Applied Foundation Testing

Alabama Certificate of Authorization CA3058-E

June 8, 2018
Revision 1: June 26, 2018
Revision 2: July 2, 2018

Report of High-Strain Dynamic Pile Testing and Axial Statnamic Load Testing
TP-23C
I-10 over Mobile River and Bayway
Load Test Program
Mobile Country, Alabama
AFT Project No.: 118008

Authored By:

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ALABAMA LICENSED No. 22873 PROFESSIONAL ENGINEER DONALD T. ROBERTSON

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 17:25:45 -04'00'

For: **Mr. Davis Daniel**
Jordan Pile Driving, Inc.
301 N. Water Street
Mobile, Alabama 36652

JORDAN PILE DRIVING

REVISION 2: Revision 2 includes placement of the approved inspector's pile driving log in Appendix A.

REVISION 1: Revision 1 dated June 26, 2018 to the original report dated June 8, 2018 included the following changes: The Generalized Soil Conditions section was changed to indicate that the groundwater depth, not elevation, noted in boring BW-23 was 0.0 feet. In the High-Strain Dynamic Pile Testing section, the pile tip elevation after jetting was changed so that it is based on the depth of the pile tip at start of impact driving.

INTRODUCTION

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

This report summarizes the installation and testing of the 110-feet long, 30-inch square prestressed concrete pile at location TP-23C. High-strain dynamic pile testing, also known as PDA, was performed during initial drive, 1 day restrike, and 16 day restrike. Axial Statnamic load testing was performed 15 days after the initial drive of TP-23C. A 16 day restrike was subsequently performed 1 day 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-23C	Initial Drive	4/25/2018
	1 Day Restrike	4/26/2018
	Statnamic Load Testing	5/10/2018
	16 Day Restrike	5/11/2018

The project plans indicate test pile TP-23C was located at station 630+43.00 offset left 150 feet, adjacent to the north of the existing I-10 Bayway. Please refer to the project source documents for a site plan of the actual location of the test piles.

Installation of test pile TP-23C 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., Mr. Jason Frederick, 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-23C. 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-23C is boring BW-23 located at station 632+20.32 offset left 15.51 feet.

A copy of soil boring BW-23 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 ground water depth noted in boring log BW-23 was 0.0 feet. Table 2 below provides a summary of the subsurface conditions.

Table 2: Description of Subsurface Soil Conditions(1)

Average Elevation From - To(2)	Material Description	Typical N-Value Range
-4.0 to -15.8	Silty Sand (SM)	0
-15.8 to -20.8	Sand (SP)	0
-20.8 to -35.8	Sandy Fat Clay (CH)	0
-35.8 to -40.8	Silty Sand (SM)	0
-40.8 to -45.8	Clayey Sand (SC)	3
-45.8 to -50.8	Fat Clay (CH)	0
-50.8 to -55.8	Sand (SP)	NA
-55.8 to -60.8	Sandy Lean Clay (CL)	3
-60.8 to -80.8	Silty Sand (SM)	11 to 24
-80.8 to -110.8	Sand; Sand with Gravel (SP)	24 to 57
-110.8 to -130.8	Lean Clay; Fat Clay (CL and CH)	24 to 39
-130.8 to -155.8	Sand with Silt (SP-SM)	60 to 70

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-23C was installed by Jordan Pile Driving, Inc. The test pile was prepared for high-strain dynamic testing by drilling holes and setting drop-in anchors for sensor attachment two pile diameters, or 60 inches, below the pile top.

Prior to driving pile TP-23C, the pile was jetted until the pile tip was at approximate elevation -49 feet. Pile TP-23C was then impact driven using a Delmag D62-22 open-ended diesel pile driving hammer. The Delmag D62-22 diesel hammer has a maximum rated energy of 164,250 foot-pounds (ram weight of 13,700 pounds at a stroke height of 11.25 feet). We understand the Delmag D62-22 hammer utilized a hammer cushion consisting of 6 inches of micarta and aluminum and a pile cushion consisting of 10 inches of pine plywood. The same well compressed pile cushion used for initial drive of the pile was utilized for the restrikes.

Applied Foundation Testing performed dynamic pile testing using a Pile Driving Analyzer Model PAX manufactured by Pile Dynamics, Inc. Dynamic testing was accomplished by externally attaching two piezo-resistive accelerometers and two 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-23C was driven to where the sensor attachment points were approximately 5 feet above the waterline. At this point, the pile top was approximately 2 feet above the pile template/over-water support frame 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). The top of the pile driving template was used as a reference for measuring penetration depth during the initial drive and restrikes. The top of the pile driving template was located at elevation 11.3 feet. The mudline elevation was measured as -13.1 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-23C	Delmag D62-22	+11.3	-13.1	+12.4	-97.6

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

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-23C	EOD	62 Blows Per Foot	3.38	2.01	1.25	0.68	2.02	1.14	29.8/7.43

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.)
	1 Day RS	9 Blows/1”, 7 Blows/1”, 7 Blows/1”, 6 Blows/1”	2.86	2.08	0.58	0.30	2.24	1.63	30.9/8.70
	16 Day RS	11 Blows/1”, 12 Blows/1”, 12 Blows/1”	2.27	1.98	0.25	0.08	1.93	1.68	27.2/7.82

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

Allowable maximum driving stresses for the square prestressed concrete piles are defined by the formulas located in the project special provisions. The maximum allowable compressive stress limit is defined as 4.1ksi – effective prestress. The maximum allowable tensile stress limit is defined as $3\sqrt{(f'_c)}$ + effective prestress.

In the above formula f’c is defined as the minimum concrete compressive strength for the piles, which is 5,000 psi per Plan Sheet 15. Per Plan Sheet 15, the initial prestress depending on the strand type ranges from 903 psi to 1,011 psi. The prestress strand type used for the test piles is not known by AFT. Assuming a loss of 20 percent from initial prestress provides effective prestress values of 722 psi (0.72 ksi) or 809 psi (0.81 ksi) depending on strand type used. Utilizing the worst case of these values, the maximum allowable compressive stress is calculated as 3.29 ksi, and the maximum allowable tensile stress is calculated as 0.93 ksi.

The dynamic pile testing measurements indicate the maximum compressive stress (CSX) and maximum tensile stress (TSX) exceeded allowable stress limits for portions of the initial drive. In general, the high tensile stresses for some blows occurred early in the initial drive in softer driving conditions and near the end of drive when the pile cushion was significantly compressed. The high compressive stresses for some blows were recorded during high energy blows such as when the hammer was restarted with high strokes after an interruption in driving. In a production pile driving situation, additional pile cushion material or driving procedures to avoid these high driving stresses would be needed. It is not recommended letting driving stresses reach levels exceeding allowable stress limits during production pile driving and restrikes.

The dynamic test data does not show any signs of integrity problems for TP-23C. BTA values below 100 shown in the dynamic testing data summaries are likely due to soil effects.

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-23C	EOD	1457	440	103	337	0.60	32.1/ 7.25	0.06	0.27	0.20	0.26	3.60
	1 Day Restrike	6	750	321	429	0.58	50.2/ 12.60	0.04	0.34	0.25	0.33	1.68
	16 Day Restrike	12	770	341	429	0.57	29.1/ 7.79	0.04	0.22	0.40	0.41	2.27

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

The signal matching analysis for TP-23C indicated a total ultimate resistance of 440 kips at end of initial drive, 750 kips during the 1 day restrike; and 770 kips during the 16 day restrike (1 day after axial Statnamic load testing). Based on the set measurements during initial drive and restrikes for TP-23C, the resistance values presented in this report may not be fully mobilized during restrikes due to small pile movements.

AXIAL STATNAMIC LOAD TESTING

Test pile TP-23C was subjected to axial Statnamic load testing (commonly referred to as Rapid load testing) on May 10, 2018, or 15 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 set-up the over-water frame to support the test frame. This included driving pipe piles and constructing a work platform. This over-water frame was also used as the pile driving template. The top of pile concrete was in good condition after pile driving and required only a thin layer of quick set grout to achieve a level and smooth surface.

Additional preparations for the Statnamic load test included the following:

- Construct over-water support frame and mats to support the Statnamic device at the appropriate testing elevation and allow access to the pile.
- Prepare pile top with thin layer of quick set grout for a level and smooth testing surface.
- 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 Unloading Point Method (UPM). 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 UPM 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-23C was loaded to a maximum derived static load of 1,060 kips. The maximum displacement during testing was 2.55 inches. The measured permanent displacement upon complete unloading was 2.55 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-23C is shown in Figure 1 located in Appendix D.

Table 6: Summary of Load and Displacement for Test Pile TP-23C

Description	Data
Maximum Derived Static Load	1,060 kips
Maximum Displacement	2.55 inches
Permanent Displacement	2.55 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 110-feet long, 30-inch square prestressed concrete pile at location TP-23C. TP-23C was subjected to dynamic pile testing during initial drive and 1 and 16 day restrikes and axial Statnamic load testing 15 days after initial drive. A summary of the load test results is provided below:

TP-23C Load Testing Summary:

- The signal matching analysis of the dynamic testing data for TP-23C indicated a total ultimate resistance of 440 kips at end of initial drive, 750 kips for the 1 day restrike, and 770 kips for the 16 day restrike (1 days after axial Statnamic rapid load testing).
- TP-23C was subjected to axial Statnamic load testing 15 days after initial drive with a maximum derived static load of 1,060 kips with a maximum displacement of 2.55 inches and a permanent displacement of 2.55 inches.
- The failure load during axial Statnamic load testing based on the Davisson Failure Criterion was approximately 1,055 kips. The pile top displacement at the failure load was approximately 0.80 inch.

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 110-feet long, 30-inch square prestressed concrete pile at location TP-23C are as follows:

- The dynamic pile testing results indicated lower ultimate total resistances than measured during the axial Statnamic load test at TP-23C. 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 when keeping driving stress values below allowable limits during initial drives and restrikes is of the upmost importance, due to possibly lower transfer energies, less resistance may be mobilized than shown in this report.
- Dynamic pile testing on production piles is recommended to determine bearing resistances, measure pile driving stresses, and determine hammer driving system suitability. Driving criteria may be developed based on this testing with recommendations provided to control tensile and compressive stresses at or below allowable levels.
- Signal matching analyses of the production pile dynamic test data is recommended to confirm and/or to provide a better estimate of the ultimate pile bearing resistance.

Below is a summary of the Appendix contents:

- Appendix A – Inspector's Pile Driving Records
- Appendix B – Dynamic Pile Testing Data Summaries
- Appendix C – CAPWAP Signal Matching Analysis Output
- Appendix D – 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-23C

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	County	Division
IM-I010(341)	Mobile	Southwest Region

Bridge: Station	to Station	Bridge Identification Number
630+43	630+43	

Road Between	and	Lane (if applicable)
I-10	I-10	WB

Contractor	Inspector
Jordan Pile Driving	Donald Hector

Date	Bent No.& Lane	Pile No.	Kind of Soil
4/25/2018	TEST PILE	TP-23C	Soft, Wet, Black, Fat Clay

Kind of Pile	Size of Pile	Total Length (ft)
Square Concrete Pile	30"	110

Elev. Ground Line at Pile	Final Elev. At Top of Pile	Tip Elevation
-13.1	12.4	-97.0

Hammer Make	Hammer Model	Hammer Kind
Delmag	D62-22	Diesel

Hammer Type	Hammer Action	Rated Energy (ft.-lbs.)
Open	Single	165,000 @ 11.3 Stroke

Weight of Hammer (lbs.)	Design Load (from plans) (tons)
13,700	750

	Material	Thickness (in.)	Area (sq. in.)
Hammer Cushion	Aluminum and Micarta Alternating	6	381
Pile Cushion (Before Driving)	Plywood	10	900
Pile Cushion (After Driving)	Plywood		

Pile Cap Weight (lbs.)
10,000

Height Of Fall (feet)	Energy Delivered To Pile (E) (ft.-lbs.)	Blows Per Foot Of Penetration (N)	Total Penetration (feet)	Bearing (Ru) (tons)
5.04	69,048	10	52	
5.46	74,802	10	53	
5.35	73,295	8	54	
5.29	72,473	6	55	

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
630+43	630+43	N/A

Date	Bent No.& Lane	Pile No.	Kind of Soil
4/25/2018	TEST PILE	TP-23C	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)
5.21	71,377	5	56	
4.87	66,719	5	57	
5.50	75,350	3	58	
4.99	68,363	5	59	
5.40	73,980	5	60	
5.51	75,487	6	61	
5.59	76,583	5	62	
5.59	76,583	4	63	
5.47	74,939	5	64	
5.13	70,281	5	65	
5.46	74,802	4	66	
4.94	67,678	4	67	
5.13	70,281	3	68	
4.97	68,089	4	69	
5.09	69,733	4	70	
4.32	59,184	6	71	
4.20	57,540	9	72	
4.23	57,951	12	73	
4.41	60,417	10	74	
4.51	61,787	14	75	
4.66	63,842	14	76	
4.67	63,979	17	77	

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

ALABA[illegible] DEPARTMENT OF TRANSPORT[illegible]ON
CONTINUATION OF TEST PILE RECORD

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

Bridge: Station	to Station	Bridge Identification Number
630+43	630+43	N/A

Date	Bent No.& Lane	Pile No.	Kind of Soil
4/25/2018	TEST PILE	TP-23C	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)
5.62	76,994	32	78	
5.31	72,747	35	79	
6.16	84,392	35	80	
6.67	91,379	49	81	
7.19	98,503	47	82	
7.48	102,476	66	83	
8.07	110,559	64	84	
7.91	108,367	89	85	
8.04	110,148	86	86	
8.17	111,929	90	87	
8.02	109,874	81	88	
8.05	110,285	69	89	
8.19	112,203	71	90	
8.30	113,710	66	91	
8.30	113,710	62	92	
8.46	115,902	53	93	
8.46	115,902	53	94	
7.24	99,188	54	95	
7.20	98,640	70	96	
7.20	98,640	59	97	

Appendix B

Dynamic Pile Testing Data Summaries
TP-23C

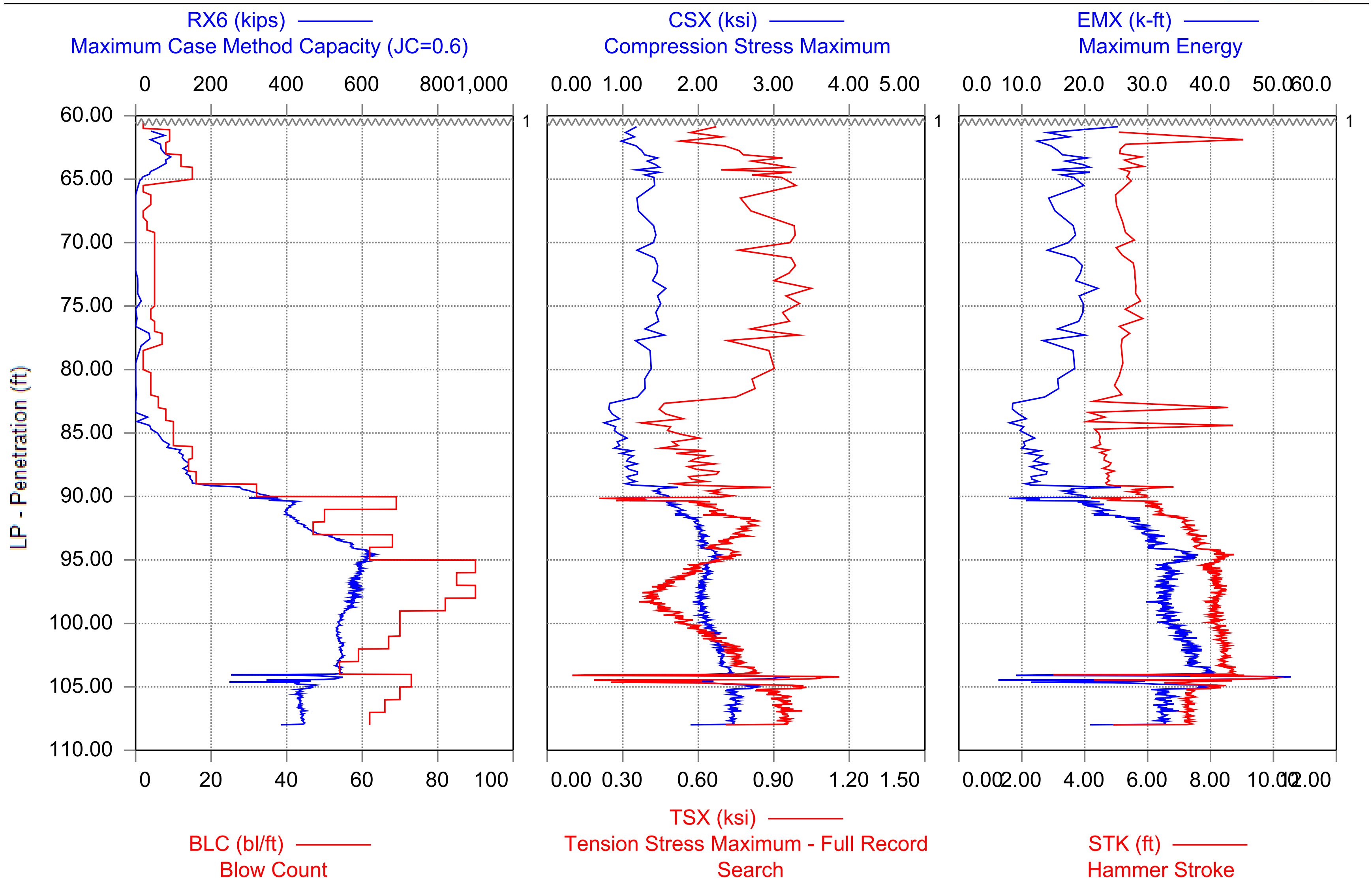
I-10 over Mobile River Bridge Load Test Program

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: 23-May-2018 Test started: 25-April-2018

I-10 MOBILE RIVER - TP-23C ID



1 - Template (Reference) El. = 11.25', Mudline El. = -13.1'

I-10 MOBILE RIVER - TP-23C ID 30" PSC, 110' LONG
OP: AFT Date: 25-April-2018

AR: 686.18 in² SP: 0.150 k/ft³
LE: 105.00 ft EM: 6,620.57 ksi
WS: 14,300.0 f/s JC: 0.60

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

BL#	Depth	BLC	TYPE	RX6	RX7	RA2	CSX	CSB	TSX	EMX	STK	BTA
	ft	bl/ft		kips	kips	kips	ksi	ksi	ksi	k-ft	ft	(%)
2	61.00	2	AV2	0	0	0	1.28	0.13	0.73	32.7	8.19	86
			STD	0	0	0	0.01	0.02	0.19	9.9	0.00	2
			MAX	0	0	0	1.29	0.15	0.92	42.6	8.19	87
			MIN	0	0	0	1.26	0.10	0.53	22.8	8.19	84
11	62.00	9	AV9	52	48	83	1.03	0.23	0.58	14.0	6.83	98
			STD	38	40	19	0.24	0.05	0.20	6.6	5.64	5
			MAX	140	140	123	1.60	0.35	1.01	31.7	17.78	100
			MIN	0	0	60	0.73	0.17	0.33	8.1	1.50	88
19	63.00	8	AV8	68	65	76	1.21	0.25	0.73	15.3	5.18	96
			STD	10	12	7	0.11	0.02	0.10	1.8	0.30	5
			MAX	82	82	87	1.37	0.28	0.89	17.8	5.71	100
			MIN	51	46	66	1.05	0.23	0.59	12.9	4.82	88
31	64.00	12	AV12	81	80	89	1.41	0.30	0.88	19.1	5.57	90
			STD	12	14	6	0.10	0.02	0.09	2.6	0.35	4
			MAX	97	96	100	1.59	0.33	1.05	23.9	6.25	100
			MIN	49	41	80	1.21	0.27	0.71	15.2	5.08	88
46	65.00	15	AV15	37	31	68	1.36	0.28	0.87	17.9	5.37	91
			STD	20	22	12	0.13	0.02	0.12	2.3	0.31	4
			MAX	79	79	90	1.53	0.30	1.02	21.5	5.88	100
			MIN	10	2	52	1.09	0.25	0.62	13.4	4.78	88
48	66.00	2	AV2	0	0	0	1.40	0.16	0.99	20.3	5.41	85
			STD	0	0	0	0.01	0.01	0.00	0.9	0.03	0
			MAX	0	0	0	1.42	0.17	0.99	21.1	5.45	85
			MIN	0	0	0	1.39	0.15	0.99	19.4	5.38	85
52	67.00	4	AV4	0	0	0	1.22	0.19	0.80	14.6	4.95	88
			STD	0	0	0	0.10	0.01	0.10	1.3	0.19	1
			MAX	0	0	0	1.31	0.20	0.89	15.8	5.16	89
			MIN	0	0	0	1.07	0.17	0.66	12.5	4.68	87
54	68.00	2	AV2	0	0	0	1.16	0.12	0.77	15.2	4.78	85
			STD	0	0	0	0.01	0.01	0.00	1.1	0.00	2
			MAX	0	0	0	1.17	0.12	0.77	16.3	4.78	86
			MIN	0	0	0	1.15	0.11	0.77	14.1	4.78	83
57	69.00	3	AV3	0	0	0	1.41	0.19	0.98	18.2	5.38	87
			STD	0	0	0	0.03	0.00	0.03	0.6	0.05	0
			MAX	0	0	0	1.44	0.19	1.01	18.9	5.42	87
			MIN	0	0	0	1.37	0.18	0.95	17.5	5.31	87

I-10 MOBILE RIVER - TP-23C ID 30" PSC, 110' LONG
OP: AFT Date: 25-April-2018

BL#	Depth	BLC	TYPE	RX6	RX7	RA2	CSX	CSB	TSX	EMX	STK	BTA
	ft	bl/ft		kips	kips	kips	ksi	ksi	ksi	k-ft	ft	(%)
62	70.00	5	AV5	0	0	40	1.44	0.23	0.99	18.4	5.46	88
			STD	0	0	9	0.06	0.01	0.05	1.3	0.19	0
			MAX	0	0	56	1.53	0.24	1.07	20.5	5.71	89
			MIN	0	0	29	1.34	0.22	0.90	16.6	5.14	88
67	71.00	5	AV5	0	0	12	1.26	0.21	0.83	15.2	5.08	90
			STD	0	0	9	0.11	0.01	0.10	1.6	0.27	5
			MAX	0	0	23	1.43	0.23	0.98	17.8	5.51	100
			MIN	0	0	0	1.13	0.19	0.71	12.9	4.76	87
72	72.00	5	AV5	0	0	10	1.45	0.26	0.98	19.3	5.55	89
			STD	0	0	6	0.07	0.02	0.07	1.2	0.24	0
			MAX	0	0	18	1.54	0.30	1.06	21.2	5.91	89
			MIN	0	0	0	1.35	0.24	0.89	17.6	5.22	88
77	73.00	5	AV5	3	1	13	1.44	0.27	0.95	19.1	5.53	89
			STD	6	3	19	0.11	0.02	0.10	2.0	0.34	0
			MAX	15	7	48	1.59	0.31	1.09	21.8	6.09	89
			MIN	0	0	0	1.27	0.25	0.79	15.9	5.05	88
82	74.00	5	AV5	6	3	37	1.50	0.30	0.98	20.6	5.67	90
			STD	8	4	22	0.10	0.02	0.09	1.9	0.33	0
			MAX	17	8	56	1.60	0.33	1.08	22.8	6.04	90
			MIN	0	0	4	1.33	0.27	0.83	18.0	5.12	89
87	75.00	5	AV5	9	4	36	1.49	0.30	0.98	19.6	5.61	90
			STD	8	5	17	0.07	0.01	0.07	1.6	0.22	0
			MAX	19	11	53	1.57	0.31	1.05	21.8	5.86	90
			MIN	0	0	11	1.39	0.28	0.89	17.2	5.33	89
91	76.00	4	AV4	0	0	9	1.49	0.29	0.97	20.5	5.62	89
			STD	0	0	10	0.15	0.03	0.12	2.7	0.42	0
			MAX	0	0	26	1.63	0.31	1.09	22.8	6.09	89
			MIN	0	0	0	1.24	0.23	0.77	16.1	4.97	88
96	77.00	5	AV5	2	0	18	1.34	0.29	0.84	16.3	5.21	89
			STD	4	1	11	0.09	0.03	0.07	1.3	0.23	0
			MAX	11	1	37	1.46	0.32	0.94	18.4	5.59	89
			MIN	0	0	1	1.18	0.25	0.72	14.3	4.85	89
103	78.00	7	AV7	38	34	43	1.36	0.31	0.86	16.8	5.26	94
			STD	34	35	5	0.19	0.06	0.14	3.2	0.43	5
			MAX	101	100	49	1.61	0.38	1.06	20.7	5.93	100
			MIN	0	0	35	1.08	0.20	0.64	12.4	4.63	89
105	79.00	2	AV2	0	0	0	1.35	0.23	0.88	18.6	5.17	86
			STD	0	0	0	0.07	0.03	0.06	0.7	0.18	1
			MAX	0	0	0	1.42	0.26	0.94	19.3	5.35	86
			MIN	0	0	0	1.28	0.20	0.82	17.9	4.99	85
107	80.00	2	AV2	0	0	0	1.41	0.25	0.94	19.6	5.32	87
			STD	0	0	0	0.04	0.01	0.03	0.7	0.10	1
			MAX	0	0	0	1.45	0.27	0.97	20.3	5.42	87

I-10 MOBILE RIVER - TP-23C ID 30" PSC, 110' LONG
OP: AFT Date: 25-April-2018

BL#	Depth	BLC	TYPE	RX6	RX7	RA2	CSX	CSB	TSX	EMX	STK	BTA
	ft	bl/ft		kips	kips	kips	ksi	ksi	ksi	k-ft	ft	(%)
			MIN	0	0	0	1.37	0.24	0.91	18.9	5.22	86
111	81.00	4	AV4	0	0	15	1.30	0.27	0.82	15.8	5.04	88
			STD	0	0	6	0.05	0.02	0.04	0.7	0.12	0
			MAX	0	0	23	1.37	0.30	0.88	16.7	5.20	89
			MIN	0	0	6	1.23	0.25	0.76	15.0	4.87	88
115	82.00	4	AV4	1	0	14	1.34	0.28	0.86	16.4	5.17	88
			STD	3	0	5	0.10	0.04	0.08	1.3	0.23	1
			MAX	6	0	20	1.46	0.32	0.96	18.0	5.45	90
			MIN	0	0	6	1.18	0.22	0.73	14.5	4.82	87
121	83.00	6	AV6	0	0	8	0.92	0.16	0.53	9.7	4.38	96
			STD	0	0	11	0.12	0.04	0.09	1.6	0.22	6
			MAX	0	0	26	1.16	0.24	0.71	12.7	4.83	100
			MIN	0	0	0	0.80	0.12	0.44	7.8	4.19	88
129	84.00	8	AV8	12	9	21	0.88	0.18	0.48	9.6	5.92	97
			STD	18	16	20	0.16	0.04	0.12	2.1	4.21	5
			MAX	43	38	63	1.15	0.25	0.68	13.6	17.03	100
			MIN	0	0	0	0.68	0.14	0.32	7.4	3.99	88
139	85.00	10	AV10	35	29	54	0.86	0.19	0.46	9.5	5.61	97
			STD	23	24	20	0.09	0.02	0.07	1.1	3.89	5
			MAX	68	66	69	0.98	0.22	0.55	11.2	17.28	100
			MIN	3	0	20	0.73	0.16	0.36	7.4	4.09	88
149	86.00	10	AV10	74	71	60	0.98	0.23	0.55	11.1	4.49	97
			STD	17	20	3	0.07	0.02	0.06	0.9	0.13	5
			MAX	98	98	65	1.11	0.26	0.65	12.6	4.72	100
			MIN	50	43	56	0.88	0.20	0.46	9.8	4.28	89
164	87.00	15	AV15	113	113	93	1.02	0.26	0.55	11.6	4.57	94
			STD	18	19	14	0.12	0.03	0.10	1.7	0.24	5
			MAX	140	140	109	1.30	0.35	0.77	15.2	5.16	100
			MIN	77	74	66	0.80	0.21	0.39	8.7	4.19	88
178	88.00	14	AV14	134	134	101	1.11	0.30	0.61	12.7	4.73	94
			STD	9	9	7	0.09	0.03	0.07	1.4	0.18	5
			MAX	147	147	112	1.25	0.34	0.72	14.8	4.99	100
			MIN	118	117	84	0.94	0.25	0.48	10.2	4.43	90
194	89.00	16	AV16	144	144	106	1.12	0.33	0.61	12.3	4.75	98
			STD	7	7	12	0.09	0.03	0.07	1.5	0.18	4
			MAX	155	155	134	1.33	0.38	0.77	15.4	5.18	100
			MIN	127	127	86	1.02	0.27	0.52	10.2	4.57	90
226	90.00	32	AV32	286	285	256	1.46	0.62	0.68	18.0	5.69	100
			STD	54	55	49	0.20	0.10	0.11	4.1	0.62	0
			MAX	357	357	324	1.75	0.73	0.92	28.3	7.42	100
			MIN	173	167	152	1.00	0.38	0.46	10.2	4.47	100
295	91.00	69	AV69	394	394	340	1.52	0.78	0.55	18.5	5.83	100

I-10 MOBILE RIVER - TP-23C ID 30" PSC, 110' LONG
OP: AFT Date: 25-April-2018

BL#	Depth	BLC	TYPE	RX6	RX7	RA2	CSX	CSB	TSX	EMX	STK	BTA
	ft	bl/ft		kips	kips	kips	ksi	ksi	ksi	k-ft	ft	(%)
			STD	31	31	25	0.28	0.10	0.16	5.0	0.68	0
			MAX	433	433	369	1.85	0.91	0.78	26.8	7.14	100
			MIN	286	286	247	0.68	0.47	0.16	5.4	4.05	100
345	92.00	50	AV50	410	409	378	1.85	0.92	0.73	25.1	6.75	100
			STD	12	12	13	0.11	0.04	0.07	2.7	0.40	0
			MAX	433	433	406	2.02	0.97	0.85	29.4	7.35	100
			MIN	391	390	359	1.56	0.82	0.52	18.9	5.80	100
392	93.00	47	AV47	456	456	445	2.01	1.02	0.79	29.2	7.31	100
			STD	17	17	24	0.04	0.04	0.03	1.3	0.18	0
			MAX	492	492	483	2.11	1.10	0.86	32.0	7.68	100
			MIN	426	426	400	1.91	0.94	0.72	26.2	6.88	100
460	94.00	68	AV68	546	545	525	2.07	1.17	0.71	31.0	7.58	100
			STD	25	24	19	0.04	0.04	0.05	1.3	0.20	0
			MAX	586	585	556	2.17	1.25	0.84	34.1	8.07	100
			MIN	495	495	485	1.98	1.09	0.60	28.4	7.25	100
522	95.00	62	AV62	609	608	576	2.20	1.32	0.72	35.2	8.19	100
			STD	16	16	12	0.07	0.04	0.04	2.4	0.35	0
			MAX	637	637	598	2.33	1.38	0.80	39.4	8.89	100
			MIN	569	566	546	2.02	1.22	0.63	29.6	7.35	100
612	96.00	90	AV90	596	595	601	2.13	1.36	0.60	33.4	8.02	100
			STD	8	8	8	0.05	0.02	0.05	1.6	0.22	0
			MAX	618	615	621	2.24	1.40	0.70	36.6	8.53	100
			MIN	580	580	584	2.02	1.33	0.51	30.0	7.49	100
697	97.00	85	AV85	582	579	579	2.08	1.36	0.51	33.1	8.16	100
			STD	11	13	14	0.05	0.02	0.05	1.4	0.21	0
			MAX	605	604	613	2.20	1.40	0.63	36.6	8.66	100
			MIN	559	552	550	1.96	1.32	0.40	29.9	7.64	100
787	98.00	90	AV90	581	569	550	2.05	1.34	0.43	32.9	8.28	100
			STD	10	12	14	0.04	0.02	0.03	1.1	0.19	0
			MAX	604	597	578	2.14	1.38	0.52	35.2	8.70	100
			MIN	558	544	518	1.94	1.30	0.35	30.3	7.79	100
869	99.00	82	AV82	569	548	517	2.03	1.32	0.44	32.5	8.12	100
			STD	10	9	8	0.05	0.02	0.03	1.2	0.19	0
			MAX	588	566	537	2.13	1.35	0.52	35.1	8.53	100
			MIN	545	530	501	1.90	1.27	0.35	29.1	7.64	100
939	100.00	70	AV70	545	525	494	2.09	1.29	0.52	33.3	8.15	100
			STD	6	6	6	0.05	0.02	0.04	1.3	0.19	0
			MAX	561	542	512	2.19	1.33	0.61	36.2	8.61	100
			MIN	533	512	483	1.98	1.24	0.41	30.3	7.64	100
1009	101.00	70	AV70	535	526	497	2.17	1.32	0.60	34.9	8.30	100
			STD	4	5	9	0.05	0.02	0.04	1.4	0.19	0
			MAX	549	538	518	2.28	1.36	0.70	37.7	8.66	100
			MIN	528	512	478	2.05	1.27	0.52	31.7	7.83	100

I-10 MOBILE RIVER - TP-23C ID 30" PSC, 110' LONG
OP: AFT Date: 25-April-2018

BL#	Depth ft	BLC bl/ft	TYPE	RX6 kips	RX7 kips	RA2 kips	CSX ksi	CSB ksi	TSX ksi	EMX k-ft	STK ft	BTA (%)
1076	102.00	67	AV67	542	538	505	2.24	1.35	0.70	36.3	8.41	100
			STD	5	7	10	0.05	0.02	0.04	1.4	0.18	0
			MAX	555	550	527	2.35	1.39	0.77	38.9	8.70	100
			MIN	532	522	485	2.11	1.32	0.60	33.1	8.03	100
1135	103.00	59	AV59	544	534	478	2.31	1.36	0.75	37.2	8.44	100
			STD	5	7	10	0.04	0.01	0.03	1.1	0.15	0
			MAX	553	548	497	2.40	1.39	0.81	39.6	8.79	100
			MIN	534	518	454	2.19	1.33	0.67	34.1	8.07	100
1189	104.00	54	AV54	539	517	454	2.38	1.37	0.79	38.6	8.56	100
			STD	6	6	7	0.07	0.02	0.04	1.7	0.21	0
			MAX	552	536	468	2.52	1.43	0.89	42.7	9.12	100
			MIN	524	505	436	2.25	1.34	0.70	34.9	8.11	100
1262	105.00	73	AV73	451	438	444	2.31	1.48	0.72	32.4	7.97	98
			STD	96	94	87	0.77	0.39	0.36	15.0	2.44	10
			MAX	561	539	529	3.38	2.02	1.25	56.0	17.52	100
			MIN	0	0	0	0.00	0.00	0.01	0.0	1.53	24
1332	106.00	70	AV70	438	436	404	2.51	1.48	0.92	33.4	7.45	100
			STD	12	12	12	0.12	0.06	0.07	2.6	0.32	0
			MAX	470	469	440	2.88	1.68	1.11	41.8	8.48	100
			MIN	418	417	382	2.33	1.39	0.80	29.6	7.01	100
1398	107.00	66	AV66	437	436	384	2.47	1.42	0.94	32.6	7.30	100
			STD	6	6	8	0.07	0.03	0.04	1.3	0.14	0
			MAX	456	455	402	2.62	1.48	1.06	35.9	7.68	100
			MIN	425	425	360	2.29	1.36	0.84	29.7	7.01	100
1460	108.00	62	AV62	440	439	381	2.44	1.39	0.94	32.1	7.26	100
			STD	17	16	8	0.15	0.06	0.08	2.8	0.32	0
			MAX	454	453	395	2.53	1.44	1.03	34.2	7.49	100
			MIN	327	327	339	1.35	0.96	0.39	11.7	4.91	100
			Average	451	445	421	2.01	1.14	0.68	29.8	7.43	99
			Std. Dev.	175	172	165	0.45	0.41	0.19	8.4	1.38	4
			Maximum	637	637	621	3.38	2.02	1.25	56.0	17.78	100
			Minimum	0	0	0	0.00	0.00	0.01	0.0	1.50	24

Total number of blows analyzed: 1460

BL# Sensors

1-1460 F3: [P454] 145.3 (1.00); F4: [P455] 145.8 (1.00); A3: [K5647] 334.0 (1.00);
A4: [K5943] 368.0 (1.00)

BL# Comments

1 Template (Reference) El. = 11.25', Mudline El. = -13.1'
1191 Stop to Remove Template Pile Pocket

Time Summary

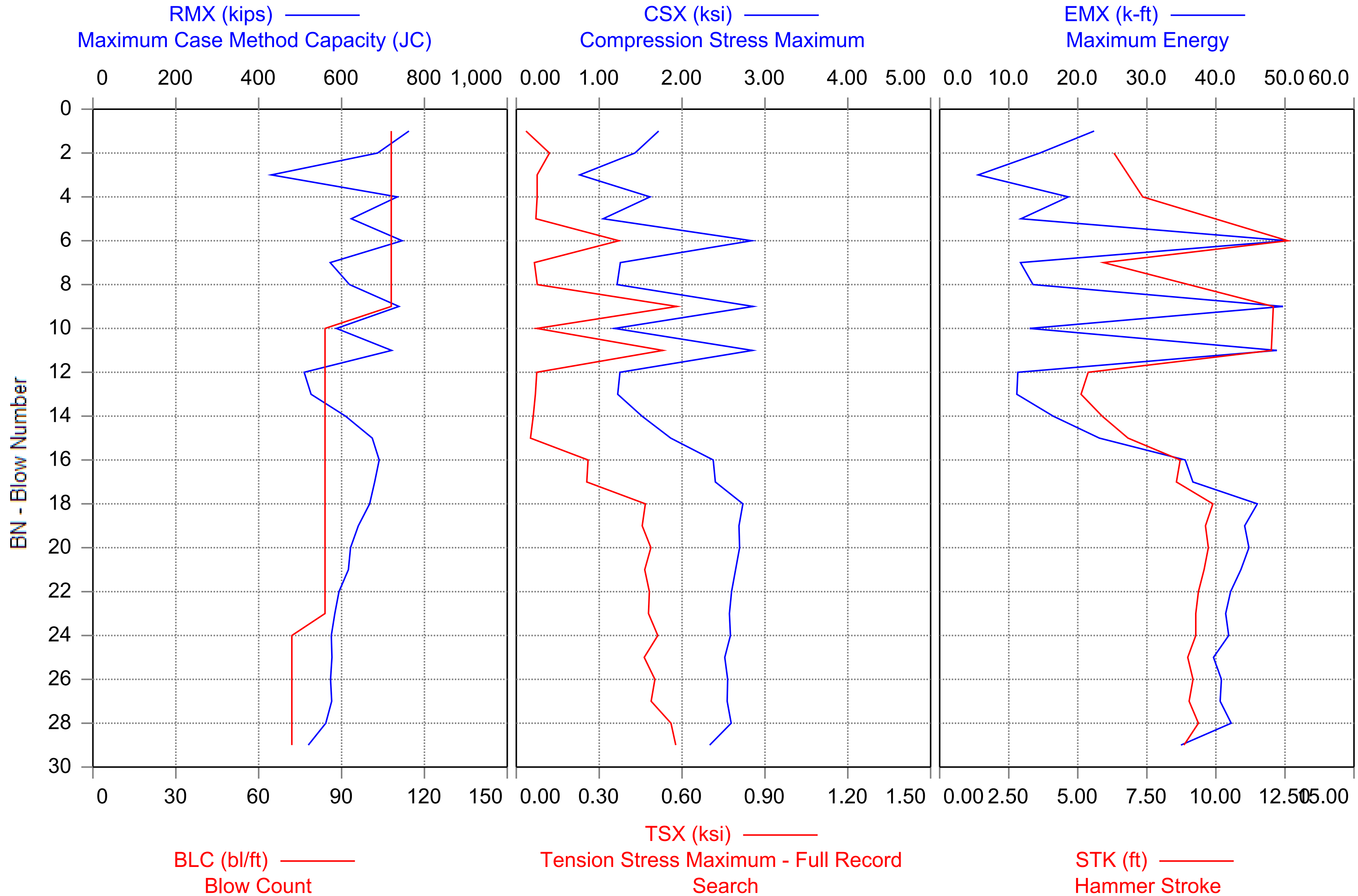
Drive 30 minutes 46 seconds 12:55 PM - 1:26 PM (4/25/2018) BN 1 - 1191
Stop 36 minutes 58 seconds 1:26 PM - 2:03 PM
Drive 9 minutes 32 seconds 2:03 PM - 2:12 PM BN 1192 - 1460

Total time [01:17:17] = (Driving [00:40:19] + Stop [00:36:58])

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

Printed: 23-May-2018 Test started: 26-April-2018

I-10 MOBILE RIVER - TP-23C 1DAY RS



I-10 MOBILE RIVER - TP-23C 1DAY RS 30" PSC, 110' LONG
OP: AFT Date: 26-April-2018

AR: 686.18 in² SP: 0.150 k/ft³
LE: 105.00 ft EM: 6,620.57 ksi
WS: 14,300.0 f/s JC: 0.58

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

BL#	BLC	RMX	RX6	RA2	CSX	CSB	TSX	EMX	STK	BTA
	bl/ft	kips	kips	kips	ksi	ksi	ksi	k-ft	ft	(%)
1	108	763	744	597	1.72	1.59	0.03	22.3	0.00	100
2	108	687	672	544	1.43	1.45	0.12	14.5	6.31	100
3	108	431	425	465	0.77	0.72	0.08	5.6	0.00	100
4	108	735	717	545	1.61	1.63	0.08	18.6	7.35	100
5	108	623	615	643	1.05	1.03	0.07	11.8	0.00	100
6	108	746	732	784	2.84	2.24	0.37	50.3	12.60	100
7	108	573	560	504	1.26	1.25	0.07	11.7	5.93	100
8	108	619	608	584	1.22	1.25	0.08	13.5	0.00	100
9	108	738	721	737	2.86	2.09	0.58	49.7	12.08	100
10	84	588	577	578	1.19	1.19	0.07	13.0	0.00	100
11	84	721	705	742	2.85	2.10	0.53	48.8	12.01	100
12	84	510	497	497	1.25	1.18	0.07	11.3	5.38	89
13	84	526	515	506	1.22	1.18	0.07	11.2	5.12	100
14	84	609	594	538	1.52	1.42	0.06	16.4	5.88	100
15	84	674	661	605	1.86	1.58	0.05	23.1	6.82	100
16	84	691	677	656	2.38	1.82	0.26	35.5	8.70	100
17	84	680	666	656	2.40	1.82	0.25	36.7	8.57	100
18	84	668	654	662	2.73	1.94	0.47	46.0	9.89	100
19	84	640	627	635	2.69	1.91	0.46	44.2	9.62	100
20	84	622	608	635	2.69	1.90	0.49	44.8	9.73	100
21	84	617	603	649	2.65	1.86	0.46	43.6	9.57	100
22	84	594	581	633	2.60	1.83	0.48	42.1	9.37	100
23	84	584	571	631	2.57	1.81	0.48	41.4	9.27	100
24	72	575	562	624	2.58	1.80	0.51	41.8	9.27	100
25	72	577	564	632	2.51	1.76	0.46	39.7	8.98	100
26	72	574	561	628	2.55	1.77	0.50	40.8	9.17	100
27	72	576	564	641	2.54	1.76	0.49	40.6	9.03	100
28	72	562	554	647	2.59	1.77	0.56	42.2	9.37	100
29	72	520	510	582	2.33	1.64	0.58	34.9	8.84	100
	Average	621	608	613	2.08	1.63	0.30	30.9	8.70	100
	Std. Dev.	78	76	72	0.66	0.35	0.21	14.6	1.98	2
	Maximum	763	744	784	2.86	2.24	0.58	50.3	12.60	100
	Minimum	431	425	465	0.77	0.72	0.03	5.6	5.12	89

Total number of blows analyzed: 29

BL# Sensors

1-29 F3: [P454] 145.3 (1.00); F4: [P455] 145.8 (1.00); A3: [K5647] 334.0 (1.00);
A4: [K5943] 368.0 (1.00)

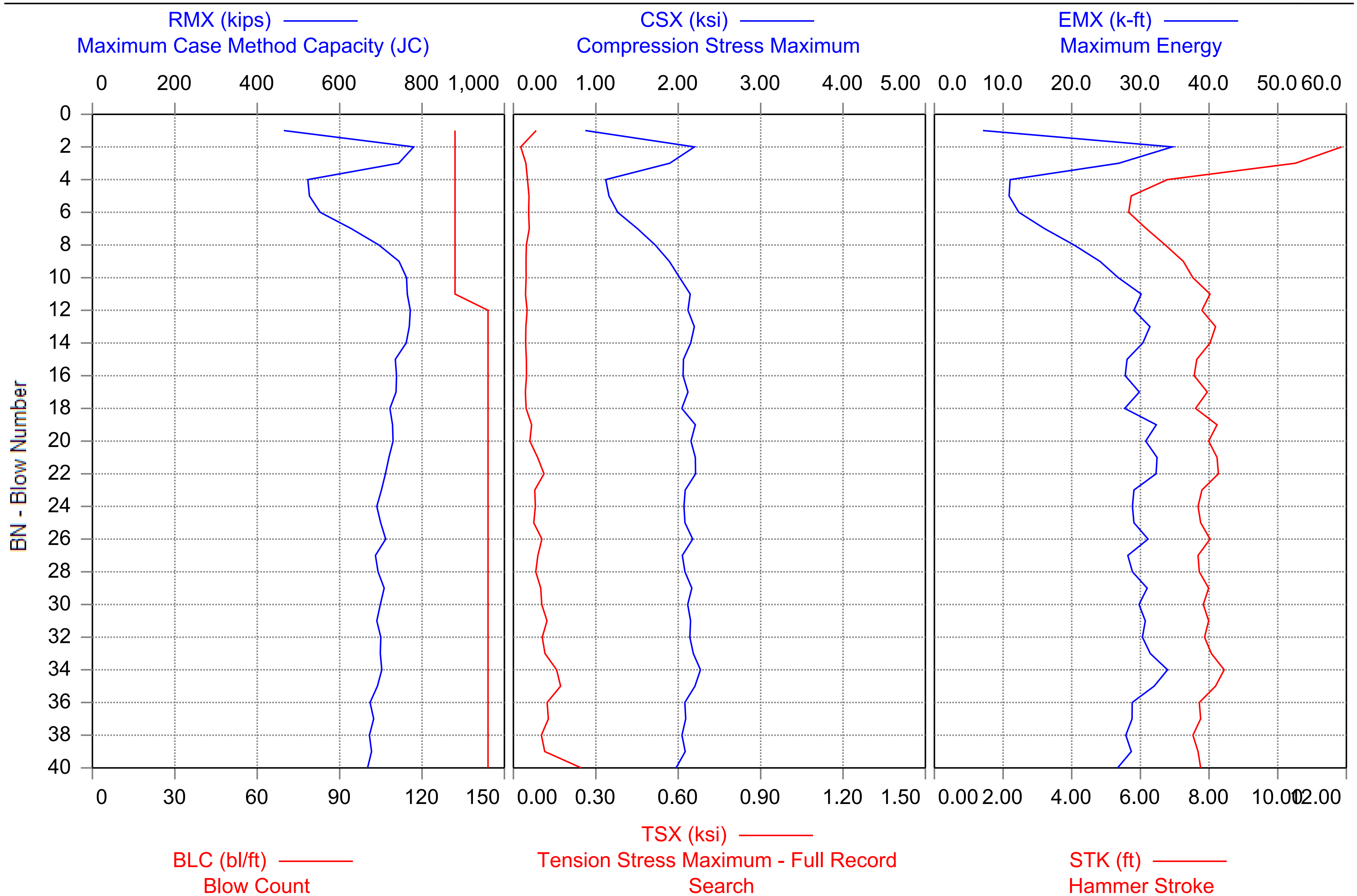
BL# Comments

29 9BL/1", 7BL/1", 7BL/1", 6BL/1"

Time Summary

Drive 3 minutes 48 seconds 11:03 AM - 11:07 AM BN 1 - 29

Applied Foundation Testing, Inc. - PDIPLOT2 Ver 2017.2.58.3 - Case Method & iCAP® Results
Printed: 23-May-2018 Test started: 11-May-2018
I-10 MOBILE RIVER - TP-23C 16DAY RS



I-10 MOBILE RIVER - TP-23C 16DAY RS 30" PSC, 110' LONG
OP: AFT Date: 11-May-2018

AR: 686.18 in² SP: 0.150 k/ft³
LE: 105.00 ft EM: 6,620.57 ksi
WS: 14,300.0 f/s JC: 0.57

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

BL#	BLC	RMX	RX6	RA2	CSX	CSB	TSX	EMX	STK	BTA
	bl/ft	kips	kips	kips	ksi	ksi	ksi	k-ft	ft	(%)
1	132	465	455	601	0.87	0.54	0.08	7.1	0.00	100
2	132	780	739	770	2.20	1.85	0.03	34.6	11.86	87
3	132	743	710	682	1.90	1.66	0.05	26.9	10.51	100
4	132	523	506	550	1.12	1.01	0.05	11.0	6.79	83
5	132	527	509	539	1.16	1.06	0.06	10.9	5.73	87
6	132	553	532	538	1.27	1.16	0.06	12.3	5.66	86
7	132	628	604	583	1.51	1.36	0.06	16.0	6.17	86
8	132	695	667	621	1.72	1.49	0.05	20.3	6.72	100
9	132	744	711	638	1.89	1.67	0.05	24.1	7.25	100
10	132	763	727	656	2.02	1.76	0.05	26.8	7.53	100
11	132	764	730	659	2.15	1.87	0.04	30.1	8.03	100
12	144	772	738	698	2.12	1.85	0.05	29.1	7.79	100
13	144	769	735	701	2.20	1.93	0.05	31.4	8.19	100
14	144	762	728	704	2.15	1.88	0.04	30.3	8.03	100
15	144	735	703	676	2.06	1.77	0.05	28.1	7.64	100
16	144	738	707	695	2.06	1.80	0.05	27.8	7.57	100
17	144	737	704	696	2.12	1.83	0.04	29.8	7.95	100
18	144	722	691	679	2.04	1.78	0.05	27.7	7.60	100
19	144	728	694	689	2.21	1.87	0.07	32.3	8.23	100
20	144	730	696	703	2.15	1.83	0.06	30.8	7.99	100
21	144	720	687	680	2.21	1.85	0.09	32.4	8.23	100
22	144	711	677	670	2.21	1.84	0.11	32.3	8.27	100
23	144	702	670	676	2.09	1.77	0.08	29.1	7.79	100
24	144	690	658	657	2.07	1.77	0.08	28.8	7.68	100
25	144	699	668	680	2.08	1.77	0.07	29.1	7.75	100
26	144	712	680	683	2.17	1.81	0.10	31.1	8.03	100
27	144	687	656	665	2.05	1.74	0.09	28.2	7.68	100
28	144	693	662	679	2.08	1.76	0.08	28.8	7.72	100
29	144	708	676	695	2.17	1.80	0.10	31.0	7.99	100
30	144	699	667	676	2.12	1.77	0.10	29.8	7.83	100
31	144	690	658	670	2.15	1.78	0.12	30.7	7.99	100
32	144	700	668	686	2.14	1.78	0.10	30.3	7.87	100
33	144	699	667	687	2.18	1.80	0.11	31.4	8.07	100
34	144	702	670	708	2.27	1.83	0.16	33.9	8.44	100
35	144	692	659	695	2.20	1.78	0.17	32.0	8.19	100
36	144	674	643	655	2.08	1.73	0.12	28.8	7.72	100
37	144	683	652	674	2.09	1.72	0.13	28.8	7.75	100
38	144	672	642	668	2.04	1.72	0.10	27.9	7.53	100
39	144	677	647	664	2.08	1.73	0.11	28.7	7.68	100
40	144	668	636	646	1.97	1.60	0.25	26.7	7.75	100
	Average	694	663	665	1.98	1.68	0.08	27.2	7.82	98
	Std. Dev.	68	63	46	0.33	0.28	0.04	6.5	1.01	5
	Maximum	780	739	770	2.27	1.93	0.25	34.6	11.86	100
	Minimum	465	455	538	0.87	0.54	0.03	7.1	5.66	83

Total number of blows analyzed: 40

I-10 MOBILE RIVER - TP-23C 16DAY RS
OP: AFT

30" PSC, 110' LONG
Date: 11-May-2018

BL#	BLC	RMX	RX6	RA2	CSX	CSB	TSX	EMX	STK	BTA
	bl/ft	kips	kips	kips	ksi	ksi	ksi	k-ft	ft	(%)

BL# Sensors

1-40 F3: [P454] 145.3 (1.00); F4: [P455] 145.8 (1.00); A3: [K5647] 334.0 (1.00);
A4: [K5943] 368.0 (1.00)

BL# Comments

40 11BL/1", 12BL/1", 12BL/1"

Time Summary

Drive 55 seconds 8:49 AM - 8:49 AM BN 1 - 40

Appendix C

CAPWAP Signal Matching Analysis Output

TP-23C

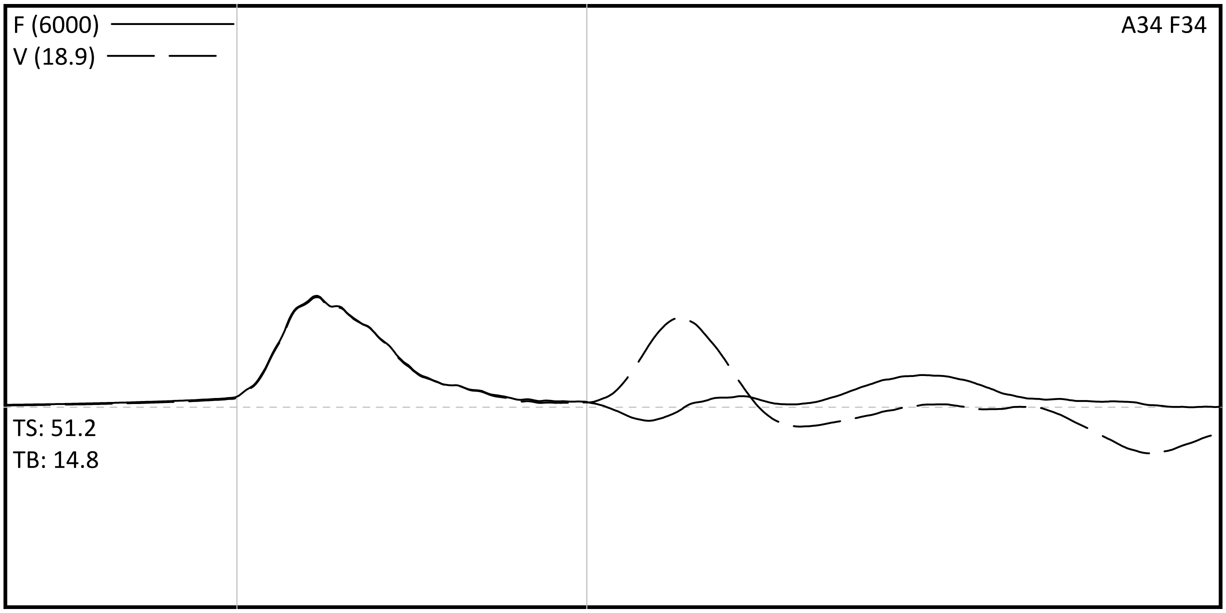
I-10 over Mobile River Bridge Load Test Program

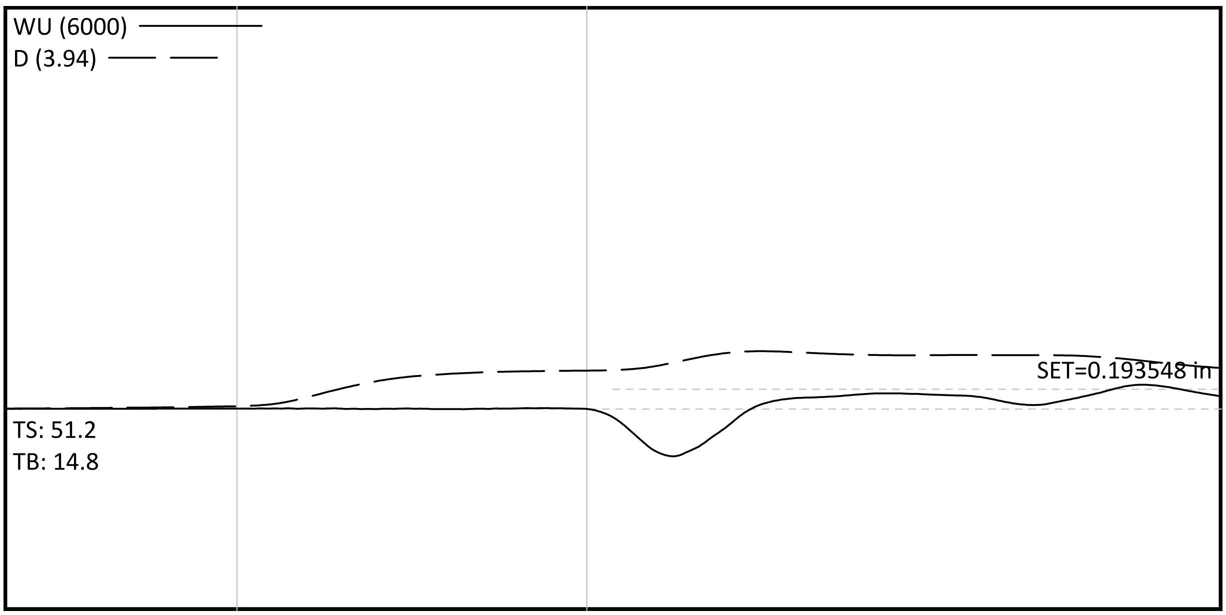
ALDOT Project No.: IM-I010(341)

Mobile County, Alabama

AFT Project No.: 118008

I-10 MOBILE RIVER TP-23C





Project Information

PROJECT: I-10 MOBILE RIVER
PILE NAME: TP-23C
DESCR: 30'' PSC, 110' LONG
OPERATOR: AFT
FILE: TP-23C ana
4/25/2018 2:12:38 PM
Blow Number 1457

Pile Properties

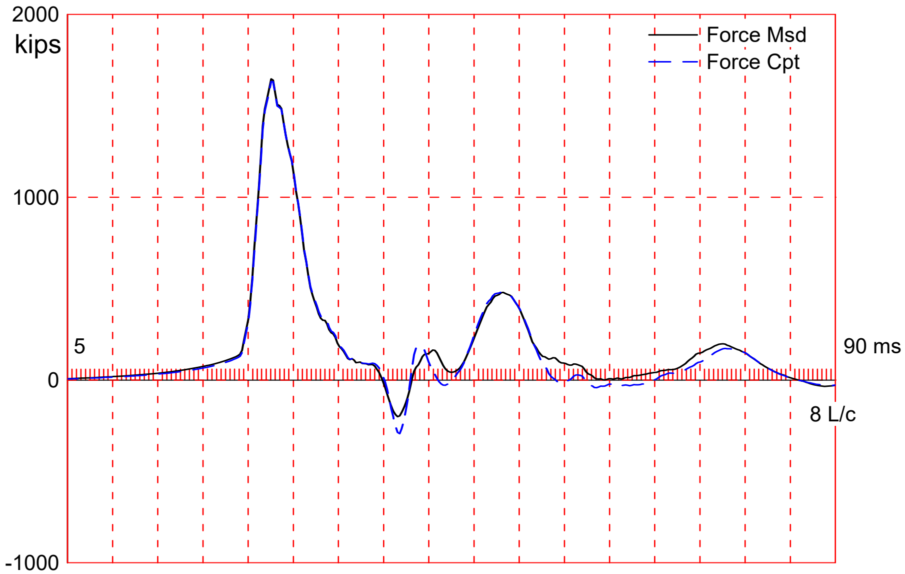
LE	105.00	ft
AR	686.18	in^2
EM	6620.57	ksi
SP	0.150	k/ft3
WS	14300.0	f/s
EA/C	317.7	ksec/ft
2L/C	14.70	ms
JC	0.60	[]
LP	107.95	ft

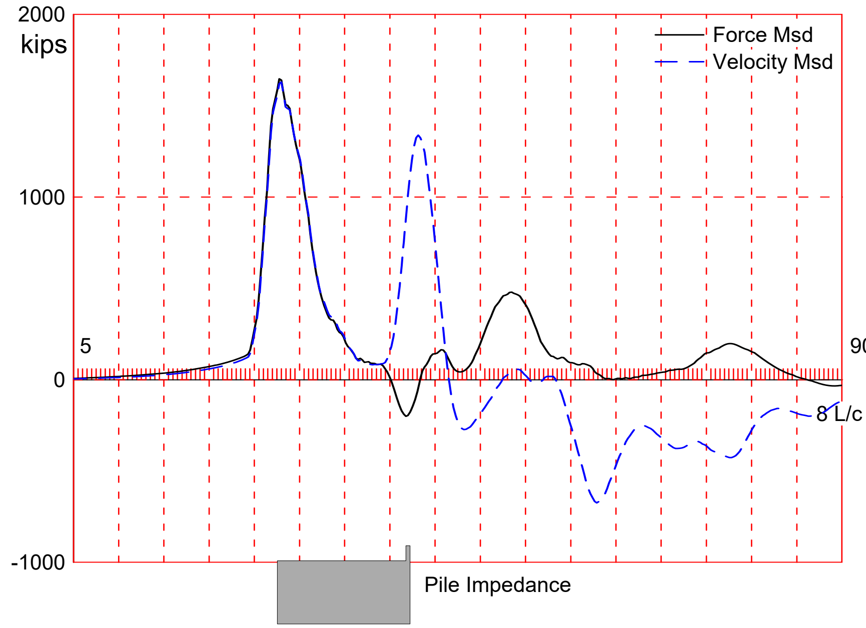
Quantity Results

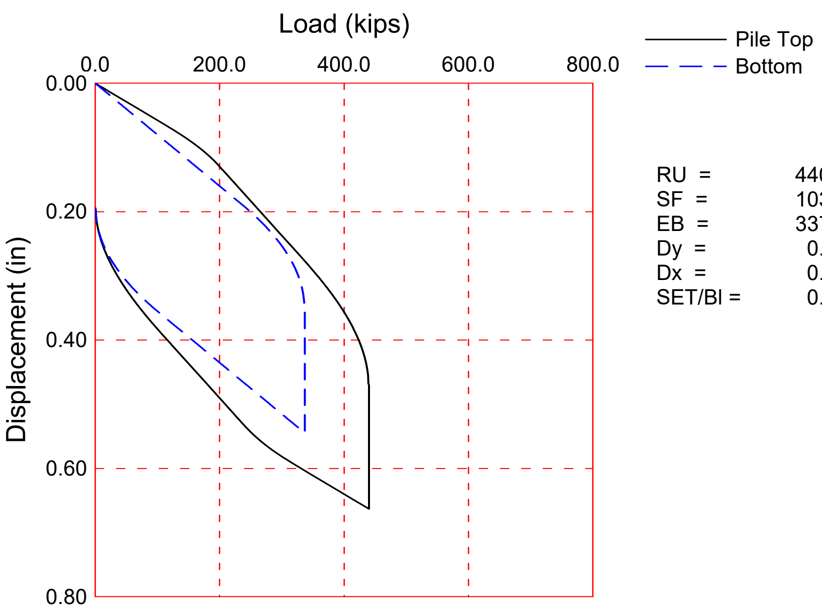
RX6	446	kips
RX7	445	kips
RA2	387	kips
CSX	2.42	ksi
CSB	1.37	ksi
TSX	0.92	ksi
EMX	32.0	k-ft
STK	7.25	ft
BTA	100	(%)

Sensors

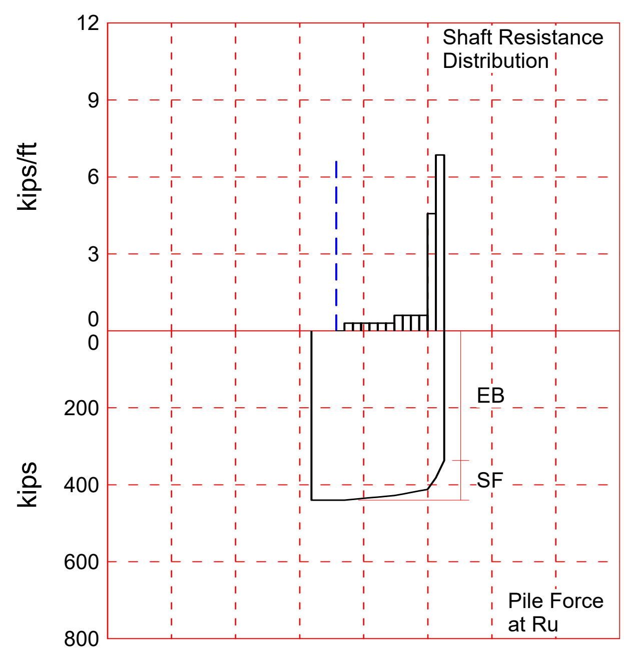
F3: [P454] 145.3 (1)
F4: [P455] 145.8 (1)
A3: [K5647] 334 mv/5000g's (1)
A4: [K5943] 368 mv/5000g's (1)
CLIP: OK







RU =	440.0 kips	
SF =	103.0 kips	
EB =	337.0 kips	
Dy =	0.47 in	
Dx =	0.66 in	
SET/Bl =	0.19 in	



Length b. Sensors	105.0 ft
Embedment	83.5 ft
Top Area	4.77 ft^2
End Bearing Area	6.25 ft^2
Top Perimeter	10.00 ft
Top E-Modulus	6621 ksi
Top Spec. Weight	150.0 lb/ft^3
Top Wave Spd.	14300 ft/s
Overall W.S.	14300 ft/s
Match Quality	3.60
Top Compr. Stress	2.4 ksi
Max Compr. Stress	2.4 ksi
Max Tension Stress	-0.98 ksi
Avg. Shaft Quake	0.06 in
Toe Quake	0.27 in
Avg. Shaft Smith Dpg.	0.20 s/ft
Toe Smith Damping	0.26 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: 440.0; along Shaft 103.0; at Toe 337.0 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	Smith Damping Factor s/ft
				440.0				
1	26.3	4.8	0.0	440.0	0.0	0.00	0.00	0.00
2	32.8	11.3	2.0	438.0	2.0	0.30	0.03	0.20
3	39.4	17.9	2.0	436.0	4.0	0.30	0.03	0.20
4	45.9	24.4	2.0	434.0	6.0	0.30	0.03	0.20
5	52.5	31.0	2.0	432.0	8.0	0.30	0.03	0.20
6	59.1	37.6	2.0	430.0	10.0	0.30	0.03	0.20
7	65.6	44.1	2.0	428.0	12.0	0.30	0.03	0.20
8	72.2	50.7	4.0	424.0	16.0	0.61	0.06	0.20
9	78.8	57.3	4.0	420.0	20.0	0.61	0.06	0.20
10	85.3	63.8	4.0	416.0	24.0	0.61	0.06	0.20
11	91.9	70.4	4.0	412.0	28.0	0.61	0.06	0.20
12	98.4	76.9	30.0	382.0	58.0	4.57	0.46	0.20
13	105.0	83.5	45.0	337.0	103.0	6.86	0.69	0.20
Avg. Shaft			7.9			1.23	0.12	0.20
Toe			337.0				53.92	0.26

Soil Model Parameters/Extensions		Shaft	Toe
Quake	(in)	0.06	0.27
Case Damping Factor		0.06	0.28
Damping Type		Viscous	Sm+Visc
Unloading Quake	(% of loading quake)	30	93
Reloading Level	(% of Ru)	100	100
Unloading Level	(% of Ru)	24	
Soil Plug Weight	(kips)		1.000

CAPWAP match quality = 3.60 (Wave Up Match) ; RSA = 0
Observed: Final Set = 0.19 in; Blow Count = 62 b/ft
Computed: Final Set = 0.19 in; Blow Count = 62 b/ft

max. Top Comp. Stress = 2.4 ksi (T= 28.2 ms, max= 1.002 x Top)
max. Comp. Stress = 2.4 ksi (Z= 32.8 ft, T= 30.3 ms)
max. Tens. Stress = -0.98 ksi (Z= 19.7 ft, T= 41.1 ms)
max. Energy (EMX) = 32.1 kip-ft; max. Measured Top Displ. (DMX)= 0.58 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	1633.3	-415.0	2.4	-0.60	32.1	5.2	0.58
2	6.6	1633.5	-517.5	2.4	-0.75	32.1	5.2	0.58
4	13.1	1633.8	-641.9	2.4	-0.94	32.1	5.1	0.58
6	19.7	1634.6	-672.0	2.4	-0.98	32.1	5.1	0.58
8	26.3	1635.5	-667.0	2.4	-0.97	32.0	5.1	0.57
10	32.8	1636.4	-663.7	2.4	-0.97	32.0	5.1	0.56
12	39.4	1633.0	-654.8	2.4	-0.95	31.8	5.1	0.55
14	45.9	1629.4	-627.2	2.4	-0.91	31.5	5.1	0.54
16	52.5	1625.7	-561.2	2.4	-0.82	31.1	5.1	0.54
18	59.1	1622.2	-484.1	2.4	-0.71	30.6	5.1	0.53
20	65.6	1618.7	-417.6	2.4	-0.61	29.9	5.1	0.52
22	72.2	1614.0	-310.5	2.4	-0.45	29.6	5.1	0.52
23	75.5	1605.4	-241.3	2.3	-0.35	29.3	5.1	0.51
24	78.8	1608.1	-126.3	2.3	-0.18	29.3	5.3	0.51
25	82.0	1593.1	-115.8	2.3	-0.17	29.0	5.8	0.51
26	85.3	1549.6	-102.9	2.3	-0.15	29.0	6.1	0.51
27	88.6	1480.5	-85.8	2.2	-0.13	28.7	6.5	0.51
28	91.9	1369.5	-78.9	2.0	-0.12	28.6	6.8	0.51
29	95.2	1225.8	-73.6	1.8	-0.11	28.3	7.1	0.51
30	98.4	1052.5	-68.8	1.5	-0.10	28.3	7.3	0.51
31	101.7	793.0	-56.6	1.2	-0.08	26.0	7.5	0.51
32	105.0	912.8	-56.8	1.1	-0.07	22.7	7.4	0.51
Absolute	32.8			2.4			(T =	30.3 ms)
	19.7				-0.98		(T =	41.1 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	962.7	727.4	492.1	256.8	21.4	0.0	0.0	0.0	0.0	0.0
RX	962.7	727.4	609.2	549.5	495.4	452.4	440.0	439.2	438.4	437.7
RU	962.7	727.4	492.1	256.8	21.4	0.0	0.0	0.0	0.0	0.0

RAU = 379.0 (kips); RA2 = 376.3 (kips)

Current CAPWAP Ru = 440.0 (kips); Corresponding J(RP)= 0.22; J(RX) = 0.60

VMX	TVP	VT1*Z	FT1	FMX	DMX	DFN	SET	EMX	QUS	KEB
ft/s	ms	kips	kips	kips	in	in	in	kip-ft	kips	kips/in
5.2	27.76	1647.3	1668.6	1668.6	0.58	0.19	0.19	32.2	1003.9	1248

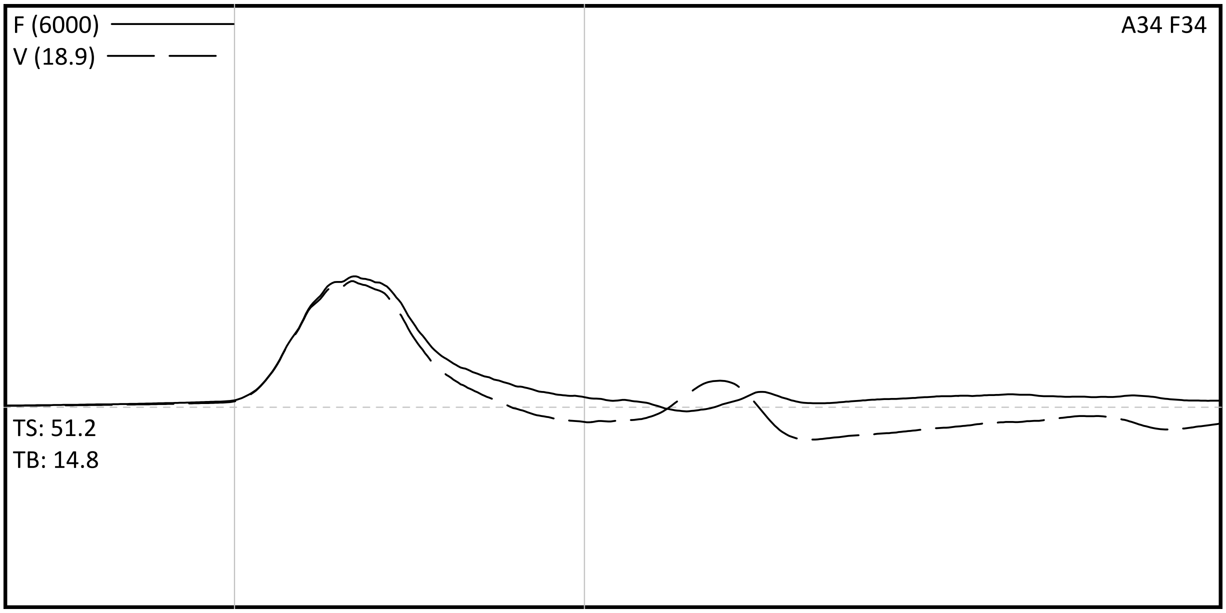
PILE PROFILE AND PILE MODEL

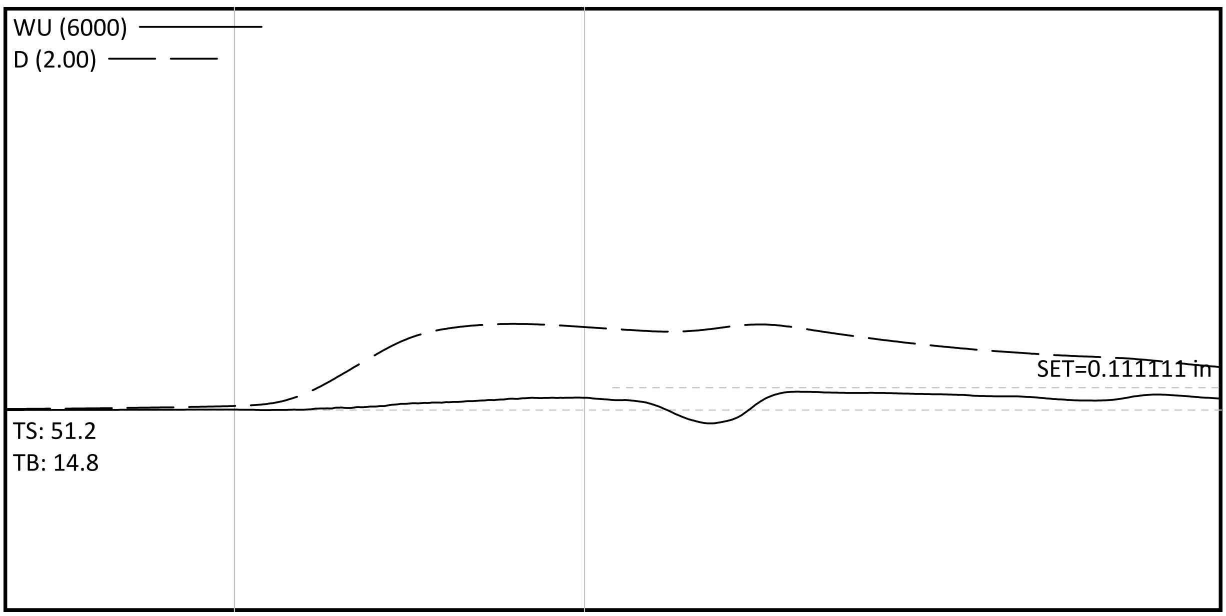
Depth	Area	E-Modulus	Spec. Weight	Perim.
ft	ft²	ksi	lb/ft³	ft
0.0	4.77	6620.6	150.000	10.00
102.5	4.77	6620.6	150.000	10.00
102.5	6.25	6620.6	150.000	10.00
105.0	6.25	6620.6	150.000	10.00

Toe Area 6.25 ft²

Segmnt Number	Dist. B.G.	Impedance	Imped. Change	Tension Slack	Tension Eff.	Compression Slack	Compression Eff.	Perim.	Wave Speed
	ft	kips/ft/s	%	in		in		ft	ft/s
1	3.3	317.69	0.00	0.00	0.000	-0.00	0.000	10.00	14300.0
32	105.0	392.96	0.00	0.00	0.000	-0.00	0.000	10.00	14300.0

Wave Speed: Pile Top 14300.0, Elastic 14300.0, Overall 14300.0 ft/s
Pile Damping 2.00 %, Time Incr 0.229 ms, 2L/c 14.7 ms
Total volume: 504.044 ft³; Volume ratio considering added impedance: 1.000





Project Information

PROJECT: I-10 MOBILE RIVER
PILE NAME: TP-23C 1DAY RS
DESCR: 30'' PSC, 110' LONG
OPERATOR: AFT
FILE: TP-23C 1DAY RS ana
4/26/2018 11:06:03 AM
Blow Number 6

Pile Properties

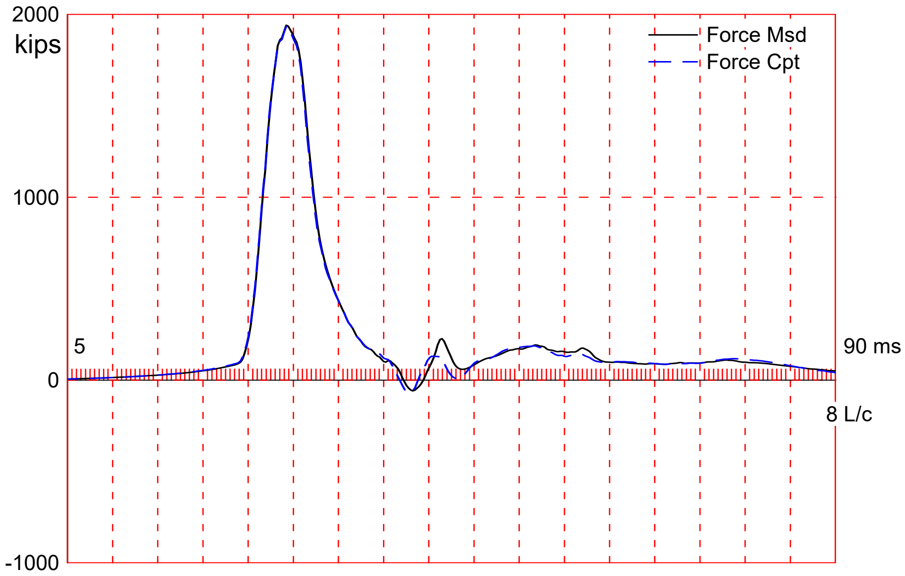
LE	105.00	ft
AR	686.18	in^2
EM	6620.57	ksi
SP	0.150	k/ft3
WS	14300.0	f/s
EA/C	317.7	ksec/ft
2L/C	14.70	ms
JC	0.58	[]
LP	108.06	ft

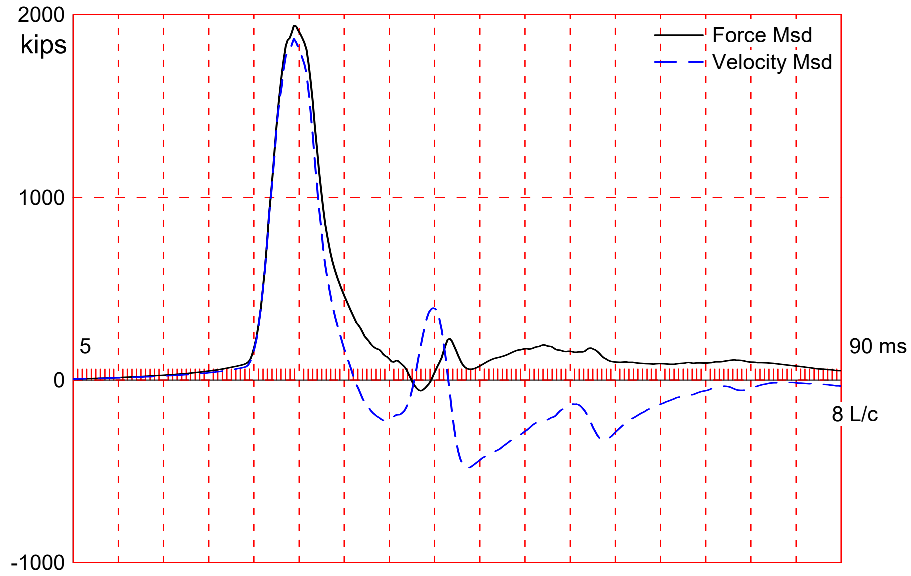
Quantity Results

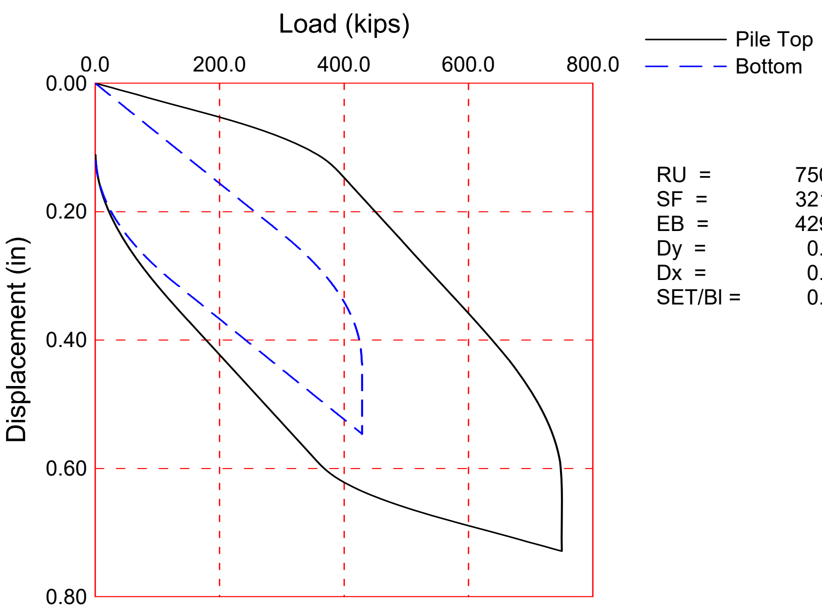
RMX	746	kips
RX6	732	kips
RA2	784	kips
CSX	2.84	ksi
CSB	2.24	ksi
TSX	0.37	ksi
EMX	50.3	k-ft
STK	12.60	ft
BTA	100	(%)

Sensors

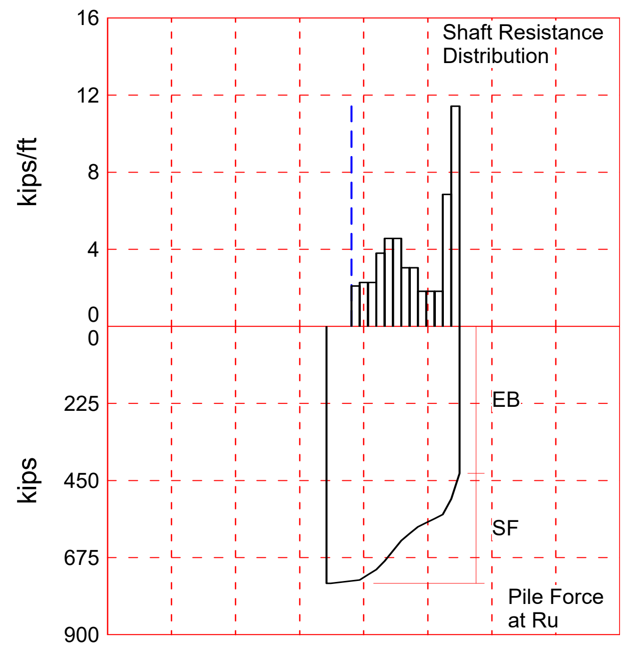
F3: [P454] 145.3 (1)
F4: [P455] 145.8 (1)
A3: [K5647] 334 mv/5000g's (1)
A4: [K5943] 368 mv/5000g's (1)
CLIP: OK







RU	=	750.0 kips
SF	=	321.0 kips
EB	=	429.0 kips
Dy	=	0.62 in
Dx	=	0.73 in
SET/Bl	=	0.11 in



Length b. Sensors	105.0 ft
Embedment	83.5 ft
Top Area	4.77 ft^2
End Bearing Area	6.25 ft^2
Top Perimeter	10.00 ft
Top E-Modulus	6621 ksi
Top Spec. Weight	150.0 lb/ft^3
Top Wave Spd.	14300 ft/s
Overall W.S.	14270 ft/s
Match Quality	1.68
Top Compr. Stress	2.8 ksi
Max Compr. Stress	2.9 ksi
Max Tension Stress	-0.29 ksi
Avg. Shaft Quake	0.04 in
Toe Quake	0.34 in
Avg. Shaft Smith Dpg.	0.25 s/ft
Toe Smith Damping	0.33 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: 750.0; along Shaft 321.0; at Toe 429.0 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
				750.0			
1	26.3	4.8	10.0	740.0	10.0	2.11	0.21
2	32.8	11.3	15.0	725.0	25.0	2.29	0.23
3	39.4	17.9	15.0	710.0	40.0	2.29	0.23
4	45.9	24.4	25.0	685.0	65.0	3.81	0.38
5	52.5	31.0	30.0	655.0	95.0	4.57	0.46
6	59.1	37.6	30.0	625.0	125.0	4.57	0.46
7	65.6	44.1	20.0	605.0	145.0	3.05	0.30
8	72.2	50.7	20.0	585.0	165.0	3.05	0.30
9	78.8	57.3	12.0	573.0	177.0	1.83	0.18
10	85.3	63.8	12.0	561.0	189.0	1.83	0.18
11	91.9	70.4	12.0	549.0	201.0	1.83	0.18
12	98.4	76.9	45.0	504.0	246.0	6.86	0.69
13	105.0	83.5	75.0	429.0	321.0	11.43	1.14
Avg. Shaft			24.7			3.84	0.38
Toe			429.0				68.64

Soil Model Parameters/Extensions		Shaft	Toe
Smith Damping Factor		0.25	0.33
Quake	(in)	0.04	0.34
Case Damping Factor		0.25	0.45
Damping Type		Viscous	Viscous
Unloading Quake	(% of loading quake)	35	89
Reloading Level	(% of Ru)	100	100
Unloading Level	(% of Ru)	0	
Resistance Gap (included in Toe Quake) (in)			0.01
Soil Plug Weight	(kips)		1.500

CAPWAP match quality = 1.68 (Wave Up Match) ; RSA = 0
Observed: Final Set = 0.11 in; Blow Count = 108 b/ft
Computed: Final Set = 0.11 in; Blow Count = 108 b/ft

max. Top Comp. Stress = 2.8 ksi (T= 29.7 ms, max= 1.029 x Top)
max. Comp. Stress = 2.9 ksi (Z= 32.8 ft, T= 32.0 ms)
max. Tens. Stress = -0.29 ksi (Z= 36.1 ft, T= 42.1 ms)
max. Energy (EMX) = 50.2 kip-ft; max. Measured Top Displ. (DMX)= 0.43 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	1938.3	-114.0	2.8	-0.17	50.2	5.9	0.43
2	6.6	1943.2	-151.2	2.8	-0.22	50.2	5.9	0.42
4	13.1	1955.4	-183.7	2.8	-0.27	50.1	5.8	0.42
6	19.7	1971.4	-186.5	2.9	-0.27	49.9	5.8	0.41
8	26.3	1992.6	-194.0	2.9	-0.28	49.8	5.7	0.41
10	32.8	1995.4	-188.9	2.9	-0.28	49.1	5.6	0.41
12	39.4	1986.6	-187.2	2.9	-0.27	48.1	5.5	0.41
14	45.9	1974.7	-170.1	2.9	-0.25	47.1	5.4	0.41
16	52.5	1936.0	-144.3	2.8	-0.21	45.5	5.4	0.41
18	59.1	1882.0	-113.1	2.7	-0.16	43.6	5.3	0.42
20	65.6	1826.7	-64.2	2.7	-0.09	41.6	5.3	0.42
22	72.2	1793.8	-37.3	2.6	-0.05	40.2	5.2	0.42
23	75.5	1743.8	-41.9	2.5	-0.06	38.9	5.2	0.42
24	78.8	1734.5	-48.0	2.5	-0.07	38.9	5.3	0.42
25	82.0	1687.6	-45.9	2.5	-0.07	38.1	5.4	0.41
26	85.3	1653.3	-41.5	2.4	-0.06	38.1	5.5	0.41
27	88.6	1576.8	-29.0	2.3	-0.04	37.2	5.7	0.41
28	91.9	1529.5	-19.1	2.2	-0.03	37.2	5.9	0.41
29	95.2	1450.5	-5.2	2.1	-0.01	36.3	6.0	0.40
30	98.4	1394.5	-0.3	2.0	-0.00	36.2	6.1	0.40
31	101.7	1267.4	0.0	1.8	0.00	33.1	6.1	0.40
32	105.0	1278.6	-0.1	1.9	-0.00	28.4	6.1	0.39
Absolute	32.8			2.9			(T =	32.0 ms)
	36.1				-0.29		(T =	42.1 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	1702.6	1498.9	1295.2	1091.5	887.9	684.2	480.5	276.8	73.1	0.0
RX	1726.4	1517.2	1308.1	1098.9	913.4	809.0	731.6	668.0	620.9	581.2
RU	1853.0	1664.4	1475.7	1287.1	1098.5	909.8	721.2	532.5	343.9	155.3

RAU = 507.9 (kips); RA2 = 783.6 (kips)

Current CAPWAP Ru = 750.0 (kips); Corresponding J(RP)= 0.47; J(RX) = 0.58

VMX	TVP	VT1*Z	FT1	FMX	DMX	DFN	SET	EMX	QUS	KEB
ft/s	ms	kips	kips	kips	in	in	in	kip-ft	kips	kips/in
5.9	29.43	1838.3	1901.1	1948.9	0.43	0.10	0.11	50.3	2239.5	1341

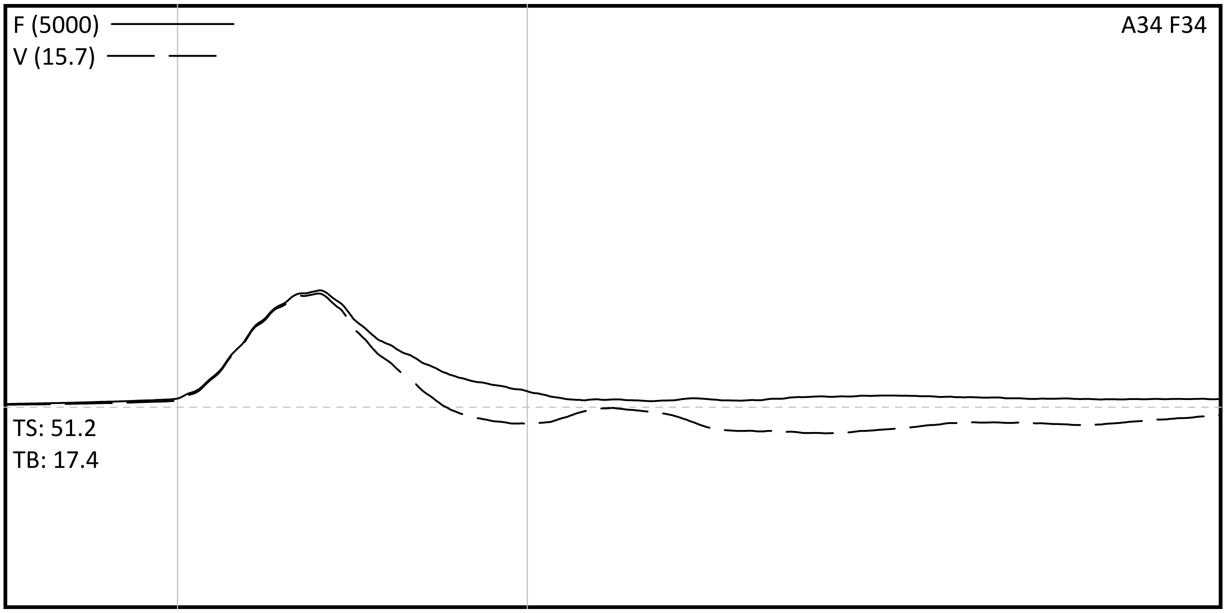
PILE PROFILE AND PILE MODEL

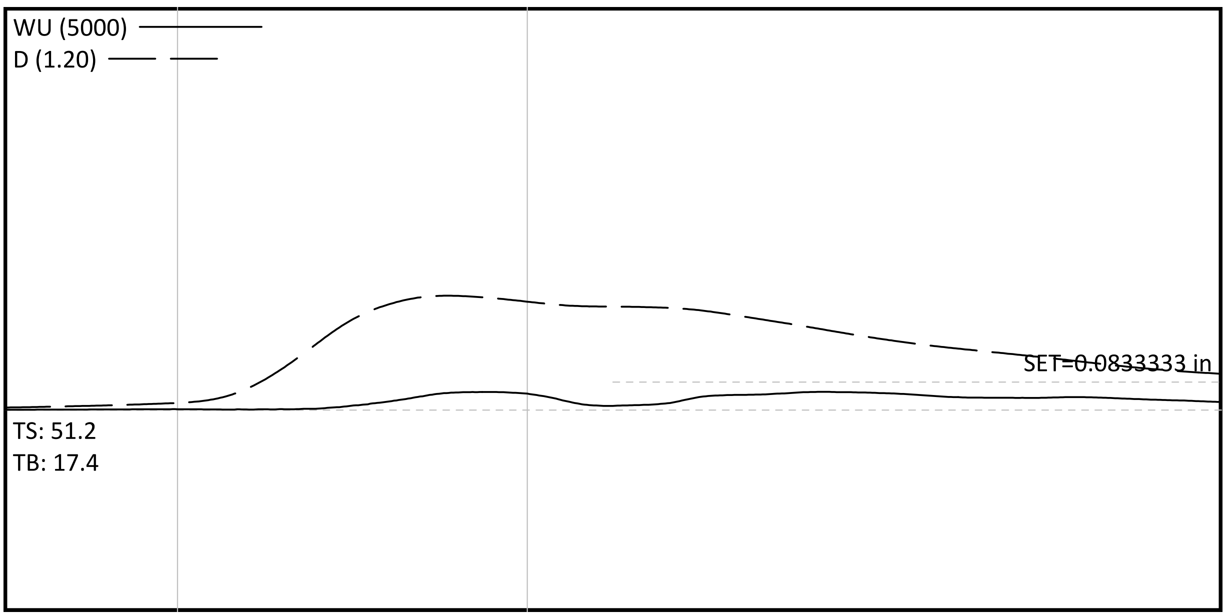
Depth	Area	E-Modulus	Spec. Weight	Perim.
ft	ft^2	ksi	lb/ft^3	ft
0.0	4.77	6620.6	150.000	10.00
105.0	4.77	6620.6	150.000	10.00

Toe Area 6.25 ft^2

Top Segment Length 3.28 ft, Top Impedance 318 kips/ft/s

Wave Speed: Pile Top 14300.0, Elastic 14300.0, Overall 14269.7 ft/s
Pile Damping 2.00 %, Time Incr 0.230 ms, 2L/c 14.7 ms
Total volume: 500.336 ft^3; Volume ratio considering added impedance: 1.000





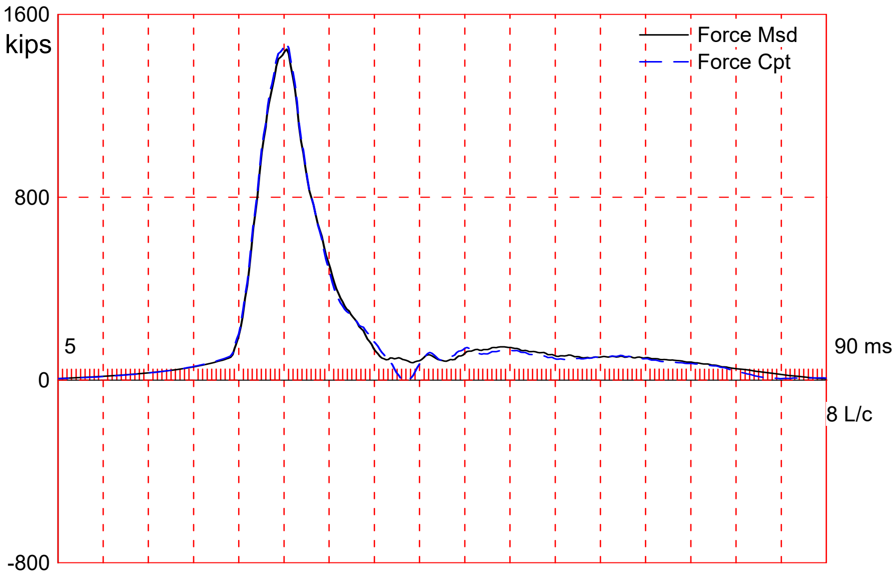
Project Information
PROJECT: I-10 MOBILE RIVER
PILE NAME: TP-23C 16DAY RS
DESCR: 30" PSC, 110' LONG
OPERATOR: AFT
FILE: TP-23C 16 DAY RS ana
5/11/2018 8:49:17 AM
Blow Number 12

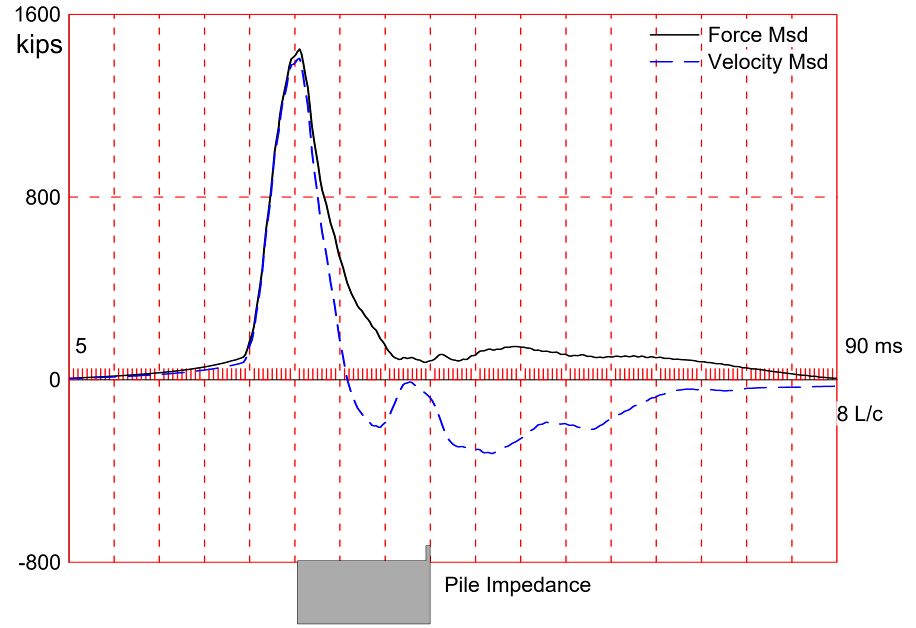
Pile Properties

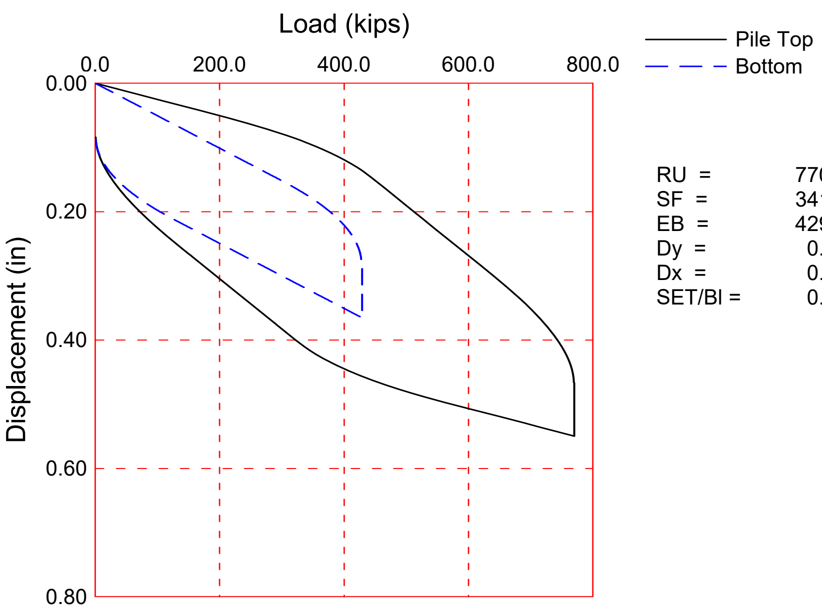
LE	105.00	ft
AR	686.18	in^2
EM	6620.57	ksi
SP	0.150	k/ft3
WS	14300.0	f/s
EA/C	317.7	ksec/ft
2L/C	14.70	ms
JC	0.57	[]
LP	108.42	ft

Quantity Results
RMX 762 kips
RX6 728 kips
RA2 668 kips
CSX 2.12 ksi
CSB 1.84 ksi
TSX 0.05 ksi
EMX 29.1 k-ft
STK 7.79 ft
BTA 100 (%)

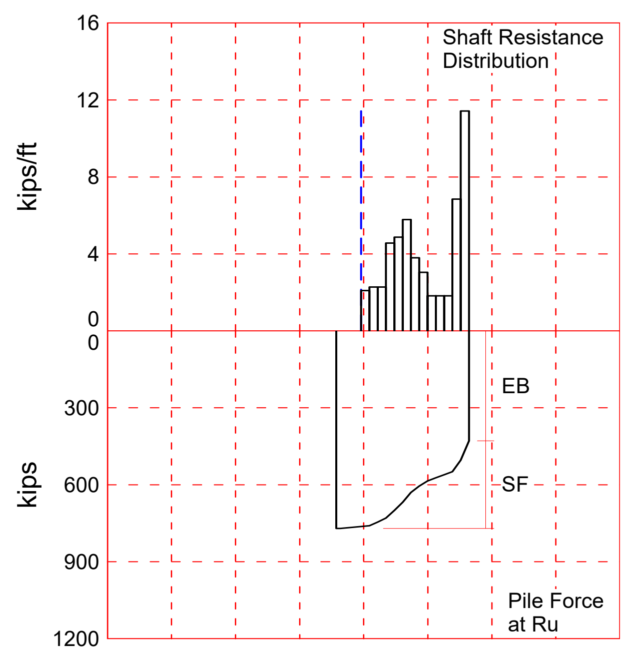
Sensors
F3: [P454] 145.3 (1)
F4: [P455] 145.8 (1)
A3: [K5647] 334 mv/5000g's (1)
A4: [K5943] 368 mv/5000g's (1)
CLIP: OK







RU =	770.0 kips
SF =	341.0 kips
EB =	429.0 kips
Dy =	0.47 in
Dx =	0.55 in
SET/Bl =	0.08 in



Length b. Sensors	105.0 ft
Embedment	83.5 ft
Top Area	4.77 ft^2
End Bearing Area	6.25 ft^2
Top Perimeter	10.00 ft
Top E-Modulus	6621 ksi
Top Spec. Weight	150.0 lb/ft^3
Top Wave Spd.	14300 ft/s
Overall W.S.	14286 ft/s
Match Quality	2.27
Top Compr. Stress	2.2 ksi
Max Compr. Stress	2.3 ksi
Max Tension Stress	-0.08 ksi
Avg. Shaft Quake	0.04 in
Toe Quake	0.22 in
Avg. Shaft Smith Dpg.	0.40 s/ft
Toe Smith Damping	0.41 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: 770.0; along Shaft 341.0; at Toe 429.0 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
				770.0			
1	26.3	4.8	10.0	760.0	10.0	2.11	0.21
2	32.8	11.3	15.0	745.0	25.0	2.29	0.23
3	39.4	17.9	15.0	730.0	40.0	2.29	0.23
4	45.9	24.4	30.0	700.0	70.0	4.57	0.46
5	52.5	31.0	32.0	668.0	102.0	4.88	0.49
6	59.1	37.6	38.0	630.0	140.0	5.79	0.58
7	65.6	44.1	25.0	605.0	165.0	3.81	0.38
8	72.2	50.7	20.0	585.0	185.0	3.05	0.30
9	78.8	57.3	12.0	573.0	197.0	1.83	0.18
10	85.3	63.8	12.0	561.0	209.0	1.83	0.18
11	91.9	70.4	12.0	549.0	221.0	1.83	0.18
12	98.4	76.9	45.0	504.0	266.0	6.86	0.69
13	105.0	83.5	75.0	429.0	341.0	11.43	1.14
Avg. Shaft			26.2			4.08	0.41
Toe			429.0				68.64

Soil Model Parameters/Extensions		Shaft	Toe
Smith Damping Factor		0.40	0.41
Quake	(in)	0.04	0.22
Case Damping Factor		0.43	0.55
Damping Type		Viscous	Smith
Unloading Quake	(% of loading quake)	30	87
Reloading Level	(% of Ru)	100	100
Unloading Level	(% of Ru)	0	
Soil Plug Weight	(kips)		0.706

CAPWAP match quality = 2.27 (Wave Up Match) ; RSA = 0
Observed: Final Set = 0.08 in; Blow Count = 144 b/ft
Computed: Final Set = 0.08 in; Blow Count = 144 b/ft

max. Top Comp. Stress = 2.2 ksi (T= 30.7 ms, max= 1.058 x Top)
max. Comp. Stress = 2.3 ksi (Z= 32.8 ft, T= 32.8 ms)
max. Tens. Stress = -0.08 ksi (Z= 23.0 ft, T= 41.8 ms)
max. Energy (EMX) = 29.1 kip-ft; max. Measured Top Displ. (DMX)= 0.34 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	1481.0	0.0	2.2	0.00	29.1	4.3	0.33
2	6.6	1489.1	0.0	2.2	0.00	29.0	4.3	0.33
4	13.1	1507.8	-26.1	2.2	-0.04	28.9	4.2	0.32
6	19.7	1532.5	-50.9	2.2	-0.07	28.7	4.2	0.31
8	26.3	1562.1	-48.3	2.3	-0.07	28.6	4.1	0.31
10	32.8	1567.4	-33.0	2.3	-0.05	28.0	4.0	0.30
12	39.4	1559.1	-13.6	2.3	-0.02	27.2	3.9	0.30
14	45.9	1546.1	0.0	2.3	0.00	26.5	3.8	0.30
16	52.5	1491.3	0.0	2.2	0.00	25.0	3.7	0.30
18	59.1	1429.0	0.0	2.1	0.00	23.5	3.7	0.30
20	65.6	1340.4	0.0	2.0	0.00	21.6	3.6	0.30
22	72.2	1245.6	0.0	1.8	0.00	20.4	3.8	0.30
23	75.5	1175.3	0.0	1.7	0.00	19.4	3.9	0.30
24	78.8	1143.1	0.0	1.7	0.00	19.4	4.0	0.29
25	82.0	1080.2	0.0	1.6	0.00	18.7	4.1	0.29
26	85.3	1037.4	0.0	1.5	0.00	18.7	4.2	0.29
27	88.6	984.3	0.0	1.4	0.00	18.0	4.3	0.28
28	91.9	974.3	0.0	1.4	0.00	18.0	4.2	0.28
29	95.2	976.5	0.0	1.4	0.00	17.3	4.2	0.28
30	98.4	1018.6	0.0	1.5	0.00	17.2	4.1	0.27
31	101.7	965.6	0.0	1.4	0.00	15.1	4.0	0.27
32	105.0	1038.1	0.0	1.2	0.00	11.9	3.9	0.27
Absolute	32.8			2.3			(T =	32.8 ms)
	23.0				-0.08		(T =	41.8 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	1491.1	1357.8	1224.4	1091.1	957.7	824.4	691.0	557.7	424.4	291.0
RX	1521.0	1387.0	1253.0	1119.0	985.6	853.1	729.6	620.4	514.9	433.8
RU	1679.5	1565.0	1450.5	1336.0	1221.5	1106.9	992.4	877.9	763.4	648.9

RAU = 421.4 (kips); RA2 = 681.5 (kips)

Current CAPWAP Ru = 770.0 (kips); Corresponding J(RP)= 0.54; J(RX) = 0.57

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
4.4	30.52	1396.1	1428.5	1453.0	0.34	0.12	0.08	29.2	1651.0	1974

PILE PROFILE AND PILE MODEL

Depth	Area	E-Modulus	Spec. Weight	Perim.
ft	ft²	ksi	lb/ft³	ft
0.0	4.77	6620.6	150.000	10.00
102.5	4.77	6620.6	150.000	10.00
102.5	6.25	6620.6	150.000	10.00
105.0	6.25	6620.6	150.000	10.00

Toe Area 6.25 ft²

Segmnt Number	Dist. B.G.	Impedance	Imped. Change	Slack	Tension Eff.	Slack	Compression Eff.	Perim.	Wave Speed
	ft	kips/ft/s	%	in		in		ft	ft/s
1	3.3	317.69	0.00	0.00	0.000	-0.00	0.000	10.00	14300.0
32	105.0	392.96	0.00	0.00	0.000	-0.00	0.000	10.00	14300.0

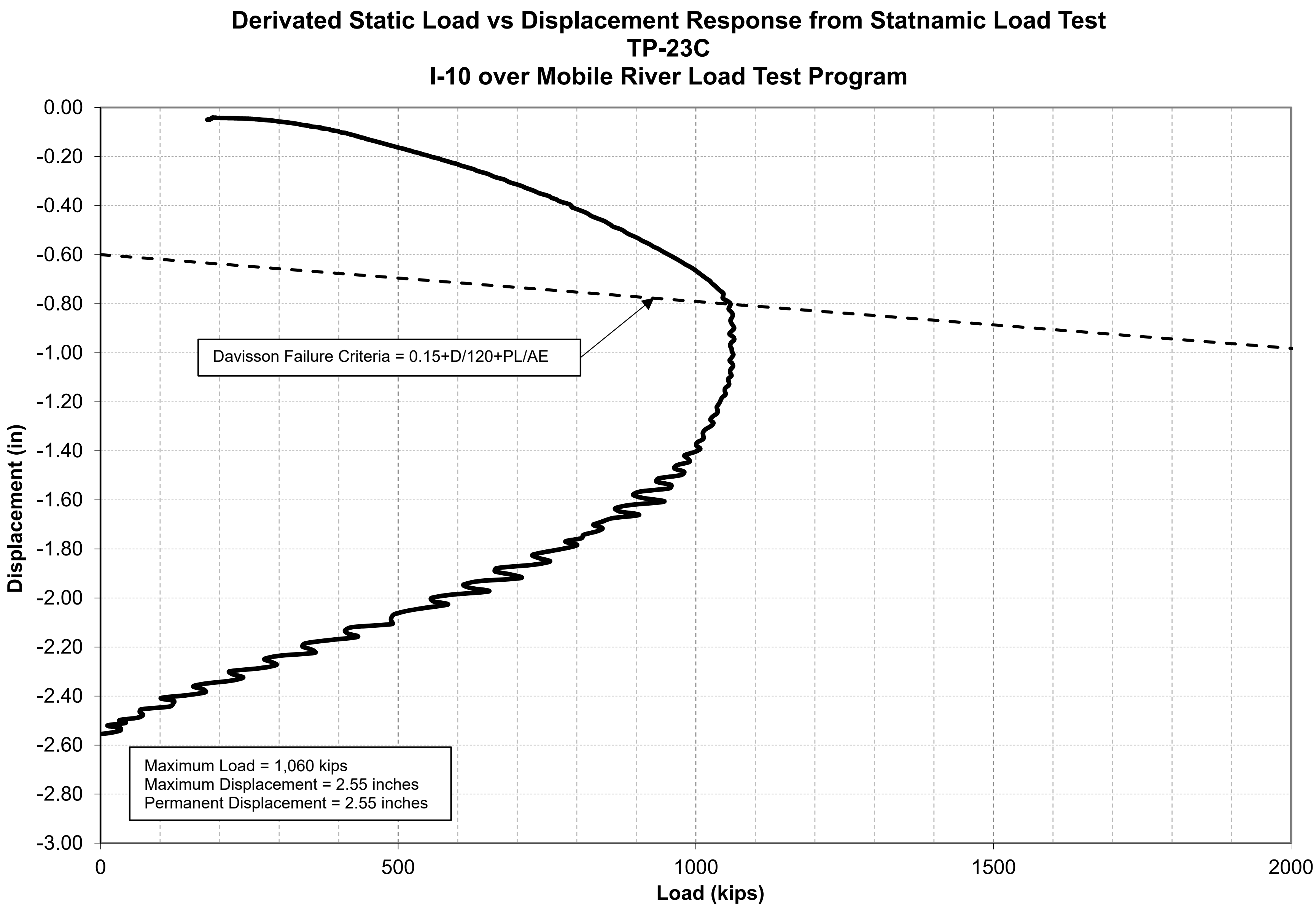
Wave Speed: Pile Top 14300.0, Elastic 14300.0, Overall 14285.7 ft/s
Pile Damping 2.00 %, Time Incr 0.229 ms, 2L/c 14.7 ms
Total volume: 504.044 ft³; Volume ratio considering added impedance: 1.000

Appendix D

Axial Compressive Statnamic Rapid Load Testing Graphical Results
TP-23C

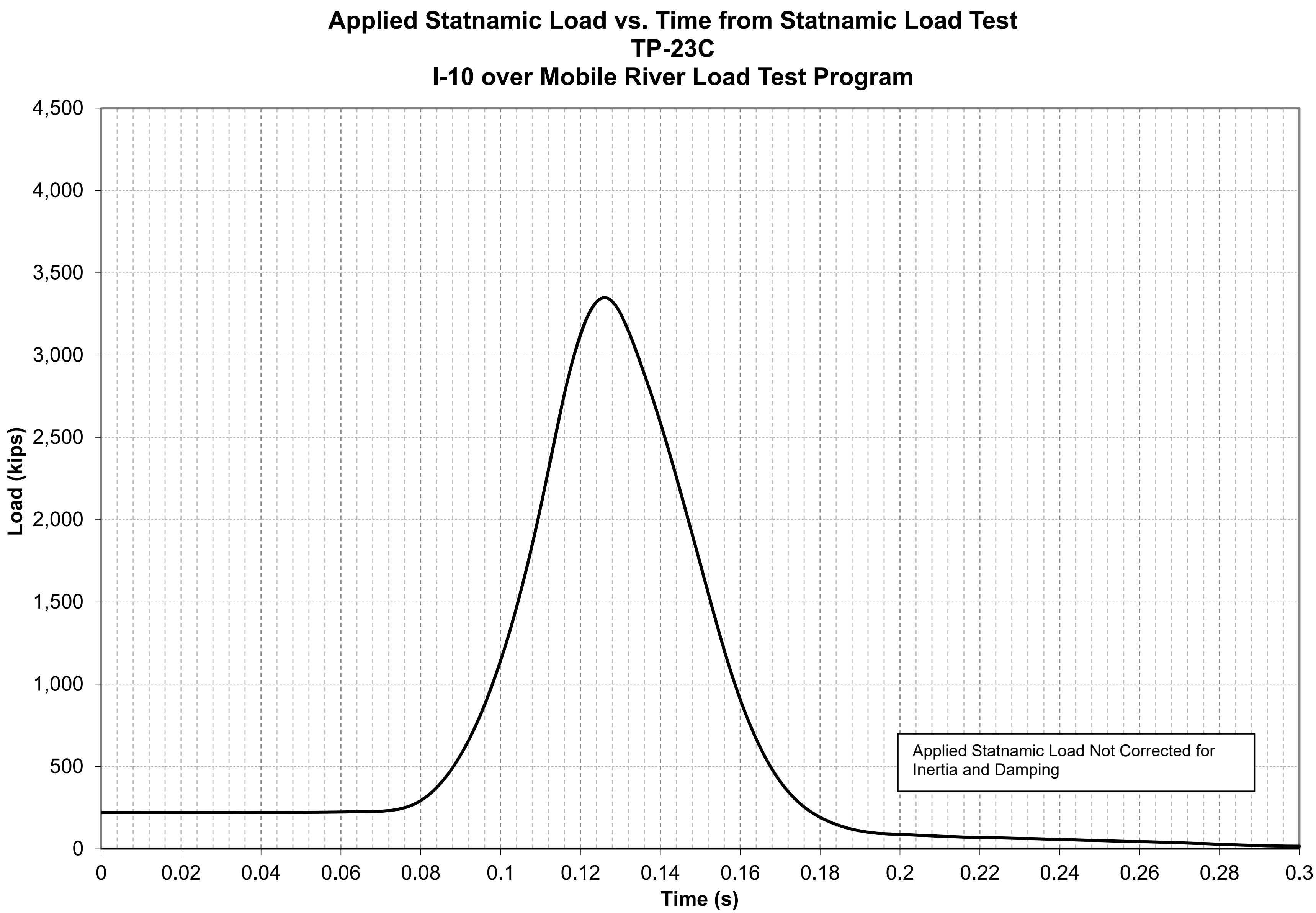
I-10 over Mobile River Bridge Load Test Program

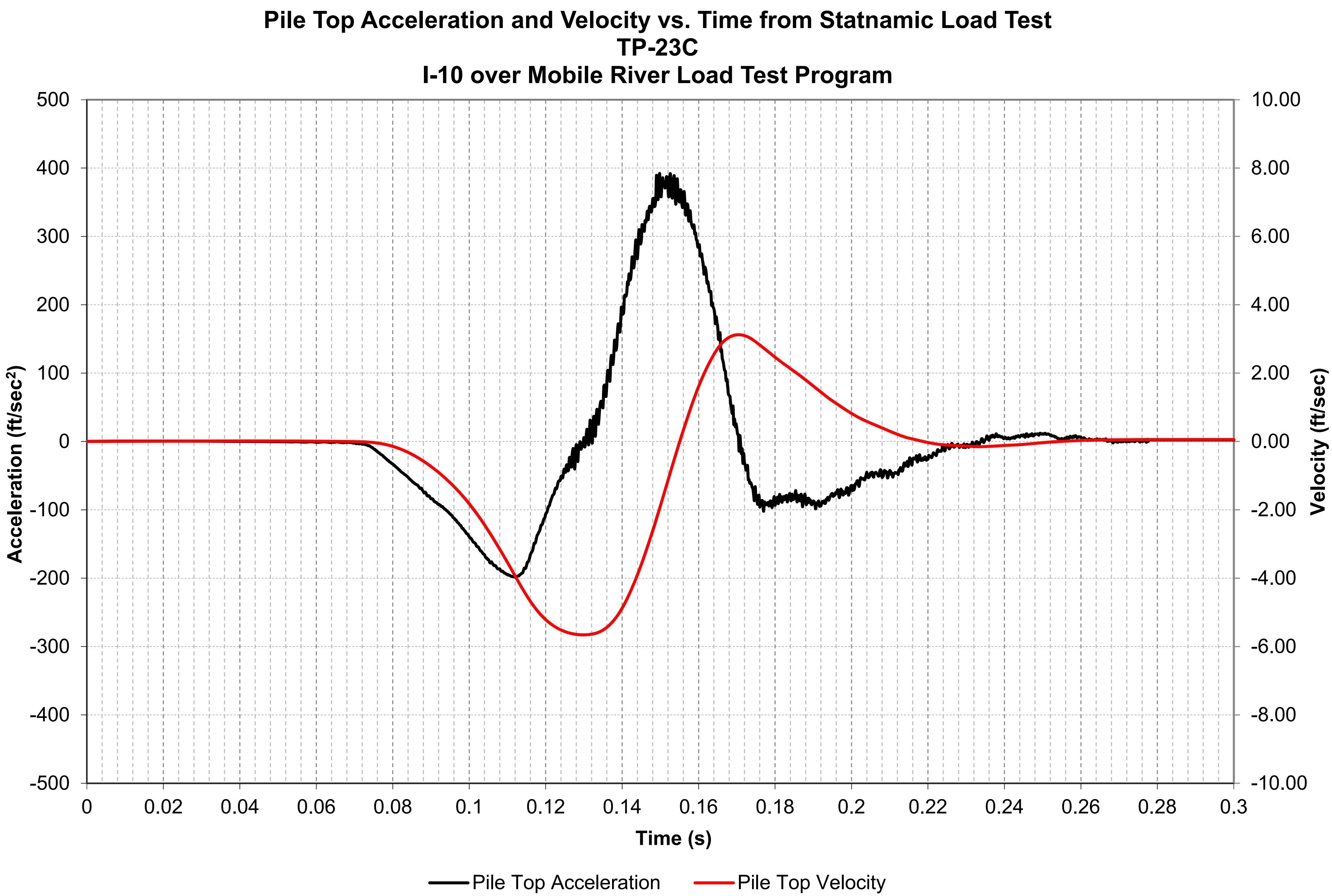
ALDOT Project No.: IM-I010(341)
Mobile County, Alabama
AFT Project No.: 118008



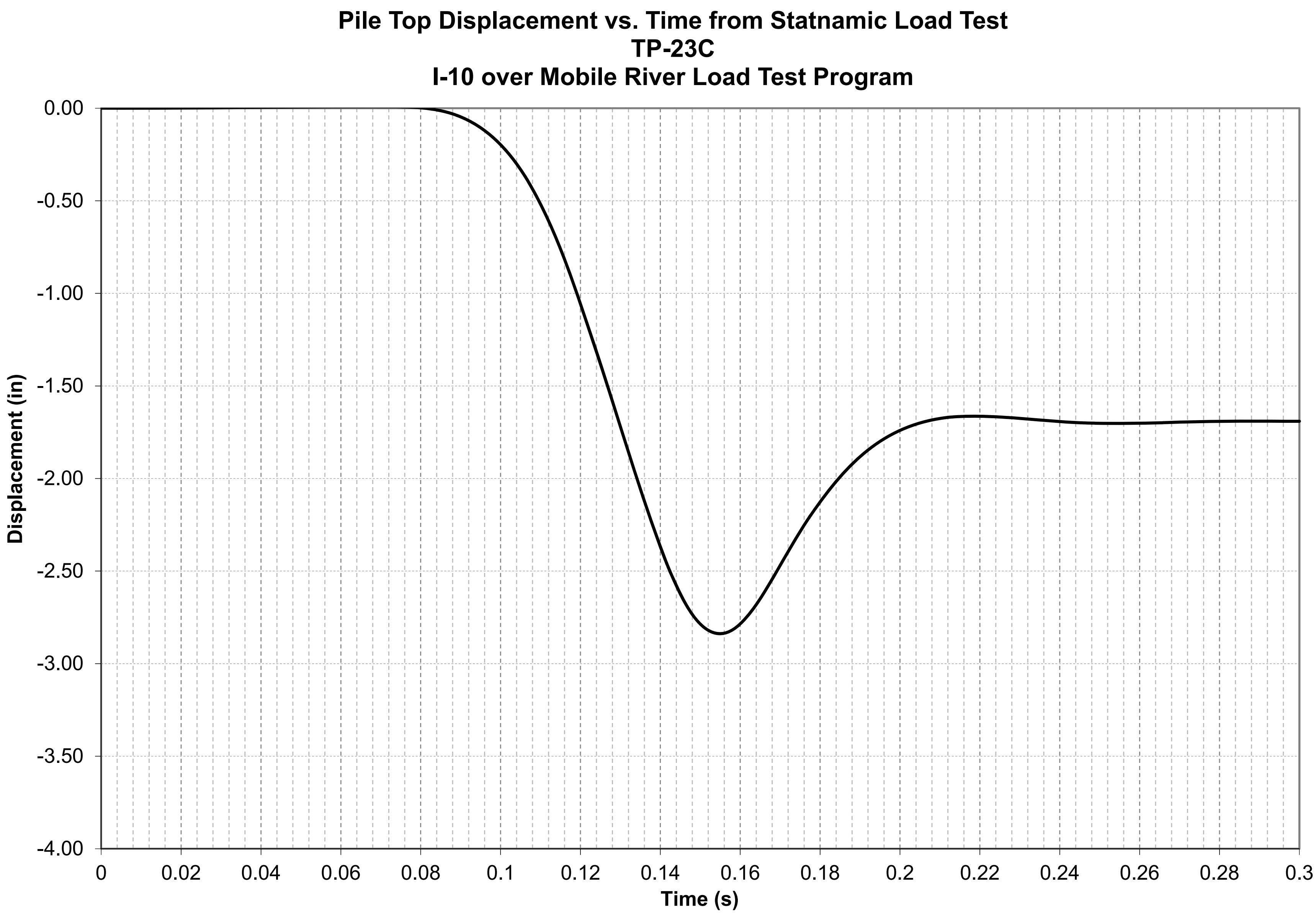
Derivated Static Load vs Displacement Response from Statnamic Load Test
TP-23C
I-10 over Mobile River Load Test Program
Displacement (in)
0.00
-0.20
-0.40
-0.60
-0.80
-1.00
-1.20
-1.40
-1.60
-1.80
-2.00
-2.20
-2.40
-2.60
-2.80
-3.00
0
500
1000
1500
2000
Load (kips)
Davisson Failure Criteria = 0.15+D/120+PL/AE
Maximum Load = 1,060 kips
Maximum Displacement = 2.55 inches
Permanent Displacement = 2.55 inches

Figure 1


Applied Statnamic Load vs. Time from Statnamic Load Test
TP-23C
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
0.02
0.04
0.06
0.08
0.1
0.12
0.14
0.16
0.18
0.2
0.22
0.24
0.26
0.28
0.3
Time (s)
Applied Statnamic Load Not Corrected for Inertia and Damping



Pile Top Acceleration and Velocity vs. Time from Statnamic Load Test
TP-23C
I-10 over Mobile River Load Test Program
Acceleration (ft/sec²)
Velocity (ft/sec)
500
400
300
200
100
0
-100
-200
-300
-400
-500
10.00
8.00
6.00
4.00
2.00
0.00
-2.00
-4.00
-6.00
-8.00
-10.00
0
0.02
0.04
0.06
0.08
0.1
0.12
0.14
0.16
0.18
0.2
0.22
0.24
0.26
0.28
0.3
Time (s)
Pile Top Acceleration
Pile Top Velocity


Pile Top Displacement vs. Time from Statnamic Load Test
TP-23C
I-10 over Mobile River Load Test Program
Displacement (in)
0.00
-0.50
-1.00
-1.50
-2.00
-2.50
-3.00
-3.50
-4.00
0
0.02
0.04
0.06
0.08
0.1
0.12
0.14
0.16
0.18
0.2
0.22
0.24
0.26
0.28
0.3
Time (s)

Appendix E

Relevant Project Documents
TP-23C

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.

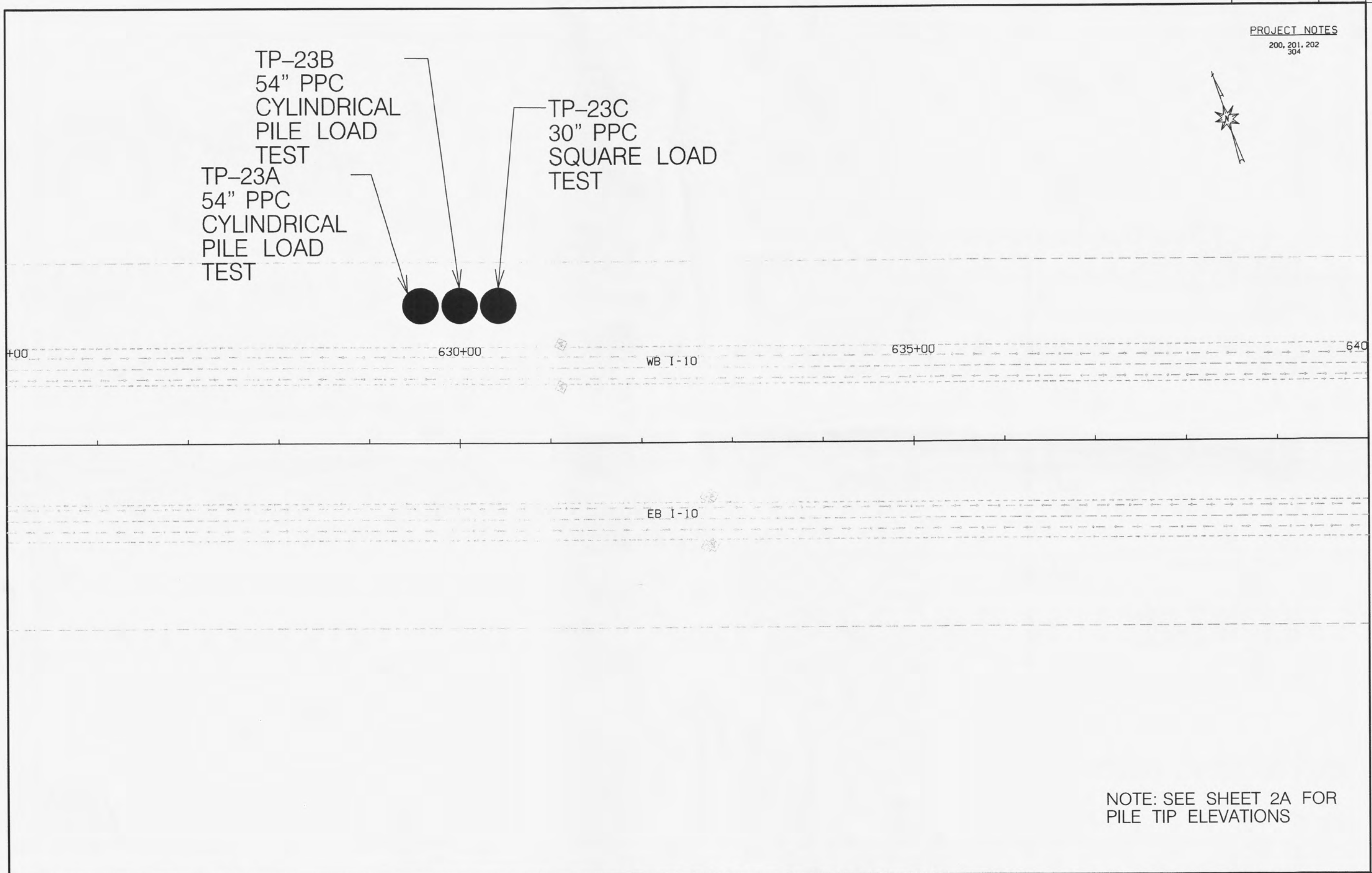
PILE TIP ELEVATIONS

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	

PLAN SHEET

REFERENCE PROJECT NO	FISCAL YEAR	SHEET NO
IM-I010(341)	2018	7



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 625+00 TO STA 640+00	I-10

RECORD OF TEST BORING

thompson ENGINEERING

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

Depth (ft)	Elevation (ft)	MATERIAL DESCRIPTION	Sample Depth (ft.)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value
	-5.0	Very loose, wet, brown, fine grained, SILTY SAND (SM)	0.0	SS-1	0	0	0	0
		Very loose, wet, brown, fine grained, SILTY SAND (SM, A-2-4(0)), LL=NP PL=NP PI=NP NMC=28.8 %#200=14.3	1.5	SS-2	0	0	0	0
		Very loose, No Recovery	3.0	SS-3	0	0	0	0
5.0		Very loose	4.5	SS-4	0	0	0	0
	-10.0	Very loose	6.0	SS-5	0	0	0	0
10.0		Very loose, wet, brown and black, fine grained, SILTY SAND (SM, A-2-4(0)), LL=NP PL=NP PI=NP NMC=51.4 %#200=29.8	8.5	SS-6	0	0	0	0
	-15.0							
15.0		Very loose, wet, brown, fine grained, POORLY GRADED SAND (SP)	13.5	SS-7	0	0	0	0
	-20.0							
20.0	-25.0	Undisturbed sample obtained from 18.5 to 20.5 feet. Approximately 24 inches of recovery. Wet, dark gray, with trace organics and shells, SANDY FAT CLAY (CH)	18.5	ST-1				
25.0	-30.0	Very soft, wet, brown, SANDY FAT CLAY (CH, A-7-6(28)), LL=67 PL=14 PI=53 NMC=41.4 %#200=60.3	23.5	SS-8	0	0	0	0
30.0		Undisturbed sample obtained from 28.5 to 30.5 feet. Approximately 21 inches of recovery.	28.5	ST-2				

● SPT N VALUE (blows/foot) — PL ✕ MC ○ LL ✕ — ▲ FINES CONTENT (%) ▲ — 10 20 30 40 50 60 70 80 90

LEGEND

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

RECORD OF TEST BORING

thompson ENGINEERING

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

Depth (ft)	Elevation (ft)	MATERIAL DESCRIPTION	Sample Depth (ft.)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value
30.0	-35.0	Dark gray, with shells						
35.0	-40.0	Very loose, wet, brown, fine grained, SILTY SAND (SM, A-2-4(0)), LL=NP PL=NP PI=NP NMC=28.4 %#200=31.3	33.5	SS-9	0	0	0	0
40.0	-45.0	Very loose, wet, brown, fine grained, with trace organics and gravel, CLAYEY SAND (SC, A-6(4)), LL=40 PL=17 PI=23 NMC=34.1 %#200=37.8	38.5	SS-10	0	0	3	3
45.0	-50.0	Very soft, wet, brown, with trace sand, FAT CLAY (CH)	43.5	SS-11	0	0	0	0
50.0	-55.0	Undisturbed sample obtained from 48.5 to 50.5 feet. Approximately 24 inches of recovery. Wet, gray, fine grained, with trace organics and trace clay, POORLY GRADED SAND (SP, A-3(0)), LL=NP PL=NP PI=NP NMC=25.7 %#200=2.0	48.5	ST-3				
55.0	-60.0	Soft, wet, brown, SANDY LEAN CLAY (CL, A-6(11)), LL=34 PL=14 PI=19 NMC=30.9 %#200=67.4	53.5	SS-12	0	0	3	3
60.0		Medium dense, wet, brown, fine to medium grained, SILTY SAND (SM, A-2-4(0)), LL=NP PL=NP PI=NP	58.5	SS-13	8	6	5	11

LEGEND

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

RECORD OF TEST BORING

thompson ENGINEERING

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

Depth (ft)	Elevation (ft)	MATERIAL DESCRIPTION	Sample Depth (ft.)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value
60.0	-65.0	NMC=31.1 %#200=23.0						
65.0	-70.0	Medium dense	63.5	SS-14	7	11	13	24
70.0	-75.0	Medium dense	68.5	SS-15	6	9	9	18
75.0	-80.0	Medium dense	73.5	SS-16	9	9	11	20
80.0	-85.0	Medium dense, wet, brown, fine to medium grained, with trace gravel, POORLY GRADED SAND with SILT (SP-SM, A-3(0)), LL=NP PL=NP PI=NP NMC=21.3 %#200=9.7	78.5	SS-17	14	15	10	25
85.0	-90.0	Medium dense	83.5	SS-18	11	12	12	24
90.0		Dense, fine to coarse grained, with trace gravel	88.5	SS-19	20	22	21	43

LEGEND

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

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

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

APPROVED : SAM STERNBERG III, P.E.
GEOTECHNICAL ENGINEER

DATE :

Preliminary Project No:

TEST BORING RECORD

REFERENCE PROJECT NUMBER	FISCAL YEAR	SHEET NUMBER
IM-I010(341)	2018	25

thompson ENGINEERING — RECORD OF TEST BORING

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

Depth (ft)	Elevation (ft)	MATERIAL DESCRIPTION	Sample Depth (ft.)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value
90.0	-95.0							
95.0	-100.0	Very dense	93.5	SS-20	19	25	29	54
100.0	-105.0	Very dense, wet, brown, medium to fine grained, POORLY GRADED SAND with GRAVEL (SP, A-1-b(0)), LL=NP PL=NP PI=NP NMC=11.6 %#200=4.4	98.5	SS-21	19	26	31	57
105.0	-110.0	Dense	103.5	SS-22	18	18	16	34
110.0	-115.0	Hard, moist, brown and gray, LEAN CLAY (CL)	108.5	SS-23	13	16	21	37
115.0	-120.0	Hard, moist, brown and gray, with trace sand, LEAN CLAY (CL, A-7-6(30)), LL=47 PL=14 PI=33 NMC=16.8 %#200=88.9	113.5	SS-24	14	15	19	34
120.0		Hard	118.5	SS-25	14	17	22	39

● SPT N VALUE (blows/foot) PL MC LL ▲ FINES CONTENT (%) ▲ 10 20 30 40 50 60 70 80 90

LEGEND

SAMPLER TYPE: SS - Split Spoon, ST - Shelby Tube, DCP - Dynamic Cone Penetrometer, AC - Auger Cuttings, GB - Grab Bag, NQ - Rock Core

DRILLING METHOD: HSA - Hollow Stem Augers, SSA - Solid Stem Augers, HA - Hand Auger, MR - Mud Rotary Wash, RC - Rock Coring

thompson ENGINEERING — RECORD OF TEST BORING

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

Depth (ft)	Elevation (ft)	MATERIAL DESCRIPTION	Sample Depth (ft.)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value
120.0	-125.0							
125.0	-130.0	Very stiff, moist, brown and gray, with trace sand, FAT CLAY (CH, A-7-6(34)), LL=50 PL=14 PI=36 NMC=21.2 %#200=91.9	123.5	SS-26	8	11	13	24
130.0	-135.0	Very dense, wet, brown, fine grained, POORLY GRADED SAND with SILT (SP-SM)	128.5	SS-27	20	28	42	70
135.0	-140.0	Very dense, fine to medium grained	133.5	SS-28	25	36	44	80
140.0	-145.0	Very dense, wet, brown, fine grained, POORLY GRADED SAND with SILT (SP-SM, A-3(0)), LL=NP PL=NP PI=NP NMC=26.2 %#200=8.7	138.5	SS-29	22	33	31	64
145.0	-150.0	Very dense	143.5	SS-30	21	27	40	67
150.0		Very dense	148.5	SS-31	11	26	34	60

● SPT N VALUE (blows/foot) PL MC LL ▲ FINES CONTENT (%) ▲ 10 20 30 40 50 60 70 80 90

LEGEND

SAMPLER TYPE: SS - Split Spoon, ST - Shelby Tube, DCP - Dynamic Cone Penetrometer, AC - Auger Cuttings, GB - Grab Bag, NQ - Rock Core

DRILLING METHOD: HSA - Hollow Stem Augers, SSA - Solid Stem Augers, HA - Hand Auger, MR - Mud Rotary Wash, RC - Rock Coring

thompson ENGINEERING — RECORD OF TEST BORING

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

Depth (ft)	Elevation (ft)	MATERIAL DESCRIPTION	Sample Depth (ft.)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value
150.0	-155.0							
155.0	-160.0	Dense, wet, brown, fine grained, SILTY SAND (SM, A-2-4(0)), LL=NP PL=NP PI=NP NMC=19.2 %#200=31.0	153.5	SS-32	15	17	21	38
160.0	-165.0	Medium dense	158.5	SS-33	6	9	12	21
165.0	-170.0	Very stiff, moist, brown and black, SANDY LEAN CLAY (CL)	163.5	SS-34	5	9	13	22
170.0	-175.0	Hard, moist, brown, SANDY LEAN CLAY (CL, A-6(5)), LL=28 PL=15 PI=13 NMC=15.5 %#200=62.1	168.5	SS-35	11	15	19	34
175.0	-180.0	Hard	173.5	SS-36	12	15	17	32
180.0		Very stiff, moist, brown, SANDY LEAN CLAY (CL, A-6(8)), LL=33 PL=13 PI=20 NMC=18.2 %#200=59.4	178.5	SS-37	10	12	15	27

● SPT N VALUE (blows/foot) PL MC LL ▲ FINES CONTENT (%) ▲ 10 20 30 40 50 60 70 80 90

LEGEND

SAMPLER TYPE: SS - Split Spoon, ST - Shelby Tube, DCP - Dynamic Cone Penetrometer, AC - Auger Cuttings, GB - Grab Bag, NQ - Rock Core

DRILLING METHOD: HSA - Hollow Stem Augers, SSA - Solid Stem Augers, HA - Hand Auger, MR - Mud Rotary Wash, RC - Rock Coring

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
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- MR - Mud Rotary

NO - Not Obtained
NE - Not Encountered
REC / RQD — Recovery / Rock Quality Designation
pp - Pocket Penetrometer
SS - Split Spoon
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Alabama Department of Transportation

Bridge Sheet of

thompson ENGINEERING
2970 COTTAGE HILL RD.
MOBILE, AL 36606

APPROVED : SAM STERNBERG III, P.E.
GEOTECHNICAL ENGINEER
DATE :

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

Preliminary Project No:

TEST BORING RECORD

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

thompson ENGINEERING — RECORD OF TEST BORING

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

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

LEGEND

SAMPLER TYPE: SS - Split Spoon; ST - Shelby Tube; DCP - Dynamic Cone Penetrometer; AC - Auger Cuttings; GB - Grab Bag; NQ - Rock Core

DRILLING METHOD: HSA - Hollow Stem Augers; SSA - Solid Stem Augers; HA - Hand Auger; MR - Mud Rotary Wash; RC - Rock Coring

thompson ENGINEERING — RECORD OF TEST BORING

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

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

LEGEND

SAMPLER TYPE: SS - Split Spoon; ST - Shelby Tube; DCP - Dynamic Cone Penetrometer; AC - Auger Cuttings; GB - Grab Bag; NQ - Rock Core

DRILLING METHOD: HSA - Hollow Stem Augers; SSA - Solid Stem Augers; HA - Hand Auger; MR - Mud Rotary Wash; RC - Rock Coring

thompson ENGINEERING — RECORD OF TEST BORING

Site Description:	I-10 Mobile River Bridge and Bayway					County:	Mobile
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Total Depth:	120.0 ft.	Soil Depth:	120.0 ft.	Core Depth:	0.0 ft.	Date Completed:	12/15/2015
Bore Hole Diameter (in):	4-inch	AASHTO / ASTM Sampling Methods:	AASHTO T206 & T207				
Drill Machine:	CME 45C	Drill Method:	MR	Hammer Type:	Manual	Energy Ratio:	86%
Core Size:	N/A	Driller:	Thompson Eng	Groundwater:	TOB 0.0 ft.	24 HR	0.0 ft.

Depth (ft)	Elevation (ft)	MATERIAL DESCRIPTION	Sample Depth (ft.)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value
35.0	-35.0	Very loose, wet, gray, fine to medium grained, POORLY GRADED SAND with SILT (SP-SM, A-2-4(0)), LL=NP PL=NP PI=NP NMC=27.3 %#200=11.7	33.5	SS-11	1	1	1	2
40.0	-40.0	Loose	38.5	SS-12	2	3	2	5
45.0	-45.0	Loose, light gray	43.5	SS-13	4	4	5	9
50.0	-50.0	Medium dense	48.5	SS-14	7	9	13	22
55.0	-55.0	Medium dense, wet, light gray, fine to medium grained, POORLY GRADED SAND with SILT (SP-SM, A-3(0)), LL=NP PL=NP PI=NP NMC=20.9 %#200=5.9	53.5	SS-15	10	11	10	21
60.0	-60.0	Loose	58.5	SS-16	5	4	4	8

LEGEND

SAMPLER TYPE: SS - Split Spoon; ST - Shelby Tube; DCP - Dynamic Cone Penetrometer; AC - Auger Cuttings; GB - Grab Bag; NQ - Rock Core

DRILLING METHOD: HSA - Hollow Stem Augers; SSA - Solid Stem Augers; HA - Hand Auger; MR - Mud Rotary Wash; RC - Rock Coring

STRATA SYMBOLS

- SAND (SP)
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- Paving
- GRAVEL (GP)
- SANDY SILT (ML)
- LEAN CLAY (CL)
- TOPSOIL
- CLAYEY SAND (SC)
- CLAYEY SILTY SAND (SC-SM)
- WELL GRADED SAND with SILT and GRAVEL (SW-SM)
- SANDSTONE
- DOLOMITE
- CLAYEY GRAVEL (GC)
- POORLY GRADED GRAVEL with SILT and SAND (GP-GM)
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NO - Not Obtained
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REC/RQD — Recovery / Rock Quality Designation
pp - Pocket Penetrometer
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Alabama Department of Transportation

Bridge Sheet of

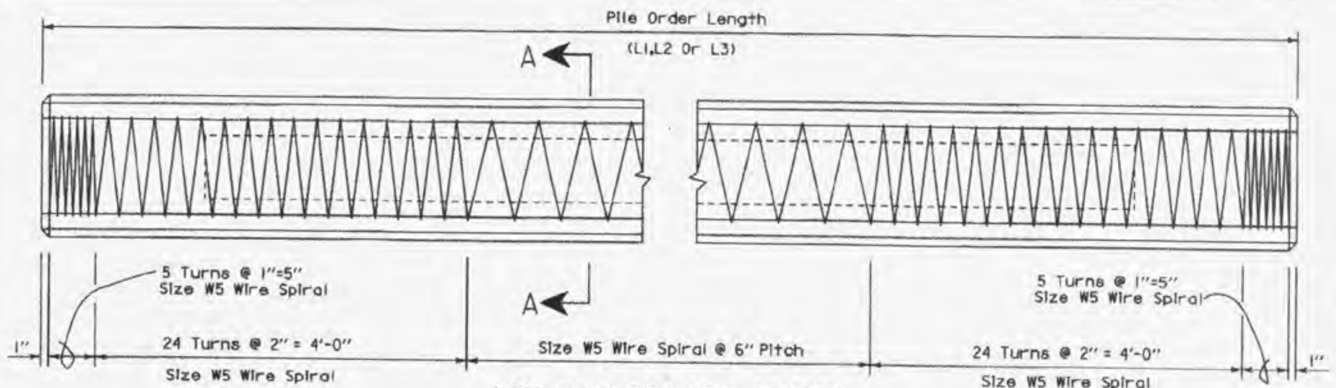
thompson ENGINEERING
2970 COTTAGE HILL RD.
MOBILE, AL 36606

APPROVED : SAM STERNBERG III, P.E.
GEOTECHNICAL ENGINEER
DATE :

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

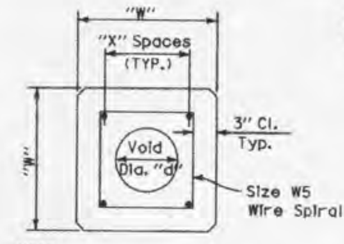
Preliminary Project No:

TEST BORING RECORD
Sheet 11 of 12



14"-36" SQUARE PILES

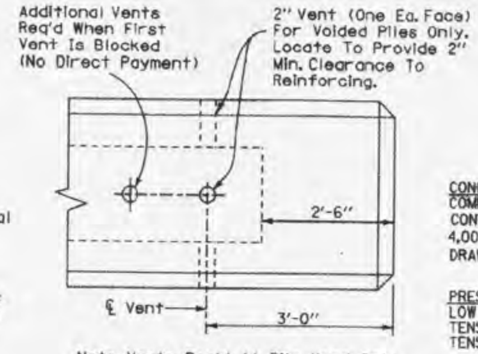
NO SCALE



NOTE:
STRAND PROTECTION: WHEN STRANDS ARE CUT FLUSH WITH END SURFACES OF PILE, THEY SHALL BE PAINTED WITH AN APPROVED EPOXY IMMEDIATELY AFTER CUTTING.

SECTION A-A

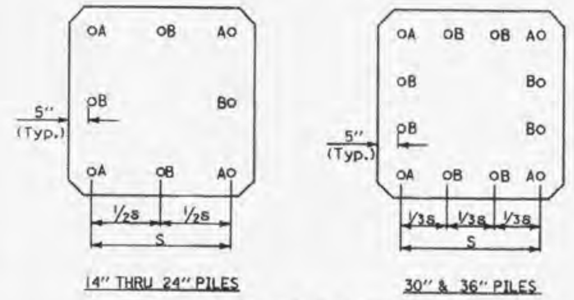
NO SCALE



Note: Vents Req'd At Pile Head Only.

PILE HEAD DETAIL

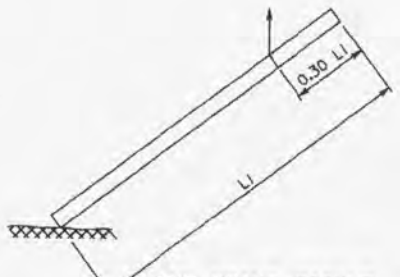
NO SCALE



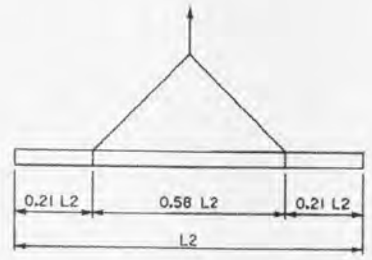
DOWEL HOLE PATTERN

DOWEL SIZE	D
#4,#6	1"
#7,#8	1¼"

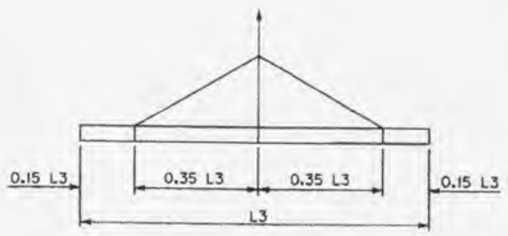
PILE SIZE	DOWEL BAR SIZE LOCATION A	LOCATION B
14"	#7	—
16"	#8	—
18"	#8	#4
20"	#8	#6
24"	#8	#6
30"	#8	#7
36"	#8	#8



ONE POINT PICKUP



TWO POINT PICKUP

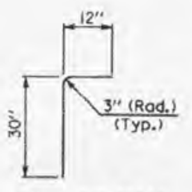


THREE POINT PICKUP

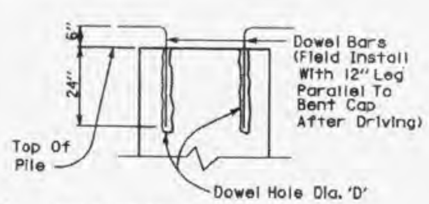
NOTE: Pick-Up Points To Be Plainly Marked On Piles

PICKUP DETAILS

NO SCALE



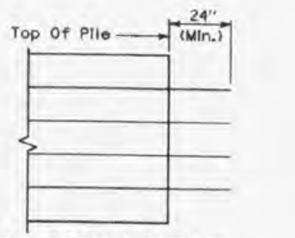
DOWEL BAR DETAIL
(TYP. #4 THRU #8)



PILE HEAD ATTACHMENT

NOTE:
Dowel Holes Shall Be Drilled After Driving Is Complete. Holes Shall Be Cleaned Prior To Setting Dowel Bars And Shall Be Free Of Dust, Oil, Water And Other Contaminents. Dowel Bars Shall Be Set Using An Approved Epoxy.

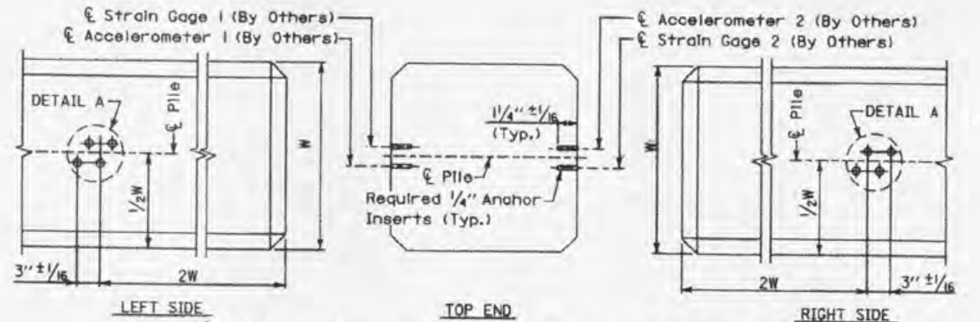
ALTERNATE 'B' (DOWEL BAR EXTENSION)



Prestressed Strands To Extend 24" Beyond Pile Cut-Off To Provide Attachment Of Pile To Bent And Abutment Caps (Typ. 14" Thru 36" Piles)

ALTERNATE 'A'
(STRAND EXTENSION)

PILE HEAD ATTACHMENT



* LOCATION OF REQUIRED ¼" INSERTS

NO SCALE

* ¼" INSERTS: INSERTS FOR ALDOT MATERIALS & TEST BUREAU USE SHALL BE EITHER CAST INTO OR DRILLED INTO ALL PILING.

GENERAL NOTES

CONCRETE: THE CONTRACTOR SHALL DESIGN AND SUBMIT FOR APPROVAL A CONCRETE MIX WITH MINIMUM COMPRESSIVE CYLINDER STRENGTH OF 5,000 P.S.I. AT 28 DAYS UNLESS SHOWN OTHERWISE ON THE CONTRACT DRAWINGS. CONCRETE STRENGTH AT TIME OF TRANSFER OF PRESTRESSING FORCE SHALL BE 4,000 P.S.I. OR GREATER. CEMENT SHALL BE TYPE II EXCEPT WHEN OTHERWISE NOTED ON THE CONTRACT DRAWINGS, SPECIFICATIONS, OR SPECIAL PROVISIONS.

PRESTRESSING STEEL: STRESSING CABLE SHALL BE ½" DIA., SEVEN WIRE, UNCOATED, STRESS-RELIEVED OR LOW RELAXATION, GRADE 270, AND SHALL CONFORM TO THE REQUIREMENTS OF AASHTO M 203. AN INITIAL TENSION OF 28,910 LBS. SHALL BE APPLIED TO EACH STRESS-RELIEVED TYPE STRAND, AND AN INITIAL TENSION OF 30,975 LBS. SHALL BE APPLIED TO EACH LOW-RELAXATION TYPE STRAND.

REINFORCING BARS: REINFORCING STEEL SHALL BE DEFORMED BILLET STEEL BARS, GRADE 60 AND SHALL MEET THE REQUIREMENTS OF AASHTO-M31.

SPIRAL REINFORCING STEEL: SPIRAL REINFORCEMENT SHALL BE SIZE W5(MIN.) COLD-DRAWN STEEL WIRE AND SHALL CONFORM TO AASHTO M-32.

FABRICATION TOLERANCES: MANUFACTURE OF THE PILING AND FABRICATION TOLERANCES SHALL BE IN ACCORDANCE WITH THE STANDARD SPECIFICATIONS. THE DETENSIONING PROCEDURE SHALL BE SUBMITTED TO THE BRIDGE ENGINEER FOR APPROVAL.

CHAMFERS AND CORNERS: ON PILES 18" OR SMALLER, ALL EXPOSED CONCRETE CORNERS ARE TO HAVE ¾" CHAMFERS. ON PILES 20" OR LARGER, ALL EXPOSED CONCRETE CORNERS ARE TO HAVE 1½" CHAMFER. A 1" RAD. CURVE WILL BE PERMITTED IN LIEU OF CHAMFERS SHOWN ABOVE. HOWEVER, ALL BENT PILES FURNISHED SHALL BE OF SAME CONFIGURATION.

PICK-UP AND HANDLING: MAXIMUM LENGTHS FOR PICK-UP HAVE BEEN DETERMINED USING THE FOLLOWING STRESS ASSUMPTIONS:

LOADING: 1½ TIMES FULL DEAD LOAD. ALLOWABLE TENSILE STRESS EQUALS $5\sqrt{f'c}$ PSI. THIS STRESS AND LOADING CRITERIA ARE BASED ON CAREFUL HANDLING OF THE PILE. ROTATION OF PILE IN THE SLING IS TO BE PREVENTED UNTIL PILE IS IN VERTICAL POSITION. PICK-UP POINTS FOR ALL PILES TO BE CLEARLY MARKED ON PILE. PICK-UP POINTS SHOWN MAY BE MODIFIED FOR TRANSPORTATION PURPOSES PROVIDED THE TENSILE STRESS BASED ON ABOVE LOADING CRITERIA DOES NOT EXCEED $5\sqrt{f'c}$ PSI. THE MODIFIED PICK-UP POINTS SHALL BE SENT TO THE BRIDGE DESIGN ENGINEER FOR REVIEW.

PICK-UP DEVICES: CAST-IN-PLACE LOOPS MAY BE USED AS PICK-UP DEVICES FOR PRESTRESSED PILES. FOR PILE ABUTMENTS AND FOR PILE FOOTINGS THAT ARE TO BE CONSTRUCTED BELOW GROUNDLINE, THE FOLLOWING SHALL APPLY: THE LOOPS SHALL BE CUT OFF FLUSH WITH FACE OF THE PILE AND EXPOSED SURFACES OF THE LOOPS SHALL BE COATED WITH AN APPROVED EPOXY. FOR PILE BENTS AND FOR PILE FOOTINGS THAT ARE TO BE CONSTRUCTED ABOVE POOL (WATERLINE), THE FOLLOWING SHALL APPLY: A 3"x3" BY 1½" DEEP RECESS (BLOCKOUT) SHALL BE PROVIDED AT EACH LOOP PROTRUSION. THE LOOPS SHALL BE CUT OFF FLUSH WITH THE RECESSED FACE OF THE PILE AND THE RECESS SHALL BE FILLED WITH AN APPROVED EPOXY. THE EPOXY SHALL OBTAIN THE 28-DAY STRENGTH SPECIFIED FOR THE PILE PRIOR TO DRIVING THE PILE. THE TYPE OF PICK-UP DEVICE TO BE USED BY THE CONTRACTOR SHALL BE CLEARLY SHOWN ON THE PRESTRESSED CONCRETE PILE SHOP DRAWINGS.

SHIPPING: PILING SHALL BE HELD AT THE PLANT FOR A MINIMUM OF 21 DAYS PRIOR TO SHIPPING. PILING SHALL NOT BE TRANSPORTED UNTIL THE MINIMUM 28 DAY COMPRESSIVE CONCRETE STRENGTH IS OBTAINED AND VERIFIED BY TEST CYLINDERS.

DRIVING: PILES SHALL BE DRIVEN TO AT LEAST THE MINIMUM TIP ELEVATION AS SHOWN ON CONTRACT PLANS UNLESS OTHERWISE DIRECTED BY THE ENGINEER.

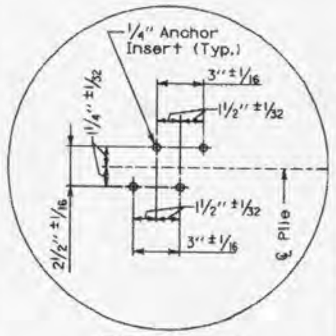
PILE HEAD ATTACHMENT: PROVISION SHALL BE MADE FOR PILE HEAD ATTACHMENT BY STRAND EXTENSION OR DOWEL BAR EXTENSION (SEE DETAIL, THIS SHEET) FOR BENT CAPS, ABUTMENT CAPS, AND FOR PILE FOOTINGS WHENEVER FOOTINGS ARE TO BE CONSTRUCTED ABOVE POOL (WATERLINE). THE CONTRACTOR'S PROPOSED METHOD OF PILE HEAD ATTACHMENT SHALL BE CLEARLY SHOWN ON THE PRESTRESSED CONCRETE PILE SHOP DRAWINGS. A PILE HEAD ATTACHMENT IS NOT REQUIRED FOR PILES IN FOOTINGS TO BE CONSTRUCTED BELOW GROUNDLINE.

BUILD-UP: THE USE OF A BUILD-UP (DRIVING OR NON-DRIVING) SHALL BE SUBJECT TO APPROVAL OF THE BRIDGE ENGINEER. SUBMIT DETAILS TO THE BRIDGE ENGINEER. CONCRETE SHALL BE THE SAME JOB MIX AS THE PRESTRESS CONCRETE.

JETTING OF PILES: JETTING OF PRESTRESSED CONCRETE PILES IS PERMISSIBLE SUBJECT TO SATISFYING THE CONDITIONS STATED IN ARTICLE 505.03(c)2 OF THE STANDARD SPECIFICATIONS. REFERENCE THIS ARTICLE OF THE SPECIFICATIONS FOR JET TUBE INSTALLATION REQUIREMENTS.

PILE PROPERTIES

PILE SIZE "W"	WEIGHT PER. LIN. FT. (Lbs./Ft.)	SECTION MODULUS OF CROSS SECTION (In.³)	AREA OF NORMAL CROSS SECTION (In.²)	VOID DIA. "d"	STRESS RELIEVED STRAND: NO. OF STRANDS	STRAND LAYOUT ("X" SPACES)	INITIAL PRESTRESS (PSI)	MAX. CASTING LENGTH: 1 POINT PICK-UP L1	2 POINT PICK-UP L2	3 POINT PICK-UP L3	LOW RELAXATION STRAND: NO. OF STRANDS	STRAND LAYOUT ("X" SPACES)	INITIAL PRESTRESS (PSI)	MAX. CASTING LENGTH: 1 POINT PICK-UP L1	2 POINT PICK-UP L2	3 POINT PICK-UP L3
14" Solid	204	457	196	0.00"	8	2	1180	60'-0"	85'-0"	121'-0"	8	2	1264	61'-0"	87'-0"	125'-0"
16" Solid	267	683	256	0.00"	8	2	903	58'-0"	83'-0"	118'-0"	8	2	968	60'-0"	84'-0"	121'-0"
18" Solid	338	972	324	0.00"	12	3	1071	66'-0"	93'-0"	133'-0"	12	3	1147	67'-0"	95'-0"	136'-0"
20" Solid	417	1,333	400	0.00"	16	4	1156	71'-0"	101'-0"	144'-0"	12	3	929	66'-0"	93'-0"	134'-0"
24" Voided	510	2,254	489	10.50"	16	4	946	78'-0"	110'-0"	158'-0"	16	4	1013	80'-0"	113'-0"	162-0"
30" Voided	715	4,257	686	16.50"	24	6	1011	93'-0"	131'-0"	188'-0"	20	5	903	89'-0"	126'-0"	181'-0"
36" Voided	936	7,077	898	22.50"	32	8	1030	105'-0"	149'-0"	213'-0"	28	7	966	103'-0"	145'-0"	208'-0"



DETAIL A

ASSISTANT BRIDGE ENGINEER

BRIDGE ENGINEER

ALABAMA DEPARTMENT OF TRANSPORTATION

THIS SPECIAL PROJECT DRAWING TO BE USED WITH ANY OF THE FOLLOWING STANDARDS

REVISIONS

CHECKED BY: | DRAWN BY: K.R.T.
DATE CHECKED: 10-19-04 | DATE DRAWN: 11-20-91

BRIDGE SPECIAL PROJECT DRAWING

PRECAST PRESTRESSED CONCRETE PILES 14-16-18-20-24-30 & 36 INCHES

ESTIMATED QUANTITIES
COMPUTED BY:
VERIFIED BY:
DESIGNED BY:
SCALE:

SPECIAL PROJ. DWG. NO.

PSCP-1

SHEET NO. 1 OF 1

(THIS SPECIAL PROJECT DRAWING FOR USE ON PROJECT NO. IM-I010(341), Mobile & Baldwin COUNTY ONLY)

Appendix F

Instrument Calibrations

TP-23C

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: P454

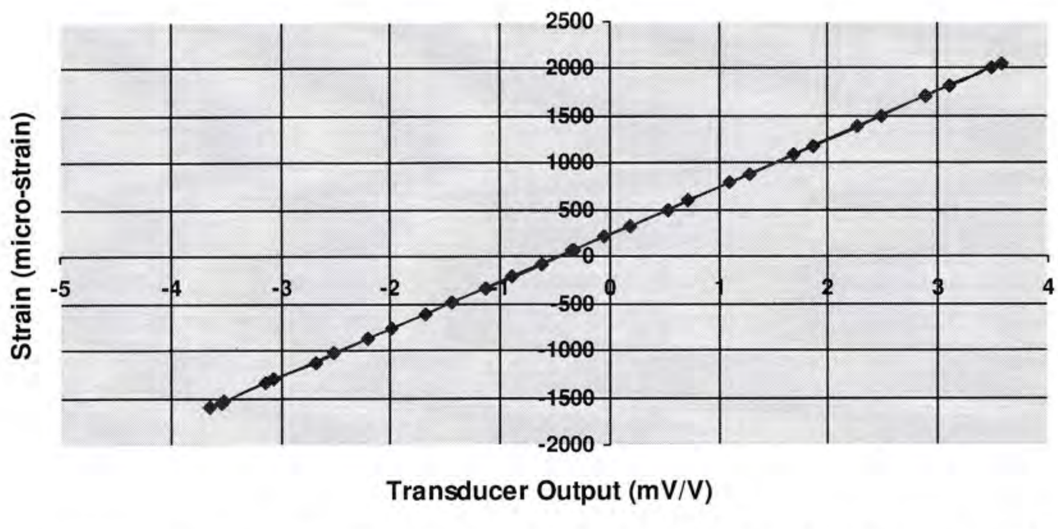
PDI Gage Factor: 145.3 με/V

General Gage Factor: 504.7 με/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: VThach

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

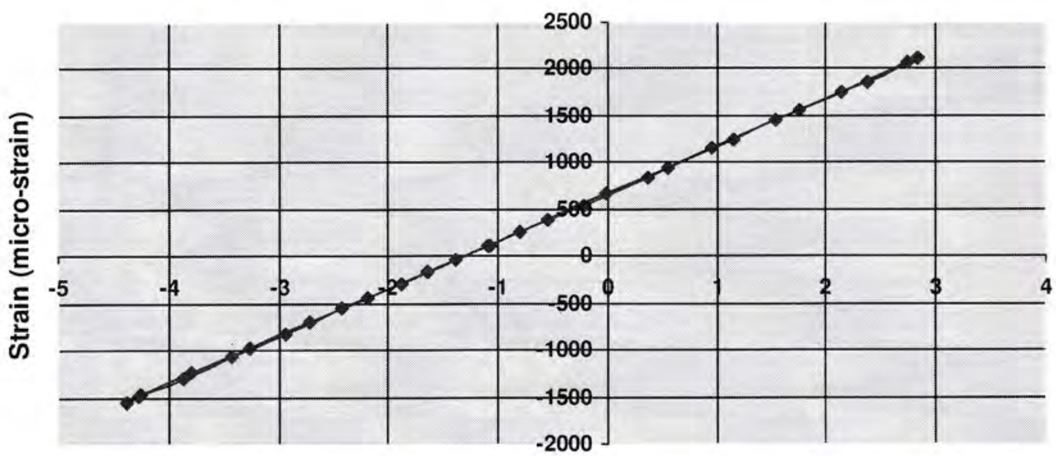
PDI Gage Factor: 145.8 με/V

General Gage Factor: 506.2 με/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. TG F2 DPF

Pile Dynamics 22-Aug-17 20:39	FS — 10	BN 732 SL 658/ 3440/ 99	PJ: PN: HOPBAR	A 4 F 2	-- VS 3.3

LE 39.6 ft
AR 1.7 in2
EM 30000 Ksi
SP 0.492 K/ft3
WS 16810 ft/s
WC 17043 ft/s

JC 0.40
FM 1.00
VM 1.00

EA/C 30.3 Ks/ft
UN KIPS*0.1
FR 20000 MB 30

DL -38
VT -1
PK 1 TM-PEAK

F1/2 500/ 213
F3/4 213/ 213
A1/2 999/ 999
A3/4 999/ 368

TS 12 E B PD: k5943 LP 0.00 ft
TB 8.0 T1 9.6 2L/C 4.7 VA 1000 VE 1022 LI 1.0

VMX= 4.8 FMX= 74 AMX= 159
EMX= 0.3 MEX= 145 FVP= 0.99

ACCEPT SQ-OFF FL-OFF PR-OFF

ACCELEROMETER CALIBRATION N.I.S.T. Traceable

SERIAL NUMBER: K5943

CALIBRATION FACTOR: .0736 mV/G

PAK (*5000): 368 DATE: 23AUG17

PDA OPERATOR: [signature]

contact Pile Dynamics USA
with your questions
tel USA - 216 - 831- 6131
fax USA - 216 - 831- 0916

<-AT:PIEZORESISTIVE OP: laine [ver:4.05] AT:PIEZOELECTRIC->

Smart Sensor

Smart Chip Programmed By [signature] **on** 23AUG17 **CRC Value** BADD

QBTA: ON [ALT-F1/BB=60] Pile Dynamics, Inc. TG F2 DPF

Pile Dynamics 04-May-16 04:55	FS — 10	BN 422 SL 545/ 3440/ 99	PJ: PN: HOPBAR
A 4 F 2	-- VS 3.3		

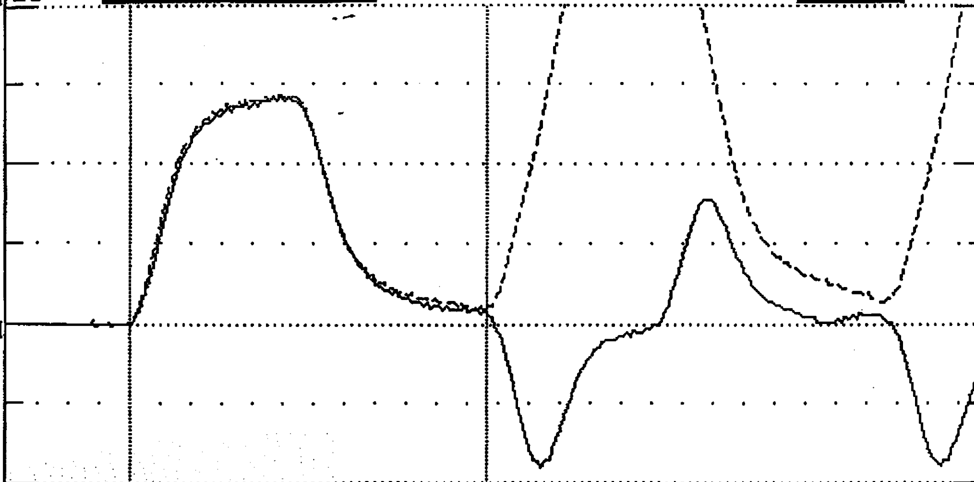
LE 39.6 ft
AR 1.7 in2
EM 30000 Ksi
SP 0.492 K/ft3
WS 16810 ft/s
WC 17043 ft/s

JC 0.40
FM 1.00
VM 1.00

EA/C 30.3 Ks/ft
UN KIPS*0.1
FR 20000 MB 30

DL -40
VT -1
PK 1 TM-PEAK

F1/2 500/ 213
F3/4 213/ 213
A1/2 999/ 999
A3/4 999/ 334



TS 12 E B PD: k5647 LP 0.00 ft
TB 8.0 T1 9.6 2L/C 4.7 VA 1000 VE 1004 LI 1.0

ACCEPT SQ-OFF FL-OFF PR-OFF

VMX= 4.7 FMX= 72 AMX= 139
EMX= 0.3 MEX= 141 FVP= 1.00

contact Pile Dynamics USA
with your questions
tel USA - 216 - 831- 6131
fax USA - 216 - 831- 0916

ACCELEROMETER CALIBRATION N.I.S.T. Traceable

SERIAL NUMBER: K5647

CALIBRATION FACTOR: .0668 MV/G

PAK (*5000): 334 DATE: 7 JUNE 16

PDA OPERATOR: [signature]

<-AT:PIEZORESISTIVE OP: laine [ver:4.05] AT:PIEZOELECTRIC->

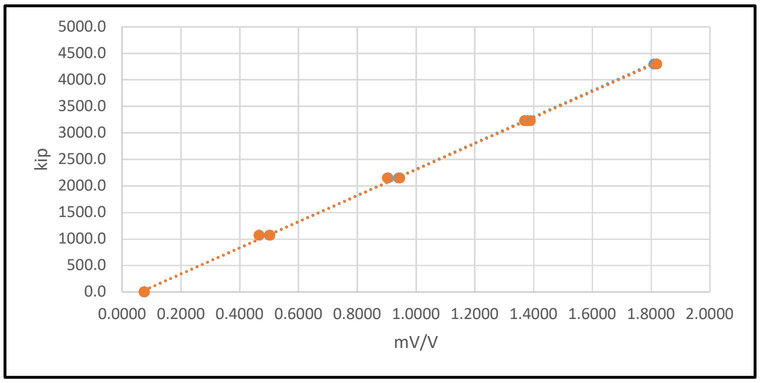
Smart Sensor

Smart Chip Programmed By X.M.W. **on** 7 June 16 **CRC Value** 34B5

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	2/28/2017	**Description**	19MN Kelk Load Cell
Calibration Due	2/28/2018	**Model**	C3929-1
Technician	Justin Eason	**Serial Number**	15
Ambient	81.2	**Range**	4300 kip



Calibrating Equipment		
Item	**Description**	**Serial**
Pressure Gauge	20000 PSIG	1659929
Load Reference	40MN	C027-12
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	0.0751	0.0751	0.0	0.0750	0.0750	0.78%
1070.0	0.5013	0.5013	1070.0	0.5035	0.5035	0.38%
2150.0	0.9404	0.9404	2150.0	0.9448	0.9448	0.48%
3230.0	1.3800	1.3800	3230.0	1.3900	1.3900	0.71%
4300.0	1.8100	1.8100	4300.0	1.8200	1.8200	0.46%
3230.0	1.3700	1.3700	3230.0	1.3700	1.3700	-0.15%
2150.0	0.9045	0.9045	2150.0	0.9029	0.9029	-1.75%
1070.0	0.4655	0.4655	1070.0	0.4658	0.4658	-1.72%
0.0	0.0750	0.0750	0.0	0.0756	0.0756	0.80%

Comments:

Linear Gage Factor	**2463.2948**	kip/mV/V
Regression Zero	**-151.1177**	kip
Maximum Nonlinearity	**-1.75%**	
Sensitivity	**1.7456**	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:

Approved:

~ Calibration Certificate ~

Per ISO 16063-21

Model Number: **3701G2FA50G**

Serial Number: **3795**

Description: DC Accelerometer

Manufacturer: PCB

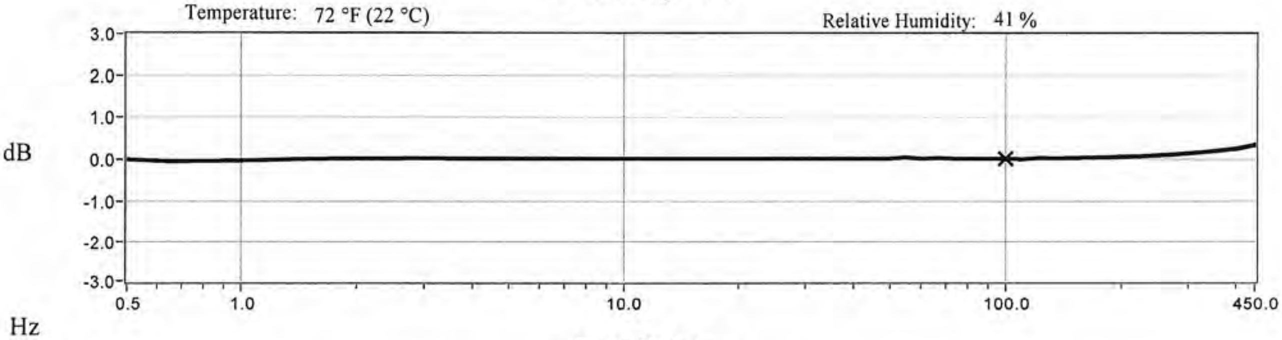
Method: Back-to-Back Comparison AT401-12

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

Temperature: 72 °F (22 °C) Relative Humidity: 41 %



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

CAL96-3599767065.696+1

ACS-11

~ *Calibration Certificate* ~

Per ISO 16063-21

Model Number: **3701G2FA50G**

Serial Number: **3795**

Description: DC Accelerometer

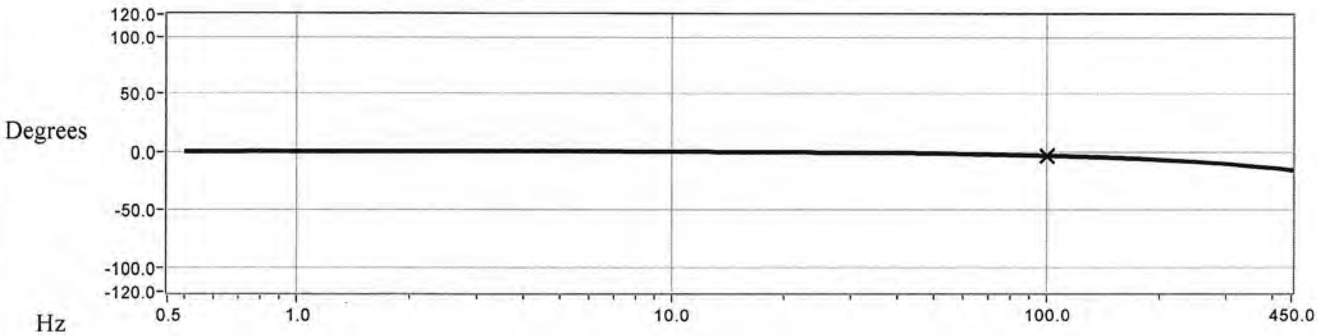
Manufacturer: PCB

Method: Back-to-Back Comparison AT401-12

Calibration Data

Sensitivity @ 100 Hz **59.9 mV/g** **(6.10 mV/m/s²)**

Phase Plot



Data Points

Frequency (Hz)	Phase (°)	Frequency (Hz)	Phase (°)
0.5	-0.6	30	-1.3
1	-0.2	50	-2.0
2	-0.2	70	-2.8
5	-0.3	REF. FREQ.	-4.0
7	-0.3	200	-7.3
10	-0.5	450	-16.4
15	-0.7		
20	-0.9		

Notes

1. Calibration is traceable to one or more of the following; PTB 10065, PTB 10066 and NIST 683/283498.
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Technician: Ronald Stevens RS 4270 Date: 1/25/2018

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CAL96-3599767065.696+1

ACS-11

~ Calibration Certificate ~

Per ISO 16063-21

Model Number: 3701G2FA50G

Serial Number: 7984

Description: DC Accelerometer

Manufacturer: PCB

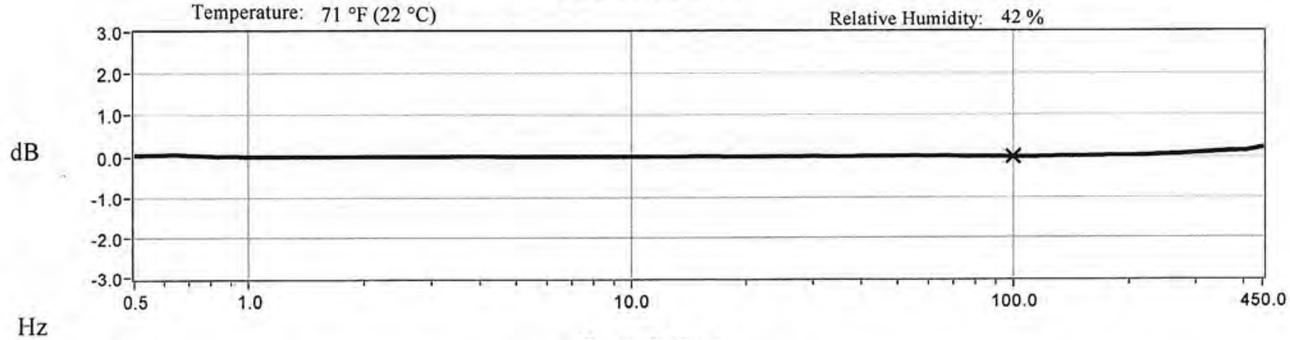
Method: Back-to-Back Comparison AT401-12

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

Temperature: 71 °F (22 °C) Relative Humidity: 42 %



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

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

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ACS-11

~ Calibration Certificate ~

Per ISO 16063-21

Model Number: **3701G2FA50G**

Serial Number: **7984**

Description: DC Accelerometer

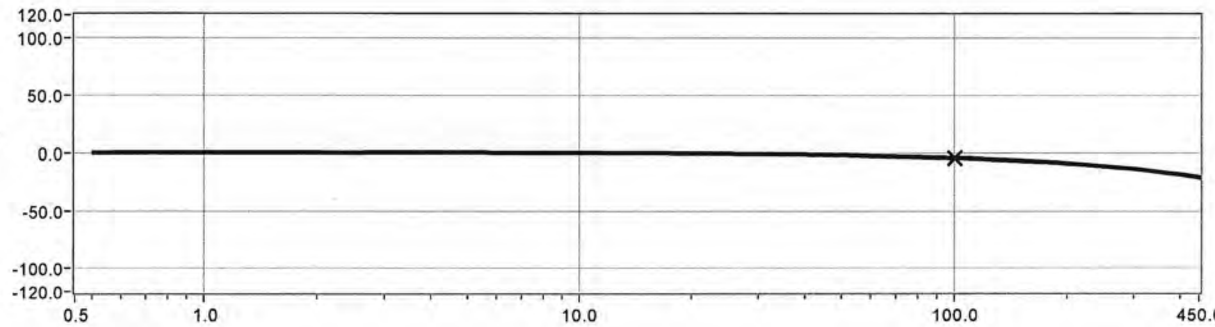
Manufacturer: PCB

Method: Back-to-Back Comparison AT401-12

Calibration Data

Sensitivity @ 100 Hz **60.9 mV/g** **(6.21 mV/m/s²)**

Phase Plot



Data Points

Frequency (Hz)	Phase (°)	Frequency (Hz)	Phase (°)
0.5	-0.3	30	-1.6
1	-0.1	50	-2.5
2	-0.2	70	-3.6
5	-0.3	REF. FREQ.	-5.0
7	-0.4	200	-9.5
10	-0.6	450	-21.4
15	-0.8		
20	-1.0		

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~ 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

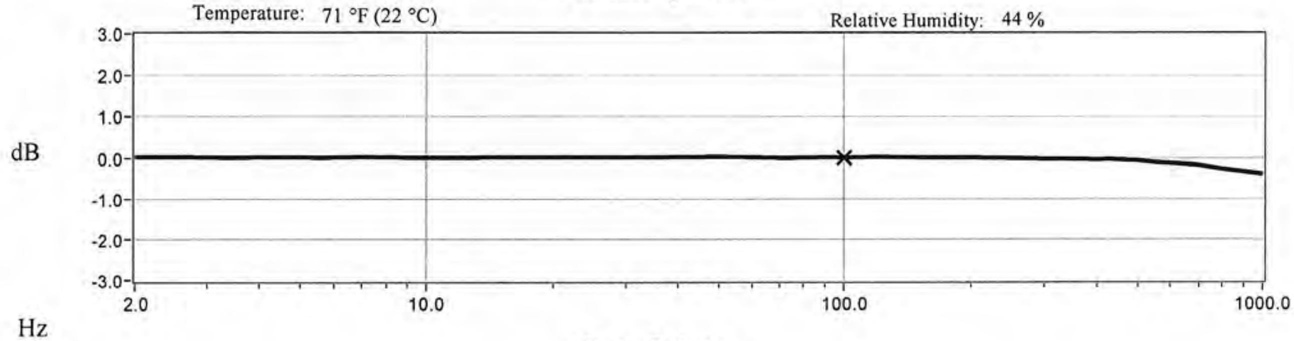
Sensitivity @ 100 Hz **40.2 mV/g** **(4.10 mV/m/s²)**

Offset Voltage (@ 0 g) 9.3 mVDC

Sensitivity Plot

Temperature: 71 °F (22 °C)

Relative Humidity: 44 %



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

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ACS-145

~ Calibration Certificate ~

Per ISO 16063-21

Model Number: **3711E1150G**

Serial Number: **8860**

Description: DC Accelerometer

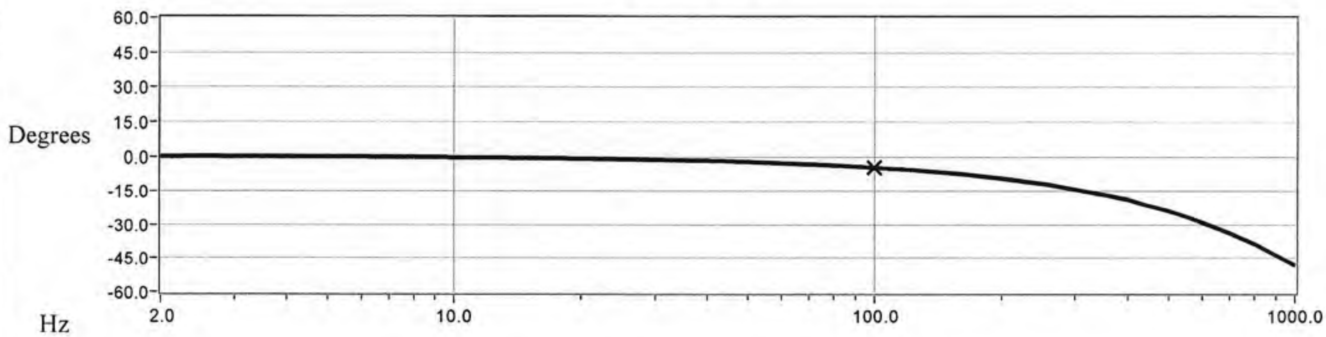
Manufacturer: PCB

Method: Back-to-Back Comparison AT401-12

Calibration Data

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

Phase Plot



Data Points

Frequency (Hz)	Phase (°)	Frequency (Hz)	Phase (°)
2	-0.2	70	-3.5
5	-0.3	REF. FREQ.	-4.9
7	-0.3	200	-9.5
10	-0.6	500	-23.9
15	-0.8	1000	-48.2
20	-1.0		
30	-1.5		
50	-2.4		

Notes

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5. 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%.

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