CUMMINGS ROAD OVER THE MAINE TURNPIKE

Scarborough, Maine
Contract ID: 2018.19

Geotechnical Design Report

SEPTEMBER 21, 2018

PREPARED FOR

The Maine Turnpike
2360 Congress Street
Portland, ME 04102

PREPARED BY

HNTB Corporation
9 Entin Road, Suite 202
Parsippany, NJ 07054
Phone: (973) 434-3100

GEOTECHNICAL DESIGN REPORT
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SCARBOROUGH, MAINE

Geotechnical Design Report
September 21, 2018

STATE OF MAINE
MATTHEW D. RIEGEL
13843
LICENSED
PROFESSIONAL ENGINEER

9/21/18

Matthew D. Riegel, PE

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1.0 PROJECT DESCRIPTION AND SCOPE

1.1 Introduction

The following represents the results of the geotechnical assessment prepared by HNTB for the replacement of the existing Cummings Road Bridge structure over the Maine Turnpike in Scarborough, Maine and the associated approach embankment widening (**Figure 1** Project Site Location Map). The existing approach embankments and four-span structure carry Cummings Road with two travel lanes and two shoulder lanes between Exit 44 and Exit 45. This geotechnical assessment was prepared to develop the design recommendations for support of the proposed bridge structure and embankments.

1.2 Scope of Services

In completing this study, HNTB has performed the following scope of services:

- Reviewed available geotechnical data for the project site.
- Implemented a two-stage phased subsurface investigation including a geotechnical boring and laboratory testing program.
- Analyzed the resulting data collected to identify subsurface conditions that impact the design and construction of the project.
- Prepared a geologic subsurface profile summarizing geotechnical data from the borings and laboratory testing.
- Established geotechnical engineering design parameters based on the available borings.
- Conducted geotechnical analyses and provided recommendations and design parameters for the support of the proposed bridge and approach embankments.

1.3 Existing Structure and Proposed Improvements

The project begins on Cummings Road approximately 715 feet south of the Maine Turnpike Centerline, at Station 62+86, and ends on Cummings Road approximately 900 feet north of the Maine Turnpike Centerline, at Station 79+04. This section of the Maine Turnpike is aligned southwest to northeast, while Cummings Road is aligned south to north. The Cummings Road Underpass is considered to be functionally obsolete due to substandard under clearance and horizontal width.

Cummings Road is a two-lane roadway with 11-foot lanes and gravel shoulders that vary from 1.5 to 6 feet. The existing bridge is a two-lane, four-span continuous bridge with an overall length of 280 feet and an out-to-out deck width of 28.67 feet which will be removed in its entirety and replaced. The roadway will be widened and reconstructed west of the existing roadway and the bridge will be raised and widened to accommodate the new lane configuration and bridge span arrangement. The proposed roadway centerline will be constructed approximately 24.5 feet west of the existing roadway centerline. The approach roadway will be widened to accommodate four, 11 feet lanes and two, 5 feet shoulders for an overall width of 54 feet between guardrail faces. The profile of Cummings Road will be raised a maximum of approximately 3.5 feet to provide a 16.5-foot minimum vertical clearance over the Maine Turnpike.

The existing substructure units are constructed from reinforced concrete founded on steel H-piles driven to bedrock. The abutments are stub type abutments, while the piers consist of wall piers with cantilevered pier caps. Abutments will be completely replaced with cast-in-place concrete stub abutments founded on H-piles driven to bedrock. Proposed abutments will be located behind the existing abutments. Corresponding wingwalls will be parallel to the roadway, will support the traffic railing, and will share a common pile cap with the abutment.

Two new concrete piers are proposed and will provide support to the structure: one located in the existing median and one located between a future southbound on-ramp and southbound mainline traffic. The proposed hammerhead piers will be founded on H-piles driven to bedrock.

1.4 Survey Control

The project vertical datum and elevations referenced are in feet and reference the North American Vertical Datum of 1988 (NAVD 88). Boring locations were field located with elevations estimated based on topographic survey data.

2.0 Geology And Site Conditions

2.1 Site Geology

The project is located within the Portland West 7.5-minute quadrangle in the coastal lowland of southwestern Maine. The region has been subjected to recent glaciation within the last 25,000 years (late Wisonsinan glaciation) resulting in a physiographic surficial geology primarily composed of unconsolidated sediments such as sand and gravel of glacial and nonglacial origin. The bedrock geology of the southwestern part of the physiographic region is underlain by metamorphic rock formations of the Casco Bay Group which are characteristically composed of fine grained, thinly laminated gneiss, schist, marble and quartzite with north-northeast trending upright folds.

Existing geologic mapping available for the project site include bedrock and surficial geology mapping prepared by the Maine Geological Survey (MGS) for Portland West Quadrangle, Maine.

MGS surficial geology mapping identifies soil overburden in the project area as marine regressive sand deposits. The marine regressive sand deposits are said to consist of sand, silt, and minor gravel deposited in shallow marine waters from the late-glacial regression of the sea; they also may include a variety of nearshore and fluvial sediments. They commonly occur as flat sandy areas and are likely to be underlain by marine clay-silt deposits. Test soil borings done along the Maine Turnpike suggest loose interbedded marine silts and sands underlain by soft sensitive marine silts and clays typical of the Presumpscot Formation. The soft silts and clays are particularly prone to problems associated with low strength, compressibility and stability issues. A surficial geology map and the bedrock geology map are presented in **Figures 2** and **3**, respectively.

3.0 SUBSURFACE EXPLORATIONS

3.1 General

A subsurface investigation was performed by Schonewald Engineering Associates, Inc. of Cumberland Maine, under the direction of HNTB, and included borings BB-CUM-101 through BB-CUM-106 and BB-CUM-201 to BB-CUM-205. The boring location plan depicting the location of the borings is presented in **Attachment 2**. The subsurface investigation borings were advanced using cased wash boring methods from a Mobile drill rig using 4.0 inch (HW-size) and 3.0 inch (NW-size) inside diameter steel casing. Standard Penetration Testing (SPT) was performed by driving a 1-3/8 inch ID split spoon sampler with a 140-lb hammer dropped 30 inches to obtain samples at approximately 5 foot intervals. Each sample was removed from the sampler in the field, examined, and classified in accordance with Maine DOT standards. The number of hammer blows required to advance the sampler through each six-inch interval using a safety hammer was recorded and is provided on each boring log. The uncorrected SPT N-value is defined as the total number of blows required to advance the sampler through the second and third six-inch interval of any given 24-inch sampling interval. All SPT N-values discussed in this report have been corrected to reflect the 60 percent hammer efficiency (N_{60}) unless noted otherwise.

In-situ vane shear testing was completed in accordance with the requirements outlined in ASTM D 2573 and are outlined below. In situ vane shear testing involves using a simple rotated blade of specified dimensions to evaluate undrained shear strengths (Su) and remolded shear strengths (Sr) in soft to stiff clays (FHWA-IF-02-034 GEC No. 5). The vane is advanced into the test soil and the blade is rotated at a maximum rate of six degrees per minute until failure of the soil occurs while the resulting torque measurement is recorded. This first test is used to approximate the peak undrained shear strength of the soil. Following the initial test, the remolded strength of the soil is measured after 10 rapid turns of the vane (FHWA-IF-02-034 GEC No. 5).

3.2 Geotechnical Subsurface Exploration

For preliminary design of the proposed bridge foundations and approach embankments, six soil borings were initially advanced between June 11th and June 28th of 2017. Six additional borings were advanced in support of final design between February 19th and February 26th. All borings were performed by New England Boring Contractors, with boring inspection carried out by HNTB's subconsultant, Schonewald Engineering Associates, Inc. A summary of the all borings performed with approximate locations and depths of exploration are included in **Table 3-1**.

Table 3-1: Summary of Subsurface Exploration

Boring No.	Station	Offset (feet)	Ground Elevation (feet)	Depth of Boring (feet)	Bottom of Exploration Elevation (feet)
BB-CUM-101	67+50	65.0 LT	64.5	62.0	2.5
BB-CUM-102	67+90	30.0 LT	66.0	66.9	-0.9
BB-CUM-103	68+55	20.0 RT	85.5	107.8	-22.3
BB-CUM-104	72+95	90.0 LT	65.0	92.0	-27.0
BB-CUM-105	72+10	47.0 LT	67.0	103.2	-36.2
BB-CUM-106	72+00	20.0 RT	86.5	138.9	-52.4
BB-CUM-201	66+25	31.0 LT	65.5	52.0	13.5
BB-CUM-201A	66+37	37.0 LT	65.5	47.0	18.5
BB-CUM-202	70+00	1.0 LT	68.5	86.7	-18.2
BB-CUM-203	70+96	5.0 LT	65.0	98.5	-33.5
BB-CUM-204	74+15	33.0 LT	66.5	90.0	-23.5
BB-CUM-205	76+00	35.0 LT	65.5	100.0	-34.5

In-situ vane shear testing was completed in accordance with the requirements outlined in ASTM D 2573 and the results of the tests performed during the investigation are reported in **Attachment 3**.

Bedrock was encountered and sampled in borings BB-CUM-103, BB-CUM-106, BB-CUM-202 and BB-CUM-203. Rock was cored using a 2.0-inch inner diameter NQ-2 size core barrel. Approximately 12 feet of bedrock was cored in borings BB-CUM-103 and BB-CUM-106. Approximately 5 feet of bedrock was cored in borings BB-CUM-202 and BB-CUM-203. The recovery and rock quality designation (RQD) of each core was calculated and is included on the borings logs. The final boring logs and boring location plan are included in **Attachment 1** and **Attachment 2** respectively. **Table 3-2** presents the recovery and RQD of the rock samples obtained during the investigation.

Table 3-2: Summary of Subsurface Exploration Rock REC and RQD

Boring No.	Rock Core	Depth (feet)	REC (%)	RQD (%)
BB-CUM-103	R1	97.2 – 99.1	78	0
BB-CUM-103	R2	99.1 – 100.6	67	0
BB-CUM-103	R3	100.6 – 102.6	92	17
BB-CUM-103	R4	102.6 – 105.0	100	38
BB-CUM-103	R5	105.0 – 105.3	100	0
BB-CUM-103	R6	105.3 – 107.1	100	41
BB-CUM-103	R7	107.1 – 107.8	100	0
BB-CUM-106	R1	125.0 – 127.6	100	0
BB-CUM-106	R2	127.6 – 130.3	78	0
BB-CUM-106	R3	130.3 – 132.4	88	20
BB-CUM-106	R4	132.4 – 135.0	58	0
BB-CUM-106	R5	135.0 – 138.9	55	15
BB-CUM-202	R1	81.7 - 86.7	100	73
BB-CUM-203	R1	93.5 - 98.5	95	60

4.0 LABORATORY TEST RESULTS

Upon completion of the subsurface investigation program, a laboratory testing program was performed to verify the visual-manual field classifications and to aid in determination of the engineering soil properties. Soil laboratory testing was performed by R.W Gillespie & Associates, Inc. of Saco Maine. Rock laboratory testing was performed by Thielsch Engineering of Cranston, Rhode Island.

Laboratory soil testing consisted of six standard grain size analyses with natural water content, 25 Atterberg limit tests and 12 one dimensional consolidation tests. Laboratory rock testing consisted of three unconfined compression tests.

Corrosion testing was performed by GeoTesting Express of Acton, Maine. Corrosion testing was performed in accordance with AASHTO standards to determine the pH, sulfate content and chloride content to aid in the determination of corrosion potential at each of the proposed abutments.

A summary of the laboratory tests to determine index properties, consolidation and corrosion potential are presented in the following sections. The complete laboratory results are presented in **Attachment 1**.

4.1 Soil Tests

The soil testing was performed in general accordance with the following Standards:

Natural Moisture Content	ASTM D2216
Atterberg Limits	ASTM D4318
Grain Size Analysis	ASTM D422
Percent Passing No. 200 Sieve	ASTM D1140
Unit Weight Determination	ASTM D2937
One Dimensional Consolidation Using Incremental Loading	ASTM D2435-M
Unconsolidated Undrained Triaxial Test	ASTM D2850

The laboratory soil testing results are included in **Attachment 1** and are summarized below in **Table 4-1, Table 4-2** and **Table 4-3**.

Table 4-1: Summary of Identification Tests Results

Boring No.	Sample No.	Depth (feet)	Water Content (%)	Passing # 200 (%)	Atterberg Limits			Particle Distribution (%)		
					LL	PL	PI	Gravel	Sand	Fines
BB-CUM-101	4D	15-17	39.3	96.6	-	19.1	-	-	3.4	96.6
BB-CUM-101	8D	45-47	43.4	-	35.4	22.6	12.8	-	-	-
BB-CUM-102	1D	2-4	17.2	6.4	-	-	-	1.5	92.1	6.4
BB-CUM-102	7D	35-37	35.1	-	34.7	23.2	11.5	-	-	-
BB-CUM-102	9D	55-57	36.1	-	33.6	21.5	12.1	-	-	-
BB-CUM-103	10D	45-47	26.4	87.3	-	NP	-	-	12.7	87.3
BB-CUM-104	2D	5-7	21.8	1.9	-	-	-	1.4	96.7	1.9
BB-CUM-104	9D	40-42	27.1	80.5	-	NP	-	-	19.5	80.5
BB-CUM-104	13D	70-72	24.4	-	32.0	21.2	10.8	-	-	-
BB-CUM-105	8D	35-37	26.0	55.1	-	-	-	-	44.9	55.1
BB-CUM-105	12D	55-57	40.3	-	33.4	22.3	11.1	-	-	-
BB-CUM-105	14D	70-72	47.6	-	43.7	25.2	18.5	-	-	-
BB-CUM-105	17D	90-92	33.7	-	32.0	20.0	12.0	-	-	-
BB-CUM-106	18D	95-97	37.7	-	29.1	19.3	9.8	-	-	-
BB-CUM-106	21D	115-117	19.3	-	32.0	19.9	12.1	-	-	-
BB-CUM-201	6D	25-27	39.9	-	38.9	19.7	19.2	-	-	-
BB-CUM-201A	3D	20-22	43.4	-	38.6	22.1	16.5	-	-	-
BB-CUM-204	11D	50-52	40.3	-	40.5	22.3	18.2	-	-	-
BB-CUM-204	12D	60-62	47.1	-	49.8	24.3	25.5	-	-	-
BB-CUM-205	11D	49-51	37.9	-	35.1	20.5	14.6	-	-	-
BB-CUM-205	13D	65-67	39.3	-	38.9	21.1	17.8	-	-	-

Table 4-2: Summary of Consolidation Tests Results

Boring No.	Sample No.	Depth (feet)	Atterberg Limits			Water Content	Initial Void Ratio	Compression Indices	
			LL	PL	PI	w, %	e_o	C_C	C_r
BB-CUM-101	U-2	40 - 42	42.8	25.4	17.4	48.2	1.342	0.75	0.13
BB-CUM-102	U-1	30 - 32	35.0	23.8	11.2	42.6	1.141	0.20	0.06
BB-CUM-103	U-2	65 - 67	39.9	23.7	16.2	37.9	1.112	0.29	0.10
BB-CUM-104	U-1	60 - 62	39.5	23.5	16.0	37.6	1.020	0.50	0.09
BB-CUM-105	U-1	60 - 62	33.1	23.0	10.1	40.5	1.114	0.40	0.08
BB-CUM-106	U-2	90 - 92	47.8	24.4	23.4	42.3	1.177	0.50	0.08
BB-CUM-201A	U-1	27 - 29	38.4	21.7	16.7	40.6	1.096	0.41	0.07
BB-CUM-201A	U-2	35 - 37	44.6	23.5	21.1	46.6	1.300	0.82	0.11
BB-CUM-204	U-1	55 - 57	41.4	21.1	20.3	38.7	1.087	0.52	0.08
BB-CUM-204	U-3	75 - 77	40.0	23.4	16.6	40.1	1.077	0.47	0.12
BB-CUM-205	U-1	60 - 62	42.1	23.1	19.0	49.2	1.193	0.43	0.08
BB-CUM-205	U-2	70 - 72	47.5	22.8	24.7	42.6	1.177	0.54	0.09

Table 4-3: Summary of UU Tests Results

Boring No.	Sample No.	Test No.	Depth (feet)	Undrained Shear Strength (psf)
BB-CUM-102	U-1	UU-5	30-32	186.4
BB-CUM-102	U-1	UU-6	30-32	205.7
BB-CUM-103	U-2	UU-1	65-67	234
BB-CUM-103	U-2	UU-2	65-67	228
BB-CUM-105	U-1	UU-7	60-62	285
BB-CUM-105	U-1	UU-8	60-62	220
BB-CUM-106	U-2	UU-3	90-92	587
BB-CUM-106	U-2	UU-4	90-92	547
BB-CUM-201A	U-1	1	27.04	313
BB-CUM-201A	U-1	2	27.20	313
BB-CUM-201A	U-2	1	35.04	418
BB-CUM-201A	U-2	2	35.20	418
BB-CUM-204	U-1	1	55.06	386
BB-CUM-204	U-1	2	55.25	407
BB-CUM-204	U-3	1	75.04	564
BB-CUM_204	U-3	2	72.20	512
BB-CUM-205	U-1	1	60.04	543
BB-CUM-205	U-1	2	60.24	689
BB-CUM-205	U-2	1	70.04	407
BB-CUM-205	U-2	2	70.17	459

4.2 Rock Tests

Intact rock core specimens were tested for compressive strength and elastic modulus in accordance with ASTM D-7012. A summary of the laboratory tests is presented in **Table 4-4**, and the complete laboratory results are presented in **Attachment 1**.

Table 4-4: Summary of Rock Test Results

Boring No.	Sample No.	Depth (ft)	Total Unit Weight (pcf)	Unconfined Compressive Strength (psi)
BB-CUM-103	R4	102.6 - 105.0	168.9	4843
BB-CUM-106	R5	135.0 - 138.9	165.4	1714
BB-CUM-106	R3	130.3 - 130.7	160.0	437

4.3 Corrosion Tests

Select soil samples were tested for pH, sulfate content, and chloride content.

The corrosivity testing was performed in accordance with the following Standards:

pH	AASHTO T289
Sulfates	AASHTO T290
Chlorides	AASHTO T291
Soil Resistivity	AASHTO T288

A summary of the laboratory corrosion tests is presented in **Table 4-5**. The complete laboratory results are presented in **Attachment 1**.

Table 4-5: Summary of Corrosion Test Results

Boring No.	Sample No.	Depth (ft)	pH	Sulfate (ppm)	Chloride (ppm)	Resistivity (ohm-cm)
BB-CUM-103	6D	25-27	6.01	281	267	2,479
BB-CUM-106	5D/6D	20-24	5.99	91	207	1,859
BB-CUM-202	2D	5-7	6.4	25	200	16,461
BB-CUM-203	2D	5-7	6.42	22	37	3,507

5.0 Subsurface Conditions

5.1 Generalized Subsurface Stratification

The interpretation of soil and groundwater conditions at the project site are based on information obtained at the boring locations only. This information has been used as the basis for the conclusions and recommendations contained in this report. Significant variations at areas not explored by the project borings may require reevaluation of the findings and conclusions contained herein if found during construction.

A generalized interpretive subsurface profile developed along the bridge alignment is included as **Figures 4A and 4B** and is intended to convey trends in subsurface conditions. The boundaries between strata are approximate and idealized, and have been developed through interpretations of widely spaced borings and samples. Actual soil transitions included in the subsurface profile may vary and may be more erratic than indicated.

Subsurface conditions encountered in the test borings generally consist of the following strata:

- Embankment Fill
- Loose to Dense Sand and Silt (Fill)
- Very Loose to Loose Sand and Silt
- Interbedded Sand and Silt
- Marine Silty Clay
- Glacial Till
- Phyllite Bedrock

Stratum 1: Embankment Fill

The embankment fill was encountered at the south approach at boring BB-CUM-103 and BB-CUM-201 where it extends from existing grade to approximately 24 feet below ground surface (BGS). This material generally consists of a fine to medium sand, little to some fine gravel and trace to little silt. The corrected (for overburden stress and hammer efficiency) SPT blow count $N1_{60}$ average value of the fill is 65 blows per foot (bpf).

The embankment fill was encountered at the north approach at boring BB-CUM-106 and BB-205 where it extends from existing grade to approximately 23.5 feet BGS. This material generally consists of fine to medium sand, trace to some gravel and trace to little silt with an $N1_{60}$ average value of 55 bpf. Sampling at 21.6 feet below ground surface (estimated Elevation 64.9 feet) contained apparent asphalt with petroleum odor.

Stratum 2: Loose to Dense Sand and Silt (Fill)

This stratum is encountered in all borings either below the embankment fill or below ground surface where embankment fill is not encountered. This layer consists of fine to coarse sand, trace gravel and trace to little silt. This stratum is fairly consistent along the majority of the alignment with the bottom of the stratum ranging from El. 60 to El. 55 feet. The stratum generally ranges in thickness from 5 to 15 feet. At the northern end of the alignment the stratum tapers out and gives way to a loose sand and silt. This material is generally loose to medium dense with an average SPT blow count $N1_{60}$ than ranges from 7 bpf on along the south approach to 11 bpf along the north approach.

Stratum 3: Loose Sand and Silt

This stratum is encountered beneath Stratum 2 at all borings with the exception of BB-CUM-204 where it is found directly beneath the ground surface. This stratum generally consists of fine to medium grained sand and trace to little silt. Along the south approach the bottom of the stratum generally varies from El. 58 to El. 42.5 where the bottom of the stratum slopes down toward the north. The thickness of the stratum along the north approach generally ranges from 2 to 12 feet and consists of loose sand with an average $N1_{60}$ value of 3 bpf. The bottom of the stratum along the north approach generally ranges in elevation from 55 to 60 with a thickness that ranges from 0 to 12 feet. This material along the north approach generally consists of loose to medium sand with an average $N1_{60}$ value of 6 bpf.

Stratum 4: Very Loose Sand and Silt

This stratum is encountered along the north approach and only at borings BB-CUM-204 and BB-CUM-205. This stratum underlies Stratum 3 and consists of fine to medium sand with minor amounts of gravel and silt. The bottom of the stratum generally varies from El. 40 to El. 55 and has a thickness that generally ranges from 0 to 15 feet. The material is found in a very loose condition with an average SPT blow count $N1_{60}$ of 2 bpf.

Stratum 5: Interbedded Sand and Silt

This stratum was encountered in all borings performed within the project site. Generally, this stratum underlies Stratum 3 along the south approach and slops downward as the project alignment moves to the north. The bottom of this stratum dives down along the alignment from approximately El. 51 at the southern limits of the project site to approximate El. 17 at Pier 2. The thickness of this stratum increases from the southern limits of the project site to Pier 2 from approximately 7 feet to 29 feet. From Pier 2 to the northern terminus of the project the bottom of the stratum rises to approximate El. 24 and has a thickness that ranges from 29 feet to 15 feet. The material is encountered is very loose with an average SPT blow count $N1_{60}$ of 1 bpf for the entire stratum.

Stratum 6: Marine Silty Clay

The marine silty clay layer was encountered in all borings performed within the project limits. The stratum is, on average, thicker and deeper at the north approach than at the south approach. The clay layer primarily consists of saturated dark gray silty clay frequently encountered with black streaks. Concretions were encountered along the bottom 10.0 feet to 18.5 feet of the stratum. This layer underlies the interbedded sand and silt along the entire alignment of the bridge.

Along the south approach, the bottom of this stratum is generally found between El. 22 and El. -15 and has a thickness that ranges from 28 to 40 feet. The average liquid limit and plasticity index of the samples tested was 36 and 14.5, respectively. Occasional SPT sampling was performed within this layer and field vane shear tests were performed to obtain the in-situ and remolded undrained shear strength. The average in-situ undrained shear strength was approximately 530 psf and the average remolded undrained shear strength was approximately 24 psf.

Along the north approach, the bottom of this stratum is generally found between El. -15 and El. -38 and has a thickness that ranges from 40 to 58 feet. The average liquid limit and plasticity index of the samples tested was 37 and 15, respectively. Occasional SPT sampling was performed within this layer and field vane shear tests were performed to obtain the in-situ and remolded undrained shear strength. The average in-situ undrained shear strength was approximately 678 psf and the average remolded undrained shear strength was approximately 22 psf.

Stratum 7: Glacial Till

The glacial till stratum was identified at each abutment through SPT sampling and coring. The thickness of the layer varied by boring but was consistently the layer directly underlying the marine silty clay, with the exception of boring BB-CUM-106 where the till was not encountered. The stratum consists of dense sand and gravel with some silt. At several boring locations, the till was identified through drill cuttings and noted drilling action from the rig and operator.

The elevation of the bottom of this stratum varies from approximately elevation 14 at the south approach to El. -40 at the north approach. Borings BB-CUM-101, BB-CUM-102, BB-CUM-201 and BB-CUM-201A were terminated in this material. This layer was encountered in a medium dense to dense condition with an average SPT blow count $N1_{60}$ of 30 to 31 bpf along the south and north approaches respectively.

Stratum 8: Phyllite Bedrock

Bedrock was sampled at BB-CUM-103, BB-CUM-106, BB-CUM-202 and BB-CUM-203. Bedrock encountered at the site generally consists of medium hard to hard, slightly to highly weathered, aphanitic to fine grained, dark gray phyllite. Sampling at BB-CUM-103 along the south approach consisted of interbedding of thick layers of soft to medium, slightly weathered, aphanitic to medium grained, greenish-tan limestone. Sampling at BB-CUM-203 consisted of interbedded phyllite and metasandstone.

Rock quality designation (RQD) is a common parameter that is used to help assess the competency of the sampled bedrock. RQD is defined as the sum of the pieces of recovered bedrock greater than 4 inches in length divided by the total length of core run. RQD values of the bedrock that were encountered on site ranged from 0 to 73 percent.

5.2 Groundwater

The groundwater tables measured in each of the borings drilled as part of the subsurface investigation are included below in **Table 5-1**.

Table 5-1: Summary of Encountered Groundwater Elevation

Boring	Groundwater Elevation (ft)
BB-CUM-101	61.5
BB-CUM-102	62.0
BB-CUM-103	62.5
BB-CUM-104	60.8
BB-CUM-105	62.8
BB-CUM-106	62.8
BB-CUM-201	58.5
BB-CUM-202	63.5
BB-CUM-203	63.0
BB-CUM-204	63.5
BB-CUM-205	63.5

Water level readings were performed on March 23rd, 2018 in observation wells installed in borings BB-CUM-201 and BB-CUM-204 with readings of El. 61.7 and 63.8 respectively.

6.0 GEOTECHNICAL DESIGN RECOMMENDATIONS

6.1 Bridge Foundation Design

Geotechnical design recommendations for the substructure foundations and approach embankments associated with the Cummings Road Bridge Replacement and embankment widening project are discussed in the following sections. Recommendations have been developed in accordance with the 2017 AASHTO Load and Resistance Factor Design (LRFD) Bridge Design Specifications, Eighth Edition and the 2003 MaineDOT Bridge Design Guide (BDG) with updates through 2018.

6.1.1 Foundation Type Selection

Pile supported stub abutments and piers were chosen as the preferred superstructure /substructure combination. Abutments and piers will be founded on H-Piles driven either into the glacial till material or to top of bedrock. H-Pile supported foundations will provide an effective solution to resist the axial and lateral loads imparted by the superstructure at all abutment and pier locations.

6.1.2 Resistance Factors

All foundations were designed and assessed under service, strength and extreme limit state load combinations in accordance with AASHTO LRFD Sections 3, 6, 10 and 11.

The design of H-Pile foundations under the required limit state conditions has been performed in consideration of the lateral displacement, the compressive axial geotechnical resistance of individual piles; drivability resistance; structural resistance in axial compression and combined axial and flexure loading. The overall stability of each abutment has also been assessed under the service limit state.

Geotechnical resistance factors have been determined in accordance with AASHTO LRFD Table 10.5.5.2.3-1, Article 6.5.4.2 and Article 11.6.2.3. The resistance factors used for substructure foundation design are provided in **Table 6-1**.

Table 6-1: Resistance Factors

	Resistance Factor		
	Service Limit State	Strength Limit State	Extreme Limit State
Pile Foundation			
Axial Compression Resistance	-	0.65	1.0
Uplift Resistance	-	0.50	0.8
Lateral Resistance	1.0	-	-

6.1.3 Subsurface Material Properties

Geotechnical design parameters for soil and rock were developed for each stratum based on material descriptions, standard published correlations, results from laboratory testing, and engineering judgment. A summary of soil design properties at the abutments and piers are included below as **Tables 6-2** through **Tables 6-5.**

Table 6-2: Engineering Properties of Soil at Abutment 1

Soil Properties	Strata				
	Loose to Dense Sand and Silt	Loose Sand and Silt	Interbedded Sand & Silt	Soft to Medium Marine Silty Clay	Sand and Gravel (Glacial Till)
N_{60}, (bpf)	7	2	1	-	35
$N1_{60}$, (bpf)	11	3	1	-	30
γ (pcf)	114	107	100	114	121
ϕ', (deg)	33	29	28	-	37
k,(pci)	60	29	24	-	108
c, (psf)	-	-	-	357 - 663	-
ε_{50}	-	-	-	0.02 - 0.012	-
E_s (ksf)	6.9	1.7	1.7	0.4	13.6

Table 6-3: Engineering Properties of Soil at Pier 1

Soil Properties	Strata				
	Loose to Dense Sand and Silt	Loose Sand and Silt	Interbedded Sand & Silt	Soft to Medium Marine Silty Clay	Sand and Gravel (Glacial Till)
N_{60}, (bpf)	12	4	1	-	42
$N1_{60}$, (bpf)	17	5	1	-	33
γ (pcf)	114	107	100	105	125
ϕ', (deg)	33	29	28	-	37
k, (pci)	60	29	24	-	108
c, (psf)	-	-	-	440 - 746	-
ε_{50}	-	-	-	0.02	-
E_s (ksf)	3.3	2.0	1.4	3.3	6.3

Table 6-4: Engineering Properties of Soil at Pier 2

Soil Properties	Strata				
	Loose to Dense Sand and Silt	Loose Sand and Silt	Interbedded Sand & Silt	Soft to Medium Marine Silty Clay	Sand and Gravel (Glacial Till)
N_{60}, (bpf)	10	5	1	-	63
$N1_{60}$, (bpf)	15	7	1	-	48
γ (pcf)	111	112	100	105	123
ϕ', (deg)	31	31	28	-	38
k, (pci)	42	42	24	-	122
c, (psf)	-	-	-	377-850	-
ε_{50}	-	-	-	0.02	-
E_s (ksf)	3.3	2.0	1.4	3.3	6.3

Table 6-5: Engineering Properties of Soil at Abutment 2

Soil Properties	Strata					
	Loose to Dense Sand and Silt	Very Loose Sand and Silt	Loose Sand and Silt	Interbedded Sand and Silt	Soft to Medium Marine Silty Clay	Sand and Gravel (Glacial Till)
N_{60}, (bpf)	4	1	5	1	-	38
$N1_{60}$, (bpf)	7	2	6	1	-	31
γ (pcf)	111	102	112	100	114	123
ϕ', (deg)	31	28	31	28	-	38
k, AGW (pci)	61	-	-	-	-	-
k, BGW (pci)	40	24	42	24	-	122
c, (psf)	-	-	-	-	300-950	-
ε_{50}	-	-	-	-	0.02-0.005	-
E_s (ksf)	6.9	1.7	5.0	1.7	0.4	13.6

Where: $\overline{N_{60}}$= Average SPT-N value of stratum, corrected for hammer efficiency, in blows per foot.
$\overline{N1_{60}}$= Average SPT-N value of stratum, corrected for hammer efficiency and effective overburden pressure, in blows per foot.
γ = Total unit weight of soil - correlated.
ϕ' = Internal friction angle of drained soil, per multiple SPT-N value correlations.
k= Subgrade modulus – correlated (above WT / below WT).
c= Undrained shear strength based on in-situ vain shear testing.
ε_{50}= Strain at 50% - correlated.

6.1.4 Pile Demands

Design loading information at each abutment and pier was provided by the structural engineer. The service, strength and extreme limit state load combinations were provided at the top of the foundation. The loads used for each of the abutments and piers, are presented in **Attachment 4.**

6.1.5 Axial and Lateral Foundation Design and Recommendations

The pile group behavior of the foundations was modeled using FB Multipier, version 5.0 (FBMP). The piles were analyzed using a pinned head connection as per the recommendations from the structural designers. The proposed abutment and wingwall foundations were modeled as one element in the final configuration. The number piles required for each foundation element was determined based on the lateral deflection criteria under the service limit state load cases. The maximum load demand per pile in compression and uplift was determined by the strength and extreme limit state load cases.

Lateral resistance reduction factors (p-multipliers) are applied to the FBMP models in accordance with AASHTO LRFD Article 10.7.2.4. Lateral deflection has been limited to 1.0 inch at the pile cap elevation. The design has been performed using HP 14x117 piles, Grade 50. In cases of piles driven to refusal the geotechnical axial resistance has been limited to the factored structural resistance of the proposed piles.

Based on the laboratory test results and the limits provided in section 6.12 of the FHWA GEC No 12 "Design and Construction of Driven Pile Foundations" the steel piles have been designed to account for an appropriate level of section loss due to corrosion. Analyses have been checked by reducing the pile dimensions by 0.125 inches on all sides to account for corrosion loss per the aforementioned standard. It should be noted that corrosion has not governed the selection of pile size which has been dictated by drivability at the abutment and pier locations.

The pile layout for the abutment and wingwall and for the pier is included in **Attachment 5**. **Table 6-6** includes the governing pile demands that result from distributing structural loads at the pile cap using FBMP. Once the maximum factored axial demand is determined, the geotechnical resistance factors provided in **Section 6.2.2** are applied to derive the maximum required nominal geotechnical resistance in compression and in uplift excluding downdrag.

Table 6-6: Summary of Pile Group Analysis

Structure	Limit State	Axial Demand (kips)		Maximum Moment (kip-ft)	Depth to Maximum Moment (ft)	Lateral Deflection (in)		D/C
		Compression	Uplift			Longitudinal	Transverse	
Abutment 1	SER	227	0	126	6	0.6	0.2	-
	STR	305	23	209	6	-	-	0.5
	EXT	211	23	84	6	-	-	0.2
Pier 1	SER	292	0	33	4	0.2	0.1	-
	STR	452	24	47	4	-	-	0.5
	EXT	296	0	208	7	-	-	0.5
Pier 2	SER	287	0	40	5	0.2	0.1	-
	STR	446	19	57	5	-	-	0.5
	EXT	293	0	244	9	-	-	0.5
Abutment 2	SER	202	26	118	5	0.6	0.2	-
	STR	268	58	197	7	-	-	0.4
	EXT	187	41	76	7	-	-	0.2

Note: D/C is the Demand/Capacity ratio.

Due to the presence of soft compressible materials and placement of new fill at the abutments, downdrag has been accounted for in the design. A settlement analysis has been performed at each abutment to determine the depth along the pile where the cumulative settlement is more than 0.4 inches relative to the tip of the pile. The abutment piles will experience downdrag in addition to the structural demand from the superstructure.

A load factor of 1.05 is required for downdrag based on Table 3.4.1-2 of AASHTO LRFD. Static analysis to determine the side shear resistance of the piles has been performed using APile, version 2015.7.7. Nominal side shear resistance over the length of the pile is estimated based on the lambda method, as 131 kips and 142 kips, at Abutment 1 and Abutment 2, respectively. The total factored pile axial demand in compression is the factored pile demand from the structural loads plus the factored downdrag load. **Table 6-7** presents the total pile demands with downdrag included, where applicable.

Table 6-7: Summary of Pile Demand

Substructure	Axial Factored Demand in Compression from Structural Loads (kips)	Axial Nominal Side Resistance to Consider for Downdrag (kips)	Axial Factored Demand from Downdrag (kips)	Axial Total Factored Demand in Compression (kips)
Abutment 1	305	131	138	443
Pier 1	452	NA	NA	452
Pier 2	446	NA	NA	446
Abutment 2	268	142	149	417

Downdrag forces indicated in **Table 6-7** have been calculated assuming that piles at both abutments will be driven after the preload and surcharge has been placed and allowed to consolidate. It is our understanding that there may be a desire to drive piles concurrently with the preload and surcharge. In this scenario, downdrag forces need to be accounted for over the entire length of the pile which results in forces that the piles cannot accommodate. Therefore, piles will receive a friction reducing coating, such as Slickcoat™ or an approved equal applied to the bottom 20 feet of all piles at Abutment 1 and the bottom 50 feet of all piles at Abutment 2 in order to reduce the friction resistance and limit the downdrag forces to the values indicated in **Table 6-7**.

The required nominal resistance of the pier piles is a function of the nominal structural demand which is divided by the required resistance factor. The required nominal resistance of the abutment piles is a function of the nominal structural demand plus the factored downdrag load divided by the required resistance factor in addition to the side shear resistance along the downdrag depth.

The required nominal driving resistance has been checked against the lesser of the factored structural resistance, the factored geotechnical resistance, or the factored resistance that piles can be driven without exceeding the maximum permissible driving stresses as per AASHTO LRFD Article 10.7.8 using an axial resistance factor of 1.0 for resistance during driving as stipulated in AASHTO LRFD Article 6.5.4.2. It is anticipated that the H-piles will be driven to refusal conditions, and therefore pile axial design will be structurally controlled, either by stresses in the pile during driving or the structural resistance of the pile under static loading.

To determine whether the piles can be installed to the minimum tip elevations, preliminary wave equation analyses were performed using the software program GRL WEAP 2010 distributed by GRL Engineers, Inc. Additionally, a relationship between nominal axial geotechnical compressive resistance and the corresponding stresses in the pile was developed. Analyses were performed assuming a Delmag D36-32 hammer for this assessment. The contractor will be required to reassess drivability and independently determine an appropriate pile driving system.

Nominal axial geotechnical resistance was determined from the wave equation assessment at the specific resistance where stresses in the pile exceeded 45 ksi (the maximum permissible structural limit as per AASHTO LRFD Article 10.7.8) assuming the proposed H-Piles having a yield strength of 50 ksi.

Table 6-8 summarizes the maximum factored load imposed onto a single pile compared to the factored geotechnical resistance based on structural limitations and drivability of a single pile under the governing strength limit state.

Table 6-8: Limiting Factored Axial Resistance of an HP 14x117 at the Strength Limit State

Substructure	Axial Total Factored Demand in Compression (kips)	Limiting Factored Structural Resistance[1] (kips)	Limiting Factored Geotechnical Resistance[2] (kips)	Estimated Factored Drivability Resistance[3] (kips)	Governing Factored Axial Compressive Resistance (kips)
Abutment 1	443	860	860	875	860
Pier 1	452	860	860	875	860
Pier 2	446	860	860	825	825
Abutment 2	417	860	860	875	860

1. Based on severe driving conditions and a resistance factor of 0.5. Structural resistance is equivalent to geotechnical resistance when piles are driven to hard rock of refusal.
2. Assumes piles are driven to hard rock or refusal conditions.
3. Based on a resistance factor of 1.0 using a Delmag 36-32 with a Fuel Setting of 4.

The controlling factored axial compressive resistance is governed by either the structural resistance of the pile or the drivability at all foundation locations. The governing factored axial compressive resistance is greater than the maximum factored demand and satisfies design requirements.

HNTB anticipates that the piles will be driven to refusal conditions and will have negligible settlement at the pile tip. Therefore, majority of the settlement at the bridge abutments will be a result of the elastic compression of the H-Pile itself. This elastic shortening at the foundations is estimated to be less than 0.4 inches.

6.1.6 Recommended Pile Tip Elevations and Nominal Driving Resistances

HNTB anticipates that piles will reach refusal when the top of bedrock is encountered. Estimated pile tip elevations have been based on top of rock elevations and lateral requirements and are indicated in **Table 6-9**. Additionally, minimum nominal driving resistances have also been included in **Table 6-9**. All pile should be driven to at least the minimum pile tip elevations and to a suitable penetration depth so that the minimum required nominal driving resistance is achieved.

Table 6-9: Estimated and Minimum Pile Tip Elevations

Location	Bottom of Pile Cap Elevation (ft)	Minimum Pile Tip Elevation (ft)	Estimated Pile Tip Elevation (ft)	Factored Axial Load (kips)	Minimum Required Nominal Driving Resistance (kips)
Abutment 1	72.5	-10	-10	443	812
Pier 1	60.5	-22	-22	452	695
Pier 2	60.5	-31	-31	446	686
Abutment 2	71.5	-39	-39	417	783

HNTB recommends ordering lengths of piles that reflect a minimum of 5 additional feet per pile to accommodate variations in pile penetration, dynamic pile test instrumentation and pile head damage during driving.

6.2 Approach Embankment Design of Global Stability

6.2.1 Design Methodology

AASHTO LRFD Bridge Design Specifications (AASHTO) requires that the embankments be analyzed for global stability in the Service-I loading condition using limit equilibrium methods. A global stability resistance factor of 0.75 is required when embankments are not supporting or do not contain structural elements. This resistance factor noted above results in a minimum required factor of safety of approximately 1.3 in accordance with AASHTO Section 11.6.2.3. When global stability analysis is performed and the geotechnical parameters are based on limited information, or when the slope contains or supports a structural element, AASHTO requires that a resistance factor of 0.65 be utilized. This resistance factor results in a minimum required factor of safety of approximately 1.5 in accordance with AASHTO Section 11.6.2.3.

In analyzing global stability, limit equilibrium analyses were performed along each approach embankment and at Abutment 1 and Abutment 2 using the Slope/W module of GeoStudio 2016, version 8.16 distributed by Geo-Slope International Ltd. Subsurface conditions for global stability analysis at each approach were selected based on review and interpretation of the available borings with stratigraphy based on the Interpretive Subsurface Profile at a given station. Spencer's method has been used to perform all global stability analyses which satisfies both force and moment equilibrium and meets the requirements prescribed by AASHTO LRFD Article C11.6.2.2 for slope stability. Results of the analysis were assessed using optimized failure surfaces and have been provided herein.

6.2.2 Subsurface Design Parameters

Global stability analyses were performed for long-term loading conditions using drained soil strength design parameters and short-term loading conditions using undrained soil strength design parameters as specified in **Table 6-10** through **Table 6-12.** Additionally, a surcharge load of 250 psf was applied to the approach embankment to simulate the vehicular live load.

For the drained clay analyses, an effective internal angle of friction of 15° was conservatively assumed. It was necessary to make an assumption for the drained strength of the clay as standard penetration test results do not correlate reasonably to strengths of cohesive materials, particularly soft saturated cohesive materials. Despite the conservative assumption, none of the drained analyses presented a controlling condition.

For the undrained clay shear strengths, vane shear test results were utilized and a linear function of strength increase with depth was fit to the vane shear results. For transverse stability along the south approach, the vane shear results from borings taken through the existing embankments were utilized to determine increased shear strength values accounting for effects of the clays having been consolidated under the additional weight of the existing embankments. For the consolidated clay shear strengths, the datum value increased from 240 psf at El. 52 outside the embankment zone of influence to 325 psf at El. 52 for clay under a 20 foot high embankment. Datum values were linearly interpolated for embankment heights between 0 and 20 feet.

Table 6-10: Engineering Properties of Soil for South Approach Stability

Soil Properties	Strata					
	Existing Embankment Fill	Loose to Dense Sand and Silt	Loose Sand and Silt	Interbedded Sand and Silt	Soft Marine Silty Clay	Glacial Till
γ (pcf)	130	111	112	100	114	123
ϕ', (deg)	38	31	31	28	15 (assumed)	38
c, (psf)	-	-	-	-	240 to 325 at el. 52ft	-
Δc, (psf/ft)	-	-	-	-	9	-

Where: γ = Total unit weight of soil - correlated.
ϕ' = Internal friction angle of drained soil, per multiple SPT-N value correlations.
c= Undrained shear strength datum value based on in-situ vane shear testing. Datum value increases above minimum value based upon existing embankment overburden thickness from 0 to 20 feet.
Δc = Increase in undrained shear strength with depth based on in-situ vane shear testing.

Table 6-11: Engineering Properties of Soil for North Approach Stability

Soil Properties	Strata						
	Existing Embankment Fill	Loose to Dense Sand and Silt	Very Loose Sand and Silt	Loose Sand and Silt	Interbedded Sand and Silt	Soft Marine Silty Clay	Glacial Till
γ (pcf)	128	111	102	112	100	114	123
ϕ', (deg)	38	31	28	31	28	15 (assumed)	38
c, (psf)	-	-	-	-	-	300 at el. 25ft	-
Δc, (psf/ft)	-	-	-	-	-	11	-

Table 6-12: Assumed Engineering Properties of Proposed Expansion Materials for Stability

Properties	Material		
	Proposed Embankment Fill	Geofoam	Pavement Box
γ (pcf)	120	3	135
ϕ', (deg)	34	36	36

6.2.3 Stability Assessment

In analyzing the approach embankments, HNTB performed limit equilibrium analysis of three representative transverse cross sections for each approach as well as a longitudinal section through each abutment. The transverse cross sections were of Stations 66+00, 67+50, 68+00, 73+00, 73+50, and 75+00.

Preliminary results of transverse sections indicate that the factor of safety of the approach embankments in their existing condition when assessed in the short-term undrained condition is approximately 1.1. Since the existing embankment has been in place for approximately 60 years the undrained condition is no longer applicable in assessing the existing conditions (assuming the excess pore water pressures induced from the construction of the existing embankment have dissipated) and the embankment in its current state should be assessed in the long-term drained condition. Across the existing roadway where weight compensation by excavation and replacement with Geofoam is utilized the recommended design solution does not increase the net pressure at the ground surface and does not theoretically increase pore water pressure. Therefore, the soils beneath the east slope will remain in the long-term drained condition where the factor of safety against global stability meets requirements.

Analyses of transverse sections were performed to check conditions during surcharging and at completion of Phase 1 Maintenance-of-Traffic construction with traffic being moved onto the new roadway. Stability during construction stages was deemed satisfactory.

Analyses of the final expanded embankment were assessed using optimized failure surfaces, the results of which have been provided herein. Note transverse sections at Stations 68+00 and 73+00 require a minimum factor of safety of 1.5 at the abutment structures. **Table 6-13** provides the resulting factors of safety for transverse analyses of final design conditions in the applicable long-term drained and short-term undrained clay states.

Table 6-13: Resulting Factors of Safety against Global Stability Failure: Transverse Sections

Location	Direction of Failure	EAST		WEST	
	Clay State	Drained – FS	Undrained – FS	Drained – FS	Undrained – FS
STA 66+00		1.3	n/a	1.6	1.6
STA 67+50		1.5	n/a	1.5	1.3
STA 68+00		1.5	n/a	2.0	1.5
STA 73+00		2.1	1.7	1.5	1.5
STA 73+50		1.6	1.3	1.4	1.4
STA 75+00		2.1	1.8	2.0	2.0

If the expansion were to be constructed with regular weight embankment fill alone, both the north and south approaches would have global stability issues. The use of Geofoam was determined to be the effective solution, which would not only allow for sufficient stability, but would also be useful in limiting settlements and improving ride quality. Providing weight compensation on the west expansion with lightweight aggregate would require significant excavation beneath the water table along significant portions of the embankments. Much of the transverse south approach stability conditions necessitated use of Geofoam, and where stability did not control, Geofoam was utilized to help reduce imposed stresses which would otherwise cause excessive settlement of the adjacent hotel parking lot.

The geofoam arrangement was optimized beyond Station 66+50 to the edge of the wingwalls so that global stability was the controlling factor, i.e. larger settlements were allowed. At the abutment the geofoam configuration is controlled by the need to reduce lateral earth pressures. The geofoam configuration at Station 68+00 was fixed by the abutment and resulted in unsatisfactory stability results. Therefore, sheeting is required to remain in place beginning at Station 67+50 and ending at the south abutment to prevent portions of the clay soils east of the Phase 1 MOT construction from being influenced and pushed into an undrained state by the placement of material on the west. As was previously discussed, the Geofoam placement during Phase 2 along the east as a weight compensation is necessary for stability of the east to keep the east end clays in a drained condition.

Along the north approach it was determined that Geofoam was required for global stability at station 73+00. The Geofoam necessary for the abutment structure lateral earth pressure assumption proved sufficient. Analyses run at Station 73+50 assumed no Geofoam and proved satisfactory for stability. While no Geofoam is necessary beyond station 73+50 for global stability purposes, the use of Geofoam continues to Station 73+67 as the Geofoam thickness needed to be stepped to prevent significant lateral earth pressures transferred into the abutment.

The stratigraphy utilized for the south abutment longitudinal section is based on Station 68+00 and likewise the stratigraphy for the north abutment longitudinal section is based on Station 73+00. For longitudinal stability through the south abutment it was determined a minimum 4-foot thickness of Geofoam behind the abutment was sufficient. For longitudinal stability through the north abutment it was determined a minimum 4-ft thickness of geofoam was necessary behind the abutment to Station 73+00. These requirements for Geofoam thickness were usually met or exceeded by other design needs such as needs for the lateral earth pressures at the abutment and transverse stability.

Analyses of the final design conditions were assessed using optimized failure surfaces. Note the longitudinal sections require a minimum factor of safety of 1.5 at the abutment structures. **Table 6-14** provides the resulting factors of safety for longitudinal analyses of final design conditions in the applicable long-term drained and short-term undrained clay states.

Table 6-14: Resulting Factors of Safety against Global Stability Failure: Longitudinal Sections

Location	Clay State	
	Drained – FS	Undrained – FS
South Abutment	2.2	1.6
North Abutment	1.9	1.5

6.3 Approach Embankment Design of Settlement

6.3.1 Settlement Assessment

Settlement induced by the proposed embankment construction was analyzed utilizing SETTLE3D by Rocscience with a Boussinesq stress distribution assumed. Models were simplified as an extruded cross-sectional geometry of a given station. With the exception of the top layer which varies in thickness by ground surface elevation, the thickness of each stratum is constant across a model, with flat transitions between strata. The Soft to Medium Silty Clay layer and the Medium Silty Clay layer are treated by the models as a single stratum. The Post-Surcharge settlements are calculated as the settlement due to preloading subtracted from the settlement which would be induced by the final loading configuration modeled as though the material had been placed without preloading. Please note settlements are queried from an elevation just beneath the toe of the existing embankment. Given the existing embankment is comprised of medium dense to very dense granular soils, the elastic compressions of the embankment fill above the query elevation are typically small and have therefore been neglected.

By theory, settlements are broken into three forms. Elastic compression or compaction is experienced by all soils except saturated cohesive soils. Elastic settlements usually occur within a few weeks of load application, and as such is expected to occur during construction. On this project, elastic compression had little to no impact on the designed solutions, given the saturated soft clays. Primary consolidation is experienced in saturated fine-grained deposits, primarily soils classifying as clay. Primary consolidation is a long-term settlement response due to the low rate at which water can escape from the voids in the fine-grained soil deposits. Primary consolidation settlement can take months to several years, or in especially thick clay deposits may take over a decade. Secondary compression, also known as creep, is generally significant in thick clay deposits after decades. Secondary compression is usually only discernable after over ninety five percent of the primary consolidation has occurred. The rate of secondary compression is generally not dependent on load magnitude but occurs after load induced settlement and generally decreases over time.

6.3.2 Design Approach

The design scheme implements preloading with Prefabricated Vertical Drains (PVDs) to improve soils, along with Geofoam to lessen the load imposed upon the soils. The embankment is constructed in stages to allow maintenance of traffic.

Preloading or surcharging is a conventional method for improving soft clay soils which when loaded compress significantly over a long duration. Load induced compressions of thick deposits may continue over several years past the load placement. Preloading is to be performed with common borrow material, and portions of the preload material are to remain in place as embankment fill. Preloading is commonly performed with a greater loading than that of the final construction to more quickly achieve a compression equivalent to that estimated for the final construction, to mitigate effects of secondary compression, and to achieve more favorable strength conditions.

Preloading is typically performed with vertical drains to expedite compression in clays. The duration of the compression is dependent upon the permeability of the clay soil and the distance by which the void water must flow to escape the clay deposit. The introduction of vertical drains provides significantly shorter drainage paths, allowing the water to escape at an accelerate rate, thereby expediting the primary consolidation. Prefabricated vertical drains (PVDs) also known as “wick” drains are commonly used for this purpose.

The time constraints for the Phase 1 preloading are stringent. Estimations of soil permeability and consolidation rates by laboratory tests are generally highly variable (of poor precision) and can deviate significantly from the field as permeability of in-situ soils are dependent on many factors. To help ensure successful completion of the preload induced settlement on schedule, a considerably tight spacing of PVDs is planned and is illustrated in the construction plans.

There are limitations to where the PVDs can be reasonably constructed. For example, PVDs are not being utilized along the existing roadway or through the existing embankment. PVDs are also not being utilized along steep slopes along the existing embankment due to equipment limitations. The extents of the PVDs are to be limited to the area extending from the west toe of the existing embankment slope, except in cases where the existing embankment is low and the slope has a shallow incline.

In addition to the introduction of PVD’s to accelerate consolidation, Geofoam is being utilized to provide sufficient global stability, as well as to mitigate settlement. The use of Geofoam provides benefits in reducing settlement magnitudes from those that would be induced if only regular weight, common borrow materials were used. This is of importance where grade is being raised over the existing roadway where preloading is not being applied, as well as over existing steep embankment slopes where PVDs will be absent. The use of Geofoam allows reduced surcharge heights. With the typical Geofoam having a unit weight of 3 pcf, it is nearly weightless in comparison to soil.

6.3.3 Subsurface Material Properties

Elastic compression of cohesionless granular soils are calculated using the elastic modulus of the soil. Elastic modulus values were estimated from standard penetration test N values. For saturated clays, primary consolidation is modeled using the recompression ratio and virgin compression ratios which transition at the preconsolidation pressure. These parameters are determined through consolidation tests performed in the laboratory on samples carefully extruded from the field to limit sample disturbance. Consolidation test results have been estimated using results determined at load steps of similar magnitude to stresses expected to occur in construction. Groundwater was modeled at El. 62 feet on the south approach and El. 63 feet on the north approach. **Tables 6-15** through **6-17** provide the parameters utilized for settlement analyses of the south and north approaches.

Table 6-15: Consolidation Parameters for the Soft to Medium Silty Clay

Location	Cεc	Cεr	OCR	Cv (ft^2/day)	Cvr (ft^2/day)	Ch/Cv	Cαε (% strain)	Cαεr (% strain)
South Approach	0.22	0.045	1.18	0.25	0.93	2	0.008	0.003
North Approach	0.22	0.043	1.19	0.36	0.87	2	0.005	0.005

Table 6-16: Elastic Modulus Values for the South Approach Soils

Property \ Material	Sand and Gravel (Embankment Fill)	Loose to Dense Sand (Fill)	Loose Sand and Silt	Interbedded Sand and Silt	Soft to Medium Silty Clay	Glacial Till
Es (ksf)	1064	434	291	127	-	700

Table 6-17: Elastic Modulus Values for the North Approach Soils

Property \ Material	Sand and Gravel (Embankment Fill)	Loose to Dense Sand (Fill)	Very Loose Sand and Silt	Loose Sand and Silt	Interbedded Sand and Silt	Soft to Medium Silty Clay	Glacial Till
Es (ksf)	1058	358	204	396	153	-	863

6.3.4 South Approach Design Recommendations and Results

From Stations 64+50 to 67+00, preload of approximately six feet high is required to offset the final loading condition. The majority of the preload material will be removed after consolidation in order to build the Phase 1 widening with Geofoam. This portion of the embankment will use a significant amount of Geofoam to limit the stress influence upon the soils beneath the proposed embankment and the adjacent hotel parking lot. The weight of the pavement box, subgrade fill, and embankment fill necessitates preloading to minimize post-construction settlements. Settlements estimated for Station 66+00 are representative of the limits noted above and are presented by **Table 6-18**. Post construction settlements reported include both the contribution of primary and secondary settlement.

Table 6-18: Results of Settlement Analysis at Station 66+00

<table>
<tr><th rowspan="2">Description</th><th rowspan="2">Transverse Location (ft)</th><th>Surcharge Settlement (inch)</th><th colspan="4">Post-Surcharge Settlement (inch)</th></tr>
<tr><th>4 months</th><th>1 year</th><th>5 years</th><th>20 years</th><th>100 years</th></tr>
<tr><td>Edge of Parking Lot</td><td>53 LT</td><td>0.6</td><td>n/a</td><td>n/a</td><td>n/a</td><td>n/a</td></tr>
<tr><td>New Embankment Toe</td><td>48 LT</td><td>1.5</td><td><0.1</td><td>0.5</td><td>1.2</td><td>2.2</td></tr>
<tr><td>West Crest</td><td>30 LT</td><td>3.9</td><td><0.1</td><td><0.1</td><td>0.4</td><td>1.7</td></tr>
<tr><td>Roadway Center</td><td>0</td><td>0.6</td><td><0.1</td><td>0.1</td><td>0.3</td><td>0.5</td></tr>
<tr><td>Existing Roadway West Edge</td><td>12 RT</td><td>0.2</td><td>n/a</td><td>n/a</td><td>n/a</td><td>n/a</td></tr>
<tr><td>Existing Roadway Center</td><td>25 RT</td><td>0.1</td><td>n/a</td><td>n/a</td><td>n/a</td><td>n/a</td></tr>
<tr><td>East Crest</td><td>29 RT</td><td>0.1</td><td><0.1</td><td><0.1</td><td><0.1</td><td><0.1</td></tr>
<tr><td>Existing Roadway East Edge</td><td>38 RT</td><td><0.1</td><td>n/a</td><td>n/a</td><td>n/a</td><td>n/a</td></tr>
<tr><th rowspan="2">Description</th><th rowspan="2">Transverse Location (ft)</th><th colspan="5">Total Settlement (inch)</th></tr>
<tr><th colspan="2">1 year</th><th colspan="2">5 years</th><th>20 years</th></tr>
<tr><td>Edge of Parking Lot</td><td>53 LT</td><td colspan="2">0.7</td><td colspan="2">1.3</td><td>2.0</td></tr>
</table>

Beginning at station 67+00 and continuing north to the abutment, a sizable portion of the preload material is to remain in place as embankment fill. The configuration of Geofoam along this portion of the embankment is controlled by global stability and is also utilized to reduce lateral earth pressures behind the abutment. The surcharge extents are to be taken past the planned south abutment location, to approximate Station 68+50. This is to ensure the material beneath the longitudinal end of the embankment supported roadway is properly consolidated. Estimated settlements for Stations 67+50 and 68+00 are provided in **Table 6-19** and **6-20**.

Table 6-19: Results of Settlement Analysis at Station 67+50

Description	Transverse Location (ft)	Surcharge Settlement (inch)	Post-Surcharge Settlement (inch)			
		4 months	1 year	5 years	20 years	100 years
New Embankment Toe	72 LT	4.1	<0.1	<0.1	1.7	3.8
West Crest	30 LT	11.3	<0.1	<0.1	0.9	3.4
Roadway Center	0	1.1	0.1	0.8	1.6	2.6
Existing Roadway West Edge	12 RT	0.5	n/a	n/a	n/a	n/a
Existing Roadway Center	25 RT	0.3	n/a	n/a	n/a	n/a
East Crest	30 RT	0.2	<0.1	<0.1	<0.1	<0.1
Existing Roadway East Edge	38 RT	0.1	n/a	n/a	n/a	n/a

Table 6-20: Results of Settlement Analysis at Station 68+00

Description	Transverse Location (ft)	Surcharge Settlement (inch)	Post-Surcharge Settlement (inch)			
		4 months	1 year	5 years	20 years	100 years
New Embankment Toe	75 LT	2.2	0.0	0.3	1.5	2.8
West Crest	28 LT	9.1	<0.1	<0.1	<0.1	<0.1
Roadway Center	0	0.9	<0.1	<0.1	<0.1	<0.1
Existing Roadway West Edge	12 RT	0.4	n/a	n/a	n/a	n/a
Existing Roadway Center	25 RT	0.2	n/a	n/a	n/a	n/a
East Crest	30 RT	0.2	<0.1	<0.1	<0.1	<0.1
Existing Roadway East Edge	38 RT	0.1	n/a	n/a	n/a	n/a

The preload is estimated to induce an insignificant amount of settlements along the existing in-service roadway of 0.5 inches or less. It is anticipated that these settlements will be tolerable for maintaining traffic and do not require any further accommodation.

Once traffic has been moved over to the Phase 1 expansion on the west, the existing roadway will be removed and the new roadway built. This will involve excavation of the existing embankment material and installation of a limited amount of Geofoam to provide a weight compensation for the new regular weight embankment material placed. This will reduce future settlement and is practical for this portion of the embankment considering that the grade raise is typically less than three feet.

In the final condition, deflections experienced by the pavement are of concern. Estimated settlements for the final conditions have been previously reported in **Tables 6-18** through **6-20**. The settlements which occur prior to paving are not experienced by the pavement, thus settlement values reported are the deformations estimated to occur after surcharging is completed. The analyses ignore the time of construction between the end of surcharging and the opening of the entire roadway. Given these results, it appears a typical paving cycle (15 to 20-year intervals) will be sufficient to address any post construction deformations.

6.3.5 North Approach Design Recommendations and Results

South of Station 73+67 a sizable portion of the preload material will be removed and replaced with Geofoam. The configuration and need for Geofoam along this portion of the embankment is controlled by global stability but will also serve to reduce lateral earth pressures behind the abutment. The surcharge extents are to begin prior to the proposed north abutment location to approximate Station 72+25. This is to ensure the material beneath the longitudinal end of the embankment supported roadway is properly consolidated. Estimated settlements for Station 73+00 are reported in **Table 6-21**.

Table 6-21: Results of Settlement Analysis at Station 73+00

Description	Transverse Location (ft)	Surcharge Settlement (inch)	Post-Surcharge Settlement (inch)			
		4 months	1 year	5 years	20 years	100 years
New Embankment Toe	72 LT	2.1	<0.1	0.4	2.4	4.6
West Crest	30 LT	4.0	<0.1	0.2	2.2	4.4
Roadway Center	0	0.9	<0.1	0.3	0.9	1.6
Existing Roadway West Edge	12 RT	0.5	n/a	n/a	n/a	n/a
Existing Roadway Center	25 RT	0.3	n/a	n/a	n/a	n/a
East Crest	30 RT	0.2	<0.1	<0.1	<0.1	<0.1
Existing Roadway East Edge	38 RT	0.2	n/a	n/a	n/a	n/a

Beyond Station 73+67 Geofoam is no longer utilized and the limits of the preload encroach further to the east towards the existing roadway. The preload configuration is approximately equivalent to the Phase 1 Maintenance-of-Traffic (MOT) geometry as shown in the construction plans, with an additional 2-feet of surcharge material to prestress the clay slightly beyond the stresses anticipated in the final condition. With the exception of the additional 2-feet of surcharge, the existing preload material has been designed to remain in place as embankment fill. Estimated settlements for the extents of the alignment to the north of the Geofoam are provided in **Table 6-22** and **6-23**. Note the model of 73+50 was simplified to represent the highest section of the north approach without Geofoam and as such the results for the Station 73+50 are representative of the configuration beyond Station 73+67.

Table 6-22: Results of Settlement Analysis at Station 73+50

Description	Transverse Location (ft)	Surcharge Settlement (inch)	Post-Surcharge Settlement (inch)			
		4 months	1 year	5 years	20 years	100 years
New Embankment Toe	67 LT	3.4	0.0	0.4	2.1	4.2
West Crest	30 LT	9.5	0.0	0.0	1.3	3.3
Roadway Center	0	2.8	0.9	1.8	3.6	5.6
Existing Roadway West Edge	12 RT	1.6	n/a	n/a	n/a	n/a
Existing Roadway Center	25 RT	0.9	n/a	n/a	n/a	n/a
East Crest	30 RT	0.8	0.8	1.5	3.3	5.3
Existing Roadway East Edge	38 RT	0.6	n/a	n/a	n/a	n/a

Table 6-23: Results of Settlement Analysis at Station 75+00

Description	Transverse Location (ft)	Surcharge Settlement (inch)	Post-Surcharge Settlement (inch)			
		4 months	1 year	5 years	20 years	100 years
New Embankment Toe	71 LT	1.4	0.4	1.2	3.1	5.3
West Crest	34 LT	5.8	<0.1	<0.1	1.7	3.9
Roadway Center	0	1.9	0.7	1.5	3.4	5.6
Existing Roadway West Edge	7 RT	1.4	n/a	n/a	n/a	n/a
Existing Roadway Center	19 RT	0.8	n/a	n/a	n/a	n/a
East Crest	30 RT	0.5	0.9	1.5	3.4	5.6
Existing Roadway East Edge	32 RT	0.5	n/a	n/a	n/a	n/a

Along the north approach, the induced settlements may warrant maintenance repaving along the west edge of the in-service roadway where it is expected to experience as much as 1.6 inches of settlement.

It should be noted that the model for Station 73+50 assumes no Geofoam. The Geofoam planned for Station 73+50 is up to 4-feet thick as the Geofoam thickness tapers in the longitudinal direction to end at station 73+67. This Geofoam configuration is controlled by the need to minimize lateral earth pressures applied to the abutment. The results of the analysis at Station 73+50 are to be representative of the highest portion of the north approach to be constructed without Geofoam.

An existing water line runs parallel to the north approach embankment from Station 72+50 to Station 80+50. The water line is closest to the embankment at approximately Station 73+65 where it is approximately 78 feet west of the new roadway centerline. Where the water line is closest to the embankment, settlement is estimated to be approximately 0.5 inches.

6.3.6 Instrumentation

Instrumentation is important for tracking settlements and determining surcharge durations and allow the Authority to provide the approval to move beyond the preload phase. Given the variability of field conditions and the low precision in permeability measurements, calculated estimates of time durations for settlements are not considered to provide a final standard as to when construction should be allowed to commence past preloading. Settlement will be monitored through the use of piezometers to measure the increase and subsequent fall of excess pore pressure and settlement plates will be placed at the bottom of the embankments prior to backfilling to track the rate of settlement over time.

Tracking of the settlement plates will not only provide magnitudes for verification purposes, but will provide the variation of compression over time, which is necessary to provide clear confirmation as to when primary consolidation induced by preloading is substantially complete. The piezometers, which provide pore pressure measurements, while not providing settlement values, provide a reliable means of tracking the effects of the preload efforts and confirm when the primary consolidation is substantially complete.

A complete schedule of piezometers and settlement plate locations are included in the contract plans and special provisions.

7.0 SEISMIC DESIGN RECOMMENDATIONS

7.1 Design Spectrum using the Generalized Procedure

A seismic assessment has been performed for the project site. In accordance with AASHTO LRFD, seismic analysis was performed for a seismic event having a 7 percent probability of being exceeded in 75 years (1,000 year Return Period). Values for the peak ground coefficient (PGA) and the spectral coefficients (SS and Sl) for the design event were obtained from the USGS web site using the longitude (-70.3479) and latitude (43.6286) for the bridge site. As per AASHTO Table 3.4.2.1-1, and given the soils encountered, the site is classified as Site Class E. A preliminary analysis was performed and a design spectrum developed based on the general Three Point Method prescribed in Section 3.4.1 of AASHTO LRFD.

The ground peak acceleration (PGA) of bedrock and other parameters for designs obtained from AASHTO and the USGS map data are given in **Table 7-1** below.

Table 7-1: Recommended Seismic Design Parameters from USGS

Return Period (years)	Peak Ground Acceleration (PGA)	Site Class B		Site Class E		
		S_S	S_l	A_S	S_{DS}	S_{Dl}
1,000	0.088	0.176	0.045	0.220	0.440	0.158

S_S- horizontal spectral acceleration coefficient at 0.2-sec period on rock.
S_l- horizontal spectral acceleration coefficient at 1.0-sec period on rock.
A_S- Site adjusted peak ground acceleration.
S_{DS}- design spectral acceleration coefficient at 0.2-sec period.
S_{Dl}- design spectral acceleration coefficient at 1.0-sec period.

7.2 Site Specific Study

In accordance with Table 3.10.6-1 of AASHTO LRFD, for a site with the SD1 larger than 0.15, the bride is assigned as Seismic Performance Zone 2. A Zone 2 categorization requires a detailed seismic analysis to be performed as part of the assessment and design. Since the initially calculated value of SD1 was very close to the boundary between a Seismic Zone 1 and Seismic Zone 2 classification, a site-specific study was performed to refine the spectral acceleration shown in Table 8-1. The analysis relies on published correlations for index properties and shear wave velocities of the subsurface materials from SCPT data.

7.2.1 Selection of Ground Motions

Ground motions were selected from earthquakes with magnitudes ranging from 5.0 to 7.0. Acceleration time histories of these earthquakes were recorded at several instrumented locations. Ground motions for several earthquakes recorded within 5 miles to 100 miles of the instrument stations were selected for analysis and provided in **Table 7-2** below.

Table 7-2: List of Ground Motions used for Site Specific Study

Earthquake	Magnitude	Distance from Instrumentation (miles)	PGA (g)
1984 Morgan Hill	6.2 M	10	0.095
1986 North Palm Springs	6.0 M	39	0.096
1987 Whittier Narrows	6.0 M	6	0.092
1988 Saguenay, Canada	5.7 m_b	40	0.091
1982 New Hampshire	4.7 M	5	0.116

7.2.2 Scaling of Ground Motions

A target spectrum for the site was developed from the Three Point Method specified in Section 3.4.1 of AASHTO LRFD for the soft bedrock (Site Class B). The ground motions were spectrally matched using RSP Match software to develop the site-specific ground motions. The target spectrum and the spectrally matched ground motions are shown in **Figure 5**.

7.2.3 Site Specific Geotechnical Parameters

Soil and rock material properties affect the shear wave amplification. In order to accommodate the site variability, upper bound, average, and lower bound material properties were used in the analysis.

Shear wave velocity profiles were developed from SCPT soundings No. 205 form an adjacent project site. The Vs values obtained from the SCPT No. 205 was considered as the average velocity profile. The lower bound and upper bound Vs data were obtained by lowering or increasing the average velocity by 30 percent. Established shear wave velocity profiles used in the analysis are shown in **Figure 6**.

Laboratory test results as well as published correlations were utilized to determine the unit weights and plasticity indices throughout the site. The plasticity index was utilized to obtain the shear modulus and damping ratio at different shear strains. Plasticity indices were adjusted to match the material classification in the boring logs. Unit weights were used for the determination of initial shear modulus. Unit weights were adjusted to 5 pcf above and below the values obtained at the midpoint of each stratum. Units weights obtained at the midpoint of each layer are indicated in **Figure 6**.

7.2.4 Modulus Reduction and Damping Ratio

The following published modulus reduction and damping ratio curves for sand, cohesive soils, and rock were utilized as shown in **Table 7-3**.

Table 7-3: Published Modulus Reduction and Damping Ratio Curves for Sand, Cohesive Soils, and Rock

Material	Models
Sand	Seed & Idriss 1970
	EPRI 1993
Cohesive	Vucetic & Dobry 1991
	Darendeli 2001
Rock	Idriss 1991
	Schnabal 1973

7.3 Site Specific Analysis

A one-dimensional analysis was performed, using the software PRO SHAKE Version 1.1, at different locations to represent the entire project site. Several analyses were performed at each location by varying input parameters to accommodate the variants in ground motions and site soils as outlined above. The spectral acceleration-period data were obtained from the Shake analysis for a return period of 1,000 years. Mean and standard deviation of the scattered spectra were computed. The mean values and one standard deviation above and below were used in establishing the site-specific response spectrum. The site-specific analysis results are shown in **Figure 7**.

7.3.1 Site Specific Response Spectrum

The recommended horizontal response spectrum for the 1,000 Year return period is shown below in **Table 7-4**. Based on the site-specific analysis and revised response spectrum, the design spectral acceleration coefficient at 1.0-sec period (SD1) is reduced to 0.13 and classified as Seismic Performance Zone 1.

Table 7-4: List of Ground Motions used for Site Specific Study

1,000-Year Event	
Period (sec.)	Spectral Acceleration (g)
0.00	0.17
0.07	0.36
0.40	0.36
0.52	0.30
0.75	0.20
1.00	0.13
1.50	0.09
2.00	0.06
3.00	0.05
4.00	0.04
5.00	0.03

7.4 Liquefaction Screening

As part of the seismic assessment, a determination of the liquefaction hazards present at the project site was conducted. Liquefaction is a phenomenon whereby a soil substantially loses strength in response to an applied cyclic stress, typically associated with earthquake loading. This temporary loss of soil strength causes the soil to behave like a liquid, impacting bearing capacity and lateral stiffness. Liquefaction induced ground movement can cause serious damage to structures. Damage may occur during the earthquake itself, or continue to occur or be initiated subsequent to the earthquake in situations where the static factor of safety against lateral movement is reduced to less than unity. Two types of post-liquefaction deformations are possible:

1. Horizontal shear deformation arising from the large shearing strains occurring in zones where the earthquake has induced initial liquefaction.

2. Settlements arising from volume changes that occur on reconsolidation accompanying dissipation of the large excess pore pressures in liquefied zones.

In general, strata meeting the following criteria are typically not susceptible to liquefaction and can be eliminated from the screening:

- Soil with fines content (percent passing through No. 200 sieve) more than 35 percent
- Soils classified as Marine and Lacustrine Silt and Clay
- Layers with SPT-N values greater than 30 blows per foot
- Unsaturated soils above the groundwater table

The conditions at the project site satisfy the above screening criteria, and are not susceptible to liquefaction.

8.0 LIMITATIONS OF REPORT

The conclusions and recommendations contained in this report are based upon the subsurface data obtained during this investigation and on details stated in this report. The validity of the conclusions and recommendations contained in this report are necessarily limited by, among other things, the scope of field investigation and by the number of borings. Therefore, given the nature of this subsurface study, there is a possibility that actual conditions encountered will differ from those discussed in this report. Should conditions arise which differ from those described in this report, HNTB should be notified immediately and provided with all information when available regarding subsurface conditions.

As part of the geotechnical recommendations presented in this report, HNTB makes no warranty as to the absence or presence of any environmental hazard or waste present on any property evaluated hereunder and all reports generated here to are qualified as being based upon existing data reasonably available to HNTB and not subject to independent verification. HNTB is not responsible for any latent defects that could not be reasonably discovered during the performance of its services and makes no legal representations whatsoever concerning any matter, including but not limited to, the ownership of any property or the interpretation of any law. These limitations form a material part of this report and are considered incorporated by reference therein. No warranty for the contents of this report, neither expressed nor implied, is made except that professional services were performed in accordance with generally accepted principles and practices.

9.0 REFERENCES

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FIGURES

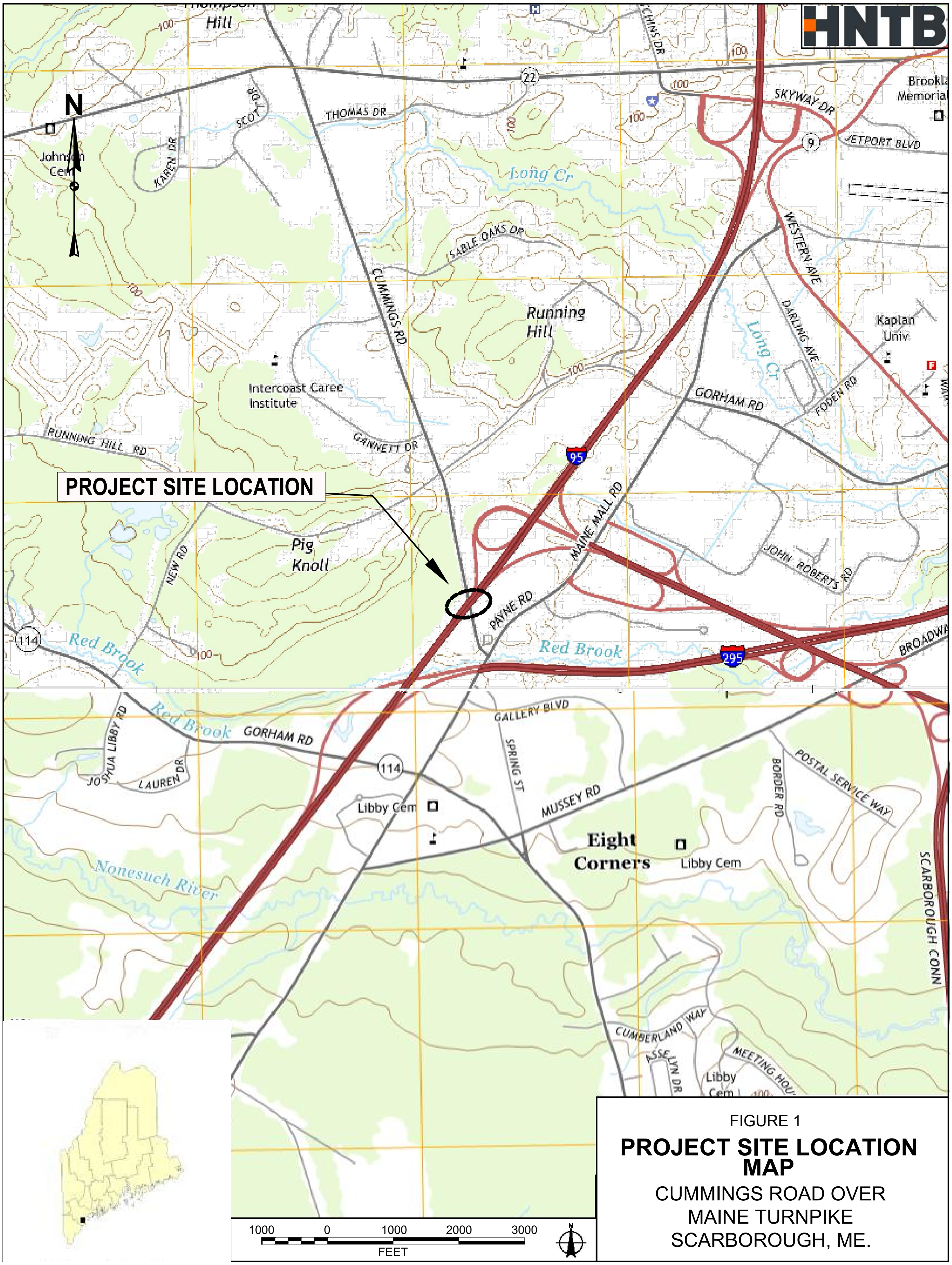


FIGURE 1

PROJECT SITE LOCATION MAP

CUMMINGS ROAD OVER
MAINE TURNPIKE
SCARBOROUGH, ME.

Basemap: U.S.G.S. Portland West Quadrangle, US Topo, 2014

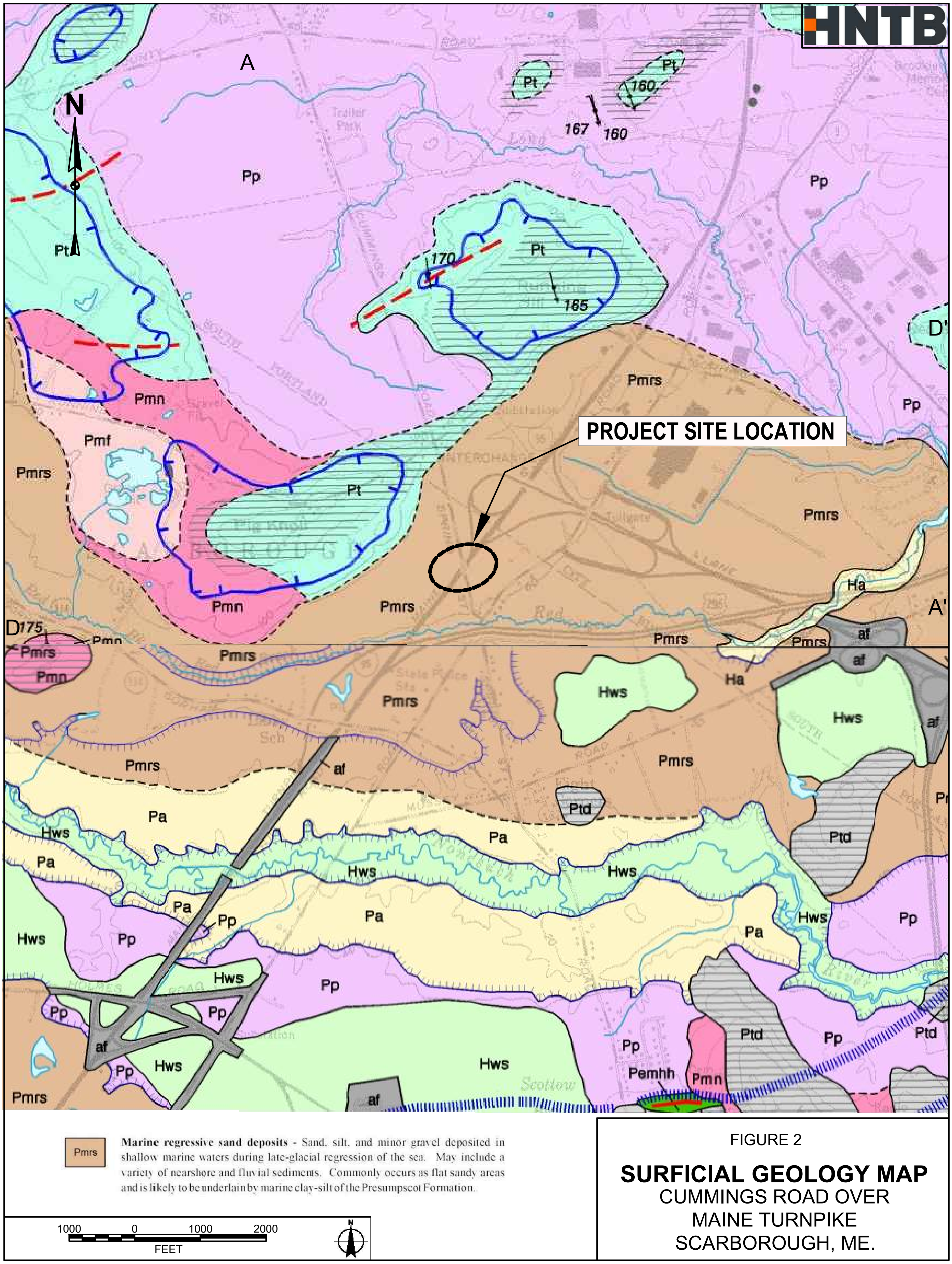
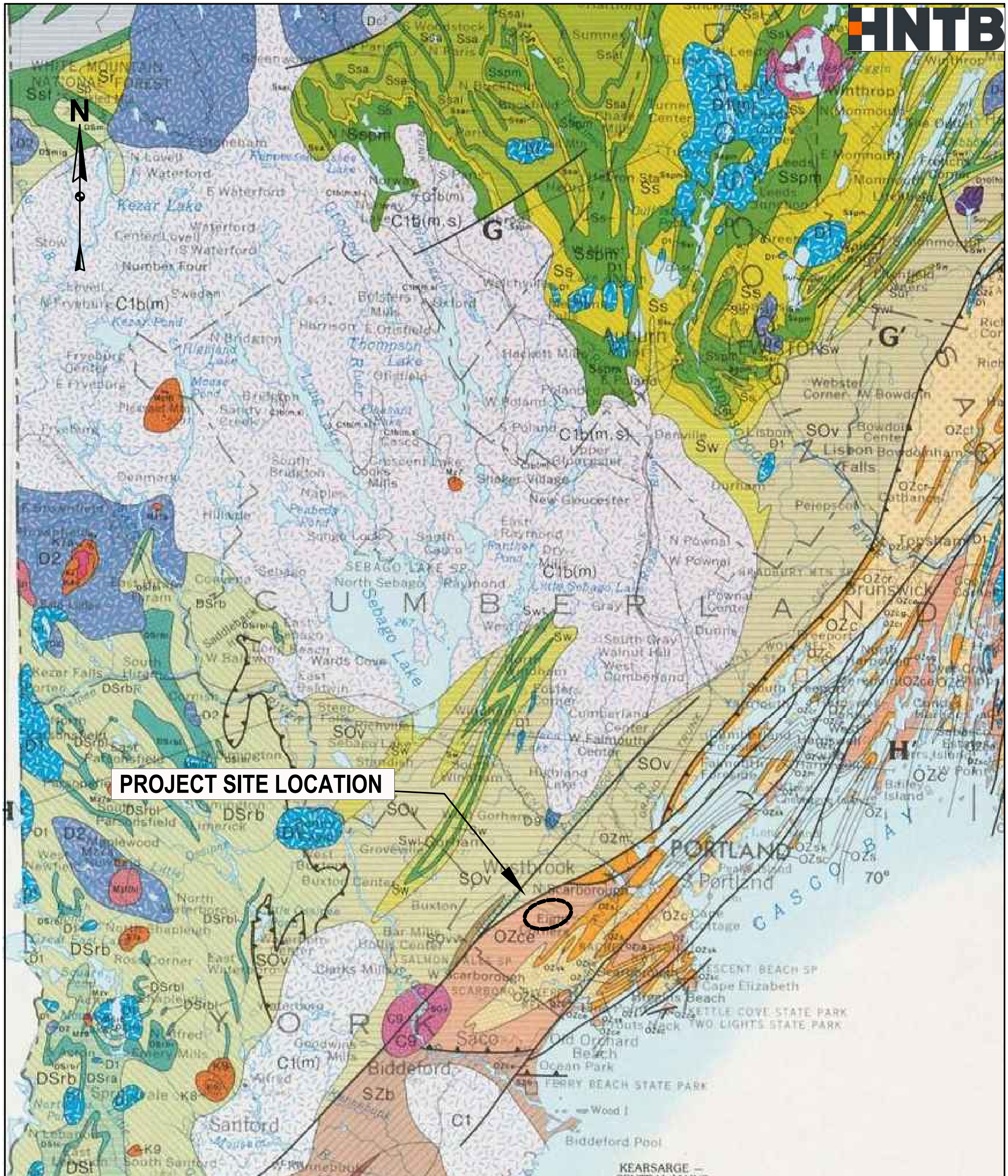


FIGURE 2

SURFICIAL GEOLOGY MAP

CUMMINGS ROAD OVER
MAINE TURNPIKE
SCARBOROUGH, ME.

Basemap: MEGS Surficial Geologic Map, West Portland Quadrangle, 2008; Prouts Neck Quadrangle, 1999



OZce – Cape Elizabeth formation - Named as a formation in Casco Bay group. Consists of an assemblage of mostly thin-bedded, light-gray, siliceous and sericitic slates; and heavier beds of graywacke slate, schist, and quartzite containing, at short intervals, thin layers or laminae of black, micaceous phyllite and light-bluish calcareous schist or slate. Thickness about 600 ft. Underlies Spring Point greenstone; overlies Kittery quartzite.

1000 0 1000 2000

FEET

N

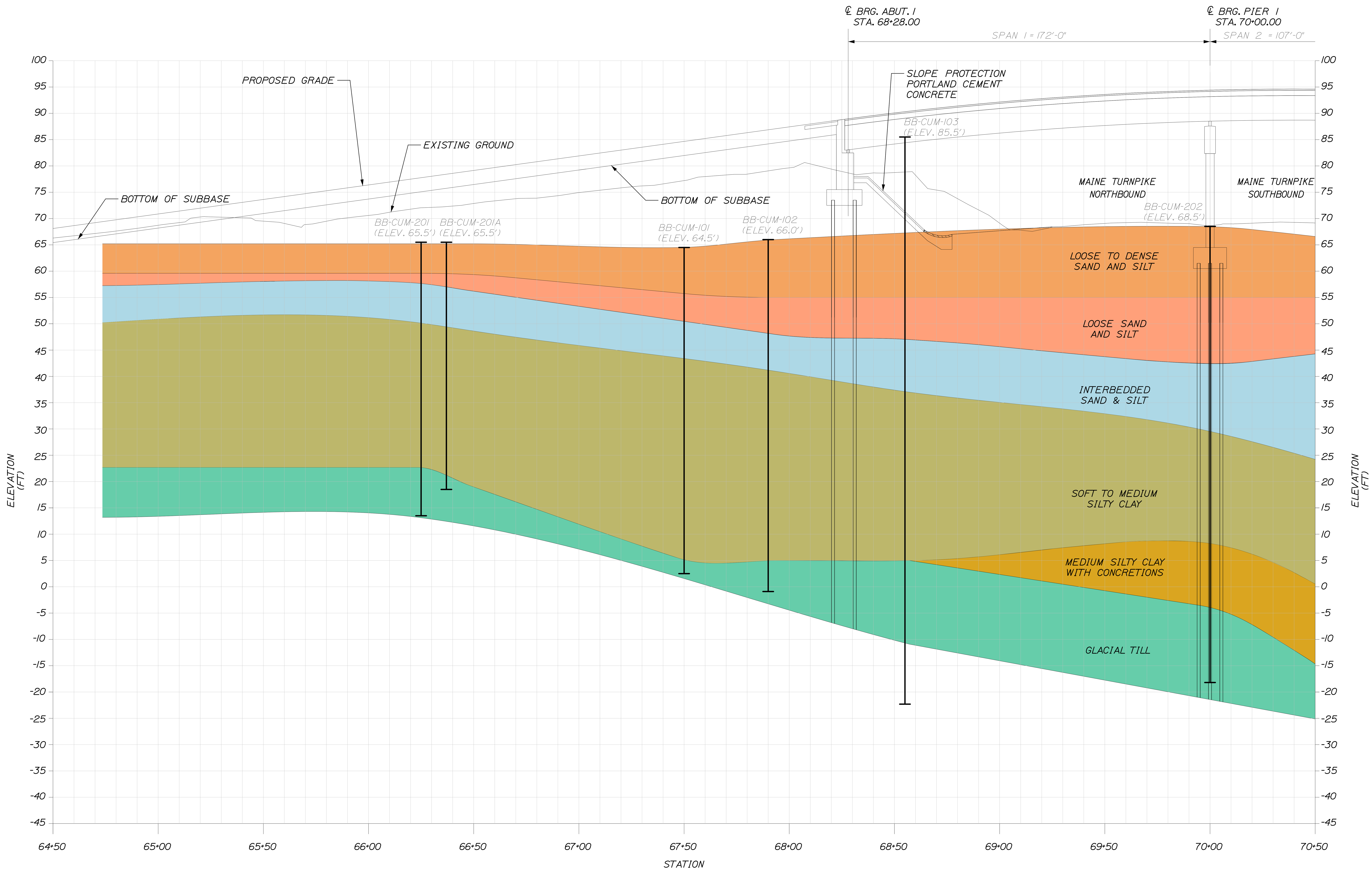
FIGURE 3

BEDROCK GEOLOGY MAP

CUMMINGS ROAD OVER
MAINE TURNPIKE
SCARBOROUGH, ME.

Basemap: MEGS Bedrock Geologic Map, Portland West Quadrangle, 1985

Date:9/20/2018



Horiz 25 0 25 50

Vert 10 0 10 20

Scale of Feet

NOTE:

This generalized interpretive soil profile is intended to convey trends in subsurface conditions. The boundaries between strata are approximate and idealized, and have been developed by interpretations of widely spaced explorations and samples. Actual soil transitions may vary and are probably more erratic. For more specific information refer to the exploration logs.

FIGURE 4A

Scale:

No.	Revision	By	Date

Designed by:

HNTB

CONSULTANT PROJECT MANAGER: Tim Cote, P.E.

	By	Date		By	Date
Designed			Checked		
Drawn			In Charge of	RAL	

HNTB CORPORATION
340 County Road, Suite 6-C
Westbrook, ME 04092
TEL (207) 774-5155
FAX (207) 228-0909

MAINE TURNPIKE

THE GOLD STAR MEMORIAL HIGHWAY

MTA PROJECT MANAGER: Ralph C. Norwood, IV, P.E., P.T.O.E.

BRIDGE REPLACEMENT
CUMMINGS ROAD UNDERPASS

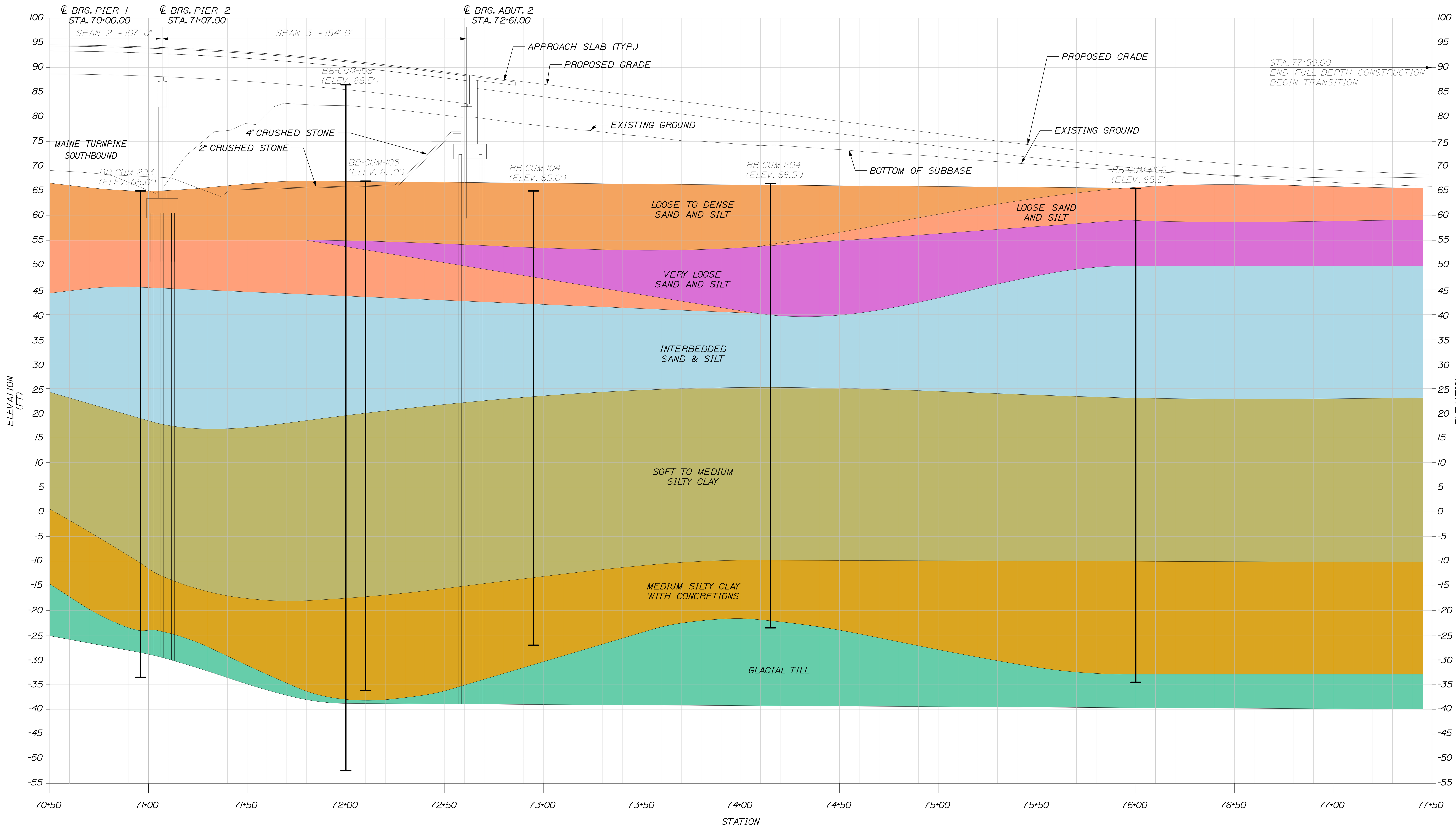
INTERPRETIVE SUBSURFACE PROFILE 1

SHEET NUMBER:

CONTRACT:

1 OF 2

Filename: z_Interpretive Subsurface Profile - PDT.dgn



Horiz 25 0 25 50
Vert 10 0 10 20
Scale of Feet

NOTE:

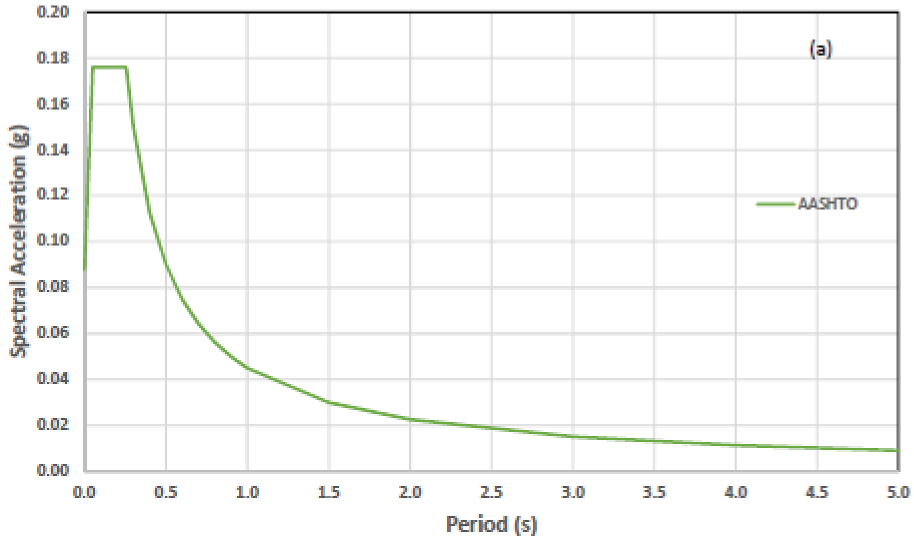
This generalized interpretive soil profile is intended to convey trends in subsurface conditions. The boundaries between strata are approximate and idealized, and have been developed by interpretations of widely spaced explorations and samples. Actual soil transitions may vary and are probably more erratic. For more specific information refer to the exploration logs.

FIGURE 4B

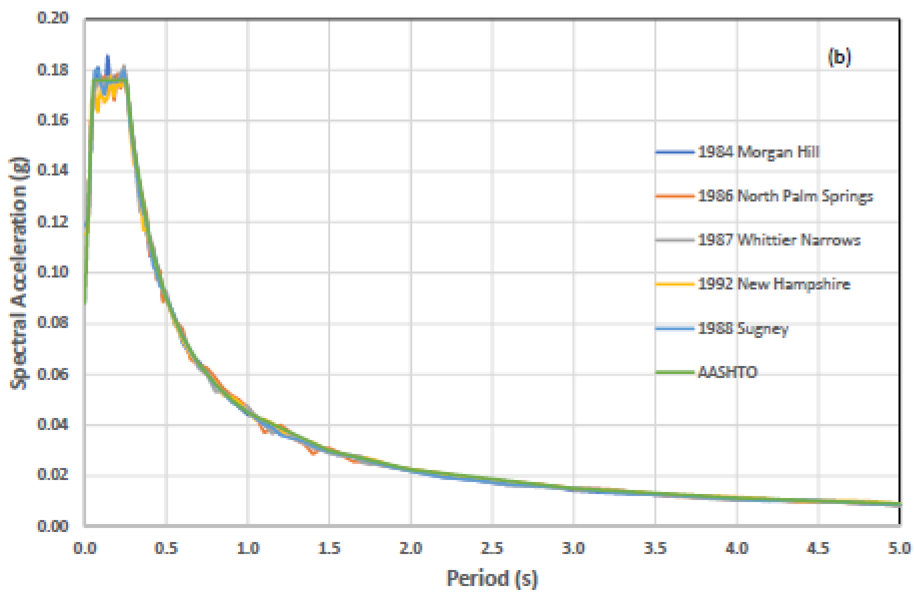
Scale:	Designed by:	HNTB CORPORATION	THE GOLD STAR MEMORIAL HIGHWAY	BRIDGE REPLACEMENT CUMMINGS ROAD UNDERPASS
No. / Revision / By / Date	CONSULTANT PROJECT MANAGER: Tim Cote, P.E.	340 County Road, Suite 6-C Westbrook, ME 04092 TEL (207) 774-5155 FAX (207) 228-0909	MAINE TURNPIKE	INTERPRETIVE SUBSURFACE PROFILE 2
	Designed / By / Date / Checked / By / Date			SHEET NUMBER:
	Drawn / In Charge of RAL		MTA PROJECT MANAGER: Ralph C. Norwood, IV, P.E., P.T.O.E.	CONTRACT: 2 OF 2

Date: 9/20/2018

Filename: z_Interpretive Subsurface Profile - PDT.dgn



(a) Target Spectrum



(b) Spectrum of Input Motions

FIGURE 5

Response Spectrum of Input Motions

CUMMINGS ROAD OVER MAINE TURNPIKE
SCARBOROUGH, ME

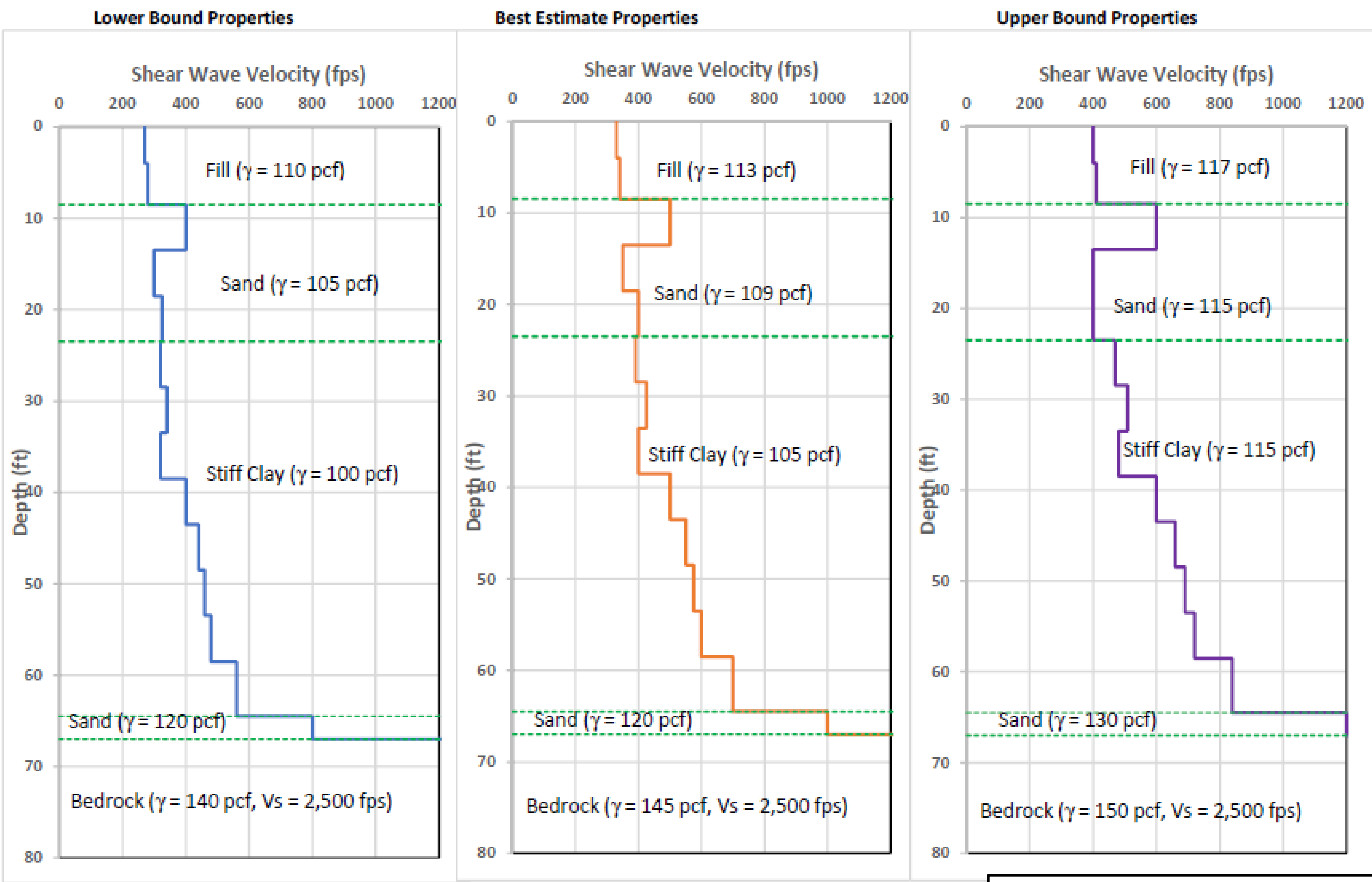


FIGURE 6

Shear Wave Velocity Profiles

CUMMINGS ROAD OVER MAINE TURNPIKE
SCARBOROUGH, ME

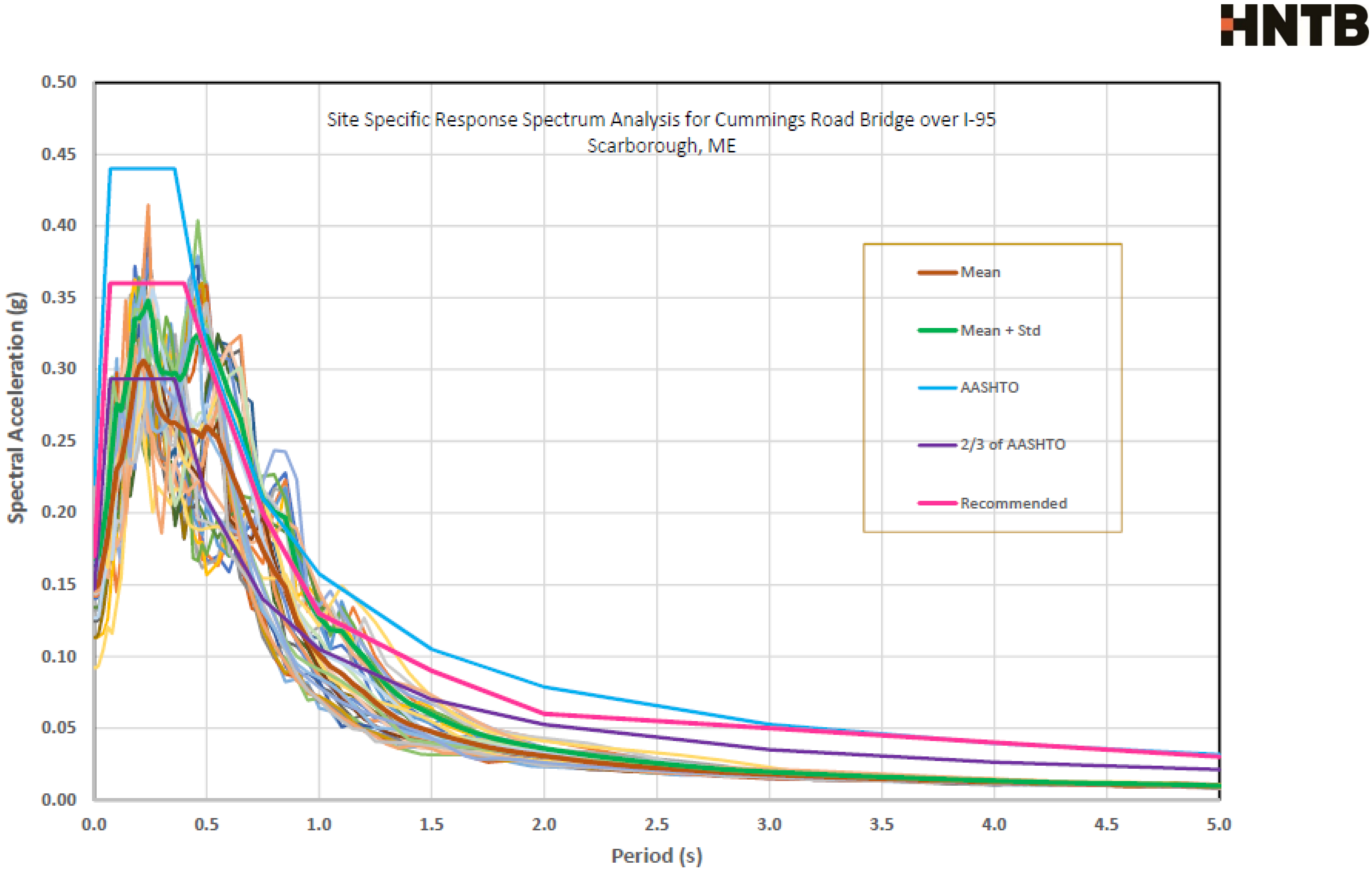


FIGURE 7

Site Specific Response Spectrum

CUMMINGS ROAD OVER MAINE TURNPIKE
SCARBOROUGH, ME

ATTACHMENTS

ATTACHMENT 1

Geotechnical Data Reports

SCHONEWALD
ENGINEERING
ASSOCIATES, INC.
■ www.SchonewaldEngineering.com ■

FIELD AND LABORATORY DATA REPORT
PRELIMINARY GEOTECHNICAL PROGRAM
BRIDGE REPLACEMENT
CUMMINGS ROAD OVER THE MAINE TURNPIKE
SCARBOROUGH, MAINE

PREPARED FOR:

HNTB Corporation
Westbrook, Maine

PREPARED BY:

Isabel V. (Be) Schonewald, P.E.
Schonewald Engineering Associates, Inc. (SchonewaldEA)
129 Middle Road
Cumberland, Maine 04021
Be@SchonewaldEngineering.com

October 13, 2017

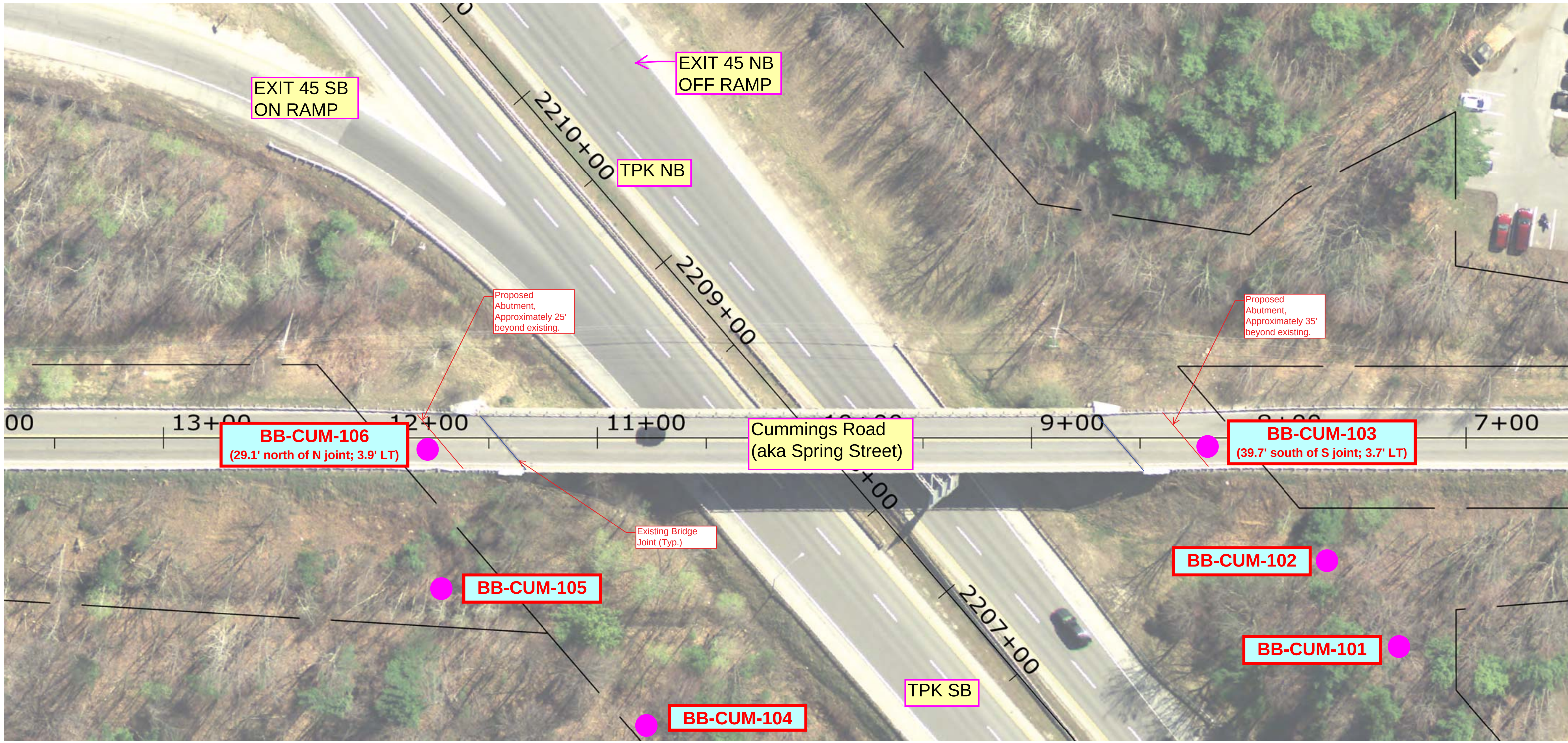
SchonewaldEA Project No. 17-013

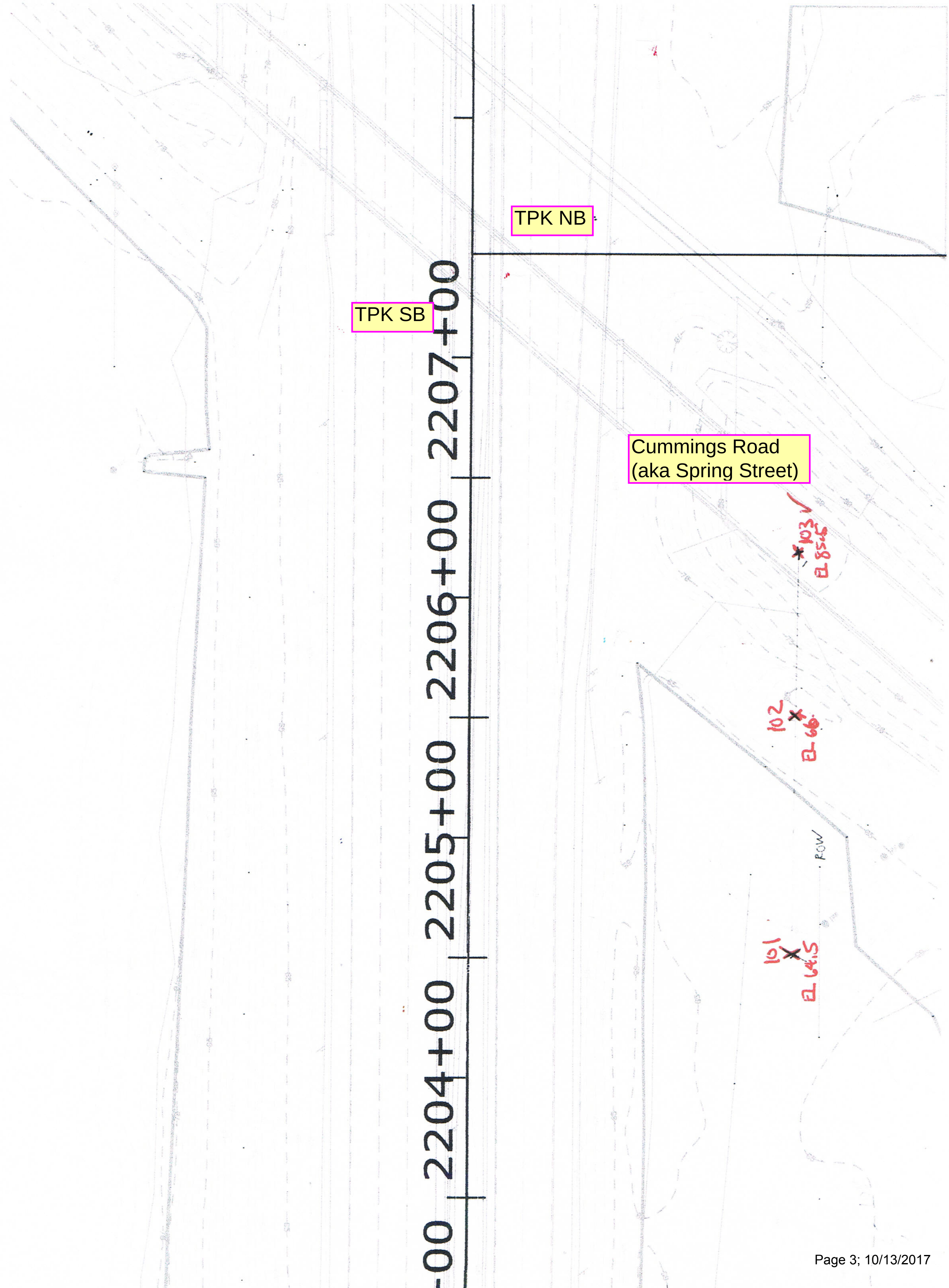
SCHONEWALD ENGINEERING ASSOCIATES, INC.
www.SchonewaldEngineering.com

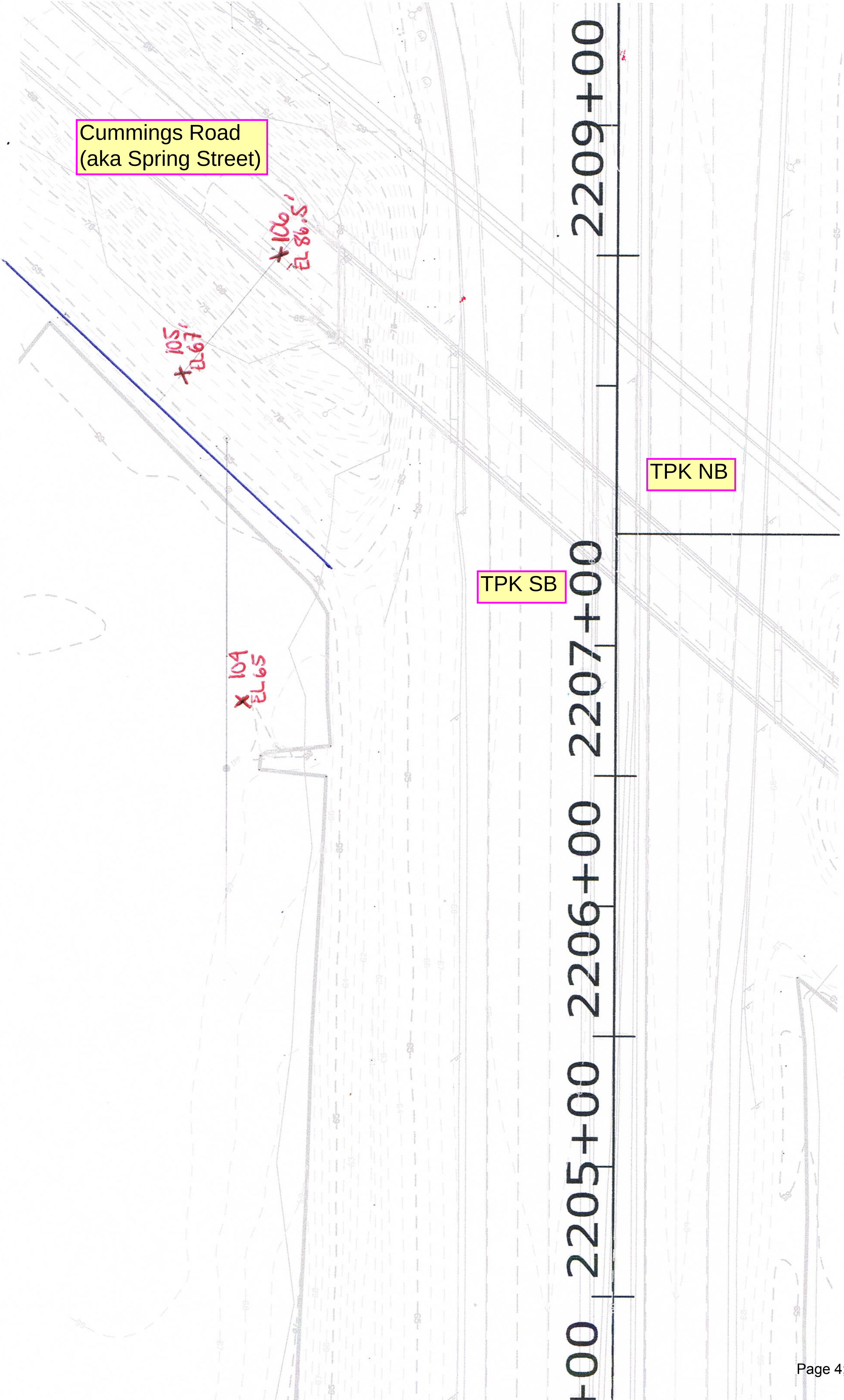
FIELD AND LABORATORY DATA REPORT
PRELIMINARY GEOTECHNICAL PROGRAM
BRIDGE REPLACEMENT
CUMMINGS ROAD OVER THE MAINE TURNPIKE
SCARBOROUGH, MAINE

TABLE OF CONTENTS

SUBSURFACE EXPLORATION LOCATION SKETCH


EXIT 45 SB
ON RAMP
EXIT 45 NB
OFF RAMP
2210+00
TPK NB
2209+00
Proposed Abutment, Approximately 25' beyond existing.
Proposed Abutment, Approximately 35' beyond existing.
13+00
12+00
11+00
9+00
8+00
7+00
BB-CUM-106
(29.1' north of N joint; 3.9' LT)
Cummings Road
(aka Spring Street)
BB-CUM-103
(39.7' south of S joint; 3.7' LT)
Existing Bridge Joint (Typ.)
BB-CUM-102
BB-CUM-105
2207+00
BB-CUM-101
TPK SB
BB-CUM-104


TPK NB
TPK SB
Cummings Road
(aka Spring Street)
2207+00
2206+00
2205+00
2204+00
103
102
101
EL 64.5
ROW



Cummings Road
(aka Spring Street)
106 EL 86.5'
105 EL 67'
104 EL 65
TPK NB
TPK SB
2209+00
2207+00
2206+00
2205+00
+00

SCHONEWALD ENGINEERING ASSOCIATES, INC.
■ www.SchonewaldEngineering.com ■

LOGS OF PRELIMINARY SUBSURFACE EXPLORATIONS

SCHONEWALD ENGINEERING ASSOCIATES, INC.

PROJECT: Cummings Road Bridge over MeTPK

LOCATION: Scarborough, Maine

Boring No.: BB-CUM-101

Proj. No.: 17-013

Driller:	New England Boring Contractors	**Elevation (ft.)**	64.5 ft (est'd)	**Core Barrel:**	
Operator:	Enos / Share	**Datum:**	NAVD88	**Sampler:**	std. split-spoon
Logged By:	Schonewald	**Rig Type:**	Mobile Drill B-53 (rubber track)	**Hammer Wt./Fall:**	140 lbs/30 in (auto hammer)
Date Start/Finish:	6/28/17; 0700 - 1440	**Drilling Method:**	cased wash boring	**Hammer Type:**	auto
Boring Location:	see sketch	**Casing ID/OD:**	HW to 60.0'	**Hammer Efficiency:**	0.677
		Auger ID/OD:	SSA to 5'	**Water Level*:**	3.0 ft. (open)

IN-SITU SAMPLING AND TESTING:
D = Split Spoon Sample
MD = Unsuccessful Split Spoon Sample attempt
U = Thin Wall Tube Sample
MU = Unsuccessful Thin Wall Tube Sample attempt
V = Insitu Vane Shear Test
MV = Unsuccessful Insitu Vane Shear Test attempt

ADDITIONAL DEFINITIONS:
N-uncorrected = N value
N_{60} = N value corrected for hammer efficiency
hammer efficiency = calculated hammer efficiency
S_u = Insitu Field Vane Shear Strength (psf)
R = Rock Core Sample
RQD = Rock Quality Designation (%)

ADDITIONAL DEFINITIONS:
WOH = weight of 140lb. hammer
WOR = weight of rods
-- = not recorded

BOREHOLE ADVANCEMENT METHODS:
SSA/HSA=solid/hollow stem auger
RC=roller cone/OPEN/PUSH=hydraulic push

LABORATORY TEST RESULTS:
AASHTO / USCS soil classifications
-#200 = percent fines WC = water content (%)
CONSOL= 1-D consolidation test
UU=Unconsolidated undrained triaxial test
LL=Liquid Limit / PL=Plastic Limit / PI=Plasticity Index
UCT qp = peak compressive strength of rock

Depth (ft.)	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-uncorrected	N-60	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Lab. Testing Results
0							SSA				
	1D	24/19	2.0 - 4.0	4-3-6-6	9	10.155				Red-brown, moist to wet, fine to coarse SAND, trace Gravel, trace Silt; changing at 3.0 ft to: 1D: Red-tan, fine to coarse SAND, trace Silt grading at 3.5 ft to grey-tan, fine to medium SAND, trace to little Silt.	
								61.0		3.5	
5	2D	24/24	5.0 - 7.0	3-1-7-13	8	9.02667	17			Grey-tan, wet, fine to medium SAND, trace to little Silt, trace fine Gravel; changing at 6.7 ft to:	
							20	57.8		6.7	
							50			2D: Grey, interbedded fine to medium SAND, trace to little Silt and fine Sandy SILT.	
							34				
							26				
10	3D	24/15	10.0 - 12.0	WOR-WOH-2-4	2	2.25667	14			3D: Grey, v. loose, interbedded, Silty fine SAND; fine Sandy SILT; and Silty CLAY, trace fine Sand.	
							26				
							45				
							30				
							32				
15	4D	24/24	15.0 - 17.0	1/24"	0	0	22			4D: Grey, v. soft, interbedded Silty CLAY, trace fine Sand; fine Sandy SILT; and Silty fine SAND.	A-4(0) ML WC=39.3% -#200=96.6% non-plastic
							12				
							11				
							10				
							12				
20	5D	24/0	20.0 - 22.0	1/24"	0	0	15			5D: No recovery. Several attempts to grab sample unsuccessful.	
							14				
							13				
							15	41.0		23.5	
							14				
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.

PROJECT: Cummings Road Bridge over MeTPK		**Boring No.:**	BB-CUM-101
LOCATION: Scarborough, Maine		**Proj. No.:**	17-013

Driller:	New England Boring Contractors	**Elevation (ft.)**	64.5 ft (est'd)	**Core Barrel:**	
Operator:	Enos / Share	**Datum:**	NAVD88	**Sampler:**	std. split-spoon
Logged By:	Schonewald	**Rig Type:**	Mobile Drill B-53 (rubber track)	**Hammer Wt./Fall:**	140 lbs/30 in (auto hammer)
Date Start/Finish:	6/28/17; 0700 - 1440	**Drilling Method:**	cased wash boring	**Hammer Type:**	auto
Boring Location:	see sketch	**Casing ID/OD:**	HW to 60.0'	**Hammer Efficiency:**	0.677
		Auger ID/OD:	SSA to 5'	**Water Level*:**	3.0 ft. (open)

IN-SITU SAMPLING AND TESTING:
D = Split Spoon Sample
MD = Unsuccessful Split Spoon Sample attempt
U = Thin Wall Tube Sample
MU = Unsuccessful Thin Wall Tube Sample attempt
V = Insitu Vane Shear Test
MV = Unsuccessful Insitu Vane Shear Test attempt

ADDITIONAL DEFINITIONS:
N-uncorrected = N value
N_{60} = N value corrected for hammer efficiency
hammer efficiency = calculated hammer efficiency
S_u = Insitu Field Vane Shear Strength (psf)
R = Rock Core Sample
RQD = Rock Quality Designation (%)

ADDITIONAL DEFINITIONS:
WOH = weight of 140lb. hammer
WOR = weight of rods
-- = not recorded

BOREHOLE ADVANCEMENT METHODS:
SSA/HSA=solid/hollow stem auger
RC=roller cone/OPEN/PUSH=hydraulic push

LABORATORY TEST RESULTS:
AASHTO / USCS soil classifications
-#200 = percent fines   WC = water content (%)
CONSOL= 1-D consolidation test
UU=Unconsolidated undrained triaxial test
LL=Liquid Limit / PL=Plastic Limit / PI=Plasticity Index
UCT qp = peak compressive strength of rock

Depth (ft.)	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-uncorrected	N-60	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Lab. Testing Results
25	6D V1	24/24	25.0 - 27.0 25.6 - 26.0	VANE INTERVAL Su= 302 / 14 psf			15			6D: Grey, Silty CLAY, with numerous partings and seams of fine Sandy SILT. V1: Tu=11 / Tr=0.5 ft-lbs (65 mm x 130 mm vane)	
	V2		26.6 - 27.0	Su= 385 / 27 psf			12			V2: Tu=14 / Tr=1 ft-lbs (65 mm x 130 mm vane)	
							12				
							15				
							16				
30	U1	24/21	30.0 - 32.0	HYD PUSH			16			U1: Dark grey with black streaks, Silty CLAY.	
							16				
							15				
							17				
							17				
35	7D V3	24/24	35.0 - 37.0 35.6 - 36.0	VANE INTERVAL Su= 343 / 14 psf			15			7D: Dark grey with black streaks, Silty CLAY. V3: Tu=12.5 / Tr=0.5 ft-lbs (65 mm x 130 mm vane)	
	V4		36.6 - 37.0	Su= 467 / 14 psf			12			V4: Tu=17 / Tr=0.5 ft-lbs (65 mm x 130 mm vane)	
							12				
							10				
							10				
40	U2	24/21	40.0 - 42.0	HYD PUSH			10			U2: Dark grey with black streaks, Silty CLAY with shell fragments.	CONSOL WC=48.2% LL=42.8 PL=25.4 PI=17.4
							6				
							9				
							9				
							9				
45	8D V5	24/20	45.0 - 47.0 45.6 - 46.0	VANE INTERVAL Su= 618 / 14 psf			12			8D: Dark grey with black streaks, Silty CLAY with soft concretions throughout. V5: Tu=22.5 / Tr=0.5 ft-lbs (65 mm x 130 mm vane)	WC=43.4% LL=35.4 PL=22.6 PI=12.8
	V6		46.6 - 47.0	Su= 522 / 14 psf			9			V6: Tu=19 / Tr=0.5 ft-lbs (65 mm x 130 mm vane)	
							10				
							10				
50							9				

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.

SCHONEWALD ENGINEERING ASSOCIATES, INC.

PROJECT: Cummings Road Bridge over MeTPK

LOCATION: Scarborough, Maine

Boring No.: BB-CUM-101

Proj. No.: 17-013

Driller:	New England Boring Contractors	**Elevation (ft.)**	64.5 ft (est'd)	**Core Barrel:**	
Operator:	Enos / Share	**Datum:**	NAVD88	**Sampler:**	std. split-spoon
Logged By:	Schonewald	**Rig Type:**	Mobile Drill B-53 (rubber track)	**Hammer Wt./Fall:**	140 lbs/30 in (auto hammer)
Date Start/Finish:	6/28/17; 0700 - 1440	**Drilling Method:**	cased wash boring	**Hammer Type:**	auto
Boring Location:	see sketch	**Casing ID/OD:**	HW to 60.0'	**Hammer Efficiency:**	0.677
		Auger ID/OD:	SSA to 5'	**Water Level*:**	3.0 ft. (open)

IN-SITU SAMPLING AND TESTING:
D = Split Spoon Sample
MD = Unsuccessful Split Spoon Sample attempt
U = Thin Wall Tube Sample
MU = Unsuccessful Thin Wall Tube Sample attempt
V = Insitu Vane Shear Test
MV = Unsuccessful Insitu Vane Shear Test attempt

ADDITIONAL DEFINITIONS:
N-uncorrected = N value
N_{60} = N value corrected for hammer efficiency
hammer efficiency = calculated hammer efficiency
S_u = Insitu Field Vane Shear Strength (psf)
R = Rock Core Sample
RQD = Rock Quality Designation (%)

ADDITIONAL DEFINITIONS:
WOH = weight of 140lb. hammer
WOR = weight of rods
-- = not recorded
BOREHOLE ADVANCEMENT METHODS:
SSA/HSA=solid/hollow stem auger
RC=roller cone/OPEN/PUSH=hydraulic push

LABORATORY TEST RESULTS:
AASHTO / USCS soil classifications
-#200 = percent fines WC = water content (%)
CONSOL= 1-D consolidation test
UU=Unconsolidated undrained triaxial test
LL=Liquid Limit / PL=Plastic Limit / PI=Plasticity Index
UCT qp = peak compressive strength of rock

Depth (ft.)	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-uncorrected	N-60	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Lab. Testing Results
50	U3	24/19	50.0 - 52.0	HYD PUSH			16			U3: Black, Silty CLAY.	
							13				
	V7		52.6 - 53.0	Su= 618 / 41 psf			13			V7: Tu=22.5 / Tr=1.5 ft-lbs (65 mm x 130 mm vane)	
	V8		53.6 - 54.0	Su= 604 / 14 psf			15			V8: Tu=22 / Tr=0.5 ft-lbs (65 mm x 130 mm vane)	
							13				
55	U4	24/23	55.0 - 57.0	HYD PUSH			14			U4: Dark grey, Silty CLAY.	
							9				
							10				
							11	5.5		59.0	
							11			59 ft: Gravel in wash water.	
60	9D	24/9	60.0 - 62.0	3-6-8-7	14	15.7967				9D: Dark grey, Silty GRAVEL, some fine to coarse Sand. TILL	
								2.5		62.0	
										Bottom of Exploration at 62.0 feet below ground surface. No refusal.	
65											
70											
75											

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.

Schonewald Engineering Associates, Inc.

PROJECT: Cummings Road Bridge over MeTPK

LOCATION: Scarborough, Maine

Boring No.: BB-CUM-102

Proj. No.: 17-013

Driller:	New England Boring Contractors	**Elevation (ft.)**	66 ft (est'd)	**Core Barrel:**	
Operator:	Enos / Share	**Datum:**	NAVD88	**Sampler:**	std. split-spoon
Logged By:	Schonewald	**Rig Type:**	Mobile Drill B-53 (rubber track)	**Hammer Wt./Fall:**	140 lbs/30 in (auto hammer)
Date Start/Finish:	6/27/17; 0645 - 1445	**Drilling Method:**	cased wash boring	**Hammer Type:**	auto
Boring Location:	see sketch	**Casing ID/OD:**	HW to 65.0'	**Hammer Efficiency:**	0.677
		Auger ID/OD:	SSA to 5'	**Water Level*:**	4.0 ft. (open)

IN-SITU SAMPLING AND TESTING:
D = Split Spoon Sample
MD = Unsuccessful Split Spoon Sample attempt
U = Thin Wall Tube Sample
MU = Unsuccessful Thin Wall Tube Sample attempt
V = Insitu Vane Shear Test
MV = Unsuccessful Insitu Vane Shear Test attempt

ADDITIONAL DEFINITIONS:
N-uncorrected = N value
N_{60} = N value corrected for hammer efficiency
hammer efficiency = calculated hammer efficiency
S_u = Insitu Field Vane Shear Strength (psf)
R = Rock Core Sample
RQD = Rock Quality Designation (%)

ADDITIONAL DEFINITIONS:
WOH = weight of 140lb. hammer
WOR = weight of rods
-- = not recorded
BOREHOLE ADVANCEMENT METHODS:
SSA/HSA=solid/hollow stem auger
RC=roller cone/OPEN/PUSH=hydraulic push

LABORATORY TEST RESULTS:
AASHTO / USCS soil classifications
-#200 = percent fines WC = water content (%)
CONSOL= 1-D consolidation test
UU=Unconsolidated undrained triaxial test
LL=Liquid Limit / PL=Plastic Limit / PI=Plasticity Index
UCT qp = peak compressive strength of rock

Depth (ft.)	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-uncorrected	N-60	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Lab. Testing Results
0							SSA				
	1D	24/14	2.0 - 4.0	3-2-4-5	6	6.77				Tan, damp to moist, loose, fine to coarse SAND, little to some Gravel, trace to little Silt; changing at 3.4 ft to:	
								62.6		3.4 — 1D: Red brown, fine to medium SAND, trace Silt, trace Gravel, trace coarse Sand; minor organics (roots) at 3.4 ft.	A-1-b, SP-SM WC=17.2% -#200=6.4%
5	2D	24/16	5.0 - 7.0	5-6-6-7	12	13.54	115			Red tan, wet, fine to coarse SAND, trace Gravel, trace Silt; changing at 6. 0 ft to:	
							67	60.0		6.0 — 2D: Grey tan, wet, fine to medium SAND, trace to little Silt, with one 2-inch layer fine Sandy SILT in bottom of sample.	
							35	59.2		6.8	
							32				
							29				
10	3D	24/12	10.0 - 12.0	5-5-9-7	14	15.7967	47			3D: Grey, medium dense, interbedded fine SAND, little Silt; fine to medium SAND, trace SIlt; and fine Sandy SILT.	
							48				
							56				
							52				
							66				
15	4D	24/9	15.0 - 17.0	3-2-3-2	5	5.64167	53			4D: Grey, loose, fine to medium SAND, trace Silt.	
							45				
							38				
							46				
							49				
20	5D V1	24/19	20.0 - 22.0 20.6 - 21.0	VANE INTERVAL Su= 467 / 41 psf			49			5D: Grey, interbedded, fine Sandy SILT; Silty CLAY, trace fine Sand; and fine SAND, some Silt. V1: Tu=17 / Tr=1.5 ft-lbs (65 mm x 130 mm vane); sand lenses apparent. MV: Unable to push vane past 21.8 ft.	
	MV		21.6 - 21.8				33				
							45				
							40				
25							48				

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.

SCHONEWALD ENGINEERING ASSOCIATES, INC.	**PROJECT:** Cummings Road Bridge over MeTPK **LOCATION:** Scarborough, Maine	**Boring No.:** BB-CUM-102 **Proj. No.:** 17-013

Driller:	New England Boring Contractors	**Elevation (ft.)**	66 ft (est'd)	**Core Barrel:**	
Operator:	Enos / Share	**Datum:**	NAVD88	**Sampler:**	std. split-spoon
Logged By:	Schonewald	**Rig Type:**	Mobile Drill B-53 (rubber track)	**Hammer Wt./Fall:**	140 lbs/30 in (auto hammer)
Date Start/Finish:	6/27/17; 0645 - 1445	**Drilling Method:**	cased wash boring	**Hammer Type:**	auto
Boring Location:	see sketch	**Casing ID/OD:**	HW to 65.0'	**Hammer Efficiency:**	0.677
		Auger ID/OD:	SSA to 5'	**Water Level*:**	4.0 ft. (open)

IN-SITU SAMPLING AND TESTING:
D = Split Spoon Sample
MD = Unsuccessful Split Spoon Sample attempt
U = Thin Wall Tube Sample
MU = Unsuccessful Thin Wall Tube Sample attempt
V = Insitu Vane Shear Test
MV = Unsuccessful Insitu Vane Shear Test attempt

ADDITIONAL DEFINITIONS:
N-uncorrected = N value
N_{60} = N value corrected for hammer efficiency
hammer efficiency = calculated hammer efficiency
S_u = Insitu Field Vane Shear Strength (psf)
R = Rock Core Sample
RQD = Rock Quality Designation (%)

ADDITIONAL DEFINITIONS:
WOH = weight of 140lb. hammer
WOR = weight of rods
-- = not recorded
BOREHOLE ADVANCEMENT METHODS:
SSA/HSA=solid/hollow stem auger
RC=roller cone/OPEN/PUSH=hydraulic push

LABORATORY TEST RESULTS:
AASHTO / USCS soil classifications
-#200 = percent fines WC = water content (%)
CONSOL= 1-D consolidation test
UU=Unconsolidated undrained triaxial test
LL=Liquid Limit / PL=Plastic Limit / PI=Plasticity Index
UCT qp = peak compressive strength of rock

Depth (ft.)	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-uncorrected	N-60	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Lab. Testing Results
25	6D	24/24	25.0 - 27.0	WOR/24"	0	0	45			6D: Grey, v. soft, Silty CLAY, with one 1-inch and one 1/4-inch seams fine Sandy SILT near top of sample.	
							33	40.0		26.0	
							32				
							31				
							35				
30	U1	24/24	30.0 - 32.0	HYD PUSH			37			U1: Grey, Silty CLAY.	CONSOL UU WC=42.6% LL=35.0 PL=23.8 PI=11.2
							41				
							45				
							50				
							53				
35	7D V2	24/14	35.0 - 37.0 35.6 - 36.0	VANE INTERVAL Su= 440 / 27 psf			49			7D: Dark grey with black streaks, Silty CLAY; strong organic odor. V2: Tu=16 / Tr=1 ft-lbs (65 mm x 130 mm vane)	WC=35.1% LL=34.7 PL=23.2 PI=11.5
	V3		36.6 - 37.0	Su= 481 / 27 psf			40			V3: Tu=17.5 / Tr=1 ft-lbs (65 mm x 130 mm vane)	
							41				
							44				
							47				
40	U2	24/18	40.0 - 42.0	HYD PUSH			46			U2: Dark grey, Silty CLAY.	
							39				
							36				
							42				
							45				
45	MD V4	24/0	45.0 - 47.0 45.6 - 46.0	VANE INTERVAL Su= 508 / 14 psf			37			MD: No recovery. V4: Tu=18.5 / Tr=0.5 ft-lbs (65 mm x 130 mm vane)	
	V5		46.6 - 47.0	Su= 536 / 14 psf			38			V5: Tu=19.5 / Tr=0.5 ft-lbs (65 mm x 130 mm vane)	
							40				
							46				
50							44				

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.

SCHONEWALD ENGINEERING ASSOCIATES, INC.	**PROJECT:** Cummings Road Bridge over MeTPK **LOCATION:** Scarborough, Maine	**Boring No.:** BB-CUM-102 **Proj. No.:** 17-013

Driller:	New England Boring Contractors	**Elevation (ft.)**	66 ft (est'd)	**Core Barrel:**	
Operator:	Enos / Share	**Datum:**	NAVD88	**Sampler:**	std. split-spoon
Logged By:	Schonewald	**Rig Type:**	Mobile Drill B-53 (rubber track)	**Hammer Wt./Fall:**	140 lbs/30 in (auto hammer)
Date Start/Finish:	6/27/17; 0645 - 1445	**Drilling Method:**	cased wash boring	**Hammer Type:**	auto
Boring Location:	see sketch	**Casing ID/OD:**	HW to 65.0'	**Hammer Efficiency:**	0.677
		Auger ID/OD:	SSA to 5'	**Water Level*:**	4.0 ft. (open)

IN-SITU SAMPLING AND TESTING:
D = Split Spoon Sample
MD = Unsuccessful Split Spoon Sample attempt
U = Thin Wall Tube Sample
MU = Unsuccessful Thin Wall Tube Sample attempt
V = Insitu Vane Shear Test
MV = Unsuccessful Insitu Vane Shear Test attempt

ADDITIONAL DEFINITIONS:
N-uncorrected = N value
N_{60} = N value corrected for hammer efficiency
hammer efficiency = calculated hammer efficiency
S_u = Insitu Field Vane Shear Strength (psf)
R = Rock Core Sample
RQD = Rock Quality Designation (%)

ADDITIONAL DEFINITIONS:
WOH = weight of 140lb. hammer
WOR = weight of rods
-- = not recorded

BOREHOLE ADVANCEMENT METHODS:
SSA/HSA=solid/hollow stem auger
RC=roller cone/OPEN/PUSH=hydraulic push

LABORATORY TEST RESULTS:
AASHTO / USCS soil classifications
-#200 = percent fines WC = water content (%)
CONSOL= 1-D consolidation test
UU=Unconsolidated undrained triaxial test
LL=Liquid Limit / PL=Plastic Limit / PI=Plasticity Index
UCT qp = peak compressive strength of rock

Depth (ft.)	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-uncorrected	N-60	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Lab. Testing Results
50	U3	24/20	50.0 - 52.0	HYD PUSH			41			U3: Dark grey with black streaks, Silty CLAY.	
							39				
	8D	24/20	52.0 - 54.0	WOR/24"	0	0	44			8D: Dark grey, v. soft, Silty CLAY, with soft concretions throughout and shell fragments.	
							44				
							52				
55	9D V6	24/13	55.0 - 57.0 55.6 - 56.0	VANE INTERVAL Su= 549 / 14 psf			52			9D: Dark grey, Silty CLAY. V6: Tu=20 / Tr=0.5 ft-lbs (65 mm x 130 mm vane)	WC=36.1% LL=33.6 PL=21.5 PI=12.1
	V7		56.6 - 57.0	Su= 604 / 27 psf			52			V7: Tu=22 / Tr=1 ft-lbs (65 mm x 130 mm vane)	
							46				
							50				
							55				
60	10D	24/20	60.0 - 62.0	WOR/12"-8-12	8	9.02667	50			Dark grey with black streaks, Silty CLAY, with soft concretions and Silty fine SAND partings throughout; changing at 61.3 ft to:	
							64	4.7		61.3 10D: Grey, fine to medium SAND, some Silt, little Gravel, trace coarse Sand. TILL	
							75				
							103				
							100				
65	11D	23/10	65.0 - 66.9	15-16-36-50/5"	52	58.6733				11D: Grey, v. dense, Silty GRAVEL, some fine to medium Sand, trace coarse Sand. TILL	
								-0.9		66.9 **Bottom of Exploration at 66.9 feet below ground surface.** No refusal.	
70											
75											

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.

SCHONEWALD ENGINEERING ASSOCIATES, INC.

PROJECT: Cummings Road Bridge over MeTPK

LOCATION: Scarborough, Maine

Boring No.: BB-CUM-103

Proj. No.: 17-013

Driller:	New England Boring Contractors	**Elevation (ft.)**	85.5 ft (est'd)	**Core Barrel:**	NQ2
Operator:	Enos / Share	**Datum:**	NAVD88	**Sampler:**	std. split-spoon
Logged By:	Schonewald	**Rig Type:**	Mobile Drill B-53 (rubber track)	**Hammer Wt./Fall:**	140 lbs/30 in (auto hammer)
Date Start/Finish:	6/14/17; 0045 - 6/16/17; 0245	**Drilling Method:**	cased wash boring	**Hammer Type:**	auto
Boring Location:	see remarks	**Casing ID/OD:**	HW to 55.0'; NW to 97.2'	**Hammer Efficiency:**	0.677
		Auger ID/OD:	SSA to 10'	**Water Level*:**	23.0 ft. (end, open)

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D = Split Spoon Sample
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ADDITIONAL DEFINITIONS:
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WOR = weight of rods
-- = not recorded

BOREHOLE ADVANCEMENT METHODS:
SSA/HSA=solid/hollow stem auger
RC=roller cone/OPEN/PUSH=hydraulic push

LABORATORY TEST RESULTS:
AASHTO / USCS soil classifications
-#200 = percent fines WC = water content (%)
CONSOL= 1-D consolidation test
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LL=Liquid Limit / PL=Plastic Limit / PI=Plasticity Index
UCT qp = peak compressive strength of rock

Depth (ft.)	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-uncorrected	N-60	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Lab. Testing Results
0							SSA	85.0		6" HMA	
										0.5	
	1D	24/16	1.0 - 3.0	20-21-24-32	45	50.775				1D: Light brown, dry, dense, Gravelly fine to coarse SAND, trace to little Silt.	
								81.5		4.0	
5	2D	24/19	5.0 - 7.0	18-33-37-37	70	78.9833				2D: Light brown, dry, v. dense, fine to medium SAND, little to some fine Gravel, trace to little Silt, trace coarse Sand.	
10	3D	24/19	10.0 - 12.0	15-29-53-69	82	92.5233	RC			3D: Light brown, dry to damp, v. dense, fine to medium SAND, little fine Gravel, trace to little Silt, trace coarse Sand.	
15	4D	24/14	15.0 - 17.0	24-32-35-22	67	75.5983	RC			4D: Light brown, damp, v. dense, fine to medium SAND, some Gravel, trace to little Silt, trace coarse Sand.	
20	5D	24/14	20.0 - 22.0	17-24-30-43	54	60.93	RC			5D: Light brown, damp to moist, v. dense, fine to medium SAND, little Gravel, trace Silt, trace coarse Sand.	
								61.5		24.0	
										24.0 ft: Possible stratum change; soil less tight.	
25											

Remarks:

LOCATION: 39.7 ft south of south bridge joint; offset 3.7 ft LT of existing centerline

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SCHONEWALD ENGINEERING ASSOCIATES, INC.	PROJECT: Cummings Road Bridge over MeTPK LOCATION: Scarborough, Maine	Boring No.: BB-CUM-103 Proj. No.: 17-013

Driller:	New England Boring Contractors	**Elevation (ft.)**	85.5 ft (est'd)	**Core Barrel:**	NQ2
Operator:	Enos / Share	**Datum:**	NAVD88	**Sampler:**	std. split-spoon
Logged By:	Schonewald	**Rig Type:**	Mobile Drill B-53 (rubber track)	**Hammer Wt./Fall:**	140 lbs/30 in (auto hammer)
Date Start/Finish:	6/14/17; 0045 - 6/16/17; 0245	**Drilling Method:**	cased wash boring	**Hammer Type:**	auto
Boring Location:	see remarks	**Casing ID/OD:**	HW to 55.0'; NW to 97.2'	**Hammer Efficiency:**	0.677
		Auger ID/OD:	SSA to 10'	**Water Level*:**	23.0 ft. (end, open)

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LABORATORY TEST RESULTS:
AASHTO / USCS soil classifications
-#200 = percent fines WC = water content (%)
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Depth (ft.)	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-uncorrected	N-60	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Lab. Testing Results
25	6D	24/11	25.0 - 27.0	3-5-7-6	12	13.54	--			6D: Reddish brown, m. dense, fine to medium SAND, little to some Gravel, trace Silt, trace coarse Sand; organic odor. Grading to grey fine sand in tip of spoon.	AASHTO CORROSIVITY SERIES
							41				
							45	58.5		27.0	
							42				
							48				
30	7D	24/9	30.0 - 32.0	3-3-3-3	6	6.77	51	55.5		30.0 7D: Grey, loose, fine to medium SAND, trace Silt, with one 1-inch layer Grey, Silty CLAY, trace fine Sand at top of sample.	
							46				
							57				
							55				
							70				
35	8D	24/10	35.0 - 37.0	2-3-3-1	6	6.77	56			8D: Grey, loose, fine SAND, trace Silt with one 1-inch layer Grey SILT, some fine Sand.	
							51				
							60				
							59				
							45				
40	9D	24/1	40.0 - 42.0	1/24"	0	0	51			9D: Grey, fine Sandy SILT.	
							57				
							59				
							61				
							55				
45	10D	24/10	45.0 - 47.0	3-1/18"	0	0	49			10D: Grey, interbedded Silty fine SAND and Clayey SILT, little fine Sand.	A-4(0) ML WC=26.4% -#200=87.3% non-plastic
							55				
							67				
							61	37.0		48.5 48.5 ft: Inferred stratum change.	
							--				
50											

Remarks:

LOCATION: 39.7 ft south of south bridge joint; offset 3.7 ft LT of existing centerline

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Schonewald Engineering Associates, Inc.	PROJECT: Cummings Road Bridge over MeTPK LOCATION: Scarborough, Maine	Boring No.: BB-CUM-103 Proj. No.: 17-013

Driller:	New England Boring Contractors	**Elevation (ft.)**	85.5 ft (est'd)	**Core Barrel:**	NQ2
Operator:	Enos / Share	**Datum:**	NAVD88	**Sampler:**	std. split-spoon
Logged By:	Schonewald	**Rig Type:**	Mobile Drill B-53 (rubber track)	**Hammer Wt./Fall:**	140 lbs/30 in (auto hammer)
Date Start/Finish:	6/14/17; 0045 - 6/16/17; 0245	**Drilling Method:**	cased wash boring	**Hammer Type:**	auto
Boring Location:	see remarks	**Casing ID/OD:**	HW to 55.0'; NW to 97.2'	**Hammer Efficiency:**	0.677
		Auger ID/OD:	SSA to 10'	**Water Level*:**	23.0 ft. (end, open)

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Depth (ft.)	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-uncorrected	N-60	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Lab. Testing Results
50	11D V1	24/24	50.0 - 52.0 50.6 - 51.0	VANE INTERVAL Su=563 / 55 psf			28			11D: Dark grey, Silty CLAY with 3 partings Silty fine SAND. V1: Tu=20.5/Tr=2 ft-lbs (65 mm x 130 mm vane)	
	V2		51.6 - 52.0	Su=549 / 55 psf			35			V2: Tu=20/Tr=2 ft-lbs (65 mm x 130 mm vane)	
							37				
							42				
							39				
55	U1	24/18	55.0 - 57.0	HYD PUSH			rc			U1: Dark grey, Silty CLAY.	
60	12D V3	24/19	60.0 - 62.0 60.6 - 61.0	VANE INTERVAL Su=604 / 27 psf			open			12D: Dark grey, Silty CLAY. V3: Tu=22/Tr=1 ft-lbs (65 mm x 130 mm vane)	
	V4		61.6 - 62.0	Su=673 / 27 psf						V4: Tu=24.5/Tr=1 ft-lbs (65 mm x 130 mm vane)	
65	U2	24/22	65.0 - 67.0	HYD PUSH						U2: Dark grey, Silty CLAY.	CONSOL UU WC=37.9% LL=39.9 PL=23.7 PI=16.2
70	13D V5	24/20	70.0 - 72.0 70.6 - 71.0	VANE INTERVAL Su=646 / 27 psf						13D: Dark grey, Silty CLAY. V5: Tu=23.5/Tr=1 ft-lbs (65 mm x 130 mm vane)	
	V6		71.6 - 72.0	Su=646 / 27 psf						V6: Tu=23.5/Tr=1 ft-lbs (65 mm x 130 mm vane)	
75											

Remarks:

LOCATION: 39.7 ft south of south bridge joint; offset 3.7 ft LT of existing centerline

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SCHONEWALD ENGINEERING ASSOCIATES, INC.	**PROJECT:** Cummings Road Bridge over MeTPK **LOCATION:** Scarborough, Maine	**Boring No.:** BB-CUM-103 **Proj. No.:** 17-013

Driller:	New England Boring Contractors	**Elevation (ft.)**	85.5 ft (est'd)	**Core Barrel:**	NQ2
Operator:	Enos / Share	**Datum:**	NAVD88	**Sampler:**	std. split-spoon
Logged By:	Schonewald	**Rig Type:**	Mobile Drill B-53 (rubber track)	**Hammer Wt./Fall:**	140 lbs/30 in (auto hammer)
Date Start/Finish:	6/14/17; 0045 - 6/16/17; 0245	**Drilling Method:**	cased wash boring	**Hammer Type:**	auto
Boring Location:	see remarks	**Casing ID/OD:**	HW to 55.0'; NW to 97.2'	**Hammer Efficiency:**	0.677
		Auger ID/OD:	SSA to 10'	**Water Level*:**	23.0 ft. (end, open)

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UCT qp = peak compressive strength of rock

Depth (ft.)	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-uncorrected	N-60	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Lab. Testing Results
75	U3	24/16	75.0 - 77.0	HYD PUSH						U3: Dark grey, Silty CLAY.	
								8.0		77.5 ft.: Stratum change; gravelly. 77.5	
80	14D	24/8	80.0 - 82.0	23-16-22-22	38	42.8767	22			14D: Grey, dense, Gravelly fine to coarse SAND, some Silt. TILL	
							67				
							55				
							56				
							57				
85	15D	24/8	85.0 - 87.0	24-49-79-47	128	144.427	72			15D: Grey, v. dense, Silty fine to medium SAND, some Gravel, trace coarse Sand. TILL	
							172				
							104				
							--			88.6 ft.: Casing refusal.	
	MR	50/6	89.0 - 93.2				DRIVE			MR: Cored as though soil with cobbles and boulders; confirmed by pieces recovered.	
90											
95	16D	24/15	95.0 - 97.0	38-47-47-61	94	106.063				16D: Dark grey, v. dense, Silty GRAVEL, some fine to coarse Sand. TILL Changing at 96.4 ft. to:	
								-10.9		96.4	
								-11.7		16D-A: White-green decomposed rock; talc-like; very thin laminations. 97.2	
	R1	23/18	97.2 - 99.1	RQD: 0"=0%						R1 to R7: Hard, fresh to slightly weathered, aphanitic to fine grained, dark grey PHYLLITE with veining and typically high angle remnant bedding, interbedded with thick layers of soft to medium, slightly weathered, aphanitic to medium grained,	
100	R2	18/12	99.1 - 100.6	RQD: 0"=0%							

Remarks:

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SCHONEWALD ENGINEERING ASSOCIATES, INC.	PROJECT: Cummings Road Bridge over MeTPK LOCATION: Scarborough, Maine	Boring No.: BB-CUM-103 Proj. No.: 17-013

Driller:	New England Boring Contractors	**Elevation (ft.)**	85.5 ft (est'd)	**Core Barrel:**	NQ2
Operator:	Enos / Share	**Datum:**	NAVD88	**Sampler:**	std. split-spoon
Logged By:	Schonewald	**Rig Type:**	Mobile Drill B-53 (rubber track)	**Hammer Wt./Fall:**	140 lbs/30 in (auto hammer)
Date Start/Finish:	6/14/17; 0045 - 6/16/17; 0245	**Drilling Method:**	cased wash boring	**Hammer Type:**	auto
Boring Location:	see remarks	**Casing ID/OD:**	HW to 55.0'; NW to 97.2'	**Hammer Efficiency:**	0.677
		Auger ID/OD:	SSA to 10'	**Water Level*:**	23.0 ft. (end, open)

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Depth (ft.)	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-uncorrected	N-60	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Lab. Testing Results
100	R3	24/22	100.6 - 102.6	RQD: 4"=17%						greenish-tan LIMESTONE. Typically v. close to close, high angle and lesser low angle breaks resulting in blocky pieces; typically undulating, smooth, discolored, and open with mud infilling. Core times: 2:35 / -- / 2:20 / 2:25 / -- / 2:50 / 3:30 / -- / 3: 05 / -- min:sec/ft. POOR TO VERY POOR ROCK QUALITY	
	R4	29/29	102.6 - 105.0	RQD: 11"=38%							UCT qp = 4.84 ksi
105	R5 R6	4/4 22/22	105.0 - 105.3 105.3 - 107.1	RQD: 0"=0% RQD: 9"=41%							
	R7	8/8	107.1 - 107.8	RQD: 0"=0%				-22.3		107.8 **Bottom of Exploration at 107.8 feet below ground surface.**	
110											
115											
120											
125											

Remarks:

LOCATION: 39.7 ft south of south bridge joint; offset 3.7 ft LT of existing centerline

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SCHONEWALD ENGINEERING ASSOCIATES, INC.	PROJECT: Cummings Road Bridge over MeTPK LOCATION: Scarborough, Maine	Boring No.: BB-CUM-104 OW Proj. No.: 17-013

Driller:	New England Boring Contractors	**Elevation (ft.)**	65 ft (est'd)	**Core Barrel:**	
Operator:	Schaefer / Titus	**Datum:**	NAVD88	**Sampler:**	std. split-spoon
Logged By:	Schonewald	**Rig Type:**	Mobile Drill B-51 (track)	**Hammer Wt./Fall:**	140 lbs/30 in
Date Start/Finish:	6/23/17; 0700 - 0915	**Drilling Method:**	cased wash boring	**Hammer Type:**	rope & cathead
Boring Location:	offset approx. 8 feet westerly from BB-CUM-104	**Casing ID/OD:**	NW to 15.0'	**Hammer Efficiency:**	0.60
		Auger ID/OD:		**Water Level*:**	

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CONSOL= 1-D consolidation test
UU=Unconsolidated undrained triaxial test
LL=Liquid Limit / PL=Plastic Limit / PI=Plasticity Index
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Depth (ft.)	Sample Information: Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-uncorrected	N-60	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Lab. Testing Results
0							24				
							35				
							50				
							39				
							20				
5	1D	24/8	5.0 - 7.0	8-5-5-4	10	10	4			1D: Red brown, loose, fine to coarse SAND, trace Silt.	
							8				
							12				
							18				
							19				
10	2D	24/11	10.0 - 12.0	3-4-4-6	8	8	6			2D: Red tan grading to grey, loose, fine to coarse SAND, trace Gravel, trace Silt.	
							7				
							16				
							32				
							32				
15								50.0		15.0 **Bottom of Exploration at 15.0 feet below ground surface.** No refusal.	
20											
25											

Remarks:

Boring advanced for the installation of a groundwater level observation well. Observation well:
1-inch dia. PVC; well screen 14.5 to 9.5 ft BGS; riser to 3 ft stick up.
Filter sand 15.0 to 7.0 ft BGS; bentonite plug 7.0 to 2.5 ft BGS.
Locking protective casing set; stick up without cover 3.21 ft.

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.

Boring No.: BB-CUM-104 OW

SCHONEWALD ENGINEERING ASSOCIATES, INC.	**PROJECT:** Cummings Road Bridge over MeTPK **LOCATION:** Scarborough, Maine	**Boring No.:** BB-CUM-104 **Proj. No.:** 17-013

Driller:	New England Boring Contractors	**Elevation (ft.)**	65 ft (est'd)	**Core Barrel:**	
Operator:	Schaefer / Titus	**Datum:**	NAVD88	**Sampler:**	std. split-spoon
Logged By:	Schonewald	**Rig Type:**	Mobile Drill B-51 (track)	**Hammer Wt./Fall:**	140 lbs/30 in
Date Start/Finish:	6/21/17; 1025 - 6/22/17; 1530	**Drilling Method:**	cased wash boring	**Hammer Type:**	rope & cathead
Boring Location:	see sketch	**Casing ID/OD:**	HW to 80.0'	**Hammer Efficiency:**	0.60
		Auger ID/OD:	SSA to 5'	**Water Level*:**	4.2 ft. (open)

IN-SITU SAMPLING AND TESTING:
D = Split Spoon Sample
MD = Unsuccessful Split Spoon Sample attempt
U = Thin Wall Tube Sample
MU = Unsuccessful Thin Wall Tube Sample attempt
V = Insitu Vane Shear Test
MV = Unsuccessful Insitu Vane Shear Test attempt

ADDITIONAL DEFINITIONS:
N-uncorrected = N value
N_{60} = N value corrected for hammer efficiency
hammer efficiency = calculated hammer efficiency
S_u = Insitu Field Vane Shear Strength (psf)
R = Rock Core Sample
RQD = Rock Quality Designation (%)

ADDITIONAL DEFINITIONS:
WOH = weight of 140lb. hammer
WOR = weight of rods
-- = not recorded
BOREHOLE ADVANCEMENT METHODS:
SSA/HSA=solid/hollow stem auger
RC=roller cone/OPEN/PUSH=hydraulic push

LABORATORY TEST RESULTS:
AASHTO / USCS soil classifications
-#200 = percent fines WC = water content (%)
CONSOL= 1-D consolidation test
UU=Unconsolidated undrained triaxial test
LL=Liquid Limit / PL=Plastic Limit / PI=Plasticity Index
UCT qp = peak compressive strength of rock

Depth (ft.)	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-uncorrected	N-60	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Lab. Testing Results
0							SSA				
	1D	24/16	2.0 - 4.0	14-24-22-12	46	46				1D: Dark red brown, moist, dense, fine to coarse SAND, trace to little Silt, trace fine Gravel.	
5	2D	24/14	5.0 - 7.0	2-1-1-2	2	2	push			2D: Red tan, wet, v. loose, fine to coarse SAND, trace Silt, trace fine Gravel.	A-1-b, SP WC=21.8% -#200=1.9%
							4				
							7				
							10				
							12				
10	3D	24/13	10.0 - 12.0	2-3-4-4	7	7	4			3D: Red tan, loose, fine to coarse SAND, trace Silt, trace fine Gravel; grading to fine to medium SAND.	
							6				
							15				
							15	51.5		13.5	
							30				
15	4D	24/12	15.0 - 17.0	4-6-10-12	16	16	25			4D: Grey, medium dense, fine to medium SAND, trace Silt.	
							25				
							21				
							16				
							15				
20	5D	24/--	20.0 - 22.0	3-5-4-1	9	9	10	45.0		20.0 5D: Grey, loose, fine SAND, trace Silt, with two 1-inch layers fine Sandy SILT.	
							12				
							12				
							13				
25							12				

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.

SCHONEWALD ENGINEERING ASSOCIATES, INC.	**PROJECT:** Cummings Road Bridge over MeTPK **LOCATION:** Scarborough, Maine	**Boring No.:** BB-CUM-104 **Proj. No.:** 17-013

Driller:	New England Boring Contractors	**Elevation (ft.)**	65 ft (est'd)	**Core Barrel:**	
Operator:	Schaefer / Titus	**Datum:**	NAVD88	**Sampler:**	std. split-spoon
Logged By:	Schonewald	**Rig Type:**	Mobile Drill B-51 (track)	**Hammer Wt./Fall:**	140 lbs/30 in
Date Start/Finish:	6/21/17; 1025 - 6/22/17; 1530	**Drilling Method:**	cased wash boring	**Hammer Type:**	rope & cathead
Boring Location:	see sketch	**Casing ID/OD:**	HW to 80.0'	**Hammer Efficiency:**	0.60
		Auger ID/OD:	SSA to 5'	**Water Level*:**	4.2 ft. (open)

IN-SITU SAMPLING AND TESTING:
D = Split Spoon Sample
MD = Unsuccessful Split Spoon Sample attempt
U = Thin Wall Tube Sample
MU = Unsuccessful Thin Wall Tube Sample attempt
V = Insitu Vane Shear Test
MV = Unsuccessful Insitu Vane Shear Test attempt

ADDITIONAL DEFINITIONS:
N-uncorrected = N value
N_{60} = N value corrected for hammer efficiency
hammer efficiency = calculated hammer efficiency
S_u = Insitu Field Vane Shear Strength (psf)
R = Rock Core Sample
RQD = Rock Quality Designation (%)

ADDITIONAL DEFINITIONS:
WOH = weight of 140lb. hammer
WOR = weight of rods
-- = not recorded

BOREHOLE ADVANCEMENT METHODS:
SSA/HSA=solid/hollow stem auger
RC=roller cone/OPEN/PUSH=hydraulic push

LABORATORY TEST RESULTS:
AASHTO / USCS soil classifications
-#200 = percent fines   WC = water content (%)
CONSOL= 1-D consolidation test
UU=Unconsolidated undrained triaxial test
LL=Liquid Limit / PL=Plastic Limit / PI=Plasticity Index
UCT qp = peak compressive strength of rock

Depth (ft.)	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-uncorrected	N-60	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Lab. Testing Results
25	6D	24/22	25.0 - 27.0	3-1/18"	0	0	13			6D: Grey, v. soft, interbedded Silty CLAY and Silty fine SAND.	
							13				
							14				
							13				
							12				
30	7D	24/24	30.0 - 32.0	2-1/18"	0	0	13			7D: Grey, v. soft, interbedded Silty CLAY; fine Sandy SILT; and fine SAND, trace Silt.	
							12				
							12				
							11				
							9				
35	8D	24/24	35.0 - 37.0	WOR/24"	0	0	11			8D: Grey, v. soft, Silty CLAY with partings and two 1-inch layers Silty fine SAND.	
							11				
							15				
							16				
							17				
40	9D	24/24	40.0 - 42.0	3-WOH/18"	0	0	12			9D: Grey, v. loose, interbedded Silty fine SAND and Silty CLAY, trace fine Sand.	A-4(0) ML WC=27.1% -#200=80.5% non-plastic
							11				
							15				
							20				
							13				
45	10D	24/--	45.0 - 47.0	WOR/24"	0	0	8			10D: Grey, v. soft, Silty CLAY, with one 1-inch layer fine Sandy SILT.	
							9				
							7	18.0		47.0	
							7				
							8				
50											

Remarks:

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

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Schonewald Engineering Associates, Inc.	PROJECT: Cummings Road Bridge over MeTPK	Boring No.: BB-CUM-104
	LOCATION: Scarborough, Maine	Proj. No.: 17-013

Driller:	New England Boring Contractors	**Elevation (ft.)**	65 ft (est'd)	**Core Barrel:**	
Operator:	Schaefer / Titus	**Datum:**	NAVD88	**Sampler:**	std. split-spoon
Logged By:	Schonewald	**Rig Type:**	Mobile Drill B-51 (track)	**Hammer Wt./Fall:**	140 lbs/30 in
Date Start/Finish:	6/21/17; 1025 - 6/22/17; 1530	**Drilling Method:**	cased wash boring	**Hammer Type:**	rope & cathead
Boring Location:	see sketch	**Casing ID/OD:**	HW to 80.0'	**Hammer Efficiency:**	0.60
		Auger ID/OD:	SSA to 5'	**Water Level*:**	4.2 ft. (open)

IN-SITU SAMPLING AND TESTING:
D = Split Spoon Sample
MD = Unsuccessful Split Spoon Sample attempt
U = Thin Wall Tube Sample
MU = Unsuccessful Thin Wall Tube Sample attempt
V = Insitu Vane Shear Test
MV = Unsuccessful Insitu Vane Shear Test attempt

ADDITIONAL DEFINITIONS:
N-uncorrected = N value
N_{60} = N value corrected for hammer efficiency
hammer efficiency = calculated hammer efficiency
S_u = Insitu Field Vane Shear Strength (psf)
R = Rock Core Sample
RQD = Rock Quality Designation (%)

ADDITIONAL DEFINITIONS:
WOH = weight of 140lb. hammer
WOR = weight of rods
-- = not recorded

BOREHOLE ADVANCEMENT METHODS:
SSA/HSA=solid/hollow stem auger
RC=roller cone/OPEN/PUSH=hydraulic push

LABORATORY TEST RESULTS:
AASHTO / USCS soil classifications
-#200 = percent fines WC = water content (%)
CONSOL= 1-D consolidation test
UU=Unconsolidated undrained triaxial test
LL=Liquid Limit / PL=Plastic Limit / PI=Plasticity Index
UCT qp = peak compressive strength of rock

Depth (ft.)	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-uncorrected	N-60	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Lab. Testing Results
50	11D	24/24	50.0 - 52.0	WOR/24"			push			11D: Dark grey with minor black streaks, v. soft, Silty CLAY.	
55	12D V1	24/22	55.0 - 57.0 55.6 - 56.0	VANE INTERVAL Su= 536 / 14 psf			push			12D: Dark grey with black streaks, Silty CLAY. V1: Tu=19.5 / Tr=0.5 ft-lbs (65 mm x 130 mm vane).	
	V2		56.6 - 57.0	Su= 467 / 14 psf						V2: Tu=17 / Tr=0.5 ft-lbs (65 mm x 130 mm vane).	
60	U1	24/23	60.0 - 62.0	HYD PUSH			push			U1: Dark grey, Silty CLAY, with fine Sand partings.	CONSOL UU WC=37.6% LL=39.5 PL=23.5 PI=16.0
65	V3		65.6 - 66.0	Su= 563 / 14 psf			push			V3: Tu=20.5 / Tr=0.5 ft-lbs (65 mm x 130 mm vane).	
	V4		66.6 - 67.0	Su= 604 / 0 psf						V4: Tu=22 / Tr=0 ft-lbs (65 mm x 130 mm vane).	
70	13D V5	24/--	70.0 - 72.0 70.6 - 71.0	VANE INTERVAL Su= 700 / 0 psf			push			13D: Dark grey with black streaks, Silty CLAY. V5: Tu=25.5 / Tr=0 ft-lbs (65 mm x 130 mm vane).	WC=-- LL=32.0 PL=21.2 PI=10.8
	V6		71.6 - 72.0	Su= 742 / 0 psf						V6: Tu=27 / Tr=0 ft-lbs (65 mm x 130 mm vane)	
75											

Remarks:

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SCHONEWALD ENGINEERING ASSOCIATES, INC.

PROJECT: Cummings Road Bridge over MeTPK

LOCATION: Scarborough, Maine

Boring No.: BB-CUM-104

Proj. No.: 17-013

Driller:	New England Boring Contractors	**Elevation (ft.)**	65 ft (est'd)	**Core Barrel:**	
Operator:	Schaefer / Titus	**Datum:**	NAVD88	**Sampler:**	std. split-spoon
Logged By:	Schonewald	**Rig Type:**	Mobile Drill B-51 (track)	**Hammer Wt./Fall:**	140 lbs/30 in
Date Start/Finish:	6/21/17; 1025 - 6/22/17; 1530	**Drilling Method:**	cased wash boring	**Hammer Type:**	rope & cathead
Boring Location:	see sketch	**Casing ID/OD:**	HW to 80.0'	**Hammer Efficiency:**	0.60
		Auger ID/OD:	SSA to 5'	**Water Level*:**	4.2 ft. (open)

IN-SITU SAMPLING AND TESTING:
D = Split Spoon Sample
MD = Unsuccessful Split Spoon Sample attempt
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MU = Unsuccessful Thin Wall Tube Sample attempt
V = Insitu Vane Shear Test
MV = Unsuccessful Insitu Vane Shear Test attempt

ADDITIONAL DEFINITIONS:
N-uncorrected = N value
N_{60} = N value corrected for hammer efficiency
hammer efficiency = calculated hammer efficiency
S_u = Insitu Field Vane Shear Strength (psf)
R = Rock Core Sample
RQD = Rock Quality Designation (%)

ADDITIONAL DEFINITIONS:
WOH = weight of 140lb. hammer
WOR = weight of rods
-- = not recorded

BOREHOLE ADVANCEMENT METHODS:
SSA/HSA=solid/hollow stem auger
RC=roller cone/OPEN/PUSH=hydraulic push

LABORATORY TEST RESULTS:
AASHTO / USCS soil classifications
-#200 = percent fines   WC = water content (%)
CONSOL= 1-D consolidation test
UU=Unconsolidated undrained triaxial test
LL=Liquid Limit / PL=Plastic Limit / PI=Plasticity Index
UCT qp = peak compressive strength of rock

Depth (ft.)	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-uncorrected	N-60	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Lab. Testing Results
75	U2	24/23	75.0 - 77.0	HYD PUSH			push			U2: Dark grey with black streaks, SIlty CLAY.	
80	14D V7	24/20	80.0 - 82.0 80.6 - 81.0	VANE INTERVAL Su= 989 / 0 psf			rc			14D: Dark grey with black streaks, SIlty CLAY, with soft concretions throughout. V7: Tu=36 / Tr=0 ft-lbs (65 mm x 130 mm vane).	
	V8		81.6 - 82.0	Su= 989 / 0 psf						V8: Tu=36 / Tr=0 ft-lbs (65 mm x 130 mm vane)	
85	15D MV	24/20	85.0 - 87.0 85.6 - 85.6	1/24"	0	0	rc			15D: Dark grey, v.soft, Silty CLAY, with few soft concretions; broken rock in tip of spoon. MV: Unable to push vane to 85.6 ft.	
								-22.5		87.5 ft: Roller cone on denser granular material. 87.5	
90	16D	24/9	90.0 - 92.0	29-14-24-25	38	38				16D: Grey, dense, Silty GRAVEL, some fine to coarse Sand. TILL	
								-27.0		92.0 **Bottom of Exploration at 92.0 feet below ground surface.** No refusal.	
95											
100											

Remarks:

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

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Boring No.: BB-CUM-104

SCHONEWALD ENGINEERING ASSOCIATES, INC.	PROJECT: Cummings Road Bridge over MeTPK LOCATION: Scarborough, Maine	Boring No.: BB-CUM-105 Proj. No.: 17-013

Driller:	New England Boring Contractors	**Elevation (ft.)**	67 ft (est'd)	**Core Barrel:**	
Operator:	Schaefer / Titus	**Datum:**	NAVD88	**Sampler:**	std. split-spoon
Logged By:	Schonewald	**Rig Type:**	Mobile Drill B-51 (track)	**Hammer Wt./Fall:**	140 lbs/30 in
Date Start/Finish:	6/19/17; 1215 - 6/21/17; 0955	**Drilling Method:**	cased wash boring	**Hammer Type:**	rope & cathead
Boring Location:	see sketch	**Casing ID/OD:**	HW to 70.0'	**Hammer Efficiency:**	0.60
		Auger ID/OD:	SSA to 5'	**Water Level*:**	4.2' (overnight)

IN-SITU SAMPLING AND TESTING:
D = Split Spoon Sample
MD = Unsuccessful Split Spoon Sample attempt
U = Thin Wall Tube Sample
MU = Unsuccessful Thin Wall Tube Sample attempt
V = Insitu Vane Shear Test
MV = Unsuccessful Insitu Vane Shear Test attempt

ADDITIONAL DEFINITIONS:
N-uncorrected = N value
N_{60} = N value corrected for hammer efficiency
hammer efficiency = calculated hammer efficiency
S_u = Insitu Field Vane Shear Strength (psf)
R = Rock Core Sample
RQD = Rock Quality Designation (%)

ADDITIONAL DEFINITIONS:
WOH = weight of 140lb. hammer
WOR = weight of rods
-- = not recorded
BOREHOLE ADVANCEMENT METHODS:
SSA/HSA=solid/hollow stem auger
RC=roller cone/OPEN/PUSH=hydraulic push

LABORATORY TEST RESULTS:
AASHTO / USCS soil classifications
-#200 = percent fines WC = water content (%)
CONSOL= 1-D consolidation test
UU=Unconsolidated undrained triaxial test
LL=Liquid Limit / PL=Plastic Limit / PI=Plasticity Index
UCT qp = peak compressive strength of rock

Depth (ft.)	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-uncorrected	N-60	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Lab. Testing Results
0							SSA				
	1D	24/19	2.0 - 4.0	2-2-7-10	9	9				1D: Grey brown grading to red brown, damp to moist, loose, fine to medium SAND, trace to little Silt, trace Gravel, trace coarse Sand.	
5	2D	24/16	5.0 - 7.0	6-13-8-7	21	21				2D: Red brown, wet, m. dense, fine to coarse SAND, some Gravel, trace Silt.	
10	3D	24/9	10.0 - 12.0	2-4-4-6	8	8				3D: Grey tan, loose, fine to medium SAND, trace Silt, trace coarse Sand.	
								56.0		11.0	
15	4D	24/9	15.0 - 17.0	3-3-2-5	5	5				4D: Grey, loose, fine SAND, trace to little Silt.	
20	5D	24/8	20.0 - 22.0	11-6-4-5	10	10	55			5D: Grey, loose, fine SAND, trace Silt.	
							47				
							50				
							55	43.5		23.5	
25							57				

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.

SCHONEWALD ENGINEERING ASSOCIATES, INC.	PROJECT: Cummings Road Bridge over MeTPK LOCATION: Scarborough, Maine	Boring No.: BB-CUM-105 Proj. No.: 17-013

Driller:	New England Boring Contractors	**Elevation (ft.)**	67 ft (est'd)	**Core Barrel:**	
Operator:	Schaefer / Titus	**Datum:**	NAVD88	**Sampler:**	std. split-spoon
Logged By:	Schonewald	**Rig Type:**	Mobile Drill B-51 (track)	**Hammer Wt./Fall:**	140 lbs/30 in
Date Start/Finish:	6/19/17; 1215 - 6/21/17; 0955	**Drilling Method:**	cased wash boring	**Hammer Type:**	rope & cathead
Boring Location:	see sketch	**Casing ID/OD:**	HW to 70.0'	**Hammer Efficiency:**	0.60
		Auger ID/OD:	SSA to 5'	**Water Level*:**	4.2' (overnight)

IN-SITU SAMPLING AND TESTING:
D = Split Spoon Sample
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MU = Unsuccessful Thin Wall Tube Sample attempt
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MV = Unsuccessful Insitu Vane Shear Test attempt

ADDITIONAL DEFINITIONS:
N-uncorrected = N value
N_{60} = N value corrected for hammer efficiency
hammer efficiency = calculated hammer efficiency
S_u = Insitu Field Vane Shear Strength (psf)
R = Rock Core Sample
RQD = Rock Quality Designation (%)

ADDITIONAL DEFINITIONS:
WOH = weight of 140lb. hammer
WOR = weight of rods
-- = not recorded
BOREHOLE ADVANCEMENT METHODS:
SSA/HSA=solid/hollow stem auger
RC=roller cone/OPEN/PUSH=hydraulic push

LABORATORY TEST RESULTS:
AASHTO / USCS soil classifications
-#200 = percent fines   WC = water content (%)
CONSOL= 1-D consolidation test
UU=Unconsolidated undrained triaxial test
LL=Liquid Limit / PL=Plastic Limit / PI=Plasticity Index
UCT qp = peak compressive strength of rock

Depth (ft.)	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-uncorrected	N-60	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Lab. Testing Results
25	6D	24/19	25.0 - 27.0	1-1-6-6	7	7	40			6D: Grey, loose, interbedded, fine SAND, trace to little Silt and fine Sandy SILT, with one 4-inch layer Silty CLAY at top of sample.	
							45				
							48				
							55				
							54				
30	7D	24/24	30.0 - 32.0	1-1/12"-4	1	1	40			7D: Grey, v. soft, interbedded Silty CLAY, little fine Sand and fine Sandy SILT.	
							40				
							36				
							36				
							35				
35	8D	24/24	35.0 - 37.0	3-2-1-1	3	3	27			8D: Grey, soft, interbedded Silty CLAY, trace fine Sand; Silty fine SAND; and fine SAND, trace Silt.	A-4(0) ML WC=26.0% -#200=55.1% non-plastic
							29				
							37				
							30				
							31				
40	9D	24/24	40.0 - 42.0	WOR/24"	0	0	push			9D: Grey, v. soft, Silty CLAY, with multiple partings and seams Silty fine SAND.	
45	10D V1	24/--	45.0 - 47.0 45.6 - 46.0	VANE INTERVAL Su= 522 / 55 psf			open			10D: Grey, Silty CLAY, with multiple seams and layers fine SAND, some Silt. V1: Tu=19 / Tr=2 ft-lbs (65 mm x 130 mm vane).	
	V2		46.6 - 47.0	Su= 522 / 41 psf						V2: Tu=19 / Tr=1.5 ft-lbs (65 mm x 130 mm vane).	
								18.5		48.5	
50											

Remarks:

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SCHONEWALD ENGINEERING ASSOCIATES, INC.

PROJECT: Cummings Road Bridge over MeTPK

LOCATION: Scarborough, Maine

Boring No.: BB-CUM-105

Proj. No.: 17-013

Driller:	New England Boring Contractors	**Elevation (ft.)**	67 ft (est'd)	**Core Barrel:**	
Operator:	Schaefer / Titus	**Datum:**	NAVD88	**Sampler:**	std. split-spoon
Logged By:	Schonewald	**Rig Type:**	Mobile Drill B-51 (track)	**Hammer Wt./Fall:**	140 lbs/30 in
Date Start/Finish:	6/19/17; 1215 - 6/21/17; 0955	**Drilling Method:**	cased wash boring	**Hammer Type:**	rope & cathead
Boring Location:	see sketch	**Casing ID/OD:**	HW to 70.0'	**Hammer Efficiency:**	0.60
		Auger ID/OD:	SSA to 5'	**Water Level*:**	4.2' (overnight)

IN-SITU SAMPLING AND TESTING:
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MU = Unsuccessful Thin Wall Tube Sample attempt
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MV = Unsuccessful Insitu Vane Shear Test attempt

ADDITIONAL DEFINITIONS:
N-uncorrected = N value
N_{60} = N value corrected for hammer efficiency
hammer efficiency = calculated hammer efficiency
S_u = Insitu Field Vane Shear Strength (psf)
R = Rock Core Sample
RQD = Rock Quality Designation (%)

ADDITIONAL DEFINITIONS:
WOH = weight of 140lb. hammer
WOR = weight of rods
-- = not recorded

BOREHOLE ADVANCEMENT METHODS:
SSA/HSA=solid/hollow stem auger
RC=roller cone/OPEN/PUSH=hydraulic push

LABORATORY TEST RESULTS:
AASHTO / USCS soil classifications
-#200 = percent fines WC = water content (%)
CONSOL= 1-D consolidation test
UU=Unconsolidated undrained triaxial test
LL=Liquid Limit / PL=Plastic Limit / PI=Plasticity Index
UCT qp = peak compressive strength of rock

Depth (ft.)	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-uncorrected	N-60	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Lab. Testing Results
50	11D	24/24	50.0 - 52.0	WOR/24"	0	0	open			11D: Grey, v. soft, Silty CLAY.	
55	12D V3	24/24	55.0 - 57.0 55.6 - 56.0	VANE INTERVAL Su= 467 / 14 psf			open			12D: Grey with darker grey streaks, Silty CLAY. V3: Tu=17 / Tr=0.5 ft-lbs (65 mm x 130 mm vane).	WC=40.3% LL=33.4 PL=22.3 PI=11.1
	V4		56.6 - 57.0	Su= 522 / 14 psf						V4: Tu=19 / Tr=0.5 ft-lbs (65 mm x 130 mm vane).	
60	U1	24/24	60.0 - 62.0	HYD PUSH			open			U1:Grey to dark grey with darker streaks, Silty CLAY.	CONSOL UU WC=40.5% LL=33.1 PL=23.0 PI=10.1
65	13D V5	24/24	65.0 - 67.0 65.6 - 66.0	VANE INTERVAL Su= 714 / 0 psf			push			13D: Dark grey with black streaks, Silty CLAY. V5: Tu=26 / Tr=0 ft-lbs (65 mm x 130 mm vane).	
	V6		66.6 - 67.0	Su= 797 / 0 psf						V6: Tu=29 / Tr=0 ft-lbs (65 mm x 130 mm vane). 65 to 70 ft: Open hole necks in; advance HW casing by hydraulic push to 70 ft.	
70	14D V7	24/--	70.0 - 72.0 70.6 - 71.0	VANE INTERVAL Su= 659 / 14 psf			open			14D: Dark grey with black streaks, Silty CLAY. V7: Tu=24 / Tr=0.5 ft-lbs (65 mm x 130 mm vane).	WC=47.6% LL=43.7 PL=25.2 PI=18.5
	V8		71.6 - 72.0	Su= 893 / 0 psf						V8: Tu=32.5 / Tr=0 ft-lbs (65 mm x 130 mm vane).	
75											

Remarks:

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

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Schonewald Engineering Associates, Inc.	**PROJECT:** Cummings Road Bridge over MeTPK **LOCATION:** Scarborough, Maine	**Boring No.:** BB-CUM-105 **Proj. No.:** 17-013

Driller:	New England Boring Contractors	**Elevation (ft.)**	67 ft (est'd)	**Core Barrel:**	
Operator:	Schaefer / Titus	**Datum:**	NAVD88	**Sampler:**	std. split-spoon
Logged By:	Schonewald	**Rig Type:**	Mobile Drill B-51 (track)	**Hammer Wt./Fall:**	140 lbs/30 in
Date Start/Finish:	6/19/17; 1215 - 6/21/17; 0955	**Drilling Method:**	cased wash boring	**Hammer Type:**	rope & cathead
Boring Location:	see sketch	**Casing ID/OD:**	HW to 70.0'	**Hammer Efficiency:**	0.60
		Auger ID/OD:	SSA to 5'	**Water Level*:**	4.2' (overnight)

IN-SITU SAMPLING AND TESTING:
D = Split Spoon Sample
MD = Unsuccessful Split Spoon Sample attempt
U = Thin Wall Tube Sample
MU = Unsuccessful Thin Wall Tube Sample attempt
V = Insitu Vane Shear Test
MV = Unsuccessful Insitu Vane Shear Test attempt

ADDITIONAL DEFINITIONS:
N-uncorrected = N value
N_{60} = N value corrected for hammer efficiency
hammer efficiency = calculated hammer efficiency
S_u = Insitu Field Vane Shear Strength (psf)
R = Rock Core Sample
RQD = Rock Quality Designation (%)

ADDITIONAL DEFINITIONS:
WOH = weight of 140lb. hammer
WOR = weight of rods
-- = not recorded
BOREHOLE ADVANCEMENT METHODS:
SSA/HSA=solid/hollow stem auger
RC=roller cone/OPEN/PUSH=hydraulic push

LABORATORY TEST RESULTS:
AASHTO / USCS soil classifications
-#200 = percent fines WC = water content (%)
CONSOL= 1-D consolidation test
UU=Unconsolidated undrained triaxial test
LL=Liquid Limit / PL=Plastic Limit / PI=Plasticity Index
UCT qp = peak compressive strength of rock

Depth (ft.)	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-uncorrected	N-60	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Lab. Testing Results
75	U2	24/23	75.0 - 77.0	HYD PUSH			open			U2: Dark grey, Silty CLAY.	
80	15D V9	24/24	80.0 - 82.0 80.6 - 81.0	VANE INTERVAL Su= 659 / 0 psf			open			15D: Dark grey, Silty CLAY. V9: Tu=24 / Tr=0 ft-lbs (65 mm x 130 mm vane).	
	V10		81.6 - 82.0	Su= 783 / 0 psf						V10: Tu=28.5 / Tr=0 ft-lbs (65 mm x 130 mm vane).	
85	MV 16D	24/24	85.0 - 85.1 85.1 - 87.1	WOR/24"	0	0	open	-18.1		MV: Unable to push vane past 85.1 ft. 85.1 16D: Dark grey, v. soft, Silty CLAY, with significant concretions (coarse sand to fine gravel size) at top of sample fewer nodules throughout.	
90	17D	24/24	90.0 - 92.0	WOR/24"	0	0	open			17D: Dark grey, v. soft, Silty CLAY, with concretions (coarse sand to fine gravel size) throughout.	WC=33.7% LL=32.0 PL=20.0 PI=12.0
95	18D	24/24	95.0 - 97.0	WOR/24"	0	0	open			18D: Dark grey, v. soft, Silty CLAY, with concretions (coarse sand to fine gravel size) throughout.	
100										99.5 ft: Resistance to roller cone.	

Remarks:

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

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SCHONEWALD ENGINEERING ASSOCIATES, INC.

PROJECT: Cummings Road Bridge over MeTPK

LOCATION: Scarborough, Maine

Boring No.: BB-CUM-105

Proj. No.: 17-013

Driller:	New England Boring Contractors	**Elevation (ft.)**	67 ft (est'd)	**Core Barrel:**	
Operator:	Schaefer / Titus	**Datum:**	NAVD88	**Sampler:**	std. split-spoon
Logged By:	Schonewald	**Rig Type:**	Mobile Drill B-51 (track)	**Hammer Wt./Fall:**	140 lbs/30 in
Date Start/Finish:	6/19/17; 1215 - 6/21/17; 0955	**Drilling Method:**	cased wash boring	**Hammer Type:**	rope & cathead
Boring Location:	see sketch	**Casing ID/OD:**	HW to 70.0'	**Hammer Efficiency:**	0.60
		Auger ID/OD:	SSA to 5'	**Water Level*:**	4.2' (overnight)

IN-SITU SAMPLING AND TESTING:
D = Split Spoon Sample
MD = Unsuccessful Split Spoon Sample attempt
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MV = Unsuccessful Insitu Vane Shear Test attempt

ADDITIONAL DEFINITIONS:
N-uncorrected = N value
N_{60} = N value corrected for hammer efficiency
hammer efficiency = calculated hammer efficiency
S_u = Insitu Field Vane Shear Strength (psf)
R = Rock Core Sample
RQD = Rock Quality Designation (%)

ADDITIONAL DEFINITIONS:
WOH = weight of 140lb. hammer
WOR = weight of rods
-- = not recorded

BOREHOLE ADVANCEMENT METHODS:
SSA/HSA=solid/hollow stem auger
RC=roller cone/OPEN/PUSH=hydraulic push

LABORATORY TEST RESULTS:
AASHTO / USCS soil classifications
-#200 = percent fines WC = water content (%)
CONSOL= 1-D consolidation test
UU=Unconsolidated undrained triaxial test
LL=Liquid Limit / PL=Plastic Limit / PI=Plasticity Index
UCT qp = peak compressive strength of rock

Depth (ft.)	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-uncorrected	N-60	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Lab. Testing Results
100	19D	24/21	100.0 - 102.0	WOR/24"	0	0	RC			19D: Dark grey, v. soft, Silty CLAY, with concretions (coarse sand to fine gravel size) throughout.	
								-35.0		102.0	
										102.0 ft: Split-spoon abruptly stops. Boney under roller cone.	
								-36.2		103.2	
										Bottom of Exploration at 103.2 feet below ground surface. Roller cone refusal.	
105											
110											
115											
120											
125											

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.

SCHONEWALD ENGINEERING ASSOCIATES, INC.	PROJECT: Cummings Road Bridge over MeTPK LOCATION: Scarborough, Maine	Boring No.: BB-CUM-106 Proj. No.: 17-013

Driller:	New England Boring Contractors	**Elevation (ft.)**	86.5 ft (est'd)	**Core Barrel:**	NQ2
Operator:	Enos / Share	**Datum:**	NAVD88	**Sampler:**	std. split-spoon
Logged By:	Schonewald	**Rig Type:**	Mobile Drill B-53 (rubber track)	**Hammer Wt./Fall:**	140 lbs/30 in (auto hammer)
Date Start/Finish:	6/11/17; 2020 - 6/14/17; 0025	**Drilling Method:**	cased wash boring	**Hammer Type:**	auto
Boring Location:	see remarks	**Casing ID/OD:**	HW to 75.0'; NW to 125.0'	**Hammer Efficiency:**	0.677
		Auger ID/OD:	SSA to 10'	**Water Level*:**	23.5 ft. (end, open)

IN-SITU SAMPLING AND TESTING:
D = Split Spoon Sample
MD = Unsuccessful Split Spoon Sample attempt
U = Thin Wall Tube Sample
MU = Unsuccessful Thin Wall Tube Sample attempt
V = Insitu Vane Shear Test
MV = Unsuccessful Insitu Vane Shear Test attempt

ADDITIONAL DEFINITIONS:
N-uncorrected = N value
N_{60} = N value corrected for hammer efficiency
hammer efficiency = calculated hammer efficiency
S_u = Insitu Field Vane Shear Strength (psf)
R = Rock Core Sample
RQD = Rock Quality Designation (%)

ADDITIONAL DEFINITIONS:
WOH = weight of 140lb. hammer
WOR = weight of rods
-- = not recorded
BOREHOLE ADVANCEMENT METHODS:
SSA/HSA=solid/hollow stem auger
RC=roller cone/OPEN/PUSH=hydraulic push

LABORATORY TEST RESULTS:
AASHTO / USCS soil classifications
-#200 = percent fines WC = water content (%)
CONSOL= 1-D consolidation test
UU=Unconsolidated undrained triaxial test
LL=Liquid Limit / PL=Plastic Limit / PI=Plasticity Index
UCT qp = peak compressive strength of rock

Depth (ft.)	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-uncorrected	N-60	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Lab. Testing Results
0							SSA	85.9		8 inches HMA 0.7	
	1D	24/21	1.0 - 3.0	24-22-14-18	36	40.62				1D: Light brown, dry, dense, Gravelly fine to coarse SAND, little Silt. ROAD GRAVEL	
								83.5		3.0	
5	2D	24/18	5.0 - 7.0	18-16-26-35	42	47.39				2D: Light brown, dry, dense, fine to medium SAND, some Gravel, trace to little Silt, trace coarse Sand. FILL	
10	3D	24/22	10.0 - 12.0	21-21-20-27	41	46.2617	116			3D: Light brown, dry to damp, dense, fine to medium SAND, little to some Gravel, trace to little Silt, trace coarse Sand; somewhat layered.	
							125				
							207				
							RC				
15	4D	24/20	15.0 - 17.0	28-48-48-51	96	108.32	RC			4D: Light brown, damp to moist (tight), v. dense, fine to medium SAND, little Gravel, trace Silt, trace coarse Sand; somewhat layered.	
20	5D(A)	22/15	20.0 - 21.8	19-34-44-50/4"	78	88.01	RC			5D: Light brown, damp to moist (tight), v. dense, fine to medium SAND, little to some Gravel, trace to little Silt, trace coarse Sand; somewhat layered.	5D THRU 6D-A COMPOSITE SAMPLE: AASHTO CORROSIVITY SERIES
								64.9		21.6 5D-A: Bottom 2 inches of sample appears to be asphalt; petroleum odor.	
	6D(A)	24/16	22.0 - 24.0	38-38-22-14	60	67.7	RC			6D: Brown, wet, v. loose, fine to coarse Sandy GRAVEL, little Silt; changing at 23.5 ft. to:	
								63.0		23.5 6D-A: Black-brown, fine to medium SAND, little to some fine Gravel, trace to little Silt, trace coarse Sand; organic odor.	
25											

Remarks:

LOCATION: 29.1 ft north of north bridge joint; offset 3.9 ft LT of existing centerline

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.

SCHONEWALD ENGINEERING ASSOCIATES, INC.	PROJECT: Cummings Road Bridge over MeTPK	Boring No.: BB-CUM-106
	LOCATION: Scarborough, Maine	Proj. No.: 17-013

Driller:	New England Boring Contractors	**Elevation (ft.)**	86.5 ft (est'd)	**Core Barrel:**	NQ2
Operator:	Enos / Share	**Datum:**	NAVD88	**Sampler:**	std. split-spoon
Logged By:	Schonewald	**Rig Type:**	Mobile Drill B-53 (rubber track)	**Hammer Wt./Fall:**	140 lbs/30 in (auto hammer)
Date Start/Finish:	6/11/17; 2020 - 6/14/17; 0025	**Drilling Method:**	cased wash boring	**Hammer Type:**	auto
Boring Location:	see remarks	**Casing ID/OD:**	HW to 75.0'; NW to 125.0'	**Hammer Efficiency:**	0.677
		Auger ID/OD:	SSA to 10'	**Water Level*:**	23.5 ft. (end, open)

IN-SITU SAMPLING AND TESTING:
D = Split Spoon Sample
MD = Unsuccessful Split Spoon Sample attempt
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MU = Unsuccessful Thin Wall Tube Sample attempt
V = Insitu Vane Shear Test
MV = Unsuccessful Insitu Vane Shear Test attempt

ADDITIONAL DEFINITIONS:
N-uncorrected = N value
N_{60} = N value corrected for hammer efficiency
hammer efficiency = calculated hammer efficiency
S_u = Insitu Field Vane Shear Strength (psf)
R = Rock Core Sample
RQD = Rock Quality Designation (%)

ADDITIONAL DEFINITIONS:
WOH = weight of 140lb. hammer
WOR = weight of rods
-- = not recorded

BOREHOLE ADVANCEMENT METHODS:
SSA/HSA=solid/hollow stem auger
RC=roller cone/OPEN/PUSH=hydraulic push

LABORATORY TEST RESULTS:
AASHTO / USCS soil classifications
-#200 = percent fines   WC = water content (%)
CONSOL= 1-D consolidation test
UU=Unconsolidated undrained triaxial test
LL=Liquid Limit / PL=Plastic Limit / PI=Plasticity Index
UCT qp = peak compressive strength of rock

Depth (ft.)	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-uncorrected	N-60	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Lab. Testing Results
25	7D	24/14	25.0 - 27.0	15-23-32-27	55	62.0583	RC			7D: Red brown, wet, v. dense, fine to coarse SAND, trace to little Silt, trace Gravel.	
30	8D(A)	30/0	30.0 - 32.5	2-5-4-3	9	10.155	100			(split-spoon empty; resample; overdrive to 32.5 ft) 8D: Red brown, wet, loose, fine to coarse SAND, trace Gravel, trace Silt; changing at 32.3 ft. to:	
							95				
							110	54.2		32.3 8D-A: Grey, wet, fine Sandy SILT.	
							113				
							117				
35	MD	24/0	35.0 - 37.0	2-4-5-7	9	10.155	104			(split-spoon empty; resample; overdrive to 38 ft; no recovery) Grey, fine SAND, some Silt in tip of spoon.	
							113				
							141				
							159				
							137				
40	9D	24/0	40.0 - 42.0	1-2-4-4	6	6.77	RC			(split-spoon empty; grab sample 40 to 45 ft) 9D: Greyish-tan, loose, fine to coarse SAND, trace Silt.	
45	10D	24/6	45.0 - 47.0	2-2-1-4	3	3.385	113			10D: Grey, v. loose, fine Gravelly fine to coarse SAND, trace Silt, with Silty fine SAND layer in bottom of sample.	
							124				
							121				
							128				
							123				
50											

Remarks:

LOCATION: 29.1 ft north of north bridge joint; offset 3.9 ft LT of existing centerline

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.

SCHONEWALD ENGINEERING ASSOCIATES, INC.	**PROJECT:** Cummings Road Bridge over MeTPK **LOCATION:** Scarborough, Maine	**Boring No.:** BB-CUM-106 **Proj. No.:** 17-013

Driller:	New England Boring Contractors	**Elevation (ft.)**	86.5 ft (est'd)	**Core Barrel:**	NQ2
Operator:	Enos / Share	**Datum:**	NAVD88	**Sampler:**	std. split-spoon
Logged By:	Schonewald	**Rig Type:**	Mobile Drill B-53 (rubber track)	**Hammer Wt./Fall:**	140 lbs/30 in (auto hammer)
Date Start/Finish:	6/11/17; 2020 - 6/14/17; 0025	**Drilling Method:**	cased wash boring	**Hammer Type:**	auto
Boring Location:	see remarks	**Casing ID/OD:**	HW to 75.0'; NW to 125.0'	**Hammer Efficiency:**	0.677
		Auger ID/OD:	SSA to 10'	**Water Level*:**	23.5 ft. (end, open)

IN-SITU SAMPLING AND TESTING:
D = Split Spoon Sample
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MU = Unsuccessful Thin Wall Tube Sample attempt
V = Insitu Vane Shear Test
MV = Unsuccessful Insitu Vane Shear Test attempt

ADDITIONAL DEFINITIONS:
N-uncorrected = N value
N_{60} = N value corrected for hammer efficiency
hammer efficiency = calculated hammer efficiency
S_u = Insitu Field Vane Shear Strength (psf)
R = Rock Core Sample
RQD = Rock Quality Designation (%)

ADDITIONAL DEFINITIONS:
WOH = weight of 140lb. hammer
WOR = weight of rods
-- = not recorded

BOREHOLE ADVANCEMENT METHODS:
SSA/HSA=solid/hollow stem auger
RC=roller cone/OPEN/PUSH=hydraulic push

LABORATORY TEST RESULTS:
AASHTO / USCS soil classifications
-#200 = percent fines WC = water content (%)
CONSOL= 1-D consolidation test
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LL=Liquid Limit / PL=Plastic Limit / PI=Plasticity Index
UCT qp = peak compressive strength of rock

Depth (ft.)	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-uncorrected	N-60	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Lab. Testing Results
50	11D	24/5	50.0 - 52.0	WOR-WOH/12"-1	0	0	132			11D: Grey, v. loose, Silty fine SAND.	
							128				
							124				
							116				
							121				
55	12D	24/4	55.0 - 57.0	WOH/18"-2	0	0	124			12D: Grey, v. loose, fine SAND, trace to little Silt.	
							121				
							127				
							133				
							132				
60	13D	24/24	60.0 - 62.0	1/12"-1/12"	1	1.12833	--	26.0		13D: Grey, v. soft, Silty CLAY; upper 6 inches of sample contains significant fine SAND. 60.5	
							--				
							--				
							--				
							--				
65	14D	24/11	65.0 - 67.0	WOR/24"	0	0	114			14D: Grey, v. soft, interbedded, Silty CLAY and fine Sandy SILT; sand layers apparent from hesitations under weight of hammer.	
							121				
							129				
							113				
							119				
70	MV 15D	6/-- 24/--	70.0 - 70.5 70.5 - 72.5	-- 1/24"	0	0	121			MV: unable to push vane past 70.5 ft. 15D: Grey, v. soft, interbedded Silty CLAY and fine Sandy SILT.	
							117				
							121				
							124	13.0		73.5	
							136				
75											

Remarks:

LOCATION: 29.1 ft north of north bridge joint; offset 3.9 ft LT of existing centerline

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.

SCHONEWALD ENGINEERING ASSOCIATES, INC.	**PROJECT:** Cummings Road Bridge over MeTPK **LOCATION:** Scarborough, Maine	**Boring No.:** BB-CUM-106 **Proj. No.:** 17-013

Driller:	New England Boring Contractors	**Elevation (ft.)**	86.5 ft (est'd)	**Core Barrel:**	NQ2
Operator:	Enos / Share	**Datum:**	NAVD88	**Sampler:**	std. split-spoon
Logged By:	Schonewald	**Rig Type:**	Mobile Drill B-53 (rubber track)	**Hammer Wt./Fall:**	140 lbs/30 in (auto hammer)
Date Start/Finish:	6/11/17; 2020 - 6/14/17; 0025	**Drilling Method:**	cased wash boring	**Hammer Type:**	auto
Boring Location:	see remarks	**Casing ID/OD:**	HW to 75.0'; NW to 125.0'	**Hammer Efficiency:**	0.677
		Auger ID/OD:	SSA to 10'	**Water Level*:**	23.5 ft. (end, open)

IN-SITU SAMPLING AND TESTING:
D = Split Spoon Sample
MD = Unsuccessful Split Spoon Sample attempt
U = Thin Wall Tube Sample
MU = Unsuccessful Thin Wall Tube Sample attempt
V = Insitu Vane Shear Test
MV = Unsuccessful Insitu Vane Shear Test attempt

ADDITIONAL DEFINITIONS:
N-uncorrected = N value
N_{60} = N value corrected for hammer efficiency
hammer efficiency = calculated hammer efficiency
S_u = Insitu Field Vane Shear Strength (psf)
R = Rock Core Sample
RQD = Rock Quality Designation (%)

ADDITIONAL DEFINITIONS:
WOH = weight of 140lb. hammer
WOR = weight of rods
-- = not recorded

BOREHOLE ADVANCEMENT METHODS:
SSA/HSA=solid/hollow stem auger
RC=roller cone/OPEN/PUSH=hydraulic push

LABORATORY TEST RESULTS:
AASHTO / USCS soil classifications
-#200 = percent fines WC = water content (%)
CONSOL= 1-D consolidation test
UU=Unconsolidated undrained triaxial test
LL=Liquid Limit / PL=Plastic Limit / PI=Plasticity Index
UCT qp = peak compressive strength of rock

Depth (ft.)	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-uncorrected	N-60	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Lab. Testing Results
75	16D V1	24/24	75.0 - 77.0 75.6 - 76.0	VANE INTERVAL Su=522 / 27 psf			open			16D: Grey, Silty CLAY with one Silty fine SAND parting. V1: Tu=19/Tr=1 ft-lbs (65 mm x 130 mm vane)	
	V2		76.6 - 77.0	Su=481 / 27 psf						V2: Tu=17.5/Tr=1 ft-lbs (65 mm x 130 mm vane)	
80	U1	24/18	80.0 - 82.0	HYD PUSH						U1: Grey, Silty CLAY.	
	V3		82.6 - 83.0	Su=591 / 41 psf						V3: Tu=21.5/Tr=1.5 ft-lbs (65 mm x 130 mm vane)	
	V4		83.6 - 84.0	Su=646 / 27 psf						V4: Tu=23.5/Tr=1 ft-lbs (65 mm x 130 mm vane)	
85	17D	24/24	85.0 - 87.0	WOR/24"						17D: Dark grey with black streaks, Silty CLAY.	
90	U2	24/24	90.0 - 92.0	HYD PUSH						U2: Dark grey, Silty CLAY.	CONSOL UU WC=42.3% LL=47.8 PL=24.4 PI=23.4
95	18D V5	24/24	95.0 - 97.0 95.6 - 96.0	VANE INTERVAL Su=673 / 55 psf						18D: Dark grey with black streaks, Silty CLAY. V5: Tu=24.5/Tr=2 ft-lbs (65 mm x 130 mm vane)	WC=37.7% LL=29.1 PL=19.3 PI=9.8
	V6		96.6 - 97.0	Su=893 / 14 psf						V6: Tu=32.5/Tr=0.5 ft-lbs (65 mm x 130 mm vane)	
100											

Remarks:

LOCATION: 29.1 ft north of north bridge joint; offset 3.9 ft LT of existing centerline

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.

SCHONEWALD ENGINEERING ASSOCIATES, INC.	PROJECT: Cummings Road Bridge over MeTPK LOCATION: Scarborough, Maine	Boring No.: BB-CUM-106 Proj. No.: 17-013

Driller:	New England Boring Contractors	**Elevation (ft.)**	86.5 ft (est'd)	**Core Barrel:**	NQ2
Operator:	Enos / Share	**Datum:**	NAVD88	**Sampler:**	std. split-spoon
Logged By:	Schonewald	**Rig Type:**	Mobile Drill B-53 (rubber track)	**Hammer Wt./Fall:**	140 lbs/30 in (auto hammer)
Date Start/Finish:	6/11/17; 2020 - 6/14/17; 0025	**Drilling Method:**	cased wash boring	**Hammer Type:**	auto
Boring Location:	see remarks	**Casing ID/OD:**	HW to 75.0'; NW to 125.0'	**Hammer Efficiency:**	0.677
		Auger ID/OD:	SSA to 10'	**Water Level*:**	23.5 ft. (end, open)

IN-SITU SAMPLING AND TESTING:
D = Split Spoon Sample
MD = Unsuccessful Split Spoon Sample attempt
U = Thin Wall Tube Sample
MU = Unsuccessful Thin Wall Tube Sample attempt
V = Insitu Vane Shear Test
MV = Unsuccessful Insitu Vane Shear Test attempt

ADDITIONAL DEFINITIONS:
N-uncorrected = N value
N_{60} = N value corrected for hammer efficiency
hammer efficiency = calculated hammer efficiency
S_u = Insitu Field Vane Shear Strength (psf)
R = Rock Core Sample
RQD = Rock Quality Designation (%)

ADDITIONAL DEFINITIONS:
WOH = weight of 140lb. hammer
WOR = weight of rods
-- = not recorded
BOREHOLE ADVANCEMENT METHODS:
SSA/HSA=solid/hollow stem auger
RC=roller cone/OPEN/PUSH=hydraulic push

LABORATORY TEST RESULTS:
AASHTO / USCS soil classifications
-#200 = percent fines WC = water content (%)
CONSOL= 1-D consolidation test
UU=Unconsolidated undrained triaxial test
LL=Liquid Limit / PL=Plastic Limit / PI=Plasticity Index
UCT qp = peak compressive strength of rock

Depth (ft.)	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-uncorrected	N-60	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Lab. Testing Results
100	U3	24/24	100.0 - 102.0	HYD PUSH						U3: Dark grey, Silty CLAY.	
105	19D V7	24/24	105.0 - 107.0 105.6 - 106.0	VANE INTERVAL Su=755 / 55 psf						19D: Dark grey, Silty CLAY, trace fine SAND and one concretion. V7: Tu=27.5/Tr=2 ft-lbs (65 mm x 130 mm vane)	
								-19.5		106.0	
	MV		106.0 - 106.4	--						MV: unable to push past 106.4 ft.	
110	20D	24/24	110.0 - 112.0	WOR/24"	0	0				20D: Dark grey Silty CLAY, with fine gravel-size concretions.	
115	21D	24/24	115.0 - 117.0	WOR/24"	0	0				21D: Dark grey Silty CLAY, with fine gravel-size concretions.	WC=-- LL=32.0 PL=19.9 PI=12.1
120	22D	24/24	120.0 - 122.0	WOR-1/18"	0	0				22D: Dark grey Silty CLAY, with fine gravel-size concretions.	
								-37.7		124.2	
125										124.2 ft.: Casing fetches up; possible top of weathered rock.	

Remarks:

LOCATION: 29.1 ft north of north bridge joint; offset 3.9 ft LT of existing centerline

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.

Boring No.: BB-CUM-106

Schonewald Engineering Associates, Inc.	**PROJECT:** Cummings Road Bridge over MeTPK **LOCATION:** Scarborough, Maine	**Boring No.:** BB-CUM-106 **Proj. No.:** 17-013

Driller:	New England Boring Contractors	**Elevation (ft.)**	86.5 ft (est'd)	**Core Barrel:**	NQ2
Operator:	Enos / Share	**Datum:**	NAVD88	**Sampler:**	std. split-spoon
Logged By:	Schonewald	**Rig Type:**	Mobile Drill B-53 (rubber track)	**Hammer Wt./Fall:**	140 lbs/30 in (auto hammer)
Date Start/Finish:	6/11/17; 2020 - 6/14/17; 0025	**Drilling Method:**	cased wash boring	**Hammer Type:**	auto
Boring Location:	see remarks	**Casing ID/OD:**	HW to 75.0'; NW to 125.0'	**Hammer Efficiency:**	0.677
		Auger ID/OD:	SSA to 10'	**Water Level*:**	23.5 ft. (end, open)

IN-SITU SAMPLING AND TESTING:
D = Split Spoon Sample
MD = Unsuccessful Split Spoon Sample attempt
U = Thin Wall Tube Sample
MU = Unsuccessful Thin Wall Tube Sample attempt
V = Insitu Vane Shear Test
MV = Unsuccessful Insitu Vane Shear Test attempt

ADDITIONAL DEFINITIONS:
N-uncorrected = N value
N_{60} = N value corrected for hammer efficiency
hammer efficiency = calculated hammer efficiency
S_u = Insitu Field Vane Shear Strength (psf)
R = Rock Core Sample
RQD = Rock Quality Designation (%)

ADDITIONAL DEFINITIONS:
WOH = weight of 140lb. hammer
WOR = weight of rods
-- = not recorded
BOREHOLE ADVANCEMENT METHODS:
SSA/HSA=solid/hollow stem auger
RC=roller cone/OPEN/PUSH=hydraulic push

LABORATORY TEST RESULTS:
AASHTO / USCS soil classifications
-#200 = percent fines WC = water content (%)
CONSOL= 1-D consolidation test
UU=Unconsolidated undrained triaxial test
LL=Liquid Limit / PL=Plastic Limit / PI=Plasticity Index
UCT qp = peak compressive strength of rock

Depth (ft.)	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-uncorrected	N-60	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Lab. Testing Results
125	R1	31/31	125.0 - 127.6	RQD: 0"=0%				-38.5		125.0 R1: Medium hard to hard, slightly to moderately weathered, aphanitic to fine grained, medium and dark grey PHYLLITE with tightly spaced and highly undulating foliation. Very close to close, moderately dipping to high angle breaks. Typically undulating, smooth, discolored to decomposed, and open with clay infilling. Highly broken 126.6 to 127.0 ft. Core times: 2:00 / 1:40 / -- min:sec/ft.	
	R2	32/25	127.6 - 130.3	RQD: 0"=0%						R2: Same as R1. No recovery 128.8 to 129.5 ft. Core times: -- / 1:25 / -- / - - min:sec/ft.	
130	R3	25/22	130.3 - 132.4	RQD: 5"=20%						R3: Same as R1. Highly weathered and broken 132.0 to 132.4 ft. Core times: -- / 1:45 / -- min:sec/ft.	UCT qp = 0.44 ksi
	R4	31/18	132.4 - 135.0	RQD: 0"=0%						R4: Same as R1. Highly weathered and broken throughout. Core times: -- / 3:05 / 2:45 min:sec/ft.	
135	R5	47/26	135.0 - 138.9	RQD: 7"=15%						R5: Same as R1. Highly weathered and broken below 135.9 ft. Core times: 2:00 / 1:55 / 2:35 / -- min:sec/ft.	UCT qp = 1.71 ksi
								-52.4		138.9 **Bottom of Exploration at 138.9 feet below ground surface.**	
140											
145											
150											

Remarks:

LOCATION: 29.1 ft north of north bridge joint; offset 3.9 ft LT of existing centerline

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.

PHOTOGRAPHS OF ROCK CORE OBTAINED IN PRELIMINARY SUBSURFACE EXPLORATIONS

Photo 1: Core box containing wetted rock core from test boring BB-CUM-103 left side of core box (top portion of cores).
Slots from top to bottom:
1) BB-CUM-103, R1 thru top of R3;
2) BB-CUM-103, bottom of R4 thru top of R6.

Photo 2: Core box containing wetted rock core from test boring BB-CUM-103 – right side of core box (bottom portion of cores).
Slots from top to bottom
1) BB-CUM-103, bottom of R2 thru top of R4;
2) BB-CUM-103, bottom of R5 thru R7.

SCHONEWALD ENGINEERING ASSOCIATES, INC.

ROCK CORE PHOTOGRAPHS
TEST BORING BB-CUM-103
BRIDGE REPLACEMENT
CUMMINGS ROAD OVER MAINE TURNPIKE
SCARBOROUGH, MAINE

Sheet No.:
1 of 2

Photo 3: Core box containing dried rock core from test boring BB-CUM-106 left side of core box (top portion of cores).
Slots from top to bottom:
1) BB-CUM-106, R1 thru top of R2;
2) BB-CUM-106, R3 thru top of R4;
3) BB-CUM-106, bottom of R5.

Photo 4: Core box containing dried rock core from test boring BB-CUM-106 – right side of core box (bottom portion of cores).
Slots from top to bottom
1) BB-CUM-106, bottom of R1 thru R2;
2) BB-CUM-106, bottom of R4 thru top of R5.

SCHONEWALD ENGINEERING ASSOCIATES, INC.

ROCK CORE PHOTOGRAPHS
TEST BORING BB-CUM-106
BRIDGE REPLACEMENT
CUMMINGS ROAD OVER MAINE TURNPIKE
SCARBOROUGH, MAINE

Sheet No.:

2 of 2

RWG&A: RESULTS OF SOILS LABORATORY TESTS ON SOIL SAMPLES

R. W. Gillespie & Associates, Inc.
86 Industrial Park Road, Suite 4, Saco, ME 04072 207-286-8008
200 Int'l Drive, Suite 170, Portsmouth, NH 03801 603-427-0244

LETTER OF TRANSMITTAL

Date: 09/28/2017	Project No.: 1368-005
Attention: Isabel Schonewald (ischonewald@maine.rr.com)	
Re: LaboratoryTesting BB-CUM-101 Scarborough, ME	

Schonewald Engineering Associates, Inc.

129 Middle Road

Cumberland, ME 04021

We are sending you attached laboratory test results.

Laboratory No. (s)	Test (s) Performed
14649a: 4D, 15'-17'	Washed Gradation with hydrometer, Atteberg, Moisture

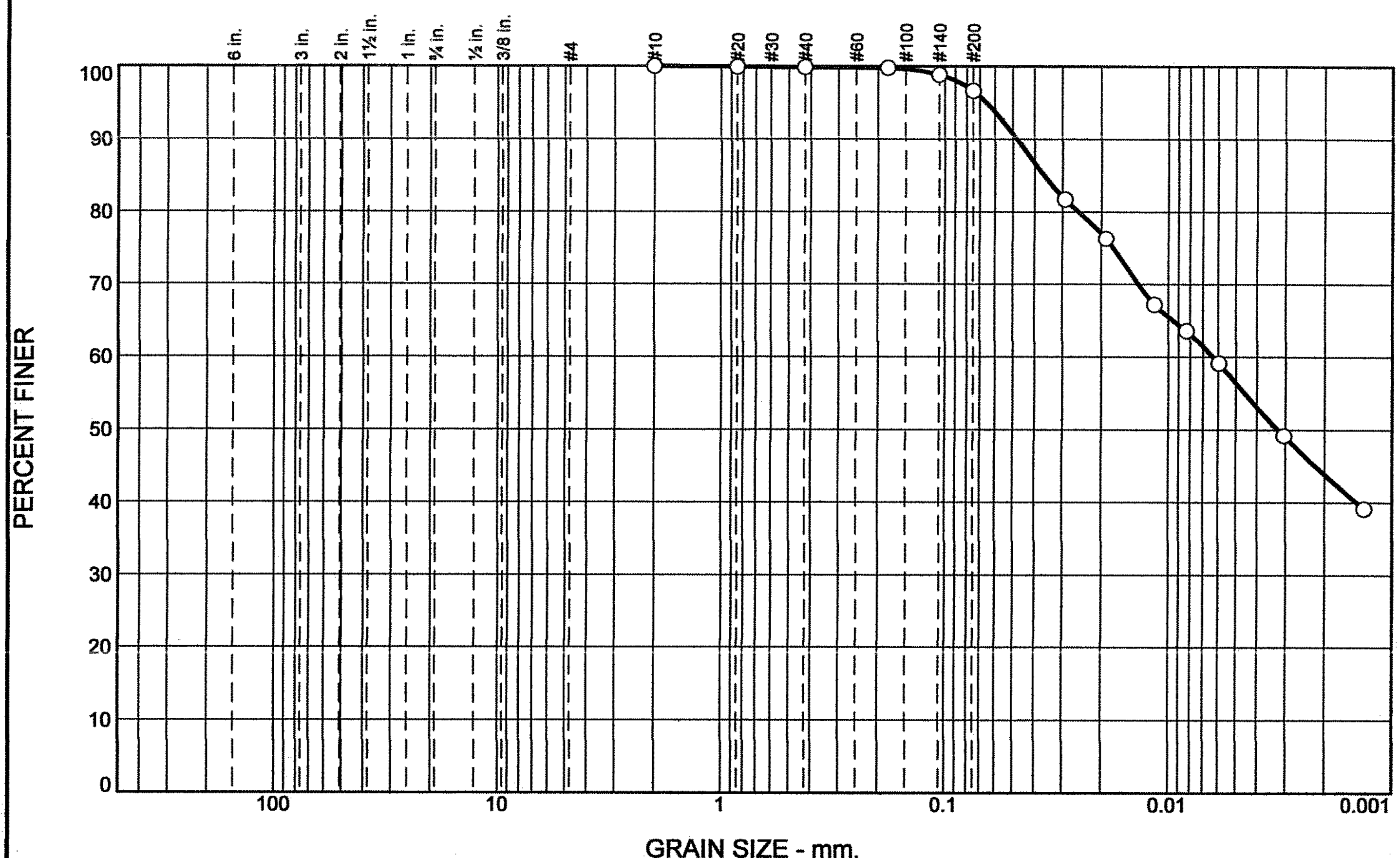
Remarks:

Copy to:

Signed: Matthew T. Grady

If enclosures are not as noted, kindly notify us at once.

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	0.1	3.3	40.1	56.5

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#10	100.0		
#20	99.9		
#40	99.9		
#80	99.8		
#140	98.8		
#200	96.6		
0.0293 mm.	81.7		
0.0191 mm.	76.3		
0.0115 mm.	67.2		
0.0083 mm.	63.6		
0.0060 mm.	59.1		
0.0030 mm.	49.2		
0.0013 mm.	39.1		

* (no specification provided)

Soil Description

Silt

Atterberg Limits

PL= 19.06 LL= NV PI= CNBD

Coefficients

D_{90}= 0.0480 D_{85}= 0.0363 D_{60}= 0.0063
D_{50}= 0.0032 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= ML AASHTO= A-4(0)

Remarks

Moisture Content: 39.3%
CNBD = COULD NOT BE DETERMINED
NV = NON - VISCOUS

Location: BB-CUM-101
Sample Number: 4D **Depth:** 15'-17' **Date:** 9/27/17

R.W. Gillespie & Associates, Inc. Saco, Maine

Client: Schonewald Engineering Associates
Project: Cummings Road Over Maine Turnpike #17-013
Project No: 1368-005 **Lab No.** 14649a

Tested By: JRF/AGS **Checked By:** MTG MTG

R. W. Gillespie & Associates, Inc.

86 Industrial Park Road, Suite 4, Saco, ME 04072 207-286-8008

200 Int'l Drive, Suite 170, Portsmouth, NH 03801 603-427-0244

LETTER OF TRANSMITTAL

Date: 09/26/2017	Project No.: 1368-005
Attention: Isabel Schonewald (ischonewald@maine.rr.com)	
Re: Laboratory Testing BB-CUM-101 Scarborough, ME	

Schonewald Engineering Associates, Inc.

129 Middle Road

Cumberland, ME 04021

We are sending you attached laboratory test results.

Laboratory No. (s)	Test (s) Performed
14649b: U2, 40'-42'	Consolidation, Atteberg, Moisture Content

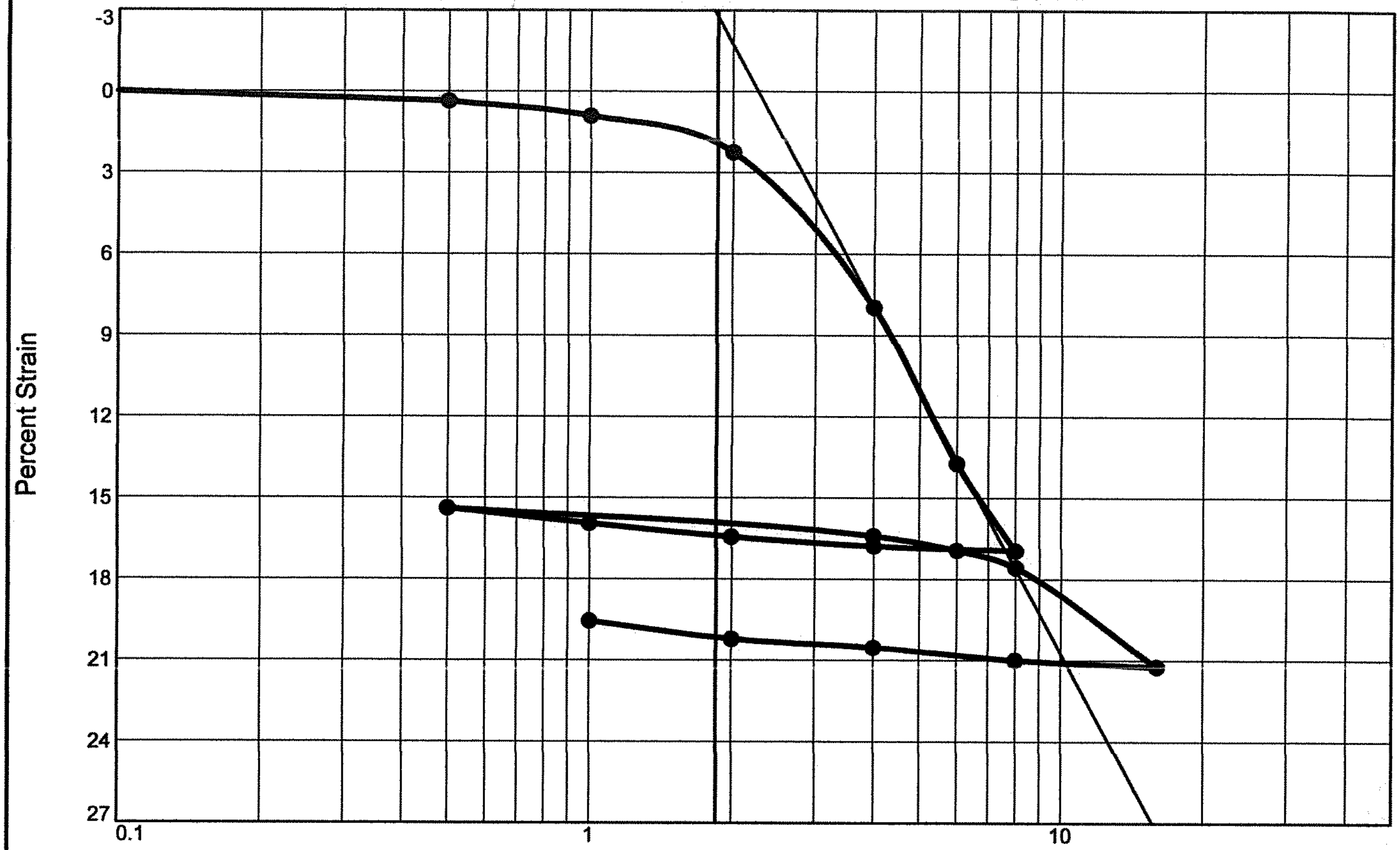
Remarks:

Copy to:

Signed: Matthew T. Grady

If enclosures are not as noted, kindly notify us at once.

CONSOLIDATION TEST REPORT



Coefficients of Consolidation and Secondary Consolidation

No.	Load (ksf)	C_v (ft.^{2}/day)	C_α	No.	Load (ksf)	C_v (ft.^{2}/day)	C_α	No.	Load (ksf)	C_v (ft.^{2}/day)	C_α
1	0.50	1.157		8	2.00	1.273		15	8.00	3.369	
2	1.00	1.228		9	1.00	0.350		16	4.00	1.185	
3	2.00	1.165		10	0.50	0.153		17	2.00	0.501	
4	4.00	0.132		11	4.00	0.741		18	1.00	0.189	
5	6.00	0.101		12	6.00	0.752					
6	8.00	0.069		13	8.00	0.671					
7	4.00	3.571		14	16.00	0.354					

Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	Overburden (ksf)	P_c (ksf)	C_c	C_r	Initial Void Ratio
Saturation	Moisture									
98.8 %	48.2 %	73.3	42.8	17.4	2.75		2.7	0.75	0.13	1.342

MATERIAL DESCRIPTION	USCS	AASHTO
Lean Clay		

Project No. 1368-005 **Client:** Schonewald Engineering Associates

Project: Cummings Road Over Maine Turnpike #17-013

Location: BB-CUM-101 **Depth:** 40'-42' **Sample Number:** U-2

Remarks:

R.W. Gillespie & Associates, Inc.

Saco, Maine

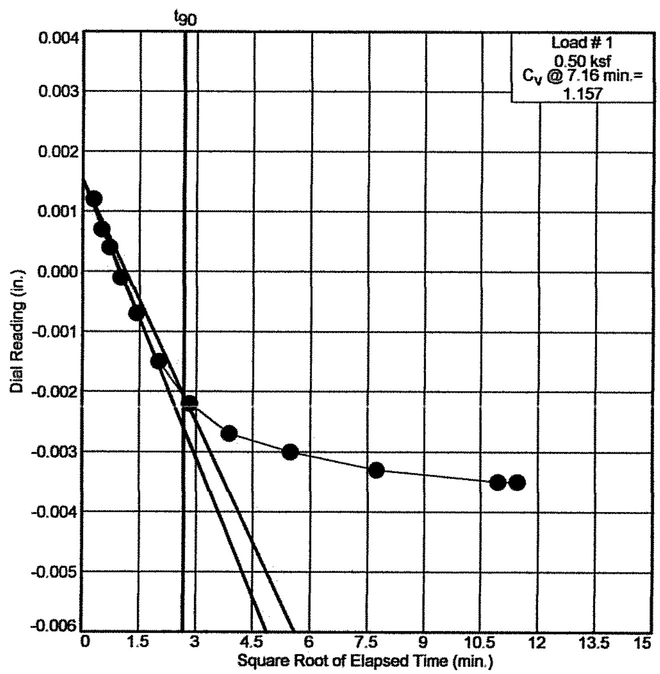
Lab No. 14649b

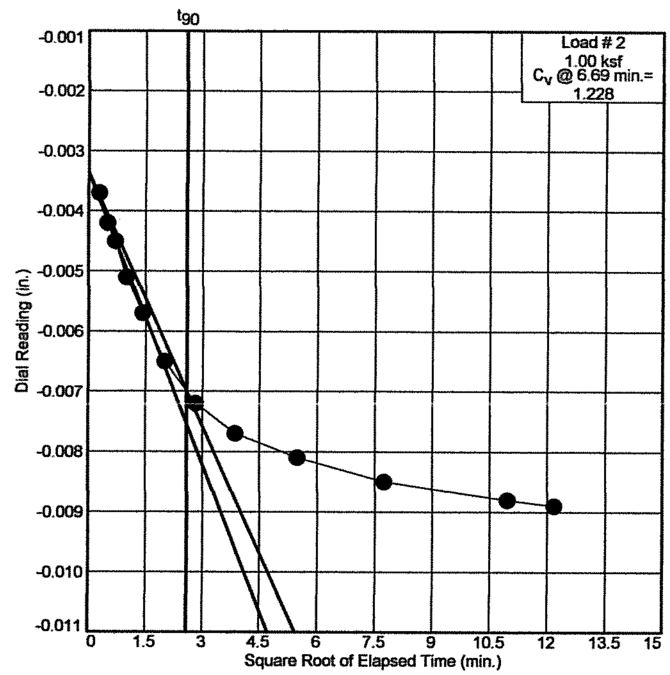
Tested By: JRF/AGS **Checked By:** MTG MTG

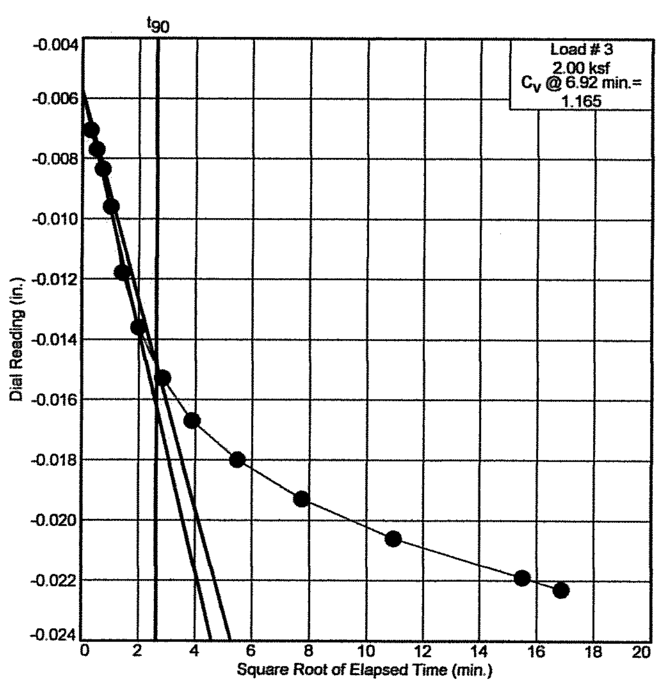
Dial Reading vs. Time

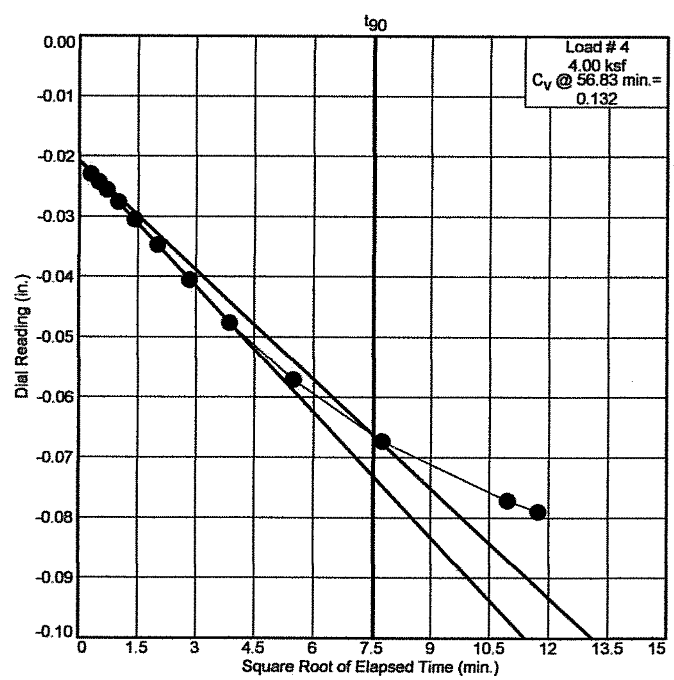
Project No.: 1368-005
Project: Cummings Road Over Maine Turnpike #17-013

Location: BB-CUM-101 **Depth:** 40'-42' **Sample Number:** U-2









R.W. Gillespie & Associates, Inc.

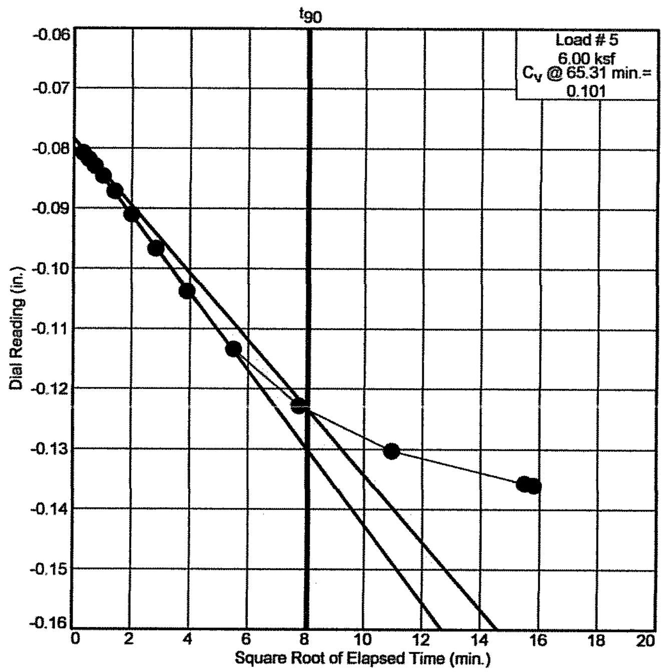
Saco, Maine

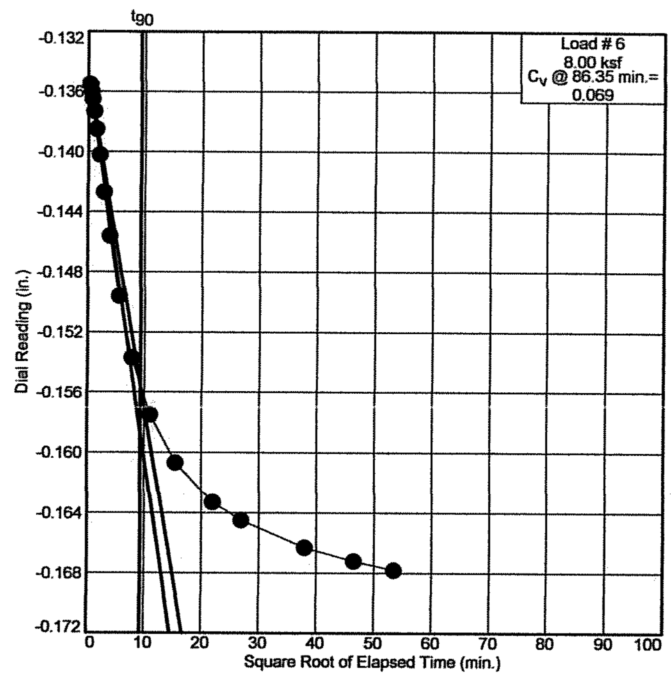
Lab No. 14649b

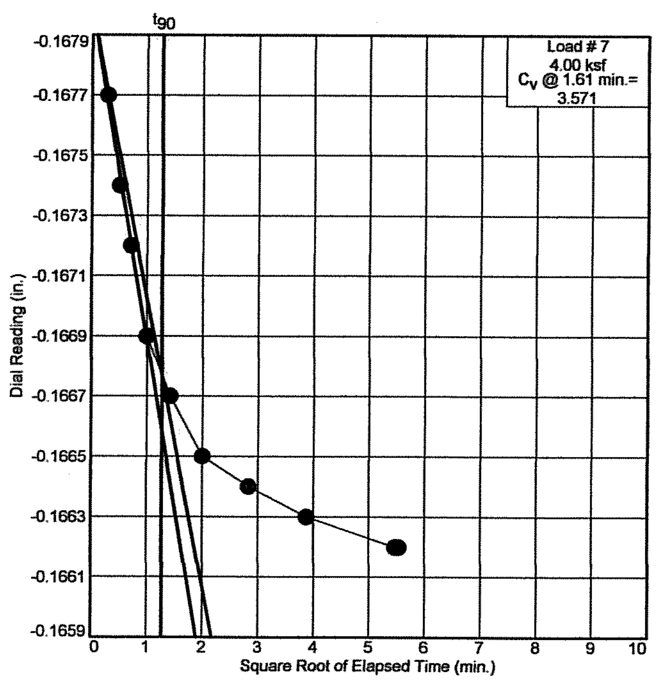
Dial Reading vs. Time

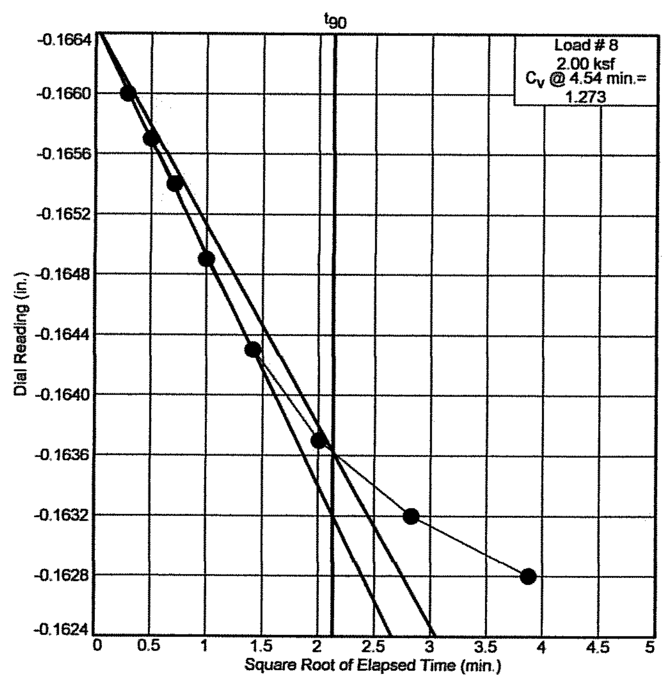
Project No.: 1368-005
Project: Cummings Road Over Maine Turnpike #17-013

Location: BB-CUM-101 Depth: 40'-42' Sample Number: U-2









R.W. Gillespie & Associates, Inc.

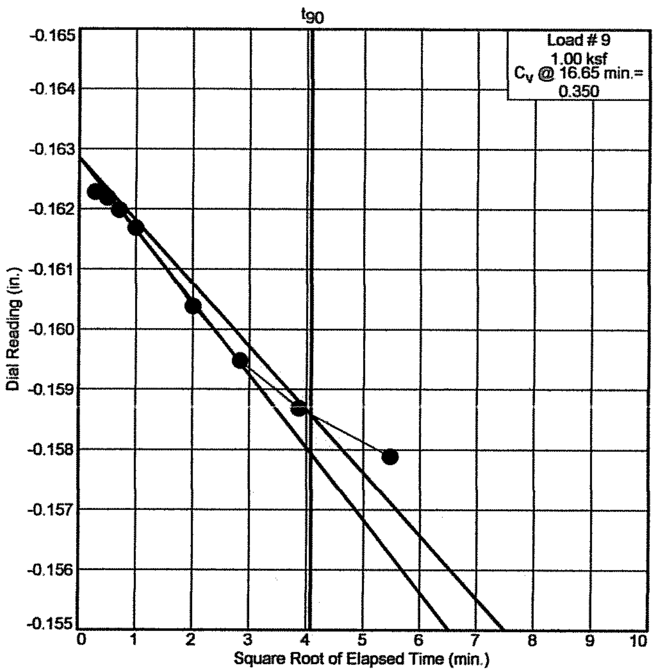
Saco, Maine

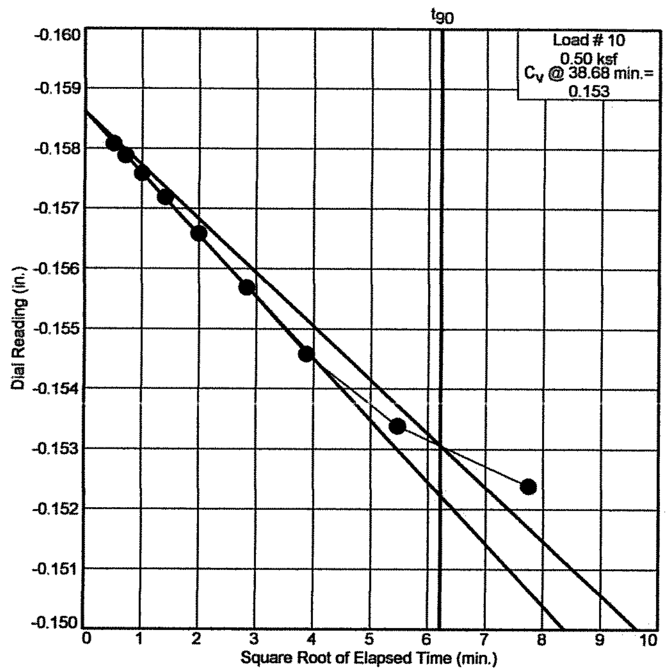
Lab No. 14649b

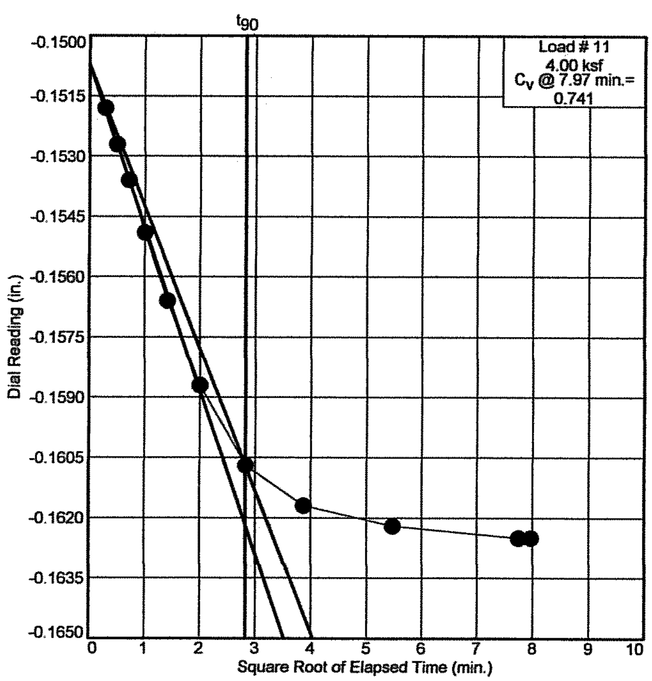
Dial Reading vs. Time

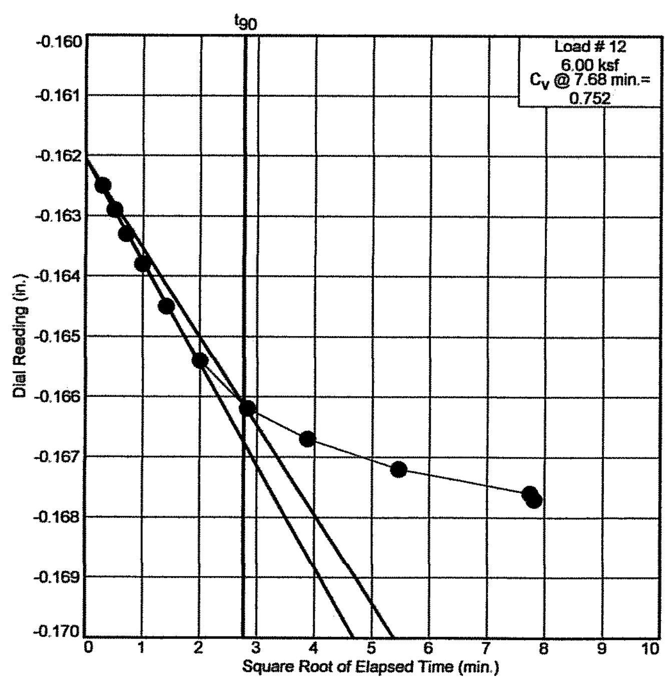
Project No.: 1368-005
Project: Cummings Road Over Maine Turnpike #17-013

Location: BB-CUM-101 **Depth:** 40'-42' **Sample Number:** U-2









R.W. Gillespie & Associates, Inc.

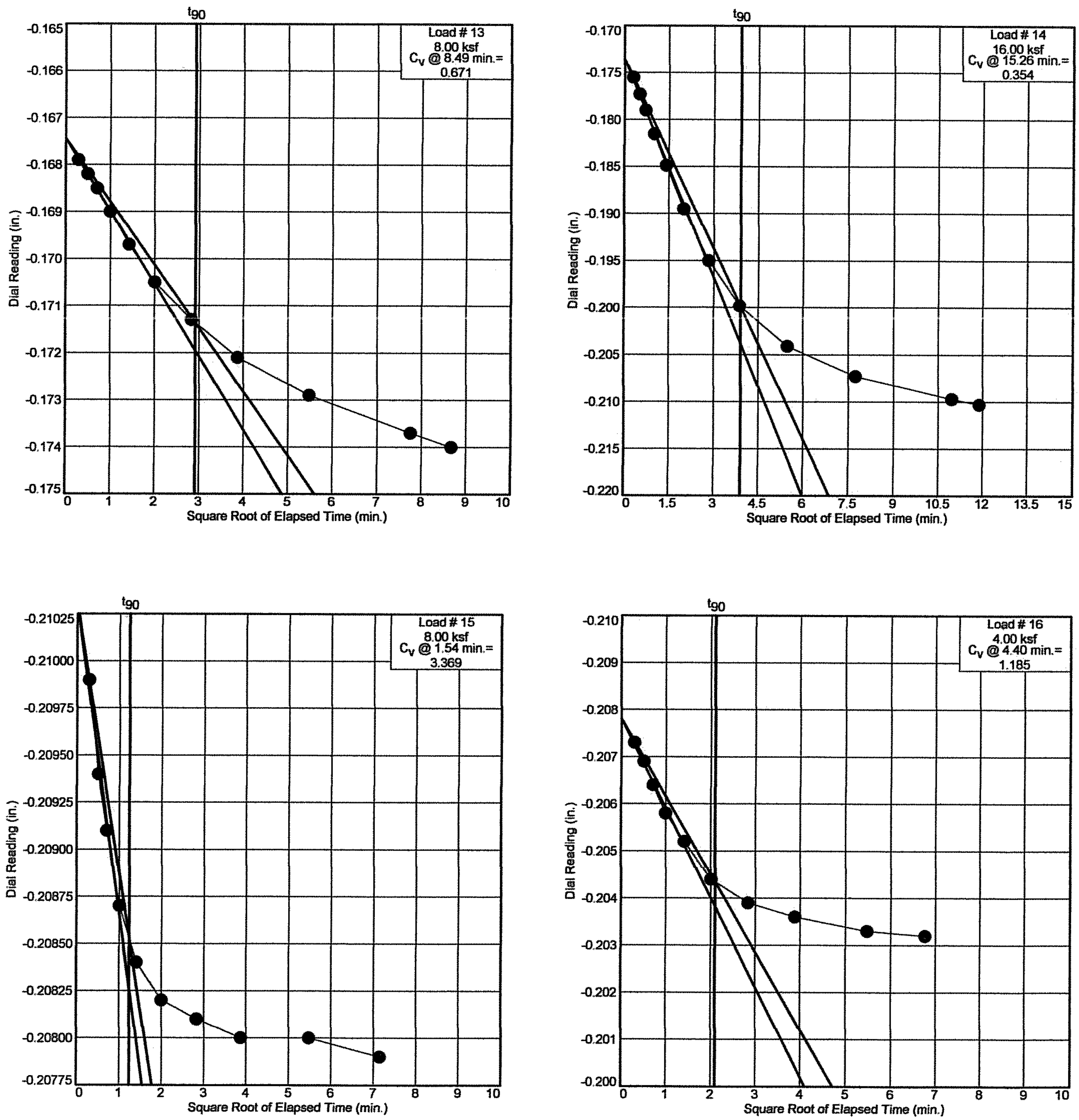
Saco, Maine

Lab No. 14649b

Dial Reading vs. Time

Project No.: 1368-005
Project: Cummings Road Over Maine Turnpike #17-013

Location: BB-CUM-101 **Depth:** 40'-42' **Sample Number:** U-2



R.W. Gillespie & Associates, Inc.

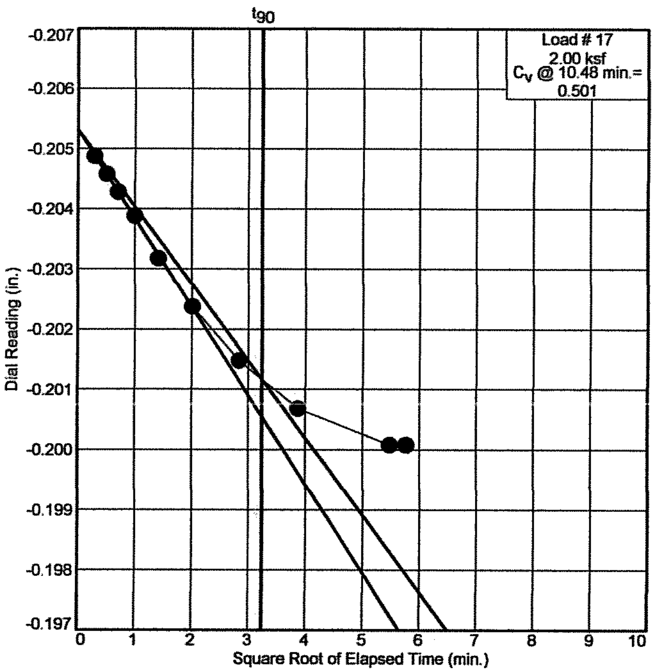
Saco, Maine

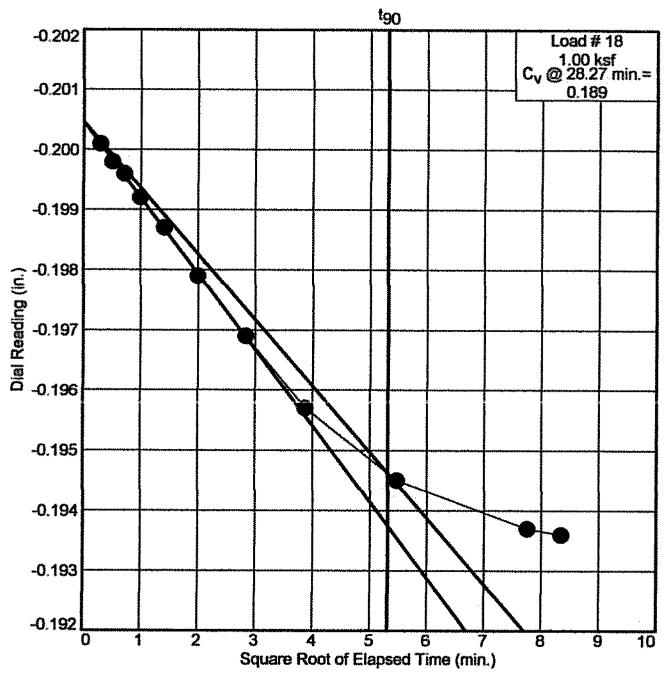
Lab No. 14649b

Dial Reading vs. Time

Project No.: 1368-005
Project: Cummings Road Over Maine Turnpike #17-013

Location: BB-CUM-101 **Depth:** 40'-42' **Sample Number:** U-2





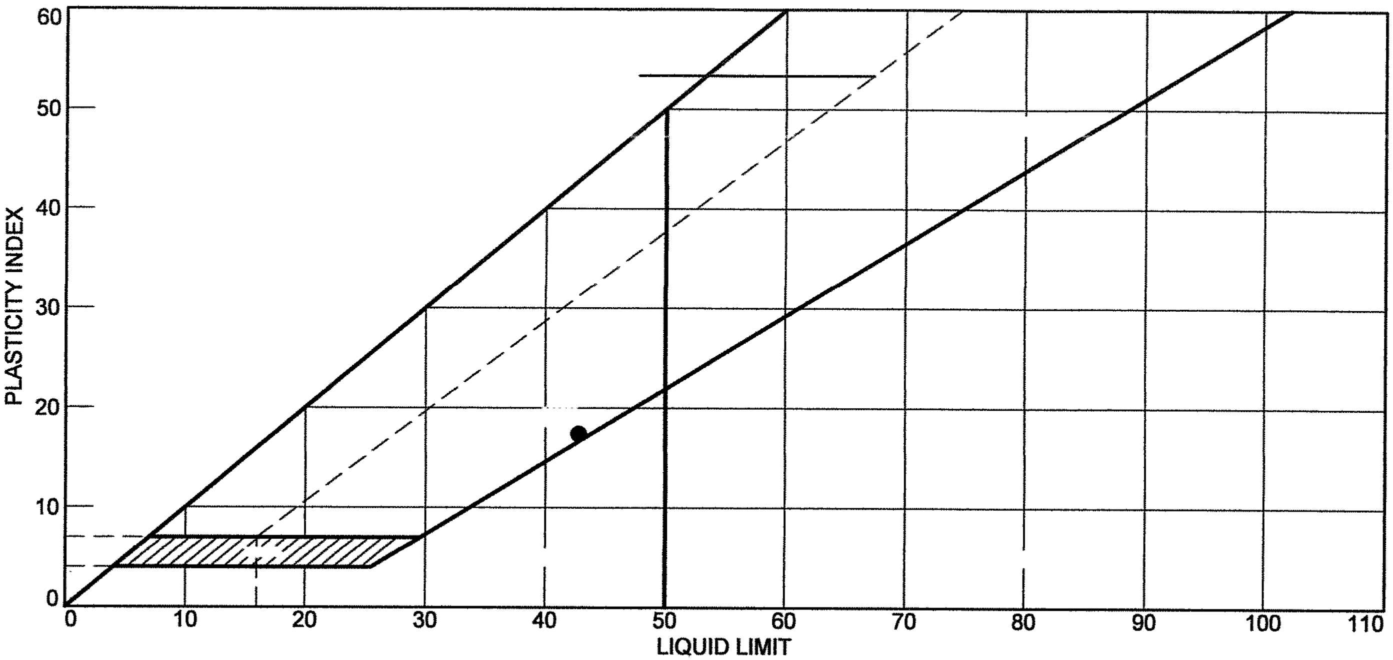
R.W. Gillespie & Associates, Inc.

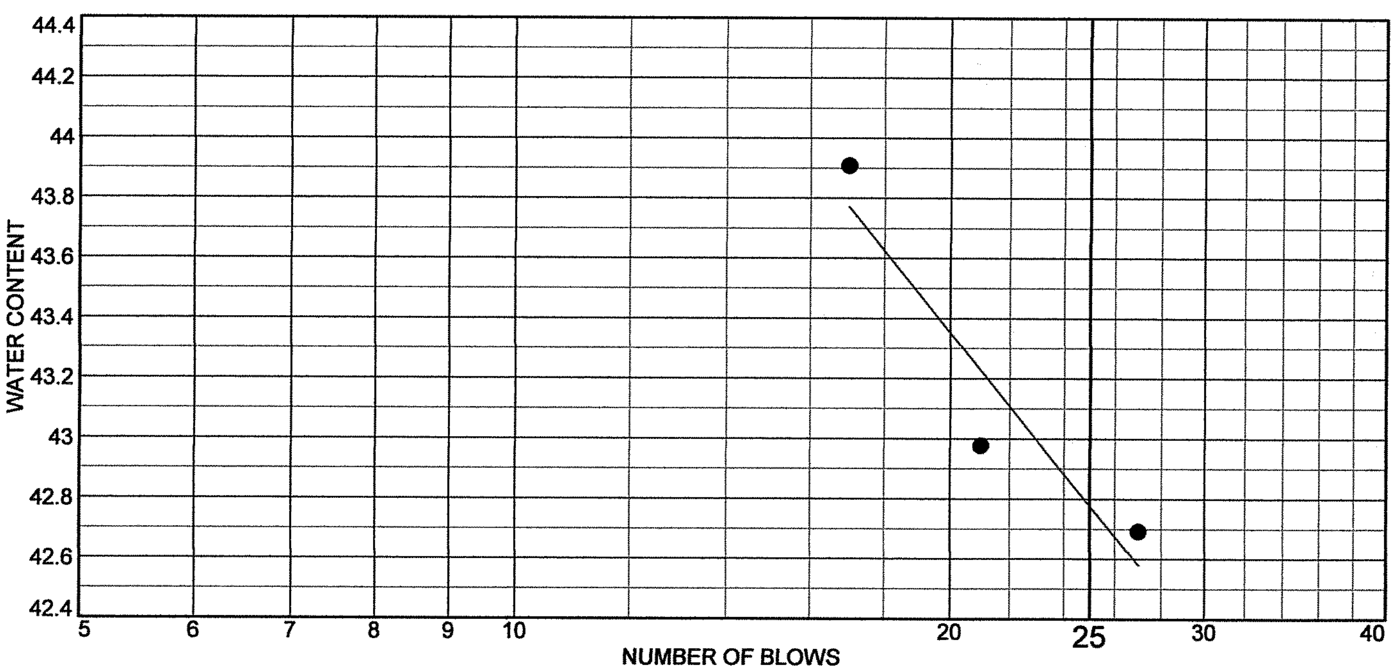
Saco, Maine

Lab No. 14649b

MTE

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Lean Clay	42.8	25.4	17.4			

Project No. 1368-005 **Client:** Schonewald Engineering Associates

Project: Cummings Road Over Maine Turnpike #17-013

Location: BB-CUM-101

Sample Number: U-2 **Depth:** 40'-42'

R.W. Gillespie & Associates, Inc.

Saco, Maine

Remarks:

Lab No. 14649b

Tested By: AGS **Checked By:** MTG MTG

Laboratory Vane Shear Test Results

ASTM D4648 Standard Test Method for Laboratory Miniature Vane Shear Test for Saturated Fine-Grained Clayey Soil

Project:	Cummings Road Over Maine Turnpike #1	Location:	Scarborough, ME
Client:	Schonewald Engineering Associates, Inc.	Date:	8/10/2017
Project No.:	1368-005	Test Depth:	40' to 42'

Boring/Sample No.	BB-CUM-101/U2				Lab No.	14649b	
Test No.	Test Depth (ft)	Vane Size	Max. Torque (Undisturbed) (kg-cm)	Max. Torque (Remolded) (kg-cm)	Undrained Shear Strength (psf)	Undrained Shear Strength (psf)	Moisture Content
1	1"	L	40	0	418	0	51%
2	3"	L	38	0	397	0	53%
3	9"	L	27	0	282	0	48%

Vane Size	
	(mm)
S	16 x 32
M	20 x 40
L	24.5 x 50.8

Tested By: JRF/AGS

Checked By: MTG

R.W. Gillespie & Associates

86 Industrial Park Rd., Suite 4, Saco ME 04072, 207-286-8008 / 200 International Dr., Suite 170, Portsmouth NH 03801, 603-427-0244

R. W. Gillespie & Associates, Inc.
86 Industrial Park Road, Suite 4, Saco, ME 04072 207-286-8008
200 Int'l Drive, Suite 170, Portsmouth, NH 03801 603-427-0244

LETTER OF TRANSMITTAL

Date: 09/28/2017	Project No.: 1368-005
Attention: Isabel Schonewald (ischonewald@maine.rr.com)	
Re: LaboratoryTesting BB-CUM-101 Scarborough, ME	

Schonewald Engineering Associates, Inc.

129 Middle Road

Cumberland, ME 04021

We are sending you attached laboratory test results.

Laboratory No. (s)	Test (s) Performed
14649c: 8D, 45'-47'	Atteberg, Moisture

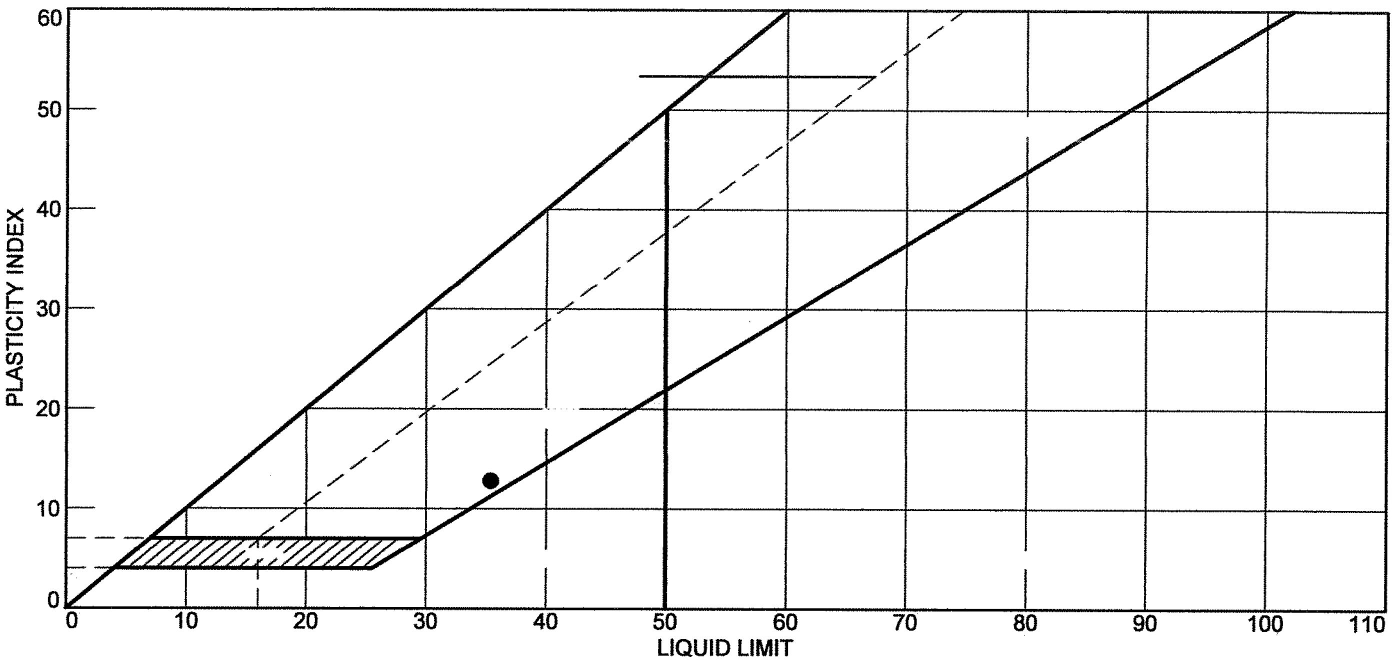
Remarks:

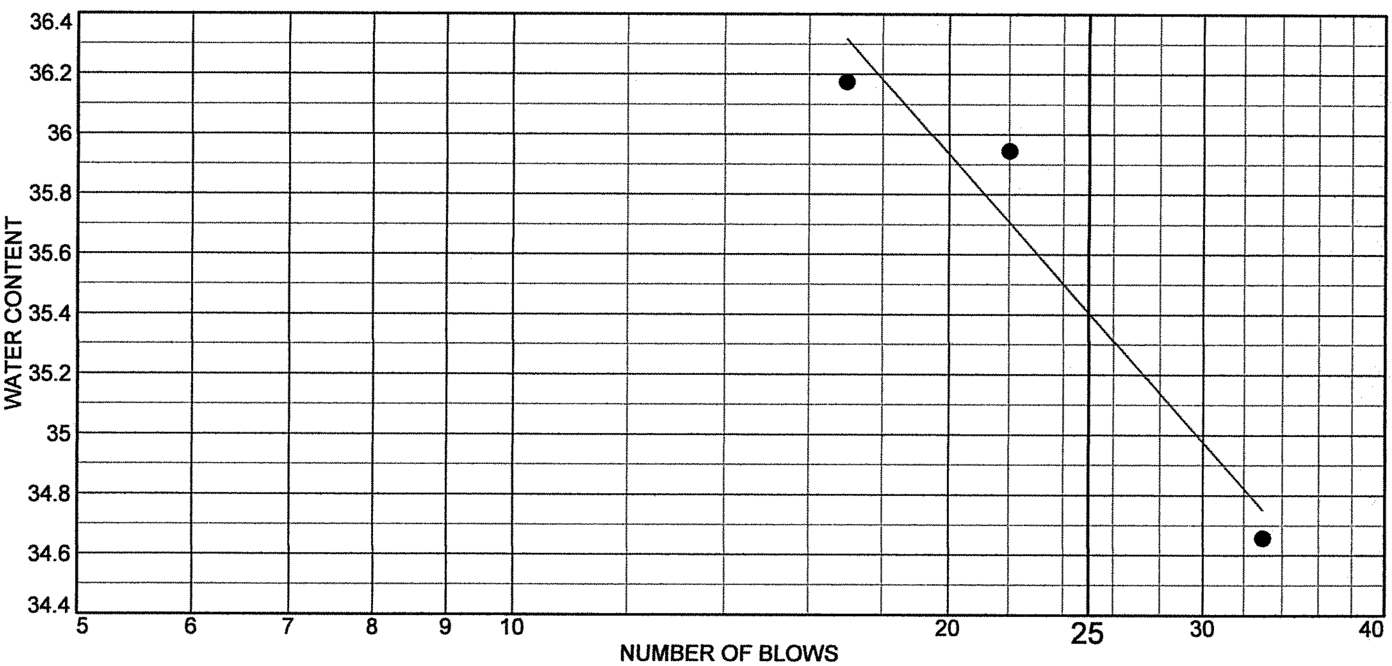
Copy to:

Signed: Matthew T. Grady

If enclosures are not as noted, kindly notify us at once.

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Lean Clay	35.4	22.6	12.8			

Project No. 1368-005 **Client:** Schonewald Engineering Associates

Project: Cummings Road Over Maine Turnpike #17-013

Location: BB-CUM-101
Sample Number: 8D **Depth:** 45'-47'

Remarks:
● Moisture Content: 43.4%

R.W. Gillespie & Associates, Inc.

Saco, Maine

Lab No. 14649c

Tested By: JRF/AGS **Checked By:** MTG MTG

R. W. Gillespie & Associates, Inc.
86 Industrial Park Road, Suite 4, Saco, ME 04072 207-286-8008
200 Int'l Drive, Suite 170, Portsmouth, NH 03801 603-427-0244

LETTER OF TRANSMITTAL

Date: 09/28/2017	Project No.: 1368-005
Attention: Isabel Schonewald (ischonewald@maine.rr.com)	
Re: LaboratoryTesting BB-CUM-102 Scarborough, ME	

Schonewald Engineering Associates, Inc.

129 Middle Road

Cumberland, ME 04021

We are sending you attached laboratory test results.

Laboratory No. (s)	Test (s) Performed
14650a: 1D, 2'-4'	Washed gradations

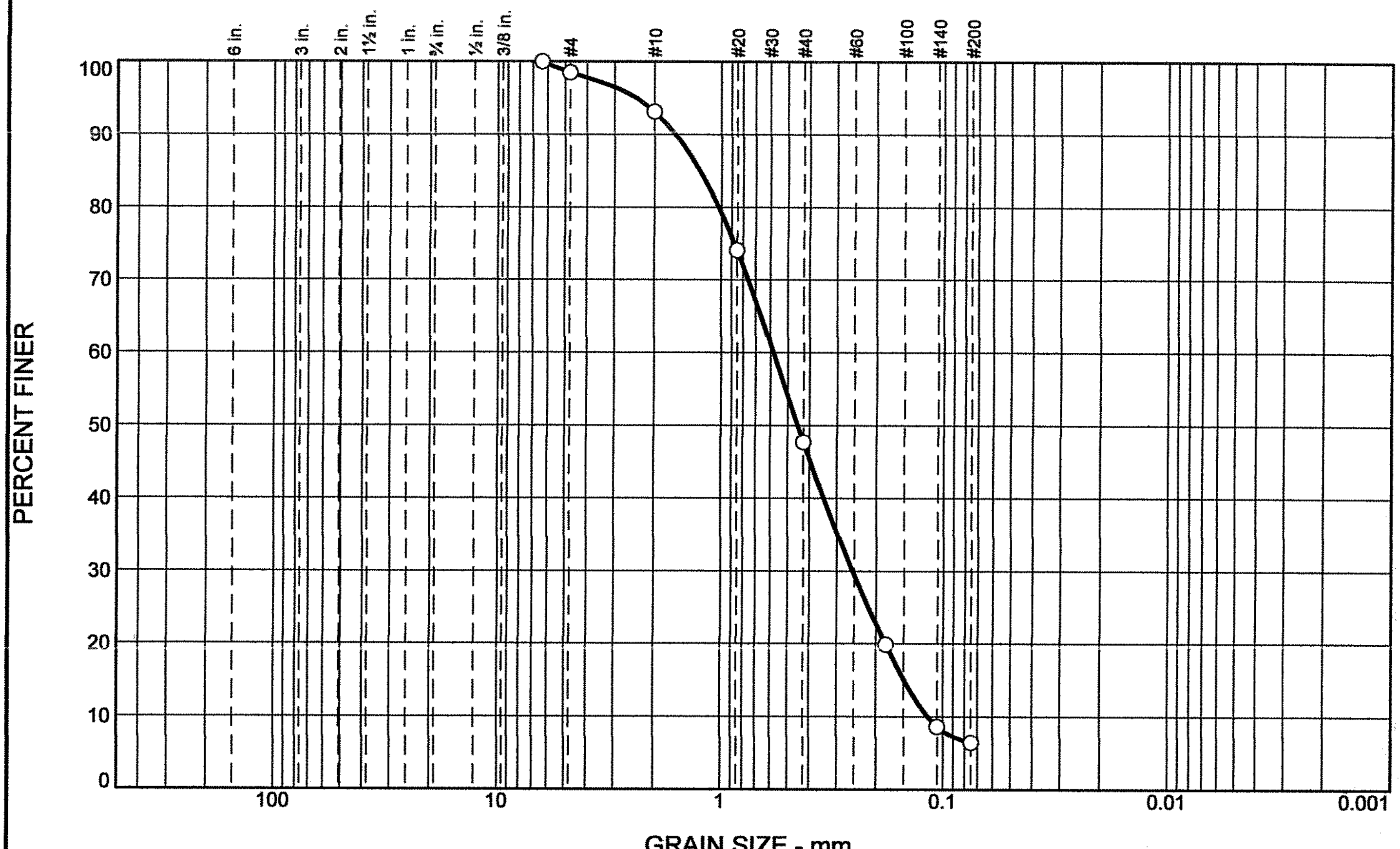
Remarks:

Copy to:

Signed: Matthew T. Grady

If enclosures are not as noted, kindly notify us at once.

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	1.5	5.4	45.4	41.3	6.4	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1/4"	100.0		
#4	98.5		
#10	93.1		
#20	74.1		
#40	47.7		
#80	19.9		
#140	8.6		
#200	6.4		

* (no specification provided)

Soil Description

Poorly Graded Sand with Silt

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 1.6089 D_{85}= 1.2535 D_{60}= 0.5819
D_{50}= 0.4514 D_{30}= 0.2546 D_{15}= 0.1492
D_{10}= 0.1168 C_u= 4.98 C_c= 0.95

Classification

USCS= SP-SM AASHTO= A-1-b

Remarks

Moisture Content: 17.2%

Location: BB-CUM-102
Sample Number: 1D **Depth:** 2'-4' **Date:** 9/26/27

R.W. Gillespie & Associates, Inc. Saco, Maine

Client: Schonewald Engineering Associates
Project: Cummings Road Over Maine Turnpike #17-013
Project No: 1368-005 **Lab No.** 14650a

Tested By: JJB **Checked By:** MTG MTG

R. W. Gillespie & Associates, Inc.
86 Industrial Park Road, Suite 4, Saco, ME 04072 207-286-8008
200 Int'l Drive, Suite 170, Portsmouth, NH 03801 603-427-0244

LETTER OF TRANSMITTAL

Date: 09/26/2017	Project No.: 1368-005
Attention: Isabel Schonewald (ischonewald@maine.rr.com)	
Re: Laboratory Testing BB-CUM-102 Scarborough, ME	

Schonewald Engineering Associates, Inc.

129 Middle Road

Cumberland, ME 04021

We are sending you attached laboratory test results.

Laboratory No. (s)	Test (s) Performed
14650b: U1, 30'-32'	Consolidation, Atteberg, Moisture Content

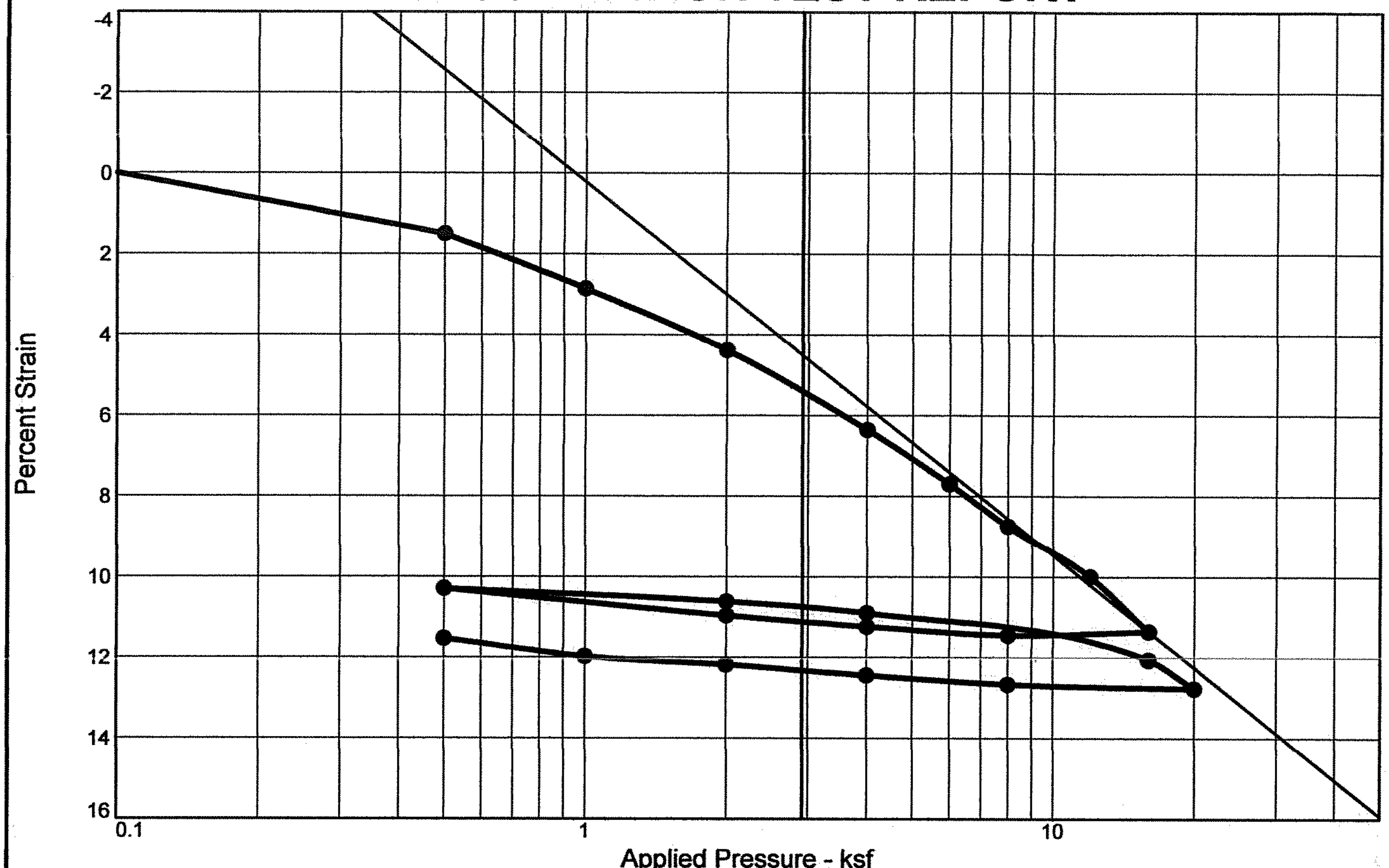
Remarks:

Copy to:

Signed: Matthew T. Grady

If enclosures are not as noted, kindly notify us at once.

CONSOLIDATION TEST REPORT



Coefficients of Consolidation and Secondary Consolidation											
No.	Load (ksf)	C_v (ft.^{2}/day)	C_α	No.	Load (ksf)	C_v (ft.^{2}/day)	C_α	No.	Load (ksf)	C_v (ft.^{2}/day)	C_α
1	0.50	0.491		8	16.00	1.864		15	16.00	7.653	
2	1.00	0.826		9	8.00	16.818		16	20.00	1.209	
3	2.00	0.990		10	4.00	14.130		17	8.00	8.957	
4	4.00	1.733		11	2.00	4.187		18	4.00	8.594	
5	6.00	1.161		12	0.50	0.921		19	2.00	3.466	
6	8.00	1.134		13	2.00	3.340		20	1.00	1.518	
7	12.00	2.102		14	4.00	4.457		21	0.50	0.753	

Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	Overburden (ksf)	P_c (ksf)	C_c	C_r	Initial Void Ratio
Saturation	Moisture									
102.7 %	42.6 %	80.2	35.0	11.2	2.75		4.1	0.20	0.06	1.141

MATERIAL DESCRIPTION	USCS	AASHTO
Lean Clay		

Project No. 1368-005 **Client:** Schonewald Engineering Associates

Project: Cummings Road Over Maine Turnpike #17-013

Location: BB-CUM-102 **Depth:** 30'-32' **Sample Number:** U1

R.W. Gillespie & Associates, Inc.

Saco, Maine

Remarks:

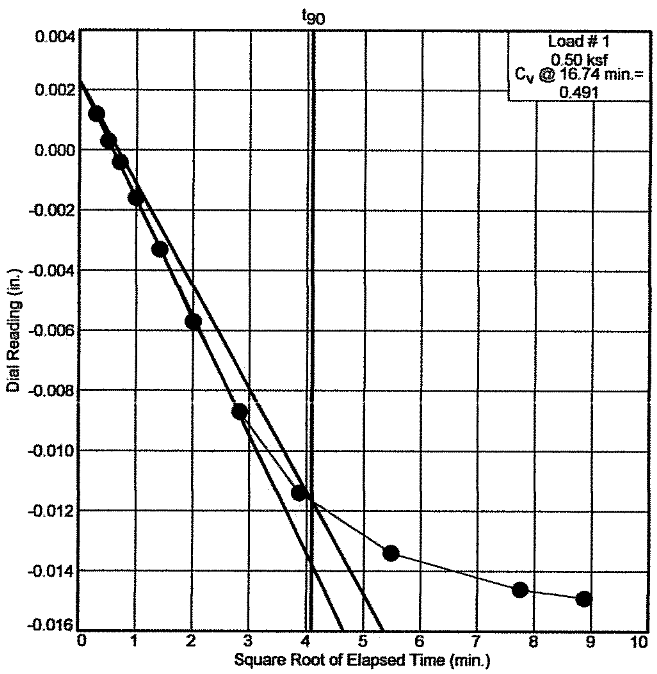
Lab No. 14650b

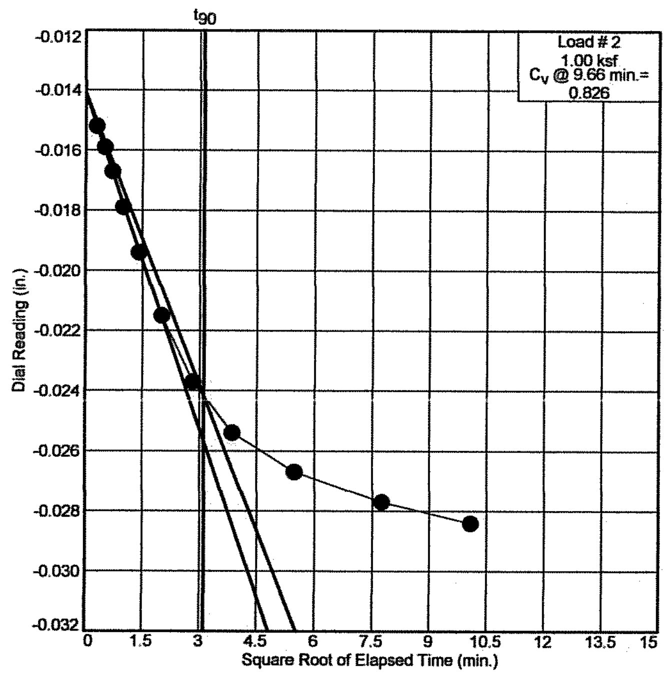
Tested By: JRF **Checked By:** MTG MTG

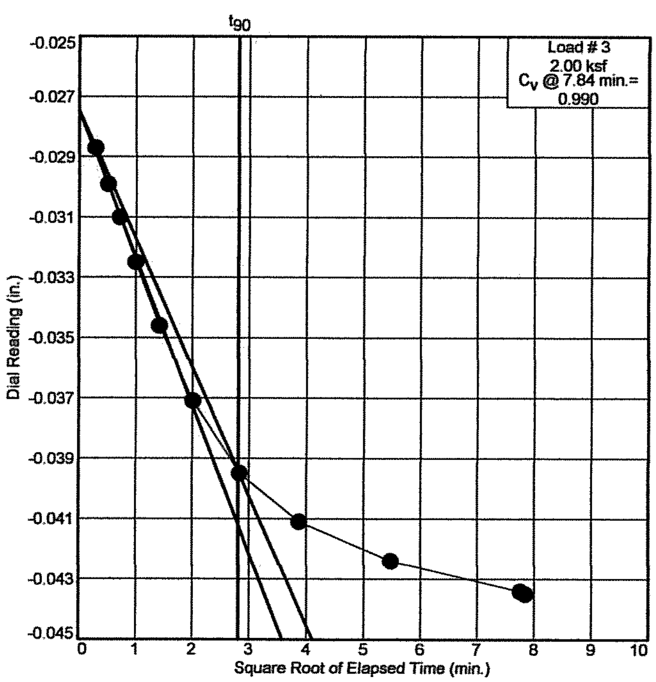
Dial Reading vs. Time

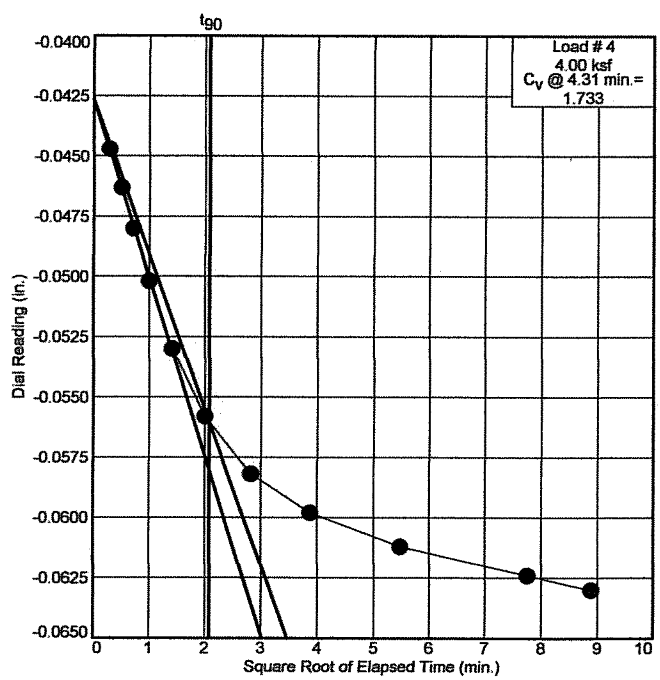
Project No.: 1368-005
Project: Cummings Road Over Maine Turnpike #17-013

Location: BB-CUM-102 Depth: 30'-32' Sample Number: U1









R.W. Gillespie & Associates, Inc.

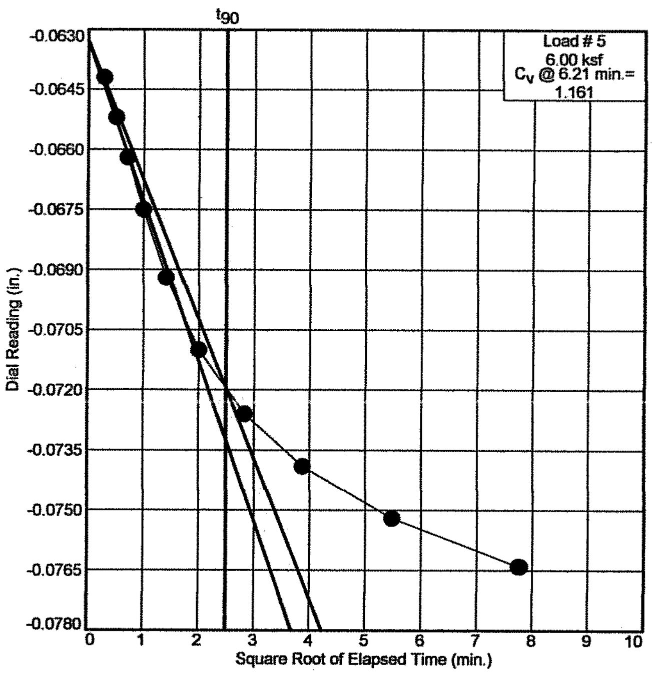
Saco, Maine

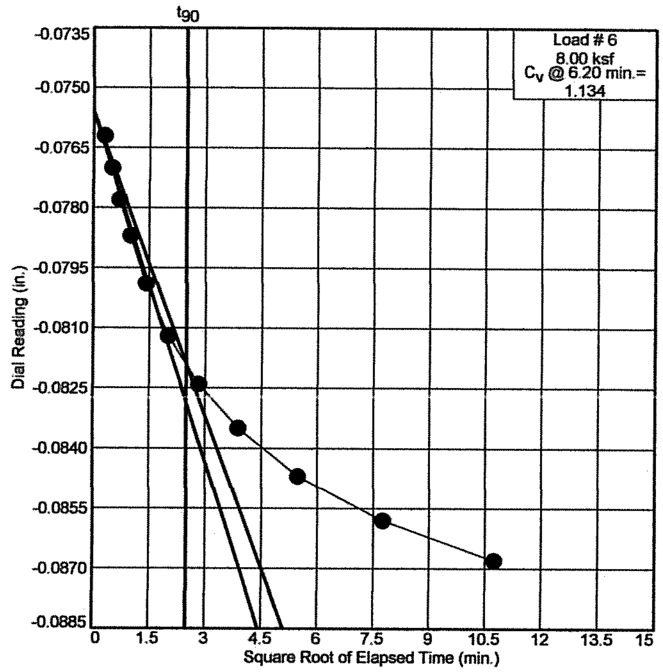
Lab No. 14650b

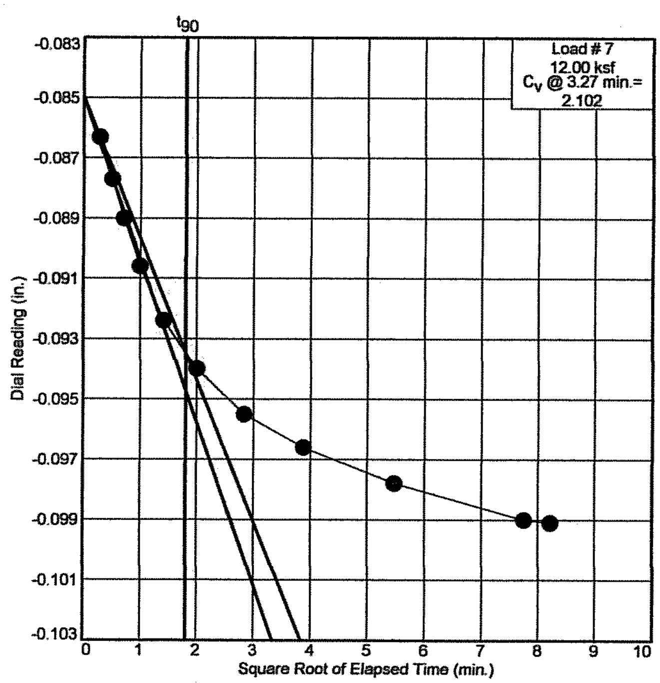
Dial Reading vs. Time

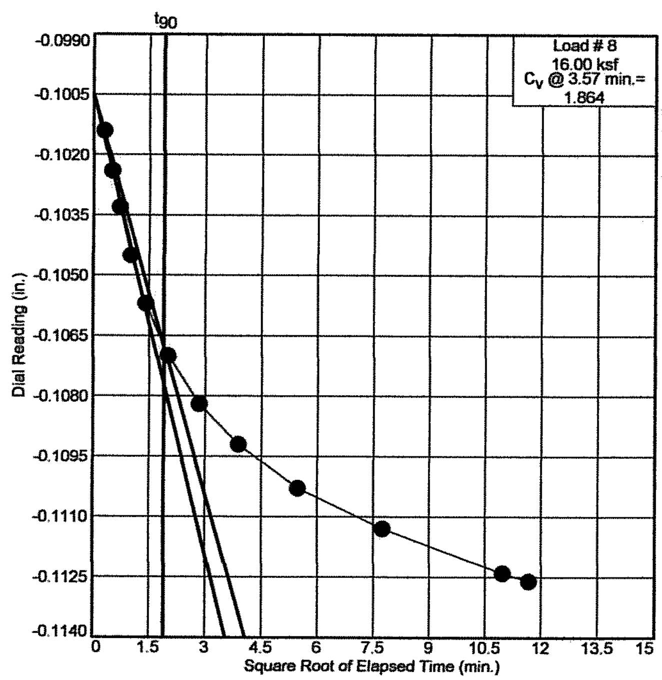
Project No.: 1368-005
Project: Cummings Road Over Maine Turnpike #17-013

Location: BB-CUM-102 **Depth:** 30'-32' **Sample Number:** U1









R.W. Gillespie & Associates, Inc.

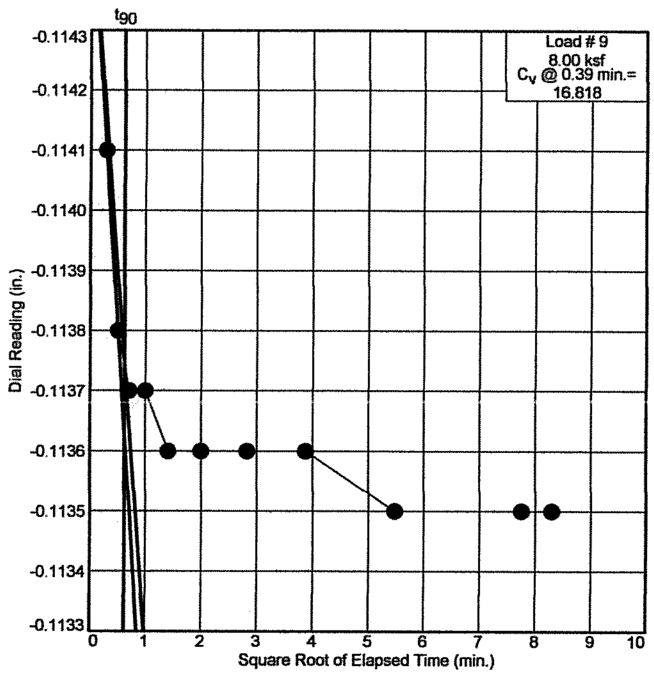
Saco, Maine

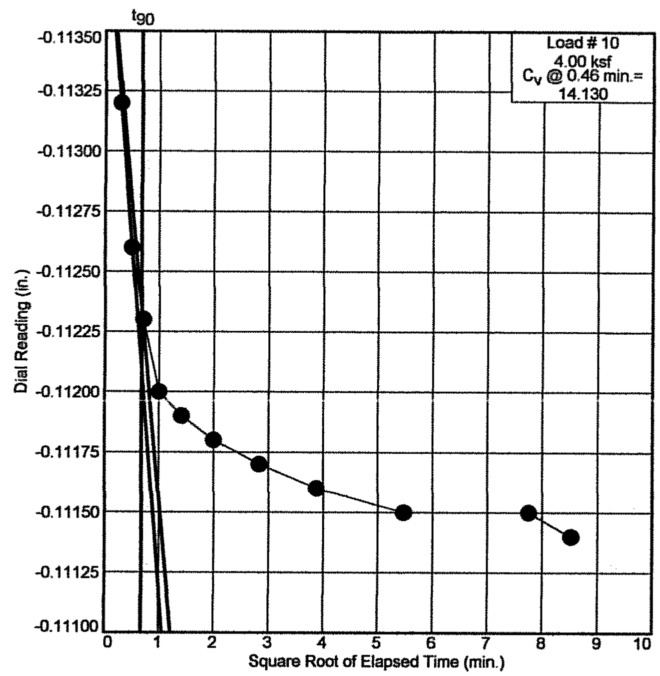
Lab No. 14650b

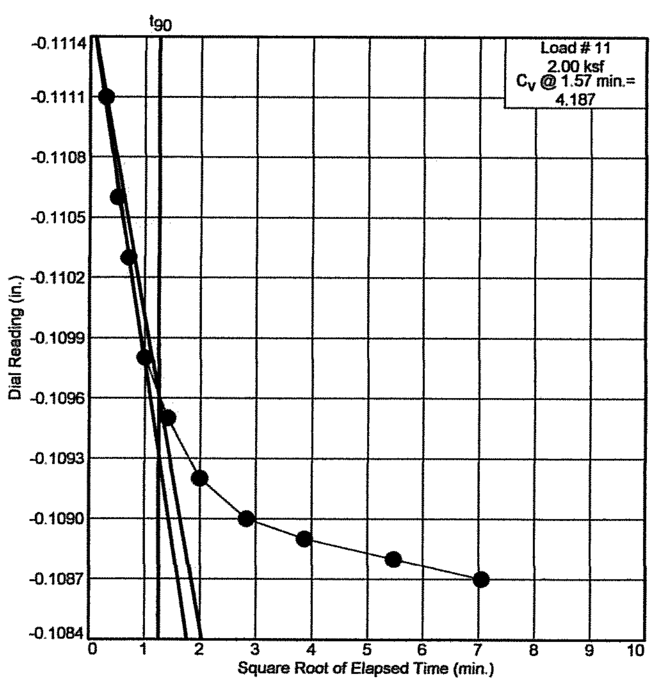
Dial Reading vs. Time

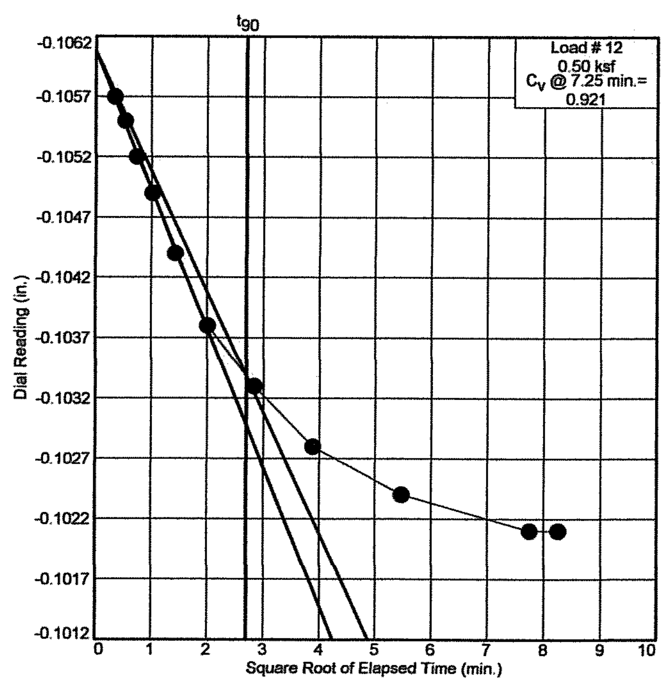
Project No.: 1368-005
Project: Cummings Road Over Maine Turnpike #17-013

Location: BB-CUM-102 **Depth:** 30'-32' **Sample Number:** U1









R.W. Gillespie & Associates, Inc.

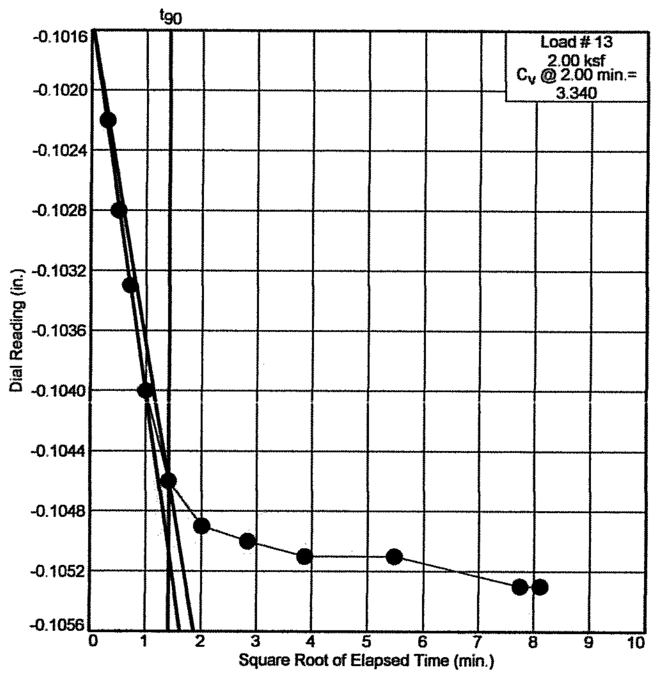
Saco, Maine

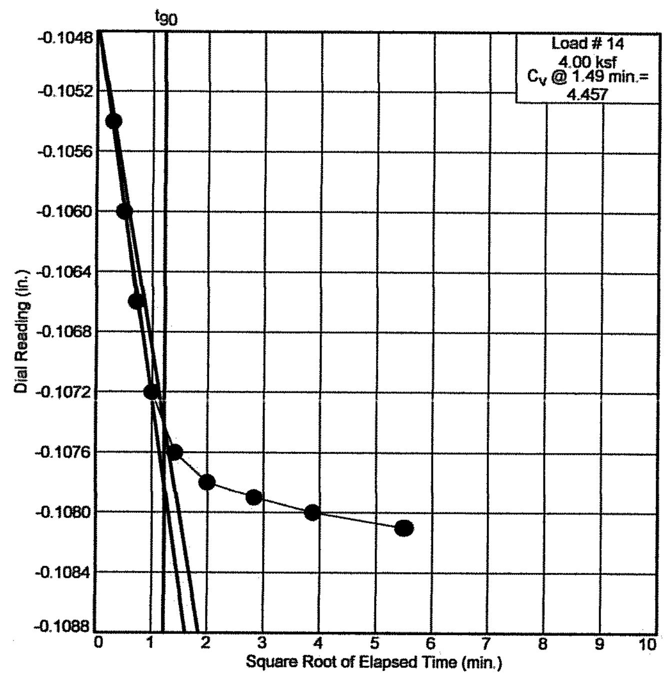
Lab No. 14650b

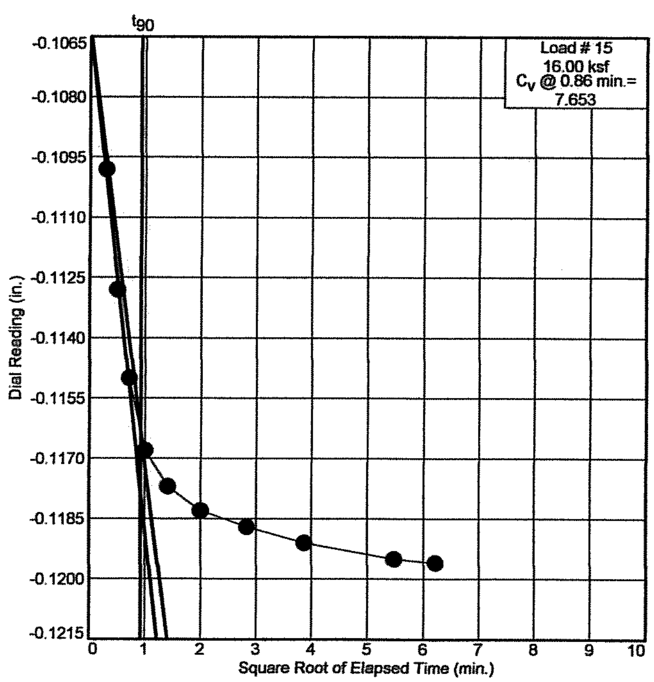
Dial Reading vs. Time

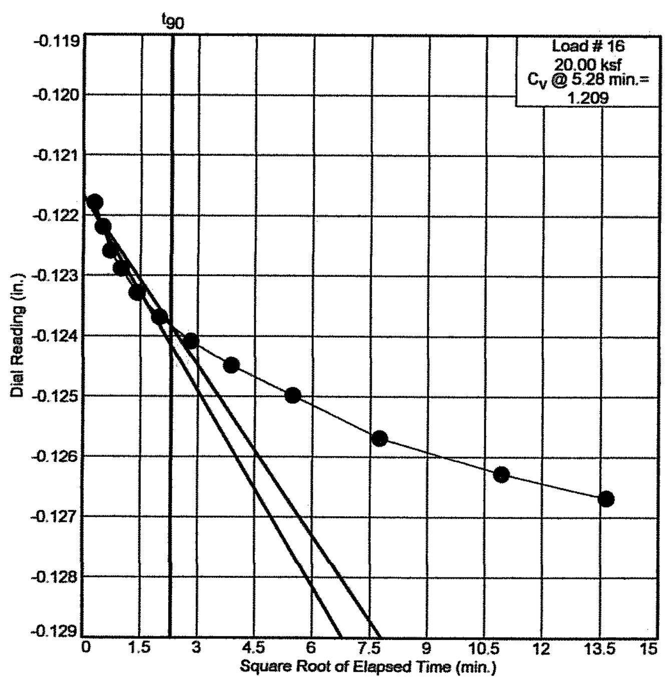
Project No.: 1368-005
Project: Cummings Road Over Maine Turnpike #17-013

Location: BB-CUM-102 **Depth:** 30'-32' **Sample Number:** U1









R.W. Gillespie & Associates, Inc.

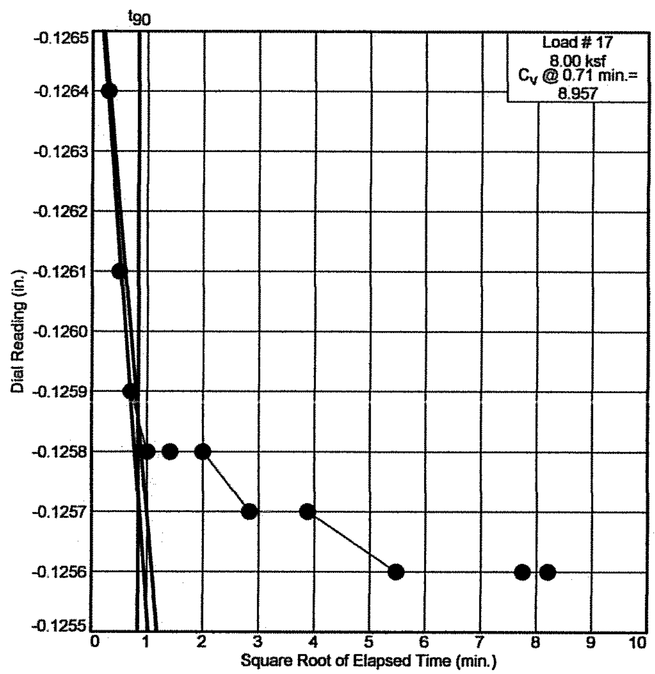
Saco, Maine

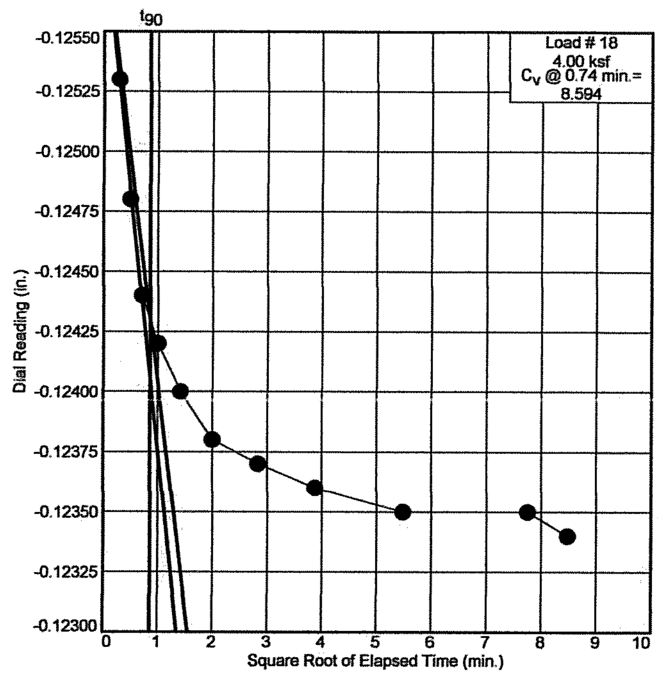
Lab No. 14650b

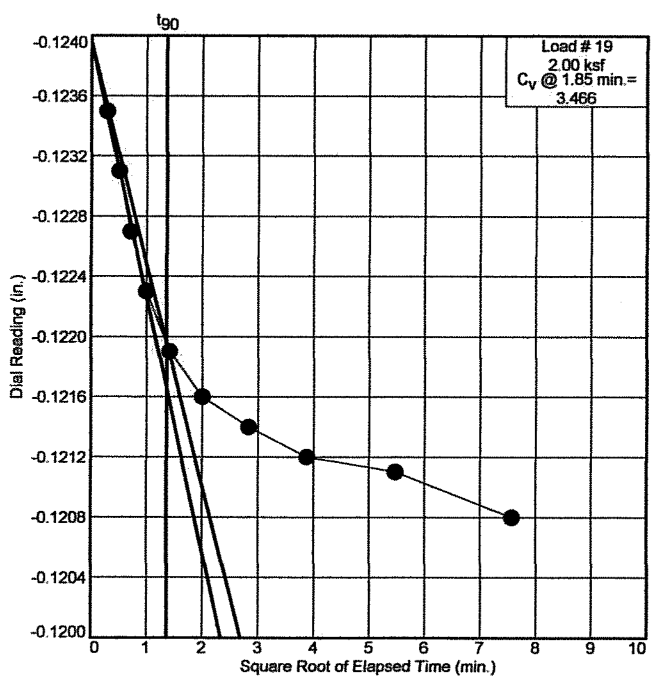
Dial Reading vs. Time

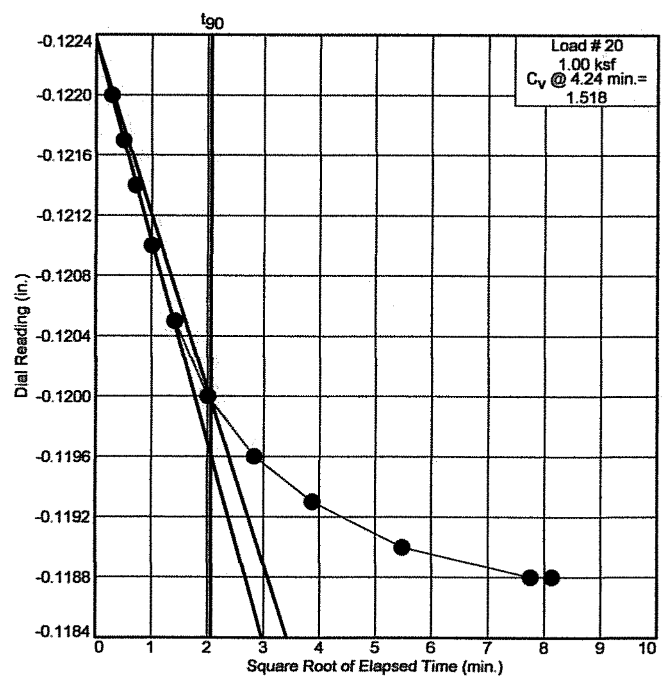
Project No.: 1368-005
Project: Cummings Road Over Maine Turnpike #17-013

Location: BB-CUM-102 **Depth:** 30'-32' **Sample Number:** U1









R.W. Gillespie & Associates, Inc.

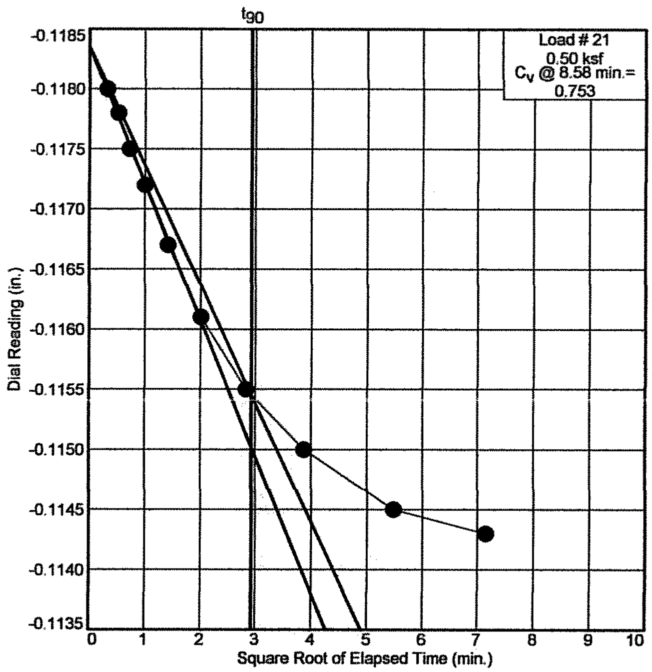
Saco, Maine

Lab No. 14650b

Dial Reading vs. Time

Project No.: 1368-005
Project: Cummings Road Over Maine Turnpike #17-013

Location: BB-CUM-102 **Depth:** 30'-32' **Sample Number:** U1

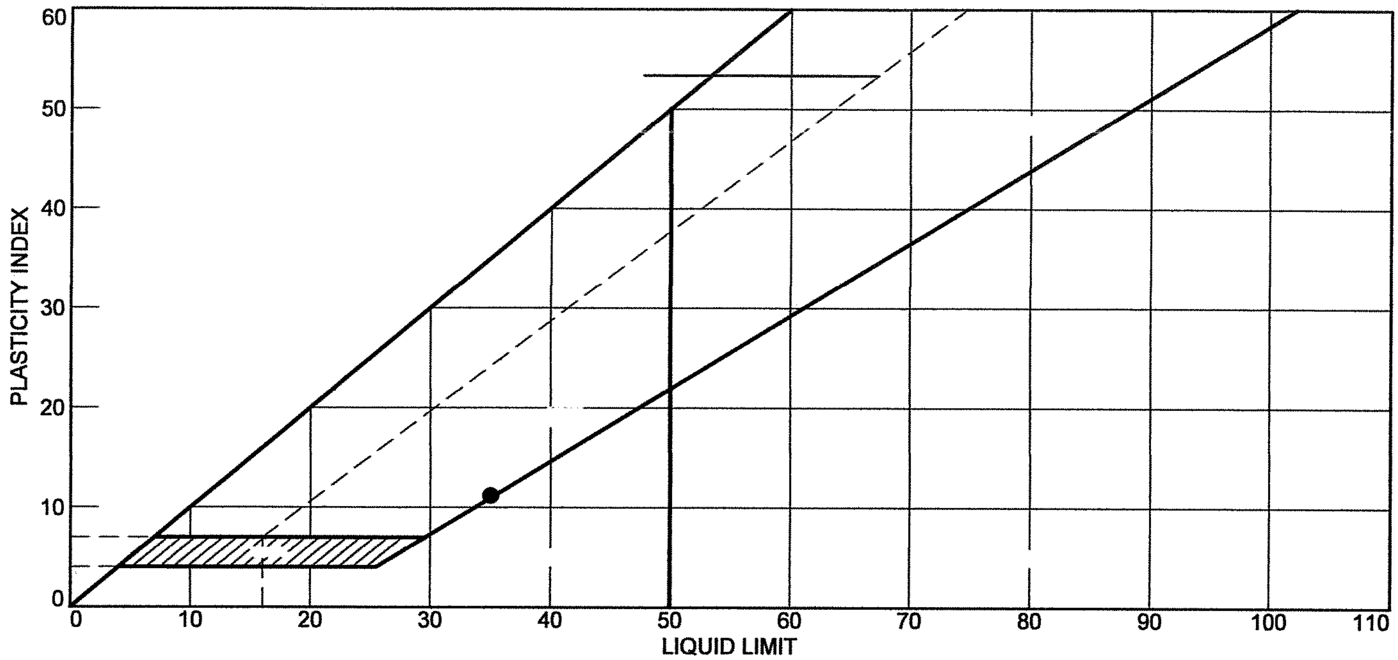


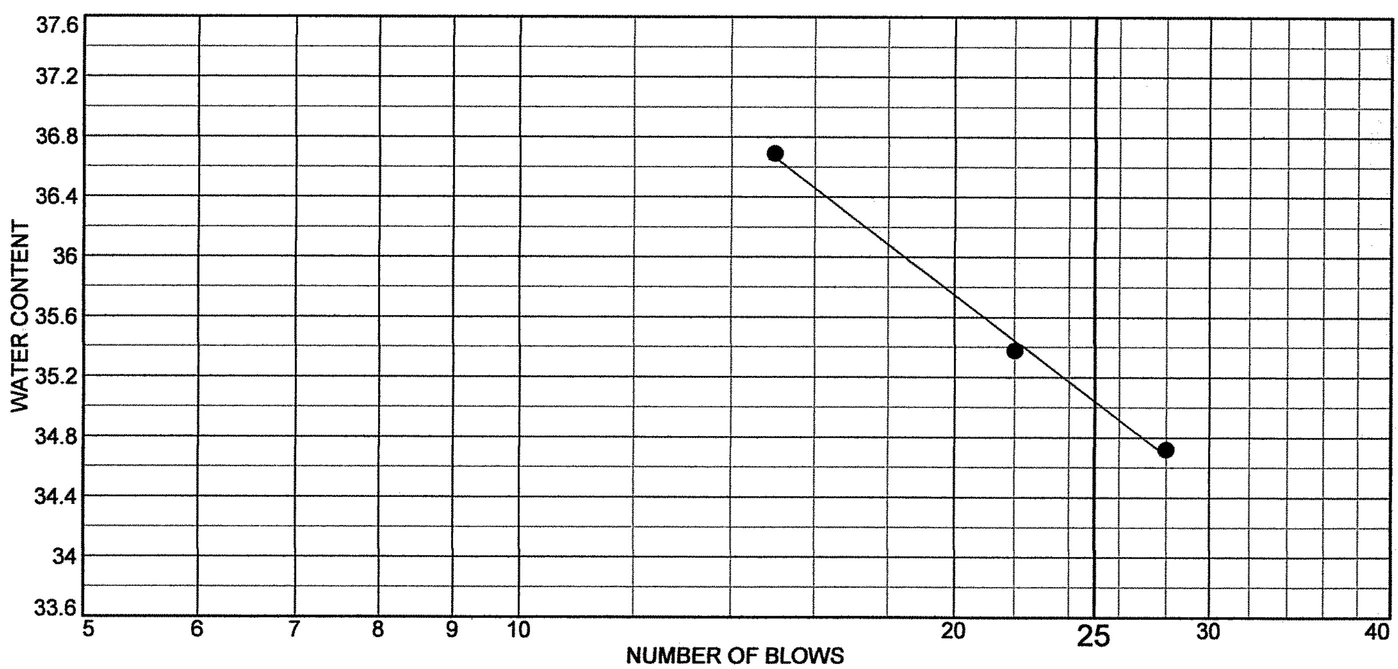
R.W. Gillespie & Associates, Inc.

Saco, Maine

Lab No. 14650b

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Lean Clay	35.0	23.8	11.2			

Project No. 1368-005 **Client:** Schonewald Engineering Associates

Project: Cummings Road Over Maine Turnpike #17-013

Location: BB-CUM-102
Sample Number: U1 **Depth:** 30'-32'

Remarks:

R.W. Gillespie & Associates, Inc.

Saco, Maine

Lab No. 14650b

Tested By: AGS **Checked By:** MTG MTG

Laboratory Vane Shear Test Results

ASTM D4648 Standard Test Method for Laboratory Miniature Vane Shear Test for Saturated Fine-Grained Clayey Soil

Project: Cummings Road Over Maine Turnpike #1
Client: Schonewald Engineering Associates, Inc.
Project No.: 1368-005

Location: Scarborough, ME
Date: 8/10/2017
Test Depth: 30' to 32'

Boring/Sample No.	BB-CUM-102/V1			Lab No.	14650b	
Test No.	**Test Depth (ft)**	**Vane Size**	**Max. Torque (Undisturbed) (kg-cm)**	**Max. Torque (Remolded) (kg-cm)**	**Undrained Shear Strength (psf)**	**Undrained Shear Strength (psf)**	**Moisture Content**
1	4.5"	L	23	6	240	6	45%
2	9"	L	27	3	282	3	41%

Vane Size	
	(mm)
S	16 x 32
M	20 x 40
L	24.5 x 50.8

Tested By: JRF/AGS

Checked By: MTG

R.W. Gillespie & Associates

86 Industrial Park Rd., Suite 4, Saco ME 04072, 207-286-8008 / 200 International Dr., Suite 170, Portsmouth NH 03801, 603-427-0244

R. W. Gillespie & Associates, Inc.
86 Industrial Park Road, Suite 4, Saco, ME 04072 207-286-8008
200 Int'l Drive, Suite 170, Portsmouth, NH 03801 603-427-0244

LETTER OF TRANSMITTAL

Date: 09/28/2017	Project No.: 1368-005
Attention: Isabel Schonewald (ischonewald@maine.rr.com)	
Re: LaboratoryTesting BB-CUM-102 Scarborough, ME	

Schonewald Engineering Associates, Inc.

129 Middle Road

Cumberland, ME 04021

We are sending you attached laboratory test results.

Laboratory No. (s)	Test (s) Performed
14650c: 7D, 35'-37'	Atteberg and Moisture

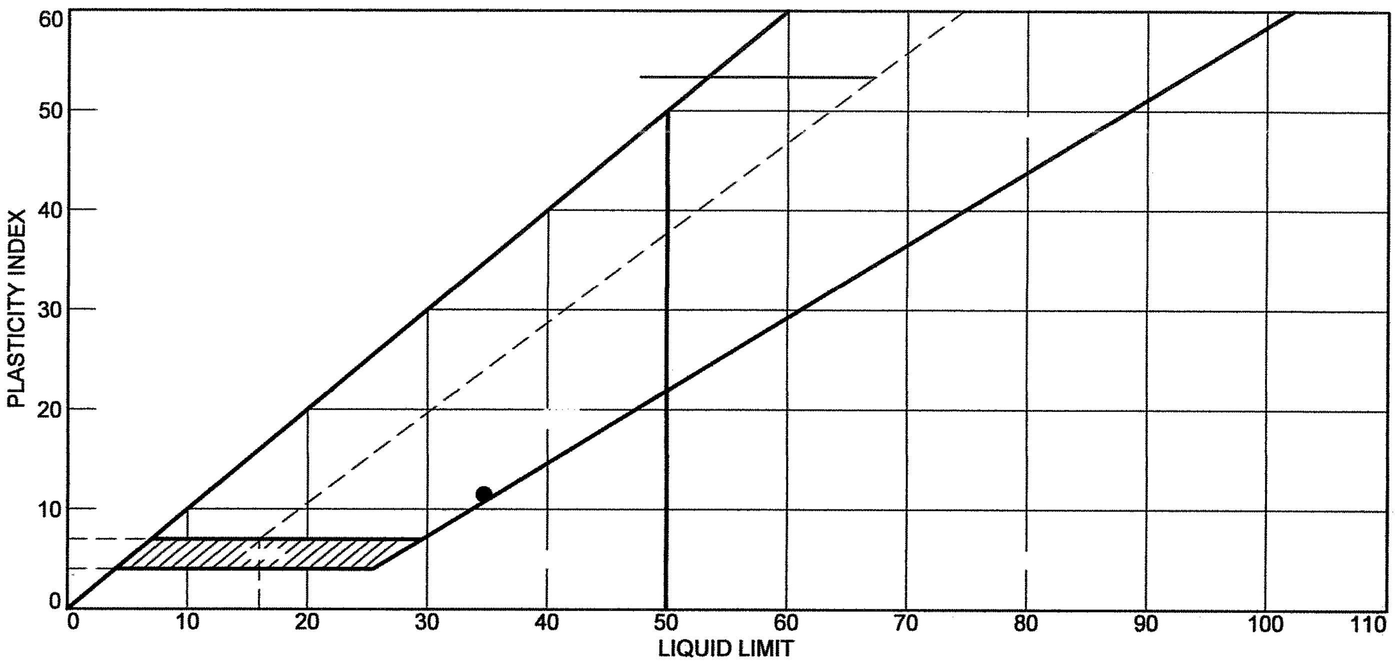
Remarks:

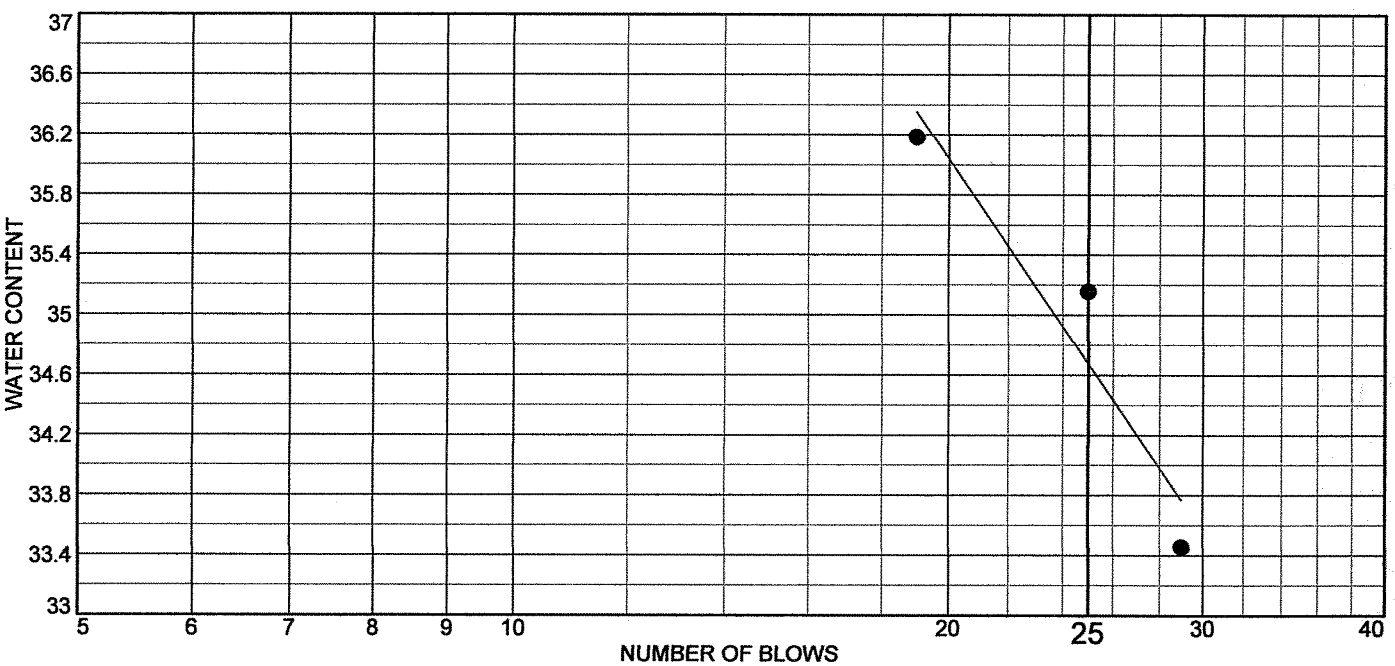
Copy to:

Signed: Matthew T. Grady

If enclosures are not as noted, kindly notify us at once.

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Lean Clay	34.7	23.2	11.5			

Project No. 1368-005 **Client:** Schonewald Engineering Associates

Project: Cummings Road Over Maine Turnpike #17-013

Location: BB-CUM-102
Sample Number: 7D **Depth:** 35'-37'

Remarks:
● Moisture Content: 35.1%

R.W. Gillespie & Associates, Inc.

Saco, Maine

Lab No. 14650c

Tested By: JRF/AGS **Checked By:** MTG MTG

R. W. Gillespie & Associates, Inc.
86 Industrial Park Road, Suite 4, Saco, ME 04072 207-286-8008
200 Int'l Drive, Suite 170, Portsmouth, NH 03801 603-427-0244

LETTER OF TRANSMITTAL

Date: 09/28/2017	Project No.: 1368-005
Attention: Isabel Schonewald (ischonewald@maine.rr.com)	
Re: LaboratoryTesting BB-CUM-102 Scarborough, ME	

Schonewald Engineering Associates, Inc.
129 Middle Road
Cumberland, ME 04021

We are sending you attached laboratory test results.

Laboratory No. (s)	Test (s) Performed
14650d: 9D, 55'-57'	Atteberg, Moisture

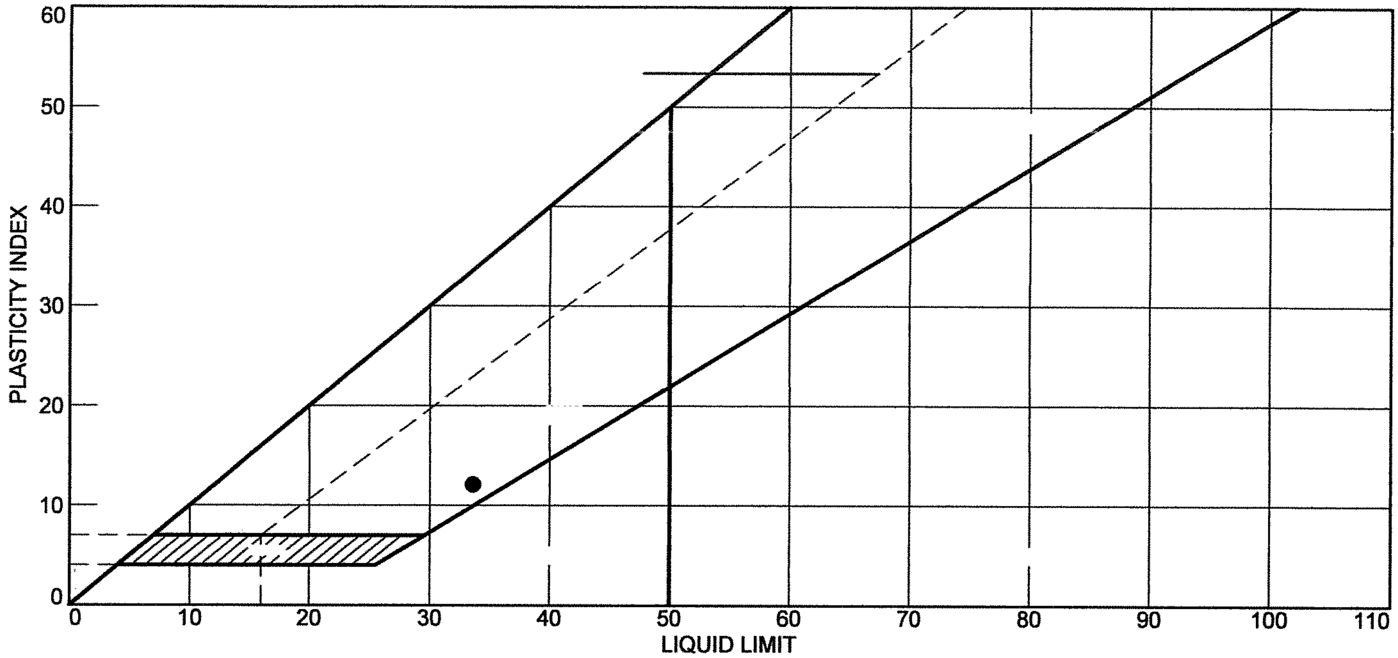
Remarks:

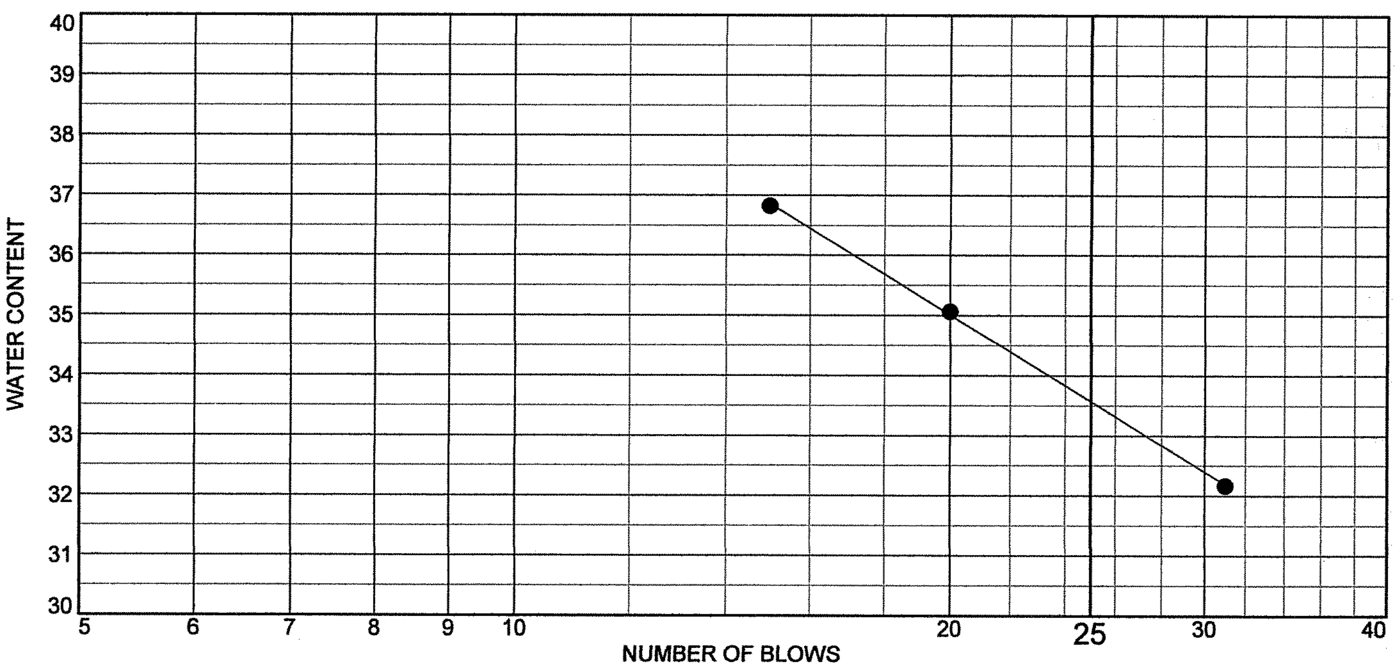
Copy to:

Signed: Matthew T. Grady

If enclosures are not as noted, kindly notify us at once.

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Lean Clay	33.6	21.5	12.1			

Project No. 1368-005 **Client:** Schonewald Engineering Associates

Project: Cummings Road Over Maine Turnpike #17-013

Location: BB-CUM-102
Sample Number: 9D **Depth:** 55'-57'

R.W. Gillespie & Associates, Inc.

Saco, Maine

Remarks:
● Moisture Content: 36.1%

Lab No. 14650d

Tested By: JRF/AGS **Checked By:** MTG MTG

R. W. Gillespie & Associates, Inc.
86 Industrial Park Road, Suite 4, Saco, ME 04072 207-286-8008
200 Int'l Drive, Suite 170, Portsmouth, NH 03801 603-427-0244

LETTER OF TRANSMITTAL

Date: 09/28/2017	Project No.: 1368-005
Attention: Isabel Schonewald (ischonewald@maine.rr.com)	
Re: LaboratoryTesting BB-CUM-103 Scarborough, ME	

Schonewald Engineering Associates, Inc.

129 Middle Road

Cumberland, ME 04021

We are sending you attached laboratory test results.

Laboratory No. (s)	Test (s) Performed
14651a: 10D, 45'-47'	Atteberg, Moisture

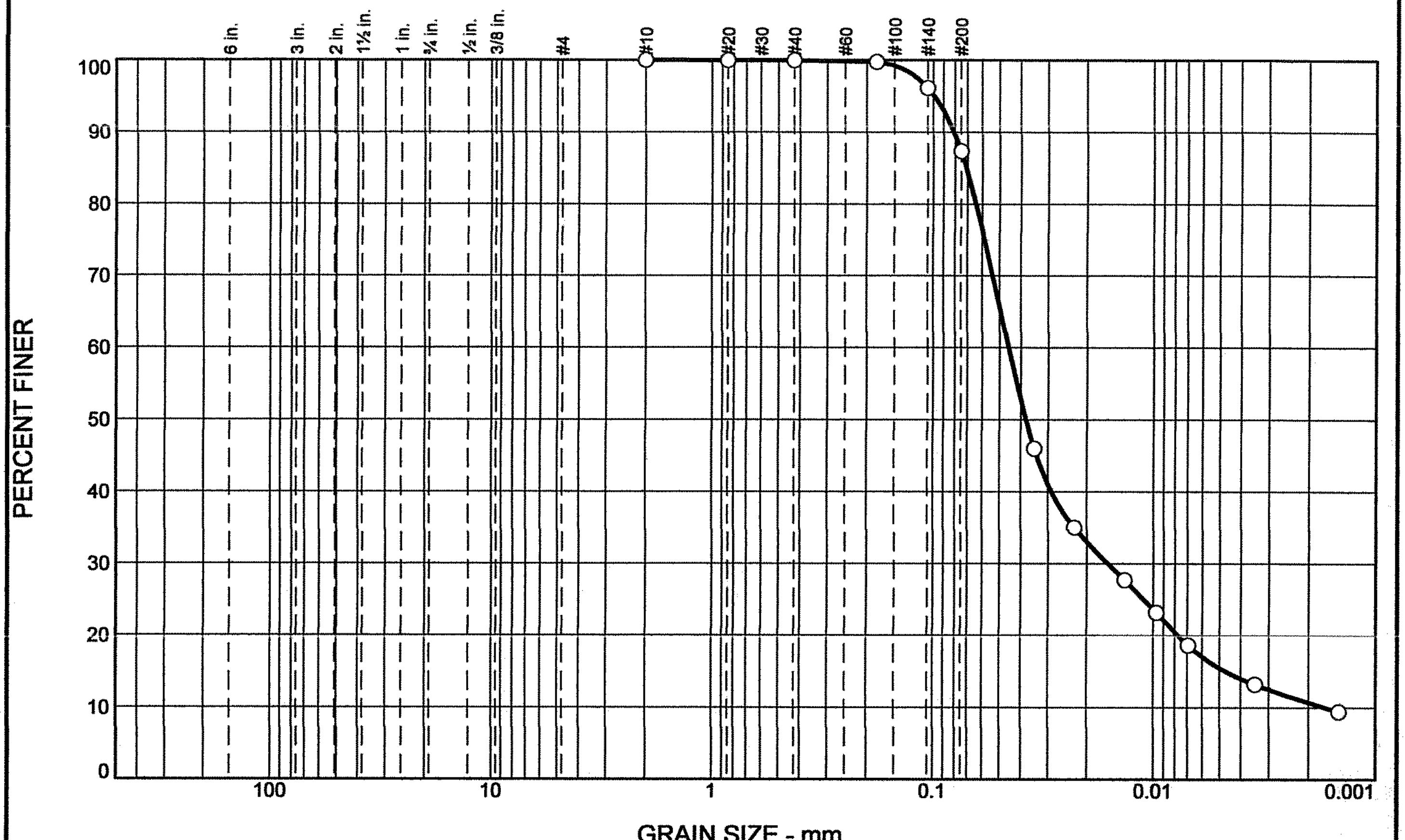
Remarks:

Copy to:

Signed: Matthew T. Grady

If enclosures are not as noted, kindly notify us at once.

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	0.1	12.6	71.8	15.5

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#10	100.0		
#20	100.0		
#40	99.9		
#80	99.8		
#140	96.2		
#200	87.3		
0.0346 mm.	45.9		
0.0228 mm.	35.0		
0.0135 mm.	27.7		
0.0097 mm.	23.2		
0.0069 mm.	18.6		
0.0035 mm.	13.2		
0.0015 mm.	9.4		

* (no specification provided)

Soil Description

Silt

Atterberg Limits

PL= NP LL= NV PI= CNBD

Coefficients

D_{90}= 0.0807 D_{85}= 0.0710 D_{60}= 0.0454
D_{50}= 0.0378 D_{30}= 0.0161 D_{15}= 0.0047
D_{10}= 0.0017 C_u= 27.01 C_c= 3.40

Classification

USCS= ML AASHTO= A-4(0)

Remarks

Moisture Content: 26.4%
NP = NON-PLASTIC
NV = NON-VISCOUS
CNBD = COULD NOT BE DETERMINED

Location: BB-CUM-103
Sample Number: 10D **Depth:** 45'-47' **Date:** 9/27/17

R.W. Gillespie & Associates, Inc. Saco, Maine

Client: Schonewald Engineering Associates
Project: Cummings Road Over Maine Turnpike #17-013
Project No: 1368-005 **Lab No.** 14651a

Tested By: JRF/AGS **Checked By:** MTG MTG

R. W. Gillespie & Associates, Inc.
86 Industrial Park Road, Suite 4, Saco, ME 04072 207-286-8008
200 Int'l Drive, Suite 170, Portsmouth, NH 03801 603-427-0244

LETTER OF TRANSMITTAL

Date: 09/26/2017	Project No.: 1368-005
Attention: Isabel Schonewald (ischonewald@maine.rr.com)	
Re: Laboratory Testing BB-CUM-103 Scarborough, ME	

Schonewald Engineering Associates, Inc.

129 Middle Road

Cumberland, ME 04021

We are sending you attached laboratory test results.

Laboratory No. (s)	Test (s) Performed
14651b: U2, 65'-67'	Consolidation, Atteberg, Moisture Content

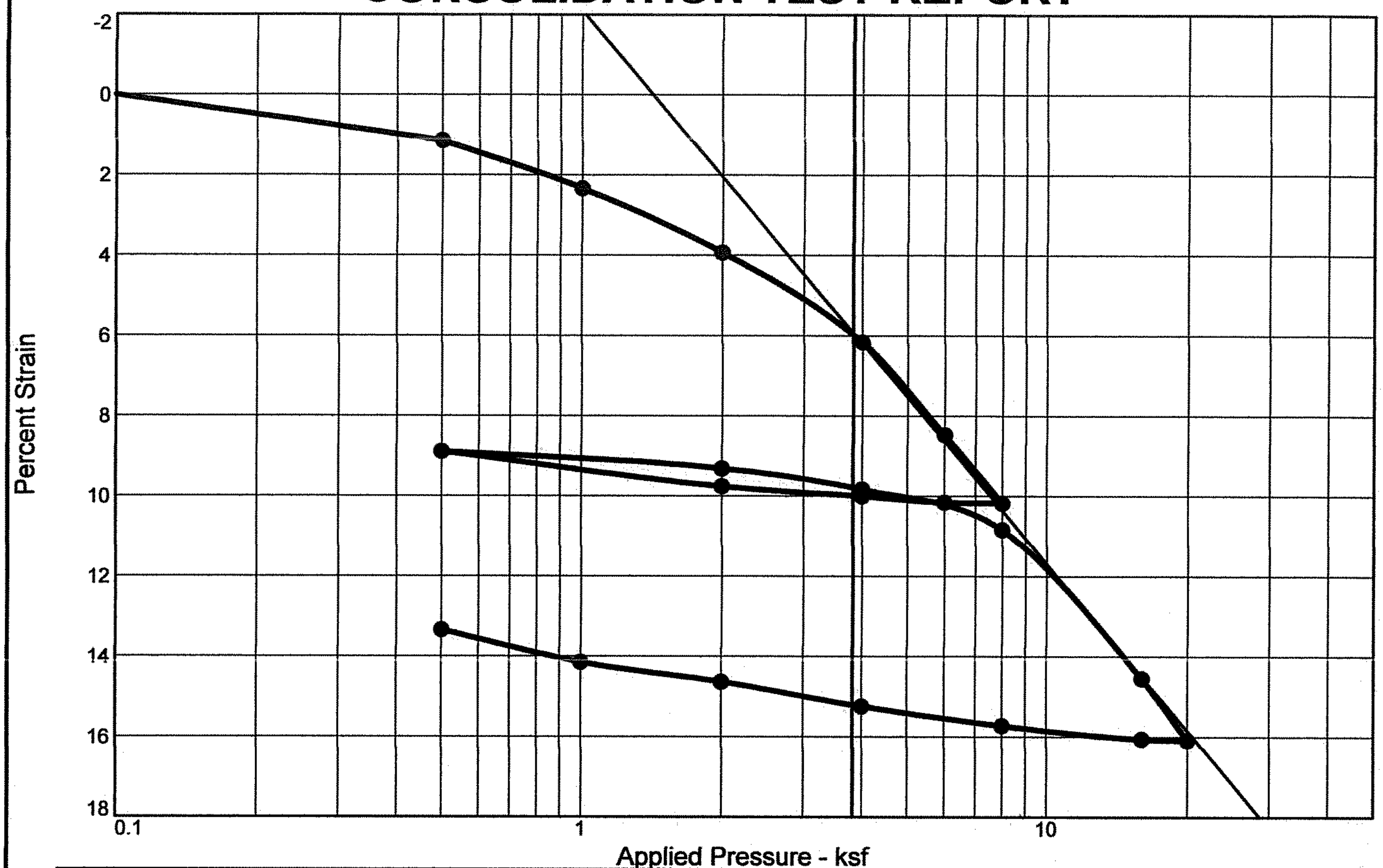
Remarks:

Copy to:

Signed: Matthew T. Grady

If enclosures are not as noted, kindly notify us at once.

CONSOLIDATION TEST REPORT



Coefficients of Consolidation and Secondary Consolidation											
No.	Load (ksf)	C_v (ft.^{2}/day)	C_α	No.	Load (ksf)	C_v (ft.^{2}/day)	C_α	No.	Load (ksf)	C_v (ft.^{2}/day)	C_α
1	0.50	0.189		8	4.00	4.793		15	20.00	0.263	
2	1.00	0.219		9	2.00	1.530		16	16.00	8.783	
3	2.00	0.340		10	0.50	0.194		17	8.00	2.880	
4	4.00	0.389		11	2.00	0.847		18	4.00	0.955	
5	6.00	0.233		12	4.00	1.083		19	2.00	0.365	
6	8.00	0.222		13	8.00	0.977		20	1.00	0.181	
7	6.00	4.874		14	16.00	0.431		21	0.50	0.066	

Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	Overburden (ksf)	P_c (ksf)	C_c	C_r	Initial Void Ratio
Saturation	Moisture									
93.8 %	37.9 %	83.5	39.9	16.2	2.75		3.9	0.29	0.10	1.112

MATERIAL DESCRIPTION	USCS	AASHTO
Lean Clay		

Project No. 1368-005 **Client:** Schonewald Engineering Associates

Project: Cummings Road Over Maine Turnpike #17-013

Location: BB-CUM-103 **Depth:** 65'-67' **Sample Number:** U2

Remarks:

R.W. Gillespie & Associates, Inc.

Saco, Maine

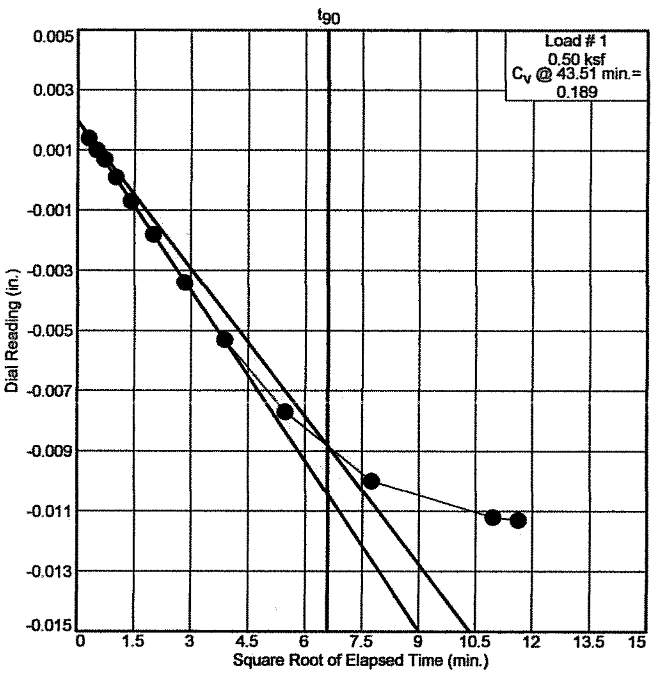
Lab No. 14651b

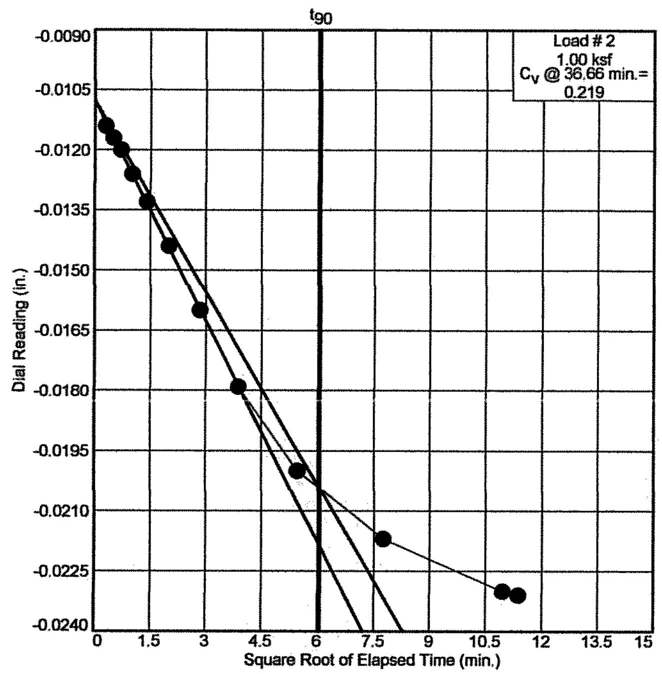
Tested By: JRF **Checked By:** MTG MTG

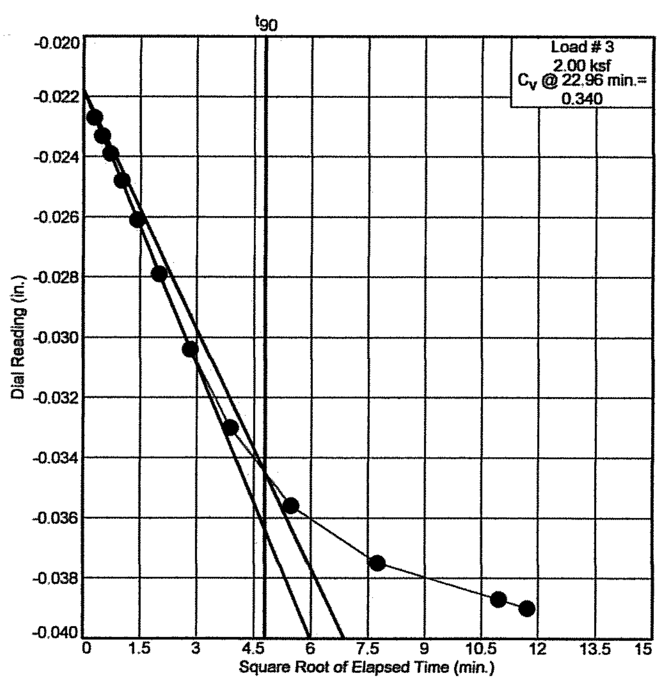
Dial Reading vs. Time

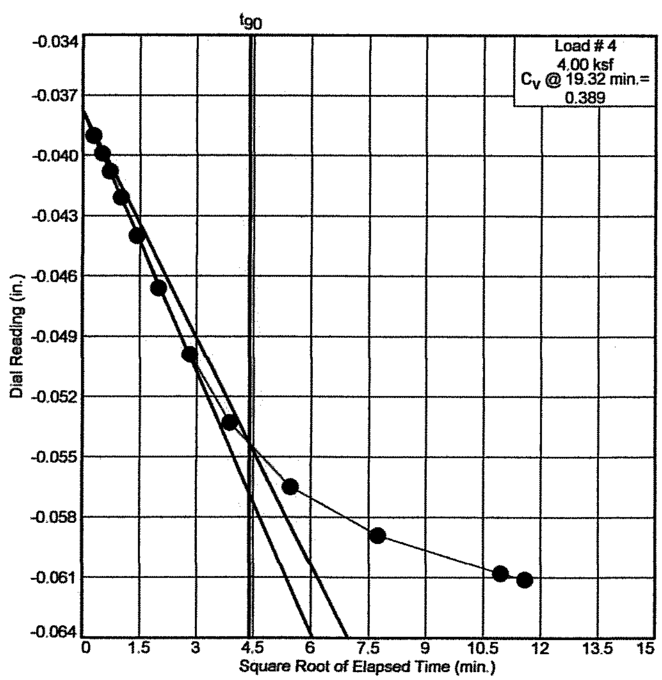
Project No.: 1368-005
Project: Cummings Road Over Maine Turnpike #17-013

Location: BB-CUM-103 **Depth:** 65'-67' **Sample Number:** U2









R.W. Gillespie & Associates, Inc.

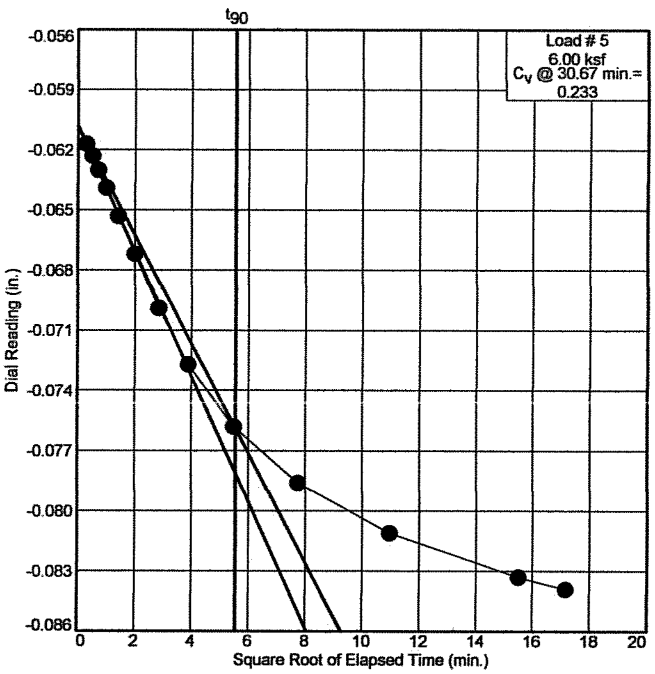
Saco, Maine

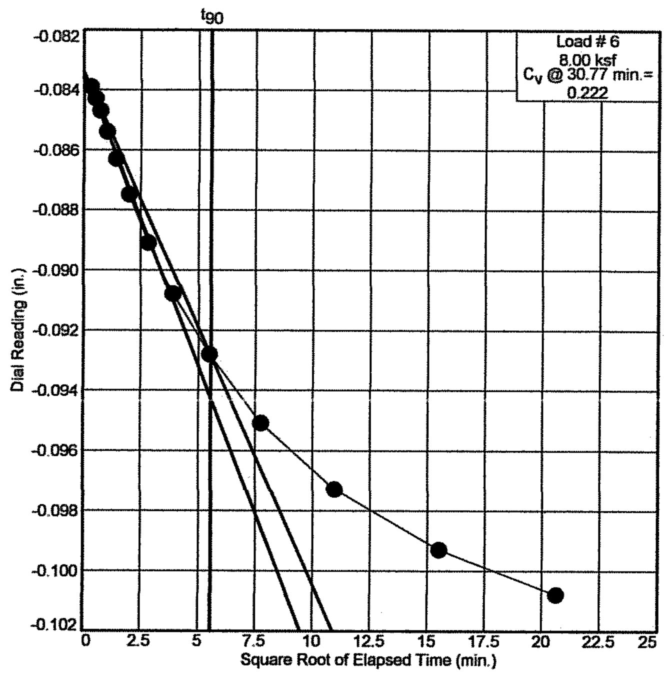
Lab No. 14651b

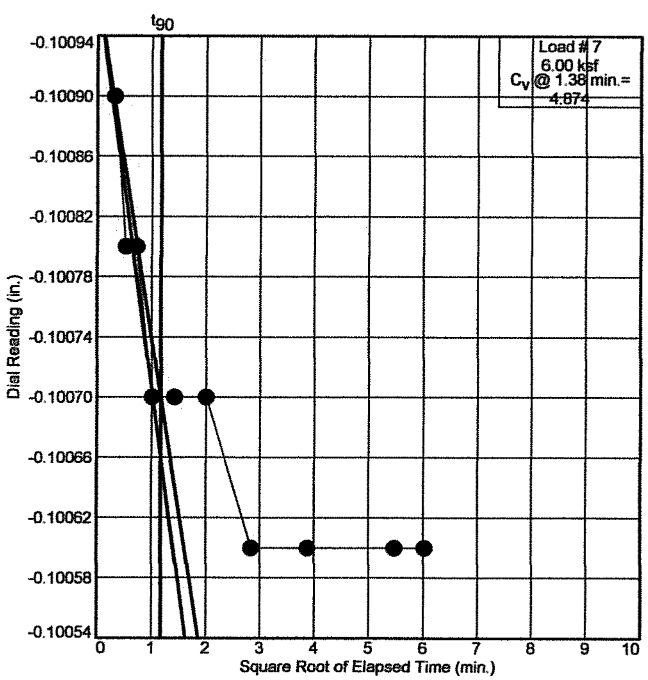
Dial Reading vs. Time

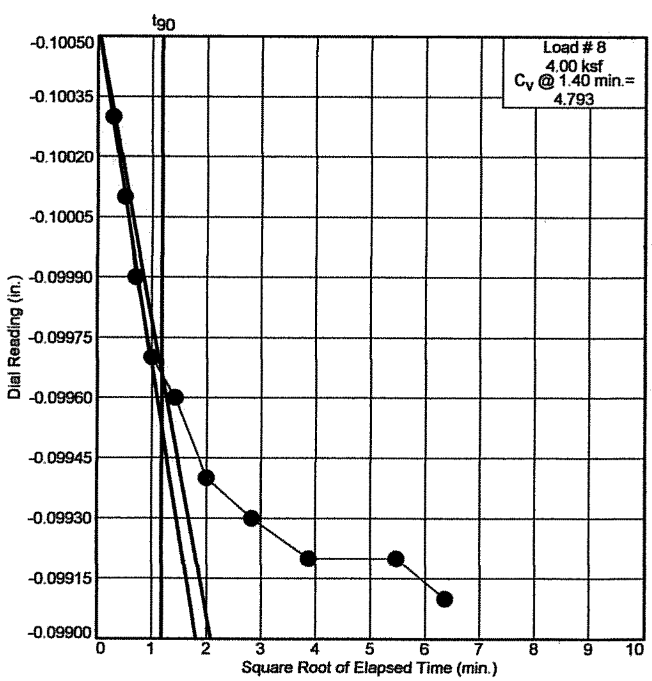
Project No.: 1368-005
Project: Cummings Road Over Maine Turnpike #17-013

Location: BB-CUM-103 **Depth:** 65'-67' **Sample Number:** U2









R.W. Gillespie & Associates, Inc.

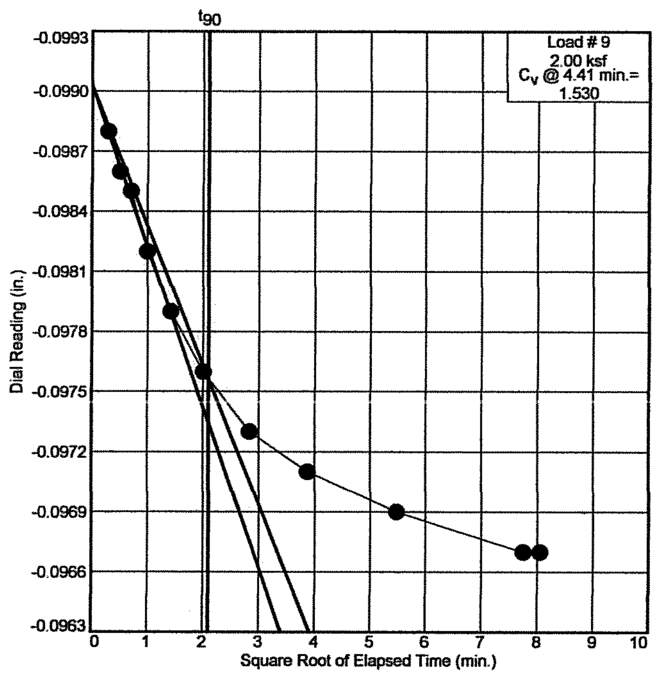
Saco, Maine

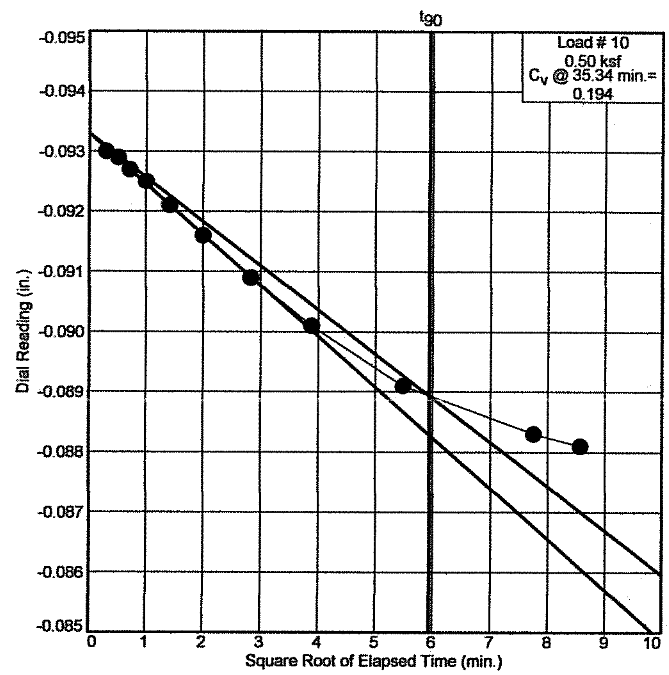
Lab No. 14651b

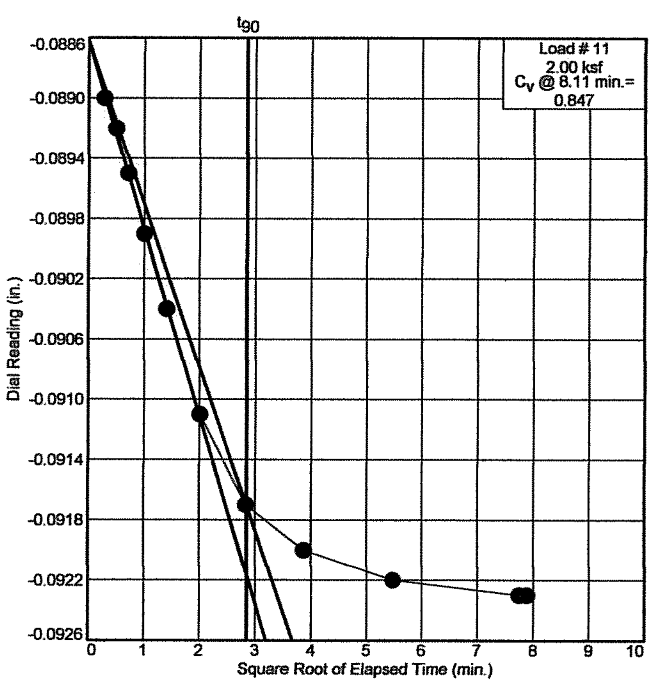
Dial Reading vs. Time

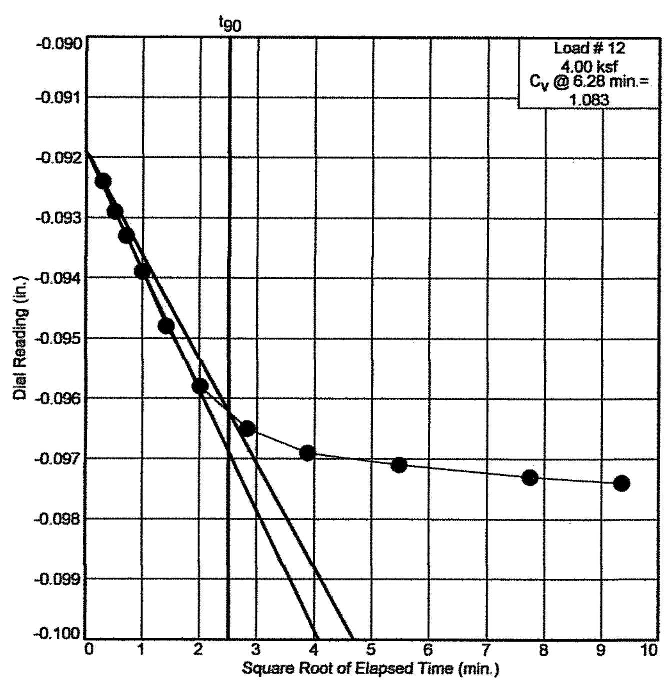
Project No.: 1368-005
Project: Cummings Road Over Maine Turnpike #17-013

Location: BB-CUM-103 **Depth:** 65'-67' **Sample Number:** U2









R.W. Gillespie & Associates, Inc.

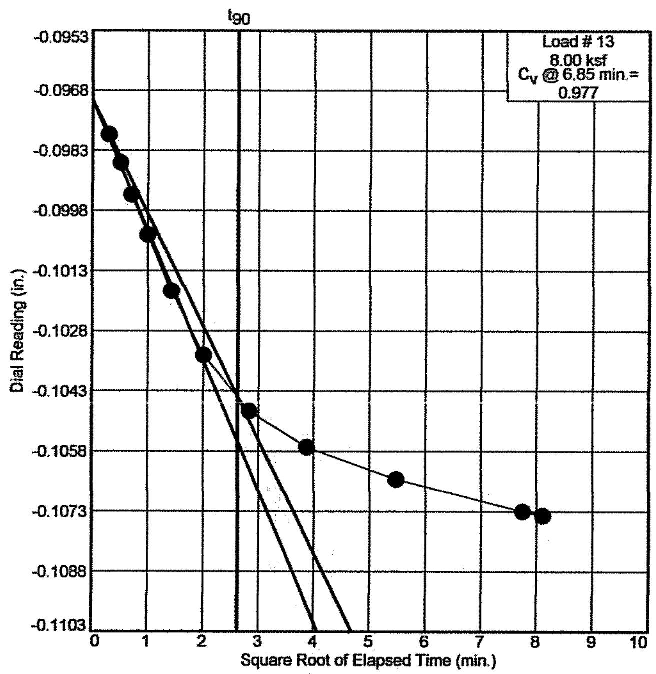
Saco, Maine

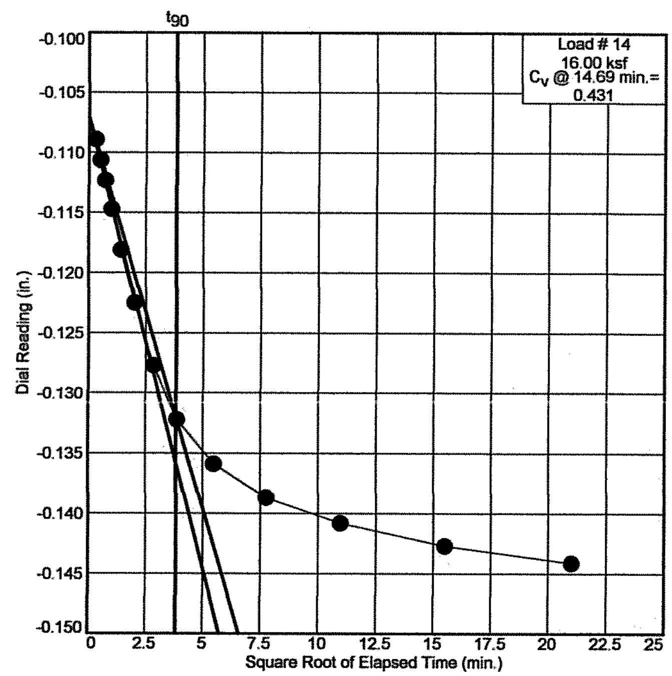
Lab No. 14651b

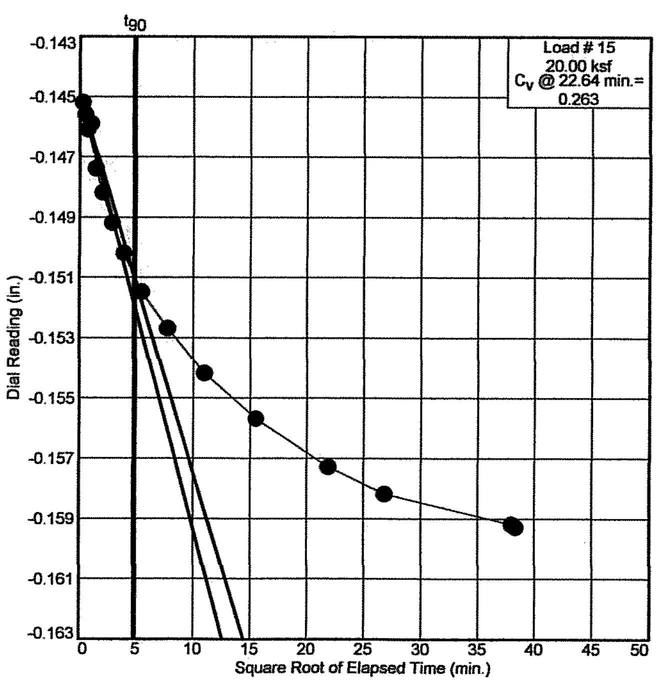
Dial Reading vs. Time

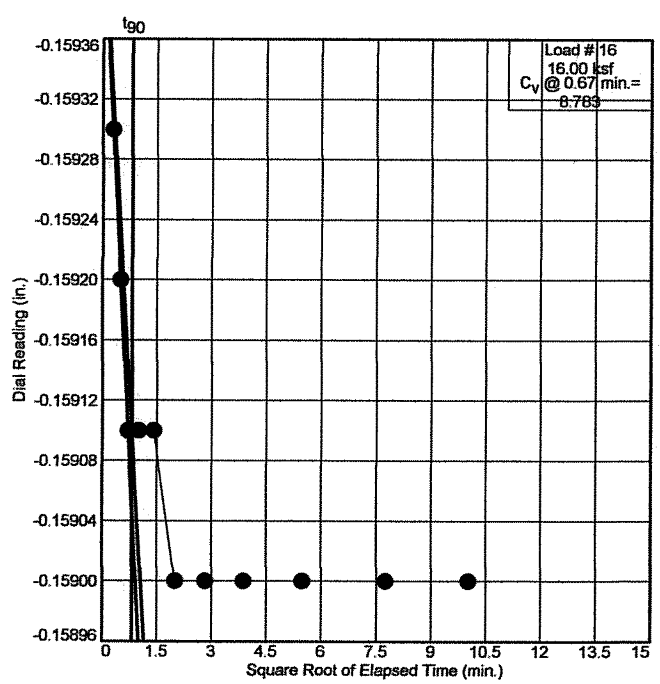
Project No.: 1368-005
Project: Cummings Road Over Maine Turnpike #17-013

Location: BB-CUM-103 **Depth:** 65'-67' **Sample Number:** U2









R.W. Gillespie & Associates, Inc.

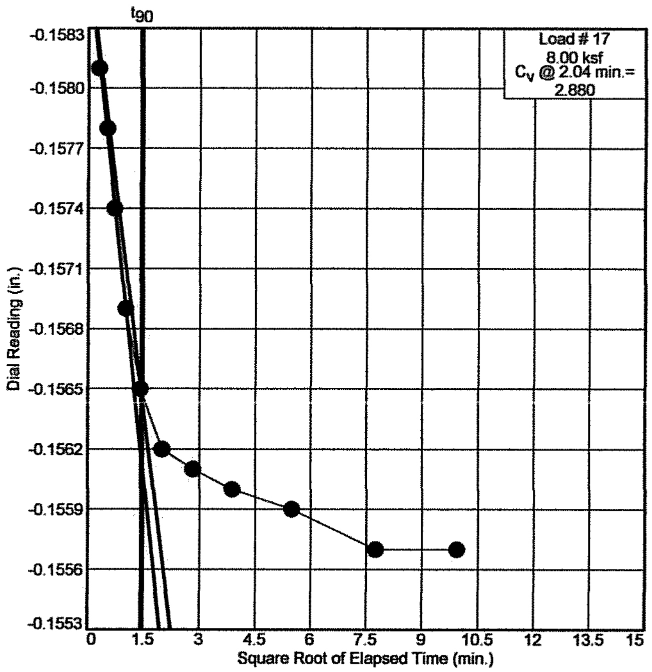
Saco, Maine

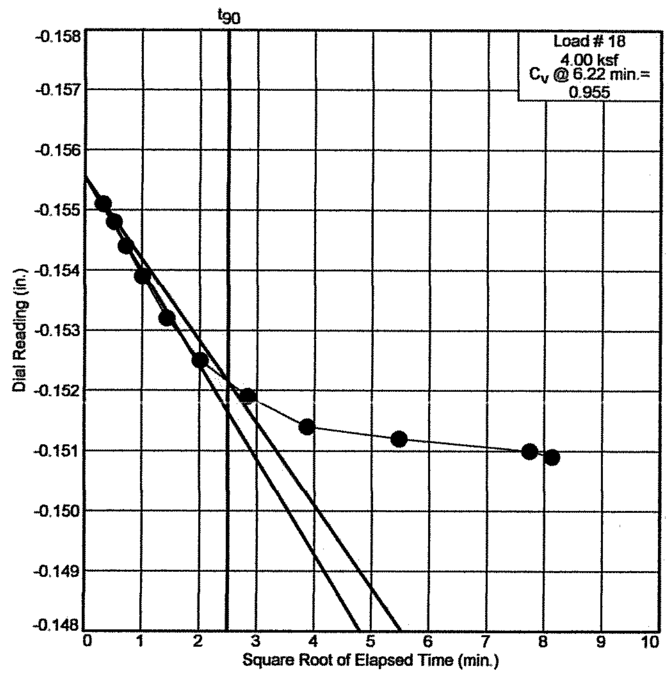
Lab No. 14651b

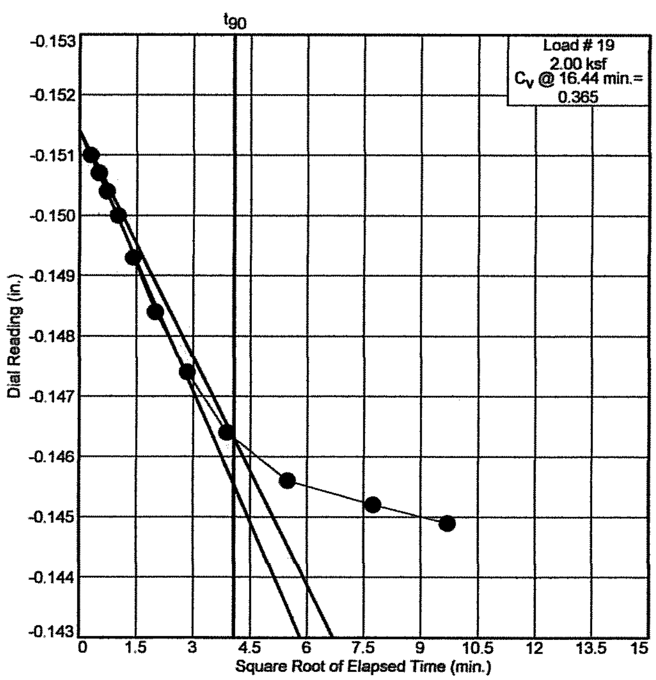
Dial Reading vs. Time

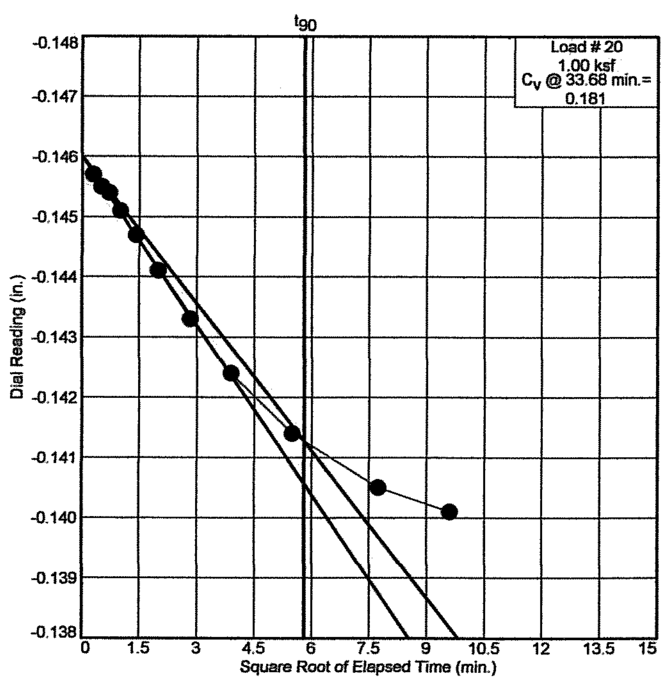
Project No.: 1368-005
Project: Cummings Road Over Maine Turnpike #17-013

Location: BB-CUM-103 **Depth:** 65'-67' **Sample Number:** U2









R.W. Gillespie & Associates, Inc.

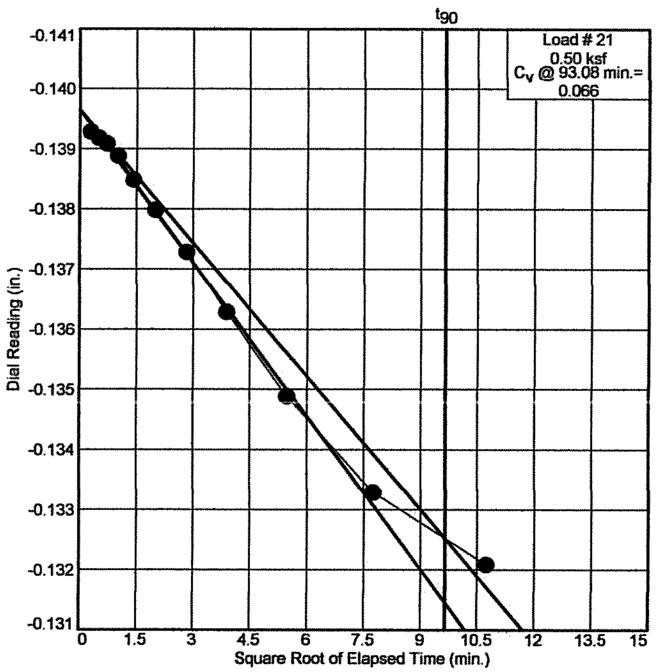
Saco, Maine

Lab No. 14651b

Dial Reading vs. Time

Project No.: 1368-005
Project: Cummings Road Over Maine Turnpike #17-013

Location: BB-CUM-103 **Depth:** 65'-67' **Sample Number:** U2

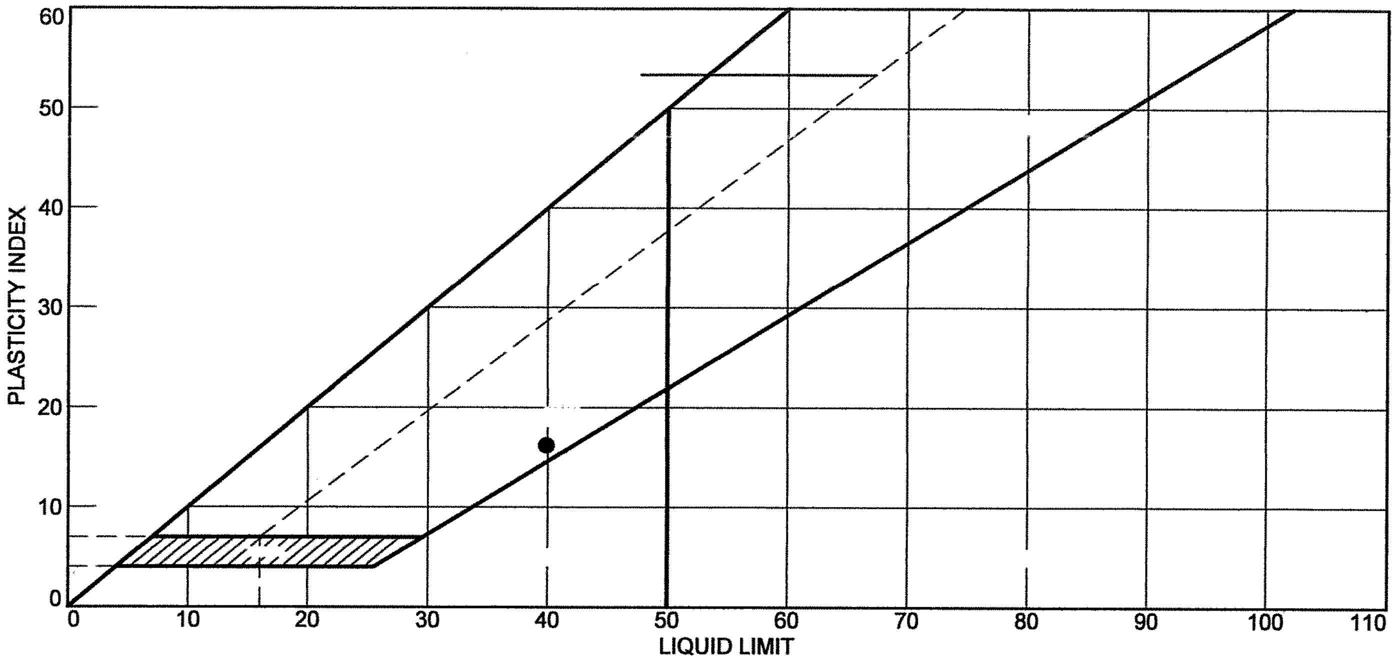


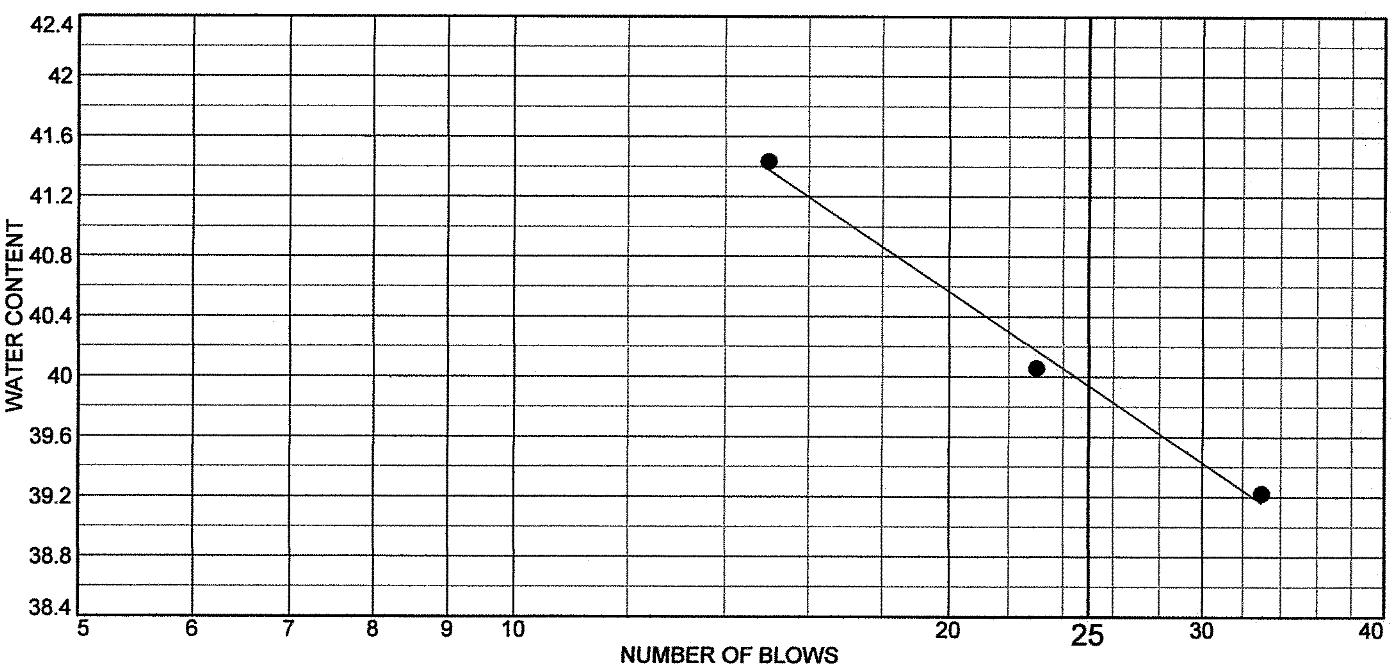
R.W. Gillespie & Associates, Inc.

Saco, Maine

Lab No. 14651b

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Lean Clay	39.9	23.7	16.2			

Project No. 1368-005 **Client:** Schonewald Engineering Associates

Project: Cummings Road Over Maine Turnpike #17-013

Location: BB-CUM-103
Sample Number: U2 **Depth:** 65'-67'

Remarks:

R.W. Gillespie & Associates, Inc.

Saco, Maine

Lab No. 14651b

Tested By: AGS **Checked By:** MTG MTG

Laboratory Vane Shear Test Results

ASTM D4648 Standard Test Method for Laboratory Miniature Vane Shear Test for Saturated Fine-Grained Clayey Soil

Project: Cummings Road Over Maine Turnpike #1
Client: Schonewald Engineering Associates, Inc.
Project No.: 1368-005

Location: Scarborough, ME
Date: 8/10/2017
Test Depth: 65' to 67'

Boring/Sample No.		BB-CUM-103/U2			Lab No.	14651b	
Test No.	Test Depth (ft)	Vane Size	Max. Torque (Undisturbed) (kg-cm)	Max. Torque (Remolded) (kg-cm)	Undrained Shear Strength (psf)	Undrained Shear Strength (psf)	Moisture Content
1	1"	L	38	0	397	0	39%
2	4.5"	L	29	3	303	3	40%

Vane Size	
	(mm)
S	16 x 32
M	20 x 40
L	24.5 x 50.8

Tested By: JRF

Checked By: MTG

R.W. Gillespie & Associates

86 Industrial Park Rd., Suite 4, Saco ME 04072, 207-286-8008 / 200 International Dr., Suite 170, Portsmouth NH 03801, 603-427-0244

R. W. Gillespie & Associates, Inc.
86 Industrial Park Road, Suite 4, Saco, ME 04072 207-286-8008
200 Int'l Drive, Suite 170, Portsmouth, NH 03801 603-427-0244

LETTER OF TRANSMITTAL

Date: 09/28/2017	Project No.: 1368-005
Attention: Isabel Schonewald (ischonewald@maine.rr.com)	
Re: LaboratoryTesting BB-CUM-104 Scarborough, ME	

Schonewald Engineering Associates, Inc.
129 Middle Road
Cumberland, ME 04021

We are sending you attached laboratory test results.

Laboratory No. (s)	Test (s) Performed
14652a: 2D, 5'-7'	Washed Gradation

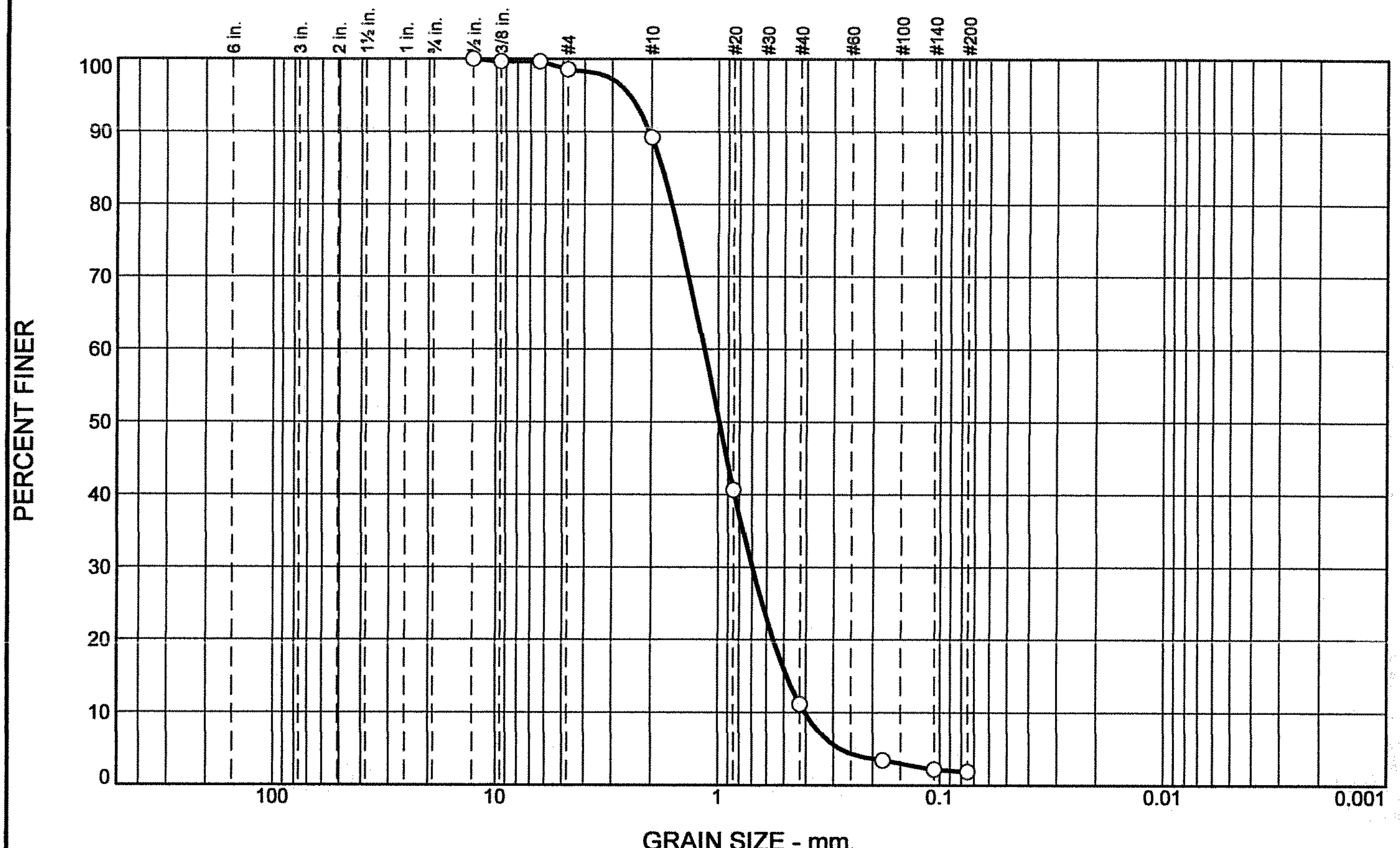
Remarks:

Copy to:

Signed: Matthew T. Grady

If enclosures are not as noted, kindly notify us at once.

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	1.4	9.4	78.0	9.3	1.9	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1/2"	100.0		
3/8"	99.6		
1/4"	99.6		
#4	98.6		
#10	89.2		
#20	40.6		
#40	11.2		
#80	3.4		
#140	2.2		
#200	1.9		

* (no specification provided)

Soil Description

Poorly Graded Sand

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 2.0453 D_{85}= 1.8001 D_{60}= 1.1590
D_{50}= 0.9908 D_{30}= 0.6993 D_{15}= 0.4865
D_{10}= 0.4041 C_u= 2.87 C_c= 1.04

Classification

USCS= SP AASHTO= A-1-b

Remarks

Moisture Content: 21.8%

Location: BB-CUM-104
Sample Number: 2D **Depth:** 5'-7' **Date:** 9/26/17

R.W. Gillespie & Associates, Inc. Saco, Maine

Client: Schonewald Engineering Associates
Project: Cummings Road Over Maine Turnpike #17-013
Project No: 1368-005 **Lab No.** 14652a

Tested By: JJB **Checked By:** MTG MTG

R. W. Gillespie & Associates, Inc.

86 Industrial Park Road, Suite 4, Saco, ME 04072 207-286-8008
200 Int'l Drive, Suite 170, Portsmouth, NH 03801 603-427-0244

LETTER OF TRANSMITTAL

Date: 09/28/2017	Project No.: 1368-005
Attention: Isabel Schonewald (ischonewald@maine.rr.com)	
Re: LaboratoryTesting BB-CUM-104 Scarborough, ME	

Schonewald Engineering Associates, Inc.

129 Middle Road

Cumberland, ME 04021

We are sending you attached laboratory test results.

Laboratory No. (s)	Test (s) Performed
14652b: 9D, 40'-42'	Atteberg and Hydrometer

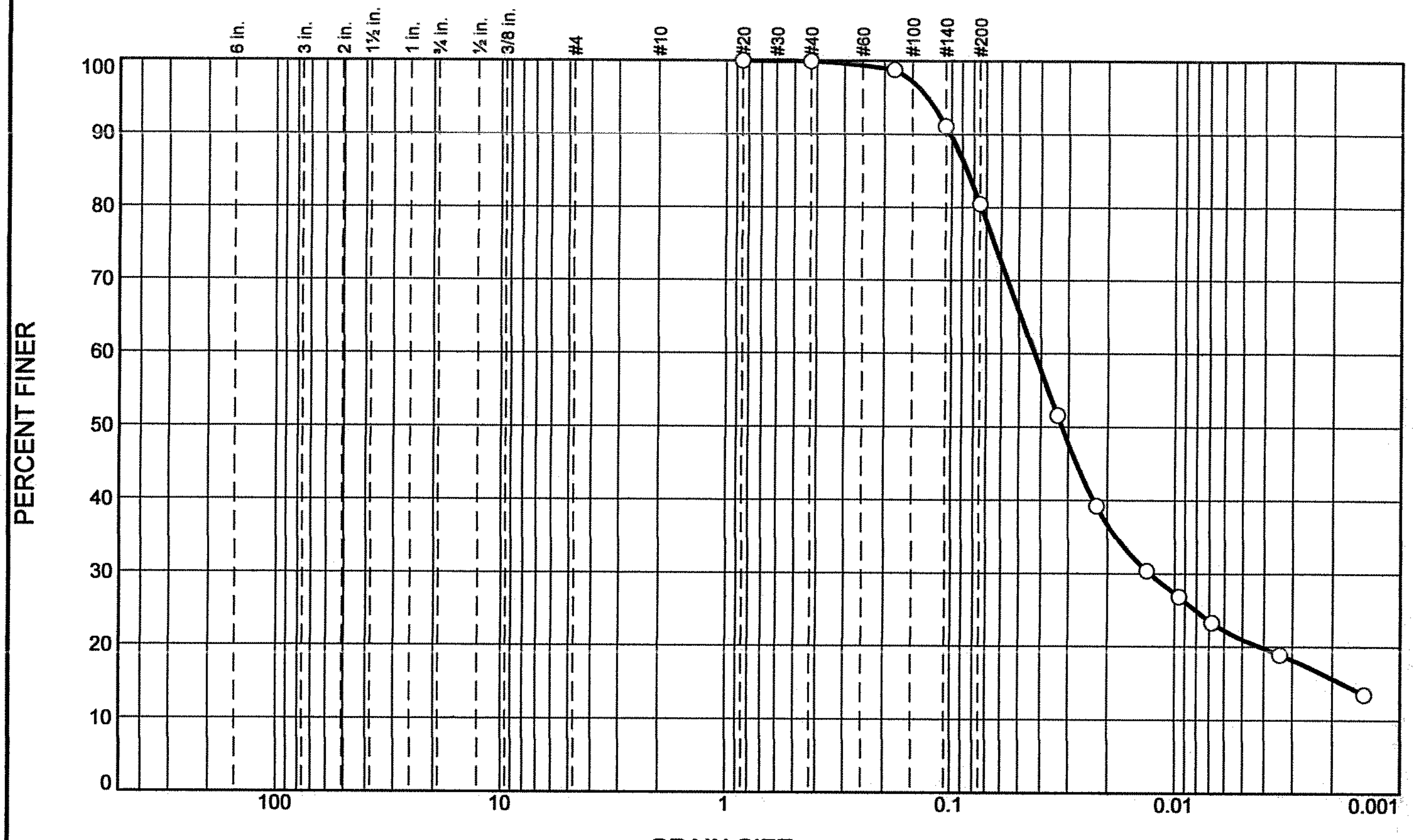
Remarks:

Copy to:

Signed: Matthew T. Grady

If enclosures are not as noted, kindly notify us at once.

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	0.1	19.4	59.5	21.0

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#20	100.0		
#40	99.9		
#80	98.8		
#140	91.1		
#200	80.5		
0.0336 mm.	51.6		
0.0224 mm.	39.2		
0.0133 mm.	30.4		
0.0096 mm.	26.8		
0.0068 mm.	23.3		
0.0034 mm.	18.9		
0.0014 mm.	13.5		

* (no specification provided)

Soil Description

Silt with Sand

Atterberg Limits

PL= NP LL= NV PI= CNBD

Coefficients

D_{90}= 0.1015 D_{85}= 0.0858 D_{60}= 0.0426
D_{50}= 0.0321 D_{30}= 0.0129 D_{15}= 0.0018
D_{10}= C_u= C_c=

Classification

USCS= ML AASHTO= A-4(0)

Remarks

Moisture Content: 27.1%
NP= NON-PLASTIC
NV= NON-VISCOUS
CNBD = COULD NOT BE DETERMINED.

Location: BB-CUM-104
Sample Number: 9D **Depth:** 40'-42' **Date:** 9/27/17

R.W. Gillespie & Associates, Inc. Saco, Maine

Client: Schonewald Engineering Associates
Project: Cummings Road Over Maine Turnpike #17-013
Project No: 1368-005 **Lab No.** 14652b

Tested By: JRF/AGS **Checked By:** MTG MTG

R. W. Gillespie & Associates, Inc.

86 Industrial Park Road, Suite 4, Saco, ME 04072 207-286-8008
200 Int'l Drive, Suite 170, Portsmouth, NH 03801 603-427-0244

LETTER OF TRANSMITTAL

Date: 09/26/2017	Project No.: 1368-005
Attention: Isabel Schonewald (ischonewald@maine.rr.com)	
Re: Laboratory Testing BB-CUM-104 Scarborough, ME	

Schonewald Engineering Associates, Inc.

129 Middle Road

Cumberland, ME 04021

We are sending you attached laboratory test results.

Laboratory No. (s)	Test (s) Performed
14652c: U1, 60'-62'	Consolidation, Atteberg, Moisture Content

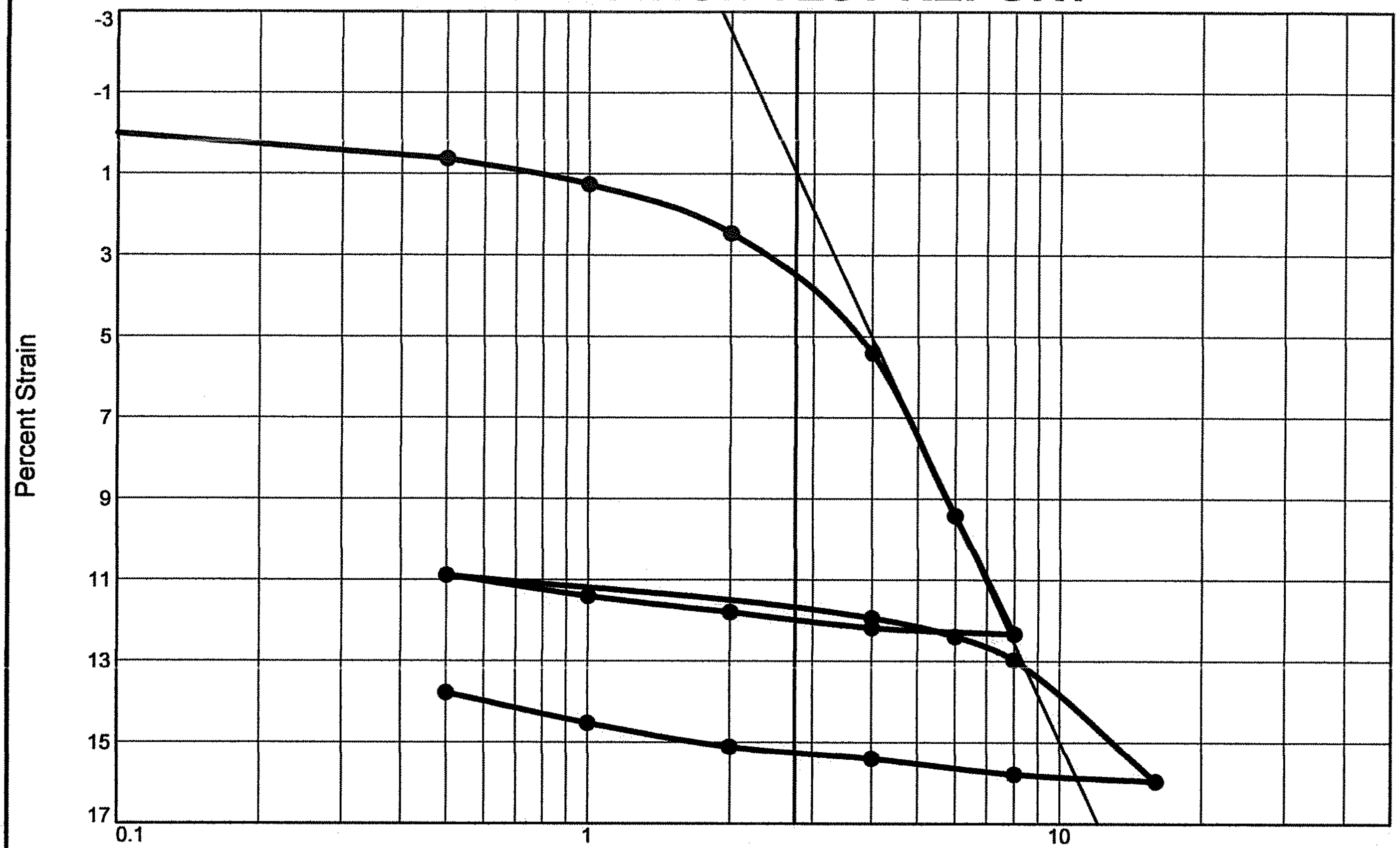
Remarks:

Copy to:

Signed: Matthew T. Grady

If enclosures are not as noted, kindly notify us at once.

CONSOLIDATION TEST REPORT



Coefficients of Consolidation and Secondary Consolidation											
No.	Load (ksf)	C_v (ft.^{2}/day)	C_α	No.	Load (ksf)	C_v (ft.^{2}/day)	C_α	No.	Load (ksf)	C_v (ft.^{2}/day)	C_α
1	0.50	0.992		8	2.00	3.104		15	8.00	4.513	
2	1.00	1.138		9	1.00	0.784		16	4.00	3.229	
3	2.00	0.600		10	0.50	0.296		17	2.00	1.332	
4	4.00	0.428		11	4.00	1.801		18	1.00	0.443	
5	6.00	0.188		12	6.00	2.004		19	0.50	0.219	
6	8.00	0.082		13	8.00	1.454					
7	4.00	8.145		14	16.00	0.828					

Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	Overburden (ksf)	P_c (ksf)	C_c	C_r	Initial Void Ratio
Saturation	Moisture									
101.5 %	37.6 %	84.5	39.5	16.0	2.75		3.6	0.50	0.09	1.020

MATERIAL DESCRIPTION	USCS	AASHTO
Lean Clay		

Project No. 1368-005 **Client:** Schonewald Engineering Associates

Project: Cummings Road Over Maine Turnpike #17-013

Location: BB-CUM-104 **Depth:** 60'-62' **Sample Number:** U1

R.W. Gillespie & Associates, Inc.

Saco, Maine

Remarks:

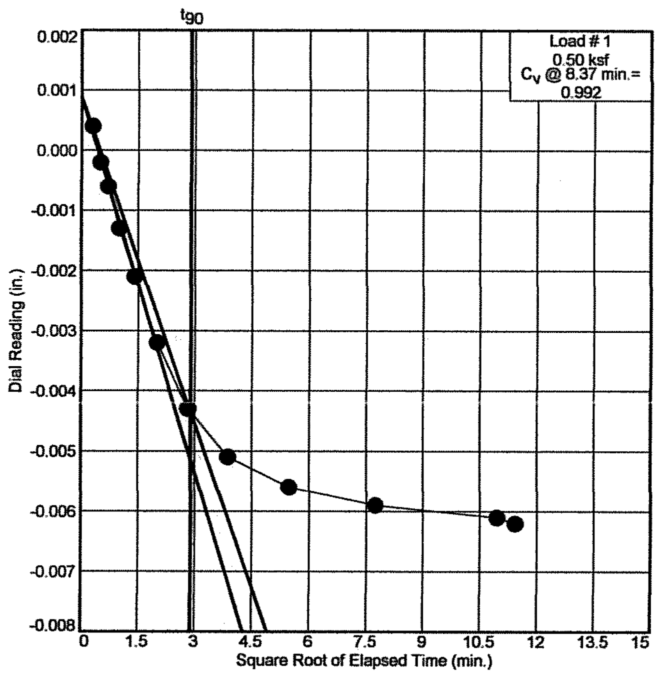
Lab No. 14652

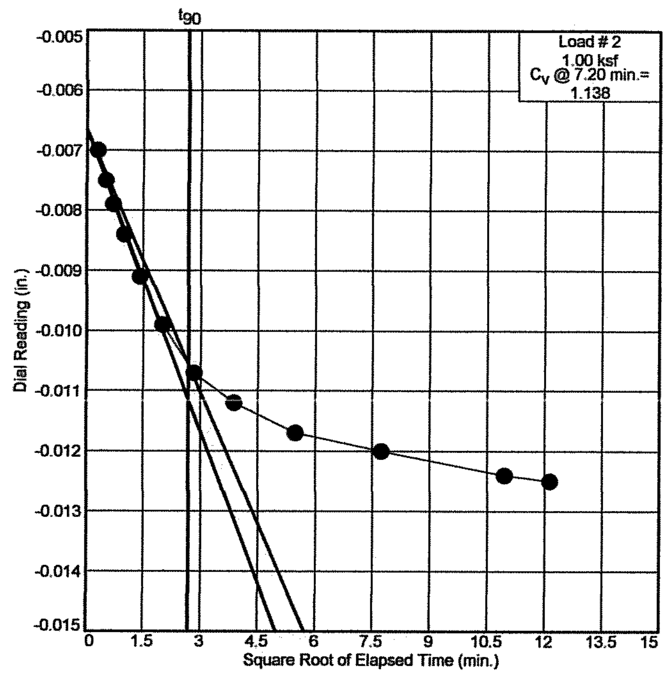
Tested By: JRF/AGS **Checked By:** MTG MB

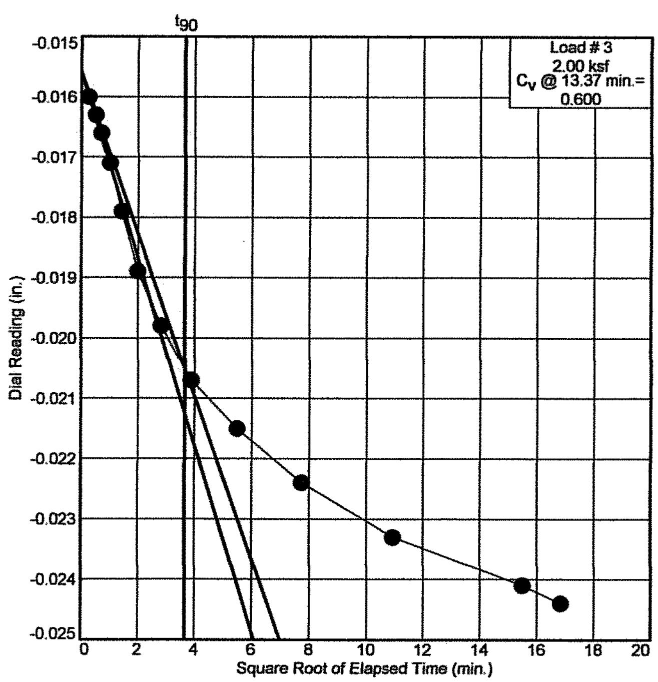
Dial Reading vs. Time

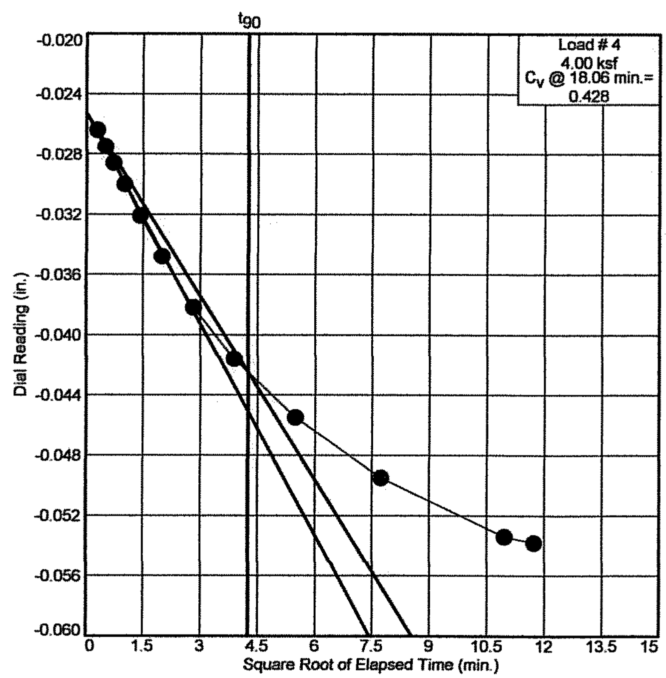
Project No.: 1368-005
Project: Cummings Road Over Maine Turnpike #17-013

Location: BB-CUM-104 **Depth:** 60'-62' **Sample Number:** U1









R.W. Gillespie & Associates, Inc.

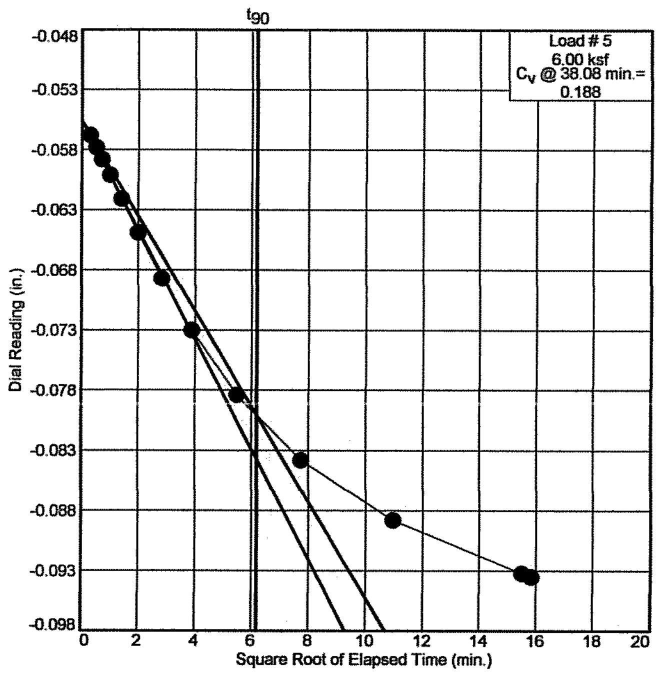
Saco, Maine

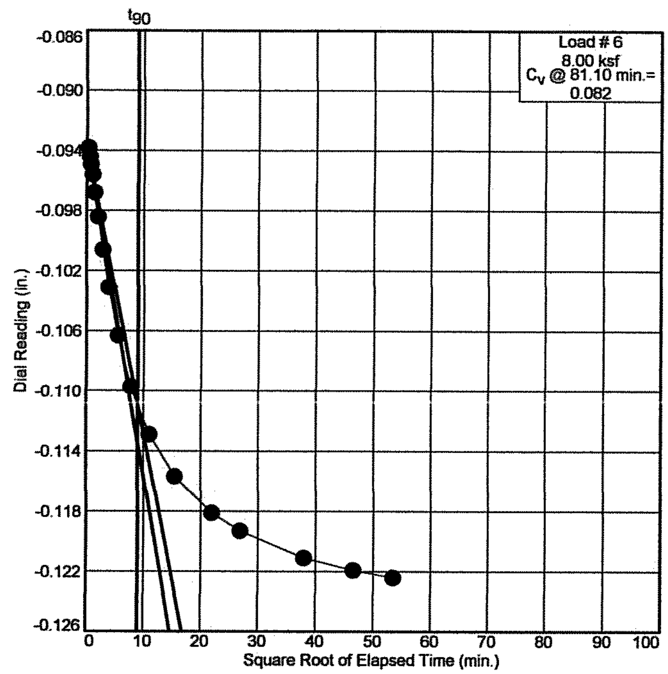
Lab No. 14652

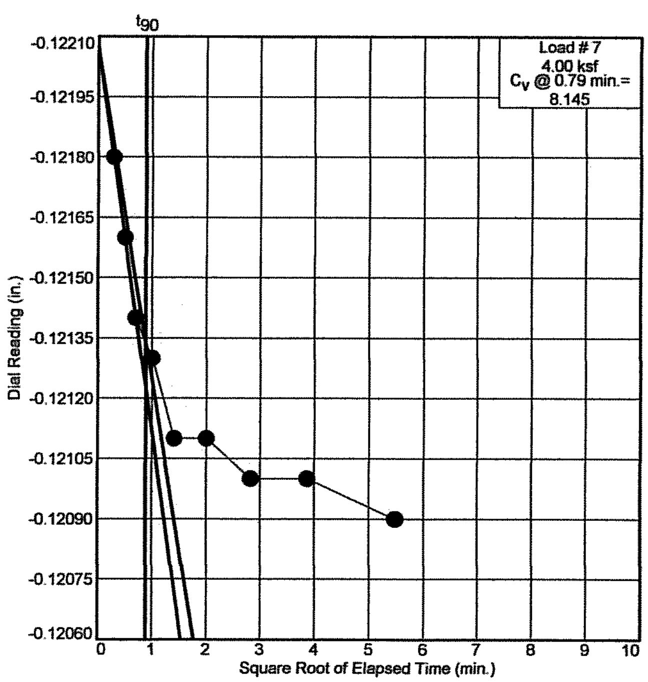
Dial Reading vs. Time

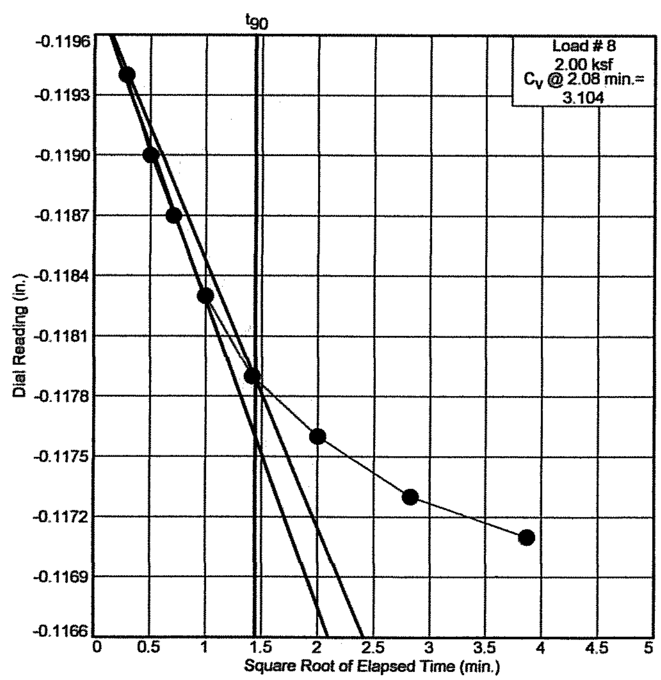
Project No.: 1368-005
Project: Cummings Road Over Maine Turnpike #17-013

Location: BB-CUM-104 **Depth:** 60'-62' **Sample Number:** U1









R.W. Gillespie & Associates, Inc.

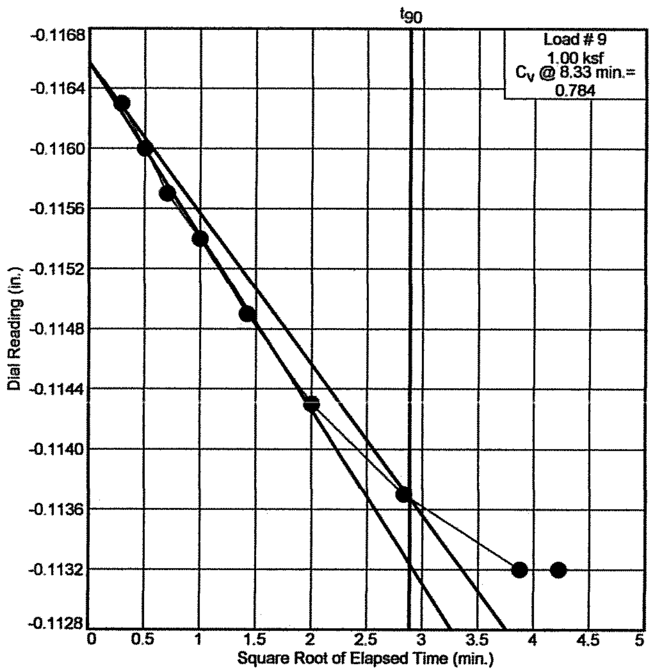
Saco, Maine

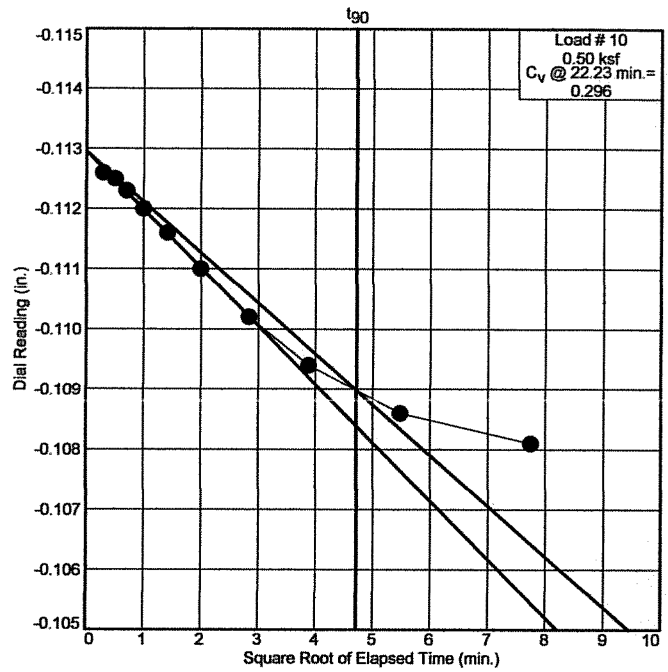
Lab No. 14652

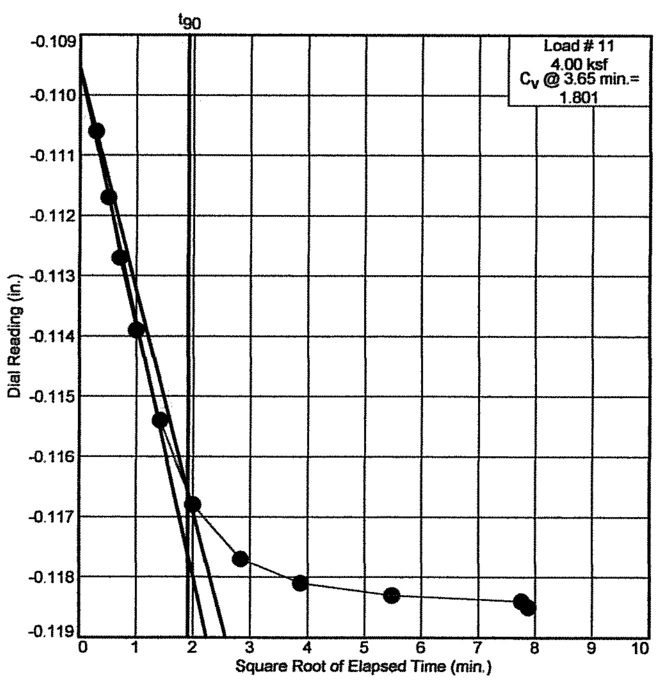
Dial Reading vs. Time

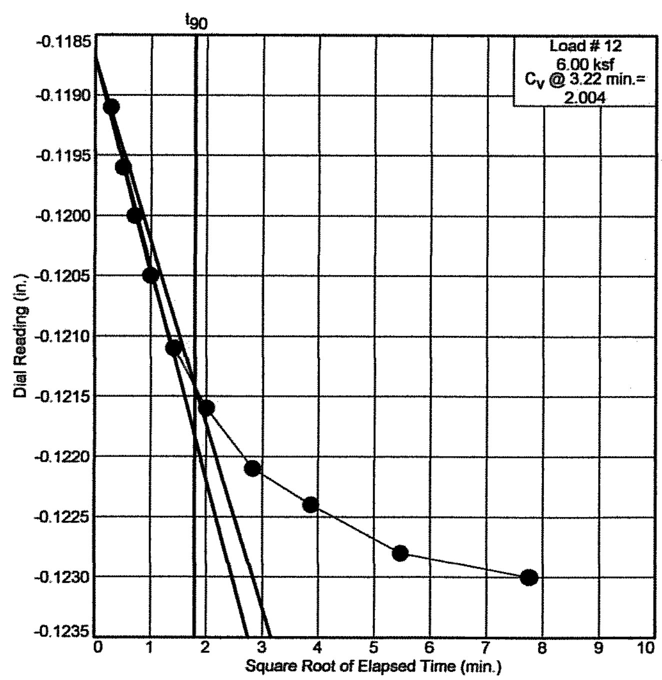
Project No.: 1368-005
Project: Cummings Road Over Maine Turnpike #17-013

Location: BB-CUM-104 Depth: 60'-62' Sample Number: U1









R.W. Gillespie & Associates, Inc.

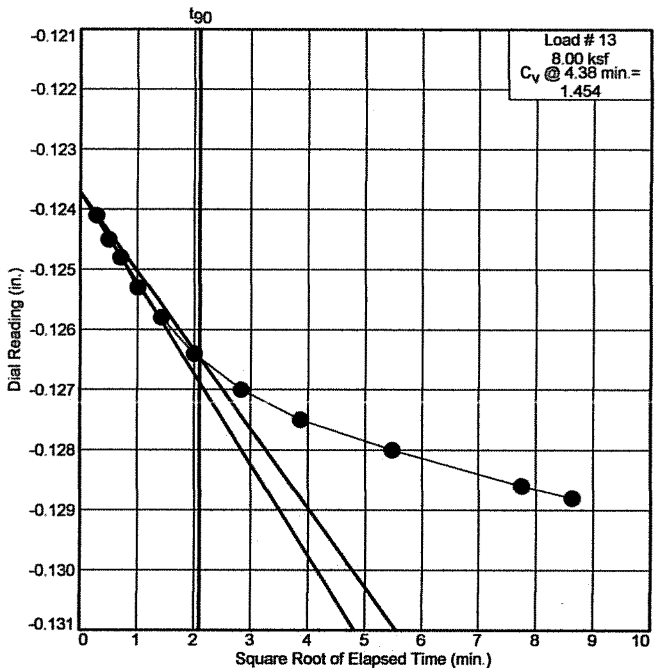
Saco, Maine

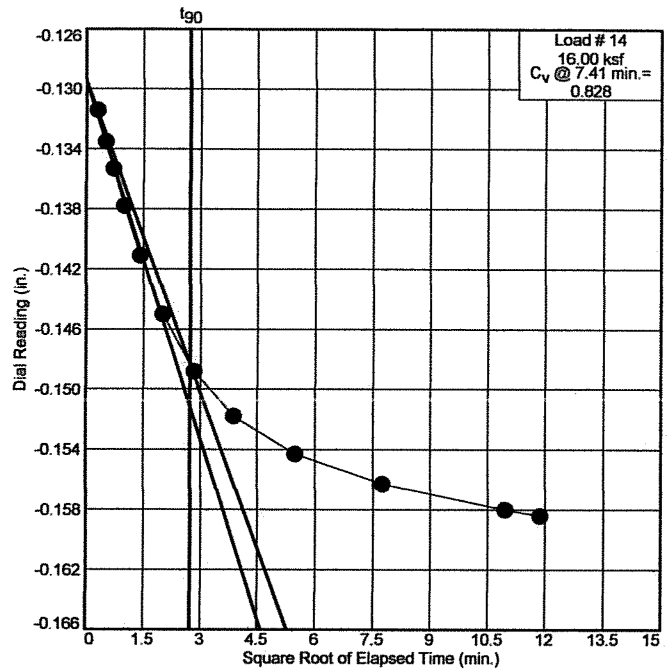
Lab No. 14652

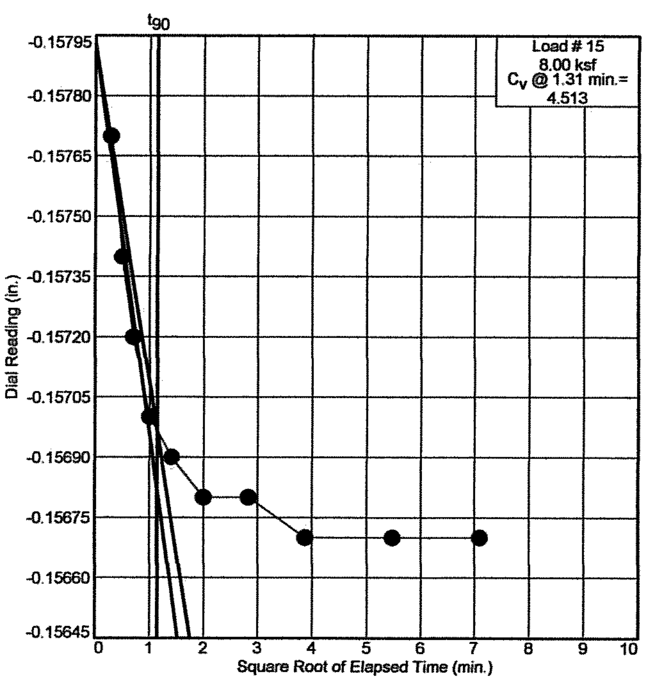
Dial Reading vs. Time

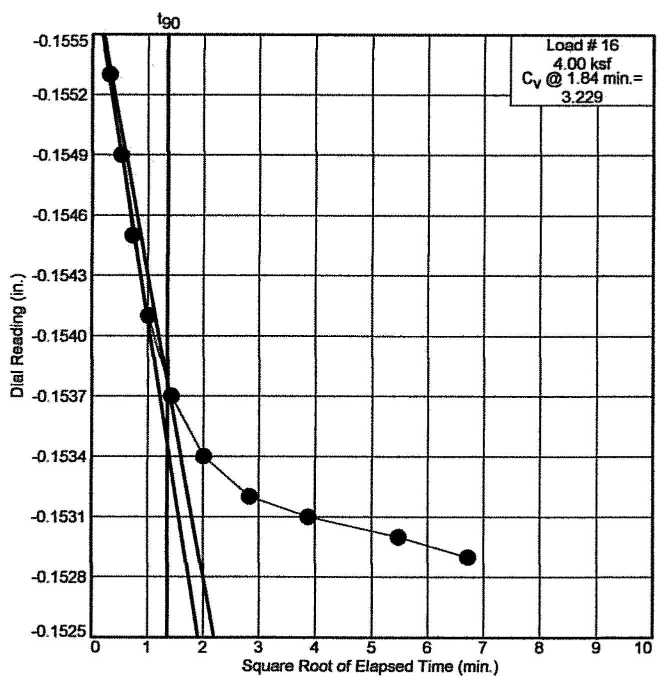
Project No.: 1368-005
Project: Cummings Road Over Maine Turnpike #17-013

Location: BB-CUM-104 Depth: 60'-62' Sample Number: U1









R.W. Gillespie & Associates, Inc.

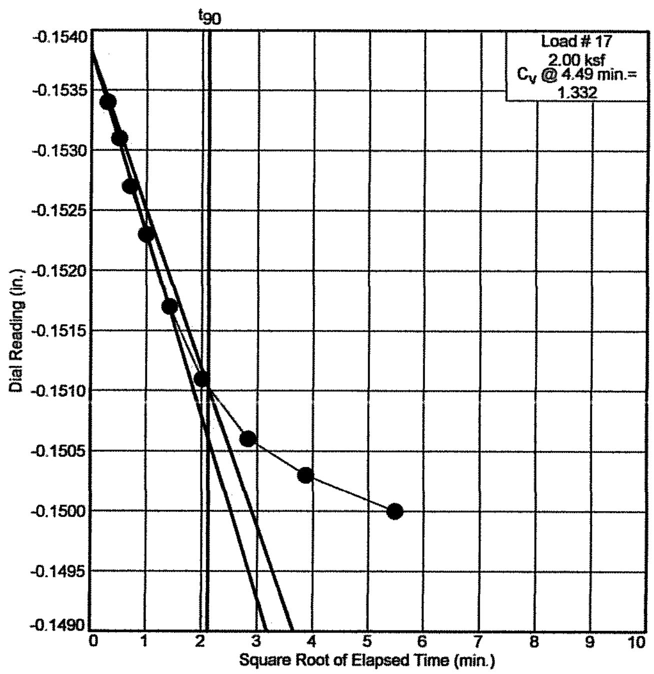
Saco, Maine

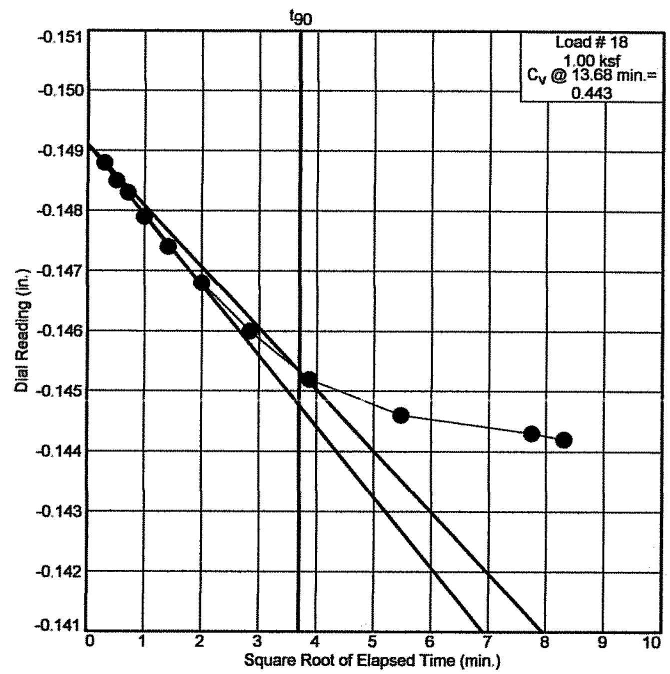
Lab No. 14652

Dial Reading vs. Time

Project No.: 1368-005
Project: Cummings Road Over Maine Turnpike #17-013

Location: BB-CUM-104 **Depth:** 60'-62' **Sample Number:** U1



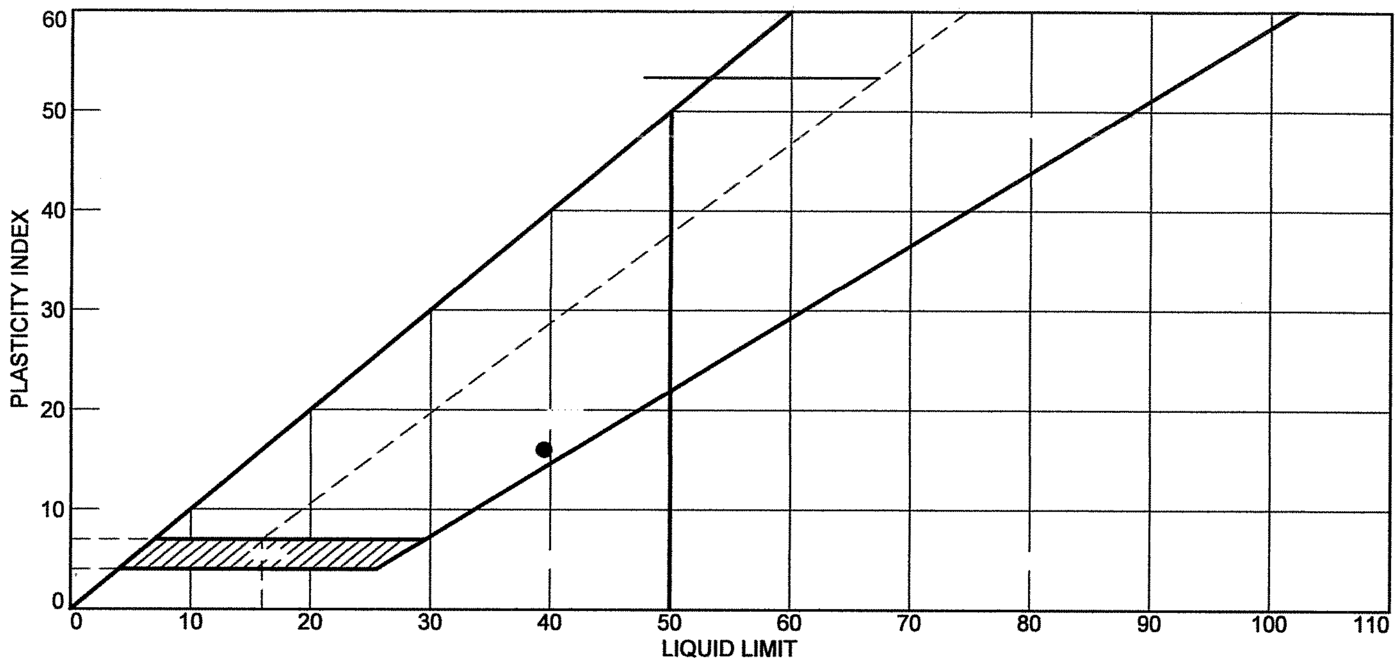


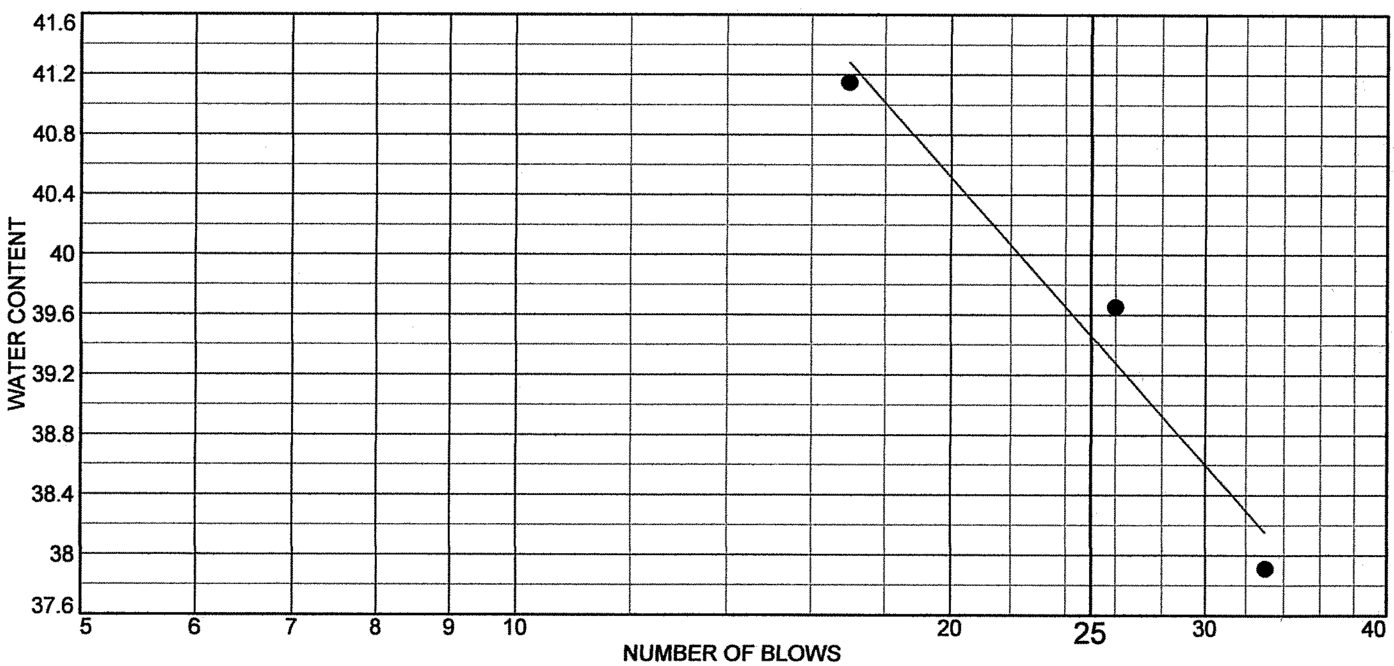
R.W. Gillespie & Associates, Inc.

Saco, Maine

Lab No. 14652

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Lean Clay	39.5	23.5	16.0			

Project No. 1368-005 **Client:** Schonewald Engineering Associates

Project: Cummings Road Over Maine Turnpike #17-013

Location: BB-CUM-104
Sample Number: U1 **Depth:** 60'-62'

Remarks:

R.W. Gillespie & Associates, Inc.

Saco, Maine

Lab No. 14652c

Tested By: AGS **Checked By:** MTG MTG

Laboratory Vane Shear Test Results

ASTM D4648 Standard Test Method for Laboratory Miniature Vane Shear Test for Saturated Fine-Grained Clayey Soil

Project: Cummings Road Over Maine Turnpike #1
Client: Schonewald Engineering Associates, Inc.
Project No.: 1368-005

Location: Scarborough, ME
Date: 8/10/2017
Test Depth: 60' to 62'

Boring/Sample No.		BB-CUM-104/U1			Lab No.	14652c	
Test No.	Test Depth (ft)	Vane Size	Max. Torque (Undisturbed) (kg-cm)	Max. Torque (Remolded) (kg-cm)	Undrained Shear Strength (psf)	Undrained Shear Strength (psf)	Moisture Content
1	0.25"	L	32	0	334	0	40%
2	2.25"	L	35	0	365	0	40%
3	5.75"	L	35	0	365	0	38%

Vane Size	
	(mm)
S	16 x 32
M	20 x 40
L	24.5 x 50.8

Tested By: JRF/AGS

Checked By: MTC

R.W. Gillespie & Associates

86 Industrial Park Rd., Suite 4, Saco ME 04072, 207-286-8008 / 200 International Dr., Suite 170, Portsmouth NH 03801, 603-427-0244

R. W. Gillespie & Associates, Inc.
86 Industrial Park Road, Suite 4, Saco, ME 04072 207-286-8008
200 Int'l Drive, Suite 170, Portsmouth, NH 03801 603-427-0244

LETTER OF TRANSMITTAL

Date: 09/28/2017	Project No.: 1368-005
Attention: Isabel Schonewald (ischonewald@maine.rr.com)	
Re: LaboratoryTesting BB-CUM-104 Scarborough, ME	

Schonewald Engineering Associates, Inc.

129 Middle Road

Cumberland, ME 04021

We are sending you attached laboratory test results.

Laboratory No. (s)	Test (s) Performed
14652d: 13D, 70'-72'	Atteberg and Moisture

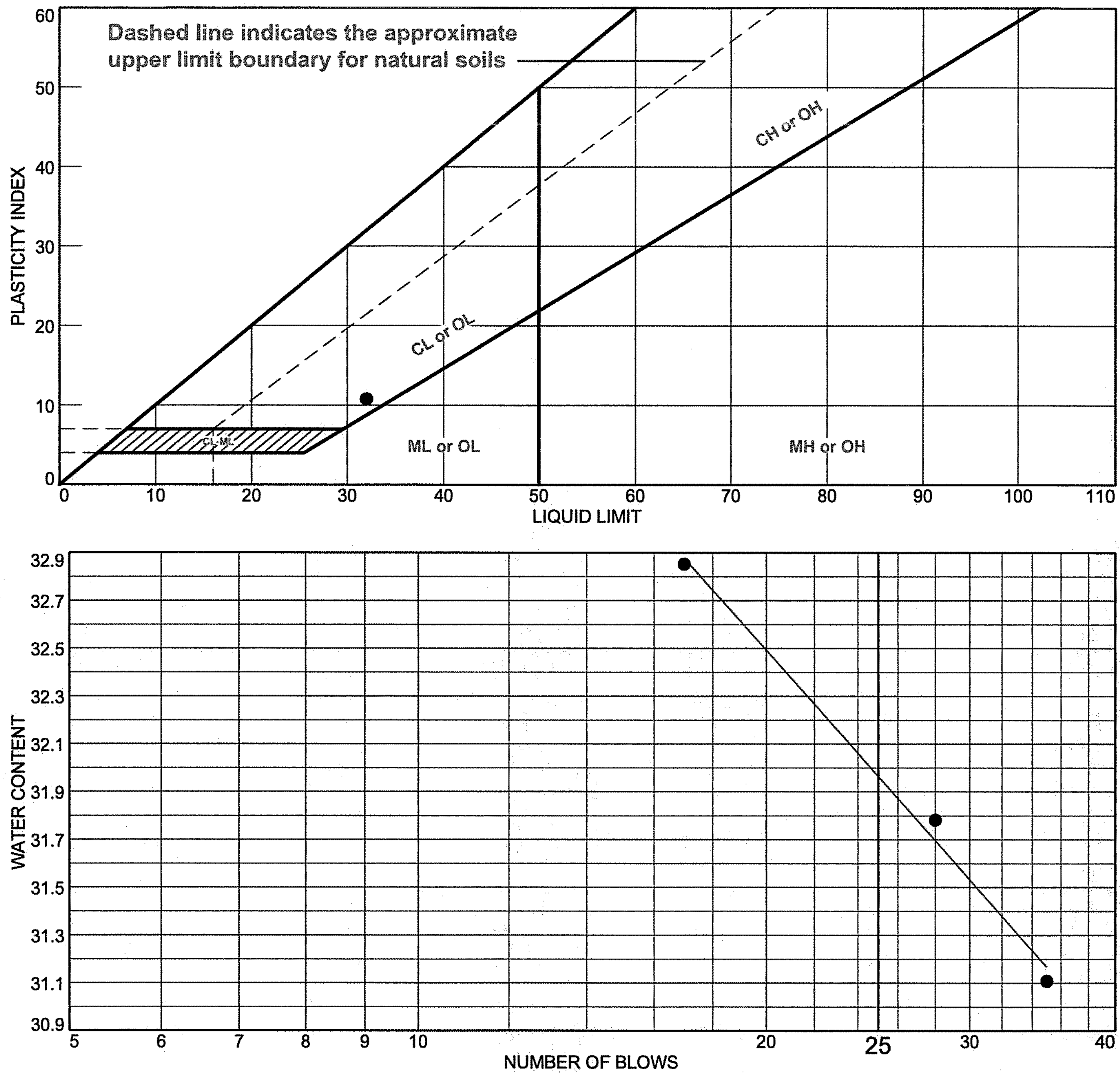
Remarks:

Copy to:

Signed: Matthew T. Grady

If enclosures are not as noted, kindly notify us at once.

LIQUID AND PLASTIC LIMITS TEST REPORT



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Lean Clay	32.0	21.2	10.8			

Project No. 1368-005 **Client:** Schonewald Engineering Associates

Project: Cummings Road Over Maine Turnpike #17-013

Location: BB-CUM-104, Scarborough, ME
Sample Number: 13D **Depth:** 70'-72'

R.W. Gillespie & Associates, Inc.

Saco, Maine

Remarks:
● Lid of jar was not screwed on tightly allowing some moisture to escape. As Recieved Moisture: 24.4%

Lab No. 14652d

Tested By: JRF, AGS **Checked By:** MTG MTG

R. W. Gillespie & Associates, Inc.
86 Industrial Park Road, Suite 4, Saco, ME 04072 207-286-8008
200 Int'l Drive, Suite 170, Portsmouth, NH 03801 603-427-0244

LETTER OF TRANSMITTAL

Date: 09/28/2017	Project No.: 1368-005
Attention: Isabel Schonewald (ischonewald@maine.rr.com)	
Re: LaboratoryTesting BB-CUM-105 Scarborough, ME	

Schonewald Engineering Associates, Inc.

129 Middle Road

Cumberland, ME 04021

We are sending you attached laboratory test results.

Laboratory No. (s)	Test (s) Performed
14653a: 8D, 35'-37'	Atteberg and Hydrometer

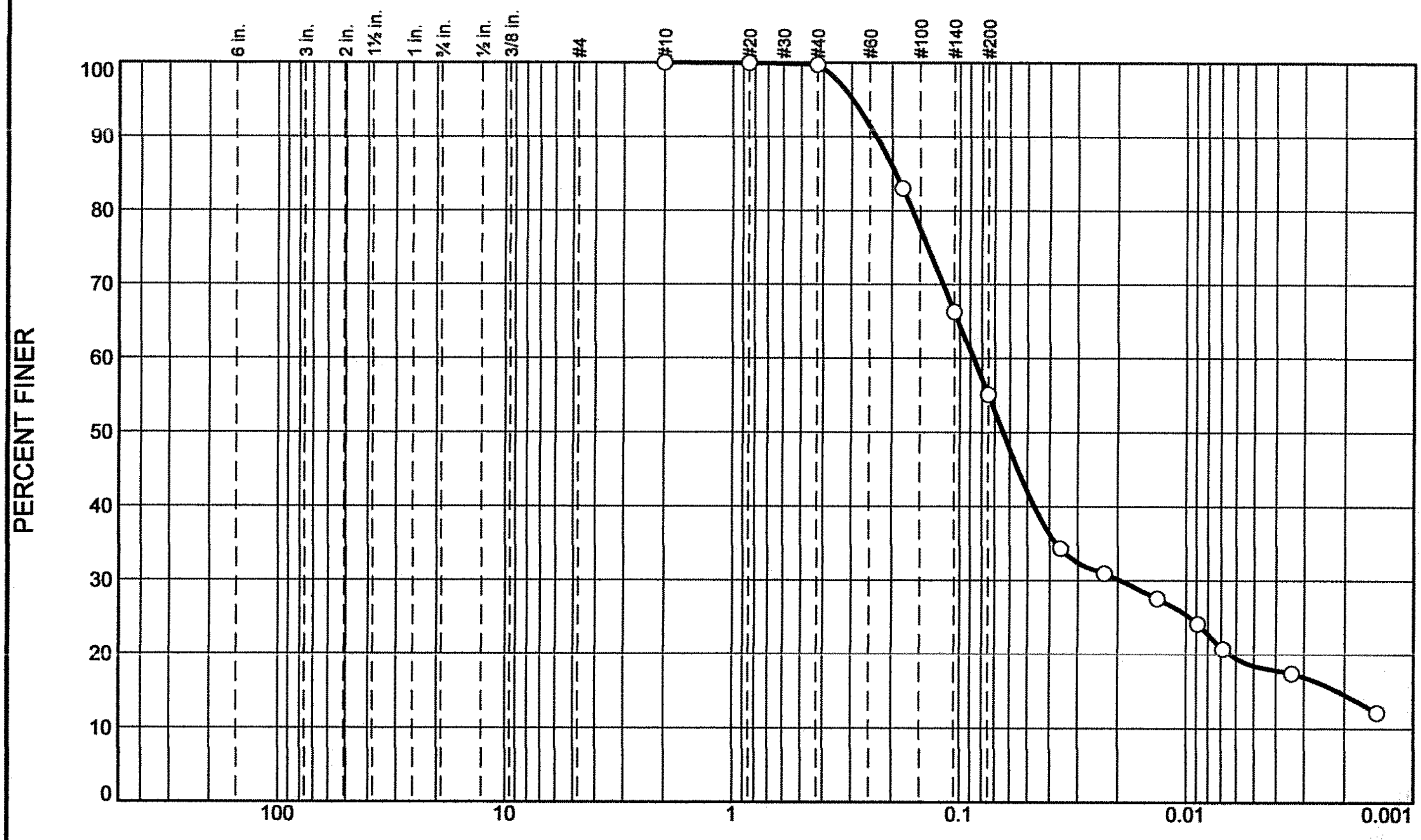
Remarks:

Copy to:

Signed: Matthew T. Grady

If enclosures are not as noted, kindly notify us at once.

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	0.2	44.7	36.6	18.5

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#10	100.0		
#20	100.0		
#40	99.8		
#80	83.0		
#140	66.3		
#200	55.1		
0.0358 mm.	34.3		
0.0230 mm.	30.9		
0.0134 mm.	27.5		
0.0089 mm.	24.2		
0.0069 mm.	20.7		
0.0034 mm.	17.4		
0.0014 mm.	12.2		

* (no specification provided)

Soil Description

Sandy Silt

Atterberg Limits

PL= NP LL= NV PI= CNBD

Coefficients

D_{90}= 0.2342 D_{85}= 0.1932 D_{60}= 0.0871
D_{50}= 0.0644 D_{30}= 0.0195 D_{15}= 0.0021
D_{10}= C_u= C_c=

Classification

USCS= ML AASHTO= A-4(0)

Remarks

Moisture Content: 26.0%
NP = NON-PLASTIC
NV = NON-VISCOUS
CNDB = COULD NOT BE DETERMINED

Location: BB-CUM-105
Sample Number: 8D **Depth:** 35'-37' **Date:** 9/27/17

R.W. Gillespie & Associates, Inc.
Saco, Maine

Client: Schonewald Engineering Associates
Project: Cummings Road Over Maine Turnpike #17-013
Project No: 1368-005 **Lab No.** 14653a

Tested By: JRF/AGS **Checked By:** MTG MTG

R. W. Gillespie & Associates, Inc.
86 Industrial Park Road, Suite 4, Saco, ME 04072 207-286-8008
200 Int'l Drive, Suite 170, Portsmouth, NH 03801 603-427-0244

LETTER OF TRANSMITTAL

Date: 09/28/2017	Project No.: 1368-005
Attention: Isabel Schonewald (ischonewald@maine.rr.com)	
Re: LaboratoryTesting BB-CUM-105 Scarborough, ME	

Schonewald Engineering Associates, Inc.

129 Middle Road

Cumberland, ME 04021

We are sending you attached laboratory test results.

Laboratory No. (s)	Test (s) Performed
14653b: 12D, 55'-57'	Atteberg and Moisture

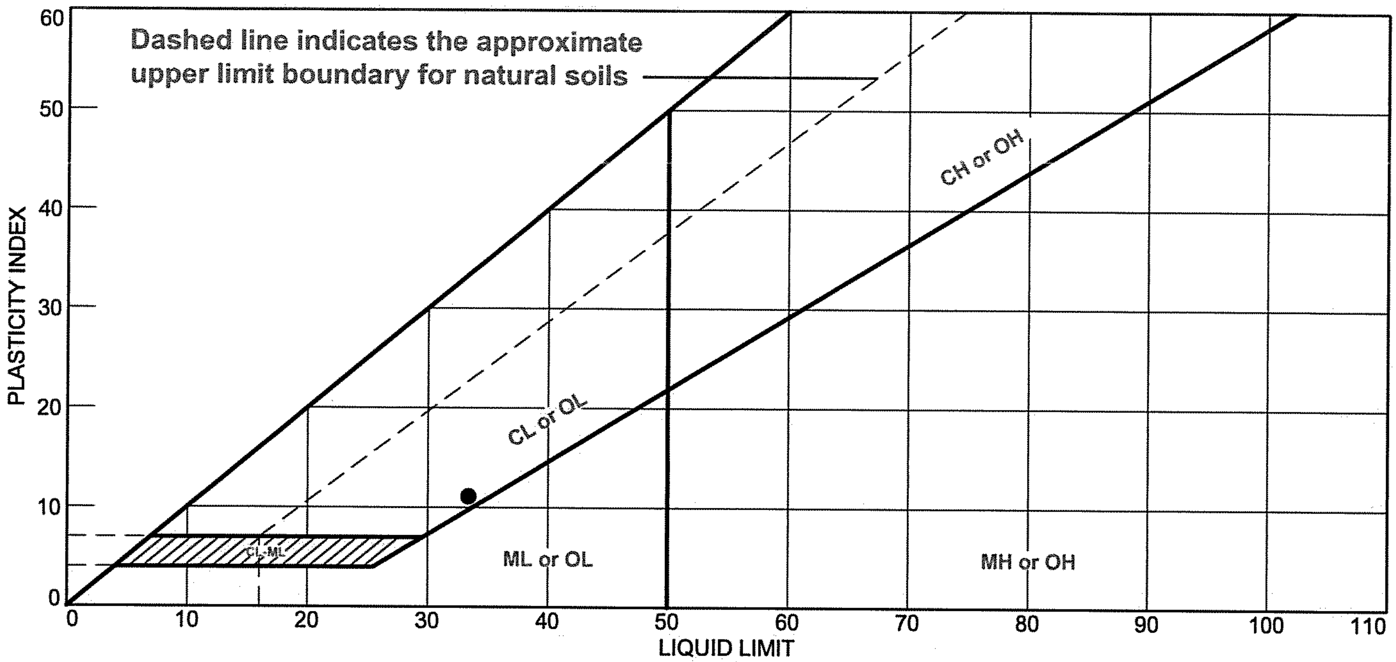
Remarks:

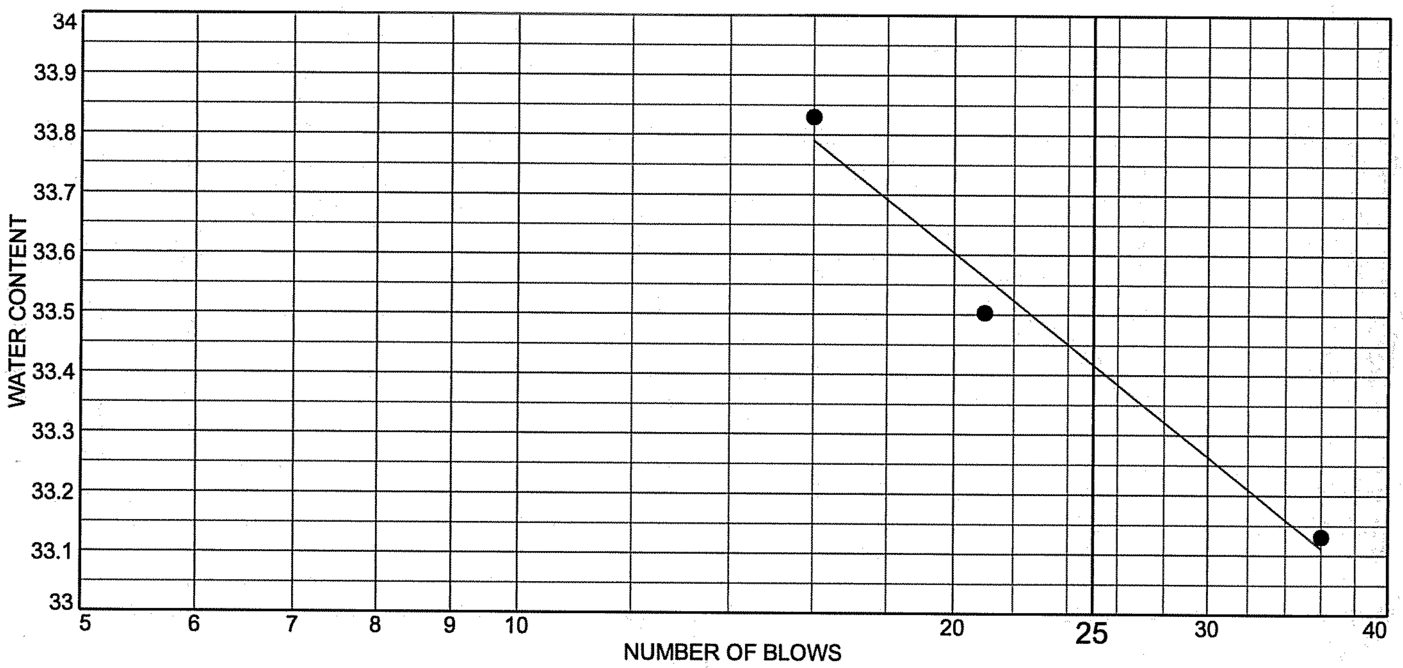
Copy to:

Signed: Matthew T. Grady

If enclosures are not as noted, kindly notify us at once.

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Lean Clay	33.4	22.3	11.1			

Project No. 1368-005 **Client:** Schonewald Engineering Associates

Project: Cummings Road Over Maine Turnpike #17-013

Location: BB-CUM-105, Scarborough, ME

Sample Number: 12D **Depth:** 55'-57'

R.W. Gillespie & Associates, Inc.

Saco, Maine

Remarks:

● Natural Moisture: 40.3%

Lab No. 14653b

Tested By: AGS, JRF **Checked By:** MTG MTG

R. W. Gillespie & Associates, Inc.

86 Industrial Park Road, Suite 4, Saco, ME 04072 207-286-8008
200 Int'l Drive, Suite 170, Portsmouth, NH 03801 603-427-0244

LETTER OF TRANSMITTAL

Date: 09/26/2017	Project No.: 1368-005
Attention: Isabel Schonewald (ischonewald@maine.rr.com)	
Re: Laboratory Testing BB-CUM-105 Scarborough, ME	

Schonewald Engineering Associates, Inc.

129 Middle Road

Cumberland, ME 04021

We are sending you attached laboratory test results.

Laboratory No. (s)	Test (s) Performed
14653c: U1, 60'-62'	Consolidation, Atteberg, Moisture Content

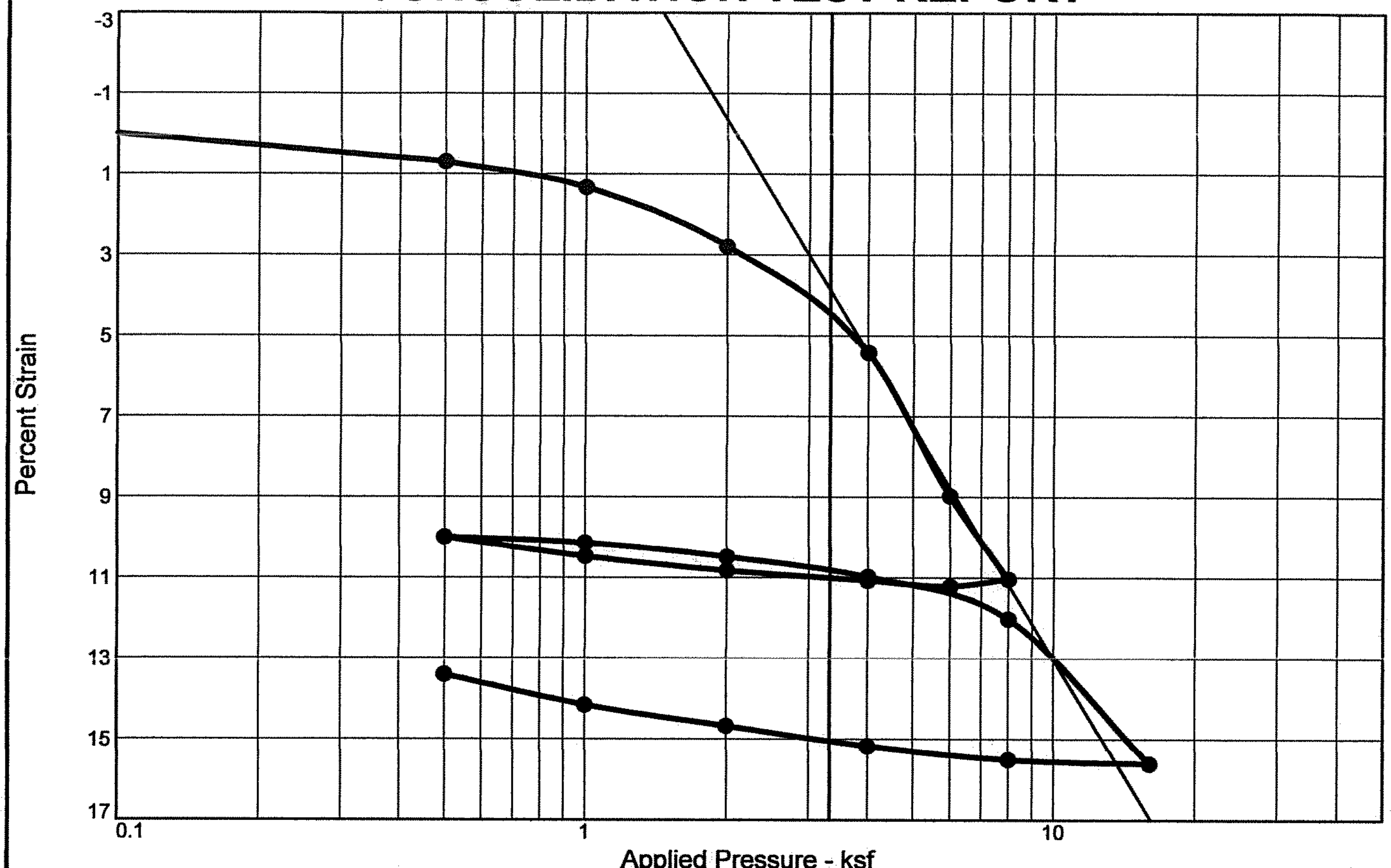
Remarks:

Copy to:

Signed: Matthew T. Grady

If enclosures are not as noted, kindly notify us at once.

CONSOLIDATION TEST REPORT



Coefficients of Consolidation and Secondary Consolidation											
No.	Load (ksf)	C_v (ft.[2]/day)	C_α	No.	Load (ksf)	C_v (ft.[2]/day)	C_α	No.	Load (ksf)	C_v (ft.[2]/day)	C_α
1	0.50	0.895		8	4.00	8.386		15	8.00	1.590	
2	1.00	1.079		9	2.00	2.442		16	16.00	0.559	
3	2.00	0.660		10	1.00	0.719		17	8.00	6.701	
4	4.00	0.551		11	0.50	0.317		18	4.00	1.893	
5	6.00	0.217		12	1.00	1.250		19	2.00	0.821	
6	8.00	0.220		13	2.00	1.163		20	1.00	0.349	
7	6.00	4.360		14	4.00	1.848		21	0.50	0.140	

Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	Overburden (ksf)	P_c (ksf)	C_c	C_r	Initial Void Ratio
Saturation	Moisture									
100.0 %	40.5 %	81.1	33.1	10.1	2.75		3.6	0.40	0.08	1.114

MATERIAL DESCRIPTION	USCS	AASHTO
Lean Clay		

Project No. 1368-005 **Client:** Schonewald Engineering Associates

Project: Cummings Road Over Maine Turnpike #17-013

Location: BB-CUM-105 **Depth:** 60'-62' **Sample Number:** U-1

Remarks:

R.W. Gillespie & Associates, Inc.

Saco, Maine

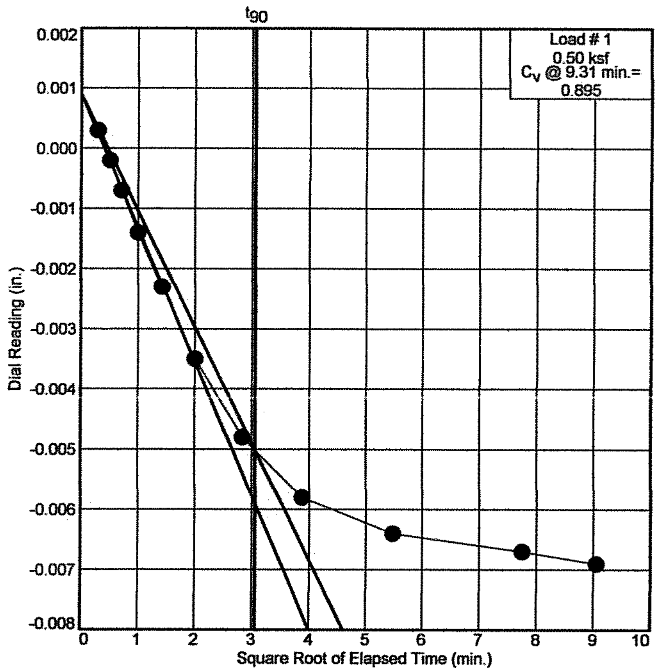
Lab No. 14653c

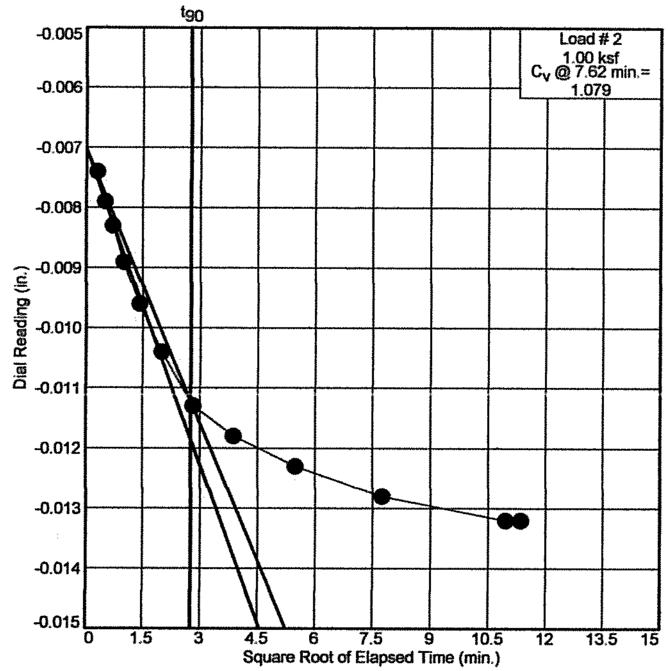
Tested By: JRF **Checked By:** MTG MTG

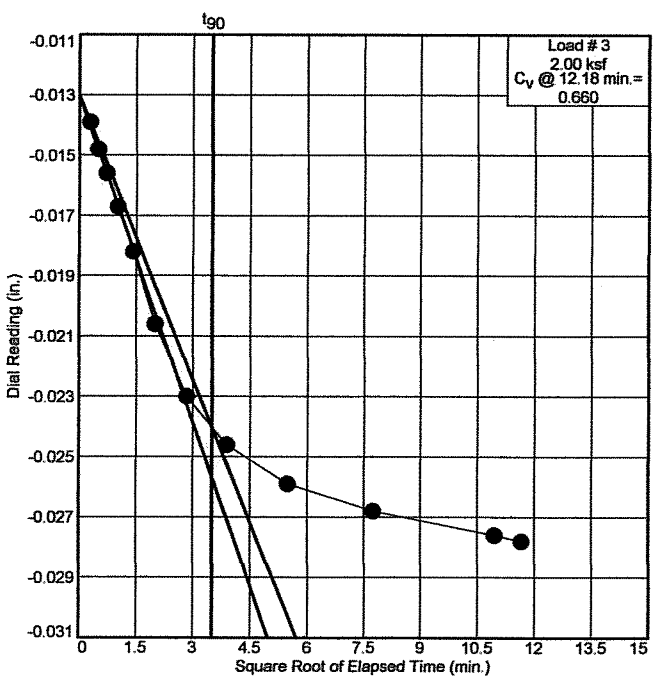
Dial Reading vs. Time

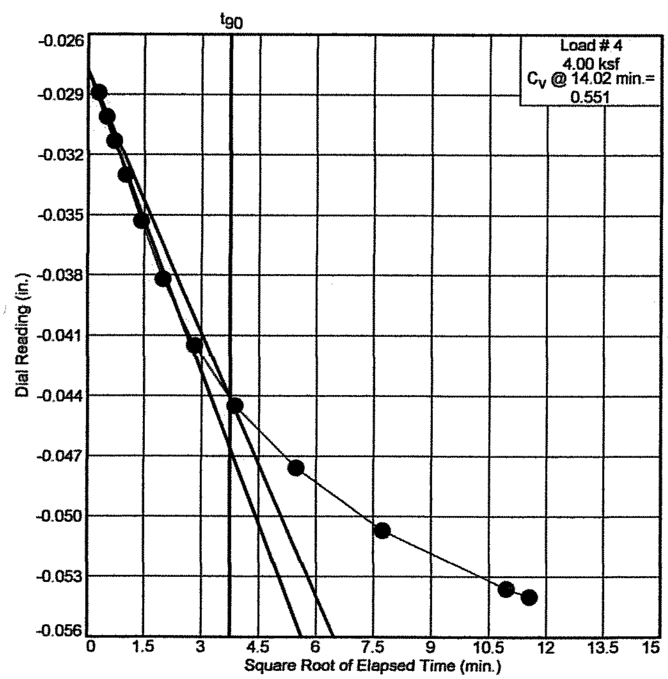
Project No.: 1368-005
Project: Cummings Road Over Maine Turnpike #17-013

Location: BB-CUM-105 **Depth:** 60'-62' **Sample Number:** U-1









R.W. Gillespie & Associates, Inc.

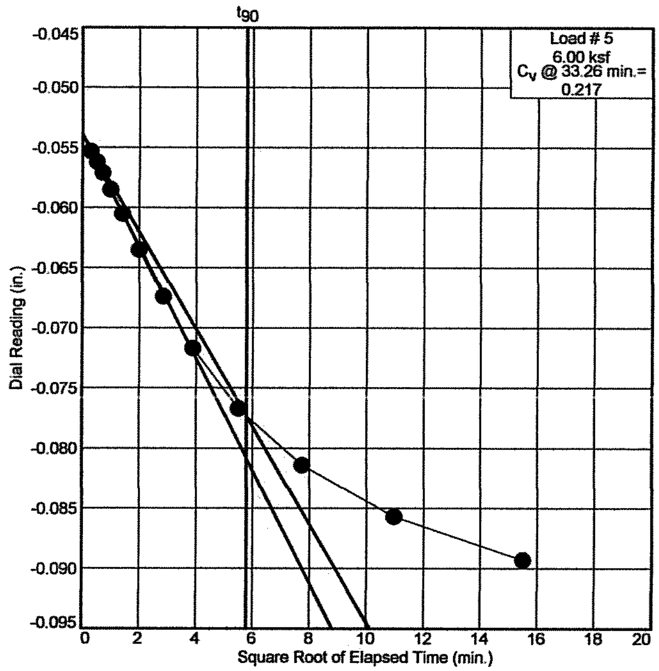
Saco, Maine

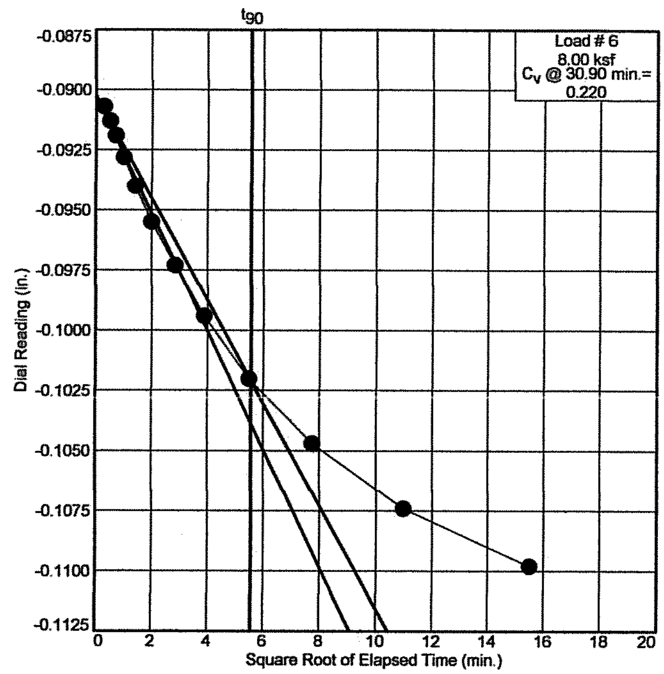
Lab No. 14653c

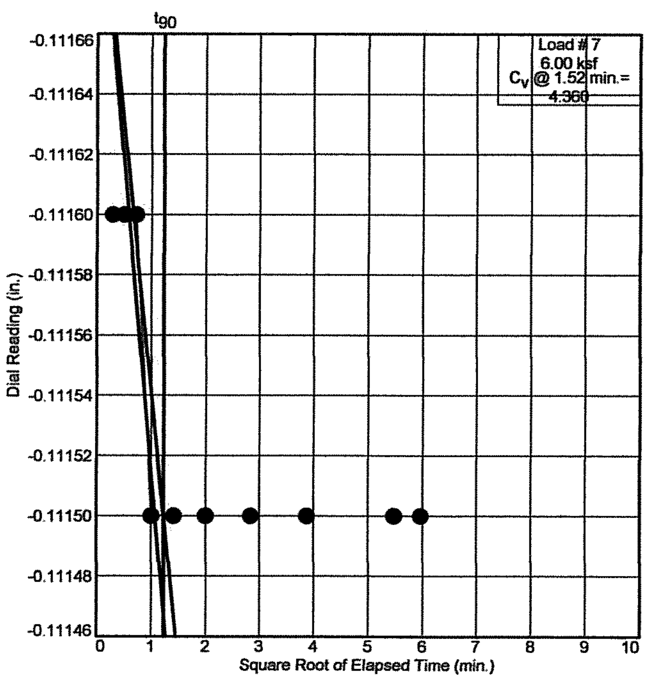
Dial Reading vs. Time

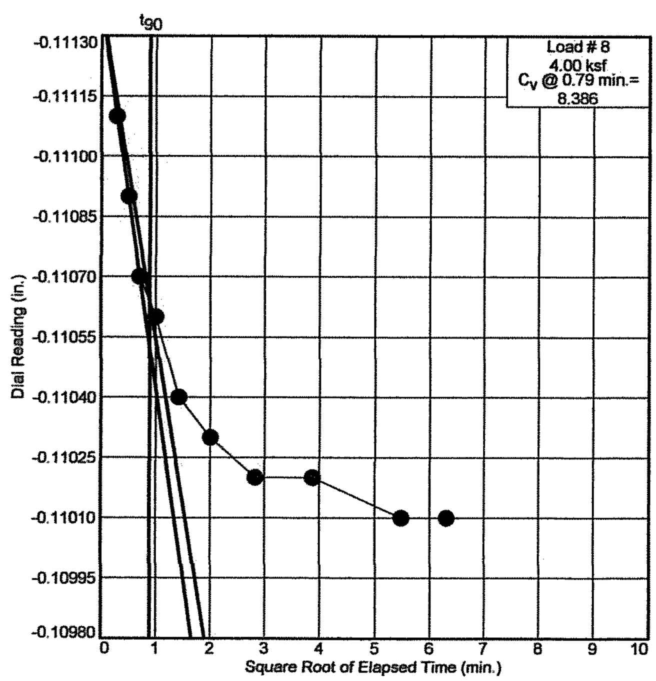
Project No.: 1368-005
Project: Cummings Road Over Maine Turnpike #17-013

Location: BB-CUM-105 **Depth:** 60'-62' **Sample Number:** U-1









R.W. Gillespie & Associates, Inc.

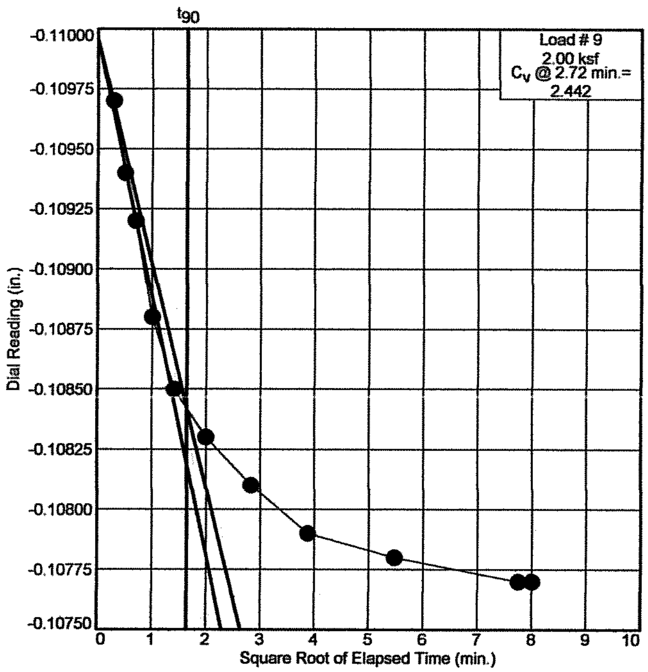
Saco, Maine

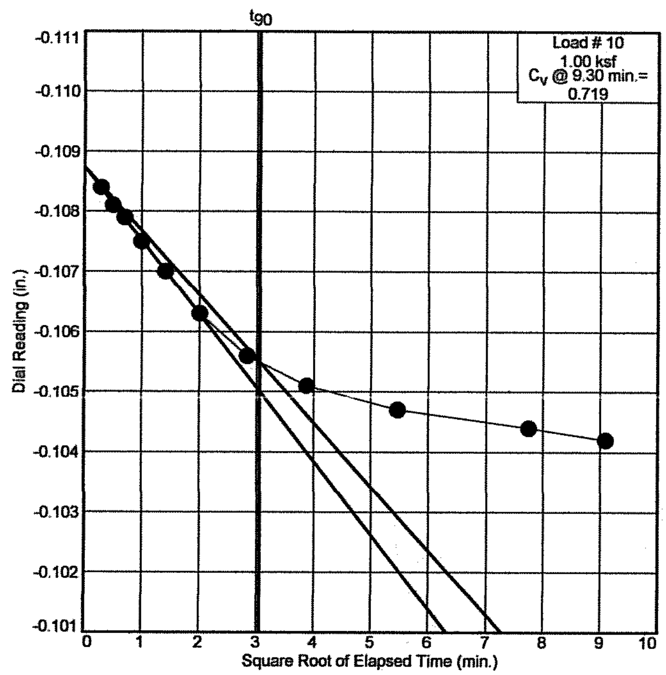
Lab No. 14653c

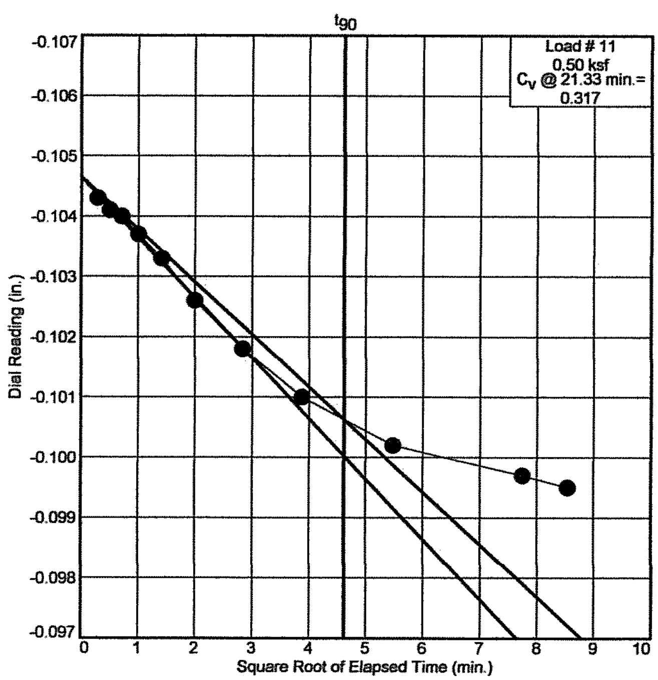
Dial Reading vs. Time

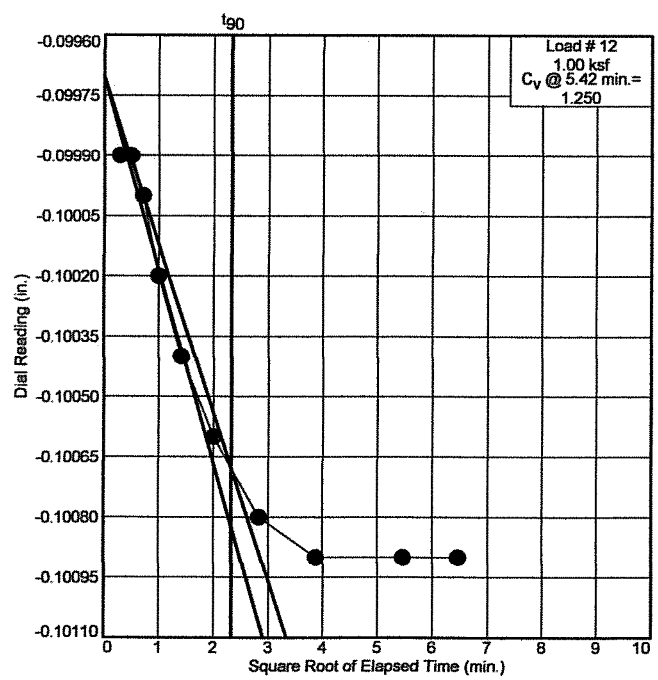
Project No.: 1368-005
Project: Cummings Road Over Maine Turnpike #17-013

Location: BB-CUM-105 **Depth:** 60'-62' **Sample Number:** U-1









R.W. Gillespie & Associates, Inc.

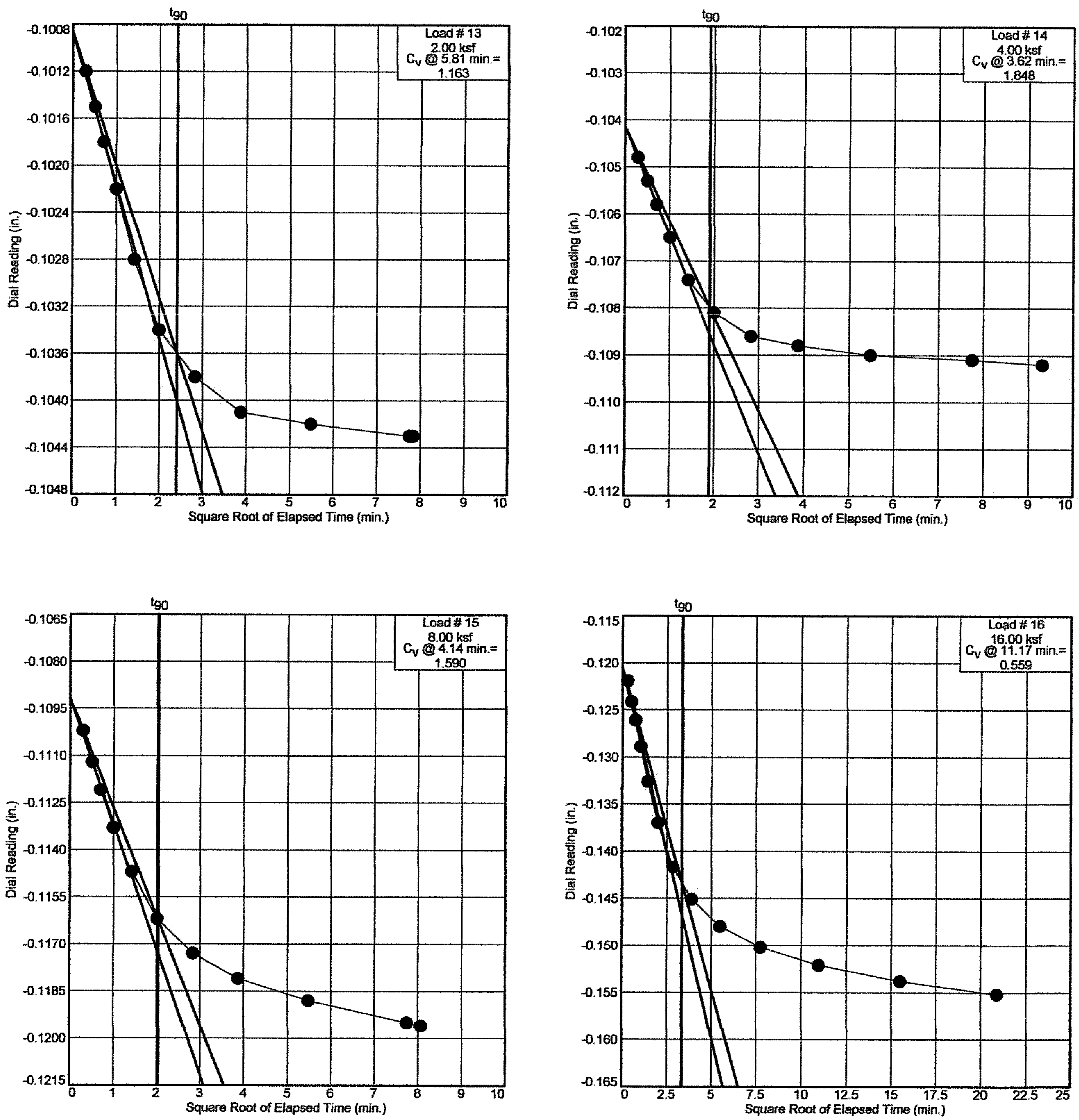
Saco, Maine

Lab No. 14653c

Dial Reading vs. Time

Project No.: 1368-005
Project: Cummings Road Over Maine Turnpike #17-013

Location: BB-CUM-105 **Depth:** 60'-62' **Sample Number:** U-1



R.W. Gillespie & Associates, Inc.

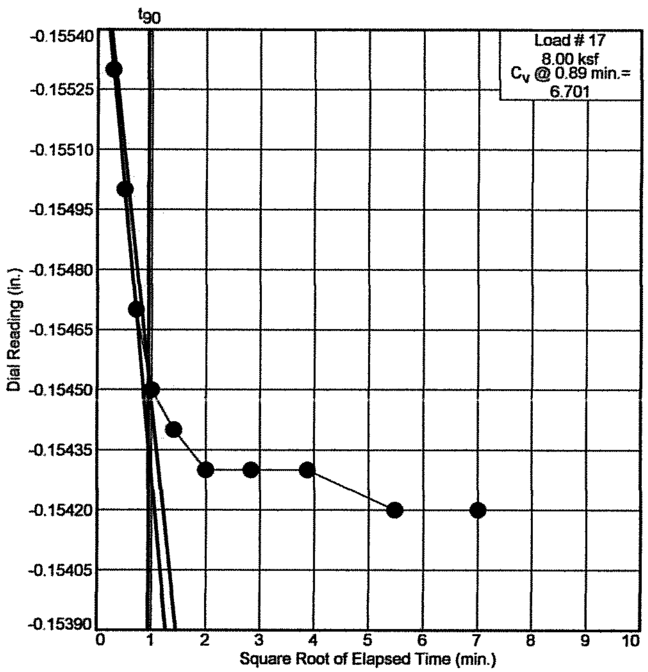
Saco, Maine

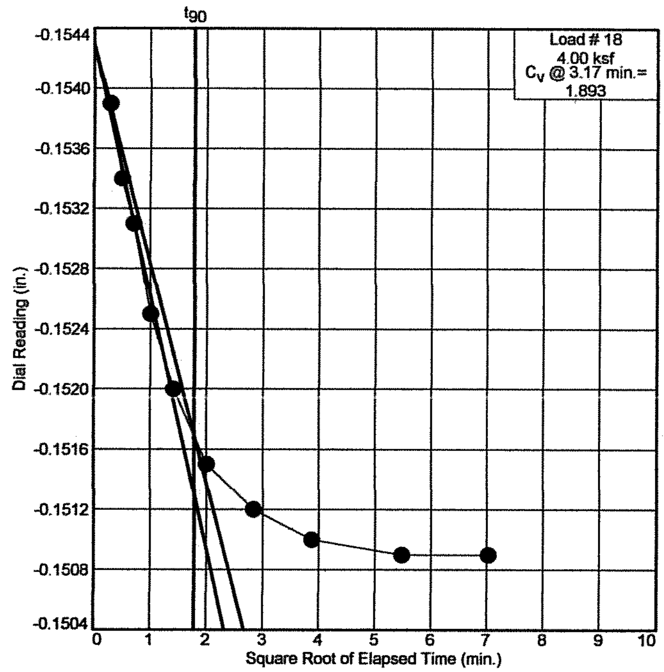
Lab No. 14653c

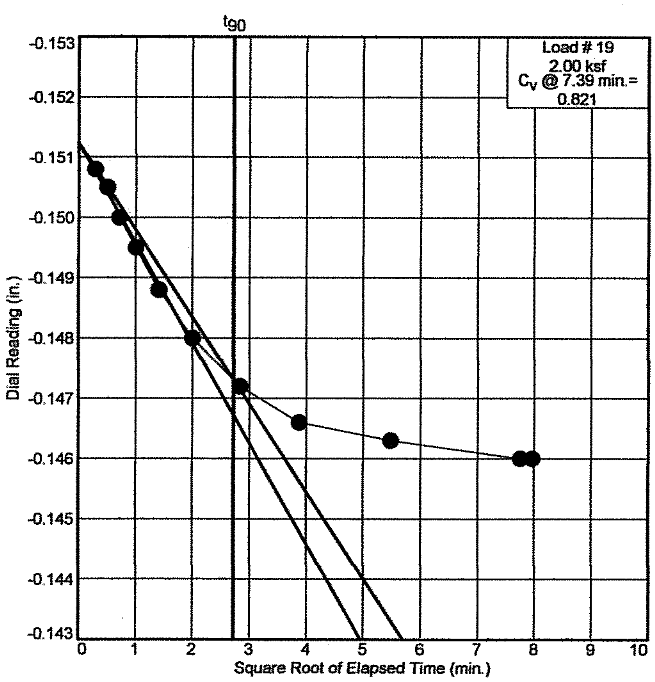
Dial Reading vs. Time

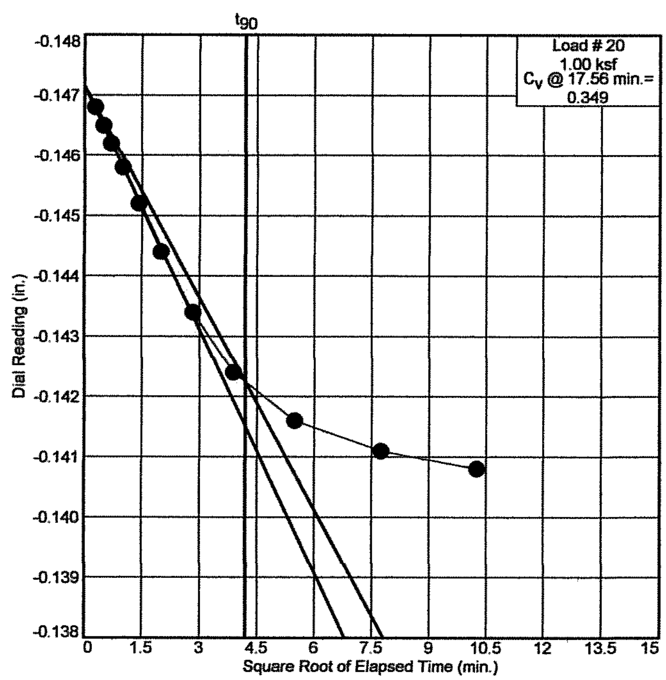
Project No.: 1368-005
Project: Cummings Road Over Maine Turnpike #17-013

Location: BB-CUM-105 **Depth:** 60'-62' **Sample Number:** U-1









R.W. Gillespie & Associates, Inc.

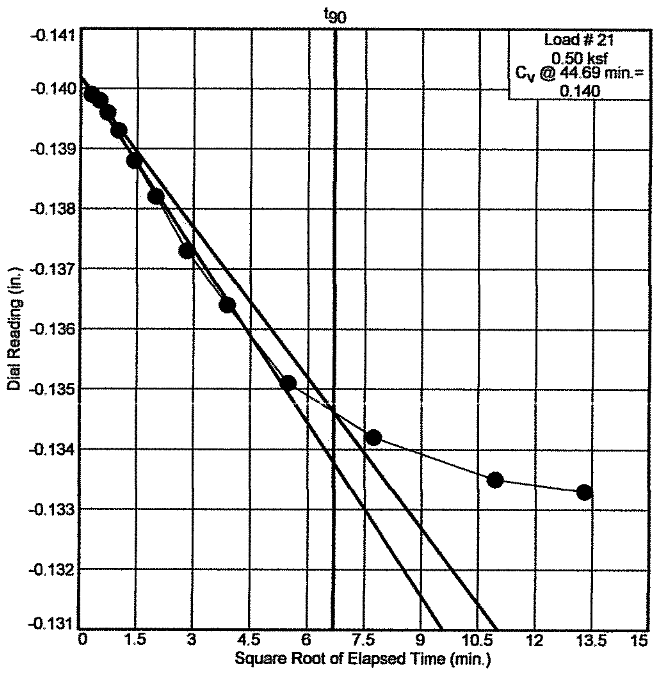
Saco, Maine

Lab No. 14653c

Dial Reading vs. Time

Project No.: 1368-005
Project: Cummings Road Over Maine Turnpike #17-013

Location: BB-CUM-105 **Depth:** 60'-62' **Sample Number:** U-1

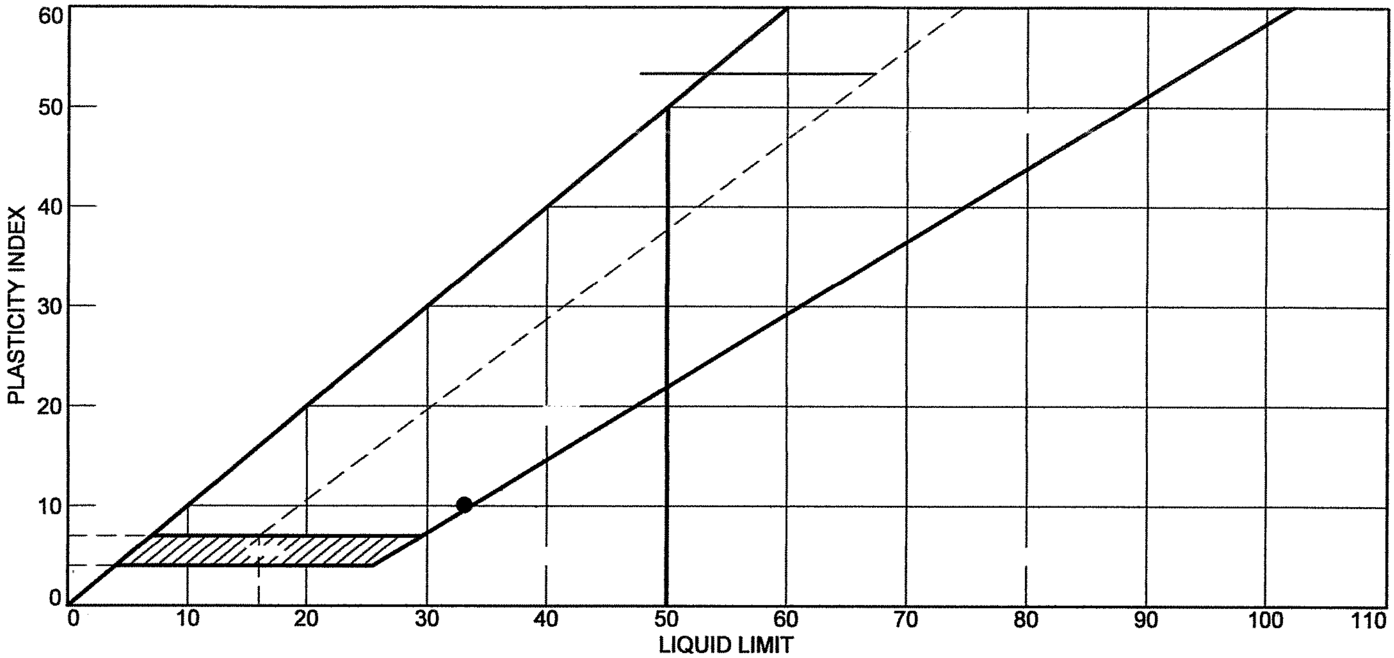


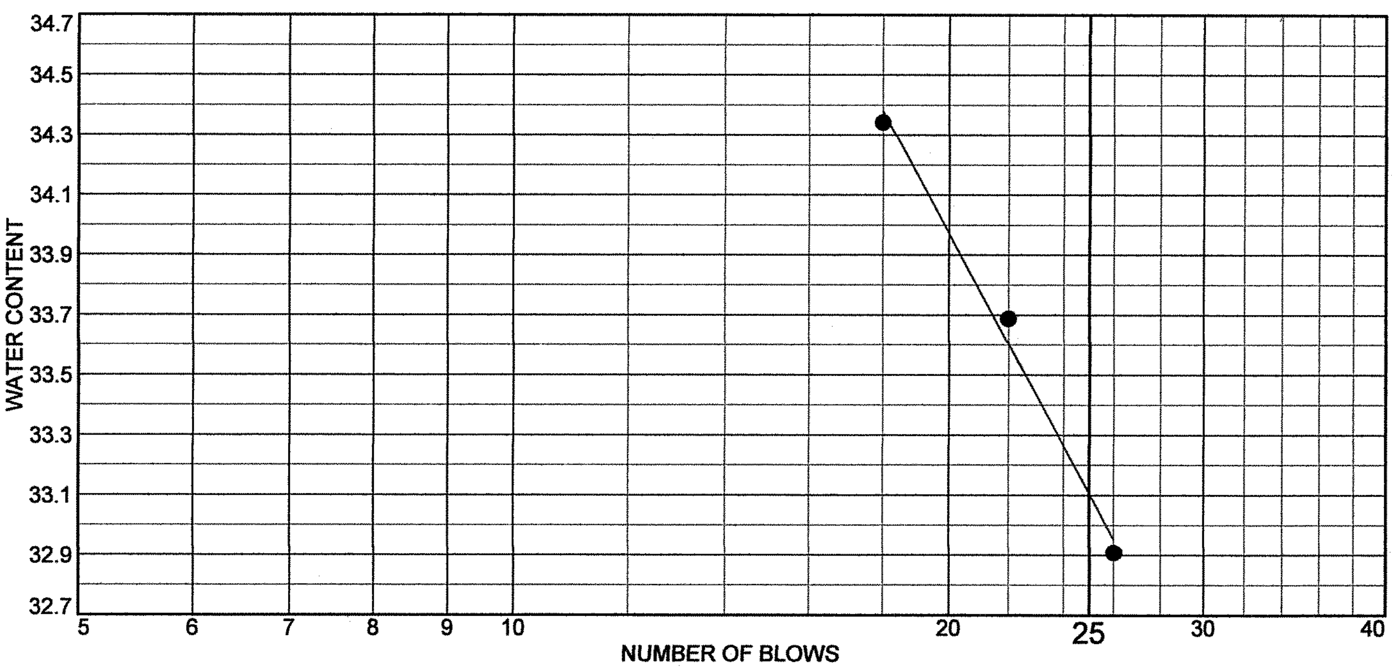
R.W. Gillespie & Associates, Inc.

Saco, Maine

Lab No. 14653c

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Lean Clay	33.1	23.0	10.1			

Project No. 1368-005 **Client:** Schonewald Engineering Associates

Project: Cummings Road Over Maine Turnpike #17-013

Location: BB-CUM-105
Sample Number: U-1 **Depth:** 60'-62'

R.W. Gillespie & Associates, Inc.

Saco, Maine

Remarks:

Lab No. 14653c

Tested By: AGS **Checked By:** MTG MTG

Laboratory Vane Shear Test Results

ASTM D4648 Standard Test Method for Laboratory Miniature Vane Shear Test for Saturated Fine-Grained Clayey Soil

Project: Cummings Road Over Maine Turnpike #1 Location: Scarborough, ME
Client: Schonewald Engineering Associates, Inc. Date: 8/10/2017
Project No.: 1368-005 Test Depth: 60' to 62'

Boring/Sample No.	BB-CWM-105/U1				Lab No.	14653c	
Test No.	Test Depth (ft)	Vane Size	Max. Torque (Undisturbed) (kg-cm)	Max. Torque (Remolded) (kg-cm)	Undrained Shear Strength (psf)	Undrained Shear Strength (psf)	Moisture Content
1	1"	L	38	1	397	1	39%

Vane Size	
	(mm)
S	16 x 32
M	20 x 40
L	24.5 x 50.8

Tested By: JRF Checked By: MTG

R.W. Gillespie & Associates

86 Industrial Park Rd., Suite 4, Saco ME 04072, 207-286-8008 / 200 International Dr., Suite 170, Portsmouth NH 03801, 603-427-0244

R. W. Gillespie & Associates, Inc.
86 Industrial Park Road, Suite 4, Saco, ME 04072 207-286-8008
200 Int'l Drive, Suite 170, Portsmouth, NH 03801 603-427-0244

LETTER OF TRANSMITTAL

Date: 09/28/2017	Project No.: 1368-005
Attention: Isabel Schonewald (ischonewald@maine.rr.com)	
Re: LaboratoryTesting BB-CUM-105 Scarborough, ME	

Schonewald Engineering Associates, Inc.

129 Middle Road

Cumberland, ME 04021

We are sending you attached laboratory test results.

Laboratory No. (s)	Test (s) Performed
14653d: 14D, 70'-72'	Atteberg and Moisture

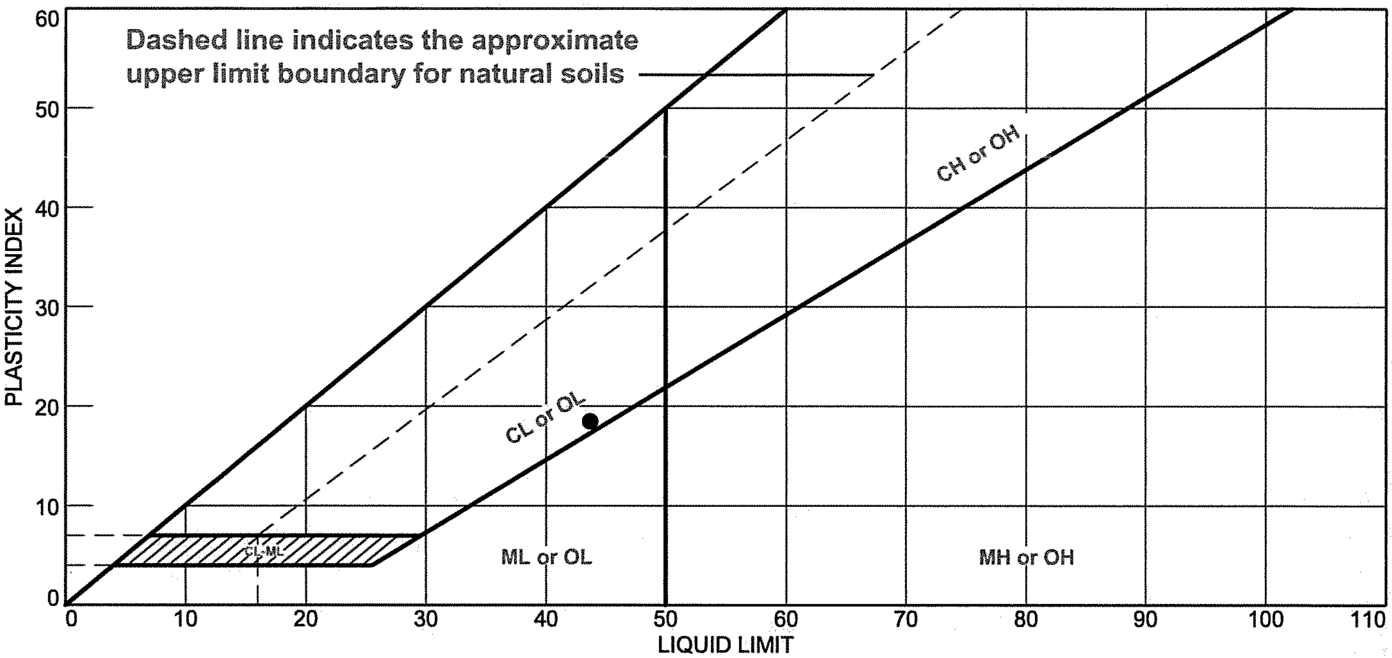
Remarks:

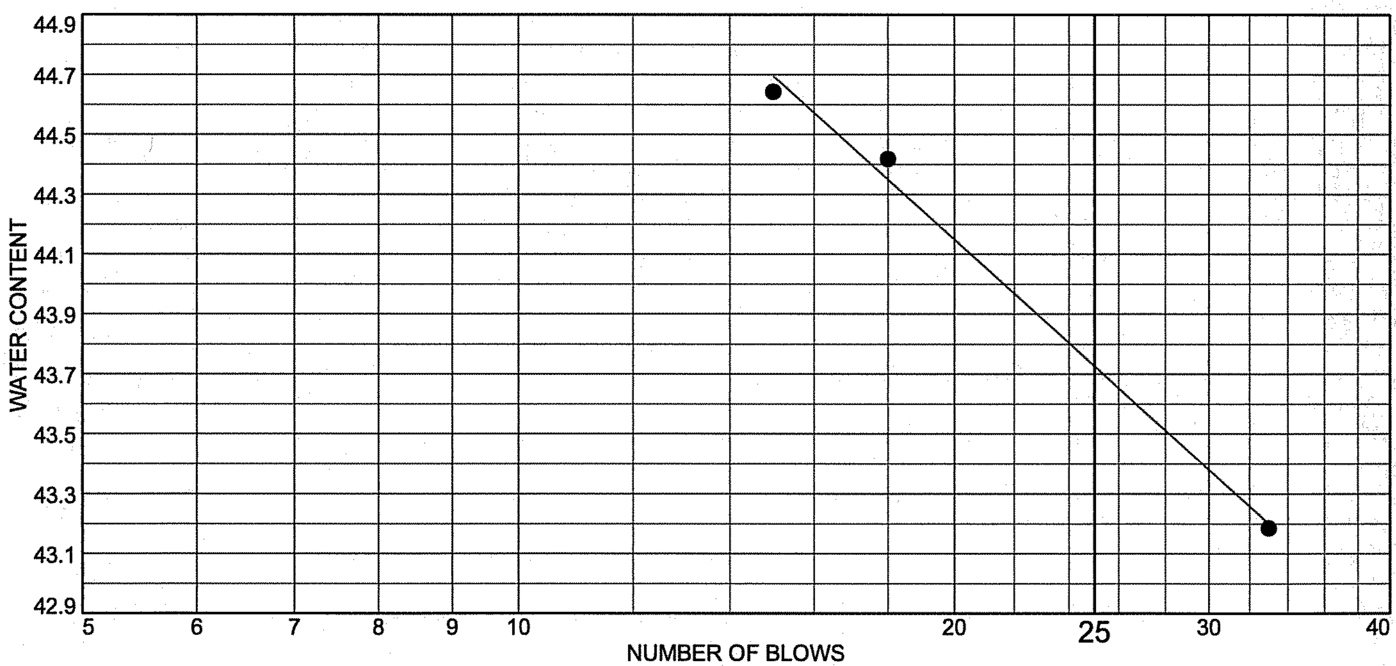
Copy to:

Signed: Matthew T. Grady

If enclosures are not as noted, kindly notify us at once.

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Lean Clay	43.7	25.2	18.5			

Project No. 1368-005 **Client:** Schonewald Engineering Associates

Project: Cummings Road Over Maine Turnpike #17-013

Location: BB-CUM-105, Scarborough, ME

Sample Number: 14D **Depth:** 70'-72'

R.W. Gillespie & Associates, Inc.

Saco, Maine

Remarks:

● Natural Moisture: 47.6%

Lab No. 14653d

Tested By: AGS, JRF **Checked By:** MTG MTG

R. W. Gillespie & Associates, Inc.

86 Industrial Park Road, Suite 4, Saco, ME 04072 207-286-8008
200 Int'l Drive, Suite 170, Portsmouth, NH 03801 603-427-0244

LETTER OF TRANSMITTAL

Date: 09/28/2017	Project No.: 1368-005
Attention: Isabel Schonewald (ischonewald@maine.rr.com)	
Re: LaboratoryTesting BB-CUM-105 Scarborough, ME	

Schonewald Engineering Associates, Inc.

129 Middle Road

Cumberland, ME 04021

We are sending you attached laboratory test results.

Laboratory No. (s)	Test (s) Performed
14653e: 17D, 90'-92'	Atteberg and Moisture

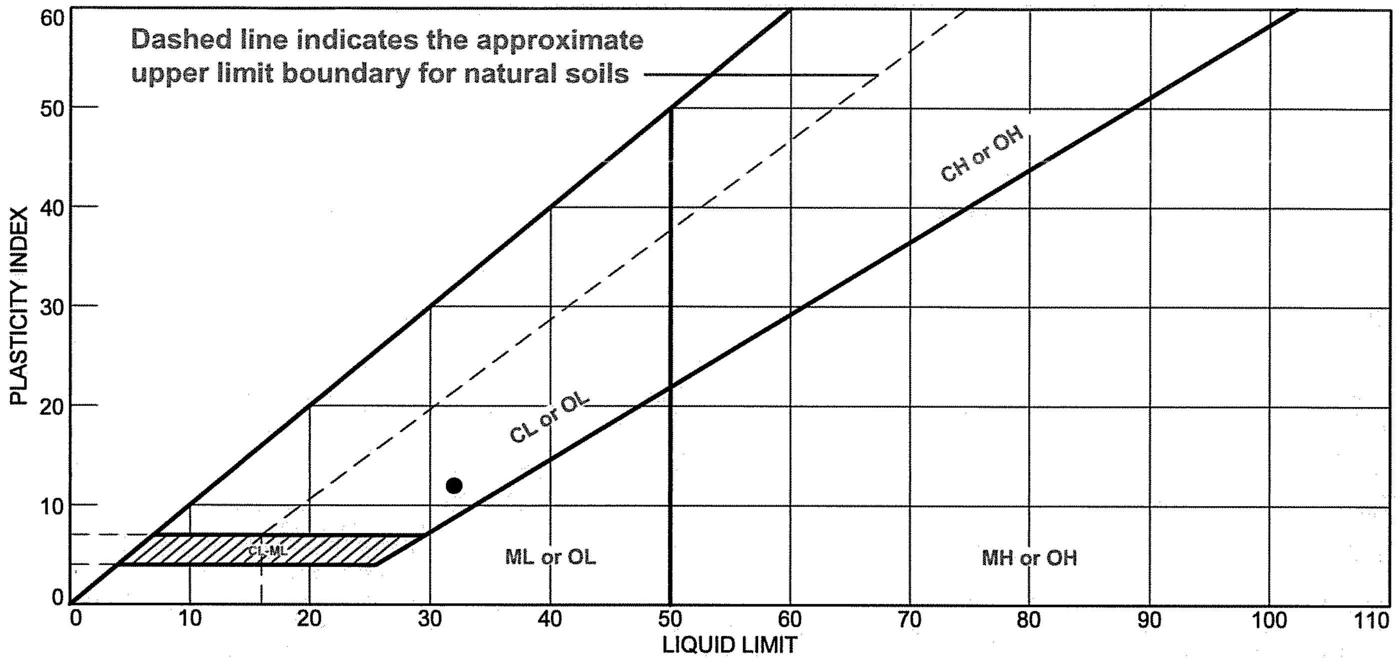
Remarks:

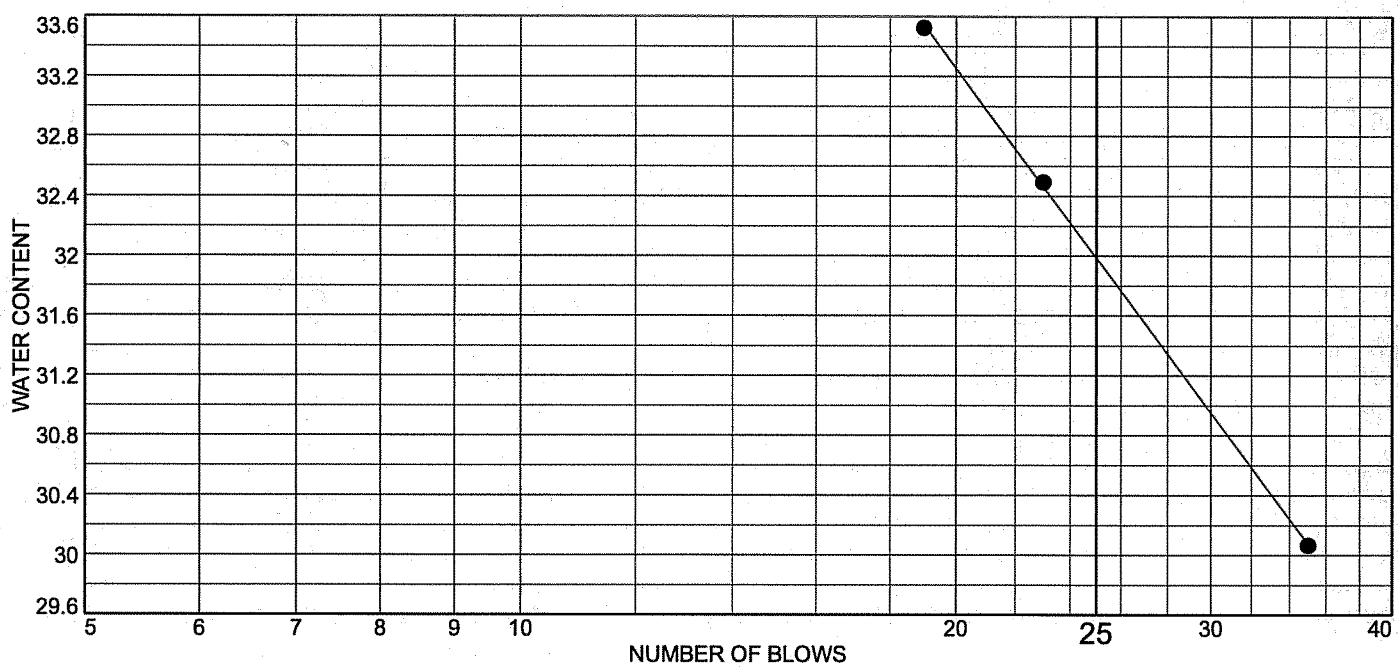
Copy to:

Signed: Matthew T. Grady

If enclosures are not as noted, kindly notify us at once.

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Lean Clay	32.0	20.0	12.0			

Project No. 1368-005 **Client:** Schonewald Engineering Associates

Project: Cummings Road Over Maine Turnpike #17-013

Location: BB-CUM-105, Scarborough, ME
Sample Number: 17D **Depth:** 90'-92'

R.W. Gillespie & Associates, Inc.

Saco, Maine

Remarks:
● Natural Moisture: 33.7%

Lab No. 14653e

Tested By: AGS, JRF **Checked By:** MTG MTG

R. W. Gillespie & Associates, Inc.

86 Industrial Park Road, Suite 4, Saco, ME 04072 207-286-8008
200 Int'l Drive, Suite 170, Portsmouth, NH 03801 603-427-0244

LETTER OF TRANSMITTAL

Date: 09/26/2017	Project No.: 1368-005
Attention: Isabel Schonewald (ischonewald@maine.rr.com)	
Re: Laboratory Testing BB-CUM-106 Scarborough, ME	

Schonewald Engineering Associates, Inc.

129 Middle Road

Cumberland, ME 04021

We are sending you attached laboratory test results.

Laboratory No. (s)	Test (s) Performed
14654a: U2, 90'-92'	Consolidation, Atteberg

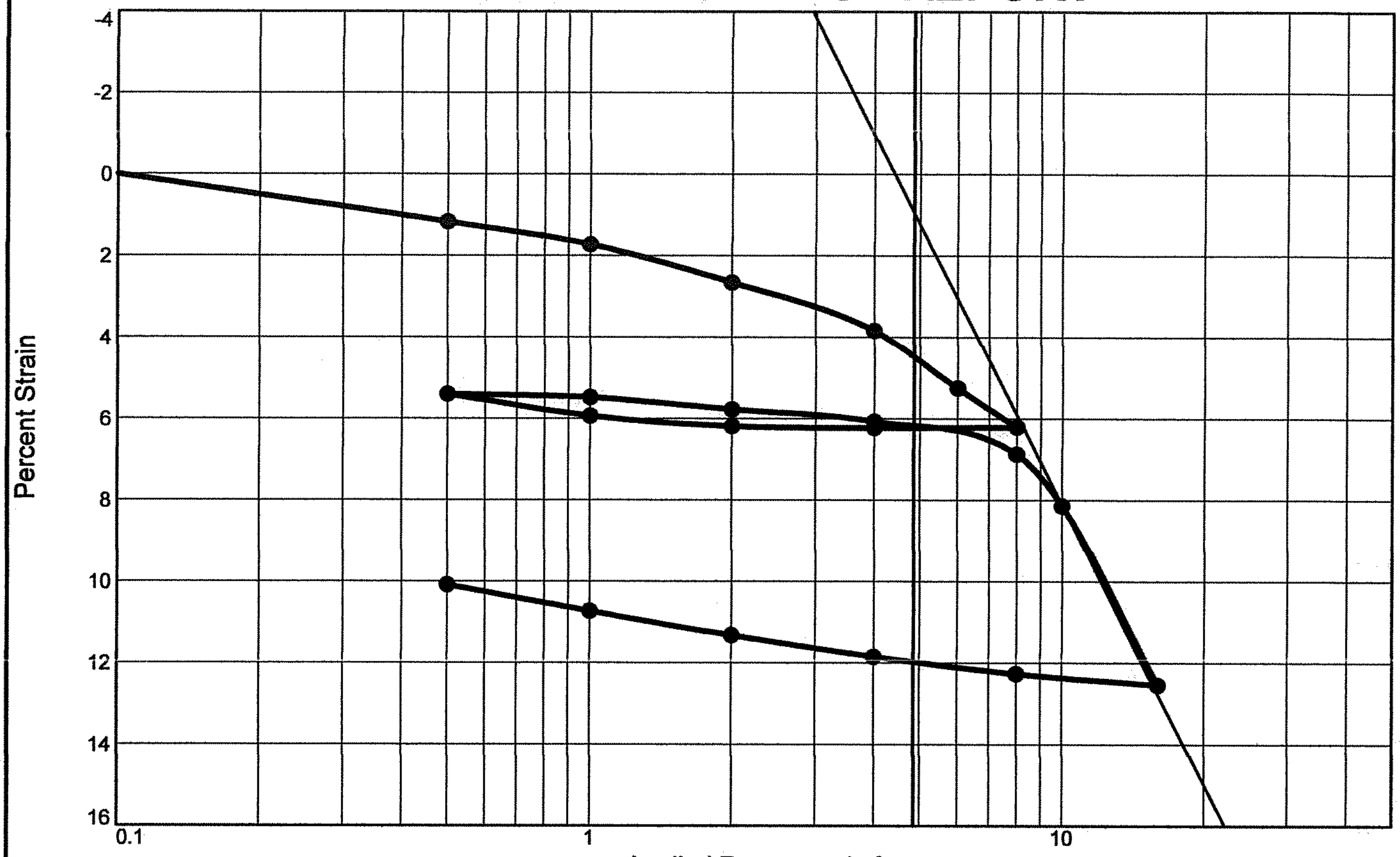
Remarks:

Copy to:

Signed: Matthew T. Grady

If enclosures are not as noted, kindly notify us at once.

CONSOLIDATION TEST REPORT



Coefficients of Consolidation and Secondary Consolidation											
No.	Load (ksf)	C_v (ft.^{2}/day)	C_α	No.	Load (ksf)	C_v (ft.^{2}/day)	C_α	No.	Load (ksf)	C_v (ft.^{2}/day)	C_α
1	0.50	0.493		8	2.00	0.863		15	10.00	0.168	
2	1.00	0.493		9	1.00	0.812		16	16.00	0.198	
3	2.00	0.358		10	0.50	0.228		17	8.00	1.825	
4	4.00	0.510		11	1.00	0.712		18	4.00	0.779	
5	6.00	0.364		12	2.00	0.911		19	2.00	0.332	
6	8.00	0.361		13	4.00	1.246		20	1.00	0.150	
7	4.00	5.019		14	8.00	1.782		21	0.50	0.065	

Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	Overburden (ksf)	P_c (ksf)	C_c	C_r	Initial Void Ratio
Saturation	Moisture									
98.8 %	42.3 %	78.9	47.8	23.4	2.75		7.6	0.50	0.08	1.177

MATERIAL DESCRIPTION	USCS	AASHTO
Lean Clay		

Project No. 1368-005 **Client:** Schonewald Engineering Associates

Project: Cummings Road Over Maine Turnpike #17-013

Location: BB-CUM-106 **Depth:** 90'-92'

Remarks:

R.W. Gillespie & Associates, Inc.

Saco, Maine

Lab No. 14654a

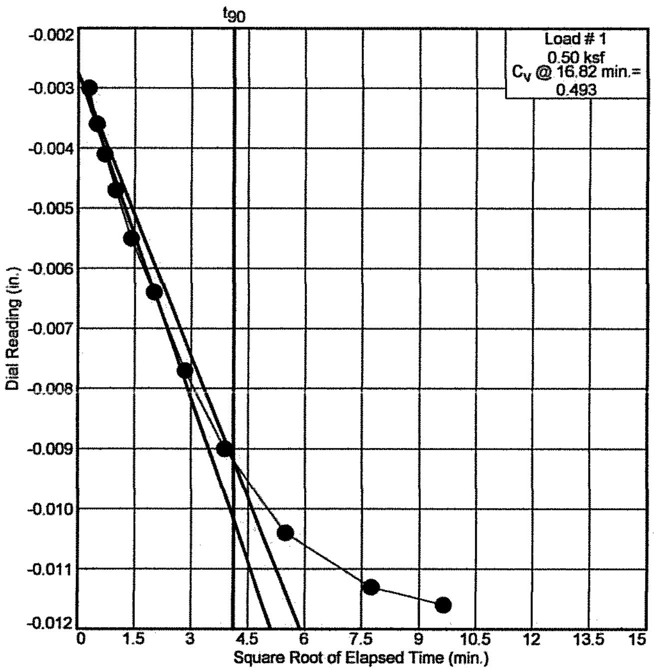
Tested By: JRF **Checked By:** MTG

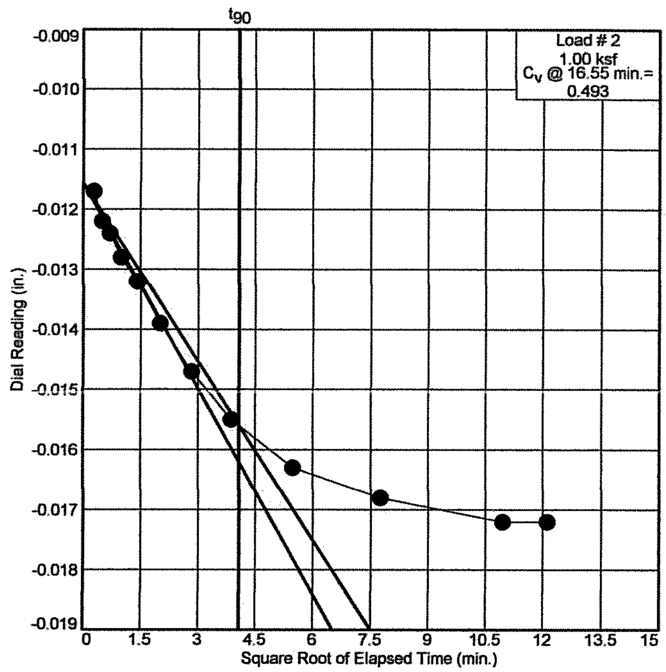
MTG

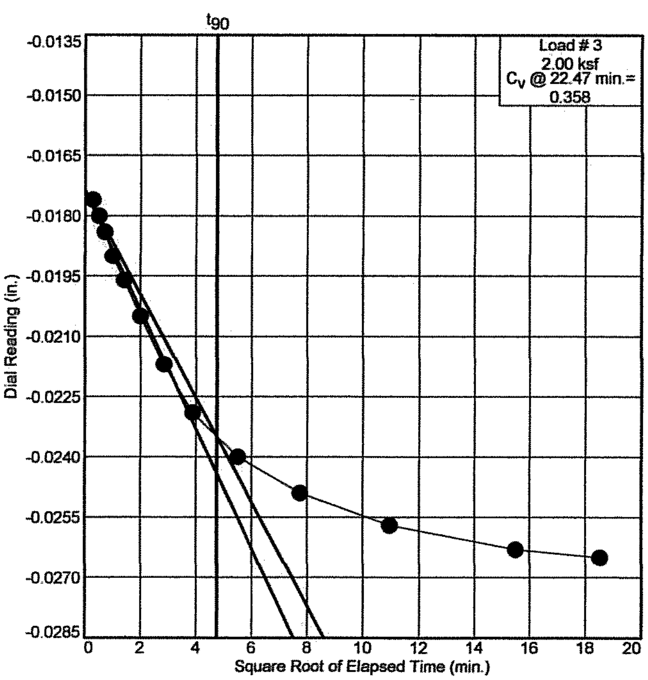
Dial Reading vs. Time

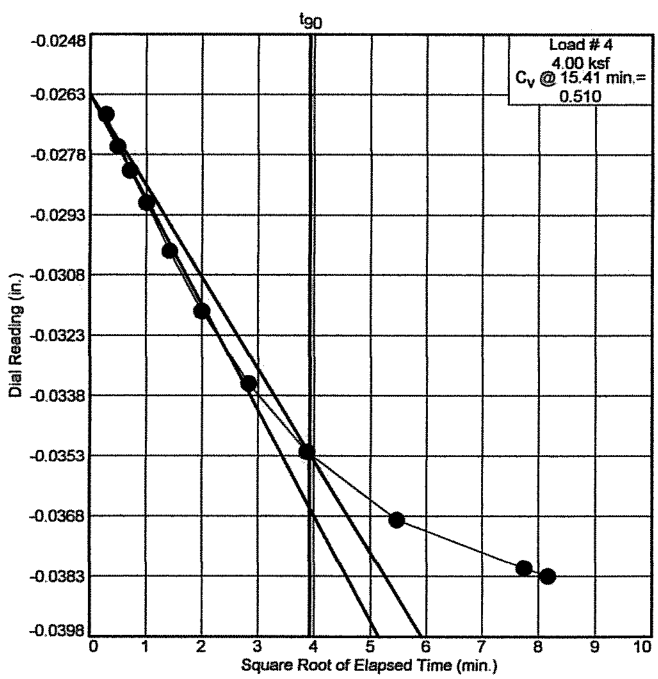
Project No.: 1368-005
Project: Cummings Road Over Maine Turnpike #17-013

Location: BB-CUM-106 Depth: 90'-92'









R.W. Gillespie & Associates, Inc.

Saco, Maine

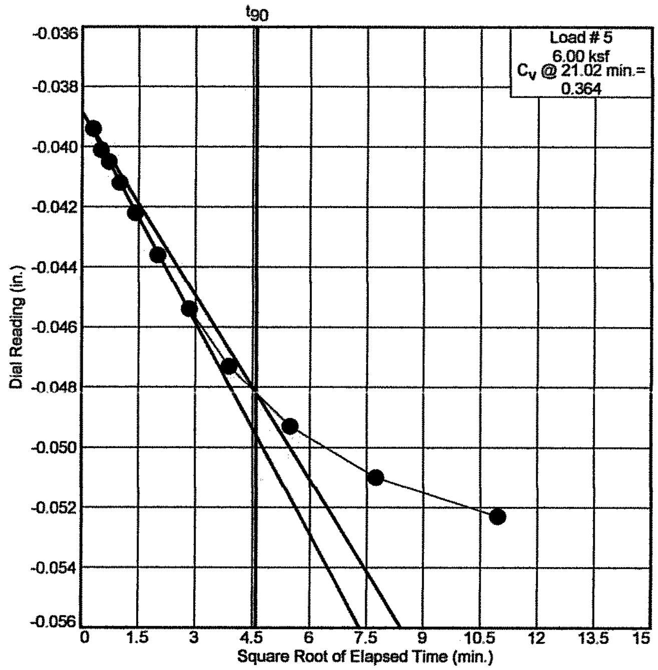
Lab No. 14654a

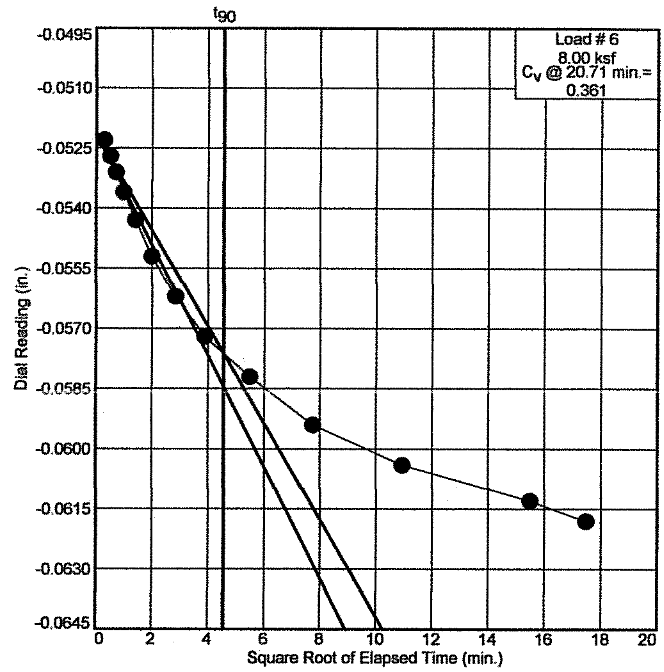
MTC

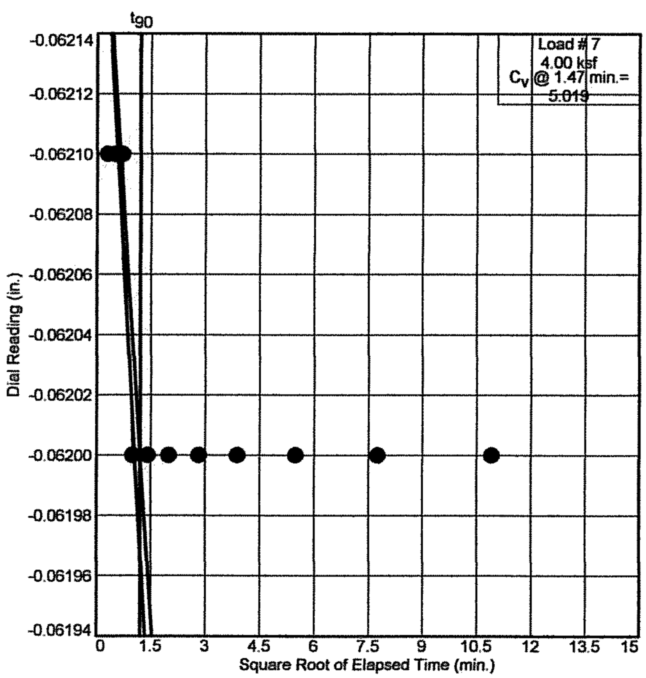
Dial Reading vs. Time

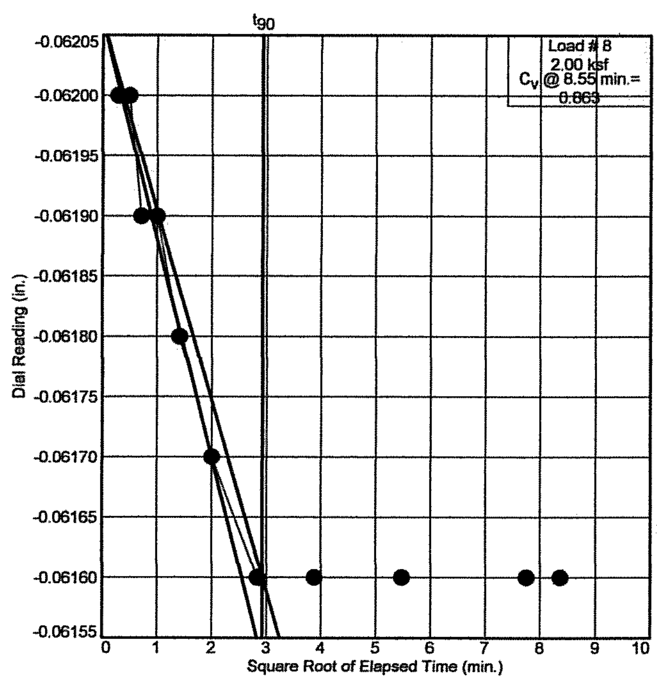
Project No.: 1368-005
Project: Cummings Road Over Maine Turnpike #17-013

Location: BB-CUM-106 Depth: 90'-92'









R.W. Gillespie & Associates, Inc.

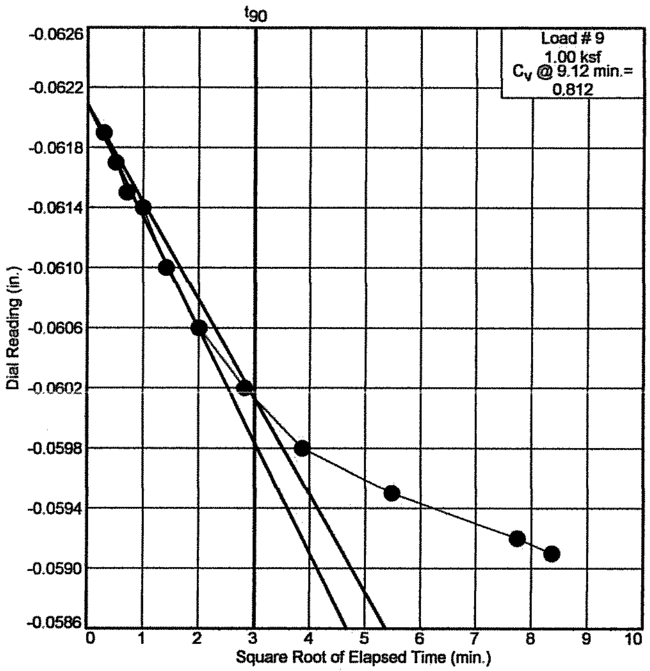
Saco, Maine

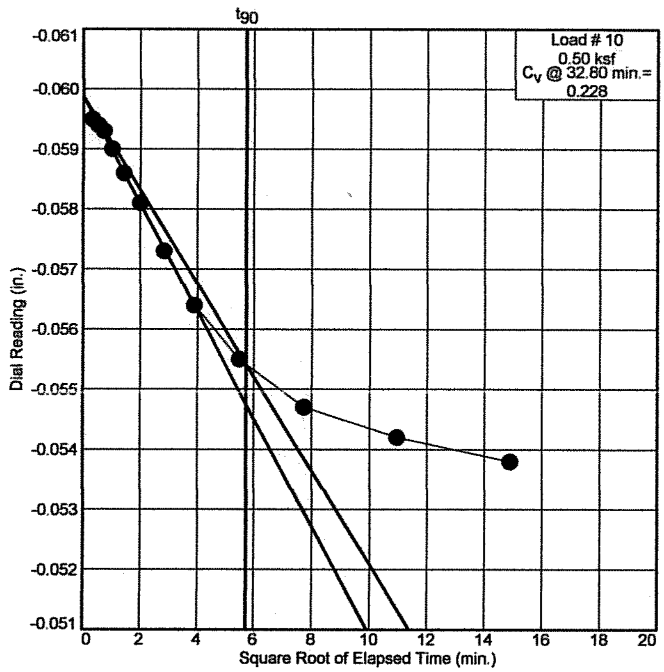
Lab No. 14654a

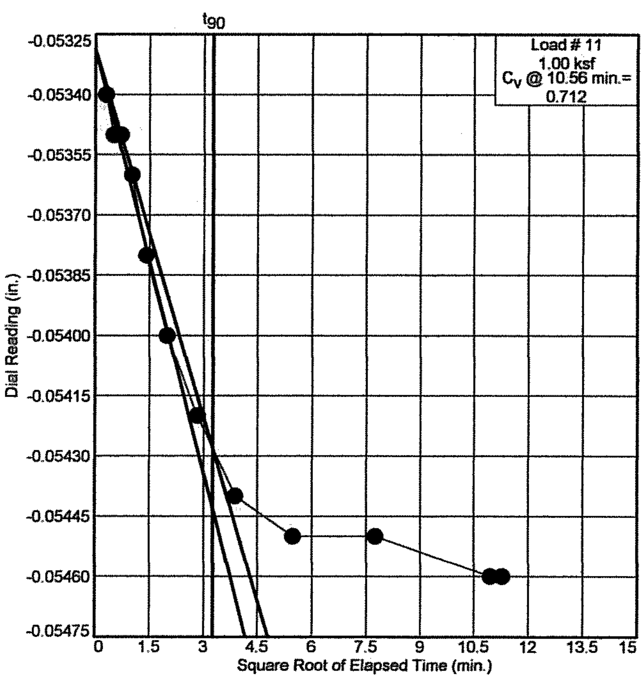
Dial Reading vs. Time

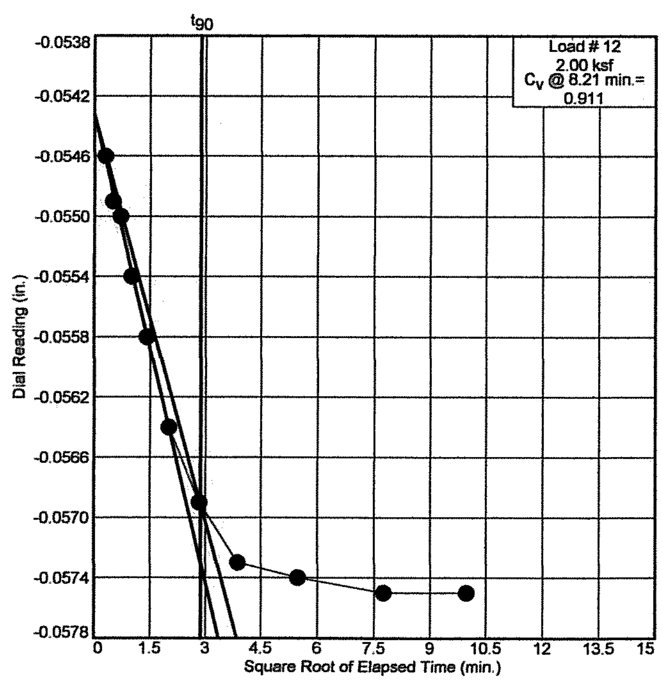
Project No.: 1368-005
Project: Cummings Road Over Maine Turnpike #17-013

Location: BB-CUM-106 **Depth:** 90'-92'









R.W. Gillespie & Associates, Inc.

Saco, Maine

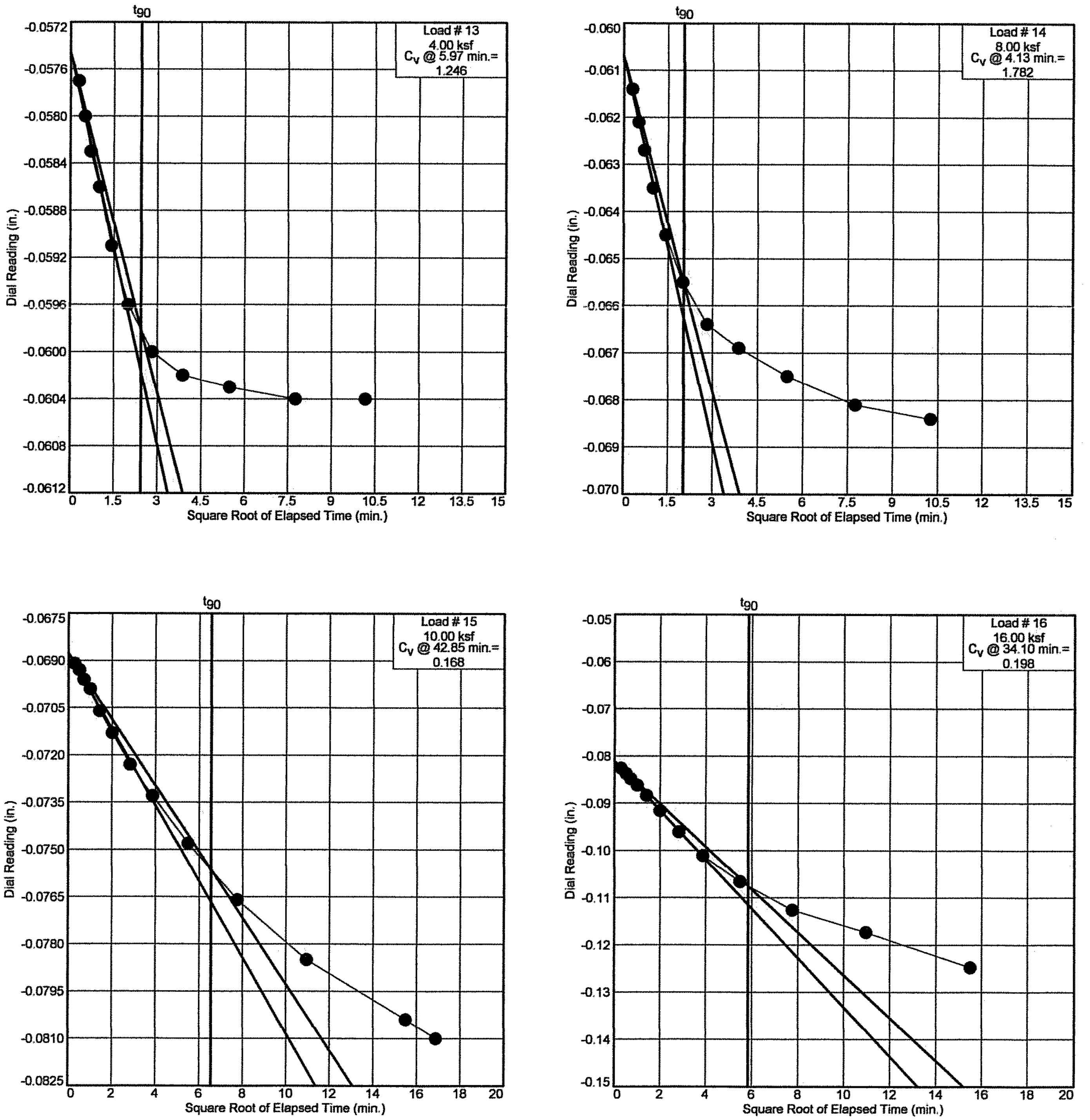
Lab No. 14654a

MTC

Dial Reading vs. Time

Project No.: 1368-005
Project: Cummings Road Over Maine Turnpike #17-013

Location: BB-CUM-106 Depth: 90'-92'



R.W. Gillespie & Associates, Inc.

Saco, Maine

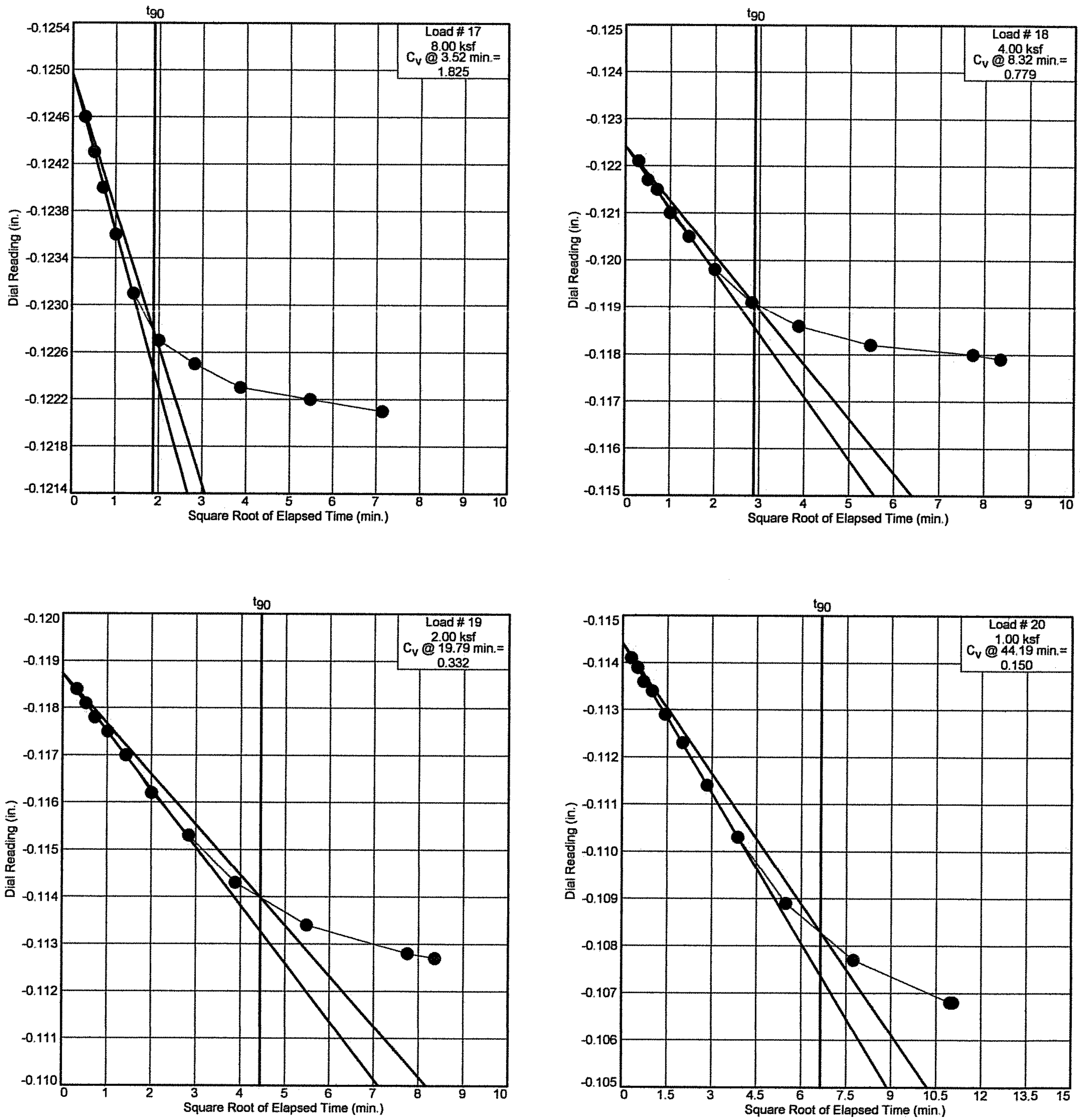
Lab No. 14654a

MP

Dial Reading vs. Time

Project No.: 1368-005
Project: Cummings Road Over Maine Turnpike #17-013

Location: BB-CUM-106 Depth: 90'-92'



R.W. Gillespie & Associates, inc.

Saco, Maine

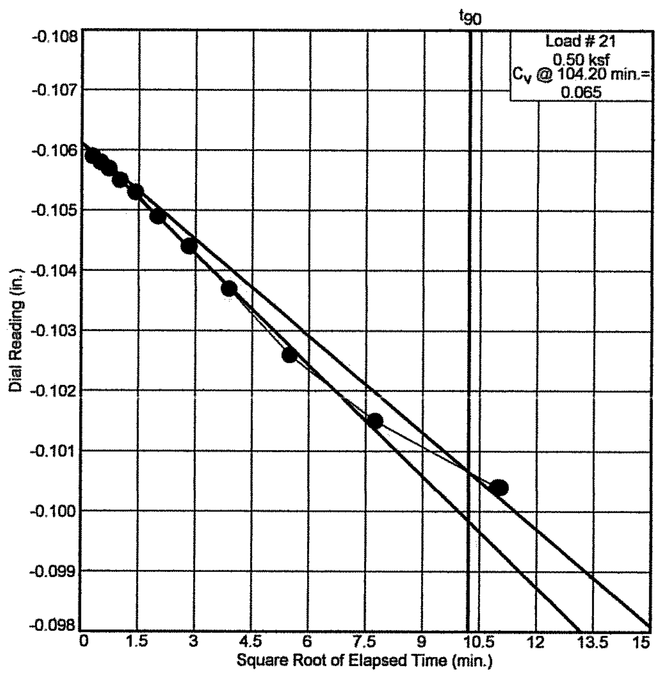
Lab No. 14654a

MK

Dial Reading vs. Time

Project No.: 1368-005
Project: Cummings Road Over Maine Turnpike #17-013

Location: BB-CUM-106 Depth: 90'-92'

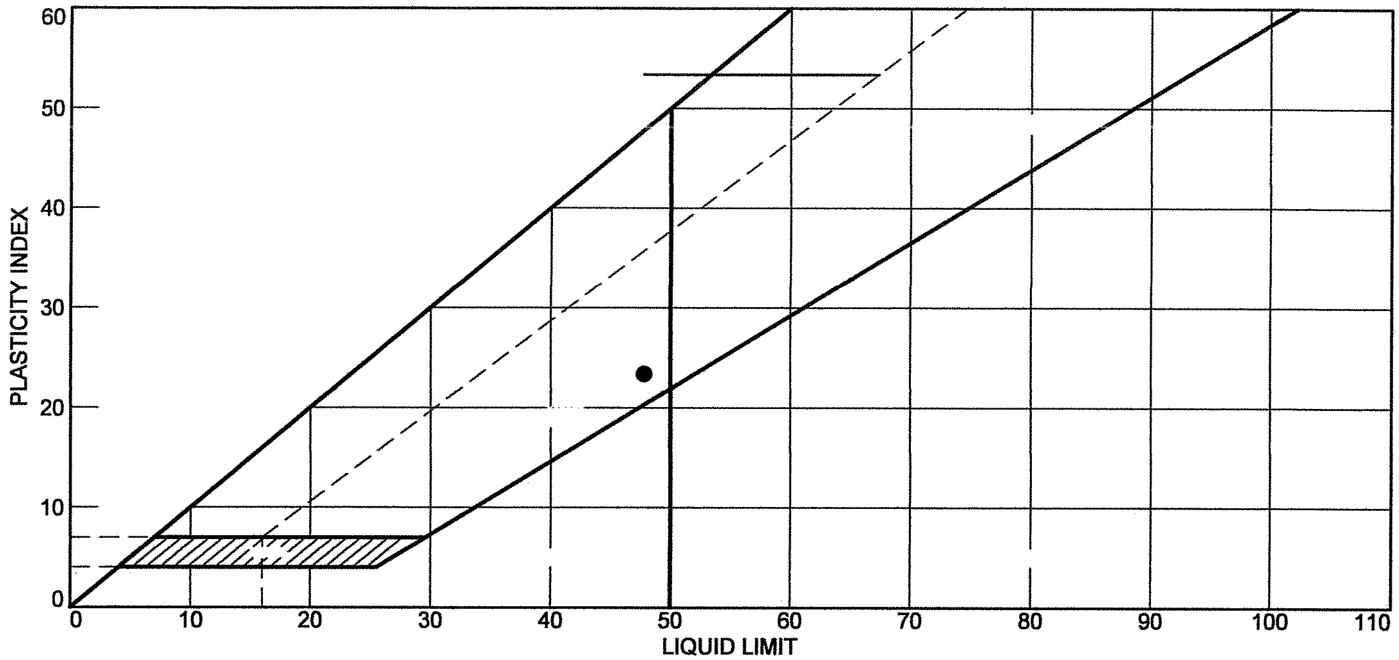


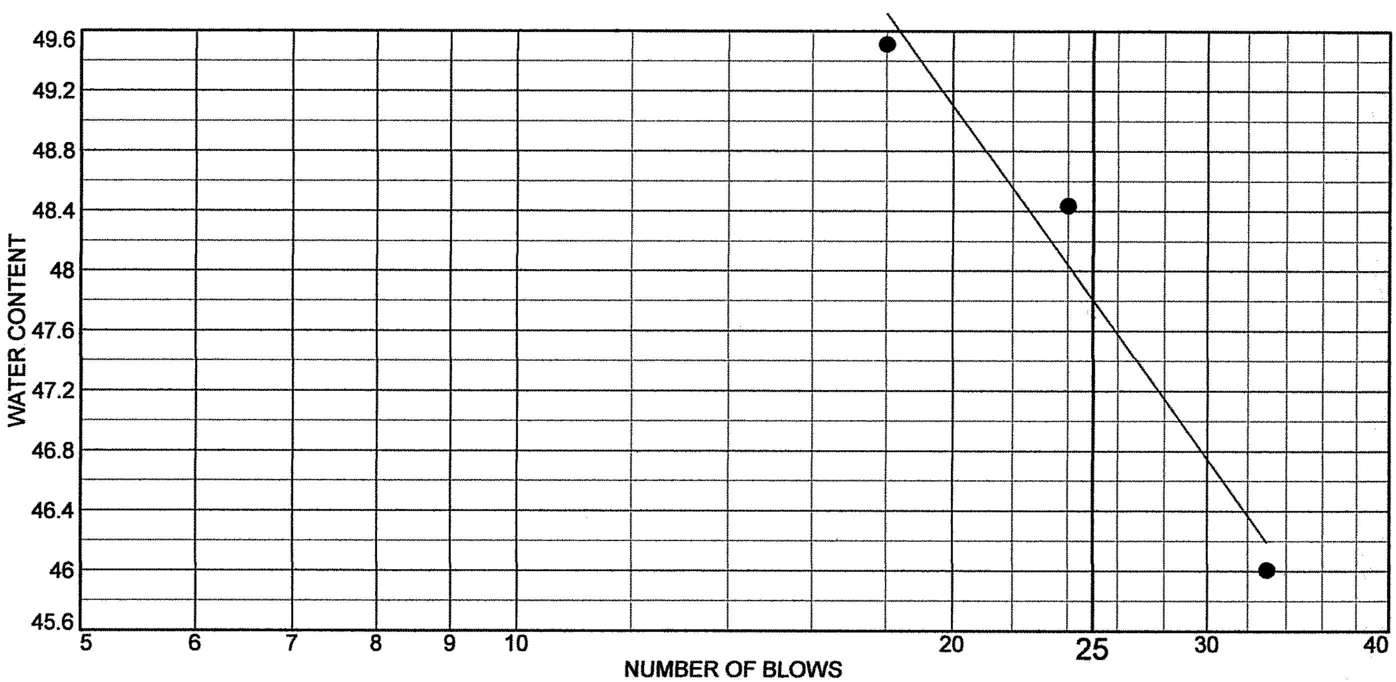
R.W. Gillespie & Associates, Inc.

Saco, Maine

Lab No. 14654a

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Lean Clay	47.8	24.4	23.4			

Project No. 1368-005 **Client:** Schonewald Engineering Associates
Project: Cummings Road Over Maine Turnpike #17-013

Location: BB-CUM-106

Remarks:

R.W. Gillespie & Associates, Inc.

Saco, Maine

Lab No. 14654a

Tested By: AGS **Checked By:** MTG MTG

Laboratory Vane Shear Test Results

ASTM D4648 Standard Test Method for Laboratory Miniature Vane Shear Test for Saturated Fine-Grained Clayey Soil

Project: Cummings Road Over Maine Turnpike #1
Client: Schonewald Engineering Associates, Inc.
Project No.: 1368-005

Location: Scarborough, ME
Date: 8/10/2017
Test Depth: 90' to 92'

Boring/Sample No.		BB-CUM-106/V2			Lab No.	14654a	
Test No.	Test Depth (ft)	Vane Size	Max. Torque (Undisturbed) (kg-cm)	Max. Torque (Remolded) (kg-cm)	Undrained Shear Strength (psf)	Undrained Shear Strength (psf)	Moisture Content
1	0.25"	L	48	0	501	0	45%

Vane Size	
	(mm)
S	16 x 32
M	20 x 40
L	24.5 x 50.8

Tested By: JRF

Checked By: MB

R.W. Gillespie & Associates

86 Industrial Park Rd., Suite 4, Saco ME 04072, 207-286-8008 / 200 International Dr., Suite 170, Portsmouth NH 03801, 603-427-0244

R. W. Gillespie & Associates, Inc.

86 Industrial Park Road, Suite 4, Saco, ME 04072 207-286-8008
200 Int'l Drive, Suite 170, Portsmouth, NH 03801 603-427-0244

LETTER OF TRANSMITTAL

Date: 05/09/2014	Project No.: 1368-005
Attention: Isabel Schonewald (ischonewald@maine.rr.com)	
Re: LaboratoryTesting BB-CUM-106 Scarborough, ME	

Schonewald Engineering Associates, Inc.

129 Middle Road

Cumberland, ME 04021

We are sending you attached laboratory test results.

Laboratory No. (s)	Test (s) Performed
14654b: 18D, 95'-97'	Atteberg and Moisture

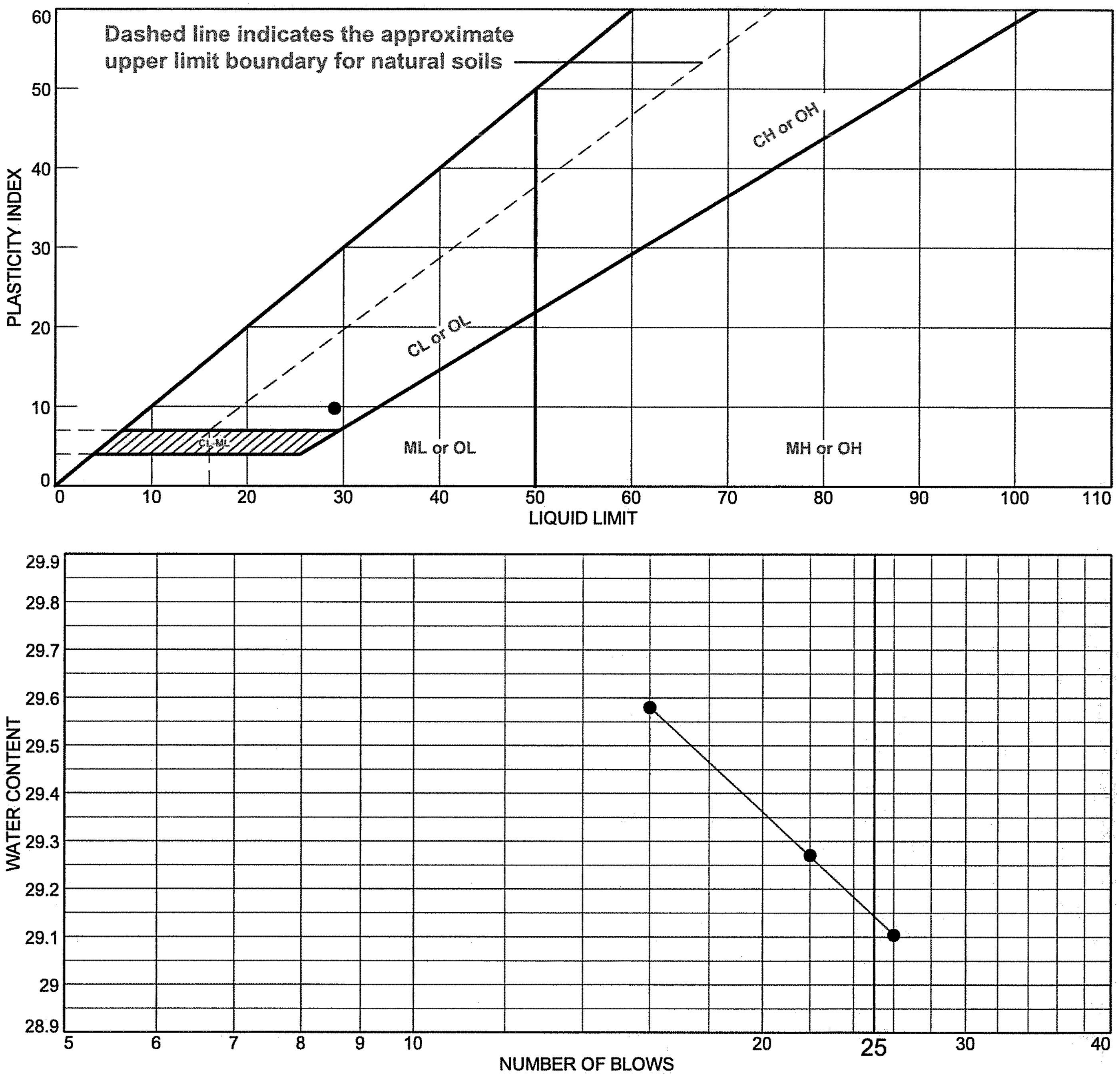
Remarks:

Copy to:

Signed: Matthew T. Grady

If enclosures are not as noted, kindly notify us at once.

LIQUID AND PLASTIC LIMITS TEST REPORT



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Lean Clay	29.1	19.3	9.8			

Project No. 1368-005 **Client:** Schonewald Engineering Associates

Project: Cummings Road Over Maine Turnpike #17-013

Location: BB-CUM-106

Sample Number: 18D **Depth:** 95'-97'

R.W. Gillespie & Associates, Inc.

Saco, Maine

Remarks:

● Moisture Content: 37.7%

Lab No. 14654b

Tested By: JRF/AGS **Checked By:** MTG MTG

R. W. Gillespie & Associates, Inc.
86 Industrial Park Road, Suite 4, Saco, ME 04072 207-286-8008
200 Int'l Drive, Suite 170, Portsmouth, NH 03801 603-427-0244

LETTER OF TRANSMITTAL

Date: 09/28/2017	Project No.: 1368-005
Attention: Isabel Schonewald (ischonewald@maine.rr.com)	
Re: LaboratoryTesting BB-CUM-106 Scarborough, ME	

Schonewald Engineering Associates, Inc.

129 Middle Road

Cumberland, ME 04021

We are sending you attached laboratory test results.

Laboratory No. (s)	Test (s) Performed
14654c: 21D, 115'-117'	Atteberg and Moisture

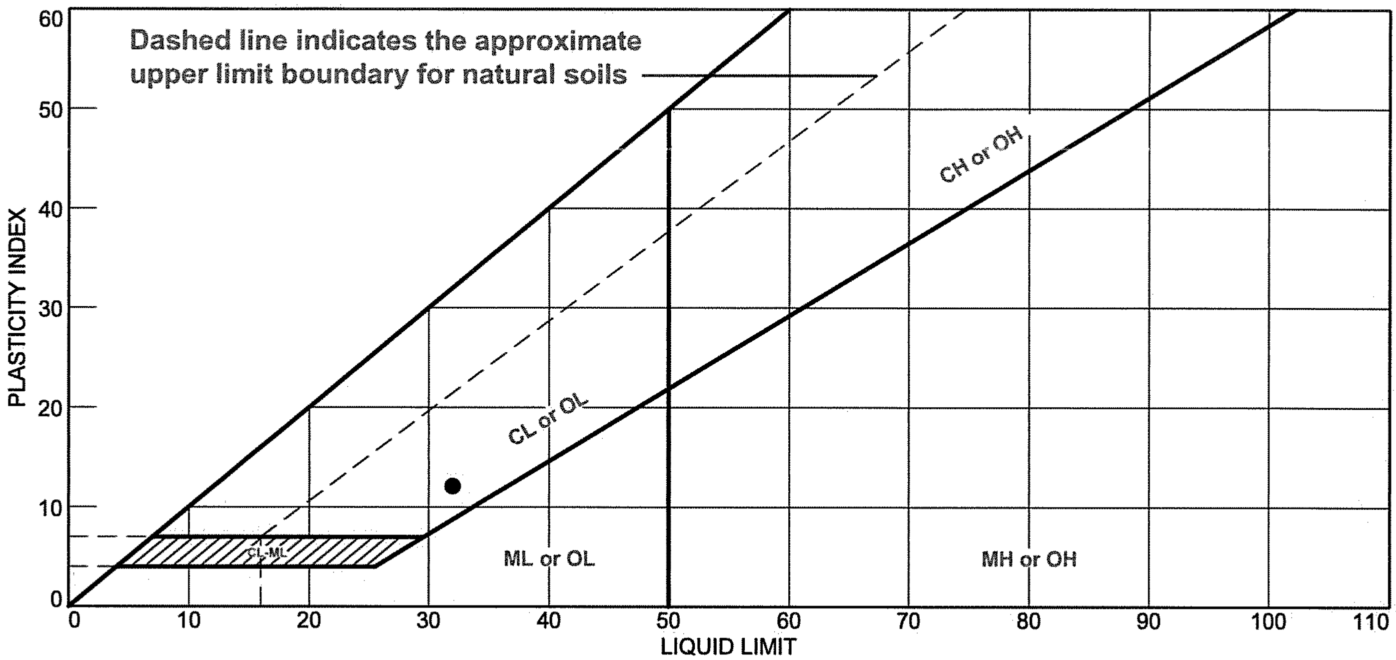
Remarks:

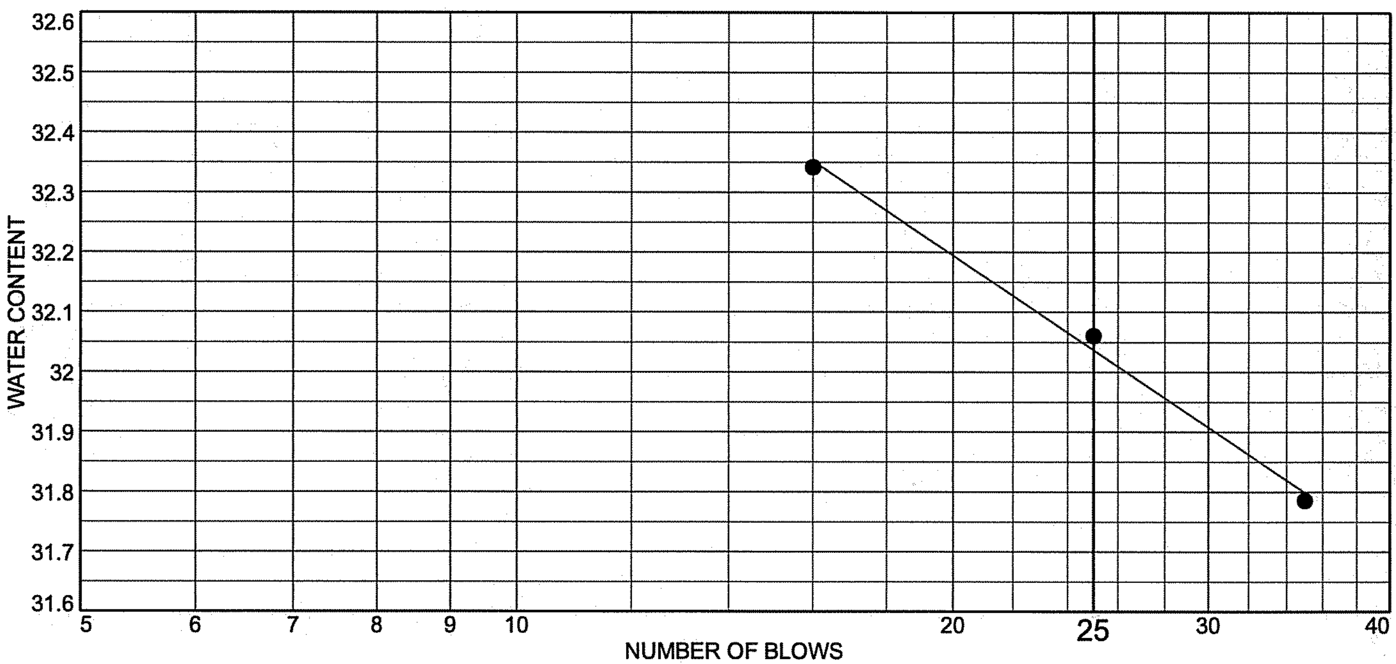
Copy to:

Signed: Matthew T. Grady

If enclosures are not as noted, kindly notify us at once.

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Lean Clay	32.0	19.9	12.1			

Project No. 1368-005 **Client:** Schonewald Engineering Associates

Project: Cummings Road Over Maine Turnpike #17-013

Location: BB-CUM-106, Scarborough, ME
Sample Number: 21D **Depth:** 115'-117'

R.W. Gillespie & Associates, Inc.

Saco, Maine

Remarks:
● Lid of jar was not screwed on tightley allowing for moisture to escape. As Recieved Moisture: 19.3%

Lab No. 14654c

Tested By: JRF, AGS **Checked By:** MTG MTG

Schonewald Engineering Associates, Inc.
129 Middle Road
Cumberland, ME 04021
207/ 829-5226

LETTER OF TRANSMITTAL

DATE	8/9/2017	JOB NO.	17-013
ATTENTION	Matt Grady		
RE.	Geotechnical Laboratory Testing		
	Soil Samples		
	Cummings Road over MeTPK		
	Scarborough, ME		

TO **R. W. Gillespie & Associates, Inc.**
Geotechnical Testing Laboratory
86 Industrial Park Road, Suite 4
Saco, ME 04072

WE ARE SENDING YOU: ☑ Enclosed ☑ soil (jar and tube) samples - hand delivered

COPIES	DATE	NO.	DESCRIPTION
		15	jar samples of soils as described below submitted for lab testing
		6	Shelby tubes for consol testing

REMARKS:

Hi Matt-

Please complete the following tests on the soil samples listed below. Please reference SchonewaldEA's project #17-013 (MTA's Cummings Road over Maine Turnpike) on results and invoice. Please call me with any questions or issues.

My cell number is 207/272-9879. Thanks- Be

Boring No.	Sample No.	Sample Depth (ft., BGS)	Material	Requested Tests
BB-CUM-101	4D	15-17	interbedded silt and sand	wash sieve with hydrometer; moisture content; Atterberg limits
BB-CUM-101	U2	40-42	sensitive NC silt-clay	1D consol w/ moisture contents and Atterberg limits
BB-CUM-101	8D	45-47	sensitive NC silt-clay	Atterberg limits with moisture content
BB-CUM-102	1D	2-4	clean sand	wash sieve/ gradation analysis; moisture content
BB-CUM-102	U1 *	30-32	sensitive NC silt-clay	1D consol w/ moisture contents and Atterberg limits
BB-CUM-102	7D	35-37	sensitive NC silt-clay	Atterberg limits with moisture content
BB-CUM-102	9D	55-57	sensitive NC silt-clay	Atterberg limits with moisture content
BB-CUM-103	10D	45-47	interbedded silt and sand	wash sieve with hydrometer; moisture content; Atterberg limits
BB-CUM-103	U2 *	65-67	sensitive NC silt-clay	1D consol w/ moisture contents and Atterberg limits
BB-CUM-104	2D	5-7	clean sand	wash sieve/ gradation analysis; moisture content
BB-CUM-104	9D	40-42	interbedded silt and sand	wash sieve with hydrometer; moisture content; Atterberg limits
BB-CUM-104	U1	60-62	sensitive NC silt-clay	1D consol w/ moisture contents and Atterberg limits
BB-CUM-104	13D	70-72	sensitive NC silt-clay	Atterberg limits with moisture content
BB-CUM-105	8D	35-37	interbedded silt and sand	wash sieve with hydrometer; moisture content; Atterberg limits
BB-CUM-105	12D	55-57	sensitive NC silt-clay	Atterberg limits with moisture content
BB-CUM-105	U1 *	60-62	sensitive NC silt-clay	1D consol w/ moisture contents and Atterberg limits
BB-CUM-105	14D	70-72	sensitive NC silt-clay	Atterberg limits with moisture content
BB-CUM-105	17D	90-92	sensitive NC silt-clay	Atterberg limits with moisture content
BB-CUM-106	U2 *	90-92	sensitive NC silt-clay	1D consol w/ moisture contents and Atterberg limits
BB-CUM-106	18D	95-97	sensitive NC silt-clay	Atterberg limits with moisture content
BB-CUM-106	21D	115-117	sensitive NC silt-clay	Atterberg limits with moisture content

1D consol tests: ASTM D2435, Method B (end of primary with 2 loads held longer for secondary compression evaluations); time-deformation readings for all load increments; square root of time method of determining coefficient of consolidation. I may add 1 or 2 intermediate loads. I assume Atterberg limits and moisture content are determined from samples obtained from tube.

NOTE: * DENOTES RESEAL TUBE AFTER OBTAIN TEST SPECIMENS. Tube to be transferred to GTX for UU testing by SchonewaldEA

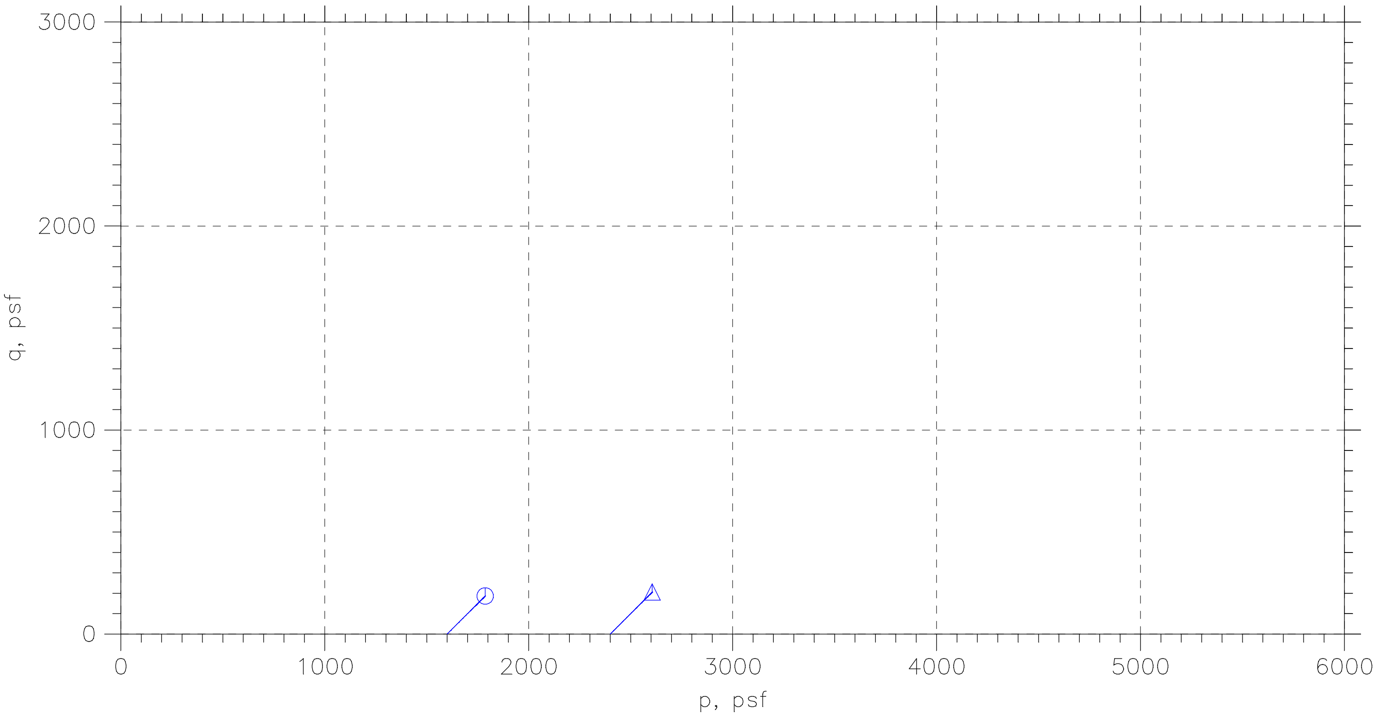
SIGNED:

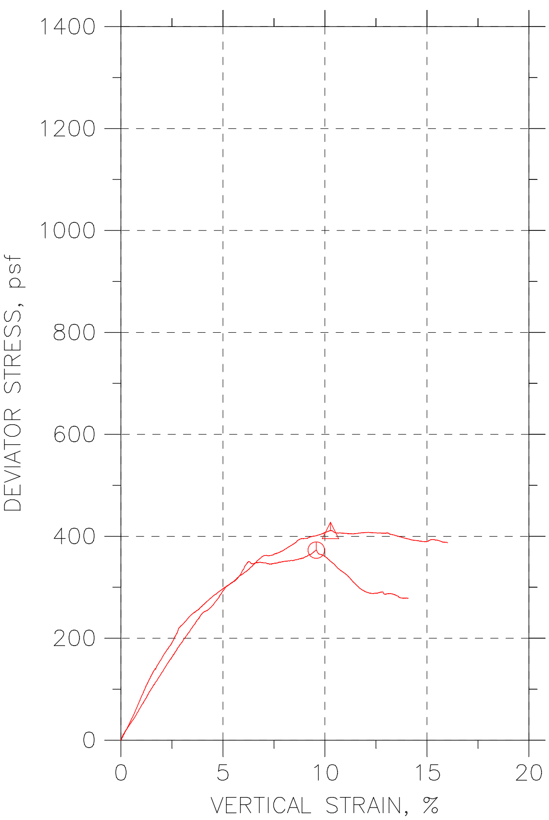
Isabel V. (Be) Schonewald, P.E.

SCHONEWALD ENGINEERING ASSOCIATES, INC.
▪ www.SchonewaldEngineering.com ▪

GTX: RESULTS OF UNCONSOLIDATED UNDRAINED LABORATORY TESTS ON UNDISTURBED SOIL SAMPLES

UNCONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D2850





Symbol	○	△		
Sample No.	U-1	U-1		
Test No.	UU-5	UU-6		
Depth	30-32 ft	30-32 ft		
Tested by	md	md		
Test Date	9/12/17	9/12/17		
Checked by	njh	njh		
Check Date	9/19/17	9/19/17		
Diameter, in	2.85	2.86		
Height, in	5.8	5.7		
Water Content, %	38.6	41.0		
Dry Density, pcf	80.77	79.99		
Saturation, %	95.8	99.9		
Void Ratio	1.09	1.11		
Confining Stress, psf	1600	2400		
Undrained Strength, psf	186.4	205.7		
Max. Dev. Stress, psf	372.9	411.3		
Strain at Failure, %	9.58	10.3		
Strain Rate, %/min	1	1		
Estimated Specific Gravity	2.7	2.7		
Liquid Limit	---	---		
Plastic Limit	---	---		
Plasticity Index	---	---		

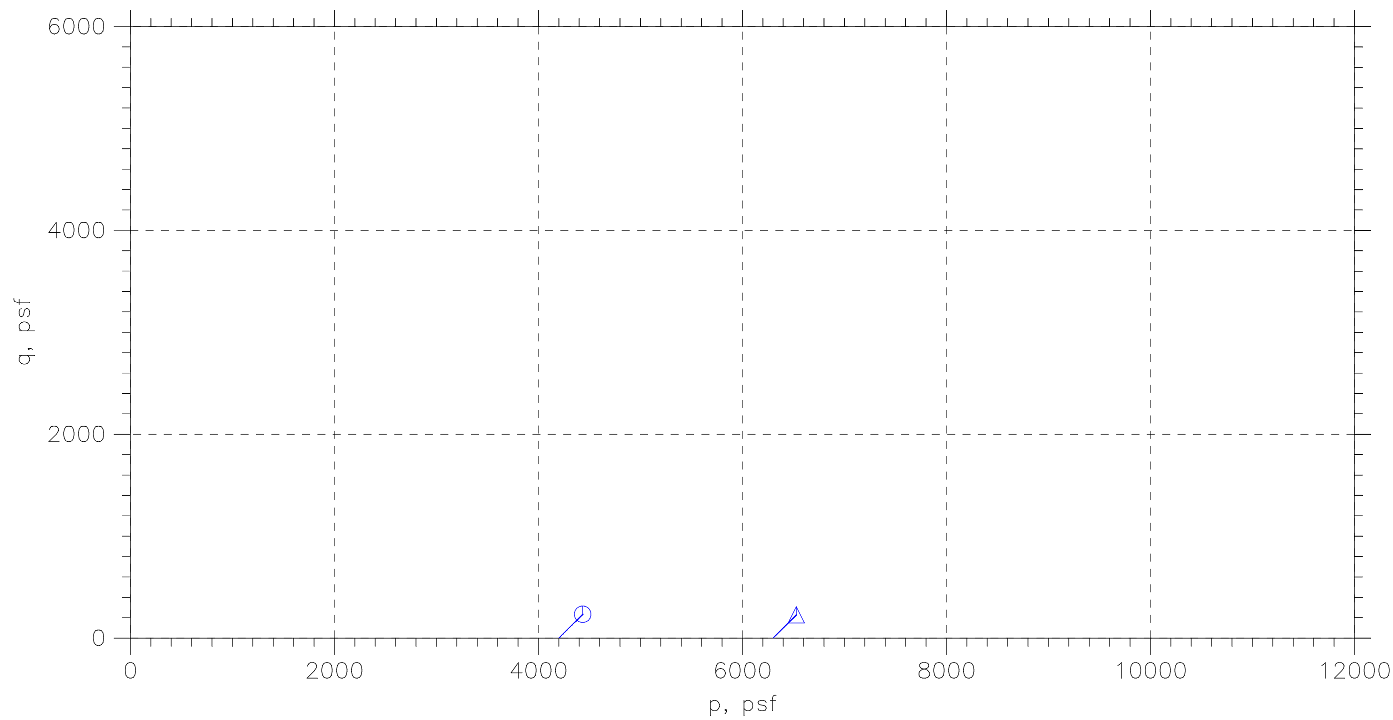
GeoTesting EXPRESS

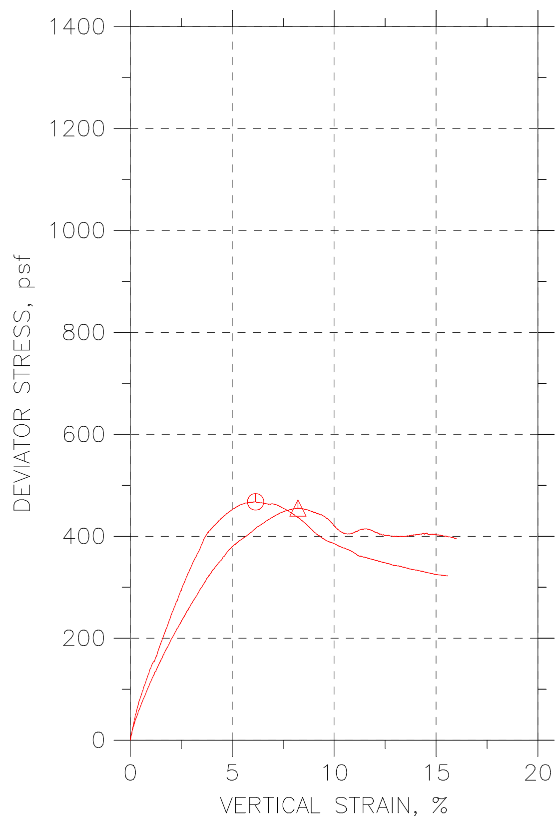
Project: Cummings Rd over MeTPK
Location: Scarborough, ME
Project No.: GTX-306845
Boring No.: BB-CUM-102
Sample Type: intact
Description: Wet, gray silt
Remarks: System X

Phase calculations based on start and end of test.

Tue, 19-SEP-2017 14:41:20

UNCONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D2850

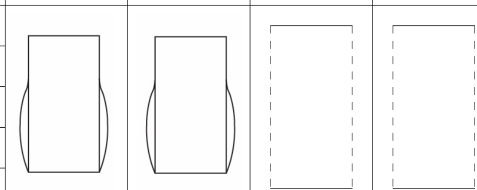




Symbol	○	△		
Sample No.	U2	U2		
Test No.	UU-1	UU-2		
Depth	65-67 ft	65-67 ft		
Tested by	md	md		
Test Date	9/12/17	9/12/17		
Checked by	njh	njh		
Check Date	9/19/17	9/19/17		
Diameter, in	2.7	2.88		
Height, in	5.9	5.92		
Water Content, %	38.0	40.3		
Dry Density, pcf	82.8	80.03		
Saturation, %	99.0	98.5		
Void Ratio	1.04	1.11		
Confining Stress, psf	4200	6300		
Undrained Strength, psf	233.8	227.6		
Max. Dev. Stress, psf	467.7	455.3		
Strain at Failure, %	6.15	8.23		
Strain Rate, %/min	1	1		
Estimated Specific Gravity	2.7	2.7		
Liquid Limit	---	---		
Plastic Limit	---	---		
Plasticity Index	---	---		

GeoTesting EXPRESS

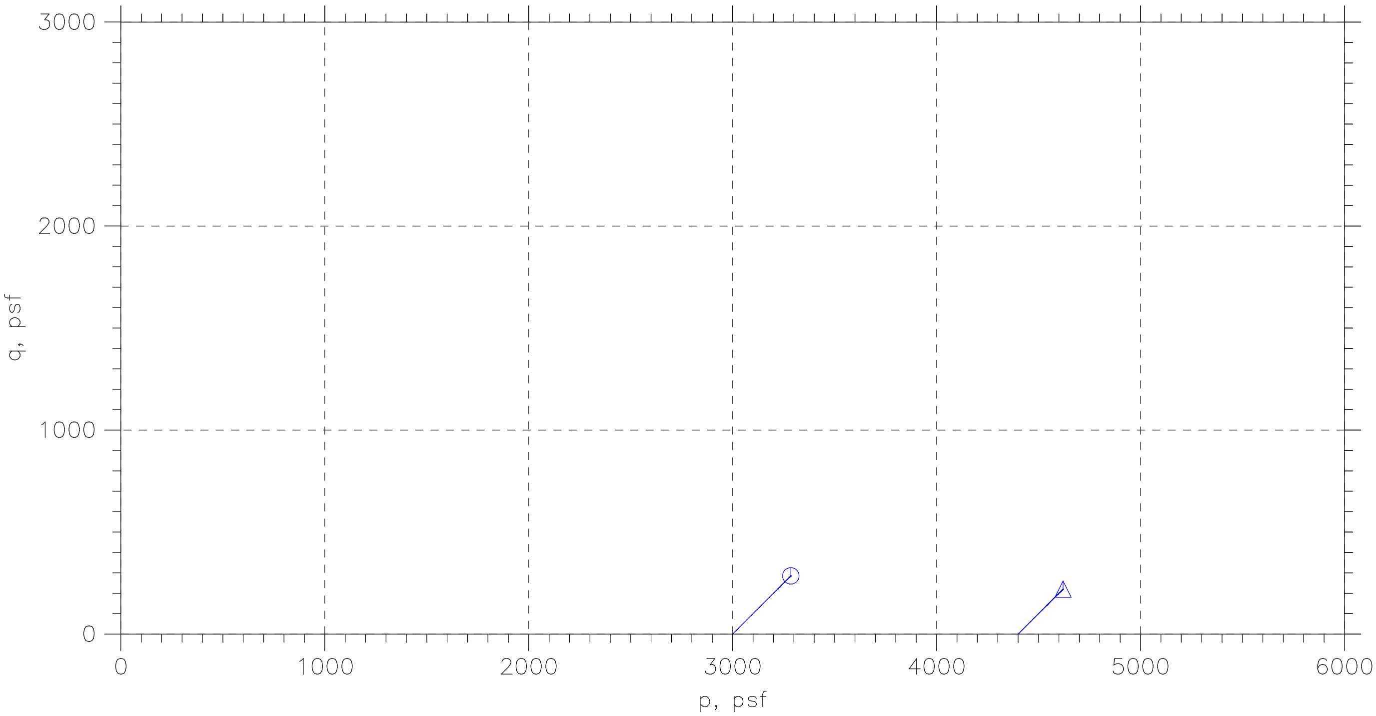
Project: Cummings Rd over MeTPK
Location: Scarborough, ME
Project No.: GTX-306845
Boring No.: BB-CUM-103
Sample Type: intact
Description: Wet, gray silt
Remarks: System X

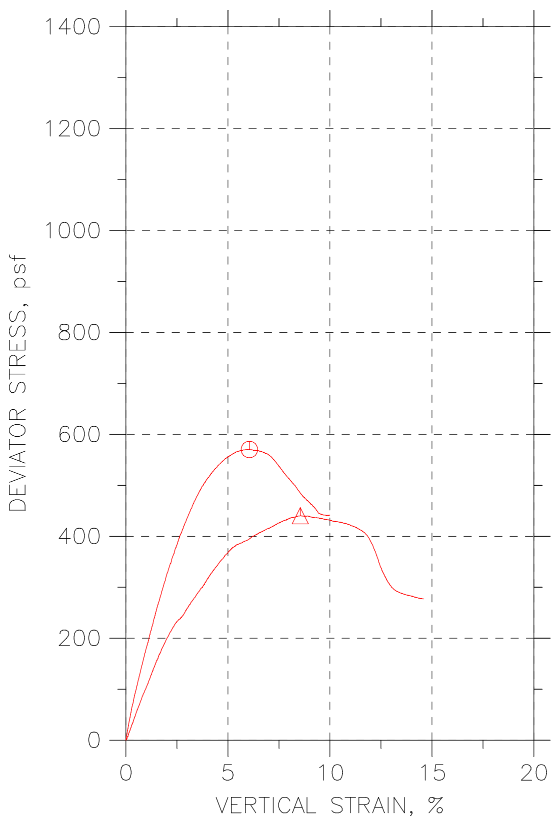


Phase calculations based on start and end of test.

Tue, 19-SEP-2017 14:02:51

UNCONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D2850





Symbol	⊙	△		
Sample No.	U-1	U-1		
Test No.	UU-7	UU-8		
Depth	60-62 ft	60-62 ft		
Tested by	md	md		
Test Date	9/12/17	9/12/17		
Checked by	njh	njh		
Check Date	9/19/17	9/19/17		
Diameter, in	2.84	2.86		
Height, in	6.01	6.09		
Water Content, %	36.0	33.2		
Dry Density, pcf	81.01	82.32		
Saturation, %	89.9	85.5		
Void Ratio	1.08	1.05		
Confining Stress, psf	3000	4400		
Undrained Strength, psf	285.1	220.1		
Max. Dev. Stress, psf	570.3	440.3		
Strain at Failure, %	6.05	8.55		
Strain Rate, %/min	1	1		
Estimated Specific Gravity	2.7	2.7		
Liquid Limit	---	---		
Plastic Limit	---	---		
Plasticity Index	---	---		

GeoTesting EXPRESS

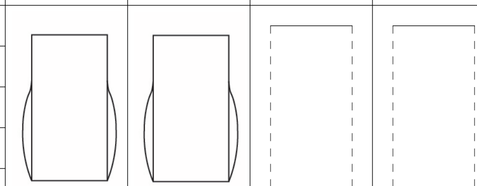
Project: Cummings Rd over MeTPK

Location: Scarborough, ME

Project No.: GTX-306845

Boring No.: BB-CUM-105

Sample Type: intact

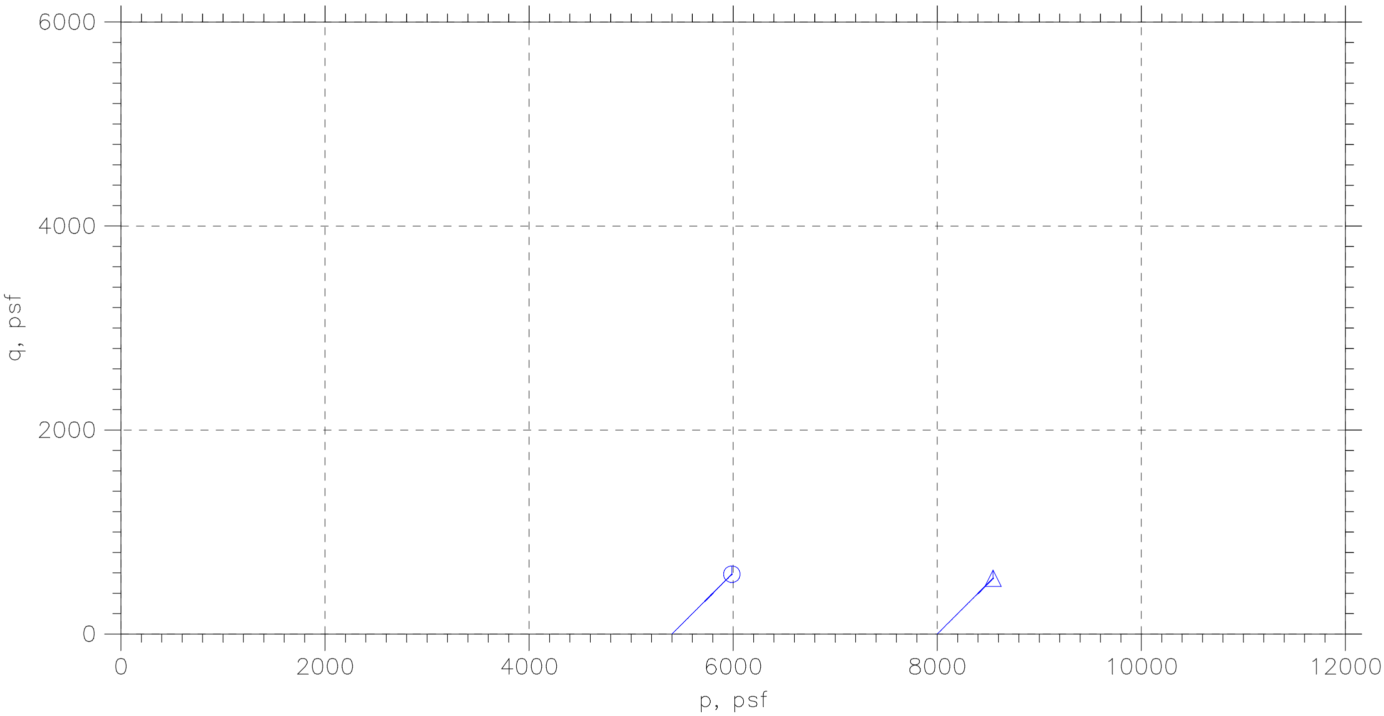


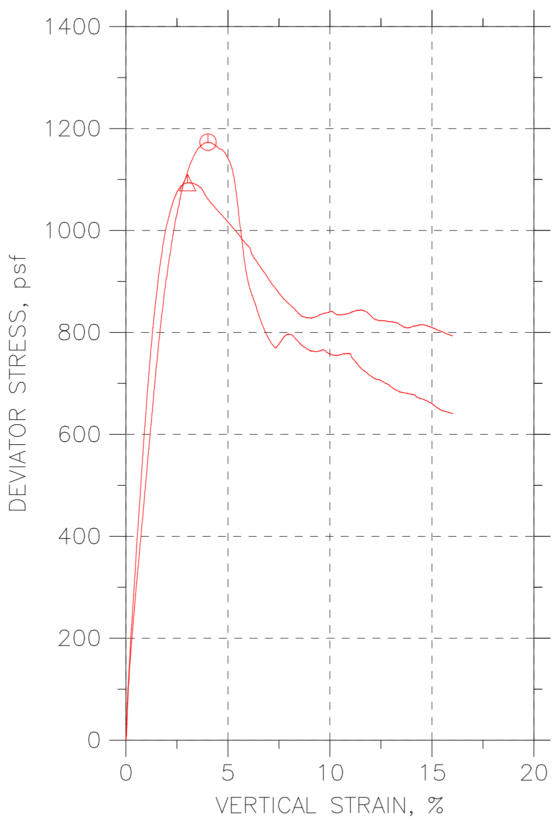
Description: Wet, gray silt

Remarks: System X

Phase calculations based on start and end of test.

UNCONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D2850

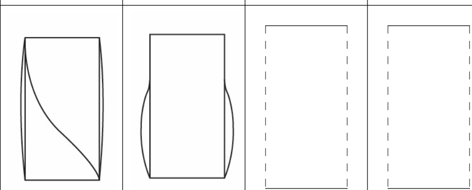




Symbol	○	△		
Sample No.	U-2	U-2		
Test No.	UU-3	UU-4		
Depth	90-92 ft	90-92 ft		
Tested by	md	md		
Test Date	9/12/17	9/12/17		
Checked by	njh	njh		
Check Date	9/19/17	9/19/17		
Diameter, in	2.86	2.86		
Height, in	6.15	6.11		
Water Content, %	42.9	45.4		
Dry Density, pcf	78.1	71.62		
Saturation, %	99.9	90.6		
Void Ratio	1.16	1.35		
Confining Stress, psf	5400	8000		
Undrained Strength, psf	586.6	546.9		
Max. Dev. Stress, psf	1173	1094		
Strain at Failure, %	4.02	3.03		
Strain Rate, %/min	1	1		
Estimated Specific Gravity	2.7	2.7		
Liquid Limit	---	---		
Plastic Limit	---	---		
Plasticity Index	---	---		

GeoTesting EXPRESS

Project: Cummings Rd over MeTPK
Location: Scarborough, ME
Project No.: GTX-306845
Boring No.: BB-CUM-106
Sample Type: intact



Description: Wet, gray silt
Remarks: System X

Phase calculations based on start and end of test.

Tue, 19-SEP-2017 14:27:14

SCHONEWALD ENGINEERING ASSOCIATES, INC.
129 Middle Road
Cumberland, ME 04021
207/ 829-5226

LETTER OF TRANSMITTAL

DATE	9/5/2017	JOB NO.	17-013
ATTENTION	Mark Dobday		
RE.	Unconsolidated Undrained Triaxial Testing		
	Cummings Rd over MeTPK		
	Scarborough, ME		

TO GeoTesting Express
Geotechnical Testing Laboratory
125 Nagog Park
Acton, MA 01720

WE ARE SENDING YOU: ☑ Enclosed ☑ soil (bag) samples

COPIES	DATE	NO.	DESCRIPTION
		4	undisturbed tube samples of soils as described below submitted for lab testing

REMARKS:

Hi Mark-

Please complete the following tests on the soil samples listed below. Please reference SchonewaldEA's project #17-013 (Cummings Road over Maine TPK) on results and invoice. Standard turnaround requested.

Please call me with any questions or issues. My cell number is 207/272-9879. Thanks- Be

Boring No.	Sample No.	Sample Depth (ft., BGS)	Material	Requested Tests
BB-CUM-102	U1 *	30-32	sensitive NC silt-clay	triaxial unconsolidated undrained compression test
BB-CUM-103	U2 *	65-67	sensitive NC silt-clay	triaxial unconsolidated undrained compression test
BB-CUM-105	U1 *	60-62	sensitive NC silt-clay	triaxial unconsolidated undrained compression test
BB-CUM-106	U2 *	90-92	sensitive NC silt-clay	triaxial unconsolidated undrained compression test

NOTES:

Tube samples opened and resealed by another lab (RW Gillespie) where I had traditional consolidations tests run.

Each test: 2-point unconsolidated undrained triaxial tests (ASTM D2850); highly sensitive clay. Confining pressures as follows: test at 0.8*in-situ effective stress and 1.2*in-situ effective. Use your discretion to increase confining pressures to counteract some of the effects of sample disturbance given the sensitivity of the silt-clay.

SIGNED: ______________________

Isabel V. (Be) Schonewald, P.E.

SCHONEWALD ENGINEERING ASSOCIATES, INC.
129 Middle Road
Cumberland, ME 04021
207/ 829-5226

LETTER OF TRANSMITTAL

DATE	9/7/2017	JOB NO.	17-013
ATTENTION	Ethan Marro		
RE.	Confining Pressures		
	UU Triaxial Testing		
	Cummings Rd over MeTPK		
	Scarborough, ME		

TO
GeoTesting Express
Geotechnical Testing Laboratory
125 Nagog Park
Acton, MA 01720

WE ARE SENDING YOU: ☑ Enclosed ☑ soil (partial resealed tube) samples

COPIES	DATE	NO.	DESCRIPTION
		4	undisturbed tube samples of soils as described below submitted for lab testing

REMARKS:

Hi Ethan-

Please complete the following tests on the soil samples listed below. Please reference SchonewaldEA's project #17-013 (Cummings Road over Maine TPK) on results and invoice. Standard turnaround requested.

Please call me with any questions or issues. My cell number is 207/272-9879. Thanks- Be

Boring No.	Sample No.	Sample Depth (ft., BGS)	Requested Tests
BB-CUM-102	U1 *	30-32	2-point UU triaxial test at the following confining pressures: 1,600 psf and 2,400 psf
BB-CUM-103	U2 *	65-67	2-point UU triaxial test at the following confining pressures: 4,200 psf and 6,300 psf
BB-CUM-105	U1 *	60-62	2-point UU triaxial test at the following confining pressures: 3,000 psf and 4,400 psf
BB-CUM-106	U2 *	90-92	2-point UU triaxial test at the following confining pressures: 5,400 psf and 8,000 psf

NOTES:

Tube samples opened and resealed by another lab (RW Gillespie) where I had traditional consolidations tests run.

Each test: 2-point unconsolidated undrained triaxial tests (ASTM D2850); highly sensitive clay. Confining pressures as follows: test at 0.8*in-situ effective stress and 1.2*in-situ effective as noted above. Use your discretion to increase confining pressures to counteract some of the effects of sample disturbance given the sensitivity of the silt-clay.

cc: ______________________

SIGNED: Be
Isabel V. (Be) Schonewald, P.E.

Schonewald Engineering Associates, Inc.
■ www.SchonewaldEngineering.com ■

GTX: RESULTS OF CORROSIVITY SERIES
(RESISTIVITY, pH, SULFATES, AND CHLORIDES BY AASHTO METHODS)
LABORATORY TESTS ON SOIL SAMPLES

Client:	Schonewald Engineering Associates, Inc.
Project Name:	Cummings Road over ME TPK
Project Location:	Scarborough, ME
GTX #:	306845
Test Date:	08/16/17
Tested By:	jbr
Checked By:	jdt

pH by AASHTO T 289

Boring ID	Sample ID	Depth, ft	Description	pH
BB-CUM-103	6D	25-27	Moist, brown sand	6.01
BB-CUM-106	5D/6D	20-24	Moist, mottled brown and very dark brown silty sand with gravel	5.99

Notes:

Client:	Schonewald Engineering Associates, Inc.
Project Name:	Cummings Road over ME TPK
Project Location:	Scarborough, ME
GTX #:	306845
Test Date:	08/16/17
Tested By:	jbr
Checked By:	jdt

Minimum Laboratory Soil Resistivity by AASHTO T 288

Boring ID	Sample ID	Depth, ft.	Sample Description	Minimum Soil Resistivity, ohm-cm
BB-CUM-103	6D	25-27	Moist brown sand	2,479
BB-CUM-106	5D/6D	20-24	Moist, mottled brown and very dark brown silty sand with gravel	1,859

Comments: Test Equipment: Nilsson Model 400 Soil Resistance Meter, MC Miller Soil Box
Test conducted in standard laboratory atmosphere: 68-73 F

FUGRO USA LAND, INC.

6100 HILLCROFT
PHONE (713) 369-5400

HOUSTON, TEXAS 77081
FAX (713) 369-5518

RESULTS OF TESTS

PROJECT:	**CUMMINGS ROAD OVER MeTPK (GTX 306845)** **SAMPLE ID: BB-CUM-103, S-6D, 25 - 27**	**REPORT DATE:**	**08-17-17**
		CLIENT NUMBER:	
		JOB NUMBER:	**04.1115-0003**
FOR:	**GEOTESTING EXPRESS, INC.** **125 NAGOG PARK ACTION, MA 01720**	**REPORT NUMBER:**	
		DATE SAMPLED:	
		TIME SAMPLED:	
REPORTED TO:	**ETHAN MARRO**	**SAMPLED BY:**	**CLIENT**
		DATE RECEIVED:	**08-11-17**
		TIME RECEIVED:	**1100**
LAB NUMBER:	**0811013**	**RECEIVED BY:**	**SD**

PARAMETER	RESULTS	UNITS	METHOD	TIME/DATE	ANALYST
Sulfate, Soluble	281 *	mg/kg	AASHTO T 290	1300/08-16-17	SD
Chloride, Soluble	267 *	mg/kg	AASHTO T 291	1100/08-17-17	SD

SO4CL 078-17

Respectfully submitted,

*** Dry weight basis**

Steve DeGregorio
Chemist

SD

THE RESULTS RELATE AS TO THE LOCATION TESTED AND NO OTHER REFERENCE SHALL BE MADE.
THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE WRITTEN APPROVAL OF THE LABORATORY.

END OF REPORT

FUGRO USA LAND, INC.

6100 HILLCROFT
PHONE (713) 369-5400

HOUSTON, TEXAS 77081
FAX (713) 369-5518

RESULTS OF TESTS

PROJECT:	CUMMINGS ROAD OVER MeTPK (GTX 306845) SAMPLE ID: BB-CUM-106, S-5D/6D, 20 - 24	REPORT DATE:	08-17-17
		CLIENT NUMBER:	
		JOB NUMBER:	04.1115-0003
FOR:	GEOTESTING EXPRESS, INC. 125 NAGOG PARK ACTION, MA 01720	REPORT NUMBER:	
		DATE SAMPLED:	
		TIME SAMPLED:	
REPORTED TO:	ETHAN MARRO	SAMPLED BY:	CLIENT
		DATE RECEIVED:	08-11-17
		TIME RECEIVED:	1100
LAB NUMBER:	0811014	RECEIVED BY:	SD

PARAMETER	RESULTS	UNITS	METHOD	TIME/DATE	ANALYST
Sulfate, Soluble	91 *	mg/kg	AASHTO T 290	1300/08-16-17	SD
Chloride, Soluble	207 *	mg/kg	AASHTO T 291	1100/08-17-17	SD

SO4CL 078-17

Respectfully submitted,

* Dry weight basis

Steve DeGregorio
Chemist

SD

END OF REPORT

SCHONEWALD ENGINEERING ASSOCIATES, INC.

129 Middle Road
Cumberland, ME 04021
207/ 829-5226

LETTER OF TRANSMITTAL

DATE	8/8/2017	JOB NO.	17-013
ATTENTION	Mark Dobday		
RE.	AASHTO Corrosivity Series Testing		
	Cummings Rd over MeTPK		
	Scarborough, ME		

TO GeoTesting Express
Geotechnical Testing Laboratory
125 Nagog Park
Acton, MA 01720

WE ARE SENDING YOU: ☑ Enclosed ☑ soil (bag) samples

COPIES	DATE	NO.	DESCRIPTION
		2	bag samples of soils as described below submitted for lab testing

REMARKS:

Hi Mark-

Please complete the following tests on the soil samples listed below. Please reference SchonewaldEA's project #17-013 (Cummings Road over Maine TPK) on results and invoice. Standard turnaround requested.

Please call me with any questions or issues. My cell number is 207/272-9879. Thanks- Be

Boring No.	Sample No.	Sample Depth (ft., BGS)	Material	Requested Tests
BB-CUM-103	6D	25-27	native sand	resistivity by AASHTO T288
				pH by AASHTO T289
				sulfates by AASHTO T290
				chlorides by AASHTO T291
BB-CUM-106	5D/6D	20-24	transition fill to native sand	composited sample
				resistivity by AASHTO T288
				pH by AASHTO T289
				sulfates by AASHTO T290
				chlorides by AASHTO T291

SIGNED:

Isabel V. (Be) Schonewald, P.E.

Schonewald Engineering Associates, Inc.
www.SchonewaldEngineering.com

THIELSCH: RESULTS OF UNCONFINED COMPRESSION LABORATORY TESTS ON ROCK CORE SPECIMENS

LABORATORY TESTING DATA SHEET (Rev 1)

Project Name MTA's Cummings Rd over ME TPK
Project No. 17-013
Project Manager Be Schonewald, P.E.

Location Scarborough, ME
Assigned By Be Schonewald, P.E.
Report Date 08.22.17

Reviewed By [signature]
Date Revised 08.28.17

Boring No.	Sample No.	Depth Ft.	Lab No.	Sample Data: Moh's Hard-ness	Do in.	L in.	(1) Unit Wt. PCF	(2) Wet Density PCF	Bulk Gs.	Compression Tests: (3) Other Tests	(4) Strength PSI	(5) Strain %	(6) Conf. Stress	(7) E sec PSI EE+06	(8) Poisson's Ratio	στ PSI	Is_{50} PSI	Rock Formation or Description or Remarks
BB-CUM-103	R4	102.6-105.0	1205		1.997	4.708	168.9			U	4,843	0.168		1.99	0.37			PHYLLITE interbedded with LIMESTONE; broke along foliation
BB-CUM-106	R5	135.0-138.9	1206		1.992	4.741	165.4			U	1,714							Fractured PHYLLITE; broke along foliation
BB-CUM-106	R3	130.3-130.7	1260		1.990	4.761	160.0			U	437							Weathered PHYLLITE; broke along foliation

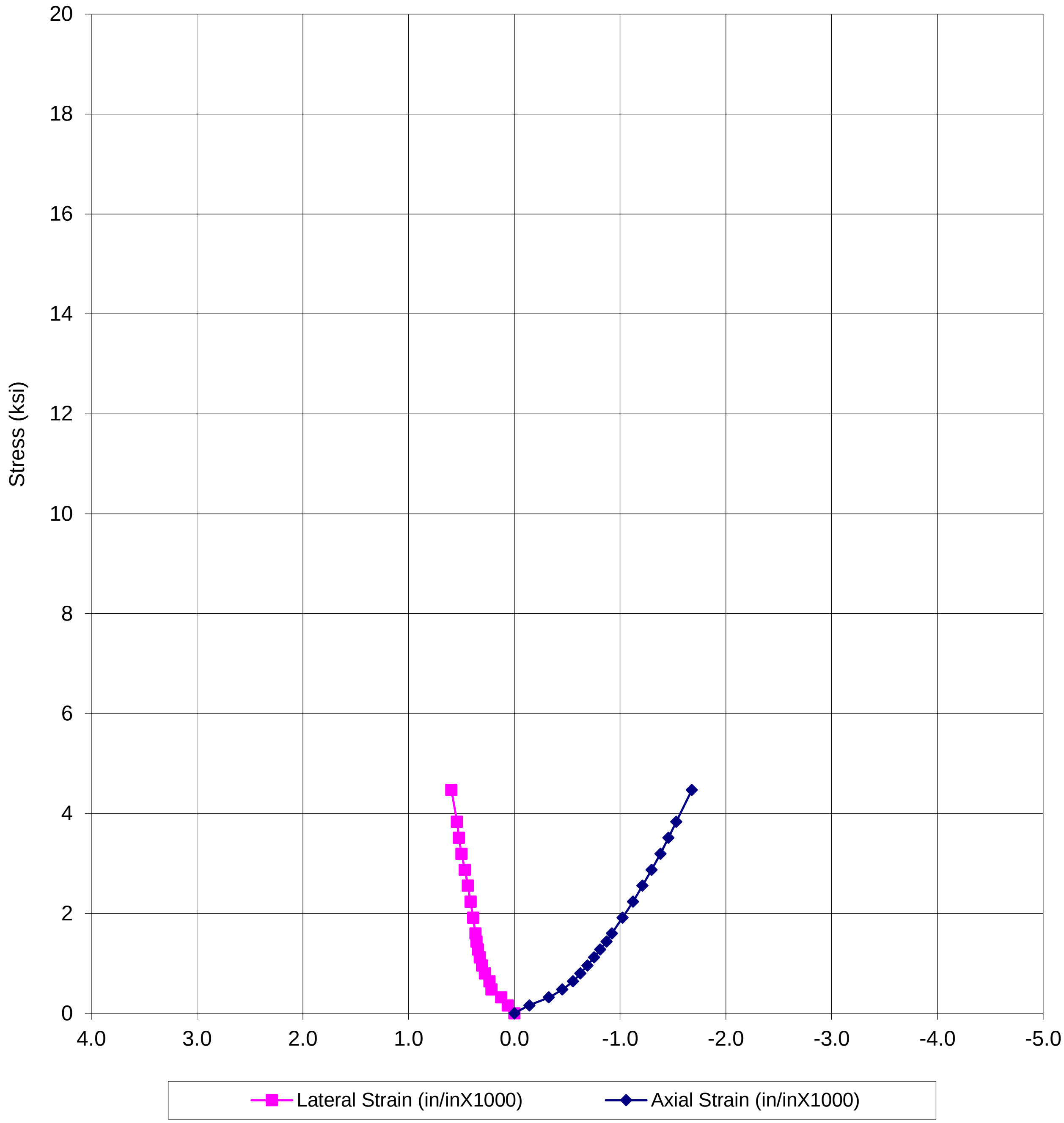
(1) Volume Determined By Measuring Dimensions
(2) Determined by Measuring Dimensions and Weight of Saturated Sample

(3) P=Petrographic PLD=Point Load (diametrical), PLA= Point Load (Axial) ST= Splitting Tensile U= Unconfined Compressive Strength
(4) Taken at Peak Deviator Stress

(5) Strain at Peak Deviator Stress
(6) Represents Confining Stress on Triaxial Tests
(7) Represents Secant Modulus at 50% of Total Failure Stress
(8) Represents Secant Poisson's Ratio at 50% of Total Failure Stress

THIELSCH ENGINEERING
195 Frances Avenue
Cranston, RI 02910
401-467-6454

MTA's Cummings Rd over ME TPK
Scarborough, ME



Rock Unconfined Compression Testing - ASTM D7012

Boring No. BB-CUM-103
Sample No. R-4
Depth: 102.6-105.0

File No. 17-013
Date: 08.22.17
Test No. R4

THIELSCH ENGINEERING


MTA's Cummings Rd. over ME TPK
Scarborough, ME
Schonewald Engineering Associates, Inc.
74-17-012
THIELSCH ENGINEERING, INC.
24 HOUR EMERGENCY SERVICE
195 Frances Avenue
Cranston, RI 02910
Tel. (401) 467-6454
Fax (401) 467-2398
103.0
17-013
BB-CUM-103
R4
103.5
Boring No.
Sample No.
Depth
BB-CUM-103
R4
102.6-105.0'


MTA's Cummings Rd. over ME TPK
Scarborough, ME
Schonewald Engineering Associates, Inc.
74-17-012
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195 Frances Avenue
Cranston, RI 02910
Tel. (401) 467-6454
Fax (401) 467-2398
17-013
BB-CUM-103
R4
Boring No.
Sample No.
Depth
BB-CUM-103
R4
102.6-105.0'

MTA's Cummings Rd. over ME TPK
Scarborough, ME
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THIELSCH ENGINEERING, INC.
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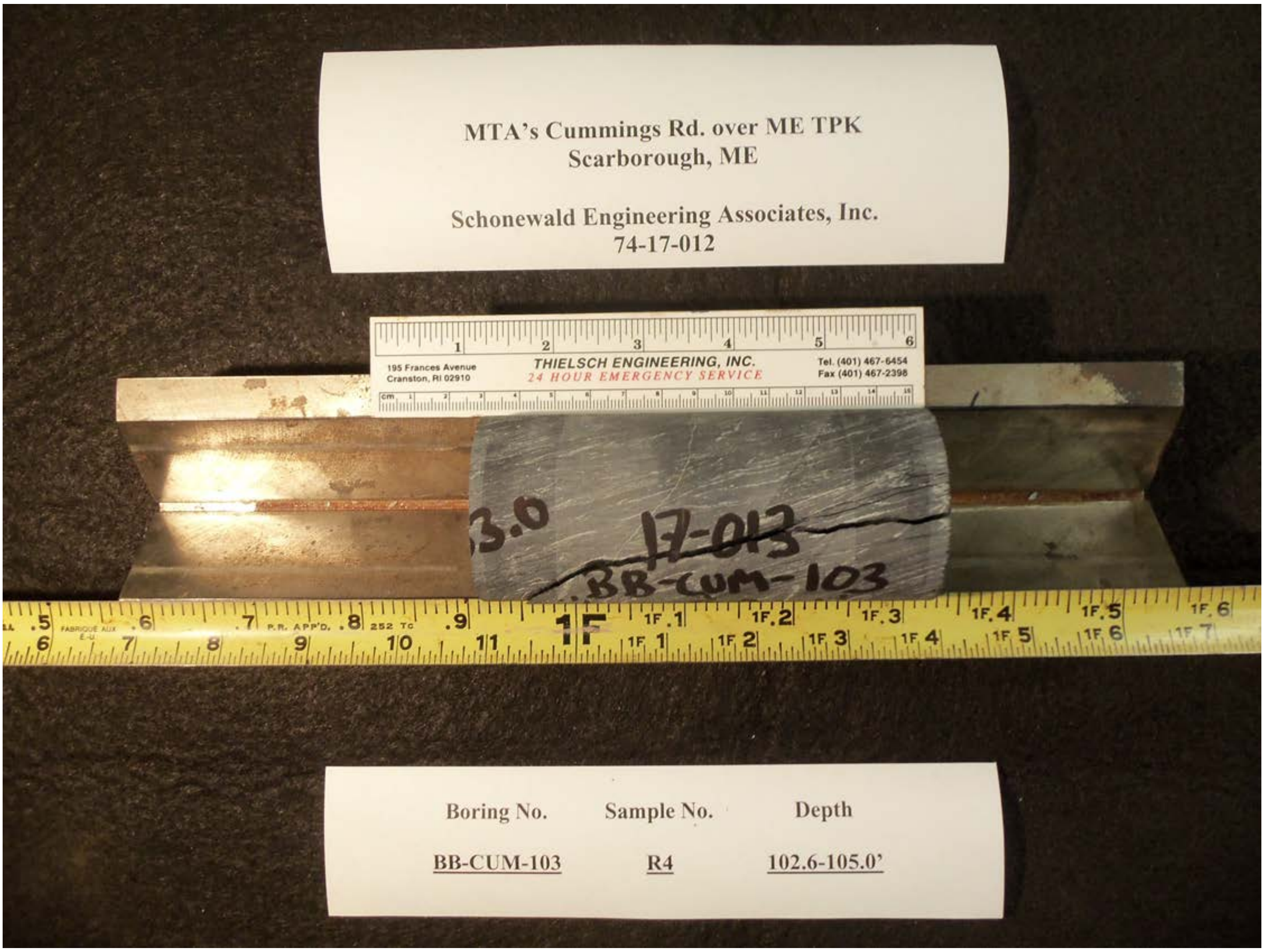
195 Frances Avenue
Cranston, RI 02910
Tel. (401) 467-6454
Fax (401) 467-2398
Boring No.
Sample No.
Depth
BB-CUM-103
R4
102.6-105.0'


MTA's Cummings Rd. over ME TPK
Scarborough, ME
Schonewald Engineering Associates, Inc.
74-17-012
THIELSCH ENGINEERING, INC.
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Tel. (401) 467-6454
Fax (401) 467-2398
17-013
BB-CUM-103
Boring No.
Sample No.
Depth
BB-CUM-103
R4
102.6-105.0'


MTA's Cummings Rd. over ME TPK
Scarborough, ME
Schonewald Engineering Associates, Inc.
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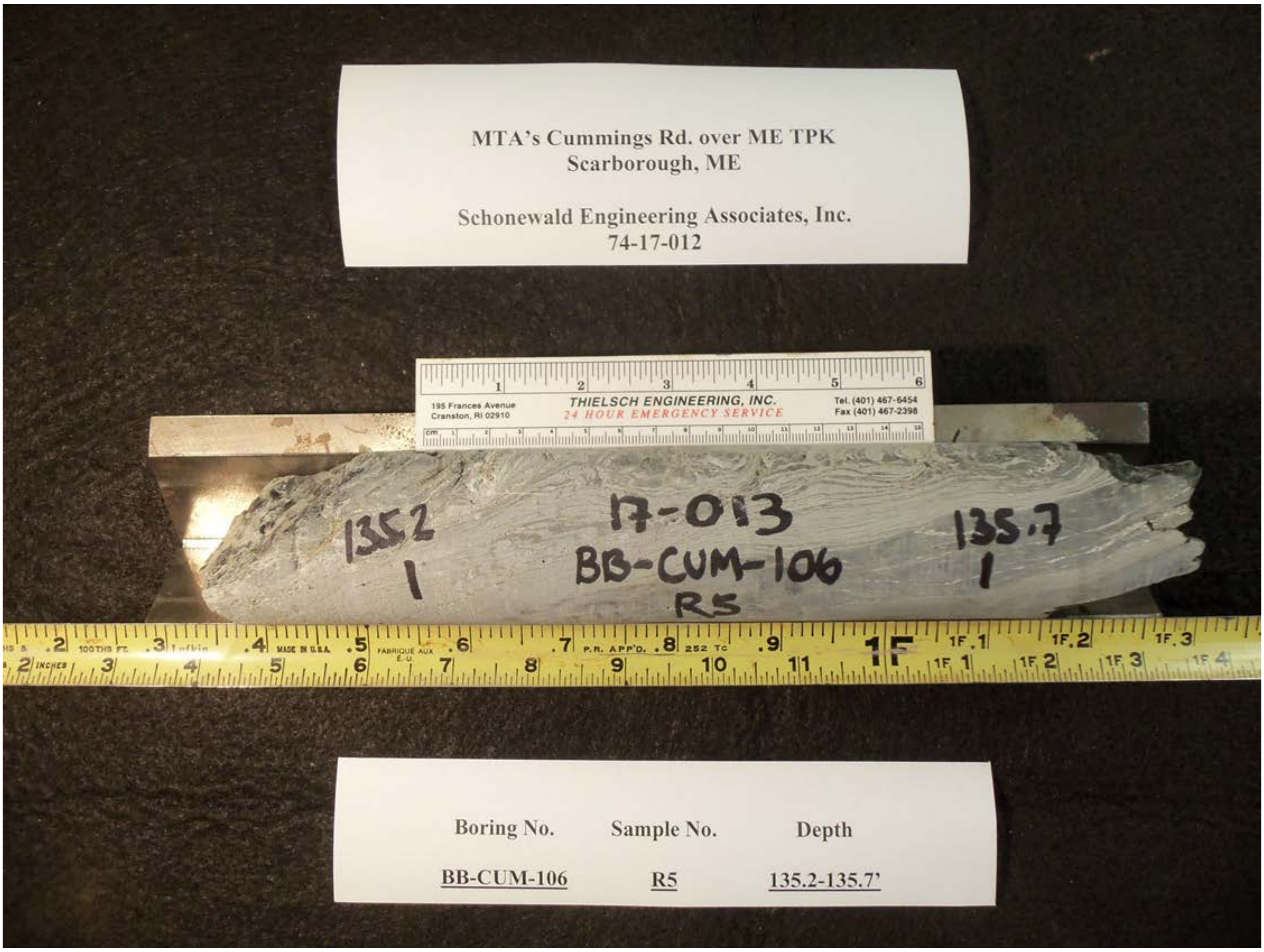
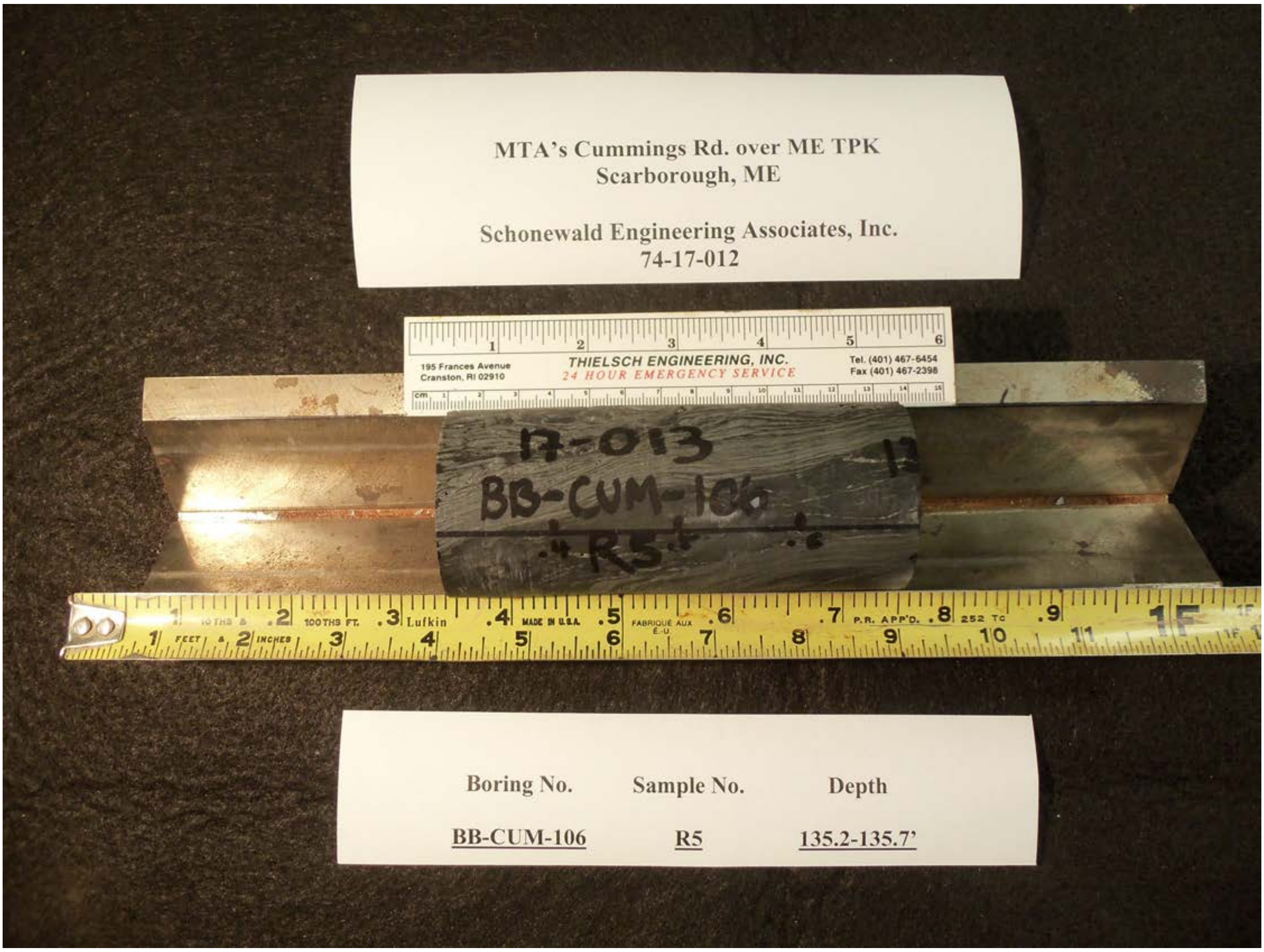
195 Frances Avenue
Cranston, RI 02910
Tel. (401) 467-6454
Fax (401) 467-2398
Boring No.
Sample No.
Depth
BB-CUM-103
R4
102.6-105.0'


MTA's Cummings Rd. over ME TPK
Scarborough, ME
Schonewald Engineering Associates, Inc.
74-17-012
THIELSCH ENGINEERING, INC.
24 HOUR EMERGENCY SERVICE
195 Frances Avenue
Cranston, RI 02910
Tel. (401) 467-6454
Fax (401) 467-2398
135.2
1
17-013
BB-CUM-106
R5
135.7
1
Boring No.
Sample No.
Depth
BB-CUM-106
R5
135.2-135.7'


MTA's Cummings Rd. over ME TPK
Scarborough, ME
Schonewald Engineering Associates, Inc.
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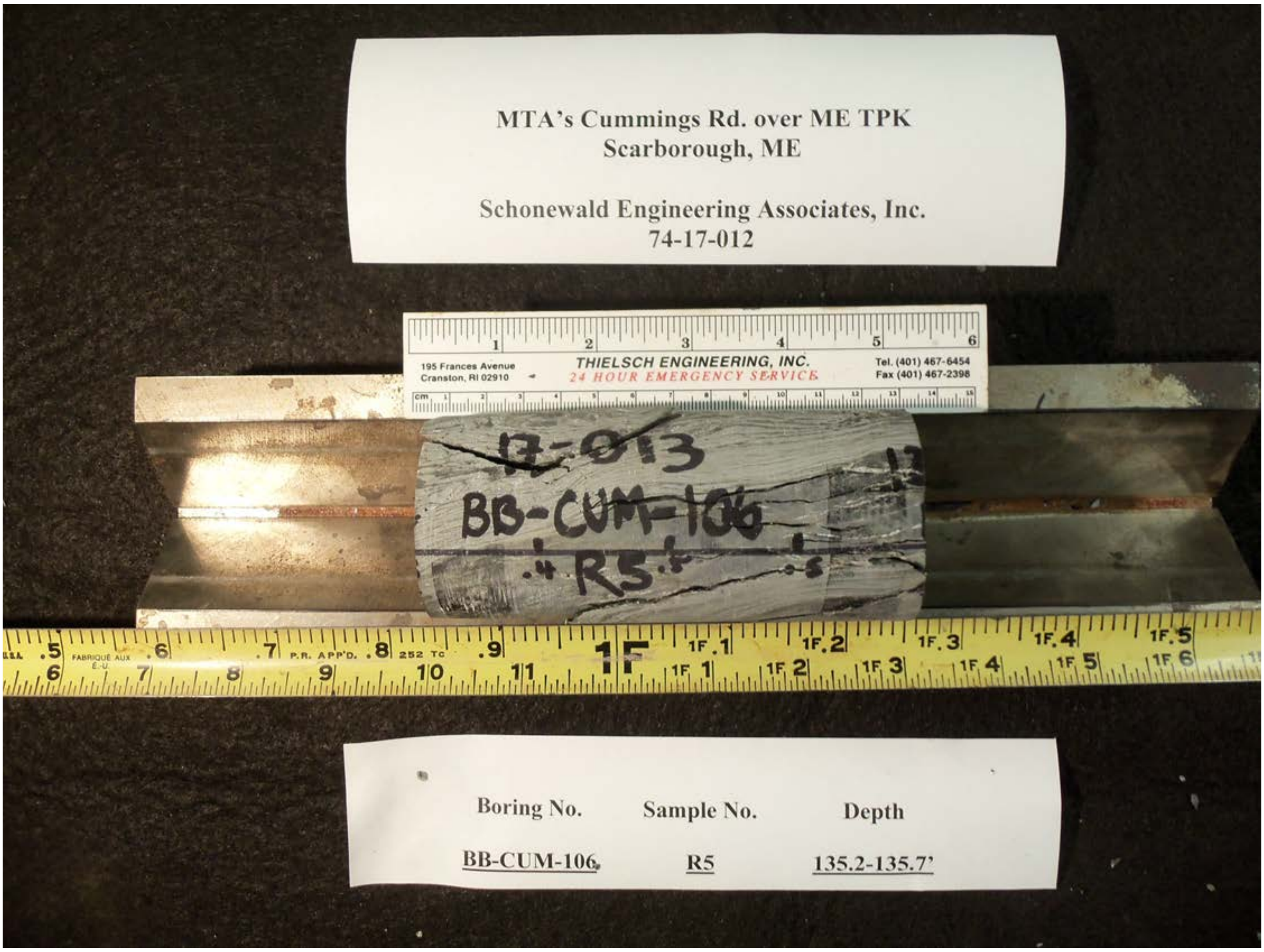
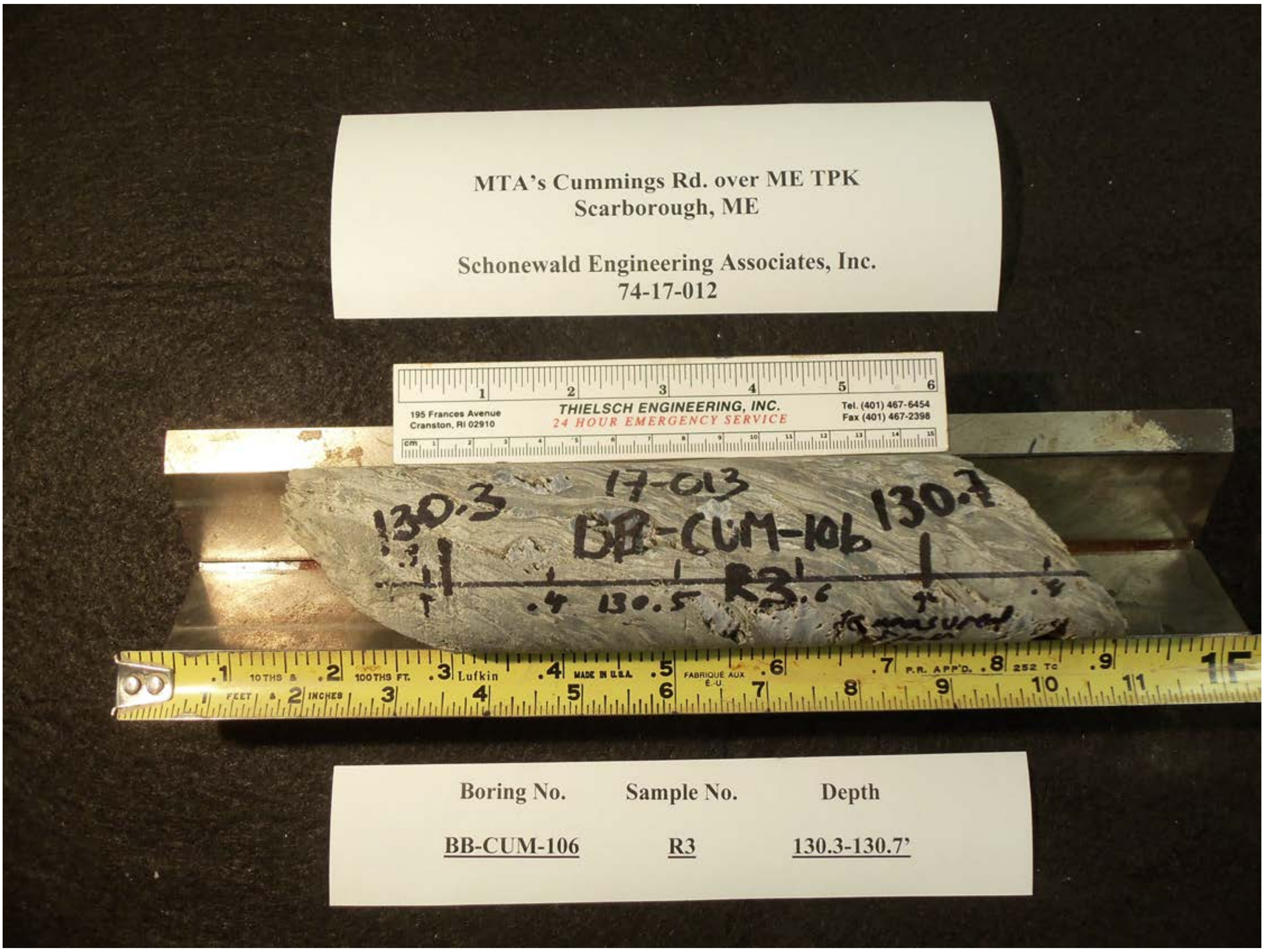
195 Frances Avenue
Cranston, RI 02910
Tel. (401) 467-6454
Fax (401) 467-2398
17-013
BB-CUM-106
R5
Lufkin
Boring No.
Sample No.
Depth
BB-CUM-106
R5
135.2-135.7'


MTA's Cummings Rd. over ME TPK
Scarborough, ME
Schonewald Engineering Associates, Inc.
74-17-012
THIELSCH ENGINEERING, INC.
24 HOUR EMERGENCY SERVICE
195 Frances Avenue
Cranston, RI 02910
Tel. (401) 467-6454
Fax (401) 467-2398
Boring No.
Sample No.
Depth
BB-CUM-106
R5
135.2-135.7'


MTA's Cummings Rd. over ME TPK
Scarborough, ME
Schonewald Engineering Associates, Inc.
74-17-012
Boring No. Sample No. Depth
BB-CUM-106 R5 135.2-135.7'
THIELSCH ENGINEERING, INC.
24 HOUR EMERGENCY SERVICE
195 Frances Avenue
Cranston, RI 02910
Tel. (401) 467-6454
Fax (401) 467-2398


MTA's Cummings Rd. over ME TPK
Scarborough, ME
Schonewald Engineering Associates, Inc.
74-17-012
THIELSCH ENGINEERING, INC.
24 HOUR EMERGENCY SERVICE
195 Frances Avenue
Cranston, RI 02910
Tel. (401) 467-6454
Fax (401) 467-2398
BB-CUM-106
R5
Boring No.
Sample No.
Depth
BB-CUM-106
R5
135.2-135.7'


MTA's Cummings Rd. over ME TPK
Scarborough, ME
Schonewald Engineering Associates, Inc.
74-17-012
THIELSCH ENGINEERING, INC.
24 HOUR EMERGENCY SERVICE
195 Frances Avenue
Cranston, RI 02910
Tel. (401) 467-6454
Fax (401) 467-2398
R5
Boring No.
Sample No.
Depth
BB-CUM-106
R5
135.2-135.7'


MTA's Cummings Rd. over ME TPK
Scarborough, ME
Schonewald Engineering Associates, Inc.
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THIELSCH ENGINEERING, INC.
24 HOUR EMERGENCY SERVICE
195 Frances Avenue
Cranston, RI 02910
Tel. (401) 467-6454
Fax (401) 467-2398
17-013
BB-CUM-106
130.3
130.7
R3
Boring No.
Sample No.
Depth
BB-CUM-106
R3
130.3-130.7'


MTA's Cummings Rd. over ME TPK
Scarborough, ME
Schonewald Engineering Associates, Inc.
74-17-012
THIELSCH ENGINEERING, INC.
24 HOUR EMERGENCY SERVICE
195 Frances Avenue
Cranston, RI 02910
Tel. (401) 467-6454
Fax (401) 467-2398
Lufkin
Boring No.
Sample No.
Depth
BB-CUM-106
R3
130.3-130.7'


MTA's Cummings Rd. over ME TPK
Scarborough, ME
Schonewald Engineering Associates, Inc.
74-17-012
THIELSCH ENGINEERING, INC.
24 HOUR EMERGENCY SERVICE
195 Frances Avenue
Cranston, RI 02910
Tel. (401) 467-6454
Fax (401) 467-2398
Boring No.
Sample No.
Depth
BB-CUM-106
R3
130.3-130.7'


MTA's Cummings Rd. over ME TPK
Scarborough, ME
Schonewald Engineering Associates, Inc.
74-17-012
THIELSCH ENGINEERING, INC.
24 HOUR EMERGENCY SERVICE
195 Frances Avenue
Cranston, RI 02910
Tel. (401) 467-6454
Fax (401) 467-2398
Boring No.
Sample No.
Depth
BB-CUM-106
R3
130.3-130.7'


MTA's Cummings Rd. over ME TPK
Scarborough, ME
Schonewald Engineering Associates, Inc.
74-17-012
THIELSCH ENGINEERING, INC.
24 HOUR EMERGENCY SERVICE
195 Frances Avenue
Cranston, RI 02910
Tel. (401) 467-6454
Fax (401) 467-2398
Lufkin
Boring No.
Sample No.
Depth
BB-CUM-106
R3
130.3-130.7'

SCHONEWALD ENGINEERING ASSOCIATES, INC.

129 Middle Road
Cumberland, ME 04021
207/ 829-5226

LETTER OF TRANSMITTAL

DATE	8/8/2017	JOB NO.	17-013
ATTENTION	Matt Colman		
RE.	Unconfined Compression Tests		
	Rock Core Samples		
	MTA's Cummings Rd over MeTPK		

TO **Thielsch Engineering**
Geotechnical Testing Laboratory
195 Frances Ave.
Cranston, RI 02910

GENTLEMEN:

WE ARE SENDING YOU ☑ Enclosed Under separate cover via ______ the following items.

☐ Shop Drawings ☐ Prints ☐ Plans ☐ Samples ☐ Specifications

☐ Copy of report ☐ Change order ☑ rock core samples

SAMPLES	DATE	NO.	DESCRIPTION
4			rock core samples described below
			NOTE: 2 samples to be tested; 2 samples are back-ups if needed

THESE ARE TRANSMITTED as checked below:

☑ For testing ☐ Approved as submitted
☐ For review and approval ☐ Approved as noted
☐ As requested ☐ Returned for corrections
☐ For your information

REMARKS:

Hi Matt-

Please prep and complete unconfined compression tests with stress-strain plots and modulus determinations (ASTM D7012 Method D) on the rock core samples from test borings for MTA's Cummings Road over MeTPK, Scarborough, ME. Please provide before and after photos of the test specimens.

SAMPLES TO BE TESTED:

No.	Boring No.	Core No.	Core depth	Sample Depth
17-013	BB-CUM-103	R4	102.6 to 105.0 ft BGS	103.0 to 103.5 ft BGS
17-013	BB-CUM-106	R5	135.0 to 138.9 ft BGS	135.2 to 135.7 ft BGS

PLEASE HOLD THE FOLLOWING SAMPLES AS "BACK-UPS":

No.	Boring No.	Core No.	Core depth	Sample Depth
17-013	BB-CUM-103	R3	100.6 to 102.6 ft BGS	100.6 to 101.0 ft BGS
17-013	BB-CUM-106	R3	130.3 to 132.4 ft BGS	130.3 to 130.7 ft BGS

Please reference SchonewaldEA Job No. 17-013: "MTA's Cummings Road over MeTPK, Scarborough, ME" on results and invoice. Please call me with any questions or issues. My cell number is 207/272-9879.

Thanks- Be

SIGNED: ______________________

Isabel V. (Be) Schonewald, P.E.

SCHONEWALD ENGINEERING ASSOCIATES, INC.
■ www.SchonewaldEngineering.com ■

FIELD AND LABORATORY DATA REPORT
PHASE 2 GEOTECHNICAL PROGRAM
BRIDGE REPLACEMENT
CUMMINGS ROAD OVER THE MAINE TURNPIKE
SCARBOROUGH, MAINE

PREPARED FOR:

HNTB Corporation
Westbrook, Maine

PREPARED BY:

Isabel V. (Be) Schonewald, P.E.
Schonewald Engineering Associates, Inc. (SchonewaldEA)
129 Middle Road
Cumberland, Maine 04021
Be@SchonewaldEngineering.com

April 2018

SchonewaldEA Project No. 18-001

SCHONEWALD ENGINEERING ASSOCIATES, INC.
■ www.SchonewaldEngineering.com ■

FIELD AND LABORATORY DATA REPORT
PHASE 2 GEOTECHNICAL PROGRAM
BRIDGE REPLACEMENT
CUMMINGS ROAD OVER THE MAINE TURNPIKE
SCARBOROUGH, MAINE

TABLE OF CONTENTS

SCHONEWALD ENGINEERING ASSOCIATES, INC.
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LOGS OF 200-SERIES SUBSURFACE EXPLORATIONS

SCHONEWALD ENGINEERING ASSOCIATES, INC.	**PROJECT:** Cummings Road Bridge over MeTPK **LOCATION:** Scarborough, Maine	**Boring No.:** BB-CUM-201 (OW) **Proj. No.:** 18-001

Driller:	New England Boring Contractors	**Elevation (ft.)**	65.5	**Core Barrel:**	n/a
Operator:	Enos/ Steen/ Cotter	**Datum:**	NAVD88	**Sampler:**	std. split-spoon
Logged By:	Schonewald	**Rig Type:**	Mobile Drill B-53 (rubber track)	**Hammer Wt./Fall:**	140 lbs/30 in (auto hammer)
Date Start/Finish:	2/19/18; 1010-2/20/18; 0945	**Drilling Method:**	cased wash boring	**Hammer Type:**	auto
Boring Location:	66+25, 31 ft LT	**Casing ID/OD:**	HW to 19 ft	**Hammer Efficiency:**	0.677
		Auger ID/OD:	SSA to 4 ft	**Water Level*:**	3.1 ft (open); 7.0 ft (19 hours)

IN-SITU SAMPLING AND TESTING:
D = Split Spoon Sample
MD = Unsuccessful Split Spoon Sample attempt
U = Thin Wall Tube Sample
MU = Unsuccessful Thin Wall Tube Sample attempt
V = Insitu Vane Shear Test
MV = Unsuccessful Insitu Vane Shear Test attempt

ADDITIONAL DEFINITIONS:
N-uncorrected = N value
N_{60} = N value corrected for hammer efficiency
hammer efficiency = calculated hammer efficiency
S_u = Insitu Field Vane Shear Strength (psf)
R = Rock Core Sample
RQD = Rock Quality Designation (%)

ADDITIONAL DEFINITIONS:
WOH = weight of 140lb. hammer
WOR = weight of rods
-- = not recorded
BOREHOLE ADVANCEMENT METHODS:
SSA/HSA=solid/hollow stem auger
RC=roller cone/OPEN/PUSH=hydraulic push

LABORATORY TEST RESULTS:
AASHTO / USCS soil classifications
-#200 = percent fines WC = water content (%)
CONSOL= 1-D consolidation test
UU=Unconsolidated undrained triaxial test
LL=Liquid Limit / PL=Plastic Limit / PI=Plasticity Index
UCT qp = peak compressive strength of rock

Depth (ft.)	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-uncorrected	N-60	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Lab. Testing Results
0							SSA				
	1D	24/16	2.0 - 4.0	2-6-5-2	11	12				1D: Red tan changing to white brown changing to red brown, damp to moist, m. dense, fine to medium SAND, little Silt. Olive brown, mottled, SILT, little fine Sand in tip of spoon. FILL	
	2D	24/11	4.0 - 6.0	5-7-5-4	12	14	SPIN			2D: Red brown, wet, m. dense, fine Sandy SILT.	
5								59.9		5.6 — Changing to grey at 5.6 ft.	
								58.0		7.5	
	3D	24/24	9.0 - 11.0	WOH/18"-1	0	0	20			3D: Grey, v. soft, interbedded, Silty CLAY, little very fine Sand; and Silty fine SAND.	
10							20				
							20				
							26				
							22				
	4D	24/20	14.0 - 16.0	WOR/12'-WOH/12"	0	0	27			4D: Grey with dark grey streaks, v soft, Silty CLAY, trace very fine Sand, with two 1-inch seams and several partings very fine Sandy SILT.	
15							26	50.5		15.0	
							22				
							24				
							21				
	5D	24/24	19.0 - 21.0	WOR/24"	0	0	OPEN			5D: Dark grey with black streaks in bottom 12 inches of sample, v. soft, Silty CLAY, trace very fine Sand, with one 1/8-inch seam very fine Sandy SILT in upper half of sample.	
20											
25											

Remarks:

Groundwater level observation well installed upon completion of test boring. Observation well:
1-inch dia. PVC; well screen 25 to 15 ft BGS; riser to 2.5 ft stick up.
Caved at 47 ft BGS; Gravel 47 to 33 ft BGS; Filter sand 33.0 to 12.0 ft BGS; Bentonite plug 12.0 to 6.5 ft BGS.
Locking protective casing set; stick up without cover 2.34 ft.

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.

Schonewald Engineering Associates, Inc.	PROJECT: Cummings Road Bridge over MeTPK LOCATION: Scarborough, Maine	Boring No.: BB-CUM-201 (OW) Proj. No.: 18-001

Driller:	New England Boring Contractors	**Elevation (ft.)**	65.5	**Core Barrel:**	n/a
Operator:	Enos/ Steen/ Cotter	**Datum:**	NAVD88	**Sampler:**	std. split-spoon
Logged By:	Schonewald	**Rig Type:**	Mobile Drill B-53 (rubber track)	**Hammer Wt./Fall:**	140 lbs/30 in (auto hammer)
Date Start/Finish:	2/19/18; 1010-2/20/18; 0945	**Drilling Method:**	cased wash boring	**Hammer Type:**	auto
Boring Location:	66+25, 31 ft LT	**Casing ID/OD:**	HW to 19 ft	**Hammer Efficiency:**	0.677
		Auger ID/OD:	SSA to 4 ft	**Water Level*:**	3.1 ft (open); 7.0 ft (19 hours)

IN-SITU SAMPLING AND TESTING:
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MV = Unsuccessful Insitu Vane Shear Test attempt

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N-uncorrected = N value
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hammer efficiency = calculated hammer efficiency
S_u = Insitu Field Vane Shear Strength (psf)
R = Rock Core Sample
RQD = Rock Quality Designation (%)

ADDITIONAL DEFINITIONS:
WOH = weight of 140lb. hammer
WOR = weight of rods
-- = not recorded
BOREHOLE ADVANCEMENT METHODS:
SSA/HSA=solid/hollow stem auger
RC=roller cone/OPEN/PUSH=hydraulic push

LABORATORY TEST RESULTS:
AASHTO / USCS soil classifications
-#200 = percent fines WC = water content (%)
CONSOL= 1-D consolidation test
UU=Unconsolidated undrained triaxial test
LL=Liquid Limit / PL=Plastic Limit / PI=Plasticity Index
UCT qp = peak compressive strength of rock

Depth (ft.)	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-uncorrected	N-60	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Lab. Testing Results
25	6D V1	24/21	25.0 - 27.0 25.6 - 26.0	VANE INTERVAL Su= 371 / 41 psf						6D: Dark grey black, Silty CLAY, trace very fine Sand. V1: Tu=13.5 / Tr=1.5 ft-lbs (65 mm x 130 mm vane)	WC=39.9% LL=38.9 PL=19.7 PI=19.2
	V2		26.6 - 27.0	Su= 371 / 27 psf						V2: Tu=13.5 / Tr=1 ft-lbs (65 mm x 130 mm vane)	
30	U1	24/19	30.0 - 32.0	HYD PUSH						U1: Dark grey black, Silty CLAY.	
35	7D V3	24/22	35.0 - 37.0 35.6 - 36.0	VANE INTERVAL Su= 440 / 27 psf						7D: Dark grey black, Silty CLAY, with occasional nodules; organic odor. V3: Tu=16 / Tr=1 ft-lbs (65 mm x 130 mm vane)	
	V4		36.6 - 37.0	Su= 343 / 14 psf						V4: Tu=12.5 / Tr=0.5 ft-lbs (65 mm x 130 mm vane)	
40	MU	24/11	40.0 - 42.0	HYD PUSH						MU: Less than half of sample retrieved; extrude sample and jar: Dark grey, Silty CLAY, with 2-inch layer fine Sandy SILT; three concretions.	
								23.0		42.5 42.5 ft: Apparent stratum change; gravelly.	
45	8D	18/18	45.0 - 46.5	16-19-19	--					8D: Grey, Silty fine to coarse SAND, some Gravel. TILL	
50											

Remarks:

Groundwater level observation well installed upon completion of test boring. Observation well:
1-inch dia. PVC; well screen 25 to 15 ft BGS; riser to 2.5 ft stick up.
Caved at 47 ft BGS; Gravel 47 to 33 ft BGS; Filter sand 33.0 to 12.0 ft BGS; Bentonite plug 12.0 to 6.5 ft BGS.
Locking protective casing set; stick up without cover 2.34 ft.

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.

SCHONEWALD ENGINEERING ASSOCIATES, INC.	PROJECT: Cummings Road Bridge over MeTPK LOCATION: Scarborough, Maine	Boring No.: BB-CUM-201 (OW) Proj. No.: 18-001

Driller:	New England Boring Contractors	**Elevation (ft.)**	65.5	**Core Barrel:**	n/a
Operator:	Enos/ Steen/ Cotter	**Datum:**	NAVD88	**Sampler:**	std. split-spoon
Logged By:	Schonewald	**Rig Type:**	Mobile Drill B-53 (rubber track)	**Hammer Wt./Fall:**	140 lbs/30 in (auto hammer)
Date Start/Finish:	2/19/18; 1010-2/20/18; 0945	**Drilling Method:**	cased wash boring	**Hammer Type:**	auto
Boring Location:	66+25, 31 ft LT	**Casing ID/OD:**	HW to 19 ft	**Hammer Efficiency:**	0.677
		Auger ID/OD:	SSA to 4 ft	**Water Level*:**	3.1 ft (open); 7.0 ft (19 hours)

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MU = Unsuccessful Thin Wall Tube Sample attempt
V = Insitu Vane Shear Test
MV = Unsuccessful Insitu Vane Shear Test attempt

ADDITIONAL DEFINITIONS:
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N_{60} = N value corrected for hammer efficiency
hammer efficiency = calculated hammer efficiency
S_u = Insitu Field Vane Shear Strength (psf)
R = Rock Core Sample
RQD = Rock Quality Designation (%)

ADDITIONAL DEFINITIONS:
WOH = weight of 140lb. hammer
WOR = weight of rods
-- = not recorded

BOREHOLE ADVANCEMENT METHODS:
SSA/HSA=solid/hollow stem auger
RC=roller cone/OPEN/PUSH=hydraulic push

LABORATORY TEST RESULTS:
AASHTO / USCS soil classifications
-#200 = percent fines WC = water content (%)
CONSOL= 1-D consolidation test
UU=Unconsolidated undrained triaxial test
LL=Liquid Limit / PL=Plastic Limit / PI=Plasticity Index
UCT qp = peak compressive strength of rock

Depth (ft.)	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-uncorrected	N-60	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Lab. Testing Results
50	9D	24/12	50.0 - 52.0	13-14-14-14	28	32				9D: Grey, m. dense, Silty fine to medium SAND, trace to little Gravel, trace coarse Sand.	
								13.5		52.0	
										Bottom of Exploration at 52.0 feet below ground surface. No refusal.	
55											
60											
65											
70											
75											

Remarks:

Groundwater level observation well installed upon completion of test boring. Observation well:
1-inch dia. PVC; well screen 25 to 15 ft BGS; riser to 2.5 ft stick up.
Caved at 47 ft BGS; Gravel 47 to 33 ft BGS; Filter sand 33.0 to 12.0 ft BGS; Bentonite plug 12.0 to 6.5 ft BGS.
Locking protective casing set; stick up without cover 2.34 ft.

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* 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.

Boring No.: BB-CUM-201 (OW)

SCHONEWALD ENGINEERING ASSOCIATES, INC.

PROJECT: Cummings Road Bridge over MeTPK

LOCATION: Scarborough, Maine

Boring No.: BB-CUM-201A

Proj. No.: 18-001

Driller:	New England Boring Contractors	**Elevation (ft.)**	65.5	**Core Barrel:**	n/a
Operator:	Enos/ Steen	**Datum:**	NAVD88	**Sampler:**	std. split-spoon
Logged By:	Schonewald	**Rig Type:**	Mobile Drill B-53 (rubber track)	**Hammer Wt./Fall:**	140 lbs/30 in (auto hammer)
Date Start/Finish:	2/20/18; 1010-1510	**Drilling Method:**	cased wash boring	**Hammer Type:**	auto
Boring Location:	66+37, 37 ft LT	**Casing ID/OD:**	HW to 20 ft	**Hammer Efficiency:**	0.677
		Auger ID/OD:	SSA to 5 ft	**Water Level*:**	--

IN-SITU SAMPLING AND TESTING:
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V = Insitu Vane Shear Test
MV = Unsuccessful Insitu Vane Shear Test attempt

ADDITIONAL DEFINITIONS:
N-uncorrected = N value
N_{60} = N value corrected for hammer efficiency
hammer efficiency = calculated hammer efficiency
S_u = Insitu Field Vane Shear Strength (psf)
R = Rock Core Sample
RQD = Rock Quality Designation (%)

ADDITIONAL DEFINITIONS:
WOH = weight of 140lb. hammer
WOR = weight of rods
-- = not recorded

BOREHOLE ADVANCEMENT METHODS:
SSA/HSA=solid/hollow stem auger
RC=roller cone/OPEN/PUSH=hydraulic push

LABORATORY TEST RESULTS:
AASHTO / USCS soil classifications
-#200 = percent fines WC = water content (%)
CONSOL= 1-D consolidation test
UU=Unconsolidated undrained triaxial test
LL=Liquid Limit / PL=Plastic Limit / PI=Plasticity Index
UCT qp = peak compressive strength of rock

Depth (ft.)	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-uncorrected	N-60	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Lab. Testing Results
0							SSA			Advanced borehole to 10 feet BGS without sampling or testing.	
5							SPIN				
10	1D	24/16	10.0 - 12.0	2-1/18"			23	55.5		10.0 1D: Grey, v. soft, Silty CLAY, trace very fine Sand, with two 1-inch seams Silty fine SAND.	
							15				
							15				
							14				
							15				
15	2D V1	24/22	15.0 - 17.0 15.6 - 16.0	VANE INTERVAL Su= 494 / 41 psf			18			2D: Grey, Silty CLAY, with partings and one 4-inch layer Silty fine SAND. V1: Tu=18 / Tr=1.5 ft-lbs (65 mm x 130 mm vane); sand seams noted during push.	
	V2		16.2 - 16.2				13	49.0		V2: Unable to push past 16.2 ft. 16.5	
							11				
							10				
							12				
20	3D V3	24/20	20.0 - 22.0 20.6 - 21.0	VANE INTERVAL Su= 357 / 27 psf			OPEN			3D: Grey with dark grey streaks, Silty CLAY, trace very fine Sand. V3: Tu=13 / Tr=1 ft-lbs (65 mm x 130 mm vane); sand seams noted during push.	WC=43.4% LL=38.6 PL=22.1 PI=16.5
	V4		21.6 - 22.0	Su= 330 / 27 psf						V4: Tu=12 / Tr=1 ft-lbs (65 mm x 130 mm vane); sand seams noted during push.	
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.

SCHONEWALD ENGINEERING ASSOCIATES, INC.	PROJECT: Cummings Road Bridge over MeTPK LOCATION: Scarborough, Maine	Boring No.: BB-CUM-201A Proj. No.: 18-001

Driller:	New England Boring Contractors	**Elevation (ft.)**	65.5	**Core Barrel:**	n/a
Operator:	Enos/ Steen	**Datum:**	NAVD88	**Sampler:**	std. split-spoon
Logged By:	Schonewald	**Rig Type:**	Mobile Drill B-53 (rubber track)	**Hammer Wt./Fall:**	140 lbs/30 in (auto hammer)
Date Start/Finish:	2/20/18; 1010-1510	**Drilling Method:**	cased wash boring	**Hammer Type:**	auto
Boring Location:	66+37, 37 ft LT	**Casing ID/OD:**	HW to 20 ft	**Hammer Efficiency:**	0.677
		Auger ID/OD:	SSA to 5 ft	**Water Level*:**	--

IN-SITU SAMPLING AND TESTING:
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AASHTO / USCS soil classifications
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CONSOL= 1-D consolidation test
UU=Unconsolidated undrained triaxial test
LL=Liquid Limit / PL=Plastic Limit / PI=Plasticity Index
UCT qp = peak compressive strength of rock

Depth (ft.)	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-uncorrected	N-60	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Lab. Testing Results
25	MU	24/7	25.0 - 27.0	HYD PUSH						MU: Dark grey black, Silty CLAY	
	U1	24/24	27.0 - 29.0	HYD PUSH						U1: Dark grey black, Silty CLAY.	CONSOL (Cv, Cα) WC=40.6% LL=38.4 PL=21.7 PI=16.7
30	4D V5	24/21	30.0 - 32.0 30.6 - 31.0	VANE INTERVAL Su= 371 / 27 psf						4D: Dark grey black, Silty CLAY with occasional nodules. V5: Tu=13.5 / Tr=1 ft-lbs (65 mm x 130 mm vane).	
	V6		31.6 - 32.0	Su= 398 / 14 psf						V6: Tu=14.5 / Tr=0.5 ft-lbs (65 mm x 130 mm vane).	
35	U2	24/22	35.0 - 37.0	HYD PUSH						U2: Dark grey black, Silty CLAY.	CONSOL (Cv, Cα) WC=45.7% LL=44.6 PL=23.5 PI=21.1
40	5D V7	24/19	40.0 - 42.0 40.6 - 41.0	VANE INTERVAL Su= 494 / 14 psf						5D: Dark grey black, Silty CLAY, with nodules throughout. V7: Tu=18 / Tr=0.5 ft-lbs (65 mm x 130 mm vane).	
	V8		41.6 - 42.0	Su= 591 / 14 psf						V8: Tu=21.5 / Tr=0.5 ft-lbs (65 mm x 130 mm vane).	
	MV										
45	6D	24/24	45.0 - 47.0	(WOR)-1-4-10	5	6				MV: Unable to push past 45.6 ft. Dark grey, Silty CLAY, changing at 46.0 ft to:	
								19.5		46.0 6D: Dark grey, Silty fine to medium SAND, trace coarse Sand. TILL	
								18.5		47.0 **Bottom of Exploration at 47.0 feet below ground surface.** No refusal.	
50											

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.

Schonewald Engineering Associates, Inc.	**PROJECT:** Cummings Road Bridge over MeTPK **LOCATION:** Scarborough, Maine	**Boring No.:** BB-CUM-202 **Proj. No.:** 18-001

Driller:	New England Boring Contractors	**Elevation (ft.)**	68.5	**Core Barrel:**	NQ2
Operator:	Enos / Share	**Datum:**	NAVD88	**Sampler:**	std. split-spoon
Logged By:	Schonewald	**Rig Type:**	Mobile Drill B-53 (rubber track)	**Hammer Wt./Fall:**	140 lbs/30 in (auto hammer)
Date Start/Finish:	2/26/18; 2035-2/28/18; 0005	**Drilling Method:**	cased wash boring	**Hammer Type:**	auto
Boring Location:	70+00, 1 ft LT	**Casing ID/OD:**	HW to 45 ft; NW to 81.7 ft	**Hammer Efficiency:**	0.677
		Auger ID/OD:	SSA to 5 ft	**Water Level*:**	5.0 ft (open)

IN-SITU SAMPLING AND TESTING:
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RQD = Rock Quality Designation (%)

ADDITIONAL DEFINITIONS:
WOH = weight of 140lb. hammer
WOR = weight of rods
-- = not recorded

BOREHOLE ADVANCEMENT METHODS:
SSA/HSA=solid/hollow stem auger
RC=roller cone/OPEN/PUSH=hydraulic push

LABORATORY TEST RESULTS:
AASHTO / USCS soil classifications
-#200 = percent fines WC = water content (%)
CONSOL= 1-D consolidation test
UU=Unconsolidated undrained triaxial test
LL=Liquid Limit / PL=Plastic Limit / PI=Plasticity Index
UCT qp = peak compressive strength of rock

Depth (ft.)	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-uncorrected	N-60	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Lab. Testing Results
0							SSA				
	1D	24/24	2.0 - 4.0	3-5-6-6	11	12				Brown, moist, Silty fine to medium SAND, trace Gravel. FILL Changing at 3.1 ft to:	
								65.4		3.1 — 1D: Dark red brown, moist, fine to coarse SAND, trace to little Silt, trace fine Gravel.	
5	2D	24/19	5.0 - 7.0	2-6-12-12	18	20	PUSH			2D: Dark red brown, wet, m. dense, fine to coarse SAND, trace Silt, trace fine Gravel.	AASHTO corrosivity
							PUSH				
							49				
							45				
							51				
10	3D	24/10	10.0 - 12.0	5-5-8-5	13	15	34			3D: Red tan, m. dense, fine to medium SAND, trace fine Gravel, trace Silt, trace coarse Sand.	
							39				
							47				
							57	55.0		13.5	
							54				
15	4D	24/14	15.0 - 17.0	2-1-2-2	3	3	28			4D: Grey, v. loose, interbedded, Silty fine SAND; Clayey SILT; and fine SAND, little Silt.	
							30				
							33				
							37				
							37				
20	5D	24/11	20.0 - 22.0	1-3-5-6	8	9	36			5D: Grey, loose, interbedded, fine SAND, little Silt; Silty CLAY; and Silty fine SAND.	
							40				
							65				
							65				
							57				
25											

Remarks:

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* 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.

Schonewald Engineering Associates, Inc.	**PROJECT:** Cummings Road Bridge over MeTPK **LOCATION:** Scarborough, Maine	**Boring No.:** BB-CUM-202 **Proj. No.:** 18-001

Driller:	New England Boring Contractors	**Elevation (ft.)**	68.5	**Core Barrel:**	NQ2
Operator:	Enos / Share	**Datum:**	NAVD88	**Sampler:**	std. split-spoon
Logged By:	Schonewald	**Rig Type:**	Mobile Drill B-53 (rubber track)	**Hammer Wt./Fall:**	140 lbs/30 in (auto hammer)
Date Start/Finish:	2/26/18; 2035-2/28/18; 0005	**Drilling Method:**	cased wash boring	**Hammer Type:**	auto
Boring Location:	70+00, 1 ft LT	**Casing ID/OD:**	HW to 45 ft; NW to 81.7 ft	**Hammer Efficiency:**	0.677
		Auger ID/OD:	SSA to 5 ft	**Water Level*:**	5.0 ft (open)

IN-SITU SAMPLING AND TESTING:
D = Split Spoon Sample
MD = Unsuccessful Split Spoon Sample attempt
U = Thin Wall Tube Sample
MU = Unsuccessful Thin Wall Tube Sample attempt
V = Insitu Vane Shear Test
MV = Unsuccessful Insitu Vane Shear Test attempt

ADDITIONAL DEFINITIONS:
N-uncorrected = N value
N_{60} = N value corrected for hammer efficiency
hammer efficiency = calculated hammer efficiency
S_u = Insitu Field Vane Shear Strength (psf)
R = Rock Core Sample
RQD = Rock Quality Designation (%)

ADDITIONAL DEFINITIONS:
WOH = weight of 140lb. hammer
WOR = weight of rods
-- = not recorded
BOREHOLE ADVANCEMENT METHODS:
SSA/HSA=solid/hollow stem auger
RC=roller cone/OPEN/PUSH=hydraulic push

LABORATORY TEST RESULTS:
AASHTO / USCS soil classifications
-#200 = percent fines WC = water content (%)
CONSOL= 1-D consolidation test
UU=Unconsolidated undrained triaxial test
LL=Liquid Limit / PL=Plastic Limit / PI=Plasticity Index
UCT qp = peak compressive strength of rock

Depth (ft.)	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-uncorrected	N-60	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Lab. Testing Results
25	6D	24/8	25.0 - 27.0	2-3-2-2	5	6	61			6D: Grey, loose, fine SAND, trace Silt.	
							47				
							50				
							56				
							56				
30	7D	24/17	30.0 - 32.0	WOR/12"-WOH/12"	0	0	62			7D: Grey, v. soft, interbedded, Silty CLAY, trace to little very fine Sand; and fine Sandy SILT.	
							54				
							62				
							63				
							68				
35	8D	24/4	35.0 - 37.0	1/24"	0	0	65			8D: Grey, v. loose, interbedded, fine SAND, little Silt; fine Sandy SILT; and Silty CLAY, little very fine Sand, with one layer Silty fine GRAVEL, some very fine Sand. (resampled with 3-inch dia. spoon)	
							52				
							54				
							60	30.0		38.5	
							59				
40	9D	24/21	40.0 - 42.0	WOH/24"	0	0	73			9D: Olive grey, v. soft, Silty CLAY, trace very fine Sand.	
							50				
							59				
							62				
							64				
45	10D V1	24/24	45.0 - 47.0 45.6 - 46.0	VANE INTERVAL Su= 442 / 27 psf			OPEN			10D: Dark grey black, Silty CLAY, with occasional nodules. V1: Tu=16 / Tr=1 ft-lbs (65 mm x 130 mm vane)	
	V2		46.6 - 47.0	Su= 398 / 14 psf						V2: Tu=14.5 / Tr=0.5 ft-lbs (65 mm x 130 mm vane)	
50											

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.

SCHONEWALD ENGINEERING ASSOCIATES, INC.	**PROJECT:** Cummings Road Bridge over MeTPK **LOCATION:** Scarborough, Maine	**Boring No.:** BB-CUM-202 **Proj. No.:** 18-001

Driller:	New England Boring Contractors	**Elevation (ft.)**	68.5	**Core Barrel:**	NQ2
Operator:	Enos / Share	**Datum:**	NAVD88	**Sampler:**	std. split-spoon
Logged By:	Schonewald	**Rig Type:**	Mobile Drill B-53 (rubber track)	**Hammer Wt./Fall:**	140 lbs/30 in (auto hammer)
Date Start/Finish:	2/26/18; 2035-2/28/18; 0005	**Drilling Method:**	cased wash boring	**Hammer Type:**	auto
Boring Location:	70+00, 1 ft LT	**Casing ID/OD:**	HW to 45 ft; NW to 81.7 ft	**Hammer Efficiency:**	0.677
		Auger ID/OD:	SSA to 5 ft	**Water Level*:**	5.0 ft (open)

IN-SITU SAMPLING AND TESTING:
D = Split Spoon Sample
MD = Unsuccessful Split Spoon Sample attempt
U = Thin Wall Tube Sample
MU = Unsuccessful Thin Wall Tube Sample attempt
V = Insitu Vane Shear Test
MV = Unsuccessful Insitu Vane Shear Test attempt

ADDITIONAL DEFINITIONS:
N-uncorrected = N value
N_{60} = N value corrected for hammer efficiency
hammer efficiency = calculated hammer efficiency
S_u = Insitu Field Vane Shear Strength (psf)
R = Rock Core Sample
RQD = Rock Quality Designation (%)

ADDITIONAL DEFINITIONS:
WOH = weight of 140lb. hammer
WOR = weight of rods
-- = not recorded

BOREHOLE ADVANCEMENT METHODS:
SSA/HSA=solid/hollow stem auger
RC=roller cone/OPEN/PUSH=hydraulic push

LABORATORY TEST RESULTS:
AASHTO / USCS soil classifications
-#200 = percent fines WC = water content (%)
CONSOL= 1-D consolidation test
UU=Unconsolidated undrained triaxial test
LL=Liquid Limit / PL=Plastic Limit / PI=Plasticity Index
UCT qp = peak compressive strength of rock

Depth (ft.)	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-uncorrected	N-60	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Lab. Testing Results
50	11D V3	24/24	50.0 - 52.0 50.6 - 51.0	VANE INTERVAL Su= 618 / 27 psf						11D: Dark grey black, Silty CLAY, with nodules throughout. V3: Tu=22.5 / Tr=1 ft-lbs (65 mm x 130 mm vane)	
	V4		51.6 - 52.0	Su= 494 / 14 psf						V4: Tu=18 / Tr=0.5 ft-lbs (65 mm x 130 mm vane)	
55	12D V5	24/20	55.0 - 57.0 55.6 - 56.0	VANE INTERVAL Su= 646 / 14 psf						12D: Dark grey black, Silty CLAY, with nodules throughout. V5: Tu=23.5 / Tr=0.5 ft-lbs (65 mm x 130 mm vane)	
	V6		56.6 - 57.0	Su= 632 / 14 psf						V6: Tu=23 / Tr=0.5 ft-lbs (65 mm x 130 mm vane)	
60	13D V7	24/21	60.0 - 62.0 60.6 - 61.0	VANE INTERVAL Su= 797 / 27 psf						13D: Dark grey black, Silty CLAY, with nodules throughout, some hardening. V7: Tu=29 / Tr=1 ft-lbs (65 mm x 130 mm vane)	
	V8		61.6 - 62.0	Su= 632 / 14 psf						V8: Tu=23 / Tr=0.5 ft-lbs (65 mm x 130 mm vane)	
65	14D V9	24/20	65.0 - 67.0 65.6 - 66.0	VANE INTERVAL Su= 577 / 27 psf						14D: Dark grey black, Silty CLAY, with nodules throughout and occasional concretions. V9: Tu=21 / Tr=1 ft-lbs (65 mm x 130 mm vane)	
	V10		66.6 - 67.0	Su= 907 / 27 psf						V10: Tu=33 / Tr=1 ft-lbs (65 mm x 130 mm vane); concretions noted during push.	
70	15D V11	24/15	70.0 - 72.0 70.6 - 71.0	VANE INTERVAL Su= 907 / 27 psf						15D: Dark grey black, Silty CLAY, with nodules throughout and occasional concretions. V11: Tu=33 / Tr=1 ft-lbs (65 mm x 130 mm vane)	
	MV							-3.5		MV: Unable to push vane past 71.7 ft. 72.0	
75											

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.

SCHONEWALD ENGINEERING ASSOCIATES, INC.

PROJECT: Cummings Road Bridge over MeTPK		**Boring No.:** BB-CUM-202
LOCATION: Scarborough, Maine		**Proj. No.:** 18-001

Driller:	New England Boring Contractors	**Elevation (ft.)**	68.5	**Core Barrel:**	NQ2
Operator:	Enos / Share	**Datum:**	NAVD88	**Sampler:**	std. split-spoon
Logged By:	Schonewald	**Rig Type:**	Mobile Drill B-53 (rubber track)	**Hammer Wt./Fall:**	140 lbs/30 in (auto hammer)
Date Start/Finish:	2/26/18; 2035-2/28/18; 0005	**Drilling Method:**	cased wash boring	**Hammer Type:**	auto
Boring Location:	70+00, 1 ft LT	**Casing ID/OD:**	HW to 45 ft; NW to 81.7 ft	**Hammer Efficiency:**	0.677
		Auger ID/OD:	SSA to 5 ft	**Water Level*:**	5.0 ft (open)

IN-SITU SAMPLING AND TESTING:
D = Split Spoon Sample
MD = Unsuccessful Split Spoon Sample attempt
U = Thin Wall Tube Sample
MU = Unsuccessful Thin Wall Tube Sample attempt
V = Insitu Vane Shear Test
MV = Unsuccessful Insitu Vane Shear Test attempt

ADDITIONAL DEFINITIONS:
N-uncorrected = N value
N_{60} = N value corrected for hammer efficiency
hammer efficiency = calculated hammer efficiency
S_u = Insitu Field Vane Shear Strength (psf)
R = Rock Core Sample
RQD = Rock Quality Designation (%)

ADDITIONAL DEFINITIONS:
WOH = weight of 140lb. hammer
WOR = weight of rods
-- = not recorded

BOREHOLE ADVANCEMENT METHODS:
SSA/HSA=solid/hollow stem auger
RC=roller cone/OPEN/PUSH=hydraulic push

LABORATORY TEST RESULTS:
AASHTO / USCS soil classifications
-#200 = percent fines WC = water content (%)
CONSOL= 1-D consolidation test
UU=Unconsolidated undrained triaxial test
LL=Liquid Limit / PL=Plastic Limit / PI=Plasticity Index
UCT qp = peak compressive strength of rock

Depth (ft.)	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-uncorrected	N-60	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Lab. Testing Results
75	16D	24/9	75.0 - 77.0	18-18-18-21	36	41	83			16D: Grey, dense, fine to coarse Sandy GRAVEL, some Silt. TILL	
							78				
							98				
							256				
							76				
80	17D	18/11	80.0 - 81.5	16-15-23-30/0"	38	43	55			17D: Grey brown, dense, Silty GRAVEL, some fine to coarse Sand.	
	R1	60/60	81.7 - 86.7	RQD: 44" = 73%				-13.0		81.5 R1: Hard, typically fresh, aphanitic to fine grained, grey, PHYLLITE, with thin bedding foliation (typically moderately dipping and planar) and few calcsilicate veins (typically weathered). Typically moderately spaced and moderately dipping breaks; undulating, rough, typically fresh and open. One open fracture at 83.3 ft. Core times: 2:40/ 2:05/ 2:15/ 1:55/ 2:00 min:sec/ft. GOOD TO FAIR ROCK QUALITY	
85											
										Bottom of Exploration at 86.7 feet below ground surface.	
90											
95											
100											

Remarks:

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

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SCHONEWALD ENGINEERING ASSOCIATES, INC.	**PROJECT:** Cummings Road Bridge over MeTPK **LOCATION:** Scarborough, Maine	**Boring No.:** BB-CUM-203 **Proj. No.:** 18-001

Driller:	New England Boring Contractors	**Elevation (ft.)**	65	**Core Barrel:**	NQ2
Operator:	Enos / Steen	**Datum:**	NAVD88	**Sampler:**	std. split-spoon
Logged By:	Schonewald	**Rig Type:**	Mobile Drill B-53 (rubber track)	**Hammer Wt./Fall:**	140 lbs/30 in (auto hammer)
Date Start/Finish:	2/21/18; 0915-2/22/18; 1440	**Drilling Method:**	cased wash boring	**Hammer Type:**	auto
Boring Location:	70+96, 5 ft LT	**Casing ID/OD:**	HW to 50 ft; NW to 93.5 ft	**Hammer Efficiency:**	0.677
		Auger ID/OD:	SSA to 2 ft	**Water Level*:**	2.0 ft (open)

IN-SITU SAMPLING AND TESTING:
D = Split Spoon Sample
MD = Unsuccessful Split Spoon Sample attempt
U = Thin Wall Tube Sample
MU = Unsuccessful Thin Wall Tube Sample attempt
V = Insitu Vane Shear Test
MV = Unsuccessful Insitu Vane Shear Test attempt

ADDITIONAL DEFINITIONS:
N-uncorrected = N value
N_{60} = N value corrected for hammer efficiency
hammer efficiency = calculated hammer efficiency
S_u = Insitu Field Vane Shear Strength (psf)
R = Rock Core Sample
RQD = Rock Quality Designation (%)

ADDITIONAL DEFINITIONS:
WOH = weight of 140lb. hammer
WOR = weight of rods
-- = not recorded
BOREHOLE ADVANCEMENT METHODS:
SSA/HSA=solid/hollow stem auger
RC=roller cone/OPEN/PUSH=hydraulic push

LABORATORY TEST RESULTS:
AASHTO / USCS soil classifications
-#200 = percent fines WC = water content (%)
CONSOL= 1-D consolidation test
UU=Unconsolidated undrained triaxial test
LL=Liquid Limit / PL=Plastic Limit / PI=Plasticity Index
UCT qp = peak compressive strength of rock

Depth (ft.)	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-uncorrected	N-60	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Lab. Testing Results
0							SSA				
	1D	24/19	2.0 - 4.0	5-11-9-8	20	23	SPIN	62.4		Grey brown, wet, fine to coarse SAND, some Silt, trace fine Gravel. FILL Changing at 2.6 ft to: 2.6	
										1D: Dark red brown, wet, m. dense, fine to coarse SAND, trace Silt.	
5	2D	24/10	5.0 - 7.0	3-6-4-4	10	11	8			2D: Red brown, loose, fine to coarse SAND, little fine Gravel, trace Silt.	AASHTO corrosivity
							4				
							8				
							11				
							14				
10	3D	24/6	10.0 - 12.0	1-2-2-3	4	5	5			3D: Tan, v. loose, fine to medium SAND, trace coarse Sand, trace Silt.	
							9				
							18				
							22	51.5		13.5	
							25				
15	4D	24/19	15.0 - 17.0	3-7-9-9	16	18	22			4D: Grey with black pockets, m. dense, fine SAND, trace Silt, with 4-inch layer grey SILT at top of sample.	
							34				
							29				
							31				
							39				
20	5D	24/21	20.0 - 22.0	WOH/12"-1-2	1	1	23			5D: Grey, v. loose, interbedded SILT, trace very fine Sand; fine SAND, some Silt; and Silty CLAY, little very fine SAND.	
							22				
							26				
							23				
							26				
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.

SCHONEWALD ENGINEERING ASSOCIATES, INC.	**PROJECT:** Cummings Road Bridge over MeTPK **LOCATION:** Scarborough, Maine	**Boring No.:** BB-CUM-203 **Proj. No.:** 18-001

Driller:	New England Boring Contractors	**Elevation (ft.)**	65	**Core Barrel:**	NQ2
Operator:	Enos / Steen	**Datum:**	NAVD88	**Sampler:**	std. split-spoon
Logged By:	Schonewald	**Rig Type:**	Mobile Drill B-53 (rubber track)	**Hammer Wt./Fall:**	140 lbs/30 in (auto hammer)
Date Start/Finish:	2/21/18; 0915-2/22/18; 1440	**Drilling Method:**	cased wash boring	**Hammer Type:**	auto
Boring Location:	70+96, 5 ft LT	**Casing ID/OD:**	HW to 50 ft; NW to 93.5 ft	**Hammer Efficiency:**	0.677
		Auger ID/OD:	SSA to 2 ft	**Water Level*:**	2.0 ft (open)

IN-SITU SAMPLING AND TESTING:
D = Split Spoon Sample
MD = Unsuccessful Split Spoon Sample attempt
U = Thin Wall Tube Sample
MU = Unsuccessful Thin Wall Tube Sample attempt
V = Insitu Vane Shear Test
MV = Unsuccessful Insitu Vane Shear Test attempt

ADDITIONAL DEFINITIONS:
N-uncorrected = N value
N_{60} = N value corrected for hammer efficiency
hammer efficiency = calculated hammer efficiency
S_u = Insitu Field Vane Shear Strength (psf)
R = Rock Core Sample
RQD = Rock Quality Designation (%)

ADDITIONAL DEFINITIONS:
WOH = weight of 140lb. hammer
WOR = weight of rods
-- = not recorded
BOREHOLE ADVANCEMENT METHODS:
SSA/HSA=solid/hollow stem auger
RC=roller cone/OPEN/PUSH=hydraulic push

LABORATORY TEST RESULTS:
AASHTO / USCS soil classifications
-#200 = percent fines WC = water content (%)
CONSOL= 1-D consolidation test
UU=Unconsolidated undrained triaxial test
LL=Liquid Limit / PL=Plastic Limit / PI=Plasticity Index
UCT qp = peak compressive strength of rock

Depth (ft.)	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-uncorrected	N-60	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Lab. Testing Results
25	6D	24/22	25.0 - 27.0	1/12"-1-1	1	1	30			6D: Grey, v. loose, interbedded, fine SAND, little Silt; Silt, some fine Sand; and Silty CLAY, trace very fine Sand.	
							22				
							20				
							17				
							15				
30	7D V1	24/24	30.0 - 32.0 30.6 - 31.0	(WOR/12")-1-1 Su= 591 / 55 psf			20			7D: Grey, v. loose, interbedded, fine SAND, little Silt; Silt, some fine Sand; and Silty CLAY, trace very fine Sand. V1: Tu=21.5 / Tr=2 ft-lbs (65 mm x 130 mm vane)	
	MV						13			MV: Unable to push vane past 31.4 ft.	
							13				
							14				
	MV						17			MV: Unable to push vane at 35 ft.	
35	8D	24/22	35.0 - 37.0	WOR/12"-1-4	1	1	26			8D: Grey, v. loose, interbedded, fine SAND, little Silt; Silt, some fine Sand; and Silty CLAY, trace very fine Sand.	
							10				
							9				
							8				
	MV						12			MV: Unable to push vane at 40 ft.	
40	9D	24/22	40.0 - 42.0	WOR/18"-WOH	0	0	18			9D: Grey, v. soft, Silty CLAY, trace very fine Sand, with one 2-inch seam Silty fine SAND.	
							19				
							30				
							38				
	MV						32			MV: Unable to push vane at 45 ft.	
45	10D	24/24	45.0 - 47.0	WOH/24"	0	0	40			10D: Grey, v. soft, Silty CLAY, trace very fine Sand, with two 4-inch seams fine Sandy SILT in upper 12 inches of sample.	
							38	19.0		46.0	
							35				
							35				
50							37				

Remarks:

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SCHONEWALD ENGINEERING ASSOCIATES, INC.

PROJECT: Cummings Road Bridge over MeTPK

LOCATION: Scarborough, Maine

Boring No.: BB-CUM-203

Proj. No.: 18-001

Driller:	New England Boring Contractors	**Elevation (ft.)**	65	**Core Barrel:**	NQ2
Operator:	Enos / Steen	**Datum:**	NAVD88	**Sampler:**	std. split-spoon
Logged By:	Schonewald	**Rig Type:**	Mobile Drill B-53 (rubber track)	**Hammer Wt./Fall:**	140 lbs/30 in (auto hammer)
Date Start/Finish:	2/21/18; 0915-2/22/18; 1440	**Drilling Method:**	cased wash boring	**Hammer Type:**	auto
Boring Location:	70+96, 5 ft LT	**Casing ID/OD:**	HW to 50 ft; NW to 93.5 ft	**Hammer Efficiency:**	0.677
		Auger ID/OD:	SSA to 2 ft	**Water Level*:**	2.0 ft (open)

IN-SITU SAMPLING AND TESTING:
D = Split Spoon Sample
MD = Unsuccessful Split Spoon Sample attempt
U = Thin Wall Tube Sample
MU = Unsuccessful Thin Wall Tube Sample attempt
V = Insitu Vane Shear Test
MV = Unsuccessful Insitu Vane Shear Test attempt

ADDITIONAL DEFINITIONS:
N-uncorrected = N value
N_{60} = N value corrected for hammer efficiency
hammer efficiency = calculated hammer efficiency
S_u = Insitu Field Vane Shear Strength (psf)
R = Rock Core Sample
RQD = Rock Quality Designation (%)

ADDITIONAL DEFINITIONS:
WOH = weight of 140lb. hammer
WOR = weight of rods
-- = not recorded
BOREHOLE ADVANCEMENT METHODS:
SSA/HSA=solid/hollow stem auger
RC=roller cone/OPEN/PUSH=hydraulic push

LABORATORY TEST RESULTS:
AASHTO / USCS soil classifications
-#200 = percent fines WC = water content (%)
CONSOL= 1-D consolidation test
UU=Unconsolidated undrained triaxial test
LL=Liquid Limit / PL=Plastic Limit / PI=Plasticity Index
UCT qp = peak compressive strength of rock

Depth (ft.)	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-uncorrected	N-60	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Lab. Testing Results
50	11D V2	24/22	50.0 - 52.0 50.6 - 51.0	VANE INTERVAL Su= 522 / 27 psf			OPEN			11D: Dark grey with darker grey streaks, Silty CLAY, trace fine SAND, with occasional nodules. V2: Tu=19 / Tr=1 ft-lbs (65 mm x 130 mm vane)	
	V3		51.6 - 52.0	Su= 453 / 14 psf						V3: Tu=16.5 / Tr=0.5 ft-lbs (65 mm x 130 mm vane)	
55	12D V4	24/22	55.0 - 57.0 55.6 - 56.0	VANE INTERVAL Su= 549 / 27 psf						12D: Dark grey black, Silty CLAY, with nodules throughout. V4: Tu=20 / Tr=1 ft-lbs (65 mm x 130 mm vane)	
	V5		56.6 - 57.0	Su= 508 / 27 psf						V5: Tu=18.5 / Tr=1 ft-lbs (65 mm x 130 mm vane)	
60	13D V6	24/23	60.0 - 62.0 60.6 - 61.0	VANE INTERVAL Su= 591 / 27 psf						13D: Dark grey black, Silty CLAY, with nodules throughout. V6: Tu=21.5 / Tr=1 ft-lbs (65 mm x 130 mm vane)	
	V7		61.6 - 62.0	Su= 728 / 14 psf						V7: Tu=26.5 / Tr=0.5 ft-lbs (65 mm x 130 mm vane)	
65	14D V8	24/22	65.0 - 67.0 65.6 - 66.0	VANE INTERVAL Su= 783 / 27 psf						14D: Dark grey black, Silty CLAY, with shell fragments and nodules throughout. V8: Tu=28.5 / Tr=1 ft-lbs (65 mm x 130 mm vane)	
	V9		66.6 - 67.0	Su= 728 / 14 psf						V9: Tu=26.5 / Tr=0.5 ft-lbs (65 mm x 130 mm vane)	
70	15D V10	24/20	70.0 - 72.0 70.6 - 71.0	VANE INTERVAL Su= 797 / 41 psf						15D: Dark grey black, Silty CLAY, with nodules throughout. V10: Tu=29 / Tr=1.5 ft-lbs (65 mm x 130 mm vane)	
	V11		71.6 - 72.0	Su= 934 / 27 psf						V11: Tu=34 / Tr=1 ft-lbs (65 mm x 130 mm vane)	
75											

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.

SCHONEWALD ENGINEERING ASSOCIATES, INC.	PROJECT: Cummings Road Bridge over MeTPK LOCATION: Scarborough, Maine	Boring No.: BB-CUM-203 Proj. No.: 18-001

Driller:	New England Boring Contractors	**Elevation (ft.)**	65	**Core Barrel:**	NQ2
Operator:	Enos / Steen	**Datum:**	NAVD88	**Sampler:**	std. split-spoon
Logged By:	Schonewald	**Rig Type:**	Mobile Drill B-53 (rubber track)	**Hammer Wt./Fall:**	140 lbs/30 in (auto hammer)
Date Start/Finish:	2/21/18; 0915-2/22/18; 1440	**Drilling Method:**	cased wash boring	**Hammer Type:**	auto
Boring Location:	70+96, 5 ft LT	**Casing ID/OD:**	HW to 50 ft; NW to 93.5 ft	**Hammer Efficiency:**	0.677
		Auger ID/OD:	SSA to 2 ft	**Water Level*:**	2.0 ft (open)

IN-SITU SAMPLING AND TESTING:
D = Split Spoon Sample
MD = Unsuccessful Split Spoon Sample attempt
U = Thin Wall Tube Sample
MU = Unsuccessful Thin Wall Tube Sample attempt
V = Insitu Vane Shear Test
MV = Unsuccessful Insitu Vane Shear Test attempt

ADDITIONAL DEFINITIONS:
N-uncorrected = N value
N_{60} = N value corrected for hammer efficiency
hammer efficiency = calculated hammer efficiency
S_u = Insitu Field Vane Shear Strength (psf)
R = Rock Core Sample
RQD = Rock Quality Designation (%)

ADDITIONAL DEFINITIONS:
WOH = weight of 140lb. hammer
WOR = weight of rods
-- = not recorded
BOREHOLE ADVANCEMENT METHODS:
SSA/HSA=solid/hollow stem auger
RC=roller cone/OPEN/PUSH=hydraulic push

LABORATORY TEST RESULTS:
AASHTO / USCS soil classifications
-#200 = percent fines WC = water content (%)
CONSOL= 1-D consolidation test
UU=Unconsolidated undrained triaxial test
LL=Liquid Limit / PL=Plastic Limit / PI=Plasticity Index
UCT qp = peak compressive strength of rock

Depth (ft.)	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-uncorrected	N-60	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Lab. Testing Results
75	16D V12	24/20	75.0 - 77.0 75.6 - 76.0	VANE INTERVAL Su= 1,044/27psf						16D: Dark grey black, Silty CLAY, with nodules throughout; some hardening. V12: Tu=38 / Tr=1 ft-lbs (65 mm x 130 mm vane)	
	V13		76.6 - 77.0	Su= 907 / 27 psf						V13: Tu=33 / Tr=1 ft-lbs (65 mm x 130 mm vane)	
80	17D V14	24/24	80.0 - 82.0 80.6 - 81.0	VANE INTERVAL Su= 838 / 27 psf						17D: Dark grey black, Silty CLAY, with nodules throughout; many hardening. V14: Tu=30.5 / Tr=1 ft-lbs (65 mm x 130 mm vane)	
	V15		81.6 - 82.0	Su> 1,099/-psf						V15: Tu>40 / Tr=-- ft-lbs (65 mm x 130 mm vane)	
85	18D V16	24/21	85.0 - 87.0 85.6 - 86.0	VANE INTERVAL Su= 1,071/41psf						18D: Dark grey black, Silty CLAY, with nodules throughout and occasional concretions. V16: Tu=39 / Tr=1.5 ft-lbs (65 mm x 130 mm vane)	
	MV									MV: Unable to push vane beyond 86.7 ft.	
								-24.0		89.0 ft: Stratum change based on drilling behavior. 89.0	
90	19D	24/9	90.0 - 92.0	18-25-31-24	56	63				19D: Dark grey, v. dense, Silty GRAVEL, some Sand. TILL	
	R1	60/57	93.5 - 98.5	RQD: 36" = 60%				-28.4		93.4 ft: Possible top of rock based on drilling behavior. 93.4 R1: Hard, fresh to slightly weathered, aphanitic to fine grained, grey, interbedded PHYLLITE and METASANDSTONE, with thin bedding foliation (both moderately dipping, planar; and highly undulating) and calcsilicate veins (typically weathered). Typically moderately spaced and moderately dipping breaks, often along foliation; undulating, rough, typically fresh and open. Two drill breaks (95.2 and 97.4 ft.) Core times: 1:55/ 1:45/ 1:50/ 1:35/ 1:50 min:sec/ft. FAIR ROCK QUALITY	
95											
										Bottom of Exploration at 98.5 feet below ground surface.	
100											

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.

Schonewald Engineering Associates, Inc.	PROJECT: Cummings Road Bridge over MeTPK LOCATION: Scarborough, Maine	Boring No.: BB-CUM-204 (OW) Proj. No.: 18-001

Driller:	New England Boring Contractors	**Elevation (ft.)**	66.5	**Core Barrel:**	n/a
Operator:	Enos / Cotter	**Datum:**	NAVD88	**Sampler:**	std. split-spoon
Logged By:	Schonewald	**Rig Type:**	Mobile Drill B-53 (rubber track)	**Hammer Wt./Fall:**	140 lbs/30 in (auto hammer)
Date Start/Finish:	2/15/18; 1005-2/16/18; 1410	**Drilling Method:**	cased wash boring	**Hammer Type:**	auto
Boring Location:	74+15, 33 ft LT	**Casing ID/OD:**	HW to 49 ft	**Hammer Efficiency:**	0.677
		Auger ID/OD:	SSA to 5 ft	**Water Level*:**	3.0 ft (open)

IN-SITU SAMPLING AND TESTING:
D = Split Spoon Sample
MD = Unsuccessful Split Spoon Sample attempt
U = Thin Wall Tube Sample
MU = Unsuccessful Thin Wall Tube Sample attempt
V = Insitu Vane Shear Test
MV = Unsuccessful Insitu Vane Shear Test attempt

ADDITIONAL DEFINITIONS:
N-uncorrected = N value
N_{60} = N value corrected for hammer efficiency
hammer efficiency = calculated hammer efficiency
S_u = Insitu Field Vane Shear Strength (psf)
R = Rock Core Sample
RQD = Rock Quality Designation (%)

ADDITIONAL DEFINITIONS:
WOH = weight of 140lb. hammer
WOR = weight of rods
-- = not recorded

BOREHOLE ADVANCEMENT METHODS:
SSA/HSA=solid/hollow stem auger
RC=roller cone/OPEN/PUSH=hydraulic push

LABORATORY TEST RESULTS:
AASHTO / USCS soil classifications
-#200 = percent fines WC = water content (%)
CONSOL= 1-D consolidation test
UU=Unconsolidated undrained triaxial test
LL=Liquid Limit / PL=Plastic Limit / PI=Plasticity Index
UCT qp = peak compressive strength of rock

Depth (ft.)	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-uncorrected	N-60	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Lab. Testing Results
0							SSA				
	1D	24/15	2.0 - 4.0	5-4-8-9	12	14				Tan, moist, m. dense, fine to medium SAND, trace Silt; changing at 3.6 ft to: 1D: Dark red brown, wet, fine to coarse SAND, trace to little Silt.	
5	2D	24/16	5.0 - 7.0	1-6-8-6	14	16	SPIN			2D: Dark red brown, wet, m. dense, fine to coarse SAND, trace Silt, trace fine Gravel.	
	3D	24/7	9.0 - 11.0	1-2-1-3	3	3	35			3D: Red tan, v. loose, fine to medium SAND, trace fine Gravel, trace Silt.	
10							28				
							45				
							58	54.0		12.5	
							69				
	4D	24/17	14.0 - 16.0	1-1/12"-2	1	1	30			4D: Grey, v. loose, interbedded fine SAND, trace to little Silt; Silty very fine SAND; and SILT, little to some very fine Sand.	
15							35				
							35				
							60				
							48				
	5D	24/13	19.0 - 21.0	WOH-1-3-3	4	5	40			5D: Grey with two dark grey pockets, v. loose, fine SAND, trace to little Silt; organic odor.	
20							43				
							45				
							50				
							51				
25	6D	24/6	24.0 - 26.0	1-1-1-1	2	2	30			6D: Grey with two dark grey seams, v. loose, fine SAND, trace Silt; organic odor.	

Remarks:

Groundwater level observation well installed upon completion of test boring. Observation well:
2-inch dia. PVC; well screen 25 to 15 ft BGS; riser to 2.5 ft stick up.
Bentonite plug 48 to 38.8 ft BGS; Filter sand 38.8 to 4.0 ft BGS .
Locking protective casing set; stick up without cover 2.30 ft.

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.

Schonewald Engineering Associates, Inc.	PROJECT: Cummings Road Bridge over MeTPK LOCATION: Scarborough, Maine	Boring No.: BB-CUM-204 (OW) Proj. No.: 18-001

Driller:	New England Boring Contractors	**Elevation (ft.)**	66.5	**Core Barrel:**	n/a
Operator:	Enos / Cotter	**Datum:**	NAVD88	**Sampler:**	std. split-spoon
Logged By:	Schonewald	**Rig Type:**	Mobile Drill B-53 (rubber track)	**Hammer Wt./Fall:**	140 lbs/30 in (auto hammer)
Date Start/Finish:	2/15/18; 1005-2/16/18; 1410	**Drilling Method:**	cased wash boring	**Hammer Type:**	auto
Boring Location:	74+15, 33 ft LT	**Casing ID/OD:**	HW to 49 ft	**Hammer Efficiency:**	0.677
		Auger ID/OD:	SSA to 5 ft	**Water Level*:**	3.0 ft (open)

IN-SITU SAMPLING AND TESTING:
D = Split Spoon Sample
MD = Unsuccessful Split Spoon Sample attempt
U = Thin Wall Tube Sample
MU = Unsuccessful Thin Wall Tube Sample attempt
V = Insitu Vane Shear Test
MV = Unsuccessful Insitu Vane Shear Test attempt

ADDITIONAL DEFINITIONS:
N-uncorrected = N value
N_{60} = N value corrected for hammer efficiency
hammer efficiency = calculated hammer efficiency
S_u = Insitu Field Vane Shear Strength (psf)
R = Rock Core Sample
RQD = Rock Quality Designation (%)

ADDITIONAL DEFINITIONS:
WOH = weight of 140lb. hammer
WOR = weight of rods
-- = not recorded
BOREHOLE ADVANCEMENT METHODS:
SSA/HSA=solid/hollow stem auger
RC=roller cone/OPEN/PUSH=hydraulic push

LABORATORY TEST RESULTS:
AASHTO / USCS soil classifications
-#200 = percent fines WC = water content (%)
CONSOL= 1-D consolidation test
UU=Unconsolidated undrained triaxial test
LL=Liquid Limit / PL=Plastic Limit / PI=Plasticity Index
UCT qp = peak compressive strength of rock

Depth (ft.)	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-uncorrected	N-60	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Lab. Testing Results
25							46				
							48	40.5		26.0	
							49				
							56				
	7D	24/20	29.0 - 31.0	WOH-1/18"	1	1	54			7D: Grey, v. soft, interbedded, Silty CLAY, trace very fine Sand; and fine SAND, little to some Silt.	
30							60				
							50				
							52				
							43				
	8D	24/20	34.0 - 36.0	WOR/18"-WOH	0	0	30			8D: Grey, v. loose, interbedded, Silty fine SAND; Silty CLAY, trace to little fine Sand; and fine to medium SAND, little to some Silt.	
35							43				
							38				
							33				
							35				
	9D	24/22	39.0 - 41.0	WOH/24"	0	0	49			9D: Grey, v. soft, Silty CLAY, trace fine Sand, with two 2-inch seams fine SAND, some Silt.	
40							44				
							46	25.5		41.0	
							56				
							52				
	10D	24/21	44.0 - 46.0	WOR/18"-1	0	0	52			10D: Grey, v. soft, Silty CLAY, trace fine Sand, with occasional seams and partings fine Sandy SILT.	
45							36				
							38				
							33				
							39				
50							open				

Remarks:

Groundwater level observation well installed upon completion of test boring. Observation well:
2-inch dia. PVC; well screen 25 to 15 ft BGS; riser to 2.5 ft stick up.
Bentonite plug 48 to 38.8 ft BGS; Filter sand 38.8 to 4.0 ft BGS .
Locking protective casing set; stick up without cover 2.30 ft.

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.

SCHONEWALD ENGINEERING ASSOCIATES, INC.

PROJECT: Cummings Road Bridge over MeTPK

LOCATION: Scarborough, Maine

Boring No.: BB-CUM-204 (OW)

Proj. No.: 18-001

Driller:	New England Boring Contractors	**Elevation (ft.)**	66.5	**Core Barrel:**	n/a
Operator:	Enos / Cotter	**Datum:**	NAVD88	**Sampler:**	std. split-spoon
Logged By:	Schonewald	**Rig Type:**	Mobile Drill B-53 (rubber track)	**Hammer Wt./Fall:**	140 lbs/30 in (auto hammer)
Date Start/Finish:	2/15/18; 1005-2/16/18; 1410	**Drilling Method:**	cased wash boring	**Hammer Type:**	auto
Boring Location:	74+15, 33 ft LT	**Casing ID/OD:**	HW to 49 ft	**Hammer Efficiency:**	0.677
		Auger ID/OD:	SSA to 5 ft	**Water Level*:**	3.0 ft (open)

IN-SITU SAMPLING AND TESTING:
D = Split Spoon Sample
MD = Unsuccessful Split Spoon Sample attempt
U = Thin Wall Tube Sample
MU = Unsuccessful Thin Wall Tube Sample attempt
V = Insitu Vane Shear Test
MV = Unsuccessful Insitu Vane Shear Test attempt

ADDITIONAL DEFINITIONS:
N-uncorrected = N value
N_{60} = N value corrected for hammer efficiency
hammer efficiency = calculated hammer efficiency
S_u = Insitu Field Vane Shear Strength (psf)
R = Rock Core Sample
RQD = Rock Quality Designation (%)

ADDITIONAL DEFINITIONS:
WOH = weight of 140lb. hammer
WOR = weight of rods
-- = not recorded

BOREHOLE ADVANCEMENT METHODS:
SSA/HSA=solid/hollow stem auger
RC=roller cone/OPEN/PUSH=hydraulic push

LABORATORY TEST RESULTS:
AASHTO / USCS soil classifications
-#200 = percent fines WC = water content (%)
CONSOL= 1-D consolidation test
UU=Unconsolidated undrained triaxial test
LL=Liquid Limit / PL=Plastic Limit / PI=Plasticity Index
UCT qp = peak compressive strength of rock

Depth (ft.)	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-uncorrected	N-60	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Lab. Testing Results
50	11D V1	24/21	50.0 - 52.0 50.6 - 51.0	VANE INTERVAL Su= 426 / 14 psf	--					11D: Dark grey with darker grey streaks, Silty CLAY, trace fine SAND. V1: Tu=15.5 / Tr=0.5 ft-lbs (65 mm x 130 mm vane)	WC=40.3% LL=40.5 PL=22.3 PI=18.2
	V2		51.6 - 52.0	Su= 440 / 14 psf						V2: Tu=16 / Tr=0.5 ft-lbs (65 mm x 130 mm vane)	
55	U1	24/24	55.0 - 57.0	HYD PUSH						U1: Dark grey black, Silty CLAY.	CONSOL (Cv, Cα) WC=38.0% LL=41.4 PL=21.1 PI=20.3
60	12D V3	24/21	60.0 - 62.0 60.6 - 61.0	VANE INTERVAL Su= 646 / 14 psf						12D: Dark grey black, Silty CLAY, with nodules throughout. V3: Tu=23.5 / Tr=0.5 ft-lbs (65 mm x 130 mm vane)	WC=47.1% LL=49.8 PL=24.3 PI=25.5
	V4		61.6 - 62.0	Su= 577 / 14 psf						V4: Tu=21 / Tr=0.5 ft-lbs (65 mm x 130 mm vane)	
65	U2	24/24	65.0 - 67.0	HYD PUSH						U2: Dark grey black, Silty CLAY.	
70	13D V5	24/22	70.0 - 72.0 70.6 - 71.0	VANE INTERVAL Su= 687 / 41 psf						13D: Dark grey black, Silty CLAY, with large nodules throughout. V5: Tu=25 / Tr=1.5 ft-lbs (65 mm x 130 mm vane)	
	V6		71.6 - 72.0	Su= 879 / 27 psf						V6: Tu=32 / Tr=1 ft-lbs (65 mm x 130 mm vane)	
75											

Remarks:

Groundwater level observation well installed upon completion of test boring. Observation well:
2-inch dia. PVC; well screen 25 to 15 ft BGS; riser to 2.5 ft stick up.
Bentonite plug 48 to 38.8 ft BGS; Filter sand 38.8 to 4.0 ft BGS .
Locking protective casing set; stick up without cover 2.30 ft.

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.

Page 3 of 4

Boring No.: BB-CUM-204 (OW)

SCHONEWALD ENGINEERING ASSOCIATES, INC.	**PROJECT:** Cummings Road Bridge over MeTPK	**Boring No.:** BB-CUM-204 (OW)
	LOCATION: Scarborough, Maine	**Proj. No.:** 18-001

Driller:	New England Boring Contractors	**Elevation (ft.)**	66.5	**Core Barrel:**	n/a
Operator:	Enos / Cotter	**Datum:**	NAVD88	**Sampler:**	std. split-spoon
Logged By:	Schonewald	**Rig Type:**	Mobile Drill B-53 (rubber track)	**Hammer Wt./Fall:**	140 lbs/30 in (auto hammer)
Date Start/Finish:	2/15/18; 1005-2/16/18; 1410	**Drilling Method:**	cased wash boring	**Hammer Type:**	auto
Boring Location:	74+15, 33 ft LT	**Casing ID/OD:**	HW to 49 ft	**Hammer Efficiency:**	0.677
		Auger ID/OD:	SSA to 5 ft	**Water Level*:**	3.0 ft (open)

IN-SITU SAMPLING AND TESTING:
D = Split Spoon Sample
MD = Unsuccessful Split Spoon Sample attempt
U = Thin Wall Tube Sample
MU = Unsuccessful Thin Wall Tube Sample attempt
V = Insitu Vane Shear Test
MV = Unsuccessful Insitu Vane Shear Test attempt

ADDITIONAL DEFINITIONS:
N-uncorrected = N value
N_{60} = N value corrected for hammer efficiency
hammer efficiency = calculated hammer efficiency
S_u = Insitu Field Vane Shear Strength (psf)
R = Rock Core Sample
RQD = Rock Quality Designation (%)

ADDITIONAL DEFINITIONS:
WOH = weight of 140lb. hammer
WOR = weight of rods
-- = not recorded
BOREHOLE ADVANCEMENT METHODS:
SSA/HSA=solid/hollow stem auger
RC=roller cone/OPEN/PUSH=hydraulic push

LABORATORY TEST RESULTS:
AASHTO / USCS soil classifications
-#200 = percent fines WC = water content (%)
CONSOL= 1-D consolidation test
UU=Unconsolidated undrained triaxial test
LL=Liquid Limit / PL=Plastic Limit / PI=Plasticity Index
UCT qp = peak compressive strength of rock

Depth (ft.)	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-uncorrected	N-60	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Lab. Testing Results
75	U3	24/24	75.0 - 77.0	HYD PUSH						U3: Dark grey, Silty CLAY.	CONSOL (Cv, Cα) WC=40.0% LL=40.0 PL=23.4 PI=16.6
80	14D V7	24/24	80.0 - 82.0 80.6 - 81.0	VANE INTERVAL Su= 879 / 27 psf						14D: Dark grey black, Silty CLAY, with few concretions and nodules throughout. V7: Tu=32 / Tr=1 ft-lbs (65 mm x 130 mm vane)	
	V8		81.6 - 82.0	Su= 714 / 55 psf						V8: Tu=26 / Tr=2 ft-lbs (65 mm x 130 mm vane)	
85	U4	24/23	85.0 - 87.0	HYD PUSH						U4: Dark grey black, Silty CLAY.	
								-21.5		88.0 88.0 ft: Possible top of weathered rock based on drilling behavior. 88.4 ft: Possible top of rock based on drilling behavior.	
90								-23.5		90.0 **Bottom of Exploration at 90.0 feet below ground surface.** Roller cone refusal.	
95											
100											

Remarks:

Groundwater level observation well installed upon completion of test boring. Observation well:
2-inch dia. PVC; well screen 25 to 15 ft BGS; riser to 2.5 ft stick up.
Bentonite plug 48 to 38.8 ft BGS; Filter sand 38.8 to 4.0 ft BGS .
Locking protective casing set; stick up without cover 2.30 ft.

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.

SCHONEWALD ENGINEERING ASSOCIATES, INC.

PROJECT: Cummings Road Bridge over MeTPK

LOCATION: Scarborough, Maine

Boring No.: BB-CUM-205

Proj. No.: 18-001

Driller:	New England Boring Contractors	**Elevation (ft.)**	65.5	**Core Barrel:**	n/a
Operator:	Enos / Royal / Cotter	**Datum:**	NAVD88	**Sampler:**	std. split-spoon
Logged By:	Schonewald	**Rig Type:**	Mobile Drill B-53 (rubber track)	**Hammer Wt./Fall:**	140 lbs/30 in (auto hammer)
Date Start/Finish:	2/12/18; 1205-2/15/18; 0950	**Drilling Method:**	cased wash boring	**Hammer Type:**	auto
Boring Location:	76+00, 35 ft LT	**Casing ID/OD:**	HW to 49 ft	**Hammer Efficiency:**	0.677
		Auger ID/OD:	SSA to 4 ft	**Water Level*:**	2.0 ft (open)

IN-SITU SAMPLING AND TESTING:
D = Split Spoon Sample
MD = Unsuccessful Split Spoon Sample attempt
U = Thin Wall Tube Sample
MU = Unsuccessful Thin Wall Tube Sample attempt
V = Insitu Vane Shear Test
MV = Unsuccessful Insitu Vane Shear Test attempt

ADDITIONAL DEFINITIONS:
N-uncorrected = N value
N_{60} = N value corrected for hammer efficiency
hammer efficiency = calculated hammer efficiency
S_u = Insitu Field Vane Shear Strength (psf)
R = Rock Core Sample
RQD = Rock Quality Designation (%)

ADDITIONAL DEFINITIONS:
WOH = weight of 140lb. hammer
WOR = weight of rods
-- = not recorded

BOREHOLE ADVANCEMENT METHODS:
SSA/HSA=solid/hollow stem auger
RC=roller cone/OPEN/PUSH=hydraulic push

LABORATORY TEST RESULTS:
AASHTO / USCS soil classifications
-#200 = percent fines WC = water content (%)
CONSOL= 1-D consolidation test
UU=Unconsolidated undrained triaxial test
LL=Liquid Limit / PL=Plastic Limit / PI=Plasticity Index
UCT qp = peak compressive strength of rock

Depth (ft.)	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-uncorrected	N-60	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Lab. Testing Results
0							SSA				
	1D	24/20	2.0 - 4.0	2-2-3-5	5	6				1D: Red brown, wet, loose, fine to coarse SAND, trace fine Gravel, trace Silt.	
5	2D	24/17	4.0 - 6.0	3-5-4-4	9	10				2D: Red brown, wet, loose, fine to coarse SAND, trace to little Silt, trace fine Sand.	
10	3D	24/2	9.0 - 11.0	1-1-2-1	3	3	10			3D: Light brown, v. loose, fine to coarse SAND, little to some fine Gravel, trace Silt.	
							15				
							23				
							28				
							45				
15	4D	24/7	14.0 - 16.0	WOH-1-2-2	3	3	17			4D: Light brown, v. loose, fine to coarse SAND, trace fine Gravel, trace Silt; changing at 15.8 ft to:	
							24	49.7		15.8 Grey tan, very fine Sandy SILT.	
							49				
							59				
							76				
20	5D	24/7	19.0 - 21.0	WOH-1-2-2	3	3	39			5D: Grey tan, v. loose, fine to medium SAND, trace Silt.	
							44				
							70				
							83				
							80				
25	6D	24/7	24.0 - 26.0	WOH-2-3-3	5	6	42			6D: Grey, loose, interbedded, fine to medium SAND, trace to little Silt; and Silty fine to medium 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.

SCHONEWALD ENGINEERING ASSOCIATES, INC.	PROJECT: Cummings Road Bridge over MeTPK	Boring No.: BB-CUM-205
	LOCATION: Scarborough, Maine	Proj. No.: 18-001

Driller:	New England Boring Contractors	**Elevation (ft.)**	65.5	**Core Barrel:**	n/a
Operator:	Enos / Royal / Cotter	**Datum:**	NAVD88	**Sampler:**	std. split-spoon
Logged By:	Schonewald	**Rig Type:**	Mobile Drill B-53 (rubber track)	**Hammer Wt./Fall:**	140 lbs/30 in (auto hammer)
Date Start/Finish:	2/12/18; 1205-2/15/18; 0950	**Drilling Method:**	cased wash boring	**Hammer Type:**	auto
Boring Location:	76+00, 35 ft LT	**Casing ID/OD:**	HW to 49 ft	**Hammer Efficiency:**	0.677
		Auger ID/OD:	SSA to 4 ft	**Water Level*:**	2.0 ft (open)

IN-SITU SAMPLING AND TESTING:
D = Split Spoon Sample
MD = Unsuccessful Split Spoon Sample attempt
U = Thin Wall Tube Sample
MU = Unsuccessful Thin Wall Tube Sample attempt
V = Insitu Vane Shear Test
MV = Unsuccessful Insitu Vane Shear Test attempt

ADDITIONAL DEFINITIONS:
N-uncorrected = N value
N_{60} = N value corrected for hammer efficiency
hammer efficiency = calculated hammer efficiency
S_u = Insitu Field Vane Shear Strength (psf)
R = Rock Core Sample
RQD = Rock Quality Designation (%)

ADDITIONAL DEFINITIONS:
WOH = weight of 140lb. hammer
WOR = weight of rods
-- = not recorded

BOREHOLE ADVANCEMENT METHODS:
SSA/HSA=solid/hollow stem auger
RC=roller cone/OPEN/PUSH=hydraulic push

LABORATORY TEST RESULTS:
AASHTO / USCS soil classifications
-#200 = percent fines WC = water content (%)
CONSOL= 1-D consolidation test
UU=Unconsolidated undrained triaxial test
LL=Liquid Limit / PL=Plastic Limit / PI=Plasticity Index
UCT qp = peak compressive strength of rock

Depth (ft.)	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-uncorrected	N-60	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Lab. Testing Results
25							45				
							55				
							62				
							78				
	7D	24/24	29.0 - 31.0	WOH-2-3-2	5	6	60			7D: Grey, loose, interbedded, fine to medium SAND, trace to little Silt; and Silty CLAY, little very fine Sand.	
30							66				
							61				
							61				
							54				
	8D	24/24	34.0 - 36.0	WOH/24"	0	0	63			8D: Grey, v. loose, interbedded, Silty fine to medium SAND; Silty CLAY, trace fine Sand; and fine to medium SAND, little Silt.	
35							60				
							48				
							43				
							38				
	9D	24/21	39.0 - 41.0	1-2-2-1	4	5	38			9D: Grey, v. loose, interbedded, fine to medium SAND, trace to little Silt; Silty CLAY, trace fine Sand; and Silty fine to medium SAND.	
40							33				
							28				
							30	23.0		42.5	
							31				
	10D	24/21	44.0 - 46.0	WOR/24"	0	0	29			10D: Grey, v. soft, Silty CLAY, trace fine Sand.	
45							23				
							24				
							25				
							23				
50	11D V1	24/22	49.0 - 51.0 49.6 - 50.0	VANE INTERVAL Su= 549 / 41 psf	--		open			11D: Grey with occasional black streaks, Silty CLAY, trace fine to medium SAND as partings and lenses.	WC=37.9% LL=35.1

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.

SCHONEWALD ENGINEERING ASSOCIATES, INC.	PROJECT: Cummings Road Bridge over MeTPK LOCATION: Scarborough, Maine	Boring No.: BB-CUM-205 Proj. No.: 18-001

Driller:	New England Boring Contractors	**Elevation (ft.)**	65.5	**Core Barrel:**	n/a
Operator:	Enos / Royal / Cotter	**Datum:**	NAVD88	**Sampler:**	std. split-spoon
Logged By:	Schonewald	**Rig Type:**	Mobile Drill B-53 (rubber track)	**Hammer Wt./Fall:**	140 lbs/30 in (auto hammer)
Date Start/Finish:	2/12/18; 1205-2/15/18; 0950	**Drilling Method:**	cased wash boring	**Hammer Type:**	auto
Boring Location:	76+00, 35 ft LT	**Casing ID/OD:**	HW to 49 ft	**Hammer Efficiency:**	0.677
		Auger ID/OD:	SSA to 4 ft	**Water Level*:**	2.0 ft (open)

IN-SITU SAMPLING AND TESTING:
D = Split Spoon Sample
MD = Unsuccessful Split Spoon Sample attempt
U = Thin Wall Tube Sample
MU = Unsuccessful Thin Wall Tube Sample attempt
V = Insitu Vane Shear Test
MV = Unsuccessful Insitu Vane Shear Test attempt

ADDITIONAL DEFINITIONS:
N-uncorrected = N value
N_{60} = N value corrected for hammer efficiency
hammer efficiency = calculated hammer efficiency
S_u = Insitu Field Vane Shear Strength (psf)
R = Rock Core Sample
RQD = Rock Quality Designation (%)

ADDITIONAL DEFINITIONS:
WOH = weight of 140lb. hammer
WOR = weight of rods
-- = not recorded
BOREHOLE ADVANCEMENT METHODS:
SSA/HSA=solid/hollow stem auger
RC=roller cone/OPEN/PUSH=hydraulic push

LABORATORY TEST RESULTS:
AASHTO / USCS soil classifications
-#200 = percent fines WC = water content (%)
CONSOL= 1-D consolidation test
UU=Unconsolidated undrained triaxial test
LL=Liquid Limit / PL=Plastic Limit / PI=Plasticity Index
UCT qp = peak compressive strength of rock

Depth (ft.)	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-uncorrected	N-60	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Lab. Testing Results
50	V2		50.6 - 51.0	Su= 440 / 27 psf						V1: Tu=20 / Tr=1.5 ft-lbs (65 mm x 130 mm vane) V2: Tu=16 / Tr=1 ft-lbs (65 mm x 130 mm vane)	PL=20.5 PI=14.6
55	12D V3	24/22	55.0 - 57.0 55.6 - 56.0	VANE INTERVAL Su= 508 / 27 psf						12D: Dark grey with occasional black streaks, Silty CLAY, trace very fine SAND, with small nodules throughout. V3: Tu=18.5 / Tr=1 ft-lbs (65 mm x 130 mm vane)	
	V4		56.6 - 57.0	Su= 494 / 14 psf						V4: Tu=18 / Tr=0.5 ft-lbs (65 mm x 130 mm vane)	
60	U1	24/24	60.0 - 62.0	HYD PUSH						U1: Dark grey black, Silty CLAY, trace very fine Sand. Bottom of tube crimped and side gouged up to 61.3 ft; appears to have pushed against a drop stone.	CONSOL (Cv) WC=49.2% LL=42.1 PL=23.1 PI=19.0
65	13D V5	24/24	65.0 - 67.0 65.6 - 66.0	VANE INTERVAL Su= 522 / 27 psf						13D: Dark grey black, Silty CLAY, trace very fine Sand; nodules throughout. Changing at 66.5 ft. to grey, Silty CLAY. V5: Tu=19 / Tr=1 ft-lbs (65 mm x 130 mm vane)	WC=39.3% LL=38.9 PL=21.1 PI=17.8
	V6		66.6 - 67.0	Su= 618 / 14 psf						V6: Tu=22.5 / Tr=0.5 ft-lbs (65 mm x 130 mm vane)	
70	U2	24/24	70.0 - 72.0	HYD PUSH						U2: Dark grey, Silty CLAY.	CONSOL (Cv) WC=43.0% LL=47.5 PL=22.8 PI=24.7
75											

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.

SCHONEWALD ENGINEERING ASSOCIATES, INC.	**PROJECT:** Cummings Road Bridge over MeTPK **LOCATION:** Scarborough, Maine	**Boring No.:** BB-CUM-205 **Proj. No.:** 18-001

Driller:	New England Boring Contractors	**Elevation (ft.)**	65.5	**Core Barrel:**	n/a
Operator:	Enos / Royal / Cotter	**Datum:**	NAVD88	**Sampler:**	std. split-spoon
Logged By:	Schonewald	**Rig Type:**	Mobile Drill B-53 (rubber track)	**Hammer Wt./Fall:**	140 lbs/30 in (auto hammer)
Date Start/Finish:	2/12/18; 1205-2/15/18; 0950	**Drilling Method:**	cased wash boring	**Hammer Type:**	auto
Boring Location:	76+00, 35 ft LT	**Casing ID/OD:**	HW to 49 ft	**Hammer Efficiency:**	0.677
		Auger ID/OD:	SSA to 4 ft	**Water Level*:**	2.0 ft (open)

IN-SITU SAMPLING AND TESTING:
D = Split Spoon Sample
MD = Unsuccessful Split Spoon Sample attempt
U = Thin Wall Tube Sample
MU = Unsuccessful Thin Wall Tube Sample attempt
V = Insitu Vane Shear Test
MV = Unsuccessful Insitu Vane Shear Test attempt

ADDITIONAL DEFINITIONS:
N-uncorrected = N value
N_{60} = N value corrected for hammer efficiency
hammer efficiency = calculated hammer efficiency
S_u = Insitu Field Vane Shear Strength (psf)
R = Rock Core Sample
RQD = Rock Quality Designation (%)

ADDITIONAL DEFINITIONS:
WOH = weight of 140lb. hammer
WOR = weight of rods
-- = not recorded

BOREHOLE ADVANCEMENT METHODS:
SSA/HSA=solid/hollow stem auger
RC=roller cone/OPEN/PUSH=hydraulic push

LABORATORY TEST RESULTS:
AASHTO / USCS soil classifications
-#200 = percent fines WC = water content (%)
CONSOL= 1-D consolidation test
UU=Unconsolidated undrained triaxial test
LL=Liquid Limit / PL=Plastic Limit / PI=Plasticity Index
UCT qp = peak compressive strength of rock

Depth (ft.)	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-uncorrected	N-60	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Lab. Testing Results
75	14D V7	24/24	75.0 - 77.0 75.6 - 76.0	VANE INTERVAL Su= 810 / 27 psf						14D: Dark grey, Silty CLAY, with nodules throughout. V7: Tu=29.5 / Tr=1 ft-lbs (65 mm x 130 mm vane)	
	V8		76.6 - 77.0	Su= 907 / 27 psf						V8: Tu=33 / Tr=1 ft-lbs (65 mm x 130 mm vane)	
80	U3	24/24	80.0 - 82.0	HYD PUSH						U3: Dark grey, Silty CLAY.	
85	15D V9	24/24	85.0 - 87.0 85.6 - 86.0	VANE INTERVAL Su= 810 / 41 psf						15D: Dark grey with occasional black streaks, Silty CLAY, trace very fine Sand, with nodules throughout and two concretions. V9: Tu=29.5 / Tr=1.5 ft-lbs (65 mm x 130 mm vane)	
	MV									MV: Unable to push past 86.5 ft.	
90	MU	24/--	90.0 - 92.0	HYD PUSH						MU: Sampler slipped when brought to surface; dropped 90 ft; sampler and tube retrieved, but tube discarded; sample field extruded and jarred: Dark grey, Silty CLAY, with one significant Sandy SILT seam at 90.6 ft and two concretions below seam.	
95	U4	24/24	95.0 - 97.0	HYD PUSH						U4: Dark grey, Silty CLAY.	
								-33.0		98.5 98.5 ft: Possible top of weathered rock based on drilling behavior. 99.0 ft: Possible top of rock based on drilling behavior.	
100											

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.

SCHONEWALD ENGINEERING ASSOCIATES, INC.	PROJECT: Cummings Road Bridge over MeTPK LOCATION: Scarborough, Maine	Boring No.: BB-CUM-205 Proj. No.: 18-001

Driller:	New England Boring Contractors	**Elevation (ft.)**	65.5	**Core Barrel:**	n/a
Operator:	Enos / Royal / Cotter	**Datum:**	NAVD88	**Sampler:**	std. split-spoon
Logged By:	Schonewald	**Rig Type:**	Mobile Drill B-53 (rubber track)	**Hammer Wt./Fall:**	140 lbs/30 in (auto hammer)
Date Start/Finish:	2/12/18; 1205-2/15/18; 0950	**Drilling Method:**	cased wash boring	**Hammer Type:**	auto
Boring Location:	76+00, 35 ft LT	**Casing ID/OD:**	HW to 49 ft	**Hammer Efficiency:**	0.677
		Auger ID/OD:	SSA to 4 ft	**Water Level*:**	2.0 ft (open)

IN-SITU SAMPLING AND TESTING:
D = Split Spoon Sample
MD = Unsuccessful Split Spoon Sample attempt
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V = Insitu Vane Shear Test
MV = Unsuccessful Insitu Vane Shear Test attempt

ADDITIONAL DEFINITIONS:
N-uncorrected = N value
N_{60} = N value corrected for hammer efficiency
hammer efficiency = calculated hammer efficiency
S_u = Insitu Field Vane Shear Strength (psf)
R = Rock Core Sample
RQD = Rock Quality Designation (%)

ADDITIONAL DEFINITIONS:
WOH = weight of 140lb. hammer
WOR = weight of rods
-- = not recorded

BOREHOLE ADVANCEMENT METHODS:
SSA/HSA=solid/hollow stem auger
RC=roller cone/OPEN/PUSH=hydraulic push

LABORATORY TEST RESULTS:
AASHTO / USCS soil classifications
-#200 = percent fines WC = water content (%)
CONSOL= 1-D consolidation test
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LL=Liquid Limit / PL=Plastic Limit / PI=Plasticity Index
UCT qp = peak compressive strength of rock

Depth (ft.)	Sample Information: Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-uncorrected	N-60	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Lab. Testing Results
100								-34.5		100.0 **Bottom of Exploration at 100.0 feet below ground surface.** **Bottom of Exploration at 100.0 feet below ground surface.** Roller cone refusal.	
105											
110											
115											
120											
125											

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.

**PHOTOGRAPHS OF ROCK CORE OBTAINED IN
200-SERIES SUBSURFACE EXPLORATIONS**

Photo 1: Core box containing rock core from test borings BB-CUM-202 & -203 left side of core box (top portion of cores).
Slots from top to bottom:
1) BB-CUM-202, R1;
2) Empty;
3) BB-CUM-203, R1;
4) Empty.

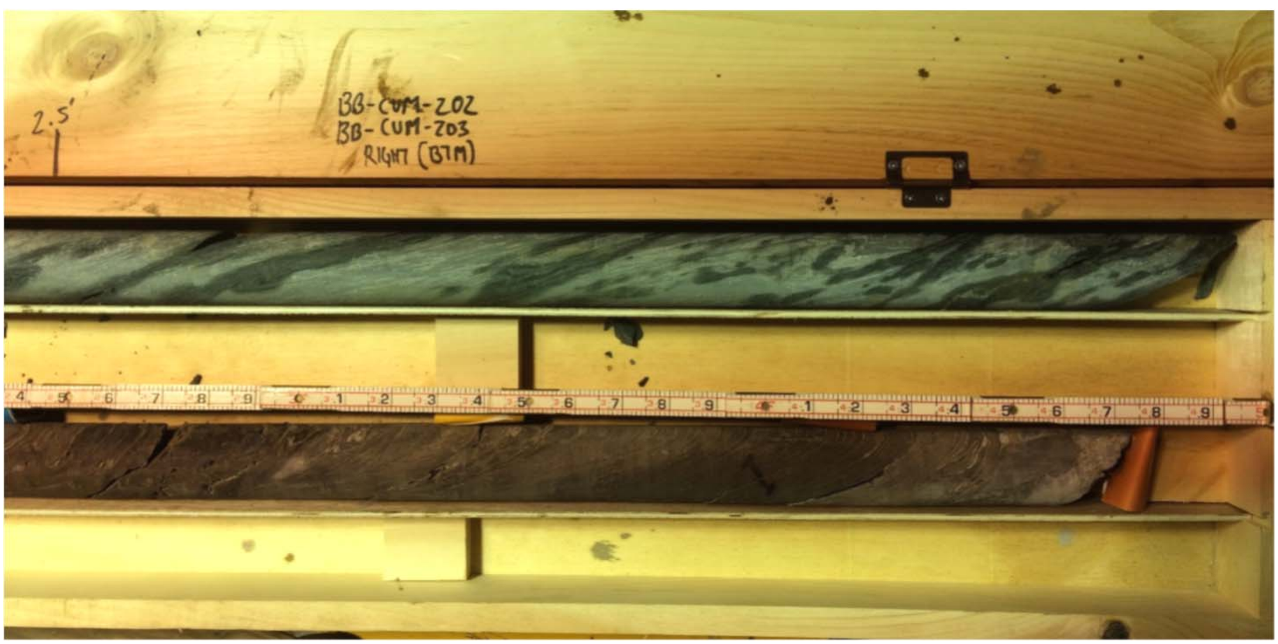


Photo 2: Core box containing rock core from test borings BB-CUM-202 & -203 – right side of core box (bottom portion of cores).
Slots from top to bottom:
1) BB-CUM-202, R1;
2) Empty;
3) BB-CUM-203, R1;
4) Empty.

SCHONEWALD ENGINEERING ASSOCIATES, INC.

ROCK CORE PHOTOGRAPHS
TEST BORINGS BB-CUM-202 AND -203
BRIDGE REPLACEMENT
CUMMINGS ROAD OVER MAINE TURNPIKE
SCARBOROUGH, MAINE

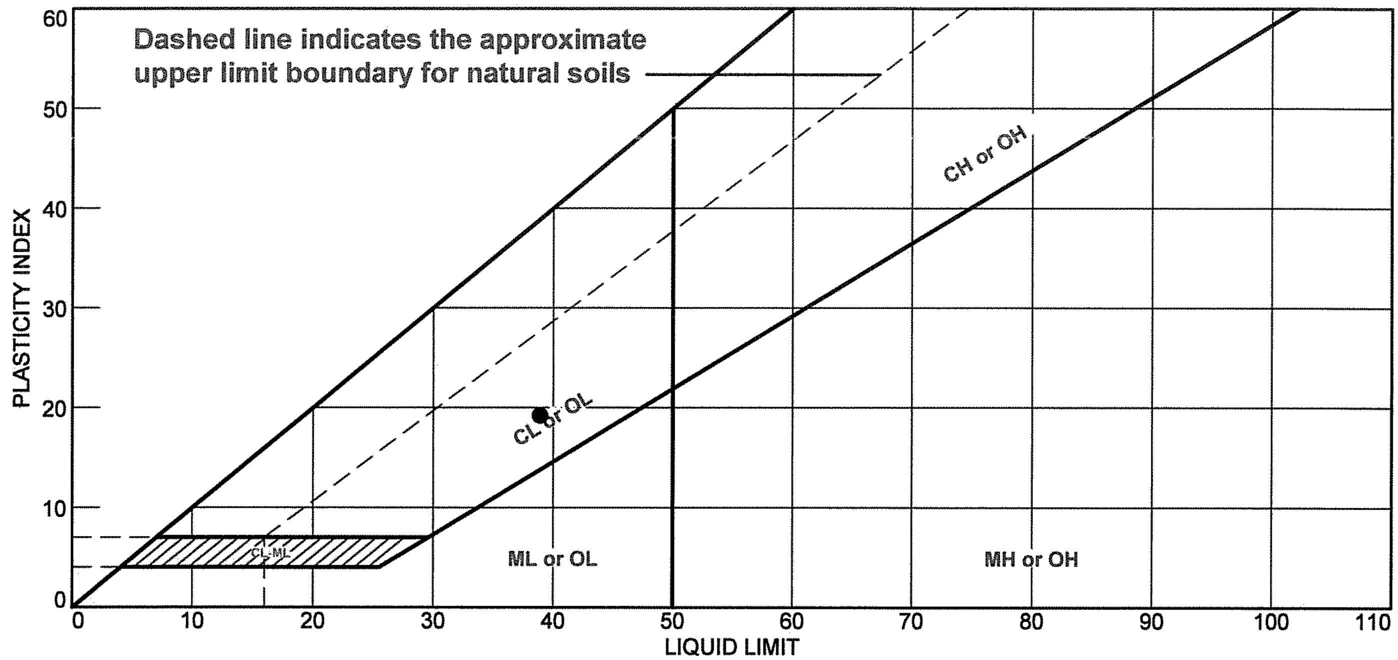
Sheet No.:

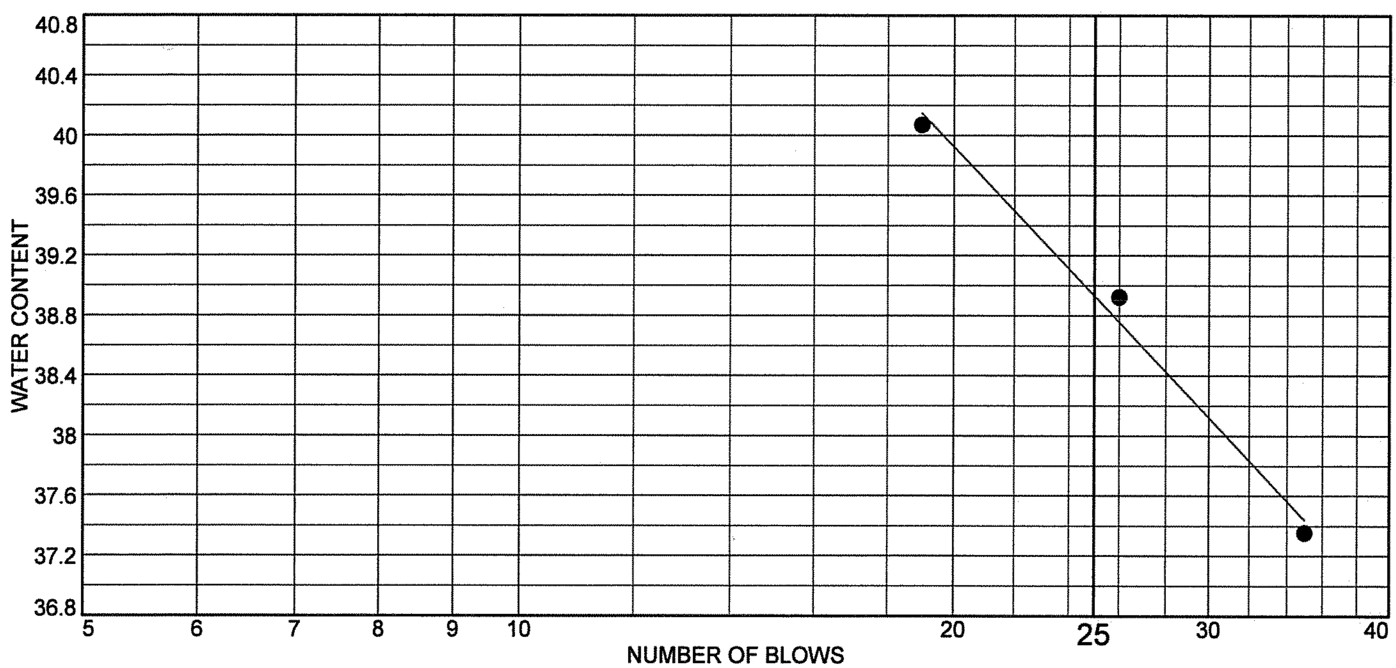
1 of 1

SCHONEWALD ENGINEERING ASSOCIATES, INC.
■ www.SchonewaldEngineering.com ■

RWG&A: RESULTS OF SOILS LABORATORY TESTS ON UNDISTURBED TUBE AND SOIL JAR SAMPLES

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●		38.9	19.7	19.2			

Project No. 1368-010 **Client:** Schonewald Engineering Associates, Inc.

Project: Cummings Road Over Maine Turnpike #18-001

Scarborough, ME

Location: HB-CUM-201

Sample Number: 6-D **Depth:** 25'-27'

R.W. Gillespie & Associates, Inc.

Saco, Maine

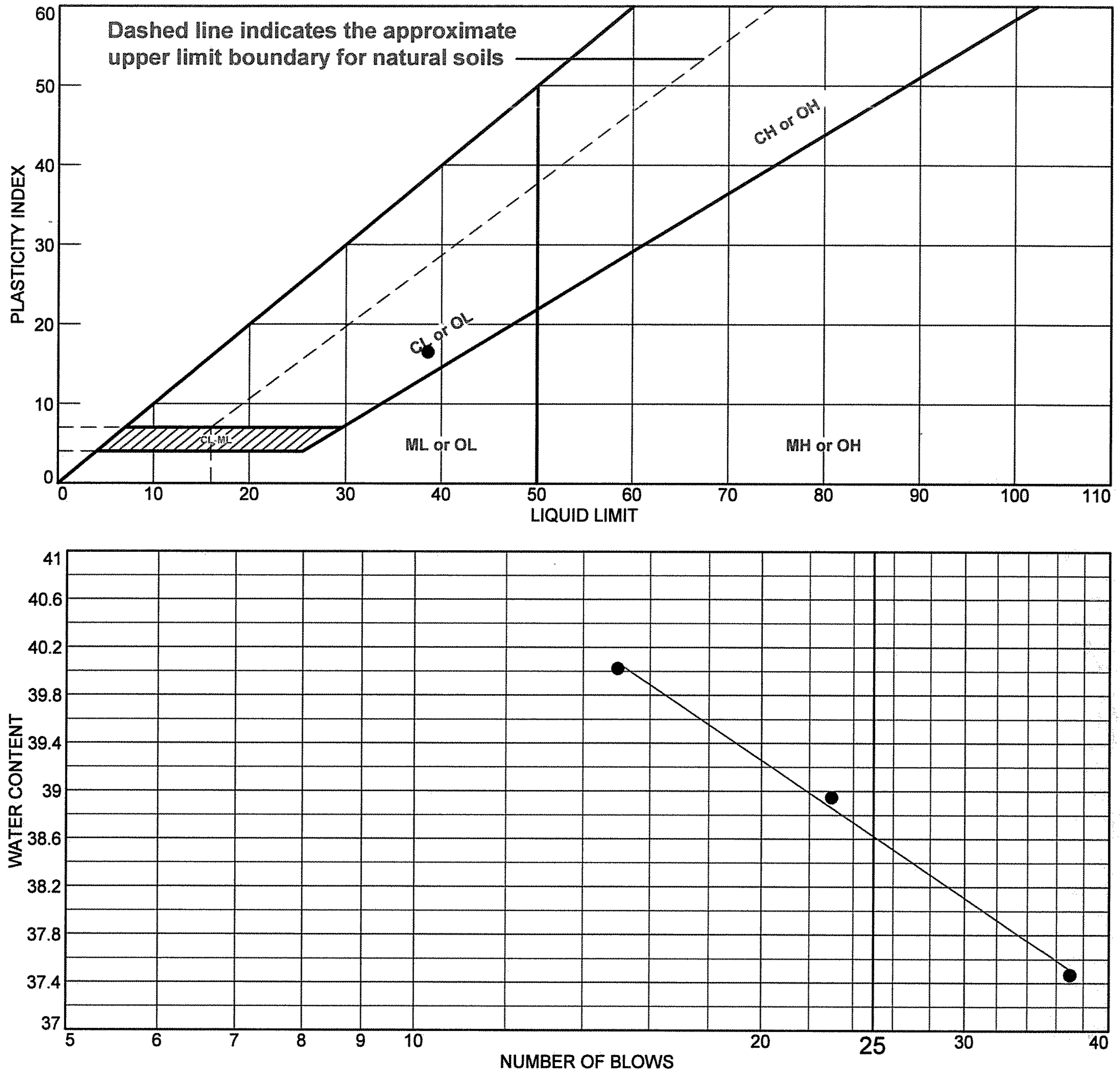
Remarks:

● Natural Moisture: 39.9%

Lab No. 14889a

Tested By: JRF **Checked By:** MTG MTG

LIQUID AND PLASTIC LIMITS TEST REPORT



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●		38.6	22.1	16.5			

Project No. 1368-010 **Client:** Schonewald Engineering Associates, Inc.

Project: Cummings Road Over Maine Turnpike #18-001

Scarborough, ME

Location: HB-CUM-201a

Sample Number: 3-D **Depth:** 20'-22'

R.W. Gillespie & Associates, Inc.

Saco, Maine

Remarks:

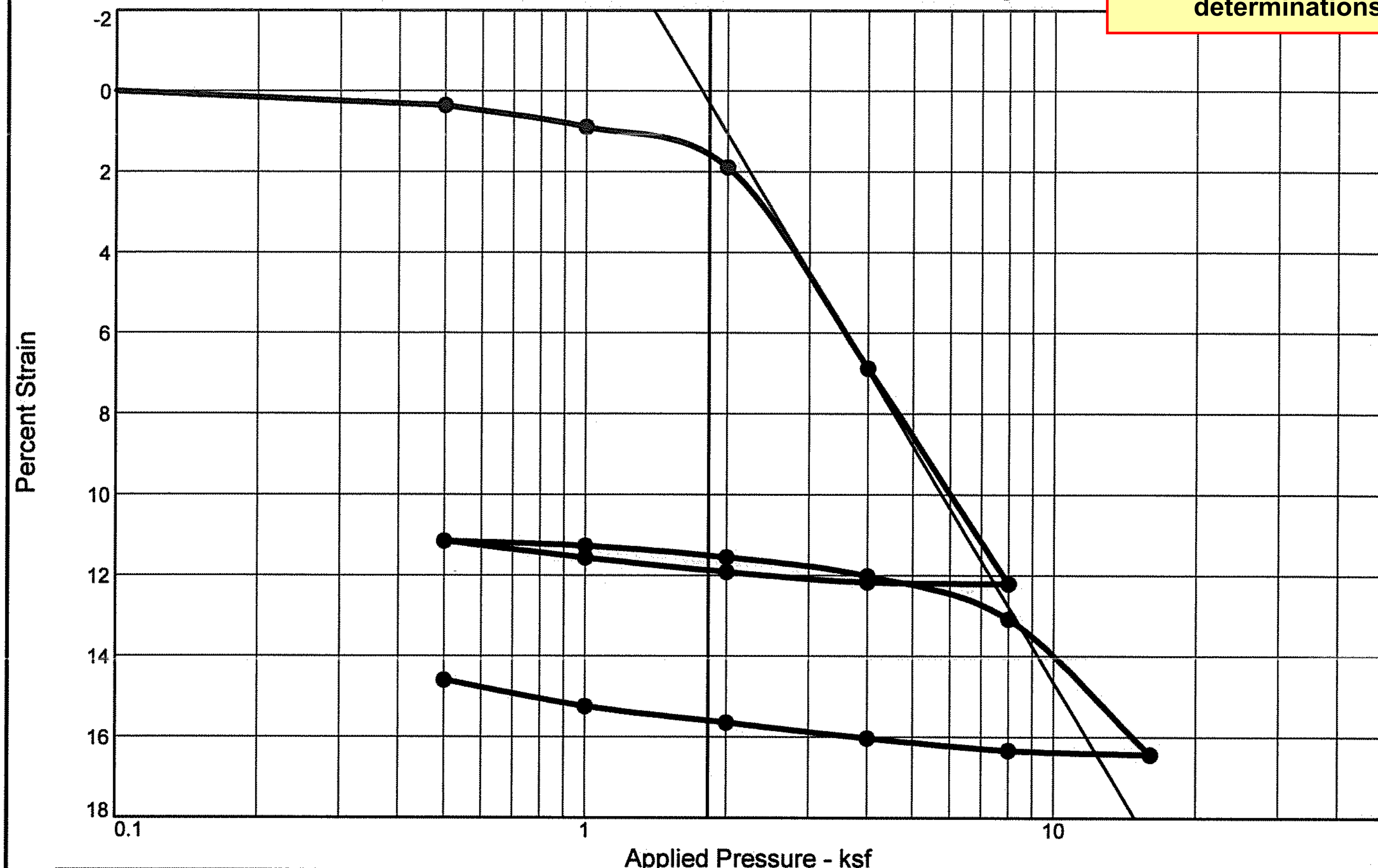
● Natural Moisture: 43.4%

Lab No. 14889b

Tested By: AGS **Checked By:** MTG MTG

CONSOLIDATION including Cv determinations

CONSOLIDATION TEST REPORT



Coefficients of Consolidation and Secondary Consolidation											
No.	Load (ksf)	C_v (ft.²/day)	C_α	No.	Load (ksf)	C_v (ft.²/day)	C_α	No.	Load (ksf)	C_v (ft.²/day)	C_α
1	0.50	1.192		8	1.00	0.695		15	8.00	8.170	
2	1.00	1.701		9	0.50	0.338		16	4.00	2.808	
3	2.00	1.568		10	1.00	2.342		17	2.00	0.850	
4	4.00	0.227		11	2.00	1.332		18	1.00	0.353	
5	8.00	0.360		12	4.00	1.587		19	0.50	0.161	
6	4.00	3.006		13	8.00	1.437					
7	2.00	2.078		14	16.00	0.653					

Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	Overburden (ksf)	P_c (ksf)	C_c	C_r	Initial Void Ratio
Saturation	Moisture									
101.8 %	40.6 %	81.5	38.4	16.7	2.75		2.2	0.41	0.07	1.096

MATERIAL DESCRIPTION	USCS	AASHTO
Lean Clay		

Project No. 1368-010 **Client:** Schonewald Engineering Associates, Inc.

Project: Cummings Road Over Maine Turnpike #18-001
Scarborough, ME

Location: HB-CUM-201a **Depth:** 27'-29' **Sample Number:** U-1

R.W. Gillespie & Associates, Inc.

Saco, Maine

Remarks:

Lab No. 14874a

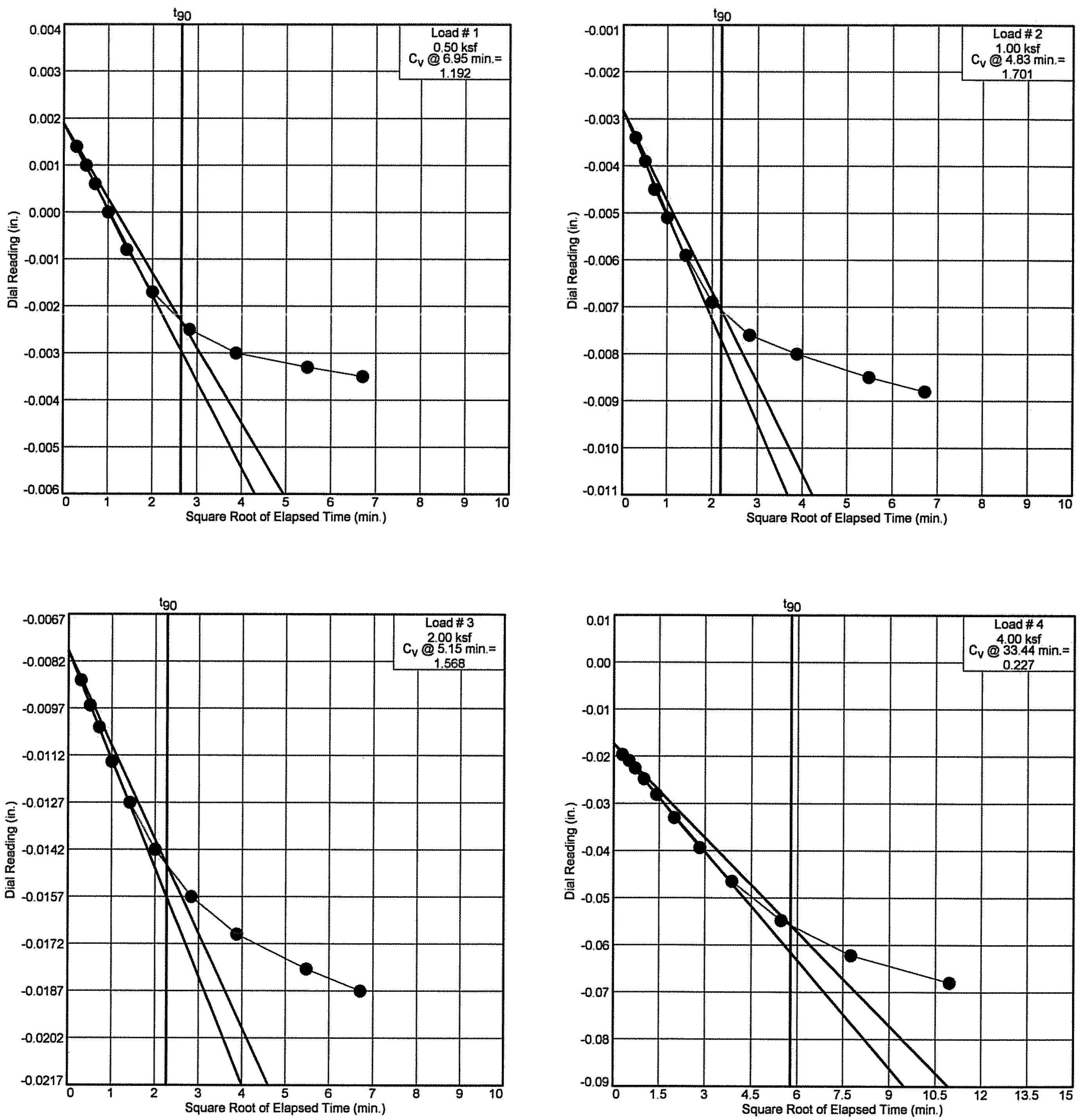
MTG

Tested By: JRF **Checked By:** MTG

Dial Reading vs. Time

Project No.: 1368-010
Project: Cummings Road Over Maine Turnpike #18-001

Location: HB-CUM-201a **Depth:** 27'-29' **Sample Number:** U-1



R.W. Gillespie & Associates, Inc.

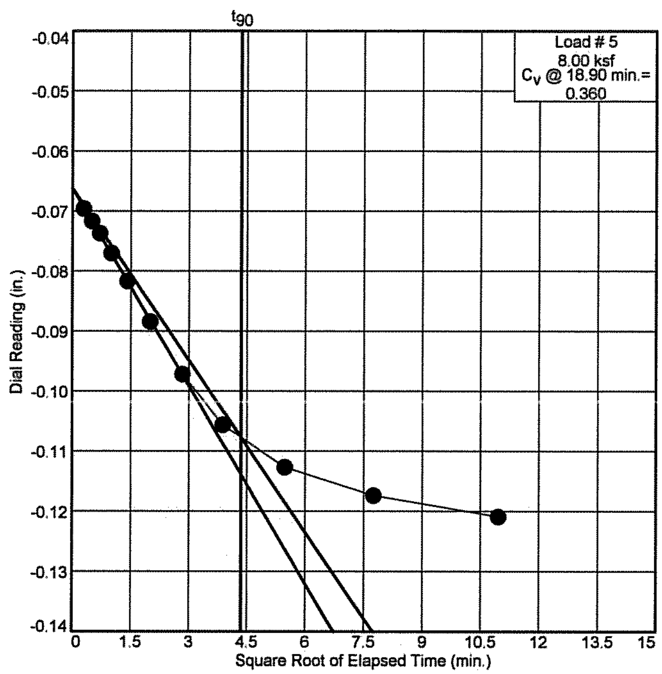
Saco, Maine

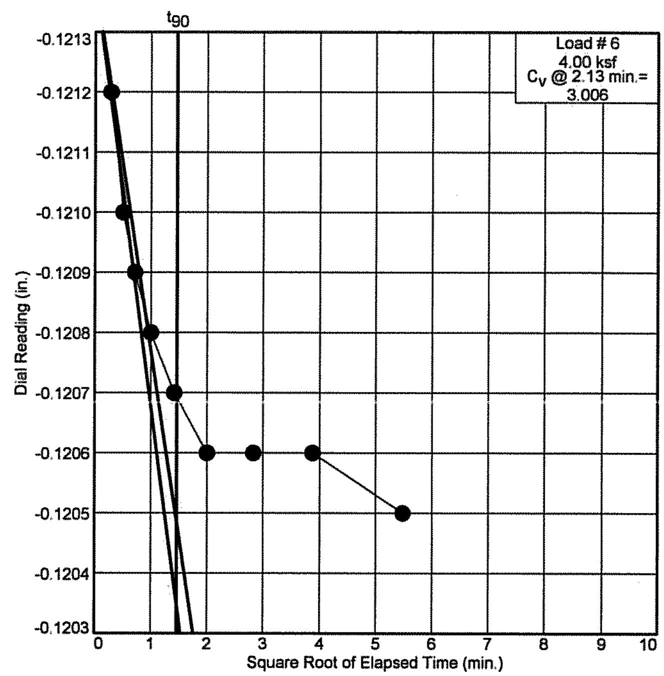
Lab No. 14874a

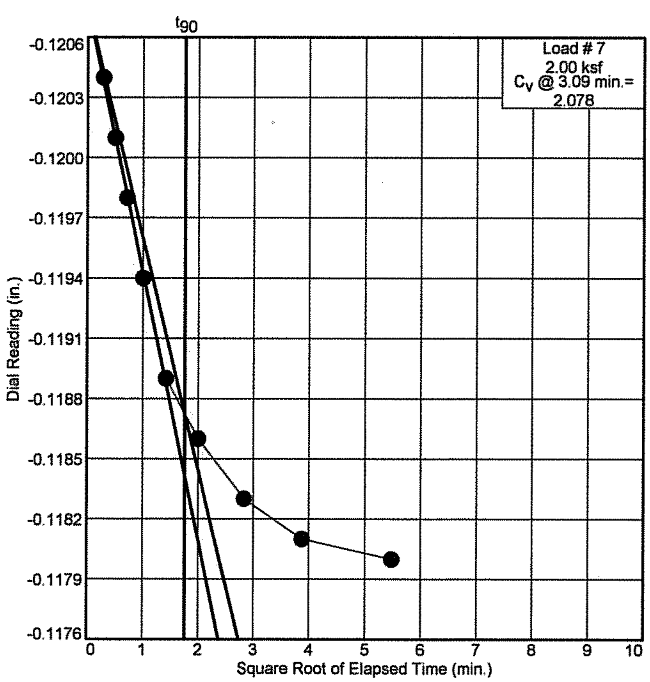
Dial Reading vs. Time

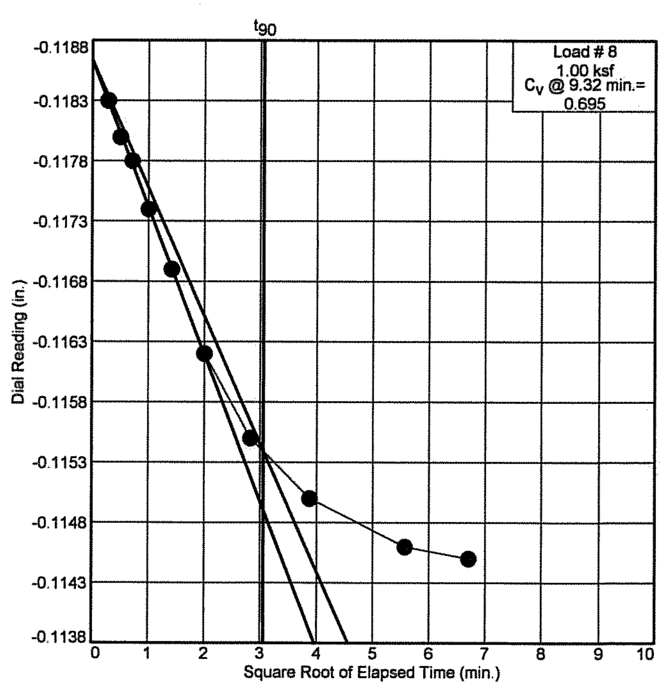
Project No.: 1368-010
Project: Cummings Road Over Maine Turnpike #18-001

Location: HB-CUM-201a **Depth:** 27'-29' **Sample Number:** U-1









R.W. Gillespie & Associates, Inc.

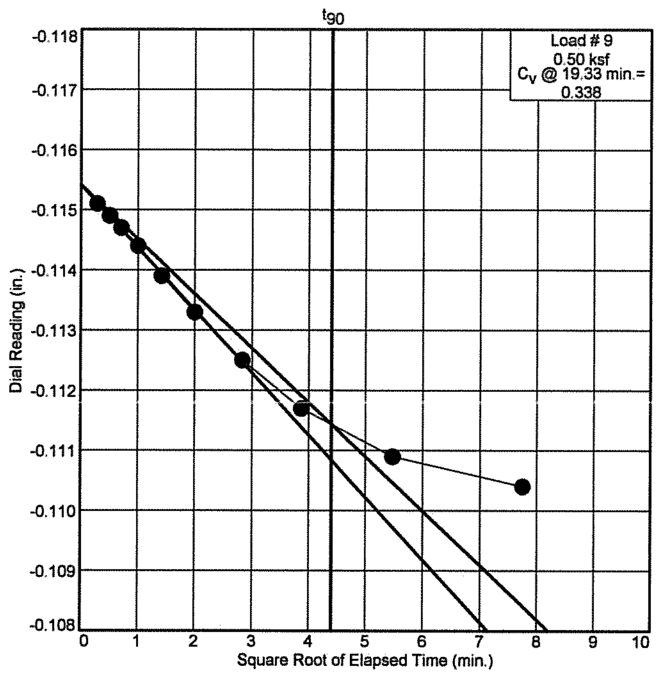
Saco, Maine

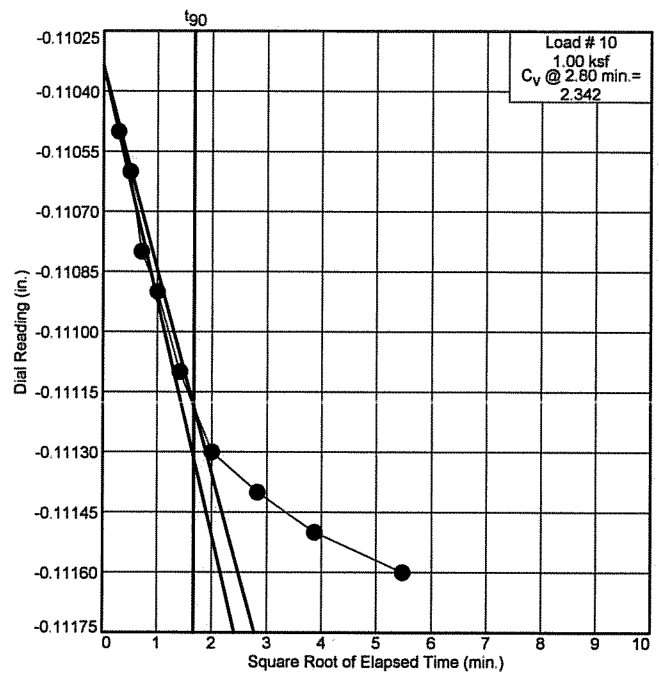
Lab No. 14874a

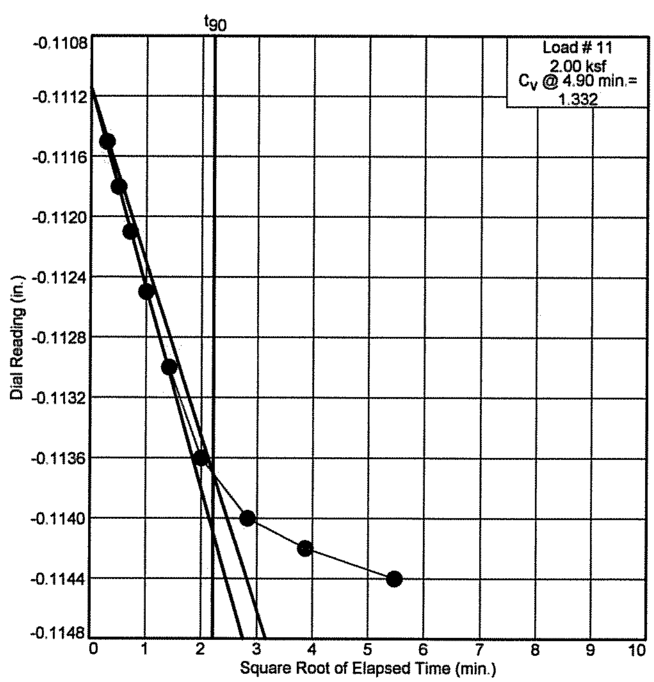
Dial Reading vs. Time

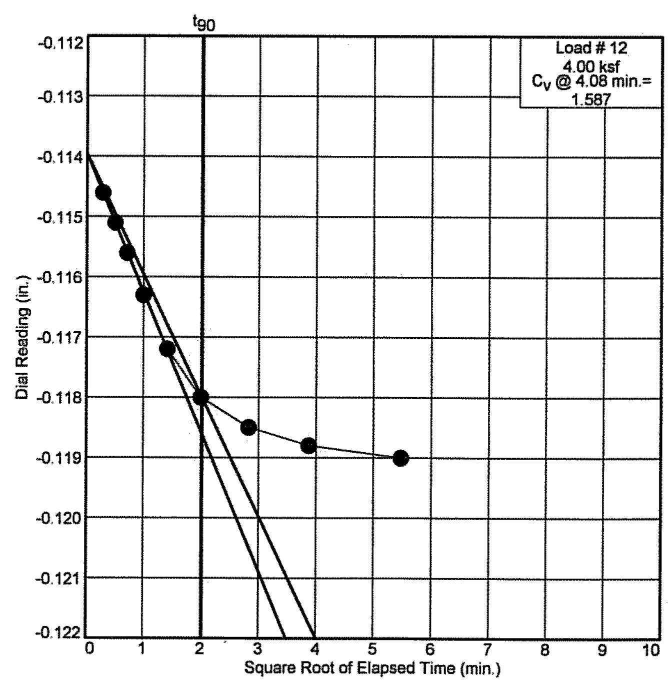
Project No.: 1368-010
Project: Cummings Road Over Maine Turnpike #18-001

Location: HB-CUM-201a **Depth:** 27'-29' **Sample Number:** U-1









R.W. Gillespie & Associates, Inc.

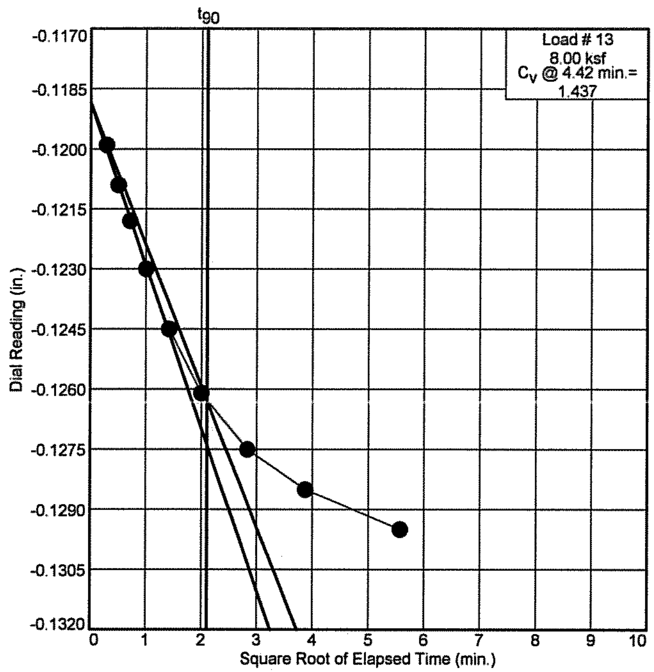
Saco, Maine

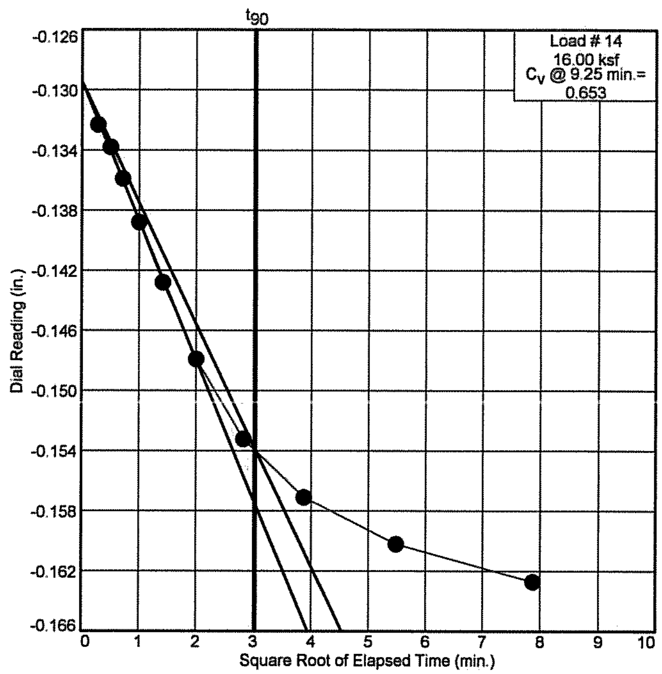
Lab No. 14877a

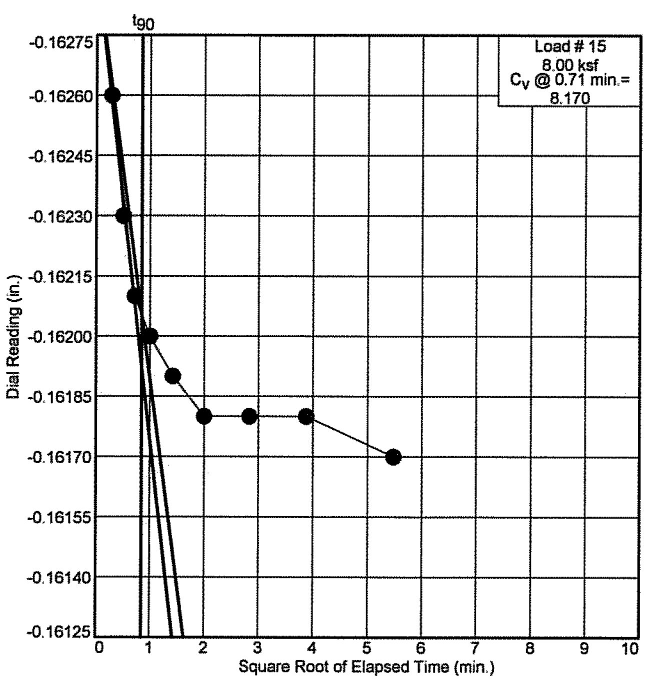
Dial Reading vs. Time

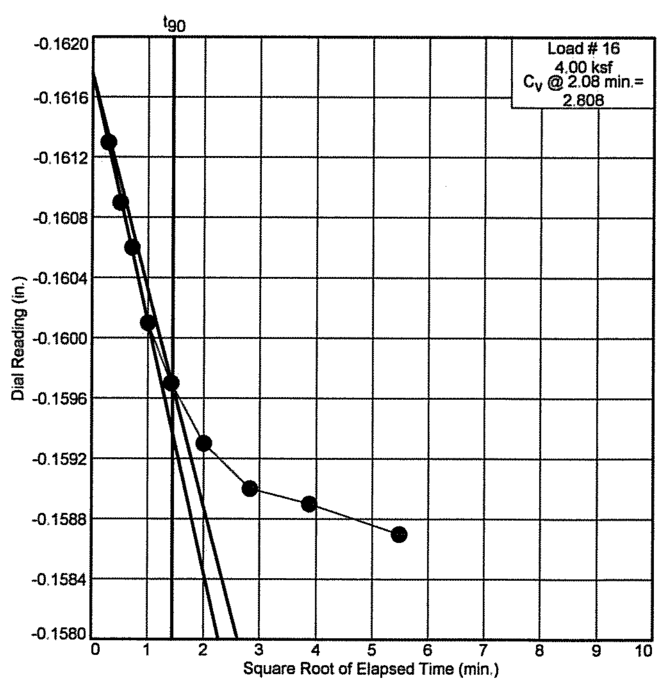
Project No.: 1368-010
Project: Cummings Road Over Maine Turnpike #18-001

Location: HB-CUM-201a **Depth:** 27'-29' **Sample Number:** U-1









R.W. Gillespie & Associates, Inc.

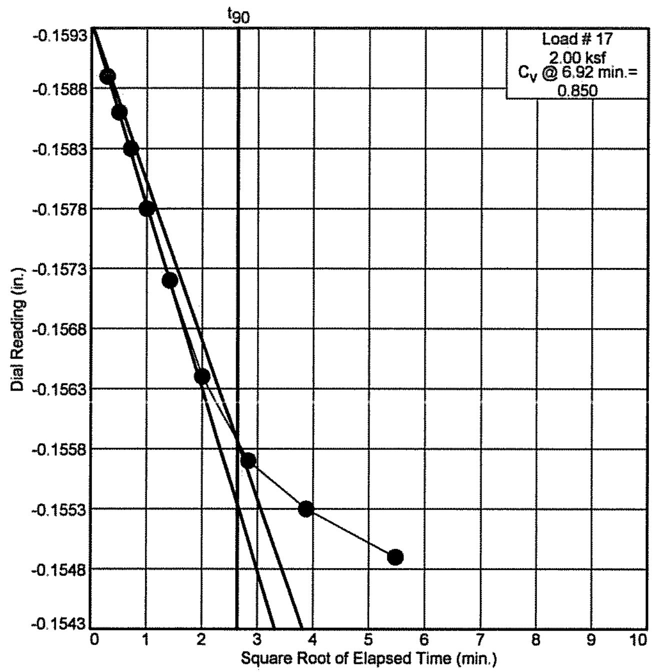
Saco, Maine

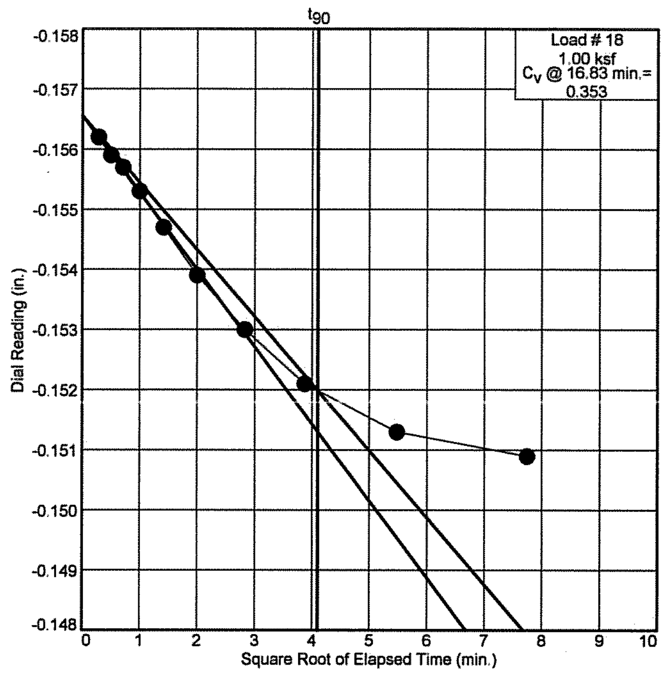
Lab No. 14874a

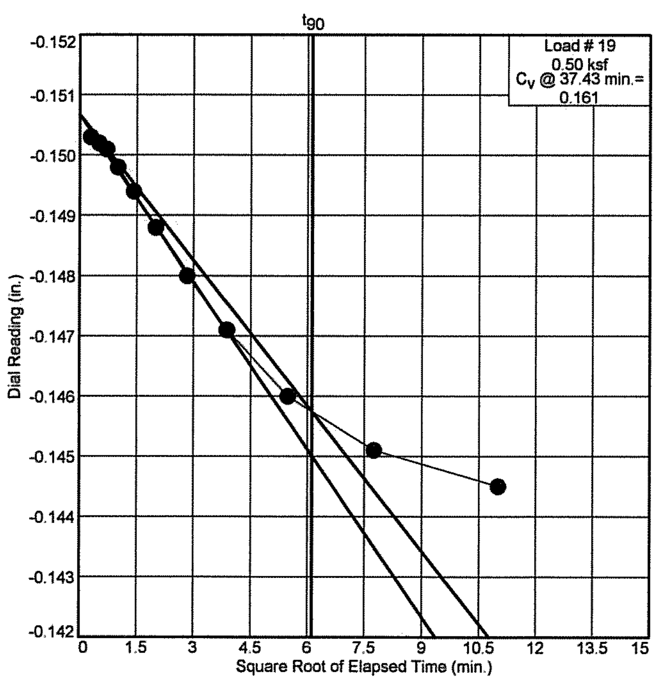
Dial Reading vs. Time

Project No.: 1368-010
Project: Cummings Road Over Maine Turnpike #18-001

Location: HB-CUM-201a **Depth:** 27'-29' **Sample Number:** U-1







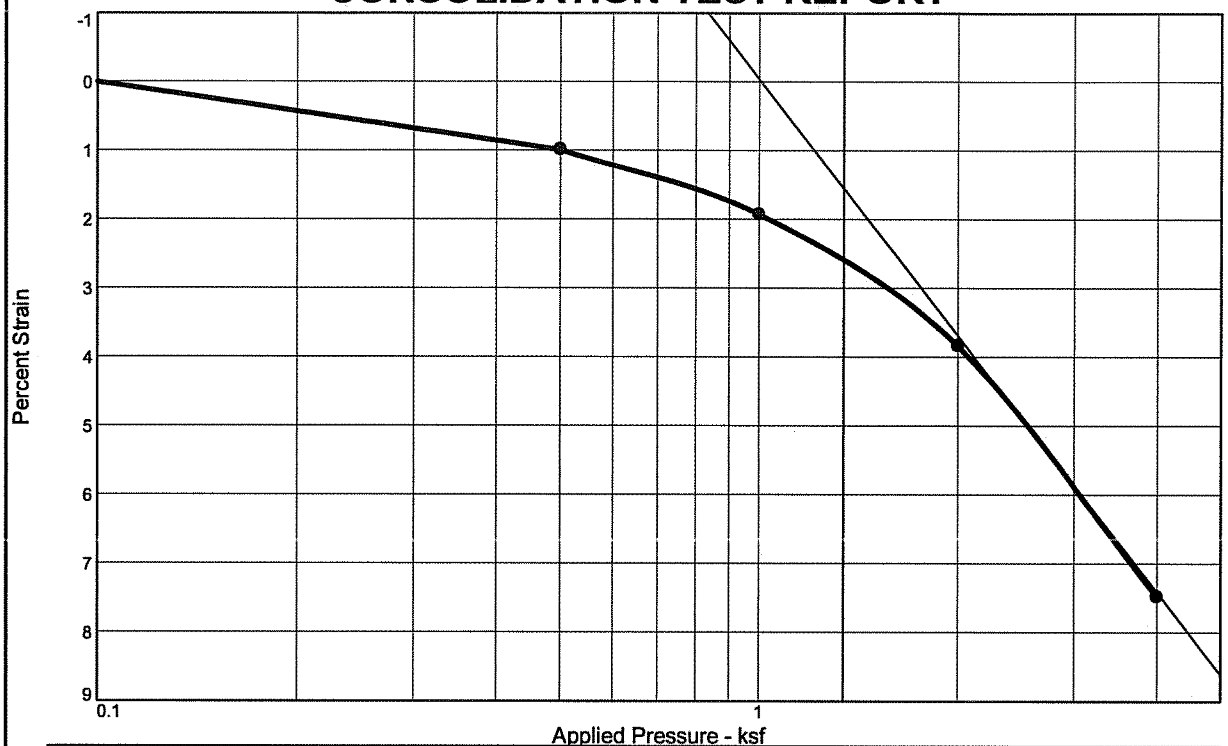
R.W. Gillespie & Associates, Inc.

Saco, Maine

Lab No. 14874a

CONSOLIDATION reduced loading sequence for Cα determinations

CONSOLIDATION TEST REPORT



Coefficients of Consolidation and Secondary Consolidation

No.	Load (ksf)	C_v (ft.2/day)	C_α	No.	Load (ksf)	C_v (ft.2/day)	C_α	No.	Load (ksf)	C_v (ft.2/day)	C_α
1	0.50	0.358									
2	1.00	0.494									
3	2.00	0.381	0.005								
4	4.00	0.175	0.008								

Natural Saturation	Natural Moisture	Dry Dens. (pcf)	LL	PI	Sp. Gr.	Overburden (ksf)	P_c (ksf)	C_c	C_r	Initial Void Ratio
97.0 %	36.1 %	84.9			2.75					1.023

MATERIAL DESCRIPTION	USCS	AASHTO
Lean Clay		

Project No. 1368-010 **Client:** Schonewald Engineering Associates, Inc.

Project: Cummings Road Over Maine Turnpike #18-001
Scarborough, ME

Location: HB-CUM-201a **Depth:** 27'-29' **Sample Number:** U-1

R.W. Gillespie & Associates, Inc.

Saco, Maine

Remarks:

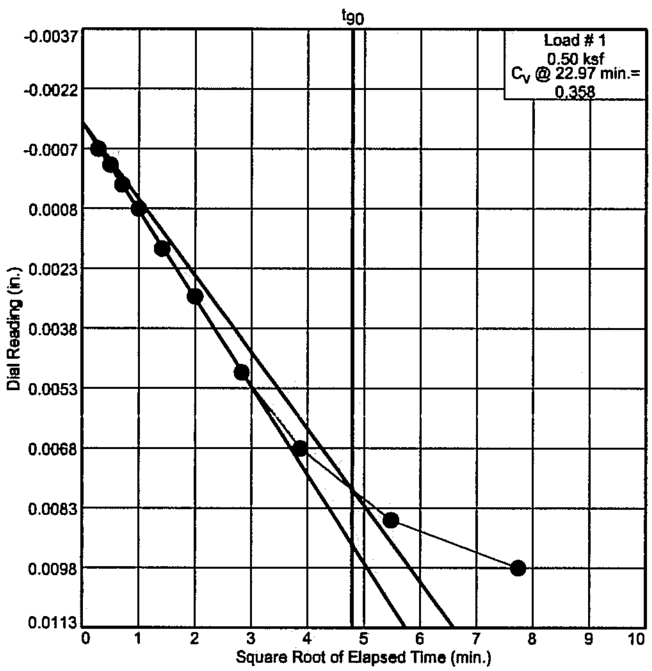
Lab No. 14895a

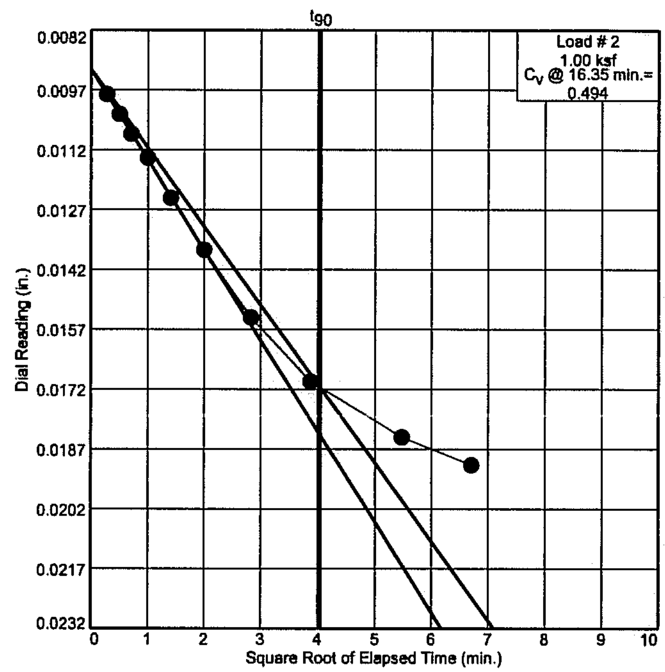
Tested By: JRF **Checked By:** MTG

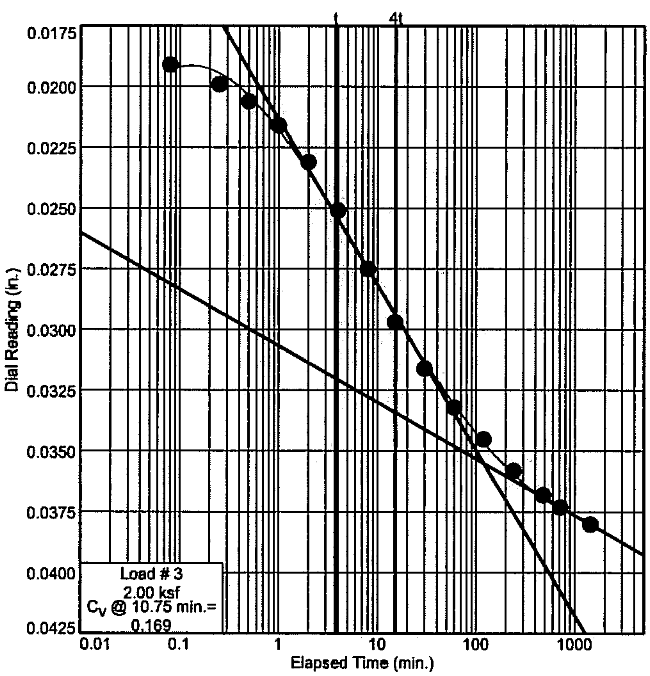
Dial Reading vs. Time

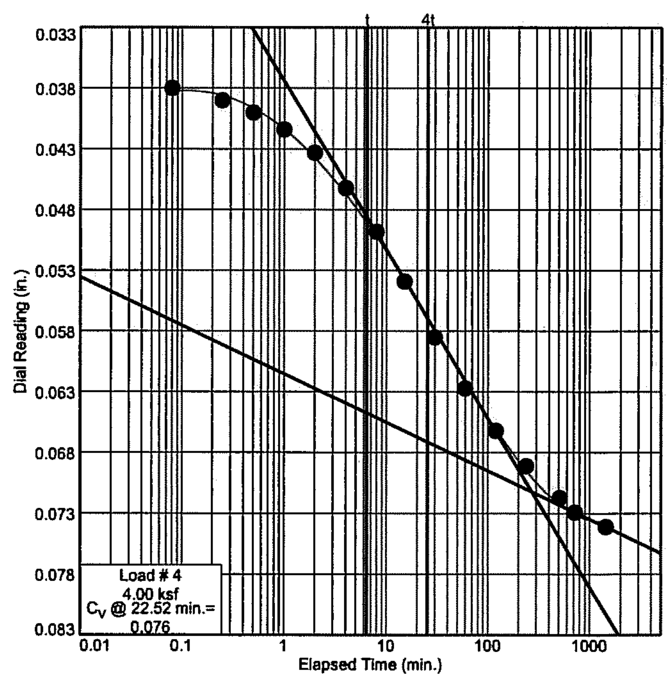
Project No.: 1368-010
Project: Cummings Road Over Maine Turnpike #18-001

Location: HB-CUM-201a Depth: 27'-29' Sample Number: U-1







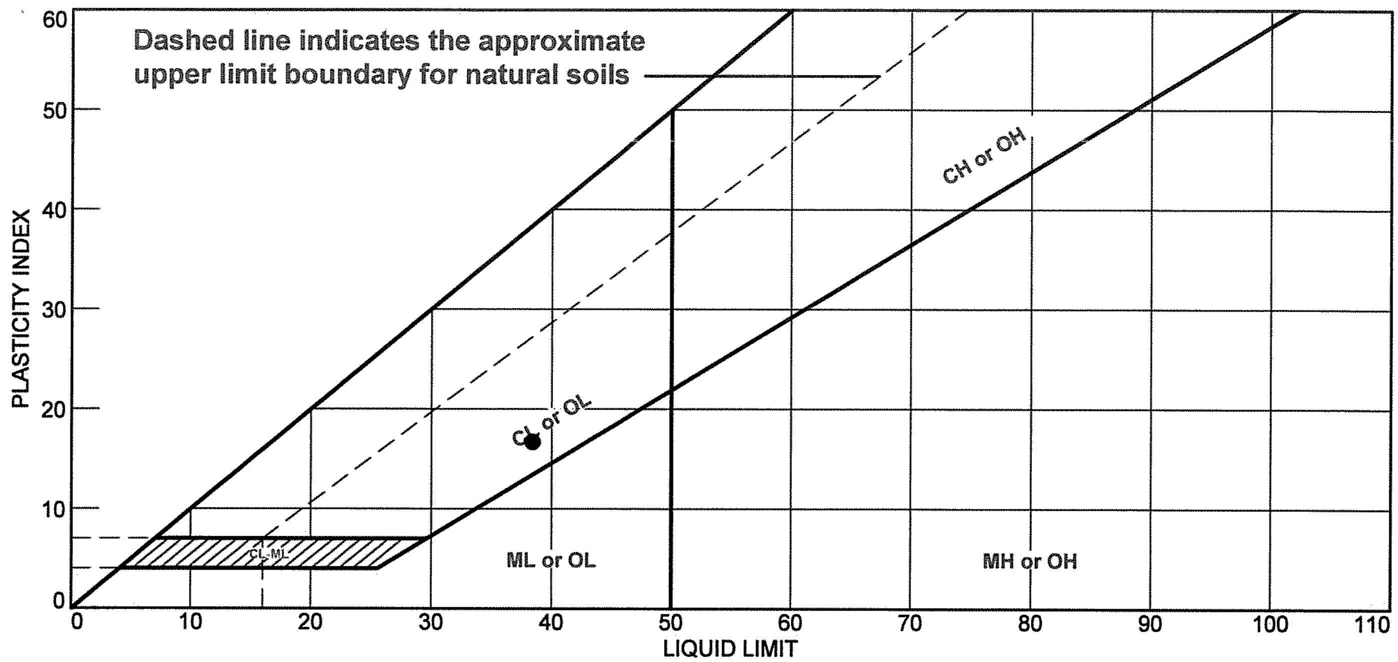


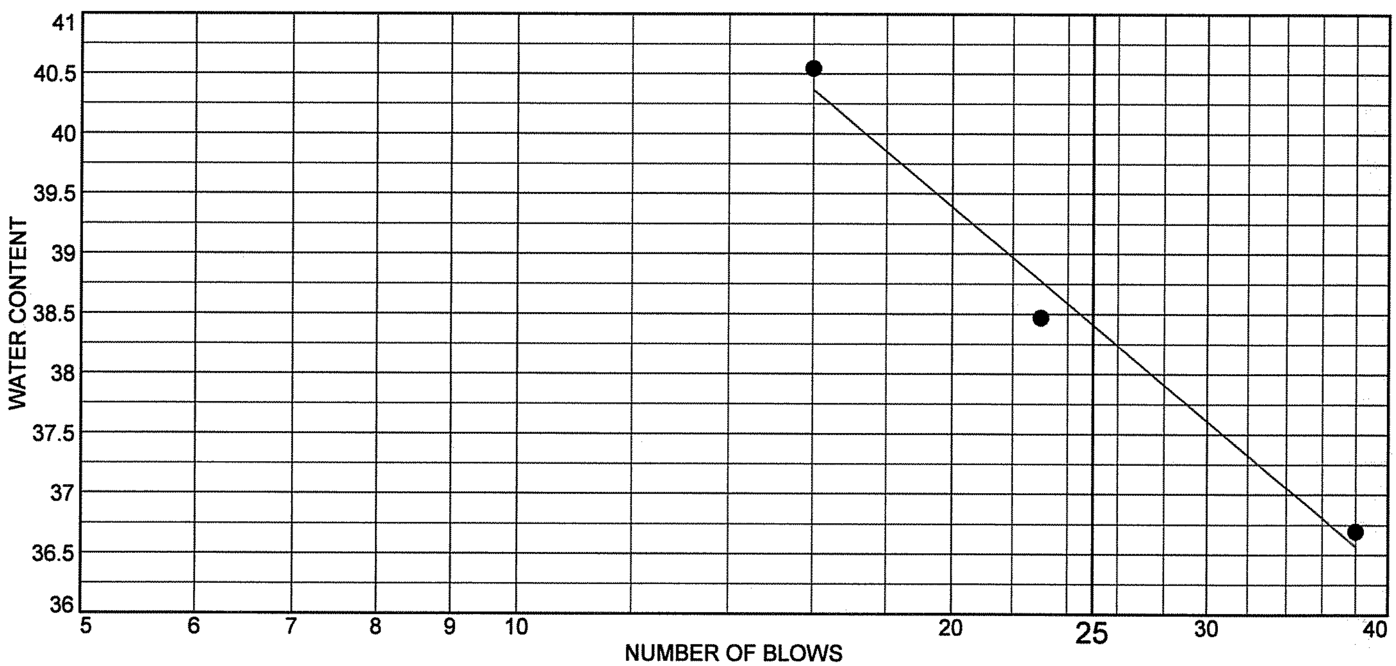
R.W. Gillespie & Associates, Inc.

Saco, Maine

Figure 14895a

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Lean Clay	38.4	21.7	16.7			

Project No. 1368-010 **Client:** Schonewald Engineering Associates, Inc.

Project: Cummings Road Over Maine Turnpike #18-001

Scarborough, ME

Location: HB-CUM-201a

Sample Number: U-1 **Depth:** 27'-29'

Remarks:

● Natural Moisture: 40.6%

R.W. Gillespie & Associates, Inc.

Saco, Maine

Lab No. 14874a

Tested By: AGS **Checked By:** MTG MTG

Laboratory Vane Shear Test Results

ASTM D4648 Standard Test Method for Laboratory Miniature Vane Shear Test for Saturated Fine-Grained Clayey Soil

Project: Cummings Road Over Maine Turnpike #1ξ
Client: Schonewald Engineering Associates, Inc.
Project No.: 1368-010

Location: Scarborough, ME
Date: 2/20/2018
Test Depth: 27.04' to 27.20'

Boring/Sample No.	HB-CUM-201a	U-1			Lab No.	14874a	
Test No.	Test Depth (ft)	Vane Size	Max. Torque (Undisturbed) (kg-cm)	Max. Torque (Remolded) (kg-cm)	Undrained Shear Strength (psf)	Undrained Shear Strength (psf)	Moisture Content
1	27.04	L	30	2	313	21	41%
2	27.2	L	30	2	313	21	41%

Vane Size	
	(mm)
S	16 x 32
M	20 x 40
L	24.5 x 50.8

Tested By: JRF

Checked By: MC

R.W. Gillespie & Associates

86 Industrial Park Rd., Suite 4, Saco ME 04072, 207-286-8008 / 200 International Dr., Suite 170, Portsmouth NH 03801, 603-427-0244

CONSOLIDATION including Cv determinations

CONSOLIDATION TEST REPORT

Coefficients of Consolidation and Secondary Consolidation

No.	Load (ksf)	C_v (ft.^{2}/day)	C_α	No.	Load (ksf)	C_v (ft.^{2}/day)	C_α	No.	Load (ksf)	C_v (ft.^{2}/day)	C_α
1	0.50	1.299		8	1.00	0.510		15	8.00	3.857	
2	1.00	1.366		9	0.50	0.236		16	4.00	1.355	
3	2.00	2.037		10	1.00	1.043		17	2.00	0.487	
4	4.00	1.117		11	2.00	0.791		18	1.00	0.240	
5	8.00	0.201		12	4.00	1.039		19	0.50	0.103	
6	4.00	4.777		13	8.00	0.725					
7	2.00	1.449		14	16.00	0.415					

Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	Overburden (ksf)	P_c (ksf)	C_c	C_r	Initial Void Ratio
Saturation	Moisture									
98.6 %	46.6 %	75.3	44.6	21.1	2.75		4.0	0.82	0.11	1.300

MATERIAL DESCRIPTION	USCS	AASHTO
Lean Clay		

Project No. 1368-010 **Client:** Schonewald Engineering Associates, Inc.

Project: Cummings Road Over Maine Turnpike #18-001
Scarborough, ME

Location: HB-CUM-201a **Depth:** 35'-37' **Sample Number:** U-2

R.W. Gillespie & Associates, Inc.

Saco, Maine

Remarks:

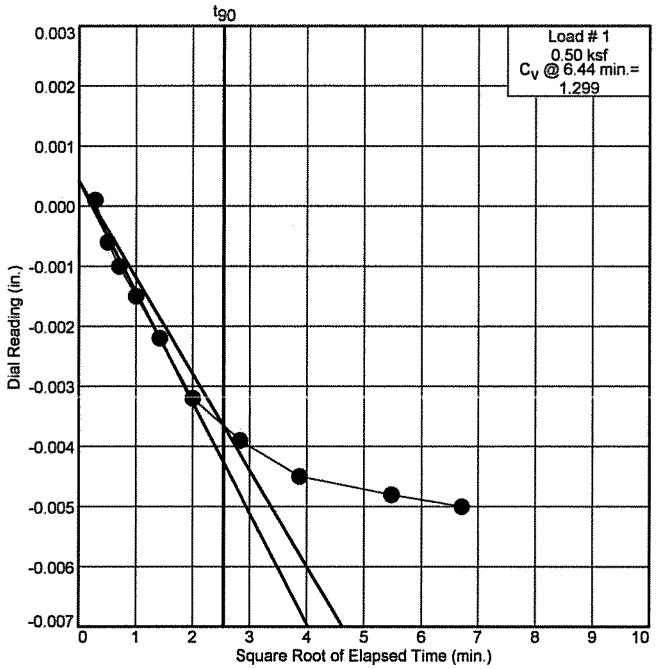
Lab No. 14874b

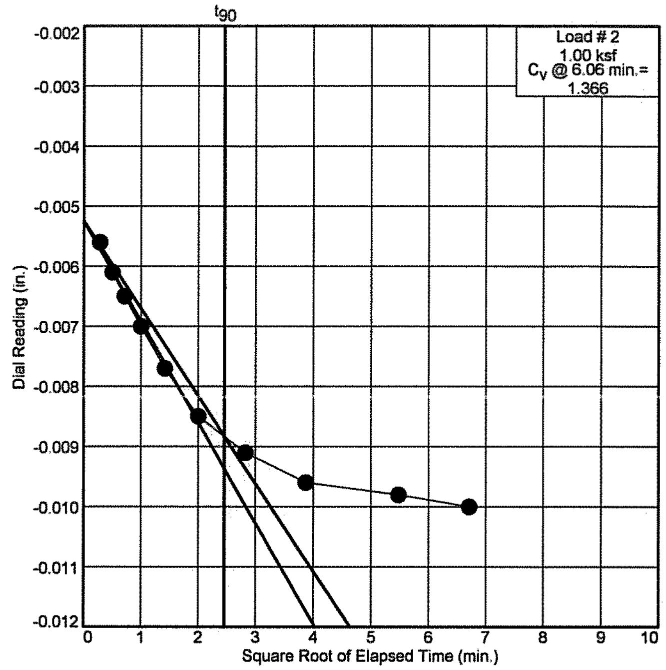
Tested By: JRF **Checked By:** MTG MTG

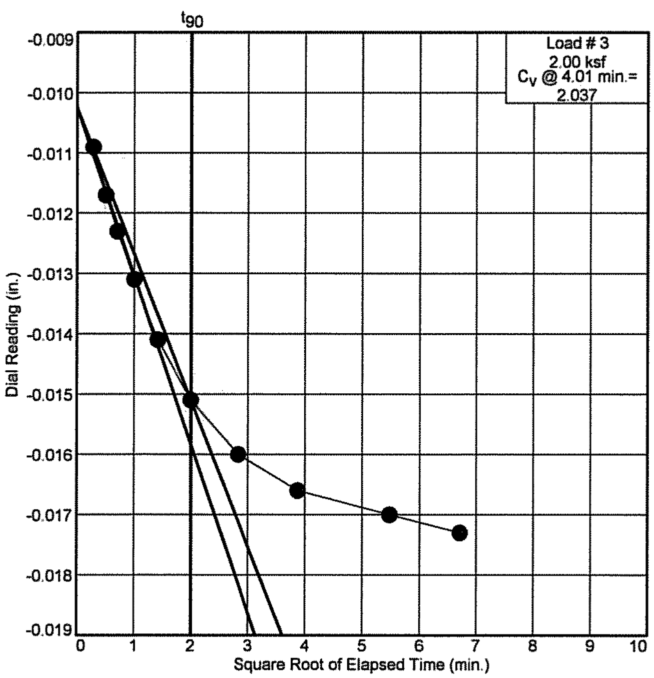
Dial Reading vs. Time

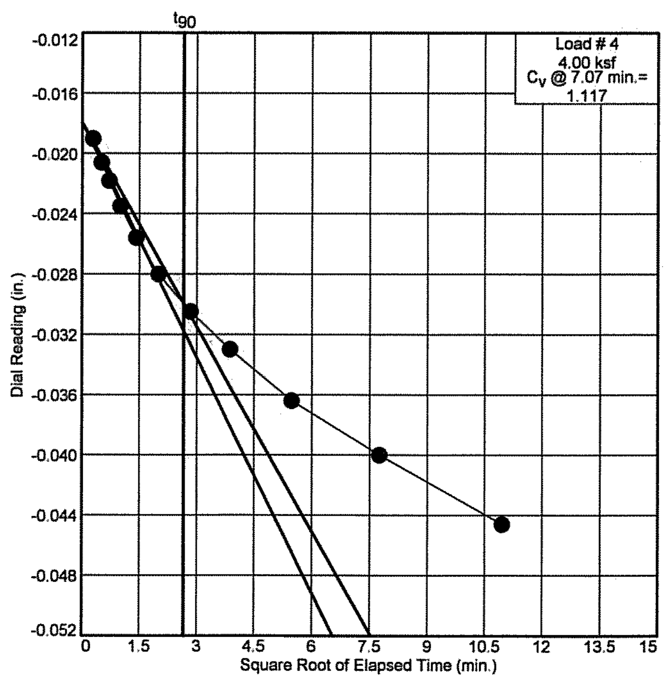
Project No.: 1368-010
Project: Cummings Road Over Maine Turnpike #18-001

Location: HB-CUM-201a **Depth:** 35'-37' **Sample Number:** U-2









R.W. Gillespie & Associates, Inc.

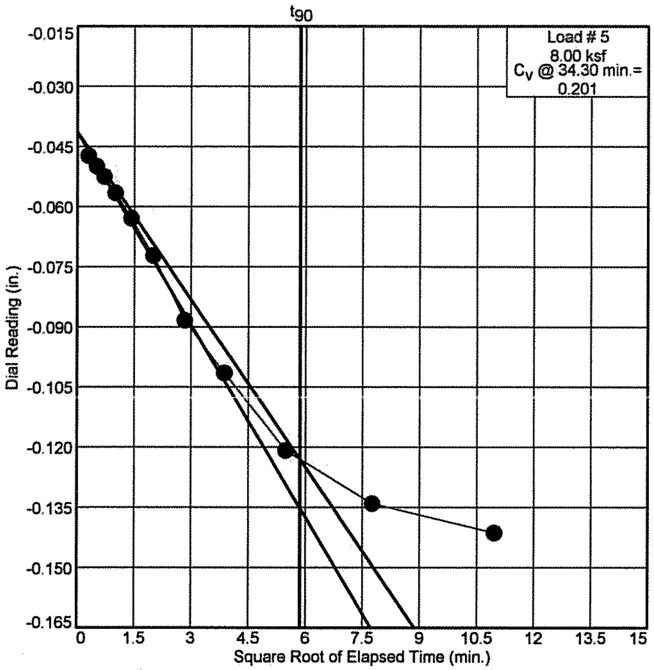
Saco, Maine

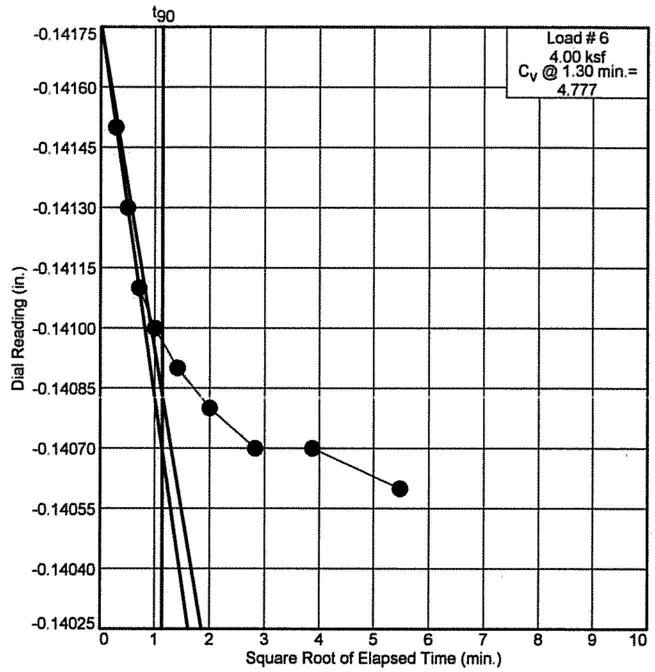
Lab No. 14874b

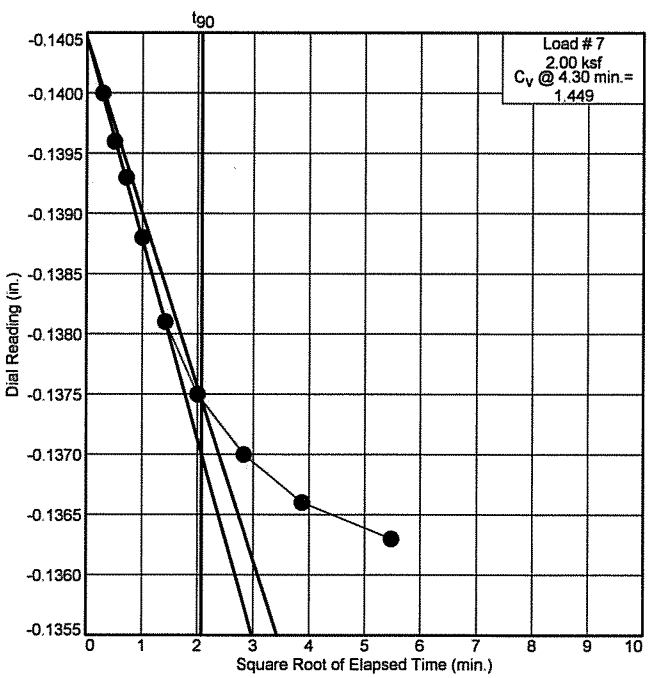
Dial Reading vs. Time

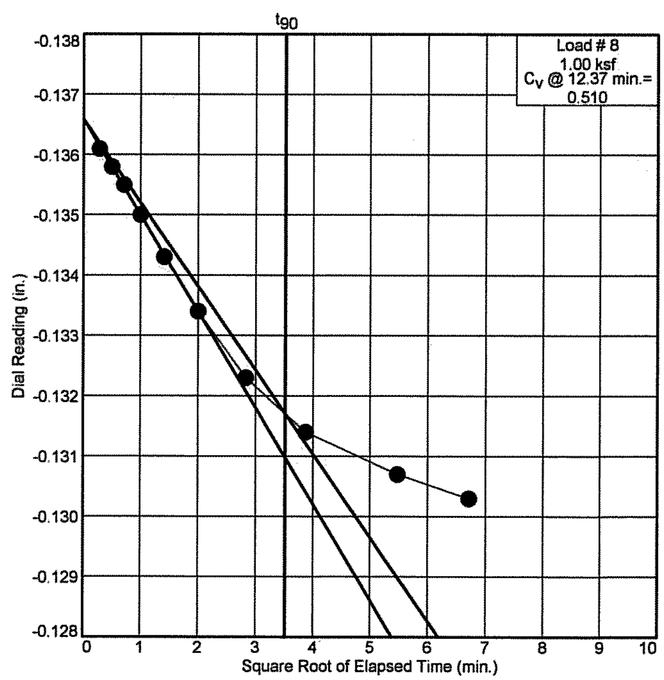
Project No.: 1368-010
Project: Cummings Road Over Maine Turnpike #18-001

Location: HB-CUM-201a **Depth:** 35'-37' **Sample Number:** U-2









R.W. Gillespie & Associates, Inc.

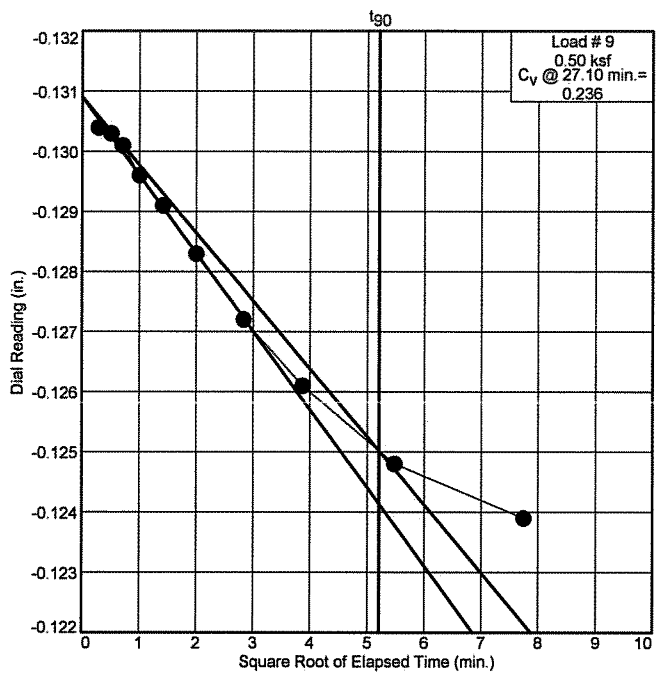
Saco, Maine

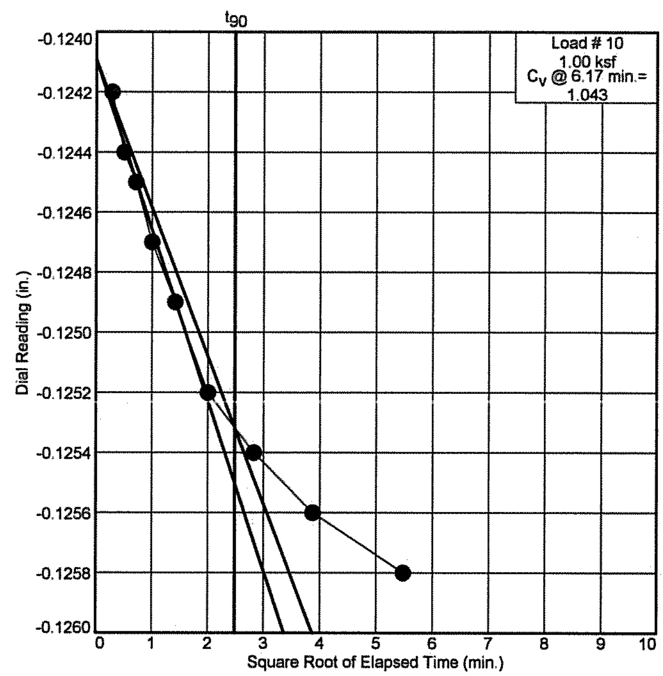
Lab No. 14874b

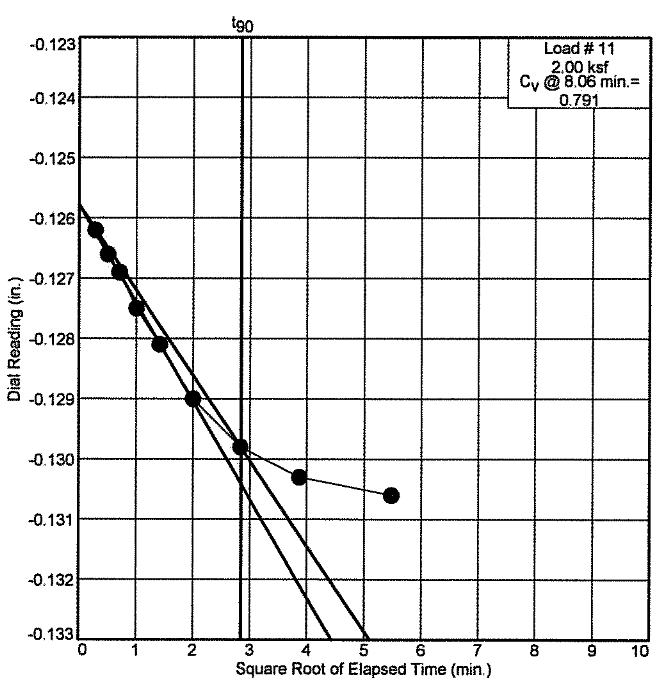
Dial Reading vs. Time

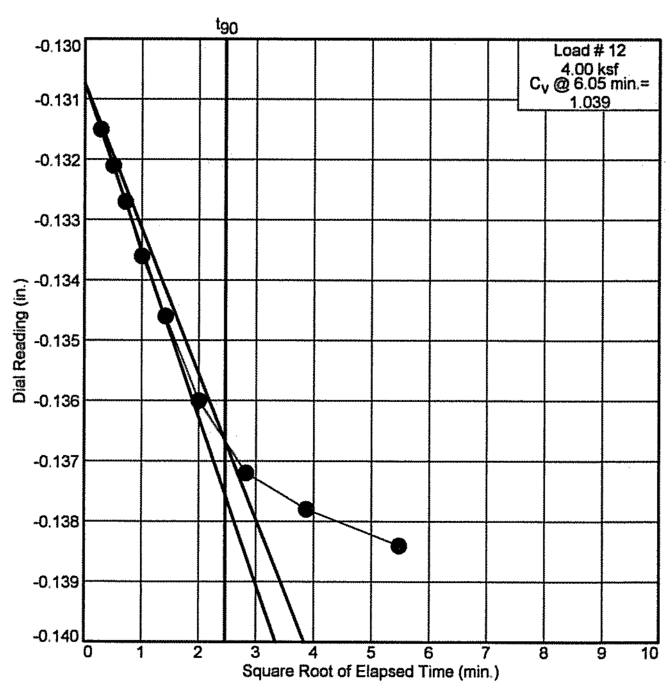
Project No.: 1368-010
Project: Cummings Road Over Maine Turnpike #18-001

Location: HB-CUM-201a **Depth:** 35'-37' **Sample Number:** U-2









R.W. Gillespie & Associates, Inc.

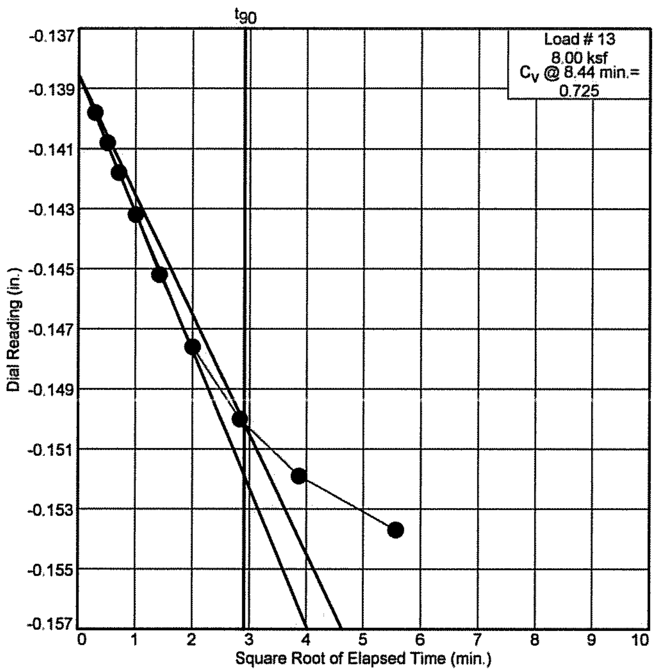
Saco, Maine

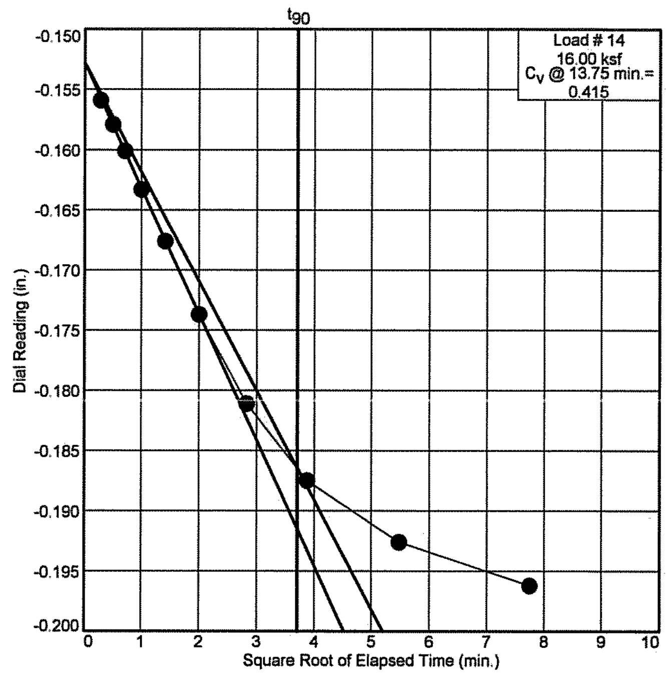
Lab No. 14874b

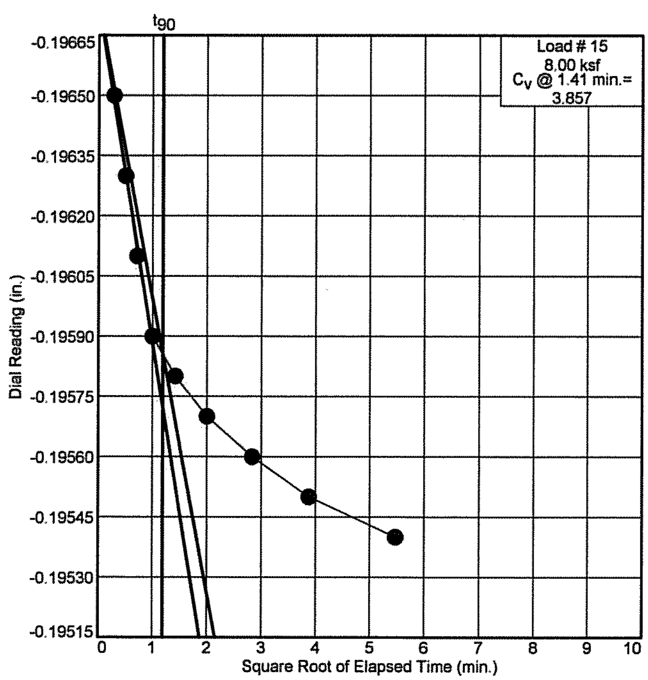
Dial Reading vs. Time

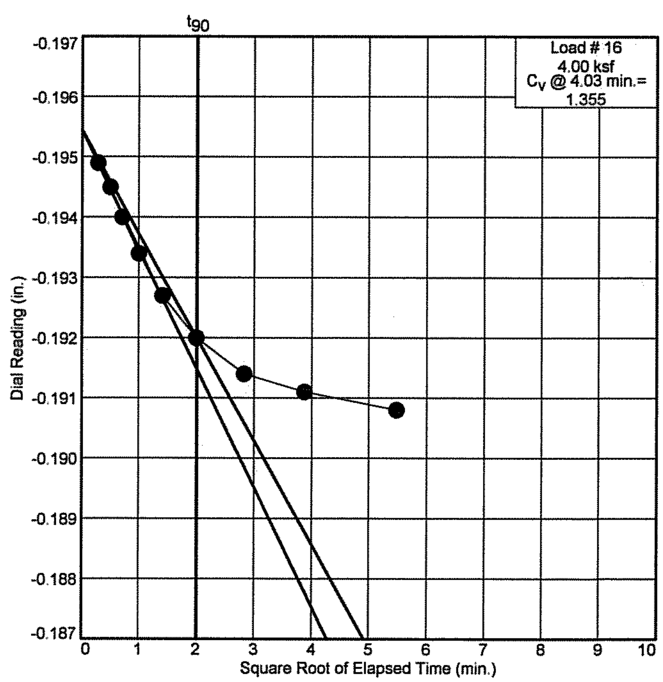
Project No.: 1368-010
Project: Cummings Road Over Maine Turnpike #18-001

Location: HB-CUM-201a **Depth:** 35'-37' **Sample Number:** U-2





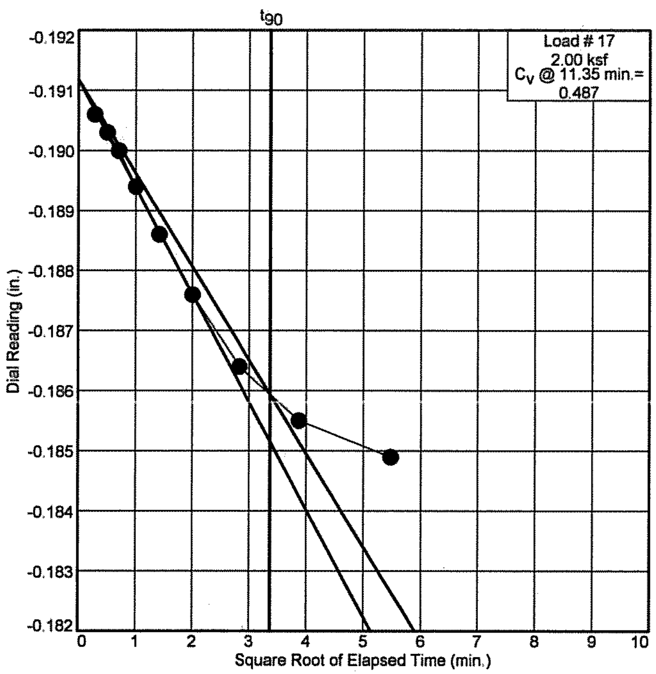


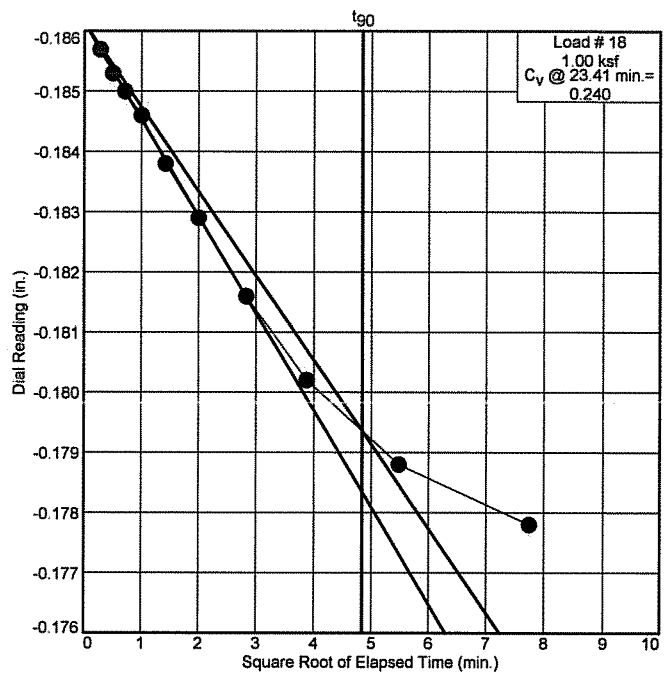


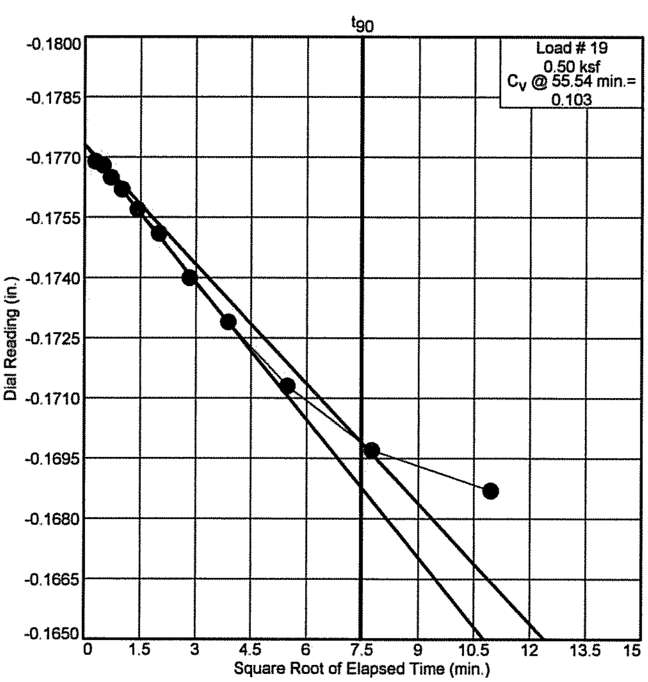
Dial Reading vs. Time

Project No.: 1368-010
Project: Cummings Road Over Maine Turnpike #18-001

Location: HB-CUM-201a   Depth: 35'-37'   Sample Number: U-2







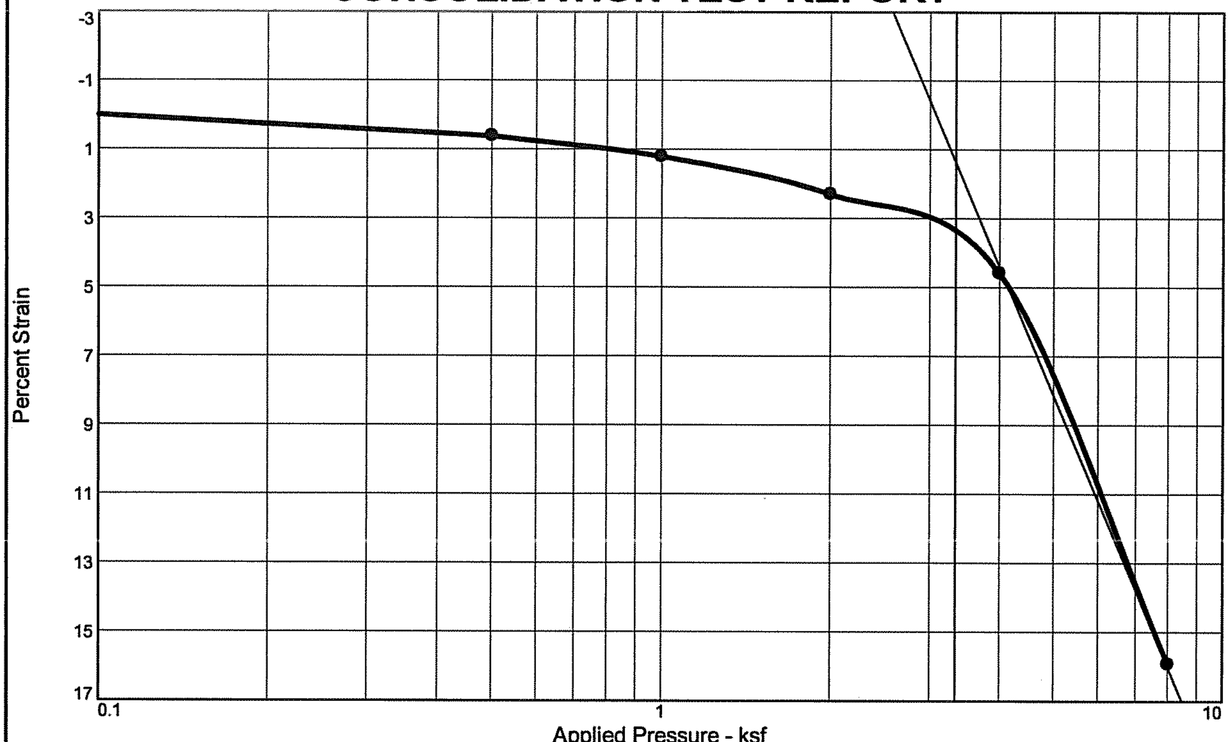
R.W. Gillespie & Associates, Inc.

Saco, Maine

Lab No. 14874b

CONSOLIDATION reduced loading sequence for Cα determinations

CONSOLIDATION TEST REPORT



Coefficients of Consolidation and Secondary Consolidation											
No.	Load (ksf)	C_v (ft.^{2}/day)	C_α	No.	Load (ksf)	C_v (ft.^{2}/day)	C_α	No.	Load (ksf)	C_v (ft.^{2}/day)	C_α
1	0.50	1.742									
2	1.00	1.669									
3	2.00	1.415	0.003								
4	4.00	0.939									
5	8.00	0.137	0.008								

Natural Saturation	Natural Moisture	Dry Dens. (pcf)	LL	PI	Sp. Gr.	Overburden (ksf)	P_c (ksf)	C_c	C_r	Initial Void Ratio
97.9 %	45.9 %	75.0			2.75		3.8	0.88		1.288

MATERIAL DESCRIPTION	USCS	AASHTO
Lean Clay		

Project No. 1368-010 **Client:** Schonewald Engineering Associates, Inc.

Project: Cummings Road Over Maine Turnpike #18-001
Scarborough, ME

Location: HB-CUM-201a **Depth:** 35'-37' **Sample Number:** U-2

Remarks:

R.W. Gillespie & Associates, Inc.

Saco, Maine

Lab No. 14895b

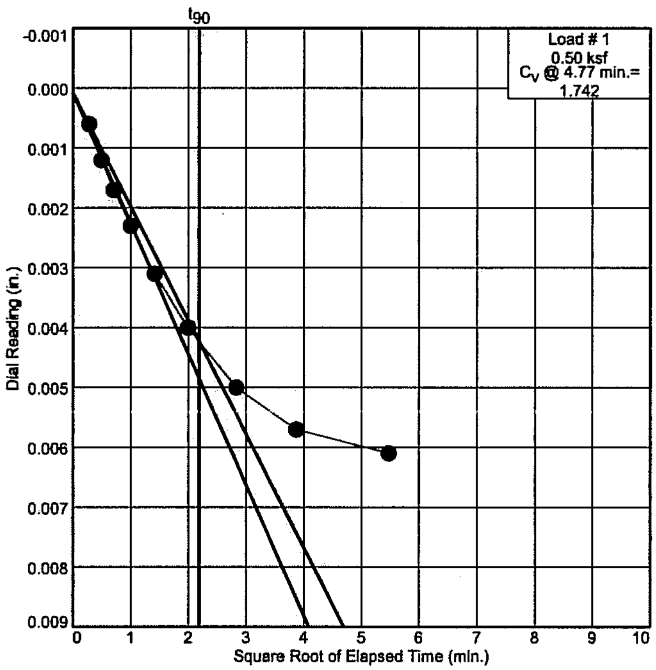
Tested By: JRF **Checked By:** MTG

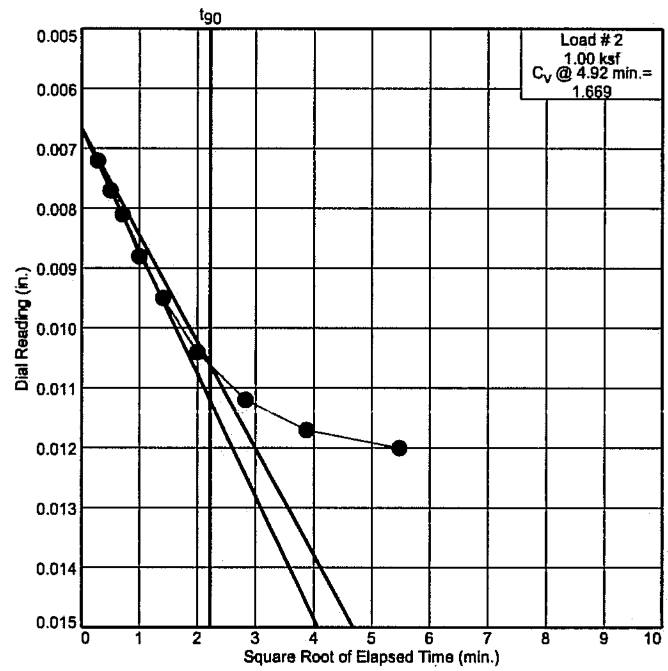
MTG

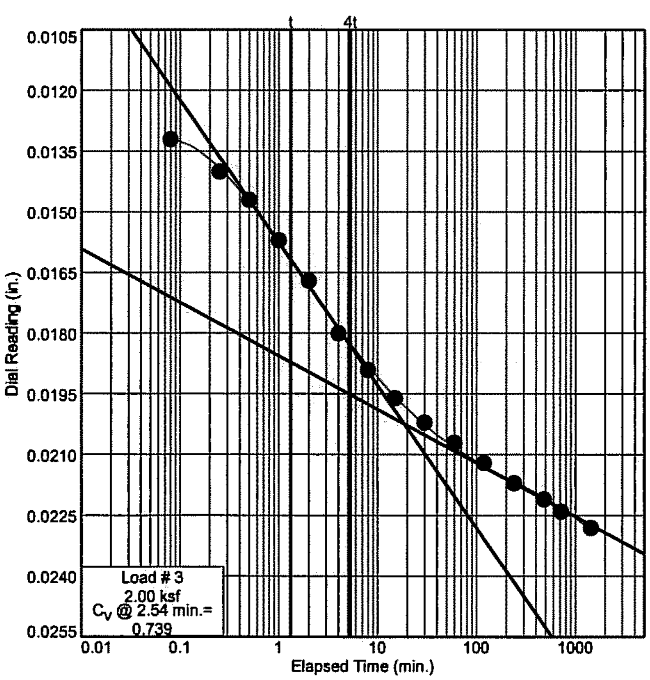
Dial Reading vs. Time

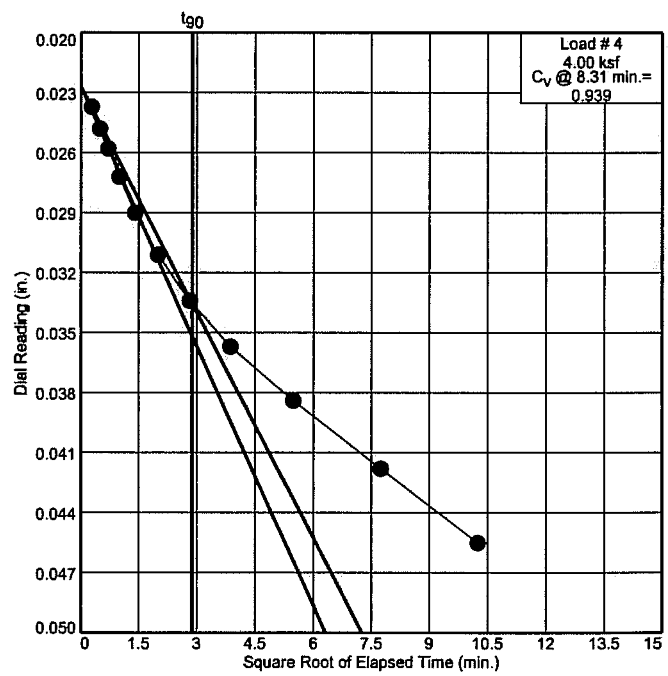
Project No.: 1368-010
Project: Cummings Road Over Maine Turnpike #18-001

Location: HB-CUM-201a   Depth: 35'-37'   Sample Number: U-2









R.W. Gillespie & Associates, Inc.

Saco, Maine

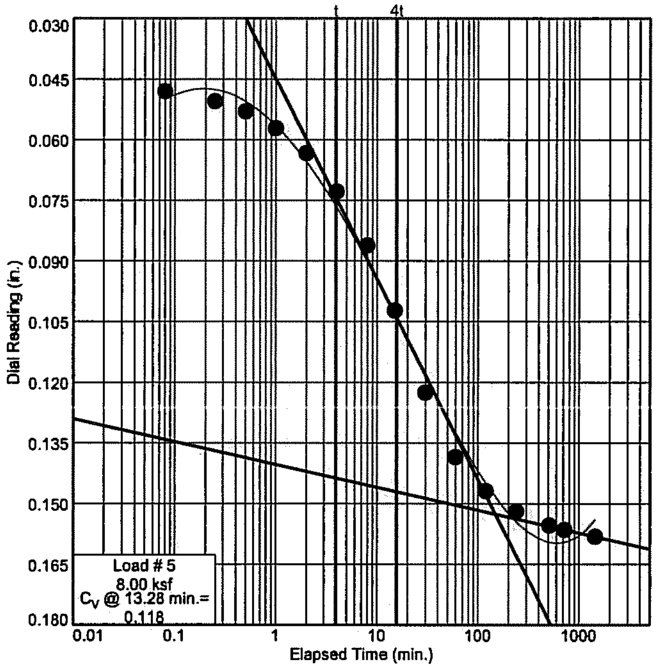
Figure 14895b

MSG

Dial Reading vs. Time

Project No.: 1368-010
Project: Cummings Road Over Maine Turnpike #18-001

Location: HB-CUM-201a Depth: 35'-37' Sample Number: U-2

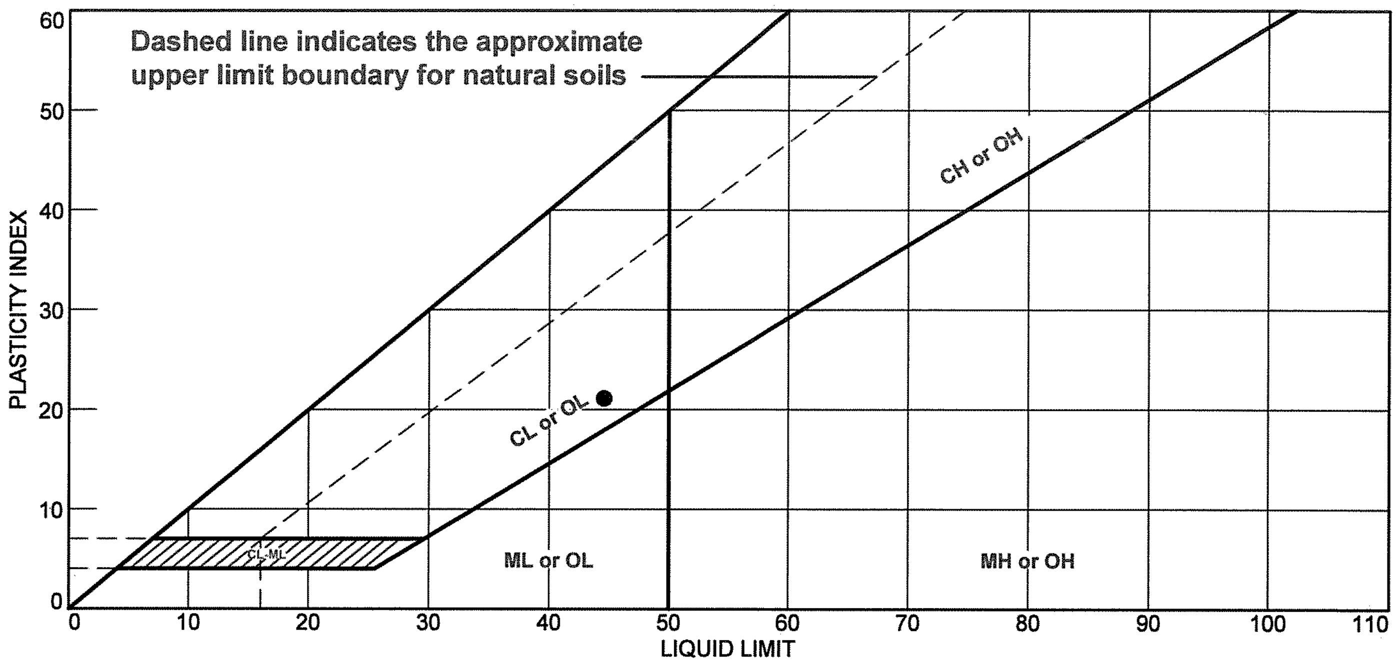


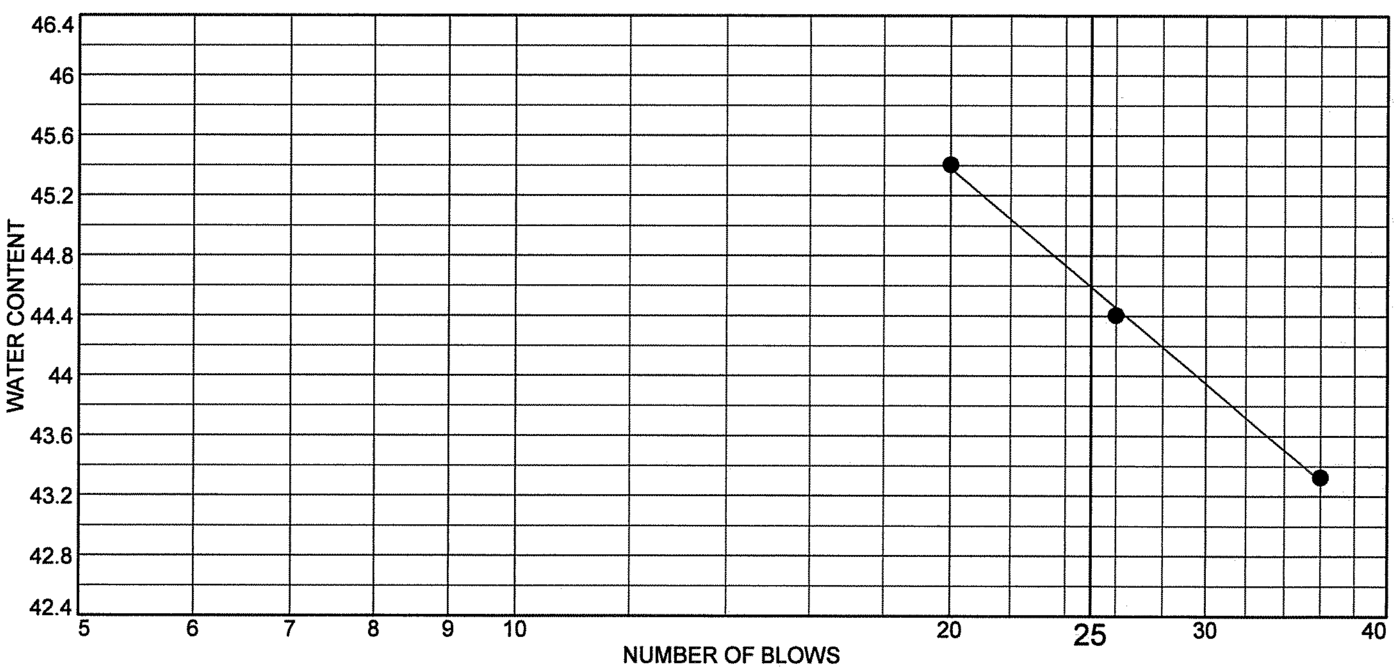
R.W. Gillespie & Associates, Inc.

Saco, Maine

Figure 14895b

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Lean Clay	44.6	23.5	21.1			

Project No. 1368-010 **Client:** Schonewald Engineering Associates, Inc.

Project: Cummings Road Over Maine Turnpike #18-001

Scarborough, ME

Location: HB-CUM-201a

Sample Number: U-2 **Depth:** 35'-37'

Remarks:

● Natural Moisture: 45.7%

R.W. Gillespie & Associates, Inc.

Saco, Maine

Lab No. 14874b

Tested By: AGS **Checked By:** MTG MTG

Laboratory Vane Shear Test Results

ASTM D4648 Standard Test Method for Laboratory Miniature Vane Shear Test for Saturated Fine-Grained Clayey Soil

Project:	Cummings Road Over Maine Turnpike #1	Location:	Scarborough, ME
Client:	Schonewald Engineering Associates, Inc.	Date:	2/20/2018
Project No.:	1368-010	Test Depth:	35.04' to 35.20'

U-2

Boring/Sample No.		HB-CUM-201a			Lab No.	14874b	
Test No.	Test Depth (ft)	Vane Size	Max. Torque (Undisturbed) (kg-cm)	Max. Torque (Remolded) (kg-cm)	Undrained Shear Strength (psf)	Undrained Shear Strength (psf)	Moisture Content
1	35.04	L	40	3	418	31	47%
2	35.2	L	40	3	418	31	46%

Vane Size	
	(mm)
S	16 x 32
M	20 x 40
L	24.5 x 50.8

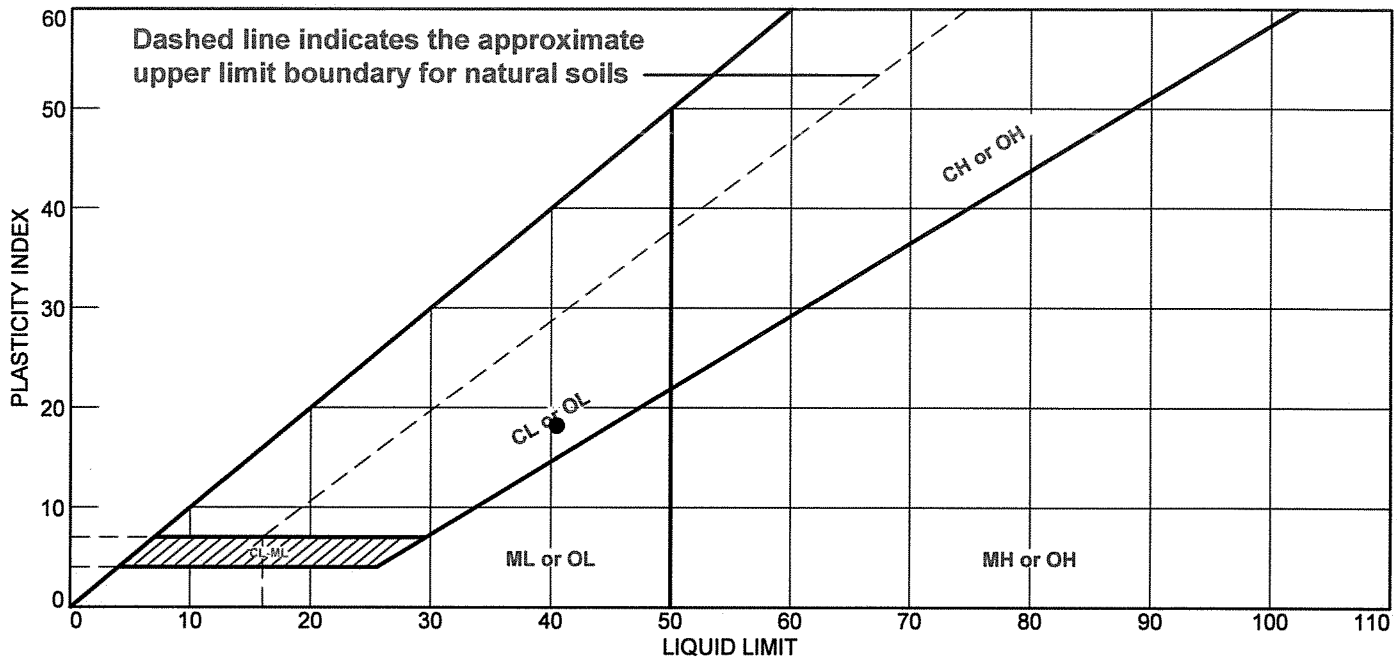
Tested By: JRF

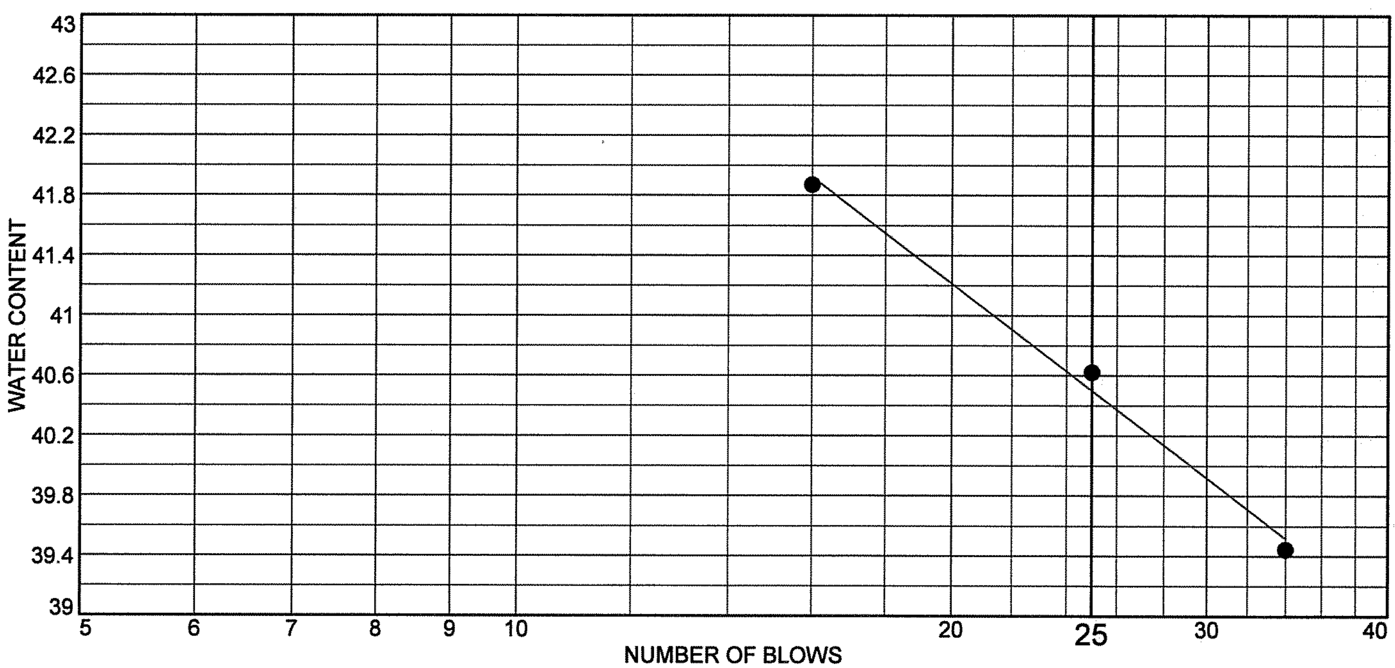
Checked By: MTB

R.W. Gillespie & Associates

86 Industrial Park Rd., Suite 4, Saco ME 04072, 207-286-8008 / 200 International Dr., Suite 170, Portsmouth NH 03801, 603-427-0244

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●		40.5	22.3	18.2			

Project No. 1368-010 **Client:** Schonewald Engineering Associates, Inc.

Project: Cummings Road Over Maine Turnpike #18-001

Scarborough, ME

Location: HB-CUM-204

Sample Number: 11-D **Depth:** 50'-52'

R.W. Gillespie & Associates, Inc.

Saco, Maine

Remarks:

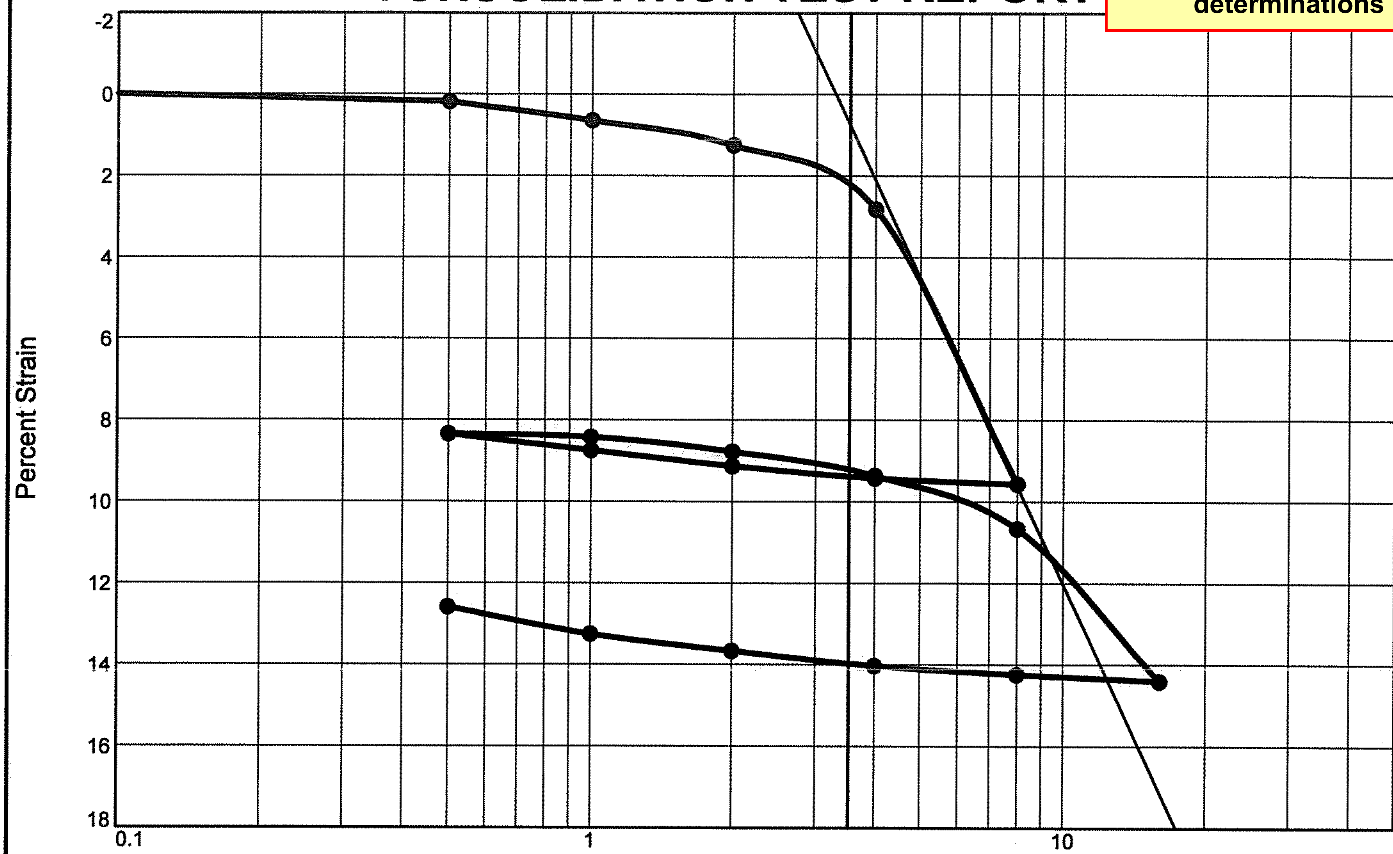
● Natural Moisture: 40.3%

Lab No. 14890a

Tested By: AGS **Checked By:** MTG MTG

CONSOLIDATION including Cv determinations

CONSOLIDATION TEST REPORT



Coefficients of Consolidation and Secondary Consolidation											
No.	Load (ksf)	C_v (ft.^{2}/day)	C_α	No.	Load (ksf)	C_v (ft.^{2}/day)	C_α	No.	Load (ksf)	C_v (ft.^{2}/day)	C_α
1	0.50	0.927		8	1.00	0.767		15	8.00	4.136	
2	1.00	1.753		9	0.50	0.380		16	4.00	5.680	
3	2.00	2.387		10	1.00	1.568		17	2.00	1.039	
4	4.00	1.189		11	2.00	1.418		18	1.00	0.403	
5	8.00	0.360		12	4.00	2.063		19	0.50	0.183	
6	4.00	7.560		13	8.00	1.385					
7	2.00	2.155		14	16.00	0.722					

Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	Overburden (ksf)	P_c (ksf)	C_c	C_r	Initial Void Ratio
Saturation	Moisture									
97.9 %	38.7 %	82.7	41.4	20.3	2.75		4.1	0.52	0.08	1.087

MATERIAL DESCRIPTION	USCS	AASHTO
Lean CLay		

Project No. 1368-010 **Client:** Schonewald Engineering Associates, Inc.

Project: Cummings Road Over Maine Turnpike #18-001
Scarborough, ME

Location: HB-CUM-204 **Depth:** 55'-57' **Sample Number:** U-1

R.W. Gillespie & Associates, Inc.

Saco, Maine

Remarks:

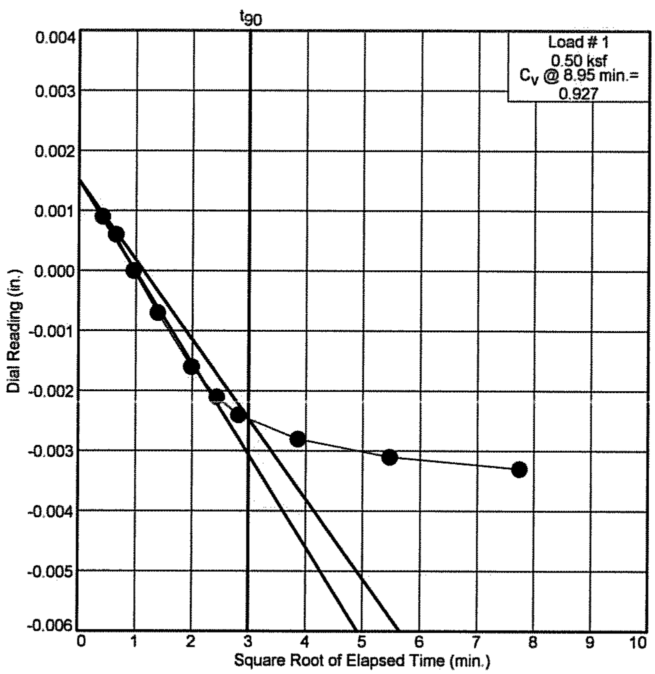
Lab No. 14868a

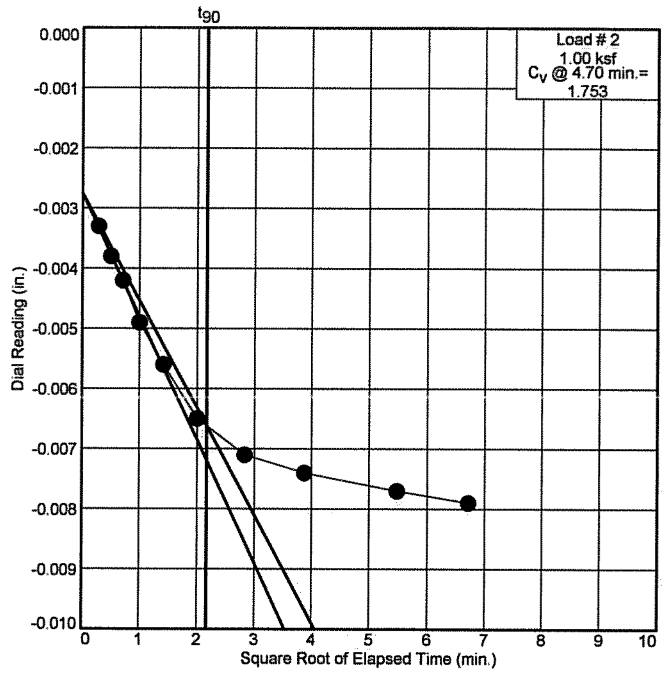
Tested By: JRF **Checked By:** MTG MTG

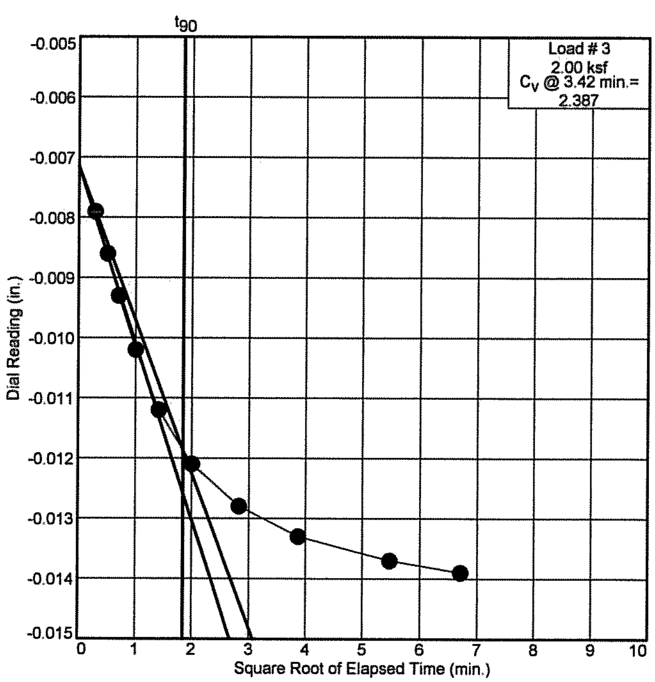
Dial Reading vs. Time

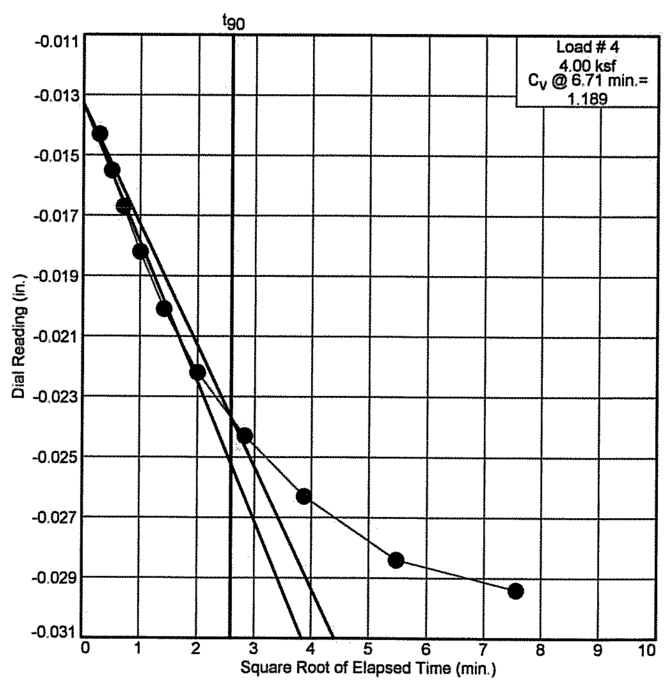
Project No.: 1368-010
Project: Cummings Road Over Maine Turnpike #18-001

Location: HB-CUM-204 Depth: 55'-57' Sample Number: U-1









R.W. Gillespie & Associates, Inc.

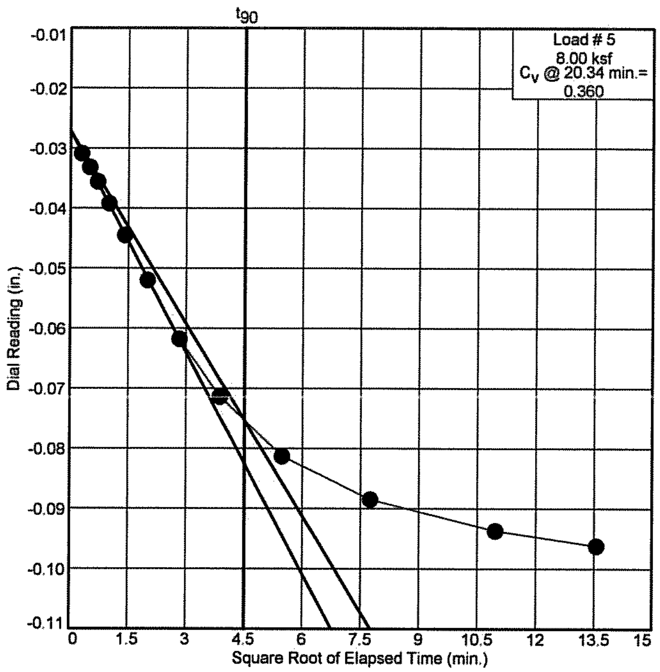
Saco, Maine

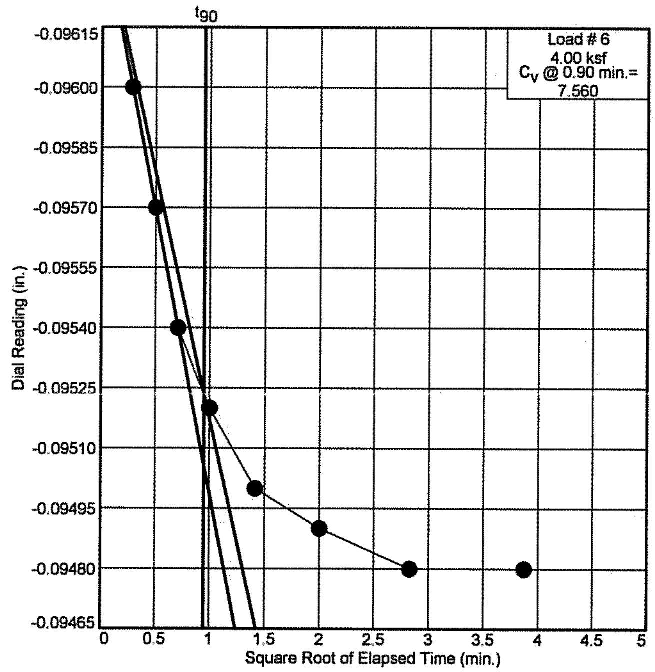
Lab No. 14869a

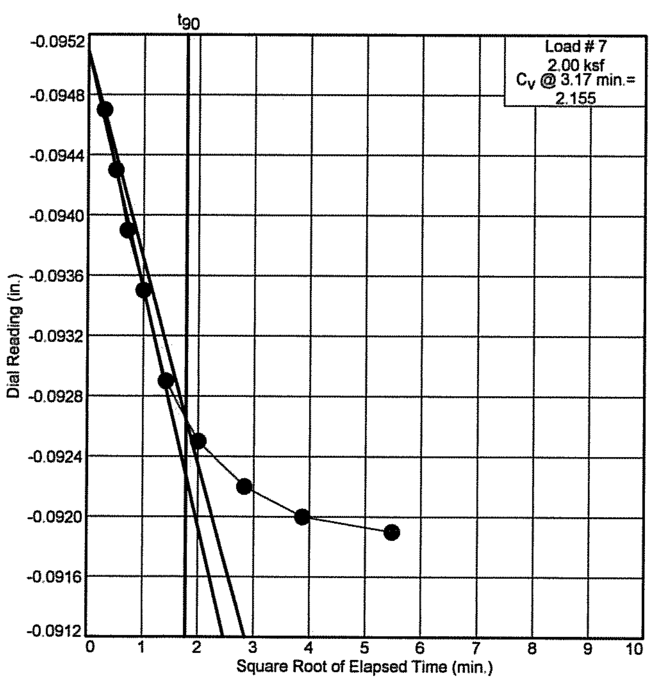
Dial Reading vs. Time

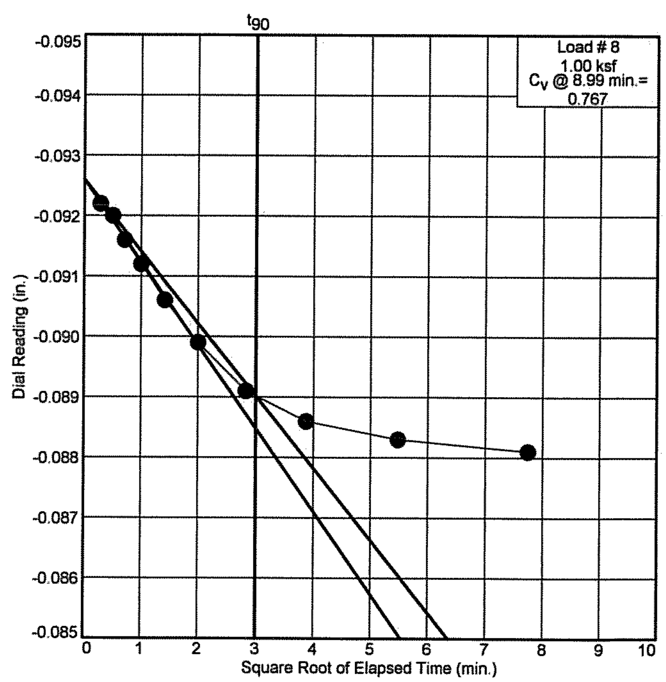
Project No.: 1368-010
Project: Cummings Road Over Maine Turnpike #18-001

Location: HB-CUM-204 Depth: 55'-57' Sample Number: U-1









R.W. Gillespie & Associates, Inc.

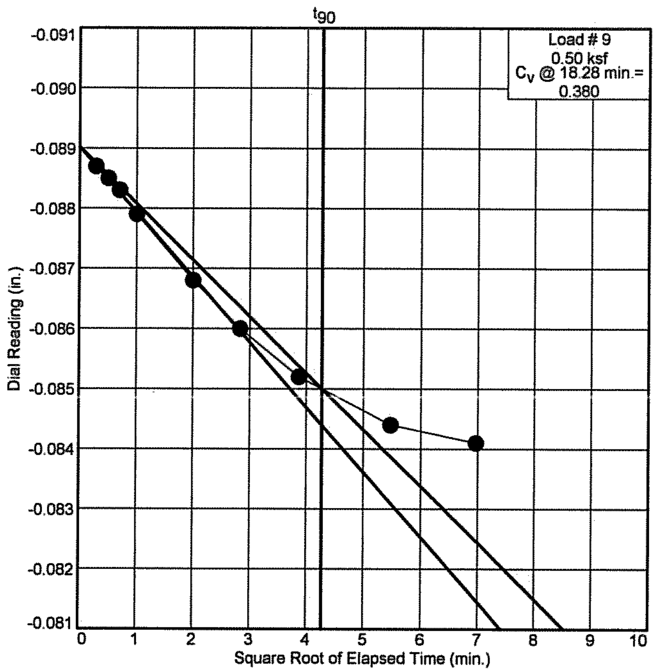
Saco, Maine

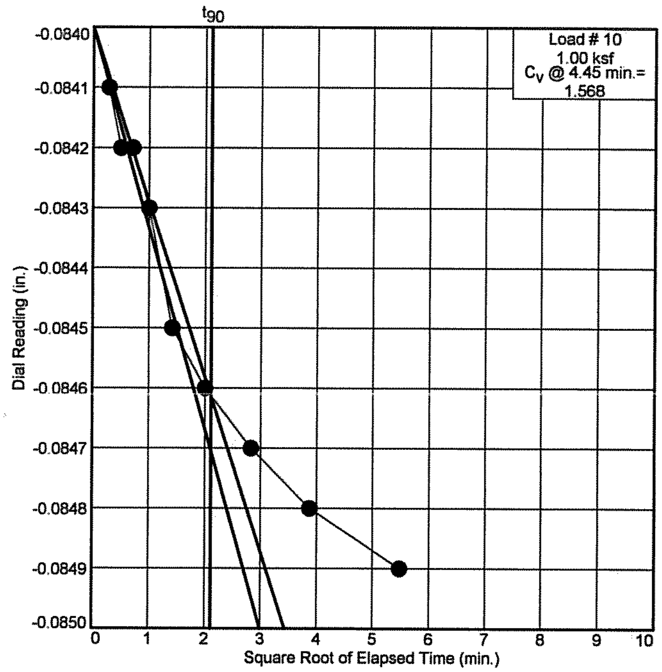
Lab No. 14868a

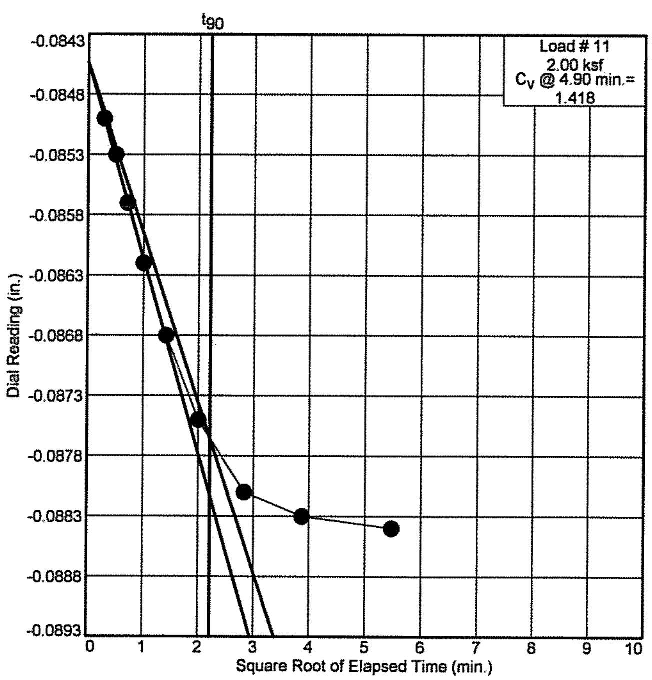
Dial Reading vs. Time

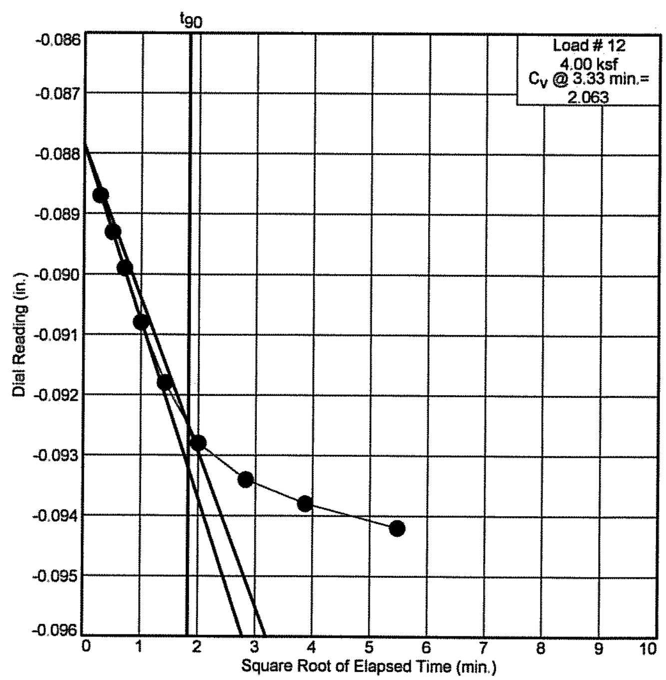
Project No.: 1368-010
Project: Cummings Road Over Maine Turnpike #18-001

Location: HB-CUM-204 Depth: 55'-57' Sample Number: U-1









R.W. Gillespie & Associates, Inc.

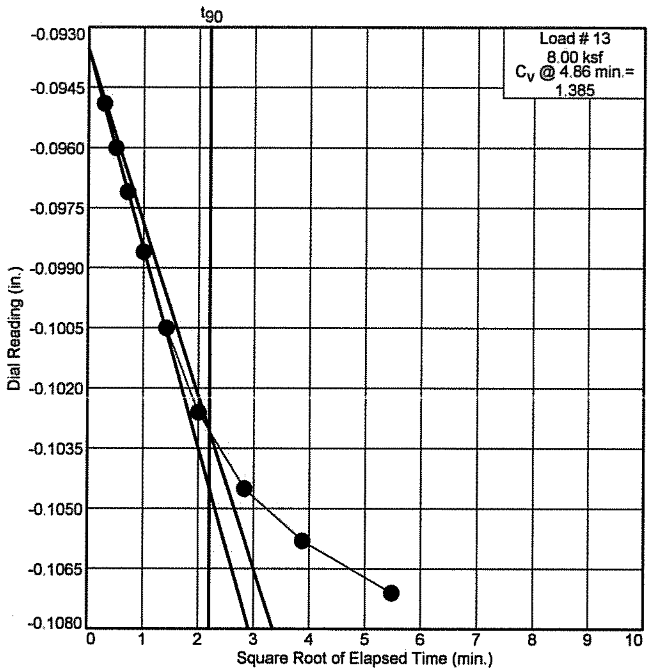
Saco, Maine

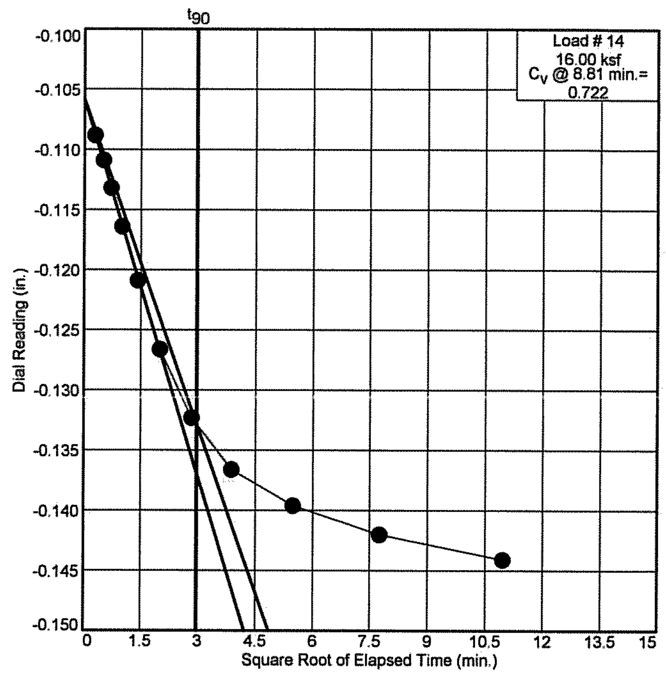
Lab No. 14868a

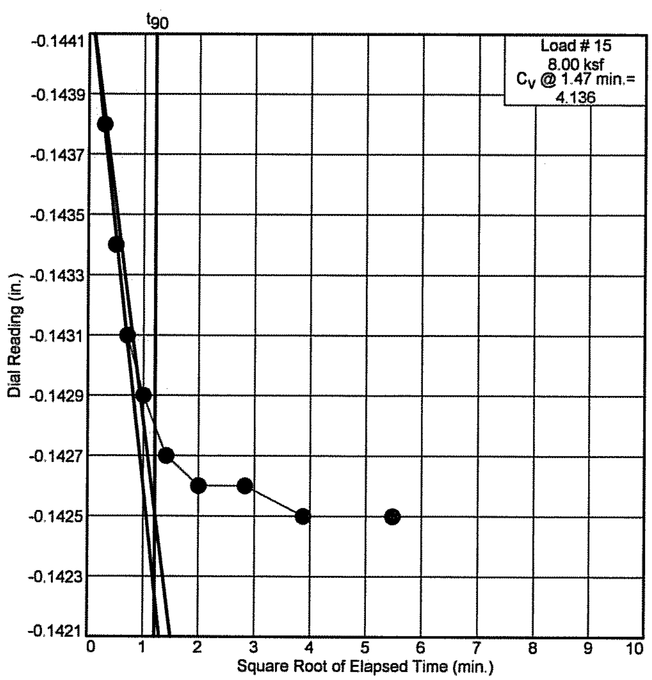
Dial Reading vs. Time

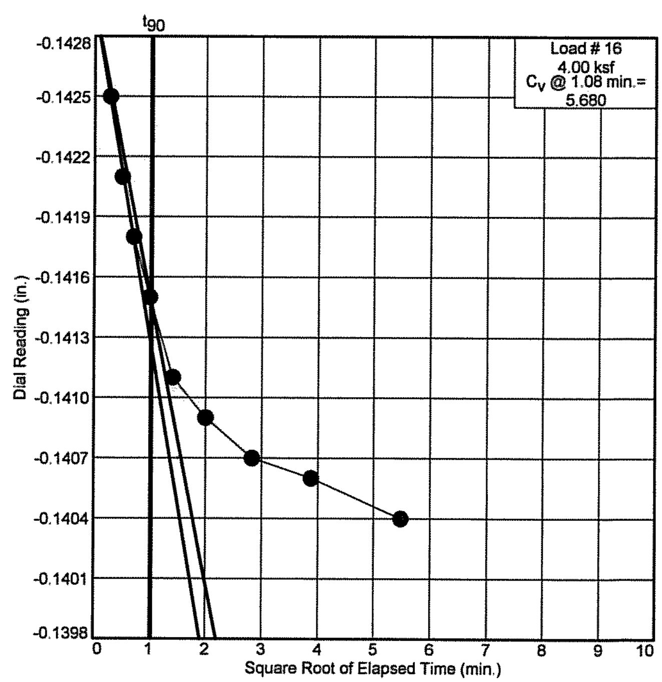
Project No.: 1368-010
Project: Cummings Road Over Maine Turnpike #18-001

Location: HB-CUM-204 Depth: 55'-57' Sample Number: U-1









R.W. Gillespie & Associates, Inc.

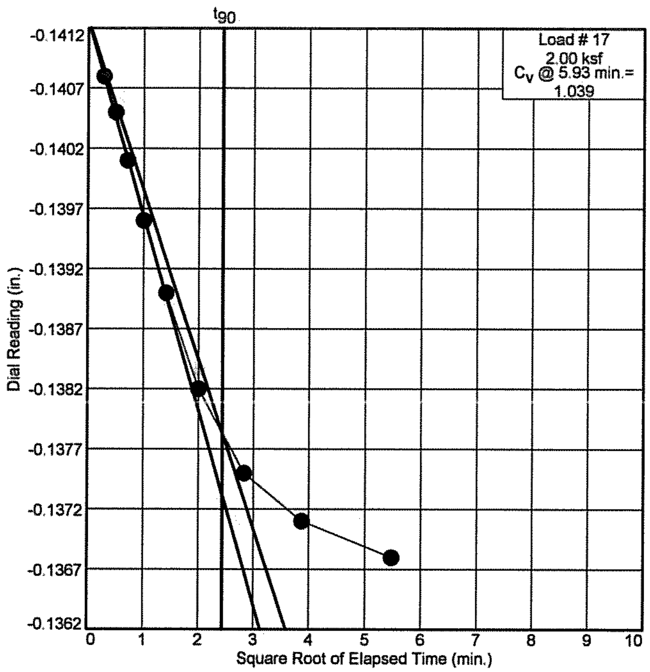
Saco, Maine

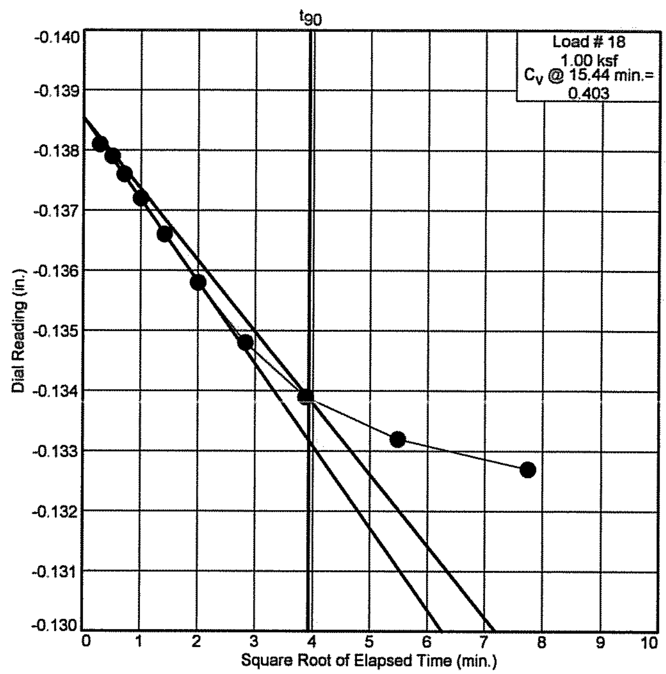
Lab No. 148[illegible]a

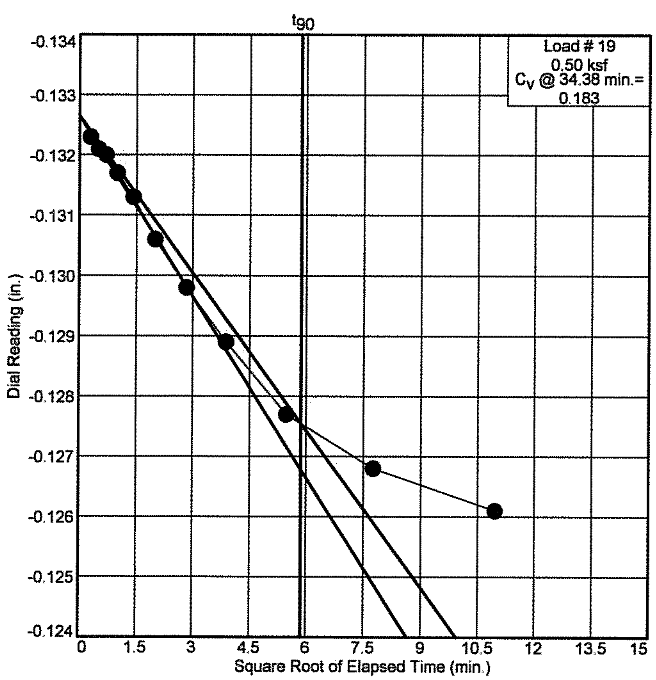
Dial Reading vs. Time

Project No.: 1368-010
Project: Cummings Road Over Maine Turnpike #18-001

Location: HB-CUM-204 Depth: 55'-57' Sample Number: U-1







R.W. Gillespie & Associates, Inc.

Saco, Maine

CONSOLIDATION reduced loading sequence for Cα determinations

CONSOLIDATION TEST REPORT

Coefficients of Consolidation and Secondary Consolidation											
No.	Load (ksf)	C_v (ft.^{2}/day)	C_α	No.	Load (ksf)	C_v (ft.^{2}/day)	C_α	No.	Load (ksf)	C_v (ft.^{2}/day)	C_α
1	0.50	0.809									
2	1.00	1.550									
3	2.00	1.355	0.005								
4	4.00	0.821									
5	8.00	0.188	0.015								

Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	Overburden (ksf)	P_c (ksf)	C_c	C_r	Initial Void Ratio
Saturation	Moisture									
99.2 %	39.5 %	81.9			2.75		3.8	0.52		1.097

MATERIAL DESCRIPTION	USCS	AASHTO
Lean Clay		

Project No. 1368-010 **Client:** Schonewald Engineering Associates, Inc.
Project: Cummings Road Over Maine Turnpike #18-001
Scarborough, ME
Location: HB-CUM-204 **Depth:** 55'-57' **Sample Number:** U-1

Remarks:

R.W. Gillespie & Associates, Inc.

Saco, Maine

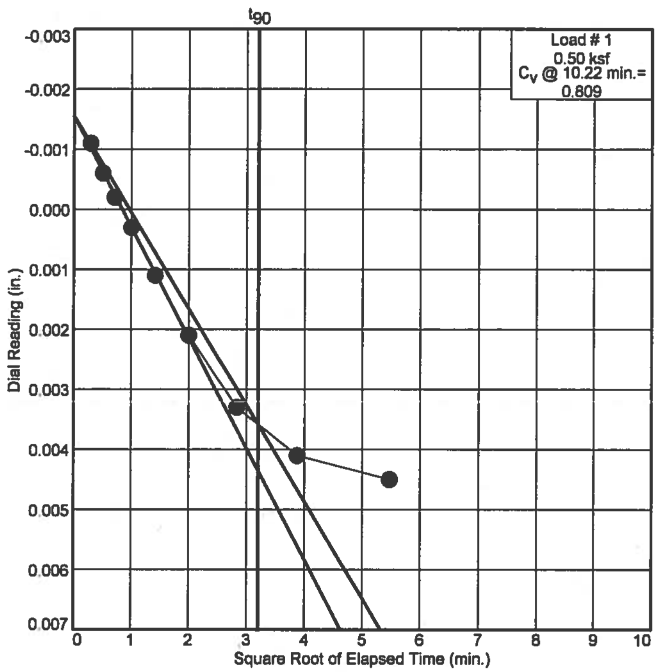
Lab No. 14896a

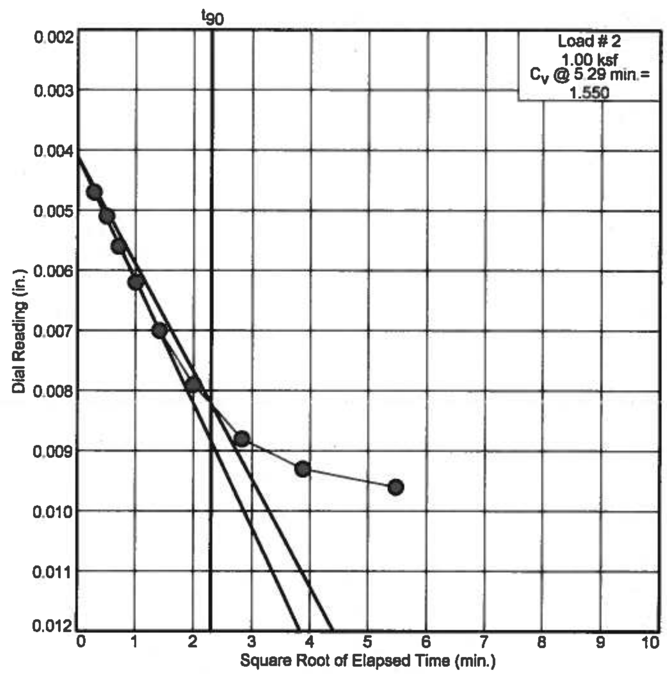
Tested By: JRF **Checked By:** MTG MTG

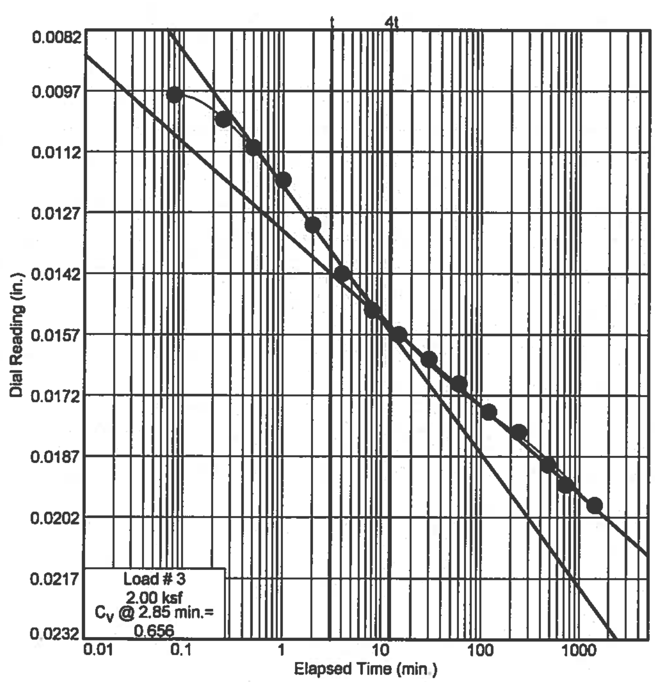
Dial Reading vs. Time

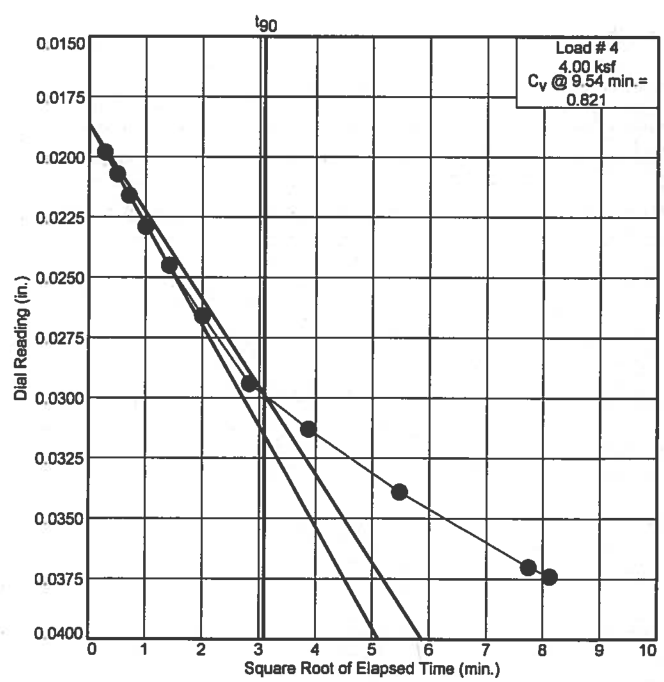
Project No.: 1368-010
Project: Cummings Road Over Maine Turnpike #18-001

Location: HB-CUM-204 **Depth:** 55'-57' **Sample Number:** U-1









R.W. Gillespie & Associates, Inc.

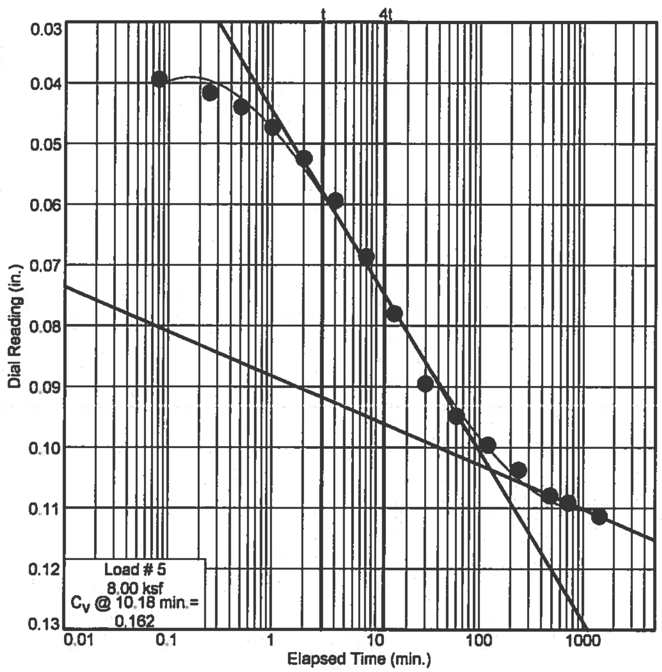
Saco, Maine

Lab No. 14896a

Dial Reading vs. Time

Project No.: 1368-010
Project: Cummings Road Over Maine Turnpike #18-001

Location: HB-CUM-204 Depth: 55'-57' Sample Number: U-1

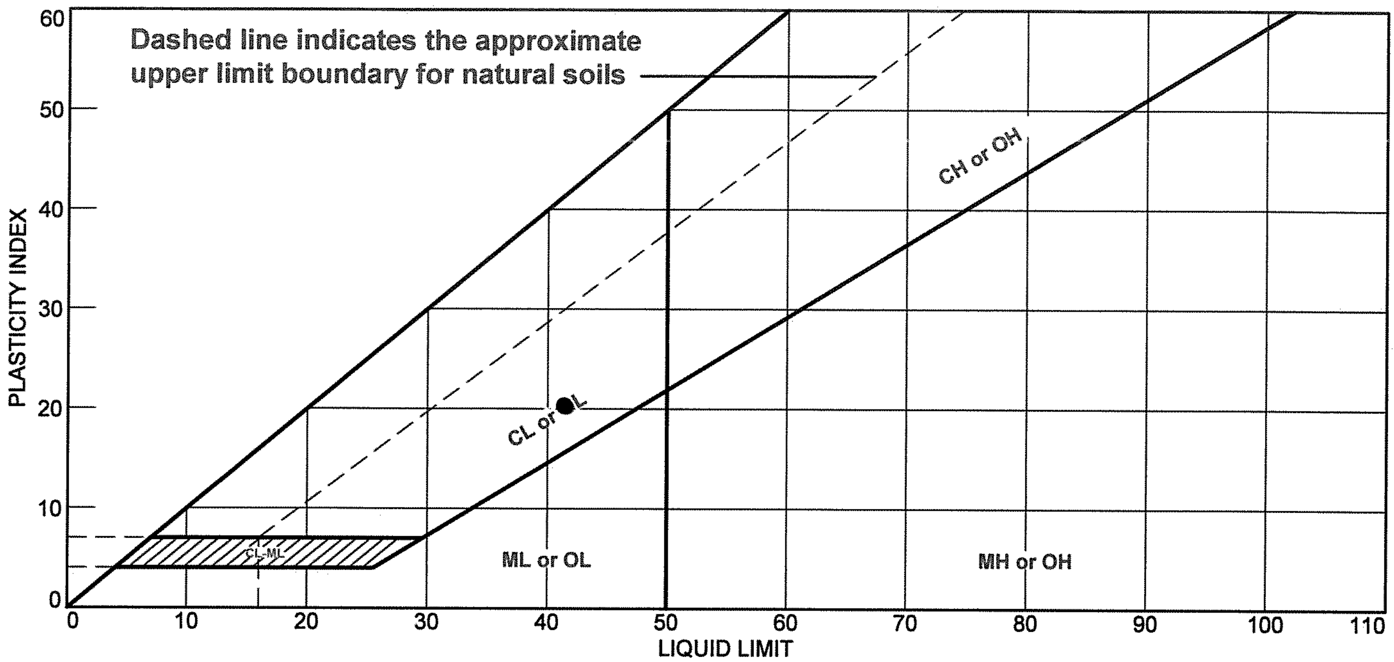


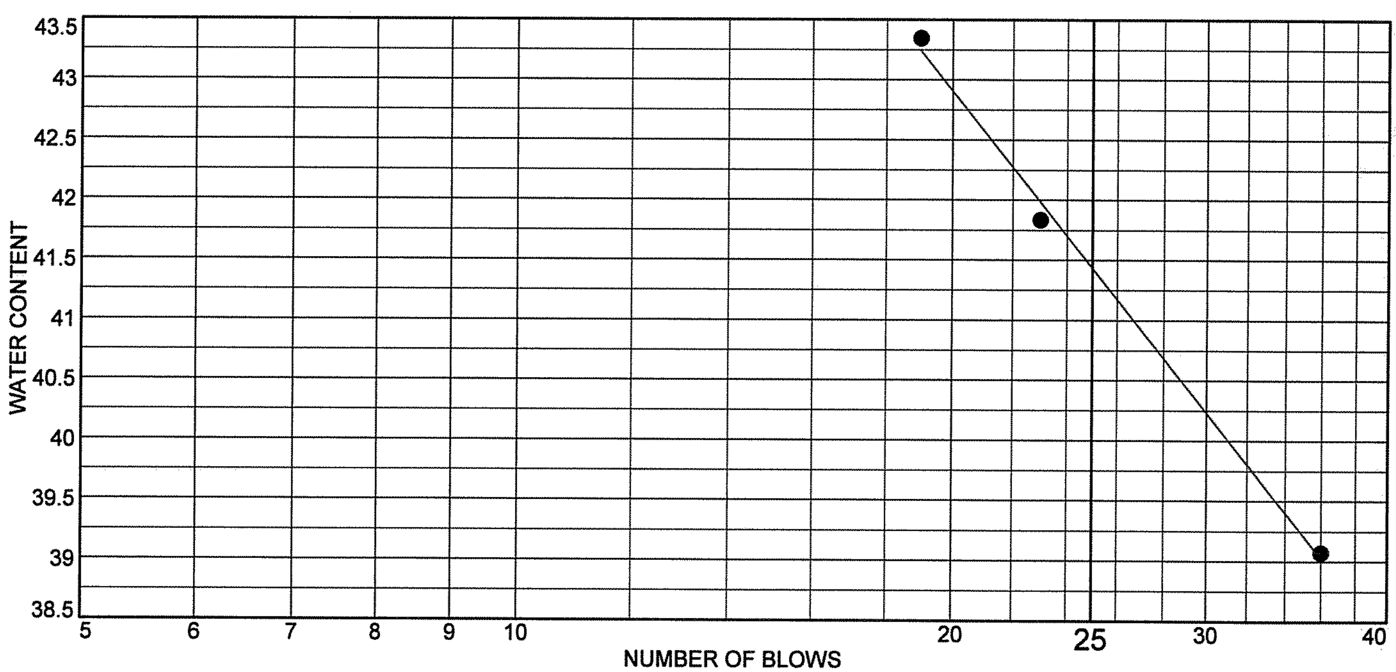
R.W. Gillespie & Associates, Inc.

Saco, Maine

Lab No. 14896a

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Lean CLay	41.4	21.1	20.3			

Project No. 1368-010 **Client:** Schonewald Engineering Associates, Inc.

Project: Cummings Road Over Maine Turnpike #18-001

Scarborough, ME

Location: HB-CUM-204

Sample Number: U-1 **Depth:** 55'-57'

R.W. Gillespie & Associates, Inc.

Saco, Maine

Remarks:

● Natural Moisture: 38%

Lab No. 14868a

Tested By: JRF **Checked By:** MTG MTG

Laboratory Vane Shear Test Results

ASTM D4648 Standard Test Method for Laboratory Miniature Vane Shear Test for Saturated Fine-Grained Clayey Soil

Project: Cummings Road Over Maine Turnpike #1
Client: Schonewald Engineering Associates, Inc.
Project No.: 1368-010

Location: Scarborough, ME
Date: 2/19/2018
Test Depth: 55.06 to 55.25

U-1

Boring/Sample No.		HB-CUM-204			Lab No.	14868a	
Test No.	Test Depth (ft)	Vane Size	Max. Torque (Undisturbed) (kg-cm)	Max. Torque (Remolded) (kg-cm)	Undrained Shear Strength (psf)	Undrained Shear Strength (psf)	Moisture Content
1	55.06	L	37	2	386	21	37%
2	55.25	L	39	2	407	21	39%

Vane Size	
	(mm)
S	16 x 32
M	20 x 40
L	24.5 x 50.8

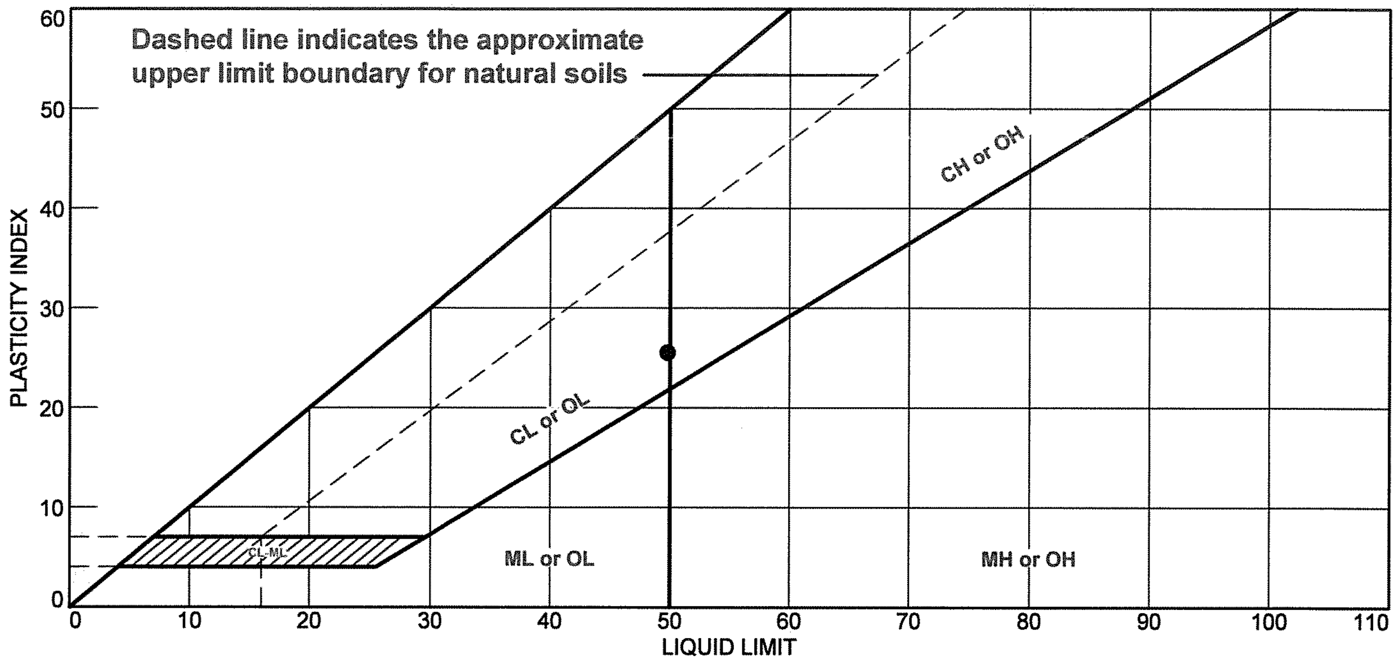
Tested By: JRF

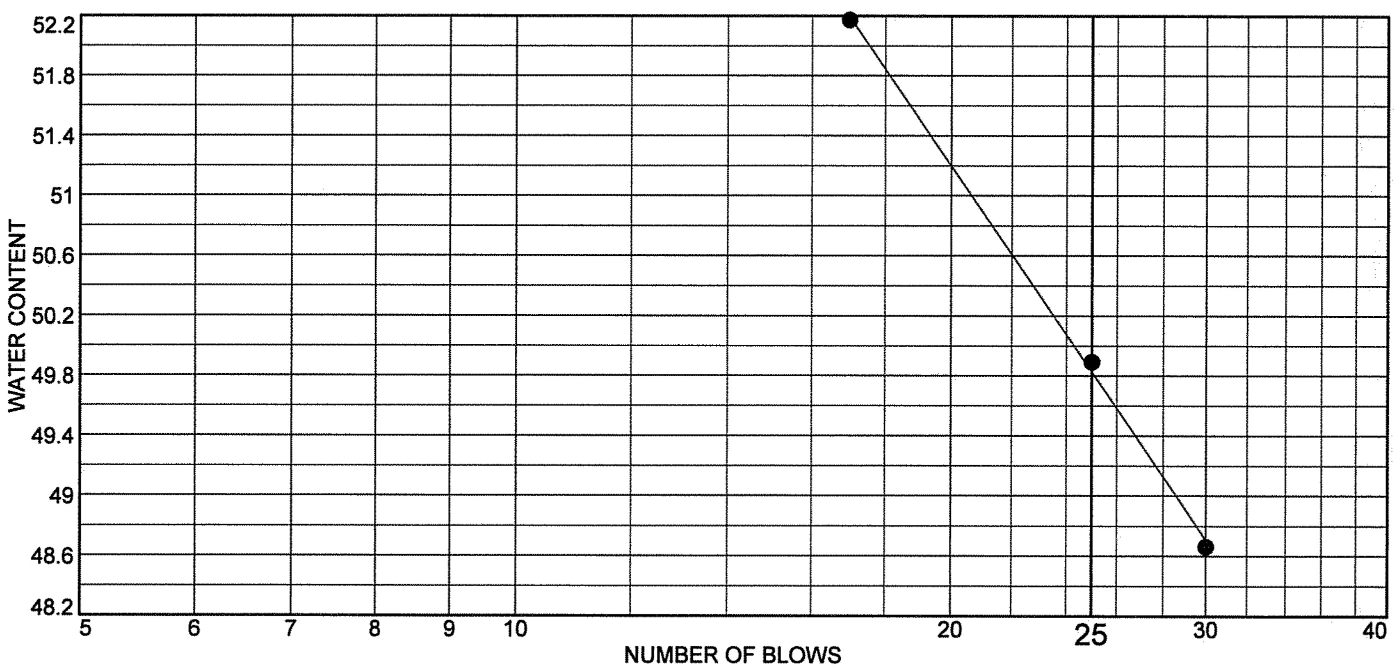
Checked By: MTG

R.W. Gillespie & Associates

86 Industrial Park Rd., Suite 4, Saco ME 04072, 207-286-8008 / 200 International Dr., Suite 170, Portsmouth NH 03801, 603-427-0244

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●		49.8	24.3	25.5			

Project No. 1368-010 **Client:** Schonewald Engineering Associates, Inc.

Project: Cummings Road Over Maine Turnpike #18-001

Scarborough, ME

Location: HB-CUM-204

Sample Number: 12-D **Depth:** 60'-62'

R.W. Gillespie & Associates, Inc.

Saco, Maine

Remarks:

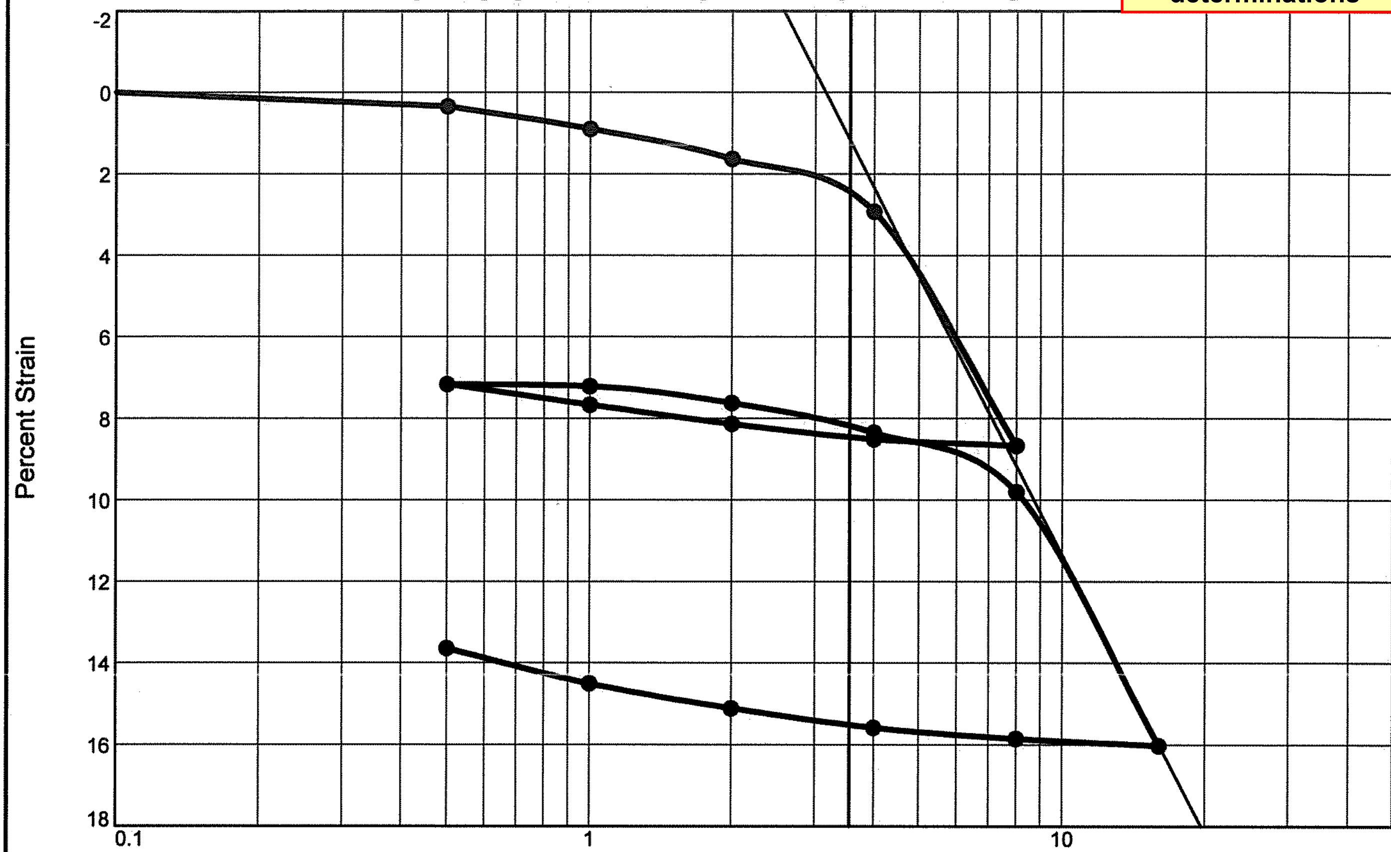
● Natural Moisture: 47.1%

Lab No. 14890b

Tested By: AGS **Checked By:** MTG

CONSOLIDATION including Cv determinations

CONSOLIDATION TEST REPORT



Coefficients of Consolidation and Secondary Consolidation											
No.	Load (ksf)	C_v (ft.^{2}/day)	C_α	No.	Load (ksf)	C_v (ft.^{2}/day)	C_α	No.	Load (ksf)	C_v (ft.^{2}/day)	C_α
1	0.50	0.566		8	1.00	0.595		15	8.00	3.172	
2	1.00	0.882		9	0.50	0.236		16	4.00	5.174	
3	2.00	1.291		10	1.00	1.471		17	2.00	0.466	
4	4.00	1.293		11	2.00	0.696		18	1.00	0.194	
5	8.00	0.235		12	4.00	1.189		19	0.50	0.088	
6	4.00	4.113		13	8.00	0.772					
7	2.00	1.259		14	16.00	0.365					

Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	Overburden (ksf)	P_c (ksf)	C_c	C_r	Initial Void Ratio
Saturation	Moisture									
102.3 %	40.1 %	82.8	40.0	16.6	2.75		4.2	0.47	0.12	1.077

MATERIAL DESCRIPTION	USCS	AASHTO
Lean Clay		

Project No. 1368-010 **Client:** Schonewald Engineering Associates, Inc.

Project: Cummings Road Over Maine Turnpike #18-001
Scarborough, ME

Location: HB-CUM-204 **Depth:** 75'-77' **Sample Number:** U-3

Remarks:

R.W. Gillespie & Associates, Inc.

Saco, Maine

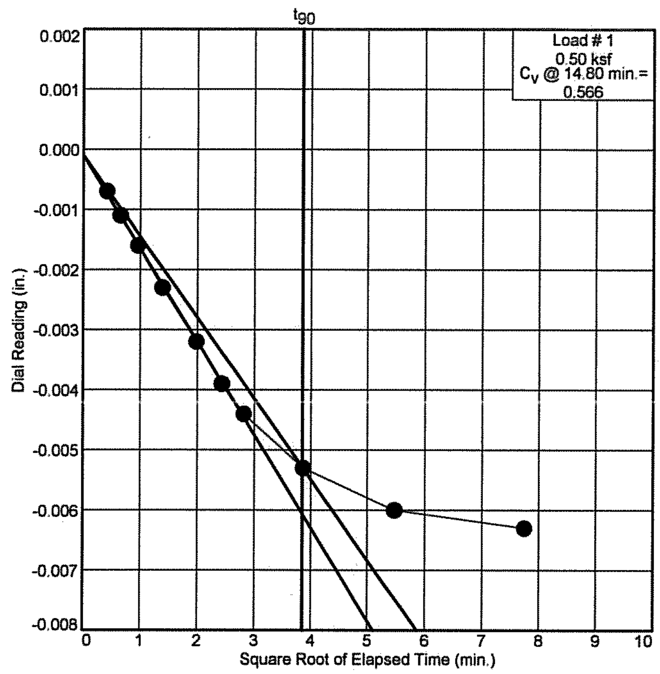
Lab No. 14868c

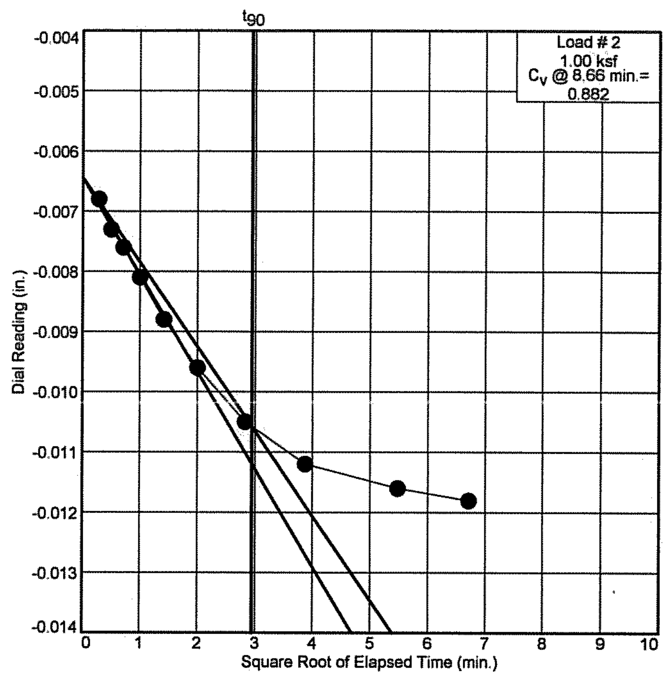
Tested By: JRF **Checked By:** MTG MTG

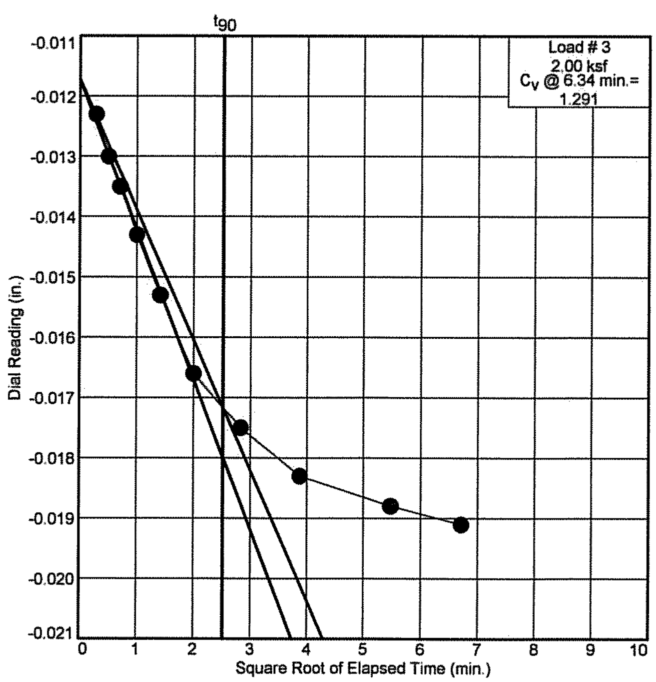
Dial Reading vs. Time

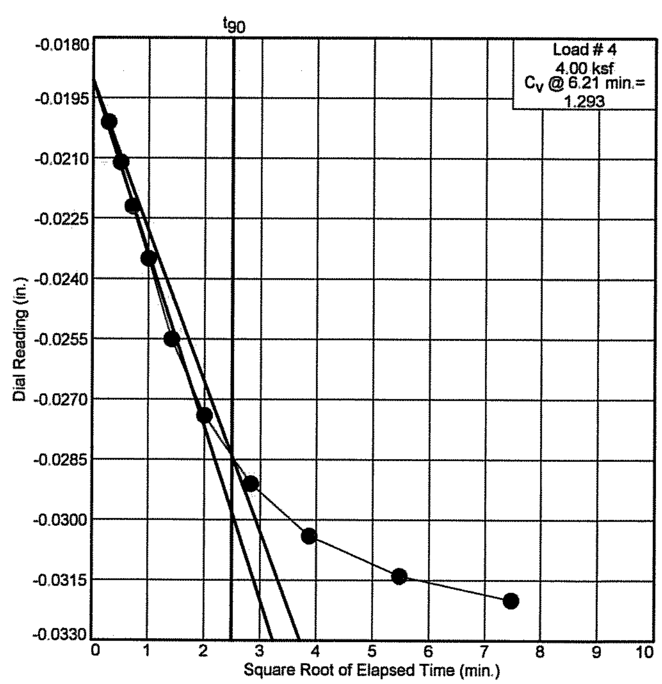
Project No.: 1368-010
Project: Cummings Road Over Maine Turnpike #18-001

Location: HB-CUM-204 **Depth:** 75'-77' **Sample Number:** U-3









R.W. Gillespie & Associates, Inc.

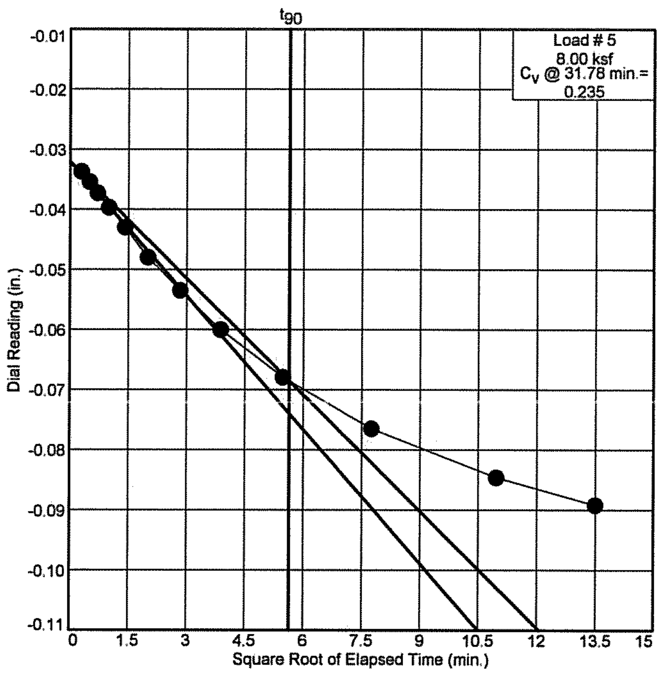
Saco, Maine

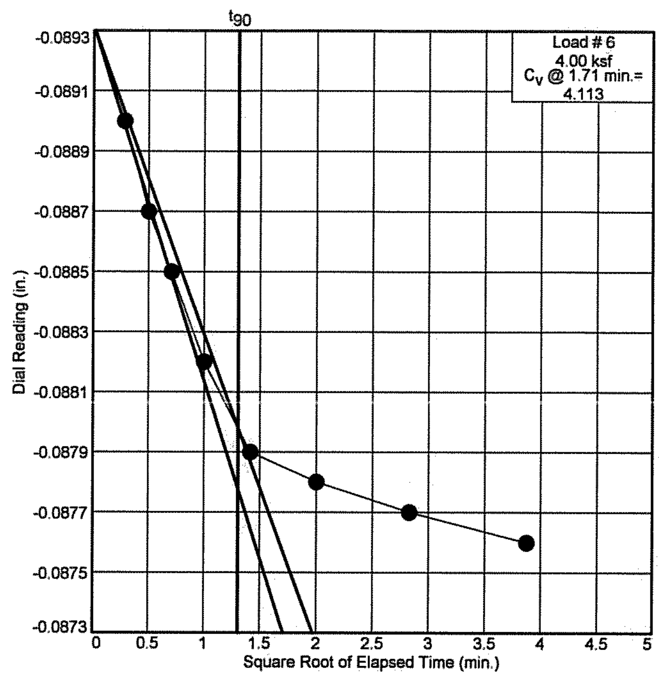
Lab No. 1486[illegible]c

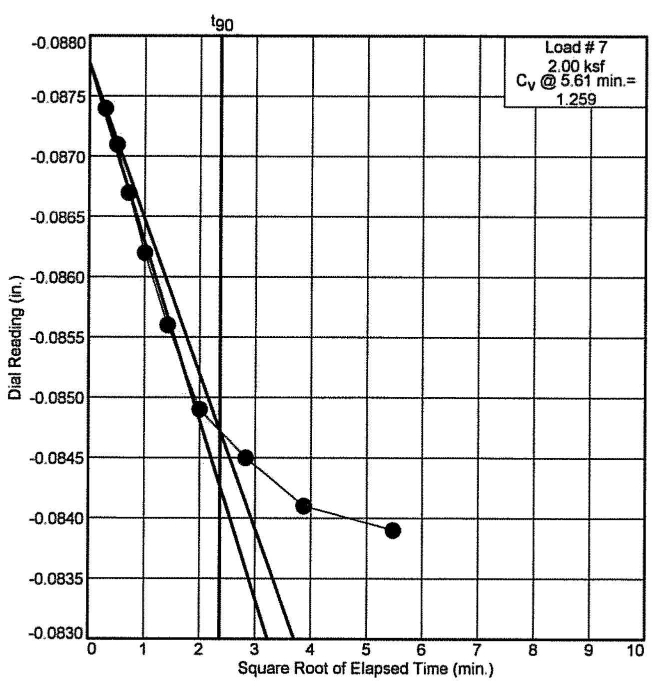
Dial Reading vs. Time

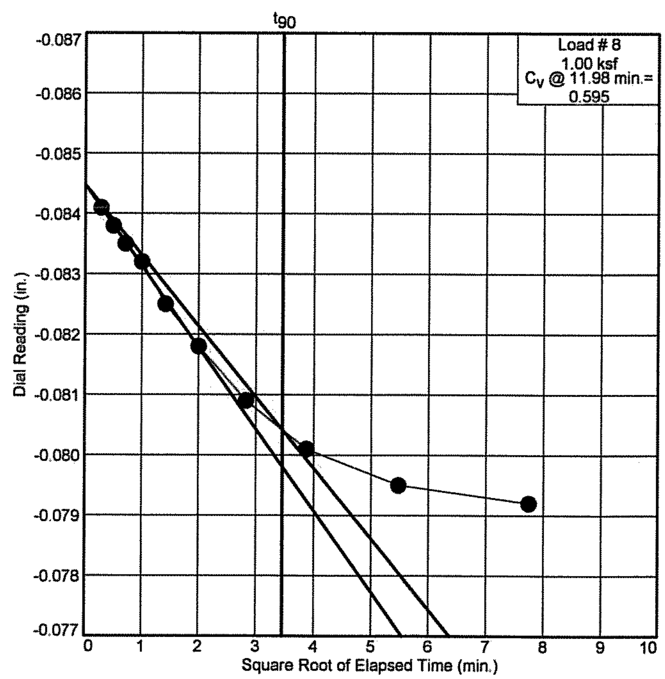
Project No.: 1368-010
Project: Cummings Road Over Maine Turnpike #18-001

Location: HB-CUM-204 **Depth:** 75'-77' **Sample Number:** U-3









R.W. Gillespie & Associates, Inc.

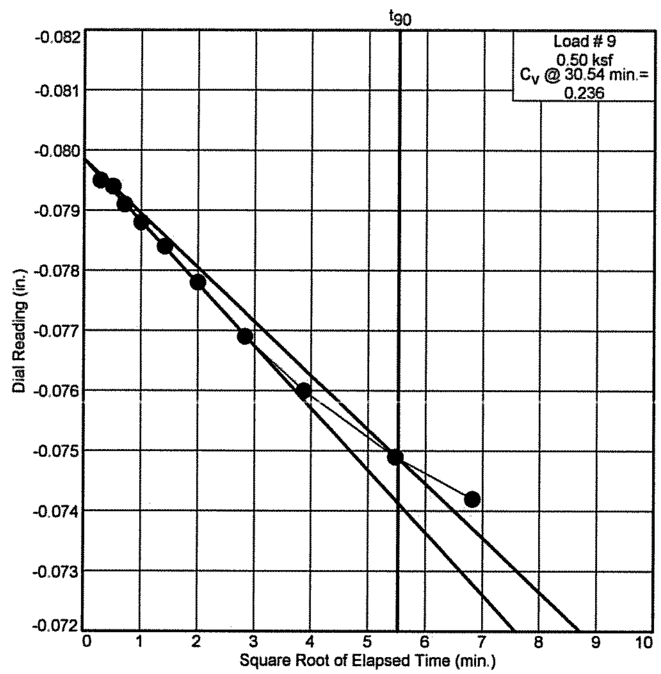
Saco, Maine

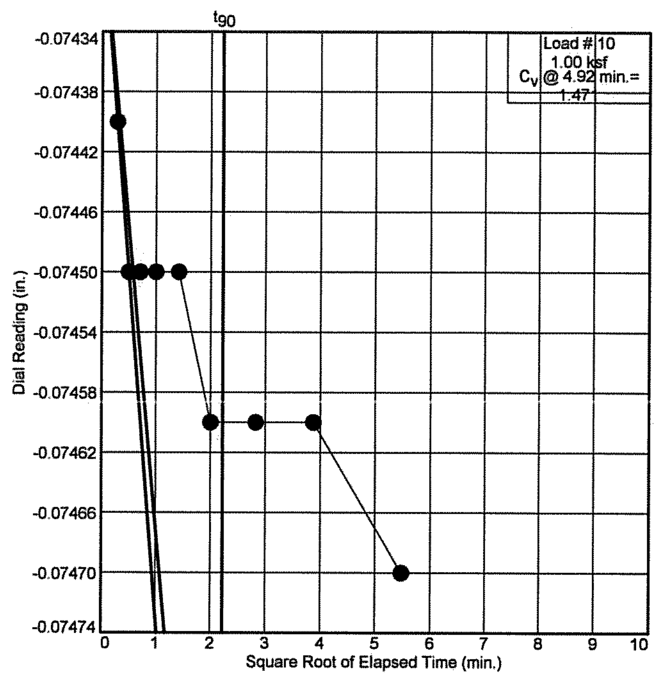
Lab No. 14816c

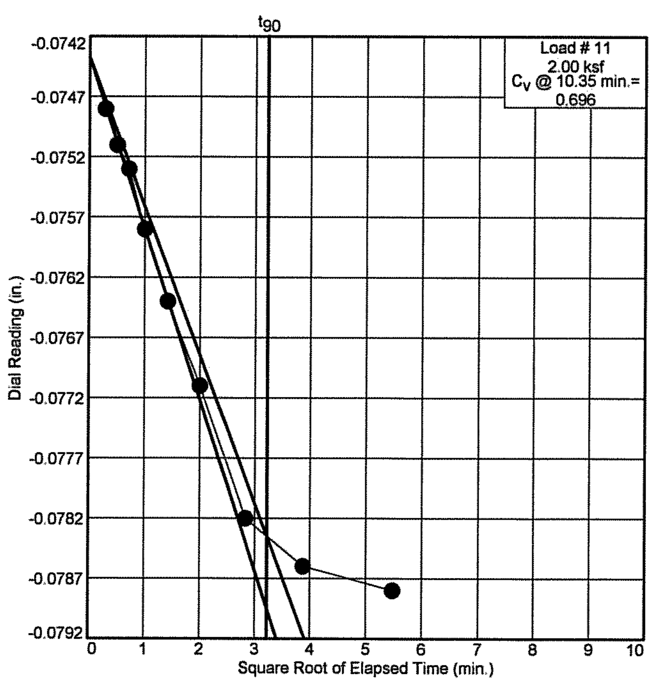
Dial Reading vs. Time

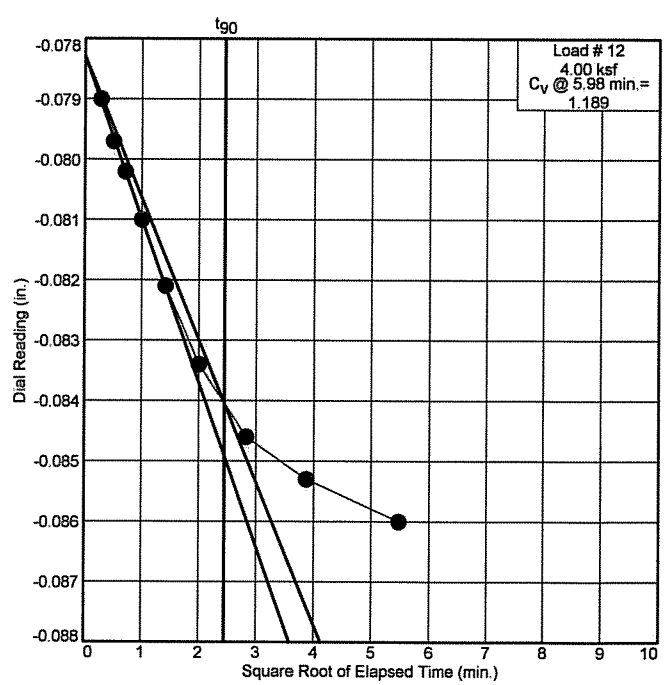
Project No.: 1368-010
Project: Cummings Road Over Maine Turnpike #18-001

Location: HB-CUM-204 **Depth:** 75'-77' **Sample Number:** U-3









R.W. Gillespie & Associates, Inc.

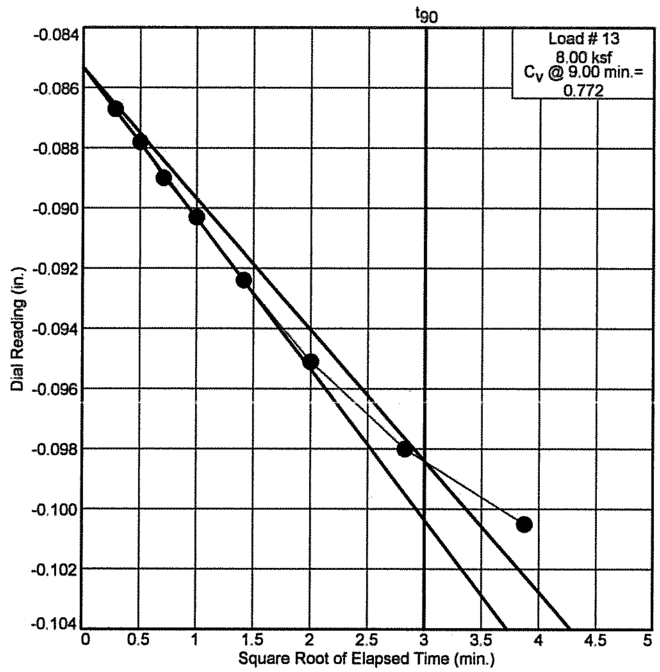
Saco, Maine

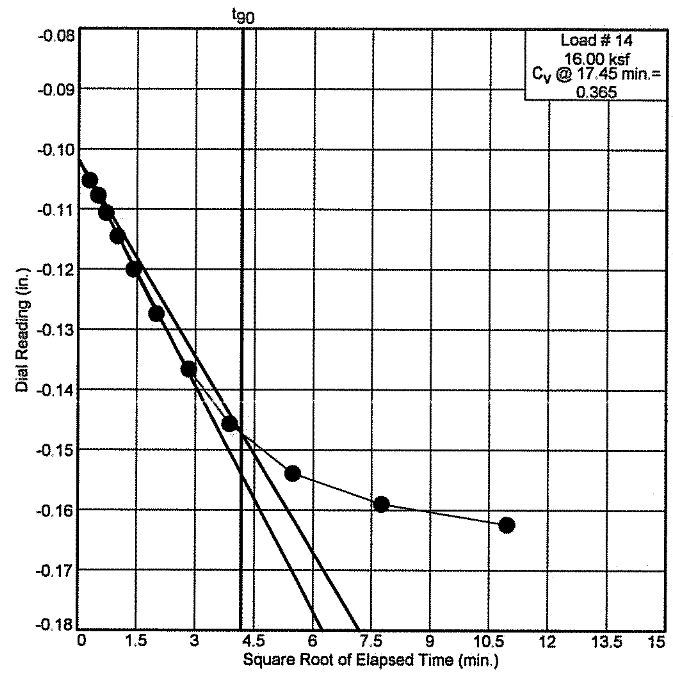
Lab No. 14864c

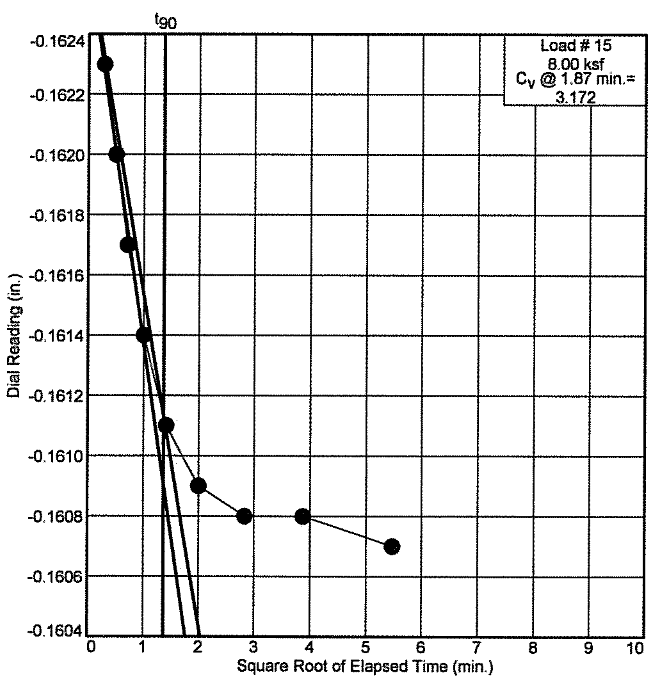
Dial Reading vs. Time

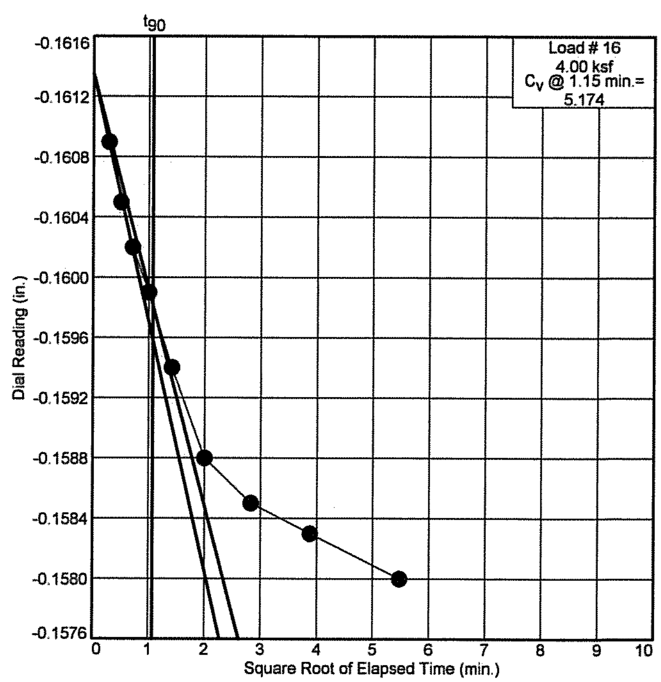
Project No.: 1368-010
Project: Cummings Road Over Maine Turnpike #18-001

Location: HB-CUM-204 **Depth:** 75'-77' **Sample Number:** U-3









R.W. Gillespie & Associates, Inc.

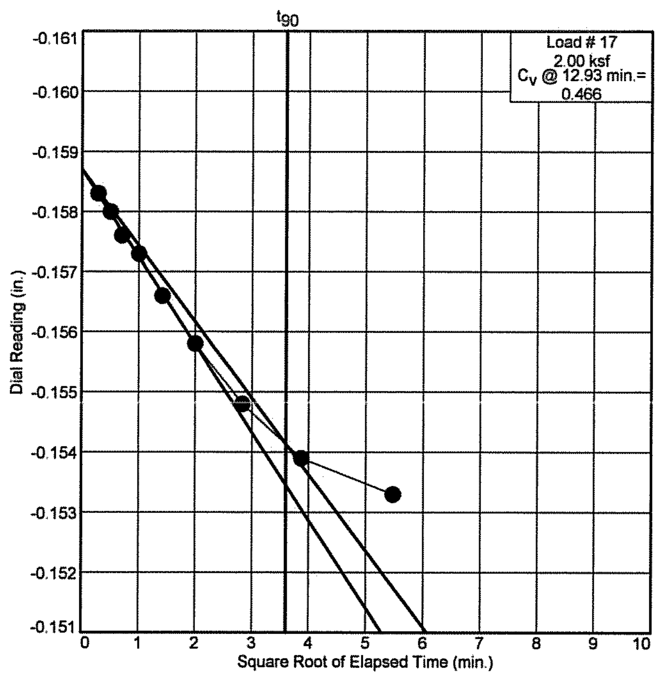
Saco, Maine

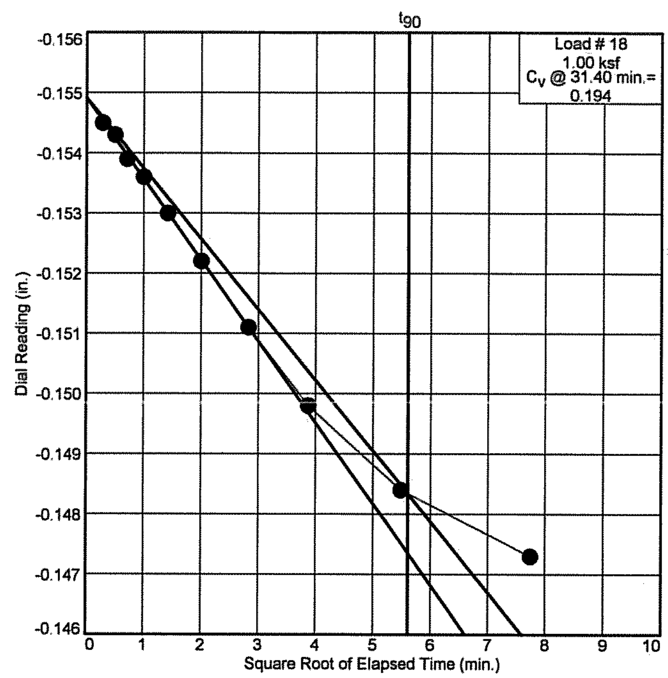
Lab No. 148[illegible]c

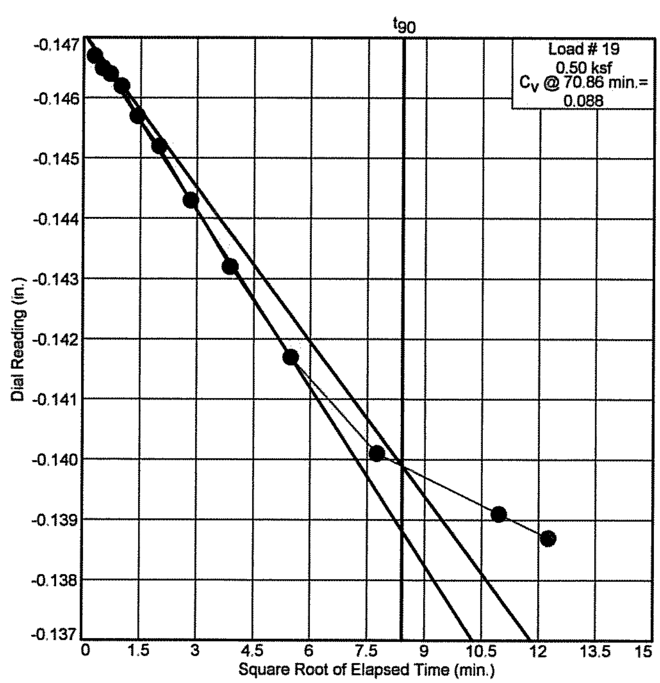
Dial Reading vs. Time

Project No.: 1368-010
Project: Cummings Road Over Maine Turnpike #18-001

Location: HB-CUM-204 Depth: 75'-77' Sample Number: U-3







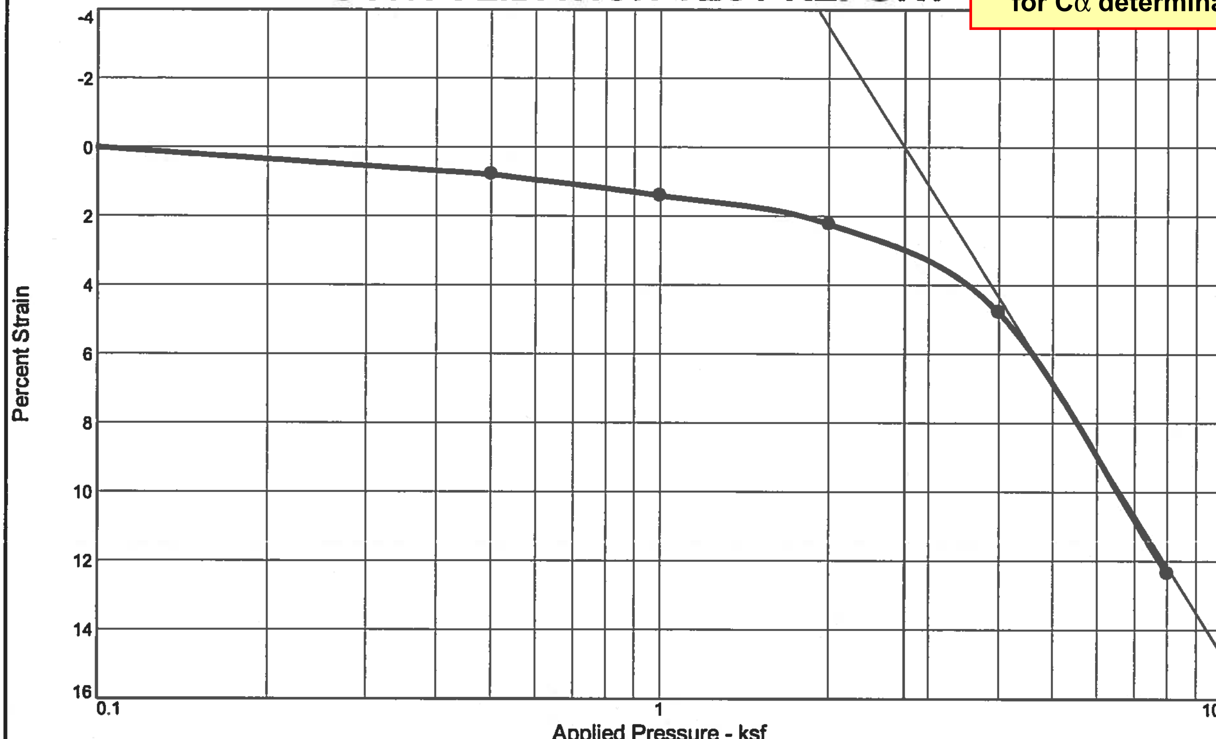
R.W. Gillespie & Associates, Inc.

Saco, Maine

Lab No. 14868c

CONSOLIDATION
reduced loading sequence
for Cα determinations

CONSOLIDATION TEST REPORT



Coefficients of Consolidation and Secondary Consolidation											
No.	Load (ksf)	C_v (ft.²/day)	C_α	No.	Load (ksf)	C_v (ft.²/day)	C_α	No.	Load (ksf)	C_v (ft.²/day)	C_α
1	0.50	0.821									
2	1.00	1.033									
3	2.00	1.681									
4	4.00	0.743	0.012								
5	8.00	0.133	0.023								

Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	Overburden (ksf)	P_c (ksf)	C_c	C_r	Initial Void Ratio
Saturation	Moisture									
98.6 %	39.1 %	82.1			2.75		3.7	0.54		1.091

MATERIAL DESCRIPTION	USCS	AASHTO
Lean Clay		

Project No. 1368-010 **Client:** Schonewald Engineering Associates, Inc.

Project: Cummings Road Over Maine Turnpike #18-001
Scarborough, ME

Location: HB-CUM-204 **Depth:** 75'-77' **Sample Number:** U-3

R.W. Gillespie & Associates, Inc.

Saco, Maine

Remarks:

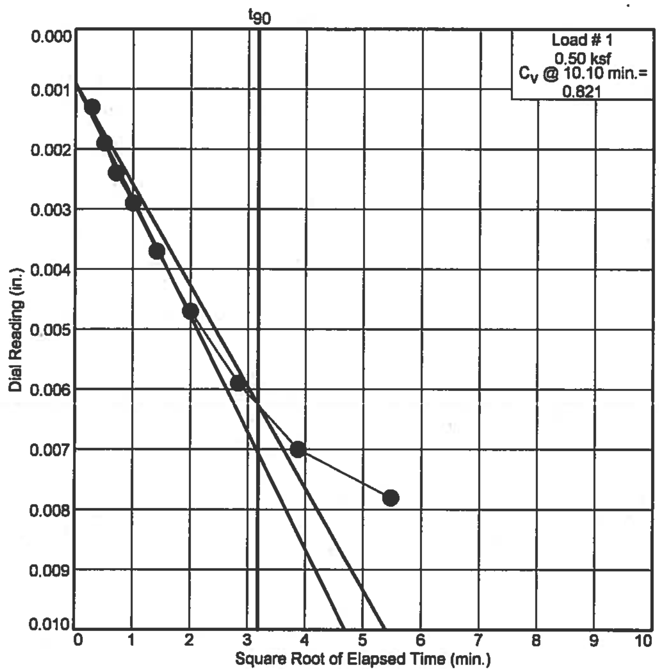
Lab No. 14896b

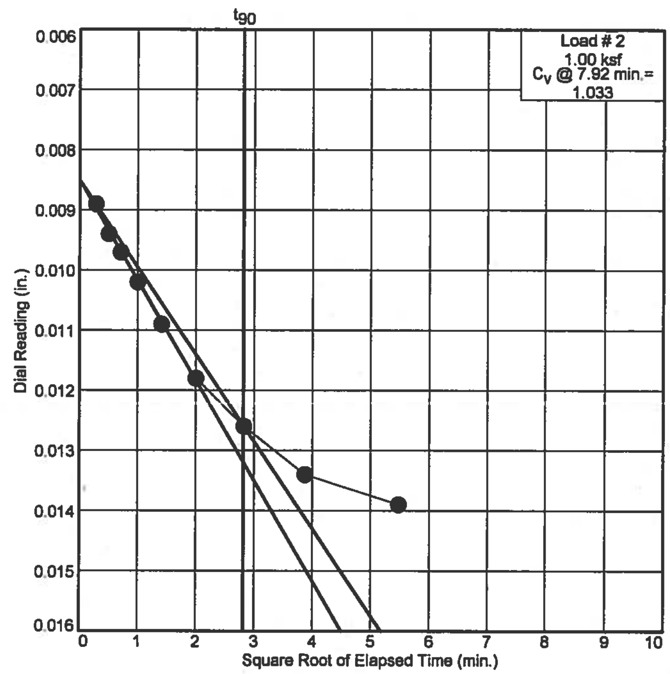
Tested By: JRF **Checked By:** MTG MTG

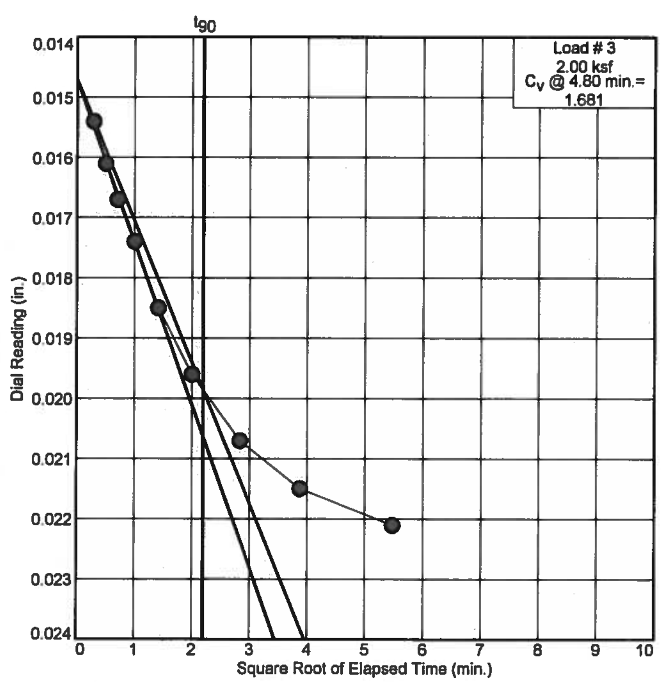
Dial Reading vs. Time

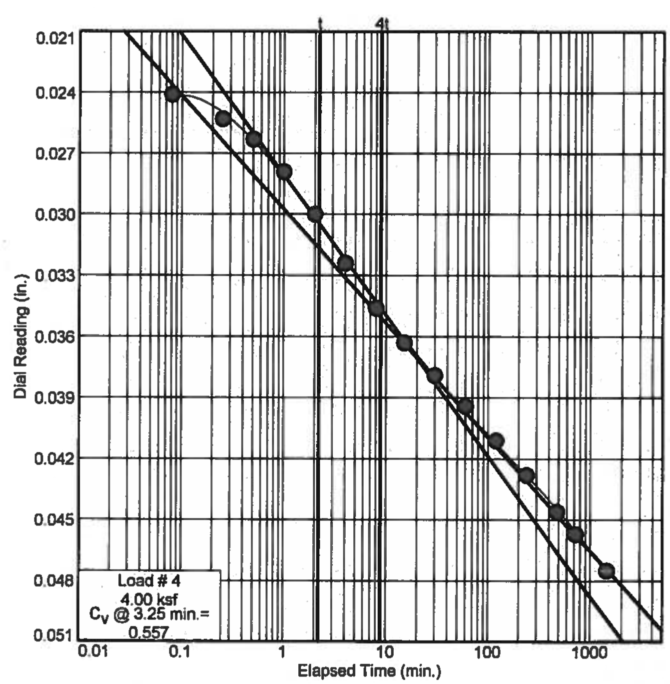
Project No.: 1368-010
Project: Cummings Road Over Maine Turnpike #18-001

Location: HB-CUM-204 **Depth:** 75'-77' **Sample Number:** U-3









R.W. Gillespie & Associates, Inc.

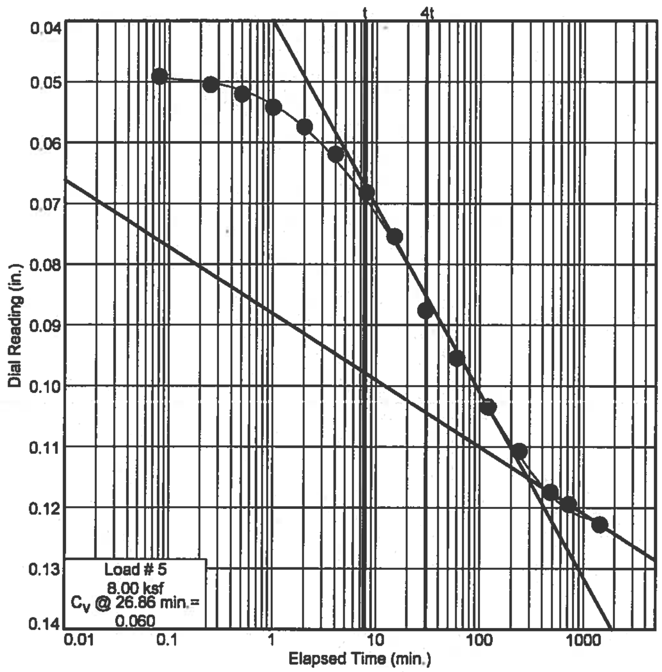
Saco, Maine

Lab No. 14896b

Dial Reading vs. Time

Project No.: 1368-010
Project: Cummings Road Over Maine Turnpike #18-001

Location: HB-CUM-204 **Depth:** 75'-77' **Sample Number:** U-3

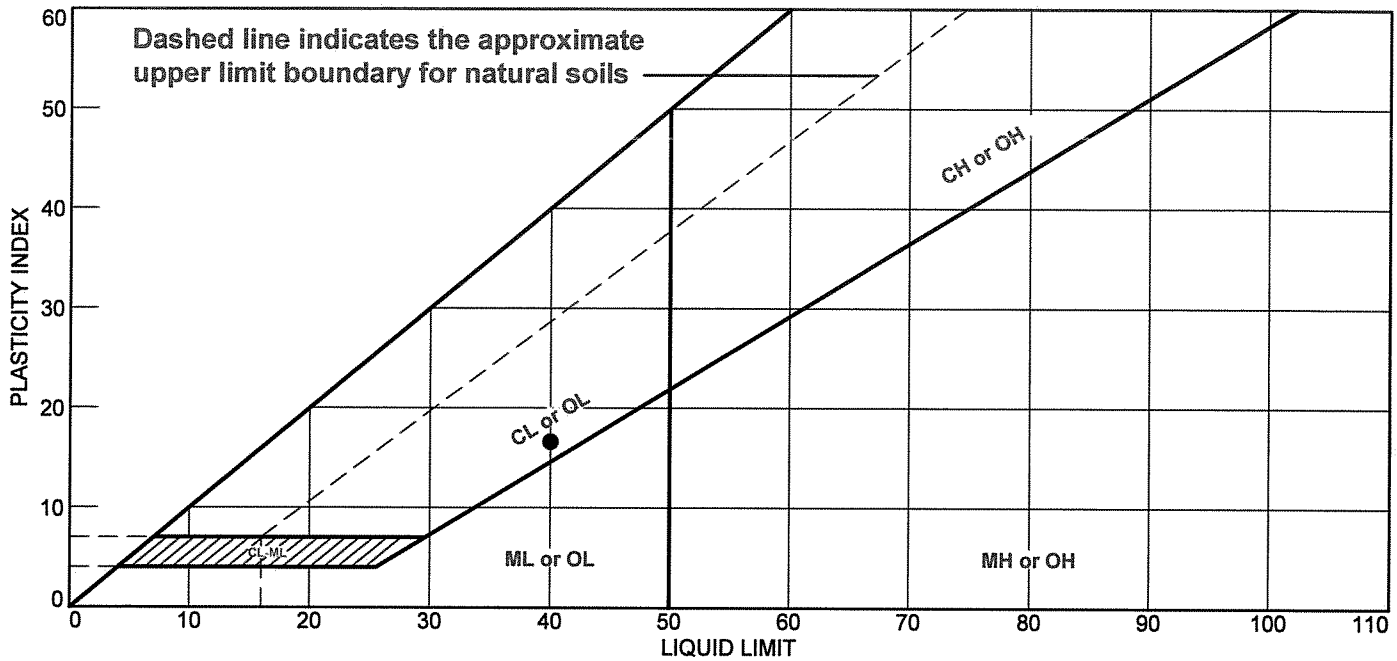


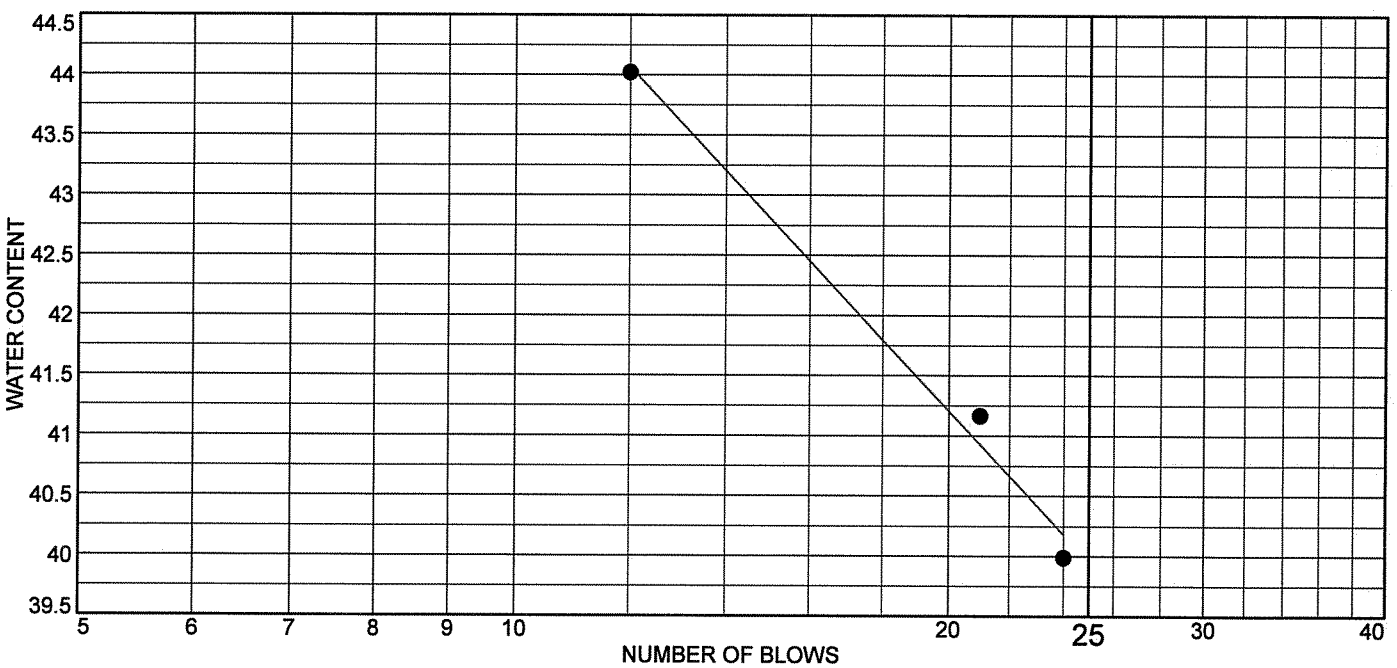
R.W. Gillespie & Associates, Inc.

Saco, Maine

Lab No. 14898b

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Lean Clay	40.0	23.4	16.6			

Project No. 1368-010 **Client:** Schonewald Engineering Associates, Inc.

Project: Cummings Road Over Maine Turnpike #18-001

Scarborough, ME

Location: HB-CUM-204

Sample Number: U-3 **Depth:** 75'-77'

R.W. Gillespie & Associates, Inc.

Saco, Maine

Remarks:

● Natural Moisture: 40%

Lab No. 14868c

Tested By: JRF **Checked By:** MTG MTG

Laboratory Vane Shear Test Results

ASTM D4648 Standard Test Method for Laboratory Miniature Vane Shear Test for Saturated Fine-Grained Clayey Soil

Project: Cummings Road Over Maine Turnpike #1 | Location: Scarborough, ME
Client: Schonewald Engineering Associates, Inc. | Date: 2/19/2018
Project No.: 1368-010 | Test Depth: 72.20 to 75.04

U-3

Boring/Sample No.	HB-CUM-204				Lab No.	14868c	
Test No.	Test Depth (ft)	Vane Size	Max. Torque (Undisturbed) (kg-cm)	Max. Torque (Remolded) (kg-cm)	Undrained Shear Strength (psf)	Undrained Shear Strength (psf)	Moisture Content
1	75.04	L	54	4	564	42	39%
2	72.2	L	49	0	512	0	40%

Vane Size	
	(mm)
S	16 x 32
M	20 x 40
L	24.5 x 50.8

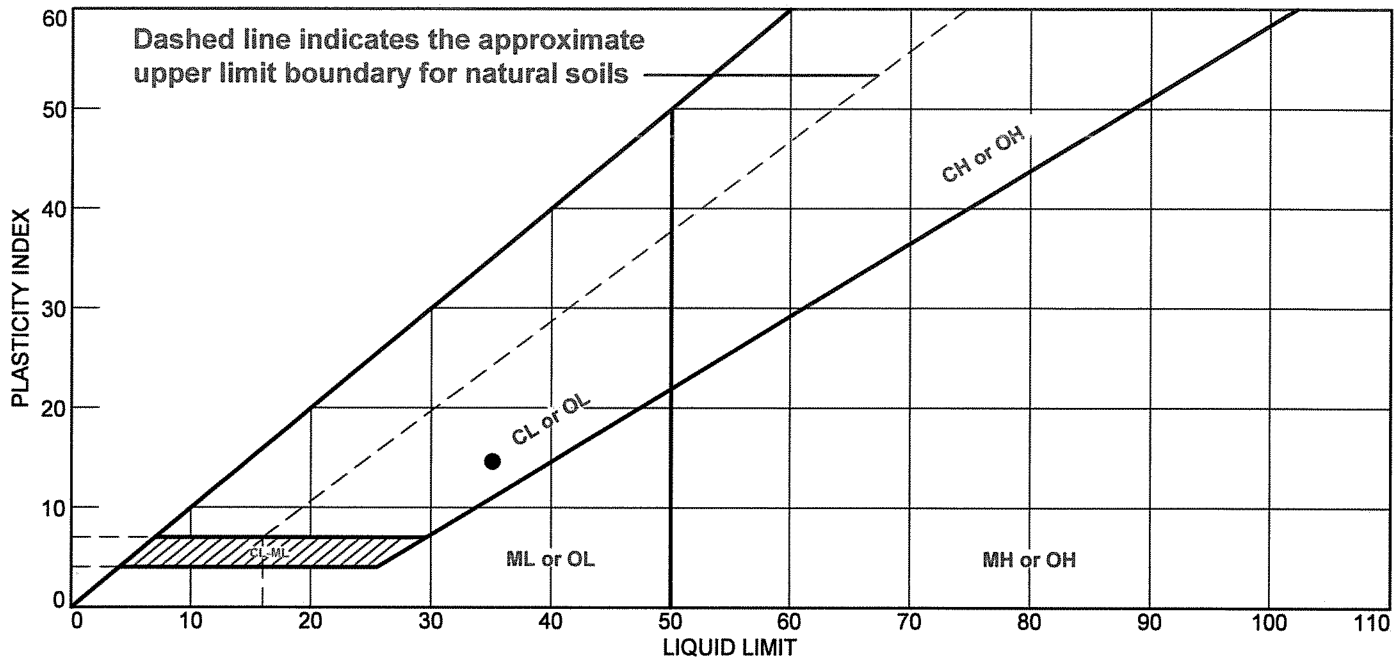
Tested By: JRF

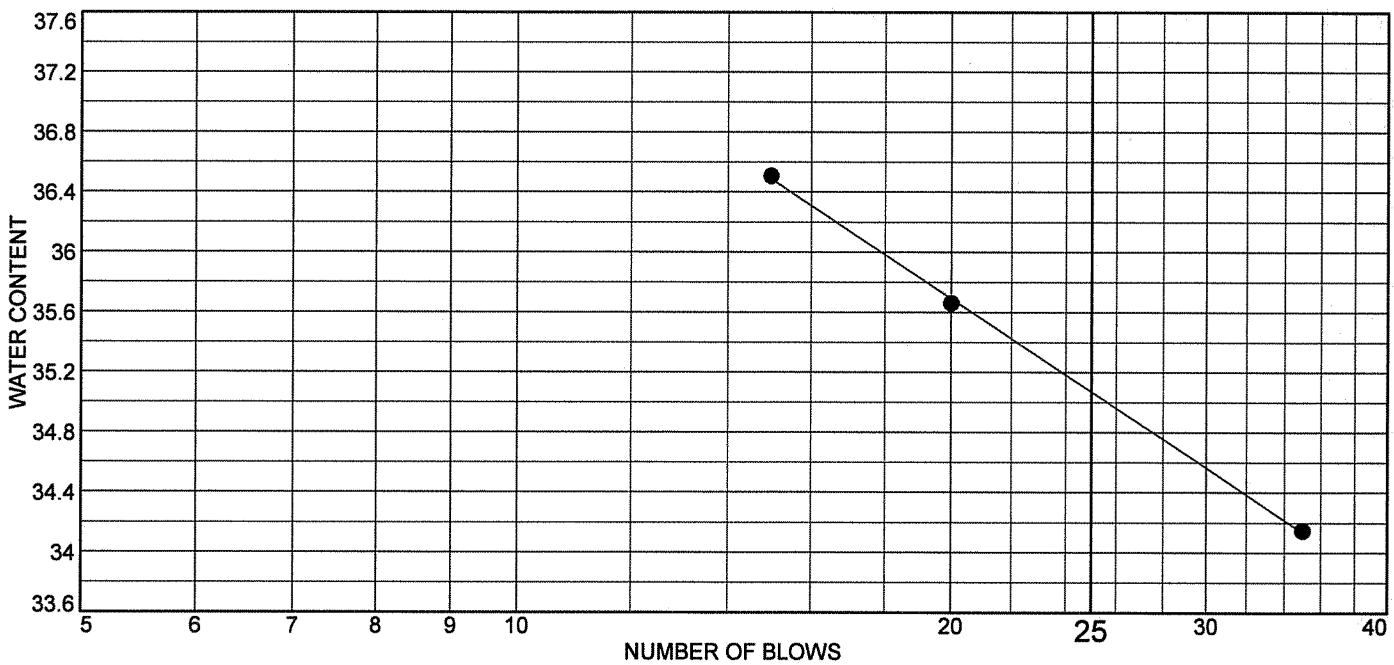
Checked By: MTG

R.W. Gillespie & Associates

86 Industrial Park Rd., Suite 4, Saco ME 04072, 207-286-8008 / 200 International Dr., Suite 170, Portsmouth NH 03801, 603-427-0244

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Lean Clay	35.1	20.5	14.6			

Project No. 1368-010 **Client:** Schonewald Engineering Associates, Inc.

Project: Cummings Road Over Maine Turnpike #18-001

Scarborough, ME

Location: HB-CUM-205

Sample Number: 11-D **Depth:** 49'-51'

R.W. Gillespie & Associates, Inc.

Saco, Maine

Remarks:

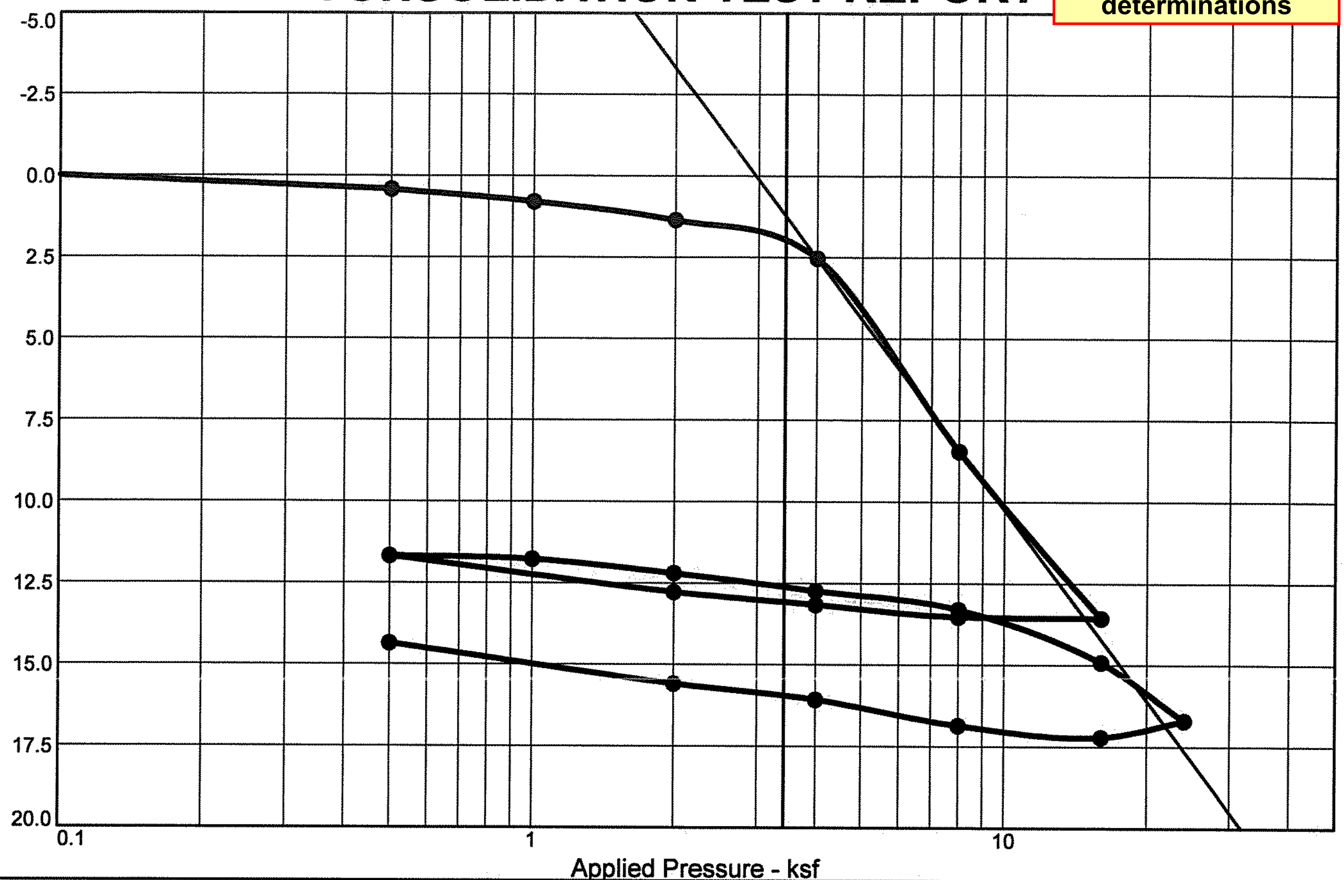
● Natural Moisture: 37.9%

Lab No. 14891a

Tested By: AGS **Checked By:** MTG

CONSOLIDATION including Cv determinations

CONSOLIDATION TEST REPORT



Coefficients of Consolidation and Secondary Consolidation											
No.	Load (ksf)	C_v (ft.^{2}/day)	C_α	No.	Load (ksf)	C_v (ft.^{2}/day)	C_α	No.	Load (ksf)	C_v (ft.^{2}/day)	C_α
1	0.50	0.711		8	4.00	1.342		15	16.00	0.934	
2	1.00	1.057		9	2.00	0.641		16	24.00	0.642	
3	2.00	1.978		10	0.50	0.145		17	16.00	5.068	
4	4.00	1.165		11	1.00	0.821		18	8.00	3.451	
5	8.00	0.257		12	2.00	0.650		19	4.00	1.005	
6	16.00	0.377		13	4.00	0.776		20	2.00	70.579	
7	8.00	3.835		14	8.00	1.302		21	0.50	0.091	

Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	Overburden (ksf)	P_c (ksf)	C_c	C_r	Initial Void Ratio
Saturation	Moisture									
113.4 %	49.2 %	78.3	42.1	19.0	2.75		3.8	0.43	0.08	1.193

MATERIAL DESCRIPTION	USCS	AASHTO
Lean Clay		

Project No. 1368-010 **Client:** Schonewald Engineering Associates, Inc.

Project: Cummings Road Over Maine Turnpike #18-001
Scarborough, ME

Location: HB-CUM-205 **Depth:** 60'-62' **Sample Number:** U-1

R.W. Gillespie & Associates, Inc.

Saco, Maine

Remarks:

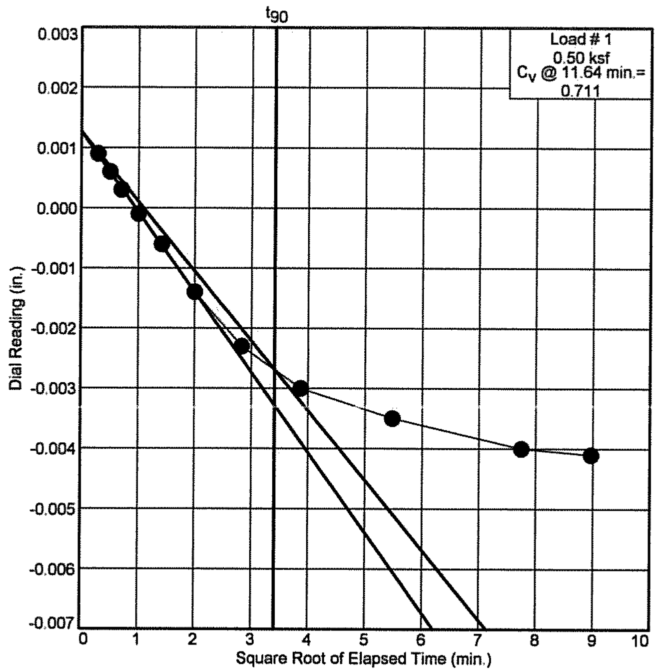
Lab No. 14869a

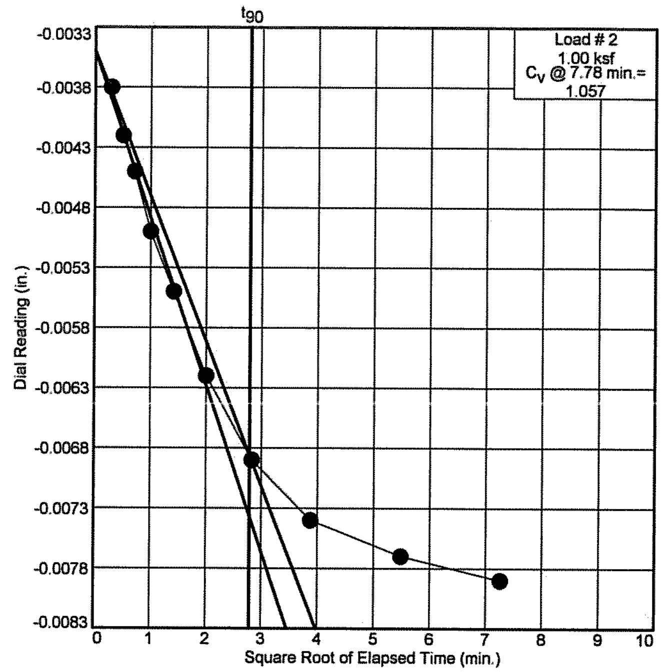
Tested By: JRF **Checked By:** MTG MTG

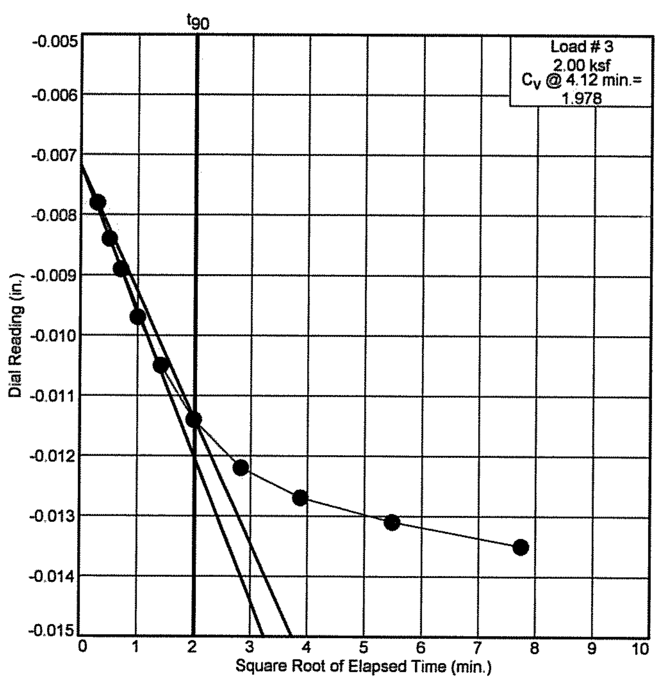
Dial Reading vs. Time

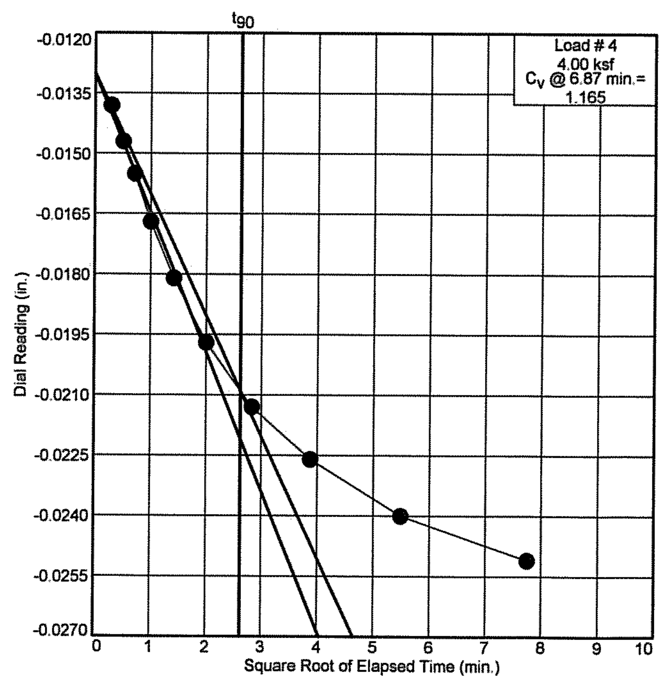
Project No.: 1368-010
Project: Cummings Road Over Maine Turnpike #18-001

Location: HB-CUM-205 Depth: 60'-62' Sample Number: U-1









R.W. Gillespie & Associates, Inc.

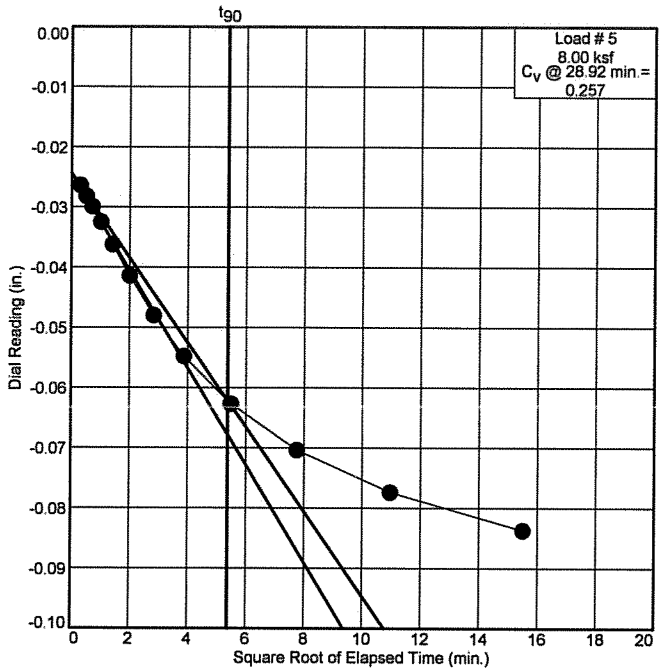
Saco, Maine

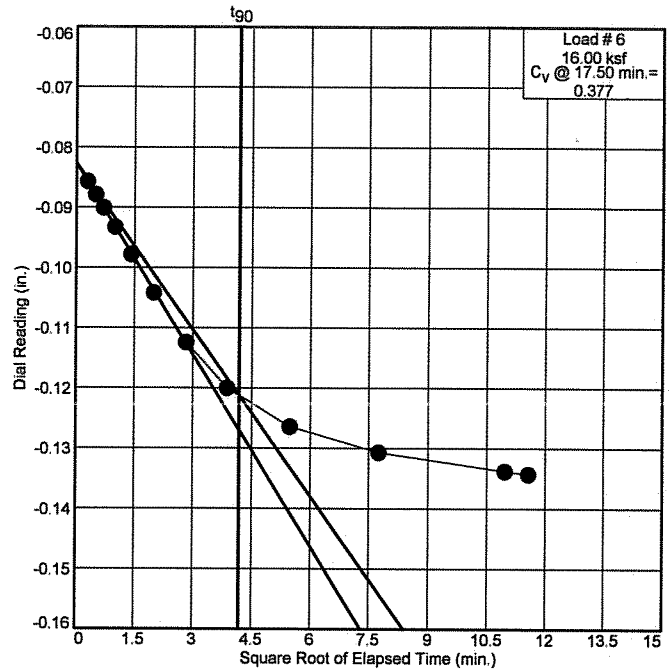
Lab No. 14870a

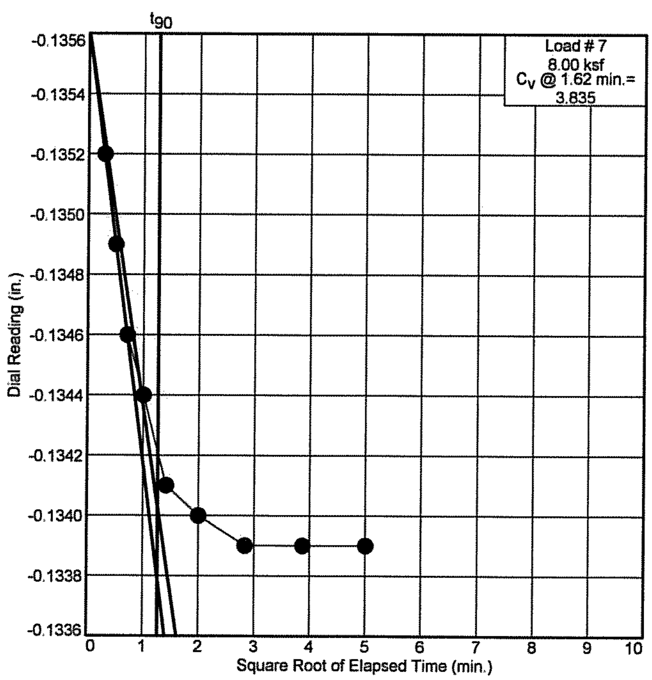
Dial Reading vs. Time

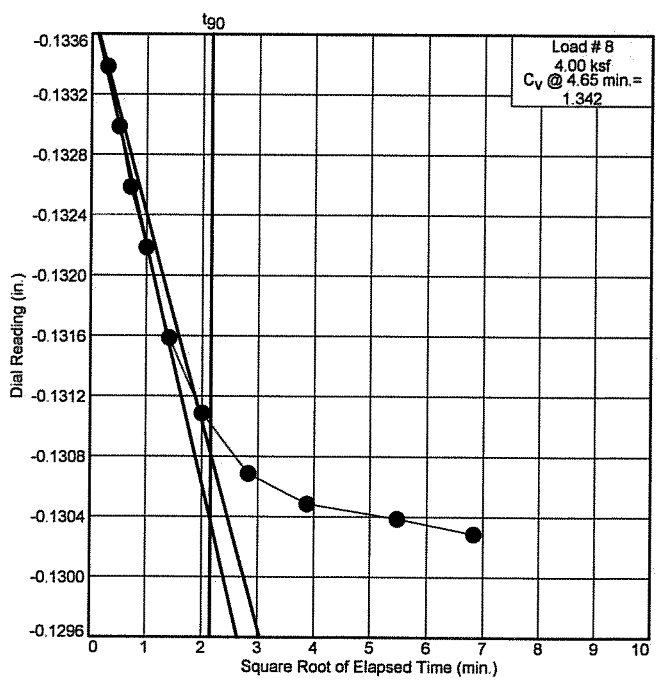
Project No.: 1368-010
Project: Cummings Road Over Maine Turnpike #18-001

Location: HB-CUM-205 Depth: 60'-62' Sample Number: U-1









R.W. Gillespie & Associates, Inc.

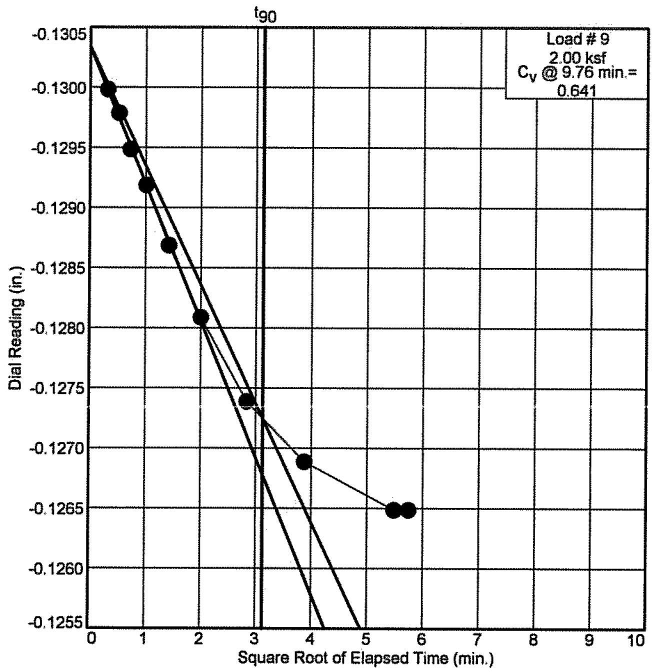
Saco, Maine

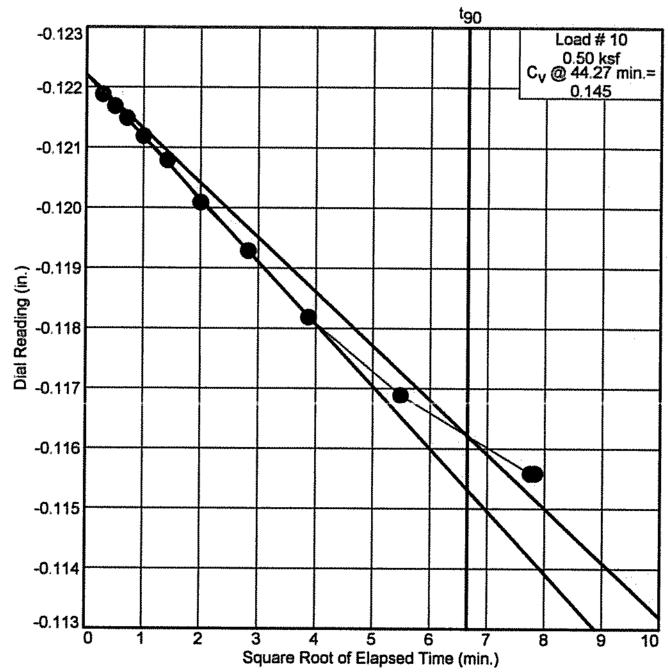
Lab No. 1487/1a

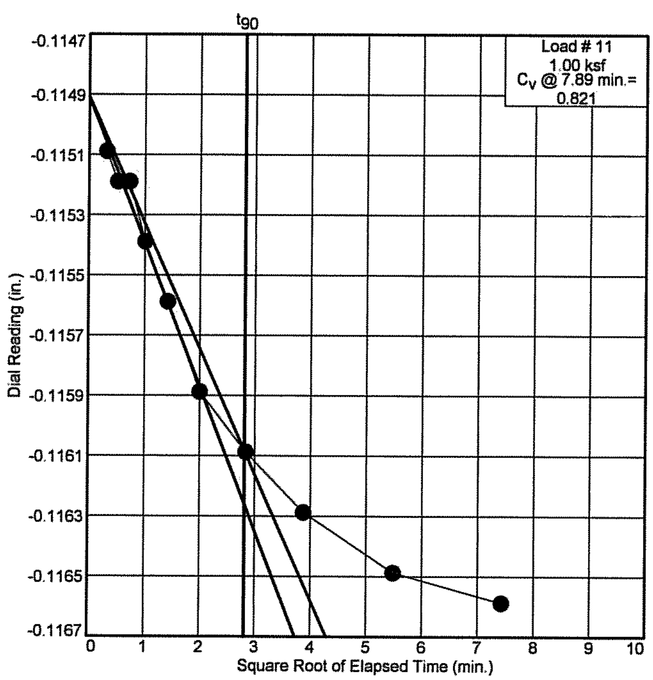
Dial Reading vs. Time

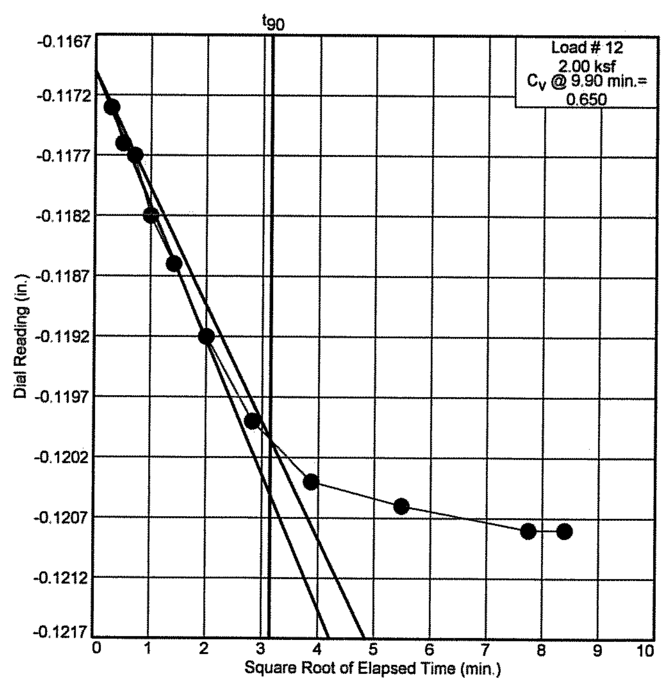
Project No.: 1368-010
Project: Cummings Road Over Maine Turnpike #18-001

Location: HB-CUM-205 Depth: 60'-62' Sample Number: U-1









R.W. Gillespie & Associates, Inc.

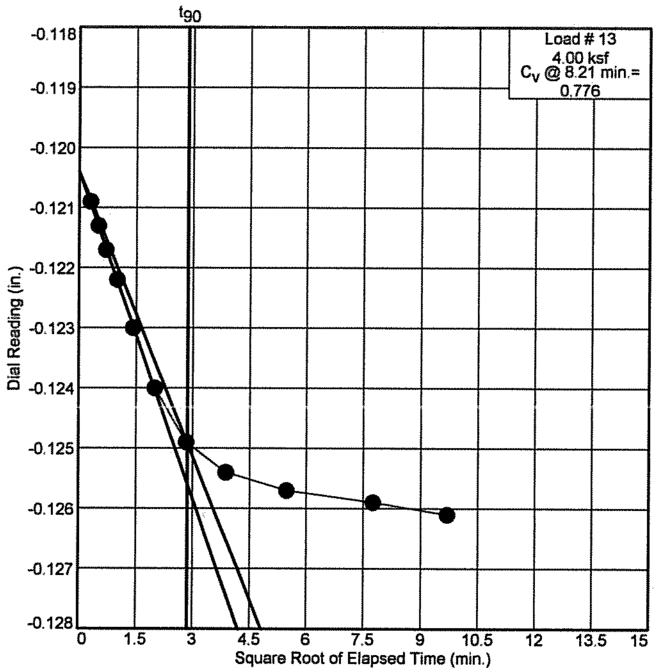
Saco, Maine

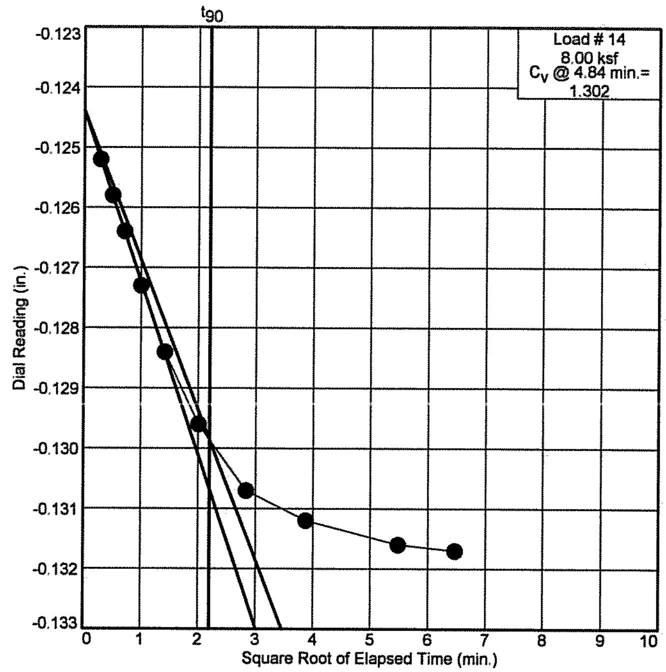
Lab No. 14872a

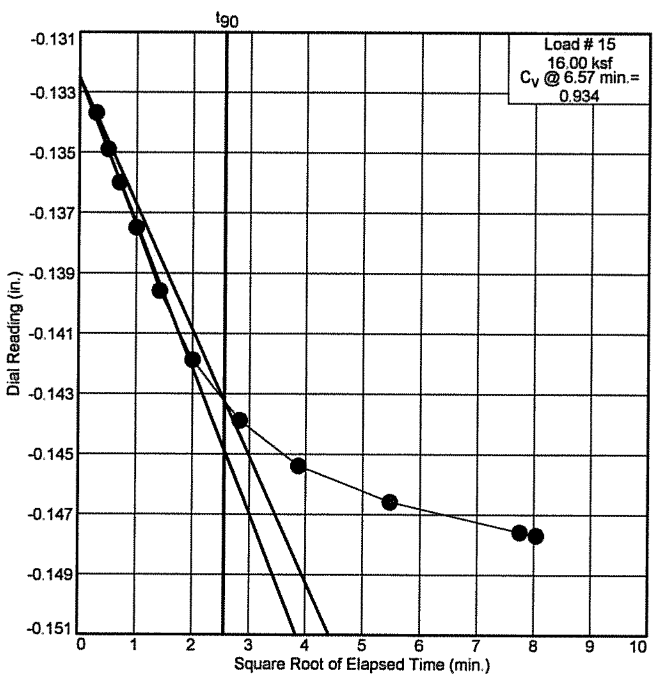
Dial Reading vs. Time

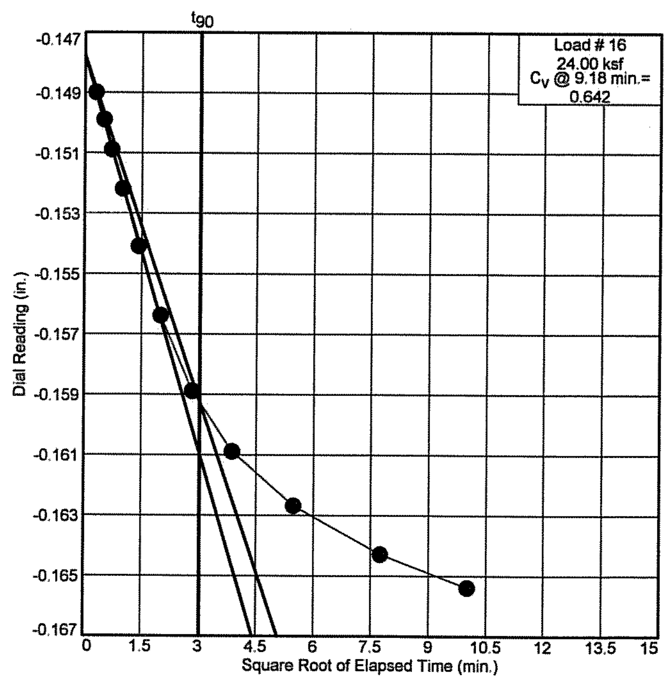
Project No.: 1368-010
Project: Cummings Road Over Maine Turnpike #18-001

Location: HB-CUM-205 Depth: 60'-62' Sample Number: U-1









R.W. Gillespie & Associates, Inc.

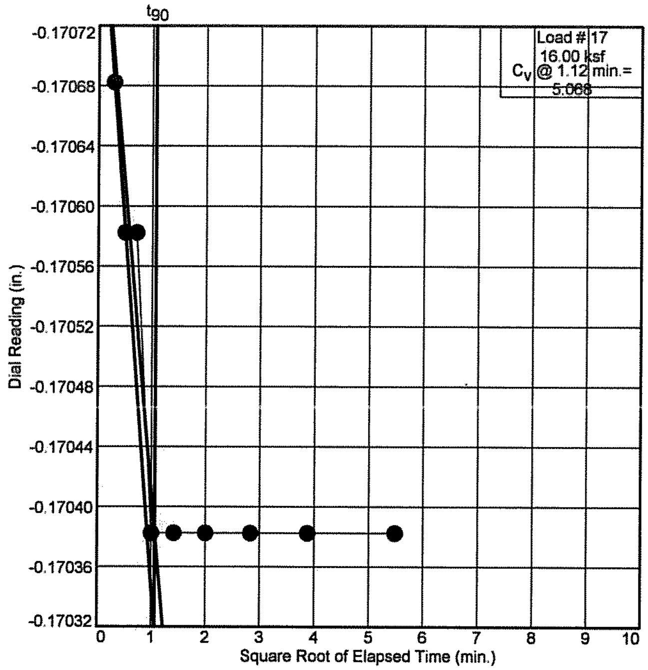
Saco, Maine

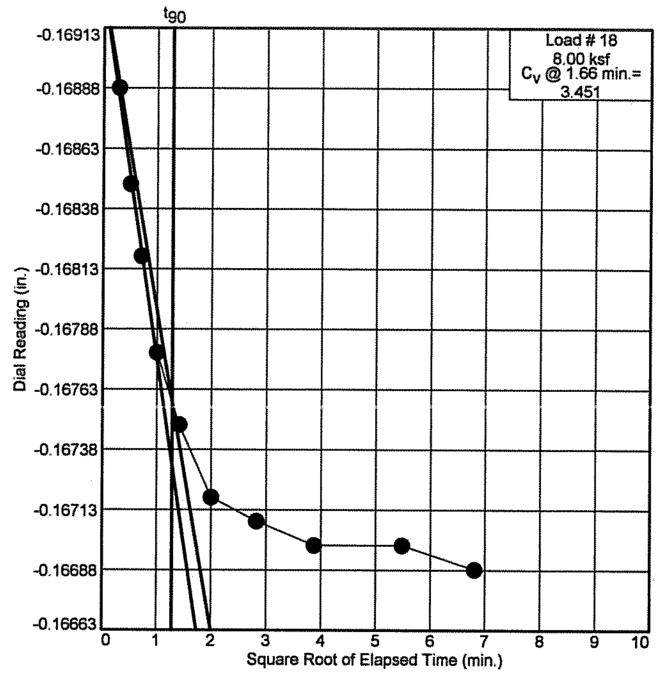
Lab No. 14873a 64

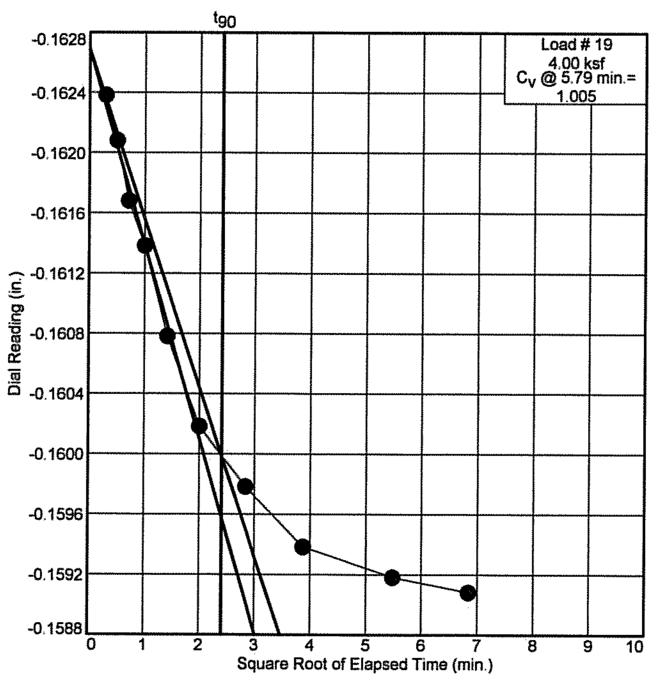
Dial Reading vs. Time

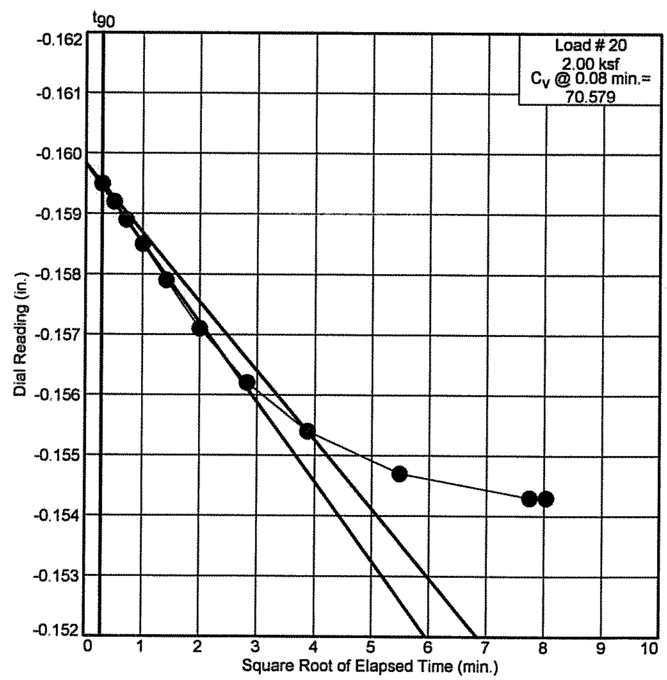
Project No.: 1368-010
Project: Cummings Road Over Maine Turnpike #18-001

Location: HB-CUM-205 **Depth:** 60'-62' **Sample Number:** U-1









R.W. Gillespie & Associates, Inc.

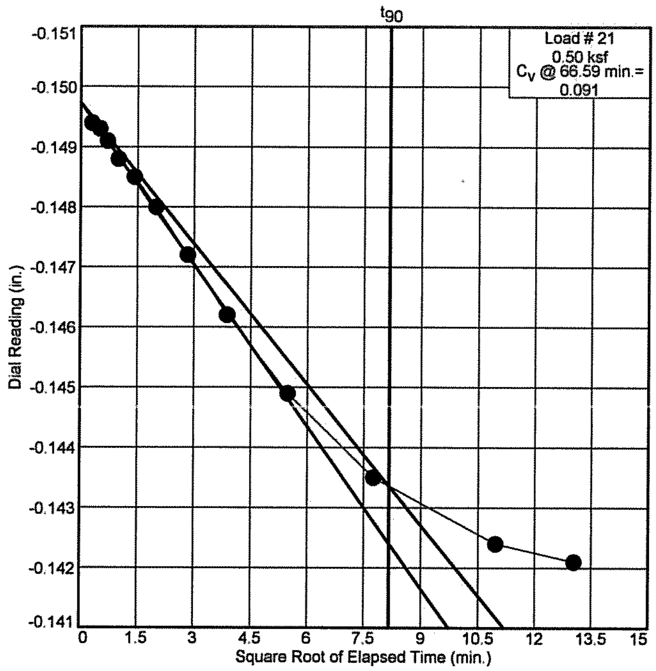
Saco, Maine

Lab No. 148~~74~~a 69

Dial Reading vs. Time

Project No.: 1368-010
Project: Cummings Road Over Maine Turnpike #18-001

Location: HB-CUM-205 Depth: 60'-62' Sample Number: U-1

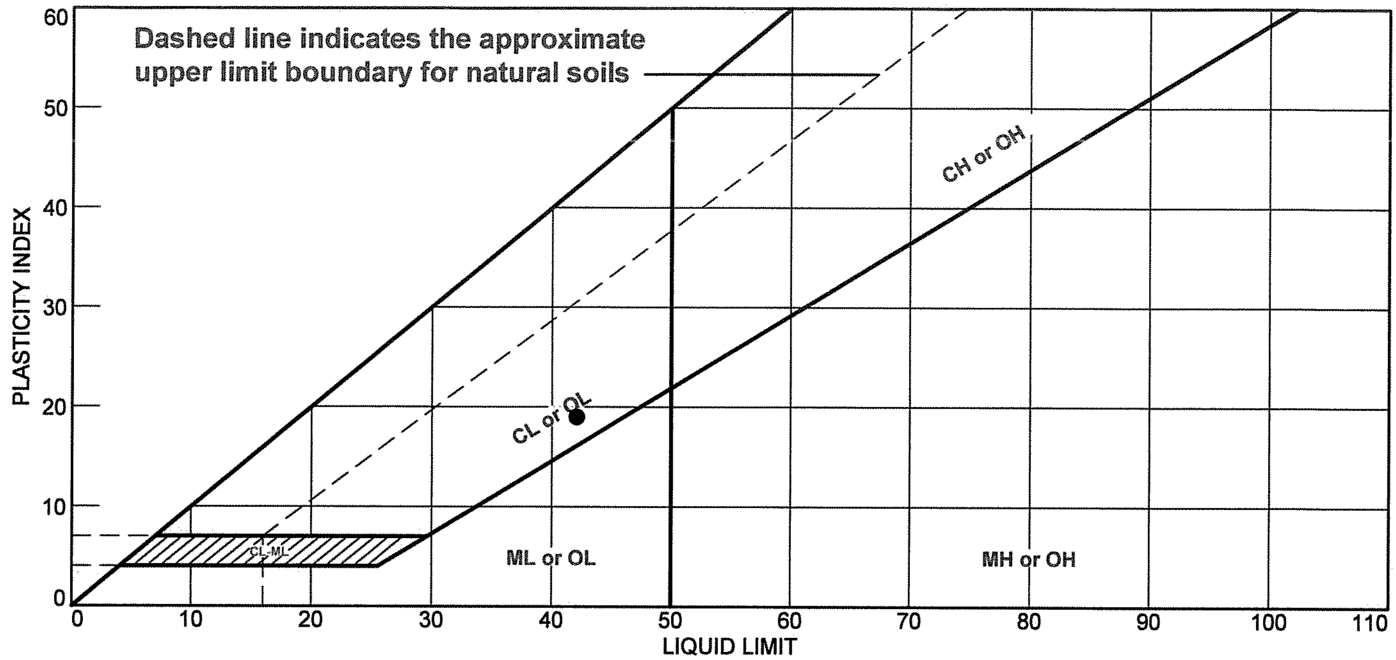


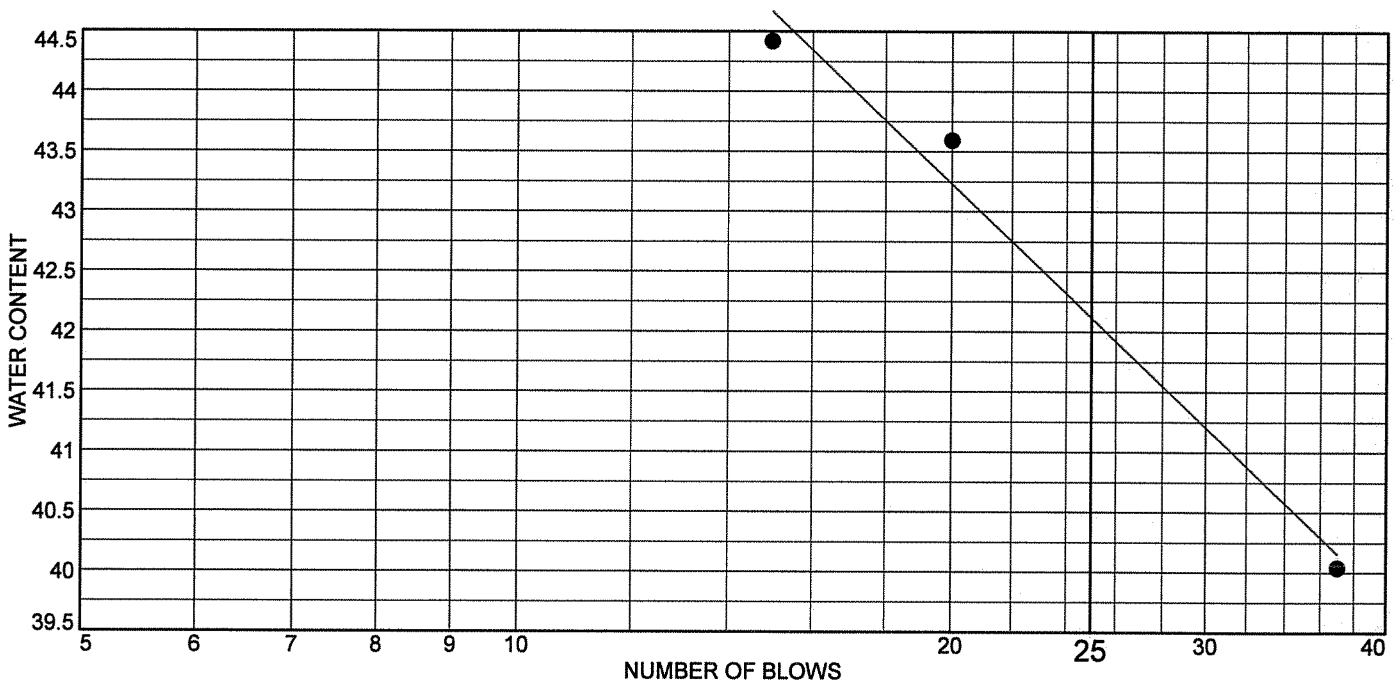
R.W. Gillespie & Associates, Inc.

Saco, Maine

Lab No. 14875a

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Lean Clay	42.1	23.1	19.0			

Project No. 1368-010 **Client:** Schonewald Engineering Associates, Inc.

Project: Cummings Road Over Maine Turnpike #18-001

Scarborough, ME

Location: HB-CUM-205

Sample Number: U-1 **Depth:** 60'-62'

Remarks:

● Natural Moisture: 49.2%

R.W. Gillespie & Associates, Inc.

Saco, Maine

Lab No. 14869a

Tested By: AGS **Checked By:** MTG MTG

Laboratory Vane Shear Test Results

ASTM D4648 Standard Test Method for Laboratory Miniature Vane Shear Test for Saturated Fine-Grained Clayey Soil

Project: Cummings Road Over Maine Turnpike #1 Location: Scarborough, ME
Client: Schonewald Engineering Associates, Inc. Date: 2/19/2018
Project No.: 1368-010 Test Depth: 60.04 to 60.24

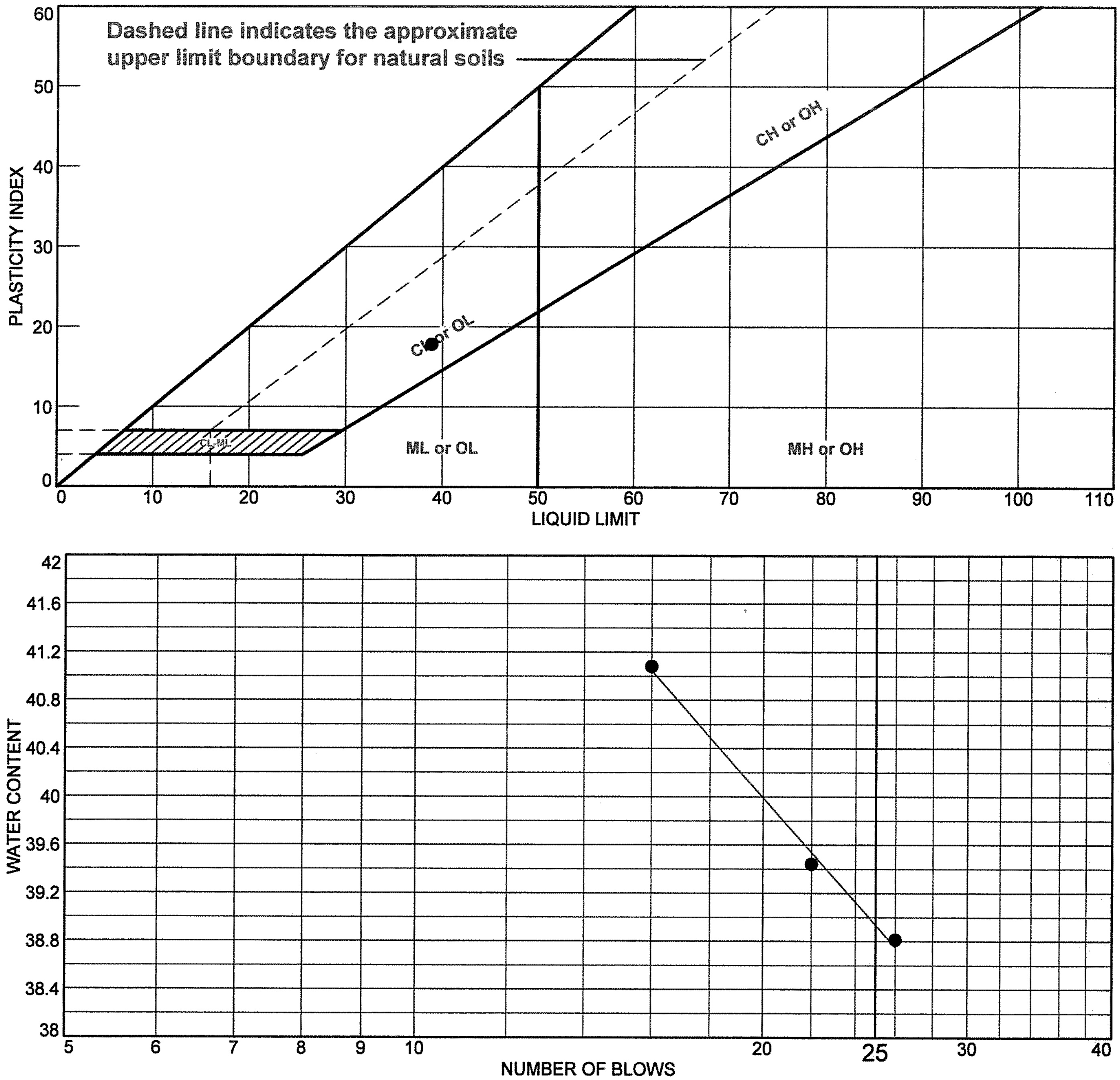
U-1

Boring/Sample No.		HB-CUM-205			Lab No.	14869a	
Test No.	Test Depth (ft)	Vane Size	Max. Torque (Undisturbed) (kg-cm)	Max. Torque (Remolded) (kg-cm)	Undrained Shear Strength (psf)	Undrained Shear Strength (psf)	Moisture Content
1	60.04	M	26	0	543	0	49%
2	60.24	L	66	0	689	0	49%

Vane Size	
	(mm)
S	16 x 32
M	20 x 40
L	24.5 x 50.8

Tested By: JRF Checked By: MB

LIQUID AND PLASTIC LIMITS TEST REPORT



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Lean Clay	38.9	21.1	17.8			

Project No. 1368-010 **Client:** Schonewald Engineering Associates, Inc.

Project: Cummings Road Over Maine Turnpike #18-001

Scarborough, ME

Location: HB-CUM-205

Sample Number: 13-D **Depth:** 65'-67'

Remarks:

● Natural Moisture: 39.3%

R.W. Gillespie & Associates, Inc.

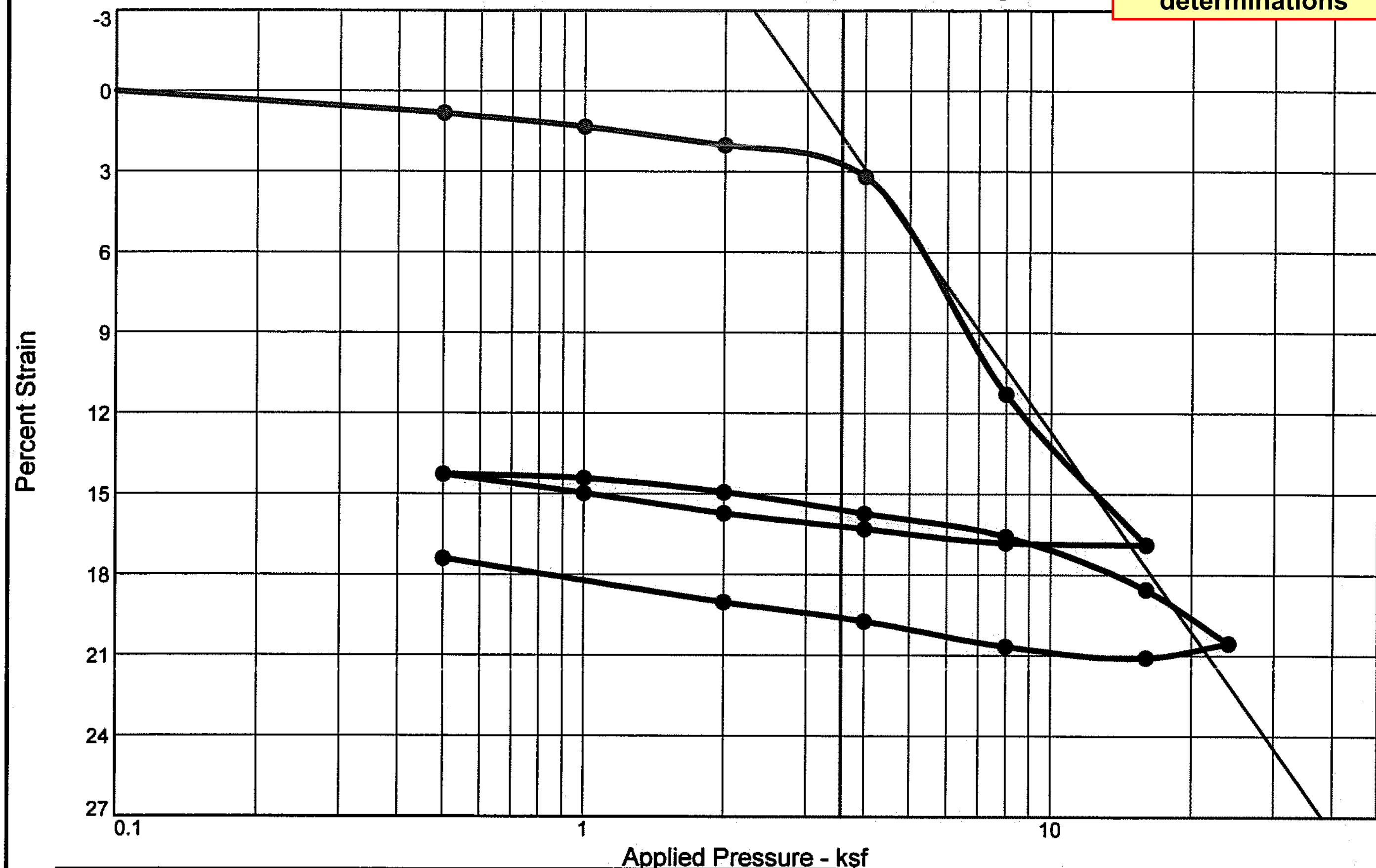
Saco, Maine

Lab No. 14891b

Tested By: AGS **Checked By:** MTG

CONSOLIDATION including Cv determinations

CONSOLIDATION TEST REPORT



Coefficients of Consolidation and Secondary Consolidation											
No.	Load (ksf)	C_v (ft.^{2}/day)	C_α	No.	Load (ksf)	C_v (ft.^{2}/day)	C_α	No.	Load (ksf)	C_v (ft.^{2}/day)	C_α
1	0.50	1.053		8	4.00	1.430		17	24.00	0.384	
2	1.00	1.026		9	2.00	0.608		18	16.00	2.177	
3	2.00	1.895		10	1.00	0.233		19	8.00	1.705	
4	4.00	1.865		13	2.00	0.485		20	4.00	0.664	
5	8.00	0.118		14	4.00	0.608		21	2.00	0.297	
6	16.00	0.318		15	8.00	0.826		22	0.50	0.056	
7	8.00	5.493		16	16.00	0.686					

Natural Saturation	Natural Moisture	Dry Dens. (pcf)	LL	PI	Sp. Gr.	Overburden (ksf)	P_c (ksf)	C_c	C_r	Initial Void Ratio
99.6 %	42.6 %	79.5	47.5	24.7	2.75		3.9	0.54	0.09	1.177

MATERIAL DESCRIPTION	USCS	AASHTO
Lean Clay		

Project No. 1368-010 **Client:** Schonewald Engineering Associates, Inc.

Project: Cummings Road Over Maine Turnpike #18-001
Scarborough, ME

Location: HB-CUM-205 **Depth:** 70'-72' **Sample Number:** U-2

Remarks:

R.W. Gillespie & Associates, Inc.

Saco, Maine

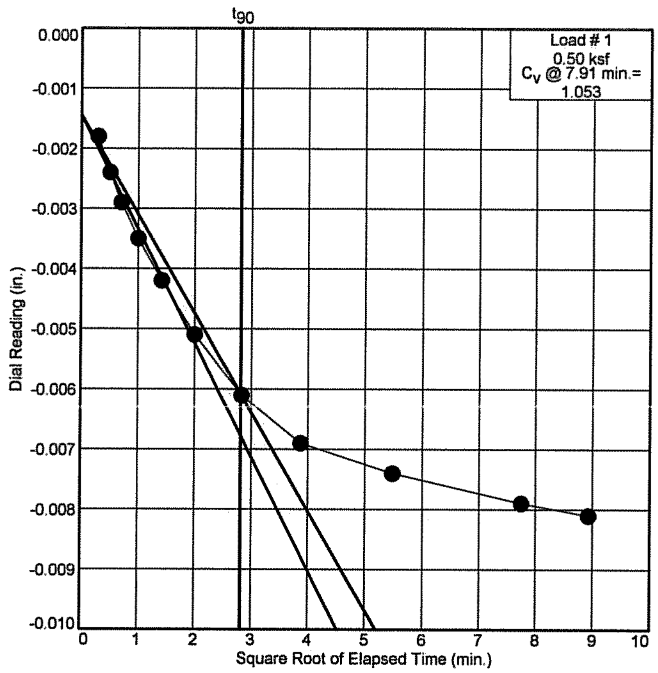
Lab No. 14869b

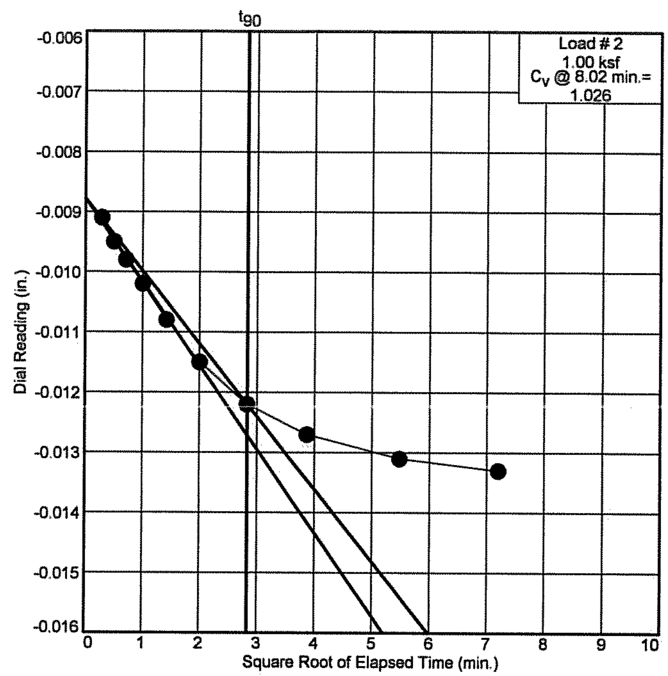
Tested By: JRF **Checked By:** MTG MTG

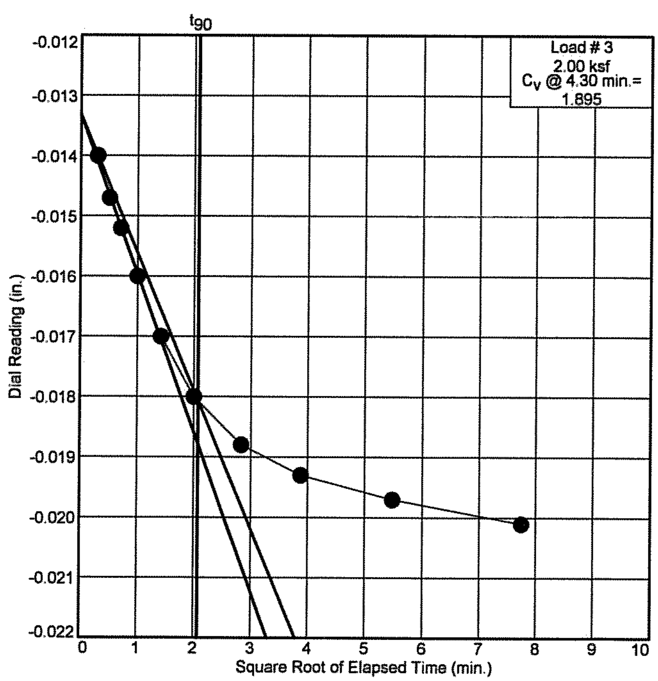
Dial Reading vs. Time

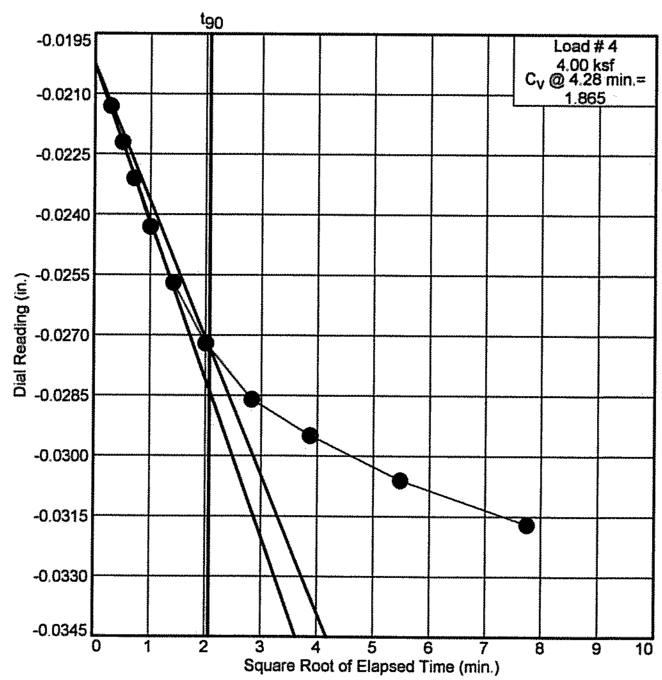
Project No.: 1368-010
Project: Cummings Road Over Maine Turnpike #18-001

Location: HB-CUM-205 Depth: 70'-72' Sample Number: U-2









R.W. Gillespie & Associates, Inc.

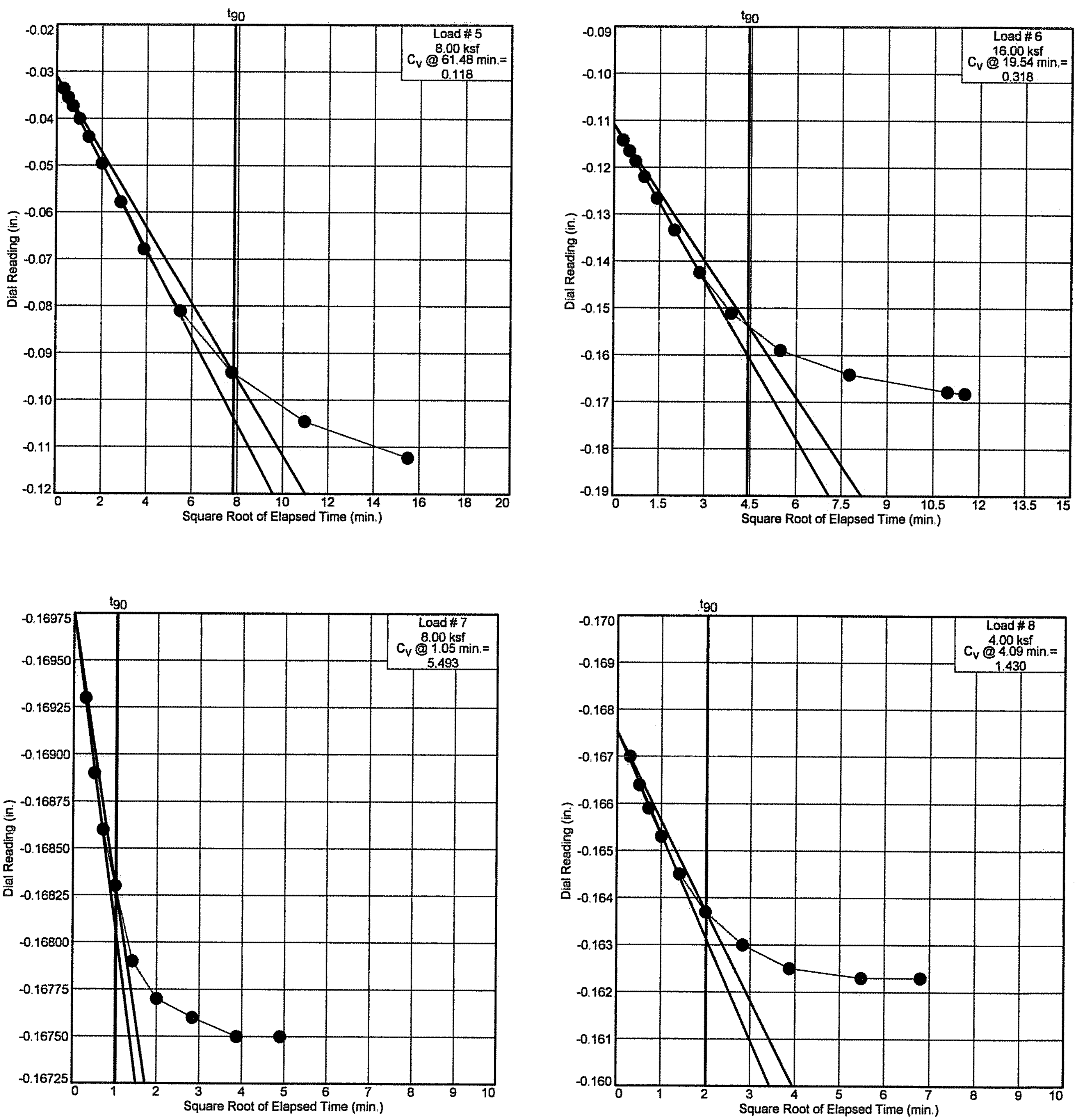
Saco, Maine

Lab No. 14870b 69

Dial Reading vs. Time

Project No.: 1368-010
Project: Cummings Road Over Maine Turnpike #18-001

Location: HB-CUM-205 Depth: 70'-72' Sample Number: U-2



R.W. Gillespie & Associates, Inc.

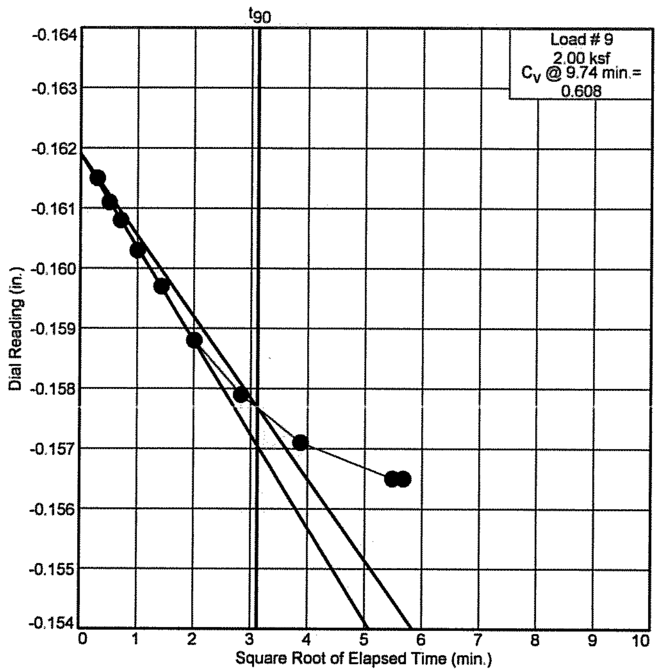
Saco, Maine

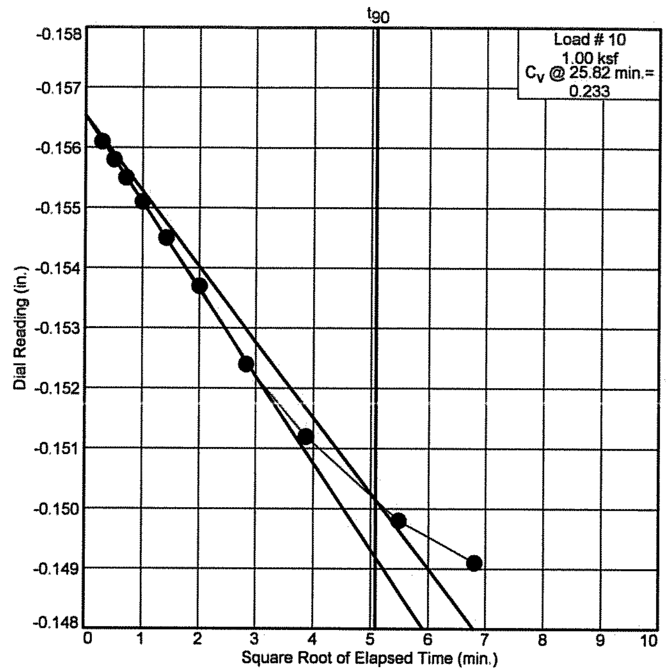
Lab No. 1487 1b

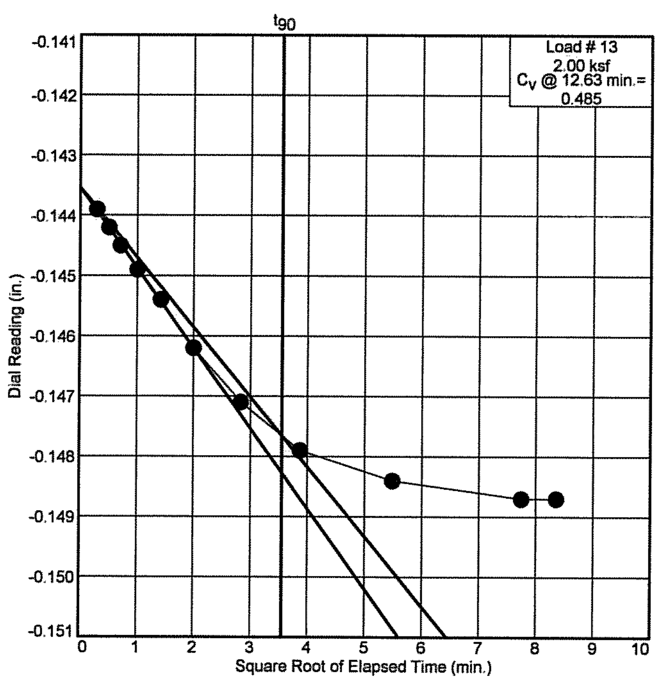
Dial Reading vs. Time

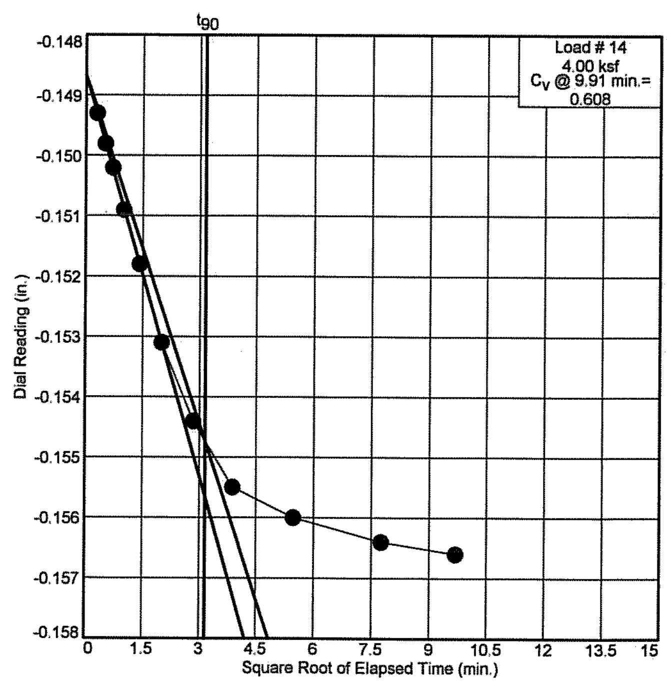
Project No.: 1368-010
Project: Cummings Road Over Maine Turnpike #18-001

Location: HB-CUM-205 Depth: 70'-72' Sample Number: U-2









R.W. Gillespie & Associates, Inc.

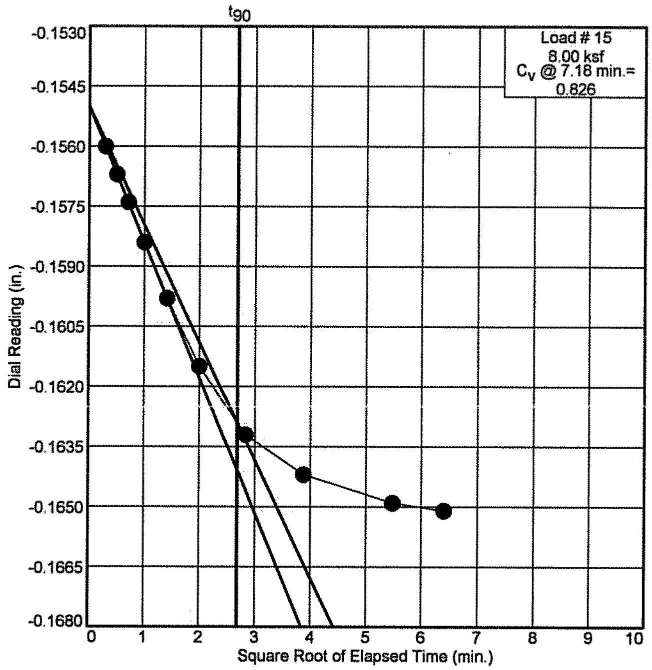
Saco, Maine

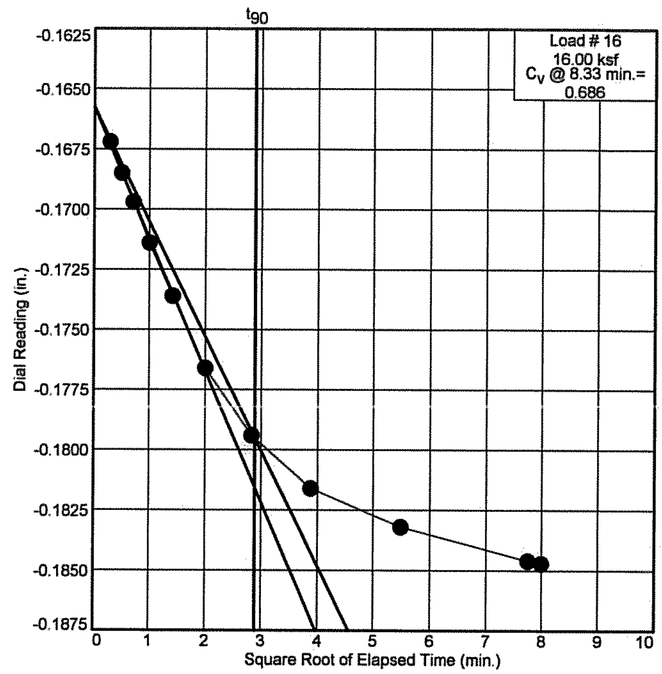
Lab No. 14872b

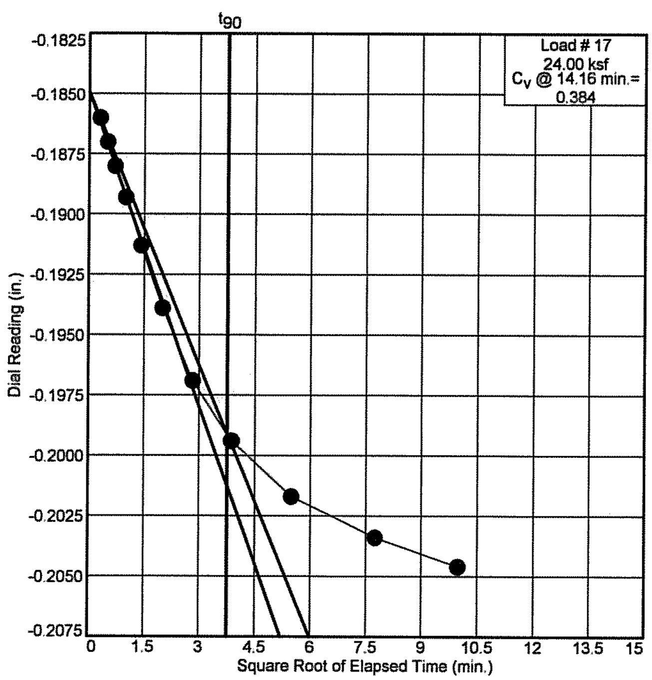
Dial Reading vs. Time

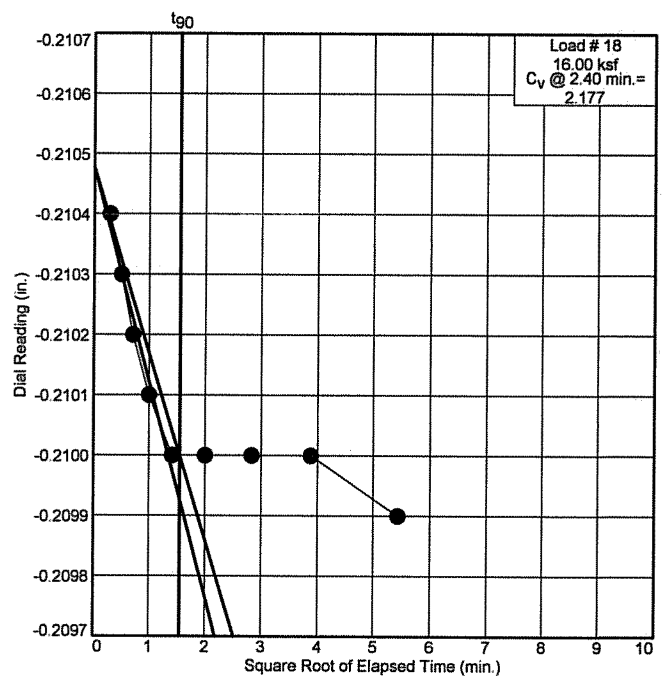
Project No.: 1368-010
Project: Cummings Road Over Maine Turnpike #18-001

Location: HB-CUM-205 Depth: 70'-72' Sample Number: U-2









R.W. Gillespie & Associates, Inc.

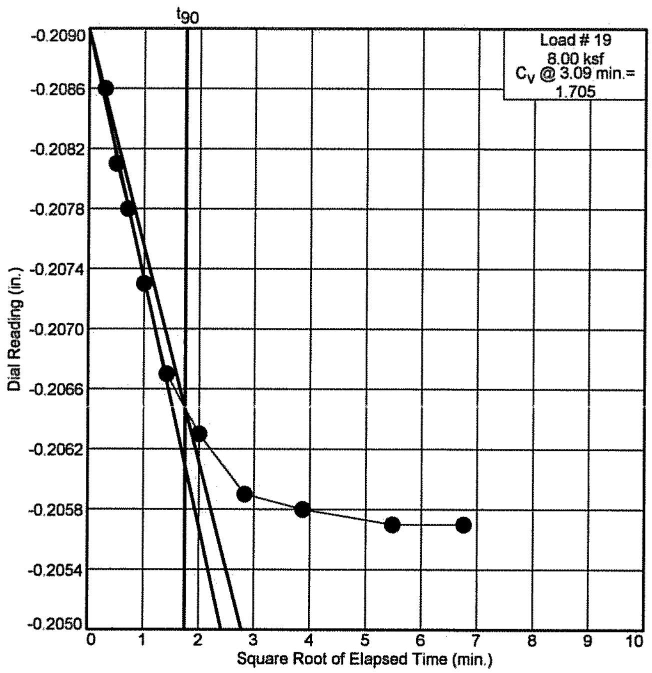
Saco, Maine

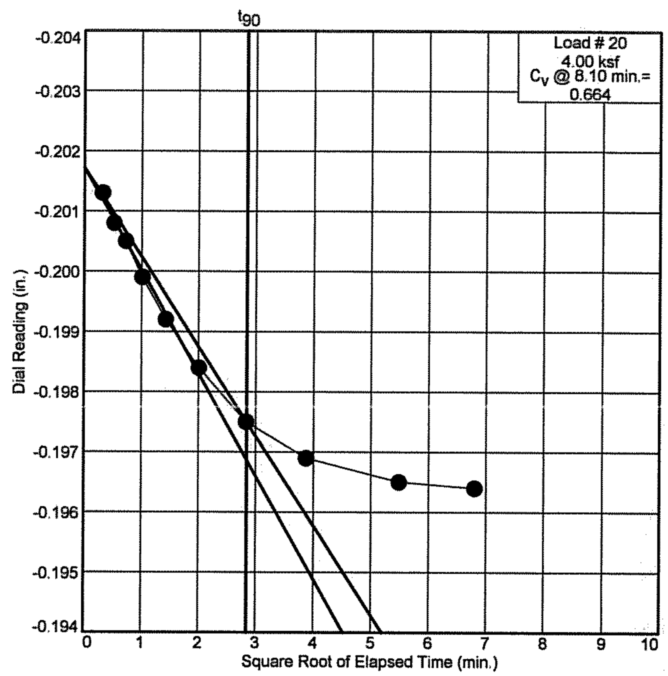
Lab No. 14873b

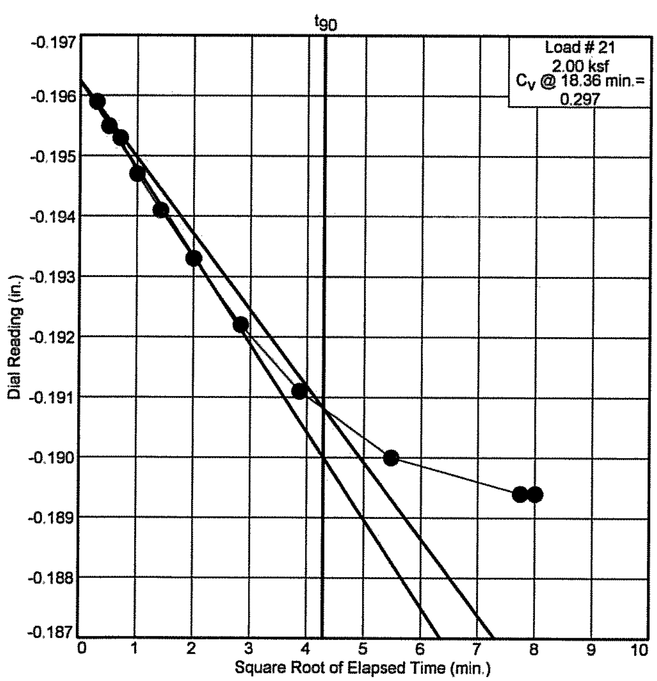
Dial Reading vs. Time

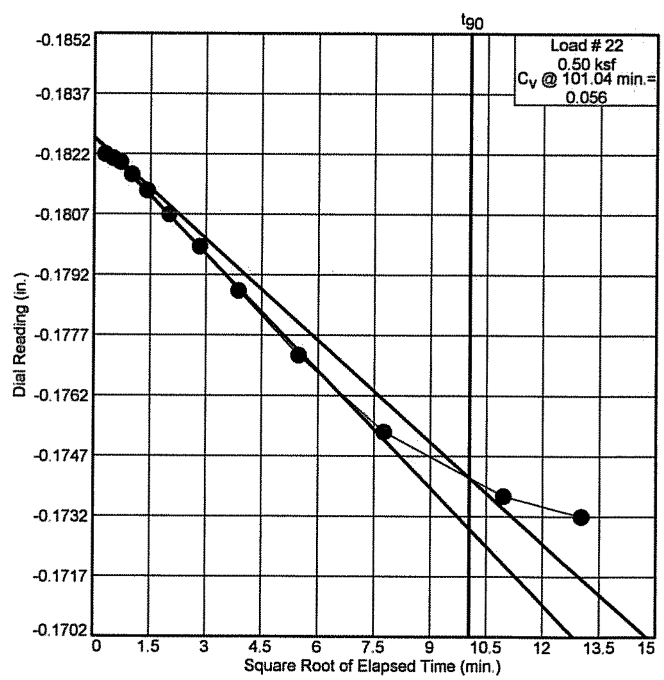
Project No.: 1368-010
Project: Cummings Road Over Maine Turnpike #18-001

Location: HB-CUM-205 Depth: 70'-72' Sample Number: U-2







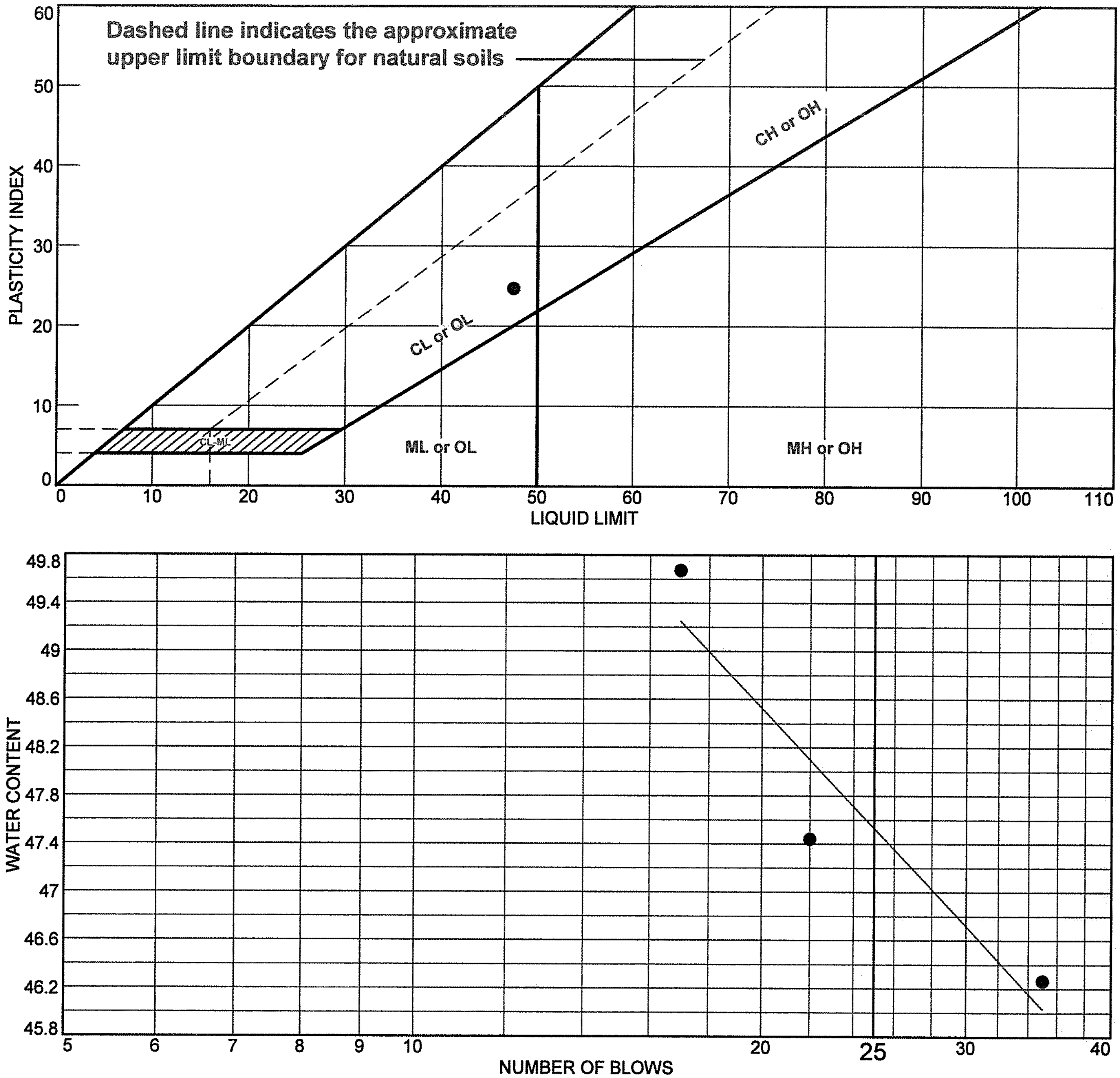


R.W. Gillespie & Associates, Inc.

Saco, Maine

Lab No. 14~~874~~b 69

LIQUID AND PLASTIC LIMITS TEST REPORT



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Lean Clay	47.5	22.8	24.7			

Project No. 1368-010 **Client:** Schonewald Engineering Associates, Inc.

Project: Cummings Road Over Maine Turnpike #18-001

Scarborough, ME

Location: HB-CUM-205

Sample Number: U-2 **Depth:** 70'-72'

R.W. Gillespie & Associates, Inc.

Saco, Maine

Remarks:

● Natural Moisture: 43.0%

Lab No. 14869b

Tested By: AGS **Checked By:** MTG

MTG

Laboratory Vane Shear Test Results

ASTM D4648 Standard Test Method for Laboratory Miniature Vane Shear Test for Saturated Fine-Grained Clayey Soil

Project: Cummings Road Over Maine Turnpike #1ε
Client: Schonewald Engineering Associates, Inc.
Project No.: 1368-010

Location: Scarborough, ME
Date: 2/19/2018
Test Depth: 70.04 to 70.17

U-2

Boring/Sample No.	HB-CUM-205				Lab No.	14869b	
Test No.	Test Depth (ft)	Vane Size	Max. Torque (Undisturbed) (kg-cm)	Max. Torque (Remolded) (kg-cm)	Undrained Shear Strength (psf)	Undrained Shear Strength (psf)	Moisture Content
1	70.04	L	39	0	407	0	42%
2	70.167	L	44	0	459	0	43%

Vane Size	
	(mm)
S	16 x 32
M	20 x 40
L	24.5 x 50.8

Tested By: JRF

Checked By: MTG

R.W. Gillespie & Associates

86 Industrial Park Rd., Suite 4, Saco ME 04072, 207-286-8008 / 200 International Dr., Suite 170, Portsmouth NH 03801, 603-427-0244

SCHONEWALD ENGINEERING ASSOCIATES, INC.
■ www.SchonewaldEngineering.com ■

GTX: RESULTS OF CORROSIVITY SERIES
(RESISTIVITY, pH, SULFATES, AND CHLORIDES BY AASHTO METHODS)
LABORATORY TESTS ON SOIL SAMPLES

Client:	Schonewald Engineering Associates, Inc.
Project Name:	Cummings Rd over ME TPK
Project Location:	Scarborough, ME
GTX #:	307850
Test Date:	03/29/18
Tested By:	jbr
Checked By:	emm

pH by AASHTO T 289

Boring ID	Sample ID	Depth, ft	Description	pH
BB-CUM-202	2D	5-7	Moist, brown sand	6.4
BB-CUM-203	2D	5-7	Moist, brown sand	6.42

Notes:

GeoTesting EXPRESS

Client:	Schonewald Engineering Associates, Inc.
Project Name:	Cummings Rd over ME TPK
Project Location:	Scarborough, ME
GTX #:	307850
Test Date:	03/29/18
Tested By:	jbr
Checked By:	jdt

Minimum Laboratory Soil Resistivity by AASHTO T 288

Boring ID	Sample ID	Depth, ft.	Sample Description	Minimum Soil Resistivity, ohm-cm
BB-CUM-202	2D	5-7	Moist, brown sand	16,461
BB-CUM-203	2D	5-7	Moist, brown sand	3,507

Comments: Test Equipment: Nilsson Model 400 Soil Resistance Meter, MC Miller Soil Box
Test conducted in standard laboratory atmosphere: 68-73 F

PO Box 572455 / Salt Lake City UT 84157-2455 / USA
TEL +1 801 262 2448 · FAX +1 801 262 9870 · www.TEi-TS.com

GEOTESTING EXPRESS INCORPORATED
125 NAGOG PARK
ACTON MA 01720-3451
USA

Analysis No.	TS-A1807403
Report Date	23 March 2018
Date Sampled	21 March 2018
Date Received	22 March 2018
Where Sampled	Acton, MA USA
Sampled By	Client

This is to attest that we have examined: Soil for Project Name: Cummings Road over MeTPK, Site Location: Scarborough, ME, Job Number: 307850

When examined to the applicable requirements of:

AASHTO T-291-13 "Standard Method of Test for Determining Water-Soluble Chloride Ion Content in Soil" Method B

AASHTO T-290-16 "Standard Method of Test for Determining Water-Soluble Sulfate Ion Content in Soil"

Results:

AASHTO T-291 - Chloride (soluble) Method B

Sample	Results		Detection Limit
	ppm (mg/kg)	%[1]	
BB-CUM-202; 2D; 5' – 7'	200.	0.0200	10. ppm
BB-CUM-203; 2D; 5' – 7'	37.	0.0037	

NOTE: [1]Percent by weight as received

AASHTO T-290 – Sulfates (Soluble)

Sample	Results		Detection Limit
	ppm (mg/kg)	%[1]	
BB-CUM-202; 2D; 5' – 7'	25.	0.0025	10. ppm
BB-CUM-203; 2D; 5' – 7'	22.	0.0022	

NOTE: [1]Percent by weight as received

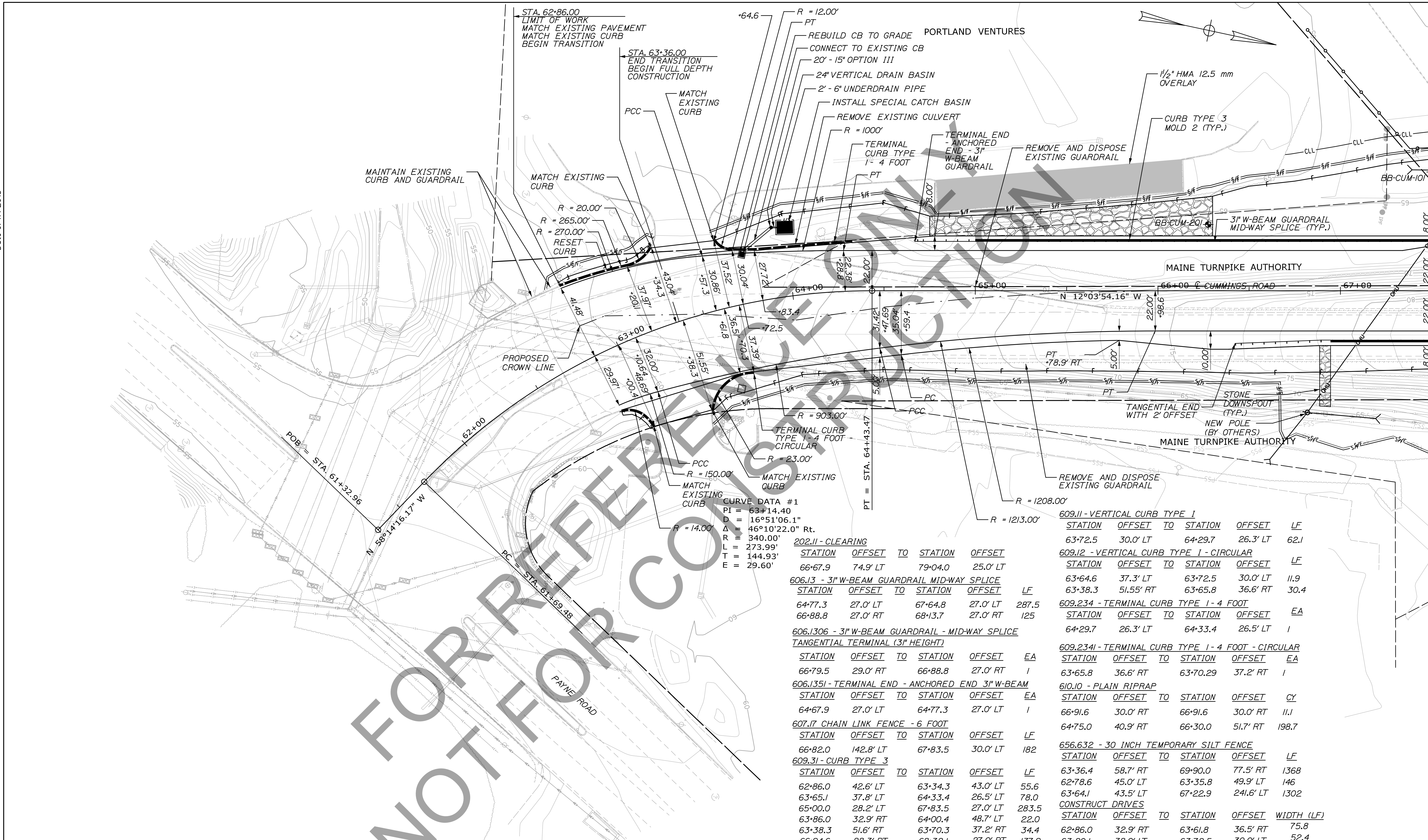
END OF ANALYSIS

USEPA Laboratory ID UT00930

Merrill Gee P.E. – Engineer in Charge

ATTACHMENT 2

Boring Location Plan



CURVE DATA #1
PI = 63+14.40
D = 16°51'06.1"
Δ = 46°10'22.0" Rt.
R = 340.00'
L = 273.99'
T = 144.93'
E = 29.60'

202.11 - CLEARING

STATION	OFFSET	TO	STATION	OFFSET
66+67.9	74.9' LT		79+04.0	25.0' LT

606.13 - 31" W-BEAM GUARDRAIL MID-WAY SPLICE

STATION	OFFSET	TO	STATION	OFFSET	LF
64+77.3	27.0' LT		67+64.8	27.0' LT	287.5
66+88.8	27.0' RT		68+13.7	27.0' RT	125

606.1306 - 31" W-BEAM GUARDRAIL - MID-WAY SPLICE TANGENTIAL TERMINAL (31" HEIGHT)

STATION	OFFSET	TO	STATION	OFFSET	EA
66+79.5	29.0' RT		66+88.8	27.0' RT	1

606.1351 - TERMINAL END - ANCHORED END 31" W-BEAM

STATION	OFFSET	TO	STATION	OFFSET	EA
64+67.9	27.0' LT		64+77.3	27.0' LT	1

607.17 CHAIN LINK FENCE - 6 FOOT

STATION	OFFSET	TO	STATION	OFFSET	LF
66+82.0	142.8' LT		67+83.5	30.0' LT	182

609.31 - CURB TYPE 3

STATION	OFFSET	TO	STATION	OFFSET	LF
62+86.0	42.6' LT		63+34.3	43.0' LT	55.6
63+65.1	37.8' LT		64+33.4	26.5' LT	78.0
65+00.0	28.2' LT		67+83.5	27.0' LT	283.5
63+86.0	32.9' RT		64+00.4	48.7' LT	22.0
63+38.3	51.6' RT		63+70.3	37.2' RT	34.4
66+94.6	28.3' RT		68+32.1	27.0' RT	137.9

609.11 - VERTICAL CURB TYPE I

STATION	OFFSET	TO	STATION	OFFSET	LF
63+72.5	30.0' LT		64+29.7	26.3' LT	62.1

609.12 - VERTICAL CURB TYPE I - CIRCULAR

STATION	OFFSET	TO	STATION	OFFSET	LF
63+64.6	37.3' LT		63+72.5	30.0' LT	11.9
63+38.3	51.55' RT		63+65.8	36.6' RT	30.4

609.234 - TERMINAL CURB TYPE I - 4 FOOT

STATION	OFFSET	TO	STATION	OFFSET	EA
64+29.7	26.3' LT		64+33.4	26.5' LT	1

609.2341 - TERMINAL CURB TYPE I - 4 FOOT - CIRCULAR

STATION	OFFSET	TO	STATION	OFFSET	EA
63+65.8	36.6' RT		63+70.29	37.2' RT	1

610.10 - PLAIN RIPRAP

STATION	OFFSET	TO	STATION	OFFSET	CY
66+91.6	30.0' RT		66+91.6	30.0' RT	11.1
64+75.0	40.9' RT		66+30.0	51.7' RT	198.7

656.632 - 30 INCH TEMPORARY SILT FENCE

STATION	OFFSET	TO	STATION	OFFSET	LF
63+36.4	58.7' RT		69+90.0	77.5' RT	1368
62+78.6	45.0' LT		63+35.8	49.9' LT	146
63+64.1	43.5' LT		67+22.9	241.6' LT	1302

CONSTRUCT DRIVES

STATION	OFFSET	TO	STATION	OFFSET	WIDTH (LF)
62+86.0	32.9' RT		63+61.8	36.5' RT	75.8
63+20.1	38.0' LT		63+72.5	30.0' LT	52.4

Scale: 25 0 25 50
Scale of Feet

No.	Revision	By	Date

Designed by:

HNTB

CONSULTANT PROJECT MANAGER: Tim Cote, P.E.

	By	Date		By	Date
Designed	LSK	09\18	Checked	LZD	09\18
Drawn	LSK	09\18	In Charge of	RAL	09\18

HNTB CORPORATION
340 County Road, Suite 6-C
Westbrook, ME 04092
TEL (207) 774-5155
FAX (207) 228-0909

MAINE TURNPIKE

THE GOLD STAR MEMORIAL HIGHWAY

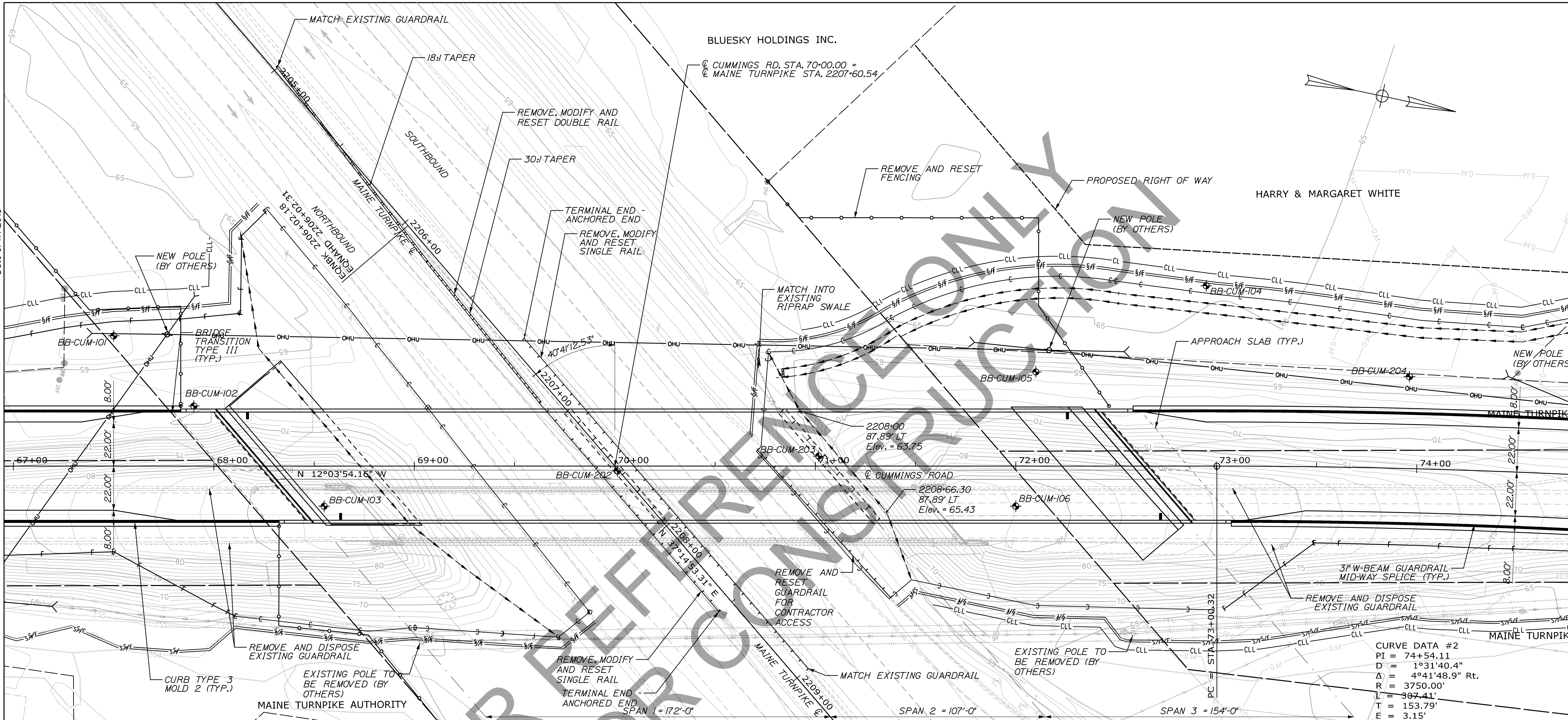
MTA PROJECT MANAGER: Ralph C. Norwood, IV, P.E., P.T.O.E.

BRIDGE REPLACEMENT
CUMMINGS ROAD UNDERPASS

PLAN 1

SHEET NUMBER: PL-01

CONTRACT:2018.19



606.13 - 31" W-BEAM GUARDRAIL MID-WAY SPLICE

STATION	OFFSET	TO	STATION	OFFSET	LF
72+77.3	27.0' LT		75+50.6	27.0' LT	275.0
73+26.4	27.0' RT		76+40.8	20.0' RT	275.0

606.1351 - TERMINAL END - ANCHORED END 31" W-BEAM

STATION	OFFSET	TO	STATION	OFFSET	EA
2206+82.7	7.3' LT		2206+92.1	7.3' LT	1
2208+40.1	8.0' RT		2208+49.5	8.0' RT	1

606.3605 - REMOVE, MODIFY AND RESET SINGLE RAIL

STATION	OFFSET	TO	STATION	OFFSET	LF
2207+12.0	8.0' RT		2208+40.1	8.0' RT	128.0
2206+82.7	7.3' LT		2209+00.2	7.3' LT	218.0

606.3606 - REMOVE, MODIFY AND RESET DOUBLE RAIL

STATION	OFFSET	TO	STATION	OFFSET	LF
2204+99.3	2.0' LT		2207+12.0	8.0' RT	213.0

606.1723 - BRIDGE TRANSITION TYPE III

STATION	EA
67+79.2	1
68+26.2	1
72+61.7	1
73+10.8	1

607.17 CHAIN LINK FENCE - 6 FOOT

STATION	OFFSET	TO	STATION	OFFSET	LF
68+32.5	30.0' RT		69+15.7	132.2' RT	157
70+78.9	138.1' LT		72+46.5	30.0' LT	269

609.31 - CURB TYPE 3

STATION	OFFSET	TO	STATION	OFFSET	LF
72+58.5	27.0' LT		74+96.0	27.0' LT	238.9
73+07.4	27.0' RT		75+46.0	24.8' RT	266.8

610.08 - PLAIN RIPRAP

STATION	OFFSET	CY
75+00	36.9' LT	2.3
75+50	36.0' RT	1.7

656.632 - 30 INCH TEMPORARY SILT FENCE

STATION	OFFSET	TO	STATION	OFFSET	LF
71+40.8	69.5' RT		79+12.5	13.6' RT	1658
70+68.3	14.7' LT		77+36.5	40.1' LT	1468

Scale: 25 0 25 50
Scale of Feet

No.	Revision	By	Date

Designed by: HNTB

CONSULTANT PROJECT MANAGER: Tim Cote, P.E.

	By	Date		By	Date
Designed	LSK	09\18	Checked	LZD	09\18
Drawn	LSK	09\18	In Charge of	RAL	09\18

HNTB CORPORATION
340 County Road, Suite 6-C
Westbrook, ME 04092
TEL (207) 774-5155
FAX (207) 228-0909

MAINE TURNPIKE

THE GOLD STAR MEMORIAL HIGHWAY

MTA PROJECT MANAGER: Ralph C. Norwood, IV, P.E., P.T.O.E.

BRIDGE REPLACEMENT
CUMMINGS ROAD UNDERPASS

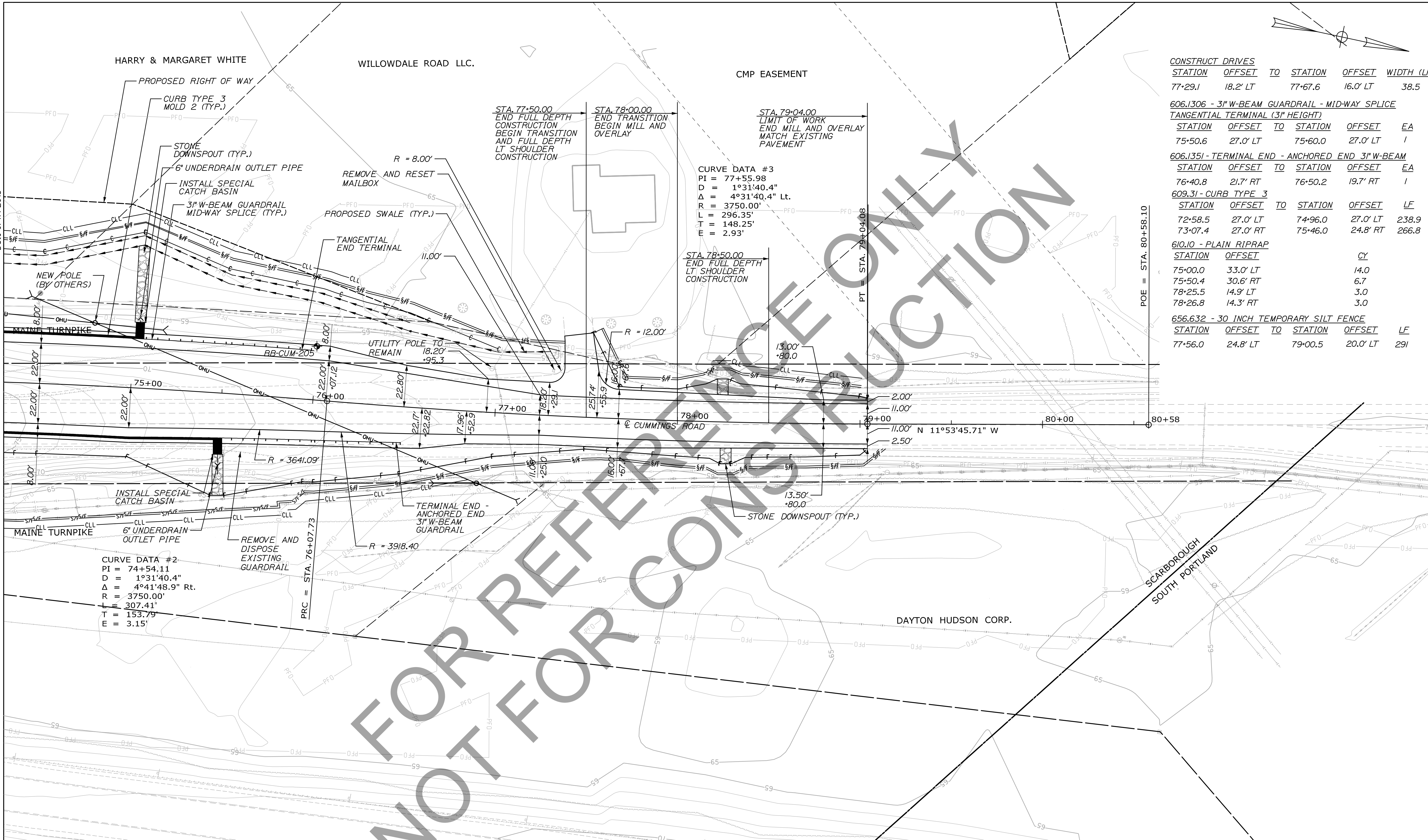
PLAN II

SHEET NUMBER: PL-02

CONTRACT: 2018.19

Date: 9/17/2018

Filename: 027_HDPlan_02.dgn



CONSTRUCT DRIVES

STATION	OFFSET	TO	STATION	OFFSET	WIDTH (LF)
77+29.1	18.2' LT		77+67.6	16.0' LT	38.5

606.1306 - 31" W-BEAM GUARDRAIL - MID-WAY SPLICE TANGENTIAL TERMINAL (31" HEIGHT)

STATION	OFFSET	TO	STATION	OFFSET	EA
75+50.6	27.0' LT		75+60.0	27.0' LT	1

606.1351 - TERMINAL END - ANCHORED END 31" W-BEAM

STATION	OFFSET	TO	STATION	OFFSET	EA
76+40.8	21.7' RT		76+50.2	19.7' RT	1

609.31 - CURB TYPE 3

STATION	OFFSET	TO	STATION	OFFSET	LF
72+58.5	27.0' LT		74+96.0	27.0' LT	238.9
73+07.4	27.0' RT		75+46.0	24.8' RT	266.8

610.10 - PLAIN RIPRAP

STATION	OFFSET	CY
75+00.0	33.0' LT	14.0
75+50.4	30.6' RT	6.7
78+25.5	14.9' LT	3.0
78+26.8	14.3' RT	3.0

656.632 - 30 INCH TEMPORARY SILT FENCE

STATION	OFFSET	TO	STATION	OFFSET	LF
77+56.0	24.8' LT		79+00.5	20.0' LT	291

Date: 9/17/2018

Scale: 25 0 25 50
Scale of Feet

No.	Revision	By	Date

Designed by:

HNTB

CONSULTANT PROJECT MANAGER: Tim Cote, P.E.

	By	Date		By	Date
Designed	LSK	09\18	Checked	LZD	09\18
Drawn	LSK	09\18	In Charge of	RAL	09\18

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Westbrook, ME 04092
TEL (207) 774-5155
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MAINE TURNPIKE

THE GOLD STAR MEMORIAL HIGHWAY

MTA PROJECT MANAGER: Ralph C. Norwood, IV, P.E., P.T.O.E.

BRIDGE REPLACEMENT
CUMMINGS ROAD UNDERPASS

PLAN III

SHEET NUMBER: PL-03

CONTRACT: 2018.19

Filename: 028_HDPlan_03.dgn

ATTACHMENT 3

Summary of In-Situ Vane Shear Results

Summary of In-Situ Vane Shear Tests

Boring No.	Test No.	Test Depth (feet)	Test Elevation (feet)	Undrained Shear Strength (psf)	Remolded Shear Strength (psf)
BB-CUM-101	V1	25.8	38.7	302	14
BB-CUM-101	V2	26.8	37.7	385	27
BB-CUM-101	V3	35.8	28.7	343	14
BB-CUM-101	V4	36.8	27.7	467	14
BB-CUM-101	V5	45.8	18.7	618	14
BB-CUM-101	V6	46.8	17.7	522	14
BB-CUM-101	V7	52.8	11.7	618	41
BB-CUM-101	V8	53.8	10.7	604	14
BB-CUM-102	V1	20.8	45.2	467	41
BB-CUM-102	V2	35.8	30.2	440	27
BB-CUM-102	V3	36.8	29.2	481	27
BB-CUM-102	V4	45.8	20.2	508	14
BB-CUM-102	V5	46.8	19.2	536	14
BB-CUM-102	V6	55.8	10.2	549	14
BB-CUM-102	V7	56.8	9.2	604	27
BB-CUM-103	V1	50.8	34.7	563	55
BB-CUM-103	V2	51.8	33.7	549	55
BB-CUM-103	V3	60.8	24.7	604	27
BB-CUM-103	V4	61.8	23.7	673	27
BB-CUM-103	V5	70.8	14.7	646	27
BB-CUM-103	V6	71.8	13.7	646	27
BB-CUM-104	V1	55.8	9.2	536	14

Boring No.	Test No.	Test Depth (feet)	Test Elevation (feet)	Undrained Shear Strength (psf)	Remolded Shear Strength (psf)
BB-CUM-104	V2	56.8	8.2	467	14
BB-CUM-104	V3	65.8	-0.8	563	14
BB-CUM-104	V4	66.8	-1.8	604	0
BB-CUM-104	V5	70.8	-5.8	700	0
BB-CUM-104	V6	71.8	-6.8	742	0
BB-CUM-104	V7	80.8	-15.8	989	0
BB-CUM-104	V8	81.8	-16.8	989	0
BB-CUM-105	V1	45.8	21.2	522	55
BB-CUM-105	V2	46.8	20.2	522	41
BB-CUM-105	V3	55.8	11.2	467	14
BB-CUM-105	V4	56.8	10.2	522	14
BB-CUM-105	V5	65.8	1.2	714	0
BB-CUM-105	V6	66.8	0.2	797	0
BB-CUM-105	V7	70.8	-3.8	659	14
BB-CUM-105	V8	71.8	-4.8	893	0
BB-CUM-105	V9	80.8	-13.8	659	0
BB-CUM-105	V10	81.8	-14.8	783	0
BB-CUM-106	V1	75.8	10.7	522	27
BB-CUM-106	V2	76.8	9.7	481	27
BB-CUM-106	V3	82.8	3.7	591	41
BB-CUM-106	V4	83.8	2.7	646	27
BB-CUM-106	V5	95.8	-9.3	673	55
BB-CUM-106	V6	96.8	-10.3	893	14
BB-CUM-106	V7	105.8	-19.3	755	55

Boring No.	Test No.	Test Depth (feet)	Test Elevation (feet)	Undrained Shear Strength (psf)	Remolded Shear Strength (psf)
BB-CUM-201	V1	25.6	39.9	371	41
BB-CUM-201	V2	26.6	38.9	371	27
BB-CUM-201	V3	35.6	29.9	440	27
BB-CUM-201	V4	36.6	28.9	343	14
BB-CUM-201A	V1	15.6	49.9	494	41
BB-CUM-201A	V2*	-	-	-	-
BB-CUM-201A	V3	20.6	44.9	357	27
BB-CUM-201A	V4	21.6	43.9	330	27
BB-CUM-201A	V5	30.6	34.9	371	27
BB-CUM-201A	V6	31.6	33.9	398	14
BB-CUM-201A	V7	40.6	24.9	494	14
BB-CUM-201A	V8	41.6	23.9	591	14
BB-CUM-202	V1	45.6	22.9	442	27
BB-CUM-202	V2	46.6	21.9	398	14
BB-CUM-202	V3	50.6	17.9	618	27
BB-CUM-202	V4	51.6	16.9	494	14
BB-CUM-202	V5	55.6	12.6	646	14
BB-CUM-202	V6	56.6	11.9	632	14
BB-CUM-202	V7	60.6	7.9	797	27
BB-CUM-202	V8	61.6	6.9	632	14
BB-CUM-202	V9	65.6	2.9	577	27
BB-CUM-202	V10	66.6	1.9	907	27
BB-CUM-202	V11	70.6	-2.1	907	27
BB-CUM-203	V1	30.6	34.4	591	55

Boring No.	Test No.	Test Depth (feet)	Test Elevation (feet)	Undrained Shear Strength (psf)	Remolded Shear Strength (psf)
BB-CUM-203	V2	50.6	14.4	522	27
BB-CUM-203	V3	51.6	13.4	453	14
BB-CUM-203	V4	55.6	9.4	549	27
BB-CUM-203	V5	56.6	8.4	508	27
BB-CUM-203	V6	60.6	4.4	591	27
BB-CUM-203	V7	61.6	3.4	728	14
BB-CUM-203	V8	65.6	-0.6	783	27
BB-CUM-203	V9	66.6	-1.6	728	14
BB-CUM-203	V10	70.6	-5.6	797	41
BB-CUM-203	V11	71.6	-6.6	943	27
BB-CUM-203	V12	75.6	-10.6	1044	27
BB-CUM-203	V13	76.6	-11.6	907	27
BB-CUM-203	V14	80.6	-15.6	838	27
BB-CUM-203	V15	81.6	-16.6	>1099	0
BB-CUM-203	V16	85.6	-20.6	1071	41
BB-CUM-204	V1	50.6	15.9	426	14
BB-CUM-204	V2	51.6	14.9	440	14
BB-CUM-204	V3	60.6	5.9	646	14
BB-CUM-204	V4	61.6	4.9	577	14
BB-CUM-204	V5	70.6	-4.1	687	41
BB-CUM-204	V6	71.6	-5.1	879	27
BB-CUM-204	V7	80.6	-14.1	879	27
BB-CUM-204	V8	81.6	-15.1	714	55
BB-CUM-205	V1	49.6	15.9	549	41

Boring No.	Test No.	Test Depth (feet)	Test Elevation (feet)	Undrained Shear Strength (psf)	Remolded Shear Strength (psf)
BB-CUM-205	V2	50.6	14.9	440	27
BB-CUM-205	V3	55.6	9.9	508	27
BB-CUM-205	V4	56.6	8.9	494	14
BB-CUM-205	V5	65.6	-0.1	522	27
BB-CUM-205	V6	66.6	-1.1	618	14
BB-CUM-205	V7	75.6	-10.1	812	27
BB-CUM-205	V8	76.6	-11.1	907	27
BB-CUM-205	V9	85.6	-20.1	810	41

ATTACHMENT 4

Structural Loads for Foundation Analyses

Abutment Loads

HNTB
Client: Maine Turnpike Authority
Job Number: 63272-DS-514

Cummings Road Bridge

Abutment Foundation Loads

Designer: TJP Date:6/1/18
Checker: HJW Date:6/1/18

Abutment Width 71.21 ft

Distributed Loads					
	P_vert (kip / ft)	H_norm (kip / ft)	M_norm (kip * ft / ft)	H_trans (kip / ft)	M_trans (kip * ft / ft)
Strength I	50.46	10.50	87.71	3.31	130.71
Strength I	50.24	0.32	-5.16	-1.43	81.81
Strength I	27.01	8.32	66.14	1.43	11.08
Strength I	26.80	0.32	-6.62	-1.43	20.52
Strength V	33.95	9.67	88.61	3.34	108.72
Strength V	47.86	9.67	80.95	3.34	108.72
Service I	37.04	7.46	64.97	2.97	85.73
Service I	30.31	7.46	65.69	2.97	27.26
Extreme II	33.43	3.24	35.17	1.97	109.47
Extreme II	30.06	3.24	35.53	1.97	80.23

Point Loads					
	P_vert (kip)	H_norm (kip)	M_norm (kip * ft)	H_trans (kip)	M_trans (kip * ft)
Strength IA	3593.43	747.74	6246.13	235.72	9308.31
Strength IB	3577.77	22.79	-367.46	-101.84	5825.97
Strength IC	1923.48	592.50	4710.06	101.84	789.05
Strength ID	1908.52	22.79	-471.43	-101.84	1461.30
Strength VA	2417.70	688.63	6310.23	237.85	7742.33
Strength VB	3408.28	688.63	5764.73	237.85	7742.33
Service IA	2637.75	531.25	4626.74	211.50	6105.13
Service IB	2158.48	531.25	4678.01	211.50	1941.28
Extreme IA	2380.67	230.73	2504.58	140.29	7795.74
Extreme IB	2140.68	230.73	2530.21	140.29	5713.46

Wingwall Acute Corners (Wingwalls 2 and 3)

Wingwall Length 19.50 ft

Note: Assumed design for wingwall is based on longest obtuse wingwall length

Distributed Loads			
	P_vert (kip / ft)	H_norm (kip / ft)	M_norm (kip * ft / ft)
Strength I	26.50	9.02	51.89
Strength I	26.20	2.34	-7.31
Strength I	14.26	9.02	69.55
Strength I	13.96	2.34	10.34
Strength V	14.26	7.85	58.34
Strength V	24.85	7.85	44.39
Service I	19.02	5.52	31.58
Service I	14.91	5.52	40.83
Extreme II	14.91	2.60	12.83
Extreme II	14.91	2.60	12.83

Point Loads			
	P_vert (kip)	H_norm (kip)	M_norm (kip * ft)
Strength I	516.75	175.89	1011.86
Strength I	510.90	45.63	-142.55
Strength I	278.07	175.89	1356.23
Strength I	272.22	45.63	201.63
Strength V	278.07	153.08	1137.63
Strength V	484.58	153.08	865.61
Service I	370.89	107.64	615.81
Service I	290.75	107.64	796.19
Extreme I	290.75	50.70	250.19
Extreme I	290.75	50.70	250.19

Wingwall Obtuse Corners (Wingwalls 1 and 4)

Wingwall Length 19.50 ft

Note: Assumed design for wingwall is based on longest obtuse wingwall length

Distributed Loads			
	P_vert (kip / ft)	H_norm (kip / ft)	M_norm (kip * ft / ft)
Strength I	26.50	9.02	51.89
Strength I	26.20	2.34	-7.31
Strength I	14.26	9.02	69.55
Strength I	13.96	2.34	10.34
Strength V	14.26	7.85	58.34
Strength V	24.85	7.85	44.39
Service I	19.02	5.52	31.58
Service I	14.91	5.52	40.83
Extreme II	17.97	4.06	24.20
Extreme II	14.91	7.44	120.98

Point Loads			
	P_vert (kip)	H_norm (kip)	M_norm (kip * ft)
Strength I	516.75	175.89	1011.86
Strength I	510.90	45.63	-142.55
Strength I	278.07	175.89	1356.23
Strength I	272.22	45.63	201.63
Strength V	278.07	153.08	1137.63
Strength V	484.58	153.08	865.61
Service I	370.89	107.64	615.81
Service I	290.75	107.64	796.19
Extreme I	350.42	79.17	471.90
Extreme I	290.75	145.08	2359.11

Pier Loads

Strength Load Combinations							
Combo #	Combo Desc.	Fx (kip)	Fy (kip)	Fz (kip)	Mx (kip*ft)	My (kip*ft)	Mz (kip*ft)
14C	STR GP 1	120	-5092	-140	-4802	-1	-17368
34C	STR GP 1	-120	-5092	140	4802	-1	-9217
141C	STR GP 1	-55	-3150	65	2209	0	-8256
34C	STR GP 1	-120	-5092	140	4802	-1	-9217
34C	STR GP 1	-120	-5092	140	4802	-1	-9217
14C	STR GP 1	120	-5092	-140	-4802	-1	-17368
34C	STR GP 1	-120	-5092	140	4802	-1	-9217
14C	STR GP 1	120	-5092	-140	-4802	-1	-17368
143C	STR GP 1	-55	-3150	65	2209	0	-16809
134C	STR GP 1	120	-3906	-140	-4793	-1	-17926
27C	STR GP 1	-92	-4768	108	3692	-1	30317
128C	STR GP 1	92	-3582	-108	-3684	-1	-27814
5306C	STR1 Mod	150	-5443	-175	-6007	-2	-22091
5293C	STR1 Mod	69	-4497	-81	-2768	-1	-14718
5353C	STR1 Mod	69	-3312	-81	-2762	-1	-15274
5306C	STR1 Mod	150	-5443	-175	-6007	-2	-22091
5293C	STR1 Mod	69	-4497	-81	-2768	-1	-14718
5306C	STR1 Mod	150	-5443	-175	-6007	-2	-22091
5353C	STR1 Mod	69	-3312	-81	-2762	-1	-15274
5306C	STR1 Mod	150	-5443	-175	-6007	-2	-22091
5355C	STR1 Mod	69	-3312	-81	-2762	-1	-25961
5366C	STR1 Mod	150	-4257	-175	-5995	-2	-22650
5299C	STR1 Mod	116	-5038	-134	-4617	-1	29680
5360C	STR1 Mod	116	-3852	-134	-4608	-1	-35010
177C	STR GP 3	98	-3910	85	1622	0	-3760
166C	STR GP 3	-98	-3464	-85	-1621	0	6821
232C	STR GP 3	-98	-2279	-85	-1619	0	6269
177C	STR GP 3	98	-3910	85	1622	0	-3760
180C	STR GP 3	29	-3687	125	2172	0	834
169C	STR GP 3	-29	-3687	-125	-2172	0	2226
180C	STR GP 3	29	-3687	125	2172	0	834
169C	STR GP 3	-29	-3687	-125	-2172	0	2226
243C	STR GP 3	98	-2724	85	1620	0	-4316
238C	STR GP 3	72	-2501	-40	-671	0	-469
166C	STR GP 3	-98	-3464	-85	-1621	0	6821
243C	STR GP 3	98	-2724	85	1620	0	-4316
806C	STR GP 5	154	-4834	-55	-2588	-1	-15674
586C	STR GP 5	-154	-4707	55	2587	-1	-4134
3213C	STR GP 5	-104	-2938	-3	591	0	-3518
1026C	STR GP 5	-32	-4834	160	4818	0	-9385
1066C	STR GP 5	-55	-4771	174	5038	-1	-7813
406C	STR GP 5	55	-4771	-174	-5038	-1	-11996
1066C	STR GP 5	-55	-4771	174	5038	-1	-7813
406C	STR GP 5	55	-4771	-174	-5038	-1	-11996
3655C	STR GP 5	18	-3065	102	2816	0	-15370
3346C	STR GP 5	130	-3585	-129	-4113	-1	-14578
579C	STR GP 5	-132	-4457	31	1732	0	26363
3440C	STR GP 5	132	-3399	-31	-1728	0	-23860

Extreme Event II Load Combinations

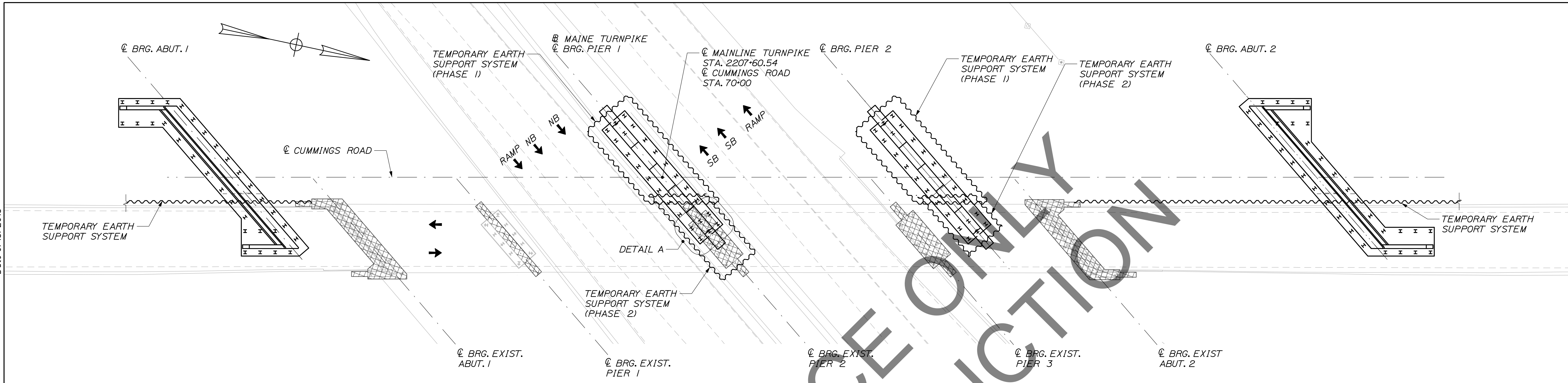
Combo #	Combo Desc.	Fx (kip)	Fy (kip)	Fz (kip)	Mx (kip*ft)	My (kip*ft)	Mz (kip*ft)
3786C	EXT GP 2	634	-4088	-40	-1370	0	-8607
3906C	EXT GP 2	-634	-4088	40	1370	0	3197
4373C	EXT GP 2	-616	-2687	18	631	0	3075
3906C	EXT GP 2	-634	-4088	40	1370	0	3197
3926C	EXT GP 2	-614	-4088	195	2597	0	3039
3806C	EXT GP 2	614	-4088	-195	-2597	0	-8449
3926C	EXT GP 2	-614	-4088	195	2597	0	3039
3806C	EXT GP 2	614	-4088	-195	-2597	0	-8449
4353C	EXT GP 2	564	-2687	-137	-595	0	-6241
3806C	EXT GP 2	614	-4088	-195	-2597	0	-8449
3899C	EXT GP 2	-626	-3996	31	1053	0	14492
4260C	EXT GP 2	626	-2810	-31	-1051	0	-11987

Service Load Combinations

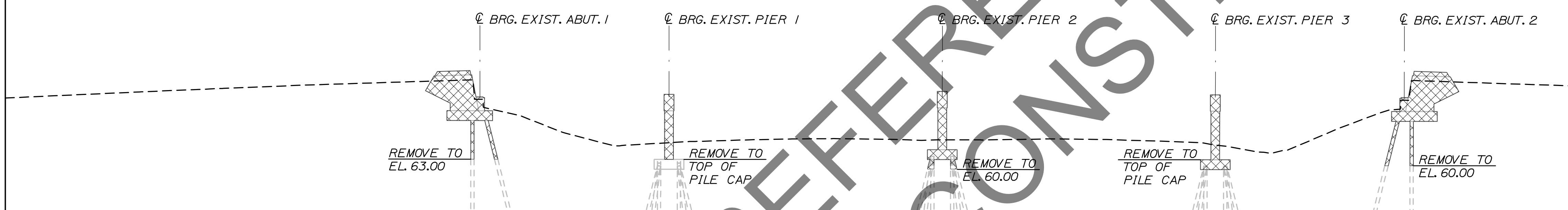
Combo #	Combo Desc.	Fx (kip)	Fy (kip)	Fz (kip)	Mx (kip*ft)	My (kip*ft)	Mz (kip*ft)
4966C	SER GP 1	123	-3729	-34	-1740	0	-11884
4746C	SER GP 1	-123	-3633	34	1740	0	-2724
4733C	SER GP 1	-86	-3201	-9	265	0	-1861
5186C	SER GP 1	-15	-3729	126	3735	0	-7222
5226C	SER GP 1	-36	-3681	137	3916	0	-5935
4566C	SER GP 1	36	-3681	-137	-3916	0	-8674
5226C	SER GP 1	-36	-3681	137	3916	0	-5935
4566C	SER GP 1	36	-3681	-137	-3916	0	-8674
5173C	SER GP 1	22	-3296	83	2259	0	-6360
4866C	SER GP 1	101	-3681	-98	-3108	-1	-10504
4739C	SER GP 1	-107	-3448	15	1108	0	19866
4960C	SER GP 1	107	-3543	-15	-1108	0	-17535

ATTACHMENT 5

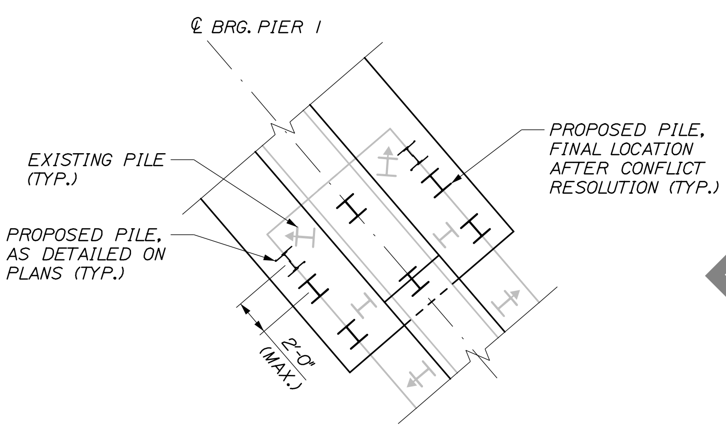
Pile Geometry and Plan Layout



SUBSTRUCTURE DEMOLITION PLAN
1" = 20'-0"



SUBSTRUCTURE DEMOLITION ELEVATION
1" = 20'-0"



DETAIL A
3/16" = 1'-0"
(PIER 1 PILE CONFLICT SHOWN, OTHER LOCATIONS MAY EXIST)

NOTES:

1. ALL EXISTING SUBSTRUCTURES, FOUNDATIONS, AND PORTIONS OF PILES CONTAINED THEREIN SHALL BE REMOVED TO THE LIMITS IDENTIFIED ON THIS SHEET. THE RESULTING DEPRESSIONS SHALL BE BACKFILLED WITH GRAVEL BORROW AND COMPACTED TO 95% OF MAXIMUM DENSITY. EXCAVATION AND REMOVAL OF EXISTING FOUNDATIONS, AS WELL AS THE COST OF FURNISHING, PLACING, AND COMPACTING GRAVEL BORROW, SHALL BE INCIDENTAL TO ITEM 202.19 - "REMOVING EXISTING BRIDGE".

2. THE EXISTING PILES SHALL BE CUT OFF AT OR BELOW THE ELEVATION NOTED. CUTTING AND DISPOSAL OF THE EXISTING PILES SHALL BE INCIDENTAL TO ITEM 202.19 - "REMOVING EXISTING BRIDGE". REMOVAL BEYOND THE LIMITS SHOWN SHALL BE AT THE CONTRACTORS EXPENSE.

3. TEMPORARY EARTH SUPPORT STRUCTURES SHALL BE PROVIDED AND INSTALLED IN ACCORDANCE WITH SPECIAL PROVISION SECTION 511. PAYMENT FOR TEMPORARY EARTH SUPPORT STRUCTURES SHALL BE MADE UNDER ITEM 511.091 - "TEMPORARY EARTH SUPPORT SYSTEMS".

4. THE CONTRACTOR SHOULD ANTICIPATE PILE INSTALLATION CONFLICTS WITH EXISTING PILE FOUNDATIONS. PROPOSED PILE LOCATIONS MAY BE ADJUSTED A MAXIMUM OF 2'-0" TO PREVENT INSTALLATION CONFLICTS, MEASURED PARALLEL WITH THE CENTERLINE OF BEARING. RELOCATED PILES SHALL MAINTAIN A MINIMUM CENTER TO CENTER DISTANCE OF 3'-0" BETWEEN PROPOSED PILES AND A MINIMUM DISTANCE OF 1'-6" FROM THE CENTER OF PILE TO THE EDGE OF A PILE CAP. PAYMENT FOR REMOVAL, ABANDONMENT, OR OTHER CONFLICT MITIGATION TECHNIQUES WILL NOT BE MADE SEPARATELY AND WILL BE CONSIDERED INCIDENTAL TO RELATED CONTRACT ITEMS.

5. DAMAGE TO THE MAINLINE PAVEMENT RESULTING FROM THE CONTRACTORS DEMOLITION EFFORTS SHALL BE REPAIRED TO THE SATISFACTION OF THE RESIDENT. DAMAGED PAVEMENT SHALL BE SAWCUT, REMOVED, AND REPLACED TO A TOTAL PAVEMENT THICKNESS MATCHING EXISTING CONDITIONS. PAYMENT WILL BE CONSIDERED INCIDENTAL TO ITEM 202.19 - "REMOVING EXISTING BRIDGE".

Date: 9/18/2018
Filename: 092_Substructure Demolition Plan.dgn

Scale:

No.	Revision	By	Date

Designed by: HNTB

CONSULTANT PROJECT MANAGER: Tim Cote, P.E.

	By	Date		By	Date
Designed	TJP	08\18	Checked	HJW	08\18
Drawn	PEB	08\18	In Charge of	RAL	08\18

HNTB CORPORATION
340 County Road, Suite 6-C
Westbrook, ME 04092
TEL (207) 774-5155
FAX (207) 228-0909

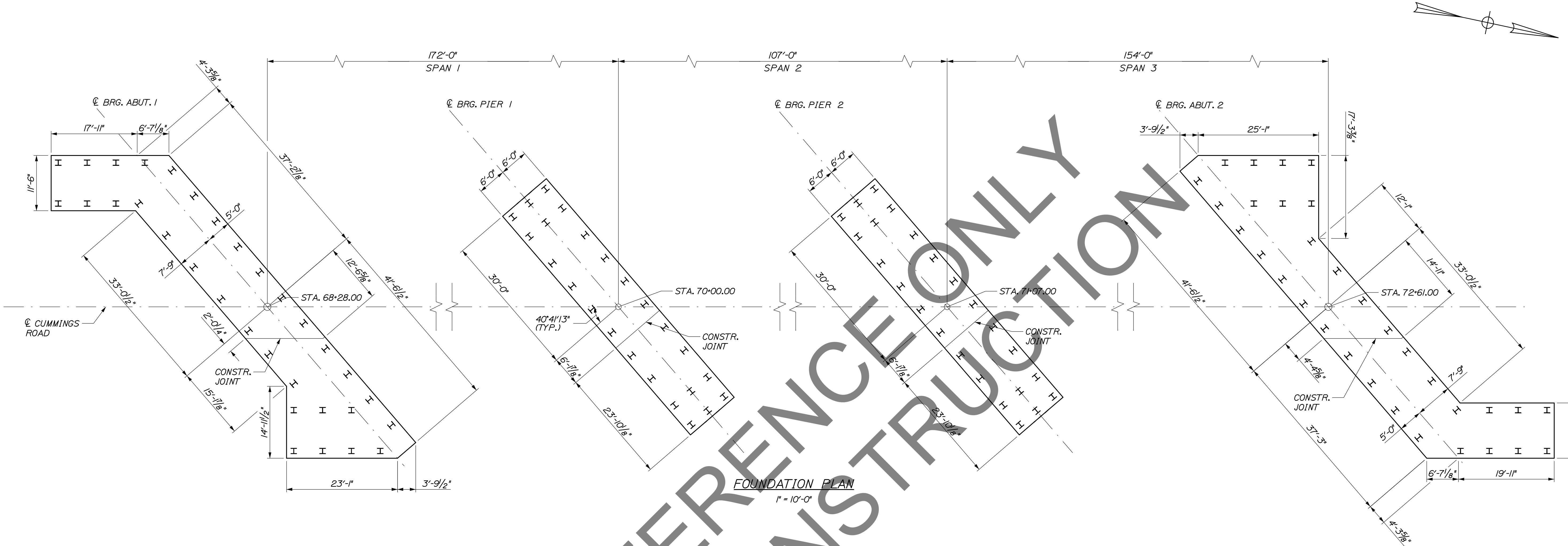
MAINE TURNPIKE
THE GOLD STAR MEMORIAL HIGHWAY

MTA PROJECT MANAGER: Ralph C. Norwood, IV, P.E., P.T.O.E.

BRIDGE REPLACEMENT
CUMMINGS ROAD UNDERPASS

SUBSTRUCTURE DEMOLITION PLAN

SHEET NUMBER: S-17
CONTRACT: 2018.19



FOUNDATION PLAN
1" = 10'-0"

PILE NOTES

1. SEE SHEETS S-19, S-22, AND S-28 FOR PILE LAYOUTS.

2. THE MAXIMUM CALCULATED FACTORED AXIAL PILE LOADS ARE:

   ABUTMENT NO. 1: 450 KIPS (INCLUDING 145 KIPS ALLOWED FOR DOWNDRAG)
   ABUTMENT NO. 2: 425 KIPS (INCLUDING 155 KIPS ALLOWED FOR DOWNDRAG)
   PIER NO. 1: 455 KIPS
   PIER NO. 2: 455 KIPS

3. PILES SHALL BE DRIVEN TO THE FOLLOWING NOMINAL DRIVING RESISTANCES:

   ABUTMENT NO. 1: 825 KIPS
   ABUTMENT NO. 2: 825 KIPS
   PIER NO. 1: 700 KIPS
   PIER NO. 2: 700 KIPS

4. ESTIMATE OF PILES REQUIRED:

   ABUTMENT NO. 1: 32 ~ HP 14x117 @ 84 FEET
   ABUTMENT NO. 2: 32 ~ HP 14x117 @ 112 FEET
   PIER NO. 1: 24 ~ HP 14x117 @ 84 FEET
   PIER NO. 2: 24 ~ HP 14x117 @ 94 FEET

5. ALL PILES SHALL BE EQUIPPED WITH A PILE TIP IN ACCORDANCE WITH STANDARD SPECIFICATIONS SUBSECTION 501.048, PREFABRICATED PILE TIPS.

6. A FRICTION REDUCING COATING, SUCH AS SLICKCOAT OR AN APPROVED EQUAL, SHALL BE APPLIED TO THE BOTTOM 20 FEET OF ALL PILES AT ABUTMENT 1 AND THE BOTTOM 50 FEET OF ALL PILES AT ABUTMENT 2. THE FRICTION REDUCING COATING SHALL BE APPROVED BY THE RESIDENT AND APPLIED IN ACCORDANCE WITH MANUFACTURERS RECOMMENDATIONS. TOUCH-UP APPLICATIONS AT FIELD SPLICE LOCATIONS ARE NOT REQUIRED. PAYMENT FOR OF THE COATING WILL BE MADE UNDER ITEM 501.54, STEEL H-BEAM PILES 117 LB/FT, DELIVERED.

7. THE CONTRACTOR SHALL PERFORM AND SUBMIT A WAVE EQUATION ANALYSIS FOR REVIEW AND ACCEPTANCE BY THE RESIDENT. THE MAXIMUM ALLOWABLE DRIVING STRESS IS 0.90 TIMES FY. THE SUBMITTAL ANALYSES SHALL INCLUDE THE PROPOSED STOPPING CRITERIA BASED ON THE WAVE EQUATION ANALYSIS AND THE PROPOSED DRIVING SYSTEM. THE STOPPING CRITERIA SHALL INCLUDE THE BLOWS PER INCH AND THE NUMBER OF 1-IN. INTERVALS AT WHICH PILE INSTALLATION MAY BE TERMINATED. THE COST OF PERFORMING THE WAVE EQUATION ANALYSIS WILL BE CONSIDERED INCIDENTAL TO ITEM NO. 501.92, PILE DRIVING EQUIPMENT MOBILIZATION.

8. THE CONTRACTOR SHALL PERFORM 4 DYNAMIC LOAD TESTS, ONE AT EACH SUBSTRUCTURE LOCATION, TO CONFIRM THE NOMINAL DRIVING RESISTANCES HAVE BEEN MET. THE DYNAMIC TESTS SHALL BE PERFORMED ON THE FIRST PRODUCTION PILE DRIVEN AT EACH SUBSTRUCTURE. MINIMUM 24 HOUR PILE RESTRIKES SHALL BE CONDUCTED ON ALL TEST PILES IN ORDER TO ENSURE THE REQUIRED NOMINAL RESISTANCE HAS BEEN ACHIEVED AND VERIFY PILE RELAXATION HAS NOT OCCURRED. THE CONTRACTOR MAY DRIVE PRODUCTION PILES TO THE PRELIMINARY DRIVING CRITERIA, HOWEVER PILE CUT-OFF WILL NOT BE PERMITTED UNTIL COMPLETION OF RESTRIKE TESTING AND ESTABLISHMENT OF FINAL DRIVING CRITERIA.

Date: 9/18/2018

Filename: 093_Foundation Plan.dgn

Scale:

No.	Revision	By	Date

Designed by: HNTB

CONSULTANT PROJECT MANAGER: Tim Cote, P.E.

	By	Date		By	Date
Designed	TJP	08\18	Checked	HJW	08\18
Drawn	PEB	08\18	In Charge of	RAL	08\18

HNTB CORPORATION
340 County Road, Suite 6-C
Westbrook, ME 04092
TEL (207) 774-5155
FAX (207) 228-0909

MAINE TURNPIKE

THE GOLD STAR MEMORIAL HIGHWAY

MTA PROJECT MANAGER: Ralph C. Norwood, IV, P.E., P.T.O.E.

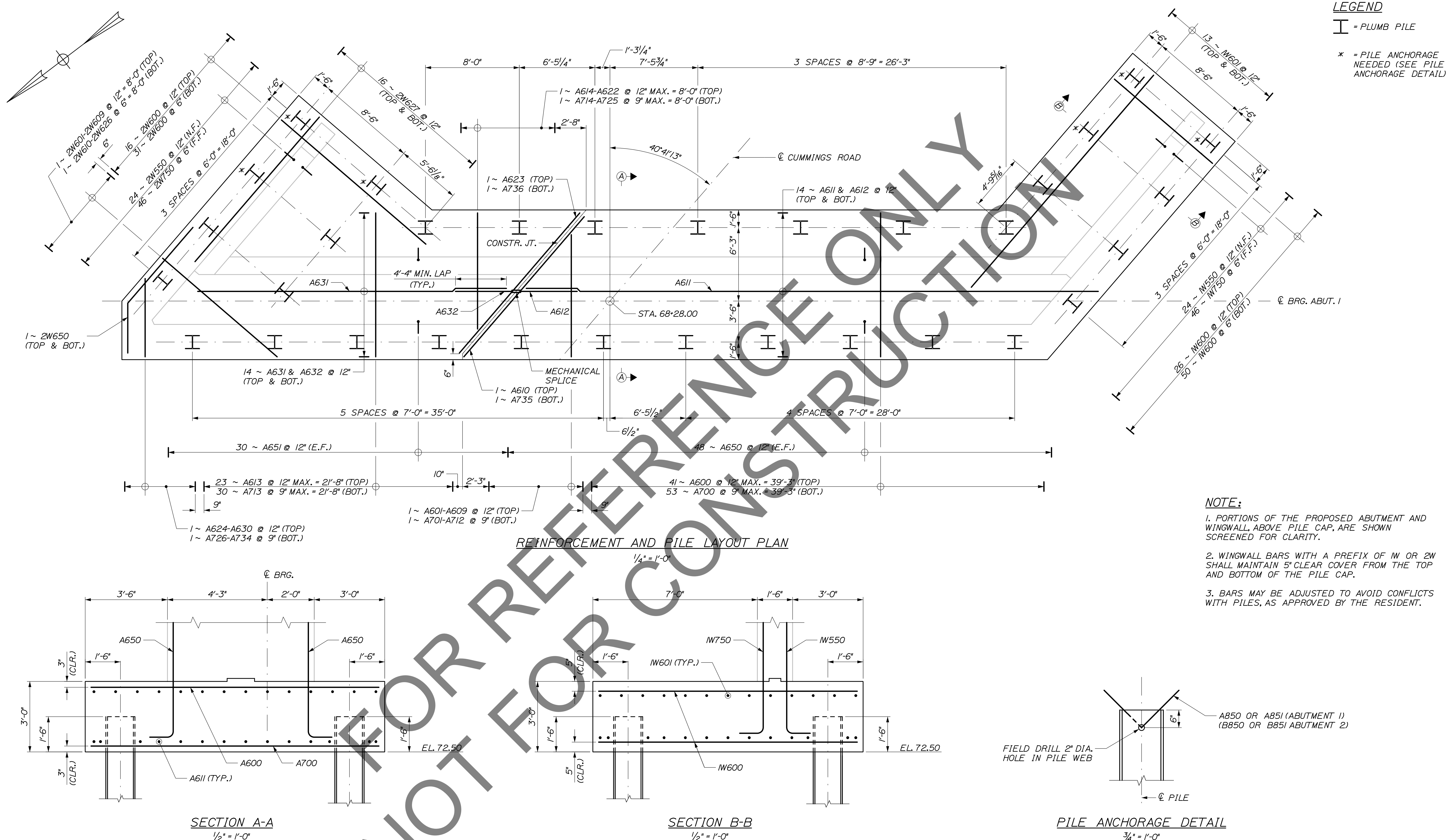
BRIDGE REPLACEMENT
CUMMINGS ROAD UNDERPASS

FOUNDATION PLAN

SHEET NUMBER: S-18

CONTRACT: 2018.19

Date:9/18/2018



LEGEND

- = PLUMB PILE
- * = PILE ANCHORAGE NEEDED (SEE PILE ANCHORAGE DETAIL)

NOTE:

1. PORTIONS OF THE PROPOSED ABUTMENT AND WINGWALL, ABOVE PILE CAP, ARE SHOWN SCREENED FOR CLARITY.

2. WINGWALL BARS WITH A PREFIX OF 1W OR 2W SHALL MAINTAIN 5" CLEAR COVER FROM THE TOP AND BOTTOM OF THE PILE CAP.

3. BARS MAY BE ADJUSTED TO AVOID CONFLICTS WITH PILES, AS APPROVED BY THE RESIDENT.

Filename: 094_Abutment 1 Foundation.dgn

Scale:

No.	Revision	By	Date

Designed by:

HNTB

CONSULTANT PROJECT MANAGER: Tim Cote, P.E.

	By	Date		By	Date
Designed	TJP	08\18	Checked	HJW	08\18
Drawn	PEB	08\18	In Charge of	RAL	08\18

HNTB CORPORATION
340 County Road, Suite 6-C
Westbrook, ME 04092
TEL (207) 774-5155
FAX (207) 228-0909

MAINE TURNPIKE

THE GOLD STAR MEMORIAL HIGHWAY

MTA PROJECT MANAGER: Ralph C. Norwood, IV, P.E., P.T.O.E.

BRIDGE REPLACEMENT
CUMMINGS ROAD UNDERPASS

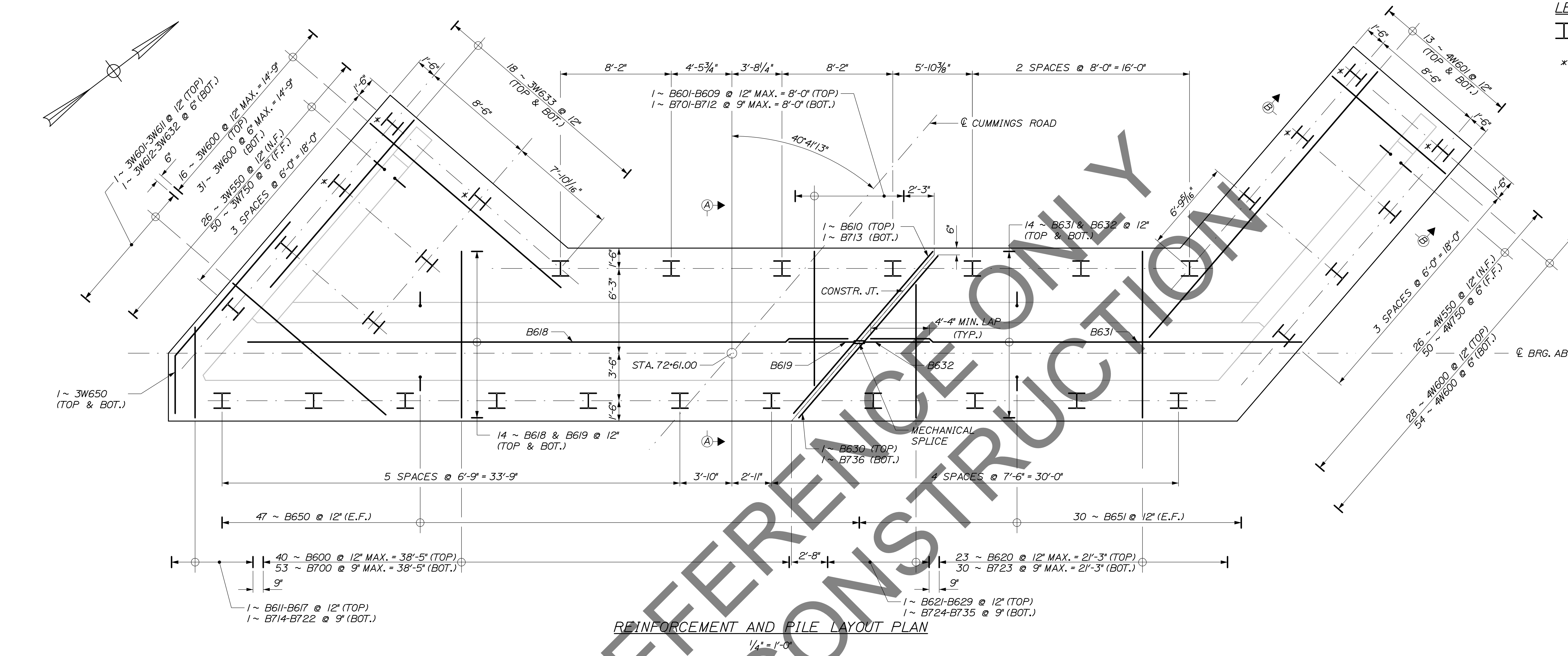
ABUTMENT 1
FOUNDATION

SHEET NUMBER: S-19

CONTRACT:2018.19

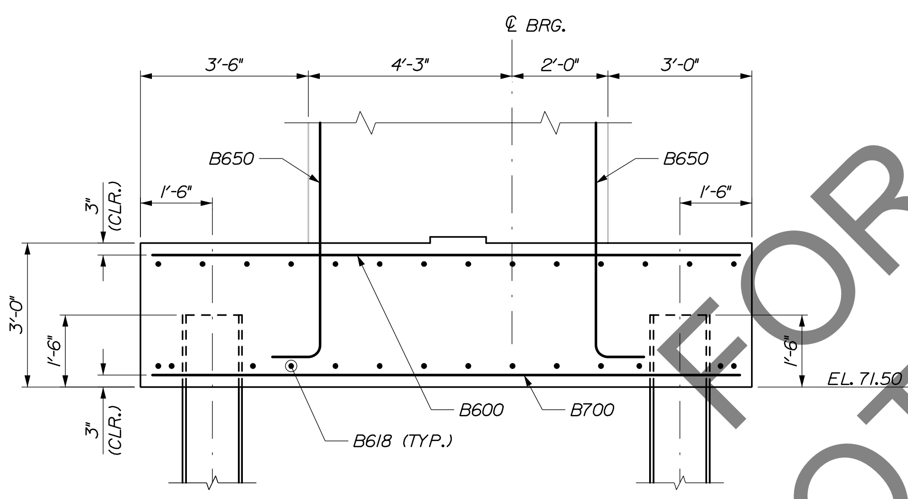
LEGEND

- I = PLUMB PILE
- * = PILE ANCHORAGE NEEDED (SEE PILE ANCHORAGE DETAIL, NOTE 2)



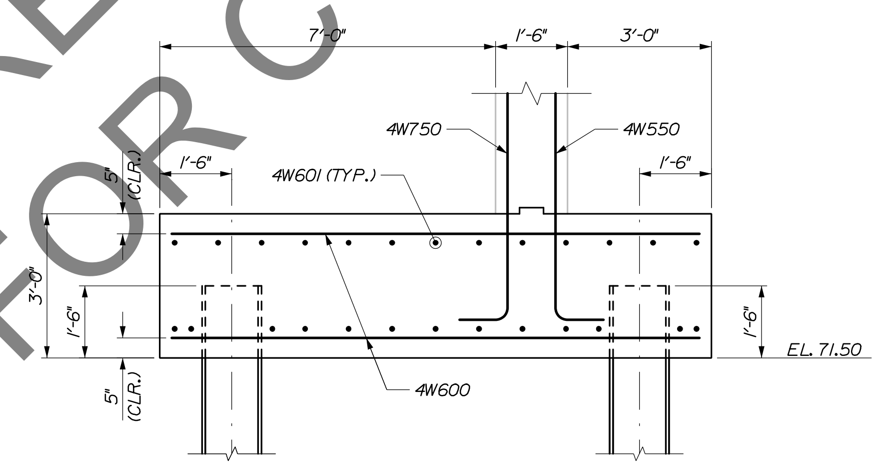
REINFORCEMENT AND PILE LAYOUT PLAN

1/4" = 1'-0"



SECTION A-A

1/2" = 1'-0"



SECTION B-B

1/2" = 1'-0"

NOTE:

1. PORTIONS OF THE PROPOSED ABUTMENT AND WINGWALL, ABOVE THE PILE CAP, ARE SHOWN SCREENED FOR CLARITY.

2. SEE S-19 FOR PILE ANCHORAGE DETAIL.

3. WINGWALL BARS WITH A PREFIX OF 3W OR 4W SHALL MAINTAIN 5" CLEAR COVER FROM THE TOP AND BOTTOM OF THE PILE CAP.

4. BARS MAY BE ADJUSTED TO AVOID CONFLICTS WITH PILES, AS APPROVED BY THE RESIDENT.

Scale:

No.	Revision	By	Date

Designed by:

HNTB

CONSULTANT PROJECT MANAGER: Tim Cote, P.E.

	By	Date		By	Date
Designed	TJP	08\18	Checked	HJW	08\18
Drawn	PEB	08\18	In Charge of	RAL	08\18

HNTB CORPORATION
340 County Road, Suite 6-C
Westbrook, ME 04092
TEL (207) 774-5155
FAX (207) 228-0909

MAINE TURNPIKE

THE GOLD STAR MEMORIAL HIGHWAY

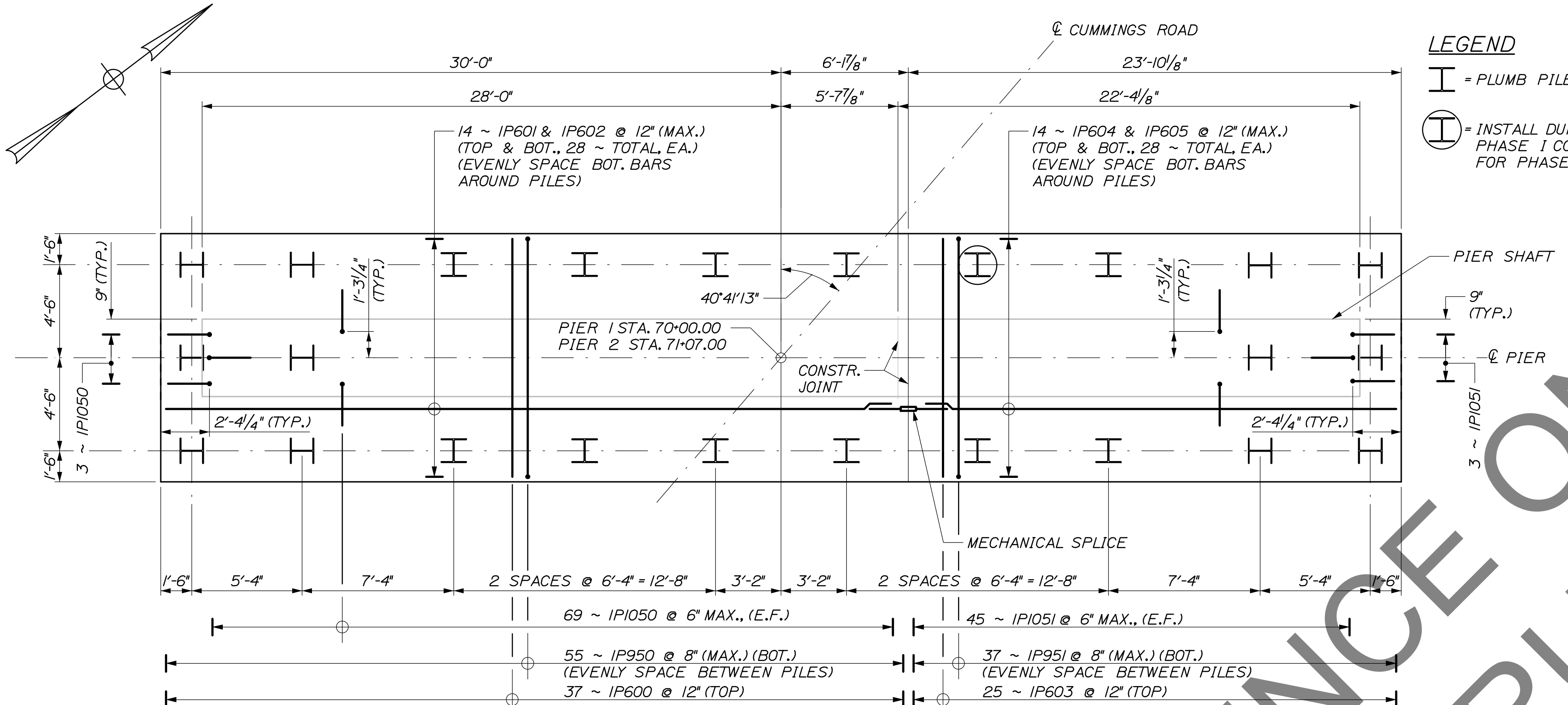
MTA PROJECT MANAGER: Ralph C. Norwood, IV, P.E., P.T.O.E.

BRIDGE REPLACEMENT
CUMMINGS ROAD UNDERPASS

ABUTMENT 2
FOUNDATION

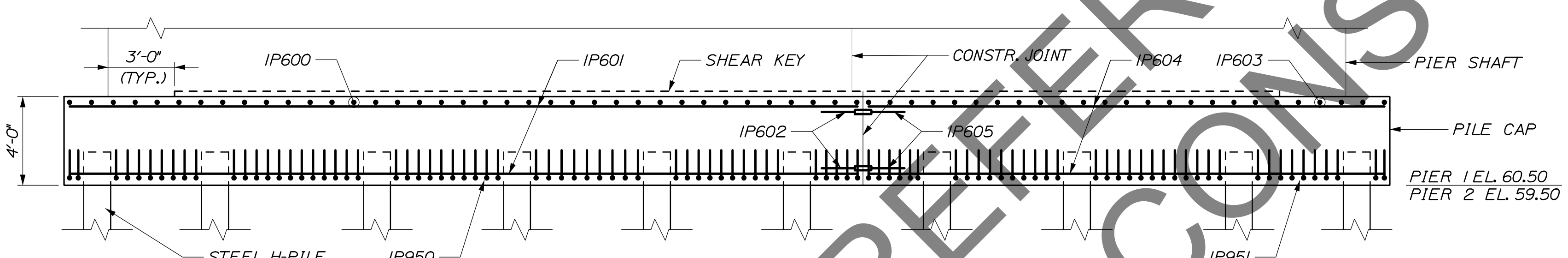
SHEET NUMBER: S-22

CONTRACT:2018.19



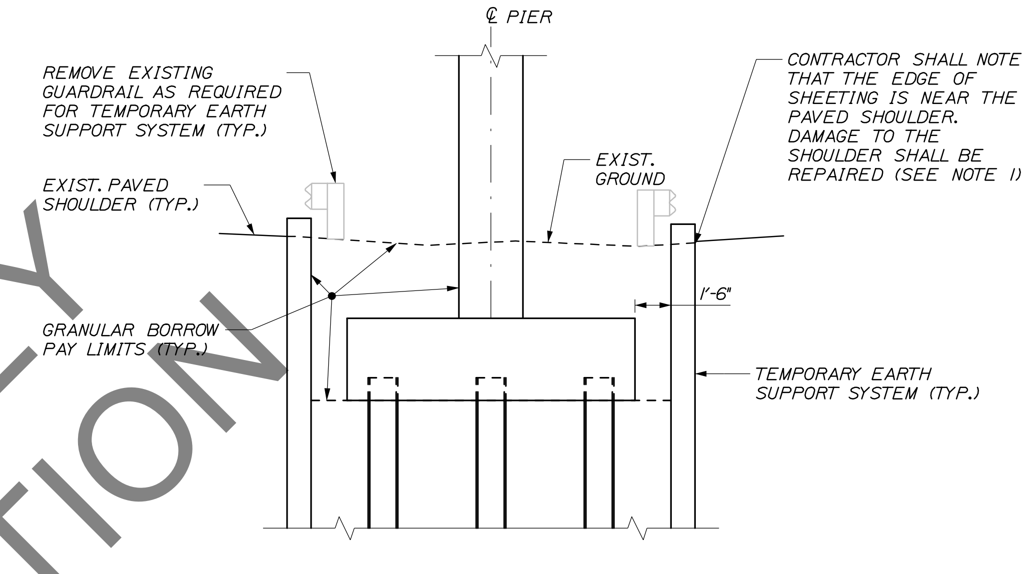
LAYOUT PLAN

(PIER SHAFT SCREENED FOR CLARITY)
(REINFORCEMENT SETS "A" & "B" NOT SHOWN FOR CLARITY)
1/4" = 1'-0"



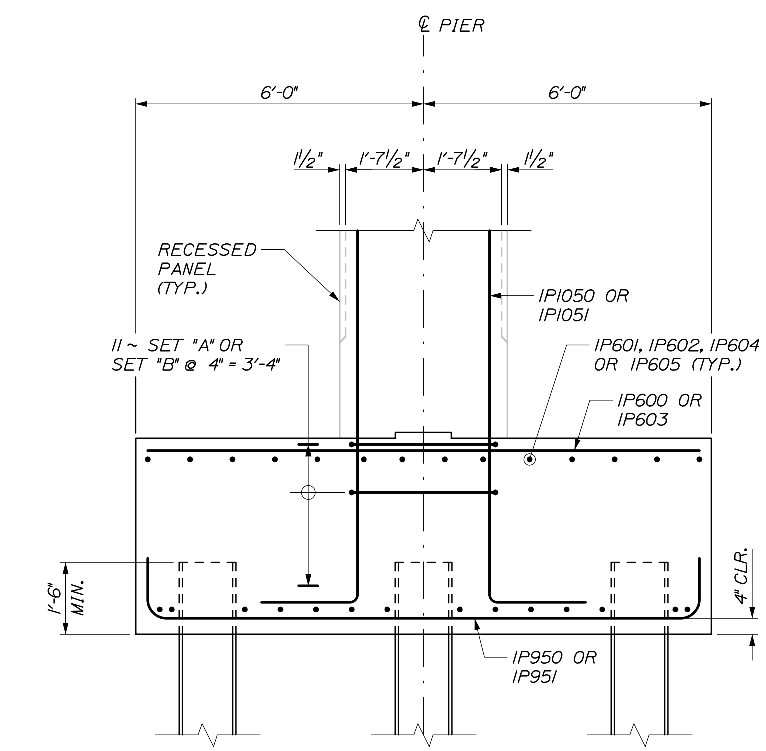
PILE CAP ELEVATION

(PIER SHAFT SCREENED FOR CLARITY)
(REINFORCEMENT SETS "A" & "B" NOT SHOWN FOR CLARITY)
1/4" = 1'-0"



TEMPORARY EARTH SUPPORT SYSTEM DETAIL

N.T.S.



TYPICAL SECTION

1/2" = 1'-0"

NOTES:

1. ON EACH SIDE OF PIER 1, THE CONTRACTOR SHALL SURVEY THE SOLID YELLOW LANE LINES OF THE MAINE TURNPIKE AT 10 FOOT INTERVALS EXTENDING 80 FEET EAST AND WEST OF THE CUMMINGS ROAD CENTERLINE, MEASURED ALONG THE TURNPIKE, PRIOR TO INSTALLATION OF THE TEMPORARY EARTH SUPPORT STRUCTURES. THE POINTS SHALL BE RE-SURVEYED AFTER PIER CONSTRUCTION IS COMPLETE AND THE TEMPORARY EARTH SUPPORT STRUCTURE IS REMOVED. THE CONTRACTOR SHALL BE RESPONSIBLE FOR REPAIRING ANY SETTLEMENT OF THE NORTHBOUND AND SOUTHBOUND ROADWAY GREATER THAN 1/2-INCH RESULTING FROM MOVEMENT, INSTALLATION, OR REMOVAL OF THE TEMPORARY EARTH SUPPORT STRUCTURE TO ADEQUATELY SUPPORT THE TURNPIKE SUBBASE MATERIAL. SETTLEMENT WILL BE DETERMINED FROM THE PRE- AND POST-CONSTRUCTION SURVEY ELEVATIONS. ANY REPAIRS REQUIRED WILL BE COMPLETED TO THE SATISFACTION OF THE AUTHORITY AT NO ADDITIONAL COST TO THE AUTHORITY. SURVEY IS INCIDENTAL TO THE RELATED CONTRACT ITEMS.

2. SEE S-32 FOR REBAR SETS "A" AND "B" DETAILS.

3. PIER 1 BAR MARKS SHOWN; PIER 2 BAR MARKS SIMILAR.

4. PIER 1 TIES (IP550 & IP552) AND PIER 2 TIES (2P550 & 2P552) MAY BE OMITTED FROM SETS "A" & "B" WITHIN THE PILE CAP WHERE CONFLICT WITH PILES OCCUR.

Date: 9/18/2018

Filename: 103_Pier Foundation.dgn

Scale:				Designed by: HNTB						HNTB CORPORATION 340 County Road, Suite 6-C Westbrook, ME 04092 TEL (207) 774-5155 FAX (207) 228-0909	MAINE TURNPIKE — THE GOLD STAR MEMORIAL HIGHWAY	BRIDGE REPLACEMENT CUMMINGS ROAD UNDERPASS — PIER FOUNDATION
No.	Revision	By	Date	CONSULTANT PROJECT MANAGER: Tim Cote, P.E.								SHEET NUMBER: S-28
					By	Date		By	Date			
				Designed	JKO	08\18	Checked	TJP	08\18			
				Drawn	PEB	08\18	In Charge of	RAL	08\18		MTA PROJECT MANAGER: Ralph C. Norwood, IV, P.E., P.T.O.E.	CONTRACT: 2018.19 — 103 OF 135