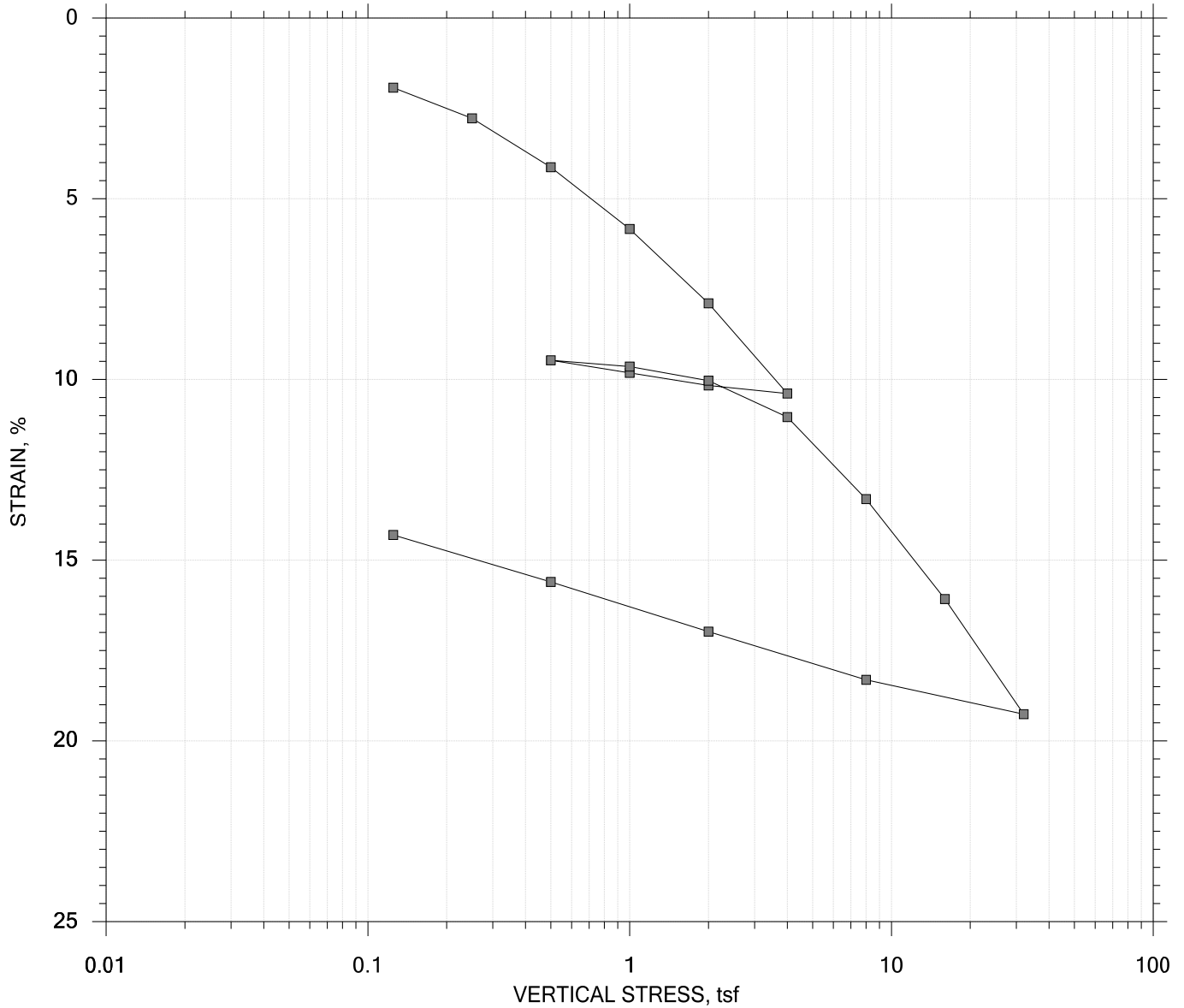
SUMMARY REPORT




	Project: Second Otter Bridge	Location: Milford, ME	Project No.: GTX-303508
	Boring No.: BB-MOS-501	Tested By: md	Checked By: jdt
	Sample No.: 1U	Test Date: 7/28/15	Test No.: IP-1
	Depth: 24.5-26.5 ft	Sample Type: intact	Elevation: ---
	Description: Wet, dark gray clay		
	Remarks: System S		
	Displacement at End of Increment		

One-Dimensional Consolidation by ASTM D2435 - Method B

SUMMARY REPORT



				Before Test	After Test	
Current Vertical Effective Stress: ---				Water Content, %	33.60	23.20
Preconsolidation Stress: ---				Dry Unit Weight, pcf	88.687	104.34
Compression Ratio: ---				Saturation, %	99.52	100.00
Diameter: 2.5 in		Height: 1 in		Void Ratio	0.92	0.63
LL: 30	PL: 20	PI: 10	GS: 2.73			

	Project: Second Otter Bridge		Location: Milford, ME		Project No.: GTX-303508	
	Boring No.: BB-MOS-501		Tested By: md		Checked By: jdt	
	Sample No.: 1U		Test Date: 7/28/15		Test No.: IP-1	
	Depth: 24.5-26.5 ft		Sample Type: intact		Elevation: ---	
	Description: Wet, dark gray clay					
	Remarks: System S					
	Displacement at End of Increment					

One-Dimensional Consolidation by ASTM D2435 - Method B

Project: Second Otter Bridge
 Boring No.: BB-MOS-501
 Sample No.: 1U
 Test No.: IP-1

Location: Milford, ME
 Tested By: md
 Test Date: 7/28/15
 Sample Type: intact

Project No.: GTX-303508
 Checked By: jdt
 Depth: 24.5-26.5 ft
 Elevation: ---

Soil Description: Wet, dark gray clay
 Remarks: System S

Estimated Specific Gravity: 2.73
 Initial Void Ratio: 0.922
 Final Void Ratio: 0.633

Liquid Limit: 30
 Plastic Limit: 20
 Plasticity Index: 10

Specimen Diameter: 2.50 in
 Initial Height: 1.00 in
 Final Height: 0.85 in

	Before Consolidation		After Consolidation	
	Trimmings	Specimen+Ring	Specimen+Ring	Trimmings
Container ID	16912	RING		A703
Wt. Container + Wet Soil, gm	170.14	261.57	249.69	149.39
Wt. Container + Dry Soil, gm	129.47	223.18	223.18	122.83
Wt. Container, gm	8.4300	108.90	108.90	8.3600
Wt. Dry Soil, gm	121.04	114.28	114.28	114.47
Water Content, %	33.60	33.60	23.20	23.20
Void Ratio	---	0.922	0.633	---
Degree of Saturation, %	---	99.52	100.00	---
Dry Unit Weight, pcf	---	88.687	104.34	---

Note: Specific Gravity and Void Ratios are calculated assuming the degree of saturation equals 100% at the end of the test. Therefore, values may not represent actual values for the specimen.

One-Dimensional Consolidation by ASTM D2435 - Method B

Project: Second Otter Bridge
 Boring No.: BB-MOS-501
 Sample No.: 1U
 Test No.: IP-1

Location: Milford, ME
 Tested By: md
 Test Date: 7/28/15
 Sample Type: intact

Project No.: GTX-303508
 Checked By: jdt
 Depth: 24.5-26.5 ft
 Elevation: ---

Soil Description: Wet, dark gray clay
 Remarks: System S

Displacement at End of Increment

	Applied Stress tsf	Final Displacement in	Void Ratio	Strain at End %	Sq.Rt T90 min	Cv ft ² /sec	Mv 1/tsf	k ft/day
1	0.125	0.01928	0.885	1.93	42.845	5.62e-007	1.54e-001	2.34e-004
2	0.250	0.02775	0.868	2.77	52.969	4.42e-007	6.78e-002	8.07e-005
3	0.500	0.04126	0.842	4.13	17.908	1.28e-006	5.40e-002	1.86e-004
4	1.00	0.05833	0.810	5.83	13.473	1.64e-006	3.42e-002	1.51e-004
5	2.00	0.07891	0.770	7.89	8.282	2.57e-006	2.06e-002	1.43e-004
6	4.00	0.1039	0.722	10.4	7.163	2.83e-006	1.25e-002	9.53e-005
7	2.00	0.1016	0.726	10.2	0.000	0.00e+000	1.13e-003	0.00e+000
8	1.00	0.09818	0.733	9.82	2.416	8.23e-006	3.46e-003	7.67e-005
9	0.500	0.09467	0.740	9.47	8.862	2.26e-006	7.02e-003	4.28e-005
10	1.00	0.09643	0.736	9.64	2.595	7.73e-006	3.52e-003	7.34e-005
11	2.00	0.1003	0.729	10.0	2.196	9.08e-006	3.90e-003	9.56e-005
12	4.00	0.1104	0.710	11.0	12.487	1.57e-006	5.03e-003	2.14e-005
13	8.00	0.1331	0.666	13.3	4.853	3.90e-006	5.67e-003	5.97e-005
14	16.0	0.1607	0.613	16.1	3.059	5.84e-006	3.46e-003	5.44e-005
15	32.0	0.1926	0.552	19.3	2.428	6.85e-006	1.99e-003	3.68e-005
16	8.00	0.1831	0.570	18.3	3.972	4.07e-006	3.96e-004	4.36e-006
17	2.00	0.1698	0.595	17.0	3.115	5.34e-006	2.22e-003	3.20e-005
18	0.500	0.1560	0.622	15.6	13.960	1.23e-006	9.18e-003	3.05e-005
19	0.125	0.1430	0.647	14.3	47.142	3.76e-007	3.46e-002	3.51e-005

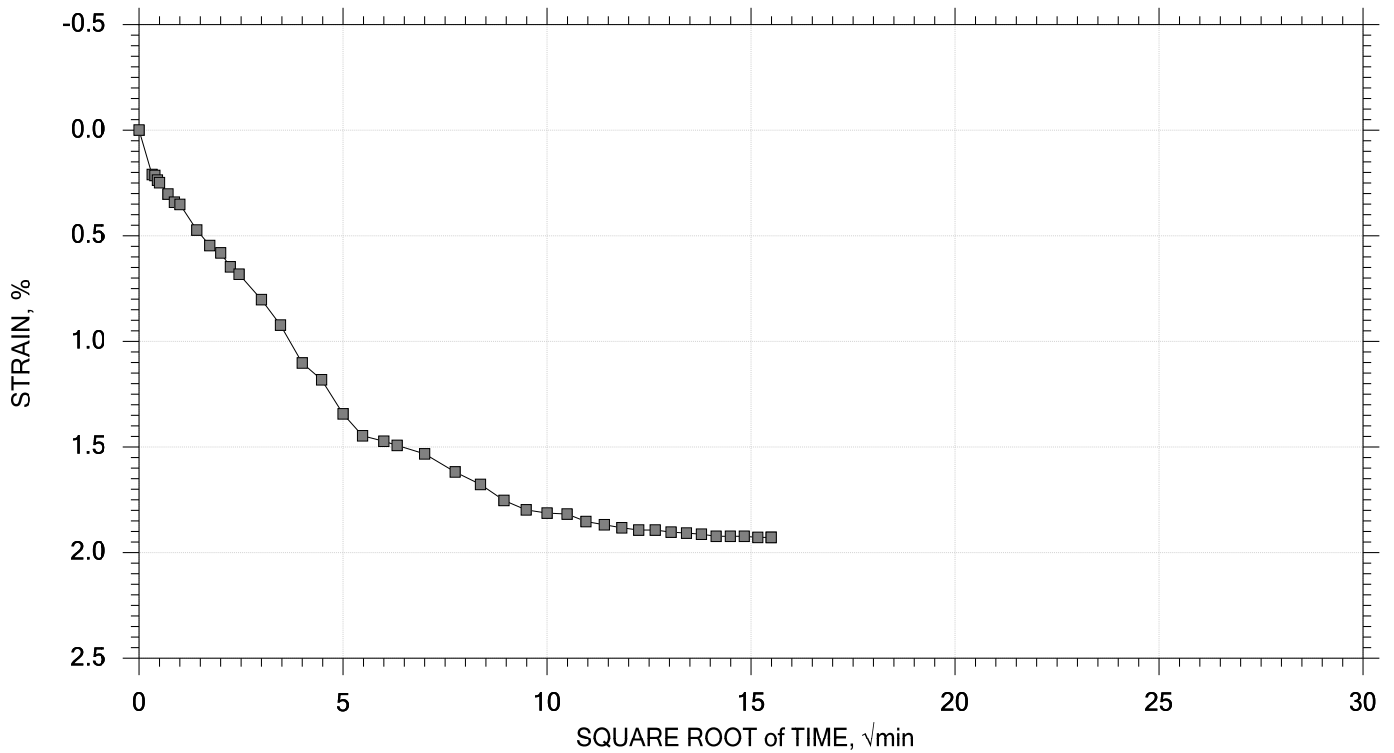
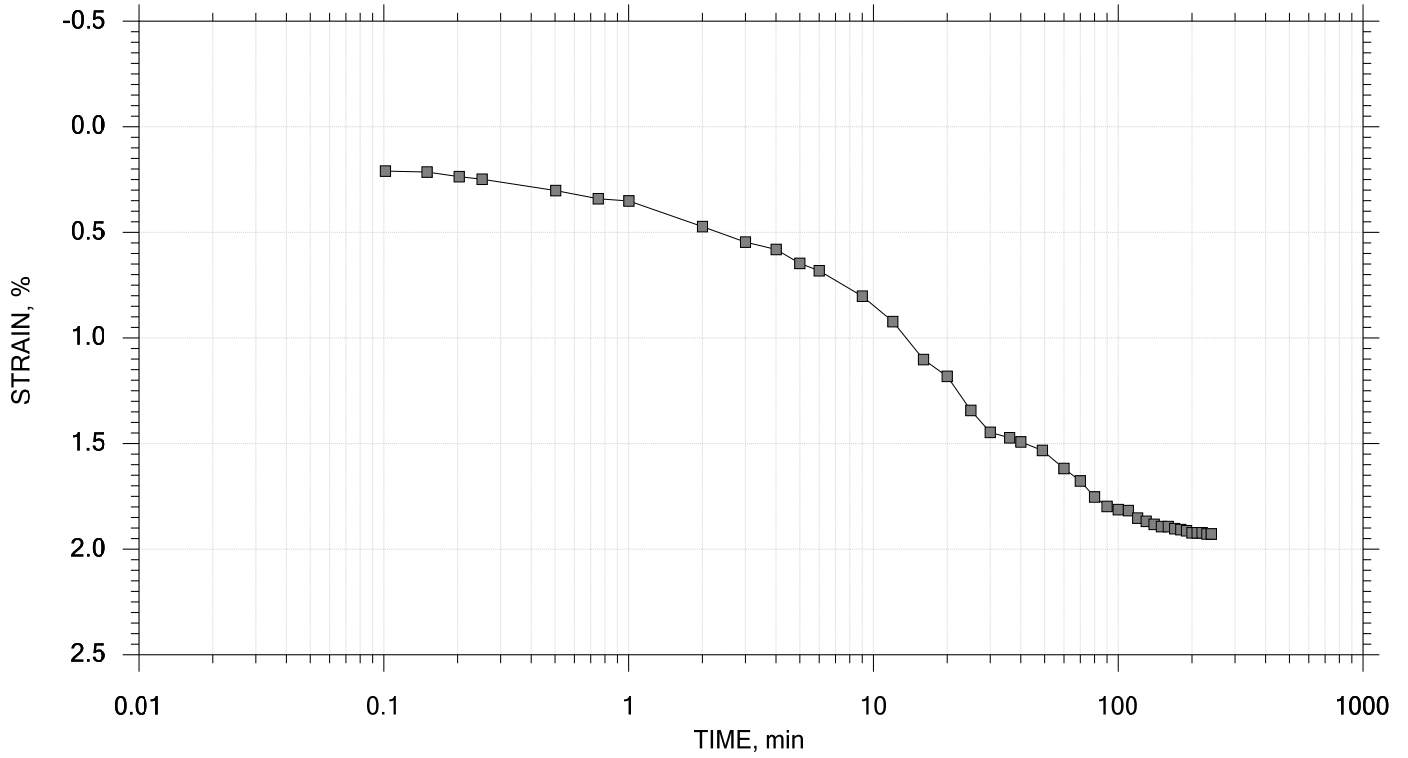
	Applied Stress tsf	Final Displacement in	Void Ratio	Strain at End %	Log T50 min	Cv ft ² /sec	Mv 1/tsf	k ft/day	Ca %
1	0.125	0.01928	0.885	1.93	12.728	4.39e-007	1.54e-001	1.83e-004	0.00e+000
2	0.250	0.02775	0.868	2.77	14.424	3.77e-007	6.78e-002	6.89e-005	0.00e+000
3	0.500	0.04126	0.842	4.13	4.209	1.26e-006	5.40e-002	1.84e-004	0.00e+000
4	1.00	0.05833	0.810	5.83	2.166	2.38e-006	3.42e-002	2.19e-004	0.00e+000
5	2.00	0.07891	0.770	7.89	2.214	2.23e-006	2.06e-002	1.24e-004	0.00e+000
6	4.00	0.1039	0.722	10.4	1.628	2.89e-006	1.25e-002	9.74e-005	0.00e+000
7	2.00	0.1016	0.726	10.2	0.000	0.00e+000	1.13e-003	0.00e+000	0.00e+000
8	1.00	0.09818	0.733	9.82	0.000	0.00e+000	3.46e-003	0.00e+000	0.00e+000
9	0.500	0.09467	0.740	9.47	0.000	0.00e+000	7.02e-003	0.00e+000	0.00e+000
10	1.00	0.09643	0.736	9.64	0.000	0.00e+000	3.52e-003	0.00e+000	0.00e+000
11	2.00	0.1003	0.729	10.0	0.000	0.00e+000	3.90e-003	0.00e+000	0.00e+000
12	4.00	0.1104	0.710	11.0	0.000	0.00e+000	5.03e-003	0.00e+000	0.00e+000
13	8.00	0.1331	0.666	13.3	1.086	4.05e-006	5.67e-003	6.19e-005	0.00e+000
14	16.0	0.1607	0.613	16.1	0.830	5.00e-006	3.46e-003	4.66e-005	0.00e+000
15	32.0	0.1926	0.552	19.3	0.372	1.04e-005	1.99e-003	5.58e-005	0.00e+000
16	8.00	0.1831	0.570	18.3	0.000	0.00e+000	3.96e-004	0.00e+000	0.00e+000
17	2.00	0.1698	0.595	17.0	1.012	3.82e-006	2.22e-003	2.29e-005	0.00e+000
18	0.500	0.1560	0.622	15.6	0.000	0.00e+000	9.18e-003	0.00e+000	0.00e+000
19	0.125	0.1430	0.647	14.3	13.722	3.00e-007	3.46e-002	2.80e-005	0.00e+000


One-Dimensional Consolidation by ASTM D2435 - Method B

TIME CURVES

Constant Load Step 1 of 19

Stress: 0.125 tsf



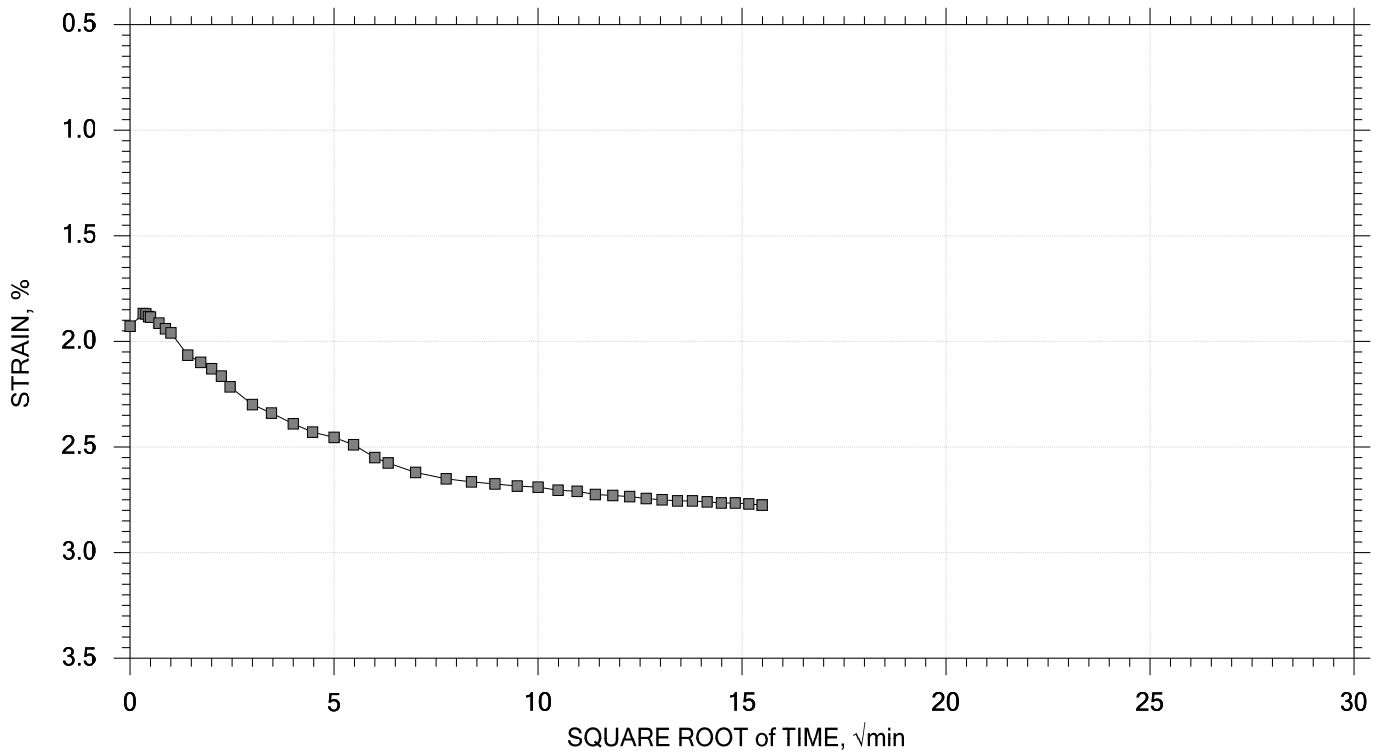
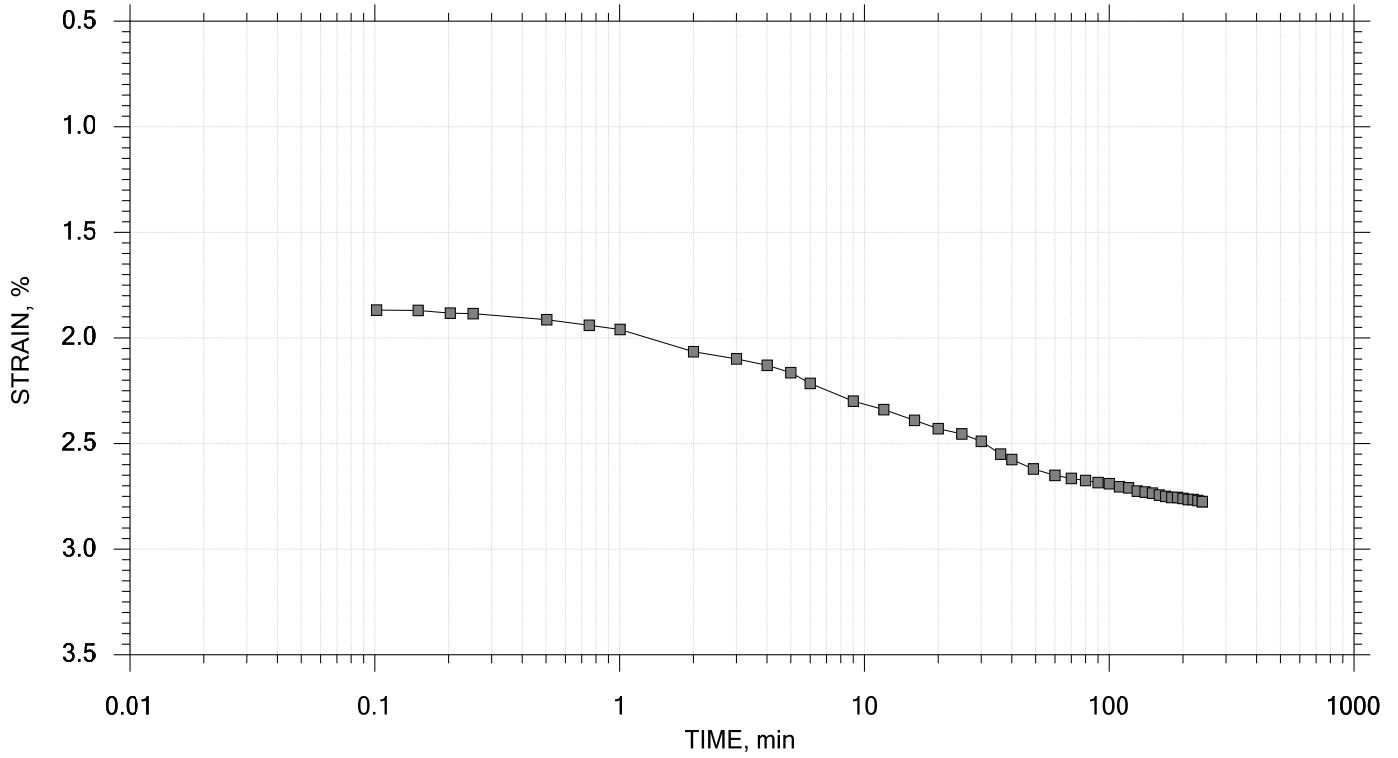
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	Sample No.: 1U	Test Date: 7/28/15	Test No.: IP-1
	Depth: 24.5-26.5 ft	Sample Type: intact	Elevation: ---
	Description: Wet, dark gray clay		
	Remarks: System S		


One-Dimensional Consolidation by ASTM D2435 - Method B

TIME CURVES

Constant Load Step 2 of 19

Stress: 0.25 tsf



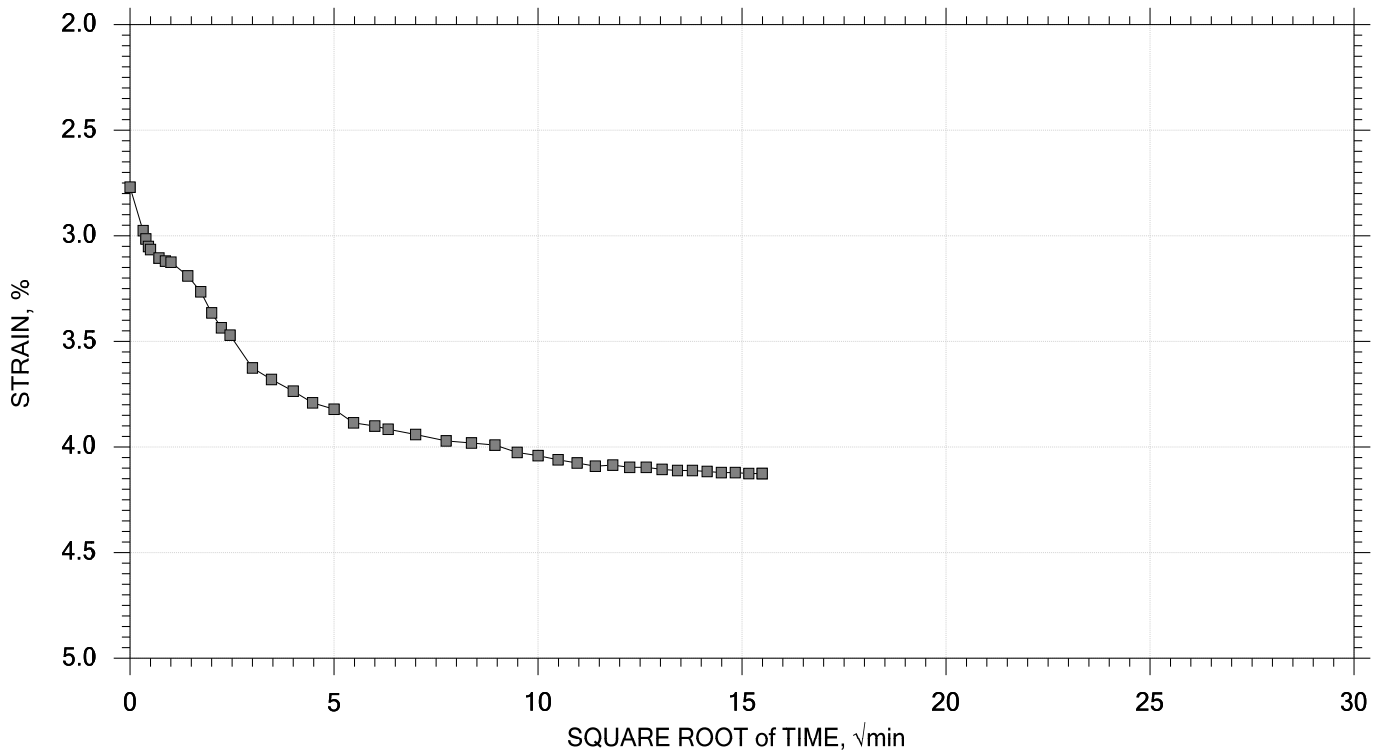
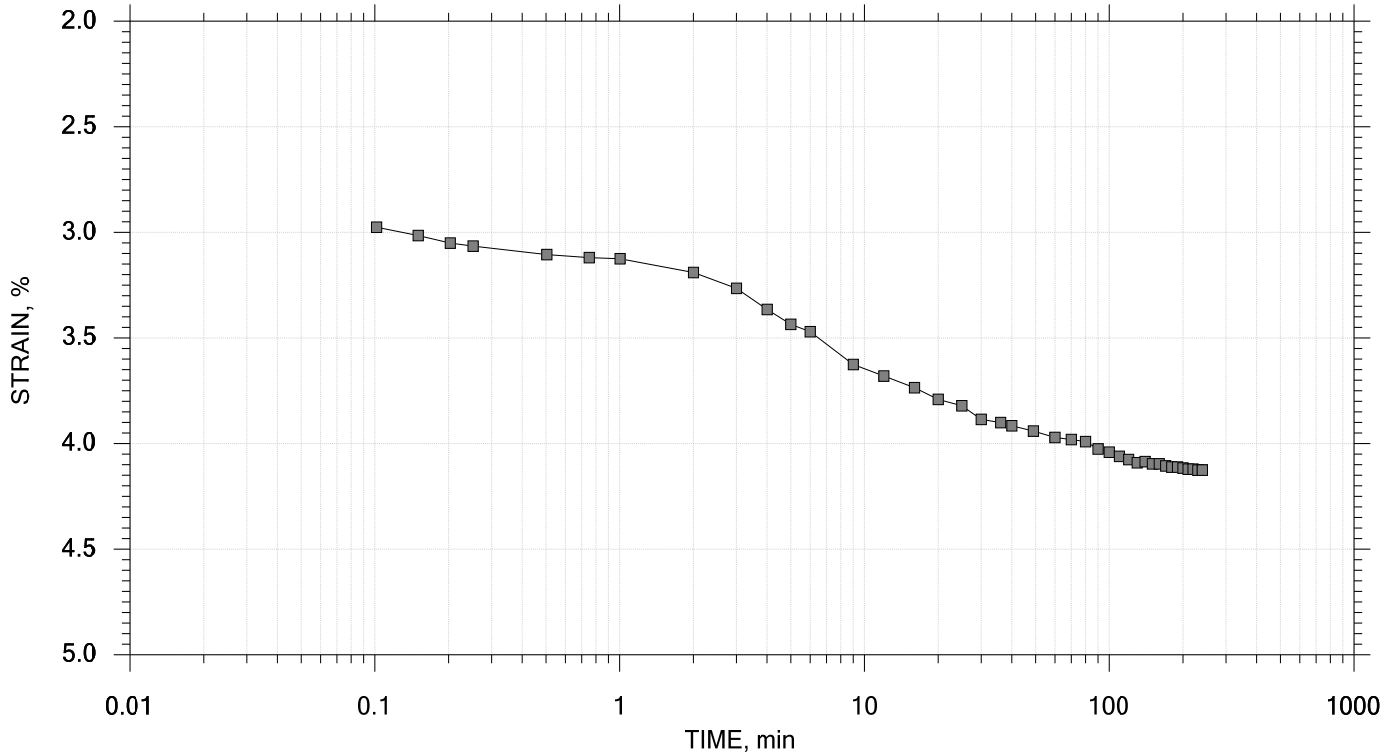
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	Boring No.: BB-MOS-501	Tested By: md	Checked By: jdt
	Sample No.: 1U	Test Date: 7/28/15	Test No.: IP-1
	Depth: 24.5-26.5 ft	Sample Type: intact	Elevation: ---
	Description: Wet, dark gray clay		
	Remarks: System S		


One-Dimensional Consolidation by ASTM D2435 - Method B

TIME CURVES

Constant Load Step 3 of 19

Stress: 0.5 tsf



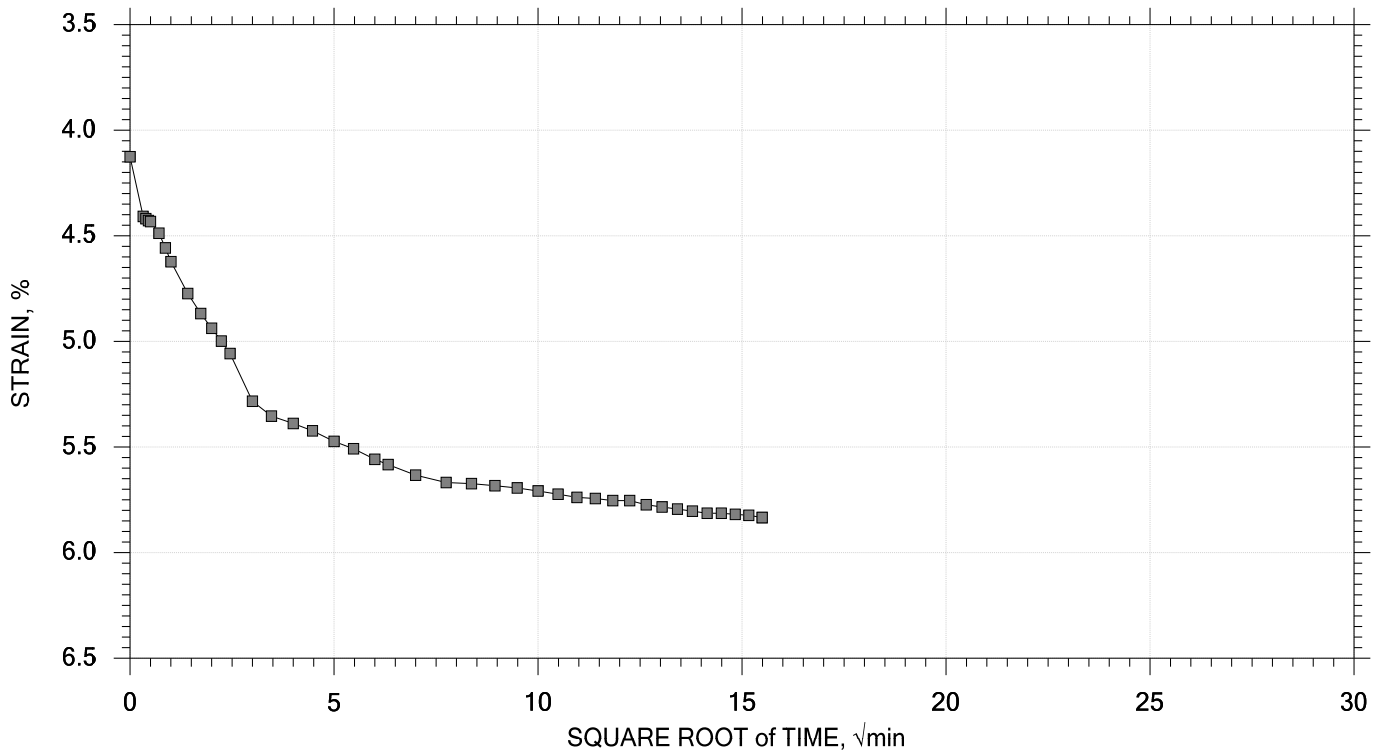
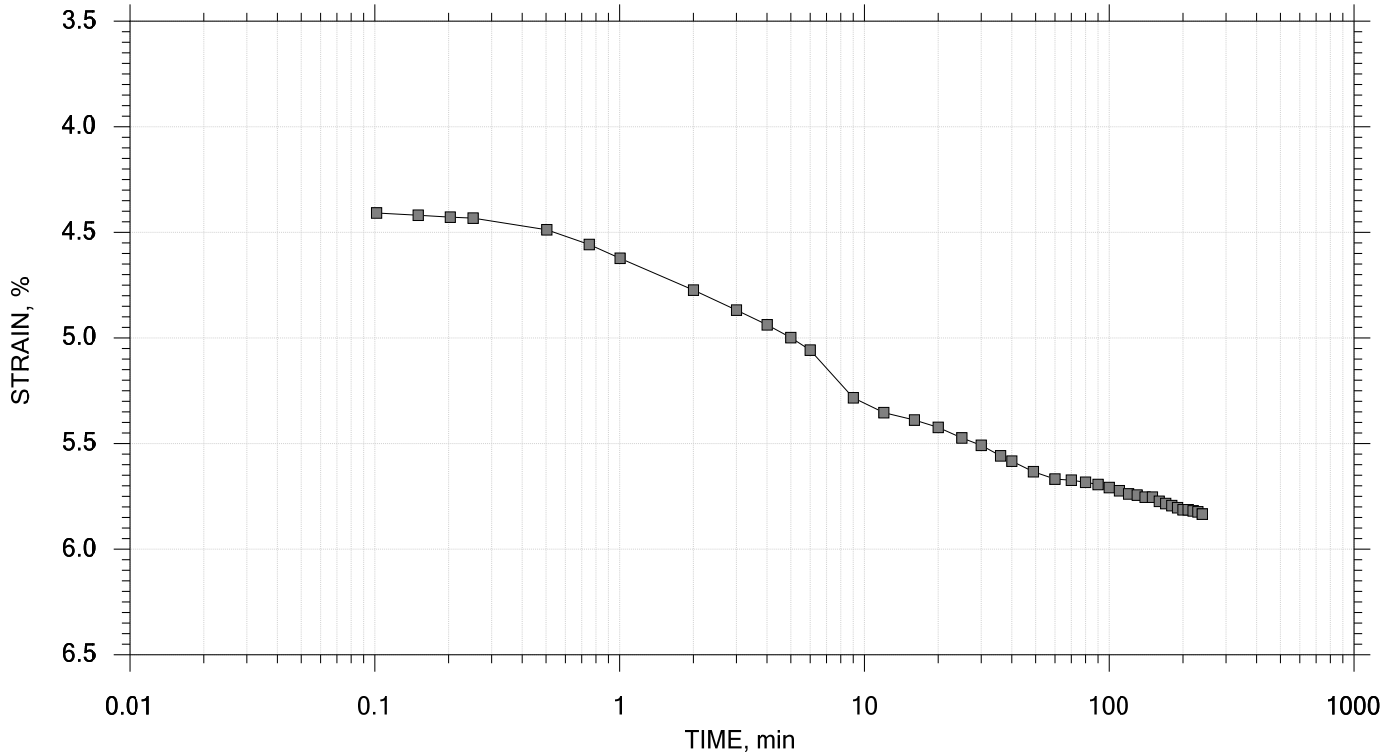
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	Boring No.: BB-MOS-501	Tested By: md	Checked By: jdt
	Sample No.: 1U	Test Date: 7/28/15	Test No.: IP-1
	Depth: 24.5-26.5 ft	Sample Type: intact	Elevation: ---
	Description: Wet, dark gray clay		
	Remarks: System S		


One-Dimensional Consolidation by ASTM D2435 - Method B

TIME CURVES

Constant Load Step 4 of 19

Stress: 1 tsf



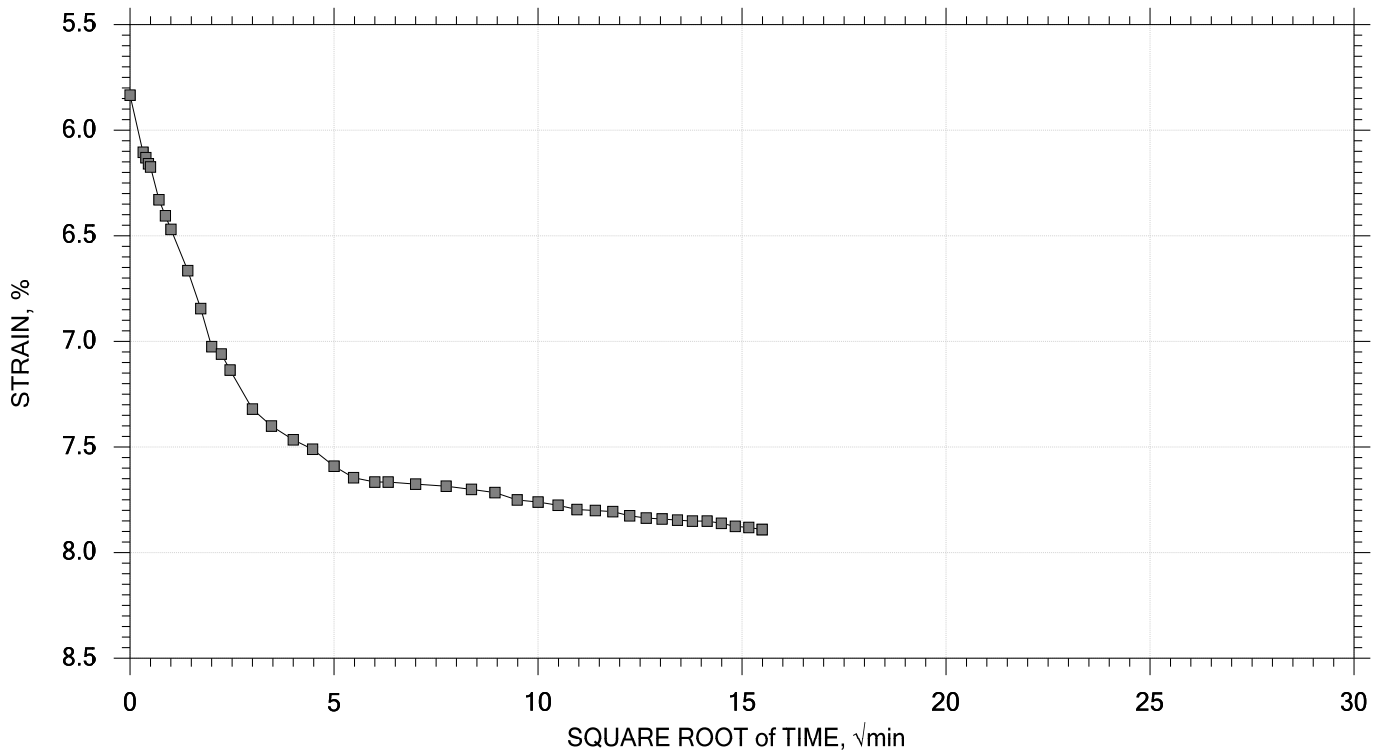
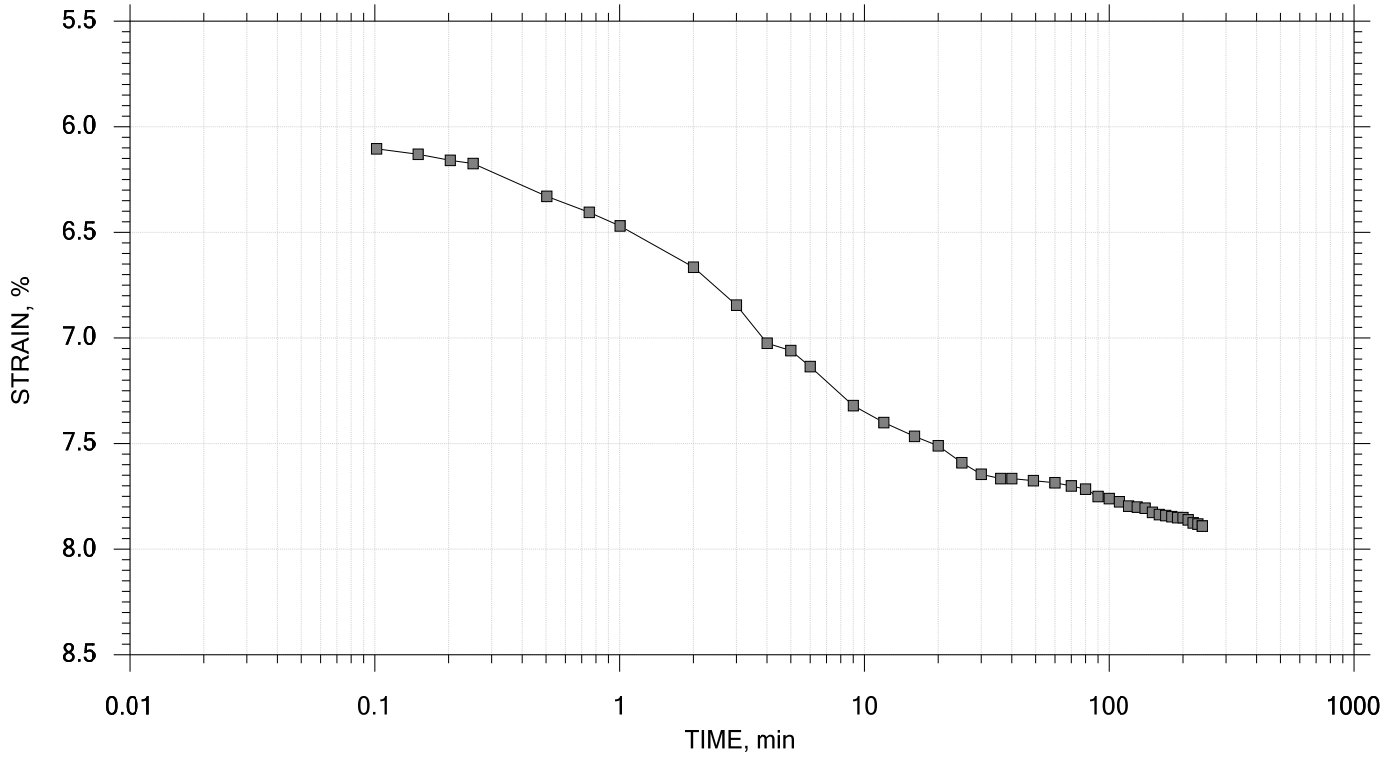
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	Boring No.: BB-MOS-501	Tested By: md	Checked By: jdt
	Sample No.: 1U	Test Date: 7/28/15	Test No.: IP-1
	Depth: 24.5-26.5 ft	Sample Type: intact	Elevation: ---
	Description: Wet, dark gray clay		
	Remarks: System S		


One-Dimensional Consolidation by ASTM D2435 - Method B

TIME CURVES

Constant Load Step 5 of 19

Stress: 2 tsf



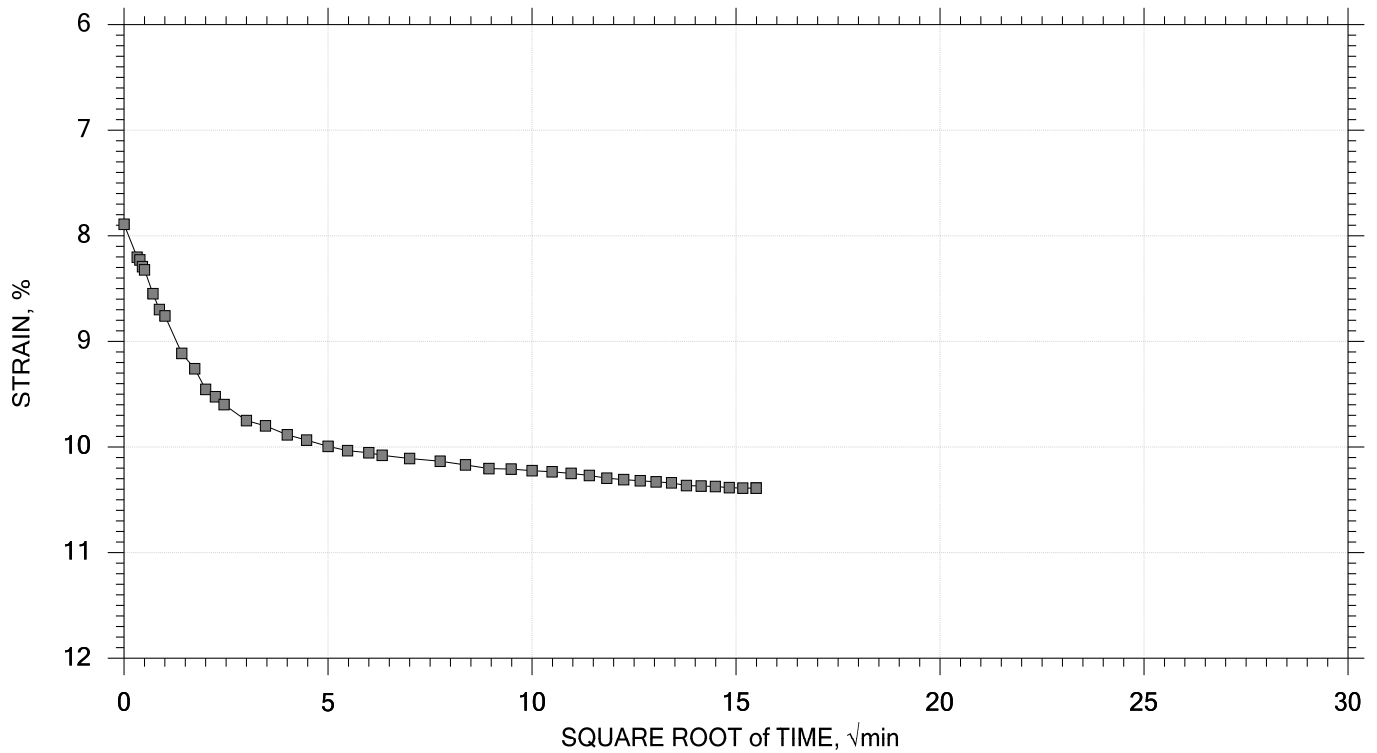
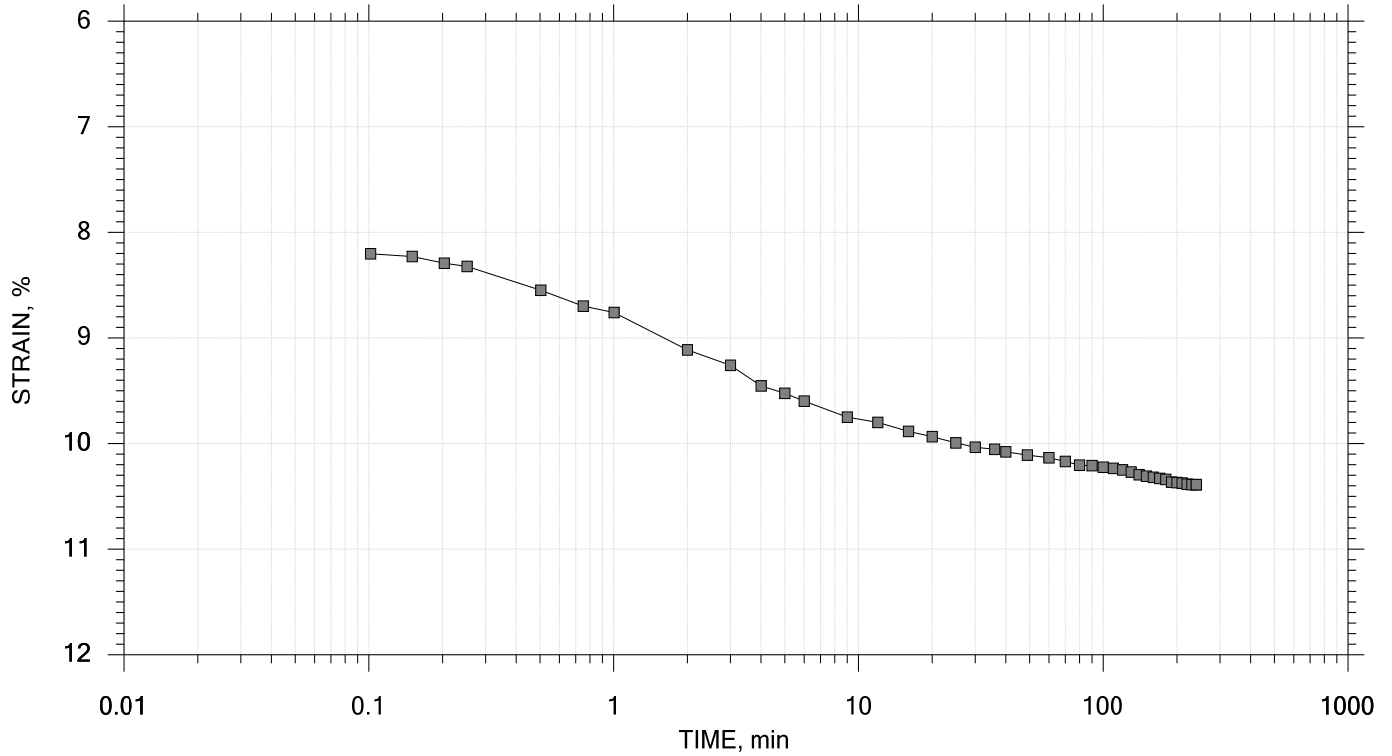
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	Sample No.: 1U	Test Date: 7/28/15	Test No.: IP-1
	Depth: 24.5-26.5 ft	Sample Type: intact	Elevation: ---
	Description: Wet, dark gray clay		
	Remarks: System S		


One-Dimensional Consolidation by ASTM D2435 - Method B

TIME CURVES

Constant Load Step 6 of 19

Stress: 4 tsf



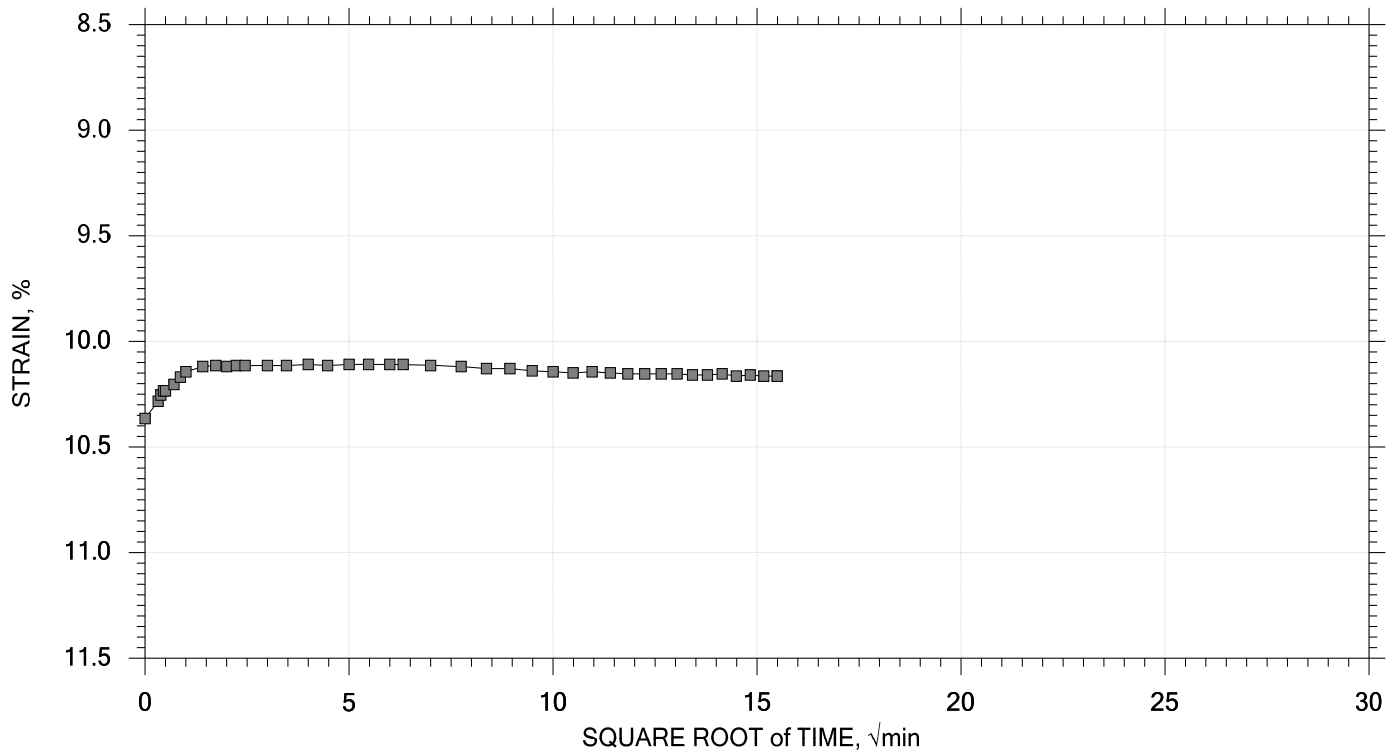
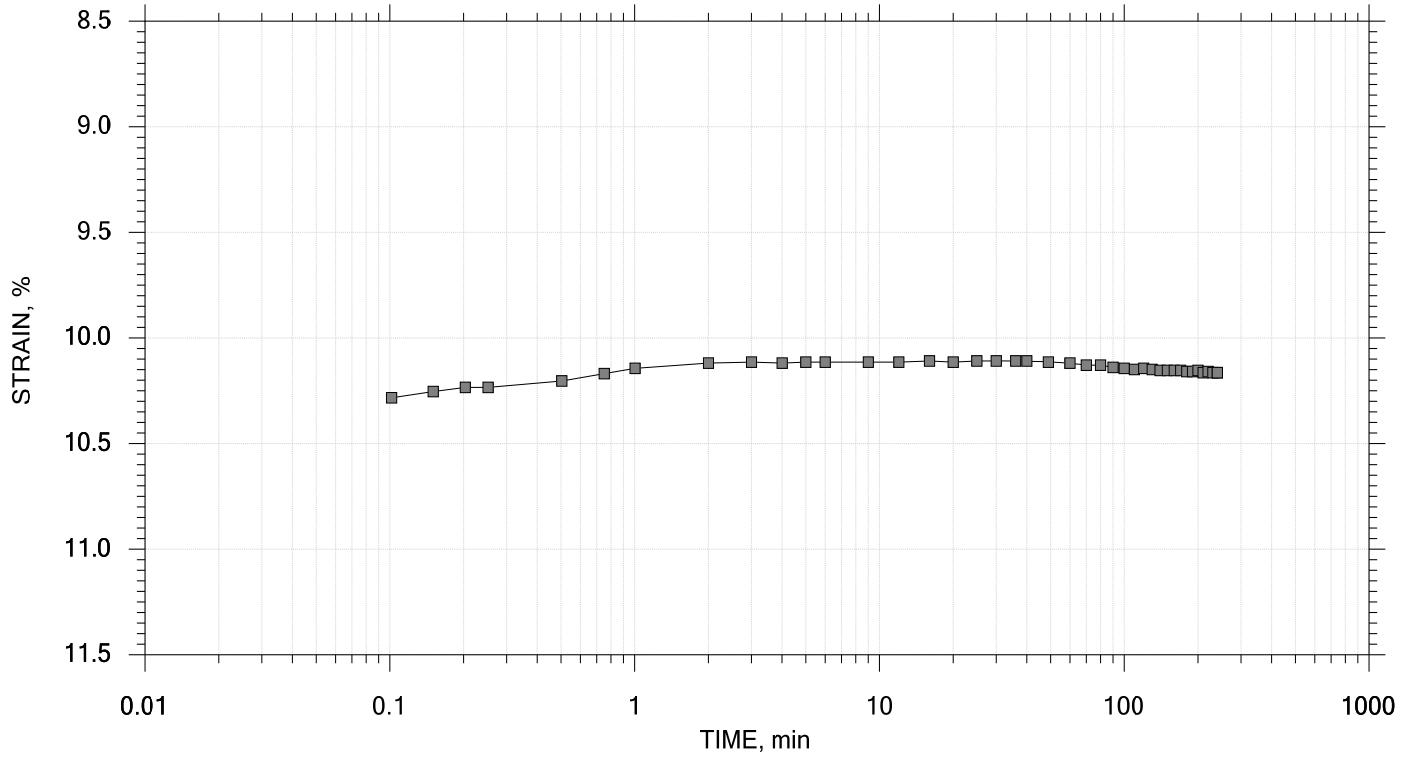
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	Sample No.: 1U	Test Date: 7/28/15	Test No.: IP-1
	Depth: 24.5-26.5 ft	Sample Type: intact	Elevation: ---
	Description: Wet, dark gray clay		
	Remarks: System S		


One-Dimensional Consolidation by ASTM D2435 - Method B

TIME CURVES

Constant Load Step 7 of 19

Stress: 2 tsf



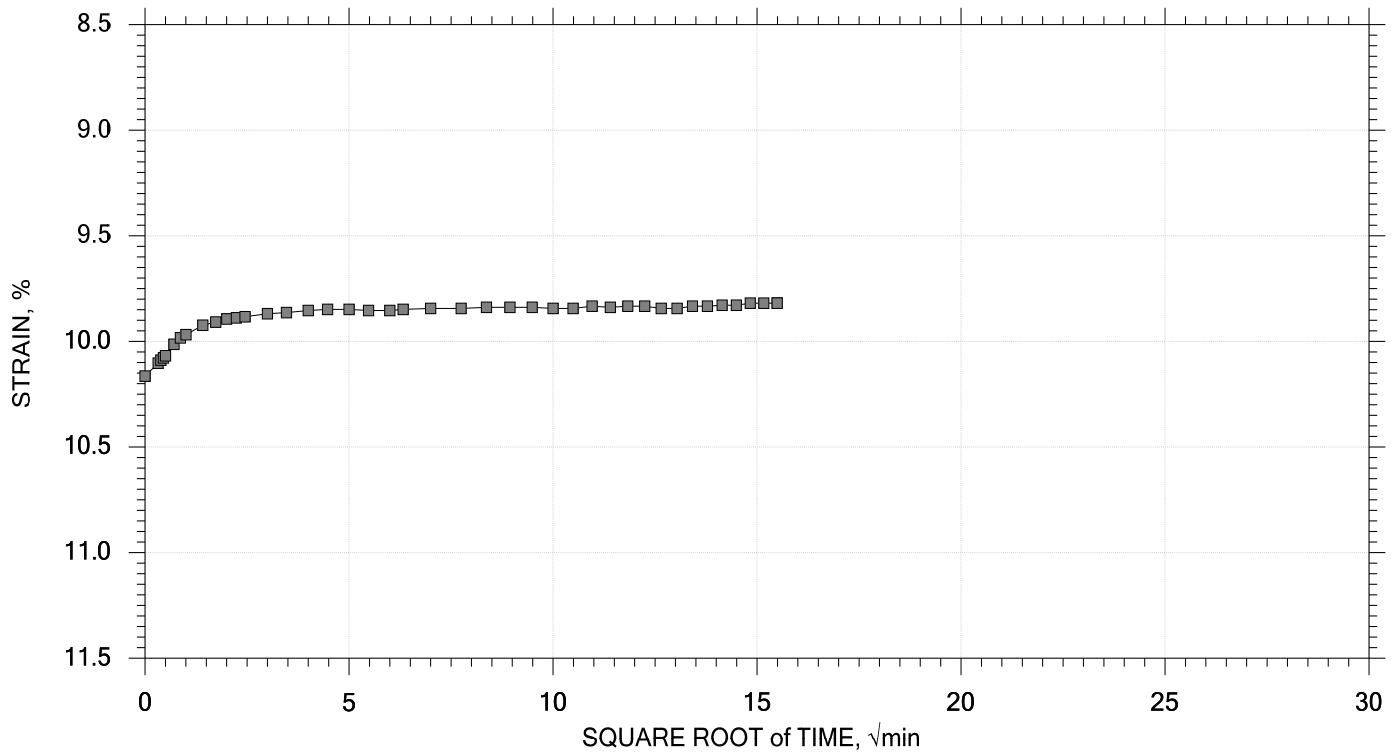
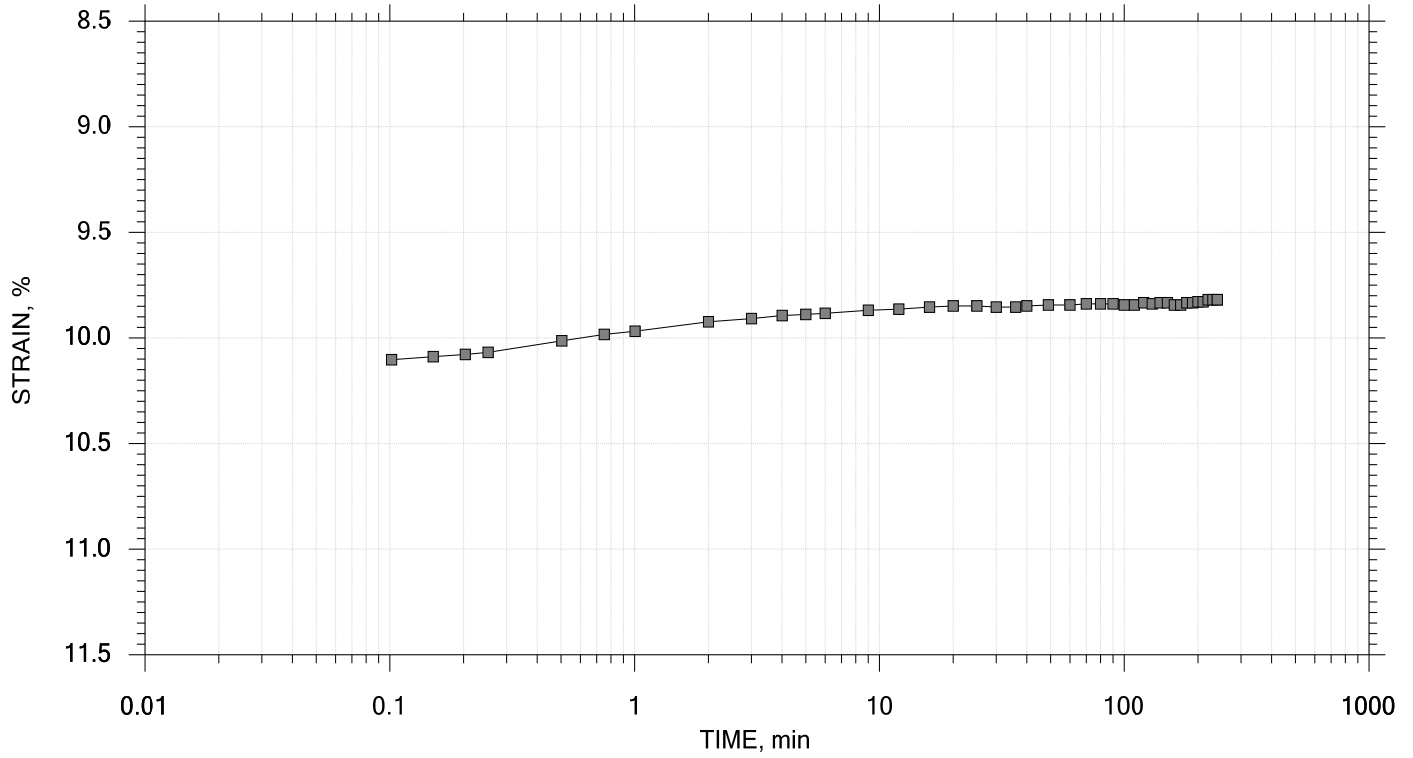
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	Boring No.: BB-MOS-501	Tested By: md	Checked By: jdt
	Sample No.: 1U	Test Date: 7/28/15	Test No.: IP-1
	Depth: 24.5-26.5 ft	Sample Type: intact	Elevation: ---
	Description: Wet, dark gray clay		
	Remarks: System S		


One-Dimensional Consolidation by ASTM D2435 - Method B

TIME CURVES

Constant Load Step 8 of 19

Stress: 1 tsf



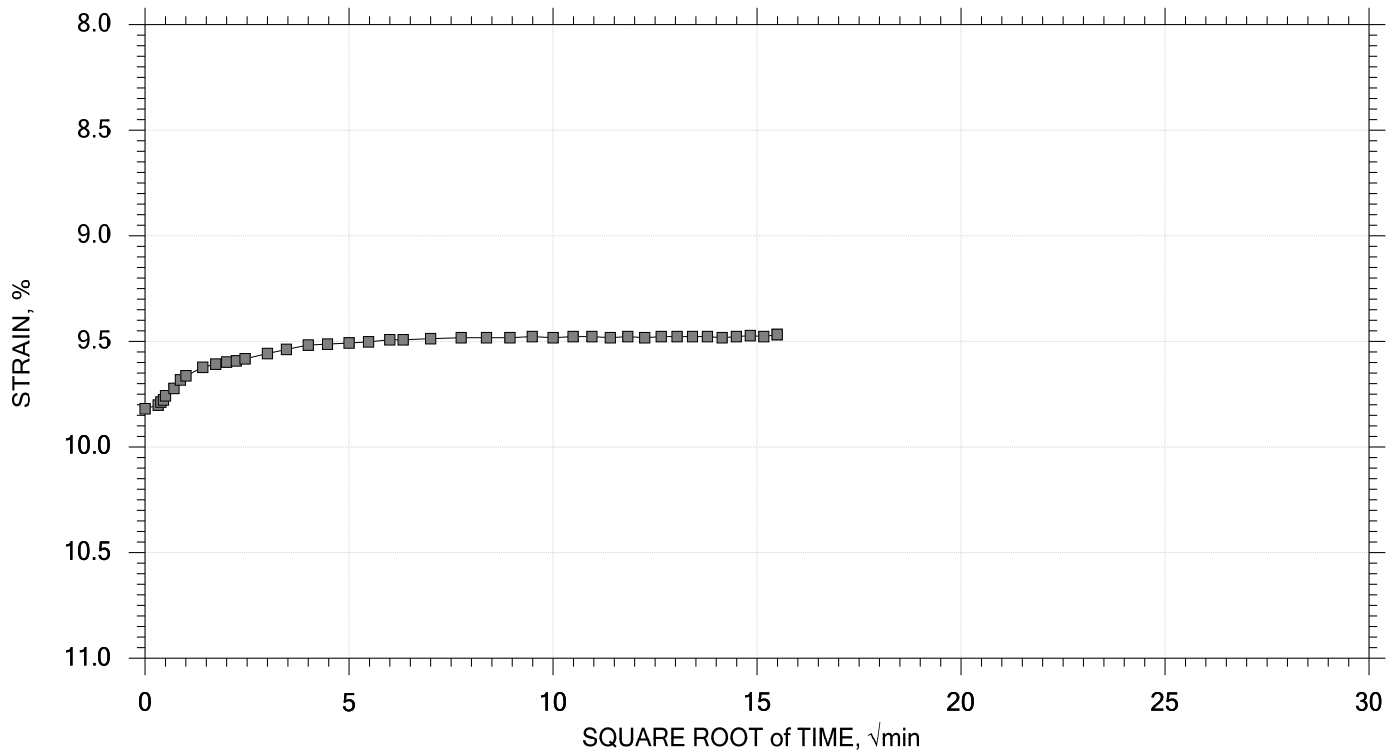
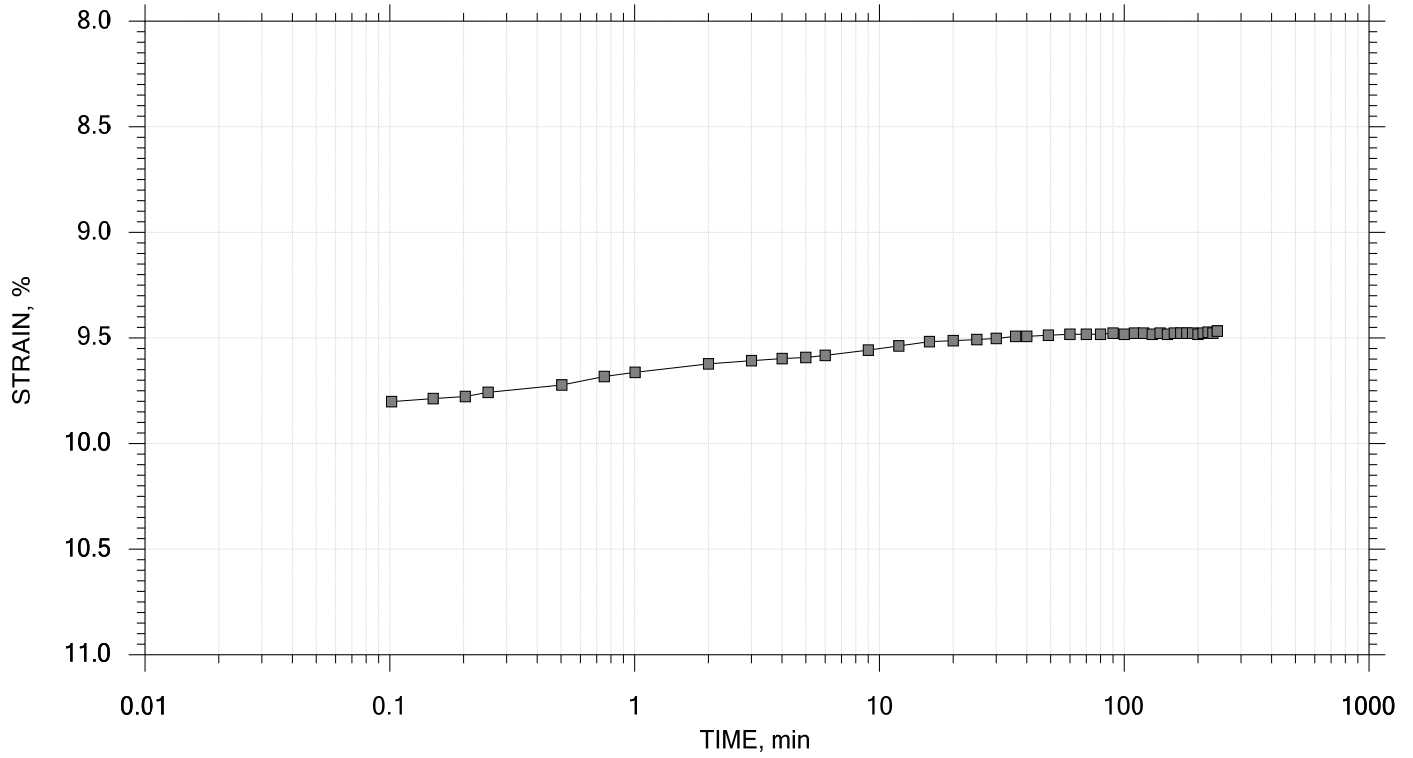
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	Boring No.: BB-MOS-501	Tested By: md	Checked By: jdt
	Sample No.: 1U	Test Date: 7/28/15	Test No.: IP-1
	Depth: 24.5-26.5 ft	Sample Type: intact	Elevation: ---
	Description: Wet, dark gray clay		
	Remarks: System S		


One-Dimensional Consolidation by ASTM D2435 - Method B

TIME CURVES

Constant Load Step 9 of 19

Stress: 0.5 tsf



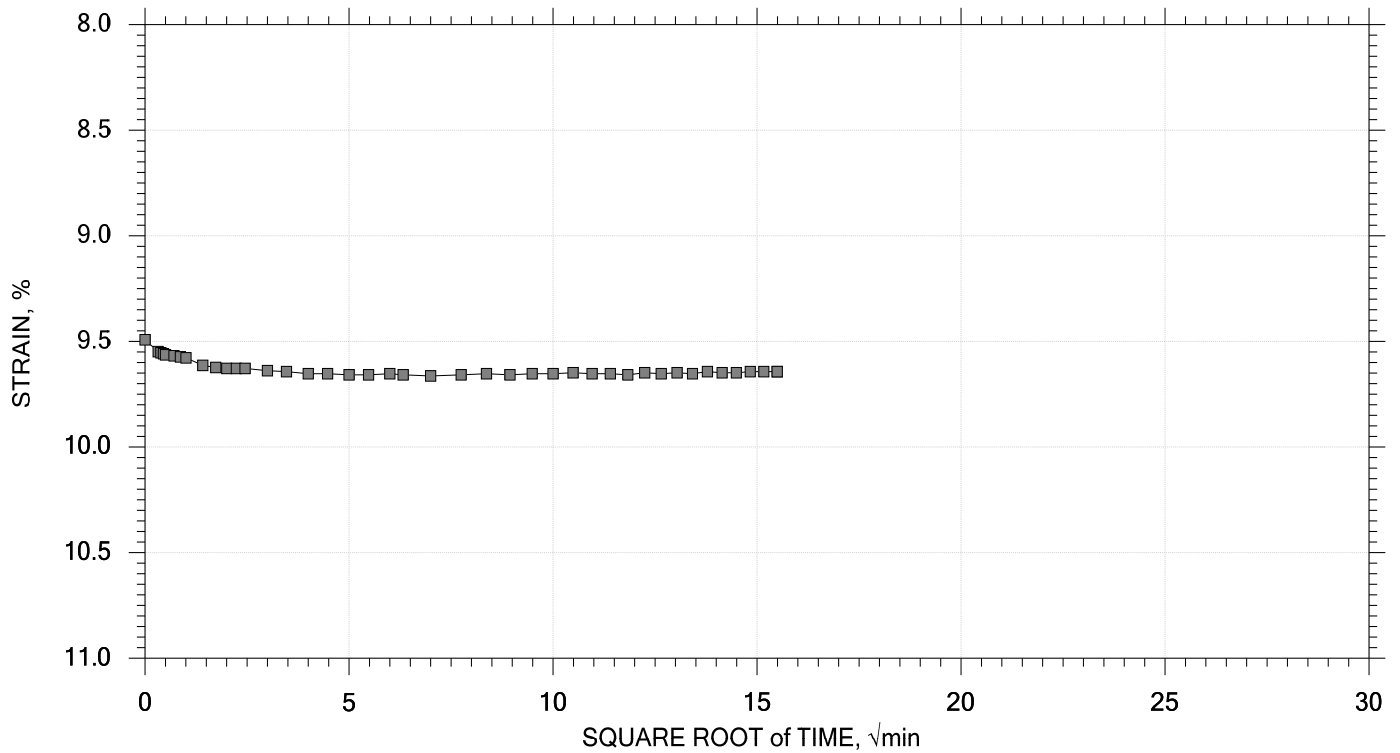
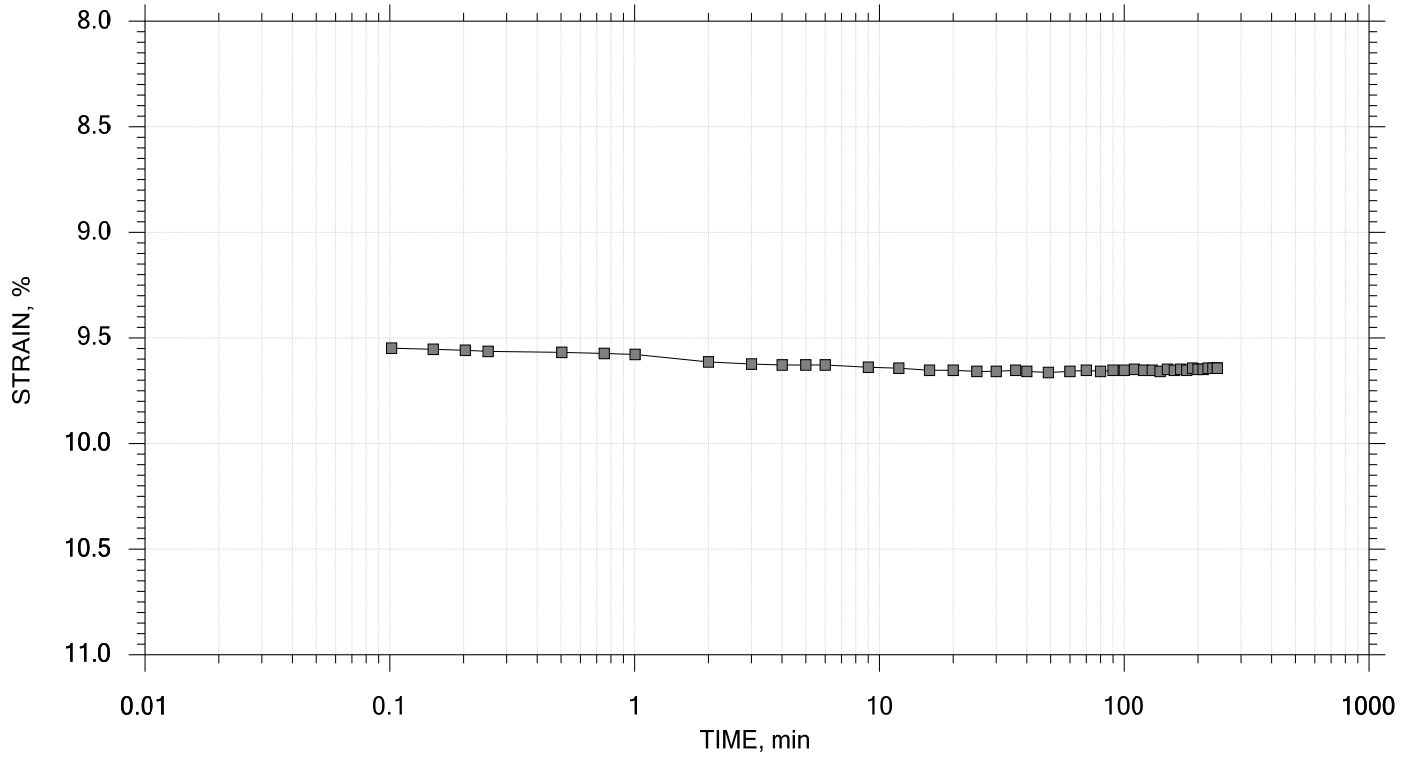
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	Sample No.: 1U	Test Date: 7/28/15	Test No.: IP-1
	Depth: 24.5-26.5 ft	Sample Type: intact	Elevation: ---
	Description: Wet, dark gray clay		
	Remarks: System S		


One-Dimensional Consolidation by ASTM D2435 - Method B

TIME CURVES

Constant Load Step 10 of 19

Stress: 1 tsf



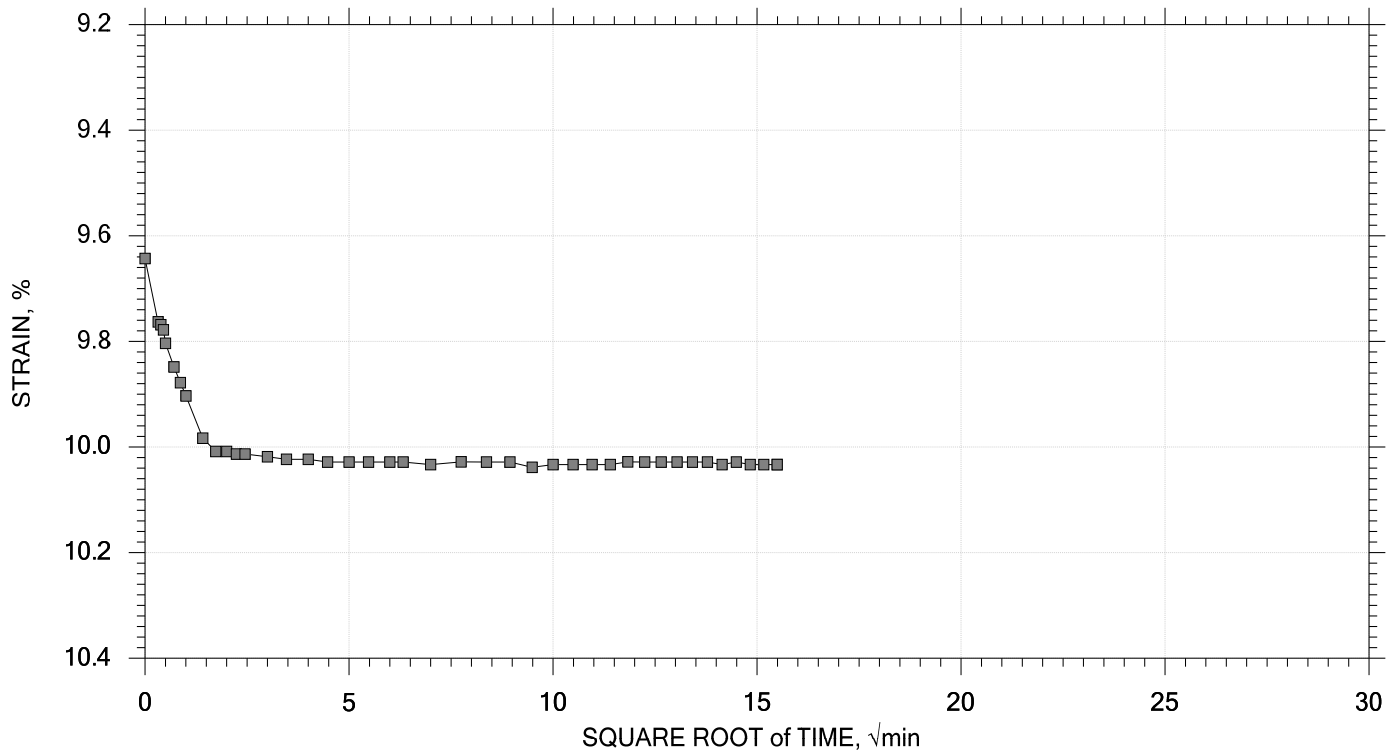
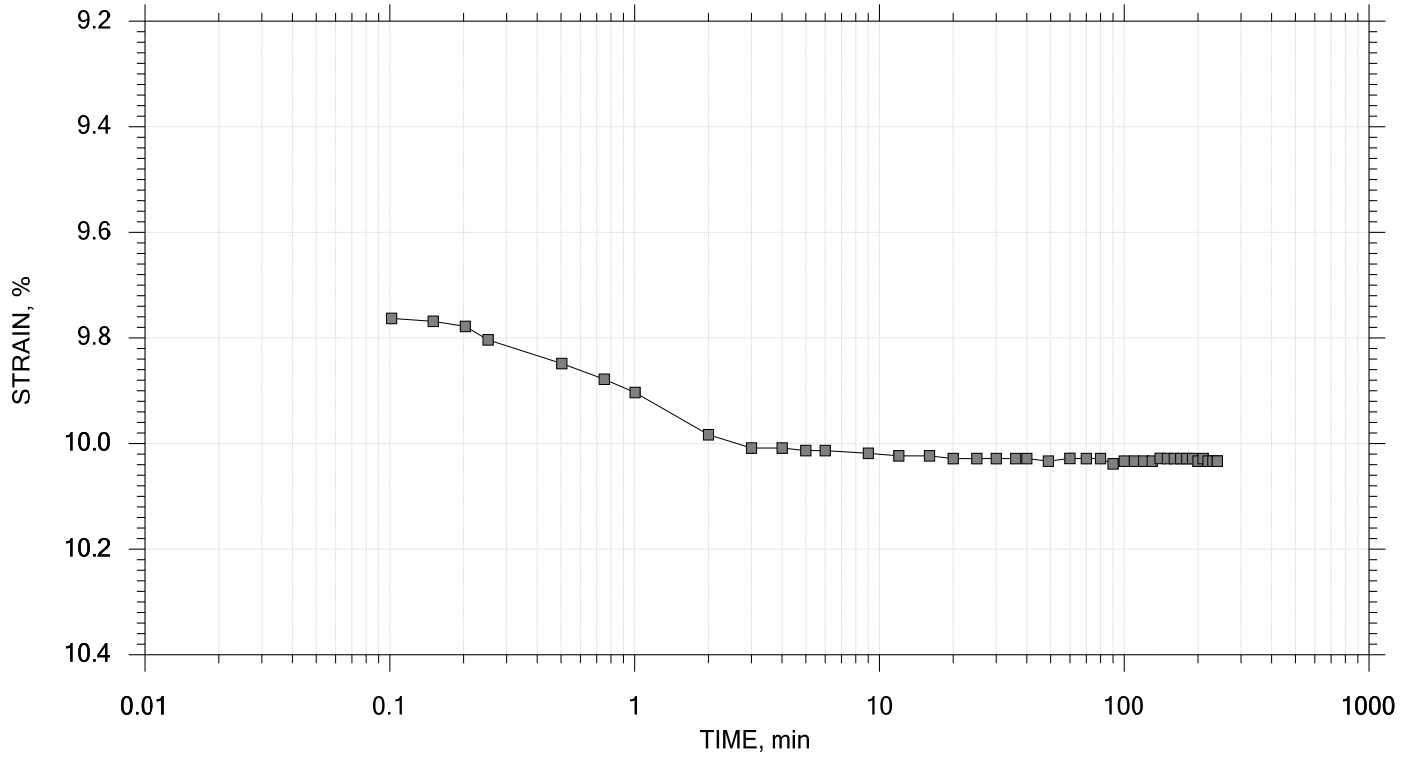
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	Sample No.: 1U	Test Date: 7/28/15	Test No.: IP-1
	Depth: 24.5-26.5 ft	Sample Type: intact	Elevation: ---
	Description: Wet, dark gray clay		
	Remarks: System S		


One-Dimensional Consolidation by ASTM D2435 - Method B

TIME CURVES

Constant Load Step 11 of 19

Stress: 2 tsf



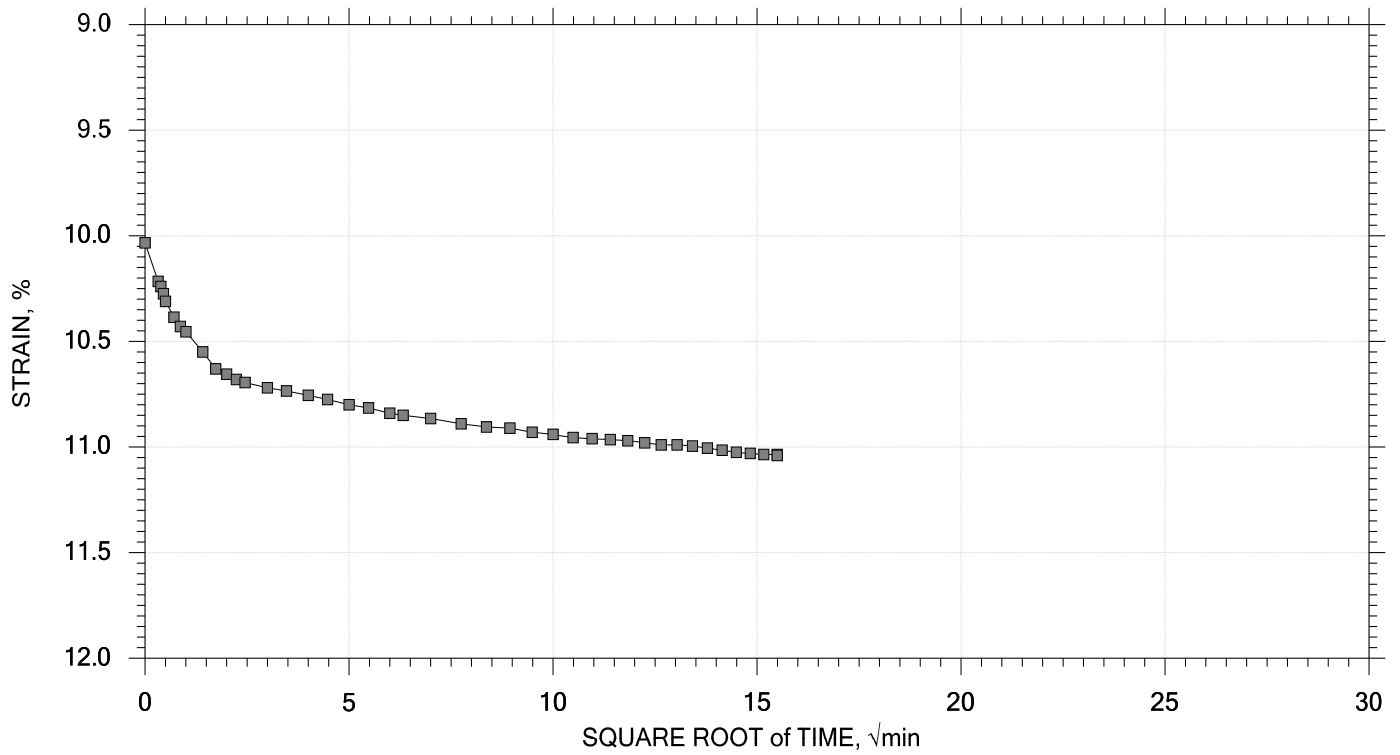
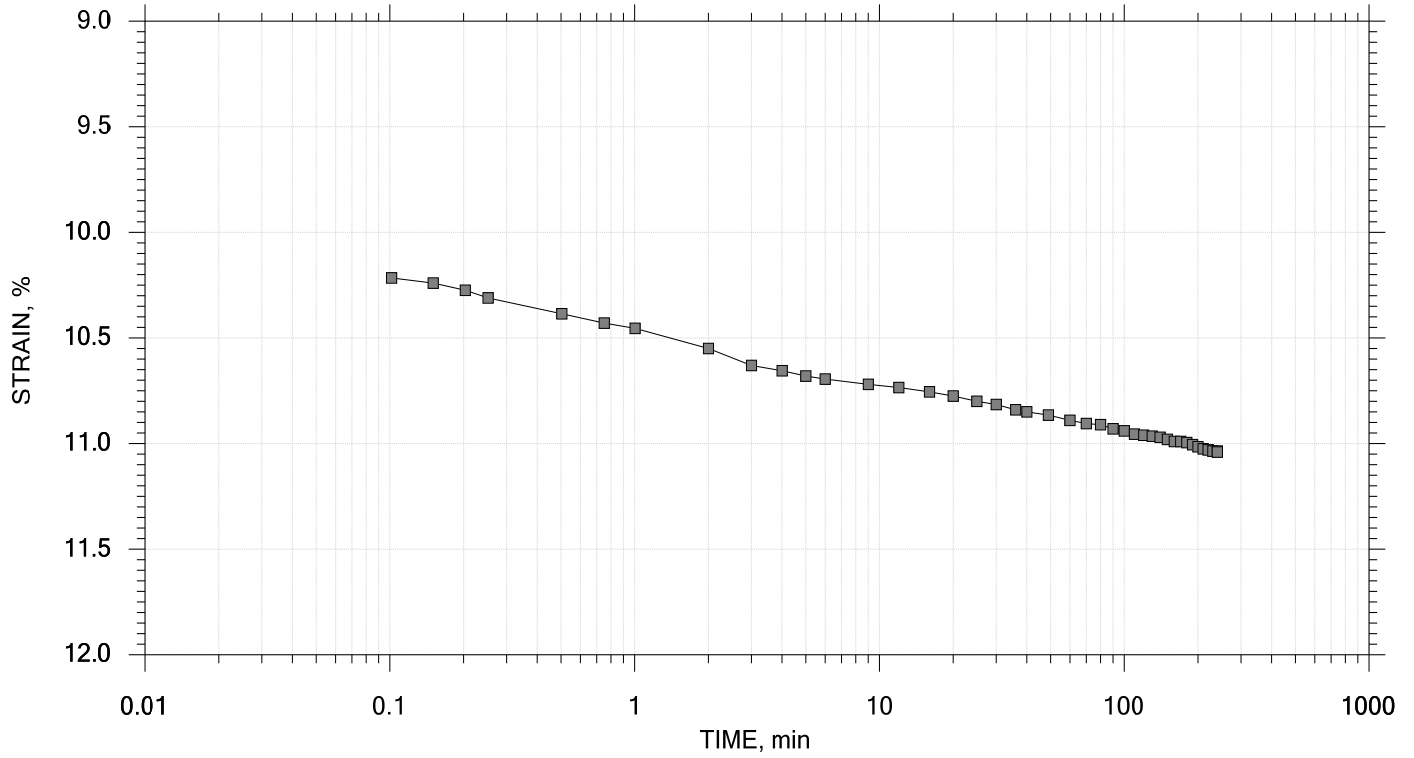
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	Boring No.: BB-MOS-501	Tested By: md	Checked By: jdt
	Sample No.: 1U	Test Date: 7/28/15	Test No.: IP-1
	Depth: 24.5-26.5 ft	Sample Type: intact	Elevation: ---
	Description: Wet, dark gray clay		
	Remarks: System S		


One-Dimensional Consolidation by ASTM D2435 - Method B

TIME CURVES

Constant Load Step 12 of 19

Stress: 4 tsf



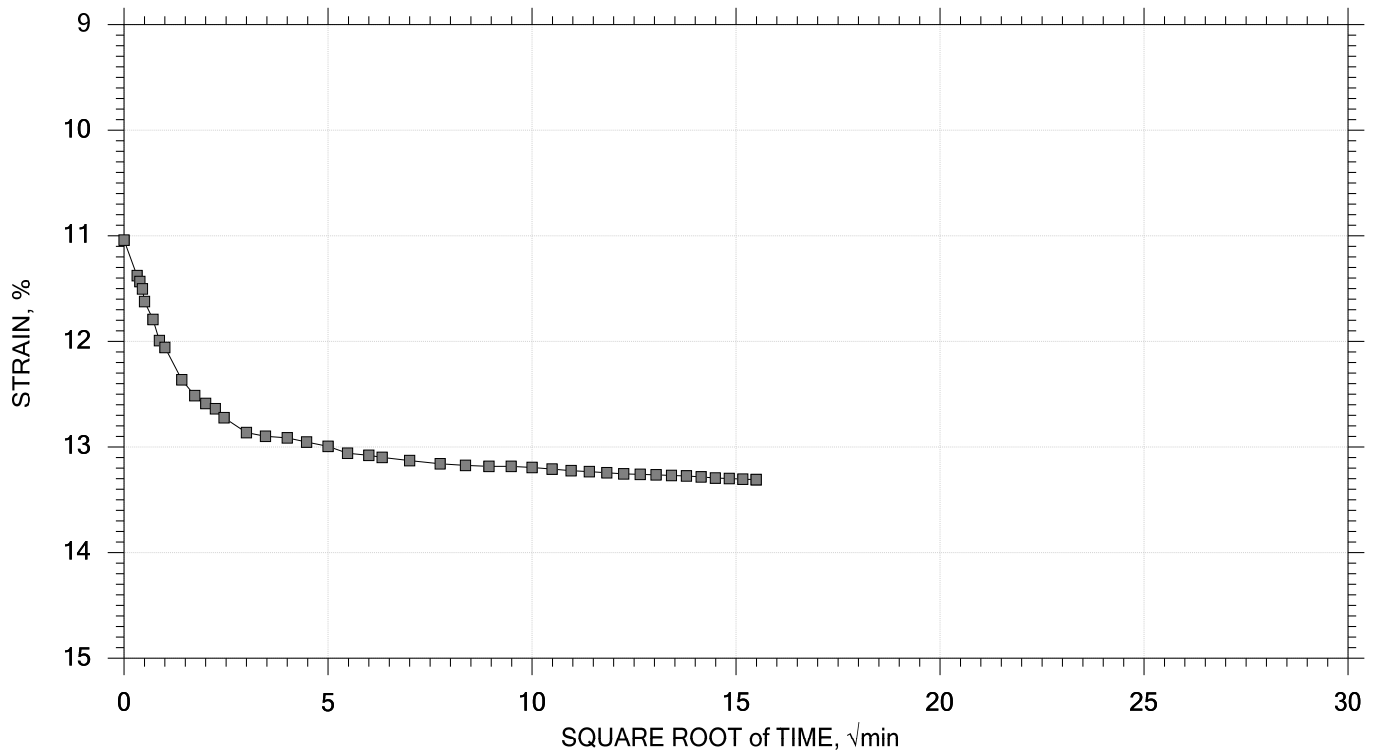
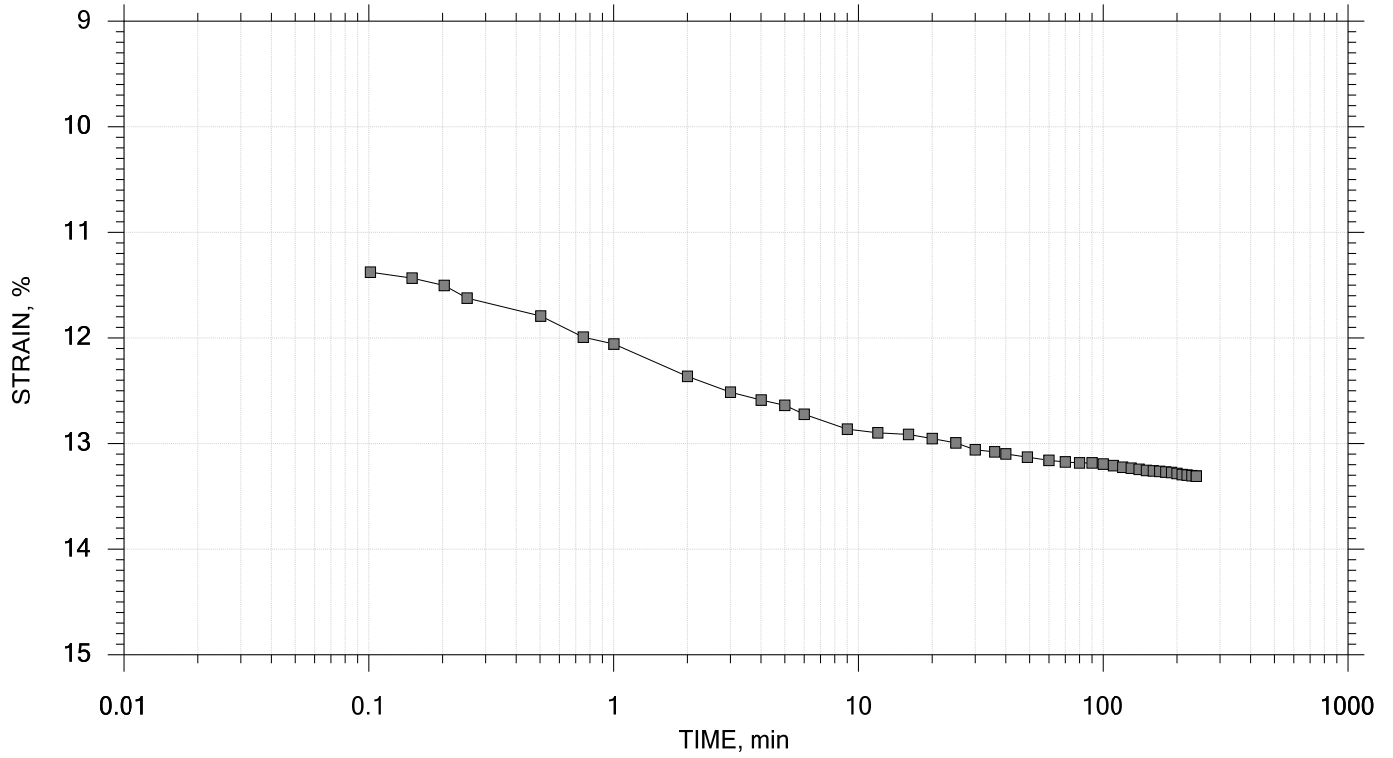
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	Boring No.: BB-MOS-501	Tested By: md	Checked By: jdt
	Sample No.: 1U	Test Date: 7/28/15	Test No.: IP-1
	Depth: 24.5-26.5 ft	Sample Type: intact	Elevation: ---
	Description: Wet, dark gray clay		
	Remarks: System S		


One-Dimensional Consolidation by ASTM D2435 - Method B

TIME CURVES

Constant Load Step 13 of 19

Stress: 8 tsf



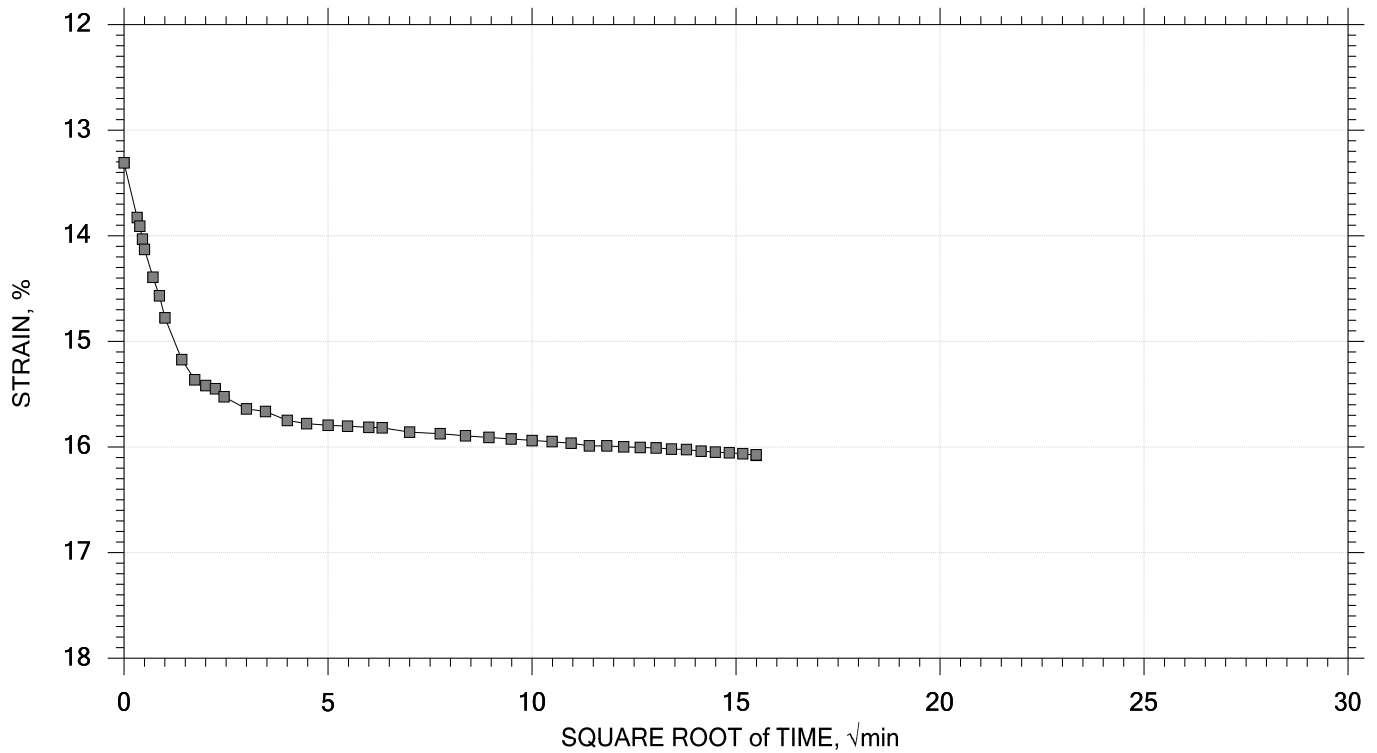
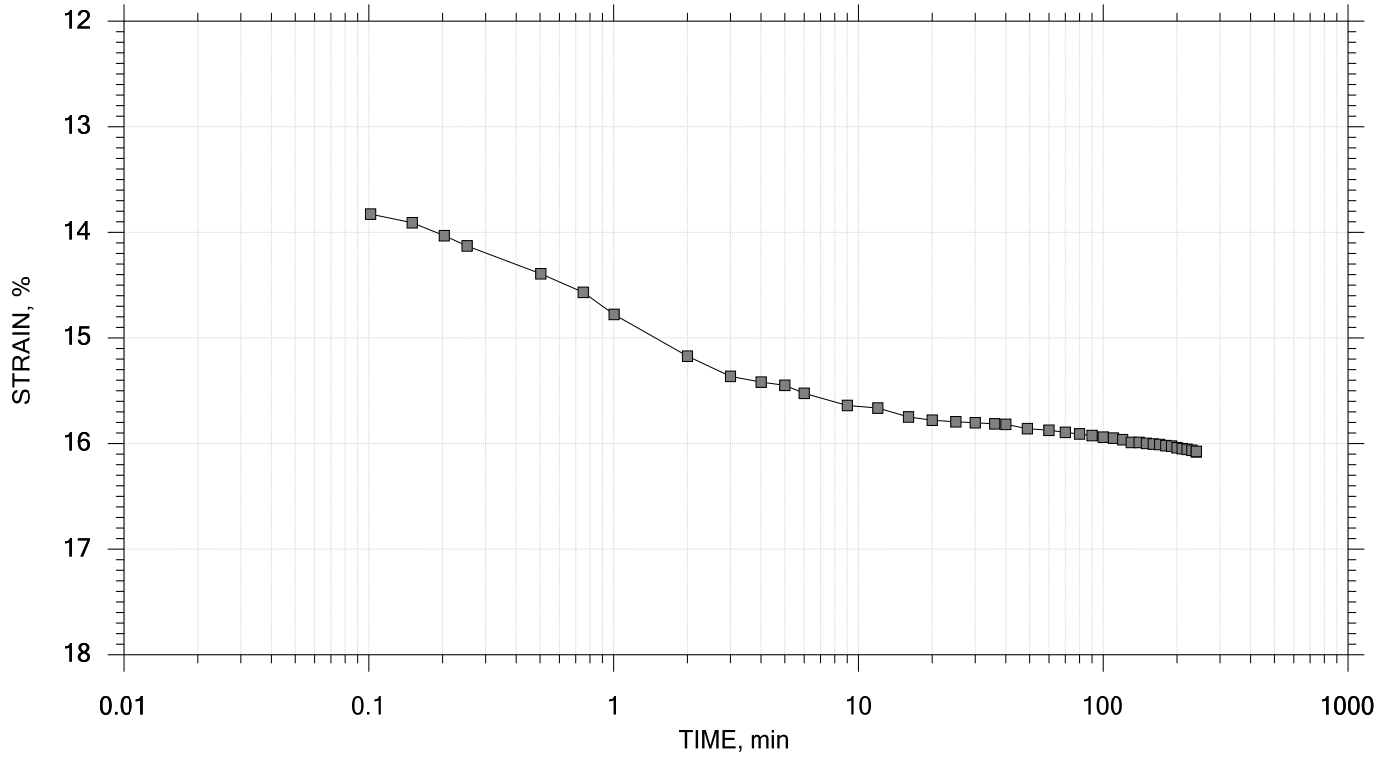
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	Boring No.: BB-MOS-501	Tested By: md	Checked By: jdt
	Sample No.: 1U	Test Date: 7/28/15	Test No.: IP-1
	Depth: 24.5-26.5 ft	Sample Type: intact	Elevation: ---
	Description: Wet, dark gray clay		
	Remarks: System S		


One-Dimensional Consolidation by ASTM D2435 - Method B

TIME CURVES

Constant Load Step 14 of 19

Stress: 16 tsf



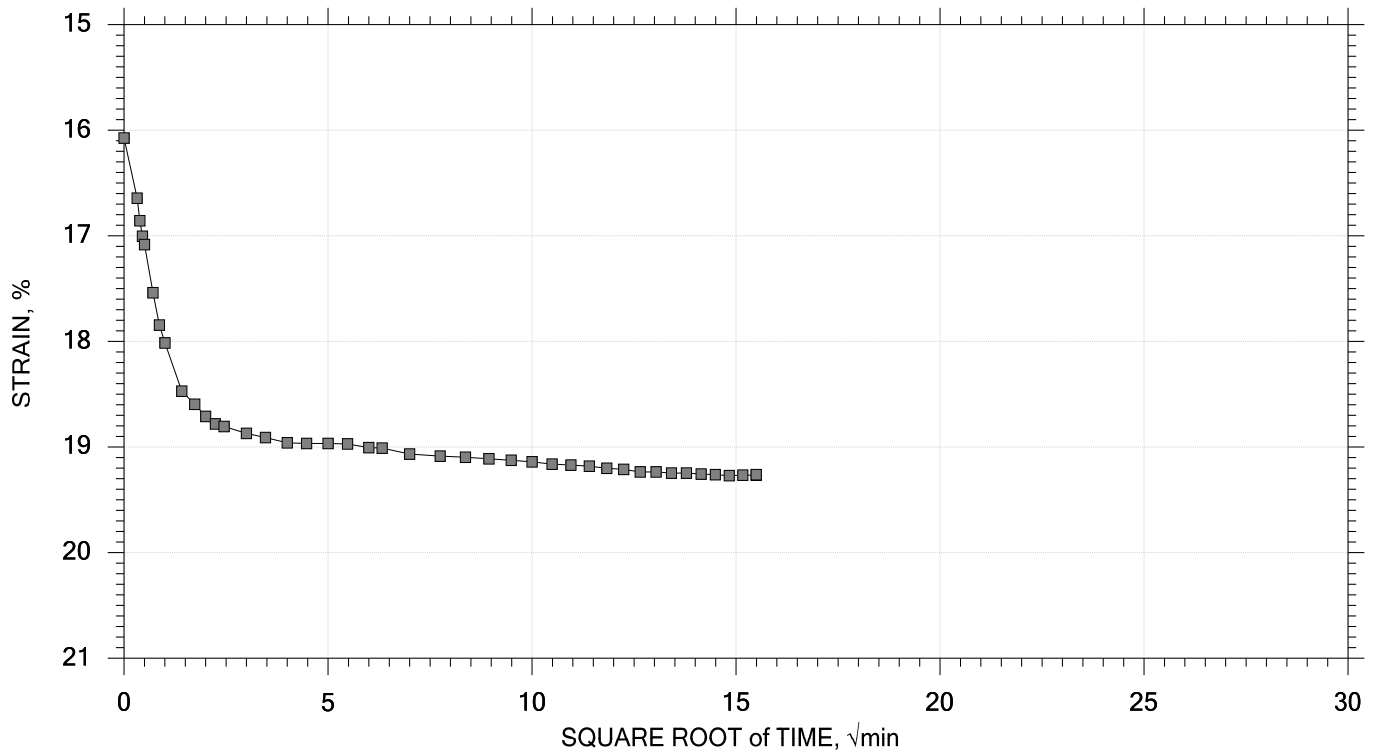
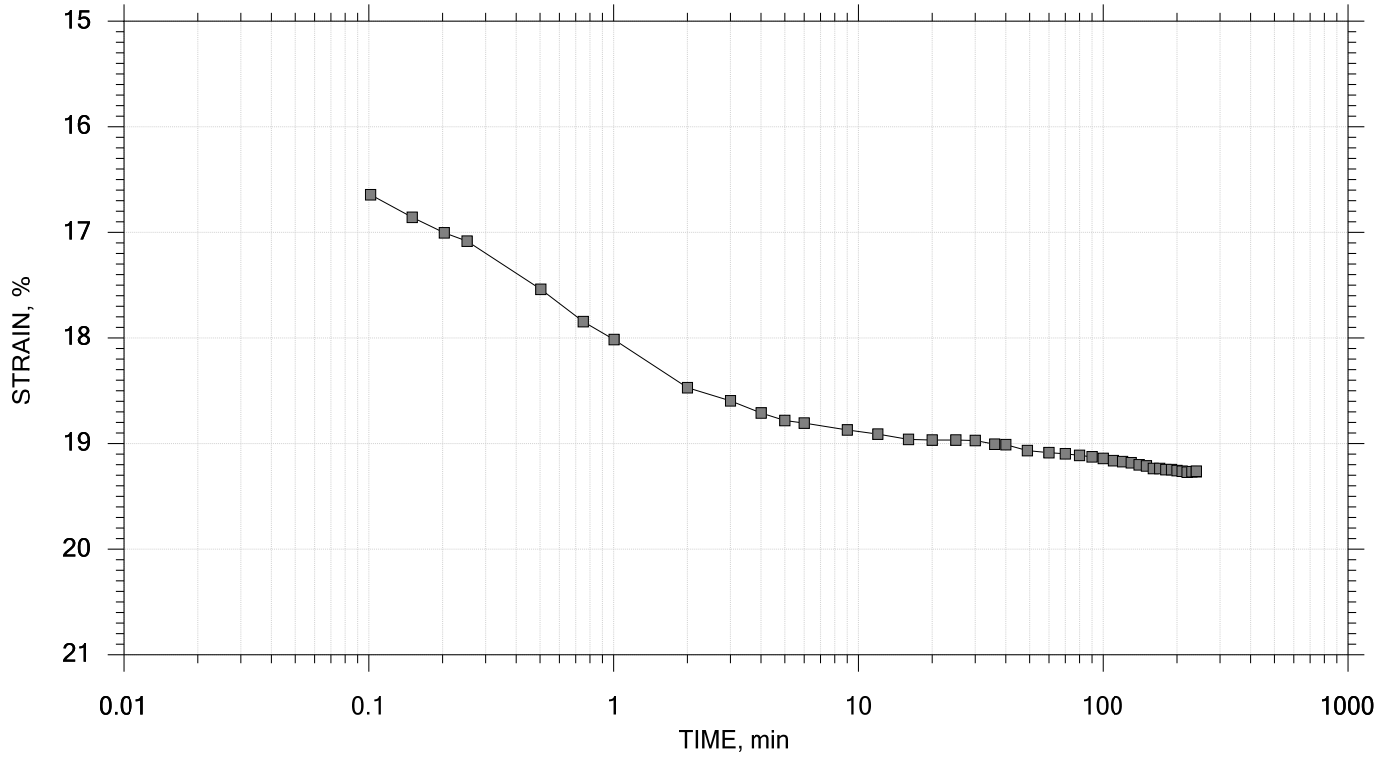
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	Sample No.: 1U	Test Date: 7/28/15	Test No.: IP-1
	Depth: 24.5-26.5 ft	Sample Type: intact	Elevation: ---
	Description: Wet, dark gray clay		
	Remarks: System S		


One-Dimensional Consolidation by ASTM D2435 - Method B

TIME CURVES

Constant Load Step 15 of 19

Stress: 32 tsf



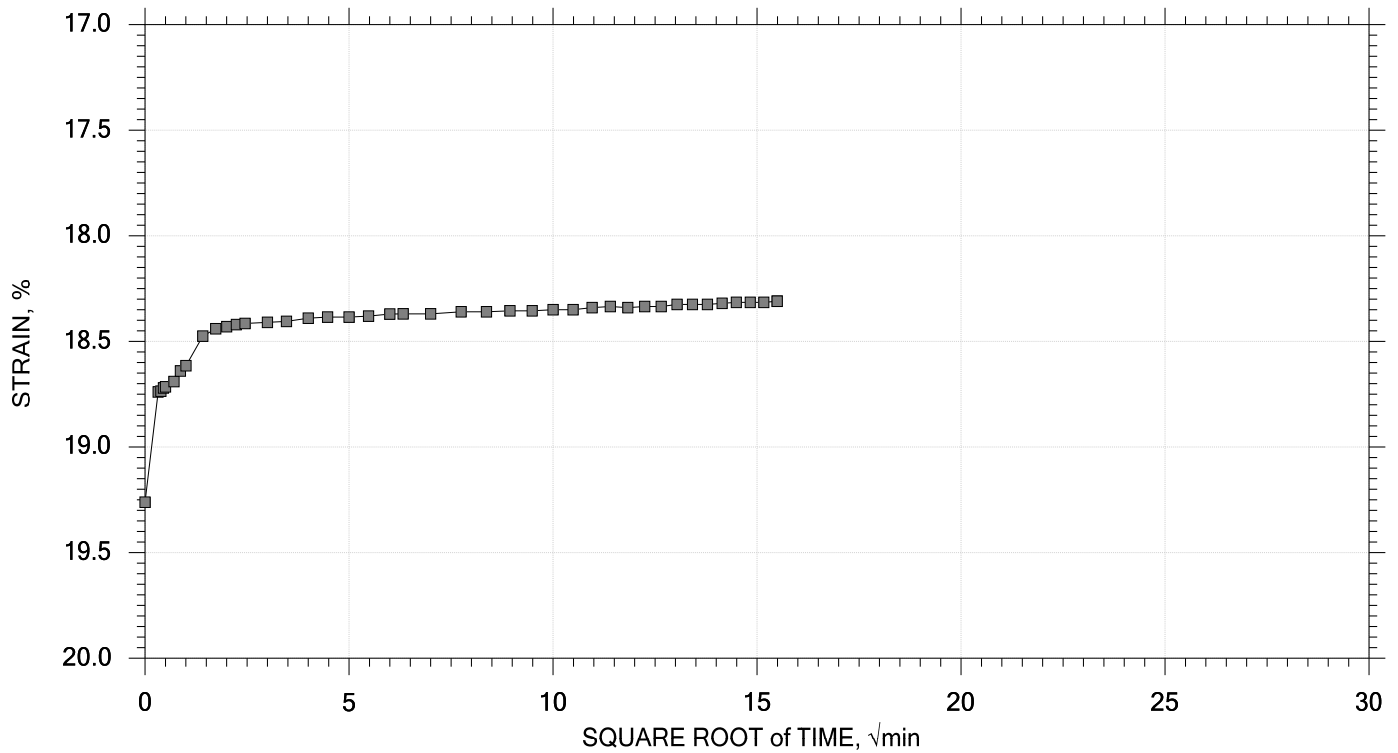
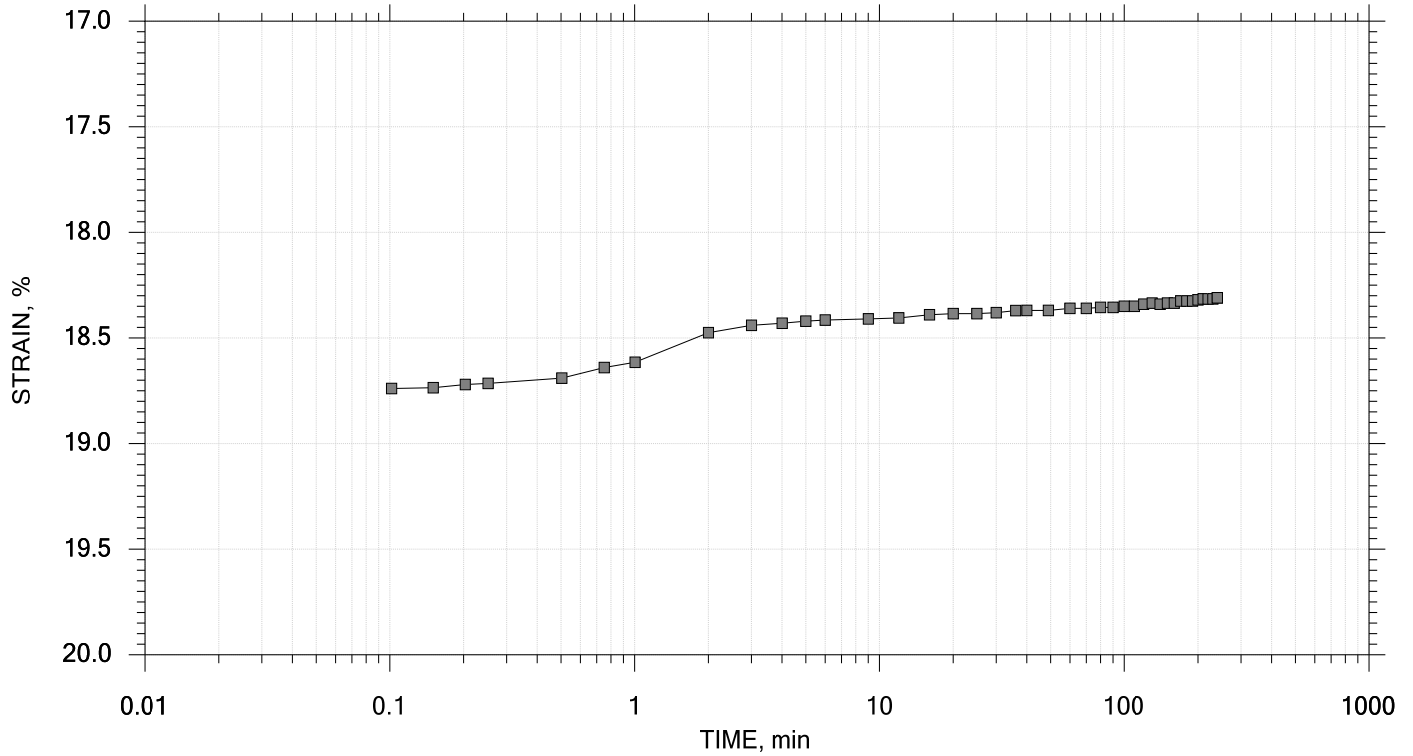
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	Boring No.: BB-MOS-501	Tested By: md	Checked By: jdt
	Sample No.: 1U	Test Date: 7/28/15	Test No.: IP-1
	Depth: 24.5-26.5 ft	Sample Type: intact	Elevation: ---
	Description: Wet, dark gray clay		
	Remarks: System S		


One-Dimensional Consolidation by ASTM D2435 - Method B

TIME CURVES

Constant Load Step 16 of 19

Stress: 8 tsf



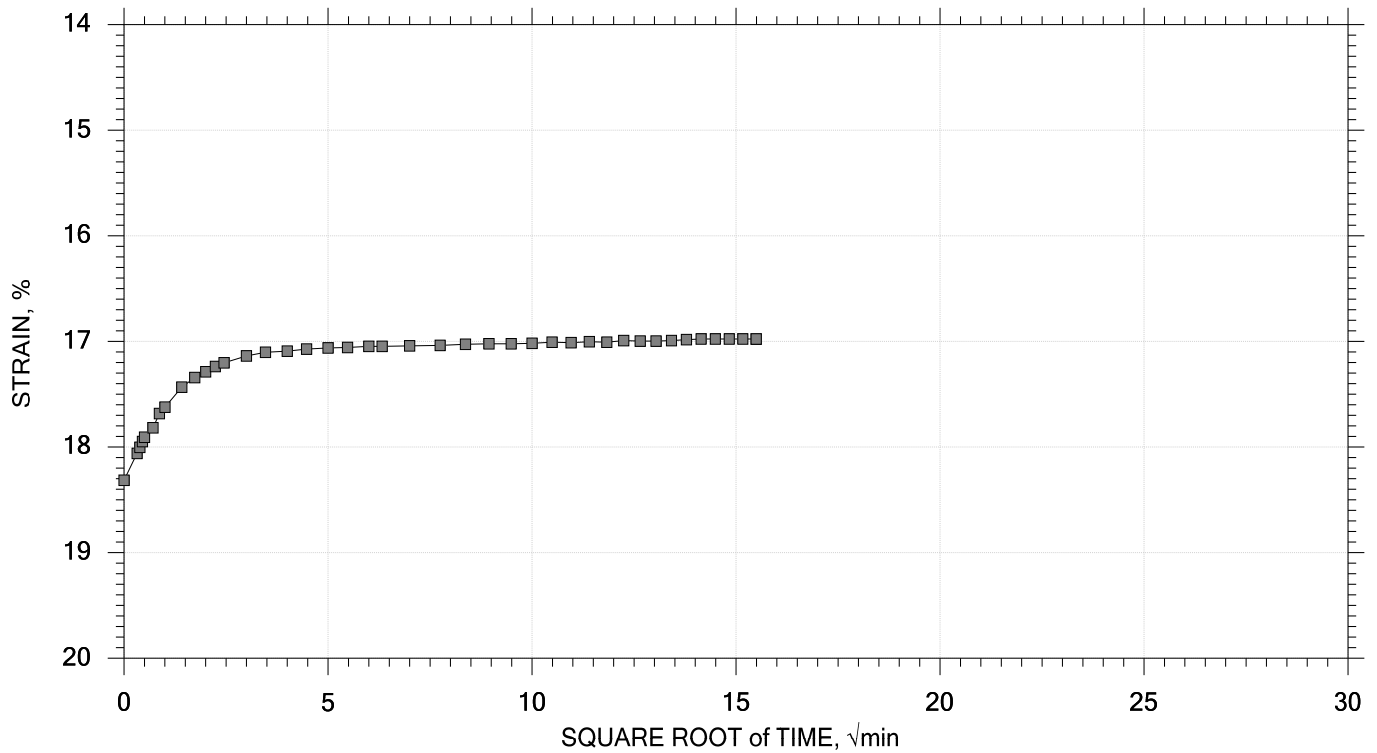
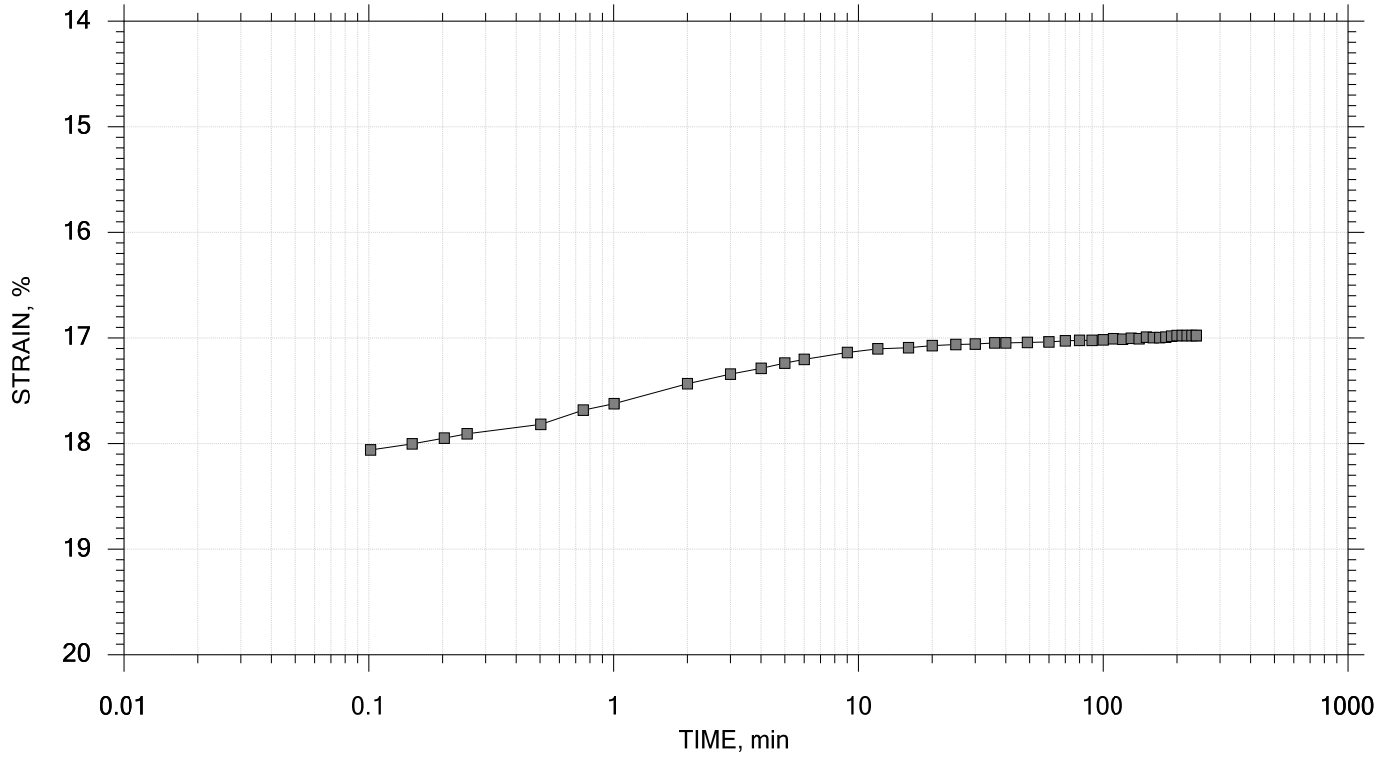
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	Boring No.: BB-MOS-501	Tested By: md	Checked By: jdt
	Sample No.: 1U	Test Date: 7/28/15	Test No.: IP-1
	Depth: 24.5-26.5 ft	Sample Type: intact	Elevation: ---
	Description: Wet, dark gray clay		
	Remarks: System S		


One-Dimensional Consolidation by ASTM D2435 - Method B

TIME CURVES

Constant Load Step 17 of 19

Stress: 2 tsf



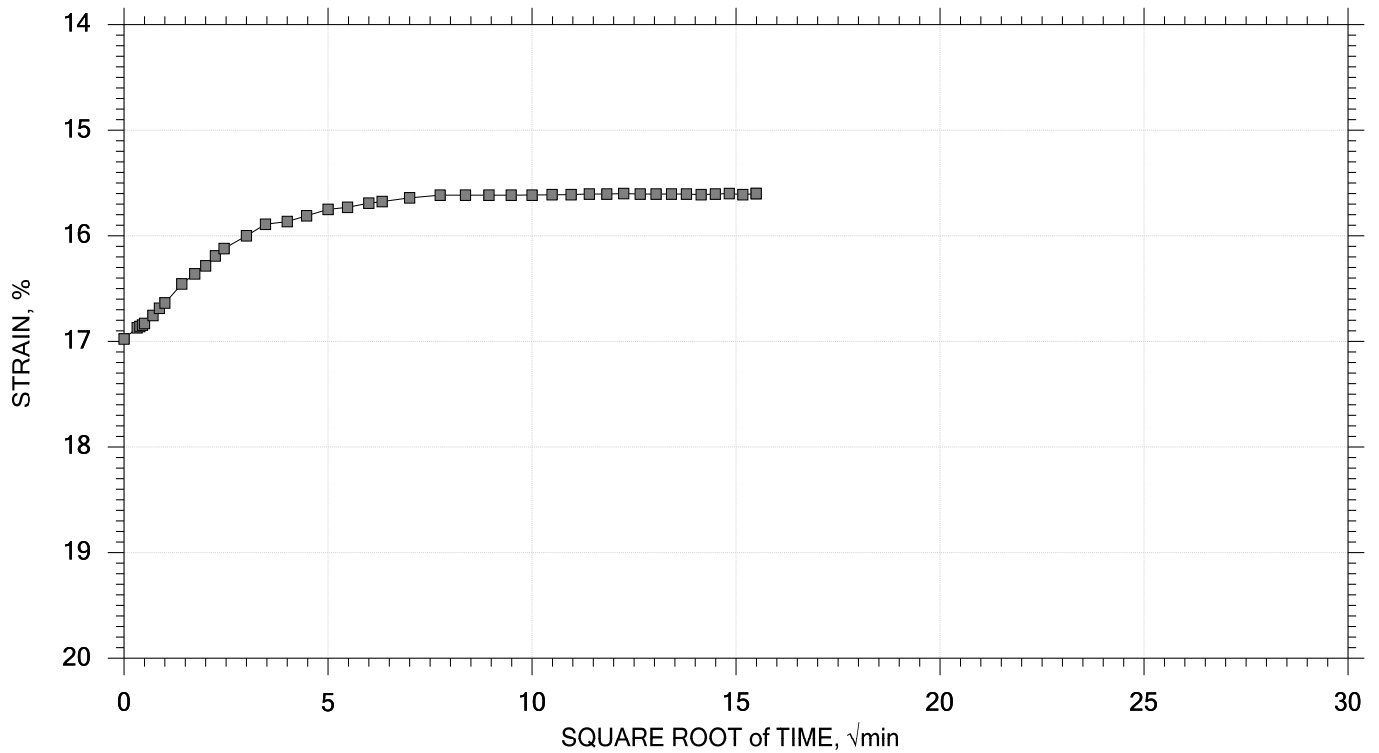
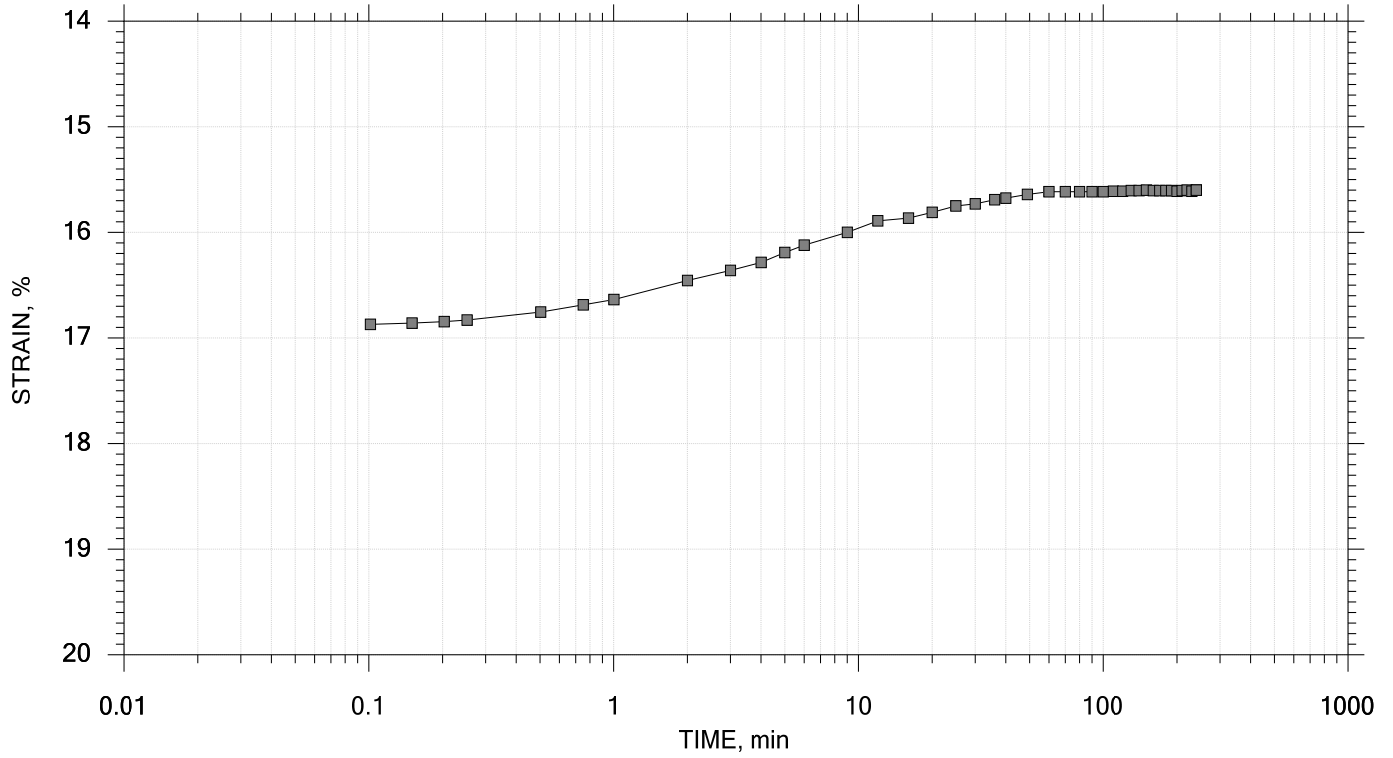
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	Boring No.: BB-MOS-501	Tested By: md	Checked By: jdt
	Sample No.: 1U	Test Date: 7/28/15	Test No.: IP-1
	Depth: 24.5-26.5 ft	Sample Type: intact	Elevation: ---
	Description: Wet, dark gray clay		
	Remarks: System S		


One-Dimensional Consolidation by ASTM D2435 - Method B

TIME CURVES

Constant Load Step 18 of 19

Stress: 0.5 tsf



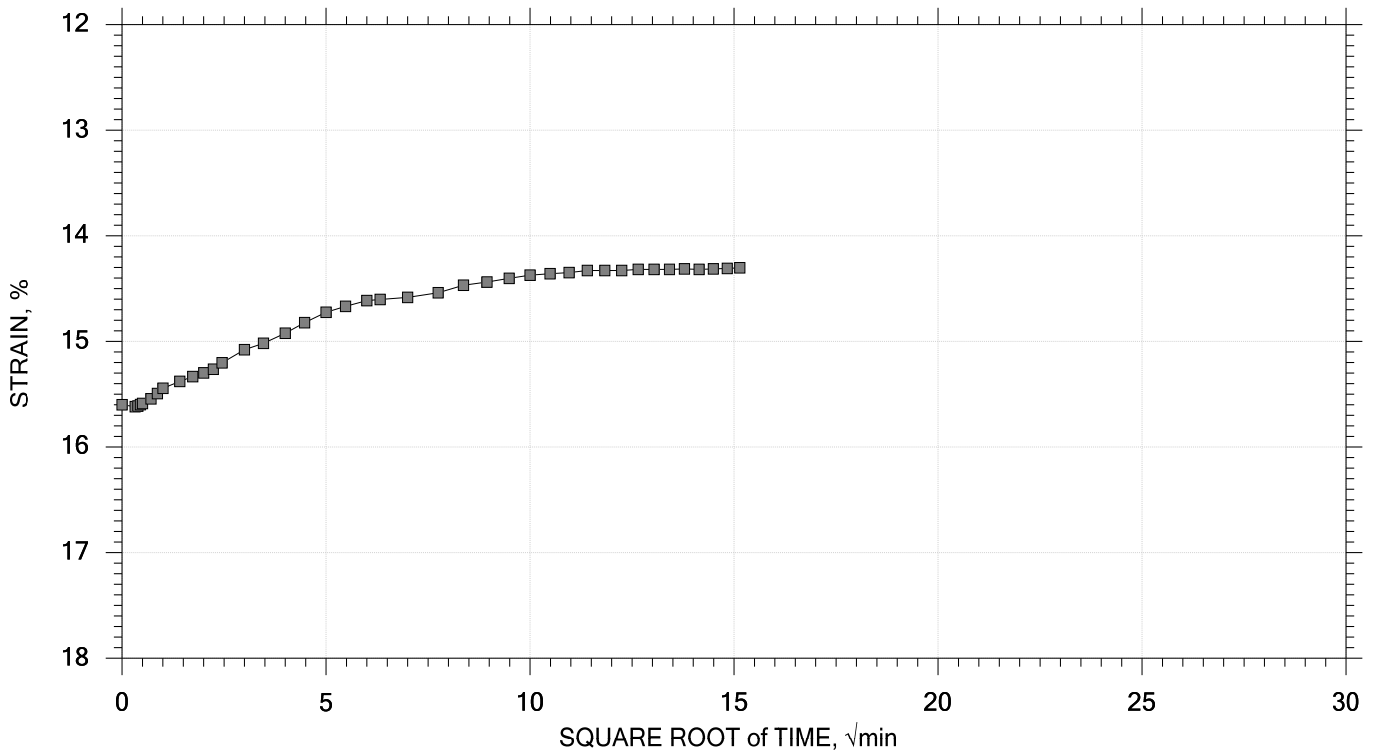
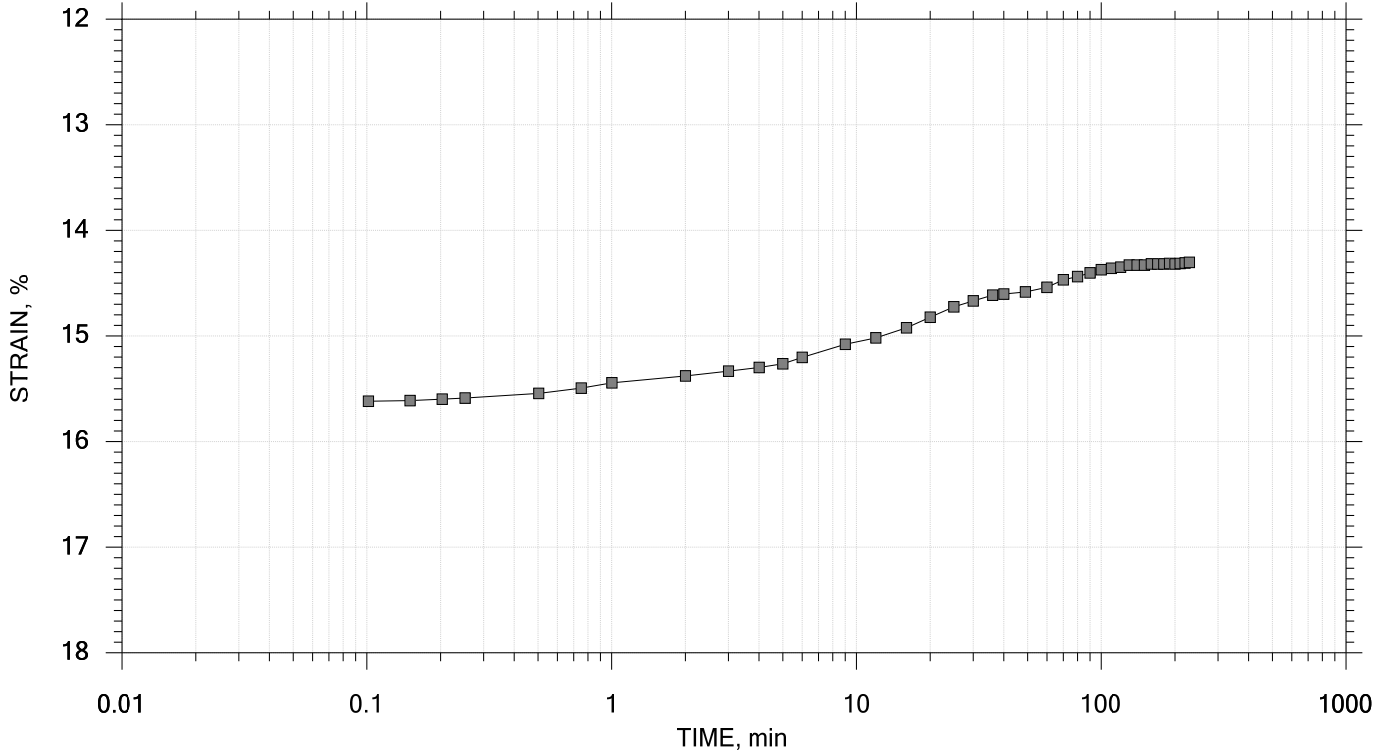
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	Boring No.: BB-MOS-501	Tested By: md	Checked By: jdt
	Sample No.: 1U	Test Date: 7/28/15	Test No.: IP-1
	Depth: 24.5-26.5 ft	Sample Type: intact	Elevation: ---
	Description: Wet, dark gray clay		
	Remarks: System S		


One-Dimensional Consolidation by ASTM D2435 - Method B

TIME CURVES

Constant Load Step 19 of 19

Stress: 0.125 tsf



	Project: Second Otter Bridge	Location: Milford, ME	Project No.: GTX-303508
	Boring No.: BB-MOS-501	Tested By: md	Checked By: jdt
	Sample No.: 1U	Test Date: 7/28/15	Test No.: IP-1
	Depth: 24.5-26.5 ft	Sample Type: intact	Elevation: ---
	Description: Wet, dark gray clay		
	Remarks: System S		

Appendix C

Geotechnical Evaluations

DESIGN MEMORANDUM

Rev 1

18-0043

March 6, 2018

Geotechnical Engineering Services

WIN 23466.00 (Formerly WIN 16667)
Second Otter Bridge over Otter Stream
Second Otter Bridge #2754
Milford, Maine

Prepared For:

Maine Department of Transportation
Attention: Laura Krusinski, P.E.
State House Station 16
Augusta, ME 04333-0016

Prepared By:

S. W. Cole Engineering, Inc.
26 Coles Crossing Drive
Sidney, ME 04330
T: (207) 626-0600



- *Geotechnical Engineering*
- *Construction Materials Testing and Special Inspections*
- *GeoEnvironmental Services*
- *Test Boring Explorations*

www.swcole.com

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Appendix B	Computations
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	Settlement
Appendix C	Conceptual Sketches

18-0043

March 6, 2018

Maine Department of Transportation
Attention: Laura Krusinski, P.E.
State House Station 16
Augusta, ME 04333-0016

Subject: Geotechnical Engineering Services – Rev 1
WIN 23466.00 (Formerly WIN 16667)
Second Otter Bridge over Otter Stream
Second Otter Bridge #2754
Milford, Maine

Dear Laura:

In accordance with our Proposal, dated January 15, 2018 and Assignment Letter #17, Revision 1 dated February 15, 2018, we have made the requested geotechnical engineering evaluations for the subject project. This Design Memorandum summarizes our geotechnical evaluations and design recommendations in support of the Maine Department of Transportation (MaineDOT) Preliminary Design Report (PDR). The contents herein are subject to the limitations set forth in Appendix A.

INTRODUCTION

The purpose of our services is to review existing information and geotechnical analyses completed to date and provide an independent geotechnical evaluation for the existing Abutment No. 2 (East Abutment) approach.

Our scope of services included a review of the existing subsurface data (explorations and laboratory testing), Project Plans for the existing bridge dated January 2013 and geotechnical analyses (soil parameters, global stability, and settlement) completed to date (by MaineDOT). Following our review, S. W. Cole Engineering, Inc. (S.W.COLE) developed soil parameters and completed geotechnical evaluations (global stability and settlement) for the existing east approach.

BACKGROUND

The site is located on County Road at the crossing of Otter Stream in Milford, Maine. Based on the provided information, the single-span bridge was constructed in 2013 and the east abutment is supported on single row of steel, HP 14x117 H-piles.

Based on a review of the Historical Bridge Plans dated January 1931 and current Bridge Plans dated February 2013, we understand the existing east abutment was constructed about 25 feet in front of the previous abutment and the approach was filled from about Station 31+25 to 31+50. We understand the new approach embankment is about 15 feet high and constructed with normal-weight fill and 1.75H:1V rip rap sideslopes. We understand the east approach has settled up to about 6 inches since construction.

We understand the preferred settlement mitigation option under consideration consists of removal of existing approach fill soils and replacement with lightweight material. Lightweight materials under consideration include:

- Geofam;
- Lightweight Foamed Concrete Fill (LFCF); and
- Expanded Shale Aggregate (ESA).

EVALUATION AND RECOMMENDATIONS

S.W.COLE conducted geotechnical engineering evaluations in accordance with 2017 AASHTO LRFD Bridge Design Specifications, 8th Edition (AASHTO LRFD) and the MaineDOT Bridge Design Guide, 2003 Edition with revisions through August 2014 (MaineDOT BDG):

Geotechnical engineering calculations and reference documents used to support the recommendations within this memorandum are provided in Appendix B.

Soil Profile and Design Parameters

Five soil units were generally encountered in the borings made for Abutment No. 2 below the roadway embankment:

- Medium dense to dense, Sand some to little gravel, trace silt, (Sand Fill);
- Soft, Organic Peat;
- Very soft to soft, Clayey Silt and Silty Clay (Glaciomarine Deposit);
- Very stiff to hard, Sandy Silt and Silt, some gravel, some sand (Silt/Sand); and

- Very dense, Glacial Till

The generalized soil descriptions, thicknesses and soil parameters for each of the soil units based on the completed explorations are as follows:

Design Soil Parameters					
Strata	Approx. Elevation	Approx. Strata Thickness (ft)	Unit Weight (pcf)	Friction Angle, ϕ	Undrained Shear, S_u (psf)
Sand Fill	98	5	125	32	-
Peat	93	2	65	27	-
Clayey Silt	91	5	115	-	650
Silty Clay	86	8	115	-	250
Silt/Sand	78	7	120	30	-
Glacial Till	71	-	135	36	-

The embankment fill, rip rap side slopes and lightweight materials were modeled with the following parameters:

Design Soil and Material Parameters		
Material	Unit Weight (pcf)	Friction Angle, ϕ
Embankment Fill	125	32
Rip Rap	140	45
Geofoam ¹	2	30
Lightweight Foamed Concrete Fill (LFCF)	36	40
Expanded Shale Aggregate (ESA)	60	36

SHANSEP Clay Strength Increase

We evaluated strength increase from consolidation of the underlying silty clay layer since construction of the approach embankment. The strength increase was evaluated using the Stress History and Normalized Soil Engineering Properties (SHANSEP) Method with further refinement using the Observational Method considering measured and estimated settlements with the following assumptions:

- Embankment consisting of 15 feet of normal-weight fill with 1.75H:1V side slopes;
- Preconsolidation Pressure equal to the vertical effective stress plus the change in stress from the embankment load;

¹ Geofoam, Geofoam Technical Bulletin No. 5009: Geofoam Friction, March 2011 (Revised April 2017).

- Available consolidation and triaxial consolidated-undrained laboratory test data; and
- Average percent consolidation based on observed roadway settlement and calculated estimated total settlement.

Based on our evaluation, we estimate the following strength increase of the silty clay:

Design Soil Parameters					
Strata	Approx. Elevation	Approx. Strata Thickness (ft)	Unit Weight (pcf)	Friction Angle, ϕ	Undrained Shear, S_u (psf)
Clayey Silt	91	5	115	-	650
Silty Clay	86	8	115	-	320

Global Stability

We performed initial global stability evaluations for the existing east embankment and mitigation options using SLOPE/W computer software. We evaluated global stability considering the soil parameters provided above, resistance factors outlined in AASHTO LRFD Section 11.6.2.3 and guidance in Section C11.6.2.3 as follows:

Global Stability for Static Conditions

$FS \geq 1.5$ ($\phi = 0.65$) for slopes or walls containing/supporting a structural element

Geotextile reinforcement was used to improve the overall safety factor for the mitigation options. Geotextile reinforcement was modeled assuming Mirafi HP-series HP 570 with an ultimate tensile strength of 4,800 lbs/ft.

Results of our global stability model runs are summarized in the following table and included in Appendix B.

Model	Safety Factor
Existing Conditions – 15 foot approach embankment	1.03
Existing Conditions – 15 foot approach embankment SHANSEP	1.08
Geofoam Option – Replace 8 feet of fill with Geofoam, unreinforced	1.32
Geofoam Option – Replace 8 feet of fill with Geofoam, 3 layers of geogrid	1.56
Geofoam Option – Replace 8 feet of fill with Geofoam, unreinforced, SHANSEP	1.39
Geofoam Option – Replace 8 feet of fill with Geofoam, 2 layers of geogrid, SHANSEP	1.54
LFCF Option – Replace 10 feet of fill with LFCF, unreinforced	1.35
LFCF Option – Replace 10 feet of fill with LFCF, 3 layers of geogrid	1.59
LFCF Option – Replace 10 feet of fill with LFCF, unreinforced, SHANSEP	1.42
LFCF Option – Replace 10 feet of fill with LFCF, 2 layers of geogrid, SHANSEP	1.51
ESA Option – Replace 10 feet of fill with ESA, unreinforced	1.25
ESA Option – Replace 10 feet of fill with ESA, 4 layers of geogrid	1.55
ESA Option – Replace 10 feet of fill with ESA, unreinforced, SHANSEP	1.31
ESA Option – Replace 10 feet of fill with ESA, 3 layers of geogrid, SHANSEP	1.53

Settlement

We developed initial and detailed settlement models for the existing conditions and proposed geofoam, LFCF and ESA mitigation options to estimate the immediate, consolidation and total settlement resulting from placement of the roadway embankment. Settlement evaluations were completed using Settle3D software considering:

- Subsurface soil conditions from boring BB-MOS-501;
- Grading based on the Cross-Section at Station 31+25 and 31+50;
- Estimated immediate (elastic) soil parameters based on soil type;
- Estimated consolidation parameters for peat; and
- Consolidation test results from boring BB-MOS-501, sample 1U;

Based on the completed laboratory testing, we estimated the following compressibility and stress history characteristics of the glaciomarine clayey silt and silty clay:

Boring No.	Sample No.	Sample Elevation (ft)	Stress History			Compressibility		
			Existing Vertical Effective Stress (psf)	Maximum Previous Stress (psf)	OCR	C _c	C _R	C _v (ft ² /day)
BB-MOS-501	1U	88.8	1,750	1,800	1.0	0.189	0.033	0.22

Initial settlement evaluations were completed to estimate the magnitude of settlement for the existing and mitigated embankment options. The evaluations for the mitigated options were made assuming no preloading from construction of the initial embankment.

Estimates of the magnitude of total ground surface settlement for the existing conditions and mitigation options at the centerline and edges of the embankment are summarized below. The estimated settlement summarized below for the three lightweight fill options do not take into consideration the settlement that has occurred due to the preloading from the normal weight fill embankment construction in 2014. Model run output are provided in Appendix B.

Model	Location	Range of Estimated Settlement (inches)		
		Immediate	Consolidation	Total
Existing Conditions 15 foot Roadway Embankment	West Edge of Road	1½ to 3¼	2¼ to 4½	3½ to 7¾
	Centerline of Road	1¾ to 4	2½ to 5¼	4 to 9
	East Edge of Road	1½ to 3¼	2¼ to 4½	3½ to 7¾
Geofoam Option; Replace 8 feet of Fill with Geofoam	West Edge of Road	¾ to 1¾	1 to 2½	1¾ to 4
	Centerline of Road	1 to 2	1½ to 3	2¼ to 5
	East Edge of Road	¾ to 1¾	1 to 2½	1¾ to 4
LFCF Option; Replace 10 feet of Fill with LFCF	West Edge of Road	¾ to 1¾	1¼ to 2¾	2 to 4½
	Centerline of Road	1 to 2¼	1½ to 3½	2½ to 5½
	East Edge of Road	¾ to 1¾	1¼ to 2¾	2 to 4½
ESA Option; Replace 10 feet of Fill with ESA	West Edge of Road	1½ to 2½	1¾ to 3¼	2¾ to 5¾
	Centerline of Road	1¼ to 2¾	2 to 4	3¼ to 6¾
	East Edge of Road	1½ to 2½	1¾ to 3¼	2¾ to 5¾

Detailed settlement evaluations were completed to model the embankment using construction stages to simulate:

- Stage 1: Placement of the existing normal-weight fill embankment;
- Stage 2: Settlement of existing embankment after about 5 years; and
- Stage 3: Settlement of mitigated embankment option after additional 10 years.

Estimates of the magnitude of total ground surface settlement for the existing conditions and mitigation options at each stage are summarized below. Model run output are provided in Appendix B.

Model	Range of Estimated Total Settlement (inches)			Net Change from Stage 2 and 3 ¹
	Stage 1	Stage 2 (2018)	Stage 3 (15 years)	
Existing Conditions 15 foot Roadway Embankment	3 to 4¼	6 to 6¾	-	N/A
Geofoam Option; Replace 8 feet of Fill with Geofoam			5¼ to 5¾	-¼
LFCF Option; Replace 10 feet of Fill with LFCF			5¼ to 5¾	-¼
ESA Option; Replace 10 feet of Fill with ESA			5½ to 6	-¼

Note: 1. Refer to Appendix B for detailed Stage 2 and 3 evaluations.

Approximately 6 inches of settlement has occurred to date due to the “preload” of the existing normal-weight fill embankment. The results of the long-term settlement analyses (Stage 3) for the three lightweight fill options indicate immediate and long-term settlement from the three lightweight fill options will be negligible. As indicated by the rightmost column "Net Change from Stage 2 and 3", practical rebound is anticipated.

Mitigation Options

The proposed mitigation options will consist of over-excavations to remove the existing normal-weight fills to about Elevation 102 to 100 feet (project datum), depending on selected alternative, and replacement with lightweight materials and geotextile reinforcement. Conceptual sketches (plan and cross-section views) of the proposed mitigation options are included in Appendix C.

We recommend the mitigation be constructed from behind the existing abutment at about Sta. 31+25 to the previous abutment at about Sta. 31+50.

Construction Considerations

Earth support systems, such as sheet piles or trench boxes, will be required if laying back construction slopes are not feasible. Regardless of excavation methods, excavations and earth support systems must be properly shored or sloped in accordance with OSHA regulations to prevent sloughing and caving of slopes during construction. The design and planning of excavations, excavation support systems, and dewatering is the responsibility of the Contractor.

The Contractor shall control groundwater and surface water infiltration using temporary ditches, sumps, granular drainage blankets, stone ditch protection or hand-laid riprap with geotextile underlayment to divert groundwater and surface water as necessary.

Geotextile reinforcement between layers of Geofoam shall be placed between layers of 703.19 Granular Borrow modified to contain material passing 3 inch sieve only. The Granular Borrow shall be a minimum 3 inches thick totaling 6 inches.

Fill and backfill shall be placed in horizontal lifts and compacted such that the desired density is achieved throughout the lift thickness with 2 to 5 passes of the compaction equipment. Loose lift thicknesses for grading, fill and backfill activities should be limited to 12 inches. Small, hand operated or walk-behind compaction equipment shall be used within 3 feet of the existing abutment wall and wing walls to avoid over-compaction of material adjacent to the existing walls. We recommend fill and backfill be compacted to at least 95 percent of its maximum dry density as determined by AASHTO T-180.

Preliminary Unit Cost Information

Based on the design options summarized herein, unit costs for the lightweight materials were obtained for comparison and summarized below.

Material	Range of Unit Cost	Average Unit Cost
Geofoam ^{1,2}	\$110 to 130/cubic yard	\$120/cubic yard
Lightweight Foamed Concrete Fill (LFCF)	\$350 to 375/cubic yard	\$362.50/cubic yard
Expanded Shale Aggregate (ESA) ³	\$136.05/ton	\$96/cubic yard

Notes:

1. Unit cost for Geofoam EPS29 or equivalent
2. Unit cost for Geofoam does not include freight fee.
3. Unit costs as delivered to site for Expanded Shale Aggregate from Norlite, LLC of Cohoes, New York.

The preliminary unit costs do not include any mark up for mobilization, freight, placement or compaction unless noted above.

CLOSURE

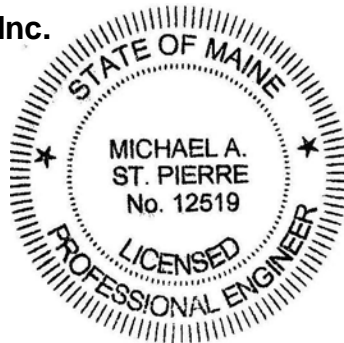
It has been a pleasure to be of assistance to you with this phase of your project. We look forward to working with you during the construction phase of the project.

Sincerely,

S. W. Cole Engineering, Inc.

A handwritten signature in black ink, appearing to read 'Michael A. St. Pierre'.

Michael A. St. Pierre, P.E.
Geotechnical Engineer



MAS:ejb-tjb-rec

APPENDIX A

Limitations

This report has been prepared for the exclusive use of Maine Department of Transportation for specific application to the Second Otter Bridge #2754 over Otter Stream (WIN 023466.00) on County Road in Milford, Maine. S. W. Cole Engineering, Inc. (S.W.COLE) has endeavored to conduct our services in accordance with generally accepted soil and foundation engineering practices. No warranty, expressed or implied, is made.

The soil profiles described in the report are intended to convey general trends in subsurface conditions. The boundaries between strata are approximate and are based upon interpretation of exploration data and samples.

The analyses performed during this investigation and recommendations presented in this report are based in part upon the data obtained from subsurface explorations made at the site. Variations in subsurface conditions may occur between explorations and may not become evident until construction. If variations in subsurface conditions become evident after submission of this report, it will be necessary to evaluate their nature and to review the recommendations of this report.

Observations have been made during exploration work to assess site groundwater levels. Fluctuations in water levels will occur due to variations in rainfall, temperature, and other factors.

S.W.COLE's scope of services has not included the investigation, detection, or prevention of any Biological Pollutants at the project site or in any existing or proposed structure at the site. The term "Biological Pollutants" includes, but is not limited to, molds, fungi, spores, bacteria, and viruses, and the byproducts of any such biological organisms.

Recommendations contained in this report are based substantially upon information provided by others regarding the proposed project. In the event that any changes are made in the design, nature, or location of the proposed project, S.W.COLE should review such changes as they relate to analyses associated with this report. Recommendations contained in this report shall not be considered valid unless the changes are reviewed by S.W.COLE.

APPENDIX B

Computations

Soil Parameters

Objective

Develop/correlate soil parameters for use in elastic and consolidation settlement evaluations using Settle3D software.

References

1. Lambe, T.W. and Whitman, R.V., Soil Mechanics, 1969.
2. Bowles, J.E., Foundation Analysis and Design, 3rd Ed., 1996.
3. Das, B.M., Principles of Foundation Engineering, 8th Ed., 2014.
4. Rowe, R.K. and Soderman, K.L. Geotextile Reinforcement of Embankments of Peat, Geotextiles and Geomembranes, 1985.
5. FHWA, Geotechnical Engineering Circular No. 6, Shallow Foundations, 2002.
6. Mesri, G. and Ajlouni, M., Engineering Properties of Fibrous Peats, Journal of Geotechnical and Geoenvironmental Engineering, Vol 113, July 2007.

Assumptions

Generalized soil profile based on boring BB-MOS-501
 medium dense to dense Sand Fill
 soft Organic Peat
 very soft to soft Clayey Silt and Silty Clay
 very stiff to hard Silt/Sand
 very dense Glacial Till

1. Estimate properties of Sand Fill $p_a := 14.7 \text{ psi}$
 - $\gamma_{sat_sand} := 125 \text{ pcf}$
 - From Reference 1, Table 11.3 $\phi_{sand} := 32 \text{ deg}$
 - From Reference 2, Table 2-7 $\mu_{sand} := 0.325$
 - From Reference 3, Eqn 3.32 with $N_{60_sand} := 20$
 - $a_{sand} := 10$
 - $E_{s_sand} := p_a a_{sand} N_{60_sand} = 423 \text{ ksf}$
 - use $E_{s_sand} := 425 \text{ ksf}$

2. Estimate properties of Organic Peat

From Reference 4, Table 1

$$\gamma_{sat_peat} := 65 \text{ pcf}$$

$$\phi_{peat} := 27 \text{ deg}$$

$$\mu_{peat} := 0.15$$

$$E_{s_peat} := 5 \text{ ksf} \quad \text{Assumes vertical effective stress} > 60\text{kPa} (\pm 1.5 \text{ ksf})$$

From Reference 5, Table 5-11

$$w_{c_peat} := 90.6 \quad \text{from lab testing}$$

$$C_{c_peat} := w_{c_peat} \cdot 0.0115 = 1.042$$

From Reference 6, pg 856

Cr is between 0.1 to 0.3 Cc, use 0.3

$$C_{r_peat} := 0.3 \cdot C_{c_peat} = 0.313$$

From Reference 6, Fig 11

$$e_{o_peat} := 7.5$$

From Reference 6, page 856

secondary compression index is 0.06 ± 0.01 , use

$$C_{\alpha} := 0.06$$

3. Estimate properties of Clayey Silt / Silty Clay

$$\gamma_{sat_clay} := 115 \text{ pcf}$$

From Reference 2, Table 2-7

$$\mu_{clay} := 0.45$$

From laboratory testing

$$C_{c_clay} := 0.189$$

$$C_{r_clay} := 0.033$$

$$e_{o_clay} := 0.92$$

$$c_{v_clay} := 0.22 \frac{\text{ft}^2}{\text{day}}$$

4. Estimate properties of Silt/Sand

$$\gamma_{sat_sand} := 120 \text{ pcf}$$

From Reference 1, Table 11.3

$$\phi_{sand} := 30 \text{ deg}$$

From Reference 2, Table 2-7

$$\mu_{sand} := 0.325$$

From Reference 3, Eqn 3.32 with

$$N_{60_silt} := 33$$

$$a_{silt} := 5$$

$$E_{s_silt} := p_a a_{silt} N_{60_silt} = 349 \text{ ksf}$$

$$\text{use } E_{s_silt} := 350 \text{ ksf}$$

5. Estimate properties of Glacial Till

$$\gamma_{sat_sand} := 135 \text{ pcf}$$

From Reference 1, Table 11.3

$$\phi_{sand} := 36 \text{ deg}$$

From Reference 2, Table 2-7

$$\mu_{sand} := 0.4$$

From Reference 3, Eqn 3.32 with

$$N_{60_till} := 139$$

$$a_{till} := 15$$

$$E_{s_till} := p_a a_{till} N_{60_till} = 4414 \text{ ksf}$$

$$\text{use } E_{s_till} := 4400 \text{ ksf}$$

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2. Schmertmann (1975) provided the correlation between N_{60} , σ'_o , and ϕ' . Mathematically, the correlation can be approximated as (Kulhawy and Mayne, 1990)

$$\phi' = \tan^{-1} \left[\frac{N_{60}}{12.2 + 20.3 \left(\frac{\sigma'_o}{p_a} \right)} \right]^{0.34} \quad (3.30)$$

where

N_{60} = field standard penetration number

σ'_o = effective overburden pressure

p_a = atmospheric pressure in the same unit as σ'_o

ϕ' = soil friction angle

3. Hatanaka and Uchida (1996) provided a simple correlation between ϕ' and $(N_1)_{60}$ that can be expressed as

$$\phi' = \sqrt{20(N_1)_{60}} + 20 \quad (3.31)$$

The following qualifications should be noted when standard penetration resistance values are used in the preceding correlations to estimate soil parameters:

1. The equations are approximate.
2. Because the soil is not homogeneous, the values of N_{60} obtained from a given borehole vary widely.
3. In soil deposits that contain large boulders and gravel, standard penetration numbers may be erratic and unreliable.

Although approximate, with correct interpretation the standard penetration test provides a good evaluation of soil properties. The primary sources of error in standard penetration tests are inadequate cleaning of the borehole, careless measurement of the blow count, eccentric hammer strikes on the drill rod, and inadequate maintenance of water head in the borehole. Figure 3.17 shows approximate borderline values for D_r , N_{60} , $(N_1)_{60}$, ϕ' and $\frac{(N_1)_{60}}{D_r^2}$.

Correlation between Modulus of Elasticity and Standard Penetration Number

The modulus of elasticity of granular soils (E_s) is an important parameter in estimating the elastic settlement of foundations. A first-order estimation for E_s was given by Kulhawy and Mayne (1990) as

$$\frac{E_s}{p_a} = \alpha N_{60} \quad (3.32)$$

where

p_a = atmospheric pressure (same unit as E_s)

$$\alpha = \begin{cases} 5 & \text{for sands with fines} \\ 10 & \text{for clean normally consolidated sand} \\ 15 & \text{for clean overconsolidated sand} \end{cases}$$

TABLE 1
Peat Parameters

<i>Parameters</i>	<i>Value</i>
Cohesion intercept, c'	1.8 kPa
Angle of internal friction, ϕ'	27°
Dilatancy angle, ψ'	0
Poisson's ratio, ν'	0.15
Coefficient of Earth pressure at rest, K_0	0.176
Specific gravity, G_s	1.5
Initial void ratio, e_0	9
Unit weight, γ	10.3 kN/m ³
Young's modulus, E' ($0 \leq \sigma'_v \leq 20$ kPa)	85 kPa
E' ($20 < \sigma'_v \leq 40$ kPa)	110 kPa
E' ($40 < \sigma'_v \leq 60$ kPa)	140 kPa
E' ($\sigma'_v > 60$ kPa)	225 kPa

above and a soil node below the geotextile. Thus slip could occur independently either above or below the inclusion. As part of the large deformation analysis, the co-ordinates of both the soil and the geotextile were updated during the analysis, thereby allowing the development of 'membrane forces' due to deformation.

4. PREDICTION OF COLLAPSE HEIGHTS

Even though an embankment may be stable, there will often be significant local shear failure within the weak underlying foundation material. Provided that these zones where the shear strength has been reached, referred to as 'plastic zones', are contained or surrounded by soil which is not plastic, that is where the shear stress is less than the shear strength, collapse will not occur. However, the deformation of the embankment may be greatly affected by the development of these contained plastic regions. Thus both deformation and shear strength parameters are required for an elasto-plastic finite element deformation analysis. The collapse height of the embankment is simply the height at which uncontained plastic flow occurs and the shear strain becomes

TABLE 5-11: CORRELATIONS FOR COMPRESSION INDEX, C_c

Correlation	Soil	Source
$C_c = 0.009 (LL-10)^{(1)}$	Clay of medium to low sensitivity ($S_t < 4$) ⁽²⁾	Terzaghi & Peck (1967)
$C_c = 0.0115 w_n^{(3)}$	Organic soils, peat	ASCE (1994)
$C_c = 0.04$ to 0.006 ⁽⁴⁾	Uniform silts	Hough (1959)
$C_c = 0.015$ to 0.02 ⁽⁴⁾	Uniform sand, loose	Hough (1959)
$C_c = 0.004$ to 0.008 ⁽⁴⁾	Uniform sand, dense	Hough (1959)

¹ LL=liquid limit

² S_t =sensitivity=Undisturbed undrained shear strength/Remolded undrained shear strength

³ w_n = natural water content

⁴ $C_c = 1/C'$ where C' is the bearing capacity index (Figure 5-19). *Note:* These are for cohesionless soils, but are included here for comparison purposes.

where: S_c = primary consolidation due to the change in void ratio of the soil
 C_c = compression index of the normally consolidated portion of the e -log σ'_v curve
 e_o = initial void ratio
 H_o = thickness of layer n
 σ'_{vo} = initial effective vertical stress at the center of layer n
 σ'_{vf} = final effective vertical stress at the center of layer n

The final effective vertical stress is computed by adding the stress change due to the foundation load to the initial vertical effective stress. The change in the vertical effective stress is computed using the methods discussed in Section 5.3.2. The total settlement will be the sum of the compression in each of the n layers of soil.

Normally, the slope, C_c , of the virgin portion of the e -log σ'_v curve is determined from the corrected one-dimensional consolidation curve measured on specimens taken from each relevant soil in the stratigraphic column.

Sometimes the consolidation data are presented in terms of vertical strain (ϵ_v) instead of void ratio (Figure 5-15). In this case, the slope of the virgin portion of the ϵ_v versus log σ_v curve is denoted as C_{ce} , and the settlement is computed using Equation 5-21 for normally consolidated soils.

$$S_c = \sum_1^n H_o C_{ce} \log_{10}(\sigma'_{vf} / \sigma'_{vo}) \quad (5-21)$$

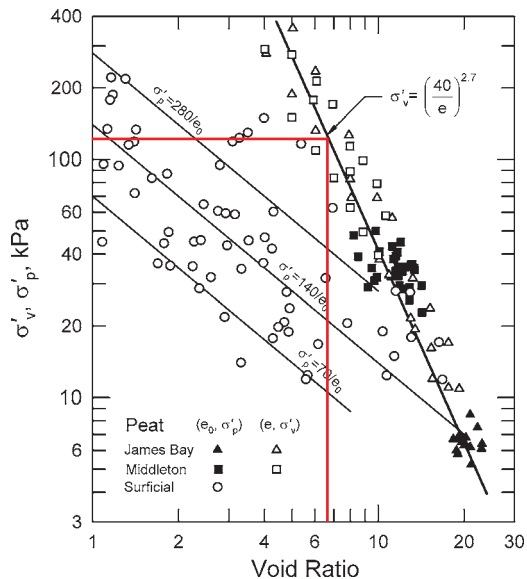


Fig. 11. Relationship between preconsolidation pressure and in situ void ratio e_0 for peat deposits (Kogure and Ohira 1977) as well as σ'_v versus e relationship resulting from compression of Middleton and James Bay peats

oped an empirical correlation between σ'_p and in situ void ratio e_0 for surficial peat deposits. A correlation between σ'_p and e_0 for peats based on compression data of Middleton peat and James Bay peat, together with the Kogure and Ohira (1977) data, is shown in Fig. 11. Note that (e, σ'_v) data from the EOP compression range have been used to extrapolate the (e_0, σ'_p) data of Middleton and James Bay peat.

Therefore, an appropriate equation for EOP settlement of fibrous peats is

$$S = \frac{C_c}{1 + e_0} L_0 \left[\frac{C_r}{C_c} \log \frac{\sigma'_p}{\sigma'_{v0}} + \log \frac{\sigma'_{vf}}{\sigma'_p} \right] \quad (5)$$

The values of C_r/C_c for fibrous peats are in the range of 0.1 to 0.3. In the absence of undisturbed sampling and oedometer testing, σ'_p may be estimated from an empirical correlation such as those in Fig. 11 or correlations with undrained shear strength described subsequently.

The progress of primary consolidation and associated settlement are determined using a theory of consolidation [e.g., Terzaghi (1923), Mesri et al. (1994a)]. Reliable observations of 1D consolidation in the laboratory and in the field suggest that the time required for primary consolidation of peat is directly proportional to the square of the maximum drainage distance (Hanrahan 1954; Lake 1960; Lea and Brawner 1959, 1963; MacFarlane 1969; Samson and La Rochelle 1972; Hanrahan and Rogers 1981). Computed values for the exponent lower than 2.0 (e.g., 1.5 and 1.6) have been attributed to the contribution of horizontal drainage in the field (Lea and Brawner 1963; Samson and La Rochelle 1972).

Primary consolidation can be speeded up by the use of vertical drains (Mesri and Lo 1991). Because initial permeability of surficial fibrous peat deposits is very high, vertical drains are unnecessary for typical highway embankments and construction schedules, provided that a pervious blanket provides adequate surface drainage. For construction of high embankments in stages, permeability and coefficient of consolidation of peat decrease sufficiently to make the use of vertical drains economical

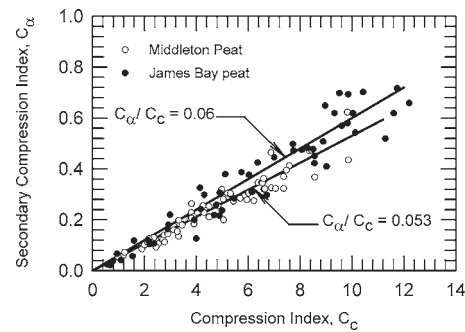


Fig. 12. Secondary compression index, C_α , versus compression index, C_c , for Middleton and James Bay peats

in speeding up excess pore-water pressure dissipation and compression, especially when there is an underlying soft clay layer that is also penetrated by the drains (Hansbo 1982). However, the very large compression commonly associated with fibrous peat layers may lead to crimping of prefabricated wick drains. The reinforcing action of the sand drains may improve the stability of the peat layer (Weber 1969). Because of the high initial horizontal permeability, k_{ho} , of fibrous peat deposits, the vertical drain type must possess high discharge capacity to operate without well resistance (Mesri and Lo 1991).

Secondary Compression

Secondary compression behavior of soils is completely explained and predicted by the C_α/C_c law of compressibility (Mesri and Godlewski 1977, 1979; Mesri and Castro 1987; Mesri 1987; Mesri et al. 1994a, 1997). For any soil a unique interrelationship exists between $C_\alpha = \Delta e / \Delta \log t$ and $C_c = \Delta e / \Delta \log \sigma'_v$ throughout the secondary consolidation stage, and for all pressures in the recompression and compression range.

The values of C_α/C_c for all geotechnical materials are in the range of 0.01 to 0.07. An important aspect of C_α/C_c law of compressibility is the very narrow range of values of C_α/C_c for all geotechnical materials considered together. The magnitude of C_α/C_c appears to depend on the compressibility and deformability of the soil particles. Because peat particles, consisting of a system of cells and baffle walls, are highly compressible, fibrous peat deposits display the highest values of C_α/C_c , whereas the granular materials display the lowest values. Examples of C_α versus C_c are shown in Fig. 12. A significant body of published data indicates values of $C_\alpha/C_c = 0.06 \pm 0.01$ for peat deposits [e.g., Samson and La Rochelle (1972); Berry and Vickers (1975) Lefebvre et al. (1984); Matsuo et al. (1986); Mesri (1986); Mesri et al. (1997)]. Therefore, the fourth distinctive characteristic of fibrous peats is that they display the highest values of C_α/C_c among geotechnical materials.

For the following three reasons, secondary compression and associated settlement are often more significant for peat deposits than other geotechnical materials: (1) fibrous peat deposits display the highest values of C_c ; (2) fibrous peat deposits have the highest values of C_α/C_c ; and (3) primary consolidation of fibrous peat layers in the field is completed commonly within a few weeks or months. Examples of secondary compression of fibrous peats are shown in Fig. 13. The Middleton peat specimen in Fig. 13(a) is loaded to a consolidation pressure near the preconsolidation pressure σ'_p . The coefficient of consolidation in the recompression range is large, and primary consolidation of the 20 mm



Geofoam No. 5009

Subject: Geofoam Friction

Date: March 2011 (Revised April 2017)

Foam-Control Geofoam is manufactured in conformance to ASTM D6817, "Standard Specification for Rigid Cellular Polystyrene Geofoam." This standard covers the material properties of Geofoam that are most often required for project design. However, Foam-Control Geofoam is often used in applications which require additional information of the friction resistance between layers of Geofoam blocks.

Various researchers have conducted tests following the general procedures of ASTM D5321, "Standard Test Method for Determining the Coefficient of Soil and Geosynthetic or Geosynthetic and Geosynthetic Friction by the Direct Shear Method" to determine the friction coefficient/friction angle for Geofoam.

The range of friction coefficient values generally reported for Geofoam to Geofoam range from 0.7 to 1.0¹.

The range of friction angle values generally reported for Geofoam to Geofoam for **peak** and **residual** shear resistance range from **32 to 48 degrees** and from **27 to 35 degrees** respectively².

There is a large variability in results since there is no industry standard testing conditions for sample size, surface roughness, displacement rate, and normal stress levels.

Based upon these results, researchers generally recommend an Geofoam/Geofoam friction coefficient of approximately 0.6 or an equivalent friction angle of 31 degrees for preliminary design.

References

1. http://geofoam.syr.edu/GRC_i15.asp
2. NCHRP Report 529, "Guideline and Recommended Standard for Geofoam Applications in Highway Embankments", Transportation Research Board, 2004

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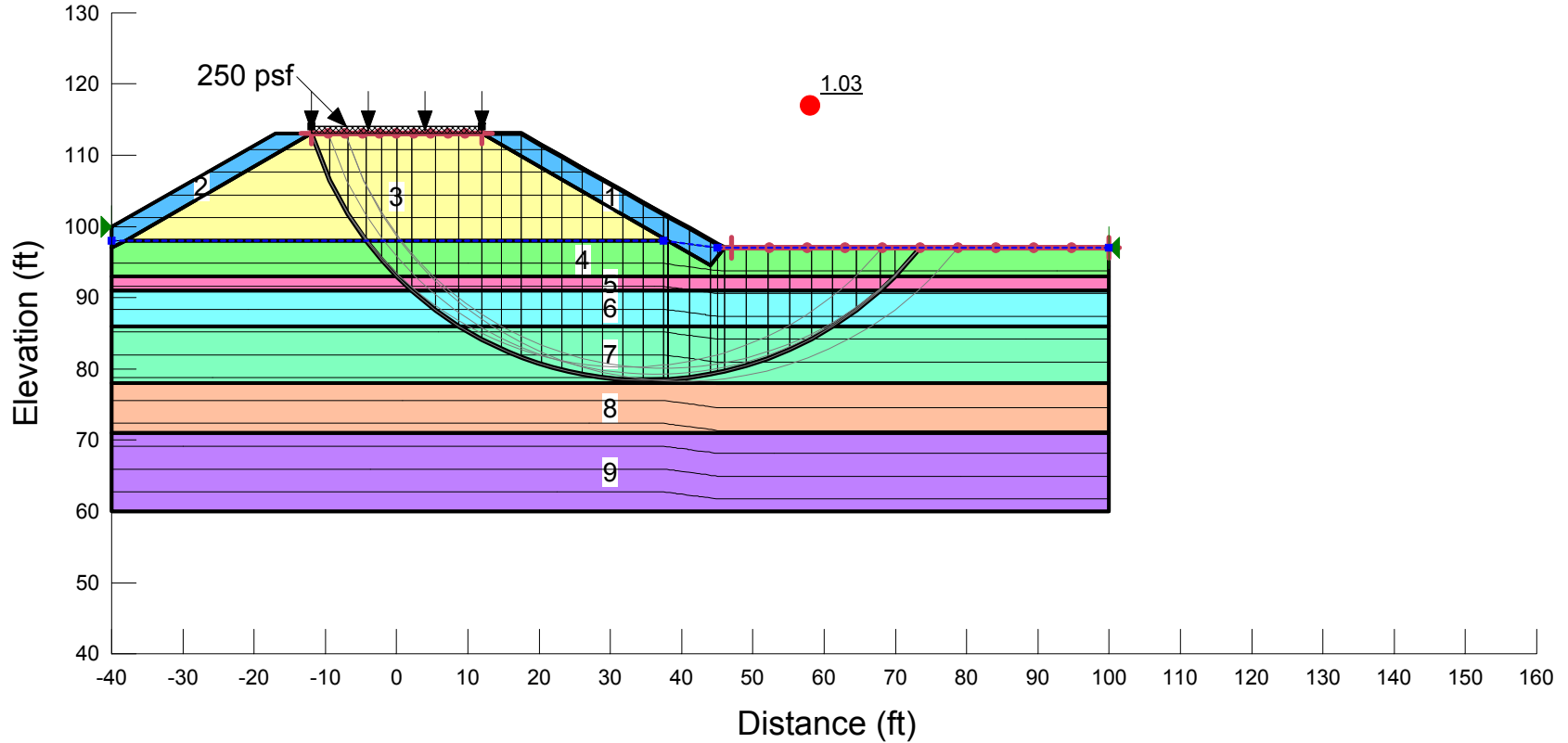
Global Stability

Materials

- 1+2. Riprap: Unit Wt = 140 pcf, Phi = 45 deg
- 3. Fill: Unit Wt = 125 pcf, Phi = 32 deg
- 4. Sand/Gravel: Unit Wt = 125 pcf, Phi = 34 deg
- 5. Peat: Unit Wt = 65 pcf, Phi = 27 deg
- 6. Clay 1: Unit Wt = 115 pcf, C = 650 psf
- 7. Clay 2: Unit Wt = 115 pcf, C = 250 psf
- 8. Sandy Silt: Unit Wt = 120 pcf, Phi = 30 deg
- 9. Till: Unit Wt = 135 pcf, Phi = 36 deg

WIN 23466.00 (Former PIN 16667.00)
Second Otter Bridge #2754
Milford, Maine

±Sta. 31+25
Existing Conditions

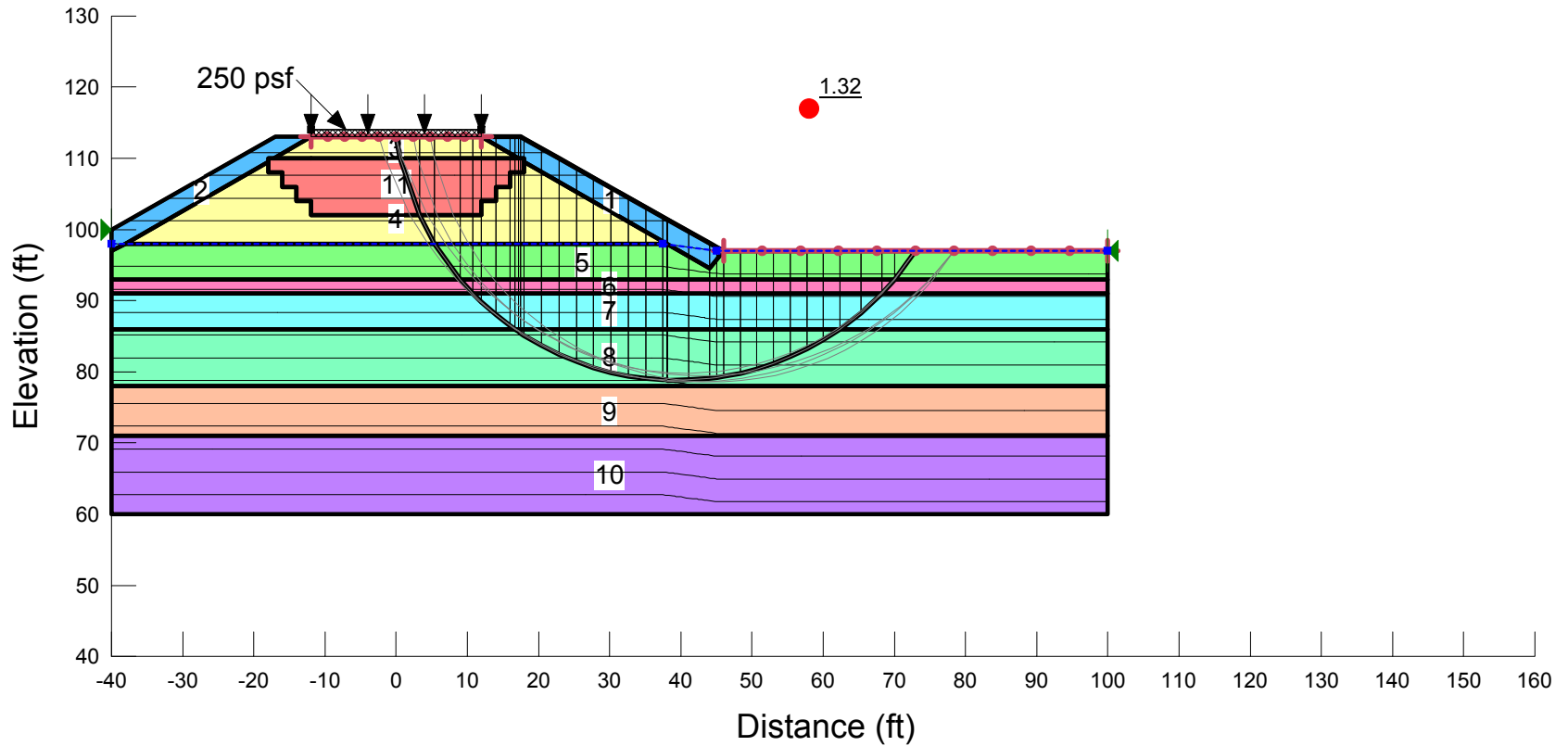


Materials

- 1+2. Riprap: Unit Wt = 140 pcf, Phi = 45 deg
- 3+4. Fill: Unit Wt = 125 pcf, Phi = 32 deg
- 5. Sand/Gravel: Unit Wt = 125 pcf, Phi = 34 deg
- 6. Peat: Unit Wt = 65 pcf, Phi = 27 deg
- 7. Clay 1: Unit Wt = 115 pcf, C = 650 psf
- 8. Clay 2: Unit Wt = 115 pcf, C = 250 psf
- 9. Sandy Silt: Unit Wt = 120 pcf, Phi = 30 deg
- 10. Till: Unit Wt = 135 pcf, Phi = 36 deg
- 11. Geofoam: Unit Wt = 2 pcf, Phi = 30

WIN 23466.00 (Former PIN 16667.00)
Second Otter Bridge #2754
Milford, Maine

±Sta. 31+25
Replace ±8 ft of Fill with Geofoam

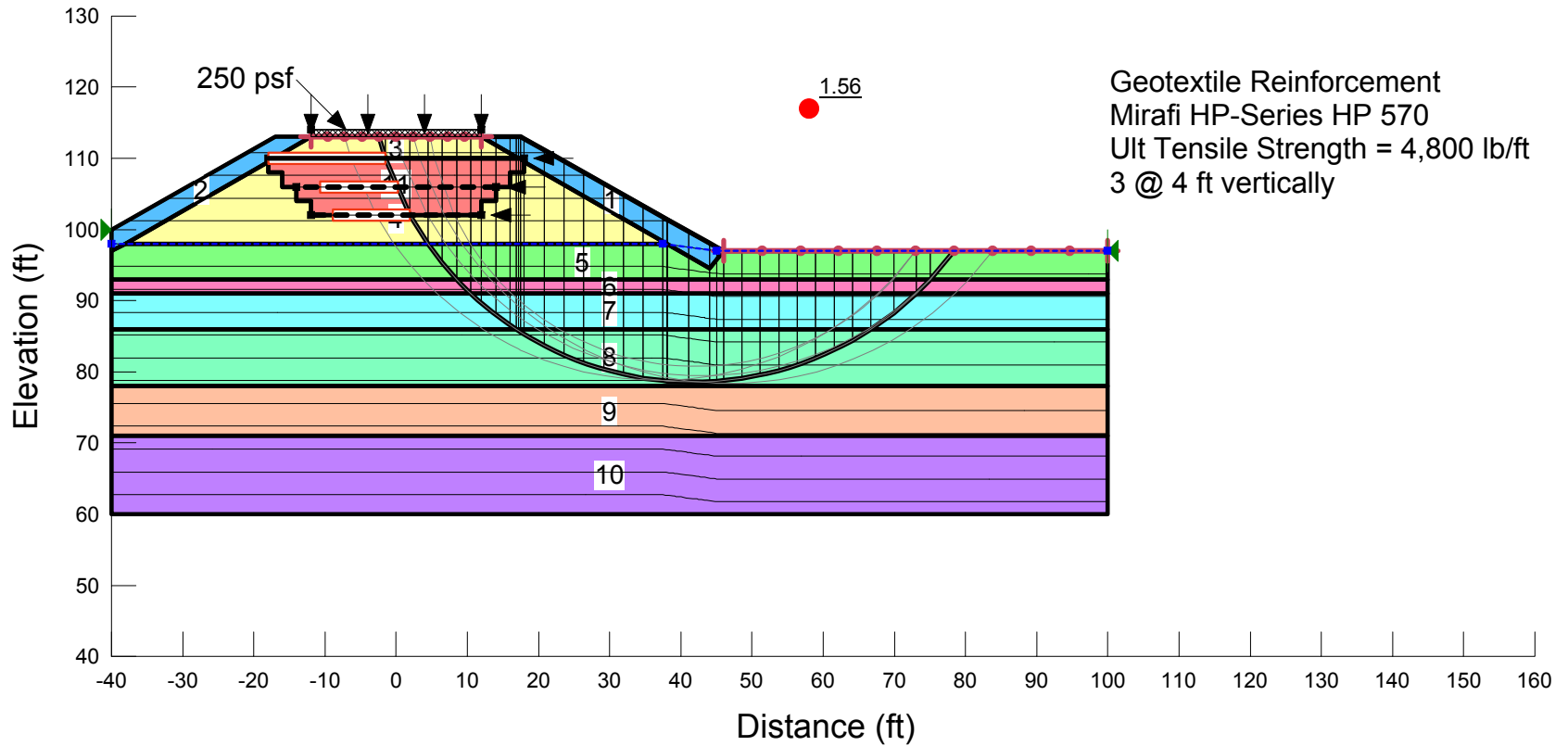


Materials

- 1+2. Riprap: Unit Wt = 140 pcf, Phi = 45 deg
- 3+4. Fill: Unit Wt = 125 pcf, Phi = 32 deg
- 5. Sand/Gravel: Unit Wt = 125 pcf, Phi = 34 deg
- 6. Peat: Unit Wt = 65 pcf, Phi = 27 deg
- 7. Clay 1: Unit Wt = 115 pcf, C = 650 psf
- 8. Clay 2: Unit Wt = 115 pcf, C = 250 psf
- 9. Sandy Silt: Unit Wt = 120 pcf, Phi = 30 deg
- 10. Till: Unit Wt = 135 pcf, Phi = 36 deg
- 11. Geofabric: Unit Wt = 2 pcf, Phi = 30

WIN 23466.00 (Former PIN 16667.00)
 Second Otter Bridge #2754
 Milford, Maine

±Sta. 31+25
 Replace ±8 ft of Fill with Geofabric



Materials

- 1+2. Riprap: Unit Wt = 140 pcf, Phi = 45 deg
- 3+4. Fill: Unit Wt = 125 pcf, Phi = 32 deg
- 5. Sand/Gravel: Unit Wt = 125 pcf, Phi = 34 deg
- 6. Peat: Unit Wt = 65 pcf, Phi = 27 deg
- 7. Clay 1: Unit Wt = 115 pcf, C = 650 psf
- 8. Clay 2: Unit Wt = 115 pcf, C = 250 psf
- 9. Sandy Silt: Unit Wt = 120 pcf, Phi = 30 deg
- 10. Till: Unit Wt = 135 pcf, Phi = 36 deg
- 11. LFCF: Unit Wt = 36 pcf, Phi = 40

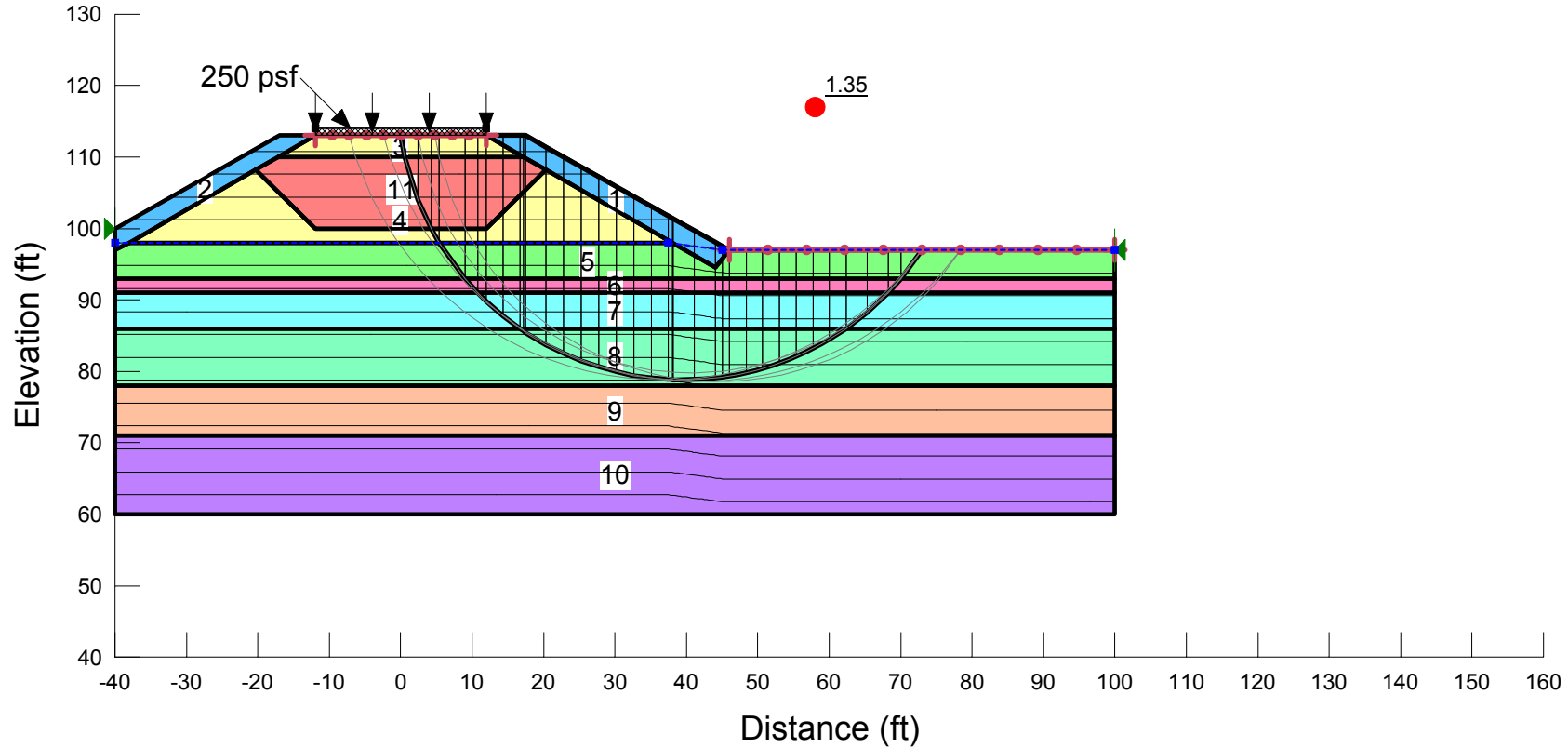
WIN 23466.00 (Former PIN 16667.00)

Second Otter Bridge #2754

Milford, Maine

±Sta. 31+25

Replace ±10 ft of Fill with Lightweight Foam Concrete Fill



Materials

- 1+2. Riprap: Unit Wt = 140 pcf, Phi = 45 deg
- 3+4. Fill: Unit Wt = 125 pcf, Phi = 32 deg
- 5. Sand/Gravel: Unit Wt = 125 pcf, Phi = 34 deg
- 6. Peat: Unit Wt = 65 pcf, Phi = 27 deg
- 7. Clay 1: Unit Wt = 115 pcf, C = 650 psf
- 8. Clay 2: Unit Wt = 115 pcf, C = 250 psf
- 9. Sandy Silt: Unit Wt = 120 pcf, Phi = 30 deg
- 10. Till: Unit Wt = 135 pcf, Phi = 36 deg
- 11. LFCF: Unit Wt = 36 pcf, Phi = 40

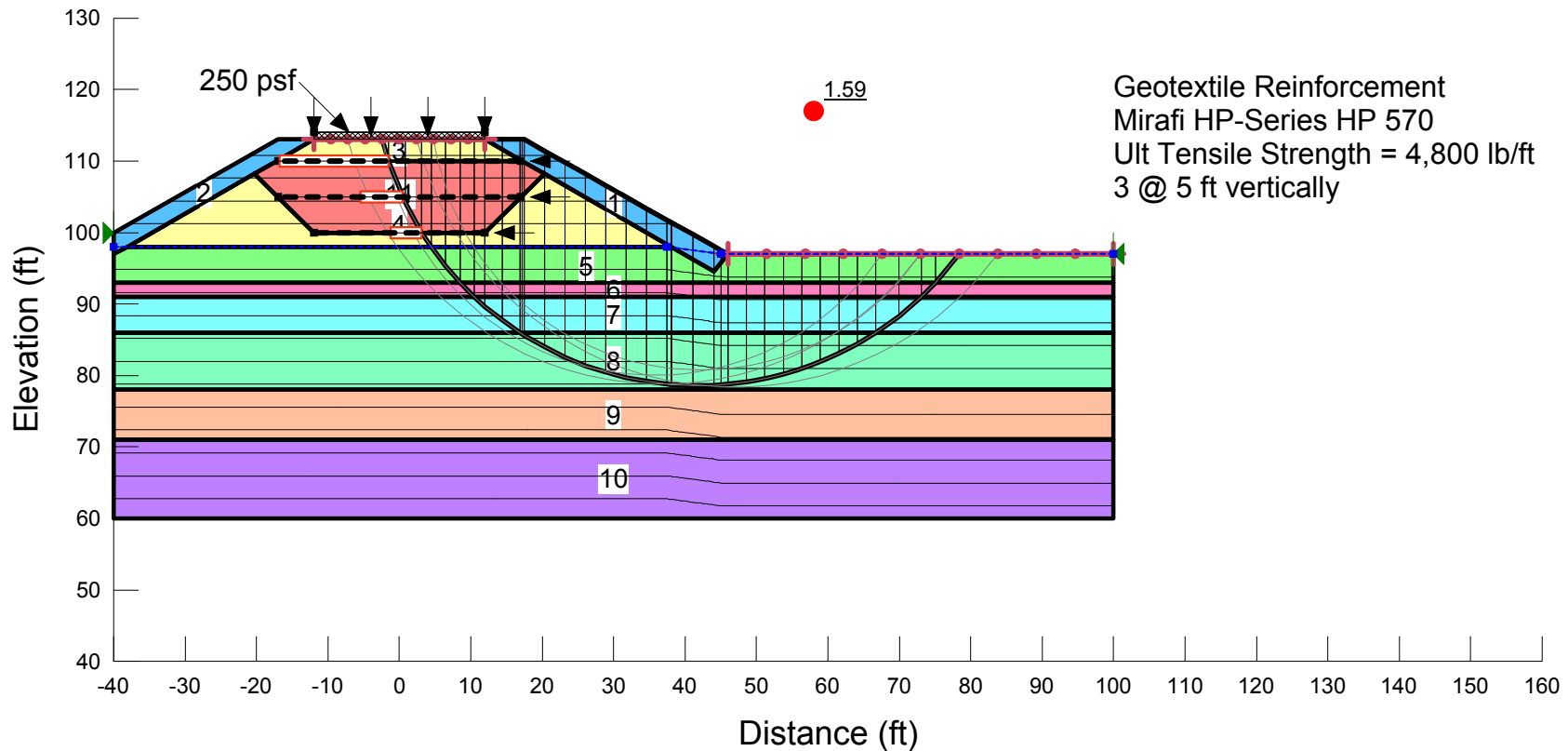
WIN 23466.00 (Former PIN 16667.00)

Second Otter Bridge #2754

Milford, Maine

±Sta. 31+25

Replace ±10 ft of Fill with Lightweight Foam Concrete Fill



Materials

- 1+2. Riprap: Unit Wt = 140 pcf, Phi = 45 deg
- 3+4. Fill: Unit Wt = 125 pcf, Phi = 32 deg
- 5. Sand/Gravel: Unit Wt = 125 pcf, Phi = 34 deg
- 6. Peat: Unit Wt = 65 pcf, Phi = 27 deg
- 7. Clay 1: Unit Wt = 115 pcf, C = 650 psf
- 8. Clay 2: Unit Wt = 115 pcf, C = 250 psf
- 9. Sandy Silt: Unit Wt = 120 pcf, Phi = 30 deg
- 10. Till: Unit Wt = 135 pcf, Phi = 36 deg
- 11. ESA: Unit Wt = 60 pcf, Phi = 36 deg

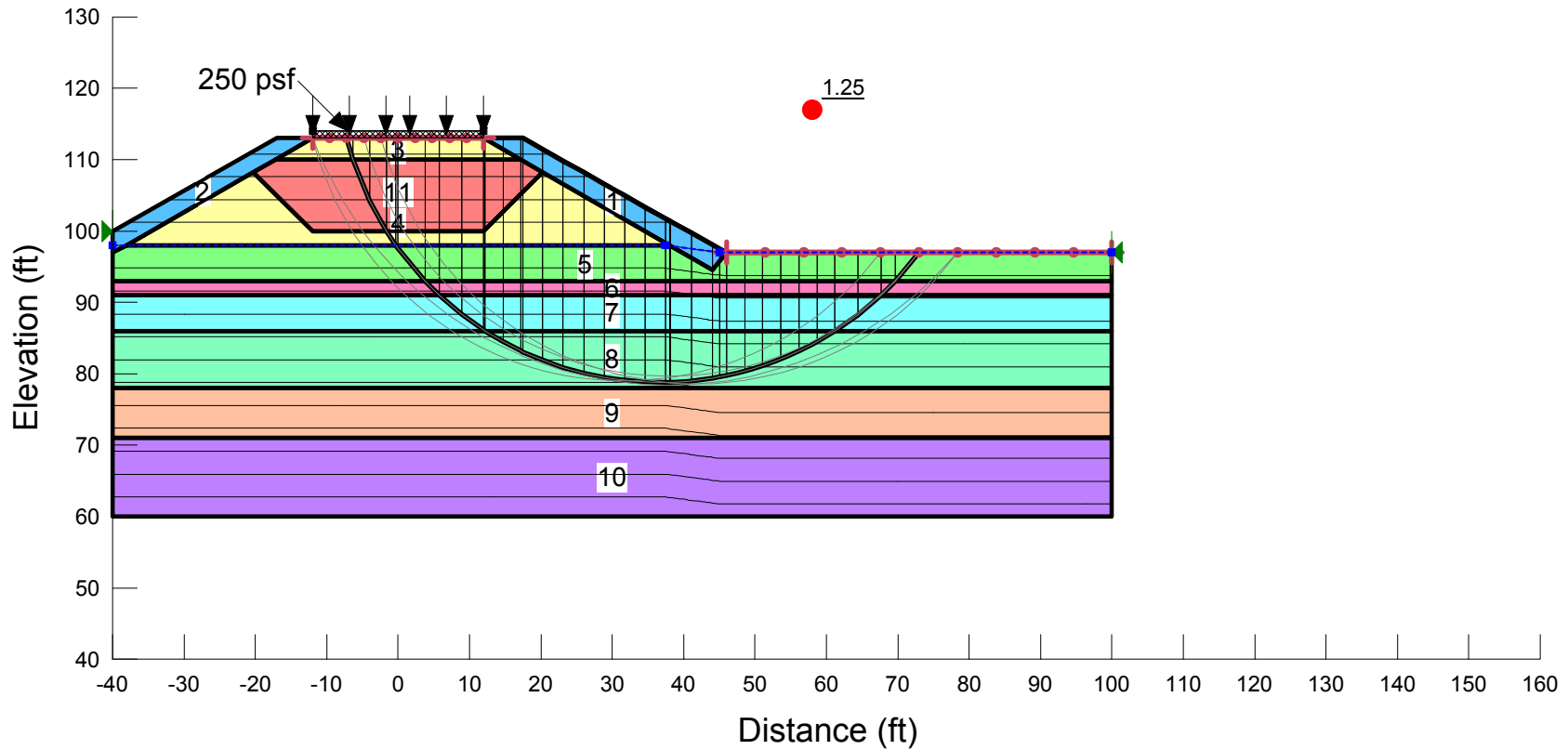
WIN 23466.00 (Former PIN 16667.00)

Second Otter Bridge #2754

Milford, Maine

±Sta. 31+25

Replace ±10 ft of Fill with Expanded Shale Aggregate



Materials

- 1+2. Riprap: Unit Wt = 140 pcf, Phi = 45 deg
- 3+4. Fill: Unit Wt = 125 pcf, Phi = 32 deg
- 5. Sand/Gravel: Unit Wt = 125 pcf, Phi = 34 deg
- 6. Peat: Unit Wt = 65 pcf, Phi = 27 deg
- 7. Clay 1: Unit Wt = 115 pcf, C = 650 psf
- 8. Clay 2: Unit Wt = 115 pcf, C = 250 psf
- 9. Sandy Silt: Unit Wt = 120 pcf, Phi = 30 deg
- 10. Till: Unit Wt = 135 pcf, Phi = 36 deg
- 11. ESA: Unit Wt = 60 pcf, Phi = 36 deg

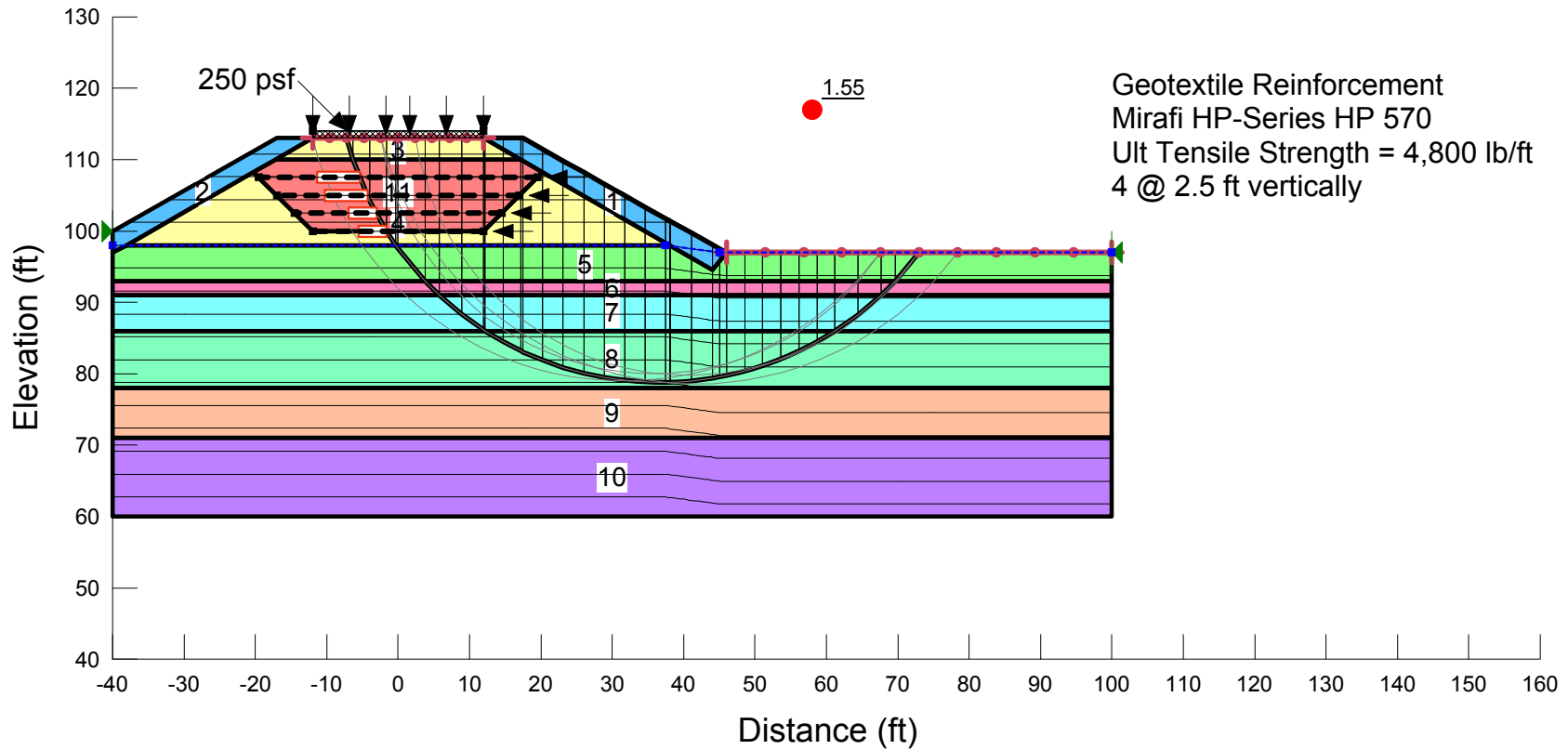
WIN 23466.00 (Former PIN 16667.00)

Second Otter Bridge #2754

Milford, Maine

±Sta. 31+25

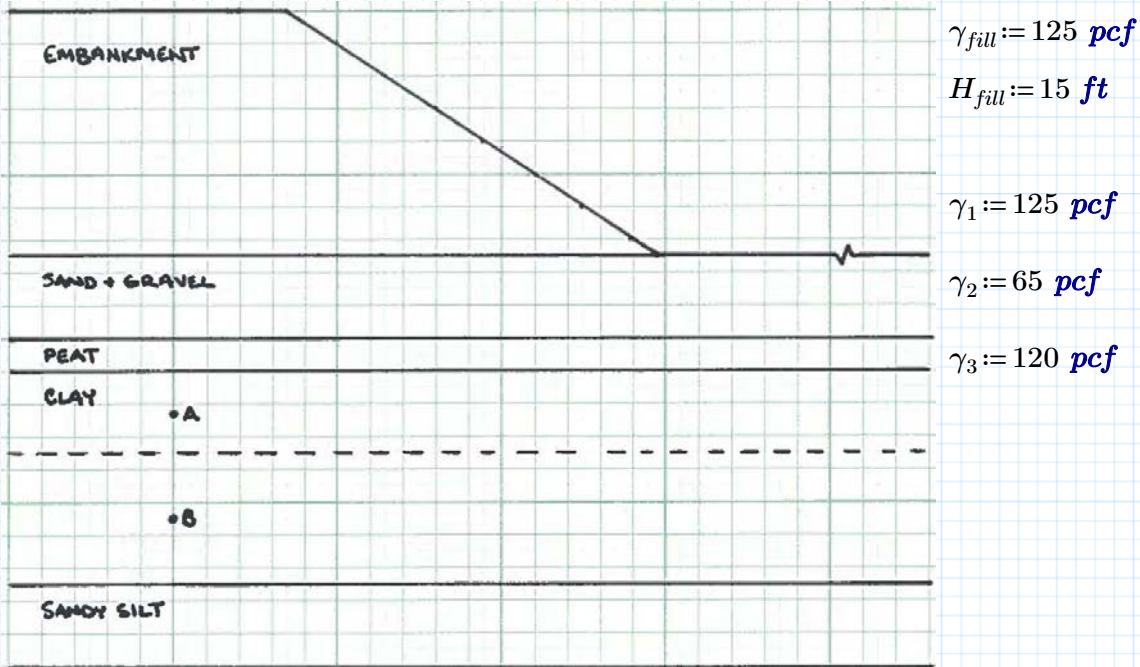
Replace ±10 ft of Fill with Expanded Shale Aggregate



Determine SHANSEP Strength Gain of Clay

Evaluate based on Laboratory Testing

As a result of the embankment construction in 2013-2014 and limited test data, assume the Over-Consolidation Ratio (OCR) was eliminated and preconsolidation pressure now equal to the vertical effective stress plus the change in stress from the embankment.



Determine Change in Vertical Stress from Embankment

$$\Delta\sigma := \gamma_{fill} \cdot H_{fill} = 1875 \text{ psf}$$

Determine Influence of Vertical Stress under Embankment at Points A and B
 (assume Points A and B under center of embankment)

$$\begin{array}{llll}
 a := 26.25 & b := 34 & z_A := 9.5 & z_B := 16 \\
 \frac{a}{z_A} = 2.763 & \frac{b}{z_A} = 3.579 & \frac{a}{z_B} = 1.641 & \frac{b}{z_B} = 2.125
 \end{array}$$

From NAVFAC DM 7.1, Figure 6 (page 7.1-170)

$$I_A := 0.5$$

$$I_B := 0.485$$

Determine Effective Vertical Stress at Points A and B

$$\sigma'_{A'} := (\gamma_1 \cdot 5 \text{ ft} + \gamma_2 \cdot 2 \text{ ft} + \gamma_3 \cdot 2.5 \text{ ft} - 62.4 \text{ pcf} \cdot 9.5 \text{ ft}) + \Delta\sigma \cdot 2 \cdot I_A = 2337.2 \text{ psf}$$

$$\sigma'_{B'} := (\gamma_1 \cdot 5 \text{ ft} + \gamma_2 \cdot 2 \text{ ft} + \gamma_3 \cdot 9 \text{ ft} - 62.4 \text{ pcf} \cdot 16 \text{ ft}) + \Delta\sigma \cdot 2 \cdot I_B = 2655.4 \text{ psf}$$

Determine Time Factor (T) since Embankment Construction from laboratory testing

from triaxial testing $c_{v_triax} := 33.3 \frac{ft^2}{yr}$
 BB-MOS-301, 1U
 test CU-2-1

assume earthwork completed in 2013 $t := 5 \text{ yr}$

assume single drainage $H_{dr} := 13 \text{ ft}$

from consolidation testing $c_{v_consol} := 1.64 \cdot 10^{-6} \frac{ft^2}{sec}$
 BB-MOS-501, 1U

for 1 tsf Load Increment $c_{v_consol} = 51.753 \frac{ft^2}{yr}$

Conservatively use c_v from triaxial testing

$$T := \frac{c_{v_triax} \cdot t}{H_{dr}^2} = 0.985$$

Determine Percent Consolidation (U)

From Holtz and Kovacs (1981) Equation 9-11 (page 390)

$$U := 100 - 10^{\left(\frac{1.781 - T}{0.933}\right)} = 93 \quad Use \quad U := 90$$

Calculate Strength Increase

$$s_u = (0.22 \pm 0.04) \sigma'_v (\%U)$$

$$s_{uA} := \begin{bmatrix} 0.18 \\ 0.19 \\ 0.20 \\ 0.21 \\ 0.22 \\ 0.23 \\ 0.24 \\ 0.25 \\ 0.26 \end{bmatrix} \cdot \sigma'_A \cdot U\% = \begin{bmatrix} 379 \\ 400 \\ 421 \\ 442 \\ 463 \\ 484 \\ 505 \\ 526 \\ 547 \end{bmatrix} \text{ psf}$$

Use $s_u = 650 \text{ psf}$
 based on insitu vane shear test data

$$s_{uB} := \begin{bmatrix} 0.18 \\ 0.19 \\ 0.20 \\ 0.21 \\ 0.22 \\ 0.23 \\ 0.24 \\ 0.25 \\ 0.26 \end{bmatrix} \cdot \sigma'_B \cdot U\% = \begin{bmatrix} 430 \\ 454 \\ 478 \\ 502 \\ 526 \\ 550 \\ 574 \\ 597 \\ 621 \end{bmatrix} \text{ psf}$$

Use $s_{uB} := 430 \text{ psf}$

Determine Average Percent Consolidation (U_{avg}) using Observational Method (using estimated and observed settlements)

$s_{5yr} := 6 \text{ in}$ Observed roadway settlement

$s_c := 9 \text{ in}$ Estimated settlement (From Settle3D)

$$U_{avg} := \frac{s_{5yr}}{s_c} = 0.667$$

Calculate Strength Increase

$$s_u = (0.22 \pm 0.04) \sigma'_v (U_{avg})$$

$$s_{uA} := \begin{bmatrix} 0.18 \\ 0.19 \\ 0.20 \\ 0.21 \\ 0.22 \\ 0.23 \\ 0.24 \\ 0.25 \\ 0.26 \end{bmatrix} \cdot \sigma'_A \cdot U_{avg} = \begin{bmatrix} 280 \\ 296 \\ 312 \\ 327 \\ 343 \\ 358 \\ 374 \\ 390 \\ 405 \end{bmatrix} \text{ psf}$$

Use $s_u = 650 \text{ psf}$
 based on insitu vane shear test data

$$s_{uB} := \begin{bmatrix} 0.18 \\ 0.19 \\ 0.20 \\ 0.21 \\ 0.22 \\ 0.23 \\ 0.24 \\ 0.25 \\ 0.26 \end{bmatrix} \cdot \sigma'_B \cdot U_{avg} = \begin{bmatrix} 319 \\ 336 \\ 354 \\ 372 \\ 389 \\ 407 \\ 425 \\ 443 \\ 460 \end{bmatrix} \text{ psf}$$

Use $s_{uB} := 320 \text{ psf}$

Use conservative strength increase from Observational Method (using observed/estimated settlement)

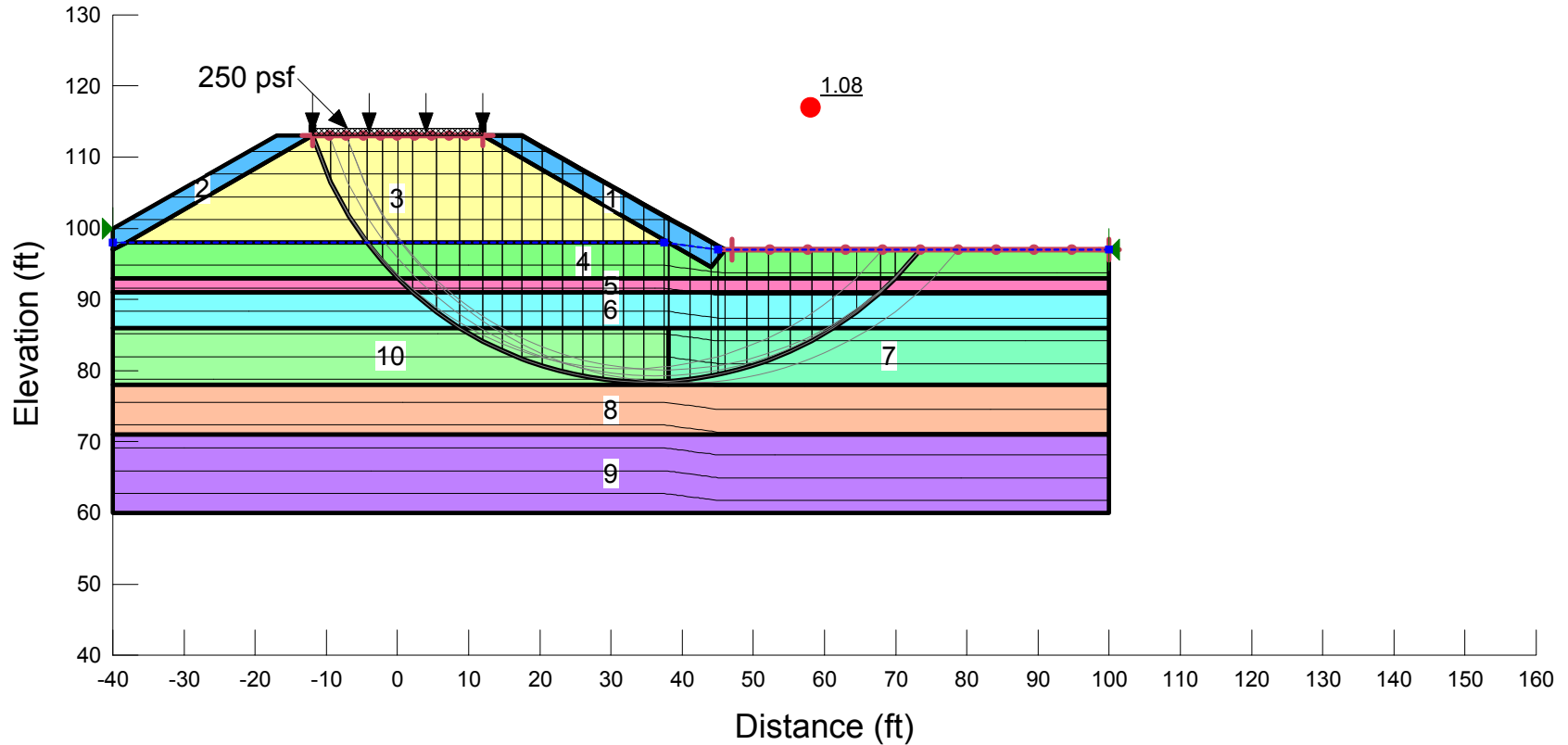
Materials

- 1+2. Riprap: Unit Wt = 140 pcf, Phi = 45 deg
- 3. Fill: Unit Wt = 125 pcf, Phi = 32 deg
- 4. Sand/Gravel: Unit Wt = 125 pcf, Phi = 34 deg
- 5. Peat: Unit Wt = 65 pcf, Phi = 27 deg
- 6. Clay 1: Unit Wt = 115 pcf, C = 650 psf
- 7. Clay 2: Unit Wt = 115 pcf, C = 250 psf
- 8. Sandy Silt: Unit Wt = 120 pcf, Phi = 30 deg
- 9. Till: Unit Wt = 135 pcf, Phi = 36 deg
- 10. Clay 2 SHANSEP: Unit Wt = 115 pcf, C = 320 psf

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Second Otter Bridge #2754
Milford, Maine

±Sta. 31+25
Existing Conditions

SHANSEP Clay Strength Increase



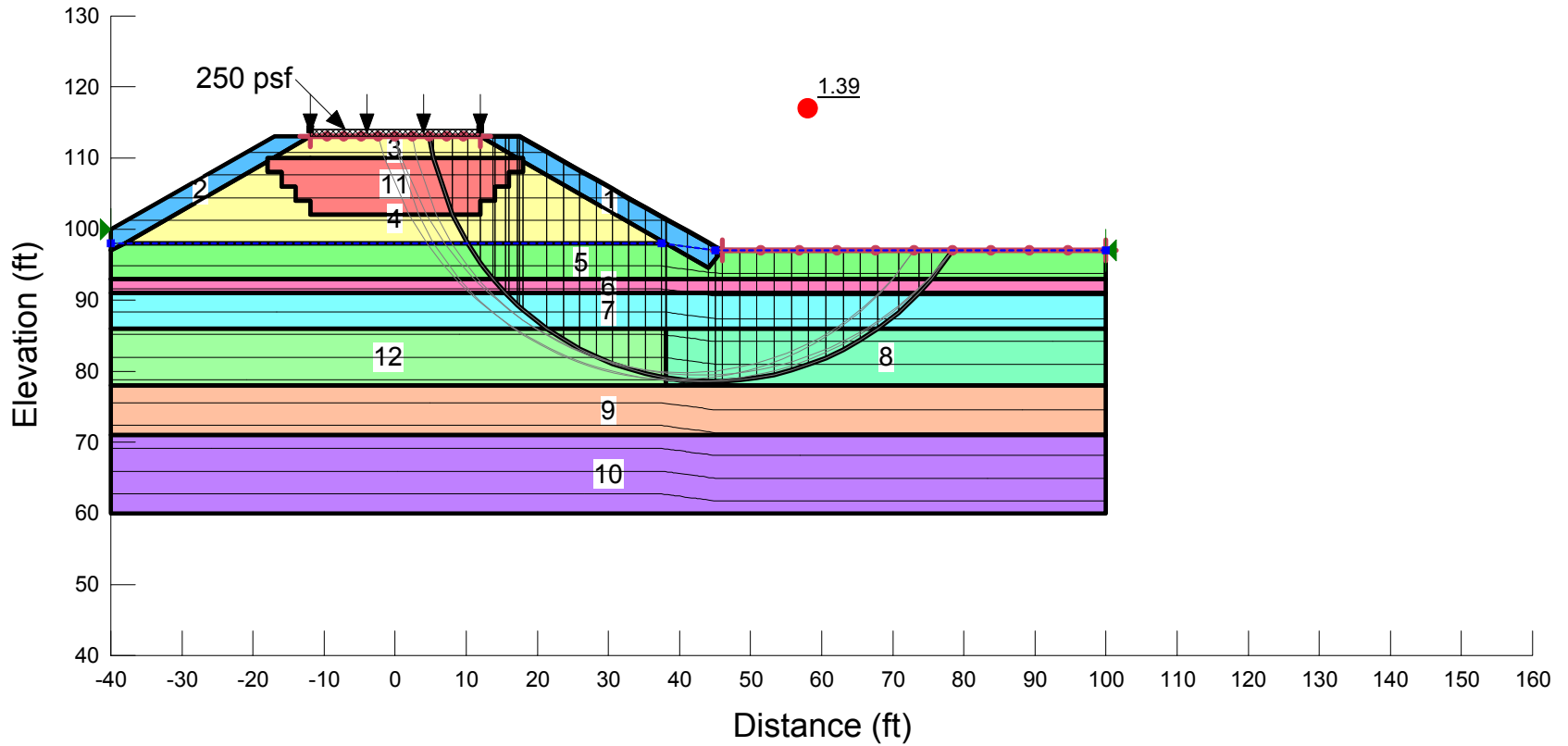
Materials

- 1+2. Riprap: Unit Wt = 140 pcf, Phi = 45 deg
- 3+4. Fill: Unit Wt = 125 pcf, Phi = 32 deg
- 5. Sand/Gravel: Unit Wt = 125 pcf, Phi = 34 deg
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- 7. Clay 1: Unit Wt = 115 pcf, C = 650 psf
- 8. Clay 2: Unit Wt = 115 pcf, C = 250 psf
- 9. Sandy Silt: Unit Wt = 120 pcf, Phi = 30 deg
- 10. Till: Unit Wt = 135 pcf, Phi = 36 deg
- 11. Geofabric: Unit Wt = 2 pcf, Phi = 30
- 12. Clay 2 SHANSEP: Unit Wt = 115 pcf, C = 320 psf

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Second Otter Bridge #2754
Milford, Maine

±Sta. 31+25
Replace ±8 ft of Fill with Geofabric

SHANSEP Clay Strength Increase



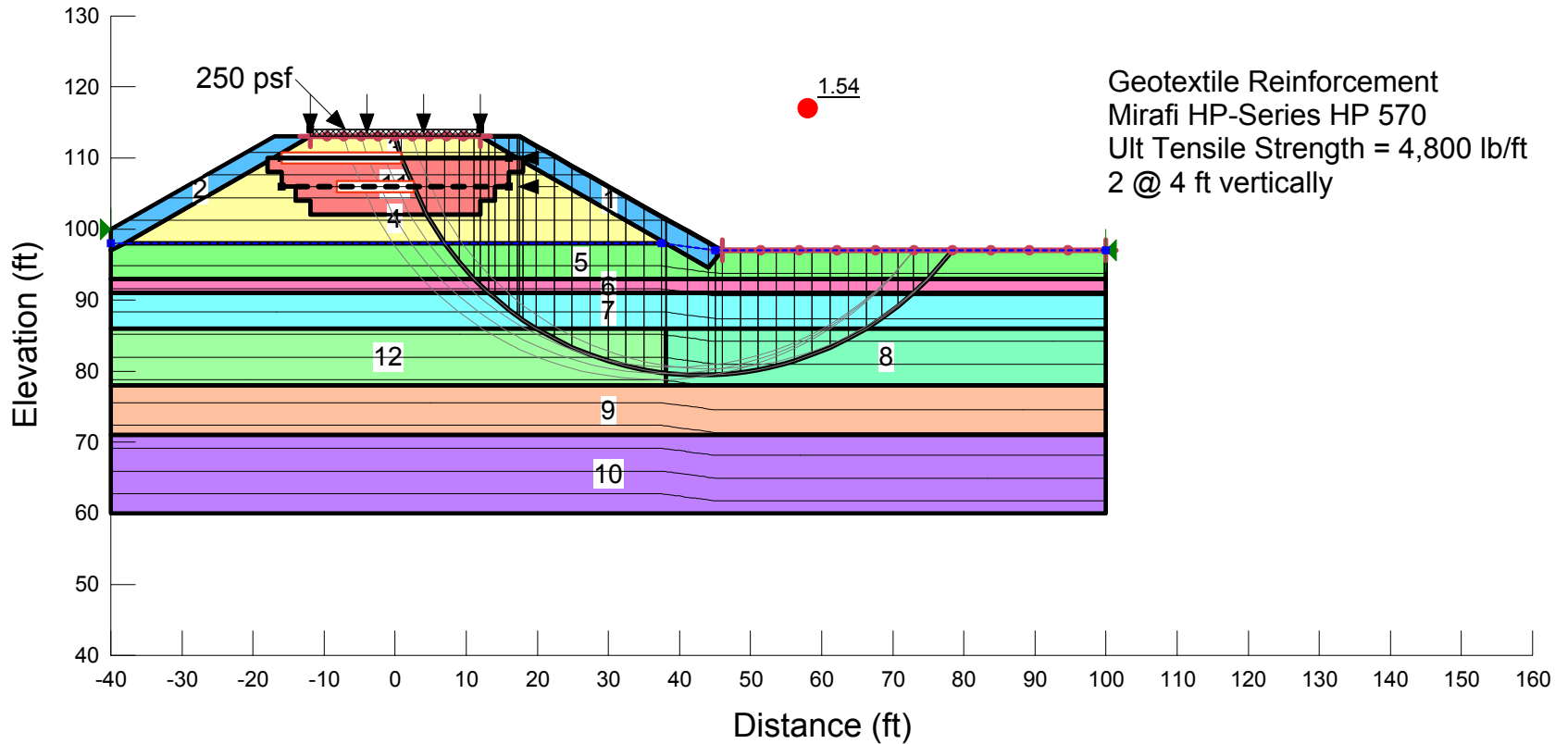
Materials

- 1+2. Riprap: Unit Wt = 140 pcf, Phi = 45 deg
- 3+4. Fill: Unit Wt = 125 pcf, Phi = 32 deg
- 5. Sand/Gravel: Unit Wt = 125 pcf, Phi = 34 deg
- 6. Peat: Unit Wt = 65 pcf, Phi = 27 deg
- 7. Clay 1: Unit Wt = 115 pcf, C = 650 psf
- 8. Clay 2: Unit Wt = 115 pcf, C = 250 psf
- 9. Sandy Silt: Unit Wt = 120 pcf, Phi = 30 deg
- 10. Till: Unit Wt = 135 pcf, Phi = 36 deg
- 11. Geofabric: Unit Wt = 2 pcf, Phi = 30
- 12. Clay 2 SHANSEP: Unit Wt = 115 pcf, C = 320 psf

WIN 23466.00 (Former PIN 16667.00)
Second Otter Bridge #2754
Milford, Maine

±Sta. 31+25
Replace ±8 ft of Fill with Geofabric

SHANSEP Clay Strength Increase



Materials

- 1+2. Riprap: Unit Wt = 140 pcf, Phi = 45 deg
- 3+4. Fill: Unit Wt = 125 pcf, Phi = 32 deg
- 5. Sand/Gravel: Unit Wt = 125 pcf, Phi = 34 deg
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- 8. Clay 2: Unit Wt = 115 pcf, C = 250 psf
- 9. Sandy Silt: Unit Wt = 120 pcf, Phi = 30 deg
- 10. Till: Unit Wt = 135 pcf, Phi = 36 deg
- 11. LFCF: Unit Wt = 36 pcf, Phi = 40
- 12. Clay 2 SHANSEP: Unit Wt = 115 pcf, C = 320 psf

WIN 23466.00 (Former PIN 16667.00)

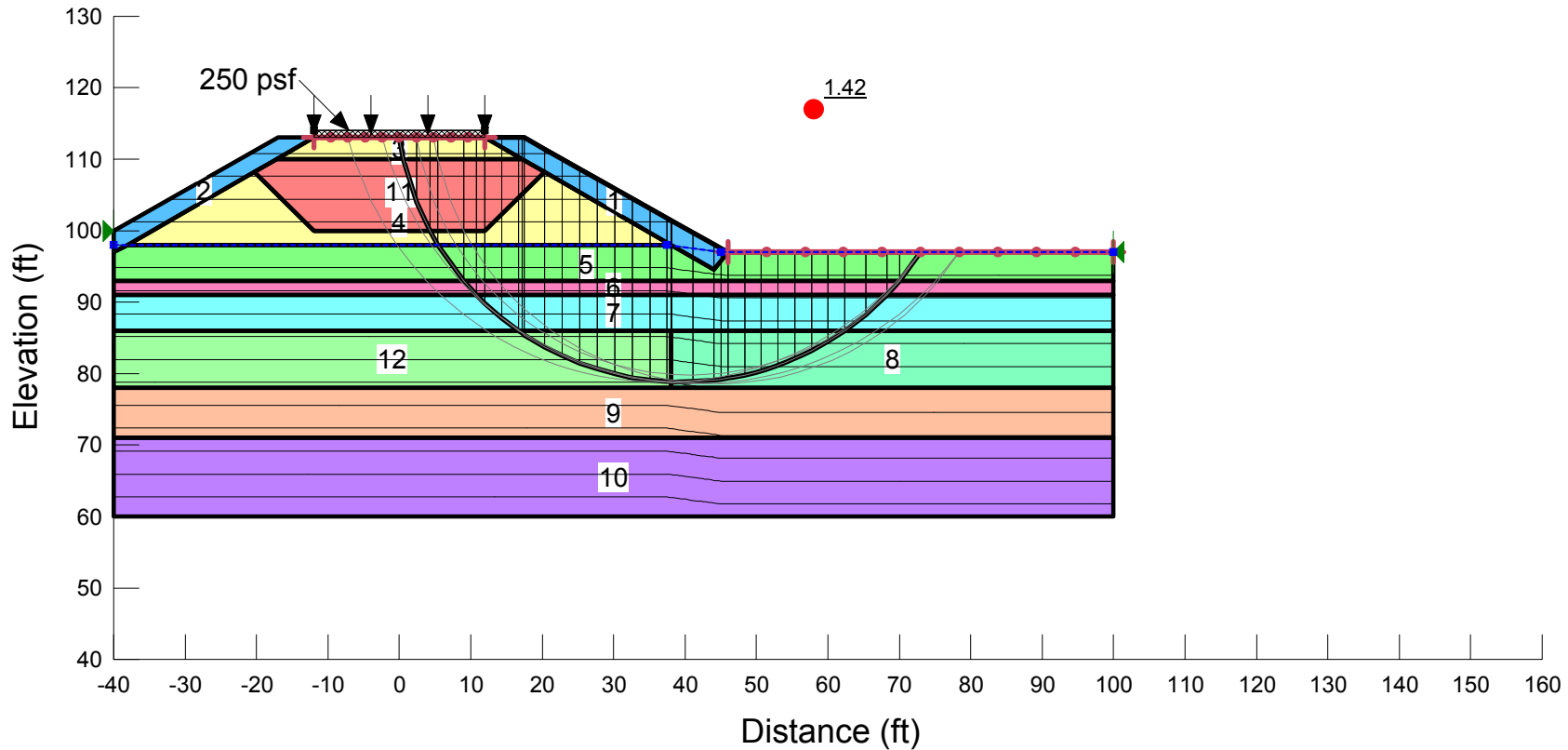
Second Otter Bridge #2754

Milford, Maine

±Sta. 31+25

Replace ±10 ft of Fill with Lightweight Foam Concrete Fill

SHANSEP Clay Strength Increase



Materials

- 1+2. Riprap: Unit Wt = 140 pcf, Phi = 45 deg
- 3+4. Fill: Unit Wt = 125 pcf, Phi = 32 deg
- 5. Sand/Gravel: Unit Wt = 125 pcf, Phi = 34 deg
- 6. Peat: Unit Wt = 65 pcf, Phi = 27 deg
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- 10. Till: Unit Wt = 135 pcf, Phi = 36 deg
- 11. LFCF: Unit Wt = 36 pcf, Phi = 40
- 12. Clay 2 SHANSEP: Unit Wt = 115 pcf, C = 320 psf

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Second Otter Bridge #2754

Milford, Maine

±Sta. 31+25

Replace ±10 ft of Fill with Lightweight Foam Concrete Fill

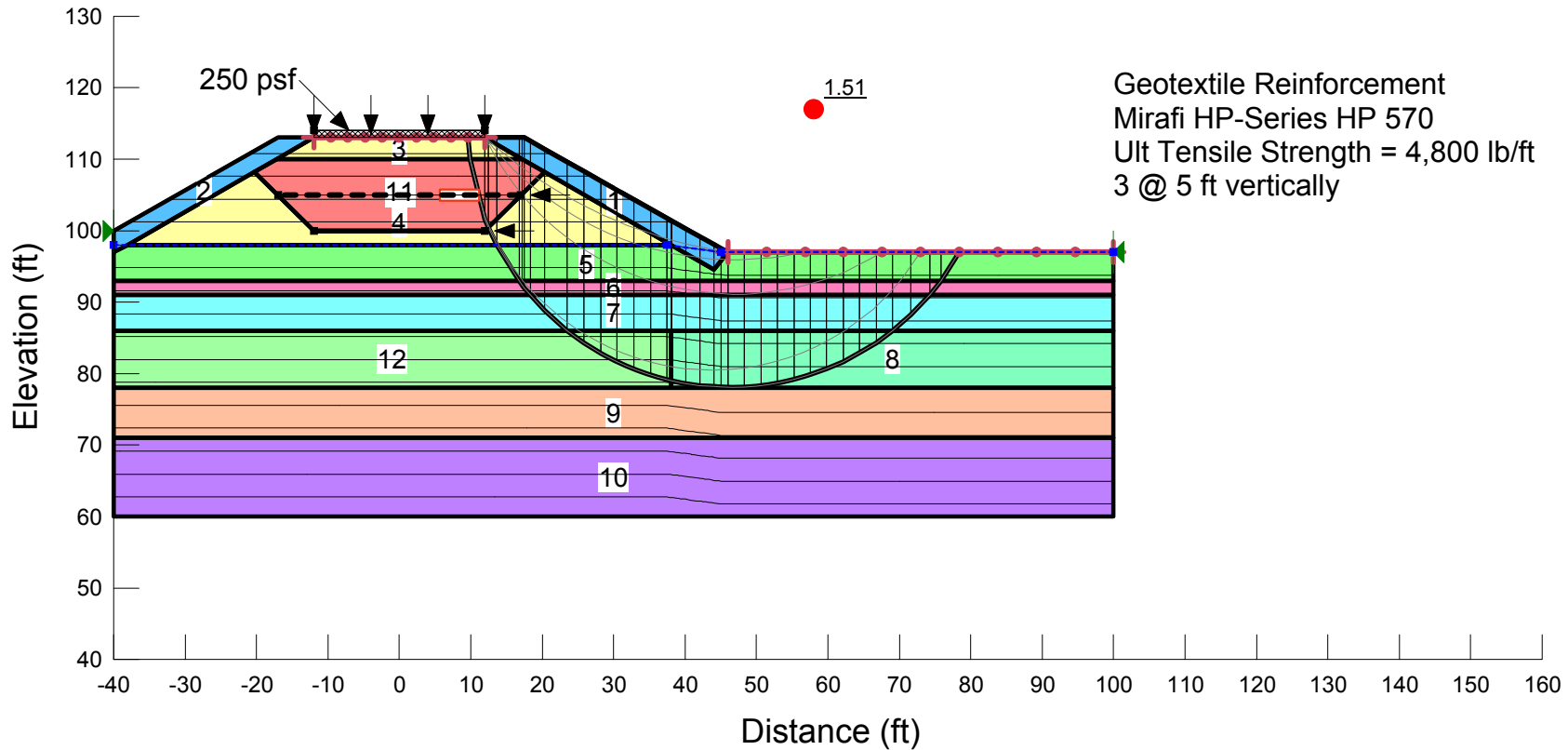
SHANSEP Clay Strength Increase

Geotextile Reinforcement

Mirafi HP-Series HP 570

Ult Tensile Strength = 4,800 lb/ft

3 @ 5 ft vertically



Materials

- 1+2. Riprap: Unit Wt = 140 pcf, Phi = 45 deg
- 3+4. Fill: Unit Wt = 125 pcf, Phi = 32 deg
- 5. Sand/Gravel: Unit Wt = 125 pcf, Phi = 34 deg
- 6. Peat: Unit Wt = 65 pcf, Phi = 27 deg
- 7. Clay 1: Unit Wt = 115 pcf, C = 650 psf
- 8. Clay 2: Unit Wt = 115 pcf, C = 250 psf
- 9. Sandy Silt: Unit Wt = 120 pcf, Phi = 30 deg
- 10. Till: Unit Wt = 135 pcf, Phi = 36 deg
- 11. ESA: Unit Wt = 60 pcf, Phi = 36 deg
- 12. Clay 2 SHANSEP: Unit Wt = 115 pcf, C = 320 psf

WIN 23466.00 (Former PIN 16667.00)

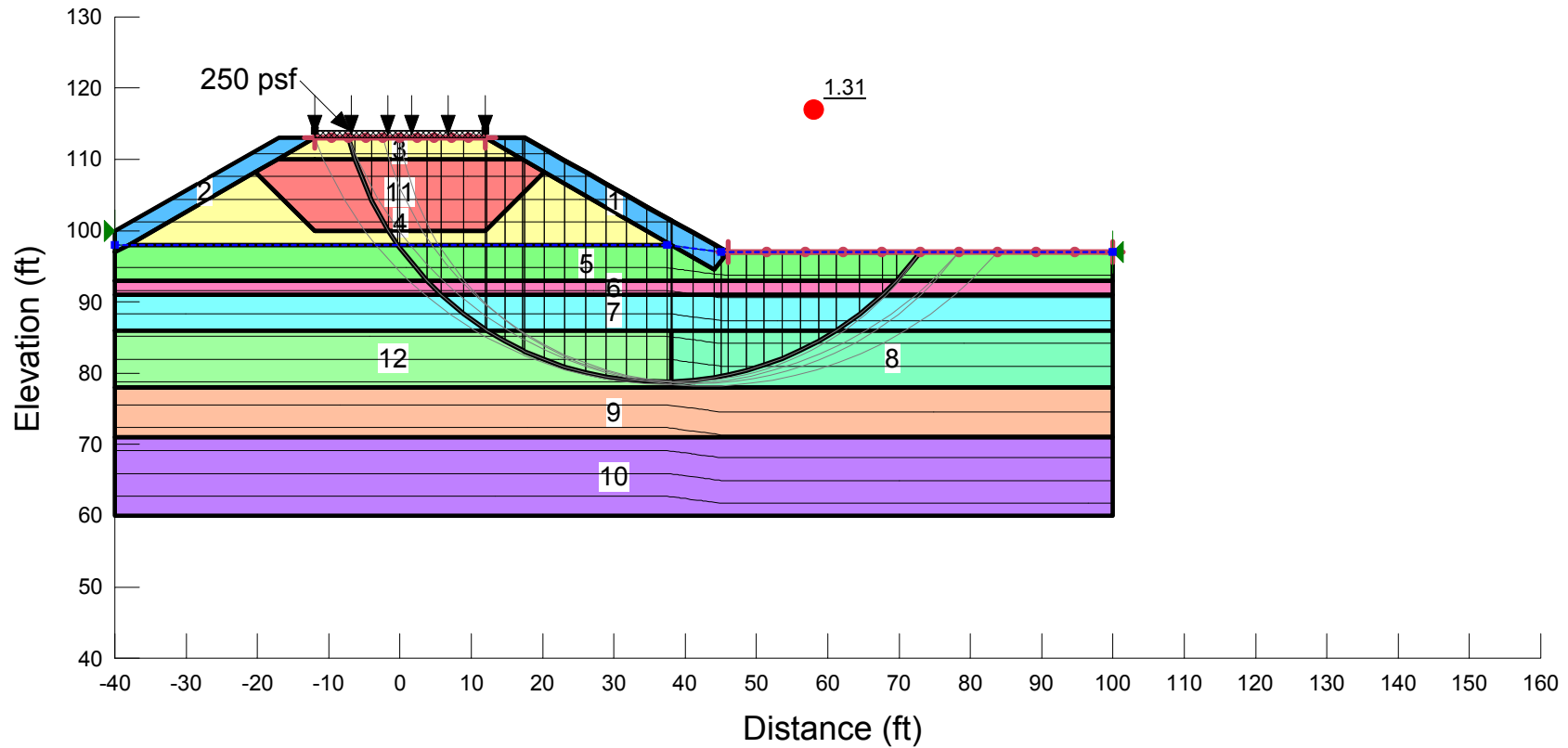
Second Otter Bridge #2754

Milford, Maine

±Sta. 31+25

Replace ±10 ft of Fill with Expanded Shale Aggregate

SHANSEP Clay Strength Increase



Materials

- 1+2. Riprap: Unit Wt = 140 pcf, Phi = 45 deg
- 3+4. Fill: Unit Wt = 125 pcf, Phi = 32 deg
- 5. Sand/Gravel: Unit Wt = 125 pcf, Phi = 34 deg
- 6. Peat: Unit Wt = 65 pcf, Phi = 27 deg
- 7. Clay 1: Unit Wt = 115 pcf, C = 650 psf
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- 9. Sandy Silt: Unit Wt = 120 pcf, Phi = 30 deg
- 10. Till: Unit Wt = 135 pcf, Phi = 36 deg
- 11. ESA: Unit Wt = 60 pcf, Phi = 36 deg
- 12. Clay 2 SHANSEP: Unit Wt = 115 pcf, C = 320 psf

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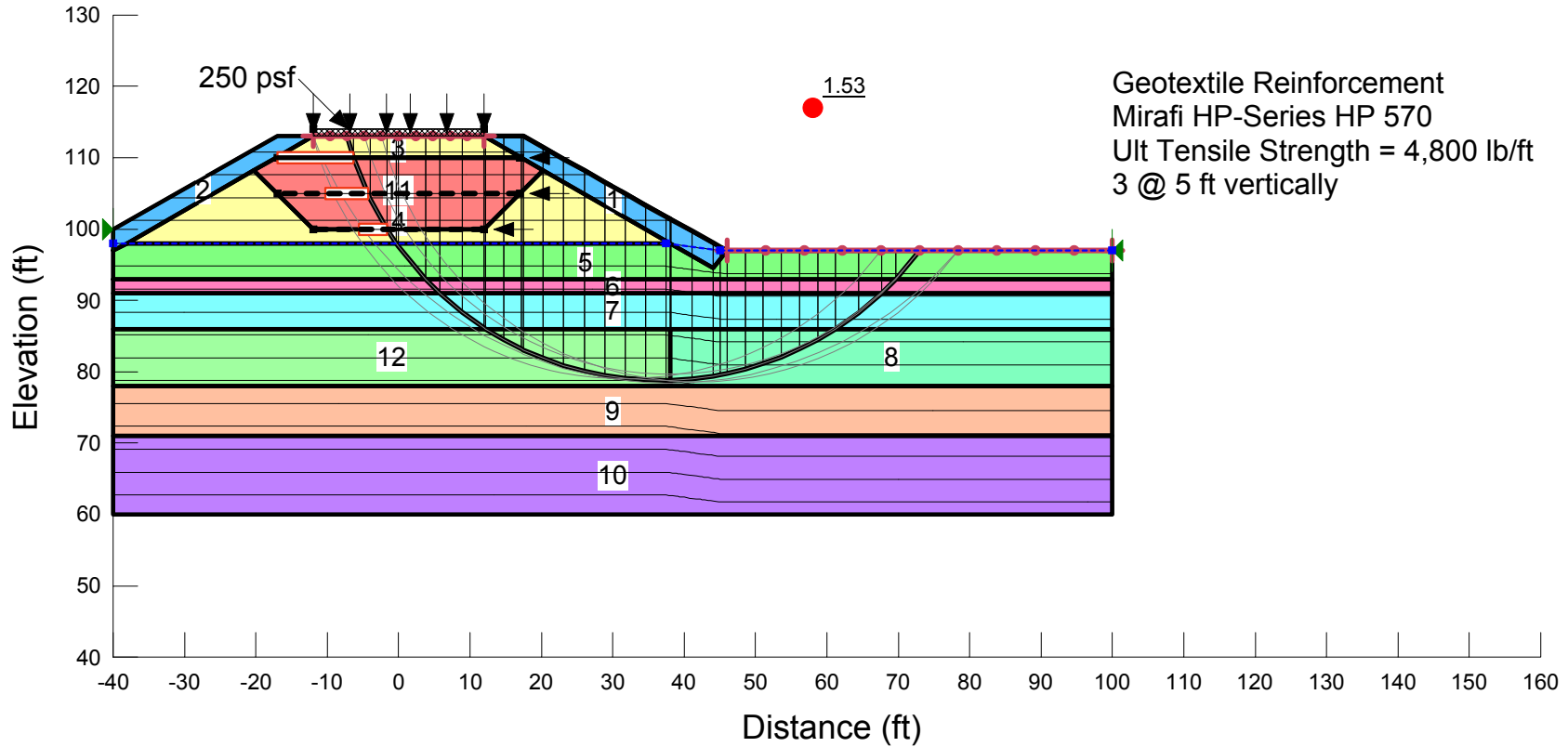
Second Otter Bridge #2754

Milford, Maine

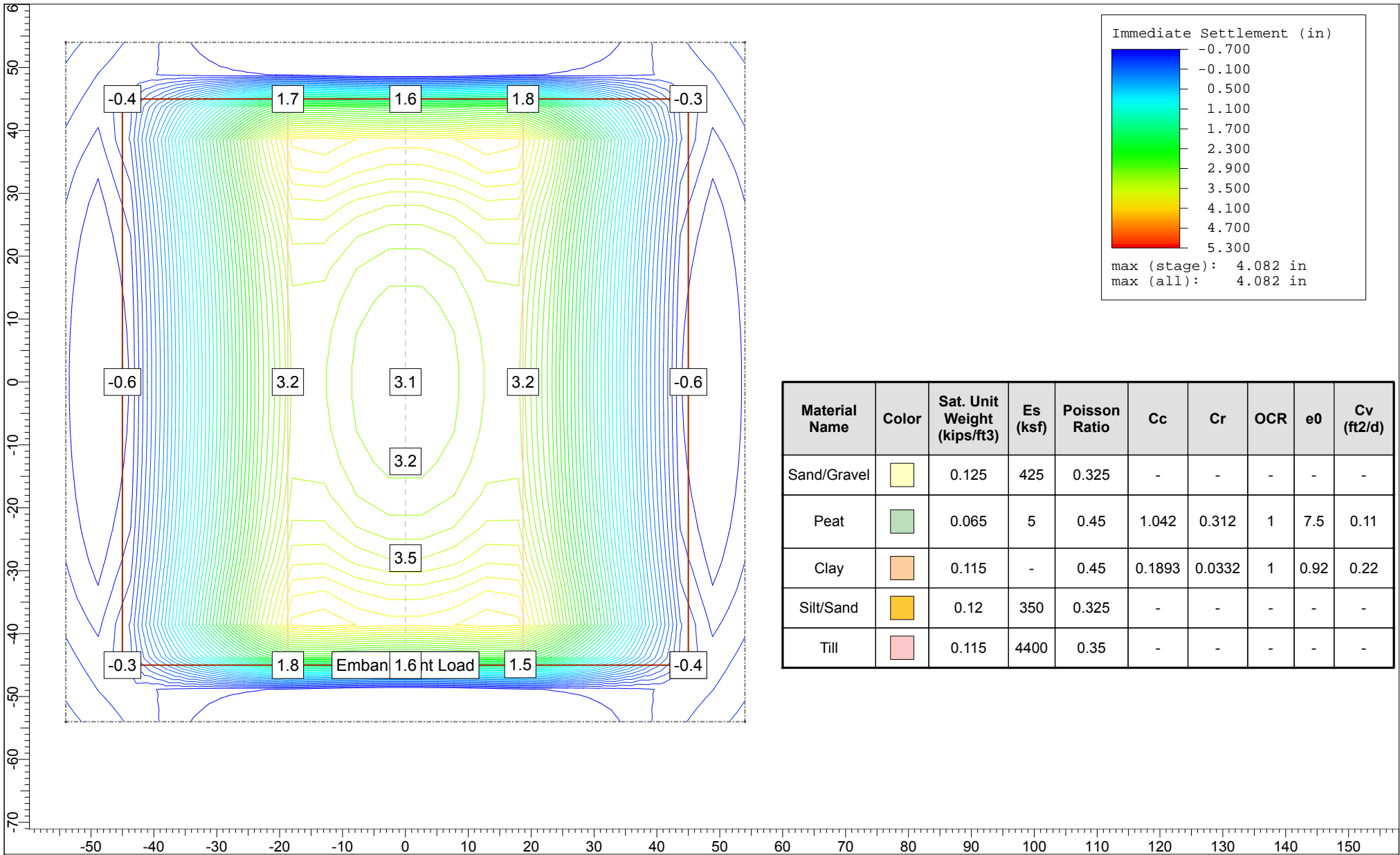
±Sta. 31+25

Replace ±10 ft of Fill with Expanded Shale Aggregate

SHANSEP Clay Strength Increase

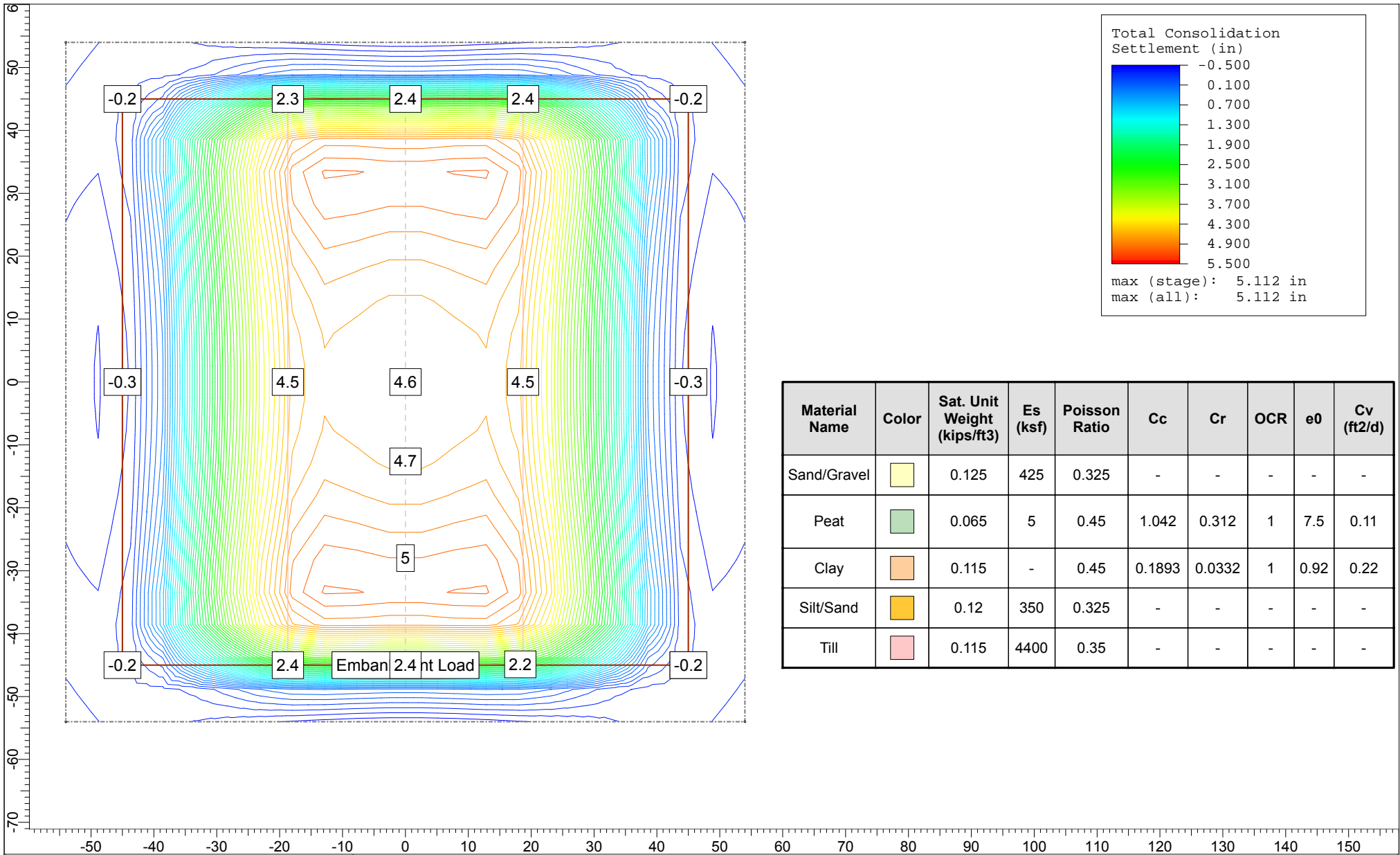


Settlement



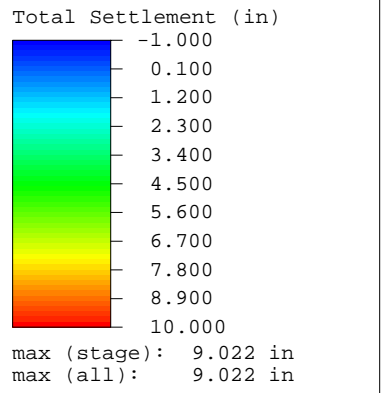
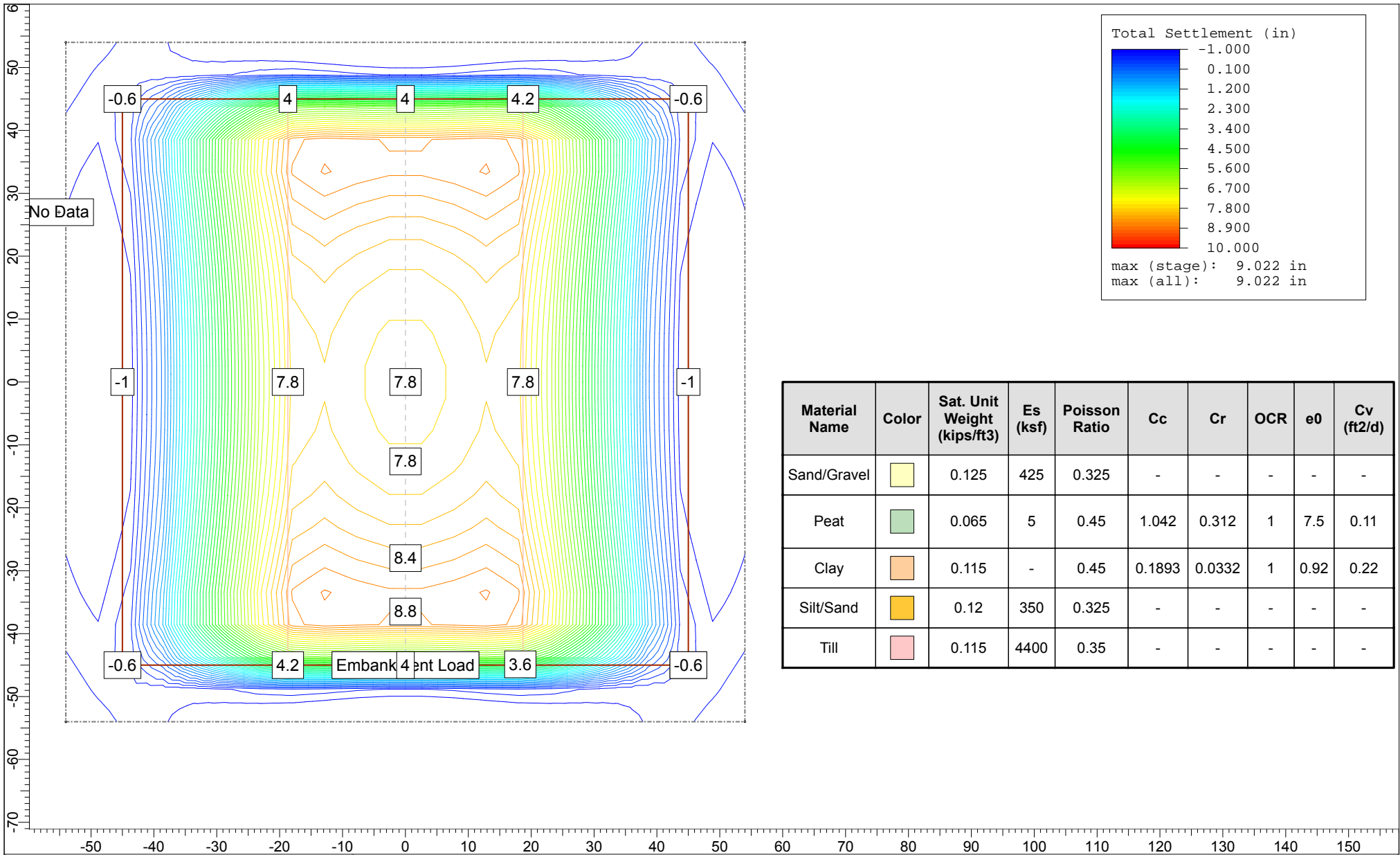
Material Name	Color	Sat. Unit Weight (kips/ft ³)	Es (ksf)	Poisson Ratio	Cc	Cr	OCR	e ₀	Cv (ft ² /d)
Sand/Gravel		0.125	425	0.325	-	-	-	-	-
Peat		0.065	5	0.45	1.042	0.312	1	7.5	0.11
Clay		0.115	-	0.45	0.1893	0.0332	1	0.92	0.22
Silt/Sand		0.12	350	0.325	-	-	-	-	-
Till		0.115	4400	0.35	-	-	-	-	-

	Project		Second Otter Bridge #2754 - Abutment No. 2	
	Analysis Description		Elastic and Consolidation Settlement - Existing Conditions	
	Drawn By	Michael St. Pierre, P.E.	Company	S. W. Cole Engineering, Inc.
	Date	1/25/2018, 11:02:16 AM	File Name	Abutment 2 Existing.s3z



Material Name	Color	Sat. Unit Weight (kips/ft ³)	Es (ksf)	Poisson Ratio	Cc	Cr	OCR	e ₀	Cv (ft/d)
Sand/Gravel		0.125	425	0.325	-	-	-	-	-
Peat		0.065	5	0.45	1.042	0.312	1	7.5	0.11
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Silt/Sand		0.12	350	0.325	-	-	-	-	-
Till		0.115	4400	0.35	-	-	-	-	-

	<i>Project</i> Second Otter Bridge #2754 - Abutment No. 2	
	<i>Analysis Description</i> Elastic and Consolidation Settlement - Existing Conditions	
	<i>Drawn By</i> Michael St. Pierre, P.E.	<i>Company</i> S. W. Cole Engineering, Inc.
	<i>Date</i> 1/25/2018, 11:02:16 AM	<i>File Name</i> Abutment 2 Existing.s3z

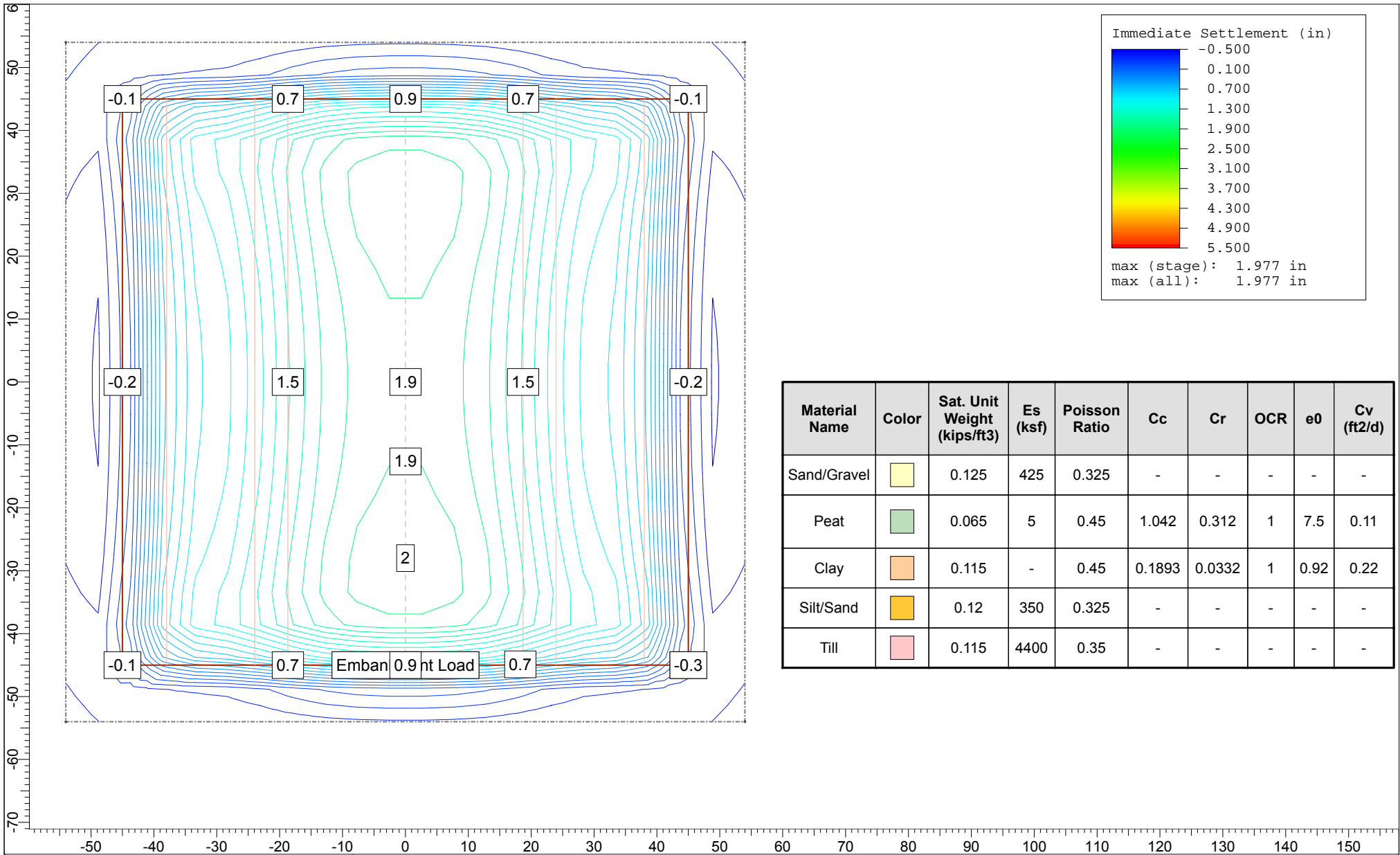


Material Name	Color	Sat. Unit Weight (kips/ft3)	Es (ksf)	Poisson Ratio	Cc	Cr	OCR	e0	Cv (ft2/d)
Sand/Gravel		0.125	425	0.325	-	-	-	-	-
Peat		0.065	5	0.45	1.042	0.312	1	7.5	0.11
Clay		0.115	-	0.45	0.1893	0.0332	1	0.92	0.22
Silt/Sand		0.12	350	0.325	-	-	-	-	-
Till		0.115	4400	0.35	-	-	-	-	-



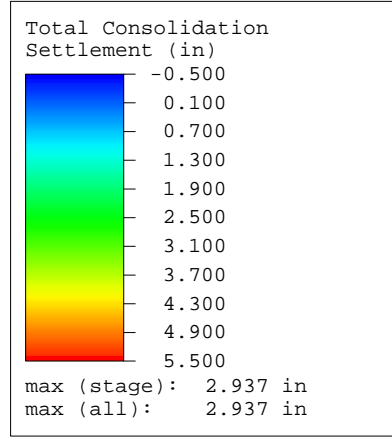
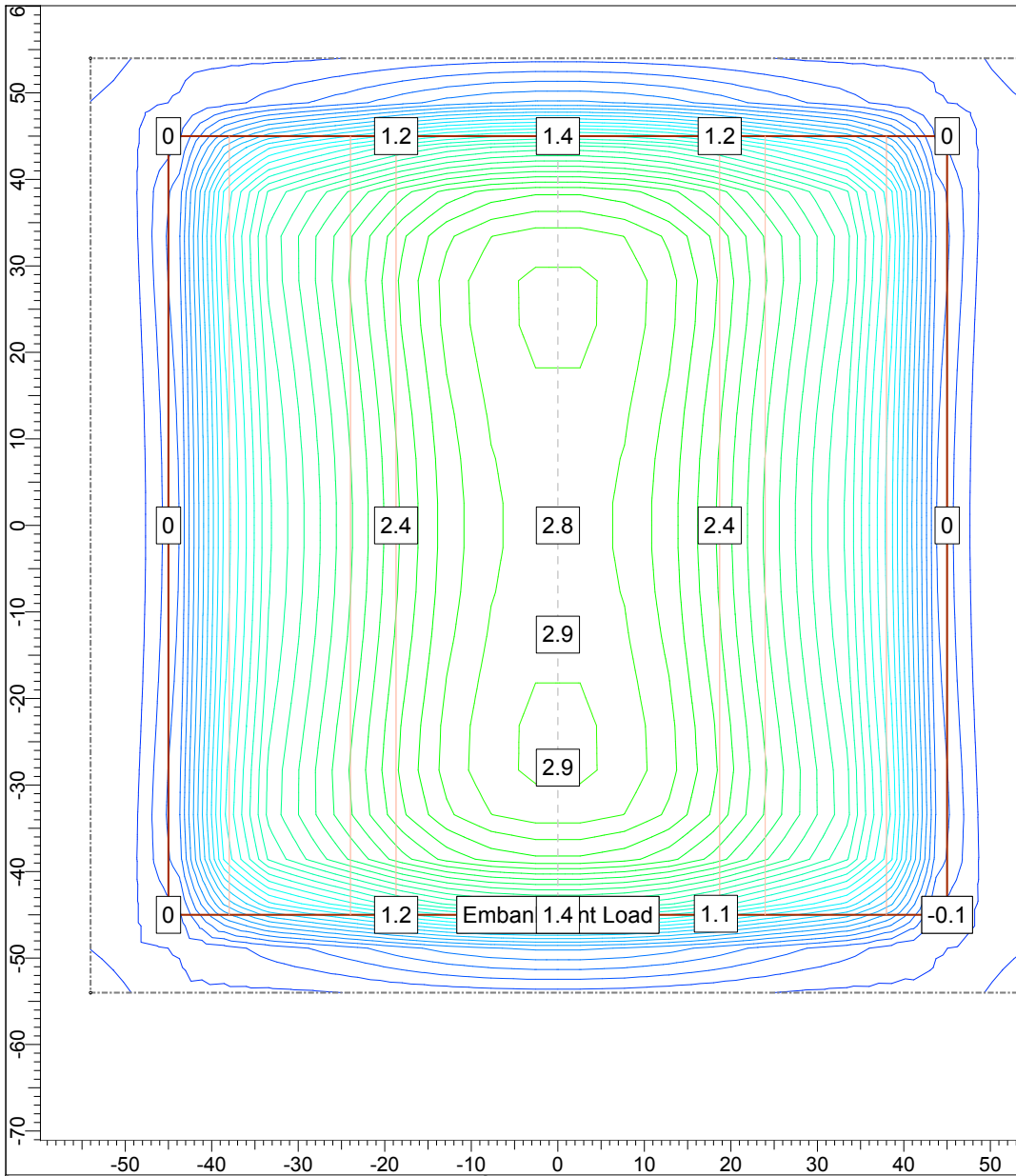
SETTLE3D 4.011

Project		Second Otter Bridge #2754 - Abutment No. 2	
Analysis Description		Elastic and Consolidation Settlement - Existing Conditions	
Drawn By	Michael St. Pierre, P.E.	Company	S. W. Cole Engineering, Inc.
Date	1/25/2018, 11:02:16 AM	File Name	Abutment 2 Existing.s3z



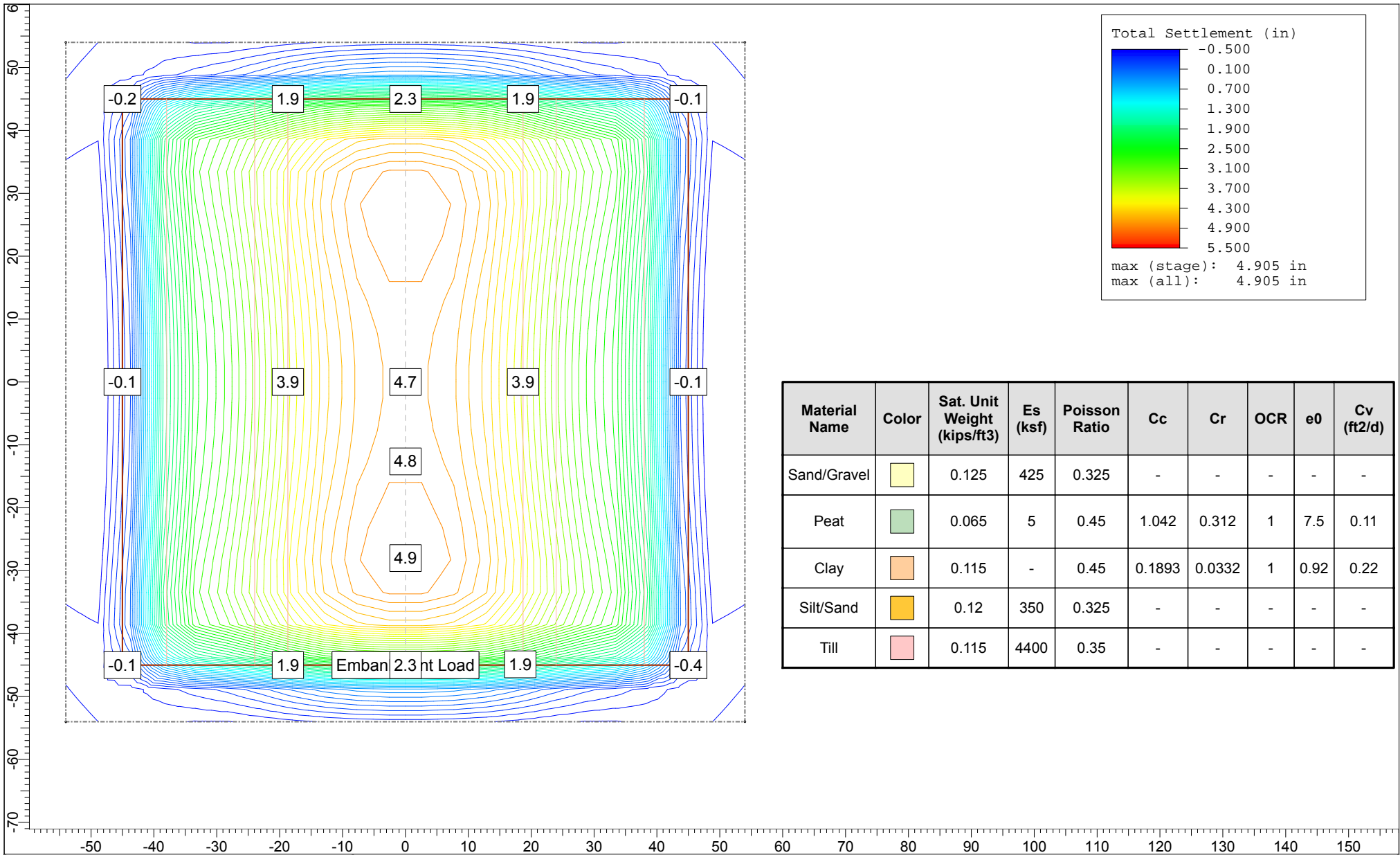
Material Name	Color	Sat. Unit Weight (kips/ft ³)	Es (ksf)	Poisson Ratio	Cc	Cr	OCR	e ₀	Cv (ft ² /d)
Sand/Gravel		0.125	425	0.325	-	-	-	-	-
Peat		0.065	5	0.45	1.042	0.312	1	7.5	0.11
Clay		0.115	-	0.45	0.1893	0.0332	1	0.92	0.22
Silt/Sand		0.12	350	0.325	-	-	-	-	-
Till		0.115	4400	0.35	-	-	-	-	-

	Project		Second Otter Bridge #2754 - Abutment No. 2	
	Analysis Description		Elastic and Consolidation Settlement - 8 feet of Geofoam	
	Drawn By	Michael St. Pierre, P.E.	Company	S. W. Cole Engineering, Inc.
	Date	1/25/2018, 11:02:16 AM	File Name	Abutment 2 Geofoam.s3z



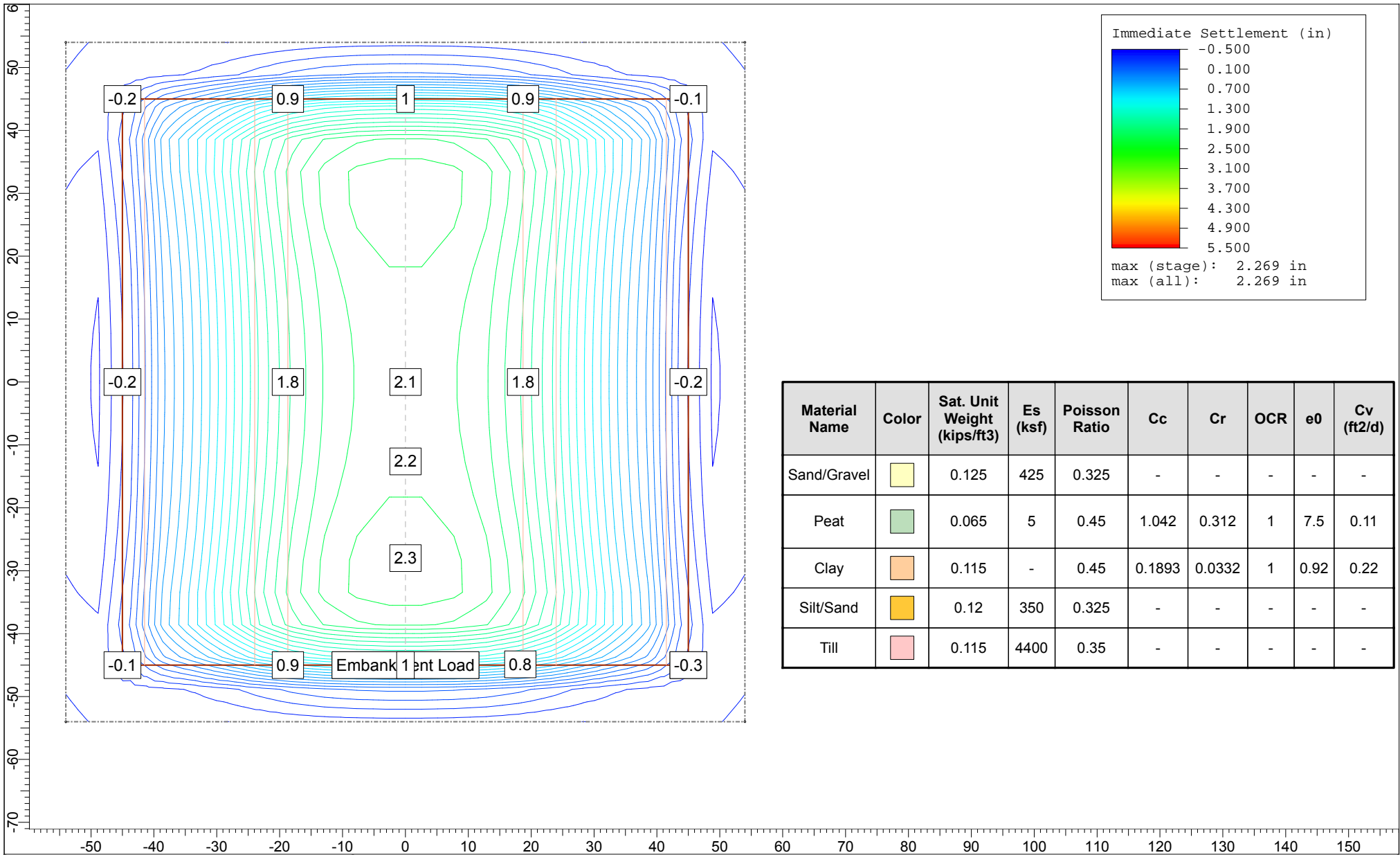
Material Name	Color	Sat. Unit Weight (kips/ft ³)	Es (ksf)	Poisson Ratio	Cc	Cr	OCR	e ₀	Cv (ft ² /d)
Sand/Gravel		0.125	425	0.325	-	-	-	-	-
Peat		0.065	5	0.45	1.042	0.312	1	7.5	0.11
Clay		0.115	-	0.45	0.1893	0.0332	1	0.92	0.22
Silt/Sand		0.12	350	0.325	-	-	-	-	-
Till		0.115	4400	0.35	-	-	-	-	-

	Project		Second Otter Bridge #2754 - Abutment No. 2	
	Analysis Description		Elastic and Consolidation Settlement - 8 feet of Geofoam	
	Drawn By	Michael St. Pierre, P.E.	Company	S. W. Cole Engineering, Inc.
	Date	1/25/2018, 11:02:16 AM	File Name	Abutment 2 Geofoam.s3z



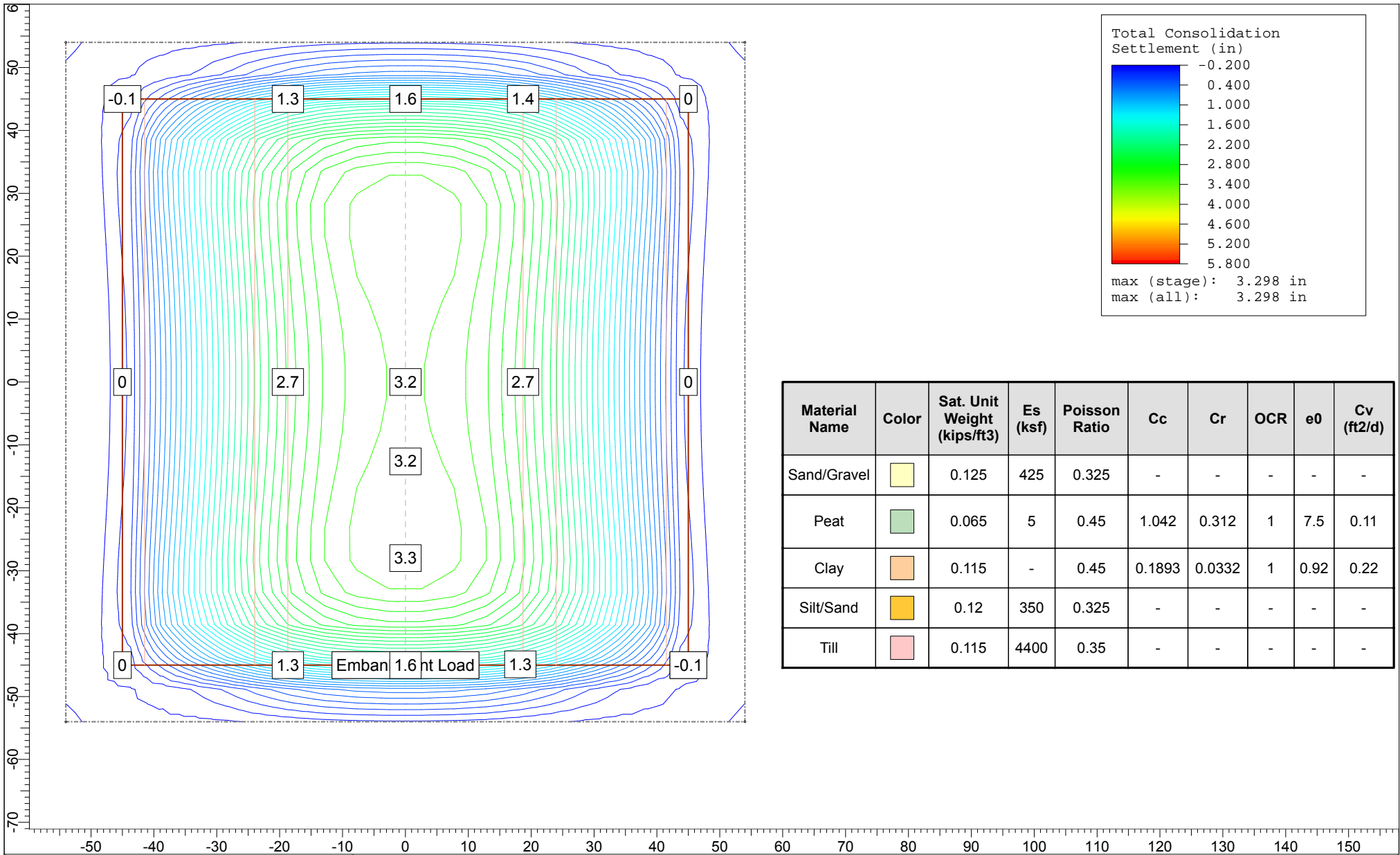
Material Name	Color	Sat. Unit Weight (kips/ft ³)	Es (ksf)	Poisson Ratio	Cc	Cr	OCR	e ₀	Cv (ft ² /d)
Sand/Gravel		0.125	425	0.325	-	-	-	-	-
Peat		0.065	5	0.45	1.042	0.312	1	7.5	0.11
Clay		0.115	-	0.45	0.1893	0.0332	1	0.92	0.22
Silt/Sand		0.12	350	0.325	-	-	-	-	-
Till		0.115	4400	0.35	-	-	-	-	-

	Project		Second Otter Bridge #2754 - Abutment No. 2	
	Analysis Description		Elastic and Consolidation Settlement - 8 feet of Geofoam	
	Drawn By	Michael St. Pierre, P.E.	Company	S. W. Cole Engineering, Inc.
	Date	1/25/2018, 11:02:16 AM	File Name	Abutment 2 Geofoam.s3z



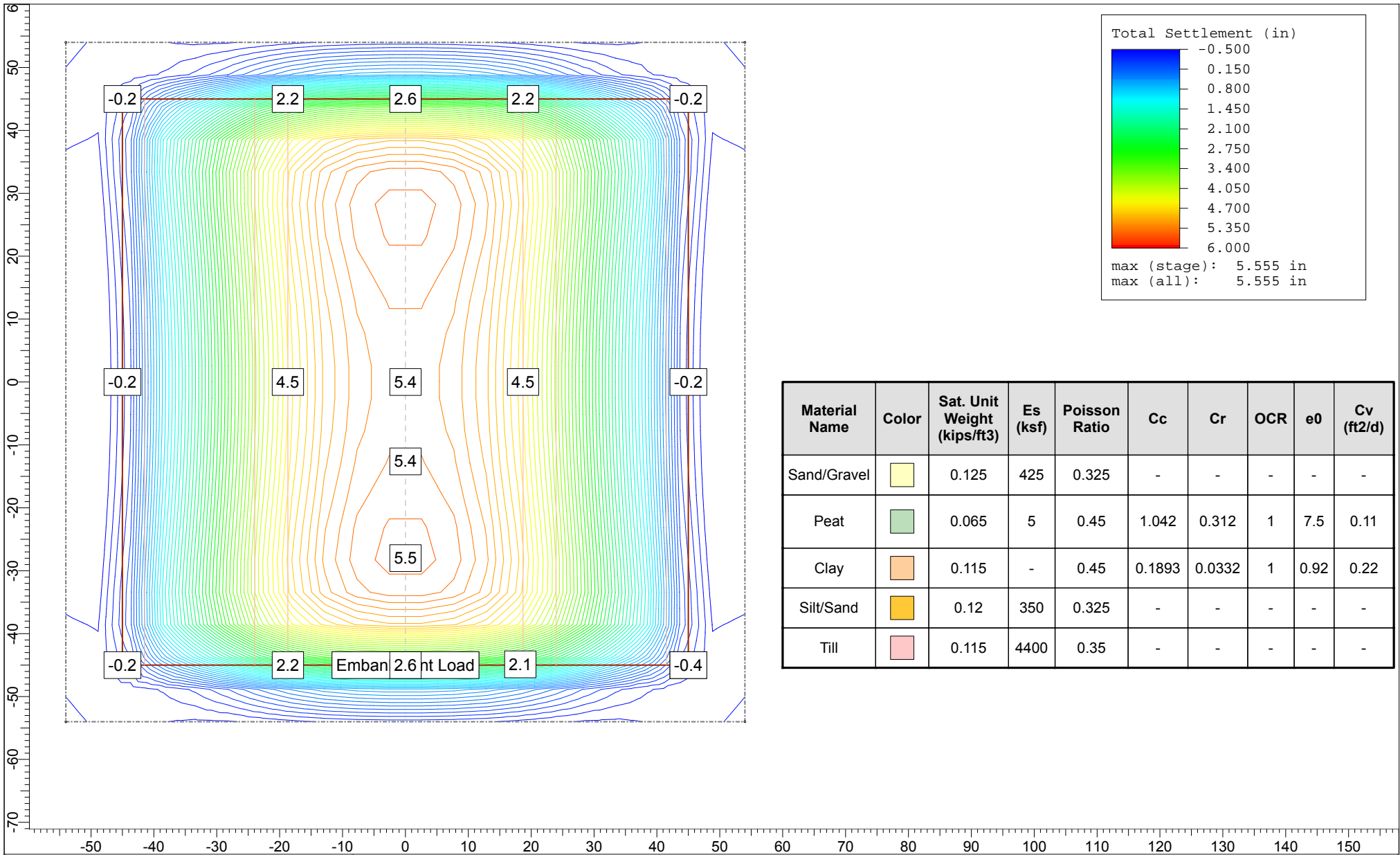
Material Name	Color	Sat. Unit Weight (kips/ft ³)	Es (ksf)	Poisson Ratio	Cc	Cr	OCR	e ₀	Cv (ft ² /d)
Sand/Gravel		0.125	425	0.325	-	-	-	-	-
Peat		0.065	5	0.45	1.042	0.312	1	7.5	0.11
Clay		0.115	-	0.45	0.1893	0.0332	1	0.92	0.22
Silt/Sand		0.12	350	0.325	-	-	-	-	-
Till		0.115	4400	0.35	-	-	-	-	-


	Project	Second Otter Bridge #2754 - Abutment No. 2	
	Analysis Description	Elastic and Consolidation Settlement - 10 feet of LFCF	
	Drawn By	Michael St. Pierre, P.E.	Company S. W. Cole Engineering, Inc.
	Date	1/25/2018, 11:02:16 AM	File Name Abutment 2 LFCF.s3z

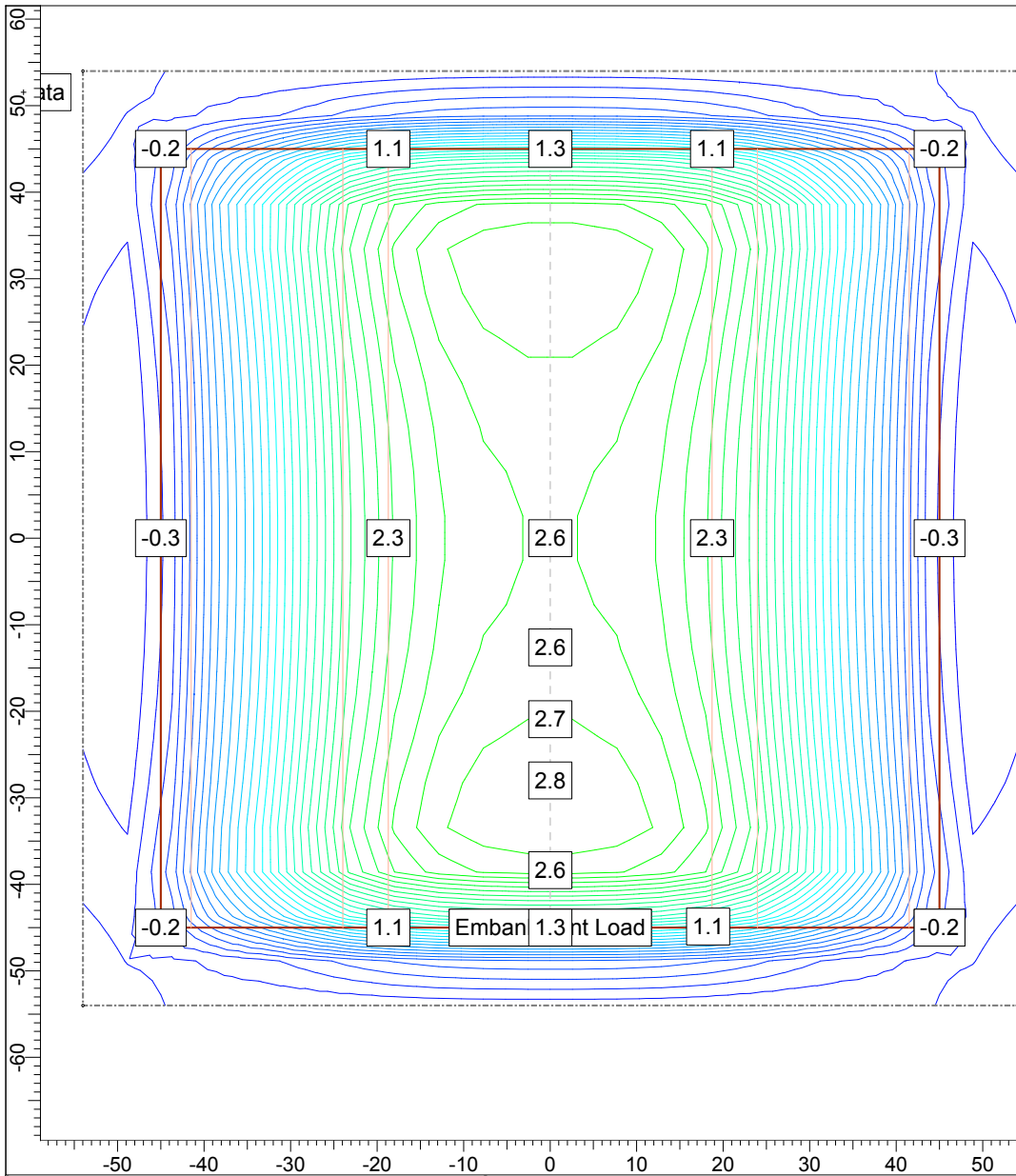


Material Name	Color	Sat. Unit Weight (kips/ft ³)	Es (ksf)	Poisson Ratio	Cc	Cr	OCR	e ₀	Cv (ft ² /d)
Sand/Gravel		0.125	425	0.325	-	-	-	-	-
Peat		0.065	5	0.45	1.042	0.312	1	7.5	0.11
Clay		0.115	-	0.45	0.1893	0.0332	1	0.92	0.22
Silt/Sand		0.12	350	0.325	-	-	-	-	-
Till		0.115	4400	0.35	-	-	-	-	-

	<i>Project</i> Second Otter Bridge #2754 - Abutment No. 2	
	<i>Analysis Description</i> Elastic and Consolidation Settlement - 10 feet of LFCF	
	<i>Drawn By</i> Michael St. Pierre, P.E.	<i>Company</i> S. W. Cole Engineering, Inc.
	<i>Date</i> 1/25/2018, 11:02:16 AM	<i>File Name</i> Abutment 2 LFCF.s3z

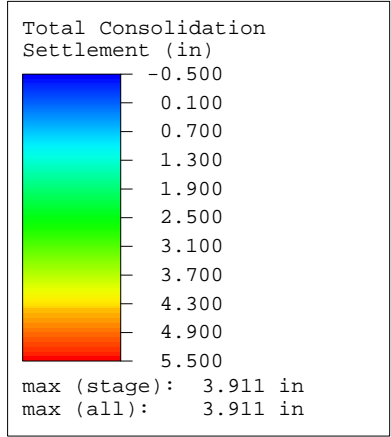
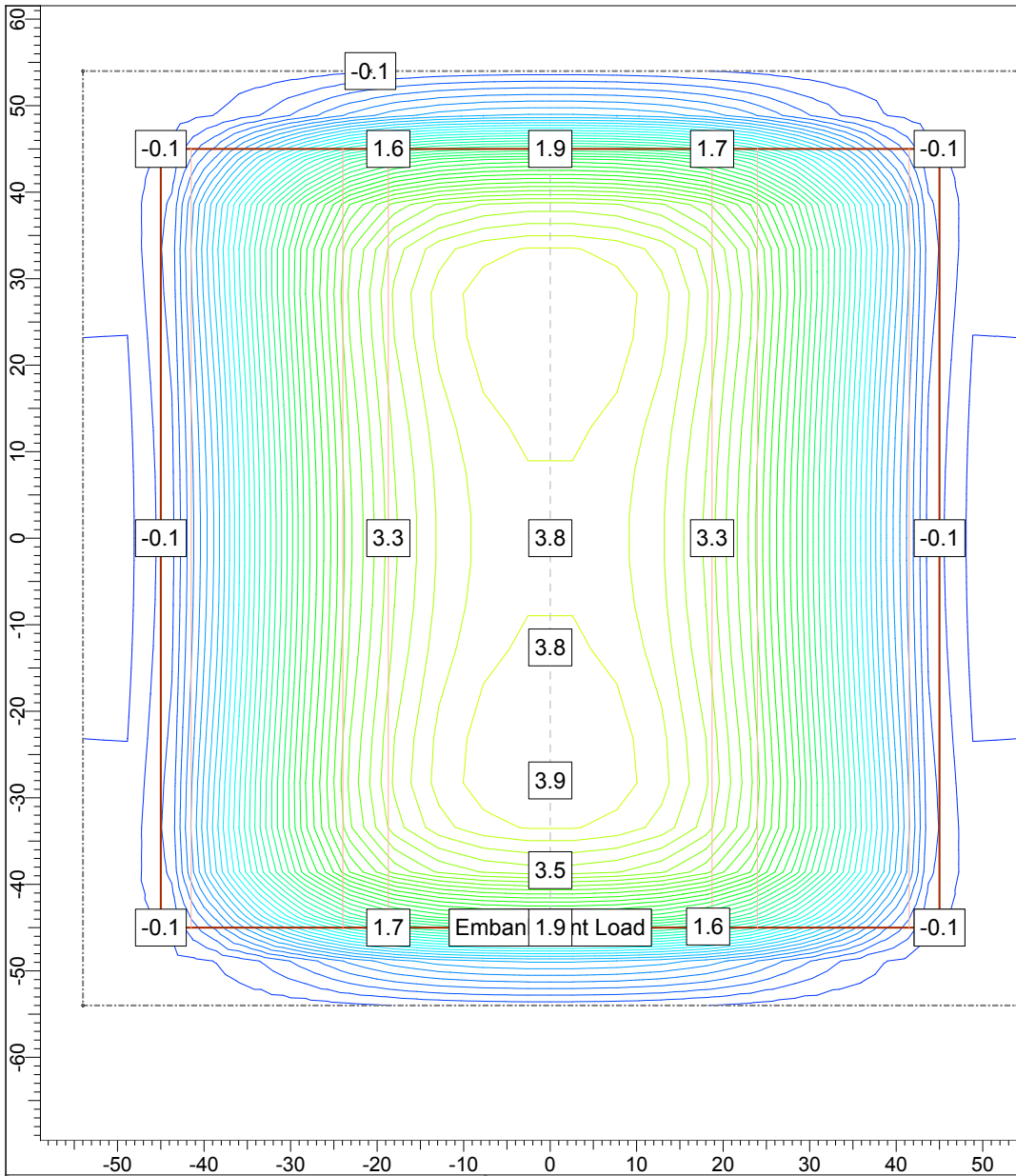


	Project		Second Otter Bridge #2754 - Abutment No. 2	
	Analysis Description		Elastic and Consolidation Settlement - 10 feet of LFCF	
	Drawn By	Michael St. Pierre, P.E.	Company	S. W. Cole Engineering, Inc.
	Date	1/25/2018, 11:02:16 AM	File Name	Abutment 2 LFCF.s3z



Material Name	Color	Sat. Unit Weight (kips/ft ³)	Es (ksf)	Poisson Ratio	Cc	Cr	OCR	e0	Cv (ft ² /d)
Sand/Gravel		0.125	425	0.325	-	-	-	-	-
Peat		0.065	5	0.45	1.042	0.312	1	7.5	0.11
Clay		0.115	-	0.45	0.1893	0.0332	1	0.92	0.22
Silt/Sand		0.12	350	0.325	-	-	-	-	-
Till		0.115	4400	0.35	-	-	-	-	-

	Project	Second Otter Bridge #2754 - Abutment No. 2	
	Analysis Description	Elastic and Consolidation Settlement - 10 feet of ESA	
	Drawn By	Michael St. Pierre, P.E.	Company S. W. Cole Engineering, Inc.
	Date	1/25/2018, 11:02:16 AM	File Name Abutment 2 ESA.s3z

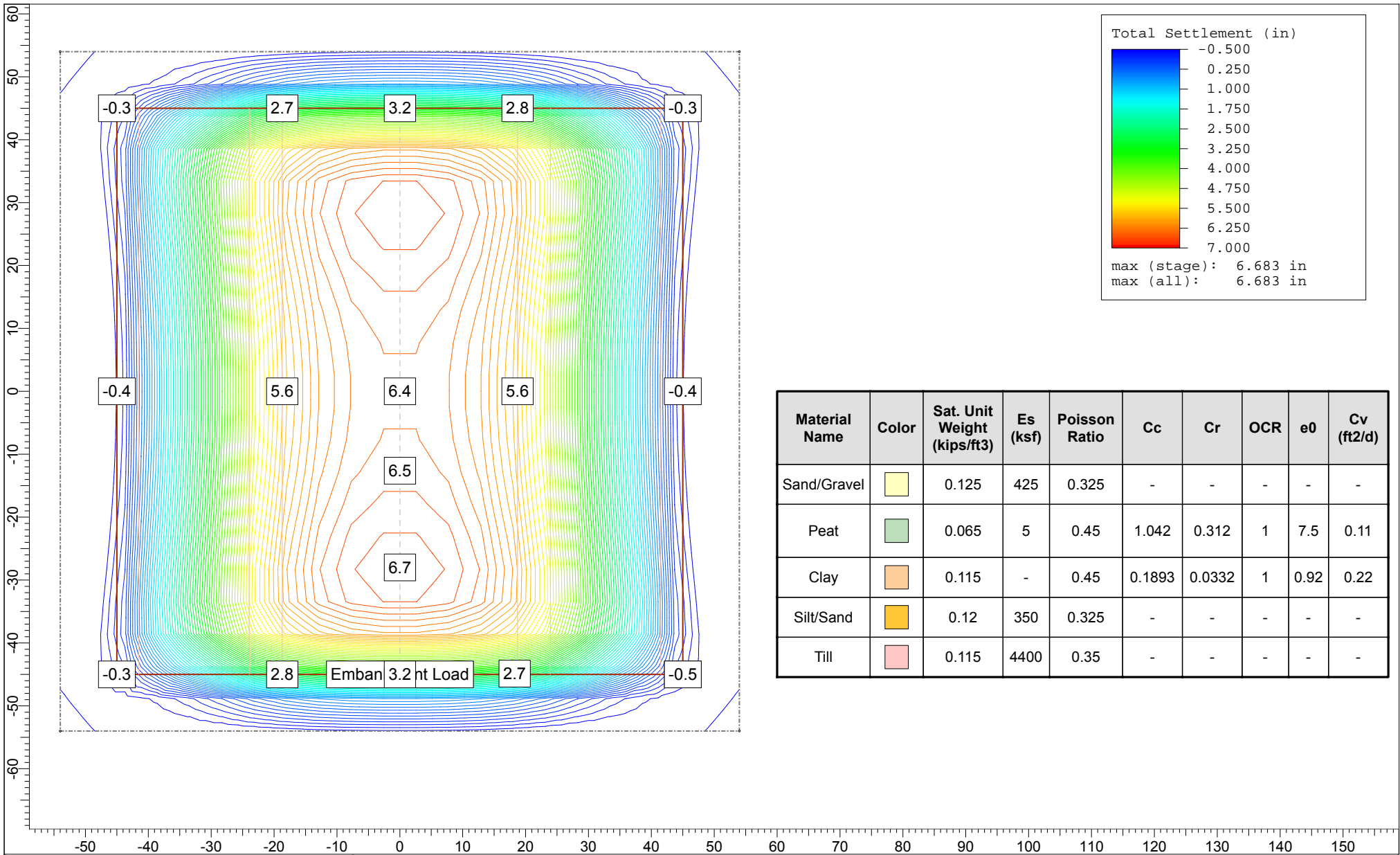


Material Name	Color	Sat. Unit Weight (kips/ft ³)	Es (ksf)	Poisson Ratio	Cc	Cr	OCR	e0	Cv (ft ² /d)
Sand/Gravel		0.125	425	0.325	-	-	-	-	-
Peat		0.065	5	0.45	1.042	0.312	1	7.5	0.11
Clay		0.115	-	0.45	0.1893	0.0332	1	0.92	0.22
Silt/Sand		0.12	350	0.325	-	-	-	-	-
Till		0.115	4400	0.35	-	-	-	-	-



SETTLE3D 4.014

Project		Second Otter Bridge #2754 - Abutment No. 2	
Analysis Description		Elastic and Consolidation Settlement - 10 feet of ESA	
Drawn By	Michael St. Pierre, P.E.	Company	S. W. Cole Engineering, Inc.
Date	1/25/2018, 11:02:16 AM	File Name	Abutment 2 ESA.s3z



Material Name	Color	Sat. Unit Weight (kips/ft ³)	Es (ksf)	Poisson Ratio	Cc	Cr	OCR	e0	Cv (ft ² /d)
Sand/Gravel		0.125	425	0.325	-	-	-	-	-
Peat		0.065	5	0.45	1.042	0.312	1	7.5	0.11
Clay		0.115	-	0.45	0.1893	0.0332	1	0.92	0.22
Silt/Sand		0.12	350	0.325	-	-	-	-	-
Till		0.115	4400	0.35	-	-	-	-	-

	Project		Second Otter Bridge #2754 - Abutment No. 2	
	Analysis Description		Elastic and Consolidation Settlement - 10 feet of ESA	
	Drawn By	Michael St. Pierre, P.E.	Company	S. W. Cole Engineering, Inc.
	Date	1/25/2018, 11:02:16 AM	File Name	Abutment 2 ESA.s3z

Find Volume of Embankment Fill per foot

$$V_{fill} := (2 \cdot (0.5 \cdot 21 \text{ ft} \cdot 15 \text{ ft}) + 48 \text{ ft} \cdot 15 \text{ ft}) \cdot 1 \text{ ft} = 1035 \text{ ft}^3$$

Find Volume of Lightweight Materials per foot

$$V_{geofoam} := (2 \text{ ft} \cdot (36 \text{ ft} + 32 \text{ ft} + 28 \text{ ft} + 24 \text{ ft})) \cdot 1 \text{ ft} = 240 \text{ ft}^3$$

$$V_{LFCF} := (2 \text{ ft} \cdot 40 \text{ ft} + 2 \cdot (0.5 \cdot 8 \text{ ft} \cdot 8 \text{ ft}) + 8 \text{ ft} \cdot 24 \text{ ft}) \cdot 1 \text{ ft} = 336 \text{ ft}^3$$

$$V_{ESA} := (2 \text{ ft} \cdot 40 \text{ ft} + 2 \cdot (0.5 \cdot 8 \text{ ft} \cdot 8 \text{ ft}) + 8 \text{ ft} \cdot 24 \text{ ft}) \cdot 1 \text{ ft} = 336 \text{ ft}^3$$

Unit Weight of Embankment Embankment Materials

$$\gamma_{fill} := 125 \text{ pcf}$$

$$\gamma_{LFCF} := 36 \text{ pcf}$$

$$\gamma_{geofoam} := 2 \text{ pcf}$$

$$\gamma_{ESA} := 60 \text{ pcf}$$

Find Total Weight of Embankment per foot

$$W_{fill} := V_{fill} \cdot \gamma_{fill} = 129.375 \text{ kip}$$

$$W_{fill_geofoam} := (V_{fill} - V_{geofoam}) \cdot \gamma_{fill} + V_{geofoam} \cdot \gamma_{geofoam} = 99.855 \text{ kip}$$

$$W_{fill_LFCF} := (V_{fill} - V_{LFCF}) \cdot \gamma_{fill} + V_{LFCF} \cdot \gamma_{LFCF} = 99.471 \text{ kip}$$

$$W_{fill_ESA} := (V_{fill} - V_{ESA}) \cdot \gamma_{fill} + V_{ESA} \cdot \gamma_{ESA} = 107.535 \text{ kip}$$

Determine Unit Pressure of Embankment Options

$$q_{fill} := \frac{W_{fill}}{90 \text{ ft} \cdot 1 \text{ ft}} = 1.438 \text{ ksf}$$

$$q_{geofoam} := \frac{W_{fill_geofoam}}{90 \text{ ft} \cdot 1 \text{ ft}} = 1.11 \text{ ksf}$$

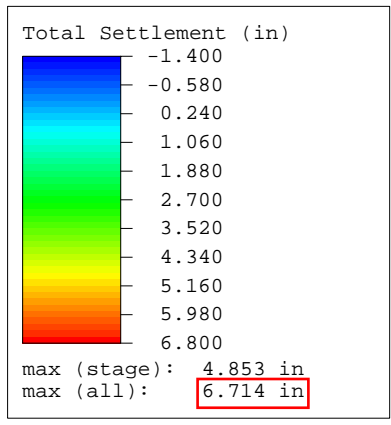
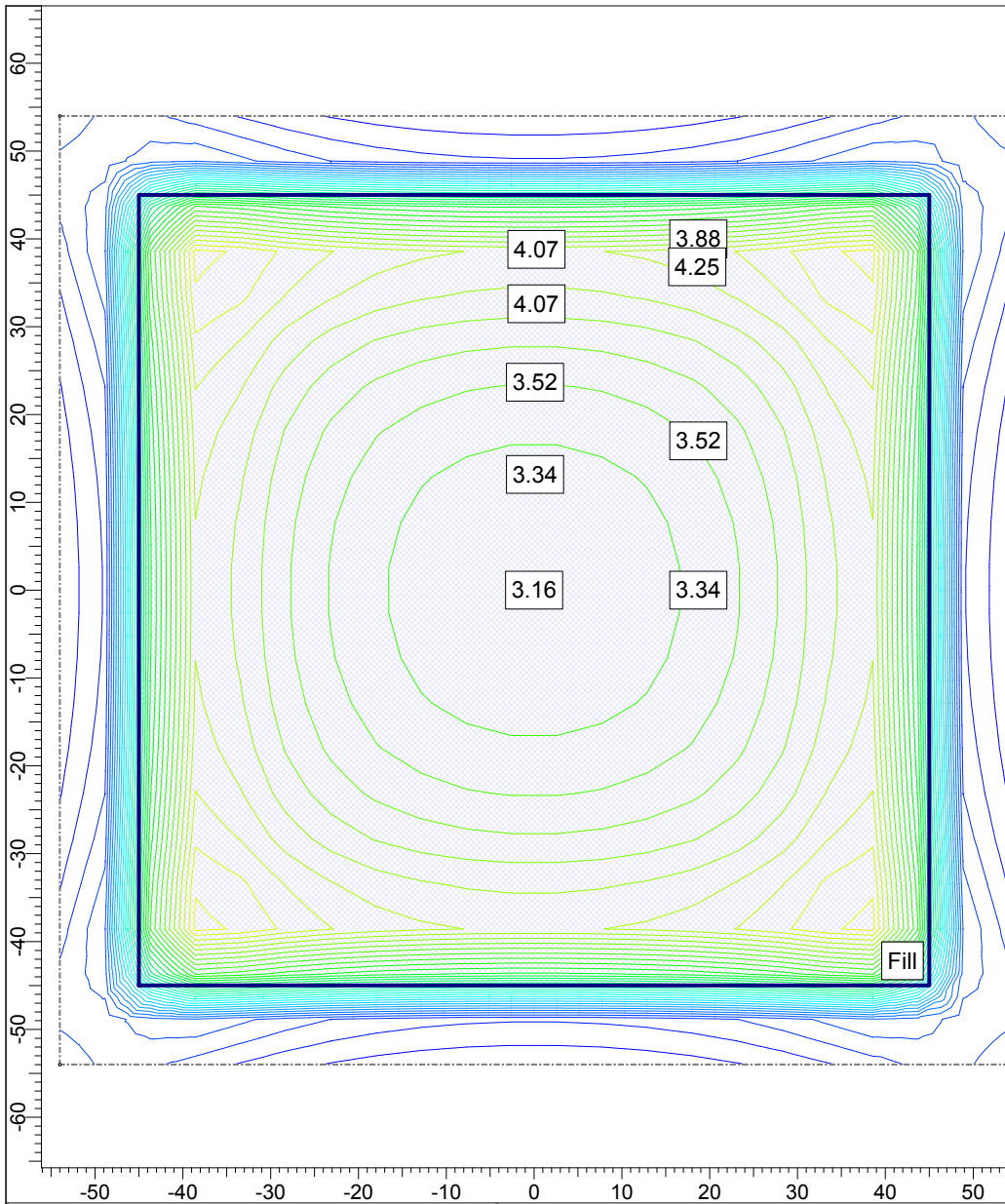
$$\Delta_{geofoam} := q_{fill} - q_{geofoam} = 0.328 \text{ ksf}$$

$$q_{LFCF} := \frac{W_{fill_LFCF}}{90 \text{ ft} \cdot 1 \text{ ft}} = 1.105 \text{ ksf}$$

$$\Delta_{LFCF} := q_{fill} - q_{LFCF} = 0.332 \text{ ksf}$$

$$q_{ESA} := \frac{W_{fill_ESA}}{90 \text{ ft} \cdot 1 \text{ ft}} = 1.195 \text{ ksf}$$

$$\Delta_{ESA} := q_{fill} - q_{ESA} = 0.243 \text{ ksf}$$

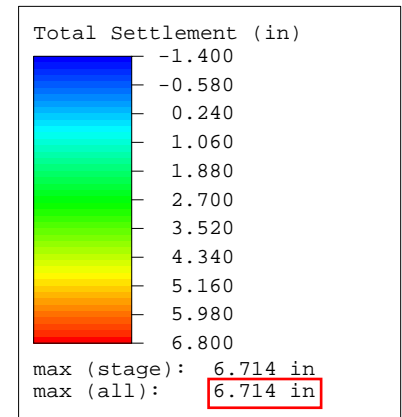
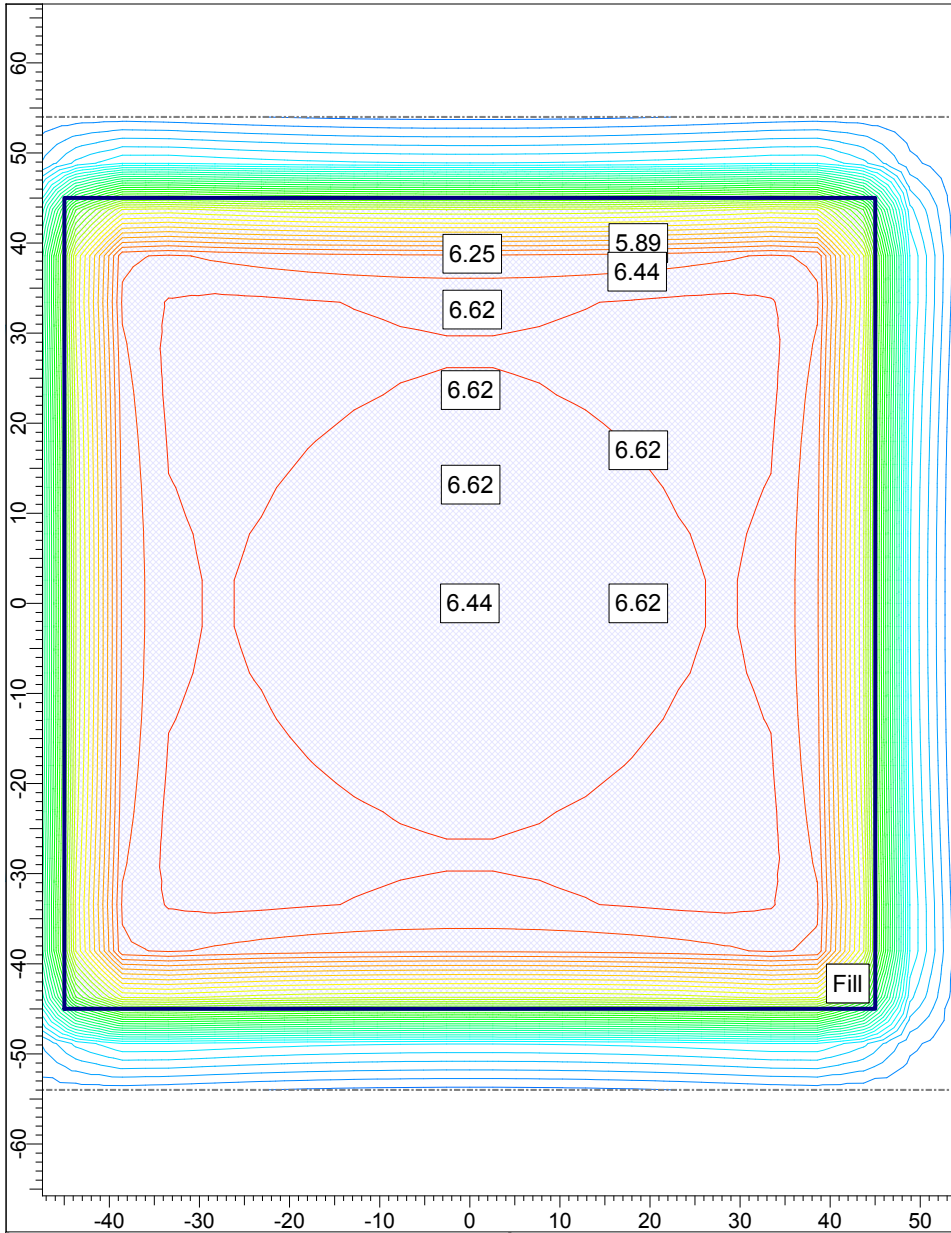


Material Name	Color	Sat. Unit Weight (kips/ft ³)	Es (ksf)	Poisson Ratio	Cc	Cr	Pc (ksf)	OCR	e0	Cv (ft ² /d)
Sand/Gravel		0.125	425	0.325	-	-	-	-	-	-
Peat		0.065	5	0.45	1.042	0.312	-	1	7.5	0.11
Clay		0.115	-	0.45	0.189	0.033	1.8	-	0.92	0.22
Silt/Sand		0.12	350	0.325	-	-	-	-	-	-
Till		0.135	4400	0.35	-	-	-	-	-	-



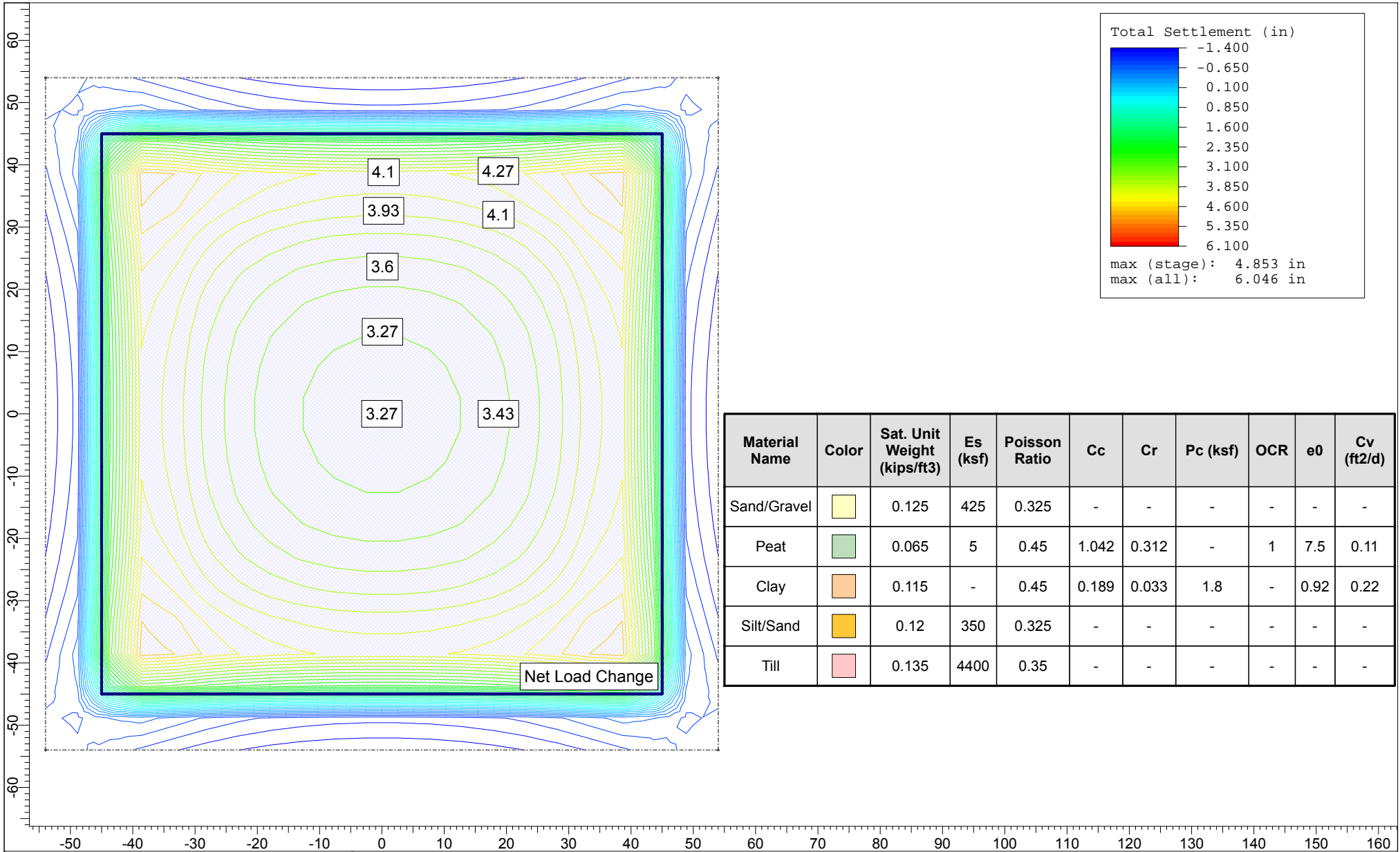
SETTLE3D 4.014

Project	Second Otter Bridge #2754 - Abutment No. 2		
Analysis Description	Settlement Evaluation - Stage I - Placement of Normal-Weight Fill Embankment		
Drawn By	Michael St. Pierre, P.E.	Company	S. W. Cole Engineering, Inc.
Date	1/25/2018, 11:02:16 AM	File Name	Abutment 2 ExistingV2.s3z

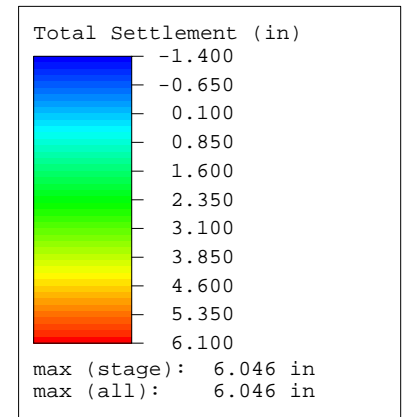
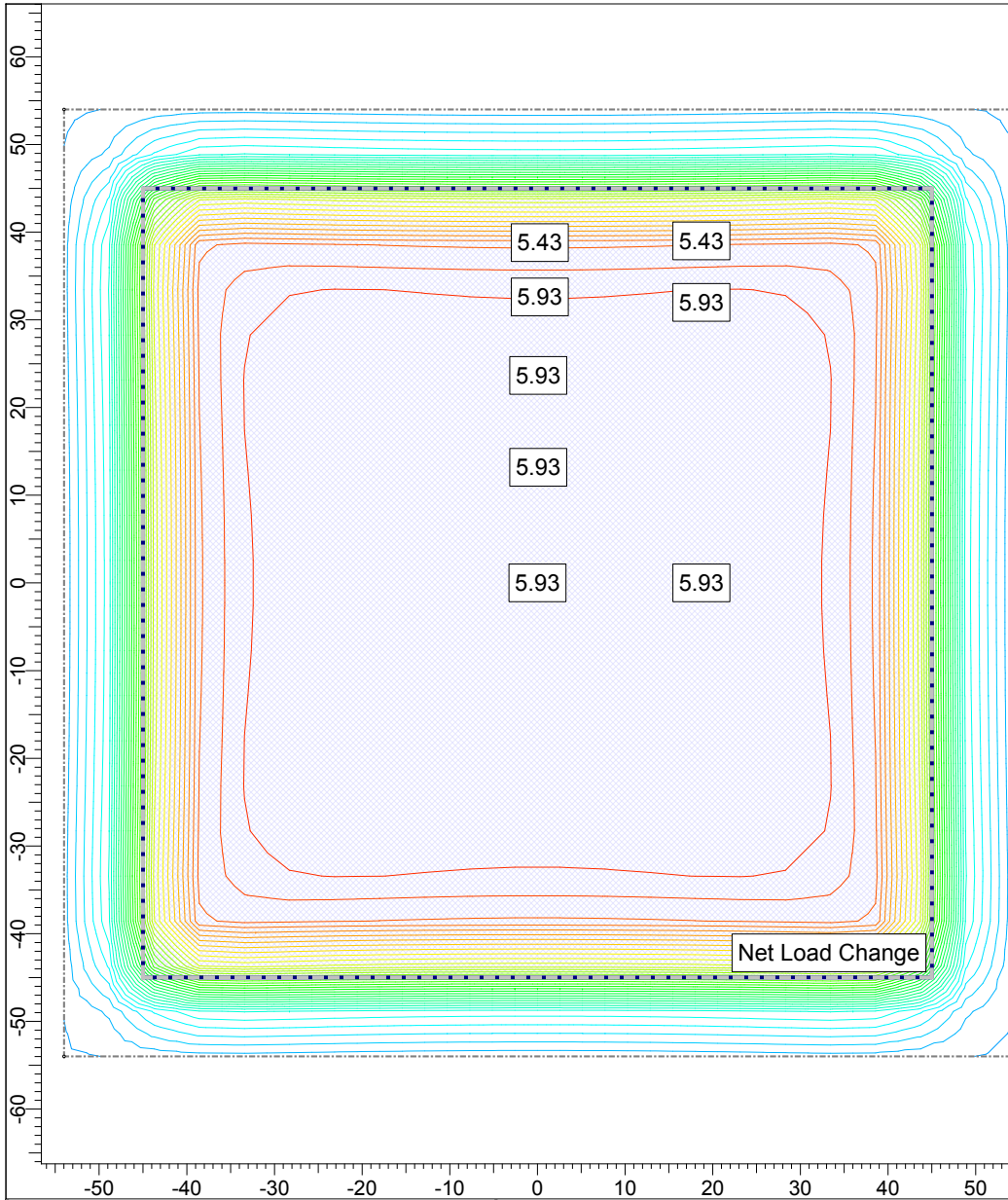


Material Name	Color	Sat. Unit Weight (kips/ft ³)	Es (ksf)	Poisson Ratio	Cc	Cr	Pc (ksf)	OCR	e0	Cv (ft ² /d)
Sand/Gravel		0.125	425	0.325	-	-	-	-	-	-
Peat		0.065	5	0.45	1.042	0.312	-	1	7.5	0.11
Clay		0.115	-	0.45	0.189	0.033	1.8	-	0.92	0.22
Silt/Sand		0.12	350	0.325	-	-	-	-	-	-
Till		0.135	4400	0.35	-	-	-	-	-	-

	Project		Second Otter Bridge #2754 - Abutment No. 2	
	Analysis Description		Settlement Evaluation - Stage II - Settlement after 5 years (2018) due to Normal-Weight Fill Embankment	
	Drawn By	Michael St. Pierre, P.E.	Company	S. W. Cole Engineering, Inc.
	Date	1/25/2018, 11:02:16 AM	File Name	Abutment 2 ExistingV2.s3z

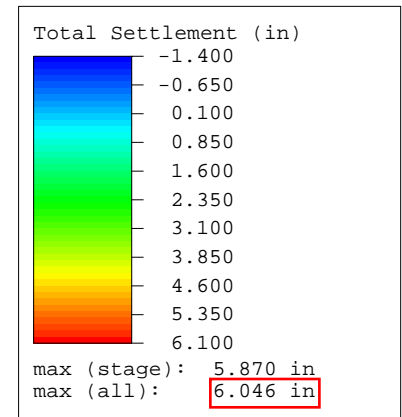
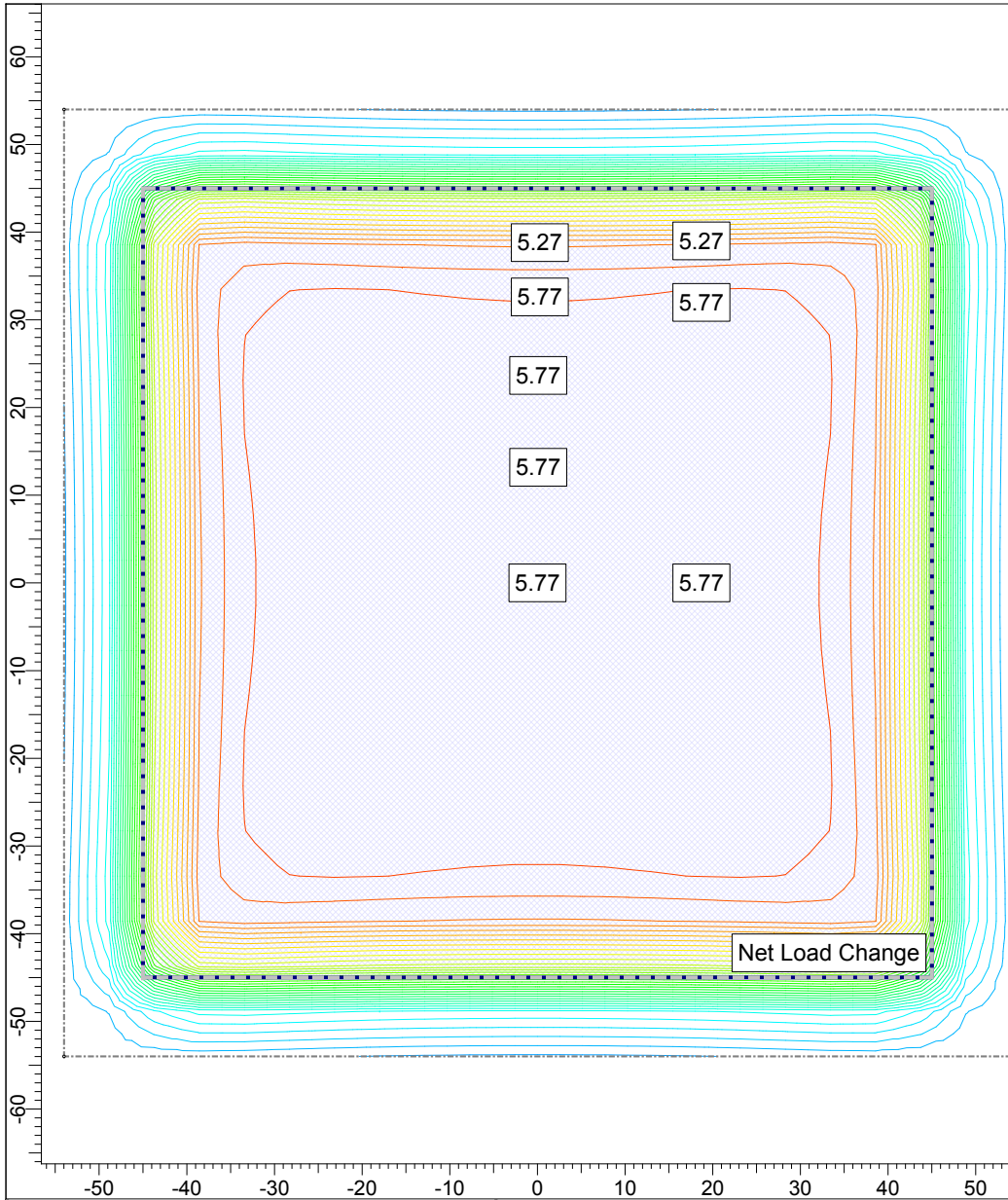


	Project Second Otter Bridge #2754 - Abutment No. 2	
	Analysis Description Settlement Evaluation - Stage I - Placement of Normal-Weight Fill Embankment	
	Drawn By Michael St. Pierre, P.E.	Company S. W. Cole Engineering, Inc.
	Date 1/25/2018, 11:02:16 AM	File Name Abutment 2 Geofoam_staged.s3z



Material Name	Color	Sat. Unit Weight (kips/ft3)	Es (ksf)	Poisson Ratio	Cc	Cr	Pc (ksf)	OCR	e0	Cv (ft2/d)
Sand/Gravel		0.125	425	0.325	-	-	-	-	-	-
Peat		0.065	5	0.45	1.042	0.312	-	1	7.5	0.11
Clay		0.115	-	0.45	0.189	0.033	1.8	-	0.92	0.22
Silt/Sand		0.12	350	0.325	-	-	-	-	-	-
Till		0.135	4400	0.35	-	-	-	-	-	-

	Project Second Otter Bridge #2754 - Abutment No. 2	
	Analysis Description Settlement Evaluation - Stage II - Settlement after 5 years (2018) due to Normal-Weight Fill Embankment	
	Drawn By Michael St. Pierre, P.E.	Company S. W. Cole Engineering, Inc.
	Date 1/25/2018, 11:02:16 AM	File Name Abutment 2 Geofoam_staged.s3z



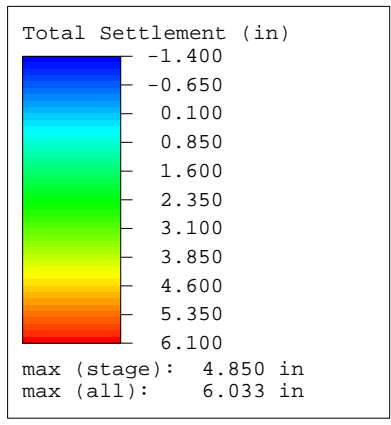
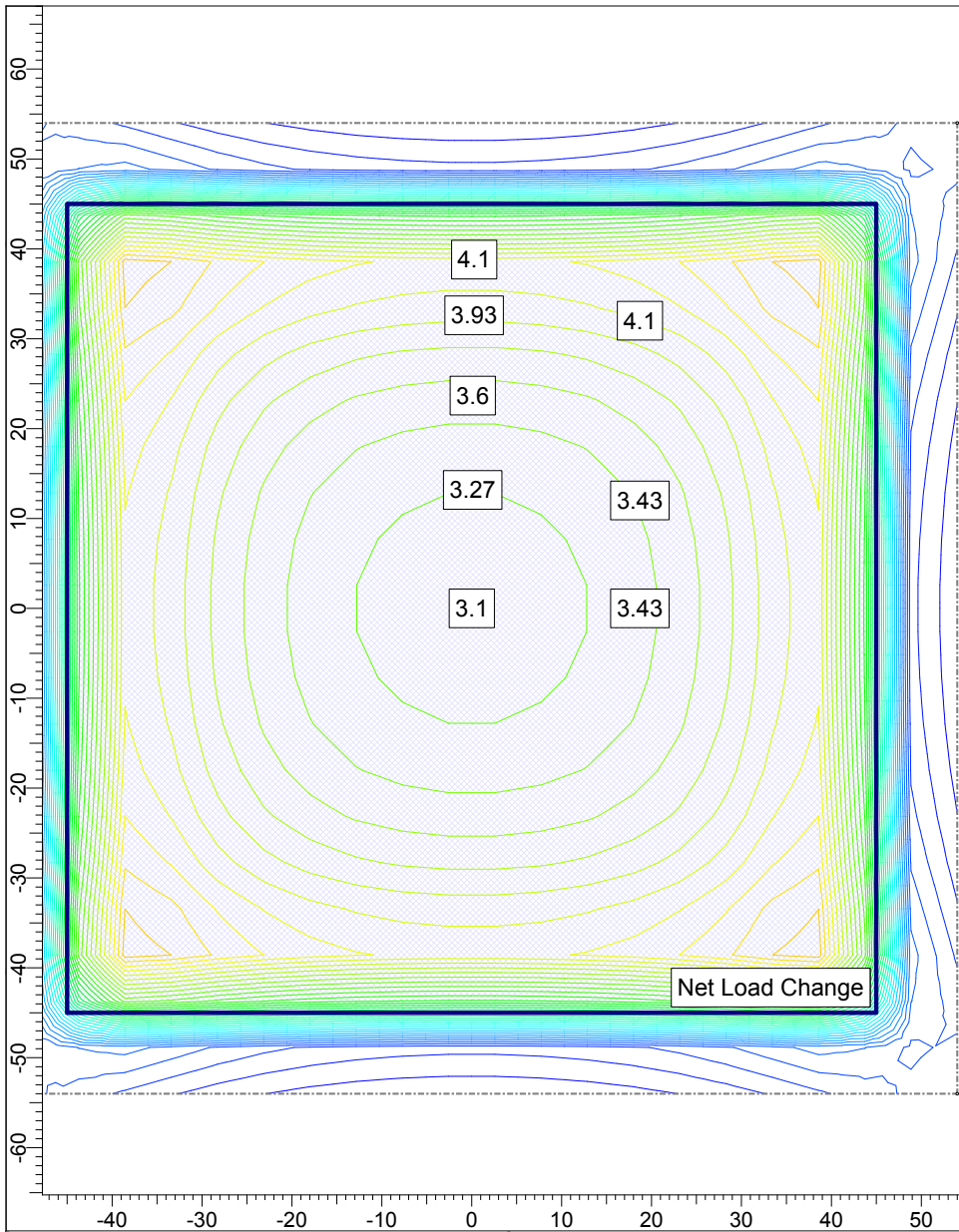
Note: Approximately 6" of settlement observed to date due to normal-weight fill "preloading". Long term settlement of embankment reconstructed with geofoam will be negligible.

Material Name	Color	Sat. Unit Weight (kips/ft3)	Es (ksf)	Poisson Ratio	Cc	Cr	Pc (ksf)	OCR	e0	Cv (ft2/d)
Sand/Gravel		0.125	425	0.325	-	-	-	-	-	-
Peat		0.065	5	0.45	1.042	0.312	-	1	7.5	0.11
Clay		0.115	-	0.45	0.189	0.033	1.8	-	0.92	0.22
Silt/Sand		0.12	350	0.325	-	-	-	-	-	-
Till		0.135	4400	0.35	-	-	-	-	-	-



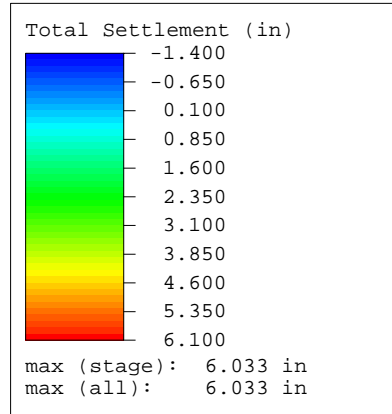
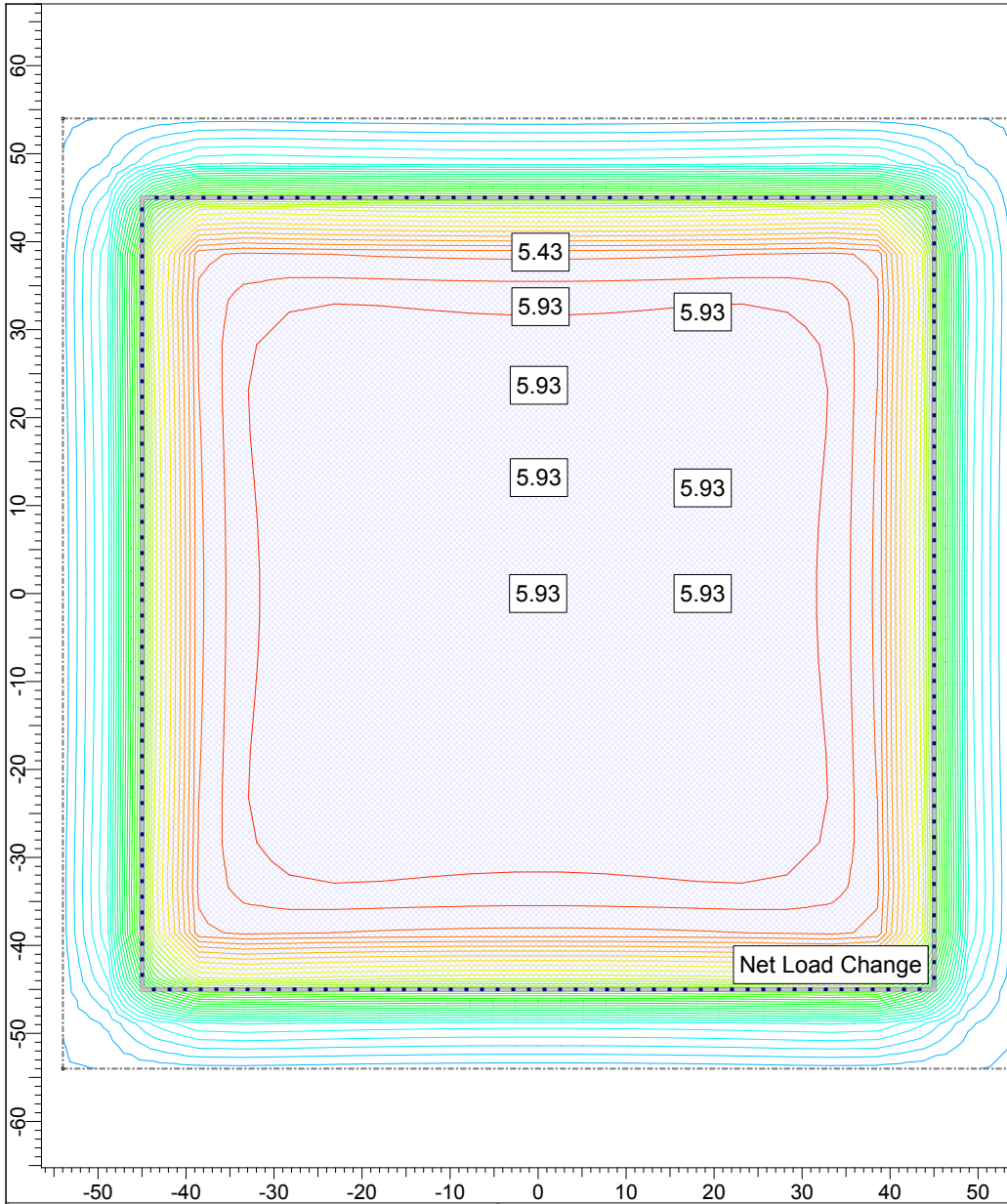
SETTLE3D 4.014

Project		Second Otter Bridge #2754 - Abutment No. 2	
Analysis Description		Settlement Evaluation - Stage III - Settlement after 10 years of Mitigated Embankment with 8ft of Geofoam	
Drawn By	Michael St. Pierre, P.E.	Company	S. W. Cole Engineering, Inc.
Date	1/25/2018, 11:02:16 AM	File Name	Abutment 2 Geofoam_staged.s3z



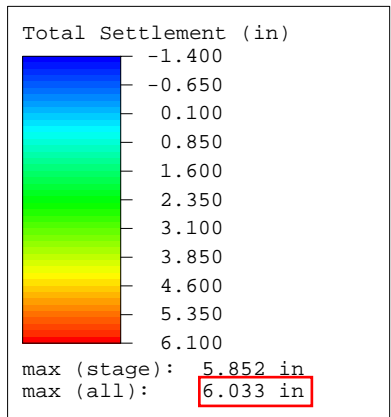
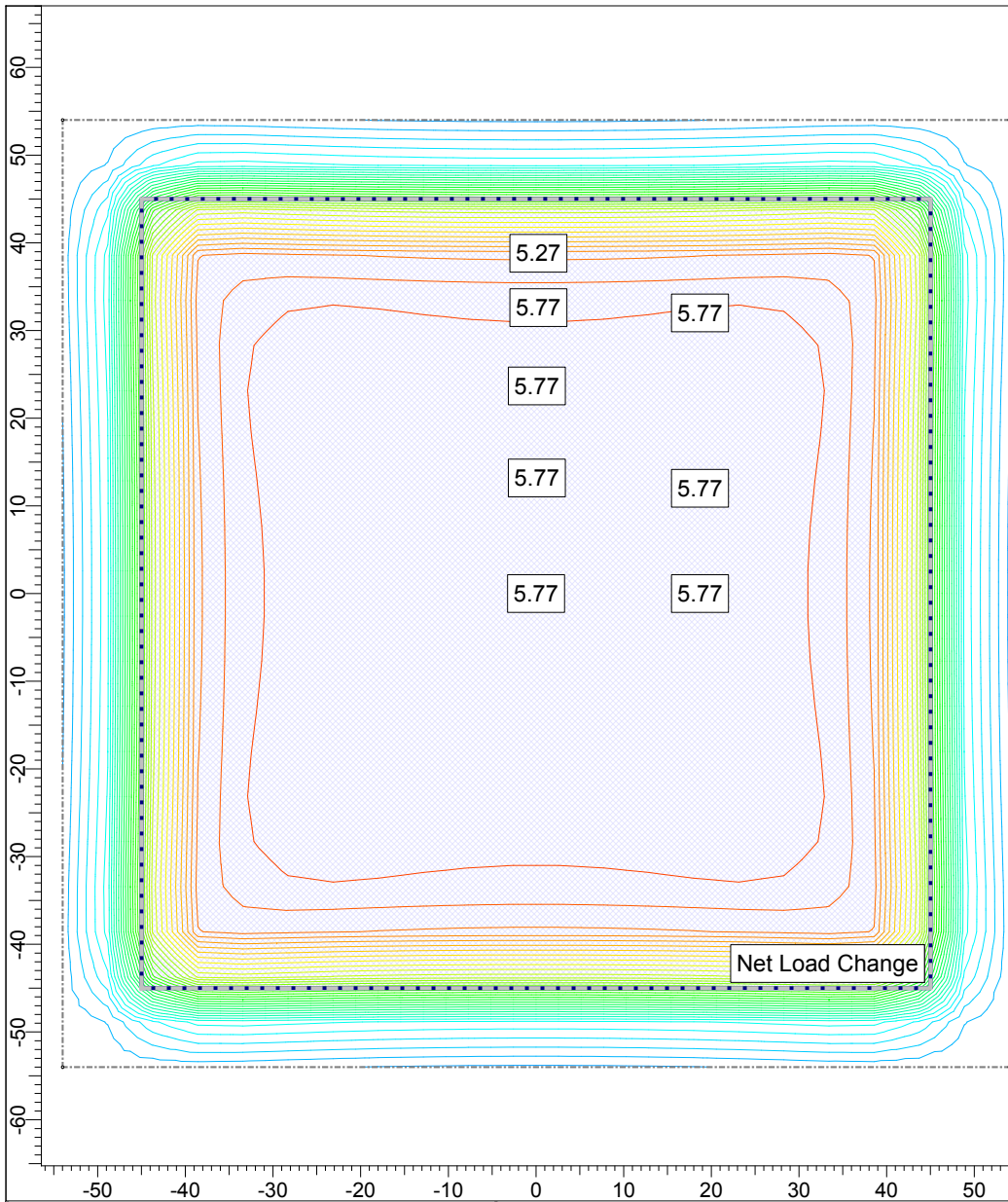
Material Name	Color	Sat. Unit Weight (kips/ft ³)	Es (ksf)	Poisson Ratio	Cc	Cr	Pc (ksf)	OCR	e0	Cv (ft ² /d)
Sand/Gravel		0.125	425	0.325	-	-	-	-	-	-
Peat		0.065	5	0.45	1.042	0.312	-	1	7.5	0.11
Clay		0.115	-	0.45	0.189	0.033	1.8	-	0.92	0.22
Silt/Sand		0.12	350	0.325	-	-	-	-	-	-
Till		0.135	4400	0.35	-	-	-	-	-	-

	Project		Second Otter Bridge #2754 - Abutment No. 2	
	Analysis Description		Settlement Evaluation - Stage I - Placement of Normal-Weight Fill Embankment	
	Drawn By	Michael St. Pierre, P.E.	Company	S. W. Cole Engineering, Inc.
	Date	1/25/2018, 11:02:16 AM	File Name	Abutment 2 LFCF_staged.s3z



Material Name	Color	Sat. Unit Weight (kips/ft ³)	Es (ksf)	Poisson Ratio	Cc	Cr	Pc (ksf)	OCR	e0	Cv (ft ² /d)
Sand/Gravel		0.125	425	0.325	-	-	-	-	-	-
Peat		0.065	5	0.45	1.042	0.312	-	1	7.5	0.11
Clay		0.115	-	0.45	0.189	0.033	1.8	-	0.92	0.22
Silt/Sand		0.12	350	0.325	-	-	-	-	-	-
Till		0.135	4400	0.35	-	-	-	-	-	-

	Project		Second Otter Bridge #2754 - Abutment No. 2	
	Analysis Description		Settlement Evaluation - Stage II - Settlement after 5 years (2018) due to Normal-Weight Fill Embankment	
	Drawn By	Michael St. Pierre, P.E.	Company	S. W. Cole Engineering, Inc.
	Date	1/25/2018, 11:02:16 AM	File Name	Abutment 2 LFCF_staged.s3z



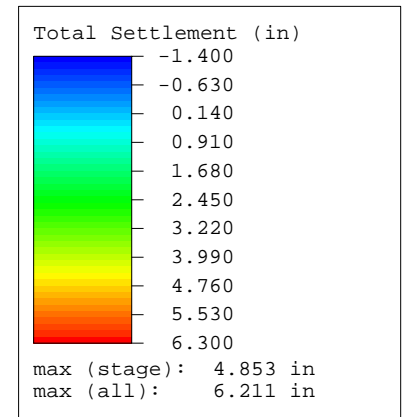
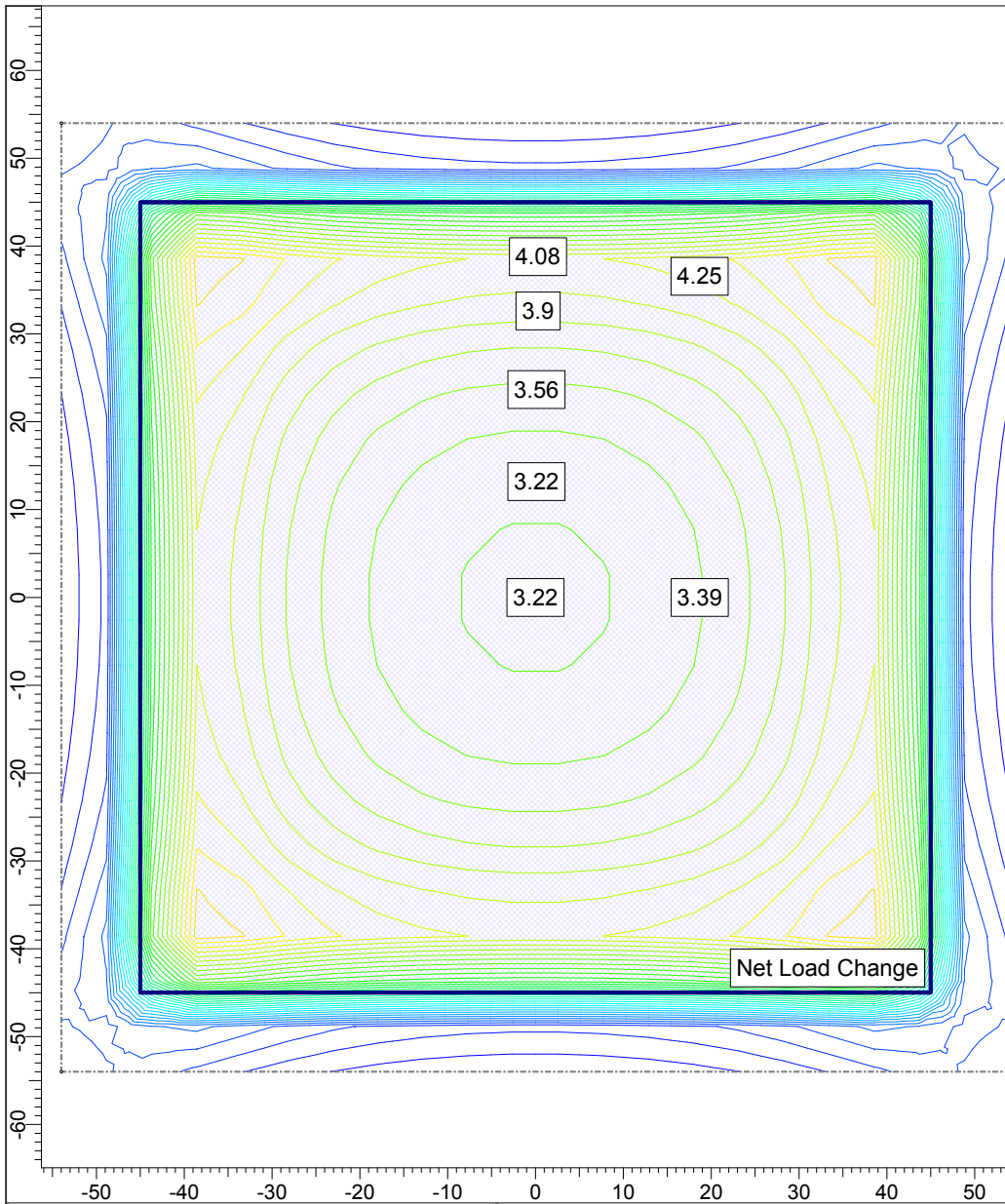
Note: Approximately 6" of settlement observed to date due to normal-weight fill "preloading". Long term settlement of embankment reconstructed with LFCF will be negligible.

Material Name	Color	Sat. Unit Weight (kips/ft ³)	Es (ksf)	Poisson Ratio	Cc	Cr	Pc (ksf)	OCR	e ₀	C _v (ft ² /d)
Sand/Gravel		0.125	425	0.325	-	-	-	-	-	-
Peat		0.065	5	0.45	1.042	0.312	-	1	7.5	0.11
Clay		0.115	-	0.45	0.189	0.033	1.8	-	0.92	0.22
Silt/Sand		0.12	350	0.325	-	-	-	-	-	-
Till		0.135	4400	0.35	-	-	-	-	-	-



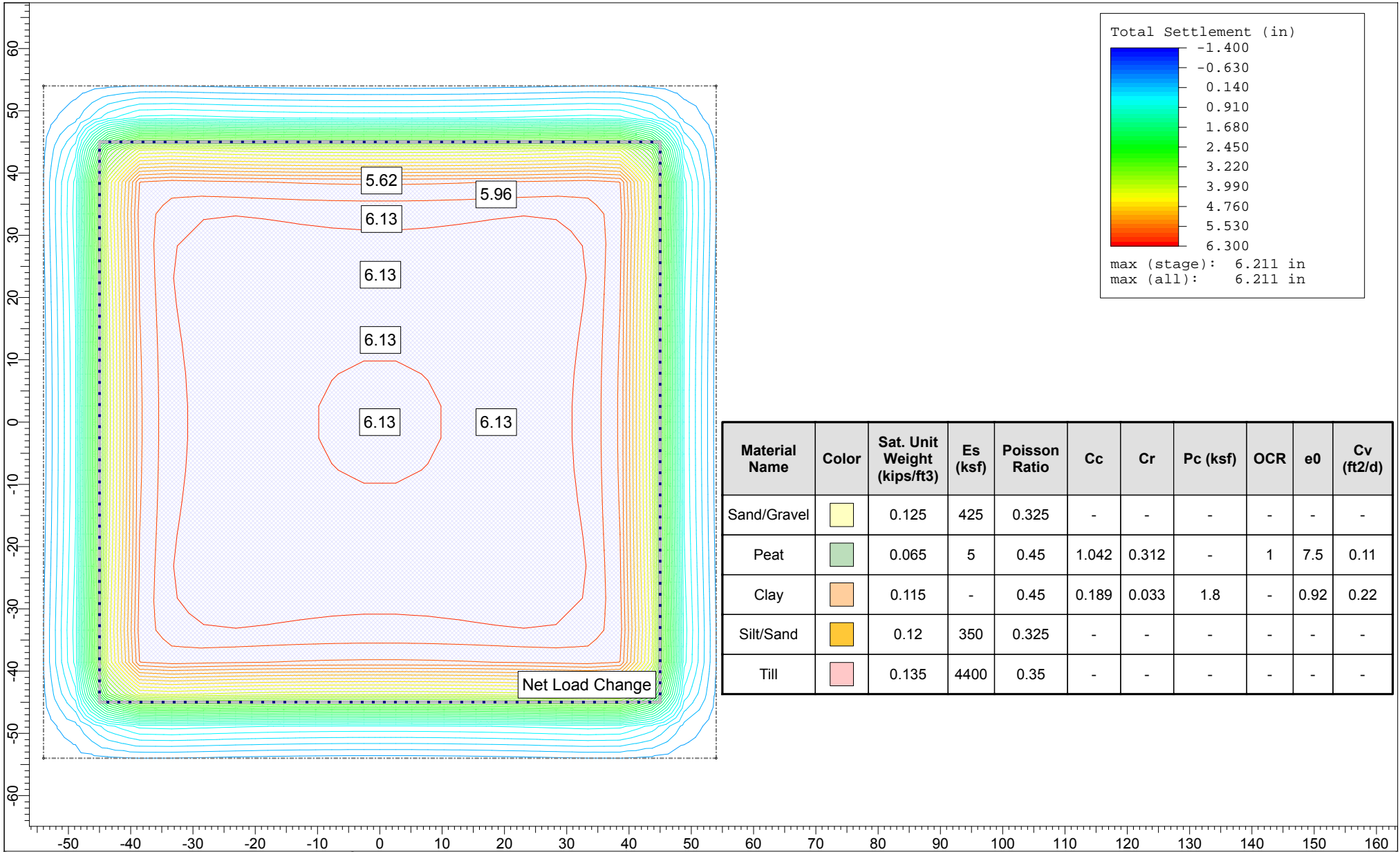
SETTLE3D 4.014

Project	Second Otter Bridge #2754 - Abutment No. 2		
Analysis Description	Settlement Evaluation - Stage III - Settlement after 10 years of Mitigated Embankment with 10ft of LFCF		
Drawn By	Michael St. Pierre, P.E.	Company	S. W. Cole Engineering, Inc.
Date	1/25/2018, 11:02:16 AM	File Name	Abutment 2 LFCF_staged.s3z



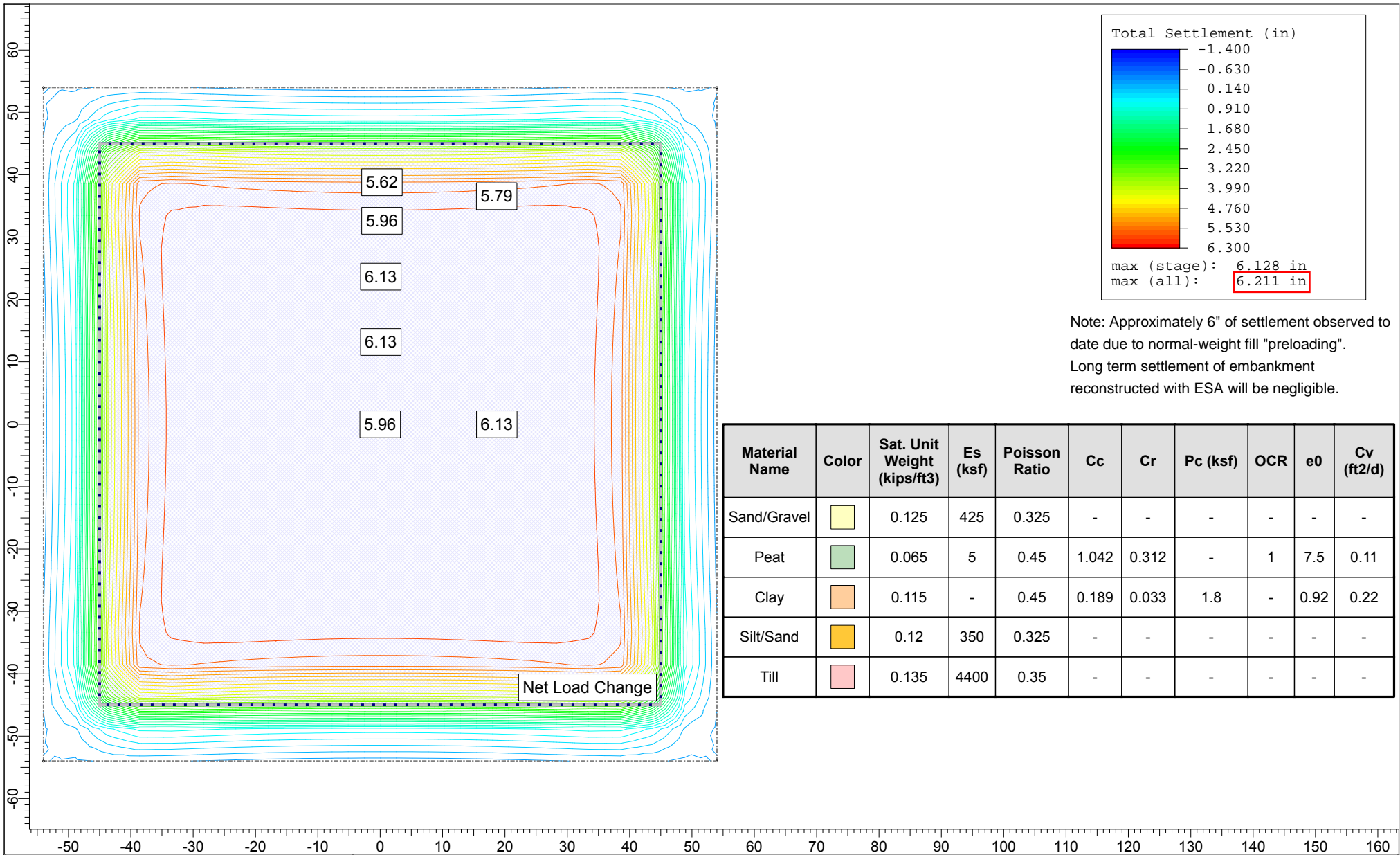
Material Name	Color	Sat. Unit Weight (kips/ft ³)	Es (ksf)	Poisson Ratio	Cc	Cr	Pc (ksf)	OCR	e0	Cv (ft ² /d)
Sand/Gravel		0.125	425	0.325	-	-	-	-	-	-
Peat		0.065	5	0.45	1.042	0.312	-	1	7.5	0.11
Clay		0.115	-	0.45	0.189	0.033	1.8	-	0.92	0.22
Silt/Sand		0.12	350	0.325	-	-	-	-	-	-
Till		0.135	4400	0.35	-	-	-	-	-	-

	Project		Second Otter Bridge #2754 - Abutment No. 2	
	Analysis Description		Settlement Evaluation - Stage I - Placement of Normal-Weight Fill Embankment	
	Drawn By	Michael St. Pierre, P.E.	Company	S. W. Cole Engineering, Inc.
	Date	1/25/2018, 11:02:16 AM	File Name	Abutment 2 ESA_staged.s3z








Material Name	Color	Sat. Unit Weight (kips/ft ³)	Es (ksf)	Poisson Ratio	Cc	Cr	Pc (ksf)	OCR	e0	Cv (ft ² /d)
Sand/Gravel		0.125	425	0.325	-	-	-	-	-	-
Peat		0.065	5	0.45	1.042	0.312	-	1	7.5	0.11
Clay		0.115	-	0.45	0.189	0.033	1.8	-	0.92	0.22
Silt/Sand		0.12	350	0.325	-	-	-	-	-	-
Till		0.135	4400	0.35	-	-	-	-	-	-

	Project		Second Otter Bridge #2754 - Abutment No. 2	
	Analysis Description		Settlement Evaluation - Stage II - Settlement after 5 years (2018) due to Normal-Weight Fill Embankment	
	Drawn By	Michael St. Pierre, P.E.	Company	S. W. Cole Engineering, Inc.
	Date	1/25/2018, 11:02:16 AM	File Name	Abutment 2 ESA_staged.s3z



Note: Approximately 6" of settlement observed to date due to normal-weight fill "preloading". Long term settlement of embankment reconstructed with ESA will be negligible.

Material Name	Color	Sat. Unit Weight (kips/ft ³)	Es (ksf)	Poisson Ratio	Cc	Cr	Pc (ksf)	OCR	e0	Cv (ft ² /d)
Sand/Gravel		0.125	425	0.325	-	-	-	-	-	-
Peat		0.065	5	0.45	1.042	0.312	-	1	7.5	0.11
Clay		0.115	-	0.45	0.189	0.033	1.8	-	0.92	0.22
Silt/Sand		0.12	350	0.325	-	-	-	-	-	-
Till		0.135	4400	0.35	-	-	-	-	-	-



SETTLE3D 4.014

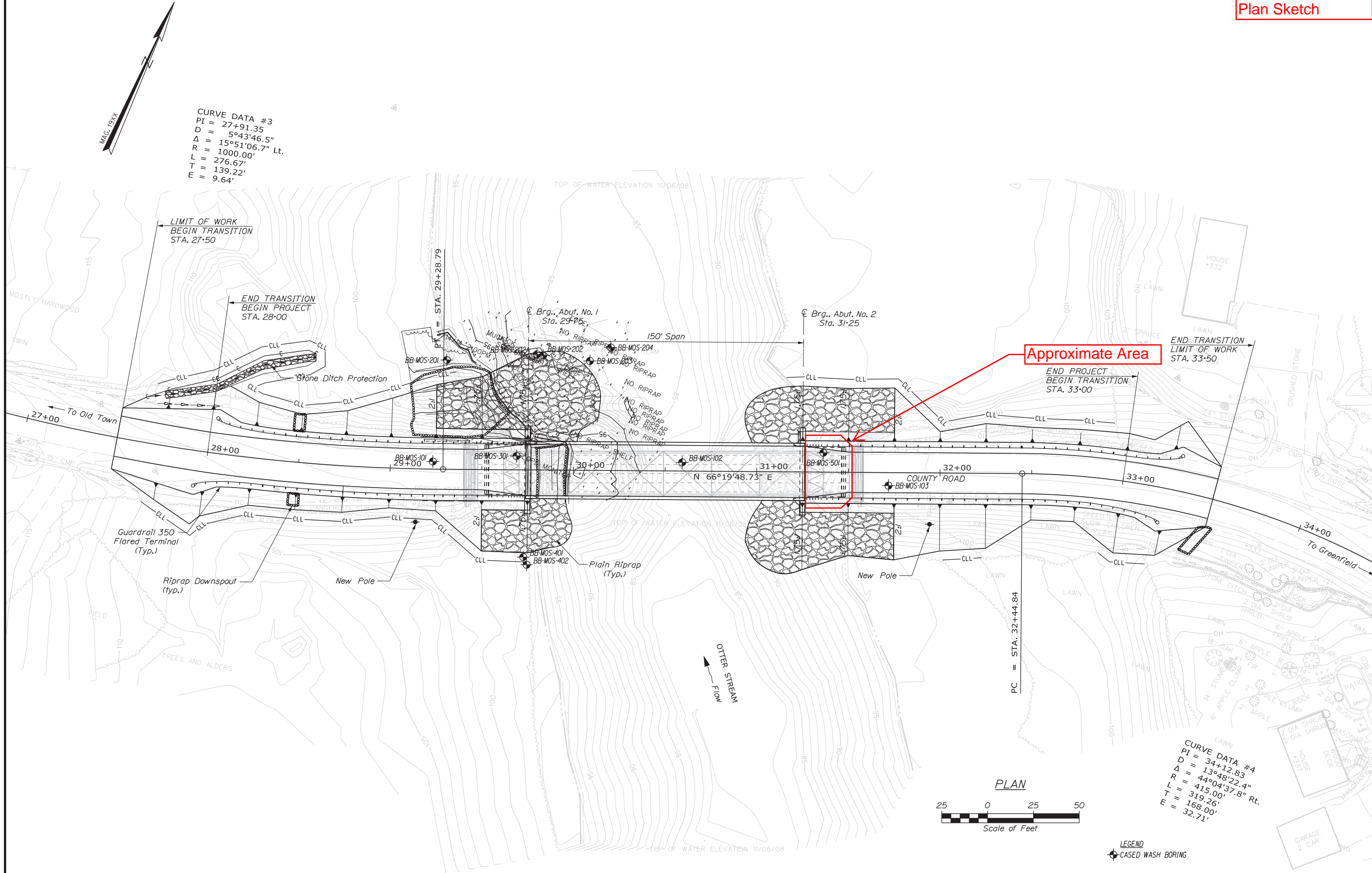
Project	Second Otter Bridge #2754 - Abutment No. 2		
Analysis Description	Settlement Evaluation - Stage III - Settlement after 10 years of Mitigated Embankment with 10ft of ESA		
Drawn By	Michael St. Pierre, P.E.	Company	S. W. Cole Engineering, Inc.
Date	1/25/2018, 11:02:16 AM	File Name	Abutment 2 ESA_staged.s3z

APPENDIX C

Conceptual Sketches

Filename: ... \00\GEOTECH\MSTAN005_BLP1.dgn Division: GEOTECH Username: Laura.Krusinski Date: 1/12/2018

Geofoam Option
Plan Sketch



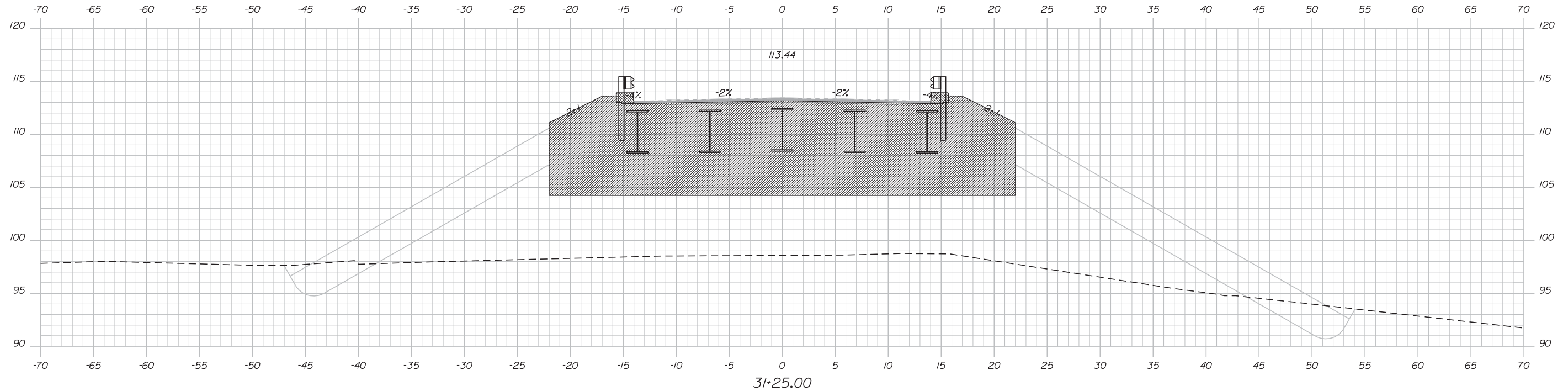
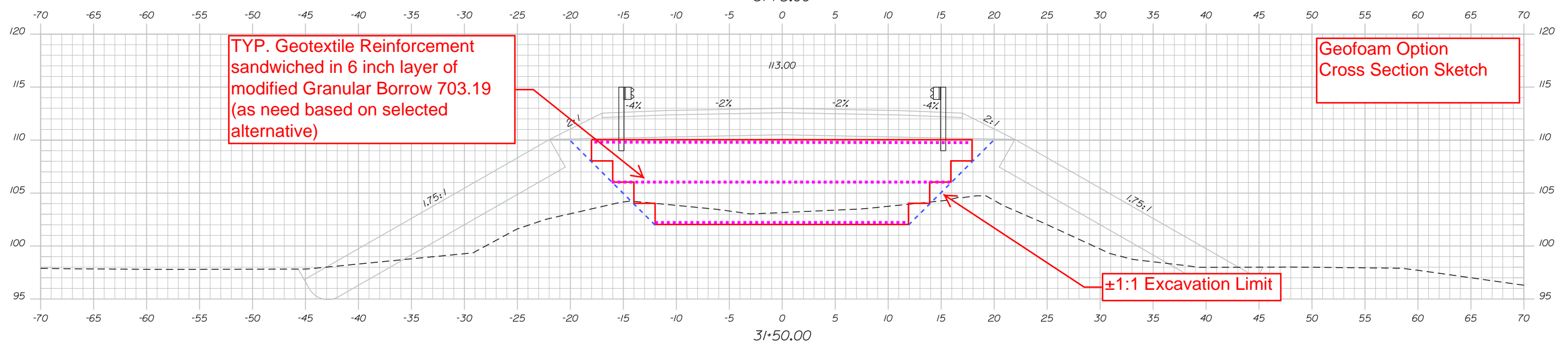
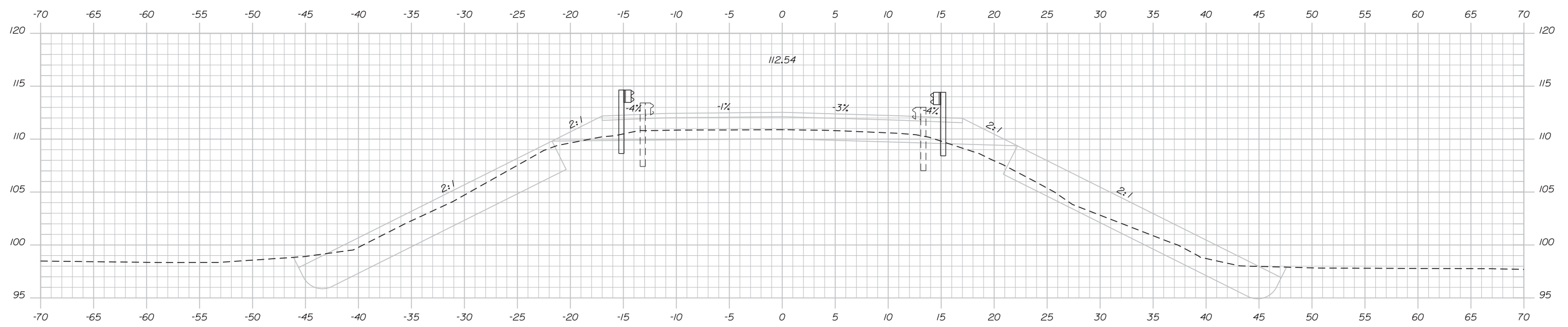
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PROJECT NAME SECOND OTTER BRIDGE OTTER STREAM PENOBSCOT COUNTY		SHEET NUMBER 2		BRIDGE NO. 2754	
DATE JAN 2018		SIGNATURE L. KRUSINSKI		P.E. NUMBER	
BY S. BOODE		DATE		DATE	
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CHECKED-REVIEWED		REVISIONS 1		REVISIONS 2	
DESIGNS-DETAILED		REVISIONS 3		REVISIONS 4	
FIELD CHANGES		FIELD CHANGES		FIELD CHANGES	
MILFORD		BORING LOCATION PLAN		SHEET NUMBER	
		2		OF 5	

Date: 1/12/2018

Username: Laura.Krusinski

Division: GEOTECH

Filename: ... \024_z_xsect_31+25_005.dgn



TYP. Geotextile Reinforcement sandwiched in 6 inch layer of modified Granular Borrow 703.19 (as need based on selected alternative)

Geofoam Option Cross Section Sketch

±1:1 Excavation Limit

STATE OF MAINE
DEPARTMENT OF TRANSPORTATION
BR-1666(700)X
BRIDGE NO. 2754
PIN 16667.00
BRIDGE PLANS

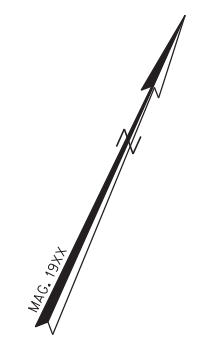
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FIELD CHANGES				

SECOND OTTER BRIDGE
OTTER STREAM
PENOBSCOT COUNTY
MILFORD
CROSS SECTIONS

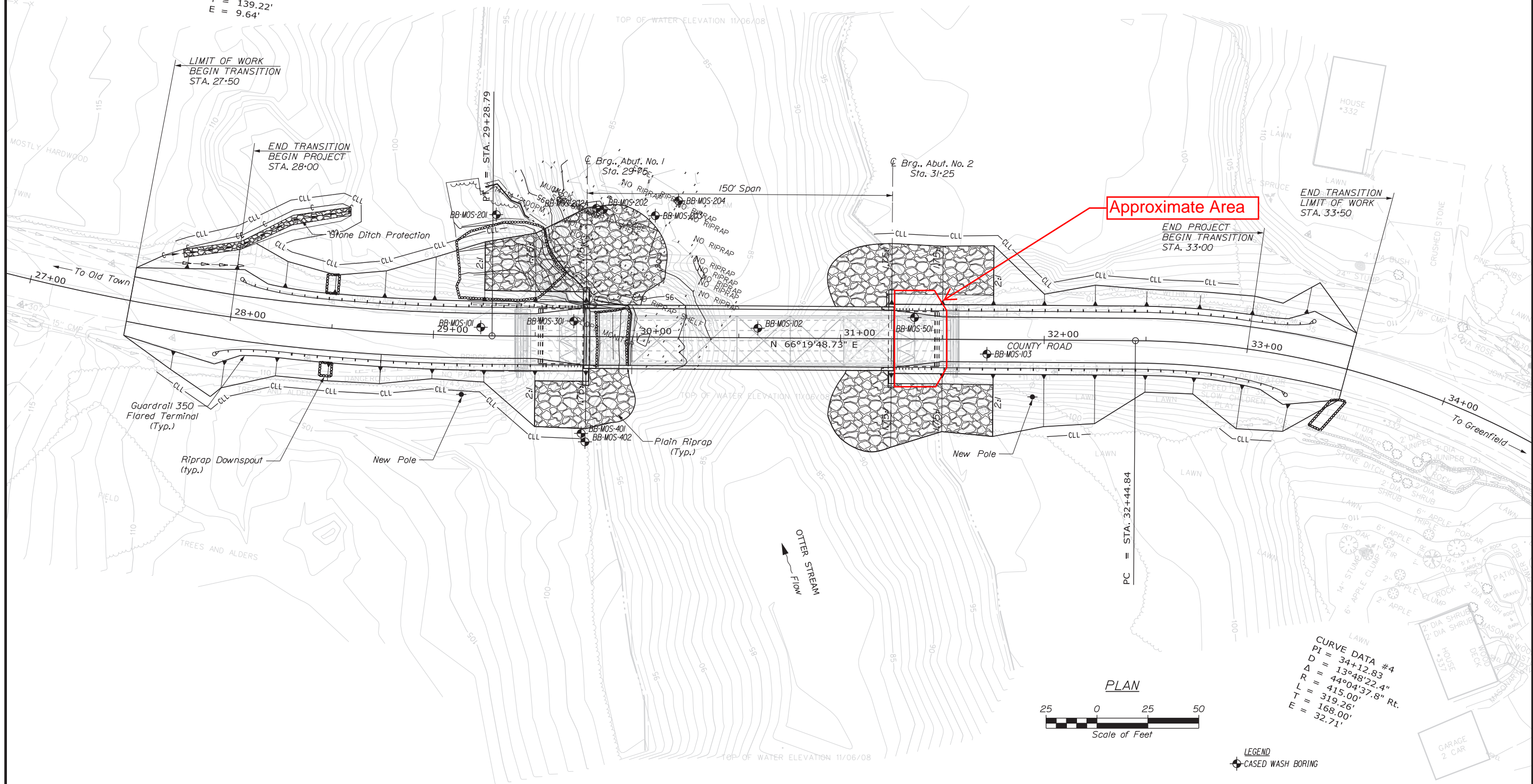
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24
OF 6

Filename: ... \00\GEOTECH\MSTA005_BLP1.dgn Division: GEOTECH Username: Laura.Krusinski Date: 1/12/2018

Lightweight Foam Concrete Fill Option
Plan Sketch



CURVE DATA #3
 PI = 27+91.35
 D = 5°43'46.5"
 Δ = 15°51'06.7" Lt.
 R = 1000.00'
 L = 276.67'
 T = 139.22'
 E = 9.64'



LIMIT OF WORK
 BEGIN TRANSITION
 STA. 27-50

END TRANSITION
 BEGIN PROJECT
 STA. 28-00

Approximate Area

END TRANSITION
 LIMIT OF WORK
 STA. 33-50

END PROJECT
 BEGIN TRANSITION
 STA. 33-00

Guardrail 350
 Flared Terminal
 (Typ.)

Riprap Downspout
 (typ.)

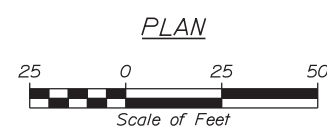
New Pole

Plain Riprap
 (Typ.)

New Pole

PC = STA. 32+44.84

OTTER STREAM
 FLOW



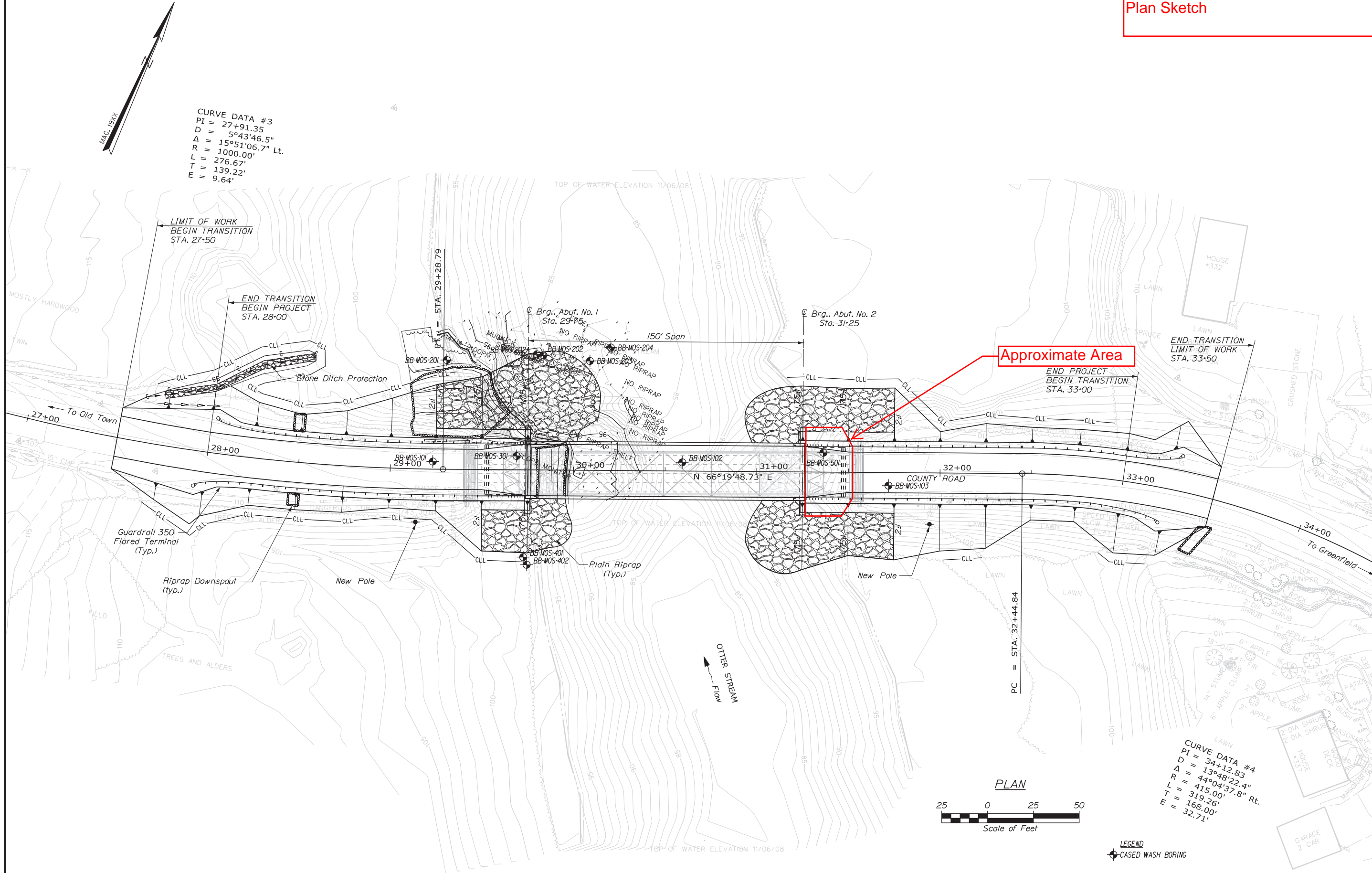
LEGEND
 CASED WASH BORING

CURVE DATA #4
 PI = 34+12.83
 D = 13°48'22.4"
 Δ = 44°04'37.8" Rt.
 R = 415.00'
 L = 319.26'
 T = 168.00'
 E = 32.71'

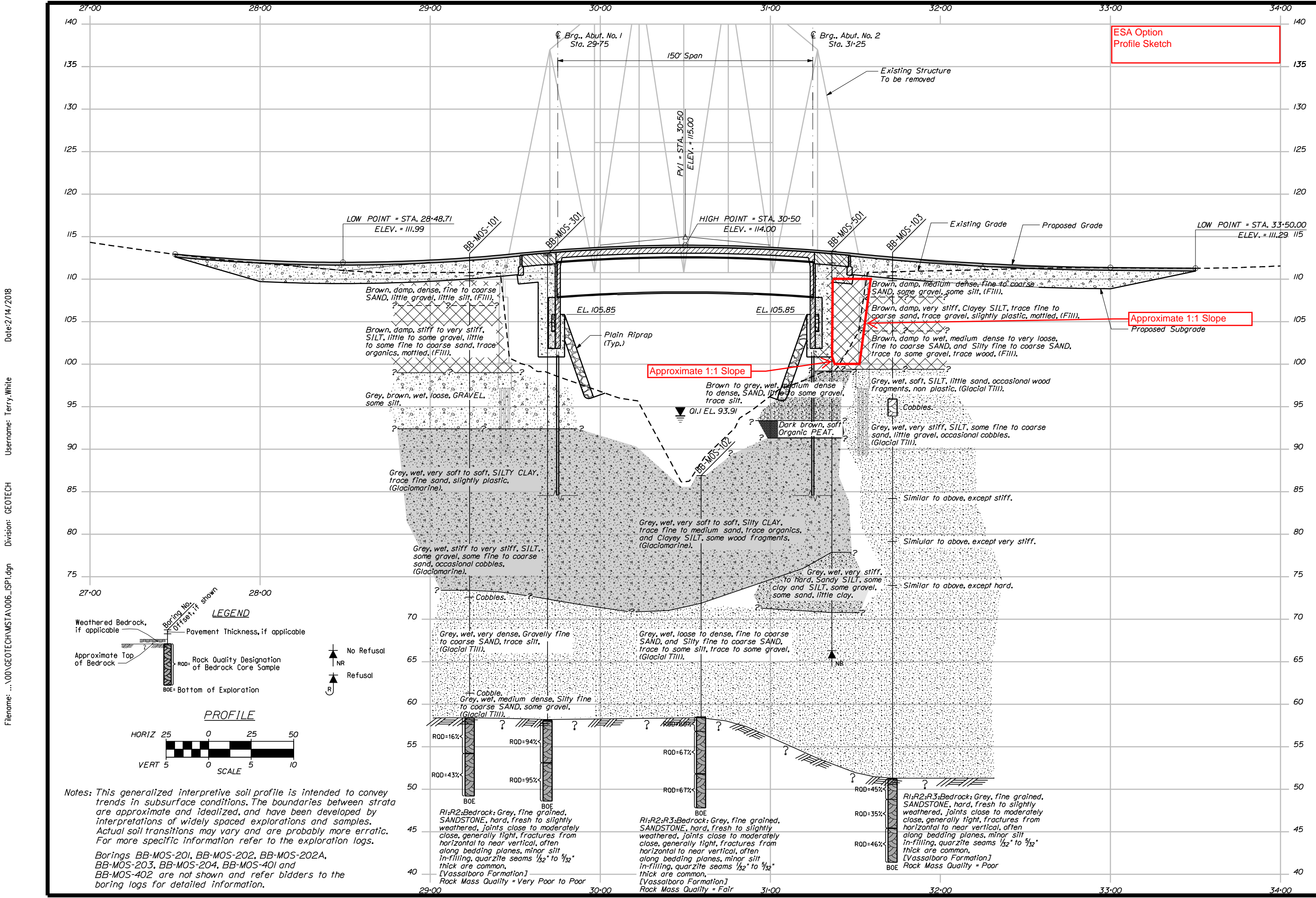
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BORING LOCATION PLAN		SHEET NUMBER	
DATE JAN 2018		SIGNATURE	
BY L. KRUSINSKI		P.E. NUMBER	
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CHECKED-REVIEWED		FIELD CHANGES	
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Expanded Shale Aggregate Option
Plan Sketch



STATE OF MAINE DEPARTMENT OF TRANSPORTATION		PROJECT NO. 2346600		WIN 023466.00	
MILFORD		PENOBSCOT COUNTY		BORING LOCATION PLAN	
SECOND OTTER BRIDGE		OTTER STREAM		SHEET NUMBER	
DATE: JAN 2018		SIGNATURE: T. WHITE		P.E. NUMBER	
BY: L. KRUSINSKI		DATE: JAN 2018		DATE	
DESIGN-DETAILED		CHECKED-REVIEWED		DESIGNS-DETAILED	
DESIGNS-DETAILED		DESIGNS-DETAILED		DESIGNS-DETAILED	
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MILFORD		PENOBSCOT COUNTY		BORING LOCATION PLAN	
SHEET NUMBER		2		OF 5	



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 Username: Terry.White
 Date: 2/14/2018

STATE OF MAINE		DEPARTMENT OF TRANSPORTATION	
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BRIDGE NO. 2754		BRIDGE PLANS	
MILFORD		PENOBSCOT COUNTY	
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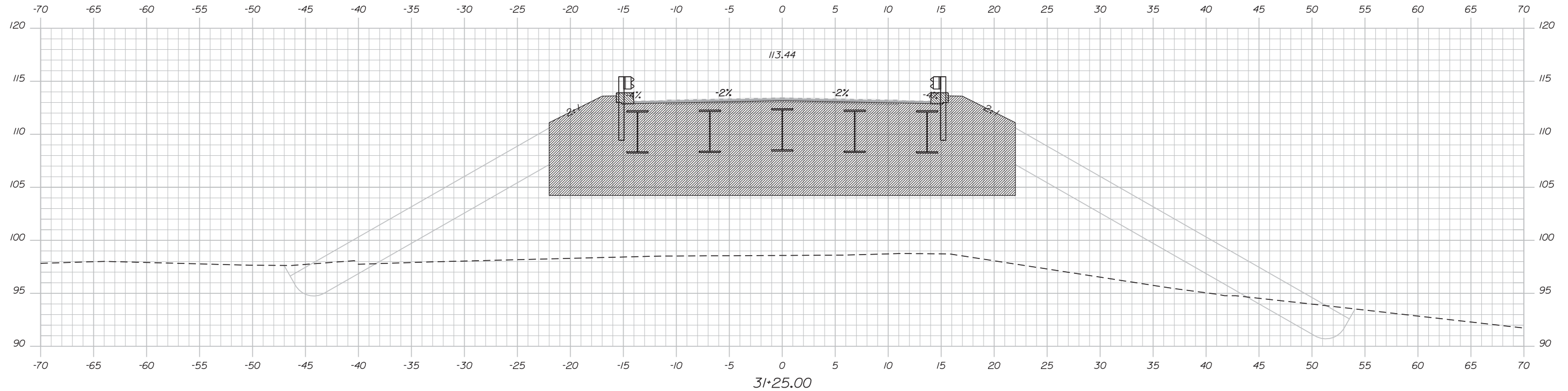
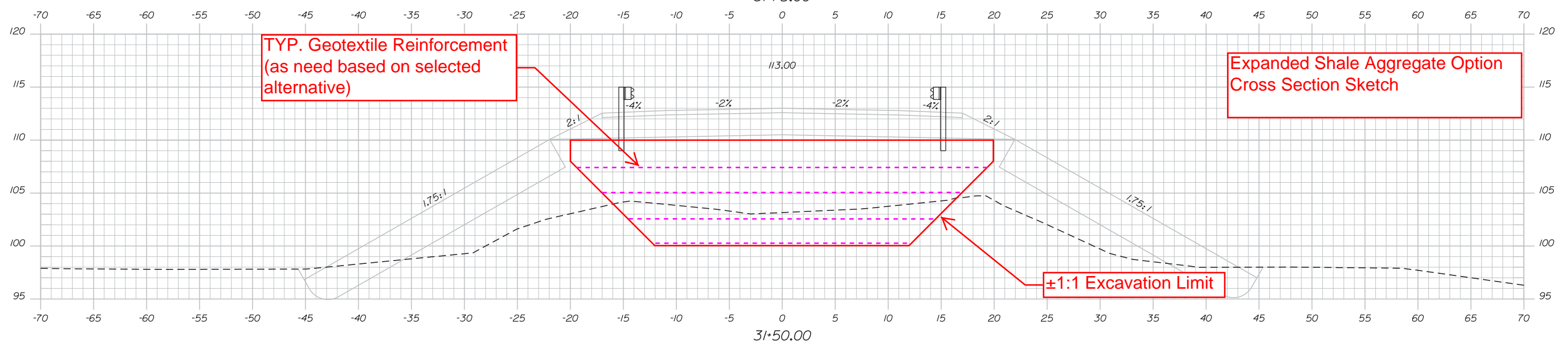
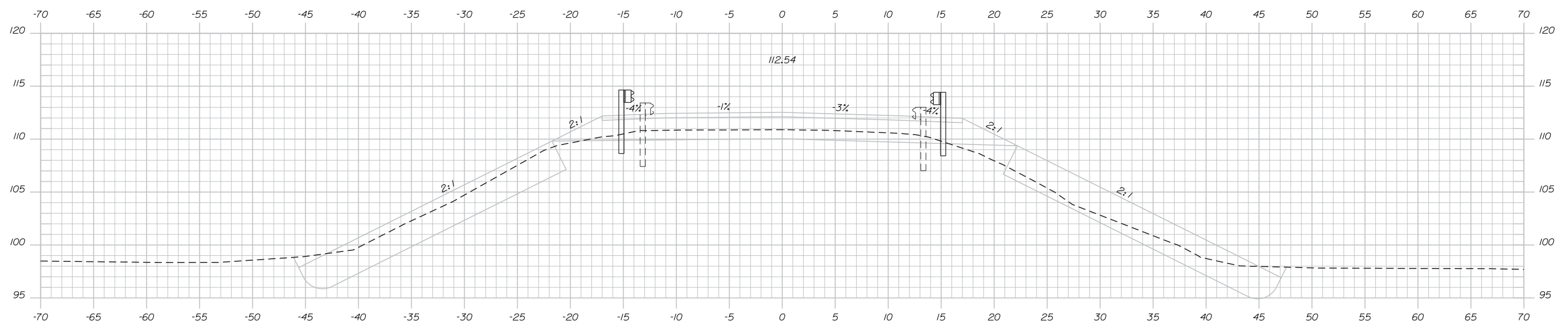
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FIELD CHANGES			

Date: 1/12/2018

Username: Laura.Krusinski

Division: GEOTECH

Filename: ... \024_z_xsect_31+25_005.dgn



STATE OF MAINE
DEPARTMENT OF TRANSPORTATION
BR-1666(700)X
BRIDGE NO. 2754
PIN 16667.00
BRIDGE PLANS

PROJ. MANAGER	S. BODGE	DATE	AUG 2011
CHECKED-REVIEWED	B. REEVES	D.E.S.	
DESIGNS-DETAILED		M.R.P.	
REVISIONS 1			
REVISIONS 2			
REVISIONS 3			
REVISIONS 4			
FIELD CHANGES			

DESIGN-REVIEWED	SIGNATURE
DESIGNS-DETAILED	P.E. NUMBER
REVISIONS 1	DATE
REVISIONS 2	
REVISIONS 3	
REVISIONS 4	
FIELD CHANGES	

SECOND OTTER BRIDGE
OTTER STREAM
PENOBSCOT COUNTY
MILFORD
CROSS SECTIONS

SHEET NUMBER
24
OF 6