MAINE DEPARTMENT OF TRANSPORTATION
BRIDGE PROGRAM
GEOTECHNICAL SECTION
AUGUSTA, MAINE

GEOTECHNICAL DESIGN REPORT

For the Replacement of:

STANLEY BROOK BRIDGE
ROUTE 3 OVER STANLEY BROOK
MT. DESERT, MAINE

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Hancock County | Soils Report No. 2010-29
PIN 16718.00 | Bridge No. 5570

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GEOTECHNICAL DESIGN SUMMARY

This report provides geotechnical recommendations for the replacement of Stanley Brook Bridge over the Stanley Brook in Mt. Desert, Maine. The proposed replacement bridge will be an 8-foot high by 26-foot wide concrete box culvert. Staged construction will be used to construct the new box culvert. The bridge will be widened to 38 feet rail to rail width with 11-foot travel lanes, 4-foot shoulders, a 5-foot wide sidewalk and accommodation for guardrail. No significant horizontal alignment changes are planned but the vertical alignment will be raised a maximum of about two feet. The design and construction recommendations below are discussed in greater detail in Section 7.0 Foundation Considerations and Recommendations.

Box Culvert Design and Construction – The concrete box culvert will be supplier-designed and the design shall consider all relevant strength and service limit states and load combinations in accordance with the AASHTO LRFD Bridge Design Specifications, 5th Edition, 2010 (herein referred to as LRFD). The culvert will be constructed in general conformance with the MaineDOT Bridge Design Guide (BDG) Section 8, Buried Structures, and Special Provision 534, Precast Structural Concrete Arches, Box Culverts. A copy of the special provision is presented in Appendix D, Special Provision. The box culvert designer may assume Soil Type 4 (BDG Section 3.6.1) for backfill soil properties. The backfill properties are as follows: ϕ = 32 degrees, γ = 125 pcf.

The box culvert will be bedded on a two foot thick layer of ¾-inch crushed stone reinforced with geogrid and wrapped in geotextile fabric. The soil envelope backfill shall consist of Standard Specification 703.19, Granular Borrow, Material for Underwater Backfill with a maximum particle size of 4.0 inches. Bedding and/or backfill should be placed in lifts 6 to 8 inches thick loose measure and compacted to manufacturer's specifications, but in no case shall the bedding and/or backfill soil be compacted less than 92 percent of the AASHTO T-180 maximum dry density.

Culvert Headwall and Wingwall Design - Culvert headwalls and wingwalls should consider all relevant LRFD strength and service limit states and load combinations and be designed to resist and/or absorb lateral earth loads, a live load surcharge of 250 psf, other vehicular loads, creep, and temperature and shrinkage deformations of the concrete box culverts. Footings for any headwall or wingwall constructed independently of the box culvert shall be placed no less than 2 feet below the maximum anticipated depth of scour.

Culvert headwall and wingwall sections that are fixed to the box culverts to resist movement should be designed for earth pressure using an at-rest earth pressure coefficient, K_o, of 0.5. Headwall and wingwall sections that are independent of the box culvert should be designed using the Rankine active earth pressure coefficient, K_a, equal to 0.31. This assumes level backslope. The earth pressure coefficient may change if backslope conditions are different.

Box Culvert Bearing Resistance – For this project, the service limit state controls. In our analysis, we determined that a factored bearing resistance of 6.0 ksf should be used to control settlement when analyzing box bottom slabs. In no instance shall the bearing stress exceed the nominal resistance of concrete, which may be taken as $0.3f'c$.

Settlement – Total settlement of the prepared culvert subgrade consisting of compacted fill or native soil will be on the order of 1 inch or less which will largely occur during construction. Post-construction settlement will be negligible.

Scour Protection – The box culverts will be fitted with concrete integral headwalls and wingwalls and inlet and outlet seepage cutoff walls below the culvert, all to provide scour protection. The inlet and outlet cutoff walls should extend below the maximum depth of scour. We recommend that the bridge approach slopes be armored with a 4-foot thick layer of heavy riprap adjacent to the culvert openings. The heavy riprap shall be underlain by a Class 1 erosion control geotextile and a 1-foot thick layer of cushion material conforming to Standard Specification 703.19, Granular Borrow for Underwater Backfill. Heavy riprap shall meet the requirements of 703.28, Heavy Riprap, of Special Provision 703, Aggregates. The riprap slope protection should be constructed no steeper than a maximum 1.75:1 (H:V) extending from the edge of roadway down to the existing ground surface. The toe of riprap sections shall be constructed 1 foot below the streambed elevation.

Frost Protection – If used, foundations placed on granular soils shall be founded a minimum of 5.0 feet below finish exterior grade for frost protection. This minimum embedment depth applies only to foundations placed on soil and not those founded on bedrock.

Seismic Design Considerations – Since the buried structure does not cross active faults, no seismic analysis is required.

Construction Considerations –

Excavation

- Construction of the new concrete box culvert will require staged construction and soil excavation. Earth support systems may be required.
- Protect the excavated subgrade from exposure to water and unnecessary construction traffic. Remove and replace water-softened, disturbed, or rutted subgrade soil with compacted gravel borrow.

Dewatering

- Control groundwater and surface water infiltration to permit construction in-the-dry.
- Temporary ditches, French drains, pumping from sumps, granular drainage blankets, stone ditch protection, or hand-laid riprap with geotextile underlayment may be needed to divert groundwater if significant seepage is encountered during excavation.

Reuse of Excavated Soil and Bedrock

- Do not use excavated existing subbase aggregate or approach fill soil for pavement structure construction or to re-base shoulders. Excavated subbase sand and gravel or granular fill may be used as fill below subgrade elevation in fill embankment areas provided all other requirements of MaineDOT Standard Specification Sections 203 and 703 are met.

- Do not use excavated marine clay-silt or glacial till soils for fill anywhere beneath the pavement structure or dressing slopes. Use these soils to dress slopes only below the bottom elevation of the shoulder subbase gravel.
- Marine silty sand and glacial till may be used as common borrow in accordance with MaineDOT Standard Specification Sections 203 and 703. It may be necessary to spread out and dry portions of these soils that are excessively moist.

Embankment Fill Areas

- Bench existing fill slope soils in accordance with MaineDOT Standard Specification 203.09, Preparation of Embankment Area, where new fill slope extensions are constructed over existing slopes.

Erosion Control

- Use MaineDOT Best Management Practices February 2008 to minimize erosion of fine-grained soils found on the project site.

1.0 INTRODUCTION

The Maine Department of Transportation (MaineDOT) plans to replace Stanley Brook Bridge carrying Route 3 over Stanley Brook in the Town of Mt. Desert, Hancock County, Maine. We show the project location on Sheet 1, Site Location Map, appended to this report. We conducted subsurface investigations at the bridge site to develop geotechnical recommendations for the structure replacement. This report summarizes our findings, discusses our evaluation of the subsurface conditions and presents our geotechnical recommendations for design and construction of the bridge foundations.

The existing structure built in 1953 consists of single-span painted steel beams, a structural concrete slab, and an integral wearing surface. The substructures are stone masonry abutments and return wing walls with concrete bearing cap. The dry-laid stone abutments and wing walls are timber pile supported. A major scour event in 2008 exposed the timber pile supports. Scour repairs consisted of grout bags, replacing stones and mortaring joints. The bridge had a sufficiency rating of 53.1 in 2009.

MaineDOT is proposing an 8-foot high by 26-foot wide, concrete box culvert to replace the existing bridge. The new box culvert will be on the same horizontal alignment but the vertical alignment will be raised a maximum of about two feet. The new structure will have a rail-to-rail width of approximately 38 feet. Current plans include 11-foot travel lanes, 4-foot shoulders and a 5-foot sidewalk, as well as accommodation for guardrail, construction of integral concrete culvert headwalls, flared wingwalls and toe walls, and armoring the embankments with riprap.

2.0 GEOLOGIC SETTING

The Maine Geologic Survey (MGS) "Surficial Geology of Bar Harbor Quadrangle, Maine, Open-file No. 74-1" (1974) indicates that surficial soils in the vicinity of Stanley Brook Bridge consist primarily of glacial till soils with bedrock outcrops and nearby glaciomarine soil unit contacts. The predominant native soil units at the site based on our subsurface explorations are glaciomarine which may consist of silt, clay and sands, and glacial till which consists of heterogeneous mixtures of sand, silt, clay and stones.

According to the "Bedrock Geologic Map of Maine" MGS (1985), the bedrock at the Stanley Brook Bridge site consists of Devonian coarse-grained granite with hornblende which we also observed in the borings.

3.0 SUBSURFACE INVESTIGATION

We investigated subsurface conditions at the site by drilling three test borings, BB-MDSB-101, BB-MDSB-101A, and BB-MDSB-102, and three auger probe borings, all conducted by the MaineDOT drill crew in early March 2010. BB-MDSB-101A and BB-MDSB-102 were terminated with bedrock cores. The auger probe borings terminated on obstructions (likely granite blocks) as well as BB-MDSB-101 which also terminated with roller cone refusal on an obstruction. The boring and auger probe locations and soil profile are shown on Sheet 2, Boring Location Plan and Sheet 3, Interpretive Subsurface Profile. Details and sampling methods used, field data obtained, and soil and groundwater conditions encountered are presented on Sheet 4, Boring Logs, and in Appendix A, Boring Logs and Auger Probe Summary Sheet, provided at the end of this report.

The MaineDOT geotechnical team member selected the boring locations and drilling methods, designated the type and depth of sampling techniques, and identified field and laboratory testing requirements. A MaineDOT Certified Subsurface Inspector logged the subsurface conditions encountered on the field logs. The field crew tied down the boring locations by taping distances to adjacent site features. The boring locations were later picked up by MaineDOT survey.

We used solid stem auger and cased wash boring techniques to conduct the borings. Undisturbed tube samples were obtained in the soft soil deposits where possible. In-situ vane shear tests were made at regular intervals in the soft soil deposits to measure the shear strength of the strata. Soil samples were obtained, where possible, at 5-foot intervals using Standard Penetration Test (SPT) methods. The standard penetration resistances, or N-values, discussed in this report are corrected for average hammer energy transfer. We compute the corrected or, N_{60}-values, by applying an average hammer energy transfer factor of 0.84 to the raw field N-values obtained with the MaineDOT drill rig. Bedrock was cored using an NQ-2 core barrel producing a 2.0-inch diameter rock core.

4.0 LABORATORY TESTING

We conducted a laboratory soil testing program on selected samples recovered from the test borings to evaluate soil classification, material reuse, and subgrade soil properties. Laboratory testing consisted of nine (9) standard grain size analyses with natural water contents tests, four (4) with hydrometer analysis, five (5) Atterberg limits tests, one (1) each ignition and consolidation tests. We present results of laboratory testing in Appendix B, Laboratory Test Data. The AASHTO and Unified Soil Classification System (USCS) soil classifications and water content data are also presented on the boring logs in Appendix A.

5.0 SUBSURFACE CONDITIONS

Regional surficial geology maps show that the bridge site is situated in an area of predominantly glacial till soils with numerous bedrock outcrops and lesser amounts of glaciomarine sediments. Nevertheless, the glaciomarine sediment contacts were close to the bridge site as evidenced by the numerous distinct glaciomarine soil units we found in the borings.

The bridge itself is situated at the end of short fill extensions built into the Stanley Brook flood plain. The approach embankment soil behind the existing bridge abutments consists of 4.5 to 11.0 feet of granular fill overlying approximately 9.0 to 13.0 feet of glaciomarine silt, sandy silt and sand which is underlain by approximately 25.0 to 41.8 feet of glaciomarine clay-silt. The clay-silt is underlain by approximately 3.7 to 9.0 feet of glaciomarine sand which in turn is underlain by 5.4 to 10.4 feet of glacial till which overlies bedrock. We present a profile depicting the generalized soil stratigraphy at the bridge site on Sheet 2, Boring Location Plan and Sheet 3, Interpretive Subsurface Profile, provided at the end of this report. A summary description of the subsurface conditions follows.

5.1 Granular Fill

We encountered granular fill to a depth ranging between approximately 4.5 and 11.0 feet below ground surface (bgs). The granular fill consists of fine to coarse sand, with little gravel to gravelly and trace to little silt. Drill attitude also indicated the presence of cobbles and granite blocks at various levels in the fill. The SPT N_{60}-values in the granular fill ranged from 6 to 17 blows per foot (bpf) indicating that the unit is loose to medium dense in consistency.

The granular fill samples had water contents ranging between approximately 6 and 24 percent. Grain size analyses conducted on selected samples of the fill soils indicate that the soils are classified as A-1-a and A-3 by the AASHTO Classification System and SW-SM and SP-SM under the Unified Soil Classification System.

5.2 Glaciomarine Sand, Silt and Clay

We encountered numerous glaciomarine soil units beneath the approach fills. These soil units consist of approximately 9.0 to 13.0 feet of glaciomarine silt, sandy silt and sand, approximately 25.0 to 41.8 feet of glaciomarine clay-silt and 3.7 to 9.0 feet of glaciomarine sand. The clay-silt soil unit is over-consolidated and moderately plastic. At BB-MDSB-101A, there is also a minor peat layer 1.5 feet thick 11.0 to 12.5 feet bgs. SPT N_{60}-values ranged from Weight of Hammer (WOH) to 20 bpf, indicating that the silts and clay-silts are soft to very stiff and the sands are very loose to medium dense in consistency. The tested silt and clay-silt samples had liquid limits ranging between 22 and 41 and plasticity indices ranging between Non-Plastic and 22, and natural water contents ranging between 17 and 78 percent. Grain size analyses indicate that the soils are classified as A-1b, A-2-4, A-4, A-6, and A-7-6 by the AASHTO classification system and SP, SM, ML, and CL by the Unified Soil Classification System. Below the glaciomarine silt and clay we encountered the glacial till soil unit.

5.3 Glacial Till

The glacial till found in the borings generally comprised of fine to coarse sand with little gravel, with trace to some silt. The thickness of this soil unit ranged between approximately 5.4 and 10.4 feet. SPT N_{60}-values ranged from 31 to 78 bpf, indicating the till deposit is dense to very dense in consistency. We observed the glacial till unit over apparent bedrock in BB-MDSB-101A and BB-MDSB-102.

No testing was performed on the glacial till samples.

5.4 Bedrock

We encountered bedrock at approximate depths ranging from 63.4 to 69.4 feet bgs. Locally, the bedrock is mapped as Devonian granite with hornblende which was also observed in borings BB-MDSB-101A and BB-MDSB-102. We determined that the rock quality designation (RQD) of the bedrock ranged from 28 to 48 percent which correlates to a poor rock mass quality. The table below summarizes the top of bedrock elevations at the boring locations:

Substructure	Boring	Station	Depth to Apparent Bedrock (feet bgs)	Elev. of Apparent Bedrock Surface (feet)
Abutment No. 1	BB-MDSB-101A	13+99.7, 5.7 RT	63.4	-53.6
Abutment No. 2	BB-MDSB-102	14+51.9, 9.5 LT	69.4	-59.3

Bedrock Depth and Elevation at the Boring Locations

5.5 Groundwater

We observed the groundwater level at approximately 12.0 feet bgs in boring BB-MDSB-101A and 10.0 feet bgs in BB-MDSB-102. However, the groundwater level will fluctuate with seasonal changes, runoff, and adjacent construction activities.

For a more detailed description of the subsurface conditions, please refer to Appendix A, Boring Logs attached to this report.

6.0 FOUNDATION ALTERNATIVES

The project team considered two alternate replacement designs: 1) 8-foot high by 26-foot wide concrete box culvert; and 2) 38-foot single span with butted precast concrete voided slabs and precast stub integral abutments on piles. The project team selected alternate No. 1, 8-foot high by 26-foot wide concrete box culvert, for the replacement structure. The following section presents geotechnical design recommendations for the concrete box culvert alternate.

7.0 FOUNDATION CONSIDERATIONS AND RECOMMENDATIONS

The design team has selected a concrete box culvert to replace the structure at the Mt. Desert site. The proposed replacement structure will consist of an 8-foot high by 26-foot wide concrete box culvert. The new box culvert will be on the same horizontal alignment but the vertical alignment will be raised a maximum of about two feet. The new structure will have a rail-to-rail width of approximately 38 feet. Current plans include 11-foot travel lanes, 4-foot shoulders and a 5-foot sidewalk, as well as accommodation for guardrail, construction of integral concrete culvert headwalls and wingwalls, toe walls, and armoring the embankments with riprap. The base of the bottom slab will be buried approximately 3.5 feet. The design methodology used in the following evaluation is referenced from the AASHTO LRFD Bridge Design Specifications, 5th Edition, 2010. See Appendix C, Calculations, for supporting documentation for the design parameters discussed below.

7.1 Box Culvert Design and Construction

Precast concrete boxes are typically detailed on the contract plans with only the basic layout and required hydraulic opening so that the contractor may choose among available proprietary products. The manufacturer is responsible for the design of the structure in accordance with Special Provision 534, Precast Structural Concrete Arches, Box Culverts, in Appendix D which includes determination of the wall thickness, haunch thickness and reinforcement. The loading specified for the structure should be Modified HL-93 Strength 1, in which the HL-93 wheel loads are increased by a factor of 1.25. The designer should use Soil Type 4 as presented in Section 3.6, Earth Loads, of the BDG to design earth loads from the soil envelope. The Soil Type properties are as follows: ϕ = 32 degrees, γ = 125 pcf.

The concrete box culverts will be supplier-designed for all relevant strength and service limit states and load combinations specified in LRFD Article 3.4.1, and LRFD Section 12. The culverts will be constructed in general conformance with BDG Section 8, Buried Structures, and Special Provision 534, Precast Structural Concrete Arches, Box Culverts.

The box culvert will be bedded on a two foot thick layer of ¾-inch crushed stone reinforced with geogrid and wrapped in geotextile fabric. The soil envelope and backfill shall consist of Standard Specification 703.19, Granular Borrow, Material for Underwater Backfill with a maximum particle size of 4.0 inches. The crushed stone bedding should be placed in 12-inch thick maximum lifts and compacted with a minimum of four passes of a large walk-behind compactor. The granular borrow backfill should be placed in lifts 6 to 8 inches thick loose measure and compacted to manufacturer's specifications, but in no case shall the backfill soil be compacted less than 92 percent of the AASHTO T-180 maximum dry density.

7.2 Integral Culvert Headwall and Wingwall Design

Integral culvert headwalls and wingwalls are essentially retaining walls sharing a continuous base slab and should be designed for all relevant strength and service limit states and load combinations specified in LRFD Articles 3.4.1, and 11.5.5 and 11.6. The headwalls shall be designed to resist and/or absorb lateral earth loads, vehicular loads, creep, and temperature and shrinkage deformations of the concrete box culvert. The wall shall also be designed considering a live load surcharge equal to a uniform horizontal earth pressure due to an equivalent height of soil (h_{eq}) taken from the table below. For this culvert replacement, the live load surcharge is 250 psf which is equivalent to two feet of soil.

Retaining Wall Height (feet)	h_{eq} (feet)	
	Distance from wall pressure surface to edge of traffic: 0 feet	Distance from wall pressure surface to edge of traffic: $\geq$ 1 feet
5	5.0	2.0
10	3.5	2.0
$\geq$ 20	2.0	2.0

Culvert headwall and wingwall sections that are fixed to the box culverts to resist movement should be designed using an at-rest earth pressure coefficient, K_o, of 0.5. Headwall and wingwall sections that are independent of the box culvert should be designed using the Rankine active earth pressure coefficient, K_a, equal to 0.31. This assumes level backslope. The earth pressure coefficient may change if backslope conditions are different.

Footings for any headwall or wingwall constructed independently of the box culvert should be placed no less than 2 feet below the maximum anticipated depth of scour.

7.3 Box Culvert Bearing Resistance

In our analysis we determined the factored bearing resistance at the strength limit state for the box culvert on compacted fill should not exceed 11.0 ksf. However, when analyzing box bottom slabs for the service limit state as allowed in LRFD C10.6.2.6.1., we determined that a factored bearing resistance of 6 ksf should be used to control settlement based on presumptive bearing resistance values. Thus in this case, the service limit state bearing resistance controls. In no instance shall the bearing stress exceed the nominal resistance of the structure concrete, which may be taken as 0.3 $f'c$.

7.4 Settlement

We have evaluated the potential settlement at the Mt. Desert site. MaineDOT currently plans a vertical alignment grade rise of about two feet maximum. Thus, we estimate that total settlement as a result of fill placement over existing fill and natural soils will be on the order of 1 inch or less. Since the compressible clay-silt layer is over-consolidated, we anticipate that most of the settlement will occur during construction and post-construction settlement will be negligible. Supporting calculations are provided in Appendix C, Calculations.

7.5 Scour Protection

The box culvert will be fitted with integral concrete headwalls and wingwalls and inlet and outlet section seepage cutoff walls below the culvert, all to provide scour protection per BDG 8.3.1. We recommend that the bridge approach slopes be armored with a 4-foot thick layer of heavy riprap adjacent to the culvert openings. The riprap shall be underlain by a Class 1 erosion control geotextile and a 1-foot thick layer of bedding material conforming to Standard Specification 703.19, Granular Borrow for Underwater Backfill and as shown in Standard Detail 610(02). Riprap shall meet the requirements of 703.28, Heavy Riprap, of Special Provision 703, Aggregates. The riprap slope protection should be constructed no steeper than a maximum 1.75:1 (H:V) extending from the edge of roadway down to the existing ground surface. The toe of riprap sections shall be constructed 1 foot below the streambed elevation.

7.6 Frost Protection

We have evaluated the potential frost depth at the Mt. Desert site. Based on State of Maine frost depth maps, MaineDOT Bridge Design Guide (BDG) Figure 5-1, the site has a design-freezing index of approximately 1880 F-degree days. Considering site soils and natural water contents, this correlates to a frost depth of 5.7 feet at this site. We also considered Modberg frost depth projections. The results of the Modberg frost depth model indicate a potential frost depth of 4.4 feet. Consequently, if spread footings are used, we recommend that any spread footing or leveling pads constructed at the site be founded a minimum of 5.0 feet below finished exterior grade for frost protection.

7.7 Seismic Design Considerations

In accordance with LRFD Article 12.6.1, Loading, earthquake loading should only be considered where buried structures cross active faults. Since there are no known active faults in Maine, no seismic analysis is required.

7.8 Construction Considerations

7.8.1 Excavation

Construction of the new concrete box culvert will require soil excavation. Earth support systems may be required. The fill and native glaciomarine and glacial till soils at the site will be susceptible to disturbance and rutting as a result of exposure to water or construction traffic. We recommend that the contractor protect any subgrade from exposure to water and any unnecessary construction traffic. If disturbance and rutting occur, we recommend that the contractor remove and replace the disturbed materials with compacted gravel borrow. If the subgrade soil contains cobbles or boulders, we recommend that the contractor remove any cobbles and boulders larger than 6 inches in diameter. After excavating to the subgrade level, the contractor should proof-roll the surface to identify weak soil areas.

If encountered, unsuitable soils should also be excavated from the subgrade to a depth of one foot and replaced with compacted granular borrow. Granular borrow should conform to MaineDOT Standard Specification 703.19, Granular Borrow. The granular borrow should be compacted to 92 percent of the Modified Proctor maximum dry density (AASHTO T-180).

7.8.2 Dewatering

The native soils within the project area are both poorly drained and moderately to highly frost susceptible. In some locations, these soil units may be saturated and significant water seepage may be encountered during excavation. The groundwater may be trapped in layers and lenses of coarse-grained soil overlying glacial till or between glaciomarine sediments. We anticipate that this seepage will be temporary but there may be localized sloughing and near-surface instability of some soil slopes.

The contractor should control groundwater and surface water infiltration to permit construction in-the-dry. We recommend that the contractor use temporary ditches, sumps, granular drainage blankets, stone ditch protection, or hand-laid riprap with geotextile underlayment to divert groundwater if significant seepage is encountered during construction. We also recommend using French drains daylighted to nearby ditches if significant seepage is encountered in the subgrade along the construction areas. If the amount of seepage is significant, we anticipate that pumping from sumps will likely be needed to control the water.

7.8.3 Reuse of Excavated Soil

The project plans call for excavation of the existing approach areas to achieve planned grades. In the process, the contractor will excavate both the existing subbase gravel, and subgrade fill soils. We do not recommend using the excavated subbase aggregate to re-base the bridge approaches. Excavated subbase and subgrade sand and gravel may be used as fill below the roadway subgrade elevation in fill embankment areas provided all other requirements of MaineDOT Standard Specification Sections 203 and 703 are met.

We do not recommend using any clay-silt soil excavation as fill beneath the pavement structure. This soil may be used as common borrow in accordance with MaineDOT Standard Specification Sections 203 and 703. Contractors should expect that, prior to placement and compaction, it may be necessary to spread out and dry portions of these soils that are excessively moist. This soil may also be used for dressing slopes, but only below the bottom elevation of the shoulder subbase gravel.

7.8.4 Embankment Fill Areas

The current project plans require construction of fill extensions along the bridge approaches. The plans indicate that the side slopes will be constructed to 1.75:1 (H:V) grades or flatter and will be armored with riprap. We recommend benching the existing fill slope soils in accordance with MaineDOT Standard Specification 203.09, Preparation of Embankment

Area, where new fill slope extensions are constructed over existing slopes in preparation for construction of the riprap layer.

7.8.5 Erosion Control Recommendations

The fine-grained soils along the project are susceptible to erosion. We recommend using appropriate erosion control measures during construction as described in the MaineDOT Best Management Practices February 2008 guidelines to minimize erosion of the fine-grained soils at the site.

8.0 CLOSURE

This report has been prepared for use by the MaineDOT Bridge Program for specific application to the replacement of the Stanley Brook Bridge over Stanley Brook in Mt. Desert, Maine. We have prepared the report in accordance with generally accepted soil 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. Further, the analyses and recommendations are based in part upon limited soil explorations completed at discrete locations on the project 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.

We recommend that we be provided the opportunity for a general review of the final design drawings and specifications in order that we may verify that the earthwork and foundation recommendations have been properly interpreted and implemented in the design.

REFERENCES

AASHTO, (2010), LRFD Bridge Design Specifications, Fifth, AASHTO, Washington, D.C.

Bowles, Joseph E. (1996), Foundation Analysis and Design, Fifth Edition, McGraw-Hill, New York, NY.

MaineDOT, (2003), Bridge Design Guide, MaineDOT Bridge Program, Augusta, ME with various Interims.

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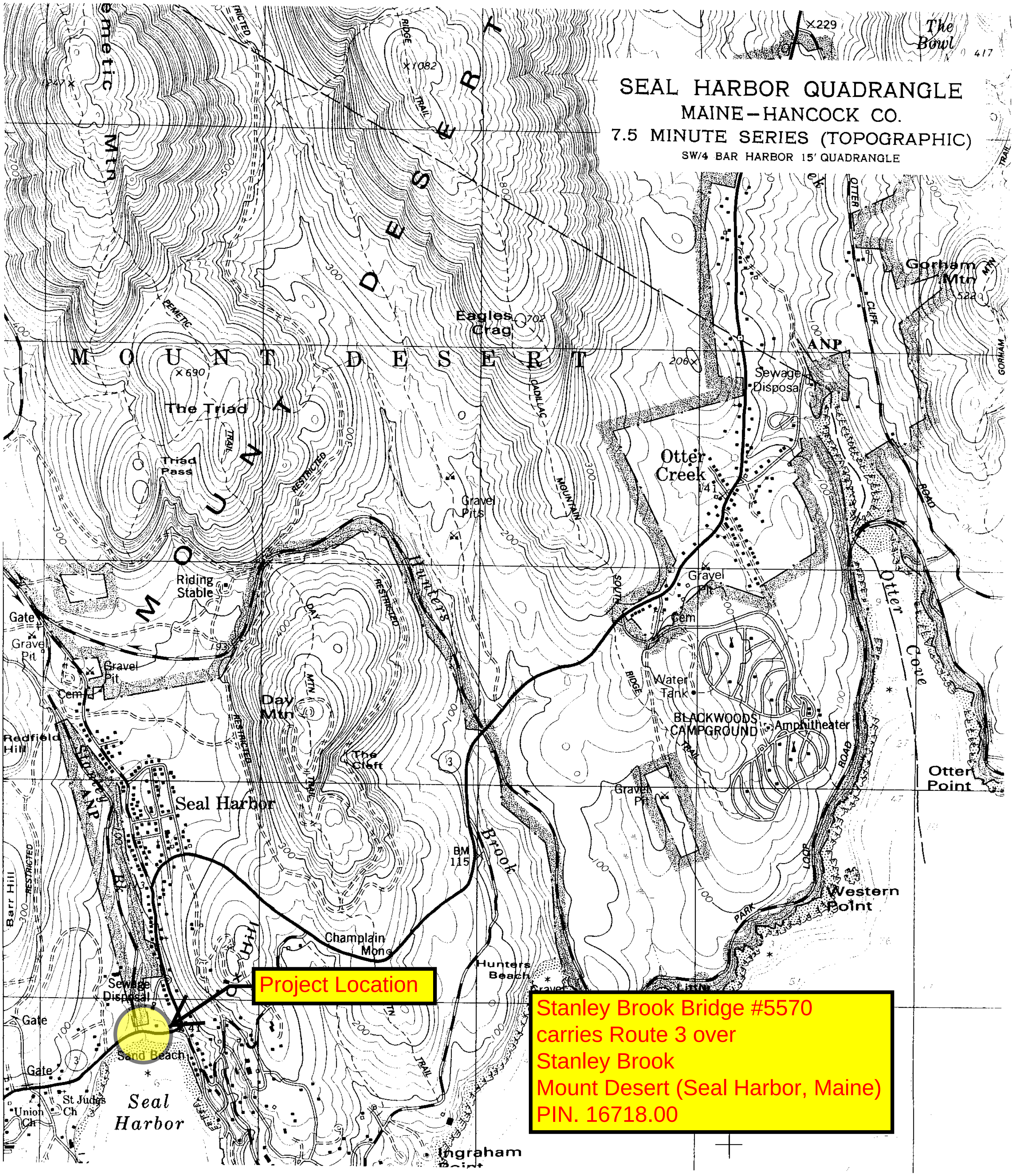

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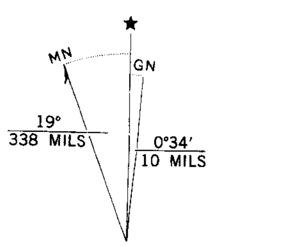

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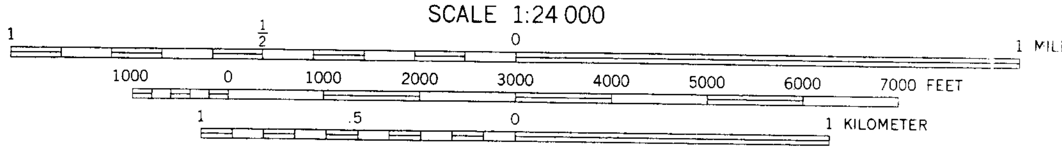

CONTOUR INTERVAL 20 FEET
SUPPLEMENTARY CONTOUR INTERVAL 10 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929
DEPTH CURVES AND SOUNDINGS IN FEET—DATUM IS MEAN LOW WATER
THE RELATIONSHIP BETWEEN THE TWO DATUMS IS VARIABLE
SHORELINE SHOWN REPRESENTS THE APPROXIMATE LINE OF MEAN HIGH WATER
THE MEAN RANGE OF TIDE IS APPROXIMATELY 10.4 FEET

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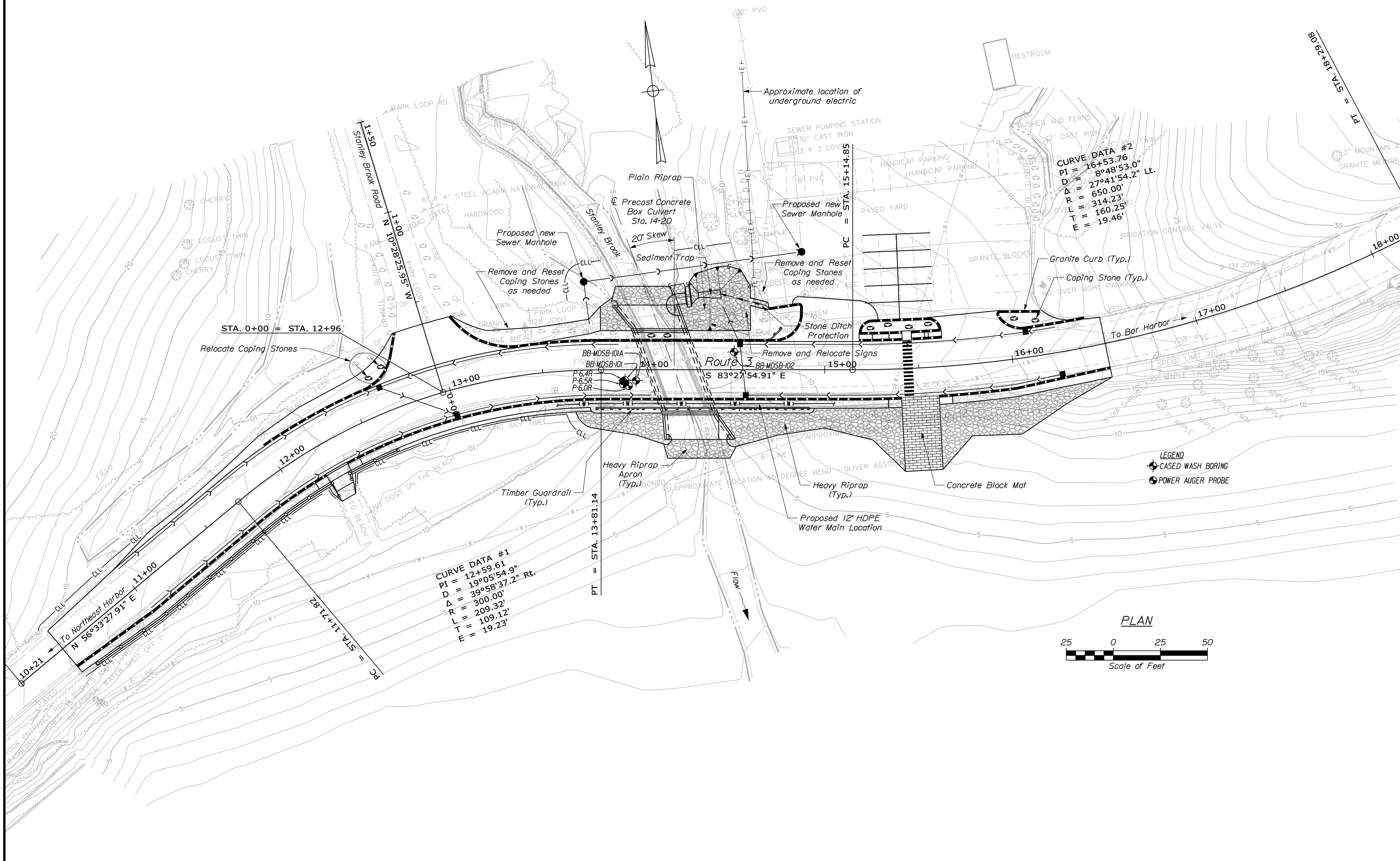


STATE OF MAINE
DEPARTMENT OF TRANSPORTATION

BRIDGE NO. 5570
PIN 16718.00
BRIDGE PLANS

	BY	DATE
PROJ. MANAGER	D. ANDERSON	
DESIGN-DETAILED	M.MOREAU	
CHECKED-REVIEWED	T.WHITE	MAR 2010
DESIGN2-DETAILED2		
DESIGN3-DETAILED3		
REVISIONS 1		
REVISIONS 2		
REVISIONS 3		
REVISIONS 4		
FIELD CHANGES		

SIGNATURE

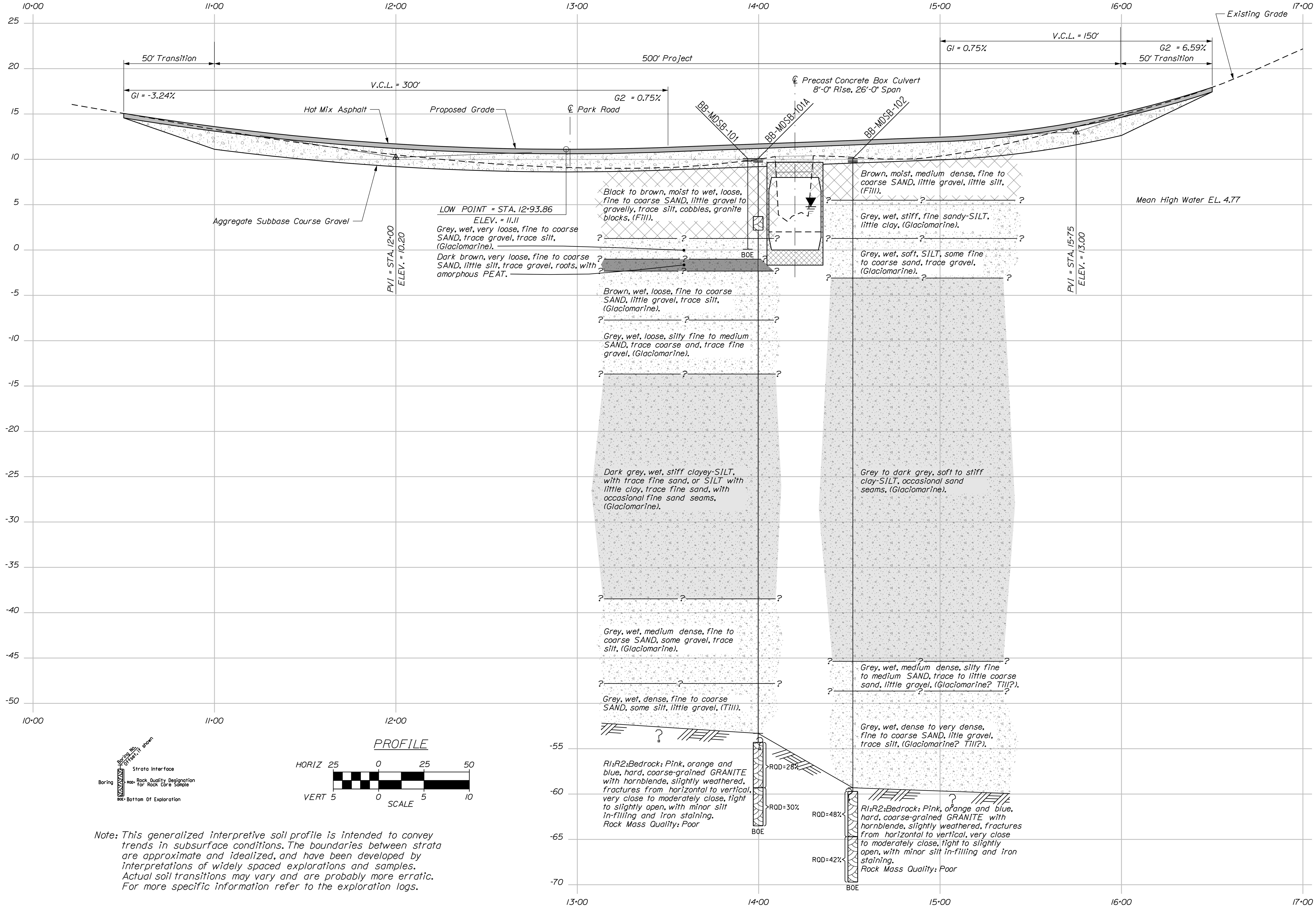
P.E. NUMBER

DATE

STANLEY BROOK BRIDGE
STANLEY BROOK
MOUNT DESERT   HANCOCK COUNTY

BORING LOCATION PLAN

SHEET NUMBER
2
OF 4



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

STATE OF MAINE
DEPARTMENT OF TRANSPORTATION

BRIDGE NO. 5570 | PIN 16718.00 | BRIDGE PLANS

PROJ. MANAGER	D. ANDERSON	BY	DATE
DESIGN-DETAILED	M.MOREAU	T.WHITE	MAR 2010
CHECKED-REVIEWED	-----	-----	-----
DESIGN2-DETAILED2	-----	-----	-----
DESIGN3-DETAILED3	-----	-----	-----
REVISIONS 1	-----	-----	-----
REVISIONS 2	-----	-----	-----
REVISIONS 3	-----	-----	-----
REVISIONS 4	-----	-----	-----
FIELD CHANGES	-----	-----	-----

SIGNATURE
P.E. NUMBER
DATE

STANLEY BROOK BRIDGE
STANLEY BROOK
MOUNT DESERT HANCOCK COUNTY

INTERPRETIVE SUBSURFACE PROFILE

SHEET NUMBER
3
OF 4

Filename: ...\00\geotech\msta\007_ISP1.dgn Division: GEOTECH Username: terry.white Date:10/25/2010

Filename: ...\msta\008_BORING LOGS1.dgn   Division: GEOTECH   Username: terry.white   Date:10/25/2010

Maine Department of Transportation
Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: Stanley Brook Bridge #5570 carries Route 3 over Stanley		Location: Mount Desert, Maine		Boring No.: BB-MDSB-101	PIN: 16718.00
Driller:	MaineDOT	Elevation (ft.)	9.7	Auger ID/OD:	5" Solid Stem
Operator:	Giguere-Giles	Datum:	NAVD88	Sampler:	Standard Split Spoon
Logged By:	B. Wilder	Rig Type:	CME 45C	Hammer Wt./Fall:	140#/30"
Date Start/Finish:	3/15/2010; 11:00-12:00	Drilling Method:	Cased Wash Boring	Core Barrel:	N/A
Boring Location:	13+93.8, 5.6 Rt.	Casing ID/OD:	HW	Water Level*:	None Observed
Hammer Efficiency Factor: 0.84		Hammer Type:	Automatic ☒ Hydraulic ☐ Rope & Cathead ☐		

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

Sample Information

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.)
0							SSA	9.40
	1D	24/6	1.00 - 3.00	5/2/2/8	4	6		
5								
	2D	24/12	6.00 - 8.00	10/3/4/6	7	10	58	
							100	
							RC	
10								-0.30

Depth	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class
0.30	PAVEMENT.	
	Black, moist, loose, gravelly fine to coarse SAND, trace silt, (Fill).	G#238201 A-1-a, SW-SM WC=5.7%
	Cobble from 4.5-6.0' bgs.	
	Brown, very wet, loose, fine to coarse SAND, little gravel, trace silt, (Fill).	G#238202 A-3, SP-SM WC=24.0%
	Roller Coned ahead to 10.0' bgs.	
10.00	Bottom of Exploration at 10.00 feet below ground surface. SEE REMARKS	

Remarks:
Bent spoon, casing at 6.0' bgs, moved to BB-MDSB-101A.

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 1 Boring No.: BB-MDSB-101

Maine Department of Transportation
Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: Stanley Brook Bridge #5570 carries Route 3 over Stanley		Location: Mount Desert, Maine		Boring No.: BB-MDSB-101A	PIN: 16718.00
Driller:	MaineDOT	Elevation (ft.)	9.8	Auger ID/OD:	5" Solid Stem
Operator:	Giguere-Giles	Datum:	NAVD88	Sampler:	Standard Split Spoon
Logged By:	B. Wilder	Rig Type:	CME 45C	Hammer Wt./Fall:	140#/30"
Date Start/Finish:	3/15/2010, 3/17/2010	Drilling Method:	Cased Wash Boring	Core Barrel:	NQ-2"
Boring Location:	13+99.7, 5.7 Rt.	Casing ID/OD:	HW & NW	Water Level*:	12.0 bgs.
Hammer Efficiency Factor: 0.84		Hammer Type:	Automatic ☒ Hydraulic ☐ Rope & Cathead ☐		

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

Sample Information

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.)
0							SSA	9.40
5								
	R1	18/18	6.40 - 7.90				NQ-2	3.40
								1.80
10	1D/A	24/20	10.00 - 12.00	1/1/1/2	2	3		
								-1.20
								-2.70
15	2D	24/4	15.00 - 17.00	4/2/3/1	5	7	20	
							15	
							18	
							22	-8.20
							23	
20	3D	24/16	20.00 - 22.00	2/2/4/2	6	8	aOH	
								-14.20
25	4D	24/24	25.00 - 27.00	WOH/WOH/WOH/WOH	---			
	V1		27.00 - 27.37	Su=1741/402 psf				
	V2		28.00 - 28.37	Su=1071/312 psf				
30	1U	24/18	30.00 - 32.00	Hydraulic Push				
	V3		32.00 - 32.37	Su=1071/312 psf				
	V4		33.00 - 33.37	Su=1518/625 psf				
35	5D/V5	24/24	35.00 - 37.00	WOH/WOH/WOH/WOH				
40	2U	24/24	40.00 - 42.00	Hydraulic Push				
	V6		42.00 - 42.37	Su=1562/670 psf				
	V7		43.00 - 43.37	Su=₵2009 psf				
45	6D V8	24/16	45.00 - 47.00 45.00 - 45.37	Hydraulic Push Su=1384/536 psf			WOH	
	V9		46.00 - 46.37	Su=1696/588 psf			8	
							13	
							14	-39.20
							32	
50	7D	24/15	50.00 - 52.00	4/11/7/11	18	25	19	
							33	
							31	
							33	
							43	
55	8D	24/4	55.00 - 57.00	4/5/7/10	12	17	20	
							43	
							55	
							79	-48.20
							69	
60	9D	24/20	60.00 - 62.00	8/9/13/13	22	31	41	
							53	
							b60 71	
							RC	-53.60
	R2	60/60	64.40 - 69.40	RQD = 28%			NQ-2	-54.60
65								
	R3	50.4/50.4	69.40 - 73.60	RQD = 30%				
70								
								-63.80
75								

Depth	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class
0.40	PAVEMENT.	
	Fill, See BB-MDSB-101.	
	Cobble from 5.0-5.6' bgs.	
6.40	GRANITE BLOCK.	
8.00		
11.00	(1D) 10.0-11.0' bgs. Grey, wet, very loose, fine to coarse SAND, trace gravel and silt, (Glaciomarine).	G#238203 A-1-b, SP WC=30.9%
12.50	(1D/A) 11.0-12.0' bgs. Dark brown, very loose, organic SAND, trace gravel, little silt, roots, with amorphous PEAT.	G#238204 A-2-4, SM WC=78.0%
18.00	Brown, wet, loose, fine to coarse SAND, little gravel, trace silt, (Glaciomarine).	
24.00	Grey, wet, loose, silty fine to medium SAND, trace coarse sand and fine gravel, (Glaciomarine). aOpen Hole	
	Dark grey, wet, stiff, Clayey-SILT, with trace fine sand, or SILT with little clay, trace fine sand, with occasional fine sand seams, moderately plastic, (Glaciomarine). 55x110 mm vane raw torque readings: V1: 39.0-9.0 ft-lbs V2: 24.0-7.0 ft-lbs	G#238205 A-6, CL WC=29.8% LL=39 PL=18 PI=21
	Similar to above. 55x110 mm vane raw torque readings: V3: 24.0-7.0 ft-lbs V4: 34.0-14.0 ft-lbs	G,C#238206 A-6, CL WC=31.2% LL=40 PL=19 PI=21
	5D-Similar to above. V5-Failed 55x110 mm vane attempt, could not push.	G#238207 A-7-6, CL WC=30.5% LL=41 PL=19 PI=22
	Similar to above. 55x110 mm vane raw torque readings: V6: 35.0-15.0 ft-lbs V7: greater than 45.0 ft-lbs	
49.00	Similar to above. Changed to NW Casing at 45.0' bgs. 55x110 mm vane raw torque readings: V8: 31.0-12.0 ft-lbs V9: 38.0-12.5.0 ft-lbs	
58.00	Grey, wet, medium dense, fine to coarse SAND, some gravel, trace silt, (Glaciomarine). Similar to above.	
63.40	Grey, wet, dense, fine to coarse SAND, little gravel, some silt, (Till). b60 blows for 0.4'.	
64.40	Top of Bedrock at Elev. -53.6'. Roller Coned ahead to 64.4' bgs.	
73.60	R2, R3 Bedrock: Pink, orange and blue, hard, coarse-grained GRANITE with hornblende, slightly weathered, fractures from horizontal to vertical, very close to moderately close, tight to slightly open, with minor silt in-filling and iron staining. R2:Core Times (min:sec) 64.4-65.4' (2:21) 65.4-66.4' (2:15) 66.4-67.4' (2:51) 67.4-68.4' (3:06) 68.4-69.4' (3:10) 100% Recovery R3:Core Times (min:sec) 69.4-70.4' (2:00) 70.4-71.4' (2:26) 71.4-72.4' (3:14) 72.4-73.4' (3:50) 73.4-73.6' (1:50) 100% Recovery Core Blocked	
	Bottom of Exploration at 73.60 feet below ground surface.	

Remarks:
500-600# of down pressure on Core Barrel.

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 1 Boring No.: BB-MDSB-101A

Maine Department of Transportation
Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: Stanley Brook Bridge #5570 carries Route 3 over Stanley		Location: Mount Desert, Maine		Boring No.: BB-MDSB-102	PIN: 16718.00
Driller:	MaineDOT	Elevation (ft.)	10.1	Auger ID/OD:	5" Solid Stem
Operator:	Giguere-Giles	Datum:	NAVD88	Sampler:	Standard Split Spoon
Logged By:	B. Wilder	Rig Type:	CME 45C	Hammer Wt./Fall:	140#/30"
Date Start/Finish:	3/8,9/2010, 3/15/2010	Drilling Method:	Cased Wash Boring	Core Barrel:	NQ-2"
Boring Location:	14+51.9, 9.5 Lt.	Casing ID/OD:	HW & NW	Water Level*:	10.0 bgs.
Hammer Efficiency Factor: 0.84		Hammer Type:	Automatic ☒ Hydraulic ☐ Rope & Cathead ☐		

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

Sample Information

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.)
0							SSA	9.70
	1D	24/15	1.00 - 3.00	7/5/7/10	12	17		
								5.60
5	2D	24/19	5.00 - 7.00	2/6/3/6	9	13		
								1.10
10	3D	24/18	10.00 - 12.00	1/1/1/1	2	3	44	
							52	
							54	
							66	-3.40
							73	
15	4D/V1	24/22	15.00 - 17.00	3/2/1/1	3	4	aOH	
	V2		17.00 - 17.37	Su=1161/179 psf				
	MV3		18.00 - 18.00					
20								
								-13.90
25	1U	24/24	25.00 - 27.00	Hydraulic Push				
	V4		27.00 - 27.37	Su=1317/223 psf				
	MV5		28.00 - 28.00					
30	5D V6	24/24	30.00 - 32.00 30.00 - 30.37	Hydraulic Push Su=1451/312 psf				
	V7		31.00 - 31.37	Su=1473/268 psf				
35	2U	24/24	35.00 - 37.00	Hydraulic Push				
	V8		37.00 - 37.37	Su=1518/357 psf				
	V9		38.00 - 38.37	Su=1562/402 psf				
40	6D V10	24/24	40.00 - 42.00 40.00 - 40.37	Hydraulic Push Su=1384/268 psf				
	V11		41.00 - 41.37	Su=1518/268 psf				
45	V12 7D	24/24	45.00 - 45.37 45.00 - 47.00	Su=1250/312 psf Hydraulic Push				
	V13		46.00 - 46.37	Su=1295/179 psf				
50								

Depth	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class
0.40	PAVEMENT.	
4.50	Brown, moist, medium dense, fine to coarse SAND, little gravel, little silt, (Fill).	
9.00	Grey, wet, stiff, SILT, little clay, trace fine sand, (Glaciomarine).	G#238208 A-4, CL WC=17 PL=14 PI=8
13.50	Grey, wet, soft, SILT, some fine to coarse sand, trace gravel, (Glaciomarine).	G#238209 A-4, ML WC=22.5% Non-PLastic
24.00	4D-Grey, wet, soft to stiff, Clay-SILT, occasional sand seams, moderately plastic, (Glaciomarine). V1-Failed 55x110 mm vane attempt, could not push. aOpen Hole Washed ahead to 17.0' bgs. 55x110 mm vane raw torque readings: V2: 26.0-4.0 ft-lbs Failed 55x110 mm vane attempt, could not push. Washed ahead to 25.0' bgs.	
	Dark grey in wash.	
	Dark grey, wet, stiff, Clayey-SILT, occasional sand seams, moderately plastic, (Glaciomarine). 55x110 mm vane raw torque readings: V4: 29.5-5.0 ft-lbs Failed 55x110 mm vane attempt, could not push.	
	Similar to above. 55x110 mm vane raw torque readings: V6: 32.5-7.0 ft-lbs V7: 33.0-6.0 ft-lbs	
	Similar to above. 55x110 mm vane raw torque readings: V8: 34.0-8.0 ft-lbs V9: 35.0-9.0 ft-lbs	
	Similar to above. 55x110 mm vane raw torque readings: V10: 31.0-6.0 ft-lbs V11: 34.0-6.0 ft-lbs	
	55x110 mm vane raw torque readings: V12: 28.0-7.0 ft-lbs Similar to above. V13: 29.0-4.0 ft-lbs	

Remarks:
500-600# of down pressure on Core Barrel.

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.: BB-MDSB-102

Maine Department of Transportation
Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: Stanley Brook Bridge #5570 carries Route 3 over Stanley		Location: Mount Desert, Maine		Boring No.: BB-MDSB-102	PIN: 16718.00
Driller:	MaineDOT	Elevation (ft.)	10.1	Auger ID/OD:	5" Solid Stem
Operator:	Giguere-Giles	Datum:	NAVD88	Sampler:	Standard Split Spoon
Logged By:	B. Wilder	Rig Type:	CME 45C	Hammer Wt./Fall:	140#/30"
Date Start/Finish:	3/8,9/2010, 3/15/2010	Drilling Method:	Cased Wash Boring	Core Barrel:	NQ-2"
Boring Location:	14+51.9, 9.5 Lt.	Casing ID/OD:	HW & NW	Water Level*:	10.0 bgs.
Hammer Efficiency Factor: 0.84		Hammer Type:	Automatic ☒ Hydraulic ☐ Rope & Cathead ☐		

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

Sample Information

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.)
50	MV14 8D	24/24	50.00 - 50.00 50.00 - 52.00	WOR/1/1/1	2	3		-40.40
55	MV15 9D	24/12	55.00 - 55.00 55.00 - 57.00	WOH/9/5/12	14	20	2	-45.20
							9	
							29	
							31	-48.90
							42	
60	10D	24/18	60.00 - 62.00	13/19/14/14	33	46	20	
							22	
							24	
							43	
							69	
65	11D	24/4	65.00 - 67.00	41/30/26/26	56	78	12	
							29	
							46	
							63	
70	R1	60/60	69.80 - 74.80	RQD = 48%			b100 RC NQ-2	-59.30 -59.70
75	R2	60/60	74.80 - 79.80	RQD = 42%				
80								-69.70
85								
90								
95								
100								

Depth	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class
	Failed 55x110 mm vane attempt, could not push.	
50.50	Grey, wet, soft, Clayey-SILT, with 1/4-1/2" fine sand layers, (Glaciomarine).	
	Failed 55x110 mm vane attempt, could not push. Changed to NW Casing at 55.0' bgs.	
55.30	Grey, wet, medium dense, silty, fine to medium SAND, trace to little coarse sand, little gravel, (Glaciomarine? Till?).	
59.00	Grey, wet, dense, fine to coarse SAND, little gravel, trace silt, (Glaciomarine? Till?). Similar to above, except very dense. b100 blows for 0.4'.	
69.40	Top of Bedrock at Elev. -59.3'. Roller Coned ahead to 69.8' bgs.	
69.80	R1, R2 Bedrock: Pink, orange and blue, hard, coarse-grained GRANITE with hornblende, slightly weathered, fractures from horizontal to vertical, very close to moderately close, tight to slightly open, with minor silt in-filling and iron staining. R1:Core Times (min:sec) 69.8-70.8' (3:39) 70.8-71.8' (3:13) 71.8-72.8' (3:03) 72.8-73.8' (3:19) 73.8-74.8' (2:38) 100% Recovery R2:Core Times (min:sec) 74.8-75.8' (2:32) 75.8-76.8' (2:02) 76.8-77.8' (2:06) 77.8-78.8' (2:16) 78.8-79.8' (3:14) 100% Recovery	
79.80	Bottom of Exploration at 79.80 feet below ground surface.	

Remarks:
500-600# of down pressure on Core Barrel.

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.: BB-MDSB-102

State of Maine - Department of Transportation
Auger Probe Summary Sheet

Town(s): Mount Desert **Project Number: 16718.00**

Station (Feet)	Offset (Feet)	Weathered Rock (Feet)	Refusal (Feet)	No Refusal (Feet)	Water Depth (Ft.)	Comments / Date 3/15/2010
13+95.8	8.6 Rt.		6.0			Granite Block
13+92.8	7.6 Rt.		6.5			Granite Block
13+92.8	6.0 Rt.		6.4			Granite Block

STATE OF MAINE
DEPARTMENT OF TRANSPORTATION

BRIDGE PLANS
PIN 16718.00
BRIDGE NO. 5570

PROJ. MANAGER	D. ANDERSON	BY	DATE
DESIGN-DETAILED	M.MOREAU	T.WHITE	MAR 2010
CHECKED-REVIEWED			
DESIGN2-DETAILED2			
DESIGN3-DETAILED3			
REVISIONS 1			
REVISIONS 2			
REVISIONS 3			
REVISIONS 4			
FIELD CHANGES			

SIGNATURE
P.E. NUMBER
DATE

STANLEY BROOK BRIDGE
STANLEY BROOK
MOUNT DESERT HANCOCK COUNTY

BORING LOGS

SHEET NUMBER
4
OF 4

Appendix A

Boring Logs and Auger Probe Summary Sheet

UNIFIED SOIL CLASSIFICATION SYSTEM

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

Desired Soil Observations: (in this order)

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

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

TERMS DESCRIBING DENSITY/CONSISTENCY

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

Modified Burmister System

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

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

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

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

Rock Quality Designation (RQD):

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

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

Correlation of RQD to Rock Mass Quality

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

Desired Rock Observations: (in this order)

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

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

Sample Container Labeling Requirements:

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

Maine Department of Transportation Soil/Rock Exploration Log US CUSTOMARY UNITS	**Project:** Stanley Brook Bridge #5570 carries Route 3 over Stanley Brook **Location:** Mount Desert, Maine	**Boring No.:** BB-MDSB-101 **PIN:** 16718.00

Driller:	MaineDOT	**Elevation (ft.)**	9.7	**Auger ID/OD:**	5" Solid Stem
Operator:	Giguere-Giles	**Datum:**	NAVD88	**Sampler:**	Standard Split Spoon
Logged By:	B. Wilder	**Rig Type:**	CME 45C	**Hammer Wt./Fall:**	140#/30"
Date Start/Finish:	3/15/2010; 11:00-12:00	**Drilling Method:**	Cased Wash Boring	**Core Barrel:**	N/A
Boring Location:	13+93.8, 5.6 Rt.	**Casing ID/OD:**	HW	**Water Level*:**	None Observed
Hammer Efficiency Factor:	0.84	**Hammer Type:**	Automatic ☒ Hydraulic ☐ Rope & Cathead ☐		

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

Depth (ft.)	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-uncorrected	N_{60}	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.
0							SSA	9.40		PAVEMENT. 0.30	
	1D	24/6	1.00 - 3.00	5/2/2/8	4	6				Black, moist, loose, gravelly fine to coarse SAND, trace silt, (Fill).	G#238201 A-1-a, SW-SM WC=5.7%
5										Cobble from 4.5-6.0' bgs.	
	2D	24/12	6.00 - 8.00	10/3/4/6	7	10	58			Brown, very wet, loose, fine to coarse SAND, little gravel, trace silt, (Fill).	G#238202 A-3, SP-SM WC=24.0%
							100				
							RC			Roller Coned ahead to 10.0' bgs.	
10								-0.30		10.00 **Bottom of Exploration at 10.00 feet below ground surface.** SEE REMARKS	
15											
20											
25											

Remarks:

Bent spoon, casing at 6.0' bgs, moved to BB-MDSB-101A.

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

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

Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: Stanley Brook Bridge #5570 carries Route 3 over Stanley Brook
Location: Mount Desert, Maine

Boring No.: BB-MDSB-101A
PIN: 16718.00

Driller:	MaineDOT	**Elevation (ft.)**	9.8	**Auger ID/OD:**	5" Solid Stem
Operator:	Giguere-Giles	**Datum:**	NAVD88	**Sampler:**	Standard Split Spoon
Logged By:	B. Wilder	**Rig Type:**	CME 45C	**Hammer Wt./Fall:**	140#/30"
Date Start/Finish:	3/15/2010, 3/17/2010	**Drilling Method:**	Cased Wash Boring	**Core Barrel:**	NQ-2"
Boring Location:	13+99.7, 5.7 Rt.	**Casing ID/OD:**	HW & NW	**Water Level*:**	12.0 bgs.
Hammer Efficiency Factor:	0.84	**Hammer Type:**	Automatic ☒ Hydraulic ☐ Rope & Cathead ☐		

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

Depth (ft.)	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-uncorrected	N60	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.
0							SSA	9.40		PAVEMENT. 0.40	
										Fill, See BB-MDSB-101.	
5										Cobble from 5.0-5.6' bgs.	
	R1	18/18	6.40 - 7.90				NQ-2	3.40		6.40 GRANITE BLOCK.	
								1.80		8.00	
10	1D/A	24/20	10.00 - 12.00	1/1/1/2	2	3		-1.20		(1D) 10.0-11.0' bgs. Grey, wet, very loose, fine to coarse SAND, trace gravel and silt, (Glaciomarine). 11.00	G#238203 A-1-b, SP WC=30.9%
								-2.70		(1D/A) 11.0-12.0' bgs. Dark brown, very loose, organic SAND, trace gravel, little silt, roots, with amorphous PEAT. 12.50	G#238204 A-2-4, SM WC=78.0%
15	2D	24/4	15.00 - 17.00	4/2/3/1	5	7	20			Brown, wet, loose, fine to coarse SAND, little gravel, trace silt, (Glaciomarine).	
							15				
							18				
							22	-8.20		18.00	
							23				
20	3D	24/16	20.00 - 22.00	2/2/4/2	6	8	aOH			Grey, wet, loose, silty fine to medium SAND, trace coarse sand and fine gravel, (Glaciomarine). aOpen Hole	
								-14.20		24.00	
25											

Remarks:

500-600# of down pressure on Core Barrel.

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Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: Stanley Brook Bridge #5570 carries Route 3 over Stanley Brook
Location: Mount Desert, Maine

Boring No.: BB-MDSB-101A
PIN: 16718.00

Driller:	MaineDOT	**Elevation (ft.)**	9.8	**Auger ID/OD:**	5" Solid Stem
Operator:	Giguere-Giles	**Datum:**	NAVD88	**Sampler:**	Standard Split Spoon
Logged By:	B. Wilder	**Rig Type:**	CME 45C	**Hammer Wt./Fall:**	140#/30"
Date Start/Finish:	3/15/2010, 3/17/2010	**Drilling Method:**	Cased Wash Boring	**Core Barrel:**	NQ-2"
Boring Location:	13+99.7, 5.7 Rt.	**Casing ID/OD:**	HW & NW	**Water Level*:**	12.0 bgs.
Hammer Efficiency Factor:	0.84	**Hammer Type:**	Automatic ☒ Hydraulic ☐ Rope & Cathead ☐		

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

Depth (ft.)	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-uncorrected	N_{60}	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.
25	4D	24/24	25.00 - 27.00	WOH/WOH/WOH/ WOH	---					Dark grey, wet, stiff, Clayey-SILT, with trace fine sand, or SILT with little clay, trace fine sand, with occasional fine sand seams, moderately plastic, (Glaciomarine).	G#238205 A-6, CL WC=29.8% LL=39 PL=18 PI=21
	V1		27.00 - 27.37	Su=1741/402 psf						55x110 mm vane raw torque readings: V1: 39.0-9.0 ft-lbs	
	V2		28.00 - 28.37	Su=1071/312 psf						V2: 24.0-7.0 ft-lbs	
30	1U	24/18	30.00 - 32.00	Hydraulic Push						Similar to above.	G,C#238206 A-6, CL WC=31.2% LL=40 PL=19 PI=21
	V3		32.00 - 32.37	Su=1071/312 psf						55x110 mm vane raw torque readings: V3: 24.0-7.0 ft-lbs	
	V4		33.00 - 33.37	Su=1518/625 psf						V4: 34.0-14.0 ft-lbs	
35	5D/V5	24/24	35.00 - 37.00	WOH/WOH/WOH/ WOH						5D-Similar to above. V5-Failed 55x110 mm vane attempt, could not push.	G#238207 A-7-6, CL WC=30.5% LL=41 PL=19 PI=22
40	2U	24/24	40.00 - 42.00	Hydraulic Push						Similar to above.	
	V6		42.00 - 42.37	Su=1562/670 psf						55x110 mm vane raw torque readings: V6: 35.0-15.0 ft-lbs	
	V7		43.00 - 43.37	Su=>2009 psf						V7: greater than 45.0 ft-lbs	
45	6D	24/16	45.00 - 47.00	Hydraulic Push			WOH			Similar to above. Changed to NW Casing at 45.0' bgs.	
	V8		45.00 - 45.37	Su=1384/536 psf						55x110 mm vane raw torque readings: V8: 31.0-12.0 ft-lbs	
	V9		46.00 - 46.37	Su=1696/588 psf			8			V9: 38.0-12.5.0 ft-lbs	
							13				
							14	-39.20		49.00	
50							32				

Remarks:

500-600# of down pressure on Core Barrel.

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Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: Stanley Brook Bridge #5570 carries Route 3 over Stanley Brook
Location: Mount Desert, Maine

Boring No.: BB-MDSB-101A
PIN: 16718.00

Driller:	MaineDOT	**Elevation (ft.)**	9.8	**Auger ID/OD:**	5" Solid Stem
Operator:	Giguere-Giles	**Datum:**	NAVD88	**Sampler:**	Standard Split Spoon
Logged By:	B. Wilder	**Rig Type:**	CME 45C	**Hammer Wt./Fall:**	140#/30"
Date Start/Finish:	3/15/2010, 3/17/2010	**Drilling Method:**	Cased Wash Boring	**Core Barrel:**	NQ-2"
Boring Location:	13+99.7, 5.7 Rt.	**Casing ID/OD:**	HW & NW	**Water Level*:**	12.0 bgs.

Hammer Efficiency Factor: 0.84 **Hammer Type:** Automatic ☒ Hydraulic ☐ Rope & Cathead ☐

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

Depth (ft.)	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-uncorrected	N_{60}	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.
50	7D	24/15	50.00 - 52.00	4/11/7/11	18	25	19			Grey, wet, medium dense, fine to coarse SAND, some gravel, trace silt, (Glaciomarine).	
							33				
							31				
							33				
							43				
55	8D	24/4	55.00 - 57.00	4/5/7/10	12	17	20			Similar to above.	
							43				
							55	-48.20		58.00	
							79				
							69				
60	9D	24/20	60.00 - 62.00	8/9/13/13	22	31	41			Grey, wet, dense, fine to coarse SAND, little gravel, some silt, (Till).	
							53				
							b60 71			b60 blows for 0.4'.	
							RC	-53.60		63.40 Top of Bedrock at Elev. -53.6'. Roller Coned ahead to 64.4' bgs.	
	R2	60/60	64.40 - 69.40	RQD = 28%			NQ-2	-54.60		64.40 R2, R3 Bedrock: Pink, orange and blue, hard, coarse-grained GRANITE with hornblende, slightly weathered, fractures from horizontal to vertical, very close to moderately close, tight to slightly open, with minor silt in-filling and iron staining. R2:Core Times (min:sec) 64.4-65.4' (2:21) 65.4-66.4' (2:15) 66.4-67.4' (2:51) 67.4-68.4' (3:06) 68.4-69.4' (3:10) 100% Recovery	
65											
	R3	50.4/50.4	69.40 - 73.60	RQD = 30%						R3:Core Times (min:sec) 69.4-70.4' (2:00) 70.4-71.4' (2:26) 71.4-72.4' (3:14) 72.4-73.4' (3:50) 73.4-73.6' (1:50) 100% Recovery Core Blocked	
70											
								-63.80		73.60 **Bottom of Exploration at 73.60 feet below ground surface.**	
75											

Remarks:

500-600# of down pressure on Core Barrel.

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Boring No.: BB-MDSB-101A

Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: Stanley Brook Bridge #5570 carries Route 3 over Stanley Brook
Location: Mount Desert, Maine

Boring No.: BB-MDSB-102
PIN: 16718.00

Driller:	MaineDOT	**Elevation (ft.)**	10.1	**Auger ID/OD:**	5" Solid Stem
Operator:	Giguere-Giles	**Datum:**	NAVD88	**Sampler:**	Standard Split Spoon
Logged By:	B. Wilder	**Rig Type:**	CME 45C	**Hammer Wt./Fall:**	140#/30"
Date Start/Finish:	3/8,9/2010, 3/15/2010	**Drilling Method:**	Cased Wash Boring	**Core Barrel:**	NQ-2"
Boring Location:	14+51.9, 9.5 Lt.	**Casing ID/OD:**	HW & NW	**Water Level*:**	10.0 bgs.
Hammer Efficiency Factor:	0.84	**Hammer Type:**	Automatic ☒ Hydraulic ☐ Rope & Cathead ☐		

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

Depth (ft.)	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-uncorrected	N_{60}	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.
0							SSA	9.70		PAVEMENT. 0.40	
	1D	24/15	1.00 - 3.00	7/5/7/10	12	17				Brown, moist, medium dense, fine to coarse SAND, little gravel, little silt, (Fill).	
5								5.60		4.50	
	2D	24/19	5.00 - 7.00	2/6/3/6	9	13				Grey, wet, stiff, SILT, little clay, trace fine sand, (Glaciomarine).	G#238208 A-4, CL WC=17 PL=14 PI=8
								1.10		9.00	
10	3D	24/18	10.00 - 12.00	1/1/1/1	2	3	44			Grey, wet, soft, SILT, some fine to coarse sand, trace gravel, (Glaciomarine).	G#238209 A-4, ML WC=22.5% Non-PLastic
							52				
							54				
							66	-3.40		13.50	
							73				
15	4D/V1	24/22	15.00 - 17.00	3/2/1/1	3	4	aOH			4D-Grey, wet, soft to stiff, Clay-SILT, occasional sand seams, moderately plastic, (Glaciomarine). V1-Failed 55x110 mm vane attempt, could not push. aOpen Hole Washed ahead to 17.0' bgs. 55x110 mm vane raw torque readings: V2: 26.0-4.0 ft-lbs Failed 55x110 mm vane attempt, could not push. Washed ahead to 25.0' bgs.	
	V2		17.00 - 17.37	Su=1161/179 psf							
	MV3		18.00 - 18.00								
20											
								-13.90		24.00	
25										Dark grey in wash.	

Remarks:

500-600# of down pressure on Core Barrel.

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Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: Stanley Brook Bridge #5570 carries Route 3 over Stanley Brook
Location: Mount Desert, Maine

Boring No.: BB-MDSB-102

PIN: 16718.00

Driller:	MaineDOT	**Elevation (ft.)**	10.1	**Auger ID/OD:**	5" Solid Stem
Operator:	Giguere-Giles	**Datum:**	NAVD88	**Sampler:**	Standard Split Spoon
Logged By:	B. Wilder	**Rig Type:**	CME 45C	**Hammer Wt./Fall:**	140#/30"
Date Start/Finish:	3/8,9/2010, 3/15/2010	**Drilling Method:**	Cased Wash Boring	**Core Barrel:**	NQ-2"
Boring Location:	14+51.9, 9.5 Lt.	**Casing ID/OD:**	HW & NW	**Water Level*:**	10.0 bgs.
Hammer Efficiency Factor:	0.84	**Hammer Type:**	Automatic ☒ Hydraulic ☐ Rope & Cathead ☐		

Definitions:

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

Depth (ft.)	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-uncorrected	N_{60}	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.
25	1U	24/24	25.00 - 27.00	Hydraulic Push						Dark grey, wet, stiff, Clayey-SILT, occasional sand seams, moderately plastic, (Glaciomarine).	
	V4		27.00 - 27.37	Su=1317/223 psf						55x110 mm vane raw torque readings: V4: 29.5-5.0 ft-lbs	
	MV5		28.00 - 28.00							Failed 55x110 mm vane attempt, could not push.	
30	5D	24/24	30.00 - 32.00	Hydraulic Push						Similar to above.	
	V6		30.00 - 30.37	Su=1451/312 psf						55x110 mm vane raw torque readings: V6: 32.5-7.0 ft-lbs	
	V7		31.00 - 31.37	Su=1473/268 psf						V7: 33.0-6.0 ft-lbs	
35	2U	24/24	35.00 - 37.00	Hydraulic Push						Similar to above.	
	V8		37.00 - 37.37	Su=1518/357 psf						55x110 mm vane raw torque readings: V8: 34.0-8.0 ft-lbs	
	V9		38.00 - 38.37	Su=1562/402 psf						V9: 35.0-9.0 ft-lbs	
40	6D	24/24	40.00 - 42.00	Hydraulic Push						Similar to above.	
	V10		40.00 - 40.37	Su=1384/268 psf						55x110 mm vane raw torque readings: V10: 31.0-6.0 ft-lbs	
	V11		41.00 - 41.37	Su=1518/268 psf						V11: 34.0-6.0 ft-lbs	
45	V12	24/24	45.00 - 45.37	Su=1250/312 psf						55x110 mm vane raw torque readings: V12: 28.0-7.0 ft-lbs	
	7D		45.00 - 47.00	Hydraulic Push						Similar to above.	
	V13		46.00 - 46.37	Su=1295/179 psf						V13: 29.0-4.0 ft-lbs	
50											

Remarks:

500-600# of down pressure on Core Barrel.

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

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

Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: Stanley Brook Bridge #5570 carries Route 3 over Stanley Brook
Location: Mount Desert, Maine

Boring No.: BB-MDSB-102
PIN: 16718.00

Driller:	MaineDOT	**Elevation (ft.)**	10.1	**Auger ID/OD:**	5" Solid Stem
Operator:	Giguere-Giles	**Datum:**	NAVD88	**Sampler:**	Standard Split Spoon
Logged By:	B. Wilder	**Rig Type:**	CME 45C	**Hammer Wt./Fall:**	140#/30"
Date Start/Finish:	3/8,9/2010, 3/15/2010	**Drilling Method:**	Cased Wash Boring	**Core Barrel:**	NQ-2"
Boring Location:	14+51.9, 9.5 Lt.	**Casing ID/OD:**	HW & NW	**Water Level*:**	10.0 bgs.
Hammer Efficiency Factor:	0.84	**Hammer Type:**	Automatic ☒ Hydraulic ☐ Rope & Cathead ☐		

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

Depth (ft.)	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-uncorrected	N_{60}	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.
50	MV14 ~~8D~~	24/24	50.00 - 50.00 ~~50.00 - 52.00~~	WOR/1/1/1	2	3		-40.40		Failed 55x110 mm vane attempt, could not push.	
										50.50	
										Grey, wet, soft, Clayey-SILT, with 1/4-1/2" fine sand layers, (Glaciomarine).	
55	MV15 ~~9D~~	24/12	55.00 - 55.00 ~~55.00 - 57.00~~	WOH/9/5/12	14	20	2	-45.20		Failed 55x110 mm vane attempt, could not push. Changed to NW Casing at 55.0' bgs.	
										55.30	
							9			Grey, wet, medium dense, silty, fine to medium SAND, trace to little coarse sand, little gravel, (Glaciomarine? Till?).	
							29				
							31				
							42	-48.90		59.00	
60	10D	24/18	60.00 - 62.00	13/19/14/14	33	46	20			Grey, wet, dense, fine to coarse SAND, little gravel, trace silt, (Glaciomarine? Till?).	
							22				
							24				
							43				
							69				
65	11D	24/4	65.00 - 67.00	41/30/26/26	56	78	12			Similar to above, except very dense.	
							29				
							46				
							63			b100 blows for 0.4'.	
	R1	60/60	69.80 - 74.80	RQD = 48%			b100	-59.30		69.40	
70							RC	-59.70		Top of Bedrock at Elev. -59.3'. Roller Coned ahead to 69.8' bgs.	
							NQ-2			69.80	
										R1, R2 Bedrock: Pink, orange and blue, hard, coarse-grained GRANITE with hornblende, slightly weathered, fractures from horizontal to vertical, very close to moderately close, tight to slightly open, with minor silt in-filling and iron staining. R1:Core Times (min:sec) 69.8-70.8' (3:39) 70.8-71.8' (3:13) 71.8-72.8' (3:03)	
75	R2	60/60	74.80 - 79.80	RQD = 42%							

Remarks:

500-600# of down pressure on Core Barrel.

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

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

Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project:	Stanley Brook Bridge #5570 carries Route 3 over Stanley Brook	**Boring No.:**	BB-MDSB-102		
Location:	Mount Desert, Maine	**PIN:**	16718.00		
Driller:	MaineDOT	**Elevation (ft.)**	10.1	**Auger ID/OD:**	5" Solid Stem
Operator:	Giguere-Giles	**Datum:**	NAVD88	**Sampler:**	Standard Split Spoon
Logged By:	B. Wilder	**Rig Type:**	CME 45C	**Hammer Wt./Fall:**	140#/30"
Date Start/Finish:	3/8,9/2010, 3/15/2010	**Drilling Method:**	Cased Wash Boring	**Core Barrel:**	NQ-2"
Boring Location:	14+51.9, 9.5 Lt.	**Casing ID/OD:**	HW & NW	**Water Level*:**	10.0 bgs.
Hammer Efficiency Factor:	0.84	**Hammer Type:**	Automatic ☒ Hydraulic ☐ Rope & Cathead ☐		

Definitions:
D = Split Spoon Sample
MD = Unsuccessful Split Spoon Sample attempt
U = Thin Wall Tube Sample
MU = Unsuccessful Thin Wall Tube Sample attempt
V = Insitu Vane Shear Test, PP = Pocket Penetrometer
MV = Unsuccessful Insitu Vane Shear Test attempt

R = Rock Core Sample
SSA = Solid Stem Auger
HSA = Hollow Stem Auger
RC = Roller Cone
WOH = weight of 140lb. hammer
WOR/C = weight of rods or casing
WO1P = Weight of one person

S_u = Insitu Field Vane Shear Strength (psf)
T_v = Pocket Torvane Shear Strength (psf)
q_p = Unconfined Compressive Strength (ksf)
N-uncorrected = Raw field SPT N-value
Hammer Efficiency Factor = Annual Calibration Value
N_{60} = SPT N-uncorrected corrected for hammer efficiency
N_{60} = (Hammer Efficiency Factor/60%)*N-uncorrected

$S_{u(lab)}$ = Lab Vane Shear Strength (psf)
WC = water content, percent
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index
G = Grain Size Analysis
C = Consolidation Test

Depth (ft.)	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-uncorrected	N_{60}	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.
75										72.8-73.8' (3:19) 73.8-74.8' (2:38) 100% Recovery R2:Core Times (min:sec) 74.8-75.8' (2:32) 75.8-76.8' (2:02) 76.8-77.8' (2:06) 77.8-78.8' (2:16) 78.8-79.8' (3:14) 100% Recovery	
								-69.70		79.80 **Bottom of Exploration at 79.80 feet below ground surface.**	
80											
85											
90											
95											
100											

Remarks:

500-600# of down pressure on Core Barrel.

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

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

Boring No.: BB-MDSB-102

State of Maine - Department of Transportation

Auger Probe Summary Sheet

Town(s): Mount Desert Project Number: 16718.00

Station (Feet)	Offset (Feet)	Weathered Rock (Feet)	Refusal (Feet)	No Refusal (Feet)	Water Depth (Ft.)	Comments / Date 3/15/2010
13+95.8	8.6 Rt.		6.0			Granite Block
13+92.8	7.6 Rt.		6.5			Granite Block
13+92.8	6.0 Rt.		6.4			Granite Block

MaineDOT Drill Crew
Logged By: B. Wilder
Drill Rig: CME 45C

5" Solid Stem Auger

Appendix B

Laboratory Test Data

State of Maine - Department of Transportation

Laboratory Testing Summary Sheet

Town(s): Mount Desert   Project Number: 16718.00

Boring & Sample Identification Number	Station (Feet)	Offset (Feet)	Depth (Feet)	Reference Number	G.S.D.C. Sheet	W.C. %	L.L.	P.I.	Classification Unified	AASHTO	Frost
BB-MDSB-101, 1D	13+93.8	5.6 Rt.	1.0-3.0	238201	1	5.7			SW-SM	A-1-a	0
BB-MDSB-101, 2D	13+93.8	5.6 Rt.	6.0-8.0	238202	1	24.0			SP-SM	A-3	0
BB-MDSB-101A, 1D	13+99.7	5.7 Rt.	10.0-11.0	238203	2	30.9			SP	A-1-b	0
BB-MDSB-101A, 1D/A	13+99.7	5.7 Rt.	11.0-12.0	238204	2	78.0			SM	A-2-4	II
BB-MDSB-101A, 4D	13+99.7	5.7 Rt.	25.0-27.0	238205	2	29.8	39	21	CL	A-6	III
BB-MDSB-101A, 1U	13+99.7	5.7 Rt.	30.0-32.0	238206	2	31.2	40	21	CL	A-6	III
BB-MDSB-101A, 5D	13+99.7	5.7 Rt.	35.0-37.0	238207	2	30.5	41	22	CL	A-7-6	III
BB-MDSB-102, 2D	14+51.9	9.5 Lt.	5.0-7.0	238208	3	17.0	22	8	CL	A-4	IV
BB-MDSB-102, 3D	14+51.9	9.5 Lt.	10.0-12.0	238209	3	22.5	-N	P-	ML	A-4	IV
							Loss on Ignition (T 267)				
							Loss %		H_2O %		
BB-MDSB-101A, 1D/A	13+99.7	5.7 Rt.	11.0-12.0	238204	2	78.0	10.3		73.9		
BB-MDSB-101A, 1U	13+99.7	5.7 Rt.	30.0-32.0	238206	2	31.2	Consolidation Test (T 216)				

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

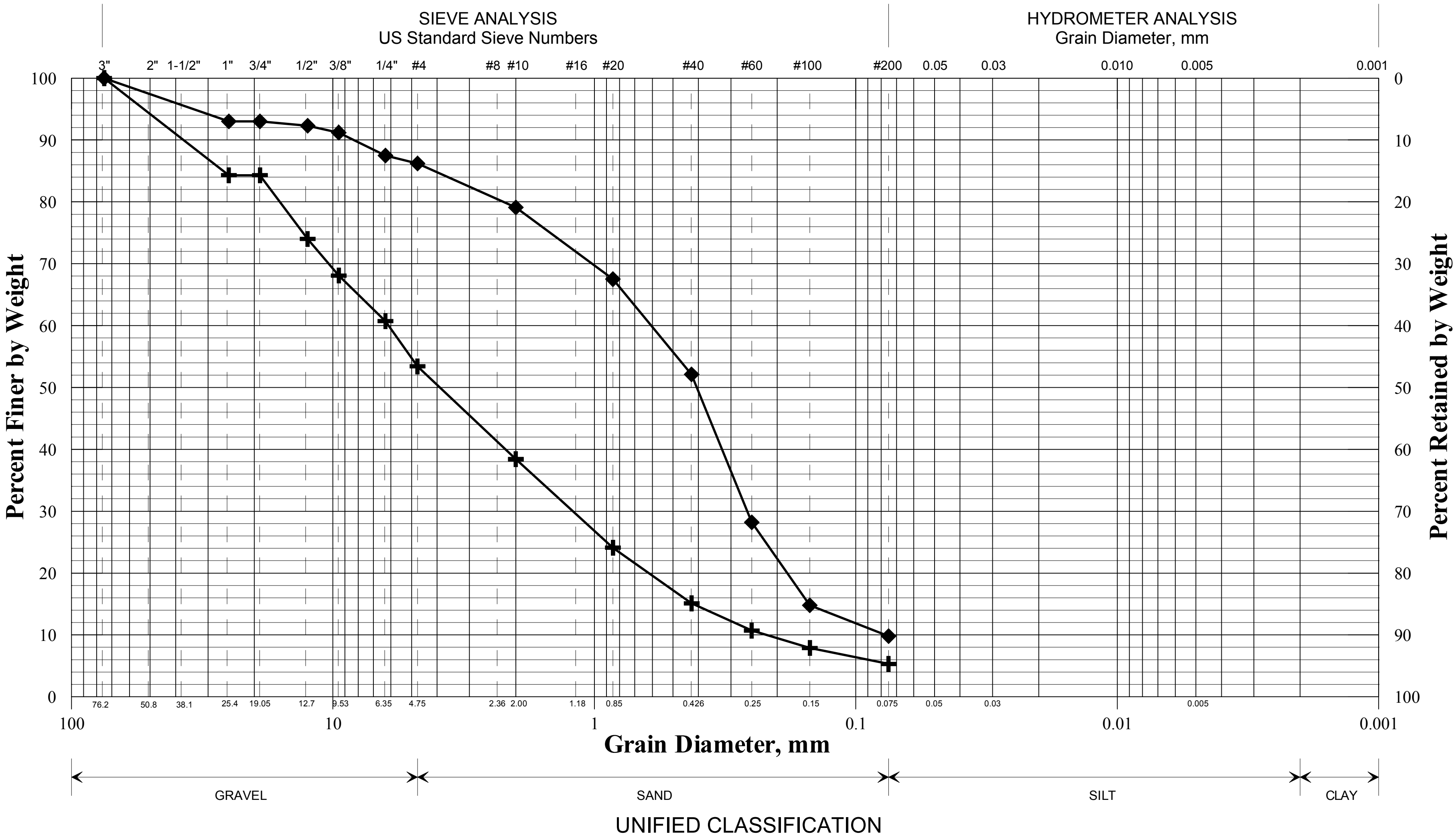
GSDC = Grain Size Distribution Curve as determined by AASHTO T 88-93 (1996) and/or ASTM D 422-63 (Reapproved 1998)

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

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

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

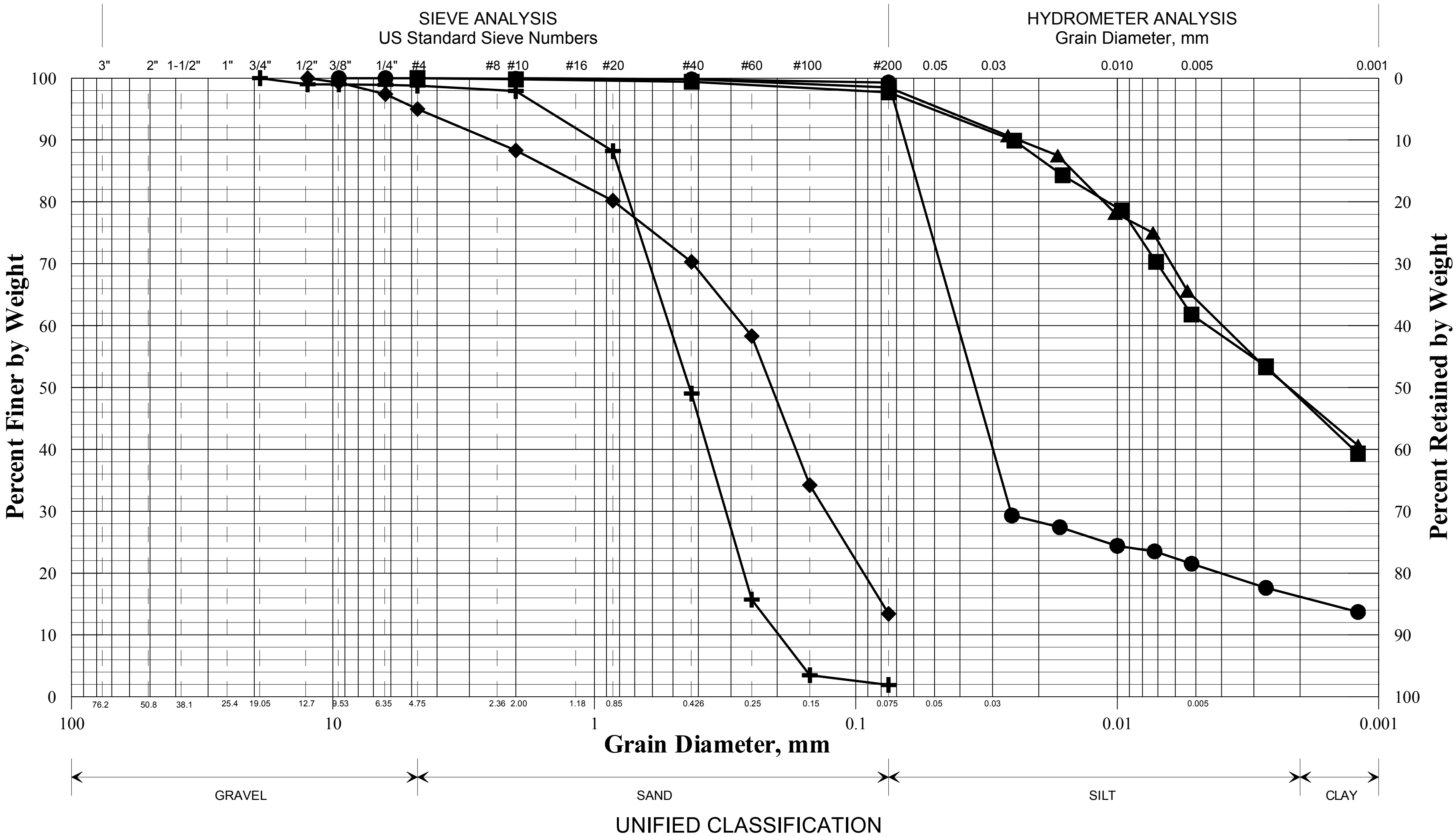
State of Maine Department of Transportation
GRAIN SIZE DISTRIBUTION CURVE



	Boring/Sample No.	Station	Offset, ft	Depth, ft	Description	W, %	LL	PL	PI
✚	BB-MDSB-101/1D	13+93.8	5.6 RT	1.0-3.0	Gravelly SAND, trace silt.	5.7			
◆	BB-MDSB-101/2D	13+93.8	5.6 RT	6.0-8.0	SAND, little gravel, trace silt.	24.0			
■									
●									
▲									
✖									

PIN
016718.00
Town
Mount Desert
Reported by/Date
WHITE, TERRY A 6/14/2010

State of Maine Department of Transportation
GRAIN SIZE DISTRIBUTION CURVE

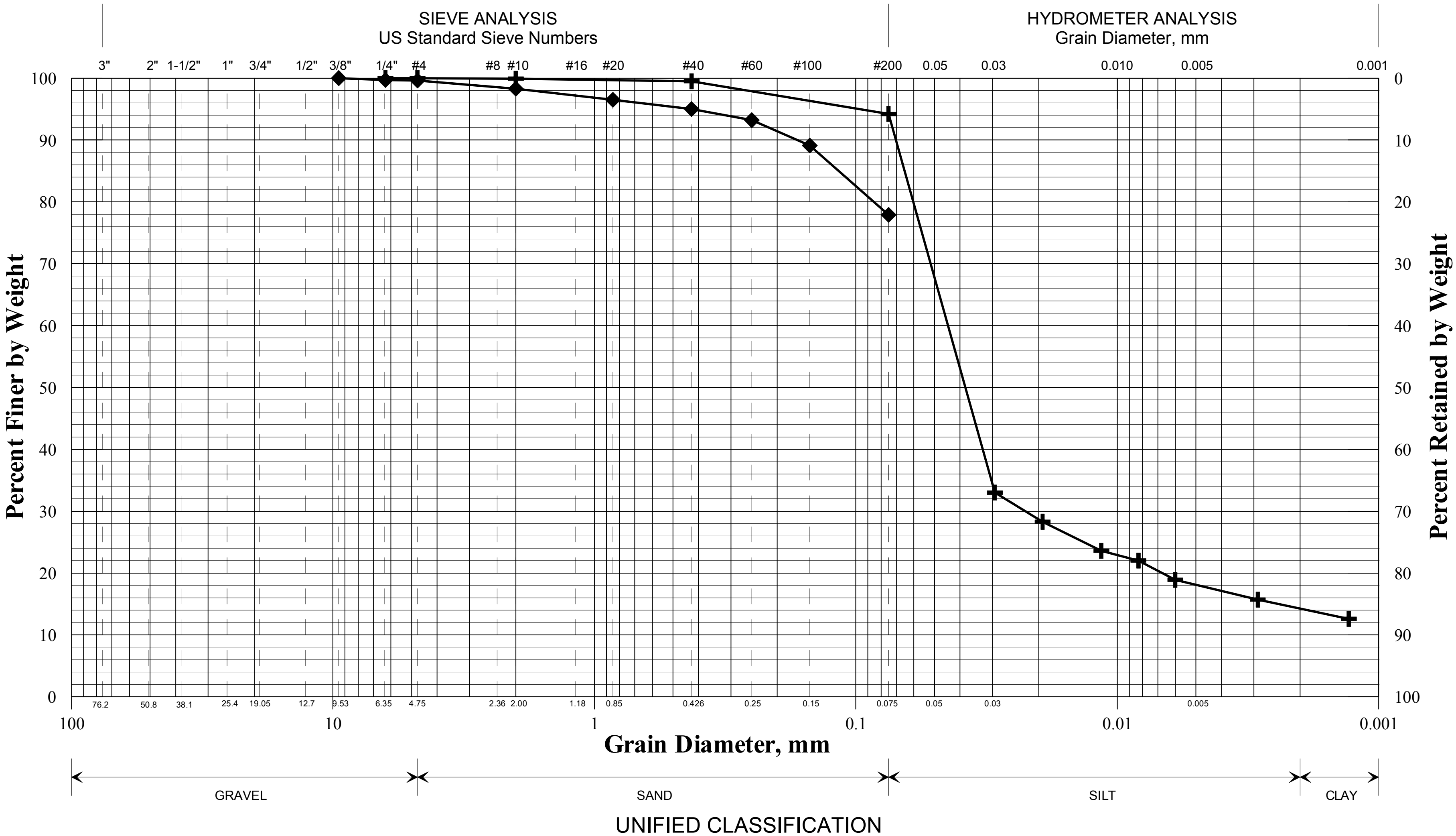


	Boring/Sample No.	Station	Offset, ft	Depth, ft	Description	W, %	LL	PL	PI
✚	BB-MDSB-101A/1D	13+99.7	5.7 RT	10.0-11.0	SAND, trace silt, trace gravel.	30.9			
◆	BB-MDSB-101A/1DA	13+99.7	5.7 RT	11.0-12.0	SAND, little silt, trace gravel.	78.0			
■	BB-MDSB-101A/4D	13+99.7	5.7 RT	25.0-27.0	Clayey SILT, trace sand.	29.8	39	18	21
●	BB-MDSB-101A/1U	13+99.7	5.7 RT	30.0-32.0	SILT, little clay, trace sand.	31.2	40	19	21
▲	BB-MDSB-101A/5D	13+99.7	5.7 RT	35.0-37.0	Clayey SILT, trace sand.	30.5	41	19	22
✖									

PIN
016718.00
Town
Mount Desert
Reported by/Date
WHITE, TERRY A 6/14/2010

SHEET 2

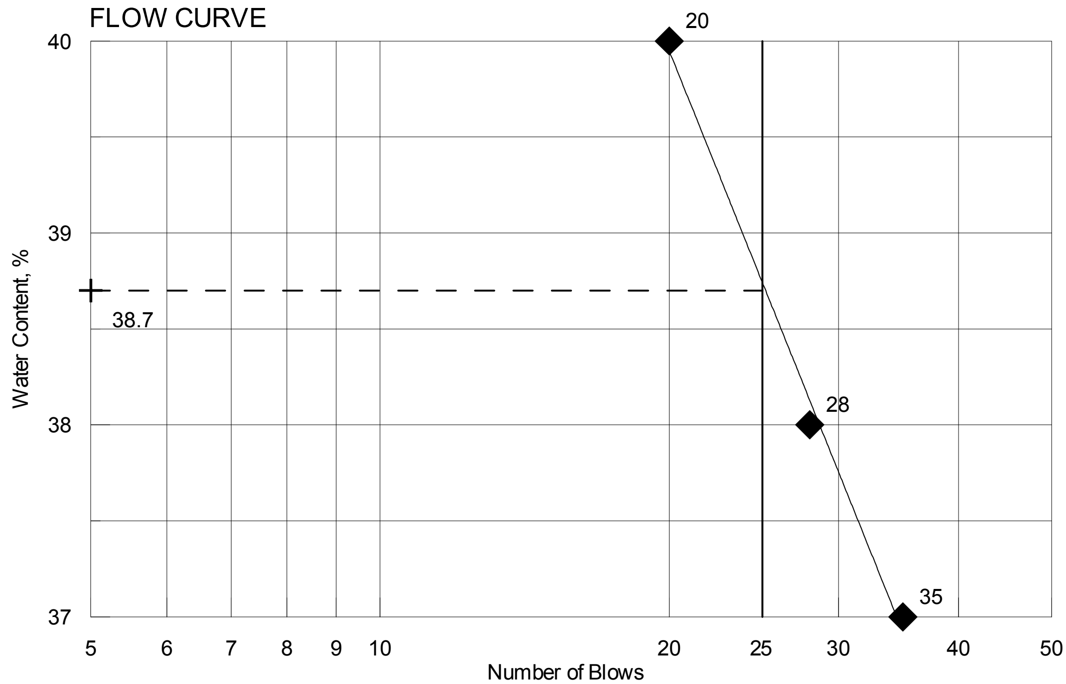
State of Maine Department of Transportation
GRAIN SIZE DISTRIBUTION CURVE

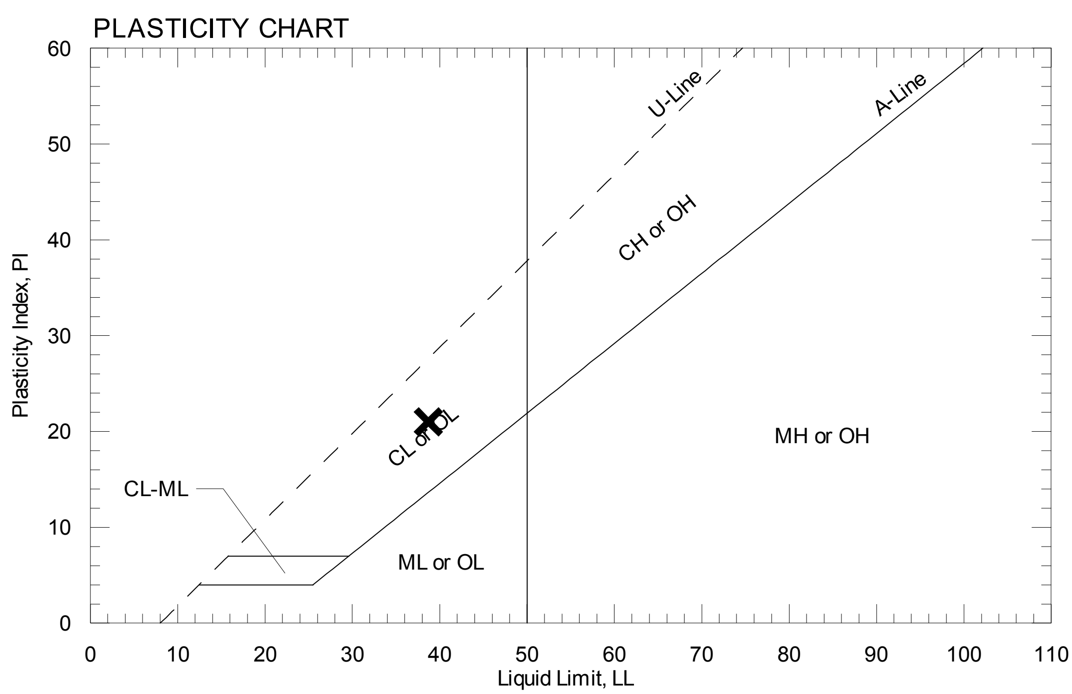


	Boring/Sample No.	Station	Offset, ft	Depth, ft	Description	W, %	LL	PL	PI
✚	BB-MDSB-102/2D	14+51.9	9.5 LT	5.0-7.0	SILT, little clay, trace sand.	17.0	22	14	8
◆	BB-MDSB-102/3D	14+51.9	9.5 LT	10.0-12.0	SILT, some sand, trace gravel.	22.5	24	27	NP
■									
●									
▲									
✖									

PIN
016718.00
Town
Mount Desert
Reported by/Date
WHITE, TERRY A 7/21/2010

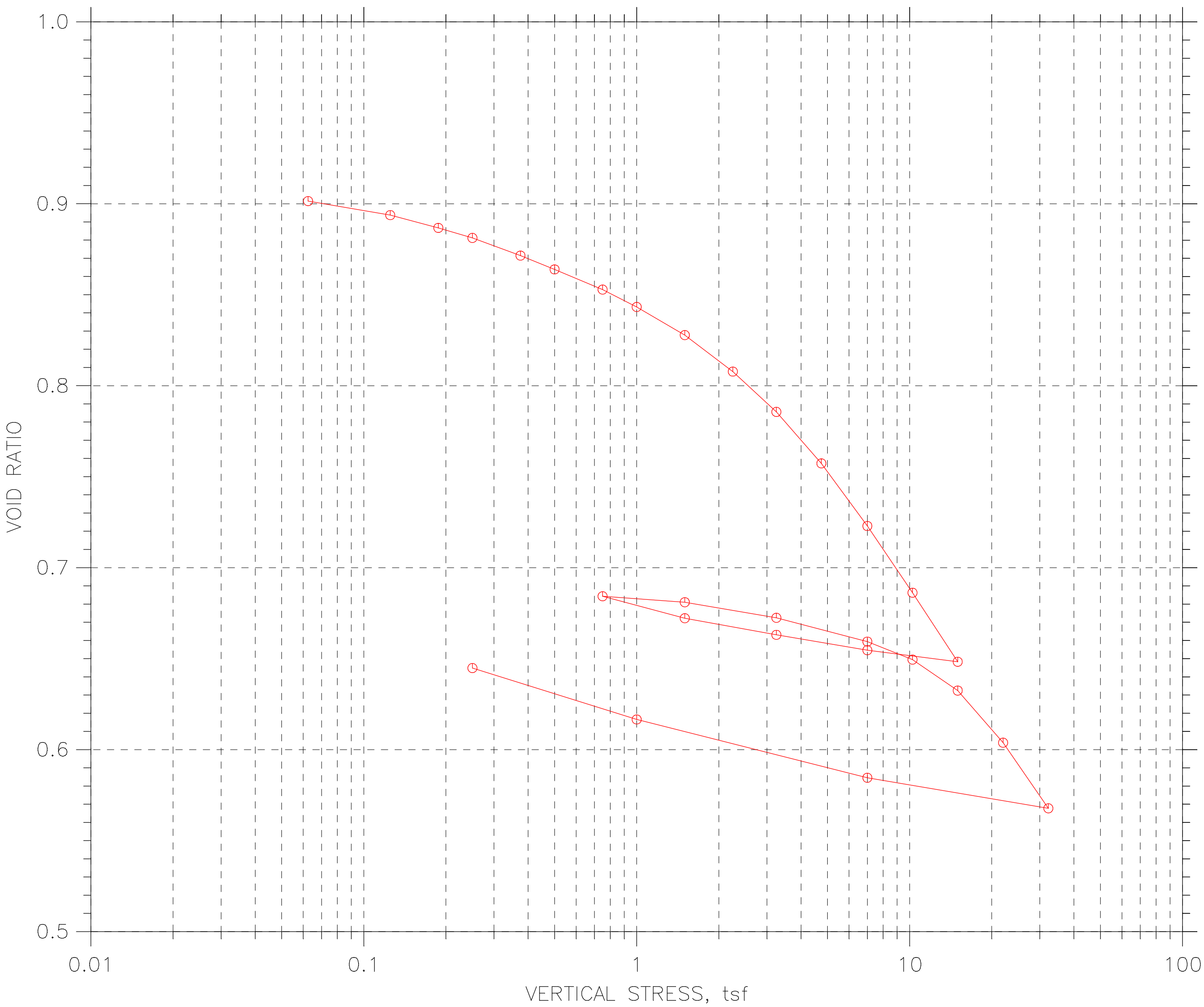
TOWN	Mount Desert	Reference No.	238205
PIN	016718.00	Water Content, %	29.8
Sampled	3/16/2010	Plastic Limit	18
Boring No./Sample No.	BB-MDSB-101A/4D	Liquid Limit	39
Station	13+99.7	Plasticity Index	21
Depth	25.0-27.0	Tested By	KDRES





CONSOLIDATION TEST DATA

SUMMARY REPORT



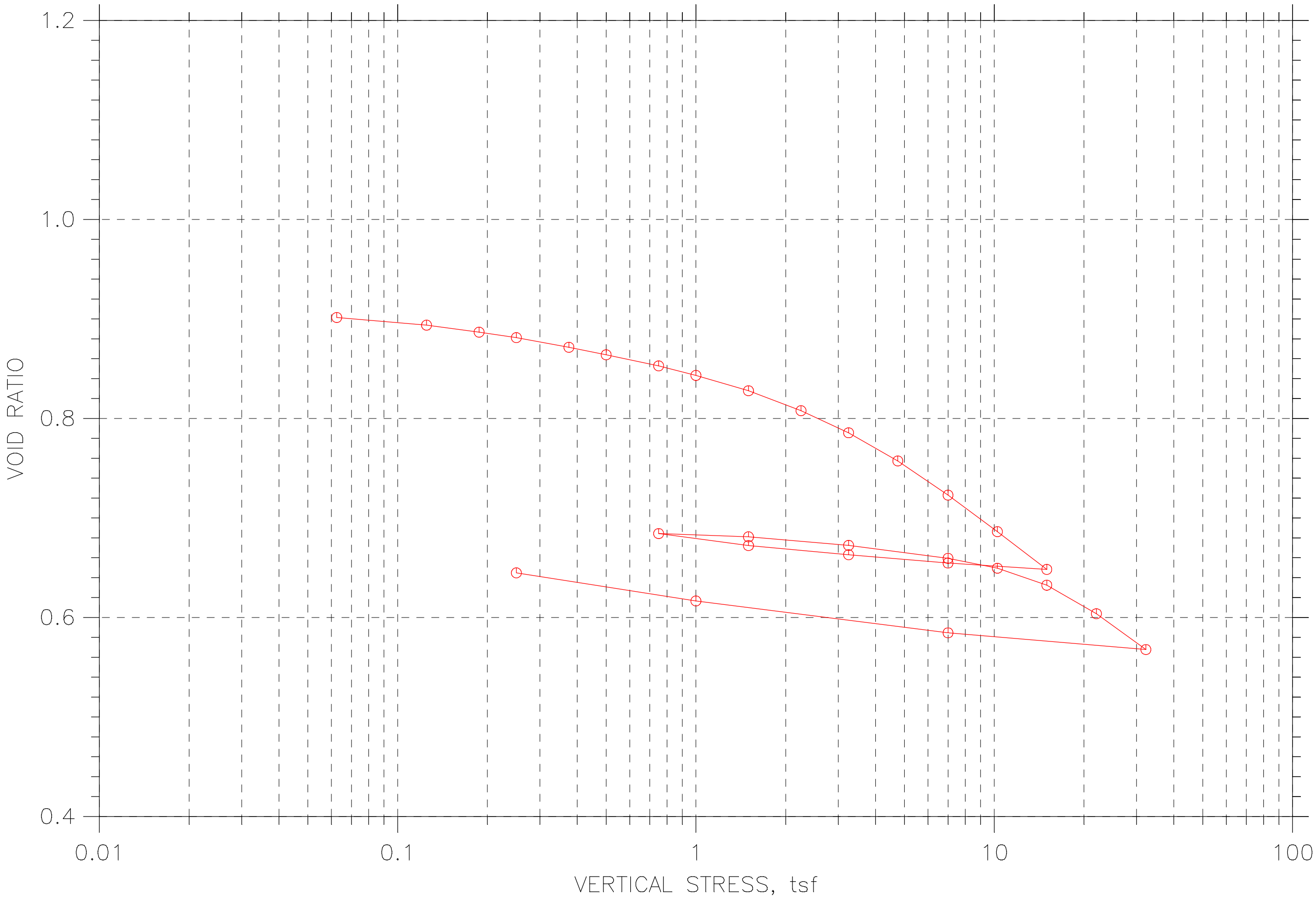
					Before Test	After Test
Overburden Pressure: 1.27 tsf				Water Content, %	30.68	23.73
Preconsolidation Pressure: 2.9 tsf				Dry Unit Weight, pcf	86.52	103.2
Compression Index: 0.236				Saturation, %	86.71	100.09
Diameter: 2.485 in		Height: 1.075 in		Void Ratio	0.96	0.64
LL: 40	PL: 21	PI: 19	GS: 2.72			

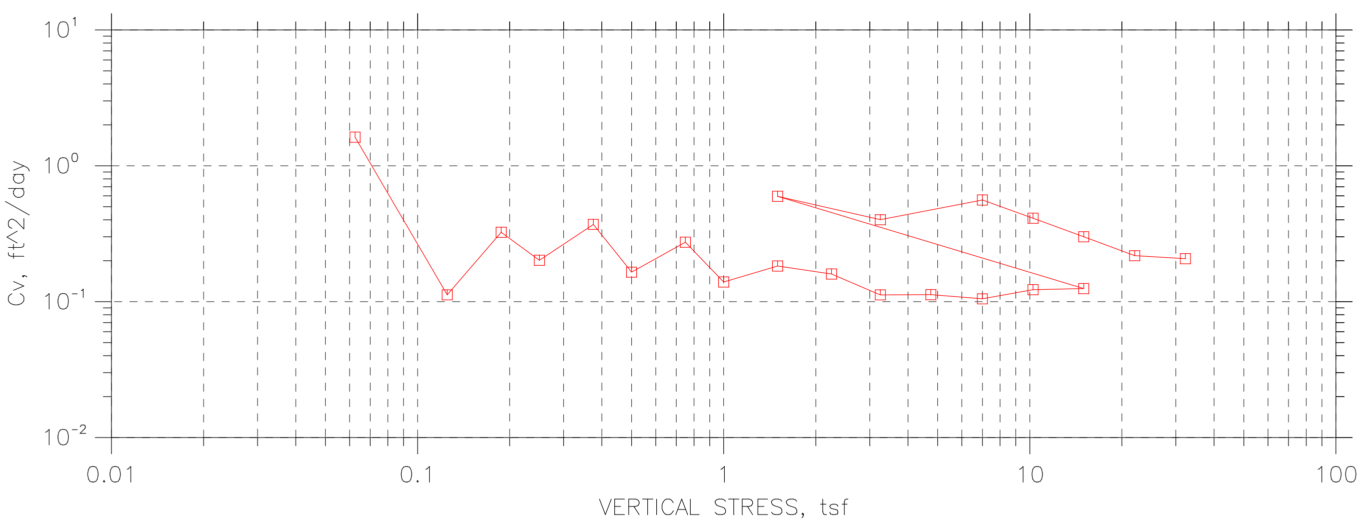
	Project: STANLEY BROOK BRIDGE	Location: MT. DESERT	Project No.: 016718.00
	Boring No.: BB-MDSB101A	Tested By: Brian Fogg	Checked By: Mike Moreau
	Sample No.: 1U	Test Date: 4/28/2010	Depth: 30-32FT
	Test No.: 238206	Sample Type: Shelby Tube	Elevation: -20.2--22.2
	Description: CLAY-SILT AND TRACE FINE SAND		
	Remarks:		

Wed, 27-OCT-2010 09:41:05

CONSOLIDATION TEST DATA

SUMMARY REPORT





Project: STANLEY BROOK BRIDGE	Location: MT. DESERT	Project No.: 016718.00
Boring No.: BB-MDSB101A	Tested By: Brian Fogg	Checked By: Mike Moreau
Sample No.: 1U	Test Date: 4/28/2010	Depth: 30-32FT
Test No.: 238206	Sample Type: Shelby Tube	Elevation: -20.2--22.2
Description: CLAY-SILT AND TRACE FINE SAND		
Remarks:		

Wed, 27-OCT-2010 09:41:04

CONSOLIDATION TEST DATA

Project: STANLEY BROOK BRIDGE
Boring No.: BB-MDSB101A
Sample No.: 1U
Test No.: 238206

Location: MT. DESERT
Tested By: Brian Fogg
Test Date: 4/28/2010
Sample Type: Shelby Tube

Project No.: 016718.00
Checked By: Mike Moreau
Depth: 30-32FT
Elevation: -20.2--22.2

Soil Description: CLAY-SILT AND TRACE FINE SAND
Remarks:

Measured Specific Gravity: 2.72
Initial Void Ratio: 0.96
Final Void Ratio: 0.64

Liquid Limit: 40
Plastic Limit: 21
Plasticity Index: 19

Initial Height: 1.08 in
Specimen Diameter: 2.48 in

	Before Consolidation		After Consolidation	
	Trimmings	Specimen+Ring	Specimen+Ring	Trimmings
Container ID	67	RING	RING	215
Wt. Container + Wet Soil, gm	214.61	416.89	408.65	213.84
Wt. Container + Dry Soil, gm	179.23	380.54	380.54	185.83
Wt. Container, gm	66.95	262.07	262.07	67.78
Wt. Dry Soil, gm	112.28	118.47	118.47	118.05
Water Content, %	31.51	30.68	23.73	23.73
Void Ratio	---	0.96	0.64	---
Degree of Saturation, %	---	86.71	100.09	---
Dry Unit Weight, pcf	---	86.524	103.24	---

CONSOLIDATION TEST DATA

Project: STANLEY BROOK BRIDGE
Boring No.: BB-MDSB101A
Sample No.: 1U
Test No.: 238206

Location: MT. DESERT
Tested By: Brian Fogg
Test Date: 4/28/2010
Sample Type: Shelby Tube

Project No.: 016718.00
Checked By: Mike Moreau
Depth: 30-32FT
Elevation: -20.2--22.2

Soil Description: CLAY-SILT AND TRACE FINE SAND
Remarks:

	Applied Stress tsf	Final Displacement in	Void Ratio	Strain at End %	T50 Fitting Sq.Rt. min	T50 Fitting Log min	Coefficient of Consolidation Sq.Rt. ft^2/day	Coefficient of Consolidation Log ft^2/day	Coefficient of Consolidation Ave. ft^2/day
1	0.0625	0.03346	0.901	3.11	0.3	0.0	1.62e+000	0.00e+000	1.62e+000
2	0.125	0.0377	0.894	3.50	4.8	0.0	1.12e-001	0.00e+000	1.12e-001
3	0.188	0.04153	0.887	3.86	1.6	0.0	3.24e-001	0.00e+000	3.24e-001
4	0.25	0.04456	0.881	4.14	2.6	2.6	2.03e-001	2.00e-001	2.02e-001
5	0.375	0.04988	0.872	4.64	1.4	0.0	3.70e-001	0.00e+000	3.70e-001
6	0.5	0.05404	0.864	5.02	3.1	0.0	1.65e-001	0.00e+000	1.65e-001
7	0.75	0.0601	0.853	5.59	2.0	1.7	2.50e-001	3.02e-001	2.74e-001
8	1	0.06535	0.843	6.08	3.4	3.8	1.47e-001	1.33e-001	1.40e-001
9	1.5	0.07382	0.828	6.86	3.0	2.4	1.66e-001	2.04e-001	1.83e-001
10	2.25	0.08481	0.808	7.89	3.3	2.8	1.47e-001	1.74e-001	1.60e-001
11	3.25	0.09696	0.786	9.01	4.6	3.9	1.03e-001	1.23e-001	1.12e-001
12	4.75	0.1125	0.757	10.46	4.5	3.8	1.04e-001	1.23e-001	1.13e-001
13	7	0.1313	0.723	12.21	4.9	3.6	9.09e-002	1.24e-001	1.05e-001
14	10.3	0.1514	0.686	14.08	3.5	3.6	1.24e-001	1.21e-001	1.23e-001
15	15	0.1722	0.648	16.01	3.4	3.2	1.21e-001	1.29e-001	1.25e-001
16	7	0.1687	0.655	15.69	0.1	0.0	5.20e+000	0.00e+000	5.20e+000
17	3.25	0.1641	0.663	15.26	0.5	0.0	8.82e-001	0.00e+000	8.82e-001
18	1.5	0.1591	0.672	14.79	1.4	2.0	2.88e-001	2.01e-001	2.37e-001
19	0.75	0.1525	0.684	14.18	4.7	4.1	8.97e-002	1.02e-001	9.55e-002
20	1.5	0.1543	0.681	14.34	0.7	0.0	5.95e-001	0.00e+000	5.95e-001
21	3.25	0.159	0.672	14.78	1.0	0.0	4.01e-001	0.00e+000	4.01e-001
22	7	0.1661	0.659	15.45	0.8	0.7	5.18e-001	6.08e-001	5.60e-001
23	10.3	0.1716	0.649	15.95	1.0	1.0	4.11e-001	4.11e-001	4.11e-001
24	15	0.1809	0.632	16.82	1.3	0.0	3.00e-001	0.00e+000	3.00e-001
25	22	0.1966	0.604	18.28	1.8	1.7	2.11e-001	2.25e-001	2.18e-001
26	32.3	0.2163	0.568	20.12	1.6	2.0	2.27e-001	1.90e-001	2.07e-001
27	7	0.2071	0.585	19.26	0.1	0.0	6.14e+000	0.00e+000	6.14e+000
28	1	0.1896	0.617	17.63	2.4	2.5	1.58e-001	1.51e-001	1.54e-001
29	0.25	0.1741	0.645	16.19	11.7	0.0	3.35e-002	0.00e+000	3.35e-002

Maine DOT, Materials Testing & Exploration, 219 Hogan Road, Bangor, Maine 04401

GEOTECHNICAL TEST REPORT
Central Laboratory

SAMPLE INFORMATION

Reference No.	Boring No./Sample No.	Sample Description	Sampled	Received
238206	BB-MDSB-101A/1U	GEOTECHNICAL (UNDISTURBED)	3/16/2010	4/22/2010

Sample Type: **GEOTECHNICAL** Location: **OTHER** Station: **13+99.7** Offset, ft: **5.7** **RT** Dbfg, ft: **30.0-32.0**

PIN: **016718.00** Town: **Mount Desert** Sampler: **WILDER, BRUCE H**

TEST RESULTS

Sieve Analysis (T 88)

Wash Method

SIEVE SIZE U.S. [SI]	% Passing
3 in. [75.0 mm]	
1 in. [25.0 mm]	
¾ in. [19.0 mm]	
½ in. [12.5 mm]	
⅜ in. [9.5 mm]	100.0
¼ in. [6.3 mm]	100.0
No. 4 [4.75 mm]	100.0
No. 10 [2.00 mm]	99.9
No. 20 [0.850 mm]	
No. 40 [0.425 mm]	99.8
No. 60 [0.250 mm]	
No. 100 [0.150 mm]	
No. 200 [0.075 mm]	99.3
[0.0253 mm]	29.3
[0.0166 mm]	27.4
[0.0100 mm]	24.4
[0.0072 mm]	23.5
[0.0052 mm]	21.5
[0.0027 mm]	17.6
[0.0012 mm]	13.7

Direct Shear (T 236)

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

Consolidation (T 216)

Trimmings, Water Content, % **31.5**

	Initial	Final		Void Ratio	% Strain
Water Content, %	30.7	23.7	Pmin		
Dry Density, lbs/ft³	86.7	103.2	Pp		
Void Ratio	0.96	0.64	Pmax	2.9 tsf	
Saturation, %	86.5	100.1	Cc/C'c	0.236	

Miscellaneous Tests

Test	Result
Liquid Limit @ 25 blows (T 89), %	40
Plastic Limit (T 90), %	19
Plasticity Index (T 90), %	21
Specific Gravity, Corrected to 20°C (T 100)	2.72
Loss on Ignition (T 267): Loss, % / H2O, %	
Water Content (T 265), %	31.2

Vane Shear Test on Shelby Tubes (Maine DOT)

Depth taken in tube, ft	3 In. U. Shear tons/ft²	3 In. Remold tons/ft²	6 In. U. Shear tons/ft²	6 In. Remold tons/ft²	Water Content, %	Description of Material Sampled at the Various Tube Depths
0-0.5	0.63	0.05	0.55	0.13	30.4	Light gray clay.
0.625-1.0	0.59	0.07	0.62	0.08	31.6	Light gray clay.
1.0-1.5	0.41	0.02			31.5	Light gray clay with a 3" by 1" stone at 14". Super saturated from 15" to 18".
1.5-1.75	0.05	0			33.8	Super saturated light gray clay.

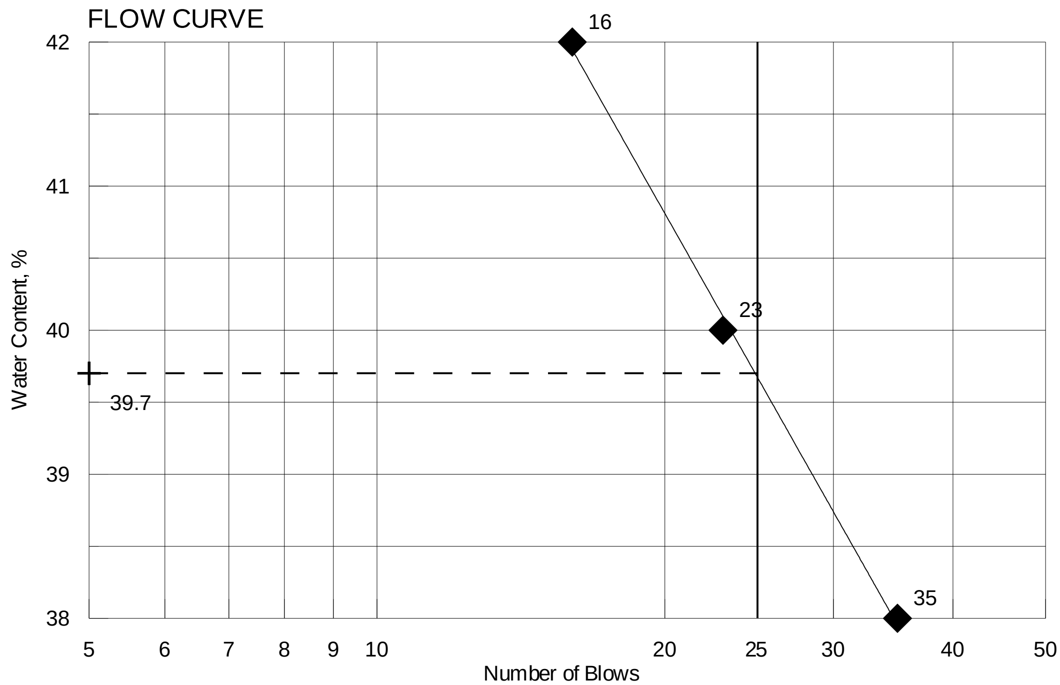
Comments:

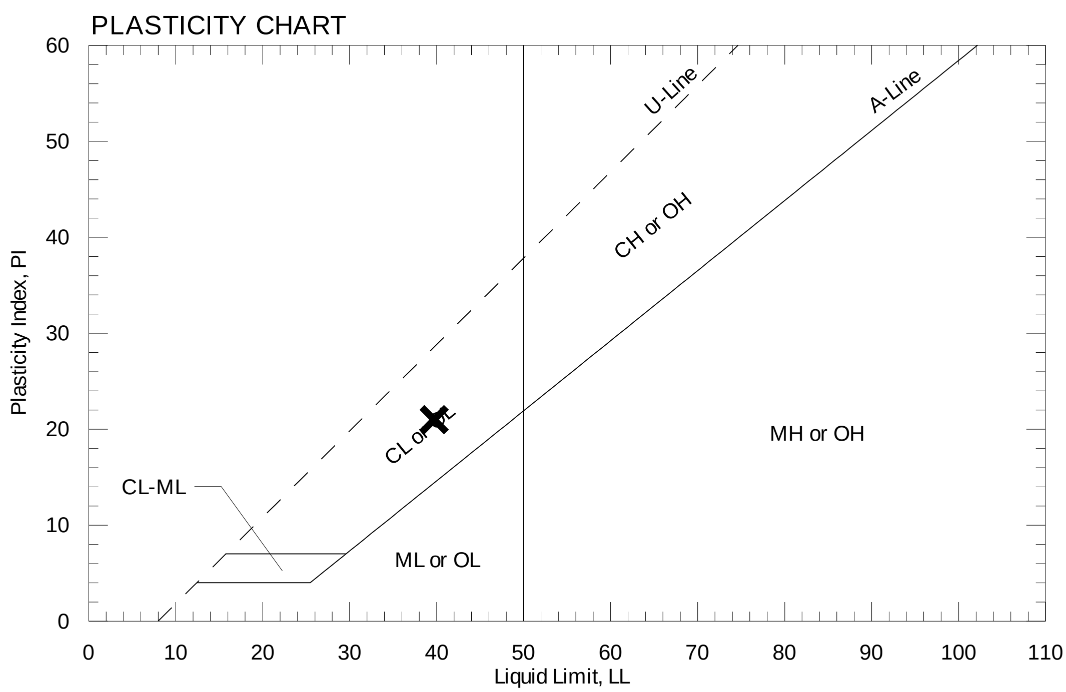
AUTHORIZATION AND DISTRIBUTION

Reported by: **FOGG, BRIAN** Date Reported: **6/3/2010**

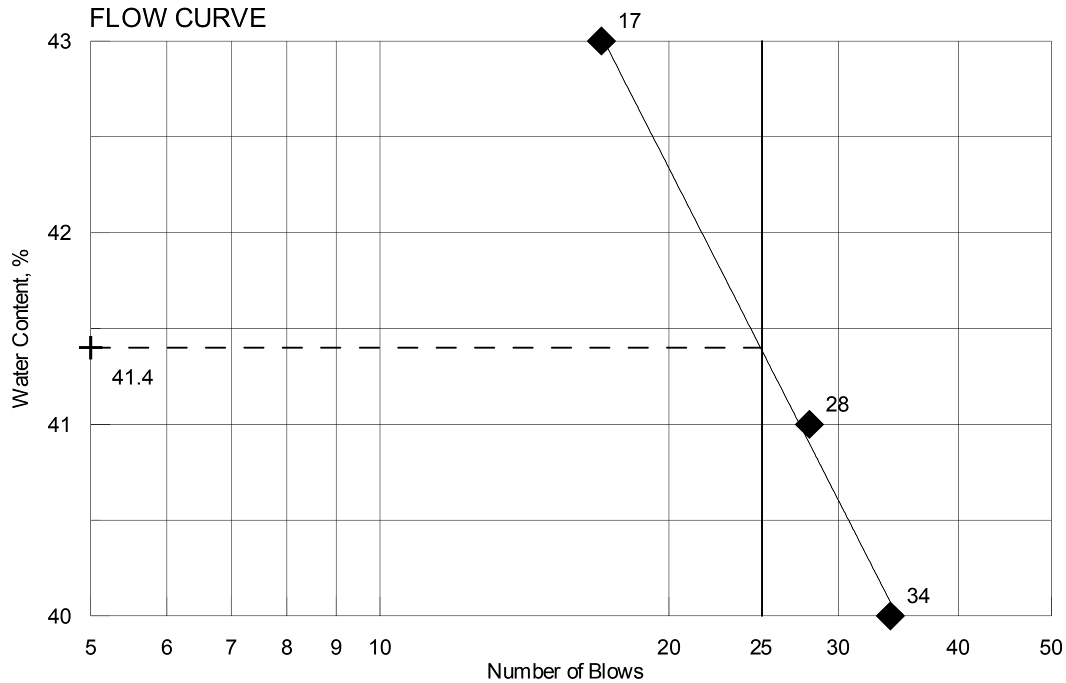
Paper Copy: Lab File; Project File; Geotech File

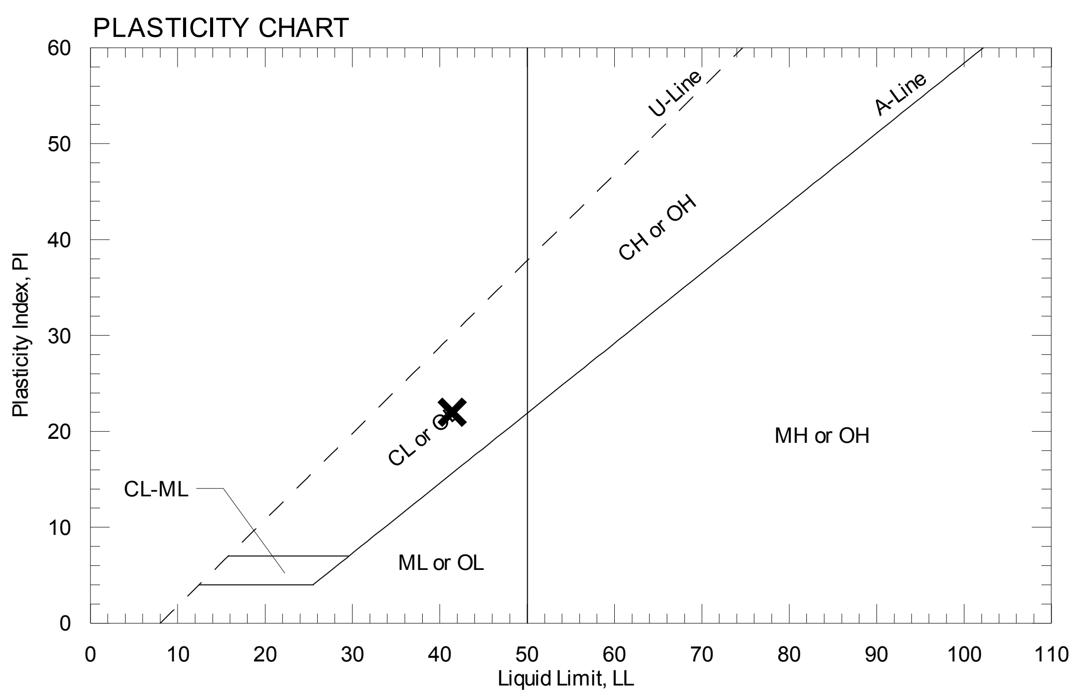
TOWN	Mount Desert	Reference No.	238206
PIN	016718.00	Water Content, %	31.2
Sampled	3/16/2010	Plastic Limit	19
Boring No./Sample No.	BB-MDSB-101A/1U	Liquid Limit	40
Station	13+99.7	Plasticity Index	21
Depth	30.0-32.0	Tested By	KDRES



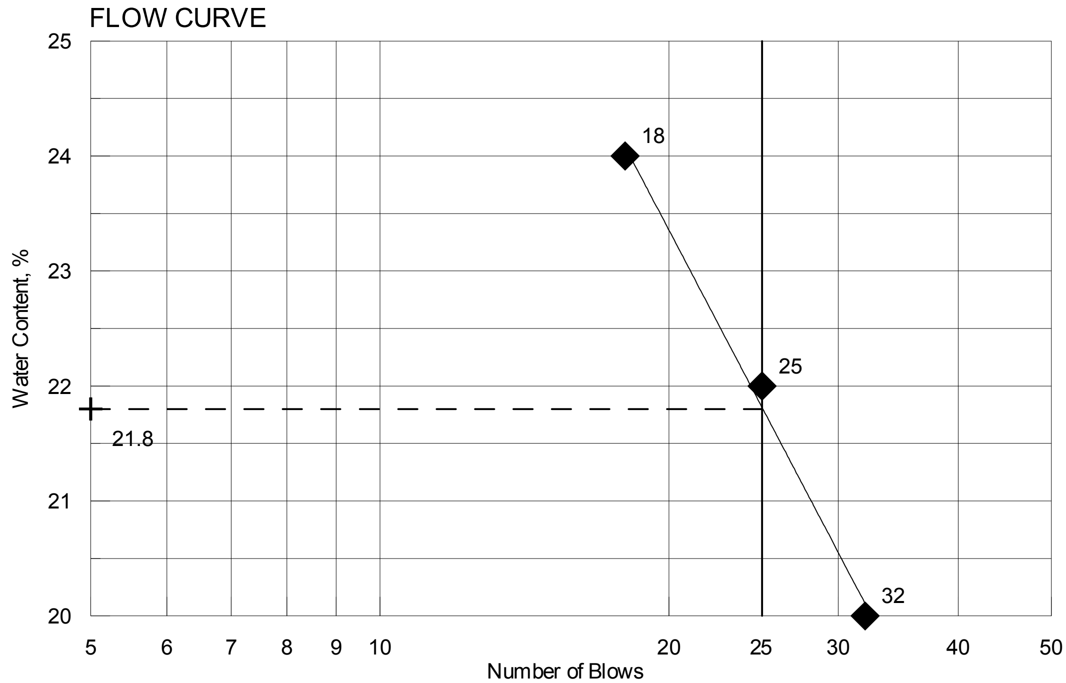


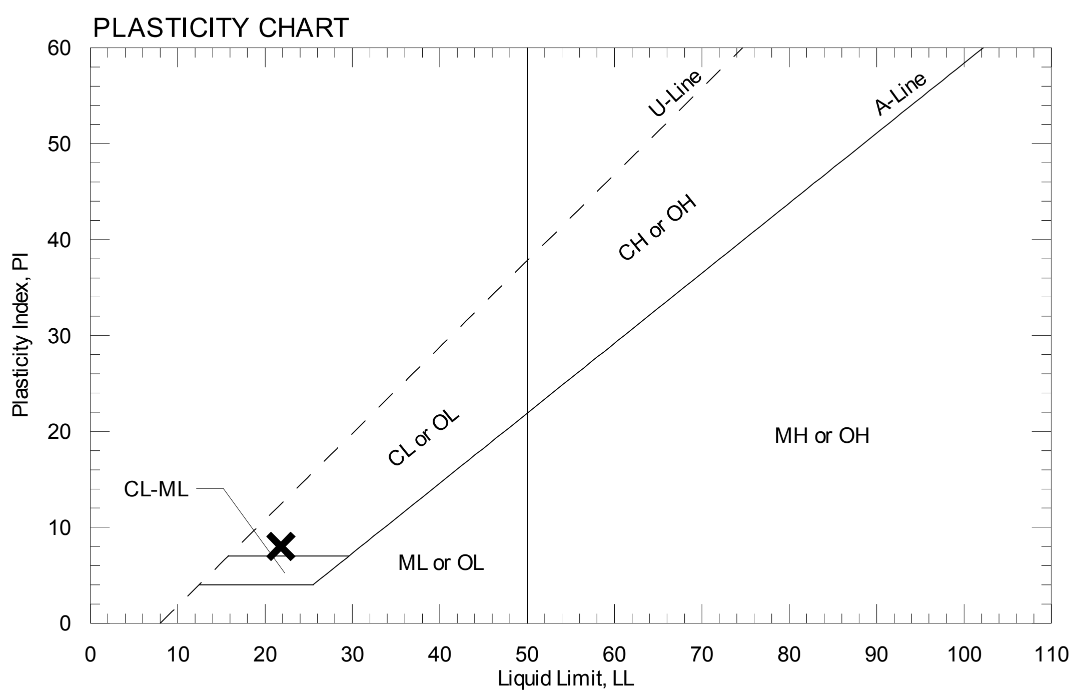
TOWN	Mount Desert	Reference No.	238207
PIN	016718.00	Water Content, %	30.5
Sampled	3/16/2010	Plastic Limit	19
Boring No./Sample No.	BB-MDSB-101A/5D	Liquid Limit	41
Station	13+99.7	Plasticity Index	22
Depth	35.0-37.0	Tested By	KDRES



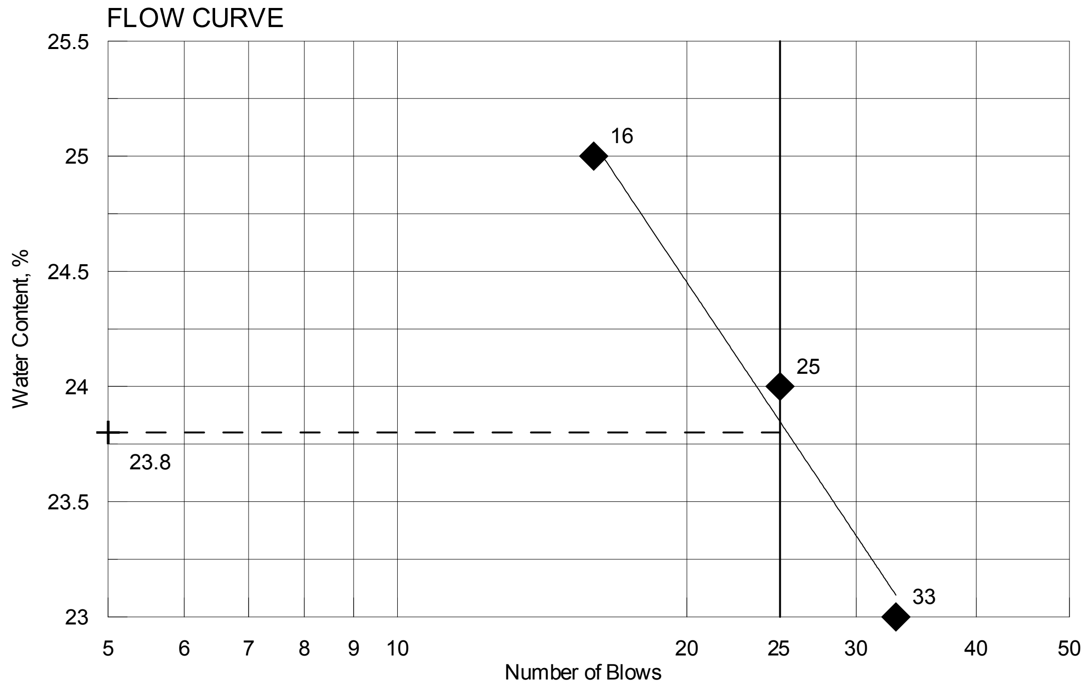


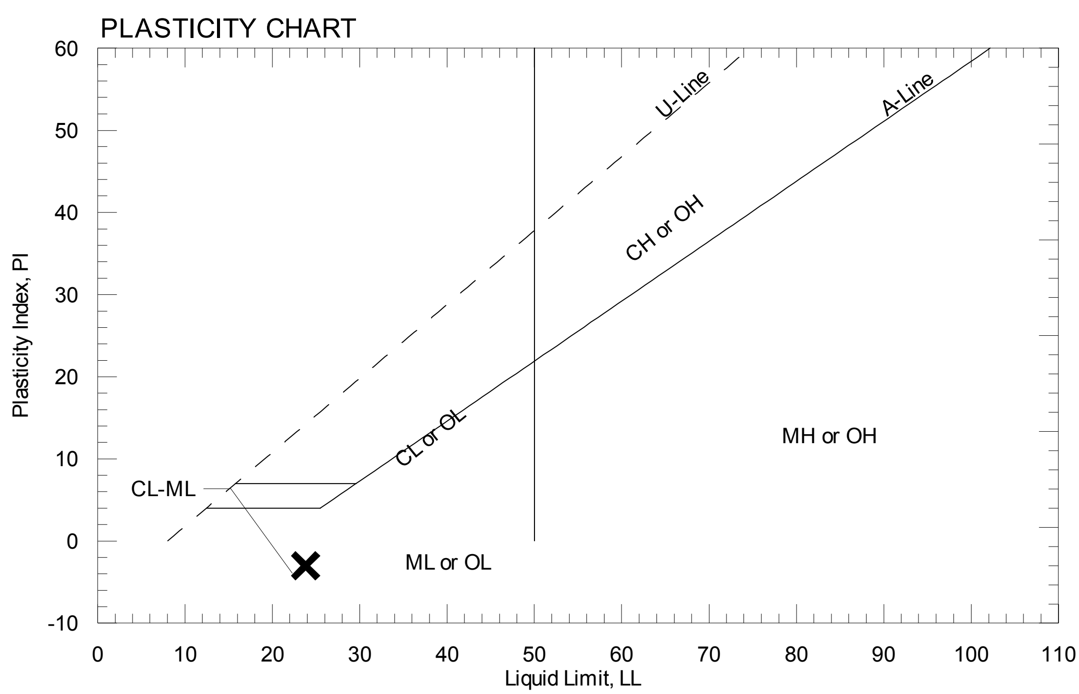
TOWN	Mount Desert	Reference No.	238208
PIN	016718.00	Water Content, %	17
Sampled	3/16/2010	Plastic Limit	14
Boring No./Sample No.	BB-MDSB-102/2D	Liquid Limit	22
Station	14+51.9	Plasticity Index	8
Depth	5.0-7.0	Tested By	KDRES





TOWN	Mount Desert	Reference No.	238209
PIN	016718.00	Water Content, %	22.5
Sampled	3/16/2010	Plastic Limit	27
Boring No./Sample No.	BB-MDSB-102/3D	Liquid Limit	24
Station	14+51.9	Plasticity Index	NP
Depth	10.0-12.0	Tested By	KDRES





Appendix C

Calculations

HEADWALL ACTIVE EARTH PRESSURE:

Rankine Theory - Active Earth Pressure from MaineDOT Bridge Design Guide Section 3.6.5.2, pg. 3-7

Either Rankine or Coulomb may be used for long-heeled cantilever walls where the failure surface is uninterrupted by the top of the wall stem. In general, use Rankine though.

Soil angle of internal friction: $\phi := 32deg$

Slope angle of backfill soil from horizontal: $\beta := 0deg$

$$K_a := \tan\left[45deg - \left(\frac{\phi}{2}\right)\right]^2$$

$K_a = 0.31$

FROST PROTECTION

Method 1:

From the Maine Design Freezing Index Map:
DFI = 1050 degree-days
Site has Coarse Grained Fill Soils With Wn < 10%

From the 2003 Bridge Design Guide Table 5-1:

$$Frost\_depth := [0.5\cdot(69.8in - 66.3in) + 66.3in]$$

$$Frost\_depth = 68.05\cdot in$$

$$Frost\_depth = 5.67\cdot ft$$

Method 2:

```
                    ------------------------
                    --- ModBerg Results ---
                    -----------------------

 Project Location: Ellsworth, Maine

 Air Design Freezing Index         =  1256 F-days
 N-Factor                          =  0.70
 Surface Design Freezing Index     =   879 F-days
 Mean Annual Temperature           =  44.6 deg F
 Design Length of Freezing Season  =  126 days

 ---------------------------------------------------------
 Layer
 #:Type            t    w%     d    Cf  Cu   Kf   Ku     L
 ---------------------------------------------------------
 1-Asphalt        6.0   .1 140.0  28  28   .9   .9      0
 2-Coarse        46.9 10.0 125.0  28  34  2.0  1.6  1,800
 ---------------------------------------------------------

 t  = Layer thickness, in inches.
 w% = Moisture content, in percentage of dry density.
 d  = Dry density, in lbs/cubic ft.
 Cf = Heat Capacity of frozen phase, in BTU/(cubic ft degree F).
 Cu = Heat Capacity of thawed phase, in BTU/(cubic ft degree F).
 Kf = Thermal conductivity in frozen phase, in BTU/(ft hr degree).
 Ku = Thermal conductivity in thawed phase, in BTU/(ft hr degree).
 L  = Latent heat of fusion, in BTU / cubic ft.

 *********************************************************
   Total Depth of Frost Penetration = 4.41 ft = 52.9 in.
 *********************************************************
```

Use 5.0 feet

BEARING RESISTANCE ON COMPACTED FILL SOILS:

Consider this for use with Box Culverts, Headwalls and Wingwalls.

SERVICE LIMIT STATE:

LRFD Table C10.6.2.6.1-1, (Based on NAVFAC DM 7.2) - "Presumptive Bearing Resistances for Spread Footing Foundations at the Service Limit State"

Bearing Material	Consistency in Place	Bearing Resistance (kips per sq. foot)	Recommend Value
Coarse to Medium sand, little gravel	Very dense	8 to 12	8 ksf
	Medium dense to dense	4 to 8	6 ksf
	Loose	2 to 4	3 ksf

Recommend **6.0 ksf** to control settlements for **Service Limit State** analyses and for preliminary footing sizing.

STRENGTH LIMIT STATE:

Nominal and Factored Bearing Resistance for box culvert and retaining wall base slab on fill soils at the Strength Limit State:

Assumptions:

1. Box Culvert will be embedded 3.5 feet for streambed simulation.

$D_f := 3.5ft$

2. Assumed parameters for soils:
   Assume granular fill

   Moist unit weight: $\gamma_m := 125pcf$

   Saturated unit weight: $\gamma_{sat} := 130pcf$

   Soil angle of internal friction: $\phi_{ns} := 32$

   Undrained shear strength (cohesion): $c_{ns} := 0psf$

3. Use Terzaghi strip equations as L > B

Depth to Groundwater table based on boring data: $D_w := 0 \cdot ft$

Unit weight of water: $\gamma_w := 62.4pcf$

Effective Stress at the footing bearing level: $q_{eff\_str} := D_w \cdot \gamma_m + (D_f - D_w) \cdot (\gamma_{sat} - \gamma_w)$

$q_{eff\_str} = 0.24 \cdot ksf$

Box Culvert Width: $B := 26ft$

Terzaghi Shape Factors from Table 4-1, p. 220
For strip footing:

$s_c := 1.0$

$s_\gamma := 1.0$

Meyerhof Bearing Capacity Factors For $\phi = 32$ deg Bowles 5th Ed. Table 4-4 pg. 223

$N_c := 35.47$ $N_q := 23.2$ $N_\gamma := 22.0$

Nominal Bearing Resistance per Terzaghi equation Bowles 5th Ed. Table 4-1 pg. 220

$q_{nom} := c_{ns} \cdot N_c \cdot s_c + q_{eff\_str} \cdot N_q + 0.5(\gamma_{sat} - \gamma_w) \cdot B \cdot N_\gamma \cdot s_\gamma$

$q_{nom} = 24.8 \cdot ksf$

Resistance Factor from LRFD Table 10.5.5.2.2-1 pg. 10-32: $\phi_b := 0.45$

$q_{fac} := q_{nom} \cdot \phi_b$

$q_{fac} = 11.2 \cdot ksf$

The **Strength Limit State** Factored Bearing Resistance is **11.0 ksf** for the box culvert.

For this project settlement controls. Recommend 6.0 ksf Factored Bearing Resistance for box culvert design.

EMBANKMENT SETTLEMENT ANALYSIS:

$P_o := 8ft \cdot 125pcf + 4ft \cdot 120pcf + [12ft \cdot (120pcf - 62.4pcf)] + [7ft \cdot (115pcf - 62.4pcf)]$

$P_o = 2539.4 \cdot psf$

The consolidation test on the sample from 31 ft indicates P_c = 5800 psf

$P_c := 5800psf$

$OCR_1 := \dfrac{P_c}{P_o}$ $\qquad OCR_1 = 2.28$

Check using SHANSEP with Lowest Soil Shear Strength Adjacent
to the Consolidation Sample:

$S_{vane} := 1070psf$

$$\left(\frac{S_{vane}}{P_o}\right) = 0.2 \cdot OCR^{0.8}$$

Rearranging:

$OCR_{SHANSEP} := \left(\dfrac{S_{vane}}{P_o \cdot 0.2}\right)^{1.25}$ $\qquad OCR_{SHANSEP} = 2.54$ $\qquad$ OK, use OCR = 2.3 (Conservative)

FoSSA -- Foundation Stress & Settlement Analysis $\qquad$ Mt Desert Approach Embankments

FoSSA

Mt Desert Approach Embankments

PROJECT IDENTIFICATION

Title: Mt Desert Approach Embankments
Project Number: PIN 16718 -
Client:
Designer: Mike Moreau, PE
Station Number:

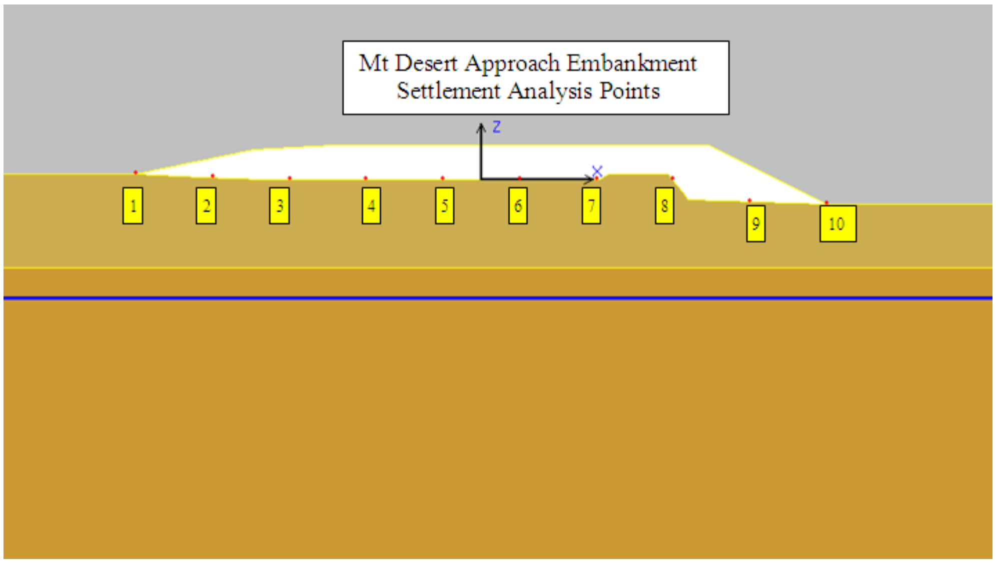
Description:

Company's information:

Name: MaineDOT
Street: 16 State House Station
Augusta, ME 04333-0016
Telephone #:
Fax #:
E-Mail:

Original file path and name: C:\FoSSA\16718 Mt Desert Approches.F2S
Original date and time of creating this file: Wed Aug 25 13:52:57 2010

GEOMETRY: Analysis of a 2D geometry



FoSSA -- Foundation Stress & Settlement Analysis
Present Date/Time: Mon Sep 27 13:48:46 2010

Mt Desert Approach Embankments
C:\FoSSA\16718 Mt Desert Approaches.F2S

INPUT DATA -- FOUNDATION LAYERS -- 3 layers

	Wet Unit Weight, γ [lb/ft^3]	Poisson's Ratio μ	Description of Soil
1	125.00	0.30	Granular Fill
2	110.00	0.45	OC Clay-Silt
3	115.00	0.30	Sand

FoSSA -- Foundation Stress & Settlement Analysis
Present Date/Time: Mon Sep 27 13:52:44 2010

Mt Desert Approach Embankments
C:\FoSSA\16718 Mt Desert Approaches.F2S

INPUT DATA -- EMBANKMENT LAYERS -- 1 layers

	Wet Unit Weight, γ [lb/ft^3]	Description of Soil
1	125.00	Sand and Gravel

FoSSA -- Foundation Stress & Settlement Analysis
Present Date/Time: Mon Sep 27 13:53:50 2010

Mt Desert Approach Embankments
C:\FoSSA\16718 Mt Desert Approaches.F2S

INPUT DATA OF WATER

Point #	Coordinates (X, Z): (X) [ft.]	(Z) [ft.]
1	295.28	315.50
2	311.68	315.50
3	328.08	315.50
4	344.49	315.50
5	360.89	315.50

FoSSA -- Foundation Stress & Settlement Analysis
Present Date/Time: Mon Sep 27 13:36:58 2010

Mt Desert Approach Embankments
C:\FoSSA\16718 Mt Desert Approaches.F2S

TABULTAED GEOMETRY INPUT OF FOUNDATION SOILS

Found. Soil #	Point #	Coordinates (X, Z): (X) [ft.]	(Z) [ft.]	DESCRIPTION
1	1	305.00	328.00	Granular Fill
	2	318.00	327.50	
	3	340.00	327.50	
	4	352.00	327.50	
	5	353.00	328.00	
	6	359.00	328.00	
	7	361.00	325.50	
	8	375.00	325.00	
2	1	295.28	318.50	OC Clay-Silt
	2	311.68	318.50	
	3	328.08	318.50	
	4	344.49	318.50	
	5	360.89	318.50	
3	1	295.28	272.00	Sand
	2	311.68	272.00	
	3	328.08	272.00	
	4	344.49	272.00	
	5	360.89	272.00	

FoSSA -- Foundation Stress & Settlement Analysis
Present Date/Time: Mon Sep 27 13:37:55 2010

Mt Desert Approach Embankments
C:\FoSSA\16718 Mt Desert Approaches.F2S

TABULTAED GEOMETRY INPUT OF EMBANKMENT SOILS

Embank. Soil #	Point #	Coordinates (X, Z): (X) [ft.]	(Z) [ft.]	DESCRIPTION
1	1	317.00	330.50	Sand and Gravel
	2	325.00	331.00	
	3	340.00	331.00	
	4	363.00	331.00	
	5	375.00	325.00	
	6	3852.69	325.00	

FoSSA -- Foundation Stress & Settlement Analysis
Present Date/Time: Mon Sep 27 13:34:55 2010

Mt Desert Approach Embankments
C:\FoSSA\16718 Mt Desert Approaches.F2S

INPUT DATA FOR CONSOLIDATION -- $\alpha = 1/2$

Layer #	Undergoing Consolidation [Yes/No]	OCR = Pc / Po	Cc	Cr	e0	Cv [ft ²/day]	Drains at :
1	No	N/A	N/A	N/A	N/A	N/A	N/A
2	Yes	2.30	0.24	0.05	0.98	0.1728	Top & Bot.
3	No	N/A	N/A	N/A	N/A	N/A	N/A

FoSSA -- Foundation Stress & Settlement Analysis
Present Date/Time: Mon Sep 27 14:50:44 2010

Mt Desert Approach Embankments
C:\FoSSA\16718 Mt Desert Approaches.F2S

IMMEDIATE SETTLEMENT, Si

Node #	Settlement along section: X [ft.]	Y [ft.]	Layer #	Young's Modulus, E [lb/ft²]	Poisson's Ratio, µ	Si(k) [ft.]	Z initial [ft.]	Z final [ft.]
1	305.00	0.00	1	1000000	0.3000	-0.0001	328.00	328.00
			2	28800000	0.4500	0.0001		
			3	1000000	0.3000	0.0018		
2	312.78	0.00	1	1000000	0.3000	0.0013	327.70	327.70
			2	28800000	0.4500	0.0002		
			3	1000000	0.3000	0.0022		
3	320.56	0.00	1	1000000	0.3000	0.0022	327.50	327.49
			2	28800000	0.4500	0.0003		
			3	1000000	0.3000	0.0026		
4	328.33	0.00	1	1000000	0.3000	0.0024	327.50	327.49
			2	28800000	0.4500	0.0003		
			3	1000000	0.3000	0.0029		
5	336.11	0.00	1	1000000	0.3000	0.0024	327.50	327.49
			2	28800000	0.4500	0.0003		
			3	1000000	0.3000	0.0031		
6	343.89	0.00	1	1000000	0.3000	0.0024	327.50	327.49
			2	28800000	0.4500	0.0003		
			3	1000000	0.3000	0.0031		
7	351.67	0.00	1	1000000	0.3000	0.0023	327.50	327.49
			2	28800000	0.4500	0.0003		
			3	1000000	0.3000	0.0030		
8	359.44	0.00	1	1000000	0.3000	0.0028	327.44	327.44
			2	28800000	0.4500	0.0003		
			3	1000000	0.3000	0.0028		
9	367.22	0.00	1	1000000	0.3000	0.0019	325.28	325.27
			2	28800000	0.4500	0.0002		
			3	1000000	0.3000	0.0025		
10	375.00	0.00	1	1000000	0.3000	0.0001	325.00	325.00
			2	28800000	0.4500	0.0001		
			3	1000000	0.3000	0.0021		

FoSSA -- Foundation Stress & Settlement Analysis
Present Date/Time: Mon Sep 27 14:05:28 2010

Mt Desert Approach Embankments
C:\FoSSA\16718 Mt Desert Approaches.F2S

ULTIMATE SETTLEMENT, Sc

Node #	X [ft.]	Y [ft.]	Original Z [ft.]	Settlement Sc [ft.]	Final Z* [ft.]	Total Settlement (in) Elastic	Consol	Total
1	305.00	0.00	328.00	0.03	327.97	0.002	0.36	0.362
2	312.78	0.00	327.70	0.04	327.66	0.004	0.48	0.484
3	320.56	0.00	327.50	0.06	327.44	0.005	0.72	0.725
4	328.33	0.00	327.50	0.07	327.43	0.005	0.84	0.845
5	336.11	0.00	327.50	0.07	327.43	0.006	0.84	0.846
6	343.89	0.00	327.50	0.07	327.43	0.006	0.84	0.846
7	351.67	0.00	327.50	0.07	327.43	0.005	0.84	0.845
8	359.44	0.00	327.44	0.07	327.38	0.006	0.84	0.846
9	367.22	0.00	325.28	0.06	325.21	0.004	0.72	0.724
10	375.00	0.00	325.00	0.04	324.96	0.002	0.48	0.482

*Note: Final Z is calculated assuming only 'Ultimate Settlement' exists.

OK, Say on the order of 1 inch or less fill-induced settlement will occur during embankment construction.

CONSOLIDATION TEST REULTS:

Maximum Past Pressure:

Applying the Casagrande Construction Method to the Consolidation Curve,
the Maximum Past Pressure Is: 2.9 tsf

Compression Index:

Using Void Ratio Values from the Consolidation Curve,
The Compression Index C_c Is:

$$C_c := 0.863 - 0.627 = 0.24$$

Re-compression Index:

Using Void Ratio Values from the Consolidation Curve,
The Re-compression Index C_r Is:

$$C_r := 0.691 - 0.644 = 0.05$$

<u>Appendix D</u>

Special Provision

SPECIAL PROVISION
SECTION 534
PRECAST STRUCTURAL CONCRETE
(Precast Structural Concrete Arches, Box Culverts)

534.10 Description The Contractor shall design, manufacture, furnish, and install elements, precast structural concrete structures, arches, or box culverts and associated wings, headwalls, and appurtenances, in accordance with the contract documents.

534.20 Materials Structural precast elements for the arch or box culvert and associated precast elements shall meet the requirements of the following Subsection:

Structural Precast Concrete Units	712.061

Grout, concrete patching material, and geotextiles shall be one of the products listed on the Department's list of prequalified materials, unless otherwise approved by the Department.

Box culvert bedding and backfill material shall consist of Standard Specification 703.19, Granular Borrow, Material for Underwater Backfill, with the additional requirement that the maximum particle size be limited to 4 inches, or as shown on the plans.

534.30 Design Requirements The Contractor shall design the precast structural concrete structure in accordance with the AASHTO Standard Specifications for Highway Bridges, current edition. The design live load shall be as follows: *modified HL-93 Strength I for LRFD method. *(modify HL-93 by increasing all wheel loads by a factor of 1.25)

The Contractor shall submit design calculations and shop drawings for the precast structure to the Department for approval. A Registered Professional Engineer, licensed in accordance with State of Maine laws, shall sign and seal all design calculations and drawings. The Contractor shall submit a bridge rating on the Department's Standard Bridge Rating Summary Sheet with the design calculations. Drawings shall conform with Section 105.7 - Working Drawings.

The Contractor shall submit the following items for review by the Resident at least ten working days prior to production:

A) The name and location of the manufacturer.
B) Method of manufacture and material certificates.
C) Description of method of handling, storing, transporting, and erecting the members.
D) Shop Drawings with the following minimum details:

1) Fully dimensioned views showing the geometry of the members, including all projections, recesses, notches, openings, block outs, and keyways.
2) Details and bending schedules of reinforcing steel including the size, spacing, and location. Reinforcing provided under lifting devices shall be shown in detail.

3) Details and locations of all items to be embedded.
4) Total mass (weight) of each member.

534.40 Construction Requirements The applicable provisions of Subsection 535.10 - Forms and Casting Beds and Subsection 535.20 – Finishing Concrete and Repairing Defects shall be met.

Manufacture of Precast Units The internal dimensions shall not vary by more than 1 percent from the design dimensions or 38 mm [1 ½ in], whichever is less. The haunch dimensions shall not vary by more than 19 mm [¾ in] from the design dimension. The dimension of the legs shall not vary by more than 6 mm [¼ in] from the dimension shown on the approved shop drawings.

The slab and wall thickness shall not be less than the design thickness by more than 6 mm [¼ in]. A thickness greater than the design thickness shall not be cause for rejection.

Variations in laying lengths of two opposite surfaces shall not be more than 15 mm [⅝ in] in any section, except where beveled ends for laying of curves are specified.

The under-run in length of any section shall not be more than 12 mm [½ in].

The cover of concrete over the outside circumferential reinforcement shall be 50 mm [2 in] minimum. The concrete cover over the inside reinforcement shall be 38 mm [1 ½ in] minimum. The clear distance of the end of circumferential wires shall not be less than 25 mm [1 in] or more than 50 mm [2 in] from the end of the sections. Reinforcement shall be single or multiple layers of welded wire fabric or a single layer of deformed billet steel bars.

Welded wire fabric shall meet the space requirements and contain sufficient longitudinal wires extending through the section to maintain the shape and position of the reinforcement. Longitudinal distribution reinforcement may be welded wire fabric or deformed billet steel bars which meet the spacing requirements. The ends of the longitudinal distribution reinforcement shall be not more than 75 mm [3 in] from the ends of the sections.

The inside circumferential reinforcing steel for the haunch radii or fillet shall be bent to match the radii or fillets of the forms.

Tension splices in the reinforcement will not be permitted. For splices other than tension splices, the overlap shall be a minimum of 300 mm [12 in] for welded wire fabric or billet steel bars. The spacing center to center of the circumferential wires in a wire fabric sheet shall be not less than 50 mm [2 in] or more than 100 mm [4 in]. For the wire fabric, the spacing center to center of the longitudinal wires shall not be more than 200 mm [8 in]. The spacing center to center of the longitudinal distribution steel for either line of reinforcing in the top slab shall be not more than 375 mm [15 in].

The members shall be free of fractures. The ends of the members shall be normal to the walls and centerline of the section, within the limits of variation provided, except where beveled ends are specified. The surfaces of the members shall be a smooth steel form or troweled surface finish, unless a form liner is specified. The ends and interior of the assembled structure shall make a continuous line of members with a smooth interior surface.

Defects which may cause rejection of precast units include the following:

1) Any discontinuity (crack or rock pocket etc.) of the concrete which could allow moisture to reach the reinforcing steel.
2) Rock pockets or honeycomb over 4000 mm² [6 in²] in area or over 25 mm [1 in] deep.
3) Edge or corner breakage exceeding 300 mm [12 in] in length or 25 mm [1 in] in depth.
4) Extensive fine hair cracks or checks.
5) Any other defect that clearly and substantially impacts the quality, durability, or maintainability of the structure as measured by accepted industry standards.

The Contractor shall store and transport members in a manner to prevent cracking or damage. The Contractor shall not place precast members in an upright position until a compressive strength of at least 30 MPa [4350 psi] is attained.

Installation of Precast Units The Contractor shall not ship precast members until sufficient strength has been attained to withstand shipping, handling and erection stresses without cracking, deformation, or spalling (but in no case less than 30 MPa [4350 psi].

The Contractor shall set precast members on 12 mm [½ in] neoprene pads during shipment to prevent damage to the section legs. The Contractor shall repair any damage to precast members resulting from shipping or handling by saw cutting a minimum of 12 mm [½ in] deep around the perimeter of the damaged area and placing a polymer-modified cementitious patching material.

When footings are required, the Contractor shall install the precast members on concrete footings that have reached a compressive strength of at least 20 MPa [2900 psi]. The Contractor shall construct the completed footing surface to the lines and grades shown on the plans. When checked with a 3 m [10 ft] straightedge, the surface shall not vary more than 6 mm [¼ in] in 3 meters [10 ft]. The footing keyway shall be filled with a non-shrink flowable cementitious grout with a design compressive strength of at least 35 MPa [5075 psi].

The Contractor shall fill holes that were cast in the units for handling, with either Portland cement mortar, or with precast plugs secured with Portland cement mortar or other approved adhesive. The Contractor shall completely fill the exterior face of joints between precast members with an approved material and cover with a minimum 300 mm [12 in] wide joint wrap. The surface shall be free of dirt and deleterious materials before applying the filler material and joint wrap. The Contractor shall install the external wrap in one continuous piece over each member joint, taking care to keep the joint wrap in place during backfilling. The Contractor shall seal the joints between the end unit and attached elements with a non-woven geotextile. The Contractor shall install and tighten the bolts fastening the connection plate(s) between the elements that are designed to be fastened together as designated by the manufacturer. Final assembly shall be approved by the manufacturer's representative prior to backfilling.

The Contractor shall place and compact the bedding material as shown on the plans prior to lifting and setting the box culvert sections. The Contractor shall backfill the structure in accordance with the manufacturer's instructions and the Contract Documents. The Contractor shall uniformly distribute backfill material in layers of not more than 200 mm [8 in] depth, loose measure, and thoroughly compact each layer using approved compactors before successive layers are placed. The Contractor shall compact the Granular Borrow bedding and backfill in accordance with Section 203.12 - Construction of Earth Embankment with Moisture and Density Control, except that the minimum required compaction shall be 92 percent of maximum density as determined by AASHTO T180, Method C or D. The Contractor shall place and compact backfill without disturbance or displacement of the wall units, keeping the fill at approximately the same elevation on both sides of the structure. Whenever a compaction test fails, the Contractor shall not place additional backfill over the area until the lift is re-compacted and a passing test achieved.

The Contractor shall use hand-operated compactors within 1.5 m [5 ft] of the precast structure as well as over the top until it is covered with at least 300 mm [12 in] of backfill. Equipment in excess of 11 Mg [12 ton] shall not use the structure until a minimum of 600 mm [24 in] of backfill cover is in place and compacted.

<u>534.50 Method of Measurement</u> The Department will measure Precast Structural Concrete Arch or Box Culvert for payment per Lump Sum each, complete in place and accepted.

<u>534.60 Basis of Payment</u> The Department will pay for the accepted quantity of Precast Structural Concrete Arch or Box Culvert at the Contract Lump Sum price, such payment being full compensation for all labor, equipment, materials, professional services, and incidentals for furnishing and installing the precast concrete elements and accessories. Falsework, reinforcing steel, jointing tape, grout, cast-in-place concrete fill or grout fill for anchorage of precast wings and/or other appurtenances is incidental to the Lump Sum pay item. Cast-in-place concrete, reinforcing steel in cast-in-place elements, excavation, backfill material, and membrane waterproofing will be measured and paid for separately under the provided Contract pay items. Pay adjustments for quality level will not be made for precast concrete.

Payment will be made under:

Pay Item	Pay Unit
534.71 Precast Concrete Box Culvert	Lump Sum