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**VIA EMAIL**

**TO:** Bruce Munger, P.E., HNTB Corporation (HNTB)
Ray Hanf, P.E., HNTB

**FROM:** Be Schonewald, P.E., Schonewald Engineering Associates, Inc. (SchonewaldEA)

STATE OF MAINE
ISABEL V. SCHONEWALD
No. 7528
LICENSED
PROFESSIONAL ENGINEER
1/29/18

**DATE:** January 29, 2018

**PROJ. NO.:** 17-032

**RE:** Preliminary Summary of Geotechnical Findings and Recommendations
Mitigation of On-Going Slope Instability
Maine Turnpike, Exit 75
Auburn, Maine

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The purpose of this memorandum is to 1) present the findings of the geotechnical program completed to evaluate the type and possible cause of, and 2) evaluate alternatives and provide recommendations for mitigating the observed slope failures along the sideslope of the northbound (NB) off ramp (Ramp D) of the Maine Turnpike's Exit 75 located in Auburn, Maine.

SchonewaldEA's work was completed in accordance with Task Order Number 405.01 dated October 31, 2017 to our Master / Task Order Agreement (HNTB Project Number 63272) that is dated February 23, 2016. This memorandum is subject to the limitations contained in the Closure section of the memorandum. A quality assurance review of the technical aspects of SchonewaldEA's work was completed by Stephen J. Rabasca, P.E. of SoilMetrics, LLC located in Cape Elizabeth, Maine.

## EXECUTIVE SUMMARY

Localized slope failures and associated open tension cracks are visible along the southerly side of the NB off ramp (Ramp D) of Exit 75 of the Maine Turnpike in Auburn, Maine. The observed distress is present along both sideslopes of a drainageway ("special ditch") that runs along the toe Exit 75 off ramp. The numerous tensions cracks observed between the top of the failures and the off ramp travelway, suggest the scarp of the failures is working its way toward the travelway.

A limited geotechnical subsurface exploration and laboratory testing program was completed to evaluate the type and possible cause of the observed on-going failures, with the underlying objective of identifying options for mitigating the progressive slope failure. Based on the work completed and described in this memorandum, the underlying cause for the slope failures does not appear to be directly linked to subsurface conditions (e.g., weak soils); rather the cause appears to be related to the overly steep sideslopes of the special ditch

Seven options were evaluated for mitigating the observed on-going slope failures. The seven options are described in a subsequent section of this memorandum. Six of the seven options have been eliminated based on the individual merits of each option and discussions with Maine Turnpike Authority representatives and the project consulting team. Option 7, slope reconstruction with stream relocation, is the option best suited for achieving the long-term stabilization of the special ditch and adjacent ramp travelway, in terms of environmental impacts, geotechnical risk, constructability, and maintenance when considered in aggregate.

## PROJECT BACKGROUND AND OBJECTIVES

Localized slope failures and associated open tension cracks are located along the southerly side of the NB and combined off ramp (Ramp D) of Exit 75 of the Maine Turnpike in Auburn, Maine. The observed failures are located along both sides of what was referred to as a "special ditch" on the original interchange design plans that are dated November 1953. Based on those 1956 interchange as-built plans, the special ditch is a deep, steep-sided cut that apparently was excavated to relocate a brook that bisected the interchange. The brook passes under the NB off ramp via a box culvert upstream of the special ditch. The special ditch created a relatively isolated knoll immediately to the south of and separated from the ramp by the relocated brook. In the years since the interchange was constructed, the property to the south of the special ditch was developed as a motel. These features are noted on attached Figure 1.

It appears that the top width of the special ditch was held constant and the ditch sideslopes steepened as needed to achieve the required ditch invert elevation. This would have resulted in overly steep sideslopes in the areas of the deepest cuts. Based on the ground surface topography depicted on the original interchange plans, SchonewaldEA estimates cuts up to approximately 22 feet deep were required to construct the special ditch along the southerly side of the off ramp to maintain flow in the relocated brook. Figure 2 was taken from the 1956 interchange as-built plans and depicts SchonewaldEA's interpretation of the original ground surface contours. The deepest cuts appear to be located in the same general area where the most significant slope failures and open tension cracks are observed. This suggests that the failures may be shallow sloughing failures related to the steepness of the cut, rather than to deeper global instability.

It is unclear when the distress / localized failures commenced. Although SchonewaldEA observed some stream bottom erosion and undercutting at the toe of the slope, it appears to be in areas where sloughing occurred and is likely the result of the stream reestablishing flow. Inverts of the ditch upgradient and downgradient of the sloughed area do not appear to be substantially different than those depicted on the 1956 interchange as-built drawings.

It is important to note that the numerous tensions cracks observed between the top of the failures and the off ramp travelway, suggest the scarp of the failures is working its way toward the travelway. ***Loss of the outer portion of the shoulder or even the travelway should be considered a real possibility if no mitigation is undertaken.***

Therefore, the primary objectives of SchonewaldEA's work were to:

- Assess subsurface conditions in the vicinity of the Exit 75 "special ditch;"
- Evaluate the probable type and cause of the failures based on the observed subsurface conditions;
- Assess possible alternatives for mitigating the failed special ditch sideslopes, taking into consideration the loss of soil strength and slope integrity caused by the on-going, progressive failures; and
- Provide preliminary geotechnical recommendations with respect to selecting the mitigation option to take through final design.

## GEOLOGICAL SETTING

According to the geological map entitled "Surficial Geology, Minot Quadrangle, Maine," published by the Maine Geological Survey, Open File No. 02-231, scale 1:24,000, the surficial soils are mapped as marine silt-clay (Presumpscot Formation) under the off ramp, special ditch, and knoll (area of interest). It is interesting to note that the eolian deposits (sand dunes) that are mapped immediately to the west of the area of interest appear to have been excavated based on a recent topographic survey. An excerpt from the surficial soils map is provided as Figure 3.

## TEST BORING PROGRAM

SchonewaldEA retained New England Boring Contractors (NEBC) of Hermon, Maine to drill three test borings (HB-EXIT75-101 through -103). The test borings were drilled in the shoulder of the off ramp and across the special ditch on the knoll. The borings were drilled using auger boring techniques to avoid the use of drilling water. The approximate locations of the explorations are shown on attached Figure 1. Details of sampling methods used, field data obtained, and soil and groundwater conditions encountered are provided on the boring logs attached as Appendix A. The drilling work was completed on October 26 and 27, 2017 and was observed and logged by SchonewaldEA.

Standard Penetration Tests (SPTs) were completed and split-spoon soil samples obtained continuously from near the ground surface to near the bottom of one test boring and at the more typical 5-foot spacing in the other two borings. A significant thickness of soft or very soft silt-clay was not encountered so vane shear testing was not performed. The borings were terminated once encountering glacial till and split-spoon refusal. The depth of the bottom of the borings ranged from 30.3 to 35.3 feet Below the Ground Surface (BGS). The boreholes were backfilled with drill cuttings supplemented by manufactured sand and gravel upon completion of the test boring; and pavement patched where applicable.

## LABORATORY TESTING PROGRAM

A limited geotechnical laboratory testing program was completed. Select samples of the marine silt-clay soils that were encountered at various depths in test boring HB-EXIT75-102 were submitted to the R. W. Gillespie & Associates, Inc. geotechnical laboratory in Saco, Maine for gradation analyses with hydrometer and Atterberg Limits. The purpose of the laboratory program was to confirm the field classifications of the marine silt-clay soil. The laboratory testing program is summarized in the following table.

| Boring No. | Sample No. | Sample Depth | Sample Representative of:<br>Test Performed: |
|---|---|---|---|
| HB-EXIT75-102 | 1D | 3 to 5 ft. BGS | marine silt-clay;<br>sieve with hydrometer gradation test and Atterberg Limits |
| HB-EXIT75-102 | 3D | 7 to 9 ft. BGS | marine silt-clay;<br>sieve with hydrometer gradation test and Atterberg Limits |
| HB-EXIT75-102 | 5D | 11 to 13 ft. BGS | marine silt-clay;<br>sieve with hydrometer gradation test and Atterberg Limits |
| HB-EXIT75-102 | 7D | 15 to 17 ft. BGS | marine silt-clay;<br>sieve with hydrometer gradation test and Atterberg Limits |

Laboratory test results are attached as Appendix B and the results are summarized on the boring logs that are attached as Appendix A.

## SUBSURFACE CONDITIONS

The generalized stratigraphy encountered in the test borings consisted of granular fill (HB-EXIT75-101) or topsoil/subsoil (HB-EXIT75-102 and -103), underlain by stiff grading to soft marine silt-clay, underlain by glacial till. All the borings were terminated in the glacial till at split-spoon refusal.

The marine silt-clay encountered in the test borings graded from very stiff desiccated crust to very soft normally consolidated. The soft to very soft silt-clay was limited in thickness (up to about 6 feet thick in HB-EXIT75-102). The estimated elevation of the top of glacial till was 210.5 feet in HB-EXIT75-101;

212.4 feet in -102; and 217.5 feet in -103. This observed marine silt-clay to till stratum change is approximately 5 to 8 feet below the interpolated current invert of the special ditch adjacent to the boring location.

Groundwater levels observed and/or inferred from the test borings appear to be within the marine silt-clay, a few feet above the marine silt-clay to till interface and below the special ditch invert.

Descriptions of the soil samples obtained in the test borings are provided on the boring logs attached as Appendix A.

## KEY GEOTECHNICAL FINDINGS

The following bullet items are intended to summarize the key geotechnical findings and related conclusions of the recent work effort.

- Test borings encountered marine silt-clay overlying glacial till;
- Based on existing topography and the depth at which the top of till was encountered in the test borings, the existing bottom of the special ditch appears to be in marine silt-clay;
- Groundwater levels observed and/or inferred from the test borings appear to correspond to a few feet above the marine silt-clay to till interface and below the special ditch invert;
- Although encountered, the thickness of the soft to very soft marine silt-clay observed in the test borings was not significant with respect to global stability when taken in the context of the topographic setting of the study area;
- Groundwater elevations do not appear to be elevated and, as such, instability of the bottom of the special ditch does not appear to be a significant contributing factor to the observed failures;
- Other notable "red flags" were not observed in the test borings, such as significant zones having low blow counts (loose), clean saturated sandy layers, uniform fine sands, or perched groundwater;
- Ground surface topography serves to buttress the opposing sides of the special ditch and, therefore, does not support a deep-seated instability concern;
- Open tension cracks and near vertical surfaces in the failed areas suggest a shallow and steep failure surface consistent with sloughing;
- The underlying cause for the slope failures does not appear to be linked to subsurface conditions (e.g., weak soils); rather the cause appears to be related to the overly steep sideslopes of the special ditch.

## EVALUATION OF POTENTIAL SLOPE MITIGATION OPTIONS

This section provides descriptions and related discussion of the options considered by SchonewaldEA with the design team for mitigating the slope instability and stabilizing the special ditch sideslopes.

<u>Option 1 – Do Nothing</u>

Sloughing failures were observed along much of the length of the off ramp sideslope and opposing knoll slope, along the "special ditch" specified in the original interchange construction plans. The slopes of the "special ditch" are currently near vertical in many areas as a result of the localized failures. Numerous open tensions cracks were also observed between the top of the sloughing failures and the off ramp travelway, suggesting the scarp of the sloughing failures is working its way toward the travelway. If nothing is done, loss of the outer portion of the off ramp travelway is a real possibility. Therefore, Option 1 "Do Nothing" was eliminated from consideration.

Option 2 –Heavy Riprap on Existing Sideslopes for Slope Protection

Armoring the existing special ditch sideslopes with heavy riprap for slope protection was evaluated and eliminated due to a number of concerns. General practice is to avoid overly steep soil slopes unless those slopes are of limited longitudinal extent and/or are not proximate to active traffic, or can be reinforced with layers of geosynthetics (Reinforced Soil Slope (RSS)), noting that RSS is a technique that is typically reserved for fill slopes due to the bottom-up construction sequence. Placement of riprap on overly steep soil slopes typically results in a net destabilizing effect (would act as a driving force). For that reason and in consideration of the following points, Option 2 was eliminated:

- steepness of the existing special ditch sideslopes;
- proximity of the stream at the toe of slope;
- proximity of the off ramp travel lane to the top of slope; and
- the need for significant regrading and shaping of the special ditch sideslopes prior to placing riprap armor to address their loss of integrity due to the slough surfaces and open tension cracks.

Option 3 – Heavy Riprap to Buttress Special Ditch Sideslopes in Conjunction with Culvert Pipe

Heavy riprap / armoring would enhance stability if it were placed in the stream and was sufficiently thick to buttress the toes of the opposing special ditch sideslopes. This would essentially fill in the bottom of the special ditch with riprap and, therefore, require the installation of a culvert pipe of sufficient size to maintain stream flow "under" the riprap buttress, recognizing that flow capacity for larger storm events could be accommodated by flow through the riprap itself, thereby allowing the pipe diameter to remain small. Due to disadvantageous environmental impacts related to the length of the culvert pipe, this option was eliminated

Option 4 – Box Culvert

Option 3 was revamped with the objective of lessening the environmental effects. Option 4 – Box Culvert consists of installing a box culvert along the existing special ditch alignment; connecting the upstream end of the proposed box culvert to the outlet of the existing box culvert under the NB off ramp. The new box culvert would be embedded into the existing stream bed and the streambed would be replicated by partially filling the box culvert with Special Fill. Embankment fill would be placed over the box culvert to fill the special ditch and achieve sheet flow from the ramp. We estimate approximately 500 to 600 feet of box culvert would be required. Although the streambed would be replicated in the bottom of the box culvert, the length of the culvert is excessive with regard to environmental impacts. Therefore, Option 4 "Box Culvert" was eliminated.

Option 5 – Earth Retaining Structure

A number of earth retaining structures ("walls") were considered for supporting the off ramp travelway. Wall options included soil nail and soldier pile and lagging; others could be evaluated. All wall options would require the installation of a deep underdrain to control groundwater behind wall face. Wall design and constructability is complicated by the current condition of special ditch sideslope. Specifically, the near vertical slough surfaces and open tension cracks, as well as the loss of soil strength and slope integrity that has resulted from the on-going failures, eliminates certain wall options and/or greatly increases their construction costs. Any wall requires routine inspection and has a useful life (will require replacement). We note that a gabion wall is not feasible due to the current condition (steepness) of the slope, and insufficient room and constructability concerns to achieve adequate toe of slope embedment requirements to address wall stability and scour potential. Likewise, a mechanically stabilized earth wall is not feasible due to space requirements for reinforcing and bottom-up construction sequence. Although this remains a technically viable option, SchonewaldEA recommends eliminating it from discussion due to expected construction and maintenance costs.

Option 6 – Stream Restoration

Due consideration was given to “restoring” the brook in proximity to its original alignment downstream of where the box culvert under the NB off ramp discharges at the “head” of the special ditch. The brook is depicted on the 1956 interchange as-built drawings. Development on adjacent property since 1956, including the construction of a motel, precludes restoring the brook near its original alignment. Therefore, Option 6 “Stream Restoration” was eliminated.

Option 7 – Slope Reconstruction with Stream Relocation

Option 7 entails flattening the pitch of the sideslope down from the Exit 75 off ramp travelway to the drainageway. By reconstructing the slope to achieve a flatter stable configuration, the alignment of the stream is necessarily relocated further away from the Exit 75 ramp. Because it must be relocated, the stream will be reconstructed following appropriate fluvial geomorphology practices to replicate a proper stream habitat.

Two concepts for reconstructing the slope between the Exit 75 ramp travelway and the (relocated) stream were developed and vetted by the project team. Option 7A reconstructs the ramp sideslope as a vegetated 3H:1V slope. Option 7B reconstructs the ramp sideslope as a riprap 2H:1V slope. Option 7A has the larger overall construction footprint and pushes the stream farther away from its current location. Option 7B has the smaller overall construction footprint and the relocated stream is closer to its current location than Option 7A, but requires riprap slope protection along the entire length of the reconstructed slope. Both options require the opposing slope up from the relocated stream to the knoll to also be regraded. Because live traffic does not exist on the knoll side of the special ditch, that slope can be graded to a somewhat steeper 2.5H:1V vegetated sideslope. Both Option 7A and Option 7B achieve stable configurations of the special ditch sideslopes, which is particularly important for the slope between the Exit 75 ramp travelway and the stream.

## RECOMMENDATIONS

In summary, seven options were evaluated for mitigating the observed on-going slope failures. Six of the seven options have been eliminated based on the individual merits of each option, as described in the preceding section, together with discussions with Maine Turnpike Authority representatives and the project consulting team. Option 7, slope reconstruction with stream relocation, has been identified as being the option best suited for achieving the long-term stabilization of the special ditch and adjacent ramp travelway in terms of environmental impacts, geotechnical risk, constructability, and maintenance when considered in aggregate.

As discussed above, two alternative concepts for Option 7 have been developed and vetted. To recap, Option 7A reconstructs the ramp sideslope as a vegetated 3H:1V slope. Option 7A has the larger overall construction footprint and pushes the stream farther away from its current location. Option 7B reconstructs the ramp sideslope as a riprap 2H:1V slope. Option 7B has the smaller overall construction footprint and the relocated stream is closer to its current location than Option 7A, but the riprap slope may be less desirable from the fluvial geomorphology perspective. Ultimately, deference is given to HNTB and the Maine Turnpike Authority to select Option 7A or 7B. We understand that the Maine Turnpike Authority has opted to proceed with Option 7A (vegetated 3H:1V sideslope).

Geotechnical recommendations for the design and construction of the selected option will be developed concurrently with final design. At this time, we envision providing earthwork-related recommendations, as well as recommendations for the temporary control of groundwater and surface water. We anticipate an earthwork Special Provision will be developed to address on-site silt-clay soils.

**CLOSURE**

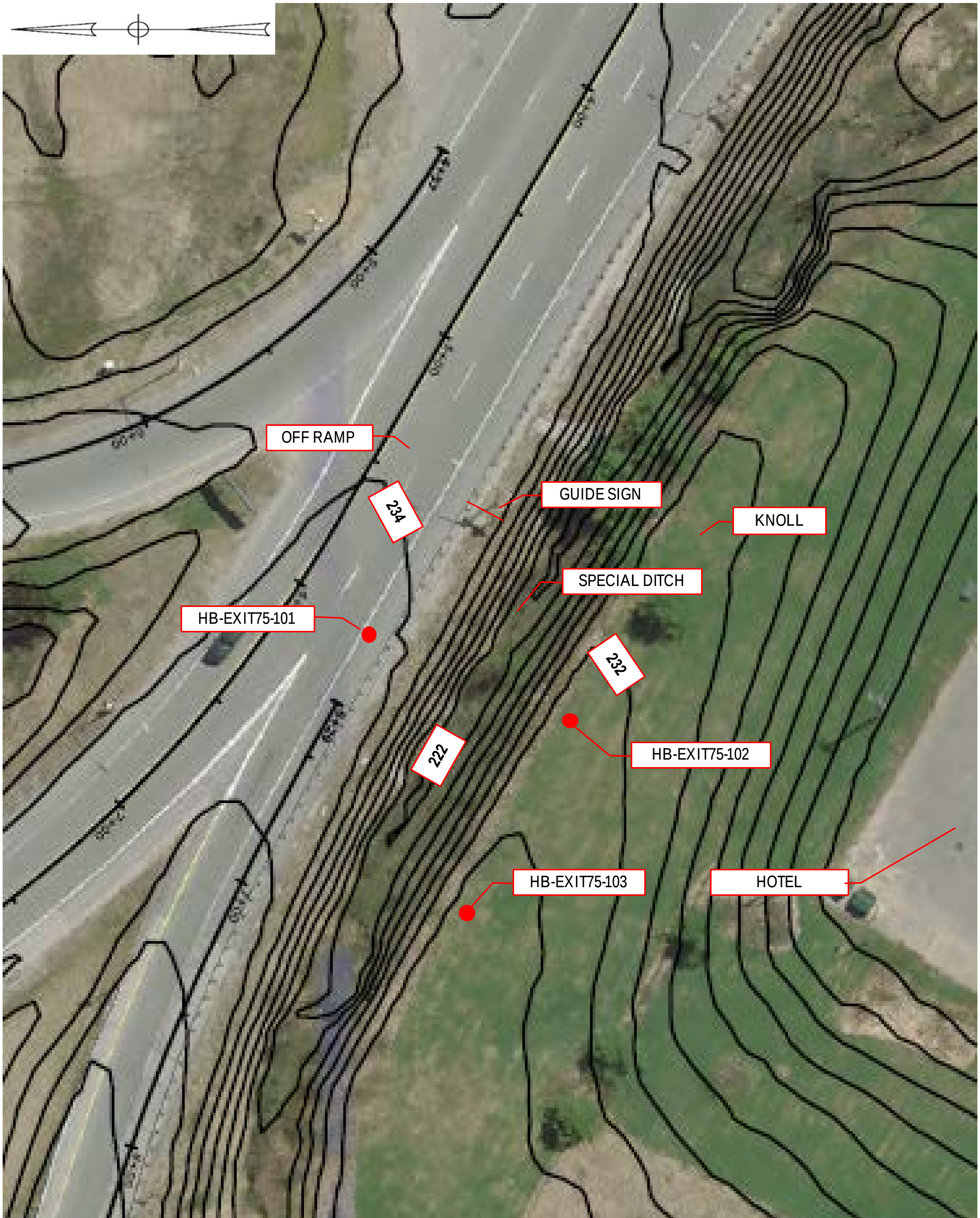
This memorandum has been prepared for the use of HNTB Corporation for specific application to mitigating the slope instability observed along the southerly sideslope of the off ramp of Exit 75 of the Maine Turnpike located in Auburn, Maine in accordance with generally accepted geotechnical and foundation engineering practices. No other intended use or warranty is expressed or implied.

As HNTB Corporation's plan(s) for the mitigation of the slope instability are developed, this report should be reviewed by SchonewaldEA to assess the appropriateness of the conclusions and recommendations and to modify the recommendations as appropriate to address the design details. The analyses and recommendations presented in this memorandum are based in part upon a limited subsurface investigation consisting of widely-spaced and discrete explorations completed in the study area. If variations from the conditions encountered during the investigation appear evident during design and/or construction activities, it may also become necessary to re-evaluate the recommendations made in this memorandum.

It is recommended that SchonewaldEA be provided the opportunity to review the design drawings and specifications to confirm that earthwork and other geotechnical recommendations and construction considerations presented in this memorandum are properly interpreted and implemented.

Attachments: Figures 1 through 3
Appendix A - Boring Logs
Appendix B - Laboratory Test Results

# FIGURES




**PLAN NOTES**

1. PLAN WAS DEVELOPED FROM AN UNTITLED PDF PLAN PROVIDED BY HNTB CORPORATION. 2-FOOT CONTOUR INTERVAL'.

2. THE AS-DRILLED LOCATIONS OF THE TEST BORINGS WERE DETERMINED IN THE FIELD BY SCHONEWALDEA BY MEASURING FROM PROMINENT SITE FEATURES DEPICTED ON THE PLAN. THE LOCATIONS SHOULD BE CONSIDERED APPROXIMATE.

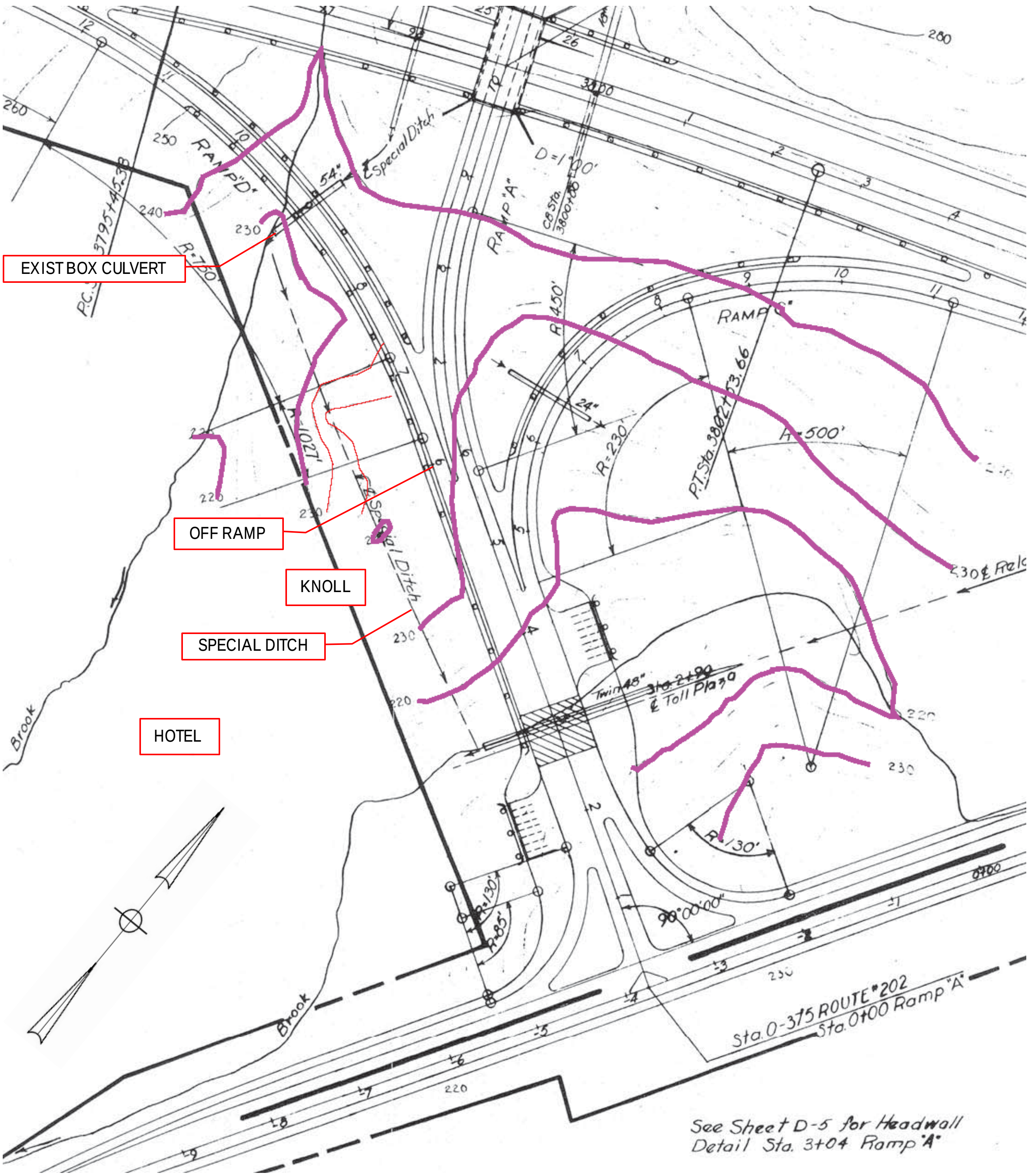
3. TEST BORINGS WERE COMPLETED BY NEW ENGLAND BORING CONTRACTORS OF HERMON, MAINE ON OCT. 26 AND 27, 2017 AND WERE OBSERVED AND LOGGED BY SCHONEWALDEA. DETAILED DESCRIPTIONS OF THE MATERIALS ENCOUNTERED ARE PROVIDED ON THE BORING LOGS.

SCHONEWALD ENGINEERING ASSOCIATES, INC.

**PROJECT NO.:** 17-032
**DATE:** JAN. 2018
**DRAWN BY:** IVS
**SCALE (APPROX):** 1" = 50'

SITE FEATURES AND BORING LOCATION PLAN
MAINE TURNPIKE EXIT 75 SLOPE STABILIZATION
AUBURN, MAINE

Figure No.: 1




**PLAN NOTES**

1. FIGURE WAS DEVELOPED FROM A PLAN ENTITLED "MAINE TURNPIKE AUTHORITY, MAINE TURNPIKE, SECTION 2 – PORTLAND TO AUGUSTA, AUBURN INTERCHANGE, STA. 3799+00;" AS-BUILT DATED 1956; ORIGINAL SCALE 1"=100' AND PROVIDED BY HNTB IN PDF FORMAT.

2. THE LOCATIONS OF THE HIGHLIGHTED GROUND SURFACE CONTOURS WERE INTERPRETED BY SCHONEWALDEA. THE LOCATIONS OF THE CONTOURS SHOULD BE CONSIDERED APPROXIMATE DUE TO THE POOR LEGIBILITY IN THE PDF FILE.

SCHONEWALD ENGINEERING ASSOCIATES, INC.

PROJECT NO.: 17-032

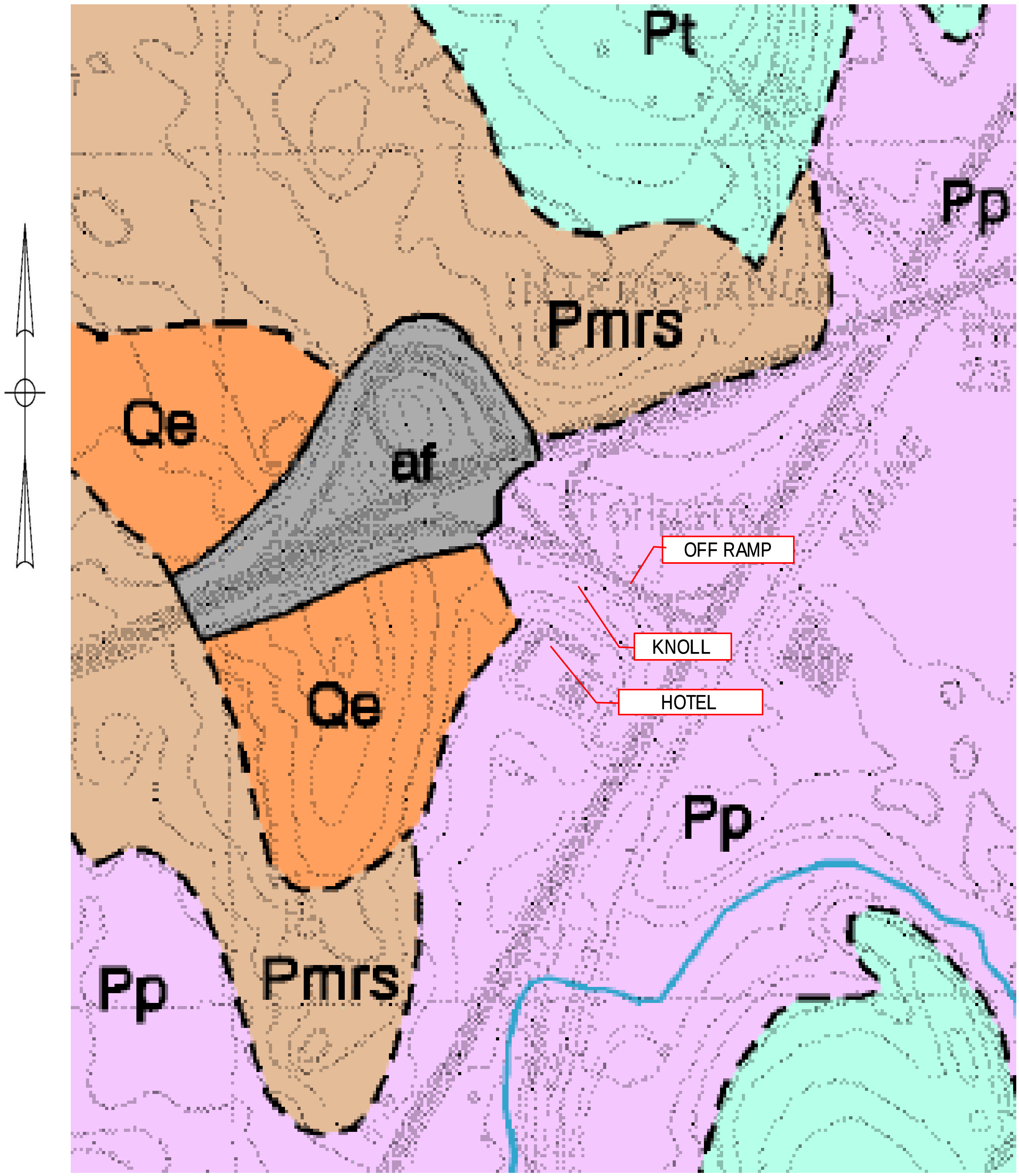
DATE: JAN. 2018

DRAWN BY: IVS

SCALE (APPROX): NTS

# INTERPRETED 1956 TOPOGRAPHY
# MAINE TURNPIKE EXIT 75 SLOPE STABILIZATION
# AUBURN, MAINE

Figure No.: 2




SOURCE: GEOLOGICAL MAP ENTITLED "SURFICIAL GEOLOGY, MINOT QUADRANGLE, MAINE," PUBLISHED BY THE MAINE GEOLOGICAL SURVEY, OPEN FILE NO. 02-231, SCALE 1:24,000

| | |
|---|---|
| Pp | MARINE SILT-CLAY (PRESUMPSCOT FM) |
| Pmrs | NEAR SHORE MARINE SANDS AND SILTS |
| Qe | EOLIAN DEPOSITS (SAND DUNES) |
| af | ARTIFICIAL FILL |
| Pt | GLACIAL TILL |

SCHONEWALD ENGINEERING ASSOCIATES, INC.

PROJECT NO.: 17-032
DATE: JAN. 2018
DRAWN BY: IVS
SCALE: NTS

SURFICIAL GEOLOGY
MAINE TURNPIKE EXIT 75 SLOPE STABILIZATION
AUBURN, MAINE

Figure No.: 3

Schonewald Engineering Associates, Inc.
www.SchonewaldEngineering.com

# APPENDIX A

# BORING LOGS

| SCHONEWALD ENGINEERING ASSOCIATES, INC. | **PROJECT:** Off Ramp Sideslope Stabilization, Maine TPK Exit 75 **LOCATION:** Auburn, Maine | **Boring No.:** HB-EXIT75-101 **Proj. No.:** 17-032 |
|---|---|---|

| | | | | | |
|---|---|---|---|---|---|
| **Driller:** | New England Boring Contractors | **Elevation (ft.)** | 234 ft (approx.) | **Core Barrel:** | n/a |
| **Operator:** | Schaefer/ Titus | **Datum:** | | **Sampler:** | std split spoon |
| **Logged By:** | Schonewald | **Rig Type:** | Mobile Drill B-51 | **Hammer Wt./Fall:** | 140 lbs / 30 in |
| **Date Start/Finish:** | 10/26/17; 0835-1150 | **Drilling Method:** | Hollow Stem Auger Boring | **Hammer Type:** | rope & cathead |
| **Boring Location:** | Station 6+00, 31 ft RT | **Casing ID/OD:** | n/a | **Hammer Efficiency:** | 0.600 |
| | | **Auger ID/OD:** | 2.25" ID/5.88" OD | **Water Level*:** | -- |

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

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

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

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

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

| Depth (ft.) | Sample No. | Pen./Rec. (in.) | Sample Depth (ft.) | Blows (/6 in.) Shear Strength (psf) or RQD (%) | N-uncorrected | N-60 | Casing Blows | Elevation (ft.) | Graphic Log | Visual Description and Remarks | Lab. Testing Results |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | | | | | | | HSA | | | 12 inches HMA | |
| | | | | | | | | 233.0 | | 1.0 | |
| | 1D | 24/15 | 2.0 - 4.0 | 26-24-20-29 | 44 | 44 | | | | 1D: Red brown, damp, fine to coarse SAND, some fine Gravel, little Silt; grading at 3.2 ft to: Tan, moist, fine to coarse SAND, trace Silt, trace fine Gravel; changing at 3.9 ft to: | |
| | | | | | | | | 230.1 | | 3.9 | |
| 5 | 2D | 24/20 | 5.0 - 7.0 | 6-10-12-14 | 22 | 22 | | | | Grey brown, mottled, Clayey SILT, little Sand; appears disturbed. Grey brown, mottled, damp, Clayey SILT, little to some Sand; appears disturbed; changing at 6.2 ft to: | |
| | | | | | | | | 227.8 | | 6.2 | |
| | | | | | | | | | | 2D: Olive brown, mottled, damp, Clayey SILT with partings of Silty fine SAND; appears native. | |
| 10 | 3D | 24/22 | 10.0 - 12.0 | 5-9-8-11 | 17 | 17 | | | | 3D: Olive brown, moist, v. stiff, SILT & CLAY, trace fine Sand. | |
| 15 | 4D | 24/21 | 15.0 - 17.0 | 3-3-3-3 | 6 | 6 | | | | 4D: Olive brown grey, moist, m. stiff, CLAY & SILT, with two partings Silty fine SAND. | |
| 20 | 5D | 24/24 | 20.0 - 22.0 | 1/12"-1-1 | 1 | 1 | | | | 5D: Grey, moist, v. soft, Silty CLAY. | |
| | | | | | | | | 210.5 | | 23.5 | |
| | | | | | | | | | | Driller notes change in drilling behavior; gravelly. | |
| 25 | | | | | | | | | | | |

**Remarks:**

(combined off ramp; 56.5 ft westerly of guide sign)

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

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

| SCHONEWALD ENGINEERING ASSOCIATES, INC. | **PROJECT:** Off Ramp Sideslope Stabilization Maine TPK Exit 75 **LOCATION:** Auburn, Maine | **Boring No.:** HB-EXIT75-101 **Proj. No.:** 17-032 |
|---|---|---|

| | | | | | |
|---|---|---|---|---|---|
| **Driller:** | New England Boring Contractors | **Elevation (ft.)** | 234 ft (approx.) | **Core Barrel:** | n/a |
| **Operator:** | Schaefer/ Titus | **Datum:** | | **Sampler:** | std split spoon |
| **Logged By:** | Schonewald | **Rig Type:** | Mobile Drill B-51 | **Hammer Wt./Fall:** | 140 lbs / 30 in |
| **Date Start/Finish:** | 10/26/17; 0835-1150 | **Drilling Method:** | Hollow Stem Auger Boring | **Hammer Type:** | rope & cathead |
| **Boring Location:** | Station 6+00, 31 ft RT | **Casing ID/OD:** | n/a | **Hammer Efficiency:** | 0.600 |
| | | **Auger ID/OD:** | 2.25" ID/5.88" OD | **Water Level*:** | -- |

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WOR = weight of rods
-- = not recorded

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

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

| Depth (ft.) | Sample No. | Pen./Rec. (in.) | Sample Depth (ft.) | Blows (/6 in.) Shear Strength (psf) or RQD (%) | N-uncorrected | N-60 | Casing Blows | Elevation (ft.) | Graphic Log | Visual Description and Remarks | Lab. Testing Results |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 25 | 6D | 24/19 | 25.0 - 27.0 | 6-8-13-15 | 21 | 21 | | | | 6D: Grey tan, wet, m. dense, interbedded fine to coarse SAND, little Gravel, trace Silt and Silty fine SAND, trace Gravel, trace medium to coarse Sand. TILL | |
| 30 | 7D | 24/17 | 30.0 - 32.0 | 20-23-34-35 | 57 | 57 | | 203.5 | | Grey tan, wet, fine to coarse SAND, little Gravel, trace Silt; changing at 30.5 ft to: 30.5 7D: Dark Grey, SIlty GRAVEL, some fine to coarse Sand. BASAL TILL | |
| 35 | MD | 3/0 | 35.0 - 35.3 | 50/3" | -- | | | 198.7 | | No recovery. 35.3 **Bottom of Exploration at 35.3 feet below ground surface.** Split-spoon refusal. | |
| 40 | | | | | | | | | | | |
| 45 | | | | | | | | | | | |
| 50 | | | | | | | | | | | |

**Remarks:**

(combined off ramp; 56.5 ft westerly of guide sign)

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

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

Schonewald Engineering Associates, Inc.

**PROJECT:** Off Ramp Sideslope Stabilization Maine TPK Exit 75
**LOCATION:** Auburn, Maine

**Boring No.:** HB-EXIT75-102
**Proj. No.:** 17-032

| | | | | | |
|---|---|---|---|---|---|
| **Driller:** | New England Boring Contractors | **Elevation (ft.)** | 233 ft (approx.) | **Core Barrel:** | n/a |
| **Operator:** | Schaefer/ Titus | **Datum:** | | **Sampler:** | std split spoon |
| **Logged By:** | Schonewald | **Rig Type:** | Mobile Drill B-51 | **Hammer Wt./Fall:** | 140 lbs / 30 in |
| **Date Start/Finish:** | 10/27/17; 0740-1240 | **Drilling Method:** | Hollow Stem Auger Boring | **Hammer Type:** | rope & cathead |
| **Boring Location:** | See remarks | **Casing ID/OD:** | n/a | **Hammer Efficiency:** | 0.600 |
| | | **Auger ID/OD:** | 2.25" ID/5.88" OD | **Water Level*:** | 19.9 ft (inside augers) |

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

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

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

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

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

| Depth (ft.) | Sample No. | Pen./Rec. (in.) | Sample Depth (ft.) | Blows (/6 in.) Shear Strength (psf) or RQD (%) | N-uncorrected | N-60 | Casing Blows | Elevation (ft.) | Graphic Log | Visual Description and Remarks | Lab. Testing Results |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | | | | | | | HSA | | | Lawn. | |
| | | | | | | | | 231.5 | | 1.5 | |
| | 1D | 24/23 | 3.0 - 5.0 | 5-7-10-10 | 17 | 17 | | | | 1D: Olive brown, mottled, damp, v. stiff, SILT & CLAY, with numerous partings v. fine Sand throughout. MARINE SILT-CLAY | A-6(16) CL -#200=94.4% WC=26.2% LL=37.5 PL=22.1 PI=15.4 |
| 5 | 2D | 24/24 | 5.0 - 7.0 | 4-6-9-7 | 15 | 15 | | | | 2D: Olive brown, slightly mottled, damp, stiff, SILT & CLAY, with zones having numerous partings of v. fine Sand. | |
| | 3D | 24/24 | 7.0 - 9.0 | 3-3-4-5 | 7 | 7 | | | | 3D: Olive brown grey, moist, m. stiff, CLAY & SILT, with four partings v. fine Sand. | A-6(18) CL -#200=97.6% WC=31.3% LL=40.2 PL=22.7 PI=17.5 |
| | 4D | 24/22 | 9.0 - 11.0 | 2-2-3-3 | 5 | 5 | | | | 4D: Olive brown grey, moist, m. stiff, CLAY & SILT, with one mottled and two partings v. fine Sand. | |
| 10 | | | | | | | | | | | |
| | 5D | 24/24 | 11.0 - 13.0 | 4-3-4-4 | 7 | 7 | | | | 5D: Olive grey grading to grey, moist, m. stiff, CLAY & SILT grading to Silty CLAY. | A-7-6(25) CL -#200=99.2% WC=37.9% LL=44.7 PL=22.0 PI=22.7 |
| | 6D | 24/24 | 13.0 - 15.0 | WOH/18"-2 | 0 | 0 | | | | 6D: Grey, saturated, v. soft, Silty CLAY, trace v. fine Sand. | |
| 15 | 7D | 24/24 | 15.0 - 17.0 | WOH-1-1-1 | 2 | 2 | | | | 7D: Grey, saturated, soft, Silty CLAY, trace v. fine Sand. | A-6(19) CL -#200=99.7% WC=38.7% LL=38.5 PL=20.3 PI=18.2 |
| 20 | 8D | 24/10 | 20.0 - 22.0 | WOH-13-18-15 | 31 | 31 | | 212.4 | | 8D: Grey, saturated, Silty CLAY, trace v. fine Sand; with fine to medium Sand on bottom of sample; tip of spoon empty. 20.6 Apparent stratum change based on blow counts and sample recovery. | |
| 25 | | | | | | | | | | | |

**Remarks:**

See boring location sketch. Located on knoll south of "special ditch;" in line with HB-EXIT75-101

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

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

| Schonewald Engineering Associates, Inc. | PROJECT: Off Ramp Sideslope Stabilization Maine TPK Exit 75<br>LOCATION: Auburn, Maine | Boring No.: HB-EXIT75-102<br>Proj. No.: 17-032 |
|---|---|---|

| | | | | | |
|---|---|---|---|---|---|
| Driller: | New England Boring Contractors | Elevation (ft.) | 233 ft (approx.) | Core Barrel: | n/a |
| Operator: | Schaefer/ Titus | Datum: | | Sampler: | std split spoon |
| Logged By: | Schonewald | Rig Type: | Mobile Drill B-51 | Hammer Wt./Fall: | 140 lbs / 30 in |
| Date Start/Finish: | 10/27/17; 0740-1240 | Drilling Method: | Hollow Stem Auger Boring | Hammer Type: | rope & cathead |
| Boring Location: | See remarks | Casing ID/OD: | n/a | Hammer Efficiency: | 0.600 |
| | | Auger ID/OD: | 2.25" ID/5.88" OD | Water Level*: | 19.9 ft (inside augers) |

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

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

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

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

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

| Depth (ft.) | Sample No. | Pen./Rec. (in.) | Sample Depth (ft.) | Blows (/6 in.) Shear Strength (psf) or RQD (%) | N-uncorrected | N-60 | Casing Blows | Elevation (ft.) | Graphic Log | Visual Description and Remarks | Lab. Testing Results |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 25 | 9D | 24/16 | 25.0 - 27.0 | 8-18-20-21 | 38 | 38 | | | | 9D: Grey tan, wet, dense, fine to coarse SAND, some Gravel, some Silt. TILL | |
| | | | | | | | | 205.0 | | 28.0 | |
| | | | | | | | | | | 28 ft: Difficult to advance augers. | |
| 30 | 10D | 3/3 | 30.0 - 30.3 | 50/3" | -- | | | 202.7 | | 10D: Dark grey, damp (tight), Silty fine SAND, some fine Gravel, trace medium to coarse Sand. BASAL TILL | |
| | | | | | | | | | | 30.3 | |
| | | | | | | | | | | **Bottom of Exploration at 30.3 feet below ground surface.** Split-spoon refusal. | |
| 35 | | | | | | | | | | | |
| 40 | | | | | | | | | | | |
| 45 | | | | | | | | | | | |
| 50 | | | | | | | | | | | |

**Remarks:**

See boring location sketch. Located on knoll south of "special ditch;" in line with HB-EXIT75-101

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

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

SCHONEWALD ENGINEERING ASSOCIATES, INC.

**PROJECT:** Off Ramp Sideslope Stabilization, Maine TPK Exit 75
**LOCATION:** Auburn, Maine

**Boring No.:** HB-EXIT75-103
**Proj. No.:** 17-032

| | | | | | |
|---|---|---|---|---|---|
| **Driller:** | New England Boring Contractors | **Elevation (ft.)** | 235 ft (approx.) | **Core Barrel:** | n/a |
| **Operator:** | Schaefer/ Titus | **Datum:** | | **Sampler:** | std split spoon |
| **Logged By:** | Schonewald | **Rig Type:** | Mobile Drill B-51 | **Hammer Wt./Fall:** | 140 lbs / 30 in |
| **Date Start/Finish:** | 10/27/17; 1250--1510 | **Drilling Method:** | Hollow Stem Auger Boring | **Hammer Type:** | rope & cathead |
| **Boring Location:** | See remarks | **Casing ID/OD:** | n/a | **Hammer Efficiency:** | 0.600 |
| | | **Auger ID/OD:** | 2.25" ID/5.88" OD | **Water Level*:** | caved at 15.2 ft; dry |

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

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

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

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

| Depth (ft.) | Sample No. | Pen./Rec. (in.) | Sample Depth (ft.) | Blows (/6 in.) Shear Strength (psf) or RQD (%) | N-uncorrected | N-60 | Casing Blows | Elevation (ft.) | Graphic Log | Visual Description and Remarks | Lab. Testing Results |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | | | | | | | HSA | | | Lawn | |
| | | | | | | | | 233.5 | | 1.5 | |
| | 1D | 24/18 | 2.0 - 4.0 | 6-12-13-18 | 25 | 25 | | | | 1D: Olive brown grey, mottled, desicated to 3 ft, damp, v. stiff, Clayey SILT, trace fine Sand; appears undisturbed. | |
| 5 | 2D | 24/22 | 5.0 - 7.0 | 4-5-6-5 | 11 | 11 | | | | 2D: Olive brown grey, slightly mottled, moist, stiff, SILT & CLAY, trace fine Sand. | |
| 10 | 3D | 24/21 | 10.0 - 12.0 | 4-5-5-6 | 10 | 10 | | | | 3D: Olive brown grey, moist, stiff, CLAY & SILT, trace fine Sand as occasional partings. | |
| 15 | 4D | 24/24 | 15.0 - 17.0 | 1/12"-1-2 | 1 | 1 | | | | 4D: Grey (bottom 3 inches olive grey), wet, v. soft, Silty CLAY, with multiple partings Silty very fine SAND; one 1/16- inch seam orange Silty very fine SAND at 16.7 ft. | |
| | | | | | | | | 217.5 | | 17.5 ft: stratum change based on drilling behavior; gravelly 17.5 | |
| 20 | 5D | 24/17 | 20.0 - 22.0 | 7-9-9-7 | 18 | 18 | | | | 5D: Grey, wet, m. dense, Silty fine to coarse SAND, some Gravel. TILL | |
| | | | | | | | | 211.5 | | 23.5 | |
| 25 | | | | | | | | | | | |

**Remarks:**

See boring location sketch. Located on knoll south of "special ditch;" approximately 53 feet westerly of HB-EXIT75-102

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

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

SCHONEWALD ENGINEERING ASSOCIATES, INC.

**PROJECT:** Off Ramp Sideslope Stabilization Maine TPK Exit 75
**LOCATION:** Auburn, Maine

**Boring No.:** HB-EXIT75-103
**Proj. No.:** 17-032

| | | | | | |
|---|---|---|---|---|---|
| **Driller:** | New England Boring Contractors | **Elevation (ft.)** | 235 ft (approx.) | **Core Barrel:** | n/a |
| **Operator:** | Schaefer/ Titus | **Datum:** | | **Sampler:** | std split spoon |
| **Logged By:** | Schonewald | **Rig Type:** | Mobile Drill B-51 | **Hammer Wt./Fall:** | 140 lbs / 30 in |
| **Date Start/Finish:** | 10/27/17; 1250--1510 | **Drilling Method:** | Hollow Stem Auger Boring | **Hammer Type:** | rope & cathead |
| **Boring Location:** | See remarks | **Casing ID/OD:** | n/a | **Hammer Efficiency:** | 0.600 |
| | | **Auger ID/OD:** | 2.25" ID/5.88" OD | **Water Level*:** | caved at 15.2 ft; dry |

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

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

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

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

| Depth (ft.) | Sample No. | Pen./Rec. (in.) | Sample Depth (ft.) | Blows (/6 in.) Shear Strength (psf) or RQD (%) | N-uncorrected | N-60 | Casing Blows | Elevation (ft.) | Graphic Log | Visual Description and Remarks | Lab. Testing Results |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 25 | 6D | 22/13 | 25.0 - 26.8 | 5-17-31-5/4" | 48 | 48 | | | | 6D: Dark grey, moist (tight), dense, Silty fine to medium SAND, some Gravel, trace coarse Sand. BASAL TILL | |
| 30 | 7D | 7/7 | 30.0 - 30.6 | 30-50/1" | -- | | | 204.4 | | 7D: Dark grey, moist (tight), dense, Silty fine to medium SAND, trace to little Gravel, trace coarse Sand. 30.6 | |
| | | | | | | | | | | **Bottom of Exploration at 30.6 feet below ground surface.** Split-spoon refusal. | |
| 35 | | | | | | | | | | | |
| 40 | | | | | | | | | | | |
| 45 | | | | | | | | | | | |
| 50 | | | | | | | | | | | |

**Remarks:**

See boring location sketch. Located on knoll south of "special ditch;" approximately 53 feet westerly of HB-EXIT75-102

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.



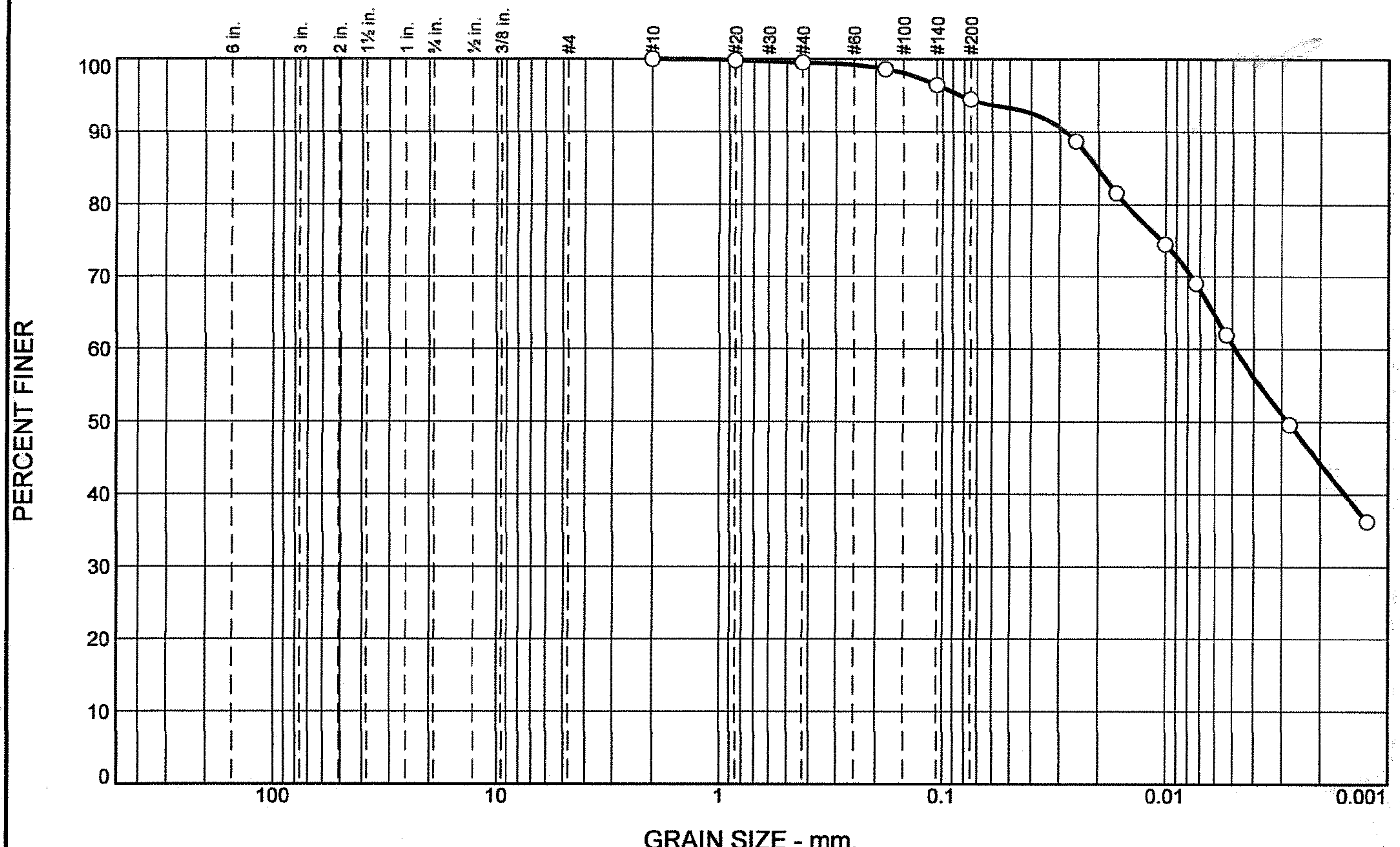
**Boring No.:** HB-EXIT75-103

SCHONEWALD ENGINEERING ASSOCIATES, INC.
www.SchonewaldEngineering.com

## APPENDIX B

## LABORATORY TEST RESULTS

# Particle Size Distribution Report




| % +3" | % Gravel | | % Sand | | | % Fines | |
|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Coarse | Medium | Fine | Silt | Clay |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.5 | 5.1 | 33.9 | 60.5 |

| SIEVE SIZE | PERCENT FINER | SPEC.* PERCENT | PASS? (X=NO) |
|---|---|---|---|
| #10 | 100.0 | | |
| #20 | 99.9 | | |
| #40 | 99.5 | | |
| #80 | 98.6 | | |
| #140 | 96.4 | | |
| #200 | 94.4 | | |
| 0.0254 mm. | 88.7 | | |
| 0.0168 mm. | 81.6 | | |
| 0.0101 mm. | 74.5 | | |
| 0.0073 mm. | 69.1 | | |
| 0.0053 mm. | 62.0 | | |
| 0.0028 mm. | 49.6 | | |
| 0.0012 mm. | 36.2 | | |

* (no specification provided)

**Soil Description**

Lean Clay

**Atterberg Limits**

PL= 22.1 LL= 37.5 PI= 15.4

**Coefficients**

$D_{90}$= 0.0281 $D_{85}$= 0.0203 $D_{60}$= 0.0049
$D_{50}$= 0.0028 $D_{30}$= $D_{15}$=
$D_{10}$= $C_u$= $C_c$=

**Classification**

USCS= CL AASHTO= A-6(16)

**Remarks**

Moisture Content: 26.2%

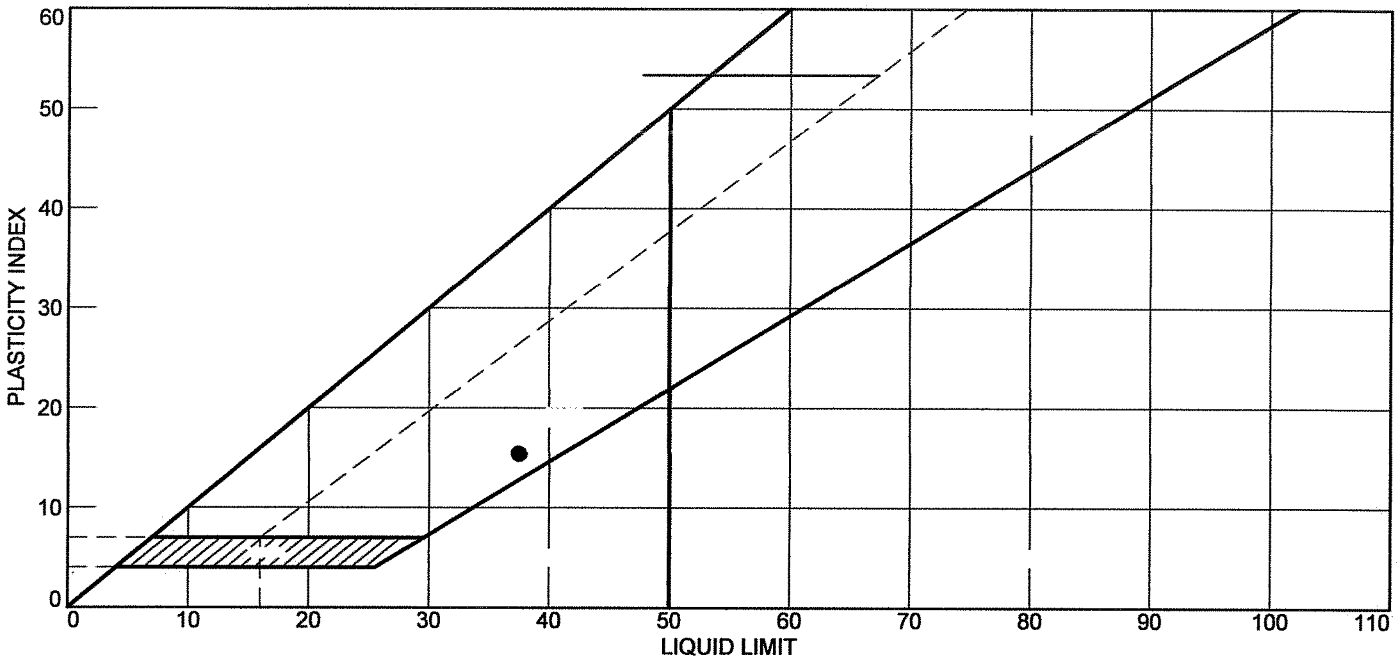
**Location:** HB-EXIT75-102: Auburn, ME
**Sample Number:** 1D **Depth:** 3'-5' **Date:** 11/8/17

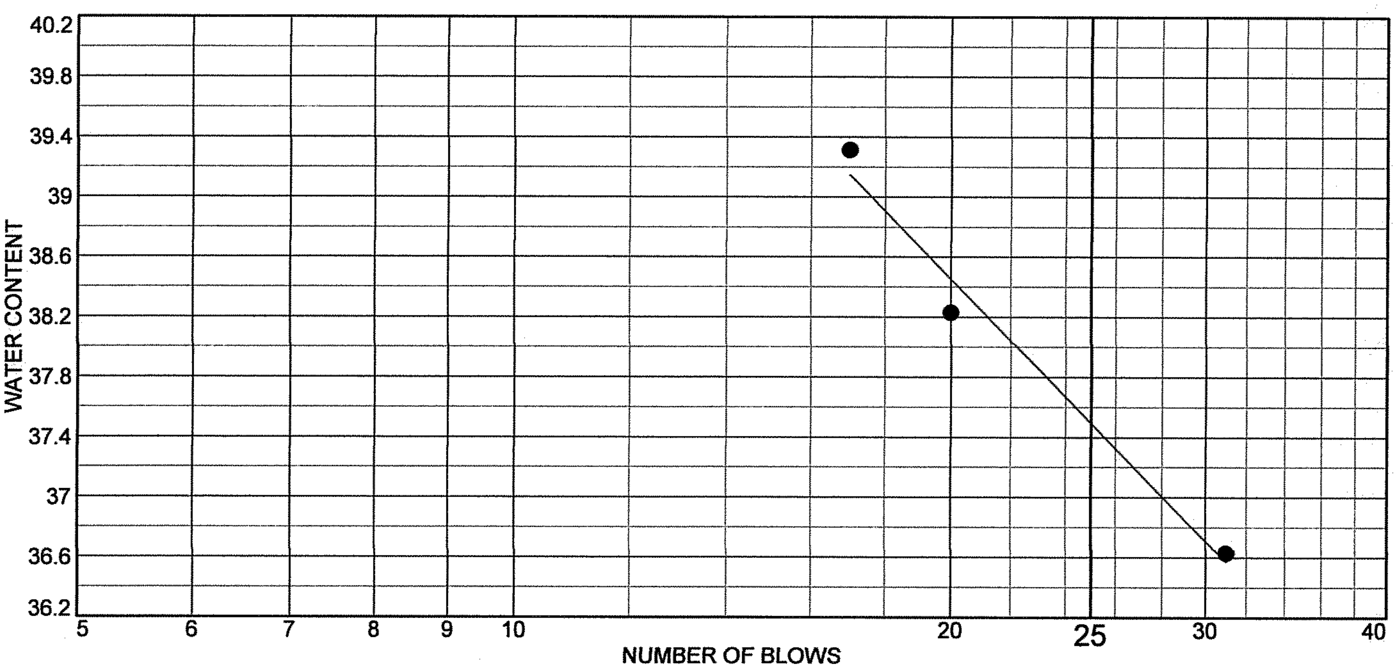
**R.W. Gillespie & Associates, Inc. Saco, Maine**

**Client:** Schonewald Engineering Associates, Inc.
**Project:** Maine Turnpike Exit 75 Slopes
**Project No:** 1368-008 **Lab No.** 14762a

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

# LIQUID AND PLASTIC LIMITS TEST REPORT




| | MATERIAL DESCRIPTION | LL | PL | PI | %<#40 | %<#200 | USCS |
|---|---|---|---|---|---|---|---|
| ● | Lean Clay | 37.5 | 22.1 | 15.4 | 99.5 | 94.4 | CL |

**Project No.** 1368-008 **Client:** Schonewald Engineering Associates, Inc.

**Project:** Maine Turnpike Exit 75 Slopes

**Location:** HB-EXIT75-102: Auburn, ME

**Sample Number:** 1D **Depth:** 3'-5'

**R.W. Gillespie & Associates, Inc.**

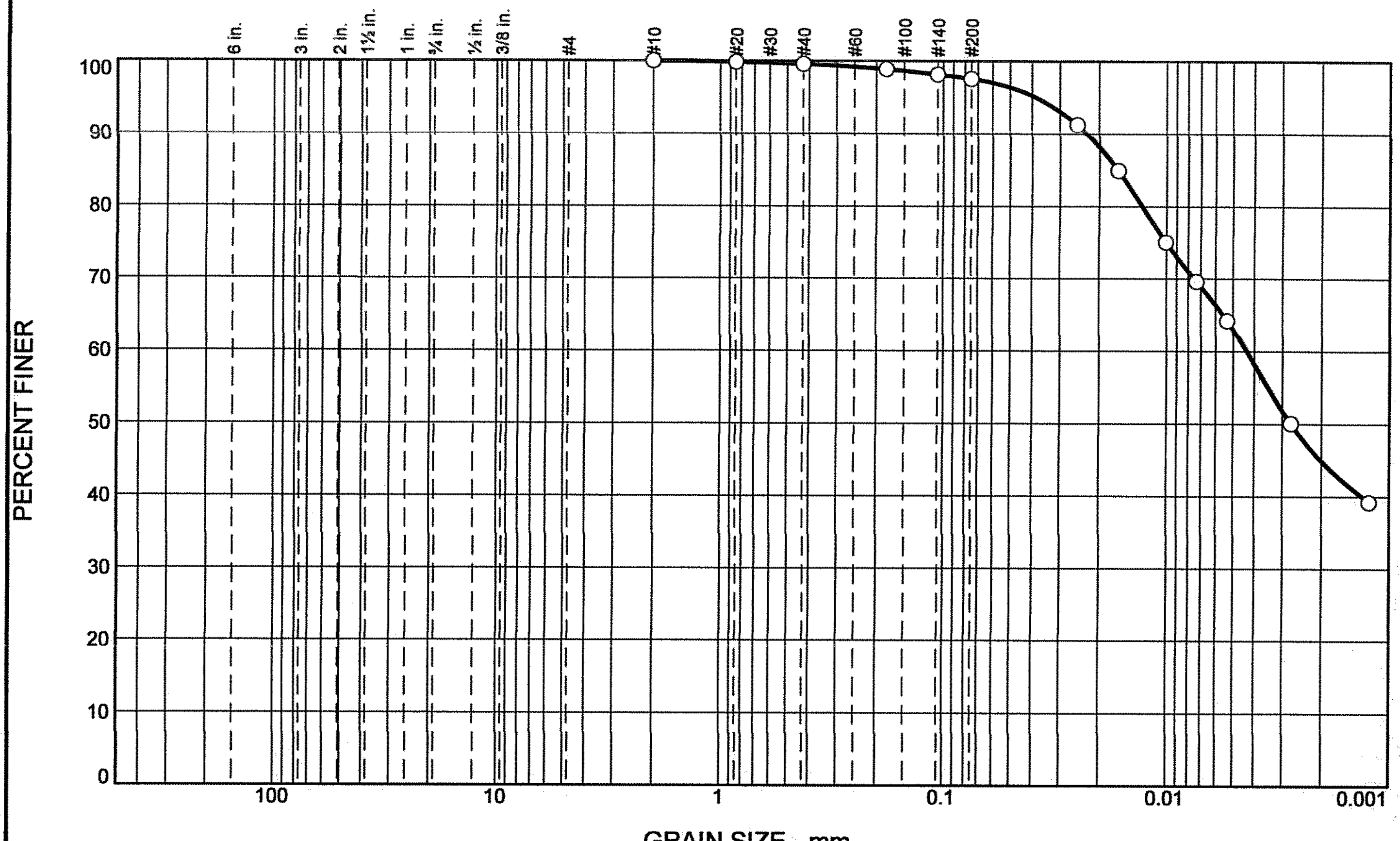
**Saco, Maine**

**Remarks:**

**Lab No.** 14762a

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

# Particle Size Distribution Report




| % +3" | % Gravel | | % Sand | | | % Fines | |
|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Coarse | Medium | Fine | Silt | Clay |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.4 | 2.0 | 34.6 | 63.0 |

| SIEVE SIZE | PERCENT FINER | SPEC.* PERCENT | PASS? (X=NO) |
|---|---|---|---|
| #10 | 100.0 | | |
| #20 | 99.9 | | |
| #40 | 99.6 | | |
| #80 | 98.9 | | |
| #140 | 98.1 | | |
| #200 | 97.6 | | |
| 0.0251 mm. | 91.2 | | |
| 0.0165 mm. | 84.9 | | |
| 0.0101 mm. | 75.1 | | |
| 0.0073 mm. | 69.6 | | |
| 0.0053 mm. | 64.2 | | |
| 0.0028 mm. | 50.1 | | |
| 0.0012 mm. | 39.2 | | |

* (no specification provided)

**Soil Description**

Lean Clay

**Atterberg Limits**

PL= 22.7 LL= 40.2 PI= 17.5

**Coefficients**

$D_{90}$= 0.0228 $D_{85}$= 0.0166 $D_{60}$= 0.0043
$D_{50}$= 0.0027 $D_{30}$= $D_{15}$=
$D_{10}$= $C_u$= $C_c$=

**Classification**

USCS= CL AASHTO= A-6(18)

**Remarks**

Moisture Content: 31.3%

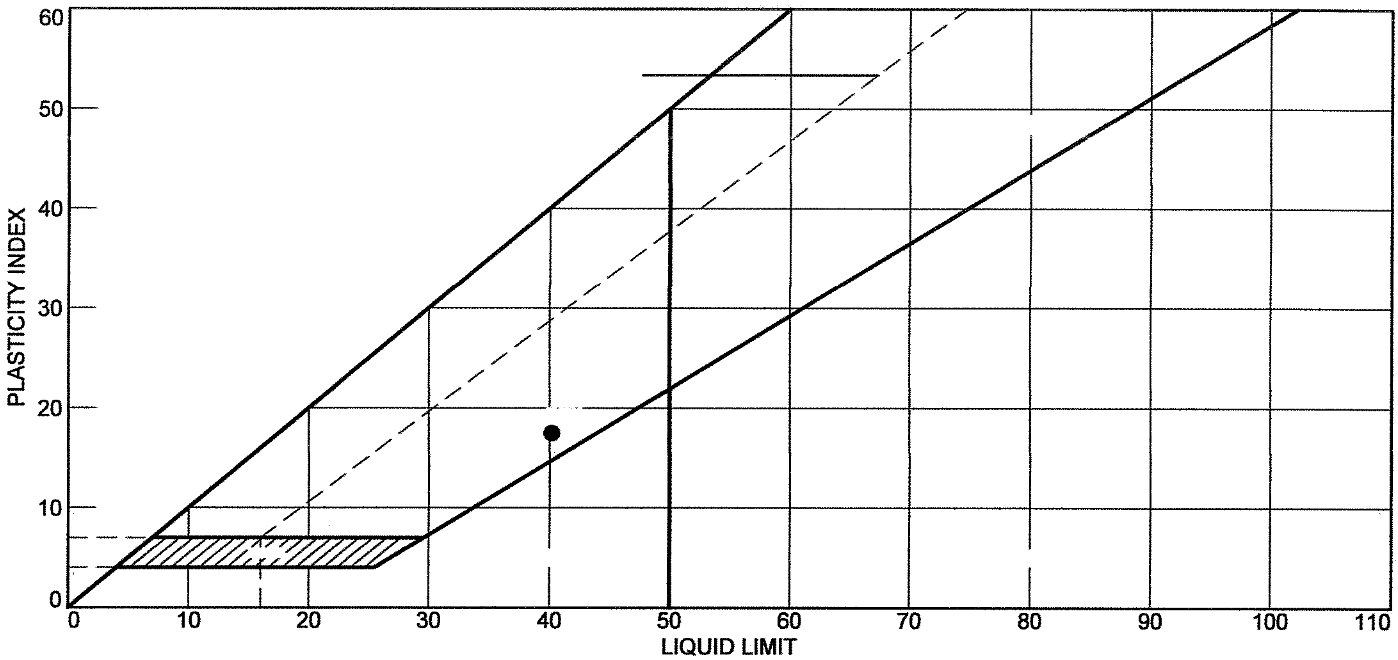
**Location:** HB-EXIT75-102: Auburn, ME
**Sample Number:** 3D **Depth:** 7'-9' **Date:** 11/8/17

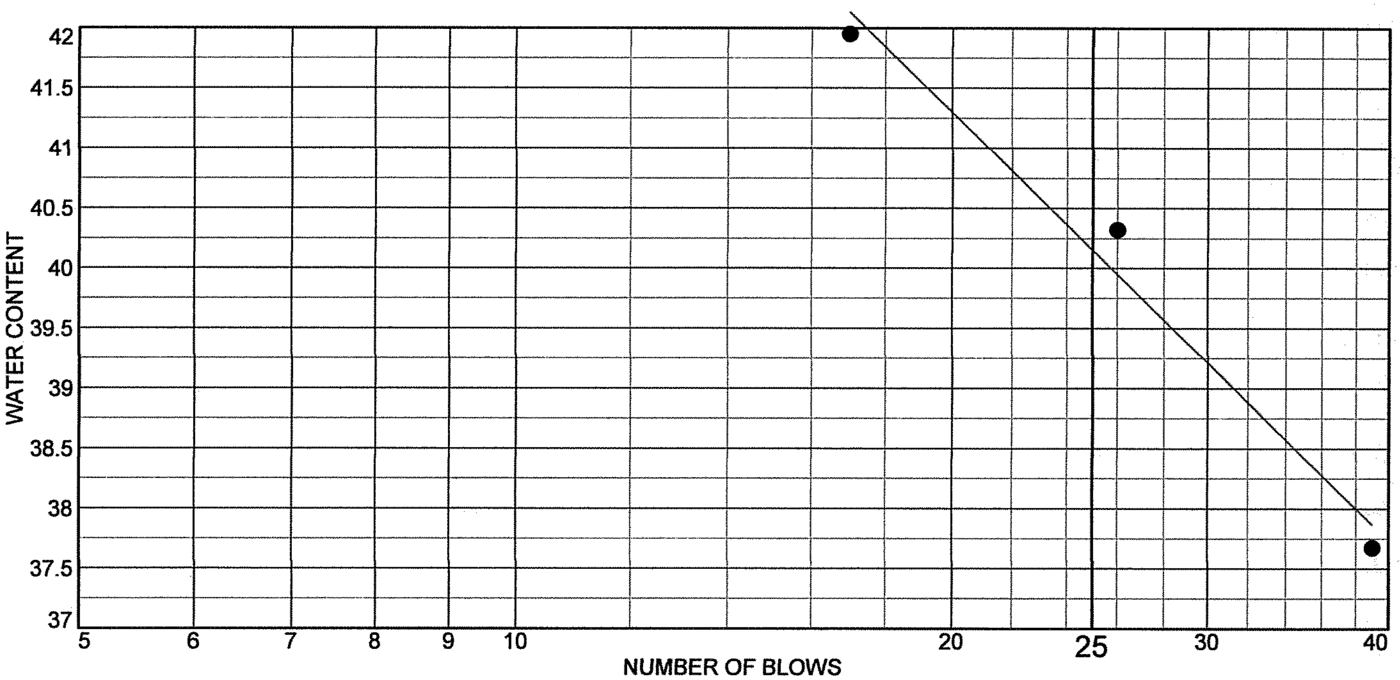
**R.W. Gillespie & Associates, Inc. Saco, Maine**

**Client:** Schonewald Engineering Associates, Inc.
**Project:** Maine Turnpike Exit 75 Slopes
**Project No:** 1368-008 **Lab No.** 14762b

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

# LIQUID AND PLASTIC LIMITS TEST REPORT




| | MATERIAL DESCRIPTION | LL | PL | PI | %<#40 | %<#200 | USCS |
|---|---|---|---|---|---|---|---|
| ● | Lean Clay | 40.2 | 22.7 | 17.5 | 99.6 | 97.6 | CL |

**Project No.** 1368-008 **Client:** Schonewald Engineering Associates, Inc.

**Project:** Maine Turnpike Exit 75 Slopes

**Location:** HB-EXIT75-102: Auburn, ME
**Sample Number:** 3D **Depth:** 7'-9'

**R.W. Gillespie & Associates, Inc.**

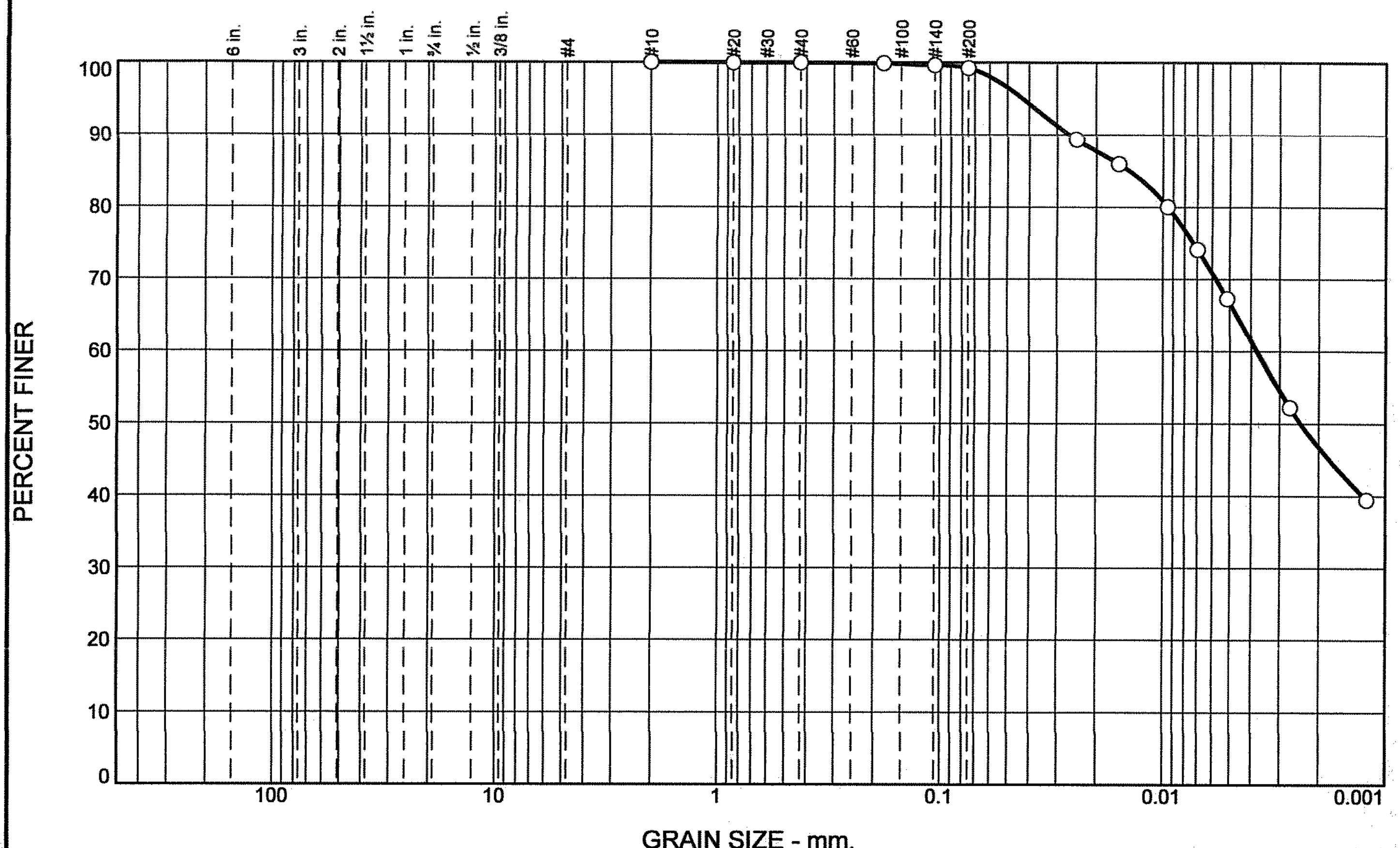
**Saco, Maine**

**Remarks:**

**Lab No.** 14762b

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

# Particle Size Distribution Report




| % +3" | % Gravel | | % Sand | | | % Fines | |
|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Coarse | Medium | Fine | Silt | Clay |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 0.7 | 32.4 | 66.8 |

| SIEVE SIZE | PERCENT FINER | SPEC.* PERCENT | PASS? (X=NO) |
|---|---|---|---|
| #10 | 100.0 | | |
| #20 | 100.0 | | |
| #40 | 99.9 | | |
| #80 | 99.9 | | |
| #140 | 99.6 | | |
| #200 | 99.2 | | |
| 0.0245 mm. | 89.3 | | |
| 0.0159 mm. | 86.0 | | |
| 0.0095 mm. | 80.0 | | |
| 0.0070 mm. | 74.1 | | |
| 0.0051 mm. | 67.3 | | |
| 0.0027 mm. | 52.2 | | |
| 0.0012 mm. | 39.5 | | |

* (no specification provided)

**Soil Description**

Lean Clay

**Atterberg Limits**

PL= 22.0 LL= 44.7 PI= 22.7

**Coefficients**

$D_{90}$= 0.0264 $D_{85}$= 0.0142 $D_{60}$= 0.0038
$D_{50}$= 0.0024 $D_{30}$= $D_{15}$=
$D_{10}$= $C_u$= $C_c$=

**Classification**

USCS= CL AASHTO= A-7-6(25)

**Remarks**

Moisture Content: 37.9%

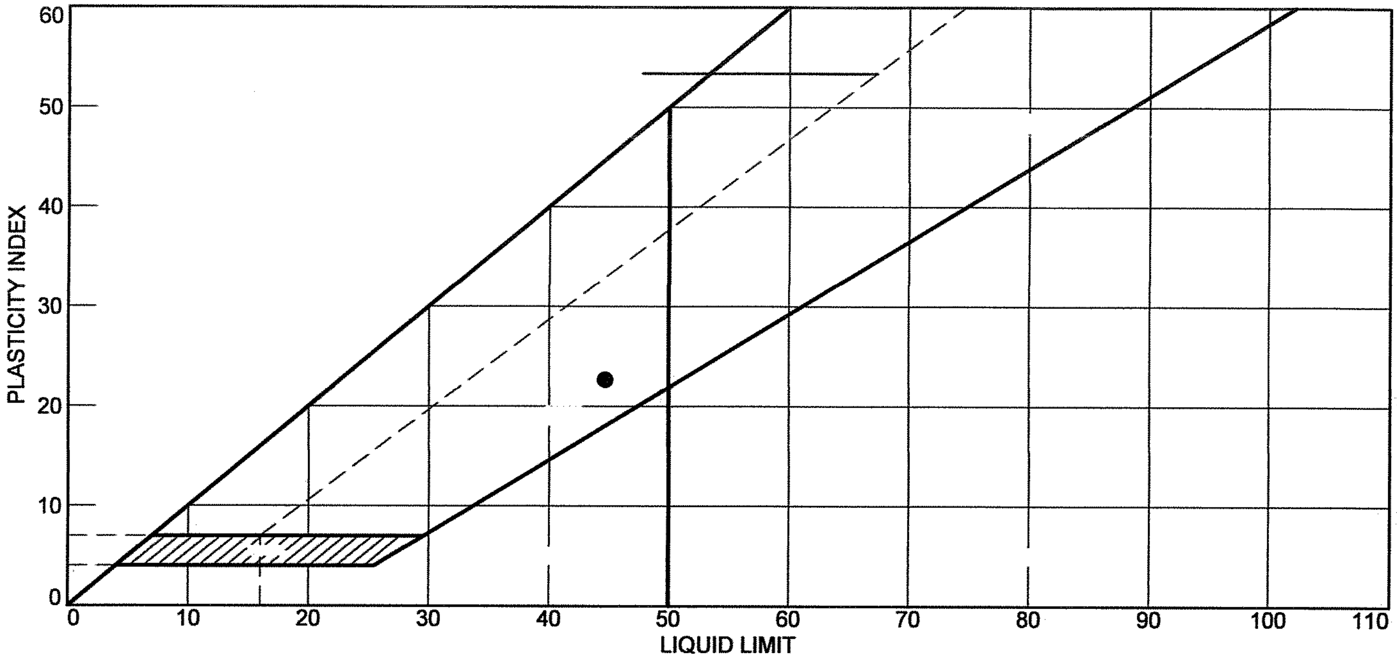
**Location:** HB-EXIT75-102: Auburn, ME
**Sample Number:** 5D **Depth:** 11'-13' **Date:** 11/8/17

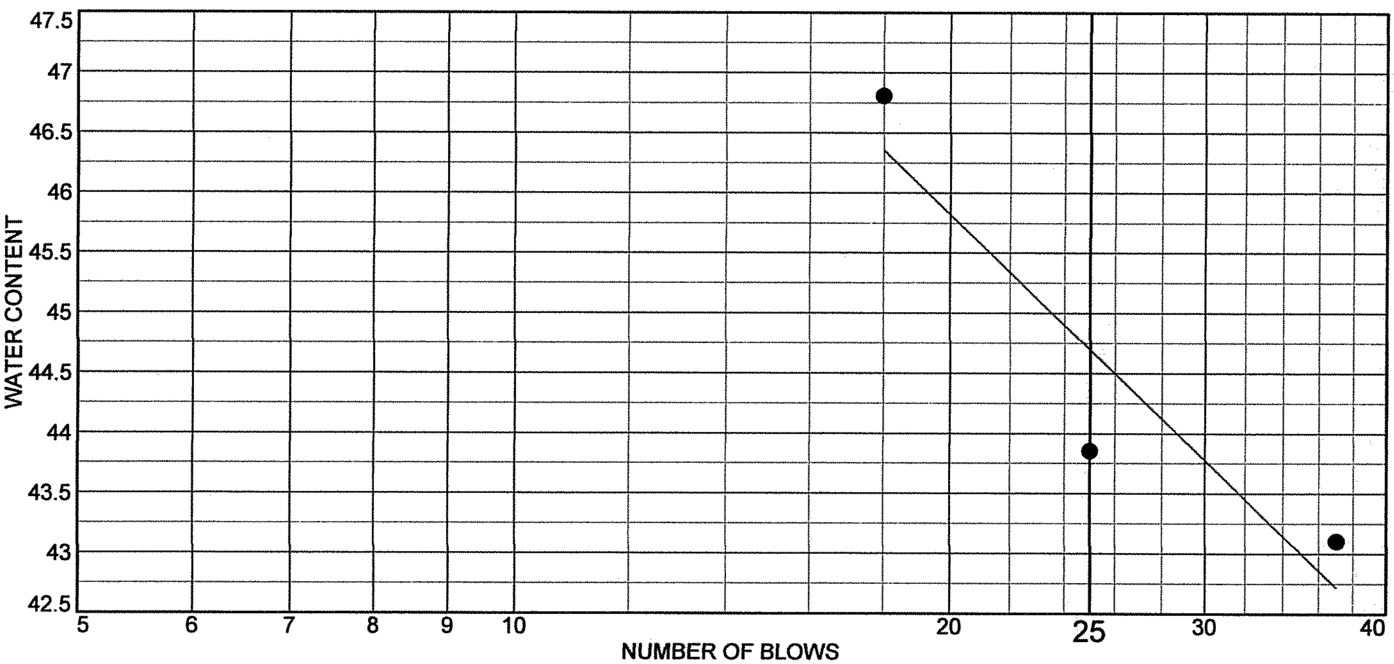
**R.W. Gillespie & Associates, Inc. Saco, Maine**

**Client:** Schonewald Engineering Associates, Inc.
**Project:** Maine Turnpike Exit 75 Slopes
**Project No:** 1368-008 **Lab No.** 14762c

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

# LIQUID AND PLASTIC LIMITS TEST REPORT




| | MATERIAL DESCRIPTION | LL | PL | PI | %<#40 | %<#200 | USCS |
|---|---|---|---|---|---|---|---|
| ● | Lean Clay | 44.7 | 22.0 | 22.7 | 99.9 | 99.2 | CL |

**Project No.** 1368-008 **Client:** Schonewald Engineering Associates, Inc.

**Project:** Maine Turnpike Exit 75 Slopes

**Location:** HB-EXIT75-102: Auburn, ME
**Sample Number:** 5D **Depth:** 11'-13'

**Remarks:**

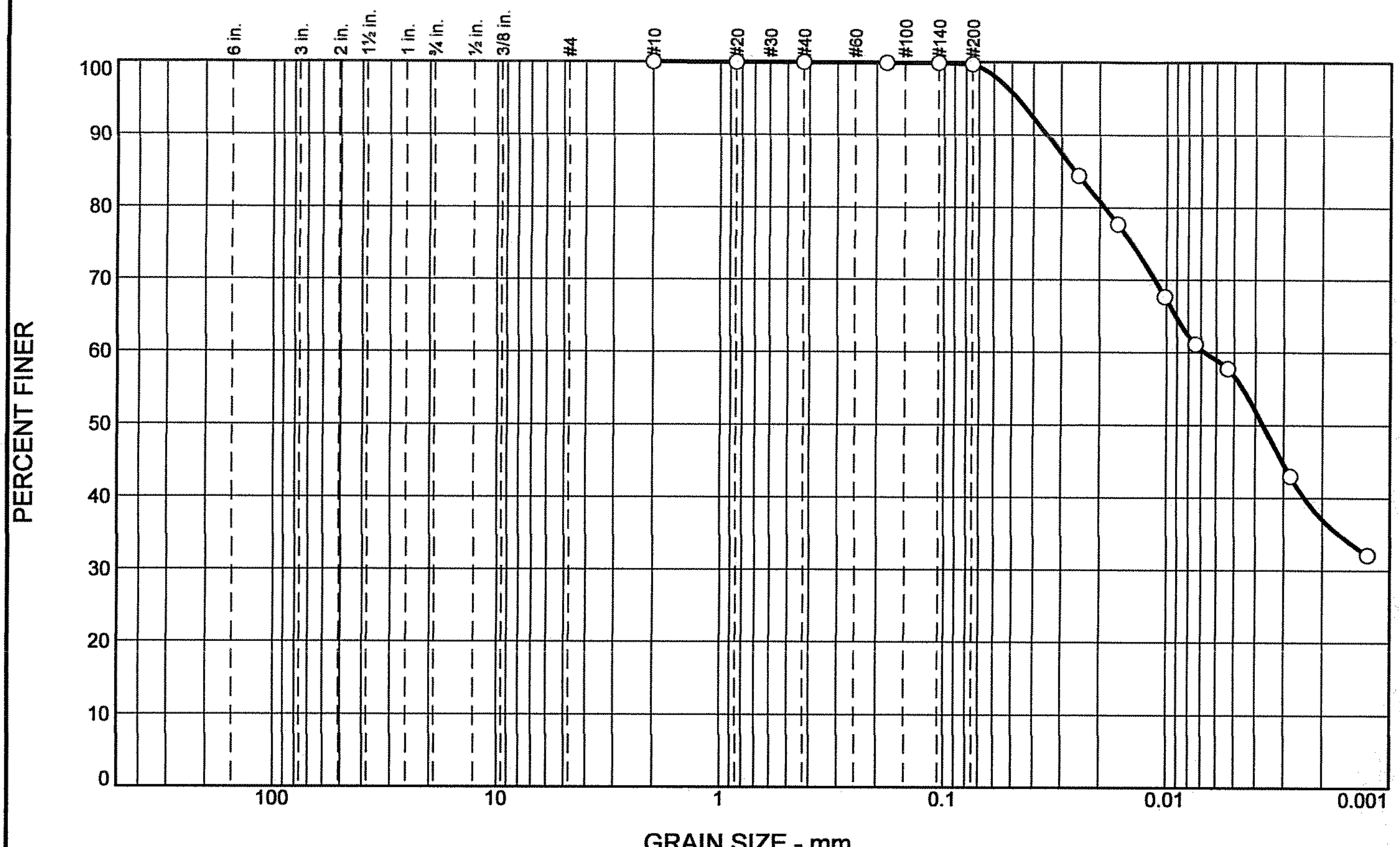
**R.W. Gillespie & Associates, Inc.**

**Saco, Maine**

**Lab No.** 14762c

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

# Particle Size Distribution Report




| % +3" | % Gravel | | % Sand | | | % Fines | |
|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Coarse | Medium | Fine | Silt | Clay |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 0.2 | 42.9 | 56.8 |

| SIEVE SIZE | PERCENT FINER | SPEC.* PERCENT | PASS? (X=NO) |
|---|---|---|---|
| #10 | 100.0 | | |
| #20 | 100.0 | | |
| #40 | 99.9 | | |
| #80 | 99.9 | | |
| #140 | 99.9 | | |
| #200 | 99.7 | | |
| 0.0251 mm. | 84.4 | | |
| 0.0166 mm. | 77.7 | | |
| 0.0102 mm. | 67.7 | | |
| 0.0074 mm. | 61.1 | | |
| 0.0053 mm. | 57.8 | | |
| 0.0028 mm. | 43.0 | | |
| 0.0013 mm. | 32.1 | | |

* (no specification provided)

**Soil Description**

Lean Clay

**Atterberg Limits**

PL= 20.3 LL= 38.5 PI= 18.2

**Coefficients**

$D_{90}$= 0.0347 $D_{85}$= 0.0261 $D_{60}$= 0.0068
$D_{50}$= 0.0037 $D_{30}$= $D_{15}$=
$D_{10}$= $C_u$= $C_c$=

**Classification**

USCS= CL AASHTO= A-6(19)

**Remarks**

Moisture Content: 38.7%

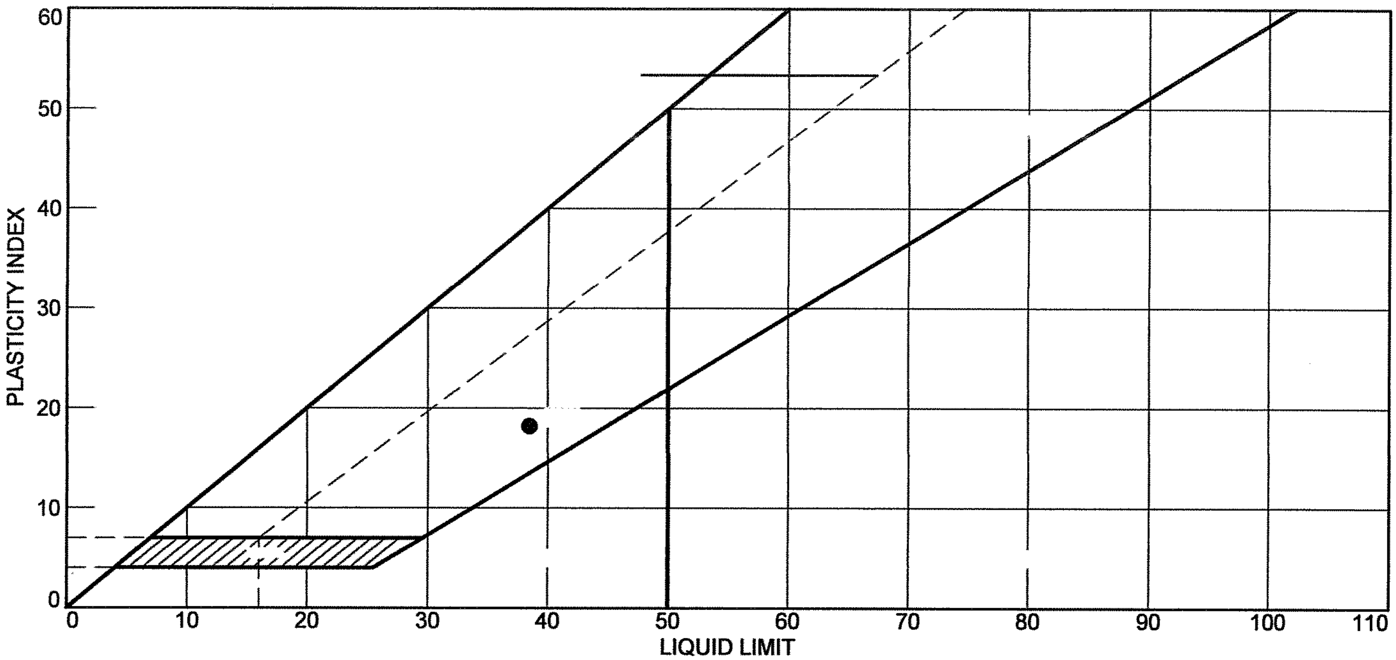
**Location:** HB-EXIT75-102: Auburn, ME
**Sample Number:** 7D **Depth:** 15'-17' **Date:** 11/8/17

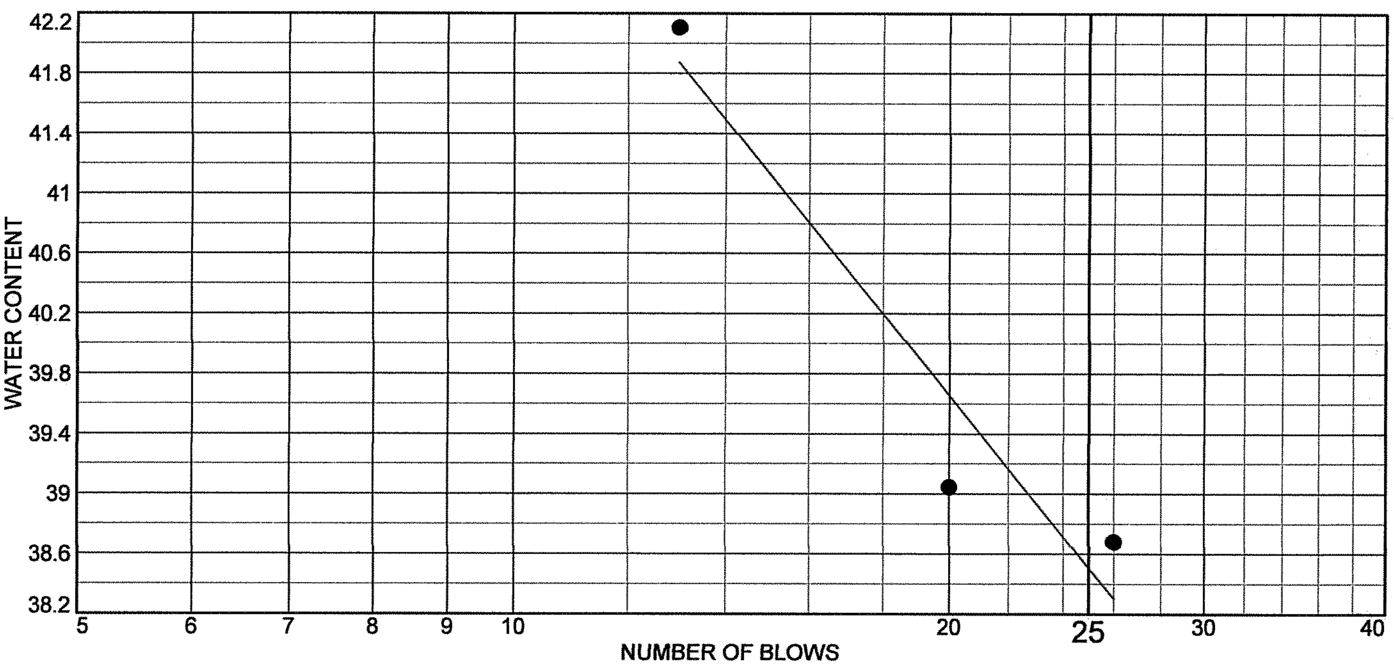
**R.W. Gillespie & Associates, Inc. Saco, Maine**

**Client:** Schonewald Engineering Associates, Inc.
**Project:** Maine Turnpike Exit 75 Slopes
**Project No:** 1368-008 **Lab No.** 14762d

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

# LIQUID AND PLASTIC LIMITS TEST REPORT




| | MATERIAL DESCRIPTION | LL | PL | PI | %<#40 | %<#200 | USCS |
|---|---|---|---|---|---|---|---|
| ● | Lean Clay | 38.5 | 20.3 | 18.2 | 99.9 | 99.7 | CL |

**Project No.** 1368-008 **Client:** Schonewald Engineering Associates, Inc.

**Project:** Maine Turnpike Exit 75 Slopes

**Location:** HB-EXIT75-102: Auburn, ME
**Sample Number:** 7D **Depth:** 15'-17'

**R.W. Gillespie & Associates, Inc.**

**Saco, Maine**

**Remarks:**

**Lab No.** 14762d

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