March 10, 2021

Mr. Adrian Viala, P.E.
Assistant District Geotechnical Engineer
Florida Department of Transportation
District 4 and 6 Materials Office
14200 West State Road 84
Davie, Florida 33325

Subject: Preliminary Report of a Geotechnical Exploration – Structures (Revision 2)
Atlantic Isle Bridge (Bridge No. 874218) Rehabilitation or Replacement
Florida Department of Transportation, District 6
Contract No. C-9Y98, Contract FPID No. 250730-3-32-01
Project FPID No. 430029-2-22-02
City of Sunny Isles
Miami-Dade County, Florida
T.W.O. No. 79
HRES Project No. HR20-1583R

Dear Adrian:

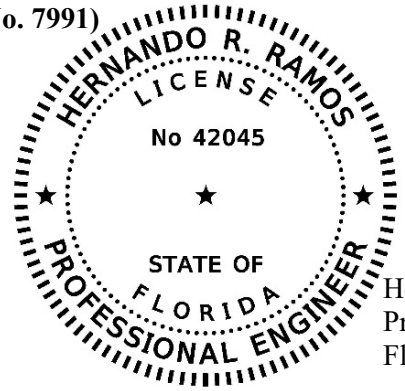
HR Engineering Services, Inc. (HRES) is presenting this Preliminary Report of a Geotechnical Exploration – Structures (Revision 2) – for the subject project. This preliminary report presents our understanding of the project, outlines our exploratory procedures, and documents the field and laboratory test data obtained for the proposed project.

We have enjoyed assisting you on this project and look forward to serving as your geotechnical consultant on the remainder of this project and on future projects. If you have any questions concerning this report, please call our office at (305) 888-8880.

Sincerely,

HR ENGINEERING SERVICES, INC.
(Certificate of Authorization No. 7991)

Paola Vargas, P.E.
Geotechnical Engineer
Florida Registration 90928



THIS ITEM HAS BEEN DIGITALLY SIGNED AND SEALED BY
Hernando R Ramos
2021.03.11 16:58:20 -05'00'
ON THE DATE ADJACENT TO THE SEAL

PRINTED COPIES OF THIS DOCUMENT ARE NOT CONSIDERED SIGNED AND SEALED AND THE SIGNATURE MUST BE VERIFIED ON ANY ELECTRONIC COPIES

Hernando R. Ramos, P.E.
Principal Geotechnical Engineer
Florida Registration 42045

Distribution: Addressee (1)
File (1)

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1.0 INTRODUCTION

The purpose of this geotechnical evaluation was to obtain information concerning the site and subsurface conditions in the area of the proposed bridge rehabilitation or replacement, and provide an evaluation of the suitability of the in-situ materials and preliminary recommendations for different foundation alternatives. This report discusses the subsurface conditions based on the available test borings, presents our findings and evaluation, and includes the following items:

Field Services

- Two (2) test borings performed by HRES for a previous study were available. Each boring was performed to a depth of 80 measured from the existing ground surface. The test boring subsurface information is presented in the Report of Core Borings in Appendix A.

Evaluation

- Review of Miami-Dade County USDA Soil Survey Maps.
- Review of USGS Quadrangle Map (1994) for North Miami, Florida.
- Review of Miami-Dade County USGS Water Level Maps.
- A general review of area and site geologic conditions.
- A general review of existing surface features and site conditions.
- Report of core borings which illustrate the estimated subsurface conditions in the area of the existing bridge.
- An evaluation of the different foundation systems for support of the bridge structure.
- Drilled shafts/augercast Piles/micropile axial compression capacities.
- Soil/rock parameters for drilled shafts/augercast piles/micropile lateral analyses.
- Driven pile axial compression capacities.
- Soil/rock parameters for driven pile lateral analysis.

Laboratory Testing

- The results of laboratory tests performed on selected soil samples obtained from the test borings.
- A brief description of our laboratory testing procedures.

2.0 PROJECT INFORMATION

2.1 GENERAL

Project information for this subsurface exploration has been provided to us by various members of the design team. Additional information has been provided during telephone conversations.

During our geotechnical study, we have been furnished with the following project-related plans and information:

- Conceptual bridge rehabilitation plans for:

  Atlantic Isle Bridge
  Bridge 874218
  Prepared by: HNTB Corporation
  Printed Date: 09/17/2020

2.2 PROJECT DESCRIPTION

The project consists of the rehabilitation or replacement of the existing 1925 historical arch bridge located in Atlantic Isle, Miami, Florida. There are 2 alternatives for the project:

Alternative 1: Consists of building a new bridge deck on top of the existing arch bridge while keeping the existing structural shell.

Alternative 2: Consists of the replacement of the existing bridge by a new structure.

This report provides the foundation recommendations for both alternatives.

3.0 FIELD EXPLORATION AND LABORATORY TESTING

3.1 FIELD EXPLORATION

The field exploration was conducted by HRES. The locations of the test borings are provided in the Summary of Test Boring Locations in Appendix A and at the approximate locations shown on the Field Exploration Plan in Appendix A.

The Report of Core Borings in Appendix A summarize the approximate boundary between soil types. In some instances, the transition between material types may be gradual. A discussion of the subsurface conditions encountered along the project alignment is provided in Section 4.2 of this report.

3.2 LABORATORY TESTING

3.2.1 Soil Testing

In order to aid in classifying and estimate engineering characteristics of the subsurface materials encountered, laboratory classification tests were performed on representative soil samples obtained from the test borings performed for the project. The laboratory testing program included the following:

- 2 Grain Size Analyses
- 1 Fines Content Test
- 3 Organic Content Tests

In addition, a total of 6 moisture content tests were performed in conjunction with the classification tests. The laboratory test results are presented in Appendix B.

3.2.2 Corrosivity Classification Testing

HRES did not perform corrosion testing. Based on the location of the bridge to the Biscayne Bay, an Extremely Aggressive Environment is recommended for both steel and concrete substructures. Due to the proximity of the ocean, the superstructures are also considered to be in an Extremely Aggressive environment.

4.0 SITE AND SUBSURFACE CONDITIONS

4.1 SITE CONDITIONS

The site conditions were observed by a Geotechnical Engineer during the month of December, 2017.

4.2 SUBSURFACE CONDITIONS

4.2.1 Miami-Dade County Soil Survey Map

The Soil Map of Miami-Dade County Area, Florida, published by the United States Department of Agriculture (USDA) was reviewed for general near-surface soil information within the general project vicinity. This information indicates that there are two (2) mapping units in the vicinity of the project. The map soil units encountered are as follows:

Table 4.2.1 Miami-Dade County Soil Survey

Miami-Dade County Area, Florida (FL686)		
Map Unit Symbol	**Map Unit Name**	**Typical Profile**
15	Urban land (55.1% of AOI)	Not Reported
99	Water (44.9% of AOI)	100 percent water

Based on the information from the USDA map, it appears that unsuitable materials are not present within the study area. A reproduction of the USDA map for the project area is included in Appendix A.

4.2.2 USGS Quadrangle Map

The North Miami Quadrangle, Florida-Dade Topographic Map (1994) published by the United States Geological Survey (USGS) was reviewed for general existing ground surface elevations in the project area. Based on the map, the existing ground elevations in the project vicinity range from 5 to 10 feet, NGVD29. A reproduction of the USGS Quadrangle Map for the project area is included in Appendix A.

4.2.3 General

A graphical representation of the subsurface conditions encountered by the test borings drilled for the proposed bridge is shown on the Report of Core Borings in Appendix A. These profiles and the following soil/rock conditions highlight the major subsurface stratification. The boring profiles on this sheet should be consulted for a detailed description of the soil/rock conditions encountered at each boring location. When reviewing the subsurface profiles, it should be understood that the soil/rock conditions may vary between and away from the boring locations.

4.2.4 Geologic Conditions

The project is located on the southern flank of the Florida Plateau, a stable, carbonate platform. In the study, the upper 200 feet of this platform is composed predominately of limestone and quartz sand. The sediments were deposited during several glacial and interglacial stages during the Pleistocene Epoch. Within the explored depths of this study, two distinct geological formations were encountered. These formations are the Miami Limestone Formation and the Fort Thompson Formation.

4.2.5 Miami Limestone

The Miami Limestone underlies the silt and organic soils and roadway fills. The Miami Limestone was encountered by the bridge borings from an average elevation of -8.0 feet to -12.0 feet, NAVD88.

The Miami Limestone can be described as a soft tan white porous to very porous fossiliferous quartz sandy fine-grained slightly oolitic limestone. The solution channels in the limestone may be up to 2 inches in diameter at some locations, are filled with quartz fine sand and uncemented calcareous materials. The limestone varies in both thickness and competency within the investigated area.

The Miami Limestone was deposited in a shallow near shore marine carbonate bank environment. Spherical carbonate sand grains called oolites formed and were deposited in this environment. Near shore, processes transported quartz sand into the area and reworked some of the carbonate material. Encrusting organisms called bryozoans were locally abundant and formed patches on the substrate. After sea level receded, the carbonate deposit was exposed to fresh water and the cementation process was initiated. The degree of cementation, and therefore the competency of the rock, was influenced by both the abundance and the type of calcareous material in the original deposit. Humic

and carbonic acids percolating downward through the material etched slots up to 4 feet deep in the surface of the stratum.

4.2.6 Fort Thompson Formation

Underlying The Miami Limestone Formation, The Fort Thompson Formation was generally encountered. The Fort Thompson Formation is composed of sediments of variable lithologies. The lithologies include non-fossiliferous quartz fine sand, fossiliferous quartz sandy limestone, coralline limestone, freshwater limestone, and quartz sandstone. These lithologies alternate abruptly in thickness and lateral extent.

The Fort Thompson limestone grades downward into a gray quartz and calcareous fine to medium sand. This sand has been cemented to varying degrees by carbonate material leached out of the overlying limestone. The cementation commonly takes the form of hard spherical sandstone nodules 1 to 2 inches in diameter occurring in a sand matrix. Sandstone lenses within the sand layer are the result of a more complete cementation.

4.2.7 Generalized Subsurface Conditions Encountered at the Bridge Location

For a detailed subsurface condition at a particular borehole location, please refer to the Report of Core Borings in Appendix A.

4.2.8 Groundwater Conditions

The groundwater levels in the borings were measured at the time of drilling. Groundwater levels in the test boring were encountered at an approximate elevation of 0.5 feet, NAVD88. A Seasonal High Ground Water Table (SHGWT) of 2.0 feet, (NAVD88) is recommended for design.

Fluctuation in the observed groundwater levels should be expected due to seasonal climatic changes, construction activity, rainfall variations, surface water runoff, storm surge and other site-specific factors. Since groundwater level variations are anticipated, design drawings and specifications should accommodate such possibilities and construction planning should be based on the assumption that variations will occur.

5.0 SUMMARY OF FOUNDATION ALTERNATIVES

5.1 GENERAL

Our preliminary foundation alternatives for support of the proposed bridge include shallow and deep foundations. Other types of foundation support have been evaluated for the proposed bridge. It is important to note that the bridge is located near residences which may preclude the use of some of the foundation support alternatives presented below due to vibration/noise issues. The following foundation alternatives are as follows:

- Shallow Foundations: Based on the results of the test borings available, a shallow foundation alternative is not feasible for support of the bridge end bents since the test borings encountered an organic to highly organic layer down to an approximate elevation of -12.5 feet, NAVD88 followed by a relatively weak to strong limestone. The organic materials will cause large foundation settlements; therefore, this foundation alternative is not recommended.

- Geosynthetic Reinforced Soil Integrated Bridge System (GRS-IBS): This is also a shallow foundation alternative. This foundation alternative is not feasible due to the organic to highly organic layer down to elevation -12.5 feet, NAVD88. The organic materials will cause large foundation settlements; therefore, this foundation alternative is not recommended.

- Steel H-Piles or Pipe Piles: The advantage of this type of piles is the relatively low vibration during driving when compared to concrete driven piles. However, the disadvantage in this project is that these piles provide relatively lower axial capacities when compared to concrete driven piles; also, the difficulty to estimate the length of the piles due to the uncertainty of determining the pile tip elevation during pile installation in addition to the extremely aggressive environment that may require sacrificial thickness to be added to the H pile sections.

- Augercast Piles (ACIP): The advantage of this type of piles is the relatively low to no vibration during construction. This type of foundation is recommended for Alternative 1 (Rehabilitation) since vibration could damage the existing historic arch bridge and adjacent residences. It can also be used for the replacement bridge alternative. However, there are site conditions that may present this

alternative not favorable for ACIP piles. These adverse conditions include constructability issues regarding the proximity of the canal water to the end bent construction. Augercast piles require to be installed on ground having the water level a minimum of one to two pile diameters below ground to help build a grout head. Since the groundwater elevation is very close to the ground surface, the head needed for the installation of the ACIP may not be sufficient. Also, the organic to highly organic layer will not provide resistance to the pressurized grout producing a bulge during installation.

These construction issues can be resolved by installing permanent steel casings at pile locations with enough diameter to allow the construction of augercast piles inside the permanent steel casings. The top of the casing could be left two-pile diameter about ground and the tip of the casings installed at -15 feet, NAVD88. The pile installation requires a collection system of the cuttings, slurry and extra pumped grout to avoid contamination of the canal. If all these issues can be solved, augercast piles could be a feasible alternative.

- Drilled Shafts: The advantage of this type of foundation is the relatively low to no vibration (when using an oscillating/rotator casing installation) during construction. This type of foundation is recommended for Alternative 1 (Rehabilitation) since vibration could damage the existing historic arch bridge and adjacent residences. It can also be used for the replacement bridge alternative.

  This type of foundation provides high axial and lateral capacities; however, it is recommended to provide shaft redundancy. It may require a minimum of 3 shafts per end bent.

  The surface conditions encountered by the borings (organic materials down to elevation -12.5 feet and high-water elevation due to the proximity of the canal) require the use of permanent casing down to elevation -15 feet, NAVD88.

  In addition, due to the weak limestone layer (with low "N" values) encountered immediately under the organic material which may present stability issues during construction, each shaft may require a temporary casing down to elevation -41 feet, NAVD88. Below elevation -41 feet, the limestone is more competent. Similar to augercast piles, the installation of drilled shafts will require a collection system of the cuttings, slurry and extra pumped concrete to avoid contamination of the canal.

- Micropiles: The advantage of this type of foundation is the relatively low to no vibration during construction. This type of foundation is recommended for Alternative 1 (Rehabilitation) since vibration could damage the existing historic arch bridge and adjacent residences. It can also be used for the replacement bridge alternative. Similar to augercast piles, the installation of micropiles will

require a collection system of the cuttings, slurry and extra pumped grout to avoid contamination of the canal.

This type of foundation provides high axial capacity; however, it provides low lateral capacities, especially since the upper organic materials encountered to elevation -12.5 feet, NAVD88 don't provide any lateral support. It will require a permanent casing to at least -15 feet, NAVD88. The lateral capacity issue can be resolved by installing a large group of micropiles.

- Concrete Driven Piles: Concrete driven piles are only recommended for Alternative 2 (Replacement) for foundation support of the new bridge structure. However, this alternative present greater vibration and noise issues when compared with the other foundation alternatives and should be used with extreme caution.

  This foundation system will provide the required axial and lateral capacities for the project and will be less impacted by the site environment, including corrosion, highwater elevation and proximity of the new bents to the canal. The pile installation will require preforming down to elevation at least 34 feet, NAVD88.

  A permanent steel casing installed to elevation -15 feet, NAVD88 will be needed at each pile location to help keep the preformed holes open (to avoid collapse of the organic soils in the hole) before installing each pile and the backfilling of the annulus between the piles and the preformed holes. Due to the potential of high vibration levels during concrete pile installation, the steel casing may need to be installed at deeper elevations to help minimize the damage to nearby residences.

  All adjacent residences will need to be monitored for settlement and vibration during casing and pile installation.

6.0 PRELIMINARY FOUNDATION EVALUATION

6.1 BASIS OF EVALUATION

Our foundation recommendations are based upon the previously presented project information and the structural conditions along with the data obtained in this exploration. The field and laboratory data have been compared with previous performances of similar structures bearing on and within soil/rock conditions similar to those encountered in this exploration. If the project information is incorrect or changes, please contact us so that our evaluation and recommendations can be reviewed.

In our evaluation of the subject project, we addressed the following geotechnical design and construction considerations:

- Alternative 1: Drilled shafts, augercast piles and micropiles are viable alternatives for foundation support of the bridge structure rehabilitation. Due to the extremely aggressive environment, 48-inch diameter drilled shafts, 30-inch diameter augercast piles and 9.625-inch diameter micropile were included in the foundation analyses.

- Alternative 2: Providing that the vibration caused by pile installation can be controlled, 24-inch square prestressed concrete driven piles are a viable alternative for foundation support of the bridge structure replacement. The axial compression analyses are also included. Drilled shaft/augercast pile/Micropiles foundation types are also recommended for support of the new bridge.

6.2 ALTERNATIVE 1 – AUGERCAST PILES, DRILLED SHAFTS AND MICROPILES

6.2.1 General

Drilled shafts and augercast piles with diameters of 48 and 30 inches, respectively and micropile with 9.625-inch diameter were considered for the support of the proposed bridge retrofit. These deep foundation systems are able to develop the necessary capacity to support the factored design loads when bearing in lower medium to hard limestone layers.

6.2.2 Drilled Shafts, Augercast Piles and Micropiles Axial Compression Capacity Analyses

Drilled shafts, augercast piles and micropiles installed in median to hard limestone derive their axial load capacities from two components; shear transfer between the concrete and soil/rock interface, and end bearing or point resistance at the base of the shaft/pile.

The drilled shaft/augercast pile/micropile axial capacity analyses neglected the end bearing resistance. In addition, the side friction resistance in sand and soft limestone (Ns<25 blows/ft) were not considered in the axial capacity analyses. The side friction resistance in the rock layer was estimated as follows:

$f_s = 0.1$ N (tsf) (FDOT Soils and Foundation Handbook)

Where,

f_s = ultimate unit side friction resistance.

N = SPT N-value (blows/ft.) ≥25

Based on the handbook, the maximum value of f_s is 5 tsf. However, we limited it to 4 tsf (i.e., maximum N=40) for this study.

When using the Load Resistance Factor Design method (LRFD), a resistance factor, ø is applied to the ultimate mobilized shaft capacity to yield the factored shaft/pile resistance capacity.

For redundant drilled shafts/augercast piles the resistance factor is 0.6. For micropiles, the resistance factor is 0.55.

For non-redundant drilled shafts, the resistance factor is 0.5, when using side friction only. Non-redundant augercast piles and micropiles are not allowed.

Drilled shaft/augercast pile and micropile tip elevations, axial compression capacities and capacity vs. tip elevation graphs are presented in Appendix C.

6.2.3 Drilled Shaft/Augercast Pile/Micropile – Soil/Rock Parameters for Lateral Analysis

A lateral loading analysis may be performed to estimate the lateral soil/rock resistance of drilled shaft/augercast pile and micropiles at each end bent.

A table of soil/rock parameters for drilled shaft /augercast pile and micropile lateral analysis is presented in Appendix C. It is understood that computer program FB-MultiPier, developed by University of Florida Bridge Software Institute (BSI) will be used to perform the lateral loading analyses.

The parameters were estimated from accepted FDOT correlations with SPT N_S (N values obtained using a safety hammer). SPT N values obtained using an automatic hammer, SPT Na, were

converted to safety hammer values, SPT Ns, by multiplying by a factor of 1.24. The following formulas and correlations with SPT (Ns) values were used:

Sands, Fills and Soft Limestone modeled as Sand:

- Friction Angle, ϕ = Ns/4+28˚ (Maximum of 38˚).
- Unit Weight γ=105pcf*friction angle of soil/30˚
- Modulus of Elasticity, E=30,000Ns (psf).
- Shear Modulus G=E/2(1+ν), where Poisson ratio, ν=0.3.
- Side friction (τ_f) estimated using β-Method for drilled shafts and micropiles.
- Modulus of subgrade reaction (k), estimated using Graphs B7 and from the FB-MultiPier Help Manual

Limestone (modeled as rock):

- Unit Weight = 120pcf.
- Side Friction, τ_f=0.1Ns (tsf).
- Unconfined compressive strength (qu), estimated using McVay's Equation for side friction, $(1/2(qu*qt)^{1/2}$ by equating to 0.1 Ns (tsf) and assuming qt=20% of qu.
- Shear Modulus G=E/2(1+ν), where Poisson ratio, ν=0.2 and the Modulus of Elasticity, E = 115qu.

The test borings performed show a thick organic layer ranging from approximate elevation +1.8. to -12.5 feet, NAVD88 and a permanent steel casing installed to -15 feet, NAVD88. For the purpose of lateral analysis, the design ground elevation should be considered at -15 feet, NAVD88.

6.3 ALTERNATIVE 2 - DRIVEN PILES

6.3.1 General

Drilled shafts, augercast piles, micropiles and driven 24-inch square prestressed concrete piles are feasible alternatives for the support of the new bridge. Drilled shafts/augercast piles/micropiles have been discussed in Alternative 1. This section only refers to driven concrete piles.

Driven piles are able to develop the necessary capacity to support the factored design loads when bearing in the natural limestone. As mentioned before, a permanent steel casing is required to be installed to elevation -15 feet, NAVD88 to help maintain the preformed hole open from collapsed organic soils.

6.3.2 Driven Pile Axial Compression Capacity Analysis

In order to evaluate the capacity of the driven pile foundations, a static analysis using the design methodology presented in FDOT Research Bulletin 121 (RB-121) developed by Professor J.H. Schmertmann, was performed. A computerized version of this method, entitled *FB-Deep v.2.06,* was used. This method generates an allowable pile capacity through the use of empirical correlations with standard penetration test (SPT) "N" values, and soil/rock end bearing and side friction curves generated for given soil/rock types. The ultimate mobilized pile capacity (Davison pile capacity) is calculated as the sum of the ultimate side friction plus one-third of the ultimate end bearing. When using the Load Resistance Factor Design method (LRFD), the estimated Davisson capacity is used to predict the ultimate bearing capacity of the pile. A resistance factor, ø is applied to the Davisson capacity to yield the factored pile resistance capacity. This resistance factor may be taken as 0.65 (with dynamic testing of ≥5% of piles) or 0.75 (with dynamic testing of 100% of piles) when using *FB-Deep* Davisson capacity as design methodology for axial compression. To help minimize vibration, 100% dynamic testing is recommended.

Pile tip elevations and capacities are provided in the *FB-Deep* computer analysis printouts presented in Appendix C.

6.3.3 Driven Pile – Soil/Rock Parameters for Lateral Analysis

A driven pile lateral analysis is required in order to determine the pile lateral loading capacity and the pile minimum tip elevation at each bridge bent support. The bridges designer is responsible for these lateral load analyses. Our recommended soil stratigraphy and the parameters to be used for the lateral analyses, based on the available subsurface exploration are presented in Appendix C. Any computer software approved by the FDOT may be used, however, we are assuming that FB-MultiPier software by University of Florida, Bridge Software Institute will be used.

The soil elastic and strength parameters provided have been estimated from correlations with the Standard Penetration Test (SPT) values (N, blows/ft) obtained from the field exploration. The modulus of elasticity (E) was estimated from correlations with SPT N_S (N values obtained using a safety hammer). Similarly, the internal friction angle (ϕ) was estimated from accepted FDOT correlations with N_S values. SPT N values obtained using an automatic hammer, SPT Na, were converted to safety hammer values, SPT Ns, by multiplying by a factor of 1.24. The following correlations with SPT Ns values were used:

- Friction Angle, ϕ = Ns/4+28˚ for sands and limestone with Ns < 10 blows/foot (modeled as sand). Maximum friction angle of 34˚.
- Limestone with Ns > 10 blows/foot was modeled as sandy gravel with ϕ = Ns/4+33˚. Maximum friction angle of 40˚.
- For sands, fills, and weak limestone modeled as sand or sandy gravel, the Modulus of Elasticity, E was estimated as E=30,000Ns (psf).
- The Shear Modulus, G was estimated as G=E/2(1+ν), where, ν is Poisson ratio (ν=0.3 for sands, fills, and 0.2 for limestone modeled as sandy gravel).
- Unit skin friction of sands and limerock fill, τ_f=0.019Ns (tsf).
- Unit skin friction of limestone, τ_f=0.01Ns (tsf)
- Unit weight of sands and fills was estimated as γ=105pcf*friction angle of soil/30˚.
- Unit weight of limestone was assumed as 120 pcf.
- The ultimate end bearing of the sand layer was estimated as q_{ult} =6.4Ns (ksf).
- The ultimate end bearing of the limestone layer was estimated as q_{ult} = 7.2Ns (ksf).
- Modulus of subgrade reaction, k (pci) was estimated using FDOT Soils and Foundation Handbook.

6.4 DOWNDRAG AT BRIDGE ABUTMENTS

Alternative 1:

The drilled shafts/augercast piles or micropiles may be installed within the existing bridge abutments. Since the additional fill volume placed over the existing embankment at these locations will be small, no significant settlements are expected at these locations. Hence, downdrag is expected to be negligible.

Alternative 2:

As in Alternative 1, the driven piles at both end bents of the proposed new bridge will be installed within the area occupied by the existing bridge abutments. Hence, downdrag is expected to be negligible.

6.5 SCOUR

Alternative 1 and 2:

Due to the close proximity to the Biscayne Bay, scour is expected. The designer might consider beneficial to use a revetment system to protect the end bents.

6.6 PERMANENT CASING

Alternative 1:

A permanent casing should be installed down to elevation -15 feet, NAVD88 (about 2.5 feet into the natural limestone) as an attempt to prevent the cave-in of the organic layer at each shaft/pile location. For the drilled shaft alternative, a temporary casing may be needed during shaft installation due to the soft limestone encountered down to elevation -41 feet, NAVD88 to prevent cave-ins. Below this elevation, the limestone appears to be more competent (high "N" values).

The installation of all casings for drilled shafts will require the use oscillation/rotator casing installation to minimize noise and vibration and avoid damage to the historical arch bridge and adjacent residences.

Alternative 2:

A permanent casing should be installed down to elevation -15 feet, NAVD88 (about 2.5 feet into the natural limestone) as an attempt to prevent the cave-in of the organic layer at each concrete pile location. The casing diameter should be 36 inches. As mentioned before, the tip of the steel casing may need to go lower to help reduce the potential high vibration levels during concrete pile driving.

6.7 PREFORMING

Alternative 2:

Based on the information from Borings B-1 and B-2, a hard layer of limestone is observed down to an approximately elevation -34 feet, NAVD88. This layer might be hard to penetrate during driving and present refusal before reaching the minimum tip elevation. Due to organic layer encountered approximately elevation -12.5 feet, NAVD88, HRES recommends preforming down to elevation -34 feet, NAVD88. Due to possible vibration levels during pile driving, this preforming elevation may require revision.

6.8 SETTLEMENT AND VIBRATION MONITORING

Construction vibrations associated with casing installation, pile driving and compaction equipment and others will occur. Settlement and vibration monitoring of existing bridge and all nearby existing structures should be performed in accordance with Section 108 of the FDOT Standard Specifications. HRES anticipates the following buildings will need to be monitored:

- 263 Atlantic Avenue, North Miami Beach, FL 33160
- 265 Atlantic Avenue, North Miami Beach, FL 33160
- Miami-Dade County Water and Sewer Department Pump Station
- Any other structure that may be identified by the Structural Engineer should be added to this list.

All existing structures in the vicinity of pile driving and compaction operations should be monitored for settlement and vibration.

6.9 CONSTRUCTION PLANS AND SPECIFICATIONS REVIEW

It is recommended that this office be provided the opportunity to make a general review of the earthwork plans and special provisions prepared from the recommendations presented in this report. We would then suggest any modifications so that our recommendations are properly interpreted and implemented.

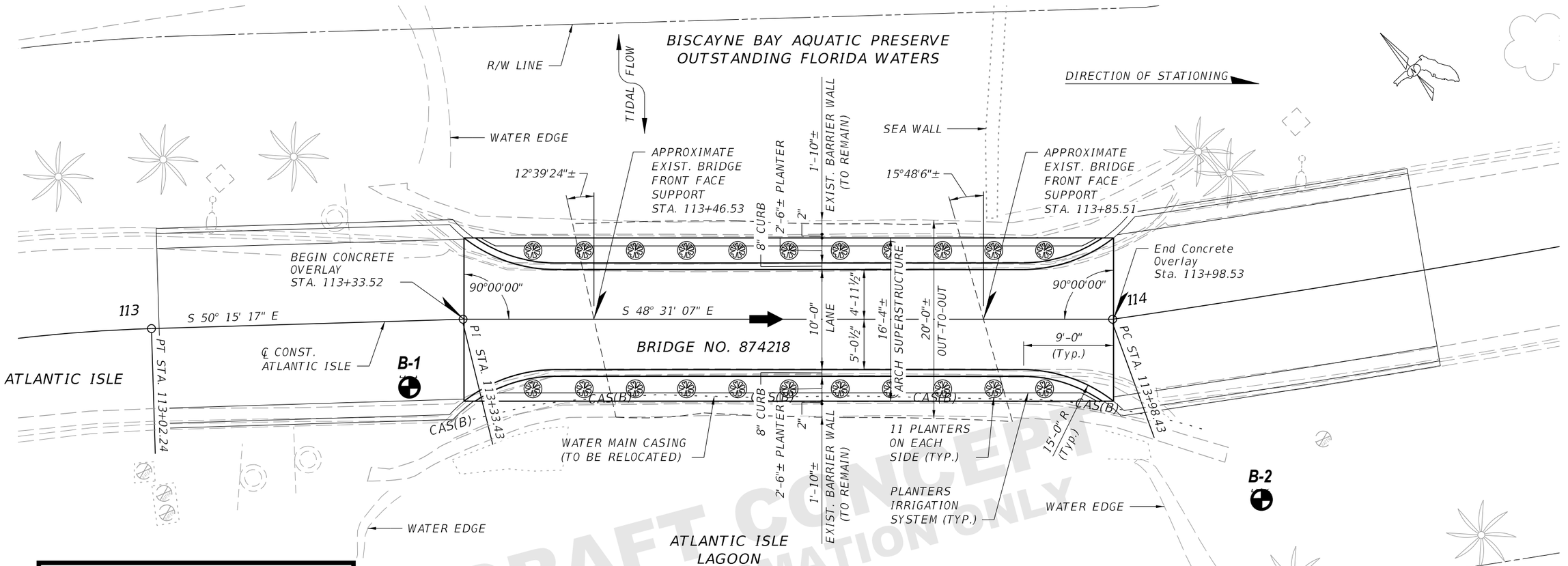
APPENDIX A

ATLANTIC ISLE BRIDGE
FPID No. 430029-2-22-02
FLORIDA DEPARTMENT OF TRANSPORTATION – DISTRICT 6
MIAMI-DADE COUNTY, FLORIDA

HRES
HR Engineering Services, Inc.

SITE LOCATION MAP A-1

DRAWN BY: PV	DATE: 02/24/21
PROJECT No: HR20-1583R	SCALE: NTS

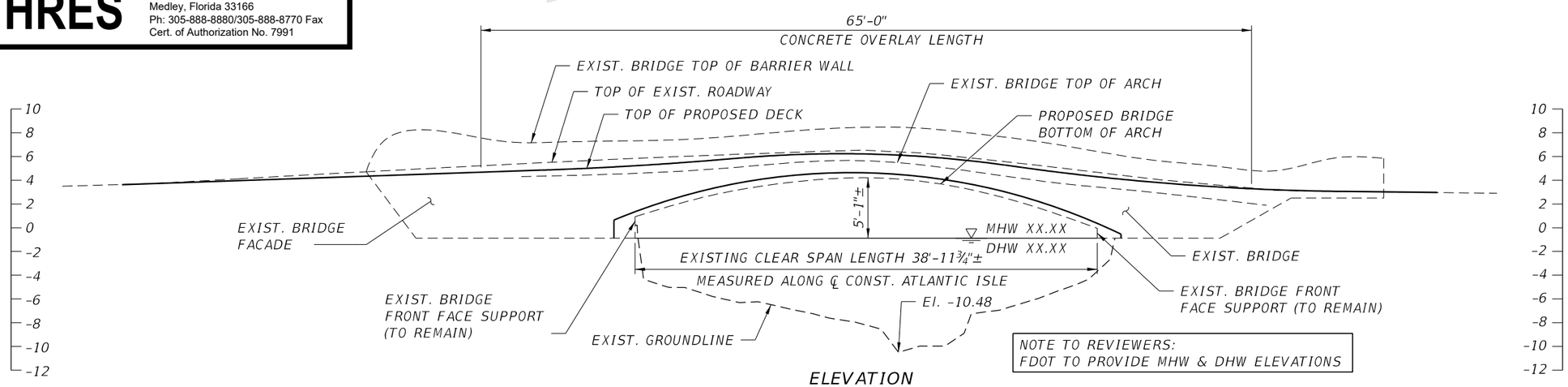


LEGEND:

TEST BORING LOCATION

HRES

HR ENGINEERING SERVICES, INC.
7815 NW 72nd Avenue
Medley, Florida 33166
Ph: 305-888-8880/305-888-8770 Fax
Cert. of Authorization No. 7991



NOTE TO REVIEWERS:
FDOT TO PROVIDE MHW & DHW ELEVATIONS

ELEVATION

BRIDGE NO. 874218

NOT FOR CONSTRUCTION PRELIMINARY AND SUBJECT TO CHANGE

REVISIONS					
DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION

HNTB CORPORATION
5900 N. ANDREWS AVE., SUITE 400
FORT LAUDERDALE, FL. 33309
P: (305) 551-8100 F: (305) 551-2800

DRAWN BY:
CHECKED BY:
DESIGNED BY:
CHECKED BY:

STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
N/A	MIAMI-DADE	430029-2-22-02

SHEET TITLE: FIELD EXPLORATION PLAN

REF. DWG. NO.

PROJECT NAME: ATLANTIC ISLE AVE OVER OCEAN CANAL

SHEET NO. A-2

gnazaire 9/17/2020 12:19:44 PM Z:\70078 D6 Structures 2017\TWO 7\9TechProd\1234567890\struct\B1PlanElev-Rehab-01.DGN

Custom Soil Resource Report
Soil Map

Map Scale: 1:1,040 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 15 30 60 90

Feet: 0 50 100 200 300

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 17N WGS84

REVISIONS					
DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION

HERNANDO R. RAMOS, P.E.
P.E. LICENSE NUMBER 42045
HR ENGINEERING SERVICES, INC
7815 NW 72ND AVENUE
MEDLEY, FLORIDA 33166
CERTIFICATE OF AUTHORIZATION 7991

DRAWN BY:	ME 03-18
CHECKED BY:	PV 03-18
DESIGNED BY:	PV 03-18
CHECKED BY:	HRR 03-18

STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
NONE	MIAMI-DADE	430029-2-22-02

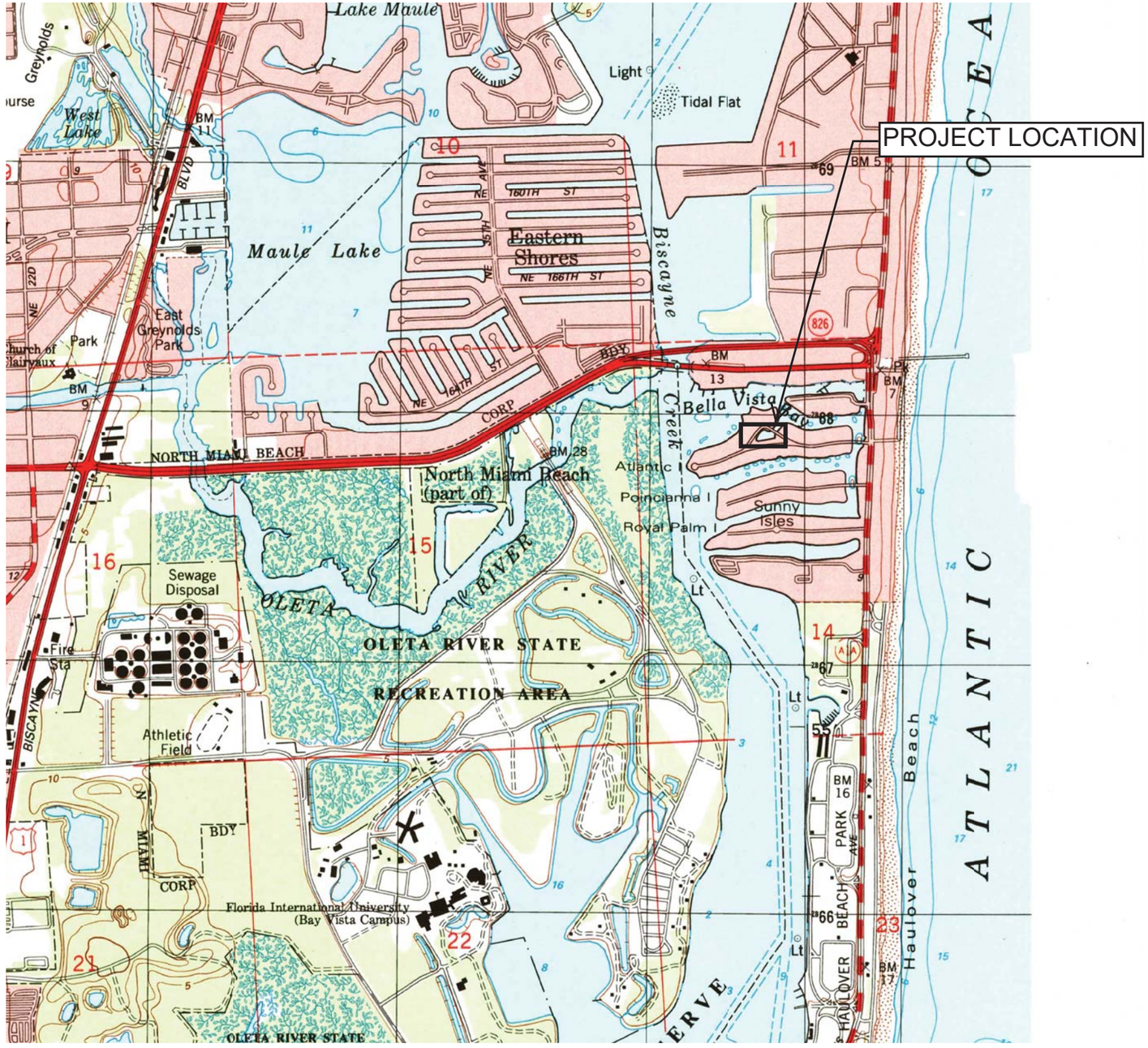
SHEET TITLE: MIAMI-DADE COUNTY AREA SOIL SURVEY MAP

REF. DWG. NO.:

PROJECT NAME: ATLANTIC ISLE LAGOON BRIDGE

SHEET NO.: A-3

HRESUser 4/7/2020 9:51:55 AM D:\DRIVE3\Paola\HR20-1583R Atlantic Isle Bridge\MIAMIDADE COUNTY SOIL MAP.dgn



N.T.S.

REVISIONS					
DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION

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HR ENGINEERING SERVICES, INC
7815 NW 72ND AVENUE
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CERTIFICATE OF AUTHORIZATION 7991

DRAWN BY:	CHECKED BY:	DESIGNED BY:	CHECKED BY:
ME 03-18	PV 03-18	PV 03-18	HRR 03-18

STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

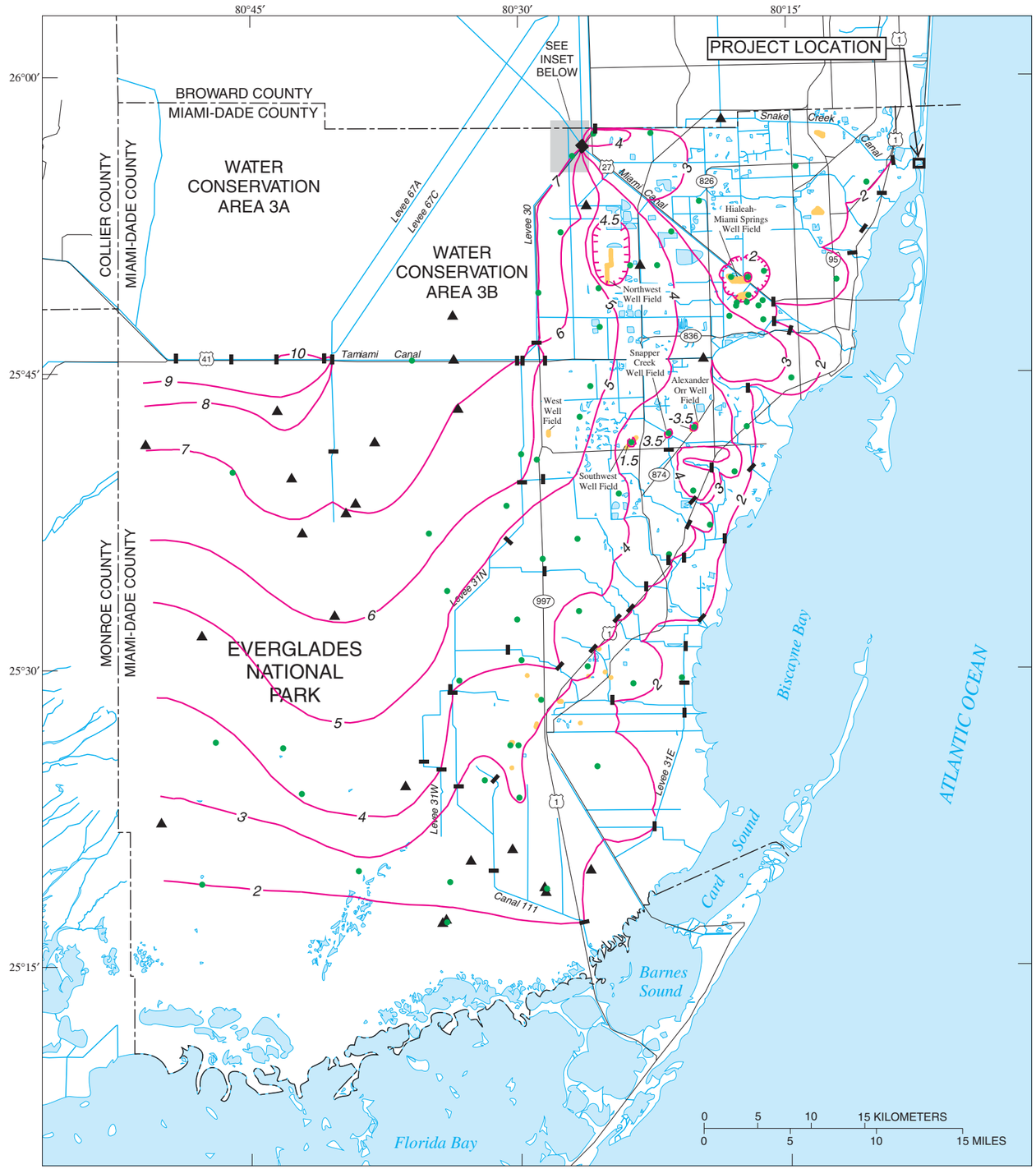
ROAD NO.	COUNTY	FINANCIAL PROJECT ID
NONE	MIAMI-DADE	430029-2-22-02

SHEET TITLE: USGS QUADRANGLE MAP

PROJECT NAME: ATLANTIC ISLE LAGOON BRIDGE

REF. DWG. NO.

SHEET NO. A-4



N.T.S.

AVERAGE OCTOBER WATER LEVELS 1990-99

REVISIONS					
DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION

HERNANDO R. RAMOS, P.E.
P.E. LICENSE NUMBER 42045
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7815 NW 72ND AVENUE
MEDLEY, FLORIDA 33166
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DRAWN BY:	ME 03-18
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DESIGNED BY:	PV 03-18
CHECKED BY:	HRR 03-18

STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

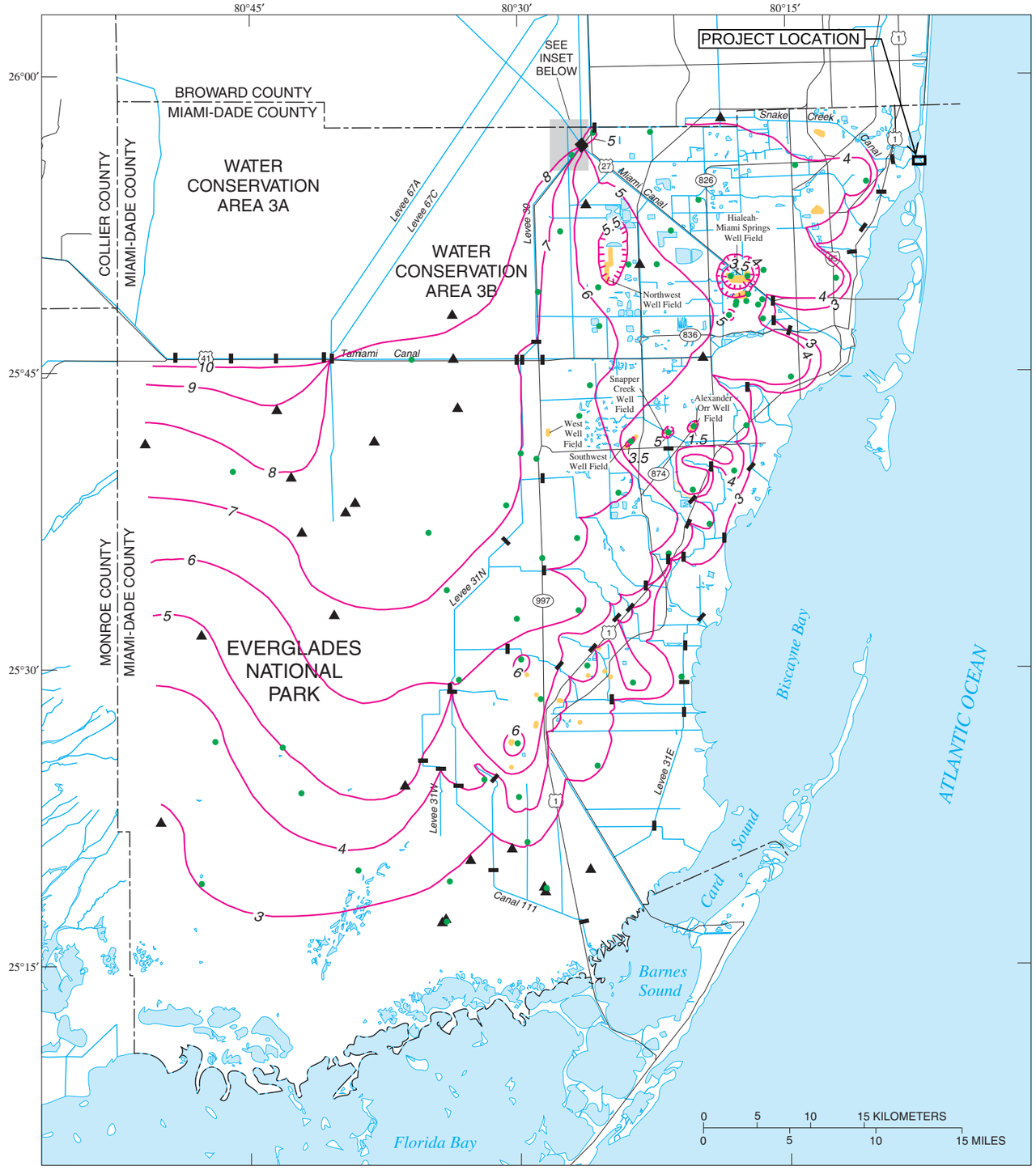
ROAD NO.	COUNTY	FINANCIAL PROJECT ID
NONE	MIAMI-DADE	430029-2-22-02

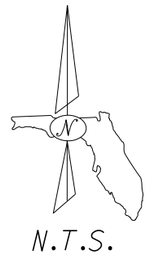
SHEET TITLE: USGS AVERAGE OCTOBER WATER LEVELS (1990-1999)

PROJECT NAME: ATLANTIC ISLE LAGOON BRIDGE

REF. DWG. NO.

SHEET NO. A-5





AVERAGE YEARLY HIGH WATER LEVELS 1990-99

REVISIONS					
DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION

HERNANDO R. RAMOS, P.E.
P.E. LICENSE NUMBER 42045
HR ENGINEERING SERVICES, INC
7815 NW 72ND AVENUE
MEDLEY, FLORIDA 33166
CERTIFICATE OF AUTHORIZATION 7991

DRAWN BY:	ME 03-18
CHECKED BY:	PV 03-18
DESIGNED BY:	PV 03-18
CHECKED BY:	HRR 03-18

STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
NONE	MIAMI-DADE	430029-2-22-02

SHEET TITLE: USGS AVERAGE YEARLY HIGH WATER LEVELS (1990-1999)

REF. DWG. NO.

PROJECT NAME: ATLANTIC ISLE LAGOON BRIDGE

SHEET NO. A-6

DATA ENTRY SHEET

Project FM# - 43002922202 , District: D6

ATLANTIC ISLE BRIDGE

Miami-Dade County, Florida

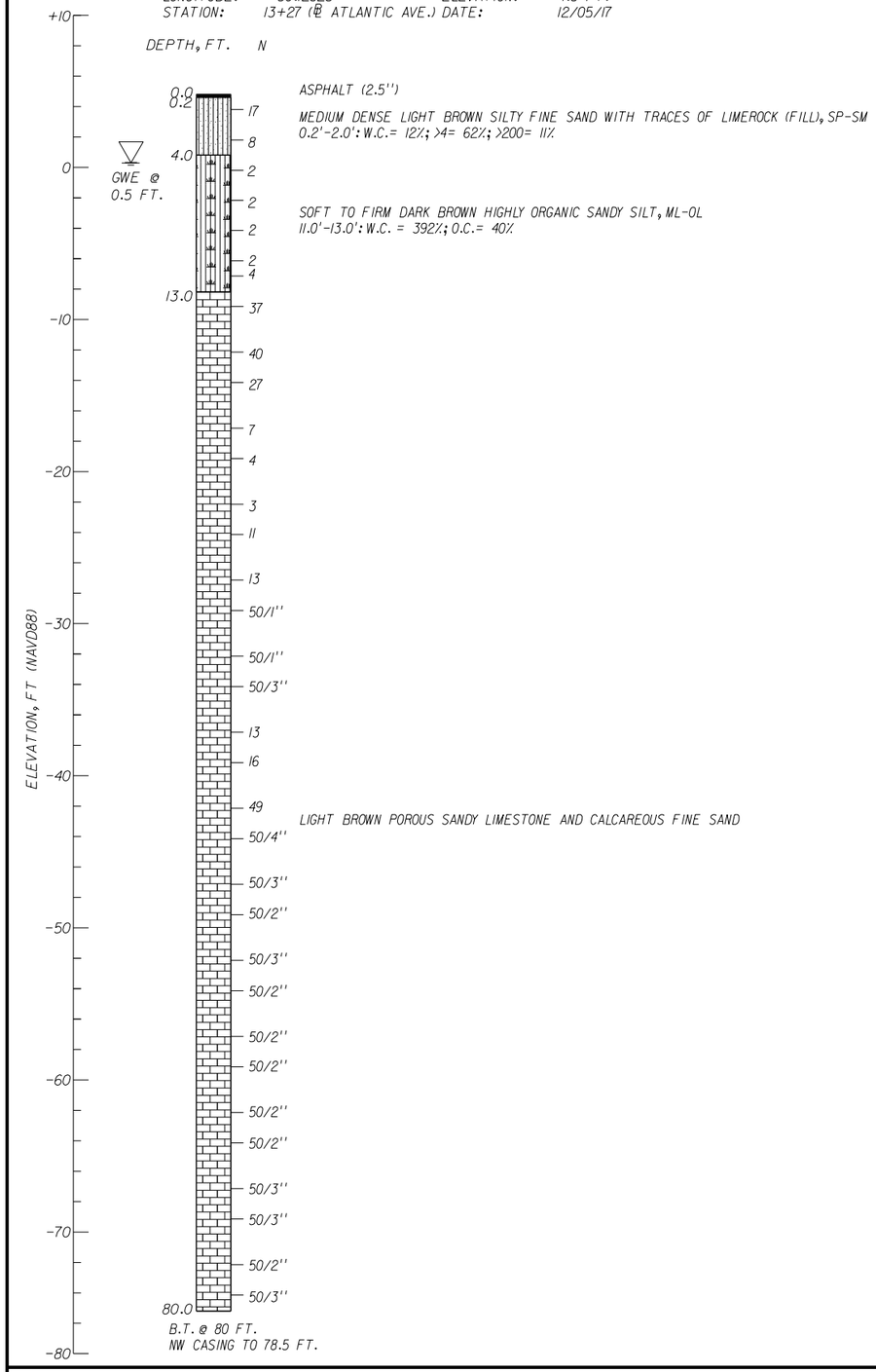
Note: RED- Locations Coordinates are not correct, Falls Out of County Boundary. Please confirm co-ordiantes.

Copy Data from Column C to K and Past with Ctrl+V on SharePoint

Test No.	Test Type	Latitude	Longitude	Test Date MM/DD/YYYY	Elevation ft.	Groundwater Depth ft.	Percolation Test Results	PDF Name
B-1	Structural Boring	25.92751	-80.12623	12/5/2017	4.8	4.3		4300292D6C4aHR.02242021.1
B-2	Structural Boring	25.92733	-80.12606	12/4/2017	2.4	1.9		4300292D6C4aHR.02242021.1

B-1

LATITUDE: 25.9275I° OFFSET: 6 RT
LONGITUDE: -80.I2623° ELEVATION: 4.8 FT.
STATION: I3+27 (Ⓑ ATLANTIC AVE.) DATE: I2/05/I7



ASPHALT (2.5'')

MEDIUM DENSE LIGHT BROWN SILTY FINE SAND WITH TRACES OF LIMEROCK (FILL), SP-SM
0.2'-2.0': W.C.= I2%; >4= 62%; >200= II%

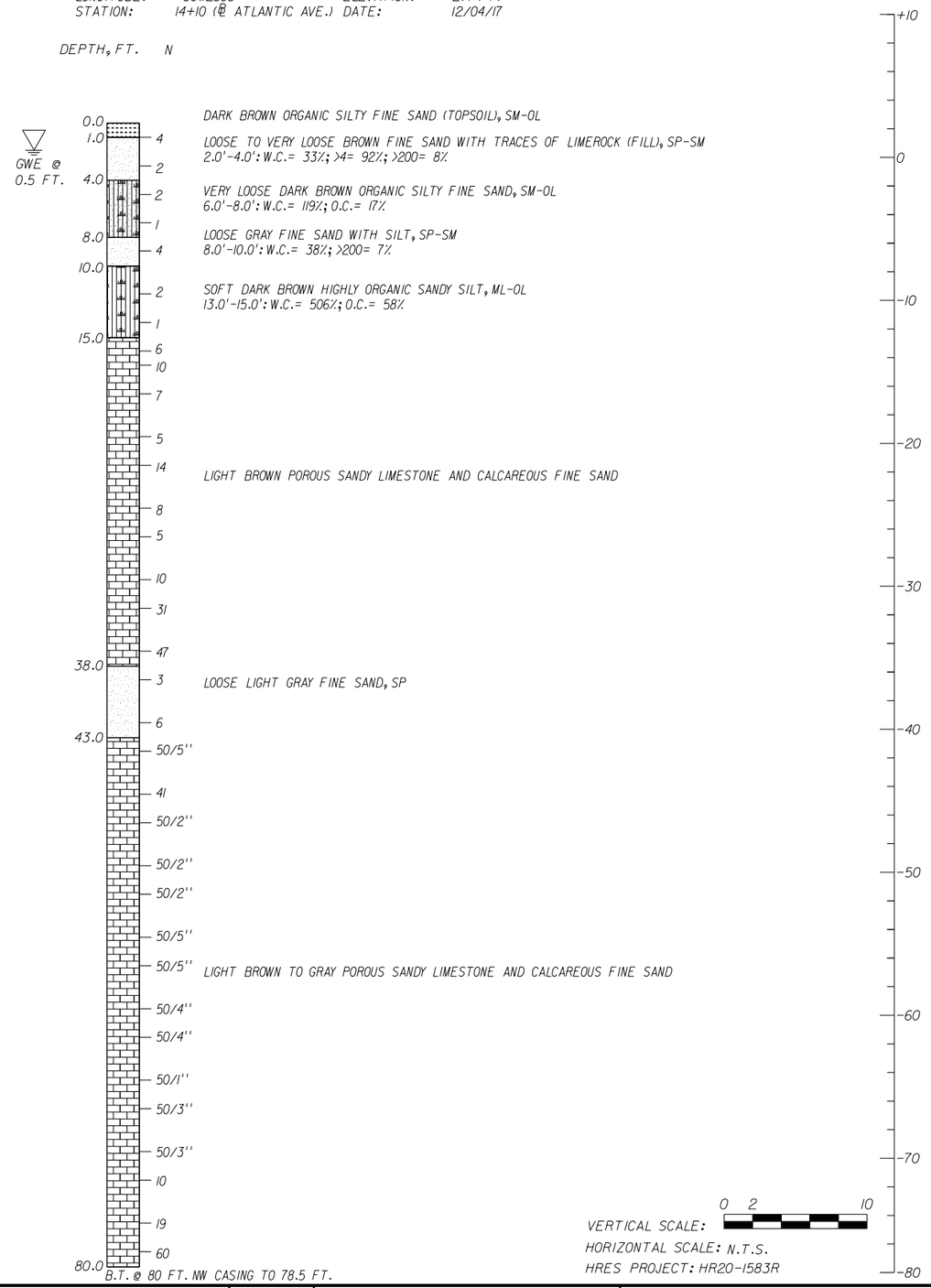
SOFT TO FIRM DARK BROWN HIGHLY ORGANIC SANDY SILT, ML-OL
II.0'-I3.0': W.C. = 392%; O.C.= 40%

LIGHT BROWN POROUS SANDY LIMESTONE AND CALCAREOUS FINE SAND

B.T.@ 80 FT.
NW CASING TO 78.5 FT.

B-2

LATITUDE: 25.92733° OFFSET: 20 RT
LONGITUDE: -80.I2606° ELEVATION: 2.4 FT.
STATION: I4+I0 (Ⓑ ATLANTIC AVE.) DATE: I2/04/I7



DARK BROWN ORGANIC SILTY FINE SAND (TOPSOIL), SM-OL

LOOSE TO VERY LOOSE BROWN FINE SAND WITH TRACES OF LIMEROCK (FILL), SP-SM
2.0'-4.0': W.C.= 33%; >4= 92%; >200= 8%

VERY LOOSE DARK BROWN ORGANIC SILTY FINE SAND, SM-OL
6.0'-8.0': W.C.= II9%; O.C.= I7%

LOOSE GRAY FINE SAND WITH SILT, SP-SM
8.0'-I0.0': W.C.= 38%; >200= 7%

SOFT DARK BROWN HIGHLY ORGANIC SANDY SILT, ML-OL
I3.0'-I5.0': W.C.= 506%; O.C.= 58%

LIGHT BROWN POROUS SANDY LIMESTONE AND CALCAREOUS FINE SAND

LOOSE LIGHT GRAY FINE SAND, SP

LIGHT BROWN TO GRAY POROUS SANDY LIMESTONE AND CALCAREOUS FINE SAND

B.T.@ 80 FT. NW CASING TO 78.5 FT.

0 2 I0
VERTICAL SCALE:
HORIZONTAL SCALE: N.T.S.
HRES PROJECT: HR20-I583R

LEGEND:

- ASPHALT
- TOPSOIL
- SILTY SAND
- FINE SAND
- ORGANIC SILTY SAND
- ORGANIC SANDY SILT
- LIMESTONE WITH SOME FINE SAND OR AND FINE SAND
- ▶ WATER LOSS
- ▽ GROUND WATER LEVEL AT BORING COMPLETION
- B.T. BORING TERMINATED
- N: STANDARD PENETRATION RESISTANCE (AUTOMATIC HAMMER)
- W.C.: WATER CONTENT
- O.C.: ORGANIC CONTENT
- >4: PERCENT PASSING #4 SIEVE
- >200: PERCENT PASSING #200 SIEVE

HAMMER WEIGHT = I40 LB
DROP HEIGHT = 30 IN

THE TEST BORINGS WERE PERFORMED BY HRES USING A CME-55 TRUCK MOUNTED RIG.

GRANULAR MATERIALS:

RELATIVE DENSITY	SPT N-VALUE (BLOWS/I2 INCHES)
VERY LOOSE	<3
LOOSE	3-8
MEDIUM DENSE	8-24
DENSE	24-40
VERY DENSE	>40

SILTS AND CLAYS:

CONSISTENCY	SPT N-VALUE (BLOWS/I2 INCHES)
VERY SOFT	<I
SOFT	I-3
FIRM	3-6
STIFF	6-I2
VERY STIFF	I2-24
HARD	>24

ENVIRONMENTAL CLASSIFICATION

SUBSTRUCTURE:
CONCRETE: EXTREMELY AGGRESSIVE
STEEL: EXTREMELY AGGRESSIVE
SUPERSTRUCTURE: EXTREMELY AGGRESSIVE

THE OFFICIAL RECORD OF THIS SHEET IS THE ELECTRONIC FILE DIGITALLY SIGNED AND SEALED UNDER RULE 6IG15-23.004, F.A.C.

REVISIONS

DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION

HERNANDO R. RAMOS, P.E.
P.E. LICENSE NUMBER 42045
HR ENGINEERING SERVICES, INC
7815 NW 72ND AVENUE
MEDLEY, FLORIDA 33166

DRAWN BY: ME I2-I7
CHECKED BY: SS I2-I7
DESIGNED BY: SS I2-I7
CHECKED BY: HRR I2-I7

STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
-	MIAMI-DADE	430029-2-22-02

SHEET TITLE: REPORT OF CORE BORINGS

PROJECT NAME: ATLANTIC ISLE BRIDGE

REF. DWG. NO.

SHEET NO. A-8

FIELD TESTING PROCEDURES

Test Borings - The test borings were made in general accordance with ASTM-D-1586, "Penetration Test and Split-Barrel Sampling of Soils." The borings were advanced using a 3-inch ID casing and a rotary drilling process. Water or bentonite drilling fluid was circulated in the boreholes to flush the cuttings. At regular intervals, the drilling tools were removed and soil samples were obtained with a standard 1.4-inch I.D., 2-inch O.D., split-tube sampler. The sampler was first seated six inches and then driven an additional foot with blows of a 140-lb hammer falling 30 inches. The number of hammer blows required to drive the sampler the final foot is designated the "Penetration Resistance". The penetration resistance, when properly interpreted, is an index to the soil strength and density.

Representative portions of the soil samples, obtained from the sampler, were placed in glass jars and transported to our laboratory. An engineer then examined the samples in order to confirm the field classifications.

APPENDIX B

SUMMARY OF LABORATORY TEST RESULTS
ATLANTIC ISLE BRIDGE
FLORIDA DEPARTMENT OF TRANSPORTATION, DISTRICT 6
MIAMI-DADE COUNTY, FLORIDA
FPID No. 430029-2-22-02
HR ENGINEERING SERVICES, INC.
HRES PROJECT No. HR20-1583R
FEBRUARY 22, 2021

Test No.	USCS Class.	Sample Depth (ft)	Grain Size Distribution - Percent Passing								Organic Loss of Ignition, %	Moisture Content %	Material in Sample, %		
			3/4"	3/8"	No. 4	No. 10	No. 40	No. 60	No. 100	No. 200			Gravel	Sand	Fines
B-1	SP-SM	0.2-2.0	100	78	62	50	35	26	16	11	-	12	38	51	11
B-1	ML-OL	11.0-13.0	-	-	-	-	-	-	-	-	40	392	-	-	-
B-2	SP-SM	2.0-4.0	95	94	92	81	51	34	18	8	-	33	8	84	8
B-2	SM-OL	6.0-8.0	-	-	-	-	-	-	-	-	17	119	-	-	-
B-2	SP-SM	8.0-10.0	-	-	-	-	-	-	-	7	-	38	-	-	7
B-2	ML-OL	13.0-15.0	-	-	-	-	-	-	-	-	58	506	-	-	-

LABORATORY TESTING PROCEDURES

Grain Size Distribution – The grain size tests were performed to determine the particle size and distribution of sample tested. Each Sample was dried, weighed, and washed over a # 200 mesh sieve. The dried sample was then passed through a standard set nested sieves to determine the grain size distribution of the soil particles coarser than the # 200 sieves. This test was conducted in general accordance with ASTM D-22.

Percent Fines Content – In this test, the sample is dried and then washed over a # 200 mesh sieve. The percentage of soil by weight passing the sieve is the percentage of fines or portion of the sample in the silt and clay size range. This test was conducted in general accordance with ASTM D-1140.

Percent Organics (Organic Loss on Ignition) – The amount of organic material in the sample was determined in this test, by measuring the loss due to ignition. The sample was first dried and weighed, then ignited and reweighed. The amount of organic material is expressed as a percentage of the soil weight. This test was conducted in general accordance with ASTM D-2974.

Water Content – The water content is the ratio, expressed as a percentage of the weight of water in a given mass of soil to the weight of the soil particles. This test was conducted in general accordance with ASTM D-2216.

HR ENGINEERING SERVICES, INC.

7815 N.W. 72nd Avenue - Medley, Florida 33166
Phone (305) 888-8880, Fax (305) 888-8770

GRAIN SIZE DATA SHEET

Project Name: ATLANTIC ISLE BRIDGE **Project No.:** HR16-1211R-2

Boring No.: B-1 **Sample No.:** 1B **Depth:** 0.2'-2.0'

Date: 03/28/2018 **Tested By:** E.M.

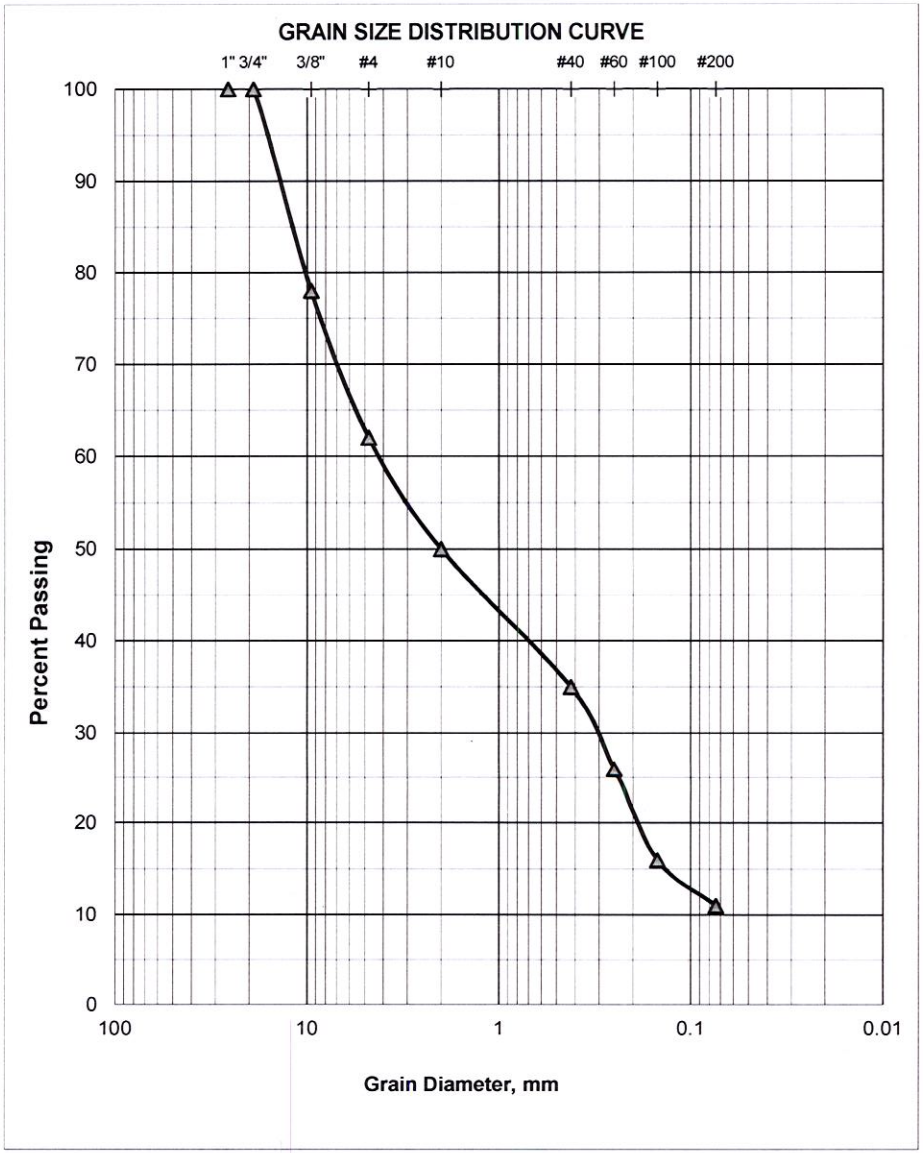
Sieve Size	Particle Size, mm.	Weight on Sieve, gr.	Accumulated Weight, gr.	Percent Retained	Percent Passing	REMARKS
1	25.70	0.00	0.00	0	100	
3/4"	19.00	0.00	0.00	0	100	
3/8"	9.51	78.40	78.40	22	78	
4	4.76	59.30	137.70	38	62	USCS Classification:
10	2.00	44.10	181.80	50	50	
40	0.420	54.00	235.80	65	35	SP-SM
60	0.250	32.20	268.00	74	26	
100	0.149	36.70	304.70	84	16	
200	0.074	18.10	322.80	89	11	
PAN						

B-3

Total Dry Weight Before Wash, (gr) =	363.40
Percent Finer than No. 200 Sieve by Wash Method=	11%

Sieve Analysis Test performed in general accordance with ASTM C 136 (AASHTO T 27 or T 311)
Moisture Content Test performed in general accordance with ASTM D 2216 (AASHTO T 265)

Material in Sample (%)		
Gravel	≤ No. 4	38
Coarse Sand	>No. 4-≤ No. 40	27
Fine Sand	>No. 40-≤ No. 200	24
Silt and Clays	>No. 200	11
Water Content		12%



Respectfully Submitted,
HR Engineering Services, Inc.

Hernando R. Ramos, P.E.
Florida Registration No. 42045

HR ENGINEERING SERVICES, INC.

7815 N.W. 72nd Avenue - Medley, Florida 33166
Phone (305) 888-8880, Fax (305) 888-8770

REPORT OF MOISTURE AND ORGANIC CONTENT BY LOSS ON IGNITION

Project Name: ATLANTIC ISLE BRIDGE **Project No.:** HR16-1211R-2

Boring No.: B-1 **Sample No.:** 6 **Depth:** 11.0'-13.0'

Date: 03/26/18

Technician:	**E.M.**
Date Sample Placed in Oven:	**03/26/2018**
Time in / Out of Oven :	**03/26/18 6:00 PM TO 03/27/18 6:00 PM**
Wt. of Wet Soil + Can, grams	**253.20**
Wt. of Dry Soil + Can, grams	**58.60**
Wt. of Can, grams No. 301	**9.00**
Wt. of Dry Soil, grams	**49.60**
Wt. of Moisture, grams	**194.60**
Water Content, w%	**392%**
Date Sample Placed in Furnace:	**03/28/18**
Time in / out of furnace (minimum 6 hrs):	**03/28/18 6:00 AM TO 03/28/18 12:00 PM**
Weight of Crucible & Oven-Dried Sample:	**29.60**
Weight of Crucible and Sample After Ignition:	**25.10**
Weight of Crucible: No. 115	**18.30**
Weight of Oven-Dried Soil:	**11.30**
Weight Loss due to Ignition:	**4.50**
Percent Organics:	**40%**

Moisture Content Test performed in general accordance with ASTM D 2216 (AASHTO T 265)
Organic Content Test performed in general accordance with ASTM D 2974 (AASHTO T 267)

Respectfully Submitted,

HR Engineering Services, Inc.

Hernando R. Ramos, P.E.
Florida Registration No. 42045

USCS Classification:

ML-OL

HR ENGINEERING SERVICES, INC.

7815 N.W. 72nd Avenue - Medley, Florida 33166
Phone (305) 888-8880, Fax (305) 888-8770

GRAIN SIZE DATA SHEET

Project Name: ATLANTIC ISLE BRIDGE **Project No.:** HR16-1211R-2
Boring No.: B-2 **Sample No.:** 2 **Depth:** 2.0'-4.0'
Date: 03/28/2018 **Tested By:** E.M.

Sieve Size	Particle Size, mm.	Weight on Sieve, gr.	Accumulated Weight, gr.	Percent Retained	Percent Passing	REMARKS
1	25.70	0.00	0.00	0	100	
3/4"	19.00	15.70	15.70	5	95	
3/8"	9.51	1.30	17.00	6	94	
4	4.76	6.80	23.80	8	92	USCS Classification:
10	2.00	31.80	55.60	19	81	
40	0.420	85.10	140.70	49	51	SP-SM
60	0.250	48.90	189.60	66	34	
100	0.149	47.20	236.80	82	18	
200	0.074	26.80	263.60	92	8	
PAN						

B-5

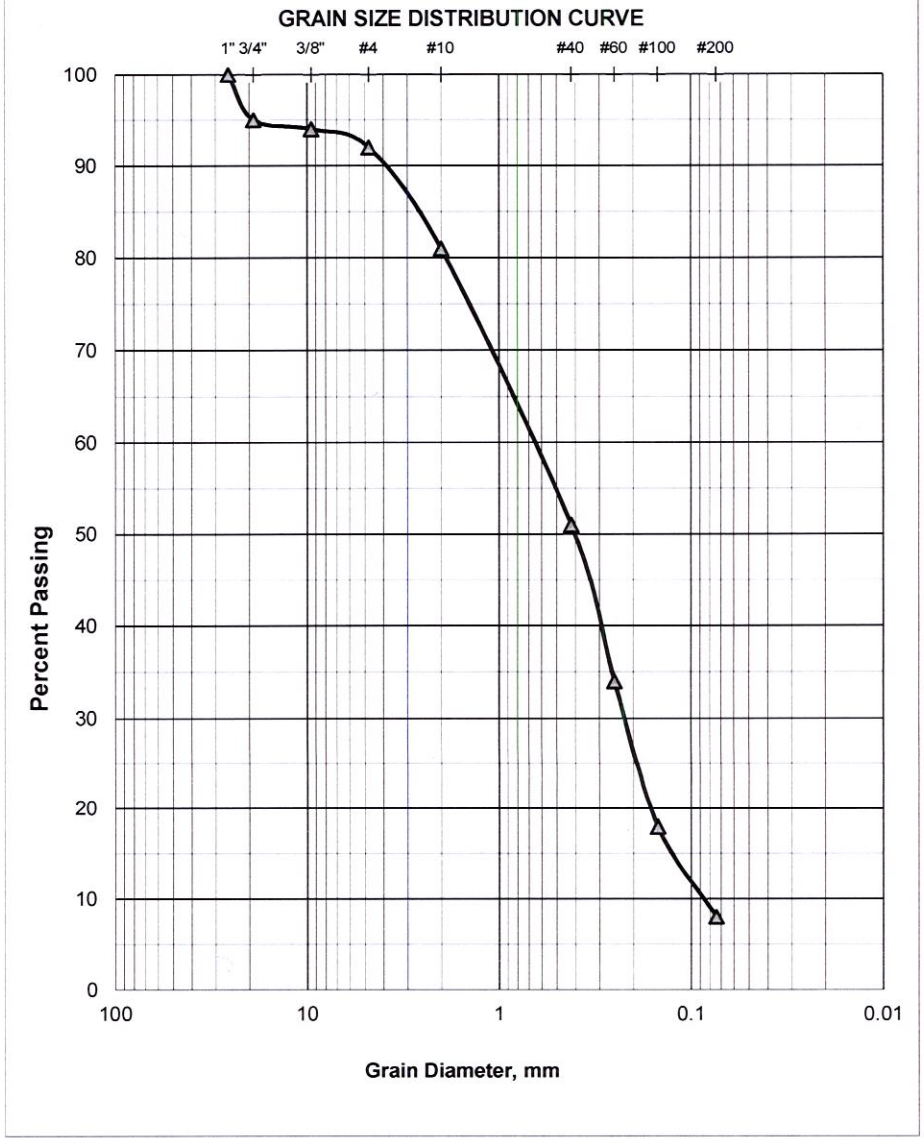
Total Dry Weight Before Wash, (gr) = 287.50
Percent Finer than No. 200 Sieve by Wash Method= 8%

Sieve Analysis Test performed in general accordance with ASTM C 136 (AASHTO T 27 or T 311)
Moisture Content Test performed in general accordance with ASTM D 2216 (AASHTO T 265)

Material in Sample (%)		
Gravel	≤ No. 4	8
Coarse Sand	>No. 4-≤ No. 40	41
Fine Sand	>No. 40-≤ No. 200	43
Silt and Clays	>No. 200	8
Water Content		33%

Respectfully Submitted,
HR Engineering Services, Inc.

Hernando R. Ramos, P.E.
Florida Registration No. 42045



HR ENGINEERING SERVICES, INC.

7815 N.W. 72nd Avenue - Medley, Florida 33166
Phone (305) 888-8880, Fax (305) 888-8770

REPORT OF MOISTURE AND ORGANIC CONTENT BY LOSS ON IGNITION

Project Name: ATLANTIC ISLE BRIDGE Project No.: HR16-1211R-2

Boring No.: B-2 Sample No.: 4 Depth: 6.0'-8.0'

Date: 03/26/18

Technician:	E.M.
Date Sample Placed in Oven:	03/26/2018
Time in / Out of Oven :	03/26/18 6:00 PM TO 03/27/18 6:00 PM
Wt. of Wet Soil + Can, grams	492.30
Wt. of Dry Soil + Can, grams	229.50
Wt. of Can, grams No. 303	9.00
Wt. of Dry Soil, grams	220.50
Wt. of Moisture, grams	262.80
Water Content, w%	119%
Date Sample Placed in Furnace:	03/28/18
Time in / out of furnace (minimum 6 hrs):	03/28/18 6:00 AM TO 03/28/18 12:00 PM
Weight of Crucible & Oven-Dried Sample:	26.70
Weight of Crucible and Sample After Ignition:	24.80
Weight of Crucible: No. 209	15.40
Weight of Oven-Dried Soil:	11.30
Weight Loss due to Ignition:	1.90
Percent Organics:	17%

Moisture Content Test performed in general accordance with ASTM D 2216 (AASHTO T 265)
Organic Content Test performed in general accordance with ASTM D 2974 (AASHTO T 267)

Respectfully Submitted,

HR Engineering Services, Inc.

Hernando R. Ramos, P.E.
Florida Registration No. 42045

USCS Classification:

SM-OL

HR ENGINEERING SERVICES, INC.

7815 N.W. 72nd Avenue - Medley, Florida 33166
Phone (305) 888-8880, Fax (305) 888-8770

REPORT OF MOISTURE AND PERCENT PASSING THE No. 200 SIEVE

Project Name: ATLANTIC ISLE BRIDGE **Project No.:** HR16-1211R-2

Boring No.: B-2 **Sample No.:** 5 **Depth:** 8.0'-10.0'

Date: 03/26/18

Technician:	E.M.
Date Sample Placed in Oven:	03/26/2018
Time in / Out of Oven :	03/26/18 6:00 PM TO 03/27/18 6:00 PM
Wt. of Wet Soil + Can, grams	390.70
Wt. of Dry Soil + Can, grams	286.30
Wt. of Can, grams No. 304	9.00
Wt. of Dry Soil, grams	277.30
Wt. of Moisture, grams	104.40
Water Content, w%	38%
Wt. of Dry Soil + Can Before Wash, grams	286.30
Wt. of Can, grams No. 304	9.00
Wt. of Dry Soil Before Wash, grams	277.30
Time in / Out of Oven :	03/27/18 8:30 PM TO 03/28/18 8:30 PM
Wt. of Dry Soil + Can After Wash, grams	265.80
Wt. of Dry Soil After Wash, grams	256.80
Total Loss, grams	20.50
Percent Finer Than No. 200 Sieve	7%

Moisture Content Test performed in general accordance with ASTM D 2216 (AASHTO T 265)
Fines Content Test performed in general accordance with ASTM D 1140

Respectfully Submitted,

HR Engineering Services, Inc.

Hernando R. Ramos, P.E.
Florida Registration No. 42045

USCS Classification:

SP-SM

HR ENGINEERING SERVICES, INC.

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Phone (305) 888-8880, Fax (305) 888-8770

REPORT OF MOISTURE AND ORGANIC CONTENT BY LOSS ON IGNITION

Project Name: ATLANTIC ISLE BRIDGE **Project No.:** HR16-1211R-2

Boring No.: B-2 **Sample No.:** 7 **Depth:** 13.0'-15.0'

Date: 03/26/18

Technician:	E.M.
Date Sample Placed in Oven:	03/26/2018
Time in / Out of Oven :	03/26/18 6:00 PM TO 03/27/18 6:00 PM
Wt. of Wet Soil + Can, grams	347.20
Wt. of Dry Soil + Can, grams	64.70
Wt. of Can, grams No. 305	8.90
Wt. of Dry Soil, grams	55.80
Wt. of Moisture, grams	282.50
Water Content, w%	506%
Date Sample Placed in Furnace:	03/28/18
Time in / out of furnace (minimum 6 hrs):	03/28/18 6:00 AM TO 03/28/18 12:00 PM
Weight of Crucible & Oven-Dried Sample:	29.60
Weight of Crucible and Sample After Ignition:	23.10
Weight of Crucible: No. 11	18.30
Weight of Oven-Dried Soil:	11.30
Weight Loss due to Ignition:	6.50
Percent Organics:	58%

Moisture Content Test performed in general accordance with ASTM D 2216 (AASHTO T 265)
Organic Content Test performed in general accordance with ASTM D 2974 (AASHTO T 267)

Respectfully Submitted,

HR Engineering Services, Inc.

Hernando R. Ramos, P.E.
Florida Registration No. 42045

USCS Classification:

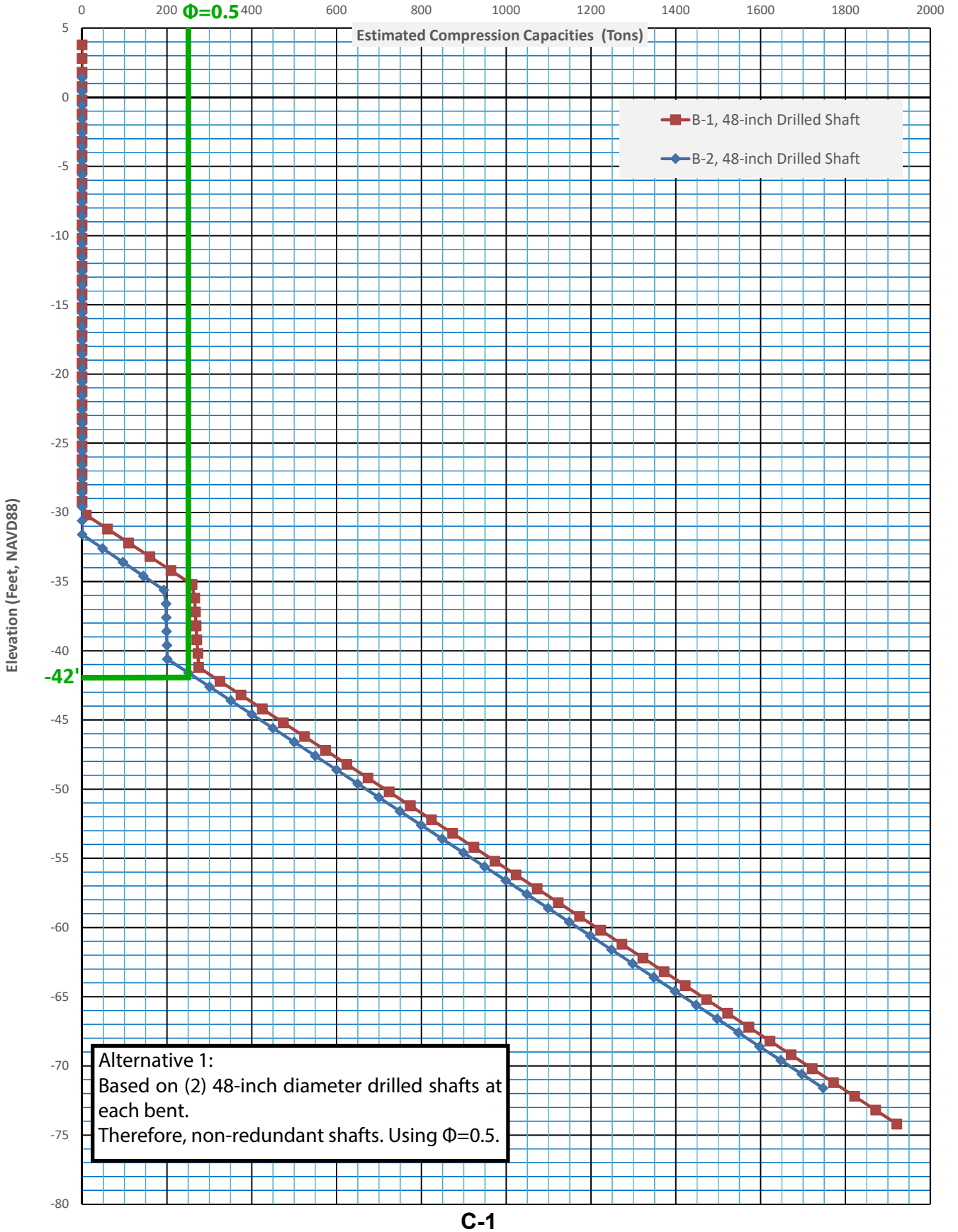
ML-OL

APPENDIX C

ALTERNATIVE 1

REHABILITATION OF EXISTING BRIDGE
DRILLED SHAFT/AUGERCAST PILE/MICROPILE

ATLANTIC ISLE BRIDGE
FPID No. 430029-2-22-02
HR ENGINEERING SERVICES, INC.
HRES PROJECT NO. HR20-1583R
ESTIMATED ULTIMATE COMPRESSION CAPACITIES FOR 48-INCH DIAMETER DRILLED SHAFT
TEST BORING B-1 AND B-2



C-1

General Information:
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Input file: .....evised II 02-18-21\Bridge\FB-DEEP\Drilled Shaft\B-1_48 inch.in
Project number: HR20-1583R
Job name: Atlantic Isle Bridge
Engineer: Chollada
Units: English

Analysis Information:
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Analysis Type: Drilled Shaft Analysis

Soil Information:
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Boring date: 12/05/17
Boring number: B-1
Station number: 13+27 Offset: 6.0 RT

Ground Elevation: 4.80(ft)
Water table Elevation = 0.50(ft)

Rock side-friction is calculated using: McVay's method
Hammer type: Automatic Hammer, Correction factor = 1.24

ID	Depth (ft)	Elevation (ft)	SPT Blows (Blows/ft)	Unit Weight (pcf)	Soil Type
1	0.00	4.80	N/A	0.00	5- Cavity layer
2	2.00	2.80	N/A	0.00	5- Cavity layer
3	4.00	0.80	N/A	0.00	5- Cavity layer
4	6.00	-1.20	N/A	120.00	5- Cavity layer
5	8.00	-3.20	N/A	120.00	5- Cavity layer
6	10.00	-5.20	N/A	120.00	5- Cavity layer
7	12.00	-7.20	N/A	120.00	5- Cavity layer
8	13.00	-8.20	N/A	120.00	5- Cavity layer
9	13.00	-8.20	N/A	120.00	5- Cavity layer
10	15.00	-10.20	N/A	120.00	5- Cavity layer
11	18.00	-13.20	N/A	120.00	5- Cavity layer
12	21.00	-16.20	N/A	120.00	5- Cavity layer
13	23.00	-18.20	N/A	120.00	5- Cavity layer
14	25.00	-20.20	N/A	120.00	5- Cavity layer
15	28.00	-23.20	N/A	120.00	5- Cavity layer
16	30.00	-25.20	N/A	120.00	5- Cavity layer
17	33.00	-28.20	N/A	120.00	5- Cavity layer
18	34.80	-30.00	N/A	120.00	5- Cavity layer
19	34.80	-30.00	N/A	120.00	4- Lime Stone/Very shelly sand
20	38.00	-33.20	N/A	120.00	4- Lime Stone/Very shelly sand
21	40.00	-35.20	N/A	120.00	4- Lime Stone/Very shelly sand
22	40.10	-35.30	13.00	120.00	3- Clean sand
23	42.00	-37.20	13.00	120.00	3- Clean sand
24	44.00	-39.20	16.00	120.00	3- Clean sand
25	45.90	-41.10	16.00	120.00	3- Clean sand
26	46.00	-41.20	N/A	120.00	4- Lime Stone/Very shelly sand
27	48.00	-43.20	N/A	120.00	4- Lime Stone/Very shelly sand
28	50.00	-45.20	N/A	120.00	4- Lime Stone/Very shelly sand
29	53.00	-48.20	N/A	120.00	4- Lime Stone/Very shelly sand
30	55.00	-50.20	N/A	120.00	4- Lime Stone/Very shelly sand
31	58.00	-53.20	N/A	120.00	4- Lime Stone/Very shelly sand
32	60.00	-55.20	N/A	120.00	4- Lime Stone/Very shelly sand
33	63.00	-58.20	N/A	120.00	4- Lime Stone/Very shelly sand
34	65.00	-60.20	N/A	120.00	4- Lime Stone/Very shelly sand
35	68.00	-63.20	N/A	120.00	4- Lime Stone/Very shelly sand
36	70.00	-65.20	N/A	120.00	4- Lime Stone/Very shelly sand
37	73.00	-68.20	N/A	120.00	4- Lime Stone/Very shelly sand
38	75.00	-70.20	N/A	120.00	4- Lime Stone/Very shelly sand
39	78.00	-73.20	N/A	120.00	4- Lime Stone/Very shelly sand
40	80.00	-75.20	N/A	120.00	4- Lime Stone/Very shelly sand

ID	Cu-DIR (tsf)	qu (tsf)	qt (tsf)	Em (ksi)	qb (tsf)
1	N/A	N/A	N/A	N/A	N/A
2	N/A	N/A	N/A	N/A	N/A
3	N/A	N/A	N/A	N/A	N/A
4	N/A	N/A	N/A	N/A	N/A
5	N/A	N/A	N/A	N/A	N/A
6	N/A	N/A	N/A	N/A	N/A
7	N/A	N/A	N/A	N/A	N/A
8	N/A	N/A	N/A	N/A	N/A
9	N/A	N/A	N/A	N/A	N/A
10	N/A	N/A	N/A	N/A	N/A
11	N/A	N/A	N/A	N/A	N/A
12	N/A	N/A	N/A	N/A	N/A
13	N/A	N/A	N/A	N/A	N/A

14	N/A	N/A	N/A	N/A	N/A
15	N/A	N/A	N/A	N/A	N/A
16	N/A	N/A	N/A	N/A	N/A
17	N/A	N/A	N/A	N/A	N/A
18	N/A	N/A	N/A	N/A	N/A
19	N/A	17.75	3.55	0.00	0.00
20	N/A	17.75	3.55	0.00	0.00
21	N/A	17.75	3.55	0.00	0.00
22	N/A	N/A	N/A	N/A	N/A
23	N/A	N/A	N/A	N/A	N/A
24	N/A	N/A	N/A	N/A	N/A
25	N/A	N/A	N/A	N/A	N/A
26	N/A	17.75	3.55	0.00	0.00
27	N/A	17.75	3.55	0.00	0.00
28	N/A	17.75	3.55	0.00	0.00
29	N/A	17.75	3.55	0.00	0.00
30	N/A	17.75	3.55	0.00	0.00
31	N/A	17.75	3.55	0.00	0.00
32	N/A	17.75	3.55	0.00	0.00
33	N/A	17.75	3.55	0.00	0.00
34	N/A	17.75	3.55	0.00	0.00
35	N/A	17.75	3.55	0.00	0.00
36	N/A	17.75	3.55	0.00	0.00
37	N/A	17.75	3.55	0.00	0.00
38	N/A	17.75	3.55	0.00	0.00
39	N/A	17.75	3.55	0.00	0.00
40	N/A	17.75	3.55	0.00	0.00

ID	RQD F.M.	S.R.I.	Rock Recovery
1	N/A	N/A	N/A
2	N/A	N/A	N/A
3	N/A	N/A	N/A
4	N/A	N/A	N/A
5	N/A	N/A	N/A
6	N/A	N/A	N/A
7	N/A	N/A	N/A
8	N/A	N/A	N/A
9	N/A	N/A	N/A
10	N/A	N/A	N/A
11	N/A	N/A	N/A
12	N/A	N/A	N/A
13	N/A	N/A	N/A
14	N/A	N/A	N/A
15	N/A	N/A	N/A
16	N/A	N/A	N/A
17	N/A	N/A	N/A
18	N/A	N/A	N/A
19	1.00	ROUGH	1.000
20	1.00	ROUGH	1.000
21	1.00	ROUGH	1.000
22	N/A	N/A	N/A
23	N/A	N/A	N/A
24	N/A	N/A	N/A
25	N/A	N/A	N/A
26	1.00	ROUGH	1.000
27	1.00	ROUGH	1.000
28	1.00	ROUGH	1.000
29	1.00	ROUGH	1.000
30	1.00	ROUGH	1.000
31	1.00	ROUGH	1.000
32	1.00	ROUGH	1.000
33	1.00	ROUGH	1.000
34	1.00	ROUGH	1.000
35	1.00	ROUGH	1.000
36	1.00	ROUGH	1.000
37	1.00	ROUGH	1.000
38	1.00	ROUGH	1.000
39	1.00	ROUGH	1.000
40	1.00	ROUGH	1.000

Drilled Shaft Data:
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Unit weight of concrete = 150.00(pcf), Concrete Slump = 6.00(in)
Modulus of Elasticity of concrete = 4000.00(ksi)

Shaft Geometry:

ID	Length (ft)	Tip Elev. (ft)	Case Len. (ft)	Diameter (in)	Base Diam. (in)	Bell Len. (ft)
1	1.00	3.80	0.00	48.00	48.00	0.00
2	2.00	2.80	0.00	48.00	48.00	0.00
3	3.00	1.80	0.00	48.00	48.00	0.00
4	4.00	0.80	0.00	48.00	48.00	0.00
5	5.00	-0.20	0.00	48.00	48.00	0.00
6	6.00	-1.20	0.00	48.00	48.00	0.00
7	7.00	-2.20	0.00	48.00	48.00	0.00
8	8.00	-3.20	0.00	48.00	48.00	0.00

9	9.00	-4.20	0.00	48.00	48.00	0.00
10	10.00	-5.20	0.00	48.00	48.00	0.00
11	11.00	-6.20	0.00	48.00	48.00	0.00
12	12.00	-7.20	0.00	48.00	48.00	0.00
13	13.00	-8.20	0.00	48.00	48.00	0.00
14	14.00	-9.20	0.00	48.00	48.00	0.00
15	15.00	-10.20	0.00	48.00	48.00	0.00
16	16.00	-11.20	0.00	48.00	48.00	0.00
17	17.00	-12.20	0.00	48.00	48.00	0.00
18	18.00	-13.20	0.00	48.00	48.00	0.00
19	19.00	-14.20	0.00	48.00	48.00	0.00
20	20.00	-15.20	0.00	48.00	48.00	0.00
21	21.00	-16.20	0.00	48.00	48.00	0.00
22	22.00	-17.20	0.00	48.00	48.00	0.00
23	23.00	-18.20	0.00	48.00	48.00	0.00
24	24.00	-19.20	0.00	48.00	48.00	0.00
25	25.00	-20.20	0.00	48.00	48.00	0.00
26	26.00	-21.20	0.00	48.00	48.00	0.00
27	27.00	-22.20	0.00	48.00	48.00	0.00
28	28.00	-23.20	0.00	48.00	48.00	0.00
29	29.00	-24.20	0.00	48.00	48.00	0.00
30	30.00	-25.20	0.00	48.00	48.00	0.00
31	31.00	-26.20	0.00	48.00	48.00	0.00
32	32.00	-27.20	0.00	48.00	48.00	0.00
33	33.00	-28.20	0.00	48.00	48.00	0.00
34	34.00	-29.20	0.00	48.00	48.00	0.00
35	35.00	-30.20	0.00	48.00	48.00	0.00
36	36.00	-31.20	0.00	48.00	48.00	0.00
37	37.00	-32.20	0.00	48.00	48.00	0.00
38	38.00	-33.20	0.00	48.00	48.00	0.00
39	39.00	-34.20	0.00	48.00	48.00	0.00
40	40.00	-35.20	0.00	48.00	48.00	0.00
41	41.00	-36.20	0.00	48.00	48.00	0.00
42	42.00	-37.20	0.00	48.00	48.00	0.00
43	43.00	-38.20	0.00	48.00	48.00	0.00
44	44.00	-39.20	0.00	48.00	48.00	0.00
45	45.00	-40.20	0.00	48.00	48.00	0.00
46	46.00	-41.20	0.00	48.00	48.00	0.00
47	47.00	-42.20	0.00	48.00	48.00	0.00
48	48.00	-43.20	0.00	48.00	48.00	0.00
49	49.00	-44.20	0.00	48.00	48.00	0.00
50	50.00	-45.20	0.00	48.00	48.00	0.00
51	51.00	-46.20	0.00	48.00	48.00	0.00
52	52.00	-47.20	0.00	48.00	48.00	0.00
53	53.00	-48.20	0.00	48.00	48.00	0.00
54	54.00	-49.20	0.00	48.00	48.00	0.00
55	55.00	-50.20	0.00	48.00	48.00	0.00
56	56.00	-51.20	0.00	48.00	48.00	0.00
57	57.00	-52.20	0.00	48.00	48.00	0.00
58	58.00	-53.20	0.00	48.00	48.00	0.00
59	59.00	-54.20	0.00	48.00	48.00	0.00
60	60.00	-55.20	0.00	48.00	48.00	0.00
61	61.00	-56.20	0.00	48.00	48.00	0.00
62	62.00	-57.20	0.00	48.00	48.00	0.00
63	63.00	-58.20	0.00	48.00	48.00	0.00
64	64.00	-59.20	0.00	48.00	48.00	0.00
65	65.00	-60.20	0.00	48.00	48.00	0.00
66	66.00	-61.20	0.00	48.00	48.00	0.00
67	67.00	-62.20	0.00	48.00	48.00	0.00
68	68.00	-63.20	0.00	48.00	48.00	0.00
69	69.00	-64.20	0.00	48.00	48.00	0.00
70	70.00	-65.20	0.00	48.00	48.00	0.00
71	71.00	-66.20	0.00	48.00	48.00	0.00
72	72.00	-67.20	0.00	48.00	48.00	0.00
73	73.00	-68.20	0.00	48.00	48.00	0.00
74	74.00	-69.20	0.00	48.00	48.00	0.00
75	75.00	-70.20	0.00	48.00	48.00	0.00
76	76.00	-71.20	0.00	48.00	48.00	0.00
77	77.00	-72.20	0.00	48.00	48.00	0.00
78	78.00	-73.20	0.00	48.00	48.00	0.00
79	79.00	-74.20	0.00	48.00	48.00	0.00

Drilled Shaft Capacity (sorted by shaft diameter):

Strength reduction factors: Skin-friction = 1.00, End-bearing = 0.00

ID	Diameter (in)	Length (ft)	Skin Fric. (tons)	End Bearing (tons)	Capacity (tons)
1	48.00	1.00	0.000	0.000	0.000
2	48.00	2.00	0.000	0.000	0.000
3	48.00	3.00	0.000	0.000	0.000
4	48.00	4.00	0.000	0.000	0.000
5	48.00	5.00	0.000	0.000	0.000
6	48.00	6.00	0.000	0.000	0.000
7	48.00	7.00	0.000	0.000	0.000
8	48.00	8.00	0.000	0.000	0.000
9	48.00	9.00	0.000	0.000	0.000
10	48.00	10.00	0.000	0.000	0.000
11	48.00	11.00	0.000	0.000	0.000

12	48.00	12.00	0.000	0.000	0.000
13	48.00	13.00	0.000	0.000	0.000
14	48.00	14.00	0.000	0.000	0.000
15	48.00	15.00	0.000	0.000	0.000
16	48.00	16.00	0.000	0.000	0.000
17	48.00	17.00	0.000	0.000	0.000
18	48.00	18.00	0.000	0.000	0.000
19	48.00	19.00	0.000	0.000	0.000
20	48.00	20.00	0.000	0.000	0.000
21	48.00	21.00	0.000	0.000	0.000
22	48.00	22.00	0.000	0.000	0.000
23	48.00	23.00	0.000	0.000	0.000
24	48.00	24.00	0.000	0.000	0.000
25	48.00	25.00	0.000	0.000	0.000
26	48.00	26.00	0.000	0.000	0.000
27	48.00	27.00	0.000	0.000	0.000
28	48.00	28.00	0.000	0.000	0.000
29	48.00	29.00	0.000	0.000	0.000
30	48.00	30.00	0.000	0.000	0.000
31	48.00	31.00	0.000	0.000	0.000
32	48.00	32.00	0.000	0.000	0.000
33	48.00	33.00	0.000	0.000	0.000
34	48.00	34.00	0.000	0.000	0.000
35	48.00	35.00	9.975	0.000	9.975
36	48.00	36.00	59.851	0.000	59.851
37	48.00	37.00	109.728	0.000	109.728
38	48.00	38.00	159.604	0.000	159.604
39	48.00	39.00	209.480	0.000	209.480
40	48.00	40.00	259.356	0.000	259.356
41	48.00	41.00	265.543	0.000	265.543
42	48.00	42.00	267.073	0.000	267.073
43	48.00	43.00	268.801	0.000	268.801
44	48.00	44.00	270.722	0.000	270.722
45	48.00	45.00	272.826	0.000	272.826
46	48.00	46.00	275.110	0.000	275.110
47	48.00	47.00	324.986	0.000	324.986
48	48.00	48.00	374.862	0.000	374.862
49	48.00	49.00	424.738	0.000	424.738
50	48.00	50.00	474.615	0.000	474.615
51	48.00	51.00	524.491	0.000	524.491
52	48.00	52.00	574.367	0.000	574.367
53	48.00	53.00	624.243	0.000	624.243
54	48.00	54.00	674.119	0.000	674.119
55	48.00	55.00	723.995	0.000	723.995
56	48.00	56.00	773.872	0.000	773.872
57	48.00	57.00	823.748	0.000	823.748
58	48.00	58.00	873.624	0.000	873.624
59	48.00	59.00	923.500	0.000	923.500
60	48.00	60.00	973.376	0.000	973.376
61	48.00	61.00	1023.253	0.000	1023.253
62	48.00	62.00	1073.129	0.000	1073.129
63	48.00	63.00	1123.005	0.000	1123.005
64	48.00	64.00	1172.881	0.000	1172.881
65	48.00	65.00	1222.757	0.000	1222.757
66	48.00	66.00	1272.633	0.000	1272.633
67	48.00	67.00	1322.510	0.000	1322.510
68	48.00	68.00	1372.386	0.000	1372.386
69	48.00	69.00	1422.262	0.000	1422.262
70	48.00	70.00	1472.138	0.000	1472.138
71	48.00	71.00	1522.014	0.000	1522.014
72	48.00	72.00	1571.891	0.000	1571.891
73	48.00	73.00	1621.767	0.000	1621.767
74	48.00	74.00	1671.643	0.000	1671.643
75	48.00	75.00	1721.519	0.000	1721.519
76	48.00	76.00	1771.395	0.000	1771.395
77	48.00	77.00	1821.272	0.000	1821.272
78	48.00	78.00	1871.148	0.000	1871.148
79	48.00	79.00	1921.024	0.000	1921.024

Drilled Shaft Capacity at User-Defined Settlement (sorted by shaft diameter):

***** Capacity is NOT modified by the strength reduction factors *****

User-Defined Settlement = 0.00%

ID	Diameter (in)	Length (ft)	Skin Fric. (tons)	End Bearing (tons)	Capacity (tons)
1	48.00	1.00	0.000	0.000	0.000
2	48.00	2.00	0.000	0.000	0.000
3	48.00	3.00	0.000	0.000	0.000
4	48.00	4.00	0.000	0.000	0.000
5	48.00	5.00	0.000	0.000	0.000
6	48.00	6.00	0.000	0.000	0.000
7	48.00	7.00	0.000	0.000	0.000
8	48.00	8.00	0.000	0.000	0.000
9	48.00	9.00	0.000	0.000	0.000
10	48.00	10.00	0.000	0.000	0.000
11	48.00	11.00	0.000	0.000	0.000

12	48.00	12.00	0.000	0.000	0.000
13	48.00	13.00	0.000	0.000	0.000
14	48.00	14.00	0.000	0.000	0.000
15	48.00	15.00	0.000	0.000	0.000
16	48.00	16.00	0.000	0.000	0.000
17	48.00	17.00	0.000	0.000	0.000
18	48.00	18.00	0.000	0.000	0.000
19	48.00	19.00	0.000	0.000	0.000
20	48.00	20.00	0.000	0.000	0.000
21	48.00	21.00	0.000	0.000	0.000
22	48.00	22.00	0.000	0.000	0.000
23	48.00	23.00	0.000	0.000	0.000
24	48.00	24.00	0.000	0.000	0.000
25	48.00	25.00	0.000	0.000	0.000
26	48.00	26.00	0.000	0.000	0.000
27	48.00	27.00	0.000	0.000	0.000
28	48.00	28.00	0.000	0.000	0.000
29	48.00	29.00	0.000	0.000	0.000
30	48.00	30.00	0.000	0.000	0.000
31	48.00	31.00	0.000	0.000	0.000
32	48.00	32.00	0.000	0.000	0.000
33	48.00	33.00	0.000	0.000	0.000
34	48.00	34.00	0.000	0.000	0.000
35	48.00	35.00	-nan(ind)	-nan(ind)	-nan(ind)
36	48.00	36.00	-nan(ind)	-nan(ind)	-nan(ind)
37	48.00	37.00	-nan(ind)	-nan(ind)	-nan(ind)
38	48.00	38.00	-nan(ind)	-nan(ind)	-nan(ind)
39	48.00	39.00	-nan(ind)	-nan(ind)	-nan(ind)
40	48.00	40.00	-nan(ind)	-nan(ind)	-nan(ind)
41	48.00	41.00	-nan(ind)	0.000	-nan(ind)
42	48.00	42.00	-nan(ind)	0.000	-nan(ind)
43	48.00	43.00	-nan(ind)	0.000	-nan(ind)
44	48.00	44.00	-nan(ind)	0.000	-nan(ind)
45	48.00	45.00	-nan(ind)	0.000	-nan(ind)
46	48.00	46.00	-nan(ind)	-nan(ind)	-nan(ind)
47	48.00	47.00	-nan(ind)	-nan(ind)	-nan(ind)
48	48.00	48.00	-nan(ind)	-nan(ind)	-nan(ind)
49	48.00	49.00	-nan(ind)	-nan(ind)	-nan(ind)
50	48.00	50.00	-nan(ind)	-nan(ind)	-nan(ind)
51	48.00	51.00	-nan(ind)	-nan(ind)	-nan(ind)
52	48.00	52.00	-nan(ind)	-nan(ind)	-nan(ind)
53	48.00	53.00	-nan(ind)	-nan(ind)	-nan(ind)
54	48.00	54.00	-nan(ind)	-nan(ind)	-nan(ind)
55	48.00	55.00	-nan(ind)	-nan(ind)	-nan(ind)
56	48.00	56.00	-nan(ind)	-nan(ind)	-nan(ind)
57	48.00	57.00	-nan(ind)	-nan(ind)	-nan(ind)
58	48.00	58.00	-nan(ind)	-nan(ind)	-nan(ind)
59	48.00	59.00	-nan(ind)	-nan(ind)	-nan(ind)
60	48.00	60.00	-nan(ind)	-nan(ind)	-nan(ind)
61	48.00	61.00	-nan(ind)	-nan(ind)	-nan(ind)
62	48.00	62.00	-nan(ind)	-nan(ind)	-nan(ind)
63	48.00	63.00	-nan(ind)	-nan(ind)	-nan(ind)
64	48.00	64.00	-nan(ind)	-nan(ind)	-nan(ind)
65	48.00	65.00	-nan(ind)	-nan(ind)	-nan(ind)
66	48.00	66.00	-nan(ind)	-nan(ind)	-nan(ind)
67	48.00	67.00	-nan(ind)	-nan(ind)	-nan(ind)
68	48.00	68.00	-nan(ind)	-nan(ind)	-nan(ind)
69	48.00	69.00	-nan(ind)	-nan(ind)	-nan(ind)
70	48.00	70.00	-nan(ind)	-nan(ind)	-nan(ind)
71	48.00	71.00	-nan(ind)	-nan(ind)	-nan(ind)
72	48.00	72.00	-nan(ind)	-nan(ind)	-nan(ind)
73	48.00	73.00	-nan(ind)	-nan(ind)	-nan(ind)
74	48.00	74.00	-nan(ind)	-nan(ind)	-nan(ind)
75	48.00	75.00	-nan(ind)	-nan(ind)	-nan(ind)
76	48.00	76.00	-nan(ind)	-nan(ind)	-nan(ind)
77	48.00	77.00	-nan(ind)	-nan(ind)	-nan(ind)
78	48.00	78.00	-nan(ind)	-nan(ind)	-nan(ind)
79	48.00	79.00	-nan(ind)	-nan(ind)	-nan(ind)

General Information:
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Input file: .....evised II 02-18-21\Bridge\FB-DEEP\Drilled Shaft\B-2_48 inch.in
Project number: HR20-1583R
Job name: Atlantic Isle Bridge
Engineer: Chollada
Units: English

Analysis Information:
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Analysis Type: Drilled Shaft Analysis

Soil Information:
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Boring date: 12/04/17
Boring number: B-2
Station number: 14+10 Offset: 20.0 RT

Ground Elevation: 2.40(ft)
Water table Elevation = 0.50(ft)

Rock side-friction is calculated using: McVay's method
Hammer type: Automatic Hammer, Correction factor = 1.24

ID	Depth (ft)	Elevation (ft)	SPT Blows (Blows/ft)	Unit Weight (pcf)	Soil Type
1	0.00	2.40	N/A	0.00	5- Cavity layer
2	2.00	0.40	N/A	0.00	5- Cavity layer
3	4.00	-1.60	N/A	0.00	5- Cavity layer
4	6.00	-3.60	N/A	120.00	5- Cavity layer
5	8.00	-5.60	N/A	120.00	5- Cavity layer
6	10.00	-7.60	N/A	120.00	5- Cavity layer
7	13.00	-10.60	N/A	120.00	5- Cavity layer
8	15.00	-12.60	N/A	120.00	5- Cavity layer
9	16.00	-13.60	N/A	120.00	5- Cavity layer
10	17.00	-14.60	N/A	120.00	5- Cavity layer
11	18.00	-15.60	N/A	120.00	5- Cavity layer
12	20.00	-17.60	N/A	120.00	5- Cavity layer
13	23.00	-20.60	N/A	120.00	5- Cavity layer
14	25.00	-22.60	N/A	120.00	5- Cavity layer
15	28.00	-25.60	N/A	120.00	5- Cavity layer
16	30.00	-27.60	N/A	120.00	5- Cavity layer
17	32.40	-30.00	N/A	120.00	5- Cavity layer
18	32.40	-30.00	10.00	120.00	3- Clean sand
19	33.00	-30.60	10.00	120.00	3- Clean sand
20	34.00	-31.60	N/A	120.00	4- Lime Stone/Very shelly sand
21	35.00	-32.60	N/A	120.00	4- Lime Stone/Very shelly sand
22	38.00	-35.60	N/A	120.00	4- Lime Stone/Very shelly sand
23	38.10	-35.70	3.00	101.26	3- Clean sand
24	40.00	-37.60	3.00	101.26	3- Clean sand
25	42.00	-39.60	6.00	104.51	3- Clean sand
26	42.90	-40.50	6.00	104.51	3- Clean sand
27	43.00	-40.60	N/A	120.00	4- Lime Stone/Very shelly sand
28	45.00	-42.60	N/A	120.00	4- Lime Stone/Very shelly sand
29	48.00	-45.60	N/A	120.00	4- Lime Stone/Very shelly sand
30	50.00	-47.60	N/A	120.00	4- Lime Stone/Very shelly sand
31	53.00	-50.60	N/A	120.00	4- Lime Stone/Very shelly sand
32	55.00	-52.60	N/A	120.00	4- Lime Stone/Very shelly sand
33	58.00	-55.60	N/A	120.00	4- Lime Stone/Very shelly sand
34	60.00	-57.60	N/A	120.00	4- Lime Stone/Very shelly sand
35	62.00	-59.60	N/A	120.00	4- Lime Stone/Very shelly sand
36	65.00	-62.60	N/A	120.00	4- Lime Stone/Very shelly sand
37	68.00	-65.60	N/A	120.00	4- Lime Stone/Very shelly sand
38	70.00	-67.60	N/A	120.00	4- Lime Stone/Very shelly sand
39	73.00	-70.60	N/A	120.00	4- Lime Stone/Very shelly sand
40	75.00	-72.60	10.00	120.00	3- Clean sand
41	78.00	-75.60	19.00	120.00	3- Clean sand
42	80.00	-77.60	N/A	120.00	4- Lime Stone/Very shelly sand

ID	Cu-DIR (tsf)	qu (tsf)	qt (tsf)	Em (ksi)	qb (tsf)
1	N/A	N/A	N/A	N/A	N/A
2	N/A	N/A	N/A	N/A	N/A
3	N/A	N/A	N/A	N/A	N/A
4	N/A	N/A	N/A	N/A	N/A
5	N/A	N/A	N/A	N/A	N/A
6	N/A	N/A	N/A	N/A	N/A
7	N/A	N/A	N/A	N/A	N/A
8	N/A	N/A	N/A	N/A	N/A
9	N/A	N/A	N/A	N/A	N/A
10	N/A	N/A	N/A	N/A	N/A
11	N/A	N/A	N/A	N/A	N/A

12	N/A	N/A	N/A	N/A	N/A
13	N/A	N/A	N/A	N/A	N/A
14	N/A	N/A	N/A	N/A	N/A
15	N/A	N/A	N/A	N/A	N/A
16	N/A	N/A	N/A	N/A	N/A
17	N/A	N/A	N/A	N/A	N/A
18	N/A	N/A	N/A	N/A	N/A
19	N/A	N/A	N/A	N/A	N/A
20	N/A	17.19	3.40	0.00	0.00
21	N/A	17.19	3.40	0.00	0.00
22	N/A	17.75	3.55	0.00	0.00
23	N/A	N/A	N/A	N/A	N/A
24	N/A	N/A	N/A	N/A	N/A
25	N/A	N/A	N/A	N/A	N/A
26	N/A	N/A	N/A	N/A	N/A
27	N/A	17.75	3.55	0.00	0.00
28	N/A	17.75	3.55	0.00	0.00
29	N/A	17.75	3.55	0.00	0.00
30	N/A	17.75	3.55	0.00	0.00
31	N/A	17.75	3.55	0.00	0.00
32	N/A	17.75	3.55	0.00	0.00
33	N/A	17.75	3.55	0.00	0.00
34	N/A	17.75	3.55	0.00	0.00
35	N/A	17.75	3.55	0.00	0.00
36	N/A	17.75	3.55	0.00	0.00
37	N/A	17.75	3.55	0.00	0.00
38	N/A	17.75	3.55	0.00	0.00
39	N/A	17.75	3.55	0.00	0.00
40	N/A	N/A	N/A	N/A	N/A
41	N/A	N/A	N/A	N/A	N/A
42	N/A	17.75	3.55	0.00	0.00

ID	RQD F.M.	S.R.I.	Rock Recovery
1	N/A	N/A	N/A
2	N/A	N/A	N/A
3	N/A	N/A	N/A
4	N/A	N/A	N/A
5	N/A	N/A	N/A
6	N/A	N/A	N/A
7	N/A	N/A	N/A
8	N/A	N/A	N/A
9	N/A	N/A	N/A
10	N/A	N/A	N/A
11	N/A	N/A	N/A
12	N/A	N/A	N/A
13	N/A	N/A	N/A
14	N/A	N/A	N/A
15	N/A	N/A	N/A
16	N/A	N/A	N/A
17	N/A	N/A	N/A
18	N/A	N/A	N/A
19	N/A	N/A	N/A
20	1.00	ROUGH	1.000
21	1.00	ROUGH	1.000
22	1.00	ROUGH	1.000
23	N/A	N/A	N/A
24	N/A	N/A	N/A
25	N/A	N/A	N/A
26	N/A	N/A	N/A
27	1.00	ROUGH	1.000
28	1.00	ROUGH	1.000
29	1.00	ROUGH	1.000
30	1.00	ROUGH	1.000
31	1.00	ROUGH	1.000
32	1.00	ROUGH	1.000
33	1.00	ROUGH	1.000
34	1.00	ROUGH	1.000
35	1.00	ROUGH	1.000
36	1.00	ROUGH	1.000
37	1.00	ROUGH	1.000
38	1.00	ROUGH	1.000
39	1.00	ROUGH	1.000
40	N/A	N/A	N/A
41	N/A	N/A	N/A
42	1.00	ROUGH	1.000

Drilled Shaft Data:
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Unit weight of concrete = 150.00(pcf), Concrete Slump = 6.00(in)
Modulus of Elasticity of concrete = 4000.00(ksi)

Shaft Geometry:

ID	Length (ft)	Tip Elev. (ft)	Case Len. (ft)	Diameter (in)	Base Diam. (in)	Bell Len. (ft)
1	1.00	1.40	0.00	48.00	48.00	0.00
2	2.00	0.40	0.00	48.00	48.00	0.00

3	3.00	-0.60	0.00	48.00	48.00	0.00
4	4.00	-1.60	0.00	48.00	48.00	0.00
5	5.00	-2.60	0.00	48.00	48.00	0.00
6	6.00	-3.60	0.00	48.00	48.00	0.00
7	7.00	-4.60	0.00	48.00	48.00	0.00
8	8.00	-5.60	0.00	48.00	48.00	0.00
9	9.00	-6.60	0.00	48.00	48.00	0.00
10	10.00	-7.60	0.00	48.00	48.00	0.00
11	11.00	-8.60	0.00	48.00	48.00	0.00
12	12.00	-9.60	0.00	48.00	48.00	0.00
13	13.00	-10.60	0.00	48.00	48.00	0.00
14	14.00	-11.60	0.00	48.00	48.00	0.00
15	15.00	-12.60	0.00	48.00	48.00	0.00
16	16.00	-13.60	0.00	48.00	48.00	0.00
17	17.00	-14.60	0.00	48.00	48.00	0.00
18	18.00	-15.60	0.00	48.00	48.00	0.00
19	19.00	-16.60	0.00	48.00	48.00	0.00
20	20.00	-17.60	0.00	48.00	48.00	0.00
21	21.00	-18.60	0.00	48.00	48.00	0.00
22	22.00	-19.60	0.00	48.00	48.00	0.00
23	23.00	-20.60	0.00	48.00	48.00	0.00
24	24.00	-21.60	0.00	48.00	48.00	0.00
25	25.00	-22.60	0.00	48.00	48.00	0.00
26	26.00	-23.60	0.00	48.00	48.00	0.00
27	27.00	-24.60	0.00	48.00	48.00	0.00
28	28.00	-25.60	0.00	48.00	48.00	0.00
29	29.00	-26.60	0.00	48.00	48.00	0.00
30	30.00	-27.60	0.00	48.00	48.00	0.00
31	31.00	-28.60	0.00	48.00	48.00	0.00
32	32.00	-29.60	0.00	48.00	48.00	0.00
33	33.00	-30.60	0.00	48.00	48.00	0.00
34	34.00	-31.60	0.00	48.00	48.00	0.00
35	35.00	-32.60	0.00	48.00	48.00	0.00
36	36.00	-33.60	0.00	48.00	48.00	0.00
37	37.00	-34.60	0.00	48.00	48.00	0.00
38	38.00	-35.60	0.00	48.00	48.00	0.00
39	39.00	-36.60	0.00	48.00	48.00	0.00
40	40.00	-37.60	0.00	48.00	48.00	0.00
41	41.00	-38.60	0.00	48.00	48.00	0.00
42	42.00	-39.60	0.00	48.00	48.00	0.00
43	43.00	-40.60	0.00	48.00	48.00	0.00
44	44.00	-41.60	0.00	48.00	48.00	0.00
45	45.00	-42.60	0.00	48.00	48.00	0.00
46	46.00	-43.60	0.00	48.00	48.00	0.00
47	47.00	-44.60	0.00	48.00	48.00	0.00
48	48.00	-45.60	0.00	48.00	48.00	0.00
49	49.00	-46.60	0.00	48.00	48.00	0.00
50	50.00	-47.60	0.00	48.00	48.00	0.00
51	51.00	-48.60	0.00	48.00	48.00	0.00
52	52.00	-49.60	0.00	48.00	48.00	0.00
53	53.00	-50.60	0.00	48.00	48.00	0.00
54	54.00	-51.60	0.00	48.00	48.00	0.00
55	55.00	-52.60	0.00	48.00	48.00	0.00
56	56.00	-53.60	0.00	48.00	48.00	0.00
57	57.00	-54.60	0.00	48.00	48.00	0.00
58	58.00	-55.60	0.00	48.00	48.00	0.00
59	59.00	-56.60	0.00	48.00	48.00	0.00
60	60.00	-57.60	0.00	48.00	48.00	0.00
61	61.00	-58.60	0.00	48.00	48.00	0.00
62	62.00	-59.60	0.00	48.00	48.00	0.00
63	63.00	-60.60	0.00	48.00	48.00	0.00
64	64.00	-61.60	0.00	48.00	48.00	0.00
65	65.00	-62.60	0.00	48.00	48.00	0.00
66	66.00	-63.60	0.00	48.00	48.00	0.00
67	67.00	-64.60	0.00	48.00	48.00	0.00
68	68.00	-65.60	0.00	48.00	48.00	0.00
69	69.00	-66.60	0.00	48.00	48.00	0.00
70	70.00	-67.60	0.00	48.00	48.00	0.00
71	71.00	-68.60	0.00	48.00	48.00	0.00
72	72.00	-69.60	0.00	48.00	48.00	0.00
73	73.00	-70.60	0.00	48.00	48.00	0.00
74	74.00	-71.60	0.00	48.00	48.00	0.00

Drilled Shaft Capacity (sorted by shaft diameter):

Strength reduction factors: Skin-friction = 1.00, End-bearing = 0.00

ID	Diameter (in)	Length (ft)	Skin Fric. (tons)	End Bearing (tons)	Capacity (tons)
1	48.00	1.00	0.000	0.000	0.000
2	48.00	2.00	0.000	0.000	0.000
3	48.00	3.00	0.000	0.000	0.000
4	48.00	4.00	0.000	0.000	0.000
5	48.00	5.00	0.000	0.000	0.000
6	48.00	6.00	0.000	0.000	0.000
7	48.00	7.00	0.000	0.000	0.000
8	48.00	8.00	0.000	0.000	0.000
9	48.00	9.00	0.000	0.000	0.000
10	48.00	10.00	0.000	0.000	0.000

11	48.00	11.00	0.000	0.000	0.000
12	48.00	12.00	0.000	0.000	0.000
13	48.00	13.00	0.000	0.000	0.000
14	48.00	14.00	0.000	0.000	0.000
15	48.00	15.00	0.000	0.000	0.000
16	48.00	16.00	0.000	0.000	0.000
17	48.00	17.00	0.000	0.000	0.000
18	48.00	18.00	0.000	0.000	0.000
19	48.00	19.00	0.000	0.000	0.000
20	48.00	20.00	0.000	0.000	0.000
21	48.00	21.00	0.000	0.000	0.000
22	48.00	22.00	0.000	0.000	0.000
23	48.00	23.00	0.000	0.000	0.000
24	48.00	24.00	0.000	0.000	0.000
25	48.00	25.00	0.000	0.000	0.000
26	48.00	26.00	0.000	0.000	0.000
27	48.00	27.00	0.000	0.000	0.000
28	48.00	28.00	0.000	0.000	0.000
29	48.00	29.00	0.000	0.000	0.000
30	48.00	30.00	0.000	0.000	0.000
31	48.00	31.00	0.000	0.000	0.000
32	48.00	32.00	0.000	0.000	0.000
33	48.00	33.00	0.039	0.000	0.039
34	48.00	34.00	0.276	0.000	0.276
35	48.00	35.00	48.311	0.000	48.311
36	48.00	36.00	96.346	0.000	96.346
37	48.00	37.00	144.381	0.000	144.381
38	48.00	38.00	192.415	0.000	192.415
39	48.00	39.00	197.892	0.000	197.892
40	48.00	40.00	198.493	0.000	198.493
41	48.00	41.00	199.155	0.000	199.155
42	48.00	42.00	199.879	0.000	199.879
43	48.00	43.00	200.846	0.000	200.846
44	48.00	44.00	250.722	0.000	250.722
45	48.00	45.00	300.599	0.000	300.599
46	48.00	46.00	350.475	0.000	350.475
47	48.00	47.00	400.351	0.000	400.351
48	48.00	48.00	450.227	0.000	450.227
49	48.00	49.00	500.103	0.000	500.103
50	48.00	50.00	549.980	0.000	549.980
51	48.00	51.00	599.856	0.000	599.856
52	48.00	52.00	649.732	0.000	649.732
53	48.00	53.00	699.608	0.000	699.608
54	48.00	54.00	749.484	0.000	749.484
55	48.00	55.00	799.360	0.000	799.360
56	48.00	56.00	849.237	0.000	849.237
57	48.00	57.00	899.113	0.000	899.113
58	48.00	58.00	948.989	0.000	948.989
59	48.00	59.00	998.865	0.000	998.865
60	48.00	60.00	1048.741	0.000	1048.741
61	48.00	61.00	1098.618	0.000	1098.618
62	48.00	62.00	1148.494	0.000	1148.494
63	48.00	63.00	1198.370	0.000	1198.370
64	48.00	64.00	1248.246	0.000	1248.246
65	48.00	65.00	1298.122	0.000	1298.122
66	48.00	66.00	1347.999	0.000	1347.999
67	48.00	67.00	1397.875	0.000	1397.875
68	48.00	68.00	1447.751	0.000	1447.751
69	48.00	69.00	1497.627	0.000	1497.627
70	48.00	70.00	1547.503	0.000	1547.503
71	48.00	71.00	1597.379	0.000	1597.379
72	48.00	72.00	1647.256	0.000	1647.256
73	48.00	73.00	1697.132	0.000	1697.132
74	48.00	74.00	1747.008	0.000	1747.008

Drilled Shaft Capacity at User-Defined Settlement (sorted by shaft diameter):

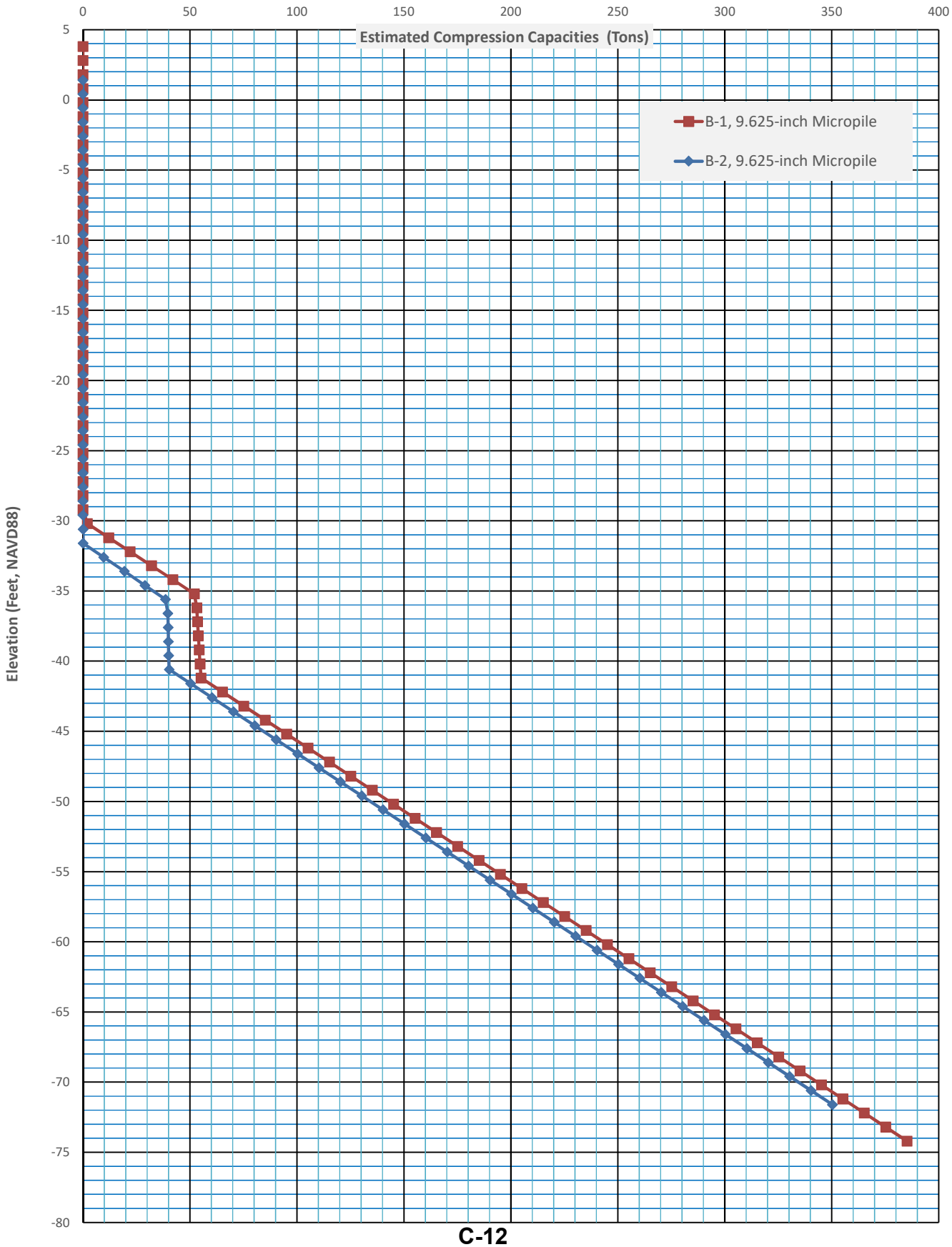
***** Capacity is NOT modified by the strength reduction factors *****

User-Defined Settlement = 0.00%

ID	Diameter (in)	Length (ft)	Skin Fric. (tons)	End Bearing (tons)	Capacity (tons)
1	48.00	1.00	0.000	0.000	0.000
2	48.00	2.00	0.000	0.000	0.000
3	48.00	3.00	0.000	0.000	0.000
4	48.00	4.00	0.000	0.000	0.000
5	48.00	5.00	0.000	0.000	0.000
6	48.00	6.00	0.000	0.000	0.000
7	48.00	7.00	0.000	0.000	0.000
8	48.00	8.00	0.000	0.000	0.000
9	48.00	9.00	0.000	0.000	0.000
10	48.00	10.00	0.000	0.000	0.000
11	48.00	11.00	0.000	0.000	0.000
12	48.00	12.00	0.000	0.000	0.000
13	48.00	13.00	0.000	0.000	0.000
14	48.00	14.00	0.000	0.000	0.000
15	48.00	15.00	0.000	0.000	0.000

16	48.00	16.00	0.000	0.000	0.000
17	48.00	17.00	0.000	0.000	0.000
18	48.00	18.00	0.000	0.000	0.000
19	48.00	19.00	0.000	0.000	0.000
20	48.00	20.00	0.000	0.000	0.000
21	48.00	21.00	0.000	0.000	0.000
22	48.00	22.00	0.000	0.000	0.000
23	48.00	23.00	0.000	0.000	0.000
24	48.00	24.00	0.000	0.000	0.000
25	48.00	25.00	0.000	0.000	0.000
26	48.00	26.00	0.000	0.000	0.000
27	48.00	27.00	0.000	0.000	0.000
28	48.00	28.00	0.000	0.000	0.000
29	48.00	29.00	0.000	0.000	0.000
30	48.00	30.00	0.000	0.000	0.000
31	48.00	31.00	0.000	0.000	0.000
32	48.00	32.00	0.000	0.000	0.000
33	48.00	33.00	0.000	0.000	0.000
34	48.00	34.00	0.000	0.000	0.000
35	48.00	35.00	0.000	0.000	0.000
36	48.00	36.00	0.000	0.000	0.000
37	48.00	37.00	0.000	0.000	0.000
38	48.00	38.00	0.000	0.000	0.000
39	48.00	39.00	0.000	0.000	0.000
40	48.00	40.00	0.000	0.000	0.000
41	48.00	41.00	0.000	0.000	0.000
42	48.00	42.00	0.000	0.000	0.000
43	48.00	43.00	0.000	0.000	0.000
44	48.00	44.00	0.000	0.000	0.000
45	48.00	45.00	0.000	0.000	0.000
46	48.00	46.00	0.000	0.000	0.000
47	48.00	47.00	0.000	0.000	0.000
48	48.00	48.00	0.000	0.000	0.000
49	48.00	49.00	0.000	0.000	0.000
50	48.00	50.00	0.000	0.000	0.000
51	48.00	51.00	0.000	0.000	0.000
52	48.00	52.00	0.000	0.000	0.000
53	48.00	53.00	0.000	0.000	0.000
54	48.00	54.00	0.000	0.000	0.000
55	48.00	55.00	0.000	0.000	0.000
56	48.00	56.00	0.000	0.000	0.000
57	48.00	57.00	0.000	0.000	0.000
58	48.00	58.00	0.000	0.000	0.000
59	48.00	59.00	0.000	0.000	0.000
60	48.00	60.00	0.000	0.000	0.000
61	48.00	61.00	0.000	0.000	0.000
62	48.00	62.00	0.000	0.000	0.000
63	48.00	63.00	0.000	0.000	0.000
64	48.00	64.00	0.000	0.000	0.000
65	48.00	65.00	0.000	0.000	0.000
66	48.00	66.00	0.000	0.000	0.000
67	48.00	67.00	0.000	0.000	0.000
68	48.00	68.00	0.000	0.000	0.000
69	48.00	69.00	0.000	0.000	0.000
70	48.00	70.00	0.000	0.000	0.000
71	48.00	71.00	0.000	0.000	0.000
72	48.00	72.00	0.000	0.000	0.000
73	48.00	73.00	0.000	0.000	0.000
74	48.00	74.00	0.000	0.000	0.000

ATLANTIC ISLE BRIDGE
FPID No. 430029-2-22-02
HR ENGINEERING SERVICES, INC.
HRES PROJECT NO. HR20-1583R
ESTIMATED ULTIMATE COMPRESSION CAPACITIES FOR 9.625-INCH DIAMETER MICROPILE
TEST BORING B-1 AND B-2



General Information:
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Input file: .....Revised II 02-18-21\Bridge\FB-DEEP\Micropile\B-1_9.625 inch.in
Project number: HR20-1583R
Job name: Atlantic Isle Bridge
Engineer: Chollada
Units: English

Analysis Information:
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Analysis Type: Drilled Shaft Analysis

Soil Information:
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Boring date: 12/05/17
Boring number: B-1
Station number: 13+27 Offset: 6.0 RT

Ground Elevation: 4.80(ft)
Water table Elevation = 0.50(ft)

Rock side-friction is calculated using: McVay's method
Hammer type: Automatic Hammer, Correction factor = 1.24

ID	Depth (ft)	Elevation (ft)	SPT Blows (Blows/ft)	Unit Weight (pcf)	Soil Type
1	0.00	4.80	N/A	0.00	5- Cavity layer
2	2.00	2.80	N/A	0.00	5- Cavity layer
3	4.00	0.80	N/A	0.00	5- Cavity layer
4	6.00	-1.20	N/A	120.00	5- Cavity layer
5	8.00	-3.20	N/A	120.00	5- Cavity layer
6	10.00	-5.20	N/A	120.00	5- Cavity layer
7	12.00	-7.20	N/A	120.00	5- Cavity layer
8	13.00	-8.20	N/A	120.00	5- Cavity layer
9	13.00	-8.20	N/A	120.00	5- Cavity layer
10	15.00	-10.20	N/A	120.00	5- Cavity layer
11	18.00	-13.20	N/A	120.00	5- Cavity layer
12	21.00	-16.20	N/A	120.00	5- Cavity layer
13	23.00	-18.20	N/A	120.00	5- Cavity layer
14	25.00	-20.20	N/A	120.00	5- Cavity layer
15	28.00	-23.20	N/A	120.00	5- Cavity layer
16	30.00	-25.20	N/A	120.00	5- Cavity layer
17	33.00	-28.20	N/A	120.00	5- Cavity layer
18	34.80	-30.00	N/A	120.00	5- Cavity layer
19	34.80	-30.00	N/A	120.00	4- Lime Stone/Very shelly sand
20	38.00	-33.20	N/A	120.00	4- Lime Stone/Very shelly sand
21	40.00	-35.20	N/A	120.00	4- Lime Stone/Very shelly sand
22	40.10	-35.30	13.00	120.00	3- Clean sand
23	42.00	-37.20	13.00	120.00	3- Clean sand
24	44.00	-39.20	16.00	120.00	3- Clean sand
25	45.90	-41.10	16.00	120.00	3- Clean sand
26	46.00	-41.20	N/A	120.00	4- Lime Stone/Very shelly sand
27	48.00	-43.20	N/A	120.00	4- Lime Stone/Very shelly sand
28	50.00	-45.20	N/A	120.00	4- Lime Stone/Very shelly sand
29	53.00	-48.20	N/A	120.00	4- Lime Stone/Very shelly sand
30	55.00	-50.20	N/A	120.00	4- Lime Stone/Very shelly sand
31	58.00	-53.20	N/A	120.00	4- Lime Stone/Very shelly sand
32	60.00	-55.20	N/A	120.00	4- Lime Stone/Very shelly sand
33	63.00	-58.20	N/A	120.00	4- Lime Stone/Very shelly sand
34	65.00	-60.20	N/A	120.00	4- Lime Stone/Very shelly sand
35	68.00	-63.20	N/A	120.00	4- Lime Stone/Very shelly sand
36	70.00	-65.20	N/A	120.00	4- Lime Stone/Very shelly sand
37	73.00	-68.20	N/A	120.00	4- Lime Stone/Very shelly sand
38	75.00	-70.20	N/A	120.00	4- Lime Stone/Very shelly sand
39	78.00	-73.20	N/A	120.00	4- Lime Stone/Very shelly sand
40	80.00	-75.20	N/A	120.00	4- Lime Stone/Very shelly sand

ID	Cu-DIR (tsf)	qu (tsf)	qt (tsf)	Em (ksi)	qb (tsf)
1	N/A	N/A	N/A	N/A	N/A
2	N/A	N/A	N/A	N/A	N/A
3	N/A	N/A	N/A	N/A	N/A
4	N/A	N/A	N/A	N/A	N/A
5	N/A	N/A	N/A	N/A	N/A
6	N/A	N/A	N/A	N/A	N/A
7	N/A	N/A	N/A	N/A	N/A
8	N/A	N/A	N/A	N/A	N/A
9	N/A	N/A	N/A	N/A	N/A
10	N/A	N/A	N/A	N/A	N/A
11	N/A	N/A	N/A	N/A	N/A
12	N/A	N/A	N/A	N/A	N/A
13	N/A	N/A	N/A	N/A	N/A

14	N/A	N/A	N/A	N/A	N/A
15	N/A	N/A	N/A	N/A	N/A
16	N/A	N/A	N/A	N/A	N/A
17	N/A	N/A	N/A	N/A	N/A
18	N/A	N/A	N/A	N/A	N/A
19	N/A	17.75	3.55	0.00	0.00
20	N/A	17.75	3.55	0.00	0.00
21	N/A	17.75	3.55	0.00	0.00
22	N/A	N/A	N/A	N/A	N/A
23	N/A	N/A	N/A	N/A	N/A
24	N/A	N/A	N/A	N/A	N/A
25	N/A	N/A	N/A	N/A	N/A
26	N/A	17.75	3.55	0.00	0.00
27	N/A	17.75	3.55	0.00	0.00
28	N/A	17.75	3.55	0.00	0.00
29	N/A	17.75	3.55	0.00	0.00
30	N/A	17.75	3.55	0.00	0.00
31	N/A	17.75	3.55	0.00	0.00
32	N/A	17.75	3.55	0.00	0.00
33	N/A	17.75	3.55	0.00	0.00
34	N/A	17.75	3.55	0.00	0.00
35	N/A	17.75	3.55	0.00	0.00
36	N/A	17.75	3.55	0.00	0.00
37	N/A	17.75	3.55	0.00	0.00
38	N/A	17.75	3.55	0.00	0.00
39	N/A	17.75	3.55	0.00	0.00
40	N/A	17.75	3.55	0.00	0.00

ID	RQD	F.M.	S.R.I.	Rock Recovery
1	N/A		N/A	N/A
2	N/A		N/A	N/A
3	N/A		N/A	N/A
4	N/A		N/A	N/A
5	N/A		N/A	N/A
6	N/A		N/A	N/A
7	N/A		N/A	N/A
8	N/A		N/A	N/A
9	N/A		N/A	N/A
10	N/A		N/A	N/A
11	N/A		N/A	N/A
12	N/A		N/A	N/A
13	N/A		N/A	N/A
14	N/A		N/A	N/A
15	N/A		N/A	N/A
16	N/A		N/A	N/A
17	N/A		N/A	N/A
18	N/A		N/A	N/A
19	1.00		ROUGH	1.000
20	1.00		ROUGH	1.000
21	1.00		ROUGH	1.000
22	N/A		N/A	N/A
23	N/A		N/A	N/A
24	N/A		N/A	N/A
25	N/A		N/A	N/A
26	1.00		ROUGH	1.000
27	1.00		ROUGH	1.000
28	1.00		ROUGH	1.000
29	1.00		ROUGH	1.000
30	1.00		ROUGH	1.000
31	1.00		ROUGH	1.000
32	1.00		ROUGH	1.000
33	1.00		ROUGH	1.000
34	1.00		ROUGH	1.000
35	1.00		ROUGH	1.000
36	1.00		ROUGH	1.000
37	1.00		ROUGH	1.000
38	1.00		ROUGH	1.000
39	1.00		ROUGH	1.000
40	1.00		ROUGH	1.000

Drilled Shaft Data:
==========
Unit weight of concrete = 150.00(pcf), Concrete Slump = 6.00(in)
Modulus of Elasticity of concrete = 4000.00(ksi)

Shaft Geometry:

ID	Length (ft)	Tip Elev. (ft)	Case Len. (ft)	Diameter (in)	Base Diam. (in)	Bell Len. (ft)
1	1.00	3.80	0.00	9.63	9.63	0.00
2	2.00	2.80	0.00	9.63	9.63	0.00
3	3.00	1.80	0.00	9.63	9.63	0.00
4	4.00	0.80	0.00	9.63	9.63	0.00
5	5.00	-0.20	0.00	9.63	9.63	0.00
6	6.00	-1.20	0.00	9.63	9.63	0.00
7	7.00	-2.20	0.00	9.63	9.63	0.00
8	8.00	-3.20	0.00	9.63	9.63	0.00

9	9.00	-4.20	0.00	9.63	9.63	0.00
10	10.00	-5.20	0.00	9.63	9.63	0.00
11	11.00	-6.20	0.00	9.63	9.63	0.00
12	12.00	-7.20	0.00	9.63	9.63	0.00
13	13.00	-8.20	0.00	9.63	9.63	0.00
14	14.00	-9.20	0.00	9.63	9.63	0.00
15	15.00	-10.20	0.00	9.63	9.63	0.00
16	16.00	-11.20	0.00	9.63	9.63	0.00
17	17.00	-12.20	0.00	9.63	9.63	0.00
18	18.00	-13.20	0.00	9.63	9.63	0.00
19	19.00	-14.20	0.00	9.63	9.63	0.00
20	20.00	-15.20	0.00	9.63	9.63	0.00
21	21.00	-16.20	0.00	9.63	9.63	0.00
22	22.00	-17.20	0.00	9.63	9.63	0.00
23	23.00	-18.20	0.00	9.63	9.63	0.00
24	24.00	-19.20	0.00	9.63	9.63	0.00
25	25.00	-20.20	0.00	9.63	9.63	0.00
26	26.00	-21.20	0.00	9.63	9.63	0.00
27	27.00	-22.20	0.00	9.63	9.63	0.00
28	28.00	-23.20	0.00	9.63	9.63	0.00
29	29.00	-24.20	0.00	9.63	9.63	0.00
30	30.00	-25.20	0.00	9.63	9.63	0.00
31	31.00	-26.20	0.00	9.63	9.63	0.00
32	32.00	-27.20	0.00	9.63	9.63	0.00
33	33.00	-28.20	0.00	9.63	9.63	0.00
34	34.00	-29.20	0.00	9.63	9.63	0.00
35	35.00	-30.20	0.00	9.63	9.63	0.00
36	36.00	-31.20	0.00	9.63	9.63	0.00
37	37.00	-32.20	0.00	9.63	9.63	0.00
38	38.00	-33.20	0.00	9.63	9.63	0.00
39	39.00	-34.20	0.00	9.63	9.63	0.00
40	40.00	-35.20	0.00	9.63	9.63	0.00
41	41.00	-36.20	0.00	9.63	9.63	0.00
42	42.00	-37.20	0.00	9.63	9.63	0.00
43	43.00	-38.20	0.00	9.63	9.63	0.00
44	44.00	-39.20	0.00	9.63	9.63	0.00
45	45.00	-40.20	0.00	9.63	9.63	0.00
46	46.00	-41.20	0.00	9.63	9.63	0.00
47	47.00	-42.20	0.00	9.63	9.63	0.00
48	48.00	-43.20	0.00	9.63	9.63	0.00
49	49.00	-44.20	0.00	9.63	9.63	0.00
50	50.00	-45.20	0.00	9.63	9.63	0.00
51	51.00	-46.20	0.00	9.63	9.63	0.00
52	52.00	-47.20	0.00	9.63	9.63	0.00
53	53.00	-48.20	0.00	9.63	9.63	0.00
54	54.00	-49.20	0.00	9.63	9.63	0.00
55	55.00	-50.20	0.00	9.63	9.63	0.00
56	56.00	-51.20	0.00	9.63	9.63	0.00
57	57.00	-52.20	0.00	9.63	9.63	0.00
58	58.00	-53.20	0.00	9.63	9.63	0.00
59	59.00	-54.20	0.00	9.63	9.63	0.00
60	60.00	-55.20	0.00	9.63	9.63	0.00
61	61.00	-56.20	0.00	9.63	9.63	0.00
62	62.00	-57.20	0.00	9.63	9.63	0.00
63	63.00	-58.20	0.00	9.63	9.63	0.00
64	64.00	-59.20	0.00	9.63	9.63	0.00
65	65.00	-60.20	0.00	9.63	9.63	0.00
66	66.00	-61.20	0.00	9.63	9.63	0.00
67	67.00	-62.20	0.00	9.63	9.63	0.00
68	68.00	-63.20	0.00	9.63	9.63	0.00
69	69.00	-64.20	0.00	9.63	9.63	0.00
70	70.00	-65.20	0.00	9.63	9.63	0.00
71	71.00	-66.20	0.00	9.63	9.63	0.00
72	72.00	-67.20	0.00	9.63	9.63	0.00
73	73.00	-68.20	0.00	9.63	9.63	0.00
74	74.00	-69.20	0.00	9.63	9.63	0.00
75	75.00	-70.20	0.00	9.63	9.63	0.00
76	76.00	-71.20	0.00	9.63	9.63	0.00
77	77.00	-72.20	0.00	9.63	9.63	0.00
78	78.00	-73.20	0.00	9.63	9.63	0.00
79	79.00	-74.20	0.00	9.63	9.63	0.00

Drilled Shaft Capacity (sorted by shaft diameter):

Strength reduction factors: Skin-friction = 1.00, End-bearing = 0.00

ID	Diameter (in)	Length (ft)	Skin Fric. (tons)	End Bearing (tons)	Capacity (tons)
1	9.63	1.00	0.000	0.000	0.000
2	9.63	2.00	0.000	0.000	0.000
3	9.63	3.00	0.000	0.000	0.000
4	9.63	4.00	0.000	0.000	0.000
5	9.63	5.00	0.000	0.000	0.000
6	9.63	6.00	0.000	0.000	0.000
7	9.63	7.00	0.000	0.000	0.000
8	9.63	8.00	0.000	0.000	0.000
9	9.63	9.00	0.000	0.000	0.000
10	9.63	10.00	0.000	0.000	0.000
11	9.63	11.00	0.000	0.000	0.000

12	9.63	12.00	0.000	0.000	0.000
13	9.63	13.00	0.000	0.000	0.000
14	9.63	14.00	0.000	0.000	0.000
15	9.63	15.00	0.000	0.000	0.000
16	9.63	16.00	0.000	0.000	0.000
17	9.63	17.00	0.000	0.000	0.000
18	9.63	18.00	0.000	0.000	0.000
19	9.63	19.00	0.000	0.000	0.000
20	9.63	20.00	0.000	0.000	0.000
21	9.63	21.00	0.000	0.000	0.000
22	9.63	22.00	0.000	0.000	0.000
23	9.63	23.00	0.000	0.000	0.000
24	9.63	24.00	0.000	0.000	0.000
25	9.63	25.00	0.000	0.000	0.000
26	9.63	26.00	0.000	0.000	0.000
27	9.63	27.00	0.000	0.000	0.000
28	9.63	28.00	0.000	0.000	0.000
29	9.63	29.00	0.000	0.000	0.000
30	9.63	30.00	0.000	0.000	0.000
31	9.63	31.00	0.000	0.000	0.000
32	9.63	32.00	0.000	0.000	0.000
33	9.63	33.00	0.000	0.000	0.000
34	9.63	34.00	0.000	0.000	0.000
35	9.63	35.00	2.000	0.000	2.000
36	9.63	36.00	12.001	0.000	12.001
37	9.63	37.00	22.003	0.000	22.003
38	9.63	38.00	32.004	0.000	32.004
39	9.63	39.00	42.005	0.000	42.005
40	9.63	40.00	52.006	0.000	52.006
41	9.63	41.00	53.247	0.000	53.247
42	9.63	42.00	53.554	0.000	53.554
43	9.63	43.00	53.900	0.000	53.900
44	9.63	44.00	54.285	0.000	54.285
45	9.63	45.00	54.707	0.000	54.707
46	9.63	46.00	55.165	0.000	55.165
47	9.63	47.00	65.166	0.000	65.166
48	9.63	48.00	75.168	0.000	75.168
49	9.63	49.00	85.169	0.000	85.169
50	9.63	50.00	95.170	0.000	95.170
51	9.63	51.00	105.171	0.000	105.171
52	9.63	52.00	115.173	0.000	115.173
53	9.63	53.00	125.174	0.000	125.174
54	9.63	54.00	135.175	0.000	135.175
55	9.63	55.00	145.176	0.000	145.176
56	9.63	56.00	155.177	0.000	155.177
57	9.63	57.00	165.179	0.000	165.179
58	9.63	58.00	175.180	0.000	175.180
59	9.63	59.00	185.181	0.000	185.181
60	9.63	60.00	195.182	0.000	195.182
61	9.63	61.00	205.183	0.000	205.183
62	9.63	62.00	215.185	0.000	215.185
63	9.63	63.00	225.186	0.000	225.186
64	9.63	64.00	235.187	0.000	235.187
65	9.63	65.00	245.188	0.000	245.188
66	9.63	66.00	255.190	0.000	255.190
67	9.63	67.00	265.191	0.000	265.191
68	9.63	68.00	275.192	0.000	275.192
69	9.63	69.00	285.193	0.000	285.193
70	9.63	70.00	295.194	0.000	295.194
71	9.63	71.00	305.196	0.000	305.196
72	9.63	72.00	315.197	0.000	315.197
73	9.63	73.00	325.198	0.000	325.198
74	9.63	74.00	335.199	0.000	335.199
75	9.63	75.00	345.200	0.000	345.200
76	9.63	76.00	355.202	0.000	355.202
77	9.63	77.00	365.203	0.000	365.203
78	9.63	78.00	375.204	0.000	375.204
79	9.63	79.00	385.205	0.000	385.205

Drilled Shaft Capacity at User-Defined Settlement (sorted by shaft diameter):

***** Capacity is NOT modified by the strength reduction factors *****

User-Defined Settlement = 0.00%

ID	Diameter (in)	Length (ft)	Skin Fric. (tons)	End Bearing (tons)	Capacity (tons)
1	9.63	1.00	0.000	0.000	0.000
2	9.63	2.00	0.000	0.000	0.000
3	9.63	3.00	0.000	0.000	0.000
4	9.63	4.00	0.000	0.000	0.000
5	9.63	5.00	0.000	0.000	0.000
6	9.63	6.00	0.000	0.000	0.000
7	9.63	7.00	0.000	0.000	0.000
8	9.63	8.00	0.000	0.000	0.000
9	9.63	9.00	0.000	0.000	0.000
10	9.63	10.00	0.000	0.000	0.000
11	9.63	11.00	0.000	0.000	0.000

12	9.63	12.00	0.000	0.000	0.000
13	9.63	13.00	0.000	0.000	0.000
14	9.63	14.00	0.000	0.000	0.000
15	9.63	15.00	0.000	0.000	0.000
16	9.63	16.00	0.000	0.000	0.000
17	9.63	17.00	0.000	0.000	0.000
18	9.63	18.00	0.000	0.000	0.000
19	9.63	19.00	0.000	0.000	0.000
20	9.63	20.00	0.000	0.000	0.000
21	9.63	21.00	0.000	0.000	0.000
22	9.63	22.00	0.000	0.000	0.000
23	9.63	23.00	0.000	0.000	0.000
24	9.63	24.00	0.000	0.000	0.000
25	9.63	25.00	0.000	0.000	0.000
26	9.63	26.00	0.000	0.000	0.000
27	9.63	27.00	0.000	0.000	0.000
28	9.63	28.00	0.000	0.000	0.000
29	9.63	29.00	0.000	0.000	0.000
30	9.63	30.00	0.000	0.000	0.000
31	9.63	31.00	0.000	0.000	0.000
32	9.63	32.00	0.000	0.000	0.000
33	9.63	33.00	0.000	0.000	0.000
34	9.63	34.00	0.000	0.000	0.000
35	9.63	35.00	-nan(ind)	-nan(ind)	-nan(ind)
36	9.63	36.00	-nan(ind)	-nan(ind)	-nan(ind)
37	9.63	37.00	-nan(ind)	-nan(ind)	-nan(ind)
38	9.63	38.00	-nan(ind)	-nan(ind)	-nan(ind)
39	9.63	39.00	-nan(ind)	-nan(ind)	-nan(ind)
40	9.63	40.00	-nan(ind)	-nan(ind)	-nan(ind)
41	9.63	41.00	-nan(ind)	0.000	-nan(ind)
42	9.63	42.00	-nan(ind)	0.000	-nan(ind)
43	9.63	43.00	-nan(ind)	0.000	-nan(ind)
44	9.63	44.00	-nan(ind)	0.000	-nan(ind)
45	9.63	45.00	-nan(ind)	0.000	-nan(ind)
46	9.63	46.00	-nan(ind)	-nan(ind)	-nan(ind)
47	9.63	47.00	0.000	0.000	0.000
48	9.63	48.00	0.000	0.000	0.000
49	9.63	49.00	0.000	0.000	0.000
50	9.63	50.00	0.000	0.000	0.000
51	9.63	51.00	0.000	0.000	0.000
52	9.63	52.00	0.000	0.000	0.000
53	9.63	53.00	0.000	0.000	0.000
54	9.63	54.00	0.000	0.000	0.000
55	9.63	55.00	0.000	0.000	0.000
56	9.63	56.00	0.000	0.000	0.000
57	9.63	57.00	0.000	0.000	0.000
58	9.63	58.00	0.000	0.000	0.000
59	9.63	59.00	0.000	0.000	0.000
60	9.63	60.00	0.000	0.000	0.000
61	9.63	61.00	0.000	0.000	0.000
62	9.63	62.00	0.000	0.000	0.000
63	9.63	63.00	0.000	0.000	0.000
64	9.63	64.00	0.000	0.000	0.000
65	9.63	65.00	0.000	0.000	0.000
66	9.63	66.00	0.000	0.000	0.000
67	9.63	67.00	0.000	0.000	0.000
68	9.63	68.00	0.000	0.000	0.000
69	9.63	69.00	0.000	0.000	0.000
70	9.63	70.00	0.000	0.000	0.000
71	9.63	71.00	0.000	0.000	0.000
72	9.63	72.00	0.000	0.000	0.000
73	9.63	73.00	0.000	0.000	0.000
74	9.63	74.00	0.000	0.000	0.000
75	9.63	75.00	0.000	0.000	0.000
76	9.63	76.00	0.000	0.000	0.000
77	9.63	77.00	0.000	0.000	0.000
78	9.63	78.00	0.000	0.000	0.000
79	9.63	79.00	0.000	0.000	0.000

General Information:
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Input file: .....Revised II 02-18-21\Bridge\FB-DEEP\Micropile\B-2_9.625 inch.in
Project number: HR20-1583R
Job name: Atlantic Isle Bridge
Engineer: Chollada
Units: English

Analysis Information:
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Analysis Type: Drilled Shaft Analysis

Soil Information:
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Boring date: 12/04/17
Boring number: B-2
Station number: 14+10 Offset: 20.0 RT

Ground Elevation: 2.40(ft)
Water table Elevation = 0.50(ft)

Rock side-friction is calculated using: McVay's method
Hammer type: Automatic Hammer, Correction factor = 1.24

ID	Depth (ft)	Elevation (ft)	SPT Blows (Blows/ft)	Unit Weight (pcf)	Soil Type
1	0.00	2.40	N/A	0.00	5- Cavity layer
2	2.00	0.40	N/A	0.00	5- Cavity layer
3	4.00	-1.60	N/A	0.00	5- Cavity layer
4	6.00	-3.60	N/A	120.00	5- Cavity layer
5	8.00	-5.60	N/A	120.00	5- Cavity layer
6	10.00	-7.60	N/A	120.00	5- Cavity layer
7	13.00	-10.60	N/A	120.00	5- Cavity layer
8	15.00	-12.60	N/A	120.00	5- Cavity layer
9	16.00	-13.60	N/A	120.00	5- Cavity layer
10	17.00	-14.60	N/A	120.00	5- Cavity layer
11	18.00	-15.60	N/A	120.00	5- Cavity layer
12	20.00	-17.60	N/A	120.00	5- Cavity layer
13	23.00	-20.60	N/A	120.00	5- Cavity layer
14	25.00	-22.60	N/A	120.00	5- Cavity layer
15	28.00	-25.60	N/A	120.00	5- Cavity layer
16	30.00	-27.60	N/A	120.00	5- Cavity layer
17	32.40	-30.00	N/A	120.00	5- Cavity layer
18	32.40	-30.00	10.00	120.00	3- Clean sand
19	33.00	-30.60	10.00	120.00	3- Clean sand
20	34.00	-31.60	N/A	120.00	4- Lime Stone/Very shelly sand
21	35.00	-32.60	N/A	120.00	4- Lime Stone/Very shelly sand
22	38.00	-35.60	N/A	120.00	4- Lime Stone/Very shelly sand
23	38.10	-35.70	3.00	101.26	3- Clean sand
24	40.00	-37.60	3.00	101.26	3- Clean sand
25	42.00	-39.60	6.00	104.51	3- Clean sand
26	42.90	-40.50	6.00	104.51	3- Clean sand
27	43.00	-40.60	N/A	120.00	4- Lime Stone/Very shelly sand
28	45.00	-42.60	N/A	120.00	4- Lime Stone/Very shelly sand
29	48.00	-45.60	N/A	120.00	4- Lime Stone/Very shelly sand
30	50.00	-47.60	N/A	120.00	4- Lime Stone/Very shelly sand
31	53.00	-50.60	N/A	120.00	4- Lime Stone/Very shelly sand
32	55.00	-52.60	N/A	120.00	4- Lime Stone/Very shelly sand
33	58.00	-55.60	N/A	120.00	4- Lime Stone/Very shelly sand
34	60.00	-57.60	N/A	120.00	4- Lime Stone/Very shelly sand
35	62.00	-59.60	N/A	120.00	4- Lime Stone/Very shelly sand
36	65.00	-62.60	N/A	120.00	4- Lime Stone/Very shelly sand
37	68.00	-65.60	N/A	120.00	4- Lime Stone/Very shelly sand
38	70.00	-67.60	N/A	120.00	4- Lime Stone/Very shelly sand
39	73.00	-70.60	N/A	120.00	4- Lime Stone/Very shelly sand
40	75.00	-72.60	10.00	120.00	3- Clean sand
41	78.00	-75.60	19.00	120.00	3- Clean sand
42	80.00	-77.60	N/A	120.00	4- Lime Stone/Very shelly sand

ID	Cu-DIR (tsf)	qu (tsf)	qt (tsf)	Em (ksi)	qb (tsf)
1	N/A	N/A	N/A	N/A	N/A
2	N/A	N/A	N/A	N/A	N/A
3	N/A	N/A	N/A	N/A	N/A
4	N/A	N/A	N/A	N/A	N/A
5	N/A	N/A	N/A	N/A	N/A
6	N/A	N/A	N/A	N/A	N/A
7	N/A	N/A	N/A	N/A	N/A
8	N/A	N/A	N/A	N/A	N/A
9	N/A	N/A	N/A	N/A	N/A
10	N/A	N/A	N/A	N/A	N/A
11	N/A	N/A	N/A	N/A	N/A

12	N/A	N/A	N/A	N/A	N/A
13	N/A	N/A	N/A	N/A	N/A
14	N/A	N/A	N/A	N/A	N/A
15	N/A	N/A	N/A	N/A	N/A
16	N/A	N/A	N/A	N/A	N/A
17	N/A	N/A	N/A	N/A	N/A
18	N/A	N/A	N/A	N/A	N/A
19	N/A	N/A	N/A	N/A	N/A
20	N/A	17.19	3.40	0.00	0.00
21	N/A	17.19	3.40	0.00	0.00
22	N/A	17.75	3.55	0.00	0.00
23	N/A	N/A	N/A	N/A	N/A
24	N/A	N/A	N/A	N/A	N/A
25	N/A	N/A	N/A	N/A	N/A
26	N/A	N/A	N/A	N/A	N/A
27	N/A	17.75	3.55	0.00	0.00
28	N/A	17.75	3.55	0.00	0.00
29	N/A	17.75	3.55	0.00	0.00
30	N/A	17.75	3.55	0.00	0.00
31	N/A	17.75	3.55	0.00	0.00
32	N/A	17.75	3.55	0.00	0.00
33	N/A	17.75	3.55	0.00	0.00
34	N/A	17.75	3.55	0.00	0.00
35	N/A	17.75	3.55	0.00	0.00
36	N/A	17.75	3.55	0.00	0.00
37	N/A	17.75	3.55	0.00	0.00
38	N/A	17.75	3.55	0.00	0.00
39	N/A	17.75	3.55	0.00	0.00
40	N/A	N/A	N/A	N/A	N/A
41	N/A	N/A	N/A	N/A	N/A
42	N/A	17.75	3.55	0.00	0.00

ID	RQD F.M.	S.R.I.	Rock Recovery
1	N/A	N/A	N/A
2	N/A	N/A	N/A
3	N/A	N/A	N/A
4	N/A	N/A	N/A
5	N/A	N/A	N/A
6	N/A	N/A	N/A
7	N/A	N/A	N/A
8	N/A	N/A	N/A
9	N/A	N/A	N/A
10	N/A	N/A	N/A
11	N/A	N/A	N/A
12	N/A	N/A	N/A
13	N/A	N/A	N/A
14	N/A	N/A	N/A
15	N/A	N/A	N/A
16	N/A	N/A	N/A
17	N/A	N/A	N/A
18	N/A	N/A	N/A
19	N/A	N/A	N/A
20	1.00	ROUGH	1.000
21	1.00	ROUGH	1.000
22	1.00	ROUGH	1.000
23	N/A	N/A	N/A
24	N/A	N/A	N/A
25	N/A	N/A	N/A
26	N/A	N/A	N/A
27	1.00	ROUGH	1.000
28	1.00	ROUGH	1.000
29	1.00	ROUGH	1.000
30	1.00	ROUGH	1.000
31	1.00	ROUGH	1.000
32	1.00	ROUGH	1.000
33	1.00	ROUGH	1.000
34	1.00	ROUGH	1.000
35	1.00	ROUGH	1.000
36	1.00	ROUGH	1.000
37	1.00	ROUGH	1.000
38	1.00	ROUGH	1.000
39	1.00	ROUGH	1.000
40	N/A	N/A	N/A
41	N/A	N/A	N/A
42	1.00	ROUGH	1.000

Drilled Shaft Data:
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Unit weight of concrete = 150.00(pcf), Concrete Slump = 6.00(in)
Modulus of Elasticity of concrete = 4000.00(ksi)

Shaft Geometry:

ID	Length (ft)	Tip Elev. (ft)	Case Len. (ft)	Diameter (in)	Base Diam. (in)	Bell Len. (ft)
1	1.00	1.40	0.00	9.63	9.63	0.00
2	2.00	0.40	0.00	9.63	9.63	0.00

3	3.00	-0.60	0.00	9.63	9.63	0.00
4	4.00	-1.60	0.00	9.63	9.63	0.00
5	5.00	-2.60	0.00	9.63	9.63	0.00
6	6.00	-3.60	0.00	9.63	9.63	0.00
7	7.00	-4.60	0.00	9.63	9.63	0.00
8	8.00	-5.60	0.00	9.63	9.63	0.00
9	9.00	-6.60	0.00	9.63	9.63	0.00
10	10.00	-7.60	0.00	9.63	9.63	0.00
11	11.00	-8.60	0.00	9.63	9.63	0.00
12	12.00	-9.60	0.00	9.63	9.63	0.00
13	13.00	-10.60	0.00	9.63	9.63	0.00
14	14.00	-11.60	0.00	9.63	9.63	0.00
15	15.00	-12.60	0.00	9.63	9.63	0.00
16	16.00	-13.60	0.00	9.63	9.63	0.00
17	17.00	-14.60	0.00	9.63	9.63	0.00
18	18.00	-15.60	0.00	9.63	9.63	0.00
19	19.00	-16.60	0.00	9.63	9.63	0.00
20	20.00	-17.60	0.00	9.63	9.63	0.00
21	21.00	-18.60	0.00	9.63	9.63	0.00
22	22.00	-19.60	0.00	9.63	9.63	0.00
23	23.00	-20.60	0.00	9.63	9.63	0.00
24	24.00	-21.60	0.00	9.63	9.63	0.00
25	25.00	-22.60	0.00	9.63	9.63	0.00
26	26.00	-23.60	0.00	9.63	9.63	0.00
27	27.00	-24.60	0.00	9.63	9.63	0.00
28	28.00	-25.60	0.00	9.63	9.63	0.00
29	29.00	-26.60	0.00	9.63	9.63	0.00
30	30.00	-27.60	0.00	9.63	9.63	0.00
31	31.00	-28.60	0.00	9.63	9.63	0.00
32	32.00	-29.60	0.00	9.63	9.63	0.00
33	33.00	-30.60	0.00	9.63	9.63	0.00
34	34.00	-31.60	0.00	9.63	9.63	0.00
35	35.00	-32.60	0.00	9.63	9.63	0.00
36	36.00	-33.60	0.00	9.63	9.63	0.00
37	37.00	-34.60	0.00	9.63	9.63	0.00
38	38.00	-35.60	0.00	9.63	9.63	0.00
39	39.00	-36.60	0.00	9.63	9.63	0.00
40	40.00	-37.60	0.00	9.63	9.63	0.00
41	41.00	-38.60	0.00	9.63	9.63	0.00
42	42.00	-39.60	0.00	9.63	9.63	0.00
43	43.00	-40.60	0.00	9.63	9.63	0.00
44	44.00	-41.60	0.00	9.63	9.63	0.00
45	45.00	-42.60	0.00	9.63	9.63	0.00
46	46.00	-43.60	0.00	9.63	9.63	0.00
47	47.00	-44.60	0.00	9.63	9.63	0.00
48	48.00	-45.60	0.00	9.63	9.63	0.00
49	49.00	-46.60	0.00	9.63	9.63	0.00
50	50.00	-47.60	0.00	9.63	9.63	0.00
51	51.00	-48.60	0.00	9.63	9.63	0.00
52	52.00	-49.60	0.00	9.63	9.63	0.00
53	53.00	-50.60	0.00	9.63	9.63	0.00
54	54.00	-51.60	0.00	9.63	9.63	0.00
55	55.00	-52.60	0.00	9.63	9.63	0.00
56	56.00	-53.60	0.00	9.63	9.63	0.00
57	57.00	-54.60	0.00	9.63	9.63	0.00
58	58.00	-55.60	0.00	9.63	9.63	0.00
59	59.00	-56.60	0.00	9.63	9.63	0.00
60	60.00	-57.60	0.00	9.63	9.63	0.00
61	61.00	-58.60	0.00	9.63	9.63	0.00
62	62.00	-59.60	0.00	9.63	9.63	0.00
63	63.00	-60.60	0.00	9.63	9.63	0.00
64	64.00	-61.60	0.00	9.63	9.63	0.00
65	65.00	-62.60	0.00	9.63	9.63	0.00
66	66.00	-63.60	0.00	9.63	9.63	0.00
67	67.00	-64.60	0.00	9.63	9.63	0.00
68	68.00	-65.60	0.00	9.63	9.63	0.00
69	69.00	-66.60	0.00	9.63	9.63	0.00
70	70.00	-67.60	0.00	9.63	9.63	0.00
71	71.00	-68.60	0.00	9.63	9.63	0.00
72	72.00	-69.60	0.00	9.63	9.63	0.00
73	73.00	-70.60	0.00	9.63	9.63	0.00
74	74.00	-71.60	0.00	9.63	9.63	0.00

Drilled Shaft Capacity (sorted by shaft diameter):

Strength reduction factors: Skin-friction = 1.00, End-bearing = 0.00

ID	Diameter (in)	Length (ft)	Skin Fric. (tons)	End Bearing (tons)	Capacity (tons)
1	9.63	1.00	0.000	0.000	0.000
2	9.63	2.00	0.000	0.000	0.000
3	9.63	3.00	0.000	0.000	0.000
4	9.63	4.00	0.000	0.000	0.000
5	9.63	5.00	0.000	0.000	0.000
6	9.63	6.00	0.000	0.000	0.000
7	9.63	7.00	0.000	0.000	0.000
8	9.63	8.00	0.000	0.000	0.000
9	9.63	9.00	0.000	0.000	0.000
10	9.63	10.00	0.000	0.000	0.000

11	9.63	11.00	0.000	0.000	0.000
12	9.63	12.00	0.000	0.000	0.000
13	9.63	13.00	0.000	0.000	0.000
14	9.63	14.00	0.000	0.000	0.000
15	9.63	15.00	0.000	0.000	0.000
16	9.63	16.00	0.000	0.000	0.000
17	9.63	17.00	0.000	0.000	0.000
18	9.63	18.00	0.000	0.000	0.000
19	9.63	19.00	0.000	0.000	0.000
20	9.63	20.00	0.000	0.000	0.000
21	9.63	21.00	0.000	0.000	0.000
22	9.63	22.00	0.000	0.000	0.000
23	9.63	23.00	0.000	0.000	0.000
24	9.63	24.00	0.000	0.000	0.000
25	9.63	25.00	0.000	0.000	0.000
26	9.63	26.00	0.000	0.000	0.000
27	9.63	27.00	0.000	0.000	0.000
28	9.63	28.00	0.000	0.000	0.000
29	9.63	29.00	0.000	0.000	0.000
30	9.63	30.00	0.000	0.000	0.000
31	9.63	31.00	0.000	0.000	0.000
32	9.63	32.00	0.000	0.000	0.000
33	9.63	33.00	0.008	0.000	0.008
34	9.63	34.00	0.055	0.000	0.055
35	9.63	35.00	9.687	0.000	9.687
36	9.63	36.00	19.319	0.000	19.319
37	9.63	37.00	28.951	0.000	28.951
38	9.63	38.00	38.583	0.000	38.583
39	9.63	39.00	39.681	0.000	39.681
40	9.63	40.00	39.802	0.000	39.802
41	9.63	41.00	39.935	0.000	39.935
42	9.63	42.00	40.080	0.000	40.080
43	9.63	43.00	40.274	0.000	40.274
44	9.63	44.00	50.275	0.000	50.275
45	9.63	45.00	60.276	0.000	60.276
46	9.63	46.00	70.278	0.000	70.278
47	9.63	47.00	80.279	0.000	80.279
48	9.63	48.00	90.280	0.000	90.280
49	9.63	49.00	100.281	0.000	100.281
50	9.63	50.00	110.282	0.000	110.282
51	9.63	51.00	120.284	0.000	120.284
52	9.63	52.00	130.285	0.000	130.285
53	9.63	53.00	140.286	0.000	140.286
54	9.63	54.00	150.287	0.000	150.287
55	9.63	55.00	160.288	0.000	160.288
56	9.63	56.00	170.290	0.000	170.290
57	9.63	57.00	180.291	0.000	180.291
58	9.63	58.00	190.292	0.000	190.292
59	9.63	59.00	200.293	0.000	200.293
60	9.63	60.00	210.295	0.000	210.295
61	9.63	61.00	220.296	0.000	220.296
62	9.63	62.00	230.297	0.000	230.297
63	9.63	63.00	240.298	0.000	240.298
64	9.63	64.00	250.299	0.000	250.299
65	9.63	65.00	260.301	0.000	260.301
66	9.63	66.00	270.302	0.000	270.302
67	9.63	67.00	280.303	0.000	280.303
68	9.63	68.00	290.304	0.000	290.304
69	9.63	69.00	300.305	0.000	300.305
70	9.63	70.00	310.307	0.000	310.307
71	9.63	71.00	320.308	0.000	320.308
72	9.63	72.00	330.309	0.000	330.309
73	9.63	73.00	340.310	0.000	340.310
74	9.63	74.00	350.311	0.000	350.311

Drilled Shaft Capacity at User-Defined Settlement (sorted by shaft diameter):

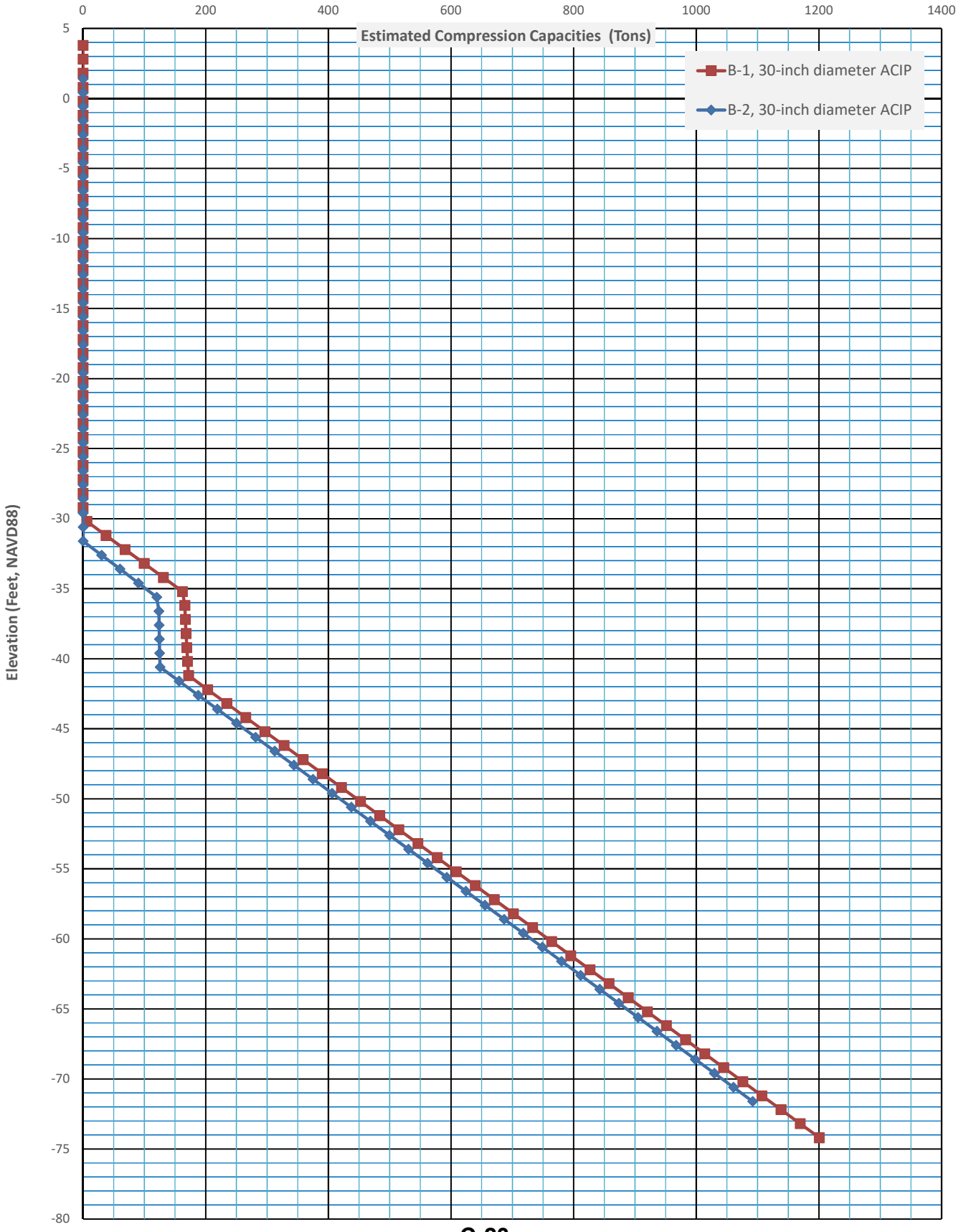
***** Capacity is NOT modified by the strength reduction factors *****

User-Defined Settlement = 0.00%

ID	Diameter (in)	Length (ft)	Skin Fric. (tons)	End Bearing (tons)	Capacity (tons)
1	9.63	1.00	0.000	0.000	0.000
2	9.63	2.00	0.000	0.000	0.000
3	9.63	3.00	0.000	0.000	0.000
4	9.63	4.00	0.000	0.000	0.000
5	9.63	5.00	0.000	0.000	0.000
6	9.63	6.00	0.000	0.000	0.000
7	9.63	7.00	0.000	0.000	0.000
8	9.63	8.00	0.000	0.000	0.000
9	9.63	9.00	0.000	0.000	0.000
10	9.63	10.00	0.000	0.000	0.000
11	9.63	11.00	0.000	0.000	0.000
12	9.63	12.00	0.000	0.000	0.000
13	9.63	13.00	0.000	0.000	0.000
14	9.63	14.00	0.000	0.000	0.000
15	9.63	15.00	0.000	0.000	0.000

16	9.63	16.00	0.000	0.000	0.000
17	9.63	17.00	0.000	0.000	0.000
18	9.63	18.00	0.000	0.000	0.000
19	9.63	19.00	0.000	0.000	0.000
20	9.63	20.00	0.000	0.000	0.000
21	9.63	21.00	0.000	0.000	0.000
22	9.63	22.00	0.000	0.000	0.000
23	9.63	23.00	0.000	0.000	0.000
24	9.63	24.00	0.000	0.000	0.000
25	9.63	25.00	0.000	0.000	0.000
26	9.63	26.00	0.000	0.000	0.000
27	9.63	27.00	0.000	0.000	0.000
28	9.63	28.00	0.000	0.000	0.000
29	9.63	29.00	0.000	0.000	0.000
30	9.63	30.00	0.000	0.000	0.000
31	9.63	31.00	0.000	0.000	0.000
32	9.63	32.00	0.000	0.000	0.000
33	9.63	33.00	0.000	0.000	0.000
34	9.63	34.00	0.000	0.000	0.000
35	9.63	35.00	0.000	0.000	0.000
36	9.63	36.00	0.000	0.000	0.000
37	9.63	37.00	0.000	0.000	0.000
38	9.63	38.00	0.000	0.000	0.000
39	9.63	39.00	0.000	0.000	0.000
40	9.63	40.00	0.000	0.000	0.000
41	9.63	41.00	0.000	0.000	0.000
42	9.63	42.00	0.000	0.000	0.000
43	9.63	43.00	0.000	0.000	0.000
44	9.63	44.00	0.000	0.000	0.000
45	9.63	45.00	0.000	0.000	0.000
46	9.63	46.00	0.000	0.000	0.000
47	9.63	47.00	0.000	0.000	0.000
48	9.63	48.00	0.000	0.000	0.000
49	9.63	49.00	0.000	0.000	0.000
50	9.63	50.00	0.000	0.000	0.000
51	9.63	51.00	0.000	0.000	0.000
52	9.63	52.00	0.000	0.000	0.000
53	9.63	53.00	0.000	0.000	0.000
54	9.63	54.00	0.000	0.000	0.000
55	9.63	55.00	0.000	0.000	0.000
56	9.63	56.00	0.000	0.000	0.000
57	9.63	57.00	0.000	0.000	0.000
58	9.63	58.00	0.000	0.000	0.000
59	9.63	59.00	0.000	0.000	0.000
60	9.63	60.00	0.000	0.000	0.000
61	9.63	61.00	0.000	0.000	0.000
62	9.63	62.00	0.000	0.000	0.000
63	9.63	63.00	0.000	0.000	0.000
64	9.63	64.00	0.000	0.000	0.000
65	9.63	65.00	0.000	0.000	0.000
66	9.63	66.00	0.000	0.000	0.000
67	9.63	67.00	0.000	0.000	0.000
68	9.63	68.00	0.000	0.000	0.000
69	9.63	69.00	0.000	0.000	0.000
70	9.63	70.00	0.000	0.000	0.000
71	9.63	71.00	0.000	0.000	0.000
72	9.63	72.00	0.000	0.000	0.000
73	9.63	73.00	0.000	0.000	0.000
74	9.63	74.00	0.000	0.000	0.000

ATLANTIC ISLE BRIDGE
FPID No. 430029-2-22-02
HR ENGINEERING SERVICES, INC.
HRES PROJECT NO. HR20-1583R
ESTIMATED ULTIMATE COMPRESSION CAPACITIES FOR 30-INCH DIAMETER AUGERCAST PILES
TEST BORING B-1 AND B-2



General Information:
==========
Input file: ..... Bridge\Revised II 02-18-21\Bridge\FB-DEEP\ACIP\B-1_30 inch.in
Project number: HR20-1583R
Job name: Atlantic Isle Bridge
Engineer: Chollada
Units: English

Analysis Information:
==========
Analysis Type: Drilled Shaft Analysis

Soil Information:
==========
Boring date: 12/05/17
Boring number: B-1
Station number: 13+27 Offset: 6.0 RT

Ground Elevation: 4.80(ft)
Water table Elevation = 0.50(ft)

Rock side-friction is calculated using: McVay's method
Hammer type: Automatic Hammer, Correction factor = 1.24

ID	Depth (ft)	Elevation (ft)	SPT Blows (Blows/ft)	Unit Weight (pcf)	Soil Type
1	0.00	4.80	N/A	0.00	5- Cavity layer
2	2.00	2.80	N/A	0.00	5- Cavity layer
3	4.00	0.80	N/A	0.00	5- Cavity layer
4	6.00	-1.20	N/A	120.00	5- Cavity layer
5	8.00	-3.20	N/A	120.00	5- Cavity layer
6	10.00	-5.20	N/A	120.00	5- Cavity layer
7	12.00	-7.20	N/A	120.00	5- Cavity layer
8	13.00	-8.20	N/A	120.00	5- Cavity layer
9	13.00	-8.20	N/A	120.00	5- Cavity layer
10	15.00	-10.20	N/A	120.00	5- Cavity layer
11	18.00	-13.20	N/A	120.00	5- Cavity layer
12	21.00	-16.20	N/A	120.00	5- Cavity layer
13	23.00	-18.20	N/A	120.00	5- Cavity layer
14	25.00	-20.20	N/A	120.00	5- Cavity layer
15	28.00	-23.20	N/A	120.00	5- Cavity layer
16	30.00	-25.20	N/A	120.00	5- Cavity layer
17	33.00	-28.20	N/A	120.00	5- Cavity layer
18	34.80	-30.00	N/A	120.00	5- Cavity layer
19	34.80	-30.00	N/A	120.00	4- Lime Stone/Very shelly sand
20	38.00	-33.20	N/A	120.00	4- Lime Stone/Very shelly sand
21	40.00	-35.20	N/A	120.00	4- Lime Stone/Very shelly sand
22	40.10	-35.30	13.00	120.00	3- Clean sand
23	42.00	-37.20	13.00	120.00	3- Clean sand
24	44.00	-39.20	16.00	120.00	3- Clean sand
25	45.90	-41.10	16.00	120.00	3- Clean sand
26	46.00	-41.20	N/A	120.00	4- Lime Stone/Very shelly sand
27	48.00	-43.20	N/A	120.00	4- Lime Stone/Very shelly sand
28	50.00	-45.20	N/A	120.00	4- Lime Stone/Very shelly sand
29	53.00	-48.20	N/A	120.00	4- Lime Stone/Very shelly sand
30	55.00	-50.20	N/A	120.00	4- Lime Stone/Very shelly sand
31	58.00	-53.20	N/A	120.00	4- Lime Stone/Very shelly sand
32	60.00	-55.20	N/A	120.00	4- Lime Stone/Very shelly sand
33	63.00	-58.20	N/A	120.00	4- Lime Stone/Very shelly sand
34	65.00	-60.20	N/A	120.00	4- Lime Stone/Very shelly sand
35	68.00	-63.20	N/A	120.00	4- Lime Stone/Very shelly sand
36	70.00	-65.20	N/A	120.00	4- Lime Stone/Very shelly sand
37	73.00	-68.20	N/A	120.00	4- Lime Stone/Very shelly sand
38	75.00	-70.20	N/A	120.00	4- Lime Stone/Very shelly sand
39	78.00	-73.20	N/A	120.00	4- Lime Stone/Very shelly sand
40	80.00	-75.20	N/A	120.00	4- Lime Stone/Very shelly sand

ID	Cu-DIR (tsf)	qu (tsf)	qt (tsf)	Em (ksi)	qb (tsf)
1	N/A	N/A	N/A	N/A	N/A
2	N/A	N/A	N/A	N/A	N/A
3	N/A	N/A	N/A	N/A	N/A
4	N/A	N/A	N/A	N/A	N/A
5	N/A	N/A	N/A	N/A	N/A
6	N/A	N/A	N/A	N/A	N/A
7	N/A	N/A	N/A	N/A	N/A
8	N/A	N/A	N/A	N/A	N/A
9	N/A	N/A	N/A	N/A	N/A
10	N/A	N/A	N/A	N/A	N/A
11	N/A	N/A	N/A	N/A	N/A
12	N/A	N/A	N/A	N/A	N/A
13	N/A	N/A	N/A	N/A	N/A

14	N/A	N/A	N/A	N/A	N/A
15	N/A	N/A	N/A	N/A	N/A
16	N/A	N/A	N/A	N/A	N/A
17	N/A	N/A	N/A	N/A	N/A
18	N/A	N/A	N/A	N/A	N/A
19	N/A	17.75	3.55	0.00	0.00
20	N/A	17.75	3.55	0.00	0.00
21	N/A	17.75	3.55	0.00	0.00
22	N/A	N/A	N/A	N/A	N/A
23	N/A	N/A	N/A	N/A	N/A
24	N/A	N/A	N/A	N/A	N/A
25	N/A	N/A	N/A	N/A	N/A
26	N/A	17.75	3.55	0.00	0.00
27	N/A	17.75	3.55	0.00	0.00
28	N/A	17.75	3.55	0.00	0.00
29	N/A	17.75	3.55	0.00	0.00
30	N/A	17.75	3.55	0.00	0.00
31	N/A	17.75	3.55	0.00	0.00
32	N/A	17.75	3.55	0.00	0.00
33	N/A	17.75	3.55	0.00	0.00
34	N/A	17.75	3.55	0.00	0.00
35	N/A	17.75	3.55	0.00	0.00
36	N/A	17.75	3.55	0.00	0.00
37	N/A	17.75	3.55	0.00	0.00
38	N/A	17.75	3.55	0.00	0.00
39	N/A	17.75	3.55	0.00	0.00
40	N/A	17.75	3.55	0.00	0.00

ID	RQD F.M.	S.R.I.	Rock Recovery
1	N/A	N/A	N/A
2	N/A	N/A	N/A
3	N/A	N/A	N/A
4	N/A	N/A	N/A
5	N/A	N/A	N/A
6	N/A	N/A	N/A
7	N/A	N/A	N/A
8	N/A	N/A	N/A
9	N/A	N/A	N/A
10	N/A	N/A	N/A
11	N/A	N/A	N/A
12	N/A	N/A	N/A
13	N/A	N/A	N/A
14	N/A	N/A	N/A
15	N/A	N/A	N/A
16	N/A	N/A	N/A
17	N/A	N/A	N/A
18	N/A	N/A	N/A
19	1.00	ROUGH	1.000
20	1.00	ROUGH	1.000
21	1.00	ROUGH	1.000
22	N/A	N/A	N/A
23	N/A	N/A	N/A
24	N/A	N/A	N/A
25	N/A	N/A	N/A
26	1.00	ROUGH	1.000
27	1.00	ROUGH	1.000
28	1.00	ROUGH	1.000
29	1.00	ROUGH	1.000
30	1.00	ROUGH	1.000
31	1.00	ROUGH	1.000
32	1.00	ROUGH	1.000
33	1.00	ROUGH	1.000
34	1.00	ROUGH	1.000
35	1.00	ROUGH	1.000
36	1.00	ROUGH	1.000
37	1.00	ROUGH	1.000
38	1.00	ROUGH	1.000
39	1.00	ROUGH	1.000
40	1.00	ROUGH	1.000

Drilled Shaft Data:
==========
Unit weight of concrete = 150.00(pcf), Concrete Slump = 6.00(in)
Modulus of Elasticity of concrete = 4000.00(ksi)

Shaft Geometry:

ID	Length (ft)	Tip Elev. (ft)	Case Len. (ft)	Diameter (in)	Base Diam. (in)	Bell Len. (ft)
1	1.00	3.80	0.00	30.00	30.00	0.00
2	2.00	2.80	0.00	30.00	30.00	0.00
3	3.00	1.80	0.00	30.00	30.00	0.00
4	4.00	0.80	0.00	30.00	30.00	0.00
5	5.00	-0.20	0.00	30.00	30.00	0.00
6	6.00	-1.20	0.00	30.00	30.00	0.00
7	7.00	-2.20	0.00	30.00	30.00	0.00
8	8.00	-3.20	0.00	30.00	30.00	0.00

9	9.00	-4.20	0.00	30.00	30.00	0.00
10	10.00	-5.20	0.00	30.00	30.00	0.00
11	11.00	-6.20	0.00	30.00	30.00	0.00
12	12.00	-7.20	0.00	30.00	30.00	0.00
13	13.00	-8.20	0.00	30.00	30.00	0.00
14	14.00	-9.20	0.00	30.00	30.00	0.00
15	15.00	-10.20	0.00	30.00	30.00	0.00
16	16.00	-11.20	0.00	30.00	30.00	0.00
17	17.00	-12.20	0.00	30.00	30.00	0.00
18	18.00	-13.20	0.00	30.00	30.00	0.00
19	19.00	-14.20	0.00	30.00	30.00	0.00
20	20.00	-15.20	0.00	30.00	30.00	0.00
21	21.00	-16.20	0.00	30.00	30.00	0.00
22	22.00	-17.20	0.00	30.00	30.00	0.00
23	23.00	-18.20	0.00	30.00	30.00	0.00
24	24.00	-19.20	0.00	30.00	30.00	0.00
25	25.00	-20.20	0.00	30.00	30.00	0.00
26	26.00	-21.20	0.00	30.00	30.00	0.00
27	27.00	-22.20	0.00	30.00	30.00	0.00
28	28.00	-23.20	0.00	30.00	30.00	0.00
29	29.00	-24.20	0.00	30.00	30.00	0.00
30	30.00	-25.20	0.00	30.00	30.00	0.00
31	31.00	-26.20	0.00	30.00	30.00	0.00
32	32.00	-27.20	0.00	30.00	30.00	0.00
33	33.00	-28.20	0.00	30.00	30.00	0.00
34	34.00	-29.20	0.00	30.00	30.00	0.00
35	35.00	-30.20	0.00	30.00	30.00	0.00
36	36.00	-31.20	0.00	30.00	30.00	0.00
37	37.00	-32.20	0.00	30.00	30.00	0.00
38	38.00	-33.20	0.00	30.00	30.00	0.00
39	39.00	-34.20	0.00	30.00	30.00	0.00
40	40.00	-35.20	0.00	30.00	30.00	0.00
41	41.00	-36.20	0.00	30.00	30.00	0.00
42	42.00	-37.20	0.00	30.00	30.00	0.00
43	43.00	-38.20	0.00	30.00	30.00	0.00
44	44.00	-39.20	0.00	30.00	30.00	0.00
45	45.00	-40.20	0.00	30.00	30.00	0.00
46	46.00	-41.20	0.00	30.00	30.00	0.00
47	47.00	-42.20	0.00	30.00	30.00	0.00
48	48.00	-43.20	0.00	30.00	30.00	0.00
49	49.00	-44.20	0.00	30.00	30.00	0.00
50	50.00	-45.20	0.00	30.00	30.00	0.00
51	51.00	-46.20	0.00	30.00	30.00	0.00
52	52.00	-47.20	0.00	30.00	30.00	0.00
53	53.00	-48.20	0.00	30.00	30.00	0.00
54	54.00	-49.20	0.00	30.00	30.00	0.00
55	55.00	-50.20	0.00	30.00	30.00	0.00
56	56.00	-51.20	0.00	30.00	30.00	0.00
57	57.00	-52.20	0.00	30.00	30.00	0.00
58	58.00	-53.20	0.00	30.00	30.00	0.00
59	59.00	-54.20	0.00	30.00	30.00	0.00
60	60.00	-55.20	0.00	30.00	30.00	0.00
61	61.00	-56.20	0.00	30.00	30.00	0.00
62	62.00	-57.20	0.00	30.00	30.00	0.00
63	63.00	-58.20	0.00	30.00	30.00	0.00
64	64.00	-59.20	0.00	30.00	30.00	0.00
65	65.00	-60.20	0.00	30.00	30.00	0.00
66	66.00	-61.20	0.00	30.00	30.00	0.00
67	67.00	-62.20	0.00	30.00	30.00	0.00
68	68.00	-63.20	0.00	30.00	30.00	0.00
69	69.00	-64.20	0.00	30.00	30.00	0.00
70	70.00	-65.20	0.00	30.00	30.00	0.00
71	71.00	-66.20	0.00	30.00	30.00	0.00
72	72.00	-67.20	0.00	30.00	30.00	0.00
73	73.00	-68.20	0.00	30.00	30.00	0.00
74	74.00	-69.20	0.00	30.00	30.00	0.00
75	75.00	-70.20	0.00	30.00	30.00	0.00
76	76.00	-71.20	0.00	30.00	30.00	0.00
77	77.00	-72.20	0.00	30.00	30.00	0.00
78	78.00	-73.20	0.00	30.00	30.00	0.00
79	79.00	-74.20	0.00	30.00	30.00	0.00

Drilled Shaft Capacity (sorted by shaft diameter):

Strength reduction factors: Skin-friction = 1.00, End-bearing = 0.00

ID	Diameter (in)	Length (ft)	Skin Fric. (tons)	End Bearing (tons)	Capacity (tons)
1	30.00	1.00	0.000	0.000	0.000
2	30.00	2.00	0.000	0.000	0.000
3	30.00	3.00	0.000	0.000	0.000
4	30.00	4.00	0.000	0.000	0.000
5	30.00	5.00	0.000	0.000	0.000
6	30.00	6.00	0.000	0.000	0.000
7	30.00	7.00	0.000	0.000	0.000
8	30.00	8.00	0.000	0.000	0.000
9	30.00	9.00	0.000	0.000	0.000
10	30.00	10.00	0.000	0.000	0.000
11	30.00	11.00	0.000	0.000	0.000

12	30.00	12.00	0.000	0.000	0.000
13	30.00	13.00	0.000	0.000	0.000
14	30.00	14.00	0.000	0.000	0.000
15	30.00	15.00	0.000	0.000	0.000
16	30.00	16.00	0.000	0.000	0.000
17	30.00	17.00	0.000	0.000	0.000
18	30.00	18.00	0.000	0.000	0.000
19	30.00	19.00	0.000	0.000	0.000
20	30.00	20.00	0.000	0.000	0.000
21	30.00	21.00	0.000	0.000	0.000
22	30.00	22.00	0.000	0.000	0.000
23	30.00	23.00	0.000	0.000	0.000
24	30.00	24.00	0.000	0.000	0.000
25	30.00	25.00	0.000	0.000	0.000
26	30.00	26.00	0.000	0.000	0.000
27	30.00	27.00	0.000	0.000	0.000
28	30.00	28.00	0.000	0.000	0.000
29	30.00	29.00	0.000	0.000	0.000
30	30.00	30.00	0.000	0.000	0.000
31	30.00	31.00	0.000	0.000	0.000
32	30.00	32.00	0.000	0.000	0.000
33	30.00	33.00	0.000	0.000	0.000
34	30.00	34.00	0.000	0.000	0.000
35	30.00	35.00	6.235	0.000	6.235
36	30.00	36.00	37.407	0.000	37.407
37	30.00	37.00	68.580	0.000	68.580
38	30.00	38.00	99.752	0.000	99.752
39	30.00	39.00	130.925	0.000	130.925
40	30.00	40.00	162.098	0.000	162.098
41	30.00	41.00	165.964	0.000	165.964
42	30.00	42.00	166.921	0.000	166.921
43	30.00	43.00	168.000	0.000	168.000
44	30.00	44.00	169.201	0.000	169.201
45	30.00	45.00	170.516	0.000	170.516
46	30.00	46.00	171.944	0.000	171.944
47	30.00	47.00	203.116	0.000	203.116
48	30.00	48.00	234.289	0.000	234.289
49	30.00	49.00	265.461	0.000	265.461
50	30.00	50.00	296.634	0.000	296.634
51	30.00	51.00	327.807	0.000	327.807
52	30.00	52.00	358.979	0.000	358.979
53	30.00	53.00	390.152	0.000	390.152
54	30.00	54.00	421.325	0.000	421.325
55	30.00	55.00	452.497	0.000	452.497
56	30.00	56.00	483.670	0.000	483.670
57	30.00	57.00	514.842	0.000	514.842
58	30.00	58.00	546.015	0.000	546.015
59	30.00	59.00	577.188	0.000	577.188
60	30.00	60.00	608.360	0.000	608.360
61	30.00	61.00	639.533	0.000	639.533
62	30.00	62.00	670.705	0.000	670.705
63	30.00	63.00	701.878	0.000	701.878
64	30.00	64.00	733.051	0.000	733.051
65	30.00	65.00	764.223	0.000	764.223
66	30.00	66.00	795.396	0.000	795.396
67	30.00	67.00	826.569	0.000	826.569
68	30.00	68.00	857.741	0.000	857.741
69	30.00	69.00	888.914	0.000	888.914
70	30.00	70.00	920.086	0.000	920.086
71	30.00	71.00	951.259	0.000	951.259
72	30.00	72.00	982.432	0.000	982.432
73	30.00	73.00	1013.604	0.000	1013.604
74	30.00	74.00	1044.777	0.000	1044.777
75	30.00	75.00	1075.949	0.000	1075.949
76	30.00	76.00	1107.122	0.000	1107.122
77	30.00	77.00	1138.295	0.000	1138.295
78	30.00	78.00	1169.467	0.000	1169.467
79	30.00	79.00	1200.640	0.000	1200.640

Drilled Shaft Capacity at User-Defined Settlement (sorted by shaft diameter):

***** Capacity is NOT modified by the strength reduction factors *****

User-Defined Settlement = 0.00%

ID	Diameter (in)	Length (ft)	Skin Fric. (tons)	End Bearing (tons)	Capacity (tons)
1	30.00	1.00	0.000	0.000	0.000
2	30.00	2.00	0.000	0.000	0.000
3	30.00	3.00	0.000	0.000	0.000
4	30.00	4.00	0.000	0.000	0.000
5	30.00	5.00	0.000	0.000	0.000
6	30.00	6.00	0.000	0.000	0.000
7	30.00	7.00	0.000	0.000	0.000
8	30.00	8.00	0.000	0.000	0.000
9	30.00	9.00	0.000	0.000	0.000
10	30.00	10.00	0.000	0.000	0.000
11	30.00	11.00	0.000	0.000	0.000

12	30.00	12.00	0.000	0.000	0.000
13	30.00	13.00	0.000	0.000	0.000
14	30.00	14.00	0.000	0.000	0.000
15	30.00	15.00	0.000	0.000	0.000
16	30.00	16.00	0.000	0.000	0.000
17	30.00	17.00	0.000	0.000	0.000
18	30.00	18.00	0.000	0.000	0.000
19	30.00	19.00	0.000	0.000	0.000
20	30.00	20.00	0.000	0.000	0.000
21	30.00	21.00	0.000	0.000	0.000
22	30.00	22.00	0.000	0.000	0.000
23	30.00	23.00	0.000	0.000	0.000
24	30.00	24.00	0.000	0.000	0.000
25	30.00	25.00	0.000	0.000	0.000
26	30.00	26.00	0.000	0.000	0.000
27	30.00	27.00	0.000	0.000	0.000
28	30.00	28.00	0.000	0.000	0.000
29	30.00	29.00	0.000	0.000	0.000
30	30.00	30.00	0.000	0.000	0.000
31	30.00	31.00	0.000	0.000	0.000
32	30.00	32.00	0.000	0.000	0.000
33	30.00	33.00	0.000	0.000	0.000
34	30.00	34.00	0.000	0.000	0.000
35	30.00	35.00	-nan(ind)	-nan(ind)	-nan(ind)
36	30.00	36.00	-nan(ind)	-nan(ind)	-nan(ind)
37	30.00	37.00	-nan(ind)	-nan(ind)	-nan(ind)
38	30.00	38.00	-nan(ind)	-nan(ind)	-nan(ind)
39	30.00	39.00	-nan(ind)	-nan(ind)	-nan(ind)
40	30.00	40.00	-nan(ind)	-nan(ind)	-nan(ind)
41	30.00	41.00	-nan(ind)	0.000	-nan(ind)
42	30.00	42.00	-nan(ind)	0.000	-nan(ind)
43	30.00	43.00	-nan(ind)	0.000	-nan(ind)
44	30.00	44.00	-nan(ind)	0.000	-nan(ind)
45	30.00	45.00	-nan(ind)	0.000	-nan(ind)
46	30.00	46.00	-nan(ind)	-nan(ind)	-nan(ind)
47	30.00	47.00	-nan(ind)	-nan(ind)	-nan(ind)
48	30.00	48.00	-nan(ind)	-nan(ind)	-nan(ind)
49	30.00	49.00	-nan(ind)	-nan(ind)	-nan(ind)
50	30.00	50.00	-nan(ind)	-nan(ind)	-nan(ind)
51	30.00	51.00	-nan(ind)	-nan(ind)	-nan(ind)
52	30.00	52.00	-nan(ind)	-nan(ind)	-nan(ind)
53	30.00	53.00	-nan(ind)	-nan(ind)	-nan(ind)
54	30.00	54.00	-nan(ind)	-nan(ind)	-nan(ind)
55	30.00	55.00	-nan(ind)	-nan(ind)	-nan(ind)
56	30.00	56.00	-nan(ind)	-nan(ind)	-nan(ind)
57	30.00	57.00	-nan(ind)	-nan(ind)	-nan(ind)
58	30.00	58.00	-nan(ind)	-nan(ind)	-nan(ind)
59	30.00	59.00	-nan(ind)	-nan(ind)	-nan(ind)
60	30.00	60.00	-nan(ind)	-nan(ind)	-nan(ind)
61	30.00	61.00	-nan(ind)	-nan(ind)	-nan(ind)
62	30.00	62.00	-nan(ind)	-nan(ind)	-nan(ind)
63	30.00	63.00	-nan(ind)	-nan(ind)	-nan(ind)
64	30.00	64.00	-nan(ind)	-nan(ind)	-nan(ind)
65	30.00	65.00	-nan(ind)	-nan(ind)	-nan(ind)
66	30.00	66.00	-nan(ind)	-nan(ind)	-nan(ind)
67	30.00	67.00	-nan(ind)	-nan(ind)	-nan(ind)
68	30.00	68.00	-nan(ind)	-nan(ind)	-nan(ind)
69	30.00	69.00	-nan(ind)	-nan(ind)	-nan(ind)
70	30.00	70.00	-nan(ind)	-nan(ind)	-nan(ind)
71	30.00	71.00	-nan(ind)	-nan(ind)	-nan(ind)
72	30.00	72.00	-nan(ind)	-nan(ind)	-nan(ind)
73	30.00	73.00	-nan(ind)	-nan(ind)	-nan(ind)
74	30.00	74.00	-nan(ind)	-nan(ind)	-nan(ind)
75	30.00	75.00	-nan(ind)	-nan(ind)	-nan(ind)
76	30.00	76.00	-nan(ind)	-nan(ind)	-nan(ind)
77	30.00	77.00	-nan(ind)	-nan(ind)	-nan(ind)
78	30.00	78.00	-nan(ind)	-nan(ind)	-nan(ind)
79	30.00	79.00	-nan(ind)	-nan(ind)	-nan(ind)

General Information:
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Input file: ..... Bridge\Revised II 02-18-21\Bridge\FB-DEEP\ACIP\B-2_30 inch.in
Project number: HR20-1583R
Job name: Atlantic Isle Bridge
Engineer: Chollada
Units: English

Analysis Information:
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Analysis Type: Drilled Shaft Analysis

Soil Information:
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Boring date: 12/04/17
Boring number: B-2
Station number: 14+10 Offset: 20.0 RT

Ground Elevation: 2.40(ft)
Water table Elevation = 0.50(ft)

Rock side-friction is calculated using: McVay's method
Hammer type: Automatic Hammer, Correction factor = 1.24

ID	Depth (ft)	Elevation (ft)	SPT Blows (Blows/ft)	Unit Weight (pcf)	Soil Type
1	0.00	2.40	N/A	0.00	5- Cavity layer
2	2.00	0.40	N/A	0.00	5- Cavity layer
3	4.00	-1.60	N/A	0.00	5- Cavity layer
4	6.00	-3.60	N/A	120.00	5- Cavity layer
5	8.00	-5.60	N/A	120.00	5- Cavity layer
6	10.00	-7.60	N/A	120.00	5- Cavity layer
7	13.00	-10.60	N/A	120.00	5- Cavity layer
8	15.00	-12.60	N/A	120.00	5- Cavity layer
9	16.00	-13.60	N/A	120.00	5- Cavity layer
10	17.00	-14.60	N/A	120.00	5- Cavity layer
11	18.00	-15.60	N/A	120.00	5- Cavity layer
12	20.00	-17.60	N/A	120.00	5- Cavity layer
13	23.00	-20.60	N/A	120.00	5- Cavity layer
14	25.00	-22.60	N/A	120.00	5- Cavity layer
15	28.00	-25.60	N/A	120.00	5- Cavity layer
16	30.00	-27.60	N/A	120.00	5- Cavity layer
17	32.40	-30.00	N/A	120.00	5- Cavity layer
18	32.40	-30.00	10.00	120.00	3- Clean sand
19	33.00	-30.60	10.00	120.00	3- Clean sand
20	34.00	-31.60	N/A	120.00	4- Lime Stone/Very shelly sand
21	35.00	-32.60	N/A	120.00	4- Lime Stone/Very shelly sand
22	38.00	-35.60	N/A	120.00	4- Lime Stone/Very shelly sand
23	38.10	-35.70	3.00	101.26	3- Clean sand
24	40.00	-37.60	3.00	101.26	3- Clean sand
25	42.00	-39.60	6.00	104.51	3- Clean sand
26	42.90	-40.50	6.00	104.51	3- Clean sand
27	43.00	-40.60	N/A	120.00	4- Lime Stone/Very shelly sand
28	45.00	-42.60	N/A	120.00	4- Lime Stone/Very shelly sand
29	48.00	-45.60	N/A	120.00	4- Lime Stone/Very shelly sand
30	50.00	-47.60	N/A	120.00	4- Lime Stone/Very shelly sand
31	53.00	-50.60	N/A	120.00	4- Lime Stone/Very shelly sand
32	55.00	-52.60	N/A	120.00	4- Lime Stone/Very shelly sand
33	58.00	-55.60	N/A	120.00	4- Lime Stone/Very shelly sand
34	60.00	-57.60	N/A	120.00	4- Lime Stone/Very shelly sand
35	62.00	-59.60	N/A	120.00	4- Lime Stone/Very shelly sand
36	65.00	-62.60	N/A	120.00	4- Lime Stone/Very shelly sand
37	68.00	-65.60	N/A	120.00	4- Lime Stone/Very shelly sand
38	70.00	-67.60	N/A	120.00	4- Lime Stone/Very shelly sand
39	73.00	-70.60	N/A	120.00	4- Lime Stone/Very shelly sand
40	75.00	-72.60	10.00	120.00	3- Clean sand
41	78.00	-75.60	19.00	120.00	3- Clean sand
42	80.00	-77.60	N/A	120.00	4- Lime Stone/Very shelly sand

ID	Cu-DIR (tsf)	qu (tsf)	qt (tsf)	Em (ksi)	qb (tsf)
1	N/A	N/A	N/A	N/A	N/A
2	N/A	N/A	N/A	N/A	N/A
3	N/A	N/A	N/A	N/A	N/A
4	N/A	N/A	N/A	N/A	N/A
5	N/A	N/A	N/A	N/A	N/A
6	N/A	N/A	N/A	N/A	N/A
7	N/A	N/A	N/A	N/A	N/A
8	N/A	N/A	N/A	N/A	N/A
9	N/A	N/A	N/A	N/A	N/A
10	N/A	N/A	N/A	N/A	N/A
11	N/A	N/A	N/A	N/A	N/A

12	N/A	N/A	N/A	N/A	N/A
13	N/A	N/A	N/A	N/A	N/A
14	N/A	N/A	N/A	N/A	N/A
15	N/A	N/A	N/A	N/A	N/A
16	N/A	N/A	N/A	N/A	N/A
17	N/A	N/A	N/A	N/A	N/A
18	N/A	N/A	N/A	N/A	N/A
19	N/A	N/A	N/A	N/A	N/A
20	N/A	17.19	3.40	0.00	0.00
21	N/A	17.19	3.40	0.00	0.00
22	N/A	17.75	3.55	0.00	0.00
23	N/A	N/A	N/A	N/A	N/A
24	N/A	N/A	N/A	N/A	N/A
25	N/A	N/A	N/A	N/A	N/A
26	N/A	N/A	N/A	N/A	N/A
27	N/A	17.75	3.55	0.00	0.00
28	N/A	17.75	3.55	0.00	0.00
29	N/A	17.75	3.55	0.00	0.00
30	N/A	17.75	3.55	0.00	0.00
31	N/A	17.75	3.55	0.00	0.00
32	N/A	17.75	3.55	0.00	0.00
33	N/A	17.75	3.55	0.00	0.00
34	N/A	17.75	3.55	0.00	0.00
35	N/A	17.75	3.55	0.00	0.00
36	N/A	17.75	3.55	0.00	0.00
37	N/A	17.75	3.55	0.00	0.00
38	N/A	17.75	3.55	0.00	0.00
39	N/A	17.75	3.55	0.00	0.00
40	N/A	N/A	N/A	N/A	N/A
41	N/A	N/A	N/A	N/A	N/A
42	N/A	17.75	3.55	0.00	0.00

ID	RQD F.M.	S.R.I.	Rock Recovery
1	N/A	N/A	N/A
2	N/A	N/A	N/A
3	N/A	N/A	N/A
4	N/A	N/A	N/A
5	N/A	N/A	N/A
6	N/A	N/A	N/A
7	N/A	N/A	N/A
8	N/A	N/A	N/A
9	N/A	N/A	N/A
10	N/A	N/A	N/A
11	N/A	N/A	N/A
12	N/A	N/A	N/A
13	N/A	N/A	N/A
14	N/A	N/A	N/A
15	N/A	N/A	N/A
16	N/A	N/A	N/A
17	N/A	N/A	N/A
18	N/A	N/A	N/A
19	N/A	N/A	N/A
20	1.00	ROUGH	1.000
21	1.00	ROUGH	1.000
22	1.00	ROUGH	1.000
23	N/A	N/A	N/A
24	N/A	N/A	N/A
25	N/A	N/A	N/A
26	N/A	N/A	N/A
27	1.00	ROUGH	1.000
28	1.00	ROUGH	1.000
29	1.00	ROUGH	1.000
30	1.00	ROUGH	1.000
31	1.00	ROUGH	1.000
32	1.00	ROUGH	1.000
33	1.00	ROUGH	1.000
34	1.00	ROUGH	1.000
35	1.00	ROUGH	1.000
36	1.00	ROUGH	1.000
37	1.00	ROUGH	1.000
38	1.00	ROUGH	1.000
39	1.00	ROUGH	1.000
40	N/A	N/A	N/A
41	N/A	N/A	N/A
42	1.00	ROUGH	1.000

Drilled Shaft Data:
==========
Unit weight of concrete = 150.00(pcf), Concrete Slump = 6.00(in)
Modulus of Elasticity of concrete = 4000.00(ksi)

Shaft Geometry:

ID	Length (ft)	Tip Elev. (ft)	Case Len. (ft)	Diameter (in)	Base Diam. (in)	Bell Len. (ft)
1	1.00	1.40	0.00	30.00	30.00	0.00
2	2.00	0.40	0.00	30.00	30.00	0.00

3	3.00	-0.60	0.00	30.00	30.00	0.00
4	4.00	-1.60	0.00	30.00	30.00	0.00
5	5.00	-2.60	0.00	30.00	30.00	0.00
6	6.00	-3.60	0.00	30.00	30.00	0.00
7	7.00	-4.60	0.00	30.00	30.00	0.00
8	8.00	-5.60	0.00	30.00	30.00	0.00
9	9.00	-6.60	0.00	30.00	30.00	0.00
10	10.00	-7.60	0.00	30.00	30.00	0.00
11	11.00	-8.60	0.00	30.00	30.00	0.00
12	12.00	-9.60	0.00	30.00	30.00	0.00
13	13.00	-10.60	0.00	30.00	30.00	0.00
14	14.00	-11.60	0.00	30.00	30.00	0.00
15	15.00	-12.60	0.00	30.00	30.00	0.00
16	16.00	-13.60	0.00	30.00	30.00	0.00
17	17.00	-14.60	0.00	30.00	30.00	0.00
18	18.00	-15.60	0.00	30.00	30.00	0.00
19	19.00	-16.60	0.00	30.00	30.00	0.00
20	20.00	-17.60	0.00	30.00	30.00	0.00
21	21.00	-18.60	0.00	30.00	30.00	0.00
22	22.00	-19.60	0.00	30.00	30.00	0.00
23	23.00	-20.60	0.00	30.00	30.00	0.00
24	24.00	-21.60	0.00	30.00	30.00	0.00
25	25.00	-22.60	0.00	30.00	30.00	0.00
26	26.00	-23.60	0.00	30.00	30.00	0.00
27	27.00	-24.60	0.00	30.00	30.00	0.00
28	28.00	-25.60	0.00	30.00	30.00	0.00
29	29.00	-26.60	0.00	30.00	30.00	0.00
30	30.00	-27.60	0.00	30.00	30.00	0.00
31	31.00	-28.60	0.00	30.00	30.00	0.00
32	32.00	-29.60	0.00	30.00	30.00	0.00
33	33.00	-30.60	0.00	30.00	30.00	0.00
34	34.00	-31.60	0.00	30.00	30.00	0.00
35	35.00	-32.60	0.00	30.00	30.00	0.00
36	36.00	-33.60	0.00	30.00	30.00	0.00
37	37.00	-34.60	0.00	30.00	30.00	0.00
38	38.00	-35.60	0.00	30.00	30.00	0.00
39	39.00	-36.60	0.00	30.00	30.00	0.00
40	40.00	-37.60	0.00	30.00	30.00	0.00
41	41.00	-38.60	0.00	30.00	30.00	0.00
42	42.00	-39.60	0.00	30.00	30.00	0.00
43	43.00	-40.60	0.00	30.00	30.00	0.00
44	44.00	-41.60	0.00	30.00	30.00	0.00
45	45.00	-42.60	0.00	30.00	30.00	0.00
46	46.00	-43.60	0.00	30.00	30.00	0.00
47	47.00	-44.60	0.00	30.00	30.00	0.00
48	48.00	-45.60	0.00	30.00	30.00	0.00
49	49.00	-46.60	0.00	30.00	30.00	0.00
50	50.00	-47.60	0.00	30.00	30.00	0.00
51	51.00	-48.60	0.00	30.00	30.00	0.00
52	52.00	-49.60	0.00	30.00	30.00	0.00
53	53.00	-50.60	0.00	30.00	30.00	0.00
54	54.00	-51.60	0.00	30.00	30.00	0.00
55	55.00	-52.60	0.00	30.00	30.00	0.00
56	56.00	-53.60	0.00	30.00	30.00	0.00
57	57.00	-54.60	0.00	30.00	30.00	0.00
58	58.00	-55.60	0.00	30.00	30.00	0.00
59	59.00	-56.60	0.00	30.00	30.00	0.00
60	60.00	-57.60	0.00	30.00	30.00	0.00
61	61.00	-58.60	0.00	30.00	30.00	0.00
62	62.00	-59.60	0.00	30.00	30.00	0.00
63	63.00	-60.60	0.00	30.00	30.00	0.00
64	64.00	-61.60	0.00	30.00	30.00	0.00
65	65.00	-62.60	0.00	30.00	30.00	0.00
66	66.00	-63.60	0.00	30.00	30.00	0.00
67	67.00	-64.60	0.00	30.00	30.00	0.00
68	68.00	-65.60	0.00	30.00	30.00	0.00
69	69.00	-66.60	0.00	30.00	30.00	0.00
70	70.00	-67.60	0.00	30.00	30.00	0.00
71	71.00	-68.60	0.00	30.00	30.00	0.00
72	72.00	-69.60	0.00	30.00	30.00	0.00
73	73.00	-70.60	0.00	30.00	30.00	0.00
74	74.00	-71.60	0.00	30.00	30.00	0.00

Drilled Shaft Capacity (sorted by shaft diameter):

Strength reduction factors: Skin-friction = 1.00, End-bearing = 0.00

ID	Diameter (in)	Length (ft)	Skin Fric. (tons)	End Bearing (tons)	Capacity (tons)
1	30.00	1.00	0.000	0.000	0.000
2	30.00	2.00	0.000	0.000	0.000
3	30.00	3.00	0.000	0.000	0.000
4	30.00	4.00	0.000	0.000	0.000
5	30.00	5.00	0.000	0.000	0.000
6	30.00	6.00	0.000	0.000	0.000
7	30.00	7.00	0.000	0.000	0.000
8	30.00	8.00	0.000	0.000	0.000
9	30.00	9.00	0.000	0.000	0.000
10	30.00	10.00	0.000	0.000	0.000

11	30.00	11.00	0.000	0.000	0.000
12	30.00	12.00	0.000	0.000	0.000
13	30.00	13.00	0.000	0.000	0.000
14	30.00	14.00	0.000	0.000	0.000
15	30.00	15.00	0.000	0.000	0.000
16	30.00	16.00	0.000	0.000	0.000
17	30.00	17.00	0.000	0.000	0.000
18	30.00	18.00	0.000	0.000	0.000
19	30.00	19.00	0.000	0.000	0.000
20	30.00	20.00	0.000	0.000	0.000
21	30.00	21.00	0.000	0.000	0.000
22	30.00	22.00	0.000	0.000	0.000
23	30.00	23.00	0.000	0.000	0.000
24	30.00	24.00	0.000	0.000	0.000
25	30.00	25.00	0.000	0.000	0.000
26	30.00	26.00	0.000	0.000	0.000
27	30.00	27.00	0.000	0.000	0.000
28	30.00	28.00	0.000	0.000	0.000
29	30.00	29.00	0.000	0.000	0.000
30	30.00	30.00	0.000	0.000	0.000
31	30.00	31.00	0.000	0.000	0.000
32	30.00	32.00	0.000	0.000	0.000
33	30.00	33.00	0.025	0.000	0.025
34	30.00	34.00	0.172	0.000	0.172
35	30.00	35.00	30.194	0.000	30.194
36	30.00	36.00	60.216	0.000	60.216
37	30.00	37.00	90.238	0.000	90.238
38	30.00	38.00	120.260	0.000	120.260
39	30.00	39.00	123.682	0.000	123.682
40	30.00	40.00	124.058	0.000	124.058
41	30.00	41.00	124.472	0.000	124.472
42	30.00	42.00	124.924	0.000	124.924
43	30.00	43.00	125.529	0.000	125.529
44	30.00	44.00	156.702	0.000	156.702
45	30.00	45.00	187.874	0.000	187.874
46	30.00	46.00	219.047	0.000	219.047
47	30.00	47.00	250.219	0.000	250.219
48	30.00	48.00	281.392	0.000	281.392
49	30.00	49.00	312.565	0.000	312.565
50	30.00	50.00	343.737	0.000	343.737
51	30.00	51.00	374.910	0.000	374.910
52	30.00	52.00	406.082	0.000	406.082
53	30.00	53.00	437.255	0.000	437.255
54	30.00	54.00	468.428	0.000	468.428
55	30.00	55.00	499.600	0.000	499.600
56	30.00	56.00	530.773	0.000	530.773
57	30.00	57.00	561.946	0.000	561.946
58	30.00	58.00	593.118	0.000	593.118
59	30.00	59.00	624.291	0.000	624.291
60	30.00	60.00	655.463	0.000	655.463
61	30.00	61.00	686.636	0.000	686.636
62	30.00	62.00	717.809	0.000	717.809
63	30.00	63.00	748.981	0.000	748.981
64	30.00	64.00	780.154	0.000	780.154
65	30.00	65.00	811.326	0.000	811.326
66	30.00	66.00	842.499	0.000	842.499
67	30.00	67.00	873.672	0.000	873.672
68	30.00	68.00	904.844	0.000	904.844
69	30.00	69.00	936.017	0.000	936.017
70	30.00	70.00	967.190	0.000	967.190
71	30.00	71.00	998.362	0.000	998.362
72	30.00	72.00	1029.535	0.000	1029.535
73	30.00	73.00	1060.707	0.000	1060.707
74	30.00	74.00	1091.880	0.000	1091.880

Drilled Shaft Capacity at User-Defined Settlement (sorted by shaft diameter):

***** Capacity is NOT modified by the strength reduction factors *****

User-Defined Settlement = 0.00%

ID	Diameter (in)	Length (ft)	Skin Fric. (tons)	End Bearing (tons)	Capacity (tons)
1	30.00	1.00	0.000	0.000	0.000
2	30.00	2.00	0.000	0.000	0.000
3	30.00	3.00	0.000	0.000	0.000
4	30.00	4.00	0.000	0.000	0.000
5	30.00	5.00	0.000	0.000	0.000
6	30.00	6.00	0.000	0.000	0.000
7	30.00	7.00	0.000	0.000	0.000
8	30.00	8.00	0.000	0.000	0.000
9	30.00	9.00	0.000	0.000	0.000
10	30.00	10.00	0.000	0.000	0.000
11	30.00	11.00	0.000	0.000	0.000
12	30.00	12.00	0.000	0.000	0.000
13	30.00	13.00	0.000	0.000	0.000
14	30.00	14.00	0.000	0.000	0.000
15	30.00	15.00	0.000	0.000	0.000

16	30.00	16.00	0.000	0.000	0.000
17	30.00	17.00	0.000	0.000	0.000
18	30.00	18.00	0.000	0.000	0.000
19	30.00	19.00	0.000	0.000	0.000
20	30.00	20.00	0.000	0.000	0.000
21	30.00	21.00	0.000	0.000	0.000
22	30.00	22.00	0.000	0.000	0.000
23	30.00	23.00	0.000	0.000	0.000
24	30.00	24.00	0.000	0.000	0.000
25	30.00	25.00	0.000	0.000	0.000
26	30.00	26.00	0.000	0.000	0.000
27	30.00	27.00	0.000	0.000	0.000
28	30.00	28.00	0.000	0.000	0.000
29	30.00	29.00	0.000	0.000	0.000
30	30.00	30.00	0.000	0.000	0.000
31	30.00	31.00	0.000	0.000	0.000
32	30.00	32.00	0.000	0.000	0.000
33	30.00	33.00	0.000	0.000	0.000
34	30.00	34.00	0.000	-nan(ind)	-nan(ind)
35	30.00	35.00	-nan(ind)	-nan(ind)	-nan(ind)
36	30.00	36.00	-nan(ind)	-nan(ind)	-nan(ind)
37	30.00	37.00	-nan(ind)	-nan(ind)	-nan(ind)
38	30.00	38.00	-nan(ind)	-nan(ind)	-nan(ind)
39	30.00	39.00	-nan(ind)	0.000	-nan(ind)
40	30.00	40.00	-nan(ind)	0.000	-nan(ind)
41	30.00	41.00	-nan(ind)	0.000	-nan(ind)
42	30.00	42.00	-nan(ind)	0.000	-nan(ind)
43	30.00	43.00	-nan(ind)	-nan(ind)	-nan(ind)
44	30.00	44.00	-nan(ind)	-nan(ind)	-nan(ind)
45	30.00	45.00	-nan(ind)	-nan(ind)	-nan(ind)
46	30.00	46.00	-nan(ind)	-nan(ind)	-nan(ind)
47	30.00	47.00	-nan(ind)	-nan(ind)	-nan(ind)
48	30.00	48.00	-nan(ind)	-nan(ind)	-nan(ind)
49	30.00	49.00	-nan(ind)	-nan(ind)	-nan(ind)
50	30.00	50.00	-nan(ind)	-nan(ind)	-nan(ind)
51	30.00	51.00	-nan(ind)	-nan(ind)	-nan(ind)
52	30.00	52.00	-nan(ind)	-nan(ind)	-nan(ind)
53	30.00	53.00	-nan(ind)	-nan(ind)	-nan(ind)
54	30.00	54.00	-nan(ind)	-nan(ind)	-nan(ind)
55	30.00	55.00	-nan(ind)	-nan(ind)	-nan(ind)
56	30.00	56.00	-nan(ind)	-nan(ind)	-nan(ind)
57	30.00	57.00	-nan(ind)	-nan(ind)	-nan(ind)
58	30.00	58.00	-nan(ind)	-nan(ind)	-nan(ind)
59	30.00	59.00	-nan(ind)	-nan(ind)	-nan(ind)
60	30.00	60.00	-nan(ind)	-nan(ind)	-nan(ind)
61	30.00	61.00	-nan(ind)	-nan(ind)	-nan(ind)
62	30.00	62.00	-nan(ind)	-nan(ind)	-nan(ind)
63	30.00	63.00	-nan(ind)	-nan(ind)	-nan(ind)
64	30.00	64.00	-nan(ind)	-nan(ind)	-nan(ind)
65	30.00	65.00	-nan(ind)	-nan(ind)	-nan(ind)
66	30.00	66.00	-nan(ind)	-nan(ind)	-nan(ind)
67	30.00	67.00	-nan(ind)	-nan(ind)	-nan(ind)
68	30.00	68.00	-nan(ind)	-nan(ind)	-nan(ind)
69	30.00	69.00	-nan(ind)	-nan(ind)	-nan(ind)
70	30.00	70.00	-nan(ind)	-nan(ind)	-nan(ind)
71	30.00	71.00	-nan(ind)	-nan(ind)	-nan(ind)
72	30.00	72.00	-nan(ind)	-nan(ind)	-nan(ind)
73	30.00	73.00	-nan(ind)	-nan(ind)	-nan(ind)
74	30.00	74.00	-nan(ind)	-nan(ind)	-nan(ind)

SOIL/ROCK PARAMETERS FOR LATERAL ANALYSIS OF DRILLED SHAFT/AUGERCAST PILE/MICROPILE WITH FB-MULTIPIER

ATLANTIC ISLES BRIDGE

FLORIDA DEPARTMENT OF TRANSPORTATION, DISTRICT 6

FINANCIAL PROJECT ID No. 430029-2-22-02

MIAMI-DADE COUNTY, FLORIDA

HR ENGINEERING SERVICES. INC.

HRES PROJECT No. HR20-1583R

FEBRUARY 24, 2021

Bent	Foundation Type	Borings	Layer No.	Top of Layer Elev. (ft.)	Bottom of Layer Elev. (ft.)	Soil Description	Soil Type	Average SPT N (blows/ft)	Lateral					Axial			Torsional					Tip	
									Soil Model	Internal Friction Angle (Deg.)	Total Unit Weight (lb/ft^3)	Lateral Soil Modulus, (lb/in^3)	Unconfined Compressive Strength, qu (psf)	Soil Model	Total Unit Weight (lb/ft3)	Ult. Unit Skin Friction (psf)	Soil Model	Internal Friction Angle (Deg.)	Total Unit Weight (lb/ft3)	Shear Modulus (k/in^2)	Torsional Shear Stress (lb/ft^2)	Soil Model	Undrained Shear Strength (lb/ft^2)
End Bents 1 and 2	Drilled Shaft/ Micropile	B-1 and B-2	1	-15.0	-30.6	Soft Limestone	Cohesionless	10	Sand Reese	30	120	20	-	Drilled Shaft Sand	120	-	Hyperbolic	30	120	0.8	600	Drilled Shaft Clay	0
			2	-30.6	-35.6	Limestone	Rock	40	Limestone (McVay)	-	120	-	35776	DS Limestone (McVay)	120	8000	Hyperbolic	0	120	11.9	8000	Drilled Shaft Clay	0
			3	-35.6	-40.6	Sand	Cohesionless	9	Sand Reese	30	105	20	-	Drilled Shaft Sand	105	-	Hyperbolic	30	105	0.7	600	Drilled Shaft Clay	0
			4	-40.6	-70.0	Limestone	Rock	40	Limestone (McVay)	-	120	-	35776	DS Limestone (McVay)	120	8000	Hyperbolic	0	120	11.9	8000	Drilled Shaft Clay	0

Notes:

ϕ = 28+N(safety)/4 for sand and soft limestone.

γ = 105*ϕ/30 for sand and 120 pcf for limestone.

Axial unit skin friction and Torsional shear stress estimated using β-Method for drilled shafts in sand and soft limestone and fs=0.1 N (tsf) in limestone,

Lateral soil modulus (k) was estimated using FDOT Soils and Foundation Handbook -sand and soft limestone

Shear Modulus G = E/2(1+ν)

E(ksf) = 30*N for sand and soft limestone and , E = 115qu for limestone ν = 0.3 for sand and soft limestone, 0.2 for limestone.

qu for limestone estimated by equating the side friction obtained by 0.1 N (tsf) and McVay's equation (0.5 (qu.qt)^.5). It is assumed that qt=20% of qu.

Clay with Cu value of 0 has been provided for tip modeling (no tip contribution on DS/MP axial capacity). A Cu value, as required for analysis convergence, may be used for lateral stability analysis purposes.

Note: Since submerged conditions are likely to exist when the design load condition occurs, make no distinction between dry and submerged conditions.

Friction Angles in Sand

The following typical correlation may be used to estimate the soil friction angle, φ:

$$\varphi = N/4 + 28$$

As an alternative, the procedure described in 6.1.1.5 Friction Angle vs. SPT-N shall be used. The maximum Φ value shall be limited to 35 degrees for silty sand (A-2-4) and 38 degrees for clean sand (A-3), unless higher friction angles are statistically supported by laboratory shear strength test results.

Walls founded on berms

When walls are founded through compacted select fill berm, include the portion of the pile with less than 2.5D horizontal soil cover (face-of-pile to face-of-slope) in the unsupported length, and design the portion of the pile with more than 2.5D soil cover as though founded in level ground.

Clay

Use the LPILE or COM624 program guideline to determine k and ε_{50} values. However, limit the properties of clay to stiff clay or weaker (design values for undrained shear strength shall not exceed 2000 psf and the ε_{50} shall not be less than 0.007), unless laboratory stress-strain measurements indicate otherwise.

Rock

The results of SPT borings are most often used for designing sound wall foundations in shallow limestone strata. Less conservative designs require more vigorous sampling and testing to demonstrate that less conservative design values are appropriate in all locations. In the absence of a comprehensive, vigorous sampling and testing program, the design based on SPT borings shall be as follows:

Rock material with N-values less than 10 blows/foot shall be modeled as sand. Rock material with N-values between 10 and 25 blows/foot shall be modeled as sandy gravel:

Friction Angle, $\varphi = N/4 + 33$

The maximum friction angle value shall be limited to 40 degrees, unless higher friction angles are statistically supported by laboratory shear strength test results.

Rock material with N-values of 25 blows/foot or more:

- Use the LPILE or COM624 program guideline to model p-y curves of weak rock.

Modeling rock as stiff clay will be acceptable, provided reasonable conservatism in the selection of k and undrained shear strength are adopted.

AXIAL LOAD RESISTANCE (doesn't normally control the design of sound barrier foundations)

Side Resistance in Sands

Side resistance in cohesionless soils shall be computed by the FHWA Method (Beta Method) specified in the Publication FHWA-IF-99-025 (August, 1999) for drilled shafts as follows:

$$f_s = P'_v \ \beta_c$$
$$\beta_c = \beta * N/15 \text{ where } \beta_c \leq \beta$$
$$\beta = 1.5 - 0.135\ (z)^{0.5} \text{ (z, depth in ft) where } 1.2 \geq \beta \geq 0.25$$

where f_s = Ultimate unit side resistance
The maximum value of f_s shall be limited to 2.1 tsf, unless load test results indicate otherwise.
P'_v = Effective vertical stress

Side Resistance in Rock:

When limestone and calcareous rock cores are obtained for laboratory testing, ultimate unit side resistance shall be estimated as discussed in Appendix A.

When rock cores and laboratory testing are not available, use the following approach:

- If SPT N-value in rock is less than 25 blows / foot, assume sand behavior.
- If SPT N-value in rock is greater than or equal to 25 blows / foot, use the following:
  $f_s = 0.1$ N (tsf) where $f_s \leq 5.0$ tsf

Side Resistance in Clay

Model inorganic clays and silts in accordance with FHWA methods. Shear strength values should be estimated from UU tests, unconfined tests, vane tests, etc. If only SPT tests are available, Consultants are expected to use reasonable judgment in the selection of undrained shear strength from correlations available in the literature.

The shear strength of clay estimated from SPT-N values or CPT results shall not exceed 2000 psf, unless laboratory stress-strain measurements indicate otherwise.

Side resistance shall be computed by the FHWA Method (Alpha Method) specified in the Publication FHWA-IF-99-025 (August, 1999) for drilled shafts as follows:

$$f_s = \alpha\ S_u$$

11.4.3 Young's Modulus

The young's modulus, of soils, can be obtained from following empirical equations:

For Sand

$$E = \alpha * p_a * N_{60} \quad \text{(psf)}$$

Eqn: 11.4.A

where

α = 5 for sands with fines
10 for clean normally consolidated sand
15 for clean overconsolidated sand

p_a = atmospheric pressure (≈ 2000 psf)

N_{60} = corrected SPT blow-count (blows/ft)

Use $\alpha = 15$

$\therefore E = 30{,}000 \cdot N_{60}$ psf

$= 30 \cdot N_{60}$ ksf

$$E = k * B * (1 - \upsilon^2) \quad \text{(psf)}$$

Eqn: 11.4.B

where

k = subgrade modulus (pcf)

B = width of pile (ft)

υ = poisson's ratio

$$E = k * z \quad \text{(psf)}$$

Eqn: 11.4.C

where

k = subgrade modulus (pcf)

z = depth below ground surface (ft)

For Clay

$$E = \beta * C_u \quad \text{(psf)}$$

Eqn: 11.4.D

Shear Modulus

The shear modulus, G of soils, is a function of soil type, past loading, and geological history. It is recommended that G be obtained from insitu tests such as dilatometer, CPT and SPT.

G can be computed from Young's Modulus , E and Poisson's ratio , ν, from the following correlation:

Eqn. b11 $$G = \frac{E}{2(1+\nu)}$$

In the case of no insitu data is available the following guide is provided:

Eqn. b12 $$G = \frac{0.5 * k * z}{(1+\nu)}$$ for sand

Eqn. b13 $$G = \frac{50 * Cu}{(1+\nu)}$$ for Clay

where

k =	soil modulus (F/L3)
z =	depth below ground surface (L)
Cu =	undrained shear strength (F/L2)
	or a spatial average, for the values of GM should be used for any soil profile.

Poisson's Ratio

The following typical values may be used for the Poisson's ratio ν for soils:

ν = 0.2 to 0.3 for sand

= 0.4 to 0.5 for clay

or a spatial average, for the values of ν over depth may be used for soils consisting of both sand and clay.

GENERAL

In order to accommodate the post supports and reinforcement with the required cover, the normal foundation diameter is approximately 30 inches. It is generally desirable and efficient to limit foundation depths to 25 or 30 feet. If the design indicates a 30 inch diameter foundation will need to be longer than 30 feet, a larger diameter foundation should be considered.

NOISE BARRIER FOUNDATIONS

See Section 8.2.4.1

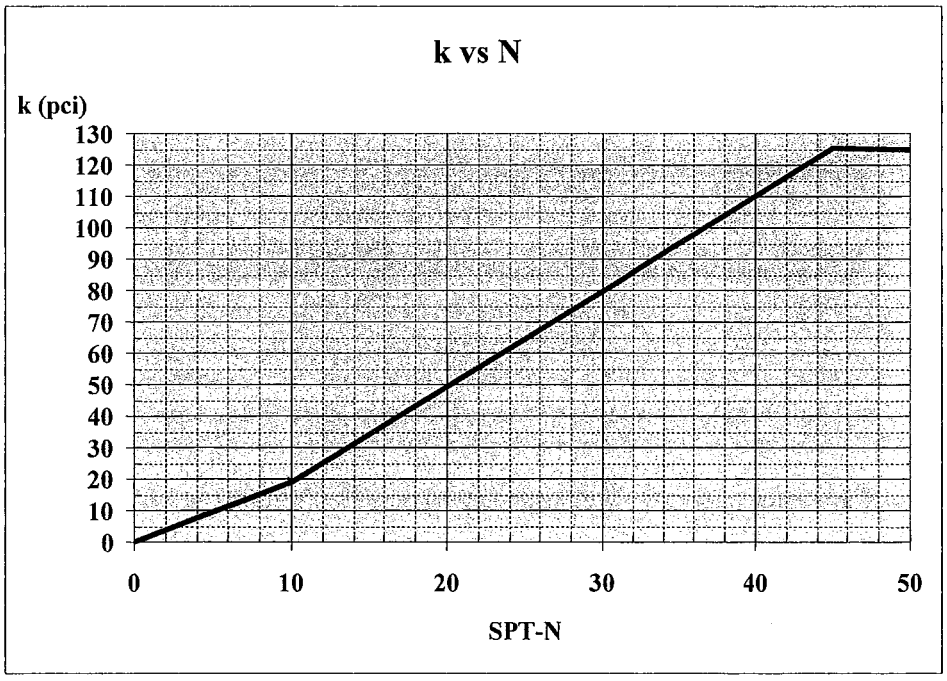
LATERAL LOAD RESISTANCE

Use a Load Factor in accordance with the latest AASHTO LRFD Bridge Design Specifications.

When required, computer programs such as FBPier, LPILE, or COM624 may be used to determine the deflections and rotations.

k values in Sands.

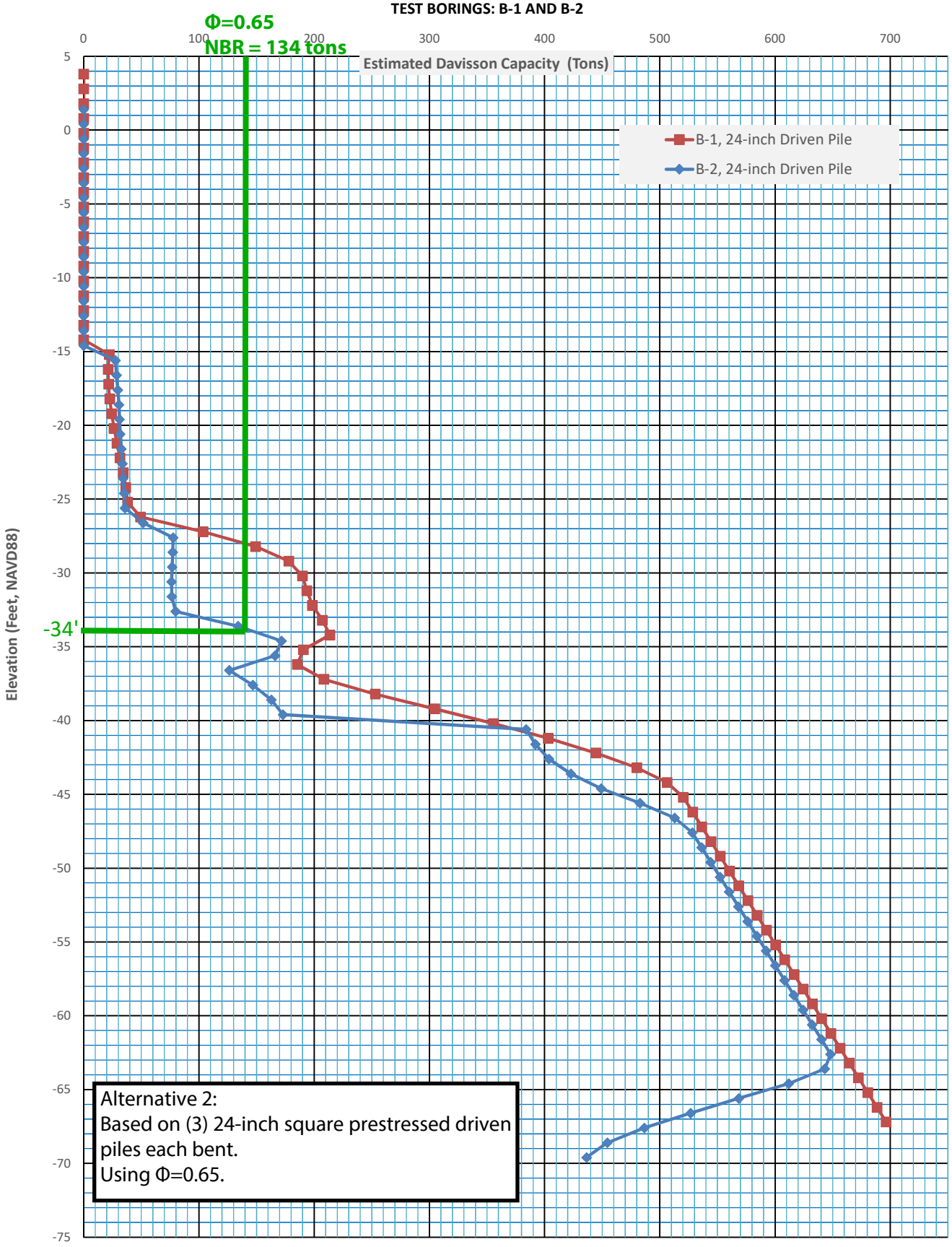
For structures subject to lateral loads due to a storm event, k values input into FBPier, LPILE, or COM624 shall not exceed the following values in pounds per cubic inch, without lateral load tests:



ALTERNATIVE 2

BRIDGE REPLACEMENT
DRIVEN PILE

ATLANTIC ISLES LAGOON BRIDGE
FPID No. 430029-2-22-02
HR ENGINEERING SERVICES, INC.
HRES PROJECT NO. HR20-1583R
DAVISSON CAPACITIES FOR 24-INCH SQUARE CONCRETE DRIVEN PILES
TEST BORINGS: B-1 AND B-2



Alternative 2:
Based on (3) 24-inch square prestressed driven piles each bent.
Using Φ=0.65.

General Information:
==========
Input file: .....tic Isles Lagoon Bridge\Revised 02-18-21\Bridge\FB-DEEP\B-1.in
Project number: HR20-1583R
Job name: Atlantic Isles Lagoon Bridge
Engineer: CS
Units: English

Analysis Information:
==========
Analysis Type: SPT

Soil Information:
==========
Boring date: 12/05/17, Boring Number: B-1
Station number: 13+27 (BL ATLANTIC AVE.) Offset: 6.0 RT

Ground Elevation: 4.800(ft)

Hammer type: Automatic Hammer, Correction factor = 1.24

ID	Depth (ft)	No. of Blows (Blows/ft)	Soil Type
1	0.00	17.00	5- Cavity layer
2	2.00	17.00	5- Cavity layer
3	4.00	8.00	5- Cavity layer
4	6.00	2.00	5- Cavity layer
5	8.00	2.00	5- Cavity layer
6	10.00	2.00	5- Cavity layer
7	12.00	2.00	5- Cavity layer
8	13.00	4.00	5- Cavity layer
9	15.00	37.00	5- Cavity layer
10	18.00	40.00	5- Cavity layer
11	19.80	40.00	5- Cavity layer
12	19.80	8.00	4- Lime Stone/Very shelly sand
13	23.00	7.00	4- Lime Stone/Very shelly sand
14	25.00	4.00	4- Lime Stone/Very shelly sand
15	28.00	3.00	4- Lime Stone/Very shelly sand
16	30.00	8.00	4- Lime Stone/Very shelly sand
17	33.00	8.00	4- Lime Stone/Very shelly sand
18	35.00	8.00	4- Lime Stone/Very shelly sand
19	38.00	8.00	4- Lime Stone/Very shelly sand
20	38.80	8.00	4- Lime Stone/Very shelly sand
21	38.80	100.00	4- Lime Stone/Very shelly sand
22	40.00	100.00	4- Lime Stone/Very shelly sand
23	43.00	13.00	4- Lime Stone/Very shelly sand
24	45.00	16.00	4- Lime Stone/Very shelly sand
25	48.00	49.00	4- Lime Stone/Very shelly sand
26	50.00	100.00	4- Lime Stone/Very shelly sand
27	53.00	100.00	4- Lime Stone/Very shelly sand
28	55.00	100.00	4- Lime Stone/Very shelly sand
29	58.00	100.00	4- Lime Stone/Very shelly sand
30	60.00	100.00	4- Lime Stone/Very shelly sand
31	63.00	100.00	4- Lime Stone/Very shelly sand
32	65.00	100.00	4- Lime Stone/Very shelly sand
33	68.00	100.00	4- Lime Stone/Very shelly sand
34	70.00	100.00	4- Lime Stone/Very shelly sand
35	73.00	100.00	4- Lime Stone/Very shelly sand
36	75.00	100.00	4- Lime Stone/Very shelly sand
37	78.00	100.00	4- Lime Stone/Very shelly sand
38	80.00	100.00	4- Lime Stone/Very shelly sand

Blowcount Average Per Soil Layer

Layer Num.	Starting Elevation (ft)	Bottom Elevation (ft)	Thickness (ft)	Average Blowcount (Blows/ft)	Soil Type
1	4.80	-15.00	19.80	14.60	5-Void
2	-15.00	-75.20	60.20	61.79	4-Limestone, Very Shelly Sand

Driven Pile Data:
==========
Pile unit weight = 150.00(pcf), Section Type: Square

Pile Geometry:

Width (in)	Length (ft)	Tip Elev. (ft)
24.00	1.00	3.80
24.00	2.00	2.80

24.00	3.00	1.80
24.00	4.00	0.80
24.00	5.00	-0.20
24.00	6.00	-1.20
24.00	7.00	-2.20
24.00	8.00	-3.20
24.00	9.00	-4.20
24.00	10.00	-5.20
24.00	11.00	-6.20
24.00	12.00	-7.20
24.00	13.00	-8.20
24.00	14.00	-9.20
24.00	15.00	-10.20
24.00	16.00	-11.20
24.00	17.00	-12.20
24.00	18.00	-13.20
24.00	19.00	-14.20
24.00	20.00	-15.20
24.00	21.00	-16.20
24.00	22.00	-17.20
24.00	23.00	-18.20
24.00	24.00	-19.20
24.00	25.00	-20.20
24.00	26.00	-21.20
24.00	27.00	-22.20
24.00	28.00	-23.20
24.00	29.00	-24.20
24.00	30.00	-25.20
24.00	31.00	-26.20
24.00	32.00	-27.20
24.00	33.00	-28.20
24.00	34.00	-29.20
24.00	35.00	-30.20
24.00	36.00	-31.20
24.00	37.00	-32.20
24.00	38.00	-33.20
24.00	39.00	-34.20
24.00	40.00	-35.20
24.00	41.00	-36.20
24.00	42.00	-37.20
24.00	43.00	-38.20
24.00	44.00	-39.20
24.00	45.00	-40.20
24.00	46.00	-41.20
24.00	47.00	-42.20
24.00	48.00	-43.20
24.00	49.00	-44.20
24.00	50.00	-45.20
24.00	51.00	-46.20
24.00	52.00	-47.20
24.00	53.00	-48.20
24.00	54.00	-49.20
24.00	55.00	-50.20
24.00	56.00	-51.20
24.00	57.00	-52.20
24.00	58.00	-53.20
24.00	59.00	-54.20
24.00	60.00	-55.20
24.00	61.00	-56.20
24.00	62.00	-57.20
24.00	63.00	-58.20
24.00	64.00	-59.20
24.00	65.00	-60.20
24.00	66.00	-61.20
24.00	67.00	-62.20
24.00	68.00	-63.20
24.00	69.00	-64.20
24.00	70.00	-65.20
24.00	71.00	-66.20
24.00	72.00	-67.20

Driven Pile Capacity:
==========

Section Type: Square
Pile Width: 24.00 (in)

Test Pile Length (ft)	Pile Width (in)	Ultimate Side Friction (tons)	Mobilized End Bearing (tons)	Estimated Davisson Capacity (tons)	Allowable Pile Capacity (tons)	Ultimate Pile Capacity (tons)
1.00	24.0	0.00	0.00	0.00	0.00	0.00
2.00	24.0	0.00	0.00	0.00	0.00	0.00
3.00	24.0	0.00	0.00	0.00	0.00	0.00
4.00	24.0	0.00	0.00	0.00	0.00	0.00
5.00	24.0	0.00	0.00	0.00	0.00	0.00
6.00	24.0	0.00	0.00	0.00	0.00	0.00

7.00	24.0	0.00	0.00	0.00	0.00	0.00
8.00	24.0	0.00	0.00	0.00	0.00	0.00
9.00	24.0	0.00	0.00	0.00	0.00	0.00
10.00	24.0	0.00	0.00	0.00	0.00	0.00
11.00	24.0	0.00	0.00	0.00	0.00	0.00
12.00	24.0	0.00	0.00	0.00	0.00	0.00
13.00	24.0	0.00	0.00	0.00	0.00	0.00
14.00	24.0	0.00	0.00	0.00	0.00	0.00
15.00	24.0	0.00	0.00	0.00	0.00	0.00
16.00	24.0	0.00	0.00	0.00	0.00	0.00
17.00	24.0	0.00	0.00	0.00	0.00	0.00
18.00	24.0	0.00	0.00	0.00	0.00	0.00
19.00	24.0	0.00	0.00	0.00	0.00	0.00
20.00	24.0	0.16	21.99	22.15	11.07	66.13
21.00	24.0	0.93	20.19	21.12	10.56	61.49
22.00	24.0	1.67	19.82	21.50	10.75	61.14
23.00	24.0	2.38	20.26	22.64	11.32	63.17
24.00	24.0	3.00	21.17	24.17	12.08	66.50
25.00	24.0	3.47	22.84	26.31	13.15	71.98
26.00	24.0	3.85	24.97	28.82	14.41	78.77
27.00	24.0	4.20	27.28	31.48	15.74	86.03
28.00	24.0	4.51	29.75	34.26	17.13	93.76
29.00	24.0	4.94	31.66	36.60	18.30	99.93
30.00	24.0	5.60	32.30	37.91	18.95	102.51
31.00	24.0	6.40	42.97	49.37	24.68	135.30
32.00	24.0	7.19	96.30	103.49	51.74	296.08
33.00	24.0	7.99	141.18	149.16	74.58	431.52
34.00	24.0	8.78	169.18	177.96	88.98	516.31
35.00	24.0	9.57	180.29	189.86	94.93	550.43
36.00	24.0	10.37	183.37	193.73	96.87	560.47
37.00	24.0	11.16	187.28	198.44	99.22	572.99
38.00	24.0	11.95	195.18	207.13	103.57	597.49
39.00	24.0	14.19	199.57	213.76	106.88	612.91
40.00	24.0	22.19	168.47	190.66	95.33	527.60
41.00	24.0	29.07	156.27	185.34	92.67	497.87
42.00	24.0	33.71	174.72	208.43	104.22	557.87
43.00	24.0	36.12	216.93	253.06	126.53	686.92
44.00	24.0	37.49	267.18	304.67	152.33	839.03
45.00	24.0	39.00	316.60	355.60	177.80	988.80
46.00	24.0	41.13	362.02	403.16	201.58	1127.20
47.00	24.0	44.36	400.29	444.64	222.32	1245.22
48.00	24.0	48.67	431.39	480.07	240.03	1342.85
49.00	24.0	54.32	452.04	506.36	253.18	1410.43
50.00	24.0	61.53	458.92	520.45	260.23	1438.29
51.00	24.0	69.53	458.92	528.45	264.23	1446.29
52.00	24.0	77.53	458.92	536.45	268.23	1454.29
53.00	24.0	85.53	458.92	544.45	272.23	1462.29
54.00	24.0	93.53	458.92	552.45	276.23	1470.29
55.00	24.0	101.53	458.92	560.45	280.23	1478.29
56.00	24.0	109.53	458.92	568.45	284.23	1486.29
57.00	24.0	117.53	458.92	576.45	288.23	1494.29
58.00	24.0	125.53	458.92	584.45	292.23	1502.29
59.00	24.0	133.53	458.92	592.45	296.23	1510.29
60.00	24.0	141.53	458.92	600.45	300.23	1518.29
61.00	24.0	149.53	458.92	608.45	304.23	1526.29
62.00	24.0	157.53	458.92	616.45	308.23	1534.29
63.00	24.0	165.53	458.92	624.45	312.23	1542.29
64.00	24.0	173.53	458.92	632.45	316.23	1550.29
65.00	24.0	181.53	458.92	640.45	320.23	1558.29
66.00	24.0	189.53	458.92	648.45	324.23	1566.29
67.00	24.0	197.53	458.92	656.45	328.23	1574.29
68.00	24.0	205.53	458.92	664.45	332.23	1582.29
69.00	24.0	213.53	458.92	672.45	336.23	1590.29
70.00	24.0	221.53	458.92	680.45	340.23	1598.29
71.00	24.0	229.53	458.92	688.45	344.23	1606.29
72.00	24.0	237.53	458.92	696.45	348.23	1614.29

NOTES

1. MOBILIZED END BEARING IS 1/3 OF THE ORIGINAL RB-121 VALUES.

2. DAVISSON PILE CAPACITY IS AN ESTIMATE BASED ON FAILURE CRITERIA, AND EQUALS ULTIMATE SIDE FRICTION PLUS MOBILIZED END BEARING.

3. ALLOWABLE PILE CAPACITY IS 1/2 THE DAVISSON PILE CAPACITY.

4. ULTIMATE PILE CAPACITY IS ULTIMATE SIDE FRICTION PLUS 3 x THE MOBILIZED END BEARING.
   EXCEPTION: FOR H-PILES TIPPED IN SAND OR LIMESTONE, THE ULTIMATE PILE CAPACITY IS ULTIMATE SIDE FRICTION PLUS 2 x THE MOBILIZED END BEARING.

General Information:
==========
Input file: ..... Bridge\Revised II 02-18-21\Bridge\FB-DEEP\Driven Piles\B-2.in
Project number: HR20-1583R
Job name: Atlantic Isles Lagoon Bridge
Engineer: CS
Units: English

Analysis Information:
==========
Analysis Type: SPT

Soil Information:
==========
Boring date: 12/04/17, Boring Number: B-2
Station number: 14+10 (BL ATLANTIC AVE.) Offset: 20.0 RT

Ground Elevation: 2.400(ft)

Hammer type: Automatic Hammer, Correction factor = 1.24

ID	Depth (ft)	No. of Blows (Blows/ft)	Soil Type
1	0.00	4.00	5- Cavity layer
2	2.00	4.00	5- Cavity layer
3	4.00	2.00	5- Cavity layer
4	6.00	2.00	5- Cavity layer
5	8.00	1.00	5- Cavity layer
6	10.00	4.00	5- Cavity layer
7	13.00	2.00	5- Cavity layer
8	15.00	1.00	5- Cavity layer
9	17.40	6.00	5- Cavity layer
10	17.40	8.00	4- Lime Stone/Very shelly sand
11	18.00	8.00	4- Lime Stone/Very shelly sand
12	20.00	7.00	4- Lime Stone/Very shelly sand
13	23.00	5.00	4- Lime Stone/Very shelly sand
14	25.00	8.00	4- Lime Stone/Very shelly sand
15	28.00	8.00	4- Lime Stone/Very shelly sand
16	30.00	5.00	4- Lime Stone/Very shelly sand
17	33.00	8.00	4- Lime Stone/Very shelly sand
18	35.00	8.00	4- Lime Stone/Very shelly sand
19	36.40	8.00	4- Lime Stone/Very shelly sand
20	36.40	47.00	4- Lime Stone/Very shelly sand
21	38.00	47.00	4- Lime Stone/Very shelly sand
22	38.00	3.00	3- Clean sand
23	40.00	3.00	3- Clean sand
24	42.00	6.00	3- Clean sand
25	42.90	6.00	3- Clean sand
26	43.00	100.00	4- Lime Stone/Very shelly sand
27	44.00	100.00	4- Lime Stone/Very shelly sand
28	48.00	41.00	4- Lime Stone/Very shelly sand
29	50.00	100.00	4- Lime Stone/Very shelly sand
30	53.00	100.00	4- Lime Stone/Very shelly sand
31	55.00	100.00	4- Lime Stone/Very shelly sand
32	58.00	100.00	4- Lime Stone/Very shelly sand
33	60.00	100.00	4- Lime Stone/Very shelly sand
34	62.00	100.00	4- Lime Stone/Very shelly sand
35	65.00	100.00	4- Lime Stone/Very shelly sand
36	68.00	100.00	4- Lime Stone/Very shelly sand
37	70.00	100.00	4- Lime Stone/Very shelly sand
38	73.00	100.00	4- Lime Stone/Very shelly sand
39	75.00	10.00	4- Lime Stone/Very shelly sand
40	78.00	19.00	4- Lime Stone/Very shelly sand
41	80.00	60.00	4- Lime Stone/Very shelly sand

Blowcount Average Per Soil Layer

Layer Num.	Starting Elevation (ft)	Bottom Elevation (ft)	Thickness (ft)	Average Blowcount (Blows/ft)	Soil Type
1	2.40	-15.00	17.40	2.55	5-Void
2	-15.00	-35.60	20.60	10.16	4-Limestone, Very Shelly Sand
3	-35.60	-40.60	5.00	3.60	3-Clean Sand
4	-40.60	-77.60	37.00	85.14	4-Limestone, Very Shelly Sand

Driven Pile Data:
==========
Pile unit weight = 150.00(pcf), Section Type: Square

Pile Geometry:

Width (in)	Length (ft)	Tip Elev. (ft)
24.00	1.00	1.40
24.00	2.00	0.40
24.00	3.00	-0.60
24.00	4.00	-1.60
24.00	5.00	-2.60
24.00	6.00	-3.60
24.00	7.00	-4.60
24.00	8.00	-5.60
24.00	9.00	-6.60
24.00	10.00	-7.60
24.00	11.00	-8.60
24.00	12.00	-9.60
24.00	13.00	-10.60
24.00	14.00	-11.60
24.00	15.00	-12.60
24.00	16.00	-13.60
24.00	17.00	-14.60
24.00	18.00	-15.60
24.00	19.00	-16.60
24.00	20.00	-17.60
24.00	21.00	-18.60
24.00	22.00	-19.60
24.00	23.00	-20.60
24.00	24.00	-21.60
24.00	25.00	-22.60
24.00	26.00	-23.60
24.00	27.00	-24.60
24.00	28.00	-25.60
24.00	29.00	-26.60
24.00	30.00	-27.60
24.00	31.00	-28.60
24.00	32.00	-29.60
24.00	33.00	-30.60
24.00	34.00	-31.60
24.00	35.00	-32.60
24.00	36.00	-33.60
24.00	37.00	-34.60
24.00	38.00	-35.60
24.00	39.00	-36.60
24.00	40.00	-37.60
24.00	41.00	-38.60
24.00	42.00	-39.60
24.00	43.00	-40.60
24.00	44.00	-41.60
24.00	45.00	-42.60
24.00	46.00	-43.60
24.00	47.00	-44.60
24.00	48.00	-45.60
24.00	49.00	-46.60
24.00	50.00	-47.60
24.00	51.00	-48.60
24.00	52.00	-49.60
24.00	53.00	-50.60
24.00	54.00	-51.60
24.00	55.00	-52.60
24.00	56.00	-53.60
24.00	57.00	-54.60
24.00	58.00	-55.60
24.00	59.00	-56.60
24.00	60.00	-57.60
24.00	61.00	-58.60
24.00	62.00	-59.60
24.00	63.00	-60.60
24.00	64.00	-61.60
24.00	65.00	-62.60
24.00	66.00	-63.60
24.00	67.00	-64.60
24.00	68.00	-65.60
24.00	69.00	-66.60
24.00	70.00	-67.60
24.00	71.00	-68.60
24.00	72.00	-69.60

Driven Pile Capacity:

Section Type: Square
Pile Width: 24.00 (in)

Test Pile Length (ft)	Pile Width (in)	Ultimate Side Friction (tons)	Mobilized End Bearing (tons)	Estimated Davisson Capacity (tons)	Allowable Pile Capacity (tons)	Ultimate Pile Capacity (tons)
1.00	24.0	0.00	0.00	0.00	0.00	0.00
2.00	24.0	0.00	0.00	0.00	0.00	0.00
3.00	24.0	0.00	0.00	0.00	0.00	0.00
4.00	24.0	0.00	0.00	0.00	0.00	0.00
5.00	24.0	0.00	0.00	0.00	0.00	0.00
6.00	24.0	0.00	0.00	0.00	0.00	0.00
7.00	24.0	0.00	0.00	0.00	0.00	0.00
8.00	24.0	0.00	0.00	0.00	0.00	0.00
9.00	24.0	0.00	0.00	0.00	0.00	0.00
10.00	24.0	0.00	0.00	0.00	0.00	0.00
11.00	24.0	0.00	0.00	0.00	0.00	0.00
12.00	24.0	0.00	0.00	0.00	0.00	0.00
13.00	24.0	0.00	0.00	0.00	0.00	0.00
14.00	24.0	0.00	0.00	0.00	0.00	0.00
15.00	24.0	0.00	0.00	0.00	0.00	0.00
16.00	24.0	0.00	0.00	0.00	0.00	0.00
17.00	24.0	0.00	0.00	0.00	0.00	0.00
18.00	24.0	0.48	27.14	27.61	13.81	81.89
19.00	24.0	1.24	27.27	28.51	14.26	83.05
20.00	24.0	1.96	27.66	29.62	14.81	84.94
21.00	24.0	2.63	27.96	30.59	15.29	86.51
22.00	24.0	3.22	27.84	31.06	15.53	86.73
23.00	24.0	3.75	27.92	31.67	15.84	87.52
24.00	24.0	4.32	28.31	32.63	16.31	89.25
25.00	24.0	5.04	28.44	33.48	16.74	90.35
26.00	24.0	5.83	28.44	34.27	17.14	91.15
27.00	24.0	6.63	28.44	35.06	17.53	91.94
28.00	24.0	7.42	28.44	35.86	17.93	92.73
29.00	24.0	8.14	43.41	51.55	25.77	138.37
30.00	24.0	8.71	68.88	77.59	38.79	215.35
31.00	24.0	9.26	68.11	77.37	38.68	213.59
32.00	24.0	9.90	66.83	76.73	38.37	210.40
33.00	24.0	10.64	65.53	76.18	38.09	207.24
34.00	24.0	11.44	64.97	76.40	38.20	206.34
35.00	24.0	12.23	67.57	79.80	39.90	214.93
36.00	24.0	13.02	120.89	133.92	66.96	375.71
37.00	24.0	16.14	155.47	171.61	85.80	482.54
38.00	24.0	20.80	145.28	166.08	83.04	456.65
39.00	24.0	21.37	105.08	126.45	63.22	336.61
40.00	24.0	21.93	124.82	146.75	73.38	396.40
41.00	24.0	22.64	140.18	162.82	81.41	443.17
42.00	24.0	23.44	149.52	172.96	86.48	472.01
43.00	24.0	25.10	358.92	384.02	192.01	1101.85
44.00	24.0	33.10	358.92	392.02	196.01	1109.85
45.00	24.0	40.61	363.08	403.69	201.85	1129.86
46.00	24.0	47.14	375.58	422.72	211.36	1173.89
47.00	24.0	52.68	396.42	449.10	224.55	1241.93
48.00	24.0	57.24	425.59	482.82	241.41	1333.99
49.00	24.0	62.29	450.59	512.87	256.44	1414.05
50.00	24.0	69.31	458.92	528.23	264.11	1446.07
51.00	24.0	77.31	458.92	536.23	268.11	1454.07
52.00	24.0	85.31	458.92	544.23	272.11	1462.07
53.00	24.0	93.31	458.92	552.23	276.11	1470.07
54.00	24.0	101.31	458.92	560.23	280.11	1478.07
55.00	24.0	109.31	458.92	568.23	284.11	1486.07
56.00	24.0	117.31	458.92	576.23	288.11	1494.07
57.00	24.0	125.31	458.92	584.23	292.11	1502.07
58.00	24.0	133.31	458.92	592.23	296.11	1510.07
59.00	24.0	141.31	458.92	600.23	300.11	1518.07
60.00	24.0	149.31	458.92	608.23	304.11	1526.07
61.00	24.0	157.31	458.92	616.23	308.11	1534.07
62.00	24.0	165.31	458.92	624.23	312.11	1542.07
63.00	24.0	173.31	458.92	632.23	316.11	1550.07
64.00	24.0	181.31	458.92	640.23	320.11	1558.07
65.00	24.0	189.31	458.92	648.23	324.11	1566.07
66.00	24.0	197.31	445.85	643.16	321.58	1534.86
67.00	24.0	205.31	406.65	611.95	305.98	1425.24
68.00	24.0	213.31	355.20	568.51	284.25	1278.90
69.00	24.0	221.31	305.41	526.72	263.36	1137.54
70.00	24.0	229.31	257.28	486.58	243.29	1001.14
71.00	24.0	237.31	217.10	454.40	227.20	888.59
72.00	24.0	245.31	191.15	436.46	218.23	818.76

NOTES

1. MOBILIZED END BEARING IS 1/3 OF THE ORIGINAL RB-121 VALUES.

2. DAVISSON PILE CAPACITY IS AN ESTIMATE BASED ON FAILURE CRITERIA, AND EQUALS ULTIMATE SIDE FRICTION PLUS MOBILIZED END BEARING.

3. ALLOWABLE PILE CAPACITY IS 1/2 THE DAVISSON PILE CAPACITY.

4. ULTIMATE PILE CAPACITY IS ULTIMATE SIDE FRICTION PLUS 3 x THE MOBILIZED END BEARING.
   EXCEPTION: FOR H-PILES TIPPED IN SAND OR LIMESTONE, THE ULTIMATE PILE CAPACITY IS ULTIMATE SIDE FRICTION PLUS

SOIL/ROCK PARAMETERS FOR LATERAL ANALYSIS WITH FB-MULTIPIER FOR DRIVEN PILES

ATLANTIC ISLE BRIDGE OVER OCEAN CANAL

FLORIDA DEPARTMENT OF TRANSPORTATION, DISTRICT 6

FINANCIAL PROJECT ID No. 430029-2-22-02

MIAMI-DADE COUNTY, FLORIDA

HR ENGINEERING SERVICES. INC.

HRES PROJECT No. HR20-1583R

FEBRUARY 24, 2021

End Bent	Pile Size (in)	Test Boring No.	Layer No.	Range of Elevation, ft		Soil Description	Soil Type	SPT N_{avg} Auto	SPT N_{avg} Safety	Lateral					Axial					Torsion				Tip			
				From	To					Soil Model	Angle of Internal Friction, ϕ (Deg.)	Total Unit Weight, γ (pcf)	Subgrade Modulus, k (pci)	Unconfined Compressive Strength (psf)	Soil Model	Total Unit Weight, γ (pcf)	Shear Modulus, G (ksi)	Poisson's Ratio, ν	Ult. Skin Friction (psf)	Soil Model	Total Unit Weight, γ (pcf)	Shear Modulus, G (ksi)	Torsional Shear Stress (psf)	Soil Model	Shear Modulus, G (ksi)	Poisson's Ratio, ν	24-inch Pile Axial Bearing Failure (kips)
1 and 2	24	B1 and B-2	1	-15.0	-34.0	Limestone	Cohesionless	8	10	Sand (Reese)	30	120	20	--	Driven Pile	120	2.9	0.2	198	Hyperbolic	120	2.9	198	Driven Pile (McVay)	2.9	0.2	286
			2	-34.0	-40.0	Sand	Cohesionless	7	9	Sand (Reese)	30	106	17	--	Driven Pile	106	0.7	0.3	330	Hyperbolic	106	0.7	330	Driven Pile (McVay)	0.7	0.3	222
			3	-40.0	-70.0	Limestone	Cohesionless	40	50	Sand (Reese)	34	120	125	--	Driven Pile	120	14.4	0.2	992	Hyperbolic	120	14.4	992	Driven Pile (McVay)	14.4	0.2	1428

Preforming Elevation (ft) : -34 Preforming is required to this elevation

Pile Size (in) : 24

Notes:

Friction Angle

ϕ = 28+N(safety)/4 with maximum of 34° for fill and sand

ϕ = 33+N(safety)/4 with maximum of 40° for limestone or sandstone

Total Unit Weight

γ = 105*ϕ/30 with maximum 119 pcf for sand and fill

γ = 120 pcf for limestone and sandstone

Subgrade Modulus

The subgrade modulus (k) for cohesionless material was estimated using the FB-Multipier Help Manual Figure 12.3b.

Shear Modulus (G)

G (ksi) = E/[2(1+ν)]

E (psf) = 30000*N(safety) for fill and sand , from FB-Multipier Manual

E (psf) = 100000*N (safety) for rock, from see below

For $qt \approx 0.2\ qu$

From $f = 0.5\sqrt{qu \times qt}$ and $fs = 0.2N\ (ksf)$

$f = 0.5\sqrt{qu \times 0.2qu}$

$f = 0.224\ qu$

$f = 0.224\ qu = 0.2N$

So $qu = 0.894N$

$Es = 115qu$

$Es = 115 \times 0.894\ N$

$Es = 103\ N$ Use $Es = 100\ N$

Poisson's Ratio (ν)

ν=0.3 for sand and fill

ν=0.2 for limestone and sandstone

Ultimate Skin Friction and Torsional Shear Stress

t_f = 0.019 N(safety) (tsf) = 38N (psf) for sand and fill

t_f = 0.01 N(safety) (tsf) = 20N (psf) for limestone and sandstone

Pile Axial Bearing Failure

Pile Axial Bearing Failure (kips) = q_{ult}*Pile Tip Area

End Bearing (q_{ult}) = 6.4N(safety) in ksf for sand and fill

End Bearing (q_{ult}) = 7.2N(safety) in ksf for limestone and sandstone

HNTB The HNTB Companies Infrastructure Solutions	Made FL	Date 2/22/2021	Job Number 70078
	Checked CAM	Date 2/24/2021	
For 430029-2 Atlantic Isle Ave over Ocean Canal	Backchk'd FL	Date 2/25/2021	Sheet No. 1

Estimated Bridge Foundation Loads for Bridge Replacement Alternative

Loads on Driven Piles Alternative

Loads per pile based on (3) piles at Each End Bent

End Bent	Factored		Service	
	Axial (tons)	Lateral (tons)	Axial (tons)	Lateral (tons)
1	87	20	54	13
2	87	20	54	13

Loads on Drilled Shafts Alternative

Loads per drilled shaft based on (2) 48" diameter drilled shafts at each End Bent

End Bent	Factored		Service	
	Axial (tons)	Lateral (tons)	Axial (tons)	Lateral (tons)
1	125	30	78	19
2	125	30	78	19

APPENDIX D

G. Structure Foundations - Piles (Pages 224-311)

In addition to the basic information listed in Section A, if pile support is recommended or given as an alternate, conclusions/recommendations should be provided in the project geotechnical report for the following:

		Yes	No	Unknown or N/A
*1.	Is the recommended pile type given (displacement, nondisplacement, pipe pile, concrete pile, H-pile, etc.) with valid reasons given for choice and/or exclusion? (Pages 224-226)	☑	☐	☐
2.	Do you consider the recommended pile type(s) to be the most suitable and economical?	☑	☐	☐
*3.	Are estimated pile lengths and estimated tip elevations given for the recommended allowable pile design loads?	☐	☐	☑
4.	Do you consider the recommended design loads to be reasonable?	☐	☐	☑
5.	Has pile group settlement been estimated (only of practical significance for friction pile groups ending in cohesive soil)? (Pages 245-247)	☐	☐	☑
6.	If a specified or minimum pile tip elevation is recommended, is a clear reason given for the required tip elevation, such as underlying soft layers, scour, downdrag, piles uneconomically long, etc.?	☑	☐	☐
*7.	Has design analysis (wave equation analysis) verified that the recommended pile section can be driven to the estimated or specified tip elevation without damage (especially applicable where dense gravel-cobble-boulder layers or other obstructions have to be penetrated)?	☐	☐	☑
8.	Where scour piles are required, have pile design and driving criteria been established based on mobilizing the full pile design capacity below the scour zone?	☐	☐	☑

*A response other than (yes) or (N/A) for any of these checklist questions is cause to contact the appropriate geotechnical engineer for a clarification and/or to discuss the project.

G. Pile Foundations - Piles (Cont.)	Yes	No	Unknown or N/A
9. Where lateral load capacity of large diameter piles is an important design consideration, are p-y curves (load vs. deflection) or soil parameters given in the geotechnical report to allow the structural engineer to evaluate lateral load capacity of all piles?	☑	☐	☐
*10. For pile supported bridge abutments over soft ground:			
a. Has abutment pile downdrag load been estimated and solutions such as bitumen coating considered in design? Not generally required if surcharging of the fill is being performed. (Pages 248-251)	☑	☐	☐
b. Is bridge approach slab recommended to moderate differential settlement between bridge ends and fill?	☐	☐	☑
c. If the majority of subsoil settlement will not be removed prior to abutment construction (by surcharging), has estimate been made of the amount of abutment rotation that can occur due to lateral squeeze of soft subsoil? (Pages 114-115)	☐	☐	☑
d. Does the geotechnical report specifically alert the structural designer to the estimated horizontal abutment movement?	☐	☐	☑
11. If bridge project is large, has pile load test program been recommended? (Pages 299-302)	☐	☐	☑
12. For a major structure in high seismic risk area, has assessment been made of liquefaction potential of foundation soil during design earthquake (note: only loose saturated sands and silts are "susceptible" to liquefaction)?	☐	☐	☑

*A response other than (yes) or (N/A) for any of these checklist questions is cause to contact the appropriate geotechnical engineer for a clarification and/or to discuss the project.

G. Structure Foundations - Piles - (Cont.)

	Yes	No	Unknown or N/A
13. Construction Considerations: (Pages 279-311)			
Have the following important construction considerations been adequately addressed?			
a. Pile driving details such as: boulders or obstructions which may be encountered during driving - need for preaugering, jetting, spudding, need for pile tip reinforcement, driving shoes, etc.?	☑	☐	☐
b. Excavation requirements - safe slope for open excavations, need for sheeting or shoring? Fluctuation of groundwater table?	☑	☐	☐
c. Have effects of pile driving operation on adjacent structures been evaluated - such as protection against damage caused by footing excavations or pile driving vibrations?	☑	☐	☐
d. Is preconstruction condition survey to be made of adjacent structures to prevent unwarranted damage claims?	☑	☐	☐
e. On large pile driving projects have other methods of pile driving control been considered such as dynamic testing or wave equation analysis?	☐	☐	☑

*A response other than (yes) or (N/A) for any of these checklist questions is cause to contact the appropriate geotechnical engineer for a clarification and/or to discuss the project.