Applied Foundation Testing

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Revision 1: June 26, 2018
Revision 2: July 2, 2018

Report of High-Strain Dynamic Pile Testing
TP-111B
I-10 over Mobile River and Bayway
Load Test Program
Mobile Country, Alabama
AFT Project No.: 118008

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Digitally signed by Donald T Robertson
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REVISION 2: Revision 2 includes placement of the approved inspector's pile driving log in Appendix A.

REVISION 1: Revision 1 dated June 26, 2018 to the original report dated June 8, 2018 included the following changes: The Generalized Soil Conditions section was changed to indicate that the groundwater depth, not elevation, noted in boring BW-110 was 0.0 feet. In the High-Strain Dynamic Pile Testing section, the pile tip elevation after jetting was changed so that it is based on the depth of the pile tip at start of impact driving.

INTRODUCTION

The proposed I-10 Mobile River Bridge and Bayway project includes the construction of a new six-lane bridge across the Mobile River and a new eight-lane Bayway. A load test program has been conducted in advance of the construction contract to optimize the foundation design. Foundation types included in the load test program include two HP14x89 steel H-piles, two 18-inch square prestressed concrete piles, one 30-inch square prestressed concrete pile, five 54-inch diameter spun-cast concrete cylinder piles, one 60-inch diameter steel pipe pile, and one 72-inch diameter drilled shaft.

This report summarizes the installation and testing of the 54-inch diameter, 6-inch wall thickness, 128-feet long spun-cast concrete cylinder pile at location TP-111B. High-strain dynamic pile testing, also known as PDA, was performed during initial drive, 1 day restrike, and 14 day restrike. A summary of the test dates is included in Table 1 below.

Table 1: Summary of Test Dates

Test Pile	Test Description	Test Date
TP-111B	Initial Drive	5/17/2018
	1 Day Restrike	5/18/2018
	14 Day Restrike	5/31/2018

The project plans indicate test pile TP-111B was located at station 898+00.00 offset right 150 feet, adjacent to the south of the existing I-10 Bayway. Please refer to the project source documents for a site plan of the actual location of the test piles.

Installation of test pile TP-111B was performed by Jordan Pile Driving, Inc. Applied Foundation Testing (AFT) was the specialty engineering firm performing the dynamic pile testing. Dynamic pile testing was performed by Mr. Michael Worsham, P.E. Data analysis and reporting was performed by Mr. Donald Robertson, P.E. and Mr. Michael Worsham, P.E.

This report contains a compilation of the results for the dynamic pile testing for TP-111B. This report includes an overview of the testing program, tabular and graphical representations of the data and analysis, discussion of the results, and instrumentation calibrations.

GENERALIZED SOIL CONDITIONS

Thompson Engineering performed the subsurface exploration as part of this project. The subsurface exploration consisted of drilling a single Standard Penetration Test (SPT) boring

near each of the proposed foundation load test locations identified for the project. The nearest soil boring to TP-111B is boring BW-110 located at station 894+44.18 offset right 19.23 feet.

A copy of soil boring BW-110 is included in Appendix D. Detailed descriptions of the subsurface conditions encountered are presented in this attached soil boring. A summary of the soil conditions given in Table 2 below represents a summary of conditions as indicated in the provided materials and is included only to assist in evaluation of the load test data. For further details regarding the soil conditions at the test site and elsewhere, the reader should reference the project source documents.

The ground water depth noted in boring log BW-110 was 0.0 feet. Table 2 below provides a summary of the subsurface conditions.

Table 2: Description of Subsurface Soil Conditions(1)

Average Elevation From - To(2)	Material Description	Typical N-Value Range
-1.5 to -13.2	Lean Clay with Sand (CL)	0 to 1
-13.2 to -18.2	Sand (SP)	1
-18.2 to -33.2	Silty Sand (SM)	0
-33.2 to -83.2	Sand with Silt (SP-SM)	2 to 37
-83.2 to -121.5	Lean Clay with Sand (CH)	18 to 61

Note 1: Table created from Thompson Engineering Test Boring Record BW-110 contained in the project plans.
Note 2: Elevations are referenced to North American Vertical Datum of 1988 (NAVD)

HIGH-STRAIN DYNAMIC PILE TESTING (PDA)

The test pile TP-111B was installed by Jordan Pile Driving, Inc. The test pile was prepared for high-strain dynamic testing by drilling holes and setting drop-in anchors for sensor attachment two pile diameters, or 108 inches, below the pile top.

Prior to driving pile TP-111B, the pile was jetted until the pile tip was at approximate elevation -37 feet. Pile TP-111B was then impact driven using a Pileco D180-32 open-ended diesel pile driving hammer. The Pileco D180-32 diesel hammer has a maximum rated energy of 443,500 foot-pounds (ram weight of 39,680 pounds at a stroke height of 11.18 feet). We understand the Pileco D180-32 hammer utilized a hammer cushion consisting of 12 inches of micarta and aluminum and a pile cushion consisting of 12 inches of pine plywood. A well compressed previously used pile cushion was utilized for the restrikes.

Applied Foundation Testing performed dynamic pile testing using a Pile Driving Analyzer Model PAX manufactured by Pile Dynamics, Inc. Dynamic testing was accomplished by externally attaching two piezo-electric accelerometers, two piezo-resistive accelerometers and four strain transducers and taking measurements during the initial drive and subsequent restrikes. Calibration information for the sensors utilized is included in Appendix E. The dynamic pile testing was performed in general accordance with the project plans and special provisions and ASTM D4945 *"Standard Test Method for High-Strain Dynamic Testing of Deep Foundations"*. During the initial drive, TP-111B was driven to where the sensor attachment points were approximately 1 foot above the waterline.

Plots and tabular summaries of the dynamic testing results are included in Appendix B. In general, these summaries include blows per foot (BLC), penetration depth below reference, maximum Case method resistance, auto capacity method resistance for friction piles (RA2), maximum compressive stress (CSX), compressive stress at the bottom of pile (CSB), maximum tensile stress (TSX), stroke (STK), maximum transfer energy (EMX), and beta pile integrity factor (BTA). The top of the pile driving template was used as a reference for measuring penetration depth during initial drive. The top of the pile driving template was located at elevation 12.7 feet. After the template was removed the reference elevation was moved to elevation 12.2 feet; however, the penetration depths shown in the plots and tabular summaries of the dynamic testing results are based on the original top of pile driving template reference elevation of 12.7 feet. The mudline elevation was measured as -17.1 feet. After driving the elevation of the top of soil inside the cylinder pile was measured as -61.7 feet. A summary of the test pile installation is provided in Tables 3 and 4 below.

Table 3: Summary of Pile Driving Information

Test Pile	Hammer Model	Approximate Reference Elevation (feet)	Approximate Ground Elevation (feet)	Approximate Final Pile Top Elevation (feet)	Approximate Final Tip Elevation[(1)] (feet)
TP-111B	Pileco D180-32	+12.7[(2)], +12.2[(3)]	-17.1	+11.6	-116.4

Note 1: Approximate reference elevation based on contractor survey measurement. Approximate final pile tip elevation based on depth below reference, pile movements during restrikes, and load test permanent displacement.
Note 2: Top of template elevation
Note 3: Reference elevation after removal of template.

Table 4: Summary of Dynamic Pile Testing Results

Test Pile	EOD or BOR[(1)]	Blows per Foot at EOD or Blows per Inch for Restrike	Max. CSX Stress (ksi)	Avg. CSX Stress (ksi)	Max. TSX Stress (ksi)	Avg. TSX Stress (ksi)	Max. CSB Stress (ksi)	Avg. CSB Stress (ksi)	Avg. Transfer Energy (k-ft) / Approx. Stroke (ft.)
TP-111B	EOD	121 Blows/1'	4.44	3.13	1.49	0.46	2.84	1.94	98.1/8.01
	1 Day RS	6 Blows/1", 4 Blows/1", 8 Blows/1" 12 Blows/1"	7.27	5.80	0.79	0.42	5.18	4.14	179.5/10.52
	14 Day RS	15 Blows/1", 14 Blows/1", 11 Blows/1"	5.80	4.98	0.71	0.42	4.40	3.55	160.8/9.81

Note 1: EOD – End of Initial Drive; RS – Restrike

Allowable maximum driving stresses for the spun-cast concrete cylinder piles are defined by the formulas located in the project special provisions. The maximum allowable compressive stress limit is defined as $0.85\sqrt{(f'_c)}$ – effective prestress. The maximum allowable tensile stress limit is defined as $3\sqrt{(f'_c)}$ + effective prestress.

In the above formula f'c is defined as the minimum concrete compressive strength for the piles, which is 10,000 psi per Plan Sheet 13. Per Plan Sheet 13, the strands shall be stressed to an initial tension of 30,900 lbs. Assuming a loss of 20 percent from initial tension provides an

effective prestress value of 546 psi (0.55 ksi). The maximum allowable compressive stress is calculated as 7.95 ksi, and the maximum allowable tensile stress is calculated as 0.85 ksi.

The dynamic pile testing measurements indicate the maximum tensile stress (TSX) exceeded allowable stress limits for portions of the initial drive. In general, the high tensile stresses for some blows occurred early in the initial drive in softer driving conditions and also later in the initial drive when high quake conditions were encountered. When high tensile stresses were measured driving through the zone with high quake conditions, fuel setting adjustments were made and additional pile cushion material was added in order to reduce stresses. In a production pile driving situation, additional pile cushion material or driving procedures to avoid these high driving stresses would be needed. It is not recommended letting driving stresses reach levels exceeding allowable stress limits during production pile driving and restrikes.

During the initial drive of TP-111B, hammer alignment issues caused a portion of the pile top concrete to spall near the end of drive. During the 1 and 14 day restrikes this concrete spalling became more severe due to the high energy blows imparted to the pile in the attempt to fully mobilize resistance; however, the spalling did not affect transfer energy or data quality during these restrikes. The dynamic test data does not show any signs of integrity problems below the sensor location for TP-111B.

SIGNAL MATCHING ANALYSIS

Signal matching analyses were performed using the computer program CAPWAP (version 2014) to further evaluate the field measurements. Summaries of these analyses are presented in Table 5 below. The complete analyses are included in Appendix C. Signal matching analysis is considered a standard procedure to estimate the total ultimate resistance as well as estimate the resistance distribution (shaft and toe) from the dynamic pile testing data. The signal matching approach is used to back calculate various soil parameters. The program uses the data measured during a single blow as a boundary condition and the user performs many iterations on soil parameters to make a calculated wave-up match the measured one.

Table 5: Signal Matching Results Summary

Test Pile	EOD or Restrike	Blow No.	R_{ult} (kips)	R_{shaft} (kips)	R_{end} (kips)	Max. Case Method JC Damping Factor	EMX (k-ft)/Stroke (feet)	Qs (in)	Qt (in)	Ss (s/ft)	St (s/ft)	Match Quality
TP-111B	EOD	3420	1437	1335	102	0.60	123.1/ 9.57	0.30	0.69	0.20	0.20	5.49
	1 Day Restrike	2	1800	1637	163	0.92	163.1/ 11.72	0.11	0.04	0.40	0.35	2.85
	14 Day Restrike	7	2250	2067	183	1.03	177.4/ 10.11	0.20	0.04	0.40	0.35	2.27

The results of the CAPWAP signal matching analyses generally have the most confidence in the total resistance value, and to a lesser extent the resistance distribution in side resistance along the length of the pile and end bearing resistance at the pile bottom. This is generally attributed to intricacies in separating side resistance and end bearing resistance from the total resistance

using signal matching techniques. The side resistance values from the analyses are the combined side resistance from the exterior and interior of the cylinder piles.

The signal matching analysis for TP-111B indicated a total ultimate resistance of 1,437 kips at end of initial drive, 1,800 kips during the 1 day restrike; and 2,250 kips during the 14 day restrike. Based on the set measurements during end of initial drive and 1 day restrike for TP-111B, the resistance values presented in this report may be considered fully mobilized for end of initial drive and 1 day restrike. Due to small set measurement during 14 day restrike the resistance value may not be fully mobilized.

SUMMARY AND CONCLUSIONS

The load test program included the installation of a 54-inch diameter, 6-inch wall thickness, 128-feet long spun-cast concrete cylinder pile at location TP-111B. TP-111B was subjected to dynamic pile testing during initial drive and 1 and 14 day restrikes. A summary of the test results is provided below:

TP-111B Testing Summary:

- The signal matching analysis of the dynamic testing data for TP-111A indicated a total ultimate resistance of 1,437 kips at end of initial drive, 1,800 kips for the 1 day restrike, and 2,250 kips for the 14 day restrike.

The purpose of this test pile program is to determine the pile bearing resistances (ultimate, side resistance, and end bearing) achievable for the pile type, size, and lengths installed. In addition, the designers may choose to use the results to optimize their foundation design and/or to minimize the risk of constructability issues. However, the design team would also need to consider the scope of the test pile program, the methods used for pile installation, and potential variability of soils along the bridge length when using the information gathered.

Some points to consider from the test pile program for the 54-inch diameter, 6-inch wall thickness, 128-feet long spun-cast concrete cylinder pile at location TP-111B are as follows:

- During production phase testing when keeping driving stress values below allowable limits during initial drives and restrikes is of the upmost importance, due to possibly lower transfer energies, less resistance may be mobilized than shown in this report.
- Dynamic pile testing on production piles is recommended to determine bearing resistances, measure pile driving stresses, and determine hammer driving system suitability. Driving criteria may be developed based on this testing with recommendations provided to control tensile and compressive stresses at or below allowable levels.
- Signal matching analyses of the production pile dynamic test data is recommended to confirm and/or to provide a better estimate of the ultimate pile bearing resistance.

Below is a summary of the Appendix contents:

- Appendix A – Inspector's Pile Driving Records
- Appendix B – Dynamic Pile Testing Data Summaries
- Appendix C – CAPWAP Signal Matching Analysis Output
- Appendix D – Relevant Project Documents
- Appendix E – Instrument Calibrations

CLOSURE

We want to thank you for the opportunity to be involved in this project. We also want to thank you for all your support in setting up the test. Please do not hesitate to call us if you have any questions regarding the information in this report.

LIMITATIONS

This report presents test measurements made by Applied Foundation Testing, Inc. Interpretations were made based upon the measurements made by AFT with the latest techniques available and currently accepted standards of care recognized by Geotechnical Engineering professionals. Applied Foundation Testing is an independent agency and is not the Geotechnical Engineer of Record. The Geotechnical Engineer of Record should ultimately make final recommendations for foundation design and construction.

Appendix A

Inspector's Pile Driving Records
TP-111B

I-10 over Mobile River Bridge Load Test Program

ALDOT Project No.: IM-I010(341)
Mobile County, Alabama
AFT Project No.: 118008

FORM C-15A
REVISED 08-07-95

ALABAMA DEPARTMENT OF TRANSPORTATION
TEST PILE RECORD

Project Number: IM-I010(341)	County: Mobile	Division: Southwest Region
Bridge: Station 898+00 to Station 898+00		Bridge Identification Number:
Road Between: I-10 and I-10		Lane (if applicable): EB
Contractor: Jordan Pile Driving	Inspector: Donald Hector	
Date: 5/17/2018	Bent No.& Lane: TEST PILE	Pile No.: TP-111B
Kind of Soil: Soft, Wet, Black, Fat Clay		
Kind of Pile: Spun Cast Cylinder	Size of Pile: 54"	Total Length (ft): 128
Elev. Ground Line at Pile: -14.9	Final Elev. At Top of Pile: 12.1	Tip Elevation: -115.8
Hammer Make: Pileco	Hammer Model: D180-32	Hammer Kind: Diesel
Hammer Type: Open	Hammer Action: Single	Rated Energy (ft.-lbs.): 443,500@11.1 Stroke
Weight of Hammer (lbs.): 39,680	Design Load (from plans) (tons):	
Hammer Cushion: Material: Aluminum and Micarta Alternating	Thickness (in.): 12	Area (sq. in.): 762
Pile Cushion (Before Driving): Material: Plywood	Thickness (in.): 12	Area (sq. in.): 904.32
Pile Cushion (After Driving): Material: Plywood	Thickness (in.):	Area (sq. in.):
Pile Cap Weight (lbs.): 25,868		

Height Of Fall (feet)	Energy Delivered To Pile (E) (ft.-lbs.)	Blows Per Foot Of Penetration (N)	Total Penetration (feet)	Bearing (Ru) (tons)
6.32	250,778	5	44	
6.12	242,842	8	45	
6.08	241,254	10	46	

REMARKS

1. When using open type and gravity hammers, record weight of hammer and height of fall of hammer. Show rated energy when using closed type hammers.
2. Energy delivered to pile should be maintained practically constant once record keeping has begun unless specified otherwise by the Engineer.
3. Pile cushion is only required with concrete piling.
4. Pile cushion thickness after driving must be at least one-half the original thickness.
5. The bearing should be determined from the graph of Blows/Foot versus Bearing which is provided from the Wave Equation Analysis or Dynamic Formula of the driving system. If a graph is not provided, refer to Item 505.03(b)2 of the specifications to estimate the bearing capacity using the Dynamic Formula.
6. Driving should be continuous. Note any interruptions exceeding one hour.
7. Draw a sketch on back of this sheet showing location of test pile.
8. For continuation of test pile record, use Form C-15C-2.
9. Test pile (check one): Static Load Tested _____ Dynamic Load Test x (If static load tested, load test report shall be attached to this report).

Correct _____
Project Manager

Approved _____
Area Operations Engineer

FORM C-15A-2
REVISED 08-07-95

ALABAMA DEPARTMENT OF TRANSPORTATION
CONTINUATION OF TEST PILE RECORD

Project Number	County	Division
IM-I010(341)	Mobile	Southwest Region

Bridge: Station	to Station	Bridge Identification Number
898+00	898+00	N/A

Date	Bent No.& Lane	Pile No.	Kind of Soil
5/17/2018	TEST PILE	TP-111B	Soft, Wet, Black, Fat Clay

Height Of Fall (feet)	Energy Delivered To Pile (E) (ft-lbs.)		Total Penetration (feet)	Bearing (Ru) (tons)
5.63	223,398	18	47	
5.72	226,970	18	48	
5.85	232,128	24	49	
5.98	237,286	27	50	
6.01	238,477	26	51	
6.08	241,254	31	52	
6.29	249,587	26	53	
6.99	277,363	23	54	
6.38	253,158	26	55	
7.01	278,157	23	56	
7.05	279,744	31	57	
7.06	280,141	29	58	
6.93	274,982	34	59	
6.59	261,491	37	60	
7.29	289,267	33	61	
7.36	292,045	33	62	
7.33	290,854	31	63	
7.33	290,854	35	64	
6.10	242,048	41	65	
5.84	231,731	40	66	
7.39	293,235	41	67	
7.31	290,061	37	68	

FORM C-15A-2
REVISED 08-07-95

ALABAMA DEPARTMENT OF TRANSPORTATION
CONTINUATION OF TEST PILE RECORD

Project Number	County	Division
IM-I010(341)	Mobile	SW Region

Bridge: Station	to Station	Bridge Identification Number
898+00	898+00	N/A

Date	Bent No.& Lane	Pile No.	Kind of Soil
5/17/2018	TEST PILE	TP-111B	Soft, Wet, Black, Fat Clay

Height Of Fall (feet)	Energy Delivered To Pile (E) (ft.-lbs.)	Blows Per Foot Of Penetration (N)	Total Penetration (feet)	Bearing (Ru) (tons)
7.01	278,157	39	69	
6.70	265,856	40	70	
6.87	272,602	37	71	
6.77	268,634	41	72	
6.60	261,888	42	73	
7.03	278,950	38	74	
6.66	264,269	41	75	
7.17	284,506	44	76	
7.19	285,299	41	77	
7.01	278,157	34	78	
6.77	268,634	45	79	
7.23	286,886	39	80	
7.85	311,488	33	81	
7.18	284,902	39	82	
7.76	307,917	38	83	
6.26	248,397	47	84	
7.11	282,125	42	85	
6.37	252,762	46	86	
6.61	262,285	45	87	
7.67	304,346	38	88	
7.20	285,696	42	89	

FORM C-15A-2
REVISED 08-07-95

ALABAMA DEPARTMENT OF TRANSPORTATION
CONTINUATION OF TEST PILE RECORD

Project Number	County	Division
IM-I010(341)	Baldwin	SW Region

Bridge: Station	to Station	Bridge Identification Number
898+00	898+00	N/A

Date	Bent No.& Lane	Pile No.	Kind of Soil
5/17/2018	TEST PILE	TP-111B	Soft, Wet, Black, Fat Clay

Height Of Fall (feet)	Energy Delivered To Pile (E) (ft-lbs.)	Blows Per Foot Of Penetration (N)	Total Penetration (feet)	Bearing (Ru) (tons)
7.42	294,426	44	90	
7.52	298,394	48	91	
7.16	284,109	54	92	
6.59	261,491	39	93	
7.68	304,742	37	94	
8.34	330,931	53	95	
8.52	338,074	43	96	
7.40	293,632	43	97	
8.25	327,360	36	98	
7.48	296,806	40	99	
7.60	301,568	48	100	
8.32	330,138	47	101	
7.95	315,456	44	102	
7.52	298,394	44	103	
7.75	307,520	48	104	
5.36	212,685	83	105	
5.65	224,192	105	106	
6.77	268,634	64	107	
6.73	267,046	74	108	
7.74	307,123	88	109	
8.46	335,693	82	110	
9.43	374,182	104	111	
8.67	344,026	118	112	

FORM C-15A-2
REVISED 08-07-95

ALABAMA DEPARTMENT OF TRANSPORTATION
CONTINUATION OF TEST PILE RECORD

Project Number	County	Division
IM-I010(341)	Baldwin	Southwest Region

Bridge: Station	to Station	Bridge Identification Number
898+00	898+00	N/A

Date	Bent No.& Lane	Pile No.	Kind of Soil
5/17/2018	TEST PILE	TP-111B	Soft, Wet, Black, Fat Clay

Height Of Fall (feet)	Energy Delivered To Pile (E) (ft.-lbs.)		Total Penetration (feet)	Bearing (Ru) (tons)
9.12	361,882	131	113	
9.01	357,517	128	114	
8.75	347,200	123	115	
7.98	316,646	92	116	

Appendix B

Dynamic Pile Testing Data Summaries
TP-111B

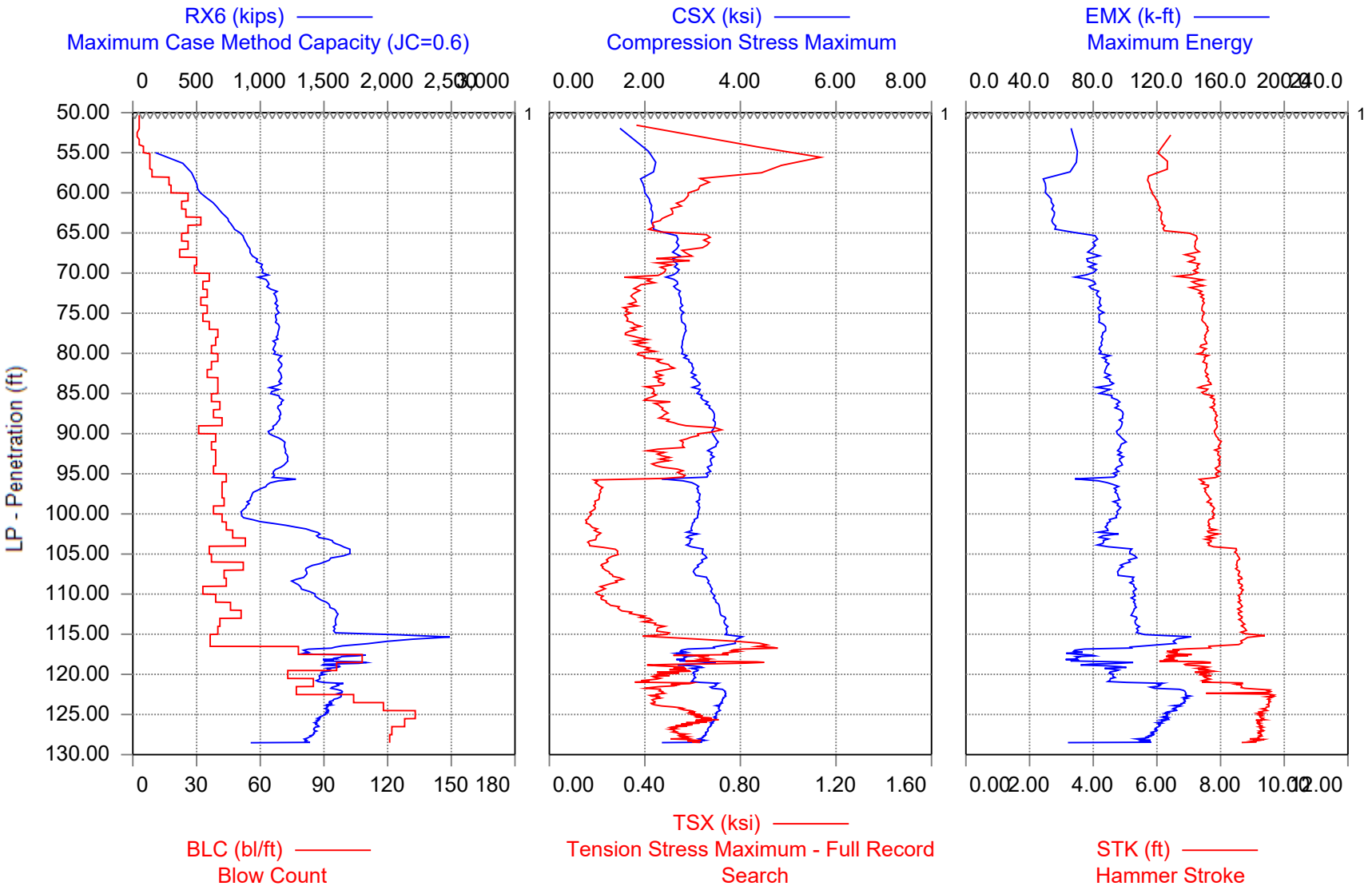
I-10 over Mobile River Bridge Load Test Program

ALDOT Project No.: IM-I010(341)
Mobile County, Alabama
AFT Project No.: 118008

Applied Foundation Testing, Inc. - PDIPLOT2 Ver 2017.2.58.3 - Case Method & iCAP® Results

Printed: 08-June-2018 Test started: 17-May-2018

I-10 MOBILE RIVER - TP-111B ID



1 - Template (Reference) El.=12.68', Mudline El.=-17.1'

I-10 MOBILE RIVER - TP-111B ID 54" CYL, 6" WALL
OP: AFT Date: 17-May-2018

AR: 904.78 in² SP: 0.150 k/ft³
LE: 119.00 ft EM: 7,778.33 ksi
WS: 15,500.0 f/s JC: 0.60

RX6: Maximum Case Method Capacity (JC=0.6)
RX7: Maximum Case Method Capacity (JC=0.7)
RA2: Auto Capacity Friction Piles
CSX: Compression Stress Maximum
CSB: Compression Stress at Bottom of Pile
TSX: Tension Stress Maximum - Full Record Search
EMX: Maximum Energy
STK: Hammer Stroke
BTA: Integrity Factor (1)

BL#	Depth ft	BLC bl/ft	TYPE	RX6 kips	RX7 kips	RA2 kips	CSX ksi	CSB ksi	TSX ksi	EMX k-ft	STK ft	BTA (%)
3	51.00	3	AV3	0	0	74	1.06	0.18	0.11	45.0	**	84
			STD	0	0	62	0.18	0.05	0.04	16.4	**	4
			MAX	0	0	152	1.29	0.25	0.16	67.3	**	89
			MIN	0	0	0	0.85	0.11	0.07	28.1	**	79
6	52.00	3	AV3	0	0	156	1.66	0.25	0.54	70.5	6.37	97
			STD	0	0	60	0.05	0.02	0.24	13.9	0.76	5
			MAX	0	0	221	1.73	0.27	0.75	88.4	7.39	100
			MIN	0	0	76	1.61	0.23	0.21	54.6	5.54	90
8	53.00	2	AV2	0	0	0	1.18	0.12	0.48	43.5	4.67	88
			STD	0	0	0	0.22	0.02	0.16	9.1	0.34	13
			MAX	0	0	0	1.39	0.15	0.64	52.6	5.01	100
			MIN	0	0	0	0.96	0.10	0.33	34.4	4.33	75
11	54.00	3	AV3	0	0	225	2.25	0.39	0.89	112.1	8.37	97
			STD	0	0	115	0.27	0.03	0.37	17.2	0.47	5
			MAX	0	0	348	2.51	0.42	1.32	134.4	8.84	100
			MIN	0	0	71	1.88	0.35	0.42	92.7	7.91	90
16	55.00	5	AV5	48	25	222	1.83	0.37	0.85	58.0	5.71	86
			STD	41	34	13	0.14	0.01	0.12	6.6	0.29	1
			MAX	117	87	242	2.09	0.38	1.06	70.4	6.25	88
			MIN	4	0	208	1.69	0.36	0.74	52.4	5.47	84
24	56.00	8	AV8	335	328	366	2.30	0.48	1.14	75.1	6.53	90
			STD	53	58	59	0.16	0.03	0.12	7.7	0.33	4
			MAX	400	399	466	2.45	0.52	1.25	83.2	6.85	100
			MIN	234	217	286	2.03	0.42	0.93	61.3	5.96	88
32	57.00	8	AV8	402	394	452	2.18	0.57	0.97	66.7	6.16	92
			STD	28	24	46	0.11	0.03	0.07	4.6	0.19	4
			MAX	445	430	508	2.34	0.63	1.07	74.6	6.45	100
			MIN	348	344	369	1.97	0.51	0.84	58.0	5.80	89
41	58.00	9	AV9	463	457	371	2.12	0.64	0.85	62.1	6.08	97
			STD	33	32	25	0.25	0.03	0.21	12.9	0.47	5
			MAX	505	497	395	2.40	0.69	1.09	76.2	6.63	100
			MIN	409	402	332	1.74	0.59	0.52	44.0	5.38	90
58	59.00	17	AV17	493	493	393	1.95	0.70	0.66	49.7	5.72	100
			STD	15	14	8	0.05	0.03	0.04	2.3	0.10	0
			MAX	511	510	408	2.04	0.74	0.72	53.6	5.88	100
			MIN	462	462	372	1.86	0.65	0.59	45.5	5.56	100

I-10 MOBILE RIVER - TP-111B ID 54" CYL, 6" WALL
OP: AFT Date: 17-May-2018

BL#	Depth ft	BLC bl/ft	TYPE	RX6 kips	RX7 kips	RA2 kips	CSX ksi	CSB ksi	TSX ksi	EMX k-ft	STK ft	BTA (%)
76	60.00	18	AV18	509	505	401	1.99	0.78	0.61	50.0	5.80	100
			STD	8	7	16	0.05	0.03	0.04	2.2	0.09	0
			MAX	531	524	437	2.09	0.84	0.68	54.4	5.98	100
			MIN	498	496	374	1.88	0.73	0.54	46.0	5.61	100
102	61.00	26	AV26	572	564	446	2.06	0.88	0.57	52.4	5.93	100
			STD	23	18	23	0.06	0.03	0.04	2.5	0.12	0
			MAX	614	596	507	2.17	0.93	0.66	56.7	6.14	100
			MIN	536	532	401	1.94	0.82	0.47	47.4	5.71	100
125	62.00	23	AV23	646	619	509	2.12	0.95	0.54	54.3	6.06	100
			STD	16	16	29	0.06	0.02	0.06	2.9	0.13	0
			MAX	668	643	564	2.29	1.00	0.71	62.3	6.45	100
			MIN	611	584	472	1.99	0.91	0.39	48.3	5.80	100
150	63.00	25	AV25	703	677	563	2.15	1.01	0.50	55.2	6.12	100
			STD	16	16	24	0.08	0.02	0.09	3.4	0.16	0
			MAX	731	706	599	2.29	1.04	0.66	62.1	6.42	100
			MIN	678	652	517	1.99	0.96	0.35	48.9	5.80	100
182	64.00	32	AV32	755	731	602	2.15	1.06	0.45	54.5	6.15	100
			STD	14	14	15	0.08	0.03	0.09	3.6	0.18	0
			MAX	784	761	632	2.33	1.12	0.60	62.4	6.51	100
			MIN	737	710	576	1.98	1.01	0.27	48.0	5.83	100
208	65.00	26	AV26	802	779	623	2.22	1.12	0.44	58.6	6.31	100
			STD	27	27	14	0.13	0.04	0.08	7.5	0.33	0
			MAX	885	862	653	2.67	1.25	0.66	84.1	7.49	100
			MIN	772	750	595	2.06	1.08	0.31	51.0	5.96	100
231	66.00	23	AV23	869	841	619	2.67	1.26	0.66	81.3	7.25	100
			STD	8	10	13	0.07	0.02	0.06	3.9	0.16	0
			MAX	891	867	642	2.81	1.31	0.80	90.1	7.64	100
			MIN	855	829	589	2.53	1.23	0.55	72.3	6.91	100
257	67.00	26	AV26	899	873	640	2.69	1.29	0.66	80.4	7.20	100
			STD	17	18	21	0.12	0.03	0.10	6.1	0.30	0
			MAX	944	923	673	2.94	1.36	0.87	94.2	7.83	100
			MIN	872	847	600	2.48	1.24	0.44	67.5	6.60	100
279	68.00	22	AV22	933	910	642	2.65	1.33	0.56	79.9	7.19	100
			STD	49	44	20	0.35	0.09	0.21	17.8	0.79	0
			MAX	989	965	678	3.05	1.45	0.78	101.6	8.11	100
			MIN	810	801	606	1.94	1.17	0.20	45.5	5.71	100
309	69.00	30	AV30	980	957	697	2.64	1.38	0.51	78.7	7.16	100
			STD	57	52	23	0.30	0.08	0.19	15.1	0.67	0
			MAX	1,034	1,009	749	3.03	1.48	0.81	98.9	8.11	100
			MIN	799	789	657	1.97	1.21	0.19	45.5	5.83	100
338	70.00	29	AV29	1,015	995	749	2.65	1.42	0.48	78.7	7.18	100
			STD	54	49	27	0.26	0.06	0.18	12.9	0.59	0
			MAX	1,066	1,046	812	2.96	1.51	0.71	95.4	7.99	100

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OP: AFT Date: 17-May-2018

BL#	Depth	BLC	TYPE	RX6	RX7	RA2	CSX	CSB	TSX	EMX	STK	BTA
	ft	bl/ft		kips	kips	kips	ksi	ksi	ksi	k-ft	ft	(%)
			MIN	861	855	696	2.12	1.29	0.18	52.8	6.04	100
374	71.00	36	AV36	1,026	1,007	777	2.58	1.44	0.41	75.2	7.08	100
			STD	89	82	26	0.31	0.09	0.18	15.6	0.69	0
			MAX	1,134	1,105	826	3.00	1.58	0.71	98.2	8.03	100
			MIN	826	818	734	2.00	1.29	0.18	46.8	5.86	100
407	72.00	33	AV33	1,065	1,045	810	2.66	1.51	0.40	79.8	7.26	100
			STD	78	73	16	0.26	0.07	0.16	13.1	0.58	0
			MAX	1,143	1,119	846	3.01	1.59	0.63	98.5	8.03	100
			MIN	870	864	774	2.14	1.38	0.17	54.2	6.17	100
442	73.00	35	AV35	1,119	1,098	840	2.72	1.56	0.35	82.4	7.37	100
			STD	31	30	11	0.10	0.03	0.07	4.9	0.22	0
			MAX	1,155	1,134	866	2.91	1.62	0.52	93.1	7.91	100
			MIN	994	980	822	2.40	1.46	0.17	66.0	6.66	100
474	74.00	32	AV32	1,126	1,104	854	2.75	1.61	0.35	84.2	7.44	100
			STD	47	43	13	0.14	0.04	0.09	7.5	0.34	0
			MAX	1,202	1,177	884	2.98	1.68	0.51	96.8	7.99	100
			MIN	983	972	832	2.43	1.53	0.17	66.5	6.66	100
509	75.00	35	AV35	1,137	1,113	865	2.77	1.64	0.33	84.6	7.45	100
			STD	17	15	14	0.05	0.02	0.03	2.6	0.10	0
			MAX	1,174	1,146	888	2.91	1.69	0.43	91.7	7.83	100
			MIN	1,103	1,082	836	2.66	1.61	0.25	79.9	7.25	100
542	76.00	33	AV33	1,125	1,103	868	2.77	1.67	0.32	84.1	7.44	100
			STD	20	18	14	0.05	0.02	0.04	2.8	0.12	0
			MAX	1,175	1,149	897	2.92	1.72	0.41	92.1	7.72	100
			MIN	1,074	1,056	838	2.64	1.64	0.21	78.0	7.18	100
578	77.00	36	AV36	1,138	1,119	900	2.83	1.74	0.36	86.2	7.54	100
			STD	49	44	11	0.13	0.04	0.11	6.9	0.31	0
			MAX	1,222	1,195	920	3.08	1.81	0.58	101.0	8.15	100
			MIN	958	958	878	2.40	1.60	0.15	64.5	6.60	100
618	78.00	40	AV40	1,140	1,117	904	2.84	1.76	0.34	86.4	7.56	100
			STD	17	16	13	0.05	0.02	0.05	3.1	0.18	0
			MAX	1,187	1,164	935	3.01	1.81	0.52	96.6	8.03	100
			MIN	1,110	1,089	882	2.72	1.71	0.26	80.7	7.25	100
657	79.00	39	AV39	1,118	1,099	894	2.79	1.77	0.38	85.6	7.51	100
			STD	66	57	19	0.16	0.04	0.13	8.5	0.35	0
			MAX	1,216	1,188	925	3.07	1.86	0.64	100.0	8.15	100
			MIN	984	976	844	2.47	1.68	0.13	68.4	6.76	100
694	80.00	37	AV37	1,103	1,083	880	2.77	1.77	0.39	83.7	7.40	100
			STD	88	78	21	0.23	0.06	0.17	11.3	0.47	0
			MAX	1,227	1,195	916	3.15	1.87	0.70	102.5	8.23	100
			MIN	935	934	838	2.37	1.64	0.13	62.6	6.57	100
734	81.00	40	AV40	1,151	1,124	882	2.87	1.82	0.42	87.8	7.51	100

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OP: AFT Date: 17-May-2018

BL#	Depth	BLC	TYPE	RX6	RX7	RA2	CSX	CSB	TSX	EMX	STK	BTA
	ft	bl/ft		kips	kips	kips	ksi	ksi	ksi	k-ft	ft	(%)
			STD	59	53	14	0.15	0.04	0.11	7.2	0.29	0
			MAX	1,251	1,215	926	3.14	1.89	0.70	100.7	8.03	100
			MIN	945	943	841	2.39	1.67	0.16	64.7	6.60	100
771	82.00	37	AV37	1,159	1,131	844	2.99	1.80	0.50	88.6	7.54	100
			STD	23	21	23	0.06	0.02	0.06	2.7	0.12	0
			MAX	1,227	1,193	884	3.17	1.84	0.67	97.5	7.87	100
			MIN	1,106	1,082	805	2.84	1.76	0.37	82.8	7.28	100
806	83.00	35	AV35	1,155	1,128	833	3.00	1.82	0.45	88.1	7.55	100
			STD	41	38	13	0.07	0.03	0.05	3.3	0.13	0
			MAX	1,262	1,224	852	3.19	1.87	0.57	97.5	7.83	100
			MIN	1,082	1,058	797	2.85	1.76	0.33	81.7	7.32	100
846	84.00	40	AV40	1,161	1,134	832	3.11	1.89	0.47	91.3	7.65	100
			STD	23	22	14	0.07	0.04	0.04	2.4	0.12	0
			MAX	1,207	1,179	866	3.23	1.94	0.56	95.4	7.83	100
			MIN	1,110	1,084	800	2.98	1.78	0.39	86.3	7.42	100
886	85.00	40	AV40	1,097	1,074	810	3.09	1.91	0.43	85.9	7.45	100
			STD	38	35	16	0.09	0.04	0.05	4.7	0.18	0
			MAX	1,183	1,154	838	3.27	1.97	0.56	95.6	7.79	100
			MIN	1,033	1,015	769	2.91	1.84	0.32	78.8	7.11	100
923	86.00	37	AV37	1,152	1,126	827	3.20	1.97	0.43	92.5	7.72	100
			STD	46	43	26	0.10	0.04	0.07	5.3	0.17	0
			MAX	1,228	1,192	883	3.41	2.05	0.59	101.9	7.99	100
			MIN	1,064	1,044	782	2.95	1.91	0.22	81.1	7.35	100
964	87.00	41	AV41	1,151	1,128	845	3.33	2.05	0.47	95.2	7.77	100
			STD	24	22	18	0.08	0.03	0.07	3.5	0.14	0
			MAX	1,203	1,174	873	3.55	2.15	0.59	105.0	8.11	100
			MIN	1,106	1,085	803	3.22	1.99	0.36	88.9	7.49	100
1002	88.00	38	AV38	1,154	1,130	864	3.44	2.12	0.48	98.2	7.84	100
			STD	24	21	17	0.09	0.03	0.07	4.1	0.16	0
			MAX	1,194	1,167	898	3.59	2.18	0.65	105.7	8.15	100
			MIN	1,090	1,074	826	3.15	2.01	0.25	86.6	7.39	100
1044	89.00	42	AV42	1,136	1,109	920	3.46	2.13	0.51	97.6	7.86	100
			STD	27	28	26	0.07	0.03	0.06	3.7	0.12	0
			MAX	1,199	1,170	983	3.58	2.18	0.63	105.0	8.07	100
			MIN	1,066	1,038	866	3.30	2.06	0.39	90.2	7.60	100
1075	90.00	31	AV31	1,084	1,057	977	3.44	1.97	0.68	96.4	7.85	100
			STD	36	41	18	0.15	0.07	0.13	6.4	0.23	0
			MAX	1,156	1,135	1,009	3.64	2.12	0.88	105.1	8.23	100
			MIN	1,006	983	929	3.16	1.85	0.45	83.0	7.39	100
1114	91.00	39	AV39	1,137	1,059	1,048	3.46	2.04	0.58	97.6	7.90	100
			STD	37	34	28	0.11	0.06	0.10	4.5	0.16	0
			MAX	1,203	1,120	1,108	3.65	2.14	0.80	105.7	8.23	100
			MIN	1,075	1,003	996	3.21	1.89	0.42	85.6	7.53	100

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BL#	Depth ft	BLC bl/ft	TYPE	RX6 kips	RX7 kips	RA2 kips	CSX ksi	CSB ksi	TSX ksi	EMX k-ft	STK ft	BTA (%)
1151	92.00	37	AV37	1,193	1,105	1,070	3.47	2.10	0.54	97.7	7.94	100
			STD	14	16	29	0.16	0.05	0.12	6.5	0.24	0
			MAX	1,218	1,136	1,139	3.69	2.18	0.74	106.4	8.27	100
			MIN	1,163	1,075	991	2.80	1.93	0.14	69.0	6.88	100
1190	93.00	39	AV39	1,205	1,121	1,087	3.39	2.08	0.46	96.9	7.94	100
			STD	16	17	51	0.28	0.05	0.21	13.0	0.50	0
			MAX	1,230	1,149	1,187	3.77	2.16	0.74	117.7	8.89	100
			MIN	1,159	1,072	990	2.73	1.91	0.13	67.2	6.85	100
1229	94.00	39	AV39	1,206	1,121	1,077	3.37	2.09	0.46	96.8	7.94	100
			STD	23	23	63	0.38	0.07	0.28	17.6	0.68	0
			MAX	1,248	1,166	1,201	3.93	2.18	0.89	122.7	8.98	100
			MIN	1,164	1,081	962	2.64	1.91	0.13	62.8	6.69	100
1267	95.00	38	AV38	1,127	1,061	1,064	3.34	2.05	0.52	94.8	7.89	100
			STD	32	32	62	0.38	0.07	0.30	16.1	0.59	0
			MAX	1,199	1,125	1,167	3.84	2.16	0.91	117.1	8.75	100
			MIN	1,056	1,003	951	2.74	1.90	0.13	69.3	6.95	100
1311	96.00	44	AV44	1,151	1,087	1,113	2.97	1.99	0.43	85.7	7.68	100
			STD	99	98	113	0.61	0.14	0.33	19.7	0.61	0
			MAX	1,486	1,423	1,416	3.84	2.16	0.99	117.2	8.79	100
			MIN	1,007	854	869	1.25	1.28	0.17	31.0	7.01	100
1353	97.00	42	AV42	1,042	957	1,043	3.07	2.13	0.21	92.8	7.52	100
			STD	30	26	24	0.07	0.02	0.02	4.1	0.15	0
			MAX	1,108	1,020	1,088	3.22	2.18	0.27	102.4	7.87	100
			MIN	981	911	997	2.94	2.09	0.19	85.8	7.32	100
1395	98.00	42	AV42	942	926	970	3.13	2.17	0.21	94.7	7.57	100
			STD	23	17	23	0.05	0.03	0.01	3.2	0.13	0
			MAX	987	960	1,016	3.24	2.21	0.25	101.6	7.87	100
			MIN	888	880	927	3.04	2.10	0.19	88.8	7.32	100
1438	99.00	43	AV43	910	908	897	3.12	2.19	0.20	95.2	7.67	100
			STD	17	17	22	0.05	0.02	0.01	3.1	0.11	0
			MAX	948	943	952	3.25	2.24	0.22	103.4	7.99	100
			MIN	884	880	859	3.04	2.15	0.17	90.0	7.46	100
1476	100.00	38	AV38	866	863	895	3.13	2.21	0.18	95.8	7.77	100
			STD	19	18	12	0.03	0.01	0.01	2.0	0.07	0
			MAX	901	895	919	3.20	2.24	0.20	100.7	7.95	100
			MIN	833	833	860	3.07	2.19	0.16	92.7	7.64	100
1518	101.00	42	AV42	901	833	877	3.08	2.19	0.16	93.0	7.72	100
			STD	53	26	18	0.05	0.02	0.01	3.1	0.11	0
			MAX	1,025	872	911	3.15	2.22	0.18	97.8	7.91	100
			MIN	844	765	838	2.95	2.13	0.14	84.6	7.42	100
1562	102.00	44	AV44	1,224	996	881	2.99	2.31	0.18	88.8	7.67	100
			STD	116	132	32	0.18	0.12	0.05	11.3	0.47	0

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BL#	Depth	BLC	TYPE	RX6	RX7	RA2	CSX	CSB	TSX	EMX	STK	BTA
	ft	bl/ft		kips	kips	kips	ksi	ksi	ksi	k-ft	ft	(%)
			MAX	1,427	1,251	954	3.38	2.62	0.33	113.7	8.79	100
			MIN	1,024	792	842	2.44	2.04	0.14	57.6	6.51	100
1609	103.00	47	AV47	1,446	1,235	945	2.96	2.41	0.20	88.1	7.71	100
			STD	33	58	42	0.33	0.21	0.06	19.5	0.80	0
			MAX	1,501	1,320	1,009	3.41	2.72	0.32	116.0	8.84	100
			MIN	1,314	1,047	836	2.24	1.97	0.14	49.8	6.17	100
1662	104.00	53	AV53	1,574	1,373	915	2.93	2.42	0.17	85.8	7.64	100
			STD	42	42	32	0.23	0.16	0.03	13.4	0.55	0
			MAX	1,672	1,455	996	3.34	2.64	0.29	109.9	8.66	100
			MIN	1,451	1,281	842	2.33	2.00	0.13	53.2	6.31	100
1698	105.00	36	AV36	1,692	1,472	913	3.15	2.57	0.26	99.9	8.32	100
			STD	28	18	19	0.16	0.10	0.05	9.7	0.42	0
			MAX	1,725	1,502	952	3.32	2.69	0.35	111.8	8.84	100
			MIN	1,585	1,432	864	2.47	2.15	0.14	62.5	6.72	100
1735	106.00	37	AV37	1,582	1,346	958	3.25	2.55	0.26	105.3	8.58	100
			STD	70	74	17	0.08	0.06	0.04	5.1	0.21	0
			MAX	1,722	1,478	992	3.42	2.69	0.35	115.7	9.03	100
			MIN	1,459	1,204	922	3.10	2.45	0.20	96.2	8.23	100
1787	107.00	52	AV52	1,412	1,179	1,014	3.10	2.36	0.23	97.8	8.50	100
			STD	57	61	18	0.10	0.08	0.03	5.7	0.25	0
			MAX	1,523	1,297	1,057	3.30	2.50	0.29	108.5	9.12	100
			MIN	1,322	1,068	959	2.84	2.20	0.18	81.2	7.87	100
1830	108.00	43	AV43	1,357	1,115	979	3.10	2.30	0.26	98.1	8.60	100
			STD	27	38	27	0.14	0.07	0.05	6.7	0.25	0
			MAX	1,414	1,191	1,021	3.49	2.49	0.39	115.8	9.17	100
			MIN	1,297	1,044	915	2.86	2.16	0.19	84.0	8.07	100
1874	109.00	44	AV44	1,281	1,014	941	3.33	2.32	0.27	104.6	8.61	100
			STD	35	31	28	0.08	0.04	0.06	4.4	0.16	0
			MAX	1,349	1,097	991	3.52	2.42	0.38	115.2	9.03	100
			MIN	1,208	966	883	3.17	2.24	0.18	94.5	8.23	100
1907	110.00	33	AV33	1,359	1,082	936	3.39	2.35	0.21	105.8	8.66	100
			STD	49	57	27	0.08	0.04	0.04	4.0	0.15	0
			MAX	1,454	1,196	975	3.53	2.41	0.30	117.1	8.98	100
			MIN	1,281	985	890	3.24	2.29	0.16	97.8	8.36	100
1946	111.00	39	AV39	1,462	1,184	927	3.46	2.36	0.22	105.8	8.60	100
			STD	36	42	21	0.09	0.04	0.05	4.6	0.19	0
			MAX	1,553	1,299	973	3.69	2.45	0.36	118.7	9.12	100
			MIN	1,379	1,074	886	3.31	2.28	0.14	97.6	8.27	100
1992	112.00	46	AV46	1,550	1,269	924	3.55	2.38	0.27	106.3	8.62	100
			STD	25	29	19	0.08	0.04	0.05	4.0	0.16	0
			MAX	1,600	1,333	969	3.79	2.48	0.36	118.0	9.07	100
			MIN	1,487	1,203	872	3.40	2.29	0.16	99.0	8.31	100

I-10 MOBILE RIVER - TP-111B ID 54" CYL, 6" WALL
OP: AFT Date: 17-May-2018

BL#	Depth	BLC	TYPE	RX6	RX7	RA2	CSX	CSB	TSX	EMX	STK	BTA
	ft	bl/ft		kips	kips	kips	ksi	ksi	ksi	k-ft	ft	(%)
2043	113.00	51	AV51	1,601	1,318	903	3.61	2.39	0.36	105.3	8.62	100
			STD	17	21	28	0.10	0.05	0.06	4.1	0.16	0
			MAX	1,642	1,358	961	3.83	2.51	0.50	114.6	8.98	100
			MIN	1,570	1,274	834	3.39	2.29	0.24	97.1	8.31	100
2084	114.00	41	AV41	1,591	1,300	884	3.67	2.39	0.43	106.5	8.66	100
			STD	18	22	31	0.08	0.05	0.06	4.4	0.17	0
			MAX	1,623	1,336	936	3.90	2.50	0.58	118.9	9.07	100
			MIN	1,555	1,254	793	3.51	2.29	0.32	99.2	8.36	100
2124	115.00	40	AV40	1,580	1,283	900	3.71	2.35	0.47	107.7	8.75	100
			STD	20	21	35	0.07	0.05	0.05	3.7	0.13	0
			MAX	1,616	1,324	958	3.92	2.46	0.61	117.9	9.17	100
			MIN	1,549	1,253	749	3.56	2.24	0.38	97.7	8.53	100
2179	116.51	36	AV55	2,086	1,803	798	3.86	2.59	0.69	129.2	8.70	100
			STD	358	366	151	0.27	0.23	0.21	16.6	0.51	0
			MAX	2,937	2,674	1,221	4.37	2.84	1.02	162.4	9.94	100
			MIN	1,542	1,233	451	2.61	1.45	0.22	58.8	7.35	100
2257	117.51	78	AV78	1,424	1,201	594	2.96	1.96	0.81	78.5	6.84	100
			STD	125	86	34	0.42	0.26	0.17	20.7	0.70	0
			MAX	1,628	1,359	666	3.54	2.37	1.18	107.7	7.87	100
			MIN	1,218	1,064	511	2.24	1.50	0.52	45.5	5.75	100
2365	118.51	108	AV108	1,642	1,438	750	2.91	1.93	0.67	74.6	6.65	100
			STD	187	152	74	0.46	0.28	0.21	22.1	0.79	0
			MAX	2,396	2,068	1,324	4.44	2.78	1.29	157.6	9.57	100
			MIN	1,252	1,133	410	1.94	1.32	0.17	34.3	5.22	100
2461	119.51	96	AV96	1,593	1,393	938	3.06	1.85	0.57	90.4	7.34	100
			STD	151	117	103	0.38	0.25	0.23	20.3	0.74	0
			MAX	1,941	1,654	1,055	3.90	2.44	1.49	140.0	9.07	100
			MIN	1,249	1,087	471	1.99	1.24	0.19	35.7	5.27	100
2534	120.51	73	AV73	1,484	1,286	1,035	3.04	1.78	0.48	91.9	7.49	100
			STD	78	54	32	0.28	0.17	0.17	16.9	0.62	0
			MAX	1,691	1,463	1,110	3.60	2.13	0.87	129.7	8.98	100
			MIN	1,348	1,176	982	2.52	1.48	0.20	62.2	6.42	100
2619	121.51	85	AV85	1,535	1,317	1,176	3.25	1.89	0.48	106.3	8.09	100
			STD	99	73	68	0.32	0.19	0.15	20.4	0.72	0
			MAX	1,735	1,460	1,308	3.87	2.28	0.81	147.2	9.47	100
			MIN	1,353	1,184	1,065	2.61	1.52	0.19	66.9	6.66	100
2696	122.51	77	AV77	1,606	1,355	1,350	3.59	2.10	0.46	131.7	9.05	100
			STD	58	44	46	0.20	0.15	0.12	13.5	1.29	0
			MAX	1,723	1,444	1,420	3.91	2.37	0.68	153.9	10.00	100
			MIN	1,473	1,240	1,244	3.02	1.72	0.20	93.9	1.48	100
2800	123.51	104	AV104	1,596	1,335	1,386	3.64	2.18	0.44	138.0	9.55	100
			STD	52	44	24	0.10	0.08	0.07	6.2	0.20	0
			MAX	1,712	1,434	1,435	3.85	2.33	0.61	151.0	10.16	100

I-10 MOBILE RIVER - TP-111B ID 54" CYL, 6" WALL
OP: AFT Date: 17-May-2018

BL#	Depth ft	BLC bl/ft	TYPE	RX6 kips	RX7 kips	RA2 kips	CSX ksi	CSB ksi	TSX ksi	EMX k-ft	STK ft	BTA (%)
			MIN	1,466	1,242	1,329	3.45	2.00	0.35	122.8	9.07	100
2918	124.51	118	AV118	1,535	1,308	1,300	3.56	2.11	0.50	133.1	9.46	100
			STD	46	25	48	0.11	0.09	0.08	6.3	0.18	0
			MAX	1,618	1,359	1,385	3.79	2.30	0.68	146.3	9.89	100
			MIN	1,426	1,244	1,190	3.32	1.86	0.36	115.5	8.89	100
3051	125.51	133	AV133	1,499	1,323	1,165	3.50	2.01	0.62	126.5	9.26	100
			STD	46	38	35	0.09	0.10	0.07	6.3	0.16	0
			MAX	1,604	1,413	1,259	3.68	2.22	0.74	138.6	9.57	100
			MIN	1,384	1,243	1,079	3.21	1.77	0.42	106.5	8.66	100
3179	126.51	128	AV128	1,448	1,348	1,125	3.42	1.96	0.61	122.9	9.23	100
			STD	42	34	23	0.10	0.09	0.09	6.6	0.18	0
			MAX	1,553	1,431	1,188	3.65	2.16	0.78	138.4	9.67	100
			MIN	1,362	1,261	1,063	3.20	1.78	0.40	108.5	8.79	100
3301	127.51	122	AV122	1,426	1,299	1,098	3.31	1.93	0.53	118.7	9.26	100
			STD	38	31	48	0.10	0.09	0.14	7.5	0.18	0
			MAX	1,514	1,369	1,181	3.50	2.08	0.77	132.6	9.67	100
			MIN	1,344	1,214	991	3.08	1.73	0.30	101.9	8.57	100
3422	128.51	121	AV121	1,371	1,318	967	3.18	1.84	0.58	112.4	9.16	100
			STD	59	74	76	0.19	0.13	0.14	12.3	0.50	0
			MAX	1,462	1,451	1,109	3.46	2.03	0.98	135.6	10.11	100
			MIN	925	852	547	1.50	0.84	0.20	21.6	5.20	100
			Average	1,294	1,165	942	3.13	1.94	0.46	98.1	8.01	100
			Std. Dev.	314	243	216	0.45	0.41	0.20	22.9	1.04	1
			Maximum	2,937	2,674	1,435	4.44	2.84	1.49	162.4	10.16	100
			Minimum	0	0	0	0.85	0.10	0.07	21.6	1.48	75

Total number of blows analyzed: 3422

BL#	Sensors
1-2126	F1: [E655] 92.7 (1.00); F2: [J762] 93.9 (1.00); F3: [P454] 145.3 (1.00); F4: [P455] 145.8 (1.00); A1: [59379] 925.0 (1.00); A2: [59462] 1055.0 (1.00); A3: [K5647] 334.0 (1.00); A4: [K5943] 368.0 (1.00)
2127-3422	F1: [H829] 92.2 (1.00); F2: [J762] 93.9 (1.00); F3: [P454] 145.3 (1.00); F4: [P455] 145.8 (1.00); A1: [59379] 925.0 (1.00); A2: [59462] 1055.0 (1.00); A3: [K5647] 334.0 (1.00); A4: [K5943] 368.0 (1.00)

BL#	Comments
1	Template (Reference) El.=12.68', Mudline El.=-17.1'
1293	CHANGE CUSHION
2126	Stop to remove template
2127	New Reference El.=12.17' (Note: Depths below reference in this summary are still based on original Reference El.=12.68')
2385	ADD CUSHION 6" USED PLYWOOD

Time Summary

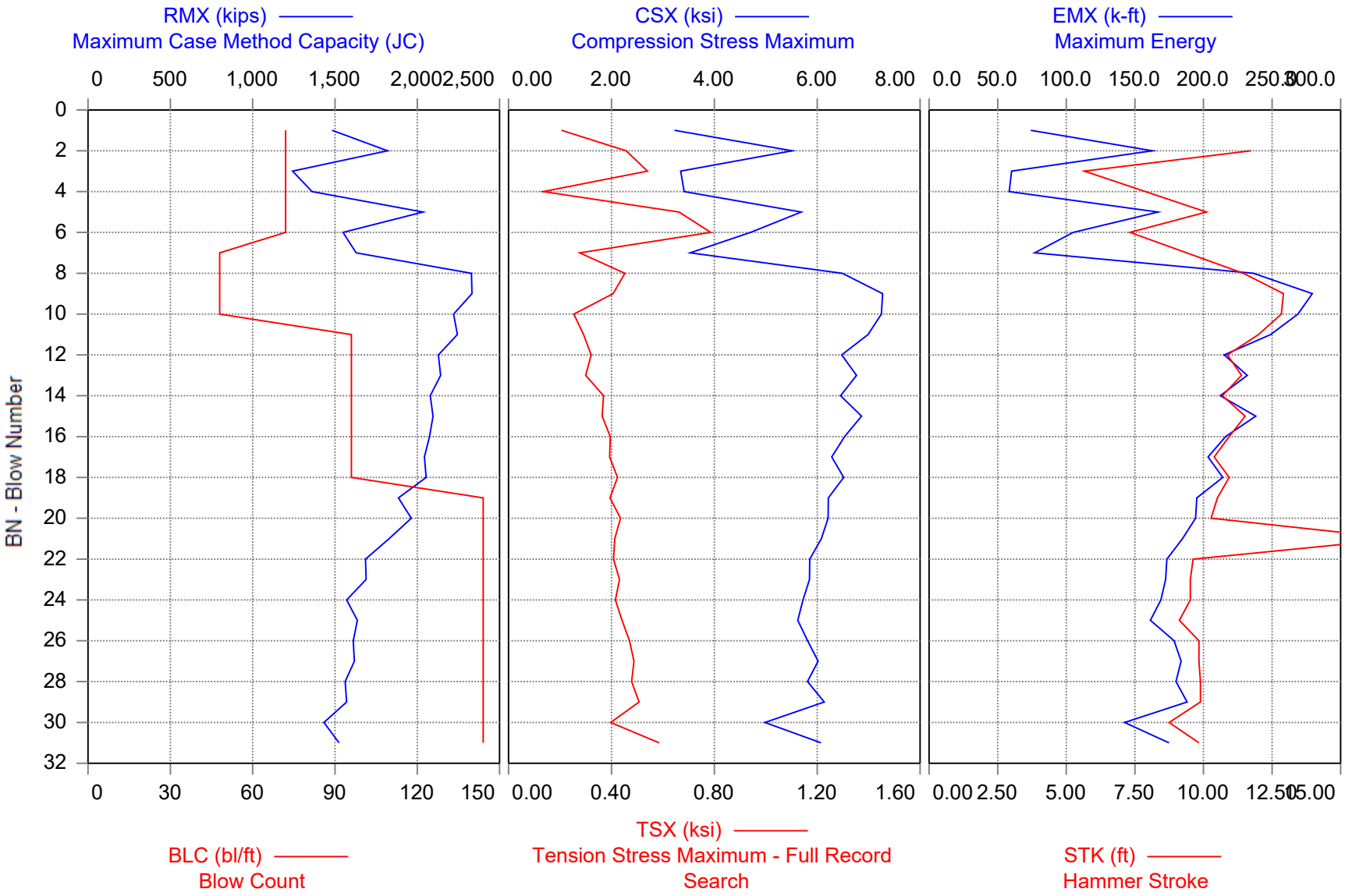
Drive	33 minutes 26 seconds	8:23 AM - 8:56 AM (5/17/2018) BN 1 - 1293
Stop	16 minutes 53 seconds	8:56 AM - 9:13 AM
Drive	20 minutes 5 seconds	9:13 AM - 9:33 AM BN 1294 - 2126
Stop	4 hours 36 minutes 41 seconds	9:33 AM - 2:10 PM
Drive	3 minutes 5 seconds	2:10 PM - 2:13 PM BN 2127 - 2260
Stop	1 hours 3 seconds	2:13 PM - 3:13 PM
Drive	2 minutes 43 seconds	3:13 PM - 3:16 PM BN 2261 - 2385
Stop	17 minutes 20 seconds	3:16 PM - 3:33 PM
Drive	26 minutes 5 seconds	3:33 PM - 3:59 PM BN 2386 - 3422

Total time [07:36:25] = (Driving [01:25:26] + Stop [06:10:59])

Applied Foundation Testing, Inc. - PDIPLOT2 Ver 2017.2.58.3 - Case Method & iCAP® Results

Printed: 08-June-2018 Test started: 18-May-2018

I-10 MOBILE RIVER - TP-111B 1 DAY RS



Search

I-10 MOBILE RIVER - TP-111B 1 DAY RS 54" CYL, 6" WALL
OP: AFT Date: 18-May-2018

AR: 904.78 in² SP: 0.150 k/ft³
LE: 119.00 ft EM: 7,778.33 ksi
WS: 15,500.0 f/s JC: 0.92

RMX: Maximum Case Method Capacity (JC)
RX10: Maximum Case Method Capacity (JC=1.0)
RA2: Auto Capacity Friction Piles
CSX: Compression Stress Maximum
CSB: Compression Stress at Bottom of Pile
TSX: Tension Stress Maximum - Full Record Search
EMX: Maximum Energy
STK: Hammer Stroke
BTA: Integrity Factor (1)

BL#	BLC	RMX	RX10	RA2	CSX	CSB	TSX	EMX	STK	BTA
	bl/ft	kips	kips	kips	ksi	ksi	ksi	k-ft	ft	(%)
1	72	1,483	1,324	1,693	3.23	1.83	0.21	74.1	0.00	100
2	72	1,819	1,501	936	5.51	4.36	0.46	162.8	11.72	100
3	72	1,242	1,056	751	3.34	2.61	0.54	60.1	5.66	100
4	72	1,361	1,178	914	3.41	2.75	0.13	58.3	0.00	100
5	72	2,035	1,712	968	5.69	4.29	0.66	166.8	10.11	100
6	72	1,549	1,275	710	4.70	3.82	0.79	105.1	7.32	100
7	48	1,628	1,449	1,353	3.53	2.50	0.28	76.9	0.00	100
8	48	2,329	1,959	1,680	6.49	4.58	0.45	236.4	11.45	100
9	48	2,332	1,905	1,477	7.27	5.18	0.41	279.3	12.91	100
10	48	2,220	1,791	1,415	7.25	5.14	0.25	268.9	12.84	100
11	96	2,243	1,835	1,312	6.99	5.02	0.29	248.9	12.01	100
12	96	2,128	1,753	1,382	6.47	4.58	0.32	215.1	10.87	100
13	96	2,142	1,745	1,321	6.77	4.75	0.30	231.9	11.39	100
14	96	2,079	1,703	1,380	6.45	4.53	0.37	212.2	10.69	100
15	96	2,095	1,688	1,374	6.86	4.80	0.36	238.1	11.52	100
16	96	2,075	1,693	1,321	6.53	4.63	0.40	216.0	10.93	100
17	96	2,043	1,676	1,351	6.28	4.49	0.39	203.3	10.39	100
18	96	2,054	1,673	1,164	6.51	4.62	0.42	214.1	10.93	100
19	144	1,886	1,517	1,189	6.21	4.33	0.39	195.1	10.51	100
20	144	1,963	1,602	1,258	6.21	4.43	0.44	194.2	10.28	100
21	144	1,829	1,477	1,167	6.08	4.34	0.41	184.6	17.16	100
22	144	1,685	1,455	1,191	5.85	4.15	0.41	173.3	9.62	100
23	144	1,689	1,508	1,186	5.85	4.12	0.43	172.4	9.52	100
24	144	1,571	1,485	1,152	5.72	4.02	0.42	169.0	9.52	100
25	144	1,636	1,546	1,277	5.62	3.94	0.44	161.3	9.12	100
26	144	1,611	1,575	1,205	5.81	4.04	0.47	178.6	9.83	100
27	144	1,618	1,618	1,219	6.02	4.21	0.49	183.7	9.83	100
28	144	1,562	1,562	1,303	5.81	4.12	0.48	179.9	9.89	100
29	144	1,570	1,570	1,057	6.14	4.22	0.51	188.0	9.89	100
30	144	1,433	1,417	1,230	4.98	3.55	0.40	142.4	8.75	100
31	144	1,525	1,312	863	6.07	4.34	0.59	174.8	9.83	100
Average		1,820	1,566	1,219	5.80	4.14	0.42	179.5	10.52	100
Std. Dev.		300	201	226	1.09	0.76	0.12	55.8	1.95	0
Maximum		2,332	1,959	1,693	7.27	5.18	0.79	279.3	17.16	100
Minimum		1,242	1,056	710	3.23	1.83	0.13	58.3	5.66	100

Total number of blows analyzed: 31

BL# Sensors

1-31 F1: [H829] 92.2 (1.00); F2: [J762] 93.9 (1.00); F3: [P454] 145.3 (1.00); F4: [P455] 145.8 (1.00);
A1: [59379] 925.0 (1.00); A2: [59462] 1055.0 (1.00); A3: [K5647] 334.0 (1.00);
A4: [K5943] 368.0 (1.00)

BL#	Comments
31	6BL/1", 4BL/1", 8BL/1", 12BL/1"

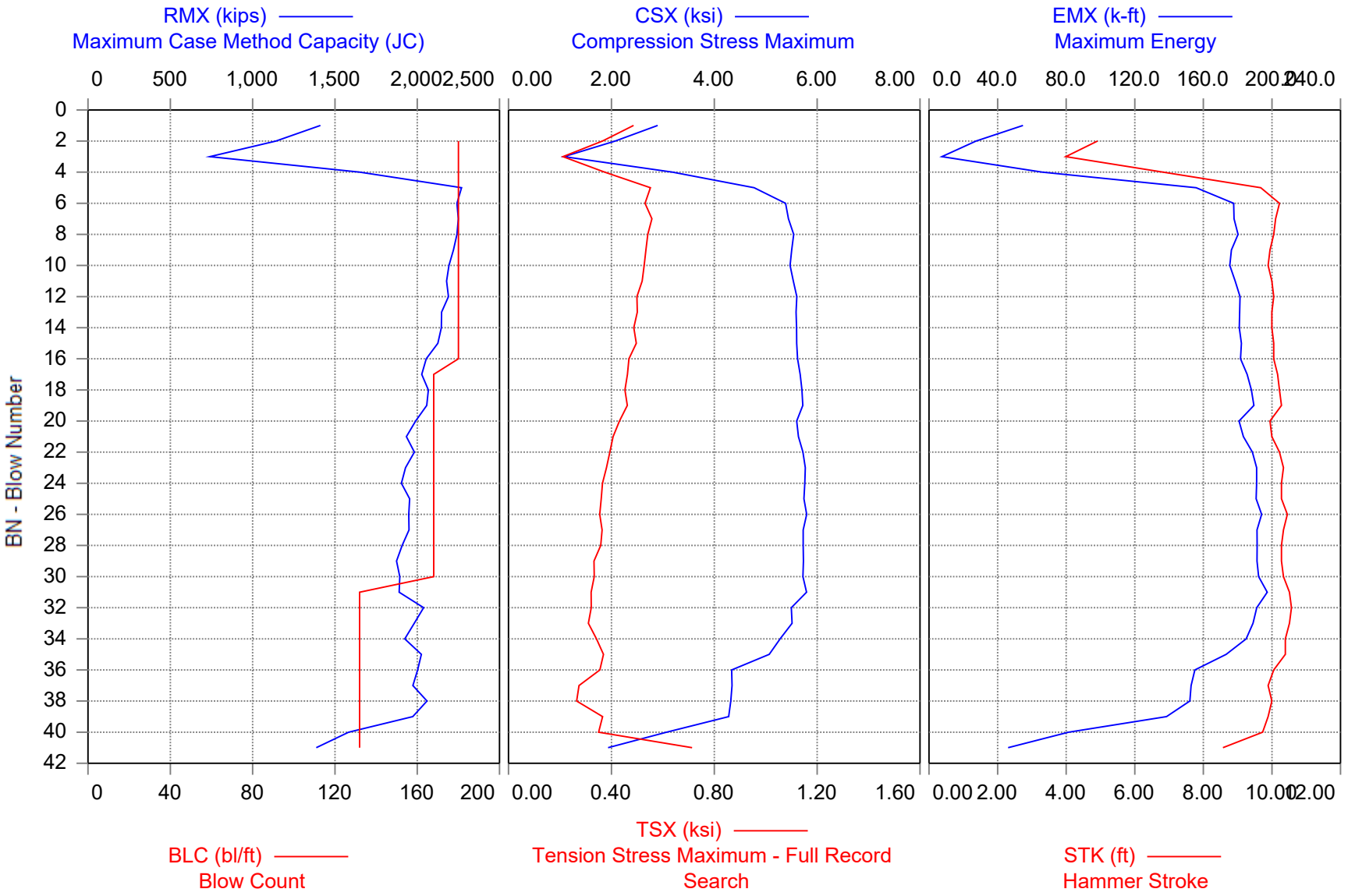
Time Summary

Drive 3 minutes 42 seconds 12:02 PM - 12:05 PM BN 1 - 31

Applied Foundation Testing, Inc. - PDIPLOT2 Ver 2017.2.58.3 - Case Method & iCAP® Results

Printed: 08-June-2018 Test started: 31-May-2018

I-10 MOBILE RIVER - TP-111B 14 DAY RS



I-10 MOBILE RIVER - TP-111B 14 DAY RS 54" CYL, 6" WALL
OP: AFT Date: 31-May-2018

AR: 904.78 in² SP: 0.150 k/ft³
LE: 119.00 ft EM: 7,778.33 ksi
WS: 15,500.0 f/s JC: 1.03

RMX: Maximum Case Method Capacity (JC)
RX11: Maximum Case Method Capacity (JC=1.1)
RA2: Auto Capacity Friction Piles
CSX: Compression Stress Maximum
CSB: Compression Stress at Bottom of Pile
TSX: Tension Stress Maximum - Full Record Search
EMX: Maximum Energy
STK: Hammer Stroke
BTA: Integrity Factor (1)

BL#	BLC	RMX	RX11	RA2	CSX	CSB	TSX	EMX	STK	BTA
	bl/ft	kips	kips	kips	ksi	ksi	ksi	k-ft	ft	(%)
1	0	1,411	1,293	1,032	2.90	2.21	0.49	54.8	0.00	100
2	180	1,142	1,063	823	2.07	1.55	0.37	27.4	4.91	100
3	180	740	708	672	1.08	0.71	0.21	7.4	3.99	100
4	180	1,650	1,521	1,362	3.18	2.60	0.37	65.9	0.00	100
5	180	2,269	2,063	1,586	4.77	3.84	0.55	155.8	9.67	100
6	180	2,241	1,997	1,549	5.39	4.30	0.53	177.7	10.22	100
7	180	2,250	2,003	1,601	5.44	4.37	0.56	177.9	10.11	100
8	180	2,241	1,988	1,637	5.54	4.40	0.54	180.2	10.05	100
9	180	2,220	1,969	1,663	5.50	4.30	0.53	176.3	9.94	100
10	180	2,193	1,942	1,648	5.47	4.22	0.53	175.4	9.89	100
11	180	2,178	1,924	1,717	5.54	4.09	0.52	178.5	10.00	100
12	180	2,190	1,932	1,688	5.60	4.16	0.50	181.4	10.05	100
13	180	2,148	1,889	1,715	5.59	4.08	0.50	181.2	10.00	100
14	180	2,146	1,887	1,681	5.60	4.03	0.49	180.9	10.00	100
15	180	2,125	1,865	1,774	5.60	3.96	0.50	182.1	10.05	100
16	180	2,055	1,791	1,696	5.62	3.87	0.47	181.7	10.05	100
17	168	2,028	1,760	1,696	5.67	3.86	0.46	185.5	10.16	100
18	168	2,067	1,799	1,725	5.70	3.91	0.45	188.0	10.22	100
19	168	2,058	1,788	1,687	5.72	3.93	0.46	189.4	10.28	100
20	168	1,990	1,725	1,682	5.60	3.85	0.43	180.8	9.94	100
21	168	1,934	1,665	1,690	5.64	3.79	0.41	183.4	10.00	100
22	168	1,983	1,710	1,693	5.72	3.89	0.39	188.6	10.22	100
23	168	1,929	1,652	1,678	5.77	3.89	0.38	191.0	10.33	100
24	168	1,904	1,626	1,625	5.76	3.88	0.37	191.0	10.28	100
25	168	1,954	1,679	1,658	5.74	3.92	0.36	190.8	10.28	100
26	168	1,948	1,670	1,650	5.80	3.96	0.35	194.0	10.45	100
27	168	1,950	1,676	1,619	5.73	3.93	0.36	191.3	10.33	100
28	168	1,909	1,633	1,644	5.73	3.90	0.36	191.3	10.28	100
29	168	1,874	1,597	1,580	5.73	3.88	0.33	191.3	10.28	100
30	168	1,894	1,618	1,600	5.72	3.90	0.33	192.2	10.33	100
31	132	1,890	1,609	1,592	5.79	3.94	0.32	197.2	10.51	100
32	132	2,039	1,782	1,548	5.50	3.83	0.32	191.2	10.57	100
33	132	1,982	1,721	1,573	5.51	3.83	0.31	188.9	10.51	100
34	132	1,924	1,676	1,564	5.28	3.57	0.34	184.9	10.39	100
35	132	2,025	1,793	1,761	5.07	3.57	0.37	173.3	10.39	100
36	132	2,002	1,813	1,884	4.34	3.01	0.36	155.1	10.05	100
37	132	1,974	1,783	1,617	4.34	3.01	0.27	152.8	9.89	100
38	132	2,060	1,872	1,734	4.32	3.04	0.26	152.1	10.00	100
39	132	1,972	1,784	1,934	4.28	3.06	0.37	138.5	9.89	100
40	132	1,583	1,473	1,783	3.07	2.14	0.35	81.4	9.73	100
41	132	1,386	1,349	1,770	1.94	1.50	0.71	46.1	8.57	100
	Average	1,938	1,709	1,606	4.98	3.55	0.42	160.8	9.81	100
	Std. Dev.	302	253	237	1.19	0.83	0.10	49.6	1.29	0
	Maximum	2,269	2,063	1,934	5.80	4.40	0.71	197.2	10.57	100
	Minimum	740	708	672	1.08	0.71	0.21	7.4	3.99	100

I-10 MOBILE RIVER - TP-111B 14 DAY RS 54" CYL, 6" WALL
OP: AFT Date: 31-May-2018

BL#	BLC	RMX	RX11	RA2	CSX	CSB	TSX	EMX	STK	BTA
	bl/ft	kips	kips	kips	ksi	ksi	ksi	k-ft	ft	(%)

Total number of blows analyzed: 41

BL# Sensors

1-41 F1: [H829] 92.2 (1.00); F2: [J762] 93.9 (1.00); F3: [P454] 145.3 (1.00); F4: [P455] 145.8 (1.00);
A1: [59379] 925.0 (1.00); A2: [59462] 1055.0 (1.00); A3: [K5647] 334.0 (1.00);
A4: [K5943] 368.0 (1.00)

BL# Comments

41
15BL/1", 14BL/1", 11BL/1"

Time Summary

Drive 2 minutes 35 seconds 8:34 AM - 8:36 AM BN 1 - 41

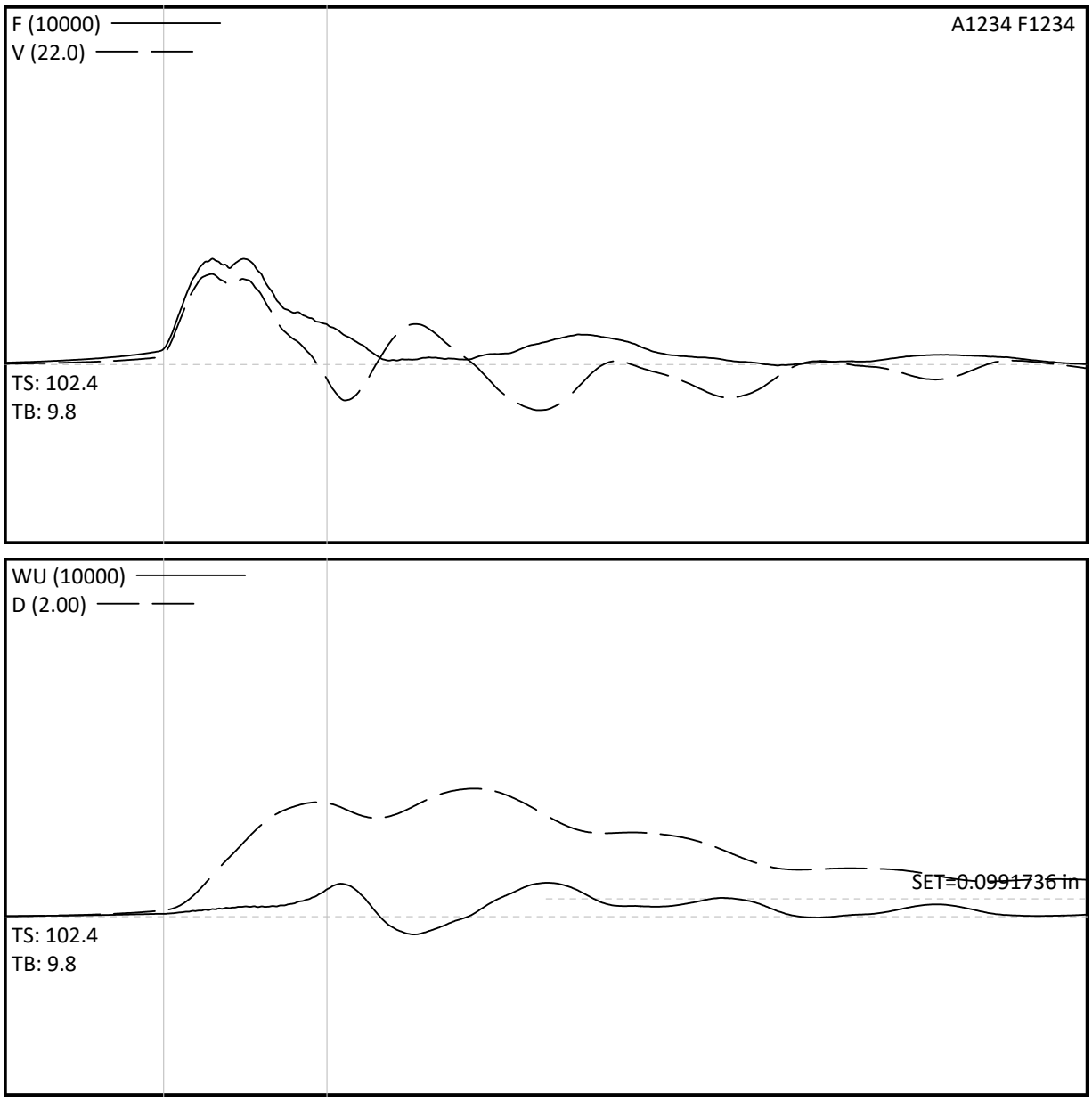
Appendix C

CAPWAP Signal Matching Analysis Output
TP-111B

I-10 over Mobile River Bridge Load Test Program

ALDOT Project No.: IM-I010(341)
Mobile County, Alabama
AFT Project No.: 118008

I-10 MOBILE RIVER TP-111B ID



Project Information

PROJECT: I-10 MOBILE RIVER
PILE NAME: TP-111B ID
DESCR: 54'' CYL, 6'' WALL
OPERATOR: AFT
FILE: TP-111B ID ana
5/17/2018 3:59:24 PM
Blow Number 3420

Pile Properties

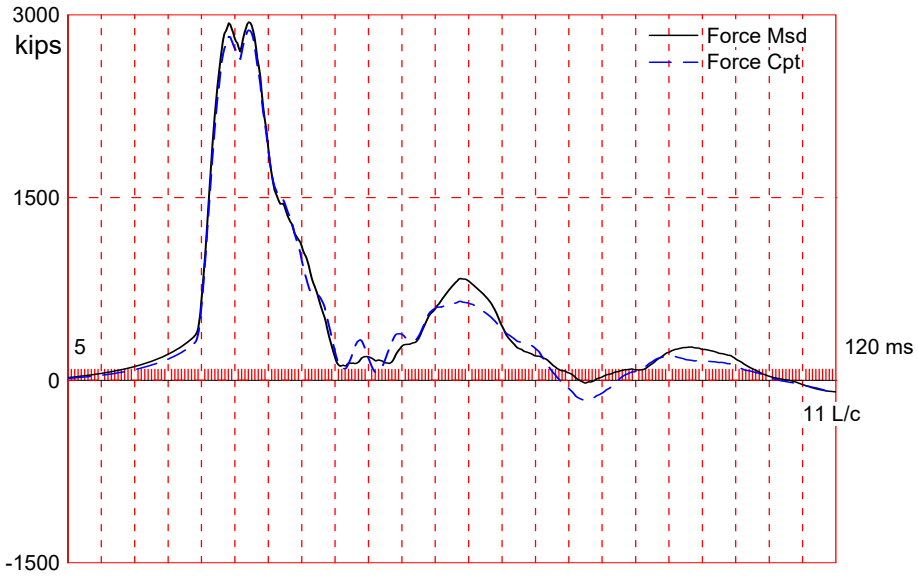
LE 119.00 ft
AR 904.78 in^2
EM 7778.33 ksi
SP 0.150 k/ft3
WS 15500.0 f/s
EA/C 454.0 ksec/ft
2L/C 15.40 ms
JC 0.60 []
LP 128.49 ft

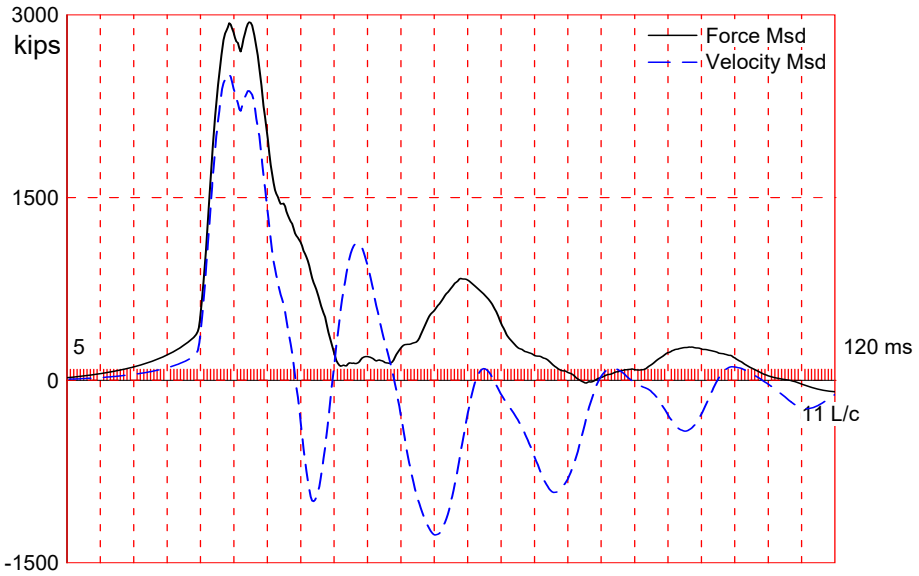
Quantity Results

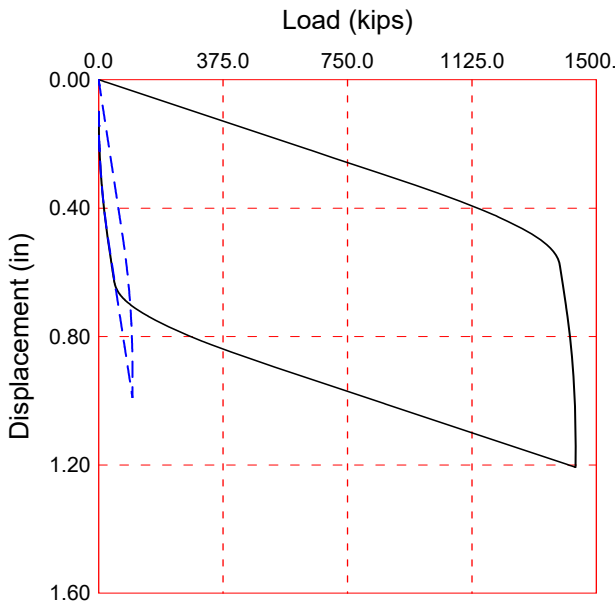
RX6 1437 kips
RX7 1437 kips
RA2 901 kips
CSX 3.26 ksi
CSB 1.94 ksi
TSX 0.68 ksi
EMX 123.2 k-ft
STK 9.57 ft
BTA 100 (%)

Sensors

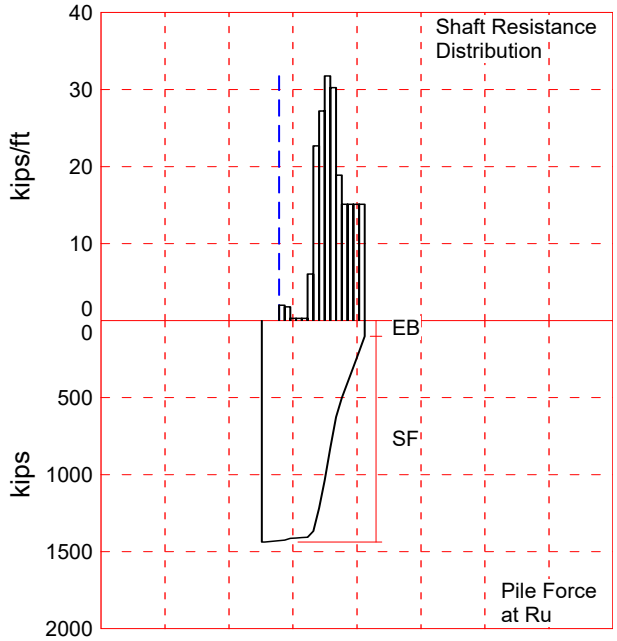
F1: [H829] 92.2 (1)
F2: [J762] 93.9 (1)
F3: [P454] 145.3 (1)
F4: [P455] 145.8 (1)
A1: [59379] 925 g's/v (1)
A2: [59462] 1055 g's/v (1)
A3: [K5647] 334 mv/5000g's (1)
A4: [K5943] 368 mv/5000g's (1)
CLIP: OK







RU =	1436.8 kips
SF =	1335.0 kips
EB =	101.8 kips
Dy =	1.11 in
Dx =	1.21 in
SET/Bl =	0.10 in



Length b. Sensors	119.0 ft
Embedment	98.5 ft
Top Area	6.28 ft^2
End Bearing Area	15.90 ft^2
Top Perimeter	14.14 ft
Top E-Modulus	7778 ksi
Top Spec. Weight	150.0 lb/ft^3
Top Wave Spd.	15500 ft/s
Overall W.S.	15455 ft/s
Match Quality	5.49
Top Compr. Stress	3.2 ksi
Max Compr. Stress	3.8 ksi
Max Tension Stress	-0.79 ksi
Avg. Shaft Quake	0.30 in
Toe Quake	0.69 in
Avg. Shaft Smith Dpg.	0.20 s/ft
Toe Smith Damping	0.20 s/ft

About the CAPWAP Results

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.

CAPWAP SUMMARY RESULTS

Total CAPWAP Capacity: 1436.8; along Shaft 1335.0; at Toe 101.8 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
				1436.8			
1	26.4	5.9	12.0	1424.8	12.0	2.02	0.14
2	33.1	12.6	12.0	1412.8	24.0	1.82	0.13
3	39.7	19.2	2.0	1410.8	26.0	0.30	0.02
4	46.3	25.8	2.0	1408.8	28.0	0.30	0.02
5	52.9	32.4	2.0	1406.8	30.0	0.30	0.02
6	59.5	39.0	40.0	1366.8	70.0	6.05	0.43
7	66.1	45.6	150.0	1216.8	220.0	22.69	1.60
8	72.7	52.2	180.0	1036.8	400.0	27.23	1.93
9	79.3	58.8	210.0	826.8	610.0	31.76	2.25
10	85.9	65.4	200.0	626.8	810.0	30.25	2.14
11	92.6	72.1	125.0	501.8	935.0	18.91	1.34
12	99.2	78.7	100.0	401.8	1035.0	15.13	1.07
13	105.8	85.3	100.0	301.8	1135.0	15.13	1.07
14	112.4	91.9	100.0	201.8	1235.0	15.13	1.07
15	119.0	98.5	100.0	101.8	1335.0	15.13	1.07
Avg. Shaft			89.0			13.55	0.96
Toe			101.8				6.40

Soil Model Parameters/Extensions		Shaft	Toe
Smith Damping Factor		0.20	0.20
Quake	(in)	0.30	0.69
Case Damping Factor		0.59	0.04
Damping Type		Viscous	Sm+Visc
Reloading Level	(% of Ru)	100	100
Unloading Level	(% of Ru)	0	
Resistance Gap (included in Toe Quake)	(in)		0.00
Soil Plug Weight	(kips)	11.600	15.000

CAPWAP match quality = 5.49 (Wave Up Match) ; RSA = 0
Observed: Final Set = 0.10 in; Blow Count = 121 b/ft
Computed: Final Set = 0.10 in; Blow Count = 121 b/ft

max. Top Comp. Stress = 3.2 ksi (T= 32.5 ms, max= 1.192 x Top)
max. Comp. Stress = 3.8 ksi (Z= 66.1 ft, T= 37.2 ms)
max. Tens. Stress = -0.79 ksi (Z= 76.0 ft, T= 46.8 ms)
max. Energy (EMX) = 123.1 kip-ft; max. Measured Top Displ. (DMX)= 0.71 in

EXTREMA TABLE

Pile Sgmnt 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	3.3	2882.5	-207.7	3.2	-0.23	123.1	5.7	0.74
2	6.6	2883.6	-247.8	3.2	-0.27	122.7	5.7	0.74
4	13.2	2905.8	-326.3	3.2	-0.36	121.8	5.6	0.73
6	19.8	2932.2	-392.9	3.2	-0.43	120.8	5.5	0.73
8	26.4	2988.2	-450.8	3.3	-0.50	120.3	5.5	0.72
10	33.1	3055.9	-555.8	3.4	-0.61	118.7	5.5	0.71
12	39.7	3139.2	-576.7	3.5	-0.64	117.0	5.4	0.70
14	46.3	3240.4	-565.2	3.6	-0.62	116.2	5.3	0.69
16	52.9	3331.2	-572.2	3.7	-0.63	115.3	5.1	0.67
18	59.5	3407.1	-564.1	3.8	-0.62	114.7	4.9	0.66
20	66.1	3436.1	-575.7	3.8	-0.64	111.5	4.7	0.65
22	72.7	3247.7	-617.1	3.6	-0.68	100.6	4.5	0.65
24	79.3	2879.2	-604.9	3.2	-0.67	87.6	4.4	0.66
26	85.9	2610.3	-590.0	2.9	-0.65	72.6	5.1	0.67
28	92.6	2419.9	-594.2	2.7	-0.66	58.3	5.7	0.67
30	99.2	2225.7	-601.9	2.5	-0.67	48.2	6.2	0.68
31	102.5	2047.4	-700.3	2.3	-0.77	40.3	6.3	0.68
32	105.8	1960.8	-611.7	2.2	-0.68	39.2	6.3	0.68
33	109.1	1714.1	-663.6	1.9	-0.73	30.8	6.3	0.69
34	112.4	1558.9	-548.6	1.7	-0.61	29.5	6.2	0.69
35	115.7	1262.9	-569.2	1.4	-0.63	20.6	6.4	0.69
36	119.0	1057.7	-412.4	1.2	-0.46	5.7	6.6	0.69
Absolute	66.1			3.8			(T =	37.2 ms)
	76.0				-0.79		(T =	46.8 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	2897.0	2640.8	2384.5	2128.3	1872.0	1615.8	1359.5	1103.3	847.1	590.8
RX	2897.0	2640.8	2384.5	2128.3	1872.0	1615.8	1436.8	1436.8	1436.8	1436.8
RU	2977.3	2729.1	2480.9	2232.7	1984.5	1736.3	1488.1	1239.9	991.6	743.4

RAU = 724.6 (kips); RA2 = 899.7 (kips)

Current CAPWAP Ru = 1436.8 (kips); Corresponding J(RP)= 0.57; J(RX) = 0.60

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
5.5	29.30	2519.7	2939.7	2949.0	0.71	0.10	0.10	123.1	3637.2	149

PILE PROFILE AND PILE MODEL

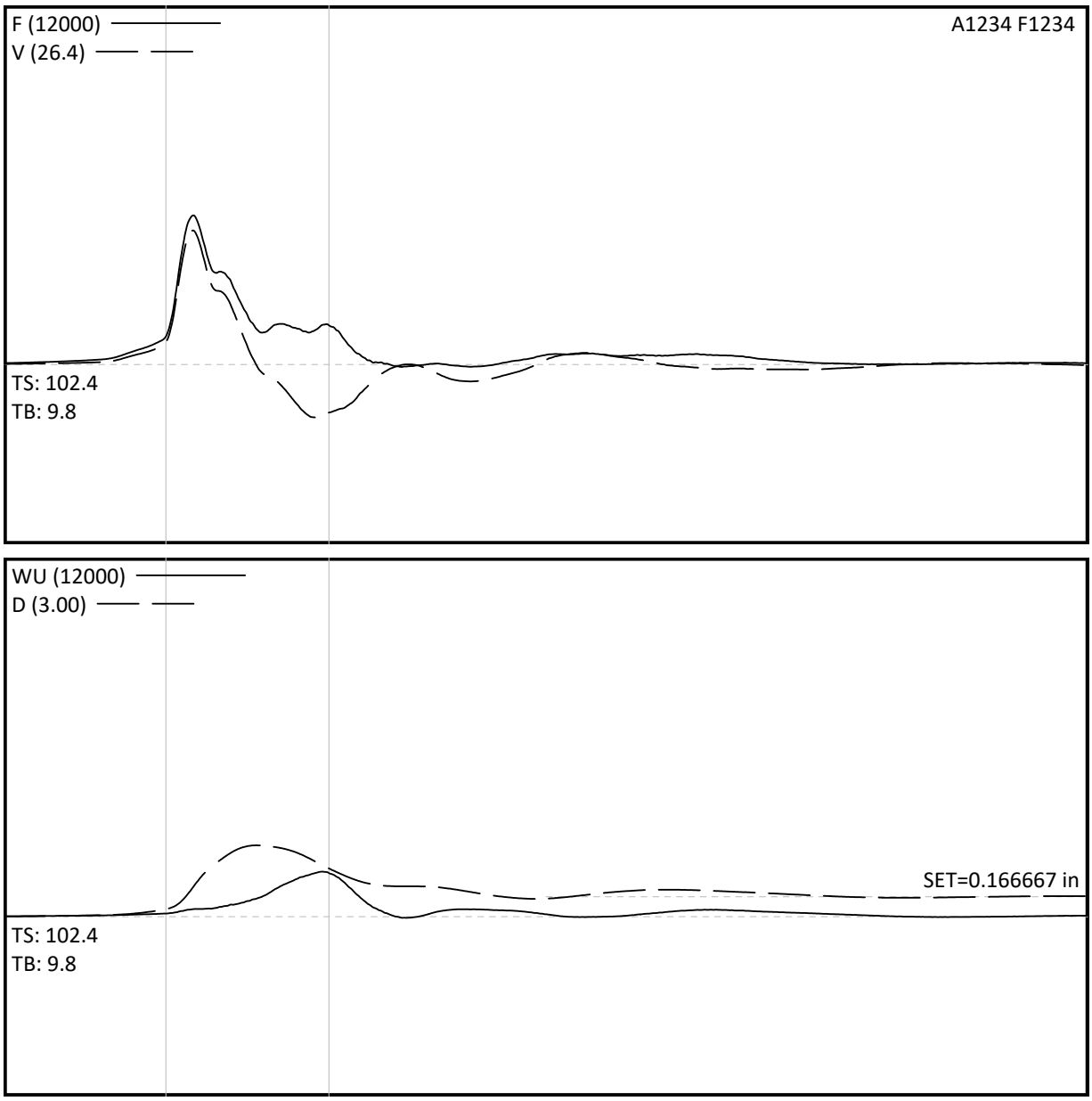
Depth ft	Area ft²	E-Modulus ksi	Spec. Weight lb/ft³	Perim. ft
0.0	6.28	7778.3	150.000	14.14
119.0	6.28	7778.3	150.000	14.14

Toe Area 15.90 ft²

Segmnt Number	Dist. B.G. ft	Impedance kips/ft/s	Imped. Change %	Tension Slack in	Tension Eff.	Compression Slack in	Compression Eff.	Perim. ft	Wave Speed ft/s	Soil Plug kips
1	3.3	454.04	0.00	0.00	0.000	-0.00	0.000	14.14	15454.5	0.000
8	26.4	454.04	0.00	0.00	0.000	-0.00	0.000	14.14	15454.5	0.400
36	119.0	454.04	0.00	0.00	0.000	-0.00	0.000	14.14	15454.5	0.400

Wave Speed: Pile Top 15500.0, Elastic 15500.0, Overall 15454.5 ft/s
Pile Damping 2.00 %, Time Incr 0.214 ms, 2L/c 15.4 ms
Total volume: 747.699 ft³; Volume ratio considering added impedance: 1.000

I-10 MOBILE RIVER TP-111B 1 DAY RS



Project Information

PROJECT: I-10 MOBILE RIVER
PILE NAME: TP-111B 1 DAY RS
DESCR: 54'' CYL, 6'' WALL
OPERATOR: AFT
FILE: TP-111B 1 DAY RS ana
5/18/2018 12:02:05 PM
Blow Number 2

Pile Properties

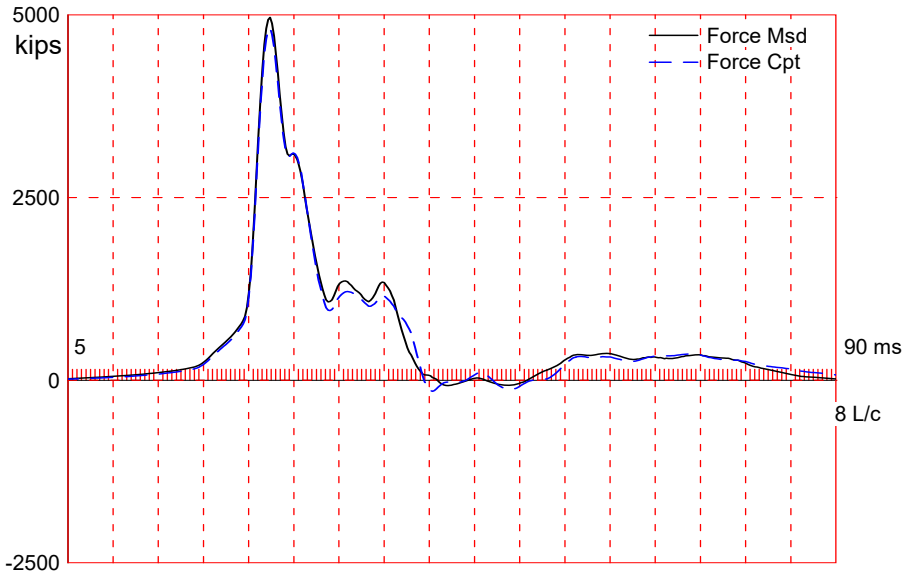
LE 119.00 ft
AR 904.78 in^2
EM 7778.33 ksi
SP 0.150 k/ft3
WS 15500.0 f/s
EA/C 454.0 ksec/ft
2L/C 15.40 ms
JC 0.92 []
LP 128.54 ft

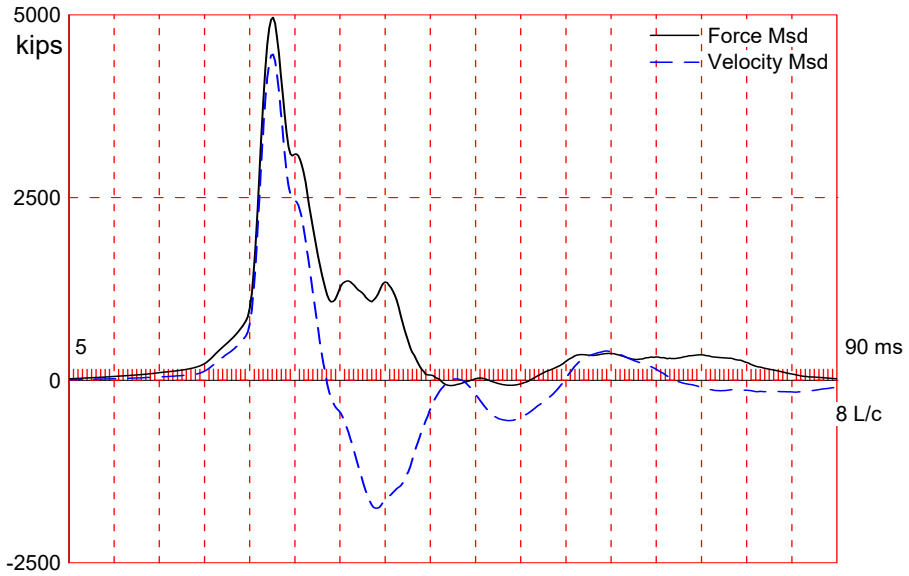
Quantity Results

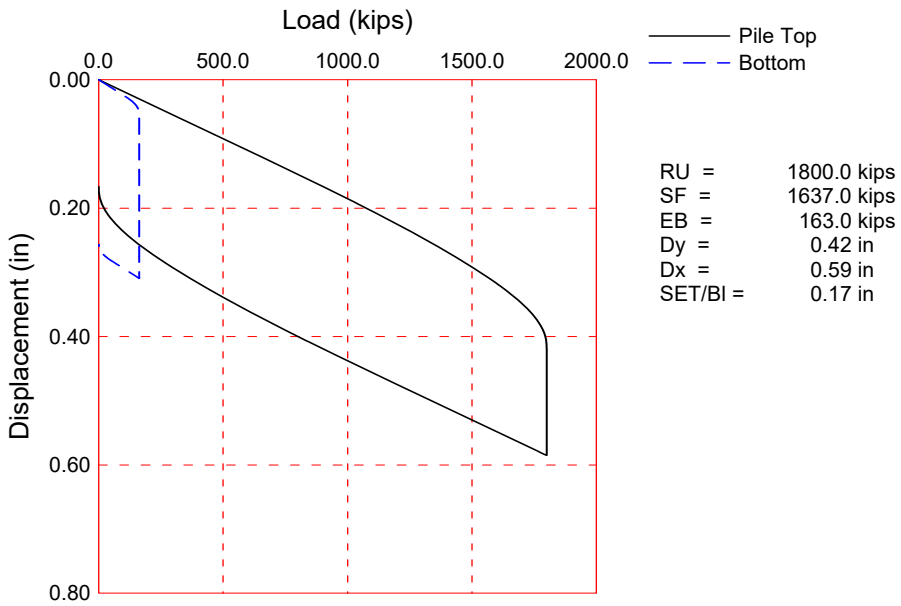
RMX 1819 kips
RX10 1501 kips
RA2 936 kips
CSX 5.51 ksi
CSB 4.36 ksi
TSX 0.46 ksi
EMX 162.8 k-ft
STK 11.72 ft
BTA 100 (%)

Sensors

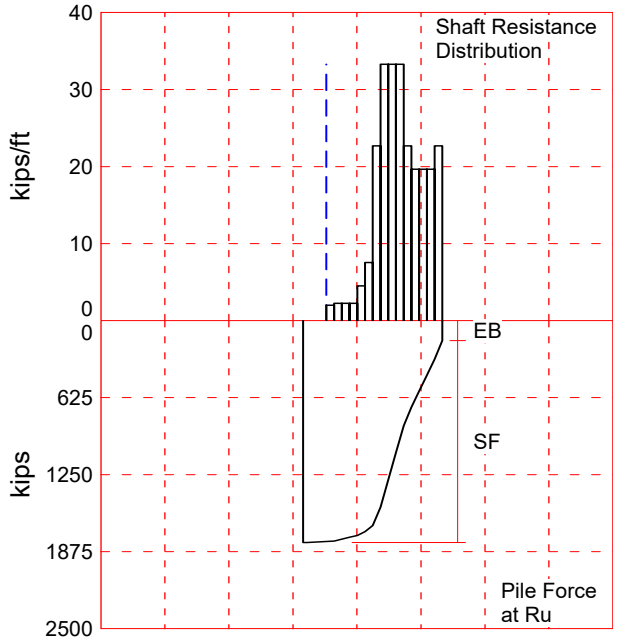
F1: [H829] 92.2 (1)
F2: [J762] 93.9 (1)
F3: [P454] 145.3 (1)
F4: [P455] 145.8 (1)
A1: [59379] 925 g's/v (1)
A2: [59462] 1055 g's/v (1)
A3: [K5647] 334 mv/5000g's (1)
A4: [K5943] 368 mv/5000g's (1)
CLIP: OK







RU =	1800.0 kips
SF =	1637.0 kips
EB =	163.0 kips
Dy =	0.42 in
Dx =	0.59 in
SET/Bl =	0.17 in



Length b. Sensors	119.0 ft
Embedment	98.5 ft
Top Area	6.28 ft^2
End Bearing Area	15.90 ft^2
Top Perimeter	14.14 ft
Top E-Modulus	7778 ksi
Top Spec. Weight	150.0 lb/ft^3
Top Wave Spd.	15500 ft/s
Overall W.S.	15455 ft/s
Match Quality	2.85
Top Compr. Stress	5.3 ksi
Max Compr. Stress	6.1 ksi
Max Tension Stress	-0.71 ksi
Avg. Shaft Quake	0.11 in
Toe Quake	0.04 in
Avg. Shaft Smith Dpg.	0.40 s/ft
Toe Smith Damping	0.35 s/ft

About the CAPWAP Results

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.

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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.

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CAPWAP SUMMARY RESULTS

Total CAPWAP Capacity: 1800.0; along Shaft 1637.0; at Toe 163.0 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
				1800.0			
1	26.4	5.9	12.0	1788.0	12.0	2.02	0.14
2	33.1	12.6	15.0	1773.0	27.0	2.27	0.16
3	39.7	19.2	15.0	1758.0	42.0	2.27	0.16
4	46.3	25.8	15.0	1743.0	57.0	2.27	0.16
5	52.9	32.4	30.0	1713.0	87.0	4.54	0.32
6	59.5	39.0	50.0	1663.0	137.0	7.56	0.53
7	66.1	45.6	150.0	1513.0	287.0	22.69	1.60
8	72.7	52.2	220.0	1293.0	507.0	33.28	2.35
9	79.3	58.8	220.0	1073.0	727.0	33.28	2.35
10	85.9	65.4	220.0	853.0	947.0	33.28	2.35
11	92.6	72.1	150.0	703.0	1097.0	22.69	1.60
12	99.2	78.7	130.0	573.0	1227.0	19.66	1.39
13	105.8	85.3	130.0	443.0	1357.0	19.66	1.39
14	112.4	91.9	130.0	313.0	1487.0	19.66	1.39
15	119.0	98.5	150.0	163.0	1637.0	22.69	1.60
Avg. Shaft			109.1			16.62	1.18
Toe			163.0				10.25

Soil Model Parameters/Extensions		Shaft	Toe
Smith Damping Factor		0.40	0.35
Quake	(in)	0.11	0.04
Case Damping Factor		1.44	0.13
Damping Type		Viscous	Sm+Visc
Unloading Quake	(% of loading quake)	100	30
Reloading Level	(% of Ru)	100	100
Unloading Level	(% of Ru)	0	
Soil Plug Weight	(kips)	8.700	15.000

CAPWAP match quality = 2.85 (Wave Up Match) ; RSA = 0
Observed: Final Set = 0.17 in; Blow Count = 72 b/ft
Computed: Final Set = 0.17 in; Blow Count = 69 b/ft

max. Top Comp. Stress = 5.3 ksi (T= 27.8 ms, max= 1.137 x Top)
max. Comp. Stress = 6.1 ksi (Z= 66.1 ft, T= 32.3 ms)
max. Tens. Stress = -0.71 ksi (Z= 102.5 ft, T= 41.5 ms)
max. Energy (EMX) = 163.1 kip-ft; max. Measured Top Displ. (DMX)= 0.60 in

EXTREMA TABLE

Pile Sgmnt 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	3.3	4826.8	-195.6	5.3	-0.22	163.1	10.1	0.62
2	6.6	4846.5	-259.4	5.4	-0.29	162.8	10.1	0.61
4	13.2	4938.3	-342.2	5.5	-0.38	161.9	9.9	0.60
6	19.8	5052.3	-406.4	5.6	-0.45	160.8	9.6	0.58
8	26.4	5115.1	-404.1	5.7	-0.45	159.1	9.5	0.56
10	33.1	5118.8	-346.3	5.7	-0.38	154.9	9.4	0.53
12	39.7	5114.0	-381.9	5.7	-0.42	149.6	9.2	0.50
14	46.3	5149.3	-354.6	5.7	-0.39	143.8	9.0	0.47
16	52.9	5247.2	-370.4	5.8	-0.41	138.1	8.6	0.44
18	59.5	5371.9	-331.5	5.9	-0.37	131.1	8.1	0.41
20	66.1	5487.4	-354.3	6.1	-0.39	122.8	7.4	0.38
22	72.7	5211.0	-397.0	5.8	-0.44	108.2	6.8	0.36
24	79.3	4677.4	-443.4	5.2	-0.49	92.4	6.2	0.36
26	85.9	4130.2	-413.4	4.6	-0.46	78.0	5.8	0.37
28	92.6	3592.8	-398.3	4.0	-0.44	64.4	5.4	0.37
30	99.2	3296.2	-525.8	3.6	-0.58	54.8	5.1	0.38
31	102.5	3067.8	-641.2	3.4	-0.71	46.2	4.9	0.38
32	105.8	3197.8	-576.0	3.5	-0.64	46.2	4.8	0.38
33	109.1	2911.4	-637.7	3.2	-0.70	37.1	5.0	0.38
34	112.4	2855.6	-524.8	3.2	-0.58	37.1	5.1	0.39
35	115.7	2361.0	-529.1	2.6	-0.58	27.3	5.7	0.39
36	119.0	2103.2	-377.2	2.3	-0.42	13.8	6.4	0.39
Absolute	66.1			6.1			(T =	32.3 ms)
	102.5				-0.71		(T =	41.5 ms)

CASE METHOD

J =	0.0	0.2	0.4	0.6	0.8	1.0	1.2	1.4	1.6	1.8
RP	5478.8	4680.7	3882.6	3084.5	2286.4					
RX	5478.8	4680.7	3882.6	3084.5	2286.4	1488.3	690.2	448.3	447.9	447.6
RU	6421.1	5811.5	5201.9	4592.2	3982.6					

RAU = 438.5 (kips); RA2 = 937.0 (kips)

Current CAPWAP Ru = 1800.0 (kips); Corresponding J(RP)= 0.00; J(RX) = 0.92

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
9.9	27.59	4482.7	4986.5	4986.5	0.60	0.17	0.17	163.1	5119.1	4075

PILE PROFILE AND PILE MODEL

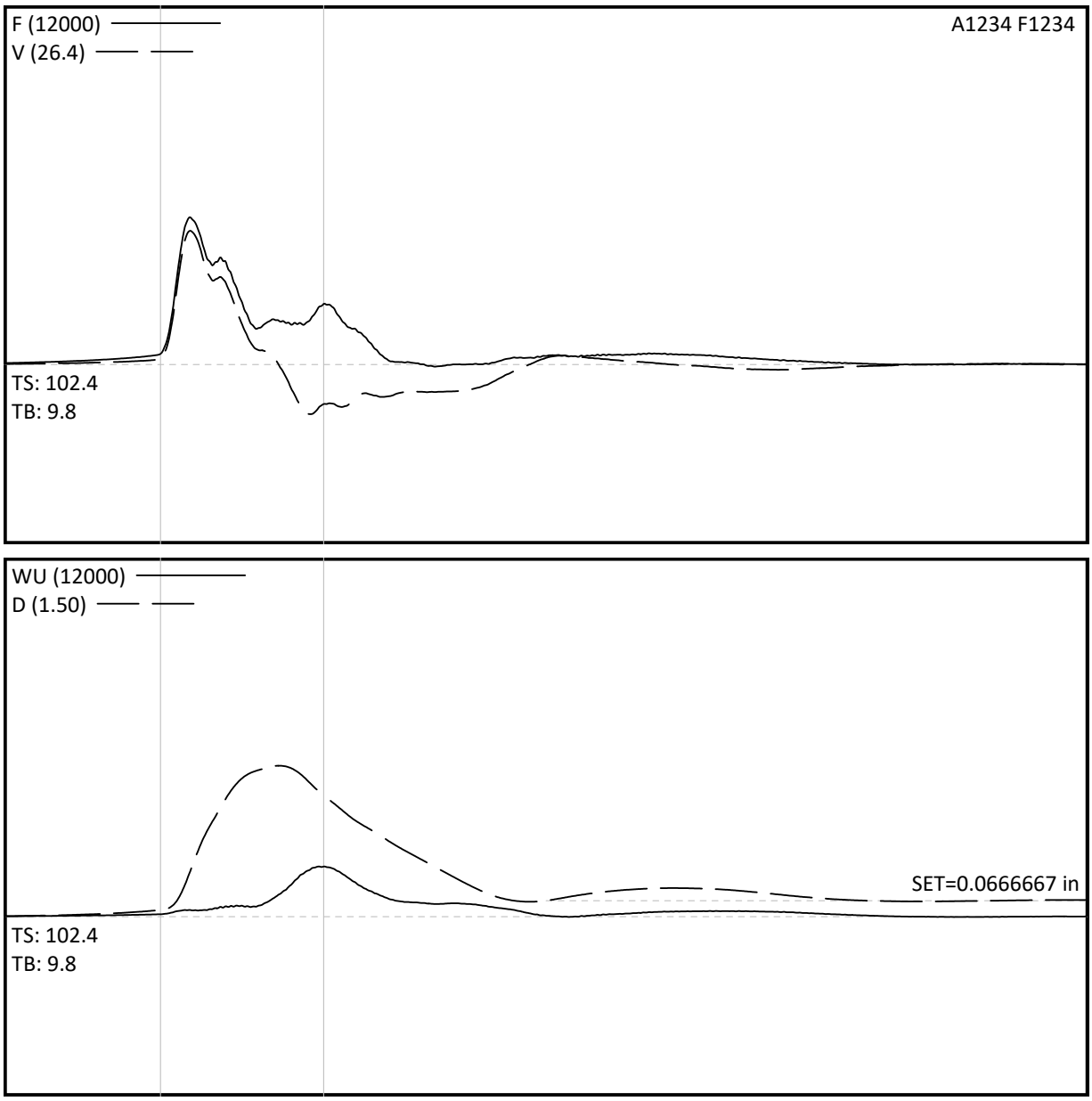
Depth	Area	E-Modulus	Spec. Weight	Perim.
ft	ft^2	ksi	lb/ft^3	ft
0.0	6.28	7778.3	150.000	14.14
119.0	6.28	7778.3	150.000	14.14

Toe Area 15.90 ft^2

Segmnt Number	Dist. B.G. ft	Impedance kips/ft/s	Imped. Change %	Tension Slack in	Tension Eff.	Compression Slack in	Compression Eff.	Perim. ft	Wave Speed ft/s	Soil Plug kips
1	3.3	454.04	0.00	0.00	0.000	-0.00	0.000	14.14	15454.5	0.000
8	26.4	454.04	0.00	0.00	0.000	-0.00	0.000	14.14	15454.5	0.300
36	119.0	454.04	0.00	0.00	0.000	-0.00	0.000	14.14	15454.5	0.300

Wave Speed: Pile Top 15500.0, Elastic 15500.0, Overall 15454.5 ft/s
Pile Damping 2.00 %, Time Incr 0.214 ms, 2L/c 15.4 ms
Total volume: 747.699 ft^3; Volume ratio considering added impedance: 1.000

I-10 MOBILE RIVER TP-111B 14 DAY RS



Project Information

PROJECT: I-10 MOBILE RIVER
PILE NAME: TP-111B 14 DAY RS
DESCR: 54'' CYL, 6'' WALL
OPERATOR: AFT
FILE: TP-111B 14 DAY RS ana
5/31/2018 8:35:45 AM
Blow Number 7

Pile Properties

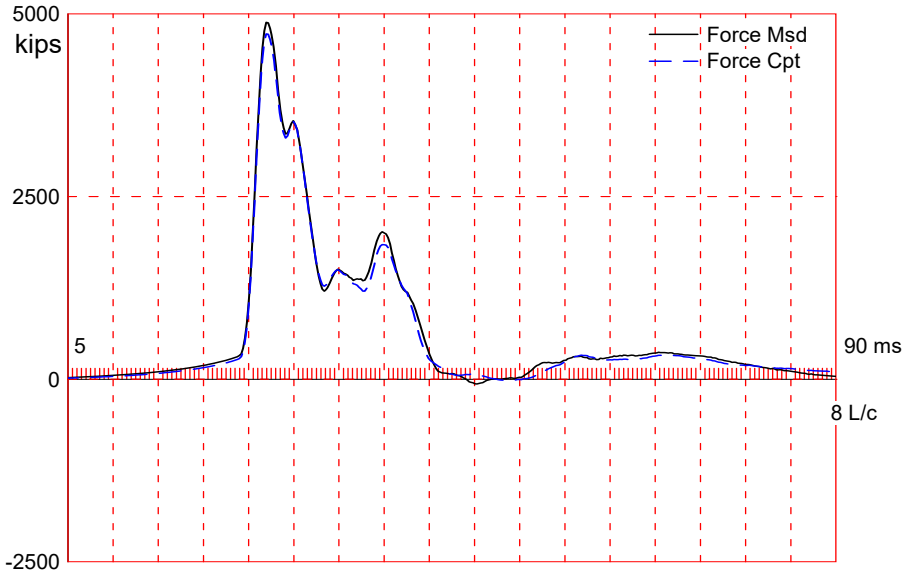
LE	119.00 ft
AR	904.78 in^2
EM	7778.33 ksi
SP	0.150 k/ft3
WS	15500.0 f/s
EA/C	454.0 ksec/ft
2L/C	15.40 ms
JC	1.03 []
LP	128.88 ft

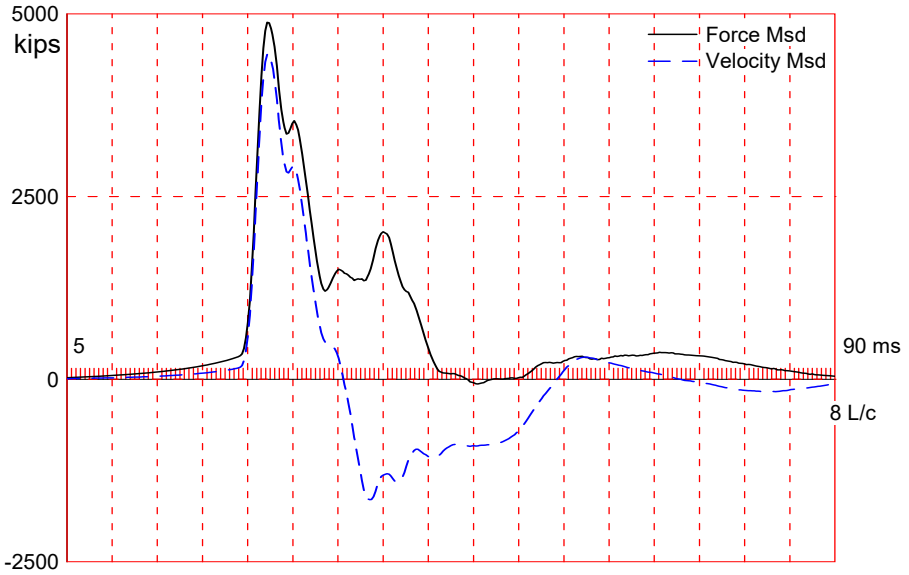
Quantity Results

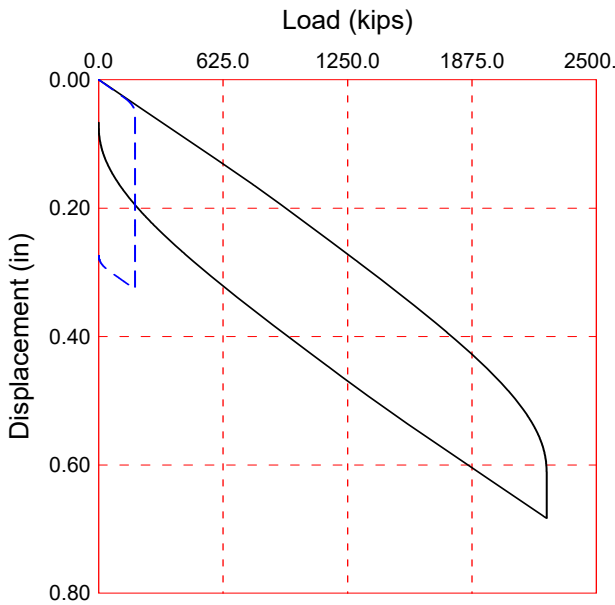
RMX	2250 kips
RX11	2003 kips
RA2	1601 kips
CSX	5.44 ksi
CSB	4.37 ksi
TSX	0.56 ksi
EMX	177.9 k-ft
STK	10.11 ft
BTA	100 (%)

Sensors

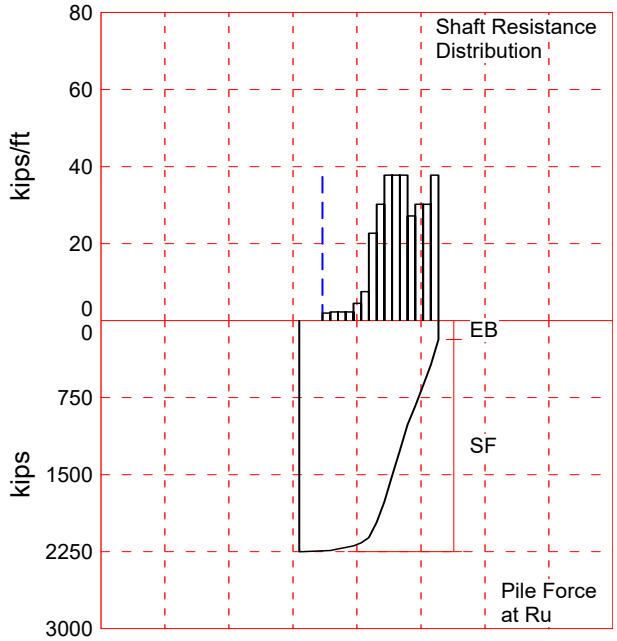
F1: [H829] 92.2 (1)
F2: [J762] 93.9 (1)
F3: [P454] 145.3 (1)
F4: [P455] 145.8 (1)
A1: [59379] 925 g's/v (1)
A2: [59462] 1055 g's/v (1)
A3: [K5647] 334 mv/5000g's (1)
A4: [K5943] 368 mv/5000g's (1)
CLIP: OK







RU =	2250.0 kips
SF =	2067.0 kips
EB =	183.0 kips
Dy =	0.62 in
Dx =	0.68 in
SET/Bl =	0.07 in



Length b. Sensors	119.0 ft
Embedment	98.5 ft
Top Area	6.28 ft^2
End Bearing Area	15.90 ft^2
Top Perimeter	14.14 ft
Top E-Modulus	7778 ksi
Top Spec. Weight	150.0 lb/ft^3
Top Wave Spd.	15500 ft/s
Overall W.S.	15455 ft/s
Match Quality	2.27
Top Compr. Stress	5.2 ksi
Max Compr. Stress	5.8 ksi
Max Tension Stress	-0.45 ksi
Avg. Shaft Quake	0.20 in
Toe Quake	0.04 in
Avg. Shaft Smith Dpg.	0.40 s/ft
Toe Smith Damping	0.35 s/ft

About the CAPWAP Results

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.

CAPWAP SUMMARY RESULTS

Total CAPWAP Capacity: 2250.0; along Shaft 2067.0; at Toe 183.0 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
				2250.0			
1	26.4	5.9	12.0	2238.0	12.0	2.02	0.14
2	33.1	12.6	15.0	2223.0	27.0	2.27	0.16
3	39.7	19.2	15.0	2208.0	42.0	2.27	0.16
4	46.3	25.8	15.0	2193.0	57.0	2.27	0.16
5	52.9	32.4	30.0	2163.0	87.0	4.54	0.32
6	59.5	39.0	50.0	2113.0	137.0	7.56	0.53
7	66.1	45.6	150.0	1963.0	287.0	22.69	1.60
8	72.7	52.2	200.0	1763.0	487.0	30.25	2.14
9	79.3	58.8	250.0	1513.0	737.0	37.82	2.67
10	85.9	65.4	250.0	1263.0	987.0	37.82	2.67
11	92.6	72.1	250.0	1013.0	1237.0	37.82	2.67
12	99.2	78.7	180.0	833.0	1417.0	27.23	1.93
13	105.8	85.3	200.0	633.0	1617.0	30.25	2.14
14	112.4	91.9	200.0	433.0	1817.0	30.25	2.14
15	119.0	98.5	250.0	183.0	2067.0	37.82	2.67
Avg. Shaft			137.8			20.98	1.48
Toe			183.0				11.51

Soil Model Parameters/Extensions		Shaft	Toe
Smith Damping Factor		0.40	0.35
Quake	(in)	0.20	0.04
Case Damping Factor		1.82	0.14
Damping Type		Viscous	Sm+Visc
Reloading Level	(% of Ru)	100	100
Unloading Level	(% of Ru)	0	
Soil Plug Weight	(kips)	8.701	4.000

CAPWAP match quality = 2.27 (Wave Up Match) ; RSA = 0
Observed: Final Set = 0.07 in; Blow Count = 180 b/ft
Computed: Final Set = 0.07 in; Blow Count = 177 b/ft

max. Top Comp. Stress = 5.2 ksi (T= 27.4 ms, max= 1.115 x Top)
max. Comp. Stress = 5.8 ksi (Z= 66.1 ft, T= 32.1 ms)
max. Tens. Stress = -0.45 ksi (Z= 59.5 ft, T= 56.9 ms)
max. Energy (EMX) = 177.4 kip-ft; max. Measured Top Displ. (DMX)= 0.63 in

EXTREMA TABLE

Pile Sgmnt 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	3.3	4731.9	-52.5	5.2	-0.06	177.4	10.1	0.65
2	6.6	4747.6	-99.9	5.2	-0.11	176.7	10.1	0.64
4	13.2	4835.7	-182.5	5.3	-0.20	175.1	9.9	0.62
6	19.8	4948.7	-243.8	5.5	-0.27	173.5	9.7	0.60
8	26.4	4998.1	-284.7	5.5	-0.31	171.9	9.5	0.58
10	33.1	4985.3	-319.3	5.5	-0.35	167.5	9.4	0.55
12	39.7	4961.0	-331.9	5.5	-0.37	162.1	9.3	0.52
14	46.3	4956.3	-369.7	5.5	-0.41	156.0	9.2	0.49
16	52.9	5034.1	-400.8	5.6	-0.44	149.5	8.9	0.46
18	59.5	5155.4	-409.0	5.7	-0.45	141.3	8.4	0.42
20	66.1	5275.3	-407.8	5.8	-0.45	131.5	7.8	0.39
22	72.7	5048.1	-369.6	5.6	-0.41	115.9	7.1	0.36
24	79.3	4682.5	-308.8	5.2	-0.34	100.7	6.4	0.35
26	85.9	4191.0	-256.1	4.6	-0.28	84.9	5.8	0.34
28	92.6	3719.3	-199.8	4.1	-0.22	70.6	5.3	0.33
30	99.2	3282.3	-154.5	3.6	-0.17	56.9	4.9	0.33
31	102.5	2924.0	-160.3	3.2	-0.18	47.3	4.7	0.33
32	105.8	2953.6	-164.0	3.3	-0.18	47.2	4.6	0.32
33	109.1	2457.7	-151.8	2.7	-0.17	36.6	4.9	0.32
34	112.4	2338.8	-138.0	2.6	-0.15	36.6	5.4	0.32
35	115.7	1706.2	-114.2	1.9	-0.13	25.9	5.8	0.32
36	119.0	1470.2	-96.5	1.6	-0.11	11.7	6.0	0.32
Absolute	66.1			5.8			(T =	32.1 ms)
	59.5				-0.45		(T =	56.9 ms)

CASE METHOD

J =	0.0	0.2	0.4	0.6	0.8	1.0	1.2	1.4	1.6	1.8
RP	5869.1	5163.6	4458.1	3752.6	3047.1					
RX	5869.1	5163.6	4458.1	3752.6	3047.1	2341.6	1636.1	930.6	877.9	877.9
RU	6091.8	5430.8	4769.9	4108.9	3448.0					

RAU = 877.9 (kips); RA2 = 1595.6 (kips)

Current CAPWAP Ru = 2250.0 (kips); Corresponding J(RP)= 0.00; J(RX) = 1.03

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
9.9	27.16	4474.3	4922.3	4922.3	0.63	0.07	0.07	178.0	6118.4	4575

PILE PROFILE AND PILE MODEL

Depth ft	Area ft²	E-Modulus ksi	Spec. Weight lb/ft³	Perim. ft
0.0	6.28	7778.3	150.000	14.14
119.0	6.28	7778.3	150.000	14.14

Toe Area 15.90 ft²

Segmnt Number	Dist. B.G. ft	Impedance kips/ft/s	Imped. Change %	Tension Slack in	Tension Eff.	Compression Slack in	Compression Eff.	Perim. ft	Wave Speed ft/s	Soil Plug kips
1	3.3	454.04	0.00	0.00	0.000	-0.00	0.000	14.14	15454.5	0.000
8	26.4	454.04	0.00	0.00	0.000	-0.00	0.000	14.14	15454.5	0.300
36	119.0	454.04	0.00	0.00	0.000	-0.00	0.000	14.14	15454.5	0.300

Wave Speed: Pile Top 15500.0, Elastic 15500.0, Overall 15454.5 ft/s
Pile Damping 2.00 %, Time Incr 0.214 ms, 2L/c 15.4 ms
Total volume: 747.699 ft³; Volume ratio considering added impedance: 1.000

Appendix D

Relevant Project Documents
TP-111B

I-10 over Mobile River Bridge Load Test Program

ALDOT Project No.: IM-I010(341)
Mobile County, Alabama
AFT Project No.: 118008

REFERENCE PROJECT NO.	FISCAL YEAR	SHEET NO.
IM-1010(341)	2018	2

GENERAL PROJECT NOTES

200 THE CONTRACTOR SHALL SUBMIT SHOP DRAWINGS DIRECTLY TO THE MATERIALS AND TESTS ENGINEER OF ALL RAPID LOAD TESTS, SHAFT LOAD TESTS AND STATIC LOAD TESTS FOR APPROVAL.

201 THE CONTRACTOR SHALL PROVIDE REPORTS TO THE MATERIALS AND TESTS ENGINEER OF ALL STATIC LOAD TESTS, RAPID LOAD TESTS AND DYNAMIC TESTS, PREPARED BY SPECIALTY ENGINEERING FIRMS.

202 THE CONTRACTOR SHALL SUBMIT AN INSTALLATION PLAN FOR REVIEW AND APPROVAL FOR ALL TEST PILES IN THIS PROJECT.

301 LOCATION TP-10:

ALL FOUR TEST PILES SHALL BE IMPACT DRIVEN WITH PDA MONITORING TO PLANNED TIP ELEVATION OR TO REFUSAL, WHICHEVER COMES FIRST (NO JETTING).
CONTRACTOR SHALL PLAN TO RESTRIKE MEASUREMENT ON EACH PILE FOR DYNAMIC LOAD TESTING AND SIGNAL MATCHING ANALYSIS AT APPROXIMATELY 1 DAY AFTER INITIAL DRIVE.
CONTRACTOR SHALL PLAN FOR RESTRIKE MEASUREMENT ON PILES TP-10A-1 AND TP-10B-1 FOR DYNAMIC LOAD TESTING AND SIGNAL MATCHING ANALYSIS AT APPROXIMATELY 7 DAYS AFTER INITIAL DRIVE.
CONTRACTOR SHALL PERFORM STATIC LOAD TEST ON PILES TP-10A-2 AND TP-10B-2 IN ACCORDANCE WITH APPLICABLE SPECIAL PROVISIONS
CONTRACTOR SHALL PLAN FOR RESTRIKE MEASUREMENT ON PILES TP-10A-2 AND TP-10B-2 FOR DYNAMIC LOAD TESTING AND SIGNAL MATCHING ANALYSIS WITHIN 7 DAYS AFTER STATIC LOAD TEST.

302 LOCATION TP-WPA STEEL PIPE PILE:

PILE MAY BE INSTALLED WITH ONE SPLICE, AND FINAL PIECE SHALL NOT BE LESS THAN 75 FT IN LENGTH.

VIBRATORY HAMMER MAY BE USED TO INSTALL FIRST PIECE, AFTER SPLICING THE PILE SHALL BE DRIVEN TO THE TARGET TIP ELEVATION USING IMPACT HAMMER.

CONTRACTOR TO PROVIDE HAMMER SUFFICIENT TO DRIVE PILE TO TIP WITH WAVE EQUATION ANALYSIS PER ALDOT SPECS, WITH TARGETED DRIVING RESISTANCE AT END OF INITIAL DRIVE NOT MORE THAN 10 BLOWS PER INCH.

DYNAMIC MONITORING OF PILE USING PDA DURING INSTALLATION AFTER SPLICE, WITH SIGNAL MATCHING ANALYSIS ON SELECTED BLOWS NEAR END OF INITIAL DRIVE.

RAPID LOAD TEST OF PILE USING 19MN RAPID LOAD TEST DEVICE BETWEEN 10 AND 21 DAYS AFTER INITIAL DRIVE.

RESTRIKE BLOWS FOR DYNAMIC LOAD TESTING AND SIGNAL MATCHING ANALYSIS WITHIN ONE WEEK AFTER COMPLETION OF RAPID LOAD TEST (RLT).

303 LOCATION TP-WPB DRILLED SHAFT:

CONTRACTOR TO PERFORM LATERAL RAPID LOAD TESTS USING RAPD LOAD TEST DEVICE AFTER COMPLETION OF AXIAL LOAD TEST(S); LATERAL RLT SHALL BE CAPABLE TO APPLY A LATERAL FORCE OF AT LEAST 1000 KIPS. LATERAL RLT SHALL BE PERFORMED IN FOUR PROGRESSIVELY LARGER INCREMENTS UP TO MAXIMUM FORCE.

LATERAL RLT SHALL INCLUDE MEASUREMENTS OF FORCE AND TOP OF SHAFT DISPLACEMENT AND OF DISPLACEMENT AT NOT LESS THAN 6 ELEVATIONS BELOW TOP OF SHAFT.

TEST SHAFT SHALL BE CONSTRUCTED USING POLYMER BASED DRILLING FLUIDS, WITH ON-SITE SUPPORT FROM FLUID SUPPLIER.

304 LOCATION TP-04:

JETTING OF TP-04 ALLOWED (BUT NOT REQUIRED) TO ELEVATION -70FT
PILE SHALL BE IMPACT DRIVEN WITH PDA MONITORING TO TIP ELEVATION -110FT OR TO REFUSAL, WHICHEVER COMES FIRST
CONTRACTOR SHALL PLAN FOR UP TO TWO RESTRIKE MEASUREMENTS ON THIS PILE AT APPROXIMATELY 1 DAY AND 14 DAYS AFTER INITIAL DRIVE FOR DYNAMIC LOAD TESTING AND SIGNAL MATCHING ANALYSIS.

305 LOCATION TP-23:

JETTING OF TP-23A SHOULD BE PERFORMED TO ELEVATION -100FT
JETTING OF TP-23B AND TP-23C ALLOWED (BUT NOT REQUIRED) TO ELEVATION -70FT
PILE SHALL BE IMPACT DRIVEN WITH PDA MONITORING TO PLANNED TIP ELEVATION OR TO REFUSAL, WHICHEVER COMES FIRST. PLANNED TIP ELEVATION:
TP-23A: -130
TP-23B: -100
TP-23C: -100
CONTRACTOR SHALL PLAN FOR RESTRIKE MEASUREMENT ON EACH PILE FOR DYNAMIC LOAD TESTING AND SIGNAL MATCHING ANALYSIS AT ONE DAY AFTER INITIAL DRIVE AND WITHIN ONE WEEK AFTER COMPLETION OF RAPID LOAD TEST (RLT).
RAPID LOAD TEST OF EACH PILE USING 19MN RAPID LOAD TEST DEVICE NOT SOONER THAN 2 WEEKS AFTER INITIAL DRIVE.

306 LOCATION TP-111:

FOR TP-111A, JETTING IS ALLOWED (BUT NOT REQUIRED) TO ELEVATION -60FT
FOR TP-111B, JETTING SHALL BE PERFORMED TO ELEVATION -90FT
BOTH PILES SHALL BE IMPACT DRIVEN WITH PDA MONITORING TO TIP ELEVATION -120FT OR TO REFUSAL, WHICHEVER COMES FIRST
CONTRACTOR SHALL PLAN FOR UP TO TWO RESTRIKE MEASUREMENTS ON THESE PILES AT APPROXIMATELY 1 DAY AND 14 DAYS AFTER INITIAL DRIVE FOR DYNAMIC LOAD TESTING AND SIGNAL MATCHING ANALYSIS.

307 TEST PILES TP-WPA AND TP-WPB SHALL BE PLACED WITHIN THE LIMITS AN EXPLORATION TRENCH. IF REQUIRED SPACING IS NOT ADEQUATE IN ONE TRENCH, ONE OF THE PILES MAY BE PLACED IN AN ADJACENT EXPLORATION TRENCH.

308 THE CONTRACTOR SHALL CONTACT BILL TURNER (334-242-6144) WITH THE ENVIRONMENTAL TECHNICAL SECTION OF THE ALABAMA DEPARTMENT OF TRANSPORTATION NO LATER THAN TWO (2) WEEKS PRIOR TO STARTING WORK IN ORDER TO MAKE SURE THE EXPLORATION TRENCHES ARE MARKED AND VISIBLE.

800 IT SHALL BE THE CONTRACTOR'S RESPONSIBILITY TO CONTACT THE VARIOUS UTILITY OWNERS AND DETERMINE THE EXACT LOCATION OF ALL EXISTING UTILITIES ON THIS PROJECT WHETHER SHOWN ON THE PLANS OR NOT. THE LOCATION OF ANY REQUIRED GUARDRAIL, SIGNS, FOOTINGS OF ANY NATURE AND/OR ELECTRICAL/COMMUNICATIONS CONDUITS MAY BE ADJUSTED AS DIRECTED BY THE ENGINEER TO PREVENT ANY CONFLICTS WITH THESE UTILITIES. UTILITY LINE LOCATE REQUESTS WILL BE LIMITED TO INCREMENTS NOT TO EXCEED 2000 LINEAR FEET PER WORKING DAY OPERATIONS. MULTIPLE REQUESTS WILL BE REQUIRED FOR PROJECTS GREATER THAN 2000 LINEAR FEET IN LENGTH.

900 NPDES PERMIT COVERAGE NOT REQUIRED FOR THIS PROJECT.

901 THERE SHALL BE NO FUEL TANKS STORED ON THE RIGHT OF WAY. IN ADDITION, FUEL TRUCKS OR VEHICLES TRANSPORTING CHEMICALS, FERTILIZER, ETC., NOT SHALL BE LEFT UNATTENDED ON THE RIGHT OF WAY.

902 THE CONTRACTOR SHALL FOLLOW ALL REQUIREMENTS CONTAINED WITHIN THE ARMY CORPS OF ENGINEERS PERMIT AND ANY REQUIREMENTS FROM U.S. FISH AND WILDLIFE SERVICE.

903 THE CONTRACTOR SHALL FOLLOW THE ALDOT STANDARD MANTEE CONSTRUCTION CONDITIONS LISTED BELOW:

A. THE LEAD PROJECT PROPONENT/CONTRACTOR SHALL INSTRUCT ALL PERSONNEL ASSOCIATED WITH THE PROJECT OF THE POTENTIAL PRESENCE OF MANATEES AND THE NEED TO AVOID COLLISIONS WITH MANATEES. ALL CONSTRUCTION PERSONNEL ARE RESPONSIBLE FOR OBSERVING WATER-RELATED ACTIVITIES FOR THE PRESENCE OF MANATEES. THE U.S. FISH AND WILDLIFE SERVICE WOULD RECOMMEND HIRING AN INDIVIDUAL FAMILIAR WITH THIS SPECIES TO ACT AS A SPOTTER FOR MANATEES DURING IN-WATER ACTIVITIES.

B. THE LEAD PROJECT PROPONENT/CONTRACTOR SHALL ADVISE ALL CONSTRUCTION PERSONNEL THAT THERE ARE CIVIL AND CRIMINAL PENALTIES FOR HARMING, HARASSING, OR KILLING MANATEES WHICH ARE PROTECTED UNDER THE MARINE MAMMAL PROTECTION ACT OF 1972 AND THE ENDANGERED SPECIES ACT OF 1973.

C. SILTATION BARRIERS SHALL BE MADE OF MATERIAL IN WHICH MANATEES CANNOT BECOME ENTANGLED, ARE PROPERLY SECURED, AND ARE REGULARLY MONITORED TO AVOID MANATEE ENTRAPMENT. BARRIERS MUST NOT BLOCK MANATEE ENTRY TO, OR EXIT FROM, ESSENTIAL HABITAT.

D. ALL VESSELS ASSOCIATED WITH THE CONSTRUCTION PROJECT SHALL OPERATE AT "NO WAKE/IDLE" SPEEDS AT ALL TIMES WHILE IN THE CONSTRUCTION AREA AND WHILE IN WATER WHERE THE DRAFT OF THE VESSEL PROVIDES LESS THAN A FOUR-FOOT CLEARANCE FROM THE BOTTOM. ALL VESSELS WILL FOLLOW ROUTES OF DEEP WATER WHENEVER POSSIBLE.

E. IF MANATEES ARE SEEN WITHIN 100 YARDS OF THE ACTIVE DAILY CONSTRUCTION/DREDGING OPERATION OR VESSEL MOVEMENT, ALL APPROPRIATE PRECAUTIONS SHALL BE IMPLEMENTED TO ENSURE THEIR PROTECTION. THESE PRECAUTIONS SHALL INCLUDE THE OPERATION OF ALL MOVING EQUIPMENT NO CLOSER THAN 50 FEET OF A MANATEE. OPERATION OF ANY EQUIPMENT CLOSER THAN 50 FEET TO A MANATEE SHALL NECESSITATE IMMEDIATE SHUTDOWN OF THAT EQUIPMENT. ACTIVITIES WILL NOT RESUME UNTIL THE MANATEE(S) HAS DEPARTED THE PROJECT AREA OF ITS OWN VOLITION.

F. ANY COLLISION WITH AND/OR INJURY TO A MANATEE SHALL BE REPORTED IMMEDIATELY TO THE U.S. FISH AND WILDLIFE SERVICE IN DAPHNE (251-441-5181).

G. TEMPORARY SIGNS CONCERNING THE MANATEES SHALL BE POSTED PRIOR TO AND DURING ALL CONSTRUCTION/DREDGING ACTIVITIES. ALL SIGNS ARE TO BE REMOVED BY THE LEAD PROJECT PROPONENT/CONTRACTOR UPON COMPLETION OF THE PROJECT. A SIGN MEASURING AT LEAST 3 FT. BY 4 FT. WHICH READS CAUTION: MANATEE AREA WILL BE POSTED IN A LOCATION PROMINENTLY VISIBLE TO WATER RELATED CONSTRUCTION CREWS. A SECOND SIGN SHOULD BE POSTED IF VESSELS ARE ASSOCIATED WITH THE CONSTRUCTION, AND SHOULD BE PLACED VISIBLE TO THE VESSEL OPERATOR. THE SECOND SIGN SHOULD BE AT LEAST 8" BY 11" WHICH READS CAUTION: MANATEE HABITAT. IDLE SPEED IS REQUIRED IF OPERATING A VESSEL IN THE CONSTRUCTION AREA. ALL EQUIPMENT MUST BE SHUTDOWN IF A MANATEE COMES WITHIN 50 FEET OF OPERATION. ANY COLLISION WITH AND/OR INJURY TO A MANATEE SHALL BE REPORTED IMMEDIATELY TO THE U.S. FISH AND WILDLIFE SERVICE IN DAPHNE (251-441-5181).

904-914 OMIT

915 BASIN BOOM SHALL BE REUSED AS NECESSARY AT EACH LOCATION (WATER).

CURRENT ALABAMA DEPARTMENT OF TRANSPORTATION

REVISIONS

ALABAMA DEPARTMENT OF TRANSPORTATION
1409 COLISEUM BOULEVARD
MONTGOMERY, AL 36130-3050

GENERAL PROJECT NOTES

DRAWN BY: _____
DATE DRAWN: _____

SPECIAL DRAWING NO.

INDEX NO.

PILE TIP ELEVATIONS

REFERENCE PROJECT NO	FISCAL YEAR	SHEET NO
IM-I010(341)	2018	2A

PILE TIP ELEVATIONS AND TARGETED NOMINAL RESISTANCE

TEST PILE	PILE TYPE	STATION	SIDE	OFFSET	PILE LENGTH (FT)	TARGETED NOMINAL RESISTANCE (kips)	ESTIMATED TIP ELEVATION (FT)	MINIMUM TIP ELEVATION (FT)
TP-10A-1	HP 14X89	STATION 469+20.00	RT	110	82	300	-65	
TP-10A-2	HP 14X89	STATION 469+20.00	RT	111	82	300	-65	
TP-10B-1	18" PPC SQUARE	STATION 469+60.00	RT	110	77	650	-60	
TP-10B-2	18" PPC SQUARE	STATION 469+60.00	RT	110	77	650	-60	
TP-WPA	60" STEEL PIPE	STATION 513+33.00	LT	100	175	3100	-170	
TP-WPB	72" DRILLED SHAFT	STATION 513+53.00	LT	100	177	N/A	-170	
TP-04	54" PPC CYLINDRICAL	STATION 574+00.00	LT	150	120	3100	-110	-80
TP-23A	54" PPC CYLINDRICAL	STATION 629+57.00	LT	150	140	3100	-130	
TP-23B	54" PPC CYLINDRICAL	STATION 630+00.00	LT	150	110	3100	-100	
TP-23C	30" PPC SQUARE	STATION 630+43.00	LT	150	110	1500	-100	
TP-111A	54" PPC CYLINDRICAL	STATION 897+50.00	RT	150	130	3100	-120	
TP-111B	54" PPC CYLINDRICAL	STATION 898+00.00	RT	150	130	3100	-120	

RESPONSIBLE PE:	SUPERVISOR:	DESIGNER:	PLAN SUBMITTAL	ALABAMA DEPARTMENT OF TRANSPORTATION		SHEET TITLE	ROUTE
DATE:	DATE:	DATE:				PILE TIP ELEVATIONS	I-10

PLAN SHEET

REFERENCE PROJECT NO	FISCAL YEAR	SHEET NO
IM-I010(341)	2018	8

PROJECT NOTES

201, 305

5+00

900+00

905+00

910+

WB I-10

STA 895+00

STA 910+00

EB I-10

TP-111B
54" PPC
CYLINDRICAL
PILE LOAD
TEST

TP-111A
54" PPC
CYLINDRICAL
PILE LOAD
TEST

END PROJECT
℄ CONSTRUCTION (I-10)
STA 905+00.00

NOTE: SEE SHEET 2A FOR
PILE TIP ELEVATIONS

RESPONSIBLE PE:	SUPERVISOR:	DESIGNER:	PLAN SUBMITTAL	ALABAMA DEPARTMENT OF TRANSPORTATION	50 0 50 HORIZ SCALE (FEET)	SHEET TITLE	ROUTE
DATE:	DATE:	DATE:				PLAN SHEET STA 895+00 TO STA 910+00	I-10

REFERENCE PROJECT NUMBER	FISCAL YEAR	SHEET NUMBER
IM-I010(341)	2018	26

RECORD OF TEST BORING

thompson ENGINEERING

Site Description:	I-10 Mobile River Bridge and Bayway					**County:**	Mobile
Boring No.:	BW-23	**Boring Location:**	632+20.32	**Offset:**	15.51 LT	**Alignment:**	I-10 Bayway
ALDOT PE No.:	DPI-0030(005)	**TE Project No.:**	15-1101-0228			**Eng./Geo.:**	Chris LaFroscia
Elev.:	-4.0 ft.	**Northing:**	249770.929	**Easting:**	1810248.834	**Date Started:**	11/18/2016
Total Depth:	180.0 ft.	**Soil Depth:**	180.0 ft.	**Core Depth:**	0.0 ft.	**Date Completed:**	11/28/2016
Bore Hole Diameter (in):	4-inch	**AASHTO / ASTM Sampling Methods:**		AASHTO T206 & T207			
Drill Machine:	CME 550X	**Drill Method:**	MR	**Hammer Type:**	Automatic	**Energy Ratio:**	88%
Core Size:	N/A	**Driller:**	Thompson Eng	**Groundwater:**	**TOB** 0.0 ft.	**24 HR**	0.0 ft.

Depth (ft)	Elevation (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft.)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value	● SPT N VALUE (blows/foot) PL MC LL ▲ FINES CONTENT (%) ▲ 10 20 30 40 50 60 70 80 90
		Boring Terminated at 180.0 feet.								

LEGEND

SAMPLER TYPE		DRILLING METHOD	
SS - Split Spoon	AC - Auger Cuttings	HSA - Hollow Stem Augers	MR - Mud Rotary Wash
ST - Shelby Tube	GB - Grab Bag	SSA - Solid Stem Augers	RC - Rock Coring
DCP - Dynamic Cone Penetrometer	NQ - Rock Core	HA - Hand Auger	

RECORD OF TEST BORING

thompson ENGINEERING

Site Description:	I-10 Mobile River Bridge and Bayway					**County:**	Mobile
Boring No.:	BW-110	**Boring Location:**	894+44.18	**Offset:**	19.23 RT	**Alignment:**	I-10 Bayway
ALDOT PE No.:	DPI-0030(005)	**TE Project No.:**	15-1101-0228			**Eng./Geo.:**	Justin Fancher
Elev.:	-1.5 ft.	**Northing:**	238883.4863	**Easting:**	1833753.01	**Date Started:**	12/14/2015
Total Depth:	120.0 ft.	**Soil Depth:**	120.0 ft.	**Core Depth:**	0.0 ft.	**Date Completed:**	12/15/2015
Bore Hole Diameter (in):	4-inch	**AASHTO / ASTM Sampling Methods:**		AASHTO T206 & T207			
Drill Machine:	CME 45C	**Drill Method:**	MR	**Hammer Type:**	Manual	**Energy Ratio:**	86%
Core Size:	N/A	**Driller:**	Thompson Eng	**Groundwater:**	**TOB** 0.0 ft.	**24 HR**	0.0 ft.

Depth (ft)	Elevation (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft.)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value	● SPT N VALUE (blows/foot) PL MC LL ▲ FINES CONTENT (%) ▲ 10 20 30 40 50 60 70 80 90
	0.0	Very soft, wet, dark gray, LEAN CLAY with SAND (CL)		0.0	SS-1	0	0	0	0	●
	-5.0	Very soft		1.5	SS-2	0	0	0	0	●
5.0		Very soft		3.0	SS-3	0	0	0	0	●
		Very soft, wet, dark gray, LEAN CLAY with SAND (CL, A-7-6(16)), LL=49 PL=26 PI=23 NMC=26.5 %#200=72.3		4.5	SS-4	0	0	0	0	● ▲
	-10.0	Very soft, No Recovery		6.0	SS-5	0	0	1	1	●
10.0		Very soft		8.5	SS-6	0	0	0	0	●
	-15.0	Very loose, wet, gray, fine grained, POORLY GRADED SAND (SP)		13.5	SS-7	0	0	1	1	●
15.0										
	-20.0	Very loose, wet, gray, fine to medium grained, SILTY SAND (SM)		18.5	SS-8	0	0	0	0	●
20.0										
	-25.0	Very loose, wet, gray, fine to medium grained, SILTY SAND (SM, A-4(0)), LL=NP PL=NP PI=NP NMC=27.9 %#200=39.1		23.5	SS-9	0	0	0	0	■ ○ ▲
25.0										
	-30.0	Very loose		28.5	SS-10	0	0	0	0	●
30.0										

LEGEND

SAMPLER TYPE		DRILLING METHOD	
SS - Split Spoon	AC - Auger Cuttings	HSA - Hollow Stem Augers	MR - Mud Rotary Wash
ST - Shelby Tube	GB - Grab Bag	SSA - Solid Stem Augers	RC - Rock Coring
DCP - Dynamic Cone Penetrometer	NQ - Rock Core	HA - Hand Auger	

RECORD OF TEST BORING

thompson ENGINEERING

Site Description:	I-10 Mobile River Bridge and Bayway					**County:**	Mobile
Boring No.:	BW-110	**Boring Location:**	894+44.18	**Offset:**	19.23 RT	**Alignment:**	I-10 Bayway
ALDOT PE No.:	DPI-0030(005)	**TE Project No.:**	15-1101-0228			**Eng./Geo.:**	Justin Fancher
Elev.:	-1.5 ft.	**Northing:**	238883.4863	**Easting:**	1833753.01	**Date Started:**	12/14/2015
Total Depth:	120.0 ft.	**Soil Depth:**	120.0 ft.	**Core Depth:**	0.0 ft.	**Date Completed:**	12/15/2015
Bore Hole Diameter (in):	4-inch	**AASHTO / ASTM Sampling Methods:**		AASHTO T206 & T207			
Drill Machine:	CME 45C	**Drill Method:**	MR	**Hammer Type:**	Manual	**Energy Ratio:**	86%
Core Size:	N/A	**Driller:**	Thompson Eng	**Groundwater:**	**TOB** 0.0 ft.	**24 HR**	0.0 ft.

Depth (ft)	Elevation (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft.)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value	● SPT N VALUE (blows/foot) PL MC LL ▲ FINES CONTENT (%) ▲ 10 20 30 40 50 60 70 80 90
30.0										
	-35.0	Very loose, wet, gray, fine to medium grained, POORLY GRADED SAND with SILT (SP-SM, A-2-4(0)), LL=NP PL=NP PI=NP NMC=27.3 %#200=11.7		33.5	SS-11	1	1	1	2	● ▲ ○
35.0										
	-40.0	Loose		38.5	SS-12	2	3	2	5	●
40.0										
	-45.0	Loose, light gray		43.5	SS-13	4	4	5	9	●
45.0										
	-50.0	Medium dense		48.5	SS-14	7	9	13	22	●
50.0										
	-55.0	Medium dense, wet, light gray, fine to medium grained, POORLY GRADED SAND with SILT (SP-SM, A-3(0)), LL=NP PL=NP PI=NP NMC=20.9 %#200=5.9		53.5	SS-15	10	11	10	21	X ▲ ●
55.0										
	-60.0	Loose		58.5	SS-16	5	4	4	8	●
60.0										

LEGEND

SAMPLER TYPE		DRILLING METHOD	
SS - Split Spoon	AC - Auger Cuttings	HSA - Hollow Stem Augers	MR - Mud Rotary Wash
ST - Shelby Tube	GB - Grab Bag	SSA - Solid Stem Augers	RC - Rock Coring
DCP - Dynamic Cone Penetrometer	NQ - Rock Core	HA - Hand Auger	

STRATA SYMBOLS

- SAND (SP)
- SILT (MH)
- FAT CLAY (CH)
- SILTY SAND (SM)
- POORLY GRADED SAND with SILT (SP-SM)
- ORGANIC SOILS (OL)
- Paving
- GRAVEL (GP)
- SANDY SILT (ML)
- LEAN CLAY (CL)
- TOPSOIL
- CLAYEY SAND (SC)
- CLAYEY SILTY SAND (SC-SM)
- WELL GRADED SAND with SILT and GRAVEL (SW-SM)
- SANDSTONE
- DOLOMITE
- CLAYEY GRAVEL (GC)
- POORLY GRADED GRAVEL with SILT and SAND (GP-GM)
- SILTY CLAY (CL-ML)
- Ground Water, ATD
- 24 Hr./Delayed Ground Water
- HSA - Hollow Stem Auger
- SSA - Solid Stem Auger
- MR - Mud Rotary

NO - Not Obtained

NE - Not Encountered

REC Recovery

RQD Rock Quality Designation

pp - Pocket Penetrometer

SS - Split Spoon

ST - Shelby Tube

DCP - Dynamic Cone Penetrometer

AC - Auger Cuttings

GB - Grab Bag

NQ - Rock Core

Alabama Department of Transportation

Bridge Sheet of

thompson ENGINEERING
2970 COTTAGE HILL RD.
MOBILE, AL 36606

APPROVED : SAM STERNBERG III, P.E.

GEOTECHNICAL ENGINEER

DATE :

PROJECT NO. 17-1101-0145
I-10 MOBILE RIVER BRIDGE
LOAD TEST PROGRAM
MOBILE COUNTY, ALABAMA

Preliminary Project No:

TEST BORING RECORD

REFERENCE PROJECT NUMBER	FISCAL YEAR	SHEET NUMBER
IM-I010(341)	2018	27

thompson ENGINEERING

RECORD OF TEST BORING

Site Description:	I-10 Mobile River Bridge and Bayway			**County:**	Mobile
Boring No.:	BW-110	**Boring Location:**	894+44.18	**Offset:**	19.23 RT
Alignment:	I-10 Bayway				
ALDOT PE No.:	DPI-0030(005)	**TE Project No.:**	15-1101-0228	**Eng./Geo.:**	Justin Fancher
Elev.:	-1.5 ft.	**Northing:**	238883.4863	**Easting:**	1833753.01
Date Started:	12/14/2015				
Total Depth:	120.0 ft.	**Soil Depth:**	120.0 ft.	**Core Depth:**	0.0 ft.
Date Completed:	12/15/2015				
Bore Hole Diameter (in):	4-inch	**AASHTO / ASTM Sampling Methods:**	AASHTO T206 & T207		
Drill Machine:	CME 45C	**Drill Method:**	MR	**Hammer Type:**	Manual
Energy Ratio:	86%				
Core Size:	N/A	**Driller:**	Thompson Eng	**Groundwater:**	**TOB** 0.0 ft.
24 HR	0.0 ft.				

Depth (ft)	Elevation (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft.)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value	● SPT N VALUE (blows/foot) PL MC LL ▲ FINES CONTENT (%) ▲ 10 20 30 40 50 60 70 80 90
60.0										
65.0	-65.0	Medium dense, gray		63.5	SS-17	8	6	7	13	●
70.0	-70.0	Medium dense		68.5	SS-18	9	9	9	18	●
75.0	-75.0	Dense, light gray		73.5	SS-19	13	25	25	50	●
80.0	-80.0	Dense		78.5	SS-20	10	14	23	37	●
85.0	-85.0	Medium dense, with trace clay		83.5	SS-21	6	11	13	24	●
90.0	-90.0	Medium dense		88.5	SS-22	7	8	9	17	●

LEGEND

SAMPLER TYPE		DRILLING METHOD	
SS - Split Spoon	AC - Auger Cuttings	HSA - Hollow Stem Augers	MR - Mud Rotary Wash
ST - Shelby Tube	GB - Grab Bag	SSA - Solid Stem Augers	RC - Rock Coring
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thompson ENGINEERING

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Date Completed:	12/15/2015				
Bore Hole Diameter (in):	4-inch	**AASHTO / ASTM Sampling Methods:**	AASHTO T206 & T207		
Drill Machine:	CME 45C	**Drill Method:**	MR	**Hammer Type:**	Manual
Energy Ratio:	86%				
Core Size:	N/A	**Driller:**	Thompson Eng	**Groundwater:**	**TOB** 0.0 ft.
24 HR	0.0 ft.				

Depth (ft)	Elevation (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft.)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value	● SPT N VALUE (blows/foot) PL MC LL ▲ FINES CONTENT (%) ▲ 10 20 30 40 50 60 70 80 90
90.0										
95.0	-95.0	Very stiff, moist, greenish gray, LEAN CLAY with SAND (CL)		93.5	SS-23	9	9	9	18	●
		Undisturbed sample obtained from 95.5 to 97.5 feet. Approximately 24 inches of recovery. Very soft, moist, greenish gray, with trace gravel, LEAN CLAY with SAND (CL, A-7-6(18)), LL=42 PL=14 PI=27 NMC=50.4 %#200=72.8		95.5	ST-1					×—× O ▲
100.0	-100.0	Very stiff		98.5	SS-24	11	11	13	24	●
105.0	-105.0	Very stiff		103.5	SS-25	10	11	15	26	●
110.0	-110.0	Hard, gray		108.5	SS-26	14	17	31	48	●
115.0	-115.0	Hard, greenish gray		113.5	SS-27	22	22	19	41	●
120.0	-120.0	Hard, gray		118.5	SS-28	19	27	34	61	●

LEGEND

SAMPLER TYPE		DRILLING METHOD	
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thompson ENGINEERING

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Core Size:	N/A	**Driller:**	Thompson Eng	**Groundwater:**	**TOB** 0.0 ft.
24 HR	0.0 ft.				

Depth (ft)	Elevation (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft.)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value	● SPT N VALUE (blows/foot) PL MC LL ▲ FINES CONTENT (%) ▲ 10 20 30 40 50 60 70 80 90
		Boring Terminated at 120.0 ft.								

LEGEND

SAMPLER TYPE		DRILLING METHOD	
SS - Split Spoon	AC - Auger Cuttings	HSA - Hollow Stem Augers	MR - Mud Rotary Wash
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- SILT (MH)
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- Paving
- GRAVEL (GP)
- SANDY SILT (ML)
- LEAN CLAY (CL)
- TOPSOIL
- CLAYEY SAND (SC)
- CLAYEY SILTY SAND (SC-SM)
- WELL GRADED SAND with SILT and GRAVEL (SW-SM)
- SANDSTONE
- DOLOMITE
- CLAYEY GRAVEL (GC)
- POORLY GRADED GRAVEL with SILT and SAND (GP-GM)
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Alabama Department of Transportation

Bridge Sheet of

thompson ENGINEERING
2970 COTTAGE HILL RD.
MOBILE, AL 36606

APPROVED : SAM STERNBERG III, P.E.

GEOTECHNICAL ENGINEER

DATE :

PROJECT NO. 17-1101-0145
I-10 MOBILE RIVER BRIDGE
LOAD TEST PROGRAM
MOBILE COUNTY, ALABAMA

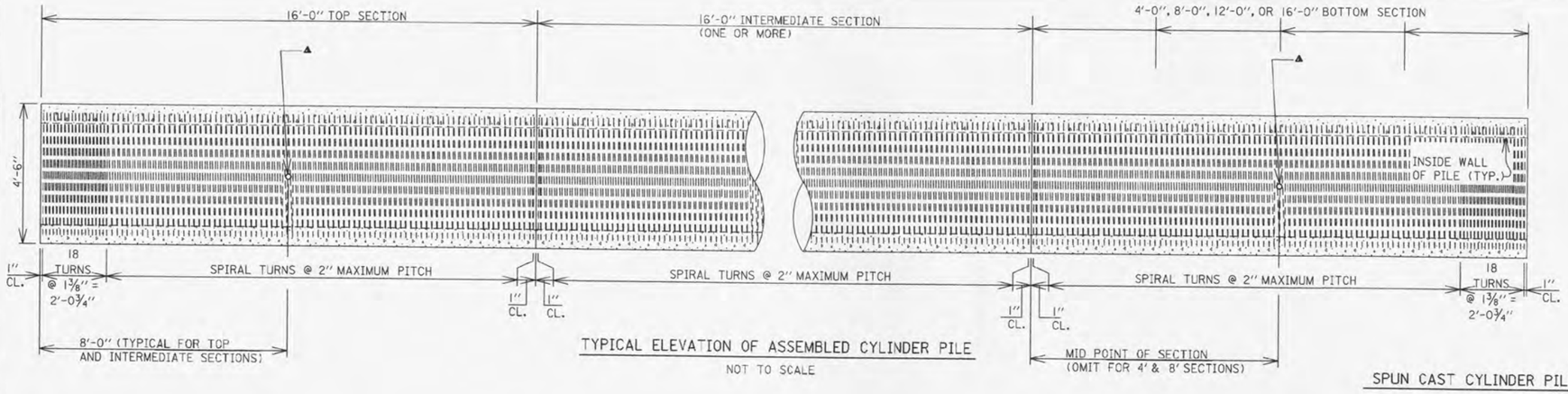
Preliminary Project No:

TEST BORING RECORD

Sheet 12 of 12

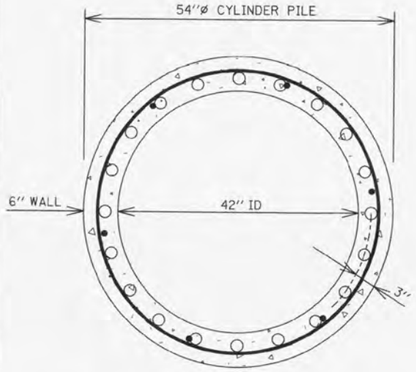
SPUN CYLINDER CONCRETE PILE DETAILS

REFERENCE PROJECT NO	FISCAL YEAR	SHEET NO
IM-I010(341)	2018	13



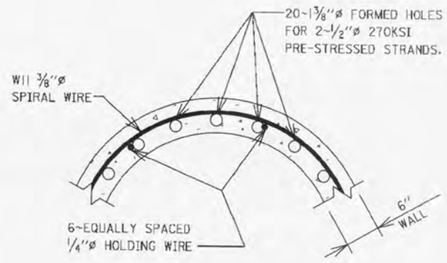
TYPICAL ELEVATION OF ASSEMBLED CYLINDER PILE

NOT TO SCALE



54" DIAMETER SECTION (20 CABLES)

NOT TO SCALE



TYPICAL REINFORCING DETAIL

NOT TO SCALE

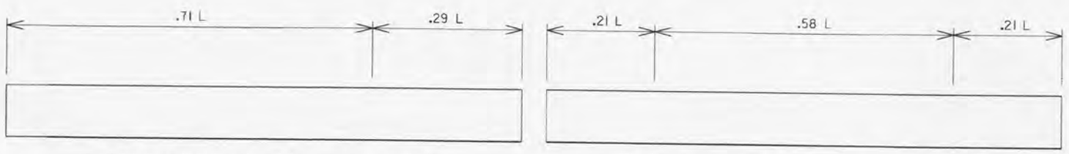
PRESTRESSED PILE SCHEDULE

QUANTITY	LENGTH	COMMENTS
1	120'-0"	TP-04
1	140'-0"	TP-23A
1	110'-0"	TP-23B
1	130'-0"	TP-111A
1	130'-0"	TP-111B
NO PILE SHALL BE PRODUCED WITHOUT WRITTEN APPROVAL OF THIS DRAWING		

SPUN CAST CYLINDER PILE GENERAL NOTES

1. STEEL FORMS FOR EACH SPUN CAST CYLINDER PILE SECTION SHALL NOT BE REMOVED UNTIL THE COMPRESSIVE STRENGTH OF THE CONCRETE HAS REACHED A MINIMUM OF 7,000 PSI.
2. THE CONCRETE IN THE SPUN CAST CYLINDER CONCRETE PILE SECTIONS SHALL HAVE A COMPRESSIVE STRENGTH OF 7,000 PSI PRIOR TO BEING ASSEMBLED INTO A SPUN CAST CYLINDER CONCRETE PILE UNIT AND RECEIVING THE PRESTRESSING FORCE.
3. SPUN CAST CYLINDER CONCRETE PILES SHALL NOT BE SHIPPED AND DRIVEN UNTIL THE MINIMUM 28-DAY COMPRESSIVE STRENGTH OF THE CONCRETE IS 10,000 PSI.
4. GROUT SHALL HAVE A MINIMUM COMPRESSIVE STRENGTH OF 4,000 PSI PRIOR TO RELEASE OF STRANDS. REFER TO ALDOT-451 FOR GROUT TESTING.
5. THE ABUTTING JOINING SURFACES OF EACH SECTION SHALL BE COVERED BY A JOINT SEALING MATERIAL AND THE SPUN CAST CYLINDER CONCRETE PILES STRESSED TO 100 PSI AS DIRECTED IN ALDOT-451.
6. THE SPUN CAST CYLINDER CONCRETE PILES SHALL HAVE CABLES PLACED AS SHOWN IN THE SECTIONS ON THIS SHEET. EACH CABLE IS COMPOSED OF 2-1/2" ø, 270 KSI LOW RELAXATION STRANDS CONFORMING TO AASHTO M 203. THE STRANDS SHALL BE STRESSED TO AN INITAL TENSION OF 30,900 LBS IN THE SEQUENCE DESCRIBED IN ALDOT-451.
7. SPIRAL AND SPACER REINFORCING SHALL BE WII COLD DRAWN STEEL WIRE CONFORMING TO AASHTO DESIGNATION M 32. THE SPIRAL REINFORCING STEEL MAY BE WELDED TO THE WII LONGITUDINAL WIRE.

▲8. PROVIDE ONE(1) 2"ø VENT HOLE (@ ℄ PILE) ON TWO(2) OPPOSITE FACES OF PILES (TYPICAL EACH PILE SECTION.



1-POINT LIFT DETAIL(MAX. LEN. 124'-0")

2-POINT LIFT DETAIL(MAX. LEN. 173'-0")

RESPONSIBLE PE:	SUPERVISOR:	DESIGNER:	PLAN SUBMITTAL	ALABAMA DEPARTMENT OF TRANSPORTATION	NOT TO SCALE	SHEET TITLE	ROUTE
DATE:	DATE:	DATE:				SPUN CYLINDER CONCRETE PILE DETAILS	I-10

Appendix E

Instrument Calibrations
TP-111B

I-10 over Mobile River Bridge Load Test Program

ALDOT Project No.: IM-I010(341)
Mobile County, Alabama
AFT Project No.: 118008

Pile Dynamics, Inc.

Certificate of Calibration

Transducer Model: BDI ST350

Serial Number: E655

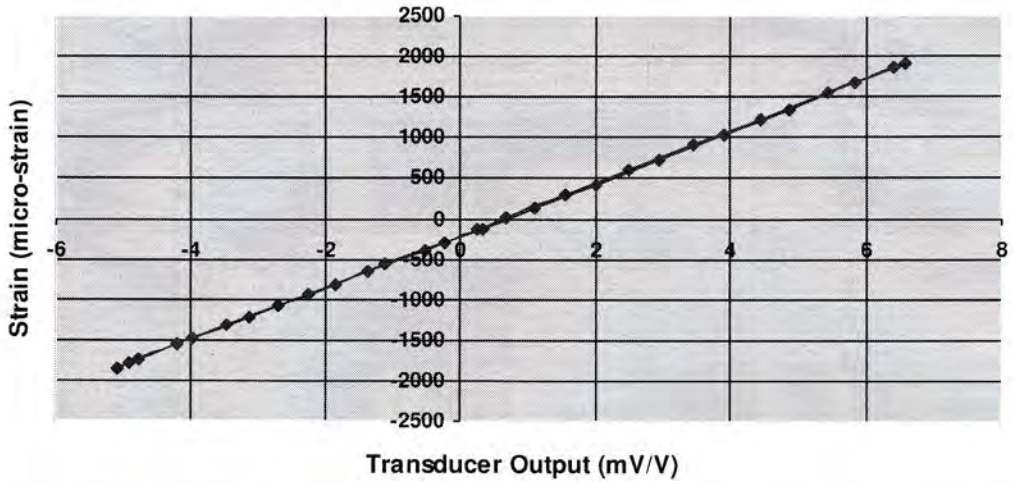
PDI Gage Factor: 92.7 με/V

General Gage Factor: 321.8 $\mu\varepsilon/mV/V_{ext}$
Initial Offset Voltage: 0.149 mV/V_{ext}

Table 1 – Representative Calibration Data

Applied Strain (με)	Transducer Output (mV/V_{ext})	Applied Strain (με)	Transducer Output (mV/V_{ext})
-132	0.253	133	1.110
-286	-0.238	423	2.009
-565	-1.103	726	2.949
-808	-1.866	1035	3.901
-1075	-2.707	1349	4.878
-1324	-3.476	1671	5.850
-1558	-4.208	1915	6.567
-1790	-4.911	1868	6.416
-1856	-5.099	1549	5.441
-1741	-4.789	1226	4.447
-1486	-3.993	912	3.460
-1209	-3.125	599	2.486
-935	-2.243	301	1.568
-662	-1.365	9	0.670
-390	-0.510	-131	0.244
-125	0.319	-132	0.240

Calibration Curve



Mean Linear Correlation Coefficient (LCC): 9.999728E-1

LCC Standard Deviation: 2.690308E-6

Calibrated By: Kay Tol

Signature: Kay Tol

Date/Time: 2/28/2018 8:04 AM

Temperature (°C): 25.3

Specifications

PDI Automated Strain Transducer Calibration System (PDI-ASTCS)

ASTCS Calibration Information	
ASTCS Serial Number:	ASTCS-0005
ASTCS Software Version:	2.310
ASTCS Independent Verification Date:	11/5/2014 11:54 AM
Strain Transducer Gage Length:	3.0 inches (76.2 mm)
Applied Full Scale Displacement Range:	±7.500000E-3 inches
Method for Applying Displacement:	Precision Step Motor Coupled to Linear Stage
Excitation Voltage for Calibration:	2.5 VDC
Displacement Measurements:	Dual Precision AC LVDT's, Output Averaged
Displacement Certification:	NIST 274437-07
Linearity Verification Technique:	Linear Correlation Coefficient > 0.9999
Repeatability Verification Technique:	Standard Deviation < 0.5 % (of mean)
ASTCS System Check	
Reference Strain Transducer:	4367T
Reference General Gage Factor:	293.000 με/mV/V
LVDT #1 Sensitivity (inches/volt):	7.916500E-3
LVDT #2 Sensitivity (inches/volt):	8.042000E-3
Date/Time of Last System Check:	2/27/2018 3:17 PM
PDI Strain Transducer Connections	
Black:	+ Excitation
Green:	- Excitation
Red:	+ Signal
White:	- Signal
Grey:/BARE	Shield

NIST Reference:

PDI certifies the above PDI-ASTCS 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. The calibration of this instrument was performed in accordance with the PDI Quality Assurance program. Measurements and information provided on this report are valid at the time of calibration only.

Pile Dynamics, Inc.

Certificate of Calibration

Transducer Model: BDI ST350

Serial Number: H829

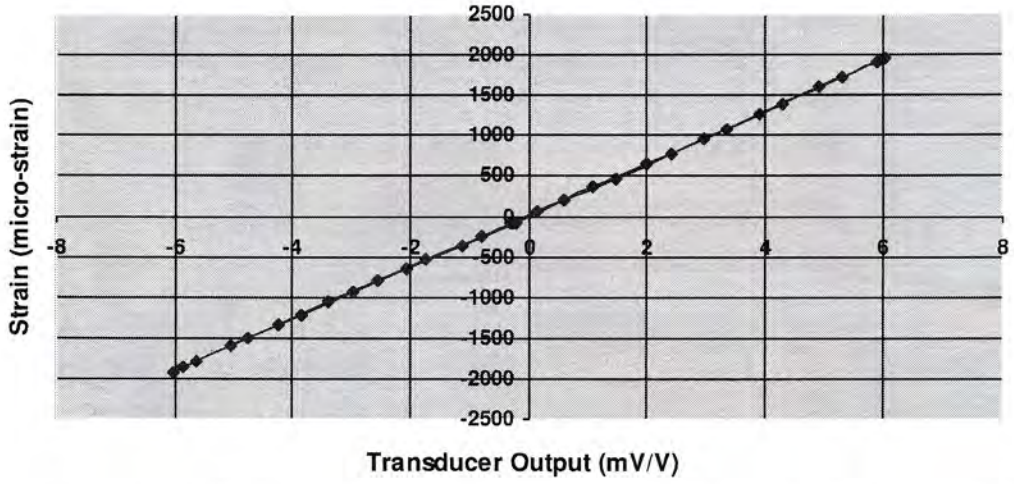
PDI Gage Factor: 92.2 με/V

General Gage Factor: 320.3 $\mu\varepsilon/mV/V_{ext}$
Initial Offset Voltage: -0.162 mV/V_{ext}

Table 1 – Representative Calibration Data

Applied Strain (με)	Transducer Output (mV/V_{ext})	Applied Strain (με)	Transducer Output (mV/V_{ext})
-83	-0.299	192	0.604
-240	-0.811	472	1.479
-536	-1.746	768	2.403
-793	-2.548	1074	3.347
-1060	-3.377	1386	4.315
-1337	-4.236	1708	5.293
-1598	-5.047	1952	6.012
-1855	-5.842	1907	5.875
-1924	-6.035	1589	4.905
-1785	-5.632	1271	3.927
-1508	-4.749	965	2.963
-1225	-3.859	657	2.007
-942	-2.962	363	1.087
-654	-2.051	62	0.147
-365	-1.133	-84	-0.291
-74	-0.218	-83	-0.292

Calibration Curve



Mean Linear Correlation Coefficient (LCC): 9.999766E-1

LCC Standard Deviation: 2.876815E-6

Calibrated By: Kay Tol

Signature: Kay Tol

Date/Time: 2/28/2018 7:59 AM

Temperature (°C): 25.4

Specifications

PDI Automated Strain Transducer Calibration System (PDI-ASTCS)

ASTCS Calibration Information	
ASTCS Serial Number:	ASTCS-0005
ASTCS Software Version:	2.310
ASTCS Independent Verification Date:	11/5/2014 11:54 AM
Strain Transducer Gage Length:	3.0 inches (76.2 mm)
Applied Full Scale Displacement Range:	±7.500000E-3 inches
Method for Applying Displacement:	Precision Step Motor Coupled to Linear Stage
Excitation Voltage for Calibration:	2.5 VDC
Displacement Measurements:	Dual Precision AC LVDT's, Output Averaged
Displacement Certification:	NIST 274437-07
Linearity Verification Technique:	Linear Correlation Coefficient > 0.9999
Repeatability Verification Technique:	Standard Deviation < 0.5 % (of mean)
ASTCS System Check	
Reference Strain Transducer:	4367T
Reference General Gage Factor:	293.000 με/mV/V
LVDT #1 Sensitivity (inches/volt):	7.916500E-3
LVDT #2 Sensitivity (inches/volt):	8.042000E-3
Date/Time of Last System Check:	2/27/2018 3:17 PM
PDI Strain Transducer Connections	
Black:	+ Excitation
Green:	- Excitation
Red:	+ Signal
White:	- Signal
Grey:/BARE	Shield

NIST Reference:

PDI certifies the above PDI-ASTCS 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. The calibration of this instrument was performed in accordance with the PDI Quality Assurance program. Measurements and information provided on this report are valid at the time of calibration only.

Pile Dynamics, Inc.

Certificate of Calibration

Transducer Model: BDI ST350

Serial Number: J762

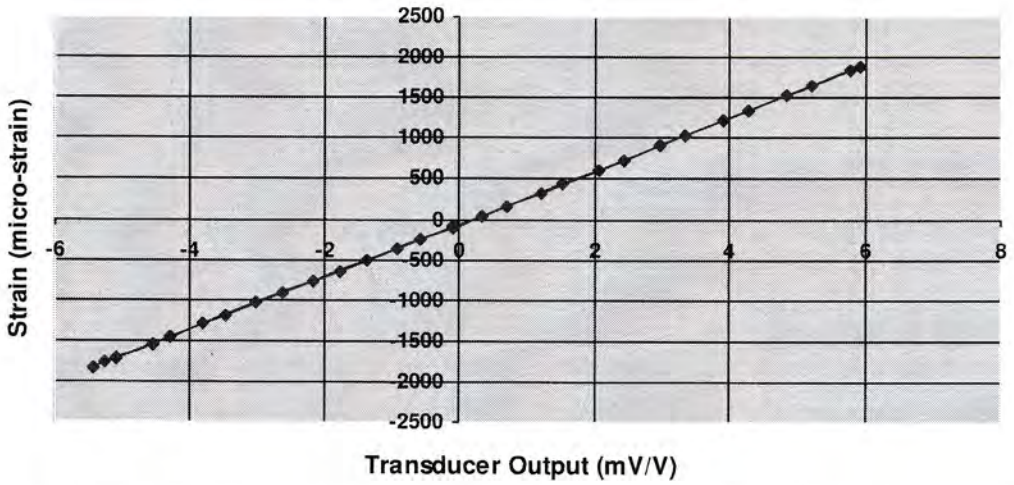
PDI Gage Factor: 93.9 με/V

General Gage Factor: 326.1 $\mu\varepsilon/mV/V_{ext}$
Initial Offset Voltage: -0.006 mV/V_{ext}

Table 1 – Representative Calibration Data

Applied Strain (με)	Transducer Output (mV/V_{ext})	Applied Strain (με)	Transducer Output (mV/V_{ext})
-95	-0.099	158	0.710
-244	-0.569	430	1.538
-507	-1.370	723	2.430
-765	-2.165	1021	3.335
-1036	-3.005	1327	4.269
-1302	-3.817	1642	5.216
-1546	-4.563	1883	5.918
-1769	-5.256	1841	5.789
-1829	-5.427	1531	4.856
-1714	-5.105	1218	3.908
-1455	-4.308	914	2.976
-1190	-3.475	616	2.064
-920	-2.631	332	1.201
-648	-1.772	47	0.328
-369	-0.905	-95	-0.086
-94	-0.057	-93	-0.090

Calibration Curve



Mean Linear Correlation Coefficient (LCC): 9.999784E-1

LCC Standard Deviation: 1.747861E-6

Calibrated By: Kay Tol

Signature: Kay Tol

Date/Time: 2/28/2018 8:02 AM

Temperature (°C): 25.3

Specifications

PDI Automated Strain Transducer Calibration System (PDI-ASTCS)

ASTCS Calibration Information	
ASTCS Serial Number:	ASTCS-0005
ASTCS Software Version:	2.310
ASTCS Independent Verification Date:	11/5/2014 11:54 AM
Strain Transducer Gage Length:	3.0 inches (76.2 mm)
Applied Full Scale Displacement Range:	±7.500000E-3 inches
Method for Applying Displacement:	Precision Step Motor Coupled to Linear Stage
Excitation Voltage for Calibration:	2.5 VDC
Displacement Measurements:	Dual Precision AC LVDT's, Output Averaged
Displacement Certification:	NIST 274437-07
Linearity Verification Technique:	Linear Correlation Coefficient > 0.9999
Repeatability Verification Technique:	Standard Deviation < 0.5 % (of mean)
ASTCS System Check	
Reference Strain Transducer:	4367T
Reference General Gage Factor:	293.000 με/mV/V
LVDT #1 Sensitivity (inches/volt):	7.916500E-3
LVDT #2 Sensitivity (inches/volt):	8.042000E-3
Date/Time of Last System Check:	2/27/2018 3:17 PM
PDI Strain Transducer Connections	
Black:	+ Excitation
Green:	- Excitation
Red:	+ Signal
White:	- Signal
Grey:/BARE	Shield

NIST Reference:

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Pile Dynamics, Inc.

Certificate of Calibration

Transducer Model: BDI ST350

Serial Number: P454

PDI Gage Factor: 145.3 με/V

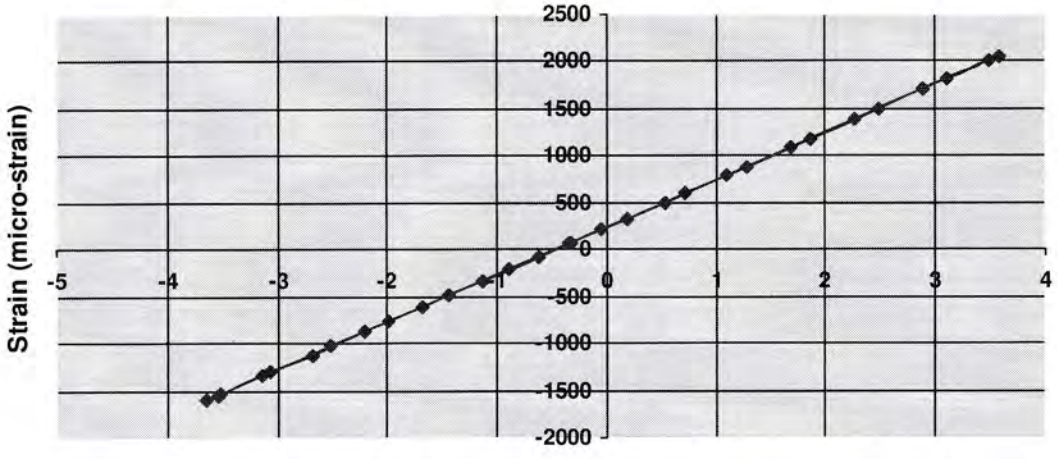
General Gage Factor: 504.7 $\mu\varepsilon/mV/V_{ext}$

Initial Offset Voltage: -0.113 mV/V_{ext}

Table 1 – Representative Calibration Data

Applied Strain (με)	Transducer Output (mV/V_{ext})	Applied Strain (με)	Transducer Output (mV/V_{ext})
65	-0.330	335	0.184
-83	-0.628	598	0.709
-331	-1.125	889	1.284
-607	-1.670	1188	1.872
-876	-2.202	1497	2.487
-1115	-2.687	1814	3.109
-1344	-3.136	2058	3.573
-1543	-3.541	2013	3.492
-1597	-3.646	1700	2.888
-1525	-3.515	1387	2.272
-1288	-3.058	1088	1.683
-1023	-2.521	794	1.100
-753	-1.982	502	0.529
-483	-1.439	210	-0.047
-210	-0.893	71	-0.319
70	-0.337	70	-0.321

Calibration Curve



Mean Linear Correlation Coefficient (LCC): 9.999805E-1

LCC Standard Deviation: 1.224288E-6

Calibrated By: Vanna Thach

Signature: Thach

Date/Time: 1/26/2018 8:12 AM

Temperature (°C): 24.3

Specifications

PDI Automated Strain Transducer Calibration System (PDI-ASTCS)

ASTCS Calibration Information	
ASTCS Serial Number:	ASTCS-0005
ASTCS Software Version:	2.310
ASTCS Independent Verification Date:	11/5/2014 11:54 AM
Strain Transducer Gage Length:	3.0 inches (76.2 mm)
Applied Full Scale Displacement Range:	±7.500000E-3 inches
Method for Applying Displacement:	Precision Step Motor Coupled to Linear Stage
Excitation Voltage for Calibration:	2.5 VDC
Displacement Measurements:	Dual Precision AC LVDT's, Output Averaged
Displacement Certification:	NIST 274437-07
Linearity Verification Technique:	Linear Correlation Coefficient > 0.9999
Repeatability Verification Technique:	Standard Deviation < 0.5 % (of mean)
ASTCS System Check	
Reference Strain Transducer:	4367T
Reference General Gage Factor:	293.000 με/mV/V
LVDT #1 Sensitivity (inches/volt):	7.916500E-3
LVDT #2 Sensitivity (inches/volt):	8.042000E-3
Date/Time of Last System Check:	1/26/2018 7:12 AM
PDI Strain Transducer Connections	
Black:	+ Excitation
Green:	- Excitation
Red:	+ Signal
White:	- Signal
Grey:/BARE	Shield

NIST Reference:

PDI certifies the above PDI-ASTCS 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. The calibration of this instrument was performed in accordance with the PDI Quality Assurance program. Measurements and information provided on this report are valid at the time of calibration only.

Pile Dynamics, Inc.

Certificate of Calibration

Transducer Model: BDI ST350

Serial Number: P455

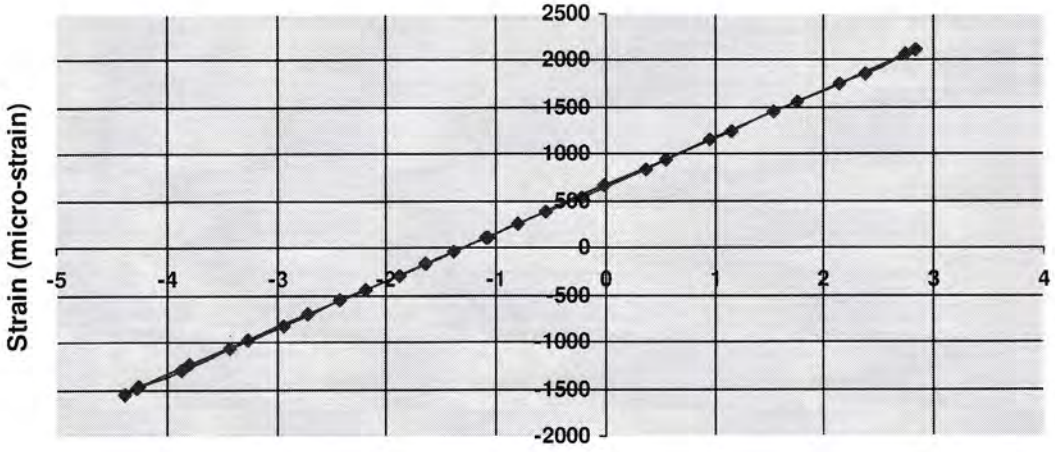
PDI Gage Factor: 145.8 με/V

General Gage Factor: 506.2 $\mu\varepsilon/mV/V_{ext}$
Initial Offset Voltage: -0.434 mV/V_{ext}

Table 1 – Representative Calibration Data

Applied Strain (με)	Transducer Output (mV/V_{ext})	Applied Strain (με)	Transducer Output (mV/V_{ext})
110	-1.082	389	-0.551
-42	-1.386	657	-0.021
-288	-1.881	947	0.552
-560	-2.418	1246	1.143
-828	-2.945	1556	1.751
-1070	-3.431	1869	2.371
-1290	-3.866	2115	2.834
-1489	-4.264	2069	2.749
-1547	-4.375	1752	2.143
-1473	-4.243	1446	1.542
-1238	-3.788	1147	0.958
-976	-3.260	845	0.360
-707	-2.726	548	-0.218
-440	-2.191	255	-0.796
-163	-1.641	114	-1.075
118	-1.086	114	-1.076

Calibration Curve



Mean Linear Correlation Coefficient (LCC): 9.999817E-1

LCC Standard Deviation: 3.891526E-7

Calibrated By: Vanna Thach

Signature: Thach

Date/Time: 1/26/2018 7:26 AM

Temperature (°C): 23.6

Specifications

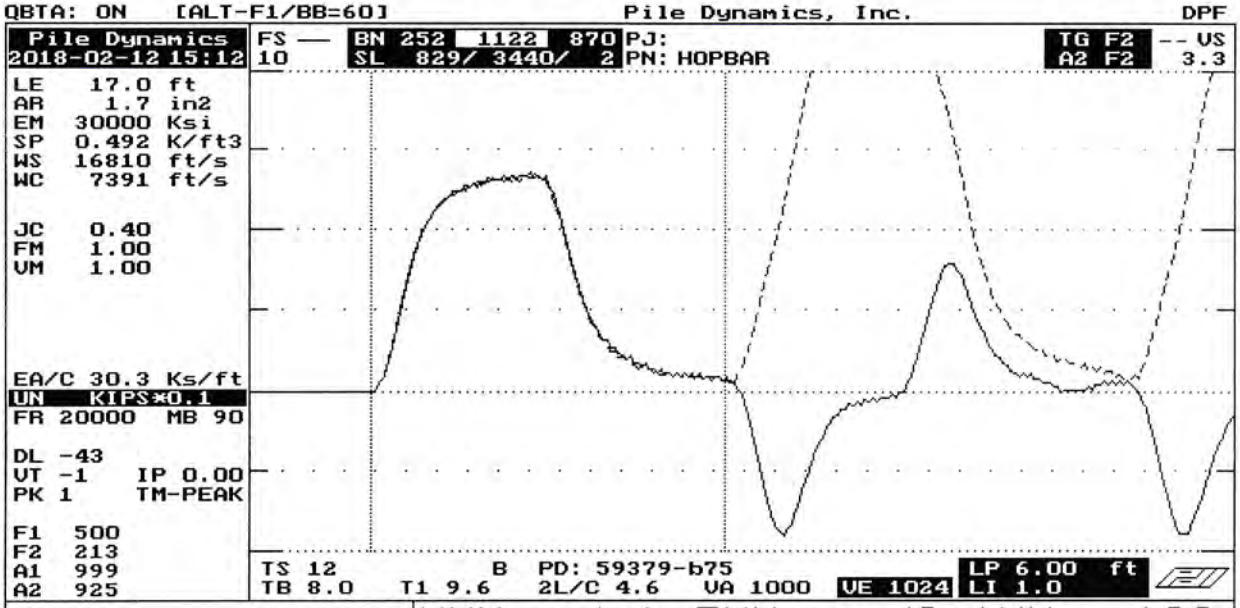
PDI Automated Strain Transducer Calibration System (PDI-ASTCS)

ASTCS Calibration Information	
ASTCS Serial Number:	ASTCS-0005
ASTCS Software Version:	2.310
ASTCS Independent Verification Date:	11/5/2014 11:54 AM
Strain Transducer Gage Length:	3.0 inches (76.2 mm)
Applied Full Scale Displacement Range:	±7.500000E-3 inches
Method for Applying Displacement:	Precision Step Motor Coupled to Linear Stage
Excitation Voltage for Calibration:	2.5 VDC
Displacement Measurements:	Dual Precision AC LVDT's, Output Averaged
Displacement Certification:	NIST 274437-07
Linearity Verification Technique:	Linear Correlation Coefficient > 0.9999
Repeatability Verification Technique:	Standard Deviation < 0.5 % (of mean)
ASTCS System Check	
Reference Strain Transducer:	4367T
Reference General Gage Factor:	293.000 με/mV/V
LVDT #1 Sensitivity (inches/volt):	7.916500E-3
LVDT #2 Sensitivity (inches/volt):	8.042000E-3
Date/Time of Last System Check:	1/26/2018 7:12 AM
PDI Strain Transducer Connections	
Black:	+ Excitation
Green:	- Excitation
Red:	+ Signal
White:	- Signal
Grey:/BARE	Shield

NIST Reference:

PDI certifies the above PDI-ASTCS 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. The calibration of this instrument was performed in accordance with the PDI Quality Assurance program. Measurements and information provided on this report are valid at the time of calibration only.

QBTA: ON [ALT-F1/BB=60] Pile Dynamics, Inc. DPF



VMX= 4.4 FMX= 68 AMX= 139
EMX= 0.3 MEX= 133 FVP= 1.00

ACCEPT SQ-OFF FL-OFF PR-OFF

ACCEPT

ACCELEROMETER CALIBRATION N.I.S.T. Traceable

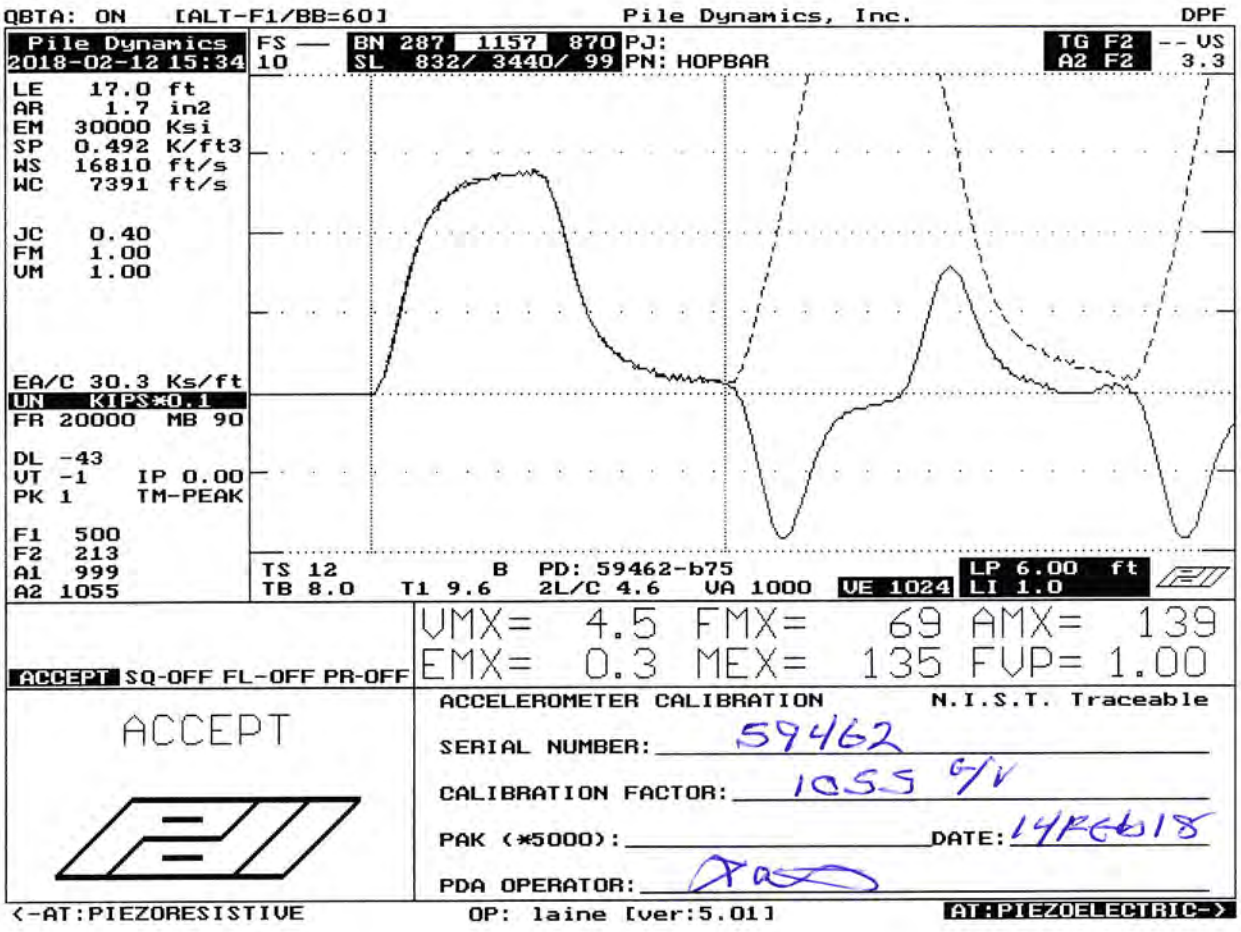
SERIAL NUMBER: 59379

CALIBRATION FACTOR: 925 e/v

PAK (*5000): _____ DATE: 14Feb18

PDA OPERATOR: [signature]

<-AT:PIEZORESISTIVE OP: laine [ver:5.01] AT:PIEZOELECTRIC->


QBTA: ON [ALT-F1/BB=60]
Pile Dynamics, Inc.
DPF
Pile Dynamics
2018-02-12 15:34
FS —
10
BN 287 1157 870
SL 832/ 3440/ 99
PJ:
PN: HOPBAR
TG F2
A2 F2
-- VS
3.3
LE 17.0 ft
AR 1.7 in2
EM 30000 Ksi
SP 0.492 K/ft3
WS 16810 ft/s
WC 7391 ft/s
JC 0.40
FM 1.00
VM 1.00
EA/C 30.3 Ks/ft
UN KIPS*0.1
FR 20000 MB 90
DL -43
VT -1 IP 0.00
PK 1 TM-PEAK
F1 500
F2 213
A1 999
A2 1055
TS 12
TB 8.0
T1 9.6
B
PD: 59462-b75
2L/C 4.6
VA 1000
VE 1024
LP 6.00 ft
LI 1.0
VMX= 4.5 FMX= 69 AMX= 139
EMX= 0.3 MEX= 135 FVP= 1.00
ACCEPT SQ-OFF FL-OFF PR-OFF
ACCEPT
ACCELEROMETER CALIBRATION
N.I.S.T. Traceable
SERIAL NUMBER: 59462
CALIBRATION FACTOR: 1055 G/V
PAK (*5000):
DATE: 14Feb18
PDA OPERATOR:
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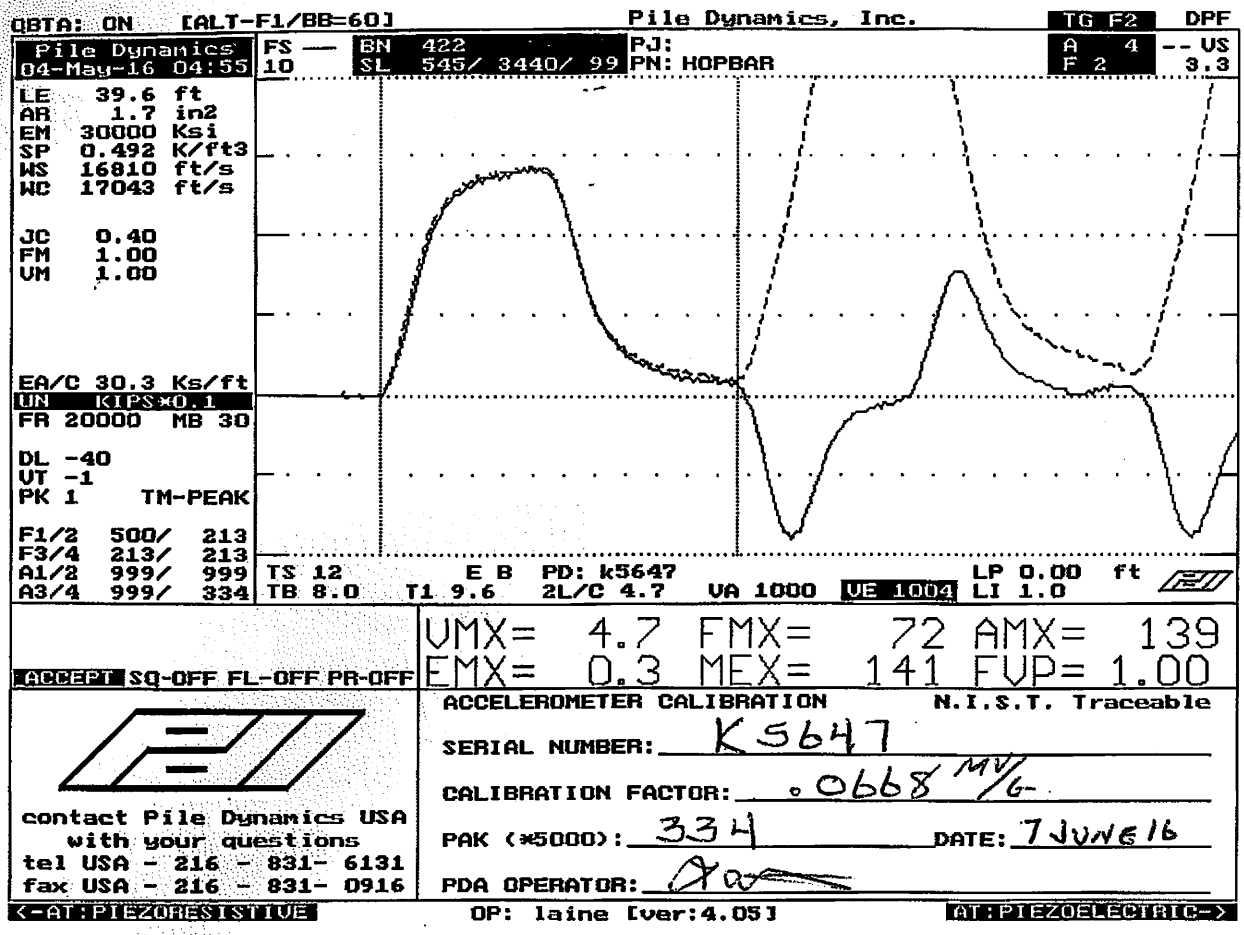
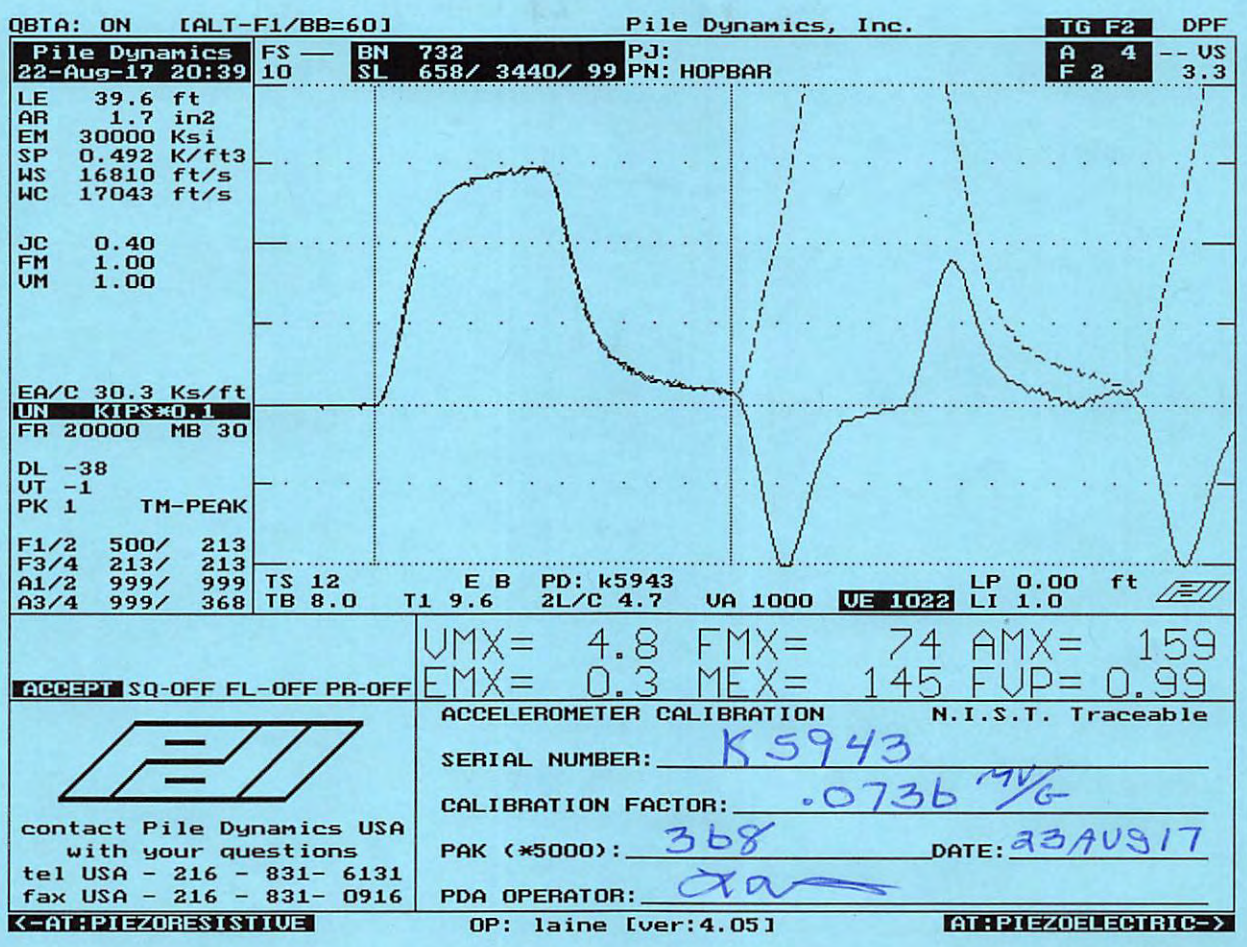
OP: laine [ver:5.01]
AT:PIEZOELECTRIC->



Smart Sensor

Smart Chip Programmed By M.W. **on** 7JUN16 **CRC Value** 34B5



Smart Sensor

Smart Chip Programmed By T.M.N. **on** 23AUG17 **CRC Value** BADD