GPE, INC.
Geotechnical Equipment

DMT DIGEST NO. 1

(1 Apr 83)
(3 pp. + 5 attached pp.)

A. New DIGEST Series

GPE has decided to begin a series of DIGESTS concerning developments of interest to users of the Marchetti dilatometer test (DMT). We plan to distribute these DIGESTS to those individuals and organizations that have purchased DMT equipment from GPE. They will come out on a non-periodic basis, as we consider appropriate. These DIGESTS have the multiple purposes of keeping you informed concerning: a) latest equipment developments, and new ways to use the dilatometer; b) improvements in methods for data reduction of DMTs; c) conferences, meetings, etc. of interest to DMT users; d) encouraging uniformity in the conduct of and data reduction from DMTs; e) providing a central point for users of the DMT to pass along experiences they would like to share; f) new technical literature relating to the DMT and g) to in general provide a vehicle for passing along news about the DMT.

Future DMT DIGESTS may refer to items in previous DIGESTS. We suggest you keep a separate file for these DIGESTS for easy reference and cross reference.

B. Change Calculation for K_o, OCR (and therefore p_c and Ø) in Sands

Experience in sands has shown that the Marchetti correlations described in his 1980 ASCE paper often did not provide reasonable estimates of K_o and OCR in sands. Dr. Schmertmann has developed a different procedure for calculating these parameters in sands, a procedure anchored to the theoretical calculation for the friction angle and the results from large calibration chamber tests. The attached pp. 1-1 thru 1-4 describe the revised approach and present an example DMT sounding log using the revised data reduction method. Schmertmann & Crapps, Inc. now uses the new method and recommends it replace the Marchetti method.

We have incorporated the new procedure into a revised DMT data reduction program for use on the HP-41CV and in FORTRAN for use on a VECTOR 3 system (Microsoft Fortran-80 compiler). Previous purchasers of DMT equipment will receive separately copies of this new program for the 41CV and instructions for its use. We will also send you (no charge) a listing of the VECTOR program if you request it.

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C. Driving Blade Alert

Evidence has accumulated to suggest that inserting the dilatometer by driving it, as with the SPT hammer, may significantly distort the results in soils sensitive to disturbance by vibrations. We have observed this in a coarse sand and gravel fill with relative densities about 50-60%, and in a sensitive Canadian clayey silt. Both cases produced lower A-readings and therefore lower K_D and K_o values when driving the DM blade compared to when pushing it quasi-statically. The B-readings also decrease, but proportionally less than for A. Usually I_D, c_u and M also decrease, but Ø increases. It seems clear that when testing in soils potentially sensitive to vibration disturbance that the engineer should check for the possible effects of driving before allowing its use in such soils. In the above cases driving the DM produced poor results and we made pushing mandatory.

On the other hand, the difference in DMT results between pushing and driving the blade might prove of use in identifying those soils that have a sensitivity to the effects of vibrations.

If you obtain driving vs. pushing DMT data and would like to share it with other DMT users, please send enough information to GPE so that we can add it to a list of drive and no-drive soil types/conditions for a future DMT DIGEST.

D. Crushing Soil Alert

Recent testing in limerock soils in southern Florida and in unsaturated loess soils in Bulgaria suggest that soils that have a structure that can crush as a result of the insertion of the DM blade might produce poor results when analyzed with the current correlations. The crushing behavior probably reduces the lateral stresses that would otherwise occur, and thus reduces the A-reading. This seems to affect many of the analyses for engineering properties in much the same manner as the C. effects of driving vibrations in sensitive soils.

As with the driving vibration problem, the effect on the DMT results when in crushable soils might prove of use in identifying such soils. For example, Dr. Lutenegger of Geotechnical Test Systems, Inc., Ames, Iowa, has proposed in a paper to the coming 18-20 May 83 "International Symposium of Soil and Rock Testing" in Paris that a K_D value below 1.4 indicates collapsible zones in some Bulgarian loess deposits.

As with the driving alert, please share any crushable soil DMT

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experiences with GPE so that we can include your experience in a warning list of crushable soil types/conditions in a future DMT DIGEST.

E. Edmonton Conference and Orlando Workshop

On 4 Feb 83 Mobile Augers Research Ltd., 5736 103A Street, Edmonton, Alberta, T6H 2J5 Canada (ph: (404) 436-3960) sponsored a one day conference on the DMT in Edmonton. Over 60 people attended from the USA and Canada. Contact Don Currie for any available reprint materials from this conference. The University of Florida 3 day workshop on the dilatometer, piezocone and self-boring pressuremeter took place from 16-18 March near Orlando and had 32 paid participants. During the workshop Schmertmann & Crapps made a 59 ft DMT sounding and reduced the data by computer. The attached example pp. 1-3 to 1-5 show the data from this workshop sounding.

F. Total Thrust Log Useful

The Schmertmann & Crapps DMT sounding experience suggests that only minor rod friction develops in most DMT soundings going to depths of 60 ft or less. This means that the DMT blade also acts as a penetrometer during its insertion. Thus, the total thrust to advance the DM blade not only provides data needed for the theoretical calculation for friction angle in sands using the Schmertmann method, but the log of this thrust vs. depth can also provide a useful adjunct to the interpretation of site stratigraphy. The attached example p. 1-5 demonstrates this. We have found that this type of DMT sounding log usually closely follows the pattern one would obtain at the same location using the CPT log of q_c vs. depth.

G. DMT Video Tapes Available

GPE has available 2 video tapes for rental use, at a nominal charge of $10 per week. A 3/4" tape using the Sony system, 30 minute length, describes the use of the DMT, through 30 ft of water from barges, in connection with the geotechnical program for the Sunshine Skyway Bridge replacement across Tampa Bay, Florida. A second 1/2" tape, recorded by Mobile Augers Research Ltd. on an RCA VK250 cassette, takes about 25 minutes. It describes the dilatometer and its operation, with some example testing in the Edmonton area.

John H. Schmertmann
Editor

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SCHMERTMANN & CRAPPS, INC.
—Consulting Geotechnical Engineers—

DMT Workshop
16-18 Mar 83

TABLE 1

REVISED PROCEDURE FOR CALCULATING K_o and OCR FROM DMTs WITH I_D > 1.2 AND WHICH INCORPORATE THE PENETRATION FORCE MEASUREMENT TO PERMIT CALCULATING THE PLANE STRAIN FRICTION ANGLE:

The chamber tests in Figure 10 were not available to Marchetti at the time he set up his correlation between K_o and K_D. He included sands in the correlation because they seem to fit with the silts and clays, although he had very limited data in sands. His correlation equation of $K_o = [K_D/1.5)^{0.47} - 0.6]$ shows that K_o will increase as K_D increases. However the chamber data shows that for normally consolidated sands K_o actually decreases as K_D increases dramatically with friction angle (relative density). Thus, the currently available chamber data (16 tests) clearly demonstrate the need for a new K_o and OCR analysis method in sands. The list below outlines this method and links it to the separate friction angle determination. In principle, the friction angle depends primarily on density or relative density of the sand and thus provides a parameter which permits the approximate separation of density and prestress effects.

Step

1. Determine K_D
2. Estimate a trial value of K_o
3. Calculate ϕ_{ps} using the Durgunoglu and Mitchell theory
4. Estimate ϕ_{ax} from approximate formula:
   $\phi_{ax} = [\phi_{ps} - (\phi_{ps} - 32)/3]$.
   If $\phi_{ps} \leq 32^o$, assume $\phi_{ax} = \phi_{ps}$.
5. Use equation (1) at the bottom of Figure 10 to calculate K_o.
6. Compare calculated K_o with estimated K_o
7. Iterate from Step 2 until the trial K_o and the calculated K_o agree to within +/- 5% (adjustable).
8. Calculate OCR using the following modified Mayne and Kulhawy equation: [(1/sin ϕ) to (1/.8sin ϕ) from chamber testing]

   $$OCR = [K_o/(1-\sin\phi_{ax})]^{(1/0.8 \sin \phi_{ax})}$$

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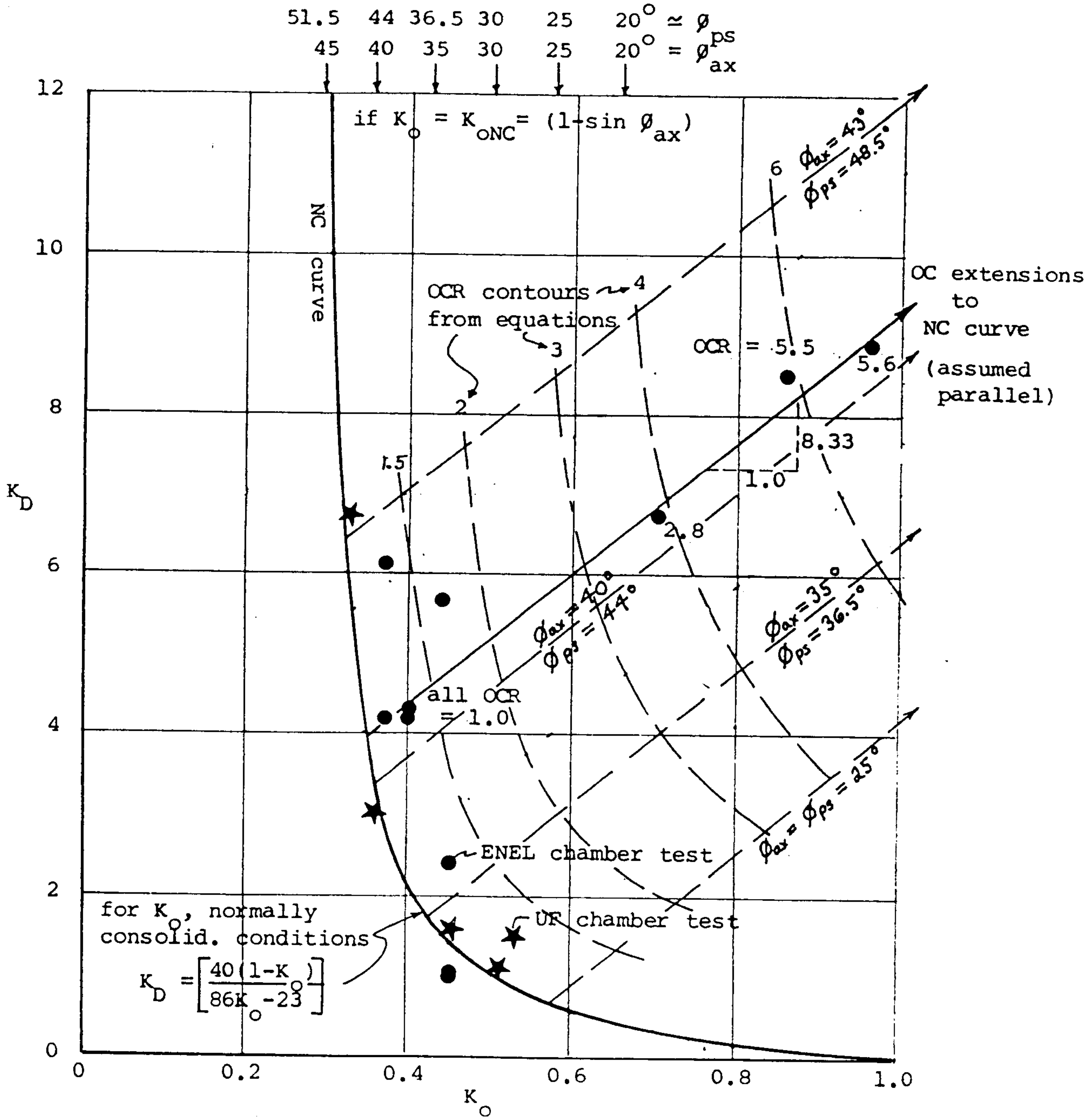
FIGURE - 10

RESULTS FROM CALIBRATION CHAMBER TESTS ON UNIFORM, FINE TO CSE. SANDS

(to develop new interpretation for K_o and OCR from DMTs in sand)



Using the information and formulas given in the above Figure yields a formula relating K_o to K_D and ϕ_{ax}:

$$K_o = \frac{40 + 23K_D - 86K_D(1-\sin\phi_{ax}) + 152(1-\sin\phi_{ax}) - 717(1-\sin\phi_{ax})^2}{192 - 717(1-\sin\phi_{ax})} \quad \ldots (1)$$

which describes the OC extensions to the NC curve.

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SCHMERTMANN & CRAPPS, INC.
FILE NAME: INSITU TESTING SHORT COURSE - SHERATON WORLD
FILE NUMBER: NORTH OF SHERATON WO

RECORD OF DILATOMETER TEST NO. D-2
USING DATA REDUCTION PROCEDURES IN MARCHETTI (ASCE,J-GED,MARCH 80)
KO IN SANDS DETERMINED USING SCHMERTMANN METHOD (1983)
PHI ANGLE CALCULATION BASED ON DURGUNOGLU AND MITCHELL (ASCE,RALEIGH CONF,JUNE 75)
MODIFIED MAYNE AND KULHAWY FORMULA USED FOR OCR IN SANDS (ASCE,J-GED,JUNE 82)

LOCATION: NEAR CPT-1 --- 30 FT. EAST OF PROPERTY LINE & 100 FT. NORTH OF ROAD C.L.
PERFORMED - DATE: 16,17 MARCH 83
BY: R.GUPTA, P.BULLOCK & DR. J.H.SCHMERTMANN

CALIBRATION INFORMATION:
DA= .13 BARS DB= .40 BARS ZM= .75 BARS ZW= .40 METERS VS0= .075 BARS
DIAM. OF FRIC. REDUCER= 5.80 CM. ROD WEIGHT= 4.00 KG./M. ROD DIAM.= 4.440 CM.

1 BAR = 1.019 KG/CM2 = 1.044 TSF = 14.51 PSI ANALYSIS USES H20 UNIT WEIGHT = 1.0 T/M3

readings taken by WORKSHOP participants — JHS, ERCHOL, NELSON, MUZZY, LANE, PHILLIPS, JHS

Z (M)	THRUST (KG)	A (BAR)	B (BAR)	ED (BAR)	UO (BAR)	ID	GAMMA (T/M3)	SV (BAR)	KD	OCR	KO	CU (BAR)	PHI (DEG)	SIGFF (BAR)	M (BAR)	SOIL TYPE	DESCR
*****	******	*****	*****	*****	*****	******	******	******	*****	*****	****	*****	*****	*****	*****	***********	********
.40	480.	1.80	5.85	128.	0.00	3.68	1.80	.075	13.39	20.34	1.69		41.2	.12	353.	SAND	CEMENTED
.60	840.	2.35	8.90	219.	.02	4.48	1.80	.091	15.54	25.34	1.89		42.8	.15	632.	SAND	CEMENTED
.80	1000.	3.25	10.20	234.	.04	2.97	1.90	.108	20.95	49.02	2.61		40.9	.18	749.	SILTY SAND	CEMENTED
1.00	760.	3.05	8.00	161.	.06	2.16	1.80	.124	17.33	36.79	2.25		38.6	.20	486.	SILTY SAND	CEMENTED
1.20	360.	1.55	4.55	90.	.08	3.56	1.70	.138	5.28	4.51	.85		37.0	.22	175.	SAND	LOOSE
1.40	800.	1.55	7.15	185.	.10	9.20	1.70	.152	3.82	1.55	.46		43.2	.26	307.	SAND	LOOSE
1.60	3000.	7.00	40.05	1185.	.12	7.37	2.00	.171	27.09	73.10	3.24		43.6	.29	3988.	SAND	CEMENTED
NEW ZM =		0.00															
1.80	5400.	21.30	64.30	1547.	.14	2.33	2.15	.194	98.94	123*8	12*0		38.9	.32	7226.	SILTY SAND	CEMENTED
2.00	7400.	19.00	52.20	1190.	.16	1.98	2.15	.216	80.16	676*7	9.70		41.8	.36	5322.	SILTY SAND	CEMENTED
2.10	8000.	30.00	85.00	1985.	.17	2.10	2.15	.228	119*6	178*4	14*5		39.3	.37	9626.	SILTY SAND	CEMENTED
NEW VS =		.800															
NEW ZM =		.85															
NEW DA =		.18		NEW DB =	.65												
4.20	2700.	6.00	22.50	571.	.37	3.94	2.00	.427	9.77	11.11	1.26		41.2	.71	1416.	SAND	CEMENTED
4.40	2800.	5.30	24.40	666.	.39	5.77	2.00	.447	7.44	6.28	.94		42.2	.75	1493.	SAND	CEMENTED
4.60	2500.	4.90	18.00	447.	.41	4.02	1.90	.464	6.90	5.74	.91		41.4	.77	974.	SAND	M RIGID
4.80	2400.	4.80	17.60	436.	.43	4.05	1.90	.482	6.43	5.15	.86		41.1	.80	923.	SAND	M RIGID
5.00	2300.	4.80	17.80	443.	.45	4.16	1.90	.500	6.14	4.87	.84		40.6	.83	921.	SAND	M RIGID
5.20	2360.	4.60	16.30	396.	.47	3.91	1.90	.517	5.64	4.12	.77		40.8	.86	793.	SAND	M RIGID
5.40	2400.	4.30	16.00	396.	.49	4.40	1.90	.535	4.35	3.07	.67		41.2	.89	741.	SAND	M RIGID
5.60	2400.	4.70	16.90	414.	.51	4.05	1.90	.553	5.34	3.79	.74		40.7	.91	810.	SAND	M RIGID
5.80	2600.	4.70	17.70	443.	.53	4.42	1.90	.570	5.07	3.32	.69		41.2	.95	847.	SAND	M RIGID
6.00	2600.	4.90	18.10	451.	.55	4.24	1.90	.588	5.21	3.58	.72		40.8	.97	871.	SAND	M RIGID
6.20	2600.	5.00	17.60	429.	.57	3.90	1.90	.606	5.24	3.67	.73		40.6	1.00	831.	SAND	M RIGID
6.40	2400.	4.90	16.40	389.	.59	3.61	1.90	.623	4.99	3.51	.72		40.0	1.02	737.	SAND	M RIGID
6.60	2200.	4.60	16.00	385.	.61	3.97	1.90	.641	4.36	2.89	.66		39.5	1.05	685.	SAND	M RIGID
6.80	2200.	4.70	16.80	411.	.63	4.17	1.90	.659	4.31	2.88	.66		39.4	1.08	726.	SAND	M RIGID
7.00	2200.	5.20	17.30	411.	.65	3.57	1.90	.676	4.91	3.68	.75		38.8	1.10	773.	SAND	M RIGID
7.20	2000.	5.00	17.20	414.	.67	3.86	1.90	.694	4.46	3.26	.72		38.1	1.12	745.	SAND	M RIGID
7.40	2100.	5.90	18.60	432.	.69	3.16	2.00	.714	5.53	4.76	.86		37.6	1.15	859.	SILTY SAND	RIGID
7.60	2000.	5.20	16.60	385.	.71	3.37	1.90	.731	4.51	3.39	.74		37.7	1.18	696.	SAND	M RIGID
7.80	1800.	4.60	14.90	345.	.73	3.64	1.90	.749	3.65	2.52	.64		37.3	1.20	560.	SAND	M RIGID
8.00	1700.	4.70	15.00	345.	.75	3.54	1.90	.767	3.67	2.63	.66		36.6	1.22	562.	SAND	M RIGID
8.20	1600.	4.20	13.50	309.	.77	3.30	1.90	.784	2.98	1.99	.59		36.4	1.25	447.	SAND	M RIGID
8.40	1600.	4.90	15.80	367.	.79	3.59	1.90	.802	3.67	2.74	.68		35.7	1.27	598.	SAND	M RIGID
8.60	1600.	4.80	15.80	371.	.80	3.79	1.90	.820	3.44	2.50	.66		35.7	1.30	583.	SAND	M RIGID
8.80	2000.	5.00	17.10	411.	.82	4.02	1.90	.837	3.51	2.38	.63		37.3	1.34	654.	SAND	M RIGID
9.00	2100.	5.10	16.50	385.	.84	3.63	1.90	.855	3.58	2.42	.63		37.5	1.37	619.	SAND	M RIGID
9.20	2700.	5.20	19.40	487.	.86	4.68	1.90	.873	3.44	2.01	.56		39.3	1.43	766.	SAND	M RIGID
9.40	4200.	6.60	26.60	698.	.88	4.92	2.00	.892	4.58	2.66	.62		41.7	1.49	1273.	SAND	RIGID
9.60	4600.	11.30	30.00	651.	.90	2.12	2.15	.915	9.66	11.68	1.30		39.6	1.50	1607.	SILTY SAND	V RIGID
9.80	3100.	6.35	21.10	507.	.92	3.60	2.00	.934	4.35	2.93	.67		39.3	1.53	901.	SAND	RIGID
10.00	2100.	5.40	17.50	411.	.94	3.67	1.90	.952	3.39	2.33	.63		36.7	1.52	640.	SAND	M RIGID
10.20	2300.	7.05	24.80	616.	.96	3.89	2.00	.972	4.71	3.86	.79		36.4	1.55	1138.	SAND	RIGID
10.40	1600.	6.25	17.30	372.	.98	2.63	2.00	.991	4.12	3.53	.79		33.5	1.54	636.	SILTY SAND	RIGID
10.60	1000.	8.10	11.90	108.	1.00	.50	1.80	1.007	6.24	5.90	1.35	.92			218.	SILTY CLAY	MED CONS
10.80	800.	9.90	13.90	115.	1.02	.41	1.90	1.025	7.86	8.45	1.58	1.25			260.	SILTY CLAY	HI CONS
11.00	800.	7.20	11.20	115.	1.04	.62	1.80	1.040	5.12	4.34	1.18	.74			210.	CLAYEY SILT	M DENSE
11.20	720.	10.90	15.10	123.	1.06	.39	1.90	1.058	8.51	9.57	1.66	1.42			287.	SILTY CLAY	HI CONS
11.40	740.	10.70	14.60	112.	1.08	.37	1.90	1.076	8.18	9.00	1.62	1.38			257.	SILTY CLAY	HI CONS

CONTINUED ON NEXT PAGE

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Z (M)	THRUST (KG)	A (BAR)	B (BAR)	ED (BAR)	UO (BAR)	ID	GAMMA (T/M3)	SV (BAR)	KD	OCR	KO	CU (BAR)	PHI (DEG)	SIGFF (BAR)	M (BAR)	SOIL TYPE	DESCR
*****	******	*****	*****	*****	*****	******	******	******	*****	*****	****	*****	*****	*****	*****	************	********
11.60	700.	10.10	14.60	134.	1.10	.47	1.90	1.093	7.45	7.78	1.52	1.25			294.	SILTY CLAY	HI CONS
11.80	640.	8.00	10.80	72.	1.12	.34	1.80	1.109	5.51	4.86	1.24	.87			136.	SILTY CLAY	MED CONS
12.00	540.	6.60	8.50	39.	1.14	.24	1.70	1.123	4.22	3.21	1.03	.63			63.	CLAY	LO CONS
12.20	520.	7.95	10.90	77.	1.16	.37	1.80	1.139	5.28	4.55	1.21	.84			143.	SILTY CLAY	MED CONS
12.40		6.95	9.55	64.	1.18	.37	1.80	1.154	4.34	3.35	1.05	.67			106.	SILTY CLAY	MED CONS
12.60	520.	5.70	8.00	54.	1.20	.41	1.70	1.168	3.22	2.10	.83	.47			72.	SILTY CLAY	LO CONS
12.80	560.	5.25	7.50	52.	1.22	.45	1.70	1.182	2.79	1.68	.74	.39			62.	SILTY CLAY	LO CONS
13.00	640.	7.30	10.95	103.	1.24	.56	1.80	1.197	4.39	3.40	1.06	.70			170.	SILTY CLAY	MED CONS
13.20	800.	8.45	12.40	114.	1.26	.51	1.80	1.213	5.25	4.51	1.20	.89			209.	SILTY CLAY	MED CONS
13.40	920.	9.75	13.95	123.	1.28	.46	1.90	1.231	6.20	5.85	1.35	1.11			247.	SILTY CLAY	HI CONS
13.60	960.	10.20	13.90	105.	1.30	.37	1.90	1.248	6.48	6.26	1.39	1.19			215.	SILTY CLAY	HI CONS
13.80	1060.	9.90	13.90	115.	1.32	.43	1.90	1.266	6.13	5.73	1.34	1.13			231.	SILTY CLAY	HI CONS
14.00	1100.	10.20	13.95	106.	1.33	.38	1.90	1.284	6.27	5.94	1.36	1.18			215.	SILTY CLAY	HI CONS
14.20	1160.	9.70	13.60	112.	1.35	.43	1.90	1.301	5.78	5.24	1.29	1.08			217.	SILTY CLAY	HI CONS
14.40	2000.	6.90	20.70	473.	1.37	3.24	2.00	1.321	3.18	2.45	.67		33.8	2.06	712.	SILTY SAND	RIGID
14.60	2600.	6.70	20.80	483.	1.39	3.51	2.00	1.341	2.96	2.01	.59		36.0	2.13	698.	SAND	RIGID
14.80	2800.	8.10	24.40	564.	1.41	3.10	2.00	1.360	3.85	2.93	.70		35.8	2.16	942.	SILTY SAND	RIGID
15.00	2000.	5.95	10.40	132.	1.43	1.04	1.80	1.376	2.66	1.56	.71				156.	SILT	M DENSE
15.20	2300.	6.15	22.80	576.	1.45	5.13	2.00	1.396	2.32	1.55	.53		35.2	2.20	709.	SAND	RIGID
15.40	2700.	7.10	20.50	458.	1.47	3.05	2.00	1.415	3.06	2.12	.61		35.8	2.24	674.	SILTY SAND	RIGID
15.60	2800.	7.55	26.10	646.	1.49	4.13	2.00	1.435	3.14	2.18	.62		35.9	2.28	964.	SAND	RIGID
15.80	2800.	6.55	22.80	562.	1.51	4.50	2.00	1.455	2.47	1.57	.53		36.3	2.32	723.	SAND	RIGID
16.00	2800.	6.10	18.60	425.	1.53	3.70	1.90	1.472	2.25	1.39	.50		36.4	2.35	512.	SAND	M RIGID
16.20	3400.	10.30	26.40	556.	1.55	2.19	2.00	1.492	4.90	4.19	.83		35.9	2.37	1026.	SILTY SAND	RIGID
16.40	2600.	5.90	14.20	272.	1.57	2.39	1.90	1.510	2.18	1.40	.51		35.7	2.39	303.	SILTY SAND	M RIGID
16.60	2000.	9.70	13.70	115.	1.59	.46	1.80	1.525	4.77	3.89	1.12	1.00			201.	SILTY CLAY	MED CONS
16.80	1600.	10.30	13.70	94.	1.61	.34	1.80	1.541	5.12	4.34	1.18	1.10			170.	SILTY CLAY	MED CONS
17.00	1400.	9.90	13.50	101.	1.63	.39	1.80	1.557	4.79	3.91	1.13	1.02			176.	SILTY CLAY	MED CONS
17.20	1400.	8.80	11.50	68.	1.65	.31	1.80	1.572	4.06	3.02	1.00	.84			107.	CLAY	MED CONS
17.40	1400.	5.80	8.95	85.	1.67	.73	1.70	1.586	2.11	1.09	.57	.37			78.	CLAYEY SILT	L DENSE
17.60	2500.	5.40	18.30	440.	1.69	5.20	1.90	1.604	1.52	.98	.43		35.5	2.53	380.	SAND	M RIGID
17.80	3000.	7.35	23.10	544.	1.71	3.71	2.00	1.623	2.60	1.72	.55		35.9	2.58	724.	SAND	RIGID
18.00	3400.	6.80	24.10	600.	1.73	4.83	2.00	1.643	2.18	1.27	.47		37.1	2.64	706.	SAND	RIGID

END OF SOUNDING

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SCHMERTMANN & CRAPPS, INC.

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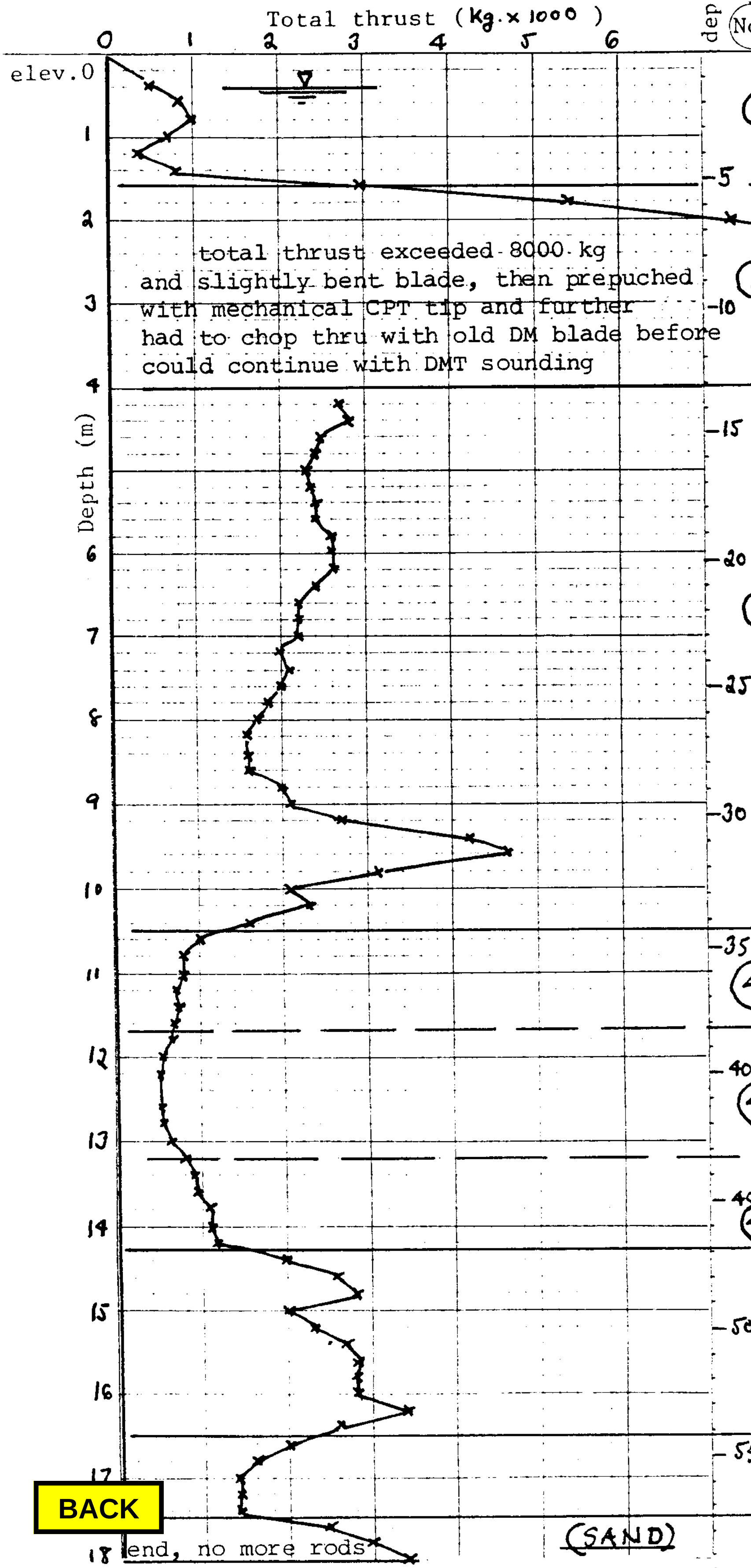
File No. 82-486

Client: UF WORKSHOP

SUMMARY LOG FOR DILATOMETER SOUNDING
No. D-2 Date finished: 17 Mar 82



lyr (No.)	ave. from DMTs (SOIL DESCRIPTION)					
			units in (bars)			
	$\frac{\sigma_h'}{\sigma_v'}=K$	ϕ'_{ps}	c_u	σ_v'	p_c	M
	(SAND)					
1	1.62	40.6	—	0.12	2.4	450
	(CEMENTED SAND, HARDPAN)					
2	—	41	—	0.24	60+	6500+
	(SAND)					
3	0.75	39.0	—	0.70	2.7	838
	(SILTY CLAY)					
4a	1.49	—	1.16	1.05	7.9	254
4b	0.65	—	0.65	1.15	3.8	107
4c	1.10	—	1.10	1.25	7.0	222
	(SAND)					
5	0.62	35.7	—	1.40	3.0	675
	(SILTY CLAY)					
6	1.00	—	0.87	1.55	5.0	146
7	0.51	36.2	—	1.62	2.1	603

Form completed by: JHS Date: 28 Mar 83

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