

July 12, 2023

Patel, Greene, & Associates, LLC
7020 Professional Parkway E. Unit E.
Sarasota, FL 34240

Attn: Mr. Richard Uptegraff, P.E.

**Re: Report of Geotechnical Engineering Services
63rd Ave E from U.S. 301 to Tuttle Avenue
Signalization of 63rd Ave & 33rd St.
Manatee County, Florida
Manatee County Project No.: 6107860
Tierra Project No.: 6511-22-126**

Mr. Uptegraff:

Tierra, Inc. (Tierra) has performed a geotechnical study for the 63rd Avenue Signal Plans submittal for the proposed mast arm signal pole structures to be located at the intersection of 63rd Avenue and 33rd Street East in Manatee County, Florida. This report presents the findings of our field exploration and our geotechnical engineering recommendations for use in the design of the proposed mast arm signal pole foundations.

Review of Topographic Information

Based on a review of the USGS Quadrangle Map titled "Bradenton, Florida" it appears that the project site natural elevations range from approximately +10 feet to +20 feet, National Geodetic Vertical Datum of 1929 (NGVD 29). This is reasonably consistent with elevations obtained by design files for the borings performed.

Review of Potentiometric Information

Based on a review of the "Potentiometric Surface of the Upper Floridan Aquifer, West-Central Florida" map published by the USGS, the potentiometric surface elevation of the Upper Floridan Aquifer at the intersection is approximately +20 to +25 feet, NGVD 29. The natural ground elevation at the project site ranges from approximately +10 to +20 feet, NAVD 88. Artesian flow conditions were not encountered during the field exploration; however the contractor's tools and construction methods should be able to handle artesian head up to +25 feet, at no additional cost to the County.

Subsurface Investigation

To evaluate the subsurface conditions, Tierra performed two (2) Standard Penetration Test (SPT) borings to a depth of 35 feet below existing grades. SPT borings were performed in the intersection quadrants associated with Mast Arm 1 and Mast Arm 3. Due to limited Right-of-Way and utility restraints, an SPT boring was unable to be performed in the quadrant of Mast Arm 2. As a result, Tierra reviewed the 2 SPT borings able to be performed and is recommending that Mast Arm 2 be designed to the strength of the lesser quality boring.

The borings were located in the field by a representative of Tierra using project design information provided by Patel, Greene, & Associates, LLC (PGA) and our hand-held, non-survey grade Global Positioning System (GPS) equipment with a manufacturer's reported accuracy of

±10 feet. The boring locations should be considered approximate. If the boring locations become critical to design, Tierra recommends that the boring locations be survey located. The approximate boring locations are provided on the attached **Report of Core Borings** sheet. The SPT borings were performed in general accordance with American Society for Testing and Materials (ASTM) Test Designation D-1586. The initial 6 feet of the borings were advanced manually by hand auger to verify clearance of underground utilities. SPT resistance values were then recorded on intervals of 2 feet to a depth of 10 feet and on intervals of 5 feet thereafter to the boring termination depths.

The SPT borings encountered sandy soils with varying amounts of silt underlain by clayey soils the boring termination depths. Detailed soil information at each boring location is presented on the attached **Report of Core Borings** sheet.

Groundwater Information

The groundwater table was encountered within the borings at depths ranging from 5 to 6 feet below existing grades. Groundwater levels are depicted adjacent to the soil profiles on the attached **Report of Core Borings** sheet. It should be noted that groundwater levels tend to fluctuate during periods of prolonged drought and extended rainfall and may be affected by man-made influences. In addition, a seasonal effect can occur in which higher groundwater levels are normally recorded in rainy seasons.

Geotechnical Considerations and Recommendations

Shaft Embedment/Length

It is our understanding that the design of the proposed mast arm signal pole structure foundations will be performed by PGA utilizing the FDOT Mathcad program. The program models the subsurface as a uniform soil type with consistent strength properties; however, the result of the borings indicates different soil types and properties throughout the boring depths. Recommended soil parameters for the proposed mast arm signal pole foundations are provided on the attached **Recommended Soil Parameters for Mast Arm Signal Structure Foundations** table. These parameters include soil type, soil unit weight, and internal angle of friction. We recommend the foundations be designed based on saturated conditions, i.e. the groundwater table at the ground surface.

The torsional resistance calculation for a SAND profile requires an average SPT N-value. Tierra recommends that the mast arm signal pole foundations be designed using the SAND model. Tierra's **Recommended Average N-Values for Mathcad Spreadsheet** are provided in the attachments of this report.

If the proposed structure foundations are to be installed on a berm or on a slope, the foundation designer should include the portion of the shaft with less than 2.5D (D=shaft diameter) horizontal soil cover (face-of-shaft to face-of-slope) in the unsupported length and design the portion of the shaft with more than 2.5D horizontal soil cover as though founded in level ground.

Shaft Installation

The proposed mast arm signal structure foundations should be installed in accordance with the FDOT Specifications. In addition, we recommend that a qualified shaft inspector be present during foundation installation and that the installation procedures comply with FDOT Specifications.

Loose soils were encountered within the borings performed in the vicinity of the proposed mast arm signal foundations. The Contractor should anticipate that concrete volume overruns may occur during the shaft installation process. In addition, temporary casing methods for shaft installation beyond what is required in the FDOT Specifications may be required in order to prevent the collapse of the sandy soils and/or groundwater intrusion during shaft construction.

Report Limitations

Our services have been performed, our findings obtained, and our recommendations prepared in accordance with generally accepted geotechnical engineering principles and practices at the time of this report. Tierra is not responsible for the conclusions, opinions or recommendations made by others based on this data.

The scope of the exploration was intended to evaluate soil conditions within the influence zone of the proposed structure foundations. The analyses and recommendations submitted in this report are based upon the data obtained from the soil borings performed at the locations indicated. If any subsoil variations become evident during the course of this project, a re-evaluation of the recommendations contained in this report will be necessary after we have had an opportunity to observe the characteristics of the condition encountered. The applicability of the report should also be reviewed in the event significant changes occur in the design, nature or location of the proposed structures.

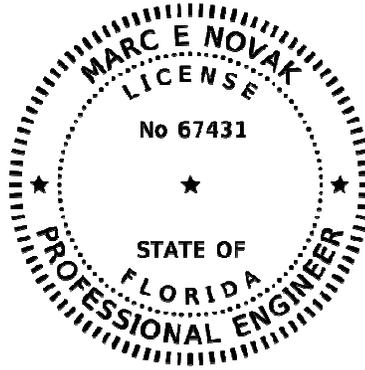
The scope of our services did not include an environmental assessment for determining the presence or absence of wetlands or hazardous or toxic materials in the soil, bedrock, groundwater, or air, on or below or around this site. The scope of our services did not include determination of the potential for sinkhole activity. Any statements in this report or on the boring logs regarding odors, colors, unusual or suspicious items or conditions are strictly for the information of PGA and their consultants for evaluating the design of the project as it relates to the geotechnical aspects discussed herein.

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Page 4 of 4

Tierra appreciates the opportunity to be of service to PGA on this project. If you have any questions or comments regarding this report, please contact our office at your earliest convenience.

Respectfully Submitted,

TIERRA, INC.



This item has been digitally signed and sealed by Marc E. Novak on the date adjacent to the seal.

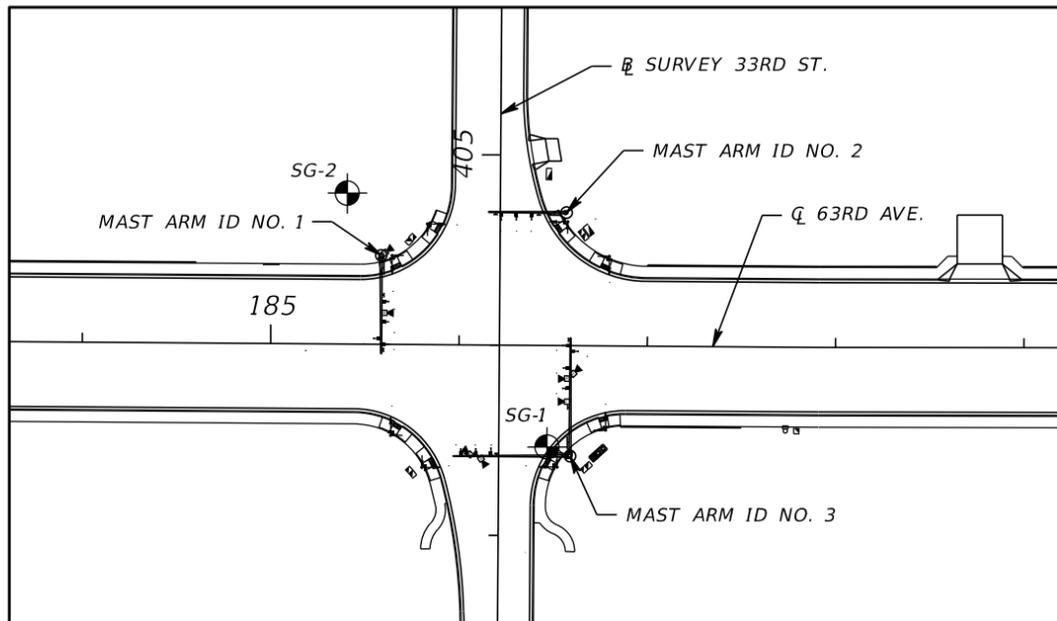
Printed copies of this document are not considered signed and sealed and the signature must be verified on any electronic documents.

Kevin L. Hill, E.I.
Geotechnical Engineer Intern

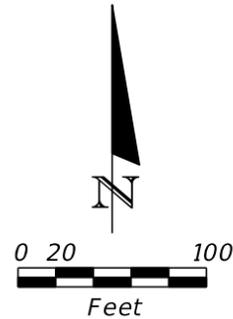
Marc E. Novak, Ph.D., P.E.
Senior Geotechnical Engineer
Florida License No. 67431

Daniel Ruel, P.E.
Geotechnical Engineer
Florida License No. 82404

Attachments: Report of Core Borings
Recommended Soil Parameters for Mast Arm Signal Structure Foundations
Recommended Average N-Values for Mathcad Spreadsheet



BORING LOCATION PLAN



NOTES:

1. THE BORINGS WERE LOCATED IN THE FIELD USING A HAND-HELD GARMIN ETREX NON-SURVEY GRADE GLOBAL POSITIONING SYSTEM GPS DEVICE WITH A REPORTED ACCURACY OF ± 10 FEET AND SHOULD BE CONSIDERED APPROXIMATE.
2. BASED ON THE REVIEW OF THE "UPPER FLORIDAN AQUIFER POTENTIOMETRIC SURFACE" MAPS PUBLISHED BY THE USGS, THE POTENTIOMETRIC SURFACE ELEVATION IN THE PROJECT VICINITY IS REPORTED UP TO APPROXIMATELY +25 FEET, NGVD 29. ARTESIAN FLOW CONDITIONS WERE NOT ENCOUNTERED WITHIN THE BORINGS PERFORMED AT THE TIME OF THE FIELD ACTIVITIES; HOWEVER, THE CONTRACTOR SHOULD BE PREPARED TO ADDRESS ARTESIAN LEVELS UP TO A HEAD OF +25 FEET, NGVD 29, AT NO ADDITIONAL COST TO THE COUNTY.
3. TEMPORARY CASING METHODS BEYOND WHAT IS REQUIRED IN THE PROJECT SPECIFICATIONS FOR THE SHAFT INSTALLATION MAY BE REQUIRED IN ORDER TO PREVENT THE COLLAPSE OF THE SANDY SOILS AND/OR GROUNDWATER INTRUSION DURING THE SHAFT INSTALLATION.

RECOMMENDED ENVIRONMENTAL CLASSIFICATION:

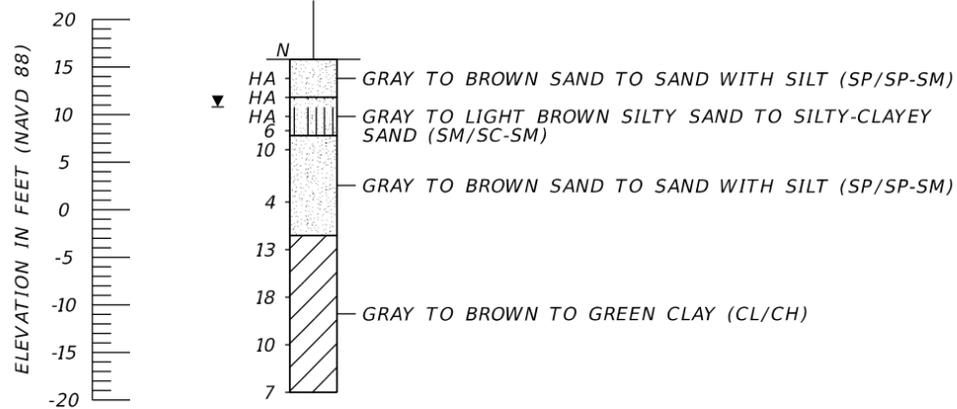
SUBSTRUCTURE CONCRETE: EXTREMELY AGGRESSIVE
 SUBSTRUCTURE STEEL: EXTREMELY AGGRESSIVE
 SUPERSTRUCTURE SLIGHTLY AGGRESSIVE

LEGEND

- GRAY TO BROWN SAND TO SAND WITH SILT (SP/SP-SM)
- GRAY TO LIGHT BROWN SILTY SAND TO SILTY-CLAYEY SAND (SM/SC-SM)
- GRAY TO BROWN CLAYEY SAND (SC)
- GRAY TO BROWN TO GREEN CLAY (CL/CH)
- SP UNIFIED SOIL CLASSIFICATION SYSTEM (ASTM D 2487) GROUP SYMBOL AS DETERMINED BY VISUAL REVIEW AND LABORATORY TESTING ON SELECTED SAMPLES FOR CONFIRMATION OF VISUAL REVIEW.
- N NUMBERS TO THE LEFT OF BORINGS INDICATE SPT VALUE FOR 12 INCHES OF PENETRATION (UNLESS OTHERWISE NOTED).
- HA HAND AUGERED TO VERIFY UTILITY CLEARANCE
- 200 PERCENT PASSING #200 SIEVE
- NMC NATURAL MOISTURE CONTENT (%)
- LL LIQUID LIMIT (%)
- PI PLASTICITY INDEX (%)
- NP NON-PLASTIC
- NAVD 88 NORTH AMERICAN VERTICAL DATUM OF 1988
- APPROXIMATE SPT BORING LOCATION
- GROUNDWATER LEVEL ENCOUNTERED DURING FIELD EXPLORATIONS

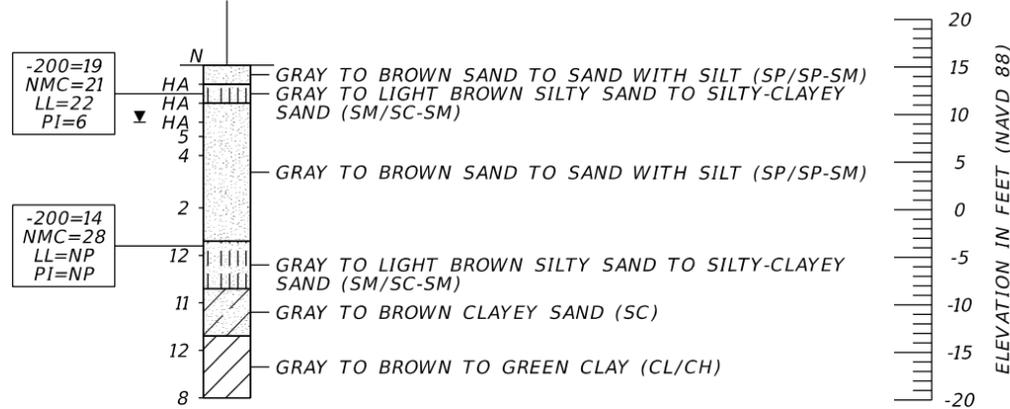
BOR # SG-2
 STA. 185+40
 REF. Q 63RD AVE.
 OFF. 79' LT.
 ELEV. 15.8
 DATE 5/1/2023
 DRILLER C. VIRGEN
 HAMMER AUTOMATIC
 RIG D-25

BOR # SG-1
 STA. 186+47
 REF. Q 63RD AVE.
 OFF. 53' RT.
 ELEV. 15.2
 DATE 2/9/2023
 DRILLER J. SHAW
 HAMMER AUTOMATIC
 RIG D-25



BORING TERMINATED AT ELEVATION -19.2 FT (NAVD 88)

LATITUDE: N 27.42924
 LONGITUDE: W 82.52213



BORING TERMINATED AT ELEVATION -19.8 FT (NAVD 88)

LATITUDE: N 27.42888
 LONGITUDE: W 82.52180

	SAFETY HAMMER	AUTOMATIC HAMMER
GRANULAR MATERIALS-RELATIVE DENSITY	SPT N-VALUE (BLOWS/FT.)	SPT N-VALUE (BLOWS/FT.)
VERY LOOSE	LESS THAN 4	LESS THAN 3
LOOSE	4 to 10	3 to 8
MEDIUM DENSE	10 to 30	8 to 24
DENSE	30 to 50	24 to 40
VERY DENSE	GREATER THAN 50	GREATER THAN 40
SILTS AND CLAYS CONSISTENCY	SPT N-VALUE (BLOWS/FT.)	SPT N-VALUE (BLOWS/FT.)
VERY SOFT	LESS THAN 2	LESS THAN 1
SOFT	2 to 4	1 to 3
FIRM	4 to 8	3 to 6
STIFF	8 to 15	6 to 12
VERY STIFF	15 to 30	12 to 24
HARD	GREATER THAN 30	GREATER THAN 24

NUMBER	DESCRIPTION	DATE	SCALE	AS NOTED	DATE	MARC E. NOVAK, Ph.D., P.E. P.E. LICENSE NUMBER 67431 TIERRA, INC. 7351 TEMPLE TERRACE HIGHWAY TAMPA, FLORIDA 33637	PUBLIC WORKS DEPARTMENT ENGINEERING SERVICES 1022 26th Avenue East Bradenton, FL 34208	REPORT OF CORE BORINGS	SHEET NO.
			DESIGNED BY	BMG	05/2023				
			DRAWN BY	BMG	PROJECT NO.				
			CHECKED BY	MEN	6107860				
									T-27

**Recommended Soil Parameters for Mast Arm Signal Structure Foundations
63rd Ave E from U.S. 301 to Tuttle Avenue
Manatee County, Florida
Manatee County Project No.: 6107860
Tierra Project No.: 6511-22-126**

Structure No.	Reference Boring	Soil Type	Total Saturated Unit Weight (γ, lb/ft³)⁽¹⁾	Effective Unit Weight (γ, lb/ft³)⁽²⁾	Friction Angle (φ, °)	Recommended N-Value
2 & 3	SG-1	SAND	105	43	29	Refer to N-Average Table
1	SG-2	SAND	105	43	29	Refer to N-Average Table

Notes:
⁽¹⁾ Recommend analysis be based on saturated conditions, i.e. analyze with the groundwater at the surface.
⁽²⁾ Effective unit weight based on submerged conditions.

Recommended Average N Value for MathCAD Spreadsheet
63rd Ave E from U.S. 301 to Tuttle Avenue - Mast Arm Signal Structure
Manatee County, Florida
Manatee County Project No.: 6107860
Tierra Project No.: 6511-22-126

Approximate Boring Elevation (feet, NAVD 88):		15.2	Reference Boring: Approximate Boring Station & Offset	SG-1 186+47 53' RT.
Approximate Structure Ground Elevation (feet, NAVD 88):		17.0	Structure Identification	2 & 3
Approximate Shaft Depth (feet)	Elevation (feet, NAVD 88)	Automatic Hammer SPT N Value	Corrected Safety Hammer N Value ⁽¹⁾	Average Weighted N Value for use in MATHCAD Torsional Calculation
1	16.0	FILL ⁽²⁾	4.0	4
2	15.0	FILL ⁽²⁾	4.0	4
3	14.0	HA ⁽²⁾	4.0	4
4	13.0	HA ⁽²⁾	4.0	4
5	12.0	HA ⁽²⁾	4.0	4
6	11.0	HA ⁽²⁾	4.0	4
7	10.0	HA ⁽²⁾	4.0	4
8	9.0	HA ⁽²⁾	4.0	4
9	8.0	5	6.2	4
10	7.0	5	6.2	4
11	6.0	4	5.0	4
12	5.0	4	5.0	4
13	4.0	4	5.0	4
14	3.0	4	5.0	4
15	2.0	4	5.0	4
16	1.0	2	2.5	4
17	0.0	2	2.5	4
18	-1.0	2	2.5	4
19	-2.0	2	2.5	3
20	-3.0	2	2.5	3
21	-4.0	12	14.9	4
22	-5.0	12	14.9	5
23	-6.0	12	14.9	6
24	-7.0	12	14.9	7
25	-8.0	12	14.9	7
26	-9.0	11	13.6	7
27	-10.0	11	13.6	7
28	-11.0	11	13.6	7
29	-12.0	11	13.6	7
30	-13.0	11	13.6	7
31	-14.0	12	14.9	6
32	-15.0	12	14.9	6
33	-16.0	12	14.9	6
34	-17.0	12	14.9	6
35	-18.0	12	14.9	6
36	-19.0	8	9.9	6
37	-20.0	8	9.9	6

⁽¹⁾ Automatic Hammer SPT N Value is corrected by a factor of 1.24 to equivalent Safety Hammer N Value in accordance with FDOT Specifications.

⁽²⁾ HA: Hand augered. Corrected Safety Hammer N Value treated as 4 for HA and Fill.

**Recommended Average N Value for MathCAD Spreadsheet
63rd Ave E from U.S. 301 to Tuttle Avenue - Mast Arm Signal Structure
Manatee County, Florida
Manatee County Project No.: 6107860
Tierra Project No.: 6511-22-126**

Approximate Boring Elevation (feet, NAVD 88):		15.8	Reference Boring: Approximate Boring Station & Offset	SG-2 185+40 79' LT.
Approximate Ground Structure Elevation (feet, NAVD 88):		17.0	Structure Identification	1
Approximate Shaft Depth (feet)	Elevation (feet, NAVD 88)	Automatic Hammer SPT N Value	Corrected Safety Hammer N Value ⁽¹⁾	Average Weighted N Value for use in MATHCAD Torsional Calculation
1	16.0	FILL ⁽²⁾	4.0	4
2	15.0	HA ⁽²⁾	4.0	4
3	14.0	HA ⁽²⁾	4.0	4
4	13.0	HA ⁽²⁾	4.0	4
5	12.0	HA ⁽²⁾	4.0	4
6	11.0	HA ⁽²⁾	4.0	4
7	10.0	HA ⁽²⁾	4.0	4
8	9.0	6	7.4	4
9	8.0	6	7.4	5
10	7.0	10	12.4	6
11	6.0	10	12.4	7
12	5.0	10	12.4	8
13	4.0	10	12.4	9
14	3.0	10	12.4	9
15	2.0	4	5.0	8
16	1.0	4	5.0	8
17	0.0	4	5.0	8
18	-1.0	4	5.0	7
19	-2.0	4	5.0	7
20	-3.0	13	16.1	7
21	-4.0	13	16.1	8
22	-5.0	13	16.1	8
23	-6.0	13	16.1	8
24	-7.0	13	16.1	8
25	-8.0	18	22.3	8
26	-9.0	18	22.3	9
27	-10.0	18	22.3	9
28	-11.0	18	22.3	9
29	-12.0	18	22.3	9
30	-13.0	10	12.4	9
31	-14.0	10	12.4	8
32	-15.0	10	12.4	8
33	-16.0	10	12.4	8
34	-17.0	10	12.4	8
35	-18.0	7	8.7	8
36	-19.0	7	8.7	7

⁽¹⁾ Automatic Hammer SPT N Value is corrected by a factor of 1.24 to equivalent Safety Hammer N Value in accordance with FDOT Specifications.

⁽²⁾ HA: Hand augered. Corrected Safety Hammer N Value treated as 4 for HA and Fill.