REPORT

Preliminary Geotechnical Data Report (REV02)

Kenduskeag Avenue Bridge No. 5798 over Interstate 95, Bangor, Maine (WIN 026095.00)

Submitted to:

Maine Department of Transportation

Submitted by:

WSP USA, Inc.

428 Dow Highway Eliot, Maine 03903

207.865.4024

WIN 026095.00 / WSP US0025840.3905

September 16, 2024 (Revised Oct. 15, 2024)

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1.0 INTRODUCTION

This Preliminary Geotechnical Data Report (PGDR) summarizes the results of the geotechnical subsurface investigation and laboratory testing program of site soils and rock that WSP USA Inc. (WSP) performed to support the replacement of the Bridge No. 5798 that carries Kenduskeag Avenue over Interstate 95 (I-95) in Bangor, Maine. Figure 1 shows the site location.

2.0 PROJECT UNDERSTANDING

WSP reviewed the 1959 historic as-built drawings[1] for the existing Kenduskeag Avenue bridge structure and boring logs provided by MaineDOT. The existing structure was constructed in 1958 and consists of a four-span bridge with three (3) piers and two (2) abutments.

3.0 GEOLOGIC SETTING

Available site geology information, consisting of surficial[2] geologic maps of the area indicate subsurface conditions consist of road embankment fills overlying Pleistocene Presumpscot Formation glaciomarine deposits generally consisting predominantly of silt and fine sand.

Available site geology information, consisting of bedrock[3] geologic maps of the area indicate bedrock in the region is mapped as the Medium bedded facies of the Penobscot River Member of the Silurian-aged Bangor Formation of the Vassalboro Group, consisting of medium to dark gray, fine-grained to very fine-grained, Metawacke; a metamorphosed impure, poorly sorted sandstone with appreciable clay minerals. The historical boring logs[1] characterize bedrock as phyllite (a general term for metamorphosed clay-rich rocks).

4.0 SUBSURFACE INVESTIGATION

WSP completed two (2) test borings (BB-BKA-101 and BB-BKA-103) within the paved roadway of Kenduskeag Avenue behind the existing bridge abutments on May 5 and 6, 2024 and one (1) test boring (BB-BKA-102) south of Kenduskeag Avenue on the paved shoulder of I-95 southbound near the existing bridge pier on August 1, 2024. The as-drilled boring locations and elevations are summarized in Table 1 and boring locations with respect to existing site features are illustrated in the Boring Location Plan in Figure 2.

WSP subcontracted Seaboard Drilling, LLC (Seaboard) of Bangor, Maine, who completed the borings using a Diedrich D-50 drill rig for all borings. Borings were advanced either using solid stem augers (SSA) followed by 4-inch casing and drive and wash methods to refusal or using 4-inch casing and drive and wash methods to refusal. At refusal, rock coring was performed in a 3-inch casing seated in rock.

SPT was performed using a calibrated automatic hammer system and standard 2-inch split spoon sampler in general accordance with American Society for Testing and Materials (ASTM) D1586. Sampling was conducted at approximately 5-foot intervals, where split spoons were advanced 24 inches with a 140-pound hammer dropped 30 inches. WSP recorded the number of hammer blows required to advance the sampler through each 6-inch

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[1] Maine State Highway Commission, February 24, 1958. Final As Built Plans, Project No. I-95-8(7) 177, Interstate #95 under Kenduskeag Ave. in the City of Bangor, Penobscot County, Key Plans and Profiles, 8 sheets, Received from HNTB, Filename: 5798 Bangor 1959 As-Built.pdf.

[2] Syverson, K.M., Thompson, A.M., and Johnston, R.A., (2011). Surficial Geology, Bangor Quadrangle, Maine. Open-File No. 11-6, Maine Geological Survey, 1 sheet, scale 1:24,000.

[3] Pollock, S.G., Johnston, R.A., (2011). Bedrock Geology of the Bangor Quadrangle, Maine, Open-File No. 11-57, Maine Geological Survey, 1 sheet, scale 1:240,000.

increment. Measured, uncorrected N-values, are calculated as the sum of the hammer blows to advance the sampler during the 6-inch to 18-inch intervals. Seaboard provided WSP with a copy of the automatic hammer calibration report from November 2023[4] for both drill rigs used. WSP used a calibrated hammer energy transfer ratio of 106.6% for the May borings and 108.7% for the August boring provided by in the report to convert the measured N-values to N_{60} values. Uncorrected N-values and N_{60} are shown on the boring logs (Appendix A). WSP collected and stored soil samples in sealed glass jars for later evaluation and laboratory testing.

Up to 15 feet of rock core was collected in each boring using NX size (1-7/8-inch diameter) diamond tipped core barrels following either refusal of casing or failure to advance the split spoon sampler or roller bit. Rock core samples were placed in wooden boxes and transported to the WSP office. WSP recorded the lithology, Total Core Recovery (TCR), Rock Quality Designation (RQD), and coring rates for each core run which are provided in the boring logs in Appendix A. Photographs of all collected rock core are presented in Appendix B.

The boring logs provided in Appendix A present details of the sampling methods used, field data obtained, and soil and rock conditions encountered during the investigation. A description of the boring log symbols and terms used for the soil and rock descriptions precedes the boring logs. A WSP geotechnical engineer monitored drilling activities, selected sampling intervals, logged subsurface conditions encountered, and obtained soil samples for use in visual descriptions and subsequent laboratory testing and classification WSP field characterized the soils in general accordance with ASTM D2488. WSP field characterized the bedrock lithology.

5.0 LABORATORY TESTING

After reviewing the collected samples in the office, WSP transferred select samples to GeoTesting Express (GTX) of Acton, Massachusetts for geotechnical laboratory testing in accordance with applicable AASHTO and ASTM testing procedures. The types and numbers of each of the laboratory tests conducted on soil samples and rock core are presented in Table 5-1. Soil testing results are included on the boring logs in Appendix A. Complete soil and rock core laboratory testing results are provided in Appendix C.

Table 5-1: Number and Type of Laboratory Tests Performed

Laboratory Test	Test Standard	No. Tests Completed
Moisture content	AASHTO T267, ASTM D2216	4
Grain size analysis (coarse)	AASHTO T88, ASTM D6913	10
Grain size (fine)	AASHTO T88, ASTM D7928	1
Atterberg limits	AASHTO T89 / T90, ASTM D4318	4
Chlorides	AASHTO T291, ASTM D512	1
pH	AASHTO T289, ASTM D4972	1
Sulfates	AASHTO T290	1
Electric Resistivity	ASTM G57	1
Elastic Moduli of Rock in Uniaxial Compression - Rock	ASTM D7012 Method D	2

[4] GRL Engineers, Inc., SPT Energy Calibration on November 2, 2023, Submitted to Eric Baron of S.W. Cole Explorations, LLC (now known as Seaboard Drilling LLC) on November 10, 2023.

6.0 SUBSURFACE CONDITIONS

The boring logs in Appendix A provide detailed descriptions of the soil, bedrock, and measured groundwater conditions encountered in the borings.

Soils: The soils encountered in the borings generally consist of fill materials placed during construction of the bridge and roadway, clay deposits, and naturally occurring sand and gravel interpreted as glacial till. Table 6-1 summarizes the major stratigraphic units, the range of thicknesses, and generalized material descriptions for soils encountered.

Table 6-1: Summary of Subsurface Fill and Soil Encountered

Stratigraphic Unit	Approximate Range in Encountered Thickness (feet)	Generalized Description
Asphalt	0.5 to 1.0	Asphalt pavement approximately 6-inch to 12-inch thick (*Encountered in the three borings)*
Fill	3.3 to 9.8	The fill consists of olive brown to brown or grey to brown, dry, loose to very dense, fine to coarse Sand with some fine to coarse gravel, and trace to little silt. USCS: SM. AASHTO: A-1-b (0) *(Encountered in the three borings)*
Fill (Silt and Clay)	0 to 8.3	The silt and clay fill consists of brown to olive brown, moist, very stiff, Silt to Clay with trace to some fine to coarse sand, trace to some fine gravel, and medium plasticity. USCS: CL and ML. AASHTO: A-6 (13), A-4 (0) *(encountered in BB-BKA-103)*
Clay	8.7 to 11.8	Brown to grey, moist to wet, soft to very stiff, Clay, some to trace fine to coarse sand and trace gravel. USCS: CL. AASHTO: A-4(5), A-6(12), A-6(13), A-6(17) *(Encountered in BB-BKA-101 and BB-BKA-103)*
Glacial Till	2.3 to 7.0	Brown to grey, moist to wet, dense to very dense, fine to coarse Gravel, some fine to coarse sand, little to some silt, and weathered rock fragments. USCS: SM-GM, GM. AASHTO: A-2-4(0), A-1b(0), A-1-a(0) *(Encountered in the three borings)*

Notes: USCS classification from laboratory testing in accordance with ASTM D2487. AASHTO classification from laboratory testing and includes Group Classification and Group Index in parentheses in accordance with AASHTO M145.

Bedrock: Bedrock was cored in each boring. The top of bedrock surface was at approximately 24.5 feet bgs (EL. 84.4 feet NAVD88) in BB-BKA-101, 6.7 feet bgs (EL. 77.3 feet NAVD88) in BB-BKA-102, and 38.0 feet bgs (EL. 65.1 feet NAVD88) in BB-BKA-103. Bedrock consists of grey, very fine to fine grained, very thinly to thinly bedded, Metawacke [metasandstone] with calcite veins that is medium strong to very strong and slightly to moderately weathered. The bedrock is mapped as the Penobscot River Member of the Bangor Formation.[3]

Rock quality designation (RQD) is a common parameter that is used to help assess the competency of sampled bedrock. RQD is defined as the sum of pieces of recovered bedrock greater than 4 inches in length divided by the

total length of the core run. RQD values for bedrock encountered at the site ranges between 0 and 78 percent, which generally correlates to Rock Mass Quality ratings of very poor to poor with one quality rating of good.

Groundwater: Groundwater levels were measured in BB-BKA-101, BB-BKA-102, and BB-BKA-103 before the casing was withdrawn and at the end of the drilling day. Groundwater elevations vary from approximately EL. 104.2 feet to EL. 72.6 feet (NAVD88). Groundwater levels will fluctuate due to soil conditions and topography and seasonal variations in precipitation. Groundwater levels encountered during construction may differ from those recorded from the borings.

7.0 CONDITIONS OF ROCK CORE

Rock Mass Rating (RMR) and Geological Strength Index (GSI) values were calculated for the rock core collected in each boring. The RMR system[5] assigns numerical ratings to six parameters, including strength of the intact rock, RQD, discontinuity spacing, discontinuity surface conditions, groundwater conditions, and orientation of discontinuities. These ratings are summed to provide the RMR value. The GSI system[6] assigns a numerical rating to qualitative estimates of the lithology, discontinuity structure, and discontinuity surface conditions in a rock mass.

To determine the RMR, WSP used the discontinuities described in each rock core run and the RQD measured in each core run to assign ratings. The proposed foundation orientation may allow for a different rating adjustment for discontinuity orientation, and thus a modification to the RMR value. Our calculated RMR values are summarized in Table 2 (attached) for the boring rock core runs. Full RMR calculations including the individual parameter ratings are provided in Appendix D. Based on our field observations and measurements at the Kenduskeag Avenue bridge site, we estimate that RMR values range from 28 to 62 and average 42 for the rock core runs from 8 runs.

To determine the GSI, WSP used the discontinuity surface conditions described in the core runs to assign a rating. We selected the GSI value from the range established by Marinos and Hoek[6] for typical sandstone lithologies. The GSI chart is presented in Appendix D. Based on our observations and measurements, we estimate a GSI value of 50 for the Kenduskeag Avenue bridge site.

8.0 REPORT AND EXPLORATION LIMITATIONS

This Preliminary Geotechnical Data Report (PGDR) was prepared for the replacement of Kenduskeag Avenue Bridge No. 5798 over Interstate 95 in Bangor, Maine. The professional services provided by WSP for this project include only the geotechnical aspects of the subsurface conditions at this site. The presence or implications of possible surface and/or subsurface contamination resulting from previous activities or uses of the site and/or resulting from the introduction onto the site of materials from off-site sources are outside the terms of reference for this report and have not been investigated or addressed.

[5] Bieniawski, Z.T. 1989. Engineering Rock Mass Classifications: A Complete Manual for Engineers and Geologists in Mining, Civil, and Petroleum Engineering. John Wiley & Sons.

[6] Marinos, Paul and Hoek, Evert. November 2000. GSI: a geologically friendly tool for rock mass strength estimation. ISRM International Symposium, Melbourne, Australia, paper number ISRM-IS-2000-035.

Signature Page

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RJN/MEL/JDL

https://wsponlinenam.sharepoint.com/sites/us-win02609500/shared documents/06 deliverables/kenduskeag geotech data report/hntb kenduskeag ave bangor win 026095.00 wsp pgdr rev02.docx

TABLES

Table 1: Summary of Subsurface Explorations
Preliminary Geotechnical Data Report
Bridge #5798, Kenduskeag Ave over I-95, Bangor, Maine
MaineDOT WIN 026095.00

		As-Drilled Locations[4]			Approximate Strata Thickness (feet)								
	Boring No.[1,2,3]	Northing	Easting	Ground Surface Elevation[4] (feet NAVD88)	Asphalt Pavement	Fill	Fill (Silt and Clay)	Clay	Glacial Till	Approximate Top of Bedrock Depth (feet bgs[5])	Approximate Elevation of Top of Bedrock (feet NAVD88)	Approximate Bottom of Exploration Depth (feet bgs[5])	Approximate Elevation of Bottom of Exploration (feet NAVD88)
Bridge #5798	BB-BKA-101	480256.02	1728526.82	108.9	0.5	9.8	NE[5]	8.7	5.1	24.1	84.8	38.5	70.4
	BB-BKA-101A[6]	-	-	108.9	0.5	0.8	NE[5]	NE[5]	NE[5]	NE[5]	NE[5]	1.3	107.6
	BB-BKA-102	480181.49	1728595.97	84.0	1.0	3.3	NE[5]	NE[5]	2.3	6.6	77.4	16.3	67.7
	BB-BKA-103	480124.85	1728757.63	103.1	0.5	9.7	8.3	11.8	7.0	37.3	65.8	48.0	55.1

Notes:

1. Boring locations are shown in Figure 2 - Boring Location Plan of the Preliminary Geotechnical Data Report.

2. Borings BB-BKA-101, and BB-BKA-103 were performed by Seaboard Drilling, LLC in May, 2024. Boring BB-BKA-102 was performed by Seaboard Drilling, LLC in August, 2024.

3. Boring logs are presented in Appendix A of the Preliminary Geotechnical Data Report.

4. As drilled boring locations obtained from the electronic file "Lidar.Ground.dgn" provided to WSP by HNTB on August 12, 2024.

5. bgs = below ground surface, NE = not encountered

6. BB-BKA-101 was offset northeast from BB-BKA-101A due to shallow refusal encountered at BB-BKA-101A. The as-drilled northing and easting coordinates and elevation for BB-BKA-101A were not surveyed. The as-drilled elevation for BB-BKA-101 is reported for BB-BKA-101A in the absence of survey data.

Prepared By: RJN
Checked By: DEB
Reviewed By: MEL

Table 2: Summary of Rock Core Quality
Preliminary Geotechnical Design Report
Bridge #5798, Kenduskeag Avenue over I-95, Bangor, Maine
MaineDOT WIN 026095.00

Test Boring Designation	Core Size	Run						TCR [1]		RQD [2]			Physical Rock Parameters			Lithologic, Rock Mass and Discontinuity Description[5,6]
		No.	Midpoint Depth Below Bedrock Surface (ft)	Depth Below Ground Surface (ft)			Length	Length		Length		Designation	Weathering[3]	Estimated Field Strength[3]	Rock Mass Rating [RMR][4]	
	(in)			Start	End	Midpoint	(ft)	(ft)	%	(ft)	%					
BB-BKA-101	NX (1.88)	R1	2.9	24.5	29.5	27.0	5.0	4.2	83%	0.00	0%	Very Poor	Moderately Weathered (W3)	Medium Strong (R3) to Strong (R4)	28	Grey, very fine to fine grained, thinly bedded, METAWACKE [metasandstone] with calcite veins, medium strong to strong, moderately weathered; discontinuities steep to vertical dipping, very close to close spacing, planar to stepped, smooth, open, clay infilling in fractures at 28 feet bgs; severely fractured [MEDIUM BEDDED FACIES, PENOBSCOT RIVER MEMBER, BANGOR FORMATION].
		R2	7.9	29.5	34.5	32.0	5.0	4.8	95%	0.50	10%	Very Poor	Moderately Weathered (W3)	Medium Strong (R3) to Strong (R4)	29	Grey, very fine grained, thinly bedded, METAWACKE [metasandstone], medium strong to strong, moderately weathered; discontinuities steep to vertical dipping, very close to close spacing, planar to irregular, smooth, open, clay infilling in fractures; severely fractured [MEDIUM BEDDED FACIES, PENOBSCOT RIVER MEMBER, BANGOR FORMATION].
		R3	11.4	34.5	36.5	35.5	2.0	2.0	100%	0.42	21%	Very Poor	Moderately (W3) to Slightly (W2) Weathered	Strong (R4) to Very Strong (R5)	39	Grey, very fine grained, very thinly bedded, METAWACKE [metasandstone] with some calcite veins, strong to very strong, slightly to moderately weathered; discontinuities steep to vertical dipping, very close to close spacing, planar to irregular, smooth to very rough, open; severely fractured [MEDIUM BEDDED FACIES, PENOBSCOT RIVER MEMBER, BANGOR FORMATION].
		R4	13.4	36.5	38.5	37.5	2.0	2.0	100%	0.00	0%	Very Poor	Moderately (W3) to Slightly (W2) Weathered	Strong (R4) to Very Strong (R5)	37	Grey, very fine grained, very thinly bedded, METAWACKE [metasandstone] with some calcite veins, strong to very strong, slightly to moderately weathered; discontinuities steep to vertical dipping, very close to close spacing, planar to irregular, smooth to very rough, open; severely fractured [MEDIUM BEDDED FACIES, PENOBSCOT RIVER MEMBER, BANGOR FORMATION].
BB-BKA-102	NX (1.88)	R1	2.6	6.7	11.7	9.2	5.0	4.7	94%	0.50	10%	Very Poor	Fresh (W1)	Weak (R2)	41	Grey, very fine grained, thinly to very thinly bedded, METAWACKE [metasandstone] with frequent calcite veins and milky quartz intrusions, weak, fresh; discontinuities low angle to steep dipping, very close to close spacing, rough to very rough, tight to open, 4.2 fractures per foot [MEDIUM BEDDED FACIES, PENOBSCOT RIVER MEMBER, BANGOR FORMATION].
		R2	7.4	11.7	16.3	14.0	4.6	5.2	113%	2.00	43%	Poor	Fresh (W1)	Strong (R4) to Very Strong (R5)	51	Grey, very fine grained, thinly to very thinly bedded, METAWACKE [metasandstone] with frequent calcite veins and milky quartz intrusions, strong to very strong, fresh; discontinuities low angle to steep dipping, very close spacing, rough to very rough, tight to open, 2.8 fractures per foot [MEDIUM BEDDED FACIES, PENOBSCOT RIVER MEMBER, BANGOR FORMATION].
BB-BKA-103	NX (1.88)	R1	3.2	38.0	43.0	40.5	5.0	5.0	100%	1.75	35%	Poor	Slightly Weathered (W2)	Strong (R4) to Very Strong (R5)	50	Grey, very fine grained, thinly to very thinly bedded, METAWACKE [metasandstone] with calcite veins, strong to very strong, slightly weathered; discontinuities low angle to steep dipping, very close to close spacing, planar to stepped, rough to very rough, open; average 2.4 fractures per foot [MEDIUM BEDDED FACIES, PENOBSCOT RIVER MEMBER, BANGOR FORMATION].
		R2	8.2	43.0	48.0	45.5	5.0	5.0	100%	3.83	77%	Good	Fresh (W1)	Very Strong (R5)	62	Grey, very fine grained, thinly to very thinly bedded, METAWACKE [metasandstone] with calcite veins, very strong, fresh; discontinuities, low angle to steep dipping, close to moderately close spacing, planar, smooth to rough, open; average 0.8 fractures per foot [MEDIUM BEDDED FACIES, PENOBSCOT RIVER MEMBER, BANGOR FORMATION].

Table 2: Summary of Rock Core Quality
Preliminary Geotechnical Design Report
Bridge #5798, Kenduskeag Avenue over I-95, Bangor, Maine
MaineDOT WIN 026095.00

Test Boring Designation	Core Size	Run						TCR [1]		RQD [2]			Physical Rock Parameters			Lithologic, Rock Mass and Discontinuity Description[5,6]
		No.	Midpoint Depth Below Bedrock Surface	Depth Below Ground Surface (ft)			Length	Length		Length		Designation	Weathering[3]	Estimated Field Strength[3]	Rock Mass Rating [RMR][4]	
	(in)		(ft)	Start	End	Midpoint	(ft)	(ft)	%	(ft)	%					

Notes:

1. TCR = total core recovery. Total core recovery is the length of core recovered divided by the length of the run.

2. RQD = rock quality designation. RQD is the total length of intact, full diameter core pieces recovered with a length greater than or equal to 4 inches measured along the core axis. The percent RQD is the total length of RQD measured divided by the run length. Note that vertical discontinuities are not included in determination of RQD.

3. Weathering and Estimated Field Strength based on Tables II.4 and II.3 (respectively) in Wyllie and Mah, 2004, Rock Slope Engineering: Civil and Mining, 4th Edition (based on ISRM, 1981).

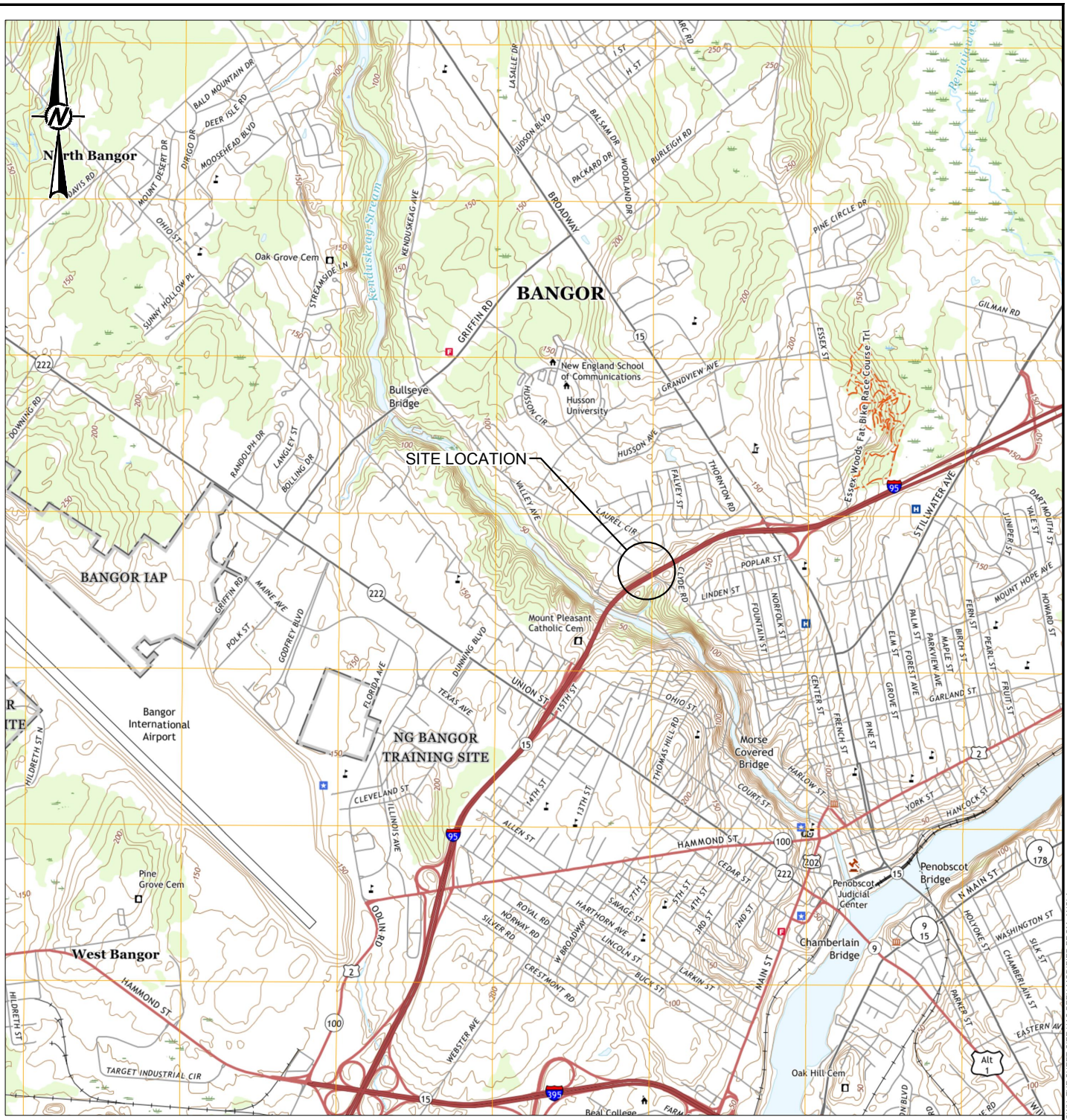
4. Rock Mass Rating (RMR) System (Bieniawski, 1989) assigns numerical ratings to six parameters, including the strength of the intact rock, the RQD, the discontinuity spacing, groundwater conditions, and orientation of discontinuities. These ratings are summed to provide the RMR value. The rating adjustment for joint orientation was assigned a value of 0; correlation of geologic field mapping data of exposed rock outcrops with the rock core samples and proposed foundation type may allow for a different rating adjustment for joint orientation, and thus a modification to the RMR value shown on this table.

5. Bedrock formation name from: Pollock, Stephen G. 2011. Bedrock geology of the Bangor Quadrangle, Maine. Maine Geological Survey Open-File No. 11-57. Map scale 1:24,000.

6. ft = feet, in = inches

Prepared by: KAR
Checked by: DEB / BK
Reviewed by: MEL

FIGURES



REFERENCE(S)

1. BASE MAP TAKEN FROM U.S.G.S. 7.5 MINUTE QUADRANGLE OF BANGOR, MAINE DATED 2021

CLIENT
HNTB CORPORATION
82 RUNNING HILL ROAD, SUITE 201
SOUTH PORTLAND, ME 04106

CONSULTANT
WSP

YYYY-MM-DD	2024-08-14
DESIGNED	DEB
PREPARED	AM
REVIEWED	MEL
APPROVED	

PROJECT
KENDUSKEAG AVENUE BRIDGE NO. 5798 OVER I-95
BANGOR, ME (WIN 026095.00)

TITLE
SITE LOCATION MAP

PROJECT NO.	CONTROL	REV.	FIGURE
US0025840.3905	0001-001	0	1

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A

Last Edited By: usam7/01004 Date: 2024-08-14 Time:9:42:28 AM | Printed By: USAM7/01004 Date: 2024-08-14 Time:9:45:14 AM
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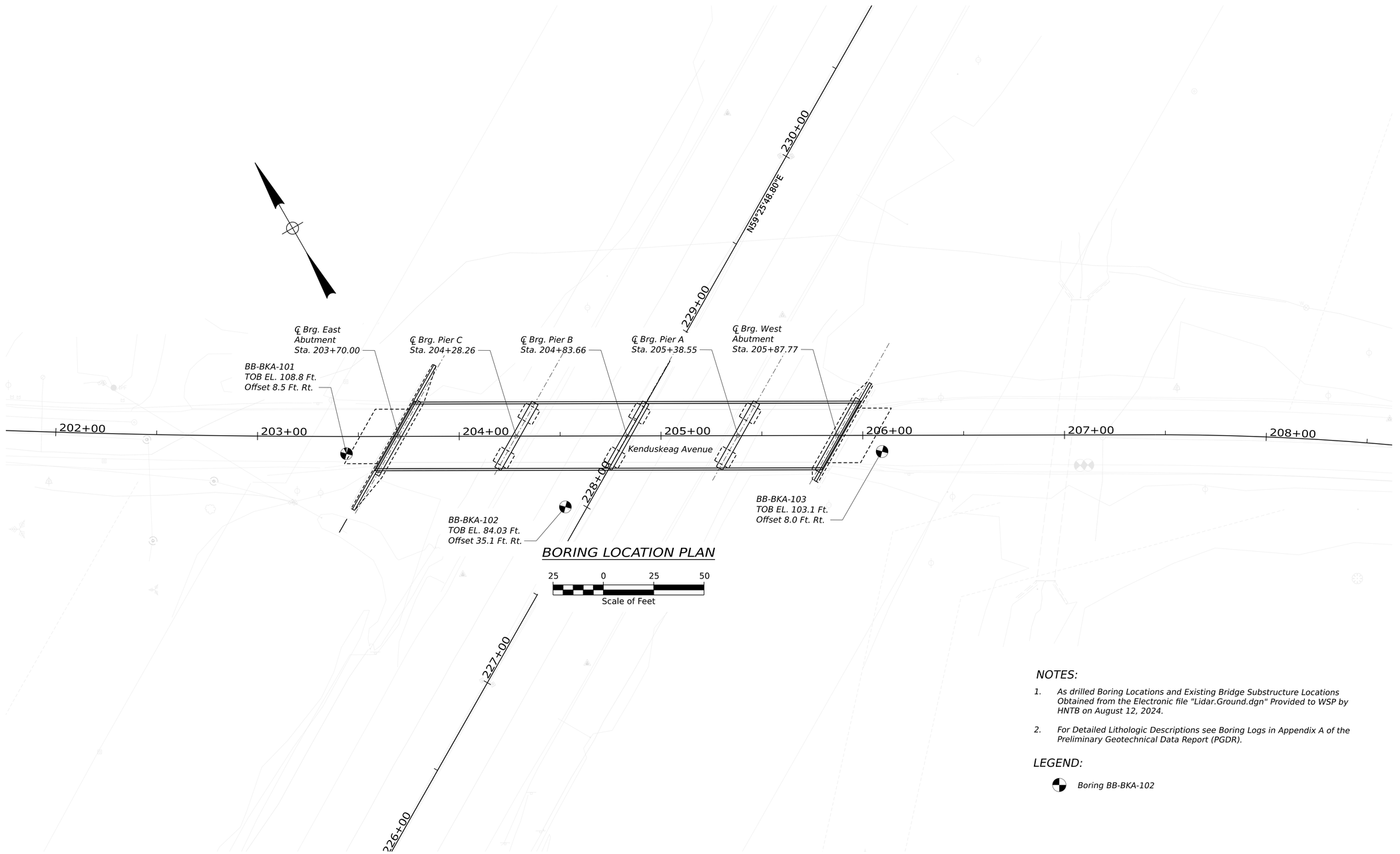

BORING LOCATION PLAN

NOTES:

1. *As drilled Boring Locations and Existing Bridge Substructure Locations Obtained from the Electronic file "Lidar.Ground.dgn" Provided to WSP by HNTB on August 12, 2024.*
2. *For Detailed Lithologic Descriptions see Boring Logs in Appendix A of the Preliminary Geotechnical Data Report (PGDR).*

LEGEND:

Boring BB-BKA-102

STATE OF MAINE
DEPARTMENT OF TRANSPORTATION

026095.00

WIN
026095.00

BRIDGE PLANS

SIGNATURE

P.E. NUMBER

DATE

	BY	DATE
PROJ. MANAGER		
DESIGN-DETAILED		
CHECKED-REVIEWED		
DESIGN2-DETAILED2		
DESIGN3-DETAILED3		
REVISIONS 1		
REVISIONS 2		
REVISIONS 3		
REVISIONS 4		
FIELD CHANGES		

BANGOR PENOBSCOT COUNTY
KENDUSKEAG AVE BRIGDE OVER I-95

BORING LOCATON PLAN

SHEET NUMBER

02

OF 02

Date: 9/13/2024

Username: gomeznl

Filename: c:\bms\wsp-pb-us-pw-02\wsp__nevin.gomez\d0895958\02_Kenduskeag_BorPlan.dgn

APPENDIX A

Boring Logs

UNIFIED SOIL CLASSIFICATION SYSTEM

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

Desired Soil Observations (in this order, if applicable):

Color (Munsell color chart)
Moisture (dry, damp, moist, wet)
Density/Consistency (from above right hand side)
Texture (fine, medium, coarse, etc.)
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.,)
Cementation (weak, moderate, or strong)
Geologic Origin (till, marine clay, alluvium, etc.)
Groundwater level

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

MODIFIED BURMISTER SYSTEM

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

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. Density is rated according to standard penetration resistance (N-value).

Density of Cohesionless Soils	Standard Penetration Resistance N_{60}-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 undrained shear strength as indicated.

Consistency of Cohesive soils	SPT N_{60}-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):

$$RQD\ (\%) = \frac{\text{sum of the lengths of intact pieces of core* > 4 inches}}{\text{length of core advance}}$$

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

Rock Quality Based on RQD

Rock Quality	RQD (%)
Very Poor	≤25
Poor	26 - 50
Fair	51 - 75
Good	76 - 90
Excellent	91 - 100

Desired Rock Observations (in this order, if applicable):

Color (Munsell color chart)
Texture (aphanitic, fine-grained, etc.)
Rock Type (granite, schist, sandstone, 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 deg., low angle - 5-35 deg., mod. dipping - 35-55 deg., steep - 55-85 deg., vertical - 85-90 deg.)
-spacing (very close - <2 inch, close - 2-12 inch, mod. close - 1-3 feet, wide - 3-10 feet, very wide >10 feet)
-tightness (tight, open, or healed)
-infilling (grain size, color, etc.)
Formation (Waterville, Ellsworth, Cape Elizabeth, etc.)
RQD and correlation to rock quality (very poor, poor, etc.)
ref: ASTM D6032 and FHWA NHI-16-072 GEC 5 - Geotechnical Site Characterization, Table 4-12
Recovery (inch/inch and percentage)
Rock Core Rate (X.X ft - Y.Y ft (min:sec))

Sample Container Labeling Requirements:

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

Table A-2

Classification of Rock Material Strengths[1]

Grade	Description	Field Identification	Approx. Range of Uniaxial Compressive Strength	
			MPa	psi
S1	Very soft clay	Easily penetrated several inches by fist	<0.025	<4
S2	Soft clay	Easily penetrated several inches by thumb	0.025-0.05	4-7
S3	Firm clay	Can be penetrated several inches by thumb with moderate effort	0.05-0.10	7-15
S4	Stiff clay	Readily indented by thumb but penetrated only with great effort	0.10-0.25	15-35
S5	Very stiff clay	Readily indented by thumbnail	0.25-0.50	35-70
S6	Hard clay	Indented with difficulty by thumbnail	>0.50	>70
R0	Extremely weak rock	Indented by thumbnail	0.25-1.0	35-150
R1	Very weak rock	Crumbles under firm blows with point of geological hammer; can be peeled by a pocket knife	1-5	150-725
R2	Weak rock	Can be peeled by a pocket knife with difficulty; shallow indentations made by firm blow with point of geological hammer	5-25	725-3,500
R3	Medium strong rock	Cannot be scraped or peeled with a pocket knife; specimen can be fractured with single firm blow of geological hammer	25-50	3,500-7,000
R4	Strong rock	Specimen requires more than one blow of geological hammer to fracture it	50-100	7,000-15,000
R5	Very strong rock	Specimen requires many blows of geological hammer to fracture it	100-250	15,000-36,000
R6	Extremely strong rock	Specimen can only be chipped with geological hammer	>250	>36,000

Note: Grades S1 to S6 apply to cohesive soils, for example clays, silty clays, and combinations of silts and clays with sand, generally slow draining. Discontinuity wall strength will generally be characterized by grades R0-R6 (rock) while S1-S6 (clay) will generally apply to filled discontinuities. Rock material strength descriptions are included in the rock core descriptions in the boring logs. Rock material strength grades (R0-R6) are not included in the rock core descriptions to avoid confusion with the numbering of the rock core runs.

[1] International Society for Rock Mechanics (ISRM), Commission on standardization of laboratory and field tests (1978): Suggested methods for the quantitative description of discontinuities in rock masses. Int. J. Rock Mech. Min. Sci. & Geomech. Abstr., Vol. 15, No. 6, pp. 319-368.

Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: MaineDOT Kenduskeag Avenue Bridge #5798 over I-95
Location: Bangor. ME

Boring No.: BB-BKA-101
WIN: 026095.00

Driller:	Seaboard	**Elevation (ft.)**	108.86	**Auger ID/OD:**	
Operator:	Kevin Hanscom	**Datum:**	Maine East Zone	**Sampler:**	Standard Split Spoon
Logged By:	Lina-Maria Pua	**Rig Type:**	Diedrich D-50	**Hammer Wt./Fall:**	140 lbs/30 in
Date Start/Finish:	5/06/24 (20:24); 5/06/24 (23:24)	**Drilling Method:**	Cased wash	**Core Barrel:**	NX
Boring Location:	N: 480256.02 E: 1728526.82	**Casing ID/OD:**	4.0 in/4.25 in and 3.0 in/3.25 in	**Water Level*:**	4.7 ft on 5/06/24 at 21:28
Hammer Efficiency Factor:	1.066	**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 = Field Vane Shear Test, PP = Pocket Penetrometer
MV = Unsuccessful Field 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 = Peak/Remolded Field Vane Undrained Shear Strength (psf)
$S_{u(lab)}$ = Lab Vane Undrained Shear Strength (psf)
q_p = Unconfined Compressive Strength (ksf)
N-uncorrected = Raw Field SPT N-value
Hammer Efficiency Factor = Rig Specific Annual Calibration Value
N_{60} = SPT N-uncorrected Corrected for Hammer Efficiency
N_{60} = (Hammer Efficiency Factor/60%)*N-uncorrected
T_v = Pocket Torvane Shear Strength (psf)
WC = Water Content, percent
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index
G = Grain Size Analysis
C = Consolidation Test

Depth (ft.)	Sample Information: Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-uncorrected	N_{60}	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.
0							SSA	108.4		Asphalt Pavement Boring offset from BB-BKA-101A location	
										0.5 Advanced with augers from 0.46 to 5.0 feet bgs.	
5	1D	24/8.5	5.00 - 7.00	10-10-11-6	21	37				Olive brown, dry, dense, fine to coarse SAND, some fine gravel, little silt (FILL).	WC = 6% Fines = 13.6% A-1b (0), SM
10	2D	24/11.5	10.00 - 12.00	1-2-1-2	3	5	13	98.6		2DA Top 3 in: Olive brown, dry, loose, fine to coarse SAND, some fine gravel, little silt (FILL).	WC = 20% Fines = 73.1%
							15			10.3 2DB Bottom 8.5 in: Brown, wet, soft, CLAY, some fine to coarse sand, trace gravel, medium plasticity, higher sand content at the bottom of the sample T_v = 0.4 ksf and 0.6 ksf; P_p = 4.0 ksf and 6.0 ksf	LL = 27 PL = 18 PI = 9 LI = 0.2 A-4 (5), CL
							28				
							34				
	MV			Would Not Push			24			Failed field vane, would not push past 15 feet bgs.	
15	3D	24/0	15.00 - 17.00	2-3-1-2	4	7	16			NO RECOVERY	
							13				
							15				
							15				
							18	89.9		19.0 Driller notes change in drill rig behavior at 19 feet bgs.	
20	4D	24/11.5	20.00 - 22.00	4-8-17-21	25	44	OPEN			Brown, wet, dense, fine to coarse sandy GRAVEL, some silt, well-graded (GLACIAL TILL).	WC = 10% Fines = 24.5% A-1b (0), GM
	R1	60/50	24.50 - 29.50	RQD = 0%			NX	84.8		24.1 Bedrock encountered at 24.1 feet bgs Top of Bedrock Elev. 84.8 ft Advanced with roller bit to 24.5 feet bgs. R1 (24.5' - 29.5'): Grey, very fine to fine grained, thinly bedded, METAWACKE [metasandstone] with calcite veins, medium strong to strong, moderately weathered; discontinuities steep to vertical dipping, very close to close spacing, planar to stepped, smooth, open, clay infilling in fractures at 28 feet bgs; severely fractured [MEDIUM	
25											

Remarks:

1. Hammer Efficiency factor provided by S.W. Cole and taken from "2023PA00074 - SW Cole - SPT Report" by GRL Engineers Inc., dated 11/10/2023.
2. As-drilled boring locations and ground surface elevations were provided by MaineDOT.
3. Water level reading taken on 5/6/24 at 21:28 was made before the start of rock coring with bottom of casing at 24.5 ft bgs.

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: MaineDOT Kenduskeag Avenue Bridge #5798 over I-95
Location: Bangor. ME

Boring No.: BB-BKA-101
WIN: 026095.00

Driller:	Seaboard	**Elevation (ft.)**	108.86	**Auger ID/OD:**	
Operator:	Kevin Hanscom	**Datum:**	Maine East Zone	**Sampler:**	Standard Split Spoon
Logged By:	Lina-Maria Pua	**Rig Type:**	Diedrich D-50	**Hammer Wt./Fall:**	140 lbs/30 in
Date Start/Finish:	5/06/24 (20:24); 5/06/24 (23:24)	**Drilling Method:**	Cased wash	**Core Barrel:**	NX
Boring Location:	N: 480256.02 E: 1728526.82	**Casing ID/OD:**	4.0 in/4.25 in and 3.0 in/3.25 in	**Water Level*:**	4.7 ft on 5/06/24 at 21:28
Hammer Efficiency Factor: 1.066		**Hammer Type:**	Automatic ☒ Hydraulic ☐ Rope & Cathead ☐		

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MV = Unsuccessful Field Vane Shear Test Attempt
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SSA = Solid Stem Auger
HSA = Hollow Stem Auger
RC = Roller Cone
WOH = Weight of 140 lb. Hammer
WOR/C = Weight of Rods or Casing
WO1P = Weight of One Person
S_u = Peak/Remolded Field Vane Undrained Shear Strength (psf)
$S_{u(lab)}$ = Lab Vane Undrained Shear Strength (psf)
q_p = Unconfined Compressive Strength (ksf)
N-uncorrected = Raw Field SPT N-value
Hammer Efficiency Factor = Rig Specific Annual Calibration Value
N_{60} = SPT N-uncorrected Corrected for Hammer Efficiency
N_{60} = (Hammer Efficiency Factor/60%)*N-uncorrected
T_v = Pocket Torvane Shear Strength (psf)
WC = Water Content, percent
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index
G = Grain Size Analysis
C = Consolidation Test

Depth (ft.)	Sample Information: Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-uncorrected	N_{60}	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.
30	R2	60/57	29.50 - 34.50	RQD = 9%						BEDDED FACIES, PENOBSCOT RIVER MEMBER, BANGOR FORMATION]. Rock Mass Quality = very poor 83% Recovery Rock Core Rate (min:sec) 24.5-25.5 ft (1:17) 25.5-26.5 ft (1:33) 26.5-27.5 ft (1:58) 27.5-28.5 ft (1:40) 28.5-29.5 ft (2:10)	
35	R3	24/24	34.50 - 36.50	RQD = 17%						R2 (29.5' - 34.5'): Grey, very fine grained, thinly bedded, METAWACKE [metasandstone], medium strong to strong, moderately weathered; discontinuities steep to vertical dipping, very close to close spacing, planar to irregular, smooth, open, clay infilling in fractures; severely fractured [MEDIUM BEDDED FACIES, PENOBSCOT RIVER MEMBER, BANGOR FORMATION]. Rock Mass Quality = very poor 95% Recovery Rock Core Rate (min:sec) 29.5-30.5 ft (1:05) 30.5-31.5 ft (1:56) 31.5-32.5 ft (1:49) 32.5-33.5 ft (1:59) 33.5-34.5 ft (2:50)	
	R4	24/24	36.50 - 38.50	RQD = 0%				70.4		R3 (34.5' -36.5'): Grey, very fine grained, very thinly bedded, METAWACKE [metasandstone] with some calcite veins, strong to very strong, slightly to moderately weathered; discontinuities steep to vertical dipping, very close to close spacing, planar to irregular, smooth to very rough, open; severely fractured [MEDIUM BEDDED FACIES, PENOBSCOT RIVER MEMBER, BANGOR FORMATION]. Rock Mass Quality = very poor 100% Recovery Rock Core Rate (min:sec) 34.5-35.5 ft (1:47) 35.5-36.5 ft (1:46)	
45										R4 (36.5' - 38.5'): Grey, very fine grained, very thinly bedded, METAWACKE [metasandstone] with some calcite veins, strong to very strong, slightly to moderately weathered; discontinuities steep to vertical dipping, very close to close spacing, planar to irregular, smooth to very rough, open; severely fractured [MEDIUM BEDDED FACIES, PENOBSCOT RIVER MEMBER, BANGOR FORMATION]. Rock Mass Quality = very poor 100% Recovery Rock Core Rate (min:sec) 36.5-37.5 ft (2:26) 37.5-38.5 ft (3:21)	
50										38.5 **Bottom of Exploration at 38.5 feet below ground surface.** Boring backfilled with bentonite chips in the rock core socket, drill cuttings and gravel to bottom of pavement and patched with cold patch asphalt.	
55											

Remarks:

1. Hammer Efficiency factor provided by S.W. Cole and taken from "2023PA00074 - SW Cole - SPT Report" by GRL Engineers Inc., dated 11/10/2023.
2. As-drilled boring locations and ground surface elevations were provided by MaineDOT.
3. Water level reading taken on 5/6/24 at 21:28 was made before the start of rock coring with bottom of casing at 24.5 ft bgs.

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: MaineDOT Kenduskeag Avenue Bridge #5798 over I-95
Location: Bangor. ME

Boring No.: BB-BKA-101A
WIN: 026095.00

Driller:	Seaboard	**Elevation (ft.)**	108.86	**Auger ID/OD:**	
Operator:	Kevin Hanscom	**Datum:**	Maine East Zone	**Sampler:**	Standard Split Spoon
Logged By:	Lina-Maria Pua	**Rig Type:**	Diedrich D-50	**Hammer Wt./Fall:**	140 lbs/30 in
Date Start/Finish:	5/06/24 (20:13); 5/06/24 (20:20)	**Drilling Method:**	Cased wash	**Core Barrel:**	NX
Boring Location:	Refer to remarks 2 and 3	**Casing ID/OD:**		**Water Level*:**	Not Measured
Hammer Efficiency Factor:	1.066	**Hammer Type:**	Automatic ☒ Hydraulic ☐ Rope & Cathead ☐		

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MV = Unsuccessful Field Vane Shear Test Attempt
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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 = Peak/Remolded Field Vane Undrained Shear Strength (psf)
$S_{u(lab)}$ = Lab Vane Undrained Shear Strength (psf)
q_p = Unconfined Compressive Strength (ksf)
N-uncorrected = Raw Field SPT N-value
Hammer Efficiency Factor = Rig Specific Annual Calibration Value
N_{60} = SPT N-uncorrected Corrected for Hammer Efficiency
N_{60} = (Hammer Efficiency Factor/60%)*N-uncorrected
T_v = Pocket Torvane Shear Strength (psf)
WC = Water Content, percent
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index
G = Grain Size Analysis
C = Consolidation Test

Depth (ft.)	Sample Information: Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-uncorrected	N_{60}	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.
0	1D	10/6.5	0.46 - 1.29	16-50/4"	R		SSA	108.4		Asphalt Pavement — 0.5	
								107.6		Brown, dry, Silty coarse GRAVEL, some sand, well-graded (FILL). — 1.3	
										Bottom of Exploration at 1.3 feet below ground surface. Roller bit refusal on reinforced concrete. Boring backfilled with drill cuttings to bottom of pavement and patched with cold patch asphalt. Boring offset to the BB-BKA-101 location.	
5											
10											
15											
20											
25											

Remarks:

1. Hammer Efficiency factor provided by S.W. Cole and taken from "2023PA00074 - SW Cole - SPT Report" by GRL Engineers Inc., dated 11/10/2023.
2. BB-BKA-101 was offset NE from BB-BSA-101A due to shallow refusal on BB-BSA-101A.
3. As-drilled boring elevation was not survey. The elevation from BB-BKA-101 was used.

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* 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: MaineDOT Kenduskeag Avenue Bridge #5798 over I-95
Location: Bangor. ME

Boring No.: BB-BKA-102
WIN: 026095.00

Driller:	Seaboard	**Elevation (ft.)**	84.03	**Auger ID/OD:**	
Operator:	Ryan Hackett	**Datum:**	Maine East Zone	**Sampler:**	Standard Split Spoon
Logged By:	Daniel Burgess	**Rig Type:**	Diedrich D-50	**Hammer Wt./Fall:**	140 lbs/30 in
Date Start/Finish:	8/01/24 (1:32); 8/01/24 (3:32)	**Drilling Method:**	Cased wash	**Core Barrel:**	NX
Boring Location:	N: 480179.15 E: 1728607.8	**Casing ID/OD:**	4.0 in/4.25 in and 3.0 in/3.25 in	**Water Level*:**	4.55 ft on 8/01/24 at 3:16
Hammer Efficiency Factor:	1.087	**Hammer Type:**	Automatic ☒ Hydraulic ☐ Rope & Cathead ☐		

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MV = Unsuccessful Field Vane Shear Test Attempt
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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 = Peak/Remolded Field Vane Undrained Shear Strength (psf)
$S_{u(lab)}$ = Lab Vane Undrained Shear Strength (psf)
q_p = Unconfined Compressive Strength (ksf)
N-uncorrected = Raw Field SPT N-value
Hammer Efficiency Factor = Rig Specific Annual Calibration Value
N_{60} = SPT N-uncorrected Corrected for Hammer Efficiency
N_{60} = (Hammer Efficiency Factor/60%)*N-uncorrected
T_v = Pocket Torvane 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			Asphalt Pavement	
								83.0		1.0	
	1D	24/17	1.50 - 3.50	16-16-13-13	29	53				Brown, dry, very dense, fine to coarse SAND, some fine to coarse gravel, little silt (FILL).	Fines = 17.4% A-1b (0), SM
								79.8		4.3	
5	2D	13.5/10	5.00 - 6.13	22-20-50/1.5"	70	127				Grey, moist, very dense, fine to medium SAND,and fine to coarse GRAVEL, some silt non-plastic (Glacial Till)	Fines = 33.1% A-2-4 (0), SM/ GM
	R1	60/56.4	6.70 - 11.70	RQD = 10%			NX	77.4		6.6	
										Auger Refusal at 6.6 feet bgs. Top of Beadrock Elev. 77.4 ft R-1 (6.7' - 11.7') Grey, very fine grained, thinly to very thinly bedded, METAWACKE [metasandstone] with frequent calcite veins and milky quartz intrusions, strong to very strong, fresh; discontinuities, low angle to steep dipping, very close to close spacing, rough to very rough, tight to open, 4.2 fractures per foot [MEDIUM BEDDED FACIES, PENOBSCOT RIVER MEMBER, BANGOR FORMATION]. Rock Mass Quality = very poor 94% recovery 10% RQD Rock Core Rate (min:sec) 6.7-7.7 ft: (4:31) 7.7-8.7 ft: (3:26) 8.7-9.7 ft: (3:34) 9.7-10.7 ft: (3:40) 10.7-11.7 ft: (6:52)	
10											
	R2	55.2/62.4	11.70 - 16.30	RQD = 43%							
15								67.7		R-2 (11.7' - 16.3') Grey, very fine grained, thinly to very thinly bedded, METAWACKE [metasandstone] with frequent calcite veins and milky quartz intrusions, strong to very strong, fresh; discontinuities, low angle to steep dipping, very close spacing, rough to very rough, tight to open, 2.8 fractures per foot [MEDIUM BEDDED FACIES, PENOBSCOT RIVER MEMBER, BANGOR FORMATION]. Rock Mass Quality = poor 100% recovery 43% RQD Rock Core Rate (min:sec) 11.7-12.7 ft: (4:23) 12.7-13.7 ft: (3:47) 13.7-14.7 ft: (2:23) 14.7-15.7 ft: (2:47) 15.7-16.3 ft: (3:23)	
20										16.3	
25										**Bottom of Exploration at 16.3 feet below ground surface.** Boring backfilled with bentonite chips in the rock core socket, drill cuttings and gravel to bottom of pavement and patched with cold patch asphalt.	

Remarks:

1. Hammer Efficiency factor provided by S.W. Cole and taken from "2023PA00074 - SW Cole - SPT Report" by GRL Engineers Inc., dated 11/10/2023.
2. As-drilled boring locations and ground surface elevations were provided by MaineDOT.
3. Water level reading taken on 8/01/24 at 3:16 am was made after the rock coring.

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: MaineDOT Kenduskeag Avenue Bridge #5798 over I-95
Location: Bangor. ME

Boring No.: BB-BKA-103
WIN: 026095.00

Driller:	Seaboard	**Elevation (ft.)**	103.10	**Auger ID/OD:**	
Operator:	Kevin Hanscom	**Datum:**	Maine East Zone	**Sampler:**	Standard Split Spoon
Logged By:	Lina-Maria Pua	**Rig Type:**	Diedrich D-50	**Hammer Wt./Fall:**	140 lbs/30 in
Date Start/Finish:	5/05/24 (20:25); 5/06/24 (00:54)	**Drilling Method:**	Cased wash	**Core Barrel:**	NX
Boring Location:	N: 480124.85 E: 1728757.63	**Casing ID/OD:**	4.0 in/4.25 in and 3.0 in/3.25 in	**Water Level*:**	30.5 ft on 5/06/24 at 00:45
Hammer Efficiency Factor:	1.066	**Hammer Type:**	Automatic ☒ Hydraulic ☐ Rope & Cathead ☐		

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RC = Roller Cone
WOH = Weight of 140lb. Hammer
WOR/C = Weight of Rods or Casing
WO1P = Weight of One Person
S_u = Peak/Remolded Field Vane Undrained Shear Strength (psf)
$S_{u(lab)}$ = Lab Vane Undrained Shear Strength (psf)
q_p = Unconfined Compressive Strength (ksf)
N-uncorrected = Raw Field SPT N-value
Hammer Efficiency Factor = Rig Specific Annual Calibration Value
N_{60} = SPT N-uncorrected Corrected for Hammer Efficiency
N_{60} = (Hammer Efficiency Factor/60%)*N-uncorrected
T_v = Pocket Torvane 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	1D	24/10.2	0.54 - 2.54	21-23-20-10	43	76	SSA	102.6		Asphalt Pavement	
										0.5	
										Brown, dry, very dense, Sandy coarse GRAVEL, some silt, well-graded (FILL).	
5	2D	24/11.5	5.00 - 7.00	6-7-7-7	14	25				Grey to brown, dry, medium dense, medium to coarse GRAVEL, some sand, trace silt (FILL).	
10	3D	20/17	10.00 - 11.67	2-3-13-50/2"	16	28				3DA Top 2 in: Grey to brown, dry, medium dense, medium to coarse GRAVEL, some sand, trace silt (FILL). 3DB Bottom 15 in: Brown, moist, very stiff, CLAY, trace sand, trace gravel, medium plasticity, cobble at bottom of sample interval (FILL). P_p= 6.0 ksf and 8.0 ksf	WC = 25% Fines = 96.2% LL = 33 PL = 19 PI = 14 LI = 0.4 A-6 (13), CL
							15				
							26				
							55				
15	4D	20/17.5	15.00 - 16.67	9-6-11-50/2"	17	30	81			Olive brown, moist, very stiff, SILT, some fine to coarse sand, some fine gravel, gravel content increase with depth (FILL)	WC = 6% Fines = 45.1% A-4 (0), ML
							238				
							250				
							88	84.6		18.5	
							39				
20	5D	24/23	20.00 - 22.00	9-8-9-10	17	30	91			Brown to grey, moist, very stiff, CLAY, trace fine sand, high plasticity (CLAY). P_p > 9.0 ksf	WC = 22% Fines = 98.4% LL = 37 PL = 21 PI = 16 LI = 0 A-6 (17), CL
							106				
							117				
							131				
							76				
25	6D	24/22	25.00 - 27.00	3-3-4-5	7	12	72			Light olive brown, wet, medium stiff, CLAY, trace fine sand, medium plasticity (CLAY).	WC = 27% Fines = 98.1% LL = 30 PL = 17 PI = 13 LI = 0.8 A-6 (12), CL
							82				
							103				
							112				

Remarks:

1. Hammer Efficiency factor provided by S.W. Cole and taken from "2023PA00074 - SW Cole - SPT Report" by GRL Engineers Inc., dated 11/10/2023.
2. As-drilled boring locations and ground surface elevations were provided by MaineDOT. 3. Water level reading taken on 5/6/24 at 00:45 was made after the completion of drilling with bottom of casing at 38 ft bgs.

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-BKA-103

Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: MaineDOT Kenduskeag Avenue Bridge #5798 over I-95
Location: Bangor. ME

Boring No.: BB-BKA-103
WIN: 026095.00

Driller:	Seaboard	**Elevation (ft.)**	103.10	**Auger ID/OD:**	
Operator:	Kevin Hanscom	**Datum:**	Maine East Zone	**Sampler:**	Standard Split Spoon
Logged By:	Lina-Maria Pua	**Rig Type:**	Diedrich D-50	**Hammer Wt./Fall:**	140 lbs/30 in
Date Start/Finish:	5/05/24 (20:25); 5/06/24 (00:54)	**Drilling Method:**	Cased wash	**Core Barrel:**	NX
Boring Location:	N: 480124.85 E: 1728757.63	**Casing ID/OD:**	4.0 in/4.25 in and 3.0 in/3.25 in	**Water Level*:**	30.5 ft on 5/06/24 at 00:45
Hammer Efficiency Factor: 1.066		**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 = Field Vane Shear Test, PP = Pocket Penetrometer
MV = Unsuccessful Field Vane Shear Test Attempt
R = Rock Core Sample
SSA = Solid Stem Auger
HSA = Hollow Stem Auger
RC = Roller Cone
WOH = Weight of 140 lb. Hammer
WOR/C = Weight of Rods or Casing
WO1P = Weight of One Person
S_u = Peak/Remolded Field Vane Undrained Shear Strength (psf)
$S_{u(lab)}$ = Lab Vane Undrained Shear Strength (psf)
q_p = Unconfined Compressive Strength (ksf)
N-uncorrected = Raw Field SPT N-value
Hammer Efficiency Factor = Rig Specific Annual Calibration Value
N_{60} = SPT N-uncorrected Corrected for Hammer Efficiency
N_{60} = (Hammer Efficiency Factor/60%)*N-uncorrected
T_v = Pocket Torvane 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.
	MV			Would Not Push			65			Failed field vane, would not push past 30 feet bgs	
30	7D	24/14	30.00 - 32.00	8-9-27-28	36	64	OPEN	72.8		7DA Top 4 in: Light olive brown, wet, hard, CLAY, trace fine sand, medium plasticity (CLAY).	
										30.3	
										7DB Bottom 10 in: Brown to grey, moist, very dense, Silty GRAVEL, some sand, weathered rock fragments (GLACIAL TILL).	
35	8D	24/6	35.00 - 37.00	20-19-24-17	43	76				Olive brown, wet, very dense, fine to coarse SAND and GRAVEL, little silt (GLACIAL TILL)	WC = 10% Fines = 13.7% A-1-a (0), SM/ GM
								65.8		37.3	
	R1	60/60	38.00 - 43.00	RQD = 36%			NX			Top of Bedrock Elev. 65.8 ft Advanced with roller bit to 38.0 feet bgs. R1 (38' - 43'): Grey, very fine grained, thinly to very thinly bedded, METAWACKE [metasandstone] with calcite veins, strong to very strong, slightly weathered; discontinuities, low angle to steep dipping, very close to close spacing, planar to stepped, rough to very rough, open; average 2.4 fractures per foot [MEDIUM BEDDED FACIES, PENOBSCOT RIVER MEMBER, BANGOR FORMATION]. Rock Mass Quality = poor 100% Recovery Rock Core Rate (min:sec) 38.0-39.0 ft (2:09) 39.0-40.0 ft (3:12) 40.0-41.0 ft (2:22) 41.0-42.0 ft (3:10) 42.0-43.0 ft (3:07)	
40											
	R2	60/60	43.00 - 48.00	RQD = 78%							
45											
								55.1		R2 (43' - 48'): Grey, very fine grained, thinly to very thinly bedded, METAWACKE [metasandstone] with calcite veins, very strong, fresh; discontinuities, low angle to steep dipping, close to moderately close spacing, planar, smooth to rough, open; average 0.8 fractures per foot [MEDIUM BEDDED FACIES, PENOBSCOT RIVER MEMBER, BANGOR FORMATION]. Rock Mass Quality = good 100% Recovery Rock Core Rate (min:sec) 43.0-44.0 ft (2:36) 44.0-45.0 ft (2:15) 45.0-46.0 ft (2:30) 46.0-47.0 ft (2:30) 47.0-48.0 ft (2:43)	
50											
										48.0	
55										**Bottom of Exploration at 48.0 feet below ground surface.** Boring backfilled with bentonite chips in the rock core socket, drill cuttings and gravel to bottom of pavement and patched with cold patch asphalt.	

Remarks:

1. Hammer Efficiency factor provided by S.W. Cole and taken from "2023PA00074 - SW Cole - SPT Report" by GRL Engineers Inc., dated 11/10/2023.
2. As-drilled boring locations and ground surface elevations were provided by MaineDOT. 3. Water level reading taken on 5/6/24 at 00:45 was made after the completion of drilling with bottom of casing at 38 ft bgs.

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

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

APPENDIX B

Rock Core Photographs

APPENDIX B
ROCK CORE PHOTOGRAPHS
BRIDGE #5798, KENDUSKEAG AVENUE OVER INTERSTATE 95
BANGOR, MAINE
MAINEDOT WIN 026095.00

Boring	Run	Depth Below Surface Feet			Recovery Feet			Recovery %	RQD Feet			RQD %	Rock Type	Box Row	Date Cored
BB-BKA-103	R1	38.0	-	43.0	5.0	-	5.0	100	1.8	-	5.0	36	Metawacke	Row 1	5/5/2024
	R2	43.0	-	48.0	5.0	-	5.0	100	3.9	-	5.0	78	Metawacke	Row 2	5/5/2024
BB-BKA-101	R1	24.5	-	29.5	4.2	-	5.0	83	0.0	-	5.0	0	Metawacke	Row 3	5/6/2024
	R2	29.5	-	34.5	4.8	-	5.0	95	0.5	-	5.0	9	Metawacke	Row 3,4	5/6/2024

Notes:
1. "Box row" indicates the section of the box where the core is contained: 1 = top, 4 = bottom.
2. Top of each core run is on the left and increases with depth to the right.

Prepared By: RJN
Checked By: DEB
Reviewed By: JDL

APPENDIX B
ROCK CORE PHOTOGRAPHS
BRIDGE #5798, KENDUSKEAG AVENUE OVER INTERSTATE 95
BANGOR, MAINE
MAINEDOT WIN 026095.00

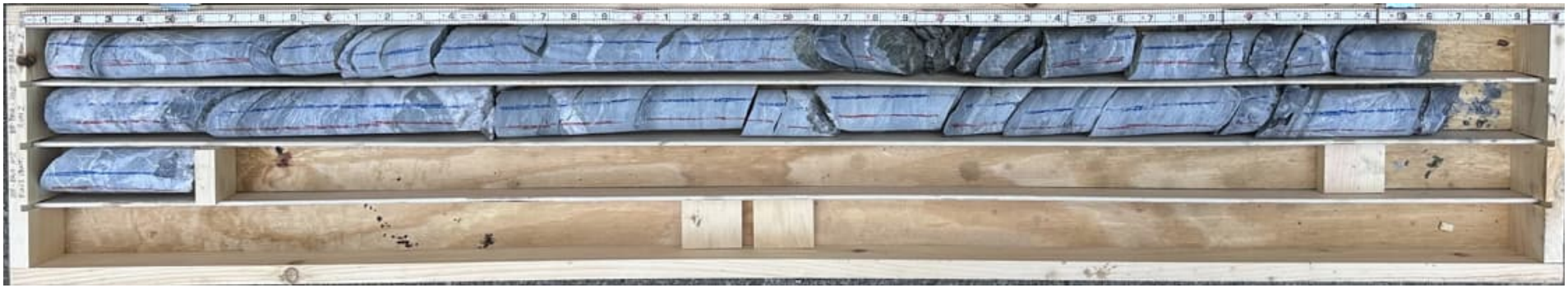
Boring	Run	Depth Below Surface (Feet)			Recovery (Feet)			Recovery (%)	RQD (Feet)			RQD (%)	Rock Type	Box Row	Date Cored
BB-BKA-101	R3	34.5	-	36.5	2.0	-	2.0	100	0.3	-	2.0	17	Metawacke	Row 1	5/6/2024
	R4	36.5	-	38.5	2.0	-	2.0	100	0.0	-	2.0	0	Metawacke	Row 1	5/6/2024

Notes:
1. "Box row" indicates the section of the box where the core is contained: 1 = top, 4 = bottom.
2. Top of each core run is on the left and increases with depth to the right.

Prepared By: RJN
Checked By: DEB
Reviewed By: JDL

APPENDIX B
ROCK CORE PHOTOGRAPHS
BRIDGE #5798, KENDUSKEAG AVENUE OVER INTERSTATE 95
BANGOR, MAINE
MAINEDOT WIN 026095.00

Boring	Run	Depth Below Surface Feet			Recovery Feet			Recovery %	RQD Feet			RQD %	Rock Type	Box Row	Date Cored
BB-BKA-102	R1	6.7	-	11.7	4.7	-	5.0	94	0.5	-	5.0	10	Metawacke	Row 1	8/1/2024
	R2	11.7	-	16.3	5.2	-	4.6	100	2.0	-	4.6	43	Metawacke	Row 2 & 3	8/1/2024



Notes:
1. "Box row" indicates the section of the box where the core is contained: 1 = top, 4 = bottom.
2. Top of each core run is on the left and increases with depth to the right.

Prepared By: RJN
Checked By: DEB
Reviewed By: JDL

APPENDIX C

Laboratory Test Results

Client:	WSP USA, Inc.				
Project:	MaineDOT I-95 Bridge Kenduskeag				
Location:	Bangor, ME			Project No:	GTX-319187
Boring ID:	---	Sample Type:	---	Tested By:	ajl
Sample ID:	---	Test Date:	06/05/24	Checked By:	ank
Depth :	---	Test Id:	771742		

Moisture Content of Soil and Rock - ASTM D2216

Boring ID	Sample ID	Depth	Description	Moisture Content,%
BB-BKA-101	1D	5-7ft	Moist, olive brown silty sand with gravel	5.9
BB-BKA-101	4D	20-22ft	Moist, sandy silty gravel with sand	9.6
BB-BKA-103	4D	15-16.7ft	Moist, olive brown silty sand with gravel	6.3
BB-BKA-103	8D	35-37ft	Moist, olive brown silty sand with gravel	10.1

Notes: Temperature of Drying : 110º Celsius

Client:	WSP USA, Inc.				
Project:	MaineDOT I-95 Bridge Kenduskeag				
Location:	Bangor, ME			Project No:	GTX-319187
Boring ID:	BB-BKA-103	Sample Type:	Jar	Tested By:	ajl
Sample ID:	1D	Test Date:	06/05/24	Checked By:	ank
Depth :	0.5-2.5ft	Test Id:	771743		
Test Comment:	---				
Visual Description:	Moist, light brown gravelly silt				
Sample Comment:	---				

pH of Soil by ASTM D4972

Boring ID	Sample ID	Depth	Visual Description	pH of Soil in Distilled Water	pH of Soil in Calcium Chloride
BB-BKA-103	1D	0.5-2.5ft	Moist, light brown gravelly silt	8.7	7.7

Notes: Sample Preparation: screened through #10 sieve

Method A, pH meter used

Client:	WSP USA, Inc.
Project:	Maine DOT I-95 Bridge Kenduskeag
Location:	Bangor, ME
GTX#:	319187
Test Date:	06/06/24
Due Date:	06/13/24
Tested By:	NMK
Checked By:	ank

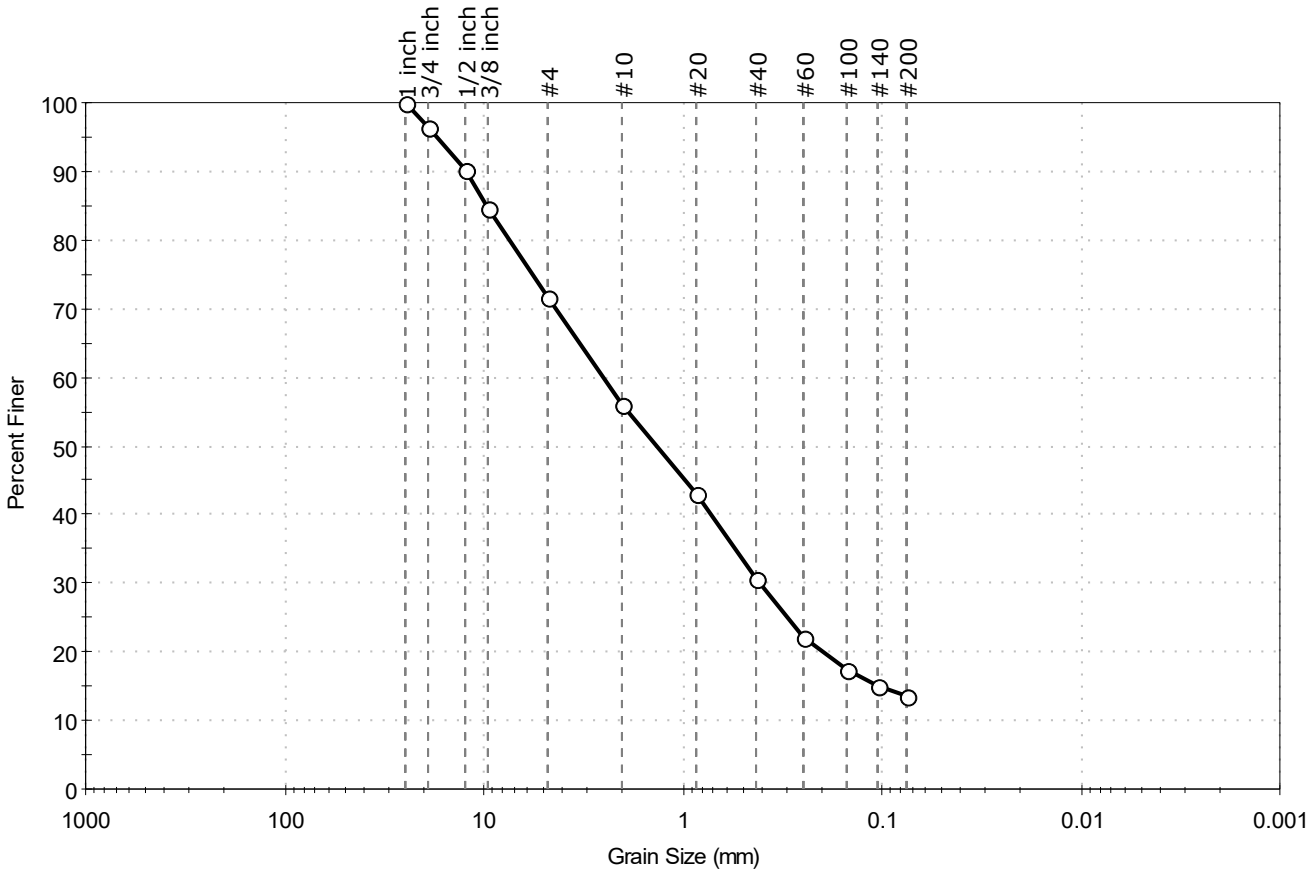
Laboratory Measurement of Soil Resistivity Using the Wenner Four-Electrode Method by ASTM G57 (Laboratory Measurement)

Boring ID	Sample ID	Depth, ft.	Sample Description	Electrical Resistivity, ohm-cm	Electrical Conductivity, $(ohm\text{-}cm)^{-1}$
BB-BKA-103	1D	0.5-2.5 ft	Moist, light brown gravelly silt	1,102	9.07E-04

Notes: Test Equipment: Nilsson Model 400 Soil Resistance Meter, MC Miller Soil Box
Water added to sample to create a thick slurry prior to testing (saturated condition).
Electrical Conductivity is calculated as inverse of Electrical Resistivity (per ASTM G57)
Test conducted in standard laboratory atmosphere: 68-73 F

Client:	WSP USA, Inc.				
Project:	MaineDOT I-95 Bridge Kenduskeag				
Location:	Bangor, ME			Project No:	GTX-319187
Boring ID:	BB-BKA-101	Sample Type:	Jar	Tested By:	ajl
Sample ID:	1D	Test Date:	06/10/24	Checked By:	ank
Depth :	5-7ft	Test Id:	771732		
Test Comment:	---				
Visual Description:	Moist, olive brown silty sand with gravel				
Sample Comment:	---				

Particle Size Analysis - ASTM D6913



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	28.2	58.2	13.6

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
1 inch	25.00	100		
3/4 inch	19.00	96		
1/2 inch	12.50	90		
3/8 inch	9.50	85		
#4	4.75	72		
#10	2.00	56		
#20	0.85	43		
#40	0.42	31		
#60	0.25	22		
#100	0.15	17		
#140	0.11	15		
#200	0.075	14		

Coefficients

D_{85} = 9.7030 mm	D_{30} = 0.4096 mm
D_{60} = 2.4790 mm	D_{15} = 0.1036 mm
D_{50} = 1.3432 mm	D_{10} = N/A
C_u = N/A	C_c = N/A

Classification

ASTM N/A

AASHTO Stone Fragments, Gravel and Sand (A-1-b (0))

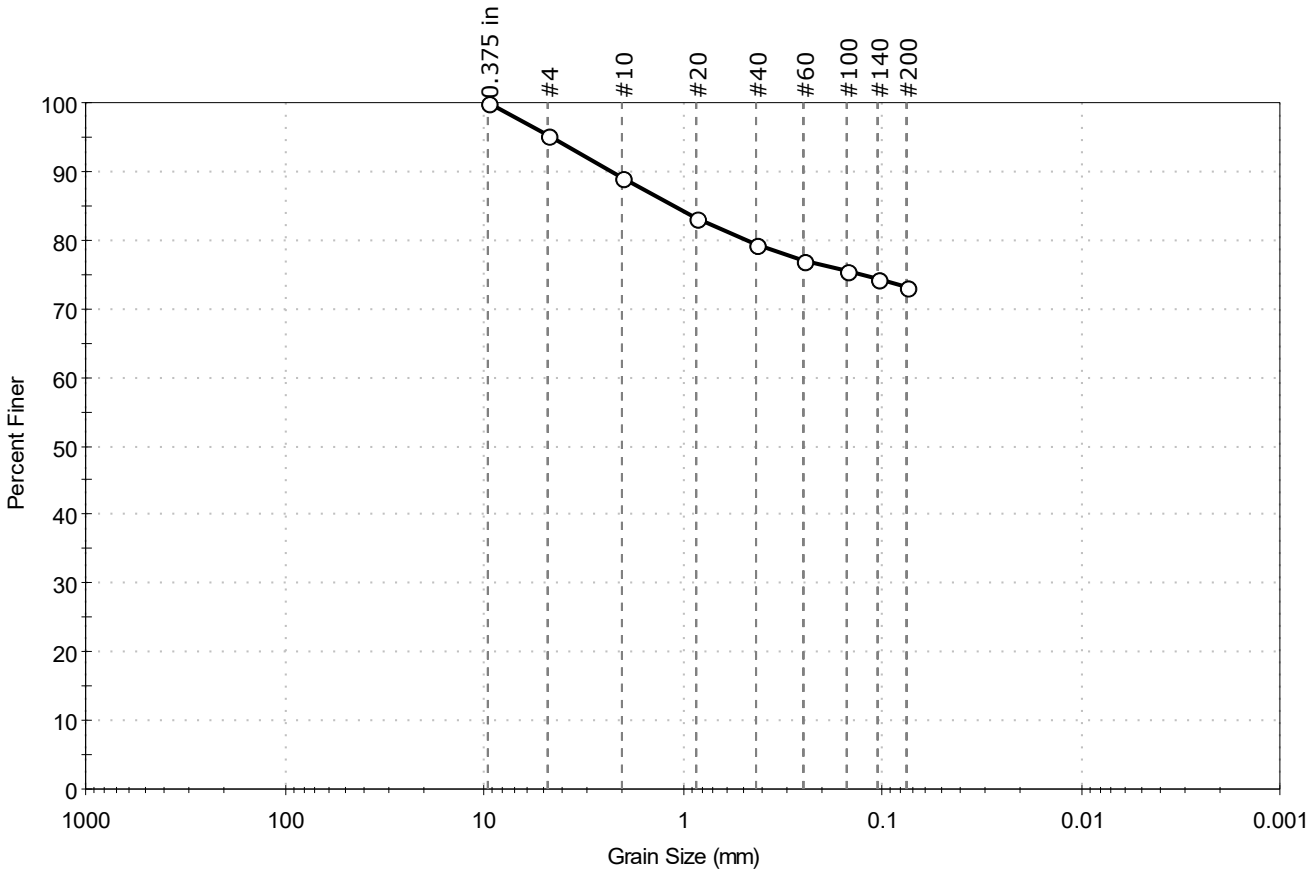
Sample/Test Description

Sand/Gravel Particle Shape : ANGULAR

Sand/Gravel Hardness : HARD

Client:	WSP USA, Inc.				
Project:	MaineDOT I-95 Bridge Kenduskeag				
Location:	Bangor, ME			Project No:	GTX-319187
Boring ID:	BB-BKA-101	Sample Type:	Jar	Tested By:	ajl
Sample ID:	2DB	Test Date:	06/10/24	Checked By:	ank
Depth :	10-12ft	Test Id:	771733		
Test Comment:	---				
Visual Description:	Moist, brown clay with sand				
Sample Comment:	---				

Particle Size Analysis - ASTM D6913



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	4.7	22.2	73.1

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
0.375 in	9.50	100		
#4	4.75	95		
#10	2.00	89		
#20	0.85	83		
#40	0.42	79		
#60	0.25	77		
#100	0.15	75		
#140	0.11	74		
#200	0.075	73		

Coefficients

D_{85} = 1.0979 mm	D_{30} = N/A
D_{60} = N/A	D_{15} = N/A
D_{50} = N/A	D_{10} = N/A
C_u = N/A	C_c = N/A

Classification

ASTM Lean CLAY with Sand (CL)

AASHTO Silty Soils (A-4 (5))

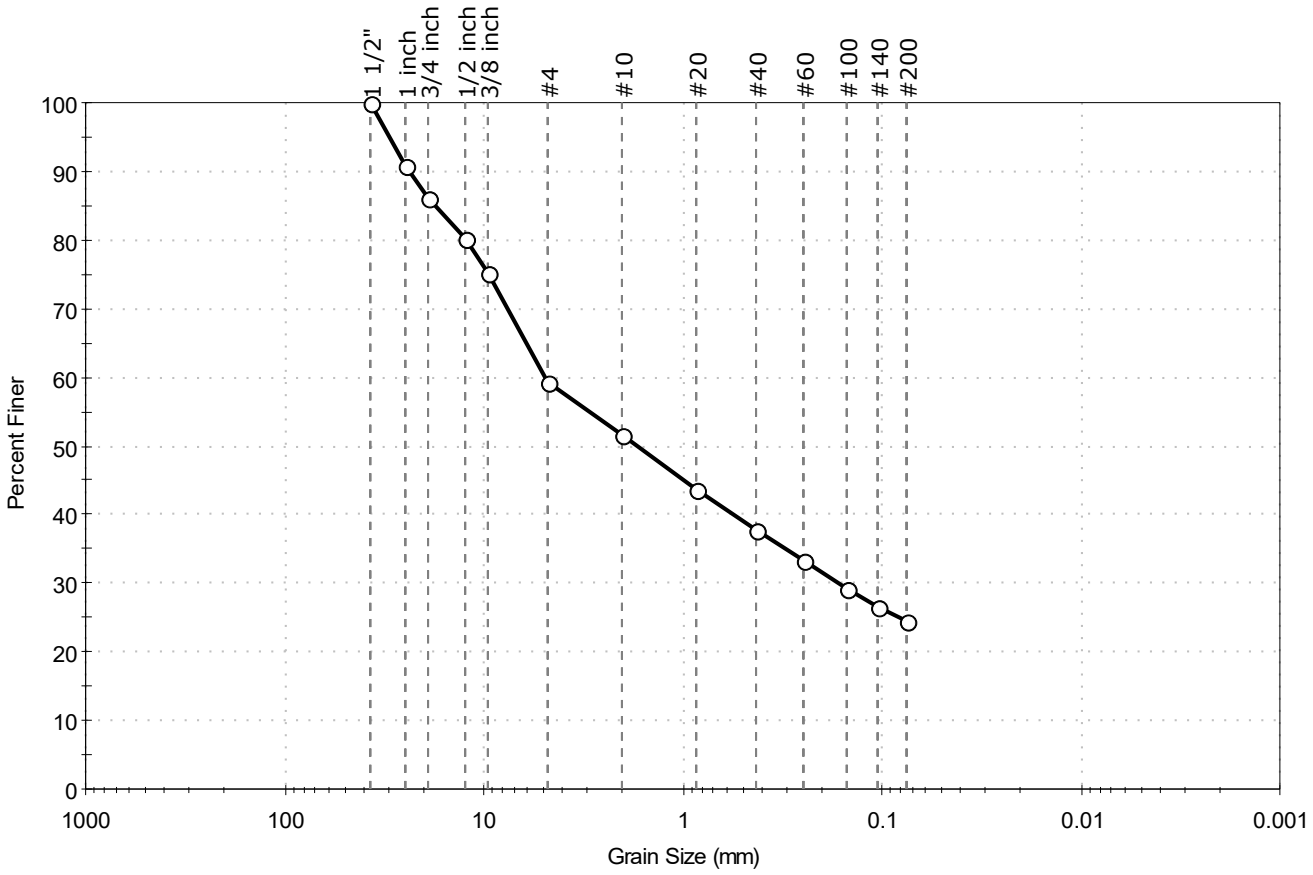
Sample/Test Description

Sand/Gravel Particle Shape : ANGULAR

Sand/Gravel Hardness : HARD

Client:	WSP USA, Inc.				
Project:	MaineDOT I-95 Bridge Kenduskeag				
Location:	Bangor, ME			Project No:	GTX-319187
Boring ID:	BB-BKA-101	Sample Type:	Jar	Tested By:	ajl
Sample ID:	4D	Test Date:	06/10/24	Checked By:	ank
Depth :	20-22ft	Test Id:	771734		
Test Comment:	---				
Visual Description:	Moist, sandy silty gravel with sand				
Sample Comment:	---				

Particle Size Analysis - ASTM D6913



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	40.7	34.8	24.5

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
1 1/2"	37.50	100		
1 inch	25.00	91		
3/4 inch	19.00	86		
1/2 inch	12.50	80		
3/8 inch	9.50	75		
#4	4.75	59		
#10	2.00	52		
#20	0.85	44		
#40	0.42	38		
#60	0.25	33		
#100	0.15	29		
#140	0.11	26		
#200	0.075	24		

Coefficients

D_{85} = 17.4405 mm	D_{30} = 0.1646 mm
D_{60} = 4.8952 mm	D_{15} = N/A
D_{50} = 1.6797 mm	D_{10} = N/A
C_u = N/A	C_c = N/A

Classification

ASTM N/A

AASHTO Stone Fragments, Gravel and Sand (A-1-b (0))

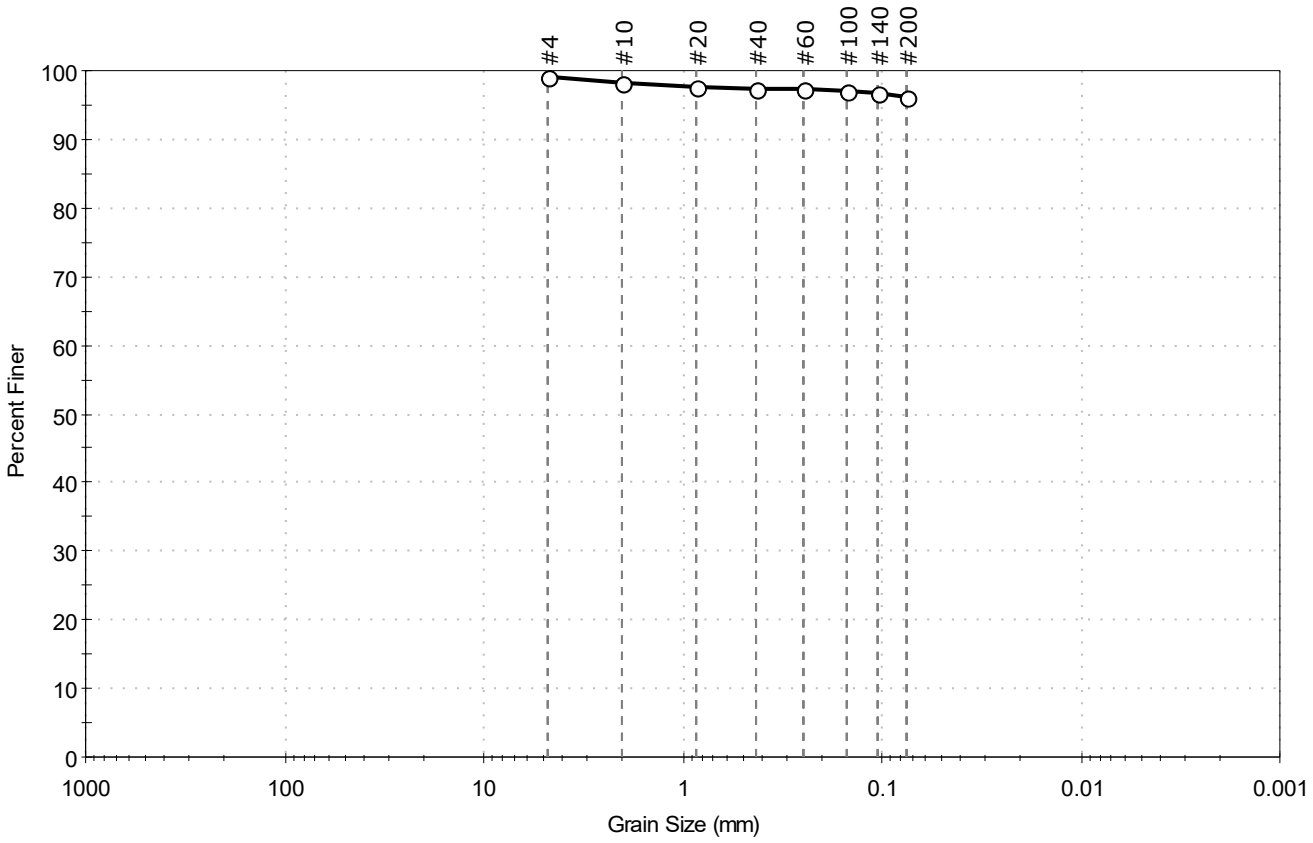
Sample/Test Description

Sand/Gravel Particle Shape : ANGULAR

Sand/Gravel Hardness : HARD

Client:	WSP USA, Inc.				
Project:	MaineDOT I-95 Bridge Kenduskeag				
Location:	Bangor, ME			Project No:	GTX-319187
Boring ID:	BB-BKA-103	Sample Type:	Jar	Tested By:	ajl
Sample ID:	3DB	Test Date:	06/10/24	Checked By:	ank
Depth :	10-11.7ft	Test Id:	771735		
Test Comment:	---				
Visual Description:	Moist, grayish brown clay				
Sample Comment:	---				

Particle Size Analysis - ASTM D6913



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	0.8	3.0	96.2

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
#4	4.75	99		
#10	2.00	98		
#20	0.85	98		
#40	0.42	97		
#60	0.25	97		
#100	0.15	97		
#140	0.11	97		
#200	0.075	96		

Coefficients

D_{85} =N/A	D_{30} =N/A
D_{60} =N/A	D_{15} =N/A
D_{50} =N/A	D_{10} =N/A
C_u =N/A	C_c =N/A

Classification

ASTM Lean CLAY (CL)

AASHTO Clayey Soils (A-6 (13))

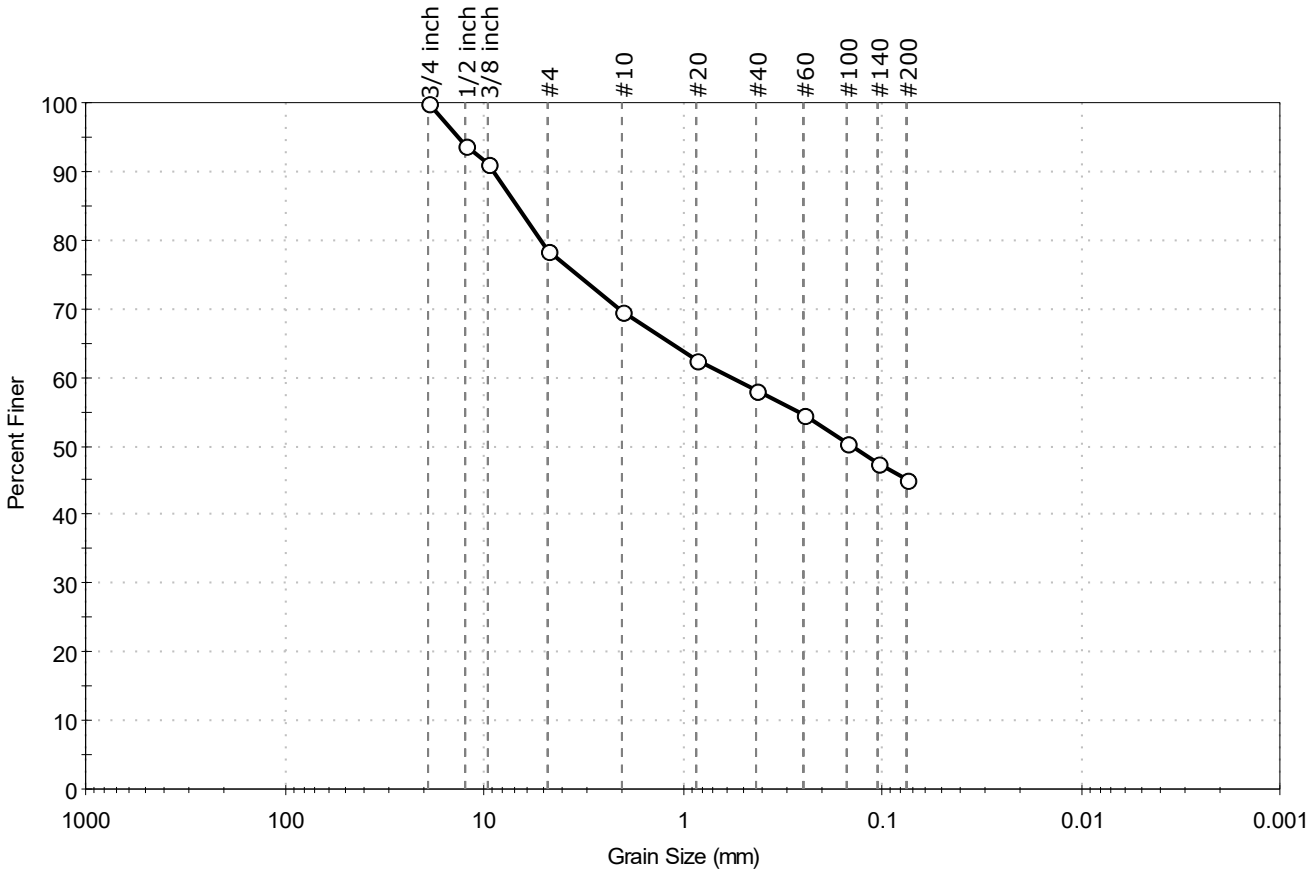
Sample/Test Description

Sand/Gravel Particle Shape : ---

Sand/Gravel Hardness : ---

Client:	WSP USA, Inc.				
Project:	MaineDOT I-95 Bridge Kenduskeag				
Location:	Bangor, ME			Project No:	GTX-319187
Boring ID:	BB-BKA-103	Sample Type:	Jar	Tested By:	ajl
Sample ID:	4D	Test Date:	06/10/24	Checked By:	ank
Depth :	15-16.7ft	Test Id:	771736		
Test Comment:	---				
Visual Description:	Moist, olive brown silty sand with gravel				
Sample Comment:	---				

Particle Size Analysis - ASTM D6913



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	21.6	33.3	45.1

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
3/4 inch	19.00	100		
1/2 inch	12.50	94		
3/8 inch	9.50	91		
#4	4.75	78		
#10	2.00	69		
#20	0.85	63		
#40	0.42	58		
#60	0.25	55		
#100	0.15	51		
#140	0.11	47		
#200	0.075	45		

Coefficients

D_{85} = 6.7781 mm D_{30} = N/A

D_{60} = 0.5678 mm D_{15} = N/A

D_{50} = 0.1417 mm D_{10} = N/A

C_u = N/A C_c = N/A

Classification

ASTM N/A

AASHTO Silty Soils (A-4 (0))

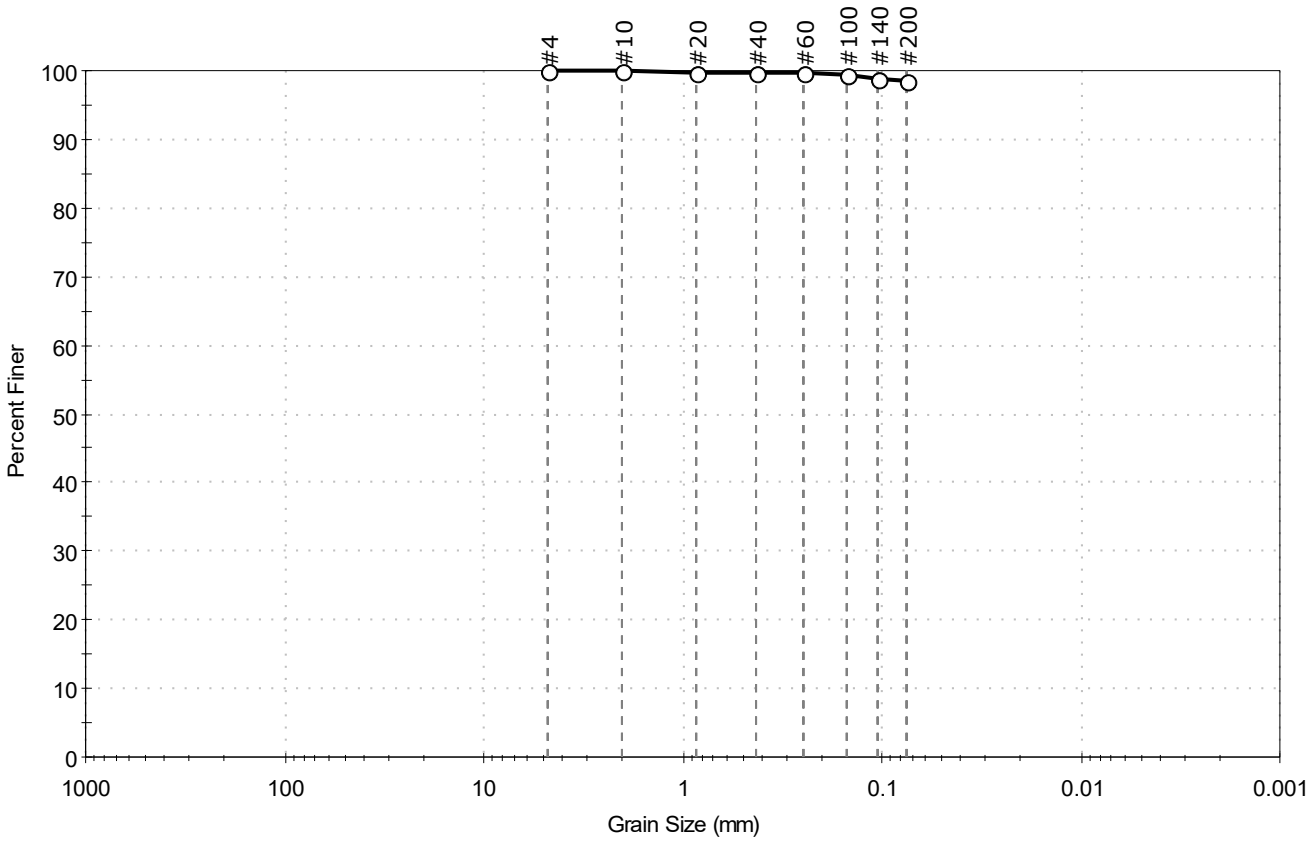
Sample/Test Description

Sand/Gravel Particle Shape : ANGULAR

Sand/Gravel Hardness : HARD

Client:	WSP USA, Inc.				
Project:	MaineDOT I-95 Bridge Kenduskeag				
Location:	Bangor, ME			Project No:	GTX-319187
Boring ID:	BB-BKA-103	Sample Type:	Jar	Tested By:	ajl
Sample ID:	5D	Test Date:	06/10/24	Checked By:	ank
Depth :	20-22ft	Test Id:	771737		
Test Comment:	---				
Visual Description:	Moist, grayish brown clay				
Sample Comment:	---				

Particle Size Analysis - ASTM D6913



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	0.0	1.6	98.4

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
#4	4.75	100		
#10	2.00	100		
#20	0.85	100		
#40	0.42	100		
#60	0.25	100		
#100	0.15	99		
#140	0.11	99		
#200	0.075	98		

Coefficients

D_{85} = N/A	D_{30} = N/A
D_{60} = N/A	D_{15} = N/A
D_{50} = N/A	D_{10} = N/A
C_u = N/A	C_c = N/A

Classification

ASTM Lean CLAY (CL)

AASHTO Clayey Soils (A-6 (17))

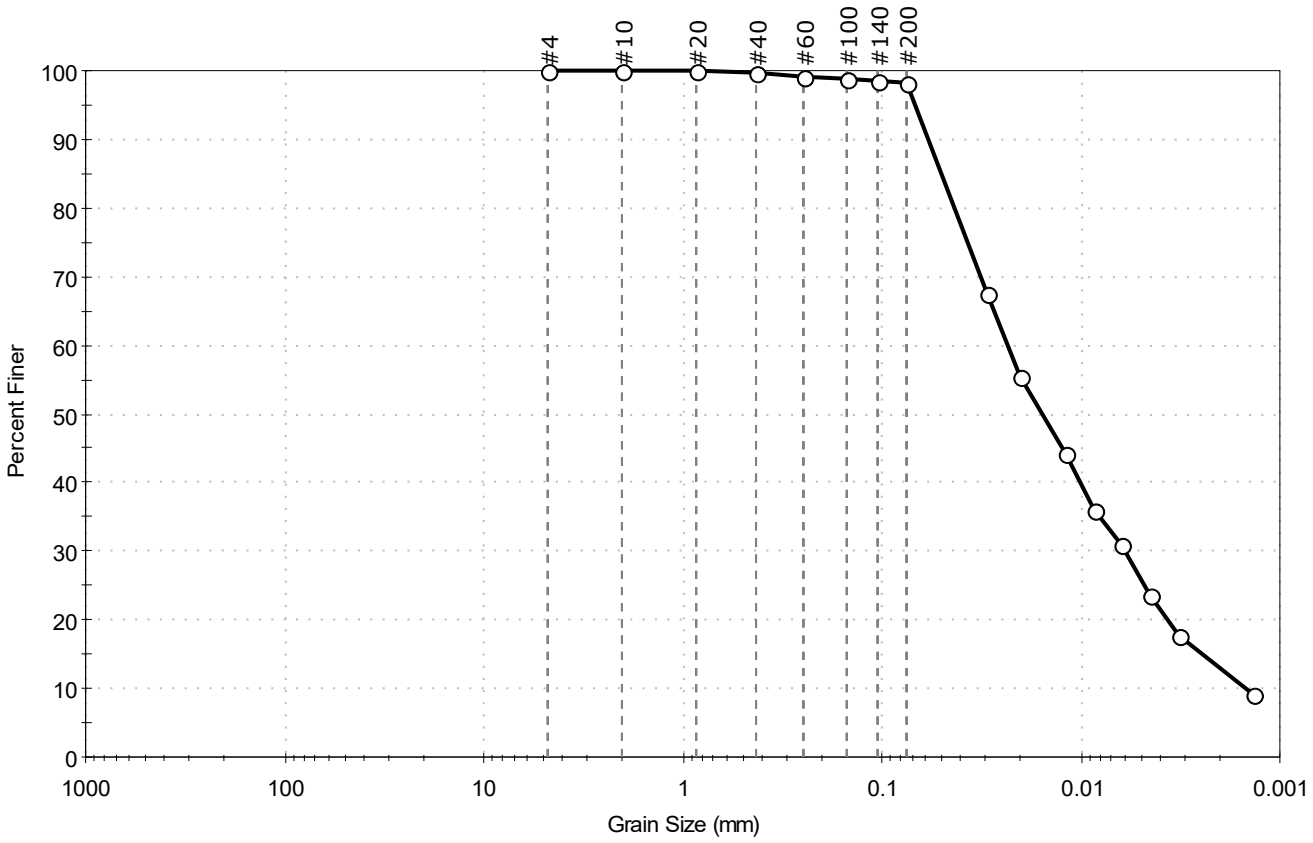
Sample/Test Description

Sand/Gravel Particle Shape : ---

Sand/Gravel Hardness : ---

Client:	WSP USA, Inc.				
Project:	MaineDOT I-95 Bridge Kenduskeag				
Location:	Bangor, ME			Project No:	GTX-319187
Boring ID:	BB-BKA-103	Sample Type:	Jar	Tested By:	ajl
Sample ID:	6D	Test Date:	06/07/24	Checked By:	ank
Depth :	25-27ft	Test Id:	771747		
Test Comment:	---				
Visual Description:	Moist, light olive brown clay				
Sample Comment:	---				

Particle Size Analysis - ASTM D6913/D7928



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	0.0	1.9	98.1

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
#4	4.75	100		
#10	2.00	100		
#20	0.85	100		
#40	0.42	100		
#60	0.25	99		
#100	0.15	99		
#140	0.11	99		
#200	0.075	98		
Hydrometer	Particle Size (mm)	Percent Finer	Spec. Percent	Complies
---	0.0295	67		
---	0.0204	55		
---	0.0121	44		
---	0.0087	36		
---	0.0062	31		
---	0.0045	24		
---	0.0032	18		
---	0.0014	9		

Coefficients

D_{85} =0.0503 mm	D_{30} =0.0060 mm
D_{60} =0.0235 mm	D_{15} =0.0025 mm
D_{50} =0.0158 mm	D_{10} =0.0015 mm
C_u =15.667	C_c =1.021

Classification

ASTM Lean CLAY (CL)

AASHTO Clayey Soils (A-6 (12))

Sample/Test Description

Sand/Gravel Particle Shape : ---

Sand/Gravel Hardness : ---

Dispersion Device : Apparatus A - Mech Mixer

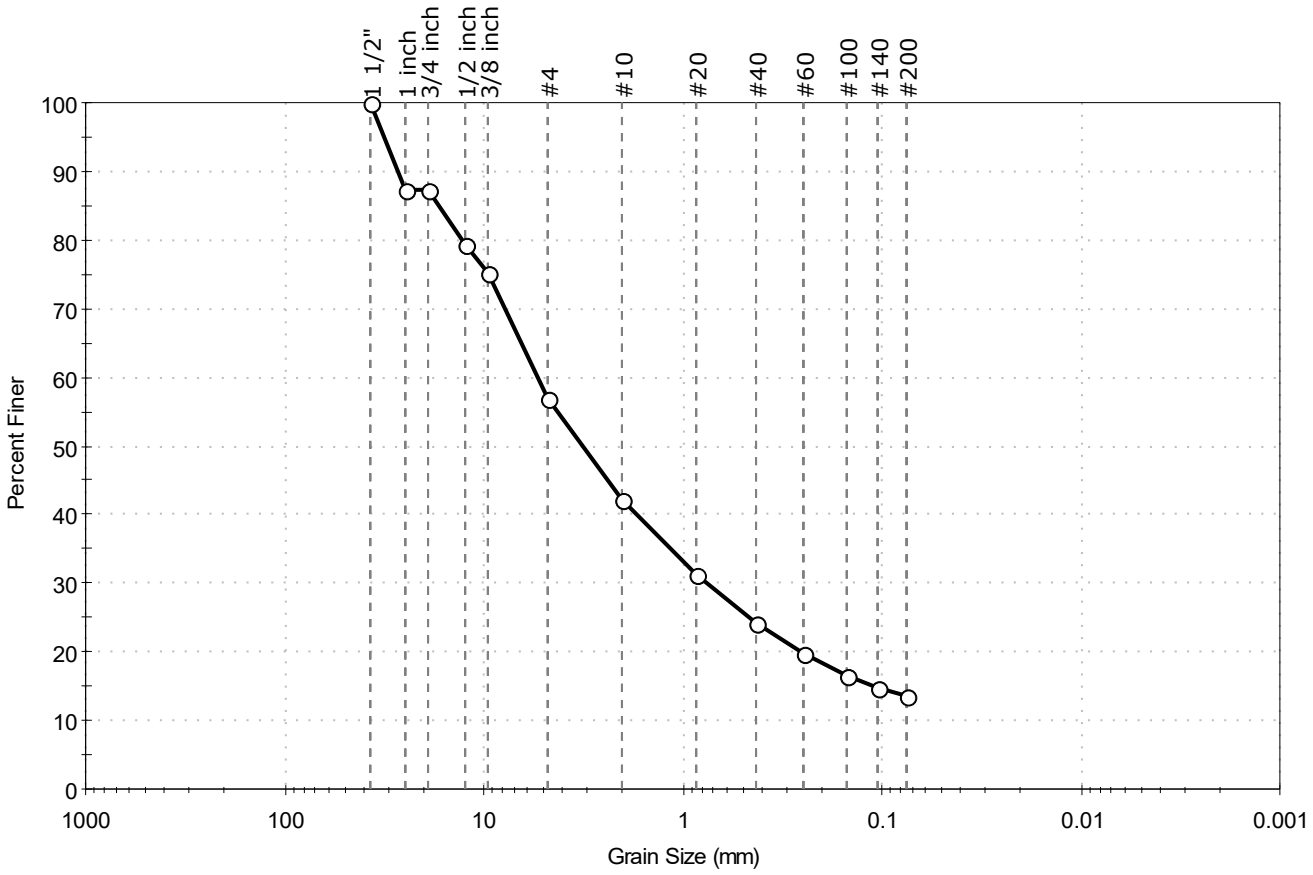
Dispersion Period : 1 minute

Est. Specific Gravity : 2.65

Separation of Sample: #200 Sieve

Client:	WSP USA, Inc.				
Project:	MaineDOT I-95 Bridge Kenduskeag				
Location:	Bangor, ME			Project No:	GTX-319187
Boring ID:	BB-BKA-103	Sample Type:	Jar	Tested By:	ajl
Sample ID:	8D	Test Date:	06/10/24	Checked By:	ank
Depth :	35-37ft	Test Id:	771738		
Test Comment:	---				
Visual Description:	Moist, olive brown silty sand with gravel				
Sample Comment:	---				

Particle Size Analysis - ASTM D6913



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	43.0	43.3	13.7

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
1 1/2"	37.50	100		
1 inch	25.00	87		
3/4 inch	19.00	87		
1/2 inch	12.50	79		
3/8 inch	9.50	75		
#4	4.75	57		
#10	2.00	42		
#20	0.85	31		
#40	0.42	24		
#60	0.25	20		
#100	0.15	17		
#140	0.11	15		
#200	0.075	14		

Coefficients

D_{85} = 16.8663 mm
D_{30} = 0.7520 mm
D_{60} = 5.3215 mm
D_{15} = 0.1084 mm
D_{50} = 3.1425 mm
D_{10} = N/A
C_u = N/A
C_c = N/A

Classification

ASTM N/A

AASHTO Stone Fragments, Gravel and Sand (A-1-a (0))

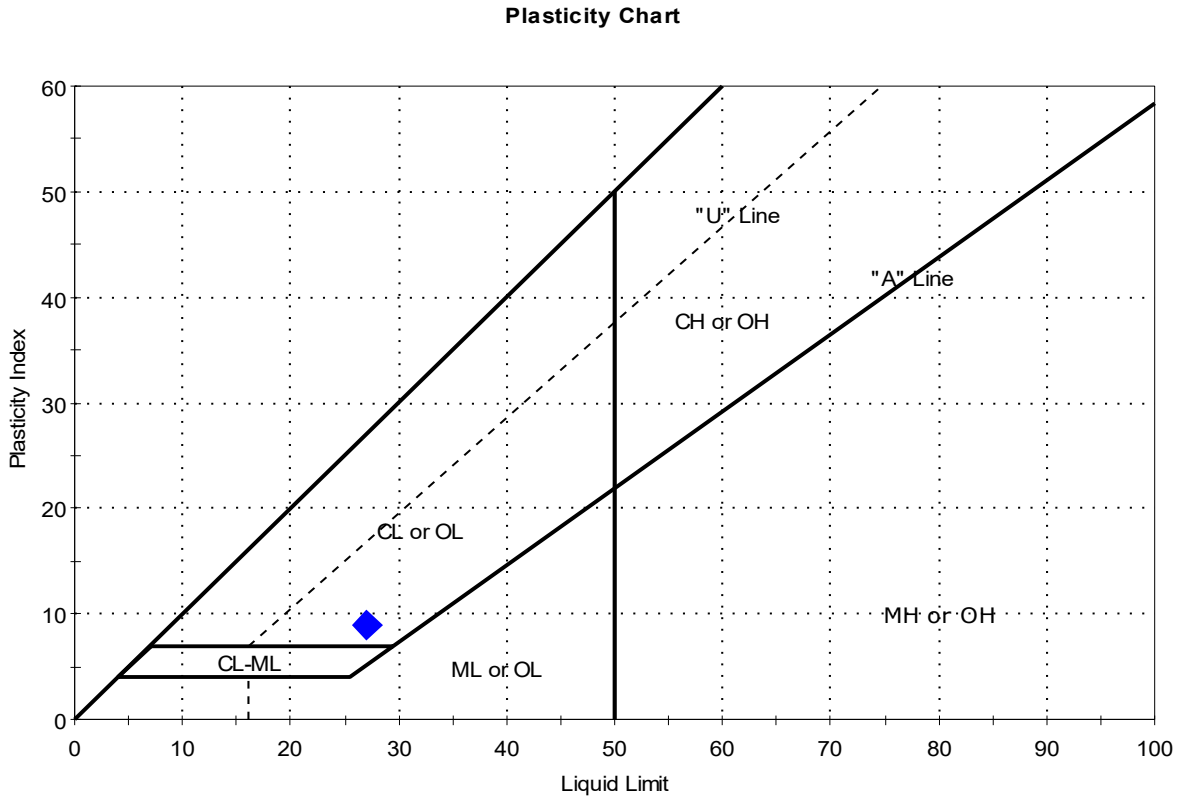
Sample/Test Description

Sand/Gravel Particle Shape : ANGULAR

Sand/Gravel Hardness : HARD

Client:	WSP USA, Inc.				
Project:	MaineDOT I-95 Bridge Kenduskeag				
Location:	Bangor, ME			Project No:	GTX-319187
Boring ID:	BB-BKA-101	Sample Type:	Jar	Tested By:	cam
Sample ID:	2DB	Test Date:	06/11/24	Checked By:	ank
Depth :	10-12ft	Test Id:	771728		
Test Comment:	---				
Visual Description:	Moist, brown clay with sand				
Sample Comment:	---				

Atterberg Limits - ASTM D4318

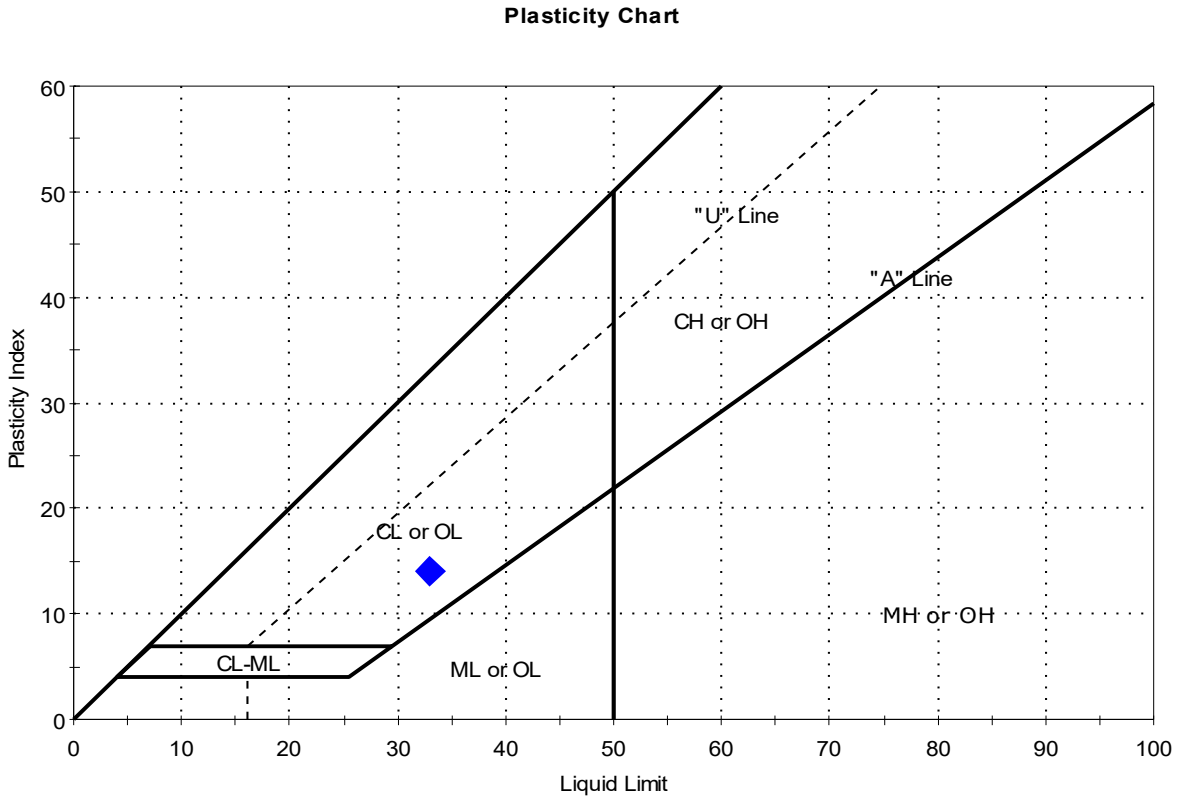


Symbol	Sample ID	Boring	Depth	Natural Moisture Content,%	Liquid Limit	Plastic Limit	Plasticity Index	Liquidity Index	Soil Classification
◆	2DB	B-BKA-10	10-12ft	20	27	18	9	0.2	Lean CLAY with Sand (CL)

Sample Prepared using the WET method
21% Retained on #40 Sieve
Dry Strength: VERY HIGH
Dilatancy: SLOW
Toughness: LOW

Client:	WSP USA, Inc.				
Project:	MaineDOT I-95 Bridge Kenduskeag				
Location:	Bangor, ME			Project No:	GTX-319187
Boring ID:	BB-BKA-103	Sample Type:	Jar	Tested By:	cam
Sample ID:	3DB	Test Date:	06/07/24	Checked By:	ank
Depth :	10-11.7ft	Test Id:	771729		
Test Comment:	---				
Visual Description:	Moist, grayish brown clay				
Sample Comment:	---				

Atterberg Limits - ASTM D4318

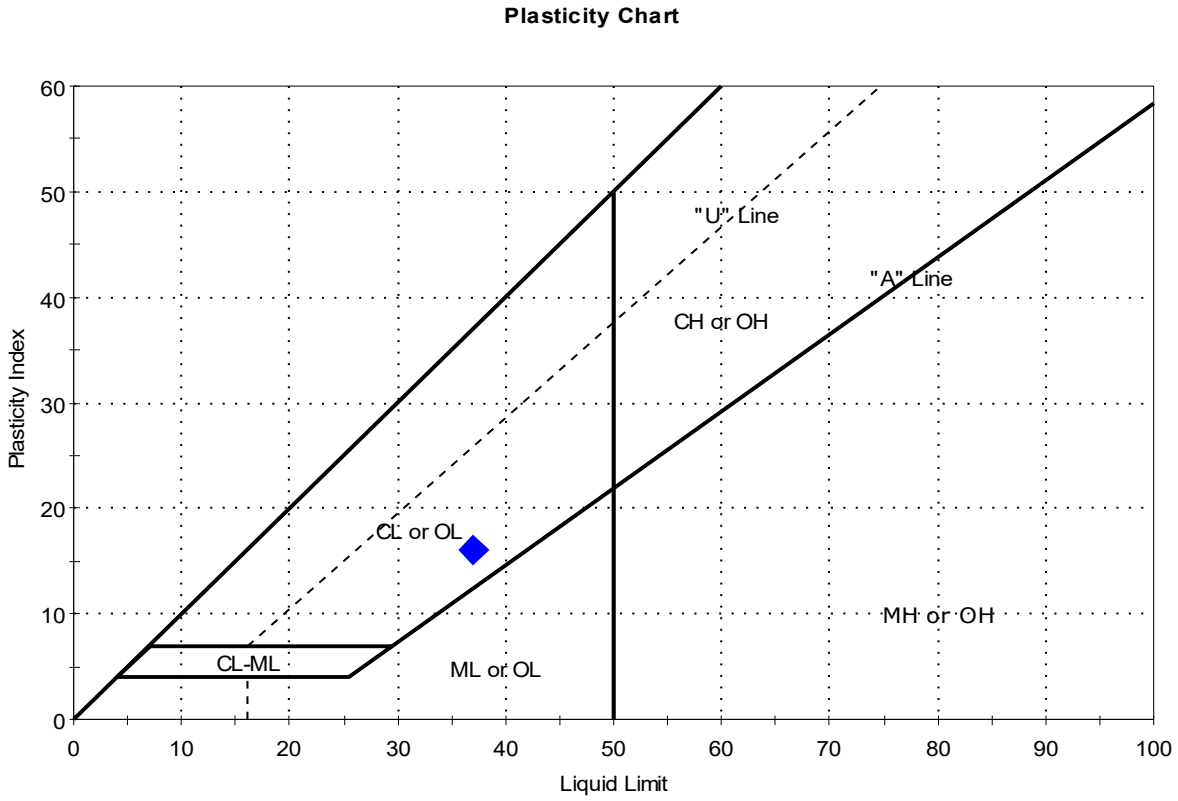


Symbol	Sample ID	Boring	Depth	Natural Moisture Content,%	Liquid Limit	Plastic Limit	Plasticity Index	Liquidity Index	Soil Classification
◆	3DB	B-BKA-10	10-11.7ft	25	33	19	14	0.4	Lean CLAY (CL)

Sample Prepared using the WET method
3% Retained on #40 Sieve
Dry Strength: VERY HIGH
Dilatancy: SLOW
Toughness: LOW

Client:	WSP USA, Inc.				
Project:	MaineDOT I-95 Bridge Kenduskeag				
Location:	Bangor, ME			Project No:	GTX-319187
Boring ID:	BB-BKA-103	Sample Type:	Jar	Tested By:	cam
Sample ID:	5D	Test Date:	06/07/24	Checked By:	ank
Depth :	20-22ft	Test Id:	771730		
Test Comment:	---				
Visual Description:	Moist, grayish brown clay				
Sample Comment:	---				

Atterberg Limits - ASTM D4318

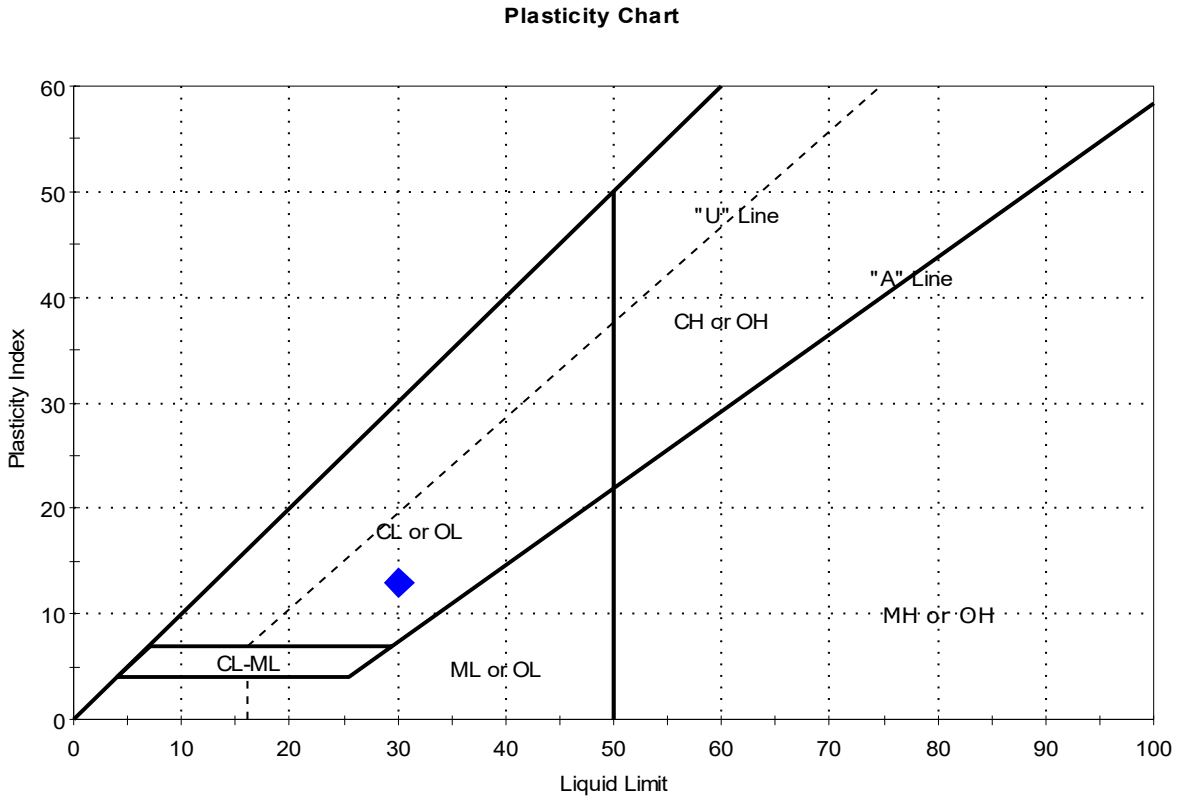


Symbol	Sample ID	Boring	Depth	Natural Moisture Content,%	Liquid Limit	Plastic Limit	Plasticity Index	Liquidity Index	Soil Classification
◆	5D	B-BKA-10	20-22ft	22	37	21	16	0	Lean CLAY (CL)

Sample Prepared using the WET method
0% Retained on #40 Sieve
Dry Strength: VERY HIGH
Dilatancy: SLOW
Toughness: LOW

Client:	WSP USA, Inc.				
Project:	MaineDOT I-95 Bridge Kenduskeag				
Location:	Bangor, ME			Project No:	GTX-319187
Boring ID:	BB-BKA-103	Sample Type:	Jar	Tested By:	cam
Sample ID:	6D	Test Date:	06/10/24	Checked By:	ank
Depth :	25-27ft	Test Id:	771731		
Test Comment:	---				
Visual Description:	Moist, light olive brown clay				
Sample Comment:	---				

Atterberg Limits - ASTM D4318



Symbol	Sample ID	Boring	Depth	Natural Moisture Content,%	Liquid Limit	Plastic Limit	Plasticity Index	Liquidity Index	Soil Classification
◆	6D	B-BKA-10	25-27ft	27	30	17	13	0.8	Lean CLAY (CL)

Sample Prepared using the WET method
0% Retained on #40 Sieve
Dry Strength: VERY HIGH
Dilatancy: SLOW
Toughness: LOW

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GEOTESTING EXPRESS INCORPORATED
125 NAGOG PARK
ACTON MA 01720-3451
USA

Analysis No.	TS-A2411934
Report Date	07 June 2024
Date Sampled	31 May 2024
Date Received	04 June 2024
Where Sampled	Acton, MA USA
Sampled By	Client

This is to attest that we have examined: Soil: Project: Maine DOT I-95 Bridge Kenduskeag; Site Location: - — -; Job Number: GTX-319187

When examined to the applicable requirements of:

AASHTO T 291-18	"Standard Method of Test for Determining Water-Soluble Chloride Ion Content in Soil" Method B
AASHTO T 290-20	"Standard Method of Test for Determining Water-Soluble Sulfate Ion Content in Soil"

Results:

AASHTO T 291 – Chloride (Method B)

Sample		Results		Minimum Detection Limit
		ppm (mg/kg)	%[1]	
BB-BKA-103		310.	0.0310	10.
1D	0.5 – 2.5'			

NOTE: [1]Percent by weight after drying and prepared as per the Standard.

AASHTO T 290 – Sulfates (Soluble)

Sample		Results		Minimum Detection Limit
		ppm (mg/kg)	%[1]	
BB-BKA-103		50.	0.0050	10.
1D	0.5 – 2.5'			

NOTE: [1]Percent by weight after drying and prepared as per the Standard.

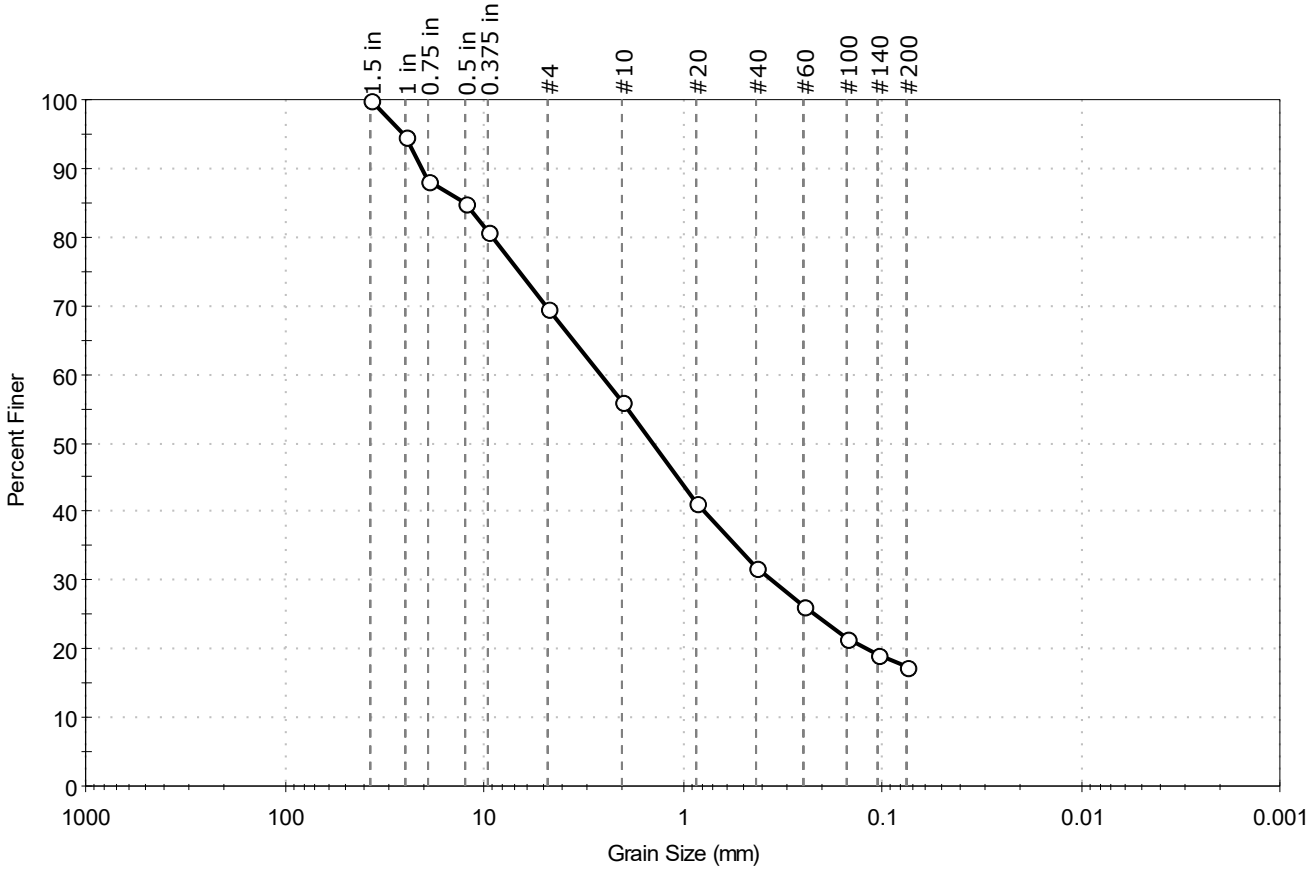
END OF ANALYSIS

USEPA Laboratory ID UT00930

Merrill Gee P.E. – Engineer in Charge

Client:	WSP USA, Inc.				
Project:	MaineDOT I-95 Bridge Kenduskeag				
Location:	Bangor, ME			Project No:	GTX-319187
Boring ID:	BB-BKA-102	Sample Type:	Jar	Tested By:	ajl
Sample ID:	1D	Test Date:	08/13/24	Checked By:	ank
Depth :	1.5-3.5 ft	Test Id:	780363		
Test Comment:	---				
Visual Description:	Moist, brown silty sand with gravel				
Sample Comment:	---				

Particle Size Analysis - ASTM D6913



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	30.4	52.2	17.4

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
1.5 in	37.50	100		
1 in	25.00	95		
0.75 in	19.00	88		
0.5 in	12.50	85		
0.375 in	9.50	81		
#4	4.75	70		
#10	2.00	56		
#20	0.85	41		
#40	0.42	32		
#60	0.25	26		
#100	0.15	21		
#140	0.11	19		
#200	0.075	17		

Coefficients

D_{85} = 12.4837 mm	D_{30} = 0.3592 mm
D_{60} = 2.5590 mm	D_{15} = N/A
D_{50} = 1.4000 mm	D_{10} = N/A
C_u = N/A	C_c = N/A

Classification

ASTM N/A

AASHTO Stone Fragments, Gravel and Sand (A-1-b (0))

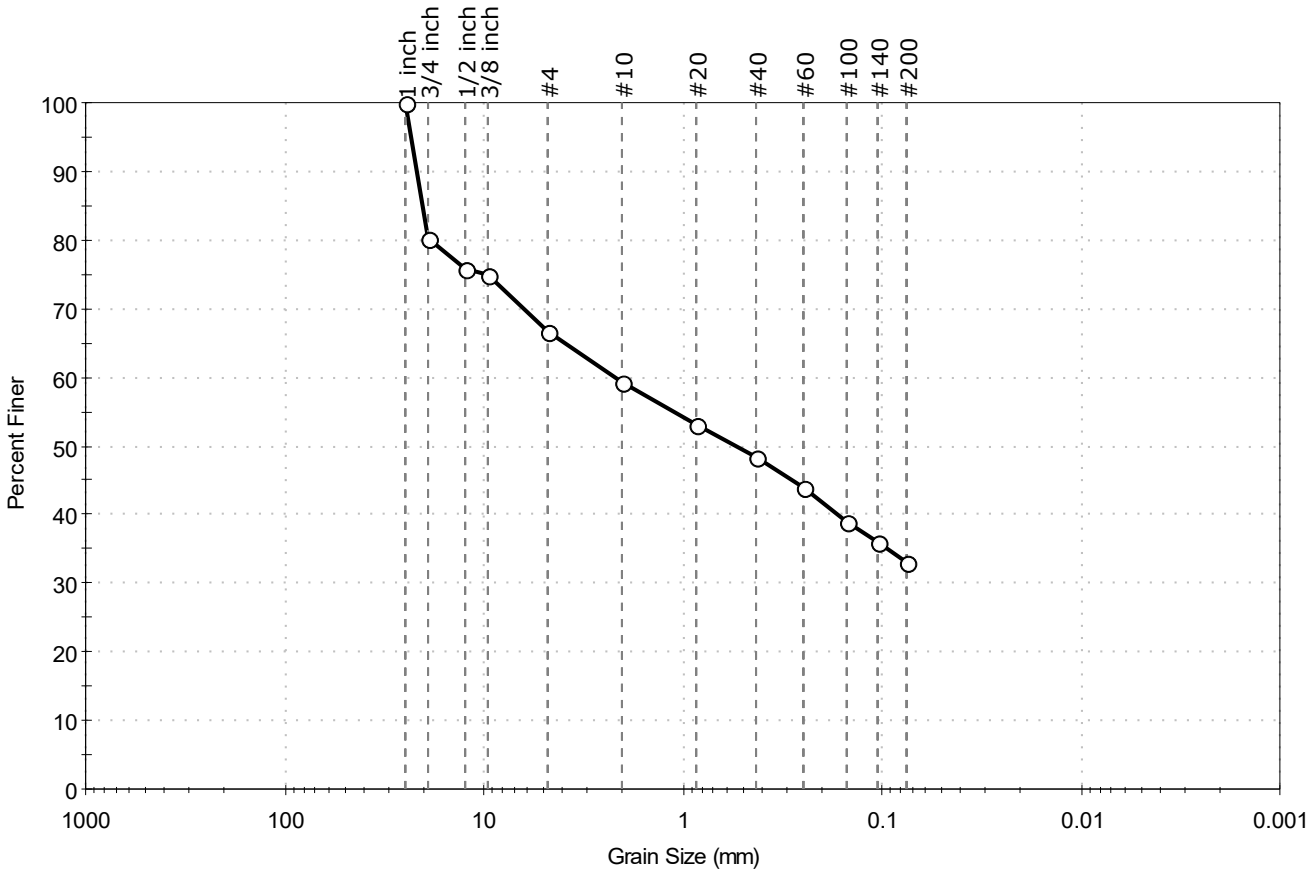
Sample/Test Description

Sand/Gravel Particle Shape : ANGULAR

Sand/Gravel Hardness : HARD

Client:	WSP USA, Inc.				
Project:	MaineDOT I-95 Bridge Kenduskeag				
Location:	Bangor, ME			Project No:	GTX-319187
Boring ID:	BB-BKA-102	Sample Type:	Jar	Tested By:	ajl
Sample ID:	2D	Test Date:	08/12/24	Checked By:	ank
Depth :	5-6.1 ft	Test Id:	780364		
Test Comment:	---				
Visual Description:	Moist, dark gray silty sand with gravel				
Sample Comment:	---				

Particle Size Analysis - ASTM D6913



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	33.3	33.6	33.1

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
1 inch	25.00	100		
3/4 inch	19.00	80		
1/2 inch	12.50	76		
3/8 inch	9.50	75		
#4	4.75	67		
#10	2.00	59		
#20	0.85	53		
#40	0.42	48		
#60	0.25	44		
#100	0.15	39		
#140	0.11	36		
#200	0.075	33		

Coefficients

D_{85} = 20.2731 mm D_{30} = N/A

D_{60} = 2.1573 mm D_{15} = N/A

D_{50} = 0.5380 mm D_{10} = N/A

C_u = N/A C_c = N/A

Classification

ASTM N/A

AASHTO Silty Gravel and Sand (A-2-4 (0))

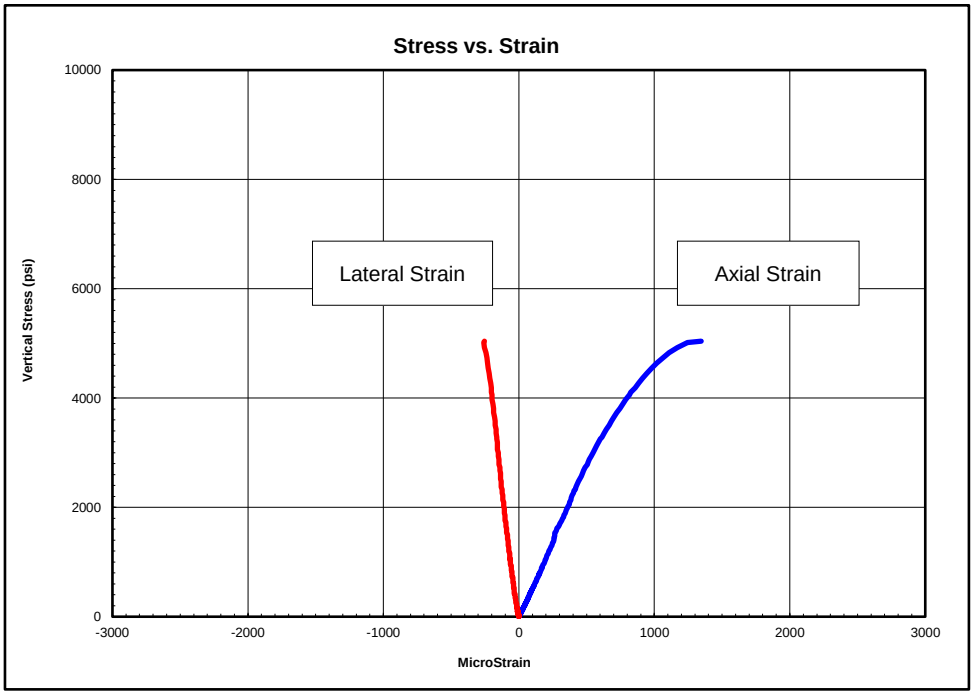
Sample/Test Description

Sand/Gravel Particle Shape : ANGULAR

Sand/Gravel Hardness : HARD

Client:	WSP USA, Inc.
Project Name:	MaineDOT I-95 Bridge Kenduskeag
Project Location:	Bangor, ME
GTX #:	319187
Test Date:	6/13/2024
Tested By:	gp
Checked By:	jsc
Boring ID:	BB-BKA-101
Sample ID:	R2
Depth, ft:	34.20-34.57
Sample Type:	rock core
Sample Description:	See photographs Intact material and discontinuity failure Best Effort end preparation performed

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



Peak Compressive Stress: 5,041 psi

Stress Range, psi	Young's Modulus, psi	Poisson's Ratio
500-1800	5,880,000	0.30
1800-3200	5,350,000	0.24
3200-4500	3,580,000	0.17

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

Client:	WSP USA, Inc.	Test Date:	6/12/2024
Project Name:	MaineDOT I-95 Bridge Kenduskeag	Tested By:	gp
Project Location:	Bangor, ME	Checked By:	smd
GTX #:	319187		
Boring ID:	BB-BKA-101		
Sample ID:	R2		
Depth (ft):	34.20-34.57		
Visual Description:	See photographs		

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

BULK DENSITY

	1	2	Average
Specimen Length, in:	4.40	4.40	4.40
Specimen Diameter, in:	1.97	1.97	1.97
Specimen Mass, g:	597.13		
Bulk Density, lb/ft^3	169	**Minimum Diameter Tolerence Met?**	YES
Length to Diameter Ratio:	2.2	**Length to Diameter Ratio Tolerance Met?**	YES

DEVIATION FROM STRAIGHTNESS (Procedure S1)

Maximum gap between side of core and reference surface plate:
Is the maximum gap ≤ 0.02 in.? YES

Maximum difference must be < 0.020 in.
Straightness Tolerance Met? YES

END FLATNESS AND PARALLELISM (Procedure FP1)

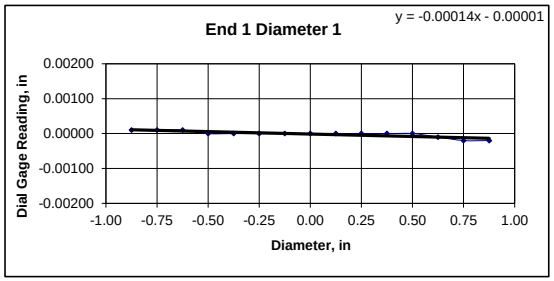
END 1	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	0.00010	0.00010	0.00010	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	-0.00010	-0.00020	-0.00020
Diameter 2, in (rotated 90°)	0.00110	0.00100	0.00090	0.00050	0.00030	0.00030	0.00010	0.00000	0.00000	-0.00020	-0.00040	-0.00060	-0.00080	-0.00110	-0.00130

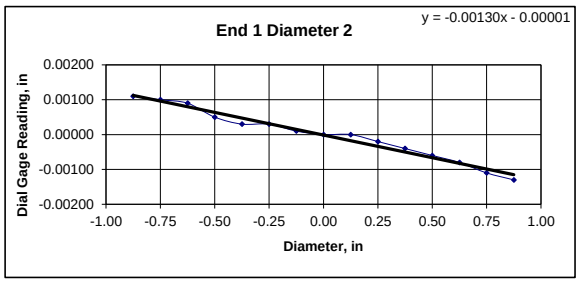
Difference between max and min readings, in:
0° = 0.00030 90° = 0.00240

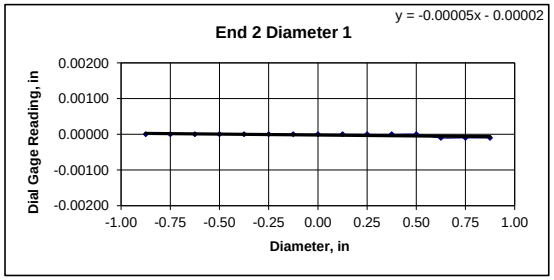
END 2	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	-0.00010	-0.00010	-0.00010
Diameter 2, in (rotated 90°)	-0.00140	-0.00110	-0.00090	-0.00070	-0.00060	-0.00030	-0.00010	0.00000	0.00020	0.00050	0.00060	0.00070	0.00080	0.00090	0.00120

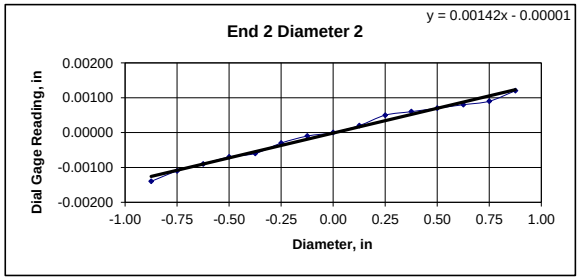
Difference between max and min readings, in:
0° = 0.0001 90° = 0.0026

Maximum difference must be < 0.0020 in. Difference = ± 0.00130
Flatness Tolerance Met? NO









DIAMETER 1

End 1:
Slope of Best Fit Line 0.00014
Angle of Best Fit Line: 0.00802

End 2:
Slope of Best Fit Line 0.00005
Angle of Best Fit Line: 0.00295

Maximum Angular Difference: 0.00507

Parallelism Tolerance Met? NO
Spherically Seated

DIAMETER 2

End 1:
Slope of Best Fit Line 0.00130
Angle of Best Fit Line: 0.07448

End 2:
Slope of Best Fit Line 0.00142
Angle of Best Fit Line: 0.08152

Maximum Angular Difference: 0.00704

Parallelism Tolerance Met? NO
Spherically Seated

PERPENDICULARITY (Procedure P1) (Calculated from End Flatness and Parallelism measurements above)

END 1	Difference, Maximum and Minimum (in.)	Diameter (in.)	Slope	Angle°	Perpendicularity Tolerance Met?
Diameter 1, in	0.00030	1.970	0.00015	0.009	YES
Diameter 2, in (rotated 90°)	0.00240	1.970	0.00122	0.070	YES
END 2					
Diameter 1, in	0.00010	1.970	0.00005	0.003	YES
Diameter 2, in (rotated 90°)	0.00260	1.970	0.00132	0.076	YES

Maximum angle of departure must be ≤ 0.25°
Perpendicularity Tolerance Met? YES

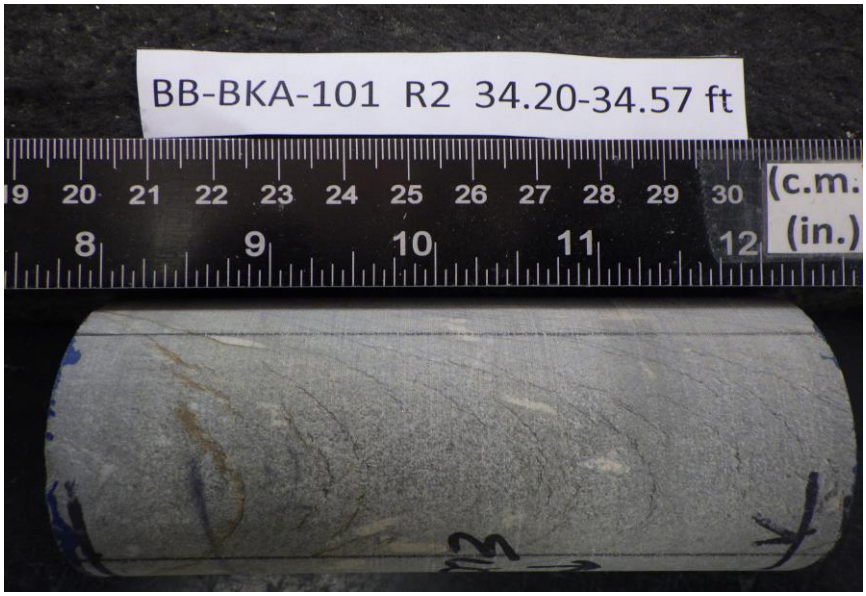
Client:	WSP USA, Inc.	Test Date:	6/12/2024
Project Name:	MaineDOT I-95 Bridge Kenduskeag	Tested By:	gp
Project Location:	Bangor, ME	Checked By:	smd
GTX #:	319187		
Boring ID:	BB-BKA-101	Reliable dial gauge measurements could not be performed on this rock type. Tolerance measurements were performed using a machinist straightedge and feeler gauges to ASTM specifications.	
Sample ID:	R2		
Depth (ft):	34.20-34.57		
Visual Description:	rock core		

BEST EFFORT END FLATNESS TOLERANCES OF ROCK CORE SPECIMENS TO ASTM D4543

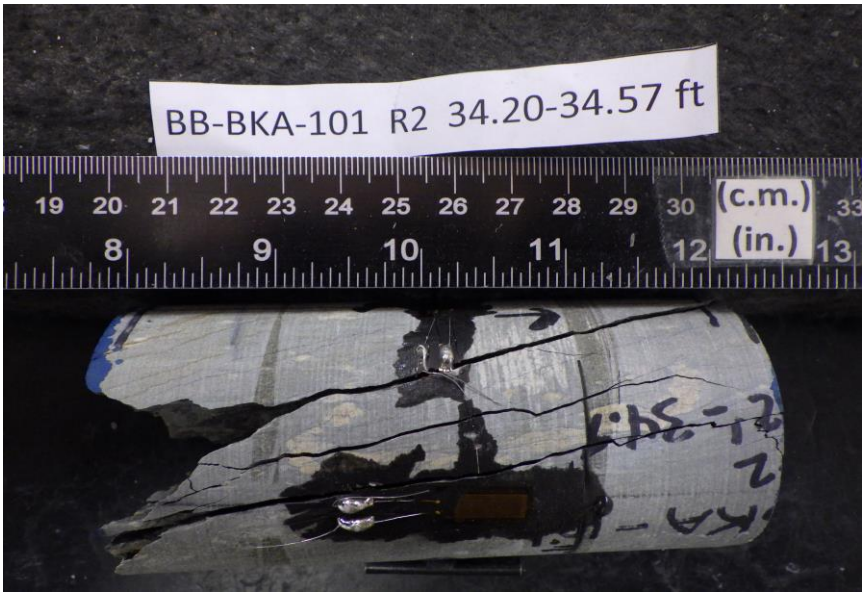
END FLATNESS		
END 1		
Diameter 1	Is the maximum gap $\leq \pm 0.001$ in.?	YES
Diameter 2 (rotated 90°)	Is the maximum gap $\leq \pm 0.001$ in.?	YES
END 2		
Diameter 1	Is the maximum gap $\leq \pm 0.001$ in.?	YES
Diameter 2 (rotated 90°)	Is the maximum gap $\leq \pm 0.001$ in.?	YES

End Flatness Tolerance Met? YES

Client:	WSP USA, Inc.
Project Name:	MaineDOT I-95 Bridge Kenduskeag
Project Location:	Bangor, ME
GTX #:	319187
Test Date:	6/13/2024
Tested By:	gp
Checked By:	smd
Boring ID:	BB-BKA-101
Sample ID:	R2
Depth, ft:	34.20-34.57



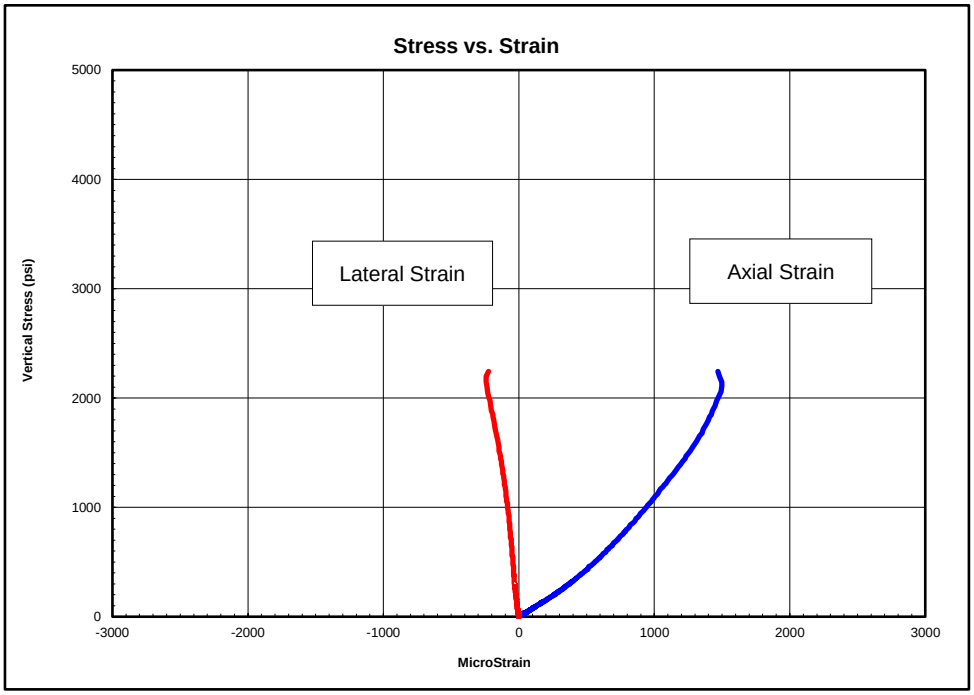
After cutting and grinding



After break

Client:	WSP USA, Inc.
Project Name:	MaineDOT I-95 Bridge Kenduskeag
Project Location:	Bangor, ME
GTX #:	319187
Test Date:	8/27/2024
Tested By:	gp
Checked By:	jsc
Boring ID:	BB-BKA-102
Sample ID:	R-1
Depth, ft:	7.1-7.4
Sample Type:	rock core
Sample Description:	See photographs Discontinuity failure Best Effort end preparation performed

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



Peak Compressive Stress: 2,518 psi

Stress Range, psi	Young's Modulus, psi	Poisson's Ratio
300-900	1,190,000	0.08
900-1600	1,580,000	0.18
1600-2300	3,270,000	0.47

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

Client:	WSP USA, Inc.	Test Date:	8/26/2024
Project Name:	MaineDOT I-95 Bridge Kenduskeag	Tested By:	gp
Project Location:	Bangor, ME	Checked By:	smd
GTX #:	319187		
Boring ID:	BB-BKA-102		
Sample ID:	R-1		
Depth (ft):	7.1-7.4		
Visual Description:	See photographs		

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

BULK DENSITY

	1	2	Average
Specimen Length, in:	3.99	3.99	3.99
Specimen Diameter, in:	1.96	1.96	1.96
Specimen Mass, g:	536.42		
Bulk Density, lb/ft^3	169	**Minimum Diameter Tolerence Met?**	YES
Length to Diameter Ratio:	2.0	**Length to Diameter Ratio Tolerance Met?**	YES

DEVIATION FROM STRAIGHTNESS (Procedure S1)

Maximum gap between side of core and reference surface plate:

Is the maximum gap ≤ 0.02 in.? NO

Maximum difference must be < 0.020 in.

Straightness Tolerance Met? NO

END FLATNESS AND PARALLELISM (Procedure FP1)

END 1	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	0.00130	0.00110	0.00090	0.00080	0.00040	0.00030	0.00010	0.00000	0.00000	-0.00030	-0.00070	-0.00090	-0.00110	-0.00120	-0.00170
Diameter 2, in (rotated 90°)	-0.00010	-0.00010	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000

Difference between max and min readings, in:

0° = 0.00300 90° = 0.00010

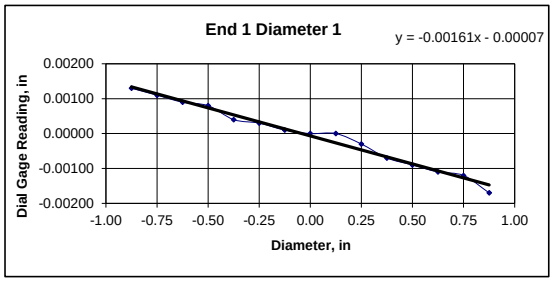
END 2	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	0.00130	0.00120	0.00080	0.00070	0.00040	0.00030	0.00000	0.00000	0.00000	-0.00020	-0.00060	-0.00080	-0.00120	-0.00150	-0.00190
Diameter 2, in (rotated 90°)	-0.00030	-0.00010	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00020	0.00030	0.00030	0.00020	0.00020	0.00020	0.00020

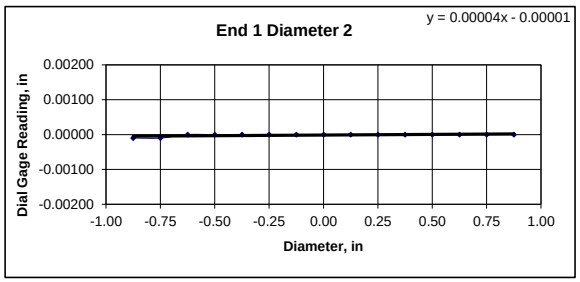
Difference between max and min readings, in:

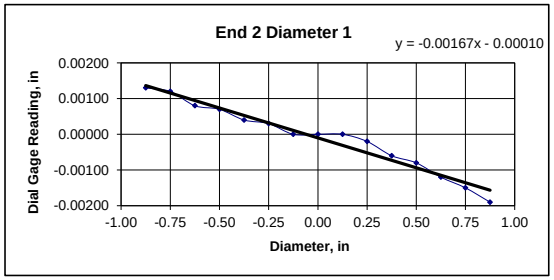
0° = 0.0032 90° = 0.0006

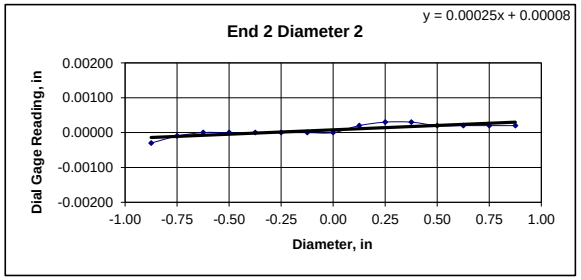
Maximum difference must be < 0.0020 in. Difference = ± 0.00160

Flatness Tolerance Met? NO









DIAMETER 1

End 1:
Slope of Best Fit Line 0.00161
Angle of Best Fit Line: 0.09200

End 2:
Slope of Best Fit Line 0.00167
Angle of Best Fit Line: 0.09593

Maximum Angular Difference: 0.00393

Parallelism Tolerance Met? YES
Spherically Seated

DIAMETER 2

End 1:
Slope of Best Fit Line 0.00004
Angle of Best Fit Line: 0.00213

End 2:
Slope of Best Fit Line 0.00025
Angle of Best Fit Line: 0.01441

Maximum Angular Difference: 0.01228

Parallelism Tolerance Met? NO
Spherically Seated

PERPENDICULARITY (Procedure P1) (Calculated from End Flatness and Parallelism measurements above)

END 1	Difference, Maximum and Minimum (in.)	Diameter (in.)	Slope	Angle°	Perpendicularity Tolerance Met?
Diameter 1, in	0.00300	1.960	0.00153	0.088	YES
Diameter 2, in (rotated 90°)	0.00010	1.960	0.00005	0.003	YES
END 2					
Diameter 1, in	0.00320	1.960	0.00163	0.094	YES
Diameter 2, in (rotated 90°)	0.00060	1.960	0.00031	0.018	YES

Maximum angle of departure must be ≤ 0.25°

Perpendicularity Tolerance Met? YES

Client:	WSP USA, Inc.	Test Date:	8/26/2024
Project Name:	MaineDOT I-95 Bridge Kenduskeag	Tested By:	gp
Project Location:	Bangor, ME	Checked By:	smd
GTX #:	319187		
Boring ID:	BB-BKA-102	Reliable dial gauge measurements could not be performed on this rock type. Tolerance measurements were performed using a machinist straightedge and feeler gauges to ASTM specifications.	
Sample ID:	R-1		
Depth (ft):	7.1-7.4		
Visual Description:	See photographs		

BEST EFFORT END FLATNESS TOLERANCES OF ROCK CORE SPECIMENS TO ASTM D4543

END FLATNESS		
END 1		
Diameter 1	Is the maximum gap $\leq \pm 0.001$ in.?	YES
Diameter 2 (rotated 90°)	Is the maximum gap $\leq \pm 0.001$ in.?	YES
END 2		
Diameter 1	Is the maximum gap $\leq \pm 0.001$ in.?	YES
Diameter 2 (rotated 90°)	Is the maximum gap $\leq \pm 0.001$ in.?	YES

End Flatness Tolerance Met? YES

Client:	WSP USA, Inc.
Project Name:	MaineDOT I-95 Bridge Kenduskeag
Project Location:	Bangor, ME
GTX #:	319187
Test Date:	8/27/2024
Tested By:	gp
Checked By:	smd
Boring ID:	BB-BKA-102
Sample ID:	R-1
Depth, ft:	7.1-7.4

After cutting and grinding

After break

APPENDIX D

Rock Core Calculations

Appendix D: Calculation of Rock Mass Rating
Preliminary Geotechnical Data Report
Bridge #5798, Kenduskeag Ave over I-95, Bangor, Maine
MaineDOT WIN 026095.00

References:

1. Bieniawski, Z.T. 1989. Engineering Rock Mass Classifications: A Complete Manual for Engineers and Geologists in Mining, Civil, and Petroleum Engineering. John Wiley & Sons.
2. Wyllie, Duncan C. 1999. Foundations on Rock, 2nd Edition. E&FN Spon.
3. Hoek, Evert. 2006. Practical Rock Engineering. Rocscience Inc.

Notes:

1. The RMR ratings for parameter 1 (intact rock strength), parameter 2 (drill core quality RQD), and parameter 3 (discontinuity spacing) are selected using Charts A, B, and C, respectively, from Bieniawski 1989 (Ref. 1). For core runs on which UCS lab testing was not performed, the intact strength rating is selected based on field strength estimates using Table 3.5 from Wyllie 1999 (Ref. 2).
2. The RMR ratings for parameter 4 (discontinuity condition) are selected using Section E of Table 4 from Hoek 2006 (Ref. 3).
3. The RMR ratings for parameter 5 (groundwater) are selected using Table 3.5 from Wyllie 1999 (Ref. 2).
4. Since outcrop data is not available at the Kenduskeag Ave bridge site, a typical persistance of 3 to 10 feet is assumed for the boring core runs.
5. Since outcrop data is not available at the Kenduskeag Ave bridge site, the rating adjustment for joint orientation is assigned a value of 0; correlation of geologic field mapping data of exposed rock outcrops with the rock core samples and proposed foundation type may allow for a different rating adjustment for joint orientation, and thus a modification to the RMR value shown on this table.

Prepared by: KAR
Checked by: BK
Reviewed by: JDL

Average RMR = 42

Boring or Outcrop	Run Number or Discontinuity ID	Intact Strength			RQD	Fracture Spacing			A. Classification Parameters									B. Rating Adjustment for joint orientation	RMR
									1	2	3	4						5	
												Condition of Joints							
		UCS (psi)	UCS (MPa)	Field Strength Estimate	(%)	Average fractures per foot	Average spacing (ft)	Average spacing (mm)	Strength of rock	RQD	Spacing of joints	Persistence	Aperture	Roughness	Infilling	Weathering	Total	Ground water	
BB-BKA-101	R1	-	-	Medium Strong (R3) to Strong (R4)	0	3.5	0.3	87	4	3	6	4	0	1	0	3	8	7	0	28
	R2	5041	35	Medium Strong (R3) to Strong (R4)	10	4.0	0.3	76	4	4	6	4	0	1	0	3	8	7	0	29
	R3	-	-	Strong (R4) to Very Strong (R5)	21	5.0	0.2	61	7	5	6	4	0	1	6	3	14	7	0	39
	R4	-	-	Strong (R4) to Very Strong (R5)	0	4.0	0.3	76	7	3	6	4	0	1	6	3	14	7	0	37
BB-BKA-102	R1	2518	17	Weak (R2)	10	4.2	0.2	73	3	4	6	4	0	5	6	6	21	7	0	41
	R2	-	-	Strong (R4) to Very Strong (R5)	43	2.8	0.4	109	7	9	7	4	0	5	6	6	21	7	0	51
BB-BKA-103	R1	-	-	Strong (R4) to Very Strong (R5)	35	2.4	0.4	127	7	8	7	4	1	5	6	5	21	7	0	50
	R2	-	-	Very Strong (R5)	77	0.8	1.3	381	12	15	10	4	1	1	6	6	18	7	0	62

Appendix D: **Calculation of Geological Strength Index**
Preliminary Geotechnical Data Report
Bridge #5798, Kenduskeag Ave over I-95, Bangor, Maine
MaineDOT WIN 026095.00

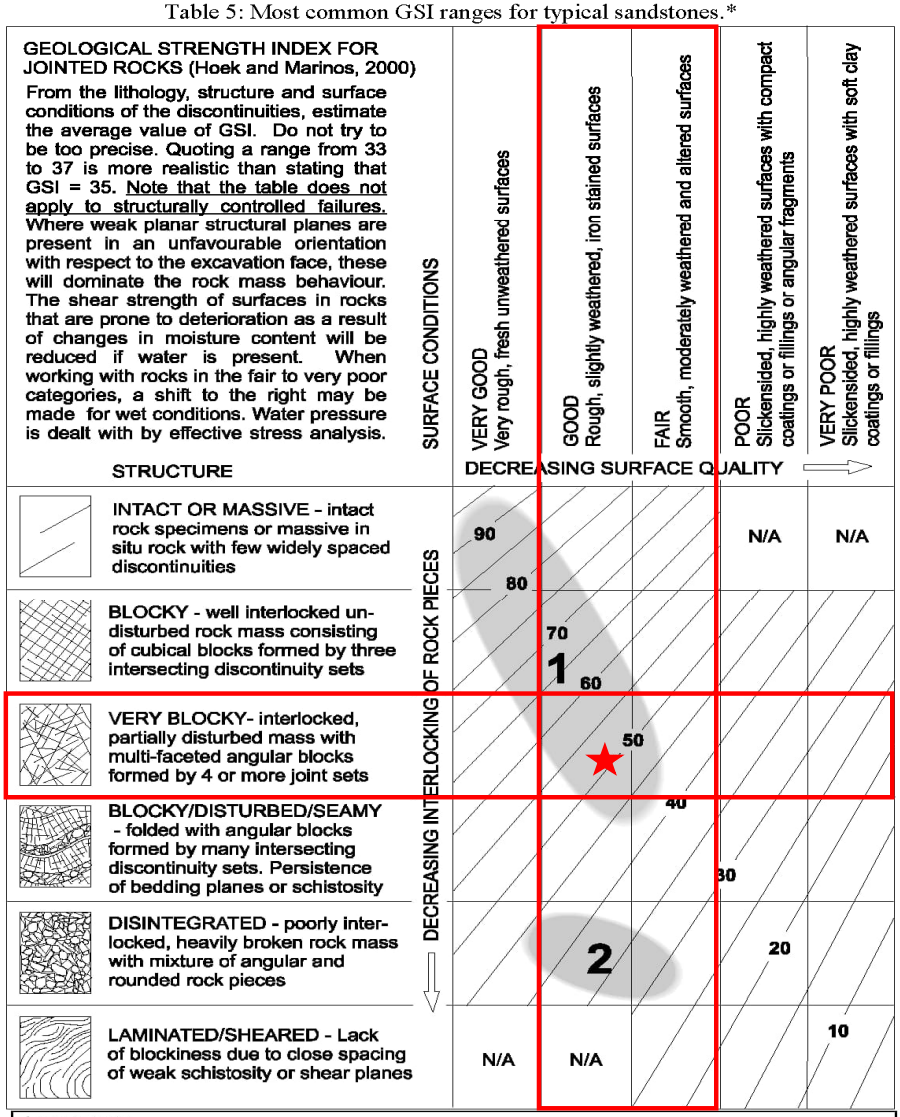
Prepared by: KAR
Checked by: BK
Reviewed by: JDL

GSI =	50

BB-BKA-102 and -103

BB-BKA-101

Table 5: Most common GSI ranges for typical sandstones.*



1. Massive or bedded (no clayey cement present)
2. Brecciated (no clayey cement present)

GSI chart from: *Marinos, Paul, and Hoek, Evert. November 2000. GSI: a geologically friendly tool for rock mass strength estimation. ISRM International Symposium, Melbourne, Australia, paper number ISRM-IS-2000-035.*

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