CAPWAP ANALYSIS - CASE HISTORY

THE USE OF "SUPERPOSITION" FOR EVALUATING TOTAL PILE CAPACITY

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GRL / PDI

PDA USERS' DAY - 1996
ORLANDO, FLORIDA, USA

PRESTRESSED CONCRETE PILE

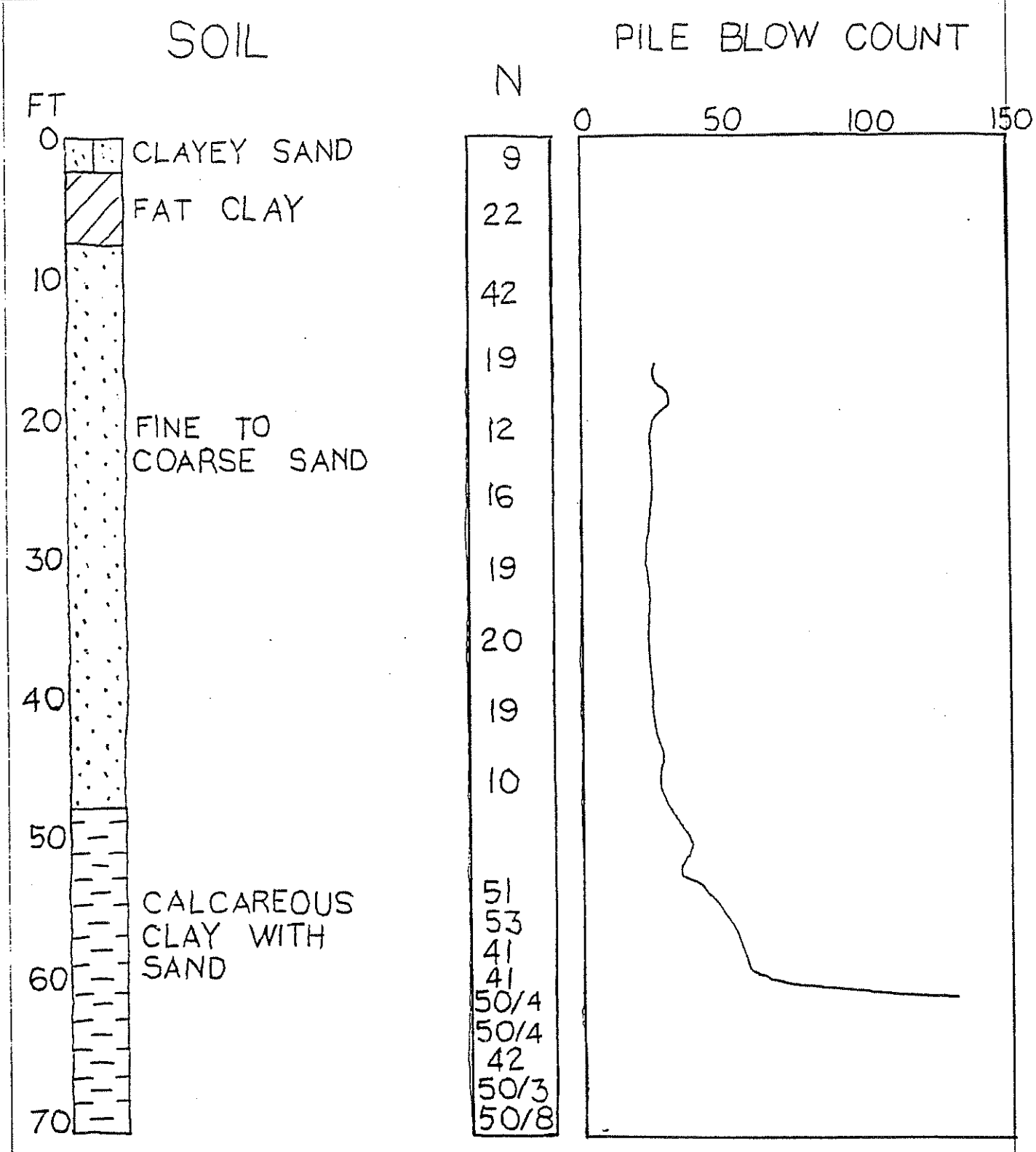
30-INCH (762 mm) SQUARE WITH
18-INCH (457 mm) HOLLOW CORE
EXTENDING TO 4 FT (1.2 m) ABOVE TIP

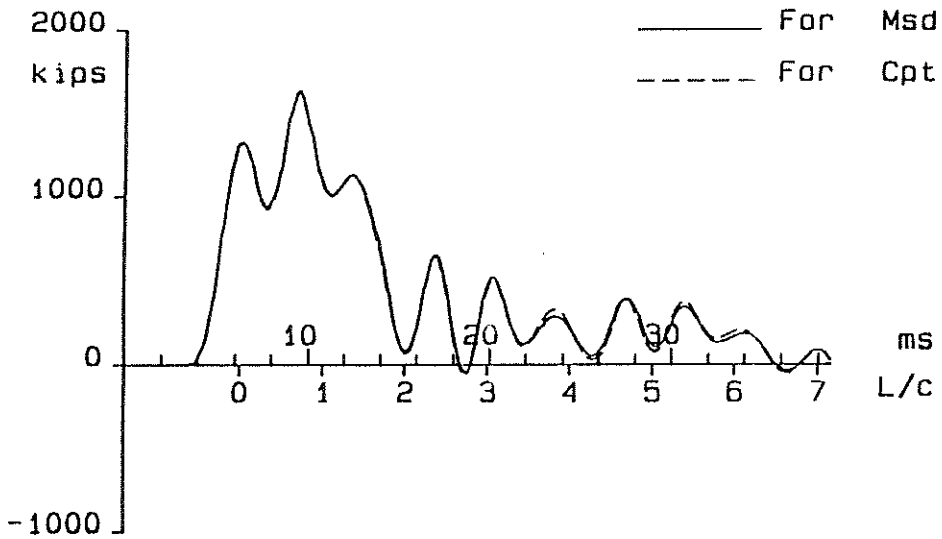
65 FT (19.8 m) LONG

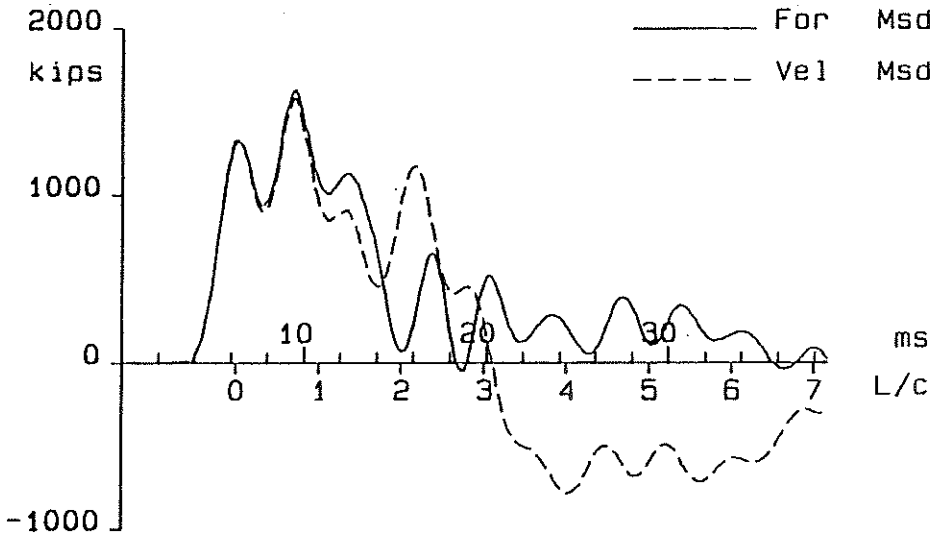
MENCK HAMMER, 88 KIP-FT (120 kJ)

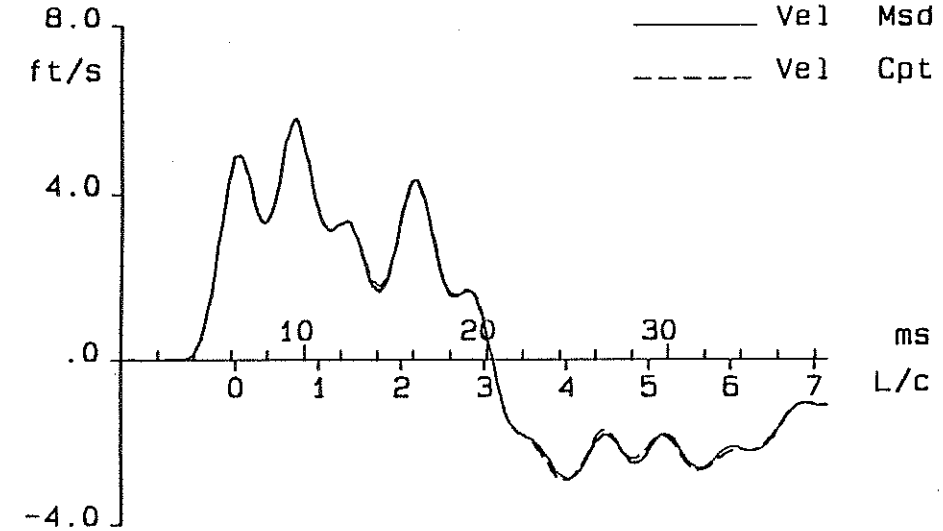
DYNAMIC TESTING DURING INITIAL
DRIVING AND RESTRIKE (42 DAYS)

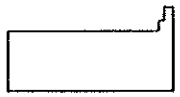
STATIC LOADING TEST

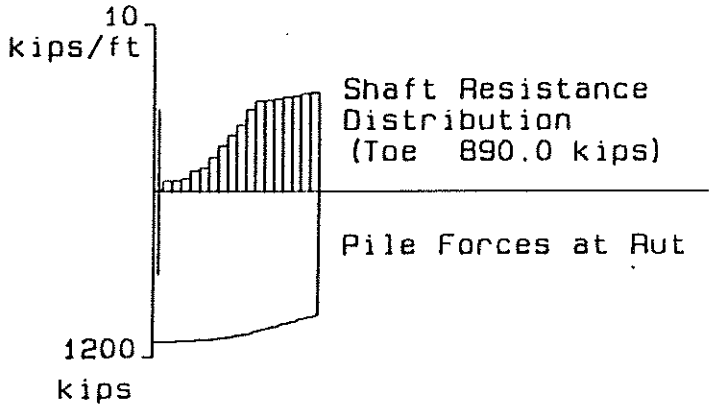

SOIL
FT
0
10
20
30
40
50
60
70
CLAYEY SAND
FAT CLAY
FINE TO
COARSE SAND
CALCAREOUS
CLAY WITH
SAND
N
9
22
42
19
12
16
19
20
19
10
51
53
41
41
50/4
50/4
42
50/3
50/8
PILE BLOW COUNT
0
50
100
150


2000
kips
1000
0
-1000
For Msd
For Cpt
10
20
30
ms
0 1 2 3 4 5 6 7
L/c


2000
kips
1000
0
-1000
For Msd
Vel Msd
10
20
30
ms
0 1 2 3 4 5 6 7
L/c


8.0
ft/s
4.0
.0
-4.0
Vel Msd
Vel Cpt
10
20
30
ms
0 1 2 3 4 5 6 7
L/c


Pile


10
kips/ft
Shaft Resistance
Distribution
(Toe 890.0 kips)
Pile Forces at Aut
1200
kips

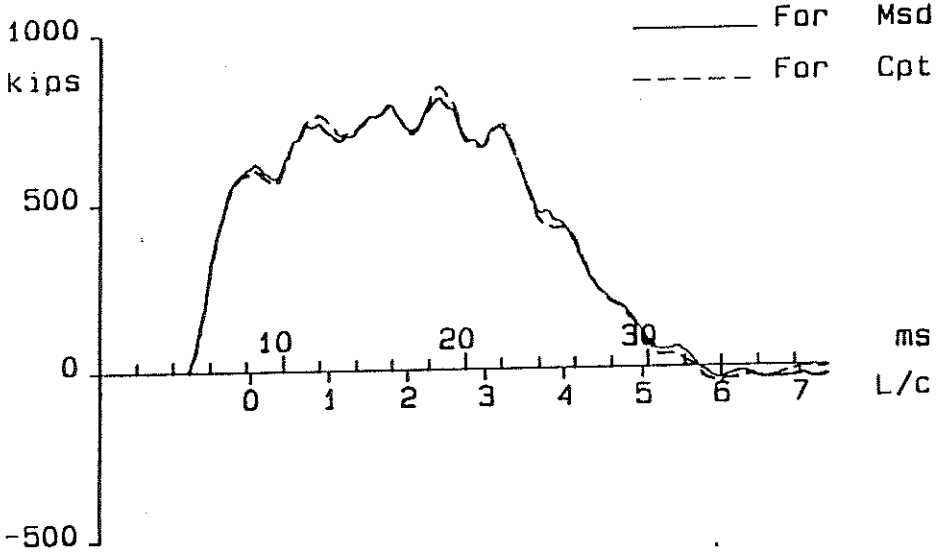
CAPWAP FINAL RESULTS

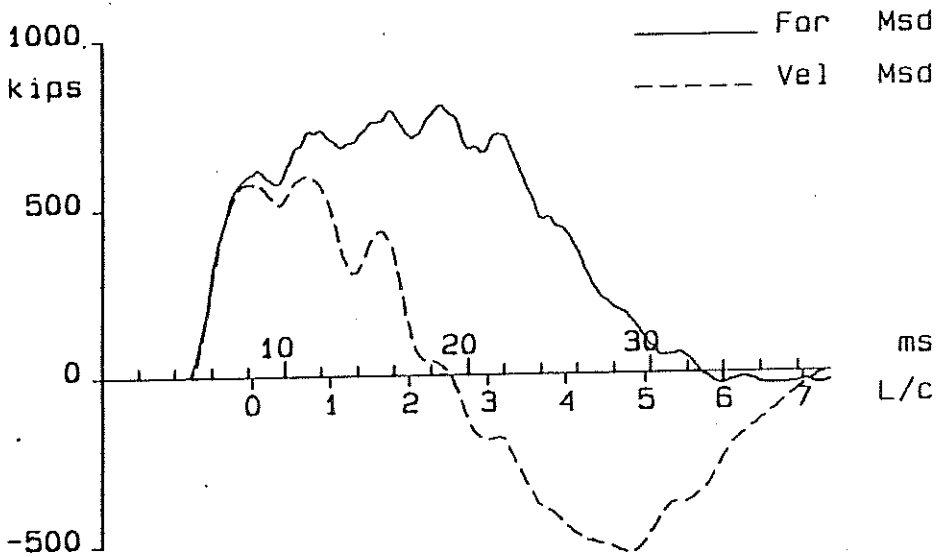
Total CAPWAP Capacity: 1090.0; along Shaft 200.0; at Toe 890.0 kips

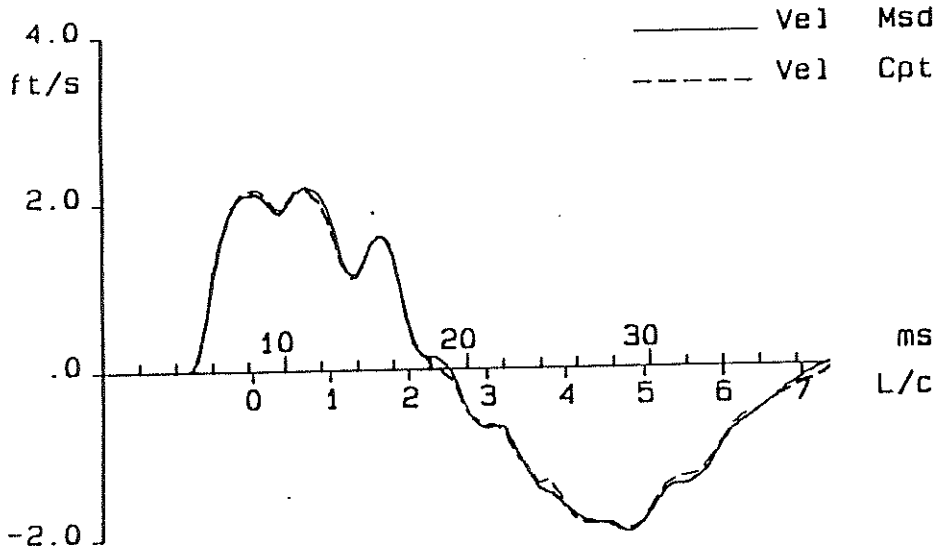
Soil Sgmnt No.	Depth Below Gages ft	Depth Below Grade ft	Ru kips	Force in Pile at Ru kips	Sum of Ru kips	Unit w. Resist. Depth kips/ft	Respect to Area kips/f2	Smith Damping Factor s/ft	Quake inch
				1090.0					
1	3.3	1.3	.0	1090.0	.0	.00	.00	.280	.100
2	6.6	4.6	1.9	1088.1	1.9	.59	.06	.280	.100
3	9.8	7.8	1.9	1086.2	3.8	.59	.06	.280	.100
4	13.1	11.1	2.3	1083.8	6.2	.71	.07	.280	.100
5	16.4	14.4	4.0	1079.8	10.2	1.22	.12	.280	.100
6	19.7	17.7	4.6	1075.2	14.8	1.41	.14	.280	.100
7	22.9	20.9	6.7	1068.5	21.5	2.05	.21	.280	.100
8	26.2	24.2	8.8	1059.7	30.3	2.70	.27	.280	.100
9	29.5	27.5	10.9	1048.7	41.3	3.34	.33	.280	.100
10	32.8	30.8	13.1	1035.7	54.3	3.99	.40	.280	.100
11	36.1	34.1	16.2	1019.5	70.5	4.93	.49	.280	.100
12	39.3	37.3	17.7	1001.8	88.2	5.39	.54	.280	.100
13	42.6	40.6	17.9	983.9	106.1	5.47	.55	.280	.100
14	45.9	43.9	18.2	965.7	124.3	5.56	.56	.280	.100
15	49.2	47.2	18.5	947.2	142.8	5.64	.56	.280	.100
16	52.4	50.4	18.8	928.4	161.6	5.73	.57	.280	.100
17	55.7	53.7	19.1	909.3	180.7	5.81	.58	.280	.100
18	59.0	57.0	19.3	890.0	200.0	5.90	.59	.280	.100
Average Skin Values			11.1			3.51	.34	.280	.100
	Toe		890.0				142.40	.060	.420

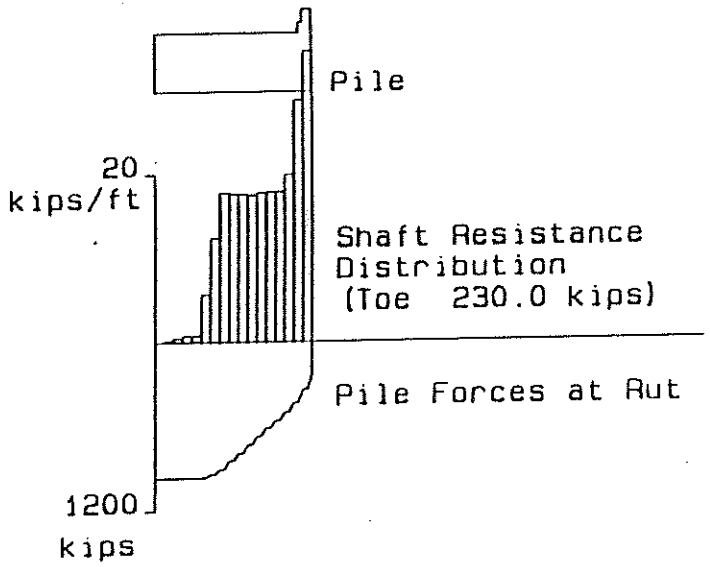
Soil Model Parameters/Extensions		Skin	Toe
Case Damping Factor		.206	.196
Unloading Quake	(% of loading quake)	7	94
Reloading Level	(% of Ru)	100	0
Unloading Level	(% of Ru)	55	
Resistance Gap (included in Toe Quake)	(inch)		.110
Soil Plug Weight	(kips)		.20

Goble Rausche Likins & Associates, Inc.









CAPWAP FINAL RESULTS

Total CAPWAP Capacity: 975.0; along Shaft 745.0; at Toe 230.0 kips

Soil Sgmnt No.	Depth Below Gages ft	Depth Below Grade ft	Ru kips	Force in Pile at Ru kips	Sum of Ru kips	Unit w. Depth kips/ft	Resist. Respect to Area kips/f2	Smith Damping Factor s/ft	Quake inch
				975.0					
1	6.6	6.1	.0	975.0	.0	.00	.00	.252	.100
2	9.9	9.4	1.3	973.7	1.3	.40	.04	.252	.100
3	13.2	12.7	2.1	971.6	3.4	.64	.06	.252	.100
4	16.4	15.9	2.1	969.5	5.5	.64	.06	.252	.100
5	19.7	19.2	18.1	951.4	23.6	5.51	.55	.252	.100
6	23.0	22.5	40.7	910.7	64.3	12.37	1.24	.252	.100
7	26.3	25.8	58.0	852.7	122.3	17.64	1.76	.252	.100
8	29.6	29.1	57.5	795.2	179.8	17.50	1.75	.252	.100
9	32.9	32.4	57.5	737.6	237.4	17.50	1.75	.252	.100
10	36.2	35.7	57.5	680.1	294.9	17.49	1.75	.252	.100
11	39.5	39.0	58.2	621.9	353.1	17.69	1.77	.252	.100
12	42.7	42.2	58.5	563.4	411.6	17.80	1.78	.252	.100
13	46.0	45.5	58.5	504.8	470.2	17.80	1.78	.252	.100
14	49.3	48.8	65.2	439.6	535.4	19.84	1.98	.252	.100
15	52.6	52.1	94.9	344.7	630.3	28.86	2.89	.252	.100
16	55.9	55.4	114.7	230.0	745.0	34.89	3.49	.252	.100
Average Skin Values			46.6			13.45	1.42	.252	.100
	Toe		230.0				36.80	.109	.070

Soil Model Parameters/Extensions	Skin	Toe
Case Damping Factor	.688	.092
Reloading Level (% of Ru)	-100	100
Unloading Level (% of Ru)	5	
Resistance Gap (included in Toe Quake) (inch)		.010

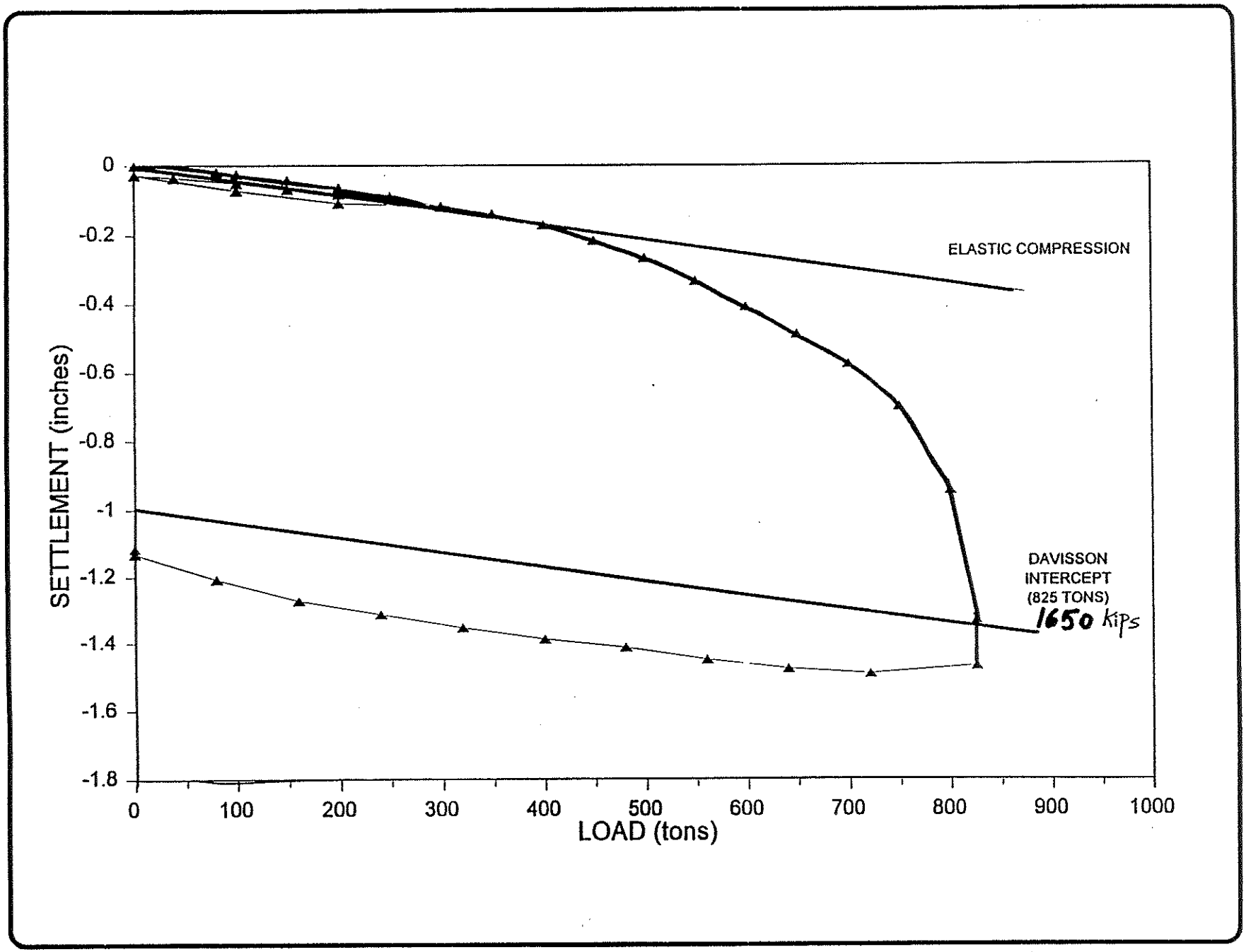
CAPWAP ANALYSES

END BEARING (EOID) = 890 KIPS

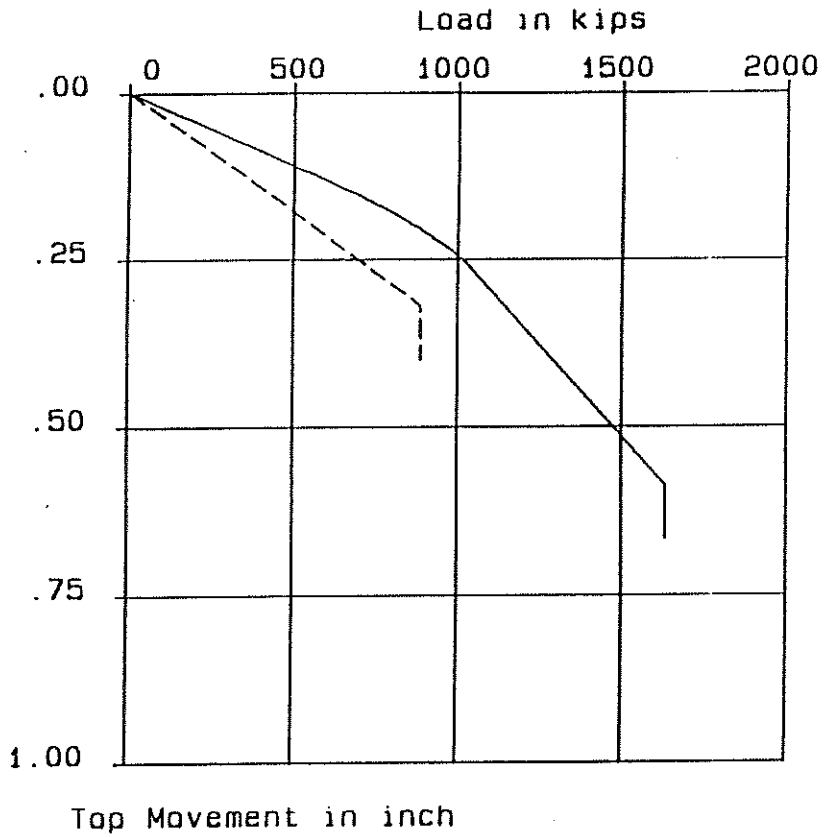
SKIN FRICTION (BOR) = 745 KIPS

TOTAL CAPACITY = 1635 KIPS

STATIC LOADING TEST 1650 KIPS


SETTLEMENT (inches)
0
-0.2
-0.4
-0.6
-0.8
-1
-1.2
-1.4
-1.6
-1.8
0
100
200
300
400
500
600
700
800
900
1000
LOAD (tons)
ELASTIC COMPRESSION
DAVISSON
INTERCEPT
(825 TONS)
1650 kips

Monotonic D-Toe, E-P R-Toe



_____ Pile Top

_ _ _ _ _ Bottom

Au = ~~1012.8~~ 1635 kips

Rs = ~~745.0~~ 745 kips

Rb = ~~267.8~~ 890 kips

Dy = .59 inch

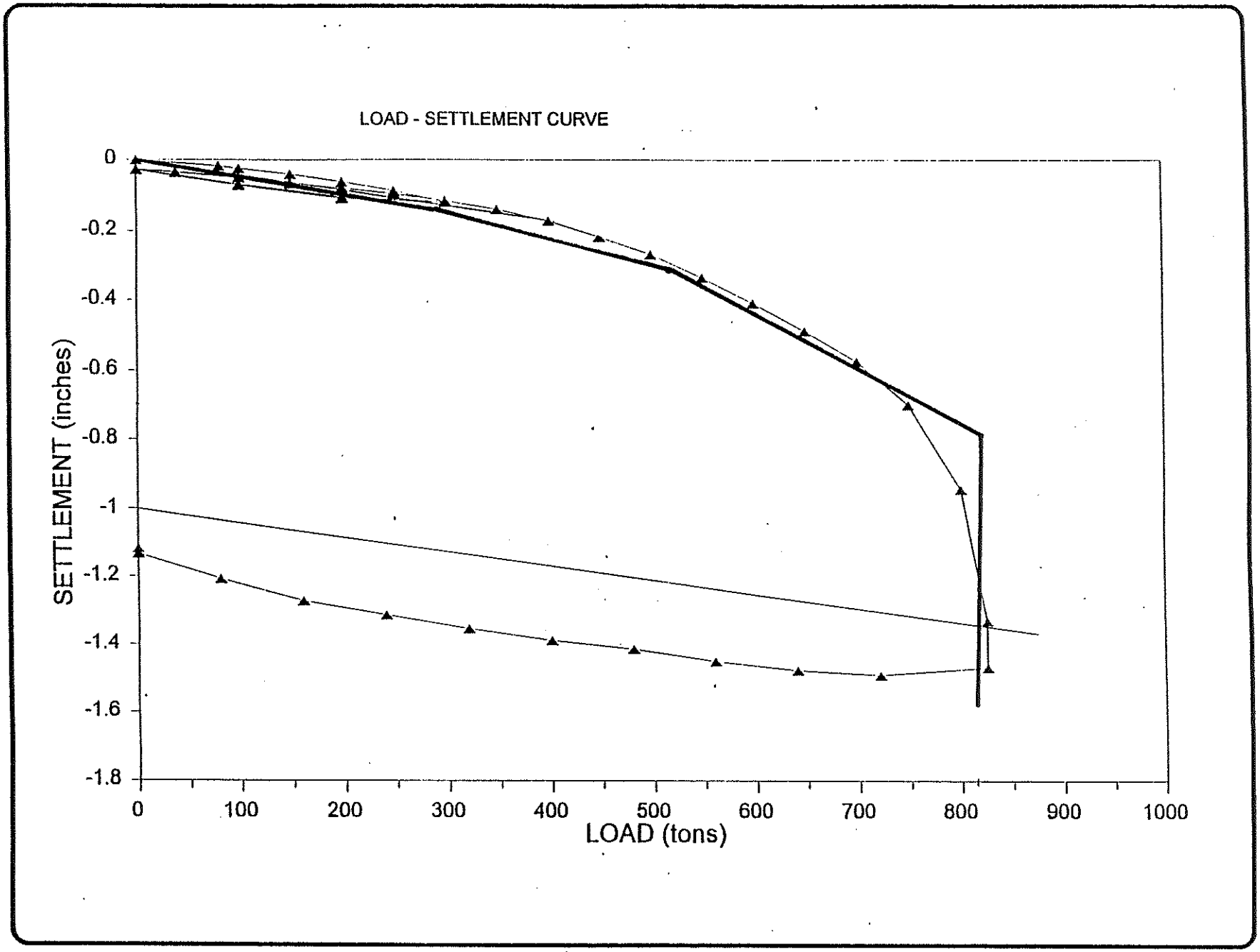
Dmx = .67 inch

Monotonic D-Toe, E-P R-Toe

Ideal Test Load 1635.00

Max. Toe Res. 890.00

Step No.	Top Load kips	Top Disp. in	Toe Load kips	Toe Disp. in
2	50.1	.011	9.0	.004
4	100.2	.023	18.0	.009
6	150.4	.034	27.0	.013
8	200.5	.046	36.0	.017
10	250.6	.057	45.0	.022
12	300.7	.069	54.0	.026
14	350.9	.080	63.1	.030
16	401.0	.091	72.1	.035
18	451.1	.103	81.1	.039
20	501.2	.114	90.1	.044
22	551.3	.126	99.1	.048
24	601.0	.137	108.1	.052
26	649.7	.148	117.1	.057
28	695.6	.159	126.1	.061
30	737.4	.170	135.1	.065
33	792.8	.186	148.6	.072
36	840.8	.200	162.1	.078
39	882.2	.214	175.7	.085
43	927.5	.231	193.7	.094
50	970.2	.254	225.2	.109
57	1001.7	.275	256.7	.124
64	1033.3	.296	288.3	.139
71	1064.8	.317	319.8	.155
78	1096.3	.338	351.3	.170
85	1127.8	.359	382.8	.185
92	1159.4	.380	414.4	.200
99	1190.9	.401	445.9	.215
106	1222.4	.422	477.4	.231
113	1254.0	.444	509.0	.246
120	1285.5	.465	540.5	.261
127	1317.0	.486	572.0	.276
134	1348.5	.507	603.5	.292
141	1380.1	.528	635.1	.307
148	1411.6	.549	666.6	.322
155	1443.1	.570	698.1	.337
162	1474.7	.591	729.7	.353
169	1506.2	.612	761.2	.368
176	1537.7	.633	792.7	.383
183	1569.2	.654	824.2	.398
190	1600.8	.675	855.8	.413
197	1632.3	.696	887.3	.429
198	1635.0	.699	890.0	.431
208	1635.0	.721	890.0	.453
218	1635.0	.743	890.0	.474
228	1635.0	.764	890.0	.496
238	1635.0	.786	890.0	.518


LOAD - SETTLEMENT CURVE
SETTLEMENT (inches)
0
-0.2
-0.4
-0.6
-0.8
-1
-1.2
-1.4
-1.6
-1.8
0
100
200
300
400
500
600
700
800
900
1000
LOAD (tons)

1996
PDA USERS DAY

ORLANDO, FLORIDA
(Sept. 10, 1996)