REPORT OF GEOTECHNICAL EXPLORATION

LONGBOAT KEY NORTON STREET IMPROVEMENTS
LONGBOAT KEY, FLORIDA

AREHNA PROJECT NO. B-23-149

January 13, 2025

Prepared For:
Kimley-Horn
1777 Main Street, Suite 200
Sarasota, FL 34236

Prepared By:
AREHNA Engineering, Inc.
5012 West Lemon Street
Tampa, Florida 33609

AREHNA | Engineering, Inc.

12296 Wiles Rd.
Coral Springs, Florida 33076
Ph 954.417.8412 | www.arehna.com

January 13, 2025

Molly C. Williams, PE
Kimley-Horn
1777 Main Street, Suite 200
Sarasota, FL 34236

Subject: **Report of Geotechnical Exploration**
Longboat Key Norton Street Improvements
Longboat Key, Florida
AREHNA Project B-23-149

AREHNA Engineering, Inc. (AREHNA) is pleased to submit this report of our geotechnical exploration for the proposed project. Services were conducted in general accordance with AREHNA Proposal B.Prop-23-141 dated June 13, 2023. The purpose of our geotechnical study was to obtain information on the general subsurface conditions for the proposed roadway improvements, which include raising the elevation of the roadway and associated drainage improvements.

This report presents our understanding of the project, outlines our exploratory procedures, documents the field data obtained, and provides our recommendations for general site preparation.

AREHNA appreciates the opportunity to have assisted Kimley-Horn on this project. Should you have any questions with regards to this report, or if we can be of any further assistance, please contact this office.

Best Regards,

AREHNA ENGINEERING, INC.
FLORIDA BOARD OF PROFESSIONAL ENGINEERS CERTIFICATE OF AUTHORIZATION NO. 28410

This item has been digitally signed and sealed by:

Kevin M Hill
2025.01.13 08:32:47 -05'00'

Gordon Appleton, E.I.
Engineering Intern

KEVIN M. HILL
LICENSE
No. 72949
★
STATE OF
FLORIDA
PROFESSIONAL ENGINEER

Kevin M. Hill P.E.
Senior Geotechnical Engineer
Florida Registration 72949
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.

TABLE OF CONTENTS

LIST OF APPENDICES

1.0 PROJECT INFORMATION AND SCOPE OF WORK

1.1 Site Description and Project Characteristics

The project site is located along Norton Street in Longboat Key, Florida. We understand that the proposed construction includes raising the elevation of the roadway and associated drainage improvements. We understand that the proposed design will raise the roadway slightly (a few inches) to the following elevations (NAVD 88): Crown of Road at El. +2.1, Edge of Pavement at El. +1.9 in order to keep the roadway below the Finished Floor Elevation of the lowest residence along the roadway.

1.2 Scope of Work

The purpose of our geotechnical study was to obtain information on the general subsurface conditions at the proposed project site. The subsurface materials encountered were evaluated with respect to the available project characteristics. In this regard, engineering assessments for the following items were formulated:

- Subsurface soil conditions and general location and description of potentially deleterious materials encountered in the borings which may have an impact on the proposed construction.
- Identification of the existing groundwater levels and estimated normal seasonal high groundwater fluctuations.
- Existing pavement and base layer thicknesses.
- General geotechnical recommendations for the proposed new pavement and drainage system construction.

The following services were performed to achieve the above-outlined objectives:

- Staked/painted borings along the roadway alignment.
- Requested utility location services from Sunshine811.
- Performed a total of eight hand auger borings extending to a maximum depth of 5 feet below existing ground surface or auger refusal. Borings were placed at approximately 250-foot intervals along the roadway.
- Performed four (4) pavement cores at the locations of the four hand augers that were performed in the roadway.
- Visually classified and stratified the soil samples in the laboratory using the American Association of State Highway and Transportation Officials (AASHTO) Soil Classification System.
- Performed a laboratory testing program consisting of natural moisture content tests (AASHTO T-265/ASTM D-2974), organic content tests (AASHTO T-267/ASTM D-2974), and sieve analysis (AASHTO T-088/ASTM D-422) to supplement the visual classifications.
- Reported the results of the field exploration and engineering analysis. The results of the subsurface exploration are presented in this report signed and sealed by a professional engineer specializing in geotechnical engineering.

2.0 FIELD EXPLORATION AND LABORATORY TESTING

2.1 Field Exploration

Our scope of work included performing eight (8) Hand Auger Borings to maximum depths of 5 feet below ground surface (bgs) or to auger refusal. Four Pavement Cores were collected at the locations of the 4 Hand Augers that were performed in the Roadway (HA-03, HA-05, HA-06, HA-08).

The hand auger borings were performed by manually advancing a 3-inch diameter, 6-inch-long sampler into the soil until the sampler was full. The sampler was then retrieved and the soils in the sampler were removed and visually classified. The soil sampling was performed in general accordance with ASTM Test Designation D-1452, entitled “Soil Investigation and Sampling by Auger Borings.” The boreholes were backfilled with auger spoils after the borings were completed.

Asphalt pavement coring is performed to determine the existing asphalt pavement thickness and base thickness, as well as base material. The pavement cores were performed with the use of a 4-inch inside diameter core bit. Upon completion, the asphalt was patched and the retrieved core was transported to our laboratory for further examination.

Representative portions of these soil samples were sealed in glass jars, labeled and transferred to AREHNA’s laboratory for appropriate classification by a Geotechnical Engineer.

The approximate locations of the hand auger borings are shown on the **Boring Location Plan** on **Sheet 2** in **Appendix A**. The borings were located in the field using GPS coordinates and a hand-held GPS unit with an accuracy of +/- 10 feet.

2.2 Laboratory Testing

Our laboratory testing program included natural moisture content tests (AASHTO T-265/ASTM D-2974), organic content tests (AASHTO T-267/ASTM D-2974), and full sieve analysis (AASHTO T-088/ASTM D-422). The results are summarized on the **Soil Boring Profiles** on **Sheet 3** in **Appendix A** and **Table 2** in **Appendix B.**

3.0 SITE AND SUBSURFACE CONDITIONS

3.1 USGS Topographic Data

The topographic survey map published by the United States Geological Survey was reviewed for ground surface features at the proposed project location, shown on **Sheet 1** in **Appendix A**. Based on this review, natural ground surface elevations at the project site are approximately EL. +0 to +5 feet North American Vertical Datum of 1988 (NAVD-88). Survey data provided by the design team revealed elevations at the boring locations ranged from +1.3 feet (HA-06) to +2.3 feet (HA-07 and HA-08).

3.2 USDA Natural Resources Conservation Service Data

The United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) soil survey for this area is shown on **Sheet 1** in **Appendix A**. This survey indicates that there are two soil types along the project alignment. A summary of the USDA soil types is provided on **Table 1** in **Appendix B**.

3.3 Subsurface Conditions

The pavement cores revealed total asphalt thickness ranging from 1.8 (PC-06) to 3.7 (PC-08) inches with 3.4 inches being the typical thickness. The base material varied significantly, from 2 inches of sand and shell (PC-03) to 4.4 inches of concrete composite (PC-05) to 2 to 3 inches of sand-asphalt hot mix (PC-06 and PC-08). The asphalt thicknesses appeared to be satisfactory; however, the base thicknesses are generally inadequate or substandard.

The soils were visually classified by a Geotechnical Professional with index property tests performed on select samples to verify visual classification. In this regard, the near surface soils below the pavement section were categorized into 1 stratum group. The stratum was determined based on its engineering properties in regards to suitability for roadway construction per FDOT Standard Plans Index 120-001. This soil is considered SELECT and may be used as embankment/fill material. Organic soils reported by the soil survey were not encountered at the boring locations.

STRATUM	SOIL DESCRIPTION	AASHTO SOIL CLASSIFICATION
P	PAVEMENT AND BASE MATERIAL	-
1	GRAY TO VERY PALE BROWN TO BROWN FINE SAND TO SLIGHTLY SILTY FINE SAND	A-3

Pictorial representation of the subsurface conditions encountered in the borings is shown on the **Roadway Boring Profiles** on **Sheet 3** in **Appendix A**. These profiles highlight the general subsurface stratification. The Roadway Boring Profiles should be consulted for a detailed description of the subsurface conditions encountered at each boring location. When reviewing the boring records and the subsurface profiles, it should be understood that soil conditions may vary between and away from boring locations.

The hand auger borings generally encountered sand with varying but minor amounts of fines content (A-3), and often contained trace to some shell fragments, trace to some decaying roots, and trace decaying wood fragments from the ground surface to the boring termination depths of 4 to 5 feet below ground surface (boring termination elevations ranged from -2.6 to -3.3 feet NAVD 88).

3.4 Groundwater Conditions

The groundwater level was encountered at depths ranging from 1.8 to 3.0 feet below existing ground surface. Groundwater elevations ranged from +0.2 feet to -0.9 feet NAVD 88. Fluctuation in groundwater levels should be expected due to seasonal climatic changes, construction activity, rainfall variations, surface water runoff, and other site-specific factors such as the adjacent coastline and changing tides. 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.

3.5 Estimated Seasonal High Groundwater Level

The Seasonal High Water Table (SHWT) is the highest average depth of soil saturation during the wet season in a normal year (South Florida Water Management District, SFWMD, Volume IV). Based on SFWMD guidelines, the procedures for estimating SHWT elevations include an examination of county soil surveys and field verification by observation and identification of indicators within the soil profile. The water levels in this location are controlled by the tides. We estimate that the seasonal high ground water level will be encountered at approximately +1.0 feet Elevation, NAVD 88 (roughly coinciding with high tide) with possible flooding above the ground surface during extreme tropical storm events. We recommend that the local high tide and king tide elevations for this area should be reviewed for the final pavement design as those tide elevations will be nearly identical to the seasonal high groundwater levels at this site.

4.0 ENGINEERING EVALUATIONS AND RECOMMENDATIONS

4.1 General

In general, the existing shallow subsurface soils are fine sands (A-3, SELECT) and are suitable to support the proposed roadway and drainage improvements after proper subgrade preparation. If the final roadway alignment or system improvements are significantly different from those described, or if the subsurface conditions during construction are different from those revealed by our borings, we should be notified immediately so that we might review our recommendations presented in this report.

4.2 ON-SITE SOIL SUITABILITY

FDOT Standard Plan Indices 120-001 and 120-002 should be followed for soil suitability along the vertical and horizontal extent of the alignment. In this regard, the following soil suitability for each soil strata encountered during our geotechnical exploration is presented below:

1. The material from Strata 1 (A-3) is Select (S) and appears satisfactory for use in the embankment when utilized in accordance with FDOT Standard Plan Index 120-001.

In regards, to the soil strata encountered during the geotechnical exploration have been summarized and presented on the **Soil Boring Profiles** on **Sheet 3** in **Appendix A**.

No unsuitable soils were encountered within the depth of exploration. Trace amounts of decayed wood fragments were encountered; however, there were no organic soil layers encountered at the borings. Limestone, high plastic clay or organic soils, if encountered, are not suitable for re-use. If deleterious materials are encountered at the base of excavations that base should be over-excavated at least 12 inches (including complete removal of the deleterious material) and backfilled with compacted suitable fill as described in **Section 4.3**.

Backfill material must be common fill material free from organic matter, muck or marl, and rock exceeding 2 ½ inches in diameter, and must not contain broken concrete, masonry rubble or other similar materials. When unstable or unsuitable material is encountered replace with AASHTO soil classification A-1, A-2, or A-3.

4.3 PAVEMENT

New pavement sections should meet all applicable local and/or county minimum standards and requirements. Pavement subgrade (including stabilized subgrade, if utilized) should be compacted to at least 98 percent of maximum dry density Modified Proctor. Even with the proposed roadway elevation increase, the water table will be shallow. We recommend using alternative base materials unaffected by moisture rather than limerock, which does not perform well in wet conditions.

We have not been provided with design traffic loading. In our experience, the following minimum recommended pavement sections should work successfully for most sites, so they are suggested for this development.

These recommendations assume an adequately drained pavement surface and at least 12 inches of separation between the seasonal high groundwater level and crushed concrete base. However, the FDOT Flexible Pavement Design Manual recommends a reduction in design Resilient Modulus if there is less than 3 feet of separation between the bottom of the base material and the seasonal high-water level. A shallow water table will effectively increase the required structural number to obtain equivalent performance versus a site with a deeper water table.

Table 4.3.1 Typical Pavement Section

Pavement Section	Component	Recommended Thickness (in.)
Standard Duty Flexible Pavement Section	Asphalt	1.5
	Base (LBR ≥ 100)	6.0
	Stabilized Subgrade (LBR ≥ 40)	6.0
Heavy Duty Flexible Pavement Section	Asphalt	2.0
	Base (LBR ≥ 100)	8.0
	Stabilized Subgrade (LBR ≥ 40)	12.0

Subgrade: Sandy existing soils and sandy engineered fill soils should be acceptable for construction and support of a flexible (crushed concrete or similar base) pavement section after proper proofrolling and subsurface preparation.

Fill soils should consist of reasonably clean fine sands (inorganic, non-plastic sands containing less than 12 percent material passing the No. 200 mesh sieve). For flexible pavements, we recommend that any fill below the stabilized subgrade be compacted to at least 95 percent of the Modified Proctor maximum dry density (ASTM D-1557). The upper foot of pavement subgrade should be compacted to 98% ASTM D1557. Traffic should not be allowed on the subgrade before the base is placed to avoid rutting.

Base: For flexible pavements, we recommend that crushed concrete (or other base material not affected by moisture) be considered for the base. Material should meet Florida Department of Transportation (FDOT) Standard Specification, Section 200 requirements, including compaction to 98 percent of its maximum dry density as determined by the Modified Proctor Test (ASTM D-1557) and a minimum Limerock Bearing Ratio (LBR) of 100. Crushed concrete should have an LBR value of 150 and be graded in accordance with Florida Department of Transportation (FDOT) Standard Specifications Section 204.

Asphaltic Concrete: The asphaltic concrete structural course should consist of Type SP asphaltic concrete material. The asphaltic concrete should meet standard FDOT material requirements and placement procedures as outlined in the current edition of the FDOT Standard Specifications for Road and Bridge Construction.

Milling and Resurfacing: We understand that the design may include milling a few inches of the existing pavement section in order to make room for the new asphalt and base layers for the proposed new section rather than complete removal of the existing pavement. We anticipate that, in most locations, this milling may expose the base material but in some areas the milling may not fully penetrate the asphalt. Existing base materials also vary along the roadway.

Because there is potential for water to get trapped between the new and old pavement systems, which has the potential to cause additional cracking to the new pavement, we recommend installing a thin drainage layer (moisture management system) between the old and new pavement systems. One such material is Mirafi H_2Ri geosynthetic which provides separation, strength (confinement) and can wick water laterally through the material to remove water from within the roadway. The geosynthetic can be installed directly on the milled surface, which is also at the bottom of the new proposed base layer. If the exposed base material is loosened or uneven after milling, the existing base should be compacted to at least 98% of maximum dry density modified Proctor prior to placing the geosynthetic or base materials.

4.4 DRAINAGE IMPROVEMENTS

Details of proposed drainage improvements were not provided. Considering the narrow width of the road right-of-way, all drainage improvements are likely to be beneath or very close to the roadway. We recommend backfill compaction to at least 98% of maximum dry density of modified Proctor for the drainage improvements. Soil may be loosened as needed beneath pipes for smoother contact with bedding soils.

Excavation widths should be wide enough to allow proper compaction on all sides of structures and pipes. Excavations should be completed in accordance with current OSHA regulations for Type C soils. Excavated soil should be suitable for re-use as backfill. Dewatering may be required for construction of any subgrade structures or pipes as the water table is shallow.

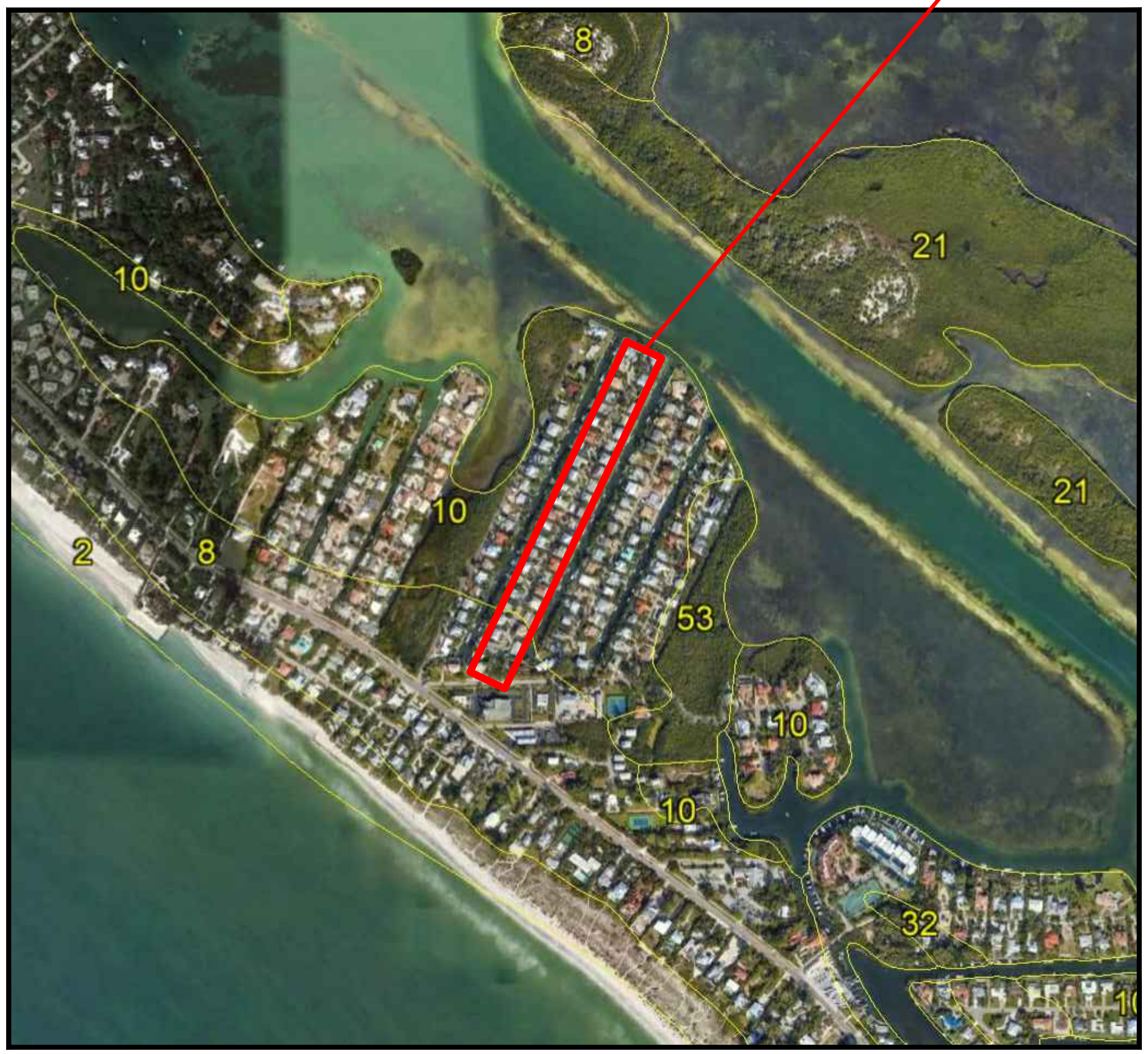
5.0 BASIS FOR RECOMMENDATIONS

The analysis and recommendations submitted in this report are based upon the data obtained from the soil borings performed at the locations indicated. Regardless of the thoroughness of a geotechnical exploration, there is always a possibility that conditions may be different from those at specific boring locations and that conditions will not be as anticipated by the designers or contractors. In addition, the construction process itself may alter soil conditions. AREHNA is not responsible for the conclusions, opinions or recommendations made by others based on the data presented in this report.

APPENDIX A

USDA & USGS Vicinity Maps – Sheet 1
Boring Location Plan – Sheet 2
Soil Boring Profiles – Sheet 3

USDA SOIL SURVEY MAP

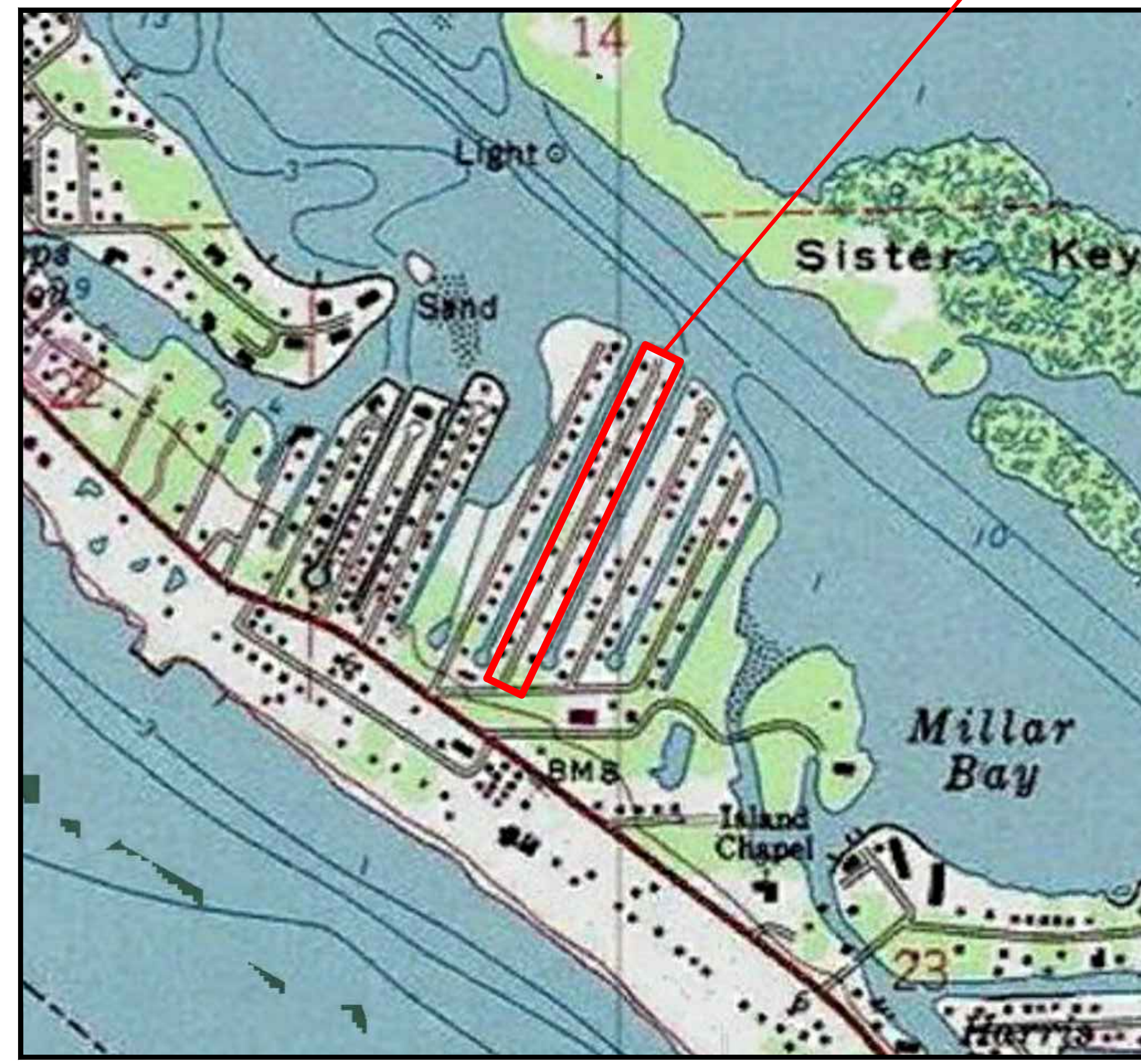


REFERENCE: USDA SOIL SURVEY OF MANATEE COUNTY, FLORIDA

0 250 1000
Feet

TOWNSHIP: 35 S
RANGE: 16 E
SECTION: 23

USGS TOPOGRAPHIC MAP



REFERENCE: "BRADENTON BEACH, FLORIDA" USGS QUADRANGLE MAP

0 250 1000
Feet

TOWNSHIP: 35 S
RANGE: 16 E
SECTION: 23

REVISIONS			
NO.	DATE	DESCRIPTIONS	APPROVED

PREPARED BY:

AREHNA Engineering, Inc.
5012 West Lemon Street, Tampa, FL 33609
Phone 813.944.3464 | Fax 813.944.4959
Certificate of Authorization No. 28410

USDA & USGS VICINITY MAPS

	NAME	DATE
DESIGNED BY:	GA	1/2024
DRAWN BY:	DG	1/2024
CHECKED BY:	KH	1/2024
SUPERVISED BY:	Kevin M. Hill, P.E.	

PROJECT NAME	PROJECT NO.	SHEET NO.
LONGBOAT KEY NORTON ST LONGBOAT KEY, FLORIDA	B-23-149	1

D:\-Arehna\Projects\2023\B-23-149 - Longboat Key Norton St\B-23-149.dwg (1-VIC) 613767 Jan 30, 2024 - 2:04pm

0 100
Feet

LEGEND

⊕ APPROXIMATE LOCATION OF AUGER BORING AND/OR PAVEMENT CORE TEST

REVISIONS			
NO.	DATE	DESCRIPTIONS	APPROVED

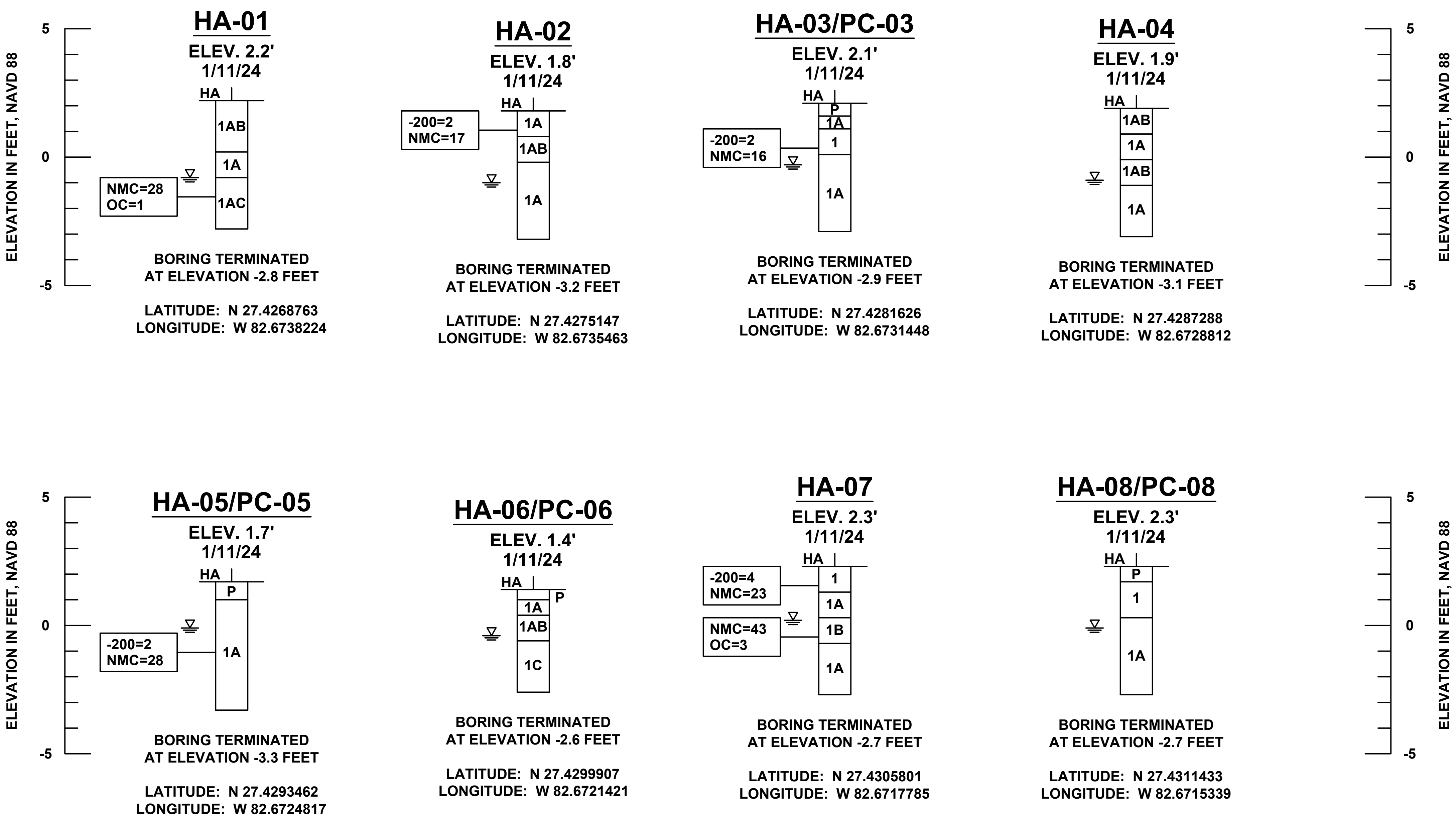
PREPARED BY:

ARehna Engineering, Inc.
5012 West Lemon Street, Tampa, FL 33609
Phone 813.944.3464 | Fax 813.944.4959
Certificate of Authorization No. 28410

BORING LOCATION PLAN

	NAME	DATE
DESIGNED BY:	GA	1/2024
DRAWN BY:	DG	1/2024
CHECKED BY:	KH	1/2024
SUPERVISED BY:	Kevin M. Hill, P.E.	

PROJECT NAME	PROJECT NO.	SHEET NO.
LONGBOAT KEY NORTON ST LONGBOAT KEY, FLORIDA	B-23-149	2



LEGEND

P	PAVEMENT AND BASE MATERIAL
1	GRAY TO VERY PALE BROWN TO BROWN FINE SAND TO SLIGHTLY SILTY FINE SAND (A-3)
A	TRACE TO SOME SHELL FRAGMENTS
B	TRACE TO SOME DECAYING ROOTS
C	TRACE DECAYING WOOD
A-3	AASHTO SOIL CLASSIFICATION GROUP SYMBOL AS DETERMINED BY VISUAL REVIEW
⊻	GROUNDWATER TABLE AT THE TIME OF DRILLING
-200	FINES PASSING THE #200 STANDARD SIEVE (%)
NMC	NATURAL MOISTURE CONTENT (%)
OC	ORGANIC CONTENT (%)
NOTE:	THE BORING LOCATIONS PRESENTED ARE APPROXIMATE AND BASED ON HAND HELD GPS WITH AN ACCURACY OF +/- 10 FEET.

D:\1-Arehna\Projects\2023\B-23-149 - Longboat Key Norton St\B-23-149.dwg (3-PRF) 613767 Feb 05, 2024 - 6:18pm

REVISIONS

NO.	DATE	DESCRIPTIONS	APPROVED

PREPARED BY:

AREHNA Engineering, Inc.
5012 West Lemon Street, Tampa, FL 33609
Phone 813.944.3464 | Fax 813.944.4959
Certificate of Authorization No. 28410

SOIL BORING PROFILES

	NAME	DATE
DESIGNED BY:	GA	1/2024
DRAWN BY:	DG	1/2024
CHECKED BY:	KH	1/2024
SUPERVISED BY:	Kevin M. Hill, P.E.	

PROJECT NAME	PROJECT NO.	SHEET NO.
LONGBOAT KEY NORTON ST LONGBOAT KEY, FLORIDA	B-23-149	3

APPENDIX B

Summary of USDA Soil Survey– Table 1
Summary of Laboratory Test Results – Table 2
Summary of Pavement Core Conditions – Table 3
Pavement Core Photos

TABLE 1
SUMMARY OF USDA SOIL SURVEY
Longboat Key Norton Street
Longboat Key, FL
AREHNA Project No. B-23-149

<table>
<tr><th rowspan="2">USDA Soil Type</th><th rowspan="2">Depth (inches)</th><th rowspan="2">USDA Soil Description</th><th rowspan="2">AASHTO</th><th rowspan="2">USCS</th><th rowspan="2">Permeability (ft/day)</th><th colspan="3">Seasonal High Groundwater</th><th colspan="2">Risk of Corrosion</th></tr>
<tr><th>Depth (feet)</th><th>Duration (months)</th><th>Kind</th><th>Steel</th><th>Concrete</th></tr>
<tr><td rowspan="4">Canaveral fine sand, 0 to 5 percent slopes</td><td>0 - 5</td><td>Fine sand</td><td>A-2-4, A-3</td><td>SM, SP-SM</td><td>40.0 - 80.0</td><td rowspan="4">1.5 - 3.5</td><td rowspan="4">Jun - Nov</td><td rowspan="4">Apparent</td><td rowspan="4">High</td><td rowspan="4">Low</td></tr>
<tr><td>5 - 17</td><td>Fine sand</td><td>A-3, A-2-4</td><td>SP-SM, SM</td><td>40.0 - 80.0</td></tr>
<tr><td>17 - 49</td><td>Paragravelly fine sand, paragravelly sand</td><td>A-2-4, A-3</td><td>SP-SM</td><td>40.0 - 80.0</td></tr>
<tr><td>49 - 80</td><td>Very paragravelly fine sand, very paragravelly sand</td><td>A-3, A-2-4</td><td>SP-SM</td><td>40.0 - 80.0</td></tr>
<tr><td rowspan="3">Canaveral sand, organic substatum</td><td>0 - 45</td><td>Sand</td><td>A-3</td><td>SP</td><td>40.0 - 100.0</td><td rowspan="3">2.5 - 5.0</td><td rowspan="3">Jan - Dec</td><td rowspan="3">Apparent</td><td rowspan="3">Low</td><td rowspan="3">Low</td></tr>
<tr><td>45 - 70</td><td>Muck</td><td>A-8</td><td>PT</td><td>4.0 - 12.0</td></tr>
<tr><td>70 - 80</td><td>Coarse sand, sand, fine sand</td><td>A-3</td><td>SP</td><td>12.0 - 40.0</td></tr>
</table>

TABLE 2
SUMMARY OF LABORATORY TEST RESULTS
Longboat Key Norton Street
Longboat Key, FL
AREHNA Project No. B-23-149

Boring No.	Sample Depth (feet)	AASHTO Classification	Sieve Analysis (% Passing)					Organic Content (%)	Natural Moisture Content (%)
			#10	#40	#60	#100	#200		
HA - 01	3.5 - 4.0	A-3	-	-	-	-	-	1	28
HA - 02	0.5 - 1.0	A-3	82	69	59	23	2	-	17
HA - 03	1.5 - 2.0	A-3	-	-	-	-	2	-	16
HA - 05	2.5 - 3.0	A-3	-	-	-	-	2	-	28
HA - 07	0.5 - 1.0	A-3	100	94	75	27	4	-	23
HA - 07	2.5 - 3.0	A-3	-	-	-	-	-	3	43

TABLE 3

SUMMARY OF PAVEMENT CORE CONDITIONS

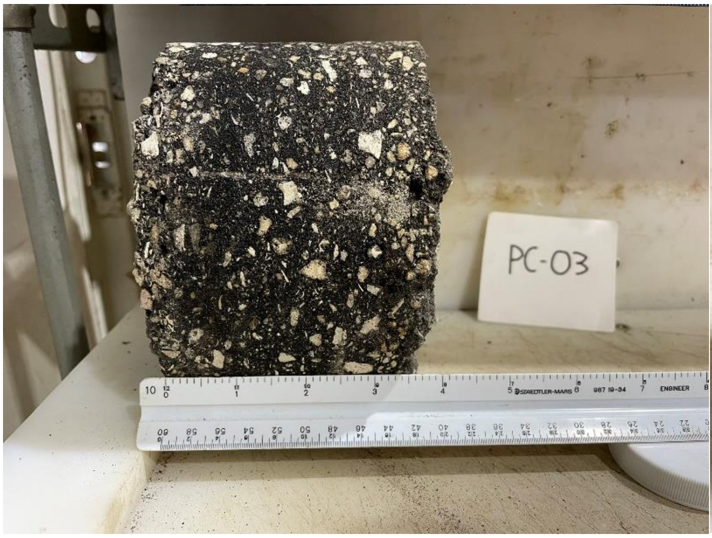
LONGBOAT KEY NORTON STREET IMPROVEMENTS

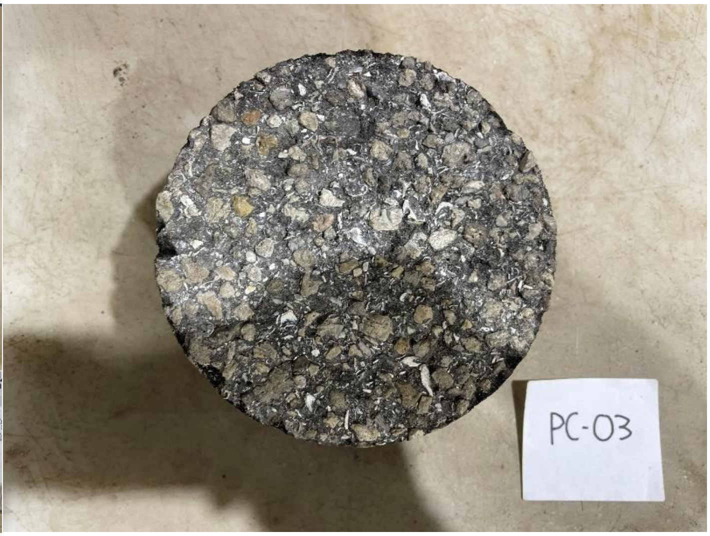
LONGBOAT KEY, FLORIDA

AREHNA Project No.: B-23-149

CORE NO.	Lane	Wheelpath (Y/N)	TOTAL CORE LENGTH (IN)	BASE (IN)			Pavement Condition	Rut Depth (LWP)	Rut Depth (RWP)	CROSS SLOPE (%)
				Sand and Shell	SAHM	Concrete Composite				
PC-03	NB	Y	3.4	2.0	-	-	Fair	0.0	0.0	2.60
PC-05	NB	Y	3.4	-	-	4.4	Poor	0.0	0.1	0.95
PC-06	NB	N	1.8	-	3.0	-	Fair	0.1	0.0	2.75
PC-08	SB	N	3.7	-	2.0	-	Good	0.25	0	0.25

PC-03





AREHNA Project No.: B-23-149 Date Performed: January 11th, 2023	**Longboat Key Norton Street Improvements**	AREHNA | Engineering, Inc. 5012 West Lemon Street, Tampa, FL 33609 Phone 813.944.3464 ▪ Fax 813.944.4959 Designed By: GA Checked By: KH Drawn By: GA

PC-05

AREHNA Project No.: B-23-149 Date Performed: January 11th, 2023	**Longboat Key Norton Street Improvements**	AREHNA Engineering, Inc. 5012 West Lemon Street, Tampa, FL 33609 Phone 813.944.3464 ▪ Fax 813.944.4959 Designed By: GA Checked By: KH Drawn By: GA

PC-06

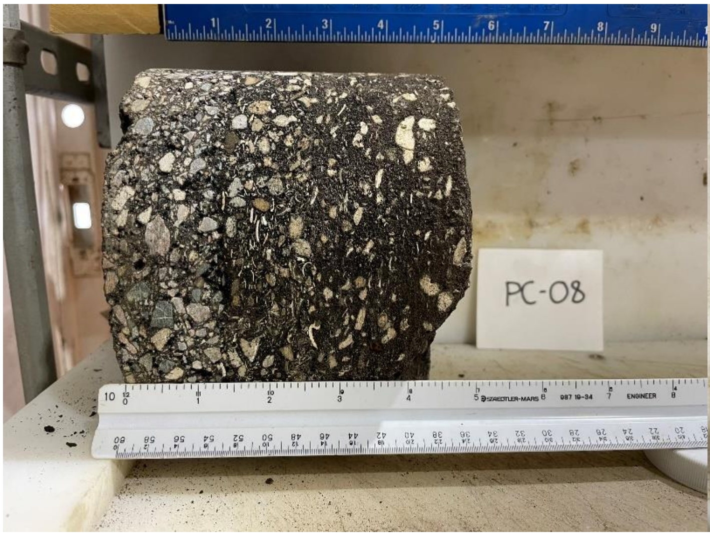
AREHNA Project No.: B-23-149
Date Performed: January 11th, 2023

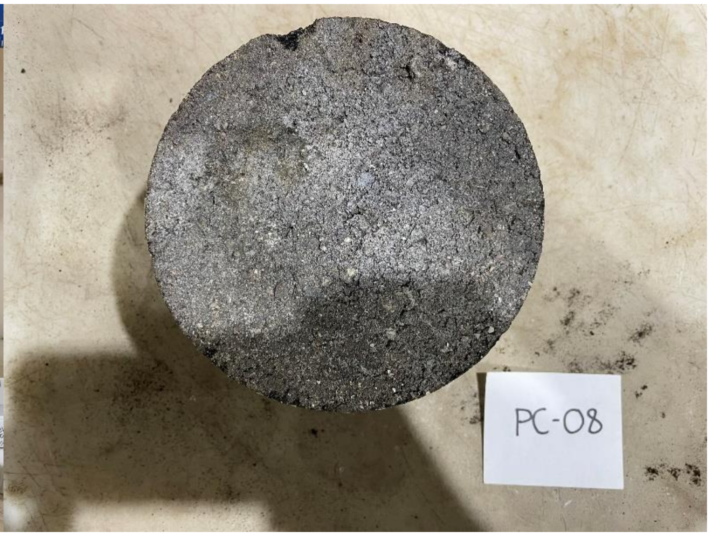
Longboat Key Norton Street Improvements

AREHNA | Engineering, Inc.
5012 West Lemon Street, Tampa, FL 33609
Phone 813.944.3464 ▪ Fax 813.944.4959

Designed By: GA
Checked By: KH
Drawn By: GA

PC-08





AREHNA Project No.: B-23-149 Date Performed: January 11th, 2023	**Longboat Key Norton Street Improvements**	AREHNA | Engineering, Inc. 5012 West Lemon Street, Tampa, FL 33609 Phone 813.944.3464 ▪ Fax 813.944.4959 Designed By: GA Checked By: KH Drawn By: GA

APPENDIX C

Field and Laboratory Procedures

Auger Boring

The auger borings are performed in general accordance with ASTM D-1452, “Standard Practice for Soil Investigation and Sampling by Auger Borings”. Auger borings are advanced manually using a bucket-type hand auger. The soils encountered are identified, in the field, from cuttings brought to the surface by the augering process. Representative soil samples from the auger borings are placed in glass jars and transported to our laboratory where they are examined by an engineer for classification.

Asphalt Pavement Coring

Pavement cores are performed to estimate the existing asphalt pavement and base thickness, as well as base material. The pavement cores were performed with the use of a 6-inch inside diameter core bit. The asphalt is patched, and asphalt pavement core is transported to our laboratory where they are further examined, measured and photographed by an engineer.

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 solid particles. This test is conducted in general accordance with AASHTO T-265/ASTM D-2974.

Percent Organics (Organic Loss on Ignition)

The amount of organic material in a sample is determined in this test. The sample is first dried and weighed, then ignited and reweighed. The amount of organic material is expressed as a percentage of the total dry weight of the sample prior to ignition. This test is conducted in general accordance with FM 1-T267.

Sieve Analysis

This test provides a direct measurement of the particle size distribution of a soil by causing the sample to pass through a series of wire screens with progressively smaller openings of known size. The amount of material retained on each sieve is weighed. See ASTM C 136.

Fines Content

In this test, the sample is dried and then washed over a No. 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 is conducted in general accordance with AASHTO T-11/ASTM D-1140.