

July 11, 2023

Mr. Billy Hardwick
Senior Project Manager
Archer-United Joint Venture
billy.hardwick@uig.net

Re: Report of Dynamic Pile Testing

Bent 2 Footing 2 Pile 13
Bridge 42b – US 176 EB (Broad River Rd.) Bridge over I-20
Project ID: P039719
Richland County, South Carolina

Dear Mr. Hardwick:

The attached results of dynamic pile testing for the subject pile and project includes measurements and analysis performed by Infrastructure Consulting & Engineering in accordance with ASTM D4945. Measurements were made with the Pile Dynamics, Inc. Model 8G and signal matching analysis was performed with CAPWAP version 2014. For further information on the test method please refer to the ASTM. The Geotechnical Engineer of Record should ultimately make final recommendations for foundation design and construction.

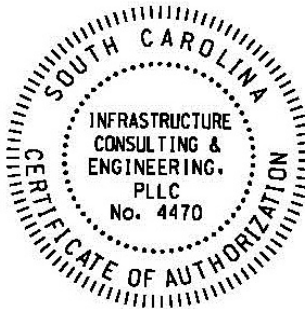
Also included are the production pile driving recommendations for Bent 2 Footings 1 and 2 of the subject project. The Geotechnical Engineer of Record should ultimately make final recommendations for foundation design and construction.

Thank you for the opportunity to provide these services.

Sincerely,
Infrastructure Consulting & Engineering (ICE), PLLC



Michael J. Simpson, P.E.
Geotechnical Testing Manager
Certified PDA Signatory "Advanced"
South Carolina Registration Number: 35396



A handwritten signature in blue ink, appearing to read "Sally G. Thomson".

Sally G. Thomson, P.E.
Geotechnical Designer
Certified PDA Signatory "Advanced"

Summary of Provided Project and Pile Driving Information

| | | | | | |
|--|--------------------------------|--|---|--------------------------------------|---------------------------------|
| Project Description | | US 176 EB (Broad River Road) Bridge over I-20 Richland County, South Carolina | | | |
| Pile Driving Contractor | | Archer United Joint Venture | | | |
| Project ID | | P039719 | | | |
| ICE Field Personnel | | Sally G. Thomson, P.E. | | | |
| ICE Responsible Engineer | | Michael J. Simpson, P.E. | | | |
| | | | | | |
| Bent Number | Station | Pile Type | Pile Batter | Hammer Used | Pile Cushion Type and Thickness |
| Bent 2 | 415+98.79 | HP14x73 with Pile Tip | Plumb | ICE I-19v2 | N/A |
| Pile Number | Total Pile Length (feet) | Pile Length Below Gages (feet) | Pile Splice Location(s) above Pile Tip (feet) | Initial Drive Test Date | Restrike Test Date |
| 13 | 55.0 | 52.7 | N/A | 7/8/23 | N/A |
| Factored Design Load (kips) | Geotechnical Resistance Factor | Nominal Resistance of Pile (kips) | Required Driving Resistance of Pile (kips) | Minimum Tip Elevation of Pile (feet) | |
| 220 | 0.65 | 340 | 340 | +270.0 | |
| Installation Records Provided to ICE | | | Please Refer to SCDOT Pile Driving Logs | | |
| Project Information and Soil Borings Provided to ICE | | | Yes, Attached in Appendix C | | |
| Pile Driving Equipment Data Form Provided to ICE | | | ICE I-19v2 Data Hammer Sheet Attached in Appendix D | | |
| Strain and Accelerometer Calibrations Attached | | | Yes, Attached in Appendix E | | |
| Steel Acceptable Compression Driving Stress Limit (ksi)* | | | | | 45 |
| Steel Acceptable Tension Driving Stress Limit (ksi)* | | | | | 45 |
| *For steel piles based on Section 711.4.2.2 and a steel yield strength (Fy) of 50 ksi. | | | | | |
| Approximate Reference Elevation (feet) | | | | | +302.2 |
| Approximate Ground/Mudline Elevation (feet) | | | | | +300.7 |
| Approximate Final Pile Penetration Below Reference at End of Initial Drive (feet) | | | | | 50.0 |
| Approximate Final Pile Tip Elevation at End of Initial Drive (feet) | | | | | +252.2 |
| Approximate Final Pile Penetration Below Reference at End of Restrike (feet) | | | | | N/A |
| Approximate Final Pile Tip Elevation at End of Restrike (feet) | | | | | N/A |
| | | | | | |

Additional Notes on Pile Installation

- Pile 13 was monitored with instrumentation for the entire initial drive.
- For additional detailed information on the hammer driving system, bridge plans, and soils information please refer to the project documents.
- The blows per foot of penetration for the pile was kept by the PDA operator on the PDA during the initial drive. A pile driving log was also maintained by a SCDOT representative.

Summary of Results

Dynamic Pile Testing Results (Detailed Results in Appendix A)

| Location* | Capacity (kips) | Case Method | Max. Comp. Stress (ksi) | Avg. Comp. Stress (ksi) | Max. Comp. Stress at Pile Bottom (ksi) | Avg. Comp. Stress at Pile Bottom (ksi) | Avg. Transferred Energy (k-ft) | Avg. Stroke (feet) |
|-----------|-----------------|--------------|-------------------------|-------------------------|--|--|--------------------------------|--------------------|
| EOD | 410 | RMX (Jc=0.8) | 32.4 | 24.0 | 23.8 | 12.0 | 15.7 | 6.6 |

Signal Matching Analyses Results (Detailed Result in Appendix A)

| Location* | R _{ult} (kips) | R _{side} / R _{end} (kips) | Equiv. BPF* | Stroke (ft) | EMX (k-ft) | Q _s (in) | Q _t (in) | S _s (sec/ft) | S _t (sec/ft) | MQN* |
|----------------|-------------------------|---|-------------|-------------|------------|---------------------|---------------------|-------------------------|-------------------------|------|
| EOD (Blow 847) | 410 | 225 / 185 | 96 | 9.0 | 22.7 | 0.10 | 0.33 | 0.18 | 0.08 | 1.56 |

*EOD – End of Drive; BPF – Blows per foot; MQN – Match Quality Number

Dynamic Pile Testing Interpretation and Commentary

The capacity listed in the Summary of Dynamic Pile Testing Results is based on the RMX (Maximum Case Method with J(c)=0.8) solution for the maximum value for the last increment of the initial drive. The summary plot and table attached for the dynamic pile testing results are based on the same capacity solution.

Signal matching analysis was performed for a representative blow (Blow 847) near the end of the initial drive. The signal matching ultimate capacity near the end of initial drive was above the required driving resistance of 340 kips for piles in Bent 2.

Compression and tension pile driving stresses were below the acceptable limit for the pile tested during the initial drive. The pile tested did not show any signs of integrity problems below the gage locations based on the test results.

Recommended Production Pile Driving Criteria

The recommended drive criteria for the up to 55-foot long HP 14x73 steel piles with pile points in Bent 2 for Footings 1 and 2 is based on the wave equation analysis and the dynamic testing results. Please see the attached wave equation outputs for additional information.

The driving criteria also only apply to piles driven with the ICE I-19v2 hammer driving system. A hammer helmet weight of 2.3 kips and a hammer cushion of 2.5 total inches of nylon, based on the project pile installation plan, was used to develop the production pile driving criteria. A change in the hammer driving system, installation procedures, and/or pile type would require re-analysis and likely would warrant modifications to the driving criteria. ICE should be notified immediately should any changes occur.

Bent 2 Footings 1 and 2

The up to 55-foot HP 14x73 steel piles at Bent 2 Footings 1 and 2 may be stopped if one of the following conditions is met, provided pile rebound is less than ¼ inch per blow and the minimum tip elevation or minimum penetration requirements in the project plans and/or specifications are met.

1. Practical refusal (20 blows per one inch or ½ inch in 10 blows with at least a stroke of 6.0 feet) is reached during driving.
2. The following maximum set per 10 blows is not exceeded (minimum blows per foot is met) for the respective stroke during driving:

| Stroke (feet) | Maximum Set in inches per 10 blows | Minimum Blows Per Foot |
|----------------|------------------------------------|------------------------|
| 6.5 | ¾ | 150 |
| 7.0 | 1 | 120 |
| 7.5 | 1-1/8 | 100 |
| 8.0 | 1-1/4 | 93 |
| 8.5 or greater | 1-1/2 | 80 |

Piles not meeting the above requirements should be brought to the Engineer's attention and may require additional testing and/or driving to meet the requirements.

Limitations

This report presents test measurements made by ICE. Interpretations were made based upon the measurements made by ICE with the latest techniques available and currently accepted standards of care recognized by Geotechnical Engineering professionals. The Geotechnical Engineer of Record should ultimately make final recommendations for foundation design and construction.

Appendix A

**Dynamic Pile Testing, Signal Matching Results, and
Calibration WEAP**

Bridge 42B, Bent 2, Footing 2, Pile 13

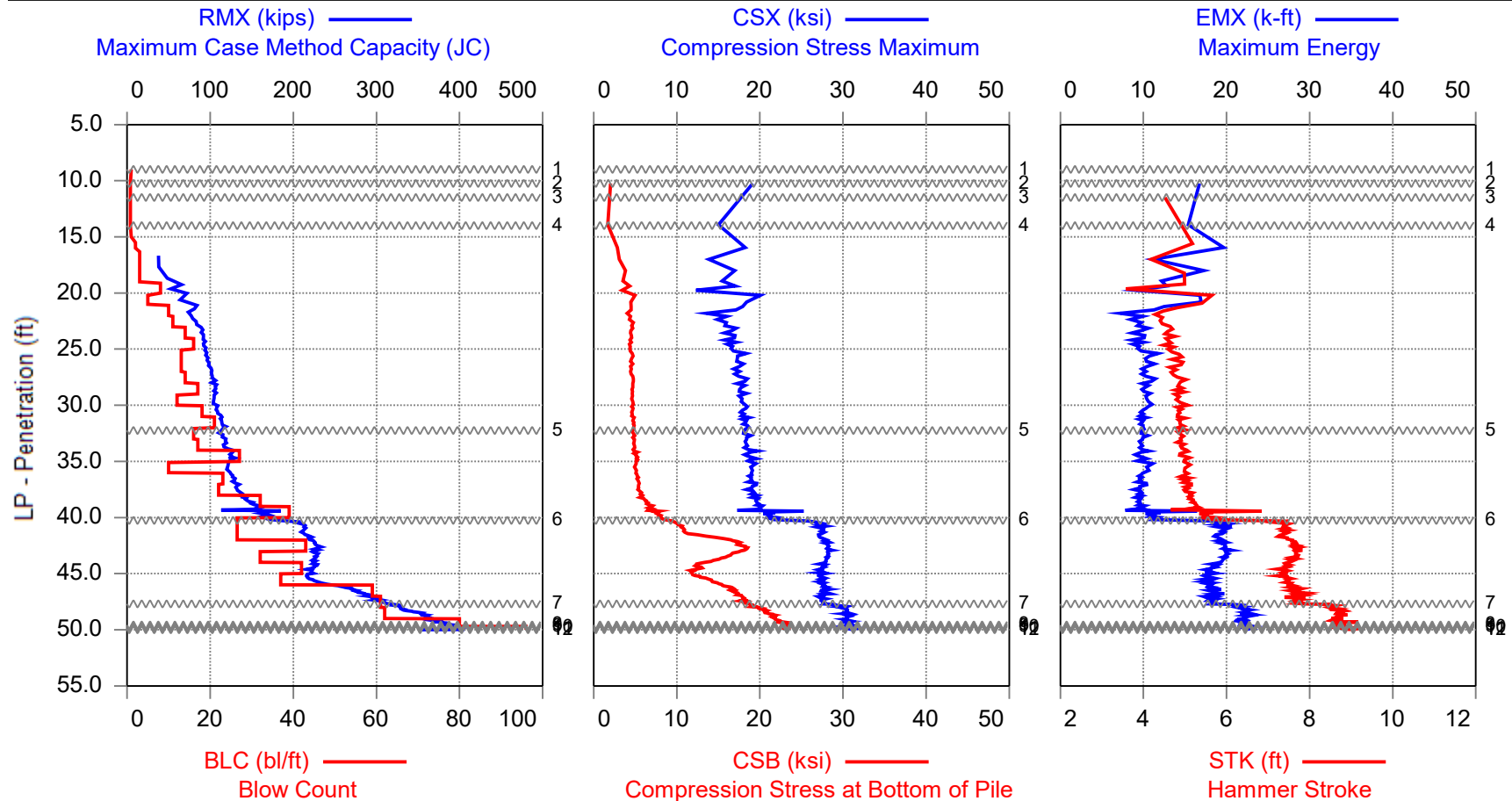


Pile Dynamics, Inc. - PDILOT2 Ver 2017.2.58.5 - Case Method & iCAP® Results
Printed: 10-July-2023

Test started: 08-July-2023



CCRP2 Bridge 42B - Bent 2 Footing 2 Pile 13
HP 14x73 w/ tip



- 1 - Template @ +302.21 ft / GSE @ +300.67 ft
- 2 - RDR = 340 kips Min. Tip Elev. @ +270.0 ft
- 3 - Fuel setting 1
- 4 - Fuel setting 2
- 5 - Minimum tip achieved
- 6 - Fuel setting 3

- 7 - Fuel setting 4
- 8 - Set in 10 blows was 1-1/2 inches
- 9 - Set in 10 blows was 1-1/2 inches
- 10 - Set in 10 blows was 1-1/4 inches
- 11 - Set in 10 blows was 1-1/4 inches
- 12 - Last set in 10 blows @ EOD was 1-1/4 inches

CCRP2 Bridge 42B - Bent 2 Footing 2 Pile 13
OP: ICE

HP 14x73 w/ tip
Date: 08-July-2023

AR: 21.40 in²

SP: 0.492 k/ft³

LE: 52.67 ft

EM: 30,000 ksi

WS: 16,807.9 f/s

JC: 0.80

RX9: Maximum Case Method Capacity (JC=0.9)

EMX: Maximum Energy

RMX: Maximum Case Method Capacity (JC)

STK: Hammer Stroke

CSX: Compression Stress Maximum

FVP: Force/Velocity Proportionality

CSB: Compression Stress at Bottom of Pile

BTA: Integrity Factor (1)

TSX: Tension Stress Maximum - Full Record Search

| BL# | Depth ft | BLC bl/ft | TYPE | RX9 kips | RMX kips | CSX ksi | CSB ksi | TSX ksi | EMX k-ft | STK ft | FVP | BTA (%) |
|-----|-------------|--------------|------|-------------|-------------|------------|------------|------------|-------------|-----------|-----|------------|
| 5 | 14.00 | 1 | AV5 | 0 | 0 | 16.7 | 1.8 | 10.8 | 15.6 | 4.52 | 1.0 | 100.0 |
| | | | STD | 0 | 0 | 5.0 | 0.5 | 4.0 | 4.6 | 1.35 | 0.0 | 0.0 |
| | | | MAX | 0 | 0 | 24.0 | 2.3 | 17.2 | 20.1 | 6.39 | 1.0 | 100.0 |
| | | | @BL | 1 | 1 | 2 | 2 | 2 | 5 | 2 | 5 | 1 |
| 6 | 15.00 | 1 | AV1 | 0 | 0 | 18.9 | 2.1 | 12.6 | 18.4 | 5.19 | 1.0 | 100.0 |
| | | | STD | 0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.00 | 0.0 | 0.0 |
| | | | MAX | 0 | 0 | 18.9 | 2.1 | 12.6 | 18.4 | 5.19 | 1.0 | 100.0 |
| | | | @BL | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
| 8 | 16.00 | 2 | AV2 | 0 | 0 | 15.3 | 2.3 | 8.5 | 16.7 | 3.77 | 1.0 | 100.0 |
| | | | STD | 0 | 0 | 3.2 | 0.5 | 1.2 | 6.5 | 0.00 | 0.0 | 0.0 |
| | | | MAX | 0 | 0 | 18.5 | 2.8 | 9.7 | 23.2 | 3.77 | 1.0 | 100.0 |
| | | | @BL | 7 | 7 | 8 | 8 | 8 | 8 | 7 | 8 | 7 |
| 14 | 18.00 | 3 | AV6 | 38 | 38 | 15.1 | 3.2 | 7.8 | 14.1 | 4.47 | 1.0 | 100.0 |
| | | | STD | 5 | 5 | 5.8 | 0.7 | 4.2 | 8.2 | 1.15 | 0.0 | 0.0 |
| | | | MAX | 45 | 45 | 24.1 | 4.0 | 15.0 | 25.5 | 6.58 | 1.0 | 100.0 |
| | | | @BL | 14 | 14 | 9 | 14 | 9 | 9 | 9 | 14 | 9 |
| 17 | 19.00 | 3 | AV3 | 48 | 48 | 17.7 | 4.1 | 9.6 | 14.8 | 5.16 | 1.0 | 100.0 |
| | | | STD | 3 | 3 | 6.1 | 1.1 | 4.6 | 8.5 | 1.48 | 0.0 | 0.0 |
| | | | MAX | 50 | 50 | 26.0 | 5.5 | 15.9 | 26.2 | 7.21 | 1.0 | 100.0 |
| | | | @BL | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 16 | 15 |
| 25 | 20.00 | 8 | AV8 | 63 | 63 | 17.0 | 4.1 | 8.0 | 14.1 | 4.99 | 1.0 | 100.0 |
| | | | STD | 9 | 9 | 7.0 | 1.0 | 5.0 | 9.1 | 1.82 | 0.0 | 0.0 |
| | | | MAX | 80 | 80 | 28.4 | 6.2 | 16.8 | 28.8 | 7.98 | 1.0 | 100.0 |
| | | | @BL | 24 | 24 | 25 | 25 | 25 | 25 | 25 | 24 | 18 |
| 30 | 21.00 | 5 | AV5 | 69 | 69 | 17.4 | 4.4 | 7.9 | 14.5 | 5.00 | 1.0 | 100.0 |
| | | | STD | 13 | 13 | 6.5 | 0.8 | 4.4 | 8.6 | 1.63 | 0.0 | 0.0 |
| | | | MAX | 86 | 87 | 27.7 | 5.5 | 15.4 | 26.8 | 7.68 | 1.0 | 100.0 |
| | | | @BL | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 28 | 26 |
| 40 | 22.00 | 10 | AV10 | 78 | 78 | 16.2 | 4.4 | 6.8 | 10.3 | 4.59 | 1.0 | 100.0 |
| | | | STD | 5 | 5 | 2.0 | 0.3 | 1.5 | 2.4 | 0.37 | 0.0 | 0.0 |
| | | | MAX | 85 | 85 | 19.3 | 4.6 | 9.3 | 13.8 | 5.19 | 1.0 | 100.0 |
| | | | @BL | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 39 | 31 |
| 51 | 23.00 | 11 | AV11 | 82 | 82 | 15.6 | 4.5 | 5.7 | 9.2 | 4.46 | 1.0 | 100.0 |
| | | | STD | 4 | 4 | 0.8 | 0.3 | 0.6 | 0.9 | 0.15 | 0.0 | 0.0 |
| | | | MAX | 89 | 89 | 16.8 | 4.9 | 6.7 | 10.6 | 4.68 | 1.0 | 100.0 |
| | | | @BL | 50 | 50 | 47 | 47 | 41 | 47 | 47 | 48 | 41 |

CCRP2 Bridge 42B - Bent 2 Footing 2 Pile 13
OP: ICE

HP 14x73 w/ tip
Date: 08-July-2023

| BL# | Depth ft | BLC bl/ft | TYPE | RX9 kips | RMX kips | CSX ksi | CSB ksi | TSX ksi | EMX k-ft | STK ft | FVP | BTA (%) |
|-----|-------------|--------------|------|-------------|-------------|------------|------------|------------|-------------|-----------|-----|------------|
| 65 | 24.00 | 14 | AV14 | 91 | 91 | 16.8 | 4.5 | 6.1 | 9.9 | 4.66 | 1.0 | 100.0 |
| | | | STD | 2 | 2 | 0.8 | 0.2 | 0.5 | 1.0 | 0.15 | 0.0 | 0.0 |
| | | | MAX | 93 | 93 | 18.1 | 5.0 | 6.6 | 11.8 | 4.92 | 1.0 | 100.0 |
| | | | @BL | 56 | 56 | 64 | 64 | 52 | 64 | 64 | 58 | 52 |
| 81 | 25.00 | 16 | AV16 | 93 | 93 | 16.4 | 4.4 | 5.6 | 9.2 | 4.59 | 1.0 | 100.0 |
| | | | STD | 3 | 3 | 0.7 | 0.2 | 0.5 | 0.7 | 0.14 | 0.0 | 0.0 |
| | | | MAX | 100 | 100 | 17.7 | 4.7 | 6.4 | 10.7 | 4.86 | 1.0 | 100.0 |
| | | | @BL | 81 | 81 | 70 | 70 | 70 | 70 | 70 | 76 | 66 |
| 94 | 26.00 | 13 | AV13 | 95 | 95 | 17.3 | 4.6 | 5.9 | 10.5 | 4.78 | 1.0 | 100.0 |
| | | | STD | 3 | 3 | 1.1 | 0.2 | 0.8 | 1.2 | 0.23 | 0.0 | 0.0 |
| | | | MAX | 99 | 99 | 19.3 | 5.0 | 7.3 | 13.1 | 5.24 | 1.0 | 100.0 |
| | | | @BL | 90 | 90 | 86 | 89 | 86 | 86 | 86 | 83 | 82 |
| 107 | 27.00 | 13 | AV13 | 99 | 100 | 17.5 | 4.5 | 5.9 | 10.6 | 4.81 | 1.0 | 100.0 |
| | | | STD | 2 | 2 | 0.9 | 0.2 | 0.6 | 1.1 | 0.19 | 0.0 | 0.0 |
| | | | MAX | 103 | 103 | 19.2 | 4.8 | 7.3 | 12.6 | 5.19 | 1.0 | 100.0 |
| | | | @BL | 105 | 106 | 97 | 97 | 97 | 97 | 97 | 99 | 95 |
| 121 | 28.00 | 14 | AV14 | 102 | 103 | 17.6 | 4.7 | 5.8 | 10.4 | 4.83 | 1.0 | 100.0 |
| | | | STD | 3 | 3 | 1.0 | 0.2 | 0.6 | 1.0 | 0.21 | 0.0 | 0.0 |
| | | | MAX | 109 | 109 | 19.9 | 5.0 | 7.3 | 13.1 | 5.35 | 1.0 | 100.0 |
| | | | @BL | 118 | 118 | 116 | 116 | 116 | 116 | 116 | 109 | 108 |
| 138 | 29.00 | 17 | AV17 | 106 | 107 | 17.8 | 4.7 | 5.9 | 10.3 | 4.86 | 1.0 | 100.0 |
| | | | STD | 3 | 3 | 0.9 | 0.2 | 0.6 | 0.9 | 0.20 | 0.0 | 0.0 |
| | | | MAX | 112 | 112 | 20.1 | 5.1 | 7.3 | 13.0 | 5.39 | 1.0 | 100.0 |
| | | | @BL | 129 | 129 | 136 | 136 | 136 | 136 | 136 | 129 | 122 |
| 150 | 30.00 | 12 | AV12 | 104 | 104 | 17.8 | 4.7 | 5.8 | 10.6 | 4.84 | 1.0 | 100.0 |
| | | | STD | 3 | 3 | 0.5 | 0.2 | 0.3 | 0.5 | 0.10 | 0.0 | 0.0 |
| | | | MAX | 109 | 109 | 18.6 | 5.0 | 6.3 | 11.3 | 5.00 | 1.0 | 100.0 |
| | | | @BL | 148 | 150 | 141 | 149 | 141 | 141 | 141 | 141 | 139 |
| 168 | 31.00 | 18 | AV18 | 108 | 109 | 18.0 | 4.6 | 5.8 | 10.0 | 4.88 | 1.0 | 100.0 |
| | | | STD | 3 | 3 | 0.7 | 0.2 | 0.5 | 0.7 | 0.16 | 0.0 | 0.0 |
| | | | MAX | 114 | 114 | 20.4 | 5.0 | 7.5 | 12.6 | 5.40 | 1.0 | 100.0 |
| | | | @BL | 167 | 167 | 151 | 151 | 151 | 151 | 151 | 161 | 151 |
| 189 | 32.00 | 21 | AV21 | 114 | 115 | 18.3 | 4.8 | 5.8 | 9.9 | 4.91 | 1.0 | 100.0 |
| | | | STD | 5 | 4 | 0.4 | 0.2 | 0.3 | 0.4 | 0.09 | 0.0 | 0.0 |
| | | | MAX | 122 | 122 | 19.3 | 5.1 | 6.5 | 10.7 | 5.11 | 1.0 | 100.0 |
| | | | @BL | 170 | 170 | 171 | 170 | 171 | 170 | 171 | 179 | 169 |
| 205 | 33.00 | 16 | AV16 | 113 | 114 | 18.3 | 4.8 | 5.7 | 10.0 | 4.90 | 1.0 | 100.0 |
| | | | STD | 4 | 4 | 0.6 | 0.2 | 0.4 | 0.5 | 0.13 | 0.0 | 0.0 |
| | | | MAX | 120 | 120 | 19.4 | 5.1 | 6.3 | 10.9 | 5.12 | 1.0 | 100.0 |
| | | | @BL | 199 | 205 | 200 | 201 | 200 | 199 | 200 | 205 | 190 |
| 222 | 34.00 | 17 | AV17 | 118 | 119 | 18.4 | 4.9 | 5.5 | 9.7 | 4.91 | 1.0 | 100.0 |
| | | | STD | 4 | 4 | 0.6 | 0.2 | 0.4 | 0.6 | 0.13 | 0.0 | 0.0 |
| | | | MAX | 128 | 128 | 19.6 | 5.3 | 6.3 | 10.7 | 5.16 | 1.0 | 100.0 |

CCRP2 Bridge 42B - Bent 2 Footing 2 Pile 13
OP: ICE

HP 14x73 w/ tip
Date: 08-July-2023

| BL# | Depth ft | BLC bl/ft | TYPE @BL | RX9 kips 222 | RMX kips 222 | CSX ksi 212 | CSB ksi 219 | TSX ksi 212 | EMX k-ft 212 | STK ft 212 | FVP 217 | BTA (%) 206 |
|-----|-------------|--------------|-------------|--------------------|--------------------|-------------------|-------------------|-------------------|--------------------|------------------|------------|-------------------|
| 249 | 35.00 | 27 | AV27 | 125 | 126 | 18.9 | 5.1 | 5.6 | 9.7 | 4.99 | 1.0 | 100.0 |
| | | | STD | 3 | 3 | 0.7 | 0.2 | 0.4 | 0.7 | 0.13 | 0.0 | 0.0 |
| | | | MAX | 134 | 134 | 20.3 | 5.5 | 6.7 | 11.5 | 5.30 | 1.0 | 100.0 |
| | | | @BL | 240 | 240 | 223 | 240 | 223 | 223 | 223 | 247 | 223 |
| 259 | 36.00 | 10 | AV10 | 120 | 121 | 19.1 | 5.1 | 5.6 | 10.6 | 5.04 | 1.0 | 100.0 |
| | | | STD | 3 | 2 | 0.5 | 0.1 | 0.3 | 0.6 | 0.10 | 0.0 | 0.0 |
| | | | MAX | 125 | 125 | 20.0 | 5.3 | 6.1 | 11.6 | 5.22 | 1.0 | 100.0 |
| | | | @BL | 252 | 252 | 252 | 257 | 252 | 252 | 252 | 255 | 250 |
| 282 | 37.00 | 23 | AV23 | 128 | 128 | 19.0 | 5.3 | 5.3 | 9.7 | 5.02 | 1.0 | 100.0 |
| | | | STD | 4 | 3 | 0.5 | 0.2 | 0.3 | 0.6 | 0.11 | 0.0 | 0.0 |
| | | | MAX | 136 | 137 | 20.2 | 5.7 | 5.8 | 10.9 | 5.28 | 1.0 | 100.0 |
| | | | @BL | 282 | 282 | 282 | 277 | 282 | 282 | 282 | 268 | 260 |
| 304 | 38.00 | 22 | AV22 | 133 | 134 | 19.1 | 5.5 | 4.9 | 9.7 | 5.08 | 1.0 | 100.0 |
| | | | STD | 4 | 4 | 0.6 | 0.2 | 0.4 | 0.7 | 0.15 | 0.0 | 0.0 |
| | | | MAX | 141 | 141 | 20.5 | 6.0 | 5.8 | 11.3 | 5.42 | 1.0 | 100.0 |
| | | | @BL | 300 | 300 | 304 | 304 | 285 | 285 | 304 | 301 | 283 |
| 336 | 39.00 | 32 | AV32 | 146 | 146 | 19.6 | 6.2 | 4.4 | 9.5 | 5.19 | 1.0 | 100.0 |
| | | | STD | 6 | 6 | 0.5 | 0.5 | 0.4 | 0.5 | 0.13 | 0.0 | 0.0 |
| | | | MAX | 162 | 162 | 20.8 | 7.2 | 5.2 | 10.7 | 5.51 | 1.0 | 100.0 |
| | | | @BL | 334 | 334 | 334 | 335 | 318 | 334 | 334 | 330 | 305 |
| 375 | 40.00 | 39 | AV39 | 161 | 162 | 20.8 | 7.4 | 4.0 | 10.8 | 5.49 | 1.0 | 100.0 |
| | | | STD | 18 | 17 | 2.4 | 0.6 | 1.2 | 2.8 | 0.67 | 0.0 | 0.0 |
| | | | MAX | 194 | 195 | 31.3 | 8.6 | 10.1 | 24.7 | 8.96 | 1.0 | 100.0 |
| | | | @BL | 352 | 352 | 352 | 352 | 352 | 352 | 352 | 340 | 337 |
| 428 | 42.00 | 27 | AV53 | 207 | 208 | 26.6 | 11.3 | 4.1 | 18.4 | 7.19 | 1.0 | 100.0 |
| | | | STD | 18 | 17 | 2.2 | 2.2 | 1.6 | 2.9 | 0.62 | 0.0 | 0.0 |
| | | | MAX | 224 | 225 | 29.5 | 16.4 | 7.6 | 23.5 | 8.21 | 1.0 | 100.0 |
| | | | @BL | 422 | 422 | 383 | 428 | 383 | 383 | 383 | 382 | 376 |
| 471 | 43.00 | 43 | AV43 | 221 | 227 | 28.2 | 17.8 | 1.2 | 19.8 | 7.67 | 1.0 | 100.0 |
| | | | STD | 4 | 3 | 0.3 | 0.6 | 0.1 | 0.5 | 0.11 | 0.0 | 0.0 |
| | | | MAX | 232 | 234 | 28.8 | 18.7 | 1.4 | 20.8 | 7.91 | 1.0 | 100.0 |
| | | | @BL | 466 | 454 | 467 | 457 | 438 | 466 | 467 | 443 | 429 |
| 503 | 44.00 | 32 | AV32 | 225 | 226 | 28.1 | 15.7 | 1.5 | 19.8 | 7.63 | 1.0 | 100.0 |
| | | | STD | 3 | 3 | 0.3 | 1.1 | 0.6 | 0.5 | 0.11 | 0.0 | 0.0 |
| | | | MAX | 231 | 233 | 28.6 | 17.6 | 2.8 | 20.7 | 7.81 | 1.0 | 100.0 |
| | | | @BL | 482 | 479 | 479 | 472 | 503 | 479 | 479 | 503 | 472 |
| 545 | 45.00 | 42 | AV42 | 222 | 224 | 27.5 | 12.3 | 3.1 | 18.3 | 7.41 | 1.0 | 100.0 |
| | | | STD | 4 | 4 | 0.4 | 0.5 | 0.3 | 0.7 | 0.15 | 0.0 | 0.0 |
| | | | MAX | 232 | 234 | 28.4 | 13.2 | 3.6 | 19.7 | 7.70 | 1.0 | 100.0 |
| | | | @BL | 511 | 511 | 519 | 522 | 540 | 519 | 519 | 536 | 504 |
| 582 | 46.00 | 37 | AV37 | 216 | 225 | 27.5 | 13.7 | 1.9 | 17.8 | 7.45 | 1.0 | 100.0 |

CCRP2 Bridge 42B - Bent 2 Footing 2 Pile 13
OP: ICE

HP 14x73 w/ tip
Date: 08-July-2023

| BL# | Depth ft | BLC bl/ft | TYPE | RX9 kips | RMX kips | CSX ksi | CSB ksi | TSX ksi | EMX k-ft | STK ft | FVP | BTA (%) |
|-----|-------------|--------------|-----------|-------------|-------------|------------|------------|------------|-------------|-----------|-----|------------|
| | | | STD | 5 | 9 | 0.5 | 1.2 | 0.7 | 0.7 | 0.19 | 0.0 | 0.0 |
| | | | MAX | 227 | 244 | 28.3 | 15.6 | 3.2 | 19.2 | 7.80 | 1.0 | 100.0 |
| | | | @BL | 580 | 582 | 581 | 581 | 546 | 580 | 581 | 570 | 546 |
| 641 | 47.00 | 59 | AV59 | 256 | 274 | 27.8 | 16.8 | 1.0 | 18.4 | 7.68 | 1.0 | 100.0 |
| | | | STD | 12 | 13 | 0.5 | 0.6 | 0.1 | 0.8 | 0.20 | 0.0 | 0.0 |
| | | | MAX | 278 | 296 | 29.0 | 18.1 | 1.3 | 20.6 | 8.22 | 1.0 | 100.0 |
| | | | @BL | 637 | 641 | 625 | 641 | 639 | 629 | 629 | 583 | 583 |
| 702 | 48.00 | 61 | AV61 | 292 | 310 | 28.1 | 18.4 | 1.4 | 19.2 | 7.93 | 1.0 | 100.0 |
| | | | STD | 12 | 12 | 1.0 | 0.6 | 0.1 | 1.7 | 0.43 | 0.0 | 0.0 |
| | | | MAX | 314 | 333 | 30.5 | 19.8 | 1.6 | 22.6 | 8.80 | 1.0 | 100.0 |
| | | | @BL | 699 | 699 | 700 | 701 | 685 | 694 | 694 | 690 | 642 |
| 764 | 49.00 | 62 | AV62 | 330 | 348 | 30.5 | 21.0 | 1.7 | 22.3 | 8.70 | 1.0 | 100.0 |
| | | | STD | 13 | 13 | 0.5 | 0.7 | 0.1 | 0.7 | 0.18 | 0.0 | 0.0 |
| | | | MAX | 348 | 365 | 31.7 | 22.4 | 1.8 | 24.2 | 9.17 | 1.0 | 100.0 |
| | | | @BL | 760 | 764 | 744 | 755 | 764 | 744 | 744 | 749 | 703 |
| 799 | 49.44 | 80 | AV35 | 358 | 373 | 30.5 | 22.4 | 1.8 | 21.9 | 8.69 | 1.0 | 100.0 |
| | | | STD | 6 | 7 | 0.6 | 0.4 | 0.1 | 0.9 | 0.26 | 0.0 | 0.0 |
| | | | MAX | 372 | 388 | 32.4 | 23.3 | 2.0 | 25.3 | 9.65 | 1.0 | 100.0 |
| | | | @BL | 796 | 796 | 789 | 789 | 797 | 789 | 789 | 782 | 765 |
| 809 | 49.56 | 80 | AV10 | 371 | 386 | 30.7 | 23.1 | 1.9 | 22.0 | 8.75 | 1.0 | 100.0 |
| | | | STD | 3 | 3 | 0.5 | 0.3 | 0.1 | 0.7 | 0.22 | 0.0 | 0.0 |
| | | | MAX | 374 | 389 | 31.3 | 23.6 | 2.1 | 22.9 | 9.04 | 1.0 | 100.0 |
| | | | @BL | 809 | 803 | 805 | 803 | 809 | 805 | 803 | 809 | 800 |
| 819 | 49.69 | 80 | AV10 | 372 | 387 | 30.5 | 23.1 | 2.0 | 21.8 | 8.72 | 1.0 | 100.0 |
| | | | STD | 4 | 4 | 0.5 | 0.3 | 0.1 | 0.7 | 0.20 | 0.0 | 0.0 |
| | | | MAX | 382 | 396 | 31.3 | 23.5 | 2.1 | 23.0 | 9.02 | 1.0 | 100.0 |
| | | | @BL | 817 | 817 | 818 | 818 | 815 | 817 | 818 | 810 | 810 |
| 829 | 49.79 | 96 | AV10 | 377 | 392 | 30.7 | 23.0 | 2.0 | 22.0 | 8.76 | 1.0 | 100.0 |
| | | | STD | 5 | 5 | 0.6 | 0.3 | 0.1 | 1.0 | 0.26 | 0.0 | 0.0 |
| | | | MAX | 382 | 397 | 32.0 | 23.6 | 2.2 | 24.2 | 9.37 | 1.0 | 100.0 |
| | | | @BL | 825 | 825 | 822 | 822 | 827 | 822 | 822 | 825 | 820 |
| 839 | 49.90 | 96 | AV10 | 385 | 400 | 31.1 | 23.1 | 2.1 | 22.6 | 8.97 | 1.0 | 100.0 |
| | | | STD | 4 | 4 | 0.5 | 0.2 | 0.1 | 0.8 | 0.23 | 0.0 | 0.0 |
| | | | MAX | 393 | 407 | 32.3 | 23.5 | 2.2 | 24.7 | 9.56 | 1.0 | 100.0 |
| | | | @BL | 837 | 837 | 831 | 831 | 837 | 831 | 831 | 839 | 830 |
| 849 | 50.00 | 96 | AV10 | 385 | 398 | 31.1 | 23.5 | 2.3 | 22.4 | 8.95 | 1.0 | 100.0 |
| | | | STD | 13 | 16 | 0.4 | 0.2 | 0.3 | 0.8 | 0.18 | 0.0 | 0.0 |
| | | | MAX | 396 | 410 | 31.5 | 23.8 | 3.2 | 23.3 | 9.16 | 1.0 | 100.0 |
| | | | @BL | 847 | 847 | 849 | 846 | 849 | 846 | 846 | 845 | 840 |
| | | | Average | 203 | 209 | 24.0 | 12.0 | 3.6 | 15.7 | 6.64 | 1.0 | 100.0 |
| | | | Std. Dev. | 95 | 101 | 5.5 | 6.8 | 2.3 | 5.3 | 1.60 | 0.0 | 0.0 |
| | | | Maximum | 396 | 410 | 32.4 | 23.8 | 17.2 | 28.8 | 9.65 | 1.0 | 100.0 |
| | | | @ Blow# | 847 | 847 | 789 | 846 | 2 | 25 | 789 | 839 | 1 |

Total number of blows analyzed: 849

CCRP2 Bridge 42B - Bent 2 Footing 2 Pile 13

HP 14x73 w/ tip

OP: ICE

Date: 08-July-2023

| BL# | Depth ft | BLC bl/ft | TYPE | RX9 kips | RMX kips | CSX ksi | CSB ksi | TSX ksi | EMX k-ft | STK ft | FVP | BTA (%) |
|-----|-------------|--------------|------|-------------|-------------|------------|------------|------------|-------------|-----------|-----|------------|
|-----|-------------|--------------|------|-------------|-------------|------------|------------|------------|-------------|-----------|-----|------------|

BL# Sensors

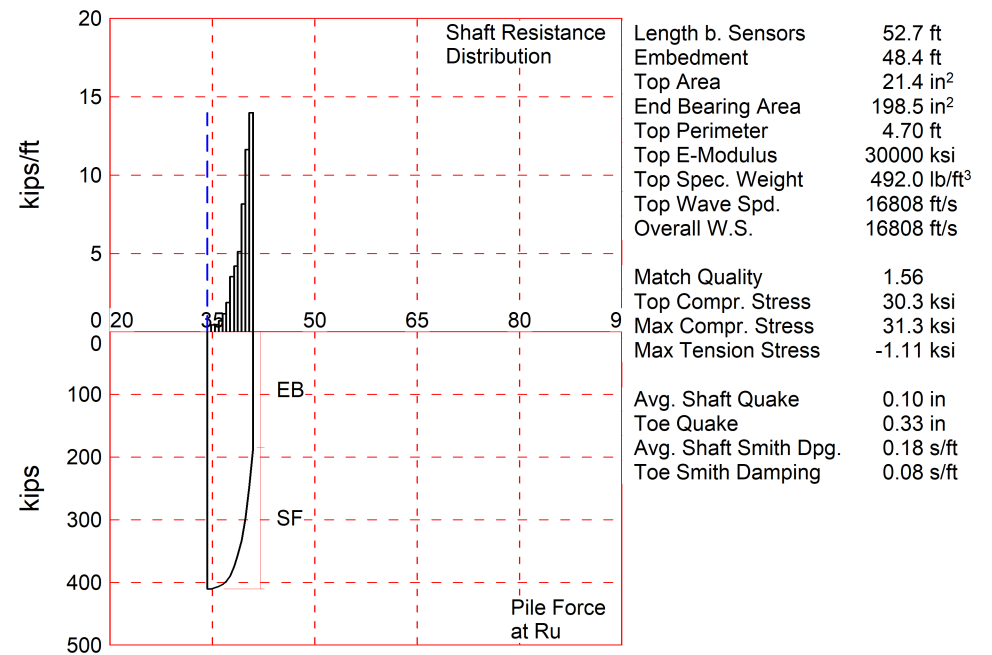
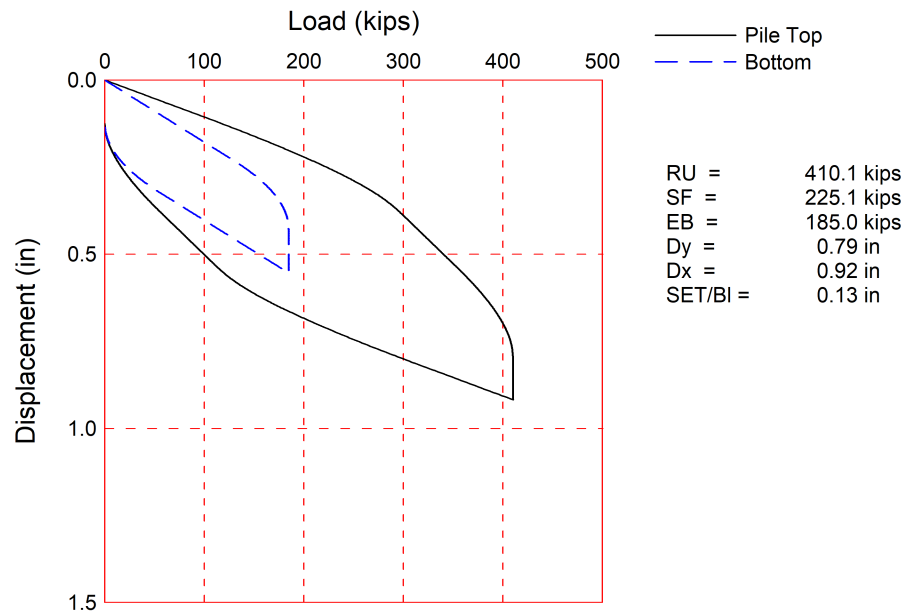
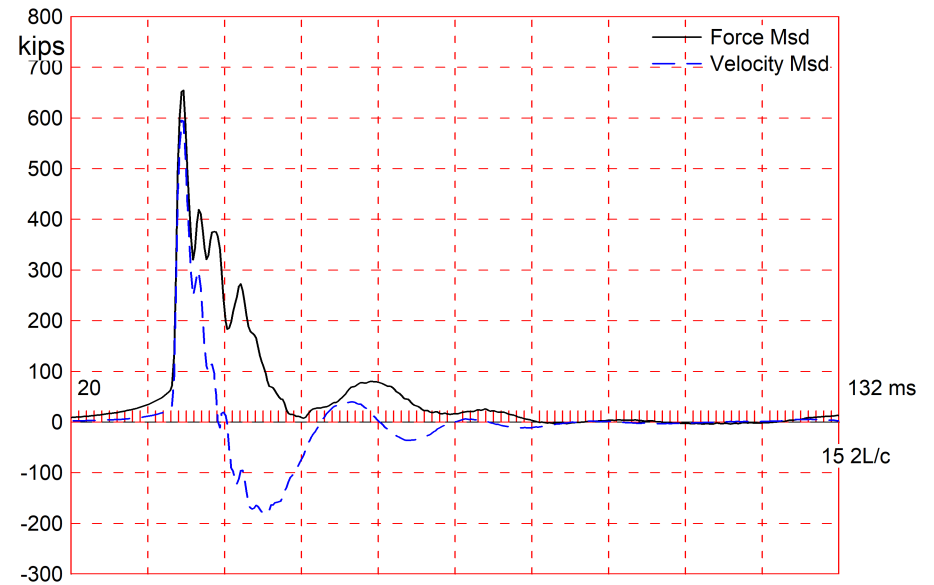
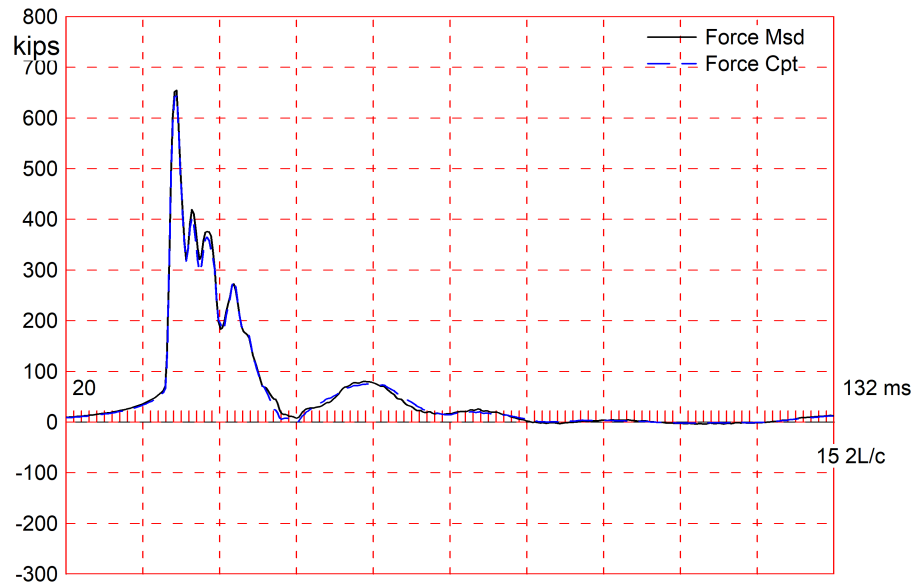
1-849 F7: [P821] 145.1 (1.00); F8: [W877] 94.7 (1.00); A5: [K12389] 483.2 (1.00);
A6: [K12388] 451.0 (1.00)

BL# Comments

1 Template @ +302.21 ft / GSE @ +300.67 ft
2 RDR = 340 kips Min. Tip Elev. @ +270.0 ft
3 Fuel setting 1
5 Fuel setting 2
193 Minimum tip achieved
382 Fuel setting 3
684 Fuel setting 4
809 Set in 10 blows was 1-1/2 inches
819 Set in 10 blows was 1-1/2 inches
829 Set in 10 blows was 1-1/4 inches
839 Set in 10 blows was 1-1/4 inches
849 Last set in 10 blows @ EOD was 1-1/4 inches

Time Summary

Drive 24 minutes 35 seconds 1:42 AM - 2:06 AM BN 1 - 849



The CAPWAP program performs a signal matching or reverse analysis based on measurements taken on a deep foundation under an impact load. The program is based on a one-dimensional mathematical model. Under certain conditions, the model only crudely approximates the often complex dynamic situations.

The CAPWAP analysis relies on the input of accurately measured dynamic data plus additional parameters describing pile and soil behavior. If the field measurements of force and velocity are incorrect or were taken under inappropriate conditions (e.g., at an inappropriate time or with too much or too little energy) or if the input pile model is incorrect, then the solution cannot represent the actual soil behavior.

Generally the CAPWAP analysis is used to estimate the axial compressive pile capacity and the soil resistance distribution. The long-term capacity is best evaluated with restrike tests since they incorporate soil strength changes (set-up gains or relaxation losses) that occur after installation. The calculated load settlement graph does not consider creep or long term consolidation settlements. When uplift is a controlling factor in the design, use of the CAPWAP results to assess uplift capacity should be made only after very careful analysis of only good measurement quality, and further used only with longer pile lengths and with nominally higher safety factors.

CAPWAP is also used to evaluate driving stresses along the length of the pile. However, it should be understood that the analysis is one dimensional and does not take into account bending effects or local contact stresses at the pile toe.

Furthermore, if the user of this software was not able to produce a solution with satisfactory signal "match quality" (MQ), then the associated CAPWAP results may be unreliable. There is no absolute scale for solution acceptability but solutions with MQ above 5 are generally considered less reliable than those with lower MQ values and every effort should be made to improve the analysis, for example, by getting help from other independent experts.

Considering the CAPWAP model limitations, the nature of the input parameters, the complexity of the analysis procedure, and the need for a responsible application of the results to actual construction projects, it is recommended that at least one static load test be performed on sites where little experience exists with dynamic behavior of the soil resistance or when the experience of the analyzing engineer with both program use and result application is limited.

Finally, the CAPWAP capacities are ultimate values. They MUST be reduced by means of an appropriate factor of safety to yield a design or working load. The selection of a factor of safety should consider the quality of the construction control, the variability of the site conditions, uncertainties in the loads, the importance of structure and other factors. The CAPWAP results should be reviewed by the Engineer of Record with consideration of applicable geotechnical conditions including, but not limited to, group effects, potential settlement from underlying compressible layers, soil resistances provided from any layers unsuitable for long term support, as well as effective stress changes due to soil surcharges, excavation or change in water table elevation.

The CAPWAP analysis software is one of many means by which the capacity of a deep foundation can be assessed. The engineer performing the analysis is responsible for proper software application and the analysis results. Pile Dynamics accepts no liability whatsoever of any kind for the analysis solution and/or the application of the analysis result.

CCRP2 Bridge 42B; Pile: Bent 2 Footing 2 Pile 13
 HP 14x73 w/ tip; Blow: 847
 Infrastructure Consulting & Eng., PLLC

Test: 08-Jul-2023 02:06
 CAPWAP(R) 2014-3
 OP: ICE

CAPWAP SUMMARY RESULTS

| Total CAPWAP Capacity: 410.1; along Shaft 225.1; at Toe 185.0 kips | | | | | | | |
|--|----------------------|----------------------|---------|--------------------|----------------|------------------------------|-------------------------|
| Soil Sgmnt No. | Dist. Below Gages ft | Depth Below Grade ft | Ru kips | Force in Pile kips | Sum of Ru kips | Unit Resist. (Depth) kips/ft | Unit Resist. (Area) ksf |
| | | | | 410.1 | | | |
| 1 | 8.8 | 4.5 | 2.0 | 408.1 | 2.0 | 0.44 | 0.09 |
| 2 | 13.2 | 8.9 | 2.0 | 406.1 | 4.0 | 0.46 | 0.10 |
| 3 | 17.6 | 13.3 | 3.1 | 403.0 | 7.1 | 0.71 | 0.15 |
| 4 | 21.9 | 17.7 | 5.1 | 397.9 | 12.2 | 1.16 | 0.25 |
| 5 | 26.3 | 22.1 | 8.2 | 389.7 | 20.4 | 1.87 | 0.40 |
| 6 | 30.7 | 26.5 | 15.5 | 374.2 | 35.9 | 3.53 | 0.75 |
| 7 | 35.1 | 30.9 | 18.4 | 355.8 | 54.3 | 4.19 | 0.89 |
| 8 | 39.5 | 35.3 | 22.5 | 333.3 | 76.8 | 5.13 | 1.09 |
| 9 | 43.9 | 39.7 | 35.8 | 297.5 | 112.6 | 8.16 | 1.74 |
| 10 | 48.3 | 44.1 | 51.1 | 246.4 | 163.7 | 11.64 | 2.48 |
| 11 | 52.7 | 48.4 | 61.4 | 185.0 | 225.1 | 13.99 | 2.98 |
| Avg. Shaft | | | 20.5 | | | 4.65 | 0.99 |
| Toe | | | 185.0 | | | | 134.20 |

| Soil Model Parameters/Extensions | | Shaft | Toe |
|----------------------------------|----------------------|---------|---------|
| Smith Damping Factor | | 0.18 | 0.08 |
| Quake | (in) | 0.10 | 0.33 |
| Case Damping Factor | | 1.06 | 0.39 |
| Damping Type | | Viscous | Sm+Visc |
| Unloading Quake | (% of loading quake) | 55 | 98 |
| Reloading Level | (% of Ru) | 100 | 100 |
| Unloading Level | (% of Ru) | 33 | |
| Soil Plug Weight | (kips) | | 0.037 |

CAPWAP match quality = 1.56 (Wave Up Match) ; RSA = 0
 Observed: Final Set = 0.13 in; Blow Count = 96 b/ft
 Computed: Final Set = 0.13 in; Blow Count = 96 b/ft
 Transducer F7 (P821) CAL: 145.1; RF: 1.00; F8 (W877) CAL: 94.7; RF: 1.00
 A5 (K12389) CAL: 483; RF: 1.00; A6 (K12388) CAL: 451; RF: 1.00
 max. Top Comp. Stress = 30.3 ksi (T= 36.7 ms, max= 1.033 x Top)
 max. Comp. Stress = 31.3 ksi (Z= 26.3 ft, T= 38.1 ms)
 max. Tens. Stress = -1.11 ksi (Z= 26.3 ft, T= 53.1 ms)
 max. Energy (EMX) = 22.7 kip-ft; max. Measured Top Displ. (DMX)= 0.61 in

CCRP2 Bridge 42B; Pile: Bent 2 Footing 2 Pile 13
 HP 14x73 w/ tip; Blow: 847
 Infrastructure Consulting & Eng., PLLC

Test: 08-Jul-2023 02:06
 CAPWAP(R) 2014-3
 OP: ICE

EXTREMA TABLE

| Pile Sgmt No. | Dist. Below Gages ft | max. Force kips | min. Force kips | max. Comp. Stress ksi | max. Tens. Stress ksi | max. Trnsfd. Energy kip-ft | max. Veloc. ft/s | max. Displ. in |
|---------------------|-------------------------------|-----------------------|-----------------------|--------------------------------|--------------------------------|-------------------------------------|------------------------|----------------------|
| 1 | 4.4 | 648.1 | -7.3 | 30.3 | -0.34 | 22.7 | 15.8 | 0.63 |
| 2 | 8.8 | 653.7 | -15.1 | 30.5 | -0.71 | 22.5 | 15.6 | 0.61 |
| 3 | 13.2 | 653.8 | -18.5 | 30.6 | -0.86 | 22.0 | 15.4 | 0.59 |
| 4 | 17.6 | 657.5 | -20.9 | 30.7 | -0.98 | 21.3 | 15.2 | 0.56 |
| 5 | 21.9 | 663.4 | -23.4 | 31.0 | -1.09 | 20.5 | 14.8 | 0.53 |
| 6 | 26.3 | 669.3 | -23.8 | 31.3 | -1.11 | 19.5 | 14.2 | 0.50 |
| 7 | 30.7 | 668.7 | -20.2 | 31.2 | -0.94 | 18.2 | 13.5 | 0.47 |
| 8 | 35.1 | 651.5 | -13.2 | 30.4 | -0.62 | 16.5 | 12.7 | 0.44 |
| 9 | 39.5 | 637.0 | -4.4 | 29.8 | -0.20 | 14.6 | 11.6 | 0.41 |
| 10 | 43.9 | 577.0 | 0.0 | 27.0 | 0.00 | 12.6 | 11.4 | 0.38 |
| 11 | 48.3 | 420.9 | 0.0 | 19.7 | 0.00 | 10.1 | 12.4 | 0.35 |
| 12 | 52.7 | 320.7 | 0.0 | 15.0 | 0.00 | 3.6 | 11.9 | 0.33 |
| Absolute | 26.3 | | | 31.3 | | | (T = | 38.1 ms) |
| | 26.3 | | | | -1.11 | | (T = | 53.1 ms) |

CASE METHOD

| J = | 0.0 | 0.1 | 0.2 | 0.3 | 0.4 | 0.5 | 0.6 | 0.7 | 0.8 | 0.9 |
|-----|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| RP | 727.0 | 672.4 | 617.8 | 563.2 | 508.6 | 454.0 | 399.4 | 344.9 | 290.3 | 235.7 |
| RX | 727.0 | 672.4 | 617.8 | 563.2 | 508.6 | 454.0 | 438.0 | 424.1 | 410.2 | 396.4 |
| RU | 730.6 | 676.4 | 622.2 | 568.0 | 513.7 | 459.5 | 405.3 | 351.1 | 296.9 | 242.6 |

RAU = 248.8 (kips); RA2 = 497.9 (kips)

Current CAPWAP Ru = 410.1 (kips); Corresponding J(RP)= 0.58; J(RX) = 0.80

| VMX | TVP | VT1*Z | FT1 | FMX | DMX | DFN | SET | EMX | QUS | KEB |
|------|-------|-------|-------|-------|------|------|------|--------|-------|---------|
| ft/s | ms | kips | kips | kips | in | in | in | kip-ft | kips | kips/in |
| 15.9 | 34.46 | 607.8 | 665.0 | 667.4 | 0.61 | 0.13 | 0.13 | 22.7 | 737.8 | 561 |

PILE PROFILE AND PILE MODEL

| Depth ft | Area in ² | E-Modulus ksi | Spec. Weight lb/ft ³ | Perim. ft |
|-------------|-------------------------|------------------|------------------------------------|--------------|
| 0.0 | 21.4 | 30000.0 | 492.000 | 4.70 |
| 52.7 | 21.4 | 30000.0 | 492.000 | 4.70 |

Toe Area 198.5 in²

Top Segment Length 4.39 ft, Top Impedance 38 kips/ft/s

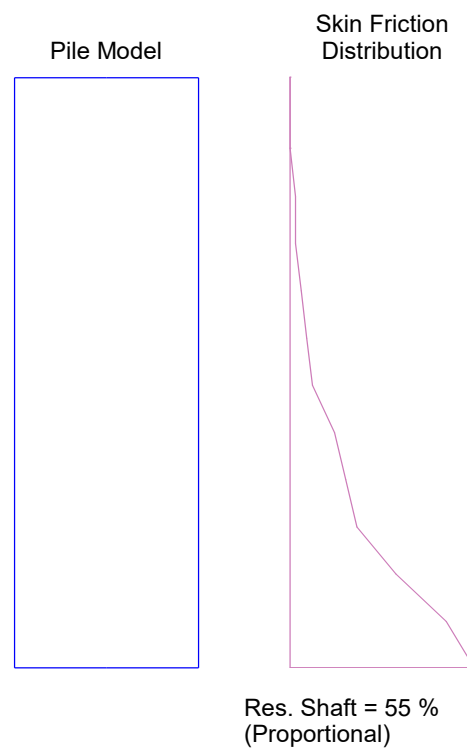
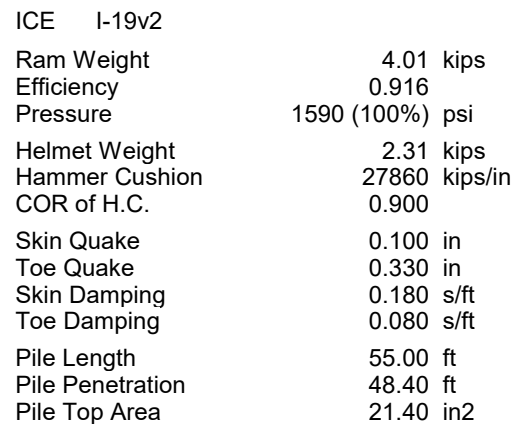
Wave Speed: Pile Top 16807.9, Elastic 16807.9, Overall 16807.9 ft/s

Pile Damping 1.00 %

Total volume: 7.827 ft³; Volume ratio considering added impedance: 1.000

Time (ms) 0.0

Time Incr 0.278

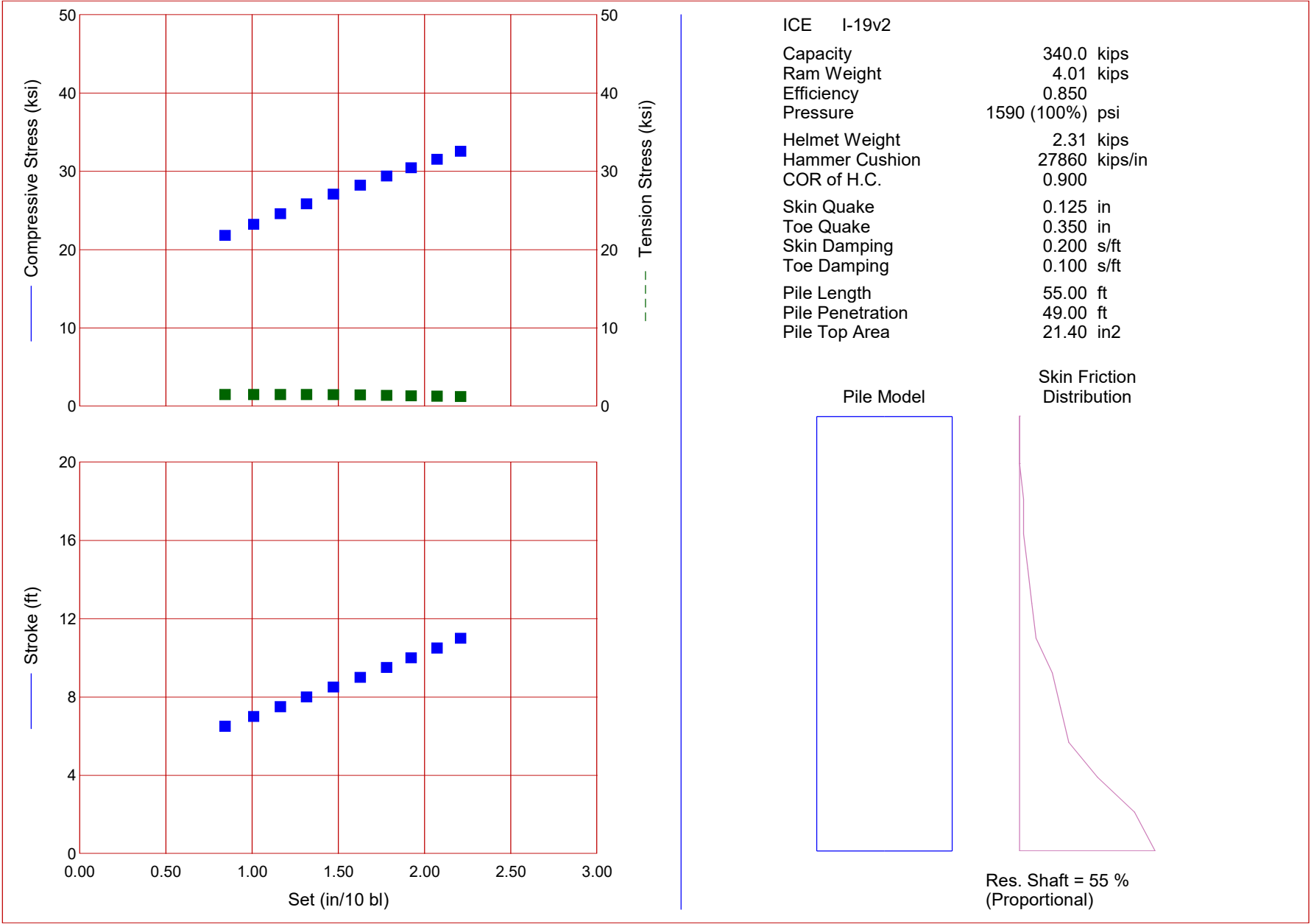


| Ultimate Capacity kips | Maximum Compression Stress ksi | Maximum Tension Stress ksi | Blow Count bl/ft | Stroke ft | Energy kips-ft |
|------------------------------|---|-------------------------------------|------------------------|--------------|-------------------|
| 410.0 | 29.41 | 2.26 | 96.0 | 8.96 | 22.03 |

Appendix B

Pile Driving Criteria

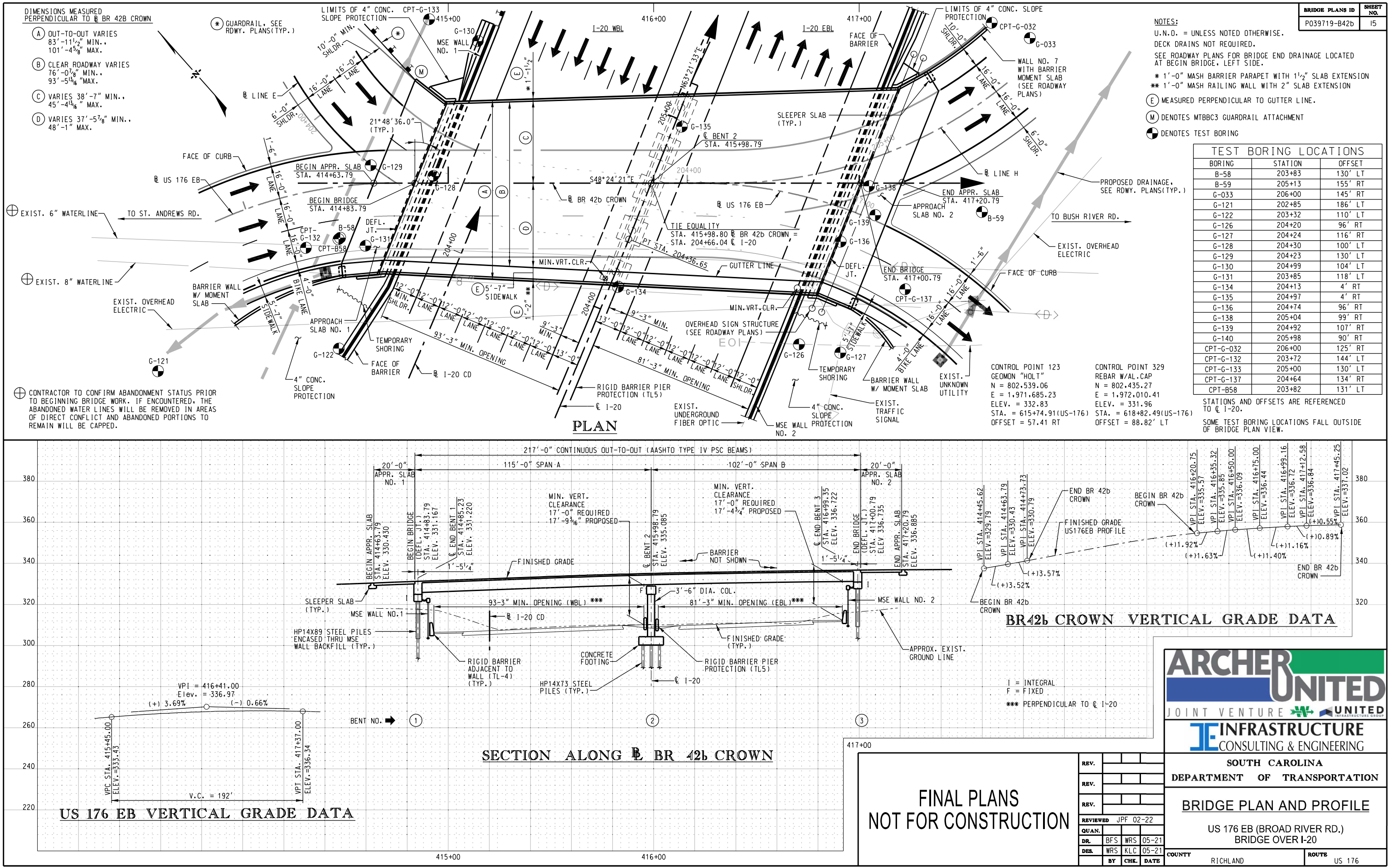
Bridge 42B, Bent 2, Footings 1 and 2



| Ultimate Capacity kips | Maximum Compression Stress ksi | Maximum Tension Stress ksi | Set in/10 bl | Stroke ft | Energy kips-ft |
|------------------------------|---|-------------------------------------|-----------------|--------------|-------------------|
| 340.0 | 21.82 | 1.48 | 0.8 | 6.50 | 14.12 |
| 340.0 | 23.22 | 1.48 | 1.0 | 7.00 | 15.56 |
| 340.0 | 24.57 | 1.49 | 1.2 | 7.50 | 16.99 |
| 340.0 | 25.84 | 1.49 | 1.3 | 8.00 | 18.41 |
| 340.0 | 27.07 | 1.48 | 1.5 | 8.50 | 19.83 |
| 340.0 | 28.22 | 1.43 | 1.6 | 9.00 | 21.22 |
| 340.0 | 29.38 | 1.38 | 1.8 | 9.50 | 22.61 |
| 340.0 | 30.45 | 1.32 | 1.9 | 10.00 | 23.95 |
| 340.0 | 31.52 | 1.28 | 2.1 | 10.50 | 25.34 |
| 340.0 | 32.55 | 1.22 | 2.2 | 11.00 | 26.68 |

Appendix C

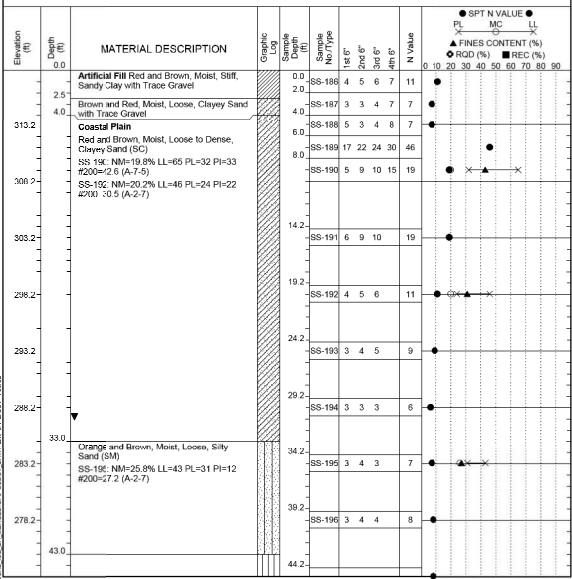
Project Information and Nearby Soil Borings



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6/12/2022
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INFRASTRUCTURE
CONSULTING & ENGINEERING

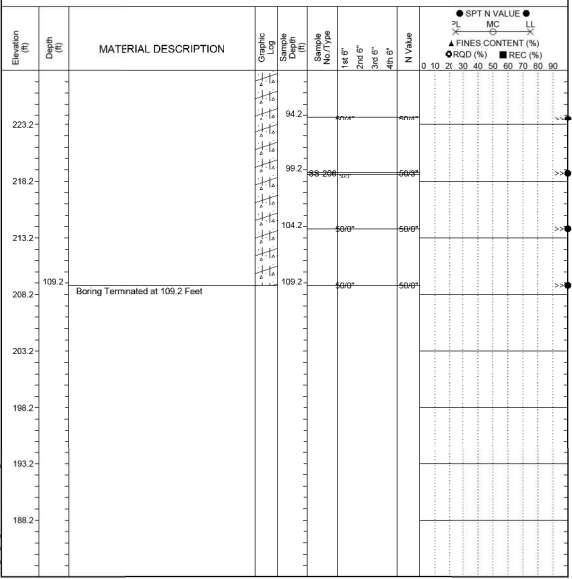
Project ID: P039719 County: Richland Boring No.: G-131
Site Description: Carolina Crossroads Phase 2 - Bridge 42B Route: Broad River Rd.
Eng./Geo.: M. Stanbury Boring Location: 203+85 Offset: 118 LT Alignment: I20CL
Elev.: 1318.2 ft Latitude: 34.0397555 Longitude: -81.09362896 Date Started: 2/23/2022
Total Depth: 109.2 ft Soil Depth: 109.2 ft Core Depth: N/A ft Date Completed: 2/23/2022
Bore Hole Diameter (in): 2.25 Sampler Configuration: Liner Required: Y (N) Liner Used: Y (N)
Drill Machine: D-50 #439 Drill Method: RW Hammer Type: Automatic Energy Ratio: 90.8%
Core Size: N/A Driller: R. Cassell Groundwater: TOB N/A 24HR 31.1 ft



LEGEND
SS - Split Spoon N2 - Rock Core, 1-7/8" HSA - Hollow Stem Auger RW - Rotary Wash
UD - Undisturbed Sample CU - Cuttings CFA - Continuous Flight Augers RC - Rock Core
AWG - Rock Core, 1-1/8" CT - Continuous Tube DC - Driving Casing

INFRASTRUCTURE
CONSULTING & ENGINEERING

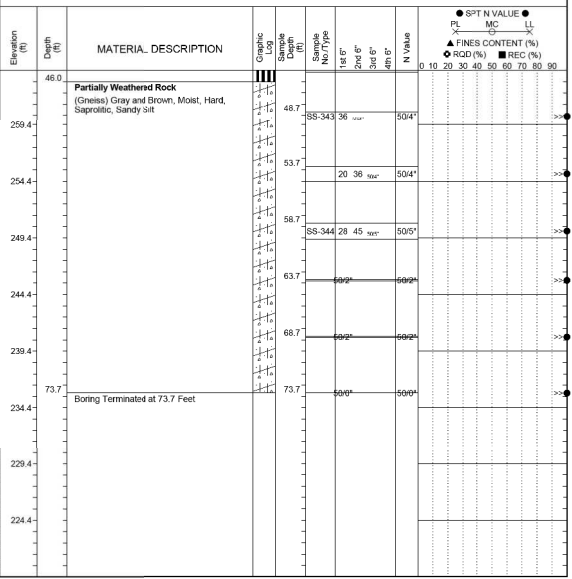
Project ID: P039719 County: Richland Boring No.: G-131
Site Description: Carolina Crossroads Phase 2 - Bridge 42B Route: Broad River Rd.
Eng./Geo.: M. Stanbury Boring Location: 203+85 Offset: 118 LT Alignment: I20CL
Elev.: 1318.2 ft Latitude: 34.0397555 Longitude: -81.09362896 Date Started: 2/23/2022
Total Depth: 109.2 ft Soil Depth: 109.2 ft Core Depth: N/A ft Date Completed: 2/23/2022
Bore Hole Diameter (in): 2.25 Sampler Configuration: Liner Required: Y (N) Liner Used: Y (N)
Drill Machine: D-50 #439 Drill Method: RW Hammer Type: Automatic Energy Ratio: 90.8%
Core Size: N/A Driller: R. Cassell Groundwater: TOB N/A 24HR 31.1 ft



LEGEND
SS - Split Spoon N2 - Rock Core, 1-7/8" HSA - Hollow Stem Auger RW - Rotary Wash
UD - Undisturbed Sample CU - Cuttings CFA - Continuous Flight Augers RC - Rock Core
AWG - Rock Core, 1-1/8" CT - Continuous Tube DC - Driving Casing

INFRASTRUCTURE
CONSULTING & ENGINEERING

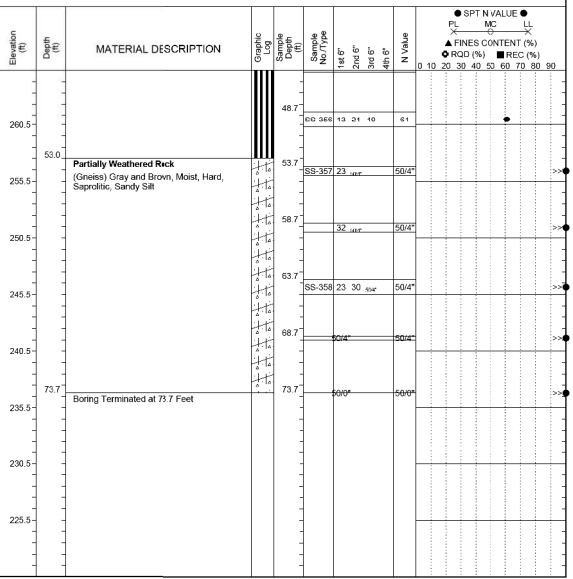
Project ID: P039719 County: Richland Boring No.: G-134
Site Description: Carolina Crossroads Phase 2 - Bridge 42B Route: Broad River Rd.
Eng./Geo.: M. Stanbury Boring Location: 204+13 Offset: 4 RT Alignment: I20CL
Elev.: 1309.4 ft Latitude: 34.03963447 Longitude: -81.09312144 Date Started: 3/14/2022
Total Depth: 73.7 ft Soil Depth: 73.7 ft Core Depth: N/A ft Date Completed: 3/14/2022
Bore Hole Diameter (in): 2.25 Sampler Configuration: Liner Required: Y (N) Liner Used: Y (N)
Drill Machine: D-50 #439 Drill Method: RW Hammer Type: Automatic Energy Ratio: 90.8%
Core Size: N/A Driller: R. Cassell Groundwater: TOB N/A 24HR FIAD



LEGEND
SS - Split Spoon N2 - Rock Core, 1-7/8" HSA - Hollow Stem Auger RW - Rotary Wash
UD - Undisturbed Sample CU - Cuttings CFA - Continuous Flight Augers RC - Rock Core
AWG - Rock Core, 1-1/8" CT - Continuous Tube DC - Driving Casing

INFRASTRUCTURE
CONSULTING & ENGINEERING

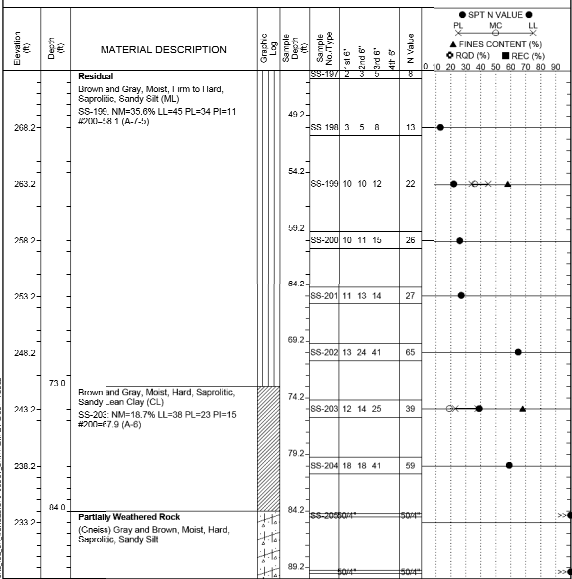
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Eng./Geo.: M. Stanbury Boring Location: 204+97 Offset: 4 RT Alignment: I20CL
Elev.: 1310.5 ft Latitude: 34.03963447 Longitude: -81.09312144 Date Started: 3/15/2022
Total Depth: 73.7 ft Soil Depth: 73.7 ft Core Depth: N/A ft Date Completed: 3/15/2022
Bore Hole Diameter (in): 2.25 Sampler Configuration: Liner Required: Y (N) Liner Used: Y (N)
Drill Machine: D-50 #439 Drill Method: RW Hammer Type: Automatic Energy Ratio: 90.8%
Core Size: N/A Driller: R. Cassell Groundwater: TOB N/A 24HR FIAD



LEGEND
SS - Split Spoon N2 - Rock Core, 1-7/8" HSA - Hollow Stem Auger RW - Rotary Wash
UD - Undisturbed Sample CU - Cuttings CFA - Continuous Flight Augers RC - Rock Core
AWG - Rock Core, 1-1/8" CT - Continuous Tube DC - Driving Casing

INFRASTRUCTURE
CONSULTING & ENGINEERING

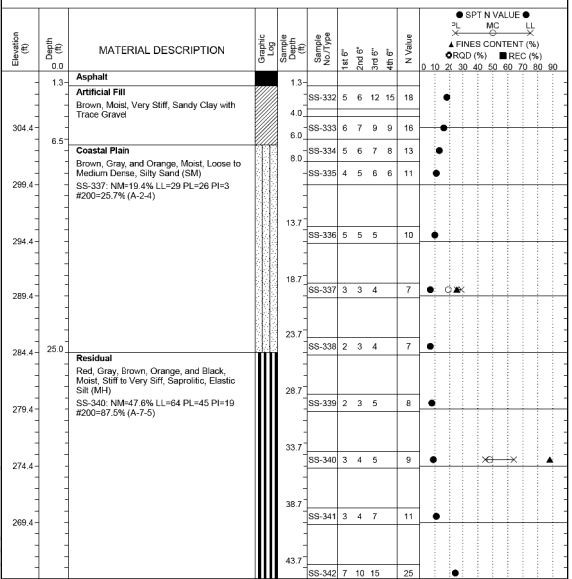
Project ID: P039719 County: Richland Boring No.: G-131
Site Description: Carolina Crossroads Phase 2 - Bridge 42B Route: Broad River Rd.
Eng./Geo.: M. Stanbury Boring Location: 203+85 Offset: 118 LT Alignment: I20CL
Elev.: 1318.2 ft Latitude: 34.0397555 Longitude: -81.09362896 Date Started: 2/23/2022
Total Depth: 109.2 ft Soil Depth: 109.2 ft Core Depth: N/A ft Date Completed: 2/23/2022
Bore Hole Diameter (in): 2.25 Sampler Configuration: Liner Required: Y (N) Liner Used: Y (N)
Drill Machine: D-50 #439 Drill Method: RW Hammer Type: Automatic Energy Ratio: 90.8%
Core Size: N/A Driller: R. Cassell Groundwater: TOB N/A 24HR 31.1 ft



LEGEND
SS - Split Spoon N2 - Rock Core, 1-7/8" HSA - Hollow Stem Auger RW - Rotary Wash
UD - Undisturbed Sample CU - Cuttings CFA - Continuous Flight Augers RC - Rock Core
AWG - Rock Core, 1-1/8" CT - Continuous Tube DC - Driving Casing

INFRASTRUCTURE
CONSULTING & ENGINEERING

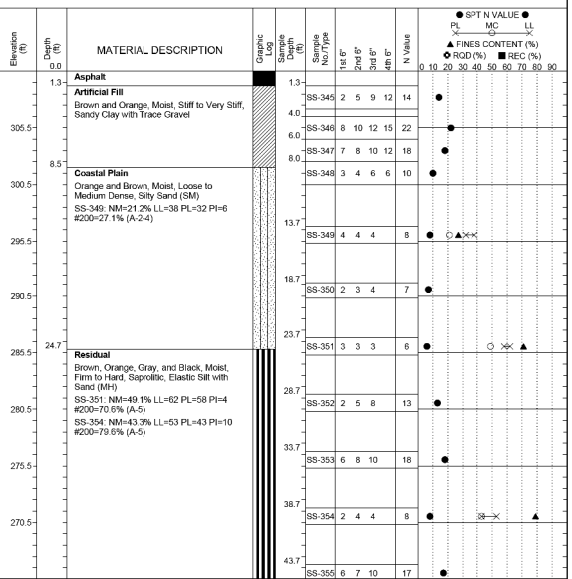
Project ID: P039719 County: Richland Boring No.: G-134
Site Description: Carolina Crossroads Phase 2 - Bridge 42B Route: Broad River Rd.
Eng./Geo.: M. Stanbury Boring Location: 204+13 Offset: 4 RT Alignment: I20CL
Elev.: 1309.4 ft Latitude: 34.03963447 Longitude: -81.09312144 Date Started: 3/14/2022
Total Depth: 73.7 ft Soil Depth: 73.7 ft Core Depth: N/A ft Date Completed: 3/14/2022
Bore Hole Diameter (in): 2.25 Sampler Configuration: Liner Required: Y (N) Liner Used: Y (N)
Drill Machine: D-50 #439 Drill Method: RW Hammer Type: Automatic Energy Ratio: 90.8%
Core Size: N/A Driller: R. Cassell Groundwater: TOB N/A 24HR FIAD



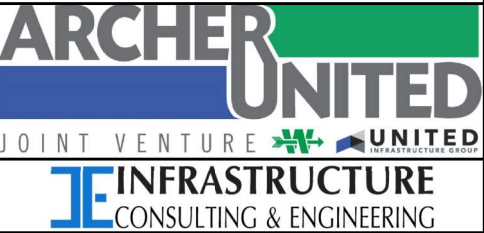
LEGEND
SS - Split Spoon N2 - Rock Core, 1-7/8" HSA - Hollow Stem Auger RW - Rotary Wash
UD - Undisturbed Sample CU - Cuttings CFA - Continuous Flight Augers RC - Rock Core
AWG - Rock Core, 1-1/8" CT - Continuous Tube DC - Driving Casing

INFRASTRUCTURE
CONSULTING & ENGINEERING

Project ID: P039719 County: Richland Boring No.: G-135
Site Description: Carolina Crossroads Phase 2 - Bridge 42B Route: Broad River Rd.
Eng./Geo.: M. Stanbury Boring Location: 204+97 Offset: 4 RT Alignment: I20CL
Elev.: 1310.5 ft Latitude: 34.03963447 Longitude: -81.09312144 Date Started: 3/15/2022
Total Depth: 73.7 ft Soil Depth: 73.7 ft Core Depth: N/A ft Date Completed: 3/15/2022
Bore Hole Diameter (in): 2.25 Sampler Configuration: Liner Required: Y (N) Liner Used: Y (N)
Drill Machine: D-50 #439 Drill Method: RW Hammer Type: Automatic Energy Ratio: 90.8%
Core Size: N/A Driller: R. Cassell Groundwater: TOB N/A 24HR FIAD



LEGEND
SS - Split Spoon N2 - Rock Core, 1-7/8" HSA - Hollow Stem Auger RW - Rotary Wash
UD - Undisturbed Sample CU - Cuttings CFA - Continuous Flight Augers RC - Rock Core
AWG - Rock Core, 1-1/8" CT - Continuous Tube DC - Driving Casing



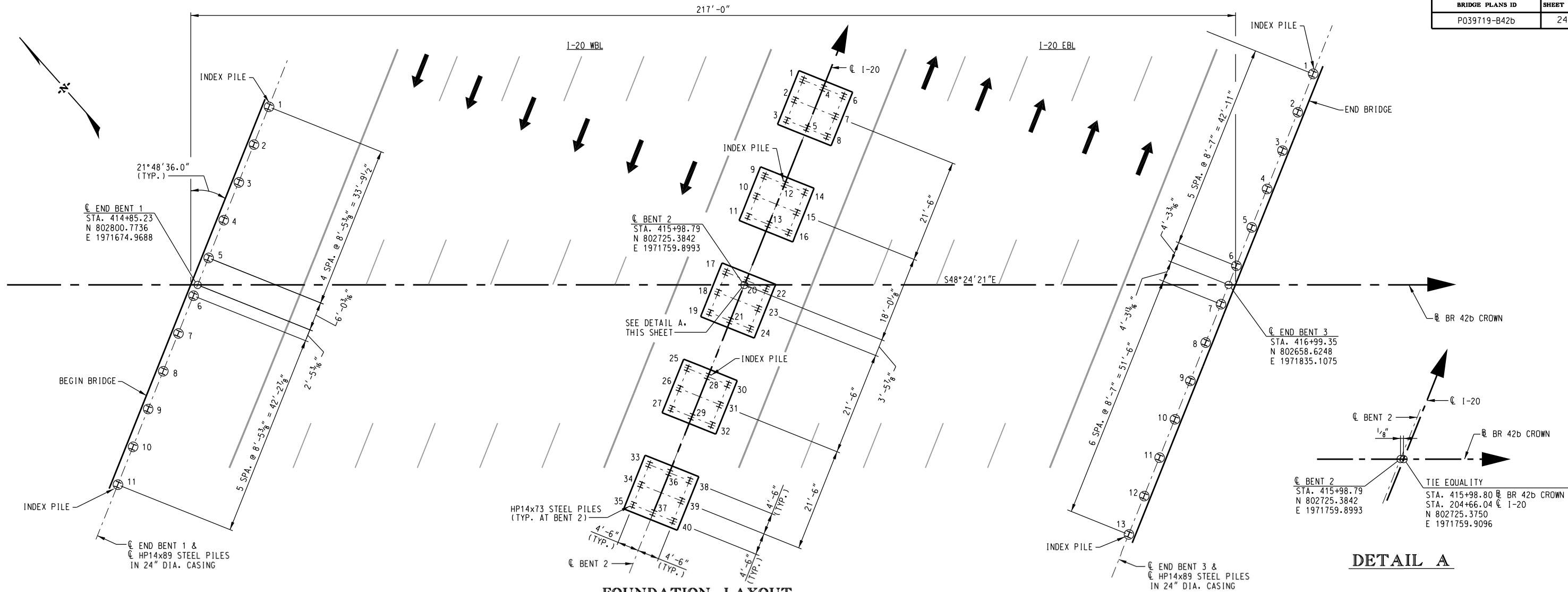
SOUTH CAROLINA
DEPARTMENT OF TRANSPORTATION
BORING LOGS (3)
US 176 EB (BROAD RIVER RD.)
BRIDGE OVER I-20
COUNTY RICHLAND ROUTE US 176

FOR INFORMATION ONLY

| | | | |
|----------|------|-------|-------|
| REV. | | | |
| REV. | | | |
| REV. | | | |
| REVIEWED | PLC | 04-22 | |
| QUAN. | | | |
| DR. | BFS | WRS | 04-22 |
| DES. | | | |
| BY | CHK. | DATE | |

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| BRIDGE PLANS ID | SHEET NO. |
|-----------------|-----------|
| P039719-B42b | 24 |



FOUNDATION LAYOUT

| PILE BEARING TABLE | | | |
|--|----------|----------|----------|
| BENT I.D. | E.B.1 | I.B.2 | E.B.3 |
| PILE SECTION | HP 14X89 | HP 14X73 | HP 14X89 |
| FACTORED DESIGN LOAD (TONS) | 185 | 110 | 185 |
| GEOTECHNICAL RESISTANCE FACTOR | 0.65 | 0.65 | 0.65 |
| NOMINAL RESISTANCE (TONS) | 285 | 170 | 285 |
| SETTLEMENT INDUCED UNFACTORED DOWNDRAW (TONS) | 0 | 0 | 0 |
| SETTLEMENT INDUCED FACTORED DOWNDRAW (TONS) | 0 | 0 | 0 |
| LIQUEFACTION INDUCED DOWNDRAW (TONS) | 0 | 0 | 0 |
| REQUIRED DRIVING RESISTANCE (TONS) | 285 | 170 | 285 |
| REQUIRED MINIMUM TIP ELEVATION TO ACHIEVE LATERAL STABILITY (FEET MSL) | 280 | 270 | 280 |
| ESTIMATED PILE TIP ELEVATION (FEET MSL) | 235 | 255 | 250 |

Initially drive End Bent 1 and End Bent 3 piles to at least the required minimum tip elevation and no deeper than tip elevation 265 before MSE wall and bridge embankment construction.

Settlement monitoring is required at End Bent 1 and End Bent 3 during MSE wall and bridge embankment construction. Final End Bent pile driving to the required driving resistance shall begin at the direction of the Geotechnical Engineer of Record after sufficient foundation soil settlement has completed.

Method of controlling installation of piles and verifying their capacity: Capacity will be verified by Pile Driving Analyzer and CAPWAP analysis of index piles. A Pile Installation Chart developed from the analysis will be used to verify the capacity of production piles.

Perform Pile Driving Analyzer (PDA) testing on six (6) index piles. An index pile shall be the first production pile driven at each bent. Include an additional two feet of pile length in order to accommodate the initial PDA testing. If a CAPWAP analysis determines that capacity has not been achieved, restrike one of the production piles. Perform the restrike on the production pile exhibiting the least blows per foot. On initial drive, piles shall be stopped at the highest allowable finished grade on the plans to accommodate a restrike while remaining within an allowable plan finished grade elevation. Perform PDA testing during the restrike. The Geotechnical Engineer of Record will determine the time between initial driving and any required restrikes.

Each pile is to be installed in one continuous operation. Include details of any anticipated temporary driving discontinuances including anticipated time intervals in the Pile Installation Plan.

The top of partially weathered rock elevation may vary across each bent and result in varying pile lengths. Practical refusal of a pile is defined as 20 blows per inch.

Reference the Standard Specifications for Highway Construction for Driven Pile Foundations, Section 711. Notes included in these plans are in addition to the requirements of the Standard Specifications.

The following estimated parameters were used for performing a drivability analysis for End Bent 1, Interior Bent 2, & End Bent 3:

| DRIVABILITY ANALYSIS | | | |
|---------------------------|--------------|--------------|--------------|
| BENT I.D. | E.B.1 | I.B.2 | E.B.3 |
| Skin Quake (QS) | 0.10 in | 0.10 in | 0.10 in |
| Toe Quake (QT) | 0.10 in | 0.10 in | 0.10 in |
| Skin Damping (SD) | 0.15 s/ft | 0.15 s/ft | 0.15 s/ft |
| Toe Damping (TD) | 0.15 s/ft | 0.15 s/ft | 0.15 s/ft |
| % Skin Friction | 30% | 50% | 30% |
| Distribution Shape Number | 0 | 0 | 0 |
| Pile Installation Chart | Proportional | Proportional | Proportional |
| Pile Penetration | 60% | 75% | 60% |
| Hammer Energy Range | 50-80 kip-ft | 30-60 kip-ft | 50-80 kip-ft |

Note: GRLWEAP 2010-7 WAS USED TO PERFORM THE WAVE EQUATION ANALYSIS.

A pile hammer having the rated energy as indicated above is considered suitable for driven pile installation. However, final hammer approval is based on a wave equation analysis that accurately reflects the Contractor's proposed driving system.

The Contractor shall retain a geotechnical engineering firm to perform the pre-construction condition assessment and Earth-borne Vibration Monitoring in accordance with the Request for Proposals.

SCDOT Supplemental Technical Specification SC-M-713 (01/19) shall apply to the project.

FINAL PLANS
NOT FOR CONSTRUCTION

| REV. | | | |
|----------|------|-------|-------|
| REV. | | | |
| REV. | | | |
| REVIEWED | PLC | 04-22 | |
| QUAN. | | | |
| DR. | RMH | WRS | 03-22 |
| DES. | WRS | ALP | 03-22 |
| BY | CHK. | DATE | |

ARCHER UNITED
JOINT VENTURE
INFRASTRUCTURE
CONSULTING & ENGINEERING

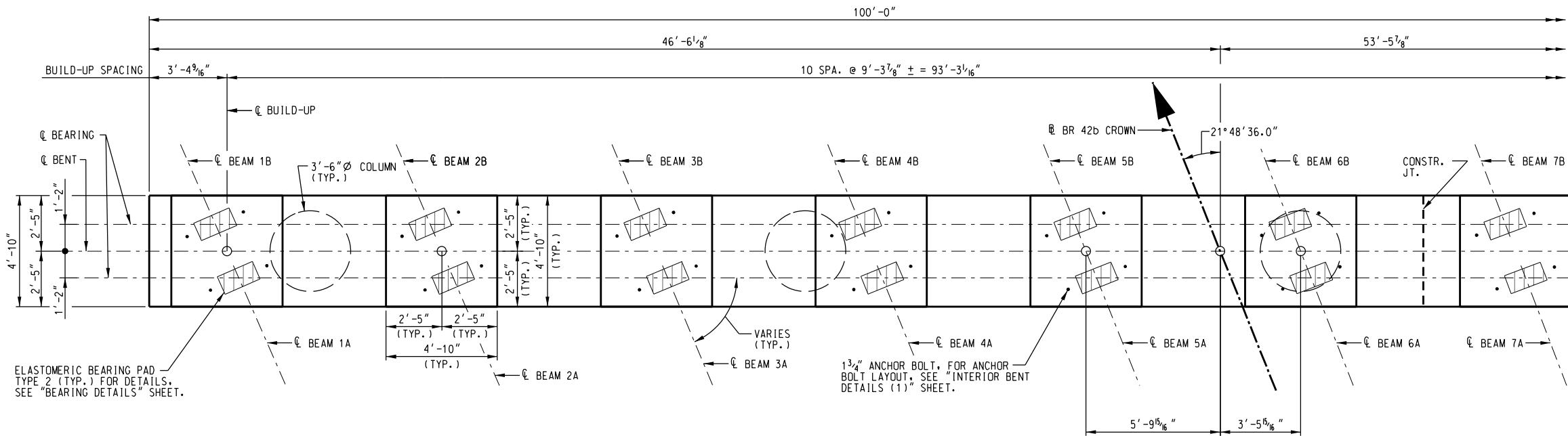
SOUTH CAROLINA
DEPARTMENT OF TRANSPORTATION

FOUNDATION LAYOUT
US 176 EB (BROAD RIVER RD.)
BRIDGE OVER I-20

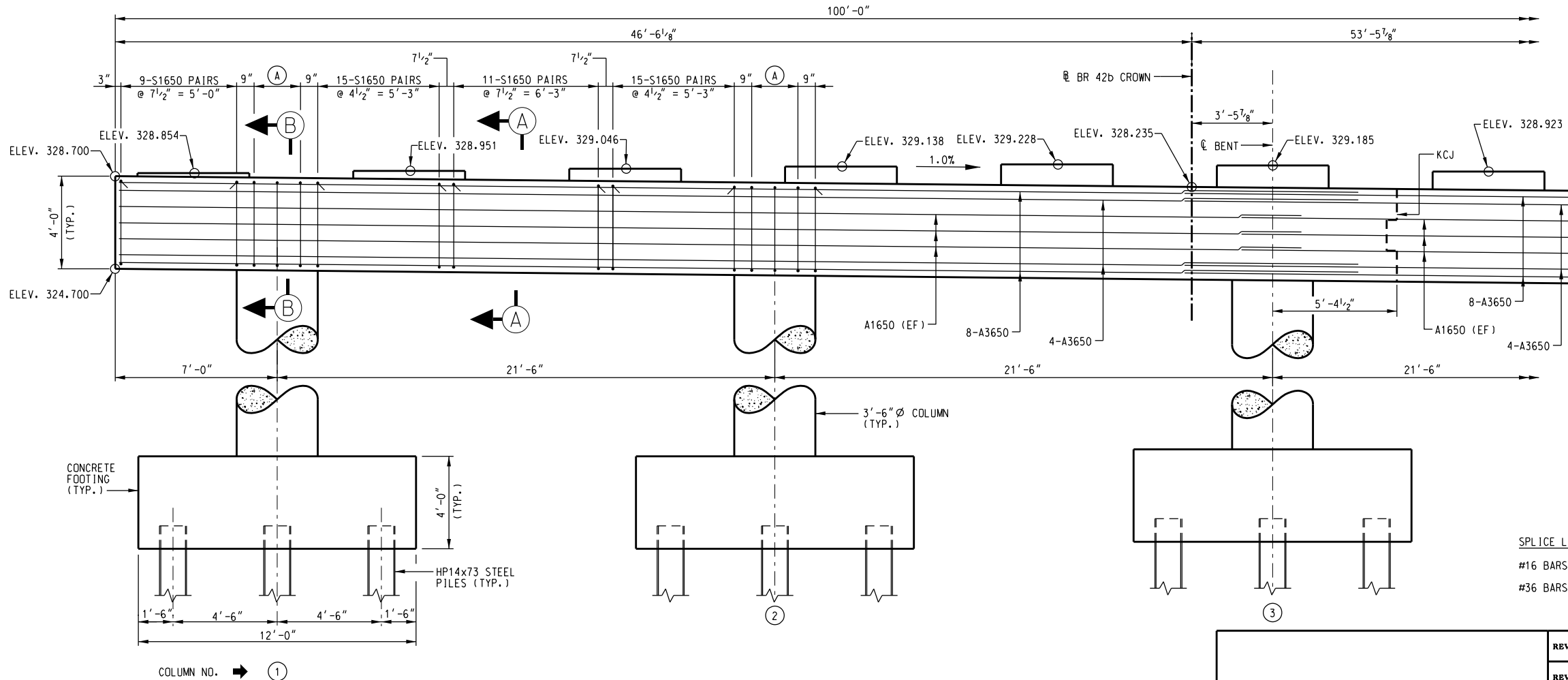
COUNTY RICHLANDROUTE US 176

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| BRIDGE PLANS ID | SHEET NO. |
|-----------------|-----------|
| P039719-B42b | 30 |



PLAN



ELEVATION
(LOOKING IN DIRECTION OF STATIONING)

NOTES:

EF - DENOTES EACH FACE

KCJ - DENOTES KEYED CONSTRUCTION JOINT. SHIFT S1650 BARS AS NECESSARY TO PROVIDE 2" CLR. TO KCJ.

BARS MAY BE SHIFTED SLIGHTLY TO CLEAR COLUMN BARS.

FOR SECTIONS A-A AND B-B, SEE "INTERIOR BENT DETAILS (1)" SHEET.

FOR BUILD-UP DETAILS, SEE "INTERIOR BENT DETAILS (1)" SHEET.

(A) 3-J1650 PAIRS @ 12" = 2'-0"

SPLICE LENGTHS:
#16 BARS = 2'-7"
#36 BARS = 7'-6"

FINAL PLANS
NOT FOR CONSTRUCTION

| REV. | | | |
|----------|------|-------|-------|
| REV. | | | |
| REV. | | | |
| REVIEWED | PLC | 04-22 | |
| QUAN. | | | |
| DR. | BFS | WRS | 03-22 |
| DES. | ALP | WRS | 03-22 |
| BY | CHK. | DATE | |

ARCHER UNITED
JOINT VENTURE
INFRASTRUCTURE
CONSULTING & ENGINEERING

SOUTH CAROLINA
DEPARTMENT OF TRANSPORTATION

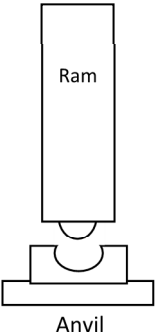
INTERIOR BENT 2 (1)
US 176 EB (BROAD RIVER RD.)
BRIDGE OVER I-20


COUNTY RICHLANDROUTE US 176

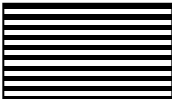
Appendix D

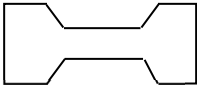
Pile Driving Hammer Information


| | | | | | |
|--------------|---|------------------|--------------|--|--|
| County: | Richland County | Bridge Plans ID: | P039719-B42b | | |
| Route: | US 176 EB (Broad River Road) Bridge Over I-20 | | | | |
| Description: | Carolina Crossroads Phase 2 Bridge 42B | | | | |
| Contractor: | Archer United Joint Venture | | | | |


| | | | | | | |
|---|---------------|---|-------------------|----|------------|-----------------------|
|  | Hammer | Manufacturer: | ICE | | Model: | I-19 |
| | | Type: | Single Act Diesel | | Serial No. | TBD |
| | | Rated Energy (k-ft) | 46.17 | at | 11.5 | Length of stroke (ft) |
| | | Lead Size (in): | 26 | | | |
| | | Modifications: | None | | | |
| | | Note: Attach any hammer modification specifications. Manufacturer's Specifications may be required if hammer is not found in Wave Equation database. | | | | |
| | | Date of Last Maintenance: | TBD | | | |
| | | Type of Maintenance: | TBD | | | |
| | | Performed By: | TBD | | | |

| | | | | | |
|---|----------------------|----------------|------|-----------------|---|
|  | Striker Plate | Weight (kips): | 0.46 | | |
| | | Diameter (in): | 22.5 | Thickness (in): | 4 |

| | | | | | | |
|---|-----------------------|-----------------------------|-------------------|----------------------|-----------------------------|----------------|
|  | Hammer Cushion | Description: | | | | |
| | | Material Description | | No. of Layers | Modulus of Elasticity (ksi) | Thickness (in) |
| | | 1 | MC-904 Blue Nylon | 1 | 175 | 2 |
| | | 2 | | | | |
| | | Area (sq. in): | 398 | Total Thickness (in) | 2.5 | |
| | | Coefficient of Restitution: | 0.90 | | | |

| | | | | | |
|---|--------------------------|-------------------------|--------------------------------------|--|--|
|  | Pile Cap (Helmet) | Dimension: | DCB-1HD Drive Cap & DCH-1 Cap Insert | | |
| | | Pile Cap Weight (kips): | 1.065 | | |
| | | Inserts Weight (kips): | 0.78 | | |

| | | | | | | |
|---|---------------------|------------------------------|-----|----------------|-----|--|
|  | Pile Cushion | Material: | N/A | | | |
| | | Thickness (in.): | N/A | Area (sq. in): | N/A | |
| | | Modulus of Elasticity (ksi): | N/A | | | |
| | | Coefficient of Restitution: | N/A | | | |

| | | | | | | |
|---|-------------|---|---|---------------------------------|-----|--|
|  | Pile | Pile Type/Size & Pile Point: | HP 14x73 14x73 Welded Reinf. Pile Tips | | | |
| | | Total Pile & Point Length (ft): | EB 2 -47.3 | Exposed Pile Point Length (ft): | N/A | |
| | | Pile Cross-Sectional Area (sq.in): | 21.4 on 14x79 | | | |
| | | Pipe Pile Wall Thickness (in): | N/A | | | |
| | | Pile Tip Description: | Welded Reinf. Tip | | | |
| | | Splice Description: | Bevel Butt per SCDOT Spec. Section 711.4.10.1 | | | |
| | | Splice Location From Pile Top (ft): | N/A | | | |
| | | Concrete Pile Strength, f'_c (psi): | N/A | | | |
| | | Steel Pile Yield Strength, F_y (ksi): | 50 | | | |

| | | | | |
|---|--|--|--|--|
| Note: Within 30 calendar days after award of contract or no later than 30 days before driving the first pile, submit form and Pile Installation Plan to the Geotechnical Design Engineer, with copy to the Bridge Construction Engineer and RCE. | | | | |
|---|--|--|--|--|

| | | | | |
|---|---------------|------------------|-------|------------|
| SCDOT – Design-Build Section Geotechnical Design Engineer P.O. Box 191 Columbia, SC 29202-0191 Telephone (803) 737-0766 FAX (803) 737-9868 | Submitted By: | Engelbert Ocampo | | |
| | Title: | Project Engineer | | |
| | Telephone No. | (954)-901-5736 | Date: | 12/06/2022 |

Appendix E

Instrumentation Calibrations



Certificate of Calibration

Transducer Model: PDI Transducer

Pile Dynamics, Inc.

Serial Number: P821

PDI Gage Factor: 145.1 me/V

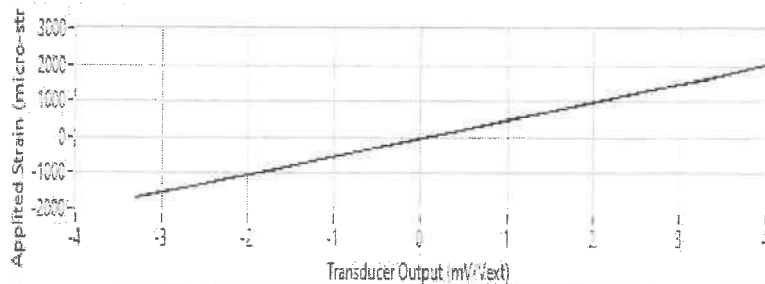
General Gage Factor: 503.9 me/mV/V_{ext}

Initial Offset Voltage: 0.006 mV/V_{ext}

Table 1: Representative Calibration Data

| Applied Strain (micro-strain) | Transducer Output (mV/V _{ext}) | Applied Strain (micro-strain) | Transducer Output (mV/V _{ext}) |
|-------------------------------|--|-------------------------------|--|
| -41.039 | -0.442 | 209.451 | 0.442 |
| -101.916 | -0.746 | 512.711 | 0.734 |
| -39.274 | -0.776 | 312.045 | 0.645 |
| -459.238 | -1.035 | 1112.332 | 0.762 |
| -412.712 | -1.742 | 1422.817 | 0.659 |
| -1581.012 | -1.242 | 1781.421 | 0.529 |
| -1421.538 | -1.733 | 2007.084 | 0.596 |
| -1619.524 | -1.193 | 1458.593 | 0.609 |
| -1887.421 | -1.333 | 1618.651 | 0.724 |
| -1881.949 | -1.193 | 1618.024 | 0.646 |
| -1352.619 | -1.315 | 881.601 | 0.713 |
| -1064.845 | -1.092 | 591.373 | 0.420 |
| -798.893 | -1.596 | 416.281 | 0.608 |
| -538.011 | -1.035 | 156.680 | 0.354 |
| -274.197 | -1.541 | 41.451 | 0.141 |
| -55.234 | -1.039 | 42.023 | 0.143 |

Calibration Curve



Mean Linear Correlation Coefficient (LCC): 0.999973

LCC Standard Deviation: 1.354270E-6

Calibrated By: DIC

Signature: *[Signature]*

Date and Time: 9/9/2021 8:53 AM

Temperature (Degrees C): 24.2

REF: PDI0125AL-08-070



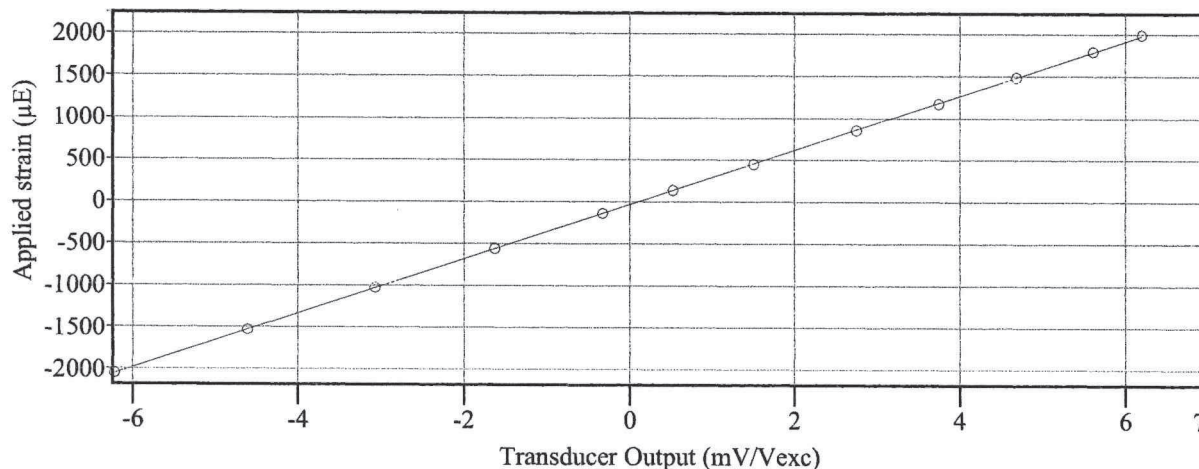
Certificate of Calibration

Pile Dynamics, Inc.
 Transducer Model: PDI Strain Transducer
 Serial Number: W877
 PDI Gage Factor: 94.7
 Mean Linear Correlation Coefficient: 0.999972

Table 1: Representative Calibration Data

| Applied strain (μE) | Gage Output (mV/Vexc) | Applied strain (μE) | Gage Output (mV/Vexc) |
|----------------------------------|-----------------------|----------------------------------|-----------------------|
| -2047.2 | -6.223 | 446.2 | 1.502 |
| -1528.9 | -4.613 | 853.0 | 2.750 |
| -1023.6 | -3.071 | 1174.5 | 3.746 |
| -557.7 | -1.629 | 1489.5 | 4.680 |
| -137.8 | -0.335 | 1797.9 | 5.608 |
| 137.8 | 0.521 | 1994.8 | 6.205 |

Calibration Curve



PDI Strain Transducer Calibration System (PDI STCS)

| | |
|-------------------------------------|-------------------|
| PDI STCS Serial Number: | 1000HA |
| Firmware version number: | 0.8.0.0 |
| Transducer Gage Length: | 3 inches (76.2mm) |
| Excitation Voltage for Calibration: | 5.0 VDC |

PDI certifies the above STCS instrument meets or exceeds published specifications and has been verified using standards and instruments whose accuracies are traceable to the National Institute of Standards and Technology (NIST), an accepted value of a natural physical constant or a ratio calibration technique.

Calibrated By: Kay Tol
 PDI Gage: W877
 Calibration Date: JUN 08 2022

Signature: *Kay Tol*



Accelerometer Calibration Certificate

Pile Dynamics, Inc.



Calibrated by Pile Dynamics, Inc.
Calibration performed on OCT 22 2021

Serial No: K12388 Temperature: 22.6 °C

Model: PR Humidity: 44%

Calibrated on: Channel 3 on 8G 5161 LE

PDA CALIBRATION FACTOR

451.0 mv/5000g

(90.2 μ v/g)

R²: 0.999955 [Chip programmed]

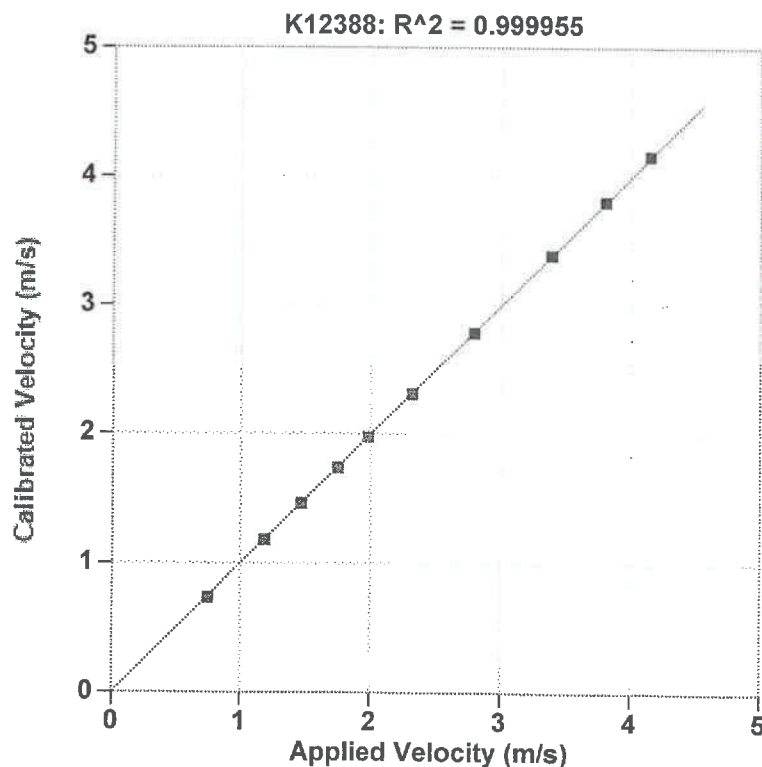
Operator: William Johnson

Ref Acc 1: 69132! Cal on: 09Feb2021
960 g's/volt

Ref Acc 2: 69096! Cal on: 27Jan2021
978 g's/volt


Signed

Reference accelerometer calibrations are traceable to the United States National Institute of Standards and Technology (NIST).



| Reference Velocity | S/N K12388 Velocity |
|--------------------|---------------------|
| m/s | m/s |
| 0.741 | 0.734 |
| 1.184 | 1.178 |
| 1.464 | 1.459 |
| 1.744 | 1.739 |
| 1.980 | 1.976 |
| 2.319 | 2.306 |
| 2.790 | 2.783 |
| 3.384 | 3.388 |
| 3.798 | 3.805 |
| 4.147 | 4.158 |

Maximum Acceleration: 919 g's

Accelerometer Calibration Certificate

Pile Dynamics, Inc.



Calibrated by Pile Dynamics, Inc.

Calibration performed on OCT 22 2021

Serial No: K12389 Temperature: 22.8 °C

Model: PR Humidity: 44%

Calibrated on: Channel 3 on 8G 5161 LE

PDA CALIBRATION FACTOR

483.2 mv/5000g

(96.6 μ v/g)

R²: 0.999989 [Chip programmed]

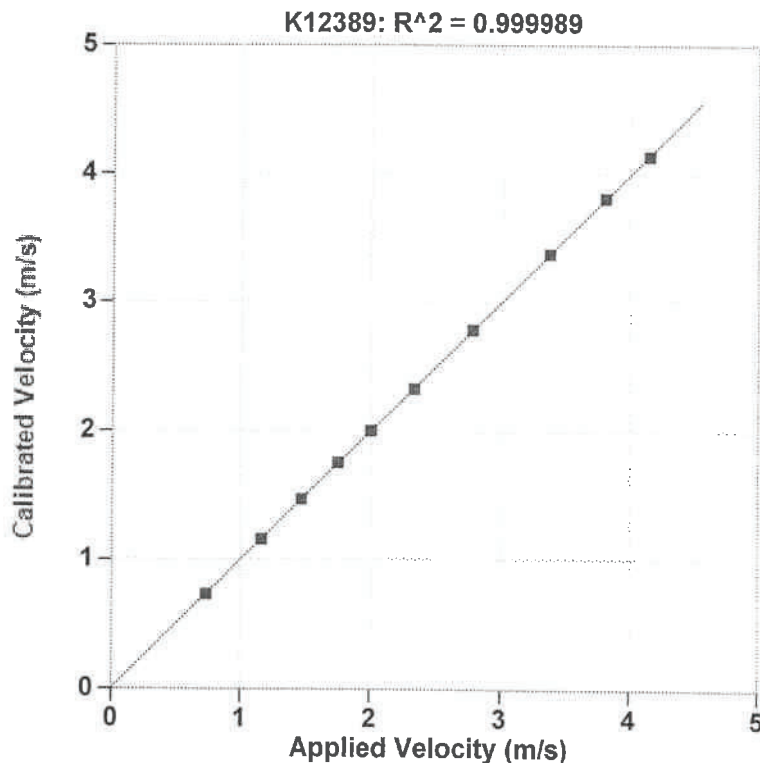
Operator: William Johnson

Ref Acc 1: 69132! Cal on: 09Feb2021
960 g's/volt

Ref Acc 2: 69096! Cal on: 27Jan2021
978 g's/volt


Signed

Reference accelerometer calibrations are traceable to the United States National Institute of Standards and Technology (NIST).



| Reference Velocity m/s | S/N K12389 Velocity m/s |
|---------------------------|-------------------------------|
| 0.730 | 0.728 |
| 1.158 | 1.158 |
| 1.470 | 1.471 |
| 1.748 | 1.755 |
| 2.001 | 2.004 |
| 2.330 | 2.326 |
| 2.780 | 2.782 |
| 3.372 | 3.373 |
| 3.803 | 3.807 |
| 4.144 | 4.137 |

Maximum Acceleration: 914 g's

Appendix F

PDA Proficiency Certifications



This documents that
Sally Thomson
Infrastructure Consulting Engineering
has on August 11, 2021 achieved the rank of
ADVANCED

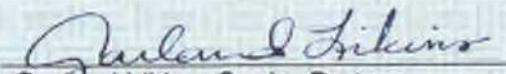
on the Dynamic Measurement and Analysis Proficiency Test.

The individual identified on this document demonstrated to the degree granted above an understanding of theory, data quality evaluation, interpretation and signal matching for high strain dynamic testing of deep foundations. ***It is recommended that individuals at the Advanced level seek Master or Expert levels through additional study within six years of the date of this document.***

The ability of the individual named to provide appropriate knowledge and advice on a specific project is not implied or warranted by the Pile Driving Contractors Association or Pile Dynamics, Inc. **This certificate can be verified at www.PDAproficiencytest.com.** The Pile Driving Contractors Association or Pile Dynamics, Inc. assumes no liability for foundation testing and analysis work performed by the bearer of this certificate.


Frank T. Peters, Executive Director
Pile Driving Contractors Association




Garland Likins, Senior Partner
Pile Dynamics, Inc.

No. 3139



This documents that
Michael Simpson
Infrastructure Consulting & Engineering

has on August 25, 2021 achieved the rank of

ADVANCED

on the Dynamic Measurement and Analysis Proficiency Test.

The individual identified on this document demonstrated to the degree granted above an understanding of theory, data quality evaluation, interpretation and signal matching for high strain dynamic testing of deep foundations. ***It is recommended that individuals at the Advanced level seek Master or Expert levels through additional study within six years of the date of this document.***

The ability of the individual named to provide appropriate knowledge and advice on a specific project is not implied or warranted by the Pile Driving Contractors Association or Pile Dynamics, Inc. **This certificate can be verified at www.PDAproficiencytest.com.** The Pile Driving Contractors Association or Pile Dynamics, Inc. assumes no liability for foundation testing and analysis work performed by the bearer of this certificate.

Frank T. Peters, Executive Director
Pile Driving Contractors Association



Garland Likins, Senior Partner
Pile Dynamics, Inc.

No. 3149