

GRL
engineers, inc.

**Dynamic
Measurements
and Analyses**

Job No. 179016-1

Report on: Standard Penetration Test Energy Measurements
F & ME Drill Rigs
Chester County, North Carolina

Prepared for F & ME Consultants, Inc.
By Scott D. Webster, P.E. and Mark A Rawlings
April 10, 2017

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April 10, 2017

Mr. Adam Shannon
F & ME Consultants, Inc.
3112 Devine Street
Columbia, SC 29205

Re: Standard Penetration Test Energy Measurements
F & ME Drill Rigs
Chester County, North Carolina

GRL Job No. 179016-1

Dear Mr. Shannon;

This report presents results of energy measurements obtained on March 31, 2017 during Standard Penetration Test (SPT) sampling. Two automatic hammers mounted on two different drill rigs owned by F & ME were tested. The drill rigs included an ATV mounted CME 550X and a trailer mounted CME 45B. Dynamic tests were performed on AWJ drill rods. GRL Engineers, Inc. obtained the dynamic measurements with an instrumented AW-J subsection and a PAX Model Pile Driving Analyzer®. This report describes the testing procedures and summarizes the test results. Appendix A describes our measurement and analysis methods, Appendix B contains the instrumentation calibration certificates, Appendix C contains a summary of the field data, and Appendix D contains plots of the force and velocity measurements.

PURPOSE AND SCOPE OF WORK

At the request of F & ME Consultants, Inc., GRL Engineers conducted SPT energy measurements according to ASTM D4633-10. Specifically, we provided SPT energy measurements for two drill rigs, at five-foot sample intervals starting at a depth of 28.5 feet and ending at a maximum depth of 55 feet below the existing ground surface. All of the SPT samples were driven for a total of three 6 inch increments, or 1.5 feet. GRL performed energy measurements during six sampling events for each drill rig. The soil retrieved was generally classified as a brown to tan sandy silt.

EQUIPMENT

Drilling and SPT Hammer Equipment

CME 550X ATV Mounted (Serial Number 249533)

SPT energy measurements were made on a CME automatic hammer mounted on a CME 550X ATV mounted drill rig. Energy measurements were collected every five feet while taking six soil samples in Boring 1. Blind drilling was performed before collecting the first sample. Testing started with sample 1 from 28.5 to 30 feet and concluding with sample 6 from 53.5 to 55 feet.

CME 45B Trailer Mounted (Serial Number 303304)

Energy measurements were made on a CME automatic SPT hammer mounted on a CME 45B trailer mounted drill rig. Energy measurements for this drill rig were collected in Boring 2. Six samples were taken at five foot intervals after blind drilling to the sample 1 depth of 28.5 to 30 feet and continuing to the sample 6 depth from 48.5 to 50 feet.

Instrumentation

A PAX Model Pile Driving Analyzer (PDA) data acquisition system was used to collect and process the dynamic measurements of force and velocity. A two foot long subsection of AWJ rod was instrumented with two full bridge foil resistance strain gages and two piezoresistive accelerometers mounted in the midpoint location of the instrumented rod.

Analog signals from the strain gages and accelerometers were conditioned, digitized, processed and stored with the PDA. Selected output from the PDA for each recorded impact included the maximum calculated maximum energy transfer, (EFV); the energy transfer ratio, (ETR); the maximum calculated rod force, (FMX); maximum rod top velocity, (VMX); the hammer operating rate, (BPM); the maximum computed displacement, (DMX); the final displacement, (DFN); and the maximum compressive stress at the gage location, (CSX).

MEASUREMENTS AND CALCULATIONS

FV Method (EFV)

Energy transfer to the PDA gage location, EFV, was computed by the PDA using force, $F(t)$, and velocity, $v(t)$, records as follows:

$$EFV = \int_a^b F(t) \cdot v(t) dt$$

The time "a" corresponds to the start of the record when the energy transfer begins, and "b" is the time at which energy transferred to the rod reaches a maximum value. The FV Method is currently recognized in ASTM D4633-10, and is the theoretically correct result; therefore, no other energy calculation methods are reported.

Corrected SPT number (N_{60})

While the primary purpose of SPT energy testing is to calculate the maximum transferred energy of each hammer blow, the overall average energy transfer value can be used to calculate the corrected SPT number (N_{60}). To adjust the SPT N-values for hammer performance, the following correction as suggested by Seed for N-value adjustment to 60 percent transfer efficiency (e.g. 210 foot-pounds) was used:

$$N_{60} = \left(\frac{E_m}{210} \right) N_m$$

Where:

N_{60} = Corrected N-value

E_m = overall average measured energy transfer (EFV)

N_m = number of blows for last 12 inches of sampler penetration

A general introduction to dynamic SPT testing methods is included in Appendix A. References for more detailed descriptions of our testing and analysis methods are available upon request.

Any cross-sectional area difference between the GRL rod subsection and the drill rods, any loose connections or changes in area at section joints, or any cross-sectional area differences between the individual drill rod sections could result in stress wave reflections that could influence the energy transfer. The EFV transferred energy calculation method, utilizing both force and velocity records, is theoretically correct and gives energy transfer results that are not significantly affected by cross-sectional area changes or loose connectors. The EFV results are included in Appendix C for all records collected and accepted after checking them for consistency.

RESULTS

The records collected by the PDA were checked for consistency and accuracy. For example, records from very weak startup or final impacts were not included in average results. Appendix C contains a representative plot of force and normalized velocity versus time, as well as plots and tables of PDA results for all hammer blows at each dynamically monitored sampling depth. The PDA results include the transferred energy by the FV method, as recommended by ASTM D4633-10, EFV; the energy transfer ratio for the EFV method, ETR; the maximum rod top force, FMX; the maximum rod top velocity, VMX; and the hammer operating rate, BPM. The plots display PDA results versus split-spoon penetration, while the tables show the individual blow results for the N value blows and also statistical summaries for each 6 inch increment. At the end of each table is a statistical evaluation of the results which includes the average and standard deviation of the entire measurement sample.

The table below and tables 1 through 2 summarize the average transferred energy values calculated by the EFV method. The records consist of averaged hammer blows from the last 12 inches (i.e. N value) at each dynamically monitored sampling depth. The “energy transfer ratio” (ETR) is defined as the ratio of maximum transferred energy EFV divided by the theoretical hammer potential energy of 350 ft-lbs (i.e., computed per the 140 pound SPT hammer and the standard 30 inch drop as specified by ASTM D1586-99). A summary of the dynamic measurements of the energy transfer to the drill rods using the EFV equation for each drill rig is provided in the table below.

Drill Rig	Avg. EFV (ft-lbs)	Avg. ETR (%)	Range of EFV (ft-lbs)	Range of ETR (%)
CME 550X S/N 249533	311	89	302 – 318	86 – 91
CME 45B S/N 303304	314	90	301 – 324	86 – 93

CONCLUSIONS

Based upon the dynamic test data obtained, the following conclusions are presented:

1. Loose connections in the drill string were sometimes observed in the force and velocity records. However, energy transfer values calculated using the EFV equation are not adversely affected by the connectors and therefore are considered a better indication of transferred energy.
2. Dynamic measurements of the transferred energy to the drill rods using the EFV equation ranged from 301 to 324 ft-lbs for both of the drill rigs. This corresponds to energy transfer ratios ranging from 86 to 93 percent of the SPT hammer energy of 350 ft-lbs.
3. The average transferred energy (EFV) and energy transfer ratio (ETR) for each drill rig tested was as follows:

CME 550X S/N 249533: Average EFV = 311 ft-lbs, Average ETR = 89%

CME 45B S/N 303304: Average EFV = 314 ft-lbs, Average ETR = 90%

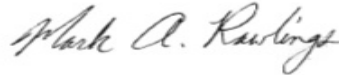
Please review both ASTM D4633-10 and ASTM D1586-99 prior to applying these test results. The energy calibrations reported herein are valid for the same hammer/drill rig, with the same drill operator, same anvil dimensions, and same drilling methods.

April 10, 2017

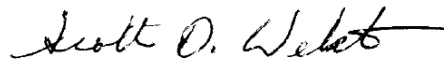
We appreciate the opportunity to be of assistance to you on this project. Please contact our office should you have any questions regarding this submittal, require additional information, or if we may be of further service.

Sincerely,

GRL Engineers, Inc.



Mark A. Rawlings



Scott D. Webster, P.E.



SDW:MAR:dms

**TABLE 1: Summary of SPT Energy Measurements
F & ME Consultants CME 550X - S/N 249533
Chester County, SC - March 30, 2017**

Soil Sample	Reported Sample Depth (feet)	Reported Rod Length ⁽¹⁾ (feet)	Reported Blow Count (blows/6")	SPT Field N Value	Average Energy Transfer To Rod ⁽²⁾ (ft-lbs)	Average Energy Transfer Ratio ⁽³⁾ (%)	SPT Hammer Operating Rate (blows / min.)	SPT N Value Corrected for 60% Energy ⁽⁴⁾ N60
Boring B1 - CME Auto Hammer - AW-J Rod								
1	28.5 - 30.0	34.0	6-8-10	18	302	86	52.8	26
2	33.5 - 35.0	39.0	5-7-9	16	305	87	53.0	23
3	38.5 - 40.0	44.0	8-11-15	26	314	90	53.7	39
4	43.5 - 45.0	49.0	6-8-10	18	313	90	52.9	27
5	48.5 - 50.0	54.0	7-9-15	24	311	89	53.2	36
6	53.5 - 55.0	59.0	7-8-14	22	318	91	52.1	33
					Average	311	89	53.0
					Standard Deviation	4	1.1	0.1

- 1) Below the testing gage location. Add 1.0 foot for total rod length.
- 2) Average energy transfer over second and third increment from FV Method.
- 3) Energy calculated by FV method divided by 350 ft-lbs (140 pound ram dropped 2.5 feet).
- 4) SPT N value corrected for 60% energy using the Seed Correction Method.

**TABLE 2: Summary of SPT Energy Measurements
F & ME Consultants CME 45B - S/N 303304
Chester County, SC - March 30, 2017**

Soil Sample	Reported Sample Depth (feet)	Reported Rod Length ⁽¹⁾ (feet)	Reported Blow Count (blows/6")	SPT Field N Value	Average Energy Transfer To Rod ⁽²⁾ (ft-lbs)	Average Energy Transfer Ratio ⁽³⁾ (%)	SPT Hammer Operating Rate (blows / min.)	SPT N Value Corrected for 60% Energy ⁽⁴⁾ N60
Boring B2 - CME Auto Hammer - AW Rod								
1	28.5 - 30.0	34.3	4-7-8	15	301	86	53.9	22
2	33.5 - 35.0	39.3	5-6-8	14	309	88	55.1	21
3	38.5 - 40.0	44.3	3-5-5	10	318	91	59.4	15
4	43.5 - 45.0	49.3	4-5-5	10	312	89	58.1	15
5	48.5 - 50.0	54.3	4-5-7	12	324	93	59.1	19
6	53.5 - 55.0	59.3	4-6-9	15	324	93	58.4	23
Average					314	90	57.1	
Standard Deviation					5	1.5	0.2	

- 1) Below the testing gage location. Add 1.0 foot for total rod length.
- 2) Average energy transfer over second and third increment from FV Method.
- 3) Energy calculated by FV method divided by 350 ft-lbs (140 pound ram dropped 2.5 feet).
- 4) SPT N value corrected for 60% energy using the Seed Correction Method.

APPENDIX A

An Introduction Into SPT Dynamic Testing Methods

APPENDIX A

AN INTRODUCTION INTO SPT DYNAMIC PILE TESTING

The following has been written by GRL Engineers, Inc. and may only be copied with its written permission.

1. BACKGROUND

The Standard Penetration Test is frequently conducted as an in-situ assessment of soil strength. This test requires that a 140 lb weight is dropped 30 inches onto a drive rod at whose bottom a sampler is usually installed. The sampler is driven for 18 inches; the number of blows required for the last 12 inches of driving is the so-called N-value. The N-value may be used as a strength indicator for foundation design or as a means of assessing the liquefaction potential of soils.

Obviously, the SPT hammer efficiency is an important consideration when using the N-values for design purposes. Measurements have indicated that the energy in the drive rod is sometimes only 30% and may reach 90% of the potential or rated energy of the SPT hammer ($E_{\text{rated}} = 0.35 \text{ kip-ft}$ or 0.475 kJ). The type of hammer used to drive the rod is the main reason for these variations. On the average, the energy in the drive rod is 60% of the standard rated energy.

Because of the variability of energy, methods based on N-values are considered unreliable. However, measurements during SPT testing using the Case Method can be done on a routine basis and these measurements yield the transferred energy values. With measured energy, EMX , known, an adjustment of the measured N-value, N_m , can be made as follows.

$$N_{60} = N_m [E_m / (0.6E_r)] \quad (1)$$

Thus, if the measured energy value is equal to the normally expected transferred energy of 60% of E_{rated} then the adjusted and measured N-values are identical. On the other hand, if the measured energy is only 30% then the adjusted blow count will be reduced by 50%.

2. DYNAMIC TESTING AND ANALYSIS METHODS APPLIED TO SPT

The Case Method of dynamic pile testing, named after the Case Institute of Technology where it was developed between 1964 and 1975, requires that a substantial ram mass (e.g. a pile driving hammer) impacts the pile top such that the pile undergoes at least a small permanent set. Thus, the method is also referred to as a "High Strain Method". The Case Method requires dynamic measurements on the pile or shaft under the ram impact and then a calculation of various quantities. Conveniently, for SPT applications, the measurements and analyses are done by a single piece of equipment: the SPT Analyzer (SPTA). The Pile Driving Analyzer® (PDA) is also suitable to perform these measurements and data processing.

A related analysis method is the "Wave Equation Analysis" which calculates a relationship between bearing capacity, pile stresses, transferred energy and field blow count. The GRLWEAP™ program performs this analysis and provides a complete set of helpful information and input data. This program can be used very effectively to simulate the SPT driving process.

3. MEASUREMENTS

GRL uses equipment manufactured by Pile Dynamics, Inc. The system includes either an SPT-Analyzer™ (SPTA) or a Pile Driving Analyzer® (PDA), an instrumented rod section and two accelerometers. SPT energy testing is very closely related to and borrows procedures from dynamic pile testing. Those interested in the basis of the SPT energy testing method may obtain extensive literature on dynamic pile testing from GRL Engineers, Inc.

3.1 SPT Analyzer or Pile Driving Analyzer

The basis for the results calculated by the SPTA or PDA are strain and acceleration measured in an instrumented rod section. These signals are

converted to rod top force, $F(t)$, and rod top velocity, $v(t)$. The SPTA or PDA conditions, calibrates and displays these signals and immediately computes average pile force and velocity thereby eliminating bending effects. The product of these two measurements is then integrated over time which yields the energy transferred to the instrumented section as a function of time (see Section 4.1).

For convenience and accuracy, strain measurements are usually taken on an instrumented section of SPT drive rod. Ideally, the section properties of the instrumented rod and those of the drive rod are the same, however, using subs, other sections can also be utilized.

For the instrumented section, PDI provides a force calibration in such a way that the output of the instrumented rod is directly calculated without the need for an accurate elastic modulus or cross sectional area of the rod section.

The acceleration measurements are often demanding in the SPT environment, because of high frequency and high acceleration motion components. An experienced measurement engineer, therefore, has to evaluate the quality of this data before final conclusions are drawn from the numerical results calculated by SPTA or PDA.

SPTA or PDA records are taken while the standard N-value is acquired in the conventional manner. This then allows a direct correlation between N-value and average transferred energy.

3.2 HPA

The SPT hammer's ram velocity may be directly obtained using radar technology in the Hammer Performance Analyzer™. The impact velocity results can be automatically processed with a PC or recorded on a strip chart. HPA measurements yield a hammer kinetic energy, but not the energy transferred to the drive rod.

4 RECORD EVALUATION BY SPTA OR PDA

4.1 HAMMER PERFORMANCE

The PDA calculates the energy transferred to the pile top from:

$$E(t) = \int_0^t F(\tau)v(\tau) d\tau \quad (2)$$

The maximum of the $E(t)$ curve is often called **ENTHRU** or **EMX**; it is the most important quantity for an overall evaluation of the performance of a hammer and driving system. **EMX** allows for a classification of the hammer's performance when presented as, e_T , the rated transfer efficiency, also called energy transfer ratio (**ETR**) or global efficiency.

$$e_T = EMX/E_R \quad (3)$$

where E_R is the hammer manufacturer's rated energy value or 0.35 kip-ft (0.475 kJ) in the case of the SPT hammer.

Often in the SPT literature one finds also reference to the EF2 energy. This evaluation is based on assumed proportionality between force and velocity (see also Section 5):

$$v(t) = F(t) / Z \quad (4)$$

where $Z = EA/c$ is the pile impedance, E is the elastic modulus, A is the cross sectional area and c is the speed of the stress wave in the pile material..

Combining equations 2 and 4 leads to

$$EF(t) = \int_0^t F(\tau)^2 / Z d\tau \quad (5)$$

The EF2 transferred energy value is the EF-value at the time $t = 2L/c$, where L is the drive rod length and c is the stress wave speed in steel (16,800 ft/s or 5,124 m/s). Since the force is easier to measure than both force and velocity, Equation 5 is preferred by some test engineers. However, the EF method is fraught with errors and certain correction factors have to be applied to make it approximately correct. Among the error sources are the following:

- Proportionality is often violated prior to time $2L/c$. The proportionality between force and velocity in a downward traveling wave only

holds if the wave does not encounter a disturbance prior to reflecting off the pile toe. Such disturbances include a change in cross sectional area, an open or loose splice or joint, or resistance along the shaft.

- Using only one force measurement precludes a data quality check based on the proportionality between force and velocity. Thus, a force measurement that is for some reason in error may not be detectable, which will lead to errors in the EF2 value. Data quality checks will be discussed further in Section 5.

The use of EF2 is therefore not recommended but it is often included in result presentations for the sake of completeness.

4.2 STRESSES

During SPT monitoring, it is also of interest to monitor compressive stresses at both the top of the drive rod and at its bottom.

At the pile top (location of sensors) the maximum compression stress averaged over the rod's cross section, **CSX**, is directly obtained from the measurements. Note that this stress value refers to the instrumented section. If the rod has a different cross sectional area then the stress in the rod will be different from CSX.

The SPTA or PDA can also calculate, in an approximate manner, the force at the rod bottom, **CFB**. To obtain the corresponding stress, this force value should be divided by the appropriate cross sectional area, e.g. by the rod area just above the sampler or by the sampler area itself. Of course, non-uniform stress components as they might occur at the sampler tip due to a sloping rock are not considered in this calculation.

5. DATA QUALITY CHECKS

Quality data is the first and foremost requirement for accurate dynamic testing results. It is therefore important that the measurement engineer performing SPTA or PDA tests has the experience necessary to recognize measurement problems and take appropriate corrective action should problems develop. Fortunately, dynamic pile testing allows for

certain data quality checks because two independent measurements are taken that have to conform to the so-called proportionality relationship.

As long as there is only a wave traveling in one direction, as is the case during impact when only a downward traveling wave exists in the rod, force and velocity measured at its top are proportional

$$F = v Z \quad (5)$$

where Z is again the pile impedance, $Z = EA/c$. This relationship can also be expressed in terms of stress

$$\sigma = F/A = v (E/c) \quad (6)$$

or strain

$$\epsilon = \sigma/E = v / c \quad (7)$$

This means that the early portion of strain times wave speed must be equal to the velocity unless the proportionality is affected by high friction near the pile top or by a pile cross sectional change not far below the sensors. Checking the proportionality is an excellent means of assuring meaningful measurements but is only truly meaningful for perfectly uniform rods. Open or loose splices, for example, will lead to a non-proportionality. For SPT rods it is fortunate that usually no soil resistance acts along the shaft and for that reason, proportionality can exist until the stress wave returns from sampler top or rod bottom unless connectors are not sufficiently tightened or have a significant mass.

Velocity data quality can also be checked by looking at the final displacement, DFN, which is calculated from the acceleration by double integration. If the calculated final displacement is much higher or lower than indicated by the N-value, the accelerometer attachment may be loose or the sensor may be faulty. If major drift in the velocity is observed, the EMX value may be in error, even though proportionality from impact to time $2L/c$ exists. In this case, it may be useful to evaluate the energy transferred to the drill rod at time $2L/c$, which is calculated by the PDA or SPTA as the E2E quantity.

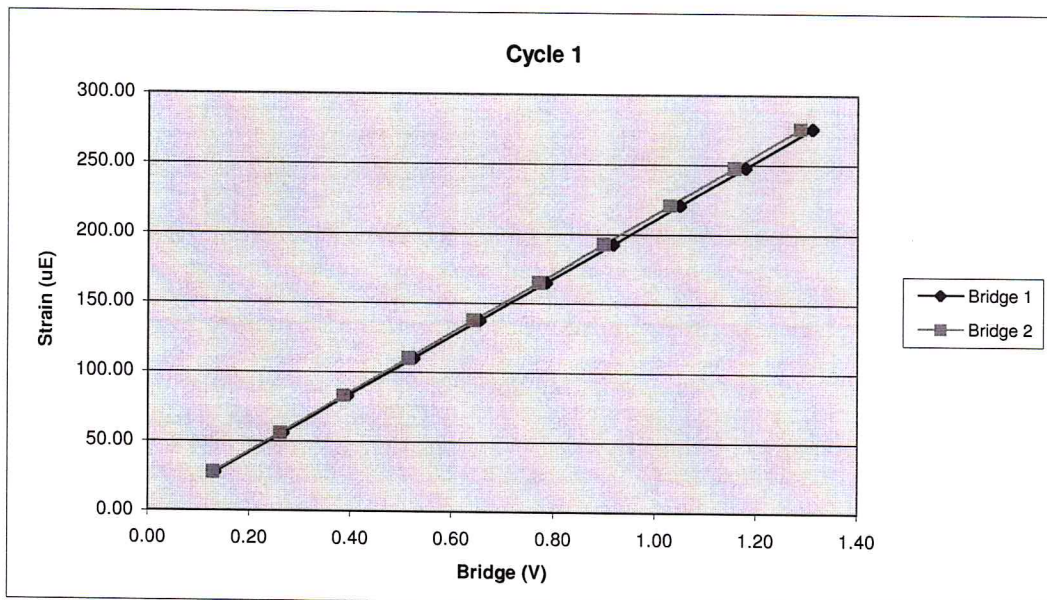
APPENDIX B

Instrumentation Calibration Information

168AWJ		Cycle 1		
Sample	Force (lb)	Strain (μ E)	Bridge 1 (V)	Bridge 2 (V)
1	0.00	0.00	0.00	0.00
2	985.12	27.81	0.13	0.13
3	1999.42	55.96	0.27	0.26
4	2962.46	82.88	0.39	0.39
5	3948.57	110.23	0.52	0.51
6	4934.08	137.55	0.65	0.64
7	5929.06	165.07	0.79	0.77
8	6918.72	192.89	0.92	0.90
9	7919.02	220.92	1.05	1.03
10	8900.20	247.97	1.18	1.16
11	9910.36	276.00	1.31	1.29

Bridge 1		Bridge 2	
Force Calibration (lb/V)	7574.02	Force Calibration (lb/V)	7709.66
Offset	-21.90	Offset	-11.13
Correlation	0.999999	Correlation	0.999999
Strain Calibration (μ E/V)	210.70	Strain Calibration (μ E/V)	214.48
Offset	-0.24	Offset	0.06
Correlation	0.999999	Correlation	0.999998

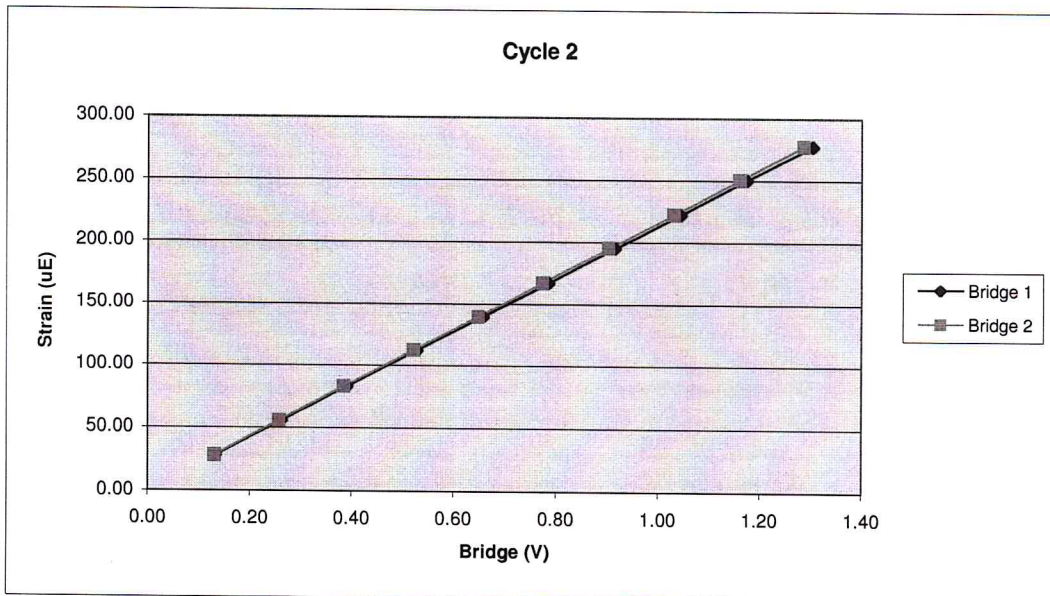
Force Strain Calibration	
EA (Kips)	35946.33
Offset	-13.36
Correlation	0.999999



168AWJ		Cycle 2		
Sample	Force (lb)	Strain (μ E)	Bridge 1 (V)	Bridge 2 (V)
1	0.00	0.00	0.00	0.00
2	982.95	28.05	0.13	0.13
3	1974.19	55.76	0.26	0.26
4	2953.39	82.87	0.39	0.38
5	4000.42	112.22	0.53	0.52
6	4972.13	139.35	0.66	0.65
7	5950.75	167.00	0.79	0.77
8	6945.33	194.94	0.92	0.90
9	7917.84	222.00	1.04	1.03
10	8919.91	250.27	1.17	1.16
11	9896.36	277.50	1.30	1.29

Bridge 1		Bridge 2	
Force Calibration (lb/V)	7606.16	Force Calibration (lb/V)	7700.14
Offset	-19.82	Offset	-11.88
Correlation	0.999999	Correlation	0.999998
Strain Calibration (μ E/V)	213.01	Strain Calibration (μ E/V)	215.64
Offset	-0.22	Offset	0.00
Correlation	0.999997	Correlation	0.999997

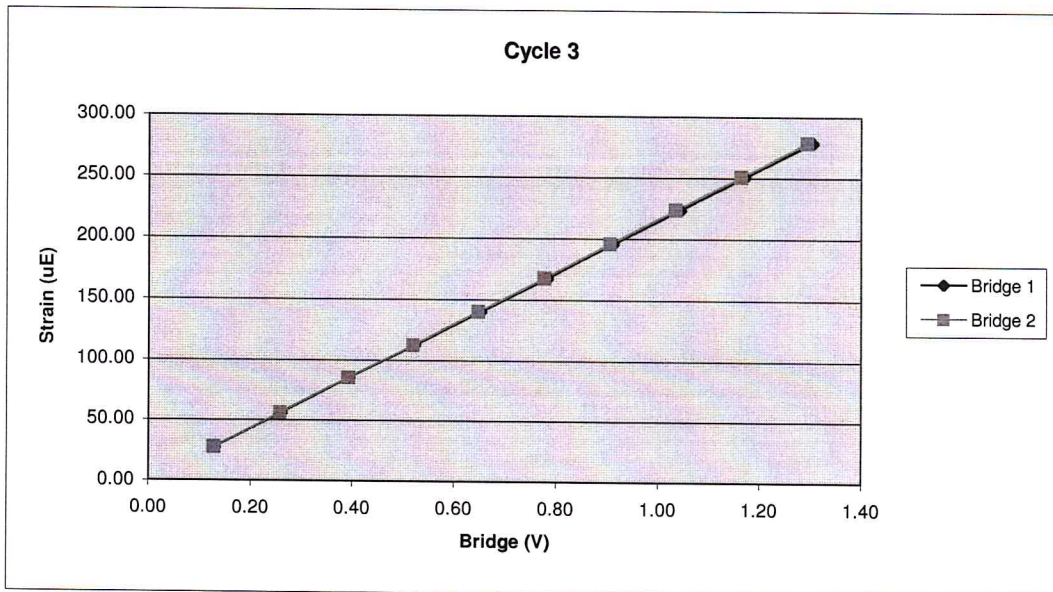
Force Strain Calibration	
EA (Kips)	35708.56
Offset	-11.96
Correlation	0.999998



168AWJ		Cycle 3		
Sample	Force (lb)	Strain (μE)	Bridge 1 (V)	Bridge 2 (V)
1	0.00	0.00	0.00	0.00
2	976.84	27.67	0.13	0.13
3	1972.21	55.77	0.26	0.26
4	3006.62	85.22	0.39	0.39
5	3988.79	112.54	0.52	0.52
6	4966.61	140.12	0.65	0.65
7	5959.03	167.81	0.78	0.78
8	6952.23	195.83	0.91	0.91
9	7951.15	223.79	1.04	1.03
10	8937.66	250.72	1.17	1.16
11	9937.17	278.64	1.30	1.29

Bridge 1		Bridge 2	
Force Calibration (lb/V)	7629.36	Force Calibration (lb/V)	7688.81
Offset	-3.45	Offset	-7.58
Correlation	0.999997	Correlation	0.999999
Strain Calibration ($\mu\text{E}/\text{V}$)	213.70	Strain Calibration ($\mu\text{E}/\text{V}$)	215.36
Offset	0.65	Offset	0.53
Correlation	0.999990	Correlation	0.999994

Force Strain Calibration	
EA (Kips)	35701.55
Offset	-26.47
Correlation	0.999992



Bridge Excitation (V) 5
Shunt Resistor (ohm) 60.4k

Calibration Factors	168AWJ		
Bridge 1 ($\mu\text{E/V}$)	212.47	Bridge 2 ($\mu\text{E/V}$)	215.16
EA Factor (Kips)	35785.48	Area (in²)	1.19

Calibrated by: 
Calibrated Date: 9/21/2015

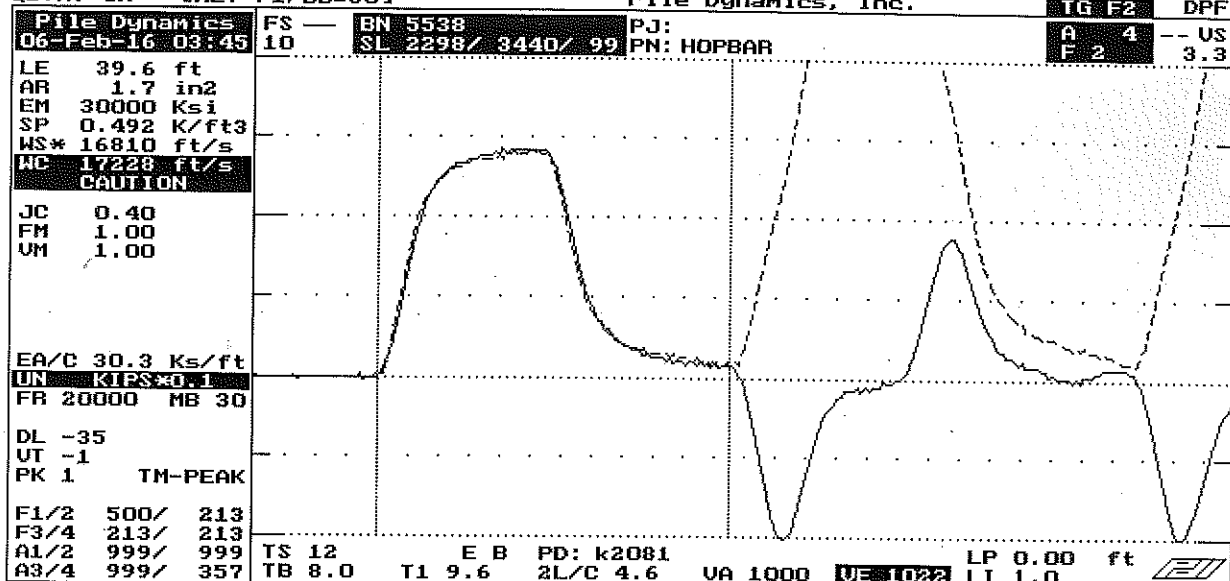
Pile Dynamics Inc
30725 Aurora Rd
Solon, OH 44139

Traceable to N.I.S.T.

QBTA: ON [ALT-F1/BB=60]

Pile Dynamics, Inc.

TG F2 DPF



ACCEPT SQ-OFF FL-OFF PR-OFF



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

←-AT-PIEZORESISTIVE

UMX= 4.6 FMX= 72 AMX= 159
 EMX= 0.3 MEX= 141 FUP= 1.01

ACCELEROMETER CALIBRATION

N.I.S.T. Traceable

SERIAL NUMBER: K2081

CALIBRATION FACTOR: .0714 MV/G

PAK (*5000): 357

DATE: 11FEB16

PDA OPERATOR: JAW

OP: laine [ver:4.05]

→-AT-PIEZOELECTRIC→

Smart Sensor

Smart Chip Programmed By A.W.W. on 11FEB16 CRC Value 5AC1

QBTA: ON [ALT-F1/BB=60]

File Dynamics, Inc.

TG F2 DPF

File Dynamics 06-Feb-16 03:33	FS — 10	BN 5514 SL 2298/ 3440/ 99	PJ: PN: HOPBAR	A 4 -- US F 2 3.3
LE 39.6 ft AR 1.7 in2 EM 30000 Ksi SP 0.492 K/ft3 WS* 16810 ft/s WC 17228 ft/s CAUTION				
JC 0.40 FM 1.00 VM 1.00				
EA/C 30.3 Ks/ft UN KIPS*0.1 FR 20000 MB 30				
DL -41 UT -1 PK 1 TM-PEAK				
F1/2 500/ 213 F3/4 213/ 213 A1/2 999/ 999 A3/4 999/ 322				
TS 12 TB 8.0	E B PD: k2082 T1 9.6 2L/C 4.6	VA 1000 UE 1022	LP 0.00 ft LI 1.0	

ACCEPT SQ-OFF FL-OFF PR-OFF



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

VMX= 7.9 FMX= 67 AMX= 149
EMX= 0.4 MEX= 131 FUP= 0.99

ACCELEROMETER CALIBRATION N.I.S.T. Traceable

SERIAL NUMBER: K2082

CALIBRATION FACTOR: .0644 mV/g

PAK (*5000): 322 DATE: 11FEB16

PDA OPERATOR: [Signature]

<-AT:PIEZORESISTIVE

OP: Iaine [ver:4.05]

AT:PIEZOELECTRIC->

Smart Sensor

Smart Chip Programmed By R.M.N. on 11FEB16 CRC Value CBFD



This documents that
Mark Rawlings
GRL Engineers, Inc.

has on January 26, 2017 achieved the rank of

MASTER

on the Dynamic Measurement and Analysis Proficiency Test.

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

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


Steven A. Hall, Executive Director
Pile Driving Contractors Association



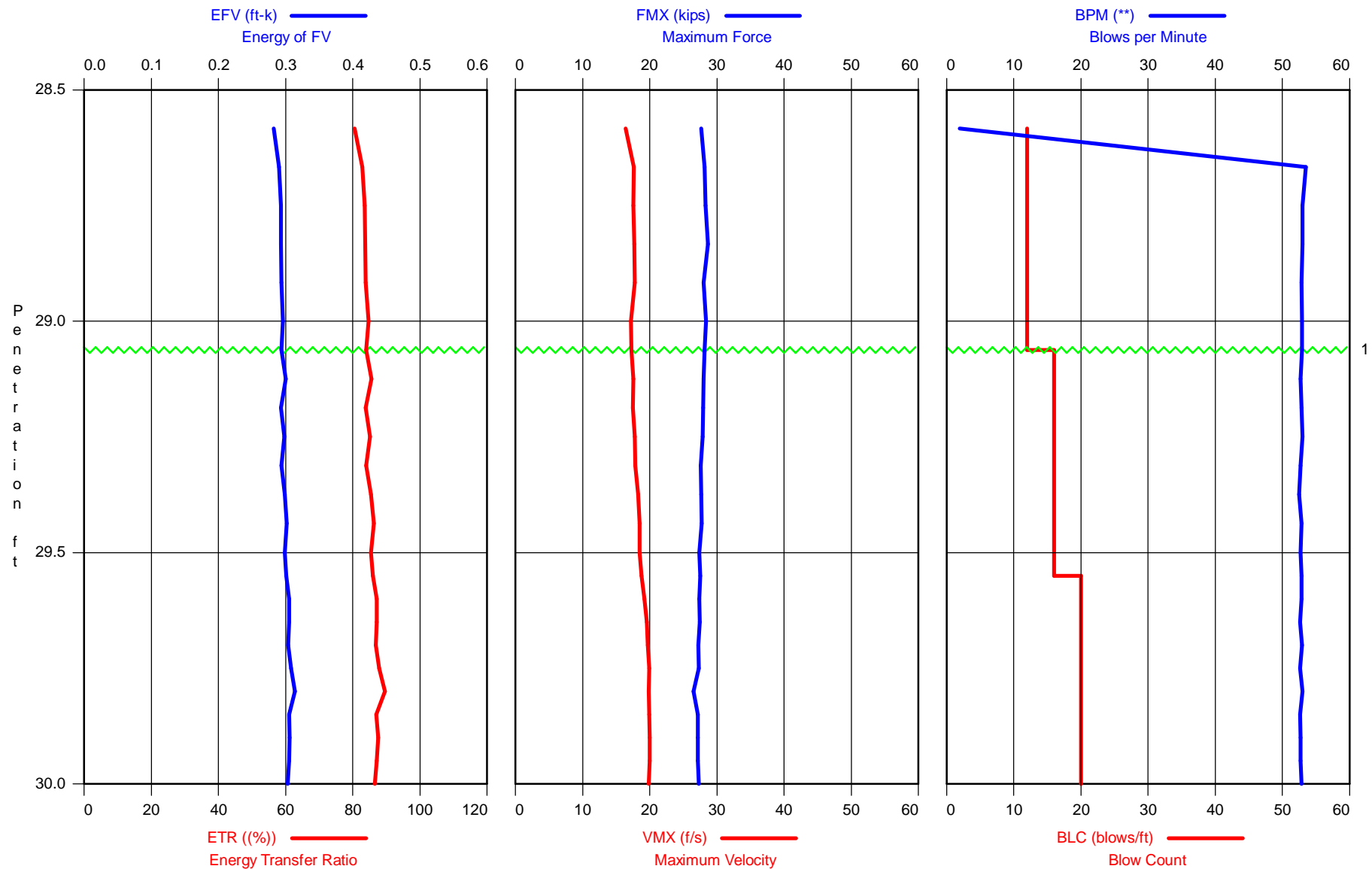

Garland Likins, Senior Partner
Pile Dynamics, Inc.

No. 2181

APPENDIX C

Dynamic Energy Measurement Results

F & ME SPT Calibration - Boring 1 Sample 1
CME 550X S/N 249533, AW-J Rod



F & ME SPT Calibration - Boring 1 Sample 1
OP: MR

CME 550X S/N 249533, AW-J Rod
Test date: 30-Mar-2017

AR: 1.19 in² SP: 0.492 k/ft³
LE: 34.00 ft EM: 30,000 ksi
WS: 16,807.9 f/s JC: 0.00

EFV: Energy of FV BPM: Blows per Minute
ETR: Energy Transfer Ratio DMX: Maximum Displacement
FMX: Maximum Force DFN: Final Displacement
VMX: Maximum Velocity CSX: Max Measured Compr. Stress

BL#	BLC	EFV	ETR	FMX	VMX	BPM	DMX	DFN	CSX
	bl/ft	ft-k	(%)	kips	f/s	**	in	in	ksi
7	16	0.294	84.0	28.2	17.3	52.9	1.06	0.75	23.7
8	16	0.300	85.6	28.0	17.6	52.7	1.06	0.75	23.5
9	16	0.293	83.9	27.9	17.5	52.8	1.00	0.75	23.5
10	16	0.298	85.1	27.9	17.8	53.0	1.03	0.75	23.4
11	16	0.294	84.1	27.6	17.8	52.7	0.94	0.75	23.2
12	16	0.299	85.4	27.7	18.3	52.5	0.89	0.75	23.3
13	16	0.302	86.3	27.8	18.5	52.8	0.90	0.75	23.3
14	16	0.299	85.4	27.4	18.5	52.7	0.86	0.75	23.0
15	20	0.301	86.0	27.5	18.8	52.8	0.81	0.60	23.1
16	20	0.305	87.2	27.4	19.2	52.8	0.79	0.60	23.0
17	20	0.305	87.1	27.5	19.6	52.6	0.75	0.60	23.1
18	20	0.304	86.8	27.2	19.7	52.9	0.74	0.60	22.9
19	20	0.308	87.9	27.3	19.9	52.6	0.77	0.60	23.0
20	20	0.314	89.6	26.5	19.8	53.0	0.82	0.60	22.3
21	20	0.305	87.0	27.1	19.9	52.6	0.69	0.60	22.8
22	20	0.306	87.5	27.2	20.0	52.7	0.66	0.60	22.9
23	20	0.305	87.1	27.2	20.0	52.7	0.63	0.60	22.8
24	20	0.303	86.6	27.3	19.8	52.8	0.61	0.60	22.9
Average		0.302	86.3	27.5	18.9	52.8	0.83	0.67	23.1
Std. Dev.		0.005	1.5	0.4	1.0	0.1	0.14	0.07	0.3
Maximum		0.314	89.6	28.2	20.0	53.0	1.06	0.75	23.7
Minimum		0.293	83.9	26.5	17.3	52.5	0.61	0.60	22.3

Total number of blows analyzed: 18

BL# Comments
7 Start of N value blows

Time Summary

Drive 27 seconds

9:28:50 AM - 9:29:17 AM (3/30/2017) BN 1 - 24

F & ME SPT Calibration - Boring 1 Sample 1
OP: MR

CME 550X S/N 249533, AW-J Rod
Test date: 30-Mar-2017

AR: 1.19 in² SP: 0.492 k/ft³
LE: 34.00 ft EM: 30,000 ksi
WS: 16,807.9 f/s JC: 0.00

EFV: Energy of FV BPM: Blows per Minute
ETR: Energy Transfer Ratio DMX: Maximum Displacement
FMX: Maximum Force DFN: Final Displacement
VMX: Maximum Velocity CSX: Max Measured Compr. Stress

BL#	depth	BLC	TYPE	EFV	ETR	FMX	VMX	BPM	DMX	DFN	CSX
end	ft	bl/ft		ft-k	(%)	kips	f/s	**	in	in	ksi
6	29.00	12	AV6	0.291	83.2	28.2	17.4	44.5	1.14	1.00	23.7
			STD	0.005	1.3	0.3	0.5	19.1	0.05	0.00	0.3
			MAX	0.296	84.7	28.7	17.7	53.5	1.22	1.00	24.1
			MIN	0.282	80.6	27.7	16.4	1.9	1.10	1.00	23.3
14	29.50	16	AV8	0.297	85.0	27.8	17.9	52.8	0.97	0.75	23.4
			STD	0.003	0.8	0.2	0.4	0.1	0.07	0.00	0.2
			MAX	0.302	86.3	28.2	18.5	53.0	1.06	0.75	23.7
			MIN	0.293	83.9	27.4	17.3	52.5	0.86	0.75	23.0
24	30.00	20	AV10	0.306	87.3	27.2	19.7	52.8	0.73	0.60	22.9
			STD	0.003	0.9	0.3	0.4	0.1	0.07	0.00	0.2
			MAX	0.314	89.6	27.5	20.0	53.0	0.82	0.60	23.1
			MIN	0.301	86.0	26.5	18.8	52.6	0.61	0.60	22.3
			Average	0.299	85.5	27.7	18.5	50.7	0.91	0.75	23.2
			Std. Dev.	0.007	1.9	0.5	1.1	10.2	0.18	0.16	0.4
			Maximum	0.314	89.6	28.7	20.0	53.5	1.22	1.00	24.1
			Minimum	0.282	80.6	26.5	16.4	1.9	0.61	0.60	22.3

Total number of blows analyzed: 24

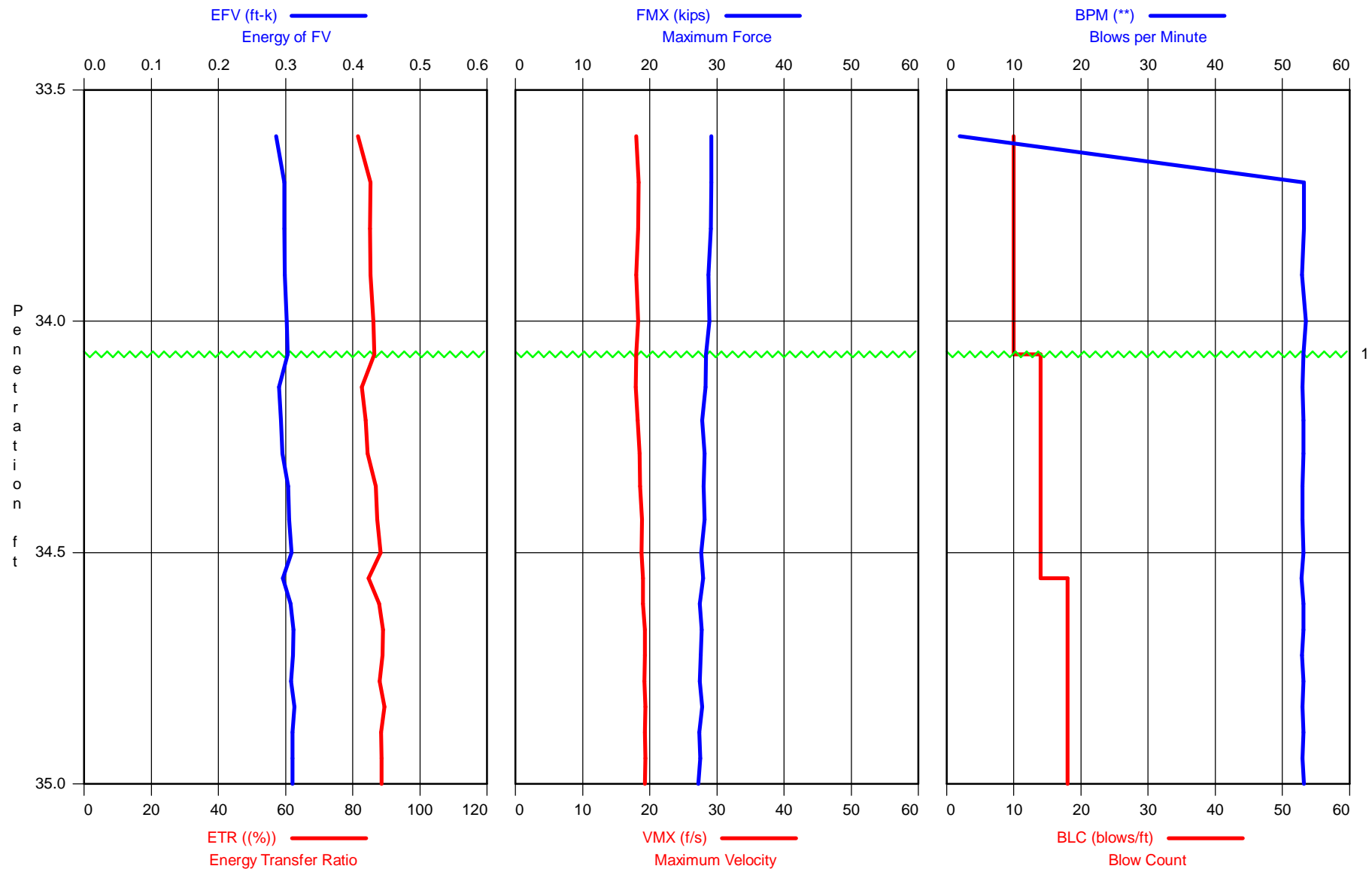
BL#	depth (ft)	Comments
7	29.06	Start of N value blows

Time Summary

Drive 27 seconds

9:28:50 AM - 9:29:17 AM (3/30/2017) BN 1 - 24

F & ME SPT Calibration - Boring 1 Sample 2
CME 550X S/N 249533, AW-J Rod



F & ME SPT Calibration - Boring 1 Sample 2
OP: MR

CME 550X S/N 249533, AW-J Rod
Test date: 30-Mar-2017

AR: 1.19 in² SP: 0.492 k/ft³
LE: 39.00 ft EM: 30,000 ksi
WS: 16,807.9 f/s JC: 0.00

EFV: Energy of FV BPM: Blows per Minute
ETR: Energy Transfer Ratio DMX: Maximum Displacement
FMX: Maximum Force DFN: Final Displacement
VMX: Maximum Velocity CSX: Max Measured Compr. Stress

BL#	BLC	EFV	ETR	FMX	VMX	BPM	DMX	DFN	CSX
	bl/ft	ft-k	(%)	kips	f/s	**	in	in	ksi
6	14	0.303	86.4	28.4	18.0	53.1	1.15	0.86	23.9
7	14	0.290	82.8	28.3	17.9	53.0	0.96	0.86	23.8
8	14	0.293	83.8	27.8	18.2	53.1	0.87	0.86	23.4
9	14	0.295	84.4	28.2	18.5	53.1	0.86	0.86	23.7
10	14	0.304	86.8	28.0	18.6	53.0	0.86	0.86	23.6
11	14	0.305	87.3	28.1	18.9	53.0	0.87	0.86	23.6
12	14	0.309	88.2	27.6	18.8	53.1	0.91	0.86	23.2
13	18	0.296	84.7	28.0	19.0	52.8	0.76	0.66	23.5
14	18	0.307	87.9	27.4	19.0	53.1	0.83	0.67	23.1
15	18	0.312	89.0	27.7	19.3	53.1	0.80	0.67	23.3
16	18	0.311	88.9	27.6	19.3	52.9	0.79	0.67	23.2
17	18	0.308	88.0	27.4	19.2	53.1	0.76	0.67	23.0
18	18	0.313	89.5	27.8	19.4	53.0	0.78	0.67	23.3
19	18	0.310	88.5	27.4	19.2	53.1	0.76	0.67	23.0
20	18	0.310	88.6	27.5	19.4	53.0	0.75	0.67	23.1
21	18	0.310	88.6	27.2	19.2	53.2	0.71	0.67	22.9
Average		0.305	87.1	27.8	18.9	53.0	0.84	0.75	23.4
Std. Dev.		0.007	2.0	0.3	0.5	0.1	0.10	0.09	0.3
Maximum		0.313	89.5	28.4	19.4	53.2	1.15	0.86	23.9
Minimum		0.290	82.8	27.2	17.9	52.8	0.71	0.66	22.9

Total number of blows analyzed: 16

BL# Comments
6 Start of N value blows

Time Summary

Drive 23 seconds

9:38:01 AM - 9:38:24 AM (3/30/2017) BN 1 - 21

F & ME SPT Calibration - Boring 1 Sample 2
OP: MR

CME 550X S/N 249533, AW-J Rod
Test date: 30-Mar-2017

AR: 1.19 in² SP: 0.492 k/ft³
LE: 39.00 ft EM: 30,000 ksi
WS: 16,807.9 f/s JC: 0.00

EFV: Energy of FV BPM: Blows per Minute
ETR: Energy Transfer Ratio DMX: Maximum Displacement
FMX: Maximum Force DFN: Final Displacement
VMX: Maximum Velocity CSX: Max Measured Compr. Stress

BL#	depth	BLC	TYPE	EFV	ETR	FMX	VMX	BPM	DMX	DFN	CSX
end	ft	bl/ft		ft-k	(%)	kips	f/s	**	in	in	ksi
5	34.00	10	AV5	0.297	84.7	29.0	18.2	42.9	1.22	1.20	24.4
			STD	0.005	1.6	0.2	0.1	20.5	0.03	0.00	0.1
			MAX	0.302	86.2	29.2	18.3	53.5	1.27	1.20	24.5
			MIN	0.286	81.6	28.8	18.0	1.9	1.20	1.20	24.2
12	34.50	14	AV7	0.300	85.7	28.1	18.4	53.1	0.92	0.86	23.6
			STD	0.007	1.9	0.3	0.3	0.0	0.10	0.00	0.2
			MAX	0.309	88.2	28.4	18.9	53.1	1.15	0.86	23.9
			MIN	0.290	82.8	27.6	17.9	53.0	0.86	0.86	23.2
21	35.00	18	AV9	0.309	88.2	27.6	19.2	53.0	0.77	0.67	23.2
			STD	0.005	1.3	0.2	0.1	0.1	0.03	0.00	0.2
			MAX	0.313	89.5	28.0	19.4	53.2	0.83	0.67	23.5
			MIN	0.296	84.7	27.2	19.0	52.8	0.71	0.66	22.9
			Average	0.303	86.5	28.1	18.7	50.6	0.93	0.86	23.6
			Std. Dev.	0.008	2.2	0.6	0.5	10.9	0.19	0.21	0.5
			Maximum	0.313	89.5	29.2	19.4	53.5	1.27	1.20	24.5
			Minimum	0.286	81.6	27.2	17.9	1.9	0.71	0.66	22.9

Total number of blows analyzed: 21

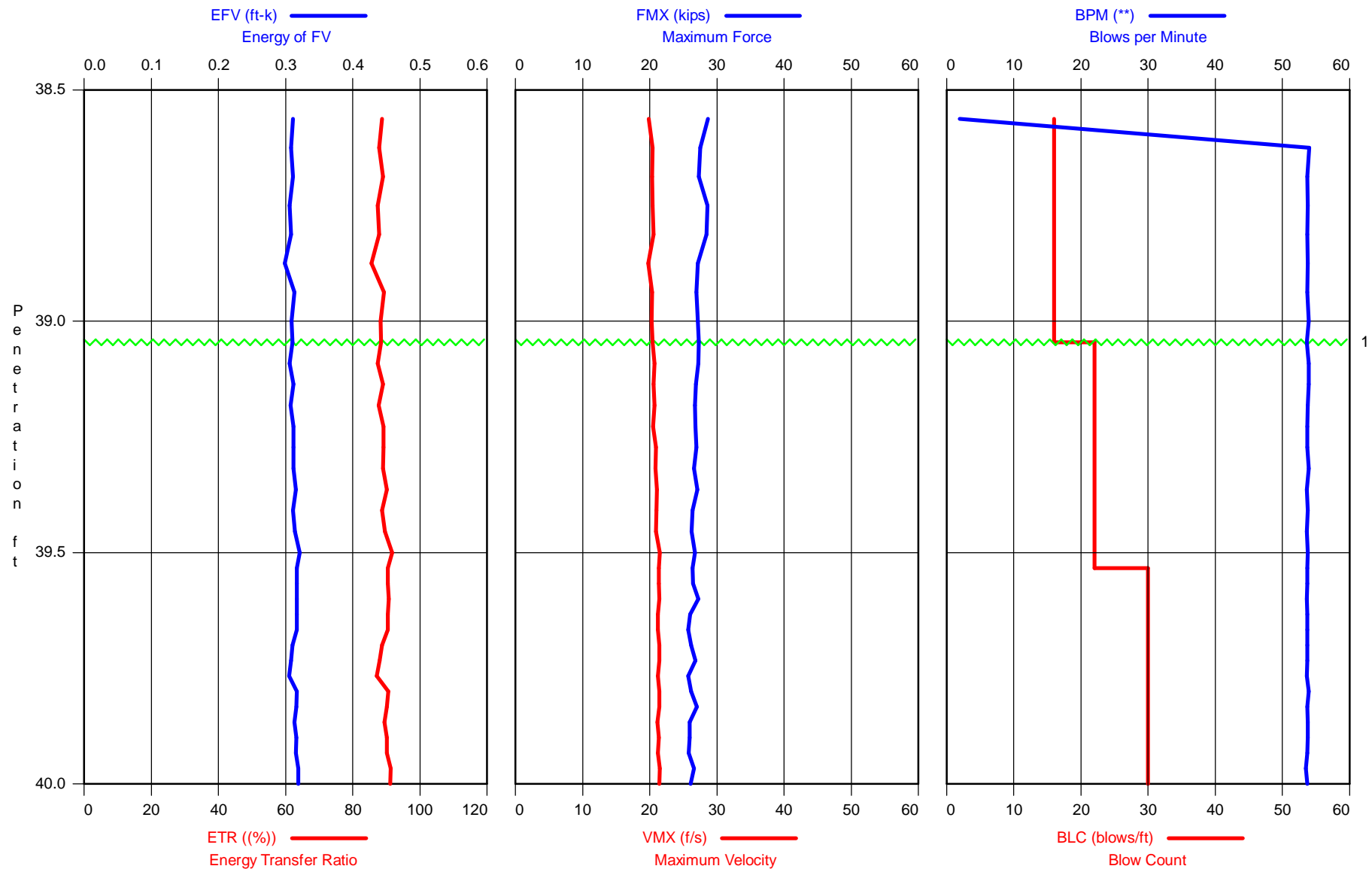
BL#	depth (ft)	Comments
6	34.07	Start of N value blows

Time Summary

Drive 23 seconds

9:38:01 AM - 9:38:24 AM (3/30/2017) BN 1 - 21

F & ME SPT Calibration - Boring 1 Sample 3
CME 550X S/N 249533, AW-J Rod



F & ME SPT Calibration - Boring 1 Sample 3
OP: MR

CME 550X S/N 249533, AW-J Rod
Test date: 30-Mar-2017

AR: 1.19 in² SP: 0.492 k/ft³
LE: 44.00 ft EM: 30,000 ksi
WS: 16,807.9 f/s JC: 0.00

EFV: Energy of FV BPM: Blows per Minute
ETR: Energy Transfer Ratio DMX: Maximum Displacement
FMX: Maximum Force DFN: Final Displacement
VMX: Maximum Velocity CSX: Max Measured Compr. Stress

BL#	BLC bl/ft	EFV ft-k	ETR (%)	FMX kips	VMX f/s	BPM **	DMX in	DFN in	CSX ksi
9	22	0.310	88.5	27.3	20.4	53.6	0.62	0.55	22.9
10	22	0.306	87.4	27.3	20.7	53.9	0.66	0.54	22.9
11	22	0.312	89.1	26.9	20.6	53.9	0.71	0.55	22.6
12	22	0.307	87.7	26.7	20.7	53.8	0.62	0.54	22.5
13	22	0.312	89.2	26.8	20.5	53.7	0.68	0.55	22.5
14	22	0.312	89.1	27.0	20.9	53.7	0.64	0.55	22.7
15	22	0.312	89.0	26.6	20.9	53.9	0.61	0.55	22.3
16	22	0.315	90.1	27.1	21.0	53.6	0.61	0.55	22.8
17	22	0.311	88.8	26.4	21.0	53.8	0.58	0.55	22.2
18	22	0.314	89.6	26.3	20.9	53.6	0.59	0.55	22.1
19	22	0.321	91.7	26.7	21.5	53.8	0.61	0.55	22.4
20	30	0.317	90.4	26.4	21.3	53.7	0.56	0.40	22.1
21	30	0.317	90.5	26.5	21.3	53.7	0.55	0.40	22.2
22	30	0.317	90.7	27.2	21.4	53.6	0.55	0.40	22.9
23	30	0.317	90.4	26.0	21.2	53.7	0.55	0.40	21.8
24	30	0.317	90.4	25.7	21.2	53.7	0.55	0.40	21.6
25	30	0.310	88.7	26.2	21.4	53.7	0.50	0.40	22.0
26	30	0.308	88.0	26.8	21.4	53.7	0.49	0.40	22.5
27	30	0.305	87.1	25.7	21.2	53.6	0.48	0.40	21.6
28	30	0.317	90.6	26.1	21.4	53.9	0.52	0.40	22.0
29	30	0.316	90.2	27.0	21.4	53.7	0.51	0.40	22.7
30	30	0.313	89.4	25.9	21.2	53.8	0.50	0.40	21.8
31	30	0.316	90.2	25.9	21.3	53.8	0.50	0.40	21.8
32	30	0.315	90.1	25.8	21.2	53.7	0.50	0.40	21.7
33	30	0.319	91.2	26.6	21.5	53.5	0.50	0.40	22.3
34	30	0.319	91.2	26.1	21.4	53.7	0.50	0.40	21.9
Average		0.314	89.6	26.5	21.1	53.7	0.57	0.46	22.3
Std. Dev.		0.004	1.2	0.5	0.3	0.1	0.06	0.07	0.4
Maximum		0.321	91.7	27.3	21.5	53.9	0.71	0.55	22.9
Minimum		0.305	87.1	25.7	20.4	53.5	0.48	0.40	21.6

Total number of blows analyzed: 26

BL# Comments
9 Start of N value blows

Time Summary

Drive 37 seconds

9:44:24 AM - 9:45:01 AM (3/30/2017) BN 1 - 34

F & ME SPT Calibration - Boring 1 Sample 3
OP: MR

CME 550X S/N 249533, AW-J Rod
Test date: 30-Mar-2017

AR: 1.19 in² SP: 0.492 k/ft³
LE: 44.00 ft EM: 30,000 ksi
WS: 16,807.9 f/s JC: 0.00

EFV: Energy of FV BPM: Blows per Minute
ETR: Energy Transfer Ratio DMX: Maximum Displacement
FMX: Maximum Force DFN: Final Displacement
VMX: Maximum Velocity CSX: Max Measured Compr. Stress

BL#	depth	BLC	TYPE	EFV	ETR	FMX	VMX	BPM	DMX	DFN	CSX
end	ft	bl/ft		ft-k	(%)	kips	f/s	**	in	in	ksi
8	39.00	16	AV8	0.308	88.0	27.7	20.2	47.3	0.79	0.75	23.3
			STD	0.004	1.1	0.7	0.3	17.2	0.03	0.00	0.6
			MAX	0.313	89.3	28.7	20.5	54.0	0.85	0.75	24.1
			MIN	0.299	85.6	26.9	19.7	1.9	0.75	0.75	22.6
19	39.50	22	AV11	0.312	89.1	26.8	20.8	53.8	0.63	0.54	22.5
			STD	0.004	1.1	0.3	0.3	0.1	0.04	0.00	0.3
			MAX	0.321	91.7	27.3	21.5	53.9	0.71	0.55	22.9
			MIN	0.306	87.4	26.3	20.4	53.6	0.58	0.54	22.1
34	40.00	30	AV15	0.315	89.9	26.3	21.3	53.7	0.52	0.40	22.1
			STD	0.004	1.1	0.5	0.1	0.1	0.02	0.00	0.4
			MAX	0.319	91.2	27.2	21.5	53.9	0.56	0.40	22.9
			MIN	0.305	87.1	25.7	21.2	53.5	0.48	0.40	21.6
			Average	0.312	89.2	26.8	20.9	52.2	0.62	0.53	22.5
			Std. Dev.	0.005	1.3	0.7	0.5	8.8	0.11	0.14	0.6
			Maximum	0.321	91.7	28.7	21.5	54.0	0.85	0.75	24.1
			Minimum	0.299	85.6	25.7	19.7	1.9	0.48	0.40	21.6

Total number of blows analyzed: 34

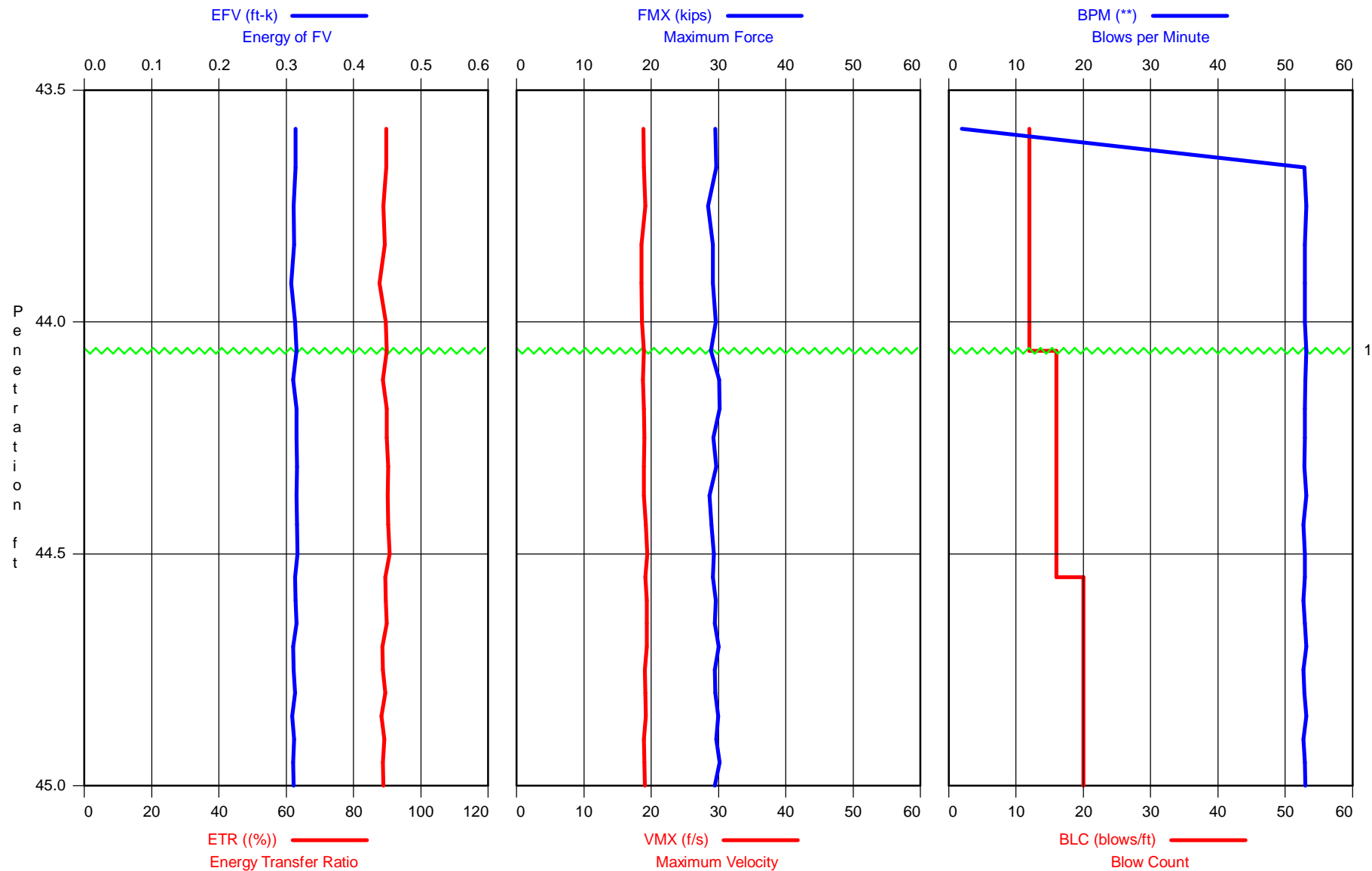
BL#	depth (ft)	Comments
9	39.05	Start of N value blows

Time Summary

Drive 37 seconds

9:44:24 AM - 9:45:01 AM (3/30/2017) BN 1 - 34

F & ME SPT Calibration - Boring 1 Sample 4
CME 550X S/N 249533, AW-J Rod



F & ME SPT Calibration - Boring 1 Sample 4
OP: MR

CME 550X S/N 249533, AW-J Rod
Test date: 30-Mar-2017

AR: 1.19 in² SP: 0.492 k/ft³
LE: 49.00 ft EM: 30,000 ksi
WS: 16,807.9 f/s JC: 0.00

EFV: Energy of FV BPM: Blows per Minute
ETR: Energy Transfer Ratio DMX: Maximum Displacement
FMX: Maximum Force DFN: Final Displacement
VMX: Maximum Velocity CSX: Max Measured Compr. Stress

BL#	BLC	EFV	ETR	FMX	VMX	BPM	DMX	DFN	CSX
	bl/ft	ft-k	(%)	kips	f/s	**	in	in	ksi
7	16	0.315	89.9	28.9	19.0	53.1	0.97	0.75	24.3
8	16	0.310	88.7	30.1	18.8	53.0	0.89	0.75	25.3
9	16	0.315	89.9	30.2	18.9	52.9	0.93	0.75	25.4
10	16	0.315	89.9	29.2	19.0	52.9	0.91	0.75	24.6
11	16	0.316	90.3	29.7	18.9	52.8	0.91	0.75	24.9
12	16	0.315	90.1	28.7	18.9	53.1	0.90	0.75	24.1
13	16	0.316	90.2	29.0	19.2	52.7	0.88	0.75	24.3
14	16	0.317	90.7	29.3	19.4	52.9	0.88	0.75	24.6
15	20	0.313	89.4	29.2	19.1	52.9	0.80	0.60	24.5
16	20	0.314	89.6	29.6	19.4	52.7	0.73	0.60	24.9
17	20	0.315	89.9	29.5	19.3	52.9	0.73	0.60	24.8
18	20	0.310	88.6	30.1	19.3	53.1	0.66	0.60	25.3
19	20	0.311	88.7	29.5	19.0	52.7	0.69	0.60	24.8
20	20	0.313	89.4	29.5	19.2	52.8	0.68	0.60	24.8
21	20	0.309	88.4	29.9	19.2	53.1	0.63	0.60	25.1
22	20	0.312	89.2	29.7	19.0	52.7	0.64	0.60	25.0
23	20	0.310	88.6	30.2	19.0	52.9	0.63	0.60	25.4
24	20	0.311	88.9	29.5	19.1	53.0	0.62	0.60	24.8
Average		0.313	89.5	29.5	19.1	52.9	0.78	0.67	24.8
Std. Dev.		0.002	0.7	0.4	0.2	0.1	0.12	0.07	0.4
Maximum		0.317	90.7	30.2	19.4	53.1	0.97	0.75	25.4
Minimum		0.309	88.4	28.7	18.8	52.7	0.62	0.60	24.1

Total number of blows analyzed: 18

BL# Comments
7 Start of N value blows

Time Summary

Drive 26 seconds

9:50:57 AM - 9:51:23 AM (3/30/2017) BN 1 - 24

F & ME SPT Calibration - Boring 1 Sample 4
OP: MR

CME 550X S/N 249533, AW-J Rod
Test date: 30-Mar-2017

AR: 1.19 in² SP: 0.492 k/ft³
LE: 49.00 ft EM: 30,000 ksi
WS: 16,807.9 f/s JC: 0.00

EFV: Energy of FV BPM: Blows per Minute
ETR: Energy Transfer Ratio DMX: Maximum Displacement
FMX: Maximum Force DFN: Final Displacement
VMX: Maximum Velocity CSX: Max Measured Compr. Stress

BL#	depth	BLC	TYPE	EFV	ETR	FMX	VMX	BPM	DMX	DFN	CSX
end	ft	bl/ft		ft-k	(%)	kips	f/s	**	in	in	ksi
6	44.00	12	AV6	0.312	89.1	29.3	18.8	44.4	1.17	1.00	24.6
			STD	0.002	0.7	0.4	0.2	19.0	0.09	0.00	0.4
			MAX	0.314	89.7	29.6	19.1	53.1	1.30	1.00	24.9
			MIN	0.307	87.8	28.4	18.6	1.9	1.08	1.00	23.9
14	44.50	16	AV8	0.315	90.0	29.4	19.0	52.9	0.91	0.75	24.7
			STD	0.002	0.5	0.5	0.2	0.1	0.03	0.00	0.4
			MAX	0.317	90.7	30.2	19.4	53.1	0.97	0.75	25.4
			MIN	0.310	88.7	28.7	18.8	52.7	0.88	0.75	24.1
24	45.00	20	AV10	0.312	89.1	29.7	19.2	52.9	0.68	0.60	24.9
			STD	0.002	0.5	0.3	0.1	0.1	0.06	0.00	0.2
			MAX	0.315	89.9	30.2	19.4	53.1	0.80	0.60	25.4
			MIN	0.309	88.4	29.2	19.0	52.7	0.62	0.60	24.5
			Average	0.313	89.4	29.5	19.0	50.8	0.88	0.75	24.8
			Std. Dev.	0.002	0.7	0.4	0.2	10.2	0.20	0.16	0.4
			Maximum	0.317	90.7	30.2	19.4	53.1	1.30	1.00	25.4
			Minimum	0.307	87.8	28.4	18.6	1.9	0.62	0.60	23.9

Total number of blows analyzed: 24

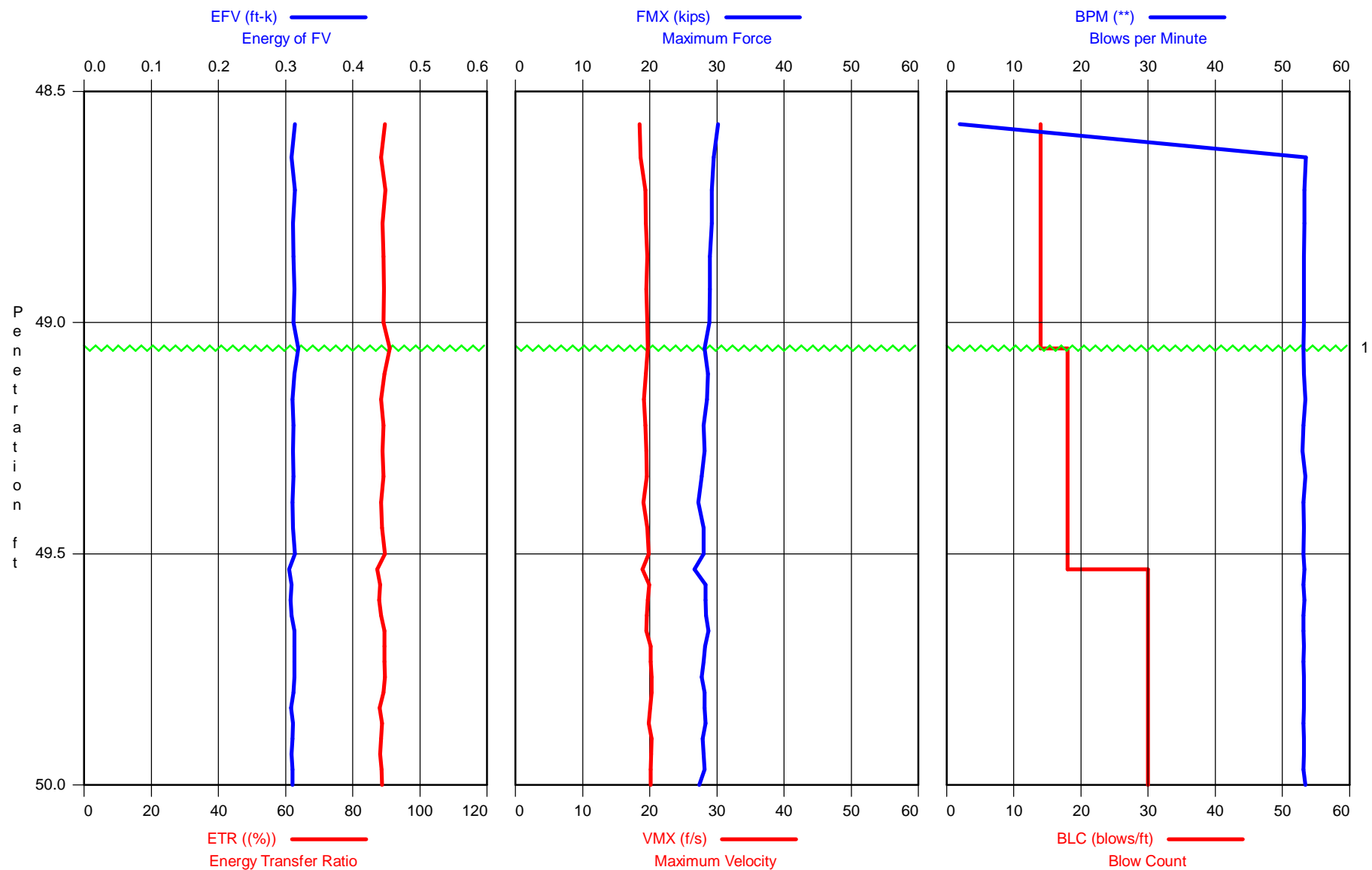
BL#	depth (ft)	Comments
7	44.06	Start of N value blows

Time Summary

Drive 26 seconds

9:50:57 AM - 9:51:23 AM (3/30/2017) BN 1 - 24

F & ME SPT Calibration - Boring 1 Sample 5
CME 550X S/N 249533, AW-J Rod



F & ME SPT Calibration - Boring 1 Sample 5
OP: MR

CME 550X S/N 249533, AW-J Rod
Test date: 30-Mar-2017

AR: 1.19 in² SP: 0.492 k/ft³
LE: 54.00 ft EM: 30,000 ksi
WS: 16,807.9 f/s JC: 0.00

EFV: Energy of FV BPM: Blows per Minute
ETR: Energy Transfer Ratio DMX: Maximum Displacement
FMX: Maximum Force DFN: Final Displacement
VMX: Maximum Velocity CSX: Max Measured Compr. Stress

BL#	BLC bl/ft	EFV ft-k	ETR (%)	FMX kips	VMX f/s	BPM **	DMX in	DFN in	CSX ksi
8	18	0.319	91.1	28.1	19.7	53.1	0.90	0.67	23.7
9	18	0.313	89.5	28.7	19.5	53.2	0.84	0.67	24.1
10	18	0.310	88.4	28.5	19.1	53.4	0.82	0.67	24.0
11	18	0.312	89.1	28.0	19.4	53.1	0.81	0.67	23.5
12	18	0.311	88.9	28.2	19.5	53.0	0.80	0.67	23.7
13	18	0.312	89.1	27.8	19.5	53.4	0.78	0.67	23.3
14	18	0.310	88.5	27.2	19.1	53.1	0.70	0.67	22.9
15	18	0.311	88.8	28.0	19.6	53.2	0.67	0.67	23.5
16	18	0.314	89.6	28.0	19.9	53.1	0.67	0.67	23.6
17	30	0.305	87.3	26.7	19.0	53.3	0.56	0.40	22.4
18	30	0.309	88.2	28.3	19.9	53.1	0.54	0.40	23.8
19	30	0.307	87.8	28.3	19.7	53.3	0.53	0.40	23.8
20	30	0.309	88.4	28.4	19.5	53.1	0.53	0.40	23.9
21	30	0.313	89.4	28.7	19.5	53.1	0.53	0.40	24.1
22	30	0.313	89.4	28.3	20.2	53.2	0.52	0.40	23.7
23	30	0.313	89.4	28.0	20.2	53.1	0.52	0.40	23.6
24	30	0.313	89.6	27.7	20.3	53.2	0.52	0.40	23.3
25	30	0.312	89.1	28.1	20.3	53.2	0.50	0.40	23.7
26	30	0.308	88.0	28.2	20.1	53.2	0.49	0.40	23.7
27	30	0.311	88.8	28.3	19.9	53.1	0.50	0.40	23.8
28	30	0.310	88.5	27.9	20.3	53.2	0.49	0.40	23.5
29	30	0.309	88.2	28.0	20.2	53.2	0.47	0.40	23.5
30	30	0.310	88.5	28.2	20.1	53.1	0.47	0.40	23.7
31	30	0.310	88.7	27.4	20.2	53.4	0.47	0.40	23.0
Average		0.311	88.8	28.0	19.8	53.2	0.61	0.50	23.6
Std. Dev.		0.003	0.8	0.5	0.4	0.1	0.14	0.13	0.4
Maximum		0.319	91.1	28.7	20.3	53.4	0.90	0.67	24.1
Minimum		0.305	87.3	26.7	19.0	53.0	0.47	0.40	22.4

Total number of blows analyzed: 24

BL# Comments
8 Start of N value blows

Time Summary

Drive 34 seconds

9:59:20 AM - 9:59:54 AM (3/30/2017) BN 1 - 31

F & ME SPT Calibration - Boring 1 Sample 5
OP: MR

CME 550X S/N 249533, AW-J Rod
Test date: 30-Mar-2017

AR: 1.19 in² SP: 0.492 k/ft³
LE: 54.00 ft EM: 30,000 ksi
WS: 16,807.9 f/s JC: 0.00

EFV: Energy of FV BPM: Blows per Minute
ETR: Energy Transfer Ratio DMX: Maximum Displacement
FMX: Maximum Force DFN: Final Displacement
VMX: Maximum Velocity CSX: Max Measured Compr. Stress

BL#	depth	BLC	TYPE	EFV	ETR	FMX	VMX	BPM	DMX	DFN	CSX
end	ft	bl/ft		ft-k	(%)	kips	f/s	**	in	in	ksi
7	49.00	14	AV7	0.312	89.2	29.3	19.2	45.9	0.97	0.86	24.6
			STD	0.002	0.4	0.4	0.4	18.0	0.03	0.00	0.3
			MAX	0.314	89.7	30.1	19.7	53.5	1.01	0.86	25.3
			MIN	0.309	88.4	28.9	18.5	1.9	0.94	0.86	24.3
16	49.50	18	AV9	0.312	89.2	28.1	19.5	53.2	0.78	0.67	23.6
			STD	0.003	0.8	0.4	0.2	0.1	0.08	0.00	0.3
			MAX	0.319	91.1	28.7	19.9	53.4	0.90	0.67	24.1
			MIN	0.310	88.4	27.2	19.1	53.0	0.67	0.67	22.9
31	50.00	30	AV15	0.310	88.6	28.0	19.9	53.2	0.51	0.40	23.6
			STD	0.002	0.7	0.5	0.4	0.1	0.03	0.00	0.4
			MAX	0.313	89.6	28.7	20.3	53.4	0.56	0.40	24.1
			MIN	0.305	87.3	26.7	19.0	53.1	0.47	0.40	22.4
			Average	0.311	88.9	28.3	19.7	51.5	0.69	0.58	23.8
			Std. Dev.	0.003	0.7	0.7	0.5	9.1	0.20	0.19	0.6
			Maximum	0.319	91.1	30.1	20.3	53.5	1.01	0.86	25.3
			Minimum	0.305	87.3	26.7	18.5	1.9	0.47	0.40	22.4

Total number of blows analyzed: 31

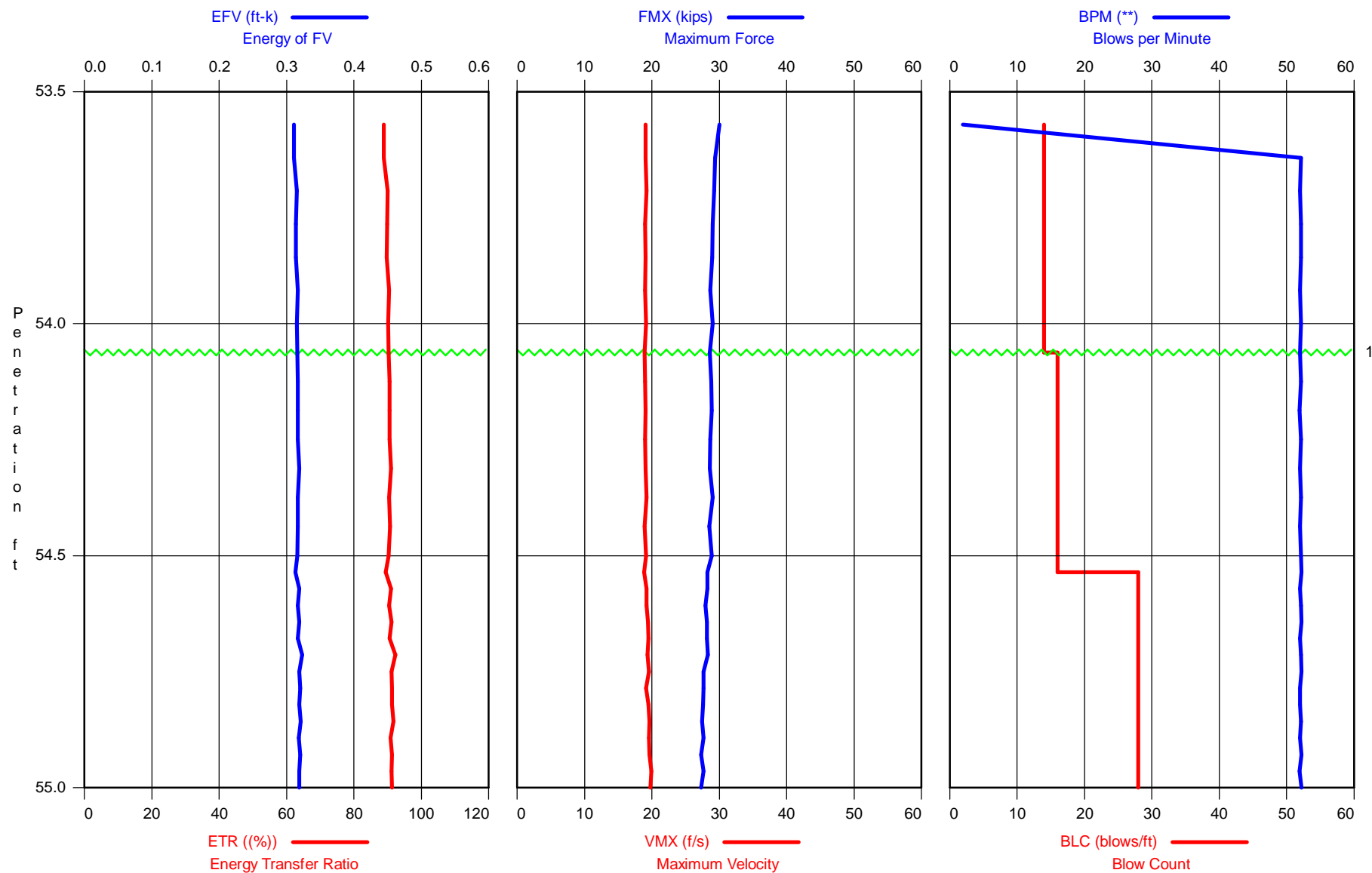
BL#	depth (ft)	Comments
8	49.06	Start of N value blows

Time Summary

Drive 34 seconds

9:59:20 AM - 9:59:54 AM (3/30/2017) BN 1 - 31

F & ME SPT Calibration - Boring 1 Sample 6
CME 550X S/N 249533, AW-J Rod



F & ME SPT Calibration - Boring 1 Sample 6
OP: MR

CME 550X S/N 249533, AW-J Rod
Test date: 30-Mar-2017

AR: 1.19 in² SP: 0.492 k/ft³
LE: 59.00 ft EM: 30,000 ksi
WS: 16,807.9 f/s JC: 0.00

EFV: Energy of FV BPM: Blows per Minute
ETR: Energy Transfer Ratio DMX: Maximum Displacement
FMX: Maximum Force DFN: Final Displacement
VMX: Maximum Velocity CSX: Max Measured Compr. Stress

BL#	BLC	EFV	ETR	FMX	VMX	BPM	DMX	DFN	CSX
	bl/ft	ft-k	(%)	kips	f/s	**	in	in	ksi
8	16	0.316	90.2	28.6	18.9	52.0	0.89	0.75	24.1
9	16	0.317	90.5	28.8	19.0	52.1	0.86	0.75	24.2
10	16	0.317	90.7	28.9	19.0	51.9	0.89	0.75	24.3
11	16	0.317	90.6	28.7	19.0	52.1	0.91	0.75	24.1
12	16	0.319	91.1	28.6	19.0	52.0	0.91	0.75	24.0
13	16	0.317	90.5	29.0	19.2	52.1	0.86	0.75	24.4
14	16	0.317	90.7	28.5	18.9	52.0	0.84	0.75	24.0
15	16	0.316	90.4	28.9	19.1	52.1	0.80	0.75	24.3
16	28	0.313	89.5	28.3	18.9	52.2	0.65	0.43	23.7
17	28	0.319	91.1	28.2	19.2	52.0	0.66	0.43	23.7
18	28	0.317	90.5	27.9	19.2	52.1	0.66	0.43	23.5
19	28	0.319	91.2	28.2	19.4	52.2	0.67	0.43	23.7
20	28	0.317	90.7	28.2	19.5	52.0	0.58	0.43	23.7
21	28	0.323	92.2	28.3	19.4	52.1	0.66	0.43	23.8
22	28	0.319	91.2	27.7	19.5	52.2	0.55	0.43	23.3
23	28	0.320	91.3	27.7	19.2	52.0	0.55	0.43	23.3
24	28	0.319	91.3	27.6	19.5	52.0	0.54	0.43	23.2
25	28	0.321	91.7	27.5	19.6	52.1	0.54	0.43	23.1
26	28	0.318	90.8	27.7	19.6	52.0	0.52	0.43	23.2
27	28	0.320	91.3	27.3	19.6	52.2	0.51	0.43	23.0
28	28	0.319	91.1	27.6	19.9	51.9	0.49	0.43	23.2
29	28	0.319	91.3	27.3	19.8	52.2	0.51	0.43	22.9
Average		0.318	90.9	28.2	19.3	52.1	0.68	0.55	23.7
Std. Dev.		0.002	0.6	0.5	0.3	0.1	0.15	0.15	0.4
Maximum		0.323	92.2	29.0	19.9	52.2	0.91	0.75	24.4
Minimum		0.313	89.5	27.3	18.9	51.9	0.49	0.43	22.9

Total number of blows analyzed: 22

BL# Comments
8 Start of N value blows

Time Summary

Drive 33 seconds

10:07:44 AM - 10:08:17 AM (3/30/2017) BN 1 - 29

F & ME SPT Calibration - Boring 1 Sample 6
OP: MR

CME 550X S/N 249533, AW-J Rod
Test date: 30-Mar-2017

AR: 1.19 in² SP: 0.492 k/ft³
LE: 59.00 ft EM: 30,000 ksi
WS: 16,807.9 f/s JC: 0.00

EFV: Energy of FV BPM: Blows per Minute
ETR: Energy Transfer Ratio DMX: Maximum Displacement
FMX: Maximum Force DFN: Final Displacement
VMX: Maximum Velocity CSX: Max Measured Compr. Stress

BL#	depth	BLC	TYPE	EFV	ETR	FMX	VMX	BPM	DMX	DFN	CSX
end	ft	bl/ft		ft-k	(%)	kips	f/s	**	in	in	ksi
7	54.00	14	AV7	0.314	89.7	29.2	19.1	44.9	0.99	0.86	24.5
			STD	0.002	0.6	0.4	0.1	17.6	0.04	0.00	0.3
			MAX	0.317	90.5	30.0	19.2	52.1	1.04	0.86	25.2
			MIN	0.311	88.8	28.7	19.0	1.9	0.93	0.86	24.1
15	54.50	16	AV8	0.317	90.6	28.8	19.0	52.0	0.87	0.75	24.2
			STD	0.001	0.2	0.2	0.1	0.1	0.04	0.00	0.1
			MAX	0.319	91.1	29.0	19.2	52.1	0.91	0.75	24.4
			MIN	0.316	90.2	28.5	18.9	51.9	0.80	0.75	24.0
29	55.00	28	AV14	0.319	91.1	27.8	19.4	52.1	0.58	0.43	23.4
			STD	0.002	0.6	0.3	0.3	0.1	0.06	0.00	0.3
			MAX	0.323	92.2	28.3	19.9	52.2	0.67	0.43	23.8
			MIN	0.313	89.5	27.3	18.9	51.9	0.49	0.43	22.9
			Average	0.317	90.6	28.4	19.2	50.3	0.76	0.62	23.9
			Std. Dev.	0.003	0.8	0.7	0.3	9.2	0.19	0.19	0.6
			Maximum	0.323	92.2	30.0	19.9	52.2	1.04	0.86	25.2
			Minimum	0.311	88.8	27.3	18.9	1.9	0.49	0.43	22.9

Total number of blows analyzed: 29

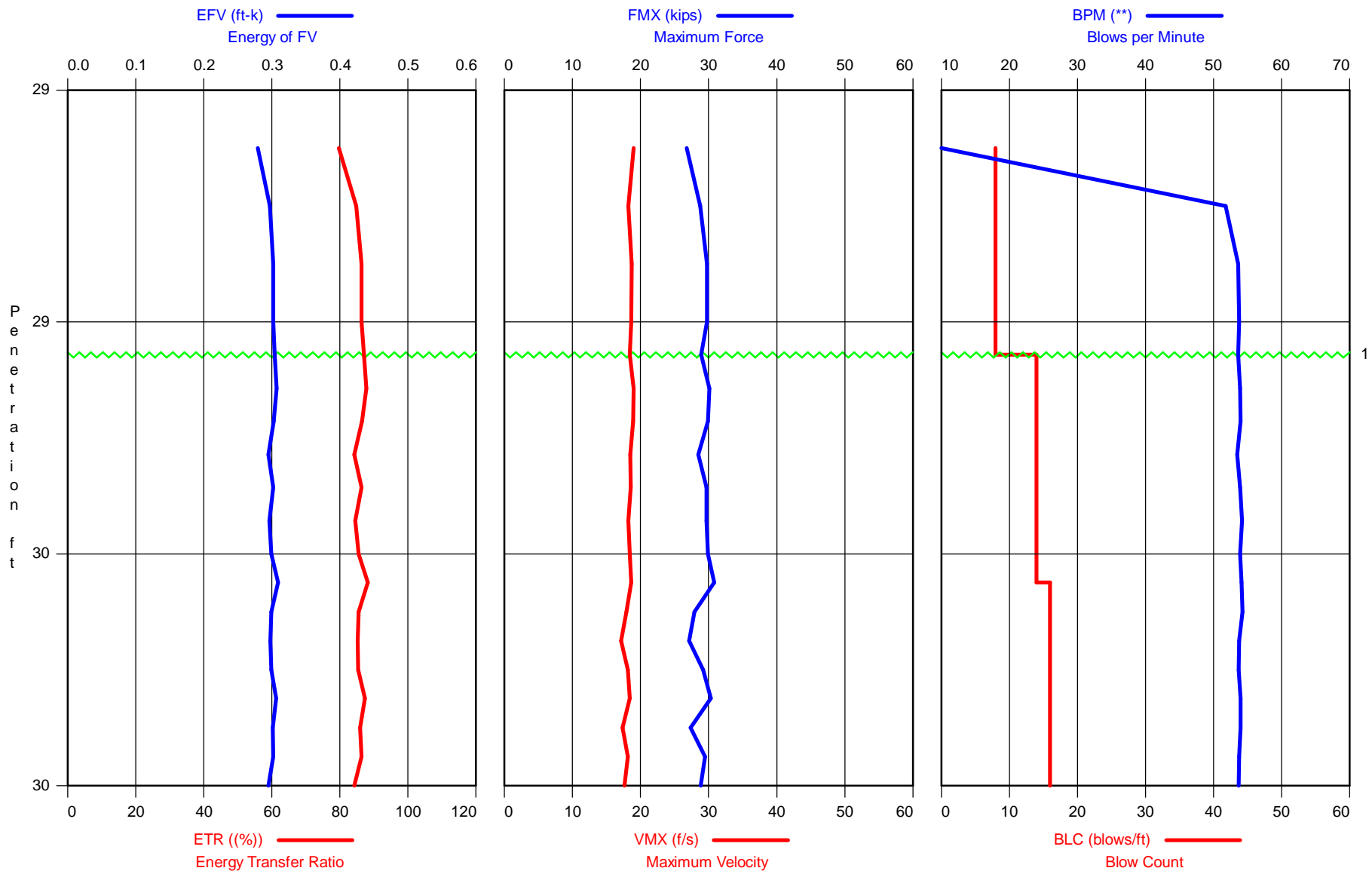
BL#	depth (ft)	Comments
8	54.06	Start of N value blows

Time Summary

Drive 33 seconds

10:07:44 AM - 10:08:17 AM (3/30/2017) BN 1 - 29

F & ME SPT Calibration - Boring 2 Sample 1
CME 45B S/N 303304, AW Rod



F & ME SPT Calibration - Boring 2 Sample 1
OP: MR

CME 45B S/N 303304, AW Rod
Test date: 30-Mar-2017

AR: 1.19 in² SP: 0.492 k/ft³
LE: 34.33 ft EM: 30,000 ksi
WS: 16,807.9 f/s JC: 0.00

EFV: Energy of FV BPM: Blows per Minute
ETR: Energy Transfer Ratio DMX: Maximum Displacement
FMX: Maximum Force DFN: Final Displacement
VMX: Maximum Velocity CSX: Max Measured Compr. Stress

BL#	BLC	EFV	ETR	FMX	VMX	BPM	DMX	DFN	CSX
	bl/ft	ft-k	(%)	kips	f/s	**	in	in	ksi
5	14	0.304	87.0	28.9	18.4	53.6	1.03	0.86	24.3
6	14	0.307	87.7	30.1	19.0	53.9	0.98	0.86	25.3
7	14	0.303	86.5	29.9	18.9	54.0	0.98	0.86	25.1
8	14	0.295	84.2	28.5	18.5	53.5	0.92	0.86	24.0
9	14	0.302	86.3	29.7	18.6	53.9	0.93	0.86	25.0
10	14	0.296	84.5	29.7	18.2	54.2	0.87	0.86	24.9
11	14	0.299	85.6	29.9	18.4	53.9	0.89	0.86	25.1
12	16	0.309	88.2	30.9	18.6	54.1	0.88	0.75	25.9
13	16	0.299	85.6	27.9	17.9	54.3	0.83	0.75	23.4
14	16	0.298	85.2	27.1	17.1	53.8	0.77	0.75	22.8
15	16	0.299	85.4	29.2	18.2	53.7	0.75	0.75	24.6
16	16	0.306	87.3	30.3	18.4	54.0	0.76	0.75	25.5
17	16	0.301	85.9	27.3	17.3	54.0	0.76	0.75	23.0
18	16	0.302	86.4	29.5	18.1	53.8	0.75	0.75	24.8
19	16	0.295	84.2	28.8	17.6	53.7	0.75	0.75	24.2
Average		0.301	86.0	29.2	18.2	53.9	0.86	0.80	24.5
Std. Dev.		0.004	1.2	1.0	0.5	0.2	0.09	0.05	0.9
Maximum		0.309	88.2	30.9	19.0	54.3	1.03	0.86	25.9
Minimum		0.295	84.2	27.1	17.1	53.5	0.75	0.75	22.8

Total number of blows analyzed: 15

BL# Comments
5 Start of N value blows

Time Summary

Drive 20 seconds

9:35:08 AM - 9:35:28 AM (3/30/2017) BN 1 - 19

F & ME SPT Calibration - Boring 2 Sample 1
OP: MR

CME 45B S/N 303304, AW Rod
Test date: 30-Mar-2017

AR: 1.19 in² SP: 0.492 k/ft³
LE: 34.33 ft EM: 30,000 ksi
WS: 16,807.9 f/s JC: 0.00

EFV: Energy of FV BPM: Blows per Minute
ETR: Energy Transfer Ratio DMX: Maximum Displacement
FMX: Maximum Force DFN: Final Displacement
VMX: Maximum Velocity CSX: Max Measured Compr. Stress

BL#	depth	BLC	TYPE	EFV	ETR	FMX	VMX	BPM	DMX	DFN	CSX
end	ft	bl/ft		ft-k	(%)	kips	f/s	**	in	in	ksi
4	29.00	8	AV4	0.295	84.3	28.8	18.6	40.3	1.70	1.50	24.2
			STD	0.009	2.7	1.2	0.3	22.2	0.30	0.00	1.0
			MAX	0.302	86.4	29.8	19.0	53.8	2.22	1.50	25.0
			MIN	0.279	79.7	26.7	18.2	1.9	1.50	1.50	22.5
11	29.50	14	AV7	0.301	86.0	29.5	18.6	53.9	0.94	0.86	24.8
			STD	0.004	1.2	0.5	0.3	0.2	0.05	0.00	0.5
			MAX	0.307	87.7	30.1	19.0	54.2	1.03	0.86	25.3
			MIN	0.295	84.2	28.5	18.2	53.5	0.87	0.86	24.0
19	30.00	16	AV8	0.301	86.0	28.9	17.9	53.9	0.78	0.75	24.3
			STD	0.004	1.2	1.3	0.5	0.2	0.04	0.00	1.1
			MAX	0.309	88.2	30.9	18.6	54.3	0.88	0.75	25.9
			MIN	0.295	84.2	27.1	17.1	53.7	0.75	0.75	22.8
			Average	0.300	85.6	29.1	18.3	51.0	1.03	0.95	24.4
			Std. Dev.	0.006	1.8	1.1	0.5	11.6	0.38	0.29	0.9
			Maximum	0.309	88.2	30.9	19.0	54.3	2.22	1.50	25.9
			Minimum	0.279	79.7	26.7	17.1	1.9	0.75	0.75	22.5

Total number of blows analyzed: 19

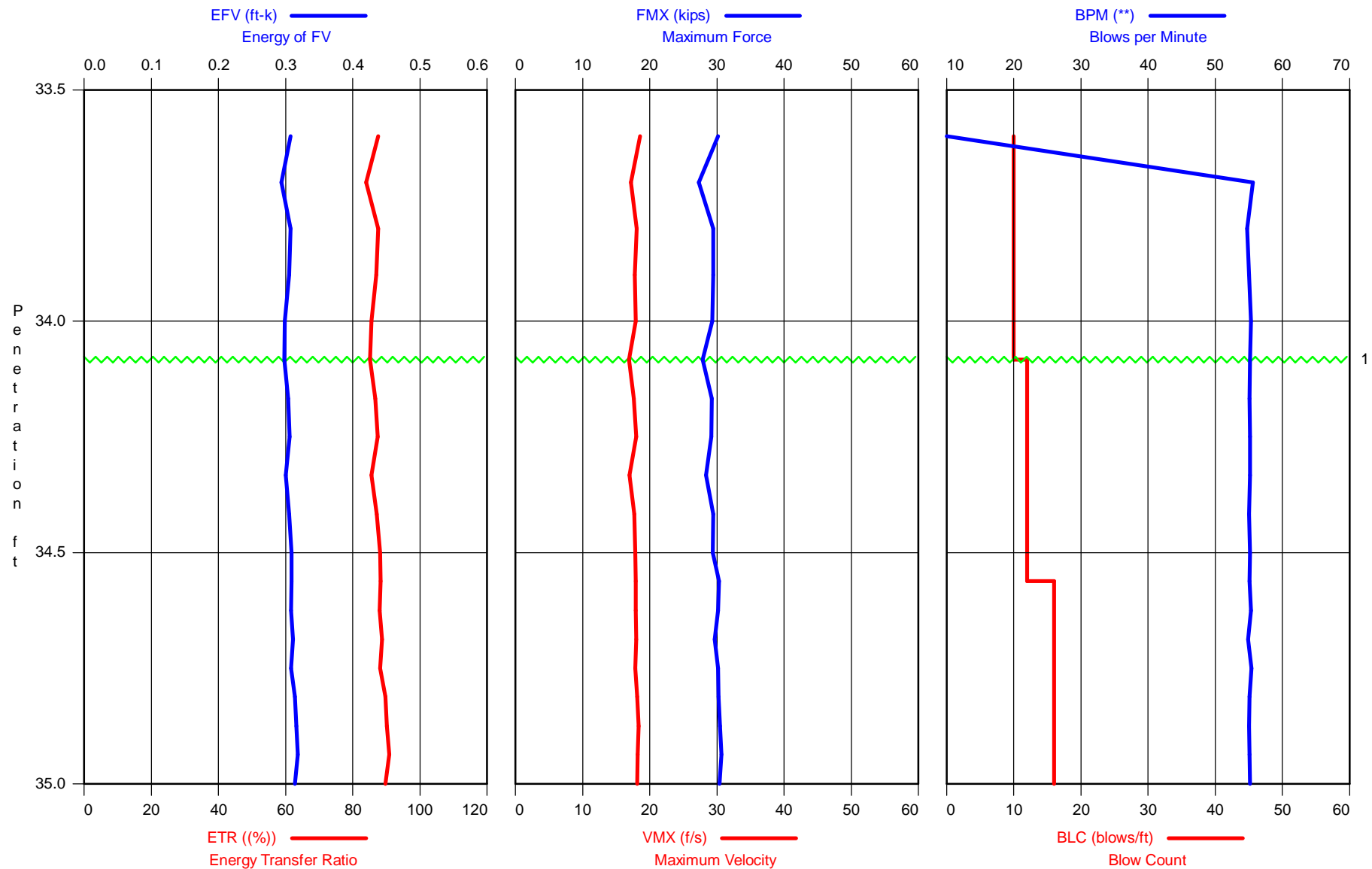
BL#	depth (ft)	Comments
5	29.07	Start of N value blows

Time Summary

Drive 20 seconds

9:35:08 AM - 9:35:28 AM (3/30/2017) BN 1 - 19

F & ME SPT Calibration - Boring 2 Sample 2
CME 45B S/N 303304, AW Rod



F & ME SPT Calibration - Boring 2 Sample 2
OP: MR

CME 45B S/N 303304, AW Rod
Test date: 30-Mar-2017

AR: 1.19 in² SP: 0.492 k/ft³
LE: 39.33 ft EM: 30,000 ksi
WS: 16,807.9 f/s JC: 0.00

EFV: Energy of FV BPM: Blows per Minute
ETR: Energy Transfer Ratio DMX: Maximum Displacement
FMX: Maximum Force DFN: Final Displacement
VMX: Maximum Velocity CSX: Max Measured Compr. Stress

BL#	BLC	EFV	ETR	FMX	VMX	BPM	DMX	DFN	CSX
	bl/ft	ft-k	(%)	kips	f/s	**	in	in	ksi
6	12	0.298	85.2	27.9	16.9	55.2	1.12	1.00	23.4
7	12	0.304	86.8	29.2	17.7	55.1	1.09	1.00	24.5
8	12	0.306	87.5	29.1	18.0	55.2	1.12	1.00	24.5
9	12	0.300	85.6	28.4	17.0	55.2	1.11	1.00	23.9
10	12	0.305	87.1	29.5	17.7	55.0	1.09	1.00	24.8
11	12	0.309	88.2	29.4	17.8	55.2	1.02	1.00	24.7
12	16	0.309	88.3	30.3	17.9	55.1	0.94	0.75	25.5
13	16	0.308	88.0	30.2	18.0	55.3	0.91	0.75	25.4
14	16	0.311	88.7	29.7	18.0	54.9	0.88	0.75	24.9
15	16	0.308	88.1	30.2	17.8	55.4	0.85	0.75	25.4
16	16	0.314	89.7	30.2	18.1	55.1	0.82	0.75	25.4
17	16	0.316	90.2	30.5	18.3	55.0	0.82	0.75	25.6
18	16	0.318	90.8	30.7	18.2	55.1	0.84	0.75	25.8
19	16	0.314	89.8	30.4	18.1	55.2	0.80	0.75	25.5
Average		0.309	88.1	29.7	17.8	55.1	0.96	0.86	25.0
Std. Dev.		0.006	1.6	0.8	0.4	0.1	0.12	0.12	0.7
Maximum		0.318	90.8	30.7	18.3	55.4	1.12	1.00	25.8
Minimum		0.298	85.2	27.9	16.9	54.9	0.80	0.75	23.4

Total number of blows analyzed: 14

BL# Comments
6 Start of N value blows

Time Summary

Drive 20 seconds

9:42:04 AM - 9:42:24 AM (3/30/2017) BN 1 - 19

F & ME SPT Calibration - Boring 2 Sample 2
OP: MR

CME 45B S/N 303304, AW Rod
Test date: 30-Mar-2017

AR: 1.19 in² SP: 0.492 k/ft³
LE: 39.33 ft EM: 30,000 ksi
WS: 16,807.9 f/s JC: 0.00

EFV: Energy of FV BPM: Blows per Minute
ETR: Energy Transfer Ratio DMX: Maximum Displacement
FMX: Maximum Force DFN: Final Displacement
VMX: Maximum Velocity CSX: Max Measured Compr. Stress

BL#	depth	BLC	TYPE	EFV	ETR	FMX	VMX	BPM	DMX	DFN	CSX
end	ft	bl/ft		ft-k	(%)	kips	f/s	**	in	in	ksi
5	34.00	10	AV5	0.302	86.4	29.1	17.9	44.5	1.30	1.20	24.5
			STD	0.005	1.4	1.0	0.4	21.3	0.06	0.00	0.8
			MAX	0.307	87.6	30.2	18.5	55.6	1.42	1.20	25.4
			MIN	0.294	84.0	27.3	17.2	1.9	1.25	1.20	22.9
11	34.50	12	AV6	0.304	86.7	28.9	17.5	55.2	1.09	1.00	24.3
			STD	0.004	1.0	0.6	0.4	0.1	0.03	0.00	0.5
			MAX	0.309	88.2	29.5	18.0	55.2	1.12	1.00	24.8
			MIN	0.298	85.2	27.9	16.9	55.0	1.02	1.00	23.4
19	35.00	16	AV8	0.312	89.2	30.3	18.1	55.1	0.86	0.75	25.4
			STD	0.004	1.0	0.3	0.1	0.1	0.05	0.00	0.2
			MAX	0.318	90.8	30.7	18.3	55.4	0.94	0.75	25.8
			MIN	0.308	88.0	29.7	17.8	54.9	0.80	0.75	24.9
			Average	0.307	87.7	29.5	17.8	52.3	1.05	0.95	24.8
			Std. Dev.	0.006	1.7	0.9	0.4	11.9	0.19	0.18	0.7
			Maximum	0.318	90.8	30.7	18.5	55.6	1.42	1.20	25.8
			Minimum	0.294	84.0	27.3	16.9	1.9	0.80	0.75	22.9

Total number of blows analyzed: 19

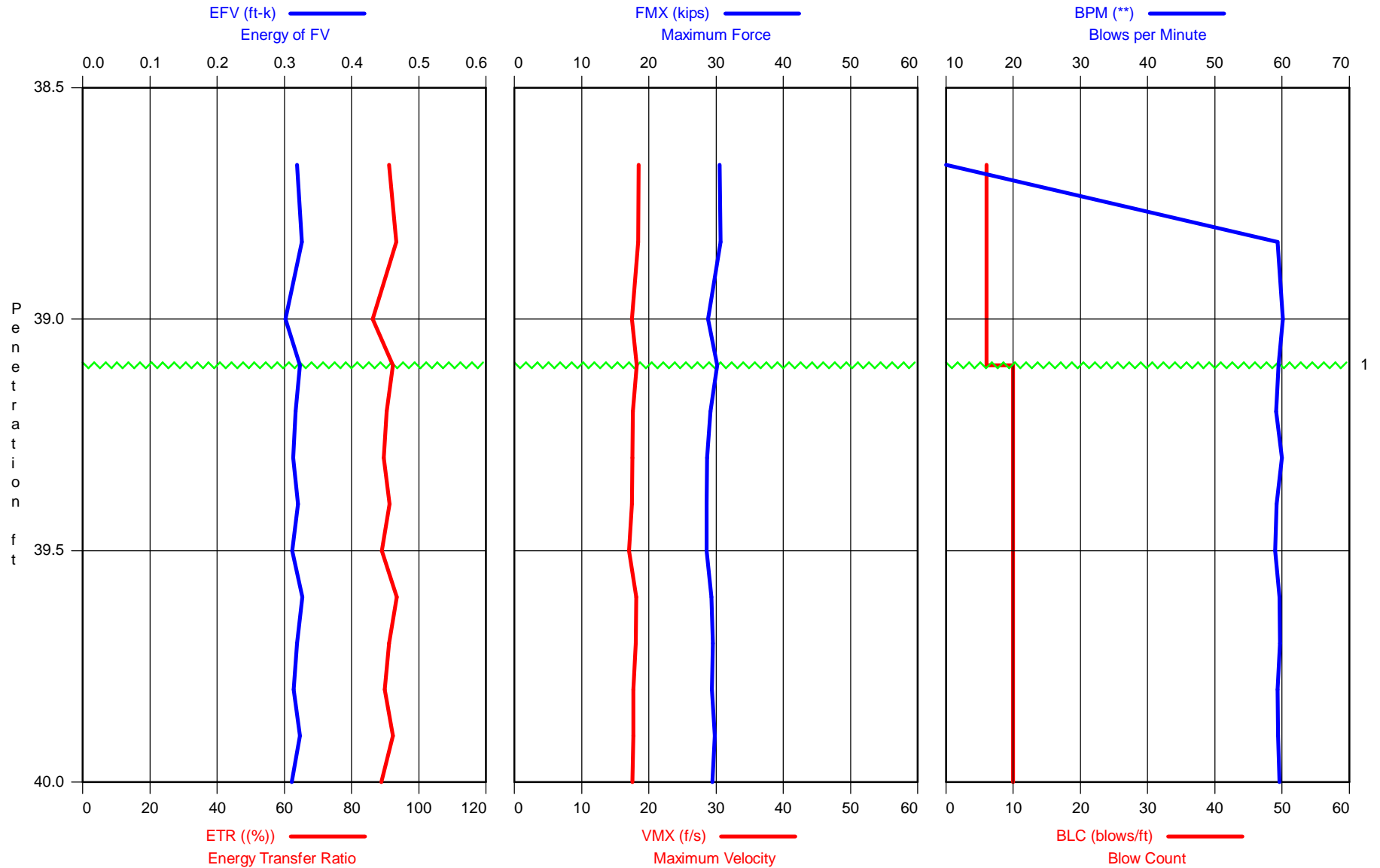
BL#	depth (ft)	Comments
6	34.08	Start of N value blows

Time Summary

Drive 20 seconds

9:42:04 AM - 9:42:24 AM (3/30/2017) BN 1 - 19

F & ME SPT Calibration - Boring 2 Sample 3
CME 45B S/N 303304, AW Rod



F & ME SPT Calibration - Boring 2 Sample 3
OP: MR

CME 45B S/N 303304, AW Rod
Test date: 30-Mar-2017

AR: 1.19 in² SP: 0.492 k/ft³
LE: 44.33 ft EM: 30,000 ksi
WS: 16,807.9 f/s JC: 0.00

EFV: Energy of FV BPM: Blows per Minute
ETR: Energy Transfer Ratio DMX: Maximum Displacement
FMX: Maximum Force DFN: Final Displacement
VMX: Maximum Velocity CSX: Max Measured Compr. Stress

BL#	BLC	EFV	ETR	FMX	VMX	BPM	DMX	DFN	CSX
	bl/ft	ft-k	(%)	kips	f/s	**	in	in	ksi
4	10	0.323	92.4	30.1	18.2	59.5	1.36	1.20	25.3
5	10	0.317	90.5	29.2	17.6	59.1	1.20	1.20	24.5
6	10	0.313	89.5	28.6	17.5	60.0	1.20	1.20	24.1
7	10	0.320	91.3	28.6	17.5	59.2	1.24	1.20	24.0
8	10	0.312	89.1	28.6	17.1	59.0	1.33	1.20	24.0
9	10	0.327	93.5	29.3	18.1	59.6	1.25	1.20	24.6
10	10	0.319	91.1	29.6	18.0	59.7	1.20	1.20	24.8
11	10	0.314	89.9	29.4	17.7	59.3	1.23	1.20	24.7
12	10	0.323	92.3	29.8	17.7	59.4	1.20	1.20	25.1
13	10	0.311	88.9	29.4	17.5	59.6	1.20	1.20	24.7
Average		0.318	90.8	29.3	17.7	59.4	1.24	1.20	24.6
Std. Dev.		0.005	1.5	0.5	0.3	0.3	0.05	0.00	0.4
Maximum		0.327	93.5	30.1	18.2	60.0	1.36	1.20	25.3
Minimum		0.311	88.9	28.6	17.1	59.0	1.20	1.20	24.0

Total number of blows analyzed: 10

BL# Comments
4 Start of N value blows

Time Summary

Drive 12 seconds

9:48:27 AM - 9:48:39 AM (3/30/2017) BN 1 - 13

F & ME SPT Calibration - Boring 2 Sample 3
OP: MR

CME 45B S/N 303304, AW Rod
Test date: 30-Mar-2017

AR: 1.19 in² SP: 0.492 k/ft³
LE: 44.33 ft EM: 30,000 ksi
WS: 16,807.9 f/s JC: 0.00

EFV: Energy of FV BPM: Blows per Minute
ETR: Energy Transfer Ratio DMX: Maximum Displacement
FMX: Maximum Force DFN: Final Displacement
VMX: Maximum Velocity CSX: Max Measured Compr. Stress

BL#	depth	BLC	TYPE	EFV	ETR	FMX	VMX	BPM	DMX	DFN	CSX
end	ft	bl/ft		ft-k	(%)	kips	f/s	**	in	in	ksi
3	39.00	6	AV3	0.316	90.2	30.0	18.1	40.4	2.07	2.00	25.2
			STD	0.010	2.9	0.8	0.5	27.2	0.10	0.00	0.7
			MAX	0.326	93.2	30.6	18.5	60.1	2.20	2.00	25.7
			MIN	0.302	86.2	28.8	17.5	1.9	2.00	2.00	24.2
8	39.50	10	AV5	0.317	90.5	29.0	17.6	59.4	1.27	1.20	24.4
			STD	0.004	1.2	0.6	0.3	0.4	0.07	0.00	0.5
			MAX	0.323	92.4	30.1	18.2	60.0	1.36	1.20	25.3
			MIN	0.312	89.1	28.6	17.1	59.0	1.20	1.20	24.0
13	40.00	10	AV5	0.319	91.1	29.5	17.8	59.5	1.22	1.20	24.8
			STD	0.006	1.7	0.2	0.2	0.1	0.02	0.00	0.2
			MAX	0.327	93.5	29.8	18.1	59.7	1.25	1.20	25.1
			MIN	0.311	88.9	29.3	17.5	59.3	1.20	1.20	24.6
			Average	0.317	90.7	29.4	17.8	55.1	1.43	1.38	24.7
			Std. Dev.	0.007	1.9	0.7	0.4	15.3	0.35	0.34	0.6
			Maximum	0.327	93.5	30.6	18.5	60.1	2.20	2.00	25.7
			Minimum	0.302	86.2	28.6	17.1	1.9	1.20	1.20	24.0

Total number of blows analyzed: 13

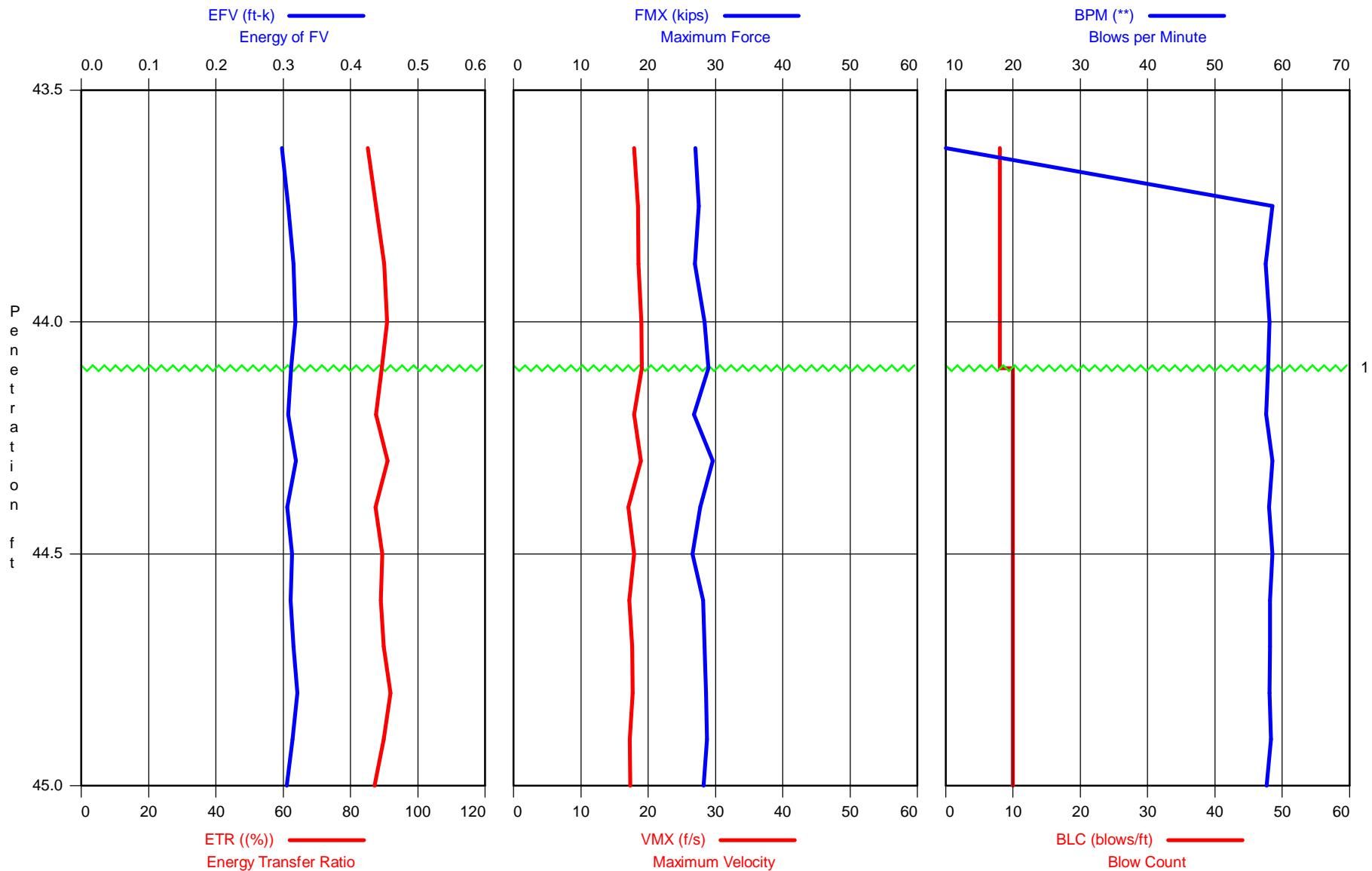
BL#	depth (ft)	Comments
4	39.10	Start of N value blows

Time Summary

Drive 12 seconds

9:48:27 AM - 9:48:39 AM (3/30/2017) BN 1 - 13

F & ME SPT Calibration - Boring 2 Sample 4
CME 45B S/N 303304, AW Rod



F & ME SPT Calibration - Boring 2 Sample 4
OP: MR

CME 45B S/N 303304, AW Rod
Test date: 30-Mar-2017

AR: 1.19 in² SP: 0.492 k/ft³
LE: 49.33 ft EM: 30,000 ksi
WS: 16,807.9 f/s JC: 0.00

EFV: Energy of FV BPM: Blows per Minute
ETR: Energy Transfer Ratio DMX: Maximum Displacement
FMX: Maximum Force DFN: Final Displacement
VMX: Maximum Velocity CSX: Max Measured Compr. Stress

BL#	BLC	EFV	ETR	FMX	VMX	BPM	DMX	DFN	CSX
	bl/ft	ft-k	(%)	kips	f/s	**	in	in	ksi
5	10	0.312	89.3	28.9	19.0	57.9	1.41	1.20	24.3
6	10	0.307	87.6	26.8	17.9	57.6	1.41	1.20	22.5
7	10	0.319	91.1	29.6	18.9	58.5	1.39	1.20	24.8
8	10	0.306	87.4	27.7	17.0	58.0	1.20	1.20	23.3
9	10	0.313	89.4	26.6	17.9	58.5	1.26	1.20	22.3
10	10	0.311	89.0	28.1	17.2	58.2	1.26	1.20	23.6
11	10	0.315	89.9	28.4	17.6	58.2	1.24	1.20	23.9
12	10	0.321	91.8	28.6	17.7	58.1	1.22	1.20	24.0
13	10	0.314	89.9	28.7	17.3	58.3	1.20	1.20	24.2
14	10	0.305	87.1	28.2	17.3	57.7	1.23	1.20	23.7
Average		0.312	89.3	28.2	17.8	58.1	1.28	1.20	23.7
Std. Dev.		0.005	1.5	0.9	0.7	0.3	0.08	0.00	0.7
Maximum		0.321	91.8	29.6	19.0	58.5	1.41	1.20	24.8
Minimum		0.305	87.1	26.6	17.0	57.6	1.20	1.20	22.3

Total number of blows analyzed: 10

BL# Comments
5 Start of N value blows

Time Summary

Drive 13 seconds

9:57:24 AM - 9:57:37 AM (3/30/2017) BN 1 - 14

F & ME SPT Calibration - Boring 2 Sample 4
OP: MR

CME 45B S/N 303304, AW Rod
Test date: 30-Mar-2017

AR: 1.19 in² SP: 0.492 k/ft³
LE: 49.33 ft EM: 30,000 ksi
WS: 16,807.9 f/s JC: 0.00

EFV: Energy of FV BPM: Blows per Minute
ETR: Energy Transfer Ratio DMX: Maximum Displacement
FMX: Maximum Force DFN: Final Displacement
VMX: Maximum Velocity CSX: Max Measured Compr. Stress

BL#	depth	BLC	TYPE	EFV	ETR	FMX	VMX	BPM	DMX	DFN	CSX
end	ft	bl/ft		ft-k	(%)	kips	f/s	**	in	in	ksi
4	44.00	8	AV4	0.310	88.4	27.5	18.5	44.0	1.68	1.50	23.1
			STD	0.008	2.2	0.6	0.4	24.3	0.08	0.00	0.5
			MAX	0.318	90.8	28.4	19.0	58.5	1.80	1.50	23.9
			MIN	0.298	85.2	26.9	17.9	1.9	1.58	1.50	22.6
9	44.50	10	AV5	0.311	88.9	27.9	18.2	58.1	1.33	1.20	23.5
			STD	0.005	1.3	1.2	0.7	0.4	0.09	0.00	1.0
			MAX	0.319	91.1	29.6	19.0	58.5	1.41	1.20	24.8
			MIN	0.306	87.4	26.6	17.0	57.6	1.20	1.20	22.3
14	45.00	10	AV5	0.313	89.6	28.4	17.4	58.1	1.23	1.20	23.9
			STD	0.005	1.5	0.2	0.2	0.2	0.02	0.00	0.2
			MAX	0.321	91.8	28.7	17.7	58.3	1.26	1.20	24.2
			MIN	0.305	87.1	28.1	17.2	57.7	1.20	1.20	23.6
			Average	0.312	89.0	28.0	18.0	54.1	1.40	1.29	23.5
			Std. Dev.	0.006	1.7	0.9	0.7	14.5	0.20	0.14	0.7
			Maximum	0.321	91.8	29.6	19.0	58.5	1.80	1.50	24.8
			Minimum	0.298	85.2	26.6	17.0	1.9	1.20	1.20	22.3

Total number of blows analyzed: 14

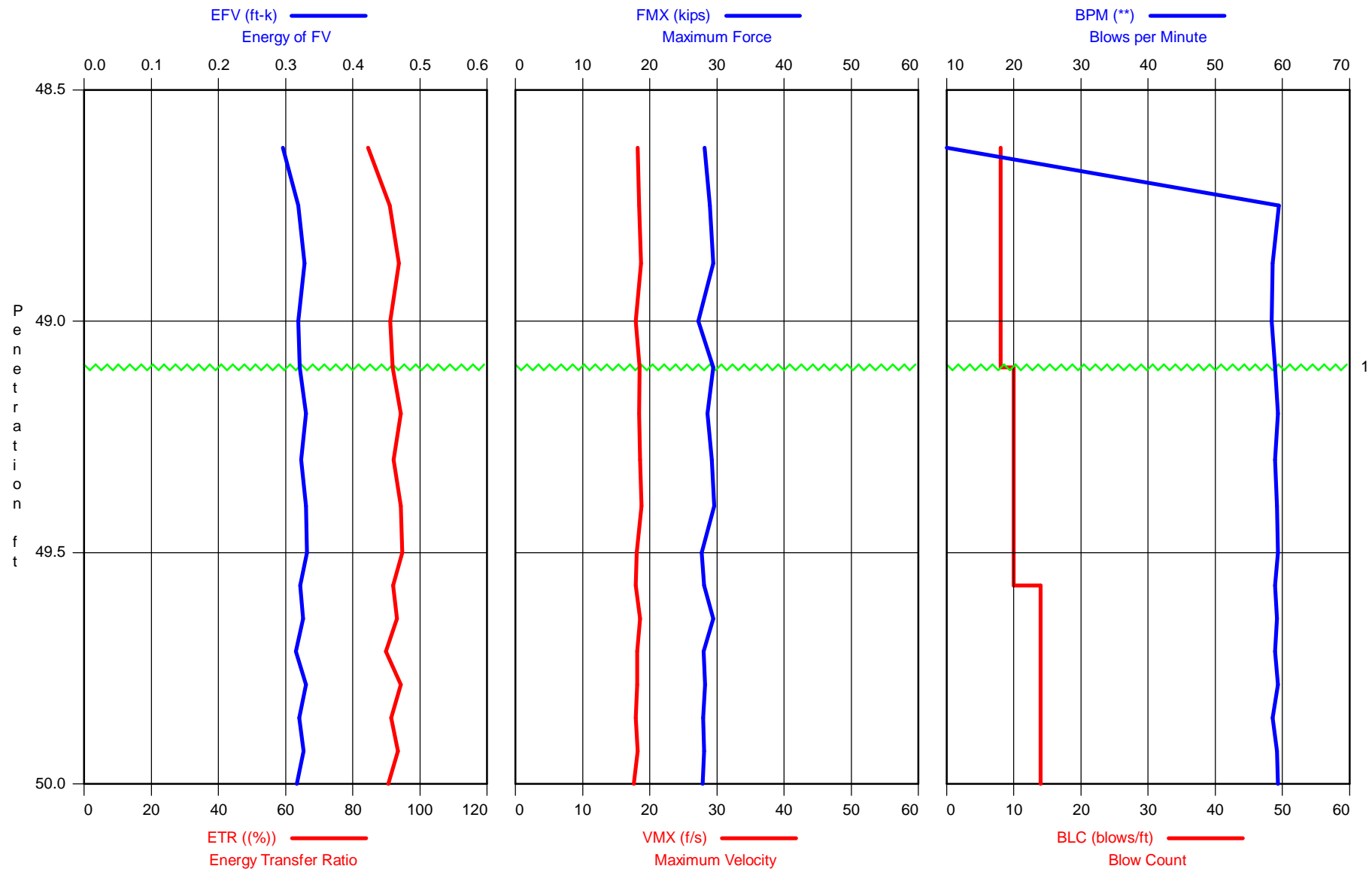
BL#	depth (ft)	Comments
5	44.10	Start of N value blows

Time Summary

Drive 13 seconds

9:57:24 AM - 9:57:37 AM (3/30/2017) BN 1 - 14

F & ME SPT Calibration - Boring 2 Sample 5
CME 45B S/N 303304, AW Rod



F & ME SPT Calibration - Boring 2 Sample 5
OP: MR

CME 45B S/N 303304, AW Rod
Test date: 30-Mar-2017

AR: 1.19 in² SP: 0.492 k/ft³
LE: 54.33 ft EM: 30,000 ksi
WS: 16,807.9 f/s JC: 0.00

EFV: Energy of FV BPM: Blows per Minute
ETR: Energy Transfer Ratio DMX: Maximum Displacement
FMX: Maximum Force DFN: Final Displacement
VMX: Maximum Velocity CSX: Max Measured Compr. Stress

BL#	BLC	EFV	ETR	FMX	VMX	BPM	DMX	DFN	CSX
	bl/ft	ft-k	(%)	kips	f/s	**	in	in	ksi
5	10	0.321	91.8	29.4	18.5	58.9	1.39	1.20	24.7
6	10	0.330	94.3	28.6	18.4	59.3	1.29	1.20	24.0
7	10	0.323	92.2	29.2	18.6	58.9	1.20	1.20	24.6
8	10	0.330	94.3	29.6	18.8	59.2	1.20	1.20	24.9
9	10	0.332	94.8	27.7	18.0	59.3	1.20	1.20	23.3
10	14	0.322	92.0	28.1	17.9	58.9	0.95	0.86	23.6
11	14	0.326	93.2	29.5	18.6	59.2	0.96	0.86	24.8
12	14	0.315	89.9	28.1	18.1	58.9	0.90	0.86	23.6
13	14	0.330	94.3	28.2	18.1	59.3	0.90	0.86	23.7
14	14	0.320	91.4	27.9	18.0	58.5	0.92	0.86	23.5
15	14	0.327	93.4	28.1	18.2	59.2	0.91	0.86	23.6
16	14	0.317	90.6	27.9	17.6	59.3	0.90	0.86	23.4
Average		0.324	92.7	28.5	18.2	59.1	1.06	1.00	24.0
Std. Dev.		0.005	1.5	0.7	0.3	0.2	0.17	0.17	0.6
Maximum		0.332	94.8	29.6	18.8	59.3	1.39	1.20	24.9
Minimum		0.315	89.9	27.7	17.6	58.5	0.90	0.86	23.3

Total number of blows analyzed: 12

BL# Comments
5 Start of N value blows

Time Summary

Drive 16 seconds

10:05:38 AM - 10:05:54 AM (3/30/2017) BN 1 - 16

F & ME SPT Calibration - Boring 2 Sample 5
OP: MR

CME 45B S/N 303304, AW Rod
Test date: 30-Mar-2017

AR: 1.19 in² SP: 0.492 k/ft³
LE: 54.33 ft EM: 30,000 ksi
WS: 16,807.9 f/s JC: 0.00

EFV: Energy of FV BPM: Blows per Minute
ETR: Energy Transfer Ratio DMX: Maximum Displacement
FMX: Maximum Force DFN: Final Displacement
VMX: Maximum Velocity CSX: Max Measured Compr. Stress

BL#	depth	BLC	TYPE	EFV	ETR	FMX	VMX	BPM	DMX	DFN	CSX
end	ft	bl/ft		ft-k	(%)	kips	f/s	**	in	in	ksi
4	49.00	8	AV4	0.316	90.1	28.4	18.3	44.6	1.67	1.50	23.9
			STD	0.012	3.4	0.8	0.3	24.6	0.02	0.00	0.7
			MAX	0.328	93.7	29.5	18.7	59.5	1.69	1.50	24.8
			MIN	0.296	84.6	27.2	17.9	1.9	1.65	1.50	22.9
9	49.50	10	AV5	0.327	93.5	28.9	18.5	59.1	1.26	1.20	24.3
			STD	0.004	1.2	0.7	0.2	0.2	0.07	0.00	0.6
			MAX	0.332	94.8	29.6	18.8	59.3	1.39	1.20	24.9
			MIN	0.321	91.8	27.7	18.0	58.9	1.20	1.20	23.3
16	50.00	14	AV7	0.322	92.1	28.3	18.1	59.0	0.92	0.86	23.7
			STD	0.005	1.5	0.5	0.3	0.3	0.02	0.00	0.4
			MAX	0.330	94.3	29.5	18.6	59.3	0.96	0.86	24.8
			MIN	0.315	89.9	27.9	17.6	58.5	0.90	0.86	23.4
			Average	0.322	92.0	28.5	18.3	55.5	1.21	1.12	24.0
			Std. Dev.	0.008	2.4	0.7	0.3	13.8	0.30	0.26	0.6
			Maximum	0.332	94.8	29.6	18.8	59.5	1.69	1.50	24.9
			Minimum	0.296	84.6	27.2	17.6	1.9	0.90	0.86	22.9

Total number of blows analyzed: 16

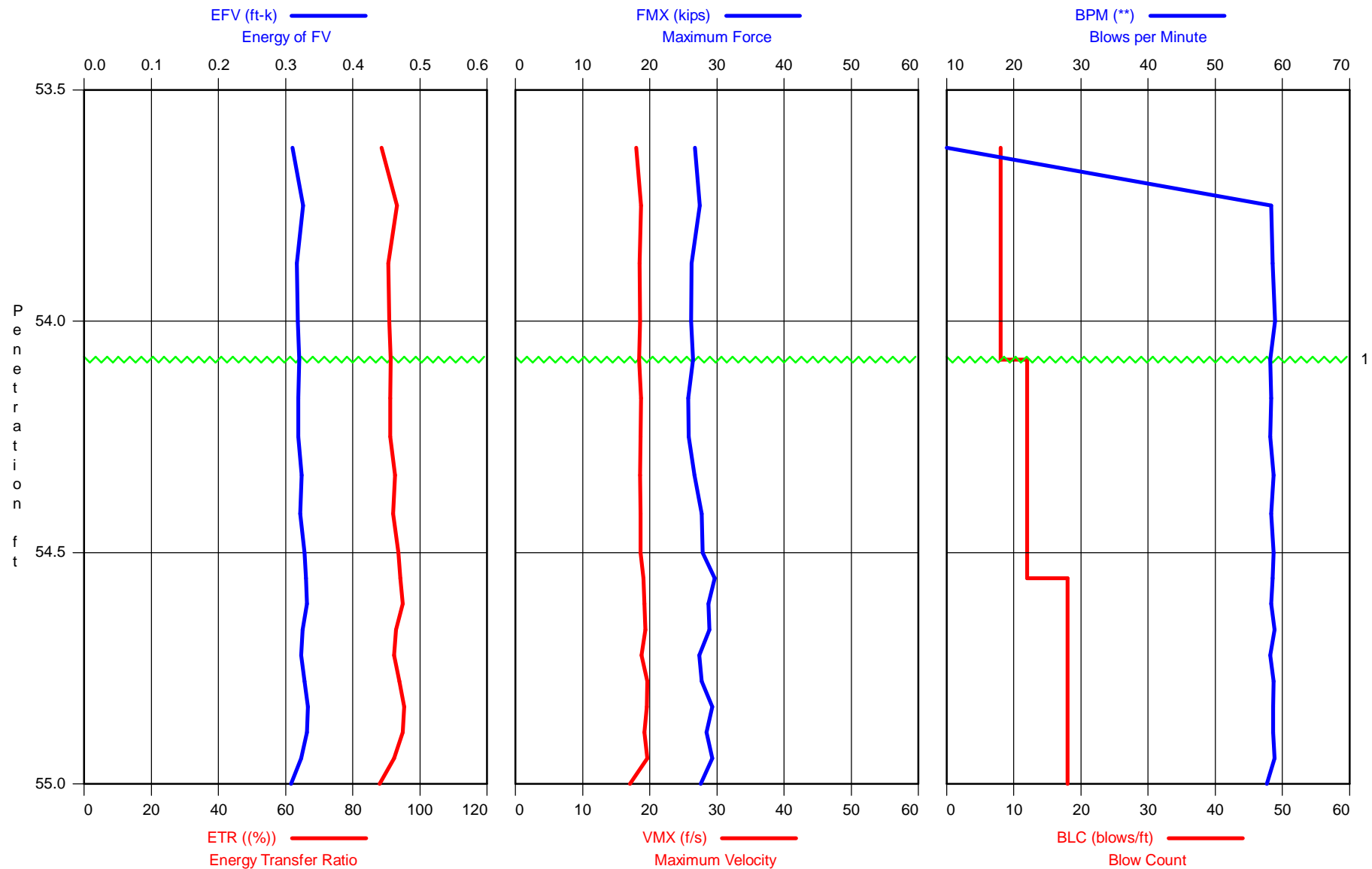
BL#	depth (ft)	Comments
5	49.10	Start of N value blows

Time Summary

Drive 16 seconds

10:05:38 AM - 10:05:54 AM (3/30/2017) BN 1 - 16

F & ME SPT Calibration - Boring 2 Sample 6
CME 45B S/N 303304, AW Rod



F & ME SPT Calibration - Boring 2 Sample 6
OP: MR

CME 45B S/N 303304, AW Rod
Test date: 30-Mar-2017

AR: 1.19 in² SP: 0.492 k/ft³
LE: 59.33 ft EM: 30,000 ksi
WS: 16,807.9 f/s JC: 0.00

EFV: Energy of FV BPM: Blows per Minute
ETR: Energy Transfer Ratio DMX: Maximum Displacement
FMX: Maximum Force DFN: Final Displacement
VMX: Maximum Velocity CSX: Max Measured Compr. Stress

BL#	BLC bl/ft	EFV ft-k	ETR (%)	FMX kips	VMX f/s	BPM **	DMX in	DFN in	CSX ksi
5	12	0.320	91.4	26.4	18.4	58.2	1.13	1.00	22.2
6	12	0.319	91.2	25.7	18.7	58.3	1.07	1.00	21.6
7	12	0.319	91.2	25.8	18.6	58.2	1.00	1.00	21.7
8	12	0.324	92.6	26.7	18.6	58.7	1.00	1.00	22.4
9	12	0.322	92.0	27.7	18.6	58.3	1.00	1.00	23.3
10	12	0.328	93.6	27.9	18.6	58.7	1.01	1.00	23.4
11	18	0.330	94.2	29.7	19.1	58.5	0.73	0.67	24.9
12	18	0.332	94.9	28.8	19.2	58.3	0.77	0.67	24.2
13	18	0.325	92.9	28.9	19.3	58.8	0.73	0.67	24.3
14	18	0.323	92.3	27.4	18.8	58.2	0.75	0.67	23.0
15	18	0.328	93.8	27.7	19.6	58.7	0.76	0.67	23.3
16	18	0.333	95.3	29.3	19.5	58.6	0.78	0.67	24.7
17	18	0.332	94.8	28.4	19.2	58.6	0.78	0.67	23.9
18	18	0.323	92.4	29.3	19.7	58.8	0.74	0.67	24.6
19	18	0.308	88.0	27.6	17.1	57.7	0.72	0.67	23.2
Average		0.324	92.7	27.8	18.9	58.4	0.86	0.80	23.4
Std. Dev.		0.006	1.8	1.2	0.6	0.3	0.14	0.16	1.0
Maximum		0.333	95.3	29.7	19.7	58.8	1.13	1.00	24.9
Minimum		0.308	88.0	25.7	17.1	57.7	0.72	0.67	21.6

Total number of blows analyzed: 15

BL# Comments
5 Start of N value blows

Time Summary

Drive 18 seconds

10:15:57 AM - 10:16:15 AM (3/30/2017) BN 1 - 19

F & ME SPT Calibration - Boring 2 Sample 6
OP: MR

CME 45B S/N 303304, AW Rod
Test date: 30-Mar-2017

AR: 1.19 in² SP: 0.492 k/ft³
LE: 59.33 ft EM: 30,000 ksi
WS: 16,807.9 f/s JC: 0.00

EFV: Energy of FV BPM: Blows per Minute
ETR: Energy Transfer Ratio DMX: Maximum Displacement
FMX: Maximum Force DFN: Final Displacement
VMX: Maximum Velocity CSX: Max Measured Compr. Stress

BL#	depth	BLC	TYPE	EFV	ETR	FMX	VMX	BPM	DMX	DFN	CSX
end	ft	bl/ft		ft-k	(%)	kips	f/s	**	in	in	ksi
4	54.00	8	AV4	0.318	90.8	26.6	18.4	44.4	1.65	1.50	22.4
			STD	0.006	1.7	0.5	0.3	24.5	0.15	0.00	0.4
			MAX	0.326	93.2	27.4	18.7	58.9	1.86	1.50	23.0
			MIN	0.310	88.6	26.2	18.0	1.9	1.50	1.50	22.0
10	54.50	12	AV6	0.322	92.0	26.7	18.6	58.4	1.04	1.00	22.4
			STD	0.003	0.9	0.8	0.1	0.2	0.05	0.00	0.7
			MAX	0.328	93.6	27.9	18.7	58.7	1.13	1.00	23.4
			MIN	0.319	91.2	25.7	18.4	58.2	1.00	1.00	21.6
19	55.00	18	AV9	0.326	93.2	28.6	19.1	58.5	0.75	0.67	24.0
			STD	0.007	2.1	0.8	0.7	0.3	0.02	0.00	0.7
			MAX	0.333	95.3	29.7	19.7	58.8	0.78	0.67	24.9
			MIN	0.308	88.0	27.4	17.1	57.7	0.72	0.67	23.0
			Average	0.323	92.3	27.6	18.8	55.5	1.03	0.95	23.2
			Std. Dev.	0.007	1.9	1.2	0.6	12.6	0.35	0.32	1.0
			Maximum	0.333	95.3	29.7	19.7	58.9	1.86	1.50	24.9
			Minimum	0.308	88.0	25.7	17.1	1.9	0.72	0.67	21.6

Total number of blows analyzed: 19

BL#	depth (ft)	Comments
5	54.08	Start of N value blows

Time Summary

Drive 18 seconds

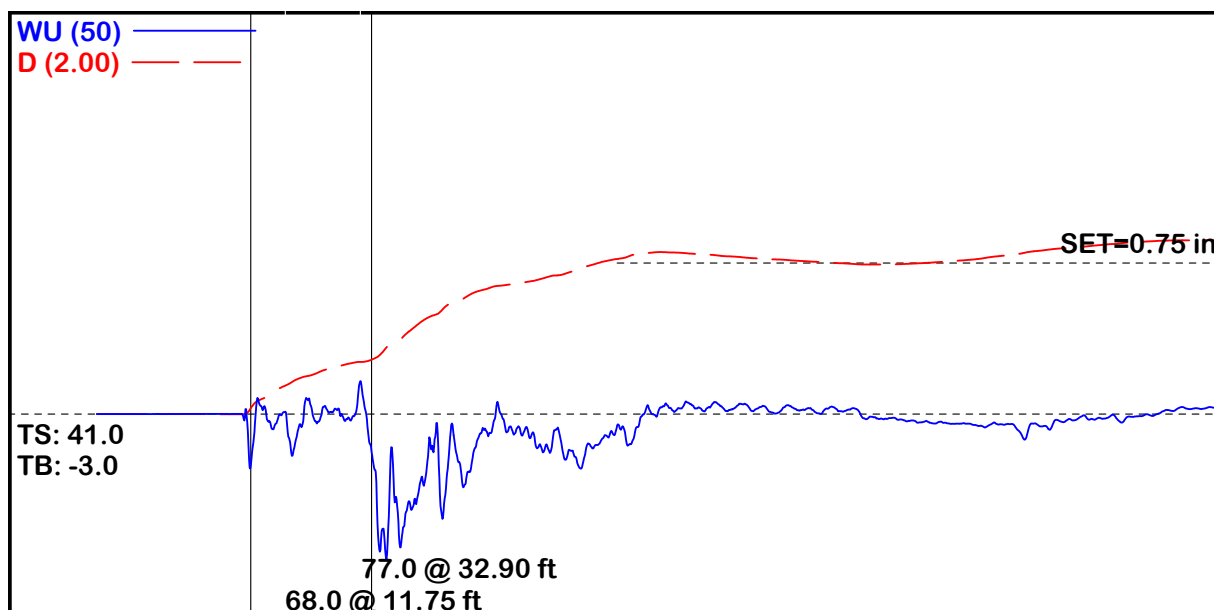
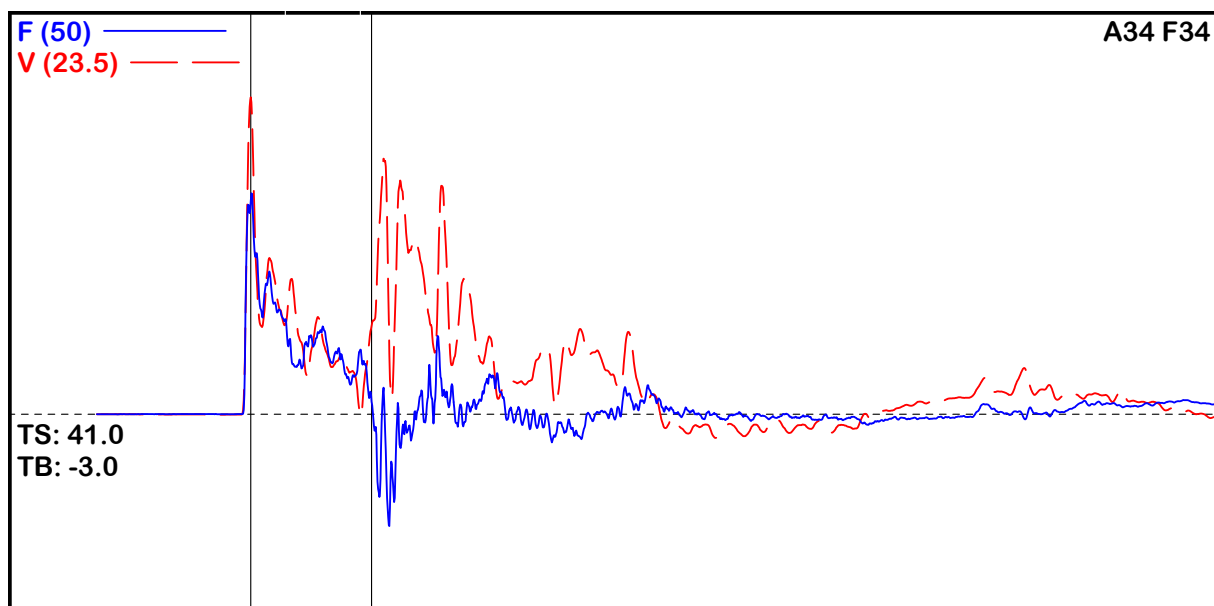
10:15:57 AM - 10:16:15 AM (3/30/2017) BN 1 - 19

APPENDIX D

Force and Velocity Plots

F & ME SPT Calibration

Boring 1 Sample 1

Project Information

PROJECT: F & ME SPT Calibration
 PILE NAME: Boring 1 Sample 1
 DESCR: CME 550 S/N 249533, AW-J Rod
 OPERATOR: MR
 FILE: Boring 1 Sample 1 Final.W01
 3/30/2017 9:29:05 AM
 Blow Number 14

Quantity Results

EFV 0.299 ft-k
 ETR 85.4 (%)
 FMX 27 kips
 VMX 18.5 f/s
 BPM 52.7 bpm
 FVP 0.67 []
 DMX 0.86 in
 DFN 0.75 in
 CSX 23.0 ksi

Pile Properties

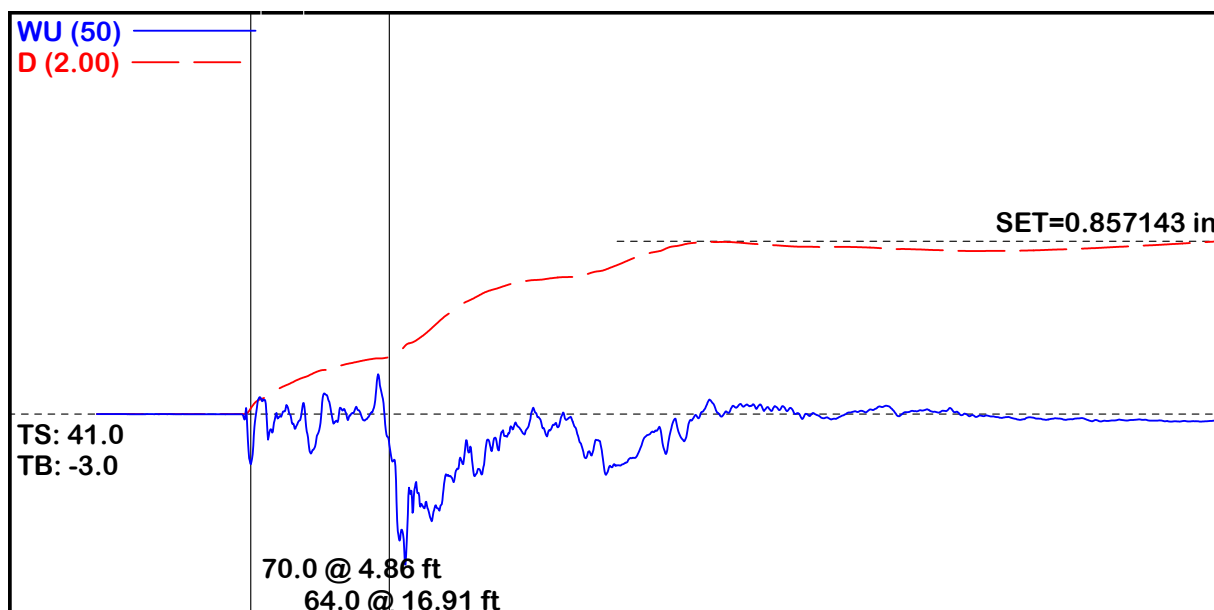
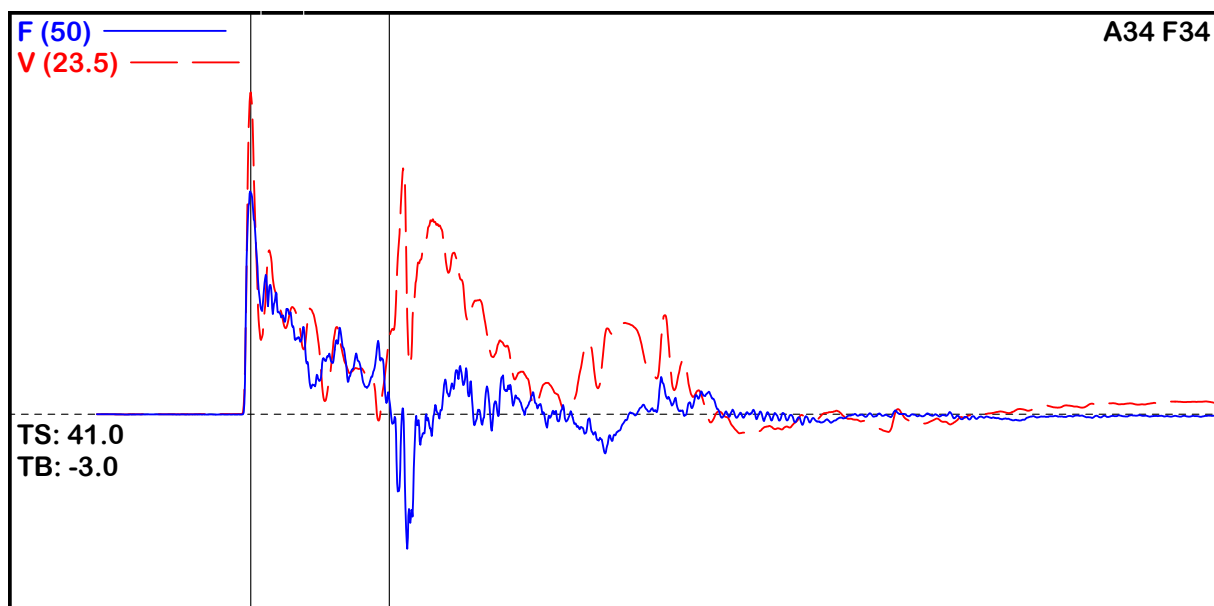
LE 34.00 ft
 AR 1.19 in^2
 EM 30000 ksi
 SP 0.492 k/ft3
 WS 16807.9 f/s
 EA/C 2.1 ksec/ft
 2L/C 4.05 ms
 JC []
 LP 29.50 ft

Sensors

F3: [168 AWJ-1] 212.47 (1)
 F4: [168 AWJ-2] 215.16 (1)
 A3: [K 2081] 357 mv/5000g's (1)
 A4: [K 2082] 322 mv/5000g's (1)
 CLIP: OK

F & ME SPT Calibration

Boring 1 Sample 2

Project Information

PROJECT: F & ME SPT Calibration
 PILE NAME: Boring 1 Sample 2
 DESCR: CME 550X S/N 249533, AW-J Rod
 OPERATOR: MR
 FILE: Boring 1 Sample 2 Final.W01
 3/30/2017 9:38:13 AM
 Blow Number 12

Quantity Results

EFV 0.309 ft-k
 ETR 88.2 (%)
 FMX 28 kips
 VMX 18.8 f/s
 BPM 53.1 bpm
 FVP 0.69 []
 DMX 0.91 in
 DFN 0.86 in
 CSX 23.2 ksi

Pile Properties

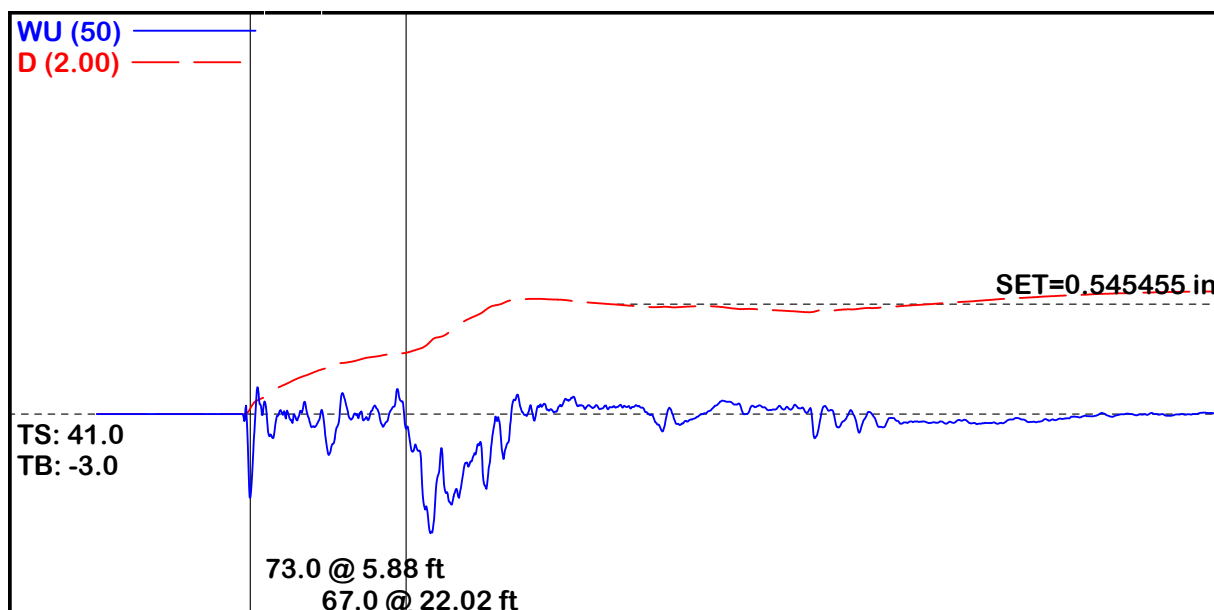
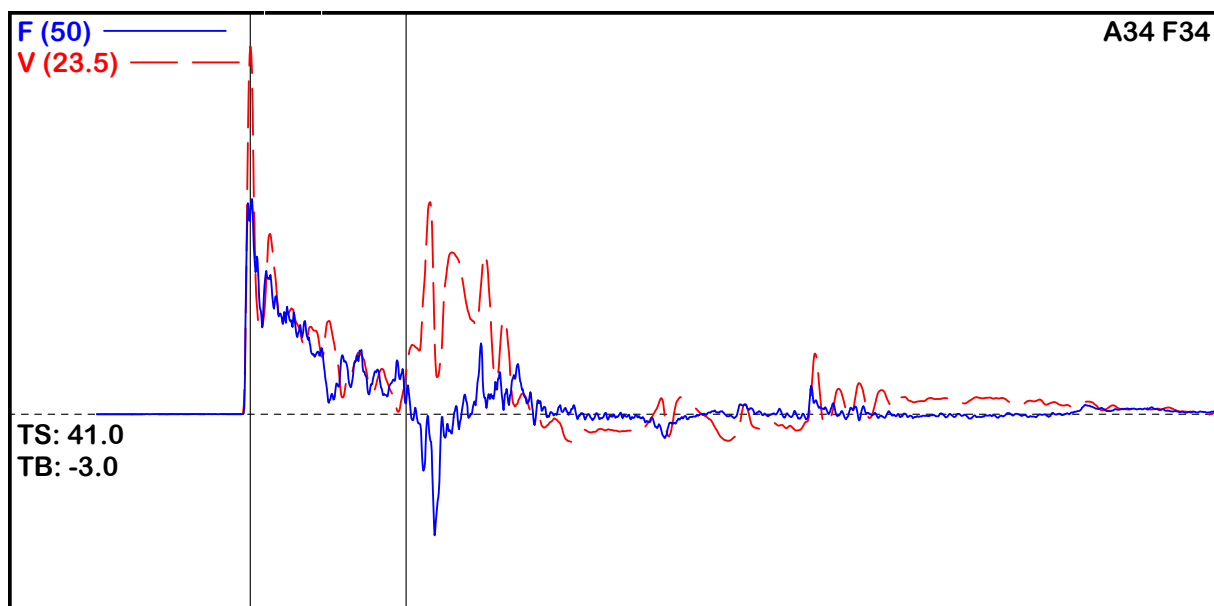
LE 39.00 ft
 AR 1.19 in^2
 EM 30000 ksi
 SP 0.492 k/ft3
 WS 16807.9 f/s
 EA/C 2.1 ksec/ft
 2L/C 4.66 ms
 JC []
 LP 34.50 ft

Sensors

F3: [168 AWJ-1] 212.47 (1)
 F4: [168 AWJ-2] 215.16 (1)
 A3: [K 2081] 357 mv/5000g's (1)
 A4: [K 2082] 322 mv/5000g's (1)
 CLIP: OK

F & ME SPT Calibration

Boring 1 Sample 3

Project Information

PROJECT: F & ME SPT Calibration
 PILE NAME: Boring 1 Sample 3
 DESCR: CME 550X S/N 249533, AW-J Rod
 OPERATOR: MR
 FILE: Boring 1 Sample 3 Final.W01
 3/30/2017 9:44:44 AM
 Blow Number 19

Quantity Results

EFV 0.321 ft-k
 ETR 91.7 (%)
 FMX 27 kips
 VMX 21.5 f/s
 BPM 53.8 bpm
 FVP 0.54 []
 DMX 0.61 in
 DFN 0.55 in
 CSX 22.4 ksi

Pile Properties

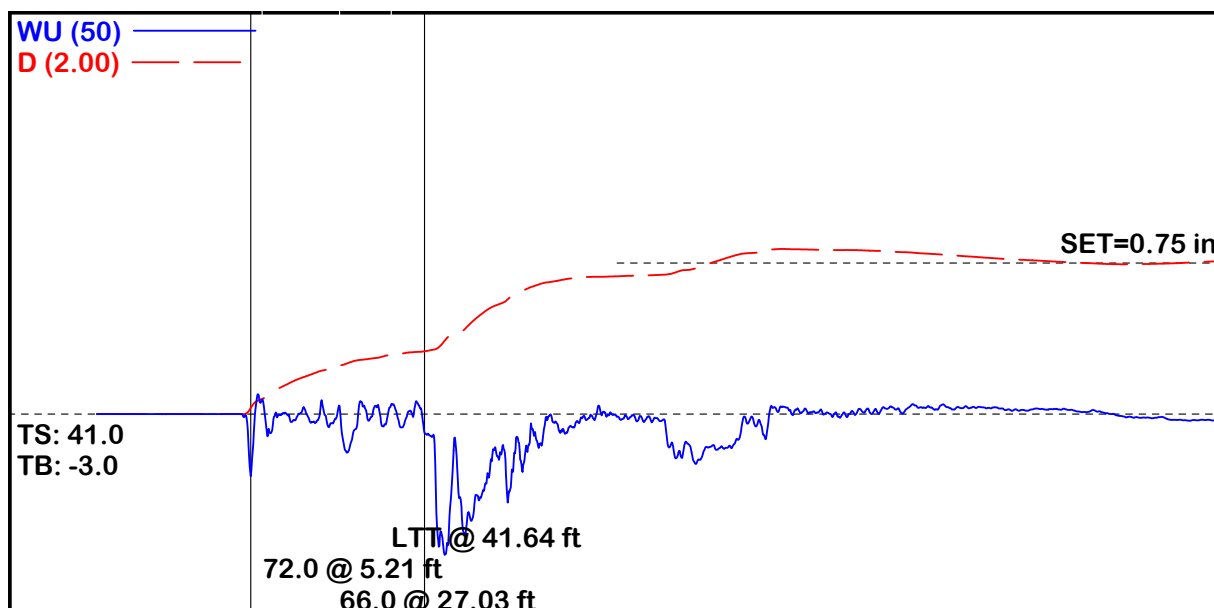
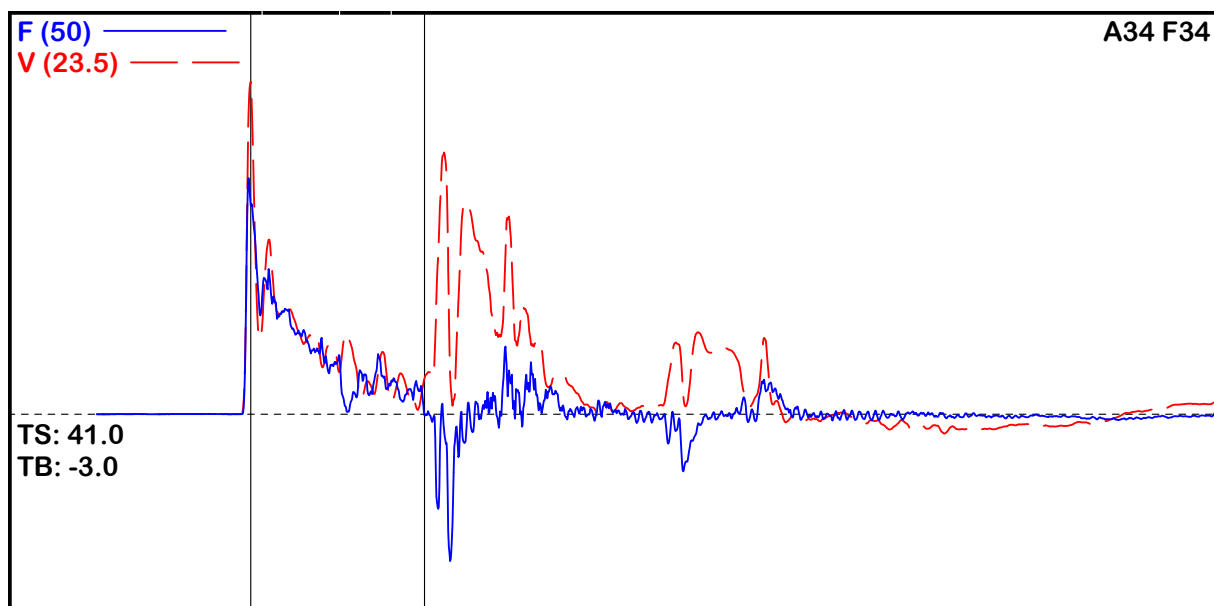
LE 44.00 ft
 AR 1.19 in^2
 EM 30000 ksi
 SP 0.492 k/ft3
 WS 16807.9 f/s
 EA/C 2.1 ksec/ft
 2L/C 5.24 ms
 JC []
 LP 39.50 ft

Sensors

F3: [168 AWJ-1] 212.47 (1)
 F4: [168 AWJ-2] 215.16 (1)
 A3: [K 2081] 357 mv/5000g's (1)
 A4: [K 2082] 322 mv/5000g's (1)
 CLIP: OK

F & ME SPT Calibration

Boring 1 Sample 4

Project Information

PROJECT: F & ME SPT Calibration
 PILE NAME: Boring 1 Sample 4
 DESCR: CME 550X S/N 249533, AW-J Rod
 OPERATOR: MR
 FILE: Boring 1 Sample 4 Final.W01
 3/30/2017 9:51:11 AM
 Blow Number 14

Quantity Results

EFV 0.317 ft-k
 ETR 90.7 (%)
 FMX 29 kips
 VMX 19.4 f/s
 BPM 52.9 bpm
 FVP 0.63 []
 DMX 0.88 in
 DFN 0.75 in
 CSX 24.6 ksi

Pile Properties

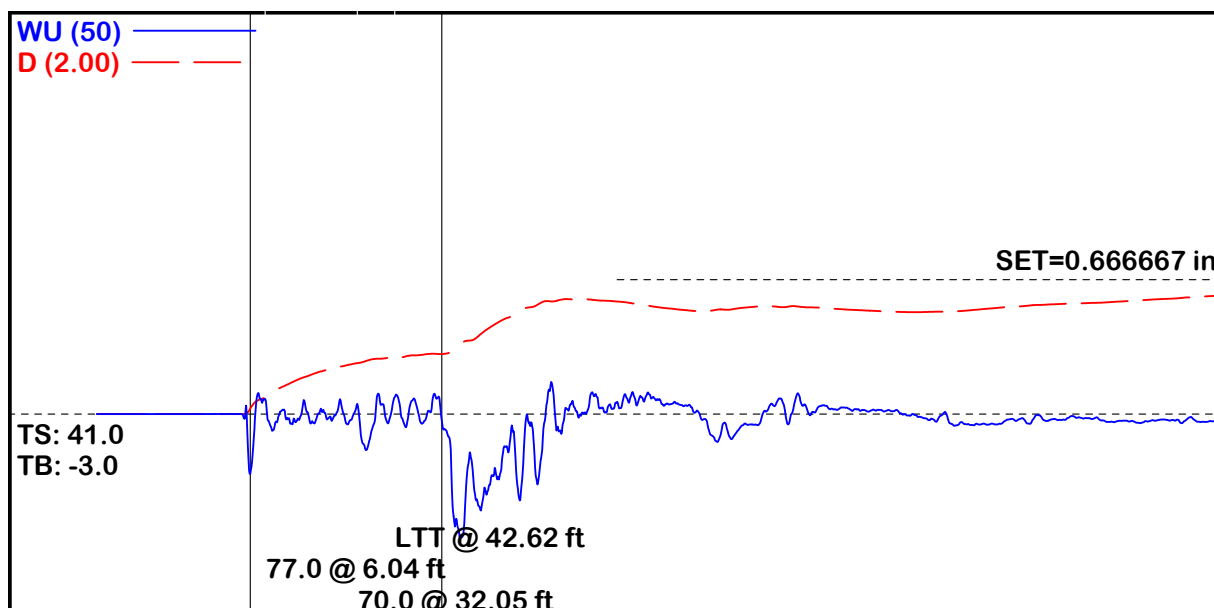
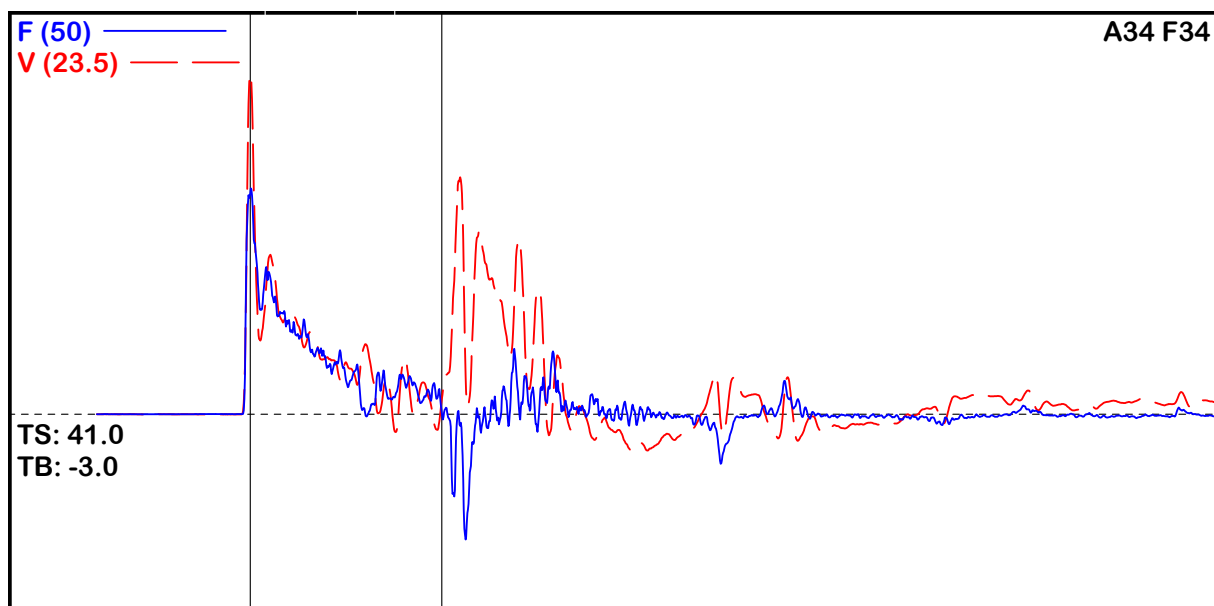
LE 49.00 ft
 AR 1.19 in^2
 EM 30000 ksi
 SP 0.492 k/ft3
 WS 16807.9 f/s
 EA/C 2.1 ksec/ft
 2L/C 5.84 ms
 JC []
 LP 44.50 ft

Sensors

F3: [168 AWJ-1] 212.47 (1)
 F4: [168 AWJ-2] 215.16 (1)
 A3: [K 2081] 357 mv/5000g's (1)
 A4: [K 2082] 322 mv/5000g's (1)
 CLIP: OK

F & ME SPT Calibration

Boring 1 Sample 5

Project Information

PROJECT: F & ME SPT Calibration
 PILE NAME: Boring 1 Sample 5
 DESCR: CME 550X S/N 249533, AW-J Rod
 OPERATOR: MR
 FILE: Boring 1 Sample 5 Final.W01
 3/30/2017 9:59:36 AM
 Blow Number 16

Quantity Results

EFV 0.314 ft-k
 ETR 89.6 (%)
 FMX 28 kips
 VMX 19.9 f/s
 BPM 53.1 bpm
 FVP 0.65 []
 DMX 0.67 in
 DFN 0.67 in
 CSX 23.6 ksi

Pile Properties

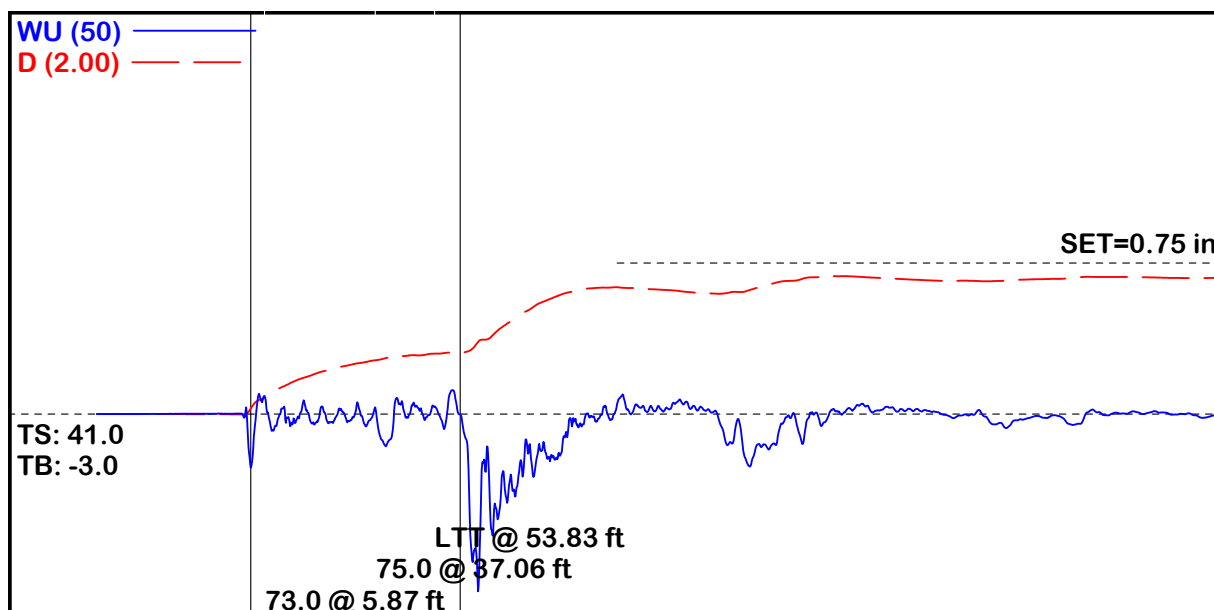
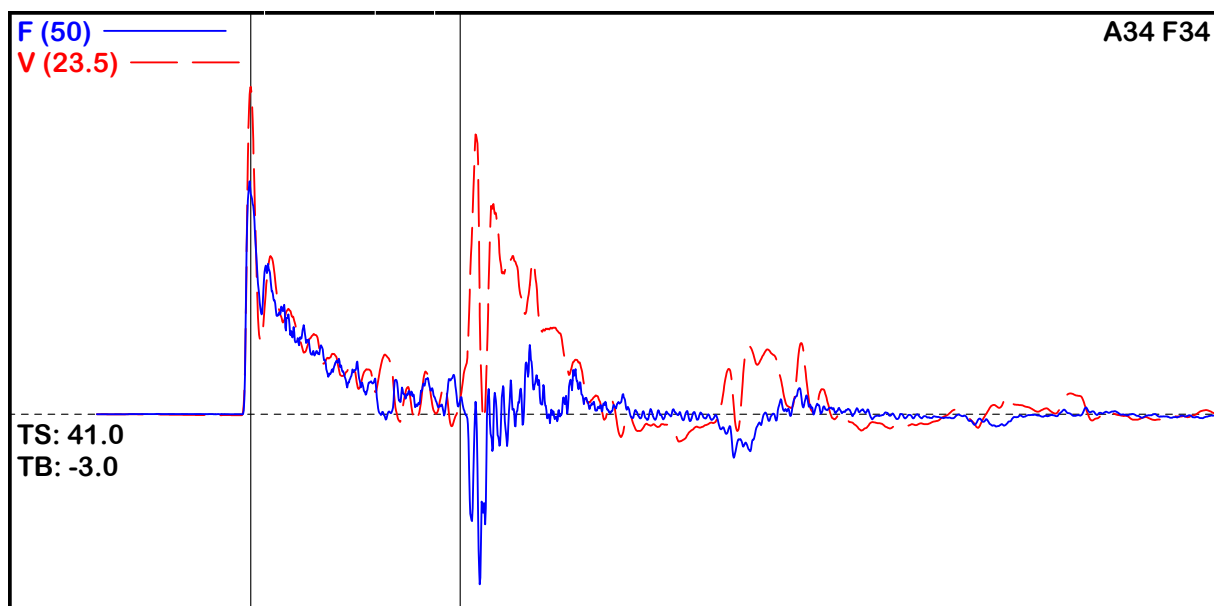
LE 54.00 ft
 AR 1.19 in^2
 EM 30000 ksi
 SP 0.492 k/ft3
 WS 16807.9 f/s
 EA/C 2.1 ksec/ft
 2L/C 6.44 ms
 JC []
 LP 49.50 ft

Sensors

F3: [168 AWJ-1] 212.47 (1)
 F4: [168 AWJ-2] 215.16 (1)
 A3: [K 2081] 357 mv/5000g's (1)
 A4: [K 2082] 322 mv/5000g's (1)
 CLIP: OK

F & ME SPT Calibration

Boring 1 Sample 6

Project Information

PROJECT: F & ME SPT Calibration
 PILE NAME: Boring 1 Sample 6
 DESCR: CME 550X S/N 249533, AW-J Rod
 OPERATOR: MR
 FILE: Boring 1 Sample 6 Final.W01
 3/30/2017 10:08:00 AM
 Blow Number 15

Pile Properties

LE 59.00 ft
 AR 1.19 in²
 EM 30000 ksi
 SP 0.492 k/ft3
 WS 16807.9 f/s
 EA/C 2.1 ksec/ft
 2L/C 7.04 ms
 JC []
 LP 54.50 ft

Quantity Results

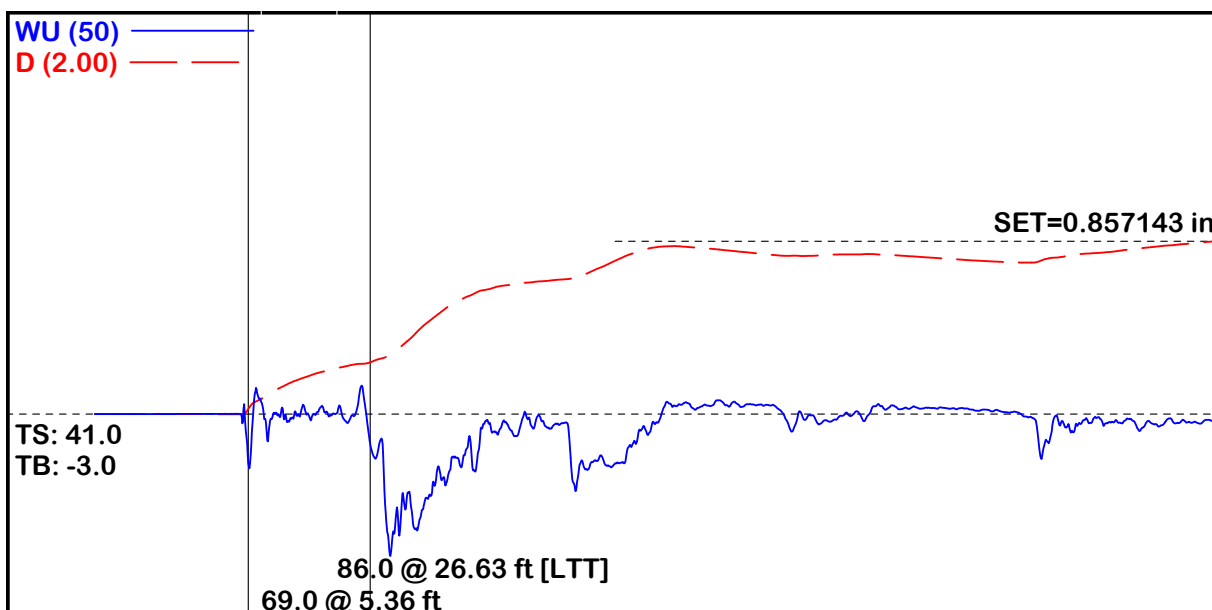
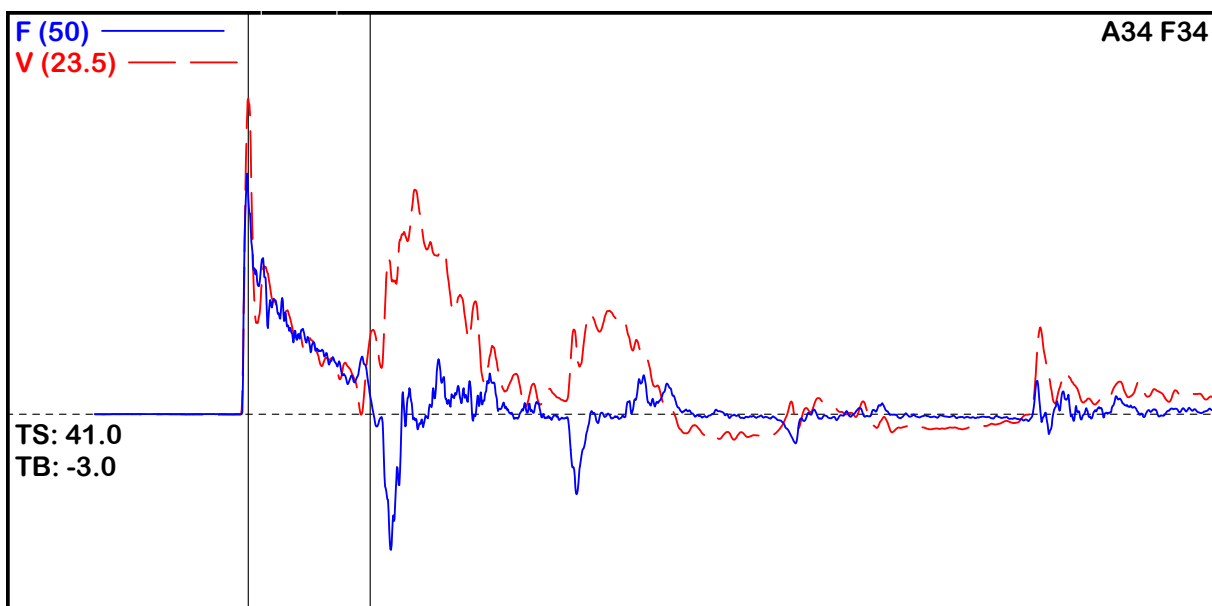
EFV 0.316 ft-k
 ETR 90.4 (%)
 FMX 29 kips
 VMX 19.1 f/s
 BPM 52.1 bpm
 FVP 0.67 []
 DMX 0.80 in
 DFN 0.75 in
 CSX 24.3 ksi

Sensors

F3: [168 AWJ-1] 212.47 (1)
 F4: [168 AWJ-2] 215.16 (1)
 A3: [K 2081] 357 mv/5000g's (1)
 A4: [K 2082] 322 mv/5000g's (1)
 CLIP: OK

F & ME SPT Calibration

Boring 2 Sample 1

Project Information

PROJECT: F & ME SPT Calibration
 PILE NAME: Boring 2 Sample 1
 DESCR: CME 45B S/N 303304, AW Rod
 OPERATOR: MR
 FILE: Boring 2 Sample 1 Final.W01
 3/30/2017 9:35:18 AM
 Blow Number 11

Quantity Results

EFV 0.299 ft-k
 ETR 85.6 (%)
 FMX 30 kips
 VMX 18.4 f/s
 BPM 53.9 bpm
 FVP 0.69 []
 DMX 0.89 in
 DFN 0.86 in
 CSX 25.1 ksi

Pile Properties

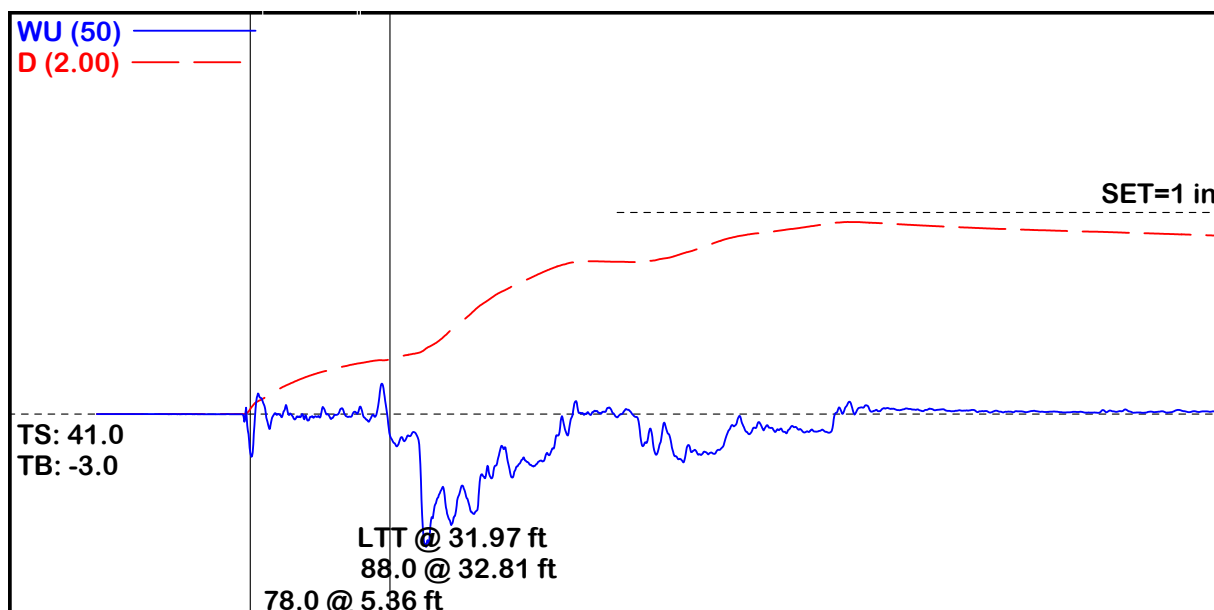
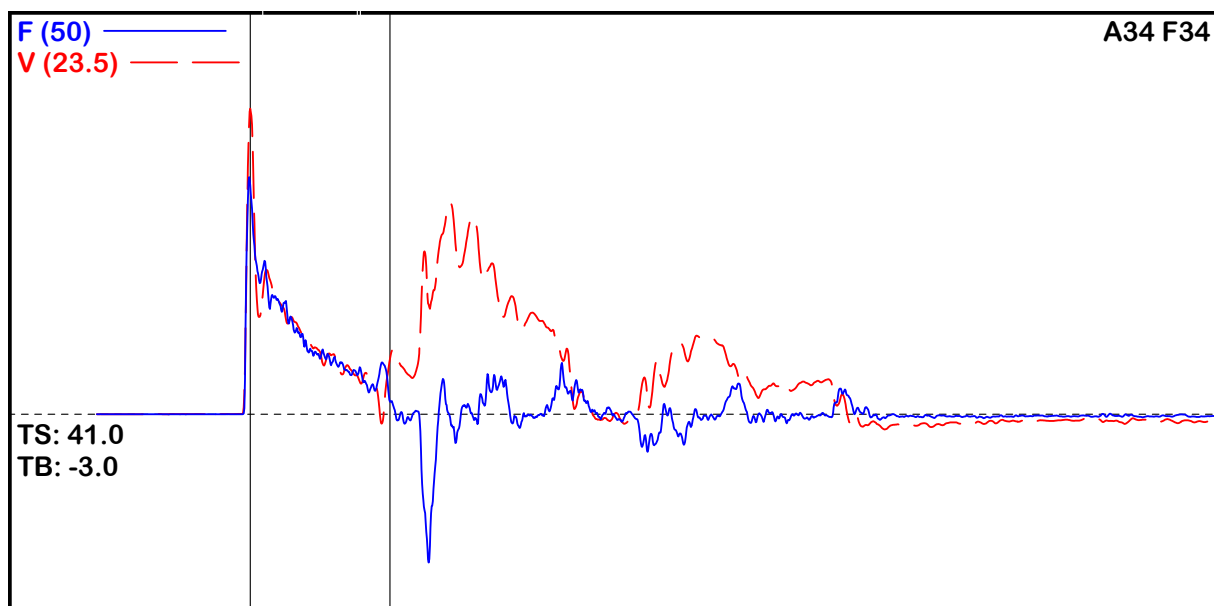
LE 34.33 ft
 AR 1.19 in^2
 EM 30000 ksi
 SP 0.492 k/ft3
 WS 16807.9 f/s
 EA/C 2.1 ksec/ft
 2L/C 4.10 ms
 JC []
 LP 29.50 ft

Sensors

F3: [168 AWJ-1] 212.47 (1)
 F4: [168 AWJ-2] 215.16 (1)
 A3: [K 2081] 357 mv/5000g's (1)
 A4: [K 2082] 322 mv/5000g's (1)
 CLIP: OK

F & ME SPT Calibration

Boring 2 Sample 2

Project Information

PROJECT: F & ME SPT Calibration
 PILE NAME: Boring 2 Sample 2
 DESCR: CME 45B S/N 303304, AW Rod
 OPERATOR: MR
 FILE: Boring 2 Sample 2 Final.W01
 3/30/2017 9:42:15 AM
 Blow Number 11

Quantity Results

EFV 0.309 ft-k
 ETR 88.2 (%)
 FMX 29 kips
 VMX 17.8 f/s
 BPM 55.2 bpm
 FVP 0.75 []
 DMX 1.02 in
 DFN 1.00 in
 CSX 24.7 ksi

Pile Properties

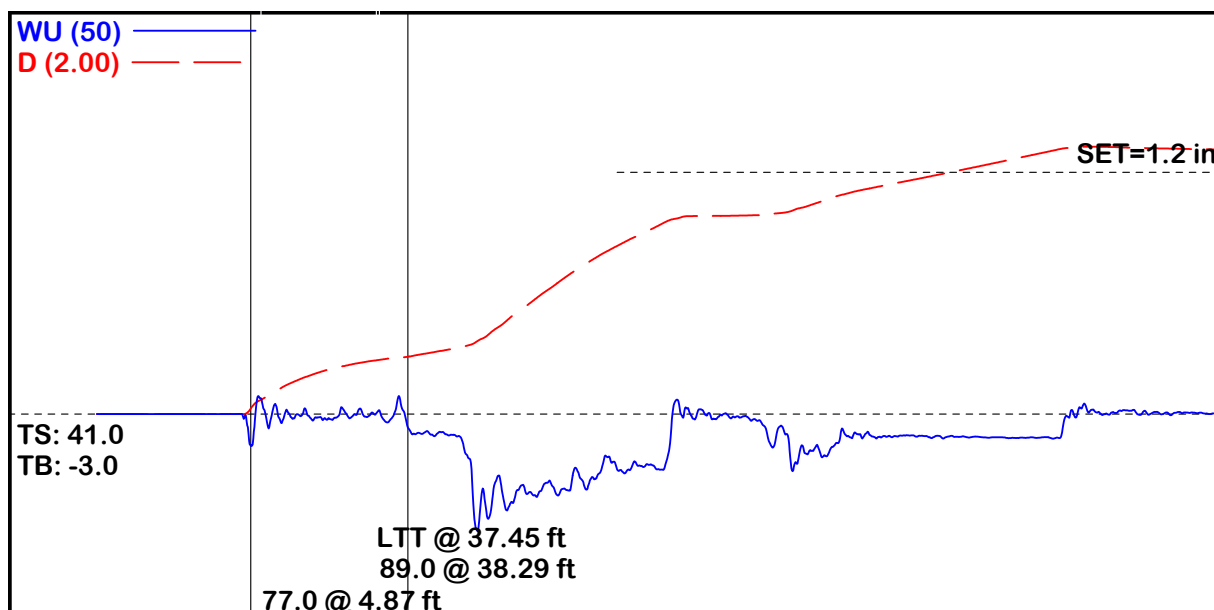
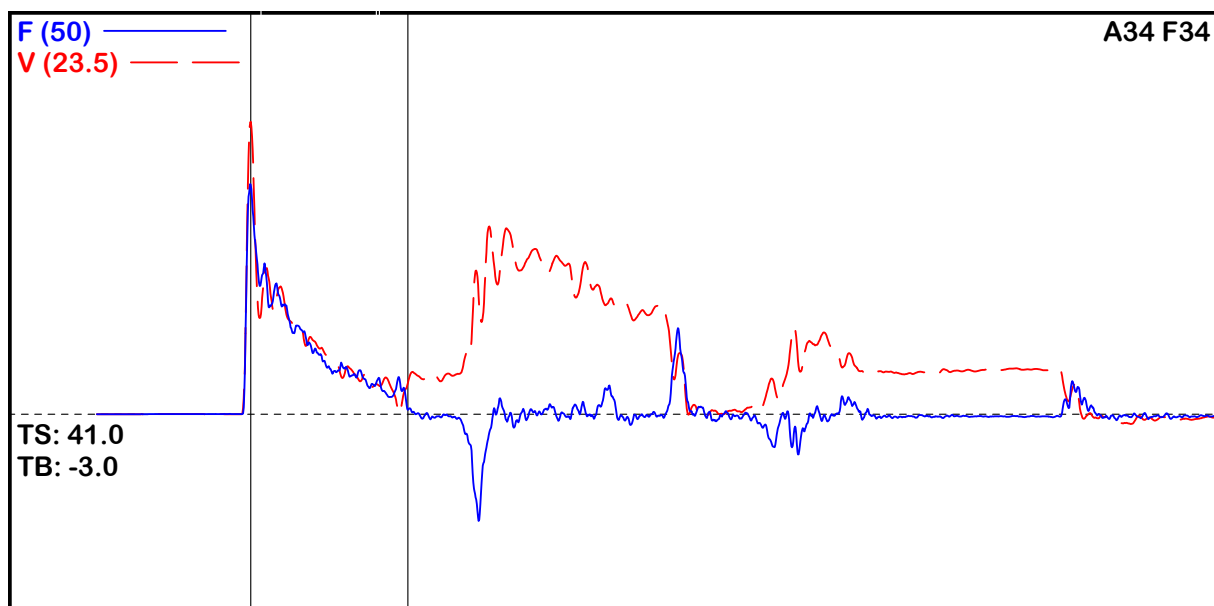
LE 39.33 ft
 AR 1.19 in^2
 EM 30000 ksi
 SP 0.492 k/ft3
 WS 16807.9 f/s
 EA/C 2.1 ksec/ft
 2L/C 4.70 ms
 JC []
 LP 34.50 ft

Sensors

F3: [168 AWJ-1] 212.47 (1)
 F4: [168 AWJ-2] 215.16 (1)
 A3: [K 2081] 357 mv/5000g's (1)
 A4: [K 2082] 322 mv/5000g's (1)
 CLIP: OK

F & ME SPT Calibration

Boring 2 Sample 3

Project Information

PROJECT: F & ME SPT Calibration
 PILE NAME: Boring 2 Sample 3
 DESCR: CME 45B S/N 303304, AW Rod
 OPERATOR: MR
 FILE: Boring 2 Sample 3 Final.W01
 3/30/2017 9:48:34 AM
 Blow Number 8

Quantity Results

EFV 0.312 ft-k
 ETR 89.1 (%)
 FMX 29 kips
 VMX 17.1 f/s
 BPM 59.0 bpm
 FVP 0.78 []
 DMX 1.33 in
 DFN 1.20 in
 CSX 24.0 ksi

Pile Properties

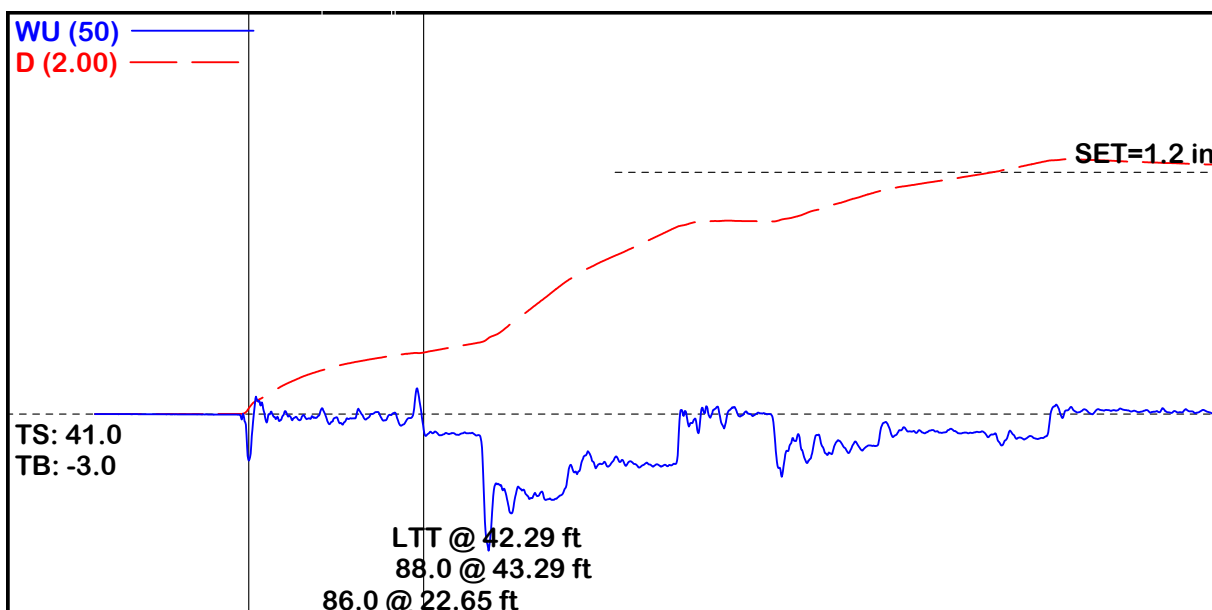
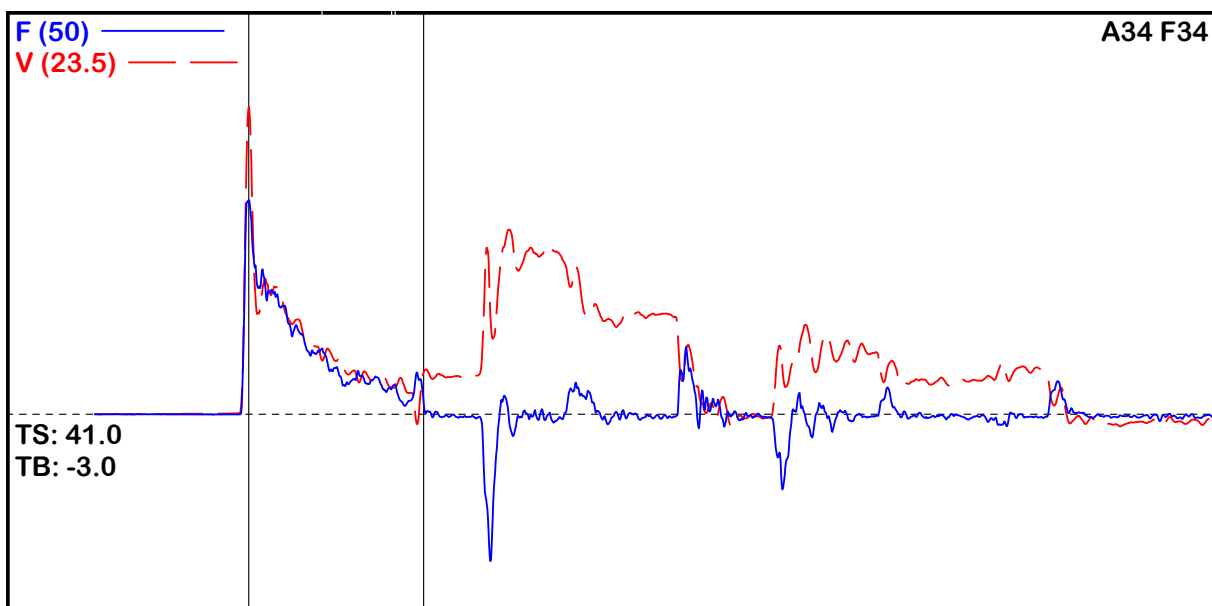
LE 44.33 ft
 AR 1.19 in^2
 EM 30000 ksi
 SP 0.492 k/ft3
 WS 16807.9 f/s
 EA/C 2.1 ksec/ft
 2L/C 5.28 ms
 JC []
 LP 39.50 ft

Sensors

F3: [168 AWJ-1] 212.47 (1)
 F4: [168 AWJ-2] 215.16 (1)
 A3: [K 2081] 357 mv/5000g's (1)
 A4: [K 2082] 322 mv/5000g's (1)
 CLIP: OK

F & ME SPT Calibration

Boring 2 Sample 4

Project Information

PROJECT: F & ME SPT Calibration
 PILE NAME: Boring 2 Sample 4
 DESCR: CME 45B S/N 303304, AW Rod
 OPERATOR: MR
 FILE: Boring 2 Sample 4 Final.W01
 3/30/2017 9:57:31 AM
 Blow Number 9

Quantity Results

EFV 0.313 ft-k
 ETR 89.4 (%)
 FMX 27 kips
 VMX 17.9 f/s
 BPM 58.5 bpm
 FVP 0.70 []
 DMX 1.26 in
 DFN 1.20 in
 CSX 22.3 ksi

Pile Properties

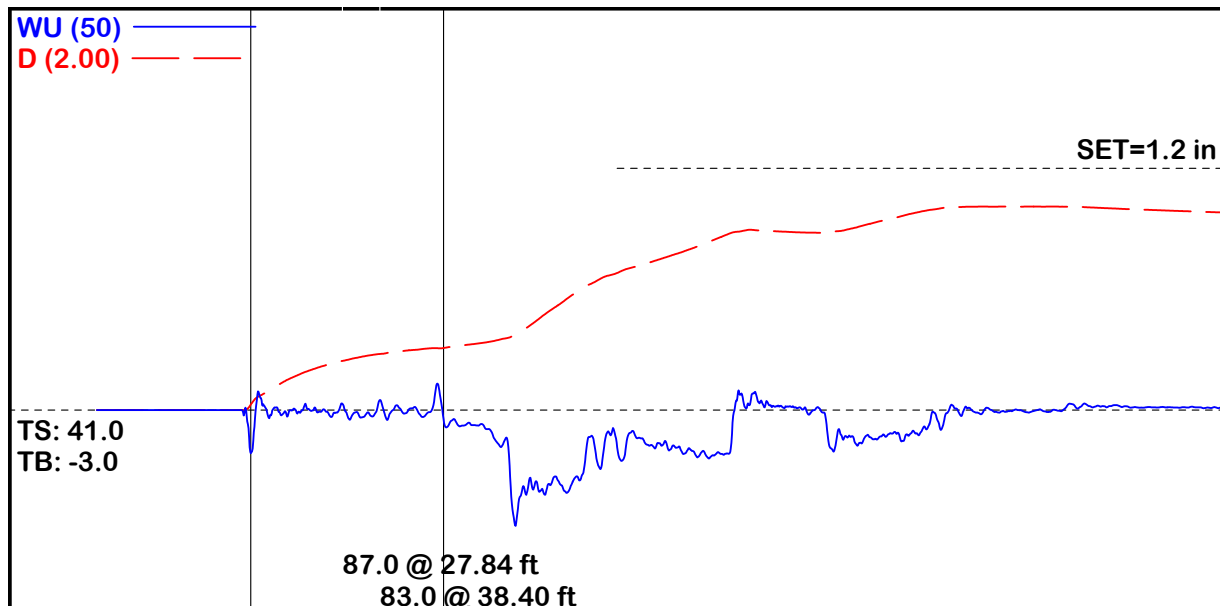
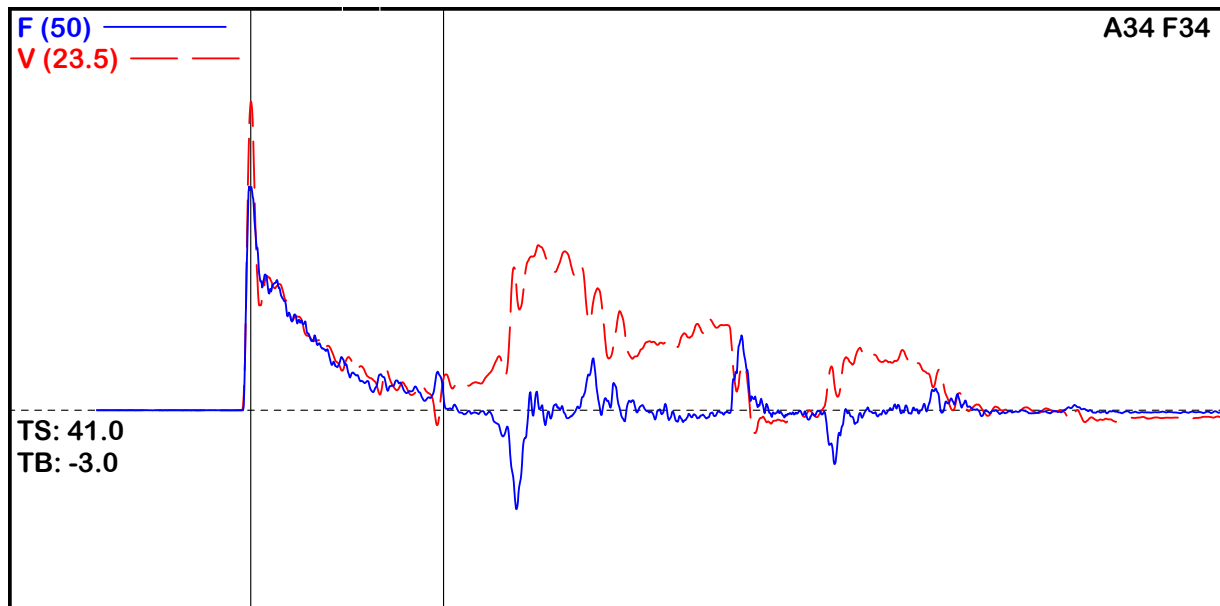
LE 49.33 ft
 AR 1.19 in^2
 EM 30000 ksi
 SP 0.492 k/ft3
 WS 16807.9 f/s
 EA/C 2.1 ksec/ft
 2L/C 5.88 ms
 JC []
 LP 44.50 ft

Sensors

F3: [168 AWJ-1] 212.47 (1)
 F4: [168 AWJ-2] 215.16 (1)
 A3: [K 2081] 357 mv/5000g's (1)
 A4: [K 2082] 322 mv/5000g's (1)
 CLIP: OK

F & ME SPT Calibration

Boring 2 Sample 5

Project Information

PROJECT: F & ME SPT Calibration
 PILE NAME: Boring 2 Sample 5
 DESCR: CME 45B S/N 303304, AW Rod
 OPERATOR: MR
 FILE: Boring 2 Sample 5 Final.W01
 3/30/2017 10:05:46 AM
 Blow Number 9

Quantity Results

EFV 0.332 ft-k
 ETR 94.8 (%)
 FMX 28 kips
 VMX 18.0 f/s
 BPM 59.3 bpm
 FVP 0.72 []
 DMX 1.20 in
 DFN 1.20 in
 CSX 23.3 ksi

Pile Properties

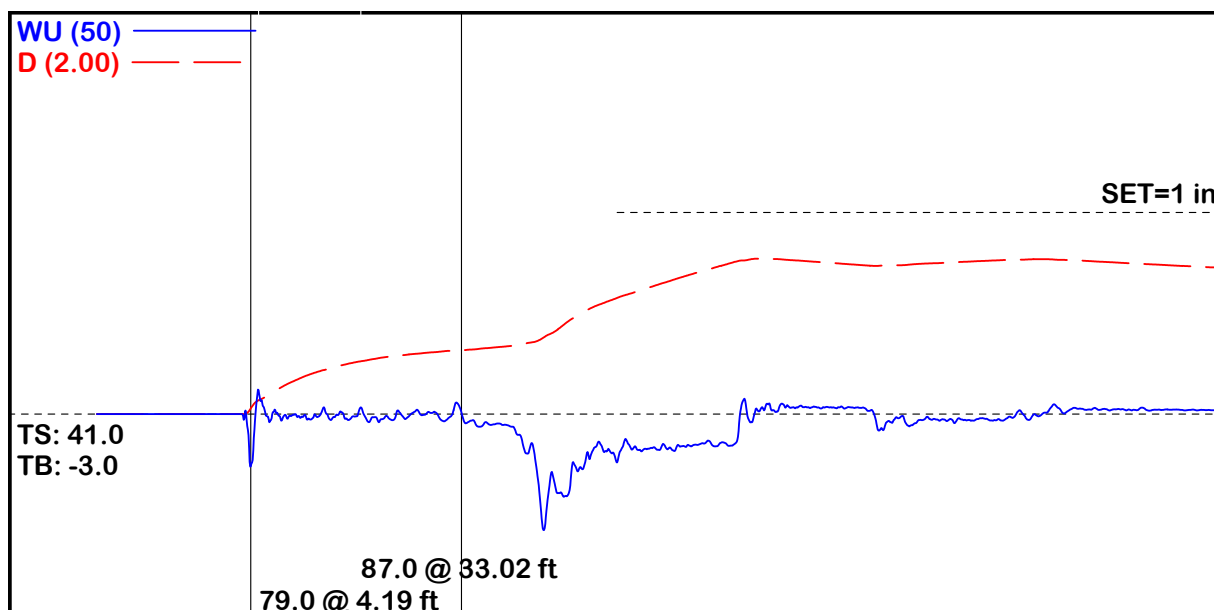
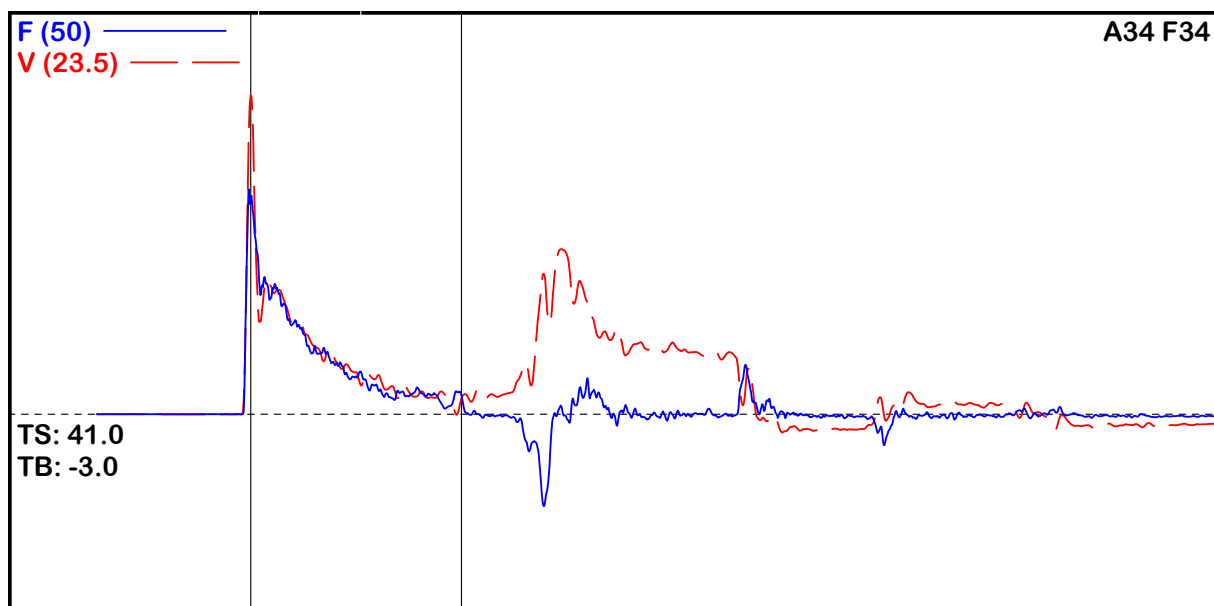
LE 54.33 ft
 AR 1.19 in^2
 EM 30000 ksi
 SP 0.492 k/ft3
 WS 16807.9 f/s
 EA/C 2.1 ksec/ft
 2L/C 6.48 ms
 JC []
 LP 49.50 ft

Sensors

F3: [168 AWJ-1] 212.47 (1)
 F4: [168 AWJ-2] 215.16 (1)
 A3: [K 2081] 357 mv/5000g's (1)
 A4: [K 2082] 322 mv/5000g's (1)
 CLIP: OK

F & ME SPT Calibration

Boring 2 Sample 6

Project Information

PROJECT: F & ME SPT Calibration
 PILE NAME: Boring 2 Sample 6
 DESCR: CME 45B S/N 303304, AW Rod
 OPERATOR: MR
 FILE: Boring 2 Sample 6 Final.W01
 3/30/2017 10:16:06 AM
 Blow Number 10

Quantity Results

EFV 0.328 ft-k
 ETR 93.6 (%)
 FMX 28 kips
 VMX 18.6 f/s
 BPM 58.7 bpm
 FVP 0.67 []
 DMX 1.01 in
 DFN 1.00 in
 CSX 23.4 ksi

Pile Properties

LE 59.33 ft
 AR 1.19 in^2
 EM 30000 ksi
 SP 0.492 k/ft3
 WS 16807.9 f/s
 EA/C 2.1 ksec/ft
 2L/C 7.08 ms
 JC []
 LP 54.50 ft

Sensors

F3: [168 AWJ-1] 212.47 (1)
 F4: [168 AWJ-2] 215.16 (1)
 A3: [K 2081] 357 mv/5000g's (1)
 A4: [K 2082] 322 mv/5000g's (1)
 CLIP: OK