EXELON VICTORIA - Boring B3290 (48.5'-50' sample)
OP: JNH

Hammer ID: CME08; Driller: L.CARTER CME550 (MACTEC)
Test date: 21-Feb-2009

AR: 2.27 in^2
LE: 54.00 ft
WS: 16,807.9 f/s

SP: 0.492 k/ft3
EM: 30,000 ksi
JC: 0.70

CSX: Max Measured Compr. Stress
TSX: Tension Stress Maximum
VMX: Maximum Velocity
FMX: Maximum Force
FVP: Force/Velocity proportionality

BPM: Blows per Minute
EF2: Energy of F^2
ETR: Energy Transfer Ratio
EMX: Max Transferred Energy

BL#	CSX ksi	TSX ksi	VMX f/s	FMX kips	FVP []	BPM **	EF2 k-ft	ETR (%)	EMX k-ft
2	15.6	13.9	14.2	35	0.6	1.9	0.232	81.9	0.287
3	14.8	12.8	13.7	34	0.6	54.2	0.220	78.5	0.275
4	15.3	12.0	14.2	35	0.6	54.9	0.217	79.1	0.277
5	15.0	12.3	13.8	34	0.6	55.8	0.219	77.7	0.272
6	15.6	11.8	13.9	35	0.6	55.4	0.222	76.3	0.267
7	14.8	12.5	13.7	34	0.6	55.4	0.214	76.2	0.267
8	15.6	13.0	13.8	35	0.6	56.2	0.227	77.5	0.271
9	15.7	12.4	13.4	36	0.6	55.6	0.226	76.3	0.267
10	15.3	12.1	13.7	35	0.6	55.9	0.221	76.4	0.267
11	15.4	12.0	13.7	35	0.6	55.8	0.214	76.2	0.267
12	15.6	11.5	13.6	35	0.6	55.2	0.217	76.6	0.268
13	14.8	11.3	12.9	34	0.6	56.1	0.221	77.1	0.270
14	14.7	11.3	12.7	33	0.6	55.8	0.211	74.0	0.259
15	15.7	11.2	13.7	36	0.6	55.2	0.221	78.7	0.275
16	15.5	11.2	13.6	35	0.6	55.9	0.215	76.0	0.266
17	15.7	11.7	13.4	36	0.6	55.8	0.219	75.6	0.264
18	14.9	11.1	13.1	34	0.6	55.4	0.221	76.3	0.267
19	15.7	11.3	13.9	36	0.6	55.8	0.225	77.3	0.271
20	14.7	10.4	13.0	33	0.6	56.0	0.212	73.8	0.258
21	16.1	10.2	13.1	37	0.6	56.1	0.212	73.2	0.256
22	16.3	10.6	13.0	37	0.6	55.2	0.216	73.8	0.258
23	16.4	10.6	13.0	37	0.6	55.8	0.217	72.8	0.255
24	16.7	11.4	13.3	38	0.6	55.7	0.222	78.2	0.274
25	16.4	11.2	12.7	37	0.6	56.0	0.220	75.3	0.264
26	15.2	10.7	12.9	35	0.6	55.8	0.223	75.2	0.263
27	16.9	11.9	13.3	38	0.6	55.7	0.227	78.4	0.274
28	16.2	10.6	13.0	37	0.6	54.9	0.221	75.1	0.263
29	16.8	11.7	13.3	38	0.6	55.8	0.233	80.6	0.282
30	16.1	11.8	12.9	37	0.6	55.5	0.222	75.4	0.264
31	15.7	10.8	12.9	36	0.6	55.6	0.219	75.5	0.264
32	15.4	11.3	12.8	35	0.6	56.1	0.227	76.9	0.269
33	15.4	11.1	12.6	35	0.6	56.0	0.222	74.7	0.262
34	15.1	12.1	12.7	34	0.7	56.0	0.224	76.8	0.269
35	15.3	12.6	12.2	35	0.7	55.5	0.228	78.2	0.274
36	15.4	11.8	12.2	35	0.7	56.0	0.222	74.4	0.261
37	16.4	11.8	12.9	37	0.6	56.2	0.233	78.3	0.274
38	16.5	11.2	12.6	37	0.6	55.8	0.227	76.9	0.269
39	16.3	12.5	13.0	37	0.6	55.9	0.231	78.1	0.273
40	15.0	9.9	12.4	34	0.7	55.5	0.219	74.9	0.262
41	14.9	10.4	12.4	34	0.7	56.3	0.224	77.7	0.272
42	15.1	10.8	12.6	34	0.7	55.5	0.218	74.1	0.259
43	16.0	12.1	12.7	36	0.7	56.3	0.232	79.5	0.278
44	16.2	11.8	12.5	37	0.7	55.8	0.235	78.0	0.273
45	16.2	10.8	12.7	37	0.7	55.0	0.231	79.7	0.279
46	15.3	10.0	12.3	35	0.7	56.2	0.213	75.3	0.263
Average	15.6	11.5	13.1	35	0.6	54.5	0.222	76.6	0.268

Total number of blows analyzed: 45

Time Summary

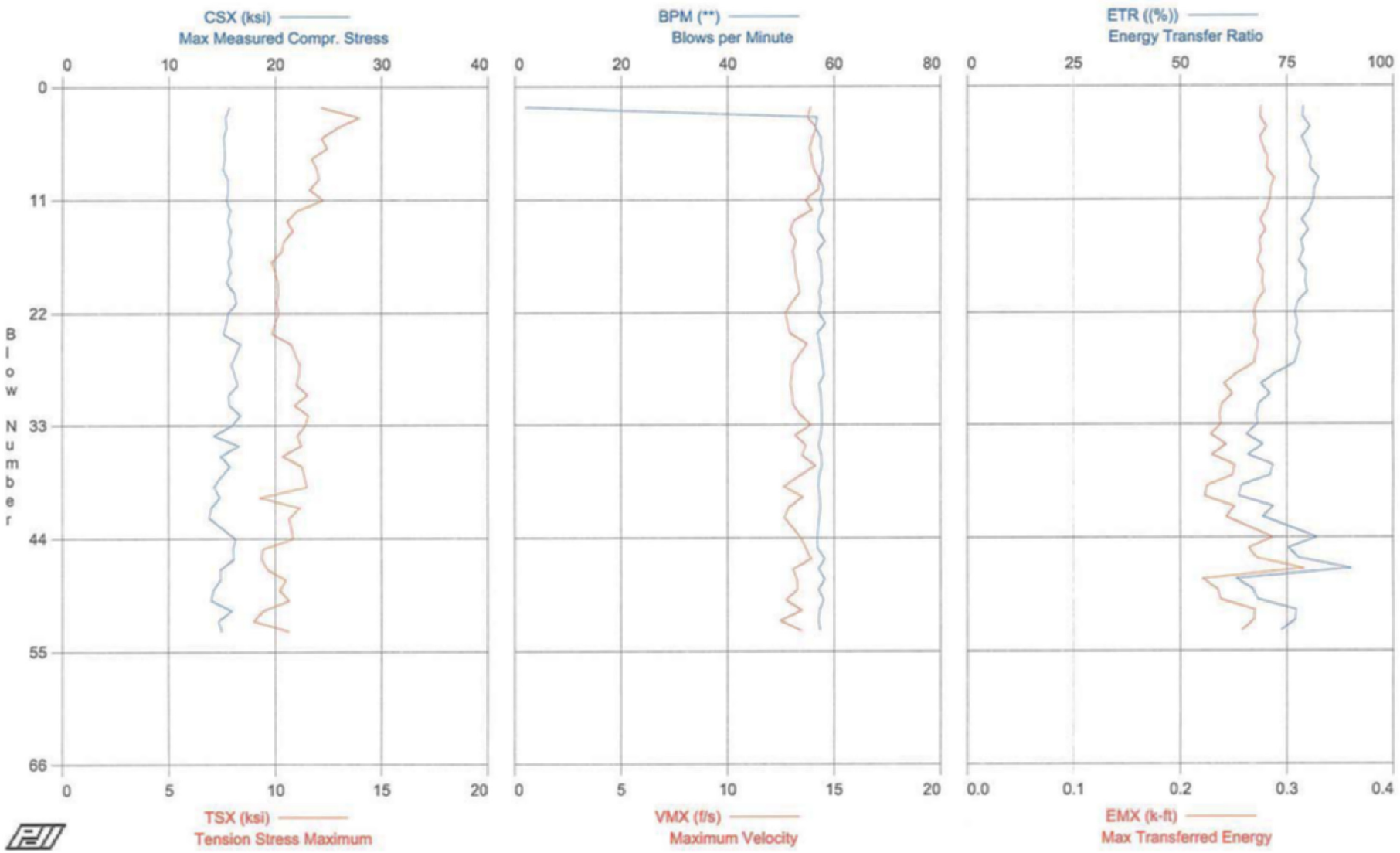
Drive 5 minutes 4 seconds 3:12:28 PM - 3:17:32 PM (2/21/2009) BN 1 - 46

MACTEC Engineering and Consulting, Inc. - Case Method Results

PDIPLOT Ver. 2008.1 - Printed: 23-Mar-2009

Test date: 21-Feb-2009

EXELON VICTORIA - Boring B3290 (53.5'-55' sample)



EXELON VICTORIA - Boring B3290 (53.5'-55' sample)
OP: JNH

Hammer ID: CME08; Driller: L.CARTER CME550 (MACTEC)
Test date: 21-Feb-2009

AR: 2.27 in^2
LE: 59.00 ft
WS: 16,807.9 f/s

SP: 0.492 k/ft3
EM: 30,000 ksi
JC: 0.70

CSX: Max Measured Compr. Stress
TSX: Tension Stress Maximum
VMX: Maximum Velocity
FMX: Maximum Force
FVP: Force/Velocity proportionality

BPM: Blows per Minute
EF2: Energy of F^2
ETR: Energy Transfer Ratio
EMX: Max Transferred Energy

BL#	CSX ksi	TSX ksi	VMX f/s	FMX kips	FVP []	BPM **	EF2 k-ft	ETR (%)	EMX k-ft
2	15.7	12.2	13.9	36	0.6	1.9	0.222	78.9	0.276
3	15.3	13.9	13.8	35	0.6	56.8	0.222	78.7	0.275
4	15.4	12.9	14.1	35	0.6	56.5	0.224	80.4	0.281
5	15.1	12.2	14.0	34	0.6	57.5	0.215	78.5	0.275
6	15.2	12.4	13.9	35	0.6	57.5	0.220	79.5	0.278
7	15.3	11.7	14.0	35	0.6	57.9	0.224	80.7	0.282
8	15.1	12.0	14.0	34	0.6	57.8	0.222	80.4	0.281
9	15.5	12.1	14.3	35	0.6	57.3	0.229	82.4	0.288
10	15.6	11.6	14.3	35	0.6	58.0	0.226	81.4	0.285
11	15.4	12.3	13.7	35	0.6	57.4	0.229	81.2	0.284
12	15.8	11.0	13.9	36	0.6	57.9	0.229	80.3	0.281
13	15.5	10.6	13.1	35	0.7	57.1	0.221	78.4	0.275
14	15.8	10.8	12.9	36	0.7	57.0	0.229	80.0	0.280
15	15.6	10.4	13.2	35	0.6	58.2	0.226	78.3	0.274
16	15.9	10.3	13.1	36	0.6	56.8	0.231	78.9	0.276
17	15.6	9.8	13.2	35	0.7	57.5	0.225	77.8	0.272
18	15.8	10.0	13.2	36	0.6	57.6	0.229	79.5	0.278
19	15.4	10.1	13.3	35	0.7	57.7	0.225	79.2	0.277
20	16.1	10.2	13.4	37	0.6	57.2	0.231	79.7	0.279
21	16.3	10.1	13.0	37	0.6	57.5	0.228	77.6	0.272
22	15.6	10.2	12.7	35	0.7	57.1	0.223	76.8	0.269
23	15.4	10.0	12.8	35	0.6	58.3	0.224	77.4	0.271
24	15.1	9.9	12.9	34	0.7	56.9	0.218	77.0	0.269
25	16.7	10.7	13.7	38	0.6	57.3	0.222	78.1	0.273
27	15.9	11.2	13.1	36	0.6	57.8	0.212	76.8	0.269
28	16.2	11.1	13.0	37	0.6	58.1	0.197	72.3	0.253
29	16.5	11.0	13.0	37	0.6	57.2	0.190	69.0	0.241
30	15.6	11.5	13.1	35	0.6	57.5	0.190	71.0	0.249
31	15.7	10.9	13.1	36	0.6	57.6	0.175	68.4	0.239
32	16.7	11.6	13.4	38	0.5	57.7	0.175	67.8	0.237
33	15.9	11.4	13.9	36	0.5	57.7	0.170	68.0	0.238
34	14.2	11.1	13.2	32	0.5	57.5	0.165	65.5	0.229
35	16.6	11.2	13.7	38	0.6	57.1	0.180	69.4	0.243
36	14.9	10.3	13.5	34	0.5	57.6	0.163	65.9	0.230
37	15.8	11.3	14.1	36	0.5	57.7	0.183	71.8	0.251
38	14.9	11.4	13.4	34	0.6	57.2	0.179	71.1	0.249
39	14.2	11.5	12.7	32	0.6	57.0	0.152	64.3	0.225
40	14.8	9.3	13.5	34	0.5	57.3	0.152	63.6	0.223
41	14.0	11.1	12.9	32	0.6	57.4	0.186	71.8	0.251
42	13.8	10.7	12.7	31	0.6	57.2	0.156	69.3	0.243
44	16.3	10.9	13.5	37	0.6	56.8	0.236	82.0	0.287
45	16.0	9.4	13.7	36	0.6	56.9	0.209	75.3	0.264
46	16.1	9.4	13.9	37	0.6	58.2	0.220	77.8	0.272
47	14.8	9.7	13.1	34	0.6	57.1	0.203	90.2	0.316
48	14.9	10.5	13.3	34	0.5	58.2	0.149	63.0	0.221
49	14.2	10.2	13.3	32	0.6	57.1	0.168	67.0	0.235
50	14.0	10.7	12.7	32	0.6	58.0	0.173	68.1	0.238
51	15.9	9.4	13.5	36	0.6	57.3	0.215	77.1	0.270
52	14.7	9.0	12.5	33	0.7	57.1	0.217	76.9	0.269
53	15.0	10.7	13.5	34	0.6	57.4	0.196	73.7	0.258
Average	15.4	10.9	13.4	35	0.6	56.3	0.204	75.2	0.263

Total number of blows analyzed: 50

Time Summary

Drive		3:22:27 PM - 3:22:27 PM (2/21/2009) BN 1 - 1
Stop	13 minutes	3:22:27 PM - 3:35:27 PM
Drive	53 seconds	3:35:27 PM - 3:36:20 PM BN 2 - 53

Total time [0:13:53] = (Driving [0:00:53] + Stop [0:13:00])

MACTEC

Engineering and constructing a better tomorrow

May 4, 2009

Memorandum to File

From: Jon Honeycutt, Staff Professional JWH

Reviewed By: Steve Kiser, Principal Professional SK

Subject: **Report of SPT Energy – MACTEC CME 45C Track**
Hammer Serial No. MEC-12 Automatic Hammer
WORK INSTRUCTION No. 311 (DCN: EXE-917)
Exelon Texas COL Project – Supplemental Investigation, Including UHS
Victoria, Texas
MACTEC Project No. 6468-07-1777

Jonathan Honeycutt, of MACTEC Engineering and Consulting, Inc. (MACTEC), performed energy measurements on the above referenced drill rig at the subject site per the referenced Work Instructions. This memorandum summarizes the field testing activities and presents the results of the energy measurements.

SPT Energy Field Measurements

SPT energy measurements were made on January 22, 2009, during drilling of Boring B3202 at the referenced site. The testing was performed by Jonathan Honeycutt from approximately 9:11 AM to 10:20 AM (ET) on January 22 under sunny skies with a temperature of about 70 degrees Fahrenheit. The boring was drilled with personnel and equipment from the MACTEC Raleigh office. The drilling equipment consisted of a CME 45C model track-mounted drill rig with an SPT automatic hammer. The drilling tools consisted of AW-J-sized drilling rods and a 2-foot long split tube sampler. Mud rotary drilling techniques were used to advance the boring. The drill rig operator during sampling was Mr. Donnie Rhodes. Energy measurements were recorded during sampling at the depth intervals shown in Table 1.

The energy measurements were performed with a Pile Driving Analyzer (PDA) model PAX (Serial No. 3622L), and calibrated accelerometers (Serial Nos. K0686 and K983) and strain gages (Serial Nos. AW#75/1 and AW#75/2). A steel drill rod, 2-feet long and instrumented with dedicated strain gages, was inserted at the top of the drill rod string immediately below the SPT hammer. The inserted rod was also instrumented with two piezoresistive accelerometers that were bolted to the outside of the rod. The instrumented rod insert had a cross-sectional area of approximately 1.22 square inches and an outside diameter of approximately 1.75 inches at the gage location. The drill rods included in the drill rod string were hollow rods in 5 to 10 foot long sections, with an outside and inside diameter of approximately 1.75 and 1.375 inches, respectively. The recommended operation rate of the hammer is not known. Due to the closed hammer system, the hammer lubrication condition and anvil dimensions could not be observed.

16 Pages Total

MACTEC Engineering and Consulting, Inc.
2801 Yorkmont Road, Suite 100 • Charlotte, NC 28208 • Phone: 704.357.8600

Calibration Records

The calibration records for all the above are filed in DCN EXE-918.

Calculations for EFV

The work was done in general accordance with ASTM D 4633-05. The strain and acceleration signals were converted to force and velocity by the PDA, and the data was interpreted by the PDA according to the Case Method equation. The maximum energy transmitted to the drill rod string (as measured at the location of the strain gages and accelerometers) was calculated by the PDA using the EFV method equation, as shown below:

$$EFV = \int F(t) * V(t) * dt$$

Where: EFV = Transferred energy (EFV equation), or Energy of FV
F(t) = Calculated force at time t
V(t) = Calculated velocity at time t

The EFV method of energy calculation is recommended in ASTM Standard D4633-05. The EFV equation, integrated over the complete wave event, measures the total energy content of the event using both force and velocity measurements. The EFV values associated with each blow analyzed are tabulated in the attached PDIPLOT tables and are also shown graphically in the PDIPLOT charts.

Calculations for ETR

The ratio of the measured transferred energy (EFV) to the theoretical potential energy of the SPT system (140 lb weight with the specified 30 inch fall) is the ETR. The ETR values (as percent of the theoretical value) are shown in Table 1.

Comparison of ETR to Typical Energy Transfer Ratio Range

Based on a research report published by the Florida Department of Transportation (FDOT) (Report WPI No. 0510859, 1999), the average ETR measured for automatic hammers is 79.6%. The standard deviation was 7.9%; therefore, the range of ETRs within one standard deviation of the average was reported to be 71.7% to 87.5%. This range of ETRs was also consistent with other research that was cited in the FDOT research paper; however, maximum and minimum ETR values of up to 98% and 56%, respectively, were reported in the literature. The ETR values shown in Table 1 are generally within the range of typical values for automatic hammers as reported in the literature.

Discussion

Based on the field testing results, observations from the SPT energy measurements are summarized below:

- The data obtained by the PDA are consistent between individual hammer blows and between the sample depths tested. In general, the first and last one (and sometimes two) hammer blow records recorded by the PDA produced poor quality data (which is relatively common) and, as such, the record(s) was(were) not used in the data reduction. This may result in more or less blows evaluated for ETR than what is shown on the boring logs.

- The average energy transferred from the hammer to the drill rods for each individual depth interval using the EFV method ranged from 292 foot-pounds to 312 foot-pounds. These average energy transfers correspond to energy transfer ratios (ETR) of 83% to 89% of the theoretical energy (350 foot-pounds) of the SPT hammer.

- The average at each depth interval was calculated as the transferred energy for each analyzed blow of the depth intervals divided by the total number of hammer blows analyzed. The overall average energy transfer of the SPT system (for all the depth intervals tested) was 294.7 foot-pounds, with an average ETR of 84.2%.

Attachments: Page 4 Table 1 - Summary of SPT Energy Measurements – 1 Page
Page 5 Work Instruction – DCN EXE-917 – 1 Page
Page 6 Record of SPT Energy Measurement – 1 Page
Pages 7 – 16 PDIPLOT Output – 10 Pages

TABLE 1
SUMMARY OF SPT ENERGY MEASUREMENTS (ASTM D4633-05)
Exelon Texas COL Project - Supplemental Investigation, Including UHS
Victoria, Texas
MACTEC Project No. 6468-07-1777

Automatic Hammer Serial Number and Rig Model	Rig Owner	Rig Operator	Boring No. Tested	Date Tested	Drill Rod Size	Sample Depth (feet)	SPT Blow Count (blows per six inches)	No. of Blows Analyzed	Average Measured Energy (Average EFV) (ft-lbs)[a]	Energy Transfer Ratio (%)[b] (Average ETR)
MEC-12 (CME 45C Track)	MACTEC Raleigh	Donnie Rhodes	B3202	1/22/2009	AW-J	18.5 - 20	2 - 4 - 4	10	312	89.1%
						23.5 - 25	4 - 6 - 7	18	292	83.4%
						28.5 - 30	14 - 21 - 25	60	293	83.7%
						33.5 - 35	7 - 12 - 11	30	295	84.3%
						38.5 - 40	3 - 5 - 8	16	293	83.7%
								Average for Rig:	**294.7**	**84.2%**

[a]Measured Energy is energy based on the EFV method, as outlined in ASTM D4633-05, for each blow recorded by the PDA. In some cases, the initial and final one to two blows produced poor quality data, and were not used to calculate the Average Measured Energy. This may result in more or less blows evaluated for ETR than what is shown on the boring logs.

EFV = EMX * 1000 lbs/kip, where EMX equals the maximum transferred energy measured by the PDA (see attached PDA data).

[b]Energy Transfer Ratio is the Measured Energy divided by the theoretical SPT energy of 350 foot-pounds (140 pound hammer falling 2.5 feet).

The average EFV and ETR values may differ slightly and insignificantly from those in the PDIPLOT tables due to roundoff.

Prepared By:	Date: 5/4/09		Checked By:	Date: 5-4-09

Work Instruction No. 311
Exelon COL Victoria Site
MACTEC Engineering and Consulting, Inc.
MACTEC Project 6468-07-1777

DCN 1/2/09

Issued To: ~~Steve Kiser and~~ Jonathan Honeycutt

Issued By: Daniel E Atkinson **Rev. No.** 0

Valid From: 1/12/09 **Date:** 1/12/09

To: 12/31/09

Task Description: Perform SPT Energy Measurements

Applicable Technical Procedures or Plans, or other reference:

1. Geotechnical Work Plan (current revision; available at Site Office), and
2. ASTM D 4633-05 (copy attached.).

Specific Instructions (note attachments where necessary): Perform energy measurements for each drill rig on site in accordance with ASTM D-4633-05. Consult with Site Manager as to schedule for performing the measurements. Hammer weights have been checked by site personnel, and records will be available on site. All rigs are using automatic hammer systems. Confirm that automatic hammer system is being operated within manufacturer's recommendations or in a typical operating fashion as observed from watching one or two SPT measurements prior to measuring energy. Check each drill rig using all hammer/rod combinations that it will be using. Depths for measurements should be coordinated with the Site Manager. See Site Manager for current boring logs of holes drilled and use these to plan most effective field measurement program. Submit copies of calibration records for equipment to Project Principal for review prior to beginning work on site.

Special Instructions (note attachments where necessary): Confirm with Site Manager that approval of equipment calibration records have been received prior to beginning field testing. If unexpected conditions are encountered that affect measurements, contact Site Manager or Project Principal immediately.

Report Format: Prepare standard report in accordance with ASTM D 4633 requirements.

Specific Quality Assurance Procedures Applicable: QAP 20-1; QAP 25-1; QAP for Reporting Nuclear-Related Defects, or Noncompliances, per Federal Regulation 10CFR21 and Section 306 of the Energy Reorganization Act of 1974. Current revisions apply.

Hold Points or Witness Points: None

Records: All records generated shall be considered QA Records.

Reviewed and Approved by: (Note: Only one signature is required for issuance)

Project Manager: _____ Date: _____

Project Principal Engineer: _____ Date: _____

Site Manager/Coordinator: _____ Date: 1/12/09

Pages: 1 plus attachment

Attachments: ASTM D 4633-05

DCN: EXE917

DCN EXE 917

MACTEC
2801 YORKMONT ROAD, SUITE 100 □ CHARLOTTE, NC 28208
Telephone: (704) 357-8600 / Facsimile: (704) 357-8638

RECORD OF SPT ENERGY MEASUREMENT

GENERAL INFORMATION		DRILL RIG DATA	
PROJECT:	Exelon	MAKE:	CME
LOCATION:	Victoria, Texas	MODEL:	45C Track
PROJECT NO.:	6468-07-1777	SERIAL NO.:	MEC 12
DATE:	1/22/2009	HAMMER TYPE:	Auto
WEATHER:	Sunny / 70°F	ROPE CONDITION:	N/A
INSPECTOR:	SNH	ROD SIZE:	AWJ.
DRILLING COMPANY:	MACTEC	NO. OF SHEAVES:	N/A

BORING DATA									
BORING NUMBER:	B3202								
DEPTH DRILLED:	Various								
TIME DRIVEN:	7:50AM - 9:30AM								
RIG OPERATOR:	D. Rhodes								
HAMMER OPERATOR:	N/A								
PDA PAK SERIAL NO.:	3622L								
INSTR. ROD AREA:	1.22 in2								
ACCEL. SERIAL NOS.:	#3 - K0686 #4 - K983								
STRAIN SERIAL NOS.:	75 AW 1/2								

	SAMPLE DEPTH (feet)	SPT N-VALUE (bpf)
*	13.5'-15'	4-6-8
	18.5'-20'	3-4-4
	23.5'-25'	4-6-7
	28.5'-30'	14-21-25
	33.5'-35'	7-12-11
	38.5'-40'	3-5-8

REMARKS:
* Confirmation. (18.5'-40') Data was questionable
Sample (13.5'-15') Taken w/ Rod 144 AW 1/2 — USED 75 AW 1/2 w/ 144 AW 1/2 Rod
Same Accelerometer #3 - K0686, #4 K983
Rod taken for 144 AW

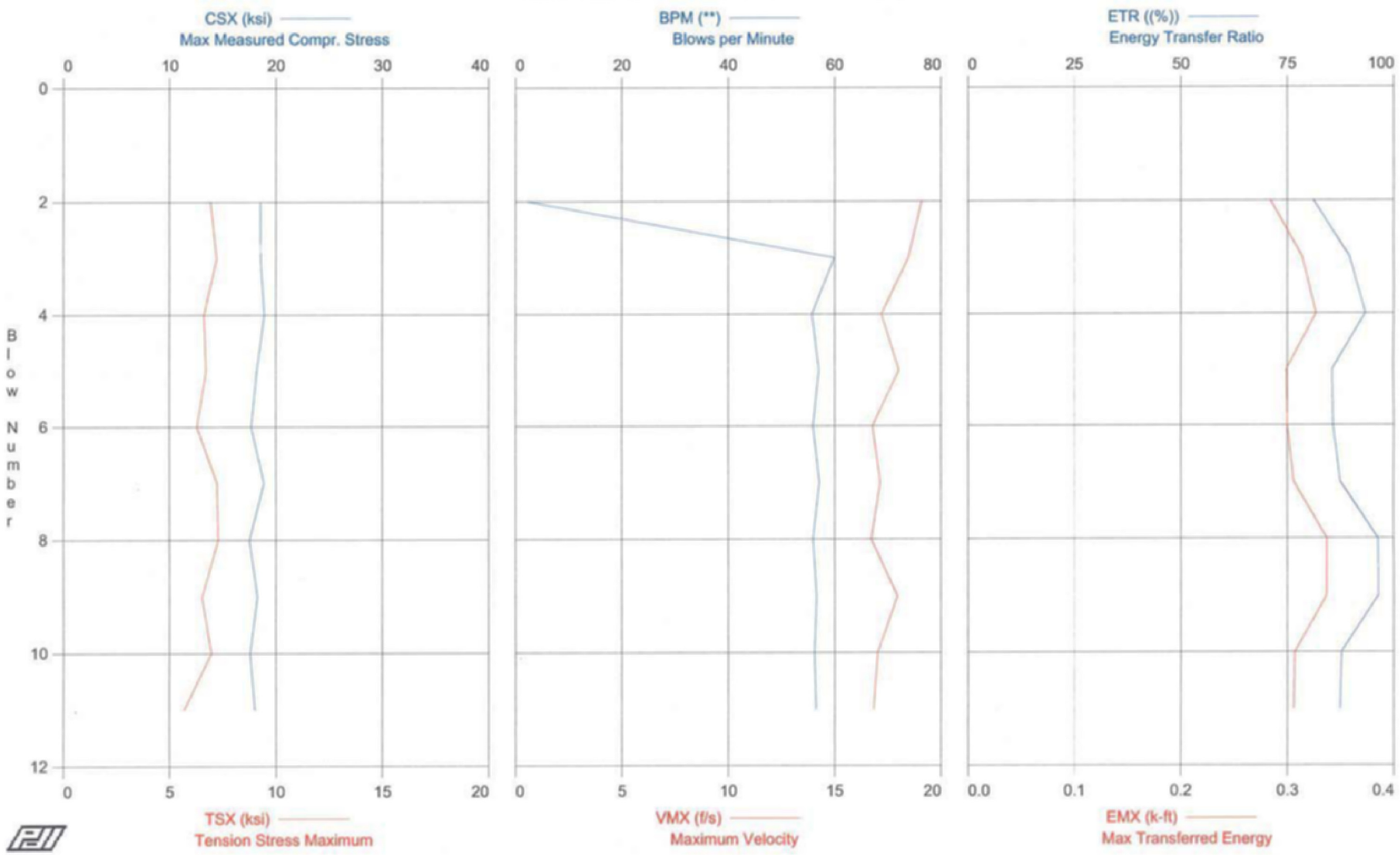
SPT Energy Testing Form, Rev. 1.1

MACTEC Engineering and Consulting, Inc. - Case Method Results

PDIPLOT Ver. 2008.2 - Printed: 2-Mar-2009

Test date: 22-Jan-2009

EXELON VICTORIA - Boring B3202 (18.5'-20' sample)



EXELON VICTORIA - Boring B3202 (18.5'-20' sample)
OP: JNH
Hammer ID MEC12; Driller: D.RHODES CME 45C (MACTEC)
Test date: 22-Jan-2009

AR: 1.22 in^2
LE: 24.00 ft
WS: 16,800.0 f/s
SP: 0.492 k/ft3
EM: 29,972 ksi
JC: 0.70

CSX: Max Measured Compr. Stress
TSX: Tension Stress Maximum
VMX: Maximum Velocity
FMX: Maximum Force
FVP: Force/Velocity proportionality
BPM: Blows per Minute
EF2: Energy of F^2
ETR: Energy Transfer Ratio
EMX: Max Transferred Energy

BL#	CSX ksi	TSX ksi	VMX f/s	FMX kips	FVP []	BPM **	EF2 k-ft	ETR (%)	EMX k-ft
2	18.5	6.9	19.1	23	0.4	1.9	0.187	81.1	0.284
3	18.5	7.2	18.5	23	0.4	59.9	0.191	89.6	0.314
4	18.9	6.6	17.2	23	0.4	55.7	0.194	93.3	0.327
5	18.2	6.7	18.0	22	0.4	57.0	0.192	85.5	0.299
6	17.7	6.3	16.8	22	0.4	55.9	0.194	85.7	0.300
7	18.9	7.2	17.1	23	0.5	57.1	0.193	87.4	0.306
8	17.5	7.3	16.7	21	0.4	55.9	0.196	96.3	0.337
9	18.2	6.5	18.0	22	0.4	56.6	0.193	96.4	0.337
10	17.6	7.0	17.0	21	0.3	56.2	0.191	87.7	0.307
11	18.0	5.7	16.8	22	0.5	56.5	0.194	87.3	0.306
Average	18.2	6.7	17.5	22	0.4	51.3	0.192	89.0	0.312

Total number of blows analyzed: 10

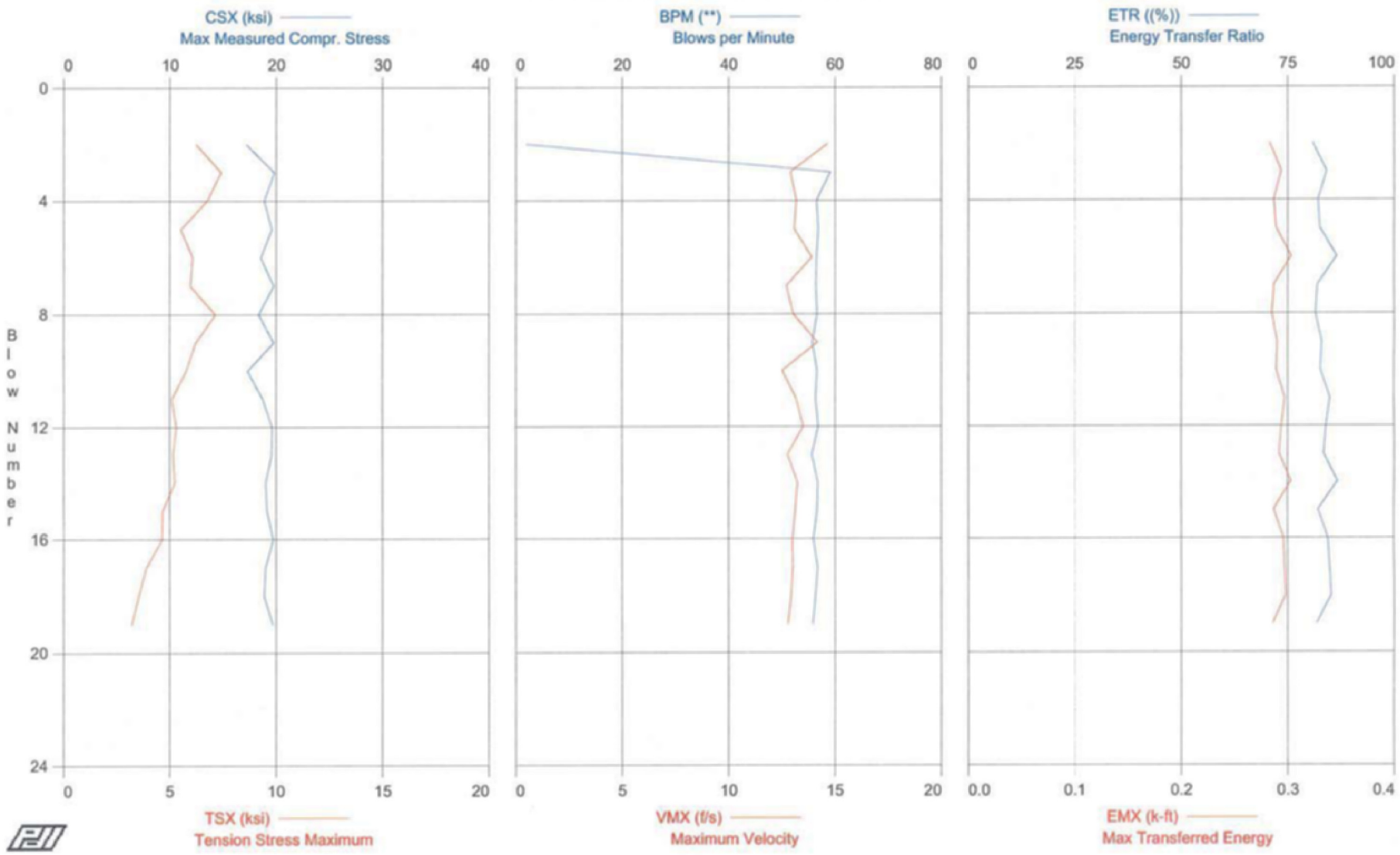
Time Summary
Drive 1 minute 26 seconds 9:11:03 AM - 9:12:29 AM (1/22/2009) BN 1 - 11

MACTEC Engineering and Consulting, Inc. - Case Method Results

PDIPLOT Ver. 2008.2 - Printed: 2-Mar-2009

Test date: 22-Jan-2009

EXELON VICTORIA - Boring B3202 (23.5'-25' sample)



EXELON VICTORIA - Boring B3202 (23.5'-25' sample)
OP: JNH
Hammer ID: MEC12; Driller: D.RHODES CME 45C (MACTEC)
Test date: 22-Jan-2009

AR: 1.22 in^2
LE: 24.00 ft
WS: 16,803.4 f/s
SP: 0.492 k/ft3
EM: 29,869 ksi
JC: 0.70

CSX: Max Measured Compr. Stress
TSX: Tension Stress Maximum
VMX: Maximum Velocity
FMX: Maximum Force
FVP: Force/Velocity proportionality
BPM: Blows per Minute
EF2: Energy of F^2
ETR: Energy Transfer Ratio
EMX: Max Transferred Energy

BL#	CSX ksi	TSX ksi	VMX f/s	FMX kips	FVP []	BPM **	EF2 k-ft	ETR (%)	EMX k-ft
2	17.2	6.2	14.6	21	0.6	1.9	0.204	80.9	0.283
3	19.8	7.4	12.9	24	0.7	59.1	0.203	84.1	0.294
4	18.9	6.8	13.2	23	0.7	56.5	0.203	82.1	0.287
5	19.6	5.5	13.1	24	0.7	56.8	0.206	82.5	0.289
6	18.5	6.1	13.9	23	0.6	56.5	0.199	86.5	0.303
7	19.8	6.0	12.7	24	0.7	56.4	0.206	81.9	0.287
8	18.3	7.1	13.0	22	0.7	56.6	0.204	81.5	0.285
9	19.8	6.2	14.2	24	0.6	55.7	0.204	83.0	0.290
10	17.3	5.8	12.5	21	0.6	56.6	0.203	82.7	0.289
11	18.7	5.1	13.2	23	0.7	56.3	0.204	84.9	0.297
12	19.6	5.3	13.5	24	0.6	56.8	0.201	83.9	0.294
13	19.6	5.1	12.8	24	0.7	55.6	0.206	83.4	0.292
14	19.0	5.2	13.2	23	0.7	56.7	0.205	86.7	0.303
15	19.1	4.7	13.1	23	0.7	56.6	0.201	82.1	0.287
16	19.7	4.6	13.0	24	0.7	55.9	0.206	84.4	0.296
17	19.0	3.9	13.0	23	0.8	56.7	0.206	84.8	0.297
18	18.9	3.5	12.9	23	0.7	56.3	0.198	85.2	0.298
19	19.7	3.2	12.8	24	0.8	55.8	0.208	81.8	0.286
Average	19.0	5.4	13.2	23	0.7	53.5	0.204	83.5	0.292

Total number of blows analyzed: 18

Time Summary

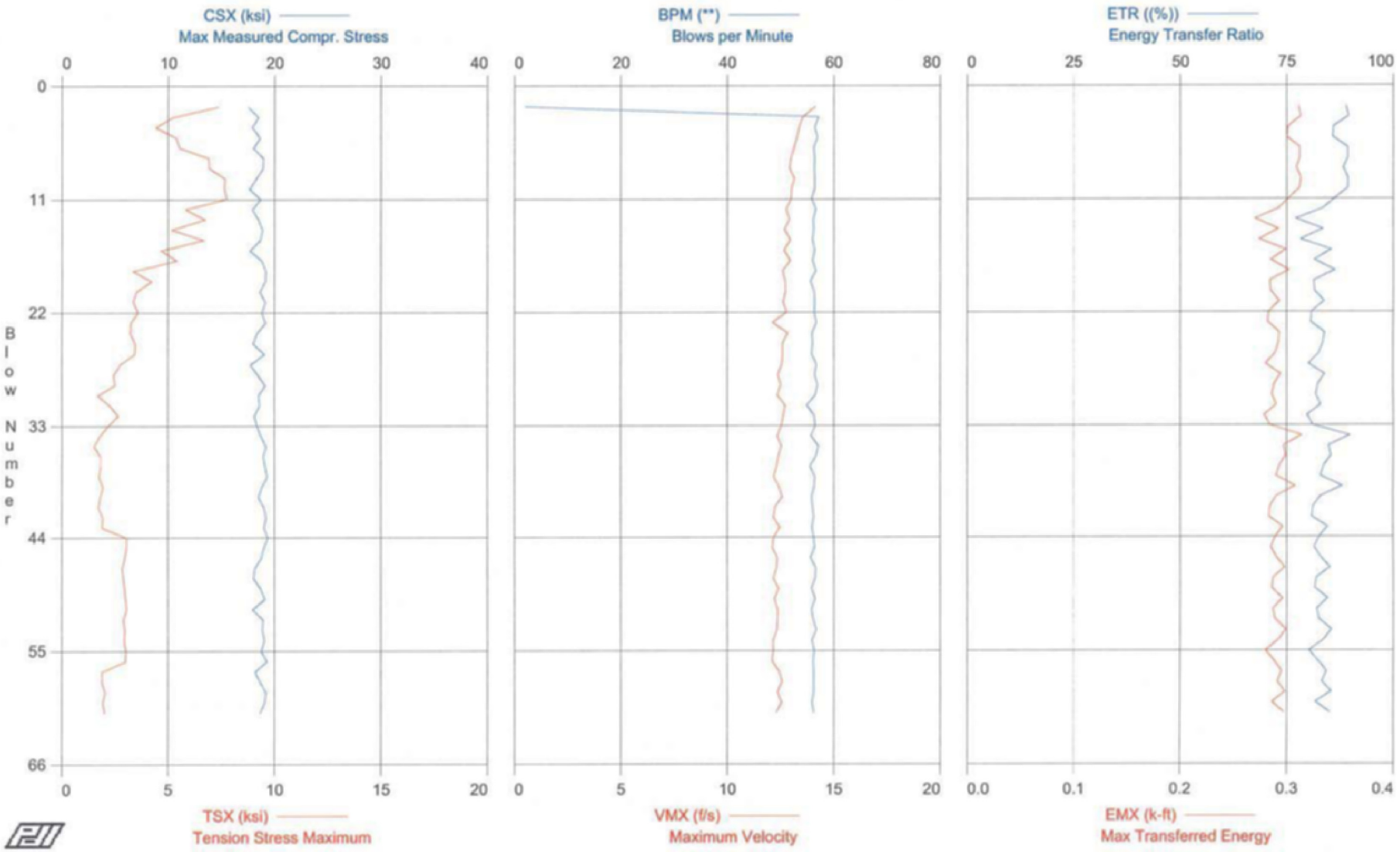
Drive 8 minutes 52 seconds 9:22:07 AM - 9:30:59 AM (1/22/2009) BN 1 - 19

MACTEC Engineering and Consulting, Inc. - Case Method Results

PDIPLOT Ver. 2008.2 - Printed: 2-Mar-2009

Test date: 22-Jan-2009

EXELON VICTORIA - Boring B3202 (28.5'-30' sample)



EXELON VICTORIA - Boring B3202 (28.5'-30' sample)
OP: JNH

Hammer ID: MEC12; Driller: D.RHODES CME 45C (MACTEC)
Test date: 22-Jan-2009

AR: 1.22 in^2
LE: 34.00 ft
WS: 16,807.9 f/s

SP: 0.492 k/ft3
EM: 30,000 ksi
JC: 0.70

CSX: Max Measured Compr. Stress
TSX: Tension Stress Maximum
VMX: Maximum Velocity
FMX: Maximum Force
FVP: Force/Velocity proportionality

BPM: Blows per Minute
EF2: Energy of F^2
ETR: Energy Transfer Ratio
EMX: Max Transferred Energy

BL#	CSX ksi	TSX ksi	VMX f/s	FMX kips	FVP []	BPM **	EF2 k-ft	ETR (%)	EMX k-ft
2	17.5	7.4	14.1	21	0.7	1.9	0.226	88.9	0.311
3	18.5	5.2	13.5	23	0.8	57.1	0.227	89.5	0.313
4	17.9	4.4	13.4	22	0.7	56.4	0.228	85.9	0.301
5	18.6	5.4	13.3	23	0.7	56.9	0.224	85.7	0.300
6	18.0	5.5	13.1	22	0.8	56.2	0.220	89.3	0.312
7	18.9	6.9	13.0	23	0.7	56.4	0.226	89.3	0.312
8	18.9	6.9	12.9	23	0.7	56.3	0.224	88.2	0.309
9	18.3	7.7	13.1	22	0.8	56.4	0.222	89.3	0.313
10	17.6	7.6	13.0	22	0.8	56.4	0.222	89.3	0.312
11	18.7	7.8	13.0	23	0.7	55.8	0.225	86.2	0.302
12	17.9	5.8	12.8	22	0.8	56.6	0.226	83.4	0.292
13	18.5	6.7	12.9	23	0.8	56.1	0.221	77.1	0.270
14	18.9	5.2	12.7	23	0.8	56.2	0.224	83.5	0.292
15	18.7	6.7	13.0	23	0.7	56.0	0.222	78.3	0.274
16	17.7	4.7	12.7	22	0.8	56.4	0.224	85.4	0.299
17	18.8	5.4	12.9	23	0.8	56.0	0.226	81.5	0.285
18	19.2	3.3	12.6	23	0.7	56.6	0.225	86.3	0.302
19	19.1	4.2	12.7	23	0.8	55.6	0.226	81.3	0.284
20	18.6	3.5	12.7	23	0.8	56.3	0.226	81.5	0.285
21	19.1	3.4	12.6	23	0.7	56.4	0.223	83.7	0.293
22	18.8	3.6	12.8	23	0.8	56.3	0.224	80.8	0.283
23	19.1	3.2	12.1	23	0.7	56.7	0.222	80.6	0.282
24	18.3	3.2	12.8	22	0.8	55.9	0.223	83.8	0.293
25	18.0	3.5	12.6	22	0.8	56.0	0.228	83.4	0.292
26	19.0	3.4	12.6	23	0.7	55.8	0.224	82.5	0.289
27	17.7	2.8	12.6	22	0.8	56.7	0.226	80.0	0.280
28	18.4	2.4	12.4	22	0.8	56.4	0.224	83.9	0.294
29	19.1	2.5	12.5	23	0.7	56.9	0.224	82.2	0.288
30	18.5	1.7	12.3	23	0.8	56.5	0.225	81.8	0.286
31	18.6	2.3	12.7	23	0.8	54.9	0.225	82.9	0.290
32	18.1	2.7	12.6	22	0.8	56.3	0.226	79.7	0.279
33	18.4	2.2	12.5	22	0.8	56.5	0.226	81.1	0.284
34	18.7	1.8	12.4	23	0.8	55.7	0.229	89.8	0.314
35	19.2	1.5	12.5	23	0.8	57.1	0.224	84.8	0.297
36	18.9	1.8	12.4	23	0.9	56.6	0.222	85.3	0.299
37	19.1	1.8	12.3	23	0.9	55.5	0.225	83.6	0.293
38	19.3	1.7	12.2	24	0.8	56.4	0.224	82.9	0.290
39	18.8	1.9	12.4	23	0.8	56.3	0.223	88.0	0.308
40	18.5	1.8	12.6	23	0.8	55.8	0.225	82.9	0.290
41	19.0	1.7	12.2	23	0.8	56.0	0.219	81.1	0.284
42	19.2	1.9	12.2	23	0.9	56.2	0.225	80.8	0.283
43	19.0	1.9	12.5	23	0.9	55.9	0.222	84.5	0.296
44	19.4	3.1	12.2	24	0.9	56.2	0.227	82.5	0.289
45	19.0	3.0	12.1	23	0.9	56.4	0.223	81.4	0.285
46	18.8	3.0	12.3	23	0.8	55.6	0.227	82.9	0.290
47	18.1	2.8	12.3	22	0.8	56.6	0.223	85.1	0.298
48	18.0	2.9	12.2	22	0.8	56.5	0.224	81.9	0.287
49	18.7	3.0	12.4	23	0.8	55.8	0.224	81.6	0.286
50	19.1	3.0	12.2	23	0.9	56.5	0.222	84.5	0.296
51	17.9	3.1	12.4	22	0.8	55.8	0.219	82.0	0.287
52	18.9	2.9	12.4	23	0.9	56.1	0.224	82.5	0.289
53	18.9	3.0	12.3	23	0.8	56.7	0.218	85.4	0.299
54	19.0	2.9	12.2	23	0.7	55.9	0.223	83.5	0.292
55	18.8	3.0	12.2	23	0.9	56.3	0.220	80.1	0.280
56	19.3	3.0	12.1	24	0.8	56.1	0.223	82.3	0.288
57	18.2	1.9	12.4	22	0.8	56.2	0.223	84.2	0.295
58	18.7	1.9	12.6	23	0.8	56.2	0.225	83.1	0.291
59	19.2	2.0	12.4	23	0.9	56.2	0.223	85.3	0.298
60	19.1	1.9	12.6	23	0.9	55.9	0.225	81.6	0.286
61	18.7	2.0	12.3	23	0.8	56.2	0.222	85.0	0.297
Average	18.6	3.6	12.6	23	0.8	55.3	0.224	83.7	0.293

Total number of blows analyzed: 60

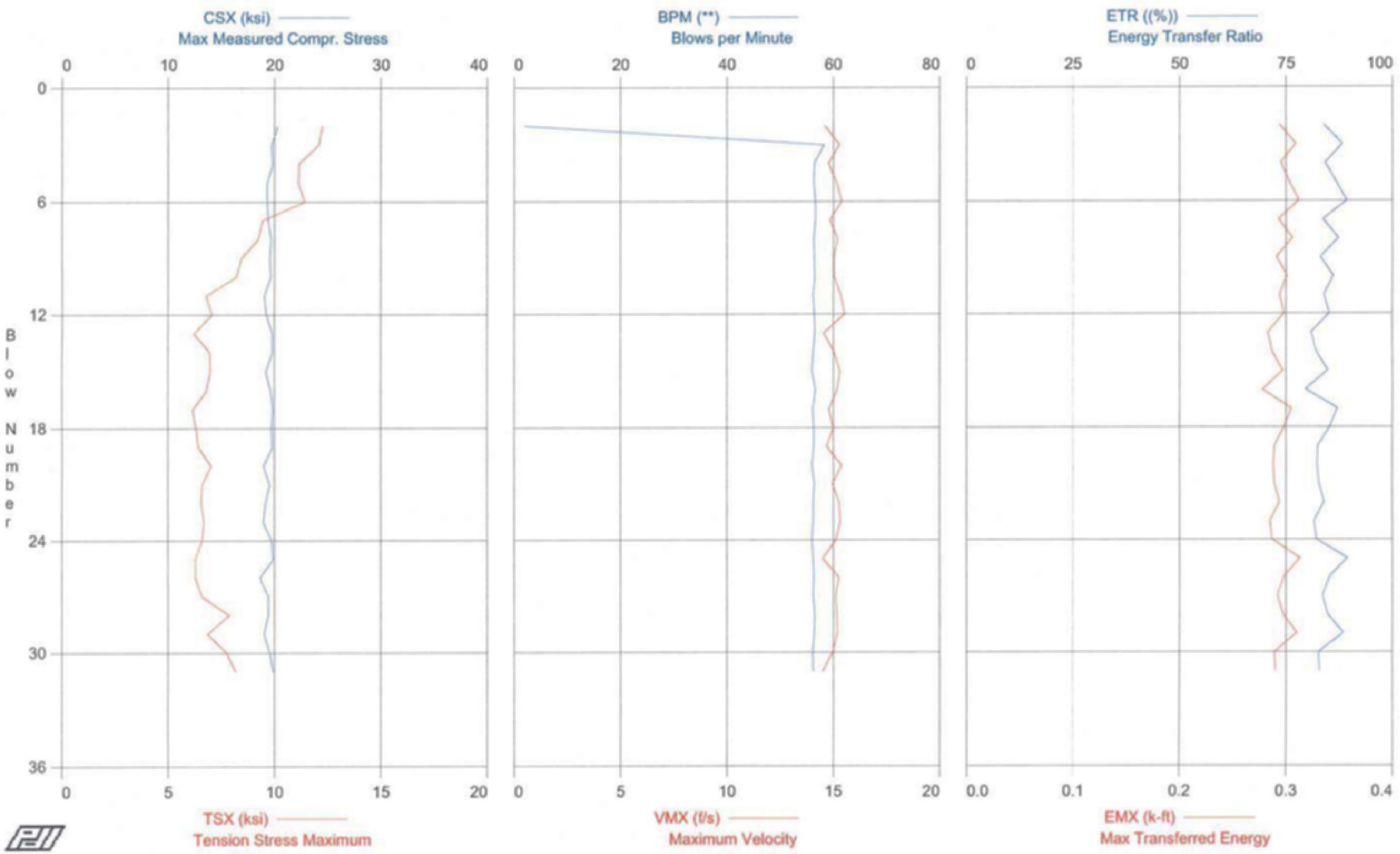
Time Summary
Drive 7 minutes 50 seconds 9:42:53 AM - 9:50:43 AM (1/22/2009) BN 1 - 61

MACTEC Engineering and Consulting, Inc. - Case Method Results

PDIPLOT Ver. 2008.2 - Printed: 2-Mar-2009

Test date: 22-Jan-2009

EXELON VICTORIA - Boring B3202 (33.5'-35' sample)



EXELON VICTORIA - Boring B3202 (33.5'-35' sample)
OP: JNH

Hammer ID: MEC12; Driller: D.RHODES CME 45C (MACTEC)
Test date: 22-Jan-2009

AR: 1.22 in^2
LE: 39.00 ft
WS: 16,807.9 f/s

SP: 0.492 k/ft3
EM: 30,000 ksi
JC: 0.70

CSX: Max Measured Compr. Stress
TSX: Tension Stress Maximum
VMX: Maximum Velocity
FMX: Maximum Force
FVP: Force/Velocity proportionality

BPM: Blows per Minute
EF2: Energy of F^2
ETR: Energy Transfer Ratio
EMX: Max Transferred Energy

BL#	CSX ksi	TSX ksi	VMX f/s	FMX kips	FVP []	BPM **	EF2 k-ft	ETR (%)	EMX k-ft
2	20.3	12.3	14.6	25	0.8	1.9	0.247	83.9	0.294
3	19.7	12.1	15.3	24	0.7	58.2	0.240	88.2	0.309
4	19.8	11.1	14.8	24	0.7	56.4	0.239	84.2	0.295
5	19.3	11.1	15.2	24	0.7	56.3	0.238	86.7	0.303
6	19.3	11.4	15.4	24	0.7	56.6	0.238	89.3	0.312
7	19.4	9.4	14.8	24	0.7	56.6	0.239	83.6	0.293
8	19.7	9.2	15.2	24	0.7	56.3	0.239	87.3	0.306
9	19.5	8.5	15.0	24	0.7	56.4	0.236	83.1	0.291
10	19.6	8.2	15.0	24	0.7	56.5	0.237	86.1	0.301
11	19.0	6.8	15.4	23	0.7	56.2	0.235	83.9	0.294
12	19.2	7.1	15.5	23	0.7	56.4	0.236	85.1	0.298
13	19.8	6.2	14.6	24	0.8	56.5	0.237	80.9	0.283
14	19.8	7.0	15.0	24	0.7	56.2	0.235	82.0	0.287
15	19.2	7.0	15.3	23	0.7	56.0	0.239	84.8	0.297
16	19.6	6.8	15.2	24	0.7	56.6	0.237	79.5	0.278
17	19.8	6.2	14.8	24	0.8	56.1	0.237	87.0	0.305
18	19.7	6.3	15.0	24	0.7	56.3	0.238	85.3	0.298
19	19.8	6.4	14.7	24	0.7	56.3	0.240	82.4	0.289
20	19.0	7.0	15.4	23	0.7	56.0	0.234	82.3	0.288
21	19.5	6.6	15.0	24	0.7	56.4	0.233	82.7	0.289
22	19.2	6.6	15.3	23	0.7	56.2	0.236	83.9	0.294
23	18.9	6.7	15.3	23	0.7	56.2	0.233	81.6	0.285
24	19.7	6.6	15.1	24	0.7	56.0	0.234	82.1	0.287
25	19.9	6.3	14.5	24	0.8	56.2	0.238	89.4	0.313
26	18.6	6.3	15.3	23	0.7	56.3	0.229	85.2	0.298
27	19.4	6.6	15.1	24	0.7	56.2	0.235	83.6	0.292
28	19.4	7.9	15.2	24	0.7	56.5	0.239	84.7	0.297
29	19.0	6.9	15.2	23	0.7	56.4	0.240	88.5	0.310
30	19.5	7.8	15.0	24	0.7	56.1	0.229	82.6	0.289
31	19.9	8.2	14.5	24	0.8	56.2	0.237	82.8	0.290
Average	19.5	7.9	15.1	24	0.7	54.5	0.237	84.4	0.295

Total number of blows analyzed: 30

Time Summary

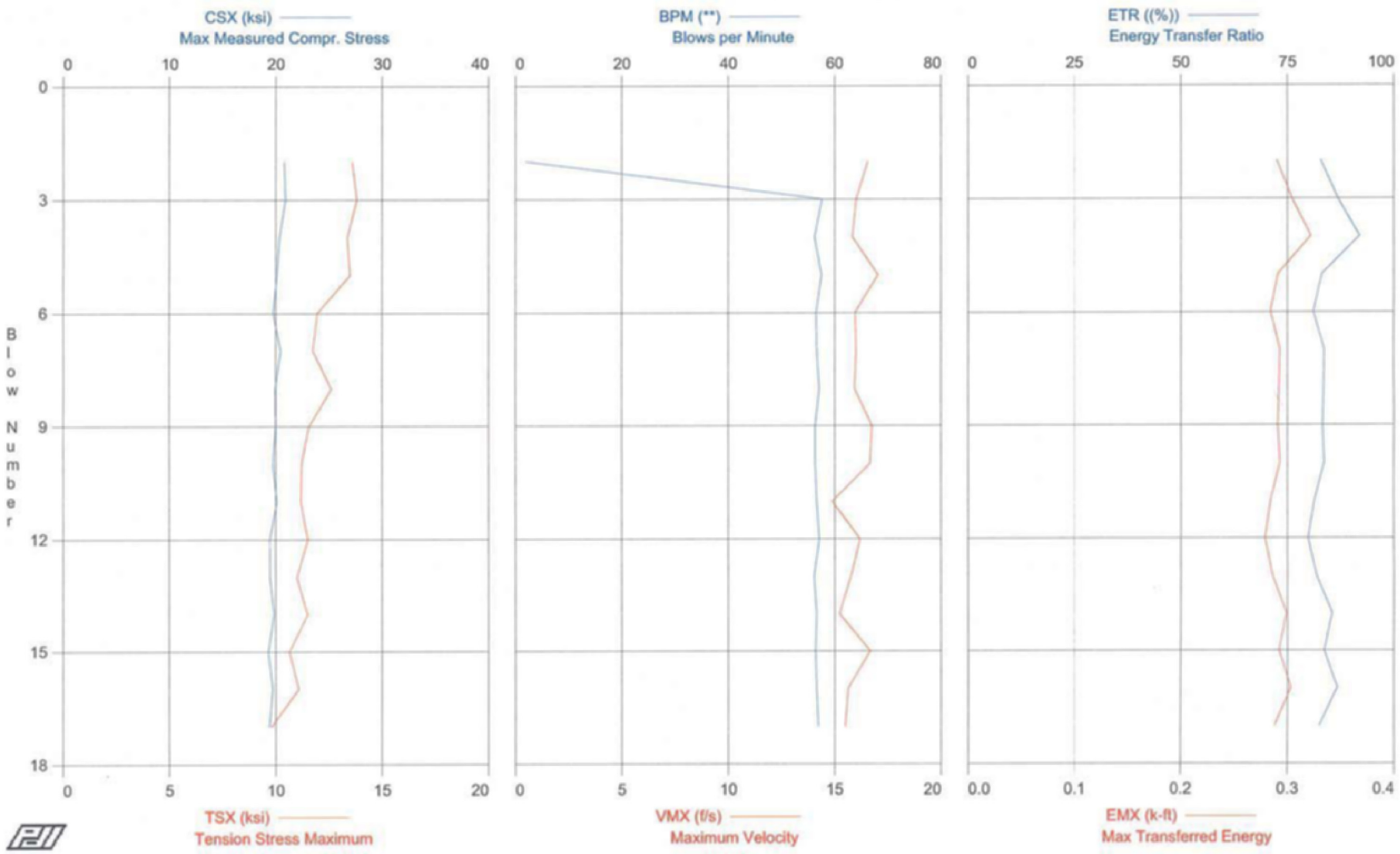
Drive 7 minutes 55 seconds 10:01:31 AM - 10:09:26 AM (1/22/2009) BN 1 - 32

MACTEC Engineering and Consulting, Inc. - Case Method Results

PDIPLOT Ver. 2008.2 - Printed: 2-Mar-2009

Test date: 22-Jan-2009

EXELON VICTORIA - Boring B3202 (38.5'-40' sample)



EXELON VICTORIA - Boring B3202 (38.5'-40' sample)
OP: JNH

Hammer ID: MEC12; Driller: D.RHODES CME 45C (MACTEC)
Test date: 22-Jan-2009

AR: 1.22 in^2
LE: 44.00 ft
WS: 16,807.9 f/s

SP: 0.492 k/ft3
EM: 30,000 ksi
JC: 0.70

CSX: Max Measured Compr. Stress
TSX: Tension Stress Maximum
VMX: Maximum Velocity
FMX: Maximum Force
FVP: Force/Velocity proportionality

BPM: Blows per Minute
EF2: Energy of F^2
ETR: Energy Transfer Ratio
EMX: Max Transferred Energy

BL#	CSX ksi	TSX ksi	VMX f/s	FMX kips	FVP []	BPM **	EF2 k-ft	ETR (%)	EMX k-ft
2	20.8	13.6	16.6	25	0.6	1.9	0.258	82.8	0.290
3	20.9	13.8	16.0	25	0.7	57.6	0.263	86.8	0.304
4	20.3	13.4	15.8	25	0.7	56.2	0.257	92.0	0.322
5	20.1	13.5	17.0	25	0.6	57.5	0.250	83.1	0.291
6	19.7	12.0	16.0	24	0.6	56.5	0.251	81.1	0.284
7	20.5	11.7	16.0	25	0.6	56.6	0.251	83.6	0.293
8	19.9	12.6	15.9	24	0.7	57.1	0.247	83.4	0.292
9	20.0	11.5	16.8	24	0.7	56.3	0.248	83.2	0.291
10	19.7	11.2	16.7	24	0.6	56.3	0.249	83.6	0.293
11	20.1	11.2	14.9	25	0.6	56.6	0.250	81.3	0.284
12	19.4	11.5	16.2	24	0.6	57.1	0.246	79.8	0.279
13	19.4	11.0	15.8	24	0.6	56.1	0.246	81.8	0.286
14	19.8	11.5	15.2	24	0.7	56.6	0.246	85.5	0.299
15	19.3	10.6	16.7	24	0.7	56.4	0.242	83.5	0.292
16	19.7	11.1	15.6	24	0.7	56.6	0.248	86.6	0.303
17	19.4	9.8	15.5	24	0.7	56.9	0.242	82.4	0.288
Average	19.9	11.9	16.0	24	0.7	53.3	0.250	83.8	0.293

Total number of blows analyzed: 16

Time Summary

Drive 7 minutes 31 seconds 10:12:54 AM - 10:20:25 AM (1/22/2009) BN 1 - 17

MACTEC

Engineering and constructing a better tomorrow

May 4, 2009

Memorandum to File

From: Jon Honeycutt, Staff Professional JNH

Reviewed By: Steve Kiser, Principal Professional SK

Subject: **Report of SPT Energy – MACTEC Atlanta CME 55 D Truck**
Hammer Serial No. MEC-20 Automatic Hammer
WORK INSTRUCTION No. 311 (DCN EXE917)
Exelon Texas COL Project – Supplemental Investigation, Including UHS
Victoria County, Texas
MACTEC Project No. 6468-07-1777

Jonathan Honeycutt, of MACTEC Engineering and Consulting, Inc. (MACTEC), performed energy measurements on the above referenced drill rig at the subject site per the referenced Work Instructions. This memorandum summarizes the field testing activities and presents the results of the energy measurements.

SPT Energy Field Measurements

Energy measurements of this drill rig were made for two different rod sizes used for drilling operations. A summary of the testing for each rod size is below:

N3 Sized Rods – SPT energy measurements were made on January 25, 2009, during drilling of Boring B3231 at the referenced site. The testing was performed by Jonathan Honeycutt from approximately 8:50 AM to 4:45 PM (ET) on January 25 under cloudy skies with a temperature of about 65 degrees Fahrenheit. The boring was drilled with personnel and equipment from the MACTEC Atlanta office. The drilling equipment consisted of a CME 55D model truck-mounted drill rig with an SPT automatic hammer. The drilling tools consisted of N3-sized drilling rods and a 2-foot long split tube sampler. Mud rotary drilling techniques were used to advance the boring. The drill rig operator during sampling was Mr. Phil Pitts. Energy measurements were recorded during sampling at the depth intervals shown in Table 3.

The energy measurements were performed with a Pile Driving Analyzer (PDA) model PAX (Serial No. 3622L), and calibrated accelerometers (Serial Nos. K990 and K1050) and strain gages (Serial Nos. NW#146/1 and NW#146/2). A steel drill rod, 2-feet long and instrumented with dedicated strain gages, was inserted at the top of the drill rod string immediately below the SPT hammer. The inserted rod was also instrumented with two piezoresistive accelerometers that were bolted to the outside of the rod. The instrumented rod insert had a cross-sectional area of approximately 2.27 square inches and an outside diameter of approximately 2.625 inches at the

39 Pages Total

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gage location. The drill rods included in the drill rod string were hollow rods in 5 to 10 foot long sections, with an outside and inside diameter of approximately 2.625 and 2.25 inches, respectively. The recommended operation rate of the hammer is not known. Due to the closed hammer system, the hammer lubrication condition and anvil dimensions could not be observed.

NW-J Sized Rods – SPT energy measurements were made on January 28, February 20, and February 21, 2009. The measurements were made during drilling of Boring B3224 (January 28) and B3232 (February 20 and 21) at the referenced site. The measurements made on February 20 and 21, 2009 were made after adjustments to the hammer weight were performed. The testing was from approximately 10:15 AM to 3:30 PM (ET) on January 28 under cloudy skies with a temperature of about 40 degrees Fahrenheit. The testing was from approximately 1:15 to 4:25 PM (ET) on February 20 under sunny skies with a temperature of about 70 degrees Fahrenheit. The testing was from approximately 8:35 to 9:40 AM (ET) on February 21 under cloudy skies with a temperature of about 65 degrees Fahrenheit. The borings were drilled with personnel and equipment from the MACTEC Atlanta office. The drilling equipment consisted of a CME 55D model truck-mounted drill rig with an SPT automatic hammer. The drilling tools consisted of NW-J-sized drilling rods and a 2-foot long split tube sampler. Mud rotary drilling techniques were used to advance the borings. The drill rig operator during sampling was Mr. Phil Pitts. Energy measurements were recorded during sampling at the depth intervals shown in Table 3.

The energy measurements were performed with a Pile Driving Analyzer (PDA) model PAX (Serial No. 3622L), and calibrated accelerometers (Serial Nos. K990 and K1050) and strain gages (Serial Nos. NW#146/1 and NW#146/2 on January 28; NW#221/1 and NW#221/2 on February 20 and 21). A steel drill rod, 2-feet long and instrumented with dedicated strain gages, was inserted at the top of the drill rod string immediately below the SPT hammer. The inserted rod was also instrumented with two piezoresistive accelerometers that were bolted to the outside of the rod. The instrumented rod inserts had cross-sectional areas of approximately 1.43 square inches (NW#146) and 2.27 square inches (NW#221) and an outside diameter of approximately 2.625 inches at the gage location. The drill rods included in the drill rod string were hollow rods in 5 to 10 foot long sections, with an outside and inside diameter of approximately 2.625 and 2.25 inches, respectively. The recommended operation rate of the hammer is not known. Due to the closed hammer system, the hammer lubrication condition and anvil dimensions could not be observed.

Calibration Records

The calibration records for all the above are filed in DCN EXE 918.

Calculations for EFV

The work was done in general accordance with ASTM D 4633-05. The strain and acceleration signals were converted to force and velocity by the PDA, and the data was interpreted by the PDA according to the Case Method equation. The maximum energy transmitted to the drill rod string (as measured at the location of the strain gages and accelerometers) was calculated by the PDA using the EFV method equation, as shown below:

$$EFV = \int F(t) * V(t) * dt$$

Where: EFV = Transferred energy (EFV equation), or Energy of FV

F(t) = Calculated force at time t
V(t) = Calculated velocity at time t

The EFV method of energy calculation is recommended in ASTM Standard D4633-05. The EFV equation, integrated over the complete wave event, measures the total energy content of the event using both force and velocity measurements. The EFV values associated with each blow analyzed are tabulated in the attached PDIPLOT tables and are also shown graphically in the PDIPLOT charts.

Calculations for ETR

The ratio of the measured transferred energy (EFV) to the theoretical potential energy of the SPT system (140 lb weight with the specified 30 inch fall) is the ETR. The ETR values (as percent of the theoretical value) are shown in Table 3.

Comparison of ETR to Typical Energy Transfer Ratio Range

Based on a research report published by the Florida Department of Transportation (FDOT) (Report WPI No. 0510859, 1999), the average ETR measured for automatic hammers is 79.6%. The standard deviation was 7.9%; therefore, the range of ETRs within one standard deviation of the average was reported to be 71.7% to 87.5%. This range of ETRs was also consistent with other research that was cited in the FDOT research paper; however, maximum and minimum ETR values of up to 98% and 56%, respectively, were reported in the literature. The ETR values shown in Table 1 are generally within the range of typical values for automatic hammers as reported in the literature.

Discussion

Based on the field testing results, observations from the SPT energy measurements are summarized below:

- The data obtained by the PDA are generally consistent between individual hammer blows and between the sample depths tested. In general, the first and last one (and sometimes two or more) hammer blow records recorded by the PDA produced poor quality data (which is relatively common) and, as such, the record(s) was(were) not used in the data reduction. This may result in more or less blows evaluated for ETR than what is shown on the boring logs.

- The range of average energy transferred from the hammer to the drill rods for each individual depth interval using the EFV method is shown in Table 1 below for each rod size tested. The corresponding energy transfer ratio of the SPT hammer system is also shown.

Table 1: Average Energy Transfer Range for the Depth Intervals Tested

Rod Size	Range of Average Energy Transferred, Per Individual Sample (foot-pounds)	Range of Average Energy Transfer Ratio (ETR)
N3	283 to 293	81% to 84%
NW-J	265 to 294	76% to 84%

- The average at each depth interval was calculated as the transferred energy for each analyzed blow of the depth intervals divided by the total number of hammer blows analyzed. The overall average energy transfer of the SPT system (for all the depth intervals tested) is shown in Table 2 below for each rod size tested.

Table 2: Overall Average Energy Testing Results for Each Rod Size

Rod Size	Overall Average Energy Transferred (foot-pounds)	Range of Overall Average Energy Transfer Ratio (ETR)
N3	289.6	82.7%
NW-J	287.2	82.0%
Average of All Rod Sizes	288.5	82.4%

Attachments: Page 5 Table 1 – Summary of SPT Energy Measurements – 1 Page
Page 6 Work Instruction No. 311 – DCN EXE917 – 1 Page
Pages 7 – 10 Record of SPT Energy Measurement – 4 Pages
Pages 11 – 39 PDIPLOT Output – 29 Pages

TABLE 3

SUMMARY OF SPT ENERGY MEASUREMENTS (ASTM D4633-05)

Exelon Texas COL Project - Supplemental Investigation, Including UHS

Victoria, Texas

MACTEC Project No. 6468-07-1777

Automatic Hammer Serial Number and Rig Model	Rig Owner	Rig Operator	Boring No. Tested	Date Tested	Drill Rod Size	Sample Depth (feet)	SPT Blow Count (blows per six inches)	No. of Blows Analyzed	Average Measured Energy (Average EFV) (ft-lbs)[a]	Energy Transfer Ratio (%)[b] (Average ETR)
MEC-20 (CME 55D Truck)	MACTEC (Atlanta)	Phil Pitts	B3231	1/25/2009	N3	318.5 - 320	5 - 11 - 22	40	284	81.1%
						328.5 - 330	6 - 16 - 19	45	283	80.9%
						338.5 - 339.4	49 - 50/5"	117	293	83.7%
						348.5 - 350	9 - 17 - 27	57	291	83.1%
						358.5 - 358.8	100/4"	88	290	82.9%
						Average for AW-J Rods:			**289.6**	**82.7%**
			B3224	1/28/2009	NW-J	38.6 - 40.1	6 - 7 - 8	21	265	75.7%
						43.5 - 45	3 - 4 - 8	16	268	76.6%
						53.5 - 55	5 - 6 - 8	20	292	83.4%
						58.5 - 60	7 - 15 - 20	43	285	81.4%
						64 - 65.5	5 - 7 - 8	20	286	81.7%
			B3232	2/20/2009		288.7 - 290.2	6 - 12 - 25	42	290	82.9%
						298.4 - 299.9	10 - 16 - 24	49	292	83.4%
				2/21/2009		308.5 - 310	15 - 17 - 21	64	294	84.0%
						Average for NW-J Rods:			**287.2**	**82.0%**
						Total Average for Rig:			**288.5**	**82.4%**

[a]Measured Energy is energy based on the EFV method, as outlined in ASTM D4633-05, for each blow recorded by the PDA. In some cases, the initial and final one to two blows produced poor quality data, and were not used to calculate the Average Measured Energy. This may result in more or less hammer blows evaluated for ETR than what is shown on the boring logs.

EFV = EMX * 1000 lbs/kip, where EMX equals the maximum transferred energy measured by the PDA (see attached PDA data).

[b]Energy Transfer Ratio is the Measured Energy divided by the theoretical SPT energy of 350 foot-pounds (140 pound hammer falling 2.5 feet).

The average EFV and ETR values may differ slightly and insignificantly from those in the PDIPLOT tables due to roundoff.

Prepared By:	Date: 5/4/09		Checked By:	Date: 5-4-09

Work Instruction No. 311
Exelon COL Victoria Site
MACTEC Engineering and Consulting, Inc.
MACTEC Project 6468-07-1777

DCN 1/2/09

Issued To: ~~Steve Kiser and~~ Jonathan Honeycutt

Issued By: Daniel E Atkinson **Rev. No.** 0

Valid From: 1/12/09 **Date:** 1/12/09

To: 12/31/09

Task Description: Perform SPT Energy Measurements

Applicable Technical Procedures or Plans, or other reference:

1. Geotechnical Work Plan (current revision; available at Site Office), and
2. ASTM D 4633-05 (copy attached.).

Specific Instructions (note attachments where necessary): Perform energy measurements for each drill rig on site in accordance with ASTM D-4633-05. Consult with Site Manager as to schedule for performing the measurements. Hammer weights have been checked by site personnel, and records will be available on site. All rigs are using automatic hammer systems. Confirm that automatic hammer system is being operated within manufacturer's recommendations or in a typical operating fashion as observed from watching one or two SPT measurements prior to measuring energy. Check each drill rig using all hammer/rod combinations that it will be using. Depths for measurements should be coordinated with the Site Manager. See Site Manager for current boring logs of holes drilled and use these to plan most effective field measurement program. Submit copies of calibration records for equipment to Project Principal for review prior to beginning work on site.

Special Instructions (note attachments where necessary): Confirm with Site Manager that approval of equipment calibration records have been received prior to beginning field testing. If unexpected conditions are encountered that affect measurements, contact Site Manager or Project Principal immediately.

Report Format: Prepare standard report in accordance with ASTM D 4633 requirements.

Specific Quality Assurance Procedures Applicable: QAP 20-1; QAP 25-1; QAP for Reporting Nuclear-Related Defects, or Noncompliances, per Federal Regulation 10CFR21 and Section 306 of the Energy Reorganization Act of 1974. Current revisions apply.

Hold Points or Witness Points: None

Records: All records generated shall be considered QA Records.

Reviewed and Approved by: (Note: Only one signature is required for issuance)

Project Manager: _____ Date: _____

Project Principal Engineer: _____ Date: _____

Site Manager/Coordinator: _____ Date: 1/12/09

Pages: 1 plus attachment

Attachments: ASTM D 4633-05

DCN: EXE917