HARDESTY & HANOVER, LLC
ENGINEERING

Geotechnical Engineering & Foundation Report

Replacement of the Bridge over the Gut on State Route 129 South Bristol, Maine

For:
Maine Department of Transportation

Submitted by:
Hardesty & Hanover, LLC

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1.0 Project Introduction

The Maine State Department of Transportation (MaineDOT) is replacing the existing Bridge over the Gut on State Route 129 in the town of South Bristol, Maine. The Gut Bridge connects Rutherford Island to Bristol Neck. Refer to Figure 1 for the project location map.

Figure 1: Project Location Map

The existing bridge was built in 1922 and consists of a 35 foot wide steel stringer bobtail swing span. The swing span is supported at the pivot on a concrete mat foundation underlain by rock fill. The original abutments were constructed of stone and granite blocks. The abutments were rebuilt in 1963 and the rest pier (South Abutment) now consists of a timber crib on a concrete leveling pad filled with boulder material consisting of the material from the previous stone and granite abutment that it replaced. The south abutment approach fill is retained by stacked granite block wing walls on the southeast and southwest corners of the bridge.

In 2013 Hardesty & Hanover was awarded the design of a new Single Leaf Cable-Stayed Bascule Bridge. The proposed structure consists of a single leaf 40’ 3” span with two bascule slot piers, new abutments, rest pier, and wing walls. The south and north approaches of the new bridge structure will be filled in order to meet bridge clearance criteria. Retaining walls will be

utilized at north and south approach to retain fill or support new bridge structure, and/or to minimize the project footprint.

2.0 Purpose and Scope of Services

The purpose of this geotechnical report is to present the results of geotechnical assessment, and to provide foundation recommendations for the proposed bridge replacement structure and retaining wall construction. The scope of the geotechnical work included:

1) Review of existing subsurface information.
2) Perform geotechnical assessment and analyses.
3) Preparation of geotechnical engineering report provided herein, and presentation of subsurface conditions summary, engineering evaluation, and subsequent recommendations.

As per MaineDOT policy, the design philosophy complies with the current MaineDOT Bridge Design Guide and AASHTO Load and Resistance Factor Design Bridge Design Specification.

3.0 Subsurface Condition

3.1 Surficial and Bedrock Geology

The Gut Bridge crosses the water body known as the Gut which serves as a channel between the Darmiscotta River and John's Bay. According to the available literature, surficial deposits consisting of marine clayey silt with sporadic sand layers are anticipated to overlie bedrock at the project site (Refer to Figure 2).

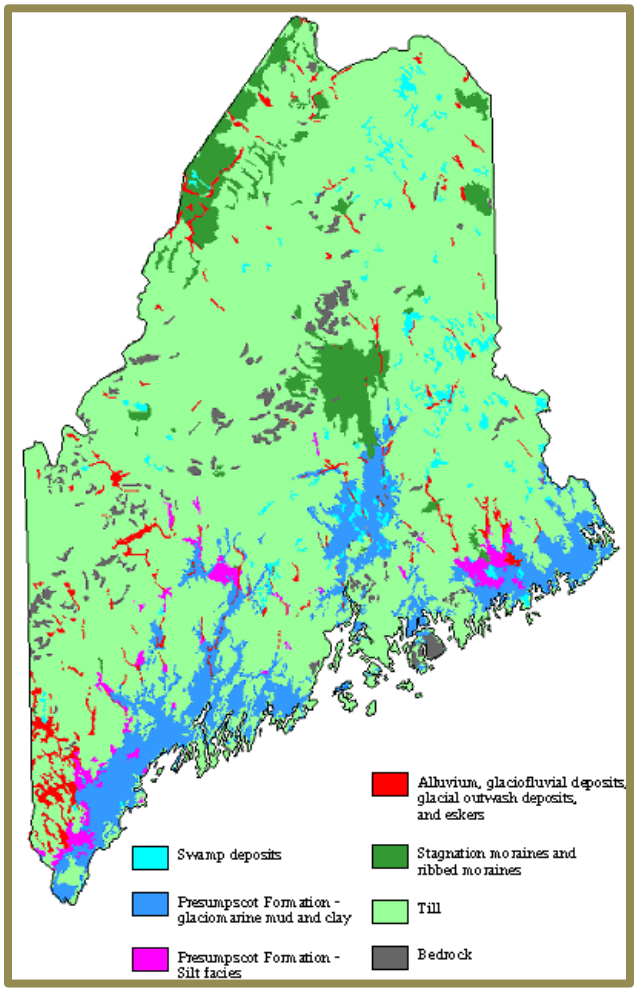

Figure 2: Surface Geologic Map of Maine

According to resources available from the USGS (Refer to Figure 3), bedrock in the area of the project can be mapped in two formations; the Cape Elizabeth formation (Oce) and the Bucksport formation (SOb).

From the USGS bedrock unit description, the Cape Elizabeth formation consists of an assemblage of mostly thin-bedded, light-gray, siliceous and sericitic slates; heavier beds consist of graywacke slate, schist, and quartzite containing, at short intervals, thin layers or laminae of black, micaceous phyllite and light-bluish calcareous schist or slate. The Bucksport formation

consists of thin-banded limey quartzite-uniform bands of light-greenish and dark-gray to purple bands. Lighter bands are quartz rich, and original calcareous minerals have been recrystallized to form lime silicates, mostly diopside; darker bands are quartz and biotite rich, and purple tints are due to finely divided biotite. The site has numerous mapped faults that likely contributed to the formation of many of the local geologic features including the Gut itself.

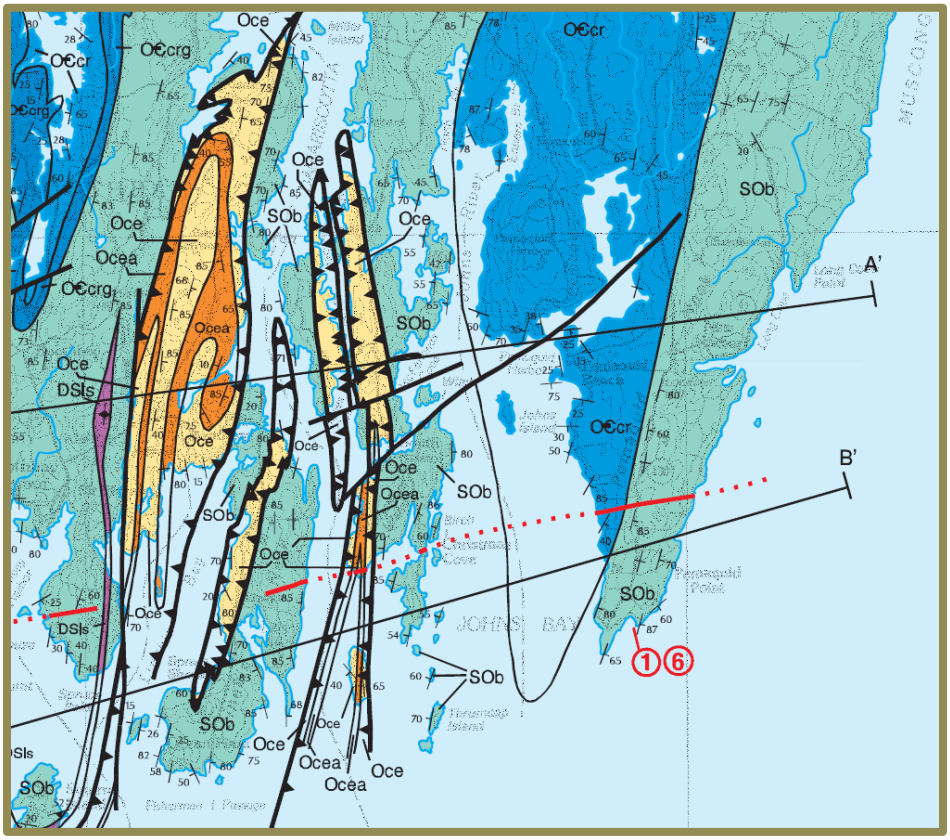

Figure 3: Bedrock Geology Map

3.2 Existing Geotechnical Information

The following reports and/or geotechnical data were made available to us to assess the subsurface conditions and to perform geotechnical evaluations:

- Soils Report 2001-31, Report on Proposed Bridge Replacement Route 129, South Bristol, Maine – Haley & Aldrich, Inc. dated July 2000

- Soils Report 2005-07, Final Geotechnical Design Report for the replacement of Gut Bridge over the Gut State Route 129 South Bristol, Maine - Maine Department of Transportation dated May 2005.

- Soils Report 2012-02C, Final Geotechnical Evaluation Route 129 Bridge over the Gut Maine DOT PIN 16750.00 South Bristol, Maine- GZA GeoEnvironmental, Inc. dated January 2012

- Soils Report 2012-17C, Supplemental Geotechnical Evaluation Route 129 Bridge over the Gut Maine DOT PIN 16750.00 South Bristol, Maine- GZA GeoEnvironmental, Inc. dated July 2012.

- Soils Report 2013-30C, Supplemental Geotechnical Evaluation Route 129 Bridge over the Gut Maine DOT PIN 16750.00 South Bristol, Maine- GZA GeoEnvironmental, Inc. dated August 2013.

According to the boring logs and subsurface information provided in the above mentioned reports and probe data, the surficial deposits overlying bedrock in the area of the project consist of manmade fills, nearshore deposits, and marine deposits. The manmade fills are encountered in all the land borings and a few water borings; the fill can be described as primarily loose to very dense sand and gravel with frequent cobbles and boulders. The Fill materials are anticipated to extend to the top of bedrock at the bridge approaches. The Nearshore deposits of around 0.5 to 4 feet are encountered in most of water borings and they can be classified as loose to medium dense sand with trace to some silt and gravel. The Marine deposits of around 6.5 to 9 feet consist of stiff Silty Clay to Clayey Silts with little sand and occasional shells. Limited SPT N-values are available due to the frequency of sampling and the relatively shallow depths of the surficial deposits. The SPT N-values range from 1 to refusal with the majority being less than 15 for Nearshore/ Marine deposits and above 20 for manmade Fill material.

According to the boring logs and probe data, bedrock was encountered at elevations ranging from elevation +1.3 to -19.5 feet. The rock slopes steeply towards the Gut on both the north and south ends of the bridge. On average, rock was encountered deeper on the north end. Rock varies from east to west as well, generally dipping from west to east on the south end of the bridge and from east to west on the north with localized portions much deeper. In general, the boring logs indicated that the RQD is above 50% with multiple borings indicating rock with RQD above 80%. The rock is described in the logs as being either schist or pegmatitic granite. Classification of schist is consistent with the USGS description of the Cape Elizabeth formation. Classification of pegmatitic granite is likely quartzite as described in the USGS description of both the Cape Elizabeth and Bucksport formations.

According to the laboratory test results of rock samples, the unconfined compressive strength ranges between 2,800 psi and 15,100 psi, the Young's modulus values ranges between 540 ksi and 3,330 ksi, and the point load ranges between 100 and 730 psi.

Refer to appendix A for Core Boring and Rock probe data.

3.3 Groundwater

The depths of the groundwater are expected to vary under the influence of tidal effects, as such the groundwater levels can be expected to vary throughout the day as well.

4.0 Retaining Wall and Foundation Design and Recommendations

This section presents a discussion on the geotechnical evaluation performed and recommendations for the construction of the proposed retaining walls and replacement bridge structure.

4.1 Retaining Walls Type Selection

North Approach

The grade along the north approach will be raised several feet in some locations to protect the new bridge operating machinery, control house, and provide a parking area for local businesses. Due to navigation requirements and to eliminate the need for a skewed bridge, the northern edge of the hydraulic channel is being shifted to the south. This shift combined with the proposed fill work results in creating an unstable column of soil and boulders ranging from approximately 13 to 31 feet in height and necessitates the construction of a new retaining wall.

South Approach

The existing retaining structure on the south approach is a structurally obsolete timber crib that cannot be reused as the bascule leaf span toe support. Due to navigation requirements and to eliminate the need for a skewed bridge, the southern edge of the hydraulic channel is being shifted to the south. The shift to the south and the requirements for a structural foundation require the construction of a new retaining wall.

As summarized in Section 3.0 of this report, competent bedrock along the alignment of the retaining walls is generally shallow with probe locations indicating rock within 10feet of the existing surface and/or channel mudline, except for those taken within the timber crib on the south approach where it is approximately 18 feet from the existing surface and/or channel mudline. The elevation varies with the deepest rock being found on the eastern limits of the south wall and the center section of the north wall.

Based on the anticipated depth of competent rock, its favorable engineering characteristics, and in consideration of the challenge mitigating construction impacts, both cast in place walls and non-gravity walls supported in bedrock were determined to be feasible options. The construction cost of cast in place wall is anticipated to be expensive with a significant impact on scheduling and little to no maintenance during service period, whereas the construction cost of a non-gravity wall is anticipated to be less expensive and more amenable to the proposed project staging with a requirement for periodic maintenance during the service life. Based on the decision of the selection committee, a non-gravity wall consisting of soldier piles socketed into the bedrock with precast concrete lagging was considered for further analysis.

In general, the lateral active pressure acting on the non-gravity wall is resisted by the passive resistance of the wall elements. When the height of the wall or the retained soil/boulder mass

exceeds 15feet as in this project, it becomes necessary to use a non-gravity wall with additional support (referred to as an anchored wall). The anchored wall derives its support from the passive pressure on the front of the embedded portion of the wall and the anchor tiebacks connected to the wall. The anchored wall can have a single or multiple levels (rows) of tiebacks to resist lateral active pressure.

According to the Soils Report 2005-07 and the Preliminary Design Report provided, during the 100 year scour event, the Nearshore/ Marine deposits are anticipated to erode completely resulting in a wall height of approximately 31 feet at the north approach. Preliminary analyses indicated the need for multiple levels of tiebacks to withstand the anticipated lateral active earth pressure. The retaining walls are subject to a tidal swing of nearly 10 feet twice per day. The large variation in tides makes installing a multiple levels of tiebacks extremely difficult due to the inability to work underwater and the limited working periods afforded between tides. The repeated wetting and drying of the tieback anchorages presented additional concerns with regards to maintenance, inspection, and durability. Therefore, the anchored wall had to be designed with only one row of tiebacks.

4.2 Retaining Wall Analyses and Recommendations

The retaining walls were designed in consideration of the latest AASHTO LRFD Bridge Design Standards and MaineDOT Bridge Design Guidelines using the Ensoft Inc. program PY-Wall. The PY-Wall program considers the soil-structure-interaction and estimates the performance of cantilever or anchored retaining wall using p-y method. The p-y method of analysis estimates the deflection of laterally loaded piles and is a modification of Terzaghi's subgrade reaction methods. The p-y curves used in PY-Wall program are the same curves used in the FHWA recommended program L-Pile, also from Ensoft Inc. The p-y curve method has the ability to capture more realistic soil-structure-interactions compared to the traditional limit equilibrium analysis and it results in a rational design/construction recommendation.

Engineering analysis showed that the wall would be subject to undesirable deflections and stress with only one row of tiebacks without some other measures to reduce the active pressures it would be subject to. Subsequent analysis indicated a need to add a layer of tremie concrete with an unconfined compressive strength of 3000 psi at the base of the wall extending from approximately the existing ground surface or mudline to the top of the competent bedrock. The tremie concrete needs to extend far enough behind and in front of the wall to shorten the effective height of the wall to a maximum of 23.5 feet (Refer to Table 1 for tremie concrete recommendations). The reduction in effective height reduces the maximum deflection and reduces the stress on the soldier piles allowing for a lighter weight section to be used with one row of tiebacks. The tremie concrete also addresses two additional concerns, lagging interface and scour. The preferred soldier pile wall uses precast concrete panels for lagging and it requires a level seat to prevent the panels from being misaligned and potentially damaged. The tremie concrete serves as a leveling pad to provide a flat surface at the lagging/ground interface. The previous geotechnical reports provided determined that scour could be a concern in the channel during the lifetime of the structure. The tremie concrete eliminates the possibility that the soldier pile wall will be undermined by protecting the toe of the wall down to rock.

The top of tremie concrete has been selected to coincide, as close as possible, with the existing surface elevations and provide a minimum of six (6) feet of clearance in the channel as measured from mean low tide. The six foot clearance corresponds to the depth of the channel maintained by the United States Army Corps of Engineers (USACE). At this time there are no plans to dredge the channel; but in the future if dredging were to occur, the top of the concrete protecting the base of the wall will not be an obstruction.

The revised analyses indicate a solider pile wall with one level of tiebacks is a feasible option with consideration given to the Table 1 recommendations. Based on the results of our analysis, we recommend soldier piles be formed of two W24x103 sections laced together with welded plates to form one composite unit. Use of a welded composite unit facilitates easy access for wall maintenance anticipated during service period. The spacing of solider piles and tieback locations is 10 feet center to center. At a few locations along the wing walls it is not possible to provide tiebacks to anchor the wall. In these locations the walls will need to be cantilevered. The subsequent analyses indicate solider piles spaced at 5 feet center to center are adequate to withstand anticipated loading since live load surcharges are not anticipated to occur in the cantilever sections.

The anchored soldier piles require a minimum socket of 12 feet into competent rock and the cantilever soldier piles require a minimum of 14 feet of socket into competent rock. The minimum socket lengths represent the minimum embedment required for fixity and lateral stability of the soldier piles. The analyses show that the tiebacks, where required for the anchored wall sections, shall have a design load of 160 kips and require a minimum of 15 feet in the bonded length and 15 feet in the free length. The tieback elevations and angles are coordinated to minimize conflicts with the superstructure, wall cap, and other tiebacks. In areas where a tieback is not possible due to conflicts with the substructure for the bridge, a tie strut will be used to anchor the wall to the substructure. Refer to Table 2 for a summary of design and construction recommendations for wall construction. Refer to appendix B for additional information.

Table 1: Tremie Concrete Recommendation

ABUTMENT	SECTION (See Sheet 37)	BEGIN LOCATION / LIMITS		END LOCATION / LIMITS		TOP OF TREMIE ELEVATION (FT)	AVG. BOTTOM OF TREMIE ELEVATION (FT) **	LIMITS OF TREMIE		REMARKS
		Station	Offset	Station	Offset			IN FRONT OF WALL	BEHIND WALL	
North	1	116+91.45	85.66	116+40.66	33.28	-10	-17	4	5	
	2	116+40.66	33.28	116+37.18	-15.88	-12.5	-20	2	5	Section To Be Constructed After Bacscule Piers
	3	116+37.18	-15.88	116+37.18	-25.88	-11.5	-13	2	5	Section To Be Constructed After Bacscule Piers
	4	116+37.18	-25.88	116+38.18	-35.73	-10	-10.5	4	5	
South	1	115+59.22	16.35	115+85.33	18.88	-5	-12	4	5	
	2	115+85.33	18.88	116+05.22	18.86	-6	-12	4	5	
	3	116+05.22	18.86	116+05.45	-20.81	-8	-8	2	5	
	4	116+05.45	-20.81	115+86.63	-48.22	-6	-6.5	4	5	

** Excavate To The Elevation Shown Or To The Top Of Bedrock Whichever Is Deeper

Table 2 - Non-Gravity wall (Soldier Pile with/without Tiebacks) Schedule

Abutment	Pile Number	TGL vs Station At Center of Pile	Offset To Center Of Pile From TGL	Pile Top Elevation	Estimated Pile Tip Elevation	Estimated Pile Length	Soldier Pile Section	Minimum Diameter of Hole	Minimum Socket Length	Anchor Level One Elevation	Required Factored Pullout Resistance	Minimum Free Length	Anchor Inclination	Axial Load
			(ft)	(ft)	(ft)	(ft)		(ft)	(ft)	(ft)	(kips)	(ft)	(DEG)	(kips)
North	1	116+91.45	85.66	+7.0	-27.0	34	2 - W24x103	3	12	+5.5	160	15	30	N/A
	2	116+82.08	82.19	+7.0	-27.0	34	2 - W24x103	3	12	+5.5	160	15	25	N/A
	3	116+72.70	78.72	+7.0	-27.0	34	2 - W24x103	3	12	+5.5	160	15	20	N/A
	4	116+63.32	75.25	+7.0	-27.0	34	2 - W24x103	3	12	+5.5	160	15	20	N/A
	5	116+54.81	70.69	+9.0	-27.0	36	2 - W24x103	3	12	+5.5	160	15	27	N/A
	6	116+51.28	61.34	+11.0	-27.0	38	2 - W24x103	3	12	+6.0	160	15	30	N/A
	7	116+47.74	51.99	+11.0	-27.0	38	2 - W24x103	3	12	+6.0	160	15	30	N/A
	8	116+44.20	42.63	+11.0	-29.0	40	2 - W24x103	3	12	+6.0	160	15	30	N/A
	9	116+40.66	33.28	+11.0	-32.0	43	2 - W24x103	3	12	+6.0	160	15	25	N/A
	10	116+37.18	24.11	+11.0	-32.0	43	2 - W24x103	3	12	N/A	N/A	N/A	N/A	N/A
	11	116+37.18	14.09	+9.0	-32.0	41	2 - W24x103	3	12	N/A	N/A	N/A	N/A	N/A
	12	116+37.18	4.11	+9.0	-31.0	40	2 - W24x103	3	12	+6.0	160	15	30	N/A
	13	116+37.18	-5.89	+9.0	-28.0	37	2 - W24x103	3	12	+6.0	160	15	30	N/A
	14	116+37.18	-15.89	+9.0	-28.0	37	2 - W24x103	3	14	N/A	N/A	N/A	N/A	N/A
	15	116+37.18	-25.89	+11.0	-26.0	37	2 - W24x103	3	14	N/A	N/A	N/A	N/A	N/A
	16	116+37.68	-30.81	+11.0	-25.0	36	2 - W24x103	3	14	N/A	N/A	N/A	N/A	N/A
	17	116+38.18	-35.73	+11.0	-24.0	35	2 - W24x103	3	14	N/A	N/A	N/A	N/A	N/A
South	18	115+58.79	17.29	+11.0	-27.0	38	2 - W24x103	3	14	N/A	N/A	N/A	N/A	N/A
	19	115+64.25	17.78	+11.0	-25.0	36	2 - W24x103	3	12	+6.0	160	15	30	N/A
	20	115+74.77	18.48	+11.0	-24.0	35	2 - W24x103	3	12	+6.0	160	15	25	N/A
	21	115+85.33	18.88	+11.0	-23.0	34	2 - W24x103	3	12	+6.0	160	15	30	N/A
	22	115+95.78	18.99	+11.0	-25.0	36	2 - W24x103	3	12	+5.0	160	15	30	N/A
	23	116+05.22	18.87	+8.0	-26.0	34	2 - W24x103	3	12	+5.0	160	15	30	317
	24	116+05.45	9.19	+8.0	-20.0	28	2 - W24x103	3	12	+5.0	160	15	20	317
	25	116+05.45	-0.81	+8.0	-20.0	28	2 - W24x103	3	12	+5.0	160	15	20	317
	26	116+05.45	-10.81	+8.0	-20.0	28	2 - W24x103	3	12	+5.0	160	15	20	317
	27	116+05.45	-20.81	+8.0	-20.0	28	2 - W24x103	3	12	+5.0	160	15	20	317
	28	116+05.45	-30.81	+11.0	-19.0	30	2 - W24x103	3	12	+5.5	160	15	30	N/A
	29	115+99.68	-38.56	+11.0	-18.0	29	2 - W24x103	3	12	+5.5	160	15	24	N/A
	30	115+93.44	-46.28	+11.0	-18.0	29	2 - W24x103	3	12	+5.5	160	15	30	N/A
	31	115+86.63	-48.22	+11.0	-18.0	29	2 - W24x103	3	12	+6.0	160	15	30	N/A

4.3 Bridge Foundation Design and Recommendations

Heel of the Bascule Leaf

The substructure elements at the heel of the Bascule leaf consist of two bascule pier boxes with fully sealed machinery enclosures. The bascule pier box is anticipated to experience torsional uplift from the leaf reaction in open and closed positions (accounting for the varying position of leaf reaction). Therefore, micropiles are recommended to support the heel of the Bascule leaf.

The foundation analyses have been performed with a formal non-linear, P-Delta analysis using the Bridge Software Institute (BSI) program FB-Pier. The loads applied to the foundation are in accordance with AASHTO recommendations. The FB-Pier analysis models are used to determine configuration of micropile groups and to determine axial compression and uplift design forces. The FB-Pier analyses consider a micropile size of 9-5/8 inch OD cased section and 8-inch dia. uncased section with 2-1/4 inch thread bar. According to the FB-Pier analyses results, eight (8) micropiles per bascule pier and three (3) micropiles per machinery enclosure socketed into bedrock provide sufficient resistance to compressive and uplift forces. Also, the recommended arrangements of micropiles are anticipated to provide adequate lateral support to the retaining wall sections that are tied to substructure of the bridge.

The engineering analyses indicate that the piles will be subject to a maximum factored axial compression load of 250 kips and a maximum factored axial uplift load of 50 kips. With consideration of the site variability, a resistance factor of 0.5 was used in determining the nominal resistance of the micropiles. Therefore, the micropiles for the bridge foundation are designed for a required nominal compression resistance of 500 kips and a nominal uplift resistance of 100 kips. Our analyses indicate a socket length of 15 feet will be required to yield the desired pile resistances.

Toe of the Bascule Leaf

As mentioned in Section 5.0, the toe of the bascule leaf span will be supported on a section of the south approach retaining walls. Per structural analyses input, only vertical loads (317kips at strength limit state and 243kips at service limit state) are anticipated to be transmitted to the rest pier/retaining wall from bascule leaf. The ability of the recommended retaining wall beam to withstand anticipated vertical load was evaluated from structural aspects as they are founded on bedrock and it was concluded that the factored structural resistance of the recommended solider pile beams (two W24x103 sections) is greater than 317 kips.

Refer to appendix C for additional information.

4.4 Operator House

The proposed operator house is recommended to be supported on micropiles to mitigate transfer of load from the operator house to the retaining walls. This is important because the location of the operator house coincides with the location of the deepest recorded bedrock within the project alignment which results in the greatest unsupported lengths of soldier piles on the project. The

lateral capacity of the micropiles in this location is greatly reduced due to the long unsupported length and the inability of the retaining wall to withstand load from operator house or to generate lateral passive resistance of micropile. Therefore when considering configuration of micropile groups, the required vertical and lateral support shall be derived from the bond zone. A bond length of 10 feet in competent bedrock is recommended to provide required pile resistances.

5.0 Construction Recommendations

The bascule pier foundations and retaining wall systems are anticipated to be constructed in the wet and shall be staged to accommodate construction and operation of the temporary bypass as well as the general construction sequence of the bascule pier foundations.

The following are the bascule pier foundation construction recommendations:

1. Geotechnical inspector with five years of experience relevant to the proposed work shall inspect the foundation construction operation.
2. Placement of tremie concrete may be done in wet or dry conditions.
3. Select construction Means and Methods, as needed to prevent damage to the existing structures.
4. Contractor shall exercise caution to avoid undermining existing structures.
5. Foundation excavation may require temporary shoring and/or bracing to be designed by the contractor.
6. The excavation support system shall be designed in compliance with MaineDOT, AASHTO and OSHA guidelines.
7. Avoid collection and drainage of surface water at or adjacent to the bridge site.
8. Consider nature of heterogeneous fill material during selection of elements for excavation support system.
9. A working platform or other temporary access may be required for the installation of the micropiles for the bascule pier and machinery enclosure locations.
10. The rock quality in the micropile bond zone shall be determined by the Resident.

The following are the retaining wall construction recommendations:

1. Geotechnical inspector with five years of experience relevant to proposed work shall inspect the retaining wall construction operation.
2. The rock quality in the tieback bond zone and solider pile socket zone shall be determined by the Resident.
3. All tieback performance tests shall be observed by the Resident.
4. Temporary excavation support and/or bracing may be required. The excavation support system shall be designed in compliance with MaineDOT, AASHTO and OSHA guidelines.
5. Select construction Means and Methods, as needed to prevent damage to the existing structures.
6. Contractor shall exercise caution to avoid undermining existing structures.
7. Excavate overburden material (including soil, stones, boulders, previous construction remnants, debris, etc.) above the bedrock to ensure good bond between tremie concrete and bedrock.
8. Soldier piles can be installed prior to or after over burden material excavation.
9. A minimum of 50 percent of the base of each hole (for the placement of solider pile) shall have less than ½ inch of sediment at the time of placement of the concrete. The maximum depth of sediment or any debris at any place on the base of the hole shall not exceed 1.5 inches.

10. Use temporary steel casings (part left in place) between existing ground surface/mean high water elevation and top of bedrock to prevent collapse of overburden, or to shut off seepage water into the predrilled hole for the placement of solider pile.
11. Provide a minimum curing time of 7 days for the concrete in the predrilled hole to cure before placing any tremie pour concrete.
12. Provide a minimum curing time of 7 days for tremie pour concrete to cure before placing lagging.
13. Tremie concrete can be placed in either wet or dry conditions. The tremie concrete shall have a minimum unconfined compressive strength of 3000 psi for dry placement condition or 4000 psi for wet placement condition.
14. Care should be taken to prevent damage to the soldier piles during excavation and concrete placement.
15. Place panels and backfill with crushed stone in coordination with the general construction sequence.
16. Heavy construction equipment should not be used within 10 feet of the soldier pile wall to prevent damage from excessive surcharge.
17. Upon reaching Elevation +6 feet with the backfill, install tiebacks prior to continuing fill operations.
18. After installing and testing the tiebacks, place separation geotextile and continue to fill with granular borrow material until final grade is achieved.

6.0 Reference

1. AASHTO LRFD Bridge Design Specifications, 6th Edition, 2012.
2. Maine Bridge Design Guide, August 2003, Maine Department of Transportation.
3. Soils Report 2001-31, "Report on Proposed Bridge Replacement, Route 129, South Bristol, Maine", July 2000, Haley & Aldrich, Inc.
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11. South Bristol Harbor Channel Survey, “Report of Channel Conditions Less Than 100 Feet Wide, ER 1130-2-520”, June 2011, United States Army Corps of Engineers New England District.
12. Reese, L. C., Et. Al., PY-Wall User’s Manual, “A Program for the Analysis of Flexible Retaining Structures”, May 2013, Ensoft Inc.
13. Reese, L. C., Et. Al., PY-Wall Technical Manual, “A Program for the Analysis of Flexible Retaining Structures”, June 2013, Ensoft Inc.

7.0 Limitations

This report has been prepared on behalf of and for the exclusive use of the Client, the State of Maine, for the design and construction of the project, Replacement of the Gut Bridge Over the Gut on State Route 129 in the town of South Bristol, Maine, as described herein. If this report is provided to prospective contractors, the Client should make it clear that the information is provided for factual data only and not as a warranty of subsurface conditions included in this report.

Hardesty & Hanover, LLC has attempted to conduct the services reported herein in a manner consistent with the level of care and skill ordinarily exercised by members of the profession currently practicing in the same locality and under similar conditions as this project. The recommendations and conclusions contained in this report are professional opinions. No other representation, expressed or implied, and no warranty or guarantee is included or intended in this document.

The conclusions and recommendations given in this report are based on interpretation of subsurface exploration data provided by Others and Hardesty & Hanover's experience. The Client must recognize that variations may occur from conditions observed in the borings, particularly within existing fills or previously developed areas. Design recommendations are based on data from borings, sampling, and related procedures. Actual subsurface conditions may vary from those encountered in the borings. Therefore, design recommendations, particularly estimated pile tip elevations and tiebacks details, are subject to adjustment in the field, based on subsurface conditions encountered during construction. Hardesty & Hanover, LLC is not responsible for the conclusions, opinions or recommendations made by Others based on these data.

The analyses, conclusions and recommendations contained in this report are based on the data obtained from the subsurface exploration performed by Others. The field exploration methods used indicate subsurface conditions only at specific locations where samples were obtained, only at the time they were obtained, and only to the depths penetrated. Discrete sampling cannot be relied on to accurately reflect natural variations in stratigraphy that may exist between sample locations. The recommendations included in this report have been based in part on assumptions about natural variations in site stratigraphy that may only be completely evaluated during earthwork and foundation construction. Unanticipated soil or rock conditions may require that additional expense be incurred to attain a properly constructed project.

The conclusions or recommendations in this report should not be used if the nature, design or location of the facilities is changed between the submittal of this report and the start of work at the site. If changes are contemplated, Hardesty & Hanover, LLC must review them to assess their impact on this report's findings, conclusions, and/or design recommendations. Hardesty & Hanover, LLC will not be responsible for any claims, damages, or liability associated with any other party's interpretations of this report's subsurface data or reuse of this report's subsurface data or engineering analyses.

The scope of our geotechnical services for this phase of the project did not include any environmental assessment or investigation for the presence or absence of wetlands or hazardous or toxic material in the soil, surface water, groundwater or air, on or below or around this site. Any statement in this geotechnical report or on the boring logs regarding odors noted or unusual or suspicious items or conditions observed are strictly for the information of our Client.

Prepared by:
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Principal Associate
Director of Geotechnical Engineering

Reviewed by:
Hardesty & Hanover, LLC

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Partner

Appendix A

Boring Logs

and

Rock Probe Data

UNIFIED SOIL CLASSIFICATION SYSTEM

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

Desired Soil Observations: (in this order)

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

TERMS DESCRIBING DENSITY/CONSISTENCY

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

Modified Burmister System

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

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

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

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

Rock Quality Designation (RQD):

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

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

Correlation of RQD to Rock Mass Quality

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

Desired Rock Observations: (in this order)

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

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

Sample Container Labeling Requirements:

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

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

Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: The Gut Bridge over The Gut
Location: South Bristol, Maine

Boring No.: B1
PIN: 8965.00

Driller:	Maine Test Borings, Inc.	**Elevation (ft.)**	10.0	**Auger ID/OD:**	
Operator:	G. Rudnicki	**Datum:**	NGVD	**Sampler:**	Standard Split Spoon
Logged By:	S. Wiercinski, H&A Rep.	**Rig Type:**	B43 Mobile Trailer	**Hammer Wt./Fall:**	140#/30"
Date Start/Finish:	6/15/00-6/15/00	**Drilling Method:**	Cased Wash Boring	**Core Barrel:**	2" NX
Boring Location:	13+30.5, 7.4 Lt.	**Casing ID/OD:**	NW	**Water Level*:**	Tidal

Definitions:
D = Split Spoon Sample
MD = Unsuccessful Split Spoon Sample attempt
U = Thin Wall Tube Sample
R = Rock Core Sample
V = Insitu Vane Shear Test
SSA = Solid Stem Auger

Definitions:
S_u = Insitu Field Vane Shear Strength (psf)
T_v = Pocket Torvane Shear Strength (psf)
q_p = Unconfined Compressive Strength (ksf)
$S_{u(lab)}$ = Lab Vane Shear Strength (psf)
WOH = weight of 140lb. hammer
WOR = weight of rods

Definitions:
WC = water content, percent
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index
G = Grain Size Analysis
C = Consolidation Test

Sample Information

Depth (ft.)	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-value	Casing Blows	Elevation (ft.)	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.
0	S1	5/1	0.4 - 0.8	50(5")			9.60	-BITUMINOUS CONCRETE- 0.4	
							9.10	Very dense brown coarse to medium SAND, some gravel and fine sand. -FILL- 0.9	
								-CONCRETE- Note: augered through concrete from 0.9-3.5 ft.	
								Spun casing through concrete from 3.5-5. 0 ft.	
5						NX		Cored concrete from 5.0-5.7 ft.	
							4.30	5.7	
								Note: cored cobbles and gravelly fill from 5.7-9.1 ft. -FILL-	
	R1	60/47	9.7 - 14.7	RQD = 38%			0.90	9.1	
10								Top of Bedrock recovered with above cobbles and boulders. R1: Moderately hard to medium hard, fresh to moderately weathered blue-grey to grey SCHIST with extremely thin to very thin beds throughout. Primary joint set is low angle to high angle (predominantly moderately dipping), very close to moderate, rough, undulating, fresh to discolored, tight to open. 78% Recovery	
	R2	60/59	14.7 - 19.7	RQD = 73%			-4.70	14.7	
15								R2: same as R1. 98% Recovery	
							-9.70	19.7	
20								**Bottom of Exploration at 19.7 feet below ground surface.**	
25									

Remarks:

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.: B1

Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project:	The Gut Bridge over The Gut	**Boring No.:**	B3
Location:	South Bristol, Maine	**PIN:**	8965.00

Driller:	Maine Test Borings, Inc.	**Elevation (ft.)**	11.0	**Auger ID/OD:**	
Operator:	G. Rudnicki	**Datum:**	NGVD	**Sampler:**	Standard Split Spoon
Logged By:	S. Wiercinski, H&A Rep.	**Rig Type:**	B43 Mobile Trailer	**Hammer Wt./Fall:**	140#/30"
Date Start/Finish:	6/15/00-6/15/00	**Drilling Method:**	Cased Wash Boring	**Core Barrel:**	2" NX
Boring Location:	12+34.1, 5.0 Rt.	**Casing ID/OD:**	NW	**Water Level*:**	9.5 ft.

Definitions:
D = Split Spoon Sample
MD = Unsuccessful Split Spoon Sample attempt
U = Thin Wall Tube Sample
R = Rock Core Sample
V = Insitu Vane Shear Test
SSA = Solid Stem Auger

Definitions:
S_u = Insitu Field Vane Shear Strength (psf)
T_v = Pocket Torvane Shear Strength (psf)
q_p = Unconfined Compressive Strength (ksf)
$S_{u(lab)}$ = Lab Vane Shear Strength (psf)
WOH = weight of 140lb. hammer
WOR = weight of rods

Definitions:
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-value	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.
0							10.50		-BITUMINOUS CONCRETE- 0.5	
	S1	24/9	1.0 - 3.0	8/13/10/50(5")	23				Medium dense, brown gravelly coarse to fine SAND, trace silt. -FILL-	
									Cored through boulder from 3.1-6.0 ft., recovered 1.3 ft. Spun casing and washed out to 8.1 ft.	
5										
	S2	18/2	8.1 - 9.6	8/21/53	74				Very dense, brown gravelly coarse to fine SAND with cobbles and boulders.	
10	S3	18/2	10.0 - 11.5	8/6/50(4")	---				Medium dense to very dense, brown coarse to medium sandy GRAVEL. -FILL-	
						NX			Spun casing to 11.3 ft., washed out and cored from 11.3-13.3 ft., recovered 0.3 ft., Spun casing to 13.8 ft., cored from 13.7-16.6 ft., recovered 1.8 ft.	
						NX				
15	R1	69.6/[a]24	16.2 - 22.0	RQD = 0%		NX	-5.20		16.2 Top of Concrete at 16.2 ft. -CONCRETE-	
							-7.80		18.8	
							-8.00		Gravelly material. 19.0	
20									R1: Moderately hard to medium hard, fresh to moderately weathered, grey-green to grey fine grained to aphanitic SCHIST, extremely thin foliations throughout. Primary joint set is high angle to modrately dipping, extremely close to moderately close, planar to undulating, smooth to rough, fresh to decomposed, tight. [a]67% Recovery	
	R2	60/54	22.0 - 27.0	RQD = 62%			-11.00		22.0 R2: same as R1 except freah to slightly weathered. 90% Recovery	
25										

Remarks:

[a]Recovery and RQD percentages are calculated only on bedrock portion of core run, excludes concrete.

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: The Gut Bridge over The Gut
Location: South Bristol, Maine

Boring No.: B3
PIN: 8965.00

Driller:	Maine Test Borings, Inc.	**Elevation (ft.)**	11.0	**Auger ID/OD:**	
Operator:	G. Rudnicki	**Datum:**	NGVD	**Sampler:**	Standard Split Spoon
Logged By:	S. Wiercinski, H&A Rep.	**Rig Type:**	B43 Mobile Trailer	**Hammer Wt./Fall:**	140#/30"
Date Start/Finish:	6/15/00-6/15/00	**Drilling Method:**	Cased Wash Boring	**Core Barrel:**	2" NX
Boring Location:	12+34.1, 5.0 Rt.	**Casing ID/OD:**	NW	**Water Level*:**	9.5 ft.

Definitions:
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Definitions:
S_u = Insitu Field Vane Shear Strength (psf)
T_v = Pocket Torvane Shear Strength (psf)
q_p = Unconfined Compressive Strength (ksf)
$S_{u(lab)}$ = Lab Vane Shear Strength (psf)
WOH = weight of 140lb. hammer
WOR = weight of rods

Definitions:
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-value	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.
25							-16.00		27.0 **Bottom of Exploration at 27.0 feet below ground surface.**	
30										
35										
40										
45										
50										

Remarks:

[a]Recovery and RQD percentages are calculated only on bedrock portion of core run, excludes concrete.

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.: B3

Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: The Gut Bridge over The Gut
Location: South Bristol, Maine

Boring No.: BB-GR-201
PIN: 8965.00

Driller:	MaineDOT	**Elevation (ft.)**	-11.4	**Auger ID/OD:**	N/A
Operator:	G. Lidstone	**Datum:**	NGVD	**Sampler:**	Standard Split Spoon
Logged By:	L. Krusinski	**Rig Type:**	CME 45C	**Hammer Wt./Fall:**	30"/140#
Date Start/Finish:	3/15/05-3/15/05	**Drilling Method:**	Cased Wash Boring	**Core Barrel:**	NX, 1.88 OD Core
Boring Location:	12+69, 6.0 Rt.	**Casing ID/OD:**	HW	**Water Level*:**	Tidal

Definitions:
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U = Thin Wall Tube Sample
R = Rock Core Sample
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$S_{u(lab)}$ = Lab Vane Shear Strength (psf)
WOH = weight of 140lb. hammer
WOR = weight of rods

Definitions:
WC = water content, percent
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index
G = Grain Size Analysis
C = Consolidation Test

Sample Information

Depth (ft.)	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-value	Casing Blows	Elevation (ft.)	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.
0						4			
						28			
						40			
	1D	24/11	3.0 - 5.0	18/9/4/6	13	60		Dark grey, damp, medium dense, sandy SILT, trace small rounded gravel.	
						51			
5						106			
						180	-18.30	Top of BEDROCK.	
	aR1	62.4/62.4	7.1 - 12.3	RQD = 18%		NX	-18.50	6.9 Roller cone ahead to 7.1' bgs. 7.1 R1:Bedrock: Green-grey, very soft to moderately hard, completely weathered to moderately weathered, fine grained SCHIST with thin banding. Joint set steep, close, open with infilling. 2.5- 5.0' very soft, decomposed white LIMONITE SCHIST. White pegmatitic granite 11.7-12.3'. Rock quality is very poor; very highly fractured. R1:Core Times (min:sec) 7.1-8.1' (3:30) 8.1-9.1' (1:40) 9.1-10.1' (2:20) UCT-201-R1, 2.4-2.8 ft dbbs 10.1-11.1' (2:00) 11.1-12.3' (1:10)	
						CORE			
	UCT	4/4	9.5 - 9.8	UCT-201-R1					
10									
	aR2	60/60	12.3 - 17.3	RQD = 23%			-23.70	12.3 R2: Green-grey, very soft to moderately hard, completely weathered to moderately weathered, fine grained SCHIST. Joint set steep, close, open and infilled with white-green, soft altered biotite (Limonite). Very soft, decomposed white LIMONITE SCHIST 13.6-14.8'. Rock quality is very poor; highly fractured. R2:Core Times (min:sec) 12.3-13.3' (3:00) 13.3-14.3' (1:20) 14.3-15.3' (3:00) UCT-201-R2(a), 7.8-8.3 ft dbbs 15.3-16.3' (2:00) UCT-201-R2(b) 8.6-9.4 ft dbbs 16.3-17.3' (2:05)	
	UCT	6/ 6	14.9 - 15.4	UCT-201-R2(a)					UCS=3,816 psi
15	UCT	9.6/9.6	15.7 - 16.5	UCT-201-R2(b)					UCS=5,444 psi
	aR3	60/60	17.3 - 22.3	RQD = 20%			-28.70	17.3 R3: Grey-green-white, very soft to moderately hard, decomposed to slightly weathered medium grained QUARTZ and fine grained SCHIST, Joints at low to steep angle, open with infilling, close. Completely weathered white LIMONITE SCHIST zone 19.3-20.3'. Rock quality is very poor; very highly fractured. R3:Core Times (min:sec) 17.3-18.3' (3:00) 18.3-19.3' (2:00) 19.3-20.3' (3:00) 20.3-21.3' (2:10) 21.3-22.3' (1:50) 80% Recovery	
20									
	bR4	51.6/51.6	22.3 - 26.6	RQD = 69%			-33.70	22.3 R4: Green-white, moderately hard to very hard, fresh to slightly weathered,	
25									

Remarks:

aRecovery poor because lost a lot of the rock core in the wash water because it was decomposed.
bCore blocked at 26.6' bgs on R4.
Assumed Bridge Deck Elevation 10.6', 22.0' from Bridge Deck to River bed.

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-GR-201

Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: The Gut Bridge over The Gut
Location: South Bristol, Maine

Boring No.: BB-GR-201
PIN: 8965.00

Driller:	MaineDOT	**Elevation (ft.)**	-11.4	**Auger ID/OD:**	N/A
Operator:	G. Lidstone	**Datum:**	NGVD	**Sampler:**	Standard Split Spoon
Logged By:	L. Krusinski	**Rig Type:**	CME 45C	**Hammer Wt./Fall:**	30"/140#
Date Start/Finish:	3/15/05-3/15/05	**Drilling Method:**	Cased Wash Boring	**Core Barrel:**	NX, 1.88 OD Core
Boring Location:	12+69, 6.0 Rt.	**Casing ID/OD:**	HW	**Water Level*:**	Tidal

Definitions:
D = Split Spoon Sample
MD = Unsuccessful Split Spoon Sample attempt
U = Thin Wall Tube Sample
R = Rock Core Sample
V = Insitu Vane Shear Test
SSA = Solid Stem Auger

Definitions:
S_u = Insitu Field Vane Shear Strength (psf)
T_V = Pocket Torvane Shear Strength (psf)
q_p = Unconfined Compressive Strength (ksf)
$S_{u(lab)}$ = Lab Vane Shear Strength (psf)
WOH = weight of 140lb. hammer
WOR = weight of rods

Definitions:
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-value	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.
25							-38.00		medium to large grained PEGMATITIC GRANITE. Joint set close, low angle, tight, no infilling. Some biotite veins. R4:Core Times (min:sec) 22.3-23.3' (4:20) 23.3-24.3' (4:00) 24.3-25.3' (3:00) 25.3-26.3' (3:40) 26.3-26.6' (2:50) Core Blocked 26.6 **Bottom of Exploration at 26.6 feet below ground surface.**	
30										
35										
40										
45										
50										

Remarks:

[a]Recovery poor because lost a lot of the rock core in the wash water because it was decomposed.
[b]Core blocked at 26.6' bgs on R4.
Assumed Bridge Deck Elevation 10.6', 22.0' from Bridge Deck to River bed.

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: The Gut Bridge over The Gut
Location: South Bristol, Maine

Boring No.: BB-GR-202
PIN: 8965.00

Driller:	MaineDOT	**Elevation (ft.)**	-12.5	**Auger ID/OD:**	N/A
Operator:	G. Lidstone	**Datum:**	NGVD	**Sampler:**	Standard Split Spoon
Logged By:	L. Krusinski	**Rig Type:**	CME 45C	**Hammer Wt./Fall:**	30"/140#
Date Start/Finish:	3/16/05-3/16/05	**Drilling Method:**	Cased Wash Boring	**Core Barrel:**	NX, 1.88 OD Core
Boring Location:	12+68.5, 5.6 Lt.	**Casing ID/OD:**	HW	**Water Level*:**	Tidal

Definitions:
D = Split Spoon Sample
MD = Unsuccessful Split Spoon Sample attempt
U = Thin Wall Tube Sample
R = Rock Core Sample
V = Insitu Vane Shear Test
SSA = Solid Stem Auger

Definitions:
S_u = Insitu Field Vane Shear Strength (psf)
T_v = Pocket Torvane Shear Strength (psf)
q_p = Unconfined Compressive Strength (ksf)
$S_{u(lab)}$ = Lab Vane Shear Strength (psf)
WOH = weight of 140lb. hammer
WOR = weight of rods

Definitions:
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-value	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.
0						37				
						42				
	1D	8.4/8.4	2.5 - 3.2	42/50(2.4")	---	50			Brown-grey, very dense, decomposed biotite schist, little gravel, trace sea shells. b155 blows for 0.6'.	
	R1	60/56	3.6 - 8.6	RQD = 19%		b155 NX CORE	-16.10		3.6 R1:Bedrock: Grey, moderately hard to soft, slightly to highly weathered, fine grained SCHIST with thin banding. Joint set at steep angle, very close to close, open, surfaces infilled with soft altered biotite (Limonite)(due to leaching by salt water). Rock quality is very poor; very highly fractured. R1:Core Times (min:sec) 3.6-4.6' (5:00) 4.6-5.6' (2:30) 5.6-6.6' (2:10) 6.6-7.6' (2:20) UCT-202-R1 3.6-4.0 dbbs 7.6-8.6' (2:40)	
5										
	UCT	4.8/4.8	7.1 - 7.5	UCT-202-R1						UCS=3,440 psi
	aR2	16.8/16.8	8.6 - 10.0	RQD = 0%			-21.10		8.6 R2: Same as R1 except, very highly fractured throughout. Last 4" is soft and decomposed. R2:Core Times (min:sec) 8.6-9.6' (2:40) 9.6-10.0' Core Blocked	
10	R3	62.4/62.4	10.0 - 15.2	RQD = 86%			-22.50		10.0 R3: Grey-green-white, hard to very hard, moderately weathered to fresh, fine grained SCHIST with thin banding, moderately dipping to steep. Joints steep, close to wide, tight, no infilling. Rock quality is good; slightly fractured. R3:Core Times (min:sec) 10.0-11.0' (4:00) 11.0-12.0' (3:00) UCT-202-R3 7.2-8.2 dbbs 12.0-13.0' (3:15) 13.0-14.0' (2:55) 14.0-15.2' (3:50)	UCS=10,493 psi
15	R4	57.6/57.6	15.2 - 20.0	RQD = 90%			-27.70		15.2 R4: Grey white, fine to medium grained, hard to very hard, slightly weathered to fresh SCHIST with thin banding. Joint set steep to vertical, tight to open, green-white soft infilling. Rock quality is good to excellent; slightly fractured to massive. R4:Core Times (min:sec) 15.2-16.2' (3:00) 16.2-17.2' (2:00) 17.2-18.2' (1:00) 18.2-19.2' (1:00) 19.2-20.0' (1:00)	
20	R5	60/60	20.0 - 25.0	RQD = 85%			-32.50		20.0 R5: Grey white, hard to very hard, slightly weathered to fresh, fine grained SCHIST, thin banding. Primary joint set moderately dipping to steep, moderately close to widely spaced, tight to open with green-white soft infilling. Rock quality is good; slightly fractured. R5:Core Times (min:sec) 20.0-21.0' (3:44) 21.0-22.0' (2:15)	
25										

Remarks:

aCore blocked at 1.4' bgs on R2.
Assumed Bridge Deck Elevation 10.6', 23.1' from Bridge Deck to River bed.

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-GR-202

Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: The Gut Bridge over The Gut
Location: South Bristol, Maine

Boring No.: BB-GR-202
PIN: 8965.00

Driller:	MaineDOT	**Elevation (ft.)**	-12.5	**Auger ID/OD:**	N/A
Operator:	G. Lidstone	**Datum:**	NGVD	**Sampler:**	Standard Split Spoon
Logged By:	L. Krusinski	**Rig Type:**	CME 45C	**Hammer Wt./Fall:**	30"/140#
Date Start/Finish:	3/16/05-3/16/05	**Drilling Method:**	Cased Wash Boring	**Core Barrel:**	NX, 1.88 OD Core
Boring Location:	12+68.5, 5.6 Lt.	**Casing ID/OD:**	HW	**Water Level*:**	Tidal

Definitions:
D = Split Spoon Sample
MD = Unsuccessful Split Spoon Sample attempt
U = Thin Wall Tube Sample
R = Rock Core Sample
V = Insitu Vane Shear Test
SSA = Solid Stem Auger

Definitions:
S_u = Insitu Field Vane Shear Strength (psf)
T_v = Pocket Torvane Shear Strength (psf)
q_p = Unconfined Compressive Strength (ksf)
$S_{u(lab)}$ = Lab Vane Shear Strength (psf)
WOH = weight of 140lb. hammer
WOR = weight of rods

Definitions:
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-value	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.
25							-37.50		22.0-23.0' (1:30) 23.0-24.0' (2:00) 24.0-25.0' (1:00) **Bottom of Exploration at 25.0 feet below ground surface.** 25.0	
									Bottom of Exploration at 25.0 feet below ground surface.	
30										
35										
40										
45										
50										

Remarks:

[a]Core blocked at 1.4' bgs on R2.
Assumed Bridge Deck Elevation 10.6', 23.1' from Bridge Deck to River bed.

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-GR-202

Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: Gut Bridge
Location: South Bristol, Maine

Boring No.: BB-GR-301
PIN: 16750.00

Driller:	Maine Test Borings	**Elevation (ft.)**	10.8	**Auger ID/OD:**	2"
Operator:	Brad Enos	**Datum:**	NAVD 88	**Sampler:**	Split Spoon
Logged By:	Kyle MacDonald	**Rig Type:**	Skid/Trailer CME-45	**Hammer Wt./Fall:**	140/30"
Date Start/Finish:	08/04/11-08/05/11	**Drilling Method:**	Spun Casing	**Core Barrel:**	NQ2
Boring Location:	N 375505, E 3113131	**Casing ID/OD:**	3"	**Water Level*:**	
Hammer Efficiency Factor:	0.6	**Hammer Type:**	Automatic ☐ Hydraulic ☐ Rope & Cathead ☒		

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

Depth (ft.)	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-uncorrected	N_{60}	Casing Blows	Elevation (ft.)	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.
0	1D	24/4	0.3 - 2.3	1-1-4-2	5	5		10.5	Topsoil. (0.3)	
									Loose, brown, fine to medium SAND and organic SILT, trace Gravel, dry.	
								8.8	-FILL- (2.0)	
									Increased drilling resistance at 2' in cobbles/boulders.	
5	2D	24/2	5.0 - 7.0	9-10-8-21	18	18			Medium dense, white-gray, GRAVEL, shells, piece of wood. Gravel consisted of pieces of angular rock between 0.25" and 1.5" maximum particle size. (Probable Rockfill) -FILL-	
10	3D	3/3	10.0 - 10.3	50/3"				0.8	(10.0)	
	R1	55/55	10.8 - 15.4	RQD = 71%				0.5	Brown, fine to coarse SAND, little Silt, trace Gravel, shells throughout, wet. -NEARSHORE DEPOSIT- (10.3)	q_p=15.1KSI
								0.0	See Remark (10.8)	
15	R2	60/60	15.4 - 20.4	RQD = 85%					Very hard, fresh, coarse grained, white/gray, PEGMATITIC GRANITE. Joints are very close to moderately spaced, low angle, undulating, rough, fresh, open to partially open, silt infilling. Trace iron staining throughout. Dark gray, Biotite prevalent from 10.8' to 11.5'. Rock Mass Quality - Fair Rock Core Times (min): 10.8-11.8 (2), 11.8-12.8 (2), 12.8-13.8 (2), 13.8-14.8 (2), 14,8-15.4 (2)	
20	R3	60/60	20.4 - 25.4	RQD = 97%					Very hard, fresh, coarse grained, white /gray, PEGMATITIC GRANITE. Joints are very close to moderately spaced, low angle, undulating, rough, fresh, tight to partially open, silt infilling. Iron staining on joints and spotty iron staining throughout. Rock Mass Quality= Good Rock Core Times (min): 15.4-16.4 (2), 16.4-17.4 (2), 17.4-18.4 (2), 18.4-19.4 (2), 19.4-20.4 (2)	
									Very hard, fresh, coarse grained, white /gray, PEGMATITIC GRANITE. Joints are close to widely spaced, low angle, undulating, rough, fresh, tight to partially open, silt infilling. Iron staining at joints. Rock Mass Quality= Excellent Rock Core Times (min): 20.4-21.4 (2), 21.4-22.4 (2), 22.4-23.4 (2), 23.4-24.4 (2), 24.4-25.4 (2)	
25	R4	60/60	25.4 - 30.4	RQD = 100%					Very hard, fresh, coarse grained, white/gray, PEGMATITIC	

Remarks:

Increased resistance on roller bit from 10.3' to 10.8', probable rock.

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: Gut Bridge
Location: South Bristol, Maine

Boring No.: BB-GR-301
PIN: 16750.00

Driller:	Maine Test Borings	**Elevation (ft.)**	10.8	**Auger ID/OD:**	2"
Operator:	Brad Enos	**Datum:**	NAVD 88	**Sampler:**	Split Spoon
Logged By:	Kyle MacDonald	**Rig Type:**	Skid/Trailer CME-45	**Hammer Wt./Fall:**	140/30"
Date Start/Finish:	08/04/11-08/05/11	**Drilling Method:**	Spun Casing	**Core Barrel:**	NQ2
Boring Location:	N 375505, E 3113131	**Casing ID/OD:**	3"	**Water Level*:**	
Hammer Efficiency Factor:	0.6	**Hammer Type:**	Automatic ☐ Hydraulic ☐ Rope & Cathead ☒		

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

Depth (ft.)	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-uncorrected	N_{60}	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.
										GRANITE. Joints are widely spaced, low angle, undulating, rough, fresh, tight. Iron staining at joints, occasional silt infilling. Rock Mass Quality=Excellent Rock Core Times (min): 25.4-26.4 (2), 26.4-27.4 (2), 27.4-28.4 (2), 28.4-29.4 (2), 29.4-30.4 (2)	
30								-19.6		30.4 **Bottom of Exploration at 30.40 feet below ground surface.**	
35											
40											
45											
50											

Remarks:

Increased resistance on roller bit from 10.3' to 10.8', probable rock.

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: Gut Bridge
Location: South Bristol, Maine

Boring No.: BB-GR-302
PIN: 16750.00

Driller:	Maine Test Borings	**Elevation (ft.)**	-5.4	**Auger ID/OD:**	2"
Operator:	Brad Enos	**Datum:**	NAVD 88	**Sampler:**	Split Spoon
Logged By:	Kyle MacDonald	**Rig Type:**	Skid/Raft CME-45	**Hammer Wt./Fall:**	140/30"
Date Start/Finish:	08/10/11-08/10/11	**Drilling Method:**	Drive Casing	**Core Barrel:**	NX
Boring Location:	N 375493, E 3113190	**Casing ID/OD:**	3"	**Water Level*:**	
Hammer Efficiency Factor:	0.6	**Hammer Type:**	Automatic ☐ Hydraulic ☐ Rope & Cathead ☒		

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

Sample Information

Depth (ft.)	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-uncorrected	N_{60}	Casing Blows	Elevation (ft.)	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.
0	1D	24/1	0.0 - 2.0	WOH-WOH-1-1	1	1			Very loose, brown, GRAVEL, trace Silt, shells throughout. (Possible rock fill mixed with some medium to coarse Sand) -FILL-	
5	2D	24/1	5.0 - 7.0	7-9-9-8	18	18		-10.4	5.0 — Spoon consists of gray Silty CLAY clumps and rock pieces. Possible transition from fill to natural soil.	
10	3D	24/12	10.0 - 12.0	1-2-2-24	4	4			Medium stiff, gray, Silty CLAY, little fine Sand, coarse Sand and little Gravel in bottom 2". -MARINE DEPOSIT-	
	R1	60/60	12.1 - 17.1	RQD = 55%				-17.4	12.0 — Hard, fresh, fine to medium grained, gray, SCHIST with flow banding. Primary joints are close to moderately spaced, high angle, planar, rough, fresh, tight to partially open. Secondary joints are close to moderately spaced, low angle to moderately dipping, planar, rough, fresh, tight to partially open. 14.9' to 16.2': Similar but very closely spaced. Rock Mass Quality= Fair Rock Core Times (min): 12.1-13.1 (3), 13.1-14.1 (2), 14.1-15.1 (2), 15.1-16.1 (1.5), 16.1-17.1 (2)	q_p=2.8KSI
15	R2	58/56	17.1 - 21.9	RQD = 66%					17.1' to 18.8': Similar to R1.	
								-24.2	18.8 — 18.8' to 21.9': Hard, fresh, medium grained, gray, GRANITE. Joints are very close to moderately spaced, planar, rough, fresh, tight. Dark gray, Biotite from 21.7' to 21.9'. Rock Mass Quality= Fair Rock Core Times (min): 17.1-18.1 (2), 18.1-19.1 (2), 19.1-20.1 (1.75), 20.1-21.1 (1.75), 21.1-21.9 (1.75)	
20								-27.3	21.9 — **Bottom of Exploration at 21.90 feet below ground surface.**	
25										

Remarks:

1. Black wash water with shells at 0' to 1'.
2. Chips of rock in wash water and heavy resistance from 12' to 12.1'.

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Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: Gut Bridge
Location: South Bristol, Maine

Boring No.: BB-GR-303
PIN: 16750.00

Driller:	Maine Test Borings	**Elevation (ft.)**	-6.6	**Auger ID/OD:**	2"
Operator:	Brad Enos	**Datum:**	NAVD 88	**Sampler:**	Split Spoon
Logged By:	Kyle MacDonald	**Rig Type:**	Skid/Raft CME-45	**Hammer Wt./Fall:**	140/30"
Date Start/Finish:	08/04/11-08/04/11	**Drilling Method:**	Drive Casing	**Core Barrel:**	NX
Boring Location:	N 375510, E 3113195	**Casing ID/OD:**	3"	**Water Level*:**	
Hammer Efficiency Factor:	0.6	**Hammer Type:**	Automatic ☐ Hydraulic ☐ Rope & Cathead ☒		

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

Sample Information

Depth (ft.)	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-uncorrected	N_{60}	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.
0	1D	24/6	0.0 - 2.0	1-1-1-4	2	2				Loose, brown-black, fine to coarse SAND, trace Silt, little Gravel, trace Glass. Organic odor. -NEARSHORE DEPOSIT-	
								-8.6		2.0	
										Cuttings consist of clay at 2'.	
5	2D	24/1	5.0 - 7.0	7-8-9-9	17	17				Very stiff, gray, Silty CLAY, some fine to coarse Sand, trace Gravel. -MARINE DEPOSIT-	
								-15.4		8.8	
	R1	55/55	9.4 - 14.0	RQD = 76%				-16.0		Increased drilling resistance at 8.8', probable rock. 9.4	q_p=14.7KSI
10										Very hard, fresh, coarse to medium grained, white-gray, PEGMATITIC GRANITE. Primary joints are very close to moderately spaced, low angle to moderately dipping, planar, rough, fresh, tight to partially open. Dark gray, Biotite vein at 13.8'. Rock Mass Quality= Good Rock Core Times (min): 9.4-10.4 (5), 10.4-11.4 (3.5), 11.4-12.4 (4.5), 12.4-13.4 (4), 13.4-14 (3)	
15	R2 R3	10/7 62/55	14.0 - 14.8 14.8 - 20.0	RQD = 0% RQD = 81%						R2: Similar to R1. Short run due to rock jamming in the core barrel. Rock Core Times (min): 14-14.8 (2) R3: 14.8'-16': Similar to R1.	
								-22.6		16.0	
										16'-20': Hard, fresh, fine to medium grained, gray, SCHIST with vertical flow banding. Joints are moderately spaced, moderately dipping to high angle, planar, rough, tight. Rock Mass Quality= Good Rock Core Times (min): 14.8-15.8 (2), 15.8-16.8 (2), 16.8-17.8 (2), 17.8-18.8 (1), 18.8-19.8 (1)	
20								-26.6		20.0	
										Bottom of Exploration at 20.00 feet below ground surface.	
25											

Remarks:

1. Gravel piece in tip of spoon for sample 1D.

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Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: Gut Bridge
Location: South Bristol, Maine

Boring No.: BB-GR-304
PIN: 16750.00

Driller:	Maine Test Borings	**Elevation (ft.)**	-11.6	**Auger ID/OD:**	2"
Operator:	Brad Enos	**Datum:**	NAVD 88	**Sampler:**	Split Spoon
Logged By:	Eric Baron	**Rig Type:**	Trailer CME-45	**Hammer Wt./Fall:**	140/30"
Date Start/Finish:	09/08/11-09/08/11	**Drilling Method:**	Drive/Spin/NQ2 Core	**Core Barrel:**	NQ2
Boring Location:	N 375554, E 3113165	**Casing ID/OD:**	4"/3"	**Water Level*:**	Tidal
Hammer Efficiency Factor:	0.6	**Hammer Type:**	Automatic ☐ Hydraulic ☐ Rope & Cathead ☒		

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

Sample Information

Depth (ft.)	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-uncorrected	N_{60}	Casing Blows	Elevation (ft.)	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.
	1D	24/8	0.5 - 2.5	12-11-12-8	23	23	HYD		Medium dense, brown/gray mottled, fine to medium SAND, little Silt, trace Gravel. Top 2": rock fragments (cobble/ gravel pieces) -NEARSHORE DEPOSIT-	
							PUSH			
							SPIN			
								-15.5	3.9	
	R1	38/36	4.5 - 7.7	RQD = 32%				-16.1	Increased drilling resistance at 3.9', probable rock. 4.5	PLA=0.24 ksi PLD=0.10 ksi
5									Hard to medium hard, fresh, medium grained, gray, SCHIST. Primary joints are close, low angle, planar, rough, fresh to discolored, tight to partially open. Secondary joints are similar with a high angle. Rock Mass Quality=Poor Rock Core Times (min): 4.5-5.5 (2.25), 5.5-6.5 (2.5), 6.5-7.7 (2.25)	
	R2	57/52	7.7 - 12.5	RQD = 51%					Hard to soft, fresh to moderately weathered, fine to medium grained, gray, SCHIST. Primary joints are close to very close, low angle to moderately dipping, planar, rough, fresh to decomposed, partially open to open.	PLA=0.38 ksi PLD=0.24 ksi PLA=0.27 ksi PLD=0.33 ksi
10								-21.8	10.2	
									Moderately weathered zone 10.2' to 12', sand and silt with latent rock structure. Rock Mass Quality=Poor	
	R3	60/60	12.5 - 17.5	RQD = 95%				-23.6	Rock Core Times (min): 7.7-8.7 (2.5), 8. 7-9.7 (3.25), 9.7-10.7 (2.25), 10.7-11.7 (2.25), 11.7-12.5 (2.5) 12.0	
15									Hard, fresh, fine grained, gray, SCHIST. Primary joints are moderately spaced, low angle to horizontal, planar, rough, fresh, tight to partially open. One secondary joint at 16.8' is moderately dipping, planar, rough, fresh, partially open. Rock Mass Quality=Excellent Rock Core Times (min): 12.5-13.5 (2.5), 13.5-14.5 (2.75), 14.5-15.5 (3.0), 15.5- 16.5 (3.0), 16.5-17.5 (3.25)	
	R4	60/60	17.5 - 22.5	RQD = 80%					Hard, fresh, fine to medium grained, gray, SCHIST. Primary joints are close to moderately spaced, low angle, planar, fresh, rough, partially open. One secondary joint is moderately dipping, planar, rough fresh , partially open. Healed low angle and near vertical fractures. Rock Mass Quality=Good Rock Core Times (min): 17.5-18.5 (3.25), 18.5-19.5 (2.75), 19.5-20.5 (2.5), 20.5-21.5 (2.5), 21.5-22.5 (2.5)	
20										
	R5	60/60	22.5 - 27.5	RQD = 92%					Hard, fresh, fine grained, gray, SCHIST. Primary joints are close to moderately spaced, low angle, planar, rough, fresh to discolored, tight to partially open, Calcite on joints. One secondary joint at 23.5' is high angle, planar, rough, fresh, tight. Rock Mass Quality=Excellent Rock Core Times (min): 22.5-23.5 (2.25), 23.5-24.5 (2.0), 24.5-25.5 (2.25), 25.5-26.5 (2.25), 26.5-27.5 (2.25)	
25										

Remarks:

1. 2 2' from top of bridge deck to mudline. (Top of Rock at 26.1' below deck.)
2. Televiewer readings taken from top of casing. 3.55' top of casing to bridge deck.
3. R3- Inner barrel did not lock into wireline barrel, allowing greater than 60 inches of recovery, extra recovery left in hole from previous run. 4. Boring location and elevation are approximate and were estimated based on hand measurements from existing site features.

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Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: Gut Bridge
Location: South Bristol, Maine

Boring No.: BB-GR-304
PIN: 16750.00

Driller:	Maine Test Borings	**Elevation (ft.)**	-11.6	**Auger ID/OD:**	2"
Operator:	Brad Enos	**Datum:**	NAVD 88	**Sampler:**	Split Spoon
Logged By:	Eric Baron	**Rig Type:**	Trailer CME-45	**Hammer Wt./Fall:**	140/30"
Date Start/Finish:	09/08/11-09/08/11	**Drilling Method:**	Drive/Spin/NQ2 Core	**Core Barrel:**	NQ2
Boring Location:	N 375554, E 3113165	**Casing ID/OD:**	4"/3"	**Water Level*:**	Tidal
Hammer Efficiency Factor:	0.6	**Hammer Type:**	Automatic ☐ Hydraulic ☐ Rope & Cathead ☒		

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

Depth (ft.)	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-uncorrected	N_{60}	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.
	R6	60/60	27.5 - 32.5	RQD = 95%						Same as R5. Primary joints are moderately spaced. Secondary joint at 34.6'. Rock Mass Quality=Excellent Rock Core Times (min): 27.5-28.5 (2.0), 28.5-29.5 (2.25), 29.5-30.5 (2.25), 30.5-31.5 (2.0), 31.5-32.5 (2.5)	
30											
	R7	60/60	32.5 - 37.5	RQD = 88%						Same as R6. Secondary joint at 40.5'. Rock Mass Quality=Good Rock Core Times (min): 32.5-33.5 (2.25), 33.5-34.5 (2.5), 34.5-35.5 (2.5), 35.5- 36.5 (2.25), 36.5-37.5 (2.0)	
35											
								-49.1		37.5 **Bottom of Exploration at 37.50 feet below ground surface.**	
40											
45											
50											

Remarks:

1. 2 2' from top of bridge deck to mudline. (Top of Rock at 26.1' below deck.)
2. Televiewer readings taken from top of casing. 3.55' top of casing to bridge deck.
3. R3- Inner barrel did not lock into wireline barrel, allowing greater than 60 inches of recovery, extra recovery left in hole from previous run. 4. Boring location and elevation are approximate and were estimated based on hand measurements from existing site features.

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Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: Gut Bridge
Location: South Bristol, Maine

Boring No.: BB-GR-305
PIN: 16750.00

Driller:	Maine Test Borings	**Elevation (ft.)**	3.9	**Auger ID/OD:**	2"
Operator:	Brad Enos	**Datum:**	NAVD 88	**Sampler:**	Split Spoon
Logged By:	Kyle MacDonald	**Rig Type:**	Skid/Trailer CME-45	**Hammer Wt./Fall:**	140/30"
Date Start/Finish:	08/04/11-08/04/11	**Drilling Method:**	Spun Casing	**Core Barrel:**	NQ2
Boring Location:	N 375574, E 3113217	**Casing ID/OD:**	3"	**Water Level*:**	
Hammer Efficiency Factor:	0.6	**Hammer Type:**	Automatic ☐ Hydraulic ☐ Rope & Cathead ☒		

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

Depth (ft.)	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-uncorrected	N_{60}	Casing Blows	Elevation (ft.)	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.
0	1D	24/10	0.0 - 2.0	5-18-7-7	25	25			Medium dense, brown, fine to coarse SAND and GRAVEL, trace Silt, damp. (Probable rock fill) -FILL-	
									See Remark 1.	
5	2D	9/7	5.0 - 5.8	4-50/3"					Stiff, brown-gray with black streaks, Silty CLAY, some fine to coarse Sand, trace Gravel. -FILL- Drill action from 5.7' to 7.9' indicates cobbles/boulders.	
								-4.0	7.9	
	R1	17/14	8.6 - 10.0	RQD = 53%				-4.7	Increased drilling resistance at 7.9', probable rock. 8.6	q_p=13.1KSI
10	R2	60/41	10.0 - 15.0	RQD = 45%				-7.4	Hard, fresh, fine grained, gray, SCHIST. Joints are very close to moderately spaced, low angle to moderately dipping, planar, rough, discolored, partially open to open, slight iron staining throughout. Coarse grained Pegmatitic Granite intrusion at 9.6' to 10.0'. Rock Mass Quality= Fair Rock Core Times (min): 8.6-9.6 (1.5), 9.6-10 (2) 10'-11.3': Very hard, fresh, fine grained, blue-gray, SCHIST. Joints are very close to close, moderately dipping to high angle, planar, rough, fresh, tight to partially open. 11.3	
15	R3	54/52	15.0 - 19.5	RQD = 65%					11.3'-15': Very hard, fresh, coarse grained, gray-white, PEGMATITIC GRANITE. Joints are close to moderately spaced, low angle, undulating, rough, fresh to discolored, tight, iron staining at joints. Rock Mass Quality= Poor Rock Core Times (min): 10-11 (2.25), 11-12 (1.25), 12-13 (2), 13-14 (4), 14-15 (3) 15'-18.3': Very hard, coarse grained, gray-white, PEGMATITIC GRANITE. Primary joints are close to moderately spaced, low angle, undulating, rough, fresh to discolored, tight, iron staining on joints. Secondary joints are close to moderately spaced, vertical to high angle, planar, rough, fresh to discolored, tight, iron staining on joints. 18.3	
								-14.4		
20	R4	30/30	19.5 - 22.0	RQD = 56%				-18.1	18.3'-19.5': Medium hard, fresh, fine grained, blue-gray, SCHIST. Joints are very close to close, high angle to moderately dipping, planar, rough, fresh to weathered, tight, partially open, silt infilling. Pegmatite intrusions at 19.3'. Rock Mass Quality= Fair Rock Core Times (min): 15-16 (3), 16-17 (3), 17-18 (3), 18-19 (3), 19-19.5 (2) Medium hard, fresh, fine grained, blue gray, SCHIST. Joints are very close to closely spaced, moderately dipping to high angle, planar, rough, fresh, tight to partially open, silt infilling. Pegmatite intrusion at 19.8' . Rock Mass Quality= Fair	
25										

Remarks:

1. At 4', change in drill action; smoother drilling.

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Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: Gut Bridge
Location: South Bristol, Maine

Boring No.: BB-GR-305
PIN: 16750.00

Driller:	Maine Test Borings	**Elevation (ft.)**	3.9	**Auger ID/OD:**	2"
Operator:	Brad Enos	**Datum:**	NAVD 88	**Sampler:**	Split Spoon
Logged By:	Kyle MacDonald	**Rig Type:**	Skid/Trailer CME-45	**Hammer Wt./Fall:**	140/30"
Date Start/Finish:	08/04/11-08/04/11	**Drilling Method:**	Spun Casing	**Core Barrel:**	NQ2
Boring Location:	N 375574, E 3113217	**Casing ID/OD:**	3"	**Water Level*:**	
Hammer Efficiency Factor:	0.6	**Hammer Type:**	Automatic ☐ Hydraulic ☐ Rope & Cathead ☒		

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

Depth (ft.)	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-uncorrected	N_{60}	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.
										Rock Core Times (min): 19.5-20.5 (2), 20.5-21.5 (2), 21.5-22 (1)	
										22.0	
										Bottom of Exploration at 22.00 feet below ground surface.	
30											
35											
40											
45											
50											

Remarks:

1. At 4', change in drill action; smoother drilling.

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Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: Gut Bridge
Location: South Bristol, Maine

Boring No.: BB-GR-306
PIN: 16750.00

Driller:	Maine Test Borings	**Elevation (ft.)**	1.6	**Auger ID/OD:**	2"
Operator:	Brad Enos	**Datum:**	NAVD 88	**Sampler:**	Split Spoon
Logged By:	Kyle MacDonald	**Rig Type:**	Skid/Barge CME-45	**Hammer Wt./Fall:**	140/30"
Date Start/Finish:	08/11/11-08/11/11	**Drilling Method:**	Drive Casing	**Core Barrel:**	NX
Boring Location:	N 375587, E 3113255	**Casing ID/OD:**	3"	**Water Level*:**	
Hammer Efficiency Factor:	0.6	**Hammer Type:**	Automatic ☐ Hydraulic ☐ Rope & Cathead ☒		

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

Sample Information

Depth (ft.)	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-uncorrected	N_{60}	Casing Blows	Elevation (ft.)	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.
0	1D	24/5	0.0 - 2.0	5-3-2-1	5	5			Loose, black, fine to coarse SAND and GRAVEL, little Silt, organics throughout. -NEARSHORE DEPOSIT-	
								-1.2	2.8	
	R1	20/7	3.4 - 5.1	RQD = 0%				-1.8	Increased drilling resistance at 2.8', probable rock. 3.4	
5	R2	24/12	5.1 - 7.1	RQD = 0%					Hard, moderately weathered, medium to coarse grained, gray to white, SCHIST and PEGMATITIC GRANITE. Joints are extremely close to close, undulating, rough, discolored, open, sand infillings, iron staining throughout. Rock Mass Quality= Very Poor Rock Core times (min): 3.4-4.4 (6), 4.4-5.1 (5)	
	R3	24/21	7.1 - 9.1	RQD = 42%					Hard, slightly to moderately weathered gray-white, PEGMATITIC GRANITE. Joints are extremely close to close, low angle, undulating, rough, discolored,open, heavy iron staining throughout. Rock Mass Quality= Very Poor Rock Core times (min): 5.1-6.1 (3), 6.1-7.1 (2)	
10	R4	52/51	9.1 - 13.4	RQD = 73%				-9.1	Very hard, fresh, coarse grained, white to gray, PEGMATITIC GRANITE and SCHIST. Joints are extremely close to close, moderately dipping, undulating, rough, fresh, partially open to open, trace silt infilling, iron staining at joints. Rock Mass Quality= Poor Rock Core Times (min): 7.1-8.1 (2), 8.1-9.1 (2)	
	R5	46/46	13.4 - 17.2	RQD = 96%					9.1'-10.7': Very hard, fresh, coarse grained, white, PEGMATITIC GRANITE. Joints are close to moderately spaced, moderately dipping to near vertical, undulating, rough, discolored, tight to partially open, iron staining throughout. 10.7	
15								-15.6	10.7'-13.4': Hard, fresh, fine grained, gray, SCHIST. Primary joints are moderately spaced, low angle, planar, rough, fresh, tight to partially open. Secondary joint at 12.6' similar but high angle with silt infilling. Rock Mass Quality= Poor Rock Core Times (min): 9.1-10.1 (3), 10.1-11.1 (2), 11.1-12.1 (1.5), 12.1-13.4 (1)	
20									Hard, fresh, fine grained, gray, SCHIST with flow banding. Primary joints are close to moderately spaced, low angle, planar, rough, fresh, tight. Secondary joint at 15.9' is high angle, planar, rough, fresh, tight with iron staining and silt infilling. Rock Mass Quality= Poor Rock Core Times (min): 13.4-14.4 (1.5), 14.4-15.4 (1.5), 15.4-16.4 (1.5), 16.4- 17.2 (1) 17.2	
25									**Bottom of Exploration at 17.20 feet below ground surface.**	

Remarks:

1. Increased resistance on roller bit from 2.8' to 4.3'.
2. Core barrel blocked at 5.1'.
3. Driller found stopper was broken in core barrel at 5.1'. Replaced.

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Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: Gut Bridge
Location: South Bristol, Maine

Boring No.: BB-GR-307
PIN: 16750.00

Driller:	Maine Test Borings	**Elevation (ft.)**	7.5	**Auger ID/OD:**	2"
Operator:	Brad Enos	**Datum:**	NAVD 88	**Sampler:**	Split Spoon
Logged By:	Kyle MacDonald	**Rig Type:**	Skid CME-45	**Hammer Wt./Fall:**	140/30"
Date Start/Finish:	08/15/11-08/15/11	**Drilling Method:**	Spun Casing	**Core Barrel:**	NQ2
Boring Location:	N 375614, E 3113226	**Casing ID/OD:**	3"	**Water Level*:**	
Hammer Efficiency Factor:	0.6	**Hammer Type:**	Automatic ☐ Hydraulic ☐ Rope & Cathead ☒		

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MV = Unsuccessful Insitu Vane Shear Test attempt
R = Rock Core Sample
SSA = Solid Stem Auger
HSA = Hollow Stem Auger
RC = Roller Cone
WOH = weight of 140lb. hammer
WOR = weight of rods
WO1P = Weight of one person
S_u = Insitu Field Vane Shear Strength (psf)
T_v = Pocket Torvane Shear Strength (psf)
q_p = Unconfined Compressive Strength (ksf)
N-uncorrected = Raw field SPT N-value
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WC = water content, percent
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index
G = Grain Size Analysis
C = Consolidation Test

Sample Information

Depth (ft.)	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-uncorrected	N_{60}	Casing Blows	Elevation (ft.)	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.
0	1D	24/11	0.3 - 2.3	8-9-11-8	20	20		7.2	Bituminous Pavement. 0.3	
									Medium dense, brown, fine to coarse SAND, some Gravel, trace Silt, dry. -FILL-	
5	2D	24/0	5.0 - 7.0	7-5-3-2	8	8			No recovery. Probable rock fill (cobbles/boulders) to 7.5' based on drilling conditions.	
	R1	57/57	7.5 - 12.3	RQD = 81%				0.0	7.5	
									Hard, fresh, fine to medium grained, blue gray, SCHIST. Primary joints are very close to moderately spaced, high angle, planar, rough, fresh, tight to partially open, silt infilling, iron staining at joints and healed fracture, flow banding throughout. Secondary joints are similar, low to moderately dipping. PEGMATITIC GRANITE from 12' to 12.3'. Rock Mass Quality= Good Rock Core Times (min): 7.5-8.5 (3), 8.5-9.5 (2.75), 9.5-10.5 (1.75), 10.5-11.5 (2), 11.5-12.3 (2)	
10								-4.5	12.0	
	R2	60/55	12.3 - 17.3	RQD = 18%					12.3'-15.4': Very hard, slightly weathered, coarse grained, white-gray, PEGMATITIC GRANITE. Primary joints are extremely close to close, high angle, planar, rough, discolored, tight to partially open, silt infilling. Secondary joints are low angle, planar, rough, discolored, tight to partially open, silt infilling, occasional thin Biotite veins throughout core.	
15								-8.8	15.4'-16.3': Hard, moderately weathered, fine grained, white with green tint, PEGMATITIC GRANITE. Joints are very close, high angle, planar, rough, decomposed, open, moderately wide. Rock Mass Quality= Very Poor Rock Core Times (min): 12.3-13.3 (3), 13.3-14.3 (3), 14.3-15.3 (3), 15.3-16.3 (2), 16.3-17.3 (2)	
	R3	60/58	17.3 - 22.3	RQD = 43%				-9.8		
								-11.5	16.3	
20									16.3-17.3': Severely weathered zone, fine to coarse SAND, trace Silt with latent rock structure	
									17.3	
								-14.8	17.3'-19': Hard, slightly weathered, fine grained, white-gray, PEGMATITIC GRANITE and SCHIST. Joints are very close to close. Primary joints are high angle, planar, rough, discolored, partially open to open, trace silt infilling, heavy iron staining throughout. Secondary joints are similar, low angle.	
									19.0	
25									19'-22.3': Very hard, fresh, fine grained, gray-white, GRANITE. Primary joints are close, high angle, planar, rough, fresh, tight to partially open with iron staining at joints. Secondary joints are close to moderately spaced, low	

Remarks:

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Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: Gut Bridge
Location: South Bristol, Maine

Boring No.: BB-GR-307
PIN: 16750.00

Driller:	Maine Test Borings	**Elevation (ft.)**	7.5	**Auger ID/OD:**	2"
Operator:	Brad Enos	**Datum:**	NAVD 88	**Sampler:**	Split Spoon
Logged By:	Kyle MacDonald	**Rig Type:**	Skid CME-45	**Hammer Wt./Fall:**	140/30"
Date Start/Finish:	08/15/11-08/15/11	**Drilling Method:**	Spun Casing	**Core Barrel:**	NQ2
Boring Location:	N 375614, E 3113226	**Casing ID/OD:**	3"	**Water Level*:**	
Hammer Efficiency Factor:	0.6	**Hammer Type:**	Automatic ☐ Hydraulic ☐ Rope & Cathead ☒		

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

Depth (ft.)	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-uncorrected	N_{60}	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.
										angle, planar, rough, fresh, tight to partially open with trace silt infilling and iron staining. Rock Mass Quality= Poor Rock Core Times (min): 17.3-18.3 (2), 18.3-19.3 (2), 19.3-20.3 (3), 20.3-21.3 (3), 21.3-22.3 (3)	
										22.3	
										Bottom of Exploration at 22.30 feet below ground surface.	
30											
35											
40											
45											
50											

Remarks:

Stratification lines represent approximate boundaries between soil types; transitions may be gradual.
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Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: Gut Bridge
Location: South Bristol, Maine

Boring No.: BB-GR-308
PIN: 16750.00

Driller:	Maine Test Borings	**Elevation (ft.)**	-8.9	**Auger ID/OD:**	2"
Operator:	Brad Enos	**Datum:**	NAVD 88	**Sampler:**	Split Spoon
Logged By:	Kyle MacDonald	**Rig Type:**	Skid/Barge CME-45	**Hammer Wt./Fall:**	140/30"
Date Start/Finish:	08/10/11-08/10/11	**Drilling Method:**	Drive Casing	**Core Barrel:**	NX
Boring Location:	N 375642, E 3113288	**Casing ID/OD:**	3"	**Water Level*:**	
Hammer Efficiency Factor:	0.6	**Hammer Type:**	Automatic ☐ Hydraulic ☐ Rope & Cathead ☒		

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

Sample Information

Depth (ft.)	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-uncorrected	N_{60}	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.
0	1D	14/8	0.0 - 1.2	WOH-27-100/1"						Medium dense, dark brown, fine to coarse SAND and SILT, little Gravel, organic odor. Upper 1" was organic silt. -NEARSHORE DEPOSIT-	
	R1	60/60	2.6 - 7.6	RQD = 77%				-11.2		2.3	
								-11.5		Increased drilling resistance at 2.3', probable rock. 2.6	
5	R2	60/57	7.6 - 12.6	RQD = 95%						Hard, fresh, fine grained, gray, SCHIST with flow banding. Joints are close to moderately spaced. Primary joints are low angle, planar, rough, fresh, tight to partially open with silt infillings. Secondary joints are high angled, planar, rough, tight with silt infilling. Iron staining from 2.6' to 4.3' and iron staining at joints. Rock Mass Quality= Good Rock Core Times (min): 2.6-3.6 (2), 3.6-4.6 (1.25), 4.6-5.6 (1. 25), 5.6-6.6 (1.25), 6.6-7.6 (1) Similar to R1. Rock Mass Quality= Excellent Rock Core Times (min): 7.6-8.6 (1), 8.6-9.6 (1), 9.6-10.6 (1), 10.6-11.6 (1), 11.6-12.6 (1)	
10								-21.5		12.6 **Bottom of Exploration at 12.60 feet below ground surface.**	
15											
20											
25											

Remarks:

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Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: Gut Bridge
Location: South Bristol, Maine

Boring No.: BB-GR-309
PIN: 16750.00

Driller:	Maine Test Borings	**Elevation (ft.)**	8.2	**Auger ID/OD:**	2"
Operator:	Brad Enos	**Datum:**	NAVD 88	**Sampler:**	Split Spoon
Logged By:	Kyle MacDonald	**Rig Type:**	Skid CME-45	**Hammer Wt./Fall:**	140/30"
Date Start/Finish:	08/3/11-08/3/11	**Drilling Method:**	Spun Casing	**Core Barrel:**	NQ2
Boring Location:	N 375823, E 3113209	**Casing ID/OD:**	3"	**Water Level*:**	
Hammer Efficiency Factor:	0.6	**Hammer Type:**	Automatic ☐ Hydraulic ☐ Rope & Cathead ☒		

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R = Rock Core Sample
SSA = Solid Stem Auger
HSA = Hollow Stem Auger
RC = Roller Cone
WOH = weight of 140lb. hammer
WOR = weight of rods
WO1P = Weight of one person
S_u = Insitu Field Vane Shear Strength (psf)
T_v = Pocket Torvane Shear Strength (psf)
q_p = Unconfined Compressive Strength (ksf)
N-uncorrected = Raw field SPT N-value
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WC = water content, percent
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index
G = Grain Size Analysis
C = Consolidation Test

Sample Information

Depth (ft.)	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-uncorrected	N_{60}	Casing Blows	Elevation (ft.)	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.
0	1D	11/7	0.3 - 1.2	26-70/5"				7.9	Bituminous Pavement (0.3)	
									Very dense, brown-gray, fine to coarse SAND and GRAVEL, trace Silt, dry. -FILL- See Remark 1.	
5	2D	16/0	5.8 - 7.1	22-5-50/4"					No recovery. -FILL- (Probable Rock Fill)	
10	3D	15/3	10.0 - 11.3	8-4-50/3"					Light gray-tan, GRAVEL, trace shell fragments, consistent with parent rock, wet. -FILL- (Probable Rock Fill)	
15	4D	24/10	15.0 - 17.0	8-4-3-5	7	7		-6.6	Drilling resistance indicates bottom of cobbles/boulders at 14.8'. (14.8) Medium stiff to stiff, gray, Clayey SILT, shells throughout, wet. -MARINE DEPOSIT-	
20	5D	24/8	20.0 - 22.0	7-9-9-18	18	18			Very stiff, mottled brown-gray, Silty CLAY, trace fine to coarse Sand, trace Gravel, fine sand lenses throughout, wet.	
25	R1	35/32	24.1 - 27.0	RQD = 0%				-15.5	(23.7)	
								-15.9	Increased drilling resistance at 23.7', probable rock. (24.1) Soft, fresh, fine grained, white-gray with green tint, SCHIST. Joints are extremely close to close, moderately dipping to high angle, planar, rough, fresh, open with trace	

Remarks:

1. Lost wash water during drilling at 2.5' and 3.5'.

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Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: Gut Bridge
Location: South Bristol, Maine

Boring No.: BB-GR-309
PIN: 16750.00

Driller:	Maine Test Borings	**Elevation (ft.)**	8.2	**Auger ID/OD:**	2"
Operator:	Brad Enos	**Datum:**	NAVD 88	**Sampler:**	Split Spoon
Logged By:	Kyle MacDonald	**Rig Type:**	Skid CME-45	**Hammer Wt./Fall:**	140/30"
Date Start/Finish:	08/3/11-08/3/11	**Drilling Method:**	Spun Casing	**Core Barrel:**	NQ2
Boring Location:	N 375823, E 3113209	**Casing ID/OD:**	3"	**Water Level*:**	
Hammer Efficiency Factor:	0.6	**Hammer Type:**	Automatic ☐ Hydraulic ☐ Rope & Cathead ☒		

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

Depth (ft.)	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-uncorrected	N_{60}	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.
	R2	37/37	27.0 - 30.1	RQD = 14%						silt infilling. Rock Mass Quality= Very Poor Rock Core Times (min): 24.1-25.1 (0), 25.1-26.1 (3.5), 26.1-27 (2.5)	
30								-21.9		Soft, fresh, fine grained, white-gray with green tint, SCHIST. Joints are extremely close to close, moderately dipping to high angle, planar, rough, fresh, open, trace silt infilling. Highly weathered zone from 29' to 29.6'. Gray SCHIST from 29.8' to 30.1'. Rock Mass Quality= Very Poor Rock Core Times (min): 27-28 (2.5), 28 29 (2.5), 29-30.1 (3.5) 30.1 **Bottom of Exploration at 30.10 feet below ground surface.**	
35											
40											
45											
50											

Remarks:

1. Lost wash water during drilling at 2.5' and 3.5'.

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Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: Gut Bridge
Location: South Bristol, Maine

Boring No.: BB-GR-310
PIN: 16750.00

Driller:	Maine Test Borings	**Elevation (ft.)**	12.4	**Auger ID/OD:**	2"
Operator:	Brad Enos	**Datum:**	NAVD 88	**Sampler:**	Split Spoon
Logged By:	Kyle MacDonald	**Rig Type:**	Skid CME-45	**Hammer Wt./Fall:**	140/30"
Date Start/Finish:	08/4/11-08/4/11	**Drilling Method:**	Spun Casing	**Core Barrel:**	NX
Boring Location:	N 375929, E 3113179	**Casing ID/OD:**	3"	**Water Level*:**	
Hammer Efficiency Factor:	0.6	**Hammer Type:**	Automatic ☐ Hydraulic ☐ Rope & Cathead ☒		

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

Sample Information

Depth (ft.)	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-uncorrected	N_{60}	Casing Blows	Elevation (ft.)	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.
0	1D	24/14	0.3 - 2.3	18-10-8-5	18	18		12.1	Bituminous Pavement — 0.3 Medium dense, brown, fine to coarse SAND, little Gravel, trace Silt, dry. -FILL-	
5	2D	24/0	5.3 - 7.3	5-18-6-3	24	24			See Remark 1. No recovery.	
								4.4	8.0 Boulder	
								2.9	9.5 See Remark 2.	
10	3D	2/1	10.5 - 10.7	50/2"				1.7	Very dense, brown, GRAVEL and fine SAND, trace Silt, wet. -FILL- (probable rock fill) — 10.7 Increased drilling resistance at 10.7', possible rock. — 11.4	
								1.0	**Bottom of Exploration at 11.40 feet below ground surface.**	
15										
20										
25										

Remarks:

1. Change in wash water/cutting from 5.0' to 8.0'. Appears to be gray, fine sand and silt (possible reworked marine deposits).
2. Drilling indicates fine to coarse sand and gravel with cobbles/boulders from 9.5' to 10.7'.
3. At 10.7', cuttings are similar to limonite schist cored in BB-GR-309. Approximately 25 minutes to advance 0.7' with roller cone.

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Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: Gut Bridge
Location: South Bristol, Maine

Boring No.: BB-GR-401
PIN: 16750.00

Driller:	Maine Test Borings	**Elevation (ft.)**	12.0	**Auger ID/OD:**	3.5"
Operator:	Mike Porter	**Datum:**	NAVD 88	**Sampler:**	Split Spoon
Logged By:	Mike Devoid	**Rig Type:**	Skid/Trailer CME-45	**Hammer Wt./Fall:**	140/30"
Date Start/Finish:	03/05/12 - 03/05/12	**Drilling Method:**	Solid Stem Auger	**Core Barrel:**	
Boring Location:	N 375453 E 3113157	**Casing ID/OD:**	-	**Water Level*:**	Dry
Hammer Efficiency Factor:	0.6	**Hammer Type:**	Automatic ☐ Hydraulic ☐ Rope & Cathead ☒		

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

Sample Information

Depth (ft.)	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-uncorrected	N_{60}	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.
0							SSA	11.4		Pavement 0.6	
	1D	24/14	1.5 - 3.5	18-20-11-7	31	31				Dense, brown, fine to coarse SAND, little Gravel, trace Silt, dry. 3.0 - 3.2': Shell layer -FILL-	
5	2D	24/5	5.0 - 7.0	4-6-9-43	15	15				Medium dense, brown, GRAVEL and fine to coarse Sand, little Silt, moist. Rock stuck in tip. -FILL-	G# 8 GP - GM WC = 14.7
	3D	24/2	7.6 - 9.6	20-17-3-2	20	20				See Remark 1. Medium dense, brown, fine to coarse SAND, some Silt, trace Gravel, moist. -FILL- Drilled ahead to 10.4', possible void at 9.5 to 10.4' based on drill action. No refusal.	
10								1.6		10.4 **Bottom of Exploration at 10.40 feet below ground surface.**	
15											
20											
25											

Remarks:

1. 7.5-7.7': Possible cobble based on drill action.
2. Hole open to 10.4', dry at end of drilling. Possible void @ 9.9' to 10.4'. Gut water level at El. -5.1 ± near south abutment.

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Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: Gut Bridge
Location: South Bristol, Maine

Boring No.: BB-GR-402
PIN: 16750.00

Driller:	Maine Test Borings	**Elevation (ft.)**	12.5	**Auger ID/OD:**	3.5"
Operator:	Mike Porter	**Datum:**	NAVD 88	**Sampler:**	Split Spoon
Logged By:	Mike Devoid	**Rig Type:**	Skid/Trailer CME-45	**Hammer Wt./Fall:**	140/30"
Date Start/Finish:	02/27/12 - 02/27/12	**Drilling Method:**	Drive & Wash	**Core Barrel:**	NQ2
Boring Location:	N 375429 E 3113170	**Casing ID/OD:**	3"	**Water Level*:**	8.2
Hammer Efficiency Factor:	0.6	**Hammer Type:**	Automatic ☐ Hydraulic ☐ Rope & Cathead ☒		

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SSA = Solid Stem Auger
HSA = Hollow Stem Auger
RC = Roller Cone
WOH = weight of 140lb. hammer
WOR = weight of rods
WO1P = Weight of one person
S_u = Insitu Field Vane Shear Strength (psf)
T_v = Pocket Torvane Shear Strength (psf)
q_p = Unconfined Compressive Strength (ksf)
N-uncorrected = Raw field SPT N-value
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N_{60} = SPT N-uncorrected corrected for hammer efficiency
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Sample Information

Depth (ft.)	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-uncorrected	N_{60}	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.
0							SSA	11.8		Pavement — 0.7	
	1D	24/14	1.5 - 3.5	4-4-2-1	6	6		10.1		1.5 - 2.4': Loose, brown, fine to coarse SAND, little Gravel, trace Silt. -FILL- — 2.4	
								8.0		2.4 - 2.7': Silty CLAY, trace fine to coarse Sand, 1" layer of Shells at transition based on wash, moist. -FILL- — 4.5	
5	2D	24/4	5.0 - 7.0	1-4-3-7	7	7	7			Loose, brown, GRAVEL and fine to coarse Sand, trace Silt, moist. -FILL-	G# 9 GP-GM WC = 7.7
							9				
							38				
							58				
							60			See Remarks 1 and 2.	
10	R1	60/60	10.0 - 15.0	RQD = 42%			NQ2	2.5		Hard, fresh, fine grained, gray SCHIST. Primary joints are very close to close, low angle, undulating, rough, fresh to discolored, partially open, silt and sand infillings. Secondary joints are high angle, planar, rough, fresh to discolored, partially open, silt and sand infillings. Rock Mass Quality = Poor. Rock Core Times (min): 10-11 (4), 11-12 (4), 12-13 (4), 14-15 (4) — 10.0	
15								-2.5		**Bottom of Exploration at 15.00 feet below ground surface.** — 15.0	
20											
25											

Remarks:

1. Cobbles/Boulders @ 8.5 and 8.8' based on rate of casing advancement.
2. At 8.8', white wash water, possible till. At 9.8', brown wash water, possible weathered rock.
3. Water level measured 10 minutes after completion of drilling. Gut water level at El. 2.2±, near south abutment.

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Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: Gut Bridge
Location: South Bristol, Maine

Boring No.: BB-GR-403
PIN: 16750.00

Driller:	Maine Test Borings	**Elevation (ft.)**	11.6	**Auger ID/OD:**	3.5"
Operator:	Mike Porter	**Datum:**	NAVD 88	**Sampler:**	Split Spoon
Logged By:	Mike Devoid	**Rig Type:**	Skid/Trailer CME-45	**Hammer Wt./Fall:**	140/30"
Date Start/Finish:	03/05/12 - 03/05/12	**Drilling Method:**	Solid Stem Auger	**Core Barrel:**	-
Boring Location:	N 375478 E 3113157	**Casing ID/OD:**	-	**Water Level*:**	Dry
Hammer Efficiency Factor:	0.6	**Hammer Type:**	Automatic ☐ Hydraulic ☐ Rope & Cathead ☒		

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MV = Unsuccessful Insitu Vane Shear Test attempt
R = Rock Core Sample
SSA = Solid Stem Auger
HSA = Hollow Stem Auger
RC = Roller Cone
WOH = weight of 140lb. hammer
WOR = weight of rods
WO1P = Weight of one person
S_u = Insitu Field Vane Shear Strength (psf)
T_v = Pocket Torvane Shear Strength (psf)
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N-uncorrected = Raw field SPT N-value
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N_{60} = SPT N-uncorrected corrected for hammer efficiency
N_{60} = (Hammer Efficiency Factor/60%)*N-uncorrected
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WC = water content, percent
LL = Liquid Limit
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G = Grain Size Analysis
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Sample Information

Depth (ft.)	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-uncorrected	N_{60}	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.
0							SSA	10.8		Pavement — 0.8	
	1D	24/17	1.5 - 3.5	20-15-9-7	24	24				1.5 - 2.3': Medium dense, brown, fine to coarse SAND, little Gravel, trace Silt, occasional clods of gray-brown Silty CLAY. 2.3 - 3.0': Medium dense, olive, fine to medium SAND and Silt, dry. -FILL-	
5	2D	5/1	5.0 - 5.4	55/5"				5.6		Recovery consists of 2 rock fragments (stuck in tip), and trace Sand. See Remark 1. No recovery. Drill action indicates possible boulder fill, auger and split spoon refusal at 6'. — 6.0	
	3D	0/0	6.0 - 6.0	50/0"						**Bottom of Exploration at 6.00 feet below ground surface.**	
10											
15											
20											
25											

Remarks:

1. 2D: 5 blows for 5", then 50/0".

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Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: Gut Bridge
Location: South Bristol, Maine

Boring No.: BB-GR-404
PIN: 16750.00

Driller:	Maine Test Borings	**Elevation (ft.)**	11.4	**Auger ID/OD:**	3.5"
Operator:	Mike Porter	**Datum:**	NAVD 88	**Sampler:**	Split Spoon
Logged By:	Mike Devoid	**Rig Type:**	Skid/Trailer CME-45	**Hammer Wt./Fall:**	140/30"
Date Start/Finish:	02/28/12 - 02/28/12	**Drilling Method:**	Drive & Wash/Spun Casing	**Core Barrel:**	NQ2
Boring Location:	N 375477 E 3113169	**Casing ID/OD:**	3"	**Water Level*:**	9.8
Hammer Efficiency Factor:	0.6	**Hammer Type:**	Automatic ☐ Hydraulic ☐ Rope & Cathead ☒		

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

Sample Information

Depth (ft.)	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-uncorrected	N_{60}	Casing Blows	Elevation (ft.)	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.
0							SSA	10.8	Pavement — 0.6	
	1D	24/11	1.5 - 3.5	3-3-3-3	6	6			Loose, brown, fine to coarse SAND, little Gravel, trace Silt, dry. Bottom 2": Silty CLAY with Shells, moist.	
5	2D	24/7	5.0 - 7.0	1-4-17-14	21	21	16		Medium dense, gray-brown, fine to coarse SAND, some Silt, little Gravel, moist. Rock stuck in tip of spoon. -FILL-	G#10 SM WC = 20.4
							21			
							28			
							16			
							4		Void at 9.0' - 9.7' based on casing advancement. No recovery.	
10	3D	1/0	10.0 - 10.1	50/1"			NQ2	1.3	10.1	
	R1	60/25	10.1 - 15.1	RQD = 22%					Very hard, fresh, medium to coarse grained, white PEGMATITIC GRANITE. Joints are very close to close, low to moderate angle, undulating, rough, fresh, partially open, silt infillings.	
								-0.7	12.1	
								-1.1	Bottom 4": Hard, fresh, fine-grained, gray SCHIST (one piece), underlain by angular GRAVEL pieces, some silt (possible highly weathered/decomposed SCHIST). Rock Mass Quality = Very Poor Rock Core Times (min): 10.1-11.1 (4), 11.1-12.1 (5), 12.1-13.1 (4), 13.1-14.1(4), 14.1-15.1(4).	
15	R2	59/59	15.1 - 20.0	RQD = 39%				-3.3	12.5	
									Possible highly weathered/decomposed SCHIST. See Remarks 1 and 2.	
									14.7	
									Hard, fresh, fine to medium grained, gray SCHIST. Primary joints are very close to close, high angle, planar, rough, fresh, tight, silt and sand infilling, iron staining at joints. Secondary joints are very close to close, low, to moderate angle, undulating, rough, fresh, tight, silt and sand infilling, iron staining at joints. Rock Mass Quality = Poor Rock Core Times (min): 15.1-16.1 (5), 16.1-17.1 (5), 17.1-18.1 (4), 18.1-19.1 (4), 19.1-20.0 (5).	
20								-8.6	20.0	
									Bottom of Exploration at 20.00 feet below ground surface.	
25										

Remarks:

1. Lost drill water during coring for R1; spun casing to 15' to complete R2.
2. Based on casing spinning from 10-15', soft seam at 13.8-14.7'.
3. Water level measured 10 min. after completion of drilling, Gut water level at El. 1.6± near south abutment.

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Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: Gut Bridge
Location: South Bristol, Maine

Boring No.: BB-GR-405
PIN: 16750.00

Driller:	Maine Test Borings	**Elevation (ft.)**	11.1	**Auger ID/OD:**	-
Operator:	Mike Porter	**Datum:**	NAVD 88	**Sampler:**	Split Spoon
Logged By:	Mike Devoid	**Rig Type:**	Skid/Trailer CME-45	**Hammer Wt./Fall:**	140/30"
Date Start/Finish:	03/06/12 - 03/06/12	**Drilling Method:**	Spun Casing	**Core Barrel:**	-
Boring Location:	N 375499 E 3113158	**Casing ID/OD:**	3"	**Water Level*:**	Dry
Hammer Efficiency Factor:	0.6	**Hammer Type:**	Automatic ☐ Hydraulic ☐ Rope & Cathead ☒		

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

Depth (ft.)	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-uncorrected	N_{60}	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.
0							Spun	10.5		Pavement 0.6	
	1D	24/8	1.7 - 3.7	17-8-7-18	15	15				Medium dense, brown, fine to coarse SAND, little Gravel, little Silt, trace Shells, moist. -FILL- See Remark 1.	
5	2D	24/5	5.5 - 7.5	3-8-4-5	12	12				Medium dense, brown, fine to coarse SAND and Gravel, trace Silt, wet. -FILL-	G# 11 SW-SM WC = 10.2
	3D	24/6	9.0 - 11.0	17-40-26-15	66	66				Dense to very dense, brown, fine to coarse SAND, little Gravel, trace Silt, wet. -FILL-	
10								0.1		11.0 **Bottom of Exploration at 11.00 feet below ground surface.**	
15											
20											
25											

Remarks:

1. Drill action indicates possible cobbles/boulders at 1.5' - 1.7', 3.7' - 4.1', 4.5' - 4.6', and 5.0' - 5.3'.
2. Gut water level at El. -3.4'± at completion of drilling near south abutment.

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: Gut Bridge
Location: South Bristol, Maine

Boring No.: BB-GR-406
PIN: 16750.00

Driller:	Maine Test Borings	**Elevation (ft.)**	11.0	**Auger ID/OD:**	-
Operator:	Mike Porter	**Datum:**	NAVD 88	**Sampler:**	Split Spoon
Logged By:	Mike Devoid	**Rig Type:**	Skid/Trailer CME-45	**Hammer Wt./Fall:**	140/30"
Date Start/Finish:	02/28/12 - 03/05/12	**Drilling Method:**	Spun Casing	**Core Barrel:**	NQ2
Boring Location:	N 375499 E 3113172	**Casing ID/OD:**	3"	**Water Level*:**	13.1' - 14.6'
Hammer Efficiency Factor:	0.6	**Hammer Type:**	Automatic ☐ Hydraulic ☐ Rope & Cathead ☒		

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

Sample Information

Depth (ft.)	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-uncorrected	N_{60}	Casing Blows	Elevation (ft.)	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.
0									Pavement	
								10.0	1.0	
	1D	24/11	1.0 - 3.0	4-4-4-9	8	8	Spun		Loose, brown, fine to coarse SAND, some Gravel, little Silt, dry. -FILL- Casing advancement indicates void at 4.9' - 5.7'.	G# 12 SM WC = 8.0
5	2D	24/4	5.7 - 7.7	1-27-26-6	53	53			Brown, fine to coarse SAND and Gravel, trace Silt, wood in tip, wet. -FILL- See Remark 1.	
10	3D	24/3	10.0 - 12.0	55-21-10-12	31	31			Dense, brown, fine to coarse GRAVEL, some fine to coarse Sand, trace Silt, wet. -FILL- See Remark 2.	G# 13 GW WC = 7.9
15										
	4D R1	0/0 60/60	16.0 - 16.0 16.5 - 21.5	75/0" RQD = 83%			NQ2	-5.2	No Recovery, see Remark 3.	
								-5.5	16.2 See Remark 4. 16.5	
20								-10.5	Very hard, fresh, fine grained, gray SCHIST. Primary joints are very close to moderately slpaced, high angle, planar, rough, fresh, tight, trace sand infillings. Secondary joints are very close to moderately spaced, low angle, undulating, rough, tight, trace sand infillings. Rock Mass Quality = Good Rock Core Times (min): 16.5-17.5 (5), 17.5-18.5 (5), 18.5-19.5 (5), 19.5-20.5 (5), 20.5-21.5 (5). 21.5	
25									**Bottom of Exploration at 21.50 feet below ground surface.**	

Remarks:

1. Drill action indicates possible boulder at 8.9' - 10.1'.
2. Drill action indicates possible cobbles/boulders at 12.0' - 12.4', 13.4' - 13.9', and 14.1' - 14.4'.
3. Based on sound and bounce of spoon and drill action, possible wood at 16.0' - 16.2'.
4. Increased resistance on roller bit from 16.2' to 16.5', probable rock.
5. 1st water level measurement at 13.1' 10 minutes after drilling, Gut water level at El.-3.8±. 2nd water level meas.'t at 14.6' 1 hour after drilling, Gut water level at El.-4.7±.

Stratification lines represent approximate boundaries between soil types; transitions may be gradual.
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Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: Gut Bridge
Location: South Bristol, Maine

Boring No.: BB-GR-407
PIN: 16750.00

Driller:	Maine Test Borings	**Elevation (ft.)**	10.9	**Auger ID/OD:**	-
Operator:	Mike Porter	**Datum:**	NAVD 88	**Sampler:**	Split Spoon
Logged By:	Mike Devoid	**Rig Type:**	Skid/Trailer CME-45	**Hammer Wt./Fall:**	140/30"
Date Start/Finish:	03/06/12 - 03/06/12	**Drilling Method:**	Spun Casing	**Core Barrel:**	NQ2
Boring Location:	N 375509 E 3113159	**Casing ID/OD:**	3"	**Water Level*:**	14.5'-15.1'
Hammer Efficiency Factor:	0.6	**Hammer Type:**	Automatic ☐ Hydraulic ☐ Rope & Cathead ☒		

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

Sample Information

Depth (ft.)	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-uncorrected	N_{60}	Casing Blows	Elevation (ft.)	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.
0							SPUN	10.2	Pavement — 0.7	
	1D	11/6	1.5 - 2.4	23 - 100/5"					Very dense, brown, fine to coarse SAND some Gravel, little Silt, dry. -FILL- See Remark 1.	
5	2D	24/1	5.0 - 7.0	13-7-25-9	32	32			Recovery consists of piece of gravel (stuck in tip). Drill action indicates persistent cobbles/boulders from 5' to 10'.	
10	3D	24/12	10.0 - 12.0	15-21-21-16	42	42			Recovery consists of wood with creosote odor, trace fine to coarse SAND and Gravel.	
	4D	13/6	12.5 - 13.6	3-12-50/0.1					Brown, fine to coarse SAND and Gravel, trace Silt, wet. -FILL- See Remark 2.	
	R1	17/11	14.4 - 15.8				NQ2		14.4': 3/8"-thick steel. 14.4' - 14.8': Cobbles/Boulders. 14.8' - 15.3': Fine to coarse SAND and Gravel, trace Silt.	
15	R2	60/60	15.8 - 20.8	RQD = 78%				-4.9	15.8 — Very hard, fresh, coarse grained, light gray PEGMATITIC GRANITE. Joints are very close to moderate spacing, low angle to moderately dipping, planar, rough, fresh, tight to partially open, iron staining on joints. See Remark 3. Rock Mass Quality = Good	
20								-9.9	20.8 — **Bottom of Exploration at 20.80 feet below ground surface.**	
25										

Remarks:

1. Drill action indicates possible cobbles/boulders from 2.4' - 2.8', 3.1' - 3.3', and 4.6' - 4.8'.
2. Split spoon bouncing on possible wood at 13.6'.
3. Attempted core run at 20.8', but could not advance core barrel or casing past steel encountered at 14.4'. Boring terminated.
4. First water level measured 20 minutes after completion of drilling, Gut water level at El. -3.7'± near south abutment.

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Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: Gut Bridge
Location: South Bristol, Maine

Boring No.: BB-GR-409
PIN: 16750.00

Driller:	Maine Test Borings	**Elevation (ft.)**	9.9	**Auger ID/OD:**	-
Operator:	Mike Porter	**Datum:**	NAVD 88	**Sampler:**	Split Spoon
Logged By:	Mike Devoid	**Rig Type:**	Skid/Trailer CME-45	**Hammer Wt./Fall:**	140/30"
Date Start/Finish:	02/29/12 - 02/29/12	**Drilling Method:**	Spun Casing	**Core Barrel:**	NQ2
Boring Location:	N 375571 E 3113181	**Casing ID/OD:**	4"	**Water Level*:**	
Hammer Efficiency Factor:	0.6	**Hammer Type:**	Automatic ☐ Hydraulic ☐ Rope & Cathead ☒		

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

Depth (ft.)	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-uncorrected	N_{60}	Casing Blows	Elevation (ft.)	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.
0									Bridge deck and void above surface of concrete layer	
							SPUN	5.6	4.3	
5	R1	54/24	5.1 - 9.6				NQ2		Spun HW casing into concrete to 5.1' and began coring. 5.1' - 6.1': Rebar and Concrete	
								3.8	6.1	
									Mix of Concrete and Boulders	
								2.8	7.1	
									Core Times (min): 5.1'-6.1' (4), 6.1'-7. 1' (3), 7.1'-8.1' (2), 8.1'-9.1' (1), 9. 1'-9.6' (1).	
	R2	60/28	9.6 - 14.6							
10									Cobbles/Boulders. Voids at 11.5' - 12.1' and 13.8' - 14.2' based on coring action. -FILL- Core Times (min): 9.6'-10.6' (3), 10.6'- 11.6' (4), 11.6'-12.6' (4), 12.6'-13.6' (3), 13.6'-14.6' (2).	
	R3	60/24	14.6 - 19.6							
15									Cobbles/Boulders. 14.6 - 15.6': several 1" voids, 1-2" hard, 1" void. 16' - 16.6': Pieces of wood in core barrel. -FILL- See Remark 1. Core Times (min): 14.6-15.6' (3), 15.6' 16.6' (3), 16.6'-17.6' (2), 17.6'-18.6 (3), 18.6'-19.6' (3).	
	R4	60/16	19.6 - 24.6	RQD = 8%					See Remark 2.	
20								-13.4	23.3	
	R5	57/54	24.6 - 29.4	RQD = 86%					Hard, fresh, fine grained, gray SCHIST. Joints are very close to closely spaced, high angle, planar, rough, fresh, tight, silt infillings, iron staining at joints. Core Times (min): 19.6'-20.6' (3), 20.6'-21.6' (3), 21.6'-22.6' (3), 22.6'- 23.6' (2).	
25										

Remarks:

1. Measurements and Depths from top of bridge deck, 4.3' from top of bridge deck to top of concrete.
2. Core barrel advancement through R2 and R3 indicates numerous probable voids as listed above. Recovery in R4 consists of parent rock; possible that upper material was finer rock fill that disintegrated during drilling. Estimate of rock at top of R4 recovery: 23.3'.

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Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: Gut Bridge
Location: South Bristol, Maine

Boring No.: BB-GR-409
PIN: 16750.00

Driller:	Maine Test Borings	**Elevation (ft.)**	9.9	**Auger ID/OD:**	-
Operator:	Mike Porter	**Datum:**	NAVD 88	**Sampler:**	Split Spoon
Logged By:	Mike Devoid	**Rig Type:**	Skid/Trailer CME-45	**Hammer Wt./Fall:**	140/30"
Date Start/Finish:	02/29/12 - 02/29/12	**Drilling Method:**	Spun Casing	**Core Barrel:**	NQ2
Boring Location:	N 375571 E 3113181	**Casing ID/OD:**	4"	**Water Level*:**	
Hammer Efficiency Factor:	0.6	**Hammer Type:**	Automatic ☐ Hydraulic ☐ Rope & Cathead ☒		

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

Depth (ft.)	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-uncorrected	N_{60}	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.
								-19.4		Very hard, fresh, fine grained, gray SCHIST. Primary joints are close to moderate spacing, high angle, planar, rough, fresh, tight, trace silt infilling. Secondary joints are very close to moderate spacing, low angle, planar, rough, fresh, tight, iron staining at joints. Rock Mass Quality = Good Core Times (min): 24.6'-25.6' (3), 25.6'-26.6' (2), 26.6'-27.6' (3), 27.6'- 28.6' (2), 28.6'-29.3' (3).	
30										-29.3- **Bottom of Exploration at 29.30 feet below ground surface.**	
35											
40											
45											
50											

Remarks:

1. Measurements and Depths from top of bridge deck, 4.3' from top of bridge deck to top of concrete.
2. Core barrel advancement through R2 and R3 indicates numerous probable voids as listed above. Recovery in R4 consists of parent rock; possible that upper material was finer rock fill that disintegrated during drilling. Estimate of rock at top of R4 recovery: 23.3'.

Stratification lines represent approximate boundaries between soil types; transitions may be gradual.
* Water level readings have been made at times and under conditions stated. Groundwater fluctuations may occur due to conditions other than those present at the time measurements were made.

Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: Gut Bridge
Location: South Bristol, Maine

Boring No.: BB-GR-501
PIN: 16750.00

Driller:	Maine Test Boring	**Elevation (ft.)**	7.2	**Auger ID/OD:**	2"
Operator:	Brad Enos	**Datum:**	NAVD 88	**Sampler:**	Split Spoon
Logged By:	Heidi Rizza	**Rig Type:**	CME 45	**Hammer Wt./Fall:**	140/30"
Date Start/Finish:	7/16/13-7/16/13	**Drilling Method:**	Spun Casing	**Core Barrel:**	NQ2
Boring Location:	N 375593, E 3113209	**Casing ID/OD:**	4"	**Water Level*:**	
Hammer Efficiency Factor:	0.6	**Hammer Type:**	Automatic ☐ Hydraulic ☐ Rope & Cathead ☒		

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

Sample Information

Depth (ft.)	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-uncorrected	N_{60}	Casing Blows	Elevation (ft.)	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.
0	1D	24/9	0.0 - 2.0	3-6-11-9			SPUN		Medium dense, brown, fine to coarse SAND, some Gravel, trace Silt. -FILL-	
5	2D	24/0	5.0 - 7.0	10-14-3-12					No recovery. Steel fragment in spoon.	
10	3D	5/3	10.5 - 10.9	20/5"						
	R1	60/55.2	11.1 - 16.1	RQD = 47%			NQ2	-3.9	Black, fine to medium SAND and Gravel, trace glass, steel fragment. 11.1	
15								-8.9	Moderately hard to hard, fresh to slightly weathered, fine grained, gray SCHIST. Joints are close to moderately spaced, horizontal to high angle, planar, rough, discolored, partially open to tight, occasional infilling. Rock Mass Quality = Poor Rock Core Times (min/ft): 11.1-12.1 (1), 12.1-13.1 (3), 13.1-14.1 (2.5), 14.1-15.1 (2), 15.1-16.1 (3). 16.1	
20									**Bottom of Exploration at 16.10 feet below ground surface.**	
25										
30										

Remarks:

Split spoon refusal at 11.1'.

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: Gut Bridge
Location: South Bristol, Maine

Boring No.: BB-GR-502A
PIN: 16750.00

Driller:	Maine Test Boring	**Elevation (ft.)**	10.3	**Auger ID/OD:**	2"
Operator:	Brad Enos	**Datum:**	NAVD 88	**Sampler:**	Split Spoon
Logged By:	Heidi Rizza	**Rig Type:**	CME 45	**Hammer Wt./Fall:**	140/30"
Date Start/Finish:	7/15/13-7/16/13	**Drilling Method:**	Spun Casing	**Core Barrel:**	NQ2
Boring Location:	N 375600, E 3113171	**Casing ID/OD:**	4"	**Water Level*:**	
Hammer Efficiency Factor:	0.6	**Hammer Type:**	Automatic ☐ Hydraulic ☐ Rope & Cathead ☒		

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

Depth (ft.)	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-uncorrected	N_{60}	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.
0							SPUN	9.9		-PAVEMENT- 0.4	
	1D	24/12	2.0 - 4.0	3-4-4-2						Loose, brown, fine to coarse SAND and Gravel, trace Silt. -FILL-	
5	2D	24/7	5.0 - 7.0	3-1-3-25						Loose, brown, fine to coarse SAND and Gravel, trace Silt. See Remarks.	
								3.3		7.0 **Bottom of Exploration at 7.00 feet below ground surface.**	
10											
15											
20											
25											
30											

Remarks:

From 0-7', steel fragments coming up persistently in cuttings. Could not spin casing through steel, moved location from side of road to center of travel lane; see BB-GR-502B.

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: Gut Bridge
Location: South Bristol, Maine

Boring No.: BB-GR-502B
PIN: 16750.00

Driller:	Maine Test Boring	**Elevation (ft.)**	10.9	**Auger ID/OD:**	2"
Operator:	Brad Enos	**Datum:**	NAVD 88	**Sampler:**	Split Spoon
Logged By:	Heidi Rizza	**Rig Type:**	CME 45	**Hammer Wt./Fall:**	140/30"
Date Start/Finish:	7/16/13-7/16/13	**Drilling Method:**	Spun Casing	**Core Barrel:**	NQ2
Boring Location:	N 375603, E 3113177	**Casing ID/OD:**	4"	**Water Level*:**	
Hammer Efficiency Factor:	0.6	**Hammer Type:**	Automatic ☐ Hydraulic ☐ Rope & Cathead ☒		

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

Sample Information

Depth (ft.)	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-uncorrected	N_{60}	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.
0							SPUN	10.5		-PAVEMENT- 0.4	
5	1D R1	4/2 56/0	5.0 - 5.3 5.3 - 10.0	50/4"			NQ2			Very dense, brown, fine to coarse GRAVEL and Sand, with Rock fragments. -FILL- No recovery in core barrel, apparent cobbles/boulders. (Time: 9 minutes total run)	
10	2D R2	1/1 57.6/30	10.0 - 10.1 10.1 - 14.9	10/1" RQD = 35%						Gray, GRAVEL, some fine to coarse Sand, trace Silt. 10.1-13.5': 13" Boulder recovered.	
								-2.6		13.5	
15	R3	60/57.6	14.9 - 19.9	RQD = 87%						13.5-14.9': Hard, slightly weathered, fine grained, gray SCHIST. Joints are very close to close, horizontal to moderately dipping, planar, rough, fresh to discolored, partially open to tight. Rock Mass Quality = Poor Rock Core Times (min/ft): 10.1-11.1 (3), 11.1-12.1 (1), 12.1-13.1 (1), 13.1-14.1 (1.5), 14.1-14.9 (2) Hard, slightly weathered, fine grained, gray SCHIST. Joints are close to moderately spaced, planar, rough, fresh to discolored, tight. Rock Mass Quality = Good Rock Core Times (min/ft): 14.9-15.9 (2), 15.9-16.9 (2), 16.9-17.9 (1.5), 17.9-18.9 (1.5), 18.9-19.9 (1.5)	
20								-9.0		19.9 **Bottom of Exploration at 19.90 feet below ground surface.**	
25											
30											

Remarks:

RQD for R2 calculated for rock portion only (13.5-14.9').

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.

Table 1 - Summary of Subsurface Data, 500-Series Borings and Probes
Gut Bridge South Bristol
MaineDOT PIN 16750.00

Boring/Probe Designation	Existing Ground Surface / Mudline Elevation	Location		Encountered Thickness of Strata (feet)			Estimated Top of Rock		Estimated Top of Intact Rock		Bottom of Exploration (feet)
		Northing	Easting	Fill	Nearshore Deposit	Marine Deposit	Depth (feet)	Elevation	Depth (feet)	Elevation	
BB-GR-501	7.2	375593	3113209	11.1	NE	NE	11.1	-3.9	11.1	-3.9	16.1
BB-GR-502A	10.3	375600	3113171	7.0	NE	NE	NE	--	--	--	7.0
BB-GR-502B	10.9	375603	3113177	13.5	NE	NE	13.5	-2.6	13.5	-2.6	19.9
P-2	-0.5	375518	3113144	No soil strata observations			0.0	-0.5	--	--	5.0
P-3	10.2	375517	3113156	No soil strata observations			18.0	-7.8	--	--	22.0
P-5	4.9	375575	3113201	No soil strata observations			19.0	-14.1	--	--	23.0
P-6	3.5	375567	3113203	No soil strata observations			23.0	-19.5	--	--	26.0
P-7	-6.9	375557	3113228	No soil strata observations			6.0	-12.9	--	--	12.0
P-8	-3.9	375563	3113237	No soil strata observations			8.0	-11.9	--	--	12.0
P-9	-3.5	375572	3113245	No soil strata observations			5.0	-8.5	--	--	12.0
P-10	-1.5	375583	3113256	No soil strata observations			5.0	-6.5	--	--	12.0

General Notes:

1. Elevations are in feet and reference the North American Vertical Datum of 1988 (NAVD 88). Coordinates are in feet and reference the North American Datum of 1983 (NAD 83), Maine State Plane 2000 Coordinate System.

2. As-drilled locations and ground surface elevations of the BB-GR-500 series borings P-series probes were surveyed by Maine Department of Transportation (MDOT) survey crew.

3. Soil samples could not be retrieved from the probes due to the air rotary drilling process; soil stratification could not be observed.

4. Encountered thickness of fill for borings includes bituminous pavement: see boring logs for depth intervals.

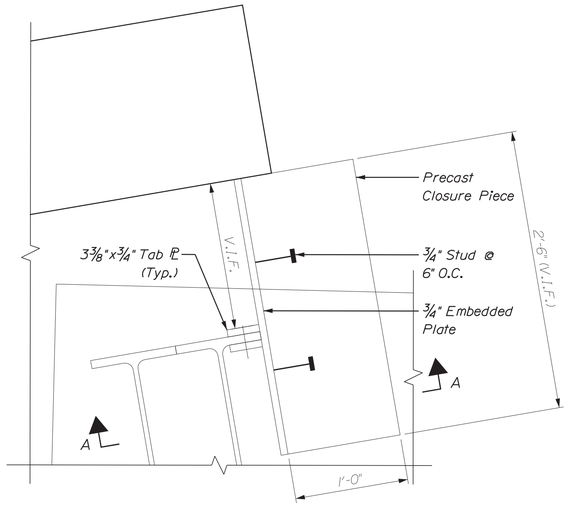
5. "NE" indicates strata not encountered; "--" indicates intact rock not could not be evaluated in probes due to drilling procedure.

Appendix B

Retaining Wall Plans

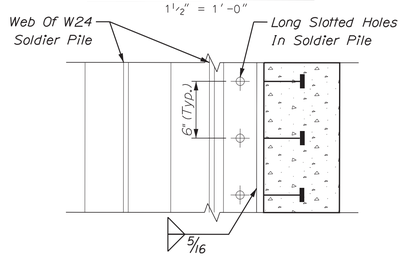
and

Design Soil Parameters



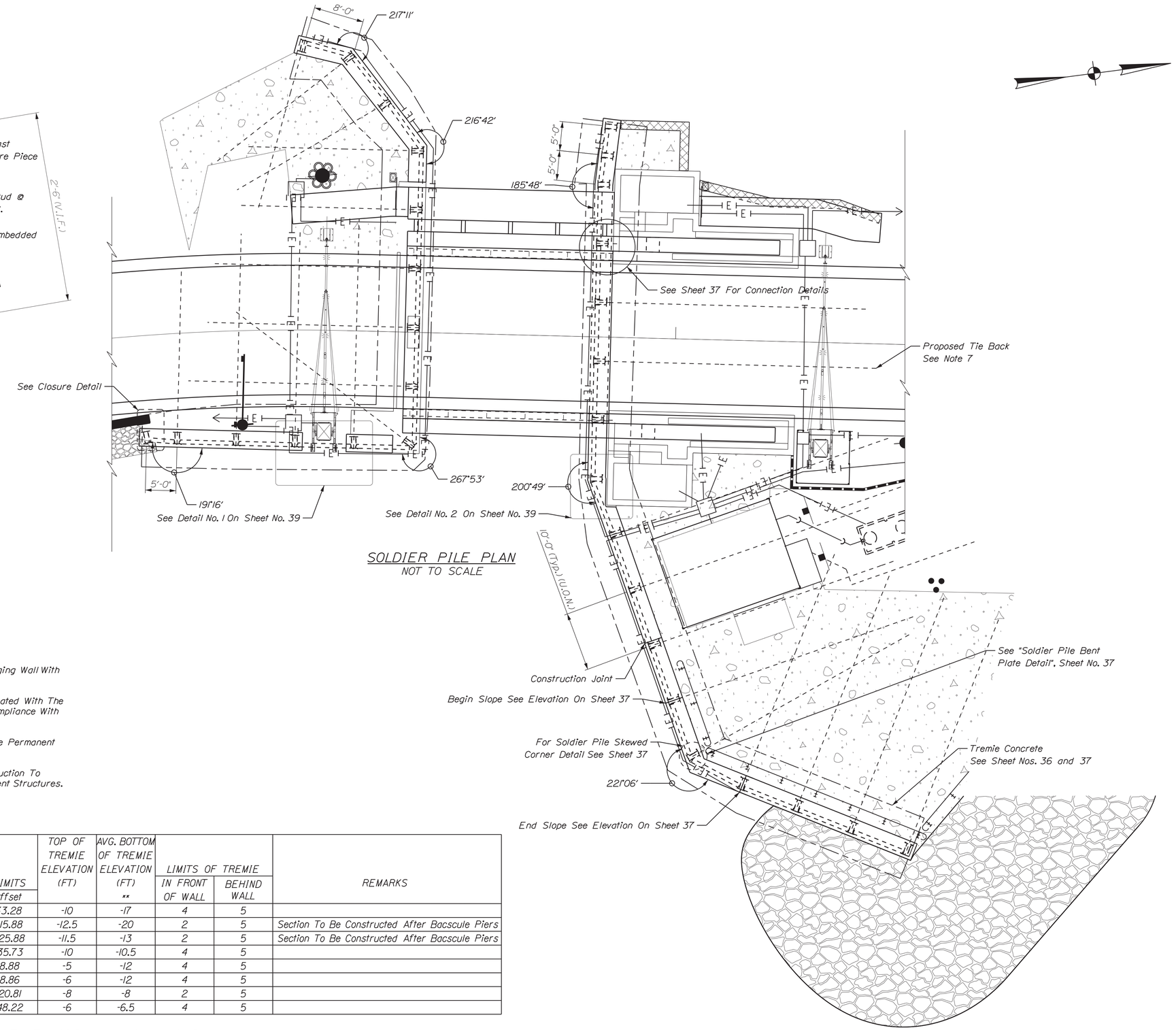
CLOSURE DETAIL

1' 9" 6" 3" 0 1'
1½" = 1'-0"



SECTION A-A

1' 9" 6" 3" 0 1'
1½" = 1'-0"



SOLDIER PILE PLAN

NOT TO SCALE

NOTES:

1. Construct Permanent Anchored Wall System (Soldier Pile And Lagging Wall With Tiebacks) At The Limits Shown On This Sheet.
2. Construction of Permanent Anchored Wall System Shall Be Coordinated With The General Construction Sequence Of Bridge Construction And In Compliance With Project Environmental Permits And/Or Restrictions.
3. Excavation Or Opening-Up Of The Entire Area Designated For The Permanent Anchored Wall System at once is not permitted.
4. Exercise Caution During Permanent Anchored Wall System Construction To Prevent Undermining The Foundations Supporting Existing Adjacent Structures.
5. For Tie Back Details, See Sheet No. 38.

ABUTMENT	SECTION (See Sheet 37)	BEGIN LOCATION / LIMITS		END LOCATION / LIMITS		TOP OF TREMIE ELEVATION (FT)	AVG. BOTTOM OF TREMIE ELEVATION (FT) **	LIMITS OF TREMIE		REMARKS
		Station	Offset	Station	Offset			IN FRONT OF WALL	BEHIND WALL	
North	1	116+91.45	85.66	116+40.66	33.28	-10	-17	4	5	
	2	116+40.66	33.28	116+37.18	-15.88	-12.5	-20	2	5	Section To Be Constructed After Bacscule Piers
	3	116+37.18	-15.88	116+37.18	-25.88	-11.5	-13	2	5	Section To Be Constructed After Bacscule Piers
	4	116+37.18	-25.88	116+38.18	-35.73	-10	-10.5	4	5	
South	1	115+59.22	16.35	115+85.33	18.88	-5	-12	4	5	
	2	115+85.33	18.88	116+05.22	18.86	-6	-12	4	5	
	3	116+05.22	18.86	116+05.45	-20.81	-8	-8	2	5	
	4	116+05.45	-20.81	115+86.63	-48.22	-6	-6.5	4	5	

** Excavate To The Elevation Shown Or To The Top Of Bedrock Whichever Is Deeper

STATE OF MAINE
DEPARTMENT OF TRANSPORTATION

APPROVED — DATE

COMMISSIONER:

CHIEF ENGINEER:

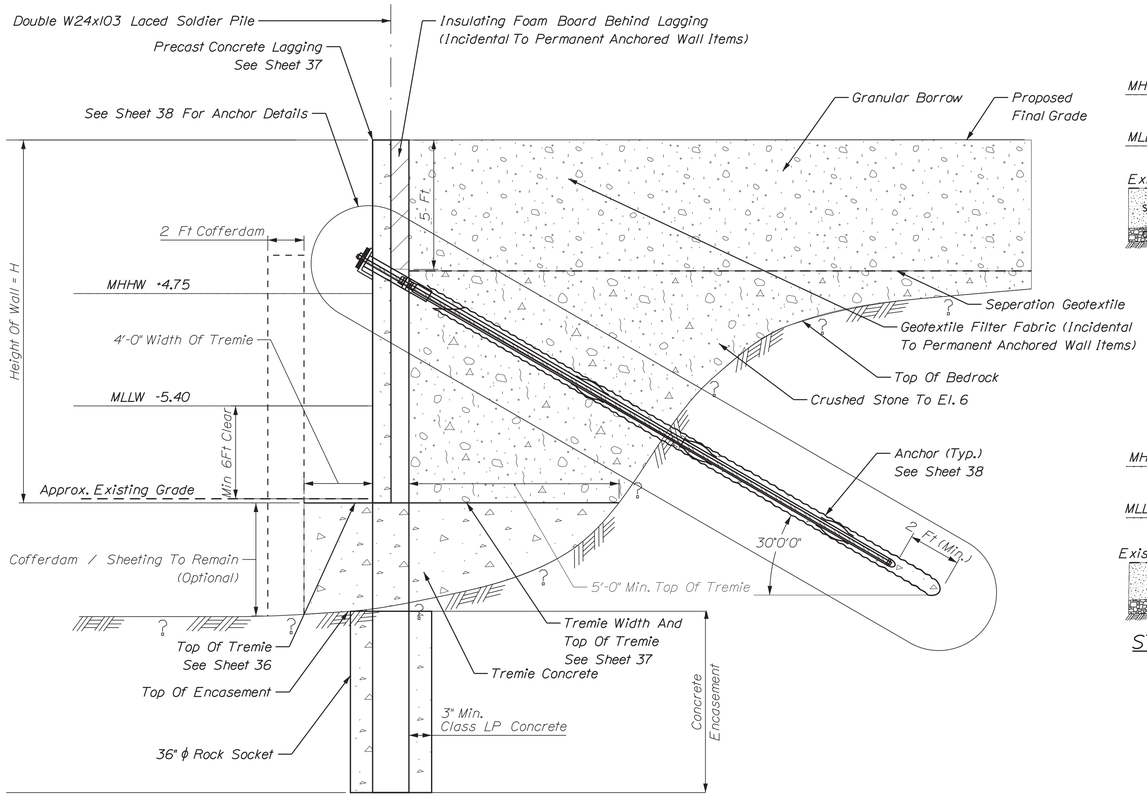
PROJECT INFORMATION		SIGNATURE
PROGRAM	BRIDGE	
PROJECT MANAGER	STEPHEN BODGE	
DESIGNER	HARDESTY & HANOVER	13196
CONSULTANT	HARDESTY & HANOVER	P.E. NUMBER
PROJECT RESIDENT		
CONTRACTOR		DATE
PROJECT COMPLETION DATE		

SOUTH BRISTOL
GUT BRIDGE

PERMANENT ANCHORED WALL
LIMITS

SHEET NUMBER
34
OF 141

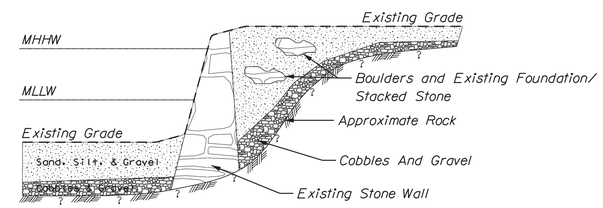
Filename: ...\034_soldier_pile_plan.dgn Division: BRIDGE Username: common Date:1/29/2014



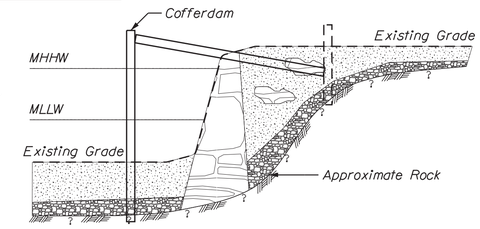
TYPICAL SECTION
(N.T.S)

*** See Sheet 37 For Permanent Anchored Wall Elements Details

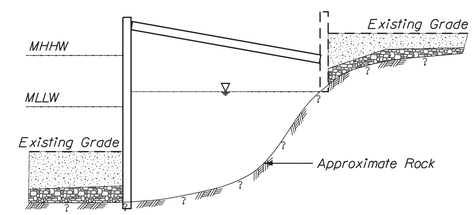
CONCEPTUAL CONSTRUCTION SEQUENCE



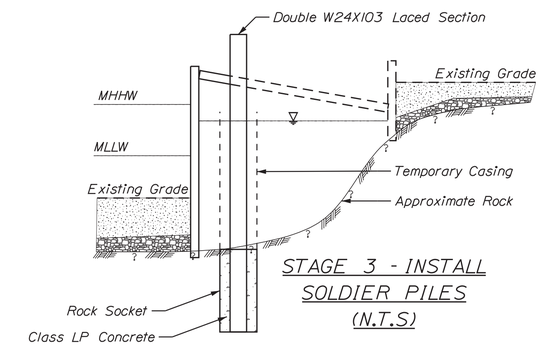
STAGE 0 - EXISTING CONDITION
(N.T.S)



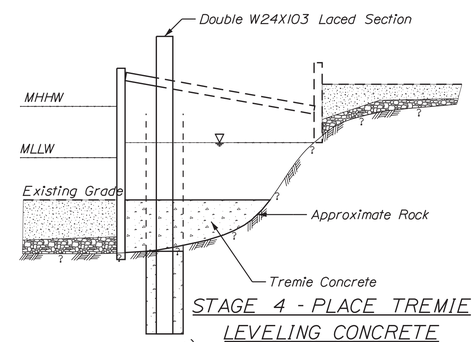
STAGE 1 - INSTALL TEMPORARY COFFERDAM
(N.T.S)



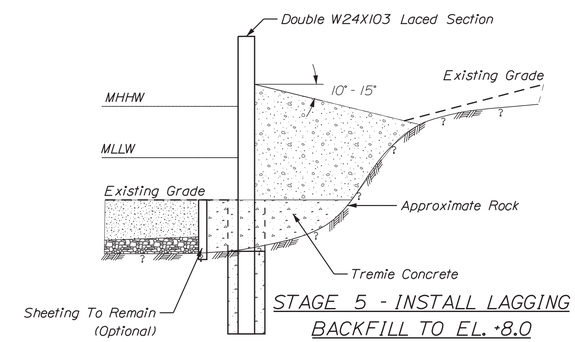
STAGE 2 - WET EXCAVATE TO BEDROCK
(N.T.S)



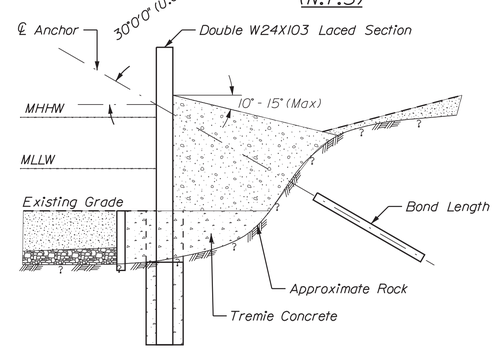
STAGE 3 - INSTALL SOLDIER PILES
(N.T.S)



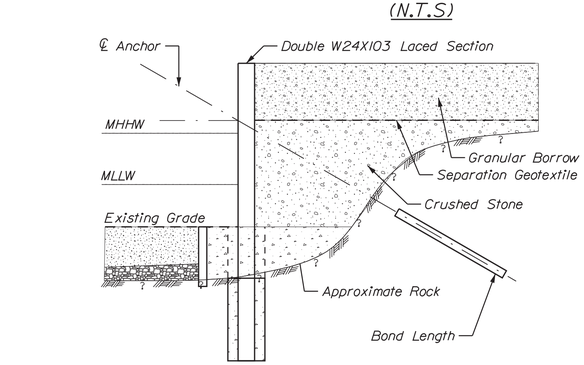
STAGE 4 - PLACE TREMIE LEVELING CONCRETE
(N.T.S)



STAGE 5 - INSTALL LAGGING BACKFILL TO EL. +8.0
(N.T.S)



STAGE 6 - INSTALL AND TEST ANCHORS
(N.T.S)



STAGE 7 - BACKFILL TO FINAL GRADE
(N.T.S)

CONSTRUCTION SEQUENCE:

1. Install Temporary Cofferdam As Per Approved Working Drawings.
2. Remove Overburden Material To The Top Of Bedrock And To The Limits Shown On Drawing Sheet No. 36.
3. Use A Temporary Casing To Install Soldier Pile Per Sheet Nos. 36-38.
4. Place Tremie Concrete To The Elevation And The Limits Shown On Sheet Nos. 34 And 36.
5. Cut Temporary Casing To Top Of Tremie Concrete And Install Precast Concete Lagging To Final Elevation.
6. Backfill Behind Lagging To Elevation +8.0 & Maintain A Backslope Of 10 to 15 Degrees And Install Rock Anchors As Per Sheet No. 38.
7. Backfill Behind Remaining Portion Of Lagging To The Final Elevation.

NOTES:

1. For Details On Permanent Anchored Wall, See Sheet Nos 34-39.
2. Revision To The Above Shown Construction Staging Of The Permanent Anchored Wall System Is Permitted As Approved By The Resident.
3. Permanent Anchored Wall Construction Staging Is Subject To Resident Review and Approval.
4. Temporary Cofferdam Shall Be Designed By The Contractor And Submitted To The Resident For Review And Approval.
5. After The Construction Of The Permanent Anchored Wall System, If The Temporary Sheet Shall Be Left In Place, Cut Sheeting 2 Feet Below Mudline And Abandon. No Additional Payment Shall Be Made For Sheeting Left In Place.

STATE OF MAINE
DEPARTMENT OF TRANSPORTATION

APPROVED | DATE
COMMISSIONER:
CHIEF ENGINEER:

PROJECT INFORMATION

PROGRAM	BRIDGE	SIGNATURE	
PROJECT MANAGER	STEPHEN BODGE		
DESIGNER	HARDESTY & HANOVER	13196	P.E. NUMBER
CONSULTANT	HARDESTY & HANOVER		
PROJECT RESIDENT		DATE	
CONTRACTOR			
PROJECT COMPLETION DATE			

SOUTH BRISTOL
GUT BRIDGE

PERMANENT ANCHORED WALL
TYPICAL SECTION AND STAGING

SHEET NUMBER
36
OF 141

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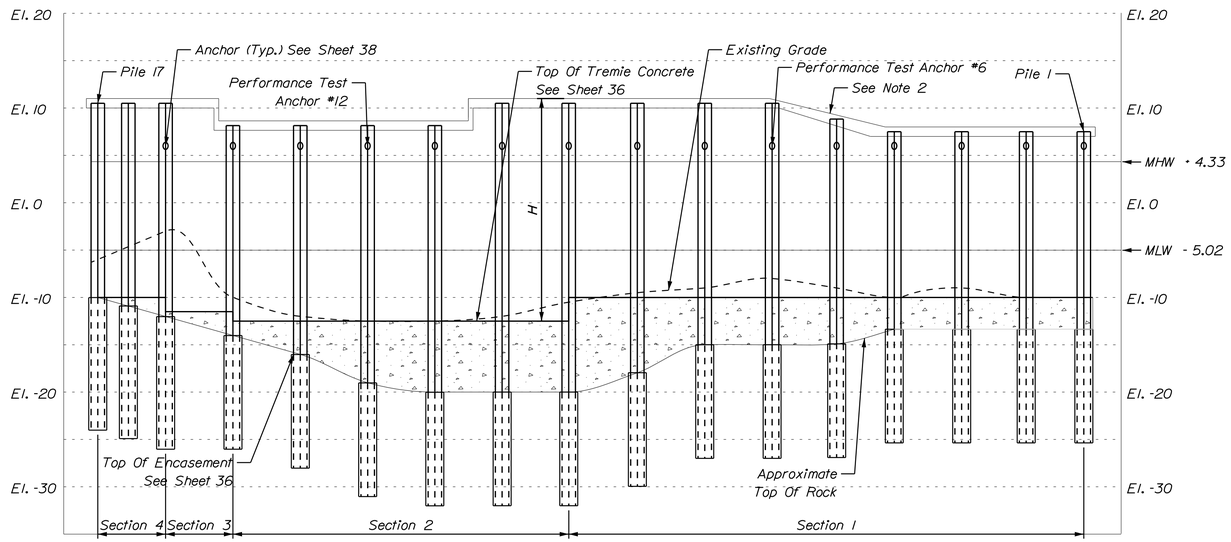
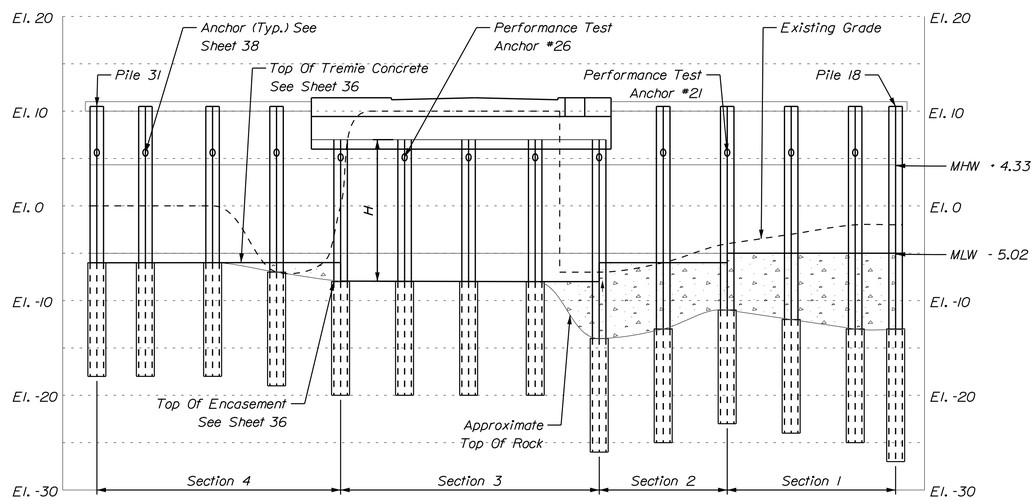
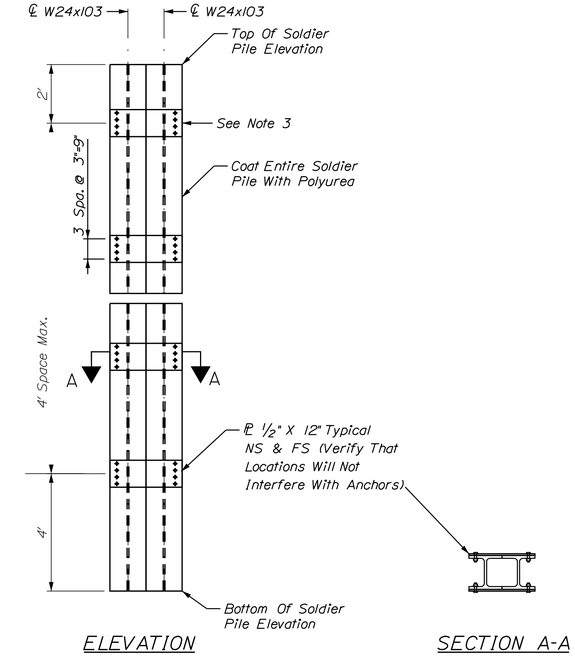
Division: BRIDGE
Username: common
Date:1/29/2014



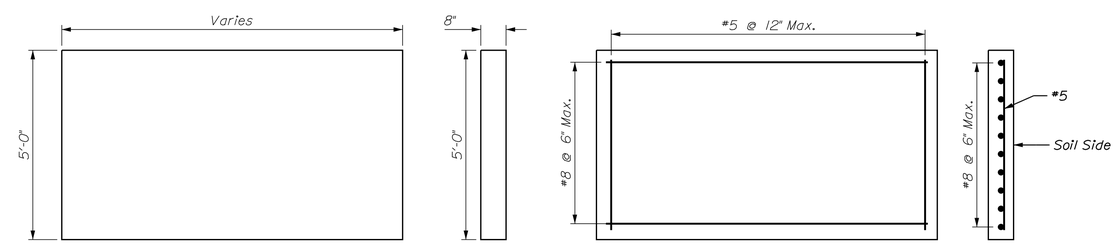
NORTH ABUTMENT DEVELOPED ELEVATION
VIEW NORTH
N.T.S



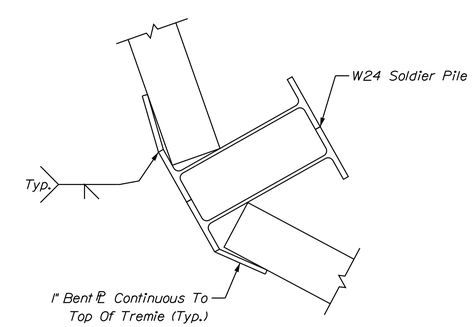
SOUTH ABUTMENT DEVELOPED ELEVATION
VIEW NORTH
N.T.S



TYPICAL SOLDIER PILE LACING DETAILS
(SOLDIER PILE WALL)
N.T.S.



SOLDIER PILE LAGGING DETAILS
N.T.S.



SOLDIER PILE BENT PLATE DETAIL

DESIGN SPECIFICATIONS:

1. AASHTO LRFD Bridge Design Specification For Service And Strength Limit States.
2. Post Tensioning Institute "Recommendations For Prestressed Rock And Soil Anchors" Latest Edition.

CONSTRUCTION SPECIFICATIONS:

1. Latest Edition Of MaineDOT Standard Specification For Road And Bridge Construction, As Modified By The Special Provisions.
2. Post Tensioning Institute "Recommendations For Prestressed Rock And Soil Anchors" Latest Edition.

NOTES:

1. Refer To Sheet 34 For Wall Section Limit Stations.
2. Soldier Pile Wall Pile Cap Requires A Minimum 6" Embedment Of The Soldier Pile And A Minimum Of 3" Of Cover At The Top.
3. Soldier Pile Walers Will Be Notched As Necessary To Accomodate The Soldier Pile Lacing.

STATE OF MAINE
DEPARTMENT OF TRANSPORTATION

APPROVED | DATE
COMMISSIONER:
CHIEF ENGINEER:

PROJECT INFORMATION

PROGRAM	BRIDGE
PROJECT MANAGER	STEPHEN BODGE
DESIGNER	HARDESTY & HANOVER
CONSULTANT	HARDESTY & HANOVER
PROJECT RESIDENT	
CONTRACTOR	
PROJECT COMPLETION DATE	

SIGNATURE
13196
P.E. NUMBER
DATE

SOUTH BRISTOL
GUT BRIDGE

PERMANENT ANCHORED WALL
DEVELOPED ELEVATION AND DETAILS

SHEET NUMBER
37
OF 141

Filename: ... 037_soldier_pile_elev.dgn Division: BRIDGE Username: common Date:2/3/2014

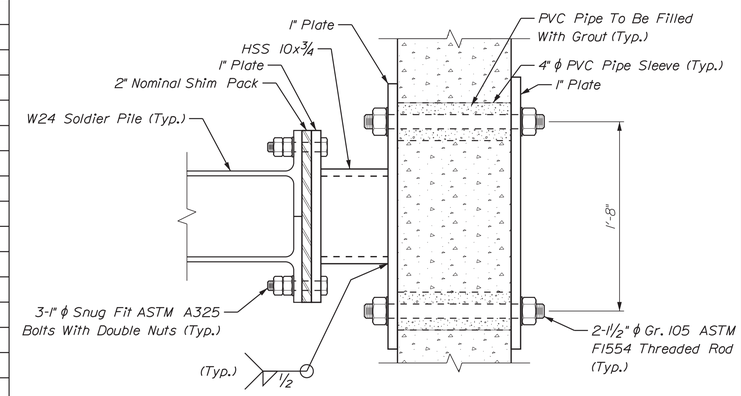
Abutment	Section Limit (See Sheet 34)	Pile Number	TGL vs Station At Center of Pile	Offset To Center Of Pile From TGL	Pile Top Elevation	Estimated Pile Tip Elevation	Estimated Pile Length	Soldier Pile Section	Minimum Diameter of Rock Socket	Minimum Socket Length	Anchor Level One Elevation	Design Load	Minimum Free Length	Bonded Length	Anchor Inclination	Axial Load	As-Built Pile Length
				(ft)	(ft)	(ft)	(ft)		(ft)	(ft)	(ft)	(kips)	(ft)	(ft)	(deg.)	(kips)	(ft)
North	1	1	116+91.45	85.66	7	-27	34	2 - W24x103	3	12	5.5	160	15	15	30	N/A	
		2	116+82.08	82.19	7	-27	34	2 - W24x103	3	12	5.5	160	15	15	25	N/A	
		3	116+72.70	78.72	7	-27	34	2 - W24x103	3	12	5.5	160	15	15	20	N/A	
		4	116+63.32	75.25	7	-27	34	2 - W24x103	3	12	5.5	160	15	15	20	N/A	
		5	116+54.81	70.69	9	-27	36	2 - W24x103	3	12	5.5	160	15	15	27	N/A	
		6	116+51.28	61.34	11	-27	38	2 - W24x103	3	12	6	160	15	15	30	N/A	
		7	116+47.74	51.99	11	-27	38	2 - W24x103	3	12	6	160	15	15	30	N/A	
		8	116+44.2	42.63	11	-29	40	2 - W24x103	3	12	6	160	15	15	30	N/A	
		9	116+40.66	33.28	11	-32	43	2 - W24x103	3	12	6	160	15	15	25	N/A	
	2	10	116+37.18	24.11	11	-32	43	2 - W24x103	3	12	N/A	N/A	N/A	N/A	N/A	N/A	
		11	116+37.18	14.09	9	-32	41	2 - W24x103	3	12	N/A	N/A	N/A	N/A	N/A	N/A	
		12	116+37.18	4.11	9	-31	40	2 - W24x103	3	12	6	160	15	15	30	N/A	
		13	116+37.18	-5.89	9	-28	37	2 - W24x103	3	12	6	160	15	15	30	N/A	
		14	116+37.18	-15.89	9	-28	37	2 - W24x103	3	14	N/A	N/A	N/A	N/A	N/A	N/A	
	3	15	116+37.18	-25.89	11	-26	37	2 - W24x103	3	14	N/A	N/A	N/A	N/A	N/A	N/A	
	4	16	116+37.68	-30.81	11	-25	36	2 - W24x103	3	14	N/A	N/A	N/A	N/A	N/A	N/A	
		17	116+38.18	-35.73	11	-24	35	2 - W24x103	3	14	N/A	N/A	N/A	N/A	N/A	N/A	
South	1	18	115+58.79	17.29	11	-27	38	2 - W24x103	3	14	N/A	N/A	N/A	N/A	N/A	N/A	
		19	115+64.25	17.78	11	-25	36	2 - W24x103	3	12	6	160	15	15	30	N/A	
		20	115+74.77	18.48	11	-24	35	2 - W24x103	3	12	6	160	15	15	25	N/A	
		21	115+85.33	18.88	11	-23	34	2 - W24x103	3	12	6	160	15	15	30	N/A	
	2	22	115+95.78	18.99	11	-25	36	2 - W24x103	3	12	5	160	15	15	30	N/A	
		23	116+05.22	18.87	8	-26	34	2 - W24x103	3	12	5	160	15	15	30	317	
	3	24	116+05.45	9.19	8	-20	28	2 - W24x103	3	12	5	160	15	15	20	317	
		25	116+05.45	-0.81	8	-20	28	2 - W24x103	3	12	5	160	15	15	20	317	
		26	116+05.45	-10.81	8	-20	28	2 - W24x103	3	12	5	160	15	15	20	317	
		27	116+05.45	-20.81	8	-20	28	2 - W24x103	3	12	5	160	15	15	20	317	
	4	28	116+05.45	-30.81	11	-19	30	2 - W24x103	3	12	5.5	160	15	15	30	N/A	
		29	115+99.68	-38.56	11	-18	29	2 - W24x103	3	12	5.5	160	15	15	24	N/A	
		30	115+93.44	-46.28	11	-18	29	2 - W24x103	3	12	5.5	160	15	15	30	N/A	
		31	115+86.63	-48.22	11	-18	29	2 - W24x103	3	12	6	160	15	15	30	N/A	

ANCHOR TESTING:

1. Anchor Testing Shall Be In Conformance With The Project Specifications.
2. Performance Test The Anchors At The Following Pile Locations: 6, 12, 21, and 26.
3. Proof Tests Shall Be Performed At All Anchors Not Performance Tested.

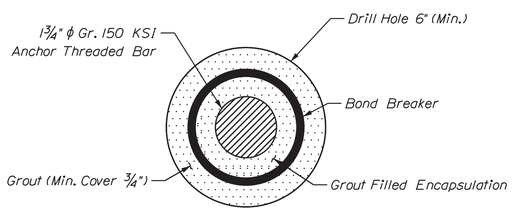
NOTE:

1. No Construction Equipment Load Shall Be Transferred To The Permanent Anchored Wall.
2. The Permanent Anchored Wall Is Not Designed To Support Any Construction Surcharge And/Or Any Loading From The Temporary Bridge.
3. Prior To The Placement Of The Soldier Piles In The Hole, The Contractor Shall Verify The Quality Of The Rock Socket Sidewalls And Bottom Cleanliness, Using An Approved Inspection Device, To The Satisfaction Of The Engineer.
4. Prior To Soldier Pile Placement, Clean The Hole So A Minimum Of 50% Of The Bottom Of The Hole Has Less Than 0.5 Inch Of Sediment At The Time Of Pile And Concrete Placement. Ensure The Maximum Depth Of Sediments And Any Other Debris Does Not Exceed 1.5 Inches.
5. Prior To The Placement Of The Tremie Concrete The Contractor Shall Demonstrate Reaching The Top Of Bedrock To The Satisfaction Of The Engineer Using A Weighted Sounding Tape Approach.
6. Provide Corrosion Protection For Anchors In Accordance With The Special Provisions.
7. Anchor Bonded Zone Shall Be Located In Competent Bedrock Under The Supervision Of A Qualified Professional Engineer Hired By The Contractor.
8. Free Length Shall Be The Minimum Shown In The Table Or The Anticipated Free Length, Whichever Is Greater.

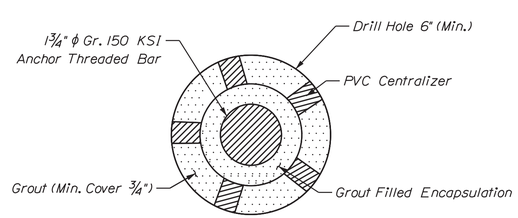


SOLDIER PILE TO BASCULE PIER STRUT
(MACHINERY ENCLOSURE STRUT SIMILAR)

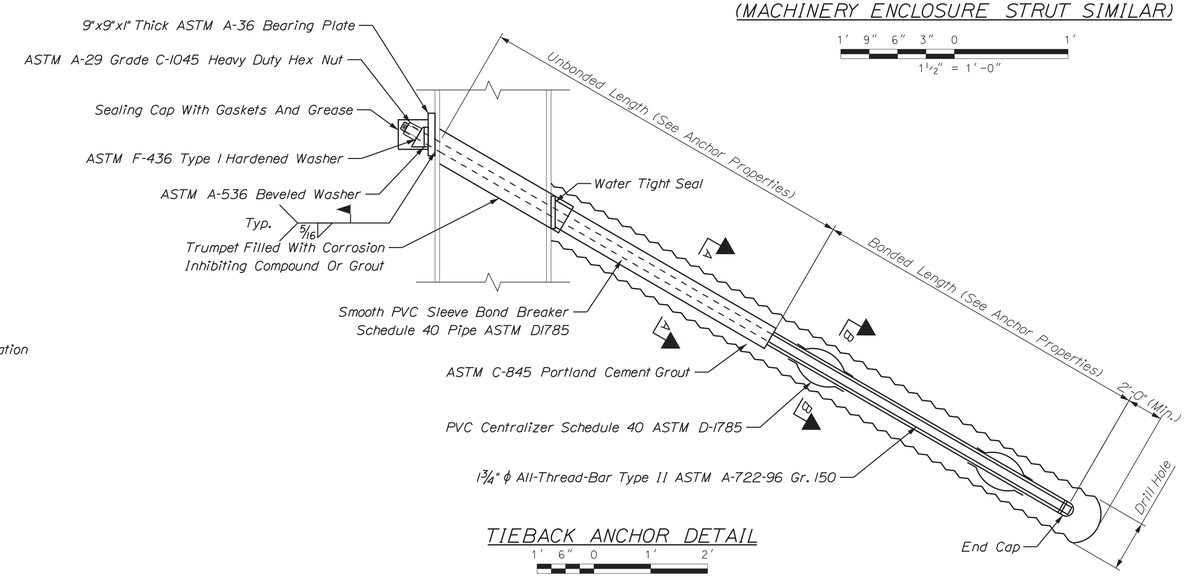
1' 9" 6" 3" 0 1'
1 1/2" = 1'-0"



SECTION A-A
NOT TO SCALE



SECTION B-B
NOT TO SCALE



TIEBACK ANCHOR DETAIL

1' 6" 0 1' 2'
3/4" = 1'-0"

STATE OF MAINE
DEPARTMENT OF TRANSPORTATION

APPROVED — DATE
COMMISSIONER:
CHIEF ENGINEER:

SIGNATURE
13196
P.E. NUMBER
DATE

PROJECT INFORMATION

PROGRAM	BRIDGE
PROJECT MANAGER	STEPHEN BODGE
DESIGNER	HARDESTY & HANOVER
CONSULTANT	HARDESTY & HANOVER
PROJECT RESIDENT	
CONTRACTOR	
PROJECT COMPLETION DATE	

SOUTH BRISTOL
GUT BRIDGE

PERMANENT PILE CHART
AND ANCHOR DETAILS

SHEET NUMBER
38
OF 141

Filename: ...\038_soldier_pile_chart.dgn Division: BRIDGE Username: common Date:1/29/2014

Computations For	Gut Bridge	Made By	JB	Date	11/16/2013	Job No.	2826.02
Soil Parameters for use in the Soldier Pile		Checked By	AR	Date	11/20/2013	Sec. No	
Wall Design		Back Checked By		Date		Sheet No.	1

Anchored Wall Section

Height:	19	ft
Width for Active Calc.:	10	ft
Width for P-Y Resistance:	1.5	ft
Depth To Water Table Front:	6	ft
Depth To Water Table Back:	16	ft
Surcharge Load:	240	psf

Cantilever Wall Section

Height:	21	ft
Width for Active Calc.:	5	ft
Width for P-Y Resistance:	1.5	ft
Depth To Water Table Front:	6	ft
Depth To Water Table Back:	16	ft
Surcharge Load:	0	psf

Soils - Anchored

Sand		Depth Range (ft)	Unit Weight (pcf)	Friction Angle (deg)	k (pci)
	Top	0-19	135	38	225
	Bottom		125	34	125

Rock		Depth Range (ft)	Unit Weight (pcf)	Uniaxial Compressive Strength (psi)
	Top	19-100	150	2500
	Bottom		150	4500

Soils - Cantilever

Sand		Depth Range (ft)	Unit Weight (pcf)	Friction Angle (deg)	k (pci)
	Top	0-23.5	135	38	225
	Bottom		125	32	60

Rock1		Depth Range (ft)	Unit Weight (pcf)	Uniaxial Compressive Strength (psi)
	Top	23.5-31	150	3000
	Bottom		150	3000

Rock2		Depth Range (ft)	Unit Weight (pcf)	Uniaxial Compressive Strength (psi)
	Top	31-100	150	2500
	Bottom		150	4500

Design Assumptions:

1) Use tremie concrete at the base of the wall to reduce active earth pressure and to generate required passive resistance.
2) Use applicable concrete placement method to ensure formation of one solid mass with the underlying competent bedrock.
3) Conduct periodic field inspection of the wall during service life and retrofit as needed.

Appendix C

Micropile Calculations

and

Soldier Pile Structural Capacity Calculations

Computations For	Gut Bridge	Made By	JB	Date	11/16/2013	Job No.	2826.02
Geotechnical Capacity of Micropiles		Checked By	AR	Date	11/20/2013	Sec. No	
for use in the bascule foundations		Back Checked By		Date		Sheet No.	1

Definitions

$$R_R = \varphi_{qp} R_p + \varphi_{qs} R_s$$ AASHTO 10.9.3.5.1-1

$$R_p = q_p A_p$$ AASHTO 10.9.3.5.1-2

$$R_s = q_s A_s$$ AASHTO 10.9.3.5.1-3

$$R_s = \pi d_b \alpha_b L_b$$ AASHTO 10.9.3.5.2-1

R_R = Factored resistance of a micropile

R_p = Nominal tip resistance (kips)

R_s = Nominal skin resistance (kips)

φ_p = Resistance factor for tip resistance

φ_s = Resistance factor for skin resistance

q_p = Unit tip resistance (ksf)

q_s = Unit grout to ground bond resistance (ksf)

A_p = Area of micropile tip (ft^2)

A_s = Area of grout to ground bond surface (ft^2)

d_b = Diameter of micropile drill hole through bonded length (ft)

α_b = nominal micropile grout to ground bond strength (ksf)

L_b = micropile bonded length

Assumptions

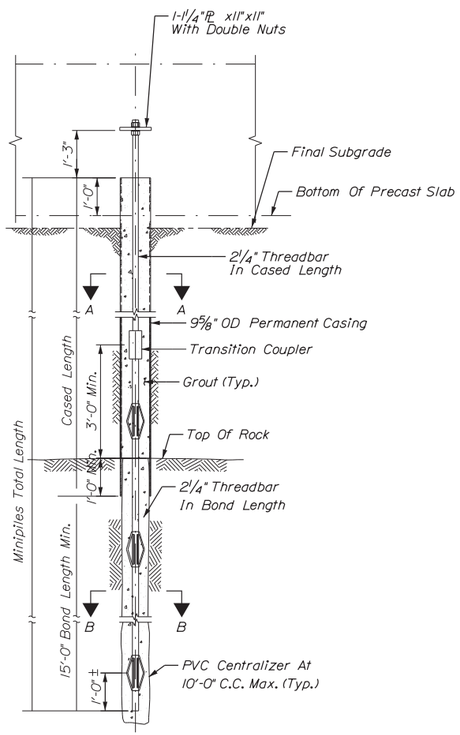
d_b =	0.67	ft	
α_b =	16	ksf	AASHTO Table C10.9.3.5.2-1
L_b =	15	ft	
q_p =	0	ksf	(limited mobilization of tip resistance expected)
φ_p =	0.50	dim	
φ_s =	0.55	dim	
A_p =	0.53	sf	

Calculations

R_s =	505	kips
R_p =	0	kips
R_R =	**278**	**kips**

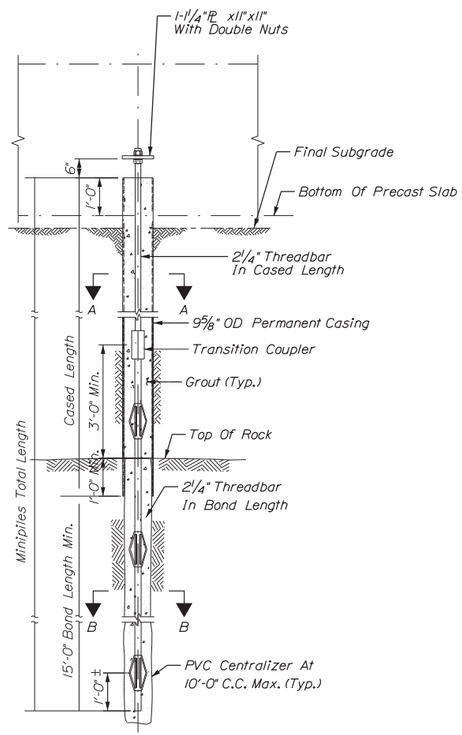
MICROPILES NOTES:

1. Micropiles Shall Be Installed By The Contractor According To Item 501.220 For A Factored Axial Compression Capacity Of 250 Kips And A Minimum Factored Uplift Capacity Of 50 Kips Or As Shown On The Plans. The Required Nominal Resistance is 500 Kips In Compression And 100 Kips In Uplift.
2. For The Installation Of The First Micropile The Geotechnical Engineer Of Record Shall Be Present To Record The Progress And Inspect The Procedures.
3. Micropiles Shall Have A Tip Elevation That Is A Minimum Of 15 Feet Into Bedrock With RQD Greater Than 50%, Which Shall Be Within The Grout Zone Length.
4. The Contractor's Submittal Shall Include Casing Connection Details And Methods Of Advance. Permanent Casing Shall Be Type N80 (FY = 80 KSI) Pipe, Of Size Shown On Drawings, Uncoated, With Flush Joint Threads. Permanent Casing Shall Be Installed From The Cut Off Elevation To The Top Of The Bond Zone. Terminating Casing Above The Bond Zone Shall Not Be Permitted Unless Approved In Writing By The Professional Engineer Hired By The Contractor Based On Review Of The Contractor's Proposed Methods To Stabilize The Open Hole And Maintain Minimum Cover For Reinforcing Steel, And Is Subject To Resident Approval.
5. Center Threadbars For All Production And Temporary Micropiles Shall Be Installed For The Full Pile Length And Of Size Shown On The Drawings. Threadbars Shall Conform To The Requirements Of Astm A615, Grade 75. Couplers Shall Be Utilized Where Required. Provide Nuts In Accordance With The Threadbar Manufacturer's Recommendations.
6. Provide Centralizers For Threadbars At 10 Feet Maximum Spacing.
7. Grout Mix Shall Consist Of Potable Water And Type II Cement. Grout Shall Have A Minimum 28 Day Compressive Strength Of 5000 psi Grout Proportions Shall Be As Shown In The Approved Grout Mix Submittal.
8. Micropiles That Encounter Existing Concrete, Masonry, Timber, Boulders, Or Bedrock Shall Be Drilled Through These Obstacles To Achieve The Required Design Capacities.
9. Construct Micropiles In Compliance With The Contract Documents Requirements Under The Supervision Of A Qualified Professional Engineer Hired By The Contractor.
10. The Engineer Will Review The Records Of Advance Of The Micropiles And Use Them And Other Subsurface Data To Establish Acceptance Criteria For Production Installation.
11. The Adequacy of Each Production Micropile Will Be Determined Solely By The Engineer Based In Part On Observation of Advance Of The Bond Zone Into Rock, The Cuttings, Installation And Concreting, Concrete Test Results, And Other Subsurface Data.
12. The Construction Sequence For The Bascule Pit Footings And The Operators House Foundation Shall Be Coordinated With The General Construction Sequence.
13. For Estimating Purposes The Cased Length At The Bascule Pier Locations Can Be Considered 10 Feet.
14. For Estimating Purposes The Cased Length At The Machinery Enclosure Can Be Considered 26 Feet.
15. For Estimating Purposes The Cased Length At The Operator House Can Be Considered 32 Feet.



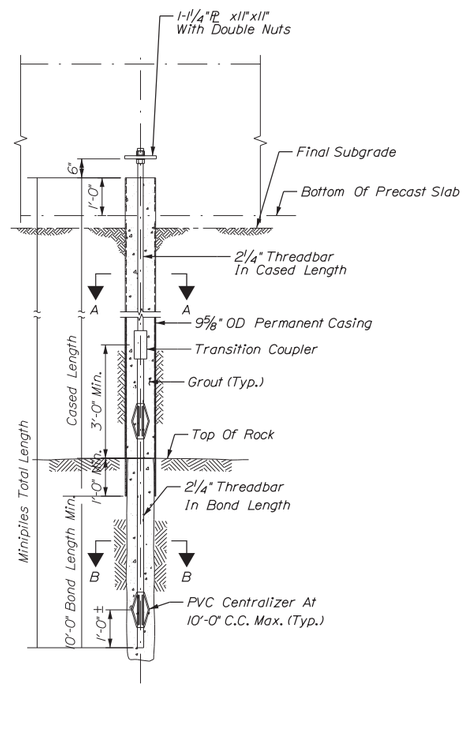
BASCULE PIER PILE SECTION

1' 6" 0 1' 2'
½" = 1'-0"



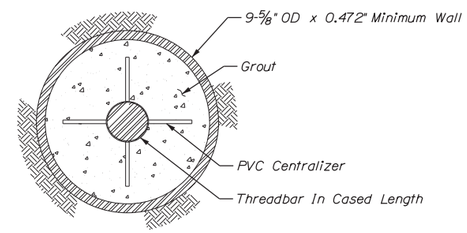
MACHINERY ENCLOSURE PILE SECTION

1' 6" 0 1' 2'
½" = 1'-0"



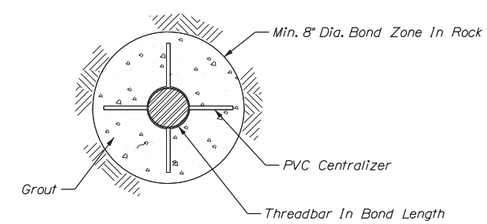
OPERATOR HOUSE PILE SECTION

1' 6" 0 1' 2'
½" = 1'-0"



SECTION A-A

1'0 8' 16'
⅛" = 1'-0"



SECTION B-B

1'0 8' 16'
⅛" = 1'-0"

STATE OF MAINE
DEPARTMENT OF TRANSPORTATION

APPROVED — DATE

COMMISSIONER:

CHIEF ENGINEER:

PROJECT INFORMATION

PROGRAM	BRIDGE	
PROJECT MANAGER	STEPHEN BODGE	SIGNATURE
DESIGNER	HARDESTY & HANOVER	13196
CONSULTANT	HARDESTY & HANOVER	P.E. NUMBER
PROJECT RESIDENT		
CONTRACTOR		DATE
PROJECT COMPLETION DATE		

SOUTH BRISTOL
GUT BRIDGE

MICROPILE SECTIONS AND DETAILS

SHEET NUMBER

57

OF 141

Filename: ...\057_micropile_section_and_detail.dgn Division: BRIDGE Username: common Date:1/29/2014

Computations For	Gut Bridge	Made By	JB	Date	11/16/2013	Job No.	2826.02
Structural Resistance of Soldier Piles		Checked By	AR	Date	11/20/2013	Sec. No	
		Back Checked By		Date		Sheet No.	1

Definitions

$$Q = 0.25 \times F_y A_s$$

AASHTO (4.5.7.3, 17th ed. 2002)

Note: The QA / QC Process used warrants the use of ASD methods rather than LRFD.

Q = Axial Resistance of the W Section. (kips)
F_y = Yield Stress of the Steel (ksi)
A_s = Area of the Steel (in^2)

Note: Ignore loss due to the corrosion since W-sections are encased in concrete.

Assumptions

Fy = 50 ksi
As = 60.6 in^2

Note: As W24x103 = 30.3 in^2, Soldier piles are 2 each W24x103.

Calculations

Q = 757.5 kips

Maximum Demand per pile = 317 kips

757.5kips > 317kips -- Therefore the pile is good

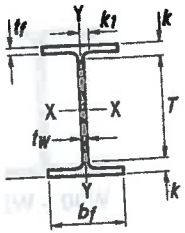


Table 1–1 (continued)
W Shapes
Dimensions

Shape	Area, A	Depth, d		Web Thickness, t_w		Web $\frac{t_w}{2}$	Flange Width, b_f		Flange Thickness, t_f		Distance k k_{des}	Distance k k_{det}	Distance k_1	Distance T	Workable Gage
	in.²	in.		in.		in.	in.		in.		in.	in.	in.	in.	in.
24×370[h]	109	28.0	28	1.52	1 1/2	3/4	13.7	13 5/8	2.72	2 3/4	3.22	3 5/8	1 9/16	20 3/4	5 1/2
×335[h]	98.4	27.5	27 1/2	1.38	1 3/8	11/16	13.5	13 1/2	2.48	2 1/2	2.98	3 3/8	1 1/2		
×306[h]	89.8	27.1	27 1/8	1.26	1 1/4	5/8	13.4	13 3/8	2.28	2 1/4	2.78	3 3/16	1 7/16		
×279[h]	82.0	26.7	26 3/4	1.16	1 3/16	5/8	13.3	13 1/4	2.09	2 1/16	2.59	3	1 7/16		
×250	73.5	26.3	26 3/8	1.04	1 1/16	9/16	13.2	13 1/8	1.89	1 7/8	2.39	2 13/16	1 3/8		
×229	67.2	26.0	26	0.960	15/16	1/2	13.1	13 1/8	1.73	1 3/4	2.23	2 5/8	1 5/16		
×207	60.7	25.7	25 3/4	0.870	7/8	7/16	13.0	13	1.57	1 9/16	2.07	2 1/2	1 1/4		
×192	56.3	25.5	25 1/2	0.810	13/16	7/16	13.0	13	1.46	1 7/16	1.96	2 3/8	1 1/4		
×176	51.7	25.2	25 1/4	0.750	3/4	3/8	12.9	12 7/8	1.34	1 5/16	1.84	2 1/4	1 3/16		
×162	47.7	25.0	25	0.705	11/16	3/8	13.0	13	1.22	1 1/4	1.72	2 1/8	1 3/16		
×146	43.0	24.7	24 3/4	0.650	5/8	5/16	12.9	12 7/8	1.09	1 1/16	1.59	2	1 1/8		
×131	38.5	24.5	24 1/2	0.605	5/8	5/16	12.9	12 7/8	0.960	15/16	1.46	1 7/8	1 1/8		
×117[c]	34.4	24.3	24 1/4	0.550	9/16	5/16	12.8	12 3/4	0.850	7/8	1.35	1 3/4	1 1/8		
×104[c]	30.6	24.1	24	0.500	1/2	1/4	12.8	12 3/4	0.750	3/4	1.25	1 5/8	1 1/16		
W24×103[c]	30.3	24.5	24 1/2	0.550	9/16	5/16	9.00	9	0.980	1	1.48	1 7/8	1 1/8	20 3/4	5 1/2
×94[c]	27.7	24.3	24 1/4	0.515	1/2	1/4	9.07	9 1/8	0.875	7/8	1.38	1 3/4	1 1/16		
×84[c]	24.7	24.1	24 1/8	0.470	1/2	1/4	9.02	9	0.770	3/4	1.27	1 11/16	1 1/16		
×76[c]	22.4	23.9	23 7/8	0.440	7/16	1/4	8.99	9	0.680	11/16	1.18	1 9/16	1 1/16		
×68[c]	20.1	23.7	23 3/4	0.415	7/16	1/4	8.97	9	0.585	9/16	1.09	1 1/2	1 1/16	20 3/4	3 1/2[g]
W24×62[c]	18.2	23.7	23 3/4	0.430	7/16	1/4	7.04	7	0.590	9/16	1.09	1 1/2	1 1/16	20 3/4	3 1/2[g]
×55[c,v]	16.2	23.6	23 5/8	0.395	3/8	3/16	7.01	7	0.505	1/2	1.01	1 7/16	1	18	5 1/2
W21×201	59.2	23.0	23	0.910	15/16	1/2	12.6	12 5/8	1.63	1 5/8	2.13	2 1/2	1 5/16		
×182	53.6	22.7	22 3/4	0.830	13/16	7/16	12.5	12 1/2	1.48	1 1/2	1.98	2 3/8	1 1/4		
×166	48.8	22.5	22 1/2	0.750	3/4	3/8	12.4	12 3/8	1.36	1 3/8	1.86	2 1/4	1 3/16		
×147	43.2	22.1	22	0.720	3/4	3/8	12.5	12 1/2	1.15	1 1/8	1.65	2	1 3/16		
×132	38.8	21.8	21 7/8	0.650	5/8	5/16	12.4	12 1/2	1.04	1 1/16	1.54	1 15/16	1 1/8		
×122	35.9	21.7	21 5/8	0.600	5/8	5/16	12.4	12 3/8	0.960	15/16	1.46	1 13/16	1 1/8		
×111	32.7	21.5	21 1/2	0.550	9/16	5/16	12.3	12 3/8	0.875	7/8	1.38	1 3/4	1 1/8		
×101[c]	29.8	21.4	21 3/8	0.500	1/2	1/4	12.3	12 1/4	0.800	13/16	1.30	1 11/16	1 1/16		

Table 1–1 (continued)
W Shapes
Properties

W24 – W21

Nominal Wt.	Compact Section Criteria $\frac{b_f}{2t_f}$	Compact Section Criteria $\frac{h}{t_w}$	Axis X-X I	Axis X-X S	Axis X-X r	Axis X-X Z	Axis Y-Y I	Axis Y-Y S	Axis Y-Y r	Axis Y-Y Z	r_{ts}	h_o	Torsional Properties J	Torsional Properties C_w
lb/ft			in.⁴	in.³	in.	in.³	in.⁴	in.³	in.	in.³	in.	in.	in.⁴	in.⁶
370	2.51	14.2	13400	957	11.1	1130	1160	170	3.27	267	3.92	25.3	201	186000
335	2.73	15.6	11900	864	11.0	1020	1030	152	3.23	238	3.86	25.0	152	161000
306	2.94	17.1	10700	789	10.9	922	919	137	3.20	214	3.81	24.9	117	142000
279	3.18	18.6	9600	718	10.8	835	823	124	3.17	193	3.76	24.6	90.5	125000
250	3.49	20.7	8490	644	10.7	744	724	110	3.14	171	3.71	24.5	66.6	108000
229	3.79	22.5	7650	588	10.7	675	651	99.4	3.11	154	3.67	24.3	51.3	96100
207	4.14	24.8	6820	531	10.6	606	578	88.8	3.08	137	3.62	24.1	38.3	84100
192	4.43	26.6	6260	491	10.5	559	530	81.8	3.07	126	3.60	24.0	30.8	76300
176	4.81	28.7	5680	450	10.5	511	479	74.3	3.04	115	3.57	23.9	23.9	68400
162	5.31	30.6	5170	414	10.4	468	443	68.4	3.05	105	3.57	23.8	18.5	62600
146	5.92	33.2	4580	371	10.3	418	391	60.5	3.01	93.2	3.53	23.7	13.4	54600
131	6.70	35.6	4020	329	10.2	370	340	53.0	2.97	81.5	3.49	23.5	9.50	47100
117	7.53	39.2	3540	291	10.1	327	297	46.5	2.94	71.4	3.46	23.4	6.72	40800
104	8.50	43.1	3100	258	10.1	289	259	40.7	2.91	62.4	3.42	23.3	4.72	35200
103	4.59	39.2	3000	245	10.0	280	119	26.5	1.99	41.5	2.40	23.6	7.07	16600
94	5.18	41.9	2700	222	9.87	254	109	24.0	1.98	37.5	2.40	23.4	5.26	15000
84	5.86	45.9	2370	196	9.79	224	94.4	20.9	1.95	32.6	2.37	23.3	3.70	12800
76	6.61	49.0	2100	176	9.69	200	82.5	18.4	1.92	28.6	2.34	23.2	2.68	11100
68	7.66	52.0	1830	154	9.55	177	70.4	15.7	1.87	24.5	2.30	23.1	1.87	9430
62	5.97	50.1	1550	131	9.23	153	34.5	9.80	1.38	15.7	1.75	23.2	1.71	4620
55	6.94	54.6	1350	114	9.11	134	29.1	8.30	1.34	13.3	1.71	23.1	1.18	3870
201	3.86	20.6	5310	461	9.47	530	542	86.1	3.02	133	3.55	21.4	40.9	62000
182	4.22	22.6	4730	417	9.40	476	483	77.2	3.00	119	3.51	21.2	30.7	54400
166	4.57	25.0	4280	380	9.36	432	435	70.0	2.99	108	3.48	21.1	23.6	48500
147	5.44	26.1	3630	329	9.17	373	376	60.1	2.95	92.6	3.45	20.9	15.4	41100
132	6.01	28.9	3220	295	9.12	333	333	53.5	2.93	82.3	3.42	20.8	11.3	36000
122	6.45	31.3	2960	273	9.09	307	305	49.2	2.92	75.6	3.40	20.7	8.98	32700
111	7.05	34.1	2670	249	9.05	279	274	44.5	2.90	68.2	3.37	20.6	6.83	29200
101	7.68	37.5	2420	227	9.02	253	248	40.3	2.89	61.7	3.35	20.6	5.21	26200

STEEL CONSTRUCTION

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