AGENCY OF TRANSPORTATION **OFFICE MEMORANDUM**

To: Derek Lyman, Highway Safety and Design, Project Manager

MLM

From: Marcy Meyers, Geotechnical Engineer, via Christopher C. Benda P.E., Soils and Foundations Engineer

CCB

Date: October 24th, 2013

Subject: Williston STP-HES 5500(12) – Geotechnical Data Report

1.0 INTRODUCTION

We have completed our geotechnical investigation for the Williston STP-HES 5500(12) project located along VT Route 2A beginning approximately 500 feet south of River Cove Road and extending northerly to approximately 600 feet north of East View Circle in the Town of Williston, Vermont. The proposed project consists of roadway rehabilitation including intersection improvements as well as the installation of two mast arms. This report summarizes the boring and laboratory testing information from our subsurface investigation and contains geotechnical parameters to be used by the mast arm foundation designer.

2.0 FIELD INVESTIGATION

The initial field investigation was conducted between August 29th and September 4th, 2013. Two standard penetration borings and eleven solid stem auger roadway borings were drilled to determine the soil strata for the proposed project. An additional boring, B-102A, was drilled on October 10th, 2013 in order to collect undisturbed Shelby tube samples for testing of cohesive material found in the initial investigation. Final boring locations were provided in an email by Erik Atkins dated July 30th, 2013. Values for Northings, Eastings, and elevations were provided on the Williston boring and pavement core plan and modified when applicable. The values for Northings and Eastings are based on the Vermont State Plane Grid NAD 83 coordinate system. Boring location information is summarized below in Table 2.1.

Table 2.1: Boring Locations

Boring	Drilling Method	Station (ft)	Offset (ft)	Approx. Northing (ft)	Approx. Easting (ft)	Approx. Elevation (ft)
B-101	WB/SPT	98+50.02	-36.0	720634.01	1480274.48	358.47
B-102	WB/SPT	98+91.32	30.2	720677.02	1480342.49	355.22
B-102A	WB/UD	98+91.30	31.0	--	--	--
PC-1	SSA	85+14.18	7.5	719299.88	1480355.90	395.85
PC-2	SSA	85+14.18	-7.7	719299.24	1480340.69	395.75
PC-3	SSA	90+6.66	7.7	719792.21	1480343.21	384.54
PC-4	SSA	90+6.66	-7.7	719791.54	1480327.79	384.46
PC-5	SSA	94+61.52	6.3	720246.91	1480329.89	371.48
PC-6	SSA	94+61.52	-7.5	720246.24	1480316.10	371.62
PC-7	SSA	100+6.66	8.0	720791.86	1480317.30	353.93
PC-8	SSA	100+6.66	-8.2	720791.30	1480301.15	354.11
PC-9	SSA	105+75.18	9.3	721360.41	1480293.58	333.43

PC-10	SSA	105+75.18	-9.3	721358.09	1480275.08	332.73
PC-11	SSA	31+7.72	-10.0	720645.07	1480205.47	355.56

SSA = Solid Stem Auger, WB = Wash Bore, SPT = Standard Penetration Test, UD = Undisturbed Shelby Tubes

Borings B-101, B-102, and B-102A were performed in general accordance with AASHTO T206, *Standard Method of Test for Penetration Test and Split-Barrel Sampling of Soils*. During boring operations, split spoon samples and standard penetration tests (SPT) were taken continuously from 2'-12' and then 5' intervals to a depth of approximately 25' for Borings B-101 and B-102.

The solid stem auger borings were performed in general accordance with AASHTO T306, *Processing Auger Borings for Geotechnical Explorations*, to determine the subsurface profile to aid in the design and reconstruction of VT Route 2A and James Brown Drive. A 4-inch sold stem auger flight was rotary drilled to 5 feet below the top of the roadway for the 11 roadway borings. The auger was then removed so that a visual observation of the soil profile could be made. This method has proven to be an efficient and reasonably accurate way to view changes in strata and obtain samples off the auger flights.

Soil samples were visually identified in the field and SPT blow counts were recorded on the boring logs when applicable. Soil samples were preserved and returned to the Materials and Research laboratory for testing and further evaluation. Upon completion of the laboratory testing, the boring logs were revised to reflect the results of the laboratory classification results.

3.0 FIELD AND LABORATORY TESTS

The standard penetration resistance of the in-situ soil is determined by the number of blows required to drive a 2 inch OD split barrel sampler into the soil with a 140 pound hammer dropped from a height of 30 inches, in accordance with procedures specified in AASHTO T206. During the standard penetration test (SPT), the sampler is driven for a total length of 2 feet, while counting the blows for each 6 inch increment. The SPT N-value, which is defined as the sum of the number of blows required to drive the sampler through the second and third increments, is commonly used with established correlations to estimate a number of soil parameters, particularly the shear strength and density of cohensionless soils. The N-values provided on the boring logs are raw values and have not been corrected for energy, borehole diameter, rod length, or overburden pressure. The VT Agency of Transportation has determined a hammer correction value, C_E, to account for the efficiency of the SPT hammer on the drill rig. For this project, a CME 45C track rig was used, with a C_E=1.34. This value, included on the boring logs, was used in soil parameter calculations. Laboratory tests were conducted on all samples to evaluate grain size, moisture content, percent finer than No. 200 sieve, and liquid and plastic limits when applicable.

When cohesive soils were encountered, undisturbed sampling was performed in accordance with AASHTO T207, *Thin Walled Tube Sampling of Soils.* A total of three Unconfined Compression Tests were performed on the undisturbed samples from B-102A in accordance with AASHTO T208, *Standard Method of Test for Unconfined Compressive Strength of Cohesive Soil.* This test provides the unconfined compressive strength (q_u) for a cohesive soil sample that can be used to determine the undrained shear strength (s_u) of the soil. The sample is loaded axially, without any confining pressures, at a relatively high rate to prevent drainage until a shear failure is reached.

The magnitude of the shear stress at the moment of failure results in the shear strength of the soil provided similar in-situ loading and drainage conditions. Results from this testing are attached.

In addition to pushing undisturbed Shelby tube samples, field vane shear testing was performed in Boring B-102A in accordance with AASHTO T223, *Standard Method of Test for Field Vane Shear Test in Cohesive Soil.* The torque required to turn the vane can be correlated to determine the undrained shear strength of the soil. The results of the vane shear testing can be found on the attached boring logs.

4.0 SOIL PROFILE

Review of the laboratory data, and boring logs revealed the following information pertaining to the soil strata. It should be noted that groundwater elevations are subject to change given the fact that the boreholes were generally left open for a short period of time and groundwater readings were collected during the same day as drilling. Because groundwater elevations can fluctuate seasonally and are effected by temperature and precipitation, groundwater may be encountered during construction even when not previously noted on the boring logs.

4.1 Roadway Auger Borings (PC-1 through PC-11)

The thickness of the bituminous pavement varied from 0.32 to 1.19 feet thick. The pavement overlies a layer comprised of silty sand with some gravel mixed throughout. PC-10 had some clay evident in the sample and was the only sample deemed plastic. All other samples were deemed non-plastic and groundwater was not encountered during drilling in any of the samples.

The attached drilling notes contain specific information regarding particle percentages, depths, and additional tests, if applicable. Also attached is a visual representation of the subsurface profile, interpreted by the borings, showing the various strata.

4.2 Mast Arm Borings (B-101 and B-102)

4.2.1 B-101: The ground surface elevation at B-101 was 358.47 feet. Groundwater was recorded at a depth of 6.0 feet below the ground surface while drilling. This results in an approximate groundwater elevation of 352.47 feet.

Depth (Below Ground Surface Elevation)	Soil Profile
0.0 – 4.0 feet	Loose Gravelly Silty Sand
4.0 – 6.0 feet	Medium Dense Silt
6.0 – 20.0 feet	Very Stiff Silty Clay
20.0 – 26.4 feet	Very Dense Gravelly Sandy Silt

4.2.2 B-102: The ground surface elevation at B-102 was 355.22 feet. Groundwater was encountered at a depth of 1.6 feet below the ground surface during drilling operations and at the ground surface after drilling was complete. B-102A drilled only 0.8 ft away, encountered groundwater at a depth of 0.5 feet below the ground surface during drilling operations. As a result, an approximate groundwater elevation at the ground surface was used in soil parameter calculations.

Depth (Below Ground Surface Elevation)	Soil Profile
0.0 – 2.0 feet	Soft Silty Clay
2.0 – 2.4 feet	Medium Dense Silty Sand
2.4 – 11.0 feet	Very Stiff Clay
11.0 – 26.9 feet	Very Dense Till

5.0 RECOMMENDATIONS

5.1 Design Guidelines

The Materials and Research Section of VTrans has developed *Materials and Research Engineering Instructions (MREI) 10-01*, which "standardizes VTrans' foundation designs for overhead structures such as signals or sign bridges, mast arms, and strain poles during plan (preliminary and final) development or construction." This document should be referenced for the contractor's use and is available on the Agency's website at the following address:
http://vtransengineering.vermont.gov/sites/aot_program_development/files/documents/materialsandresearch/MandRSoilEI_-_Overhead_Structures_030910.pdf

5.2 Design Parameters

Laboratory results from the unconfined compression tests can be found in Table 5.1 and are also attached. Based on the soil profiles above, laboratory testing, and attached boring logs, the in-situ soil properties can be found in Table 5.2. Engineering values for common construction materials can be found in Table 5.3. These values presented in Tables 5.2 and 5.3 should be used in the design of the mast arm foundations at this location.

The boreholes were generally only open for a short period of time during drilling and clean-up activities. In addition, the soils at the site have a high fines content and produce water slowly. Since groundwater elevations can fluctuate seasonally and are effected by temperature and precipitation, a groundwater level at the ground surface is recommended for design.

Table 5.1. Unconfined Compression Test

Boring	Depth Below Ground Surface Elevation (ft)	Undrained Shear Strength (s_u) in (psi)	Unconfined Compressive Strength (q_u) in (psi)
B-102A *(V. Stiff Clay)*	2.4 – 11.0	23-36	47-73

The tables below highlight the geotechnical design parameters of the in-situ soils as well as regularly specified aggregates. These values should be used when designing any substructure units. It is recommended that values of K_0 be used for calculating earth pressures where the structure is not allowed to deflect longitudinally, away from or into the retained soil mass. Values for K_a should be utilized for an active earth pressure condition where the structure is moving away from the soil mass and K_p where the structure is moving toward the soil mass. K_a and K_p values are based on a vertical back of wall and a horizontal ground surface behind the wall.

Table 5.2. Engineering Properties of In-Situ Soils

	Soft Silty Clay	**Medium Dense Silty Sand/Silt**	**Very Stiff Clay/Silty Clay**	**Loose Gravelly Silty Sand**	**Very Dense Gravelly Sandy Silt/Till**
Density, γ (lbs/ft^3):	95	110	115	110	125
Internal Friction Angle, φ (degrees)	33	34	--	31	36
Soil Modulus, k (lb/in^3)	30	60	400	25	125
Undrained Shear Strength, s_u (lb/in^2)	--	--	23	--	--
Coefficient of Friction, f					
- mass concrete cast against soil:	0.31	0.34	0.34	0.55	0.50
- soil against precast/formed concrete:	0.25	0.25	0.31	0.40	0.38
Active Earth Pressure Coef., K_a:	0.295	0.283	0.307	0.320	0.260
Passive Earth Pressure Coef., K_p:	3.392	3.537	3.255	3.124	3.852
At-Rest Earth Pressure Coef., K_o:	0.455	0.441	0.470	0.485	0.412

Table 5.3. Engineering Properties of Construction Materials

	703.01A - Granular Borrow	**704.08 - Granular Backfill for Structures**
Density (lb/ft^3):	130	140
Internal Friction Angle, φ (degrees)	32	34
Coefficient of Friction, f		
- mass concrete cast against soil:	0.45	0.55
- soil against precast/formed concrete	0.40	0.48
Active Earth Pressure Coefficient, K_a:	0.31	0.28
Passive Earth Pressure Coefficient, K_p:	3.25	3.54
At-Rest Earth Pressure Coefficient, K_o:	0.47	0.44

6.0 CONCLUSION

We recommend this report be included with the contract documents when the project is advertised.

Please feel free to contact us at (802) 828-2561 if you have any questions, or you would like to further discuss this report. Typed boring logs are attached and are available in the CADD design files:

M:\Projects\12D196\Materials&Research

Attachments: Boring Logs (3 Pages)
Drilling Notes (3 Pages)
Roadway Boring Profile Sheet (1 Page)
Unconfined Compression Test Lab Results (6 Pages)

cc: Erik Atkins, Green International Affiliates, Inc.
Read File/WEA
Project File/CCB
MLM

G:\Soils and Foundations\Projects\Williston STP-HES 5500(12)\REPORTS\Williston STP-HES 5500(12) Geotechnical Data Report.doc

STATE OF VERMONT
AGENCY OF TRANSPORTATION
MATERIALS & RESEARCH SECTION
SUBSURFACE INFORMATION

BORING LOG

WILLISTON
STP-HES 5500(12)
VT-2A ROADWAY

Boring No.: **B-101**
Page No.: 1 of 1
Pin No.: 12D196
Checked By: MLM

Boring Crew: JUDKINS, DAIGNEAULT, HALL
Date Started: 8/30/13 Date Finished: 8/30/13
VTSPG NAD83: N 720634.01 ft E 1480274.48 ft
Station: 98+50.02 Offset: -36.00
Ground Elevation: 358.47 ft

	Casing	Sampler
Type:	WB	SS
I.D.:	4 in	1.5 in
Hammer Wt:	N.A.	140 lb.
Hammer Fall:	N.A.	30 in.
Hammer/Rod Type:	Auto/AWJ	
Rig:	CME 45C TRACK	C_F = 1.34

Groundwater Observations

Date	Depth (ft)	Notes
08/30/13	6.0	While drilling.

Depth (ft)	Strata (1)	CLASSIFICATION OF MATERIALS (Description)	Blows/6" (N Value)	Moisture Content %	Gravel %	Sand %	Fines %	LL %	PI %
		A-2-4, GrSa, Dk/brn, Moist, Rec. = 0.8 ft	1-2-1-4 (3)	14.1	27.8	54.2	18.0		
		A-2-4, SiSa, Dk/brn, MTW, Rec. = 1.2 ft	2-3-3-2 (6)	21.8	16.3	62.6	21.1		
5		A-4, Si, brn-gry, Wet, Rec. = 1.4 ft	2-3-5-5 (8)	24.6	5.6	19.0	75.4		
		A-6, SiCl, brn-gry, MTW, Rec. = 1.8 ft	4-5-5-6 (10)	25.7	0.6	9.3	90.1	32	12
		A-4, ClSi, brn-gry, MTW, Rec. = 1.9 ft	3-5-8-7 (13)	26.5	7.8	6.6	85.6	29	8
10		A-6, SiCl, brn-gry, MTW, Rec. = 1.5 ft	3-5-5-10 (10)	26.9	0.8	3.9	95.3	37	15
15		Field Note:, No Recovery	4-8-8-8 (16)						
20		A-4, GrSaSi, gry, Wet, Rec. = 0.5 ft	10-22-25-25 (47)	22.0	26.5	29.2	44.3		
25		A-4, GrSaSi, gry, Moist, Rec. = 1.0 ft	19-26-R@5.0" (R)	10.2	21.9	24.6	53.5		
		Hole stopped @ 26.4 ft							

Remarks:
1. Hole collapsed at 24.5 ft.

Notes:
1. Stratification lines represent approximate boundary between material types. Transition may be gradual.
2. N Values have not been corrected for hammer energy. C_E is the hammer energy correction factor.
3. Water level readings have been made at times and under conditions stated. Fluctuations may occur due to other factors than those present at the time measurements were made.

BORING LOG 2 WILLISTON STP HES5500(12).GPJ VERMONT AOT.GDT 10/29/13

STATE OF VERMONT
AGENCY OF TRANSPORTATION
MATERIALS & RESEARCH SECTION
SUBSURFACE INFORMATION

BORING LOG

WILLISTON
STP-HES 5500(12)
VT-2A ROADWAY

Boring No.: **B-102**
Page No.: 1 of 1
Pin No.: 12D196
Checked By: MLM

Boring Crew: DAIGNEAULT, HALL
Date Started: 9/04/13 Date Finished: 9/04/13
VTSPG NAD83: N 720677.02 ft E 1480342.49 ft
Station: 98+91.32 Offset: 30.20
Ground Elevation: 355.22 ft

	Casing	Sampler
Type:	WB	SS
I.D.:	4 in	1.5 in
Hammer Wt:	N.A.	140 lb.
Hammer Fall:	N.A.	30 in.
Hammer/Rod Type:	Auto/AWJ	
Rig:	CME 45C TRACK	C_F = 1.34

Groundwater Observations

Date	Depth (ft)	Notes
09/04/13	1.6	While drilling.
09/04/13	0.0	After drilling.

Depth (ft)	Strata (1)	CLASSIFICATION OF MATERIALS (Description)	Blows/6" (N Value)	Moisture Content %	Gravel %	Sand %	Fines %	LL %	PI %
		A-6, SiCl, brn, Moist, Rec. = 1.1 ft	WH-WH-2-2 (2)	20.8	4.0	31.7	64.3	34	15
		A-2-4, SiSa, brn, Wet, Rec. = 0.4 ft	4-4-7-12 (11)	31.7	5.3	70.8	23.9		
		A-7-6, Cl, brn, Moist, Rec. = 1.6 ft		24.2	0.4	9.1	90.5	43	21
5		A-7-6, Cl, brn, Moist, Rec. = 1.8 ft	1-7-8-10 (15)	26.2	0.9	7.2	91.9	44	21
		A-7-6, Cl, brn, Moist, Rec. = 1.8 ft	2-8-9-12 (17)	24.8	2.2	6.0	91.8	48	26
		A-7-6, Cl, gry, Moist, Rec. = 1.9 ft	1-3-4-3 (7)	33.1	0.8	1.3	97.9	49	26
10		GrCl, gry, Moist, Rec. = 0.9 ft, 10.0 ft - 10.9 ft, Shelby Tube							
		Field Note:, Clean out with Roller Cone							
15		Field Note:, Till, HP. No Recovery	31-32-30-R@1.0" (62)						
		Field Note:, Clean out with Roller Cone							
20		Field Note:, Till, HP. No Recovery	R@5.0" (R)						
25		A-4, GrSaSi, gry, Moist, Rec. = 0.7 ft, R@25.9 ft.	(R)	9.0	21.1	29.1	49.8		
		Hole stopped @ 25.9 ft							

Remarks:
1. Hole collapsed at 20.2 ft.

Notes:
1. Stratification lines represent approximate boundary between material types. Transition may be gradual.
2. N Values have not been corrected for hammer energy. C_E is the hammer energy correction factor.
3. Water level readings have been made at times and under conditions stated. Fluctuations may occur due to other factors than those present at the time measurements were made.

BORING LOG 2 WILLISTON STP HES5500(12).GPJ VERMONT AOT.GDT 10/29/13

STATE OF VERMONT
AGENCY OF TRANSPORTATION
MATERIALS & RESEARCH SECTION
SUBSURFACE INFORMATION

BORING LOG

WILLISTON
STP-HES 5500(12)
VT-2A ROADWAY

Boring No.: **B-102A**
Page No.: 1 of 1
Pin No.: 12D196
Checked By: MLM

Boring Crew: DAIGNEAULT, GARROW
Date Started: 10/10/13 Date Finished: 10/10/13
VTSPG NAD83: N 720676.77 ft E 1480343.29 ft
Station: 98+91.30 Offset: 31.00
Ground Elevation: 355.22 ft

	Casing	Sampler
Type:	WB	TUBE
I.D.:	4.25 in	3 in
Hammer Wt:	N.A.	140 lb.
Hammer Fall:	N.A.	30 in.
Hammer/Rod Type:		Auto/AWJ
Rig:	CME 55 TRACK	C_F = 1.46

Groundwater Observations

Date	Depth (ft)	Notes
10/10/13	0.5	While drilling.

Depth (ft)	Strata (1)	CLASSIFICATION OF MATERIALS (Description)	Blows/6" (N Value)	Moisture Content %	Gravel %	Sand %	Fines %
2.5		Field Note:, Cl, gry, Rec. = 0.5 ft, Shelby Tube					
5.0		Field Note:, Vane Shear 1072 psf/Remold unsuccessful					
7.5		Field Note:, Cl, gry, Rec. = 1.8 ft, Shelby Tube					
10.0		Field Note:, Vane Shear 1334/459 psf					
		Hole stopped @ 10.5 ft					
12.5		Remarks: 1. Vane used was 3x6 inches. 2. Vane Shear = Inital/Remold					
15.0							
17.5							

Notes:
1. Stratification lines represent approximate boundary between material types. Transition may be gradual.
2. N Values have not been corrected for hammer energy. C_E is the hammer energy correction factor.
3. Water level readings have been made at times and under conditions stated. Fluctuations may occur due to other factors than those present at the time measurements were made.

BORING LOG 2 WILLISTON STP HES5500(12).GPJ VERMONT AOT.GDT 11/1/13

STATE OF VERMONT
AGENCY OF TRANSPORTATION
MATERIALS & RESEARCH SECTION
SOILS & FOUNDATION UNIT
DRILLING NOTES

PROJECT NAME: WILLISTON **PROJECT NUMBER:** STP HES 5500(12) **SITE:** VT 2A/JAMES BROWN DR. **DATE:** 8/2013
BORING CREW: JUDKINS, DAIGNEAULT **TESTED BY:** J. TOUCHETTE **REVIEWED BY:** M. MEYERS

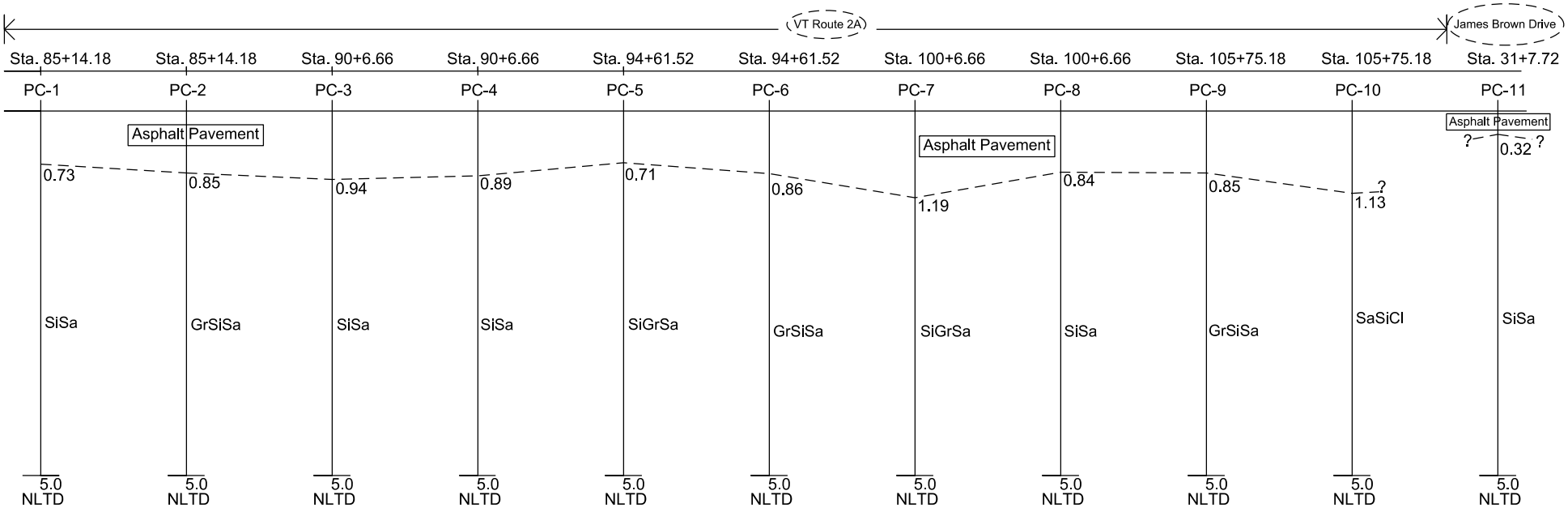
BORING No.	DATE DRILLED	STATION (FT)	OFFSET (FT)	DEPTH (FT)	SAMPLE TYPE	FIELD DESCRIPTION	LABORATORY RESULTS							
						SOIL TYPE, COLOR, MOISTURE	% MOISTURE	AASHTO CLASS.	SOIL DES.	% GRAVEL	% SAND	% FINES	LIQUID LIMIT	PLASTIC LIMIT
PC-1	8/29/13	85+14.18	7.5 RT	0.00 – 0.73	C	Asphalt Pavement								
				0.73 – 5.0	A	GrSiSa, brn, moist	9.9	A-2-4	Si Sa	10.3	60.4	29.3		
				NLTD										
PC-2	8/29/13	85+14.18	7.7 LT	0.00 – 0.85	C	Asphalt Pavement								
				0.85 – 5.0	A	GrSiSa, brn, moist	6.7	A-2-4	Gr Si Sa	22.4	43.7	33.9		
				NLTD										
PC-3	8/29/13	90+6.66	7.7 RT	0.00 – 0.94	C	Asphalt Pavement								
				0.94 – 5.0	A	SiGrSa, brn, moist	8.0	A-2-4	Si Sa	15.5	59.4	25.1		
				NLTD										
PC-4	8/29/13	90+6.66	7.7 LT	0.00 – 0.89	C	Asphalt Pavement								
				0.89 – 5.0	A	SiGrSa, brn, moist	9.8	A-2-4	Si Sa	16.3	55.3	28.4		
				NLTD										
Cont.														

BORING No.	DATE DRILLED	STATION (FT)	OFFSET (FT)	DEPTH (FT)	SAMPLE TYPE	FIELD DESCRIPTION	LABORATORY RESULTS							
						SOIL TYPE, COLOR, MOISTURE	% MOISTURE	AASHTO CLASS.	SOIL DES.	% GRAVEL	% SAND	% FINES	LIQUID LIMIT	PLASTIC LIMIT
PC-5	8/29/13	94+61.52	6.3 RT	0.00 – 0.71	C	Asphalt Pavement								
				0.71 – 5.0	A	SiGrSa, brn, moist	7.0	A-1-b	Si Gr Sa	26.8	50.7	22.5		
				NLTD										
PC-6	8/29/13	94+61.52	7.5 LT	0.00 – 0.86	C	Asphalt Pavement								
				0.86 – 5.0	A	GrSiSa, brn, moist	5.4	A-2-4	Gr Si Sa	20.8	48.2	31.0		
				NLTD										
PC-7	8/29/13	100+6.66	8.0 RT	0.00 – 1.19	C	Asphalt Pavement								
				1.19 – 5.0	A	GrSiSa, dk brn, moist	11.7	A-2-4	Si Gr Sa	28.6	44.3	27.1		
				NLTD										
PC-8	8/29/13	100+6.66	8.2 LT	0.00 – 0.84	C	Asphalt Pavement								
				0.84 – 5.0	A	GrSiSa, brn, moist	8.6	A-2-4	Si Sa	9.0	59.2	31.8		
				NLTD										
PC-9	8/29/13	105+ 75.18	9.3 RT	0.00 – 0.85	C	Asphalt Pavement								
				0.85 – 5.0	A	GrSiSa, brn, moist	6.2	A-2-4	Gr Si Sa	20.1	49.8	30.1		
				NLTD										
PC-10	8/29/13	105+ 75.18	9.3 LT	0.00 – 1.13	C	Asphalt Pavement								
				1.13 – 5.0	A	GrSaSiCl, gry/brn, moist	17.2	A-7-6	Sa Si Cl	18.6	33.2	48.2	41	22
				NLTD										
Cont.														

BORING No.	DATE DRILLED	STATION (FT)	OFFSET (FT)	DEPTH (FT)	SAMPLE TYPE	FIELD DESCRIPTION	LABORATORY RESULTS							
						SOIL TYPE, COLOR, MOISTURE	% MOISTURE	AASHTO CLASS.	SOIL DES.	% GRAVEL	% SAND	% FINES	LIQUID LIMIT	PLASTIC LIMIT
PC-11	8/29/13	31+7.72	10.0 LT	0.00 – 0.32	C	Asphalt Pavement								
				0.32 – 5.0	A	SiSa, dk brn, moist to wet	20.5	A-2-4	Si Sa	5.4	68.2	26.4		
				NLTD										
SAMPLE TYPE “A” = Auger														
SAMPLE TYPE “C” = Core														
NLTD = No Ledge to Depth														

Williston STP HES 5500(12)

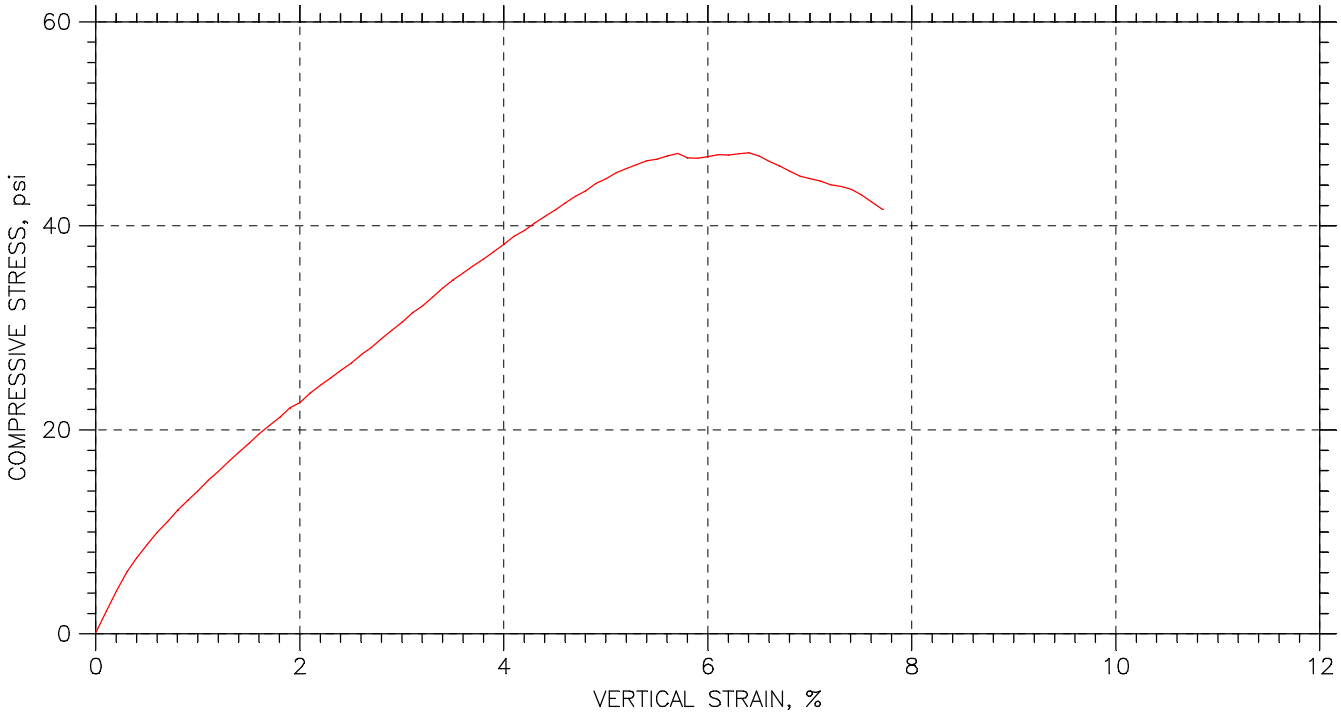
-Auger Borings-



NOTES:
NLTD - No ledge to depth.

1. Vertical depths in feet.
2. Not to horizontal scale.
3. Groundwater was not encountered during drilling.

UNCONFINED COMPRESSION TEST REPORT



Symbol					
Test No.		A			
Initial	Diameter, in	2.889			
	Height, in	5.66			
	Water Content, %	0.00			
	Dry Density, pcf	123.7			
	Saturation, %	0.00			
	Void Ratio	0.337			
Unconfined Compressive Strength, psi		47.16			
Undrained Shear Strength, psi		23.58			
Time to Failure, min		6.1816			
Strain Rate, %/min		1			
Measured Specific Gravity		2.65			
Liquid Limit		0			
Plastic Limit		0			
Plasticity Index		0			
Failure Sketch					

	Project: Williston
	Location: Williston, VT
	Project No.: 5500(12)
	Boring No.: B-102A
	Sample Type: Undisturbed
	Description: 2" into sample
	Remarks:

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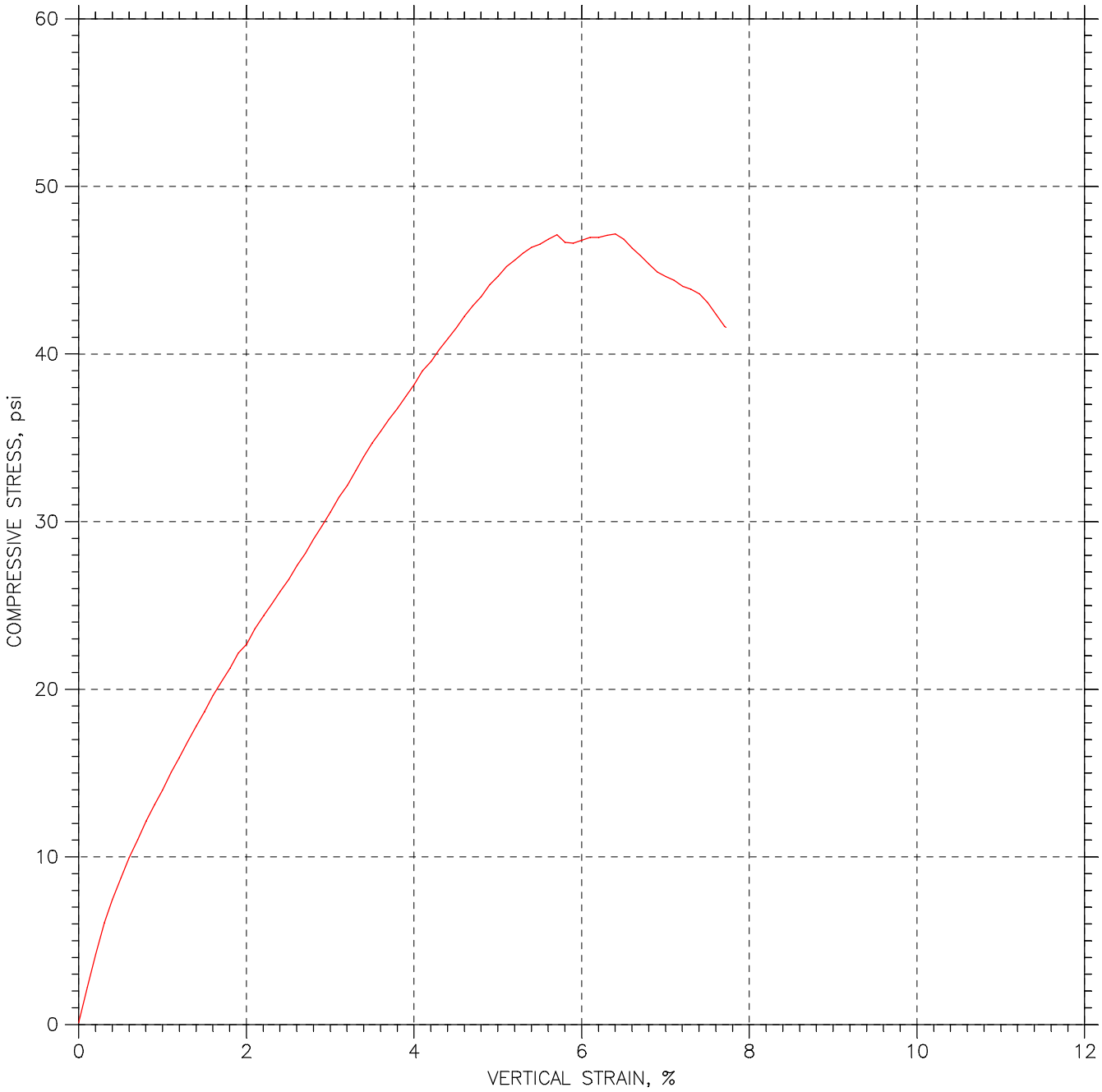
UNCONFINED COMPRESSION TEST REPORT



	Project: Williston	Location: Williston, VT	Project No.: 5500(12)
	Boring No.: B-102A	Tested By: MLM/CEE	Checked By:
	Sample No.: U2	Test Date: 10/16/13	Depth: 7-9 feet
	Test No.: A	Sample Type: Undisturbed	Elevation:
	Description: 2" into sample		
	Remarks:		

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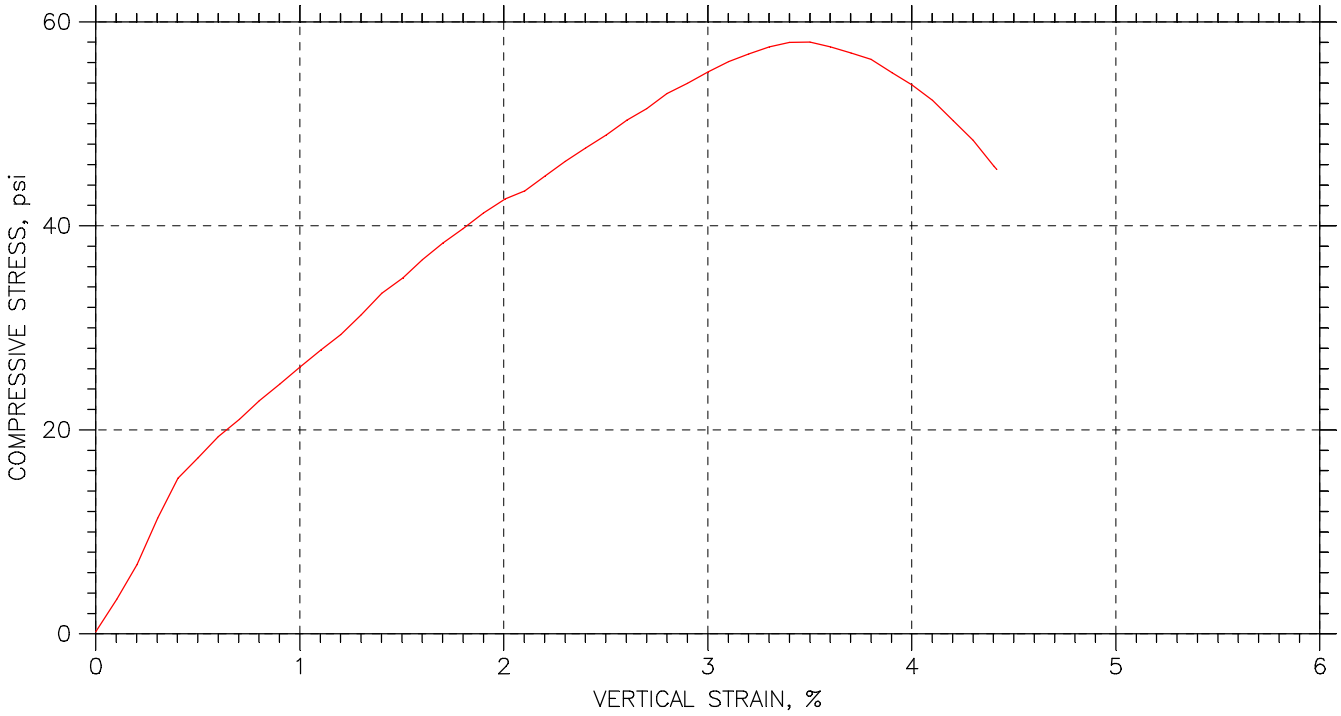
UNCONFINED COMPRESSION TEST REPORT



Symbol					
Test No.		B			
Initial	Diameter, in	2.888			
	Height, in	5.66			
	Water Content, %	0.00			
	Dry Density, pcf	122.			
	Saturation, %	0.00			
	Void Ratio	0.356			
Unconfined Compressive Strength, psi		58.01			
Undrained Shear Strength, psi		29.01			
Time to Failure, min		3.3332			
Strain Rate, %/min		1			
Measured Specific Gravity		2.65			
Liquid Limit		0			
Plastic Limit		0			
Plasticity Index		0			
Failure Sketch					

	Project: Williston
	Location: Williston, VT
	Project No.: 5500(12)
	Boring No.: B-102A
	Sample Type: Undisturbed
	Description: 8" into sample
	Remarks:

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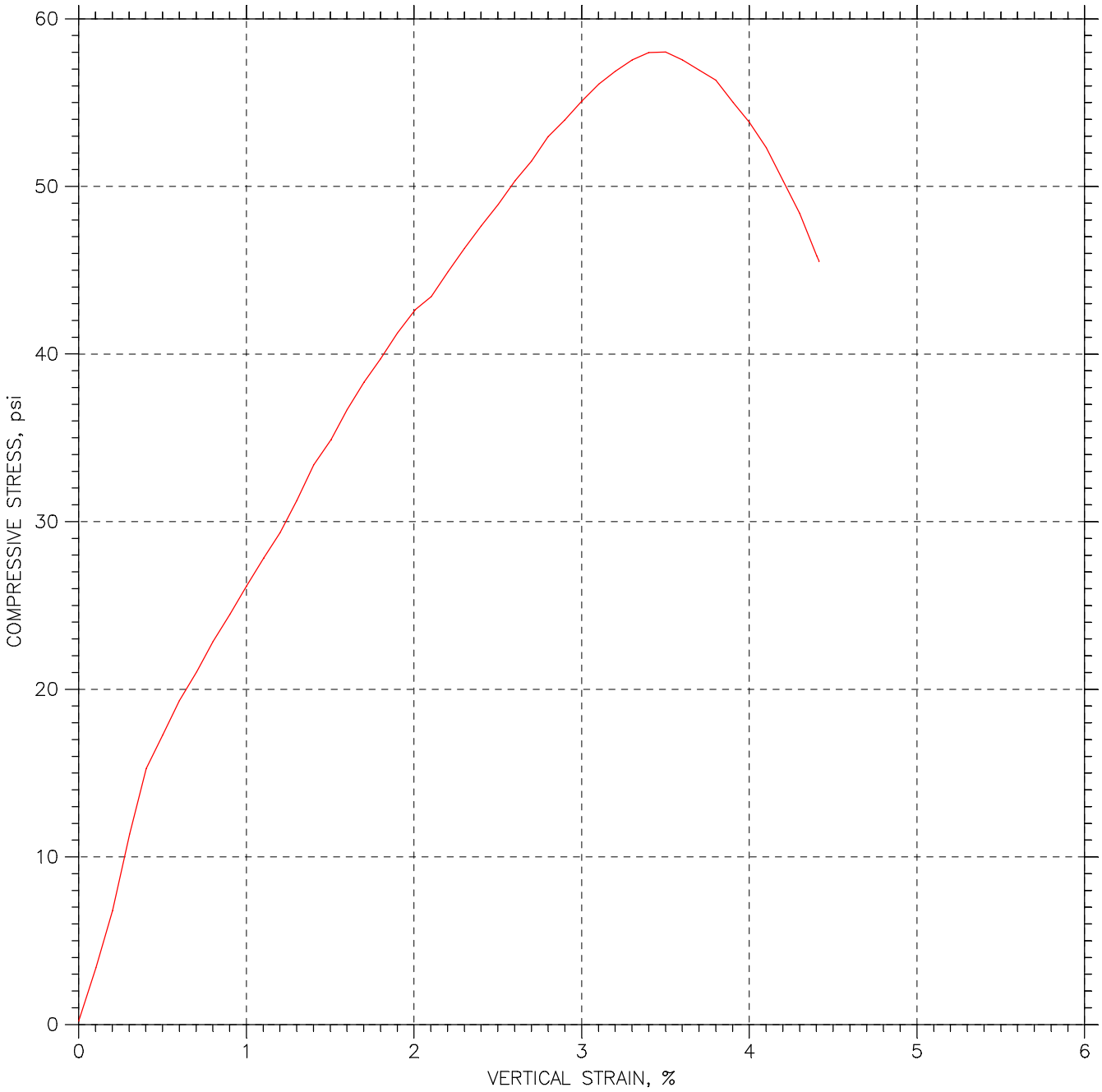
UNCONFINED COMPRESSION TEST REPORT



	Project: Williston	Location: Williston, VT	Project No.: 5500(12)
	Boring No.: B-102A	Tested By: MLM	Checked By:
	Sample No.: U2	Test Date: 10/17/13	Depth: 7-9 feet
	Test No.: B	Sample Type: Undisturbed	Elevation:
	Description: 8" into sample		
	Remarks:		

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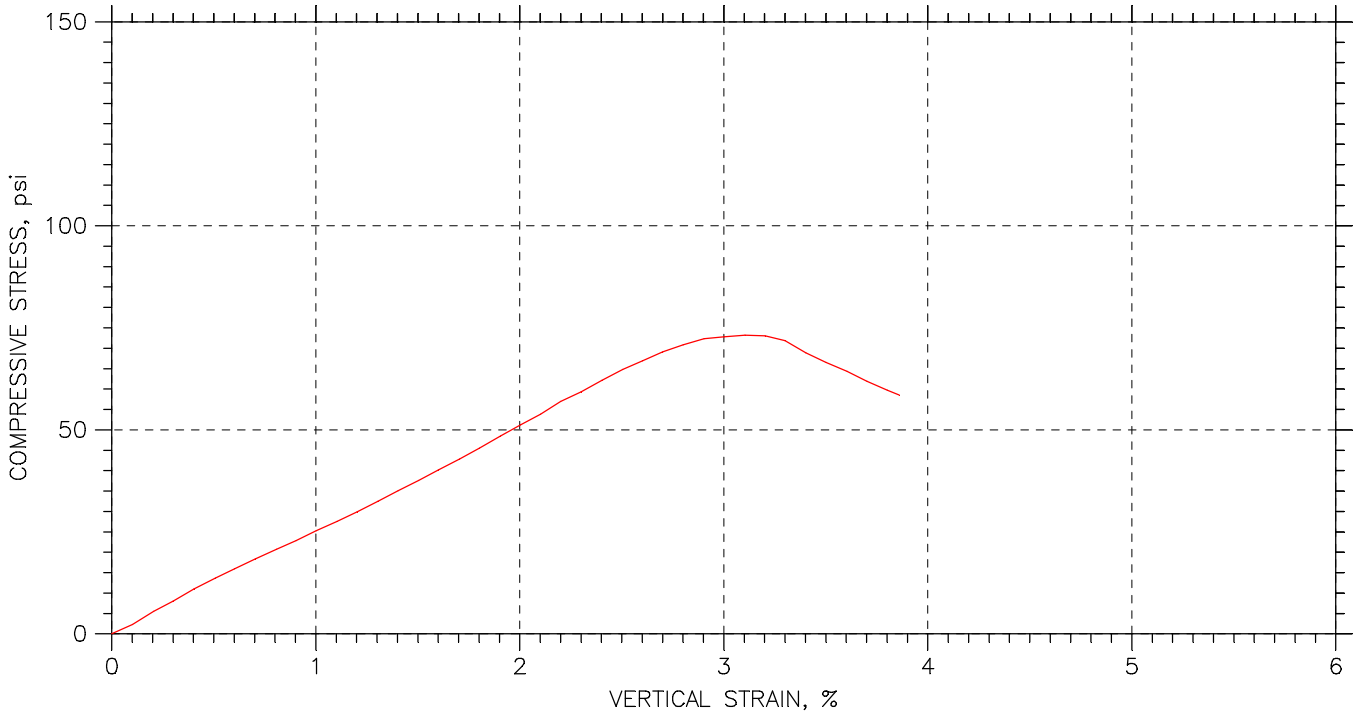
UNCONFINED COMPRESSION TEST REPORT



Symbol					
Test No.		C			
Initial	Diameter, in	2.882			
	Height, in	5.74			
	Water Content, %	0.00			
	Dry Density, pcf	124.1			
	Saturation, %	0.00			
	Void Ratio	0.333			
Unconfined Compressive Strength, psi		73.18			
Undrained Shear Strength, psi		36.59			
Time to Failure, min		3.0459			
Strain Rate, %/min		1			
Measured Specific Gravity		2.65			
Liquid Limit		0			
Plastic Limit		0			
Plasticity Index		0			
Failure Sketch					

	Project: Williston
	Location: Williston, VT
	Project No.: 5500(12)
	Boring No.: B-102A
	Sample Type: Undisturbed
	Description: 14" into sample
	Remarks:

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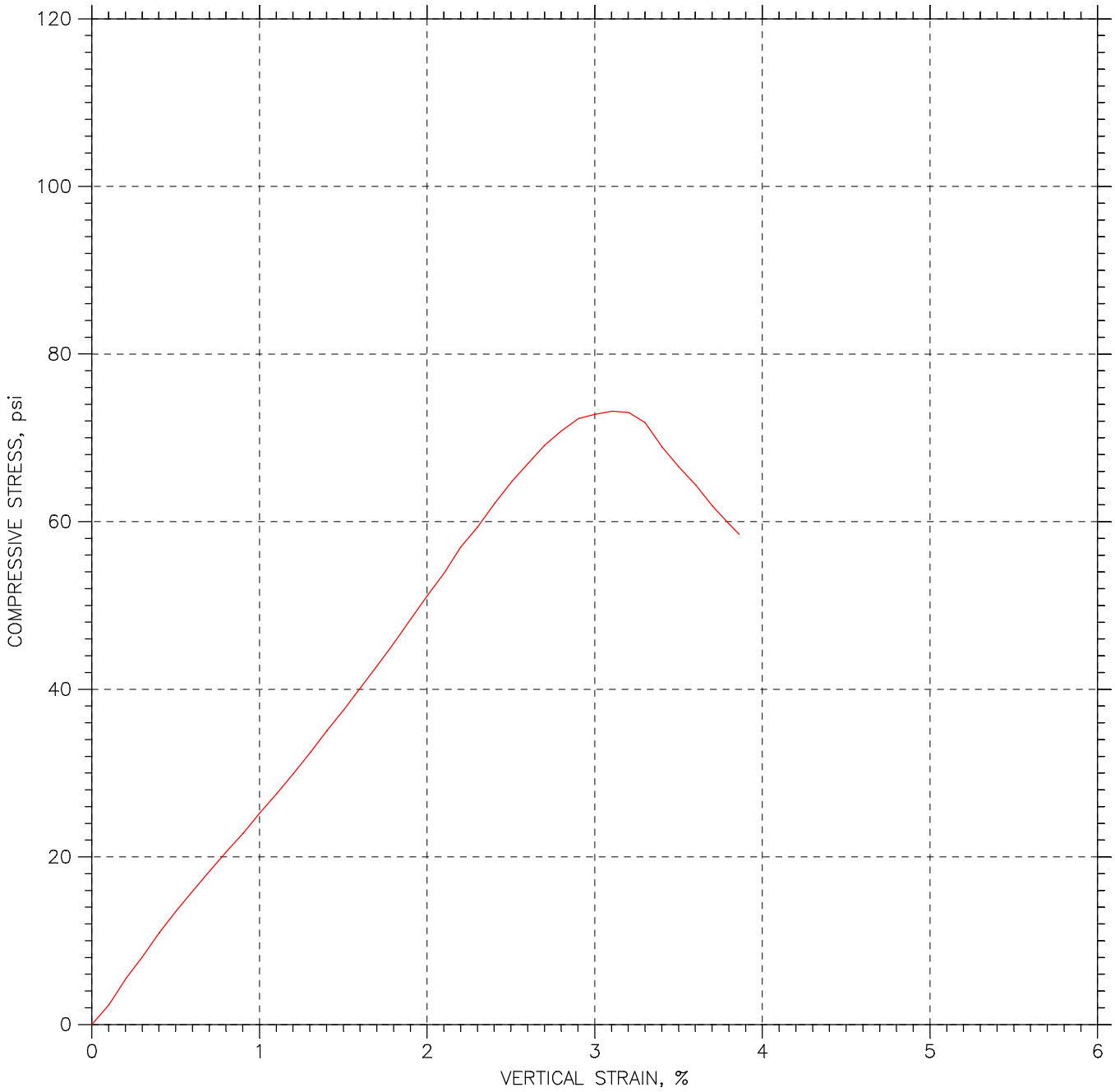
UNCONFINED COMPRESSION TEST REPORT



	Project: Williston	Location: Williston, VT	Project No.: 5500(12)
	Boring No.: B-102A	Tested By: MLM	Checked By:
	Sample No.: U2	Test Date: 10/17/13	Depth: 7-9 feet
	Test No.: C	Sample Type: Undisturbed	Elevation:
	Description: 14" into sample		
	Remarks:		

Thu, 17-OCT-2013 16:25:44