

TABLE OF CONTENTS - VOLUME III

SECTION 1: STRUCTURAL CALCULATIONS



Caribbean Boulevard Bridge Replacement

Miami-Dade County

Structural Calculations

Small Business Enterprise-Construction Program (SBE-S.):

2%

Community Workforce Program:

N/A

DTPW Capital Improvements Engineer:

Alicia Arce

RPQ Issue Date:

March 20, 2025



SolVer Structural Partnership, Inc.

Consulting Structural Engineers

Design • Inspections • Investigation • Reports

Additional Structural calculations for Submittal 018

**Project: Caribbean Boulevard Bridge
at the C12-N CANAL CROSSING**

By : Denis K. Solano

P.E. #: 56902, S.I. #: 2046

SolVer Structural Partnership, Inc.

950 NW 22 Ave, Miami Florida, 33125

**Denis K Solano, P.E. ASSUMES RESPONSIBILITY FOR BOTH MANUAL AND
COMPUTER GENERATED CALCULATIONS (PAGE 1-4)**

page 1-4

Client: SolVer Structural Part, Inc

Tel: 305-643-8699

Title: CARIBBEAN Blvd Bridge C1-N
CANAL CROSSING

Designer: D.K.S.

Page: 1

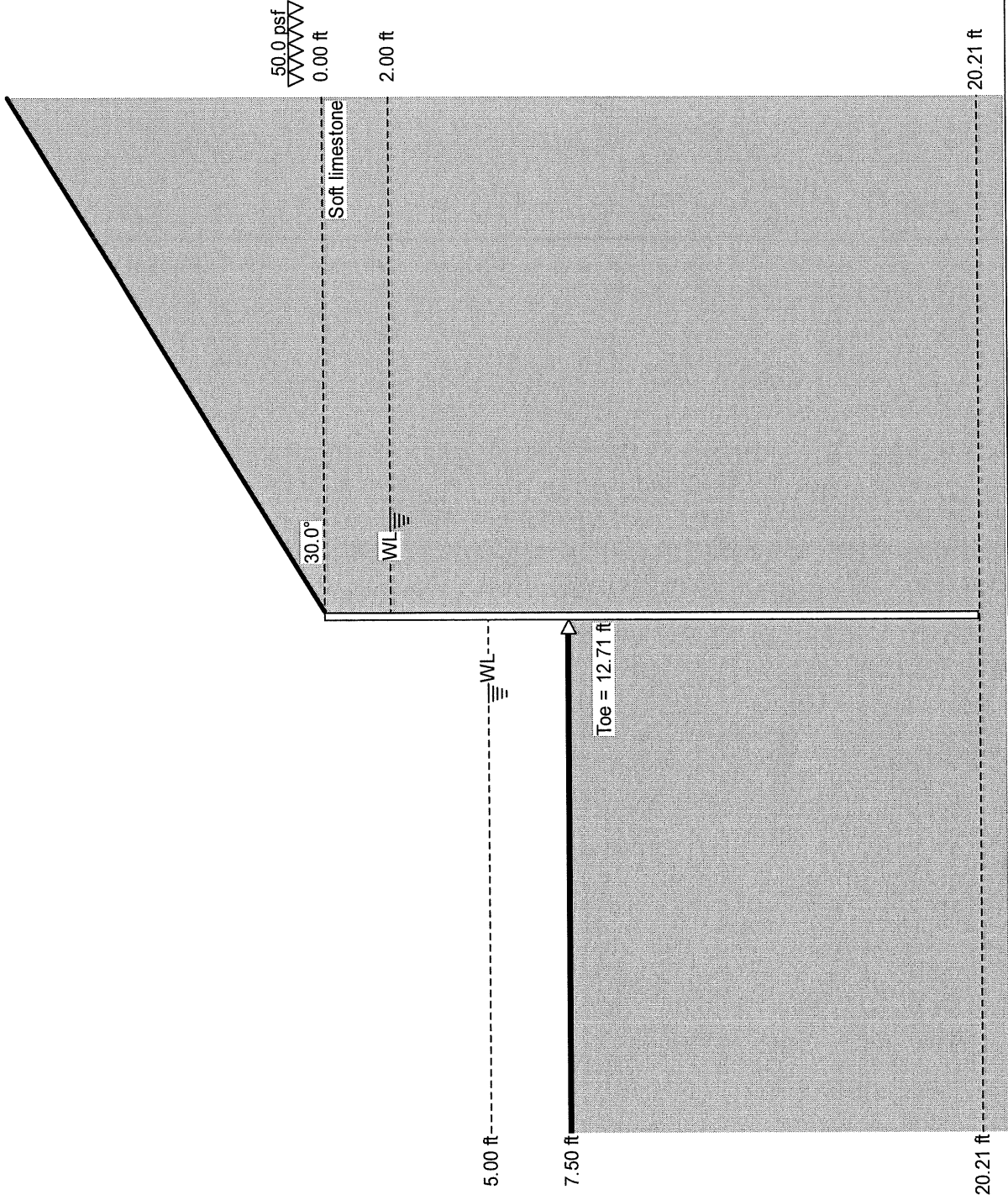
Date: 1.26.23

Sheet: Arbed AZ36

Pressure: Rankine

FOS: 1.5

Toe: Cantilever



Your Company Name

SPW911, v2.40

© 2001 - 2007, Pile Buck®, Inc.
Email: pilebuck@pilebuck.com
Web: www.pilebuck.com

Client: SolVer Structural Part, Inc
 Tel: 305-643-8699
 Title: CARIBBEAN Blvd Bridge C1-N
 CANAL CROSSING
 Designer: D.K.S.
 Page: 2
 Date: 1.26.23
 Sheet: Arbed AZ36
 Pressure: Rankine
 FOS: 1.5
 Toe: Cantilever

Input Data

Depth Of Excavation = 7.50 ft Depth Of Active Water = 2.00 ft Water Density = 62.43 pcf
 Surcharge = 50.0 psf Depth Of Passive Water = 5.00 ft Minimum Fluid Density = 31.82 pcf
 Slope (active) = 30.0 degrees

Soil Profile

Depth (ft)	Soil Name	γ (pcf)	γ' (pcf)	C (psf)	C_a (psf)	ϕ (°)	δ (°)	K_a	K_{ac}	K_p	K_{pc}
0.00	Soft limestone	120.00	60.00	0.0	0.0	35.0	17.0	0.41	0.00	3.64	0.00
22.33	Hard Limestone	125.00	65.00	6000.0	3000.0	0.0	17.0	0.99	1.99	1.01	2.01

Active Side

Soil Profile

Depth (ft)	Soil Name	γ (pcf)	γ' (pcf)	C (psf)	C_a (psf)	ϕ (°)	δ (°)	K_a	K_{ac}	K_p	K_{pc}
0.00	Soft limestone	120.00	60.00	0.0	0.0	35.0	17.0	0.24	0.00	5.63	0.00
22.33	Hard Limestone	125.00	65.00	6000.0	3000.0	0.0	17.0	1.00	2.00	1.00	2.00

Passive Side

Solution

Sheet

Sheet Name	I (in ⁴ /ft)	E (psi)	Z (in ³ /ft)	f (psi)	Maximum Bending Moment (ftlb/ft)	Upstand (ft)	Toe (ft)	Pile Length (ft)
Arbed AZ36	606.30	3.04E+07	67.00	24970.3	139417.1	0.00	12.71	20.21

Maxima

	Maximum	Depth
Bending Moment	13499.6 ftlb/ft	12.68 ft
Deflection	0.1 in	0.00 ft
Pressure	441.5 psf	7.50 ft
Shear Force	2225.0 lb/ft	8.89 ft

Your Company Name

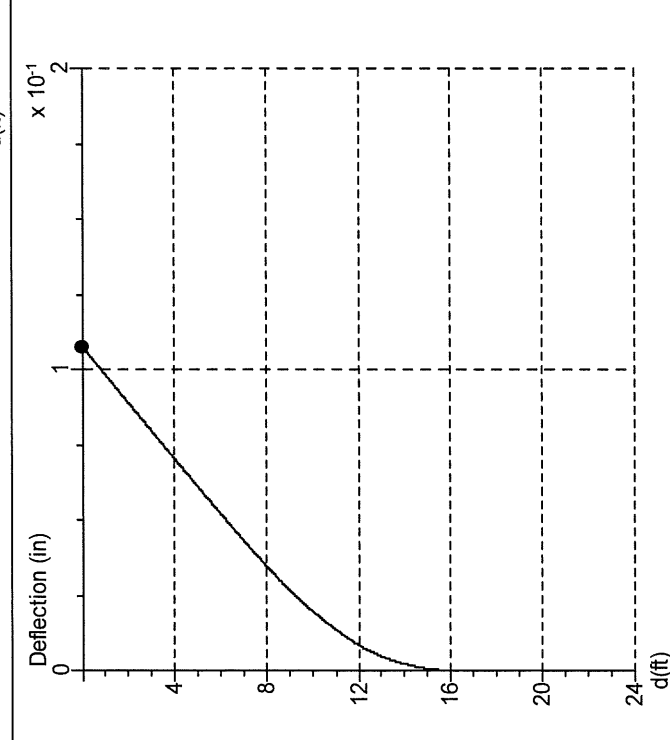
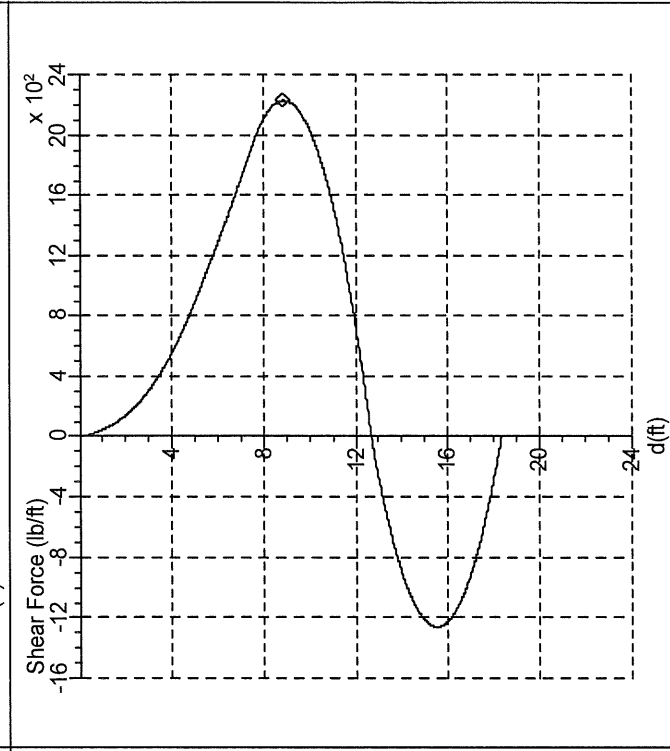
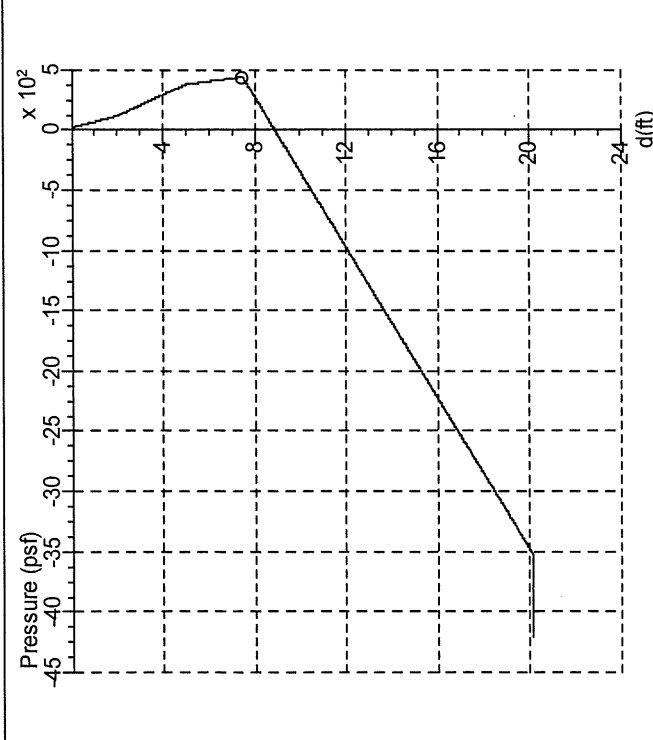
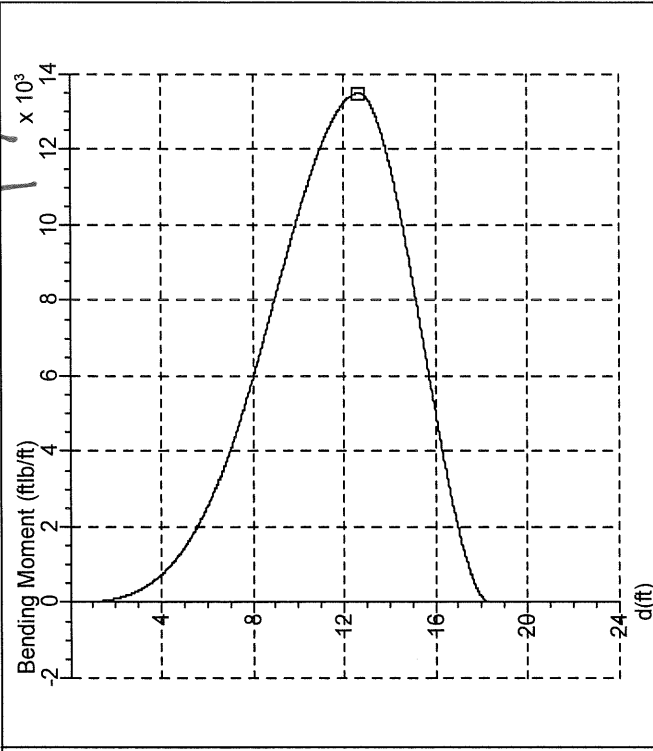
Client: SolVer Structural Part, Inc
Tel: 305-643-8699

Title: CARIBBEAN Blvd Bridge C1-N
CANAL CROSSING

Designer: D.K.S.
Page: 3
Date: 1.26.23

Sheet: Arbed AZ36
Pressure: Rankine
FOS: 1.5
Toe: Cantilever

	Maximum	d (ft)
○	441.5psf	7.50
□	13499.6ftlb/ft	12.68
◇	2225.0lb/ft	8.89
●	0.1 in	0.00



Client: SolVer Structural Part, Inc
 Tel: 305-643-8699
 Title: CARIBBEAN Blvd Bridge C1-N
 Designer: D.K.S.
 Page: 4
 Date: 1.26.23
 Sheet: Arbed AZ36
 Pressure: Rankine
 FOS: 1.5
 Toe: Cantilever

depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)	depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)	depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)
0.00	20.5	0.0	0.1	0.0	6.80	424.3	3682.6	0.0	1616.2	13.59	-1466.5	12587.0	0.0	-678.8
0.18	29.6	0.4	0.1	4.7	6.98	428.5	3959.4	0.0	1688.1	13.77	-1524.5	12205.4	0.0	-785.4
0.36	37.9	1.6	0.1	10.5	7.15	433.0	4278.0	0.0	1767.9	13.95	-1577.3	11812.1	0.0	-872.9
0.54	47.0	4.2	0.1	18.4	7.33	437.2	4580.5	0.0	1841.2	14.13	-1635.3	11333.7	0.0	-958.9
0.72	55.3	7.9	0.1	27.1	7.51	437.8	4927.5	0.0	1922.6	14.31	-1693.4	10812.8	0.0	-1034.1
0.89	64.4	13.8	0.1	38.3	7.69	379.7	5289.2	0.0	1998.0	14.49	-1746.1	10307.1	0.0	-1093.2
1.07	73.5	21.9	0.1	51.1	7.87	327.0	5629.4	0.0	2057.1	14.67	-1804.1	9720.7	0.0	-1147.9
1.25	81.8	31.5	0.1	64.3	8.05	269.0	6014.2	0.0	2111.8	14.85	-1856.9	9164.8	0.0	-1188.4
1.43	90.9	44.7	0.1	80.4	8.23	216.2	6372.1	0.0	2152.2	15.02	-1914.9	8533.4	0.0	-1222.6
1.61	100.1	61.0	0.1	98.1	8.41	158.2	6772.7	0.0	2186.4	15.20	-1972.9	7886.6	0.0	-1246.0
1.79	108.3	78.8	0.1	115.8	8.59	100.2	7178.8	0.0	2209.8	15.38	-2025.7	7290.1	0.0	-1258.0
1.97	117.5	101.9	0.1	136.8	8.76	47.4	7551.0	0.0	2221.8	15.56	-2083.7	6629.6	0.0	-1260.9
2.15	130.7	126.5	0.1	157.7	8.94	-10.6	7961.9	0.0	2224.9	15.74	-2141.7	5970.2	0.0	-1253.1
2.33	146.9	157.7	0.1	183.5	9.12	-68.6	8372.6	0.0	2218.1	15.92	-2194.5	5376.4	0.0	-1236.7
2.50	163.0	194.0	0.1	212.4	9.30	-121.4	8744.0	0.0	2202.5	16.10	-2252.5	4734.5	0.0	-1208.4
2.68	177.6	231.8	0.1	241.2	9.48	-179.4	9148.8	0.0	2175.1	16.28	-2305.3	4166.0	0.0	-1173.3
2.86	193.8	279.2	0.1	275.7	9.66	-232.2	9511.7	0.0	2140.9	16.45	-2363.3	3562.3	0.0	-1124.4
3.04	209.9	333.3	0.1	313.3	9.84	-290.2	9903.4	0.0	2093.0	16.63	-2421.3	2986.8	0.0	-1064.8
3.22	224.6	388.6	0.1	350.0	10.02	-348.2	10285.3	0.0	2034.4	16.81	-2474.1	2492.8	0.0	-1001.3
3.40	240.7	456.9	0.1	393.2	10.19	-401.0	10622.4	0.0	1971.7	16.99	-2532.1	1986.7	0.0	-921.1
3.58	255.3	526.1	0.1	435.1	10.37	-459.0	10980.2	0.0	1892.6	17.17	-2584.8	1565.1	0.0	-838.9
3.76	271.5	610.5	0.1	484.1	10.55	-517.0	11322.5	0.0	1802.6	17.35	-2642.9	1149.0	0.0	-738.3
3.93	287.6	704.3	0.1	536.0	10.73	-569.8	11618.5	0.0	1711.6	17.53	-2700.9	788.1	0.0	-626.9
4.11	302.3	798.0	0.1	585.8	10.91	-627.8	11925.6	0.0	1601.1	17.71	-2753.6	512.8	0.0	-516.3
4.29	318.4	911.1	0.1	643.5	11.09	-680.5	12186.4	0.0	1491.4	17.89	-2811.7	273.2	0.0	-384.3
4.47	333.1	1023.3	0.1	698.5	11.27	-738.6	12451.1	0.0	1360.4	18.06	-2869.7	105.3	0.0	-241.7
4.65	349.2	1157.6	0.1	761.8	11.45	-796.6	12690.7	0.0	1218.7	18.24	-2922.4	19.7	0.0	-102.6
4.83	365.3	1303.8	0.1	828.1	11.63	-849.3	12885.0	0.0	1080.5	18.42	-2980.5	0.0	0.0	0.0
5.01	380.0	1447.7	0.1	891.0	11.80	-907.4	13071.2	0.0	918.3	18.60	-3033.2	0.0	0.0	0.0
5.19	384.5	1618.2	0.1	961.9	11.98	-965.4	13226.5	0.0	745.3	18.78	-3091.2	0.0	0.0	0.0
5.37	389.1	1801.9	0.1	1033.6	12.16	-1018.1	13339.2	0.0	578.7	18.96	-3149.3	0.0	0.0	0.0
5.54	393.2	1980.5	0.1	1099.5	12.34	-1076.2	13430.1	0.0	385.2	19.14	-3202.0	0.0	0.0	0.0
5.72	397.8	2189.8	0.1	1172.8	12.52	-1128.9	13480.9	0.0	200.0	19.32	-3260.0	0.0	0.0	0.0
5.90	401.9	2391.9	0.1	1240.2	12.70	-1186.9	13499.6	0.0	-14.9	19.50	-3318.1	0.0	0.0	0.0
6.08	406.5	2627.3	0.1	1315.2	12.88	-1245.0	13453.6	0.0	-173.2	19.67	-3370.8	0.0	0.0	0.0
6.26	411.0	2876.6	0.0	1390.9	13.06	-1297.7	13341.8	0.0	-307.8	19.85	-3428.8	0.0	0.0	0.0
6.44	415.2	3115.5	0.0	1460.6	13.24	-1355.7	13147.2	0.0	-445.6	20.03	-3481.6	0.0	0.0	0.0
6.62	419.8	3391.8	0.0	1538.0	13.41	-1408.5	12909.7	0.0	-561.6	20.21	-4203.4	0.0	0.0	0.0

STRUCTURAL CALCULATIONS

**PROJECT: CARIBBEAN BOULEVARD BRIDGE
CARIBBEAN BOULEVARD AT THE
C12-N CANAL CROSSING**

**By: Denis k. Solano. P. E.
P.E. #: 56902
S.I. #: 2046
C.O.A. 00009095**

**DENIS K. SOLANO, P.E. ASSUMES RESPONSIBILITY FOR BOTH MANUAL
AND COMPUTER GENERATED CALCULATIONS (1-29)**

**SolVer Structural Partnership, Inc.
950 NW 22nd AVENUE
MIAMI, FLORIDA 33125
(305) 643-8699 PHONE
(305) 643-8692 FAX
WWW.SOLVERSP.COM**

TABLE OF CONTENTS

- **CHAPTER #1- PROJECT BACKGROUND** **Page#1-1**
- **CHAPTER #2- SHEET PILE ANALYSIS** **Page#2-9**
- **CHAPTER #3- TECHNICAL DATA** **Page#10-26**

DENIS K. SOLANO, P.E# 56902, S.I. #: 2046
950 NW 22ND AVENUE
MIAMI, FLORIDA 33125
(305) 643-8699 PHONE
(305) 643-8692 FAX

CHAPTER #1 – PROJECT BACKGROUND

SolVer Structural Partnership, Inc.

**950 NW 22ND AVENUE
MIAMI, FLORIDA 33125
(305) 643-8699 PHONE
(305) 643-8692 FAX
WWW.SOLVERSP.COM**



SolVer Structural Partnership, Inc.

Consulting Structural Engineers

Design • Inspections • Investigation • Reports

Page 1 of 1

October 4th, 2022

ATTENTION: ANTONIO M. GONZALEZ, PRESIDENT
AMERICAN EMPIRE BUILDERS
10460 SW 186TH STREET, UNIT 215
MIAMI, FLORIDA 33157

Re: Project Background
Caribbean Boulevard Bridge at the C12-N Canal Crossing, Miami Florida

BACKGROUND:

As per your American Empire Builders request this office has provided sheet pile analysis for the bridge approach condition observed at the above referenced project and found the following:

- 1) Bottom Elevation of sheet pile can be located between elevation marks -16.0' to -17.0' N.G.V.D. as long as an intermediate hard rock of layer allows it.
- 2) The sheet pile analysis shown attached has used the following information in order to complete the design:
 - a. Revised Geotechnical Report (see attached)
 - b. Revised plans for proposed drainage improvements dated March, 2020.

Should you have any questions on the foregoing, please do not hesitate to contact the undersigned.

Kind Regards

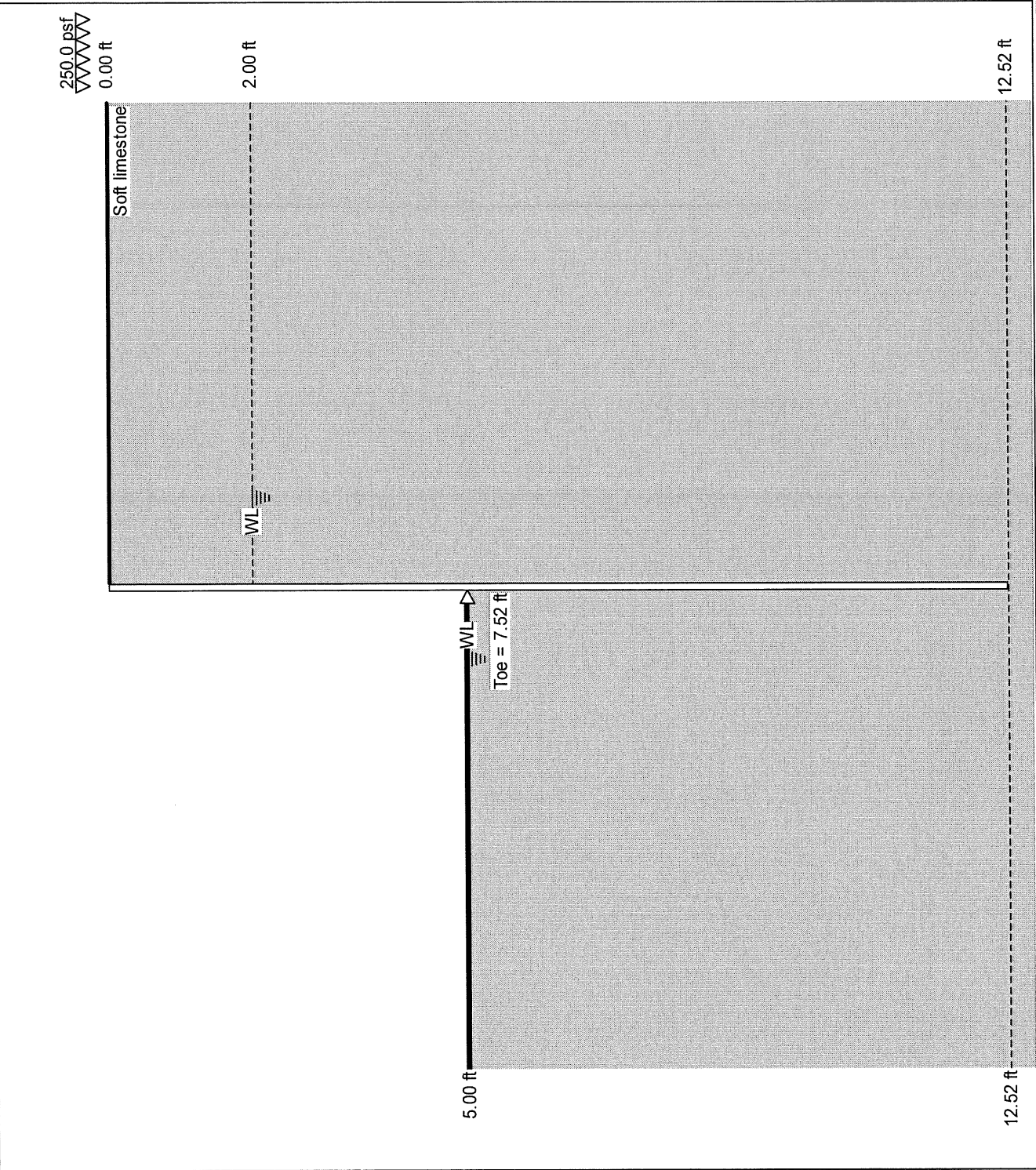
Denis K. Solano, P.E. #: 56902, S.I. #: 2046
Principal
SolVer Structural Partnership, Inc.

CHAPTER #2 – SHEET PILE ANALYSIS

SolVer Structural Partnership, Inc.

**950 NW 22ND AVENUE
MIAMI, FLORIDA 33125
(305) 643-8699 PHONE
(305) 643-8692 FAX
WWW.SOLVERSP.COM**

Client: SolVer Structural Part, Inc
Tel: 305-643-8699
Title: CARIBBEAN Blvd Bridge C1-N
CANAL CROSSING
Designer: D.K.S.
Page: 1
Date: 10.4.22
Sheet: Arbed AZ36
Pressure: Rankine
FOS: 1.0
Toe: Cantilever



Your Company Name

Client: SolVer Structural Part, Inc
Tel: 305-643-8699
Title: CARIBBEAN Blvd Bridge C1-N
CANAL CROSSING
Designer: D.K.S.
Page: 2
Date: 10.4.22
Sheet: Arbed AZ36
Pressure: Rankine
FOS: 1.0
Toe: Cantilever

Input Data

Depth Of Excavation = 5.00 ft Depth Of Active Water = 2.00 ft Water Density = 62.43 pcf
Surcharge = 250.0 psf Depth Of Passive Water = 5.00 ft Minimum Fluid Density = 31.82 pcf

Soil Profile

Depth (ft)	Soil Name	γ (pcf)	γ' (pcf)	C (psf)	C_a (psf)	ϕ (°)	δ (°)	K_a	K_{ac}	K_p	K_{pc}
0.00	Soft limestone	120.00	60.00	0.0	0.0	35.0	17.0	0.24	0.00	5.63	0.00
22.33	Hard Limestone	125.00	65.00	6000.0	3000.0	0.0	17.0	1.00	2.00	1.00	2.00

Solution

Sheet

Sheet Name	I (in ⁴ /ft)	E (psi)	Z (in ³ /ft)	f (psi)	Maximum Bending Moment (ftlb/ft)	Upstand (ft)	Toe (ft)	Pile Length (ft)
Arbed AZ36	606.30	3.04E+07	67.00	24970.3	139417.1	0.00	7.52	12.52

Maxima

	Maximum	Depth
Bending Moment	4457.7 ftlb/ft	8.65 ft
Deflection	0.0 in	0.00 ft
Pressure	348.1 psf	5.00 ft
Shear Force	1063.0 lb/ft	6.07 ft

Your Company Name

4

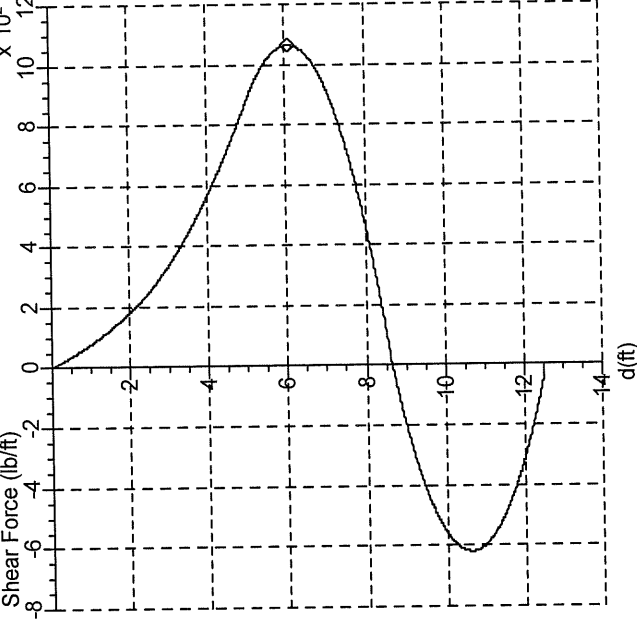
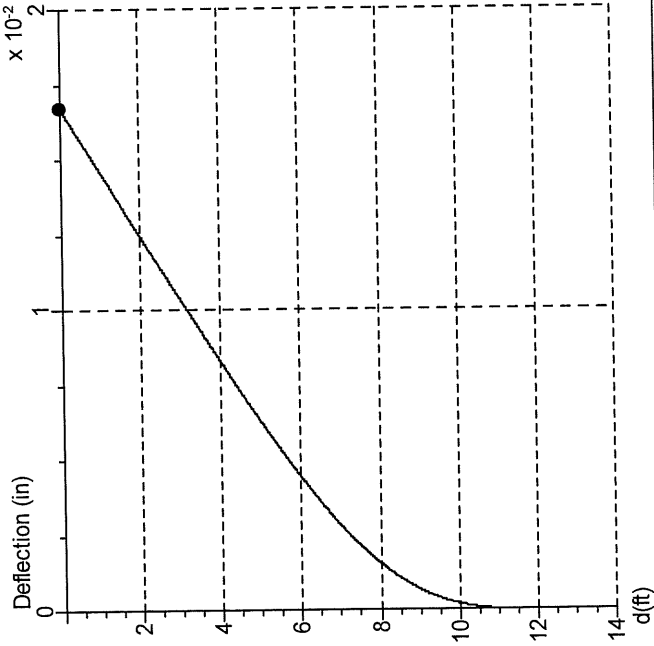
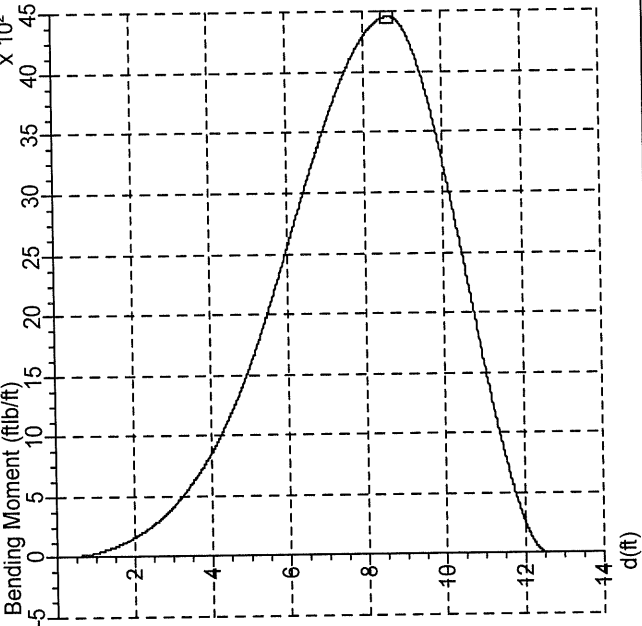
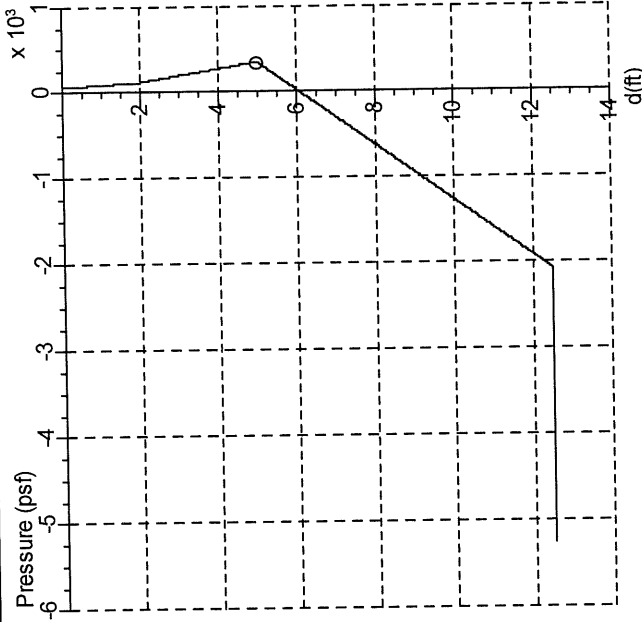
Client: SolVer Structural Part, Inc
Tel: 305-643-8699

Title: CARIBBEAN Blvd Bridge C1-N
CANAL CROSSING

Designer: D.K.S.
Page: 3
Date: 10.4.22

Sheet: Arbed AZ36
Pressure: Rankine
FOS: 1.0
Toe: Cantilever

	Maximum	d (ft)
○	348.1 psf	5.00
□	4457.7 ftlb/ft	8.65
◇	1063.0 lb/ft	6.07
●	0.0 in	0.00



Your Company Name

Client: SolVer Structural Part, Inc
Tel: 305-643-8699

Title: CARIBBEAN Blvd Bridge C1-N
CANAL CROSSING

Designer: D.K.S.

Page: 4

Date: 10.4.22

Sheet: Aibed AZ36

Pressure: Rankine

FOS: 1.0

Toe: Cantilever

depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)	depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)	depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)
0.00	60.0	0.0	0.0	0.0	4.21	287.5	974.8	0.0	627.4	8.42	-757.0	4436.0	0.0	180.9
0.11	63.3	0.4	0.0	7.1	4.32	295.6	1041.5	0.0	657.8	8.53	-794.1	4452.1	0.0	92.1
0.22	66.3	1.4	0.0	13.9	4.43	304.4	1118.6	0.0	692.3	8.64	-827.8	4457.6	0.0	7.7
0.33	69.6	3.4	0.0	21.7	4.54	312.4	1192.1	0.0	724.5	8.75	-864.9	4449.3	0.0	-64.2
0.44	72.6	6.0	0.0	29.1	4.65	321.2	1276.9	0.0	760.9	8.86	-902.0	4419.2	0.0	-130.8
0.55	75.9	9.8	0.0	37.7	4.76	330.0	1365.9	0.0	798.3	8.97	-935.7	4374.1	0.0	-187.6
0.66	79.2	14.6	0.0	46.6	4.87	338.0	1450.6	0.0	833.2	9.08	-972.8	4306.0	0.0	-246.0
0.78	82.2	19.8	0.0	55.0	4.98	346.8	1548.0	0.0	872.6	9.19	-1006.6	4228.6	0.0	-295.4
0.89	85.5	26.6	0.0	64.7	5.09	318.8	1640.4	0.0	907.5	9.30	-1043.7	4127.5	0.0	-345.8
1.00	88.8	34.5	0.0	74.7	5.21	281.7	1746.1	0.0	941.7	9.41	-1080.7	4011.0	0.0	-391.8
1.11	91.8	42.7	0.0	84.1	5.32	244.6	1855.4	0.0	971.8	9.52	-1114.5	3893.0	0.0	-430.0
1.22	95.1	52.9	0.0	94.9	5.43	210.9	1957.6	0.0	995.3	9.64	-1151.6	3751.0	0.0	-467.9
1.33	98.1	63.2	0.0	105.0	5.54	173.8	2072.7	0.0	1017.2	9.75	-1188.7	3597.6	0.0	-501.6
1.44	101.5	75.9	0.0	116.5	5.65	136.7	2190.1	0.0	1034.9	9.86	-1222.4	3449.4	0.0	-528.5
1.55	104.8	89.8	0.0	128.3	5.76	102.9	2298.3	0.0	1047.2	9.97	-1259.5	3277.9	0.0	-554.1
1.66	107.8	103.7	0.0	139.4	5.87	65.9	2418.7	0.0	1056.7	10.08	-1293.2	3115.5	0.0	-573.6
1.77	111.1	120.3	0.0	152.0	5.98	32.1	2528.9	0.0	1061.6	10.19	-1330.3	2930.9	0.0	-591.0
1.88	114.4	138.3	0.0	165.0	6.09	-5.0	2650.5	0.0	1063.0	10.30	-1367.4	2741.4	0.0	-604.2
1.99	117.4	156.0	0.0	177.1	6.20	-42.1	2772.0	0.0	1060.5	10.41	-1401.1	2566.0	0.0	-612.5
2.10	125.7	177.0	0.0	191.0	6.31	-75.8	2882.1	0.0	1054.5	10.52	-1438.2	2370.8	0.0	-617.5
2.22	133.7	197.5	0.0	204.6	6.42	-112.9	3002.3	0.0	1043.9	10.63	-1471.9	2192.6	0.0	-618.4
2.33	142.5	221.8	0.0	220.5	6.53	-150.0	3121.0	0.0	1029.0	10.74	-1509.0	1996.7	0.0	-615.4
2.44	151.3	247.9	0.0	237.4	6.65	-183.7	3227.2	0.0	1011.8	10.85	-1546.1	1802.4	0.0	-608.0
2.55	159.3	273.3	0.0	253.6	6.76	-220.8	3341.9	0.0	988.8	10.96	-1579.9	1628.3	0.0	-597.7
2.66	168.1	303.3	0.0	272.5	6.87	-254.5	3443.6	0.0	964.2	11.08	-1616.9	1440.9	0.0	-582.2
2.77	176.1	332.5	0.0	290.5	6.98	-291.6	3552.4	0.0	933.0	11.19	-1654.0	1258.9	0.0	-562.5
2.88	185.0	366.8	0.0	311.3	7.09	-328.7	3657.3	0.0	897.7	11.30	-1687.8	1099.4	0.0	-540.9
2.99	193.8	403.5	0.0	333.0	7.20	-362.4	3749.1	0.0	861.8	11.41	-1724.9	931.7	0.0	-513.0
3.10	201.8	439.1	0.0	353.7	7.31	-399.5	3845.4	0.0	818.3	11.52	-1758.6	787.4	0.0	-484.0
3.21	210.6	480.8	0.0	377.4	7.42	-436.6	3936.6	0.0	770.5	11.63	-1795.7	639.0	0.0	-448.1
3.32	219.4	525.3	0.0	402.2	7.53	-470.4	4014.6	0.0	723.4	11.74	-1832.8	502.5	0.0	-407.9
3.43	227.4	568.2	0.0	425.5	7.64	-507.4	4094.5	0.0	667.5	11.85	-1866.5	390.0	0.0	-367.6
3.54	236.2	618.3	0.0	452.2	7.75	-541.2	4161.4	0.0	613.0	11.96	-1903.6	280.3	0.0	-319.3
3.65	244.3	666.5	0.0	477.3	7.86	-578.3	4228.3	0.0	549.0	12.07	-1940.7	186.4	0.0	-266.7
3.77	253.1	722.6	0.0	505.9	7.97	-615.4	4287.6	0.0	480.7	12.18	-1974.4	116.1	0.0	-215.2
3.88	261.9	782.0	0.0	535.5	8.08	-649.1	4334.6	0.0	414.9	12.29	-2011.5	56.5	0.0	-154.4
3.99	269.9	839.0	0.0	563.3	8.20	-686.2	4378.1	0.0	338.6	12.40	-2045.2	19.5	0.0	-95.5
4.10	278.7	905.1	0.0	594.8	8.31	-719.9	4409.9	0.0	265.4	12.52	-5256.5	0.0	0.0	0.0

SPW911, V2.40

Your Company Name

Client: SolVer Structural Part, Inc
Tel: 305-643-8699

Title: CARIBBEAN Blvd Bridge C1-N
CANAL CROSSING

Designer: D.K.S.

Page: 1

Date: 10.4.22

Sheet: Arbed AZ36

Pressure: Rankine

FOS: 1.0

Toe: Cantilever

250.0 psf
VVVVVVV
0.00 ft

Soft limestone

2.00 ft

WL

5.00 ft

WL

Toe = 7.52 ft

12.52 ft

12.52 ft

SPW911, v2.40

Your Company Name

© 2001 - 2007, Pile Buck®, Inc.
Email: pilebuck@pilebuck.com
Web: www.pilebuck.com

Client: SolVer Structural Part, Inc
Tel: 305-643-8699

Title: CARIBBEAN Blvd Bridge C1-N
CANAL CROSSING

Designer: D.K.S.
Page: 2
Date: 10.4.22

Sheet: Arbed AZ36
Pressure: Rankine
FOS: 1.0
Toe: Cantilever

Input Data

Depth Of Excavation = 5.00 ft Depth Of Active Water = 2.00 ft Water Density = 62.43 pcf
Surcharge = 250.0 psf Depth Of Passive Water = 5.00 ft Minimum Fluid Density = 31.82 pcf

Soil Profile

Depth (ft)	Soil Name	γ (pcf)	γ' (pcf)	C (psf)	C_a (psf)	ϕ (°)	δ (°)	K_a	K_{ac}	K_p	K_{pc}
0.00	Soft limestone	120.00	60.00	0.0	0.0	35.0	17.0	0.24	0.00	5.63	0.00
22.33	Hard Limestone	125.00	65.00	6000.0	3000.0	0.0	17.0	1.00	2.00	1.00	2.00

Solution

Sheet

Sheet Name	I (in ⁴ /ft)	E (psi)	Z (in ³ /ft)	f (psi)	Maximum Bending Moment (ftlb/ft)	Upstand (ft)	Toe (ft)	Pile Length (ft)
Arbed AZ36	606.30	3.04E+07	67.00	24970.3	139417.1	0.00	7.52	12.52

Maxima

	Maximum	Depth
Bending Moment	4457.7 ftlb/ft	8.65 ft
Deflection	0.0 in	0.00 ft
Pressure	348.1 psf	5.00 ft
Shear Force	1063.0 lb/ft	6.07 ft

Your Company Name

SPW911, v2.40

© 2001 - 2007, Pile Buckle, Inc.
Email: pilebuck@pilebuck.com
Web: www.pilebuck.com

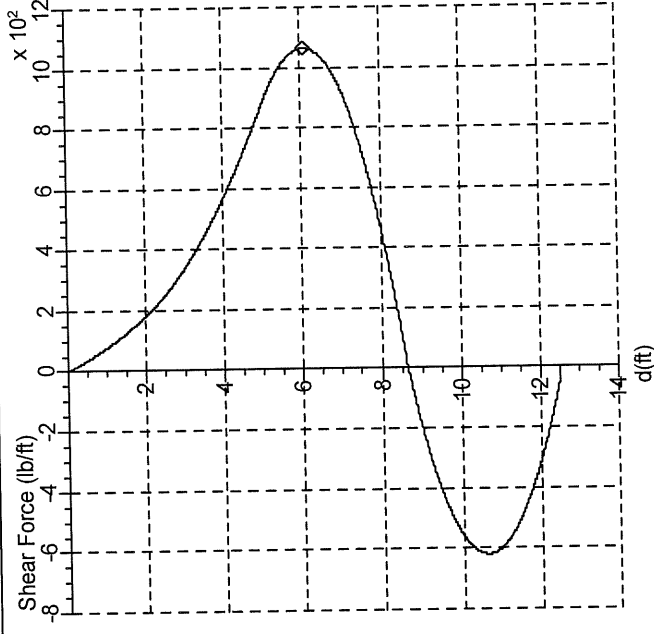
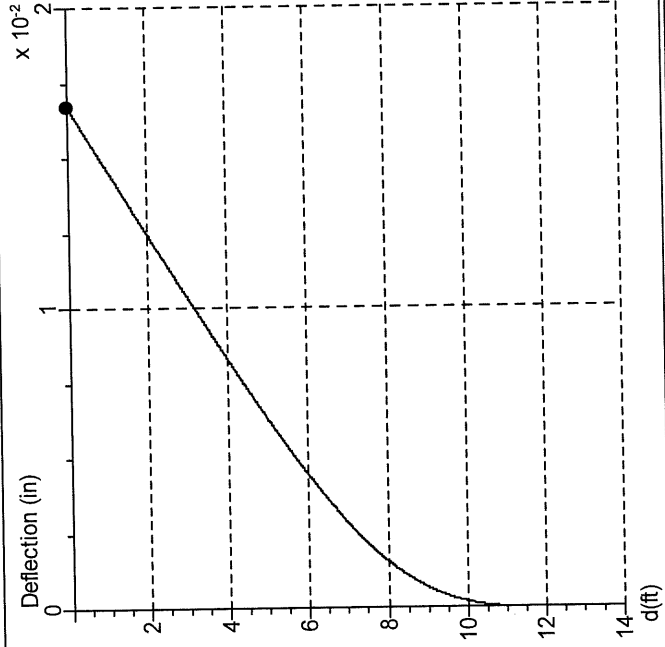
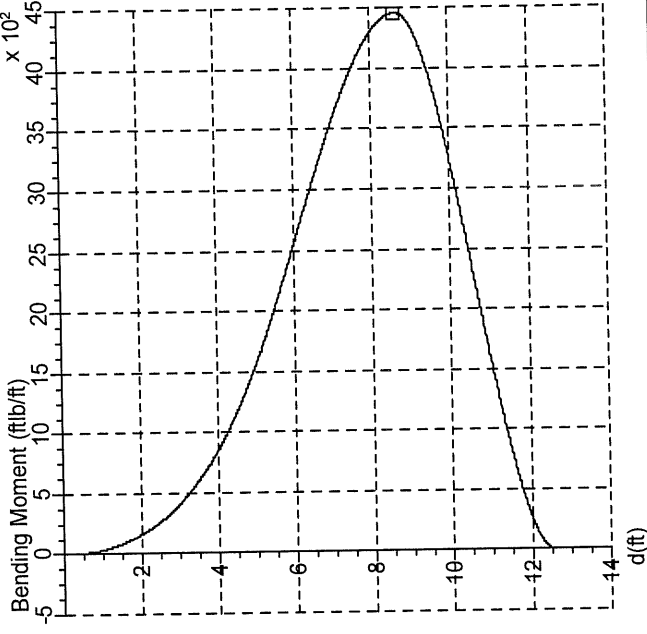
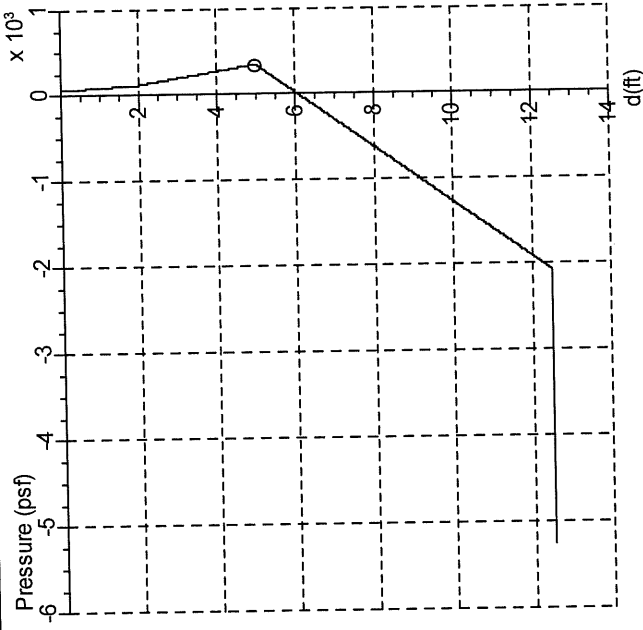
Client: SolVer Structural Part, Inc
Tel: 305-643-8699

Title: CARIBBEAN Blvd Bridge C1-N
Designer: D.K.S.

Page: 3
Date: 10.4.22

Sheet: Arbed AZ36
Pressure: Rankine
FOS: 1.0
Toe: Cantilever

	Maximum	d (ft)
○	348.1 psf	5.00
□	4457.7 ftlb/ft	8.65
◇	1063.0 lb/ft	6.07
●	0.0 in	0.00



SPW911, v2.40



Your Company Name

Client: SolVer Structural Part, Inc
Tel: 305-643-8699

Title: CARIBBEAN Blvd Bridge C1-N

CANAL CROSSING

Designer: D.K.S.

Page: 4

Date: 10.4.22

Sheet: Arbed AZ36

Pressure: Rankine

FOS: 1.0

Toe: Cantilever

depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)
0.00	60.0	0.0	0.0	0.0
0.11	63.3	0.4	0.0	7.1
0.22	66.3	1.4	0.0	13.9
0.33	69.6	3.4	0.0	21.7
0.44	72.6	6.0	0.0	29.1
0.55	75.9	9.8	0.0	37.7
0.66	79.2	14.6	0.0	46.6
0.78	82.2	19.8	0.0	55.0
0.89	85.5	26.6	0.0	64.7
1.00	88.8	34.5	0.0	74.7
1.11	91.8	42.7	0.0	84.1
1.22	95.1	52.9	0.0	94.9
1.33	98.1	63.2	0.0	105.0
1.44	101.5	75.9	0.0	116.5
1.55	104.8	89.8	0.0	128.3
1.66	107.8	103.7	0.0	139.4
1.77	111.1	120.3	0.0	152.0
1.88	114.4	138.3	0.0	165.0
1.99	117.4	156.0	0.0	177.1
2.10	125.7	177.0	0.0	191.0
2.22	133.7	197.5	0.0	204.6
2.33	142.5	221.8	0.0	220.5
2.44	151.3	247.9	0.0	237.4
2.55	159.3	273.3	0.0	253.6
2.66	168.1	303.3	0.0	272.5
2.77	176.1	332.5	0.0	290.5
2.88	185.0	366.8	0.0	311.3
2.99	193.8	403.5	0.0	333.0
3.10	201.8	439.1	0.0	353.7
3.21	210.6	480.8	0.0	377.4
3.32	219.4	525.3	0.0	402.2
3.43	227.4	568.2	0.0	425.5
3.54	236.2	618.3	0.0	452.2
3.65	244.3	666.5	0.0	477.3
3.77	253.1	722.6	0.0	505.9
3.88	261.9	782.0	0.0	535.5
3.99	269.9	839.0	0.0	563.3
4.10	278.7	905.1	0.0	594.8

depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)
4.21	287.5	974.8	0.0	627.4
4.32	295.6	1041.5	0.0	657.8
4.43	304.4	1118.6	0.0	692.3
4.54	312.4	1192.1	0.0	724.5
4.65	321.2	1276.9	0.0	760.9
4.76	330.0	1365.9	0.0	798.3
4.87	338.0	1450.6	0.0	832.2
4.98	346.8	1548.0	0.0	872.6
5.09	318.8	1640.4	0.0	907.5
5.21	281.7	1746.1	0.0	941.7
5.32	244.6	1855.4	0.0	971.8
5.43	210.9	1957.6	0.0	995.3
5.54	173.8	2072.7	0.0	1017.2
5.65	136.7	2190.1	0.0	1034.9
5.76	102.9	2298.3	0.0	1047.2
5.87	65.9	2418.7	0.0	1056.7
5.98	32.1	2528.9	0.0	1061.6
6.09	-5.0	2650.5	0.0	1063.0
6.20	-42.1	2772.0	0.0	1060.5
6.31	-75.8	2882.1	0.0	1054.5
6.42	-112.9	3002.3	0.0	1043.9
6.53	-150.0	3121.0	0.0	1029.0
6.65	-183.7	3227.2	0.0	1011.8
6.76	-220.8	3341.9	0.0	988.8
6.87	-254.5	3443.6	0.0	964.2
6.98	-291.6	3552.4	0.0	933.0
7.09	-328.7	3657.3	0.0	897.7
7.20	-362.4	3749.1	0.0	861.8
7.31	-399.5	3845.4	0.0	818.3
7.42	-436.6	3936.6	0.0	770.5
7.53	-470.4	4014.6	0.0	723.4
7.64	-507.4	4094.5	0.0	667.5
7.75	-541.2	4161.4	0.0	613.0
7.86	-578.3	4228.3	0.0	549.0
7.97	-615.4	4287.6	0.0	480.7
8.08	-649.1	4334.6	0.0	414.9
8.20	-686.2	4378.1	0.0	338.6
8.31	-719.9	4409.9	0.0	265.4

depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)
8.42	-757.0	4436.0	0.0	180.9
8.53	-794.1	4452.1	0.0	92.1
8.64	-827.8	4457.6	0.0	7.7
8.75	-864.9	4449.3	0.0	-64.2
8.86	-902.0	4419.2	0.0	-130.8
8.97	-935.7	4374.1	0.0	-187.6
9.08	-972.8	4306.0	0.0	-246.0
9.19	-1006.6	4228.6	0.0	-295.4
9.30	-1043.7	4127.5	0.0	-345.8
9.41	-1080.7	4011.0	0.0	-391.8
9.52	-1114.5	3893.0	0.0	-430.0
9.64	-1151.6	3751.0	0.0	-467.9
9.75	-1188.7	3597.6	0.0	-501.6
9.86	-1222.4	3449.4	0.0	-528.5
9.97	-1259.5	3277.9	0.0	-554.1
10.08	-1293.2	3115.5	0.0	-573.6
10.19	-1330.3	2930.9	0.0	-591.0
10.30	-1367.4	2741.4	0.0	-604.2
10.41	-1401.1	2566.0	0.0	-612.5
10.52	-1438.2	2370.8	0.0	-617.5
10.63	-1471.9	2192.6	0.0	-618.4
10.74	-1509.0	1996.7	0.0	-615.4
10.85	-1546.1	1802.4	0.0	-608.0
10.96	-1579.9	1628.3	0.0	-597.7
11.08	-1616.9	1440.9	0.0	-582.2
11.19	-1654.0	1258.9	0.0	-562.5
11.30	-1687.8	1099.4	0.0	-540.9
11.41	-1724.9	931.7	0.0	-513.0
11.52	-1758.6	787.4	0.0	-484.0
11.63	-1795.7	639.0	0.0	-448.1
11.74	-1832.8	502.5	0.0	-407.9
11.85	-1866.5	390.0	0.0	-367.6
11.96	-1903.6	280.3	0.0	-319.3
12.07	-1940.7	186.4	0.0	-266.7
12.18	-1974.4	116.1	0.0	-215.2
12.29	-2011.5	56.5	0.0	-154.4
12.40	-2045.2	19.5	0.0	-95.5
12.52	-5256.5	0.0	0.0	0.0

SPW911, v2.40

Your Company Name

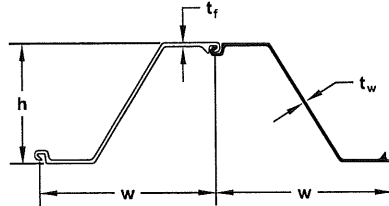
CHAPTER #3 – TECHNICAL DATA

SolVer Structural Partnership, Inc.

**950 NW 22ND AVENUE
MIAMI, FLORIDA 33125
(305) 643-8699 PHONE
(305) 643-8692 FAX
WWW.SOLVERSP.COM**

AZ

AZ Hot Rolled Steel Sheet Pile



SECTION	Width (w) in mm	Height (h) in mm	THICKNESS		Cross Sectional Area in ² /ft cm ² /m	WEIGHT		SECTION MODULUS		Moment of Inertia in ⁴ /ft cm ⁴ /m	COATING AREA	
			Flange (t _f) in mm	Web (t _w) in mm		Pile lb/ft kg/m	Wall lb/ft ² kg/m ²	Elastic in ³ /ft cm ³ /m	Plastic in ³ /ft cm ³ /m		Both Sides ft ² /ft of single m ² /m	Wall Surface ft ² /ft ² m ² /m ²
AZ 12-770	30.31 770	13.52 344	0.335 8.5	0.335 8.5	5.67 120.1	48.78 72.6	19.31 94.3	23.2 1245	27.5 1480	156.9 21430	6.07 1.85	1.20 1.20
AZ 13-770	30.31 770	13.54 344	0.354 9.0	0.354 9.0	5.94 125.3	51.14 76.1	20.24 98.8	24.2 1300	28.8 1546	163.7 22360	6.07 1.85	1.20 1.20
AZ 14-770	30.31 770	13.56 345	0.375 9.5	0.375 9.5	6.21 131.5	53.42 79.5	21.14 103.2	25.2 1355	30.0 1611	170.6 23300	6.07 1.85	1.20 1.20
AZ 17-700	27.56 700	16.52 420	0.335 8.5	0.335 8.5	6.28 133.0	49.12 73.1	21.38 104.4	32.2 1730	37.7 2027	265.3 36230	6.10 1.86	1.33 1.33
AZ 18-700	27.56 700	16.54 420	0.354 9.0	0.354 9.0	6.58 139.7	51.41 76.5	22.39 109.3	33.5 1800	39.4 2116	276.8 37800	6.10 1.86	1.33 1.33
AZ 19-700	27.56 700	16.56 421	0.375 9.5	0.375 9.5	6.88 145.6	53.76 80.0	23.35 114.3	34.8 1870	41.0 2206	288.4 39380	6.10 1.86	1.33 1.33
AZ 20-700	27.56 700	16.57 421	0.394 10.0	0.394 10.0	7.18 152.0	56.11 83.5	24.43 119.3	36.2 1945	42.7 2296	300.0 40960	6.10 1.86	1.33 1.33
AZ 18-800	31.5 800	17.68 449	0.335 8.5	0.335 8.5	6.07 128.6	54.26 80.7	20.67 100.9	34.2 1840	39.7 2135	302.6 41320	6.82 2.08	1.30 1.30
AZ 20-800	31.5 800	17.72 450	0.375 9.5	0.375 9.5	6.66 141.0	59.50 88.6	22.67 110.7	37.2 2000	43.3 2330	329.9 45050	6.82 2.08	1.30 1.30
AZ 22-800	31.5 800	17.76 451	0.413 10.5	0.413 10.5	7.25 153.5	64.77 96.4	24.68 120.5	40.3 2165	47.0 2525	357.3 48790	6.82 2.08	1.30 1.30
AZ 23-800	31.50 800	18.66 474	0.453 11.5	0.354 9.0	7.12 150.6	63.56 94.6	24.22 118.2	43.3 2330	49.9 2680	404.6 55260	6.94 2.11	1.32 1.32
AZ 25-800	31.50 800	18.70 475	0.492 12.5	0.394 10.0	7.71 163.3	68.91 102.6	26.26 128.2	46.5 2500	53.8 2890	435.1 59410	6.94 2.11	1.32 1.32
AZ 27-800	31.50 800	18.74 476	0.531 13.5	0.433 11.0	8.31 176.0	74.26 110.5	28.29 138.1	49.7 2670	57.6 3100	465.5 63570	6.94 2.11	1.32 1.32
AZ 24-700	27.56 700	18.07 459	0.441 11.2	0.441 11.2	8.23 174.1	64.30 95.7	28.00 136.7	45.2 2430	53.5 2867	408.8 55320	6.33 1.93	1.38 1.38
AZ 26-700	27.56 700	18.11 460	0.480 12.2	0.480 12.2	8.84 187.2	69.12 102.9	30.10 146.9	48.4 2600	57.1 3070	437.3 59720	6.33 1.93	1.38 1.38
AZ 28-700	27.56 700	18.15 461	0.520 13.2	0.520 13.2	9.46 200.2	73.93 110.0	32.19 157.2	51.3 2760	60.9 3273	465.9 63620	6.33 1.93	1.38 1.38
AZ 28-750	29.53 750.0	20.04 509.0	0.472 12.00	0.394 10.00	8.09 171.2	67.73 100.80	27.53 134.40	52.3 2810	60.3 3245	523.9 71540	6.93 2.11	1.41 1.41
AZ 30-750	29.53 750.0	20.08 510.0	0.512 13.00	0.433 11.00	8.73 184.7	73.08 108.80	29.70 145.00	55.9 3005	64.8 3485	561.5 76670	6.93 2.11	1.41 1.41
AZ 32-750	29.53 750.0	20.12 511.0	0.551 14.00	0.472 12.00	9.37 198.3	78.44 116.70	31.88 155.60	59.5 3200	69.2 3720	599.0 81800	6.93 2.11	1.41 1.41
AZ 36-700N	27.56 700	19.65 499	0.591 15.0	0.441 11.2	10.20 215.9	79.72 118.6	34.71 169.5	66.8 3590	76.4 4110	656.2 89610	6.73 2.05	1.47 1.47
AZ 38-700N	27.56 700	19.69 500	0.630 16.0	0.480 12.2	10.87 230.0	84.94 126.4	36.98 180.6	70.6 3795	81.1 4360	694.5 94340	6.73 2.05	1.47 1.47
AZ 40-700N	27.56 700	19.72 501	0.669 17.0	0.520 13.2	11.54 244.2	90.16 134.2	39.26 191.7	74.3 3995	85.7 4605	732.9 100080	6.73 2.05	1.47 1.47
AZ 42-700N	27.56 700	19.65 499	0.709 18.0	0.551 14.0	12.22 258.7	95.51 142.1	41.59 203.1	78.2 4205	90.3 4855	768.4 104930	6.75 2.06	1.47 1.47
AZ 44-700N	27.56 700	19.69 500	0.748 19.0	0.591 15.0	12.89 272.8	100.74 149.9	43.87 214.2	81.9 4405	95.0 5105	806.6 110150	6.75 2.06	1.47 1.47
AZ 46-700N	27.56 700	19.72 501	0.787 20.0	0.630 16.0	13.56 287.0	105.97 157.7	46.14 225.3	85.7 4605	99.5 5350	844.9 115370	6.75 2.06	1.47 1.47
AZ 48-700	27.56 700.0	19.80 503.0	0.866 22.00	0.591 15.00	13.63 288.4	106.49 158.50	46.37 226.40	88.4 4755	102.1 5490	876.2 119650	6.70 2.04	1.46 1.46
AZ 50-700	27.56 700.0	19.84 504.0	0.906 23.00	0.630 16.00	14.30 302.6	111.73 166.30	48.65 237.50	92.2 4955	106.7 5735	914.6 124890	6.70 2.04	1.46 1.46
AZ 52-700	27.56 700.0	19.88 505.0	0.945 24.00	0.669 17.00	14.97 317.0	116.97 174.10	50.93 248.70	95.9 5155	111.3 5985	953.0 130140	6.70 2.04	1.46 1.46

REPORT OF A GEOTECHNICAL EXPLORATION

SHEET-PILE WALLS BEGIN TW3 END TW4

CARIBBEAN BLVD AT THE C1-N CANAL CROSSING

**MIAMI-DADE COUNTY DEPARTMENT OF TRANSPORTATION AND
PUBLIC WORKS ROADWAY ENGINEERING AND RIGHT OF WAY
DIVISION**

**MIAMI-DADE COUNTY, FLORIDA
PROJECT No. EDP-MT-CIP209
STORMWATER UTILITY**

- Prepared for -
AMERICAN EMPIRE BUILDERS, INC.
13775 SW 145th Court, Unit B
Miami, Florida 33186

- Prepared by -
CEN GEOTECHNICAL & ENVIRONMENTAL SOLUTIONS, INC.
12560 NW 81 Avenue
Miami, Florida 33156

CEN Project No. 11111-21-0120

August 3, 2022

American Empire Builders Inc.
13775 SW 145th CT. Unit B
Miami, Florida 33186

Attention: Mr. Tony Gonzalez
Project Manager

Subject: Report of a Geotechnical Evaluation – Sheet Piles Parameters
Caribbean Boulevard Bridge Replacement over C1-N Canal
Temporary Sheet Pile Wall Begin TW3 & End TW4
Bridge No. 874650
Miami-Dade County Project No. EDP-MT-CIP209
Miami Dade County, Florida
CEN Geosolutions Project No. 11111-21-0120 CEN

Dear Tony:

CEN Geotechnical & Environmental Solutions, Inc. (CEN) is presenting this Report of a Geotechnical Exploration for the temporary Sheet Pile Wall Begin TW3 and End TW4 at the subject project. This report presents our understanding of the project, outlines our exploratory procedures, and documents the field 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) 498-3920.

Sincerely,

CEN GEOTECHNICAL & ENVIRONMENTAL SOLUTIONS, INC.

Ricardo Bernal.
Project Geotechnical Engineer

Distribution: Addressee (13)
File (1)

TABLE OF CONTENTS

	<u>Page #</u>
1.0 INTRODUCTION	1-1
2.0 PROJECT INFORMATION	2-1
2.1 GENERAL	2-1
2.2 PROJECT DESCRIPTION	2-1
3.0 FIELD EXPLORATION AND LABORATORY TESTING	3-1
3.1 FIELD EXPLORATION	3-1
4.0 SITE AND SUBSURFACE CONDITIONS	4-1
4.1 SITE CONDITIONS	4-1
4.2 SUBSURFACE CONDITIONS	4-1
4.2.1 General	4-1
4.2.2 Geologic Conditions	4-1
4.2.3 Miami Limestone	4-1
4.2.4 Fort Thompson Formation	4-2
4.2.5 Generalized Subsurface Conditions Encountered Along the Sheet-pile Alignment ..	4-2
4.2.6 Groundwater Conditions	4-2
5.0 RECOMEDATIONS OF THE ROCK PROPERTIES	5-3
5.1 ROCK PARAMETERS	5-1
5.2.1 Rock Parameters	5-1
6.0 RECOMMENDATIONS	
6.1 BASIS FOR RECOMMENDATIONS	6-4
6.2 SHEET-PILE STRUCTURE	6-4
6.2.1 Rock Coefficients for Sheet-pile Wall Design	6-4
APPENDIX A:	
Site Location Map	A-1
Field Exploration Plans	A-2
Report of Core Boring	A-3
Field Testing Procedures	A-4

1.0 INTRODUCTION

The purpose of this geotechnical exploration was to obtain information concerning the site and subsurface conditions along the proposed temporary sheet-pile wall location. This report discusses our exploratory and testing procedures, presents our findings and evaluation, and includes the following items:

Field Services

- Performed a test core boring for the proposed temporary sheet-pile wall, to a depth of 50 feet. In addition, rock parameters for the temporary sheet-pile wall are presented in this report.
- A brief description of our field-testing procedures.

Evaluation

- A general review of area and site geologic conditions.
- A general review of existing surface features and site conditions.
- Report of core boring which illustrate the estimated subsurface conditions along the temporary sheet-pile structure.
- Rock parameters and coefficients for the temporary sheet-pile wall analysis.

2.0 PROJECT INFORMATION

2.1 GENERAL

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

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

- Caribbean Blvd over C1-N Canal Replacement Bridge
Project Plans Including Cross Sections along with Foundation Layout & Plan Elevation
Prepared by: Jacobs Engineering Group, Inc.
Dated: March 2020

2.2 PROJECT DESCRIPTION

The project consists of the construction of a new bridge along Caribbean Blvd over C1-N Canal.

Includes a sheet pile wall sections:

- Temporary Sheet Pile Wall Begin TW3 End TW4, from Sta. 40+57.00 to Sta. 41+69.00.

3.0 FIELD EXPLORATION AND LABORATORY TESTING

3.1 FIELD EXPLORATION

The primary purpose of this field exploration was as follows:

1. To define the near subsurface conditions, present along the proposed temporary sheet-pile wall.
2. To obtain soil samples for examination and classification.

The field exploration was conducted by CEN Geosolutions. The location of the test boring is provided in the Summary of Test Boring Location in Appendix A. The Report of Core Boring in Appendix A summarize the approximate boundary between soil types. In some instances, the transition between material types may be gradual. A brief description of the exploratory sampling techniques used is presented in the Field-Testing Procedures section in Appendix A. A discussion of the subsurface conditions encountered along the project alignment is provided in Section 4.2 of this report.

4.0 SITE AND SUBSURFACE CONDITIONS

4.1 SITE CONDITIONS

The site conditions were observed by a geotechnical engineer during several visits.

4.2 SUBSURFACE CONDITIONS

4.2.1 General

A graphical representation of the subsurface conditions encountered by the test boring drilled near the proposed temporary sheet-pile wall is shown on the Report of Core Boring in Appendix A. This profile of rock conditions highlights the major subsurface stratification. The boring profile on this sheet should be consulted for a detailed description of the rock condition encountered at the boring location.

4.2.2 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.

4.2.3 Miami Limestone

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.

4.2.4 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 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.

4.2.5 Generalized Subsurface Conditions Encountered Along the Sheet-pile Alignment

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

4.2.6 Groundwater Conditions

The groundwater levels in the borings were measured at the time of drilling. Groundwater level in the test boring was encountered at approximately elevation of 1.7, NGVD29. A Seasonal High Ground Water Table (SHGWT) of 4.0 feet, (NGVD29) 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, and other site-specific factors such as changes of the Canal water elevations. Since groundwater level variations are anticipated, design drawings and specifications should accommodate such possibilities and construction planning should assume that variations will occur.

5.0 RECOMMENDATIONS

5.1 ROCK

The limestone parameters presented below have been estimated from correlations with the Standard Penetration Test (SPT) values (N, blows/ft) obtained from the field exploration. the internal friction angle (θ) is estimated from accepted FDOT correlations with N_s values. SPT N values obtained using an automatic hammer, SPT N_a , were covert to safety hammer values, SPT N_s , by multiplying by a factor of 1.24. The following correlations with SPT N_s values were used:

TABLE 5.2.1: SUMMARY OF ROCK PARAMETERS

Boring No.	Range of Elevation, ft.		Soil Type	Automatic Hammer N Value, blows/ft.	Equivalent Safety Hammer N Value x 1.24 auto, blows/ft.	ϕ for Soils $\phi=28+N/4$ for Rock $\phi=33+N/4$, degrees	γ Total Unit Weight lb/ft ³	δ Angle of Friction between Soil & Sheetpile, degrees
	From	To						
TB-1	5.67	1.67	Limestone	18	22	39	120	17
	1.67	-0.33	Limestone	80	99	58	122	17
	-0.33	-2.33	Limestone	43	53	46	122	17
	-2.33	-4.33	Limestone	18	22	39	120	17
	-4.33	-10.33	Limestone	15	19	38	120	17
	-10.33	-12.33	Limestone	48	60	48	122	17
	-12.33	-14.33	Limestone	28	35	42	122	17
	-14.33	-17.33	Limestone	70	87	55	122	17
	-17.33	-20.33	Limestone	17	21	38	120	17
	-20.33	-22.33	Sand/Limestone	6	7	35	115	17
	-22.33	-27.33	Limestone	37	46	44	122	17
	-27.33	-32.33	Limestone	5	6	35	120	17
	-32.33	-34.33	Limestone	42	52	46	122	17
	-34.33	-40.33	Limestone	90	112	61	122	17
	-40.33	-42.33	Limestone	27	33	41	122	17

6.0 EVALUATION

6.1 BASIS FOR EVALUATION

The following evaluation is based in the Standard Penetration Test (SPT) and the data gathered during our subsurface exploration. The stratification and consistency of the subsurface materials underlying the site may vary within even short lateral distances; therefore, any subsurface condition encountered which differs from those documented in this study should be reported to us so that our recommendations can be reviewed.

6.2 SHEET-PILE WALL STRUCTURE

6.2.1 Rock Parameters Coefficients for Sheet-Pile Wall Design Analysis

Table 7.2.1: Summary of Rock Parameters for Temporary Sheet Pile Design

Structure	Boring No.	Range of Elevation, ft		ϕ degrees	δ degrees	Coefficients of Lateral Earth Pressure			γ total pcf	Material Description
		From	To			Ka	Ko	Kp		
CARIBBEAN BLVD REPLACEMENT BRIDGE	TB-1A	5.67	1.67	39	17	0.23	0.37	4.40	120	Limestone
		1.67	-0.33	45	17	0.17	0.29	5.83	122	Limestone
		-0.33	-2.33	45	17	0.17	0.29	5.83	122	Limestone
		-2.33	-4.33	39	17	0.23	0.37	4.40	120	Limestone
		-4.33	-10.33	38	17	0.24	0.38	4.20	120	Limestone
		-10.33	-12.33	48	17	0.15	0.26	6.79	122	Limestone
		-12.33	-14.33	42	17	0.20	0.33	5.04	122	Limestone
		-14.33	-17.33	45	17	0.17	0.29	5.83	122	Limestone
		-17.33	-20.33	38	17	0.24	0.38	4.20	120	Limestone
		-20.33	-22.33	31	17	0.32	0.48	3.12	115	Sand Limestone
		-22.33	-27.33	46	17	0.18	0.31	5.55	122	Limestone
		-27.33	-32.33	35	17	0.27	0.43	3.69	120	Limestone
		-32.33	-34.33	45	17	0.17	0.29	5.83	122	Limestone
		-34.33	-40.33	45	17	0.17	0.29	5.83	122	Limestone
		-40.33	-42.33	41	17	0.21	0.34	4.81	122	Limestone

The following table reviews the rock parameters for the design of the temporary Sheet-Pile Wall
Begin TW3 End TW4:

- ϕ = Rock/soil angle of internal friction.
- ϕ = $28 + N(\text{safety})/4$ Sand; ϕ = $33 + N(\text{safety})/4$ Rock.
- γ = $105 * 30/30$ for sand or limerock fill (115 pcf max); 122 for limestone.
- δ = Friction angle between sheet-pile and rock (rock).
- Design high groundwater elevation 2.0 feet.

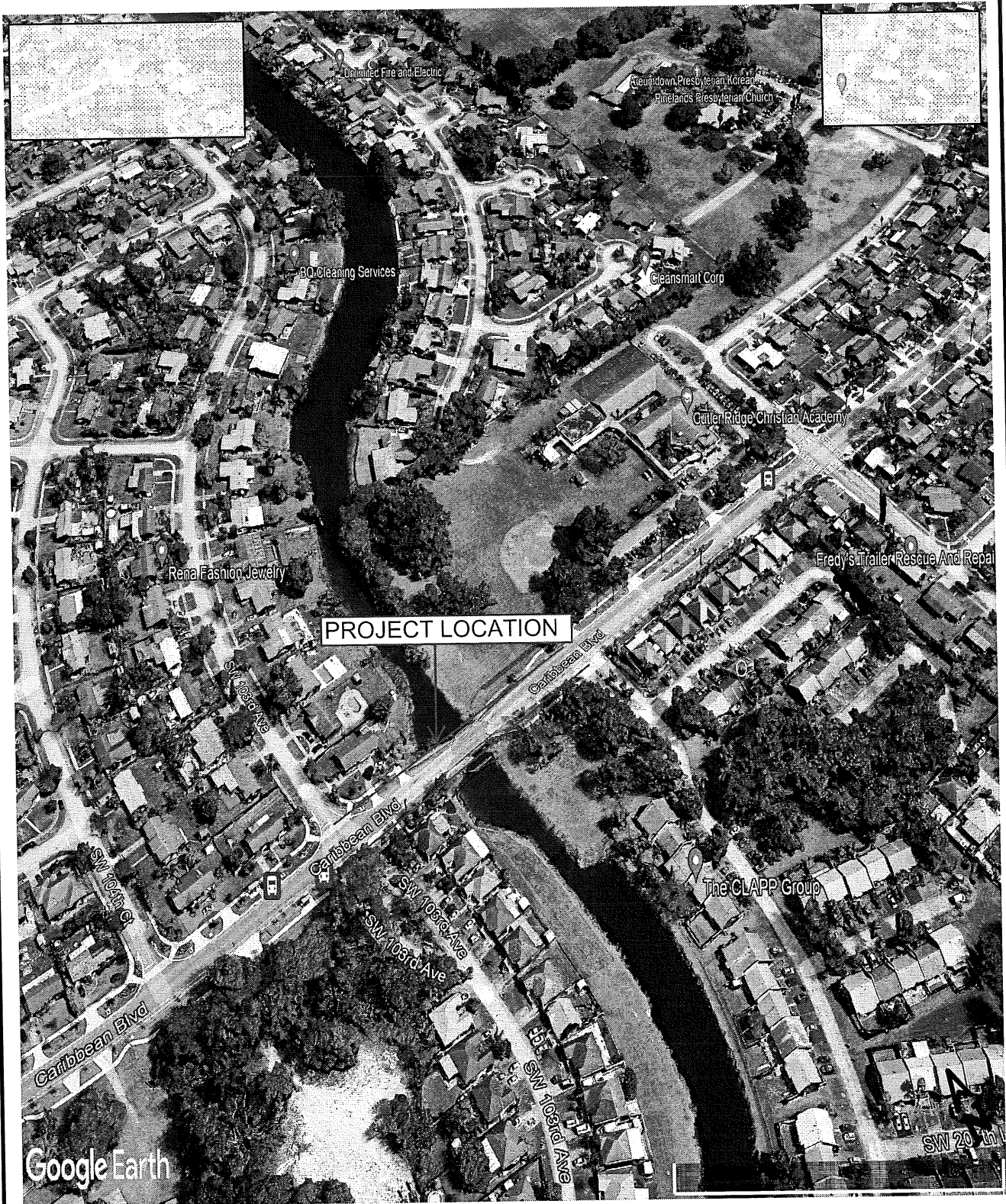
APPENDIX A

**SITE LOCATION MAP
FIELD EXPLORATION PLAN
REPORT OF CORE BORING
FIELD TESTING PROCEDURES**

**A-1
A-2
A-3
A-4**

BY: RB
 CHECKED BY: R. BERNAL
 DATE: Aug-2022

CEN PROJECT No. 11111-21-0120
 D:\296\CEN\1111 21 0120\6 CARIBBEAN BLVD REPLACEMENT

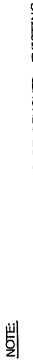


SITE VICINITY MAP

PROJECT: CARIBBEAN BLVD OVER C1-N CANAL
 LOCATION: MIAMI-DADE COUNTY, FLORIDA

CEN

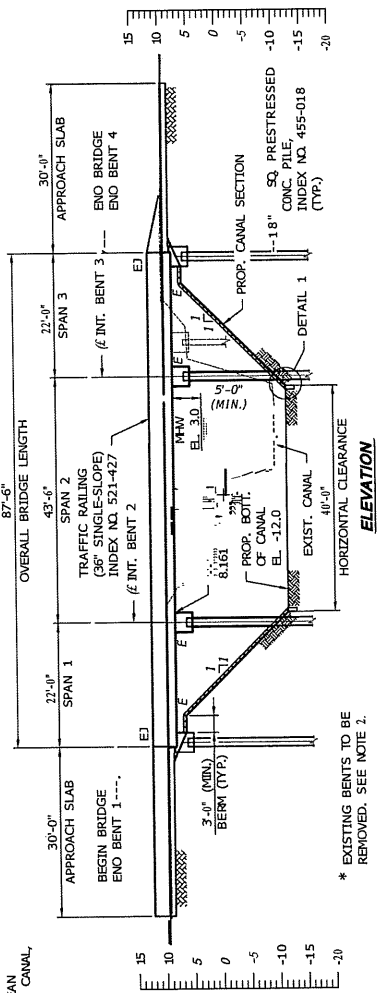
A-1



1. EXISTING UTILITY BENT TO BE REMOVED. EXISTING PILE TO BE REMOVED OR CUT TO 2'-0" BELOW PROPOSED GROUND. FILL VOID WITH SAND.
2. EXISTING BRIDGE PILES TO BE REMOVED OR CUT TO 2'-0" BELOW PROPOSED GROUND. FILL VOID WITH SAND.
3. FOR TRAFFIC RAILING AND PEO/BICYC. RAILING LOCATION, SEE SHEET 7 OF THE ROADWAY PLANS.
4. FOR TRAFFIC RAILING TRANSITION INTO APPROACH SLAB 2, SEE DETAIL ON SHEET BI-17.

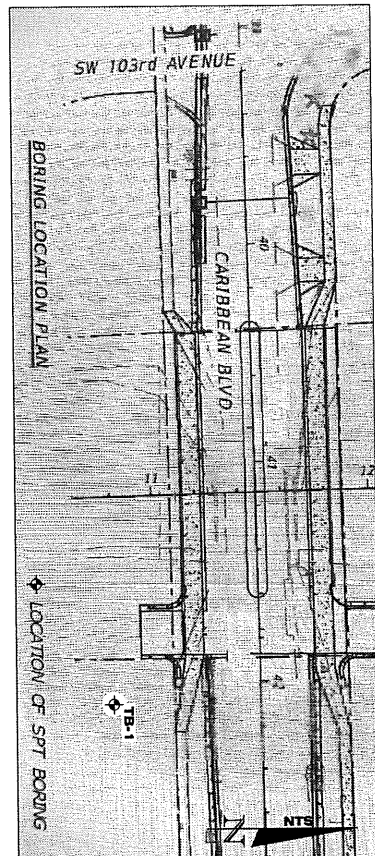
LEGEND:

- | ◆ | BORING LOCATION |
|-----|-------------------------------|
| | EXISTING BRIDGE TO BE REMOVED |
| LME | LOW MEMBER ELEVATION |
| | POINT OF LOW MEMBER ELEVATION |
| FAS | FACE OF APPROACH SLAB |
| EJ | EXPANSION JOINT |



* EXISTING BENTS TO BE REMOVED. SEE NOTE 2.

[illegible]



- LEGEND**
- Fine Sand
 - ▨ Limestone with some fine sand
 - Sand or fine sand

NOTES:

STRATA BOUNDARIES ARE APPROXIMATE AND MAY VARY BETWEEN OR AWAY FROM BORING LOCATIONS.

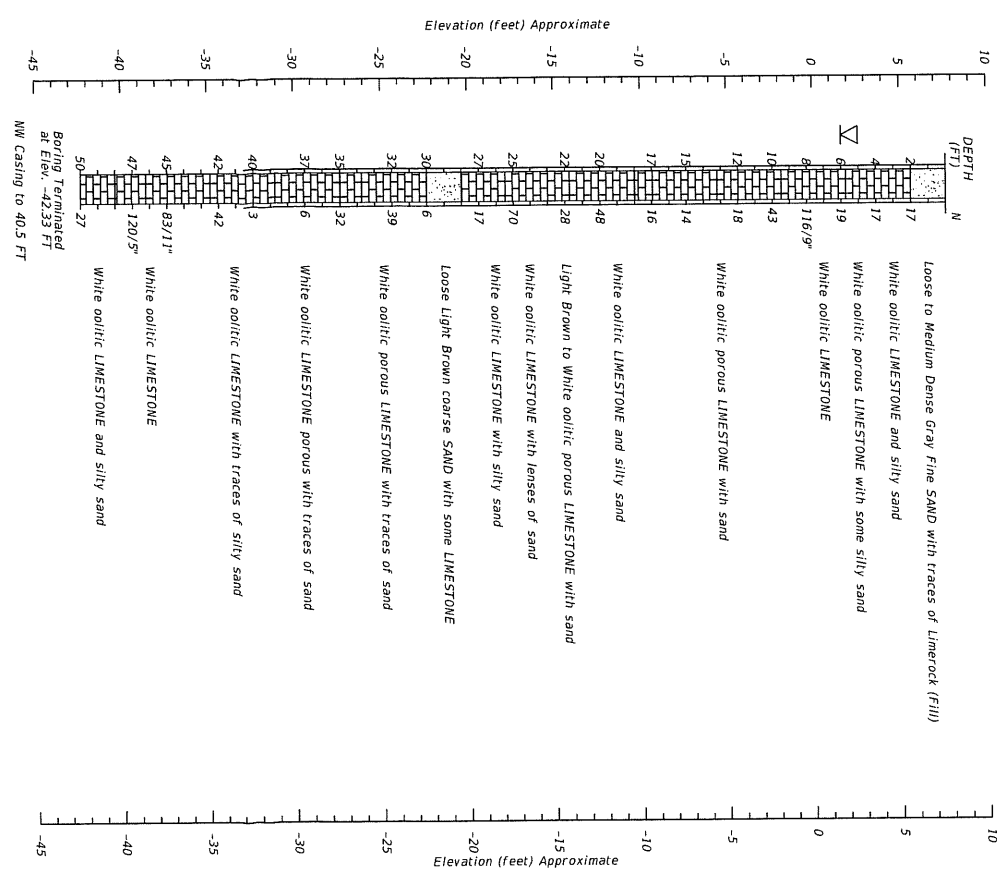
STANDARD PENETRATION TEST DATA

SPOON INSIDE DIA.	1.375 inches
SPOON OUTSIDE DIA.	2.0 inches
AVG. HAMMER DROP	30.0 inches
HAMMER WEIGHT	140.0 pounds

- SPT CONSISTENCY CHART**
- | | | |
|-------------|---------------------------------------|--|
| CONSISTENCY | SAFETY HAMMER SPT N-VALUE (BLOW/FOOT) | AUTOMATIC HAMMER SPT N-VALUE (BLOW/FOOT) |
| VERY SOFT | LESS THAN 2 | LESS THAN 1 |
| SOFT | 2 - 4 | 1 - 3 |
| FIRM | 4 - 8 | 3 - 6 |
| STIFF | 8 - 15 | 6 - 12 |
| VERY STIFF | 15 - 30 | 12 - 24 |
| HARD | GREATER THAN 30 | GREATER THAN 24 |

SPT DENSITY CHART

RELATIVE DENSITY	SAFETY HAMMER SPT N-VALUE (BLOW/FOOT)	AUTOMATIC HAMMER SPT N-VALUE (BLOW/FOOT)
VERY LOOSE	LESS THAN 4	LESS THAN 3
LOOSE	4 - 10	3 - 8
MEDIUM	10 - 30	8 - 24
DENSE	30 - 50	24 - 40
VERY DENSE	GREATER THAN 50	GREATER THAN 40



BOR # TB-1
STA. 41+59.87
OFF. 46.0 FT
ELEV. 1.61
DATE 1/20/22
HAMMER AUTOMATIC
RIG CME-55

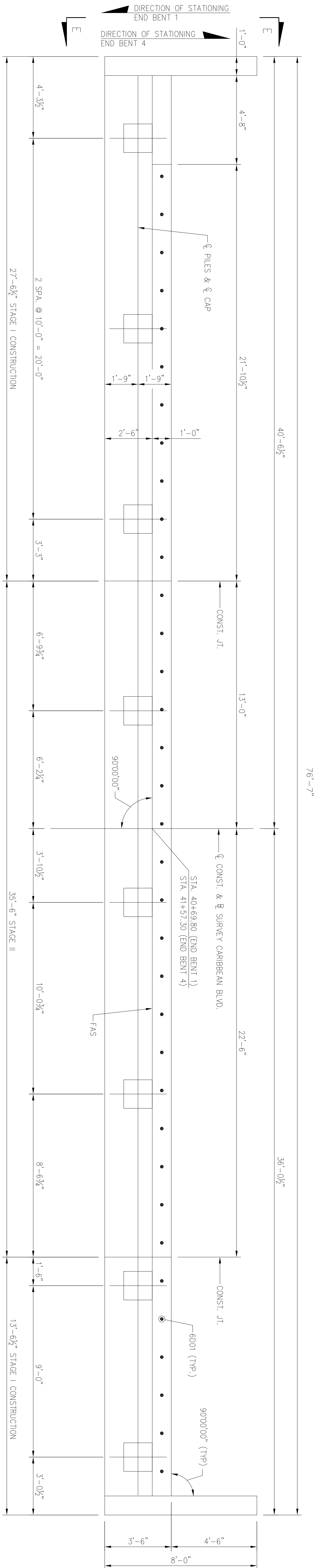
DATE	DESCRIPTION	REVISIONS	DATE	DESCRIPTION	STATE OF FLORIDA DEPARTMENT OF TRANSPORTATION ROAD NO. COUNTY FINANCIAL PROJECT ID	MIAAMI-DADE	REPORT OF CORE BORINGS	SHEET NO.
8/17/2022	9:32:38 PM						C:\Thomas Projects\22-489 Caribbean Blvd Ctn Canal\22-489 Sheets.dgn	

FIELD TESTING PROCEDURES

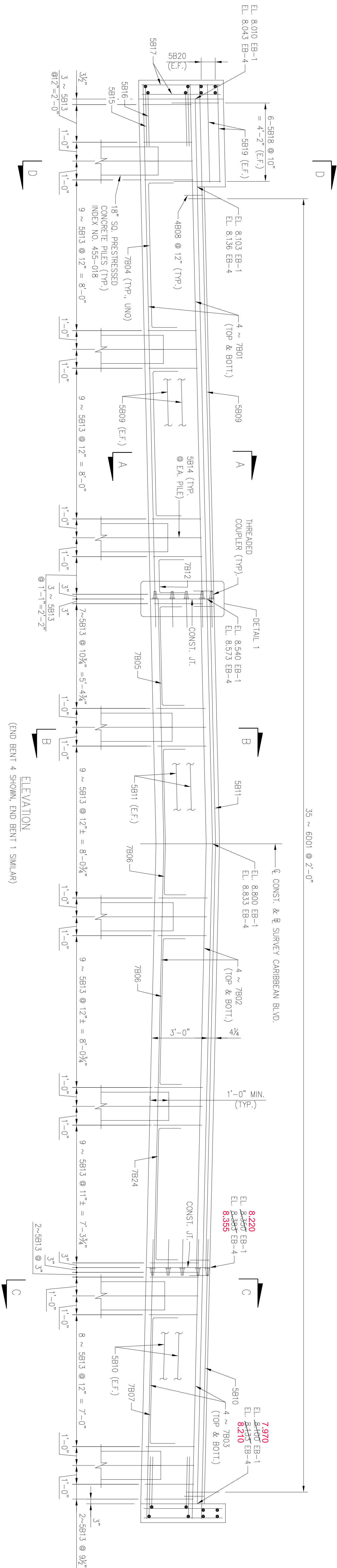
Test Borings - The test boring was made in general accordance with ASTM-D-1586, "Penetration Test and Split-Barrel Sampling of Soils." The boring was advanced using a 3-inch ID casing and a rotary drilling process. Water or bentonite drilling fluid was circulated in the boreholes to flush the cuttings. 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.

AS-BUILT SURVEY PILE CAPS ELEVATIONS



PLAN
(END BENT 4 SHOWN, END BENT 1 SIMILAR)



ESTIMATED QUANTITIES		
ITEM	UNIT	QUANTITY
CLASS II CONCRETE (SUBSTRUCTURE)	CY	63.9
REINFORCING STEEL (SUBSTRUCTURE)	LB	6,352

R E V I S I O N S					
DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION

Jacobs Engineering Group, Inc.
3150 SW 38TH AVE, SUITE 700, MIAMI, FL 33146
Tel. (305) 392-5193
CERTIFICATE OF AUTHORIZATION NO. 2822
ENGINEER OF RECORD:
BRETT K. RAKITA
P.E. NO. 59474

	NAME	DATE	NAME	DATE
DESIGNED BY	BKR	09/20/19	DRWN BY	09/20/19
CHECKED BY	RM/AM	09/20/19	CHECKED BY	SZ
SUPERVISED BY: BRETT RAKITA				

MIAMI — DADE
TRANSPORTATION AND PUBLIC
WORKS DEPARTMENT

STEPHEN P. CLARK CENTER
300 N. MIAMI AVENUE
MIAMI, FL 33128

END BENT 1 OR 4

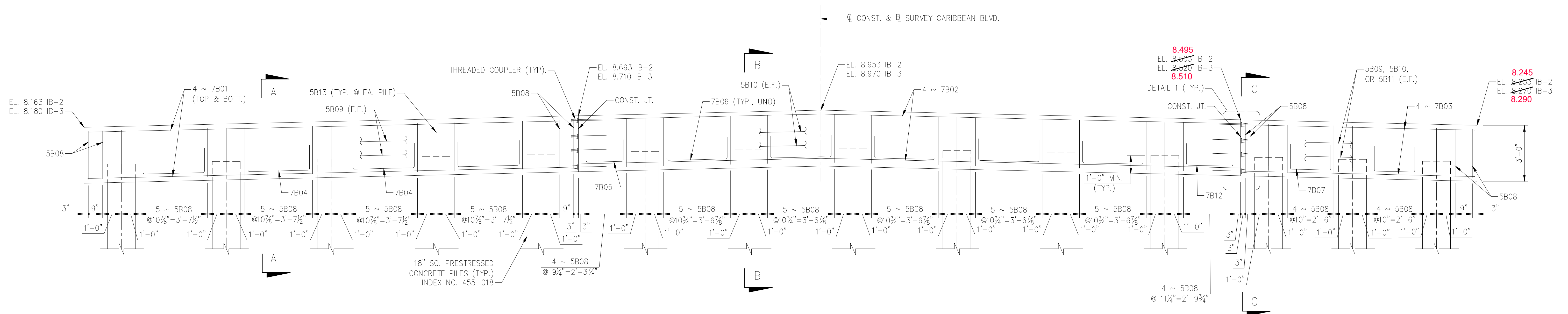
CARIBBEAN BLVD. BRIDGE OVER CI-N CANAL

BRIDGE NO. 874650

NOTES:

1. FOR SECTIONS A-A, B-B, C-C, D-D, AND VIEW E-E, SEE SHEET B1-8.
2. FOR DETAIL 1, SEE SHEET B1-10.

MIAMI-DADE COUNTY DEPARTMENT OF
TRANSPORTATION AND PUBLIC WORKS
ROADWAY ENGINEERING AND RIGHT OF WAY DIVISION
CARIBBEAN BLVD. BRIDGE OVER C-1N CANAL



ESTIMATED QUANTITIES		
ITEM	UNIT	QUANTITY
CLASS IV CONCRETE (SUBSTRUCTURE)	CY	53.2
REINFORCING STEEL (SUBSTRUCTURE)	LB	4,660

ELEVATION

NOTES:

1. FOR SECTION A-A, SECTION B-B, SECTION C-C, AND DETAIL 1,
SEE SHEET B1-10.

BRIDGE NO. 874650

R E V I S I O N S									Jacobs Engineering Group, Inc. 3150 SW 38TH AVE, SUITE 700, MIAMI, FL 33146 Tel. (305) 392-5193 CERTIFICATE OF AUTHORIZATION NO. 2822 ENGINEER OF RECORD: BRETT K. RAKITA P.E. NO. 59474		NAME		DATE		NAME		DATE		MIAMI-DADE TRANSPORTATION AND PUBLIC WORKS DEPARTMENT STEPHEN P. CLARK CENTER 111 NW 1 ST MIAMI, FL 33128	INTERMEDIATE BENT 2 OR 3	
DATE	BY	DESCRIPTION			DATE	BY	DESCRIPTION				DESIGNED BY	BKR	09/2019	DRAWN BY	CMM	09/2019	CARIBBEAN BLVD. BRIDGE OVER C1-N CANAL				
											CHECKED BY	RM/AJM	09/2019	CHECKED BY	SZ	09/2019					
											SUPERVISED BY: BRETT RAKITA										

CUT		FILL	
A	V	A	V

20
15
10
5
0
-5
-10
-15
-20

R/W LINE

R/W LINE

90

80

70

60

50

40

30

20

10

0

10

20

30

40

50

60

70

80

90

← C1-N CANAL

← C1-N CANAL

0

10

20

30

40

50

60

70

80

90

FLAT

FLAT

▽ MHW EL.3.0'

▽ MHW EL.3.0'

SECTION B-B
STA. 10+63.58

END CANAL TRANSITION
BEGIN CANAL WIDENING
BEGIN ARTICULATED BLOCK MATTING

SECTION A-A
STA. 10+38.58

BEGIN CANAL CONSTRUCTION
BEGIN CANAL TRANSITION
MATCH EXISTING

-12.23

-13.26

SURVEYOR'S NOTES.

- 1- THIS IS NOT A BOUNDARY SURVEY. THIS IS AN AS-BUILT SURVEY.
2- FIELD WORK WAS PERFORMED AUGUST 07, 2024.

SURVEYOR'S CERTIFICATE:

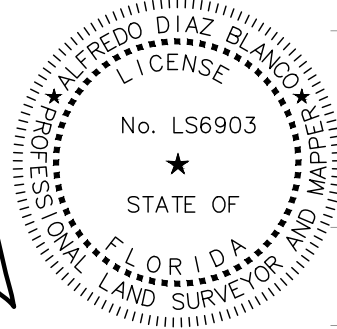
I HEREBY CERTIFY THAT THIS AS-BUILT SURVEY OF THE
PROPERTY DESCRIBED HEREON IS TRUE AND CORRECT TO THE
BEST OF MY KNOWLEDGE AND BELIEF AS RECENTLY SURVEYED
AND DRAWN UNDER MY SUPERVISION. THIS SURVEY COMPLIES
WITH THE STANDARDS OF PRACTICES SET FORTH BY THE
FLORIDA BOARD OF PROFESSIONAL LAND SURVEYORS IN
CHAPTER 5J-17 FLORIDA ADMINISTRATIVE CODE, PURSUANT TO
SECTION 427.027 FLORIDA STATUTES.

PEGASUS LAND SURVEYORS INC., A FLORIDA
CORPORATION
FLORIDA CERTIFICATE OF AUTHORIZATION NUMBER LB 8025

BY:

ALFREDO DIAZ
REGISTERED PSM. LS 6903 STATE OF FLORIDA

NOTICE: NOT VALID WITHOUT THE SIGNATURE AND ORIGINAL
RAISED SEAL OF A FLORIDA LICENSED SURVEYOR AND MAPPER.
ADDITIONS OR DELETIONS TO SURVEY MAPS BY OTHER THAN
THE SIGNING PARTY ARE PROHIBITED WITHOUT THE WRITTEN
CONSENT OF THE SIGNING PARTY.



SCALE: 1"=10' (HOR.)
1"=5' (VER.)

REVISIONS

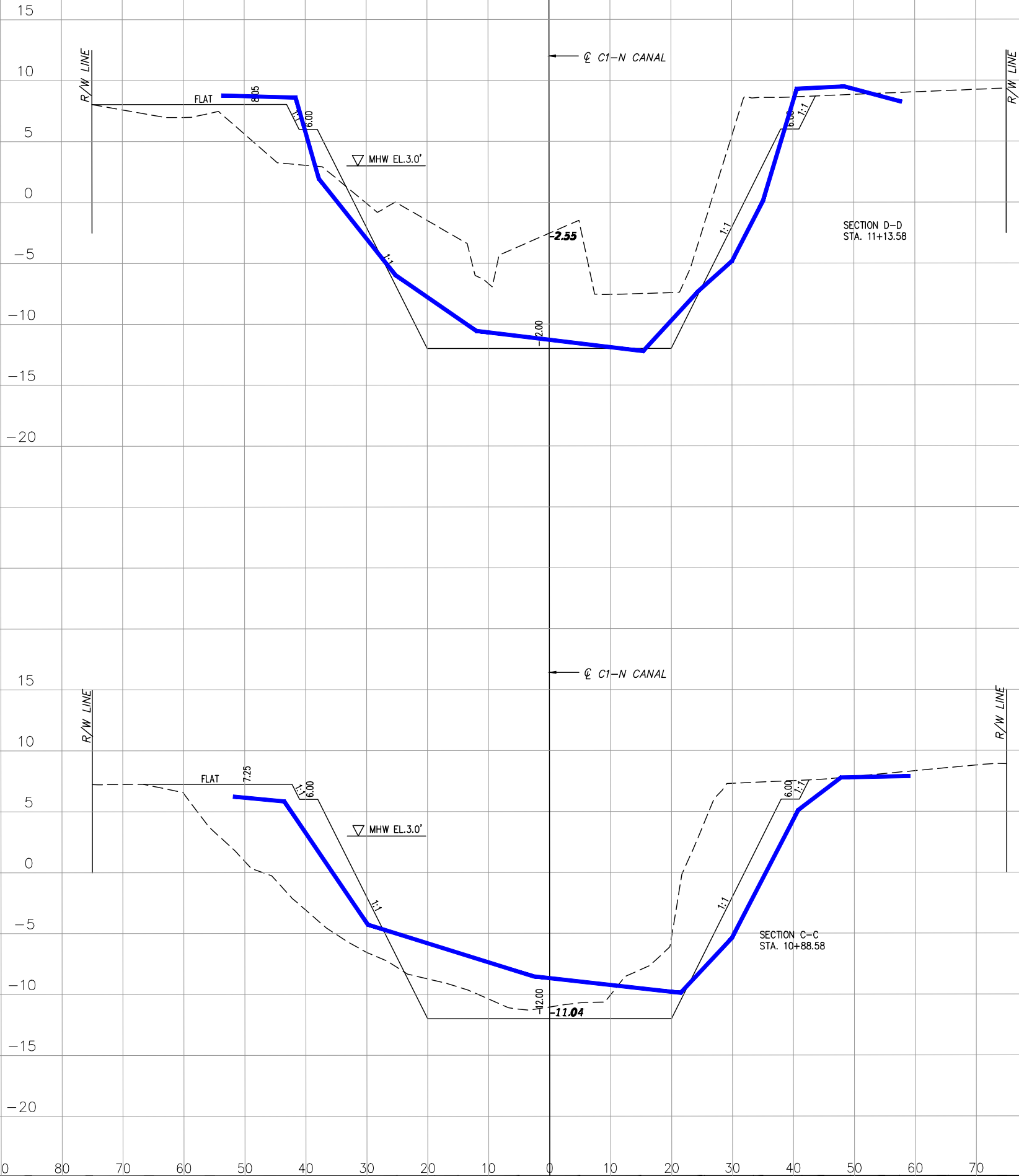
DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION

Jacobs Engineering Group, Inc.
3150 S.W. 38th Avenue, Suite 700
Miami, FL 33146
Tel. (305) 392-5196
CERTIFICATE OF AUTHORIZATION NO. 2822
ENGINEER OF RECORD:
JAVIER A. CALVO
P.E. NO. 73792

DESIGNED BY	CHECKED BY	NAME	DATE	DRAWN BY	CHECKED BY	NAME	DATE
SUPERVISED BY:							

MIAMI-DADE COUNTY
DEPARTMENT OF TRANSPORTATION AND PUBLIC WORKS
ROADWAY ENGINEERING AND RIGHT OF WAY DIVISION
STEPHEN P. CLARK CENTER
111 NW 1 ST
MIAMI, FLORIDA 33128

CANAL CROSS SECTIONS



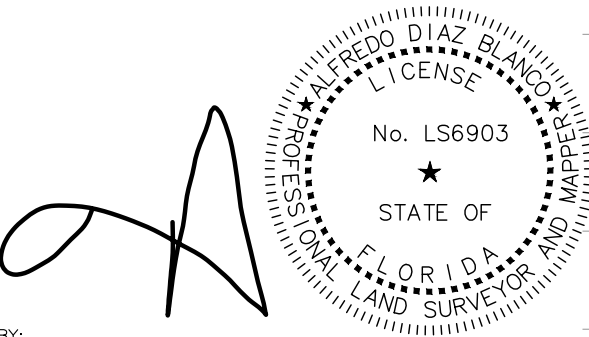
SURVEYOR'S NOTES.

- 1- THIS IS NOT A BOUNDARY SURVEY. THIS IS AN AS-BUILT SURVEY.
2- FIELD WORK WAS PERFORMED AUGUST 07, 2024.

SURVEYOR'S CERTIFICATE:

I HEREBY CERTIFY THAT THIS AS-BUILT SURVEY OF THE PROPERTY DESCRIBED HEREON IS TRUE AND CORRECT TO THE BEST OF MY KNOWLEDGE AND BELIEF AS RECENTLY SURVEYED AND DRAWN UNDER MY SUPERVISION. THIS SURVEY COMPLIES WITH THE STANDARDS OF PRACTICES SET FORTH BY THE FLORIDA BOARD OF PROFESSIONAL LAND SURVEYORS IN CHAPTER 5J-17 FLORIDA ADMINISTRATIVE CODE, PURSUANT TO SECTION 427.027 FLORIDA STATUTES.

PEGASUS LAND SURVEYORS INC., A FLORIDA CORPORATION
FLORIDA CERTIFICATE OF AUTHORIZATION NUMBER LB 8025



BY: ALFREDO DIAZ
REGISTERED PSM. LS 6903 STATE OF FLORIDA

NOTICE: NOT VALID WITHOUT THE SIGNATURE AND ORIGINAL RAISED SEAL OF A FLORIDA LICENSED SURVEYOR AND MAPPER. ADDITIONS OR DELETIONS TO SURVEY MAPS BY OTHER THAN THE SIGNING PARTY ARE PROHIBITED WITHOUT THE WRITTEN CONSENT OF THE SIGNING PARTY.

SCALE: 1"=10' (HOR.)
1"=5' (VER.)

REVISIONS

DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION

Jacobs Engineering Group, Inc.
3150 S.W. 36th Avenue, Suite 700
Miami, FL 33146
Tel. (305) 392-5196
CERTIFICATE OF AUTHORIZATION NO. 2822
ENGINEER OF RECORD:
JAVIER A. CALVO
P.E. NO. 73792

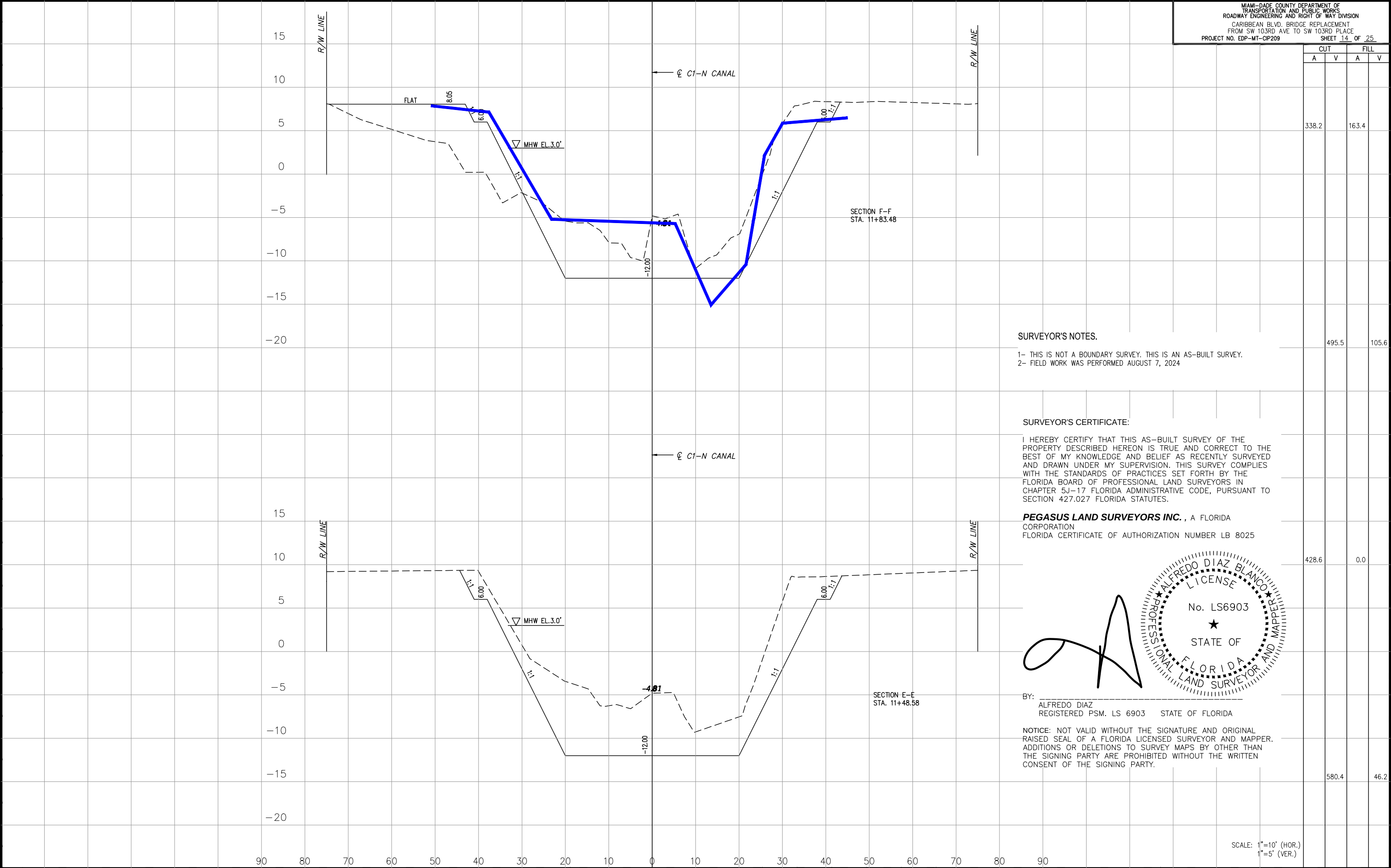
NAME	DATE	NAME	DATE
DESIGNED BY		DRAWN BY	
CHECKED BY		CHECKED BY	
SUPERVISED BY:			



DEPARTMENT OF TRANSPORTATION
AND PUBLIC WORKS
ROADWAY ENGINEERING AND
RIGHT OF WAY DIVISION
STEPHEN P. CLARK CENTER
111 NW 1 ST
MIAMI, FLORIDA 33128

CANAL CROSS SECTIONS

1/8/2020 1:25:37 PM P:\2019 Projects\EGXL2001\700CADD\roadway\RDYSRD01.dgn



CUT		FILL	
A	V	A	V
338.2		163.4	
495.5		105.6	
428.6		0.0	
580.4		46.2	

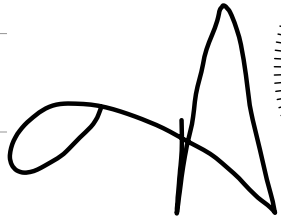
SURVEYOR'S NOTES.

1- THIS IS NOT A BOUNDARY SURVEY. THIS IS AN AS-BUILT SURVEY.
2- FIELD WORK WAS PERFORMED AUGUST 7, 2024

SURVEYOR'S CERTIFICATE:

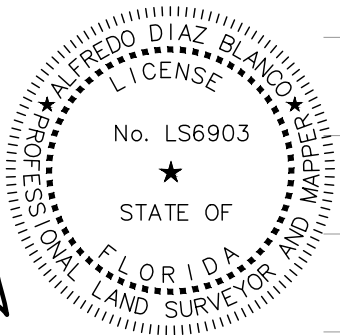
I HEREBY CERTIFY THAT THIS AS-BUILT SURVEY OF THE PROPERTY DESCRIBED HEREON IS TRUE AND CORRECT TO THE BEST OF MY KNOWLEDGE AND BELIEF AS RECENTLY SURVEYED AND DRAWN UNDER MY SUPERVISION. THIS SURVEY COMPLIES WITH THE STANDARDS OF PRACTICES SET FORTH BY THE FLORIDA BOARD OF PROFESSIONAL LAND SURVEYORS IN CHAPTER 5J-17 FLORIDA ADMINISTRATIVE CODE, PURSUANT TO SECTION 427.027 FLORIDA STATUTES.

PEGASUS LAND SURVEYORS INC., A FLORIDA CORPORATION
FLORIDA CERTIFICATE OF AUTHORIZATION NUMBER LB 8025

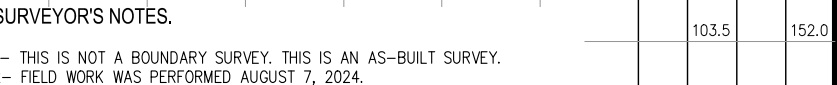
BY: 

ALFREDO DIAZ BLANCO
REGISTERED PSM. LS 6903 STATE OF FLORIDA

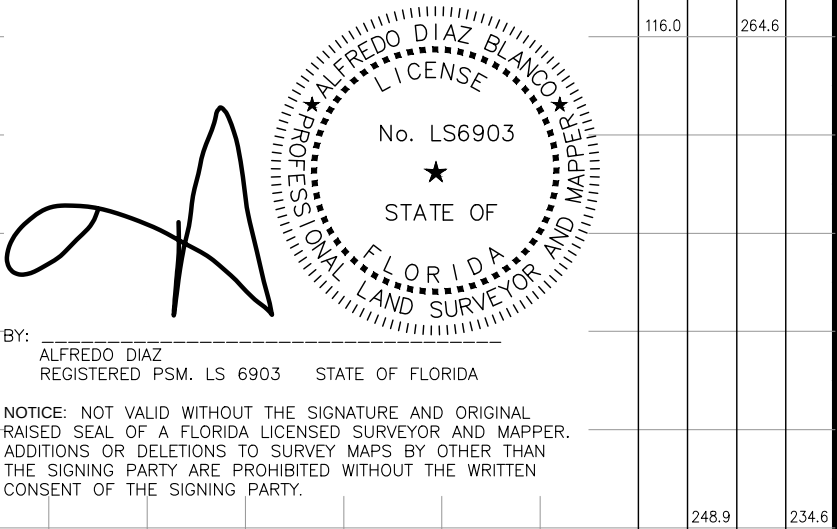
NOTICE: NOT VALID WITHOUT THE SIGNATURE AND ORIGINAL RAISED SEAL OF A FLORIDA LICENSED SURVEYOR AND MAPPER. ADDITIONS OR DELETIONS TO SURVEY MAPS BY OTHER THAN THE SIGNING PARTY ARE PROHIBITED WITHOUT THE WRITTEN CONSENT OF THE SIGNING PARTY.



SCALE: 1"=10' (HOR.)
1"=5' (VER.)



PEGASUS LAND SURVEYORS INC., A FLORIDA
CORPORATION
FLORIDA CERTIFICATE OF AUTHORIZATION NUMBER LB 8025

[illegible]

	NAME	DATE		NAME	DATE
DESIGNED BY			DRAWN BY		
CHECKED BY			CHECKED BY		
SUPERVISED BY:					

CANAL CROSS SECTIONS



SolVer Structural Partnership, Inc.

Consulting Structural Engineers

Design • Inspections • Investigation • Reports

January 26th, 2023

Page 1 of 2

Attention: Bernie Barrile. Project manager
American Empire Builders, Inc.
13775 SW 145th Ct, Suite B
Miami, FL 33186

Re: Submittal Number: 018 Response to question on design for the Project located at Caribbean Blvd Bridge Replacement Miami Dade County.

Bernie,

Below, please find our response to the aforementioned RFI:

- 1) The core boring drilled by the contractor appears to confirm presence of a dense zone in this location between elevations -10 and -20.
 - a. Answer: Positive
- 2) **TABLE 5.2.1.** The data presented in Table 5.2.1 appears reasonable except for the correlation used to convert the blowcounts to shear strength. The shear strength correlations used in this table come from Appendix B of the 2022 FDOT Soils and Foundation Handbook. However, Appendix B limits the phi angle calculated by these correlations to 35 degrees for silty sand (A-2-4), 38 degrees for clean sand (A-3), and 40 degrees for rock unless supported by laboratory test data. Alternatively, the correlations presented in Table 16 of the 2022 FDOT Soils and Foundation Handbook can also be used. These correlations result in shear strength values generally ranging between 35 - 40 degrees. The strength values greater than 40 degrees shown in this table should not be used for design.
 - a. **Answer:** Max shear friction angle used in design is 35 degree
- 3) **TABLE 7.2.1.** The shear strength data recommended for design appear more appropriate than presented in Table 5.2.1, but are still on the high side and are unconservative. Based on Table 16 and Appendix B of the 2022 FDOT Soils and Foundation Handbook, design shear strengths should be limited to 35 degrees for sand and 40 degrees for rock as a maximum. This limitation will have an impact on the calculated Coefficients of Lateral Earth Pressure which is used in the sheet pile wall analysis.
 - b. **Answer:** Max shear friction angle used in design is 35 degree
- 4) Verify that analysis for 5ft wall height and 7.52ft wall height are sufficient cantilevered heights to account for each condition of the temporary wall.
 - a. **Answer:** See attached calculation for sheet pile wall height of 7.5 ft including slope of terrain.



SolVer Structural Partnership, Inc.

Consulting Structural Engineers

Design • Inspections • Investigation • Reports

Page 2 of 2

- 5) The SPW911 Sheet Pile Design Software is not capable of LRFD design. It uses ASD. To perform LRFD design using this software, factors have to be modified to account for resistance and load factoring for checking embedment, moment, and deflection. This project is designed per the LRFD code. Please include a statement addressing if the ASD method used in these calculations are an acceptable alternative.

a. Answer: See attached statement

Should you have any questions regarding the foregoing, please do not hesitate to contact this office.

Kind Regards,

Denis K. Solano, P.E. #: 56902, S.I. #: 2046

Principal

SolVer Structural Partnership, Inc.

www.solversp.com



SolVer Structural Partnership, Inc.

Consulting Structural Engineers

Design • Inspections • Investigation • Reports

January 26th, 2023

Page 1 of 1

Attention: Bernie Barrile. Project manager
American Empire Builders, Inc.
13775 SW 145th Ct, Suite B
Miami, Fl. 33186

Re: Allowable Strength Design (ASD) used in sheet pile Structural design for the Project located at Caribbean Blvd Bridge Replacement Miami Dade County.

To whom it may concern:

- 1) This letter will serve as a certification that the steel sheet pile for this project is designed as per the ASD method as an acceptable alternative to the LRFD method specified on the structural notes.

Should you have any questions regarding the foregoing, please do not hesitate to contact this office.

Kind Regards,

Denis K. Solano, P.E. #: 56902, S.I. #: 2046
Principal
SolVer Structural Partnership, Inc.
www.solversp.com