Geotechnical Exploration and Evaluation Report

Durbin Parkway North
Manhole Replacement Project
St. Johns County, Florida

CSI Geo Project No.: 71-21-407-01
JEA Purchase Order No.: 194749

Prepared by

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Prepared for

JEA

February 3, 2021

February 3, 2021

Justin Spencer, P.E.
JEA
21 West Church Street
Jacksonville, FL 32202

RE: Durbin Parkway North
Manhole Replacement Project
St. Johns County, Florida

Subject: Geotechnical Exploration and Evaluation Report
CSI Geo Project No.: 71-21-407-01
JEA Purchase Order No.: 194749

Dear Mr. Spencer:

CSI Geo, Inc. has performed the authorized geotechnical exploration and laboratory testing program for the proposed Durbin Parkway North Manhole Replacement Project in St. Johns County, Florida. This report presents our understanding of the subsurface conditions along with our engineering evaluation and recommendations.

We have enjoyed working with you on this project and look forward to working with you on future projects. If you have any questions concerning this report, please contact our office.

Sincerely,
CSI Geo, Inc.

Bradley Sheffield, P.E.
Geotechnical Engineer
Registered, Florida No. 82409

Digitally signed by John A Iya
Date: 2021.02.03 17:13:29-05'00'

John A, Iya, P.E.
Senior Geotechnical
Registered, Florida No. 77294

JOHN A. IYA LICENSE No. 77294 STATE OF FLORIDA PROFESSIONAL ENGINEER

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1.0 PROJECT INFORMATION

1.1 General Project Information

The purpose of this geotechnical exploration was to obtain information concerning the subsurface conditions in order to evaluate the site with respect to the replacement of sanitary sewer manholes along Durbin Parkway North in St. Johns County, Florida. This report briefly describes the field and laboratory testing activities and presents our findings.

1.2 Existing Conditions and Project Description

Information regarding this project was provided to us by Mr. Justin Spencer, P.E. of JEA. The project site is located along Durbin Parkway North in St. Johns County, Florida. A Site Location Map is included in the **Appendix.** We understand that five (5) existing sanitary sewer manholes located along Durbin Parkway North between Pump Station NOR-115 and the traffic circle at the intersection of Durbin Parkway North and Buckhead Court will be replaced. The five manholes are located within the asphalt paved roadway with invert elevations of approximately 18 to 19 feet below the existing grades of Durbin Parkway North.

2.0 GEOTECHNICAL EXPLORATION

2.1 Field Exploration

To explore the subsurface conditions at the project site, a total of five (5) Standard Penetration Test (SPT) borings (B-1 through B-5) were performed to a depth of 30 feet, each below the existing asphalt paved roadway surface. The location of the borings were selected and located in the field by CSI Geo, Inc. (CSI Geo). It should be noted that the boring locations were placed with consideration given to maintenance of traffic during the field exploration, and to avoid damaging existing underground utilities/pipes. The location of the test borings performed relative to the manholes are summarized in **Table 1**.

TABLE 1. BORING AND MANHOLE DESIGNATIONS

Boring No.	Manhole Designation
B-1	MH-036647
B-2	MH-031652
B-3	MH-051632
B-4	MH-026790
B-5	MH-021517

The Report of SPT Borings sheet in the **Appendix** indicates the penetration resistance and the soil classification based on the Unified Soil Classification System (USCS) for each soil type encountered in the test borings. The stratification lines and depth designations on the boring logs represent the approximate boundaries between soil types. In some instances, the transition between soil types may be gradual. The groundwater level was measured at time of drilling, and is also shown on the Report of SPT Borings sheet. A brief description of the exploratory drilling and sampling techniques used is presented in the Field and Laboratory Test Procedures section presented in the **Appendix**.

2.2 Laboratory Testing

Quantitative laboratory testing was performed on selected samples of the soils recovered from the field exploration. The laboratory testing was necessary to better define the composition of the soils encountered. Laboratory tests were performed to determine the fines content, organic content, and natural moisture content of the selected soil samples. The results of the laboratory testing are shown on the Summary of Laboratory Test Results presented in the **Appendix**. The laboratory testing procedures used are also briefly presented in the Field and Laboratory Test Procedures sheet presented in the **Appendix**.

3.0 SUBSURFACE CONDITIONS

3.1 General

An illustrated representation of the subsurface conditions encountered in the area of the proposed manhole replacements is shown on the Report of SPT Borings sheet presented in the **Appendix**. The profiles and soil conditions outlined below highlight the major subsurface stratification. The Report of SPT Boring should be consulted for a detailed description of the subsurface conditions encountered at the boring location.

3.2 Soil Conditions

Review of SPT borings B-1 through B-5 indicates that the areas of the proposed manhole replacements are underlain generally by very loose to loose sands (SP, Unified Soil Classification System) and slightly silty sands (SP-SM) to a depth of 22 feet. Thereafter, medium dense slightly silty sands (SP-SM) were generally encountered until the boring termination depth of 30 feet below the existing pavement surface.

3.3 Groundwater Conditions

The groundwater level was measured and recorded as encountered at the time of drilling. The depth of groundwater level measured at the time of drilling ranged from 4.2 feet to 5.0 feet below the existing ground surface. The depth of the groundwater level at each test location is marked on the Report of SPT Borings sheet presented in the **Appendix**.

It should be anticipated that the groundwater level will fluctuate due to seasonal climate variations, surface water runoff patterns, construction operations, and other related factors. During seasonal high precipitation periods, groundwater levels can be expected to rise above the levels recorded during this exploration. Therefore, design drawings and specifications should account for the possibility of groundwater level variations, and construction planning should be based on the assumption that such variations will occur.

3.4 Asphalt and Limerock Thickness

The existing asphalt pavement was cored at test boring locations B-1 though B-5 to determine the thickness of the existing asphalt pavement and limerock base. The asphalt pavement thickness was found to be 2.0 inches. The limerock base thickness was found to range between 6.0 and 7.0 inches. A table summarizing the asphalt and limerock thicknesses is included in the **Appendix**.

4.0 GEOTECHNICAL ENGINEERING EVALUATION AND RECOMMENDATIONS

4.1 Basis of Evaluation & Recommendations

The following recommendations are based on the project information and the data obtained in this exploration. If the location of the proposed manhole replacements change, CSI Geo should be contacted so that our recommendations can be reviewed. The discovery of site and/or subsurface conditions during construction that deviate from the data obtained in this exploration should also be reported to us for our review.

4.2 Manhole Replacement Evaluation

We consider the existing subsurface conditions to be generally favorable for support of conventional concrete manhole Type A structures. We understand that the bearing level at the location of the manhole replacements is anticipated to be at or below 18 feet below the existing ground surface. At this depth, the subsurface soils consist of suitable very loose to loose sands (SP) and slightly silty sands (SP-SM) which are capable of providing adequate support for the concrete manhole exerting a maximum allowable soil bearing pressure of 2,000 pounds per square foot (psf). Using a 2,000 psf bearing pressure, we estimate that total settlements of the structure will be on the order of 1 inch or less.

The bearing level soils, should be compacted to densities equivalent to 98% of the Modified Proctor maximum dry density (ASTM D1557). The foundation bearing level soils should also be inspected and tested by an engineering technician, acting under the direction and supervision of the geotechnical engineer, in order to evaluate the density and acceptability of the foundation bearing material prior to construction of the manhole replacements.

As a general rule, below grade structures should be designed to resist hydrostatic uplift pressures appropriate for their depth below the wet seasonal groundwater table. The water table for hydrostatic uplift design purposes should be assumed to be 1.0 foot below prevailing grade. Recommended soil parameters for use in the design of the manhole replacements are provided in Section 4.2.1 of this report. All excavations should be performed in accordance with OSHA

Excavation Standard regulations. The replacement manhole structures should be designed and constructed in accordance with the latest applicable JEA standards and specifications.

4.2.1 Manhole Replacement Design Soil Parameters

The manhole replacements should be designed to withstand lateral earth pressures as well as hydrostatic pressures on the walls of the manhole. Soil parameters which can be used for the design are presented as follows:

MANHOLE REPLACEMENT DESIGN SOIL PARAMETERS

Borings B-1 though B-5

Soil Classification	Cohesionless (Very Loose to Loose Sands)	Cohesionless (Medium Dense Sands)
Depth (ft)	0.0 to 22.0	22.0 to 30.0
Saturated unit weight (pcf)	100	105
Effective unit weight for input purposes (pcf)	38	43
Estimated friction angle ϕ (degrees)	27	30
Cohesion C (psf)	---	---
Friction angle between soil and wall δ (degrees)	18	20
At-Rest Earth Pressure Coefficient K_o	0.55	0.50
Active Earth Pressure Coefficient K_a	0.38	0.33
Passive Earth Pressure Coefficient K_p	2.66	3.00
Modulus of Subgrade Reaction K (pci)	150	200

4.2.2 Dewatering for Manhole Construction

Based on the information provided to us, we understand that the bottom of the excavation for the manholes will be at or below 18 feet below the existing ground surface. Therefore, lowering the groundwater level at this site by means of an extensive wellpoint system will be needed. Supplemental pumping from sump pumps will also be necessary to remove any water not removed by the wellpoints. The groundwater level should be lowered to a level at least one foot below the bottom of any excavations made during construction and at least two feet below the level of any vibratory compaction operations. We recommend that the dewatering system be kept operational until the manhole replacements are constructed. The dewatering system should not be turned off unless approved by the Engineer. It is also recommended that the groundwater level should be monitored on a regular basis to ensure that the groundwater level stays below the bottom of the manhole during construction.

5.0 REPORT LIMITATIONS

The subsurface exploration program including our evaluation and recommendations was performed in general accordance of accepted geotechnical engineering principles and standard practices. CSI Geo is not responsible for any independent conclusions, opinions, or interpretations made by others based on the data presented in this report.

This report does not reflect any variations that may occur adjacent or between soil borings. The discovery of any site or subsurface condition during construction that deviates from the findings and data as presented in this report should be reported to CSI Geo for evaluation. If the location of the proposed project feature was changed, our office should be contacted so our recommendations can be re-evaluated. We recommend that CSI Geo be given the opportunity to review the final design drawings and specifications to ensure that our recommendations are properly included and implemented.

APPENDIX

Site Location Map

Field Exploration Plan

Report of SPT Borings

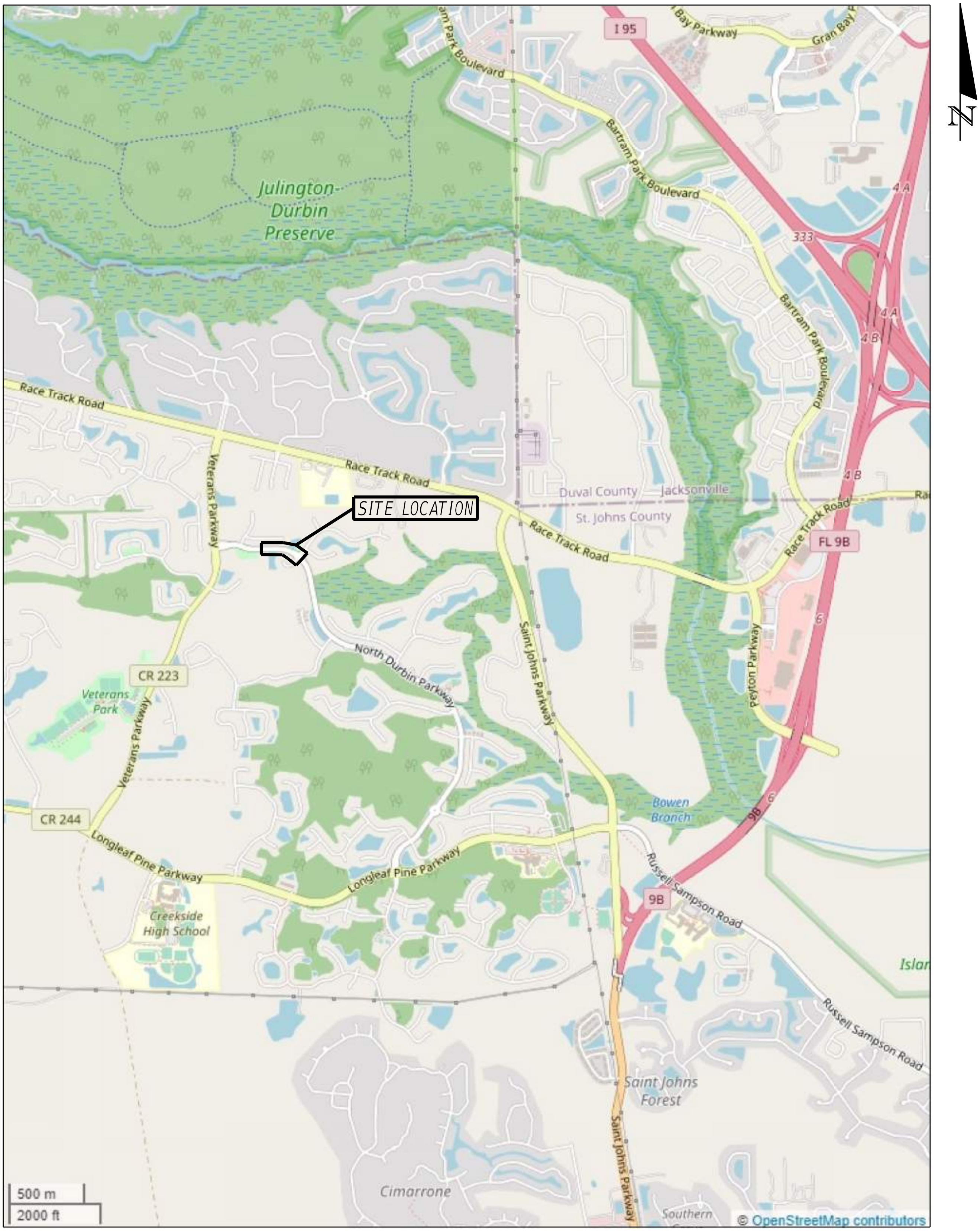
Summary of Laboratory Test Results

Existing Pavement System Thickness

Key to Soil Classification

Field and Laboratory Test Procedures

Site Location Map



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SITE LOCATION MAP
DURBIN PARKWAY NORTH
MANHOLE REPLACEMENT PROJECT
ST. JOHNS COUNTY, FLORIDA

Field Exploration Plan

LEGEND

STANDARD PENETRATION TEST (SPT) BORING LOCATION

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GEOTECHNICAL ENGINEERING
CONSTRUCTION MATERIALS TESTING
CONSTRUCTION ENGINEERING INSPECTION

FIELD EXPLORATION PLAN
DURBIN PARKWAY NORTH
MANHOLE REPLACEMENT PROJECT
ST. JOHNS COUNTY, FLORIDA

Report of SPT Boring

LEGEND

FINE SAND (SP); SLIGHTLY SILTY FINE SAND (SP–SM)

LIMEROCK

ASPHALT

(SP)	UNIFIED SOIL CLASSIFICATION SYSTEM		WATER LEVEL AT TIME OF DRILLING
B.T.	STANDARD PENETRATION TEST BORING TERMINATION	N	STANDARD PENETRATION RESISTANCE IN BLOWS PER FT UNLESS OTHERWISE NOTED, NUMBERS TO THE LEFT OF BORING INDICATE N–VALUES.
W / –200 / OC%	NATURAL MOISTURE CONTENT (%) / FINES PASSING NO. 200 SIEVE (%) / ORGANIC CONTENT PERCENT (%)	H.A.	HAND AUGERED
		W.O.H.	WEIGHT OF HAMMER

GRANULAR MATERIALS		SILT AND CLAYS	
RELATIVE DENSITY	AUTOMATIC HAMMER SPT N–VALUE (BLOWS/FT)	CONSISTENCY	AUTOMATIC HAMMER SPT N–VALUE (BLOWS/FT)
VERY LOOSE	LESS THAN 3	VERY SOFT	LESS THAN 1
LOOSE	3–8	SOFT	1–3
MEDIUM DENSE	8–24	FIRM	3–6
DENSE	24–40	STIFF	6–12
VERY DENSE	GREATER THAN 40	VERY STIFF	12–24
		HARD	GREATER THAN 24

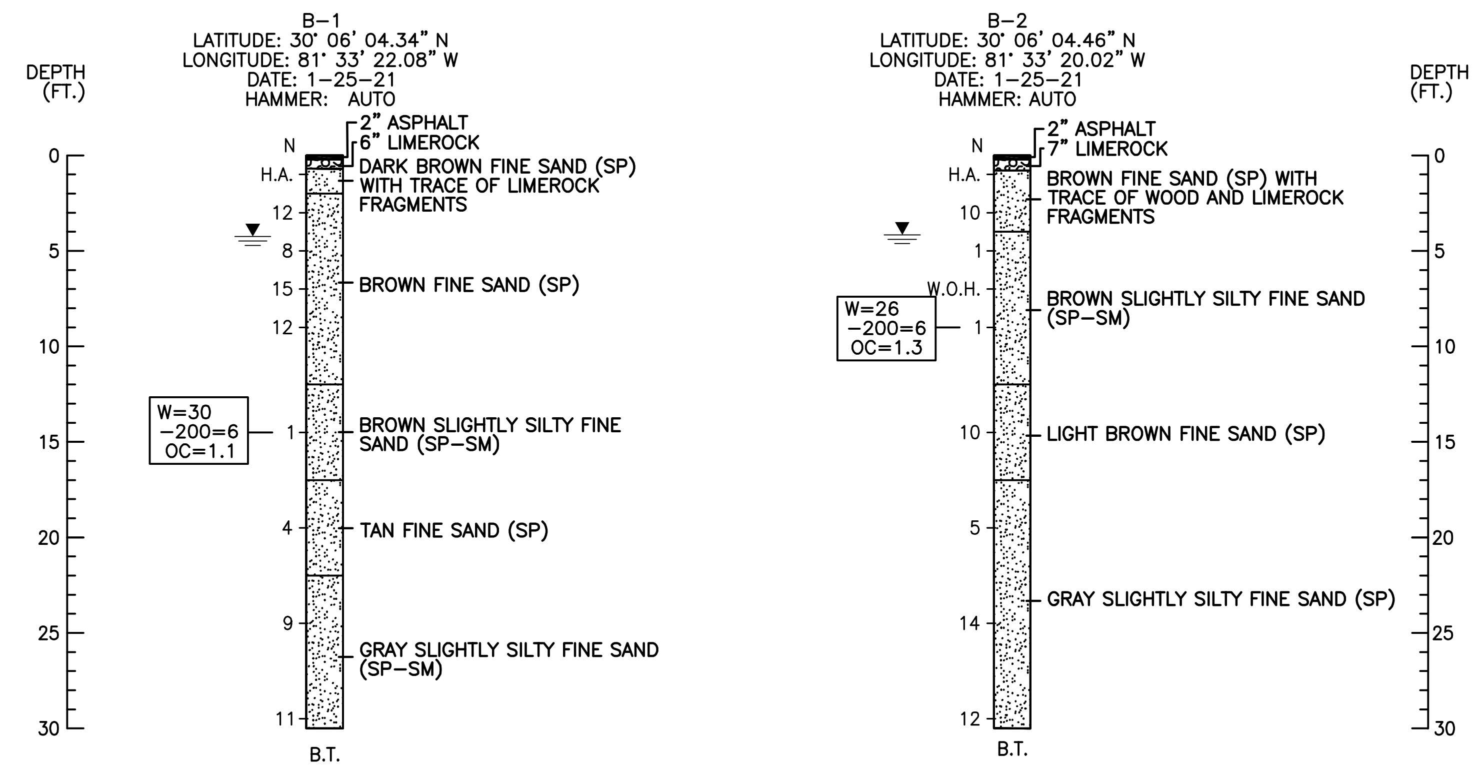
STANDARD PENETRATION TEST DATA

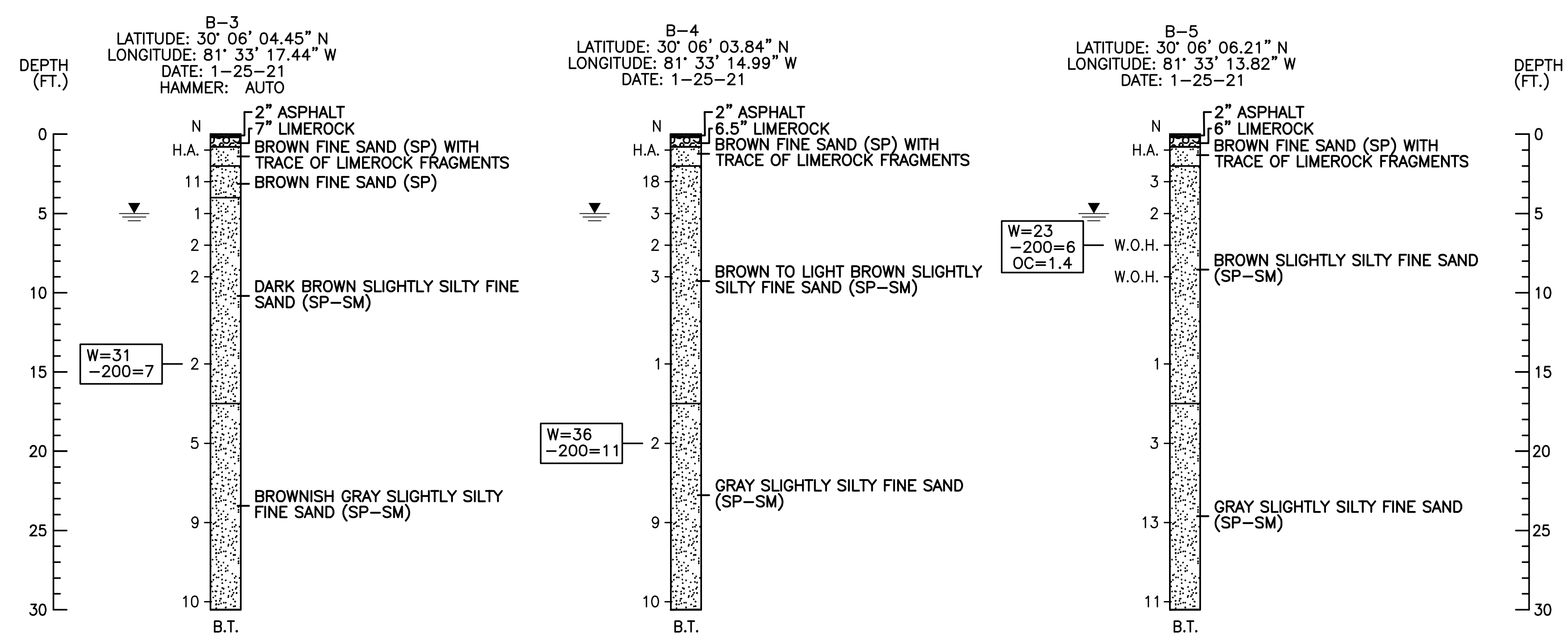
SPOON INSIDE DIA.	1.44 INCHES
SPOON OUTSIDE DIA.	2.0 INCHES
ASTM STANDARD DROP HAMMER, AUTO.	
AVG. HAMMER DROP	30.0 INCHES
HAMMER WEIGHT	140.0 LBS

NOTES:

1) DRILL AND PENETRATION TESTING WAS PERFORMED IN ACCORDANCE WITH ASTM D–1586.

2) LAYER BOUNDARIES ARE APPROXIMATE AND MAY VARY BETWEEN OR AWAY FROM BORING LOCATIONS.





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GEOTECHNICAL ENGINEERING
CONSTRUCTION MATERIAL TESTING
CONSTRUCTION ENGINEERING INSPECTION

REPORT OF SPT BORINGS

DURBIN PARKWAY NORTH MANHOLE REPLACEMENT PROJECT
JACKSONVILLE, FLORIDA

Summary of Laboratory Test Results

SUMMARY OF LABORATORY TEST RESULTS

Durbin Pkwy N Manhole Replacement Project
St. Johns County, Florida

Boring No.	Sample No.	Approximate Depth (ft)			Natural Moisture Content (%)	Organic Content (%)	Percent Passing Sieve Size (%)						Atterberg Limits		Soil Classification Symbol
							#4	#10	#40	#60	#100	#200	LL	PI	
B-1	6	13.5	-	15.0	30	1.1						6			SP-SM
B-2	5	8.0	-	10.0	26	1.3						6			SP-SM
B-3	6	13.5	-	15.0	31							7			SP-SM
B-4	7	18.5	-	20.0	36							11			SP-SM
B-5	4	6.0	-	8.0	23	1.4						6			SP-SM

Existing Pavement System Thickness

EXISTING PAVEMENT SYSTEM THICKNESS

Durbin Pkwy N Manhole Replacement Project
St. Johns County, Florida

Core No.	Latitude	Longitude	Asphalt Thickness (in)	Limerock Thickness (in)
B-1	30° 06' 04.34" N	81° 33' 22.08" W	2	6
B-2	30° 06' 04.46" N	81° 33' 20.02" W	2	7
B-3	30° 06' 04.45" N	81° 33' 17.44" W	2	7
B-4	30° 06' 03.84" N	81° 33' 14.99" W	2	6 1/2
B-5	30° 06' 03.21" N	81° 33' 13.82" W	2	6

Key to Soil Classification

KEY TO SOIL CLASSIFICATION

Correlation of Penetration Resistance with Relative Density and Consistency

Granular Materials

Relative Density	**Auto Hammer SPT N-Value (Blows/foot)**
Very Loose	Less than 3
Loose	3 – 8
Medium Dense	8 - 24
Dense	24 - 40
Very Dense	Greater than 40

Silts and Clays

Consistency	**Auto Hammer SPT N-Value (Blows/foot)**
Very Soft	Less than 1
Soft	1 – 3
Firm	3 - 6
Stiff	6 - 12
Very Stiff	12 - 24
Hard	Greater than 24

Particle Size Identification (Unified Soil Classification System)

Boulders:	Diameter exceeds 8 inches
Cobbles:	3 to 8 inches diameter
Gravel:	Coarse - 3/4 to 3 inches in diameter
	Fine - 4.76 mm to 3/4 inch in diameter
Sand:	Coarse - 2.0 mm to 4.76 mm in diameter
	Medium - 0.42 mm to 2.0 mm in diameter
	Fine - 0.074 mm to 0.42 mm in diameter

Modifiers

These modifiers provide our estimate of the amount of fines (silt or clay size particles) in soil samples.

Approximate Fines Content	Modifiers
5% Fines 12%	Slightly silty or slightly clayey
12% Fines 30%	Silty or clayey
30% Fines 50%	Very silty or very clayey

These modifiers provide our estimate of shell, rock fragments, or roots in the soil sample.

Approximate Content, By Weight	Modifiers
< 5%	Trace
5% to 10%	Few
15% to 25%	Little
30% to 45%	Some
50% to 100%	Mostly

These modifiers provide our estimate of organic content in the soil sample.

Organic Content	Modifiers
1% to 3%	Trace
3% to 5%	Slightly Organic
5% to 20%	Organic
20% to 75%	Highly Organic (Muck)
> 75%	Peat

Field and Laboratory Test Procedures

FIELD AND LABORATORY TEST PROCEDURES

FIELD TEST PROCEDURES

Standard Penetration Test (SPT) Borings

The soil penetration test borings were made in general accordance with ASTM D-1586, "Penetration Test and Split-Barrel Sampling of Soils". The boring was advanced by continuous driving the split spoon sampler to a depth of 10 feet below the existing ground surface. Below 10 feet, split spoon sampling was performed at a spacing of 5 feet until the boring termination depth. Bentonite drilling fluid was used below the ground water level to stabilize the sides and to flush the cuttings. At the sampling intervals, the drilling tools were removed and soil samples were obtained with a standard 1.4 inch I.D., 2.0 inch O.D., split-tube sampler. The sampler was first seated six inches and then driven an additional foot with blows of a 140 pound 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. The samples were then examined by a geotechnical engineer to confirm the field classifications.

LABORATORY TEST PROCEDURES

Natural Moisture 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 was conducted in the general accordance with FM 1-T 265.

Percent Fines Content – To determine the percentage of soils finer than No. 200 sieve, the dried samples were washed over a 200 mesh sieve. The material retained on the sieve was oven dried and then weighed and compared with the unwashed dry weight in order to determine the weight of the fines. The percentage of fines in the soil sample was then determined as the percentage of weight of fines in the sample to the weight of the unwashed sample. This test was conducted in accordance with ASTM D 1140.

Percent Organic Content – This test is based on the percent of organics by weight of the total sample. This test was conducted in accordance with FM I - T 267.