



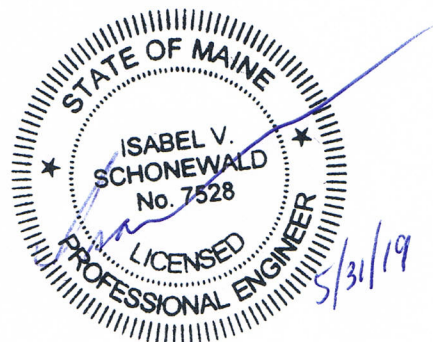
**GEOTECHNICAL DESIGN REPORT
FENDER SYSTEM MODIFICATIONS
MAINE STATE FERRY TERMINAL - ISLESBORO, MAINE
MAINEDOT WIN 23484.00**

PREPARED FOR:

HNTB Corporation
Westbrook, Maine

PREPARED BY:

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May 2019

SchonewaldEA Project No. 18-014

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INTRODUCTION

Schonewald Engineering Associates, Inc. (SchonewaldEA) has prepared this Geotechnical Design Report for HNTB Corporation (HNTB) to present subsurface information and provide final geotechnical design and construction recommendations for the fender system modifications at the Maine State Ferry Terminal located in Islesboro, Maine on West Penobscot Bay (MaineDOT WIN 23484.00).

SchonewaldEA's work on this project has been completed under a Subconsultant Task Order Agreement with HNTB that is dated May 4, 2018. This report is subject to the limitations contained in the Closure section of the report. A quality assurance review of the geotechnical analyses completed by SchonewaldEA for this project was completed by Stephen J. Rabasca, P.E. of SoilMetrics, LLC located in Cape Elizabeth, Maine.

PROJECT DESCRIPTION

The location of the Maine State Ferry Terminal located in Islesboro, Maine on West Penobscot Bay is depicted on attached Figure 1 – Locus Plan.

The fender system modifications at the Maine State Ferry Terminal in Islesboro include the installation of one mooring dolphin within the perimeter footprint of the existing pen, complete with fender panels and lighting. The proposed mooring dolphin will be located approximately in the center of the westerly side of the existing pen. The mooring dolphin will be supported by nine post-tensioned concrete-filled steel pipe piles. The pipe piles will be post-tensioned by way of threaded-bar rock anchors that are grouted into rock. Each pile will be socketed into bedrock to serve as a seal for rock anchor construction.

Associated with this work is the installation of three timber wave screens. Each of the three wave screens will be supported by an A-frame of timber piles that will be driven to rock.

Appurtenant work includes the removal and installation of fender panels, removal and installation of site lighting, and installation of aluminum gangways. The work requires the removal of existing stone-filled timber cribs that are in the area of the proposed mooring dolphin and timber wave screens.

GEOLOGICAL SETTING

Surficial geology is mapped as glacial till, with a narrow band of glaciomarine silt-clay mapped in relatively close proximity to the site (Surficial Geologic Map of Maine). Bedrock geology is mapped as the Rocks of Islesboro Formation, which is an interbedded pelite (mudstone) and limestone that has undergone low-grade metamorphism and is of Precambrian Z age (Bedrock Geologic Map of Maine).

SUBSURFACE INVESTIGATION

SchonewaldEA retained New England Boring Contractors of Hermon, Maine and Prock Marine of Rockland, Maine to provide the off-shore drilling services necessary for this project and similar fender modification projects at four other Maine State Ferry Terminals around Penobscot Bay. Due to the significant effort and cost to mobilize the barge-mounted drill rig, five ferry terminals were included in the program. These included Islesboro, Vinalhaven, Bass Harbor, Swans Island, and Frenchboro. As part of the overall program, four test borings were drilled at the Islesboro terminal to evaluate subsurface conditions in the vicinity of the proposed work. The specific modifications to the Islesboro terminal had not been finalized at the time of the subsurface investigation program. Therefore, the four borings were

located at key points around the perimeter of the existing pen. The test borings were designated MB-ISLES-101 through -104. The test borings were drilled on August 17 through 21, 2018 and were observed and logged by SchonewaldEA. The approximate locations of the test borings are depicted on Figure 2 - Boring Location Plan that is included with the Figures.

The test borings were drilled using a barge-mounted drill rig and were completed using standard cased wash boring techniques. The borings were advanced through overburden to refusal and 30.0 to 41.8 feet of rock core was obtained in each boring. Because the design of the dolphin foundation does not rely on achieving geotechnical capacity in the overburden soils, limited sampling and testing of overburden soils was completed with the objective of identifying potential constructability issues. Standard Penetration Tests (SPTs) were completed and split-spoon soil samples were obtained at select depths to define the soil stratigraphy. During SPT sampling, the sampler is driven 24 inches and the hammer blows for each 6-inch interval of penetration are recorded. The sum of the blows for the second and third intervals is the N-value, or standard penetration resistance. It is customary for the raw field N-values to be corrected based on the relative energy of the actual hammer system utilized to complete the SPTs. The corrected N-values are referred to as N_{60} values, which are used in correlations and analyses to evaluate the engineering characteristics of the overburden soils. SPTs for this project were conducted using a calibrated auto-hammer; the auto-hammer efficiency factor is provided on the boring logs and was used to obtain the N_{60} values that are also reported on the logs.

The logs of the subsurface explorations are included as Appendix A. Photographs of the rock core collected from the test boring are included as Appendix B.

LABORATORY TESTING

A total of 12 representative specimens of the rock core obtained in the Islesboro test borings were submitted to the GeoTesting Express (GTX) geotechnical laboratory in Acton, Massachusetts for unconfined (uniaxial) compressive strength testing. The unconfined compression tests on rock were conducted in accordance with ASTM D-7012 Method D (Elastic Moduli of Rock in Uniaxial Compression) and included specimen preparation per ASTM D-4543, measuring strength, developing a stress-strain curve, reporting elastic moduli (Young's Modulus and Poisson's Ratio), and providing before and after photographs of the test specimens. The laboratory testing program is summarized in the following table.

Boring No.	Core No.	Specimen Depth	Sample Representative of; Tests Performed:
MB-ISLES-101	R1	22.8-23.4 ft. BGS	bedrock; uniaxial compressive strength test
MB-ISLES-101	R3	20.1-20.8 ft. BGS	bedrock; uniaxial compressive strength test
MB-ISLES-101	R4	24.6-25.2 ft. BGS	bedrock; uniaxial compressive strength test
MB-ISLES-102	R2	19.5-19.9 ft. BGS	bedrock; uniaxial compressive strength test
MB-ISLES-102	R4	27.1-27.7 ft. BGS	bedrock; uniaxial compressive strength test
MB-ISLES-102	R6	36.9-37.5 ft. BGS	bedrock; uniaxial compressive strength test
MB-ISLES-103	R4	16.8-17.7 ft. BGS	bedrock; uniaxial compressive strength test
MB-ISLES-103	R4	20.6-20.9 ft. BGS	bedrock; uniaxial compressive strength test
MB-ISLES-103	R5	22.9-23.5 ft. BGS	bedrock; uniaxial compressive strength test
MB-ISLES-104	R1	15.0-15.7 ft. BGS	bedrock; uniaxial compressive strength test
MB-ISLES-104	R3	23.7-24.3 ft. BGS	bedrock; uniaxial compressive strength test
MB-ISLES-104	R6	39.9-40.2 ft. BGS	bedrock; uniaxial compressive strength test

Subsurface conditions, including the results of the rock testing, are discussed in the following section. Laboratory test results are summarized on the test boring logs included in Appendix A and the laboratory test reports are included as Appendix C.

SUBSURFACE CONDITIONS

Subsurface conditions encountered in the Islesboro test borings consisted of between 2 and 8 feet of Organic Silt “Muck” (recent sediment) over an approximately 4- to 9-foot thickness of Marine Silty Sands and Gravel. Bedrock underlying the Marine Silty Sands and Gravel consisted of an aphanitic to fine-grained Metapelite.

The surficial sediments consisted predominately of organic silt with varying amounts of sands, gravel, shells, and detritus. This stratum was typically Weight of Rods material, meaning that the drill rods sank under their own weight. The surficial sediments were underlain by a silt with varying amounts of sands and gravel; characteristic of older sediments rather than a glacial till. The depth of the interface between the two strata was estimated based on drilling behavior. Detailed descriptions of the overburden soils encountered in the test borings are provided on the logs included in Appendix A.

Depth to bedrock varied between the borings, as would be expected. Specifically, bedrock was encountered at the following elevations (relative to Mean Low Low Water) and depths below the ground surface (mudline) (BGS):

Boring No.	Ground Surface Elevation (ft, MLLW)	Top of Bedrock Elevation (ft, MLLW)	Depth of Top of Bedrock (ft, BGS)
MB-ISLES-101	-21.9	-31.1	9.2
MB-ISLES-102	-24.4	-37.4	13.0
MB-ISLES-103	-16.6	-22.6	6.0
MB-ISLES-104	-11.7	-24.7	13.0

The bedrock core obtained from the test borings consisted of hard, fresh to slightly weathered, aphanitic to fine-grained, grey Metapelite with highly undulating remnant bedding and thin to wide calcsilicate veins. Natural breaks varied from very close to moderately spaced and from low angle to near vertical in rock cored in the four test borings. The Rock Quality Designations (RQDs) of the rock cores obtained in the test borings ranged from 0 to 98 percent. The lower RQDs were concentrated near the top of bedrock and in zones of closely spaced and/or high angle fractures. Twelve specimens of the rock core were submitted for uniaxial compressive strength tests; three specimens from each boring. The test results reported the uniaxial compressive strength of the Metapelite ranged from 1.0 and 11.1 ksi, with an average of about 6.5 to 7.0 ksi. A summary of the rock quality and compressive strength test results from Islesboro and the other four ferry terminals is provided with the calculations attached as Appendix D.

Detailed descriptions of the rock encountered in the Islesboro test borings are provided on the logs included in Appendix A.

GEOTECHNICAL DESIGN AND CONSTRUCTION RECOMMENDATIONS

SchonewaldEA provides the following geotechnical recommendations for the design and construction of the fender system modifications at the Maine State Ferry Terminal located in Islesboro, Maine on West Penobscot Bay. These recommendations are based on geotechnical provisions set forth in the AASHTO LRFD Bridge Design Specifications, 7th Edition, 2014 (LRFD Manual), as well as established ASD methods in the absence of definitive guidance in the LRFD Manual. The calculations attached as Appendix D provide specific references.

BEDROCK COMPRESSIVE STRENGTH AND QUALITY

The bedrock underlying the Maine State Ferry Terminal in Islesboro consists of hard, aphanitic to fine-grained Metapelite. Considering the rock core descriptions, RQDs, and laboratory uniaxial compressive strength test results from the four Islesboro test borings in aggregate, SchonewaldEA recommends using a peak uniaxial compressive strength of 7.1 ksi for the Metapelite for design purposes. A summary of the rock quality and compressive strength test results is provided with the calculations attached as Appendix D.

Refer to the paragraphs below that provide recommendations for the pipe piles and rock anchors for the recommended minimum length of the Islesboro pipe pile rock socket and the minimum depth below the top of bedrock for the top of the Islesboro rock anchor bonded length.

REMOVAL OF STONE-FILLED TIMBER CRIBS

The proposed modifications to the Islesboro terminal's fender system include removing the seven existing stone-filled timber cribs that define the legs of the existing pen. The contractor should use care while removing the timber cribbing to ensure that the stone fill does not fall into the pen. Temporary steel sheet piles, thick polyethylene flat stock sheets, or other temporary measures should be considered for use to protect the pen-side of the timber cribs from losing stone ballast into the pen.

MOORING DOLPHIN - GENERAL

The structural analysis of the mooring dolphin was completed by HNTB using FB Multiplier software. The subsurface conditions underlying the proposed mooring dolphin were modeled based on the findings of MB-ISLES-103 that is located approximately 30 feet northwest of the proposed dolphin. HNTB and SchonewaldEA concurred that the limited thickness of overburden that was encountered in the boring could be neglected as it would not be expected to contribute significant resistance due to the very low effective stresses. The following geotechnical input was recommended by SchonewaldEA for use in HNTB's FB Multiplier mooring dolphin model and is based on the conditions encountered in boring MB-ISLES-103:

LAYER	DESCRIPTION	LATERAL SOIL MODEL	PARAMETERS (assign top and bottom)
1	ROCK (Limestone) Top of competent rock elevation - 27.6 ft	Limestone (McVay)	Effective unit weight = 170 pcf Uniaxial compressive strength = 850,000 psf

MOORING DOLPHINS – PIPE PILES

The mooring dolphin will be supported by nine post-tensioned concrete-filled steel pipe piles. Each pile will be socketed into competent bedrock to serve as a seal for rock anchor construction. The nominal resistance of piles bearing on hard rock, like the metapelite underlying Islesboro, is controlled by the structural limit state (structural capacity), not geotechnical capacity, per LRFD Manual Article 10.7.3.2.3

Regardless, the geotechnical capacity of the pipe piles was checked. The analysis is included with the geotechnical calculations provided as Appendix D. In the absence of definitive guidance in the LRFD Manual, the geotechnical end-bearing capacity of the pipe piles was evaluated using well-established ASD methods after Duncan C. Wyllie's "Foundations on Rock" - Section 8.3.2 "Rock Socketed Piers - End-Bearing Capacity." Per Wyllie, the allowable end-bearing capacity of rock socketed piles, which includes a Factor of Safety of 2 to 3, is a function of the uniaxial compressive strength of the rock at the base of the pile. Working through Wyllie's analysis and assuming a Factor of Safety of 2 to be

consistent with recommended resistance factors for end-bearing piles on rock per the LRFD Manual ($\phi_{\text{stat}} = 0.5$), the ultimate end-bearing capacity can be considered roughly equivalent to the nominal resistance of the pile. The geotechnical capacity of the pipe piles was found to be well in excess of the required capacity determined by HNTB, which we understand includes an additional axial load associated with prestressing the rock anchors. Additional capacity achieved via skin friction on the rock socket side wall was conservatively neglected.

The pipe piles that will support the mooring dolphin should be socketed into competent bedrock a minimum of 2 feet to seal the pipe pile into the bedrock and allow the construction of the rock anchors. The rock socket length should be measured in the field from the low side of the rock, which is the depth at which the pile is seated into bedrock around its entire circumference.

The rock sockets should be drilled using rotary down hole hammers, rotary percussive methods, or solid rock coring techniques. No attempt should be made to drive the pipe piles into bedrock. The completed rock sockets should be cleaned of all debris to the extent practicable. A grout plug should be installed in the bottom of the pipe pile prior to commencing coring for the rock anchor.

MOORING DOLPHIN – ROCK ANCHORS

The pipe piles will be post-tensioned using threaded bar grouted into holes drilled into the rock. The design calls for 1-3/8-inch diameter threaded bar installed in a 4-1/2-inch diameter core hole and grouted using 5,000 psi cement grout. A minimum 15-foot long bonded length is specified, which we understand was based in part on HNTB's design analyses that evaluated the pull-out resistance of the cone of rock that would be "dislodged" or "lifted" by the tensioned rock anchor. HNTB's rock anchor design calls for corrosion protection and for sheathing to serve as a grout-threaded bar bond break above the bonded length to ensure adequate free stressing (unbonded) length.

The core hole should be advanced into rock using methods that do not "polish" the rock wall. The core hole should extend a minimum of 12 inches below the required bottom of the bonded length to provide for drilling debris that may not be removed during flushing operations.

The geotechnical tensile capacity of the rock anchors was evaluated by SchonewaldEA using established ASD methods in the absence of definitive guidance in the LRFD Manual, Article 11.9.4.2 - "Anchor Pullout Capacity" that is related to the design of anchored retaining walls. Specific ASD guidance included Duncan C. Wyllie's "Foundations on Rock" - Section 9.3.2 "Tension Foundations - Allowable bond stresses and anchor design" and the Post-Tensioning Institute's "Recommendations for Prestressed Rock and Soil Anchors" - Article 6.0 "Design." We note that a resistance factor equal to 1.0 is allowed for per the LRFD Manual since all the rock anchors will be tested. Per Wyllie, the design against failure of the anchor at the grout interfaces requires that the length of the bond zone, and the diameter of the threadbar and drill hole are proportioned such that the average bond stress is less than the working bond strength.

Based on the analysis, the geotechnical capacity of the rock anchors was calculated to be 517 kips. Because of the high strength of the hard metapelite that underlies the Islesboro terminal, the geotechnical capacity of the rock anchors is limited by the strength of the cement grout. Rock anchor capacity calculations are included with the geotechnical calculations attached as Appendix D.

Selecting the location (depth into rock) of the top of the bonded length must recognize that stresses are concentrated near the top of the bonded length. Therefore, the quality of the rock core obtained from the Islesboro test borings was assessed to determine an appropriate depth below the

bedrock surface for the top of the bonded length of the rock anchors. Based on the evaluation, which is included with the calculations in Appendix D, SchonewaldEA recommends that the top of the bonded length of the Islesboro rock anchors be a minimum of 15 feet below the top of the bedrock surface at the pipe pile / rock anchor location.

All the rock anchors should be tested in accordance with industry standards. One rock anchor should be performance tested and the remaining rock anchors should be proof tested. Testing should be in accordance with the recommendations set forth in the Post-Tensioning Institute's "Recommendations for Prestressed Rock and Soil Anchors." Those requirements have been incorporated into the project specifications as Special Provision 504 – Structural Steel (Rock Anchors). It is recommended that the performance and proof tests be conducted prior to concreting the steel pipe piles. Testing should also include one lift off test conducted on one rock anchor as part of the final post-tensioning process.

WAVE SCREENS

The fender system modifications at the Islesboro terminal call for the installation of three wave screens between some of the dolphins that form the pen. Each wave screen will be supported by an A-frame of timber piles that will be driven to rock. As part of the design process, SchonewaldEA evaluated the uplift resistance provided by a single timber pile. The analysis is included in the geotechnical calculations provided as Appendix D. The analysis indicates that the factored uplift resistance of a single timber pile used to support the Islesboro wave screens is essentially negligible (0.4 kips). The factored uplift resistance is low due to the limited thickness and the consistency of the overburden soils encountered in the test borings.

The timber piles should be driven to bedrock and should be fitted with a pile tip to protect the tip from damage. The contractor should establish driving criteria based upon the hammer system proposed for use and should evaluate drivability so that the piles are not damaged when driven to bedrock.

CLOSURE

This report has been prepared for the use of HNTB Corporation for specific application to the fender modifications at the Maine State Ferry Terminal located in Islesboro, Maine in accordance with generally accepted geotechnical and foundation engineering practices. No other intended use or warranty is expressed or implied.

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

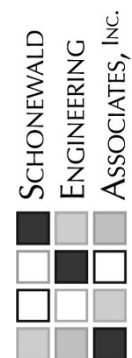
It is recommended that a geotechnical engineer be provided the opportunity for a review of the design and specifications in order that the design recommendations and construction considerations presented in this report are properly interpreted and implemented in the design and specifications.

FIGURES

PROJECT
LOCATION



Scale in Miles



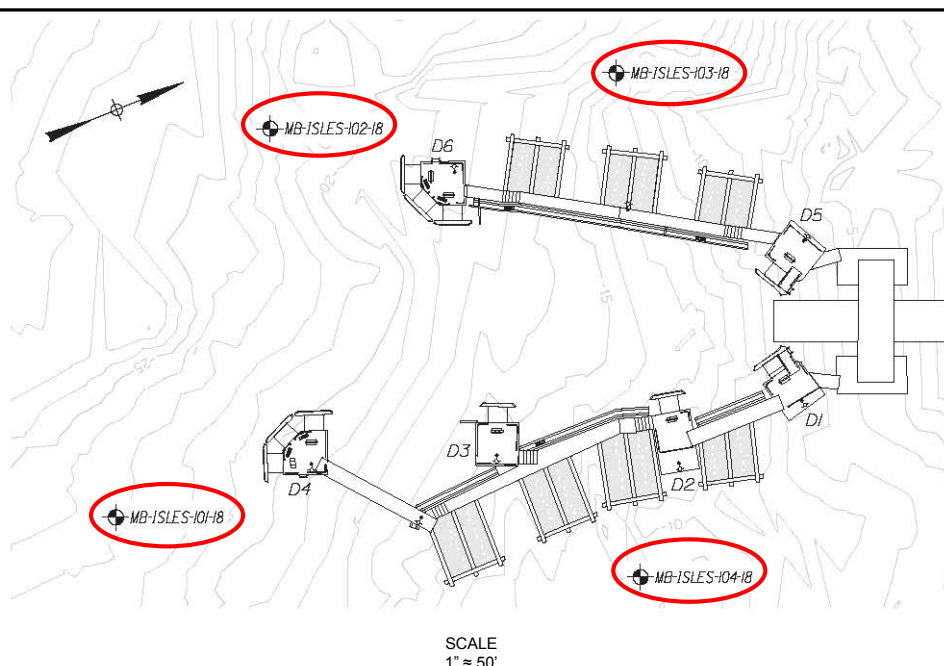
PROJECT NO.: 18-014
DATE: APRIL 2019
DRAWN BY: IVS
APPROX. SCALE: AS NOTED

LOCUS PLAN
FENDER SYSTEM MODIFICATIONS
MAINE STATE FERRY TERMINAL
ISLESBORO, MAINE
MAINEDOT WIN 23484.00

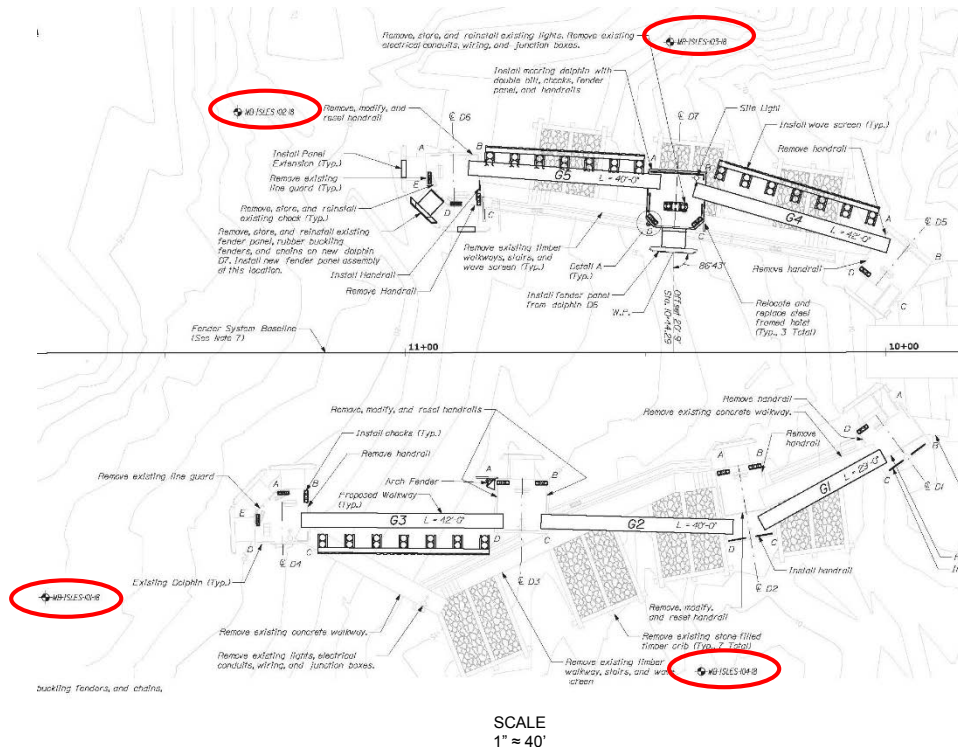
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(BASE PLANS TAKEN FROM SHEET 1 OF PROJECT
PLAN SET PREPARED BY HNTB)



BORING LOCATION PLAN
RELATIVE TO EXISTING CONDITIONS
(BASE PLAN TAKEN FROM SHEET 4 OF PROJECT PLAN SET PREPARED BY HNTB)



BORING LOCATION PLAN
RELATIVE TO PROPOSED CONDITIONS
(BASE PLAN TAKEN FROM SHEET 6 OF PROJECT PLAN SET PREPARED BY HNTB)



APPENDIX A

SUBSURFACE EXPLORATION LOGS

 SCHONEWALD ENGINEERING ASSOCIATES, INC.		PROJECT: Fender System Modifications Maine State Ferry Terminal LOCATION: Islesboro, Maine		Boring No.: MB-ISLES-101-18 WIN: 23484.00	
Driller: New England Boring Contractors		Elevation (ft.): -21.9 ft (mudline)		Core Barrel: NQ2 (wireline)	
Operator: Enos / Share		Datum: MLLW		Sampler: standard split spoon	
Logged By: Schonewald		Rig Type: Mobile Drill B-53		Hammer Wt./Fall: 140 lbs / 30 inches	
Date Start/Finish: 8/17/18; 0750-1105		Drilling Method: cased wash boring		Hammer Type: auto hammer	
Boring Location: per plan (B4A); see remarks		Casing ID/OD: HW to 9.2 ft/ NW to 9.5 ft		Hammer Efficiency: 0.906	
		Auger ID/OD: n/a		Water Level*: n/a	
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 METHOD: SSA=solid stem auger/HSA=hollow stem auger/RC=roller cone LABORATORY TEST RESULTS: LL=Liquid Limit / PL=Plastic Limit / PI=Plasticity Index WC = water content, percent -#200 = percent fines from grain size analysis UCT qp = peak compressive strength of rock					

Depth (ft.)	Sample Information							Graphic Log	Visual Description and Remarks	Lab. Testing Results
	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (6 in.) Shear Strength (psf) or RQD (%)	N-uncorrected	N-60	Casing Blows			
0	1D	24/11	0.0 - 2.0	WOR/24"	3"dia		PUSH			
5										
10	R1	60/60	9.5 - 14.5	RQD: 47%=78%			NQ2	-31.1	9.2	UCT qp= 11.05 ksi
				sample 10.1-10.5						
15	R2	60/60	14.5 - 19.5	RQD: 47%=78%						
20	R3	60/60	19.5 - 24.5	RQD: 45%=75%						UCT qp= 8.15 ksi
				sample 20.1-20.8						
25	R4	60/60	24.5 - 29.5	RQD: 36%=60%						

Remarks:
 8/17/18; 0742 hrs: 14.9' top dolphin #4 to water; 7.7' barge deck to water; 34.3' barge deck to mudline
 top of dolphin #4: elev. 19.64 ft MLLW
 49' cleat of dolphin #4 to borehole; approx. 18.5' east of line through dolphins #3 and #4.

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 1 of 2
 Boring No.: MB-ISLES-101-18

SCHONEWALD ENGINEERING ASSOCIATES, INC.		PROJECT: Fender System Modifications Maine State Ferry Terminal LOCATION: Islesboro, Maine		Boring No.: MB-ISLES-101-18 WIN: 23484.00																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																									
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(Rocks of Islesboro Fm) 1:40/ 1:35/ 1:45/ 1:45/ 1:20 min:sec/ft ROCK QUALITY = FAIR</td><td rowspan="12">UCT qp= 8.53 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(ft.)	Sample Information							Graphic Log	Visual Description and Remarks	Lab. Testing Results	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (6 in.) Shear Strength (psf) or RQD (%)	N-uncorrected	N-60	Casing Blows	Elevation (ft.)	25				sample 24.6-25.2						to 29.5 ft; calcisilicate veins not obvious. 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Remarks: 8/17/18; 0742 hrs: 14.9' top dolphin #4 to water; 7.7' barge deck to water; 34.3' barge deck to mudline top of dolphin #4: elev. 19.64 ft MLLW 49' cleat of dolphin #4 to borehole; approx. 18.5' east of line through dolphins #3 and #4.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																													
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 SCHONEWALD ENGINEERING ASSOCIATES, INC.		PROJECT: Fender System Modifications Maine State Ferry Terminal LOCATION: Islesboro, Maine		Boring No.: MB-ISLES-102-18 WIN: 23484.00	
Driller: New England Boring Contractors		Elevation (ft.): -24.4 ft (mudline)		Core Barrel: NQ2 (wireline)	
Operator: Enos / Share		Datum: MLLW		Sampler: standard split spoon	
Logged By: Schonewald		Rig Type: Mobile Drill B-53		Hammer Wt./Fall: 140 lbs / 30 inches	
Date Start/Finish: 8/20/18; 1225-1545		Drilling Method: cased wash boring		Hammer Type: auto hammer	
Boring Location: per plan (B4B); see remarks		Casing ID/OD: HW to 13.0 ft/ NW to 14.0 ft		Hammer Efficiency: 0.906	
		Auger ID/OD: n/a		Water Level*: n/a	
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 METHOD: SSA=solid stem auger/HSA=hollow stem auger/RC=roller cone LABORATORY TEST RESULTS: LL=Liquid Limit / PL=Plastic Limit / PI=Plasticity Index WC = water content, percent -#200 = percent fines from grain size analysis UCT qp = peak compressive strength of rock					

Depth (ft.)	Sample Information								Graphic Log	Visual Description and Remarks	Lab. Testing Results
	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (6 in.) Shear Strength (psf) or RQD (%)	N-uncorrected	N-60	Casing Blows	Elevation (ft.)			
25										ROCK QUALITY = VERY POOR	UCT qp= 6.94 ksi
	R4	60/60	26.8 - 31.8	RQD: 43%=72%						R4: Hard, fresh, aphanitic to fine grained, grey, METAPELITE with highly undulating, typically moderately dipping remnant bedding and occasional calcsilicate veins. Close to moderately spaced, moderately dipping breaks; undulating, rough, dull, typically discolored, and open with occasional mud infilling. (Rocks of Islesboro Fm) 1:45/ 1:30/ 1:30/ 1:25/ 1:40 min:sec/ft ROCK QUALITY = FAIR TO GOOD	
				sample 27.1-27.7							
30											
	R5	60/60	31.8 - 36.8	RQD: 44%=73%						R5: Similar to R4, except moderately to widely spaced breaks. Fracture zone from 34.1 to 34.9 ft. 1:15/ 1:10/ 1:15/ 1:10/ 1:15 min:sec/ft ROCK QUALITY = FAIR TO GOOD	UCT qp= 8.45 ksi
35											
	R6	60/60	36.8 - 41.8	RQD: 48%=80%						R6: Similar to R5, except breaks typically fresh. 1:20/ 1:05/ 1:10/ 1:15/ 1:10 min:sec/ft ROCK QUALITY = GOOD	
				sample 36.9-37.5							
40											
	R7	60/60	41.8 - 46.8	RQD: 51%=85%						R7: Similar to R6. 1:15/ 0:55/ 1:05/ 1:10/ 1:05 min:sec/ft ROCK QUALITY = GOOD	
45											
								-71.2		Bottom of Exploration at 46.8 feet below ground surface.	
50											

Remarks:
 8/20/18; 1222 hrs: 18.0' top dolphin #6 to water; 7.7' barge deck to water; 33.9' barge deck to mudline
 top of dolphin #6: elev. 19.82 ft MLLW
 50' center dolphin #6 to borehole; approx. in line with line through light posts on dolphins #5 and #6.

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 2 of 2
Boring No.: MB-ISLES-102-18

 SCHONEWALD ENGINEERING ASSOCIATES, INC.		PROJECT: Fender System Modifications Maine State Ferry Terminal LOCATION: Islesboro, Maine		Boring No.: MB-ISLES-103-18 WIN: 23484.00						
Driller: New England Boring Contractors		Elevation (ft.): -16.6 ft (mudline)		Core Barrel: NQ2 (wireline)						
Operator: Enos / Share		Datum: MLLW		Sampler: standard split spoon						
Logged By: Schonewald		Rig Type: Mobile Drill B-53		Hammer Wt./Fall: 140 lbs / 30 inches						
Date Start/Finish: 8/17/18; 1135-8/20/18; 0730-1200N		Drilling Method: cased wash boring		Hammer Type: auto hammer						
Boring Location: per plan (B4C); see remarks		Casing ID/OD: HW to 6.0 ft/ NW to 10.2 ft		Hammer Efficiency: 0.906						
		Auger ID/OD: n/a		Water Level*: n/a						
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						
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Depth (ft.)	Sample Information							Graphic Log	Visual Description and Remarks	Lab. Testing Results
	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (6 in.) Shear Strength (psf) or RQD (%)	N-uncorrected	N-60	Casing Blows			
0	1D	17/3	0.0 - 1.4	6-8-50/5"	3"dia		PUSH		1D: Pieces of rock taken from tip of 3-inch diameter split-spoon.	
							28			
							84			
							62			
5	2D	9/6	5.3 - 6.1	1-50/3"			RC		2D: Olive brown, SILT & CLAY, some gravel, little fine to coarse sand.	
	R1	48/33	6.2 - 10.2	RQD: 4"=8%			NQ2	-22.6	Top of bedrock at Elev. -22.6 ft. R1: Bedrock: Hard, slightly to moderately weathered, aphanitic to fine grained, rust with grey patches, METAPELITE with highly undulating remnant bedding and occasional thin calcsilicate veins. Very close to close, typically moderately dipping breaks; undulating, rough, dull, discolored to decomposed, and open with mud infilling. (Rocks of Islesboro Fm) Core times: 2:15/ 1:05/ 1:10/ 2:10 min:sec/ft ROCK QUALITY = VERY POOR R2: Similar to R1. 2:45 min:sec/ft ROCK QUALITY = VERY POOR R3: Similar to R1, except rust color is confined to distinct remnant beds and typically closely spaced breaks, Highly fractured from 11.2 to 12.0 and 15.4 to 16.2 ft. 1:20/ 1:30/ 1:15/ 1:10/ 1:55 min:sec/ft ROCK QUALITY = VERY POOR	
10	R2	12/12	10.2 - 11.2	RQD: 0"=0%						
	R3	60/51	11.2 - 16.2	RQD: 10"=17%						
15										
	R4	60/60	16.2 - 21.2	RQD: 34"=57%					R4: Hard, fresh to slightly weathered, aphanitic to fine grained, grey, METAPELITE with highly undulating remnant bedding and occasional calcsilicate veins. Close to moderately spaced, typically moderately dipping breaks; undulating, rough, dull, discolored, and open with occasional mud infilling. Rock mass stained rust along margins of breaks. Highly fractured from 16.2 to 16.8 ft. (Rocks of Islesboro Fm) 1:40/ 1:30/ 1:20/ 1:15/ 1:15 min:sec/ft ROCK QUALITY = FAIR	UCT qp= 6.96 ksi
				sample 16.8-17.7						
20				sample 20.6-20.9						
	R5	60/60	21.2 - 26.2	RQD: 48"=80%					R5: Similar to R4. Highly fractured from 23.8 to 24.2 and 24.4 to 24.8 ft. 1:30/ 1:25/ 1:10/ 1:30/ 1:30 min:sec/ft ROCK QUALITY = GOOD	UCT qp= 7.63 ksi
				sample 22.9-23.5						UCT qp= 6.11 ksi
25										
Remarks: 8/20/18; 0728 hrs: 10.7' top dolphin #6 to water; 7.7' barge deck to water; 33.4' barge deck to mudline top of dolphin #6: elev. 19.82 ft MLLW 36' perpendicular to centerline walkway between dolphins #5 and #6 to borehole; perpendicular line runs approx. through center of crib and through light post on walkway.										
Stratification lines represent approximate boundaries between soil types; transitions may be gradual.									Page 1 of 2	
* 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.: MB-ISLES-103-18	

SCHONEWALD ENGINEERING ASSOCIATES, INC.			PROJECT: Fender System Modifications Maine State Ferry Terminal						Boring No.: MB-ISLES-103-18																																																														
									LOCATION: Islesboro, Maine						WIN: 23484.00																																																								
Driller:			New England Boring Contractors						Elevation (ft.)			-16.6 ft (mudline)						Core Barrel:			NQ2 (wireline)																																																		
Operator:			Enos / Share						Datum:			MLLW						Sampler:			standard split spoon																																																		
Logged By:			Schonewald						Rig Type:			Mobile Drill B-53						Hammer Wt./Fall:			140 lbs / 30 inches																																																		
Date Start/Finish:			8/17/18; 1135-8/20/18; 0730-1200N						Drilling Method:			cased wash boring						Hammer Type:			auto hammer																																																		
Boring Location:			per plan (B4C); see remarks						Casing ID/OD:			HW to 6.0 ft/ NW to 10.2 ft						Hammer Efficiency:			0.906																																																		
									Auger ID/OD:			n/a						Water Level*:			n/a																																																		
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 _H = 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 METHOD: SSA=solid stem auger/HSA=hollow stem auger/RC=roller cone LABORATORY TEST RESULTS: LL=Liquid Limit / PL=Plastic Limit / PI=Plasticity Index WC = water content, percent +200 = percent fines from grain size analysis UCT qp = peak compressive strength of rock																	
Sample Information																		Visual Description and Remarks																		Lab. Testing Results																																			
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																																																																							
25																		R6: Similar to R4, except moderately spaced breaks and no visible rust staining along margins of breaks. 1:15/ 1:15/ 1:20/ 1:25/ 1:15 min:sec/ft ROCK QUALITY = GOOD																																																					
30																		R7: Similar to R6, except moderately to widely spaced breaks. 1:25/ 1:20/ 1:25/ 1:15/ 1:30 min:sec/ft ROCK QUALITY = GOOD																																																					
35																		Bottom of Exploration at 36.2 feet below ground surface.																																																					
40																																																																							
45																																																																							
50																																																																							
Remarks: 8/20/18; 0728 hrs: 10.7' top dolphin #6 to water; 7.7' barge deck to water; 33.4' barge deck to mudline top of dolphin #6: elev. 19.82 ft MLLW 36' perpendicular to centerline walkway between dolphins #5 and #6 to borehole; perpendicular line runs approx. through center of crib and through light post on walkway.																																																																							
Stratification lines represent approximate boundaries between soil types; transitions may be gradual.																																																																							
Page 2 of 2																																																																							
Boring No.: MB-ISLES-103-18																																																																							

 SCHONEWALD ENGINEERING ASSOCIATES, INC.		PROJECT: Fender System Modifications Maine State Ferry Terminal LOCATION: Islesboro, Maine		Boring No.: MB-ISLES-104-18 WIN: 23484.00	
Driller: New England Boring Contractors		Elevation (ft.): -11.7 ft (mudline)		Core Barrel: NQ2 (wireline)	
Operator: Enos / Share		Datum: MLLW		Sampler: standard split spoon	
Logged By: Schonewald		Rig Type: Mobile Drill B-53		Hammer Wt./Fall: 140 lbs / 30 inches	
Date Start/Finish: 8/21/18; 0750-1220		Drilling Method: cased wash boring		Hammer Type: auto hammer	
Boring Location: per plan (B4D); see remarks		Casing ID/OD: HW to 4.0 ft/ NW to 13.1 ft		Hammer Efficiency: 0.906	
		Auger ID/OD: n/a		Water Level*: n/a	
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 METHOD: SSA=solid stem auger/HSA=hollow stem auger/RC=roller cone LABORATORY TEST RESULTS: LL=Liquid Limit / PL=Plastic Limit / PI=Plasticity Index WC = water content, percent -#200 = percent fines from grain size analysis UCT qp = peak compressive strength of rock					

Depth (ft.)	Sample Information							Graphic Log	Visual Description and Remarks	Lab. Testing Results
	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (6 in.) Shear Strength (psf) or RQD (%)	N-uncorrected	N-60	Casing Blows			
0	1D	24/11	0.0 - 2.0	WOR-1-7-4	3"dia		PUSH			1D: Dark brown, Organic Silty fine to coarse SAND, some gravel. Decomposed rock in tip of spoon. 1.5 ft: Decomposed rock based on drilling behavior and sample 1D. 4.8 ft: Rock appears more competent based on drilling behavior. 9.0 ft: Material softer. 2D: Brown, Silty GRAVEL, some fine to coarse sand; gravel appears to be decomposed rock. 11.0 ft: Firmer material. Top of bedrock at Elev. -24.7 ft. R1: Bedrock: Hard, slightly weathered, aphanitic to fine grained, rust grey, METAPELITE with highly undulating, typically moderately dipping remnant bedding, mica (biotite) rich zones, and occasional calcisilicate veins. Typically close, moderately dipping breaks; undulating, rough, dull, discolored, often decomposed, and open. Fracture zone from 14.1 to 14.6 ft; decomposed fractures from 16.3 to 16.7 and 17.0 to 17.7 ft. (Rocks of Islesboro Fm) Core times: 1:15/ 1:00/ 0:55/ 0:55/ 0:45 min:sec/ft ROCK QUALITY = FAIR R2: Similar to R1. Fracture zones from 18.0 to 18.3 and 20.7 to 21.2 ft; decomposed fractures from 18.8 to 19.7 and 21.1 to 22.5 ft. 1:10/ 1:20/ 1:05/ 1:10 min:sec/ft ROCK QUALITY = POOR R3: Similar to R1. Majority of material lost between 24.5 and 27.2 ft. Fracture zone from 22.8 to 23.7 ft 1:25/ 1:15/ 0:50/ 1:05/ 1:05 min:sec/ft ROCK QUALITY = VERY POOR
							14			
							80			
							134			
5							RC			
10	2D	15/8	10.0 - 11.3	10-21-50/3"						
	R1	60/60	13.0 - 18.0	RQD: 33%=55%			NQ2	-24.7		
15				sample 15.0-15.7						
	R2	57/57	18.0 - 22.8	RQD: 24%=42%						
20										
	R3	60/38	22.8 - 27.8	RQD: 8%=13%						
25				sample 23.7-24.3						

Remarks:
 8/21/18; 0748 hrs: 10.4' top dolphin #2 to water; 7.7' barge deck to water; 28.7' barge deck to mudline
 top of dolphin #2: elev. 19.73 ft MLLW
 39.5' perpendicular to a line between the cleats on dolphins #2 and #3 to borehole; perpendicular line runs approx. 8.5' from dolphin #2 cleat toward dolphin #3.

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 1 of 3
Boring No.: MB-ISLES-104-18

 SCHONEWALD ENGINEERING ASSOCIATES, INC.		PROJECT: Fender System Modifications Maine State Ferry Terminal LOCATION: Islesboro, Maine		Boring No.: MB-ISLES-104-18 WIN: 23484.00	
Driller: New England Boring Contractors		Elevation (ft.): -11.7 ft (mudline)		Core Barrel: NQ2 (wireline)	
Operator: Enos / Share		Datum: MLLW		Sampler: standard split spoon	
Logged By: Schonewald		Rig Type: Mobile Drill B-53		Hammer Wt./Fall: 140 lbs / 30 inches	
Date Start/Finish: 8/21/18; 0750-1220		Drilling Method: cased wash boring		Hammer Type: auto hammer	
Boring Location: per plan (B4D); see remarks		Casing ID/OD: HW to 4.0 ft/ NW to 13.1 ft		Hammer Efficiency: 0.906	
		Auger ID/OD: n/a		Water Level*: n/a	
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 -- = not recorded	
BOREHOLE ADVANCEMENT METHOD: SSA=solid stem auger/HSA=hollow stem auger/RC=roller cone LABORATORY TEST RESULTS: LL=Liquid Limit / PL=Plastic Limit / PI=Plasticity Index WC = water content, percent -#200 = percent fines from grain size analysis UCT qp = peak compressive strength of rock					

Depth (ft.)	Sample Information								Graphic Log	Visual Description and Remarks	Lab. Testing Results
	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (6 in.) Shear Strength (psf) or RQD (%)	N-uncorrected	N-60	Casing Blows	Elevation (ft.)			
25										R4: (27.8 to 32.3 ft) Similar to R1. Majority of material lost between 27.9 to 30.3 ft. Major high angle calcsilicate vein 31.5 to 32.3 ft. R4A: (32.3 to 34.8 ft) Hard, typically fresh, aphanitic to fine grained, grey, METAPELITE with highly undulating, typically moderately dipping remnant bedding and occasional calcsilicate veins. Close to moderately spaced, typically moderately dipping breaks; undulating, rough, dull, typically discolored, and open. (Rocks of Islesboro Fm) --/ 1:05/ 0:25/ 1:20/ 1:45/ 1:55/ 1:45 min:sec/ft ROCK QUALITY = FAIR (for btm 60")	UCT qp= 5.24 ksi
	R4	84/57	27.8 - 34.8	RQD: 38"=63%							
				RQD for btm 60"							
30											
35	R5	60/60	34.8 - 39.8	RQD: 46"=78%							
40	R6	60/60	39.8 - 44.8	RQD: 37"=62%							
				sample 39.9-40.2							
45	R7	60/60	44.8 - 49.8	RQD: 36"=60%							
50	R8	60/60	49.8 - 54.8	RQD: 59"=98%							

Remarks:
 8/21/18; 0748 hrs: 10.4' top dolphin #2 to water; 7.7' barge deck to water; 28.7' barge deck to mudline
 top of dolphin #2: elev. 19.73 ft MLLW
 39.5' perpendicular to a line between the cleats on dolphins #2 and #3 to borehole; perpendicular line runs approx. 8.5' from dolphin #2 cleat toward dolphin #3.

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 2 of 3
Boring No.: MB-ISLES-104-18

[illegible]



APPENDIX B

ROCK CORE PHOTOGRAPHS



Photo 1: Core box containing rock core from test boring MB-ISLES-101; left side of core box (top portion of cores).

Slots from top to bottom:

- 1) MB-ISLES-101, R1;
- 2) MB-ISLES-101, R2;
- 3) MB-ISLES-101, R3;
- 4) Empty.



Photo 2: Core box containing rock core from test boring MB-ISLES-101; right side of core box (bottom portion of cores).

Slots from top to bottom:

- 1) MB-ISLES-101, R1;
- 2) MB-ISLES-101, R2;
- 3) MB-ISLES-101, R3;
- 4) Empty.

ROCK CORE PHOTOGRAPHS
FENDER SYSTEM MODIFICATIONS
MAINE STATE FERRY TERMINAL
ISLESBORO, MAINE
MAINEDOT WIN 23484.00

SCHONEWALD
ENGINEERING
ASSOCIATES, INC.

Sheet No.:

1 of 8

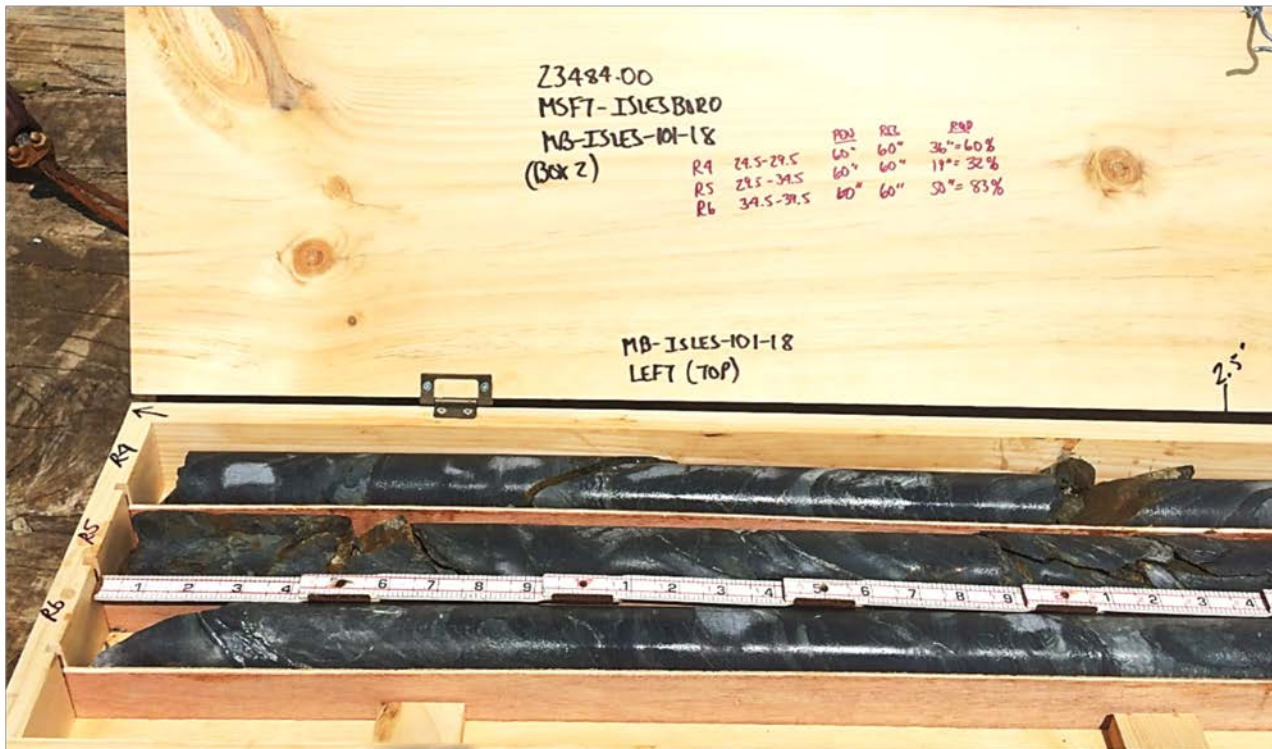


Photo 3: Core box containing wetted rock core from test boring MB-ISLES-101; left side of core box (top portion of cores).

Slots from top to bottom:

- 1) MB-ISLES-101, R4;
- 2) MB-ISLES-101, R5;
- 3) MB-ISLES-101, R6;
- 4) Empty.



Photo 4: Core box containing wetted rock core from test boring MB-ISLES-101; right side of core box (bottom portion of cores).

Slots from top to bottom:

- 1) MB-ISLES-101, R4;
- 2) MB-ISLES-101, R5;
- 3) MB-ISLES-101, R6;
- 4) Empty.

ROCK CORE PHOTOGRAPHS
FENDER SYSTEM MODIFICATIONS
MAINE STATE FERRY TERMINAL
ISLESBORO, MAINE
MAINEDOT WIN 23484.00

SCHONEWALD
ENGINEERING
ASSOCIATES, INC.

Sheet No.:

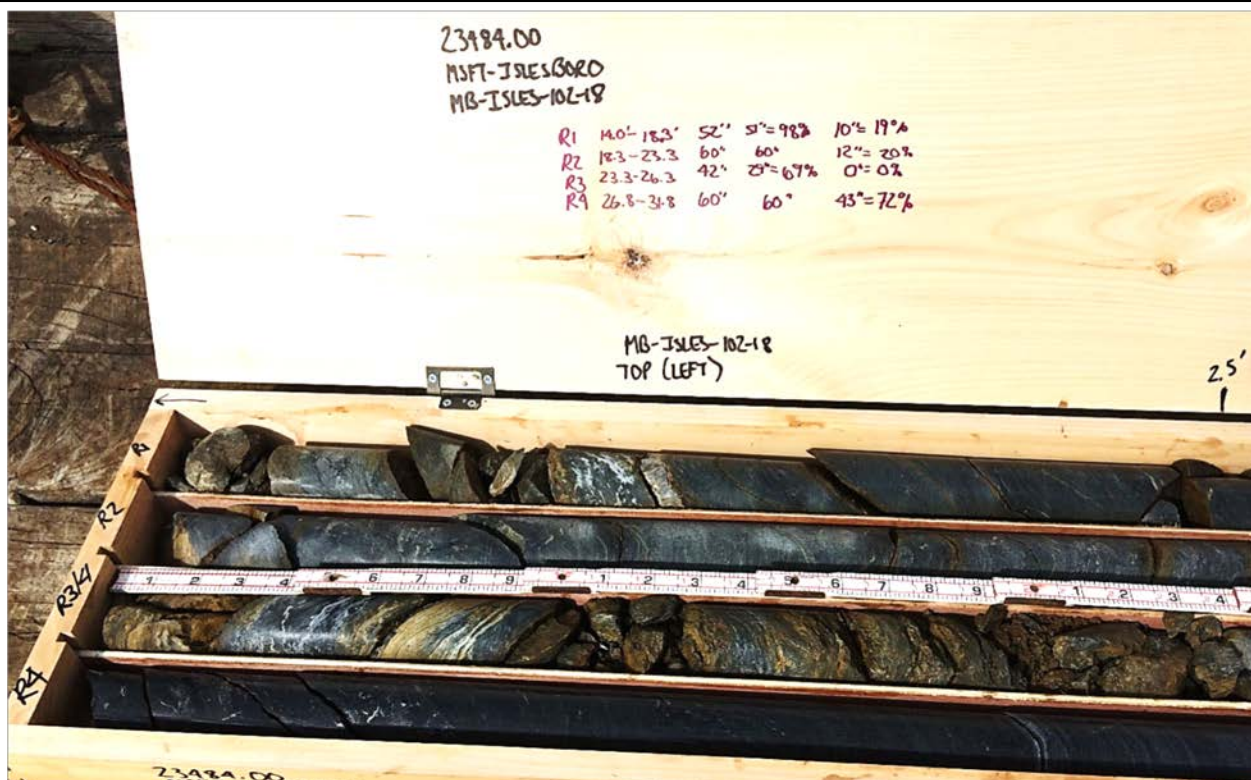


Photo 5: Core box containing wetted rock core from test boring MB-ISLES-102; left side of core box (top portion of cores). Slots from top to bottom:

- 1) MB-ISLES-102, R1;
- 2) MB-ISLES-102, R2;
- 3) MB-ISLES-102, R3/R4;
- 4) MB-ISLES-102, R4.



Photo 6: Core box containing wetted rock core from test boring MB-ISLES-102; right side of core box (bottom portion of cores).

Slots from top to bottom:

- 1) MB-ISLES-102, R1;
- 2) MB-ISLES-102, R2;
- 3) MB-ISLES-102, R4;
- 4) Empty.



Photo 7: Core box containing wetted rock core from test boring MB-ISLES-102; left side of core box (top portion of cores). Slots from top to bottom:

- 1) MB-ISLES-102, R5;
- 2) MB-ISLES-102, R6;
- 3) MB-ISLES-102, R7;
- 4) Empty.



Photo 8: Core box containing wetted rock core from test boring MB-ISLES-102; right side of core box (bottom portion of cores).

Slots from top to bottom:

- 1) MB-ISLES-102, R5;
- 2) MB-ISLES-102, R6;
- 3) MB-ISLES-102, R7;
- 4) Empty.



Photo 9: Core box containing wetted rock core from test boring MB-ISLES-103; left side of core box (top portion of cores).

Slots from top to bottom:

- 1) MB-ISLES-103, R1/R2;
- 2) MB-ISLES-103, R3;
- 3) MB-ISLES-103, R4;
- 4) Empty.



Photo 10: Core box containing wetted rock core from test boring MB-ISLES-103; right side of core box (bottom portion of cores).

Slots from top to bottom:

- 1) MB-ISLES-103, R2;
- 2) MB-ISLES-103, R3;
- 3) MB-ISLES-103, R4;
- 4) Empty.



Photo 11: Core box containing wetted rock core from test boring MB-ISLES-103; left side of core box (top portion of cores).

Slots from top to bottom:

- 1) MB-ISLES-103, R5;
- 2) MB-ISLES-103, R6;
- 3) MB-ISLES-103, R7;
- 4) Empty.



Photo 12: Core box containing wetted rock core from test boring MB-ISLES-103; right side of core box (bottom portion of cores).

Slots from top to bottom:

- 1) MB-ISLES-103, R5;
- 2) MB-ISLES-103, R6;
- 3) MB-ISLES-103, R7;
- 4) Empty.



Photo 13: Core box containing wetted rock core from test boring MB-ISLES-104; left side of core box (top portion of cores).

Slots from top to bottom:

- 1) MB-ISLES-104, R1;
- 2) MB-ISLES-104, R2;
- 3) MB-ISLES-104, R3;
- 4) MB-ISLES-104, R4.



Photo 14: Core box containing wetted rock core from test boring MB-ISLES-104; right side of core box (bottom portion of cores).

Slots from top to bottom:

- 1) MB-ISLES-104, R1;
- 2) MB-ISLES-104, R2;
- 3) MB-ISLES-104, R3/R4;
- 4) MB-ISLES-104, R4.

ROCK CORE PHOTOGRAPHS
FENDER SYSTEM MODIFICATIONS
MAINE STATE FERRY TERMINAL
ISLESBORO, MAINE
MAINEDOT WIN 23484.00

SCHONEWALD
ENGINEERING
ASSOCIATES, INC.

Sheet No.:



Photo 15: Core box containing wetted rock core from test boring MB-ISLES-104; left side of core box (top portion of cores).

Slots from top to bottom:

- 1) MB-ISLES-104, R5;
- 2) MB-ISLES-104, R6;
- 3) MB-ISLES-104, R7;
- 4) MB-ISLES-104, R8.



ROCK CORE PHOTOGRAPHS
FENDER SYSTEM MODIFICATIONS
MAINE STATE FERRY TERMINAL
ISLESBORO, MAINE
MAINEDOT WIN 23484.00

Photo 16: Core box containing wetted rock core from test boring MB-ISLES-104; right side of core box (bottom portion of cores).

Slots from top to bottom:

- 1) MB-ISLES-104, R5;
- 2) MB-ISLES-104, R6;
- 3) MB-ISLES-104, R7;
- 4) MB-ISLES-104, R8.

Sheet No.:



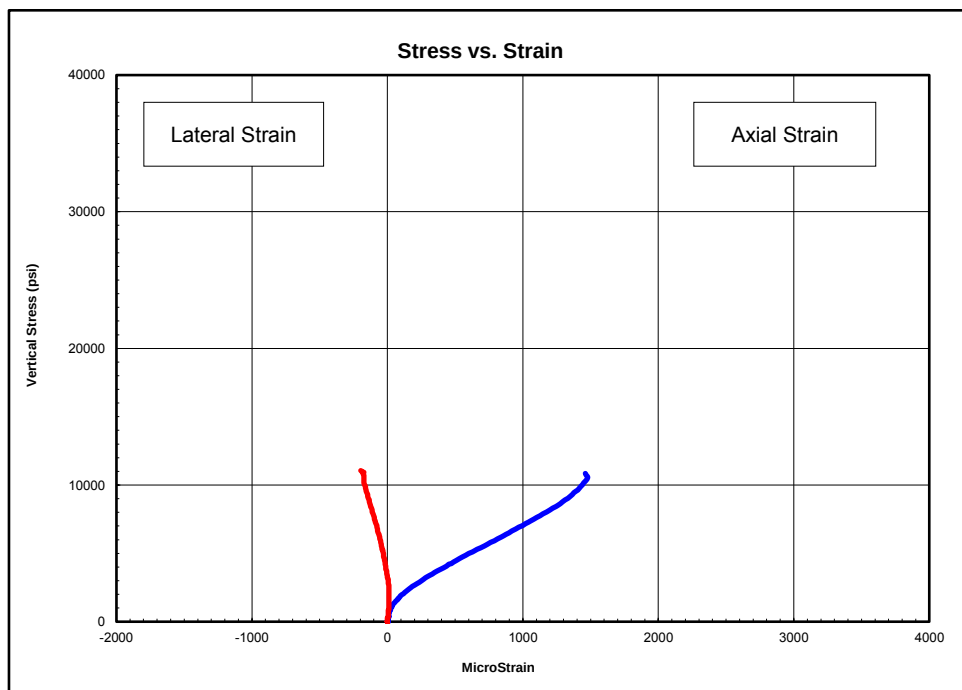
APPENDIX C

LABORATORY TEST REPORTS



Client:	Shonewald Engineering Associates, Inc.
Project Name:	MeDOT WIN 23484.00 MSFT Islesboro, ME
Project Location:	Islesboro, ME
GTX #:	308806
Test Date:	9/25/2018
Tested By:	tlm
Checked By:	jsc
Boring ID:	MB-ISLES-101
Sample ID:	R1
Depth, ft:	10.0-10.5
Sample Type:	rock core
Sample Description:	See photographs Intact material failure

Compressive Strength and Elastic Moduli of Rock by ASTM D7012 - Method D



Peak Compressive Stress: 11,054 psi

Stress Range, psi	Young's Modulus, psi	Poisson's Ratio
1100-4100	7,360,000	0.07
4100-7000	5,230,000	0.12
7000-9900	6,340,000	0.19

Notes: Test specimen tested at the approximate as-received moisture content and at standard laboratory temperature.
The axial load was applied continuously at a stress rate that produced failure in a test time between 2 and 15 minutes.
Young's Modulus and Poisson's Ratio calculated using the tangent to the line in the stress range listed.
Calculations assume samples are isotropic, which is not necessarily the case.

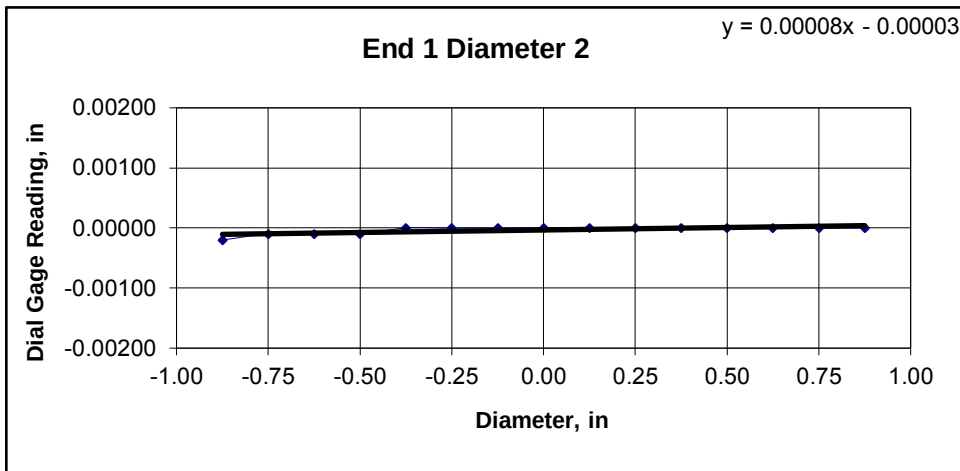
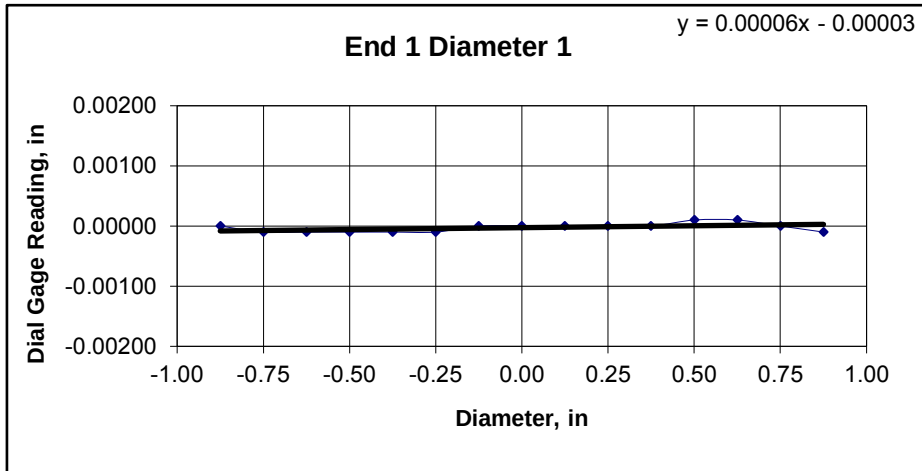


Client:	Shonewald Engineering Associates, Inc.	Test Date:	9/21/2018
Project Name:	MeDOT WIN 23484.00 MSFT Islesboro, ME	Tested By:	tlm
Project Location:	Islesboro, ME	Checked By:	jsc
GTX #:	308806		
Boring ID:	MB-ISLES-101		
Sample ID:	R1		
Depth:	10.0-10.5 ft		
Visual Description:	See photographs		

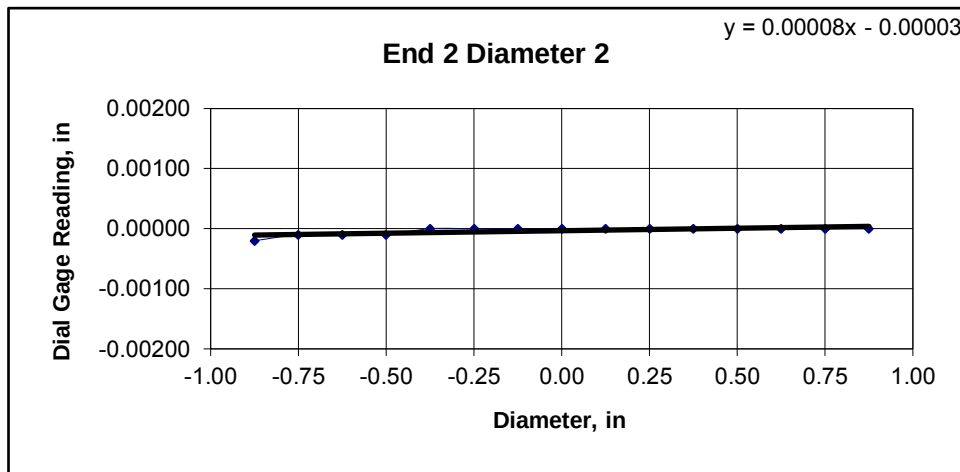
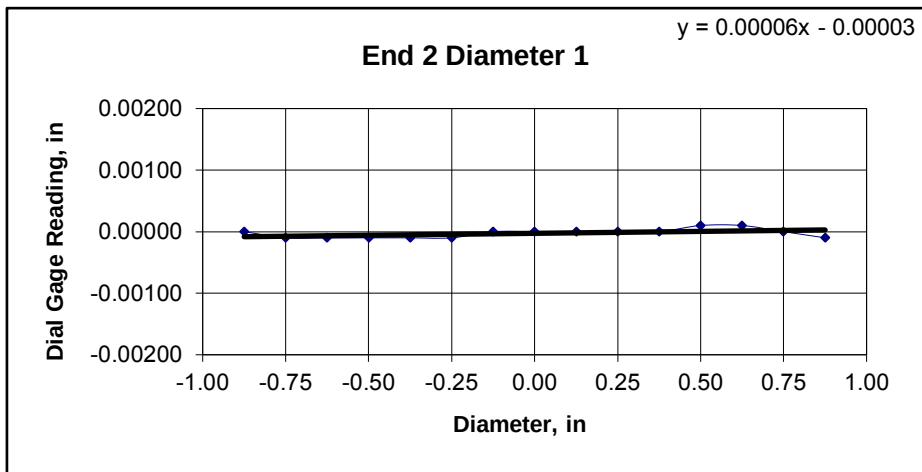
UNIT WEIGHT DETERMINATION AND DIMENSIONAL AND SHAPE TOLERANCES OF ROCK CORE SPECIMENS BY ASTM D4543

BULK DENSITY				DEVIATION FROM STRAIGHTNESS (Procedure S1)	
	1	2	Average	Maximum gap between side of core and reference surface plate:	
Specimen Length, in:	4.27	4.27	4.27	Is the maximum gap $\leq$ 0.02 in.?	
Specimen Diameter, in:	1.99	1.99	1.99	YES	
Specimen Mass, g:	592.79			Maximum difference must be < 0.020 in.	
Bulk Density, lb/ft ³	170	Minimum Diameter Tolerance Met?		Straightness Tolerance Met?	
Length to Diameter Ratio:	2.1	Length to Diameter Ratio Tolerance Met?		YES	
		YES			
		YES			

END FLATNESS AND PARALLELISM (Procedure FP1)															
END 1	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	0.00000	-0.00010	-0.00010	-0.00010	-0.00010	-0.00010	0.00000	0.00000	0.00000	0.00000	0.00000	0.00010	0.00010	0.00000	-0.00010
Diameter 2, in (rotated 90°)	-0.00020	-0.00010	-0.00010	-0.00010	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
Difference between max and min readings, in:															
0° = 0.00020 90° = 0.00020															
END 2	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	0.00000	-0.00010	-0.00010	-0.00010	-0.00010	-0.00010	0.00000	0.00000	0.00000	0.00000	0.00000	0.00010	0.00010	0.00000	-0.00010
Diameter 2, in (rotated 90°)	-0.00020	-0.00010	-0.00010	-0.00010	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
Difference between max and min readings, in:															
0° = 0.0002 90° = 0.0002															
Maximum difference must be < 0.0020 in. Difference = $\pm$ 0.00010															
Flatness Tolerance Met?															
YES															



DIAMETER 1	
End 1:	
Slope of Best Fit Line	0.00006
Angle of Best Fit Line:	0.00360
End 2:	
Slope of Best Fit Line	0.00006
Angle of Best Fit Line:	0.00360
Maximum Angular Difference:	0.00000
Parallelism Tolerance Met?	YES
Spherically Seated	



DIAMETER 2	
End 1:	
Slope of Best Fit Line	0.00008
Angle of Best Fit Line:	0.00475
End 2:	
Slope of Best Fit Line	0.00008
Angle of Best Fit Line:	0.00475
Maximum Angular Difference:	0.00000
Parallelism Tolerance Met?	YES
Spherically Seated	

PERPENDICULARITY (Procedure P1)						(Calculated from End Flatness and Parallelism measurements above)	
END 1	Difference, Maximum and Minimum (in.)	Diameter (in.)	Slope	Angle°	Perpendicularity Tolerance Met?	Maximum angle of departure must be $\leq$ 0.25°	
Diameter 1, in	0.00020	1.990	0.00010	0.006	YES		
Diameter 2, in (rotated 90°)	0.00020	1.990	0.00010	0.006	YES	Perpendicularity Tolerance Met?	
						YES	
END 2							
Diameter 1, in	0.00020	1.990	0.00010	0.006	YES		
Diameter 2, in (rotated 90°)	0.00020	1.990	0.00010	0.006	YES		

Client:	Schonewald Engineering Associates, Inc.
Project Name:	MeDOT WIN 23484.00 MSFT Islesboro, ME
Project Location:	Islesboro, ME
GTX #:	308806
Test Date:	9/21/2018
Tested By:	tlm
Checked By:	jsc
Boring ID:	MB-ISLES-101
Sample ID:	R1
Depth, ft:	10.0-10.5



After cutting and grinding

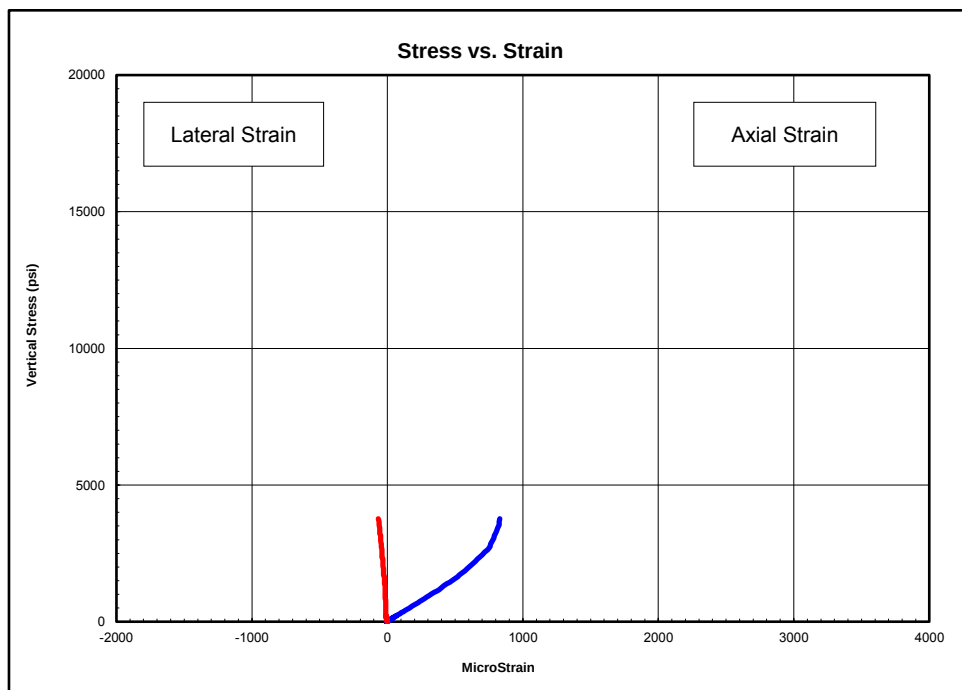


After break



Client:	Shonewald Engineering Associates, Inc.
Project Name:	MeDOT WIN 23484.00 MSFT Isleboro, ME
Project Location:	Islesboro, ME
GTX #:	308806
Test Date:	9/25/2018
Tested By:	tlm
Checked By:	jsc
Boring ID:	MB-ISLES-101
Sample ID:	R3
Depth, ft:	20.1-20.8
Sample Type:	rock core
Sample Description:	See photographs Intact material failure

Compressive Strength and Elastic Moduli of Rock by ASTM D7012 - Method D



Peak Compressive Stress: 8,150 psi

The strain gauges failed before the peak value was attained.

Stress Range, psi	Young's Modulus, psi	Poisson's Ratio
800-3000	3,970,000	0.07
3000-5200	---	---
5200-7300	---	---

Notes: Test specimen tested at the approximate as-received moisture content and at standard laboratory temperature.
The axial load was applied continuously at a stress rate that produced failure in a test time between 2 and 15 minutes.
Young's Modulus and Poisson's Ratio calculated using the tangent to the line in the stress range listed.
Calculations assume samples are isotropic, which is not necessarily the case.

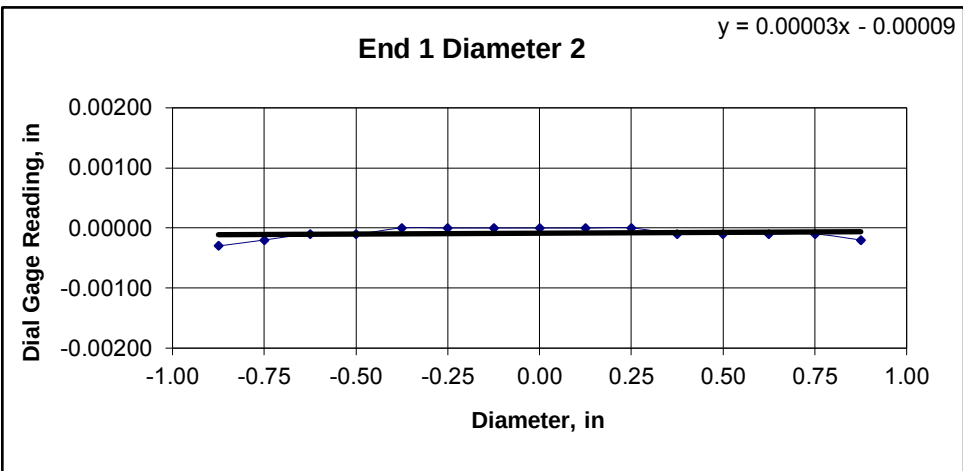
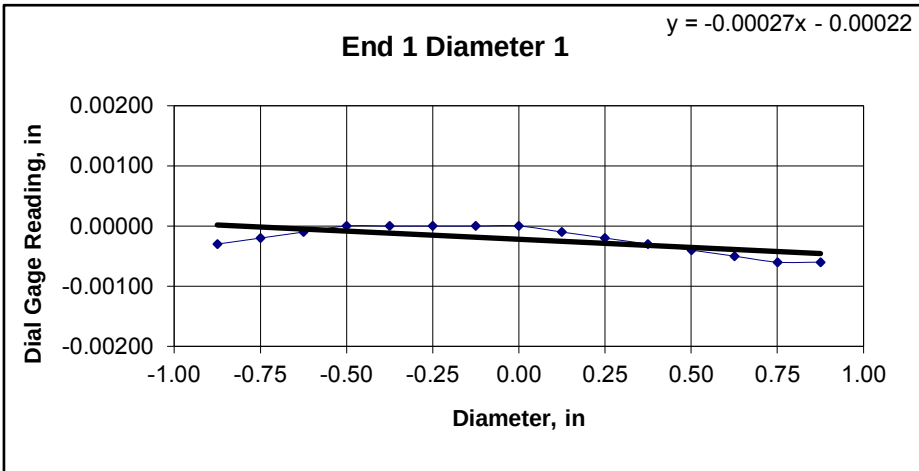


Client:	Shonewald Engineering Associates, Inc.	Test Date:	9/21/2018
Project Name:	MeDOT WIN 23484.00 MSFT Islesboro, ME	Tested By:	tlm
Project Location:	Islesboro, ME	Checked By:	jsc
GTX #:	308806		
Boring ID:	MB-ISLES-101		
Sample ID:	R3		
Depth:	20.1-20.8 ft		
Visual Description:	See photographs		

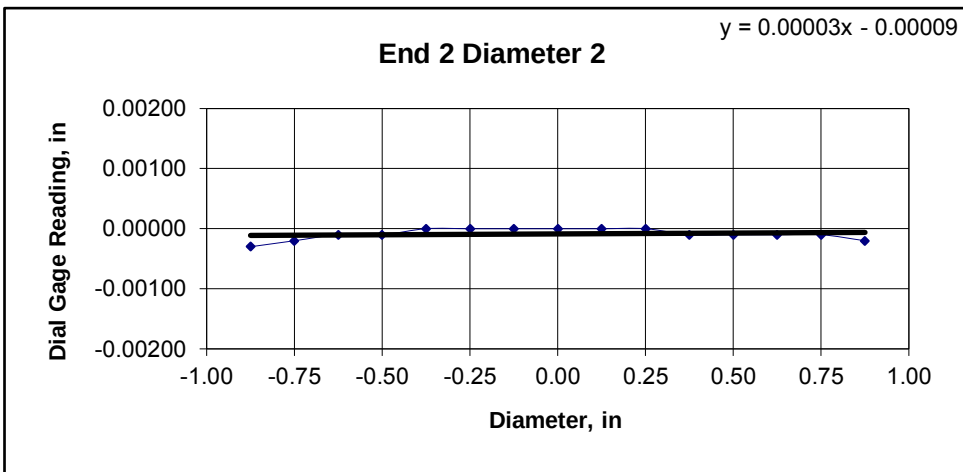
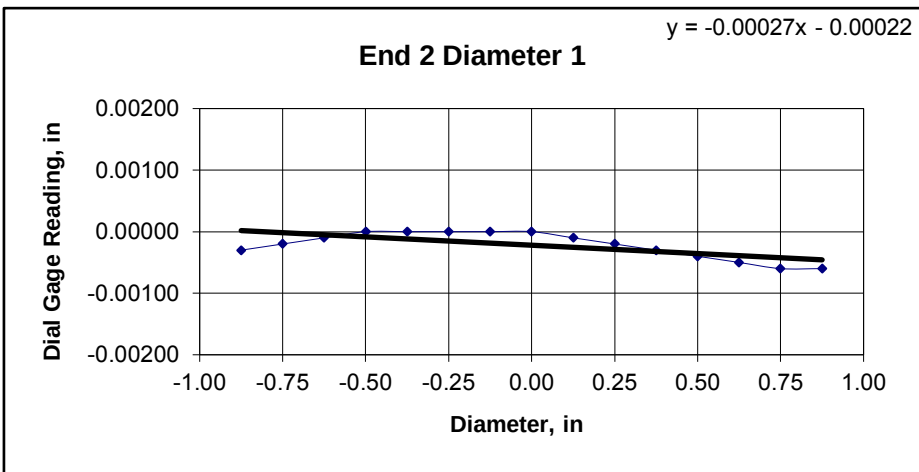
UNIT WEIGHT DETERMINATION AND DIMENSIONAL AND SHAPE TOLERANCES OF ROCK CORE SPECIMENS BY ASTM D4543

BULK DENSITY				DEVIATION FROM STRAIGHTNESS (Procedure S1)	
	1	2	Average	Maximum gap between side of core and reference surface plate:	
Specimen Length, in:	4.20	4.20	4.20	Is the maximum gap $\leq$ 0.02 in.?	
Specimen Diameter, in:	1.99	1.99	1.99	YES	
Specimen Mass, g:	581.59			Maximum difference must be < 0.020 in.	
Bulk Density, lb/ft ³	169			Straightness Tolerance Met?	
Length to Diameter Ratio:	2.1			YES	
		Minimum Diameter Tolerance Met?	YES		
		Length to Diameter Ratio Tolerance Met?	YES		

END FLATNESS AND PARALLELISM (Procedure FP1)															
END 1	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	-0.00030	-0.00020	-0.00010	0.00000	0.00000	0.00000	0.00000	0.00000	-0.00010	-0.00020	-0.00030	-0.00040	-0.00050	-0.00060	-0.00060
Diameter 2, in (rotated 90°)	-0.00030	-0.00020	-0.00010	-0.00010	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	-0.00010	-0.00010	-0.00010	-0.00010	-0.00020
Difference between max and min readings, in:															
0° = 0.00060 90° = 0.00030															
END 2	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	-0.00030	-0.00020	-0.00010	0.00000	0.00000	0.00000	0.00000	0.00000	-0.00010	-0.00020	-0.00030	-0.00040	-0.00050	-0.00060	-0.00060
Diameter 2, in (rotated 90°)	-0.00030	-0.00020	-0.00010	-0.00010	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	-0.00010	-0.00010	-0.00010	-0.00010	-0.00020
Difference between max and min readings, in:															
0° = 0.0006 90° = 0.0003															
Maximum difference must be < 0.0020 in. Difference = $\pm$ 0.00030															
Flatness Tolerance Met?															
YES															



DIAMETER 1	
End 1:	
Slope of Best Fit Line	0.00027
Angle of Best Fit Line:	0.01555
End 2:	
Slope of Best Fit Line	0.00027
Angle of Best Fit Line:	0.01555
Maximum Angular Difference:	0.00000
Parallelism Tolerance Met?	YES
Spherically Seated	



DIAMETER 2	
End 1:	
Slope of Best Fit Line	0.00003
Angle of Best Fit Line:	0.00164
End 2:	
Slope of Best Fit Line	0.00003
Angle of Best Fit Line:	0.00164
Maximum Angular Difference:	0.00000
Parallelism Tolerance Met?	YES
Spherically Seated	

PERPENDICULARITY (Procedure P1)						Perpendicularity Tolerance Met?	Maximum angle of departure must be $\leq$ 0.25°
	(Calculated from End Flatness and Parallelism measurements above)						
END 1	Difference, Maximum and Minimum (in.)	Diameter (in.)	Slope	Angle°			
Diameter 1, in	0.00060	1.990	0.00030	0.017	YES		
Diameter 2, in (rotated 90°)	0.00030	1.990	0.00015	0.009	YES		
Perpendicularity Tolerance Met?							YES
END 2							
Diameter 1, in	0.00060	1.990	0.00030	0.017	YES		
Diameter 2, in (rotated 90°)	0.00030	1.990	0.00015	0.009	YES		

Client:	Schonewald Engineering Associates, Inc.
Project Name:	MeDOT WIN 23484.00 MSFT Islesboro, ME
Project Location:	Islesboro, ME
GTX #:	308806
Test Date:	9/21/2018
Tested By:	tlm
Checked By:	jsc
Boring ID:	MB-ISLES-101
Sample ID:	R3
Depth, ft:	20.1-20.8



After cutting and grinding

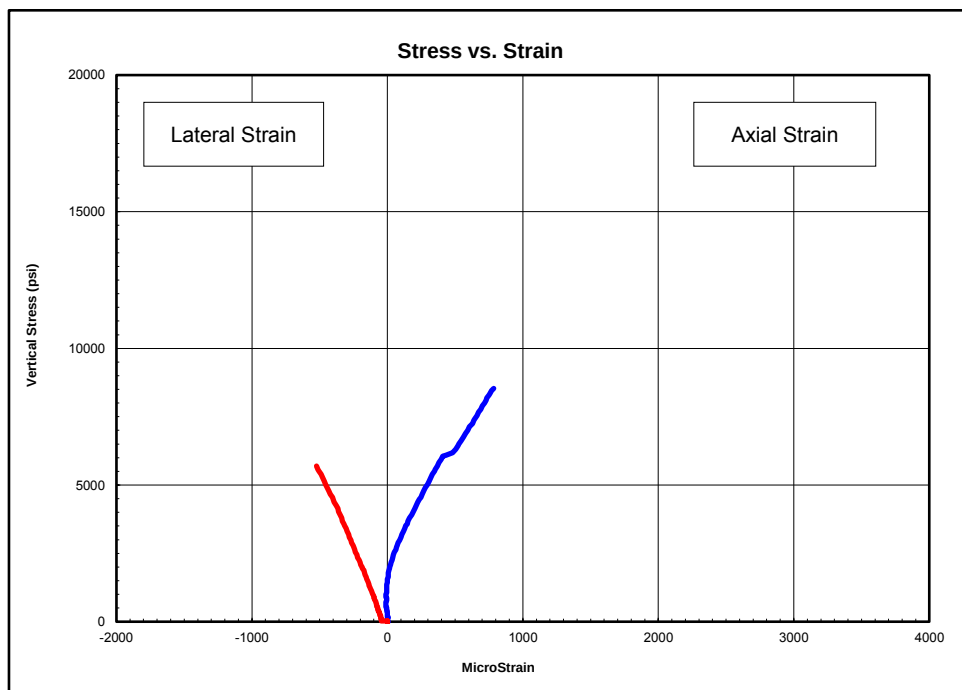


After break



Client:	Shonewald Engineering Associates, Inc.
Project Name:	MeDOT WIN 23484.00 MSFT Islesboro, ME
Project Location:	Islesboro, ME
GTX #:	308806
Test Date:	9/25/2018
Tested By:	tlm
Checked By:	jsc
Boring ID:	MB-ISLES-101
Sample ID:	R4
Depth, ft:	24.6-25.2
Sample Type:	rock core
Sample Description:	See photographs Intact material failure

Compressive Strength and Elastic Moduli of Rock by ASTM D7012 - Method D



Peak Compressive Stress: 8,534 psi

The strain values recorded for this test produce values of Poisson's Ratio that exceed maximum values found in rocks. The lateral strain gauges failed before the peak value was attained.

Stress Range, psi	Young's Modulus, psi	Poisson's Ratio
900-3100	20,600,000	---
3100-5400	9,750,000	---
5400-7700	6,040,000	---

Notes:

- Test specimen tested at the approximate as-received moisture content and at standard laboratory temperature.
- The axial load was applied continuously at a stress rate that produced failure in a test time between 2 and 15 minutes.
- Young's Modulus and Poisson's Ratio calculated using the tangent to the line in the stress range listed.
- Calculations assume samples are isotropic, which is not necessarily the case.

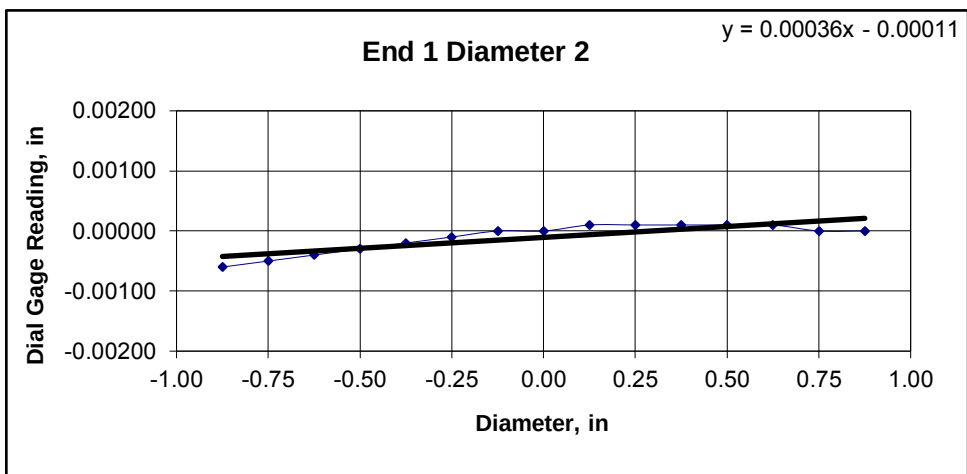
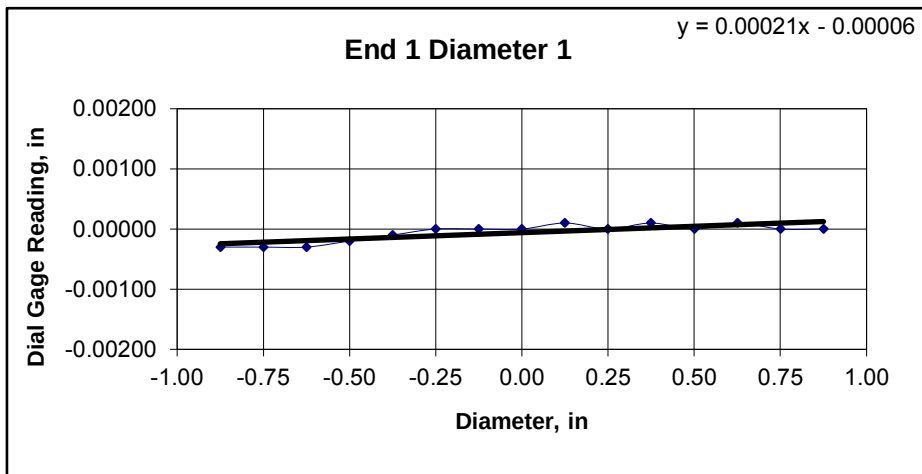


Client:	Shonewald Engineering Associates, Inc.	Test Date:	9/21/2018
Project Name:	MeDOT WIN 23484.00 MSFT Islesboro, ME	Tested By:	tlm
Project Location:	Islesboro, ME	Checked By:	jsc
GTX #:	308806		
Boring ID:	MB-ISLES-101		
Sample ID:	R4		
Depth:	24.6-25.2 ft		
Visual Description:	See photographs		

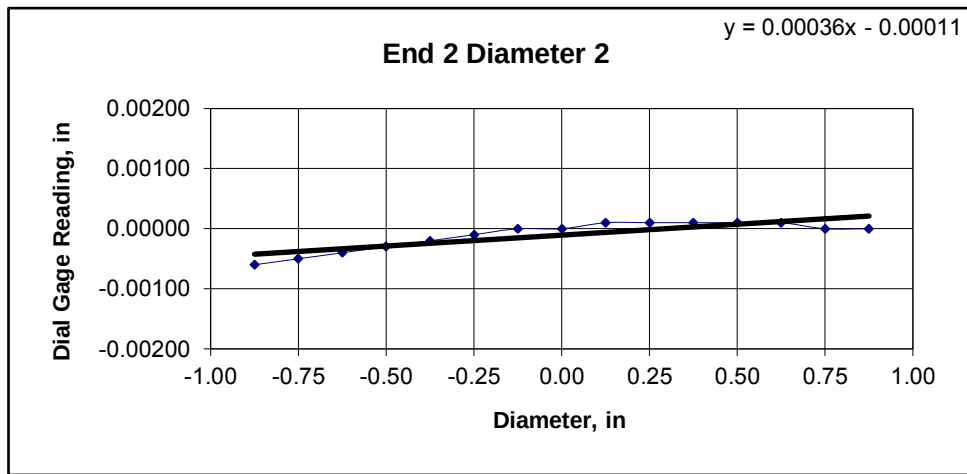
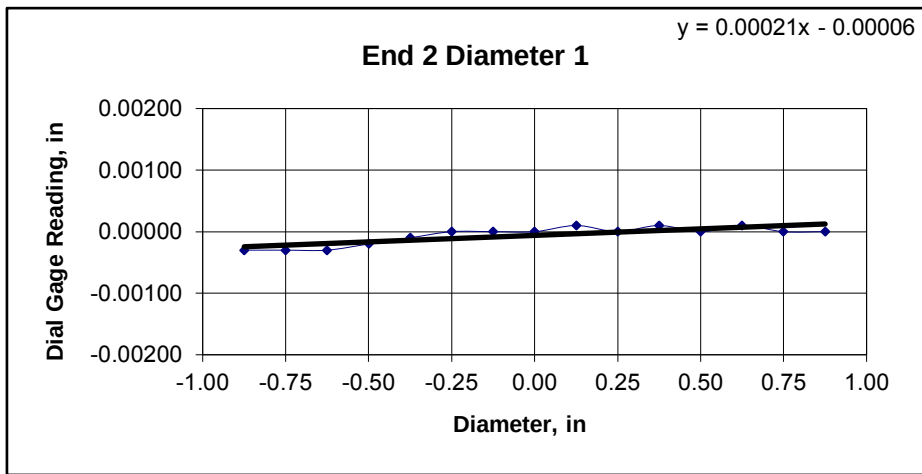
UNIT WEIGHT DETERMINATION AND DIMENSIONAL AND SHAPE TOLERANCES OF ROCK CORE SPECIMENS BY ASTM D4543

BULK DENSITY				DEVIATION FROM STRAIGHTNESS (Procedure S1)	
	1	2	Average	Maximum gap between side of core and reference surface plate: Is the maximum gap $\leq$ 0.02 in.? YES	
Specimen Length, in:	4.36	4.36	4.36	Maximum difference must be < 0.020 in. Straightness Tolerance Met? YES	
Specimen Diameter, in:	1.99	1.99	1.99		
Specimen Mass, g:	614.32				
Bulk Density, lb/ft ³	172				
Length to Diameter Ratio:	2.2	Minimum Diameter Tolerance Met? YES	Length to Diameter Ratio Tolerance Met? YES		

END FLATNESS AND PARALLELISM (Procedure FP1)																
END 1	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875	
Diameter 1, in	-0.00030	-0.00030	-0.00030	-0.00020	-0.00010	0.00000	0.00000	0.00000	0.00010	0.00000	0.00010	0.00000	0.00010	0.00000	0.00000	
Diameter 2, in (rotated 90°)	-0.00060	-0.00050	-0.00040	-0.00030	-0.00020	-0.00010	0.00000	0.00000	0.00010	0.00010	0.00010	0.00010	0.00010	0.00000	0.00000	
											Difference between max and min readings, in:					
											0° = 0.00040		90° = 0.00070			
END 2	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875	
Diameter 1, in	-0.00030	-0.00030	-0.00030	-0.00020	-0.00010	0.00000	0.00000	0.00000	0.00010	0.00000	0.00010	0.00000	0.00010	0.00000	0.00000	
Diameter 2, in (rotated 90°)	-0.00060	-0.00050	-0.00040	-0.00030	-0.00020	-0.00010	0.00000	0.00000	0.00010	0.00010	0.00010	0.00010	0.00010	0.00000	0.00000	
											Difference between max and min readings, in:					
											0° = 0.0004		90° = 0.0007			
											Maximum difference must be < 0.0020 in. Difference = ± 0.00035					
											Flatness Tolerance Met? YES					



DIAMETER 1	
End 1:	
Slope of Best Fit Line	0.00021
Angle of Best Fit Line:	0.01211
End 2:	
Slope of Best Fit Line	0.00021
Angle of Best Fit Line:	0.01211
Maximum Angular Difference:	0.00000
Parallelism Tolerance Met? Spherically Seated	YES



DIAMETER 2	
End 1:	
Slope of Best Fit Line	0.00036
Angle of Best Fit Line:	0.02079
End 2:	
Slope of Best Fit Line	0.00036
Angle of Best Fit Line:	0.02079
Maximum Angular Difference:	0.00000
Parallelism Tolerance Met? Spherically Seated	YES

PERPENDICULARITY (Procedure P1)						Perpendicularity Tolerance Met?	Maximum angle of departure must be $\leq$ 0.25°
	(Calculated from End Flatness and Parallelism measurements above)						
END 1	Difference, Maximum and Minimum (in.)	Diameter (in.)	Slope	Angle°			
Diameter 1, in	0.00040	1.990	0.00020	0.012	YES		
Diameter 2, in (rotated 90°)	0.00070	1.990	0.00035	0.020	YES		
						Perpendicularity Tolerance Met?	YES
END 2							
Diameter 1, in	0.00040	1.990	0.00020	0.012	YES		
Diameter 2, in (rotated 90°)	0.00070	1.990	0.00035	0.020	YES		

Client:	Schonewald Engineering Associates, Inc.
Project Name:	MeDOT WIN 23484.00 MSFT Islesboro, ME
Project Location:	Islesboro, ME
GTX #:	308806
Test Date:	9/21/2018
Tested By:	tlm
Checked By:	jsc
Boring ID:	MB-ISLES-101
Sample ID:	R4
Depth, ft:	24.6-25.2



After cutting and grinding

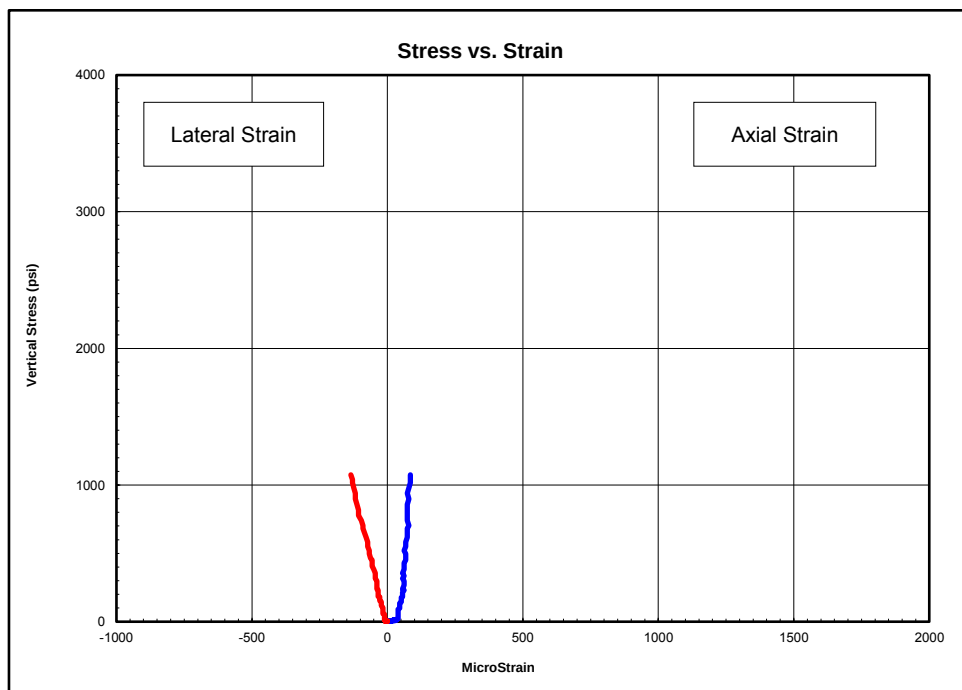


After break



Client:	Shonewald Engineering Associates, Inc.
Project Name:	MeDOT WIN 23484.00 MSFT Isleboro, ME
Project Location:	Islesboro, ME
GTX #:	308806
Test Date:	9/25/2018
Tested By:	tlm
Checked By:	jsc
Boring ID:	MB-ISLES-102
Sample ID:	R2
Depth, ft:	19.5-19.9
Sample Type:	rock core
Sample Description:	See photographs Discontinuity failure

Compressive Strength and Elastic Moduli of Rock by ASTM D7012 - Method D



Peak Compressive Stress: 1,075 psi

The strain values recorded for this test produce values of Poisson's Ratio that exceed maximum values found in rocks.

Stress Range, psi	Young's Modulus, psi	Poisson's Ratio
100-400	10,600,000	---
400-700	17,600,000	---
700-1000	6,130,000	---

Notes: Test specimen tested at the approximate as-received moisture content and at standard laboratory temperature.
The axial load was applied continuously at a stress rate that produced failure in a test time between 2 and 15 minutes.
Young's Modulus and Poisson's Ratio calculated using the tangent to the line in the stress range listed.
Calculations assume samples are isotropic, which is not necessarily the case.

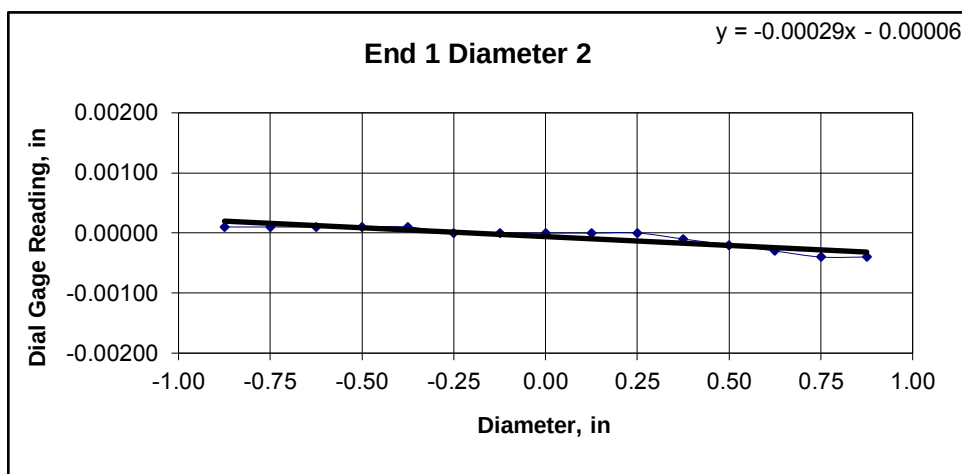
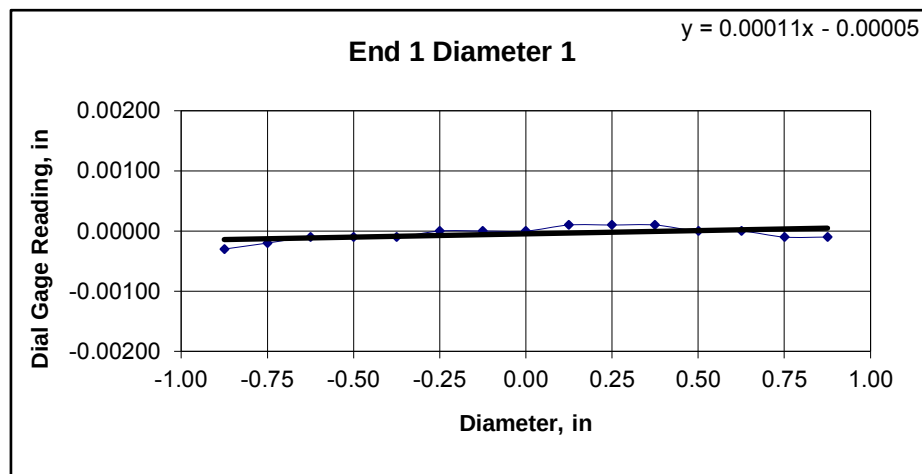


Client:	Shonewald Engineering Associates, Inc.	Test Date:	9/21/2018
Project Name:	MeDOT WIN 23484.00 MSFT Islesboro, ME	Tested By:	tlm
Project Location:	Islesboro, ME	Checked By:	jsc
GTX #:	308806		
Boring ID:	MB-ISLES-102		
Sample ID:	R2		
Depth:	19.5-19.9 ft		
Visual Description:	See photographs		

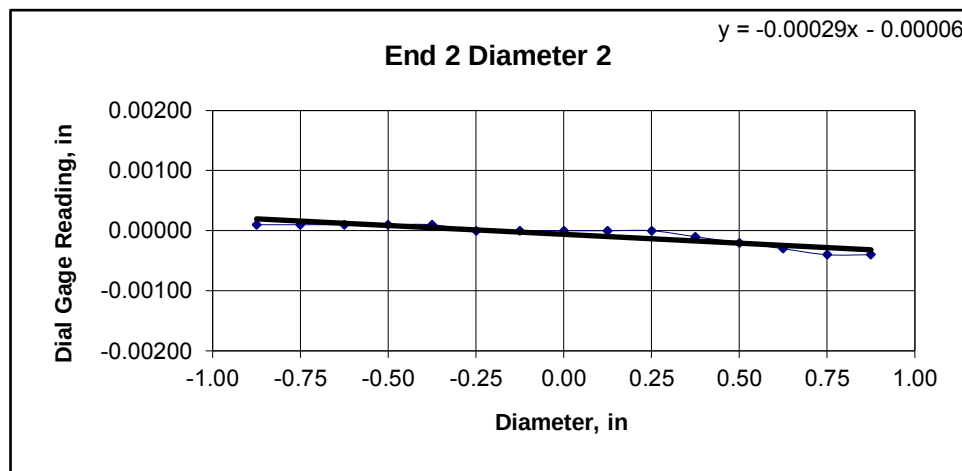
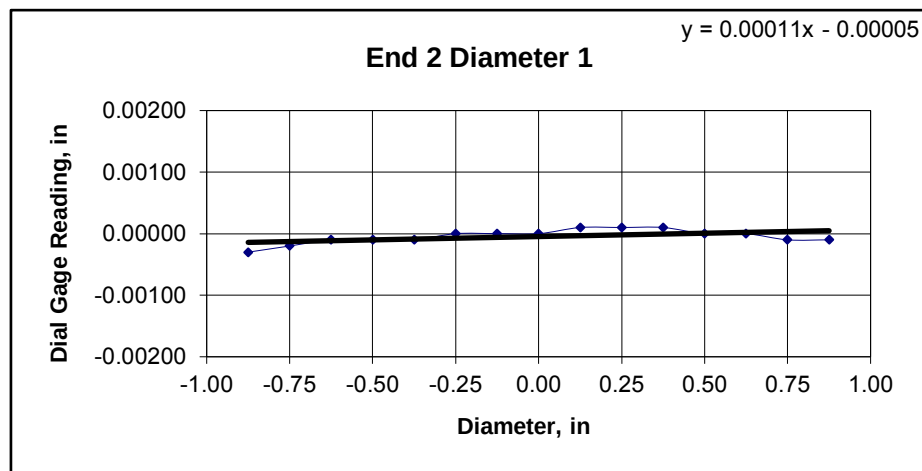
UNIT WEIGHT DETERMINATION AND DIMENSIONAL AND SHAPE TOLERANCES OF ROCK CORE SPECIMENS BY ASTM D4543

BULK DENSITY				DEVIATION FROM STRAIGHTNESS (Procedure S1)	
	1	2	Average	Maximum gap between side of core and reference surface plate:	
Specimen Length, in:	4.21	4.21	4.21	Is the maximum gap $\leq$ 0.02 in.?	
Specimen Diameter, in:	1.99	1.99	1.99	YES	
Specimen Mass, g:	594.24			Maximum difference must be < 0.020 in.	
Bulk Density, lb/ft ³	173			Straightness Tolerance Met?	
Length to Diameter Ratio:	2.1			YES	
		Minimum Diameter Tolerance Met?	YES		
		Length to Diameter Ratio Tolerance Met?	YES		

END FLATNESS AND PARALLELISM (Procedure FP1)															
END 1	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	-0.00030	-0.00020	-0.00010	-0.00010	-0.00010	0.00000	0.00000	0.00000	0.00010	0.00010	0.00010	0.00000	0.00000	-0.00010	-0.00010
Diameter 2, in (rotated 90°)	0.00010	0.00010	0.00010	0.00010	0.00010	0.00000	0.00000	0.00000	0.00000	0.00000	-0.00010	-0.00020	-0.00030	-0.00040	-0.00040
Difference between max and min readings, in:															
0° = 0.00040 90° = 0.00050															
END 2	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	-0.00030	-0.00020	-0.00010	-0.00010	-0.00010	0.00000	0.00000	0.00000	0.00010	0.00010	0.00010	0.00000	0.00000	-0.00010	-0.00010
Diameter 2, in (rotated 90°)	0.00010	0.00010	0.00010	0.00010	0.00010	0.00000	0.00000	0.00000	0.00000	0.00000	-0.00010	-0.00020	-0.00030	-0.00040	-0.00040
Difference between max and min readings, in:															
0° = 0.0004 90° = 0.0005															
Maximum difference must be < 0.0020 in. Difference = $\pm$ 0.00025															
Flatness Tolerance Met?															
YES															



DIAMETER 1	
End 1:	
Slope of Best Fit Line	0.00011
Angle of Best Fit Line:	0.00622
End 2:	
Slope of Best Fit Line	0.00011
Angle of Best Fit Line:	0.00622
Maximum Angular Difference:	0.00000
Parallelism Tolerance Met?	YES
Spherically Seated	



DIAMETER 2	
End 1:	
Slope of Best Fit Line	0.00029
Angle of Best Fit Line:	0.01686
End 2:	
Slope of Best Fit Line	0.00029
Angle of Best Fit Line:	0.01686
Maximum Angular Difference:	0.00000
Parallelism Tolerance Met?	YES
Spherically Seated	

PERPENDICULARITY (Procedure P1)						Maximum angle of departure must be $\leq$ 0.25°	
END 1	Difference, Maximum and Minimum (in.)	Diameter (in.)	Slope	Angle°	Perpendicularity Tolerance Met?		
Diameter 1, in	0.00040	1.990	0.00020	0.012	YES		
Diameter 2, in (rotated 90°)	0.00050	1.990	0.00025	0.014	YES	Perpendicularity Tolerance Met?	YES
END 2							
Diameter 1, in	0.00040	1.990	0.00020	0.012	YES		
Diameter 2, in (rotated 90°)	0.00050	1.990	0.00025	0.014	YES		

Client:	Schonewald Engineering Associates, Inc.
Project Name:	MeDOT WIN 23484.00 MSFT Islesboro, ME
Project Location:	Islesboro, ME
GTX #:	308806
Test Date:	9/21/2018
Tested By:	tlm
Checked By:	jsc
Boring ID:	MB-ISLES-102
Sample ID:	R2
Depth, ft:	19.5-19.9



After cutting and grinding

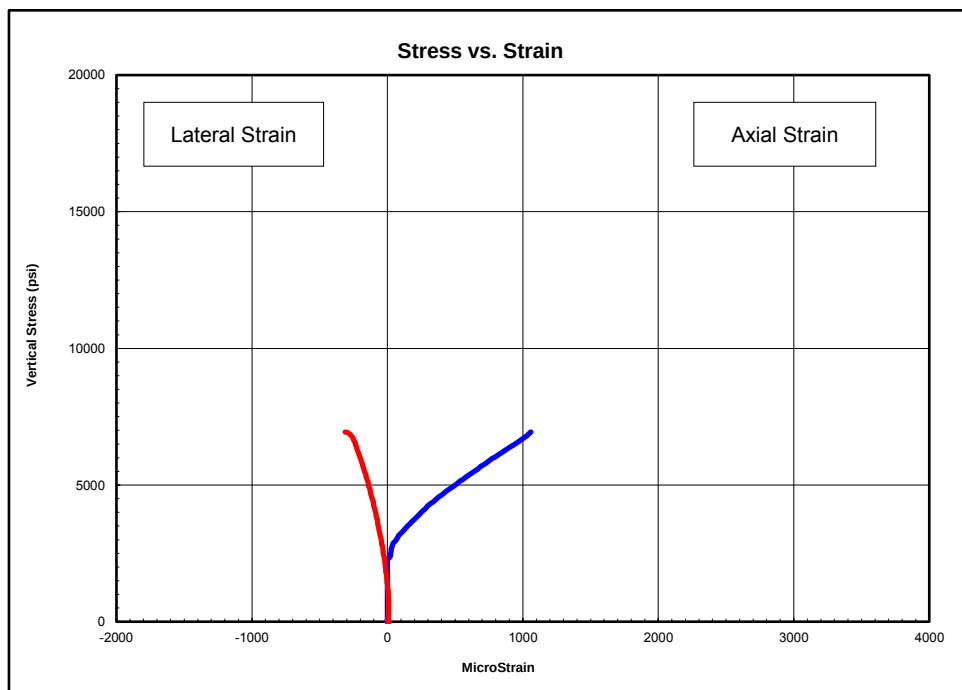


After break



Client:	Shonewald Engineering Associates, Inc.
Project Name:	MeDOT WIN 23484.00 MSFT Islesboro, ME
Project Location:	Islesboro, ME
GTX #:	308806
Test Date:	9/25/2018
Tested By:	tlm
Checked By:	jsc
Boring ID:	MB-ISLES-102
Sample ID:	R4
Depth, ft:	21.7-27.7
Sample Type:	rock core
Sample Description:	See photographs Discontinuity failure

Compressive Strength and Elastic Moduli of Rock by ASTM D7012 - Method D



Peak Compressive Stress: 6,940 psi

Stress Range, psi	Young's Modulus, psi	Poisson's Ratio
700-2500	---	---
2500-4400	5,910,000	0.24
4400-6200	3,560,000	0.21

Notes: Test specimen tested at the approximate as-received moisture content and at standard laboratory temperature.
The axial load was applied continuously at a stress rate that produced failure in a test time between 2 and 15 minutes.
Young's Modulus and Poisson's Ratio calculated using the tangent to the line in the stress range listed.
Calculations assume samples are isotropic, which is not necessarily the case.

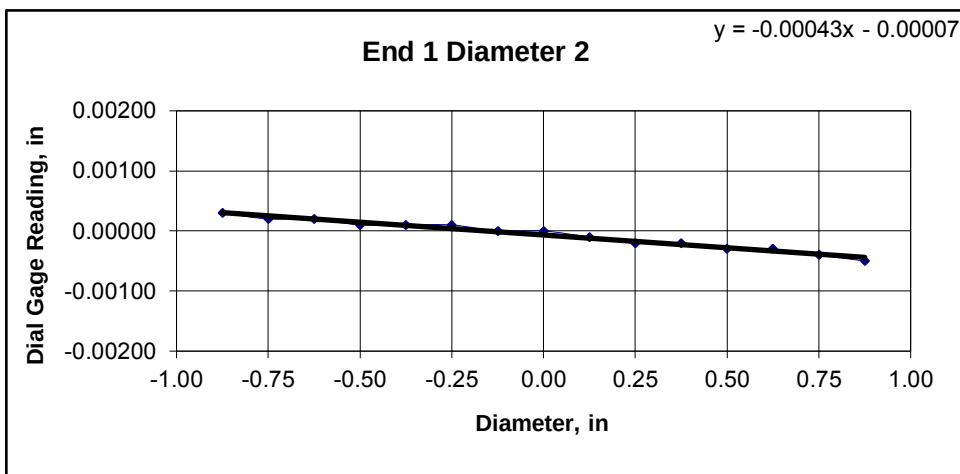
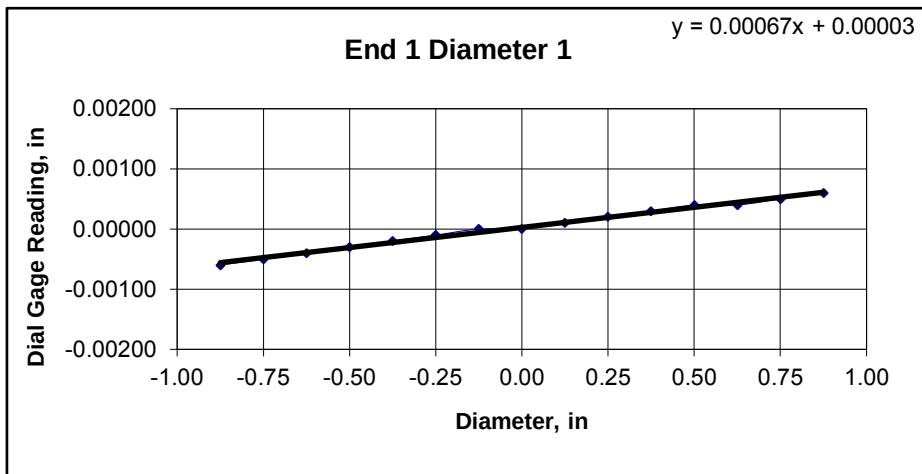


Client:	Shonewald Engineering Associates, Inc.	Test Date:	9/21/2018
Project Name:	MeDOT WIN 23484.00 MSFT Islesboro, ME	Tested By:	tlm
Project Location:	Islesboro, ME	Checked By:	jsc
GTX #:	308806		
Boring ID:	MB-ISLES-102		
Sample ID:	R4		
Depth:	21.7-27.7 ft		
Visual Description:	See photographs		

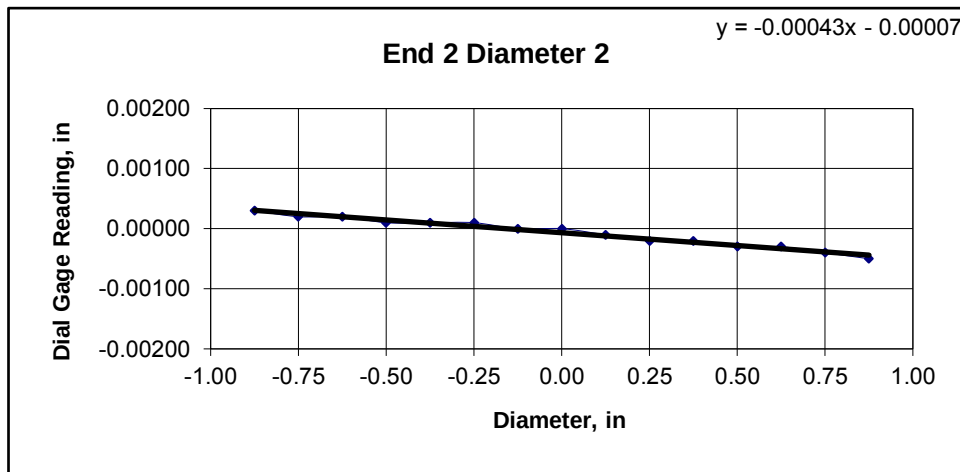
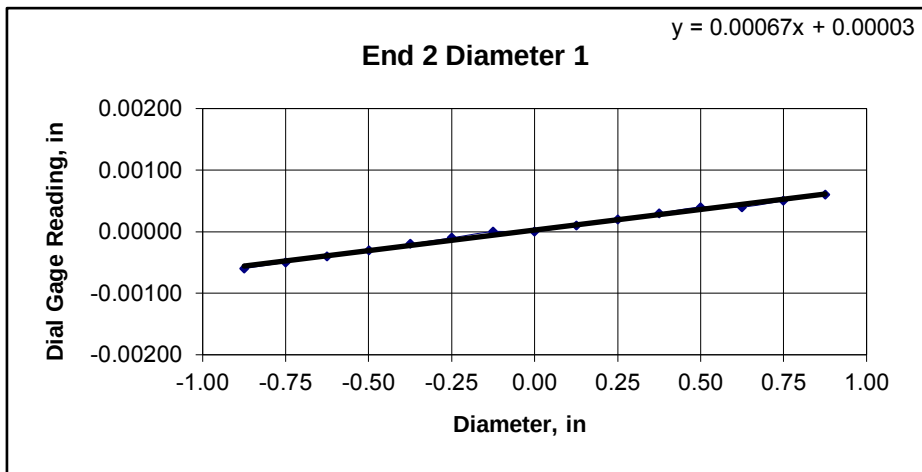
UNIT WEIGHT DETERMINATION AND DIMENSIONAL AND SHAPE TOLERANCES OF ROCK CORE SPECIMENS BY ASTM D4543

BULK DENSITY				DEVIATION FROM STRAIGHTNESS (Procedure S1)	
	1	2	Average	Maximum gap between side of core and reference surface plate: Is the maximum gap $\leq$ 0.02 in.? YES	
Specimen Length, in:	4.28	4.28	4.28		
Specimen Diameter, in:	1.99	1.99	1.99		
Specimen Mass, g:	580.39				
Bulk Density, lb/ft ³	166				
Length to Diameter Ratio:	2.2				
		Minimum Diameter Tolerance Met?	YES	Maximum difference must be < 0.020 in.	
		Length to Diameter Ratio Tolerance Met?	YES	Straightness Tolerance Met? YES	

END FLATNESS AND PARALLELISM (Procedure FP1)															
END 1	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	-0.00060	-0.00050	-0.00040	-0.00030	-0.00020	-0.00010	0.00000	0.00000	0.00010	0.00020	0.00030	0.00040	0.00040	0.00050	0.00060
Diameter 2, in (rotated 90°)	0.00030	0.00020	0.00020	0.00010	0.00010	0.00010	0.00000	0.00000	-0.00010	-0.00020	-0.00020	-0.00030	-0.00030	-0.00040	-0.00050
Difference between max and min readings, in:															
0° = 0.00120 90° = 0.00080															
END 2	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	-0.00060	-0.00050	-0.00040	-0.00030	-0.00020	-0.00010	0.00000	0.00000	0.00010	0.00020	0.00030	0.00040	0.00040	0.00050	0.00060
Diameter 2, in (rotated 90°)	0.00030	0.00020	0.00020	0.00010	0.00010	0.00010	0.00000	0.00000	-0.00010	-0.00020	-0.00020	-0.00030	-0.00030	-0.00040	-0.00050
Difference between max and min readings, in:															
0° = 0.0012 90° = 0.0008															
Maximum difference must be < 0.0020 in. Difference = $\pm$ 0.00060															
Flatness Tolerance Met? YES															



DIAMETER 1	
End 1:	
Slope of Best Fit Line	0.00067
Angle of Best Fit Line:	0.03831
End 2:	
Slope of Best Fit Line	0.00067
Angle of Best Fit Line:	0.03831
Maximum Angular Difference:	0.00000
Parallelism Tolerance Met?	YES
Spherically Seated	



DIAMETER 2	
End 1:	
Slope of Best Fit Line	0.00043
Angle of Best Fit Line:	0.02439
End 2:	
Slope of Best Fit Line	0.00043
Angle of Best Fit Line:	0.02439
Maximum Angular Difference:	0.00000
Parallelism Tolerance Met?	YES
Spherically Seated	

PERPENDICULARITY (Procedure P1)						(Calculated from End Flatness and Parallelism measurements above)	
END 1	Difference, Maximum and Minimum (in.)	Diameter (in.)	Slope	Angle°	Perpendicularity Tolerance Met?	Maximum angle of departure must be $\leq$ 0.25°	
Diameter 1, in	0.00120	1.990	0.00060	0.035	YES		
Diameter 2, in (rotated 90°)	0.00080	1.990	0.00040	0.023	YES	Perpendicularity Tolerance Met? YES	
END 2							
Diameter 1, in	0.00120	1.990	0.00060	0.035	YES		
Diameter 2, in (rotated 90°)	0.00080	1.990	0.00040	0.023	YES		

Client:	Schonewald Engineering Associates, Inc.
Project Name:	MeDOT WIN 23484.00 MSFT Islesboro, ME
Project Location:	Islesboro, ME
GTX #:	308806
Test Date:	9/21/2018
Tested By:	tlm
Checked By:	jsc
Boring ID:	MB-ISLES-102
Sample ID:	R4
Depth, ft:	21.7-27.7



After cutting and grinding

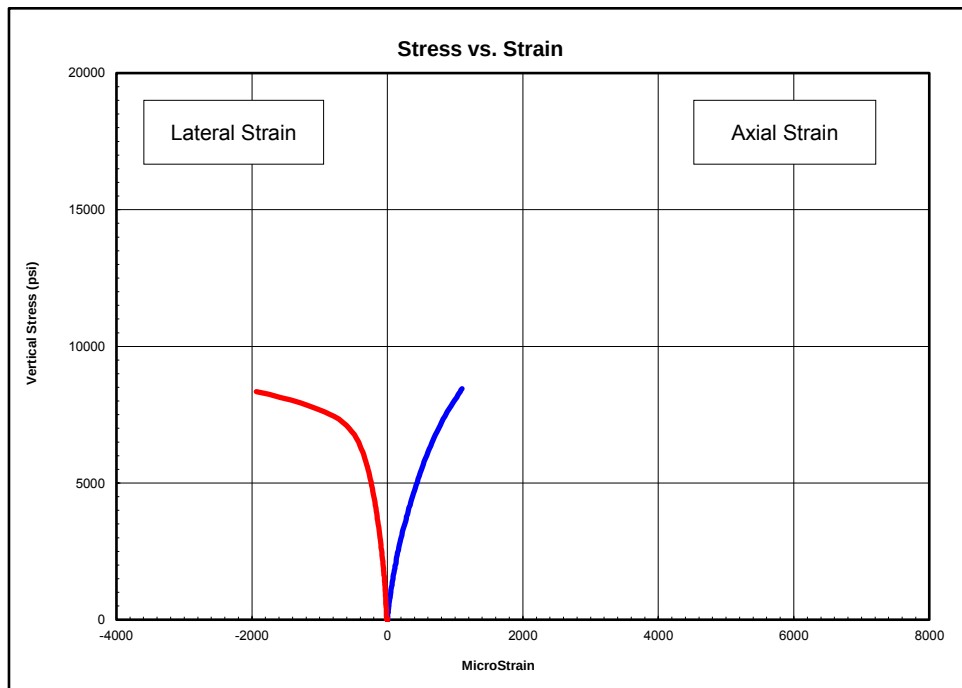


After break



Client:	Shonewald Engineering Associates, Inc.
Project Name:	MeDOT WIN 23484.00 MSFT Islesboro, ME
Project Location:	Islesboro, ME
GTX #:	308806
Test Date:	9/25/2018
Tested By:	tlm
Checked By:	jsc
Boring ID:	MB-ISLES-102
Sample ID:	R6
Depth, ft:	36.9-37.5
Sample Type:	rock core
Sample Description:	See photographs Intact material failure

Compressive Strength and Elastic Moduli of Rock by ASTM D7012 - Method D



Peak Compressive Stress: 8,453 psi

Stress Range, psi	Young's Modulus, psi	Poisson's Ratio
800-3100	13,400,000	---
3100-5400	8,390,000	---
5400-7600	5,630,000	---

Notes: Test specimen tested at the approximate as-received moisture content and at standard laboratory temperature.
The axial load was applied continuously at a stress rate that produced failure in a test time between 2 and 15 minutes.
Young's Modulus and Poisson's Ratio calculated using the tangent to the line in the stress range listed.
Calculations assume samples are isotropic, which is not necessarily the case.

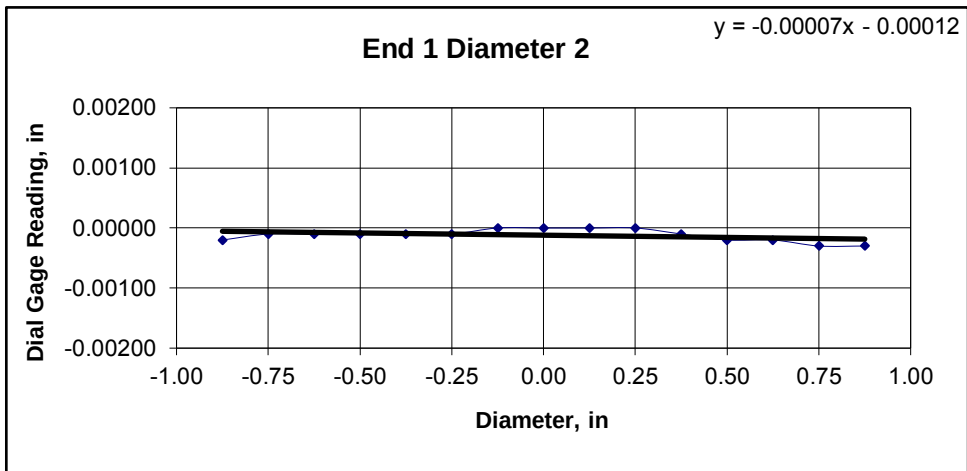
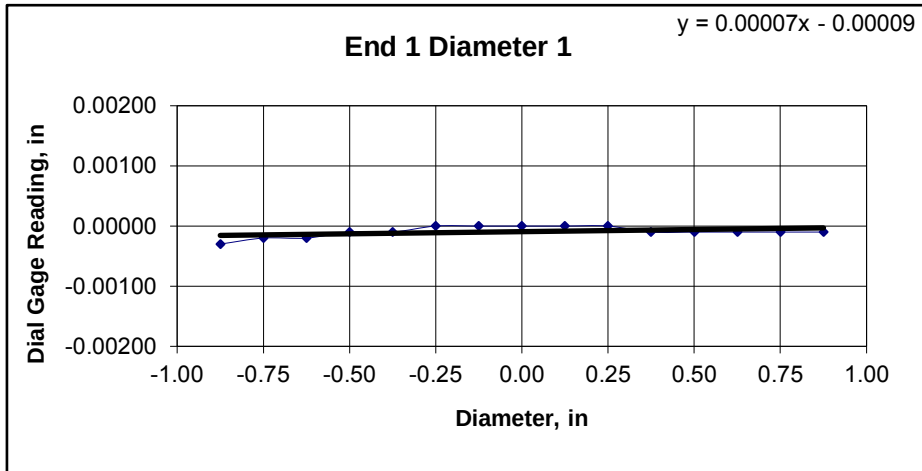


Client:	Shonewald Engineering Associates, Inc.	Test Date:	9/21/2018
Project Name:	MeDOT WIN 23484.00 MSFT Islesboro, ME	Tested By:	tlm
Project Location:	Islesboro, ME	Checked By:	jsc
GTX #:	308806		
Boring ID:	MB-ISLES-102		
Sample ID:	R6		
Depth:	36.9-37.5 ft		
Visual Description:	See photographs		

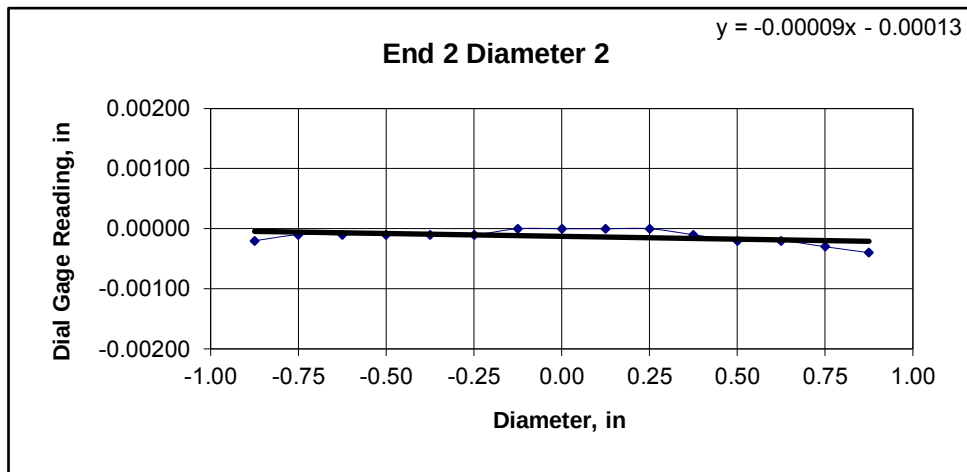
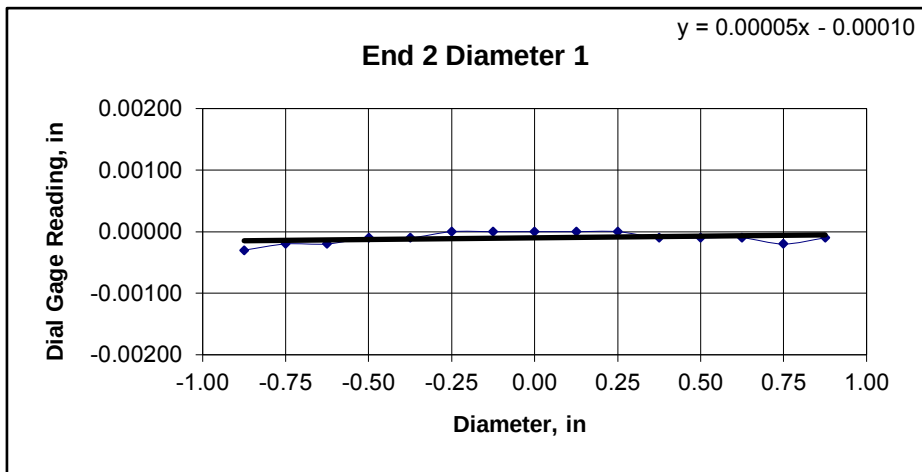
UNIT WEIGHT DETERMINATION AND DIMENSIONAL AND SHAPE TOLERANCES OF ROCK CORE SPECIMENS BY ASTM D4543

BULK DENSITY				DEVIATION FROM STRAIGHTNESS (Procedure S1)	
	1	2	Average	Maximum gap between side of core and reference surface plate:	
Specimen Length, in:	4.32	4.32	4.32	Is the maximum gap $\leq$ 0.02 in.?	
Specimen Diameter, in:	1.99	1.99	1.99	YES	
Specimen Mass, g:	602.65			Maximum difference must be < 0.020 in.	
Bulk Density, lb/ft ³	171	Minimum Diameter Tolerance Met?		Straightness Tolerance Met?	
Length to Diameter Ratio:	2.2	Length to Diameter Ratio Tolerance Met?		YES	
		YES			
		YES			

END FLATNESS AND PARALLELISM (Procedure FP1)															
END 1	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	-0.00030	-0.00020	-0.00020	-0.00010	-0.00010	0.00000	0.00000	0.00000	0.00000	0.00000	-0.00010	-0.00010	-0.00010	-0.00010	-0.00010
Diameter 2, in (rotated 90°)	-0.00020	-0.00010	-0.00010	-0.00010	-0.00010	-0.00010	0.00000	0.00000	0.00000	0.00000	-0.00010	-0.00020	-0.00020	-0.00030	-0.00030
Difference between max and min readings, in:															
0° = 0.00030 90° = 0.00030															
END 2	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	-0.00030	-0.00020	-0.00020	-0.00010	-0.00010	0.00000	0.00000	0.00000	0.00000	0.00000	-0.00010	-0.00010	-0.00010	-0.00020	-0.00010
Diameter 2, in (rotated 90°)	-0.00020	-0.00010	-0.00010	-0.00010	-0.00010	-0.00010	0.00000	0.00000	0.00000	0.00000	-0.00010	-0.00020	-0.00020	-0.00030	-0.00040
Difference between max and min readings, in:															
0° = 0.0003 90° = 0.0004															
Maximum difference must be < 0.0020 in. Difference = ± 0.00020															
Flatness Tolerance Met? YES															



DIAMETER 1	
End 1:	
Slope of Best Fit Line	0.00007
Angle of Best Fit Line:	0.00409
End 2:	
Slope of Best Fit Line	0.00005
Angle of Best Fit Line:	0.00311
Maximum Angular Difference:	0.00098
Parallelism Tolerance Met?	YES
Spherically Seated	



DIAMETER 2	
End 1:	
Slope of Best Fit Line	0.00007
Angle of Best Fit Line:	0.00426
End 2:	
Slope of Best Fit Line	0.00009
Angle of Best Fit Line:	0.00540
Maximum Angular Difference:	0.00115
Parallelism Tolerance Met?	YES
Spherically Seated	

PERPENDICULARITY (Procedure P1)						Maximum angle of departure must be $\leq 0.25^\circ$	
END 1	Difference, Maximum and Minimum (in.)	Diameter (in.)	Slope	Angle°	Perpendicularity Tolerance Met?		
Diameter 1, in	0.00030	1.990	0.00015	0.009	YES		
Diameter 2, in (rotated 90°)	0.00030	1.990	0.00015	0.009	YES	Perpendicularity Tolerance Met?	
						YES	
END 2							
Diameter 1, in	0.00030	1.990	0.00015	0.009	YES		
Diameter 2, in (rotated 90°)	0.00040	1.990	0.00020	0.012	YES		

Client:	Schonewald Engineering Associates, Inc.
Project Name:	MeDOT WIN 23484.00 MSFT Islesboro, ME
Project Location:	Islesboro, ME
GTX #:	308806
Test Date:	9/21/2018
Tested By:	tlm
Checked By:	jsc
Boring ID:	MB-ISLES-102
Sample ID:	R6
Depth, ft:	36.9-37.5



After cutting and grinding

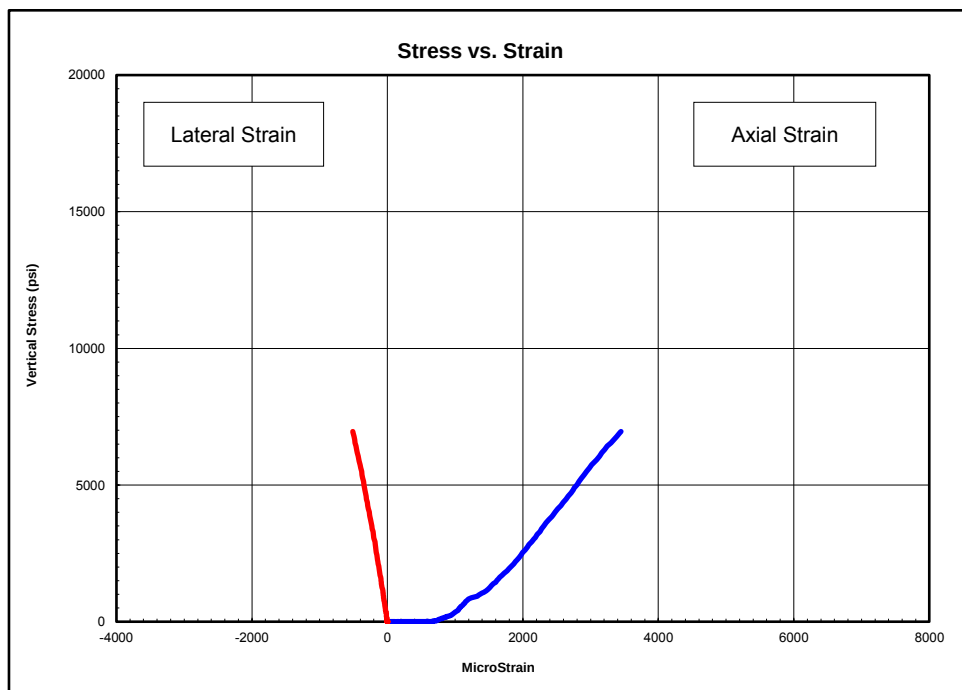


After break



Client:	Shonewald Engineering Associates, Inc.
Project Name:	MeDOT WIN 23484.00 MSFT Islesboro, ME
Project Location:	Islesboro, ME
GTX #:	308806
Test Date:	9/25/2018
Tested By:	tlm
Checked By:	jsc
Boring ID:	MB-ISLES-103
Sample ID:	R4
Depth, ft:	16.8-17.7
Sample Type:	rock core
Sample Description:	See photographs Intact material failure

Compressive Strength and Elastic Moduli of Rock by ASTM D7012 - Method D



Peak Compressive Stress: 6,958 psi

Stress Range, psi	Young's Modulus, psi	Poisson's Ratio
700-2600	2,130,000	0.14
2600-4400	3,090,000	0.24
4400-6300	3,210,000	0.25

Notes: Test specimen tested at the approximate as-received moisture content and at standard laboratory temperature.
The axial load was applied continuously at a stress rate that produced failure in a test time between 2 and 15 minutes.
Young's Modulus and Poisson's Ratio calculated using the tangent to the line in the stress range listed.
Calculations assume samples are isotropic, which is not necessarily the case.

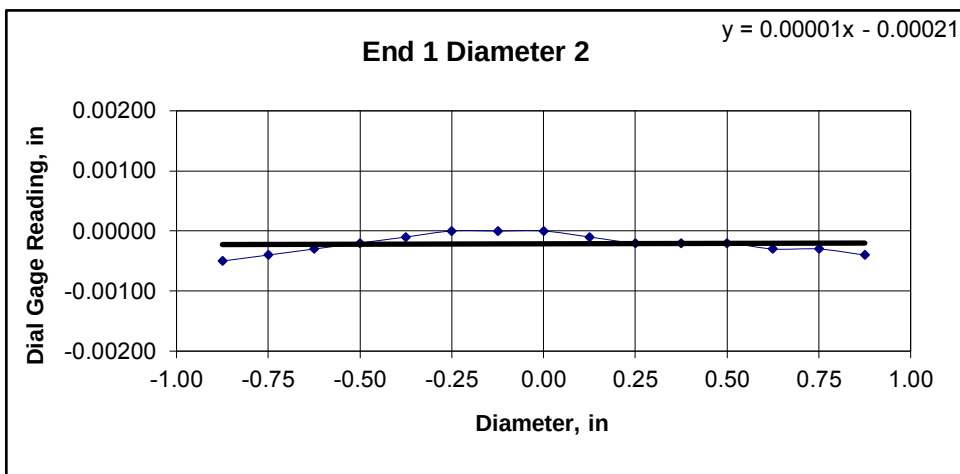
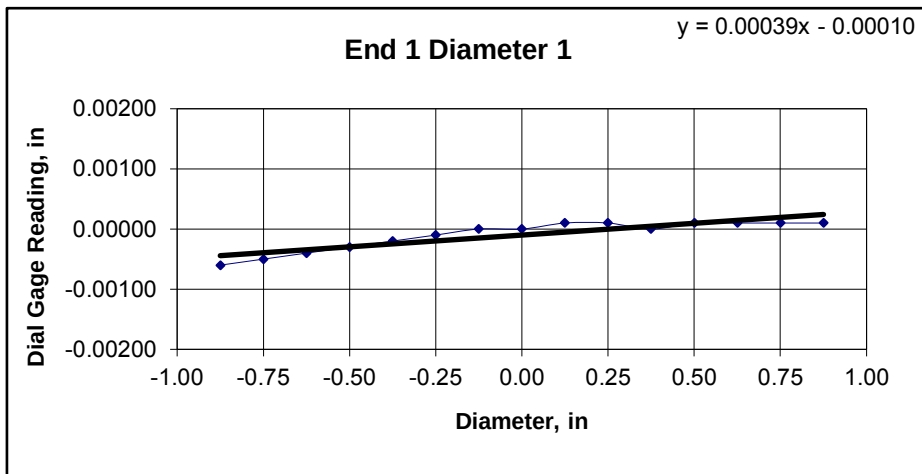


Client:	Shonewald Engineering Associates, Inc.	Test Date:	9/21/2018
Project Name:	MeDOT WIN 23484.00 MSFT Islesboro, ME	Tested By:	tlm
Project Location:	Islesboro, ME	Checked By:	jsc
GTX #:	308806		
Boring ID:	MB-ISLES-103		
Sample ID:	R4		
Depth:	16.8-17.7 ft		
Visual Description:	See photographs		

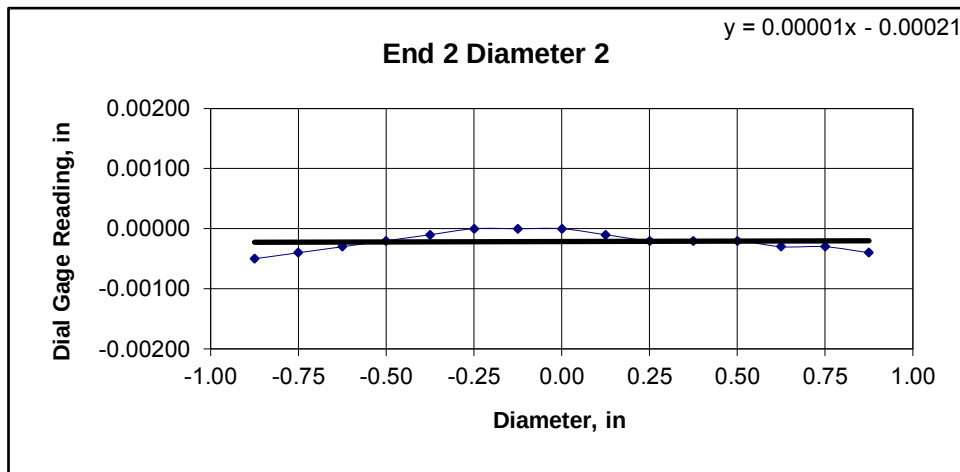
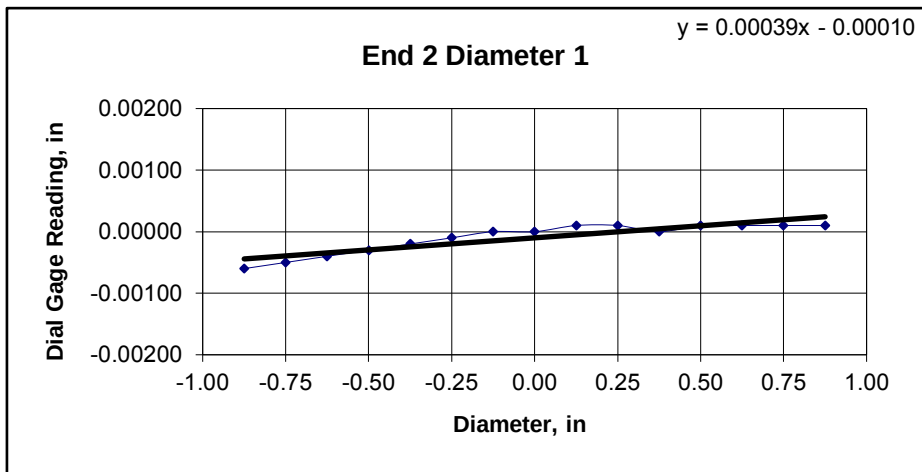
UNIT WEIGHT DETERMINATION AND DIMENSIONAL AND SHAPE TOLERANCES OF ROCK CORE SPECIMENS BY ASTM D4543

BULK DENSITY				DEVIATION FROM STRAIGHTNESS (Procedure S1)	
	1	2	Average	Maximum gap between side of core and reference surface plate:	
Specimen Length, in:	4.19	4.19	4.19	Is the maximum gap $\leq$ 0.02 in.?	
Specimen Diameter, in:	1.99	1.99	1.99	YES	
Specimen Mass, g:	585.3			Maximum difference must be < 0.020 in.	
Bulk Density, lb/ft ³	171			Straightness Tolerance Met?	
Length to Diameter Ratio:	2.1			YES	
		Minimum Diameter Tolerance Met?	YES		
		Length to Diameter Ratio Tolerance Met?	YES		

END FLATNESS AND PARALLELISM (Procedure FP1)															
END 1	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	-0.00060	-0.00050	-0.00040	-0.00030	-0.00020	-0.00010	0.00000	0.00000	0.00010	0.00010	0.00000	0.00010	0.00010	0.00010	0.00010
Diameter 2, in (rotated 90°)	-0.00050	-0.00040	-0.00030	-0.00020	-0.00010	0.00000	0.00000	0.00000	-0.00010	-0.00020	-0.00020	-0.00020	-0.00030	-0.00030	-0.00040
Difference between max and min readings, in:															
0° = 0.00070 90° = 0.00050															
END 2	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	-0.00060	-0.00050	-0.00040	-0.00030	-0.00020	-0.00010	0.00000	0.00000	0.00010	0.00010	0.00000	0.00010	0.00010	0.00010	0.00010
Diameter 2, in (rotated 90°)	-0.00050	-0.00040	-0.00030	-0.00020	-0.00010	0.00000	0.00000	0.00000	-0.00010	-0.00020	-0.00020	-0.00020	-0.00030	-0.00030	-0.00040
Difference between max and min readings, in:															
0° = 0.0007 90° = 0.0005															
Maximum difference must be < 0.0020 in. Difference = ± 0.00035															
Flatness Tolerance Met? YES															



DIAMETER 1	
End 1:	
Slope of Best Fit Line	0.00039
Angle of Best Fit Line:	0.02243
End 2:	
Slope of Best Fit Line	0.00039
Angle of Best Fit Line:	0.02243
Maximum Angular Difference:	0.00000
Parallelism Tolerance Met?	YES
Spherically Seated	



DIAMETER 2	
End 1:	
Slope of Best Fit Line	0.00001
Angle of Best Fit Line:	0.00082
End 2:	
Slope of Best Fit Line	0.00001
Angle of Best Fit Line:	0.00082
Maximum Angular Difference:	0.00000
Parallelism Tolerance Met?	YES
Spherically Seated	

PERPENDICULARITY (Procedure P1)						Maximum angle of departure must be $\leq 0.25^\circ$	
(Calculated from End Flatness and Parallelism measurements above)							
END 1	Difference, Maximum and Minimum (in.)	Diameter (in.)	Slope	Angle°	Perpendicularity Tolerance Met?		
Diameter 1, in	0.00070	1.990	0.00035	0.020	YES		
Diameter 2, in (rotated 90°)	0.00050	1.990	0.00025	0.014	YES	Perpendicularity Tolerance Met?	YES
END 2							
Diameter 1, in	0.00070	1.990	0.00035	0.020	YES		
Diameter 2, in (rotated 90°)	0.00050	1.990	0.00025	0.014	YES		

Client:	Schonewald Engineering Associates, Inc.
Project Name:	MeDOT WIN 23484.00 MSFT Islesboro, ME
Project Location:	Islesboro, ME
GTX #:	308806
Test Date:	9/21/2018
Tested By:	tlm
Checked By:	jsc
Boring ID:	MB-ISLES-103
Sample ID:	R4
Depth, ft:	16.8-17.7



After cutting and grinding

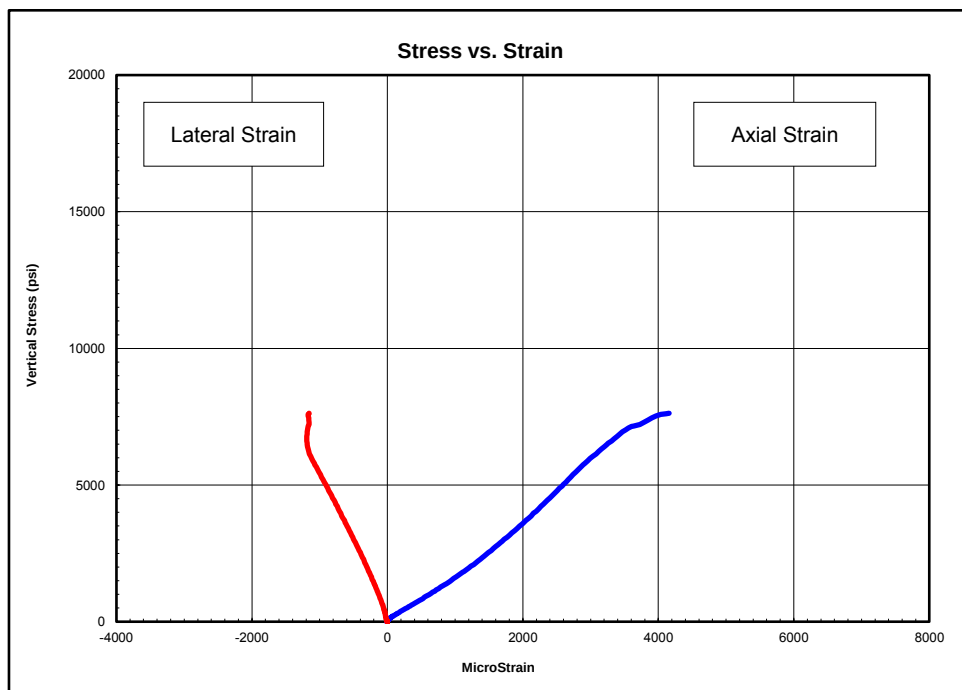


After break



Client:	Shonewald Engineering Associates, Inc.
Project Name:	MeDOT WIN 23484.00 MSFT Islesboro, ME
Project Location:	Islesboro, ME
GTX #:	308806
Test Date:	9/25/2018
Tested By:	tlm
Checked By:	jsc
Boring ID:	MB-ISLES-103
Sample ID:	R4
Depth, ft:	20.6-20.9
Sample Type:	rock core
Sample Description:	See photographs Discontinuity failure

Compressive Strength and Elastic Moduli of Rock by ASTM D7012 - Method D



Peak Compressive Stress: 7,626 psi

Stress Range, psi	Young's Modulus, psi	Poisson's Ratio
800-2800	1,740,000	0.31
2800-4800	2,270,000	0.46
4800-6900	2,240,000	0.40

Notes: Test specimen tested at the approximate as-received moisture content and at standard laboratory temperature.
The axial load was applied continuously at a stress rate that produced failure in a test time between 2 and 15 minutes.
Young's Modulus and Poisson's Ratio calculated using the tangent to the line in the stress range listed.
Calculations assume samples are isotropic, which is not necessarily the case.

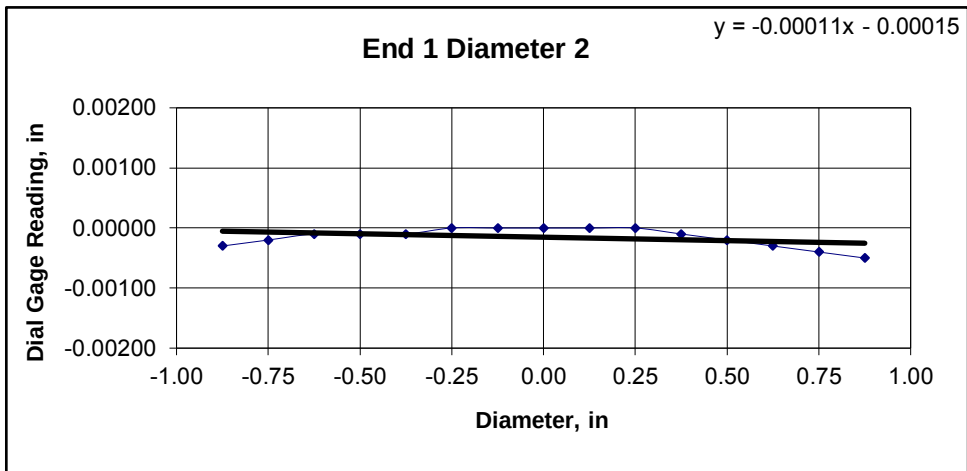
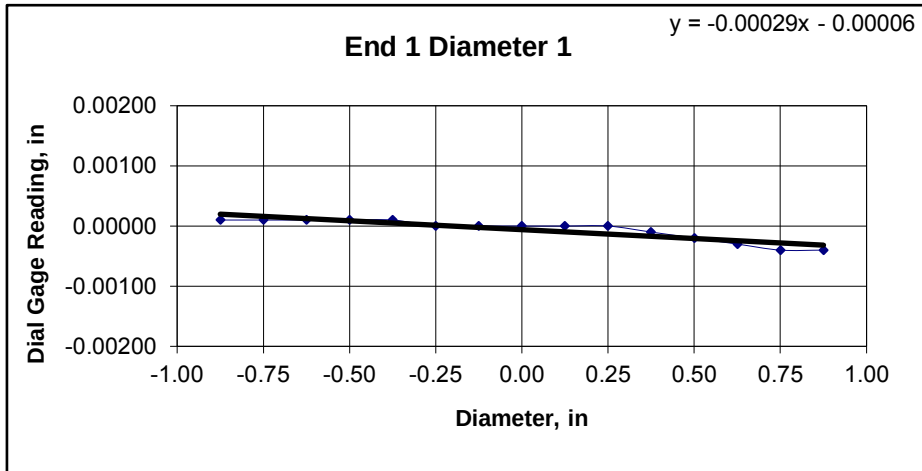


Client:	Shonewald Engineering Associates, Inc.	Test Date:	9/21/2018
Project Name:	MeDOT WIN 23484.00 MSFT Islesboro, ME	Tested By:	tlm
Project Location:	Islesboro, ME	Checked By:	jsc
GTX #:	308806		
Boring ID:	MB-ISLES-103		
Sample ID:	R4		
Depth:	20.6-20.9 ft		
Visual Description:	See photographs		

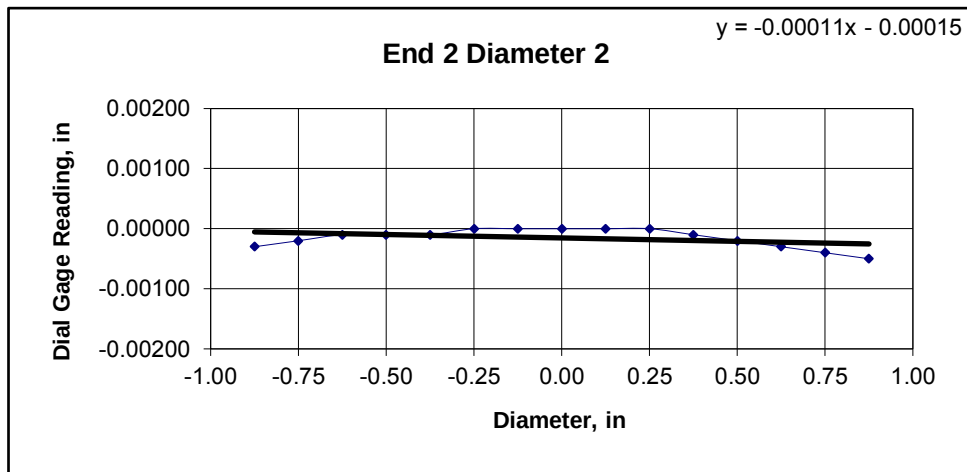
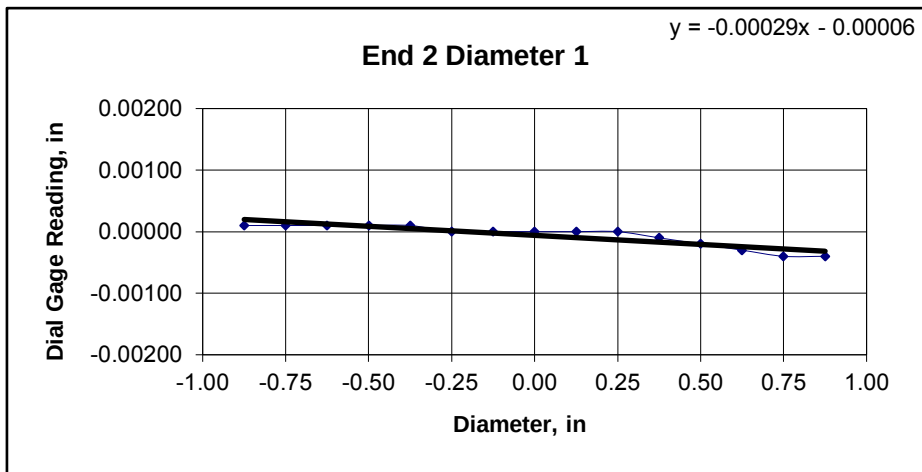
UNIT WEIGHT DETERMINATION AND DIMENSIONAL AND SHAPE TOLERANCES OF ROCK CORE SPECIMENS BY ASTM D4543

BULK DENSITY				DEVIATION FROM STRAIGHTNESS (Procedure S1)	
	1	2	Average	Maximum gap between side of core and reference surface plate:	
Specimen Length, in:	4.10	4.10	4.10	Is the maximum gap $\leq$ 0.02 in.?	
Specimen Diameter, in:	1.99	1.99	1.99	YES	
Specimen Mass, g:	578.32			Maximum difference must be < 0.020 in.	
Bulk Density, lb/ft ³	172	Minimum Diameter Tolerance Met?		Straightness Tolerance Met?	
Length to Diameter Ratio:	2.1	Length to Diameter Ratio Tolerance Met?		YES	
		YES			
		YES			

END FLATNESS AND PARALLELISM (Procedure FP1)															
END 1	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	0.00010	0.00010	0.00010	0.00010	0.00010	0.00000	0.00000	0.00000	0.00000	0.00000	-0.00010	-0.00020	-0.00030	-0.00040	-0.00040
Diameter 2, in (rotated 90°)	-0.00030	-0.00020	-0.00010	-0.00010	-0.00010	0.00000	0.00000	0.00000	0.00000	0.00000	-0.00010	-0.00020	-0.00030	-0.00040	-0.00050
Difference between max and min readings, in:															
0° = 0.00050 90° = 0.00050															
END 2	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	0.00010	0.00010	0.00010	0.00010	0.00010	0.00000	0.00000	0.00000	0.00000	0.00000	-0.00010	-0.00020	-0.00030	-0.00040	-0.00040
Diameter 2, in (rotated 90°)	-0.00030	-0.00020	-0.00010	-0.00010	-0.00010	0.00000	0.00000	0.00000	0.00000	0.00000	-0.00010	-0.00020	-0.00030	-0.00040	-0.00050
Difference between max and min readings, in:															
0° = 0.0005 90° = 0.0005															
Maximum difference must be < 0.0020 in. Difference = $\pm$ 0.00025															
Flatness Tolerance Met?															
YES															



DIAMETER 1	
End 1:	
Slope of Best Fit Line	0.00029
Angle of Best Fit Line:	0.01686
End 2:	
Slope of Best Fit Line	0.00029
Angle of Best Fit Line:	0.01686
Maximum Angular Difference:	0.00000
Parallelism Tolerance Met?	YES
Spherically Seated	



DIAMETER 2	
End 1:	
Slope of Best Fit Line	0.00011
Angle of Best Fit Line:	0.00655
End 2:	
Slope of Best Fit Line	0.00011
Angle of Best Fit Line:	0.00655
Maximum Angular Difference:	0.00000
Parallelism Tolerance Met?	YES
Spherically Seated	

PERPENDICULARITY (Procedure P1)						Maximum angle of departure must be $\leq$ 0.25°	
END 1	Difference, Maximum and Minimum (in.)	Diameter (in.)	Slope	Angle°	Perpendicularity Tolerance Met?		
Diameter 1, in	0.00050	1.990	0.00025	0.014	YES		
Diameter 2, in (rotated 90°)	0.00050	1.990	0.00025	0.014	YES	Perpendicularity Tolerance Met?	
						YES	
END 2							
Diameter 1, in	0.00050	1.990	0.00025	0.014	YES		
Diameter 2, in (rotated 90°)	0.00050	1.990	0.00025	0.014	YES		

Client:	Schonewald Engineering Associates, Inc.
Project Name:	MeDOT WIN 23484.00 MSFT Islesboro, ME
Project Location:	Islesboro, ME
GTX #:	308806
Test Date:	9/21/2018
Tested By:	tlm
Checked By:	jsc
Boring ID:	MB-ISLES-103
Sample ID:	R4
Depth, ft:	20.6-20.9



After cutting and grinding

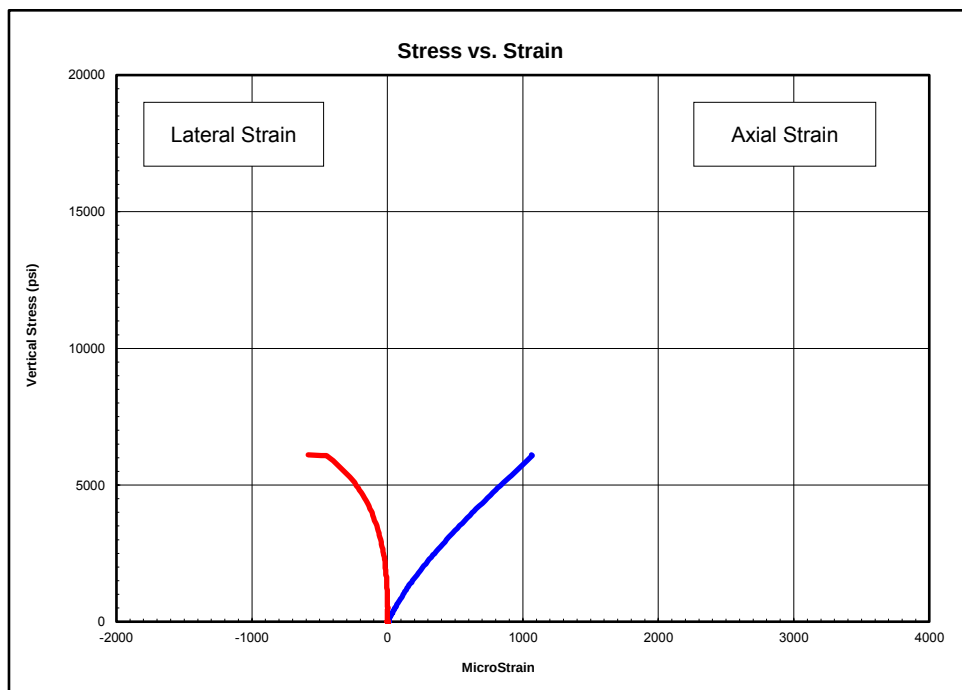


After break



Client:	Shonewald Engineering Associates, Inc.
Project Name:	MeDOT WIN 23484.00 MSFT Islesboro, ME
Project Location:	Islesboro, ME
GTX #:	308806
Test Date:	9/25/2018
Tested By:	tlm
Checked By:	jsc
Boring ID:	MB-ISLES-103
Sample ID:	R5
Depth, ft:	22.9-23.5
Sample Type:	rock core
Sample Description:	See photographs Discontinuity failure

Compressive Strength and Elastic Moduli of Rock by ASTM D7012 - Method D



Peak Compressive Stress: 6,105 psi

Stress Range, psi	Young's Modulus, psi	Poisson's Ratio
600-2200	7,070,000	0.09
2200-3900	5,440,000	0.28
3900-5500	4,750,000	---

Notes: Test specimen tested at the approximate as-received moisture content and at standard laboratory temperature.
The axial load was applied continuously at a stress rate that produced failure in a test time between 2 and 15 minutes.
Young's Modulus and Poisson's Ratio calculated using the tangent to the line in the stress range listed.
Calculations assume samples are isotropic, which is not necessarily the case.

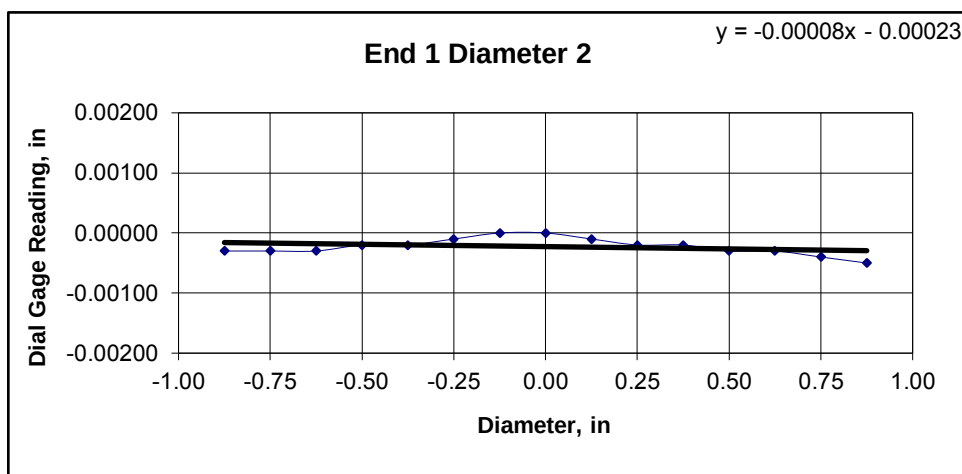
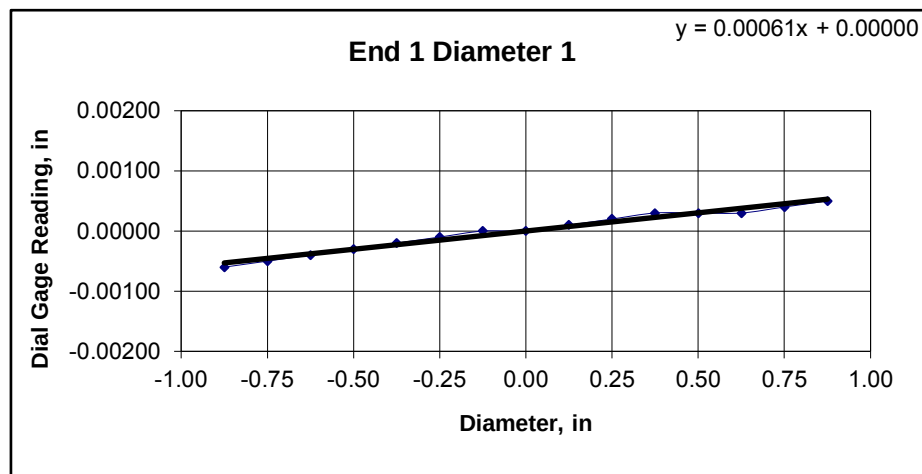


Client:	Shonewald Engineering Associates, Inc.	Test Date:	9/21/2018
Project Name:	MeDOT WIN 23484.00 MSFT Islesboro, ME	Tested By:	tlm
Project Location:	Islesboro, ME	Checked By:	jsc
GTX #:	308806		
Boring ID:	MB-ISLES-103		
Sample ID:	R5		
Depth:	22.9-23.5 ft		
Visual Description:	See photographs		

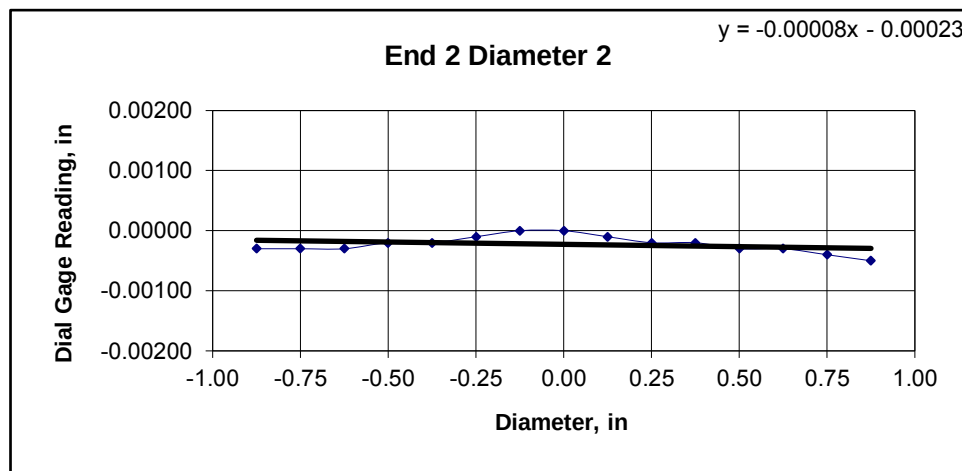
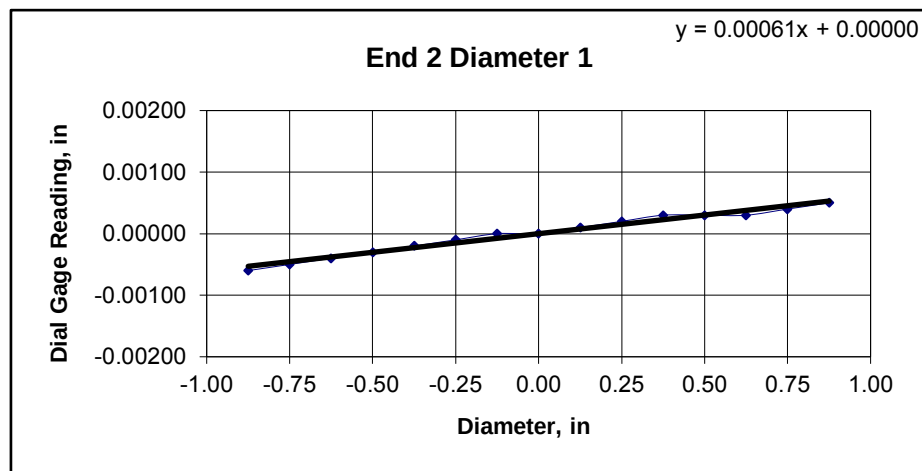
UNIT WEIGHT DETERMINATION AND DIMENSIONAL AND SHAPE TOLERANCES OF ROCK CORE SPECIMENS BY ASTM D4543

BULK DENSITY				DEVIATION FROM STRAIGHTNESS (Procedure S1)	
	1	2	Average	Maximum gap between side of core and reference surface plate:	
Specimen Length, in:	4.27	4.28	4.28	Is the maximum gap $\leq$ 0.02 in.?	
Specimen Diameter, in:	1.99	1.99	1.99	NO	
Specimen Mass, g:	590.47			Maximum difference must be < 0.020 in.	
Bulk Density, lb/ft ³	169			Straightness Tolerance Met?	
Length to Diameter Ratio:	2.1			NO	
		Minimum Diameter Tolerance Met?	YES		
		Length to Diameter Ratio Tolerance Met?	YES		

END FLATNESS AND PARALLELISM (Procedure FP1)															
END 1	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	-0.00060	-0.00050	-0.00040	-0.00030	-0.00020	-0.00010	0.00000	0.00000	0.00010	0.00020	0.00030	0.00030	0.00030	0.00040	0.00050
Diameter 2, in (rotated 90°)	-0.00030	-0.00030	-0.00030	-0.00020	-0.00020	-0.00010	0.00000	0.00000	-0.00010	-0.00020	-0.00020	-0.00030	-0.00030	-0.00040	-0.00050
Difference between max and min readings, in:															
0° = 0.00110 90° = 0.00050															
END 2	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	-0.00060	-0.00050	-0.00040	-0.00030	-0.00020	-0.00010	0.00000	0.00000	0.00010	0.00020	0.00030	0.00030	0.00030	0.00040	0.00050
Diameter 2, in (rotated 90°)	-0.00030	-0.00030	-0.00030	-0.00020	-0.00020	-0.00010	0.00000	0.00000	-0.00010	-0.00020	-0.00020	-0.00030	-0.00030	-0.00040	-0.00050
Difference between max and min readings, in:															
0° = 0.0011 90° = 0.0005															
Maximum difference must be < 0.0020 in. Difference = $\pm$ 0.00055															
Flatness Tolerance Met?															
YES															



DIAMETER 1	
End 1:	
Slope of Best Fit Line	0.00061
Angle of Best Fit Line:	0.03470
End 2:	
Slope of Best Fit Line	0.00061
Angle of Best Fit Line:	0.03470
Maximum Angular Difference:	0.00000
Parallelism Tolerance Met?	YES
Spherically Seated	



DIAMETER 2	
End 1:	
Slope of Best Fit Line	0.00008
Angle of Best Fit Line:	0.00442
End 2:	
Slope of Best Fit Line	0.00008
Angle of Best Fit Line:	0.00442
Maximum Angular Difference:	0.00000
Parallelism Tolerance Met?	YES
Spherically Seated	

PERPENDICULARITY (Procedure P1)		(Calculated from End Flatness and Parallelism measurements above)				
END 1	Difference, Maximum and Minimum (in.)	Diameter (in.)	Slope	Angle°	Perpendicularity Tolerance Met?	Maximum angle of departure must be $\leq 0.25^\circ$
Diameter 1, in	0.00110	1.990	0.00055	0.032	YES	
Diameter 2, in (rotated 90°)	0.00050	1.990	0.00025	0.014	YES	Perpendicularity Tolerance Met? YES
END 2						
Diameter 1, in	0.00110	1.990	0.00055	0.032	YES	
Diameter 2, in (rotated 90°)	0.00050	1.990	0.00025	0.014	YES	

Client:	Schonewald Engineering Associates, Inc.
Project Name:	MeDOT WIN 23484.00 MSFT Islesboro, ME
Project Location:	Islesboro, ME
GTX #:	308806
Test Date:	9/21/2018
Tested By:	tlm
Checked By:	jsc
Boring ID:	MB-ISLES-103
Sample ID:	R5
Depth, ft:	22.9-23.5



After cutting and grinding

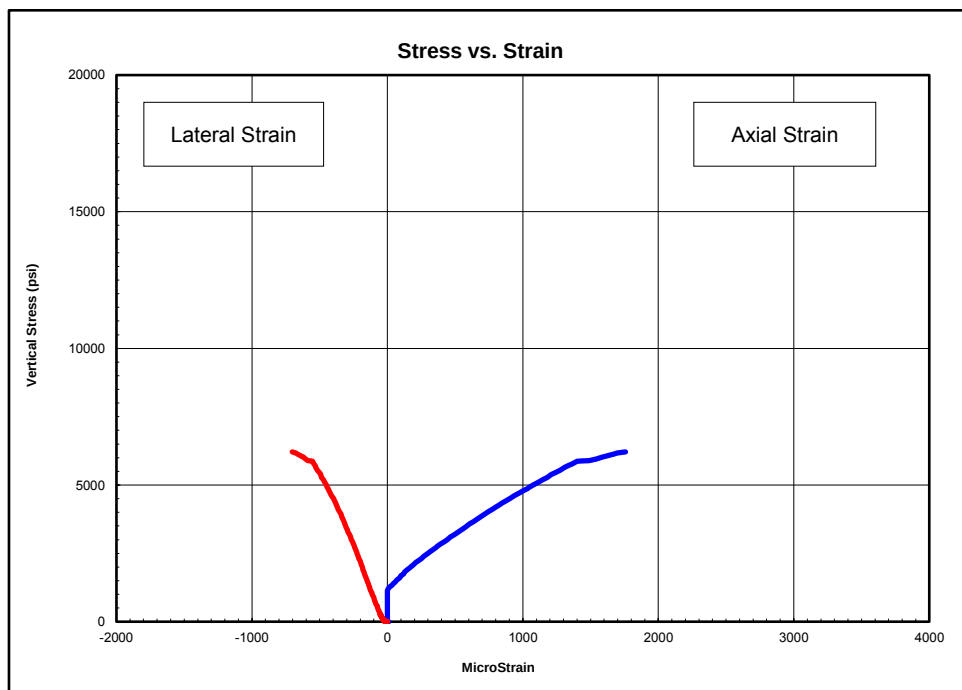


After break



Client:	Shonewald Engineering Associates, Inc.
Project Name:	MeDOT WIN 23484.00 MSFT Islesboro, ME
Project Location:	Islesboro, ME
GTX #:	308806
Test Date:	9/25/2018
Tested By:	tlm
Checked By:	jsc
Boring ID:	MB-ISLES-104
Sample ID:	R1
Depth, ft:	15.0-15.7
Sample Type:	rock core
Sample Description:	See photographs Intact material failure

Compressive Strength and Elastic Moduli of Rock by ASTM D7012 - Method D



Peak Compressive Stress: 6,213 psi

Stress Range, psi	Young's Modulus, psi	Poisson's Ratio
600-2300	6,310,000	0.47
2300-3900	3,460,000	0.29
3900-5600	2,880,000	0.30

Notes: Test specimen tested at the approximate as-received moisture content and at standard laboratory temperature.
The axial load was applied continuously at a stress rate that produced failure in a test time between 2 and 15 minutes.
Young's Modulus and Poisson's Ratio calculated using the tangent to the line in the stress range listed.
Calculations assume samples are isotropic, which is not necessarily the case.

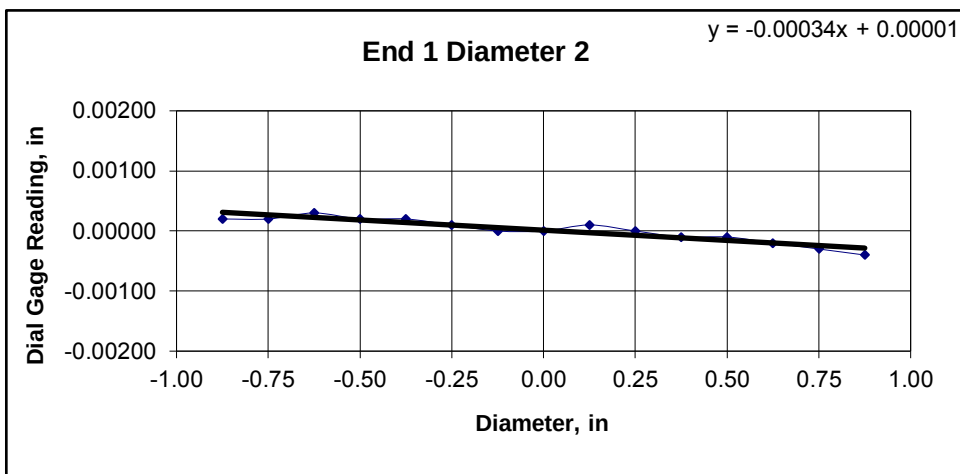
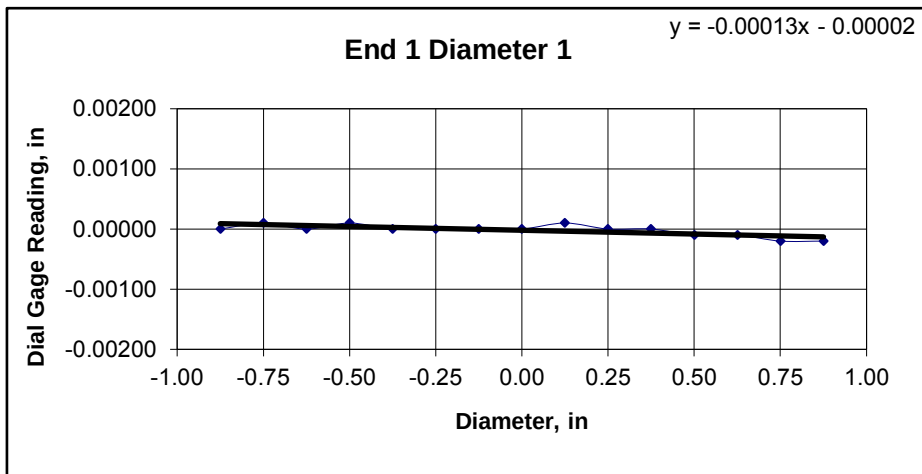


Client:	Shonewald Engineering Associates, Inc.	Test Date:	9/21/2018
Project Name:	MeDOT WIN 23484.00 MSFT Islesboro, ME	Tested By:	tlm
Project Location:	Islesboro, ME	Checked By:	jsc
GTX #:	308806		
Boring ID:	MB-ISLES-104		
Sample ID:	R1		
Depth:	15.0-15.7 ft		
Visual Description:	See photographs		

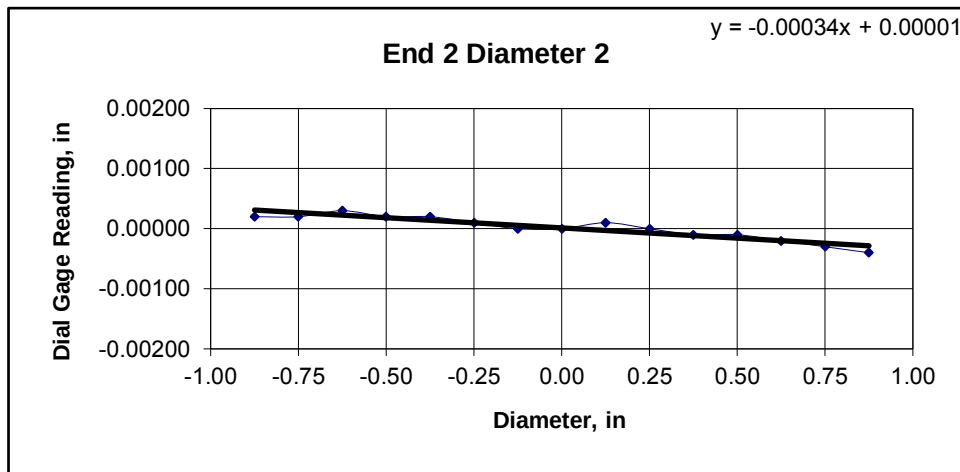
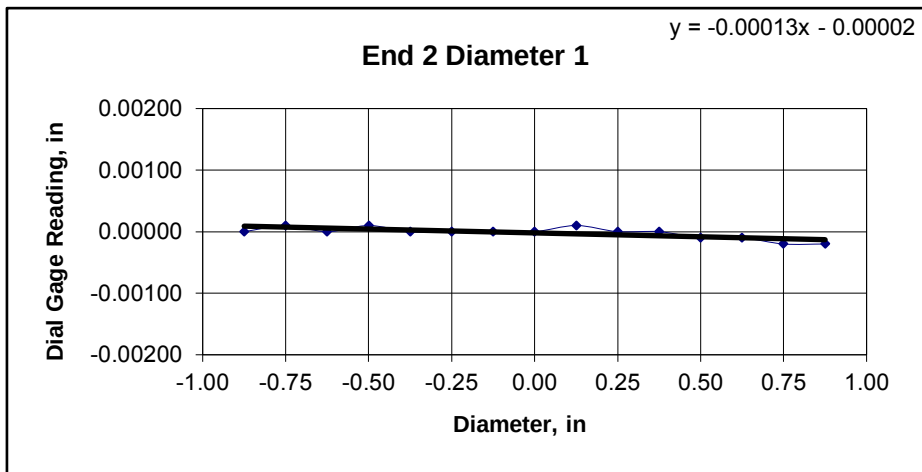
UNIT WEIGHT DETERMINATION AND DIMENSIONAL AND SHAPE TOLERANCES OF ROCK CORE SPECIMENS BY ASTM D4543

BULK DENSITY				DEVIATION FROM STRAIGHTNESS (Procedure S1)	
	1	2	Average	Maximum gap between side of core and reference surface plate: Is the maximum gap $\leq$ 0.02 in.?	
Specimen Length, in:	4.28	4.28	4.28	YES	
Specimen Diameter, in:	1.99	1.99	1.99	Maximum difference must be < 0.020 in.	
Specimen Mass, g:	573.71			Straightness Tolerance Met?	
Bulk Density, lb/ft ³	164			YES	
Length to Diameter Ratio:	2.2	Minimum Diameter Tolerance Met?	YES		
		Length to Diameter Ratio Tolerance Met?	YES		

END FLATNESS AND PARALLELISM (Procedure FP1)															
END 1	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	0.00000	0.00010	0.00000	0.00010	0.00000	0.00000	0.00000	0.00000	0.00010	0.00000	0.00000	-0.00010	-0.00010	-0.00020	-0.00020
Diameter 2, in (rotated 90°)	0.00020	0.00020	0.00030	0.00020	0.00020	0.00010	0.00000	0.00000	0.00010	0.00000	-0.00010	-0.00010	-0.00020	-0.00030	-0.00040
Difference between max and min readings, in:															
0° = 0.00030 90° = 0.00070															
END 2	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	0.00000	0.00010	0.00000	0.00010	0.00000	0.00000	0.00000	0.00000	0.00010	0.00000	0.00000	-0.00010	-0.00010	-0.00020	-0.00020
Diameter 2, in (rotated 90°)	0.00020	0.00020	0.00030	0.00020	0.00020	0.00010	0.00000	0.00000	0.00010	0.00000	-0.00010	-0.00010	-0.00020	-0.00030	-0.00040
Difference between max and min readings, in:															
0° = 0.0003 90° = 0.0007															
Maximum difference must be < 0.0020 in. Difference = $\pm$ 0.00035															
Flatness Tolerance Met?															
YES															



DIAMETER 1	
End 1:	
Slope of Best Fit Line	0.00013
Angle of Best Fit Line:	0.00720
End 2:	
Slope of Best Fit Line	0.00013
Angle of Best Fit Line:	0.00720
Maximum Angular Difference:	0.00000
Parallelism Tolerance Met?	YES
Spherically Seated	



DIAMETER 2	
End 1:	
Slope of Best Fit Line	0.00034
Angle of Best Fit Line:	0.01948
End 2:	
Slope of Best Fit Line	0.00034
Angle of Best Fit Line:	0.01948
Maximum Angular Difference:	0.00000
Parallelism Tolerance Met?	YES
Spherically Seated	

PERPENDICULARITY (Procedure P1)						Maximum angle of departure must be $\leq$ 0.25°	
END 1	Difference, Maximum and Minimum (in.)	Diameter (in.)	Slope	Angle°	Perpendicularity Tolerance Met?		
Diameter 1, in	0.00030	1.990	0.00015	0.009	YES		
Diameter 2, in (rotated 90°)	0.00070	1.990	0.00035	0.020	YES	Perpendicularity Tolerance Met?	YES
END 2							
Diameter 1, in	0.00030	1.990	0.00015	0.009	YES		
Diameter 2, in (rotated 90°)	0.00070	1.990	0.00035	0.020	YES		

Client:	Schonewald Engineering Associates, Inc.
Project Name:	MeDOT WIN 23484.00 MSFT Islesboro, ME
Project Location:	Islesboro, ME
GTX #:	308806
Test Date:	9/21/2018
Tested By:	tlm
Checked By:	jsc
Boring ID:	MB-ISLES-104
Sample ID:	R1
Depth, ft:	15.0-15.7



After cutting and grinding

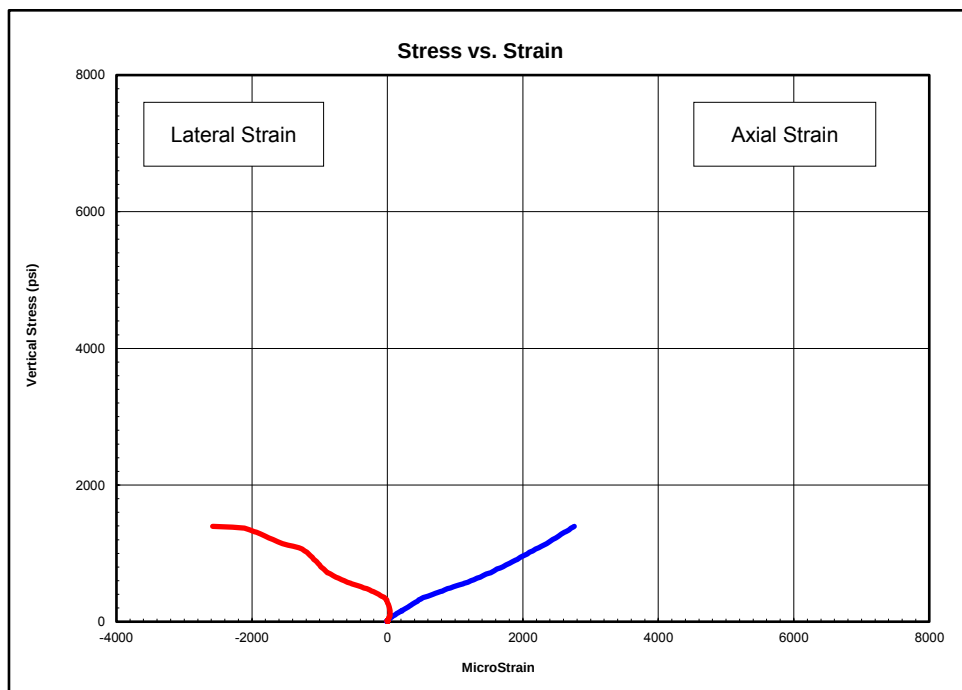


After break



Client:	Shonewald Engineering Associates, Inc.
Project Name:	MeDOT WIN 23484.00 MSFT Islesboro, ME
Project Location:	Islesboro, ME
GTX #:	308806
Test Date:	9/25/2018
Tested By:	tlm
Checked By:	jsc
Boring ID:	MB-ISLES-104
Sample ID:	R3
Depth, ft:	23.7-24.3
Sample Type:	rock core
Sample Description:	See photographs Discontinuity failure

Compressive Strength and Elastic Moduli of Rock by ASTM D7012 - Method D



Peak Compressive Stress: 1,395 psi

The strain values recorded for this test produce values of Poisson's Ratio that exceed maximum values found in rocks.

Stress Range, psi	Young's Modulus, psi	Poisson's Ratio
100-500	495,000	---
500-900	422,000	---
900-1300	551,000	---

Notes: Test specimen tested at the approximate as-received moisture content and at standard laboratory temperature.
The axial load was applied continuously at a stress rate that produced failure in a test time between 2 and 15 minutes.
Young's Modulus and Poisson's Ratio calculated using the tangent to the line in the stress range listed.
Calculations assume samples are isotropic, which is not necessarily the case.

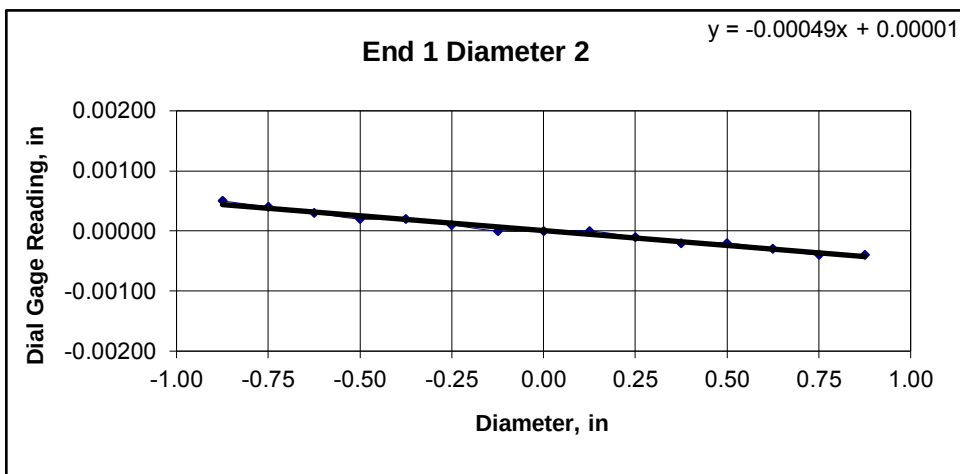
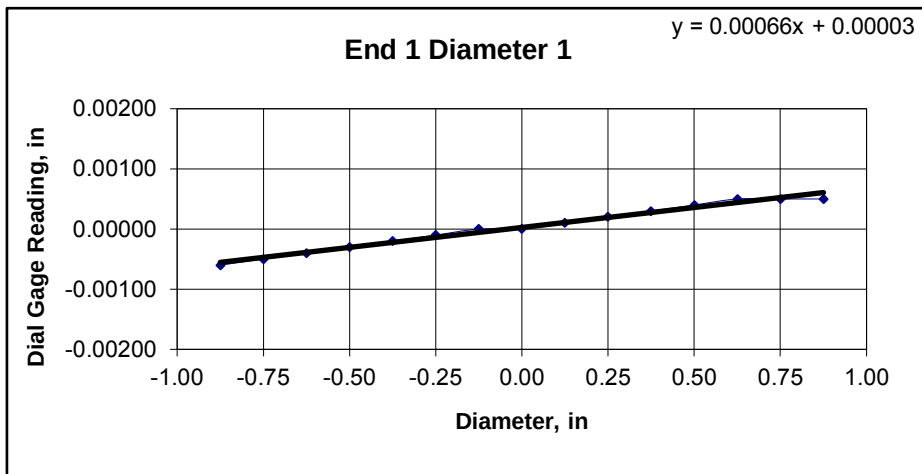


Client:	Shonewald Engineering Associates, Inc.	Test Date:	9/21/2018
Project Name:	MeDOT WIN 23484.00 MSFT Islesboro, ME	Tested By:	tlm
Project Location:	Islesboro, ME	Checked By:	jsc
GTX #:	308806		
Boring ID:	MB-ISLES-104		
Sample ID:	R3		
Depth:	23.7-24.3 ft		
Visual Description:	See photographs		

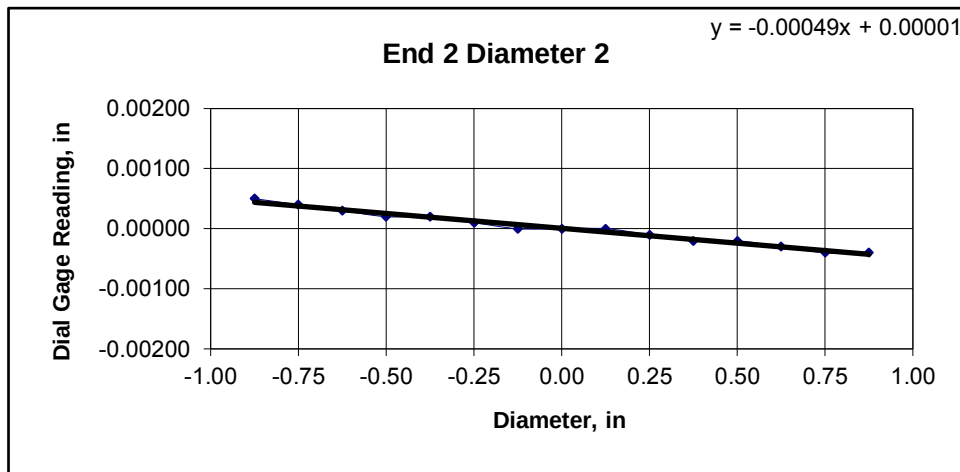
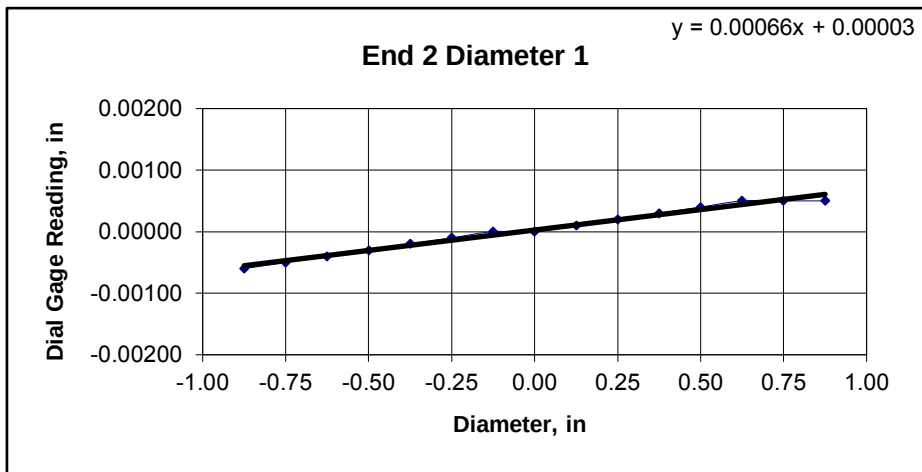
UNIT WEIGHT DETERMINATION AND DIMENSIONAL AND SHAPE TOLERANCES OF ROCK CORE SPECIMENS BY ASTM D4543

BULK DENSITY				DEVIATION FROM STRAIGHTNESS (Procedure S1)	
	1	2	Average	Maximum gap between side of core and reference surface plate: Is the maximum gap $\leq$ 0.02 in.?	
Specimen Length, in:	4.35	4.35	4.35	NO	
Specimen Diameter, in:	1.99	1.99	1.99	Maximum difference must be < 0.020 in.	
Specimen Mass, g:	574.91			Straightness Tolerance Met?	
Bulk Density, lb/ft ³	162			NO	
Length to Diameter Ratio:	2.2	Minimum Diameter Tolerance Met?	YES		
		Length to Diameter Ratio Tolerance Met?	YES		

END FLATNESS AND PARALLELISM (Procedure FP1)															
END 1	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	-0.00060	-0.00050	-0.00040	-0.00030	-0.00020	-0.00010	0.00000	0.00000	0.00010	0.00020	0.00030	0.00040	0.00050	0.00050	0.00050
Diameter 2, in (rotated 90°)	0.00050	0.00040	0.00030	0.00020	0.00020	0.00010	0.00000	0.00000	0.00000	-0.00010	-0.00020	-0.00020	-0.00030	-0.00040	-0.00040
Difference between max and min readings, in:															
0° = 0.00110 90° = 0.00090															
END 2	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	-0.00060	-0.00050	-0.00040	-0.00030	-0.00020	-0.00010	0.00000	0.00000	0.00010	0.00020	0.00030	0.00040	0.00050	0.00050	0.00050
Diameter 2, in (rotated 90°)	0.00050	0.00040	0.00030	0.00020	0.00020	0.00010	0.00000	0.00000	0.00000	-0.00010	-0.00020	-0.00020	-0.00030	-0.00040	-0.00040
Difference between max and min readings, in:															
0° = 0.0011 90° = 0.0009															
Maximum difference must be < 0.0020 in. Difference = $\pm$ 0.00055															
Flatness Tolerance Met? YES															



DIAMETER 1	
End 1:	
Slope of Best Fit Line	0.00066
Angle of Best Fit Line:	0.03798
End 2:	
Slope of Best Fit Line	0.00066
Angle of Best Fit Line:	0.03798
Maximum Angular Difference:	0.00000
Parallelism Tolerance Met?	YES
Spherically Seated	



DIAMETER 2	
End 1:	
Slope of Best Fit Line	0.00049
Angle of Best Fit Line:	0.02832
End 2:	
Slope of Best Fit Line	0.00049
Angle of Best Fit Line:	0.02832
Maximum Angular Difference:	0.00000
Parallelism Tolerance Met?	YES
Spherically Seated	

PERPENDICULARITY (Procedure P1)						(Calculated from End Flatness and Parallelism measurements above)	
END 1	Difference, Maximum and Minimum (in.)	Diameter (in.)	Slope	Angle°	Perpendicularity Tolerance Met?	Maximum angle of departure must be $\leq 0.25^\circ$	
Diameter 1, in	0.00110	1.990	0.00055	0.032	YES		
Diameter 2, in (rotated 90°)	0.00090	1.990	0.00045	0.026	YES	Perpendicularity Tolerance Met? YES	
END 2							
Diameter 1, in	0.00110	1.990	0.00055	0.032	YES		
Diameter 2, in (rotated 90°)	0.00090	1.990	0.00045	0.026	YES		

Client:	Schonewald Engineering Associates, Inc.
Project Name:	MeDOT WIN 23484.00 MSFT Islesboro, ME
Project Location:	Islesboro, ME
GTX #:	308806
Test Date:	9/21/2018
Tested By:	tlm
Checked By:	jsc
Boring ID:	MB-ISLES-104
Sample ID:	R3
Depth, ft:	23.7-24.3



After cutting and grinding

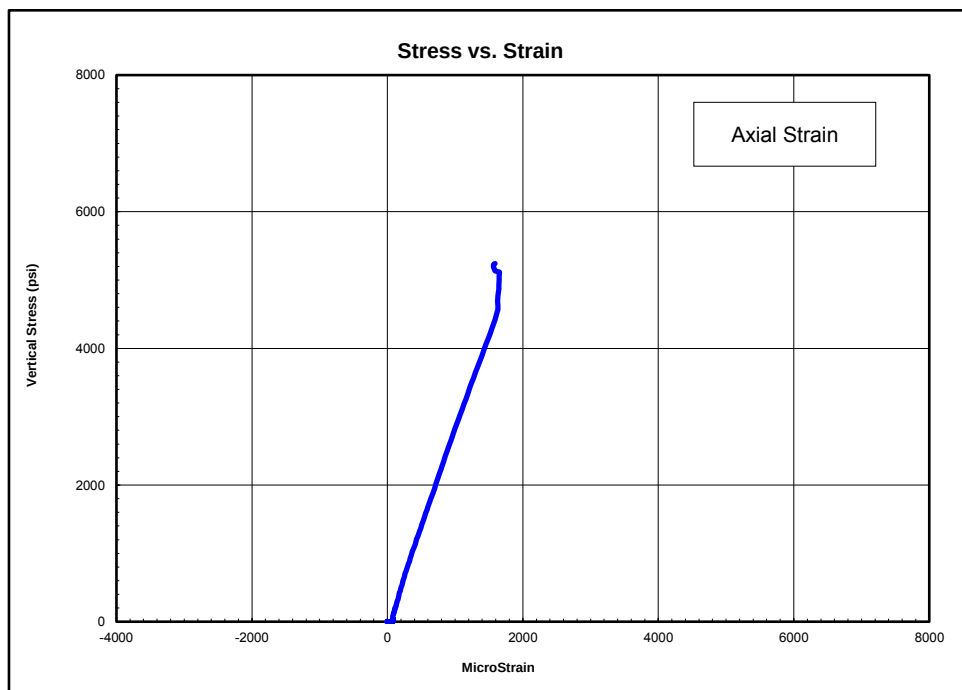


After break



Client:	Shonewald Engineering Associates, Inc.
Project Name:	MeDOT WIN 23484.00 MSFT Islesboro, ME
Project Location:	Islesboro, ME
GTX #:	308806
Test Date:	9/25/2018
Tested By:	tlm
Checked By:	jsc
Boring ID:	MB-ISLES-104
Sample ID:	R6
Depth, ft:	39.9-40.2
Sample Type:	rock core
Sample Description:	See photographs Discontinuity failure

Compressive Strength and Elastic Moduli of Rock by ASTM D7012 - Method D



Peak Compressive Stress: 5,242 psi

Both lateral strain gauges failed to record meaningful data. Poisson's Ratio could not be determined.

Stress Range, psi	Young's Modulus, psi	Poisson's Ratio
500-1900	2,930,000	---
1900-3300	2,850,000	---
3300-4700	2,750,000	---

Notes: Test specimen tested at the approximate as-received moisture content and at standard laboratory temperature.
The axial load was applied continuously at a stress rate that produced failure in a test time between 2 and 15 minutes.
Young's Modulus and Poisson's Ratio calculated using the tangent to the line in the stress range listed.
Calculations assume samples are isotropic, which is not necessarily the case.

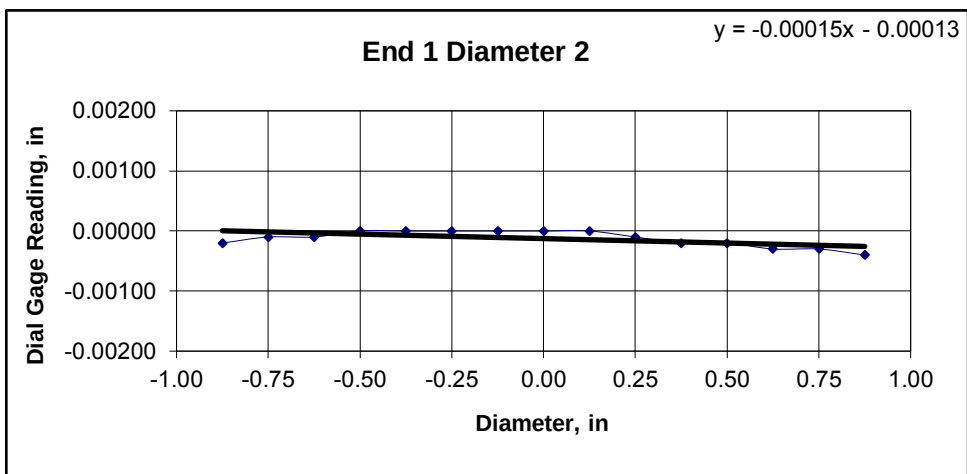
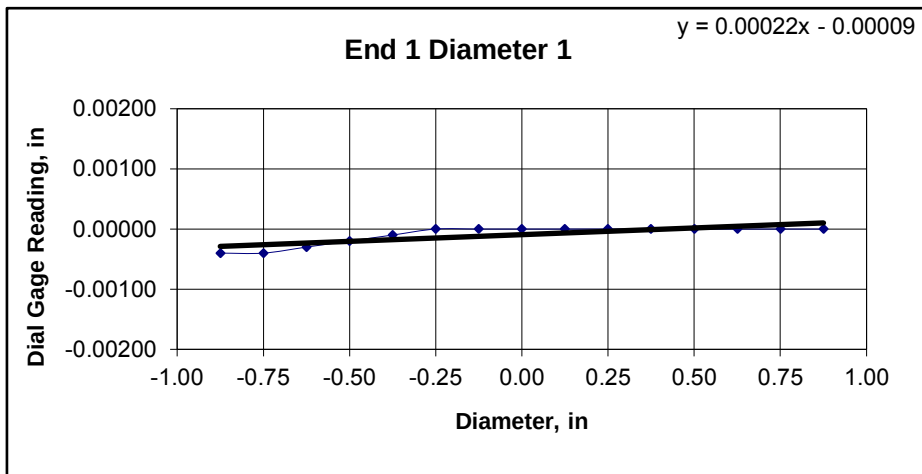


Client:	Shonewald Engineering Associates, Inc.	Test Date:	9/21/2018
Project Name:	MeDOT WIN 23484.00 MSFT Islesboro, ME	Tested By:	tlm
Project Location:	Islesboro, ME	Checked By:	jsc
GTX #:	308806		
Boring ID:	MB-ISLES-104		
Sample ID:	R6		
Depth:	39.9-40.2 ft		
Visual Description:	See photographs		

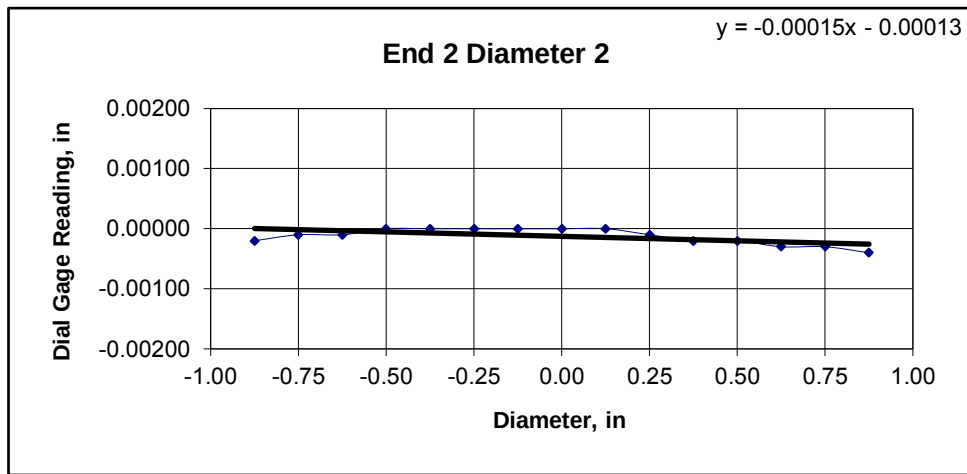
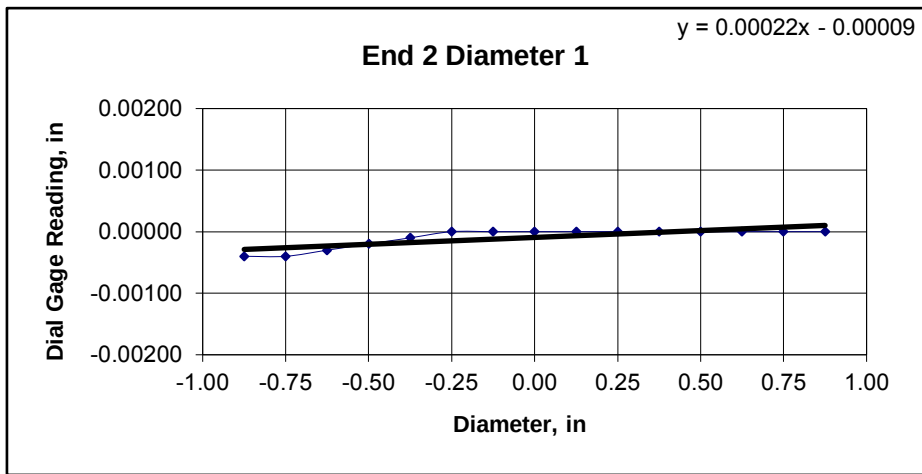
UNIT WEIGHT DETERMINATION AND DIMENSIONAL AND SHAPE TOLERANCES OF ROCK CORE SPECIMENS BY ASTM D4543

BULK DENSITY				DEVIATION FROM STRAIGHTNESS (Procedure S1)	
	1	2	Average		
Specimen Length, in:	4.03	4.03	4.03	Maximum gap between side of core and reference surface plate:	
Specimen Diameter, in:	1.99	1.99	1.99	Is the maximum gap $\leq$ 0.02 in.?	
Specimen Mass, g:	529.67			YES	
Bulk Density, lb/ft ³	161			Maximum difference must be < 0.020 in.	
Length to Diameter Ratio:	2.0	Minimum Diameter Tolerance Met?	YES	Straightness Tolerance Met?	
		Length to Diameter Ratio Tolerance Met?	YES	YES	

END FLATNESS AND PARALLELISM (Procedure FP1)															
END 1	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	-0.00040	-0.00040	-0.00030	-0.00020	-0.00010	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
Diameter 2, in (rotated 90°)	-0.00020	-0.00010	-0.00010	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	-0.00010	-0.00020	-0.00020	-0.00030	-0.00030	-0.00040
Difference between max and min readings, in:															
0° = 0.00040 90° = 0.00040															
END 2	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	-0.00040	-0.00040	-0.00030	-0.00020	-0.00010	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
Diameter 2, in (rotated 90°)	-0.00020	-0.00010	-0.00010	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	-0.00010	-0.00020	-0.00020	-0.00030	-0.00030	-0.00040
Difference between max and min readings, in:															
0° = 0.0004 90° = 0.0004															
Maximum difference must be < 0.0020 in. Difference = $\pm$ 0.00020															
Flatness Tolerance Met? YES															



DIAMETER 1	
End 1:	
Slope of Best Fit Line	0.00022
Angle of Best Fit Line:	0.01277
End 2:	
Slope of Best Fit Line	0.00022
Angle of Best Fit Line:	0.01277
Maximum Angular Difference:	0.00000
Parallelism Tolerance Met?	YES
Spherically Seated	



DIAMETER 2	
End 1:	
Slope of Best Fit Line	0.00015
Angle of Best Fit Line:	0.00851
End 2:	
Slope of Best Fit Line	0.00015
Angle of Best Fit Line:	0.00851
Maximum Angular Difference:	0.00000
Parallelism Tolerance Met?	YES
Spherically Seated	

PERPENDICULARITY (Procedure P1)						Perpendicularity Tolerance Met?	Maximum angle of departure must be $\leq$ 0.25°
	(Calculated from End Flatness and Parallelism measurements above)						
END 1	Difference, Maximum and Minimum (in.)	Diameter (in.)	Slope	Angle°			
Diameter 1, in	0.00040	1.990	0.00020	0.012	YES		
Diameter 2, in (rotated 90°)	0.00040	1.990	0.00020	0.012	YES		
Perpendicularity Tolerance Met?							YES
END 2							
Diameter 1, in	0.00040	1.990	0.00020	0.012	YES		
Diameter 2, in (rotated 90°)	0.00040	1.990	0.00020	0.012	YES		

Client:	Schonewald Engineering Associates, Inc.
Project Name:	MeDOT WIN 23484.00 MSFT Islesboro, ME
Project Location:	Islesboro, ME
GTX #:	308806
Test Date:	9/21/2018
Tested By:	tlm
Checked By:	jsc
Boring ID:	MB-ISLES-104
Sample ID:	R6
Depth, ft:	39.9-40.2



After cutting and grinding



After break



APPENDIX D

CALCULATIONS

Project: MaineDOT MSFT Fender System Modifications

Proj. No.: 18-010 - 18-014

Location: Vinalhaven, Frenchboro, Bass Hbr, Swans Is, Islesboro

Subject: Geotechnical Calculations

Last updated: Feb. 2019 **By** IVS

Rock Quality and Compressive Strength Summary

Checked: May 2019 **By** SJR

Objective: Compile field and lab data to evaluate quality and strength of bedrock underlying the five Maine State Ferry Terminal (MSFT) sites.

Data Sources: Published bedrock geological information

Site-specific test boring logs, specifically rock core descriptions and RQDs.

Site-specific laboratory test results: unconfined compression tests on rock core samples.

VINALHAVEN, FRENCHBORO, BASS HARBOR, AND SWANS ISLAND

TEST BORINGS: Rock observed underlying the Vinalhaven and Frenchboro sites consists of GRANITE. : Rock observed underlying the Bass Harbor and Swans Island sites consists of BASALT. Both are very hard, fine to medium grained igneous crystalline rock and would be expected to behave the same under loading. RQDs and the results of laboratory uniaxial compressive strength tests are summarized on the test boring stick figures on Page 3 of 4.

LABORATORY TESTS: results of laboratory uniaxial compressive strength tests on the GRANITE and BASALT encountered in Vinalhaven, Frenchboro, Bass Hbr, and Swans Is are as follows:

UCT q_p (ksi)			
17.3			
29.4			
15.9			
14.1	average peak uniaxial compressive strength =	16.4 ksi =	16,446 psi
16.4			
15.9	throw out upper and lower results (strikethroughs), average peak uniaxial compressive strength = 15.6 ksi = 15,571 psi		
12.6			
7.9			
6.7	minimum peak uniaxial compressive strength =	6.7 ksi =	6,700 psi
16.8			
7.4	maximum peak uniaxial compressive strength =	29.4 ksi =	29,400 psi
26.2			
27.5			

VINALHAVEN, FRENCHBORO, BASS HARBOR, AND SWANS ISLAND

require pipe pile to penetrate 2 ft into bedrock prior to coring for rock anchors

bond stresses are concentrated at top of bonded length, therefore, require top of bonded length a minimum of 5 ft into bedrock where bedrock is GRANITE or BASALT based on rock core RQDs (see Page 3 of 4).

Project: MaineDOT MSFT Fender System Modifications

Proj. No.: 18-010 - 18-014

Location: Vinalhaven, Frenchboro, Bass Hbr, Swans Is, Islesboro

Subject: Geotechnical Calculations

Last updated: Feb. 2019 **By** IVS

Rock Quality and Compressive Strength Summary

Checked: May 2019 **By** SJR

Objective: Compile field and lab data to evaluate quality and strength of bedrock underlying the five Maine State Ferry Terminal (MSFT) sites.

Data Sources: Published bedrock geological information

Site-specific test boring logs, specifically rock core descriptions and RQDs.

Site-specific laboratory test results: unconfined compression tests on rock core samples.

ISLESBORO

TEST BORINGS: Rock observed underlying the Islesboro site consists of METAPELITE, which is an aphanitic to fine grained, low-grade metamorphosed mudstone. RQDs and the results of laboratory uniaxial compressive strength tests are summarized on the test boring stick figures on Page 4 of 4.

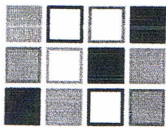
LABORATORY TESTS: results of laboratory uniaxial compressive strength tests on the METAPELITE encountered in Islesboro are as follows:

UCT q_p (ksi)			
11.4			
8.2			
8.5			
4.0	average peak uniaxial compressive strength =	6.5 ksi =	6,467 psi
6.9			
8.5	throw out upper and lower results (strikethroughs), average peak uniaxial compressive strength = 7.1 ksi = 7,122 psi		
7.0			
7.6			
6.1	minimum peak uniaxial compressive strength =	1.0 ksi =	1,000 psi
6.1			
4.4	maximum peak uniaxial compressive strength =	11.1 ksi =	11,100 psi
5.2			

ISLESBORO

require pipe pile to penetrate 2 ft into bedrock prior to coring for rock anchors

bond stresses are concentrated at top of bonded length, therefore, require top of bonded length a minimum of 15 ft into bedrock where bedrock is METAPELITE based on rock core RQDs (see Page 4 of 4)



Client HNTB
Project MEDOT MSFT FENDER SYSTEM MODIFICATIONS
Location VINHANGON, FRENCHBORO, BASS HBR, SWANS IS,
Subject ROCK QUALITY AND COMPRESSIVE STRENGTH SUMMARY

File No. 18-010 - 18-014
Prepared FEB 2019 By IUS
Checked By
Revised By

VINALMAVEN MB-VINALMAVEN-101 EL -36.9 FT	83%	R1	82%	R2	17.3 KSI 20.4 KSI UCT _{gp}	93%	R3	60%	R4	60%	R5	90%	R6	GRANITE (GABRO)						
BASS HBR MB-BASS-101 EL -62.0 FT	0%	R1	58%	R2	UCT _{gp}	78%	R3	15.9 KSI 14.1 KSI UCT _{gp}	22%	R4	26%	R5	33%	R6	55%	R7	53%	R8	BASALT	
SWANS IS MB-SWAN-101 EL -20.2 FT	25%	R1	60%	R2	15.9 KSI UCT _{gp}	80%	R3	75%	R4	57%	R5	26%	R6	BASALT						
SWANS IS MB-SWAN-102 EL -40.1 FT	35%	R1	50%	R2	12.6 KSI UCT _{gp}	44%	R3	77%	R4	62%	R5	47%	R6	97%	R7	BASALT				
FRENCHBORO MB-FBORO-101 EL -54.2 FT	63%	R1	73%	R2	16.8 KSI UCT _{gp}	80%	R3	82%	R4	71.1 KSI UCT _{gp}	GRANITE									
FRENCHBORO MB-FBORO-102 EL -47.4 FT	33%	R1	62%	R2	26.2 KSI UCT _{gp}	64%	R3	93%	R4	83%	R5	87%	R6	GRANITE						

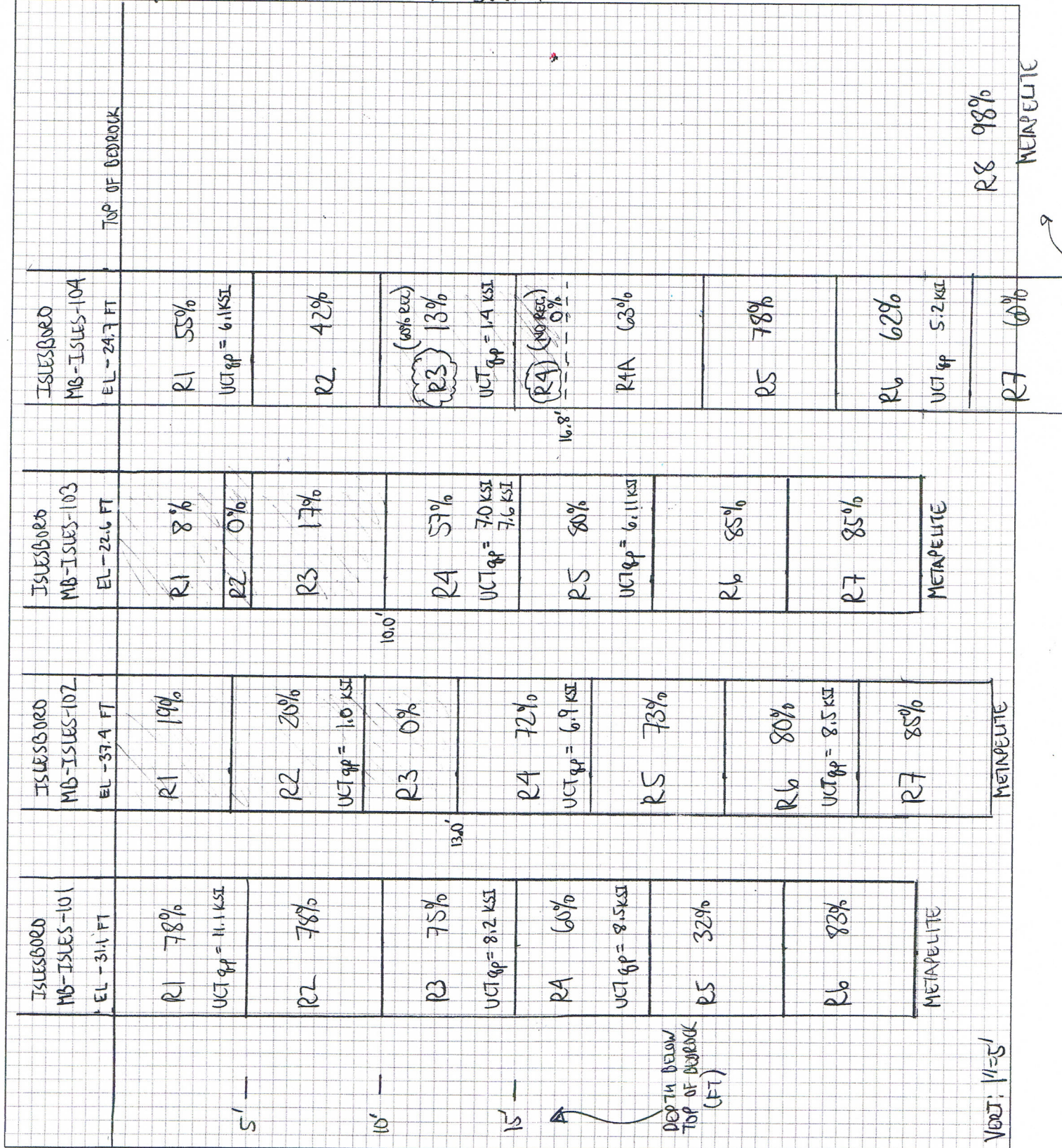
TOP OF BEDROCK

DEPTH BELOW TOP OF BEDROCK

VERT: 1" = 5'

Client HMB
Project MBOT MSFT FENDER SYSTEM MODIFICATIONS
Location ISLESBORO
Subject ROCK QUALITY AND COMPRESSIVE STRENGTH SUMMARY

File No. 18-010 - 18-014
Prepared Feb 2019 By IUS
Checked By
Revised By



Project: MaineDOT MSFT Fender System Modifications

Proj. No. 18-010 - 18-014

Location: Vinalhaven, Frenchboro, Bass Hbr, Swans Is, Islesboro

Subject: Geotechnical Calculations

Last updated: May 2019 **By** IVS

Geotechnical axial capacity of pipe piles

Checked: May 2019 **By** SJR

Objective:

Check geotechnical axial compressive capacity of pipe piles for turning dolphins and mooring dolphin.

References:

2014 LRFD Manual - Article 10.5.5 "Resistance Factors"

Article 10.7.3.2.3 "Point Bearing Piles on Rock - Piles Driven to Hard Rock"

Duncan C. Wyllie's "Foundations on Rock" - Section 8.3.2 "Rock Socketed Piers - End-Bearing Capacity"

Data Sources:

Refer to calculations entitled "Rock Quality and Compressive Strength Summary"

Discussion:

Per the LRFD Manual Article 10.7.3.2.3 - The nominal resistance of piles driven to point bearing on hard rock where pile penetration is minimal is controlled by the structural limit state. Per the LRFD Manual Article 10.5.5 - The resistance factor for driven piles, drilled shafts, and micropiles in axial compression bearing on rock is 0.50.

Per Wyllie - The allowable end-bearing capacity of rock socketed piles, which includes a Factor of Safety of 2 to 3, is a function of the uniaxial compressive strength of the rock at the base of the pile. Working through Wyllie's analysis and assuming a Factor of Safety of 2, the ultimate end-bearing capacity can be determined and can be considered roughly equivalent to the nominal resistance of the pile.

Analysis:

$$Q_{ult} = Q_{avail} * FS$$

$$Q_{ult} = (UCT_{qp}) * (\pi(B/2)^2) \quad \text{from Wyllie Eq 8.9 and conservatively assuming a FS=2}$$

where: Q_{ult} = ultimate axial capacity in end-bearing

UCT_{qp} = uniaxial compressive strength of intact rock

B = pile diameter

- ❖ capacity of **turning dolphins (TDs)** proposed at Vinalhaven, Frenchboro, Bass Hbr & Swans Is, all of which are underlain by GRANITE or BASALT with a $UCT_{qp} = 15.6$ ksi (refer to rock quality and compressive strength calcs)

$$Q_{ult} = (UCT_{qp}) * (\pi(B/2)^2)$$

$$Q_{ult} = (15.6 \text{ ksi}) * [(\pi)(8 \text{ in})^2]$$

$$Q_{ult} = 3,136 \text{ kips}$$

$$Q_{avail} = Q_{ult}/FS = Q_{ult} * \phi_{stat}$$

where: FS = factor of safety

ϕ_{stat} = resistance factor (tip resistance on rock)

$$3,136 \text{ kips} * 0.5$$

$$1,568 \text{ kips}$$

per HNTB TD design: $Q_{req'd} = 345$ kips

$Q_{avail} = 1,568 \text{ kips} \gg Q_{req'd} = 345 \text{ kips}$

OKAY

- ❖ capacity of **mooring dolphin (MDs)** proposed at Islesboro, that is underlain by METAPELITE with a $UCT_{qp} = 7.1$ ksi (refer to rock quality and compressive strength calcs)

$$Q_{ult} = (UCT_{qp}) * (\pi(B/2)^2)$$

$$Q_{ult} = (7.1 \text{ ksi}) * [(\pi)(8 \text{ in})^2]$$

$$Q_{ult} = 1,427 \text{ kips}$$

$$Q_{avail} = Q_{ult}/FS = Q_{ult} * \phi_{stat}$$

$$1,427 \text{ kips} * 0.5$$

$$714 \text{ kips}$$

per HNTB MD design: $Q_{req'd} = 163$ kips

$Q_{avail} = 714 \text{ kips} \gg Q_{req'd} = 163 \text{ kips}$

OKAY

Project: MaineDOT MSFT Fender System Modifications

Proj. No. 18-010 - 18-014

Location: Vinalhaven, Frenchboro, Bass Hbr, Swans Is, Islesboro

Subject: Geotechnical Calculations

Last updated: Mar 2019 **By** IVS

Rock anchor capacity

Checked: May 2019 **By** SJR

Objective:

Check geotechnical capacity of rock anchors proposed for turning dolphins and mooring dolphin.

References:

2014 LRFD Manual - Article 11.5.7 "Resistance Factors" (pullout resistance of anchors utilized for permanent anchored retaining walls) and Article 11.9.4.2 "Anchor Pullout Capacity"

Duncan C. Wyllie "Foundations on Rock" - Section 9.3.2 "Tension Foundations - Allowable bond stresses and anchor design"

Post-Tensioning Institute "Recommendations for Prestressed Rock and Soil Anchors" - Article 6.0 "Design"

Data Sources:

Refer to calculations entitled "Rock Quality and Compressive Strength Summary"

Discussion:

The tensile capacity of rock anchors was determined using established ASD methods (Wyllie and PTI) in the absence of definitive guidance in the LRFD Manual, Article 11.9.4.2 - "Anchor Pullout Capacity." A resistance factor equal to 1.0 is allowed for per the LRFD Manual since all the rock anchors will be tested.

Per Wyllie - The design against failure of the anchor at the grout interfaces requires that the length of the bond zone, and the diameter of the threadbar and drill hole are proportioned such that the average bond stress is less than the working bond strength. Selecting the location (depth into rock) of the top of the bonded length must recognize that stresses are concentrated near the top of the bonded length.

Analysis:

$$Q_{avail} = Q_{ult} / FS$$

$$Q_{avail} = (Lb)(\pi)(d)(T_a) \quad \text{from Wyllie Eq 9.8, which includes a } FS=3 \text{ through the } T_a \text{ term}$$

where: Q_{avail} = available tensile capacity of rock anchor

Lb = bonded length = 15 ft per design

d = drill hole diameter = 4.5 in = 0.375 ft per design

T_a = working bond strength of rock-grout interface

$T_a \approx (UCT \text{ qp})/30$ up to 1.4 Mpa or 203 psi (Wyllie, Eq 9.9)

- ❖ capacity of **turning dolphins (TDs)** proposed at Vinalhaven, Frenchboro, Bass Hbr & Swans Is, all of which are underlain by GRANITE or BASALT with a $UCT \text{ qp} = 15.6 \text{ ksi}$
(refer to rock quality and compressive strength calcs)

$$T_a \approx (UCT \text{ qp})/30 = (15,600 \text{ psi})/30 = 520 \text{ psi} \quad 520 \text{ psi} > 203 \text{ psi, use } T_a = 203 \text{ psi}$$

$$Q_{avail} = (Lb)(\pi)(d)(T_a)$$

$$Q_{avail} = (15 \text{ ft}) * (\pi)(0.375 \text{ ft}) [(203 \text{ lb/in}^2)(144 \text{ in}^2/\text{ft}^2)]$$

$$Q_{avail} = 516,557 \text{ lbs}$$

$$Q_{avail} = 517 \text{ kips}$$

per HNTB TD design: $Q_{req'd} = 112 \text{ kips}$ $Q_{avail} = 517 \text{ kips} >> Q_{req'd} = 112 \text{ kips}$ **OKAY**

- ❖ capacity of **mooring dolphin (MDs)** proposed at Islesboro, that is underlain by METAPELITE with a $UCT \text{ qp} = 7.1 \text{ ksi}$ (refer to rock quality and compressive strength calcs)

$$T_a \approx (UCT \text{ qp})/30 = (7,100 \text{ psi})/30 = 237 \text{ psi} \quad 237 \text{ psi} > 203 \text{ psi, use } T_a = 203 \text{ psi}$$

$$Q_{avail} = (Lb)(\pi)(d)(T_a)$$

$$Q_{avail} = (15 \text{ ft}) * (\pi)(0.375 \text{ ft}) [(203 \text{ lb/in}^2)(144 \text{ in}^2/\text{ft}^2)]$$

$$Q_{avail} = 516,557 \text{ lbs}$$

$$Q_{avail} = 517 \text{ kips}$$

per HNTB MD design: $Q_{req'd} = 49 \text{ kips}$ $Q_{avail} = 517 \text{ kips} >> Q_{req'd} = 49 \text{ kips}$ **OKAY**

Project: MaineDOT MSFT Fender System Modifications

Proj. No. 18-010 - 18-014

Location: Vinalhaven, Frenchboro, Bass Hbr, Swans Is, Islesboro

Subject: Geotechnical Calculations

Last updated: Apr 2019

By IVS

Geotechnical uplift capacity of wave screen timber piles

Checked: May 2019

By SJR

Objective:

Estimate geotechnical uplift capacity of timber piles for wave screens using static methods.

References:

2014 LRFD Manual - Article 10.5.5 "Resistance Factors"

Article 10.7.3.10 "Uplift Resistance of Single Piles"

Data Sources:

Overburden conditions encountered in recent subsurface explorations (refer to summary on Page 4) and historical subsurface data from Vinalhaven and Swans Island (refer to Pages 5 and 6);

Proposed wave screen locations (refer to Pages 5 and 6).

Discussion:

Per the LRFD Manual Article 10.7.3.2.3 - The nominal uplift resistance of a driven pile, R_s , is calculated using an appropriate method of determining side resistance of a single pile. This analysis uses the static Norlund method for calculating nominal side resistance in cohesionless soils and the static alpha method for calculating nominal side resistance in cohesive soils.

Per the LRFD Manual Table 10.5.5.2.3-1 - The resistance factor for the uplift resistance of a single driven pile after the Norlund method is $\phi_{up} = 0.35$ and after the alpha method is $\phi_{up} = 0.25$.

$$R_R = R_s \phi_{up}$$

where: R_R = factored uplift resistance

ϕ_{up} = uplift resistance factor (see above discussion)

R_s = nominal side resistance

$$R_s = q_s A_s$$

where: q_s = unit side resistance of pile

A_s = surface area of pile = circumference * L = $C * L$

C (timber pile) = $2\pi r = 2\pi(9 \text{ in}/2) = 2.36 \text{ ft}$

Analysis - Norlund method for cohesionless soils:

$$q_s = K \delta C_f \phi' v [(\sin(\delta + \omega)) / \cos \omega]$$

from: LRFD Manual Eq 10.7.3.8.6f-1 with ϕ_f taken as 30 deg.

where: $K \delta$ = coef. of lateral earth pressure at mid-point of layer under consideration; Fig 10.7.3.8.6f-2

C_f = correction factor for $K \delta$; Fig 10.7.3.8.6f-5

$\phi' v$ = effective overburden pressure at midpoint of layer

δ = friction angle between pile and soil; Fig 10.7.3.8.6f-6

ω = angle of pile taper from vertical = 0.47 deg

(assume taper from 12 in to 8 in over 40 ft)

function of soil: ϕ_f taken as 30 deg.

function of pile: $K \delta = 2.55$ from Fig 10.7.3.8.6f-2 with $\omega = 0.47$ deg

$\delta = 16.5$ from Fig 10.7.3.8.6f-6 for timber pile and $Vol = 0.55 \text{ cf/ft}$

$C_f = 0.8$ from Fig 10.7.3.8.6f-5 with $\phi_f = 30$ deg and $\delta = 16.5$ deg

Analysis - alpha method for cohesive soils:

$$q_s = (S_u)(\alpha)$$

where: S_u = average undrained shear strength of soil

taken as 400 psf based on field observation and experience

α = function of S_u ; taken from LRFD Fig 10.7.3.8.6b-1

with $D = 9 \text{ in} = 0.75 \text{ ft}$ and D_b from soil profile

where D_b is the length of the pile providing resistance

Project: MaineDOT MSFT Fender System Modifications

Proj. No. 18-010 - 18-014

Location: Vinalhaven, Frenchboro, Bass Hbr, Swans Is, Islesboro

Subject: Geotechnical Calculations

Last updated: Apr 2019

By IVS

Geotechnical uplift capacity of wave screen timber piles

Checked: May 2019

By SJR

ANALYSIS (cont'd)

resistance is a function of soil profile:

develop reasonable subsurface profile for modeling the proposed wave screens

refer to summary of overburden conditions (Pg 4) and proposed wave screen locations (Pgs 5 and 6)

Islesboro: cohesionless; base on **MB-ISLES-103**; ISLES-101 and ISLES-102 similar

Swans Island: cohesionless; westerly end base on **MB-ISLES-103**, that is similar to SWAN-101
cohesionless; easterly end base on **MB-ISLES-104**, that is similar to historic data

Vinalhaven: cohesive; base on **MB-VNHN-101**, that is similar to historic Vinalhaven data

Bass Harbor: cohesive; base on **MB-SWAN-102**; conservatively low, but limited data available

Frenchboro: no wave screens proposed at Frenchboro

EVALUATE FOR LOCATIONS WITH COHESIONLESS SOILS

❖ uplift capacity of single timber pile based on **MB-ISLES-103**

disregard resistance from "muck;" resistance only from soil layer between 2 and 6 ft BGS

$$\phi'v = (115 \text{ pcf} - 62.4 \text{ pcf})(4 \text{ ft}) = 210 \text{ psf (at midpoint of layer)}$$

$$qs = K\delta \text{ Cf } \phi'v [(\sin(\delta+\omega)) / \cos \omega]$$

$$qs = (2.55)(0.8)(210)[(\sin(16.5+0.47)/\cos(0.47))]$$

$$qs = 125 \text{ psf}$$

$$Rs = qs \cdot As$$

$$Rs = 125 \text{ psf} \cdot 4 \text{ ft} \cdot 2.36 \text{ ft}$$

$$Rs = 1,180 \text{ lbs}$$

$$Rs = 1.2 \text{ kips}$$

$$R_R = R_s \phi_{up}$$

$$R_R = 1.2 \text{ kips} \cdot 0.35$$

$$R_R = 0.4 \text{ kips}$$

CONCLUSION: uplift capacity negligible; (structural) design
of wave screen must limit uplift (tensile) load

NOTE applies to prop. Islesboro wave screens & westerly end of Swans Is. wave screen

❖ uplift capacity of single timber pile based on **MB-ISLES-104**

disregard resistance from "muck;" resistance only from soil layer between 2 and 13 ft BGS

$$\phi'v = (115 \text{ pcf} - 62.4 \text{ pcf})(7.5 \text{ ft}) = 395 \text{ psf (at midpoint of layer)}$$

$$qs = K\delta \text{ Cf } \phi'v [(\sin(\delta+\omega)) / \cos \omega]$$

$$qs = (2.55)(0.8)(395)[(\sin(16.5+0.47)/\cos(0.47))]$$

$$qs = 235 \text{ psf}$$

$$Rs = qs \cdot As$$

$$Rs = 235 \text{ psf} \cdot 11 \text{ ft} \cdot 2.36 \text{ ft}$$

$$Rs = 6,101 \text{ lbs}$$

$$Rs = 6.1 \text{ kips}$$

$$R_R = R_s \phi_{up}$$

$$R_R = 6.1 \text{ kips} \cdot 0.35$$

$$R_R = 2.1 \text{ kips}$$

CONCLUSION: uplift capacity limited; (structural) design
of wave screen must limit uplift (tensile) load

NOTE applies to the easterly end of Swans Is. wave screen

Project: MaineDOT MSFT Fender System Modifications

Proj. No. 18-010 - 18-014

Location: Vinalhaven, Frenchboro, Bass Hbr, Swans Is, Islesboro

Subject: Geotechnical Calculations

Last updated: Apr 2019

By IVS

Geotechnical uplift capacity of wave screen timber piles

Checked: May 2019

By SJR

ANALYSIS (cont'd)

EVALUATE FOR LOCATIONS WITH COHESIVE SOILS

❖ uplift capacity of single timber pile based on **MB-VNHN-101**

disregard resistance from "muck;" resistance only from soil layer between 5 and 15 ft BGS

Silty Clay with a $S_u = 400$ psf

$q_s = (S_u)(\alpha)$ with α taken from LRFD Fig 10.7.3.8.6b-1 with $D = 0.75$ ft and $D_b = 10$ ft
and $D_b/D = 13.3$
 $\alpha = 0.6$ (from center fig)

$$q_s = (400)(0.6)$$

$$q_s = 240 \text{ psf}$$

$$R_s = q_s \cdot A_s$$

$$R_s = 240 \text{ psf} \cdot 10 \text{ ft} \cdot 2.36 \text{ ft}$$

$$R_s = 5,664 \text{ lbs}$$

$$R_s = 5.7 \text{ kips}$$

$$R_R = R_s \phi_{up}$$

$$R_R = 5.7 \text{ kips} \cdot 0.25$$

$$R_R = 1.4 \text{ kips}$$

CONCLUSION: uplift capacity limited; (structural) design
of wave screen should limit uplift (tensile) load

NOTE applies to the prop. Vinalhaven wave screens

❖ uplift capacity of single timber pile based on **MB-SWAN-102**

disregard resistance from "muck;" resistance only from soil layer between 4 and 25.5 ft BGS

Silty Clay with a $S_u = 400$ psf

$q_s = (S_u)(\alpha)$ with α taken from LRFD Fig 10.7.3.8.6b-1 with $D = 0.75$ ft and $D_b = 21.5$ ft
and $D_b/D = 28.7$
 $\alpha = 0.95$ (from center fig)

$$q_s = (400)(0.95)$$

$$q_s = 380 \text{ psf}$$

$$R_s = q_s \cdot A_s$$

$$R_s = 380 \text{ psf} \cdot 21.5 \text{ ft} \cdot 2.36 \text{ ft}$$

$$R_s = 19,281 \text{ lbs}$$

$$R_s = 19.2 \text{ kips}$$

$$R_R = R_s \phi_{up}$$

$$R_R = 19.2 \text{ kips} \cdot 0.25$$

$$R_R = 4.8 \text{ kips}$$

CONCLUSION: modest uplift capacity; (structural) design
of wave screen should limit uplift (tensile) load

NOTE applies to the prop. Bass Harbor wave screen; could be conservatively low, but have limited subsurface data

Project: MaineDOT MSFT Fender System Modifications

Proj. No. 18-010 - 18-014

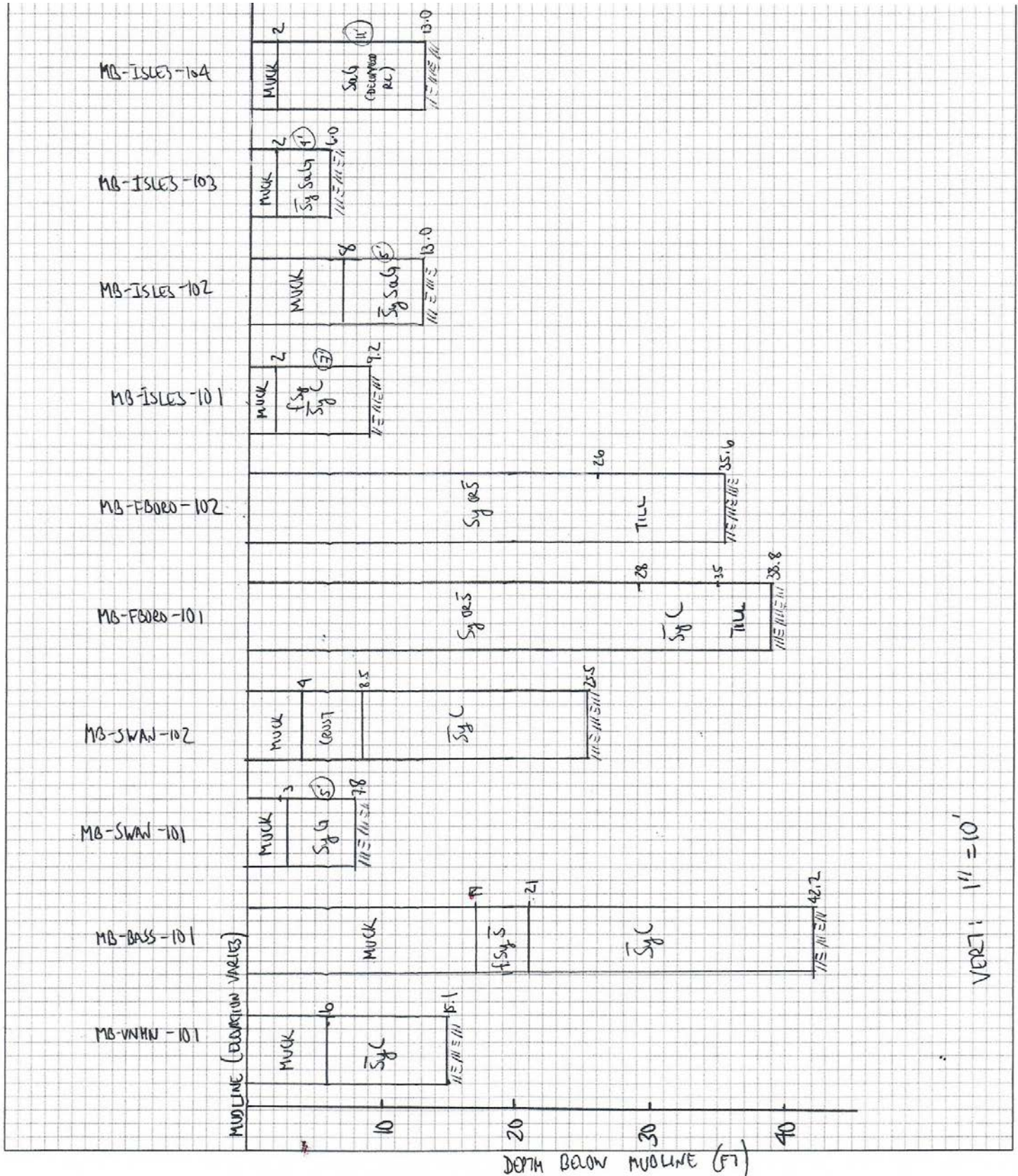
Location: Vinalhaven, Frenchboro, Bass Hbr, Swans Is, Islesboro

Subject: Geotechnical uplift capacity of wave screen timber piles

Last updated: Apr 2019

By IVS

Summary of subsurface conditions - recent test borings



Project: MaineDOT MSFT Fender System Modifications

Proj. No. 18-010 - 18-014

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Summary of wave screen and recent/historic boring locations and historic subsurface data

Legend (Pg 5 & 6):



Prop. Wave Screen



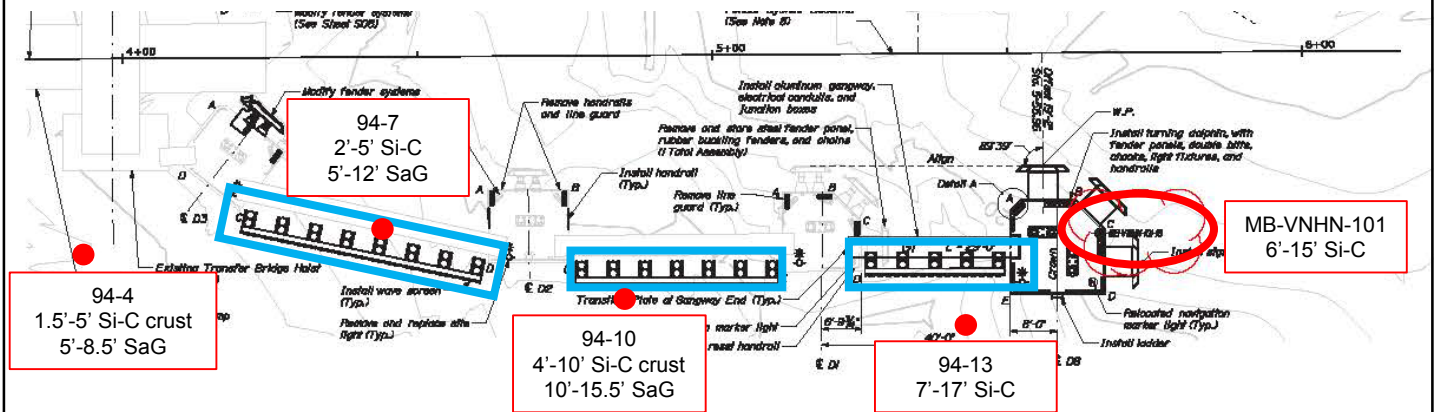
Recent Boring



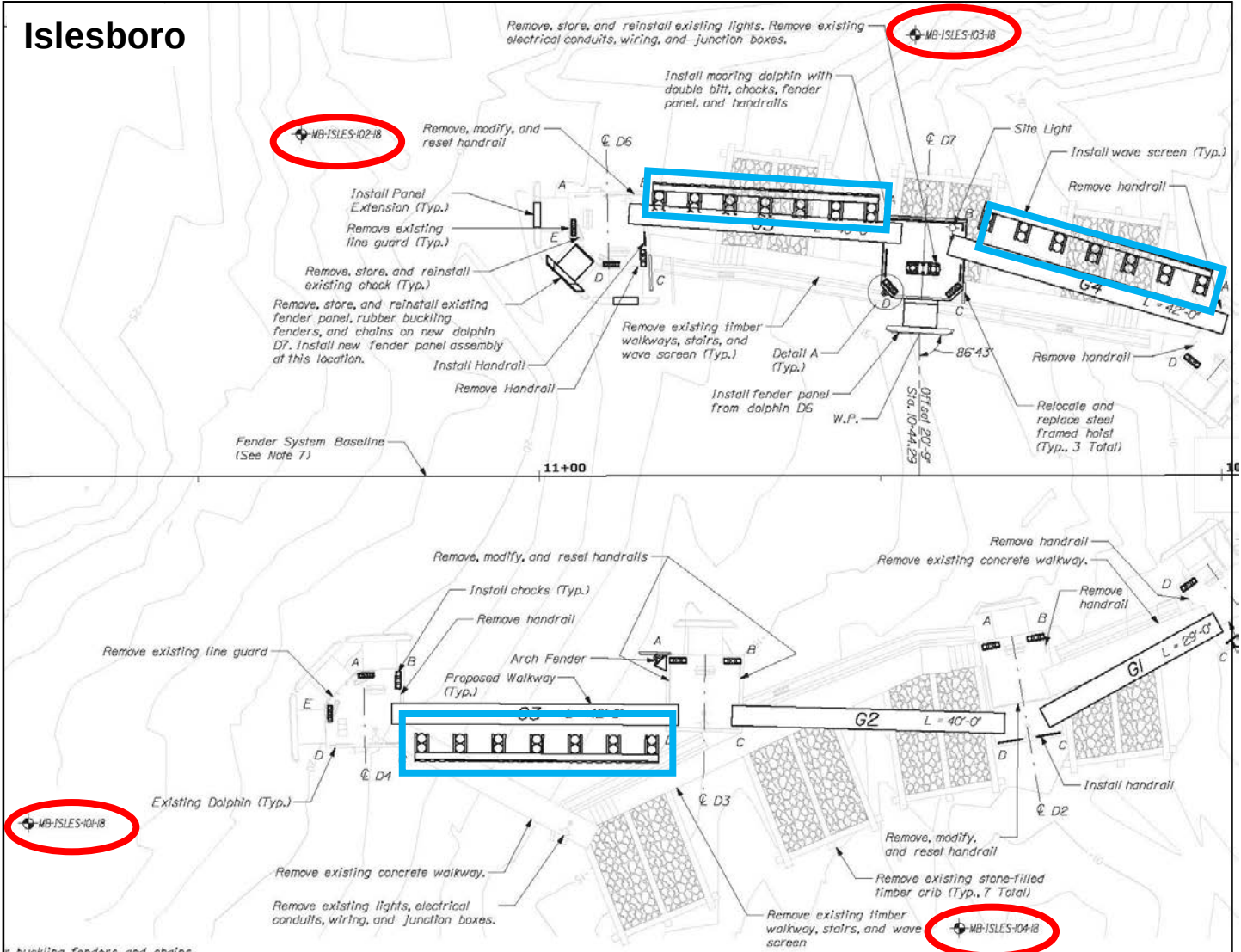
94-13
7'-17' Si-C

Approx. Historic Boring
w/ Summary of Conditions

Vinalhaven



Islesboro



Project: MaineDOT MSFT Fender System Modifications

Proj. No. 18-010 - 18-014

Location: Vinalhaven, Frenchboro, Bass Hbr, Swans Is, Islesboro

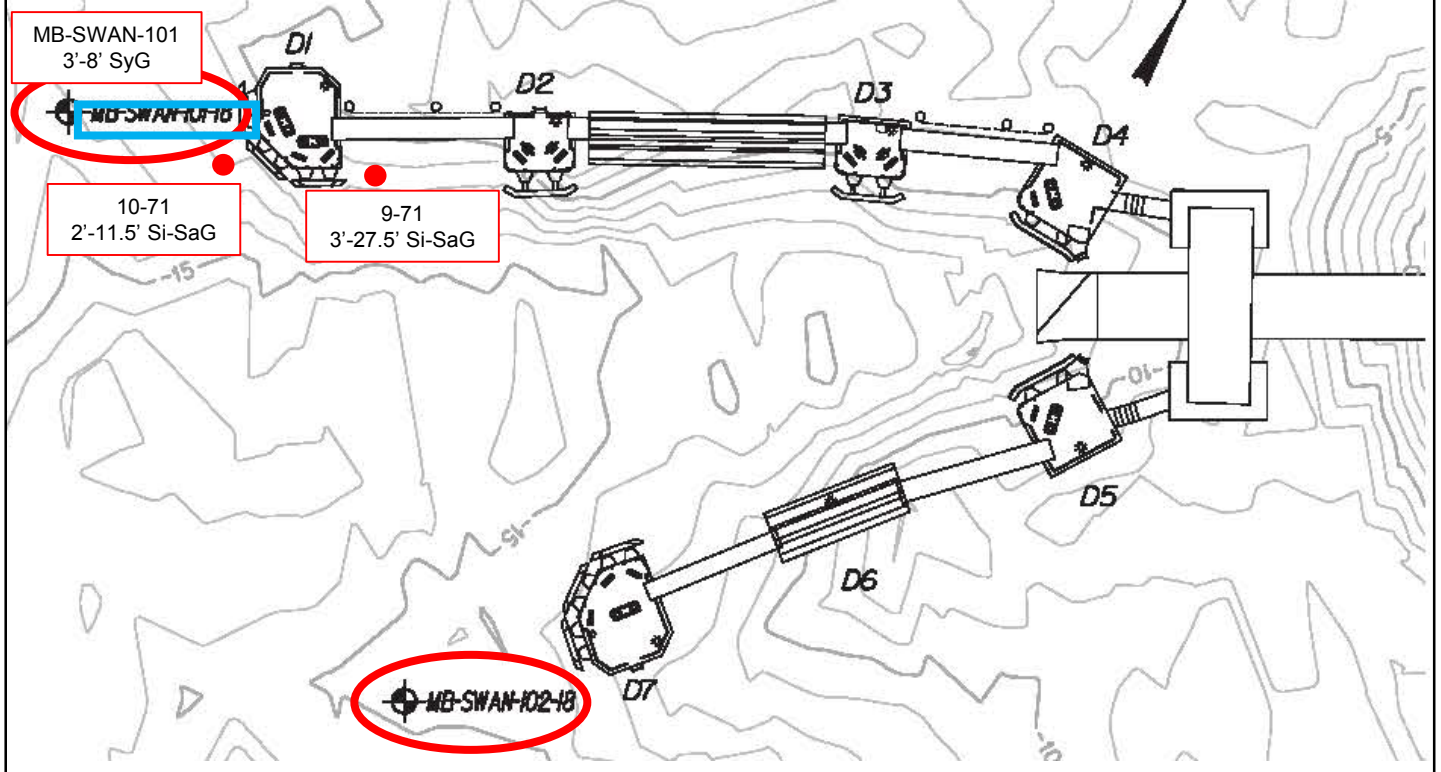
Subject: Geotechnical uplift capacity of wave screen timber piles

Last updated: Apr 2019

By IVS

Summary of wave screen and recent/historic boring locations and historic subsurface data

Swans Island



Bass Harbor

