MAINE DEPARTMENT OF TRANSPORTATION
BRIDGE PROGRAM
GEOTECHNICAL SECTION
AUGUSTA, MAINE

GEOTECHNICAL SERIES 100 REPORT

For the Rehabilitation of:

FORD BRIDGE
OVER LITTLE RIVER
LEBANON, MAINE

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York County
WIN 17873.00

Soils Report No. 2011-114
Bridge No. 1219

Fed No. BR-1787(300)X
August 17, 2011

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1.0 INTRODUCTION

A limited subsurface investigation has been completed at the Ford Bridge site on Fall Road in Lebanon, Maine. The initial purpose of the subsurface investigation was to provide data and recommendations for the replacement of the existing bridge. A decision was made by the Maine Department of Transportation (MaineDOT) Bridge Program and Calderwood Engineering during the development of the Preliminary Design Report (PDR) to rehabilitate rather than replace the structure. This report presents the geotechnical information obtained at the site for use by the design team and bidding contractors.

The existing Ford Bridge carries Fall Road over Little River and was constructed in 1950. The bridge consists of a single-span, steel girder superstructure with a steel grid deck founded on mass, dry laid, stone abutments. The abutments may date back to the 1800's. The abutment foundation and full abutment height are not known. The structure has a span length of approximately 34 feet. The 2010 Maine Department of Transportation (MaineDOT) maintenance inspection reports indicate that the bridge deck is in satisfactory condition (rating of 6), the superstructure is in fair condition (rating of 5) and the substructures are in poor condition (rating of 4). The Bridge Sufficiency Rating is 36.1. The structure has a scour critical rating of "U - unknown scour" meaning that the foundations have not been evaluated for scour. Inspection records note that the bridge is in overall fair to poor condition. The abutments have voids and loose and cracked stones. Some shifting of the stones has been noted. The bridge is currently posted at 13 tons.

The MaineDOT Bridge Program is currently proposing to rehabilitate this structure. The superstructure girders will be retrofitted with a new steel plate along the bottom flange and the girders will be coated for protection. The abutments will be pressure grouted and weep holes will be installed. The top stones of the existing abutments will be removed and a concrete bearing seat slab will be poured. The concrete slab will be attached to deadmen to stabilize the top of the abutments. A cable mat will be installed across the entire channel as scour protection. A 30 year life expectancy is anticipated with this rehabilitation. The existing vertical and horizontal alignments will be maintained in the rehabilitation of the bridge. The road and bridge will be closed during construction and traffic will be detoured around the site.

2.0 GEOLOGIC SETTING

Ford Bridge in Lebanon, Maine cross Little River approximately 0.18 miles northeasterly of Little River Road as shown on Sheet 1 - Location Map presented at the end of this report.

According to the Surficial Geologic Map, Sanford Quadrangle, Maine, Open File No. 97-55, published by the Maine Geological Survey (1997) the surficial soils in the vicinity of the site consist of glacial outwash deposits to the west and stream alluvium deposits to the east. The glacial outwash deposits are comprised of undifferentiated glacial-fluvial sand and gravel deposited in the Little and upper Mousam River valleys. The stream alluvium deposits are comprised of sand, silt, gravel and organic material deposited on the flood plains of modern rivers and streams.

According to the Kittery Quadrangle, Bedrock Geologic Map, Open File No. 08-78, published by the Maine Geological Survey (2008) the bedrock in the vicinity of the site is identified as well-bedded muscovite-biotite-garnet-sillimanite (or andalusite)-staurolite schist and micaceous quartzite of the East Rochester Formation.

3.0 SUBSURFACE INVESTIGATION

Subsurface conditions at the site were explored by drilling two (2) test borings. Test boring BB-LLR-101 was drilled behind the location of the existing west abutment. Test boring BB-LLR-102 was drilled behind the location of the existing east abutment. The boring locations are shown in Sheet 2 - Boring Location Plan and Interpretive Subsurface Profile found at the end of this report. The borings were drilled on March 22, 2011 using the MaineDOT drill rig. Details and sampling methods used, field data obtained, and soil and groundwater conditions encountered are presented in the boring logs provided in Appendix A - Boring Logs and graphically on Sheet 2 - Boring Location Plan and Interpretive Subsurface Profile found at the end of this report.

The borings were drilled using solid stem auger and driven cased wash boring drilling techniques. Soil samples were obtained where possible at 5-foot intervals using Standard Penetration Test (SPT) methods. During SPT sampling, the sampler is driven 24 inches and the hammer blows for each 6 inch interval of penetration are recorded. The standard penetration resistance, N-value, is the sum of the blows for the second and third intervals. MaineDOT drill rig is equipped with an automatic hammer to drive the split spoon. The hammer was calibrated in March of 2010 and was found to deliver approximately 40 percent more energy during driving than the standard rope and cathead system. All N-values discussed in this report are corrected values computed by applying an average energy transfer factor of 0.84 to the raw field N-values. This hammer efficiency factor (0.84) and both the raw field N-value and the corrected N-value are shown on the boring logs. The bedrock was cored in the borings using an NQ-2" core barrel and the Rock Quality Designation (RQD) of the core was calculated.

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

Details and sampling methods used, field data obtained, and soil and groundwater conditions encountered are presented in the boring logs provided in Appendix A – Boring Logs and on Sheet 3 – Boring Logs, found at the end of this report.

4.0 LABORATORY TESTING

A laboratory testing program was conducted on selected samples recovered from test borings to assist in soil classification, evaluation of engineering properties of the soils, and geologic assessment of the project site. Laboratory testing consisted of nine (9) grain size analyses and natural moisture content determinations. The tests were performed in the MaineDOT Materials and Testing Laboratory in Bangor, Maine. The results of this laboratory testing are provided in Appendix B - Laboratory Data at the end of this report. Moisture content information is also shown on the Boring Logs in Appendix A and on Sheet 3 - Boring Logs found at the end of this report.

5.0 SUBSURFACE CONDITIONS

An interpretive subsurface profile depicting the interpreted soil stratigraphy across the site is show on Sheet 2 - Boring Location Plan and Interpretive Subsurface Profile found at the end of this report. A brief summary description of the strata encountered is as follows:

5.1 Fill

A layer of fill was encountered behind the existing abutments in both of the borings. The layer was approximately 4 feet thick in boring BB-LLR-101 and approximately 5 feet thick in boring BB-LLR-102. The fill soils generally consisted of brown, damp, fine to coarse sand, some silt, trace gravel in boring BB-LLR-101 and brown, moist, gravelly, fine to coarse sand, little silt in boring BB-LLR-102. Corrected SPT N-values in the fill ranged from 31 to 39 blows per foot (bpf) indicating that the layer is dense in consistency. Two (2) grain size analyses were conducted on fill samples. The moisture contents of the samples ranged from approximately 11% to 28%. The grain size analyses resulted in the fill being classified as an A-2-4 or A-1-b under the AASHTO Soil Classification System and as an SM or SW-SW under the Unified Soil Classification System. Laboratory test results can be found in Appendix B - Laboratory Data. This testing information is also shown on the boring logs in Appendix A and on Sheet 3 - Boring Logs found at the end of this report.

5.2 Sand and Gravel

A layer of interbedded sandy gravel, sand and gravelly sand, was encountered beneath the fill in both of the borings. The layer was approximately 13.4 feet thick in boring BB-LLR-101 and approximately 16.4 feet thick in boring BB-LLR-102. This layer generally consisted of:

- Brown, moist, fine to coarse, sandy gravel, trace to little silt, trace organics and occasional cobbles,
- Brown, moist, fine to coarse, sand, some gravel, little silt,
- Grey, wet, fine to coarse, sand, some to little gravel, some to little silt, and
- Grey-brown, wet, gravelly, fine to coarse sand, little silt.

Corrected SPT N-values in the layer ranged from 17 to 48 bpf indicating that the layer is medium dense to dense in consistency. Seven (7) grain size analyses were conducted on samples from the layer. The moisture content of the samples ranged from approximately 4% to 17%. The grain size analyses resulted in the soil being classified as an A-1-a, A-1-b, or A-2-4 under the AASHTO Soil Classification System and as a GW-GM, SW-SM, SP-SM, GP-GM, or SM under the Unified Soil Classification System. Laboratory test results can be found in Appendix B - Laboratory Data. This testing information is also shown on the boring logs in Appendix A and on Sheet 3 - Boring Logs found at the end of this report.

Cobbles were encountered in boring BB-LLR-102 at depths of 9.2 and 10.1 feet below ground surface.

5.3 Bedrock

The bedrock was cored in both of the borings and was encountered at depths ranging from 17.4 feet below ground surface (El. 282.3 feet) in boring BB-LLR-101 and 21.4 feet bgs (El. 277.1 feet) in boring BB-LLR-102. The bedrock was observed to be grey to dark grey, fine grained, fresh, banded, meta-sandstone, with calcite, pyrite and garnet, joints dipping at 30 to 45 degrees and 60 to 75 degrees. The RQD of the bedrock ranged from 23% to 70% indicating that the rock is of very poor to fair quality. The top of the bedrock surface appears to slope downward from west to east.

Table 1 summarizes approximate depths to bedrock, corresponding top of bedrock elevations and RQD at the boring locations:

Boring Number	Depth to Bedrock	Bedrock Elevation	RQD
BB-LLR-101	17.4 feet	282.3 feet	25 - 70%
BB-LLR-102	21.4 feet	277.1 feet	23 - 62%

Table 1 – Summary of Bedrock Depths, Elevations and RQD

5.4 Groundwater

Groundwater was observed at a depth of approximately 11.5 feet below ground surface in boring BB-LLR-101 and 11.0 feet below ground surface in boring BB-LLR-102. The water levels measured upon completion of drilling are indicated on the boring logs found in Appendix A. Note that water was introduced into the boreholes during the drilling operations. It is likely that the water levels indicated on the boring logs do not represent stabilized groundwater conditions. Additionally, groundwater levels are expected to fluctuate seasonally depending upon the local precipitation magnitudes and construction activity.

6.0 PROJECT ALTERNATIVES

In the Preliminary Design Report (PDR), developed for the MaineDOT Bridge Program by Calderwood Engineering, four (4) project alternatives were considered as follows:

- Bridge replacement with a steel girder superstructure and concrete cantilevered abutments founded on bedrock.
- Bridge replacement with a precast, pre-stressed voided slab superstructure. The use of concrete cantilevered abutments founded on bedrock is assumed for this report as no foundation type is called out for this alternative in the PDR.
- Bridge replacement with a precast, concrete arch. The use of concrete cantilevered abutments founded on bedrock is assumed for this report as no foundation type is called out for this alternative in the PDR.
- Rehabilitation of the existing superstructure and substructure.

The PDR identifies the rehabilitation alternative as the most cost effective solution. The superstructure girders will be retrofitted with a new steel plate along the bottom flange and the girders will be coated for protection. Loose and shifted stones in the abutments will be realigned and the abutments will be pressure grouted. Weep holes will be installed in the existing stacked stone abutments. The top stones of the existing abutments will be removed and a concrete bearing seat slab will be poured. The concrete slab will be attached to deadmen to stabilize the top of the abutments. A cable mat will be installed across the entire channel as scour protection. A 30 year life expectancy is anticipated with this rehabilitation.

The design of the rehabilitation will be undertaken by Calderwood Engineering. The MaineDOT geotechnical team will provide design assistance and specification development assistance to Calderwood Engineering as needed during final design.

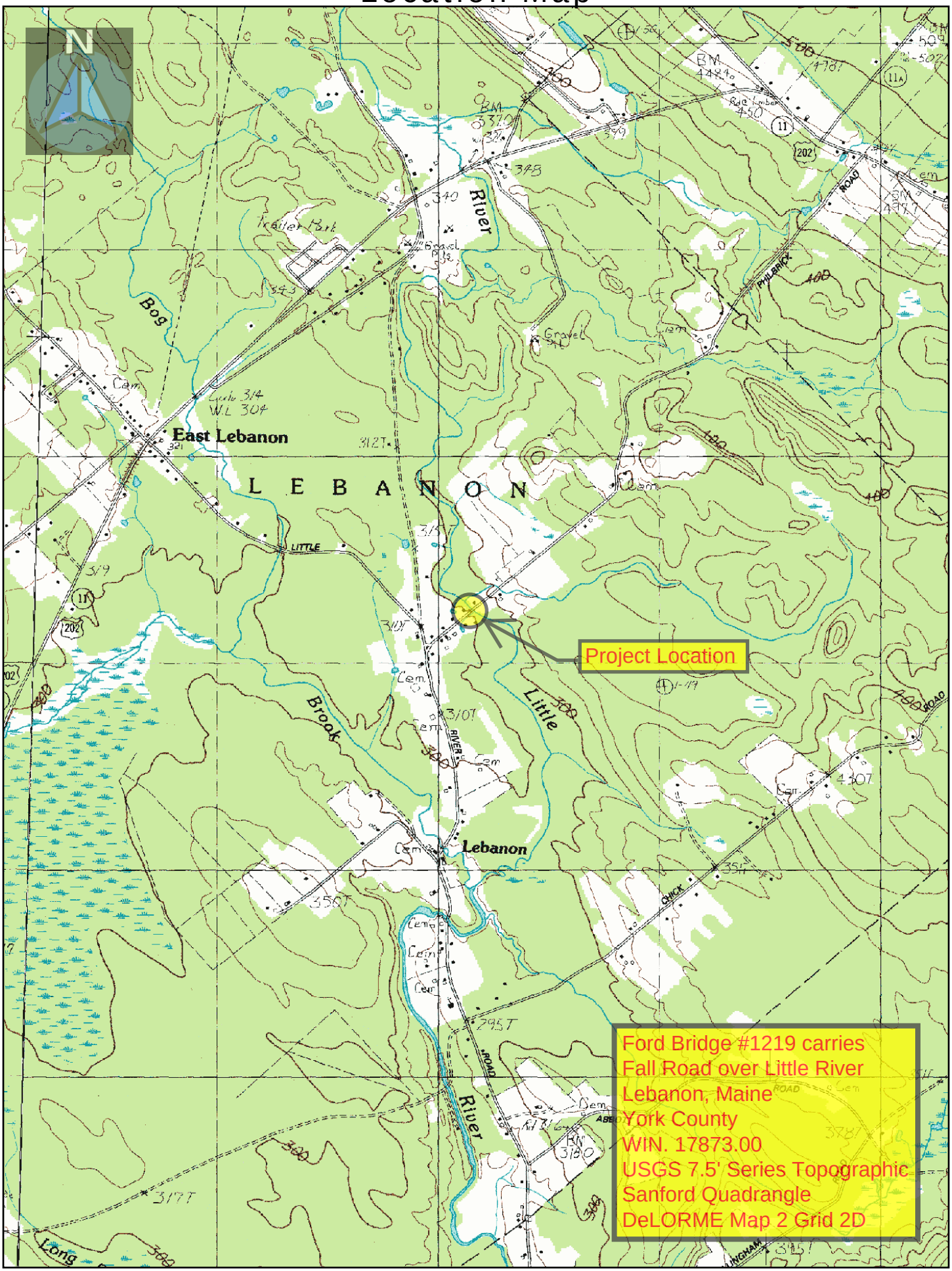
7.0 CLOSURE

This report has been prepared for the use of Calderwood Engineering and the MaineDOT Bridge Program to provide limited subsurface condition information at Ford Bridge in Lebanon, Maine. This report has been prepared in accordance with generally accepted geotechnical engineering practices. No other intended use or warranty is expressed or implied.

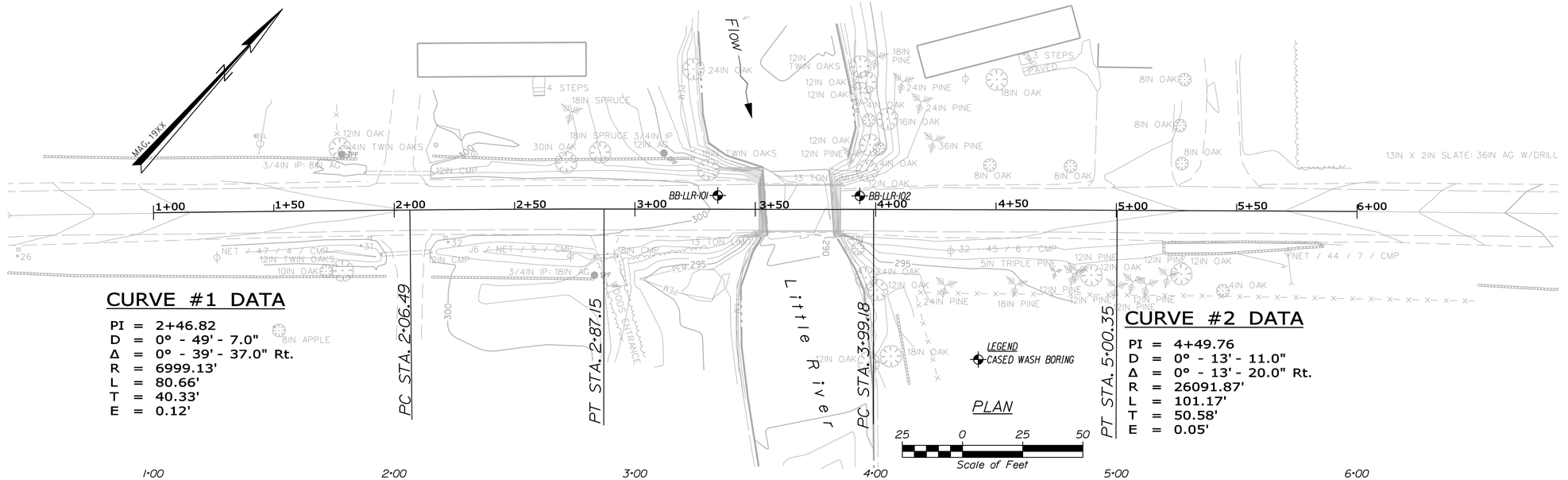
This report discusses limited soil explorations at discrete locations near the existing bridge and a limited number of laboratory soil index tests. Maine DOT shall not be responsible for the designer's, bidder's and/or contractor's interpretations of or estimates or conclusions drawn from the information contained in this report. Data provided may not be representative of the subsurface conditions at locations other than the specific boring locations explored.

Sheets

Location Map



Map Scale 1:24000

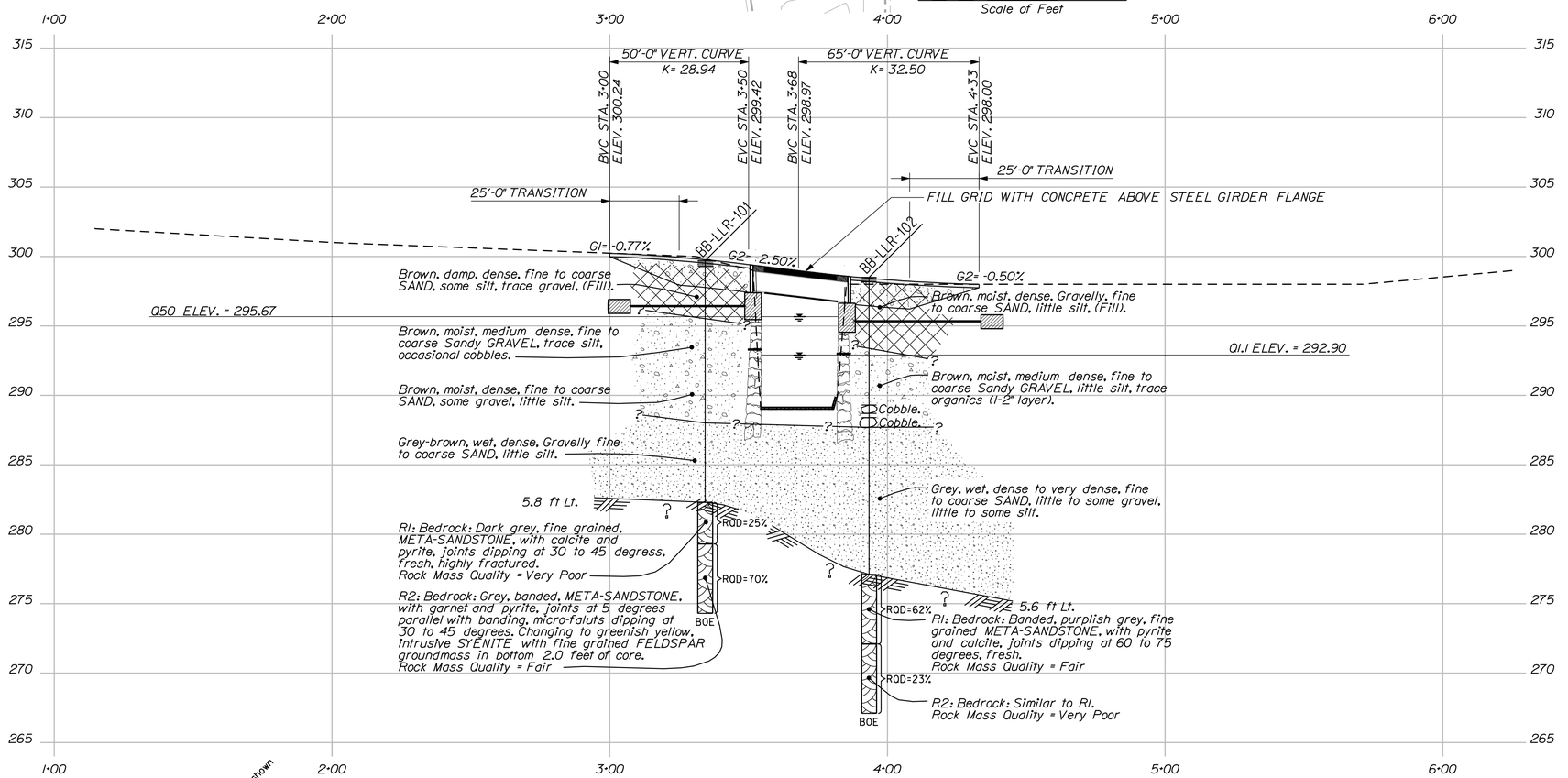


CURVE #1 DATA

PI = 2+46.82
D = 0° - 49' - 7.0"
Δ = 0° - 39' - 37.0" Rt.
R = 6999.13'
L = 80.66'
T = 40.33'
E = 0.12'

CURVE #2 DATA

PI = 4+49.76
D = 0° - 13' - 11.0"
Δ = 0° - 13' - 20.0" Rt.
R = 26091.87'
L = 101.17'
T = 50.58'
E = 0.05'



Boring No. Offset, ft shown

LEGEND
Pavement Thickness if applicable
Strata Interface
Boring
RQD= Rock Quality Designation for Rock Core Sample
BOE= Bottom Of Exploration

PROFILE
HORIZ 25 0 25 50
VERT 5 0 5 10
SCALE

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.

STATE OF MAINE
DEPARTMENT OF TRANSPORTATION

BR-1787(300)X

WIN 17873.00 BRIDGE PLANS

BRIDGE NO. 1219

	BY	DATE
PROJ. MANAGER	----------	----------
DESIGN-DETAILED	T. WHITE	MAR 2011
CHECKED-REVIEWED	K.MAGUIRE	-----
DESIGN2-DETAILED2	----------	----------
DESIGN3-DETAILED3	----------	----------
REVISIONS 1	-----	-----
REVISIONS 2	-----	-----
REVISIONS 3	-----	-----
REVISIONS 4	-----	-----
FIELD CHANGES	-----	-----

SIGNATURE

P.E. NUMBER

DATE

FORD BRIDGE
LITTLE RIVER
YORK COUNTY
LEBANON

BORING LOCATION PLAN & INTERPRETIVE SUBSURFACE PROFILE

SHEET NUMBER
2
OF 3

Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: Ford Bridge #1219 carries Fall Road over Little River
Location: Lebanon, Maine

Boring No.: BB-LLR-101
WIN: 17873.00

Driller:	MaineDOT	Elevation (ft.)	299.7	Auger ID/OD:	5" Solid Stem
Operator:	Giguere/Giles	Datum:	NAVD88	Sampler:	Standard Split Spoon
Logged By:	B. Wilder	Rig Type:	CME 45C	Hammer Wt./Fall:	140#/30"
Date Start/Finish:	3/22/11; 08:00-11:30	Drilling Method:	Cased Wash Boring	Core Barrel:	NQ-2"
Boring Location:	3+34.4, 5.8 ft Lt.	Casing ID/OD:	HW & NW	Water Level*:	11.5 ft bgs.
Hammer Efficiency Factor: 0.84		Hammer Type:	Automatic ☒ Hydraulic ☐ Rope & Cathead ☐		

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

Depth (ft.)	Sample 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	Laboratory Testing Results/ AASHTO and Unified Class
0							SSA	299.28		5" Pavement — 0.42	
	1D	24/19	1.50 - 3.50	11/15/7/4	22	31				Brown, damp, dense, fine to coarse SAND, some silt, trace gravel. (Fill).	G#245525 A-2-4, SM WC=28.2%
								295.70		4.00	
5	2D	24/14	5.00 - 7.00	4/5/9/5	14	20				Brown, moist, medium dense, fine to coarse Sandy GRAVEL, trace silt, occasional cobbles.	G#262369 A-1-a, GW-GM WC=4.4%
10	3D	3.6/3.6	10.00 - 10.30	55(3.6")	---		53	288.80		Brown, moist, dense, fine to coarse SAND, some gravel, little silt.	G#262370 A-1-b, SW-SM WC=17.4%
										10.90	
							14			Changed to NW Casing at 11.0 ft bgs., drove casing to 17.4 ft bgs. Roller Coned ahead to 15.0 ft bgs.	
							7				
							8				
							31				
15	4D	24/18	15.00 - 17.00	8/18/16/12	34	48	59			Grey-brown, wet, dense, Gravelly, fine to coarse SAND, little silt.	G#262371 A-1-b, SP-SM WC=13.2%
							64				
	R1	36/34	17.40 - 20.40	RQD = 25%			070 NQ-2	282.30		070 blows for 0.4 ft. — 17.40	
										Top of Bedrock at Elev. 282.3 ft. R1:Bedrock: Dark grey, fine grained, META-SANDSTONE, with calcite and pyrite, joints dipping at 30 and 45 degrees, fresh, highly fractured. Rock Mass Quality = Very Poor. R1:Core Times (min:sec) 17.4-18.4 ft (2:40) 18.4-19.4 ft (3:50) 19.1-20.4 ft (4:40) 94% Recovery Core Blocked	
20	R2	60/60	20.40 - 25.40	RQD = 70%						R2:Bedrock: Grey, banded, META-SANDSTONE, with garnet and pyrite, joints at 5 degrees parallel with banding, micro-faults dipping at 30 to 45 degrees. Changing to greenish yellow, intrusive, SYENITE, with a fine grained, FELDSPAR groundmass in the bottom 2 feet of core. Rock Mass Quality = Fair. R2:Core Times (min:sec) 20.4-21.4 ft (2:35) 21.4-22.4 ft (2:10) 22.4-23.4 ft (2:05) 23.4-24.4 ft (2:10) 24.4-25.4 ft (2:10) 100% Recovery	
								274.30		25.40	
25										Bottom of Exploration at 25.40 feet below ground surface.	
30											
35											
40											
45											
50											

Remarks:

Stratification lines represent approximate boundaries between soil typesit 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 1 of 1

Boring No.: BB-LLR-101

Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: Ford Bridge #1219 carries Fall Road over Little River
Location: Lebanon, Maine

Boring No.: BB-LLR-102
WIN: 17873.00

Driller:	MaineDOT	Elevation (ft.)	298.5	Auger ID/OD:	5" Solid Stem
Operator:	Giguere/Giles	Datum:	NAVD88	Sampler:	Standard Split Spoon
Logged By:	B. Wilder	Rig Type:	CME 45C	Hammer Wt./Fall:	140#/30"
Date Start/Finish:	3/22/11; 12:00-14:00	Drilling Method:	Cased Wash Boring	Core Barrel:	NQ-2"
Boring Location:	3+93.4, 5.6 ft Lt.	Casing ID/OD:	HW & NW	Water Level*:	11.0 ft bgs.
Hammer Efficiency Factor: 0.84		Hammer Type:	Automatic ☒ Hydraulic ☐ Rope & Cathead ☐		

Definitions:
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. PP = Pocket Penetrometer
MV = Unsuccessful Insitu Vane Shear Test attempt
R = Rock Core Sample
SSA = Solid Stem Auger
HSA = Hollow Stem Auger
RC = Roller Cone
WOH = weight of 140lb. hammer
WOR/C = weight of rods or casing
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S_u = Insitu Field Vane Shear Strength (psf)
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N_{60} = SPT N-uncorrected corrected for hammer efficiency
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$S_{u(lab)}$ = Lab Vane Shear Strength (psf)
WC = water content, percent
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index
G = Grain Size Analysis
C = Consolidation Test

Depth (ft.)	Sample 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	Laboratory Testing Results/ AASHTO and Unified Class
0							SSA	298.17		4" Pavement — 0.33	
	1D	24/15	2.00 - 4.00	13/17/11/15	28	39				Brown, moist, dense, Gravelly, fine to coarse SAND, little silt, (Fill) .	G#262372 A-1-b, SW-SM WC=10.7%
5	2D	24/18	5.00 - 7.00	4/6/6/13	12	17		293.50		Brown, moist, medium dense, fine to coarse Sandy GRAVEL, little silt, trace organics (1-2" layer). — 5.00	G#262373 A-1-b, GP-GM WC=7.1%
10							Wash			Roller Coned ahead from 9.2-11.0 ft bgs. Cobble from 9.2-9.8 ft bgs. Cobble from 10.1-10.6 ft bgs. — 10.60	
	3D	24/14	11.00 - 13.00	15/13/11/11	24	34	Ahead	287.90		Grey, wet, dense, fine to coarse SAND, some gravel, some silt.	G#262374 A-2-4, SM WC=11.3%
15	4D	24/18	15.00 - 17.00	10/13/17/29	30	42				Grey, wet, dense, fine to coarse SAND, some gravel, little silt. Changed to NW Casing at 15.0 ft bgs.	G#262375 A-1-b, SM WC=10.0%
20	5D	12/12	20.00 - 21.00	34/50	---					Grey, wet, very dense, fine to coarse SAND, some silt, little gravel, (Till). Roller Coned ahead to 21.4 ft bgs. — 21.40	G#262344 A-2-4, SM WC=10.2%
	R1	60/60	21.40 - 26.40	RQD = 62%			NQ-2	277.10		Top of Bedrock at Elev. 277.1 ft. R1:Bedrock: Banded, purplish grey, fine grained, META-SANDSTONE, with pyrite and calcite, joints dipping at 60 to 75 degrees, fresh. Rock Mass Quality = Fair. R1:Core Times (min:sec) 21.4-22.4 ft (2:00) 22.4-23.4 ft (2:00) 23.4-24.4 ft (2:00) 24.4-25.4 ft (1:20) 25.4-26.4 ft (1:50) 100% Recovery	
25	R2	60/60	26.40 - 31.40	RQD = 23%						R2:Bedrock: Banded, purplish grey, fine grained, META-SANDSTONE, with pyrite and calcite, joints dipping at 60 to 75 degrees, fresh. Rock Mass Quality = Very Poor. R2:Core Times (min:sec) 26.4-27.4 ft (1:20) 27.4-28.4 ft (2:40) 28.4-29.4 ft (2:30) 29.4-30.4 ft (1:20) 30.4-31.4 ft (1:50) 100% Recovery	
								267.10		31.40	
30										Bottom of Exploration at 31.40 feet below ground surface.	
35											
40											
45											
50											

Remarks:

Stratification lines represent approximate boundaries between soil typesit 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.

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Boring No.: BB-LLR-102

STATE OF MAINE
DEPARTMENT OF TRANSPORTATION

BR-1787(300)X

WIN 17873.00

BRIDGE NO. 1219

BRIDGE PLANS

	BY	DATE
PROJ. MANAGER	----------	------
DESIGN-DETAILED	T.WHITE	MAR 2011
CHECKED-REVIEWED	K.MAGUIRE	------
DESIGN2-DETAILED2	----------	------
DESIGN3-DETAILED3	----------	------
REVISIONS 1	----------	------
REVISIONS 2	----------	------
REVISIONS 3	----------	------
REVISIONS 4	----------	------
FIELD CHANGES	----------	------

SIGNATURE

P.E. NUMBER

DATE

FORD BRIDGE
LITTLE RIVER
LEBANON
YORK COUNTY

BORING LOGS

SHEET NUMBER

3

OF 3

Appendix A

Boring Logs

UNIFIED SOIL CLASSIFICATION SYSTEM

MAJOR DIVISIONS			GROUP SYMBOLS	TYPICAL NAMES
COARSE-GRAINED SOILS (more than half of material is larger than No. 200 sieve size)	GRAVELS (more than half of coarse fraction is larger than No. 4 sieve size)	CLEAN GRAVELS (little or no fines)	GW	Well-graded gravels, gravel-sand mixtures, little or no fines
			GP	Poorly-graded gravels, gravel sand mixtures, little or no fines
		GRAVEL WITH FINES (Appreciable amount of fines)	GM	Silty gravels, gravel-sand-silt mixtures.
			GC	Clayey gravels, gravel-sand-clay mixtures.
	SANDS (more than half of coarse fraction is smaller than No. 4 sieve size)	CLEAN SANDS (little or no fines)	SW	Well-graded sands, gravelly sands, little or no fines
			SP	Poorly-graded sands, gravelly sand, little or no fines.
		SANDS WITH FINES (Appreciable amount of fines)	SM	Silty sands, sand-silt mixtures
			SC	Clayey sands, sand-clay mixtures.
FINE-GRAINED SOILS (more than half of material is smaller than No. 200 sieve size)	SILTS AND CLAYS (liquid limit less than 50)		ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands, or clayey silts with slight plasticity.
			CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays.
			OL	Organic silts and organic silty clays of low plasticity.
	SILTS AND CLAYS (liquid limit greater than 50)		MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts.
			CH	Inorganic clays of high plasticity, fat clays.
			OH	Organic clays of medium to high plasticity, organic silts
	HIGHLY ORGANIC SOILS		Pt	Peat and other highly organic soils.

Desired Soil Observations: (in this order)

Color (Munsell color chart)
Moisture (dry, damp, moist, wet, saturated)
Density/Consistency (from above right hand side)
Name (sand, silty sand, clay, etc., including portions - trace, little, etc.)
Gradation (well-graded, poorly-graded, uniform, etc.)
Plasticity (non-plastic, slightly plastic, moderately plastic, highly plastic)
Structure (layering, fractures, cracks, etc.)
Bonding (well, moderately, loosely, etc., if applicable)
Cementation (weak, moderate, or strong, if applicable, ASTM D 2488)
Geologic Origin (till, marine clay, alluvium, etc.)
Unified Soil Classification Designation
Groundwater level

Maine Department of Transportation
Geotechnical Section
Key to Soil and Rock Descriptions and Terms
Field Identification Information

TERMS DESCRIBING DENSITY/CONSISTENCY

Coarse-grained soils (more than half of material is larger than No. 200 sieve): Includes (1) clean gravels; (2) silty or clayey gravels; and (3) silty, clayey or gravelly sands. Consistency is rated according to standard penetration resistance.

Modified Burmister System

Descriptive Term	Portion of Total
trace	0% - 10%
little	11% - 20%
some	21% - 35%
adjective (e.g. sandy, clayey)	36% - 50%

Density of Cohesionless Soils	Standard Penetration Resistance N-Value (blows per foot)
Very loose	0 - 4
Loose	5 - 10
Medium Dense	11 - 30
Dense	31 - 50
Very Dense	> 50

Fine-grained soils (more than half of material is smaller than No. 200 sieve): Includes (1) inorganic and organic silts and clays; (2) gravelly, sandy or silty clays; and (3) clayey silts. Consistency is rated according to shear strength as indicated.

Consistency of Cohesive soils	SPT N-Value blows per foot	Approximate Undrained Shear Strength (psf)	Field Guidelines
Very Soft	WOH, WOR, WOP, <2	0 - 250	Fist easily Penetrates
Soft	2 - 4	250 - 500	Thumb easily penetrates
Medium Stiff	5 - 8	500 - 1000	Thumb penetrates with moderate effort
Stiff	9 - 15	1000 - 2000	Indented by thumb with great effort
Very Stiff	16 - 30	2000 - 4000	Indented by thumbnail
Hard	>30	over 4000	Indented by thumbnail with difficulty

Rock Quality Designation (RQD):

$$RQD = \frac{\text{sum of the lengths of intact pieces of core* > 100 mm}}{\text{length of core advance}}$$

*Minimum NQ rock core (1.88 in. OD of core)

Correlation of RQD to Rock Mass Quality

Rock Mass Quality	RQD
Very Poor	<25%
Poor	26% - 50%
Fair	51% - 75%
Good	76% - 90%
Excellent	91% - 100%

Desired Rock Observations: (in this order)

Color (Munsell color chart)
Texture (aphanitic, fine-grained, etc.)
Lithology (igneous, sedimentary, metamorphic, etc.)
Hardness (very hard, hard, mod. hard, etc.)
Weathering (fresh, very slight, slight, moderate, mod. severe, severe, etc.)
Geologic discontinuities/jointing:
- -dip (horiz - 0-5, low angle - 5-35, mod. dipping - 35-55, steep - 55-85, vertical - 85-90)
- -spacing (very close - <5 cm, close - 5-30 cm, mod. close 30-100 cm, wide - 1-3 m, very wide >3 m)
- -tightness (tight, open or healed)
- -infilling (grain size, color, etc.)

Formation (Waterville, Ellsworth, Cape Elizabeth, etc.)
RQD and correlation to rock mass quality (very poor, poor, etc.)
ref: AASHTO Standard Specification for Highway Bridges 17th Ed. Table 4.4.8.1.2A
Recovery

Sample Container Labeling Requirements:

PIN
Bridge Name / Town
Boring Number
Sample Number
Sample Depth
Blow Counts
Sample Recovery
Date
Personnel Initials

Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: Ford Bridge #1219 carries Fall Road over Little River
Location: Lebanon, Maine

Boring No.: BB-LLR-101
WIN: 17873.00

Driller:	MaineDOT	**Elevation (ft.)**	299.7	**Auger ID/OD:**	5" Solid Stem
Operator:	Giguere/Giles	**Datum:**	NAVD88	**Sampler:**	Standard Split Spoon
Logged By:	B. Wilder	**Rig Type:**	CME 45C	**Hammer Wt./Fall:**	140#/30"
Date Start/Finish:	3/22/11; 08:00-11:30	**Drilling Method:**	Cased Wash Boring	**Core Barrel:**	NQ-2"
Boring Location:	3+34.4, 5.8 ft Lt.	**Casing ID/OD:**	HW & NW	**Water Level*:**	11.5 ft bgs.
Hammer Efficiency Factor:	0.84	**Hammer Type:**	Automatic ☒ Hydraulic ☐ Rope & Cathead ☐		

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

Depth (ft.)	Sample 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	Laboratory Testing Results/ AASHTO and Unified Class.
0							SSA	299.28		5" Pavement	
										0.42	
	1D	24/19	1.50 - 3.50	11/15/7/4	22	31				Brown, damp, dense, fine to coarse SAND, some silt, trace gravel, (Fill).	G#245525 A-2-4, SM WC=28.2%
								295.70		4.00	
5	2D	24/14	5.00 - 7.00	4/5/9/5	14	20				Brown, moist, medium dense, fine to coarse Sandy GRAVEL, trace silt, occasional cobbles.	G#262369 A-1-a, GW-GM WC=4.4%
10	3D	3.6/3.6	10.00 - 10.30	55(3.6")	---		53			Brown, moist, dense, fine to coarse SAND, some gravel, little silt.	G#262370 A-1-b, SW-SM WC=17.4%
								288.80		10.90	
							14			Changed to NW Casing at 11.0 ft bgs., drove casing to 17.4 ft bgs. Roller Coned ahead to 15.0 ft bgs.	
							7				
							8				
							31				
15	4D	24/18	15.00 - 17.00	8/18/16/12	34	48	59			Grey-brown, wet, dense, Gravelly, fine to coarse SAND, little silt.	G#262371 A-1-b, SP-SM WC=13.2%
							64				
	R1	36/34	17.40 - 20.40	RQD = 25%			a70 NQ-2	282.30		[a]70 blows for 0.4 ft.	
										17.40	
										Top of Bedrock at Elev. 282.3 ft. R1:Bedrock: Dark grey, fine grained, META-SANDSTONE, with calcite and pyrite, joints dipping at 30 and 45 degrees, fresh, highly fractured. Rock Mass Quality = Very Poor. R1:Core Times (min:sec) 17.4-18.4 ft (2:40) 18.4-19.4 ft (3:50) 19.1-20.4 ft (4:40) 94% Recovery Core Blocked	
20	R2	60/60	20.40 - 25.40	RQD = 70%						R2:Bedrock: Grey, banded, META-SANDSTONE, with garnet and pyrite, joints at 5 degrees parallel with banding, micro-faults dipping at 30 to 45 degrees. Changing to greenish yellow, intrusive, SYENITE, with a fine grained, FELDSPAR groundmass in the bottom 2 feet of core.	
25											

Remarks:

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

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

Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: Ford Bridge #1219 carries Fall Road over Little River
Location: Lebanon, Maine

Boring No.: BB-LLR-101
WIN: 17873.00

Driller:	MaineDOT	**Elevation (ft.)**	299.7	**Auger ID/OD:**	5" Solid Stem
Operator:	Giguere/Giles	**Datum:**	NAVD88	**Sampler:**	Standard Split Spoon
Logged By:	B. Wilder	**Rig Type:**	CME 45C	**Hammer Wt./Fall:**	140#/30"
Date Start/Finish:	3/22/11; 08:00-11:30	**Drilling Method:**	Cased Wash Boring	**Core Barrel:**	NQ-2"
Boring Location:	3+34.4, 5.8 ft Lt.	**Casing ID/OD:**	HW & NW	**Water Level*:**	11.5 ft bgs.
Hammer Efficiency Factor:	0.84	**Hammer Type:**	Automatic ☒ Hydraulic ☐ Rope & Cathead ☐		

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

Depth (ft.)	Sample Information: 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	Laboratory Testing Results/ AASHTO and Unified Class.
25								274.30		Rock Mass Quality = Fair. R2:Core Times (min:sec) 20.4-21.4 ft (2:35) 21.4-22.4 ft (2:10) 22.4-23.4 ft (2:05) 23.4-24.4 ft (2:10) 24.4-25.4 ft (2:10) 100% Recovery 25.40 **Bottom of Exploration at 25.40 feet below ground surface.**	
30											
35											
40											
45											
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.

Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: Ford Bridge #1219 carries Fall Road over Little River
Location: Lebanon, Maine

Boring No.: BB-LLR-102
WIN: 17873.00

Driller:	MaineDOT	**Elevation (ft.)**	298.5	**Auger ID/OD:**	5" Solid Stem
Operator:	Giguere/Giles	**Datum:**	NAVD88	**Sampler:**	Standard Split Spoon
Logged By:	B. Wilder	**Rig Type:**	CME 45C	**Hammer Wt./Fall:**	140#/30"
Date Start/Finish:	3/22/11; 12:00-14:00	**Drilling Method:**	Cased Wash Boring	**Core Barrel:**	NQ-2"
Boring Location:	3+93.4, 5.6 ft Lt.	**Casing ID/OD:**	HW & NW	**Water Level*:**	11.0 ft bgs.
Hammer Efficiency Factor:	0.84	**Hammer Type:**	Automatic ☒ Hydraulic ☐ Rope & Cathead ☐		

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

Depth (ft.)	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-uncorrected	N_{60}	Casing Blows	Elevation (ft.)	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.
0							SSA	298.17	4" Pavement	
									0.33	
	1D	24/15	2.00 - 4.00	13/17/11/15	28	39			Brown, moist, dense, Gravelly, fine to coarse SAND, little silt, (Fill) .	G#262372 A-1-b, SW-SM WC=10.7%
5	2D	24/18	5.00 - 7.00	4/6/6/13	12	17		293.50	5.00	
									Brown, moist, medium dense, fine to coarse Sandy GRAVEL, little silt, trace organics (1-2" layer).	G#262373 A-1-b, GP-GM WC=7.1%
							Wash		Roller Coned ahead from 9.2-11.0 ft bgs.	
10							Ahead		Cobble from 9.2-9.8 ft bgs. Cobble from 10.1-10.6 ft bgs.	
	3D	24/14	11.00 - 13.00	15/13/11/11	24	34		287.90	10.60	
									Grey, wet, dense, fine to coarse SAND, some gravel, some silt.	G#262374 A-2-4, SM WC=11.3%
15	4D	24/18	15.00 - 17.00	10/13/17/29	30	42			Grey, wet, dense, fine to coarse SAND, some gravel, little silt. Changed to NW Casing at 15.0 ft bgs.	G#262375 A-1-b, SM WC=10.0%
20	5D	12/12	20.00 - 21.00	34/50	---				Grey, wet, very dense, fine to coarse SAND, some silt, little gravel, (Till).	G#262344 A-2-4, SM WC=10.2%
	R1	60/60	21.40 - 26.40	RQD = 62%			NQ-2	277.10	Roller Coned ahead to 21.4 ft bgs.	
									21.40	
									Top of Bedrock at Elev. 277.1 ft. R1:Bedrock: Banded, purplish grey, fine grained, META-SANDSTONE, with pyrite and calcite, joints dipping at 60 to 75 degrees, fresh. Rock Mass Quality = Fair. R1:Core Times (min:sec) 21.4-22.4 ft (2:00) 22.4-23.4 ft (2:00)	
25										

Remarks:

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

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

Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: Ford Bridge #1219 carries Fall Road over Little River
Location: Lebanon, Maine

Boring No.: BB-LLR-102
WIN: 17873.00

Driller:	MaineDOT	**Elevation (ft.)**	298.5	**Auger ID/OD:**	5" Solid Stem
Operator:	Giguere/Giles	**Datum:**	NAVD88	**Sampler:**	Standard Split Spoon
Logged By:	B. Wilder	**Rig Type:**	CME 45C	**Hammer Wt./Fall:**	140#/30"
Date Start/Finish:	3/22/11; 12:00-14:00	**Drilling Method:**	Cased Wash Boring	**Core Barrel:**	NQ-2"
Boring Location:	3+93.4, 5.6 ft Lt.	**Casing ID/OD:**	HW & NW	**Water Level*:**	11.0 ft bgs.
Hammer Efficiency Factor:	0.84	**Hammer Type:**	Automatic ☒ Hydraulic ☐ Rope & Cathead ☐		

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

Depth (ft.)	Sample Information: 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	Laboratory Testing Results/ AASHTO and Unified Class.
25										23.4-24.4 ft (2:00) 24.4-25.4 ft (1:20) 25.4-26.4 ft (1:50) 100% Recovery	
	R2	60/60	26.40 - 31.40	RQD = 23%						R2:Bedrock: Banded, purplish grey, fine grained, META-SANDSTONE, with pyrite and calcite, joints dipping at 60 to 75 degrees, fresh. Rock Mass Quality = Very Poor. R2:Core Times (min:sec) 26.4-27.4 ft (1:20) 27.4-28.4 ft (2:40) 28.4-29.4 ft (2:30) 29.4-30.4 ft (1:20) 30.4-31.4 ft (1:50) 100% Recovery	
30								267.10		31.40 **Bottom of Exploration at 31.40 feet below ground surface.**	
35											
40											
45											
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.

Appendix B

Laboratory Data

State of Maine - Department of Transportation

Laboratory Testing Summary Sheet

Town(s): Lebanon Project Number: 17873.00

Boring & Sample Identification Number	Station (Feet)	Offset (Feet)	Depth (Feet)	Reference Number	G.S.D.C. Sheet	W.C. %	L.L.	P.I.	Classification		
									Unified	AASHTO	Frost
BB-LLR-101, 1D	3+34.4	5.8 Lt.	1.5-3.5	245525	1	28.2			SM	A-2-4	II
BB-LLR-101, 2D	3+34.4	5.8 Lt.	5.0-7.0	262369	1	4.4			GW-GM	A-1-a	0
BB-LLR-101, 3D	3+34.4	5.8 Lt.	10.0-10.3	262370	1	17.4			SW-SM	A-1-b	0
BB-LLR-101, 4D	3+34.4	5.8 Lt.	15.0-17.0	262371	1	13.2			SP-SM	A-1-b	0
BB-LLR-102, 1D	3+93.4	5.6 Lt.	2.0-4.0	262372	2	10.7			SW-SM	A-1-b	0
BB-LLR-102, 2D	3+93.4	5.6 Lt.	5.0-7.0	262373	2	7.1			GP-GM	A-1-b	0
BB-LLR-102, 3D	3+93.4	5.6 Lt.	11.0-13.0	262374	2	11.3			SM	A-2-4	II
BB-LLR-102, 4D	3+93.4	5.6 Lt.	15.0-17.0	262375	2	10.0			SM	A-1-b	II
BB-LLR-102, 5D	3+93.4	5.6 Lt.	20.0-21.0	262344	2	10.2			SM	A-2-4	II

Classification of these soil samples is in accordance with AASHTO Classification System M-145-40. This classification is followed by the "Frost Susceptibility Rating" from zero (non-frost susceptible) to Class IV (highly frost susceptible). The "Frost Susceptibility Rating" is based upon the MaineDOT and Corps of Engineers Classification Systems.

GSDC = Grain Size Distribution Curve as determined by AASHTO T 88-93 (1996) and/or ASTM D 422-63 (Reapproved 1998)

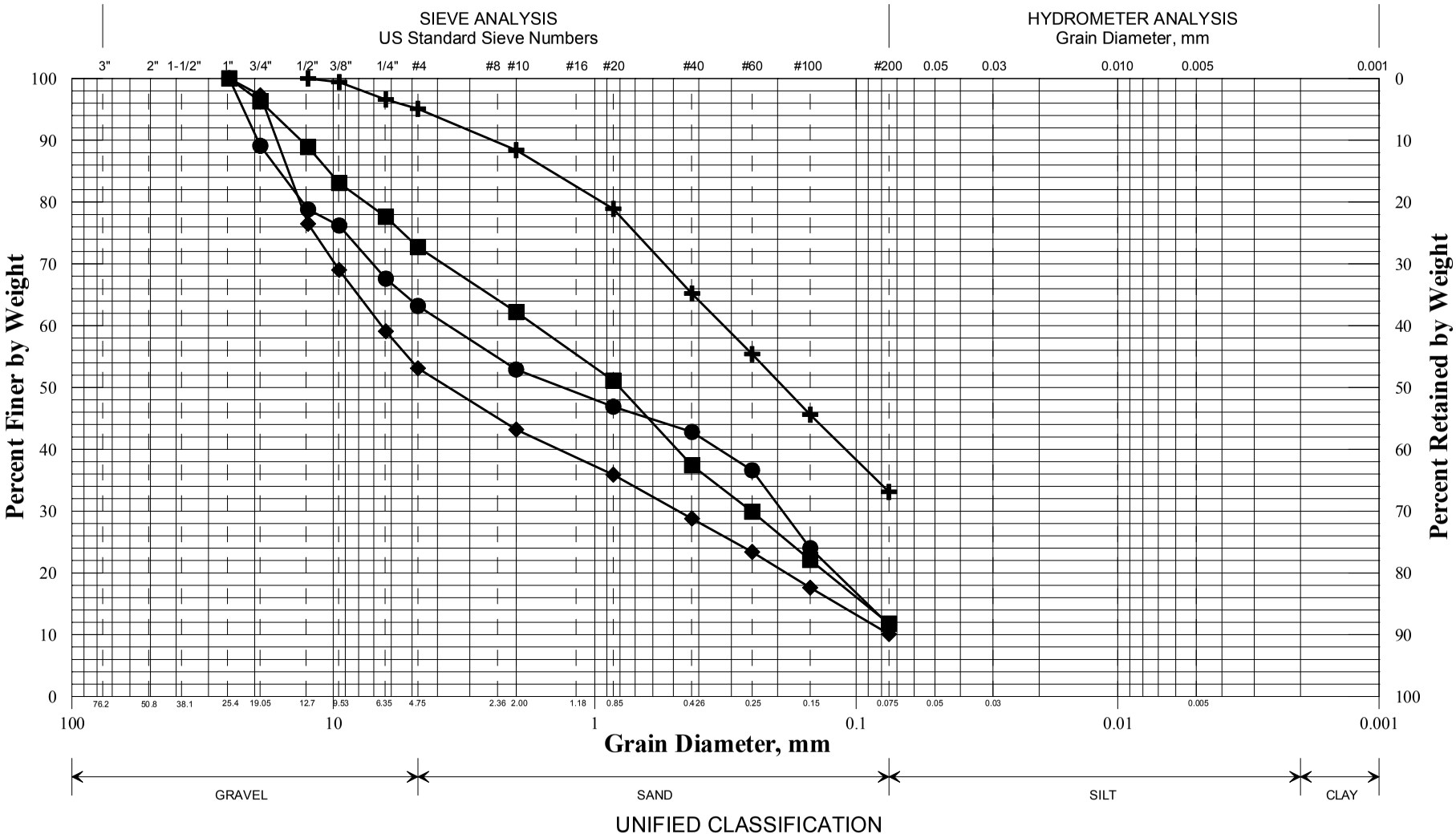
WC = water content as determined by AASHTO T 265-93 and/or ASTM D 2216-98

LL = Liquid limit as determined by AASHTO T 89-96 and/or ASTM D 4318-98

PI = Plasticity Index as determined by AASHTO 90-96 and/or ASTM D4318-98

State of Maine Department of Transportation

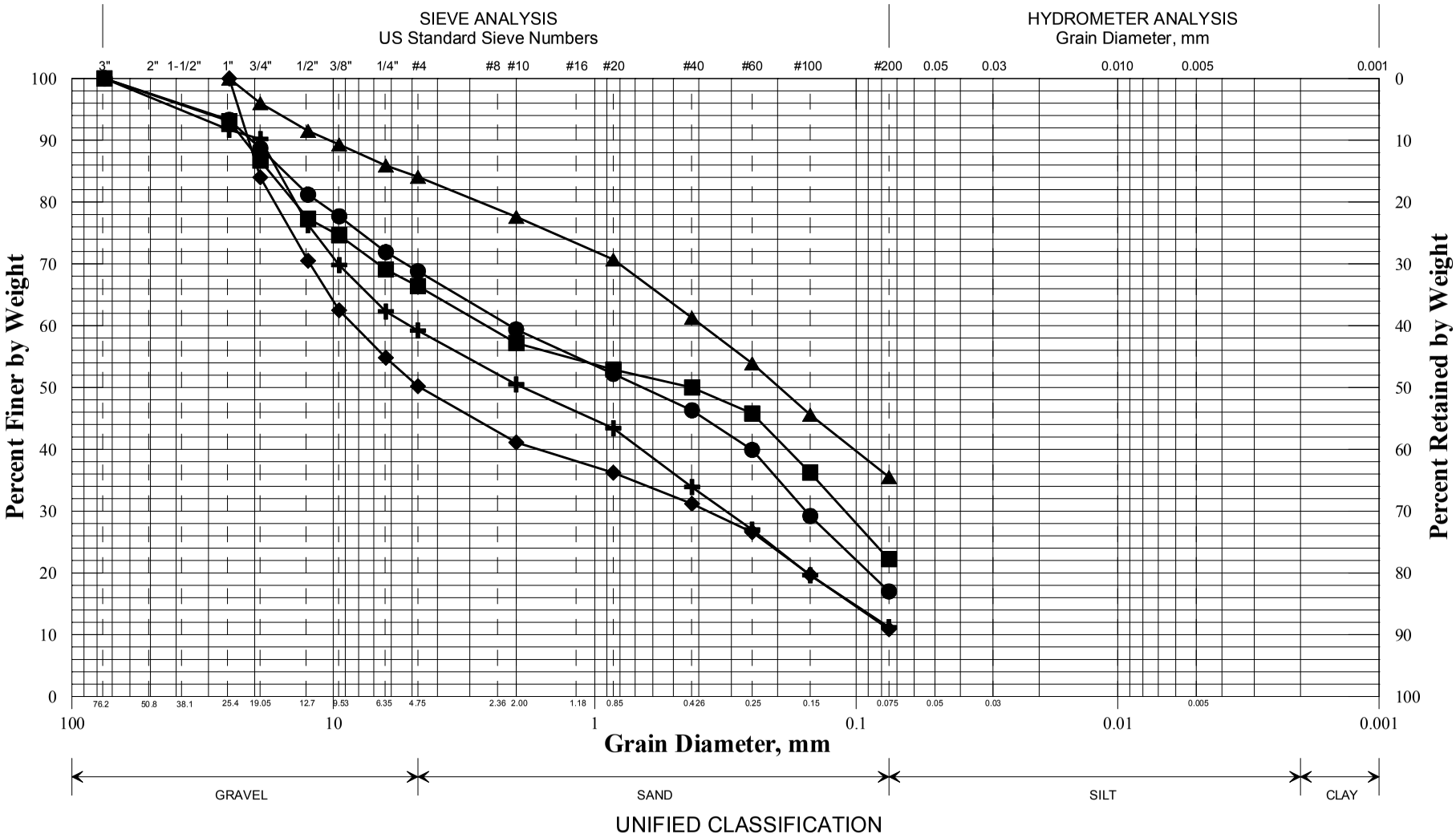
GRAIN SIZE DISTRIBUTION CURVE



	Boring/Sample No.	Station	Offset, ft	Depth, ft	Description	W, %	LL	PL	PI
✚	BB-LLR-101/1D	3+34.4	5.8 LT	1.5-3.5	SAND, some silt, trace gravel.	28.2			
◆	BB-LLR-101/2D	3+34.4	5.8 LT	5.0-7.0	Sandy GRAVEL, trace silt.	4.4			
■	BB-LLR-101/3D	3+34.4	5.8 LT	10.0-10.3	SAND, some gravel, little silt.	17.4			
●	BB-LLR-101/4D	3+34.4	5.8 LT	15.0-17.0	Gravelly SAND, little silt.	13.2			
▲									
✖									

PIN
017873.00
Town
Lebanon
Reported by/Date
WHITE, TERRY A 5/9/2011

State of Maine Department of Transportation
GRAIN SIZE DISTRIBUTION CURVE



	Boring/Sample No.	Station	Offset, ft	Depth, ft	Description	W, %	LL	PL	PI
✚	BB-LLR-102/1D	3+93.4	5.6 LT	2.0-4.0	Gravelly SAND, little silt.	10.7			
◆	BB-LLR-102/2D	3+93.4	5.6 LT	5.0-7.0	Sandy GRAVEL, little silt.	7.1			
■	BB-LLR-102/3D	3+93.4	5.6 LT	10.0-13.0	SAND, some gravel, some silt.	11.3			
●	BB-LLR-102/4D	3+93.4	5.6 LT	15.0-17.0	SAND, some gravel, little silt.	10.0			
▲	BB-LLR-102/5D	3+93.4	5.6 LT	20.0-21.0	SAND, some silt, little gravel.	10.2			
✖									

PIN
017873.00
Town
Lebanon
Reported by/Date
WHITE, TERRY A 5/9/2011