

June 27, 2007

Memorandum to File DCN VGCOL 152

From: Steve Kiser *SK*

Reviewed By: Pieter Depree *POP*

Subject: **Report of SPT Energy – MACTEC Charlotte Diedrich D-50 ATV
Hammer Serial No. 100 Automatic Hammer
WORK INSTRUCTION VGCOL 152
Vogle Units 3 & 4 COL Project
Burke County, Georgia
MACTEC Project No. 6141-06-0286**

Steve Kiser, of MACTEC Engineering and Consulting, Inc. (MACTEC), performed energy measurements on the 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 17, 2007, during drilling of Boring B-1195 at the referenced site. The testing was performed from approximately 9:55 to 11:10 AM under cloudy skies and a temperature of about 40 degrees Fahrenheit. The boring was drilled with personnel and equipment from the Charlotte office of MACTEC. The drilling equipment consisted of a Diedrich D-50 model ATV-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 below the depth at which groundwater was encountered at the time of energy testing. The drill rig operator during sampling was Mr. Gary Skoglund. 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 PAK (Serial No. 1430), and calibrated accelerometers (Serial Nos. P5953 and P5094) and strain gages (Serial Nos. AW #144/1 and AW#144/2). An AW-sized 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 1.19 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.

Calibration Records

The calibration records for all the above are filed in DCN VGCOL-14.

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 PDILOT tables and are also shown graphically in the PDILOT 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.

- The average energy transferred from the hammer to the drill rods for each individual depth interval using the EFV method ranged from 242 foot-pounds to 263 foot-pounds. These average energy transfers correspond to energy transfer ratios (ETR) of 69% to 75% 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 weighted average energy transfer of the SPT system (for all the depth intervals tested) was 253.5 foot-pounds, with a weighted average ETR of 72.4%.

Attachments: Page 4 Table 1 - Summary of SPT Energy Measurements – 1 Page
Page 5 Work Instruction – DCN VGCOL 152 – 1 Page
Page 6 Record of SPT Energy Measurement – 1 Page
Pages 7 - 18 PDILOT Output – 12 Pages

TABLE 1
SUMMARY OF SPT ENERGY MEASUREMENTS (ASTM D4633-05)

Vogtle Units 3 and 4 COL Project
 Burke County, Georgia
 MACTEC Project No. 6141-06-0286

Rig Serial No.	Rig Owner	Rig Operator	Boring No. Tested	Rod Size	Date Tested	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)
100 (Diedrich D- 50 ATV)	MACTEC Charlotte	Gary Skoglund	B-1195	AW-J	1/17/2007	18.5 - 20.0	18 - 19 - 22	57	242	69.1%
						23.5 - 25.0	17 - 15 - 18	45	252	72.0%
						28.5 - 30.0	8 - 11 - 11	30	263	75.1%
						33.5 - 35.0	9 - 8 - 9	26	257	73.4%
						38.5 - 40.0	6 - 6 - 9	20	261	74.6%
						43.5 - 45.0	7 - 7 - 8	22	262	74.9%
Weighted Average for Rig:							253.5	72.4%		

^aMeasured 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.

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

^bEnergy 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 ETR values may differ slightly and insignificantly from those in the PDILOT tables due to roundoff.

Prepared By: 	Date: 6-27-07	Checked By: 	Date: 7/31/07
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Work Instructions – SPT Energy MACTEC Dietrich D-50 (Skoglund)

(Hammer #100)

Vogtle COL Project

Project No. 6141-06-0286

Issued To: Steve Kiser

Location: Vogtle COL Project Field Office Date: 1/17/07

Issued By: Matthew F. Cooke, Site Coordinator

Valid From: 1/17/07 To: 1/17/08

Task Description: Measurement of energy transferred to the drill string rods from a Standard Penetration Test (SPT) automatic hammer mounted on a drill rig. Testing will be performed using a Pile Driving Analyzer (PDA) model PAK at various depth intervals below a depth of approximately 10 feet below the ground surface for the above referenced rig drilling SPT borings at the Vogtle COL Site.

Applicable Technical Procedures or Plans, or other reference: ASTM D4633-05 Standard Test Method for Energy Measurement for Dynamic Penetrometers.

Specific Instructions (note attachments where necessary): Obtain energy measurements with the PDA at various depth intervals below a depth of about 10 feet below the ground surface in general accordance with ASTM D4633-05. Perform energy measurement testing for the above referenced drill rig.

Report Format: Written report documenting results of field testing in general accordance with ASTM D4633-05, to include completed Summary of Daily Observations and Testing, Record of SPT Energy Measurement sheet(s), and PDILOT output data.

Specific Quality Assurance Procedures Applicable: None

Hold Points or Witness Points: Direction to perform energy measurements received from the Site Coordinator.

Records: All records generated shall be considered QA Records.

Reviewed and Approved By (Note: Only One Signature is Required to Issue):

Project Manager: Date:

Project Principal: Date:

Site Coordinator:  Date: 1/17/07

No. of Pages: 1 DCN: VGCOL 152

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

RECORD OF SPT ENERGY MEASUREMENT

GENERAL INFORMATION		DRILL RIG DATA	
PROJECT:	ALWR Vogtle COL Site	MAKE:	DIEDRICH
LOCATION:	Waynesboro, Georgia	MODEL:	D-50 ATD ^{SL} ATV
PROJECT NO.:	6141-06-0286	SERIAL NO.:	100
DATE:	1-17-07	HAMMER TYPE:	AUTOMATIC
WEATHER:	CLOUDY COLD 40°	ROPE CONDITION:	N/A
INSPECTOR:	Steve Kiser	ROD SIZE:	AW-J
DRILLING COMPANY:	MACTEL CHARLOTTE	NO. OF SHEAVES:	N/A

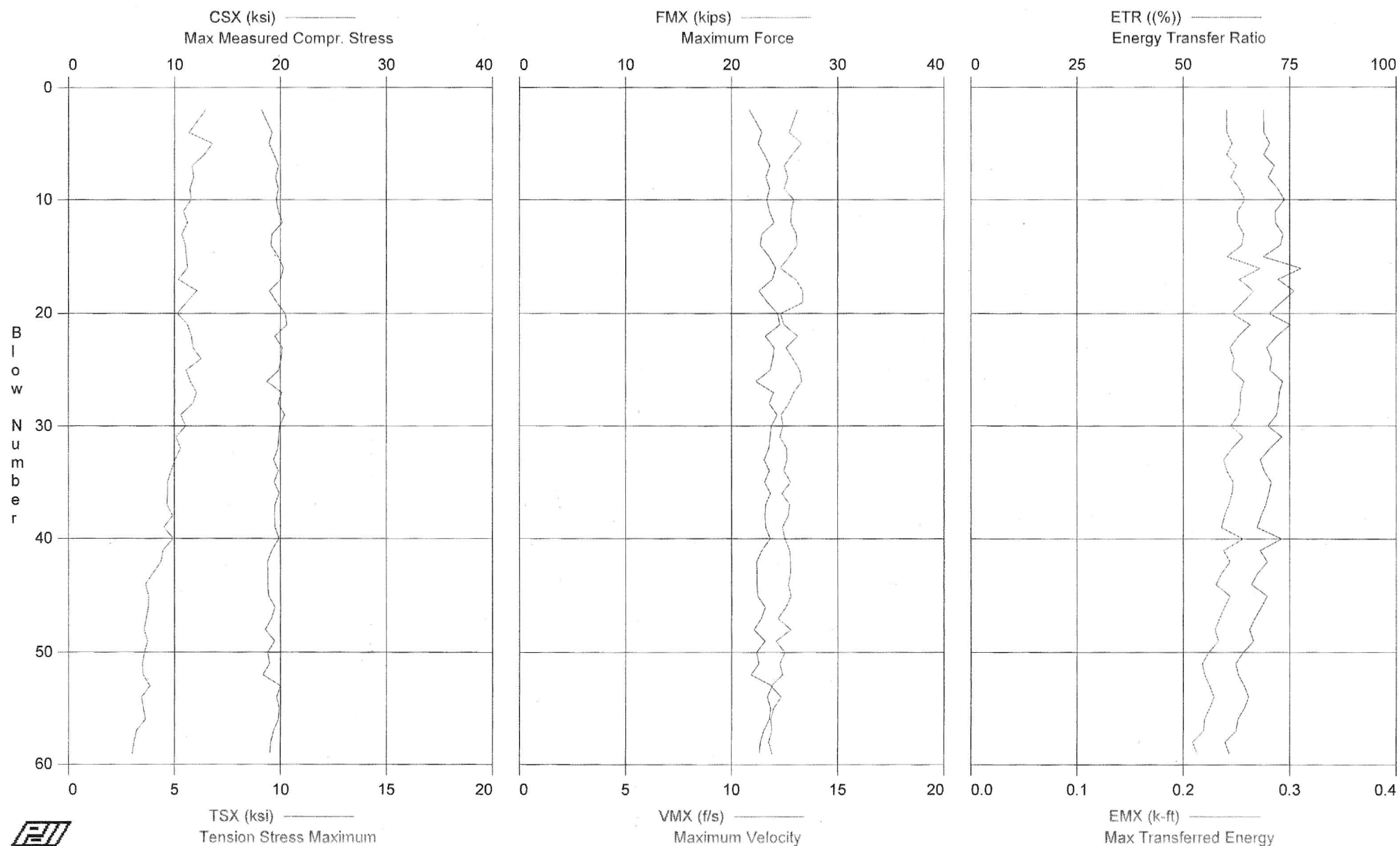
BORING DATA

BORING NUMBER:	B-1195		
DEPTH DRILLED:	50' PLANNED		
TIME DRIVEN:	11:00 AM		
RIG OPERATOR:	GARY SKOGLUND		
HAMMER OPERATOR:	N.R.		
PDA PAK SERIAL NO.:	1430	1430	1430
INSTR. ROD AREA:	1.19 in ²		
ACCEL. SERIAL NOS.:	P5094 / P5953		
STRAIN SERIAL NOS.:	144 AW 1/2		

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REMARKS:

Plant Vogtle COL Project - Boring B-1195; 18.5' - 20' Sample



Plant Vogtle COL Project - Boring B-1195; 18.5' - 20' Sample
OP: SEK

Rig Serial No. 100 (MACTEC Charlotte D-50 ATV)
Test date: 17-Jan-2007

AR: 1.19 in²
LE: 24.00 ft
WS: 16,807.9 f/s

SP: 0.492 k/ft³
EM: 30,000.0 ksi
JC: 0.60

CSX: Max Measured Compr. Stress
TSX: Tension Stress Maximum
FMX: Maximum Force
VMX: Maximum Velocity
DFN: Final Displacement

BPM: Blows per Minute
EF2: Energy of F²
ETR: Energy Transfer Ratio
EMX: Max Transferred Energy

BL#	depth ft	CSX ksi	TSX ksi	FMX kips	VMX f/s	DFN in	BPM **	EF2 k-ft	ETR (%)	EMX k-ft
2	0.00	18.22	6.46	22	13.1	0.93	42.7	0.171	68.9	0.241
4	0.00	19.21	5.68	23	12.7	0.76	43.2	0.171	68.9	0.241
5	0.00	18.91	6.78	23	13.3	1.02	47.4	0.173	70.3	0.246
6	0.00	19.43	6.40	23	12.8	1.09	47.7	0.175	68.9	0.241
7	0.00	19.82	5.82	24	12.5	0.20	47.5	0.179	71.4	0.250
8	0.00	19.53	5.90	23	12.6	0.76	48.1	0.178	70.0	0.245
9	0.00	19.81	5.74	24	12.5	1.33	47.8	0.179	72.2	0.253
10	0.00	19.60	5.79	23	12.9	1.23	47.6	0.182	73.8	0.258
11	0.00	19.80	5.42	24	12.8	1.36	47.8	0.181	71.6	0.251
12	0.00	20.16	5.61	24	12.8	1.18	47.8	0.180	71.7	0.251
13	0.00	19.20	5.35	23	13.1	0.93	48.0	0.184	73.4	0.257
14	0.00	19.08	5.52	23	13.1	0.61	47.8	0.185	72.8	0.255
15	0.00	19.77	5.56	24	12.7	0.58	47.9	0.182	68.8	0.241
16	0.00	20.28	5.61	24	12.3	1.39	48.0	0.185	77.7	0.272
17	0.00	20.03	5.18	24	13.0	0.74	47.9	0.186	72.3	0.253
18	0.00	18.96	6.06	23	13.4	1.13	47.8	0.190	76.0	0.266
19	0.00	19.65	5.57	23	13.4	0.84	48.1	0.190	73.0	0.256
20	0.00	20.44	5.13	24	12.3	0.41	48.1	0.185	70.2	0.246
21	0.00	20.63	5.61	25	12.5	0.86	47.5	0.191	75.2	0.263
22	0.00	19.48	5.81	23	13.1	0.36	47.5	0.189	72.0	0.252
23	0.00	20.17	5.87	24	12.6	0.67	46.9	0.184	69.6	0.244
24	0.00	20.07	6.27	24	12.9	0.68	47.6	0.185	70.8	0.248
25	0.00	19.87	5.57	24	13.2	0.40	47.3	0.187	70.4	0.246
26	0.00	18.72	5.76	22	13.3	0.66	47.2	0.188	73.3	0.257
27	0.00	20.13	6.05	24	12.9	1.14	47.5	0.184	72.6	0.254
28	0.00	19.78	5.87	24	12.7	0.92	47.4	0.186	72.5	0.254
29	0.00	20.42	5.30	24	12.3	0.82	47.4	0.185	71.9	0.252
30	0.00	19.96	5.53	24	12.4	0.21	47.4	0.183	69.9	0.245
31	0.00	19.86	5.08	24	12.3	0.98	47.6	0.184	73.2	0.256
32	0.00	19.76	5.28	24	12.6	0.37	47.2	0.184	70.4	0.246
33	0.00	19.38	5.03	23	12.6	0.80	47.6	0.178	68.1	0.238
34	0.00	19.80	4.85	24	12.5	0.78	47.2	0.176	69.0	0.241
35	0.00	19.43	4.68	23	12.8	0.97	47.4	0.179	70.7	0.247
36	0.00	19.88	4.67	24	12.4	0.74	47.3	0.179	70.2	0.246
37	0.00	19.50	4.64	23	12.7	1.00	47.2	0.184	69.4	0.243
38	0.00	19.43	4.91	23	12.7	0.41	47.5	0.180	68.3	0.239
39	0.00	19.50	4.50	23	12.4	0.63	47.5	0.175	67.4	0.236
40	0.00	19.87	4.94	24	12.5	1.40	47.0	0.179	73.2	0.256
41	0.00	19.20	4.46	23	12.7	0.13	47.4	0.179	68.1	0.238
42	0.00	18.80	4.36	22	12.8	0.54	47.6	0.176	69.8	0.244
43	0.00	18.81	3.99	22	12.8	0.95	47.5	0.176	67.5	0.236
44	0.00	18.81	3.63	22	12.7	0.46	47.7	0.175	66.1	0.231
45	0.00	18.87	3.77	22	12.8	1.12	47.1	0.176	69.7	0.244
46	0.00	19.48	3.76	23	12.6	1.73	47.3	0.174	68.3	0.239
47	0.00	19.17	3.66	23	12.2	0.77	47.7	0.170	66.8	0.234
48	0.00	18.58	3.57	22	12.8	0.93	47.4	0.170	65.6	0.230
49	0.00	19.46	3.72	23	12.1	0.50	47.2	0.171	66.5	0.233
50	0.00	18.79	3.58	22	12.5	0.35	47.1	0.167	64.1	0.224
51	0.00	18.96	3.48	23	12.3	0.78	47.5	0.164	62.4	0.218
52	0.00	18.35	3.52	22	12.4	0.18	47.5	0.162	63.0	0.220
53	0.00	20.01	3.83	24	11.9	0.43	47.3	0.176	64.4	0.225
54	0.00	19.63	3.43	23	12.3	0.41	47.2	0.181	65.4	0.229
55	0.00	19.89	3.54	24	12.0	0.46	47.5	0.179	64.4	0.225
56	0.00	19.79	3.62	24	11.8	1.48	47.4	0.170	62.8	0.220
57	0.00	19.34	3.20	23	11.9	1.19	47.5	0.170	62.5	0.219
58	0.00	19.10	3.09	23	11.8	0.44	47.0	0.168	59.8	0.209
59	0.00	19.01	3.01	23	11.9	0.16	47.9	0.167	60.9	0.213
Average		19.50	4.89	23	12.6	0.78	47.4	0.179	69.3	0.242

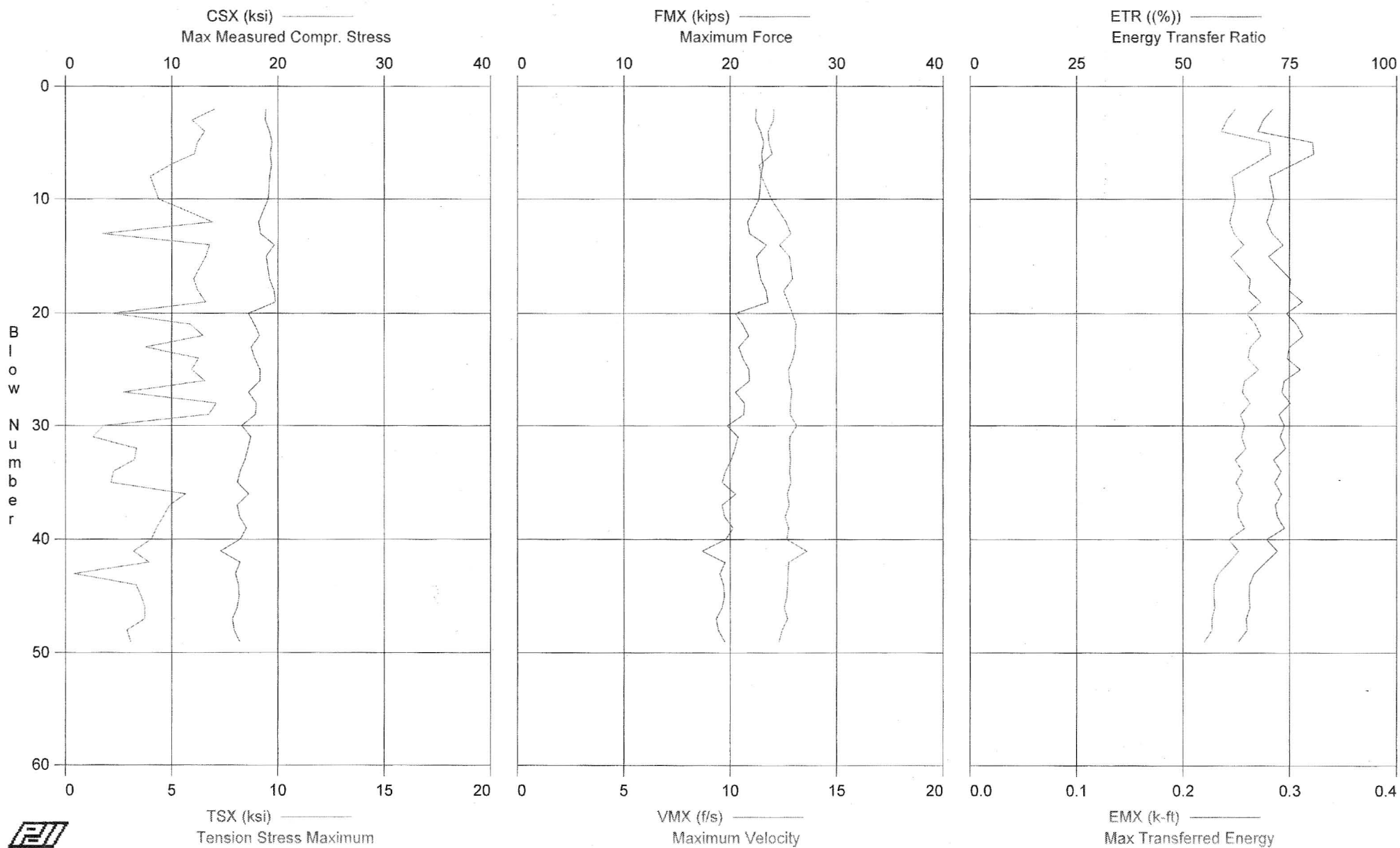
Total number of blows analyzed: 57

Time Summary

Drive 1 minute 14 seconds

9:59:39 AM - 10:00:53 AM (1/17/2007) BN 1 - 60

Plant Vogtle COL Project - Boring B-1195; 23.5' - 25' Sample



Plant Vogtle COL Project - Boring B-1195; 23.5' - 25' Sample
OP: SEK

Rig Serial No. 100 (MACTEC Charlotte D-50 ATV)
Test date: 17-Jan-2007

AR: 1.19 in²
LE: 29.00 ft
WS: 16,807.9 f/s

SP: 0.492 k/ft³
EM: 30,000.0 ksi
JC: 0.60

CSX: Max Measured Compr. Stress
TSX: Tension Stress Maximum
FMX: Maximum Force
VMX: Maximum Velocity
DFN: Final Displacement

BPM: Blows per Minute
EF2: Energy of F²
ETR: Energy Transfer Ratio
EMX: Max Transferred Energy

BL#	depth ft	CSX ksi	TSX ksi	FMX kips	VMX f/s	DFN in	BPM **	EF2 k-ft	ETR (%)	EMX k-ft
2	0.00	18.86	7.03	22	12.0	1.18	46.0	0.186	71.0	0.249
3	0.00	18.82	5.96	22	12.0	1.08	47.6	0.187	68.8	0.241
4	0.00	19.21	6.56	23	11.8	-0.37	47.8	0.183	67.6	0.236
5	0.00	19.44	6.21	23	11.8	1.67	48.6	0.192	80.4	0.281
6	0.00	19.28	6.07	23	12.0	1.56	51.1	0.193	80.6	0.282
7	0.00	19.40	4.93	23	11.4	1.08	51.9	0.187	75.7	0.265
8	0.00	19.24	3.99	23	11.5	0.28	52.0	0.182	70.3	0.246
10	0.00	19.09	4.38	23	11.9	0.82	44.2	0.182	71.2	0.249
12	0.00	18.19	6.92	22	12.6	0.60	40.2	0.198	69.6	0.244
13	0.00	18.35	1.72	22	12.8	1.10	51.5	0.000	70.9	0.248
14	0.00	19.67	6.78	23	12.3	0.98	51.9	0.201	73.4	0.257
15	0.00	18.90	6.61	22	12.8	1.23	52.1	0.197	70.1	0.245
17	0.00	19.21	6.04	23	12.9	-0.39	42.1	0.202	75.2	0.263
18	0.00	19.65	6.22	23	12.5	-0.07	51.6	0.202	74.9	0.262
19	0.00	19.79	6.61	24	12.7	1.87	51.9	0.203	78.0	0.273
20	0.00	17.22	2.19	20	12.9	1.08	52.2	0.000	74.3	0.260
21	0.00	17.80	5.87	21	13.1	0.74	51.8	0.195	76.7	0.268
22	0.00	18.28	6.48	22	13.1	1.11	52.0	0.201	78.1	0.273
23	0.00	17.49	3.76	21	13.1	0.87	51.5	0.204	75.0	0.263
24	0.00	17.82	6.28	21	13.0	1.28	52.2	0.198	74.5	0.261
25	0.00	18.31	5.94	22	12.7	1.23	51.7	0.201	77.5	0.271
26	0.00	18.33	6.56	22	12.8	1.03	51.9	0.195	73.7	0.258
27	0.00	17.24	2.72	21	12.9	1.55	51.9	0.000	73.3	0.256
28	0.00	17.96	7.10	21	12.8	1.03	51.2	0.198	75.2	0.263
29	0.00	17.89	6.75	21	12.8	1.17	51.9	0.192	72.6	0.254
30	0.00	16.59	1.82	20	13.1	1.01	51.9	0.000	73.8	0.258
31	0.00	17.45	1.29	21	12.8	0.62	52.0	0.199	72.8	0.255
32	0.00	17.19	3.35	20	12.8	0.78	51.5	0.198	74.0	0.259
33	0.00	16.90	3.25	20	12.8	0.72	51.9	0.196	71.3	0.249
34	0.00	16.44	2.26	20	12.8	0.35	51.6	0.000	73.0	0.256
35	0.00	16.19	2.15	19	12.9	0.77	51.6	0.000	71.5	0.250
36	0.00	17.24	5.67	21	12.7	0.81	51.9	0.189	73.1	0.256
37	0.00	16.17	4.91	19	12.8	0.64	51.6	0.187	71.6	0.251
38	0.00	16.37	4.61	19	12.6	2.11	51.7	0.189	72.1	0.252
39	0.00	17.03	4.28	20	12.7	1.17	51.2	0.191	73.8	0.258
40	0.00	16.45	4.03	20	12.7	0.61	52.2	0.183	69.6	0.243
41	0.00	14.60	3.21	17	13.6	-0.44	50.1	0.176	72.1	0.252
42	0.00	16.42	3.93	20	12.7	1.01	51.5	0.182	69.3	0.243
43	0.00	15.99	0.40	19	12.7	1.02	26.0	0.000	66.6	0.233
44	0.00	16.29	3.32	19	12.7	0.92	51.5	0.176	65.5	0.229
45	0.00	16.35	3.56	19	12.7	0.85	51.6	0.173	65.5	0.229
46	0.00	16.18	3.73	19	12.5	0.86	51.3	0.175	65.7	0.230
47	0.00	15.71	3.74	19	12.7	0.71	51.5	0.171	64.8	0.227
48	0.00	15.87	2.89	19	12.4	0.88	51.4	0.171	65.0	0.227
49	0.00	16.38	3.06	19	12.3	1.11	51.9	0.167	63.0	0.220
Average		17.63	4.56	21	12.6	0.89	50.1	0.160	72.1	0.252

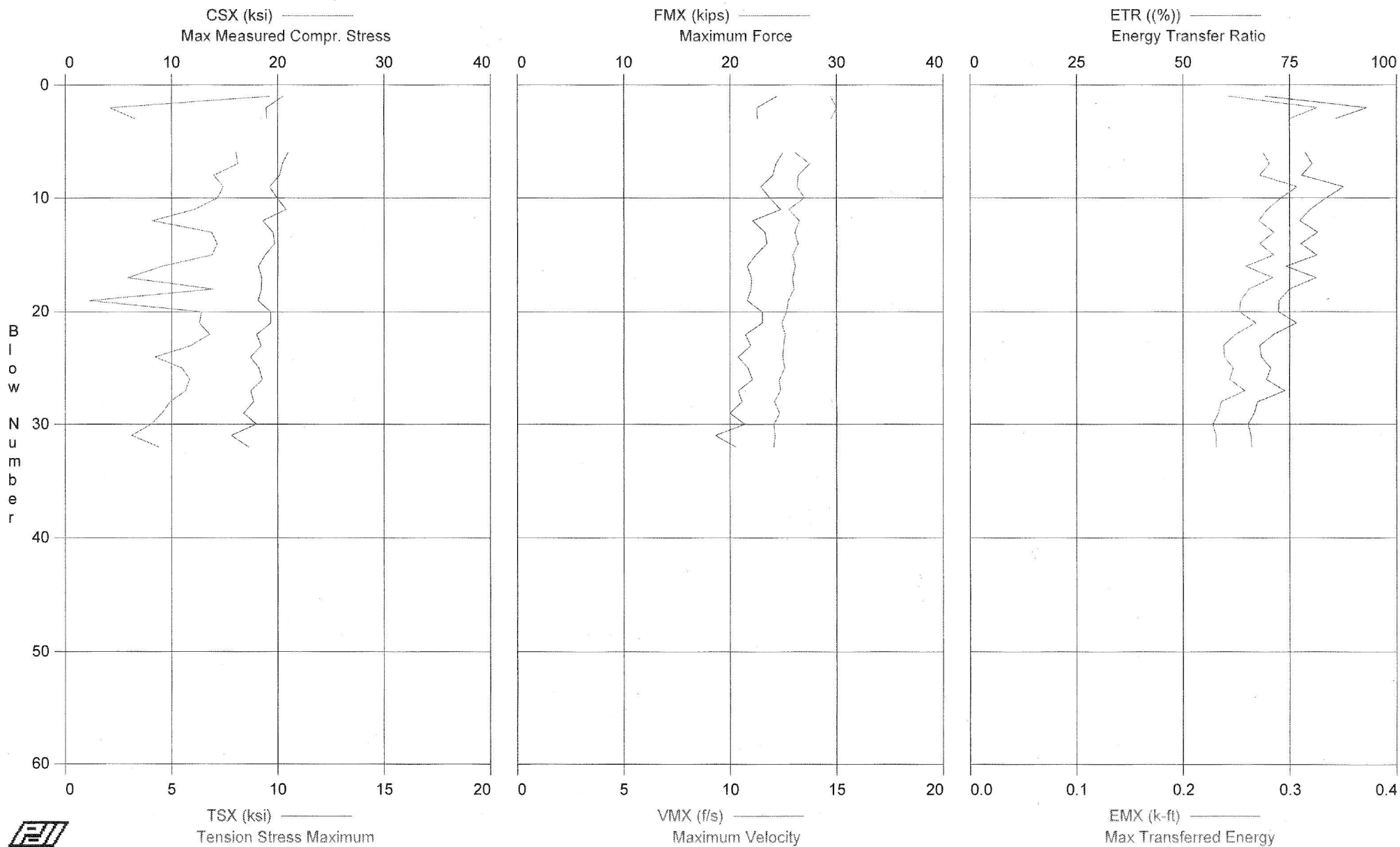
Total number of blows analyzed: 45

Time Summary

Drive 59 seconds

10:12:39 AM - 10:13:38 AM (1/17/2007) BN 1 - 50

Plant Vogtle COL Project - Boring B-1195; 28.5' - 30' Sample



Plant Vogtle COL Project - Boring B-1195; 28.5' - 30' Sample
OP: SEK

Rig Serial No. 100 (MACTEC Charlotte D-50 ATV)
Test date: 17-Jan-2007

AR: 1.19 in²
LE: 34.00 ft
WS: 16,807.9 f/s

SP: 0.492 k/ft³
EM: 30,000.0 ksi
JC: 0.60

CSX: Max Measured Compr. Stress
TSX: Tension Stress Maximum
FMX: Maximum Force
VMX: Maximum Velocity
DFN: Final Displacement

BPM: Blows per Minute
EF2: Energy of F²
ETR: Energy Transfer Ratio
EMX: Max Transferred Energy

BL#	depth ft	CSX ksi	TSX ksi	FMX kips	VMX f/s	DFN in	BPM **	EF2 k-ft	ETR (%)	EMX k-ft
1	0.00	20.51	9.62	24	14.7	2.93	0.0	0.213	69.4	0.243
2	0.00	18.93	2.11	23	15.0	1.81	41.4	0.230	93.1	0.326
3	0.00	18.97	3.28	23	14.7	2.12	42.4	0.000	85.7	0.300
6	0.00	20.98	8.05	25	13.1	0.81	42.9	0.232	78.6	0.275
7	0.00	20.44	8.12	24	13.7	0.44	42.9	0.236	80.3	0.281
8	0.00	20.18	7.00	24	13.2	0.96	43.1	0.230	77.8	0.272
9	0.00	19.23	7.44	23	13.2	1.80	43.2	0.244	87.6	0.307
10	0.00	19.93	7.16	24	13.5	1.94	42.9	0.238	83.5	0.292
11	0.00	20.82	6.08	25	12.8	1.71	43.1	0.238	79.8	0.279
12	0.00	18.58	4.10	22	13.2	1.18	42.8	0.000	77.3	0.271
13	0.00	19.55	6.89	23	13.0	1.43	42.9	0.236	81.5	0.285
14	0.00	19.70	7.15	23	13.2	1.08	43.1	0.237	77.6	0.272
15	0.00	18.81	6.91	22	12.9	1.18	42.9	0.239	81.4	0.285
16	0.00	18.17	4.53	22	13.1	0.12	43.0	0.000	74.1	0.259
17	0.00	18.50	2.95	22	12.9	1.53	43.0	0.235	81.2	0.284
18	0.00	18.47	6.96	22	13.0	1.70	43.2	0.226	75.0	0.262
19	0.00	18.16	1.13	22	12.7	0.80	43.0	0.000	72.5	0.254
20	0.00	19.33	6.43	23	12.7	0.39	43.0	0.221	72.4	0.253
21	0.00	19.34	6.31	23	12.4	1.27	43.2	0.223	76.6	0.268
22	0.00	18.02	6.79	21	12.6	0.89	43.1	0.216	71.2	0.249
23	0.00	18.44	5.91	22	12.5	1.03	43.2	0.210	68.0	0.238
24	0.00	17.45	4.22	21	12.5	0.45	43.1	0.212	68.3	0.239
25	0.00	18.23	5.51	22	12.6	0.47	43.1	0.214	70.6	0.247
26	0.00	18.56	5.86	22	12.3	0.97	43.3	0.211	69.6	0.244
27	0.00	17.46	5.67	21	12.4	1.37	43.2	0.206	73.8	0.258
28	0.00	17.74	4.94	21	12.1	0.32	43.2	0.203	67.5	0.236
29	0.00	16.80	4.55	20	12.3	0.51	43.1	0.195	66.7	0.233
30	0.00	17.97	4.05	21	12.1	0.87	43.2	0.191	65.2	0.228
31	0.00	15.64	3.12	19	12.1	1.05	43.3	0.000	65.9	0.231
32	0.00	17.26	4.40	21	12.1	1.30	43.1	0.184	66.1	0.231
Average		18.74	5.57	22	12.9	1.15	43.0	0.184	75.3	0.263

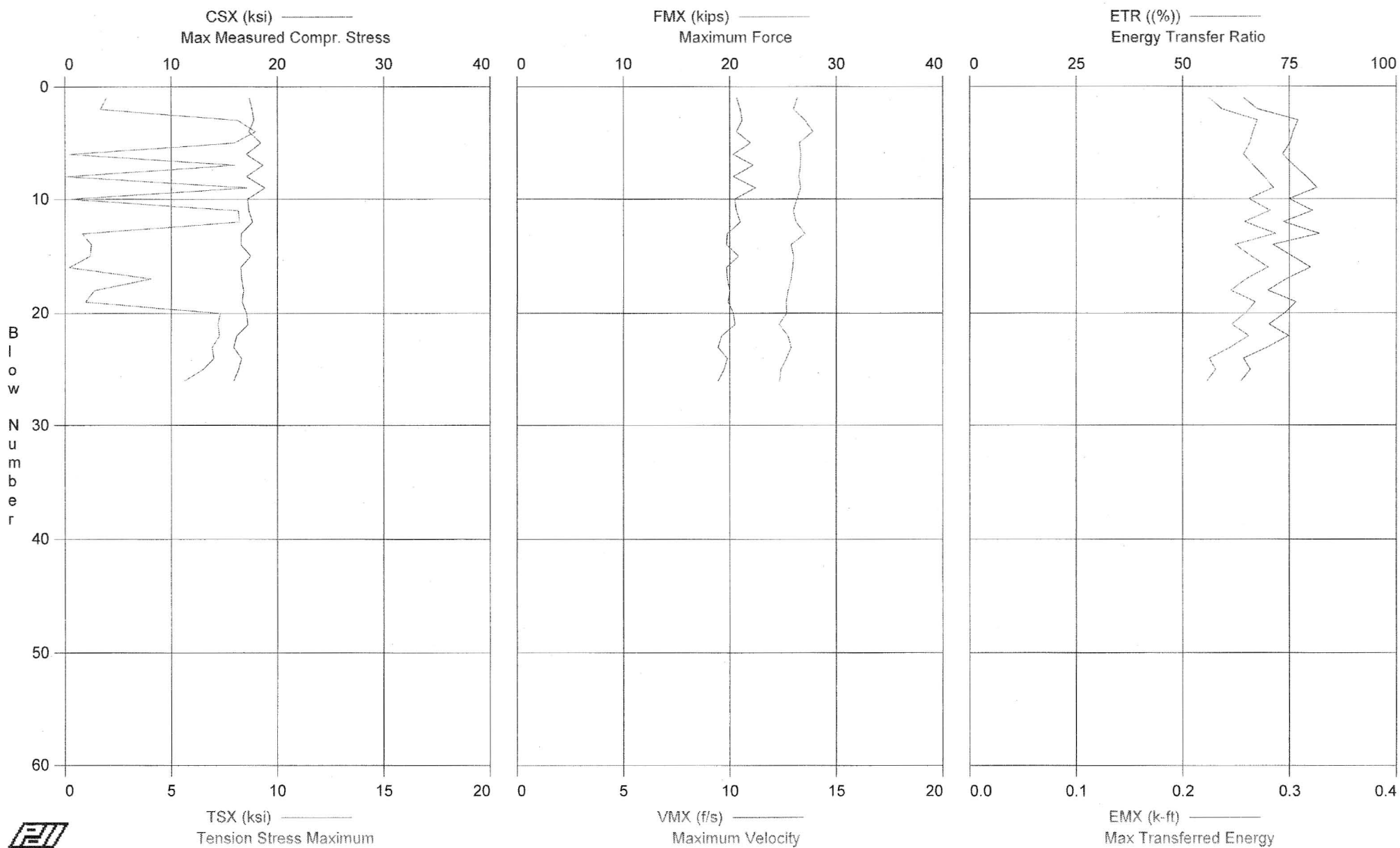
Total number of blows analyzed: 30

Time Summary

Drive 43 seconds

10:24:22 AM - 10:25:05 AM (1/17/2007) BN 1 - 32

Plant Vogtle COL Project - Boring B-1195; 33.5' - 35' Sample



Plant Vogtle COL Project - Boring B-1195; 33.5' - 35' Sample
OP: SEK

Rig Serial No. 100 (MACTEC Charlotte D-50 ATV)
Test date: 17-Jan-2007

AR: 1.19 in²
LE: 39.00 ft
WS: 16,807.9 f/s

SP: 0.492 k/ft³
EM: 30,000.0 ksi
JC: 0.60

CSX: Max Measured Compr. Stress
TSX: Tension Stress Maximum
FMX: Maximum Force
VMX: Maximum Velocity
DFN: Final Displacement

BPM: Blows per Minute
EF2: Energy of F²
ETR: Energy Transfer Ratio
EMX: Max Transferred Energy

BL#	depth ft	CSX ksi	TSX ksi	FMX kips	VMX f/s	DFN in	BPM **	EF2 k-ft	ETR (%)	EMX k-ft
1	0.00	17.36	1.95	21	13.2	1.57	0.0	0.000	64.3	0.225
2	0.00	17.64	1.68	21	13.0	1.94	54.5	0.000	67.6	0.237
3	0.00	17.79	8.14	21	13.5	1.98	50.8	0.191	77.0	0.270
4	0.00	17.32	8.97	21	13.9	1.82	51.5	0.189	75.9	0.266
5	0.00	18.43	7.99	22	13.3	1.96	51.1	0.187	75.1	0.263
6	0.00	17.09	0.24	20	13.3	1.27	51.3	0.000	73.4	0.257
7	0.00	18.65	8.01	22	13.3	1.87	51.4	0.196	76.0	0.266
8	0.00	17.10	0.09	20	13.2	2.58	51.5	0.197	78.9	0.276
9	0.00	18.83	8.59	22	13.3	2.30	51.1	0.199	81.4	0.285
10	0.00	17.21	0.21	20	13.2	0.66	51.2	0.000	74.9	0.262
11	0.00	17.32	8.16	21	13.0	1.99	51.5	0.203	80.5	0.282
12	0.00	17.65	8.23	21	13.1	1.53	51.3	0.194	73.6	0.258
13	0.00	16.60	0.82	20	13.5	1.27	51.2	0.205	82.1	0.287
14	0.00	16.55	1.24	20	12.9	1.37	51.6	0.000	71.1	0.249
15	0.00	17.49	1.20	21	13.0	1.36	51.3	0.000	75.6	0.264
16	0.00	16.55	0.18	20	13.0	1.66	51.3	0.201	80.0	0.280
17	0.00	16.61	4.05	20	12.9	0.81	51.3	0.000	74.4	0.260
18	0.00	16.81	1.38	20	12.7	1.46	51.5	0.000	69.9	0.245
19	0.00	16.68	0.96	20	12.7	1.93	51.3	0.194	76.5	0.268
20	0.00	17.10	7.31	20	12.7	0.87	51.0	0.191	73.9	0.259
21	0.00	17.23	7.20	21	12.3	0.83	51.5	0.186	70.2	0.246
22	0.00	16.18	7.27	19	12.7	2.15	51.1	0.185	74.8	0.262
23	0.00	15.88	6.93	19	12.9	1.00	51.2	0.177	69.9	0.245
24	0.00	16.63	7.01	20	12.7	0.72	51.4	0.170	64.3	0.225
25	0.00	16.35	6.49	19	12.4	1.55	50.8	0.167	65.9	0.231
26	0.00	15.90	5.62	19	12.3	1.28	51.0	0.165	63.7	0.223
Average		17.11	4.61	20	13.0	1.53	51.4	0.131	73.5	0.257

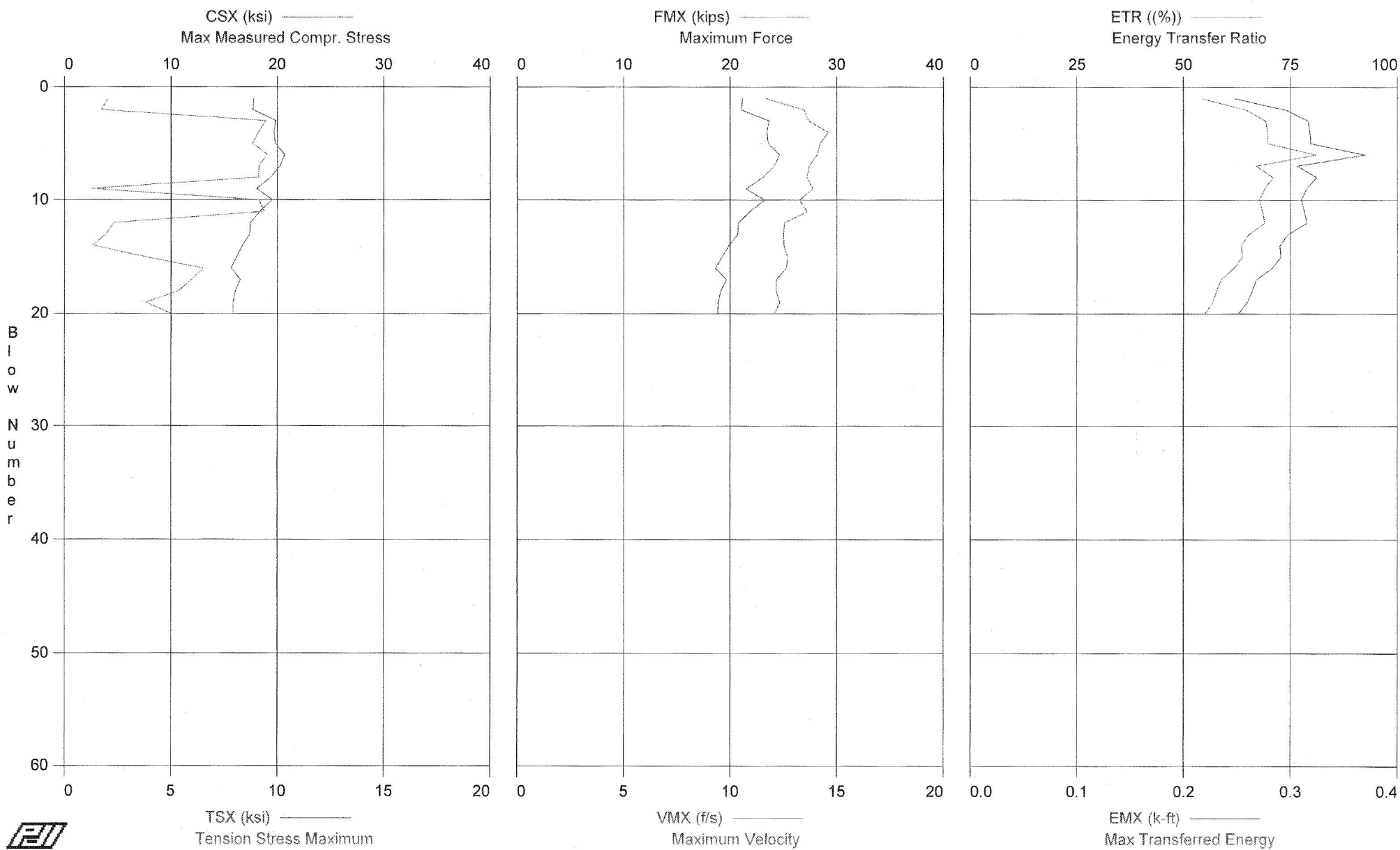
Total number of blows analyzed: 26

Time Summary

Drive 30 seconds

10:38:47 AM - 10:39:17 AM (1/17/2007) BN 1 - 27

Plant Vogtle COL Project - Boring B-1195; 38.5' - 40' Sample



Plant Vogtle COL Project - Boring B-1195; 38.5' - 40' Sample
OP: SEK

Rig Serial No. 100 (MACTEC Charlotte D-50 ATV)
Test date: 17-Jan-2007

AR: 1.19 in²
LE: 44.00 ft
WS: 16,807.9 f/s

SP: 0.492 k/ft³
EM: 30,000.0 ksi
JC: 0.60

CSX: Max Measured Compr. Stress
TSX: Tension Stress Maximum
FMX: Maximum Force
VMX: Maximum Velocity
DFN: Final Displacement

BPM: Blows per Minute
EF2: Energy of F²
ETR: Energy Transfer Ratio
EMX: Max Transferred Energy

BL#	depth ft	CSX ksi	TSX ksi	FMX kips	VMX f/s	DFN in	BPM **	EF2 k-ft	ETR (%)	EMX k-ft
1	0.00	17.79	2.04	21	11.7	1.66	0.0	0.189	62.2	0.218
2	0.00	17.71	1.72	21	13.5	1.54	54.2	0.000	74.0	0.259
3	0.00	19.89	9.47	24	13.7	3.07	54.2	0.202	79.2	0.277
4	0.00	19.70	9.12	23	14.6	2.50	53.8	0.204	79.6	0.279
5	0.00	19.82	8.84	24	14.2	1.96	53.7	0.211	79.8	0.279
6	0.00	20.69	9.52	25	14.1	2.81	54.2	0.224	92.5	0.324
7	0.00	20.29	9.14	24	13.7	2.22	54.1	0.218	76.6	0.268
8	0.00	19.39	9.13	23	13.6	1.93	53.9	0.222	81.2	0.284
9	0.00	18.07	1.28	21	13.9	2.38	53.6	0.000	78.8	0.276
10	0.00	19.54	9.13	23	13.3	1.43	53.6	0.218	77.5	0.271
11	0.00	18.36	9.40	22	13.6	1.10	53.6	0.218	78.3	0.274
12	0.00	17.47	2.31	21	12.5	1.81	26.8	0.212	78.8	0.276
13	0.00	17.40	1.95	21	12.5	1.99	53.5	0.000	74.5	0.261
14	0.00	16.72	1.33	20	12.5	2.13	26.7	0.000	72.5	0.254
15	0.00	16.17	3.77	19	12.7	1.35	53.4	0.000	72.8	0.255
16	0.00	15.65	6.51	19	12.6	2.41	53.1	0.000	70.7	0.247
17	0.00	16.52	5.97	20	12.2	1.63	53.9	0.180	67.0	0.235
18	0.00	16.07	5.36	19	12.2	2.13	53.3	0.173	66.1	0.231
19	0.00	15.86	3.81	19	12.3	1.50	53.3	0.169	64.8	0.227
20	0.00	15.85	5.01	19	12.1	1.95	53.2	0.163	62.9	0.220
Average		17.95	5.74	21	13.1	1.97	50.8	0.140	74.5	0.261

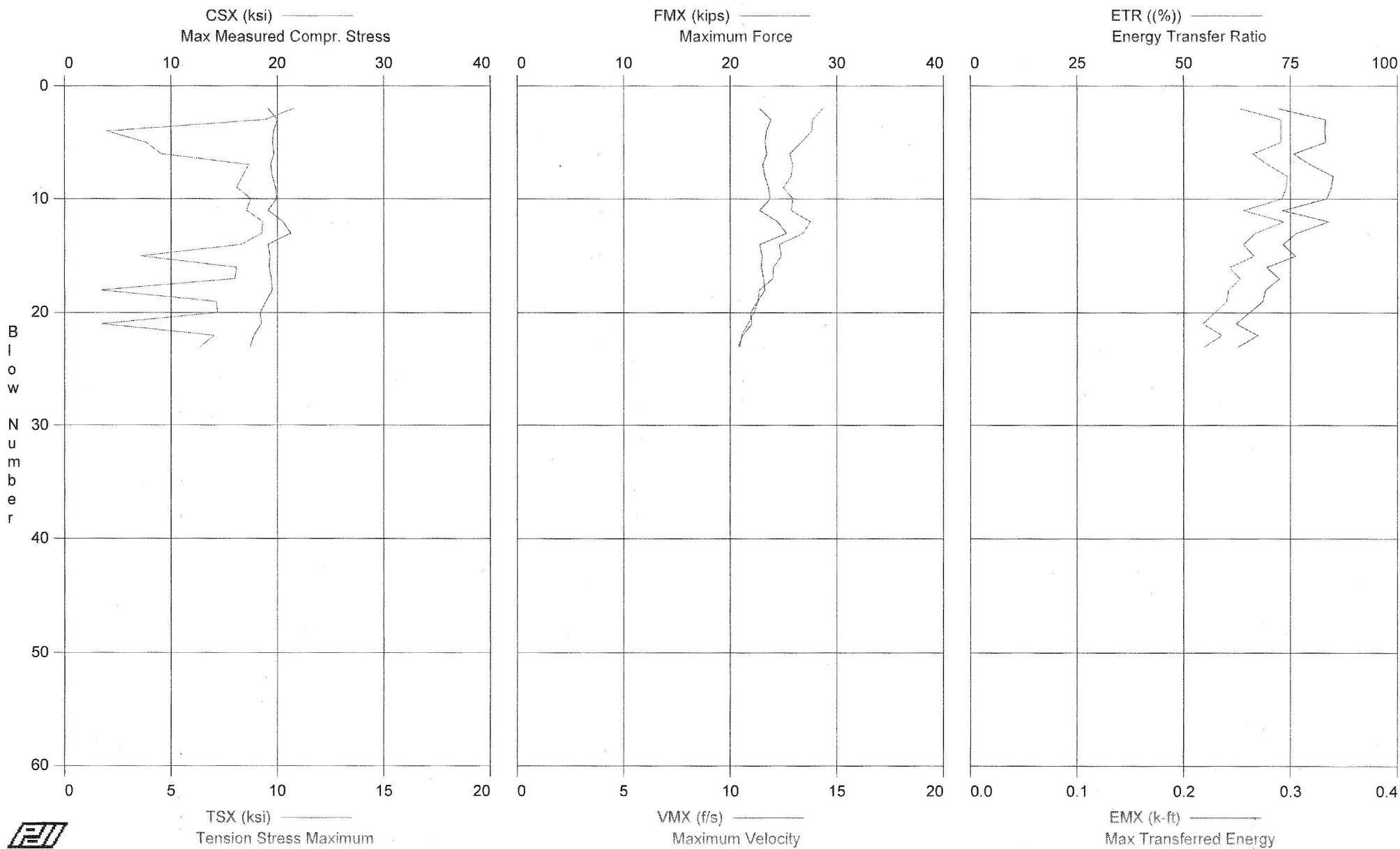
Total number of blows analyzed: 20

Time Summary

Drive 23 seconds

10:52:12 AM - 10:52:35 AM (1/17/2007) BN 1 - 20

Plant Vogtle COL Project - Boring B-1195; 43.5' - 45' Sample



Plant Vogtle COL Project - Boring B-1195; 43.5' - 45' Sample
OP: SEK

Rig Serial No. 100 (MACTEC Charlotte D-50 ATV)
Test date: 17-Jan-2007

AR: 1.19 in²
LE: 49.00 ft
WS: 16,807.9 f/s

SP: 0.492 k/ft³
EM: 30,000.0 ksi
JC: 0.60

CSX: Max Measured Compr. Stress
TSX: Tension Stress Maximum
FMX: Maximum Force
VMX: Maximum Velocity
DFN: Final Displacement

BPM: Blows per Minute
EF2: Energy of F²
ETR: Energy Transfer Ratio
EMX: Max Transferred Energy

BL#	depth ft	CSX ksi	TSX ksi	FMX kips	VMX f/s	DFN in	BPM **	EF2 k-ft	ETR (%)	EMX k-ft
2	0.00	19.15	10.76	23	14.3	2.11	57.8	0.218	72.2	0.253
3	0.00	20.03	9.42	24	13.9	1.94	54.9	0.226	83.2	0.291
4	0.00	19.68	1.99	23	13.8	2.06	54.1	0.000	83.1	0.291
5	0.00	19.55	3.82	23	13.3	2.25	54.3	0.000	83.3	0.291
6	0.00	19.69	4.55	23	12.8	1.70	54.1	0.000	75.8	0.265
7	0.00	19.37	8.66	23	12.9	2.22	54.9	0.232	79.7	0.279
8	0.00	19.54	8.36	23	12.9	2.42	53.7	0.243	85.0	0.297
9	0.00	19.83	8.08	24	12.5	1.66	54.1	0.243	84.6	0.296
10	0.00	19.94	8.75	24	12.9	1.79	54.0	0.241	83.4	0.292
11	0.00	19.13	8.55	23	12.9	1.79	54.4	0.232	73.2	0.256
12	0.00	20.54	9.31	24	13.8	1.76	53.7	0.238	83.9	0.294
13	0.00	21.25	9.27	25	13.4	1.80	54.7	0.240	76.3	0.267
14	0.00	19.12	8.30	23	12.3	1.21	54.1	0.231	73.2	0.256
15	0.00	19.30	3.56	23	12.4	1.61	54.0	0.227	76.1	0.266
16	0.00	19.25	8.09	23	12.0	0.29	53.9	0.220	69.4	0.243
17	0.00	19.44	8.01	23	12.0	1.35	53.6	0.224	72.4	0.253
18	0.00	19.52	1.71	23	11.4	1.12	53.6	0.000	69.2	0.242
19	0.00	18.93	7.13	23	11.3	0.84	53.4	0.208	68.4	0.240
20	0.00	18.39	7.19	22	11.1	0.20	53.8	0.201	65.3	0.229
21	0.00	18.50	1.74	22	10.8	1.85	53.5	0.000	62.2	0.218
22	0.00	17.79	7.03	21	10.5	1.41	54.1	0.193	67.4	0.236
23	0.00	17.44	6.38	21	10.5	1.67	53.6	0.185	62.7	0.219
Average		19.34	6.85	23	12.4	1.59	54.2	0.173	75.0	0.262

Total number of blows analyzed: 22

Time Summary

Drive 25 seconds

11:05:06 AM - 11:05:31 AM (1/17/2007) BN 1 - 23