Applied Foundation Testing

Alabama Certificate of Authorization CA3058-E

June 15, 2018
Revision 1: June 26, 2018
Revision 2: June 29, 2018

Report of High-Strain Dynamic Pile Testing and Axial Statnamic Load Testing
TP-WPA
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
DN: c=US, o=APPLIED FOUNDATION TESTING, ou=APPLIED FOUNDATION TESTING, cn=Donald T Robertson, 0.9.2342.19200300.100.1.1=A01097C000001617C717FAC0000EEB3
Date: 2018.07.02 09:14:46 -04'00'

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 15, 2018 included a change to the Generalized Soil Conditions section to indicate that the groundwater depth, not elevation, noted in boring MB-1 was 0.0 feet.

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 60-inch diameter, 1.0-inch wall thickness, 175-feet long open-ended steel pipe pile at location TP-WPA. High-strain dynamic pile testing, also known as PDA, was performed during initial drive and 13 day restrike. Axial Statnamic load testing was performed 10 days after the initial drive of TP-23B. A 13 day restrike was subsequently performed 3 days after axial Statnamic load testing. 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-WPA	Initial Drive	5/22/2018
	Statnamic Load Testing	6/1/2018
	13 Day Restrike	6/4/2018

The project plans indicate test pile TP-WPA was located at station 513+33.00 offset left 100 feet, on the west side of the Mobile River. Please refer to the project source documents for a site plan of the actual location of the test piles.

Installation of test pile TP-WPA was performed by Jordan Pile Driving, Inc. In addition, Jordan Pile Driving, Inc. provided the over-water support frame and necessary office and field support to carry out the axial Statnamic load testing. Applied Foundation Testing (AFT) was the specialty engineering firm performing the dynamic pile testing and monitoring the axial Statnamic load test. Dynamic pile testing was performed by Mr. Michael Worsham, P.E. Axial Statnamic load testing was performed by Mr. Donald Robertson, P.E., Mr. Michael Worsham, P.E., and Mr. Zack Cohens. 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 and axial Statnamic load testing for TP-WPA. This report includes an overview of the testing program, tabular and graphical representations of the data, 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-WPA is boring MB-1 located at station 514+25.88 offset left 18.84 feet.

A copy of soil boring MB-1 is included in Appendix E. 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 water surface elevation measurements noted in boring log MB-1 at the time of drilling (ATD) was +0.00 feet with respect to NAVD (North American Vertical Datum of 1988). 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
+2.9 to -0.1	Silty Sand with Gravel (SM)	8 to 12
-0.1 to -13.9	Gravel with Silt and Sand (GP-GM)	2 to 7
-13.9 to -43.9	Sand with Gravel (SP)	9 to 23
-43.9 to -53.9	Gravel with Sand (GP)	7 to 9
-53.9 to -83.9	Sand with Silt (SP-SM)	15 to 50/5”
-83.9 to -98.9	Fat Clay (CH)	5 to 8
-98.9 to -103.9	Silty Clayey Sand (SC-SM)	52
-103.9 to -123.9	Sand (SP)	38 to 65
-123.9 to -163.9	Sand with Silt (SP-SM)	18 to 100
-163.9 to -168.9	Clayey Sand (SC)	37
-168.9 to -183.9	Sand with Silt (SP-SM)	39 to 70
-183.9 to -211.4	Sandy Lean Clay; Lean Clay (CL)	32 to 38
-211.4 to -251.4	Silty Sand (SM)	8 to 81
-251.4 to -297.1	Sand with Silt (SP-SM)	90 to 50/0”

Note 1: Table created from Thompson Engineering Test Boring Record BW-23 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-WPA 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 one and two pile diameters, or 60 and 120 inches, below the pile top. The sensor attachment location 120 inches from the pile top was used until the gages were near the ground surface. At that point the sensors were moved to the sensor attachment location 60 inches from the pile top in order to continue driving until the sensors were near the water table.

The first 75 feet long section of test pile TP-WPA was installed using a vibratory hammer. A 100 feet long section of pile was then spliced to the 75 long section of pile. TP-WPA 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.

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 F. 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-WPA was driven to where the sensor attachment points were approximately 1 foot above the water table. At this point, the pile top was approximately 2 feet above the existing ground surface which is optimal for set-up of the Statnamic testing device.

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). A stringline was used as a reference for measuring penetration depth during the initial drive. The stringline was located at elevation 6.3 feet. The ground elevation was measured as 5.2 feet. After driving the elevation of the top of soil inside the cylinder pile was measured as -11.0 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-WPA	Pileco D180-32	+6.3	+5.2	+7.0	-168.0

Note 1: Approximate reference elevation based on inspector survey measurement. Approximate final pile tip elevation based on depth below reference, pile movements during restrikes, and load test permanent displacement.

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-WPA	EOD	43 Blows/1'	33.83	23.21	7.03	3.87	25.29	16.35	166.5/8.74
	13 Day RS	8 Blows/0.5", 8 Blows/1", 10 Blows/1", 7 Blows/1"	30.61	26.76	3.85	2.79	25.76	22.60	203.1/9.78

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

Allowable maximum driving stresses for steel pipe piles are defined by the formulas located in the project special provisions. The maximum allowable compressive and tensile stress limit is defined as 0.9 times F_y.

In the above formula F_y is defined as the yield strength of the steel pipe piles, which is 45 ksi per Plan Sheet 14. The maximum allowable compressive and tensile stress is calculated as 40.5 ksi.

The dynamic pile testing measurements indicate the maximum compressive (CSX) and tensile stress (TSX) did not exceeded allowable stress limits during the initial drive or restrikes. The dynamic test data does not show any signs of integrity problems for TP-WPA. Beta values lower than 100 shown in the dynamic testing data summaries are common for steel piles and are most likely due to high frequency noise from steel on steel impacts or due to soil effects and are not a sign of integrity issues.

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-WPA	EOD	3322	1850	1559	291	0.74	211.9/ 10.11	0.04	0.20	0.15	0.40	1.55
	13 Day Restrike	33	2700	2398	302	0.72	219.3/ 10.00	0.10	0.05	0.24	0.40	2.62

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 shown in the analyses are the combined side resistance from the exterior and interior of the open-ended pipe pile.

The signal matching analysis for TP-WPA indicated a total ultimate resistance of 1,850 kips at end of initial drive and 2,700 kips during the 13 day restrike (3 days after axial Statnamic load testing). Based on the set measurements during initial drive and restrike for TP-WPA, the resistance values presented in this report may be considered fully mobilized.

AXIAL STATNAMIC LOAD TESTING

Test pile TP-WPA was subjected to axial Statnamic load testing (commonly referred to as Rapid load testing) on June 1, 2018, or 10 days after initial drive of the pile. Load testing was accomplished utilizing the 19MN Statnamic device in a single load cycle.

AXIAL STATNAMIC INSTRUMENTATION

The top of the pile was instrumented with a calibrated load cell and accelerometers (to measure acceleration and to calculate velocity and displacement). A brief description of the instrumentation used during the Statnamic test is given below. Calibration data is included in Appendix F.

Statnamic Device - The Statnamic load testing was accomplished with a device capable of applying a force of approximately 19 MN. This device uses a controlled burn of fuel to generate gas pressure inside a cylinder and ram (analogous to a gas actuated jack). As the pressure builds, it reacts against a heavy mass above the foundation. The pressure eventually builds high enough to propel the reaction mass upward; in turn a downward load is simultaneously applied to the foundation top which is many times greater than the weight of the reaction mass. The Statnamic device produces a time dependent load on the order of 1/2 second or less. The load produced is not an impact, which makes the Statnamic analysis very simplified and more reliable than dynamic techniques.
Load Cell - The load cell is calibrated full scale and manufactured by the George Kelk Corporation.
Accelerometers - Three accelerometers were arranged across the top of the shaft approximately 120 degrees apart during Statnamic testing. The accelerometers were manufactured by PCB Piezotronics, Inc. From the measured accelerations, shaft displacements at each accelerometer location were calculated. This provides very reliable and highly accurate displacement data.
Data Acquisition System - A National Instruments Data Acquisition System recorded the load cell and accelerometers at 5,000 samples per second for each sensor. This was more than ample to fully define the load and displacement response of the drilled shaft foundation during the load test.

AXIAL STATNAMIC TEST SET UP

Prior to the axial Statnamic load testing, Jordan Pile Driving performed the necessary site preparation to set-up the test frame. This included leveling the ground surface and placement of crane mats. The top of pile steel was in good condition after pile driving.

Additional preparations for the Statnamic load test included the following:

- Prepare site including leveling the ground surface and placement of mats to support the Statnamic device at the appropriate testing elevation.
- Assembly of the Statnamic load system as follows:
  - Placement of the load cell and Statnamic piston on the pile top.
  - Placement of the mechanical catch frame on support mats.
  - Placement of the Statnamic silencer and reaction masses on the pile top.
- Placement of accelerometers near the pile top.
- Connecting all instrumentation (load cell and accelerometers) to the data acquisition system and computer.

AXIAL STATNAMIC LOAD TEST RESULTS

The analysis of the Statnamic load test data was performed using the Modified Unloading Point Method (MUPM) to account for the 175 foot pile length. Due to the rapid application of the load, it was also necessary to account for rate of loading effects. The analysis presented herein was performed using the MUPM method in conjunction with rate effect factors (REF) in as suggested in the National Cooperative Highway Research Program (NCHRP) Project: NCHRP 21-08.

Test Pile TP-WPA was loaded to a maximum derived static load of 2980 kips. The maximum displacement during testing was 1.15 inches. The measured permanent displacement upon complete unloading was 0.20 inches. Table 6 presents a summary of the maximum derived static load, maximum displacement, and the permanent displacement upon unloading. The derived static load versus displacement response for TP-WPA is shown in Figure 1 located in Appendix D. The derived static load versus displacement response for TP-WPA exhibited primarily elastic behavior until the failure load of approximately 2980 kips where pile to soil yielding behavior occurred.

Table 6: Summary of Load and Displacement for Test Pile TP-WPA

Description	Data
Maximum Derived Static Load	2,980 kips
Maximum Displacement	1.15 inches
Permanent Displacement	0.20 inches

Additional commentary on the data reduction is described as follows. During the Statnamic test, the load cell and accelerometers were monitored with a high speed data acquisition system. This data is then analyzed to determine the overall static resistance. Before performing any static analysis of the data, the data must be “pre-processed”, plotted and evaluated. Specifically, the load cell must be offset to account for the weight of the Statnamic reaction masses, which are supported by the pile prior to the load test. The applied Statnamic load versus time

presented in Figure 2 in Appendix D depicts this initial static weight and shows approximately zero load on the pile after the load test. Additional plots of test measurements are included in the Appendix D consisting of: the pile top average acceleration versus time, integrated velocity at the pile top versus time, and pile top displacement versus time.

SUMMARY AND CONCLUSIONS

The load test program included the installation of a 60-inch diameter, 1.0-inch wall thickness, 175-feet long open-ended steel pipe pile at location TP-WPA. TP-WPA was subjected to dynamic pile testing during initial drive and a 13 day restrike and axial Statnamic load testing 10 days after initial drive. A summary of the load test results is provided below:

TP-WPA Load Testing Summary:

- The signal matching analysis of the dynamic testing data for TP-WPA indicated a total ultimate resistance of 1,850 kips at end of initial drive, 2,700 kips for the 13 day restrike, (3 days after axial Statnamic rapid load testing).
- TP-WPA was subjected to axial Statnamic load testing 10 days after initial drive with a maximum derived static load of 2,980 kips with a maximum displacement of 1.15 inches and a permanent displacement of 0.20 inches.
- The failure load during axial Statnamic load testing based on the Davisson Failure Criterion was never reached, however, the derived static load versus displacement response for TP-WPA exhibited soil yielding behavior at approximately 2,980 kips.

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 60-inch diameter, 1.0-inch wall thickness, 175-feet long open-ended steel pipe pile at location TP-WPA are as follows:

- The dynamic pile testing results indicated a lower total resistance than measured during the axial Statnamic load test at TP-WPA. Additionally, attempting to utilize higher resistances similar to those measured during axial Statnamic load testing in the dynamic test data signal matching analysis yielded poor match qualities so this approach was not utilized. The dynamic testing analyses included in this report are based on typical methods which produce good match qualities, and do not represent an attempt to match the axial Statnamic load test results. During production phase dynamic pile testing it may not be possible to verify the higher resistances achieved in this axial Statnamic load test. Additionally, during production phase testing if transfer energies are lower than measured during this testing, 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 – Axial Compressive Statnamic Rapid Load Testing Graphical Results
    - Figure 1 – Derived Static Load versus Displacement Response from Statnamic Load Testing with Davisson Failure Criterion
    - Figure 2 – Applied Statnamic Load versus Elapsed Time
    - Figure 3 – Pile Top Acceleration and Velocity versus Elapsed Time
    - Figure 4 – Pile Top Displacement versus Elapsed Time
- Appendix E – Relevant Project Documents
- Appendix F – 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-WPA

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 513+33 to Station 513+33		Bridge Identification Number:
Road Between: I-10 and I-10		Lane (if applicable): EB
Contractor: Jordan Pile Driving	Inspector: Donald Hector	
Date: 5/22/2018	Bent No.& Lane: TEST PILE	Pile No.: TP-WPA
Kind of Soil: Soft, Wet, Black, Fat Clay		
Kind of Pile: Steel Pipe	Size of Pile: 60"	Total Length (ft): 175
Elev. Ground Line at Pile: 5.2	Final Elev. At Top of Pile: 7.1	Tip Elevation: -167.9
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:	Thickness (in.):	Area (sq. in.):
Pile Cushion (After Driving): Material:	Thickness (in.):	Area (sq. in.):
Pile Cap Weight (lbs.):		

Height Of Fall (feet)	Energy Delivered To Pile (E) (ft.-lbs.)	Blows Per Foot Of Penetration (N)	Total Penetration (feet)	Bearing (Ru) (tons)
4.68	185,702	26	67	
3.19	126,579	14	68	
3.8	150,784	31	69	

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
513+33	513+33	N/A

Date	Bent No.& Lane	Pile No.	Kind of Soil
5/22/2018	TEST PILE	TP-WPA	Soft, Wet, Black, Fat Clay

Height Of Fall (feet)	Energy Delivered To Pile (E) (ft-lbs)		Total Penetration (feet)	Bearing (Ru) (tons)
3.43	136,102	29	70	
3.88	153,958	24	71	
6.37	252,762	29	72	
5.42	215,066	29	73	
7.12	282,522	35	74	
6.68	265,062	35	75	
7.01	278,157	30	76	
7.36	292,045	31	77	
7.20	285,696	25	78	
8.20	325,376	23	79	
8.19	324,979	24	80	
7.19	285,299	24	81	
7.27	288,474	28	82	
6.66	264,269	27	83	
8.28	328,550	22	84	
7.18	284,902	22	85	
7.15	283,712	22	86	
8.16	323,789	20	87	
7.31	290,061	23	88	
4.57	181,338	28	89	
7.00	277,760	21	90	
7.39	293,235	23	91	

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

ALABA . DEPARTMENT OF TRANSPORTA ON
CONTINUATION OF TEST PILE RECORD

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

Bridge: Station	to Station	Bridge Identification Number
513+33	513+33	N/A

Date	Bent No.& Lane	Pile No.	Kind of Soil
5/22/2018	TEST PILE	TP-WPA	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)
8.40	333,312	21	92	
7.20	285,696	22	93	
8.41	333,709	20	94	
8.36	331,725	22	95	
8.30	329,344	22	96	
8.29	328,947	24	97	
4.37	173,402	32	98	
6.73	267,046	24	99	
6.01	238,477	27	100	
5.48	217,446	27	101	
8.44	334,899	26	102	
8.41	333,709	27	103	
8.52	338,074	28	104	
7.58	300,774	28	105	
8.50	337,280	28	106	
8.52	338,074	27	107	
7.84	311,091	28	108	
8.21	325,773	30	109	
8.45	335,296	28	110	
8.24	326,963	29	111	
8.71	345,613	30	112	

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

ALABA DEPARTMENT OF TRANSPORTA ON
CONTINUATION OF TEST PILE RECORD

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

Bridge: Station	to Station	Bridge Identification Number
513+33	513+33	N/A

Date	Bent No.& Lane	Pile No.	Kind of Soil
5/22/2018	TEST PILE	TP-WPA	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)
8.64	342,835	29	113	
7.71	305,933	30	114	
8.01	317,837	33	115	
7.27	288,474	34	116	
8.70	345,216	32	117	
8.80	349,184	34	118	
7.91	313,869	34	119	
8.80	349,184	37	120	
8.68	344,422	36	121	
7.77	308,314	45	122	
8.81	349,581	35	123	
8.99	356,723	36	124	
8.82	349,978	44	125	
7.70	305,536	41	126	
8.85	351,168	39	127	
8.78	348,390	33	128	
8.81	349,581	30	129	
8.97	355,930	44	130	
8.06	319,821	43	131	
7.49	297,203	40	132	
8.60	341,248	43	133	
8.65	343,232	39	134	
8.66	343,629	46	135	

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
513+33	513+33	N/A

Date	Bent No.& Lane	Pile No.	Kind of Soil
5/22/2018	TEST PILE	TP-WPA	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)
8.77	347,994	41	136	
8.68	344,422	37	137	
8.75	347,200	39	138	
8.92	353,946	33	139	
8.93	354,342	35	140	
8.92	353,946	35	141	
8.70	345,216	35	142	
8.78	348,390	33	143	
8.60	341,248	34	144	
8.74	346,803	34	145	
8.66	343,629	31	146	
7.79	309,107	34	147	
8.72	346,010	29	148	
8.59	340,851	31	149	
8.91	353,549	31	150	
8.93	354,342	36	151	
8.81	349,581	35	152	
9.03	358,310	40	153	
8.95	355,136	43	154	
8.97	355,930	43	155	
8.92	353,946	43	156	
8.91	353,549	46	157	

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
513+33	513+33	N/A

Date	Bent No.& Lane	Pile No.	Kind of Soil
5/22/2018	TEST PILE	TP-WPA	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)
8.97	355,930	48	158	
7.86	311,885	52	159	
8.38	332,518	56	160	
9.35	371,008	60	161	
9.71	385,293	50	162	
7.42	294,426	51	163	
9.07	359,898	53	164	
7.48	296,806	33	165	
8.08	320,614	38	166	
8.29	328,947	44	167	
5.37	213,082	44	168	

Appendix B

Dynamic Pile Testing Data Summaries
TP-WPA

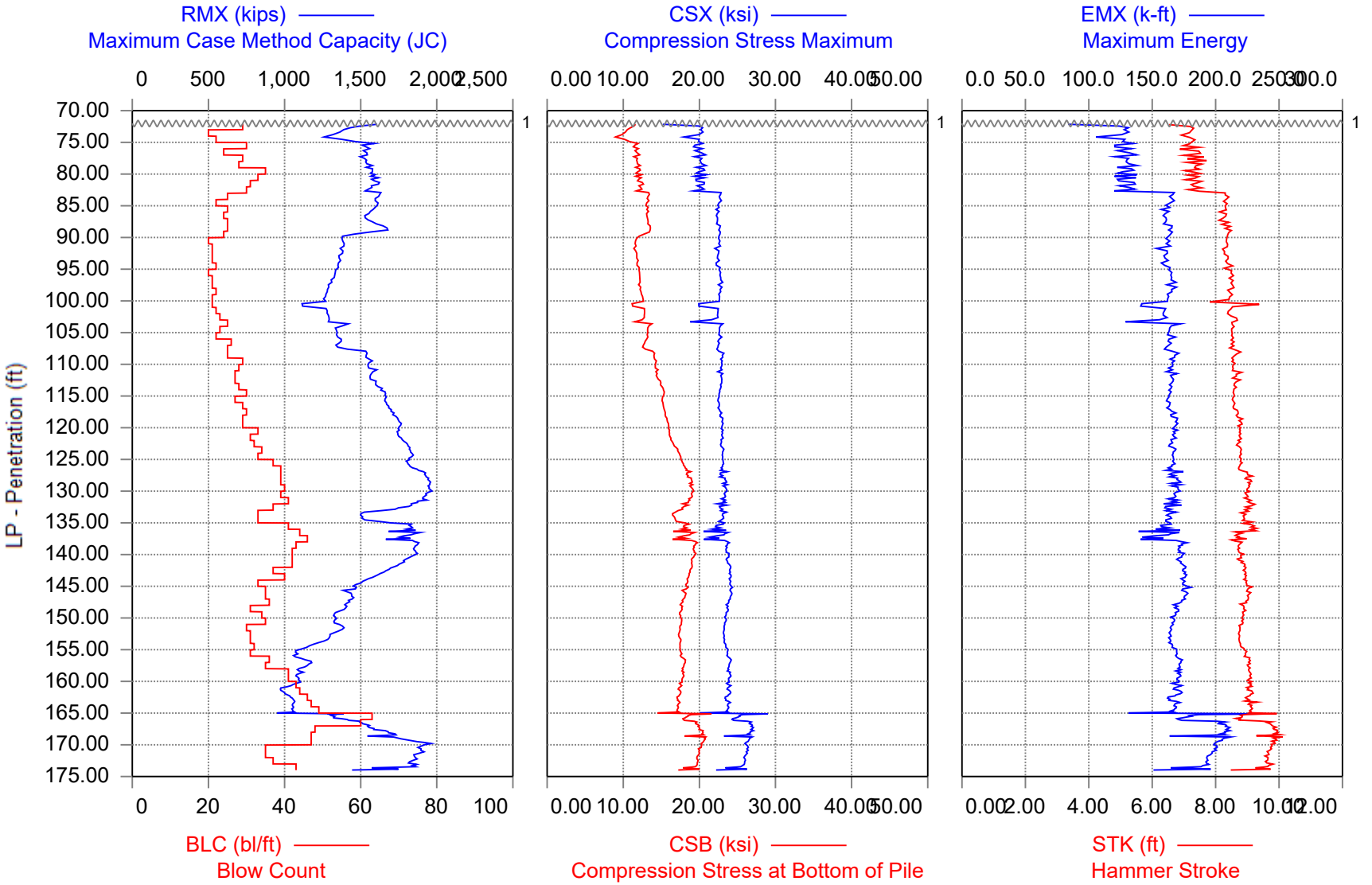
I-10 over Mobile River Bridge Load Test Program

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: 22-May-2018

I-10 MOBILE RIVER - TP-WPA ID



1 - Reference (Stringline) El.=6.27', Ground El.=5.15'

I-10 MOBILE RIVER - TP-WPA ID 60" PIPE, 1" WALL
OP: AFT Date: 22-May-2018

AR: 185.35 in² SP: 0.492 k/ft³
LE: 165.00 ft EM: 30,000.00 ksi
WS: 16,807.9 f/s JC: 0.74

RMX: Maximum Case Method Capacity (JC)
RX8: Maximum Case Method Capacity (JC=0.8)
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	RMX kips	RX8 kips	RA2 kips	CSX ksi	CSB ksi	TSX ksi	EMX k-ft	STK ft	BTA (%)
29	73.00	29	AV29	1,493	1,443	1,048	18.83	11.20	4.43	115.5	7.04	89
			STD	206	187	129	3.53	1.86	0.93	31.5	0.82	7
			MAX	2,130	2,000	1,297	22.07	15.36	5.29	153.1	8.11	100
			MIN	835	798	613	5.64	4.29	1.96	10.5	4.14	71
49	74.00	20	AV20	1,331	1,296	923	19.91	9.99	5.46	125.3	7.17	99
			STD	89	90	52	1.98	0.87	0.86	23.0	0.66	3
			MAX	1,426	1,391	1,026	22.55	10.90	7.00	160.5	8.15	100
			MIN	1,077	1,041	791	14.20	7.58	3.66	62.5	5.38	90
71	75.00	22	AV22	1,367	1,332	1,040	19.42	10.01	5.12	121.8	7.07	99
			STD	131	133	114	3.16	1.43	1.13	36.4	1.05	4
			MAX	1,589	1,558	1,287	23.11	12.04	7.03	168.6	8.40	100
			MIN	1,105	1,072	797	13.59	7.37	3.71	57.0	5.24	89
101	76.00	30	AV30	1,547	1,506	1,237	19.71	11.61	4.34	125.9	7.22	92
			STD	159	173	133	3.28	1.77	0.62	38.7	1.12	5
			MAX	1,807	1,772	1,421	23.46	13.68	5.32	175.0	8.61	100
			MIN	1,302	1,227	926	14.43	8.81	3.40	65.4	5.49	86
125	77.00	24	AV24	1,532	1,495	1,254	20.06	11.79	4.30	129.4	7.30	94
			STD	126	129	105	2.74	1.51	0.49	32.8	0.95	6
			MAX	1,719	1,684	1,383	23.29	13.67	5.24	171.5	8.48	100
			MIN	1,328	1,265	1,040	15.56	9.32	3.68	77.2	5.80	87
154	78.00	29	AV29	1,536	1,489	1,278	20.43	11.96	4.33	133.2	7.45	94
			STD	107	118	117	2.89	1.55	0.47	34.1	0.99	6
			MAX	1,684	1,646	1,449	23.37	13.62	5.32	168.7	8.44	100
			MIN	1,334	1,269	1,051	15.42	9.61	3.69	76.2	5.80	86
182	79.00	28	AV28	1,547	1,490	1,280	20.28	11.89	4.16	130.8	7.39	94
			STD	72	81	97	2.50	1.40	0.29	30.0	0.86	5
			MAX	1,668	1,628	1,440	23.14	13.60	4.94	170.8	8.44	100
			MIN	1,401	1,322	1,061	15.84	9.60	3.72	78.0	5.91	87
217	80.00	35	AV35	1,571	1,498	1,286	20.05	11.91	4.02	128.0	7.28	90
			STD	70	78	105	2.38	1.27	0.10	28.7	0.82	4
			MAX	1,690	1,631	1,408	22.81	13.48	4.23	162.7	8.27	100
			MIN	1,447	1,359	1,099	16.20	10.01	3.80	81.6	6.01	86
250	81.00	33	AV33	1,585	1,506	1,204	19.95	12.01	3.95	127.6	7.27	89
			STD	79	85	136	2.85	1.40	0.35	33.7	0.97	4
			MAX	1,723	1,653	1,421	23.27	14.01	4.35	171.0	8.48	100
			MIN	1,450	1,376	926	15.06	9.81	2.74	70.7	5.68	85

I-10 MOBILE RIVER - TP-WPA ID 60" PIPE, 1" WALL
OP: AFT Date: 22-May-2018

BL#	Depth	BLC	TYPE	RMX	RX8	RA2	CSX	CSB	TSX	EMX	STK	BTA
	ft	bl/ft		kips	kips	kips	ksi	ksi	ksi	k-ft	ft	(%)
281	82.00	31	AV31	1,601	1,517	1,189	20.26	12.35	3.98	131.3	7.37	89
			STD	65	72	87	2.47	1.25	0.32	30.1	0.85	4
			MAX	1,704	1,635	1,360	23.38	14.10	4.25	171.6	8.48	100
			MIN	1,494	1,402	1,021	15.47	10.11	3.05	78.5	5.88	84
311	83.00	30	AV30	1,569	1,489	1,174	20.70	12.43	3.95	138.2	7.56	86
			STD	63	70	86	2.65	1.22	0.29	32.6	0.91	2
			MAX	1,662	1,588	1,370	24.07	14.13	4.74	182.2	8.84	90
			MIN	1,443	1,358	1,016	15.74	10.09	3.30	76.3	5.88	83
336	84.00	25	AV25	1,614	1,537	1,211	22.72	13.28	4.13	165.4	8.32	86
			STD	29	32	28	1.11	0.56	0.30	15.0	0.43	2
			MAX	1,659	1,585	1,255	24.18	14.21	4.77	183.7	8.84	89
			MIN	1,555	1,466	1,165	20.39	11.96	3.73	135.0	7.42	82
358	85.00	22	AV22	1,605	1,527	1,214	22.61	13.15	4.06	163.8	8.33	86
			STD	34	36	52	1.22	0.57	0.28	16.7	0.47	2
			MAX	1,680	1,600	1,399	24.38	14.00	4.65	188.9	9.07	89
			MIN	1,536	1,444	1,154	19.33	11.79	3.74	120.4	7.11	82
383	86.00	25	AV25	1,586	1,504	1,203	22.55	13.23	4.02	162.8	8.31	83
			STD	34	38	52	1.10	0.56	0.30	15.3	0.42	2
			MAX	1,658	1,581	1,368	24.02	14.03	4.61	183.0	8.93	88
			MIN	1,509	1,414	1,123	19.22	11.78	3.64	118.6	7.11	80
407	87.00	24	AV24	1,535	1,446	1,165	22.24	13.07	4.09	158.6	8.22	83
			STD	28	31	42	1.16	0.54	0.34	15.5	0.44	2
			MAX	1,624	1,544	1,244	23.80	13.77	4.72	178.6	8.84	86
			MIN	1,495	1,383	1,078	19.92	12.01	3.62	130.0	7.39	78
432	88.00	25	AV25	1,575	1,471	1,182	22.35	13.25	4.17	160.6	8.26	81
			STD	33	29	41	1.20	0.49	0.15	15.9	0.46	3
			MAX	1,646	1,539	1,247	23.96	14.04	4.51	181.0	8.84	86
			MIN	1,506	1,408	1,097	19.77	12.29	3.88	128.9	7.25	77
457	89.00	25	AV25	1,666	1,544	1,188	22.66	13.53	4.48	164.5	8.39	82
			STD	28	30	42	1.01	0.46	0.11	14.0	0.39	3
			MAX	1,732	1,615	1,291	24.36	14.43	4.71	190.6	9.07	87
			MIN	1,602	1,472	1,084	20.69	12.78	4.29	139.3	7.60	76
481	90.00	24	AV24	1,455	1,376	1,263	22.71	12.70	4.67	164.9	8.43	82
			STD	74	59	66	0.88	0.72	0.50	12.3	0.35	3
			MAX	1,602	1,499	1,405	24.25	14.33	5.80	187.1	8.98	86
			MIN	1,362	1,300	1,104	20.74	11.39	4.00	139.3	7.60	76
501	91.00	20	AV20	1,382	1,328	1,235	22.62	11.63	5.59	162.2	8.36	79
			STD	16	17	66	0.92	0.38	0.49	11.9	0.34	3
			MAX	1,414	1,356	1,379	24.08	12.24	6.41	180.6	8.93	83
			MIN	1,349	1,288	1,130	20.79	10.94	4.77	137.5	7.64	74
522	92.00	21	AV21	1,382	1,327	1,194	22.44	11.54	5.55	159.6	8.28	77
			STD	22	24	56	0.95	0.37	0.44	12.8	0.35	2
			MAX	1,415	1,365	1,351	23.73	12.06	6.26	180.2	8.79	80

I-10 MOBILE RIVER - TP-WPA ID 60" PIPE, 1" WALL
OP: AFT Date: 22-May-2018

BL#	Depth	BLC	TYPE	RMX	RX8	RA2	CSX	CSB	TSX	EMX	STK	BTA
	ft	bl/ft		kips	kips	kips	ksi	ksi	ksi	k-ft	ft	(%)
			MIN	1,320	1,272	1,111	19.97	10.68	4.65	126.5	7.39	73
543	93.00	21	AV21	1,371	1,314	1,134	22.36	11.69	5.42	159.0	8.27	75
			STD	29	30	41	1.18	0.43	0.49	15.3	0.44	3
			MAX	1,419	1,365	1,193	23.83	12.34	6.18	180.6	8.84	80
			MIN	1,293	1,234	1,037	19.39	10.63	4.47	121.6	7.14	70
564	94.00	21	AV21	1,368	1,308	1,125	22.70	11.95	5.42	164.0	8.43	74
			STD	30	31	33	1.11	0.39	0.47	14.6	0.43	2
			MAX	1,433	1,377	1,187	24.25	12.53	6.21	186.5	8.98	79
			MIN	1,296	1,236	1,070	20.21	11.13	4.57	132.8	7.46	70
586	95.00	22	AV22	1,345	1,279	1,148	22.24	11.86	5.25	158.3	8.37	73
			STD	34	34	70	1.35	0.48	0.51	17.4	0.50	3
			MAX	1,417	1,357	1,304	24.51	12.72	6.17	191.7	9.22	80
			MIN	1,308	1,226	1,045	19.19	10.82	4.45	119.6	7.32	67
606	96.00	20	AV20	1,333	1,277	1,151	22.68	12.12	5.36	163.9	8.47	72
			STD	32	34	47	1.37	0.43	0.44	18.0	0.50	2
			MAX	1,369	1,313	1,244	24.24	12.68	6.05	185.4	9.12	75
			MIN	1,254	1,187	1,030	18.39	10.76	4.47	109.9	6.98	67
627	97.00	21	AV21	1,318	1,265	1,121	22.92	12.21	5.39	166.8	8.54	70
			STD	16	15	22	0.64	0.18	0.33	8.6	0.24	2
			MAX	1,352	1,295	1,177	24.14	12.50	5.99	184.0	9.03	73
			MIN	1,290	1,239	1,079	21.63	11.86	4.88	150.4	8.03	67
648	98.00	21	AV21	1,294	1,237	1,095	22.80	12.16	5.43	166.0	8.50	69
			STD	23	24	23	0.92	0.30	0.42	12.9	0.35	2
			MAX	1,325	1,269	1,123	24.43	12.78	6.31	187.7	9.12	73
			MIN	1,247	1,192	1,038	20.80	11.49	4.67	138.5	7.79	64
670	99.00	22	AV22	1,279	1,214	1,058	22.70	12.30	5.33	164.3	8.47	69
			STD	15	17	26	0.62	0.23	0.30	8.8	0.24	2
			MAX	1,302	1,243	1,093	23.65	12.72	5.79	177.8	8.84	72
			MIN	1,242	1,174	1,004	21.71	11.84	4.76	149.3	8.07	65
691	100.00	21	AV21	1,265	1,179	998	22.61	12.56	5.14	162.2	8.44	69
			STD	16	13	18	0.29	0.12	0.15	4.2	0.11	2
			MAX	1,299	1,206	1,038	23.03	12.80	5.38	169.7	8.61	74
			MIN	1,233	1,143	963	22.07	12.33	4.89	154.0	8.23	66
712	101.00	21	AV21	1,152	1,068	896	20.60	11.56	4.66	146.7	8.42	65
			STD	355	328	277	6.26	3.54	1.47	47.7	2.05	16
			MAX	1,291	1,196	1,031	22.99	12.84	5.34	167.7	15.68	73
			MIN	0	0	0	1.17	0.58	0.14	0.0	3.37	0
734	102.00	22	AV22	1,278	1,159	940	22.43	12.79	5.07	159.6	8.59	71
			STD	15	12	16	0.23	0.08	0.09	3.4	0.81	2
			MAX	1,306	1,185	969	22.89	12.94	5.29	167.6	12.30	73
			MIN	1,242	1,136	910	21.89	12.62	4.97	152.7	8.23	66
757	103.00	23	AV23	1,293	1,174	987	22.24	12.68	5.19	158.9	8.54	71

I-10 MOBILE RIVER - TP-WPA ID 60" PIPE, 1" WALL
OP: AFT Date: 22-May-2018

BL#	Depth	BLC	TYPE	RMX	RX8	RA2	CSX	CSB	TSX	EMX	STK	BTA
	ft	bl/ft		kips	kips	kips	ksi	ksi	ksi	k-ft	ft	(%)
			STD	40	46	46	1.44	0.55	0.37	16.0	0.41	2
			MAX	1,386	1,265	1,096	24.38	13.61	5.87	185.8	9.42	74
			MIN	1,227	1,105	923	18.92	11.43	4.41	123.6	7.64	68
782	104.00	25	AV25	1,351	1,245	963	21.47	12.81	4.68	155.0	8.58	70
			STD	130	126	153	3.58	1.63	0.93	40.3	1.04	7
			MAX	1,500	1,414	1,334	26.65	15.12	6.14	227.8	10.39	76
			MIN	848	773	571	9.77	6.95	2.40	27.1	4.63	43
805	105.00	23	AV23	1,342	1,225	943	22.68	13.22	5.12	164.1	8.53	70
			STD	18	19	30	0.36	0.12	0.09	4.6	0.12	2
			MAX	1,380	1,257	1,001	23.50	13.44	5.32	173.7	8.84	74
			MIN	1,311	1,196	893	22.14	13.04	4.95	155.1	8.31	67
827	106.00	22	AV22	1,348	1,259	979	22.68	13.18	5.17	164.3	8.52	71
			STD	21	24	26	0.58	0.18	0.09	7.7	0.22	2
			MAX	1,378	1,293	1,015	23.53	13.41	5.44	174.5	8.79	75
			MIN	1,292	1,198	907	21.40	12.70	5.02	144.5	7.99	67
853	107.00	26	AV26	1,362	1,272	1,030	22.54	12.84	5.28	163.6	8.54	72
			STD	21	31	24	0.62	0.23	0.31	6.9	0.16	2
			MAX	1,393	1,315	1,075	23.62	13.27	5.97	178.4	8.84	75
			MIN	1,308	1,203	994	21.28	12.34	4.83	149.1	8.19	68
878	108.00	25	AV25	1,411	1,329	1,083	22.45	12.99	5.08	162.0	8.55	71
			STD	83	77	44	0.83	0.59	0.41	9.0	0.20	4
			MAX	1,562	1,477	1,177	24.32	14.37	5.97	184.6	9.07	80
			MIN	1,293	1,196	1,009	21.10	12.34	4.12	144.8	8.07	66
903	109.00	25	AV25	1,537	1,446	1,156	23.02	14.05	4.72	168.2	8.66	74
			STD	21	18	55	0.99	0.31	0.35	11.8	0.31	2
			MAX	1,572	1,486	1,247	25.29	14.77	5.80	197.1	9.47	79
			MIN	1,495	1,406	1,043	21.09	13.52	4.10	149.9	8.15	70
932	110.00	29	AV29	1,560	1,457	1,189	22.95	14.26	4.41	166.2	8.55	75
			STD	14	12	33	0.35	0.14	0.10	4.7	0.13	2
			MAX	1,588	1,478	1,260	23.61	14.46	4.63	173.3	8.79	79
			MIN	1,531	1,431	1,118	21.89	13.75	4.22	151.9	8.15	71
960	111.00	28	AV28	1,566	1,474	1,229	22.90	14.30	4.23	164.9	8.56	79
			STD	27	31	50	0.31	0.21	0.19	4.3	0.11	2
			MAX	1,617	1,534	1,350	23.88	14.87	4.64	178.8	8.93	83
			MIN	1,531	1,437	1,142	22.50	14.03	3.96	158.5	8.40	76
987	112.00	27	AV27	1,571	1,496	1,268	22.78	14.37	4.56	165.3	8.67	82
			STD	32	32	52	1.13	0.37	0.49	14.2	0.37	3
			MAX	1,661	1,585	1,358	24.63	14.97	5.63	188.7	9.27	87
			MIN	1,497	1,421	1,172	20.11	13.55	3.69	130.2	7.68	78
1014	113.00	27	AV27	1,581	1,510	1,284	22.92	14.73	4.39	165.9	8.64	84
			STD	27	26	36	0.45	0.27	0.16	6.4	0.18	2
			MAX	1,623	1,552	1,349	23.85	15.12	4.90	177.8	8.98	87
			MIN	1,528	1,459	1,226	22.25	14.19	4.10	155.6	8.36	80

I-10 MOBILE RIVER - TP-WPA ID 60" PIPE, 1" WALL
OP: AFT Date: 22-May-2018

BL#	Depth ft	BLC bl/ft	TYPE	RMX kips	RX8 kips	RA2 kips	CSX ksi	CSB ksi	TSX ksi	EMX k-ft	STK ft	BTA (%)
1042	114.00	28	AV28	1,618	1,549	1,330	22.82	15.07	4.54	164.7	8.61	86
			STD	19	20	27	0.25	0.17	0.07	3.2	0.11	2
			MAX	1,653	1,584	1,386	23.22	15.32	4.68	170.1	8.79	90
			MIN	1,590	1,520	1,261	22.23	14.77	4.41	157.0	8.31	83
1072	115.00	30	AV30	1,656	1,585	1,374	22.62	15.34	4.43	163.8	8.56	91
			STD	15	16	26	0.20	0.10	0.08	3.1	0.08	5
			MAX	1,678	1,609	1,418	23.12	15.57	4.58	171.3	8.75	100
			MIN	1,626	1,547	1,328	22.16	15.16	4.30	157.0	8.40	86
1099	116.00	27	AV27	1,663	1,597	1,404	22.51	15.14	4.29	162.5	8.56	94
			STD	11	11	19	0.24	0.10	0.04	3.3	0.09	5
			MAX	1,693	1,625	1,438	23.07	15.37	4.36	170.6	8.79	100
			MIN	1,645	1,580	1,364	22.00	14.91	4.20	155.5	8.40	88
1128	117.00	29	AV29	1,678	1,612	1,429	22.55	15.27	4.27	163.0	8.58	98
			STD	15	16	27	0.24	0.11	0.05	3.4	0.09	4
			MAX	1,714	1,649	1,494	23.00	15.49	4.36	170.4	8.75	100
			MIN	1,655	1,588	1,382	22.14	15.05	4.16	156.1	8.40	89
1158	118.00	30	AV30	1,707	1,638	1,458	22.76	15.47	4.37	165.8	8.68	100
			STD	13	13	24	0.23	0.09	0.07	3.4	0.09	2
			MAX	1,736	1,669	1,518	23.23	15.63	4.53	173.7	8.84	100
			MIN	1,682	1,614	1,407	22.20	15.26	4.25	157.7	8.48	90
1187	119.00	29	AV29	1,739	1,651	1,482	22.91	15.67	4.44	167.4	8.74	99
			STD	18	19	28	0.30	0.14	0.09	4.4	0.12	3
			MAX	1,769	1,682	1,531	23.64	15.96	4.62	179.2	9.03	100
			MIN	1,705	1,611	1,425	22.30	15.42	4.25	159.1	8.48	90
1216	120.00	29	AV29	1,761	1,659	1,491	23.05	15.94	4.49	169.1	8.79	100
			STD	16	16	36	0.23	0.10	0.05	3.5	0.09	2
			MAX	1,787	1,691	1,553	23.43	16.14	4.57	173.6	8.93	100
			MIN	1,730	1,629	1,418	22.48	15.77	4.37	159.9	8.53	90
1249	121.00	33	AV33	1,746	1,639	1,471	23.01	16.04	4.52	167.8	8.77	99
			STD	14	13	37	0.27	0.12	0.06	4.0	0.10	2
			MAX	1,770	1,659	1,536	23.50	16.27	4.64	175.1	8.93	100
			MIN	1,711	1,609	1,392	22.50	15.80	4.38	159.2	8.57	90
1280	122.00	31	AV31	1,759	1,653	1,471	22.98	16.17	4.54	166.6	8.76	99
			STD	17	17	35	0.23	0.13	0.04	3.3	0.09	2
			MAX	1,799	1,695	1,544	23.36	16.43	4.61	171.5	8.89	100
			MIN	1,719	1,619	1,393	22.38	15.95	4.46	157.7	8.61	90
1312	123.00	32	AV32	1,801	1,696	1,477	22.85	16.56	4.59	164.5	8.71	100
			STD	16	15	21	0.19	0.15	0.05	3.1	0.07	0
			MAX	1,832	1,729	1,504	23.22	16.87	4.68	171.6	8.89	100
			MIN	1,756	1,653	1,420	22.32	16.30	4.51	157.5	8.48	100
1346	124.00	34	AV34	1,825	1,716	1,451	23.09	17.14	4.69	167.2	8.79	99
			STD	14	13	34	0.20	0.14	0.05	3.1	0.07	3

I-10 MOBILE RIVER - TP-WPA ID 60" PIPE, 1" WALL
OP: AFT Date: 22-May-2018

BL#	Depth	BLC	TYPE	RMX	RX8	RA2	CSX	CSB	TSX	EMX	STK	BTA
	ft	bl/ft		kips	kips	kips	ksi	ksi	ksi	k-ft	ft	(%)
			MAX	1,847	1,734	1,525	23.50	17.40	4.79	173.5	8.93	100
			MIN	1,789	1,687	1,350	22.62	16.74	4.59	161.0	8.66	89
1379	125.00	33	AV33	1,833	1,717	1,379	23.07	17.51	4.75	166.6	8.79	98
			STD	15	15	44	0.24	0.15	0.03	3.3	0.09	4
			MAX	1,858	1,740	1,454	23.54	17.82	4.82	173.1	8.93	100
			MIN	1,794	1,678	1,268	22.60	17.21	4.69	159.4	8.61	88
1416	126.00	37	AV37	1,811	1,689	1,218	23.11	17.80	4.68	166.7	8.79	94
			STD	12	12	59	0.22	0.16	0.07	3.4	0.08	5
			MAX	1,833	1,713	1,361	23.64	18.16	4.83	175.5	8.93	100
			MIN	1,782	1,662	1,155	22.62	17.45	4.57	159.8	8.61	88
1455	127.00	39	AV39	1,864	1,721	1,121	23.08	18.33	4.58	165.8	8.79	97
			STD	31	27	20	0.68	0.44	0.15	9.4	0.23	5
			MAX	1,931	1,780	1,167	25.29	19.71	4.71	197.2	9.57	100
			MIN	1,808	1,673	1,088	21.43	17.54	3.93	143.5	8.31	88
1494	128.00	39	AV39	1,928	1,781	1,088	22.87	18.48	3.94	165.6	9.00	98
			STD	22	26	51	1.50	0.89	0.73	17.9	0.49	5
			MAX	1,970	1,837	1,184	25.45	19.88	4.78	200.4	10.05	100
			MIN	1,885	1,725	967	20.26	16.83	2.45	134.5	8.11	87
1533	129.00	39	AV39	1,953	1,798	1,058	23.43	18.98	4.10	170.2	9.07	98
			STD	29	24	46	1.25	0.74	0.55	16.7	0.44	4
			MAX	1,999	1,836	1,162	25.73	20.33	4.77	200.8	9.83	100
			MIN	1,888	1,750	950	20.63	17.26	2.74	134.8	8.19	87
1573	130.00	40	AV40	1,952	1,796	1,071	23.47	19.03	4.32	169.9	9.03	99
			STD	26	21	34	1.09	0.66	0.51	14.0	0.36	2
			MAX	2,005	1,840	1,130	25.32	19.94	4.81	194.3	9.67	100
			MIN	1,889	1,746	961	20.37	17.00	3.03	132.5	8.11	89
1612	131.00	39	AV39	1,933	1,774	1,071	23.40	19.04	4.43	168.6	8.98	99
			STD	20	20	18	0.34	0.22	0.16	4.4	0.10	3
			MAX	1,989	1,834	1,118	23.97	19.37	4.77	176.0	9.17	100
			MIN	1,888	1,731	1,038	22.68	18.54	4.07	159.4	8.79	89
1653	132.00	41	AV41	1,891	1,738	1,051	23.08	18.53	4.00	165.5	9.04	93
			STD	43	42	35	1.33	0.85	0.67	15.6	0.38	6
			MAX	1,976	1,820	1,119	25.13	19.86	4.78	191.7	9.89	100
			MIN	1,754	1,622	981	18.76	15.67	2.06	118.4	8.07	87
1690	133.00	37	AV37	1,778	1,626	1,007	22.93	17.96	4.07	163.9	9.05	87
			STD	61	57	72	1.98	1.22	0.70	23.8	0.59	2
			MAX	1,899	1,733	1,162	25.70	19.75	4.88	199.1	9.89	90
			MIN	1,660	1,523	887	18.14	15.21	1.81	110.8	7.75	84
1723	134.00	33	AV33	1,530	1,376	1,049	23.21	16.73	4.22	164.8	8.93	78
			STD	51	51	57	1.38	0.83	0.22	17.9	0.47	2
			MAX	1,661	1,505	1,159	25.64	18.64	4.51	198.8	9.83	84
			MIN	1,456	1,314	919	19.39	14.44	3.34	115.6	7.60	76

I-10 MOBILE RIVER - TP-WPA ID 60" PIPE, 1" WALL
OP: AFT Date: 22-May-2018

BL#	Depth	BLC	TYPE	RMX	RX8	RA2	CSX	CSB	TSX	EMX	STK	BTA
	ft	bl/ft		kips	kips	kips	ksi	ksi	ksi	k-ft	ft	(%)
1756	135.00	33	AV33	1,561	1,401	1,004	22.98	16.97	3.95	162.9	8.95	77
			STD	63	59	74	1.40	0.88	0.45	16.5	0.39	2
			MAX	1,694	1,521	1,167	25.04	18.64	4.56	189.6	9.83	80
			MIN	1,500	1,338	836	19.31	15.06	2.44	124.6	8.11	75
1797	136.00	41	AV41	1,818	1,652	913	22.47	18.14	3.68	159.5	9.12	84
			STD	65	58	59	2.22	1.47	1.03	25.1	0.58	2
			MAX	1,939	1,762	1,034	25.80	20.35	5.10	203.3	10.05	87
			MIN	1,681	1,519	817	17.76	14.87	1.76	108.6	7.95	80
1841	137.00	44	AV44	1,821	1,652	921	22.80	18.43	4.21	161.1	8.89	83
			STD	178	162	114	2.85	2.30	0.89	31.6	0.83	4
			MAX	2,053	1,858	1,096	26.91	21.52	5.26	217.2	10.33	89
			MIN	794	711	345	9.09	6.95	1.58	23.0	4.59	63
1887	138.00	46	AV46	1,786	1,620	875	22.26	18.00	4.13	155.5	8.69	84
			STD	171	154	117	2.81	2.31	0.83	31.1	0.82	5
			MAX	1,959	1,769	1,051	26.43	21.30	5.28	212.7	9.83	88
			MIN	778	703	330	8.57	6.51	1.45	20.4	4.45	61
1930	139.00	43	AV43	1,867	1,698	983	23.68	19.45	4.43	173.4	8.75	87
			STD	15	14	56	0.24	0.22	0.12	3.5	0.08	1
			MAX	1,898	1,725	1,016	24.14	19.88	4.68	180.0	8.89	89
			MIN	1,831	1,665	628	23.02	18.88	4.18	163.4	8.57	84
1972	140.00	42	AV42	1,859	1,691	980	23.63	19.35	4.41	172.2	8.76	86
			STD	15	15	83	0.30	0.21	0.16	3.8	0.10	1
			MAX	1,906	1,738	1,022	24.48	19.95	4.82	183.6	9.03	88
			MIN	1,824	1,657	604	23.17	19.03	4.04	166.1	8.61	84
2014	141.00	42	AV42	1,816	1,648	960	23.71	19.15	4.51	171.5	8.77	85
			STD	29	28	134	0.36	0.28	0.15	5.3	0.14	1
			MAX	1,867	1,696	1,048	24.33	19.63	4.80	181.0	9.03	88
			MIN	1,745	1,574	609	22.80	18.47	4.11	158.5	8.40	82
2056	142.00	42	AV42	1,756	1,586	807	23.90	19.03	4.51	174.2	8.88	82
			STD	27	27	191	0.30	0.18	0.09	4.1	0.10	1
			MAX	1,814	1,643	1,071	24.62	19.38	4.69	183.2	9.12	84
			MIN	1,703	1,534	630	23.40	18.63	4.32	166.4	8.66	80
2093	143.00	37	AV37	1,670	1,499	721	24.05	18.82	4.24	175.4	8.93	81
			STD	26	26	118	0.22	0.18	0.10	3.6	0.08	1
			MAX	1,734	1,563	1,058	24.60	19.36	4.44	183.5	9.12	82
			MIN	1,622	1,449	636	23.61	18.47	4.02	167.5	8.79	78
2133	144.00	40	AV40	1,581	1,412	747	24.03	18.53	3.94	175.0	8.93	81
			STD	30	29	22	0.26	0.18	0.09	3.8	0.11	1
			MAX	1,630	1,460	795	24.61	18.82	4.17	182.3	9.17	82
			MIN	1,520	1,348	702	23.53	18.13	3.77	166.1	8.70	78
2166	145.00	33	AV33	1,491	1,329	786	24.06	18.34	3.71	174.8	8.97	81
			STD	32	31	16	0.19	0.21	0.09	2.9	0.07	1
			MAX	1,553	1,405	819	24.45	18.71	3.87	180.8	9.12	83

I-10 MOBILE RIVER - TP-WPA ID 60" PIPE, 1" WALL
OP: AFT Date: 22-May-2018

BL#	Depth	BLC	TYPE	RMX	RX8	RA2	CSX	CSB	TSX	EMX	STK	BTA
	ft	bl/ft		kips	kips	kips	ksi	ksi	ksi	k-ft	ft	(%)
			MIN	1,441	1,268	754	23.49	17.73	3.54	166.3	8.79	79
2201	146.00	35	AV35	1,434	1,289	828	24.18	18.15	3.55	176.6	9.05	80
			STD	38	22	25	0.24	0.35	0.08	4.3	0.11	1
			MAX	1,481	1,329	886	24.71	18.78	3.71	185.8	9.27	83
			MIN	1,365	1,246	776	23.66	17.39	3.39	168.5	8.84	78
2236	147.00	35	AV35	1,445	1,318	885	24.15	18.13	3.49	176.2	9.04	80
			STD	16	16	22	0.22	0.15	0.09	3.0	0.08	1
			MAX	1,485	1,355	943	24.50	18.46	3.79	181.2	9.17	82
			MIN	1,407	1,268	849	23.60	17.78	3.35	169.0	8.84	78
2272	148.00	36	AV36	1,417	1,296	920	23.80	17.70	3.55	171.7	8.93	79
			STD	20	18	36	0.31	0.25	0.17	4.7	0.13	1
			MAX	1,461	1,338	994	24.20	18.11	3.99	178.4	9.07	82
			MIN	1,370	1,255	859	22.96	17.08	3.26	158.9	8.57	77
2303	149.00	31	AV31	1,392	1,269	908	23.75	17.71	3.46	170.0	8.90	79
			STD	22	21	21	0.21	0.15	0.16	3.2	0.08	1
			MAX	1,431	1,306	963	24.36	18.03	3.89	179.5	9.12	81
			MIN	1,336	1,219	878	23.45	17.35	3.21	164.1	8.75	78
2337	150.00	34	AV34	1,330	1,209	883	23.46	17.46	3.43	167.3	8.86	80
			STD	12	12	22	0.16	0.13	0.16	2.7	0.06	1
			MAX	1,358	1,243	939	23.85	17.68	3.69	172.3	8.98	83
			MIN	1,313	1,187	831	23.04	17.17	3.08	159.2	8.70	78
2372	151.00	35	AV35	1,333	1,208	967	23.46	17.68	3.40	167.2	8.85	82
			STD	15	18	25	0.20	0.12	0.13	2.8	0.08	1
			MAX	1,375	1,259	1,013	23.80	17.89	3.64	172.7	9.03	84
			MIN	1,311	1,178	920	23.09	17.43	3.09	162.4	8.70	80
2402	152.00	30	AV30	1,379	1,266	1,043	23.24	17.46	3.56	164.6	8.77	81
			STD	14	14	25	0.19	0.11	0.06	2.7	0.08	1
			MAX	1,407	1,295	1,089	23.65	17.69	3.70	170.4	8.89	82
			MIN	1,356	1,240	998	22.93	17.23	3.46	159.9	8.61	79
2433	153.00	31	AV31	1,315	1,201	990	23.21	17.32	3.71	164.1	8.74	80
			STD	22	22	33	0.15	0.10	0.14	2.3	0.05	1
			MAX	1,361	1,245	1,047	23.49	17.52	4.00	169.0	8.84	81
			MIN	1,276	1,165	923	22.86	17.13	3.45	159.2	8.61	77
2464	154.00	31	AV31	1,264	1,137	896	23.27	17.51	3.68	163.8	8.75	79
			STD	29	29	30	0.20	0.13	0.14	2.9	0.07	1
			MAX	1,305	1,180	968	23.63	17.77	3.97	169.8	8.89	80
			MIN	1,204	1,080	838	22.82	17.19	3.37	156.7	8.61	78
2496	155.00	32	AV32	1,152	1,026	888	23.53	17.46	3.88	166.6	8.83	79
			STD	32	35	24	0.23	0.14	0.16	3.3	0.09	1
			MAX	1,201	1,086	935	23.98	17.68	4.17	173.3	8.98	81
			MIN	1,100	971	834	22.93	17.10	3.43	158.7	8.66	77
2527	156.00	31	AV31	1,074	937	893	23.69	17.57	3.75	169.3	8.94	80

I-10 MOBILE RIVER - TP-WPA ID 60" PIPE, 1" WALL
OP: AFT Date: 22-May-2018

BL#	Depth	BLC	TYPE	RMX	RX8	RA2	CSX	CSB	TSX	EMX	STK	BTA
	ft	bl/ft		kips	kips	kips	ksi	ksi	ksi	k-ft	ft	(%)
			STD	13	16	15	0.25	0.20	0.19	3.6	0.10	1
			MAX	1,098	963	930	24.27	18.12	4.18	177.7	9.22	82
			MIN	1,045	902	869	23.17	17.23	3.40	161.4	8.75	77
2563	157.00	36	AV36	1,125	973	919	24.01	17.95	3.26	171.4	9.04	80
			STD	42	40	17	0.29	0.28	0.24	3.7	0.10	1
			MAX	1,185	1,033	947	24.58	18.40	3.78	178.3	9.27	82
			MIN	1,039	889	877	23.36	17.33	2.85	161.9	8.79	79
2598	158.00	35	AV35	1,144	987	928	23.91	17.97	3.04	171.8	9.05	81
			STD	27	32	16	0.24	0.21	0.12	3.4	0.08	1
			MAX	1,192	1,043	958	24.33	18.31	3.37	178.1	9.22	83
			MIN	1,082	915	894	23.42	17.57	2.83	164.5	8.89	79
2639	159.00	41	AV41	1,096	917	933	23.91	17.84	2.91	171.0	9.07	80
			STD	18	15	21	0.31	0.23	0.15	4.3	0.10	1
			MAX	1,142	955	982	24.51	18.32	3.26	179.7	9.27	82
			MIN	1,065	888	895	23.06	17.23	2.65	159.9	8.79	78
2680	160.00	41	AV41	1,090	922	997	23.95	17.80	2.75	170.8	9.08	82
			STD	17	18	30	0.48	0.35	0.19	6.8	0.19	1
			MAX	1,132	967	1,069	25.01	18.55	3.14	187.7	9.57	83
			MIN	1,054	888	949	22.78	16.86	2.34	153.7	8.61	80
2723	161.00	43	AV43	1,055	876	1,044	23.85	17.55	2.74	169.7	9.09	81
			STD	39	42	18	0.59	0.44	0.25	8.2	0.22	1
			MAX	1,144	967	1,085	25.10	18.55	3.23	187.0	9.52	83
			MIN	978	790	1,007	22.33	16.57	2.16	150.0	8.61	80
2767	162.00	44	AV44	985	796	1,076	23.91	17.42	2.81	170.6	9.09	81
			STD	17	20	28	0.27	0.20	0.09	3.9	0.12	0
			MAX	1,013	842	1,134	24.44	17.84	3.02	177.1	9.32	82
			MIN	950	758	1,027	23.15	16.88	2.64	159.7	8.79	80
2813	163.00	46	AV46	1,042	861	1,160	23.58	17.21	2.52	165.2	9.03	81
			STD	17	24	28	0.33	0.25	0.16	4.9	0.11	1
			MAX	1,074	913	1,213	24.14	17.63	2.82	174.5	9.22	82
			MIN	1,003	818	1,108	22.73	16.54	2.18	152.5	8.70	80
2860	164.00	47	AV47	1,058	889	1,207	23.81	17.26	2.63	168.5	9.09	83
			STD	18	22	21	0.66	0.46	0.25	8.8	0.24	1
			MAX	1,088	924	1,260	25.21	18.21	3.09	188.3	9.62	84
			MIN	1,012	823	1,146	20.46	14.93	1.54	124.8	7.99	80
2909	165.00	49	AV49	1,055	883	1,236	23.71	17.17	2.38	166.8	9.11	82
			STD	10	13	22	0.22	0.18	0.16	3.2	0.10	1
			MAX	1,077	905	1,291	24.23	17.55	2.65	174.2	9.32	83
			MIN	1,033	847	1,193	23.24	16.80	2.06	159.4	8.89	81
2972	166.00	63	AV63	1,312	1,119	1,345	24.99	18.34	1.86	180.3	8.94	84
			STD	138	126	145	3.48	2.68	0.47	38.7	0.91	3
			MAX	1,554	1,315	1,815	33.83	25.29	4.26	320.6	12.91	87
			MIN	482	370	739	6.00	4.12	0.38	21.8	4.83	67

I-10 MOBILE RIVER - TP-WPA ID 60" PIPE, 1" WALL
OP: AFT Date: 22-May-2018

BL#	Depth ft	BLC bl/ft	TYPE	RMX kips	RX8 kips	RA2 kips	CSX ksi	CSB ksi	TSX ksi	EMX k-ft	STK ft	BTA (%)
3032	167.00	60	AV60	1,499	1,308	1,354	26.26	19.31	1.78	198.6	9.52	84
			STD	55	50	59	1.07	0.76	0.26	15.0	0.43	1
			MAX	1,605	1,411	1,502	27.67	20.41	2.22	217.7	10.05	86
			MIN	1,317	1,136	1,225	23.13	17.05	1.24	155.4	8.27	82
3080	168.00	48	AV48	1,603	1,410	1,497	26.91	20.13	1.96	209.3	9.87	86
			STD	59	63	102	0.52	0.38	0.29	6.8	0.18	1
			MAX	1,746	1,561	1,825	27.80	21.08	2.66	222.6	10.22	89
			MIN	1,523	1,323	1,382	25.79	19.53	1.18	196.1	9.62	84
3127	169.00	47	AV47	1,688	1,515	1,553	26.07	20.15	1.74	199.9	9.85	94
			STD	156	147	181	2.68	2.03	0.52	32.4	0.77	6
			MAX	1,953	1,774	1,890	28.72	22.35	2.92	242.0	11.12	100
			MIN	900	789	757	12.25	9.33	0.75	39.8	5.03	74
3174	170.00	47	AV47	1,875	1,724	1,582	26.30	20.50	1.81	201.9	9.85	100
			STD	79	83	59	0.56	0.38	0.36	7.2	0.18	0
			MAX	2,026	1,879	1,791	27.42	21.39	2.65	216.8	10.33	100
			MIN	1,681	1,541	1,456	24.98	19.66	0.79	184.6	9.52	100
3209	171.00	35	AV35	1,888	1,741	1,598	26.33	20.10	2.63	200.2	9.73	100
			STD	34	36	42	0.53	0.31	0.37	6.8	0.17	0
			MAX	1,964	1,814	1,666	27.31	20.60	3.43	212.8	10.05	100
			MIN	1,764	1,629	1,532	25.26	19.45	2.03	185.9	9.32	100
3244	172.00	35	AV35	1,878	1,737	1,632	26.13	19.89	2.49	196.0	9.65	100
			STD	47	46	79	0.49	0.27	0.29	5.8	0.15	0
			MAX	2,008	1,868	1,771	26.88	20.43	3.12	207.1	9.94	100
			MIN	1,799	1,664	1,490	25.15	19.31	1.87	185.8	9.37	100
3281	173.00	37	AV37	1,839	1,690	1,572	25.95	19.74	2.46	192.8	9.62	100
			STD	47	41	45	0.52	0.24	0.33	5.6	0.12	0
			MAX	1,943	1,781	1,707	26.83	20.38	3.14	204.4	9.83	100
			MIN	1,724	1,586	1,505	24.94	19.29	1.85	182.9	9.42	100
3324	174.00	43	AV43	1,746	1,592	1,489	25.03	19.14	1.91	183.3	9.51	99
			STD	246	235	224	3.64	2.63	0.53	40.3	1.12	4
			MAX	1,958	1,799	1,655	29.16	21.73	2.93	237.4	10.93	100
			MIN	804	705	598	10.02	8.27	0.62	25.6	4.59	86
			Average	1,536	1,410	1,145	23.21	16.35	3.87	166.5	8.74	86
			Std. Dev.	274	276	235	2.14	2.94	1.07	23.8	0.76	10
			Maximum	2,130	2,000	1,890	33.83	25.29	7.03	320.6	15.68	100
			Minimum	0	0	0	1.17	0.58	0.14	0.0	3.37	0

Total number of blows analyzed: 3324

BL# Sensors

1-3324 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	Reference (Stringline) El.=6.27', Ground El.=5.15'
769	STOP ALIGN HAMMER
1870	STOP INSTALL PADS ON HAMMER LEADS
2912	Sensors moved to 5' below pile top to facilitate greater penetration due to water table.; LE = 170.00 ft; WC = 16,831.7 f/s

Time Summary

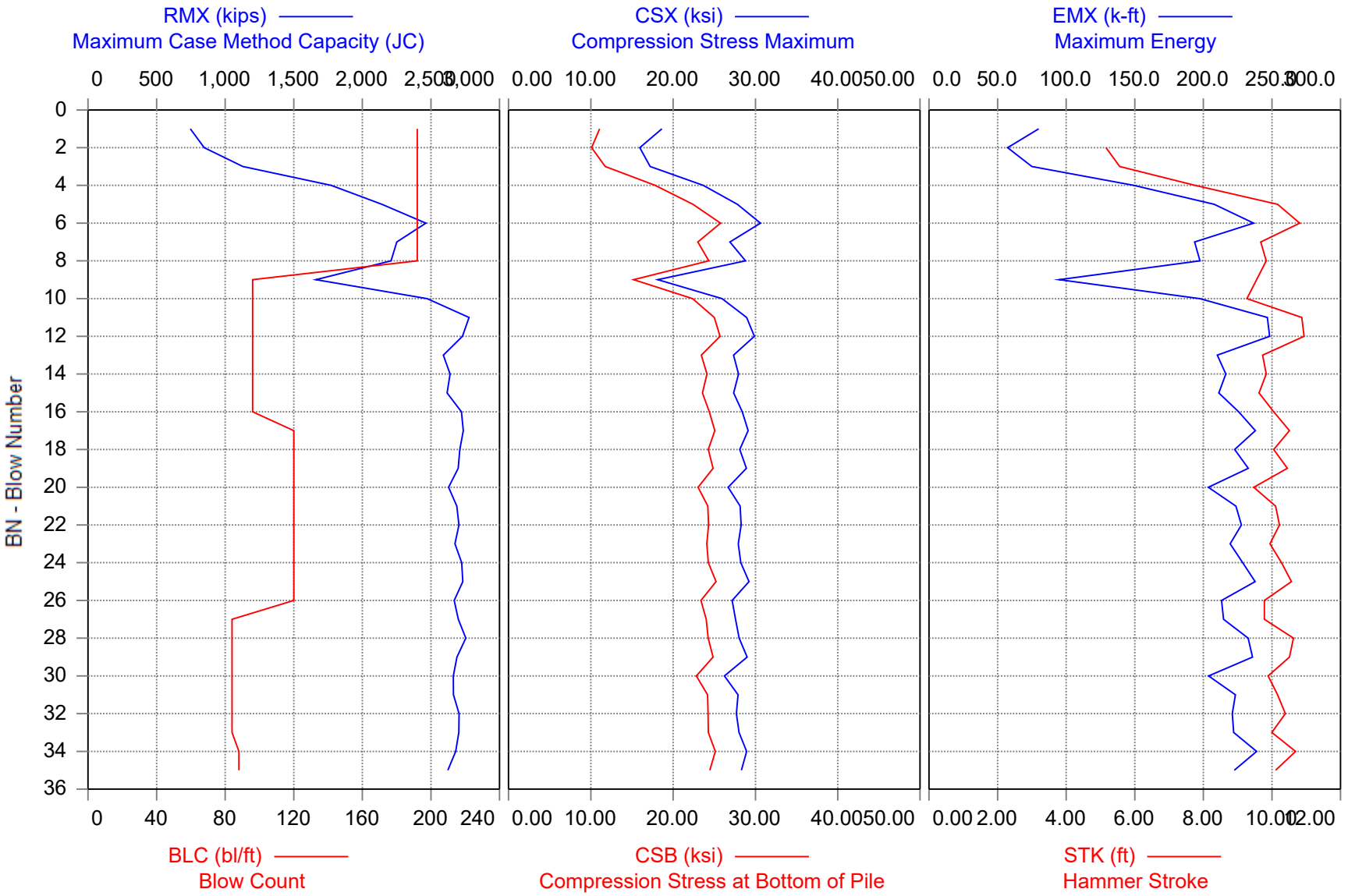
Drive	56 minutes 7 seconds	10:43 AM - 11:39 AM (5/22/2018) BN 1 - 1872
Stop	34 minutes 21 seconds	11:39 AM - 12:13 PM
Drive	26 minutes 10 seconds	12:13 PM - 12:39 PM BN 1873 - 2911
Stop	1 hours 2 minutes 39 seconds	12:39 PM - 1:42 PM
Drive	14 minutes 33 seconds	1:42 PM - 1:56 PM BN 2912 - 3324

Total time [03:13:52] = (Driving [01:36:51] + Stop [01:37:01])

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

Printed: 08-June-2018 Test started: 04-June-2018

I-10 MOBILE RIVER - TP-WPA 13 DAY RS



I-10 MOBILE RIVER - TP-WPA 13 DAY RS 60" PIPE, 1" WALL
OP: AFT Date: 04-June-2018

AR: 185.35 in² SP: 0.492 k/ft³
LE: 170.00 ft EM: 30,000.00 ksi
WS: 16,807.9 f/s JC: 0.72

RMX: Maximum Case Method Capacity (JC)
RX8: Maximum Case Method Capacity (JC=0.8)
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	BLC	RMX	RX8	RA2	CSX	CSB	TSX	EMX	STK	BTA
	ft	bl/ft	kips	kips	kips	ksi	ksi	ksi	k-ft	ft	(%)
1	174.01	192	745	496	1,423	18.63	11.07	2.86	79.9	0.00	59
2	174.01	192	846	642	1,192	15.95	10.09	1.44	57.3	5.16	64
3	174.02	192	1,129	915	1,270	17.21	11.74	0.81	75.0	5.56	66
4	174.02	192	1,773	1,477	1,578	23.65	17.81	1.32	149.2	7.75	71
5	174.03	192	2,143	1,791	1,511	27.80	22.40	2.56	207.9	10.16	79
6	174.03	192	2,463	2,076	1,639	30.61	25.76	2.68	236.6	10.81	80
7	174.04	192	2,250	1,912	1,471	26.89	23.00	2.64	193.6	9.67	87
8	174.04	192	2,209	1,837	1,465	28.79	24.33	3.18	197.5	9.83	83
9	174.05	96	1,661	1,440	1,257	18.13	15.21	1.08	94.9	0.00	82
10	174.06	96	2,472	2,157	1,764	25.95	22.36	1.61	197.4	9.27	86
11	174.07	96	2,778	2,426	1,957	28.93	25.01	2.32	246.6	10.87	87
12	174.08	96	2,729	2,358	1,900	29.87	25.70	2.85	248.2	10.93	86
13	174.09	96	2,590	2,256	1,767	27.33	23.42	2.50	210.1	9.73	85
14	174.10	96	2,639	2,295	1,741	27.94	24.11	2.98	216.3	9.83	85
15	174.11	96	2,617	2,282	1,799	27.36	23.56	2.68	211.2	9.62	87
16	174.13	96	2,722	2,375	1,891	28.39	24.39	2.86	225.7	10.05	85
17	174.13	120	2,736	2,376	1,933	29.10	25.07	3.17	237.9	10.51	88
18	174.14	120	2,710	2,367	1,903	28.09	24.28	2.92	222.8	10.05	88
19	174.15	120	2,698	2,340	1,858	28.90	24.84	3.26	232.7	10.45	87
20	174.16	120	2,628	2,305	1,824	26.69	23.04	2.82	203.6	9.47	88
21	174.17	120	2,688	2,343	1,882	28.14	24.21	3.14	223.7	10.11	89
22	174.18	120	2,704	2,356	1,911	28.27	24.31	3.20	227.7	10.22	89
23	174.18	120	2,675	2,332	1,851	27.91	24.10	3.14	219.5	9.94	87
24	174.19	120	2,724	2,382	1,918	28.22	24.27	3.08	228.6	10.28	87
25	174.20	120	2,732	2,368	1,812	29.22	25.21	3.56	237.7	10.57	87
26	174.21	120	2,669	2,341	1,856	27.17	23.39	3.06	213.2	9.78	88
27	174.22	84	2,699	2,363	1,827	27.58	24.02	3.15	214.7	9.78	89
28	174.23	84	2,754	2,415	1,938	28.01	24.26	2.90	232.7	10.63	100
29	174.24	84	2,689	2,329	1,744	28.99	24.85	3.62	235.8	10.51	87
30	174.26	84	2,663	2,351	2,015	26.24	22.82	2.67	203.8	9.89	87
31	174.27	84	2,664	2,322	1,655	27.88	24.18	3.45	223.3	10.16	88
32	174.28	84	2,705	2,369	1,864	27.69	24.25	2.95	221.0	10.39	90
33	174.29	84	2,703	2,378	1,519	28.01	24.27	3.68	222.1	10.00	82
34	174.30	88	2,680	2,319	1,831	28.93	25.13	3.62	238.8	10.69	90
35	174.31	88	2,623	2,299	1,591	28.29	24.46	3.85	222.5	10.11	84
		Average	2,426	2,097	1,724	26.76	22.60	2.79	203.1	9.78	84
		Std. Dev.	533	498	214	3.55	4.07	0.72	49.0	1.26	8
		Maximum	2,778	2,426	2,015	30.61	25.76	3.85	248.2	10.93	100
		Minimum	745	496	1,192	15.95	10.09	0.81	57.3	5.16	59

Total number of blows analyzed: 35

BL# Sensors

1-8 F1: [A788] 95.1 (1.00); F2: [I840] 94.9 (1.00); F3: off; ; F4: off; ; A1: [59379] 925.0 (1.00); A2: [42301A] 930.0 (1.00); A3: off; A4: off

I-10 MOBILE RIVER - TP-WPA 13 DAY RS 60" PIPE, 1" WALL
OP: AFT Date: 04-June-2018

9-35 F1: [A788] 95.1 (1.00); F2: [I840] 94.9 (1.00); F3: [P454] 145.3 (1.00); F4: [P455] 145.8 (1.00);
A1: [59379] 925.0 (1.00); A2: [42301A] 930.0 (1.00); A3: [K5647] 334.0 (1.00);
A4: [K5943] 368.0 (1.00)

BL# Comments

8 STOP TO TIGHTEN F3 AND F4 SENSORS
35 8BL/0.5" 8BL/1", 10BL/1", 7BL/1"

Time Summary

Drive	10 seconds	10:55 AM - 10:56 AM (6/4/2018) BN 1 - 8
Stop	12 minutes 31 seconds	10:56 AM - 11:08 AM
Drive	41 seconds	11:08 AM - 11:09 AM BN 9 - 35

Total time [00:13:23] = (Driving [00:00:52] + Stop [00:12:31])

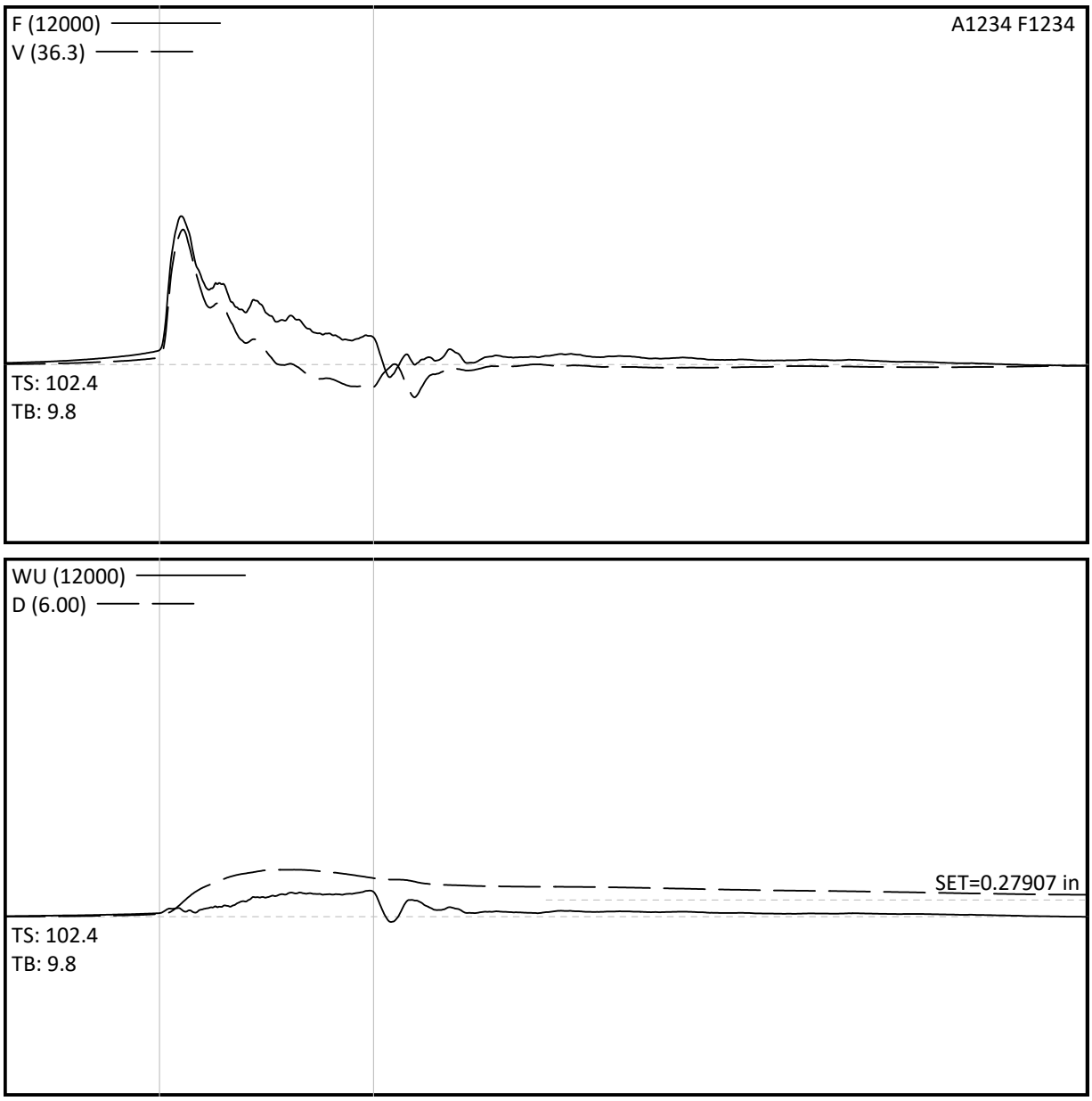
Appendix C

CAPWAP Signal Matching Analysis Output
TP-WPA

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-WPA ID



Project Information

PROJECT: I-10 MOBILE RIVER
PILE NAME: TP-WPA ID
DESCR: 60'' PIPE, 1'' WALL
OPERATOR: AFT
FILE: TP-WPA ID ana
5/22/2018 1:56:55 PM
Blow Number 3322

Pile Properties

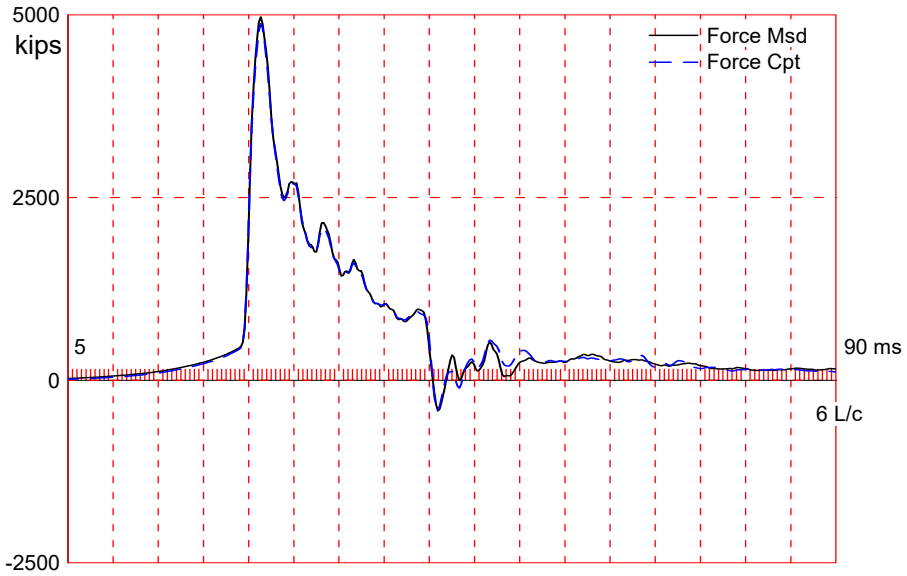
LE	170.00 ft
AR	185.35 in^2
EM	30000.00 ksi
SP	0.492 k/ft3
WS	16807.9 f/s
EA/C	330.8 ksec/ft
2L/C	20.20 ms
JC	0.74 []
LP	173.95 ft

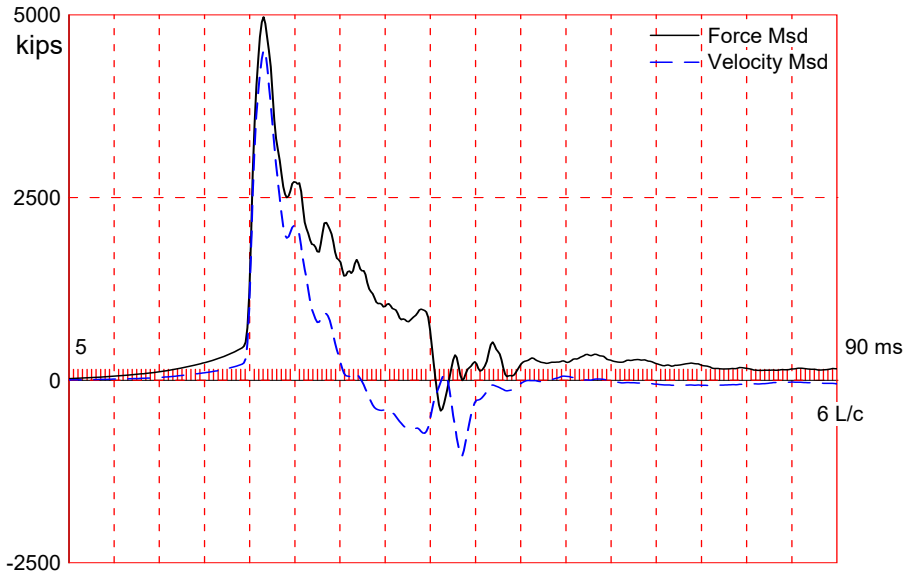
Quantity Results

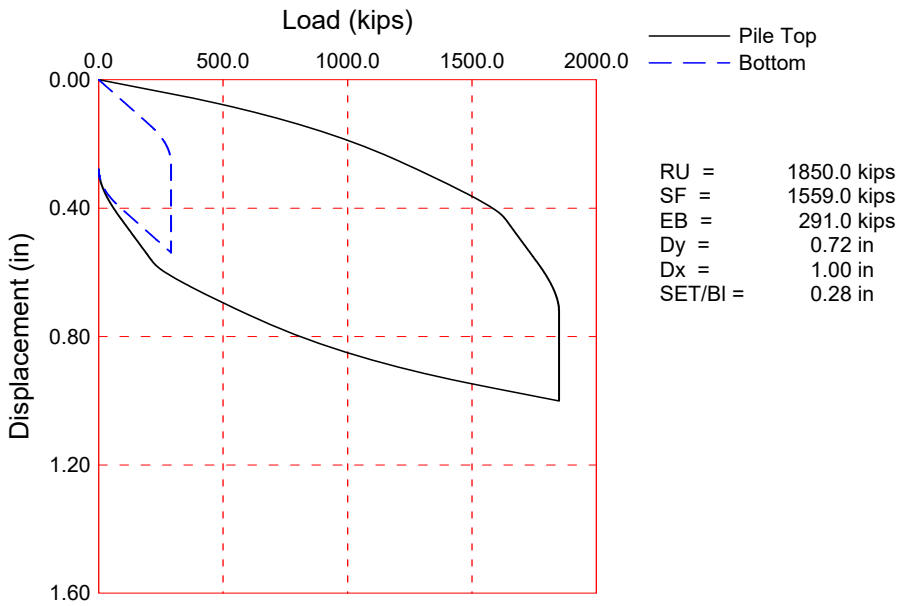
RMX	1862 kips
RX8	1684 kips
RA2	1556 kips
CSX	26.75 ksi
CSB	20.54 ksi
TSX	2.38 ksi
EMX	208.0 k-ft
STK	10.11 ft
BTA	100 (%)

Sensors

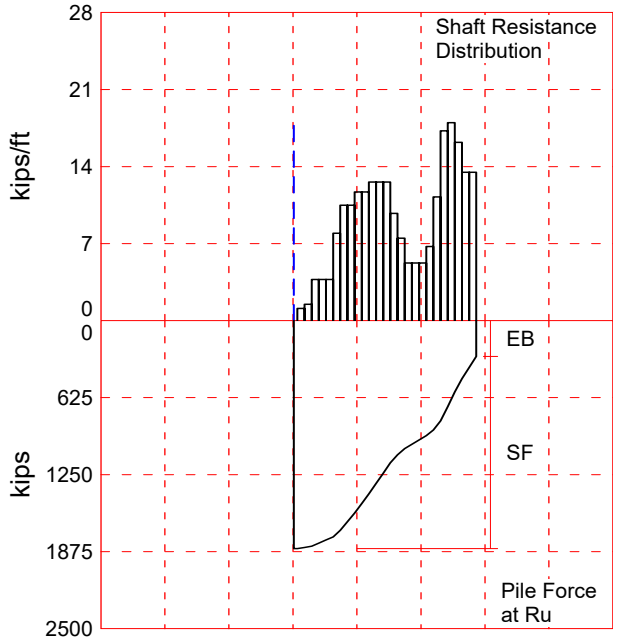
F1: [H829] 92.2 (1)
F2: [J762] 93.9 (1)
F3: [P454] 145.3 (1)
F4: [P455] 145.8 (1)
A1: [59379] 925 g's/v (1)
A2: [59462] 1055 g's/v (1)
A3: [K5647] 334 mv/5000g's (1)
A4: [K5943] 368 mv/5000g's (1)
CLIP: OK







RU =	1850.0 kips
SF =	1559.0 kips
EB =	291.0 kips
Dy =	0.72 in
Dx =	1.00 in
SET/Bl =	0.28 in



Length b. Sensors	170.0 ft
Embedment	169.0 ft
Top Area	185.4 in^2
End Bearing Area	19.63 ft^2
Top Perimeter	15.71 ft
Top E-Modulus	30000 ksi
Top Spec. Weight	492.0 lb/ft^3
Top Wave Spd.	16808 ft/s
Overall W.S.	16832 ft/s
Match Quality	1.55
Top Compr. Stress	26.4 ksi
Max Compr. Stress	26.6 ksi
Max Tension Stress	-2.10 ksi
Avg. Shaft Quake	0.04 in
Toe Quake	0.20 in
Avg. Shaft Smith Dpg.	0.15 s/ft
Toe Smith Damping	0.40 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: 1850.0; along Shaft 1559.0; at Toe 291.0 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
				1850.0			
1	10.0	9.0	10.0	1840.0	10.0	1.11	0.07
2	16.7	15.7	10.0	1830.0	20.0	1.50	0.10
3	23.3	22.3	25.0	1805.0	45.0	3.75	0.24
4	30.0	29.0	25.0	1780.0	70.0	3.75	0.24
5	36.7	35.7	25.0	1755.0	95.0	3.75	0.24
6	43.3	42.3	53.0	1702.0	148.0	7.95	0.51
7	50.0	49.0	70.0	1632.0	218.0	10.50	0.67
8	56.7	55.7	70.0	1562.0	288.0	10.50	0.67
9	63.3	62.3	78.0	1484.0	366.0	11.70	0.74
10	70.0	69.0	78.0	1406.0	444.0	11.70	0.74
11	76.7	75.7	84.0	1322.0	528.0	12.60	0.80
12	83.3	82.3	84.0	1238.0	612.0	12.60	0.80
13	90.0	89.0	84.0	1154.0	696.0	12.60	0.80
14	96.7	95.7	65.0	1089.0	761.0	9.75	0.62
15	103.3	102.3	50.0	1039.0	811.0	7.50	0.48
16	110.0	109.0	35.0	1004.0	846.0	5.25	0.33
17	116.7	115.7	35.0	969.0	881.0	5.25	0.33
18	123.3	122.3	35.0	934.0	916.0	5.25	0.33
19	130.0	129.0	45.0	889.0	961.0	6.75	0.43
20	136.7	135.7	75.0	814.0	1036.0	11.25	0.72
21	143.3	142.3	115.0	699.0	1151.0	17.25	1.10
22	150.0	149.0	120.0	579.0	1271.0	18.00	1.15
23	156.7	155.7	108.0	471.0	1379.0	16.20	1.03
24	163.3	162.3	90.0	381.0	1469.0	13.50	0.86
25	170.0	169.0	90.0	291.0	1559.0	13.50	0.86
Avg. Shaft			62.4			9.22	0.59
Toe			291.0				14.82

Soil Model Parameters/Extensions		Shaft	Toe
Smith Damping Factor		0.15	0.40
Quake	(in)	0.04	0.20
Case Damping Factor		0.71	0.35
Damping Type		Viscous	Sm+Visc
Unloading Quake	(% of loading quake)	30	30
Reloading Level	(% of Ru)	100	100
Unloading Level	(% of Ru)	0	

CAPWAP match quality = 1.55 (Wave Up Match) ; RSA = 0
Observed: Final Set = 0.28 in; Blow Count = 43 b/ft
Computed: Final Set = 0.28 in; Blow Count = 43 b/ft

max. Top Comp. Stress = 26.4 ksi (T= 26.7 ms, max= 1.008 x Top)
max. Comp. Stress = 26.6 ksi (Z= 23.3 ft, T= 27.9 ms)
max. Tens. Stress = -2.10 ksi (Z= 3.3 ft, T= 46.1 ms)
max. Energy (EMX) = 211.9 kip-ft; max. Measured Top Displ. (DMX)= 0.81 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	4891.9	-389.6	26.4	-2.10	211.9	13.9	0.82
2	6.7	4903.4	-291.2	26.5	-1.57	211.2	13.9	0.81
5	16.7	4921.1	-275.4	26.5	-1.49	207.7	13.7	0.78
8	26.7	4874.5	-194.3	26.3	-1.05	201.0	13.5	0.75
11	36.7	4887.6	-166.8	26.4	-0.90	195.9	13.2	0.72
14	46.7	4785.6	-242.9	25.8	-1.31	184.4	12.8	0.69
17	56.7	4713.7	-171.3	25.4	-0.92	174.5	12.4	0.68
20	66.7	4441.3	-244.4	24.0	-1.32	156.9	11.9	0.67
23	76.7	4369.0	-297.7	23.6	-1.61	148.3	11.5	0.66
26	86.7	4055.1	-274.9	21.9	-1.48	130.8	11.1	0.65
29	96.7	3926.4	-295.8	21.2	-1.60	122.1	10.8	0.64
32	106.7	3696.3	-269.7	19.9	-1.45	110.6	10.5	0.63
35	116.7	3674.4	-259.3	19.8	-1.40	107.0	10.3	0.62
38	126.7	3598.2	-275.9	19.4	-1.49	100.0	10.0	0.60
41	136.7	3657.7	-268.6	19.7	-1.45	95.5	9.5	0.59
44	146.7	3381.3	-191.5	18.2	-1.03	78.4	9.0	0.58
47	156.7	2985.3	-224.9	16.1	-1.21	67.6	11.5	0.57
48	160.0	2375.8	-210.0	12.8	-1.13	57.5	12.3	0.57
49	163.3	1857.6	-198.6	10.0	-1.07	57.5	12.7	0.56
50	166.7	1508.6	-132.0	8.1	-0.71	48.8	12.6	0.56
51	170.0	1781.1	-99.9	9.6	-0.54	40.8	12.0	0.56
Absolute	23.3			26.6			(T =	27.9 ms)
	3.3				-2.10		(T =	46.1 ms)

CASE METHOD

J =	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
RP	4663.0	4175.4	3687.8	3200.2	2712.7	2225.1	1737.5	1249.9	762.3	274.8
RX	4666.2	4187.9	3721.4	3330.3	2963.5	2613.1	2278.9	1972.9	1678.9	1393.3
RU	5173.6	4737.1	4300.6	3864.0	3427.5	2991.0	2554.5	2118.0	1681.4	1244.9

RAU = 302.1 (kips); RA2 = 1441.8 (kips)

Current CAPWAP Ru = 1850.0 (kips); Corresponding J(RP)= 0.58; J(RX) = 0.74

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
13.8	26.54	4554.4	4984.4	4987.4	0.81	0.28	0.28	212.1	4684.1	1455

PILE PROFILE AND PILE MODEL

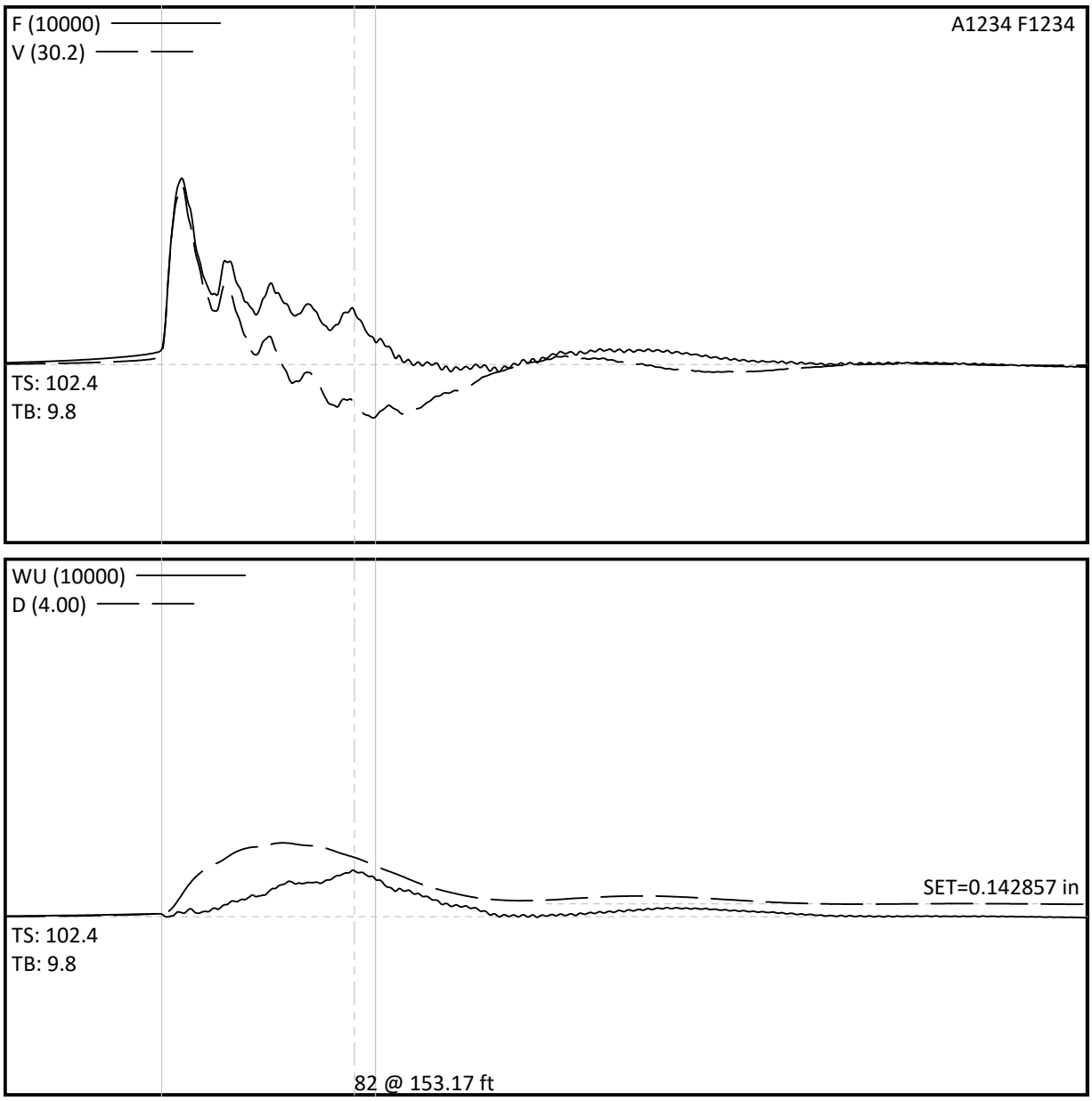
Depth ft	Area in^2	E-Modulus ksi	Spec. Weight lb/ft^3	Perim. ft
0.0	185.4	30000.0	492.000	15.71
170.0	185.4	30000.0	492.000	15.71

Toe Area 19.63 ft^2

Top Segment Length 3.33 ft, Top Impedance 331 kips/ft/s

Wave Speed: Pile Top 16807.9, Elastic 16807.9, Overall 16831.7 ft/s
Pile Damping 1.00 %, Time Incr 0.198 ms, 2L/c 20.2 ms
Total volume: 218.821 ft^3; Volume ratio considering added impedance: 1.000

I-10 MOBILE RIVER TP-WPA 13 DAY RS



Project Information

PROJECT: I-10 MOBILE RIVER
PILE NAME: TP-WPA 13 DAY RS
DESCR: 60'' PIPE, 1'' WALL
OPERATOR: AFT
FILE: TP-WPA 13 DAY RS ana
6/4/2018 11:09:11 AM
Blow Number 33

Pile Properties

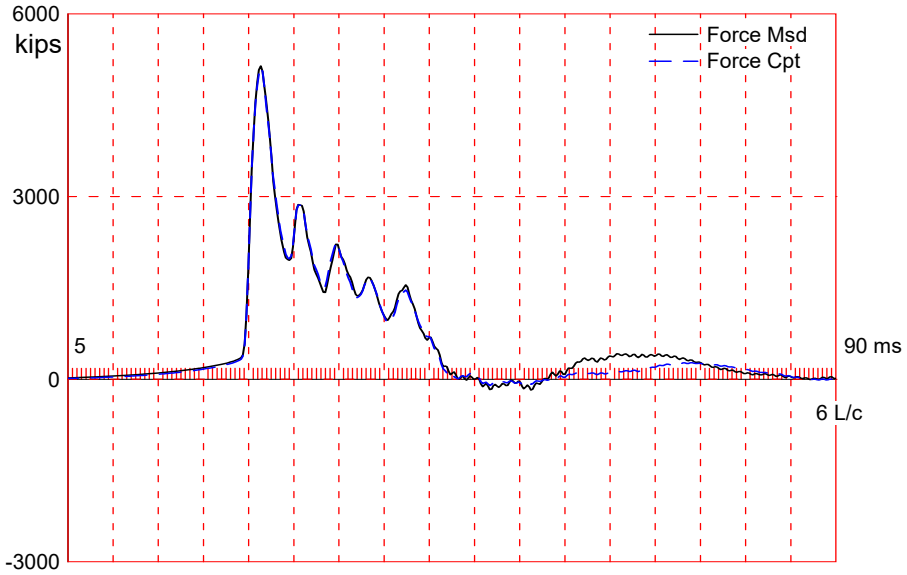
LE	170.00 ft
AR	185.35 in^2
EM	30000.00 ksi
SP	0.492 k/ft3
WS	16807.9 f/s
EA/C	330.8 ksec/ft
2L/C	20.20 ms
JC	0.72 []
LP	174.29 ft

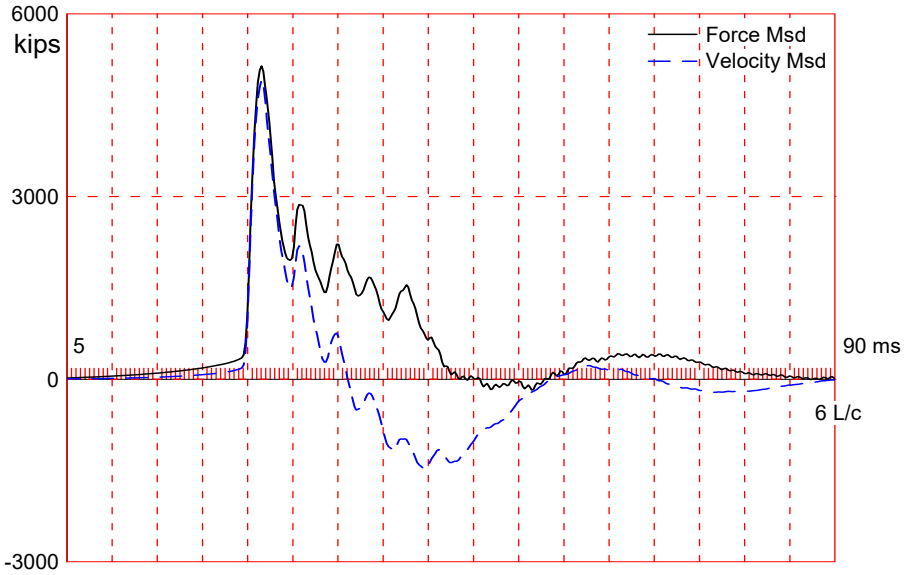
Quantity Results

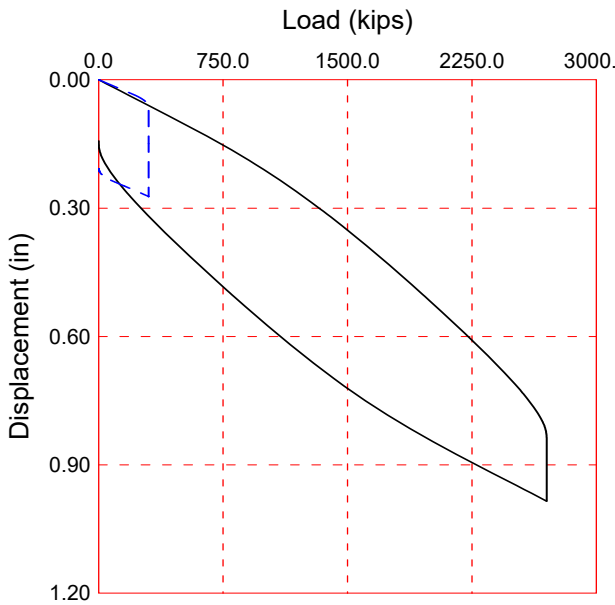
RMX	2703 kips
RX8	2378 kips
RA2	1519 kips
CSX	28.01 ksi
CSB	24.27 ksi
TSX	3.68 ksi
EMX	222.1 k-ft
STK	10.00 ft
BTA	82 (%)

Sensors

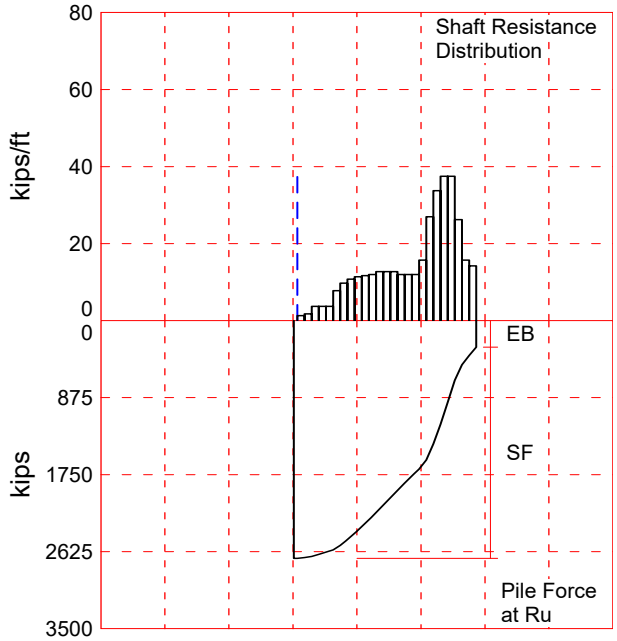
F1: [A788] 95.1 (1)
F2: [I840] 94.9 (1)
F3: [P454] 145.3 (1)
F4: [P455] 145.8 (1)
A1: [59379] 925 g's/v (1)
A2: [42301A] 930 g's/v (1)
A3: [K5647] 334 mv/5000g's (1)
A4: [K5943] 368 mv/5000g's (1)
CLIP: OK







RU =	2700.0 kips
SF =	2398.0 kips
EB =	302.0 kips
Dy =	0.84 in
Dx =	0.98 in
SET/Bl =	0.14 in



Length b. Sensors	170.0 ft
Embedment	166.0 ft
Top Area	185.4 in^2
End Bearing Area	19.63 ft^2
Top Perimeter	15.71 ft
Top E-Modulus	30000 ksi
Top Spec. Weight	492.0 lb/ft^3
Top Wave Spd.	16808 ft/s
Overall W.S.	16832 ft/s
Match Quality	2.62
Top Compr. Stress	27.7 ksi
Max Compr. Stress	27.9 ksi
Max Tension Stress	-1.69 ksi
Avg. Shaft Quake	0.10 in
Toe Quake	0.05 in
Avg. Shaft Smith Dpg.	0.24 s/ft
Toe Smith Damping	0.40 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: 2700.0; along Shaft 2398.0; at Toe 302.0 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
				2700.0			
1	10.0	6.0	8.0	2692.0	8.0	1.33	0.08
2	16.7	12.7	12.0	2680.0	20.0	1.80	0.11
3	23.3	19.3	25.0	2655.0	45.0	3.75	0.24
4	30.0	26.0	25.0	2630.0	70.0	3.75	0.24
5	36.7	32.7	25.0	2605.0	95.0	3.75	0.24
6	43.3	39.3	52.0	2553.0	147.0	7.80	0.50
7	50.0	46.0	65.0	2488.0	212.0	9.75	0.62
8	56.7	52.7	72.0	2416.0	284.0	10.80	0.69
9	63.3	59.3	76.0	2340.0	360.0	11.40	0.73
10	70.0	66.0	78.0	2262.0	438.0	11.70	0.74
11	76.7	72.7	80.0	2182.0	518.0	12.00	0.76
12	83.3	79.3	85.0	2097.0	603.0	12.75	0.81
13	90.0	86.0	85.0	2012.0	688.0	12.75	0.81
14	96.7	92.7	85.0	1927.0	773.0	12.75	0.81
15	103.3	99.3	80.0	1847.0	853.0	12.00	0.76
16	110.0	106.0	80.0	1767.0	933.0	12.00	0.76
17	116.7	112.7	80.0	1687.0	1013.0	12.00	0.76
18	123.3	119.3	105.0	1582.0	1118.0	15.75	1.00
19	130.0	126.0	180.0	1402.0	1298.0	27.00	1.72
20	136.7	132.7	225.0	1177.0	1523.0	33.75	2.15
21	143.3	139.3	250.0	927.0	1773.0	37.50	2.39
22	150.0	146.0	250.0	677.0	2023.0	37.50	2.39
23	156.7	152.7	175.0	502.0	2198.0	26.25	1.67
24	163.3	159.3	105.0	397.0	2303.0	15.75	1.00
25	170.0	166.0	95.0	302.0	2398.0	14.25	0.91
Avg. Shaft			95.9			14.45	0.92
Toe			302.0				15.38

Soil Model Parameters/Extensions		Shaft	Toe
Smith Damping Factor		0.24	0.40
Quake	(in)	0.10	0.05
Case Damping Factor		1.74	0.37
Damping Type		Viscous	Viscous
Unloading Quake	(% of loading quake)	80	100
Reloading Level	(% of Ru)	100	100
Unloading Level	(% of Ru)	75	

CAPWAP match quality = 2.62 (Wave Up Match) ; RSA = 0
Observed: Final Set = 0.14 in; Blow Count = 84 b/ft
Computed: Final Set = 0.14 in; Blow Count = 84 b/ft

max. Top Comp. Stress = 27.7 ksi (T= 26.7 ms, max= 1.009 x Top)
max. Comp. Stress = 27.9 ksi (Z= 23.3 ft, T= 27.9 ms)
max. Tens. Stress = -1.69 ksi (Z= 50.0 ft, T= 55.8 ms)
max. Energy (EMX) = 219.3 kip-ft; max. Measured Top Displ. (DMX)= 0.82 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	5130.3	-107.9	27.7	-0.58	219.3	14.9	0.81
2	6.7	5144.3	-161.3	27.8	-0.87	218.3	14.8	0.80
5	16.7	5176.7	-250.3	27.9	-1.35	213.7	14.6	0.76
8	26.7	5095.9	-281.8	27.5	-1.52	203.8	14.4	0.72
11	36.7	5115.8	-280.5	27.6	-1.51	196.3	13.9	0.68
14	46.7	4978.3	-293.1	26.9	-1.58	180.8	13.3	0.64
17	56.7	4914.5	-289.8	26.5	-1.56	167.3	12.7	0.59
20	66.7	4543.3	-183.3	24.5	-0.99	144.6	12.0	0.55
23	76.7	4463.1	-192.3	24.1	-1.04	132.6	11.4	0.51
26	86.7	4080.6	-103.3	22.0	-0.56	112.2	10.7	0.46
29	96.7	3978.6	-50.1	21.5	-0.27	100.4	10.1	0.42
32	106.7	3621.8	0.0	19.5	0.00	84.0	9.5	0.37
35	116.7	3590.6	0.0	19.4	0.00	76.3	8.9	0.34
38	126.7	3390.0	0.0	18.3	0.00	64.1	7.9	0.31
41	136.7	3298.0	0.0	17.8	0.00	54.5	6.7	0.28
44	146.7	2500.2	0.0	13.5	0.00	35.8	5.7	0.26
47	156.7	2092.4	0.0	11.3	0.00	27.2	5.5	0.25
48	160.0	1693.7	0.0	9.1	0.00	21.5	6.0	0.24
49	163.3	1516.5	0.0	8.2	0.00	21.5	6.2	0.24
50	166.7	1259.3	0.0	6.8	0.00	17.9	6.2	0.24
51	170.0	1260.4	-9.6	6.8	-0.05	14.9	6.1	0.24
Absolute	23.3			27.9			(T =	27.9 ms)
	50.0				-1.69		(T =	55.8 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	5776.9	5344.5	4912.1	4479.7	4047.3	3614.9	3182.5	2750.1	2317.7	1885.3
RX	5776.9	5344.5	4912.1	4479.7	4052.2	3624.8	3197.4	2772.0	2356.4	1946.4
RU	6596.5	6246.0	5895.6	5545.1	5194.7	4844.3	4493.8	4143.4	3793.0	3442.5

RAU = 46.1 (kips); RA2 = 1550.3 (kips)

Current CAPWAP Ru = 2700.0 (kips); Corresponding J(RP)= 0.71; J(RX) = 0.72

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
14.9	26.54	4944.4	5156.4	5157.6	0.82	0.14	0.14	221.4	5514.1	6040

PILE PROFILE AND PILE MODEL

Depth ft	Area in^2	E-Modulus ksi	Spec. Weight lb/ft^3	Perim. ft
0.0	185.4	30000.0	492.000	15.71
170.0	185.4	30000.0	492.000	15.71

Toe Area 19.63 ft^2

Top Segment Length 3.33 ft, Top Impedance 331 kips/ft/s

Wave Speed: Pile Top 16807.9, Elastic 16807.9, Overall 16831.7 ft/s
Pile Damping 1.00 %, Time Incr 0.198 ms, 2L/c 20.2 ms
Total volume: 218.821 ft^3; Volume ratio considering added impedance: 1.000

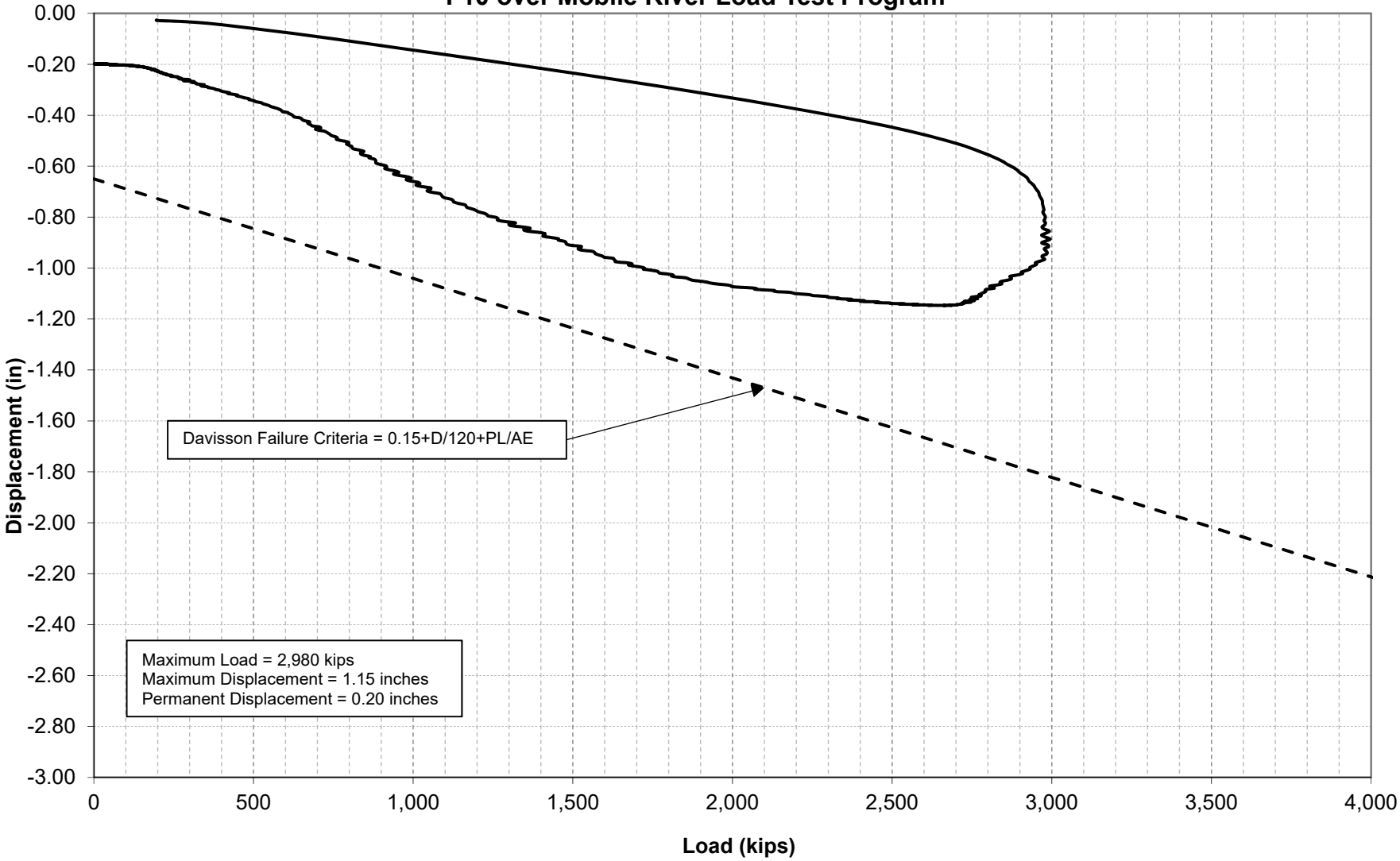
Appendix D

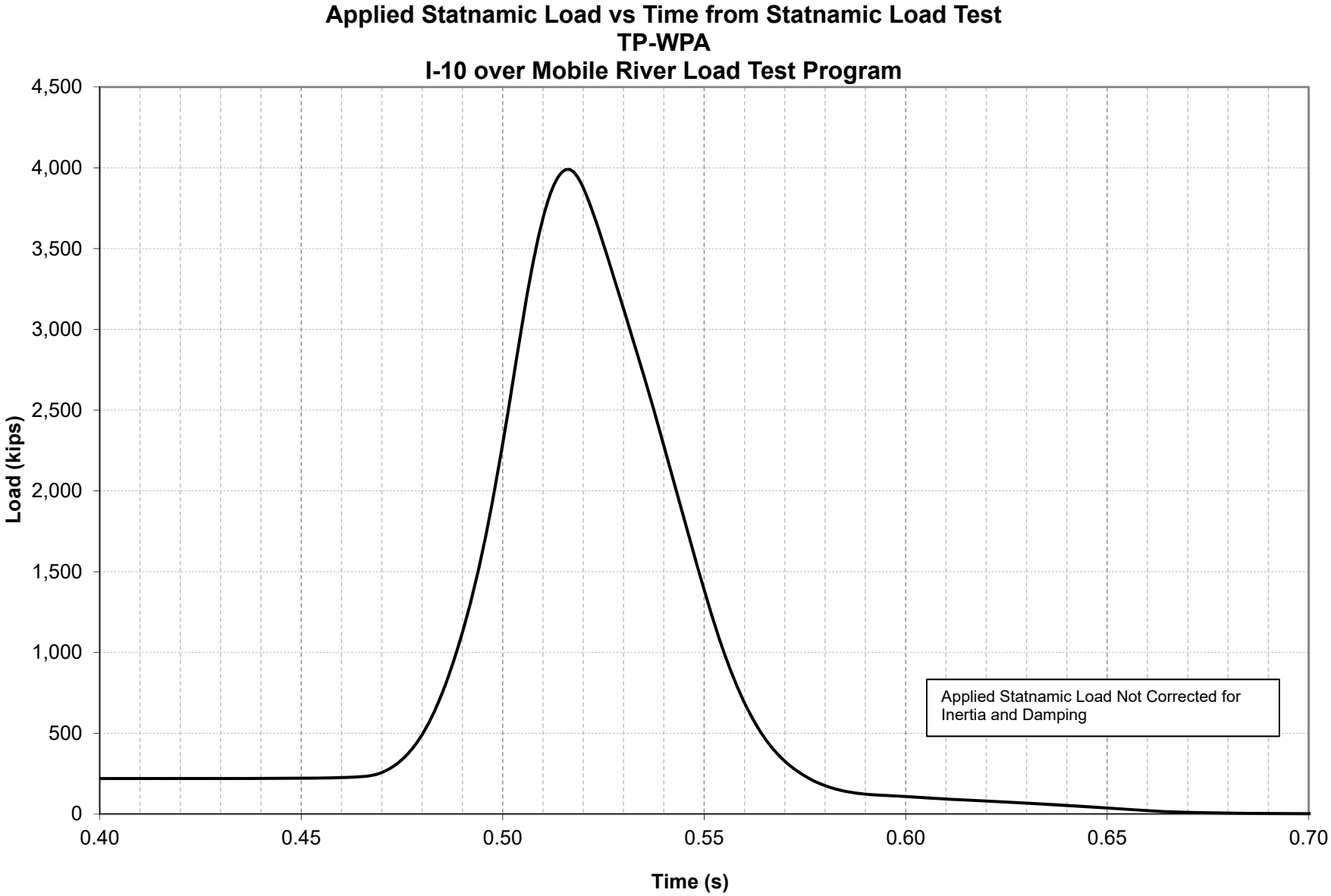
Axial Compressive Statnamic Rapid Load Testing Graphical Results
TP-WPA

I-10 over Mobile River Bridge Load Test Program

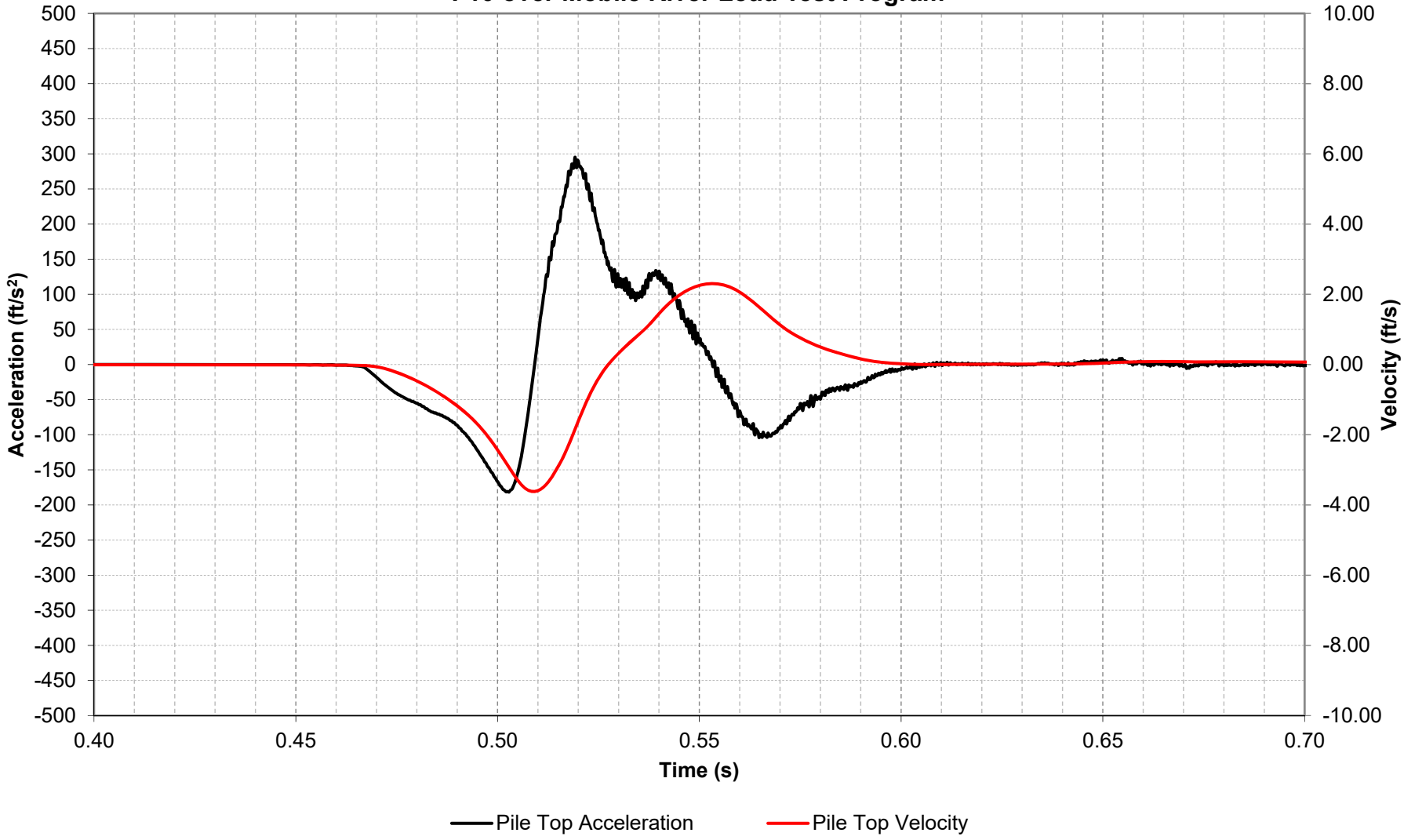
ALDOT Project No.: IM-I010(341)
Mobile County, Alabama
AFT Project No.: 118008

Derivated Static Load vs Displacement Response from Statnamic Load Test
TP-WPA
I-10 over Mobile River Load Test Program

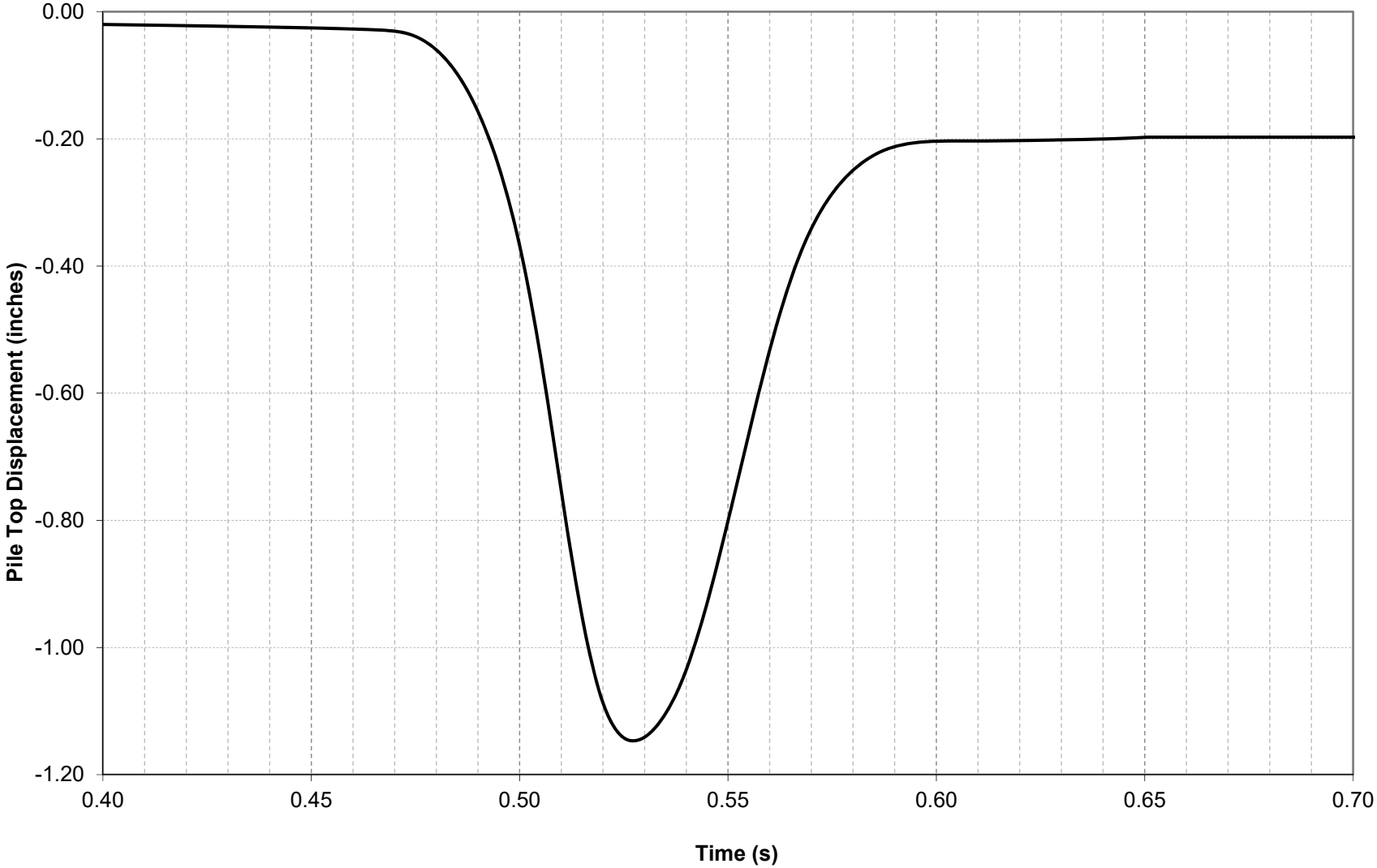



Applied Statnamic Load vs Time from Statnamic Load Test
TP-WPA
I-10 over Mobile River Load Test Program
Load (kips)
4,500
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
0.40
0.45
0.50
0.55
0.60
0.65
0.70
Time (s)
Applied Statnamic Load Not Corrected for Inertia and Damping

Pile Top Acceleration and Velocity vs Time from Statnamic Load Test
TP-WPA
I-10 over Mobile River Load Test Program



Pile Top Displacement vs Time from Statnamic Load Test
TP-WPA
I-10 over Mobile River Load Test Program



Appendix E

Relevant Project Documents
TP-WPA

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	5

PROJECT NOTES

200, 201, 202
301, 302, 307

TP-WPA
60" STEEL
PIPE PILE
LOAD TEST

TP-WPB
72" DRILLED
SHAFT LOAD
TEST

TRENCH

TRENCH

TRENCH

505+00

515+00

520

STA 505+00

STA 520+00

MADISON ST

S ROYAL ST

CL-CONST
NEW MOBILE RIVER BRIDGE

LOT 2

CITY OF MOBILE
NO DEED
PLOTTED FROM
TAX ASSESSORS MAP

NOTE: SEE SHEET 2A FOR
PILE TIP ELEVATIONS

MOBILE RIVER

RESPONSIBLE PE:	SUPERVISOR:	DESIGNER:	PLAN SUBMITTAL	ALABAMA DEPARTMENT OF TRANSPORTATION	HORIZ 50 0 50 SCALE (FEET)	SHEET TITLE	ROUTE
DATE:	DATE:	DATE:				PLAN SHEET STA 505+00 TO STA 520+00	I-10

REFERENCE PROJECT NUMBER	FISCAL YEAR	SHEET NUMBER
IM-I010(341)	2018	18

thompson ENGINEERING

RECORD OF TEST BORING

Site Description:	I-10 Mobile River Bridge and Bayway					**County:**	Mobile
Boring No.:	TH-10	**Boring Location:**	470+55.32	**Offset:**	106.31' RT	**Alignment:**	I-10 Bayway
ALDOT PE No.:	DPI-0030(005)	**TE Project No.:**	15-1101-0228			**Eng./Geo.:**	C.Tisher
Elev.:	12.9 ft.	**Northing:**	245999.249	**Easting:**	1797615.33	**Date Started:**	9/7/2017
Total Depth:	180.0 ft.	**Soil Depth:**	180.0 ft.	**Core Depth:**	0.0 ft.	**Date Completed:**	9/8/2017
Bore Hole Diameter (in):	4-inch	**AASHTO / ASTM Sampling Methods:**	AASHTO T206 & T207				
Drill Machine:	CME 45C	**Drill Method:**	MR	**Hammer Type:**	Automatic	**Energy Ratio:**	86%
Core Size:	N/A	**Driller:**	Thompson Eng	**Groundwater:**	**TOB** 1.8 ft.	**24 HR**	20.0 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. *Groundwater depth TOB most likely influenced by drilling method.								

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	

thompson ENGINEERING

RECORD OF TEST BORING

Site Description:	I-10 Mobile River Bridge and Bayway					**County:**	Mobile
Boring No.:	MB-1	**Boring Location:**	514+25.88	**Offset:**	18.84' LT	**Alignment:**	I-10 Main Span
ALDOT PE No.:	DPI-0030(005)	**TE Project No.:**	15-1101-0228			**Eng./Geo.:**	B.Ellis/C.Tisher
Elev.:	2.9 ft.	**Northing:**	249675.65	**Easting:**	1799417.497	**Date Started:**	4/20/2016
Total Depth:	300.0 ft.	**Soil Depth:**	300.0 ft.	**Core Depth:**	0.0 ft.	**Date Completed:**	4/27/2016
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
0.0	0.0	Loose, moist, dark brown, fine to coarse grained, SILTY SAND with GRAVEL (SM)		0.0	SS-1	4	4	4	8	●
		Medium dense, wet, dark brown, fine to medium grained, with wood, SILTY SAND with GRAVEL (SM, A-2-4(0)), LL=NP PL=NP PI=NP NMC=57.0 %#200=17.6		1.5	SS-2	4	5	7	12	● ▲ ○
5.0	-5.0			3.0	SS-3	4	2	2	4	●
		Very loose, wet, dark brown, fine to coarse grained, POORLY GRADED GRAVEL with SILT and SAND (GP-GM)		4.5	SS-4	2	2	5	7	●
		Loose, most likely fall in		6.0	SS-5	3	3	3	6	●
		Loose, most likely fall in								
10.0	-10.0	Very loose, most likely fall in		8.5	SS-6	2	1	1	2	●
		Very loose, wet, dark brown, fine to coarse grained, POORLY GRADED GRAVEL with SILT and SAND (GP-GM, A-1-a(0)), LL=NP PL=NP PI=NP NMC=18.9 %#200=10.9		13.5	SS-7	1	2	2	4	● ▲ ○
15.0	-15.0									
20.0	-20.0	Loose, wet, gray and brown, fine grained, POORLY GRADED SAND with GRAVEL (SP, A-1-b(0)), LL=NP PL=NP PI=NP NMC=16.9 %#200=4.7		18.5	SS-8	5	5	4	9	● ▲ ○
		Loose, dark brown and gray, fine to medium grained		23.5	SS-9	4	5	5	10	●
25.0	-25.0									
30.0		Medium dense, gray and light gray		28.5	SS-10	8	12	11	23	●

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	

thompson ENGINEERING

RECORD OF TEST BORING

Site Description:	I-10 Mobile River Bridge and Bayway					**County:**	Mobile
Boring No.:	MB-1	**Boring Location:**	514+25.88	**Offset:**	18.84' LT	**Alignment:**	I-10 Main Span
ALDOT PE No.:	DPI-0030(005)	**TE Project No.:**	15-1101-0228			**Eng./Geo.:**	B.Ellis/C.Tisher
Elev.:	2.9 ft.	**Northing:**	249675.65	**Easting:**	1799417.497	**Date Started:**	4/20/2016
Total Depth:	300.0 ft.	**Soil Depth:**	300.0 ft.	**Core Depth:**	0.0 ft.	**Date Completed:**	4/27/2016
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
30.0	-30.0	Medium dense, wet, yellowish brown and brown, fine grained, POORLY GRADED SAND with GRAVEL (SP, A-3(0)), LL=NP PL=NP PI=NP NMC=28.7 %#200=3.4		33.5	SS-11	6	5	6	11	▲ ● ○
35.0	-35.0	Loose, with trace shells		38.5	SS-12	5	4	5	9	●
40.0	-40.0	Medium dense, wet, pale brown, fine to medium grained, with trace gravel, POORLY GRADED SAND (SP, A-1-b(0)), LL=NP PL=NP PI=NP NMC=22.2 %#200=2.1		43.5	SS-13	4	8	8	14	▲ ● ○
45.0	-45.0	Loose, wet, pale brown, fine to medium grained, POORLY GRADED GRAVEL with SAND (GP, A-1-a(0)), LL=NP PL=NP PI=NP NMC=11.7 %#200=3.1		48.5	SS-14	6	5	4	9	▲ ● ○
50.0	-50.0	Loose, light brown		53.5	SS-15	4	3	4	7	●
55.0	-55.0	Medium dense, wet, pale brown, fine to medium grained, POORLY GRADED SAND with SILT		58.5	SS-16	8	10	6	16	●
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
Sheet 3 of 12

REFERENCE PROJECT NUMBER	FISCAL YEAR	SHEET NUMBER
IM-I010(341)	2018	19

thompson ENGINEERING

RECORD OF TEST BORING

Site Description:	I-10 Mobile River Bridge and Bayway					**County:**	Mobile
Boring No.:	MB-1	**Boring Location:**	514+25.88	**Offset:**	18.84' LT	**Alignment:**	I-10 Main Span
ALDOT PE No.:	DPI-0030(005)	**TE Project No.:**	15-1101-0228			**Eng./Geo.:**	B.Ellis/C.Tisher
Elev.:	2.9 ft.	**Northing:**	249675.65	**Easting:**	1799417.497	**Date Started:**	4/20/2016
Total Depth:	300.0 ft.	**Soil Depth:**	300.0 ft.	**Core Depth:**	0.0 ft.	**Date Completed:**	4/27/2016
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
60.0		(SP-SM)								
	-60.0			63.5	SS-17	6	8	12	20	
65.0		Medium dense, wet, reddish brown and brown, fine to medium grained, POORLY GRADED SAND with SILT (SP-SM, A-3(0)), LL=NP PL=NP PI=NP NMC=19.3 %#200=8.6								
	-65.0			68.5	SS-18	35	50/5	X	50/5	
70.0		Very dense, No Recovery								
	-70.0			73.5	SS-19	12	28	24	52	
75.0		Very dense, light brown								
	-75.0			78.5	SS-20	50	X	X	100+	
80.0		Very dense								
	-80.0			83.5	SS-21	7	8	7	15	
85.0		Medium dense, wet, medium to fine grained, with trace gravel								
	-85.0			88.5	SS-22	0	0	5	5	
90.0		Firm, moist, dark gray, FAT CLAY (CH) NOTE: Sample rods slipped through hoisting ring and								

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	

thompson ENGINEERING

RECORD OF TEST BORING

Site Description:	I-10 Mobile River Bridge and Bayway					**County:**	Mobile
Boring No.:	MB-1	**Boring Location:**	514+25.88	**Offset:**	18.84' LT	**Alignment:**	I-10 Main Span
ALDOT PE No.:	DPI-0030(005)	**TE Project No.:**	15-1101-0228			**Eng./Geo.:**	B.Ellis/C.Tisher
Elev.:	2.9 ft.	**Northing:**	249675.65	**Easting:**	1799417.497	**Date Started:**	4/20/2016
Total Depth:	300.0 ft.	**Soil Depth:**	300.0 ft.	**Core Depth:**	0.0 ft.	**Date Completed:**	4/27/2016
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
90.0		penetrated the first 12 inches of the sample length. Undisturbed sample obtained from 90.5 to 92.5 feet. Approximately 24 inches of recovery. Very stiff, moist, dark grayish brown, with trace sand, FAT CLAY (CH, A-7-6(29)), LL=52 PL=22 PI=31 NMC=40.1 %#200=75.7		90.5	ST-1					
95.0	-90.0	Firm		93.5	SS-23	2	4	4	8	
	-95.0	Undisturbed sample obtained from 98.5 to 100.5 feet. Approximately 24 inches of recovery. Very stiff, moist, dark brown and light gray, FAT CLAY (CH, A-7-6(71)), LL=89 PL=28 PI=61 NMC=44.0 %#200=99.4		98.5	ST-2					
100.0	-100.0	Very dense, wet, gray and light gray, fine grained, SILTY CLAYEY SAND (SC-SM, A-2-4(0)), LL=21 PL=17 PI=4 NMC=23.9 %#200=26.7		103.5	SS-24	3	20	32	52	
105.0	-105.0	Dense, wet, light gray, fine grained, POORLY GRADED SAND (SP)		108.5	SS-25	14	20	28	48	
110.0	-110.0	Very dense, wet, light gray, fine to coarse grained, POORLY GRADED SAND (SP, A-1-b(0)), LL=NP PL=NP PI=NP NMC=19.5 %#200=3.3		113.5	SS-26	19	32	33	65	
115.0	-115.0	Dense, fine grained, with trace gravel		118.5	SS-27	9	15	23	38	
120.0										

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	

thompson ENGINEERING

RECORD OF TEST BORING

Site Description:	I-10 Mobile River Bridge and Bayway					**County:**	Mobile
Boring No.:	MB-1	**Boring Location:**	514+25.88	**Offset:**	18.84' LT	**Alignment:**	I-10 Main Span
ALDOT PE No.:	DPI-0030(005)	**TE Project No.:**	15-1101-0228			**Eng./Geo.:**	B.Ellis/C.Tisher
Elev.:	2.9 ft.	**Northing:**	249675.65	**Easting:**	1799417.497	**Date Started:**	4/20/2016
Total Depth:	300.0 ft.	**Soil Depth:**	300.0 ft.	**Core Depth:**	0.0 ft.	**Date Completed:**	4/27/2016
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
120.0										
	-120.0	Very dense		123.5	SS-28	15	29	28	57	
125.0										
	-125.0	Stiff, moist, gray, with trace sand, FAT CLAY (CH, A-7-6(34)), LL=53 PL=21 PI=32 NMC=23.7 %#200=95.0		128.5	SS-29	4	5	4	9	
130.0	-130.0	Medium dense, wet, gray, fine grained, POORLY GRADED SAND with SILT (SP-SM)		133.5	SS-30	3	7	19	26	
135.0	-135.0	Medium dense		138.5	SS-31	15	14	15	29	
140.0	-140.0			143.5	SS-32	7	8	10	18	
145.0	-145.0	Very dense, wet, gray, fine grained, POORLY GRADED SAND with SILT (SP-SM, A-2-4(0)), LL=NP		148.5	SS-33	26	34	27	61	
150.0										

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
Sheet 4 of 12

REFERENCE PROJECT NUMBER	FISCAL YEAR	SHEET NUMBER
IM-I010(341)	2018	20

thompson ENGINEERING

RECORD OF TEST BORING

Site Description:	I-10 Mobile River Bridge and Bayway					**County:**	Mobile
Boring No.:	MB-1	**Boring Location:**	514+25.88	**Offset:**	18.84' LT	**Alignment:**	I-10 Main Span
ALDOT PE No.:	DPI-0030(005)	**TE Project No.:**	15-1101-0228			**Eng./Geo.:**	B.Ellis/C.Tisher
Elev.:	2.9 ft.	**Northing:**	249675.65	**Easting:**	1799417.497	**Date Started:**	4/20/2016
Total Depth:	300.0 ft.	**Soil Depth:**	300.0 ft.	**Core Depth:**	0.0 ft.	**Date Completed:**	4/27/2016
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
150.0		PL=NP PI=NP NMC=22.5 %#200=10.5								
	-150.0									
155.0		Undisturbed sample obtained from 153.5 to 155.5 feet. Approximately 24 inches of recovery. With trace clay		153.5	ST-3					
	-155.0									
160.0		Very dense		158.5	SS-34	26	24	32	56	
	-160.0									
165.0		Very dense, wet, greenish gray, fine grained, with trace gravel, POORLY GRADED SAND with SILT (SP-SM, A-2-4(0)), LL=NP PL=NP PI=NP NMC=23.8 %#200=11.5		163.5	SS-35	23	47	50+	100	
	-165.0									
170.0		Dense, wet, greenish gray, fine grained, CLAYEY SAND (SC, A-6(7)), LL=36 PL=13 PI=24 NMC=23.2 %#200=48.4		168.5	SS-36	11	19	18	37	
	-170.0									
175.0		Dense, wet, gray, fine grained, POORLY GRADED SAND with SILT (SP-SM)		173.5	SS-37	11	18	25	43	
	-175.0									
180.0		Dense		178.5	SS-38	16	19	20	39	

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	

thompson ENGINEERING

RECORD OF TEST BORING

Site Description:	I-10 Mobile River Bridge and Bayway					**County:**	Mobile
Boring No.:	MB-1	**Boring Location:**	514+25.88	**Offset:**	18.84' LT	**Alignment:**	I-10 Main Span
ALDOT PE No.:	DPI-0030(005)	**TE Project No.:**	15-1101-0228			**Eng./Geo.:**	B.Ellis/C.Tisher
Elev.:	2.9 ft.	**Northing:**	249675.65	**Easting:**	1799417.497	**Date Started:**	4/20/2016
Total Depth:	300.0 ft.	**Soil Depth:**	300.0 ft.	**Core Depth:**	0.0 ft.	**Date Completed:**	4/27/2016
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
180.0										
	-180.0	Very dense, wet, gray, fine grained, POORLY GRADED SAND with SILT (SP-SM, A-3(0)), LL=NP PL=NP PI=NP NMC=26.5 %#200=9.7		183.5	SS-39	43	41	29	70	
185.0										
	-185.0	Undisturbed sample obtained from 188.5 to 190.5 feet. Approximately 24 inches of recovery. Hard, wet, bluish gray, SANDY LEAN CLAY (CL, A-6(6)), LL=28 PL=14 PI=14 NMC=17.8 %#200=62.9		188.5	ST-4					
190.0										
	-190.0	Hard, wet, bluish gray, with trace sand, LEAN CLAY (CL, A-7-6(29)), LL=46 PL=16 PI=30 NMC=21.0 %#200=91.7		193.5	SS-40	12	14	21	35	
195.0										
	-195.0	Hard		198.5	SS-41	22	18	20	38	
200.0										
	-200.0									
205.0										
	-205.0	Hard, wet, bluish gray, with trace sand, LEAN CLAY (CL, A-6(21)), LL=39 PL=15 PI=24 NMC=17.0		208.5	SS-42	12	15	17	32	
210.0										

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	

thompson ENGINEERING

RECORD OF TEST BORING

Site Description:	I-10 Mobile River Bridge and Bayway					**County:**	Mobile
Boring No.:	MB-1	**Boring Location:**	514+25.88	**Offset:**	18.84' LT	**Alignment:**	I-10 Main Span
ALDOT PE No.:	DPI-0030(005)	**TE Project No.:**	15-1101-0228			**Eng./Geo.:**	B.Ellis/C.Tisher
Elev.:	2.9 ft.	**Northing:**	249675.65	**Easting:**	1799417.497	**Date Started:**	4/20/2016
Total Depth:	300.0 ft.	**Soil Depth:**	300.0 ft.	**Core Depth:**	0.0 ft.	**Date Completed:**	4/27/2016
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
210.0		%#200=88.7								
	-210.0									
215.0		Very dense, wet, bluish gray, fine grained, SILTY SAND (SM)		218.5	SS-43	23	33	48	81	
	-215.0									
220.0										
	-220.0									
225.0										
	-225.0	Dense, gray		228.5	SS-44	6	13	19	32	
230.0										
	-230.0									
235.0										
	-235.0	Loose, wet, gray, fine grained, SILTY SAND (SM, A-2-4(0)), LL=NP PL=NP PI=NP NMC=25.3		238.5	SS-45	4	4	4	8	
240.0										

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 / RQD — Recovery / 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
Sheet 5 of 12

REFERENCE PROJECT NUMBER	FISCAL YEAR	SHEET NUMBER
IM-I010(341)	2018	21

thompson ENGINEERING

RECORD OF TEST BORING

Site Description:	I-10 Mobile River Bridge and Bayway					**County:**	Mobile
Boring No.:	MB-1	**Boring Location:**	514+25.88	**Offset:**	18.84' LT	**Alignment:**	I-10 Main Span
ALDOT PE No.:	DPI-0030(005)	**TE Project No.:**	15-1101-0228			**Eng./Geo.:**	B.Ellis/C.Tisher
Elev.:	2.9 ft.	**Northing:**	249675.65	**Easting:**	1799417.497	**Date Started:**	4/20/2016
Total Depth:	300.0 ft.	**Soil Depth:**	300.0 ft.	**Core Depth:**	0.0 ft.	**Date Completed:**	4/27/2016
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
240.0		%#200=28.0								
	-240.0									
245.0		Medium dense		248.5	SS-46	5	10	11	21	●
	-245.0									
250.0										
	-250.0									
255.0		Very dense, wet, gray, fine grained, POORLY GRADED SAND with SILT (SP-SM)		258.5	SS-47	30	50/0	X	50/0	>>●
	-255.0									
260.0										
	-260.0									
265.0				268.5	SS-48	43	50	X	50/6	>>●
	-265.0									
270.0		Very dense, with trace gravel								

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	

thompson ENGINEERING

RECORD OF TEST BORING

Site Description:	I-10 Mobile River Bridge and Bayway					**County:**	Mobile
Boring No.:	MB-1	**Boring Location:**	514+25.88	**Offset:**	18.84' LT	**Alignment:**	I-10 Main Span
ALDOT PE No.:	DPI-0030(005)	**TE Project No.:**	15-1101-0228			**Eng./Geo.:**	B.Ellis/C.Tisher
Elev.:	2.9 ft.	**Northing:**	249675.65	**Easting:**	1799417.497	**Date Started:**	4/20/2016
Total Depth:	300.0 ft.	**Soil Depth:**	300.0 ft.	**Core Depth:**	0.0 ft.	**Date Completed:**	4/27/2016
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
270.0										
	-270.0									
275.0										
	-275.0	Very dense		278.5	SS-49	24	50/4	X	50/4	>>●
280.0										
	-280.0									
285.0										
	-285.0									
290.0		Very dense, wet, light gray, fine grained, with trace gravel, POORLY GRADED SAND with SILT (SP-SM, A-2-4(0)), LL=NP PL=NP PI=NP NMC=21.1 %#200=10.9		288.5	SS-50	43	41	49	90	X ▲ ○ ●
	-290.0									
295.0										
	-295.0			298.5	SS-51	25	50	X	50/6	>>●
300.0		Very dense, gray, with trace clay								

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	

thompson ENGINEERING

RECORD OF TEST BORING

Site Description:	I-10 Mobile River Bridge and Bayway					**County:**	Mobile
Boring No.:	MB-1	**Boring Location:**	514+25.88	**Offset:**	18.84' LT	**Alignment:**	I-10 Main Span
ALDOT PE No.:	DPI-0030(005)	**TE Project No.:**	15-1101-0228			**Eng./Geo.:**	B.Ellis/C.Tisher
Elev.:	2.9 ft.	**Northing:**	249675.65	**Easting:**	1799417.497	**Date Started:**	4/20/2016
Total Depth:	300.0 ft.	**Soil Depth:**	300.0 ft.	**Core Depth:**	0.0 ft.	**Date Completed:**	4/27/2016
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 300.0 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	

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 :

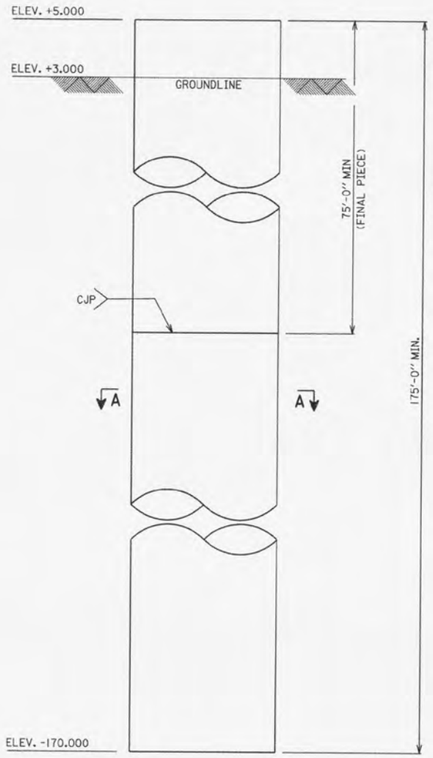
PROJECT NO. 17-1101-0145
I-10 MOBILE RIVER BRIDGE
LOAD TEST PROGRAM
MOBILE COUNTY, ALABAMA

Preliminary Project No:

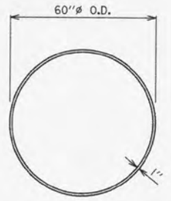
TEST BORING RECORD
Sheet 6 of 12

STEEL PIPE PILE AND DRILLED SHAFT SHEET

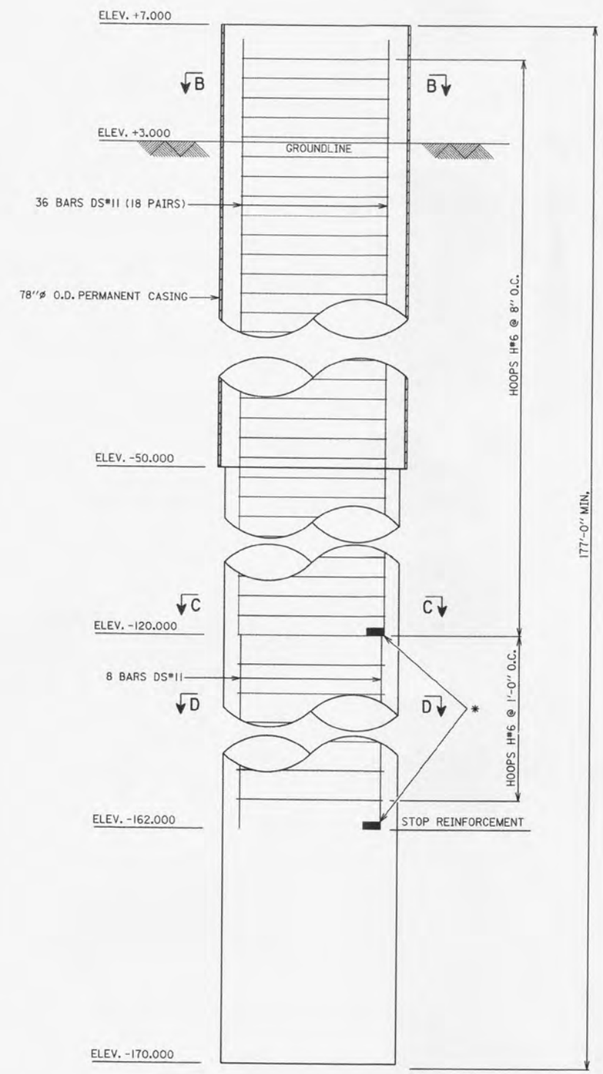
REFERENCE PROJECT NO	FISCAL YEAR	SHEET NO
IM-I010(341)	2018	14



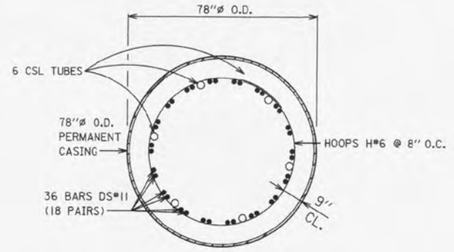
STEEL PIPE PILE
NOT TO SCALE



SECTION A-A
NOT TO SCALE

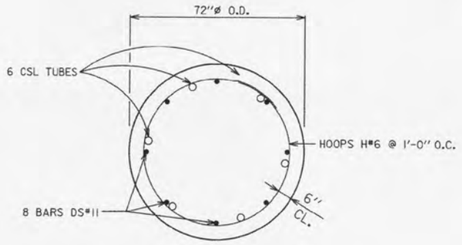


DRILLED SHAFT
NOT TO SCALE
CSL TUBES OMITTED FOR CLARITY



SECTION B-B
NOT TO SCALE

SECTION C-C
NOT TO SCALE



SECTION D-D
NOT TO SCALE

NOTES

1. PAYMENT FOR DRILLED SHAFT CONCRETE TO BE INCLUDED IN PAY ITEM 506C LINEAR FOOT DRILLED SHAFT CONSTRUCTION,) 6'-0" ø CLASS DS2 CONCRETE, (APPROXIMATE 4.189 CY/LF OF SHAFT.)
2. IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR TO INSURE THE STABILITY OF THE PERMANENT CASING DURING CONSTRUCTION OF THE DRILLED SHAFT.
3. ALL DRILLED SHAFT CONCRETE SHALL BE 6,000 PSI 28 DAY STRENGTH.
4. STEEL PIPE PILES SHALL BE MADE FROM ASTM A252 GRADE 3 (45 ksi) STEEL.
5. SEE SPECIAL PROVISIONS AND GENERAL NOTES FOR STEEL PIPE PILE AND DRILLED SHAFT REQUIREMENTS NOT SHOWN.

*6. BI-DIRECTIONAL LOAD CELL LOCATIONS.

ESTIMATED QUANTITIES			
72"ø O.D.			
14,000	POUND	502A000	STEEL REINFORCEMENT
173	LINEAR FOOT	506A001	DRILLED SHAFT EXCAVATION, 6'-0" DIAMETER
177	LINEAR FOOT	506C026	DRILLED SHAFT CONSTRUCTION, 6'-0" DIAMETER CLASS DS2 CONCRETE
57	LINEAR FOOT	506F007	PERMANENT DRILLED SHAFT CASING, 6'-6" DIAMETER
1	EACH	506G006	CROSSHOLE SONIC LOGGING, 6'-0" DIAMETER

RESPONSIBLE PE:	SUPERVISOR:	DESIGNER:	PLAN SUBMITTAL	ALABAMA DEPARTMENT OF TRANSPORTATION	NOT TO SCALE	SHEET TITLE	ROUTE
DATE:	DATE:	DATE:				STEEL PIPE PILE AND DRILLED SHAFT SHEET	I-10

Appendix F

Instrument Calibrations
TP-WPA

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: H829

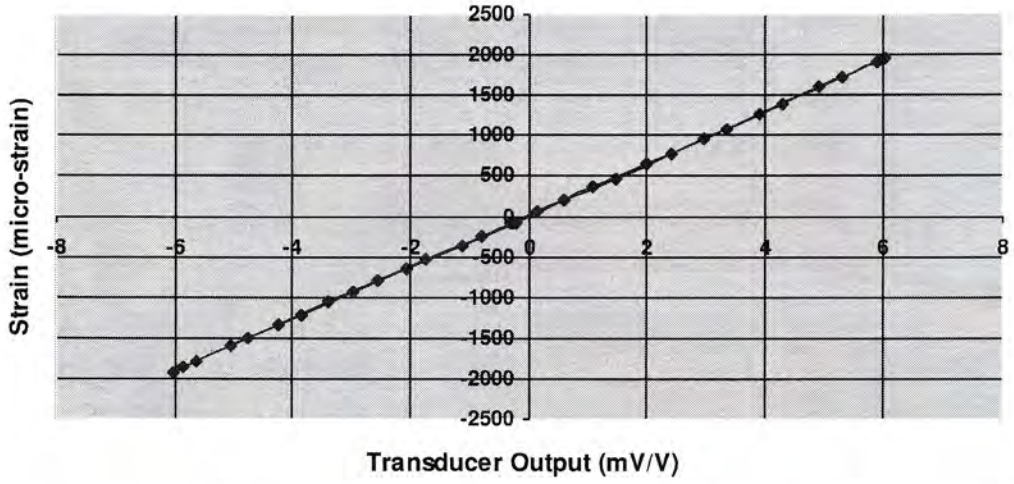
PDI Gage Factor: 92.2 με/V

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: A788

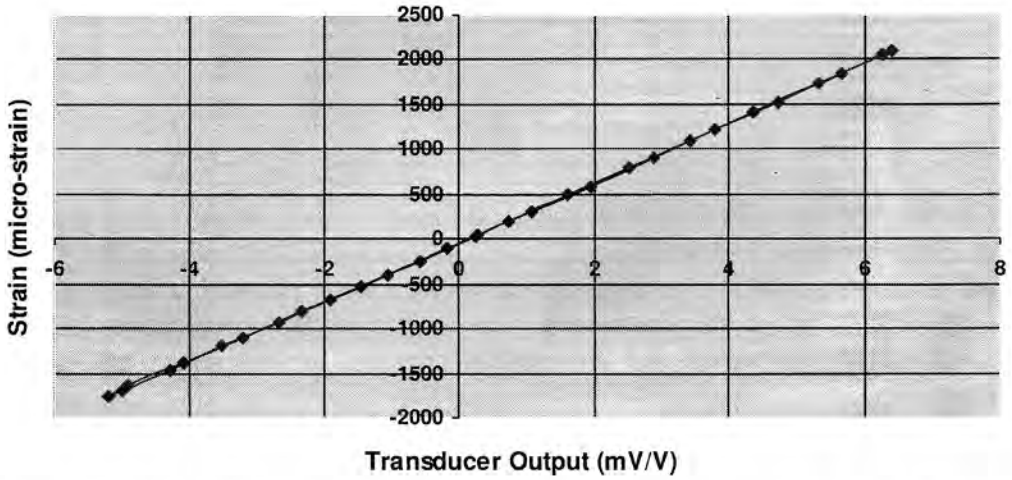
PDI Gage Factor: 95.1 με/V

General Gage Factor: 330.2 $\mu\varepsilon/mV/V_{ext}$
Initial Offset Voltage: 0.069 mV/V_{ext}

Table 1 – Representative Calibration Data

Applied Strain (με)	Transducer Output (mV/V_{ext})	Applied Strain (με)	Transducer Output (mV/V_{ext})
37	0.271	302	1.075
-111	-0.191	591	1.958
-401	-1.068	899	2.875
-672	-1.903	1213	3.811
-924	-2.687	1526	4.745
-1196	-3.519	1842	5.670
-1457	-4.307	2095	6.411
-1691	-5.011	2049	6.266
-1755	-5.201	1723	5.323
-1645	-4.908	1405	4.368
-1379	-4.094	1091	3.432
-1098	-3.226	786	2.520
-813	-2.338	488	1.618
-523	-1.449	190	0.721
-244	-0.586	39	0.272
32	0.257	39	0.271

Calibration Curve



Mean Linear Correlation Coefficient (LCC): 9.999596E-1

LCC Standard Deviation: 1.506151E-6

Calibrated By: ES

Signature:

Date/Time: 7/18/2017 1:34 PM

Temperature (°C): 26.1

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

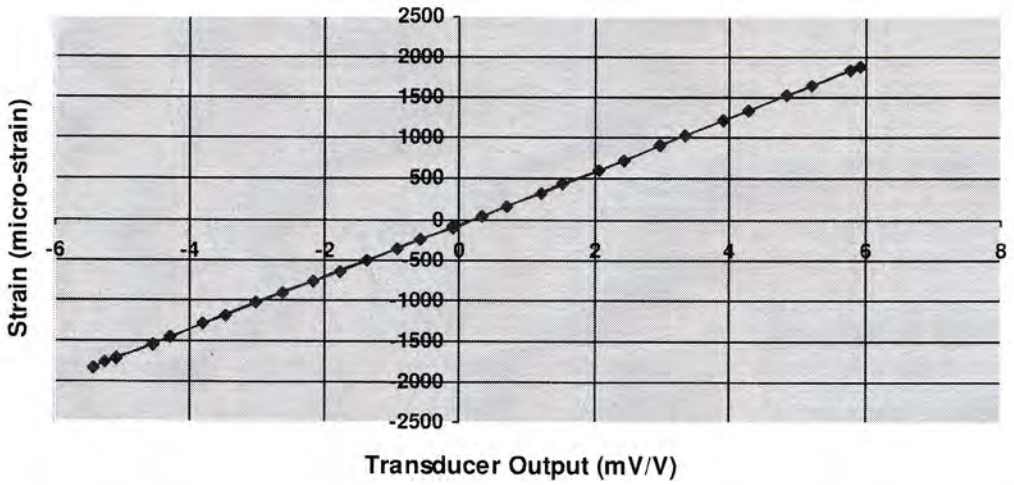
PDI Gage Factor: 93.9 με/V

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:

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: I840

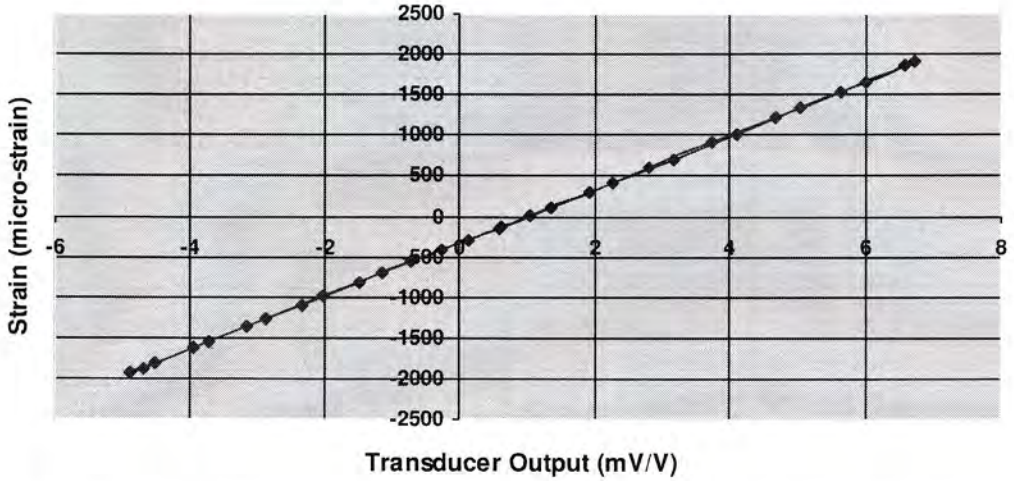
PDI Gage Factor: 94.9 με/V

General Gage Factor: 329.4 $\mu\varepsilon/mV/V_{ext}$
Initial Offset Voltage: 0.287 mV/V_{ext}

Table 1 – Representative Calibration Data

Applied Strain (με)	Transducer Output (mV/V_{ext})	Applied Strain (με)	Transducer Output (mV/V_{ext})
-133	0.623	114	1.365
-287	0.136	404	2.259
-568	-0.717	706	3.165
-818	-1.484	1012	4.097
-1095	-2.326	1329	5.050
-1367	-3.158	1652	6.009
-1626	-3.942	1899	6.725
-1874	-4.690	1857	6.592
-1941	-4.887	1533	5.646
-1816	-4.532	1216	4.687
-1551	-3.730	901	3.740
-1275	-2.888	593	2.811
-995	-2.024	299	1.919
-708	-1.149	10	1.046
-426	-0.272	-131	0.619
-147	0.577	-132	0.616

Calibration Curve



Mean Linear Correlation Coefficient (LCC): 9.999856E-1

LCC Standard Deviation: 3.104323E-7

Calibrated By: Kay Tol

Signature: Kay Tol

Date/Time: 2/28/2018 8:06 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: P454

PDI Gage Factor: 145.3 με/V

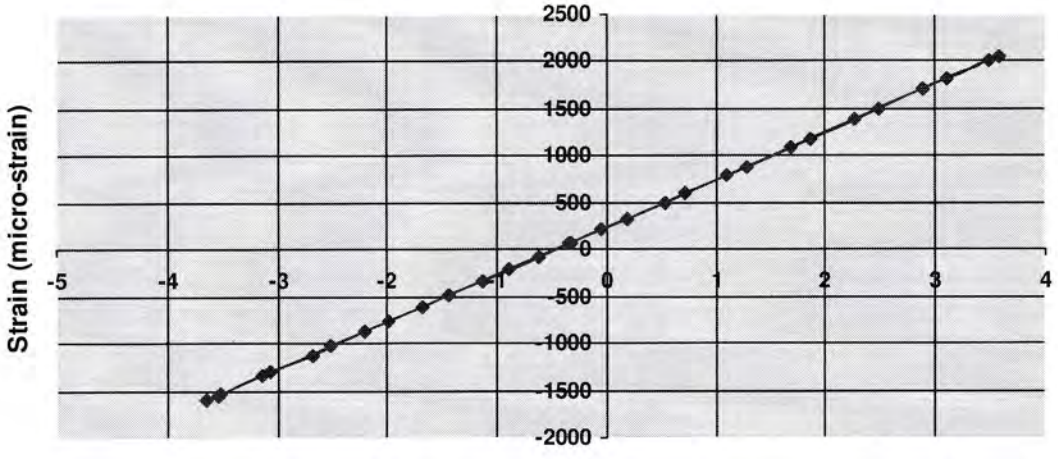
General Gage Factor: 504.7 $\mu\varepsilon/mV/V_{ext}$

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

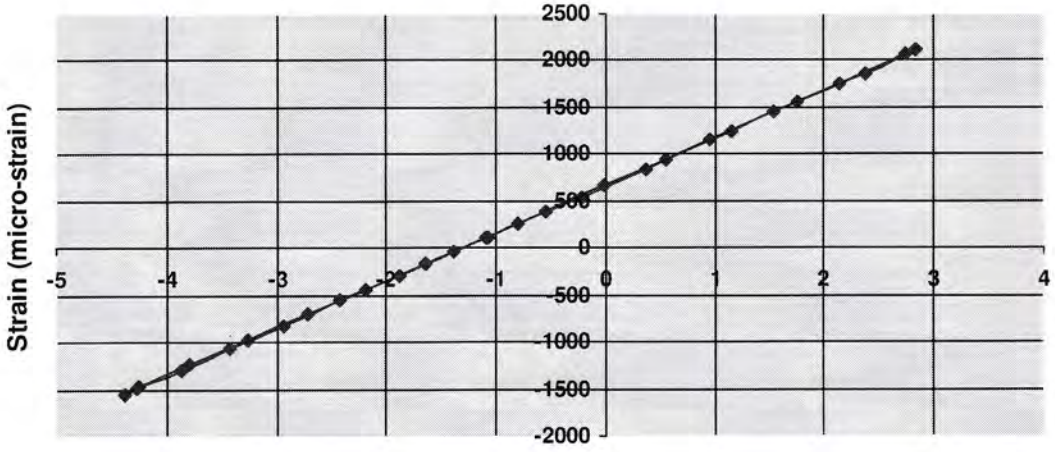
PDI Gage Factor: 145.8 με/V

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

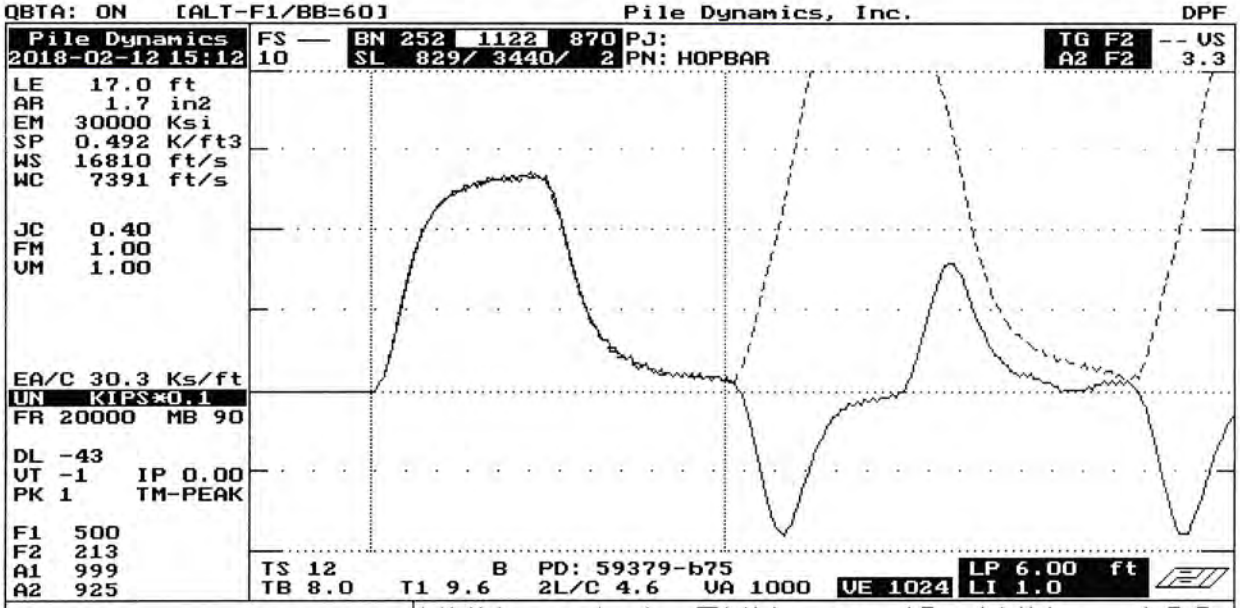
PDI Automated Strain Transducer Calibration System (PDI-ASTCS)

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

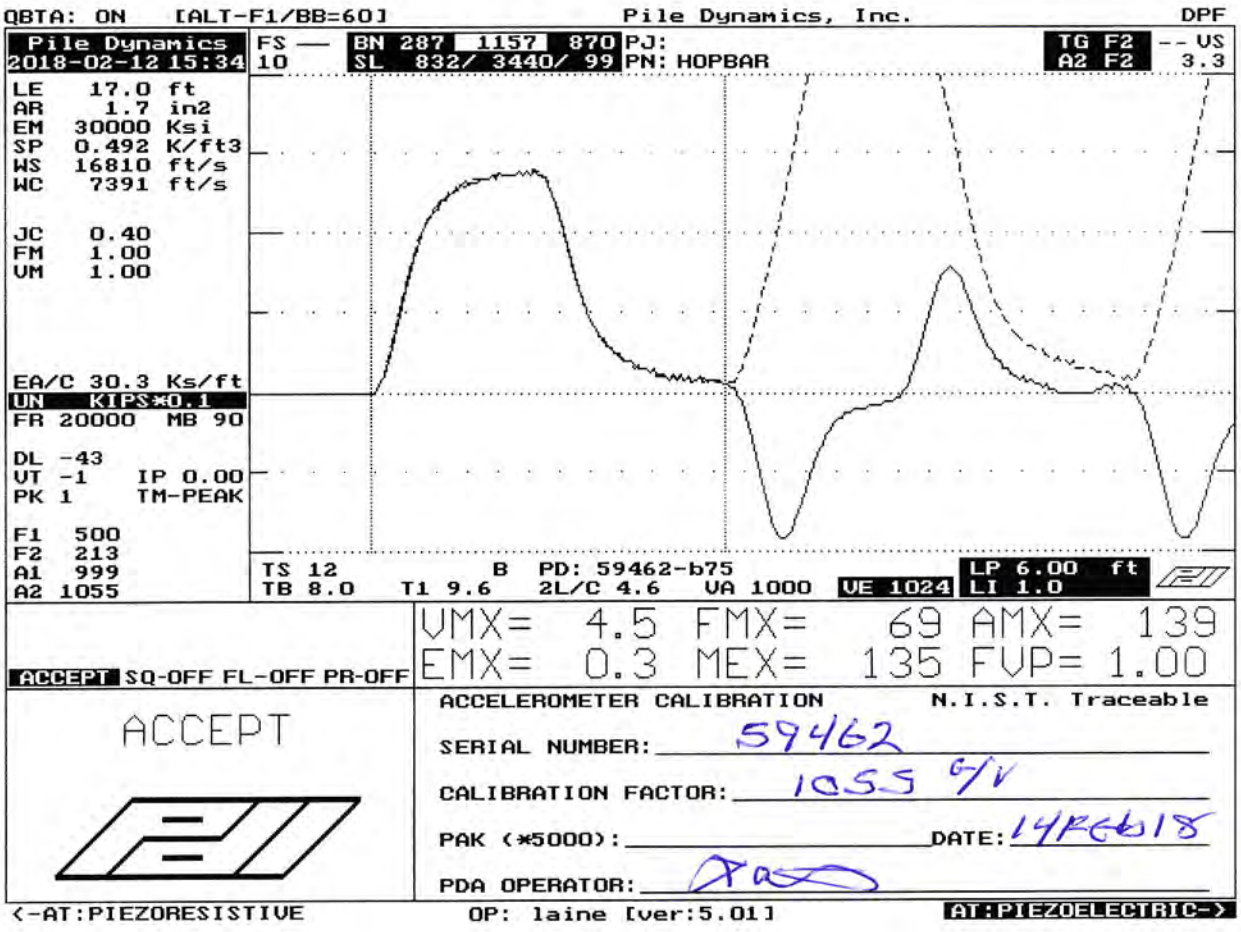
SERIAL NUMBER: 59379

CALIBRATION FACTOR: 925 e/v

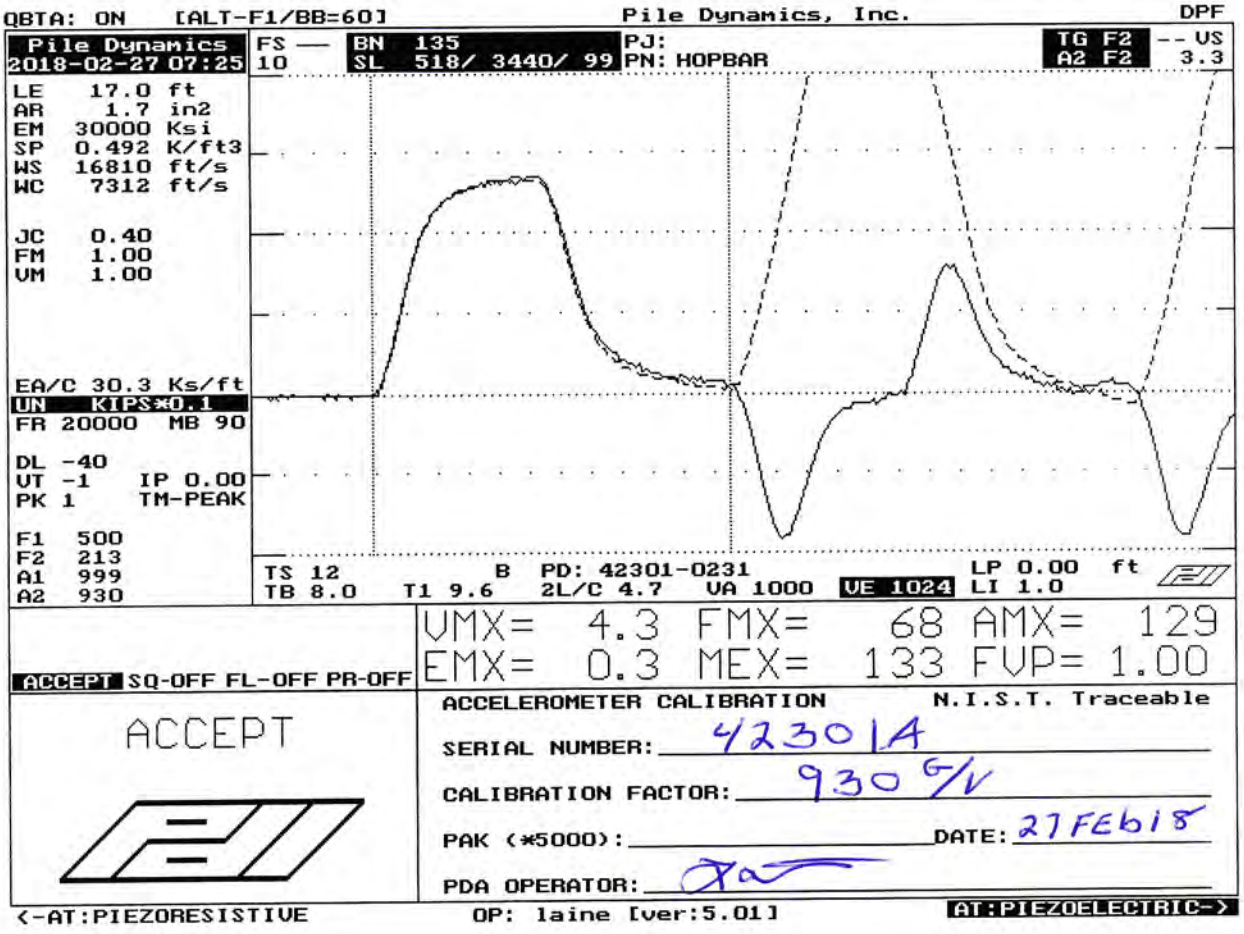
PAK (*5000): _____ DATE: 14Feb18

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

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



VMX=	4.3	FMX=	68	AMX=	129
EMX=	0.3	MEX=	133	FVP=	1.00

ACCEPT SQ-OFF FL-OFF PR-OFF

ACCEPT

ACCELEROMETER CALIBRATION N.I.S.T. Traceable

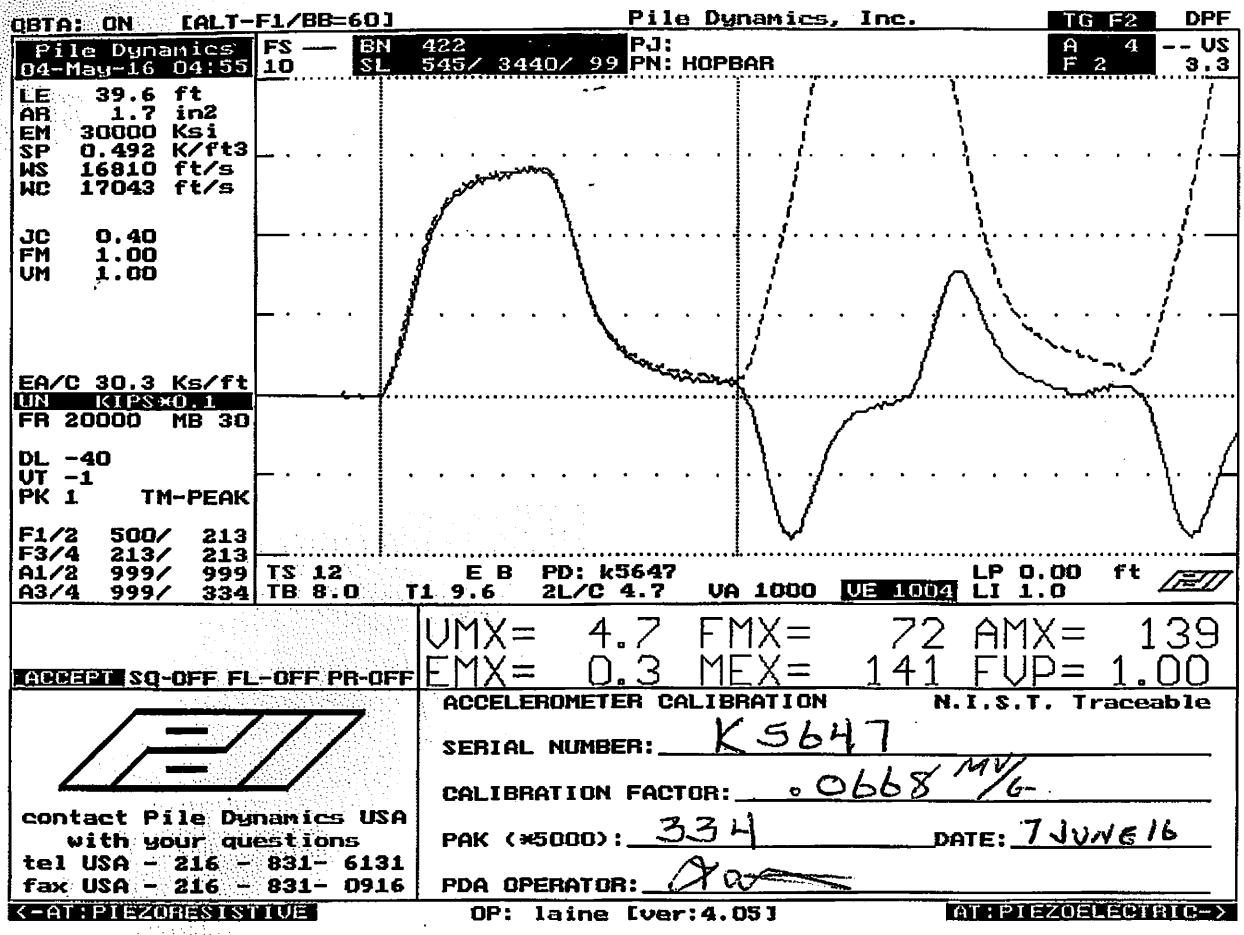
SERIAL NUMBER: 42301A

CALIBRATION FACTOR: 930 G/V

PAK (*5000): _____ DATE: 27 Feb 18

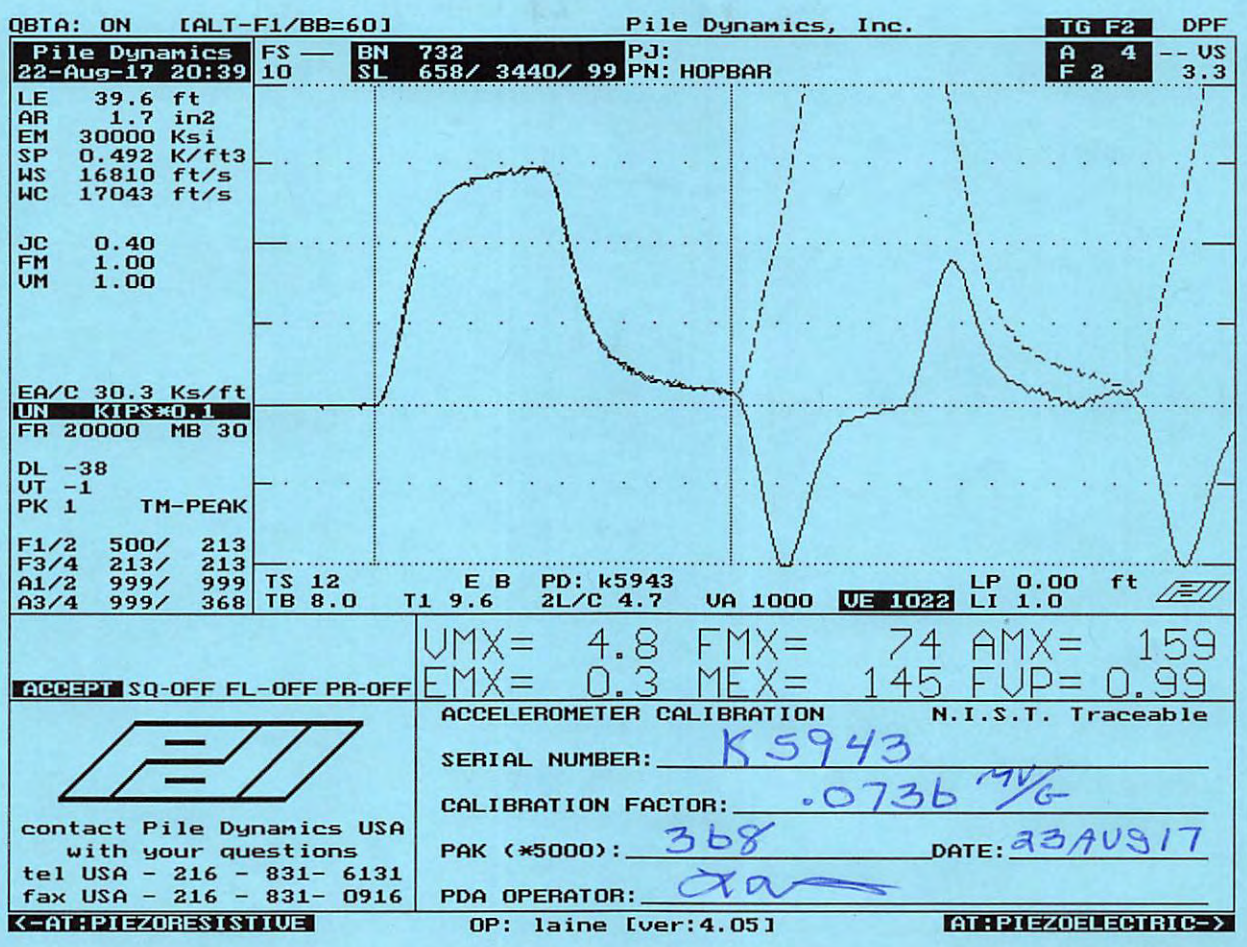
PDA OPERATOR: [signature]

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



Smart Sensor

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



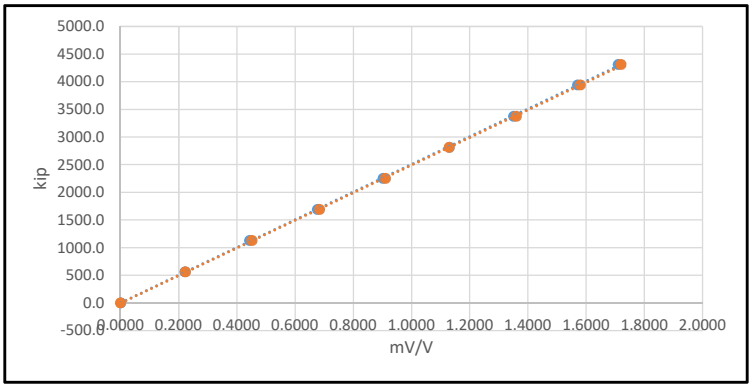
Smart Sensor

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

Applied Foundation Testing, Inc.
4035 J. Louis Street
Green Cove Springs, Fl 32043
P: (904) 284-1337
F: (904) 284-1339

Force Transducer Calibration Report

Calibration Date	6/14/2018	**Description**	19 MN KelkLoad Cell
Calibration Due	6/14/2019	**Model**	C3929-1
Technician	Austin Robertson	**Serial Number**	15
Ambient	84.2° F	**Range**	4300 kip



Calibrating Equipment		
Item	**Description**	**Serial**
Pressure Gauge	20000 PSIG	1659929
Load Reference	Geocon Loadcell	1800247
Load Reference	Geocon Loadcell	1800248
Load Reference	Geocon Loadcell	1800249
Data Acquisition	NI 9219	1A4225C

Load Cycle 1			Load Cycle 2			Average
Load Reference (kip)	**Found As (mV/V)**	**Left As (mV/V)**	**Load Reference (kip)**	**Found As (mV/V)**	**Left As (mV/V)**	**Nonlinearity (%)**
0.0	0.0008	0.0008	0.0	0.0008	0.0008	-0.04%
560	0.2210	0.2210	560	0.2232	0.2232	-0.19%
1130	0.4432	0.4432	1130	0.4525	0.4525	-0.30%
1690	0.6763	0.6763	1690	0.6837	0.6837	0.18%
2250	0.9022	0.9022	2250	0.9104	0.9104	0.33%
2810	1.1300	1.1300	2810	1.1300	1.1300	0.32%
3375	1.3500	1.3500	3375	1.3600	1.3600	0.28%
3940	1.5700	1.5700	3940	1.5800	1.5800	-0.06%
4310	1.7100	1.7100	4310	1.7200	1.7200	-0.52%

Comments:

Linear Gage Factor	**2502.3020**	**kip/mV/V**
Regression Zero	**-3.7095**	**kip**
Maximum Nonlinearity	**-0.52%**	
Sensitivity	**1.7184**	**mV/V**

Applied Foundation Testing, Inc. hereby certifies that this instrument meets or exceeds all requirements for its intended use and the reported calibration factors are accurate to within the limits of the calibrating procedure. Reference standards and calibrations are traceable to the National Institute of Standards and Technology (NIST) where applicable.

Technician: Austin Robertson

Approved:

~ Calibration Certificate ~

Per ISO 16063-21

Model Number: 3701G2FA50G

Serial Number: 3795

Description: DC Accelerometer

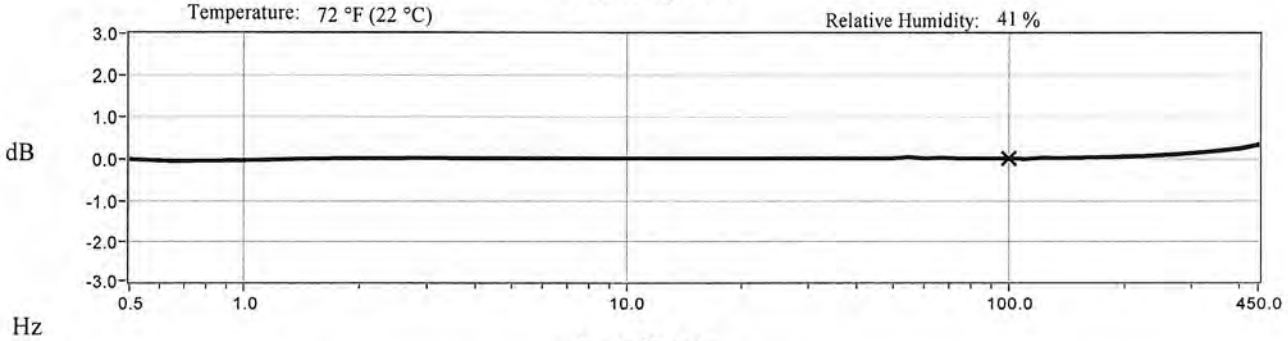
Manufacturer: PCB

Method: Back-to-Back Comparison AT401-12

Calibration Data

Sensitivity @ 100 Hz	**59.9 mV/g**	Offset Voltage (@ 0 g)	9.6 mVDC
	(6.10 mV/m/s²)	Resonant Frequency	1.59 kHz

Sensitivity Plot



Data Points

Frequency (Hz)	Dev. (%)	Frequency (Hz)	Dev. (%)	Frequency (Hz)	Dev. (%)
0.5	-0.3	10	0.1	70	0.1
1	-0.6	15	0.1	REF. FREQ.	0.0
2	0.0	20	0.0	200	0.5
5	0.0	30	0.1	450	3.9
7	0.0	50	0.1		

Mounting Surface: Calibration Fixture w/Silicone Grease Fastener: Stud Fixture Orientation: Vertical
Acceleration Level (pk)[1]: 1.00 g (9.81 m/s²)
[1]The acceleration level may be limited by shaker displacement at low frequencies. If the listed level cannot be obtained, the calibration system uses the following formula to set the vibration amplitude; Acceleration Level (g) = 0.207 x (freq)². [2]The gravitational constant used for calculations by the calibration system is; 1 g = 9.80665 m/s².

Condition of Unit

As Found: In Tolerance

As Left: In Tolerance

Notes

1. Calibration is traceable to one or more of the following; PTB 10065, PTB 10066 and NIST 683/283498.
2. This certificate shall not be reproduced, except in full, without written approval from PCB Piezotronics, Inc.
3. Calibration is performed in compliance with ISO 10012-1, ANSI Z540.3 and ISO 17025.
4. See Manufacturer's Specification Sheet for a detailed listing of performance specifications.
5. Due to state of art limitations, the test uncertainty ratio is 3:1. Measurement uncertainty (95% confidence level with coverage factor of 2) for frequency ranges tested during calibration are as follows: 0.5-0.99 Hz; +/- 1.8%, 1-30 Hz; +/- 1.0%, 30.01-199 Hz; +/- 1.5%, 200-1 kHz; +/- 3.0%.

Technician: Ronald Stevens RS 4270 Date: 1/25/2018

PCB PIEZOTRONICS INC.
VIBRATION DIVISION
3425 Walden Avenue · Depew, NY 14043
TEL: 888-684-0013 · FAX: 716-685-3886 · www.pcb.com

~ Calibration Certificate ~

Per ISO 16063-21

Model Number: 3701G2FA50G

Serial Number: 7984

Description: DC Accelerometer

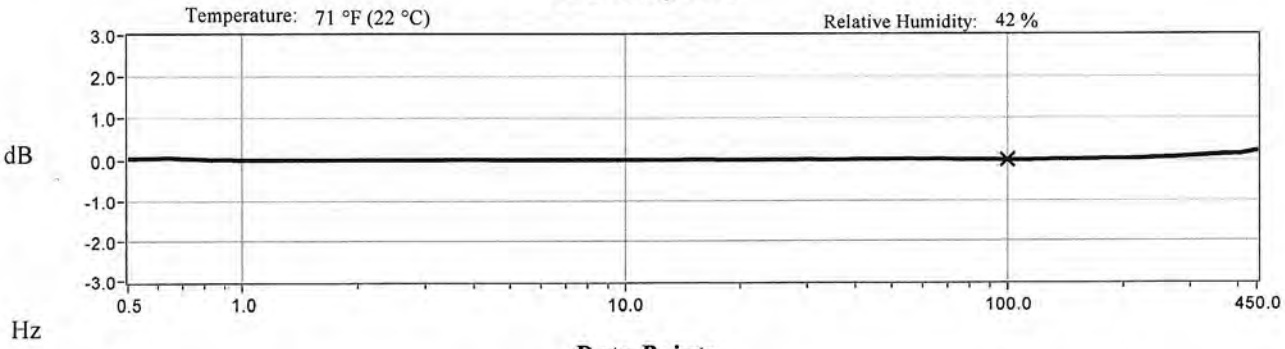
Manufacturer: PCB

Method: Back-to-Back Comparison AT401-12

Calibration Data

Sensitivity @ 100 Hz	**60.9 mV/g**	Offset Voltage (@ 0 g)	3.3 mVDC
	(6.21 mV/m/s²)	Resonant Frequency	1.53 kHz

Sensitivity Plot



Data Points

Frequency (Hz)	Dev. (%)	Frequency (Hz)	Dev. (%)	Frequency (Hz)	Dev. (%)
0.5	0.5	10	0.0	70	0.1
1	0.1	15	0.1	REF. FREQ.	0.0
2	0.0	20	0.1	200	0.2
5	0.1	30	0.1	450	2.5
7	0.1	50	0.1		

Mounting Surface: Calibration Fixture w/Silicone Grease Fastener: Stud Fixture Orientation: Vertical
Acceleration Level (pk)[1]: 1.00 g (9.81 m/s²)
[1]The acceleration level may be limited by shaker displacement at low frequencies. If the listed level cannot be obtained, the calibration system uses the following formula to set the vibration amplitude; Acceleration Level (g) = 0.207 x (freq)². [2]The gravitational constant used for calculations by the calibration system is; 1 g = 9.80665 m/s².

Condition of Unit

As Found: In Tolerance

As Left: In Tolerance

Notes

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Technician: Ronald Stevens RS 4270 Date: 1/25/2018

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TEL: 888-684-0013 · FAX: 716-685-3886 · www.pcb.com

~ Calibration Certificate ~

Per ISO 16063-21

Model Number: 3711E1150G

Serial Number: 8860

Description: DC Accelerometer

Manufacturer: PCB

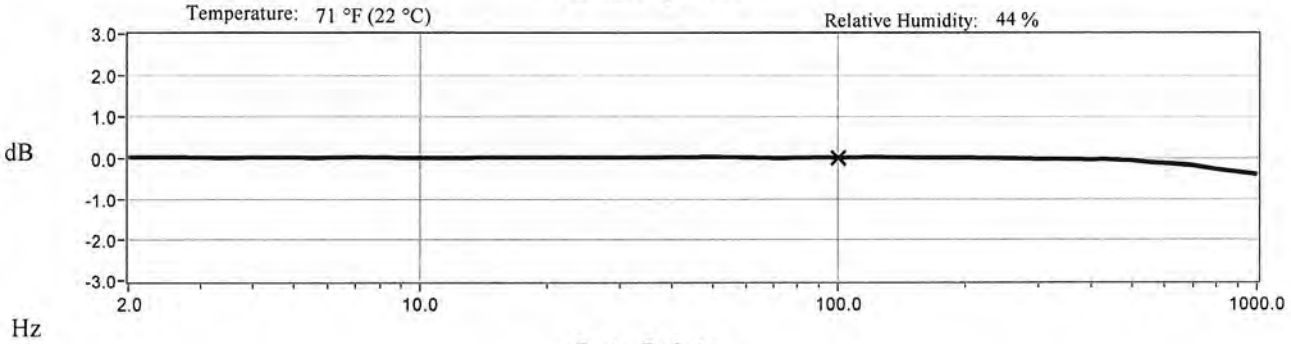
Method: Back-to-Back Comparison AT401-12

Calibration Data

Sensitivity @ 100 Hz **40.2 mV/g** **(4.10 mV/m/s²)**

Offset Voltage (@ 0 g) 9.3 mVDC

Sensitivity Plot



Data Points

Frequency (Hz)	Dev. (%)	Frequency (Hz)	Dev. (%)	Frequency (Hz)	Dev. (%)
2	0.1	20	0.1	200	-0.0
5	0.1	30	0.1	500	-0.8
7	0.1	50	0.3	1000	-4.5
10	0.0	70	-0.0		
15	0.1	REF. FREQ.	0.0		

Mounting Surface: Calibration Fixture w/Silicone Grease Fastener: Stud Fixture Orientation: Vertical
Acceleration Level (pk)[1]: 1.00 g (9.81 m/s²)
[1]The acceleration level may be limited by shaker displacement at low frequencies. If the listed level cannot be obtained, the calibration system uses the following formula to set the vibration amplitude; Acceleration Level (g) = 0.207 x (freq)². [2]The gravitational constant used for calculations by the calibration system is; 1 g = 9.80665 m/s².

Condition of Unit

As Found: In Tolerance

As Left: In Tolerance

Notes

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Technician: Ronald Stevens RS 4270 Date: 1/25/2018

ACCREDITED
CALIBRATION CERT #1862.01

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