GRL Engineers, Inc.

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TRANSMITTAL

To: Mr. Kevin Weber	From: Travis Coleman
Company: Lunda Construction Co.	No. of Sheets: 60
E-mail: kweber@lundaconstruction.com	Date: January 23, 2015

RE: Dynamic Testing Results – USH 10 over Little Lake Butte des Morts
Structure B-70-403 - Pier 10
Winnebago County, Wisconsin

On January 21, 2014, Pier 10 #1, Pier 10 #36, and Pier 10 #44 at the above structure were dynamically tested during initial driving. The piles were tested during restrike on January 22. Project plans indicated the exterior row piles have a required driving resistance, or ultimate capacity, of 480 kips (240 tons) and the interior row piles have a required driving resistance of 400 kips (200 tons). The reference elevation for the piles was the top of the ring at EL 740.8. We understand the pier was excavated to elevation of EL 717.6. The piles have a required minimum tip elevation of EL 658.5. The HP 14x73 H-piles were equipped with driving shoes and were driven with an APE D30-42 hammer (number PD 0256) reportedly operated on fuel setting 4.

Pier 10 #1 was driven to a depth of 92.8 feet, which corresponds to a pile tip elevation of EL 648.0. The blow count over the final increment of driving was 10 blows for 2 inches of penetration at an average hammer stroke of 7.8 feet. The blow count at the beginning of restrike was 5 blows for ⅝ inch of penetration at an average hammer stroke of 7.4 feet. The dynamic test results indicated the pile did not meet the required driving resistance and driving resumed until the pile met the required driving resistance. The pile was driven to a final penetration depth of 93.5 feet, with a final blow count of 10 blows over ¾ inches at an average hammer stroke of 7.0 feet.

Pier 10 #36 was driven to a depth of 87.6 feet, which corresponds to a pile tip elevation of EL 653.2. The blow count over the final increment of driving was 10 blows for 1¾ inches of penetration at an average hammer stroke of 7.5 feet. The blow count at the beginning of restrike was 5 blows for ⅝ inch of penetration at an average hammer stroke of 7.3 feet.

Pier 10 #44 was driven to a depth of 86.7 feet, which corresponds to a pile tip elevation of EL 654.1. The blow count over the final increment of driving was 10 blows for 1½ inches of penetration at an average hammer stroke of 7.3 feet. The blow count at the beginning of restrike was 5 blows for ½ inch of penetration at an average hammer stroke of 7.3 feet

We recommend the production piles at Pier 10 of Structure B-70-403 driven with the APE D30-42 hammer PD0256 obtain the minimum recommended blow count, noted below, based on the field

observed hammer stroke. We recommend maintaining the minimum blow count for **three consecutive inches** of driving at the recommended average hammer stroke. Additionally, all production piles should achieve the minimum pile tip elevation of EL 658.5 for uplift, as indicated on the plans.

Field Observed Hammer Stroke (feet)	Exterior Piles (480 kips) Recommended Minimum Blow Count (blows per inch)	Interior Piles (400 kips) Recommended Minimum Blow Count (blows per inch)
6.5	12	7
7.0	9	6
7.5	7	5
8.0	6	4
8.5	6	4

We recommend immediately terminating driving **if the blow counts exceed 10** blows over an increment of one inch or less at hammer strokes of 8.0 feet, after satisfying any minimum tip requirements. We anticipate the production piles will terminate at depths similar to those of the test piles.

These criteria should not be used for acceptance of piles under restrike and/or redrive conditions. After splicing or any other delays, we recommend not applying the criteria until a full foot of driving has occurred beyond the termination depth associated with the delay, unless the blow count exceeds 10 blows per inch.

Please call if you have any questions on these recommendations.

GRL Engineers, Inc.

Travis Coleman, P.E.

Al Ziai

cc: Jeff Horsfall – jeffrey.horsfall@dot.wi.gov

Attachments:

Dynamic Test Results - (pages 3 – 30)
CAPWAP Analysis Results - (pages 31 – 60)

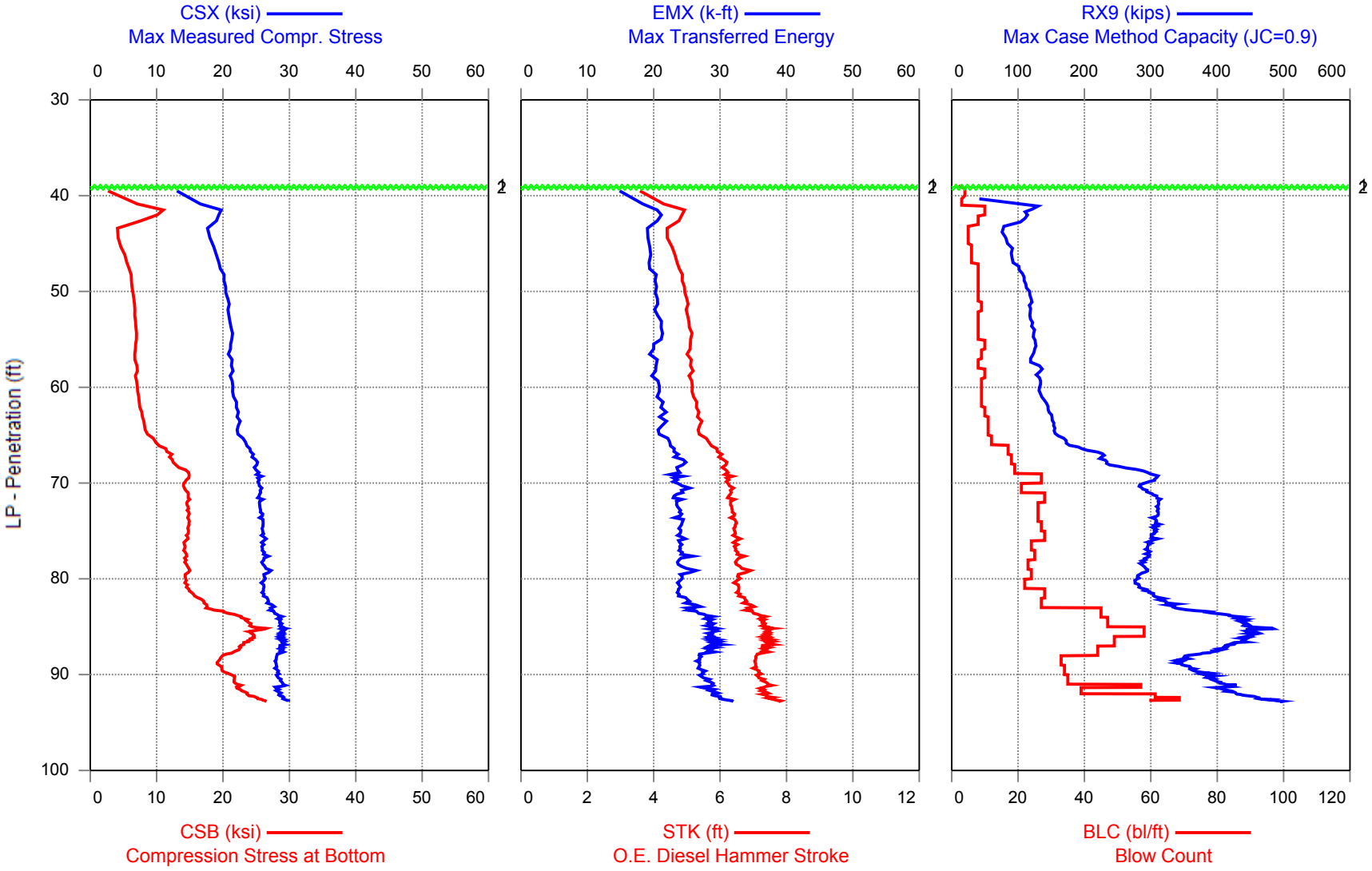
GRL Engineers, Inc. - PDIPLOT2 Ver 2014.2.48.1 - Case Method & iCAP® Results

Printed: 22-January-2015

Test started: 21-January-2015

B-70-403 - USH 10 over Little Lake Butte des Morts - Pier 10 #1 - EOID

APE D30-42, HP 14 x 73



1 - Depth reference at EL 740.8

2 - Mud line at EL 717.56

B-70-403 - USH 10 over Little Lake Butte des Morts - Pier 10 #1 - EOID APE D30-42, HP 14 x 73
OP: MR Date: 21-January-2015

CSX: Max Measured Compr. Stress
CSB: Compression Stress at Bottom
EMX: Max Transferred Energy
STK: O.E. Diesel Hammer Stroke
BPM: Blows per Minute
RX9: Max Case Method Capacity (JC=0.9)

BL#	depth ft	BLC bl/ft	TYPE	CSX ksi	CSB ksi	EMX k-ft	STK ft	BPM bpm	RX9 kips
4	39.00	2	AV1	13.3	2.3	16	3.6	60.9	0
			MAX	13.3	2.3	16	3.6	60.9	0
			MIN	13.3	2.3	16	3.6	60.9	0
5	39.25	4	AV1	13.3	2.9	14	3.7	60.5	0
			MAX	13.3	2.9	14	3.7	60.5	0
			MIN	13.3	2.9	14	3.7	60.5	0
8	40.00	4	AV3	12.9	2.7	15	3.6	61.3	6
			MAX	13.3	2.8	16	3.6	61.7	17
			MIN	12.4	2.5	13	3.5	61.0	0
11	41.00	3	AV3	14.1	5.9	16	3.8	59.8	77
			MAX	17.2	8.3	17	4.3	63.1	124
			MIN	11.2	2.6	13	3.3	56.1	10
21	42.00	10	AV10	19.9	10.4	21	5.0	52.4	120
			MAX	20.8	12.5	24	5.2	53.6	139
			MIN	18.7	8.7	19	4.7	51.4	107
29	43.00	8	AV8	18.8	7.8	20	4.7	53.7	105
			MAX	19.7	10.0	21	4.9	54.6	112
			MIN	18.0	5.0	18	4.6	52.9	90
34	44.00	5	AV5	17.6	4.0	19	4.4	55.7	75
			MAX	17.8	4.2	20	4.5	56.5	79
			MIN	17.1	3.6	18	4.2	55.2	71
39	45.00	5	AV5	18.2	4.3	19	4.5	55.2	82
			MAX	18.7	4.7	20	4.6	55.8	88
			MIN	17.9	4.0	18	4.3	54.5	76
45	46.00	6	AV6	18.7	4.7	19	4.6	54.6	89
			MAX	18.9	5.1	20	4.6	55.1	92
			MIN	18.1	4.4	18	4.5	54.2	85
51	47.00	6	AV6	19.1	5.3	19	4.7	54.0	91
			MAX	19.5	5.6	20	4.7	54.6	95
			MIN	18.7	5.2	19	4.6	53.6	87
59	48.00	8	AV8	19.7	5.8	19	4.8	53.4	101
			MAX	20.1	6.2	20	4.9	54.0	106
			MIN	19.3	5.5	19	4.7	53.0	98
67	49.00	8	AV8	20.2	6.2	20	4.9	53.0	109
			MAX	20.4	6.3	21	4.9	53.1	112
			MIN	20.0	6.1	20	4.8	52.7	105
75	50.00	8	AV8	20.3	6.3	20	4.9	52.7	114
			MAX	20.6	6.5	21	5.0	53.0	119

B-70-403 - USH 10 over Little Lake Butte des Morts - Pier 10 #1 - EOID APE D30-42, HP 14 x 73
OP: MR Date: 21-January-2015

BL#	depth ft	BLC bl/ft	TYPE	CSX ksi	CSB ksi	EMX k-ft	STK ft	BPM bpm	RX9 kips
			MIN	20.0	6.1	19	4.9	52.5	108
83	51.00	8	AV8	20.7	6.5	21	5.0	52.3	118
			MAX	21.1	6.7	21	5.1	53.0	124
			MIN	20.1	6.4	20	4.9	51.7	115
92	52.00	9	AV9	20.8	6.7	20	5.0	52.3	119
			MAX	21.7	6.9	22	5.2	53.0	129
			MIN	20.1	6.6	19	4.9	51.1	112
100	53.00	8	AV8	20.8	6.7	21	5.0	52.2	118
			MAX	21.2	7.0	22	5.1	52.9	120
			MIN	20.0	6.6	20	4.9	51.7	115
108	54.00	8	AV8	21.2	6.9	21	5.1	51.9	122
			MAX	21.8	7.0	22	5.2	52.7	127
			MIN	20.5	6.7	20	4.9	51.4	119
116	55.00	8	AV8	21.4	7.0	21	5.1	51.6	123
			MAX	21.8	7.1	22	5.2	51.9	128
			MIN	21.1	6.9	21	5.1	51.1	118
126	56.00	10	AV10	21.1	6.9	20	5.1	51.8	127
			MAX	21.5	7.0	22	5.2	52.3	128
			MIN	20.7	6.7	19	5.0	51.3	125
135	57.00	9	AV9	21.1	6.7	20	5.1	51.9	123
			MAX	21.7	6.8	21	5.2	52.8	126
			MIN	20.5	6.6	19	4.9	51.2	117
143	58.00	8	AV8	21.2	6.9	20	5.1	51.8	126
			MAX	21.6	7.2	22	5.2	52.5	140
			MIN	20.5	6.6	19	5.0	51.3	114
153	59.00	10	AV10	21.3	7.0	20	5.1	51.7	131
			MAX	21.9	7.4	21	5.3	52.4	136
			MIN	20.6	6.6	19	5.0	50.8	125
162	60.00	9	AV9	21.4	7.0	21	5.1	51.6	134
			MAX	21.6	7.2	21	5.3	51.9	139
			MIN	21.0	6.8	20	5.1	51.0	129
171	61.00	9	AV9	21.5	7.2	21	5.2	51.5	133
			MAX	22.2	7.3	22	5.4	52.4	137
			MIN	20.7	7.0	20	5.0	50.6	126
180	62.00	9	AV9	22.0	7.4	21	5.3	50.9	141
			MAX	22.6	7.6	23	5.5	51.3	148
			MIN	21.6	7.3	20	5.2	50.1	135
190	63.00	10	AV10	22.2	7.7	22	5.3	50.7	147
			MAX	22.9	8.0	23	5.5	51.4	156
			MIN	21.5	7.4	20	5.2	49.8	144

B-70-403 - USH 10 over Little Lake Butte des Morts - Pier 10 #1 - EOID APE D30-42, HP 14 x 73
OP: MR Date: 21-January-2015

BL#	depth ft	BLC bl/ft	TYPE	CSX ksi	CSB ksi	EMX k-ft	STK ft	BPM bpm	RX9 kips
201	64.00	11	AV11	22.3	8.0	21	5.4	50.5	153
			MAX	23.1	8.3	23	5.6	51.3	156
			MIN	21.6	7.6	20	5.2	49.5	147
212	65.00	11	AV11	22.2	8.4	21	5.4	50.5	155
			MAX	22.9	8.9	23	5.6	51.1	161
			MIN	21.7	8.0	20	5.2	49.7	153
224	66.00	12	AV12	23.1	9.6	22	5.6	49.6	170
			MAX	24.0	10.0	24	5.8	50.8	175
			MIN	22.1	8.8	20	5.3	48.7	161
241	67.00	17	AV17	24.1	11.4	23	5.9	48.3	204
			MAX	25.2	12.3	25	6.3	49.4	230
			MIN	23.1	10.0	22	5.6	47.0	179
259	68.00	18	AV18	24.8	12.3	24	6.1	47.7	230
			MAX	25.3	12.7	25	6.3	48.6	236
			MIN	23.9	11.6	22	5.8	47.0	221
278	69.00	19	AV19	25.1	13.9	24	6.2	47.3	270
			MAX	25.9	15.4	27	6.4	48.2	297
			MIN	24.3	12.4	23	5.9	46.5	235
305	70.00	27	AV27	25.4	14.7	23	6.2	47.1	304
			MAX	26.2	15.2	25	6.5	48.2	313
			MIN	24.4	13.9	21	5.9	46.2	293
326	71.00	21	AV21	25.7	14.3	25	6.3	46.7	288
			MAX	26.6	15.0	27	6.6	47.4	299
			MIN	24.9	13.6	23	6.1	45.7	282
354	72.00	28	AV28	25.5	14.8	23	6.3	46.9	308
			MAX	26.7	15.1	26	6.6	47.6	317
			MIN	24.9	14.3	22	6.1	45.7	296
380	73.00	26	AV26	25.5	14.7	24	6.3	46.7	310
			MAX	26.6	15.2	26	6.7	47.5	319
			MIN	24.7	14.1	22	6.1	45.6	304
406	74.00	26	AV26	25.9	14.8	24	6.4	46.4	309
			MAX	26.4	15.3	25	6.6	47.2	316
			MIN	25.1	14.5	22	6.2	45.9	299
433	75.00	27	AV27	26.0	14.8	24	6.5	46.3	307
			MAX	26.6	15.2	25	6.6	46.9	315
			MIN	25.3	14.5	23	6.3	45.7	300
461	76.00	28	AV28	26.1	14.7	24	6.5	46.2	304
			MAX	27.3	15.2	26	6.8	46.8	313
			MIN	25.5	14.3	23	6.3	45.0	297

B-70-403 - USH 10 over Little Lake Butte des Morts - Pier 10 #1 - EOID APE D30-42, HP 14 x 73
OP: MR Date: 21-January-2015

BL#	depth ft	BLC bl/ft	TYPE	CSX ksi	CSB ksi	EMX k-ft	STK ft	BPM bpm	RX9 kips
485	77.00	24	AV24	25.9	14.2	24	6.4	46.3	296
			MAX	26.5	14.5	25	6.7	47.1	303
			MIN	25.3	13.9	23	6.2	45.6	290
510	78.00	25	AV25	26.3	14.4	24	6.6	45.9	295
			MAX	27.2	14.9	27	6.9	47.0	303
			MIN	25.3	13.8	23	6.3	44.8	286
533	79.00	23	AV23	26.2	14.5	24	6.5	46.0	289
			MAX	27.0	15.1	26	6.9	47.2	295
			MIN	24.6	13.8	22	6.2	44.9	278
557	80.00	24	AV24	26.6	14.6	25	6.7	45.6	286
			MAX	28.0	15.3	28	7.3	46.5	297
			MIN	25.7	13.7	23	6.4	43.7	274
579	81.00	22	AV22	26.0	14.5	24	6.5	46.1	280
			MAX	26.7	15.0	25	6.8	46.8	288
			MIN	25.3	14.0	23	6.3	45.2	273
607	82.00	28	AV28	26.1	15.4	24	6.6	45.9	301
			MAX	26.9	16.3	26	6.9	46.6	320
			MIN	25.4	14.6	22	6.4	44.9	289
634	83.00	27	AV27	27.1	17.2	26	6.8	45.0	326
			MAX	28.6	18.2	29	7.3	46.2	343
			MIN	25.9	16.4	24	6.5	43.6	310
679	84.00	45	AV45	27.8	20.3	27	7.0	44.5	387
			MAX	29.7	23.4	30	7.6	45.9	440
			MIN	26.4	16.9	23	6.6	42.7	332
726	85.00	47	AV47	28.6	23.7	28	7.3	43.7	439
			MAX	29.5	24.7	30	7.6	44.6	454
			MIN	27.6	22.6	27	7.0	42.9	426
784	86.00	58	AV58	28.9	24.9	29	7.4	43.2	457
			MAX	29.8	27.2	31	7.7	43.8	494
			MIN	28.2	23.7	27	7.2	42.5	434
833	87.00	49	AV49	28.9	23.7	29	7.4	43.3	433
			MAX	30.7	25.0	32	8.0	44.1	452
			MIN	27.9	22.4	27	7.1	41.7	410
877	88.00	44	AV44	28.6	21.7	28	7.3	43.7	394
			MAX	29.8	23.0	31	7.6	44.8	420
			MIN	27.6	19.6	26	6.9	42.7	357
910	89.00	33	AV33	28.0	19.4	27	7.1	44.3	347
			MAX	29.0	20.0	28	7.4	45.2	358
			MIN	27.0	18.6	25	6.8	43.4	336
944	90.00	34	AV34	28.2	20.1	27	7.1	44.2	367

B-70-403 - USH 10 over Little Lake Butte des Morts - Pier 10 #1 - EOID APE D30-42, HP 14 x 73
OP: MR Date: 21-January-2015

BL#	depth ft	BLC bl/ft	TYPE	CSX ksi	CSB ksi	EMX k-ft	STK ft	BPM bpm	RX9 kips
			MAX	30.0	21.7	30	7.7	45.1	393
			MIN	27.3	19.3	25	6.8	42.5	351
979	91.00	35	AV35	28.6	21.7	28	7.3	43.7	396
			MAX	30.0	22.3	30	7.8	45.0	417
			MIN	27.3	21.0	26	6.8	42.3	382
998	91.33	57	AV19	28.8	22.4	28	7.4	43.3	417
			MAX	30.2	23.2	31	7.9	44.4	432
			MIN	25.0	20.1	23	7.0	42.1	378
1024	92.00	39	AV26	28.3	22.9	29	7.3	43.6	416
			MAX	29.3	24.0	31	7.6	45.3	434
			MIN	26.6	21.6	26	6.8	42.7	392
1047	92.38	61	AV23	28.7	24.1	29	7.4	43.4	445
			MAX	29.7	25.2	31	7.7	44.4	465
			MIN	27.8	23.0	27	7.0	42.5	424
1057	92.52	69	AV10	29.0	25.2	30	7.5	43.1	463
			MAX	29.7	25.7	31	7.7	43.8	470
			MIN	28.4	24.8	29	7.2	42.6	456
1067	92.67	69	AV10	29.4	25.8	31	7.6	42.7	476
			MAX	30.1	26.5	32	7.9	44.0	486
			MIN	28.0	24.8	28	7.2	41.9	459
1077	92.83	60	AV10	29.9	26.4	32	7.8	42.3	493
			MAX	30.6	26.8	33	8.0	42.7	504
			MIN	29.3	26.0	31	7.6	41.8	483
			Average	25.9	16.3	25	6.5	46.5	308
			Maximum	30.7	27.2	33	8.0	63.1	504
			Minimum	11.2	2.3	13	3.3	41.7	0

Total number of blows analyzed: 1074

BL# Sensors

1-1077 F3: [F607] 93.6 (0.94); F4: [D815] 93.0 (0.94); A3: [K2524] 360.0 (1.04); A4: [K3550] 360.0 (1.04)

BL# Comments

4 Depth reference at EL 740.8
5 Mud line at EL 717.56

Time Summary

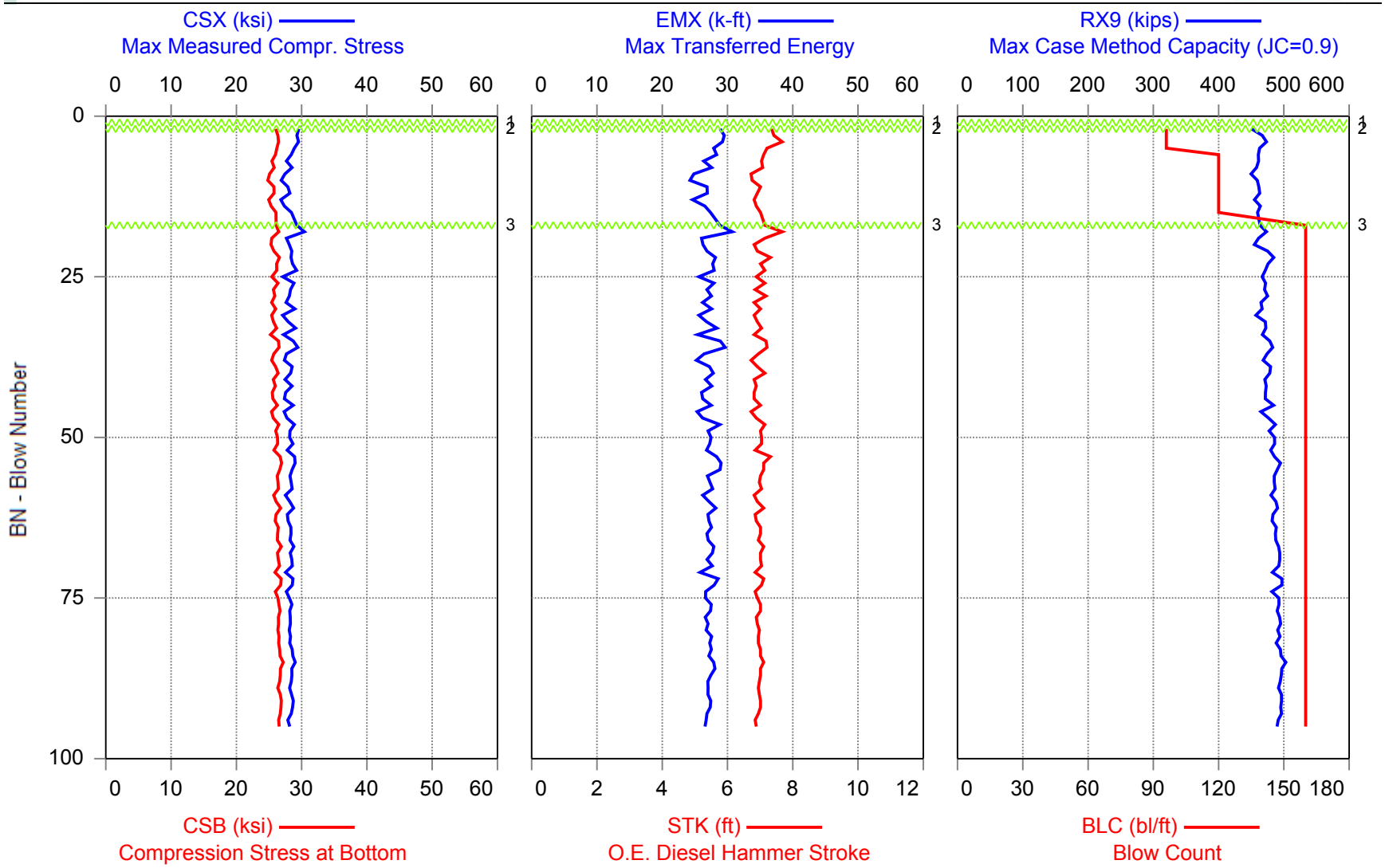
Drive 31 minutes 36 seconds 9:03 AM - 9:35 AM BN 1 - 1077

GRL Engineers, Inc. - PDIPLOT2 Ver 2014.2.48.1 - Case Method & iCAP® Results

Printed: 22-January-2015

Test started: 22-January-2015

USH 10 - B-70-403 - Pier 10 #1 Redrive



1 - Depth reference EL 740.8

2 - Mud line EL 717.6

3 - Start of Redrive

USH 10 - B-70-403 - Pier 10 #1 Redrive APE D30-42, HP 14 x 73
OP: RF Date: 22-January-2015

CSX: Max Measured Compr. Stress
CSB: Compression Stress at Bottom
EMX: Max Transferred Energy
STK: O.E. Diesel Hammer Stroke
BPM: Blows per Minute
RX9: Max Case Method Capacity (JC=0.9)

BL#	depth	BLC	TYPE	CSX	CSB	EMX	STK	BPM	RX9
	ft	bl/ft		ksi	ksi	k-ft	ft	bpm	kips
5	92.92	96	AV4	29.3	26.3	29	7.4	43.3	463
			MAX	29.6	26.5	30	7.7	43.9	473
			MIN	28.9	26.0	28	7.2	42.6	451
10	92.96	120	AV5	27.8	25.4	26	6.9	44.7	458
			MAX	28.5	26.0	28	7.1	45.4	461
			MIN	26.9	24.8	24	6.7	44.2	450
15	93.00	120	AV5	27.7	25.6	26	6.9	44.8	461
			MAX	28.4	26.1	27	7.0	45.1	464
			MIN	26.8	25.0	25	6.8	44.5	455
25	93.03	160	AV9	28.6	25.9	28	7.1	44.2	470
			MAX	30.4	26.6	31	7.7	45.1	484
			MIN	27.1	25.3	26	6.8	42.6	455
35	93.09	160	AV10	28.2	25.8	27	7.0	44.6	470
			MAX	29.1	26.5	29	7.2	45.1	478
			MIN	27.1	25.2	25	6.8	44.0	457
45	93.15	160	AV10	28.1	25.9	27	6.9	44.8	475
			MAX	29.4	26.5	30	7.2	45.4	484
			MIN	27.4	25.4	25	6.7	43.9	468
55	93.22	160	AV10	28.3	26.2	28	7.0	44.5	483
			MAX	29.0	26.9	29	7.3	45.4	495
			MIN	27.3	25.4	25	6.7	43.6	465
65	93.28	160	AV10	28.2	26.2	27	7.0	44.7	486
			MAX	28.8	26.8	28	7.1	45.1	490
			MIN	27.5	25.7	26	6.8	44.2	480
75	93.34	160	AV10	28.3	26.4	27	7.0	44.6	491
			MAX	28.8	26.9	29	7.1	45.0	497
			MIN	27.5	25.9	26	6.8	44.2	482
85	93.40	160	AV10	28.4	26.6	27	7.0	44.6	494
			MAX	29.0	27.2	28	7.1	44.9	503
			MIN	28.1	26.4	27	6.9	44.2	488
95	93.47	160	AV10	28.4	26.7	27	7.0	44.7	494
			MAX	28.7	26.9	28	7.0	45.0	497
			MIN	27.9	26.3	27	6.8	44.5	490
			Average	28.3	26.2	27	7.0	44.5	480
			Maximum	30.4	27.2	31	7.7	45.4	503
			Minimum	26.8	24.8	24	6.7	42.6	450

Total number of blows analyzed: 93

BL#	Sensors
1-95	F3: [F607] 93.6 (0.96); F4: [D815] 93.0 (0.96); A3: [K2524] 360.0 (1.04); A4: [K3550] 360.0 (1.04)

BL#	Comments
1	Depth reference EL 740.8
2	Mud line EL 717.6
17	Start of Redrive

Time Summary

Drive	18 seconds	8:01 AM - 8:01 AM (1/22/2015) BN 1 - 15
Stop	13 minutes 7 seconds	8:01 AM - 8:14 AM
Drive	1 minute 46 seconds	8:14 AM - 8:16 AM BN 16 - 95

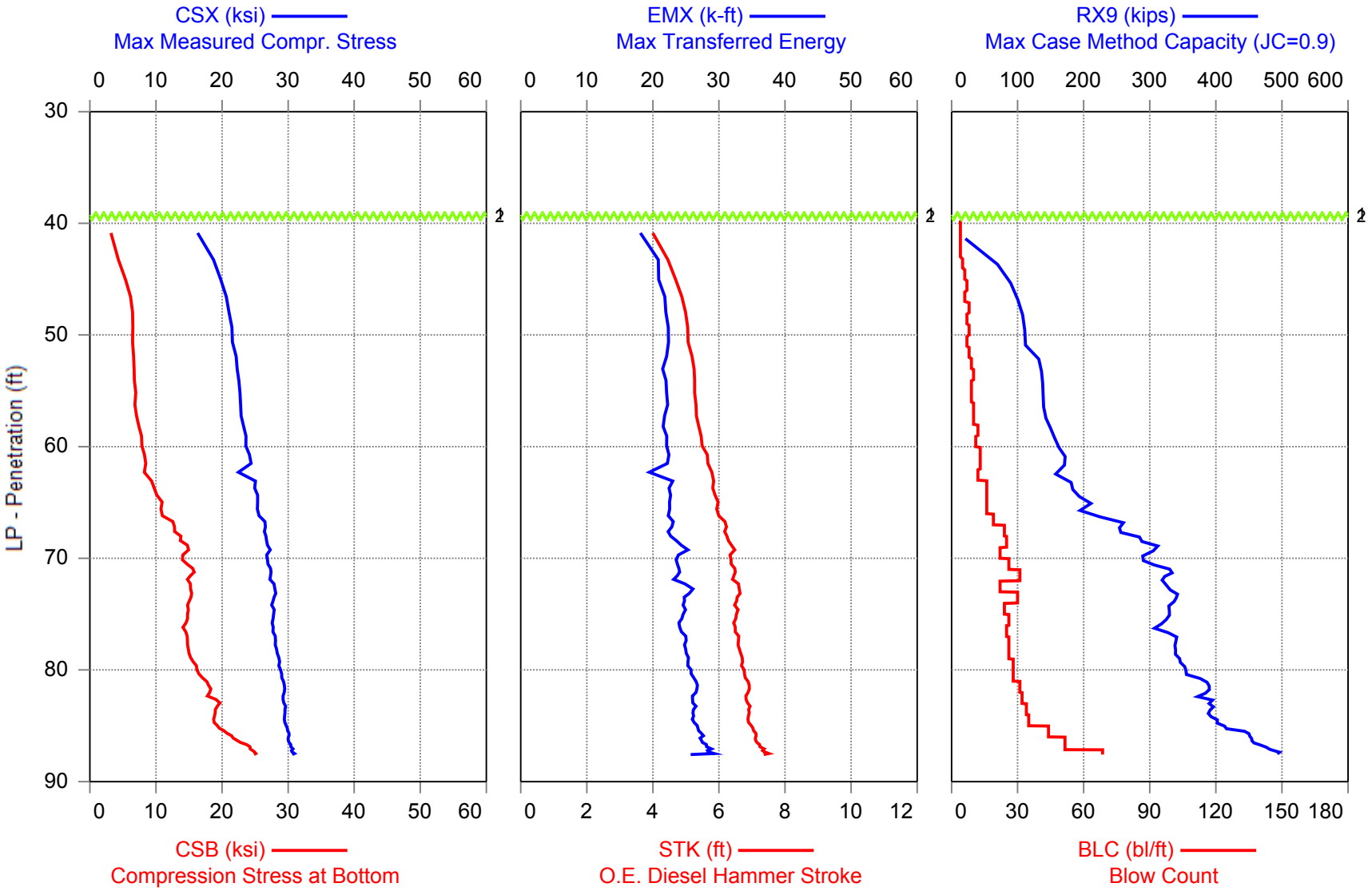
Total time [00:15:12] = (Driving [00:02:05] + Stop [00:13:07])

GRL Engineers, Inc. - PDIPLOT2 Ver 2014.2.48.1 - Case Method & iCAP® Results

Printed: 22-January-2015

Test started: 21-January-2015

USH 10 - B-70-403 - Pier 10 #36 - EOID



1 - Depth reference EL 740.8

2 - Mud line EL 717.6

USH 10 - B-70-403 - Pier 10 #36 - EOID APE D30-42, HP 14 x 73
OP: MR Date: 21-January-2015

CSX: Max Measured Compr. Stress
CSB: Compression Stress at Bottom
EMX: Max Transferred Energy
STK: O.E. Diesel Hammer Stroke
BPM: Blows per Minute
RX9: Max Case Method Capacity (JC=0.9)

BL#	depth	BLC	TYPE	CSX	CSB	EMX	STK	BPM	RX9
	ft	bl/ft		ksi	ksi	k-ft	ft	bpm	kips
4	40.00	4	AV2	14.6	2.7	15	3.6	60.6	0
			MAX	15.6	3.0	16	3.7	60.9	0
			MIN	13.5	2.4	14	3.6	60.3	0
8	41.00	4	AV4	15.7	3.1	17	3.9	58.6	9
			MAX	18.5	3.7	20	4.4	60.8	31
			MIN	13.6	2.4	14	3.6	55.3	0
12	42.00	4	AV4	17.8	3.6	21	4.2	56.5	25
			MAX	18.6	4.0	21	4.4	57.9	46
			MIN	16.6	3.1	19	4.0	55.6	11
16	43.00	4	AV4	18.2	3.8	21	4.4	55.8	42
			MAX	18.5	3.9	22	4.4	56.3	54
			MIN	17.7	3.7	20	4.3	55.4	36
21	44.00	5	AV5	19.0	4.6	21	4.5	54.9	72
			MAX	19.3	5.1	23	4.6	55.6	81
			MIN	18.4	4.2	20	4.4	54.1	66
27	45.00	6	AV6	19.5	5.1	21	4.6	54.2	83
			MAX	19.9	5.4	22	4.7	54.6	87
			MIN	19.0	4.9	20	4.6	53.7	79
34	46.00	7	AV7	20.2	5.7	21	4.8	53.5	92
			MAX	20.7	6.0	22	4.9	54.2	95
			MIN	19.7	5.4	20	4.6	53.0	87
40	47.00	6	AV6	20.7	6.2	22	4.9	52.9	98
			MAX	21.2	6.4	23	5.0	53.3	102
			MIN	20.1	6.0	22	4.8	52.2	94
48	48.00	8	AV8	21.0	6.4	22	5.0	52.4	107
			MAX	21.5	6.8	23	5.1	52.8	111
			MIN	20.5	6.1	21	4.9	52.0	101
55	49.00	7	AV7	21.3	6.5	22	5.0	52.2	106
			MAX	21.9	6.7	24	5.2	52.7	109
			MIN	20.7	6.3	22	4.9	51.4	104
63	50.00	8	AV8	21.4	6.5	22	5.0	52.1	111
			MAX	21.9	6.8	23	5.1	52.6	116
			MIN	20.9	6.2	21	4.9	51.7	104
70	51.00	7	AV7	21.6	6.4	22	5.1	51.9	111
			MAX	21.9	6.6	23	5.1	52.2	115
			MIN	21.4	6.3	22	5.0	51.6	106
78	52.00	8	AV8	22.0	6.6	22	5.2	51.5	120
			MAX	22.2	6.8	23	5.2	51.9	132

USH 10 - B-70-403 - Pier 10 #36 - EOID APE D30-42, HP 14 x 73
OP: MR Date: 21-January-2015

BL#	depth ft	BLC bl/ft	TYPE	CSX ksi	CSB ksi	EMX k-ft	STK ft	BPM bpm	RX9 kips
			MIN	21.6	6.5	22	5.1	51.2	112
87	53.00	9	AV9	22.2	6.7	22	5.2	51.2	135
			MAX	22.5	7.0	23	5.3	51.6	140
			MIN	21.8	6.6	21	5.1	50.9	132
97	54.00	10	AV10	22.4	6.7	22	5.3	51.0	138
			MAX	22.9	7.1	22	5.4	51.6	144
			MIN	22.0	6.2	21	5.1	50.6	133
106	55.00	9	AV9	22.6	6.8	22	5.2	51.1	137
			MAX	22.9	7.1	23	5.4	51.4	143
			MIN	22.3	6.4	21	5.2	50.6	134
115	56.00	9	AV9	22.8	6.9	22	5.3	50.9	138
			MAX	23.2	7.5	23	5.4	51.3	142
			MIN	22.4	6.4	21	5.2	50.6	134
125	57.00	10	AV10	22.8	6.9	22	5.3	50.8	139
			MAX	23.3	7.3	23	5.4	51.1	142
			MIN	22.6	6.4	21	5.2	50.3	138
135	58.00	10	AV10	23.1	7.2	22	5.3	50.6	144
			MAX	24.0	7.8	23	5.5	51.0	153
			MIN	22.7	6.7	21	5.3	49.8	136
147	59.00	12	AV12	23.4	7.6	22	5.4	50.3	152
			MAX	24.0	8.1	23	5.6	51.0	159
			MIN	22.6	7.1	20	5.3	49.7	144
158	60.00	11	AV11	23.6	7.9	22	5.5	50.1	157
			MAX	24.0	8.2	23	5.5	50.4	163
			MIN	23.3	7.5	21	5.4	49.8	150
171	61.00	13	AV13	24.0	8.1	22	5.6	49.5	169
			MAX	24.5	8.6	23	5.7	50.4	175
			MIN	23.3	7.8	21	5.4	49.1	161
184	62.00	13	AV13	24.4	8.5	22	5.7	49.2	171
			MAX	25.3	8.9	23	5.8	49.9	175
			MIN	23.8	7.9	21	5.5	48.6	167
196	63.00	12	AV12	23.0	8.5	21	5.8	48.7	161
			MAX	25.8	9.5	25	6.0	49.2	181
			MIN	12.9	5.3	6	5.7	47.9	82
212	64.00	16	AV16	24.9	9.6	22	5.8	48.7	182
			MAX	25.4	10.1	24	6.0	49.1	189
			MIN	24.6	9.2	21	5.7	48.0	177
228	65.00	16	AV16	25.3	10.5	23	5.9	48.3	197
			MAX	25.9	11.1	25	6.0	48.9	214
			MIN	25.0	9.8	22	5.8	47.8	185

USH 10 - B-70-403 - Pier 10 #36 - EOID APE D30-42, HP 14 x 73
OP: MR Date: 21-January-2015

BL#	depth ft	BLC bl/ft	TYPE	CSX ksi	CSB ksi	EMX k-ft	STK ft	BPM bpm	RX9 kips
244	66.00	16	AV16	25.4	10.7	23	5.9	48.2	200
			MAX	25.8	11.3	23	6.1	48.8	212
			MIN	24.7	10.4	22	5.8	47.7	190
263	67.00	19	AV19	26.1	12.0	23	6.1	47.5	241
			MAX	26.9	13.6	24	6.3	48.5	271
			MIN	25.0	10.3	21	5.9	46.8	195
287	68.00	24	AV24	26.5	12.9	23	6.2	47.2	258
			MAX	27.6	13.8	24	6.5	47.8	280
			MIN	25.9	11.9	21	6.0	46.2	242
312	69.00	25	AV25	26.8	14.2	24	6.3	46.8	295
			MAX	27.3	15.5	25	6.5	47.2	318
			MIN	26.3	13.3	22	6.2	46.1	274
334	70.00	22	AV22	27.0	14.5	25	6.4	46.5	299
			MAX	27.7	15.6	26	6.6	47.1	319
			MIN	26.3	13.5	23	6.2	45.8	278
360	71.00	26	AV26	27.0	14.7	24	6.4	46.5	305
			MAX	28.0	16.0	25	6.6	47.3	331
			MIN	26.4	13.7	22	6.2	45.7	275
391	72.00	31	AV31	27.3	15.3	24	6.5	46.3	326
			MAX	28.0	16.0	25	6.7	46.8	338
			MIN	27.0	14.6	22	6.3	45.6	311
413	73.00	22	AV22	27.9	15.2	25	6.6	45.9	327
			MAX	28.7	15.5	27	6.8	46.6	335
			MIN	27.0	14.6	23	6.4	45.3	320
443	74.00	30	AV30	27.9	15.2	25	6.6	45.9	340
			MAX	28.8	15.8	27	6.8	46.6	348
			MIN	27.2	14.8	24	6.4	45.1	331
467	75.00	24	AV24	27.8	14.8	25	6.5	46.0	329
			MAX	28.5	15.2	26	6.8	46.7	334
			MIN	27.1	14.5	23	6.3	45.3	323
493	76.00	26	AV26	27.7	14.7	24	6.5	46.2	324
			MAX	28.2	15.1	25	6.7	47.0	335
			MIN	27.0	14.1	23	6.3	45.5	314
518	77.00	25	AV25	27.8	14.4	24	6.5	46.1	321
			MAX	28.4	15.1	26	6.8	46.6	345
			MIN	27.3	13.6	23	6.4	45.3	302
544	78.00	26	AV26	28.1	14.8	25	6.6	45.8	339
			MAX	28.7	15.1	27	6.8	46.6	345
			MIN	27.3	14.4	24	6.4	45.2	334

USH 10 - B-70-403 - Pier 10 #36 - EOID APE D30-42, HP 14 x 73
OP: MR Date: 21-January-2015

BL#	depth ft	BLC bl/ft	TYPE	CSX ksi	CSB ksi	EMX k-ft	STK ft	BPM bpm	RX9 kips
570	79.00	26	AV26	28.4	15.0	25	6.7	45.6	340
			MAX	29.7	15.6	27	7.1	46.1	349
			MIN	27.9	14.6	24	6.5	44.3	334
598	80.00	28	AV28	28.7	15.9	25	6.7	45.4	350
			MAX	29.5	16.6	27	6.9	46.1	359
			MIN	28.0	15.3	24	6.5	44.7	340
626	81.00	28	AV28	29.0	16.8	26	6.8	45.2	365
			MAX	29.8	17.8	27	7.0	45.9	390
			MIN	28.4	15.9	25	6.6	44.4	351
657	82.00	31	AV31	29.4	18.1	27	6.9	44.8	389
			MAX	30.0	18.7	28	7.1	45.4	398
			MIN	28.8	17.6	25	6.7	44.2	383
689	83.00	32	AV32	29.3	18.6	26	6.8	45.1	384
			MAX	30.0	21.7	27	7.1	45.8	411
			MIN	28.6	17.4	25	6.6	44.3	363
723	84.00	34	AV34	29.6	19.1	26	6.9	44.8	392
			MAX	30.2	19.8	28	7.1	45.4	407
			MIN	29.0	18.5	25	6.7	44.2	381
758	85.00	35	AV35	29.5	18.8	26	6.9	44.8	400
			MAX	30.0	20.4	28	7.1	45.5	414
			MIN	28.8	18.2	25	6.7	44.3	377
802	86.00	44	AV44	30.0	20.4	27	7.1	44.3	437
			MAX	30.7	21.8	29	7.3	44.9	462
			MIN	29.3	19.3	26	6.9	43.7	407
861	87.15	51	AV59	30.3	23.1	28	7.2	43.9	464
			MAX	31.4	24.8	30	7.5	44.9	488
			MIN	29.2	21.3	26	6.9	43.0	444
874	87.29	69	AV13	30.5	24.6	28	7.3	43.6	487
			MAX	30.9	25.0	29	7.5	44.2	496
			MIN	29.9	23.7	27	7.1	43.2	476
884	87.44	69	AV10	30.7	24.9	29	7.4	43.4	496
			MAX	31.2	25.2	29	7.6	43.8	503
			MIN	30.1	24.6	28	7.2	42.8	489
894	87.58	69	AV10	30.9	25.1	29	7.5	43.2	493
			MAX	31.3	25.4	30	7.6	43.7	506
			MIN	30.4	24.8	23	7.3	42.7	428
			Average	27.0	14.6	25	6.3	46.9	303
			Maximum	31.4	25.4	30	7.6	60.9	506
			Minimum	12.9	2.4	6	3.6	42.7	0

Total number of blows analyzed: 892

BL# Sensors

1-894 F3: [F607] 93.6 (1.00); F4: [D815] 93.0 (1.00); A3: [K2524] 360.0 (1.00); A4: [K3550] 360.0 (1.00)

BL# Comments

1 Depth reference EL 740.8
2 Mud line EL 717.6

Time Summary

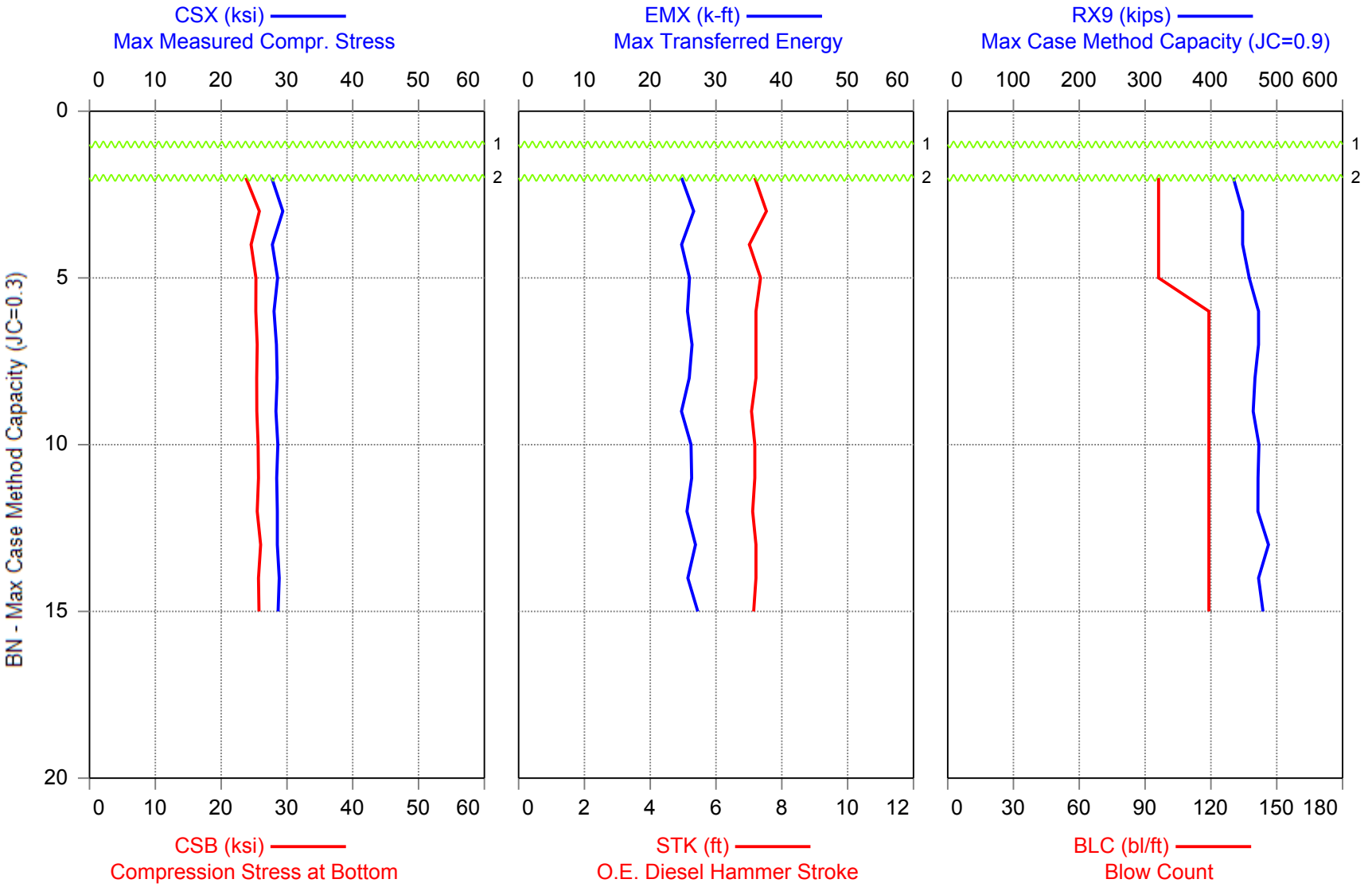
Drive 19 minutes 23 seconds 8:25 AM - 8:44 AM BN 1 - 894

GRL Engineers, Inc. - PDIPLOT2 Ver 2014.2.48.1 - Case Method & iCAP® Results

Printed: 22-January-2015

Test started: 22-January-2015

USH 10 - B-70-403 - Pier 10 #36 BOR



1 - Depth reference EL 740.8

2 - Mud line EL 717.6

USH 10 - B-70-403 - Pier 10 #36 BOR APE D30-42, HP 14 x 73
OP: RF Date: 22-January-2015

CSX: Max Measured Compr. Stress
CSB: Compression Stress at Bottom
EMX: Max Transferred Energy
STK: O.E. Diesel Hammer Stroke
BPM: Blows per Minute
RX9: Max Case Method Capacity (JC=0.9)

BL#	depth	BLC	TYPE	CSX	CSB	EMX	STK	BPM	RX9
	ft	bl/ft		ksi	ksi	k-ft	ft	bpm	kips
5	87.64	96	AV4	28.4	24.9	26	7.3	43.8	447
			MAX	29.4	25.8	27	7.5	44.5	458
			MIN	27.7	23.8	25	7.0	43.0	434
10	87.68	119	AV5	28.4	25.4	26	7.2	44.0	470
			MAX	28.6	25.6	26	7.2	44.3	473
			MIN	28.0	25.3	25	7.1	43.9	464
15	87.72	119	AV5	28.6	25.7	26	7.2	44.0	476
			MAX	28.8	26.0	27	7.2	44.2	487
			MIN	28.4	25.5	26	7.1	43.9	471
			Average	28.4	25.4	26	7.2	43.9	466
			Maximum	29.4	26.0	27	7.5	44.5	487
			Minimum	27.7	23.8	25	7.0	43.0	434

Total number of blows analyzed: 14

BL# Sensors

1-15 F3: [F607] 93.6 (0.96); F4: [D815] 93.0 (0.96); A3: [K2524] 360.0 (1.04); A4: [K3550] 360.0 (1.04)

BL# Comments

1 Depth reference EL 740.8
2 Mud line EL 717.6

Time Summary

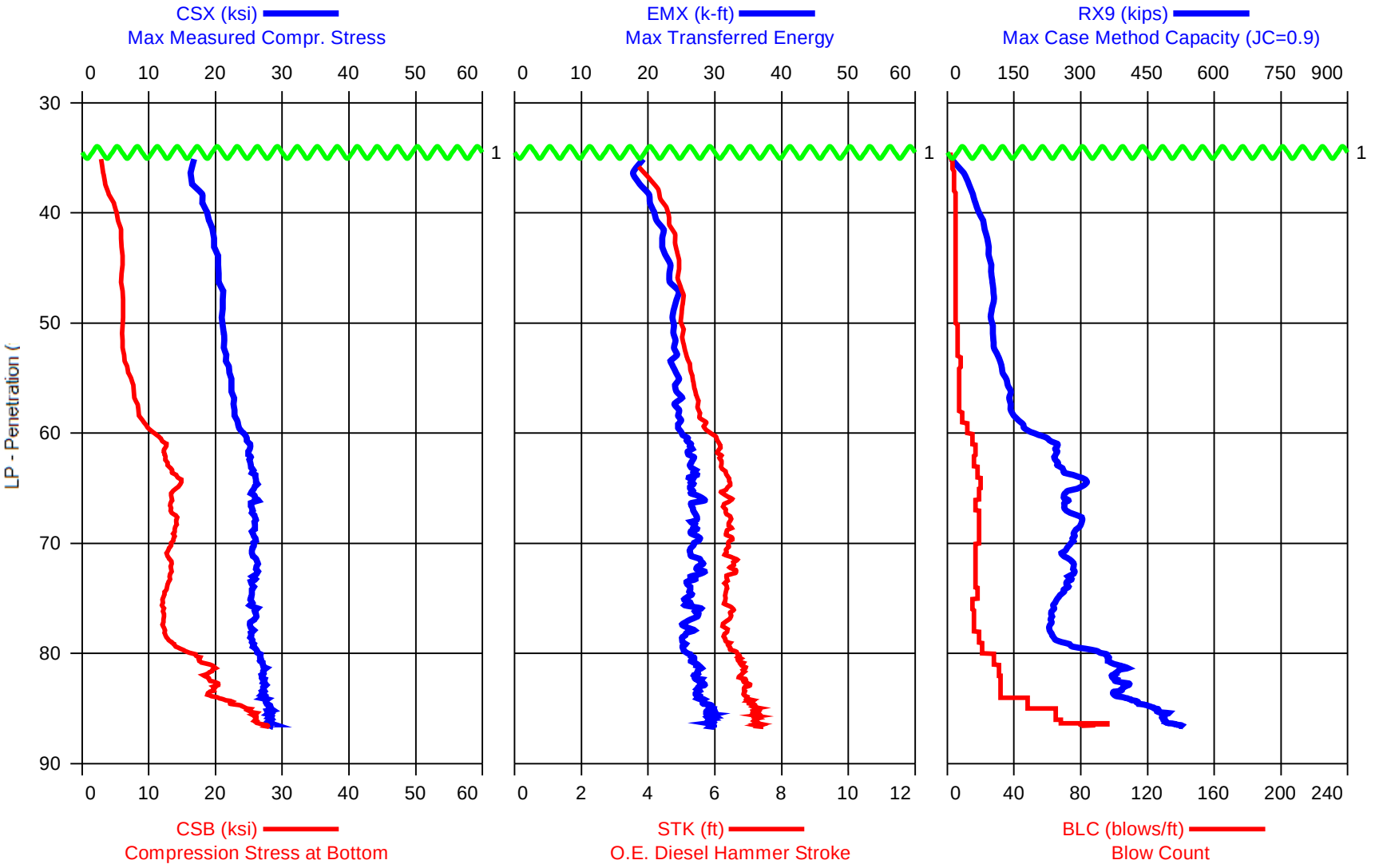
Drive 19 seconds 7:48 AM - 7:48 AM BN 1 - 15

GRL Engineers, Inc. - PDIPLOT2 Ver 2014.2.48.0 - Case Method & iCAP® Results

Printed: 22-January-2015 Test started: 21-January-2015

US 10 over LLBDM B-70-403 - Pier 10 #44

APE D30-42, HP 14 x 73



1 - Reported reference EL 740.8

US 10 over LLBDM B-70-403 - Pier 10 #44 APE D30-42, HP 14 x 73
OP: MR Date: 21-January-2015

AR: 21.40 in² SP: 0.492 k/ft³
LE: 91.50 ft EM: 30,000 ksi
WS: 16,807.9 f/s JC: 1.20 []

CSX: Max Measured Compr. Stress
CSB: Compression Stress at Bottom
STK: O.E. Diesel Hammer Stroke
EMX: Max Transferred Energy
BPM: Blows per Minute
RX9: Max Case Method Capacity (JC=0.9)

BL#	depth	BLC	TYPE	CSX	CSB	STK	EMX	BPM	RX9
	ft	blows/ft		ksi	ksi	ft	k-ft	bpm	kips
2	35.00	2	AV2	22.6	3.2	**	25	**	19
			STD	0.5	0.0	**	4	**	4
			MAX	23.1	3.2	**	29	**	23
			MIN	22.1	3.1	**	21	**	15
5	36.00	3	AV3	12.9	2.7	3.6	16	61.4	6
			STD	2.8	0.3	0.5	3	3.6	8
			MAX	16.7	3.0	4.2	20	65.1	18
			MIN	9.9	2.4	3.1	12	56.5	0
9	37.00	4	AV4	16.1	3.2	4.0	18	58.0	44
			STD	0.3	0.2	0.1	1	0.5	5
			MAX	16.4	3.4	4.1	19	58.4	49
			MIN	15.6	2.9	3.9	16	57.2	38
13	38.00	4	AV4	16.9	3.6	4.2	19	56.6	50
			STD	0.5	0.2	0.1	1	0.7	3
			MAX	17.8	3.9	4.4	22	57.4	54
			MIN	16.6	3.5	4.1	18	55.4	47
18	39.00	5	AV5	17.8	4.2	4.4	20	55.6	59
			STD	0.4	0.2	0.1	1	0.5	4
			MAX	18.4	4.6	4.5	20	56.4	65
			MIN	17.2	3.9	4.3	18	54.8	55
23	40.00	5	AV5	18.6	5.0	4.6	21	54.5	67
			STD	0.2	0.1	0.1	1	0.4	5
			MAX	19.0	5.1	4.7	22	54.9	72
			MIN	18.3	5.0	4.5	20	53.8	59
28	41.00	5	AV5	19.0	5.4	4.6	21	54.3	79
			STD	0.3	0.0	0.1	1	0.5	3
			MAX	19.4	5.4	4.7	22	54.8	82
			MIN	18.7	5.3	4.5	20	53.6	74

US 10 over LLBDM B-70-403 - Pier 10 #44 APE D30-42, HP 14 x 73
OP: MR Date: 21-January-2015

BL#	depth	BLC	TYPE	CSX	CSB	STK	EMX	BPM	RX9
	ft	blows/ft		ksi	ksi	ft	k-ft	bpm	kips
33	42.00	5	AV5	19.7	5.9	4.8	22	53.5	84
			STD	0.6	0.1	0.1	1	0.6	4
			MAX	20.4	6.0	4.9	24	54.6	90
			MIN	18.8	5.7	4.6	21	52.9	80
38	43.00	5	AV5	19.6	5.8	4.8	22	53.4	92
			STD	0.3	0.1	0.1	0	0.3	4
			MAX	20.0	5.9	4.9	22	53.8	98
			MIN	19.2	5.7	4.7	21	52.8	87
43	44.00	5	AV5	20.1	6.0	4.9	22	53.0	92
			STD	0.2	0.1	0.0	1	0.2	4
			MAX	20.5	6.2	4.9	23	53.2	100
			MIN	19.8	5.9	4.8	22	52.7	87
48	45.00	5	AV5	20.5	6.1	4.9	23	52.7	98
			STD	0.3	0.1	0.1	0	0.4	2
			MAX	20.9	6.2	5.0	24	53.1	101
			MIN	20.0	5.9	4.8	23	52.2	96
53	46.00	5	AV5	20.3	5.9	4.9	23	52.8	98
			STD	0.4	0.2	0.1	1	0.4	4
			MAX	20.9	6.1	5.0	24	53.3	105
			MIN	19.6	5.6	4.8	21	52.2	95
58	47.00	5	AV5	20.8	5.9	5.0	24	52.4	102
			STD	0.2	0.1	0.1	0	0.3	3
			MAX	21.2	6.1	5.0	24	52.9	105
			MIN	20.5	5.7	4.9	23	52.1	98
63	48.00	5	AV5	21.2	6.1	5.1	25	51.9	107
			STD	0.2	0.0	0.0	0	0.2	3
			MAX	21.6	6.2	5.1	26	52.1	111
			MIN	21.1	6.1	5.0	24	51.6	102
68	49.00	5	AV5	21.0	6.1	5.0	24	52.2	100
			STD	0.1	0.1	0.0	0	0.1	2
			MAX	21.2	6.3	5.0	25	52.5	103
			MIN	20.8	6.1	5.0	23	52.1	99
73	50.00	5	AV5	20.9	6.1	5.0	24	52.3	97

US 10 over LLBDM B-70-403 - Pier 10 #44 APE D30-42, HP 14 x 73
OP: MR Date: 21-January-2015

BL#	depth ft	BLC blows/ft	TYPE	CSX ksi	CSB ksi	STK ft	EMX k-ft	BPM bpm	RX9 kips
			STD	0.3	0.2	0.1	0	0.3	2
			MAX	21.4	6.3	5.1	24	52.8	100
			MIN	20.5	5.8	4.9	23	52.0	94
79	51.00	6	AV6	21.2	6.0	5.0	24	52.1	103
			STD	0.3	0.1	0.0	1	0.2	2
			MAX	21.6	6.1	5.1	25	52.3	106
			MIN	20.8	5.9	5.0	23	51.8	100
85	52.00	6	AV6	21.2	6.1	5.0	24	52.0	103
			STD	0.4	0.1	0.1	1	0.4	3
			MAX	21.9	6.2	5.2	25	52.8	108
			MIN	20.5	5.9	4.9	23	51.4	101
91	53.00	6	AV6	21.4	6.2	5.1	24	51.8	109
			STD	0.2	0.1	0.0	1	0.2	4
			MAX	21.7	6.3	5.2	25	52.0	115
			MIN	21.1	5.8	5.1	23	51.5	103
99	54.00	8	AV8	21.8	6.5	5.2	24	51.2	120
			STD	0.3	0.2	0.1	0	0.3	3
			MAX	22.2	6.8	5.3	24	52.0	125
			MIN	21.1	6.2	5.1	23	50.8	115
106	55.00	7	AV7	22.2	7.0	5.3	24	50.8	125
			STD	0.3	0.1	0.1	1	0.3	4
			MAX	22.8	7.3	5.4	26	51.2	133
			MIN	21.8	6.9	5.2	24	50.2	121
113	56.00	7	AV7	22.3	7.7	5.4	24	50.6	136
			STD	0.2	0.3	0.0	0	0.2	4
			MAX	22.7	8.1	5.4	25	50.8	141
			MIN	22.1	7.4	5.3	24	50.2	128
120	57.00	7	AV7	22.6	7.8	5.5	25	50.1	141
			STD	0.3	0.2	0.1	1	0.2	4
			MAX	23.2	8.0	5.6	26	50.4	146
			MIN	22.3	7.6	5.4	24	49.7	136
127	58.00	7	AV7	22.7	8.3	5.5	24	50.0	142
			STD	0.2	0.1	0.1	1	0.2	3

US 10 over LLBDM B-70-403 - Pier 10 #44 APE D30-42, HP 14 x 73
OP: MR Date: 21-January-2015

BL#	depth ft	BLC blows/ft	TYPE	CSX ksi	CSB ksi	STK ft	EMX k-ft	BPM bpm	RX9 kips
			MAX	23.1	8.5	5.6	25	50.4	146
			MIN	22.4	8.1	5.4	23	49.7	138
136	59.00	9	AV9	23.0	8.7	5.6	25	49.6	154
			STD	0.3	0.3	0.1	1	0.4	8
			MAX	23.7	9.3	5.8	26	50.1	165
			MIN	22.6	8.4	5.5	24	48.8	140
148	60.00	12	AV12	23.6	10.0	5.7	25	49.0	177
			STD	0.3	0.4	0.1	1	0.4	8
			MAX	24.2	10.7	5.9	25	49.6	193
			MIN	23.2	9.5	5.6	24	48.4	167
163	61.00	15	AV15	24.7	11.8	6.1	26	47.7	226
			STD	0.4	0.5	0.1	1	0.4	16
			MAX	25.5	12.7	6.3	27	48.3	258
			MIN	24.1	11.0	5.9	25	46.8	201
180	62.00	17	AV17	25.0	12.4	6.1	26	47.5	245
			STD	0.3	0.2	0.1	1	0.3	4
			MAX	25.7	12.7	6.3	28	48.2	252
			MIN	24.5	12.1	5.9	24	46.8	240
196	63.00	16	AV16	25.2	12.6	6.2	27	47.3	245
			STD	0.3	0.2	0.1	1	0.3	7
			MAX	25.9	13.0	6.4	27	47.7	257
			MIN	24.6	12.1	6.1	26	46.5	232
214	64.00	18	AV18	25.7	13.6	6.3	27	46.8	270
			STD	0.4	0.4	0.1	1	0.4	14
			MAX	26.4	14.4	6.5	29	47.8	299
			MIN	24.8	12.9	6.0	25	46.1	251
234	65.00	20	AV20	26.0	14.7	6.4	26	46.4	308
			STD	0.3	0.2	0.1	1	0.3	6
			MAX	26.8	15.1	6.6	28	46.9	317
			MIN	25.6	14.2	6.3	26	45.7	290
253	66.00	19	AV19	25.7	13.5	6.3	27	46.7	268
			STD	0.3	0.2	0.1	1	0.5	9
			MAX	26.3	14.0	6.6	29	47.6	292

US 10 over LLBDM B-70-403 - Pier 10 #44 APE D30-42, HP 14 x 73
OP: MR Date: 21-January-2015

BL#	depth ft	BLC blows/ft	TYPE	CSX ksi	CSB ksi	STK ft	EMX k-ft	BPM bpm	RX9 kips
			MIN	24.9	13.2	6.1	26	45.7	256
270	67.00	17	AV17	25.6	13.3	6.3	27	46.7	264
			STD	0.5	0.2	0.1	1	0.5	4
			MAX	26.7	13.7	6.6	29	47.6	275
			MIN	24.7	12.9	6.1	26	45.7	258
289	68.00	19	AV19	25.8	13.9	6.4	27	46.5	292
			STD	0.3	0.4	0.1	0	0.3	13
			MAX	26.4	14.4	6.6	28	47.0	313
			MIN	25.1	13.3	6.3	26	45.8	271
308	69.00	19	AV19	25.8	14.0	6.4	27	46.4	295
			STD	0.3	0.2	0.1	1	0.3	7
			MAX	26.3	14.3	6.5	28	47.1	305
			MIN	24.9	13.5	6.2	25	46.0	285
327	70.00	19	AV19	25.8	13.7	6.4	27	46.4	283
			STD	0.4	0.2	0.1	1	0.4	4
			MAX	26.5	14.1	6.7	29	47.0	292
			MIN	25.1	13.2	6.3	26	45.6	277
344	71.00	17	AV17	25.5	13.0	6.4	26	46.6	266
			STD	0.2	0.3	0.1	1	0.2	7
			MAX	25.9	13.4	6.5	27	46.9	276
			MIN	25.2	12.3	6.3	26	46.2	249
361	72.00	17	AV17	26.0	13.2	6.5	28	46.1	274
			STD	0.5	0.3	0.2	1	0.5	11
			MAX	26.9	13.5	6.8	29	47.1	292
			MIN	25.0	12.5	6.2	25	45.3	254
378	73.00	17	AV17	26.1	13.3	6.5	28	46.1	283
			STD	0.5	0.2	0.2	1	0.5	9
			MAX	26.9	13.6	6.8	29	46.9	301
			MIN	25.3	12.9	6.3	26	45.2	271
395	74.00	17	AV17	25.6	13.0	6.3	26	46.7	272
			STD	0.3	0.2	0.1	1	0.3	7
			MAX	26.5	13.3	6.6	28	47.4	291
			MIN	25.0	12.7	6.1	25	45.8	264

US 10 over LLBDM B-70-403 - Pier 10 #44 APE D30-42, HP 14 x 73
OP: MR Date: 21-January-2015

BL#	depth ft	BLC blows/ft	TYPE	CSX ksi	CSB ksi	STK ft	EMX k-ft	BPM bpm	RX9 kips
413	75.00	18	AV18	25.4	12.4	6.3	26	46.7	258
			STD	0.3	0.2	0.1	1	0.3	7
			MAX	26.1	12.7	6.5	27	47.2	273
			MIN	24.8	12.0	6.2	25	46.2	245
428	76.00	15	AV15	25.6	12.1	6.4	26	46.6	241
			STD	0.6	0.2	0.2	1	0.6	7
			MAX	26.7	12.4	6.7	29	47.5	255
			MIN	24.7	11.7	6.1	24	45.4	230
444	77.00	16	AV16	26.0	12.2	6.5	27	46.3	234
			STD	0.2	0.1	0.1	1	0.3	4
			MAX	26.3	12.5	6.6	28	46.8	242
			MIN	25.5	12.0	6.3	26	45.7	226
460	78.00	16	AV16	25.3	12.2	6.3	26	46.8	231
			STD	0.4	0.2	0.1	1	0.4	6
			MAX	26.0	12.5	6.5	27	47.4	241
			MIN	24.8	12.0	6.1	25	46.0	221
479	79.00	19	AV19	25.4	12.7	6.3	25	46.8	241
			STD	0.4	0.3	0.1	1	0.3	8
			MAX	25.9	13.5	6.5	27	47.4	261
			MIN	24.7	12.2	6.1	24	46.3	230
500	80.00	21	AV21	25.9	14.7	6.5	25	46.2	307
			STD	0.4	0.9	0.1	1	0.4	30
			MAX	26.7	16.5	6.7	27	46.8	346
			MIN	25.4	13.5	6.3	24	45.4	262
528	81.00	28	AV28	26.8	17.6	6.8	27	45.3	364
			STD	0.3	0.6	0.1	1	0.3	6
			MAX	27.5	19.0	6.9	28	45.8	380
			MIN	26.2	16.6	6.6	26	44.7	354
559	82.00	31	AV31	27.2	19.3	6.8	28	45.0	387
			STD	0.3	0.6	0.1	1	0.3	11
			MAX	28.2	20.4	7.1	29	45.6	414
			MIN	26.6	18.0	6.7	26	44.1	364

US 10 over LLBDM B-70-403 - Pier 10 #44 APE D30-42, HP 14 x 73
OP: MR Date: 21-January-2015

BL#	depth	BLC	TYPE	CSX	CSB	STK	EMX	BPM	RX9
	ft	blows/ft		ksi	ksi	ft	k-ft	bpm	kips
591	83.00	32	AV32	27.2	19.5	6.9	28	44.9	387
			STD	0.4	0.8	0.1	1	0.4	15
			MAX	27.7	20.8	7.1	29	45.8	417
			MIN	26.4	17.8	6.6	26	44.1	366
623	84.00	32	AV32	27.2	19.4	6.9	27	44.9	384
			STD	0.3	0.5	0.1	0	0.3	10
			MAX	27.7	20.2	7.1	28	45.7	399
			MIN	26.3	18.6	6.6	26	44.3	369
671	85.00	48	AV48	27.7	22.6	7.1	29	44.2	434
			STD	0.4	1.3	0.1	1	0.4	20
			MAX	28.7	24.9	7.4	30	45.2	470
			MIN	26.7	20.3	6.8	27	43.3	401
736	86.00	65	AV65	28.1	25.7	7.2	29	43.8	482
			STD	0.3	0.5	0.1	1	0.3	8
			MAX	28.7	26.6	7.5	31	44.6	506
			MIN	27.2	24.6	7.0	28	43.2	463
758	86.32	68	AV22	28.2	26.0	7.2	29	43.8	491
			STD	0.3	0.2	0.1	1	0.2	4
			MAX	28.9	26.5	7.4	31	44.3	499
			MIN	27.7	25.6	7.1	28	43.3	485
768	86.43	96	AV10	28.5	26.8	7.3	30	43.7	508
			STD	0.4	0.3	0.1	1	0.3	6
			MAX	28.9	27.1	7.4	31	44.2	514
			MIN	27.9	26.1	7.1	28	43.3	497
778	86.54	87	AV10	28.3	27.4	7.3	29	43.8	520
			STD	0.2	0.3	0.1	1	0.2	5
			MAX	28.6	27.9	7.4	30	44.2	529
			MIN	27.9	26.8	7.1	29	43.5	513
788	86.67	80	AV10	28.6	27.9	7.3	30	43.6	532
			STD	0.4	0.4	0.1	1	0.4	5
			MAX	29.2	28.4	7.5	31	44.3	539
			MIN	27.8	27.4	7.1	28	43.0	522
			Average	25.5	15.3	6.4	27	46.8	299
			Std. Dev.	2.6	6.4	0.8	2	3.0	126

US 10 over LLBDM B-70-403 - Pier 10 #44 APE D30-42, HP 14 x 73
OP: MR Date: 21-January-2015

BL#	depth	BLC	TYPE	CSX	CSB	STK	EMX	BPM	RX9
	ft	blows/ft		ksi	ksi	ft	k-ft	bpm	kips
			Maximum	29.2	28.4	7.5	31	65.1	539
			Minimum	9.9	2.4	3.1	12	43.0	0

Total number of blows analyzed: 788

BL# Sensors

1-788 F3: [F607] 93.6 (0.94); F4: [D815] 93.0 (0.94); A3: [K2524] 360.0 (1.06); A4: [K3550] 360.0 (1.06)

BL# Comments

1 Reported reference EL 740.8

Time Summary

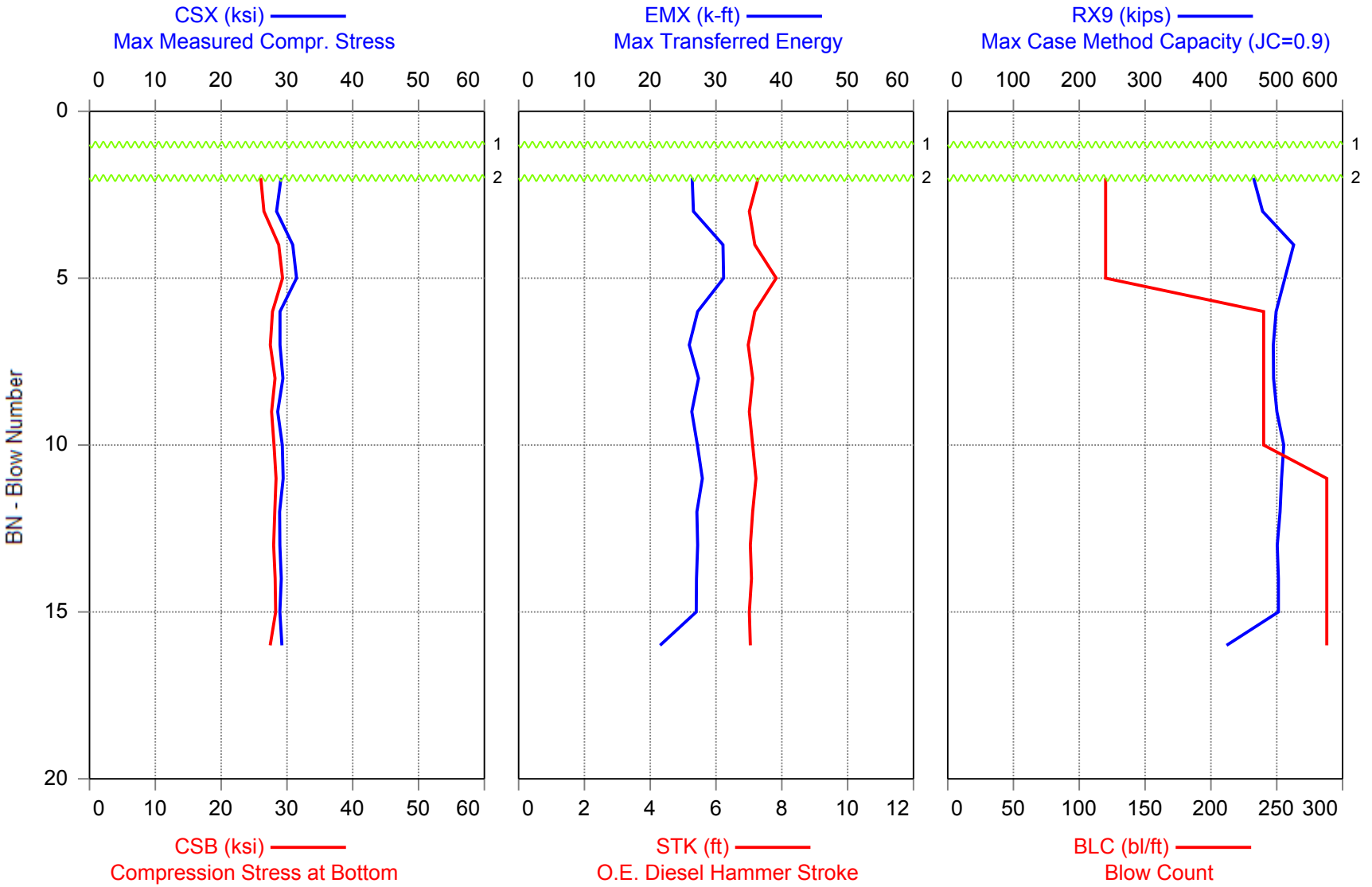
Drive 17 minutes 8 seconds 7:47 AM - 8:04 AM BN 1 - 788

GRL Engineers, Inc. - PDIPLOT2 Ver 2014.2.48.1 - Case Method & iCAP® Results

Printed: 23-January-2015

Test started: 22-January-2015

USH 10 - B-70-403 - Pier 10 #44 BOR



1 - Depth reference EL 740.8

2 - Mud line EL 717.6

USH 10 - B-70-403 - Pier 10 #44 BOR APE D30-42, HP 14 x 73
OP: RF Date: 22-January-2015

CSX: Max Measured Compr. Stress
CSB: Compression Stress at Bottom
EMX: Max Transferred Energy
STK: O.E. Diesel Hammer Stroke
BPM: Blows per Minute
RX9: Max Case Method Capacity (JC=0.9)

BL#	depth	BLC	TYPE	CSX	CSB	EMX	STK	BPM	RX9
	ft	bl/ft		ksi	ksi	k-ft	ft	bpm	kips
5	86.70	120	AV4	30.0	27.7	29	7.3	43.6	495
			MAX	31.5	29.3	31	7.8	44.5	526
			MIN	28.4	26.0	26	7.0	42.2	465
10	86.72	240	AV5	29.0	27.8	27	7.1	44.3	500
			MAX	29.4	28.2	27	7.2	44.6	511
			MIN	28.6	27.5	26	7.0	44.0	495
16	86.74	288	AV6	29.1	28.1	26	7.1	44.3	490
			MAX	29.4	28.3	28	7.2	44.5	507
			MIN	28.9	27.4	21	7.0	43.9	424
			Average	29.3	27.9	27	7.1	44.1	495
			Maximum	31.5	29.3	31	7.8	44.6	526
			Minimum	28.4	26.0	21	7.0	42.2	424

Total number of blows analyzed: 15

BL# Sensors

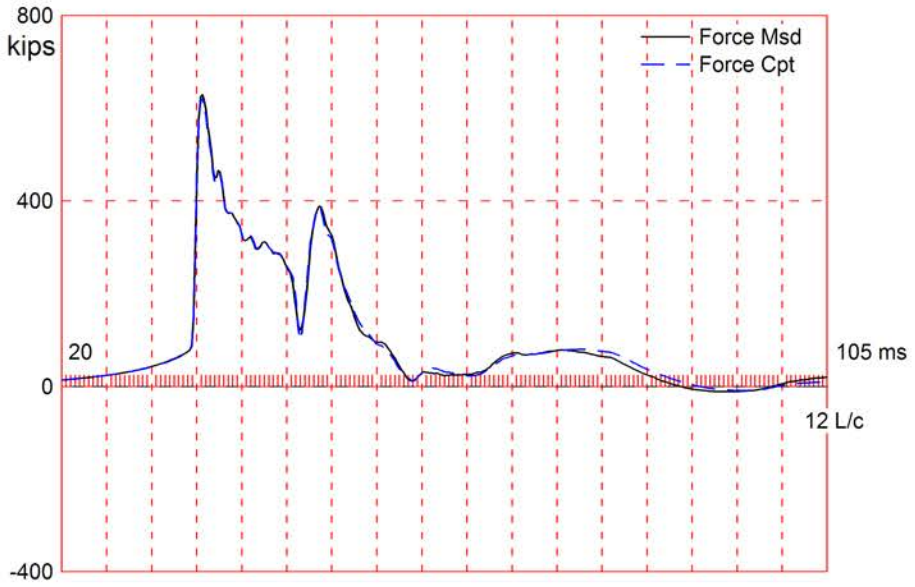
1-3 F3: [F607] 93.6 (0.95); F4: [D815] 93.0 (0.95); A3: [K2524] 360.0 (1.05); A4: [K3550] 360.0 (1.05)
4-4 F3: [F607] 93.6 (1.00); F4: [D815] 93.0 (1.00); A3: [K2524] 360.0 (1.10); A4: [K3550] 360.0 (1.10)
5-16 F3: [F607] 93.6 (0.95); F4: [D815] 93.0 (0.95); A3: [K2524] 360.0 (1.05); A4: [K3550] 360.0 (1.05)

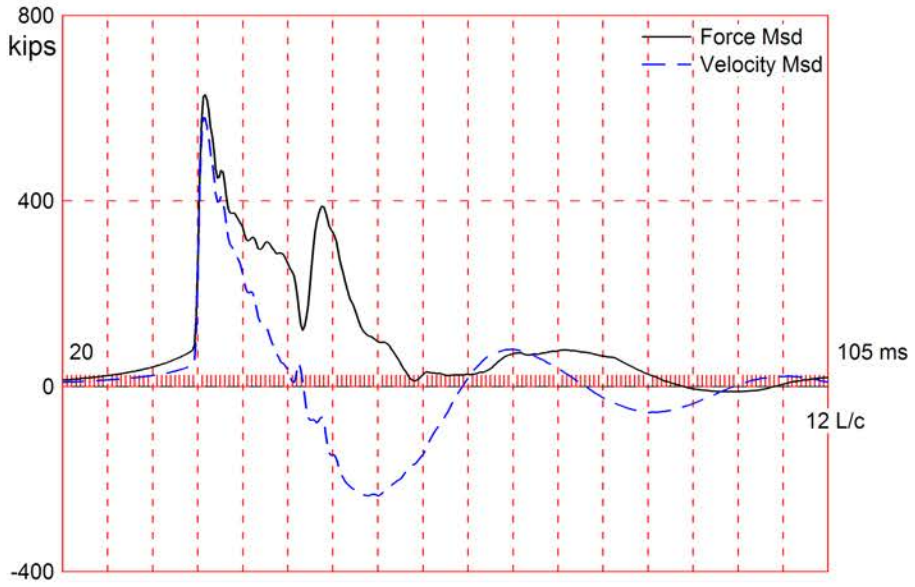
BL# Comments

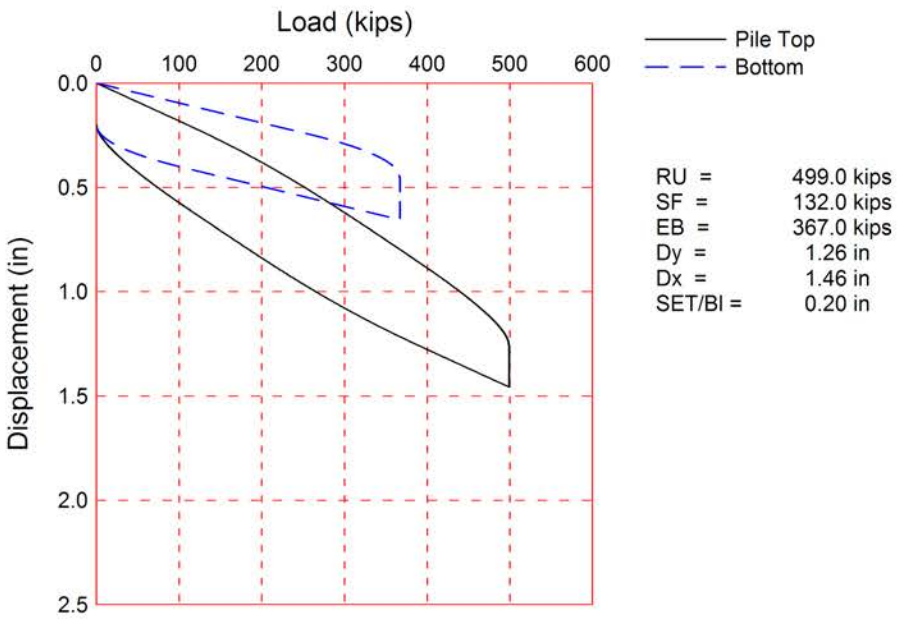
1 Depth reference EL 740.8
2 Mud line EL 717.6
4 CW

Time Summary

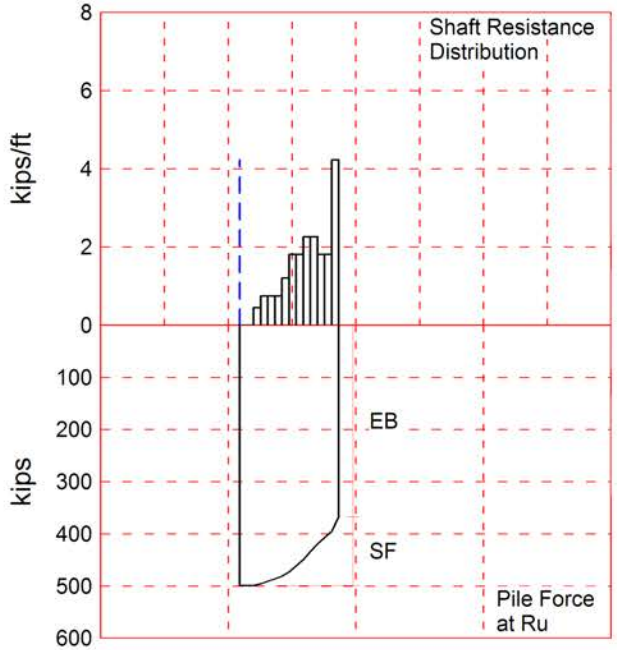
Drive 20 seconds 7:35 AM - 7:36 AM BN 1 - 16







RU =	499.0 kips
SF =	132.0 kips
EB =	367.0 kips
Dy =	1.26 in
Dx =	1.46 in
SET/Bl =	0.20 in



Length b. Sensors	92.6 ft
Embedment	92.6 ft
Top Area	21.4 in^2
End Bearing Area	198.5 in^2
Top Perimeter	4.70 ft
Top E-Modulus	29992 ksi
Top Spec. Weight	492.0 lb/ft^3
Top Wave Spd.	16808 ft/s
Overall W.S.	16808 ft/s
Match Quality	2.04
Top Compr. Stress	29.0 ksi
Max Compr. Stress	29.6 ksi
Max Tension Stress	-3.33 ksi
Avg. Shaft Quake	0.17 in
Toe Quake	0.35 in
Avg. Shaft Smith Dpg.	0.24 s/ft
Toe Smith Damping	0.10 s/ft

About the CAPWAP Results

The CAPWAP program performs a signal matching or reverse analysis based on measurements taken on a deep foundation under an impact load. The program is based on a one-dimensional mathematical model. Under certain conditions, the model only crudely approximates the often complex dynamic situations.

The CAPWAP analysis relies on the input of accurately measured dynamic data plus additional parameters describing pile and soil behavior. If the field measurements of force and velocity are incorrect or were taken under inappropriate conditions (e.g., at an inappropriate time or with too much or too little energy) or if the input pile model is incorrect, then the solution cannot represent the actual soil behavior.

Generally the CAPWAP analysis is used to estimate the axial compressive pile capacity and the soil resistance distribution. The long-term capacity is best evaluated with restrike tests since they incorporate soil strength changes (set-up gains or relaxation losses) that occur after installation. The calculated load settlement graph does not consider creep or long term consolidation settlements. When uplift is a controlling factor in the design, use of the CAPWAP results to assess uplift capacity should be made only after very careful analysis of only good measurement quality, and further used only with longer pile lengths and with nominally higher safety factors.

CAPWAP is also used to evaluate driving stresses along the length of the pile. However, it should be understood that the analysis is one dimensional and does not take into account bending effects or local contact stresses at the pile toe.

Furthermore, if the user of this software was not able to produce a solution with satisfactory signal "match quality" (MQ), then the associated CAPWAP results may be unreliable. There is no absolute scale for solution acceptability but solutions with MQ above 5 are generally considered less reliable than those with lower MQ values and every effort should be made to improve the analysis, for example, by getting help from other independent experts.

Considering the CAPWAP model limitations, the nature of the input parameters, the complexity of the analysis procedure, and the need for a responsible application of the results to actual construction projects, it is recommended that at least one static load test be performed on sites where little experience exists with dynamic behavior of the soil resistance or when the experience of the analyzing engineer with both program use and result application is limited.

Finally, the CAPWAP capacities are ultimate values. They MUST be reduced by means of an appropriate factor of safety to yield a design or working load. The selection of a factor of safety should consider the quality of the construction control, the variability of the site conditions, uncertainties in the loads, the importance of structure and other factors. The CAPWAP results should be reviewed by the Engineer of Record with consideration of applicable geotechnical conditions including, but not limited to, group effects, potential settlement from underlying compressible layers, soil resistances provided from any layers unsuitable for long term support, as well as effective stress changes due to soil surcharges, excavation or change in water table elevation.

The CAPWAP analysis software is one of many means by which the capacity of a deep foundation can be assessed. The engineer performing the analysis is responsible for proper software application and the analysis results. Pile Dynamics accepts no liability whatsoever of any kind for the analysis solution and/or the application of the analysis result.

CAPWAP SUMMARY RESULTS

Total CAPWAP Capacity: 499.0; along Shaft 132.0; at Toe 367.0 kips

Soil Sgmnt No.	Dist. Below Gages ft	Depth Below Grade ft	Ru kips	Force in Pile kips	Sum of Ru kips	Unit Resist. (Depth) kips/ft	Unit Resist. (Area) ksf	Smith Damping Factor s/ft
				499.0				
1	6.6	6.6	0.0	499.0	0.0	0.00	0.00	0.00
2	13.2	13.2	0.0	499.0	0.0	0.00	0.00	0.00
3	19.8	19.8	3.0	496.0	3.0	0.45	0.10	0.24
4	26.5	26.5	5.0	491.0	8.0	0.76	0.16	0.24
5	33.1	33.1	5.0	486.0	13.0	0.76	0.16	0.24
6	39.7	39.7	5.0	481.0	18.0	0.76	0.16	0.24
7	46.3	46.3	8.0	473.0	26.0	1.21	0.26	0.24
8	52.9	52.9	12.0	461.0	38.0	1.81	0.39	0.24
9	59.5	59.5	12.0	449.0	50.0	1.81	0.39	0.24
10	66.1	66.1	15.0	434.0	65.0	2.27	0.48	0.24
11	72.7	72.7	15.0	419.0	80.0	2.27	0.48	0.24
12	79.4	79.4	12.0	407.0	92.0	1.81	0.39	0.24
13	86.0	86.0	12.0	395.0	104.0	1.81	0.39	0.24
14	92.6	92.6	28.0	367.0	132.0	4.23	0.90	0.24
Avg. Shaft			9.4			1.43	0.30	0.24
Toe			367.0				266.23	0.10

Soil Model Parameters/Extensions		Shaft	Toe
Quake	(in)	0.17	0.35
Case Damping Factor		0.83	0.96
Damping Type		Viscous	Sm+Visc
Unloading Quake	(% of loading quake)	97	45
Reloading Level	(% of Ru)	100	100
Unloading Level	(% of Ru)	20	
Resistance Gap (included in Toe Quake)	(in)		0.08
Soil Plug Weight	(kips)		0.112

CAPWAP match quality = 2.04 (Wave Up Match) ; RSA = 0
Observed: Final Set = 0.20 in; Blow Count = 60 b/ft
Computed: Final Set = 0.16 in; Blow Count = 74 b/ft

max. Top Comp. Stress = 29.0 ksi (T= 36.0 ms, max= 1.021 x Top)
max. Comp. Stress = 29.6 ksi (Z= 19.8 ft, T= 37.0 ms)
max. Tens. Stress = -3.33 ksi (Z= 59.5 ft, T= 63.0 ms)
max. Energy (EMX) = 31.2 kip-ft; max. Measured Top Displ. (DMX)= 0.97 in

EXTREMA TABLE

Pile Sgmnt No.	Dist. Below Gages ft	max. Force kips	min. Force kips	max. Comp. Stress ksi	max. Tens. Stress ksi	max. Trnsfd. Energy kip-ft	max. Veloc. ft/s	max. Displ. in
1	3.3	620.9	-10.5	29.0	-0.49	31.2	15.4	0.97
2	6.6	621.7	-12.1	29.0	-0.56	31.1	15.3	0.96
4	13.2	625.3	-14.9	29.2	-0.69	30.8	15.2	0.93
6	19.8	633.8	-18.0	29.6	-0.84	30.4	15.0	0.89
8	26.5	630.7	-26.6	29.5	-1.24	29.2	14.7	0.85
10	33.1	618.8	-34.8	28.9	-1.63	27.6	14.5	0.81
12	39.7	608.6	-46.9	28.4	-2.19	26.0	14.1	0.77
14	46.3	604.1	-58.9	28.2	-2.75	24.3	13.7	0.72
15	49.6	581.4	-60.8	27.2	-2.84	22.6	13.4	0.69
16	52.9	591.2	-67.3	27.6	-3.15	22.2	13.1	0.67
17	56.2	552.7	-66.5	25.8	-3.11	20.0	12.8	0.64
18	59.5	563.2	-71.2	26.3	-3.33	19.6	12.5	0.62
19	62.8	528.4	-68.3	24.7	-3.19	17.5	12.2	0.59
20	66.1	538.9	-69.7	25.2	-3.25	17.1	11.9	0.56
21	69.4	494.3	-63.1	23.1	-2.95	14.8	11.6	0.54
22	72.7	502.8	-63.9	23.5	-2.98	14.4	11.4	0.51
23	76.0	457.6	-57.3	21.4	-2.68	12.3	11.2	0.49
24	79.4	464.7	-58.3	21.7	-2.72	11.9	11.0	0.46
25	82.7	429.7	-52.8	20.1	-2.47	10.3	11.7	0.43
26	86.0	453.3	-53.3	21.2	-2.49	9.9	12.8	0.41
27	89.3	456.9	-48.2	21.3	-2.25	8.5	13.5	0.38
28	92.6	467.8	-48.6	21.9	-2.27	6.7	13.3	0.36
Absolute	19.8			29.6			(T =	37.0 ms)
	59.5				-3.33		(T =	63.0 ms)

CASE METHOD

J =	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
RP	658.4	603.1	547.8	492.4	437.1	381.8	326.5	271.1	215.8	160.5
RX	685.4	644.9	623.5	602.0	580.6	559.2	537.7	519.4	508.2	498.5
RU	670.2	615.3	560.4	505.5	450.6	395.6	340.7	285.8	230.9	176.0

RAU = 317.9 (kips); RA2 = 553.2 (kips)

Current CAPWAP Ru = 499.0 (kips); Corresponding J(RP)= 0.29; J(RX) = 0.90

VMX ft/s	TVP ms	VT1*Z kips	FT1 kips	FMX kips	DMX in	DFN in	SET in	EMX kip-ft	QUS kips	KEB kips/in
15.3	35.61	581.6	630.1	633.6	0.97	0.20	0.20	31.3	641.9	1359

PILE PROFILE AND PILE MODEL

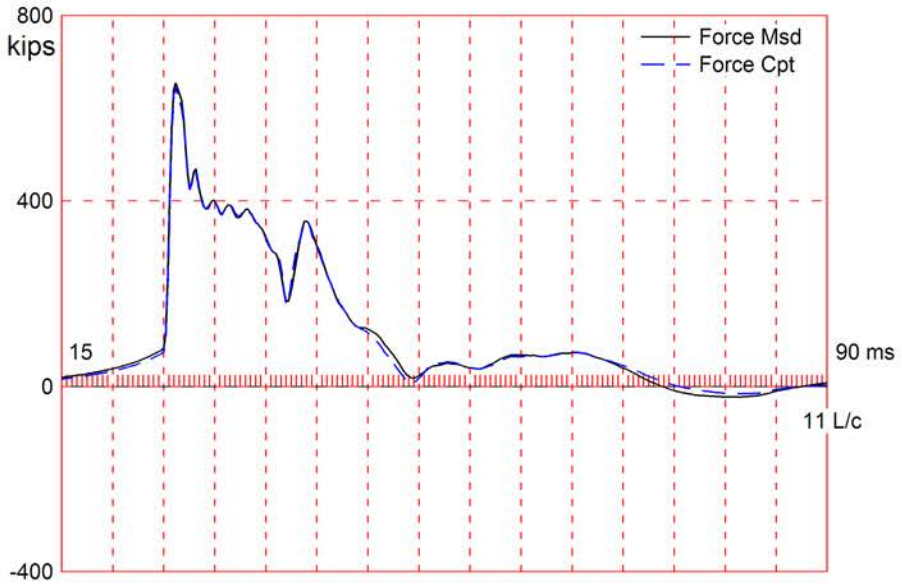
Depth ft	Area in^2	E-Modulus ksi	Spec. Weight lb/ft^3	Perim. ft
0.0	21.4	29992.2	492.000	4.70
92.6	21.4	29992.2	492.000	4.70

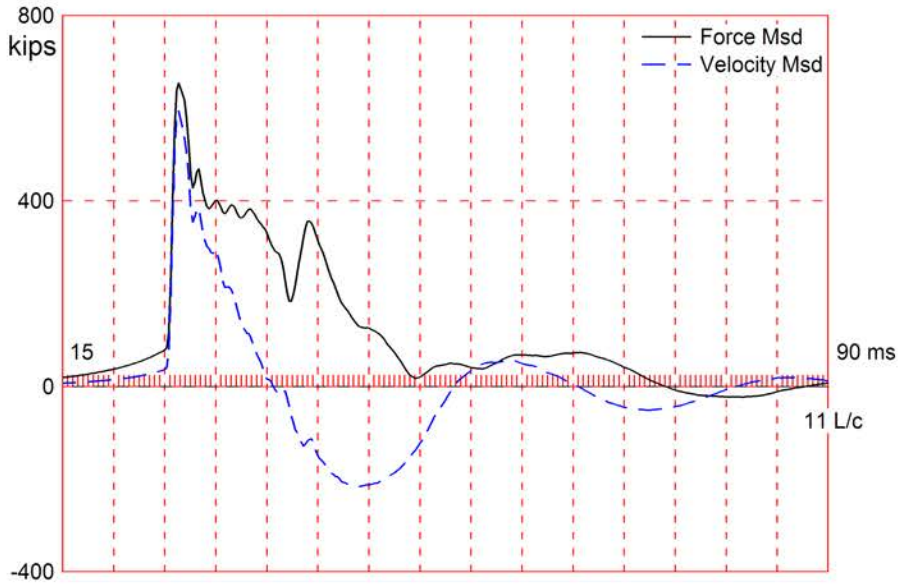
Toe Area 198.5 in^2

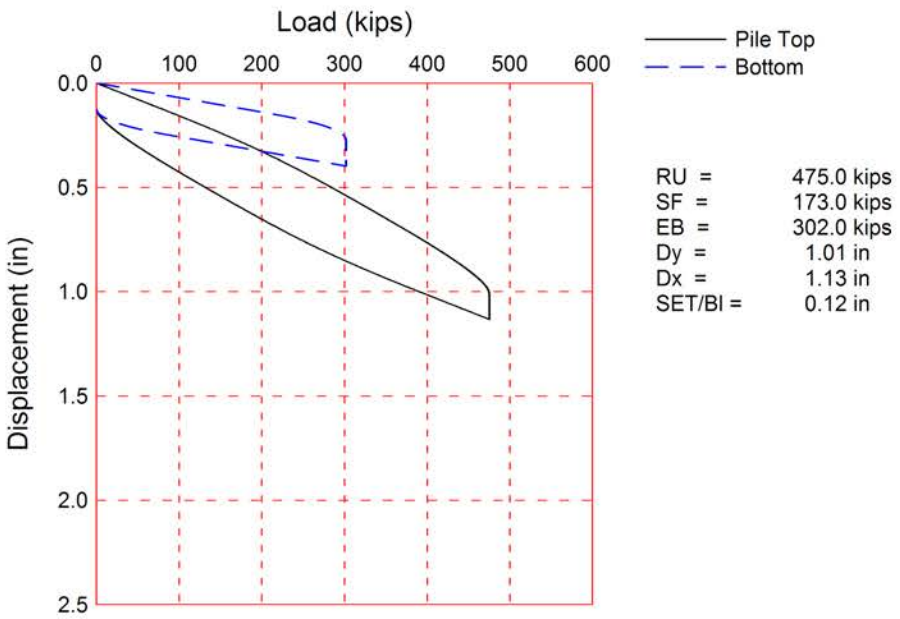
Top Segment Length 3.31 ft, Top Impedance 38 kips/ft/s

Wave Speed: Pile Top 16807.9, Elastic 16807.9, Overall 16807.9 ft/s
Pile Damping 1.00 %, Time Incr 0.197 ms, 2L/c 11.0 ms

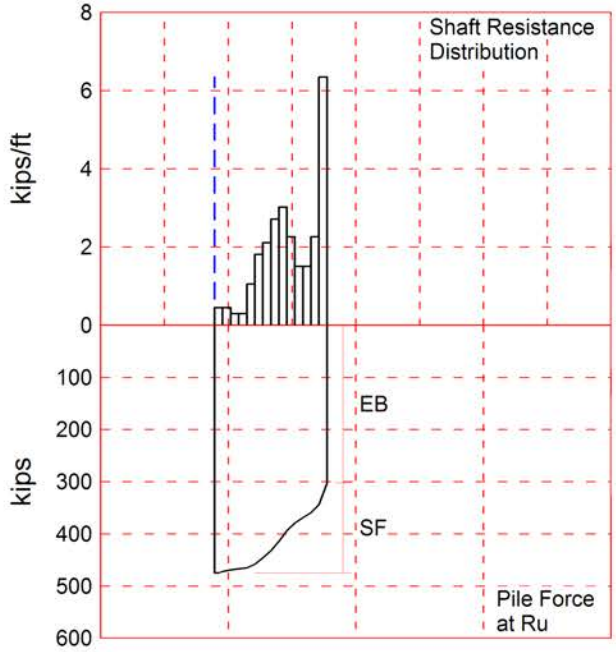
Total volume: 13.758 ft^3; Volume ratio considering added impedance: 1.000







RU =	475.0 kips
SF =	173.0 kips
EB =	302.0 kips
Dy =	1.01 in
Dx =	1.13 in
SET/Bl =	0.12 in



Length b. Sensors	92.6 ft
Embedment	92.6 ft
Top Area	21.4 in^2
End Bearing Area	198.5 in^2
Top Perimeter	4.70 ft
Top E-Modulus	29992 ksi
Top Spec. Weight	492.0 lb/ft^3
Top Wave Spd.	16808 ft/s
Overall W.S.	16808 ft/s
Match Quality	1.63
Top Compr. Stress	30.3 ksi
Max Compr. Stress	30.4 ksi
Max Tension Stress	-2.00 ksi
Avg. Shaft Quake	0.16 in
Toe Quake	0.21 in
Avg. Shaft Smith Dpg.	0.25 s/ft
Toe Smith Damping	0.11 s/ft

About the CAPWAP Results

The CAPWAP program performs a signal matching or reverse analysis based on measurements taken on a deep foundation under an impact load. The program is based on a one-dimensional mathematical model. Under certain conditions, the model only crudely approximates the often complex dynamic situations.

The CAPWAP analysis relies on the input of accurately measured dynamic data plus additional parameters describing pile and soil behavior. If the field measurements of force and velocity are incorrect or were taken under inappropriate conditions (e.g., at an inappropriate time or with too much or too little energy) or if the input pile model is incorrect, then the solution cannot represent the actual soil behavior.

Generally the CAPWAP analysis is used to estimate the axial compressive pile capacity and the soil resistance distribution. The long-term capacity is best evaluated with restrike tests since they incorporate soil strength changes (set-up gains or relaxation losses) that occur after installation. The calculated load settlement graph does not consider creep or long term consolidation settlements. When uplift is a controlling factor in the design, use of the CAPWAP results to assess uplift capacity should be made only after very careful analysis of only good measurement quality, and further used only with longer pile lengths and with nominally higher safety factors.

CAPWAP is also used to evaluate driving stresses along the length of the pile. However, it should be understood that the analysis is one dimensional and does not take into account bending effects or local contact stresses at the pile toe.

Furthermore, if the user of this software was not able to produce a solution with satisfactory signal "match quality" (MQ), then the associated CAPWAP results may be unreliable. There is no absolute scale for solution acceptability but solutions with MQ above 5 are generally considered less reliable than those with lower MQ values and every effort should be made to improve the analysis, for example, by getting help from other independent experts.

Considering the CAPWAP model limitations, the nature of the input parameters, the complexity of the analysis procedure, and the need for a responsible application of the results to actual construction projects, it is recommended that at least one static load test be performed on sites where little experience exists with dynamic behavior of the soil resistance or when the experience of the analyzing engineer with both program use and result application is limited.

Finally, the CAPWAP capacities are ultimate values. They MUST be reduced by means of an appropriate factor of safety to yield a design or working load. The selection of a factor of safety should consider the quality of the construction control, the variability of the site conditions, uncertainties in the loads, the importance of structure and other factors. The CAPWAP results should be reviewed by the Engineer of Record with consideration of applicable geotechnical conditions including, but not limited to, group effects, potential settlement from underlying compressible layers, soil resistances provided from any layers unsuitable for long term support, as well as effective stress changes due to soil surcharges, excavation or change in water table elevation.

The CAPWAP analysis software is one of many means by which the capacity of a deep foundation can be assessed. The engineer performing the analysis is responsible for proper software application and the analysis results. Pile Dynamics accepts no liability whatsoever of any kind for the analysis solution and/or the application of the analysis result.

CAPWAP SUMMARY RESULTS

Total CAPWAP Capacity: 475.0; along Shaft 173.0; at Toe 302.0 kips

Soil Sgmnt No.	Dist. Below Gages ft	Depth Below Grade ft	Ru kips	Force in Pile kips	Sum of Ru kips	Unit Resist. (Depth) kips/ft	Unit Resist. (Area) ksf
				475.0			
1	6.6	6.6	3.0	472.0	3.0	0.45	0.10
2	13.2	13.2	3.0	469.0	6.0	0.45	0.10
3	19.8	19.8	2.0	467.0	8.0	0.30	0.06
4	26.5	26.5	2.0	465.0	10.0	0.30	0.06
5	33.1	33.1	7.0	458.0	17.0	1.06	0.23
6	39.7	39.7	12.0	446.0	29.0	1.81	0.39
7	46.3	46.3	14.0	432.0	43.0	2.12	0.45
8	52.9	52.9	18.0	414.0	61.0	2.72	0.58
9	59.5	59.5	20.0	394.0	81.0	3.02	0.64
10	66.1	66.1	15.0	379.0	96.0	2.27	0.48
11	72.7	72.7	10.0	369.0	106.0	1.51	0.32
12	79.4	79.4	10.0	359.0	116.0	1.51	0.32
13	86.0	86.0	15.0	344.0	131.0	2.27	0.48
14	92.6	92.6	42.0	302.0	173.0	6.35	1.35
Avg. Shaft			12.4			1.87	0.40
Toe			302.0				219.08

Soil Model Parameters/Extensions		Shaft	Toe
Smith Damping Factor		0.25	0.11
Quake	(in)	0.16	0.21
Case Damping Factor		1.13	0.87
Damping Type		Viscous	Sm+Visc
Unloading Quake	(% of loading quake)	100	35
Reloading Level	(% of Ru)	100	100
Unloading Level	(% of Ru)	24	
Resistance Gap (included in Toe Quake)	(in)		0.01
Soil Plug Weight	(kips)	0.030	0.064

CAPWAP match quality = 1.63 (Wave Up Match) ; RSA = 0
Observed: Final Set = 0.12 in; Blow Count = 96 b/ft
Computed: Final Set = 0.13 in; Blow Count = 89 b/ft

max. Top Comp. Stress = 30.3 ksi (T= 26.6 ms, max= 1.006 x Top)
max. Comp. Stress = 30.4 ksi (Z= 6.6 ft, T= 26.8 ms)
max. Tens. Stress = -2.00 ksi (Z= 52.9 ft, T= 52.7 ms)
max. Energy (EMX) = 31.5 kip-ft; max. Measured Top Displ. (DMX)= 0.88 in

EXTREMA TABLE

Pile Sgmnt No.	Dist. Below Gages ft	max. Force kips	min. Force kips	max. Comp. Stress ksi	max. Tens. Stress ksi	max. Trnsfd. Energy kip-ft	max. Veloc. ft/s	max. Displ. in
1	3.3	648.0	-17.1	30.3	-0.80	31.5	15.7	0.89
2	6.6	651.7	-18.2	30.4	-0.85	31.3	15.6	0.87
4	13.2	644.7	-20.1	30.1	-0.94	30.3	15.4	0.84
6	19.8	636.4	-22.0	29.7	-1.03	29.2	15.2	0.81
8	26.5	635.3	-23.9	29.7	-1.12	28.2	15.0	0.76
10	33.1	643.7	-28.7	30.1	-1.34	27.1	14.5	0.71
12	39.7	636.9	-37.2	29.8	-1.74	25.0	13.8	0.66
14	46.3	613.1	-41.2	28.6	-1.92	22.2	13.1	0.61
15	49.6	573.6	-38.4	26.8	-1.79	19.9	12.6	0.58
16	52.9	588.0	-42.8	27.5	-2.00	19.4	12.2	0.55
17	56.2	537.8	-37.4	25.1	-1.75	16.9	11.8	0.53
18	59.5	550.5	-39.9	25.7	-1.87	16.4	11.4	0.50
19	62.8	493.1	-31.4	23.0	-1.47	14.0	11.1	0.47
20	66.1	502.8	-32.2	23.5	-1.50	13.5	10.8	0.45
21	69.4	468.1	-26.1	21.9	-1.22	11.8	10.4	0.42
22	72.7	477.3	-26.9	22.3	-1.26	11.4	10.2	0.40
23	76.0	447.5	-23.0	20.9	-1.08	10.3	10.1	0.38
24	79.4	451.8	-24.1	21.1	-1.12	9.9	10.0	0.35
25	82.7	432.7	-21.2	20.2	-0.99	8.9	9.8	0.33
26	86.0	440.6	-21.9	20.6	-1.02	8.6	10.6	0.31
27	89.3	435.3	-20.8	20.3	-0.97	7.4	11.2	0.29
28	92.6	461.4	-21.3	21.6	-0.99	5.7	10.7	0.27
Absolute	6.6			30.4			(T =	26.8 ms)
	52.9				-2.00		(T =	52.7 ms)

CASE METHOD

J =	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
RP	746.6	695.5	644.4	593.3	542.1	491.0	439.9	388.8	337.7	286.5
RX	750.4	708.6	666.8	626.6	586.7	567.1	547.7	528.4	510.1	493.0
RU	754.8	704.5	654.2	603.9	553.6	503.3	453.0	402.7	352.4	302.1

RAU = 292.2 (kips); RA2 = 535.2 (kips)

Current CAPWAP Ru = 475.0 (kips); Corresponding J(RP)= 0.53; matches RX9 within 5%

VMX ft/s	TVP ms	VT1*Z kips	FT1 kips	FMX kips	DMX in	DFN in	SET in	EMX kip-ft	QUS kips	KEB kips/in
15.7	26.36	599.6	658.2	658.2	0.88	0.13	0.12	31.8	761.8	1510

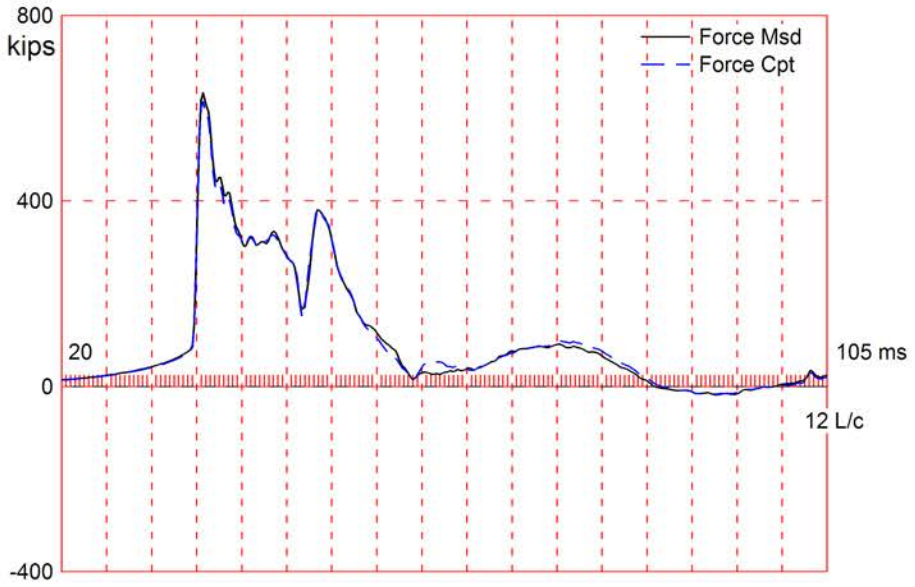
PILE PROFILE AND PILE MODEL

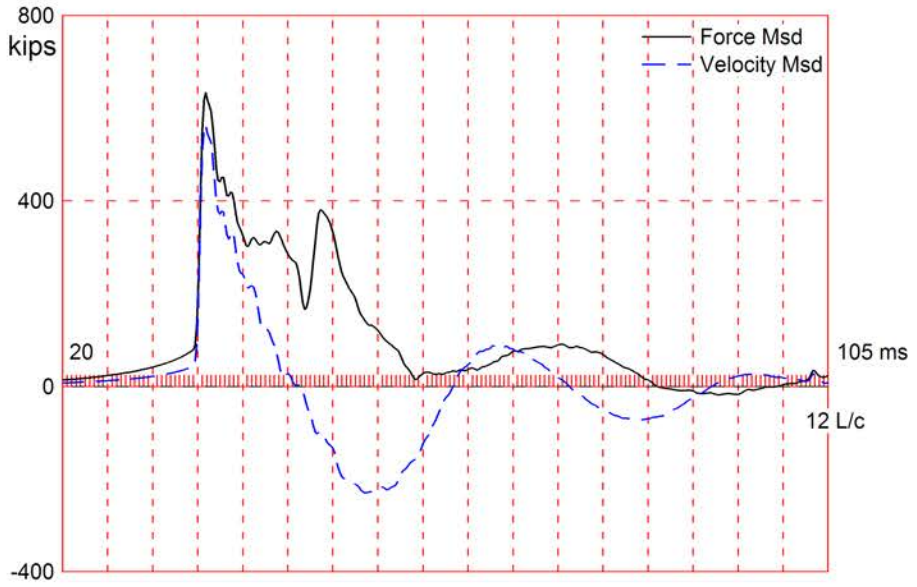
Depth ft	Area in^2	E-Modulus ksi	Spec. Weight lb/ft^3	Perim. ft
0.0	21.4	29992.2	492.000	4.70
92.6	21.4	29992.2	492.000	4.70

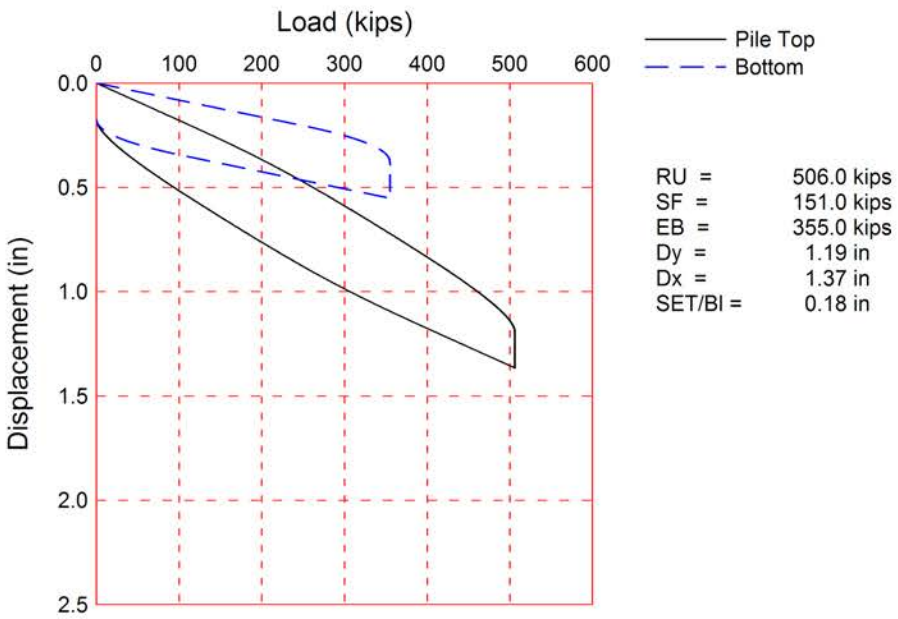
Toe Area 198.5 in^2

Segmnt Number	Dist. B.G. ft	Impedance kips/ft/s	Imped. Change %	Slack in	Tension Eff.	Compression Slack in	Compression Eff.	Perim. ft	Wave Speed ft/s	Soil Plug kips
1	3.3	38.20	0.00	0.00	0.000	-0.00	0.000	4.70	16807.9	0.000
23	76.0	38.20	0.00	0.00	0.000	-0.00	0.000	4.70	16807.9	0.020
24	79.4	38.20	0.00	0.00	0.000	-0.00	0.000	4.70	16807.9	0.010
25	82.7	38.20	0.00	0.00	0.000	-0.00	0.000	4.70	16807.9	0.000
28	92.6	38.20	0.00	0.00	0.000	-0.00	0.000	4.70	16807.9	0.000

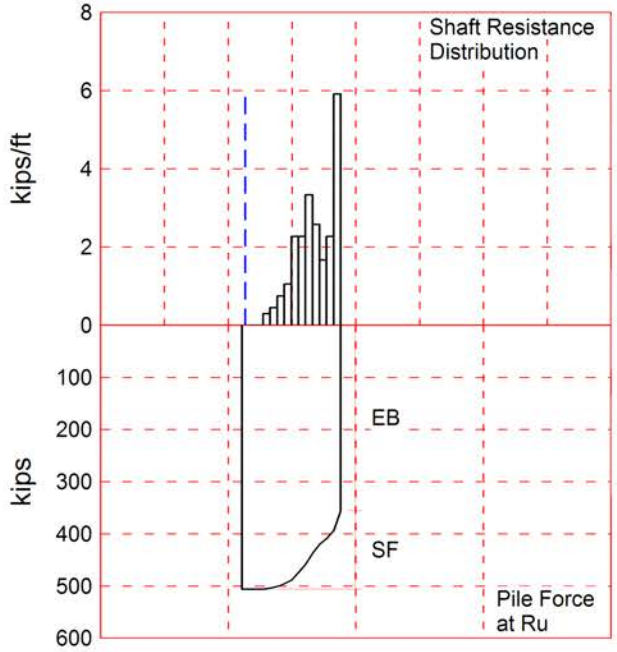
Wave Speed: Pile Top 16807.9, Elastic 16807.9, Overall 16807.9 ft/s
Pile Damping 1.00 %, Time Incr 0.197 ms, 2L/c 11.0 ms
Total volume: 13.758 ft^3, Volume ratio considering added impedance: 1.000







RU =	506.0 kips
SF =	151.0 kips
EB =	355.0 kips
Dy =	1.19 in
Dx =	1.37 in
SET/Bl =	0.18 in



Length b. Sensors	92.3 ft
Embedment	87.5 ft
Top Area	21.4 in^2
End Bearing Area	198.5 in^2
Top Perimeter	4.70 ft
Top E-Modulus	29992 ksi
Top Spec. Weight	492.0 lb/ft^3
Top Wave Spd.	16808 ft/s
Overall W.S.	16808 ft/s
Match Quality	2.02
Top Compr. Stress	28.7 ksi
Max Compr. Stress	29.2 ksi
Max Tension Stress	-3.51 ksi
Avg. Shaft Quake	0.16 in
Toe Quake	0.29 in
Avg. Shaft Smith Dpg.	0.24 s/ft
Toe Smith Damping	0.09 s/ft

About the CAPWAP Results

The CAPWAP program performs a signal matching or reverse analysis based on measurements taken on a deep foundation under an impact load. The program is based on a one-dimensional mathematical model. Under certain conditions, the model only crudely approximates the often complex dynamic situations.

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CAPWAP is also used to evaluate driving stresses along the length of the pile. However, it should be understood that the analysis is one dimensional and does not take into account bending effects or local contact stresses at the pile toe.

Furthermore, if the user of this software was not able to produce a solution with satisfactory signal "match quality" (MQ), then the associated CAPWAP results may be unreliable. There is no absolute scale for solution acceptability but solutions with MQ above 5 are generally considered less reliable than those with lower MQ values and every effort should be made to improve the analysis, for example, by getting help from other independent experts.

Considering the CAPWAP model limitations, the nature of the input parameters, the complexity of the analysis procedure, and the need for a responsible application of the results to actual construction projects, it is recommended that at least one static load test be performed on sites where little experience exists with dynamic behavior of the soil resistance or when the experience of the analyzing engineer with both program use and result application is limited.

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The CAPWAP analysis software is one of many means by which the capacity of a deep foundation can be assessed. The engineer performing the analysis is responsible for proper software application and the analysis results. Pile Dynamics accepts no liability whatsoever of any kind for the analysis solution and/or the application of the analysis result.

CAPWAP SUMMARY RESULTS

Total CAPWAP Capacity: 506.0; along Shaft 151.0; at Toe 355.0 kips

Soil Sgmnt No.	Dist. Below Gages ft	Depth Below Grade ft	Ru kips	Force in Pile kips	Sum of Ru kips	Unit Resist. (Depth) kips/ft	Unit Resist. (Area) ksf	Smith Damping Factor s/ft
				506.0				
1	13.2	8.5	0.0	506.0	0.0	0.00	0.00	0.00
2	19.8	15.0	0.0	506.0	0.0	0.00	0.00	0.00
3	26.4	21.6	2.0	504.0	2.0	0.30	0.06	0.24
4	32.9	28.2	3.0	501.0	5.0	0.46	0.10	0.24
5	39.5	34.8	5.0	496.0	10.0	0.76	0.16	0.24
6	46.1	41.4	7.0	489.0	17.0	1.06	0.23	0.24
7	52.7	48.0	15.0	474.0	32.0	2.28	0.48	0.24
8	59.3	54.6	15.0	459.0	47.0	2.28	0.48	0.24
9	65.9	61.2	22.0	437.0	69.0	3.34	0.71	0.24
10	72.5	67.8	17.0	420.0	86.0	2.58	0.55	0.24
11	79.1	74.3	11.0	409.0	97.0	1.67	0.36	0.24
12	85.7	80.9	15.0	394.0	112.0	2.28	0.48	0.24
13	92.3	87.5	39.0	355.0	151.0	5.92	1.26	0.24
Avg. Shaft			11.6			1.73	0.37	0.24
Toe			355.0				257.53	0.09

Soil Model Parameters/Extensions		Shaft	Toe
Quake	(in)	0.16	0.29
Case Damping Factor		0.95	0.84
Damping Type		Viscous	Sm+Visc
Unloading Quake	(% of loading quake)	52	30
Reloading Level	(% of Ru)	100	100
Unloading Level	(% of Ru)	18	
Resistance Gap (included in Toe Quake)	(in)		0.07
Soil Plug Weight	(kips)	0.040	0.233

CAPWAP match quality = 2.02 (Wave Up Match) ; RSA = 0
Observed: Final Set = 0.18 in; Blow Count = 69 b/ft
Computed: Final Set = 0.17 in; Blow Count = 70 b/ft

max. Top Comp. Stress = 28.7 ksi (T= 36.1 ms, max= 1.017 x Top)
max. Comp. Stress = 29.2 ksi (Z= 26.4 ft, T= 37.4 ms)
max. Tens. Stress = -3.51 ksi (Z= 59.3 ft, T= 62.7 ms)
max. Energy (EMX) = 30.3 kip-ft; max. Measured Top Displ. (DMX)= 0.93 in

EXTREMA TABLE

Pile Sgmnt No.	Dist. Below Gages ft	max. Force kips	min. Force kips	max. Comp. Stress ksi	max. Tens. Stress ksi	max. Trnsfd. Energy kip-ft	max. Veloc. ft/s	max. Displ. in
1	3.3	615.0	-18.5	28.7	-0.86	30.3	15.2	0.95
2	6.6	615.7	-20.3	28.8	-0.95	30.2	15.2	0.94
4	13.2	617.1	-25.0	28.8	-1.17	29.8	15.2	0.90
6	19.8	619.8	-29.3	29.0	-1.37	29.4	15.1	0.87
8	26.4	625.7	-32.0	29.2	-1.50	28.9	14.9	0.83
10	32.9	624.8	-40.0	29.2	-1.87	27.8	14.7	0.78
12	39.5	623.1	-54.9	29.1	-2.57	26.4	14.3	0.73
14	46.1	618.5	-65.5	28.9	-3.06	24.7	13.9	0.68
15	49.4	602.7	-68.2	28.2	-3.18	23.2	13.5	0.66
16	52.7	615.0	-74.7	28.7	-3.49	22.7	13.2	0.63
17	56.0	567.3	-72.3	26.5	-3.38	20.3	12.8	0.61
18	59.3	581.0	-75.1	27.1	-3.51	19.7	12.4	0.58
19	62.6	540.9	-69.7	25.3	-3.26	17.4	12.0	0.55
20	65.9	557.9	-70.5	26.1	-3.29	16.9	11.6	0.52
21	69.2	499.2	-60.6	23.3	-2.83	14.1	11.0	0.50
22	72.5	509.3	-62.0	23.8	-2.90	13.6	10.7	0.47
23	75.8	450.5	-54.7	21.0	-2.55	11.6	10.7	0.44
24	79.1	460.0	-56.0	21.5	-2.62	11.1	10.6	0.42
25	82.4	465.1	-53.4	21.7	-2.50	9.7	10.4	0.39
26	85.7	467.2	-53.3	21.8	-2.49	9.3	11.2	0.37
27	89.0	456.1	-48.6	21.3	-2.27	7.9	11.6	0.34
28	92.3	468.6	-48.9	21.9	-2.28	5.8	11.9	0.32
Absolute	26.4			29.2			(T =	37.4 ms)
	59.3				-3.51		(T =	62.7 ms)

CASE METHOD

J =	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
RP	697.0	645.9	594.8	543.7	492.6	441.5	390.5	339.4	288.3	237.2
RX	697.0	654.6	623.3	605.5	587.7	569.9	552.1	534.3	516.5	498.7
RU	698.7	647.8	596.9	546.0	495.1	444.2	393.3	342.4	291.5	240.6

RAU = 321.1 (kips); RA2 = 539.8 (kips)

Current CAPWAP Ru = 506.0 (kips); Corresponding J(RP)= 0.37; J(RX) = 0.86

VMX ft/s	TVP ms	VT1*Z kips	FT1 kips	FMX kips	DMX in	DFN in	SET in	EMX kip-ft	QUS kips	KEB kips/in
14.9	35.87	569.3	638.5	638.5	0.93	0.18	0.18	30.3	660.5	1614

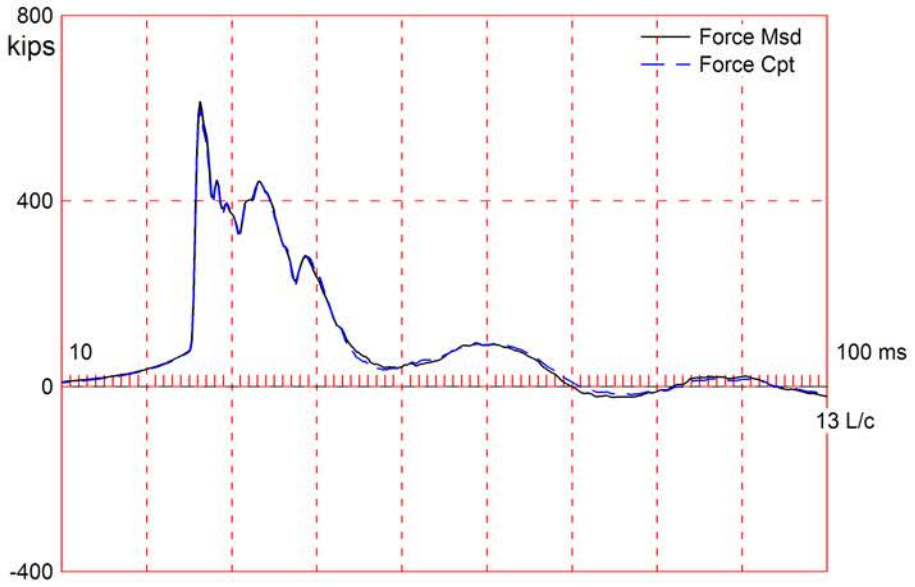
PILE PROFILE AND PILE MODEL

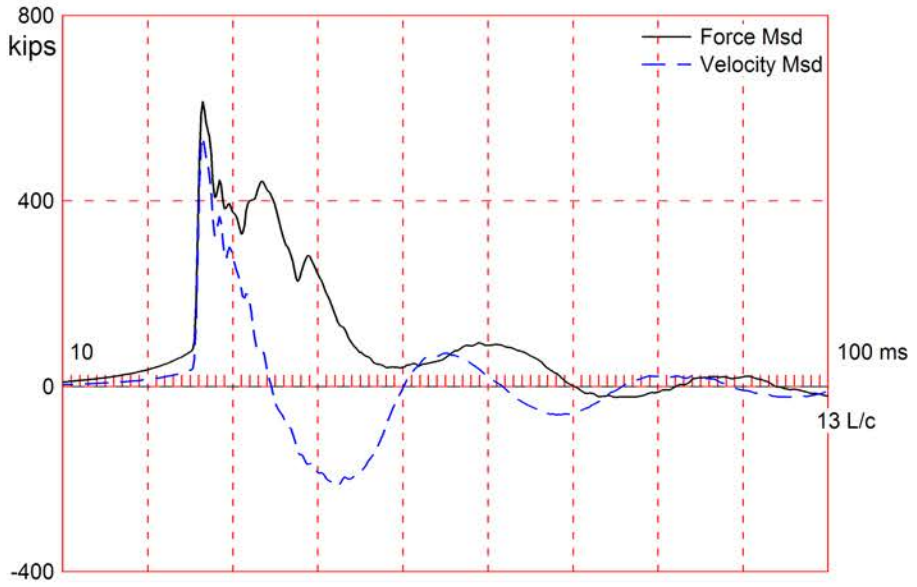
Depth ft	Area in^2	E-Modulus ksi	Spec. Weight lb/ft^3	Perim. ft
0.0	21.4	29992.2	492.000	4.70
92.3	21.4	29992.2	492.000	4.70

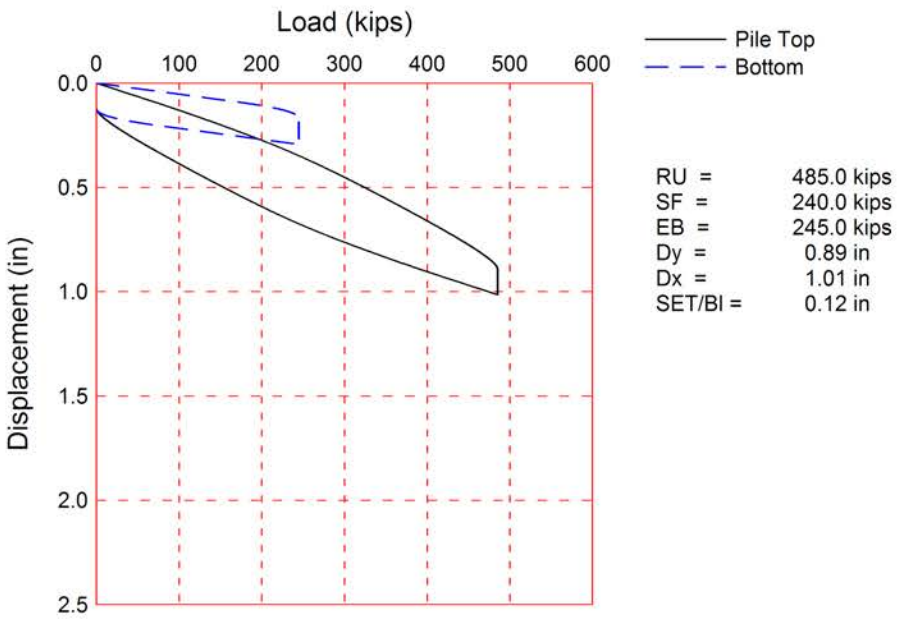
Toe Area 198.5 in^2

Segmnt Number	Dist. B.G. ft	Impedance kips/ft/s	Imped. Change %	Slack in	Tension Eff.	Compression Slack in	Compression Eff.	Perim. ft	Wave Speed ft/s	Soil Plug kips
1	3.3	38.20	0.00	0.00	0.000	-0.00	0.000	4.70	16807.9	0.000
23	75.8	38.20	0.00	0.00	0.000	-0.00	0.000	4.70	16807.9	0.030
24	79.1	38.20	0.00	0.00	0.000	-0.00	0.000	4.70	16807.9	0.010
25	82.4	38.20	0.00	0.00	0.000	-0.00	0.000	4.70	16807.9	0.000
28	92.3	38.20	0.00	0.00	0.000	-0.00	0.000	4.70	16807.9	0.000

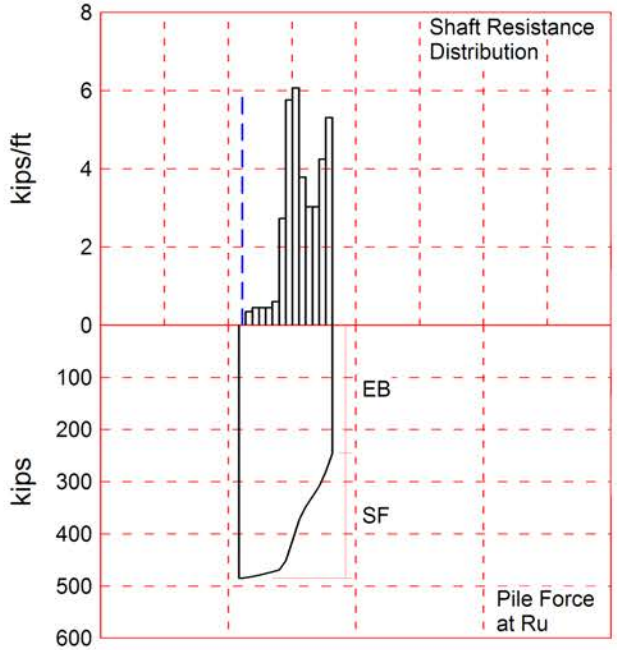
Wave Speed: Pile Top 16807.9, Elastic 16807.9, Overall 16807.9 ft/s
Pile Damping 1.00 %, Time Incr 0.196 ms, 2L/c 11.0 ms
Total volume: 13.709 ft^3; Volume ratio considering added impedance: 1.000







RU =	485.0 kips
SF =	240.0 kips
EB =	245.0 kips
Dy =	0.89 in
Dx =	1.01 in
SET/Bl =	0.12 in



Length b. Sensors	92.3 ft
Embedment	87.6 ft
Top Area	21.4 in^2
End Bearing Area	198.5 in^2
Top Perimeter	4.70 ft
Top E-Modulus	29992 ksi
Top Spec. Weight	492.0 lb/ft^3
Top Wave Spd.	16808 ft/s
Overall W.S.	16808 ft/s
Match Quality	1.73
Top Compr. Stress	28.0 ksi
Max Compr. Stress	28.8 ksi
Max Tension Stress	-1.31 ksi
Avg. Shaft Quake	0.09 in
Toe Quake	0.13 in
Avg. Shaft Smith Dpg.	0.30 s/ft
Toe Smith Damping	0.09 s/ft

About the CAPWAP Results

The CAPWAP program performs a signal matching or reverse analysis based on measurements taken on a deep foundation under an impact load. The program is based on a one-dimensional mathematical model. Under certain conditions, the model only crudely approximates the often complex dynamic situations.

The CAPWAP analysis relies on the input of accurately measured dynamic data plus additional parameters describing pile and soil behavior. If the field measurements of force and velocity are incorrect or were taken under inappropriate conditions (e.g., at an inappropriate time or with too much or too little energy) or if the input pile model is incorrect, then the solution cannot represent the actual soil behavior.

Generally the CAPWAP analysis is used to estimate the axial compressive pile capacity and the soil resistance distribution. The long-term capacity is best evaluated with restrike tests since they incorporate soil strength changes (set-up gains or relaxation losses) that occur after installation. The calculated load settlement graph does not consider creep or long term consolidation settlements. When uplift is a controlling factor in the design, use of the CAPWAP results to assess uplift capacity should be made only after very careful analysis of only good measurement quality, and further used only with longer pile lengths and with nominally higher safety factors.

CAPWAP is also used to evaluate driving stresses along the length of the pile. However, it should be understood that the analysis is one dimensional and does not take into account bending effects or local contact stresses at the pile toe.

Furthermore, if the user of this software was not able to produce a solution with satisfactory signal "match quality" (MQ), then the associated CAPWAP results may be unreliable. There is no absolute scale for solution acceptability but solutions with MQ above 5 are generally considered less reliable than those with lower MQ values and every effort should be made to improve the analysis, for example, by getting help from other independent experts.

Considering the CAPWAP model limitations, the nature of the input parameters, the complexity of the analysis procedure, and the need for a responsible application of the results to actual construction projects, it is recommended that at least one static load test be performed on sites where little experience exists with dynamic behavior of the soil resistance or when the experience of the analyzing engineer with both program use and result application is limited.

Finally, the CAPWAP capacities are ultimate values. They MUST be reduced by means of an appropriate factor of safety to yield a design or working load. The selection of a factor of safety should consider the quality of the construction control, the variability of the site conditions, uncertainties in the loads, the importance of structure and other factors. The CAPWAP results should be reviewed by the Engineer of Record with consideration of applicable geotechnical conditions including, but not limited to, group effects, potential settlement from underlying compressible layers, soil resistances provided from any layers unsuitable for long term support, as well as effective stress changes due to soil surcharges, excavation or change in water table elevation.

The CAPWAP analysis software is one of many means by which the capacity of a deep foundation can be assessed. The engineer performing the analysis is responsible for proper software application and the analysis results. Pile Dynamics accepts no liability whatsoever of any kind for the analysis solution and/or the application of the analysis result.

CAPWAP SUMMARY RESULTS

Total CAPWAP Capacity: 485.0; along Shaft 240.0; at Toe 245.0 kips

Soil Sgmnt No.	Dist. Below Gages ft	Depth Below Grade ft	Ru kips	Force in Pile kips	Sum of Ru kips	Unit Resist. (Depth) kips/ft	Unit Resist. (Area) ksf
				485.0			
1	13.2	8.6	3.0	482.0	3.0	0.35	0.07
2	19.8	15.1	3.0	479.0	6.0	0.46	0.10
3	26.4	21.7	3.0	476.0	9.0	0.46	0.10
4	32.9	28.3	3.0	473.0	12.0	0.46	0.10
5	39.5	34.9	4.0	469.0	16.0	0.61	0.13
6	46.1	41.5	18.0	451.0	34.0	2.73	0.58
7	52.7	48.1	38.0	413.0	72.0	5.77	1.23
8	59.3	54.7	40.0	373.0	112.0	6.07	1.29
9	65.9	61.3	25.0	348.0	137.0	3.79	0.81
10	72.5	67.9	20.0	328.0	157.0	3.04	0.65
11	79.1	74.4	20.0	308.0	177.0	3.04	0.65
12	85.7	81.0	28.0	280.0	205.0	4.25	0.90
13	92.3	87.6	35.0	245.0	240.0	5.31	1.13
Avg. Shaft			18.5			2.74	0.58
Toe			245.0				177.73

Soil Model Parameters/Extensions		Shaft	Toe
Smith Damping Factor		0.30	0.09
Quake	(in)	0.09	0.13
Case Damping Factor		1.88	0.58
Damping Type		Viscous	Sm+Visc
Unloading Quake	(% of loading quake)	100	109
Reloading Level	(% of Ru)	100	100
Soil Plug Weight	(kips)	0.170	0.094

CAPWAP match quality = 1.73 (Wave Up Match) ; RSA = 0
Observed: Final Set = 0.12 in; Blow Count = 96 b/ft
Computed: Final Set = 0.13 in; Blow Count = 93 b/ft

Transducer F3(F607) CAL: 93.6; RF: 1.00; F4(D815) CAL: 93.0; RF: 1.00
A3(K2524) CAL: 360; RF: 1.08; A4(K3550) CAL: 360; RF: 1.08

max. Top Comp. Stress = 28.0 ksi (T= 26.7 ms, max= 1.030 x Top)
max. Comp. Stress = 28.8 ksi (Z= 46.1 ft, T= 29.4 ms)
max. Tens. Stress = -1.31 ksi (Z= 32.9 ft, T= 75.1 ms)
max. Energy (EMX) = 26.5 kip-ft; max. Measured Top Displ. (DMX)= 0.79 in

EXTREMA TABLE

Pile Sgmnt No.	Dist. Below Gages ft	max. Force kips	min. Force kips	max. Comp. Stress ksi	max. Tens. Stress ksi	max. Trnsfd. Energy kip-ft	max. Veloc. ft/s	max. Displ. in
1	3.3	598.5	-19.6	28.0	-0.92	26.5	14.5	0.79
2	6.6	600.7	-21.1	28.1	-0.99	26.1	14.4	0.76
4	13.2	609.0	-25.3	28.5	-1.18	25.3	14.2	0.71
6	19.8	601.8	-26.3	28.1	-1.23	23.9	13.9	0.66
8	26.4	595.1	-27.5	27.8	-1.29	22.7	13.7	0.62
10	32.9	589.2	-28.1	27.5	-1.31	21.4	13.4	0.57
12	39.5	589.9	-27.8	27.6	-1.30	20.0	12.9	0.52
14	46.1	616.3	-25.6	28.8	-1.20	18.5	11.8	0.46
15	49.4	573.6	-8.3	26.8	-0.39	16.2	10.8	0.44
16	52.7	601.1	-9.1	28.1	-0.42	15.7	10.1	0.41
17	56.0	490.2	0.0	22.9	0.00	12.3	9.2	0.38
18	59.3	512.0	0.0	23.9	0.00	11.9	8.6	0.36
19	62.6	409.3	0.0	19.1	0.00	9.0	8.0	0.33
20	65.9	427.2	0.0	20.0	0.00	8.6	7.4	0.31
21	69.2	370.4	0.0	17.3	0.00	7.0	6.9	0.29
22	72.5	379.9	-0.0	17.7	-0.00	6.7	6.7	0.27
23	75.8	350.4	-0.0	16.4	-0.00	5.5	6.5	0.25
24	79.1	350.8	-0.0	16.4	-0.00	5.2	6.5	0.23
25	82.4	328.8	-0.0	15.4	-0.00	4.3	6.2	0.21
26	85.7	332.5	-0.0	15.5	-0.00	4.0	6.4	0.19
27	89.0	309.7	-0.0	14.5	-0.00	3.0	7.0	0.17
28	92.3	310.6	-0.0	14.5	-0.00	2.2	7.0	0.16
Absolute	46.1			28.8			(T =	29.4 ms)
	32.9				-1.31		(T =	75.1 ms)

CASE METHOD

J =	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
RP	760.3	720.4	680.5	640.6	600.6	560.7	520.8	480.9	440.9	401.0
RX	760.3	720.4	680.5	640.6	600.6	560.7	526.0	501.8	482.4	466.5
RU	779.3	741.3	703.2	665.2	627.2	589.1	551.1	513.1	475.1	437.0

RAU = 101.5 (kips); RA2 = 505.6 (kips)

Current CAPWAP Ru = 485.0 (kips); Corresponding J(RP)= 0.69; J(RX) = 0.79

VMX ft/s	TVP ms	VT1*Z kips	FT1 kips	FMX kips	DMX in	DFN in	SET in	EMX kip-ft	QUS kips	KEB kips/in
14.2	26.46	542.8	616.8	619.4	0.79	0.12	0.12	26.9	707.9	1885

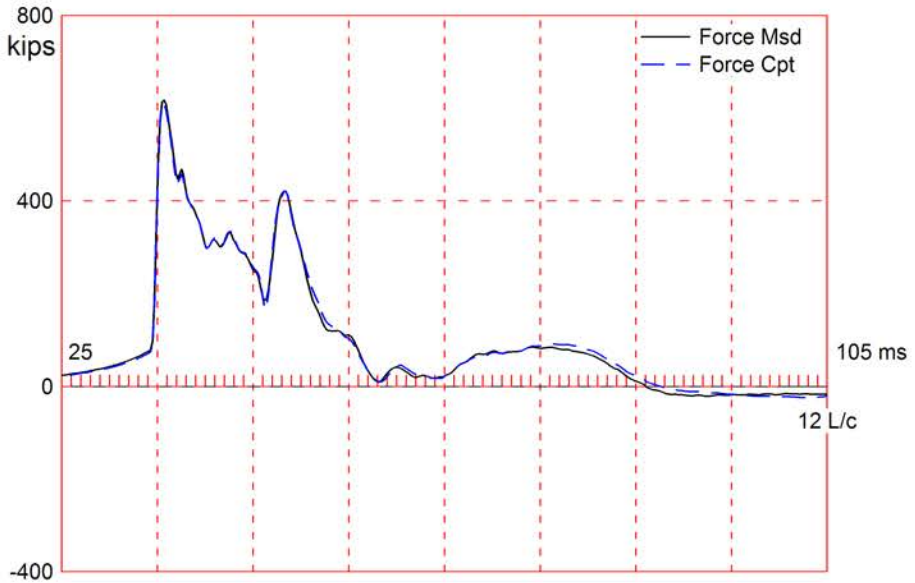
PILE PROFILE AND PILE MODEL

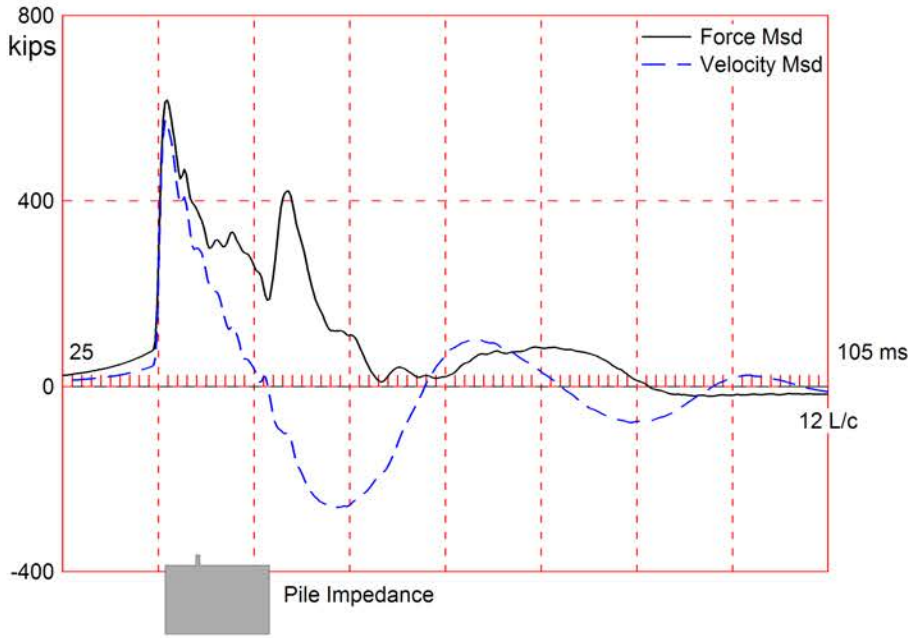
Depth ft	Area in^2	E-Modulus ksi	Spec. Weight lb/ft^3	Perim. ft
0.0	21.4	29992.2	492.000	4.70
92.3	21.4	29992.2	492.000	4.70

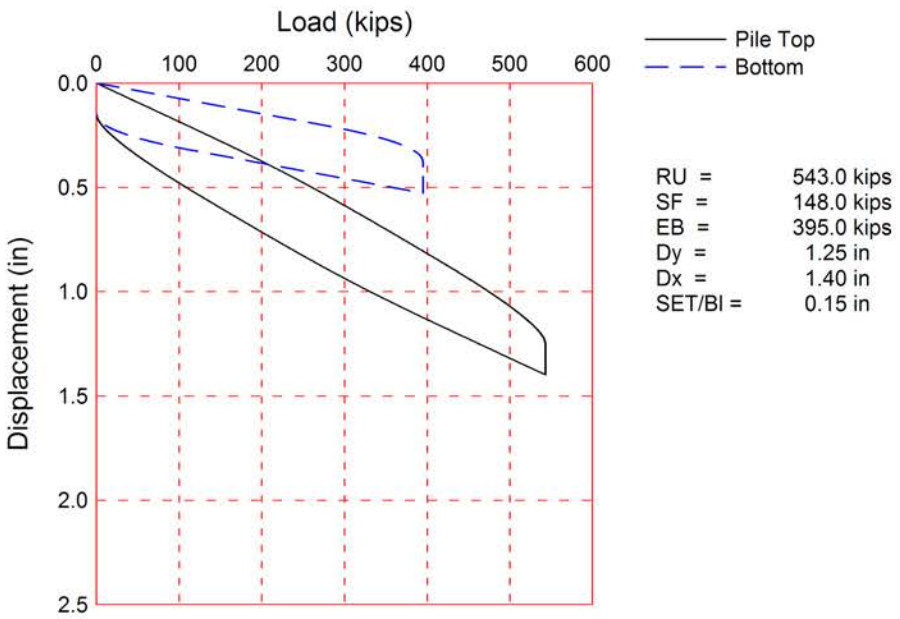
Toe Area 198.5 in^2

Segmnt Number	Dist. B.G. ft	Impedance kips/ft/s	Imped. Change %	Slack in	Tension Eff.	Compression Slack in	Compression Eff.	Perim. ft	Wave Speed ft/s	Soil Plug kips
1	3.3	38.20	0.00	0.00	0.000	-0.00	0.000	4.70	16807.9	0.000
21	69.2	38.20	0.00	0.00	0.000	-0.00	0.000	4.70	16807.9	0.020
22	72.5	38.20	0.00	0.00	0.000	-0.00	0.000	4.70	16807.9	0.050
25	82.4	38.20	0.00	0.00	0.000	-0.00	0.000	4.70	16807.9	0.000
28	92.3	38.20	0.00	0.00	0.000	-0.00	0.000	4.70	16807.9	0.000

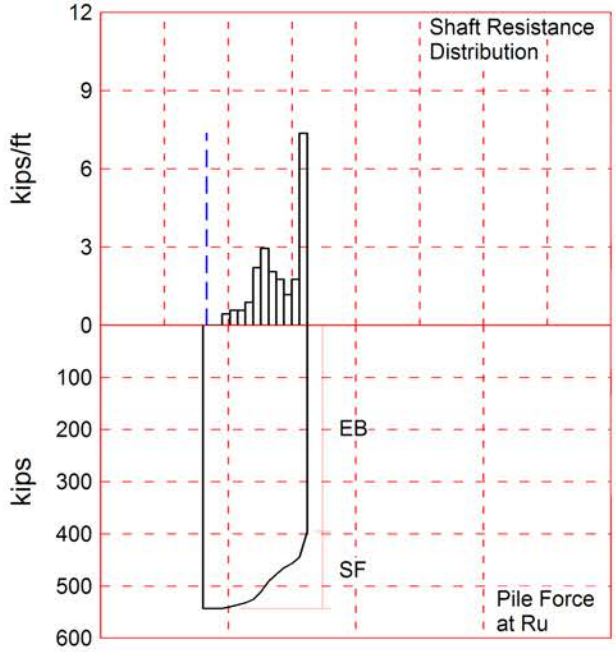
Wave Speed: Pile Top 16807.9, Elastic 16807.9, Overall 16807.9 ft/s
Pile Damping 1.00 %, Time Incr 0.196 ms, 2L/c 11.0 ms
Total volume: 13.709 ft^3; Volume ratio considering added impedance: 1.000







RU =	543.0 kips
SF =	148.0 kips
EB =	395.0 kips
Dy =	1.25 in
Dx =	1.40 in
SET/Bl =	0.15 in



Length b. Sensors	91.5 ft
Embedment	86.7 ft
Top Area	21.4 in^2
End Bearing Area	198.5 in^2
Top Perimeter	4.70 ft
Top E-Modulus	29992 ksi
Top Spec. Weight	492.0 lb/ft^3
Top Wave Spd.	16808 ft/s
Overall W.S.	16808 ft/s
Match Quality	1.96
Top Compr. Stress	28.5 ksi
Max Compr. Stress	30.0 ksi
Max Tension Stress	-4.38 ksi
Avg. Shaft Quake	0.21 in
Toe Quake	0.29 in
Avg. Shaft Smith Dpg.	0.24 s/ft
Toe Smith Damping	0.10 s/ft

About the CAPWAP Results

The CAPWAP program performs a signal matching or reverse analysis based on measurements taken on a deep foundation under an impact load. The program is based on a one-dimensional mathematical model. Under certain conditions, the model only crudely approximates the often complex dynamic situations.

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CAPWAP is also used to evaluate driving stresses along the length of the pile. However, it should be understood that the analysis is one dimensional and does not take into account bending effects or local contact stresses at the pile toe.

Furthermore, if the user of this software was not able to produce a solution with satisfactory signal "match quality" (MQ), then the associated CAPWAP results may be unreliable. There is no absolute scale for solution acceptability but solutions with MQ above 5 are generally considered less reliable than those with lower MQ values and every effort should be made to improve the analysis, for example, by getting help from other independent experts.

Considering the CAPWAP model limitations, the nature of the input parameters, the complexity of the analysis procedure, and the need for a responsible application of the results to actual construction projects, it is recommended that at least one static load test be performed on sites where little experience exists with dynamic behavior of the soil resistance or when the experience of the analyzing engineer with both program use and result application is limited.

Finally, the CAPWAP capacities are ultimate values. They MUST be reduced by means of an appropriate factor of safety to yield a design or working load. The selection of a factor of safety should consider the quality of the construction control, the variability of the site conditions, uncertainties in the loads, the importance of structure and other factors. The CAPWAP results should be reviewed by the Engineer of Record with consideration of applicable geotechnical conditions including, but not limited to, group effects, potential settlement from underlying compressible layers, soil resistances provided from any layers unsuitable for long term support, as well as effective stress changes due to soil surcharges, excavation or change in water table elevation.

The CAPWAP analysis software is one of many means by which the capacity of a deep foundation can be assessed. The engineer performing the analysis is responsible for proper software application and the analysis results. Pile Dynamics accepts no liability whatsoever of any kind for the analysis solution and/or the application of the analysis result.

CAPWAP SUMMARY RESULTS

Total CAPWAP Capacity: 543.0; along Shaft 148.0; at Toe 395.0 kips

Soil Sgmnt No.	Dist. Below Gages ft	Depth Below Grade ft	Ru kips	Force in Pile kips	Sum of Ru kips	Unit Resist. (Depth) kips/ft	Unit Resist. (Area) ksf	Smith Damping Factor s/ft
				543.0				
1	10.2	5.3	0.0	543.0	0.0	0.00	0.00	0.00
2	16.9	12.1	0.0	543.0	0.0	0.00	0.00	0.00
3	23.7	18.9	3.0	540.0	3.0	0.44	0.09	0.24
4	30.5	25.7	4.0	536.0	7.0	0.59	0.13	0.24
5	37.3	32.4	4.0	532.0	11.0	0.59	0.13	0.24
6	44.1	39.2	6.0	526.0	17.0	0.89	0.19	0.24
7	50.8	46.0	15.0	511.0	32.0	2.21	0.47	0.24
8	57.6	52.8	20.0	491.0	52.0	2.95	0.63	0.24
9	64.4	59.5	14.0	477.0	66.0	2.07	0.44	0.24
10	71.2	66.3	12.0	465.0	78.0	1.77	0.38	0.24
11	77.9	73.1	8.0	457.0	86.0	1.18	0.25	0.24
12	84.7	79.9	12.0	445.0	98.0	1.77	0.38	0.24
13	91.5	86.7	50.0	395.0	148.0	7.38	1.57	0.24
Avg. Shaft			11.4			1.71	0.36	0.24
Toe			395.0				286.55	0.10

Soil Model Parameters/Extensions		Shaft	Toe
Quake	(in)	0.21	0.29
Case Damping Factor		0.93	1.03
Damping Type		Viscous	Sm+Visc
Unloading Quake	(% of loading quake)	100	53
Reloading Level	(% of Ru)	100	100
Unloading Level	(% of Ru)	58	
Resistance Gap (included in Toe Quake)	(in)		0.08
Soil Plug Weight	(kips)	0.030	0.098

CAPWAP match quality = 1.96 (Wave Up Match) ; RSA = 0
Observed: Final Set = 0.15 in; Blow Count = 80 b/ft
Computed: Final Set = 0.13 in; Blow Count = 93 b/ft

max. Top Comp. Stress = 28.5 ksi (T= 36.1 ms, max= 1.050 x Top)
max. Comp. Stress = 30.0 ksi (Z= 23.7 ft, T= 37.3 ms)
max. Tens. Stress = -4.38 ksi (Z= 50.8 ft, T= 61.7 ms)
max. Energy (EMX) = 31.2 kip-ft; max. Measured Top Displ. (DMX)= 0.96 in

EXTREMA TABLE

Pile Sgmnt No.	Dist. Below Gages ft	max. Force kips	min. Force kips	max. Comp. Stress ksi	max. Tens. Stress ksi	max. Trnsfd. Energy kip-ft	max. Veloc. ft/s	max. Displ. in
1	3.4	610.6	-23.0	28.5	-1.07	31.2	15.2	0.97
2	6.8	611.4	-21.9	28.6	-1.02	31.0	15.2	0.96
4	13.6	613.2	-25.2	28.6	-1.18	30.7	15.1	0.92
6	20.3	634.8	-30.0	29.7	-1.40	30.2	14.7	0.88
8	27.1	618.8	-41.7	28.9	-1.95	29.0	14.6	0.84
10	33.9	606.3	-60.9	28.3	-2.85	27.4	14.5	0.79
12	40.7	601.2	-77.1	28.1	-3.60	25.7	14.1	0.74
13	44.1	612.6	-85.6	28.6	-4.00	25.3	13.9	0.71
14	47.4	600.5	-87.0	28.1	-4.07	23.8	13.5	0.69
15	50.8	615.9	-93.7	28.8	-4.38	23.3	13.2	0.66
16	54.2	571.9	-85.2	26.7	-3.98	20.6	12.7	0.63
17	57.6	584.3	-87.6	27.3	-4.09	20.0	12.4	0.60
18	61.0	520.1	-71.0	24.3	-3.32	17.0	12.1	0.57
19	64.4	529.5	-71.6	24.7	-3.34	16.5	11.8	0.54
20	67.8	487.6	-60.4	22.8	-2.82	14.4	11.6	0.51
21	71.2	494.2	-62.4	23.1	-2.92	13.8	11.4	0.48
22	74.6	480.3	-53.2	22.4	-2.49	12.0	11.3	0.45
23	77.9	490.2	-54.9	22.9	-2.57	11.4	11.1	0.42
24	81.3	497.6	-51.0	23.2	-2.38	10.2	10.8	0.39
25	84.7	520.3	-51.8	24.3	-2.42	9.6	11.6	0.36
26	88.1	520.9	-48.6	24.3	-2.27	8.2	12.2	0.34
27	91.5	532.4	-49.2	24.9	-2.30	5.8	11.4	0.31
Absolute	23.7			30.0			(T =	37.3 ms)
	50.8				-4.38		(T =	61.7 ms)

CASE METHOD

J =	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
RP	710.2	660.6	610.9	561.3	511.6	462.0	412.3	362.7	313.0	263.4
RX	735.3	701.2	672.5	651.5	633.3	615.2	597.0	578.8	560.6	542.5
RU	713.2	663.8	614.5	565.1	515.8	466.4	417.0	367.7	318.3	269.0

RAU = 370.1 (kips); RA2 = 605.3 (kips)

Current CAPWAP Ru = 543.0 (kips); Corresponding J(RP)= 0.34; J(RX) = 0.90

VMX ft/s	TVP ms	VT1*Z kips	FT1 kips	FMX kips	DMX in	DFN in	SET in	EMX kip-ft	QUS kips	KEB kips/in
15.3	35.89	582.6	624.1	624.1	0.96	0.15	0.15	31.4	677.2	1881

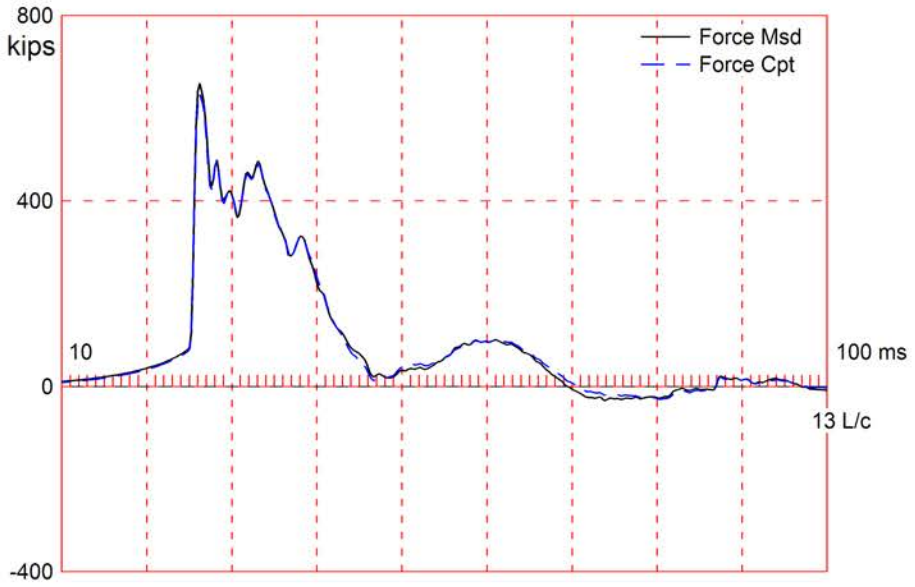
PILE PROFILE AND PILE MODEL

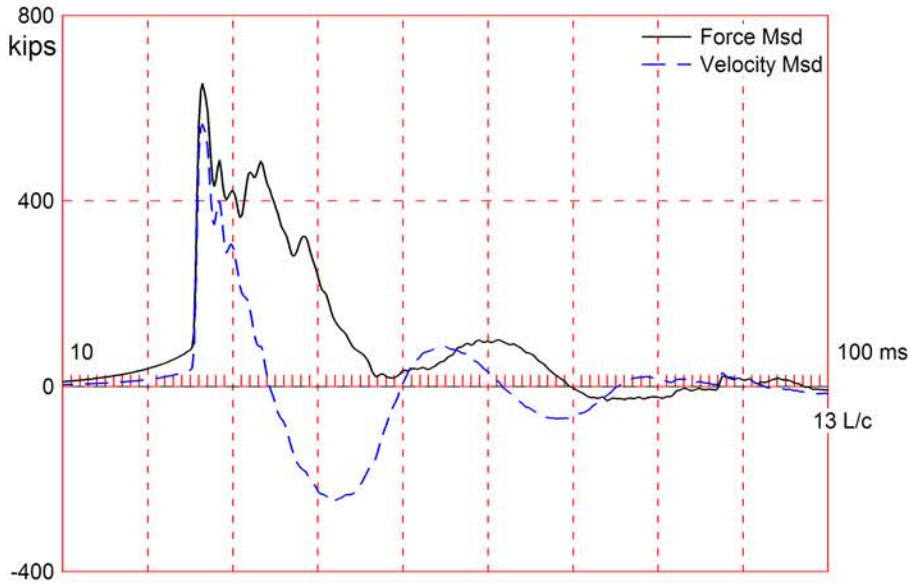
Depth ft	Area in^2	E-Modulus ksi	Spec. Weight lb/ft^3	Perim. ft
0.0	21.4	29992.2	492.000	4.70
91.5	21.4	29992.2	492.000	4.70

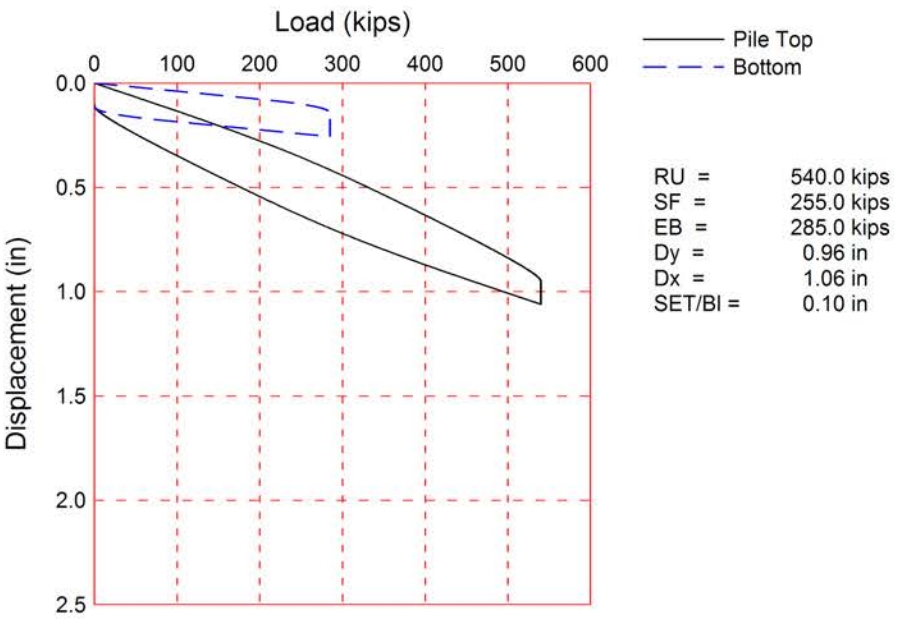
Toe Area 198.5 in^2

Segmnt Number	Dist. B.G. ft	Impedance kips/ft/s	Imped. Change %	Slack in	Tension Eff.	Compression Slack in	Compression Eff.	Perim. ft	Wave Speed ft/s	Soil Plug kips
1	3.4	38.20	0.00	0.00	0.000	-0.00	0.000	4.70	16807.9	0.000
9	30.5	44.00	15.19	0.00	0.000	-0.00	0.000	4.70	16807.9	0.000
10	33.9	38.20	0.00	0.00	0.000	-0.00	0.000	4.70	16807.9	0.000
26	88.1	38.20	0.00	0.00	0.000	-0.00	0.000	4.70	16807.9	0.010
27	91.5	38.20	0.00	0.00	0.000	-0.00	0.000	4.70	16807.9	0.020

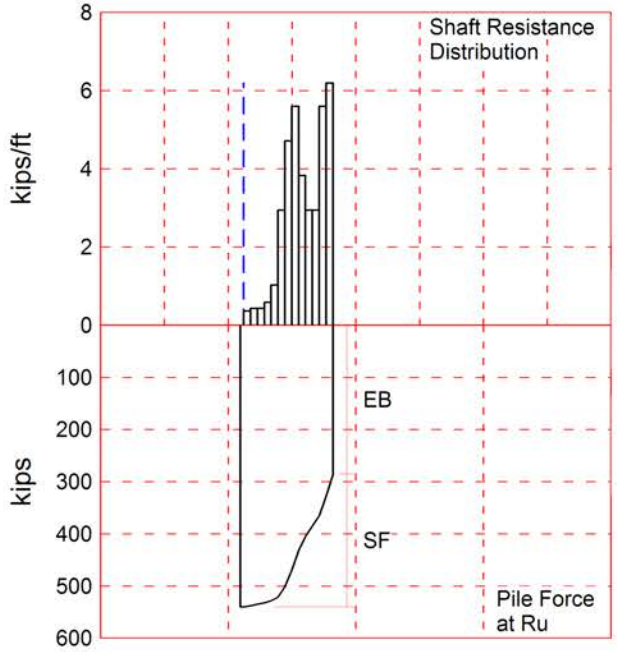
Wave Speed: Pile Top 16807.9, Elastic 16807.9, Overall 16807.9 ft/s
Pile Damping 1.00 %, Time Incr 0.202 ms, 2L/c 10.9 ms
Total volume: 13.674 ft^3; Volume ratio considering added impedance: 1.006







RU =	540.0 kips
SF =	255.0 kips
EB =	285.0 kips
Dy =	0.96 in
Dx =	1.06 in
SET/Bl =	0.10 in



Length b. Sensors	91.5 ft
Embedment	86.7 ft
Top Area	21.4 in^2
End Bearing Area	198.5 in^2
Top Perimeter	4.70 ft
Top E-Modulus	29992 ksi
Top Spec. Weight	492.0 lb/ft^3
Top Wave Spd.	16808 ft/s
Overall W.S.	16808 ft/s
Match Quality	1.73
Top Compr. Stress	29.6 ksi
Max Compr. Stress	30.6 ksi
Max Tension Stress	-2.49 ksi
Avg. Shaft Quake	0.12 in
Toe Quake	0.11 in
Avg. Shaft Smith Dpg.	0.31 s/ft
Toe Smith Damping	0.15 s/ft

About the CAPWAP Results

The CAPWAP program performs a signal matching or reverse analysis based on measurements taken on a deep foundation under an impact load. The program is based on a one-dimensional mathematical model. Under certain conditions, the model only crudely approximates the often complex dynamic situations.

The CAPWAP analysis relies on the input of accurately measured dynamic data plus additional parameters describing pile and soil behavior. If the field measurements of force and velocity are incorrect or were taken under inappropriate conditions (e.g., at an inappropriate time or with too much or too little energy) or if the input pile model is incorrect, then the solution cannot represent the actual soil behavior.

Generally the CAPWAP analysis is used to estimate the axial compressive pile capacity and the soil resistance distribution. The long-term capacity is best evaluated with restrike tests since they incorporate soil strength changes (set-up gains or relaxation losses) that occur after installation. The calculated load settlement graph does not consider creep or long term consolidation settlements. When uplift is a controlling factor in the design, use of the CAPWAP results to assess uplift capacity should be made only after very careful analysis of only good measurement quality, and further used only with longer pile lengths and with nominally higher safety factors.

CAPWAP is also used to evaluate driving stresses along the length of the pile. However, it should be understood that the analysis is one dimensional and does not take into account bending effects or local contact stresses at the pile toe.

Furthermore, if the user of this software was not able to produce a solution with satisfactory signal "match quality" (MQ), then the associated CAPWAP results may be unreliable. There is no absolute scale for solution acceptability but solutions with MQ above 5 are generally considered less reliable than those with lower MQ values and every effort should be made to improve the analysis, for example, by getting help from other independent experts.

Considering the CAPWAP model limitations, the nature of the input parameters, the complexity of the analysis procedure, and the need for a responsible application of the results to actual construction projects, it is recommended that at least one static load test be performed on sites where little experience exists with dynamic behavior of the soil resistance or when the experience of the analyzing engineer with both program use and result application is limited.

Finally, the CAPWAP capacities are ultimate values. They MUST be reduced by means of an appropriate factor of safety to yield a design or working load. The selection of a factor of safety should consider the quality of the construction control, the variability of the site conditions, uncertainties in the loads, the importance of structure and other factors. The CAPWAP results should be reviewed by the Engineer of Record with consideration of applicable geotechnical conditions including, but not limited to, group effects, potential settlement from underlying compressible layers, soil resistances provided from any layers unsuitable for long term support, as well as effective stress changes due to soil surcharges, excavation or change in water table elevation.

The CAPWAP analysis software is one of many means by which the capacity of a deep foundation can be assessed. The engineer performing the analysis is responsible for proper software application and the analysis results. Pile Dynamics accepts no liability whatsoever of any kind for the analysis solution and/or the application of the analysis result.

CAPWAP SUMMARY RESULTS

Total CAPWAP Capacity: 540.0; along Shaft 255.0; at Toe 285.0 kips

Soil Sgmnt No.	Dist. Below Gages ft	Depth Below Grade ft	Ru kips	Force in Pile kips	Sum of Ru kips	Unit Resist. (Depth) kips/ft	Unit Resist. (Area) ksf
				540.0			
1	10.2	5.4	2.0	538.0	2.0	0.37	0.08
2	16.9	12.1	3.0	535.0	5.0	0.44	0.09
3	23.7	18.9	3.0	532.0	8.0	0.44	0.09
4	30.5	25.7	4.0	528.0	12.0	0.59	0.13
5	37.3	32.5	7.0	521.0	19.0	1.03	0.22
6	44.1	39.2	20.0	501.0	39.0	2.95	0.63
7	50.8	46.0	32.0	469.0	71.0	4.72	1.00
8	57.6	52.8	38.0	431.0	109.0	5.61	1.19
9	64.4	59.6	26.0	405.0	135.0	3.84	0.82
10	71.2	66.4	20.0	385.0	155.0	2.95	0.63
11	77.9	73.1	20.0	365.0	175.0	2.95	0.63
12	84.7	79.9	38.0	327.0	213.0	5.61	1.19
13	91.5	86.7	42.0	285.0	255.0	6.20	1.32
Avg. Shaft			19.6			2.94	0.63
Toe			285.0				206.75

Soil Model Parameters/Extensions		Shaft	Toe
Smith Damping Factor		0.31	0.15
Quake	(in)	0.12	0.11
Case Damping Factor		2.07	1.12
Damping Type		Viscous	Sm+Visc
Unloading Quake	(% of loading quake)	100	30
Reloading Level	(% of Ru)	100	100
Unloading Level	(% of Ru)	62	
Soil Plug Weight	(kips)	0.070	0.020

CAPWAP match quality = 1.73 (Wave Up Match) ; RSA = 0
Observed: Final Set = 0.10 in; Blow Count = 119 b/ft
Computed: Final Set = 0.10 in; Blow Count = 116 b/ft

max. Top Comp. Stress = 29.6 ksi (T= 26.6 ms, max= 1.036 x Top)
max. Comp. Stress = 30.6 ksi (Z= 44.1 ft, T= 29.4 ms)
max. Tens. Stress = -2.49 ksi (Z= 44.1 ft, T= 49.4 ms)
max. Energy (EMX) = 30.6 kip-ft; max. Measured Top Displ. (DMX)= 0.83 in

EXTREMA TABLE

Pile Sgmnt No.	Dist. Below Gages ft	max. Force kips	min. Force kips	max. Comp. Stress ksi	max. Tens. Stress ksi	max. Trnsfd. Energy kip-ft	max. Veloc. ft/s	max. Displ. in
1	3.4	633.4	-26.9	29.6	-1.26	30.6	15.3	0.84
2	6.8	637.4	-26.0	29.8	-1.21	30.2	15.2	0.81
4	13.6	635.2	-30.3	29.7	-1.42	28.8	15.0	0.76
6	20.3	628.1	-33.5	29.3	-1.57	27.2	14.7	0.70
8	27.1	623.4	-38.4	29.1	-1.79	25.7	14.4	0.65
10	33.9	619.6	-44.5	28.9	-2.08	23.9	13.9	0.59
12	40.7	625.4	-48.0	29.2	-2.24	21.6	12.8	0.53
13	44.1	656.0	-53.4	30.6	-2.49	20.9	12.2	0.49
14	47.4	596.2	-38.5	27.9	-1.80	18.0	11.4	0.46
15	50.8	627.0	-43.8	29.3	-2.04	17.3	10.6	0.43
16	54.2	527.1	-20.1	24.6	-0.94	13.9	9.8	0.40
17	57.6	548.7	-24.5	25.6	-1.15	13.3	9.2	0.37
18	61.0	449.5	0.0	21.0	0.00	10.1	8.6	0.34
19	64.4	459.3	-2.0	21.5	-0.09	9.6	8.1	0.32
20	67.8	428.6	0.0	20.0	0.00	7.7	7.6	0.29
21	71.2	430.5	0.0	20.1	0.00	7.2	7.3	0.27
22	74.6	409.1	-0.0	19.1	-0.00	5.9	7.1	0.24
23	77.9	407.9	-0.0	19.1	-0.00	5.5	6.9	0.22
24	81.3	386.8	-0.0	18.1	-0.00	4.5	6.3	0.19
25	84.7	394.7	-0.0	18.4	-0.00	4.1	6.5	0.17
26	88.1	354.1	-0.0	16.5	-0.00	2.9	6.7	0.15
27	91.5	360.3	-0.0	16.8	-0.00	2.2	5.9	0.13
Absolute	44.1			30.6			(T =	29.4 ms)
	44.1				-2.49		(T =	49.4 ms)

CASE METHOD

J =	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
RP	833.0	793.1	753.1	713.2	673.2	633.3	593.3	553.4	513.4	473.5
RX	833.0	793.1	754.7	719.8	685.0	650.1	615.2	580.4	551.9	527.4
RU	848.0	809.5	771.1	732.6	694.1	655.7	617.2	578.8	540.3	501.9

RAU = 0.0 (kips); RA2 = 572.8 (kips)

Current CAPWAP Ru = 540.0 (kips); Corresponding J(RP)= 0.73; J(RX) = 0.85

VMX ft/s	TVP ms	VT1*Z kips	FT1 kips	FMX kips	DMX in	DFN in	SET in	EMX kip-ft	QUS kips	KEB kips/in
15.0	26.61	571.5	661.0	661.0	0.83	0.10	0.10	31.1	799.8	2591

PILE PROFILE AND PILE MODEL

Depth ft	Area in^2	E-Modulus ksi	Spec. Weight lb/ft^3	Perim. ft
0.0	21.4	29992.2	492.000	4.70
91.5	21.4	29992.2	492.000	4.70

Toe Area 198.5 in^2

Segmnt Number	Dist. B.G. ft	Impedance kips/ft/s	Imped. Change %	Slack in	Tension Eff.	Compression Slack in	Compression Eff.	Perim. ft	Wave Speed ft/s	Soil Plug kips
1	3.4	38.20	0.00	0.00	0.000	-0.00	0.000	4.70	16807.9	0.000
21	71.2	38.20	0.00	0.00	0.000	-0.00	0.000	4.70	16807.9	0.020
22	74.6	38.20	0.00	0.00	0.000	-0.00	0.000	4.70	16807.9	0.030
23	77.9	38.20	0.00	0.00	0.000	-0.00	0.000	4.70	16807.9	0.020
24	81.3	38.20	0.00	0.00	0.000	-0.00	0.000	4.70	16807.9	0.000
27	91.5	38.20	0.00	0.00	0.000	-0.00	0.000	4.70	16807.9	0.000

Wave Speed: Pile Top 16807.9, Elastic 16807.9, Overall 16807.9 ft/s
Pile Damping 1.00 %, Time Incr 0.202 ms, 2L/c 10.9 ms
Total volume: 13.598 ft^3, Volume ratio considering added impedance: 1.000