S&ME

November 18, 2003

B.P. Barber & Associates, Inc.
P.O. Box 1116
Columbia, South Carolina 29202-1116

Attention: John Culbreath

Subject: **Site Class Determination**
Lee County Industrial Park (Jordan No. 2 Industrial Site)
Lee County, South Carolina
S&ME Project No. 1611-03-484

Dear Mr. Culbreath:

As requested, S&ME, Inc. has conducted geotechnical testing services for the above mentioned project. The purpose of our geotechnical exploration was to provide information on seismic site classification from the 2000 International Building Code.

PROJECT INFORMATION

The Lee County Industrial Park is located near the intersection of Browntown Rd. and US Highway 15, just north of I-20 and just a few miles southwest of Bishopville, SC. The King Manufacturing plant is located on-site in the Lee County Industrial Park.

GEOTECHNICAL INVESTIGATION

Site work was conducted on November 11, 2003. The purpose of this work was to define characteristics of the site soils in order to provide an IBC seismic site class at the site

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location. To obtain the data required to give this evaluation, our geotechnical exploration included the following:

- Prior to conducting the cone soundings, we located public utilities in the construction area through Palmetto Utility Protection Services (PUPS).

- We performed 1 Cone Penetration Test (CPT) sounding. Sounding B-1 was conducted to a depth of 100 feet with shear wave velocity tests conducted at one meter intervals. The sounding was conducted 120 feet south and 120 west off the end of the paved portion of the industrial park entrance.

Electronic Cone Penetrometer (CPT) soundings were performed by hydraulically advancing 1-1/4 inch diameter steel rods tipped by an instrumented steel cone at a constant rate of 2 cm/sec into the soil. Electronic strain gages mounted near the tip of the cone allow measurement of the soil resistance to advance of the tip. Strain gages mounted at the intervals on the rod just behind the tip are used to measure the side resistance or friction as the rod is advanced. A pore pressure element mounted just behind the tip allows measurement of soil pore water pressure generated by advancing the CPT assembly. These measurements, when properly interpreted can be used to estimate soil composition, density, apparent strength and compressibility more or less continuously with depth.

At 1 meter intervals in sounding B-1, the shear wave velocity (V_S) was measured using the downhole method. The seismic cone penetrometer test (SCPT) measures the travel times of vibrations generated by an impulse force applied at the ground surface. For each measurement (at a depth increment of 3 ft), the travel time of the first arrival is determined and corrected for the horizontal offset of the source. Interval velocities are calculated by dividing the difference in travel times by the distance between adjacent depths.

Subsurface Conditions

Subsurface soils are grouped on the basis of "Soil Behavior Types" as derived from the CPT tip stress and sleeve stress values. The "Soil Behavior Types" are based on the Robertson definitions, not soil classifications by the Unified Soil Classification System. For a more detailed description of the "Soil Behavior Types," the CPT Soil Classification Legend attached with this report should be referenced.

Below the topsoil in sounding B-1, we encountered mainly "clays" and "silts" to a depth of about 32 feet with corrected tip stress ranging from 25 to 160 tons per square foot (tsf) and sleeve stresses ranging from less than 1 to 6 tsf.. Underlying the clays and silts was a "sand mix" to a depth of about 43 feet with tip stresses from 25 to 260 tsf and sleeve stress from less than 1 to 4.5 tsf. From 43 feet to about 62 feet, another layer of "clays" and "silts" was encountered with tip stresses from 10 to 75 tsf and sleeve stress from less than 1 to 1.5 tsf. Below those "clays" and "silts" were mostly "sands" and "sand mix" to about 83 feet with tip stress from 25 to over 700 tsf and sleeve stresses from less than 1 to 5.5 tsf. From 83 feet to termination of the sounding at 100 feet we encountered another layer of "clays" and "silts" with tip stresses from 10 to 75 tsf and sleeve stress from less than 1 to 1.5 tsf.

Groundwater was measured in the sounding at a depth of about 10 feet. The sounding log is attached in the Appendix.

Site Class

By the International Building Code (2000) section 1615, sites are to be classified as one of the site classes defined in Table 1615.1.1. Where site specific data is not available to a depth of 100 feet, soil properties can be estimated by the registered designer based on known geologic conditions. The IBC 2000 Site Class definitions are A through F according to the following table.

Table 1 – Site Class Definitions as defined in IBC Section 1615.1

SITE CLASS	SOIL PROFILE NAME	AVERAGE PROPERTIES IN TOP 100 FEET, AS PER SECTION 1615.1.5		
		Soil Shear Wave Velocity Vs (ft/s)	Standard Penetration Resistance, N	Soil Undrained Shear Strength, Su psf
A	HARD ROCK	Vs > 5000	Not applicable	Not applicable
B	ROCK	2500 < Vs < 5000	Not applicable	Not applicable
C	VERY DENSE SOIL AND SOFT ROCK	1200 < Vs < 2500	N > 50 bpf	Su > 2000
D	STIFF SOIL PROFILE	600 < Vs < 1200	15 < N < 50 bpf	1000 < Su < 2000
E	SOFT SOIL PROFILE	Vs < 600	N < 15 bpf	Su < 1000
E		Any profile with more than 10 feet of soil having the following characteristics: 1. Plasticity index, PI > 20 2. Moisture Content, w > 40 percent, and 3. Undrained shear strength, Su < 500 psf		
F		Any profile containing soils having one or more of the following characteristics 1. Soils vulnerable to potential failure or collapse under seismic loading such as liquefiable soils, quick and highly sensitive clays, collapsible weakly cemented soils. 2. Peats and highly organic clays (H>10 ft of peat and/or highly organic clay where H=thickness of soil) 3. Very high plasticity clays (H>25 ft with plasticity index PI > 75) 4. Very thick soft/medium stiff clays (H>120 ft)		

Our sounding was extended to a depth of 100 feet. Profile characteristics similar to those described for site classes E and F are not evidenced in the sounding data. The weighted average velocity to a depth of 100 feet was computed using the V_S method formula in Section 1615.1.5 and was 1070 feet per second. Based on the above criteria, sounding data and experience with similar soils, we recommend using **Site Class D** for this project. Site

coefficients F_A and F_V may be obtained directly from Table 5 in 1615.1.2(1) and 1615.1.2(2).

CLOSING

Thank you for the opportunity to conduct geotechnical testing services for the Lee County Industrial Park. If you have any questions regarding this report or if we can be of further service, please contact us at 803-561-9024.

Sincerely,
S&ME, Inc.

Trapp Harris, E.I.T.
Staff Professional

John C. Lessley, P.E.
Chief Engineer

SOUTH CAROLINA REGISTERED PROFESSIONAL ENGINEER No. 14133 JOHN C. LESSLEY

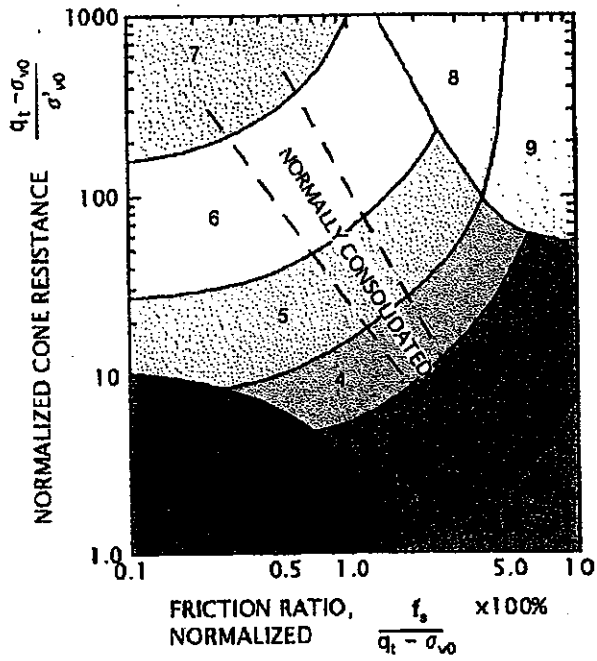
SOUTH CAROLINA S & ME, INC. No. C00473 CERTIFICATE OF AUTHORIZATION

CPT Soil Classification Legend

Zone	(q_c/p_a) N_{eq}	Soil Behavior Type (SBT)
1	2	Sensitive, Fine Grained
2	1	Organic Soils-Peats
3	1.5	Clays-Clay to Silty Clay
4	2	Silt Mixtures-Clayey Silt to Silty Clay
5	3	Sand Mixtures-Silty Sand to Sandy Silt
6	4.5	Sands-Clean Sand to Silty Sand
7	6	Gravelly Sand to Sand
8	1	Very Stiff Sand to Clayey Sand *
9	2	Very Stiff, Fine Grained *

(*) *Heavily Overconsolidated or Cemented*

Normalized Friction Ratio Classification Chart



General Notes:

UNC – Uncorrected

COR – Corrected

Class. FR – Classification based on Friction Ratio, PK Robertson , 1990, see above graph, determines Soil Behavior Type (SBT)

N_{eq}, Blow Counts – after PK Robertson 1990, uses Tip Stress UNC, q_c; atmospheric pressure, p_a

ϕ', Friction Angle - Robertson & Campanella 1988, uses Tip Stress UNC, q_c; effective overburden stress, σ'_{vo};

$$\tan\phi' = \frac{1}{2.68} * \left[\log\left(\frac{q_c}{\sigma'_{vo}}\right) + 0.29\right]$$

S_u, Undrained Shear Strength - Robertson & Campanella 1988; uses Tip Stress COR, q_t; overburden stress, σ_{vo}; $N_{kt} = 15$

$$S_u = \left(\frac{q_t - \sigma_{vo}}{N_{kt}}\right)$$

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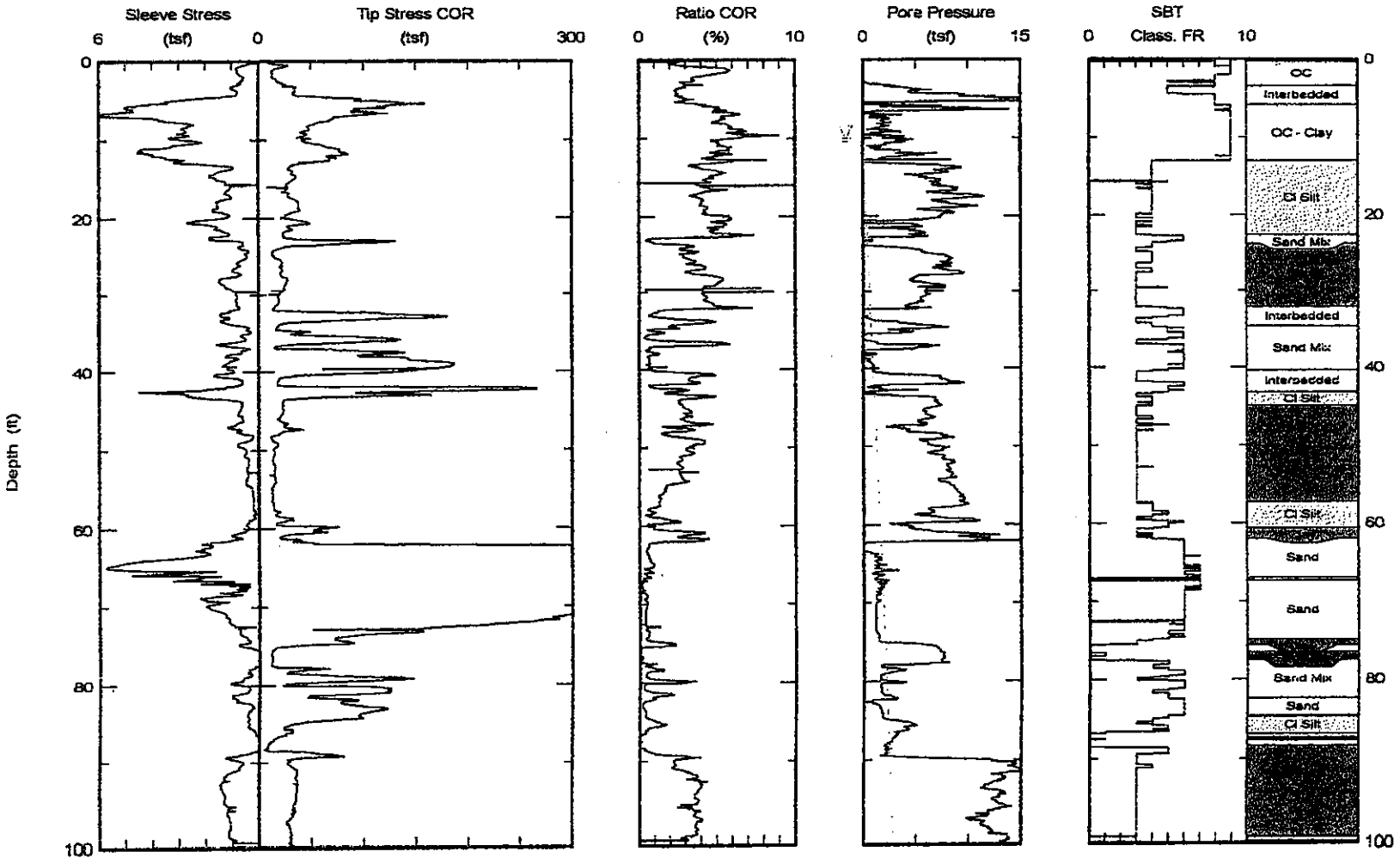
Northing:
Easting:
Elevation:

Date: 11/Nov/2003
Test ID: B-1
Project: 1611-03-484

Client: B.P. Barber
Site: Lee County Industrial Park

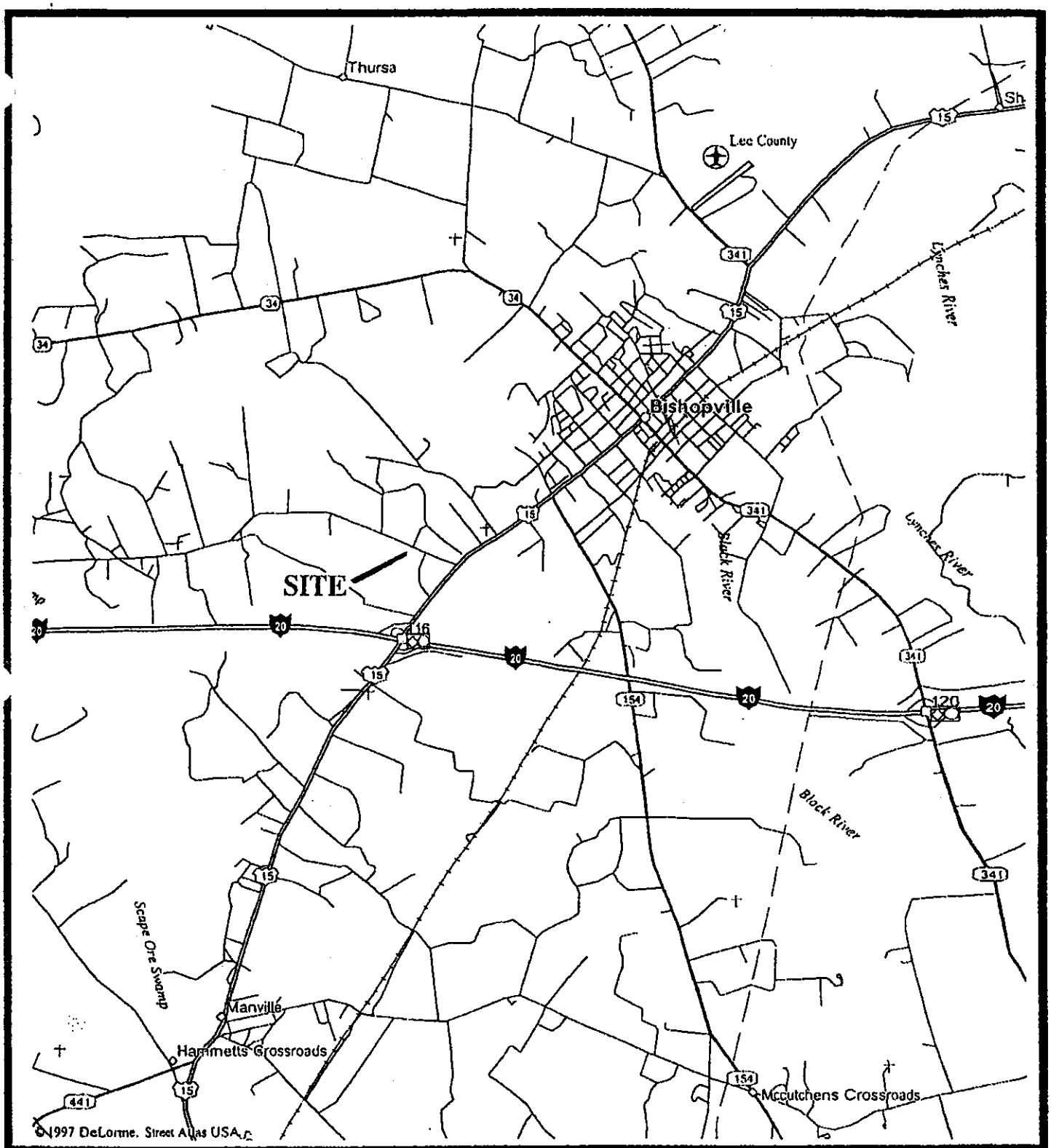


Maximum depth: 99.82 (ft)

Class FR: Friction Ratio Classification (Ref: Robertson 1990)

Estimated Phreatic Surface

Test ID: B-1
File: A11N0308C.ECP



B.P. BARBER & ASSOCIATES, INC. COLUMBIA, SC				S&ME ENVIRONMENTAL SERVICES ENGINEERING • TESTING	SITE LOCATION MAP LEE COUNTY INDUSTRIAL PARK LEE COUNTY, SC	
SCALE: NTS	DATE: 11/18/03	DRAWN BY: TH	CHECKED BY: JCL		JOB NO. 1611-03-484	FIGURE NO. 1

INTERVAL SHEAR WAVE VELOCITY CALCUL... ON SHEET

S&ME

Test ID: B-1
Site: Lee County Industrial Park
Location: Bishopville, SC
Project: 1611-03-484 Date: 11/11/2003
Client: B. P. Barber Cone Id: 2437.102

Seismic Source Components:
Offset (ft): 4
Depth (ft): 0
Type: Automatic Shearwave Generator

Depth ft.	Depth (m)	Ray Distance ft.	Ray Distance (m)	S-Wave 1 Time (sec)	S-Wave 2 Time (sec)	Savg Time (sec)	Corrected Savg (sec)	Interval Velocity ft/sec	Interval Velocity (m/sec)	Interval Depth ft.	Interval Depth (m)	depth increment (ft)	d_i/V_{si}
9.66	2.94	10.46	3.19	0.02068	0.01985	0.0203	0.0187						
12.88	3.93	13.49	4.11	0.02187	0.02292	0.0224	0.0214	1209	368	11.27	3.44	11.27	0.009
16.65	5.07	17.12	5.22	0.02461	0.02460	0.0247	0.0240	1431	436	14.77	4.50	3.50	0.002
19.87	6.06	20.27	6.18	0.02712	0.02754	0.0273	0.0268	1162	354	18.26	5.57	3.50	0.003
23.09	7.04	23.43	7.14	0.02946	0.02988	0.0297	0.0292	1319	402	21.48	6.55	3.22	0.002
26.31	8.02	26.61	8.11	0.03113	0.03176	0.0314	0.0311	1738	530	24.70	7.53	3.22	0.002
29.98	9.14	30.25	9.22	0.03510	0.03490	0.0350	0.0347	1018	310	28.15	8.58	3.45	0.003
33.19	10.12	33.43	10.19	0.03824	0.03824	0.0382	0.0380	981	299	31.59	9.63	3.44	0.004
36.42	11.10	36.64	11.17	0.04158	0.04137	0.0415	0.0412	990	302	34.81	10.61	3.22	0.003
39.64	12.08	39.84	12.14	0.04430	0.04430	0.0443	0.0441	1130	344	38.03	11.59	3.23	0.003
42.82	13.05	43.01	13.11	0.04869	0.04764	0.0482	0.0480	820	250	41.23	12.57	3.20	0.004
46.25	14.10	46.42	14.15	0.05182	0.05120	0.0515	0.0513	1020	311	44.54	13.57	3.30	0.003
49.46	15.08	49.62	15.12	0.05559	0.05412	0.0549	0.0547	956	291	47.86	14.59	3.32	0.003
52.63	16.04	52.78	16.09	0.05830	0.05768	0.0580	0.0578	1007	307	51.05	15.56	3.19	0.003
55.91	17.04	56.05	17.08	0.06208	0.06144	0.0618	0.0616	870	265	54.27	16.54	3.22	0.004
59.13	18.02	59.27	18.06	0.06645	0.06562	0.0660	0.0659	750	229	57.52	17.53	3.25	0.004
62.84	19.15	62.97	19.19	0.06980	0.06938	0.0696	0.0694	1041	317	60.99	18.59	3.47	0.003
66.05	20.13	66.17	20.17	0.07219	0.07135	0.0718	0.0716	1466	447	64.45	19.64	3.46	0.002
69.32	21.13	69.44	21.16	0.07439	0.07419	0.0743	0.0742	1294	394	67.69	20.63	3.24	0.003
72.40	22.07	72.51	22.10	0.07669	0.07711	0.0769	0.0768	1177	359	70.86	21.60	3.18	0.003
75.59	23.04	75.70	23.07	0.08058	0.07953	0.0801	0.0799	1009	308	74.00	22.55	3.14	0.003
78.79	24.02	78.89	24.05	0.08443	0.08338	0.0839	0.0838	830	253	77.19	23.53	3.19	0.004
81.98	24.99	82.08	25.02	0.08756	0.08672	0.0871	0.0870	985	300	80.39	24.50	3.20	0.003
85.82	26.16	85.91	26.19	0.09049	0.09028	0.0904	0.0903	1181	360	83.90	25.57	3.52	0.003
89.04	27.14	89.13	27.17	0.09487	0.09383	0.0944	0.0943	812	247	87.43	26.65	3.53	0.004
92.27	28.12	92.36	28.15	0.09738	0.09655	0.0970	0.0969	1233	376	90.66	27.63	3.22	0.003
95.79	29.20	95.87	29.22	0.10073	0.09968	0.1002	0.1001	1085	331	94.03	28.66	3.38	0.003
99.30	30.27	99.38	30.29	0.10367	0.10304	0.1034	0.1033	1113	339	97.55	29.73	3.52	0.003
												97.55	0.09

1069.8 Vsbar

Notes:
Corrected Savg - travel times adjusted for horizontal offset (5.5 ft) of the source from CPT location; the times were multiplied by the cosine of the angle between vertical and the ray path from source to reciever.