GRL Engineers, Inc.

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TRANSMITTAL

To: Mr. Kevin Weber	From: Al Ziai
Company: Lunda Construction Co.	No. of Sheets: 61
E-mail: kweber@lundaconstruction.com	Date: January 15, 2015

RE: Dynamic Testing Results – USH 10 over Little Lake Butte des Morts
Structure B-70-403 - Pier 9
Winnebago County, Wisconsin

On January 14, 2014, Pier 9 #1, Pier 9 #36, and Pier 9 #44 at the above structure were dynamically tested during initial driving. The piles were tested during restrike on January 15. 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 740.7. We understand the pier was excavated to elevation of EL 716.6. 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 9 #1 was driven to a depth of 88.9 feet, which corresponds to a pile tip elevation of EL 651.8. The blow count over the final increment of driving was 10 blows for 2¾ inches of penetration at an average hammer stroke of 7.8 feet. The blow count at the beginning of restrike was 5 blows for ¾ inch of penetration at an average hammer stroke of 7.7 feet.

Pier 9 #36 was driven to a depth of 90.0 feet, which corresponds to a pile tip elevation of EL 650.7. The blow count over the final increment of driving was 10 blows for 2¾ inches of penetration at an average hammer stroke of 7.1 feet. The blow count at the beginning of restrike was 5 blows for 1⅛ inches of penetration at an average hammer stroke of 8.0 feet

Pier 9 #44 was driven to a depth of 93.7 feet, which corresponds to a pile tip elevation of EL 647.0. The blow count over the final increment of driving was 10 blows for 2¾ inches of penetration at an average hammer stroke of 7.2 feet. The blow count at the beginning of restrike was 5 blows per inch of penetration at an average hammer stroke of 7.6 feet

We recommend the production piles at Pier 9 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 **one full foot** 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 foot)	Interior Piles (400 kips) Recommended Minimum Blow Count (blows per foot
6.0	82	56
6.5	61	45
7.0	50	38
7.5	50	38
8.0	50	38

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.

Al Ziai

Travis Coleman, P.E.

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

Attachments:

Dynamic Test Results - (pages 3 – 35)
CAPWAP Analysis Results - (pages 36 – 61)

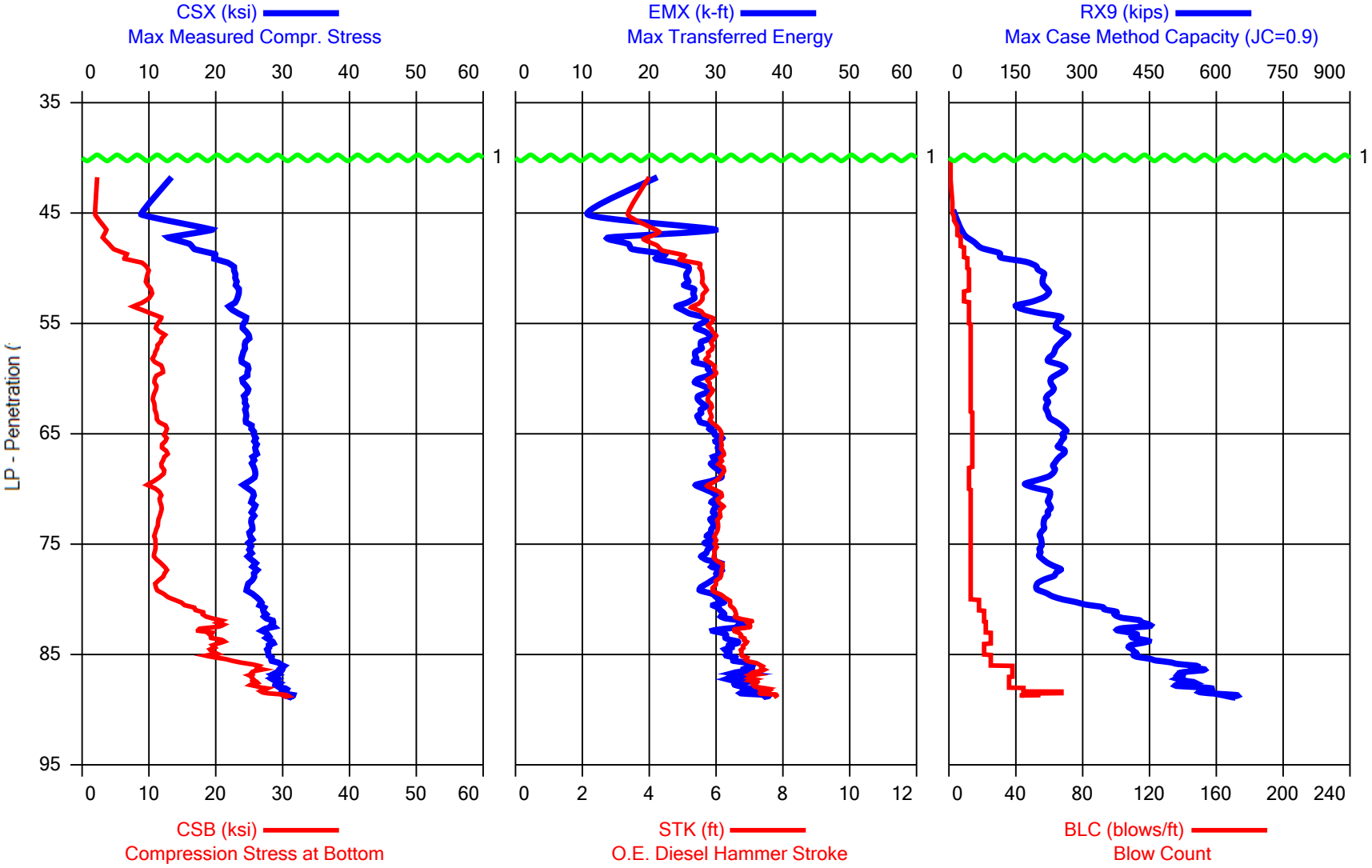
GRL Engineers, Inc. - PDIPLOT2 Ver 2014.2.48.0 - Case Method & iCAP® Results

Printed: 15-January-2015

Test started: 14-January-2015

USH 10 - B-70-403 - Pier 9 #1 - EOID

APE D30-42, HP 14 x 73



1 - Reported reference EL 740.7

USH 10 - B-70-403 - Pier 9 #1 - EOID APE D30-42, HP 14 x 73
OP: AZ Date: 14-January-2015

AR: 21.40 in² SP: 0.492 k/ft³
LE: 92.75 ft EM: 30,000 ksi
WS: 16,807.9 f/s JC: 1.10 []

CSX: Max Measured Compr. Stress EMX: Max Transferred Energy
CSB: Compression Stress at Bottom BPM: Blows per Minute
STK: O.E. Diesel Hammer Stroke 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
3	40.00	1	AV1	13.4	2.3	3.6	23	60.8	0
			STD	0.0	0.0	0.0	0	0.0	0
			MAX	13.4	2.3	3.6	23	60.8	0
			MIN	13.4	2.3	3.6	23	60.8	0
4	41.00	1	AV1	9.9	1.7	3.3	17	63.4	0
			STD	0.0	0.0	0.0	0	0.0	0
			MAX	9.9	1.7	3.3	17	63.4	0
			MIN	9.9	1.7	3.3	17	63.4	0
5	42.00	1	AV1	5.0	1.1	3.0	11	66.2	0
			STD	0.0	0.0	0.0	0	0.0	0
			MAX	5.0	1.1	3.0	11	66.2	0
			MIN	5.0	1.1	3.0	11	66.2	0
8	44.00	2	AV1	25.3	3.9	6.1	34	47.7	37
			STD	0.0	0.0	0.0	0	0.0	0
			MAX	25.3	3.9	6.1	34	47.7	37
			MIN	25.3	3.9	6.1	34	47.7	37
9	44.50	2	AV1	13.9	2.8	3.6	18	61.2	0
			STD	0.0	0.0	0.0	0	0.0	0
			MAX	13.9	2.8	3.6	18	61.2	0
			MIN	13.9	2.8	3.6	18	61.2	0
10	45.00	2	AV1	10.3	2.1	3.4	13	62.8	0
			STD	0.0	0.0	0.0	0	0.0	0
			MAX	10.3	2.1	3.4	13	62.8	0
			MIN	10.3	2.1	3.4	13	62.8	0
11	45.33	3	AV1	8.7	2.3	3.3	11	63.8	0
			STD	0.0	0.0	0.0	0	0.0	0
			MAX	8.7	2.3	3.3	11	63.8	0
			MIN	8.7	2.3	3.3	11	63.8	0

USH 10 - B-70-403 - Pier 9 #1 - EOID APE D30-42, HP 14 x 73
OP: AZ Date: 14-January-2015

BL#	depth	BLC	TYPE	CSX	CSB	STK	EMX	BPM	RX9
	ft	blows/ft		ksi	ksi	ft	k-ft	bpm	kips
12	45.67	3	AV1	2.5	0.6	3.2	1	64.0	0
			STD	0.0	0.0	0.0	0	0.0	0
			MAX	2.5	0.6	3.2	1	64.0	0
			MIN	2.5	0.6	3.2	1	64.0	0
14	46.20	5	AV1	24.1	4.0	**	44	**	18
			STD	0.0	0.0	**	0	**	0
			MAX	24.1	4.0	**	44	**	18
			MIN	24.1	4.0	**	44	**	18
18	47.00	5	AV4	16.8	3.4	4.3	22	57.1	37
			STD	5.3	0.8	1.1	13	5.8	7
			MAX	26.0	4.7	6.2	45	60.6	48
			MIN	13.5	2.8	3.6	14	47.1	31
25	48.00	7	AV7	14.6	3.6	4.0	16	58.3	53
			STD	2.4	0.5	0.4	3	2.5	11
			MAX	16.8	4.3	4.4	18	62.7	69
			MIN	10.3	2.6	3.4	10	55.7	35
34	49.00	9	AV9	18.6	5.8	4.7	20	54.0	100
			STD	1.7	1.0	0.4	3	1.9	20
			MAX	20.6	7.4	5.2	23	56.7	125
			MIN	16.4	4.1	4.2	17	51.3	71
45	50.00	11	AV11	21.6	8.5	5.3	24	50.9	173
			STD	1.3	1.4	0.3	2	1.5	28
			MAX	23.5	9.9	5.7	27	53.3	198
			MIN	19.6	5.9	4.8	20	49.1	112
57	51.00	12	AV12	22.9	9.8	5.6	26	49.7	210
			STD	0.5	0.2	0.1	1	0.4	6
			MAX	23.9	10.3	5.7	28	50.1	219
			MIN	21.9	9.5	5.5	24	49.1	197
69	52.00	12	AV12	23.2	9.9	5.6	26	49.4	214
			STD	0.5	0.3	0.1	1	0.5	6
			MAX	24.2	10.5	5.9	28	50.3	222
			MIN	22.6	9.3	5.4	25	48.5	201
78	53.00	9	AV9	23.3	10.1	5.6	27	49.4	214

USH 10 - B-70-403 - Pier 9 #1 - EOID APE D30-42, HP 14 x 73
OP: AZ Date: 14-January-2015

BL#	depth	BLC	TYPE	CSX	CSB	STK	EMX	BPM	RX9
	ft	blows/ft		ksi	ksi	ft	k-ft	bpm	kips
			STD	0.5	0.4	0.1	1	0.5	11
			MAX	24.6	10.8	5.9	28	50.0	228
			MIN	22.8	9.4	5.5	25	48.5	193
90	54.00	12	AV12	22.5	8.6	5.4	25	50.3	165
			STD	0.8	0.8	0.2	1	0.8	15
			MAX	23.8	9.9	5.7	27	51.6	189
			MIN	21.2	7.4	5.1	23	49.0	142
102	55.00	12	AV12	24.2	11.4	5.8	28	48.7	242
			STD	0.6	0.7	0.2	1	0.7	14
			MAX	25.2	12.5	6.1	30	50.0	261
			MIN	23.1	9.8	5.5	25	47.7	205
115	56.00	13	AV13	24.4	11.4	5.9	28	48.5	250
			STD	0.7	0.5	0.2	1	0.7	12
			MAX	25.2	12.4	6.1	30	49.6	269
			MIN	23.2	10.8	5.6	26	47.7	235
128	57.00	13	AV13	24.6	11.8	5.9	28	48.2	256
			STD	0.5	0.5	0.1	1	0.5	9
			MAX	25.5	12.8	6.1	29	49.2	270
			MIN	23.5	11.2	5.7	26	47.4	237
141	58.00	13	AV13	24.2	11.0	5.8	27	48.7	237
			STD	0.4	0.2	0.1	1	0.3	4
			MAX	24.9	11.5	5.9	29	49.2	243
			MIN	23.6	10.7	5.7	26	48.2	229
154	59.00	13	AV13	24.2	11.1	5.8	28	48.6	235
			STD	0.6	0.7	0.2	1	0.6	16
			MAX	25.4	12.5	6.1	30	49.5	260
			MIN	23.3	10.4	5.6	26	47.5	214
167	60.00	13	AV13	24.7	11.6	5.9	29	48.2	247
			STD	0.6	0.6	0.2	1	0.6	12
			MAX	25.4	12.5	6.1	30	49.3	267
			MIN	23.6	10.8	5.7	26	47.4	227
180	61.00	13	AV13	24.4	11.0	5.8	28	48.6	230
			STD	0.6	0.2	0.1	1	0.5	6

USH 10 - B-70-403 - Pier 9 #1 - EOID APE D30-42, HP 14 x 73
OP: AZ Date: 14-January-2015

BL#	depth ft	BLC blows/ft	TYPE	CSX ksi	CSB ksi	STK ft	EMX k-ft	BPM bpm	RX9 kips
			MAX	25.7	11.3	6.1	30	49.6	245
			MIN	23.6	10.6	5.6	25	47.6	219
193	62.00	13	AV13	24.5	10.7	5.8	28	48.7	224
			STD	0.3	0.2	0.1	1	0.3	6
			MAX	25.3	11.1	6.0	31	49.2	234
			MIN	24.0	10.4	5.7	26	47.9	214
206	63.00	13	AV13	24.4	10.8	5.8	28	48.6	220
			STD	0.4	0.1	0.1	1	0.4	5
			MAX	25.1	11.1	6.0	29	49.4	228
			MIN	23.5	10.7	5.6	27	48.0	214
220	64.00	14	AV14	24.6	11.2	5.8	28	48.5	229
			STD	0.5	0.2	0.1	1	0.5	9
			MAX	25.3	11.4	6.0	29	49.6	249
			MIN	23.7	10.8	5.6	25	47.8	217
234	65.00	14	AV14	25.4	12.5	6.1	29	47.7	257
			STD	0.6	0.4	0.1	1	0.5	8
			MAX	26.1	13.4	6.2	31	48.7	270
			MIN	24.1	11.9	5.8	27	47.2	238
248	66.00	14	AV14	25.9	12.4	6.2	30	47.3	254
			STD	0.5	0.3	0.1	1	0.4	4
			MAX	26.8	12.9	6.3	32	48.2	262
			MIN	25.2	11.9	5.9	28	46.7	244
262	67.00	14	AV14	26.0	12.4	6.2	31	47.2	254
			STD	0.3	0.5	0.1	0	0.3	8
			MAX	26.7	13.5	6.4	31	47.6	269
			MIN	25.5	11.6	6.1	30	46.5	240
276	68.00	14	AV14	25.5	12.0	6.1	30	47.5	240
			STD	0.4	0.3	0.1	1	0.4	6
			MAX	26.0	12.8	6.3	31	48.2	249
			MIN	24.9	11.6	5.9	27	47.0	228
288	69.00	12	AV12	26.0	12.1	6.2	31	47.1	232
			STD	0.5	0.3	0.1	1	0.5	8
			MAX	26.9	12.6	6.5	33	47.9	244

USH 10 - B-70-403 - Pier 9 #1 - EOID APE D30-42, HP 14 x 73
OP: AZ Date: 14-January-2015

BL#	depth	BLC	TYPE	CSX	CSB	STK	EMX	BPM	RX9
	ft	blows/ft		ksi	ksi	ft	k-ft	bpm	kips
			MIN	25.2	11.3	6.0	29	46.1	216
300	70.00	12	AV12	24.6	10.5	5.9	28	48.5	186
			STD	0.7	0.6	0.2	1	0.7	14
			MAX	25.8	11.3	6.2	30	49.3	210
			MIN	23.9	9.6	5.7	27	47.2	165
313	71.00	13	AV13	25.5	11.6	6.1	30	47.5	225
			STD	0.5	0.2	0.1	1	0.5	4
			MAX	26.6	11.9	6.4	31	48.4	232
			MIN	24.7	11.3	5.9	27	46.6	217
326	72.00	13	AV13	25.6	11.8	6.1	30	47.4	226
			STD	0.4	0.1	0.1	1	0.4	4
			MAX	26.4	12.0	6.3	32	48.0	232
			MIN	25.1	11.5	6.0	29	46.7	219
339	73.00	13	AV13	25.4	11.6	6.1	30	47.6	217
			STD	0.4	0.2	0.1	1	0.4	5
			MAX	26.2	12.0	6.3	31	48.3	225
			MIN	24.7	11.2	5.9	28	46.8	210
352	74.00	13	AV13	25.4	11.2	6.1	30	47.7	212
			STD	0.4	0.2	0.1	1	0.3	4
			MAX	26.4	11.4	6.3	31	48.1	219
			MIN	24.8	10.8	6.0	29	47.0	203
365	75.00	13	AV13	25.2	10.9	6.0	29	48.1	206
			STD	0.6	0.1	0.1	1	0.5	5
			MAX	25.8	11.2	6.1	30	49.4	214
			MIN	23.4	10.7	5.6	26	47.5	197
378	76.00	13	AV13	25.2	10.9	6.0	29	48.0	205
			STD	0.6	0.2	0.1	1	0.5	3
			MAX	26.0	11.4	6.2	30	48.9	210
			MIN	24.1	10.7	5.8	27	47.2	198
391	77.00	13	AV13	25.4	11.4	6.1	29	47.7	216
			STD	0.6	0.5	0.2	1	0.6	12
			MAX	26.7	12.4	6.4	32	48.9	238
			MIN	24.5	10.7	5.8	27	46.6	197

USH 10 - B-70-403 - Pier 9 #1 - EOID APE D30-42, HP 14 x 73
OP: AZ Date: 14-January-2015

BL#	depth ft	BLC blows/ft	TYPE	CSX ksi	CSB ksi	STK ft	EMX k-ft	BPM bpm	RX9 kips
404	78.00	13	AV13	25.9	12.4	6.2	30	47.3	242
			STD	0.6	0.2	0.1	1	0.5	9
			MAX	27.2	13.0	6.5	33	48.5	261
			MIN	24.6	12.0	5.9	27	46.2	228
417	79.00	13	AV13	25.0	11.2	6.0	29	48.0	203
			STD	0.5	0.3	0.1	1	0.5	8
			MAX	26.1	11.8	6.2	31	49.4	219
			MIN	23.8	10.8	5.6	26	47.3	194
430	80.00	13	AV13	25.5	12.2	6.1	29	47.6	223
			STD	0.7	0.9	0.2	1	0.6	18
			MAX	26.5	13.9	6.4	31	48.7	253
			MIN	24.2	11.1	5.8	27	46.6	196
448	81.00	18	AV18	26.9	15.6	6.5	30	46.3	315
			STD	0.5	1.1	0.1	1	0.4	32
			MAX	27.9	17.0	6.7	32	47.2	358
			MIN	25.9	13.6	6.2	28	45.5	260
469	82.00	21	AV21	27.6	19.0	6.7	32	45.6	391
			STD	0.6	1.2	0.2	1	0.5	25
			MAX	28.8	21.3	7.0	35	46.4	445
			MIN	26.5	17.6	6.4	29	44.4	366
491	83.00	22	AV22	27.9	19.3	6.8	32	45.1	414
			STD	0.8	1.6	0.3	2	0.8	31
			MAX	29.5	21.6	7.3	37	46.5	462
			MIN	26.5	17.1	6.4	29	43.6	372
516	84.00	25	AV25	28.1	20.1	6.8	32	45.1	428
			STD	0.6	0.9	0.2	1	0.5	14
			MAX	29.2	21.8	7.1	34	46.2	455
			MIN	26.8	18.5	6.5	30	44.2	400
537	85.00	21	AV21	27.9	19.7	6.8	32	45.3	412
			STD	0.3	0.5	0.1	1	0.3	10
			MAX	28.3	21.2	6.9	33	45.8	433
			MIN	27.4	19.0	6.6	30	44.9	397

USH 10 - B-70-403 - Pier 9 #1 - EOID APE D30-42, HP 14 x 73
OP: AZ Date: 14-January-2015

BL#	depth	BLC	TYPE	CSX	CSB	STK	EMX	BPM	RX9
	ft	blows/ft		ksi	ksi	ft	k-ft	bpm	kips
562	86.00	25	AV25	28.7	22.2	7.0	33	44.5	468
			STD	0.8	2.5	0.2	2	0.6	42
			MAX	30.6	26.5	7.5	37	45.5	551
			MIN	27.5	18.1	6.7	31	43.2	405
600	87.00	38	AV38	29.4	25.9	7.3	34	43.8	541
			STD	0.7	0.8	0.2	1	0.6	22
			MAX	31.1	27.5	7.7	37	45.6	585
			MIN	27.4	24.2	6.7	30	42.5	500
636	88.00	36	AV36	29.0	25.7	7.1	33	44.2	528
			STD	0.4	0.6	0.1	1	0.3	18
			MAX	29.8	27.1	7.4	35	44.8	567
			MIN	28.2	24.5	6.9	31	43.5	498
652	88.35	45	AV16	30.5	27.3	7.5	36	43.0	581
			STD	0.5	0.4	0.1	1	0.4	11
			MAX	31.5	28.0	7.9	39	43.7	602
			MIN	29.6	26.4	7.3	34	42.1	567
662	88.50	67	AV10	29.8	27.0	7.3	34	43.6	566
			STD	0.3	0.7	0.1	1	0.3	7
			MAX	30.5	28.7	7.5	35	44.0	578
			MIN	29.4	25.9	7.2	33	43.0	556
672	88.69	53	AV10	30.7	29.5	7.6	36	42.9	622
			STD	0.9	1.4	0.2	2	0.7	24
			MAX	32.1	32.5	8.0	39	43.9	661
			MIN	29.4	27.1	7.2	34	41.8	582
682	88.92	44	AV10	31.4	30.4	7.8	37	42.3	640
			STD	0.4	0.6	0.1	1	0.4	9
			MAX	32.0	31.7	8.0	39	42.8	655
			MIN	30.7	29.6	7.6	36	41.7	625
			Average	25.8	15.3	6.3	30	47.2	313
			Std. Dev.	3.3	6.7	0.8	4	3.2	146
			Maximum	32.1	32.5	8.0	45	66.2	661
			Minimum	2.5	0.6	3.0	1	41.7	0

Total number of blows analyzed: 677

BL#	Sensors
1-682	F3: [H880] 93.7 (1.00); F4: [F607] 93.6 (1.00); A3: [K2253] 325.0 (1.13); A4: [K2524] 360.0 (1.13)

BL#	Comments
3	Reported reference EL 740.7

Time Summary

Drive	15 minutes 16 seconds	1:49 PM - 2:05 PM BN 1 - 682

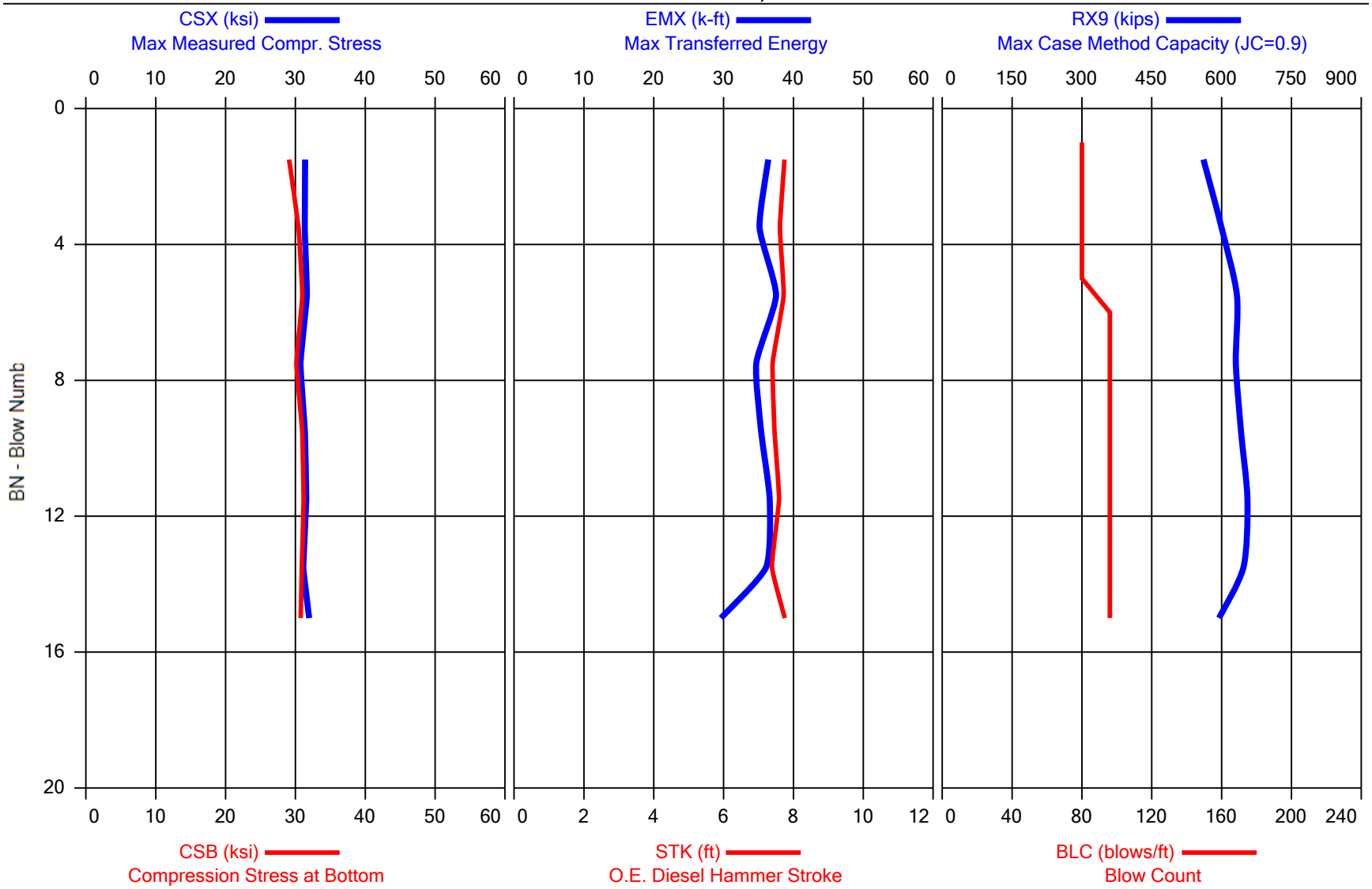
GRL Engineers, Inc. - PDIPLOT2 Ver 2014.2.48.0 - Case Method & iCAP® Results

Printed: 15-January-2015

Test started: 15-January-2015

USH 10 - B-70-403 - Pier 9 #1 - BOR

APE D30-42, HP 14 x 73



USH 10 - B-70-403 - Pier 9 #1 - BOR APE D30-42, HP 14 x 73
OP: AZ Date: 15-January-2015

AR: 21.40 in² SP: 0.492 k/ft³
LE: 92.75 ft EM: 30,000 ksi
WS: 16,807.9 f/s JC: 0.35 []

CSX: Max Measured Compr. Stress EMX: Max Transferred Energy
CSB: Compression Stress at Bottom BPM: Blows per Minute
STK: O.E. Diesel Hammer Stroke 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
5	89	80	AV4	31.4	30.4	7.7	36	42.6	602
			STD	0.9	0.3	0.3	2	0.8	13
			MAX	32.3	30.7	8.1	39	43.6	620
			MIN	30.3	29.9	7.3	33	41.6	588
10	89	96	AV5	31.3	30.7	7.5	36	43.0	638
			STD	0.7	0.6	0.2	2	0.5	7
			MAX	32.5	31.5	7.9	39	43.5	646
			MIN	30.5	30.1	7.4	34	42.0	630
15	89	96	AV5	31.5	31.0	7.5	35	43.0	640
			STD	0.4	0.3	0.2	3	0.5	23
			MAX	32.0	31.5	7.8	37	43.6	658
			MIN	30.9	30.8	7.3	30	42.4	594
			Average	31.4	30.7	7.6	36	42.9	628
			Std. Dev.	0.7	0.5	0.2	2	0.6	23
			Maximum	32.5	31.5	8.1	39	43.6	658
			Minimum	30.3	29.9	7.3	30	41.6	588

Total number of blows analyzed: 14

BL# Sensors

1-15 F3: [D815] 93.0 (1.00); F4: [F607] 93.6 (1.00); A3: [K3550] 360.0 (1.12); A4: [K2524] 360.0 (1.12)

Time Summary

Drive 19 seconds 8:16 AM - 8:16 AM BN 1 - 15

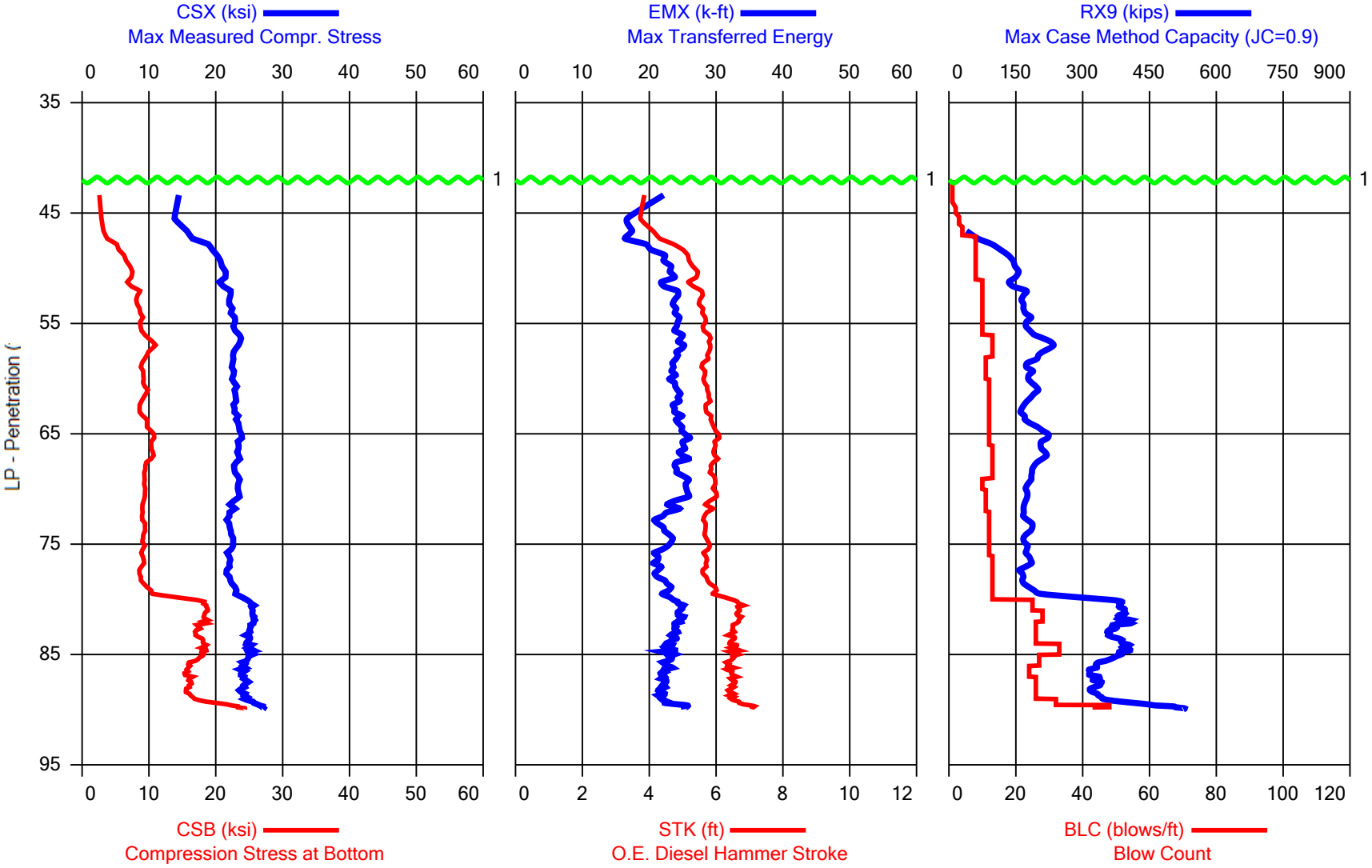
GRL Engineers, Inc. - PDIPLOT2 Ver 2014.2.48.0 - Case Method & iCAP® Results

Printed: 15-January-2015

Test started: 14-January-2015

USH 10 - B-70-403 - Pier 9 #36 - EOID

APE D30-42, HP 14 x 73



1 - Reported reference EL 740.7

USH 10 - B-70-403 - Pier 9 #36 - EOID APE D30-42, HP 14 x 73
OP: AZ Date: 14-January-2015

AR: 21.40 in² SP: 0.492 k/ft³
LE: 92.66 ft EM: 30,000 ksi
WS: 16,807.9 f/s JC: 1.10 []

CSX: Max Measured Compr. Stress EMX: Max Transferred Energy
CSB: Compression Stress at Bottom BPM: Blows per Minute
STK: O.E. Diesel Hammer Stroke 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
3	42.00	1	AV1	15.1	2.5	4.0	24	58.2	0
			STD	0.0	0.0	0.0	0	0.0	0
			MAX	15.1	2.5	4.0	24	58.2	0
			MIN	15.1	2.5	4.0	24	58.2	0
4	43.00	1	AV1	15.2	2.3	3.9	23	58.4	0
			STD	0.0	0.0	0.0	0	0.0	0
			MAX	15.2	2.3	3.9	23	58.4	0
			MIN	15.2	2.3	3.9	23	58.4	0
5	44.00	1	AV1	13.7	2.6	3.7	23	60.1	0
			STD	0.0	0.0	0.0	0	0.0	0
			MAX	13.7	2.6	3.7	23	60.1	0
			MIN	13.7	2.6	3.7	23	60.1	0
6	44.50	2	AV1	14.0	2.8	3.8	18	59.5	0
			STD	0.0	0.0	0.0	0	0.0	0
			MAX	14.0	2.8	3.8	18	59.5	0
			MIN	14.0	2.8	3.8	18	59.5	0
7	45.00	2	AV1	14.1	2.6	3.7	17	59.8	0
			STD	0.0	0.0	0.0	0	0.0	0
			MAX	14.1	2.6	3.7	17	59.8	0
			MIN	14.1	2.6	3.7	17	59.8	0
8	45.33	3	AV1	12.1	2.9	3.6	15	61.1	0
			STD	0.0	0.0	0.0	0	0.0	0
			MAX	12.1	2.9	3.6	15	61.1	0
			MIN	12.1	2.9	3.6	15	61.1	0
10	46.00	3	AV2	14.5	3.0	3.8	17	59.4	0
			STD	0.0	0.3	0.0	0	0.1	0
			MAX	14.6	3.3	3.8	17	59.4	0
			MIN	14.5	2.7	3.8	17	59.3	0

USH 10 - B-70-403 - Pier 9 #36 - EOID APE D30-42, HP 14 x 73
OP: AZ Date: 14-January-2015

BL#	depth	BLC	TYPE	CSX	CSB	STK	EMX	BPM	RX9
	ft	blows/ft		ksi	ksi	ft	k-ft	bpm	kips
14	47.00	4	AV4	15.7	3.2	4.1	17	57.3	39
			STD	0.3	0.1	0.1	0	0.4	7
			MAX	16.1	3.3	4.2	18	57.9	48
			MIN	15.3	3.1	4.0	17	56.9	29
22	48.00	8	AV8	17.7	4.5	4.5	18	54.9	80
			STD	1.3	0.8	0.2	2	1.3	18
			MAX	19.4	5.5	4.8	20	57.2	99
			MIN	15.7	3.3	4.1	15	53.2	53
30	49.00	8	AV8	19.8	5.9	5.1	21	51.9	124
			STD	0.5	0.5	0.2	1	0.7	12
			MAX	20.7	6.4	5.3	23	53.1	136
			MIN	19.1	5.1	4.8	19	50.9	101
38	50.00	8	AV8	20.8	6.9	5.2	23	51.1	146
			STD	0.4	0.3	0.1	1	0.4	5
			MAX	21.3	7.4	5.4	24	51.8	153
			MIN	20.1	6.4	5.1	21	50.5	136
46	51.00	8	AV8	21.5	7.4	5.4	23	50.3	153
			STD	0.8	0.3	0.2	2	0.8	4
			MAX	22.7	7.7	5.7	26	51.8	158
			MIN	20.3	6.9	5.1	20	49.1	147
56	52.00	10	AV10	21.1	7.4	5.3	22	50.9	145
			STD	0.7	0.7	0.1	1	0.6	14
			MAX	22.6	8.7	5.6	24	51.8	171
			MIN	20.1	6.5	5.1	21	49.5	131
66	53.00	10	AV10	22.2	8.3	5.6	24	49.6	168
			STD	0.7	0.3	0.2	1	0.8	7
			MAX	23.3	8.8	5.9	26	50.6	182
			MIN	21.1	8.0	5.4	22	48.4	157
76	54.00	10	AV10	22.3	8.5	5.6	24	49.7	168
			STD	0.5	0.3	0.1	1	0.5	4
			MAX	22.9	9.1	5.8	26	50.4	176
			MIN	21.6	8.1	5.4	23	48.6	162
86	55.00	10	AV10	22.7	8.8	5.6	24	49.4	177
			STD	0.5	0.3	0.1	1	0.5	7

USH 10 - B-70-403 - Pier 9 #36 - EOID APE D30-42, HP 14 x 73
OP: AZ Date: 14-January-2015

BL#	depth ft	BLC blows/ft	TYPE	CSX ksi	CSB ksi	STK ft	EMX k-ft	BPM bpm	RX9 kips
			MAX	23.4	9.2	5.8	25	50.5	190
			MIN	21.5	8.5	5.4	22	48.7	167
96	56.00	10	AV10	22.9	8.9	5.7	24	49.3	179
			STD	0.5	0.2	0.1	1	0.5	7
			MAX	23.7	9.5	5.9	25	50.2	187
			MIN	22.1	8.6	5.4	23	48.4	162
109	57.00	13	AV13	23.6	10.3	5.8	25	48.7	220
			STD	0.3	0.6	0.1	1	0.3	14
			MAX	24.1	11.2	6.0	26	49.1	242
			MIN	23.1	9.3	5.7	24	48.0	197
122	58.00	13	AV13	22.8	10.1	5.8	24	48.8	213
			STD	0.3	0.5	0.1	1	0.4	12
			MAX	23.7	11.0	6.0	27	49.5	236
			MIN	22.3	9.5	5.6	23	47.9	197
133	59.00	11	AV11	22.5	9.0	5.7	24	49.3	183
			STD	0.3	0.3	0.1	1	0.5	12
			MAX	23.2	9.5	6.0	25	49.9	207
			MIN	22.2	8.6	5.5	23	48.1	169
144	60.00	11	AV11	22.6	9.2	5.6	24	49.3	182
			STD	0.4	0.1	0.1	1	0.4	5
			MAX	23.1	9.4	5.8	25	50.2	193
			MIN	22.0	8.9	5.4	22	48.7	176
156	61.00	12	AV12	22.8	9.3	5.7	24	49.2	189
			STD	0.5	0.2	0.1	1	0.4	8
			MAX	23.8	9.7	5.9	25	50.1	203
			MIN	22.1	9.0	5.5	23	48.4	177
168	62.00	12	AV12	23.0	9.4	5.8	25	48.7	188
			STD	0.4	0.4	0.1	1	0.5	9
			MAX	23.7	10.2	6.0	26	49.5	204
			MIN	22.4	8.8	5.6	23	48.0	172
180	63.00	12	AV12	22.8	8.6	5.7	24	49.1	166
			STD	0.5	0.2	0.1	1	0.5	5
			MAX	23.6	8.9	5.9	25	49.9	174
			MIN	22.0	8.2	5.5	23	48.2	157

USH 10 - B-70-403 - Pier 9 #36 - EOID APE D30-42, HP 14 x 73
OP: AZ Date: 14-January-2015

BL#	depth ft	BLC blows/ft	TYPE	CSX ksi	CSB ksi	STK ft	EMX k-ft	BPM bpm	RX9 kips
192	64.00	12	AV12	23.1	9.3	5.8	24	48.7	169
			STD	0.4	0.4	0.1	1	0.6	5
			MAX	23.9	10.1	6.1	26	49.5	178
			MIN	22.4	8.8	5.6	23	47.4	161
204	65.00	12	AV12	23.6	10.1	6.0	25	48.0	205
			STD	0.3	0.4	0.1	0	0.4	11
			MAX	24.1	10.8	6.2	26	48.5	224
			MIN	23.0	9.6	5.9	24	47.3	183
216	66.00	12	AV12	23.7	10.6	6.0	26	47.8	215
			STD	0.5	0.2	0.1	1	0.5	8
			MAX	24.6	10.8	6.2	28	48.8	225
			MIN	22.8	10.2	5.8	24	47.3	204
229	67.00	13	AV13	23.4	10.5	6.0	25	48.1	213
			STD	0.2	0.2	0.1	1	0.3	7
			MAX	23.7	10.8	6.1	26	48.5	222
			MIN	23.0	10.0	5.9	24	47.5	200
242	68.00	13	AV13	23.1	9.9	5.9	25	48.2	201
			STD	0.4	0.5	0.1	1	0.4	9
			MAX	23.8	10.7	6.1	26	48.9	216
			MIN	22.5	9.1	5.8	23	47.4	187
255	69.00	13	AV13	23.0	9.4	5.9	24	48.4	187
			STD	0.4	0.1	0.1	1	0.5	4
			MAX	23.6	9.5	6.1	26	49.5	194
			MIN	22.3	9.2	5.6	23	47.6	180
265	70.00	10	AV10	23.4	9.3	6.0	26	48.1	176
			STD	0.4	0.1	0.1	1	0.5	5
			MAX	24.5	9.6	6.2	27	48.7	182
			MIN	22.9	9.2	5.8	25	47.1	169
276	71.00	11	AV11	23.4	9.4	6.0	26	48.0	175
			STD	0.3	0.2	0.1	1	0.3	3
			MAX	24.2	9.7	6.2	27	48.5	180
			MIN	23.0	9.1	5.9	24	47.3	170
287	72.00	11	AV11	22.5	9.0	5.8	23	48.8	169

USH 10 - B-70-403 - Pier 9 #36 - EOID APE D30-42, HP 14 x 73
OP: AZ Date: 14-January-2015

BL#	depth	BLC	TYPE	CSX	CSB	STK	EMX	BPM	RX9
	ft	blows/ft		ksi	ksi	ft	k-ft	bpm	kips
			STD	0.5	0.1	0.1	1	0.5	2
			MAX	23.4	9.1	6.1	26	49.6	173
			MIN	21.7	8.8	5.6	22	47.6	165
299	73.00	12	AV12	21.9	9.0	5.7	22	49.3	172
			STD	0.3	0.2	0.1	1	0.3	7
			MAX	22.3	9.5	5.8	23	49.7	185
			MIN	21.5	8.7	5.6	20	48.6	163
311	74.00	12	AV12	22.1	9.4	5.7	22	49.2	185
			STD	0.2	0.1	0.0	1	0.1	4
			MAX	22.4	9.6	5.7	23	49.4	188
			MIN	21.7	9.3	5.6	21	49.0	176
323	75.00	12	AV12	22.5	9.1	5.7	23	49.0	169
			STD	0.4	0.2	0.1	1	0.5	3
			MAX	23.1	9.4	6.0	24	49.8	175
			MIN	21.9	8.8	5.5	22	48.1	164
335	76.00	12	AV12	22.2	9.1	5.7	22	49.0	175
			STD	0.5	0.3	0.1	1	0.4	3
			MAX	22.9	9.7	5.9	24	49.6	181
			MIN	21.5	8.7	5.6	20	48.3	171
348	77.00	13	AV13	22.0	9.2	5.7	21	49.1	183
			STD	0.2	0.2	0.1	1	0.2	4
			MAX	22.4	9.5	5.8	22	49.4	188
			MIN	21.7	8.8	5.6	20	48.7	174
361	78.00	13	AV13	21.8	8.6	5.6	21	49.3	163
			STD	0.4	0.2	0.1	1	0.4	5
			MAX	22.8	9.0	5.9	23	49.9	169
			MIN	21.2	8.4	5.5	20	48.4	152
374	79.00	13	AV13	22.4	9.2	5.8	23	48.6	170
			STD	0.6	0.4	0.2	1	0.7	8
			MAX	23.6	9.9	6.2	25	49.3	187
			MIN	21.6	8.6	5.7	21	47.3	161
387	80.00	13	AV13	23.4	11.9	6.1	23	47.6	237
			STD	0.6	2.1	0.2	1	0.7	53
			MAX	24.4	16.0	6.4	24	48.6	340

USH 10 - B-70-403 - Pier 9 #36 - EOID APE D30-42, HP 14 x 73
OP: AZ Date: 14-January-2015

BL#	depth ft	BLC blows/ft	TYPE	CSX ksi	CSB ksi	STK ft	EMX k-ft	BPM bpm	RX9 kips
			MIN	22.7	10.0	5.8	21	46.4	187
412	81.00	25	AV25	25.3	18.4	6.7	25	45.5	385
			STD	0.4	0.5	0.1	1	0.3	8
			MAX	26.1	19.5	6.9	26	46.5	402
			MIN	24.3	17.0	6.4	23	44.8	366
440	82.00	28	AV28	25.6	18.4	6.7	25	45.6	390
			STD	0.3	0.4	0.1	1	0.3	11
			MAX	26.4	19.0	6.9	27	46.2	415
			MIN	25.1	17.4	6.5	23	44.9	370
466	83.00	26	AV26	25.3	17.5	6.5	24	46.0	374
			STD	0.4	0.7	0.1	1	0.4	18
			MAX	26.1	18.9	6.8	26	46.6	415
			MIN	24.8	16.7	6.4	23	45.3	350
492	84.00	26	AV26	24.8	17.6	6.5	23	46.3	375
			STD	0.4	0.5	0.1	1	0.4	14
			MAX	25.6	18.5	6.7	25	47.3	399
			MIN	23.9	16.5	6.2	22	45.5	346
525	85.00	33	AV33	25.1	18.2	6.6	23	46.0	394
			STD	0.5	0.4	0.2	1	0.6	10
			MAX	26.1	19.1	6.9	25	46.8	413
			MIN	24.3	17.5	6.3	22	44.9	377
552	86.00	27	AV27	24.6	16.9	6.4	23	46.4	354
			STD	0.4	0.8	0.1	1	0.3	19
			MAX	25.2	18.3	6.6	25	47.2	384
			MIN	23.6	15.5	6.2	21	45.7	327
576	87.00	24	AV24	24.0	15.8	6.5	22	46.3	321
			STD	0.6	0.4	0.2	1	0.6	9
			MAX	25.3	17.1	6.8	24	47.5	344
			MIN	23.1	15.0	6.1	21	45.2	307
602	88.00	26	AV26	24.4	16.2	6.5	22	46.1	333
			STD	0.6	0.3	0.2	1	0.5	9
			MAX	25.6	16.7	6.8	24	47.0	350
			MIN	23.6	15.4	6.3	20	45.1	318

USH 10 - B-70-403 - Pier 9 #36 - EOID APE D30-42, HP 14 x 73
OP: AZ Date: 14-January-2015

BL#	depth	BLC	TYPE	CSX	CSB	STK	EMX	BPM	RX9
	ft	blows/ft		ksi	ksi	ft	k-ft	bpm	kips
628	89.00	26	AV26	24.1	16.0	6.5	22	46.3	329
			STD	0.5	0.5	0.1	1	0.5	11
			MAX	25.1	16.9	6.8	24	47.1	348
			MIN	23.0	15.2	6.2	20	45.2	311
646	89.56	32	AV18	25.4	19.2	6.7	23	45.7	397
			STD	0.9	1.8	0.2	1	0.7	36
			MAX	27.1	22.0	7.0	26	46.9	454
			MIN	23.7	16.5	6.3	21	44.4	348
656	89.77	48	AV10	27.0	22.9	7.1	26	44.2	487
			STD	0.4	0.5	0.1	1	0.3	23
			MAX	27.7	23.7	7.2	27	44.7	523
			MIN	26.5	22.2	6.9	25	43.8	454
666	90.00	44	AV10	27.0	24.1	7.1	25	44.4	524
			STD	0.5	0.5	0.2	1	0.5	8
			MAX	28.0	24.9	7.4	27	45.1	536
			MIN	25.9	23.3	6.8	24	43.4	512
			Average	23.4	12.7	6.0	23	47.9	259
			Std. Dev.	2.0	4.8	0.6	2	2.4	108
			Maximum	28.0	24.9	7.4	28	61.1	536
			Minimum	12.1	2.3	3.6	15	43.4	0

Total number of blows analyzed: 664

BL# Sensors

1-666 F3: [H880] 93.7 (1.00); F4: [F607] 93.6 (1.00); A3: [K2253] 325.0 (1.00); A4: [K2524] 360.0 (1.00)

BL# Comments

3 Reported reference EL 740.7

Time Summary

Drive 14 minutes 11 seconds 1:15 PM - 1:29 PM BN 1 - 666

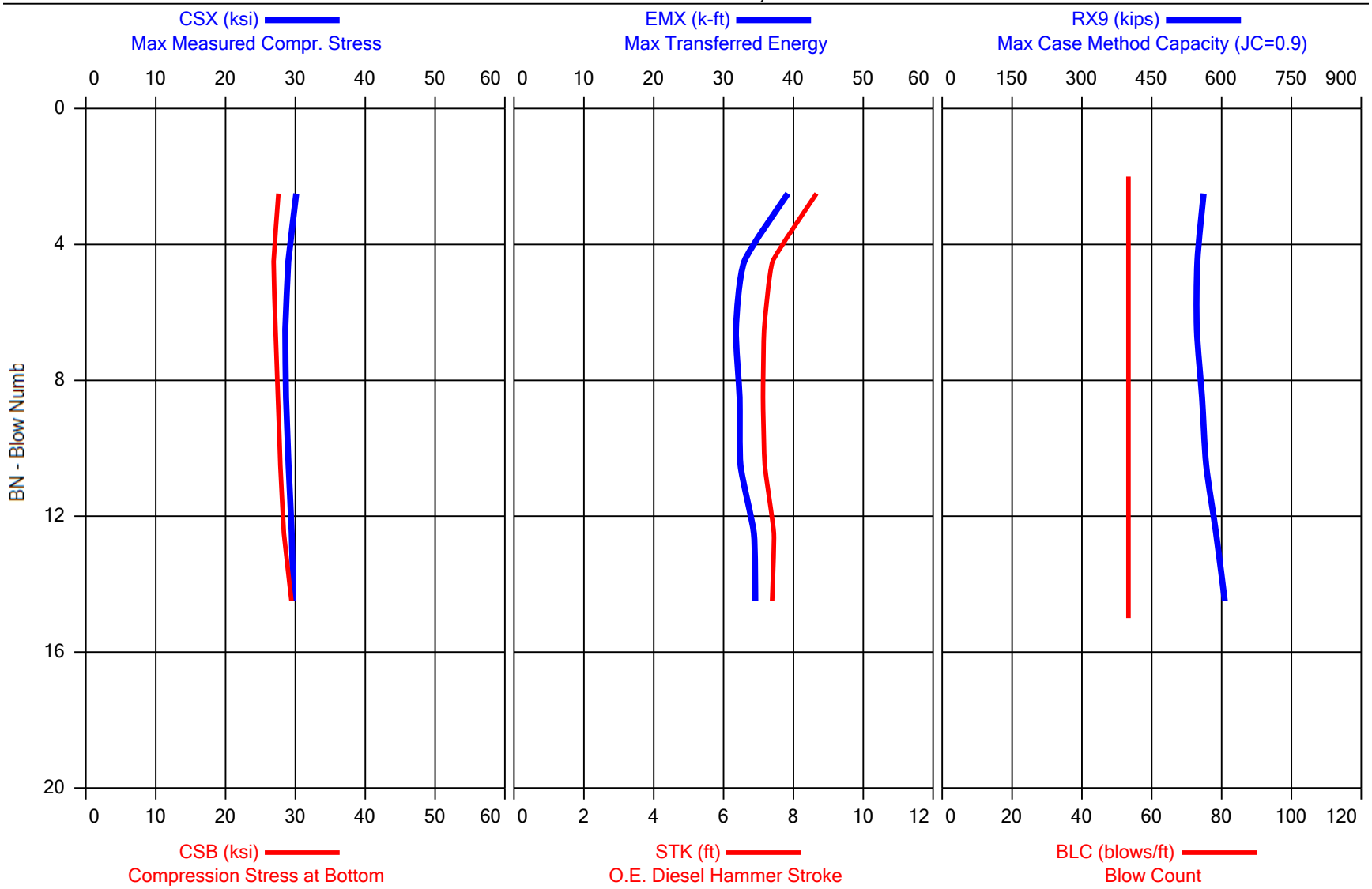
GRL Engineers, Inc. - PDIPLOT2 Ver 2014.2.48.0 - Case Method & iCAP® Results

Printed: 15-January-2015

Test started: 15-January-2015

USH 10 - B-70-403 - Pier 9 #36 - BOR

APE D30-42, HP 14 x 73



USH 10 - B-70-403 - Pier 9 #36 - BOR APE D30-42, HP 14 x 73
OP: AZ Date: 15-January-2015

AR: 21.40 in² SP: 0.492 k/ft³
LE: 92.66 ft EM: 30,000 ksi
WS: 16,807.9 f/s JC: 1.10 []

CSX: Max Measured Compr. Stress EMX: Max Transferred Energy
CSB: Compression Stress at Bottom BPM: Blows per Minute
STK: O.E. Diesel Hammer Stroke 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
5	90.09	53	AV4	29.5	27.2	8.0	36	41.8	555
			STD	1.3	0.4	0.6	4	1.6	12
			MAX	31.5	27.6	8.7	41	43.5	575
			MIN	28.0	26.6	7.4	32	40.0	546
10	90.19	53	AV5	28.7	27.5	7.2	32	44.1	555
			STD	0.3	0.4	0.0	1	0.1	11
			MAX	29.1	28.0	7.2	33	44.2	567
			MIN	28.3	26.8	7.1	31	43.9	536
15	90.28	53	AV5	29.4	28.6	7.4	34	43.5	592
			STD	0.4	0.7	0.2	1	0.5	14
			MAX	30.2	29.6	7.6	35	44.1	608
			MIN	28.9	27.6	7.1	32	42.9	570
			Average	29.2	27.8	7.5	34	43.2	568
			Std. Dev.	0.9	0.8	0.5	3	1.3	22
			Maximum	31.5	29.6	8.7	41	44.2	608
			Minimum	28.0	26.6	7.1	31	40.0	536

Total number of blows analyzed: 14

BL# Sensors

1-15 F3: [F607] 93.6 (1.00); F4: [D815] 93.0 (1.00); A3: [K2524] 360.0 (1.11); A4: [K3550] 360.0 (1.11)

Time Summary

Drive 19 seconds 8:04 AM - 8:05 AM BN 1 - 15

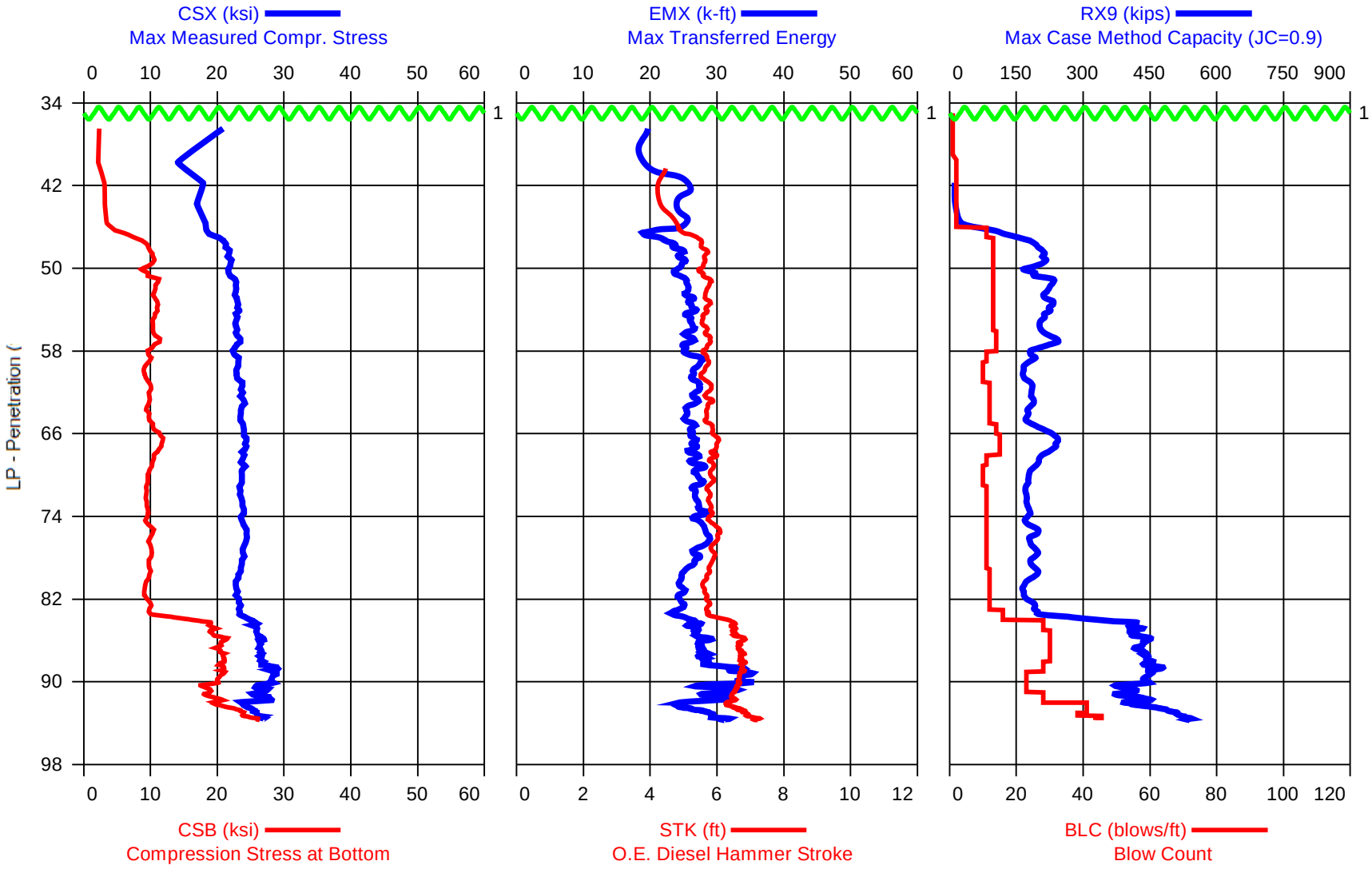
GRL Engineers, Inc. - PDIPLOT2 Ver 2014.2.48.0 - Case Method & iCAP® Results

Printed: 14-January-2015

Test started: 14-January-2015

USH 10 - B-70-403 - Pier 9 #44 - EOID

APE D30-42, HP 14 x 73



1 - Reported reference EL 740.7

USH 10 - B-70-403 - Pier 9 #44 - EOID APE D30-42, HP 14 x 73
OP: AZ Date: 14-January-2015

AR: 21.40 in² SP: 0.492 k/ft³
LE: 92.00 ft EM: 30,000 ksi
WS: 16,807.9 f/s JC: 1.00 []

CSX: Max Measured Compr. Stress EMX: Max Transferred Energy
CSB: Compression Stress at Bottom BPM: Blows per Minute
STK: O.E. Diesel Hammer Stroke 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
1	35.00	1	AV1	18.9	1.9	**	16	**	0
			STD	0.0	0.0	**	0	**	0
			MAX	18.9	1.9	**	16	**	0
			MIN	18.9	1.9	**	16	**	0
2	36.00	1	AV1	21.1	2.2	**	19	**	0
			STD	0.0	0.0	**	0	**	0
			MAX	21.1	2.2	**	19	**	0
			MIN	21.1	2.2	**	19	**	0
3	37.00	1	AV1	21.7	2.4	**	22	**	0
			STD	0.0	0.0	**	0	**	0
			MAX	21.7	2.4	**	22	**	0
			MIN	21.7	2.4	**	22	**	0
4	38.00	1	AV1	21.7	2.6	**	22	**	0
			STD	0.0	0.0	**	0	**	0
			MAX	21.7	2.6	**	22	**	0
			MIN	21.7	2.6	**	22	**	0
5	39.00	1	AV1	22.4	2.6	**	31	**	0
			STD	0.0	0.0	**	0	**	0
			MAX	22.4	2.6	**	31	**	0
			MIN	22.4	2.6	**	31	**	0
7	40.00	2	AV2	14.5	2.3	4.3	20	56.2	0
			STD	1.3	0.1	0.3	4	1.9	0
			MAX	15.8	2.3	4.6	24	58.0	0
			MIN	13.3	2.2	4.0	16	54.3	0
9	41.00	2	AV2	13.6	2.6	3.1	20	65.6	24
			STD	8.6	1.0	0.0	15	0.0	24
			MAX	22.2	3.6	3.1	36	65.6	47
			MIN	4.9	1.5	3.1	5	65.6	0

USH 10 - B-70-403 - Pier 9 #44 - EOID APE D30-42, HP 14 x 73
OP: AZ Date: 14-January-2015

BL#	depth ft	BLC blows/ft	TYPE	CSX ksi	CSB ksi	STK ft	EMX k-ft	BPM bpm	RX9 kips
11	42.00	2	AV2	20.8	3.4	5.5	30	50.2	0
			STD	2.8	0.3	0.7	6	2.9	0
			MAX	23.5	3.7	6.2	36	53.1	0
			MIN	18.0	3.1	4.8	24	47.2	0
13	43.00	2	AV2	14.9	2.7	3.3	17	63.4	19
			STD	7.1	0.8	0.0	10	0.0	19
			MAX	22.0	3.5	3.3	27	63.4	38
			MIN	7.8	2.0	3.3	7	63.4	0
15	44.00	2	AV2	14.5	2.9	4.4	23	55.6	0
			STD	1.6	0.2	0.2	3	1.3	0
			MAX	16.0	3.1	4.6	26	56.8	0
			MIN	12.9	2.7	4.2	20	54.3	0
17	45.00	2	AV2	13.4	2.7	4.0	16	58.7	7
			STD	3.5	0.6	0.6	7	3.9	6
			MAX	16.9	3.2	4.5	23	62.6	13
			MIN	10.0	2.1	3.4	9	54.8	0
19	46.00	2	AV2	23.9	4.2	6.7	39	45.5	26
			STD	1.3	0.3	0.0	0	0.0	26
			MAX	25.2	4.5	6.7	40	45.5	52
			MIN	22.6	3.9	6.7	39	45.5	0
30	47.00	11	AV11	18.4	5.6	5.0	19	52.8	113
			STD	5.0	1.5	0.9	8	4.9	34
			MAX	25.4	7.4	6.7	32	64.8	159
			MIN	5.8	2.2	3.1	3	45.6	38
43	48.00	13	AV13	21.2	9.1	5.5	23	49.8	185
			STD	0.4	0.6	0.1	1	0.6	13
			MAX	21.9	9.9	5.8	25	51.0	198
			MIN	20.2	8.2	5.3	21	48.6	160
56	49.00	13	AV13	21.7	10.1	5.7	24	49.3	210
			STD	0.4	0.3	0.1	1	0.3	5
			MAX	22.5	10.5	5.8	26	50.0	216
			MIN	21.1	9.5	5.5	23	48.9	201
69	50.00	13	AV13	22.0	10.1	5.6	25	49.5	203

USH 10 - B-70-403 - Pier 9 #44 - EOID APE D30-42, HP 14 x 73
OP: AZ Date: 14-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	0.5	0.1	1	0.3	14
			MAX	22.8	10.7	5.7	26	50.0	218
			MIN	21.6	9.2	5.5	23	49.0	172
82	51.00	13	AV13	21.8	9.5	5.6	24	49.7	190
			STD	0.5	1.0	0.1	1	0.5	21
			MAX	22.8	11.7	5.8	27	50.6	231
			MIN	21.2	8.2	5.4	23	48.8	161
95	52.00	13	AV13	22.8	10.9	5.8	26	48.8	229
			STD	0.3	0.3	0.1	1	0.3	6
			MAX	23.3	11.6	6.0	27	49.3	239
			MIN	22.4	10.5	5.7	25	48.0	221
108	53.00	13	AV13	22.7	10.5	5.7	26	49.3	215
			STD	0.3	0.2	0.1	1	0.3	5
			MAX	23.2	11.0	5.8	28	49.9	224
			MIN	22.3	10.2	5.5	25	48.9	206
121	54.00	13	AV13	23.1	11.0	5.7	26	49.0	229
			STD	0.4	0.2	0.1	1	0.5	6
			MAX	23.7	11.3	6.1	27	49.5	239
			MIN	22.4	10.4	5.6	24	47.7	220
134	55.00	13	AV13	23.0	10.7	5.6	26	49.4	215
			STD	0.3	0.2	0.1	1	0.3	7
			MAX	23.6	11.1	5.8	27	49.9	227
			MIN	22.5	10.2	5.5	24	48.7	205
147	56.00	13	AV13	22.8	10.3	5.6	26	49.4	203
			STD	0.3	0.1	0.1	1	0.5	3
			MAX	23.5	10.5	5.9	28	50.1	209
			MIN	22.3	10.1	5.5	25	48.5	197
161	57.00	14	AV14	23.1	10.9	5.7	26	49.0	226
			STD	0.5	0.5	0.1	1	0.5	14
			MAX	24.3	11.6	6.1	29	49.6	249
			MIN	22.6	10.2	5.6	24	47.6	205
175	58.00	14	AV14	22.8	10.4	5.7	25	49.1	214
			STD	0.5	0.6	0.1	1	0.5	21

USH 10 - B-70-403 - Pier 9 #44 - EOID APE D30-42, HP 14 x 73
OP: AZ Date: 14-January-2015

BL#	depth ft	BLC blows/ft	TYPE	CSX ksi	CSB ksi	STK ft	EMX k-ft	BPM bpm	RX9 kips
			MAX	23.6	11.4	5.9	26	50.1	245
			MIN	21.8	9.3	5.5	24	48.3	180
186	59.00	11	AV11	22.9	9.8	5.7	27	49.2	185
			STD	0.3	0.3	0.1	1	0.3	8
			MAX	23.4	10.2	5.9	28	49.8	195
			MIN	22.4	9.5	5.5	25	48.5	172
196	60.00	10	AV10	23.0	9.2	5.7	27	49.3	168
			STD	0.3	0.3	0.1	1	0.5	5
			MAX	23.6	9.7	5.8	28	49.9	175
			MIN	22.5	8.8	5.5	26	48.6	161
206	61.00	10	AV10	23.1	9.3	5.6	27	49.4	169
			STD	0.6	0.3	0.2	1	0.8	6
			MAX	24.4	10.0	6.1	29	50.4	180
			MIN	22.4	9.0	5.4	25	47.7	158
218	62.00	12	AV12	23.6	10.0	5.8	27	48.9	185
			STD	0.5	0.2	0.1	1	0.5	3
			MAX	24.4	10.2	6.0	29	49.6	191
			MIN	23.1	9.7	5.6	26	47.9	181
230	63.00	12	AV12	23.8	9.8	5.8	27	48.9	187
			STD	0.5	0.1	0.2	1	0.6	5
			MAX	24.6	10.0	6.0	28	49.7	196
			MIN	23.1	9.6	5.6	26	47.9	179
242	64.00	12	AV12	23.7	9.5	5.7	26	49.1	179
			STD	0.5	0.2	0.1	1	0.5	5
			MAX	24.4	9.8	5.9	27	49.7	188
			MIN	23.0	9.1	5.6	23	48.2	172
254	65.00	12	AV12	23.5	9.9	5.7	26	49.2	174
			STD	0.2	0.2	0.1	1	0.2	5
			MAX	23.8	10.2	5.8	27	49.5	181
			MIN	23.1	9.6	5.6	25	48.7	164
268	66.00	14	AV14	24.0	10.7	5.9	26	48.5	209
			STD	0.4	0.4	0.1	1	0.4	14
			MAX	24.9	11.4	6.1	28	49.0	233

USH 10 - B-70-403 - Pier 9 #44 - EOID APE D30-42, HP 14 x 73
OP: AZ Date: 14-January-2015

BL#	depth ft	BLC blows/ft	TYPE	CSX ksi	CSB ksi	STK ft	EMX k-ft	BPM bpm	RX9 kips
			MIN	23.6	10.2	5.7	25	47.7	188
283	67.00	15	AV15	24.2	11.7	6.0	26	48.0	240
			STD	0.3	0.2	0.1	1	0.3	5
			MAX	25.1	12.0	6.2	28	48.7	246
			MIN	23.7	11.4	5.8	25	47.2	229
298	68.00	15	AV15	24.1	11.2	5.9	26	48.2	229
			STD	0.4	0.4	0.1	1	0.4	9
			MAX	24.7	11.7	6.1	28	48.8	243
			MIN	23.5	10.4	5.8	25	47.6	212
309	69.00	11	AV11	23.8	10.4	5.9	27	48.5	200
			STD	0.6	0.2	0.2	2	0.7	4
			MAX	24.9	10.6	6.2	30	49.3	205
			MIN	23.1	10.0	5.7	25	47.2	190
319	70.00	10	AV10	23.8	9.9	5.9	27	48.5	184
			STD	0.6	0.2	0.1	1	0.6	6
			MAX	25.0	10.3	6.2	30	49.3	196
			MIN	23.0	9.6	5.7	25	47.3	178
329	71.00	10	AV10	23.7	9.5	5.8	27	48.6	176
			STD	0.5	0.1	0.1	1	0.5	2
			MAX	24.7	9.8	6.1	30	49.1	179
			MIN	23.1	9.4	5.7	26	47.4	170
340	72.00	11	AV11	23.3	9.4	5.7	27	49.0	171
			STD	0.3	0.1	0.1	1	0.2	2
			MAX	23.8	9.6	5.9	28	49.3	175
			MIN	22.9	9.2	5.7	26	48.5	169
351	73.00	11	AV11	23.6	9.3	5.8	27	48.9	173
			STD	0.4	0.1	0.1	1	0.4	2
			MAX	24.5	9.5	6.0	28	49.5	175
			MIN	23.1	9.2	5.6	25	48.0	169
362	74.00	11	AV11	24.0	9.6	5.9	28	48.5	180
			STD	0.4	0.1	0.1	1	0.4	4
			MAX	24.4	10.0	6.0	30	49.2	185
			MIN	23.4	9.4	5.7	26	47.9	174

USH 10 - B-70-403 - Pier 9 #44 - EOID APE D30-42, HP 14 x 73
OP: AZ Date: 14-January-2015

BL#	depth ft	BLC blows/ft	TYPE	CSX ksi	CSB ksi	STK ft	EMX k-ft	BPM bpm	RX9 kips
373	75.00	11	AV11	23.8	9.5	5.8	27	48.6	174
			STD	0.6	0.4	0.2	1	0.6	5
			MAX	24.7	10.2	6.1	30	49.3	182
			MIN	23.1	9.1	5.7	26	47.6	166
384	76.00	11	AV9	24.4	10.3	6.1	29	47.7	196
			STD	0.5	0.3	0.1	1	0.4	10
			MAX	25.3	10.9	6.3	30	48.3	212
			MIN	23.7	9.9	5.9	27	47.0	178
395	77.00	11	AV11	24.1	9.8	5.9	28	48.2	182
			STD	0.4	0.2	0.1	1	0.5	3
			MAX	24.9	10.2	6.2	30	48.9	188
			MIN	23.4	9.5	5.8	26	47.3	178
406	78.00	11	AV11	23.9	10.2	5.9	27	48.3	195
			STD	0.5	0.2	0.1	1	0.5	4
			MAX	25.1	10.4	6.2	30	49.3	203
			MIN	23.1	9.8	5.7	25	47.2	187
417	79.00	11	AV11	23.6	9.7	5.8	26	48.7	184
			STD	0.3	0.2	0.1	1	0.3	4
			MAX	24.1	10.0	5.9	28	49.2	193
			MIN	23.2	9.4	5.7	26	48.3	179
429	80.00	12	AV12	23.3	9.9	5.7	25	48.9	194
			STD	0.3	0.2	0.1	0	0.3	5
			MAX	23.9	10.2	5.9	26	49.3	200
			MIN	23.0	9.6	5.7	24	48.4	184
441	81.00	12	AV12	22.8	9.3	5.6	24	49.6	170
			STD	0.4	0.2	0.1	1	0.5	6
			MAX	23.7	9.8	5.8	26	50.4	182
			MIN	22.1	9.0	5.4	23	48.7	164
453	82.00	12	AV12	23.0	9.1	5.7	25	49.3	168
			STD	0.5	0.2	0.1	1	0.6	5
			MAX	24.1	9.5	5.9	27	50.2	179
			MIN	22.2	8.8	5.4	22	48.2	161

USH 10 - B-70-403 - Pier 9 #44 - EOID APE D30-42, HP 14 x 73
OP: AZ Date: 14-January-2015

BL#	depth	BLC	TYPE	CSX	CSB	STK	EMX	BPM	RX9
	ft	blows/ft		ksi	ksi	ft	k-ft	bpm	kips
465	83.00	12	AV12	23.4	9.9	5.7	25	49.0	188
			STD	0.5	0.2	0.1	1	0.5	5
			MAX	24.1	10.3	5.9	26	49.8	199
			MIN	22.5	9.6	5.5	23	48.2	176
481	84.00	16	AV16	23.8	11.7	5.9	24	48.5	237
			STD	0.7	2.4	0.2	1	0.9	48
			MAX	25.3	16.0	6.4	27	49.5	325
			MIN	22.9	9.6	5.6	23	46.4	194
509	85.00	28	AV28	25.7	18.9	6.5	27	46.2	406
			STD	0.4	0.9	0.1	1	0.4	25
			MAX	26.4	20.6	6.8	29	47.3	443
			MIN	24.5	16.0	6.2	25	45.2	336
539	86.00	30	AV30	26.3	19.9	6.6	27	45.7	424
			STD	0.6	1.1	0.2	1	0.6	22
			MAX	27.7	22.2	7.0	30	46.7	467
			MIN	25.3	17.4	6.3	25	44.4	373
569	87.00	30	AV30	26.4	20.4	6.7	28	45.6	430
			STD	0.3	0.5	0.1	1	0.3	9
			MAX	27.2	21.2	6.9	30	46.0	442
			MIN	25.9	19.3	6.5	26	44.7	409
599	88.00	30	AV30	26.5	20.8	6.7	28	45.4	442
			STD	0.4	0.4	0.1	1	0.4	9
			MAX	27.5	21.6	7.0	31	46.1	458
			MIN	25.7	20.0	6.5	26	44.5	425
627	89.00	28	AV28	27.8	20.8	6.8	31	45.2	456
			STD	1.2	0.6	0.1	3	0.4	24
			MAX	29.8	22.0	7.0	36	46.0	507
			MIN	26.1	19.2	6.5	27	44.4	398
650	90.00	23	AV23	28.4	20.4	6.7	34	45.6	443
			STD	0.5	0.5	0.1	1	0.4	11
			MAX	29.5	21.2	6.9	36	46.1	463
			MIN	27.3	19.5	6.5	32	44.7	424
673	91.00	23	AV21	27.0	18.8	6.6	31	45.8	408

USH 10 - B-70-403 - Pier 9 #44 - EOID APE D30-42, HP 14 x 73
OP: AZ Date: 14-January-2015

BL#	depth ft	BLC blows/ft	TYPE	CSX ksi	CSB ksi	STK ft	EMX k-ft	BPM bpm	RX9 kips
			STD	1.2	0.9	0.1	3	0.5	27
			MAX	28.9	20.5	6.8	35	46.5	459
			MIN	24.8	17.2	6.4	24	45.0	362
701	92.00	28	AV26	26.4	19.3	6.5	29	46.3	410
			STD	1.6	1.1	0.1	3	0.4	32
			MAX	28.7	21.4	6.6	33	47.3	469
			MIN	22.8	17.7	6.2	23	45.7	369
742	93.00	41	AV41	24.7	21.8	6.6	26	46.0	459
			STD	0.8	1.6	0.2	2	0.8	37
			MAX	26.2	24.3	7.0	30	47.6	520
			MIN	23.3	19.4	6.1	24	44.4	396
752	93.26	38	AV10	26.0	23.9	6.9	29	44.9	512
			STD	0.4	0.3	0.1	1	0.4	9
			MAX	26.5	24.2	7.0	31	45.6	525
			MIN	25.4	23.4	6.7	28	44.4	500
762	93.48	46	AV10	26.4	24.6	7.0	29	44.5	527
			STD	0.5	0.6	0.2	1	0.5	11
			MAX	27.3	25.7	7.4	32	45.2	548
			MIN	25.7	23.6	6.8	28	43.5	510
772	93.71	44	AV10	26.8	26.1	7.2	31	43.9	538
			STD	0.4	0.4	0.1	1	0.3	7
			MAX	27.7	26.8	7.4	33	44.5	550
			MIN	26.2	25.5	7.0	30	43.4	522
			Average	24.2	13.9	6.1	27	47.8	283
			Std. Dev.	2.5	5.6	0.6	3	2.3	131
			Maximum	29.8	26.8	7.4	40	65.6	550
			Minimum	4.9	1.5	3.1	3	43.4	0

Total number of blows analyzed: 766

BL#	Sensors
1-693	F3: [F607] 93.6 (1.00); F4: [F590] 95.0 (1.00); A3: [K2524] 360.0 (1.10); A4: [K2253] 325.0 (1.10)
694-694	F3: [F607] 93.6 (1.00); F4: [H880] 93.7 (1.00); A3: [K2524] 360.0 (1.10); A4: [K2253] 325.0 (1.10)
695-696	F3: [F607] 93.6 (1.00); F4: [F590] 95.0 (1.00); A3: [K2524] 360.0 (1.10);

	A4: [K2253] 325.0 (1.10)
697-772	F3: [F607] 93.6 (1.00); F4: [H880] 93.7 (1.00); A3: [K2524] 360.0 (1.10); A4: [K2253] 325.0 (1.10)

BL#	Comments
1	Reported reference EL 740.7

Time Summary

Drive	21 minutes 10 seconds	12:07 PM - 12:28 PM (1/14/2015) BN 1 - 696
Stop	21 minutes 6 seconds	12:28 PM - 12:49 PM
Drive	1 minute 39 seconds	12:49 PM - 12:51 PM BN 697 - 772

Total time [00:43:56] = (Driving [00:22:49] + Stop [00:21:06])

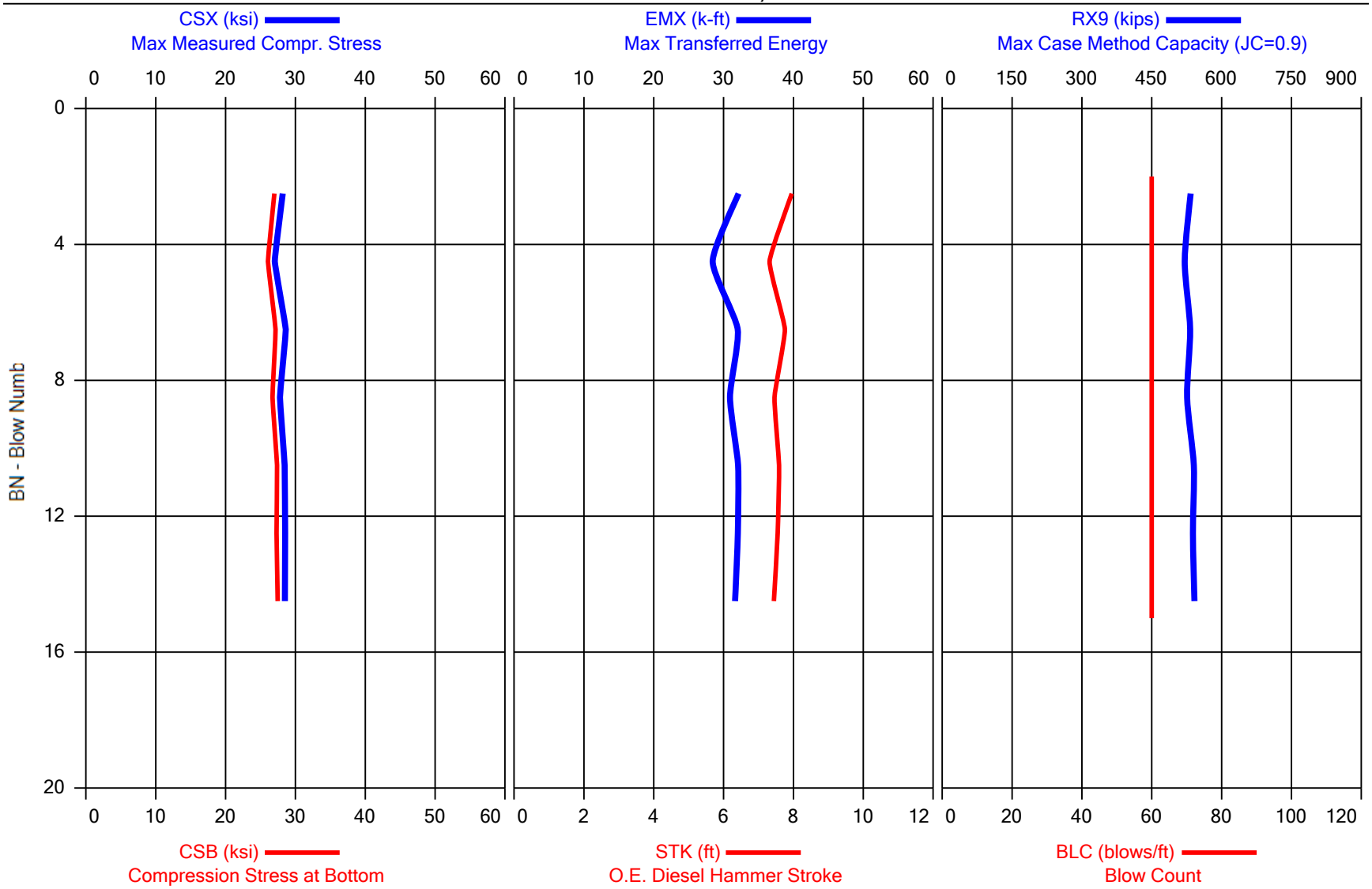
GRL Engineers, Inc. - PDIPLOT2 Ver 2014.2.48.0 - Case Method & iCAP® Results

Printed: 15-January-2015

Test started: 15-January-2015

USH 10 - B-70-403 - Pier 9 #44 - BOR

APE D30-42, HP 14 x 73



USH 10 - B-70-403 - Pier 9 #44 - BOR APE D30-42, HP 14 x 73
OP: AZ Date: 15-January-2015

AR: 21.40 in² SP: 0.492 k/ft³
LE: 92.00 ft EM: 30,000 ksi
WS: 16,807.9 f/s JC: 0.35 []

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 ft	BLC blows/ft	TYPE	CSX ksi	CSB ksi	STK ft	EMX k-ft	BPM bpm	RX9 kips
5	94.01	60	AV4	27.6	26.5	7.6	30	42.8	527
			STD	1.0	0.6	0.5	3	1.3	15
			MAX	29.2	27.5	8.5	35	43.9	540
			MIN	26.4	25.8	7.2	28	40.6	502
10	94.10	60	AV5	28.1	26.9	7.6	31	42.9	529
			STD	0.6	0.3	0.2	1	0.5	7
			MAX	29.1	27.2	7.8	32	43.5	538
			MIN	27.3	26.3	7.4	30	42.2	518
15	94.18	60	AV5	28.7	27.5	7.5	32	43.0	542
			STD	0.3	0.3	0.1	1	0.3	6
			MAX	29.3	28.1	7.8	34	43.3	551
			MIN	28.4	27.1	7.4	31	42.4	533
			Average	28.2	27.0	7.6	31	42.9	533
			Std. Dev.	0.8	0.6	0.3	2	0.8	12
			Maximum	29.3	28.1	8.5	35	43.9	551
			Minimum	26.4	25.8	7.2	28	40.6	502

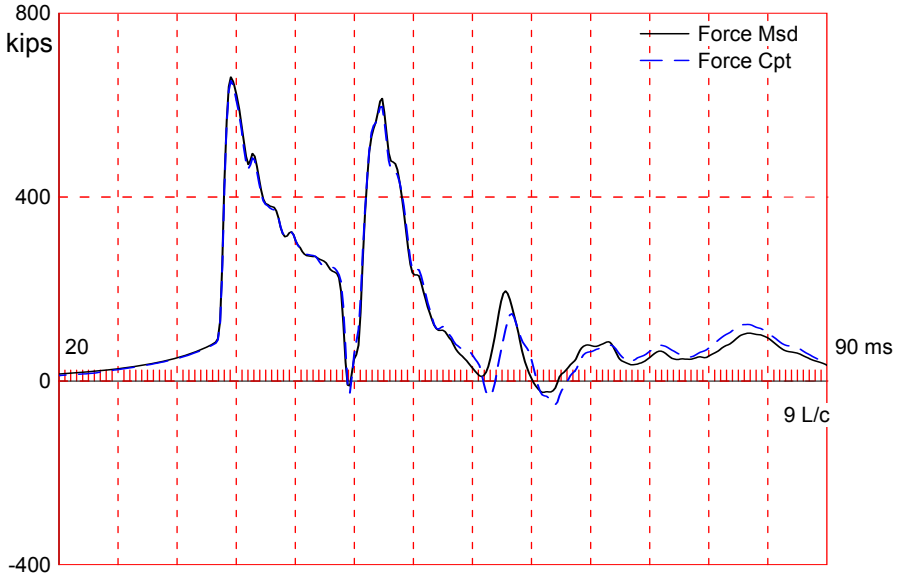
Total number of blows analyzed: 14

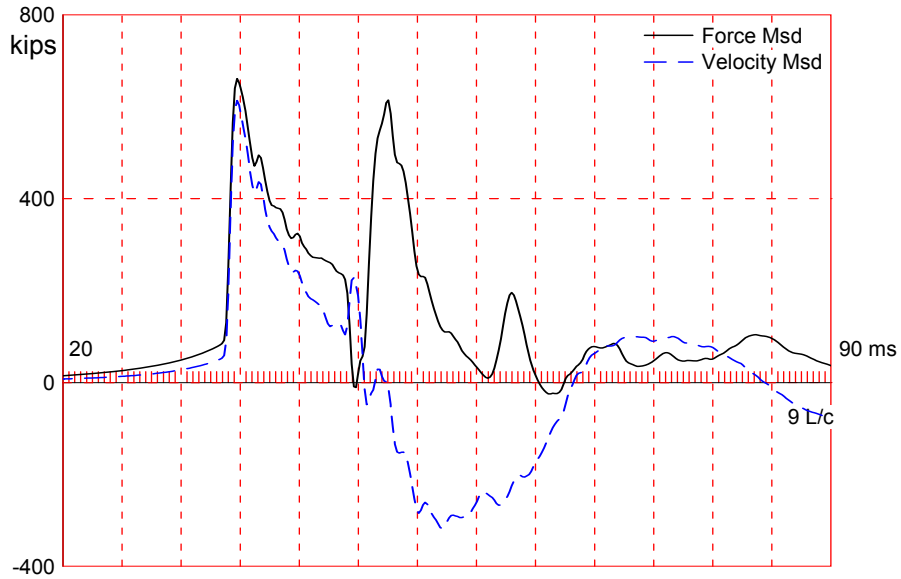
BL# Sensors

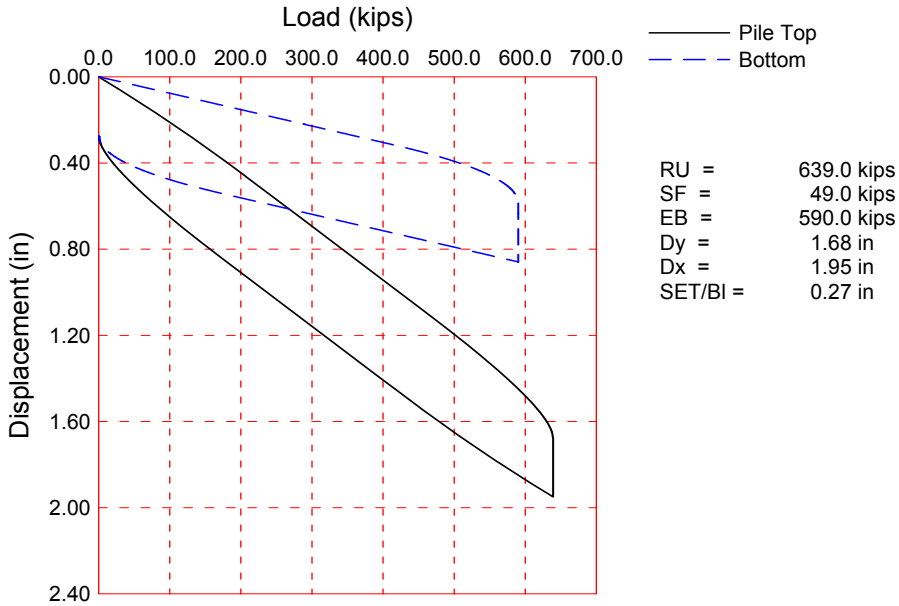
1-15 F3: [D815] 93.0 (1.00); F4: [F607] 93.6 (1.00); A3: [K3550] 360.0 (1.09); A4: [K2524] 360.0 (1.09)

Time Summary

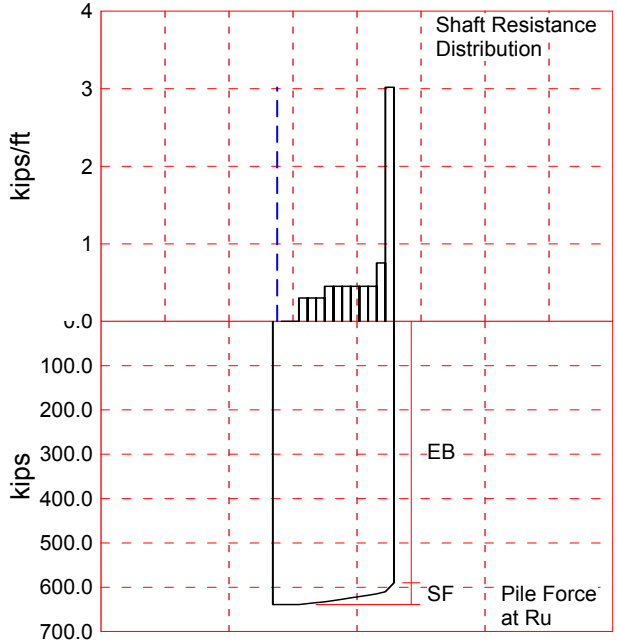
Drive 19 seconds 8:28 AM - 8:28 AM BN 1 - 15







RU =	639.0 kips
SF =	49.0 kips
EB =	590.0 kips
Dy =	1.68 in
Dx =	1.95 in
SET/Bl =	0.27 in



Length b. Sensors	92.8 ft
Embedment	88.9 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	4.37
Top Compr. Stress	30.5 ksi
Max Compr. Stress	31.8 ksi
Max Tension Stress	-5.22 ksi
Avg. Shaft Quake	0.12 in
Toe Quake	0.45 in
Avg. Shaft Smith Dpg.	0.21 s/ft
Toe Smith Damping	0.03 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: 639.0; along Shaft 49.0; at Toe 590.0 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
				639.0				
1	13.3	9.4	0.0	639.0	0.0	0.00	0.00	0.00
2	19.9	16.0	0.0	639.0	0.0	0.00	0.00	0.00
3	26.5	22.7	2.0	637.0	2.0	0.30	0.06	0.21
4	33.1	29.3	2.0	635.0	4.0	0.30	0.06	0.21
5	39.8	35.9	2.0	633.0	6.0	0.30	0.06	0.21
6	46.4	42.5	3.0	630.0	9.0	0.45	0.10	0.21
7	53.0	49.2	3.0	627.0	12.0	0.45	0.10	0.21
8	59.6	55.8	3.0	624.0	15.0	0.45	0.10	0.21
9	66.3	62.4	3.0	621.0	18.0	0.45	0.10	0.21
10	72.9	69.0	3.0	618.0	21.0	0.45	0.10	0.21
11	79.5	75.7	3.0	615.0	24.0	0.45	0.10	0.21
12	86.1	82.3	5.0	610.0	29.0	0.75	0.16	0.21
13	92.8	88.9	20.0	590.0	49.0	3.02	0.64	0.21
Avg. Shaft			3.8			0.55	0.12	0.21
Toe			590.0				428.01	0.03

Soil Model Parameters/Extensions		Shaft	Toe
Quake	(in)	0.12	0.45
Case Damping Factor		0.27	0.46
Damping Type		Viscous	Sm+Visc
Unloading Quake	(% of loading quake)	30	30
Reloading Level	(% of Ru)	-99	0
Resistance Gap (included in Toe Quake)	(in)		0.01
Soil Plug Weight	(kips)		0.000

CAPWAP match quality = 4.37 (Wave Up Match) ; RSA = 0
Observed: Final Set = 0.27 in; Blow Count = 44 b/ft
Computed: Final Set = 0.31 in; Blow Count = 38 b/ft
Transducer F3(H880) CAL: 93.7; RF: 1.00; F4(F607) CAL: 93.6; RF: 1.00
A3(K2253) CAL: 325; RF: 1.13; A4(K2524) CAL: 360; RF: 1.13

max. Top Comp. Stress = 30.5 ksi (T= 36.1 ms, max= 1.040 x Top)
max. Comp. Stress = 31.8 ksi (Z= 92.8 ft, T= 43.6 ms)
max. Tens. Stress = -5.22 ksi (Z= 59.6 ft, T= 62.5 ms)
max. Energy (EMX) = 37.6 kip-ft; max. Measured Top Displ. (DMX)= 1.22 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	653.8	-62.5	30.5	-2.92	37.6	16.3	1.23
2	6.6	654.3	-69.7	30.6	-3.25	37.5	16.2	1.22
4	13.3	655.5	-89.0	30.6	-4.16	37.2	16.2	1.19
6	19.9	657.6	-95.1	30.7	-4.44	36.7	16.1	1.15
8	26.5	662.0	-96.5	30.9	-4.51	36.0	16.0	1.11
10	33.1	657.8	-89.6	30.7	-4.18	34.7	15.8	1.06
12	39.8	654.2	-84.3	30.6	-3.94	33.3	15.7	1.01
14	46.4	651.7	-88.5	30.4	-4.14	31.8	15.5	0.95
15	49.7	642.5	-101.6	30.0	-4.74	30.6	15.4	0.92
16	53.0	645.3	-111.2	30.1	-5.19	30.0	15.3	0.90
17	56.3	636.3	-110.8	29.7	-5.18	28.7	15.2	0.86
18	59.6	639.1	-111.8	29.9	-5.22	28.1	15.1	0.83
19	62.9	630.2	-108.8	29.4	-5.08	26.7	15.0	0.80
20	66.3	633.2	-107.4	29.6	-5.02	26.0	14.9	0.77
21	69.6	624.5	-100.6	29.2	-4.70	24.7	15.0	0.73
22	72.9	627.6	-99.8	29.3	-4.66	23.9	15.6	0.70
23	76.2	619.1	-96.4	28.9	-4.50	22.5	15.2	0.67
24	79.5	623.5	-97.5	29.1	-4.56	21.6	16.5	0.63
25	82.8	614.0	-91.6	28.7	-4.28	20.2	18.2	0.59
26	86.1	646.4	-89.9	30.2	-4.20	19.2	19.4	0.55
27	89.4	664.4	-80.9	31.0	-3.78	18.1	19.9	0.53
28	92.8	680.1	-79.7	31.8	-3.72	16.6	18.9	0.50
Absolute	92.8			31.8			(T =	43.6 ms)
	59.6				-5.22		(T =	62.5 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	552.3	479.6	406.9	334.2	261.5	188.8	116.1	43.4	0.0	0.0
RX	734.0	714.5	696.5	680.5	667.8	660.0	654.2	649.0	643.9	638.8
RU	552.3	479.6	406.9	334.2	261.5	188.8	116.1	43.4	0.0	0.0

RAU = 561.6 (kips); RA2 = 685.0 (kips)

Current CAPWAP Ru = 639.0 (kips); Corresponding J(RP)= 0.00; 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
16.1	35.87	616.5	662.7	665.2	1.22	0.28	0.27	37.8	607.1	1341

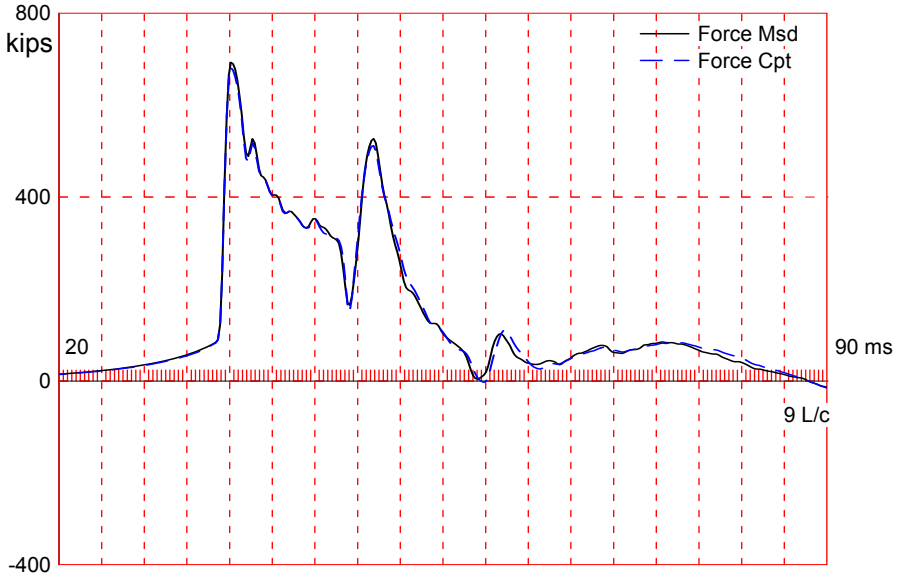
PILE PROFILE AND PILE MODEL

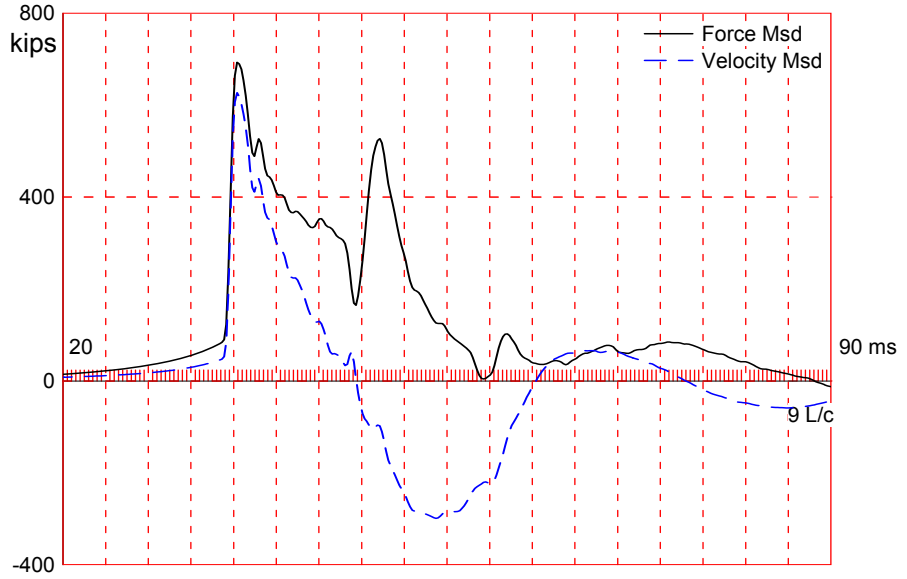
Depth ft	Area in^2	E-Modulus ksi	Spec. Weight lb/ft^3	Perim. ft
0.0	21.4	29992.2	492.000	4.70
92.8	21.4	29992.2	492.000	4.70

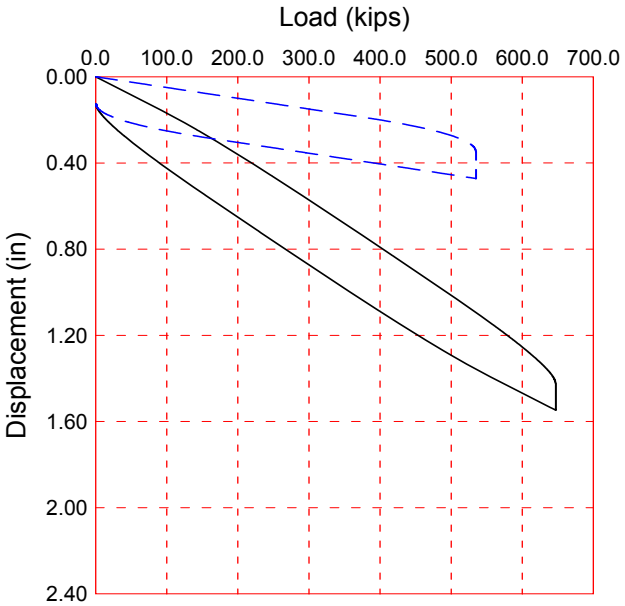
Toe Area 198.5 in^2

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

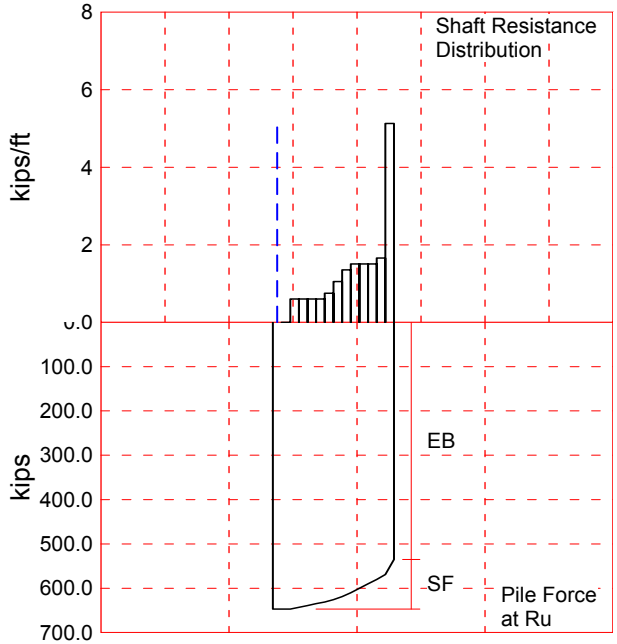
Wave Speed: Pile Top 16807.9, Elastic 16807.9, Overall 16807.9 ft/s
Pile Damping 1.00 %, Time Incr 0.197 ms, 2L/c 11.0 ms
Total volume: 13.784 ft^3; Volume ratio considering added impedance: 1.000







RU =	647.0 kips
SF =	112.0 kips
EB =	535.0 kips
Dy =	1.42 in
Dx =	1.55 in
SET/Bl =	0.12 in



Length b. Sensors	92.8 ft
Embedment	89.0 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	1.97
Top Compr. Stress	31.9 ksi
Max Compr. Stress	32.6 ksi
Max Tension Stress	-4.86 ksi
Avg. Shaft Quake	0.13 in
Toe Quake	0.27 in
Avg. Shaft Smith Dpg.	0.29 s/ft
Toe Smith Damping	0.04 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 SUMMARY RESULTS

Total CAPWAP Capacity: 647.0; along Shaft 112.0; at Toe 535.0 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
				647.0				
1	13.3	9.5	0.0	647.0	0.0	0.00	0.00	0.00
2	19.9	16.1	4.0	643.0	4.0	0.60	0.13	0.29
3	26.5	22.7	4.0	639.0	8.0	0.60	0.13	0.29
4	33.1	29.4	4.0	635.0	12.0	0.60	0.13	0.29
5	39.8	36.0	4.0	631.0	16.0	0.60	0.13	0.29
6	46.4	42.6	5.0	626.0	21.0	0.75	0.16	0.29
7	53.0	49.2	7.0	619.0	28.0	1.06	0.22	0.29
8	59.6	55.9	9.0	610.0	37.0	1.36	0.29	0.29
9	66.3	62.5	10.0	600.0	47.0	1.51	0.32	0.29
10	72.9	69.1	10.0	590.0	57.0	1.51	0.32	0.29
11	79.5	75.7	10.0	580.0	67.0	1.51	0.32	0.29
12	86.1	82.4	11.0	569.0	78.0	1.66	0.35	0.29
13	92.8	89.0	34.0	535.0	112.0	5.13	1.09	0.29
Avg. Shaft			8.6			1.26	0.27	0.29
Toe			535.0				388.11	0.04

Soil Model Parameters/Extensions		Shaft	Toe
Quake	(in)	0.13	0.27
Case Damping Factor		0.85	0.56
Damping Type		Viscous	Sm+Visc
Unloading Quake	(% of loading quake)	100	30
Reloading Level	(% of Ru)	100	0
Unloading Level	(% of Ru)	20	
Resistance Gap (included in Toe Quake)	(in)		0.02

CAPWAP match quality = 1.97 (Wave Up Match) ; RSA = 0
Observed: Final Set = 0.12 in; Blow Count = 96 b/ft
Computed: Final Set = 0.09 in; Blow Count = 132 b/ft
Transducer F3(D815) CAL: 93.0; RF: 1.00; F4(F607) CAL: 93.6; RF: 1.00
A3(K3550) CAL: 360; RF: 1.12; A4(K2524) CAL: 360; RF: 1.12

max. Top Comp. Stress = 31.9 ksi (T= 36.1 ms, max= 1.023 x Top)
max. Comp. Stress = 32.6 ksi (Z= 19.9 ft, T= 37.1 ms)
max. Tens. Stress = -4.86 ksi (Z= 46.4 ft, T= 61.7 ms)
max. Energy (EMX) = 38.9 kip-ft; max. Measured Top Displ. (DMX)= 1.07 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	682.3	-27.1	31.9	-1.26	38.9	16.7	1.08
2	6.6	683.2	-28.7	31.9	-1.34	38.7	16.7	1.06
4	13.3	687.1	-30.9	32.1	-1.44	38.2	16.5	1.03
6	19.9	698.0	-32.6	32.6	-1.52	37.5	16.2	0.98
8	26.5	685.9	-41.7	32.0	-1.95	35.6	15.9	0.93
10	33.1	674.6	-73.3	31.5	-3.43	33.6	15.6	0.88
12	39.8	665.2	-97.4	31.1	-4.55	31.5	15.3	0.82
14	46.4	659.2	-104.0	30.8	-4.86	29.5	14.9	0.77
15	49.7	642.2	-100.2	30.0	-4.68	27.8	14.6	0.74
16	53.0	652.3	-101.1	30.5	-4.72	27.1	14.4	0.70
17	56.3	627.6	-96.7	29.3	-4.52	25.0	14.1	0.67
18	59.6	638.6	-97.6	29.8	-4.56	24.3	13.8	0.64
19	62.9	605.8	-90.8	28.3	-4.24	22.0	13.5	0.60
20	66.3	616.9	-91.5	28.8	-4.28	21.2	13.2	0.57
21	69.6	580.5	-84.3	27.1	-3.94	18.8	12.8	0.53
22	72.9	591.6	-85.6	27.6	-4.00	17.9	12.6	0.50
23	76.2	574.5	-79.2	26.8	-3.70	15.7	12.3	0.46
24	79.5	591.7	-80.5	27.6	-3.76	14.9	12.0	0.43
25	82.8	592.4	-73.3	27.7	-3.42	12.9	13.1	0.39
26	86.1	624.7	-73.9	29.2	-3.45	12.0	14.1	0.36
27	89.4	619.9	-66.9	29.0	-3.13	10.1	14.4	0.32
28	92.8	626.2	-67.0	29.3	-3.13	7.9	13.0	0.28
Absolute	19.9			32.6			(T =	37.1 ms)
	46.4				-4.86		(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	766.9	711.0	655.0	599.1	543.1	487.2	431.2	375.3	319.3	263.4
RX	809.0	782.9	765.5	748.1	730.7	713.3	695.9	678.5	661.2	644.7
RU	768.4	712.6	656.8	601.0	545.2	489.4	433.6	377.8	322.0	266.2

RAU = 350.2 (kips); RA2 = 671.8 (kips)

Current CAPWAP Ru = 647.0 (kips); Corresponding J(RP)= 0.21; J(RX) = 0.89

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
16.5	35.87	630.3	696.1	696.1	1.07	0.13	0.12	39.0	782.3	2140

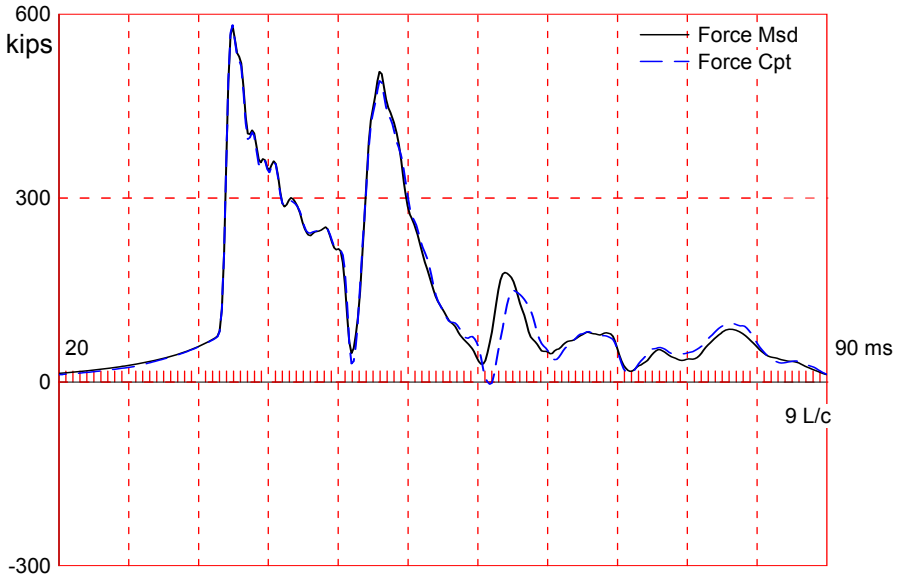
PILE PROFILE AND PILE MODEL

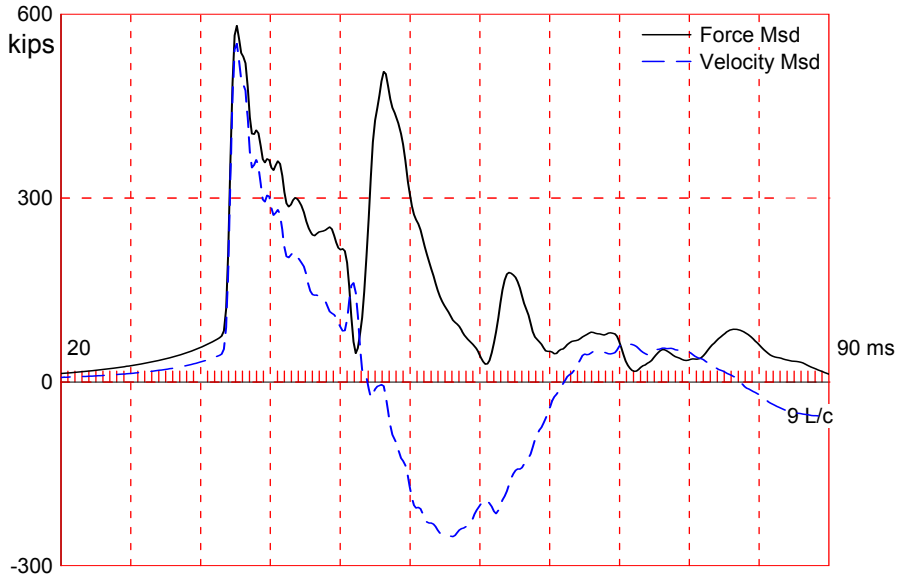
Depth ft	Area in^2	E-Modulus ksi	Spec. Weight lb/ft^3	Perim. ft
0.0	21.4	29992.2	492.000	4.70
92.8	21.4	29992.2	492.000	4.70

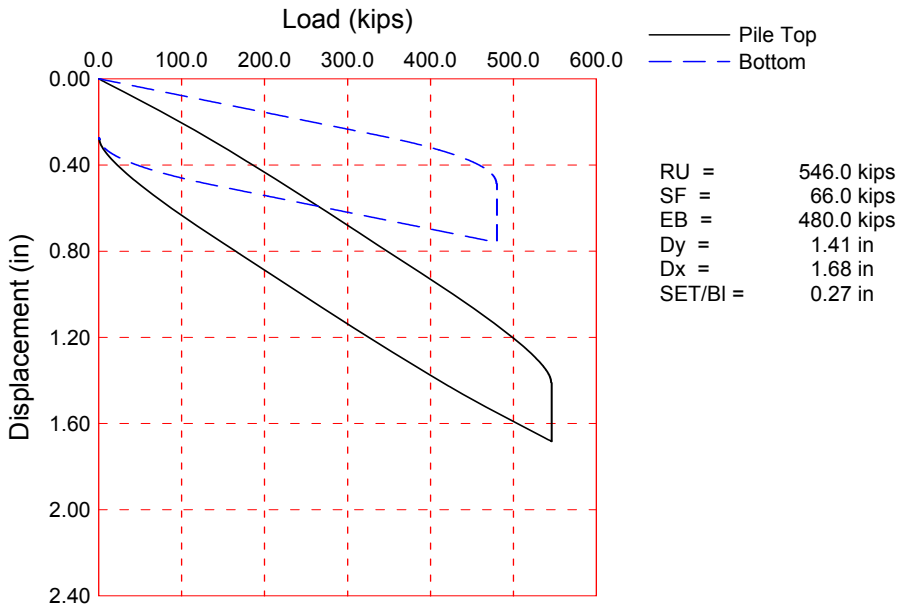
Toe Area 198.5 in^2

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

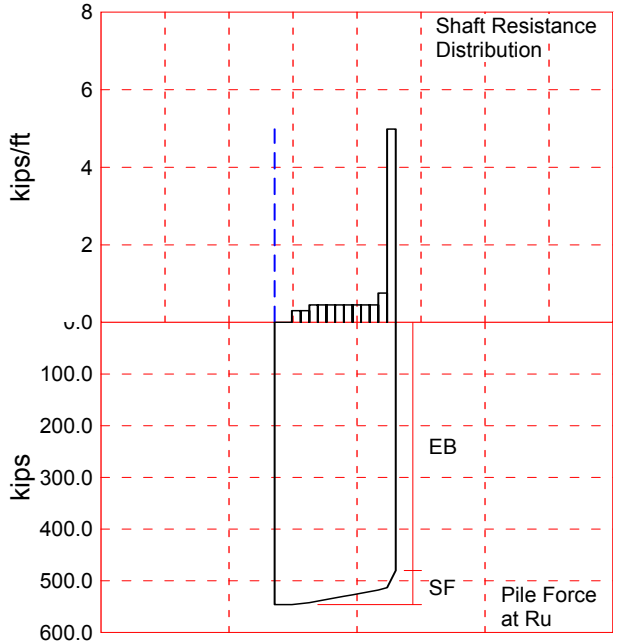
Wave Speed: Pile Top 16807.9, Elastic 16807.9, Overall 16807.9 ft/s
Pile Damping 1.00 %, Time Incr 0.197 ms, 2L/c 11.0 ms
Total volume: 13.784 ft^3; Volume ratio considering added impedance: 1.000







RU =	546.0 kips
SF =	66.0 kips
EB =	480.0 kips
Dy =	1.41 in
Dx =	1.68 in
SET/Bl =	0.27 in



Length b. Sensors	92.7 ft
Embedment	90.0 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	3.40
Top Compr. Stress	27.2 ksi
Max Compr. Stress	27.6 ksi
Max Tension Stress	-2.31 ksi
Avg. Shaft Quake	0.13 in
Toe Quake	0.37 in
Avg. Shaft Smith Dpg.	0.25 s/ft
Toe Smith Damping	0.03 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: 546.0; along Shaft 66.0; at Toe 480.0 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
				546.0				
1	6.6	4.0	0.0	546.0	0.0	0.00	0.00	0.00
2	13.2	10.6	0.0	546.0	0.0	0.00	0.00	0.00
3	19.9	17.2	2.0	544.0	2.0	0.30	0.06	0.25
4	26.5	23.8	2.0	542.0	4.0	0.30	0.06	0.25
5	33.1	30.4	3.0	539.0	7.0	0.45	0.10	0.25
6	39.7	37.1	3.0	536.0	10.0	0.45	0.10	0.25
7	46.3	43.7	3.0	533.0	13.0	0.45	0.10	0.25
8	52.9	50.3	3.0	530.0	16.0	0.45	0.10	0.25
9	59.6	56.9	3.0	527.0	19.0	0.45	0.10	0.25
10	66.2	63.5	3.0	524.0	22.0	0.45	0.10	0.25
11	72.8	70.1	3.0	521.0	25.0	0.45	0.10	0.25
12	79.4	76.8	3.0	518.0	28.0	0.45	0.10	0.25
13	86.0	83.4	5.0	513.0	33.0	0.76	0.16	0.25
14	92.7	90.0	33.0	480.0	66.0	4.99	1.06	0.25
Avg. Shaft			4.7			0.73	0.16	0.25
Toe			480.0				348.21	0.03

Soil Model Parameters/Extensions		Shaft	Toe
Quake	(in)	0.13	0.37
Case Damping Factor		0.43	0.38
Damping Type		Viscous	Smith
Unloading Quake	(% of loading quake)	85	30
Unloading Level	(% of Ru)	63	
Resistance Gap (included in Toe Quake)	(in)		0.01
Soil Plug Weight	(kips)	0.040	

CAPWAP match quality = 3.40 (Wave Up Match) ; RSA = 0
Observed: Final Set = 0.27 in; Blow Count = 44 b/ft
Computed: Final Set = 0.23 in; Blow Count = 52 b/ft
Transducer F3(H880) CAL: 93.7; RF: 1.00; F4(F607) CAL: 93.6; RF: 1.00
A3(K2253) CAL: 325; RF: 1.10; A4(K2524) CAL: 360; RF: 1.10

max. Top Comp. Stress = 27.2 ksi (T= 36.2 ms, max= 1.013 x Top)
max. Comp. Stress = 27.6 ksi (Z= 19.9 ft, T= 37.2 ms)
max. Tens. Stress = -2.31 ksi (Z= 52.9 ft, T= 62.4 ms)
max. Energy (EMX) = 28.3 kip-ft; max. Measured Top Displ. (DMX)= 1.03 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	583.2	-30.1	27.2	-1.41	28.3	14.4	1.04
2	6.6	583.8	-32.8	27.3	-1.53	28.2	14.4	1.03
4	13.2	585.9	-37.7	27.4	-1.76	27.9	14.3	1.00
6	19.9	590.6	-40.9	27.6	-1.91	27.5	14.2	0.96
8	26.5	587.5	-39.6	27.4	-1.85	26.5	14.0	0.92
10	33.1	589.1	-36.9	27.5	-1.72	25.4	13.7	0.88
12	39.7	581.7	-33.9	27.2	-1.58	24.1	13.5	0.84
14	46.3	570.6	-33.0	26.7	-1.54	22.8	13.4	0.79
15	49.6	560.9	-42.1	26.2	-1.97	21.9	13.3	0.77
16	52.9	564.0	-49.4	26.3	-2.31	21.4	13.3	0.74
17	56.3	554.6	-48.6	25.9	-2.27	20.4	13.1	0.71
18	59.6	557.7	-46.4	26.1	-2.17	19.9	13.1	0.69
19	62.9	548.4	-40.8	25.6	-1.90	18.9	12.9	0.66
20	66.2	552.6	-40.8	25.8	-1.90	18.3	12.8	0.63
21	69.5	549.9	-39.4	25.7	-1.84	17.3	12.5	0.60
22	72.8	554.4	-38.5	25.9	-1.80	16.8	12.4	0.57
23	76.1	537.7	-35.1	25.1	-1.64	15.8	12.5	0.54
24	79.4	540.2	-37.6	25.2	-1.75	15.2	12.6	0.51
25	82.7	531.7	-38.2	24.8	-1.79	14.1	14.6	0.48
26	86.0	535.8	-39.5	25.0	-1.85	13.5	15.1	0.45
27	89.4	535.4	-34.6	25.0	-1.62	12.2	16.0	0.42
28	92.7	546.4	-36.6	25.5	-1.71	9.4	15.3	0.40
Absolute	19.9			27.6			(T =	37.2 ms)
	52.9				-2.31		(T =	62.4 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	535.1	473.9	412.6	351.4	290.2	229.0	167.7	106.5	45.3	0.0
RX	617.4	601.6	588.7	581.5	574.2	567.0	559.7	552.5	545.2	538.7
RU	535.1	473.9	412.6	351.4	290.2	229.0	167.7	106.5	45.3	0.0

RAU = 434.0 (kips); RA2 = 582.8 (kips)

Current CAPWAP Ru = 546.0 (kips); Corresponding J(RP)= 0.00; 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
14.7	36.03	559.7	587.7	587.7	1.03	0.27	0.27	28.4	522.5	1333

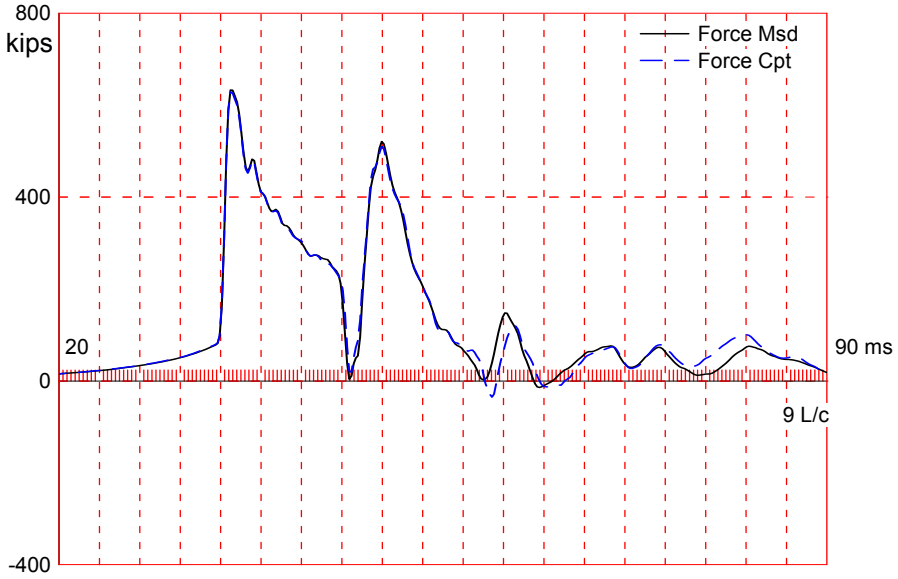
PILE PROFILE AND PILE MODEL

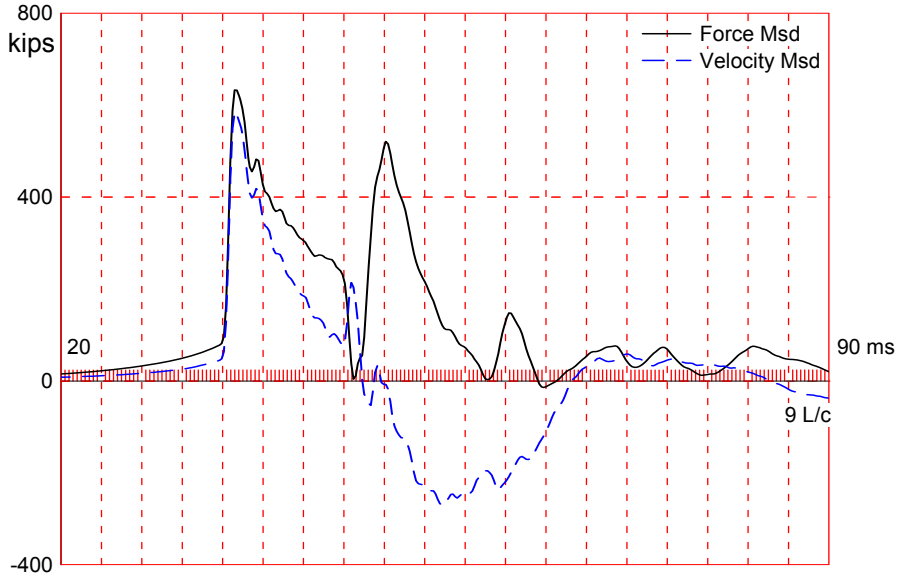
Depth ft	Area in^2	E-Modulus ksi	Spec. Weight lb/ft^3	Perim. ft
0.0	21.4	29992.2	492.000	4.70
92.7	21.4	29992.2	492.000	4.70

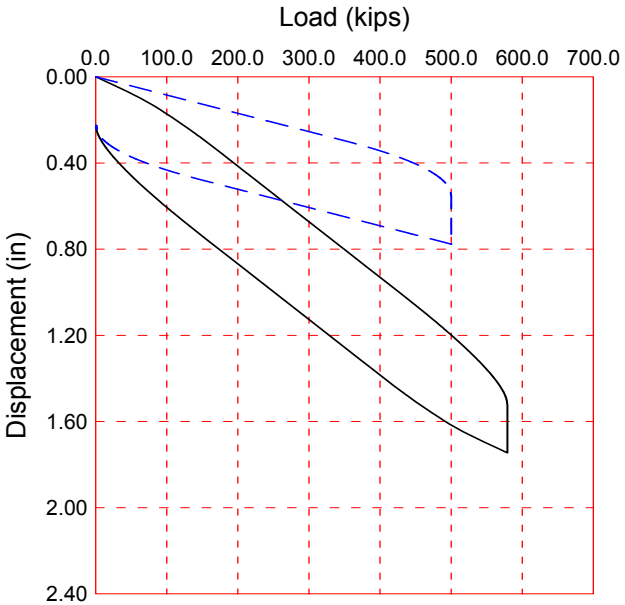
Toe Area 198.5 in^2

Segmnt Number	Dist. B.G. ft	Impedance kips/ft/s	Imped. Change %	Tension 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
11	36.4	38.20	0.00	0.00	0.000	-0.00	0.000	4.70	16807.9	0.010
12	39.7	38.20	0.00	0.00	0.000	-0.00	0.000	4.70	16807.9	0.000
13	43.0	38.20	0.00	0.00	0.000	-0.00	0.000	4.70	16807.9	0.010
14	46.3	38.20	0.00	0.00	0.000	-0.00	0.000	4.70	16807.9	0.000
23	76.1	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	0.000
28	92.7	38.20	0.00	0.00	0.000	-0.00	0.000	4.70	16807.9	0.000

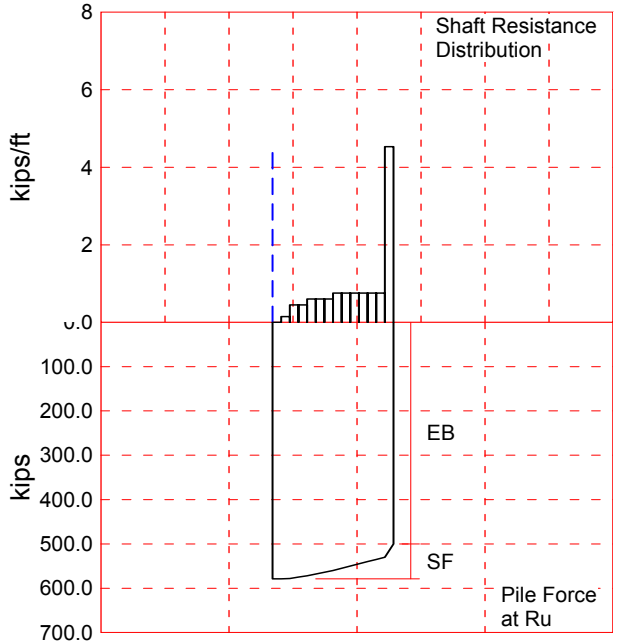
Wave Speed: Pile Top 16807.9, Elastic 16807.9, Overall 16807.9 ft/s
Pile Damping 1.00 %, Time Incr 0.197 ms, 2L/c 11.0 ms
Total volume: 13.770 ft^3; Volume ratio considering added impedance: 1.000







RU =	579.0 kips
SF =	79.0 kips
EB =	500.0 kips
Dy =	1.52 in
Dx =	1.75 in
SET/Bl =	0.23 in



Length b. Sensors	92.7 ft
Embedment	90.1 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	3.85
Top Compr. Stress	29.4 ksi
Max Compr. Stress	29.7 ksi
Max Tension Stress	-3.71 ksi
Avg. Shaft Quake	0.06 in
Toe Quake	0.42 in
Avg. Shaft Smith Dpg.	0.27 s/ft
Toe Smith Damping	0.03 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: 579.0; along Shaft 79.0; at Toe 500.0 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
				579.0				
1	6.6	4.0	0.0	579.0	0.0	0.00	0.00	0.00
2	13.2	10.7	1.0	578.0	1.0	0.15	0.03	0.27
3	19.9	17.3	3.0	575.0	4.0	0.45	0.10	0.27
4	26.5	23.9	3.0	572.0	7.0	0.45	0.10	0.27
5	33.1	30.5	4.0	568.0	11.0	0.60	0.13	0.27
6	39.7	37.1	4.0	564.0	15.0	0.60	0.13	0.27
7	46.3	43.7	4.0	560.0	19.0	0.60	0.13	0.27
8	52.9	50.4	5.0	555.0	24.0	0.76	0.16	0.27
9	59.6	57.0	5.0	550.0	29.0	0.76	0.16	0.27
10	66.2	63.6	5.0	545.0	34.0	0.76	0.16	0.27
11	72.8	70.2	5.0	540.0	39.0	0.76	0.16	0.27
12	79.4	76.8	5.0	535.0	44.0	0.76	0.16	0.27
13	86.0	83.5	5.0	530.0	49.0	0.76	0.16	0.27
14	92.7	90.1	30.0	500.0	79.0	4.53	0.96	0.27
Avg. Shaft			5.6			0.88	0.19	0.27
Toe			500.0				362.72	0.03

Soil Model Parameters/Extensions		Shaft	Toe
Quake	(in)	0.06	0.42
Case Damping Factor		0.56	0.39
Damping Type		Viscous	Smith
Unloading Quake	(% of loading quake)	100	32
Reloading Level	(% of Ru)	100	0
Unloading Level	(% of Ru)	46	
Resistance Gap (included in Toe Quake)	(in)		0.06

CAPWAP match quality = 3.85 (Wave Up Match) ; RSA = 0
Observed: Final Set = 0.23 in; Blow Count = 53 b/ft
Computed: Final Set = 0.19 in; Blow Count = 63 b/ft
Transducer F3(F607) CAL: 93.6; RF: 1.00; F4(D815) CAL: 93.0; RF: 1.00
A3(K2524) CAL: 360; RF: 1.11; A4(K3550) CAL: 360; RF: 1.11

max. Top Comp. Stress = 29.4 ksi (T= 36.0 ms, max= 1.009 x Top)
max. Comp. Stress = 29.7 ksi (Z= 19.9 ft, T= 37.2 ms)
max. Tens. Stress = -3.71 ksi (Z= 59.6 ft, T= 63.0 ms)
max. Energy (EMX) = 34.1 kip-ft; max. Measured Top Displ. (DMX)= 1.11 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	629.5	-37.0	29.4	-1.73	34.1	15.4	1.10
2	6.6	630.0	-39.2	29.4	-1.83	34.1	15.4	1.09
4	13.2	633.3	-58.6	29.6	-2.74	33.8	15.2	1.06
6	19.9	635.3	-74.8	29.7	-3.49	33.0	15.0	1.02
8	26.5	627.8	-77.2	29.3	-3.61	31.6	14.8	0.98
10	33.1	621.6	-66.7	29.0	-3.12	30.2	14.6	0.94
12	39.7	610.4	-57.7	28.5	-2.69	28.5	14.3	0.89
14	46.3	599.9	-58.3	28.0	-2.72	26.7	14.1	0.84
15	49.6	586.2	-62.2	27.4	-2.91	25.4	13.9	0.82
16	52.9	590.5	-76.8	27.6	-3.59	24.9	13.8	0.79
17	56.3	572.1	-76.3	26.7	-3.57	23.3	13.7	0.76
18	59.6	576.1	-79.5	26.9	-3.71	22.8	13.6	0.74
19	62.9	557.6	-74.5	26.1	-3.48	21.3	13.4	0.71
20	66.2	561.4	-72.2	26.2	-3.37	20.7	13.3	0.68
21	69.5	543.0	-64.4	25.4	-3.01	19.2	13.2	0.65
22	72.8	546.6	-65.2	25.5	-3.05	18.6	14.0	0.62
23	76.1	528.3	-61.6	24.7	-2.88	17.0	13.7	0.59
24	79.4	531.6	-59.9	24.8	-2.80	16.4	14.1	0.56
25	82.7	522.8	-52.4	24.4	-2.45	14.9	16.0	0.53
26	86.0	534.5	-46.7	25.0	-2.18	14.1	17.2	0.49
27	89.4	551.0	-35.9	25.7	-1.68	12.6	17.7	0.46
28	92.7	566.9	-34.0	26.5	-1.59	9.3	16.8	0.44
Absolute	19.9			29.7			(T =	37.2 ms)
	59.6				-3.71		(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	539.2	470.2	401.2	332.2	263.2	194.2	125.2	56.2	0.0	0.0
RX	666.2	643.4	623.0	607.6	597.1	586.7	576.6	567.5	559.6	553.4
RU	539.2	470.2	401.2	332.2	263.2	194.2	125.2	56.2	0.0	0.0

RAU = 366.9 (kips); RA2 = 616.8 (kips)

Current CAPWAP Ru = 579.0 (kips); Corresponding J(RP)= 0.00; J(RX) = 0.58

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
15.4	35.83	588.8	640.3	640.3	1.11	0.23	0.23	34.2	613.8	1389

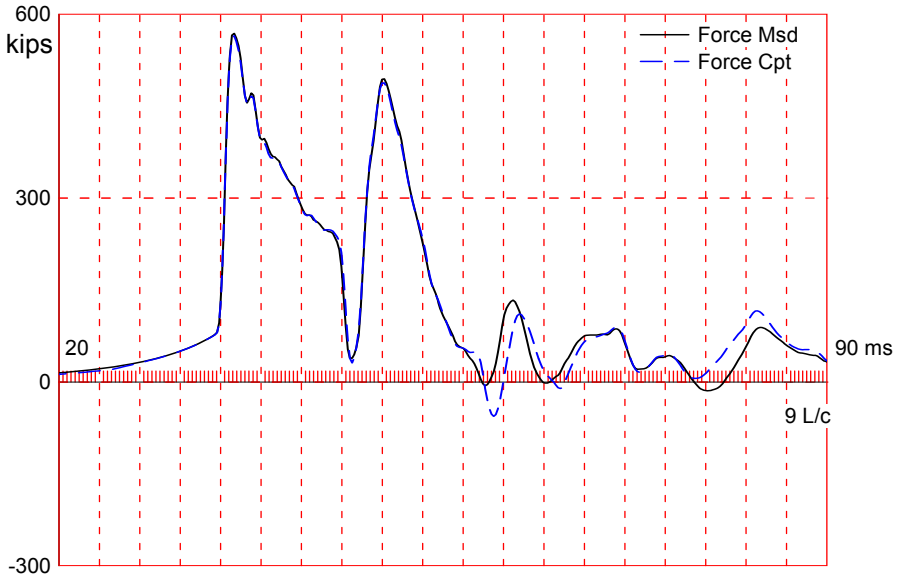
PILE PROFILE AND PILE MODEL

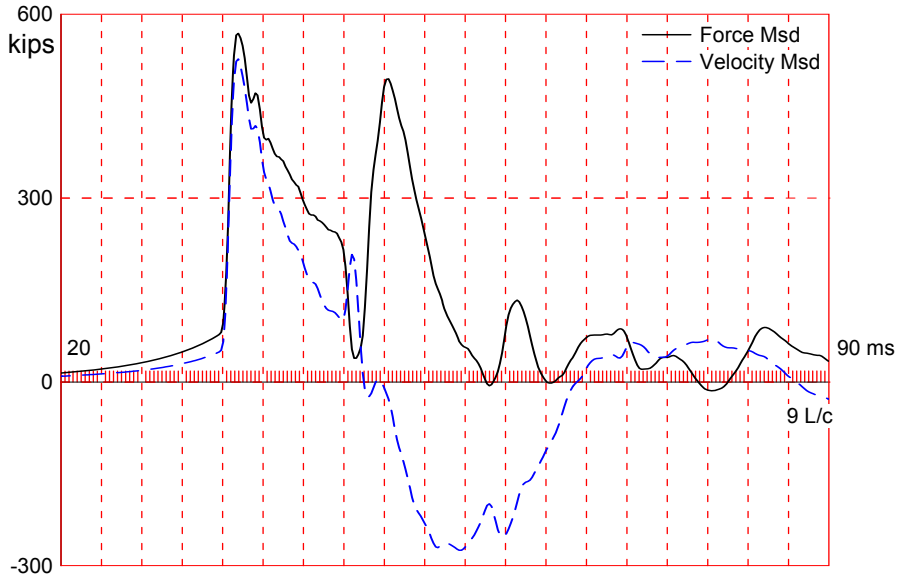
Depth ft	Area in^2	E-Modulus ksi	Spec. Weight lb/ft^3	Perim. ft
0.0	21.4	29992.2	492.000	4.70
92.7	21.4	29992.2	492.000	4.70

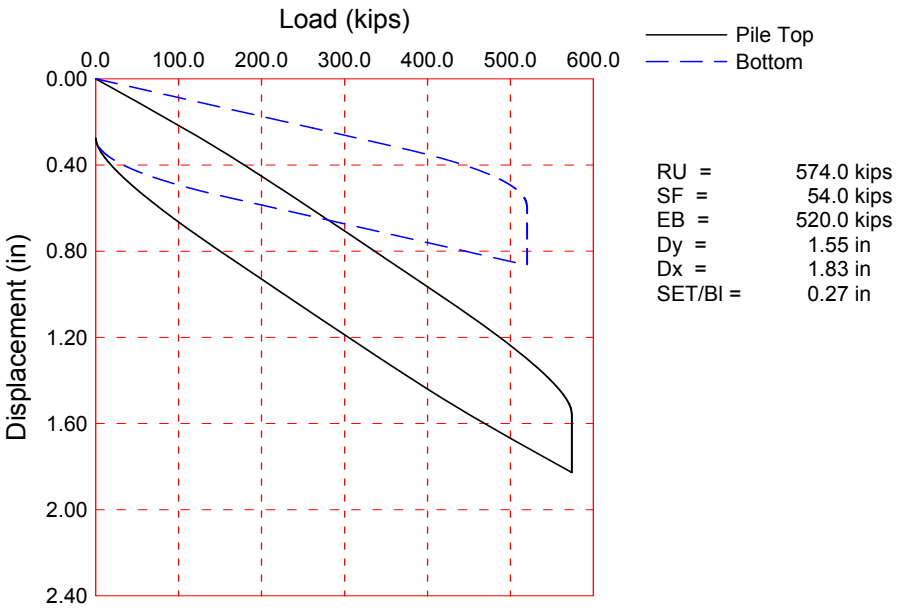
Toe Area 198.5 in^2

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

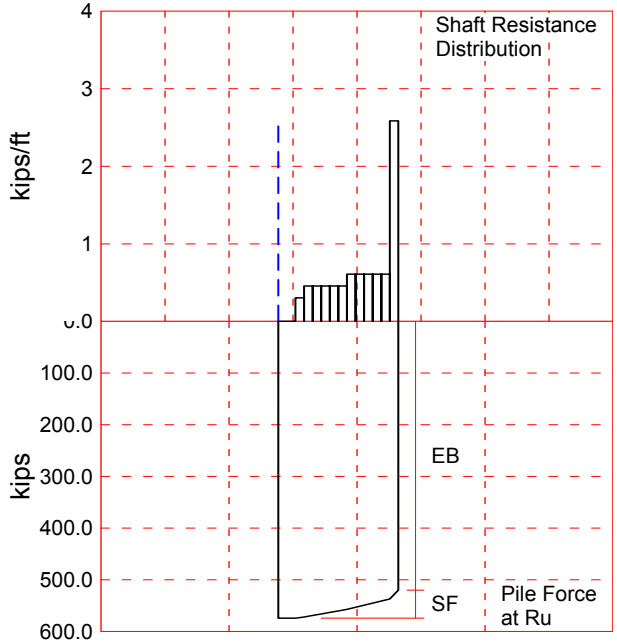
Wave Speed: Pile Top 16807.9, Elastic 16807.9, Overall 16807.9 ft/s
Pile Damping 1.00 %, Time Incr 0.197 ms, 2L/c 11.0 ms
Total volume: 13.770 ft^3; Volume ratio considering added impedance: 1.000







RU =	574.0 kips
SF =	54.0 kips
EB =	520.0 kips
Dy =	1.55 in
Dx =	1.83 in
SET/Bl =	0.27 in



Length b. Sensors	92.0 ft
Embedment	92.0 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	4.18
Top Compr. Stress	26.4 ksi
Max Compr. Stress	26.9 ksi
Max Tension Stress	-4.57 ksi
Avg. Shaft Quake	0.18 in
Toe Quake	0.45 in
Avg. Shaft Smith Dpg.	0.24 s/ft
Toe Smith Damping	0.03 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: 574.0; along Shaft 54.0; at Toe 520.0 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
				574.0				
1	6.6	6.6	0.0	574.0	0.0	0.00	0.00	0.00
2	13.1	13.1	0.0	574.0	0.0	0.00	0.00	0.00
3	19.7	19.7	2.0	572.0	2.0	0.30	0.06	0.24
4	26.3	26.3	3.0	569.0	5.0	0.46	0.10	0.24
5	32.9	32.9	3.0	566.0	8.0	0.46	0.10	0.24
6	39.4	39.4	3.0	563.0	11.0	0.46	0.10	0.24
7	46.0	46.0	3.0	560.0	14.0	0.46	0.10	0.24
8	52.6	52.6	3.0	557.0	17.0	0.46	0.10	0.24
9	59.1	59.1	4.0	553.0	21.0	0.61	0.13	0.24
10	65.7	65.7	4.0	549.0	25.0	0.61	0.13	0.24
11	72.3	72.3	4.0	545.0	29.0	0.61	0.13	0.24
12	78.9	78.9	4.0	541.0	33.0	0.61	0.13	0.24
13	85.4	85.4	4.0	537.0	37.0	0.61	0.13	0.24
14	92.0	92.0	17.0	520.0	54.0	2.59	0.55	0.24
Avg. Shaft			3.9			0.59	0.12	0.24
Toe			520.0				377.22	0.03

Soil Model Parameters/Extensions		Shaft	Toe
Quake	(in)	0.18	0.45
Case Damping Factor		0.34	0.41
Damping Type		Viscous	Smith
Unloading Quake	(% of loading quake)	30	30
Unloading Level	(% of Ru)	94	
Resistance Gap (included in Toe Quake)	(in)		0.01
Soil Plug Weight	(kips)	0.040	

CAPWAP match quality = 4.18 (Wave Up Match) ; RSA = 0
Observed: Final Set = 0.27 in; Blow Count = 44 b/ft
Computed: Final Set = 0.31 in; Blow Count = 39 b/ft
Transducer F3(F607) CAL: 93.6; RF: 1.00; F4(H880) CAL: 93.7; RF: 1.00
A3(K2524) CAL: 360; RF: 1.10; A4(K2253) CAL: 325; RF: 1.10

max. Top Comp. Stress = 26.4 ksi (T= 36.4 ms, max= 1.017 x Top)
max. Comp. Stress = 26.9 ksi (Z= 19.7 ft, T= 37.3 ms)
max. Tens. Stress = -4.57 ksi (Z= 52.6 ft, T= 62.9 ms)
max. Energy (EMX) = 31.8 kip-ft; max. Measured Top Displ. (DMX)= 1.13 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	565.4	-53.6	26.4	-2.51	31.8	13.9	1.13
2	6.6	566.1	-47.9	26.4	-2.24	31.8	13.9	1.12
4	13.1	569.4	-58.2	26.6	-2.72	31.5	13.8	1.09
6	19.7	575.0	-63.4	26.9	-2.96	31.0	13.6	1.06
8	26.3	573.0	-55.4	26.8	-2.59	30.0	13.4	1.02
10	32.9	573.4	-38.9	26.8	-1.82	28.7	13.1	0.97
12	39.4	569.0	-36.4	26.6	-1.70	27.3	12.9	0.93
14	46.0	556.8	-77.4	26.0	-3.62	25.9	12.9	0.88
15	49.3	545.6	-90.9	25.5	-4.24	24.9	12.8	0.85
16	52.6	549.3	-97.7	25.7	-4.57	24.4	12.7	0.83
17	55.9	541.0	-88.5	25.3	-4.13	23.4	12.6	0.80
18	59.1	545.3	-83.2	25.5	-3.89	22.9	12.5	0.78
19	62.4	533.2	-77.3	24.9	-3.61	21.6	12.4	0.75
20	65.7	537.5	-77.1	25.1	-3.60	21.0	12.3	0.72
21	69.0	525.6	-71.9	24.6	-3.36	19.7	12.4	0.69
22	72.3	529.9	-72.2	24.8	-3.37	19.0	13.4	0.66
23	75.6	518.4	-65.1	24.2	-3.04	17.7	13.8	0.62
24	78.9	524.3	-65.8	24.5	-3.08	17.1	13.9	0.59
25	82.1	530.6	-55.4	24.8	-2.59	15.8	15.2	0.56
26	85.4	541.6	-49.0	25.3	-2.29	15.0	15.9	0.53
27	88.7	547.4	-35.2	25.6	-1.64	13.8	16.3	0.50
28	92.0	567.3	-29.5	26.5	-1.38	12.3	15.4	0.48
Absolute	19.7			26.9			(T =	37.3 ms)
	52.6				-4.57		(T =	62.9 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	497.0	436.4	375.8	315.2	254.6	194.0	133.5	72.9	12.3	0.0
RX	634.2	611.8	601.8	591.8	581.8	571.9	563.3	557.5	551.9	546.4
RU	497.0	436.4	375.8	315.2	254.6	194.0	133.5	72.9	12.3	0.0

RAU = 471.3 (kips); RA2 = 602.9 (kips)

Current CAPWAP Ru = 574.0 (kips); Corresponding J(RP)= 0.00; J(RX) = 0.48

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
13.9	36.36	530.6	572.2	572.2	1.13	0.28	0.27	31.9	546.1	1182

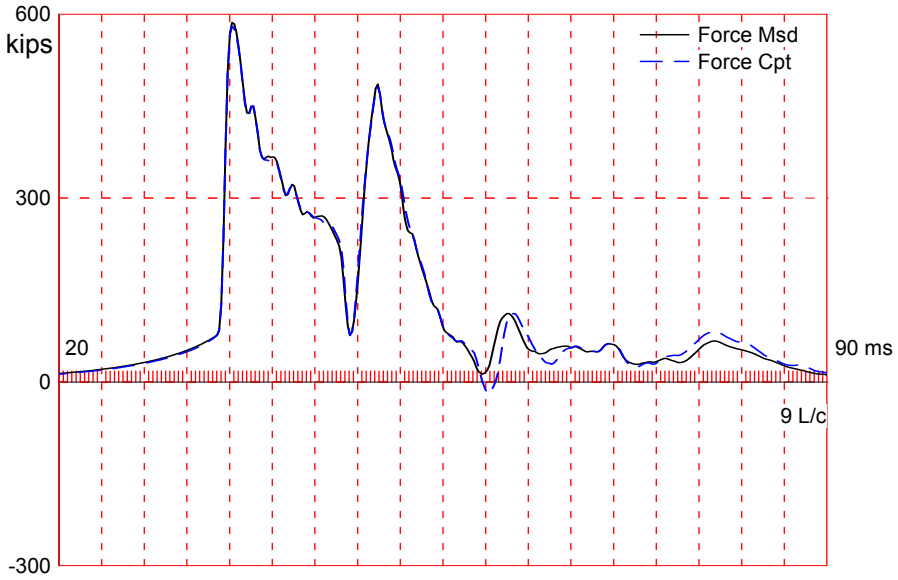
PILE PROFILE AND PILE MODEL

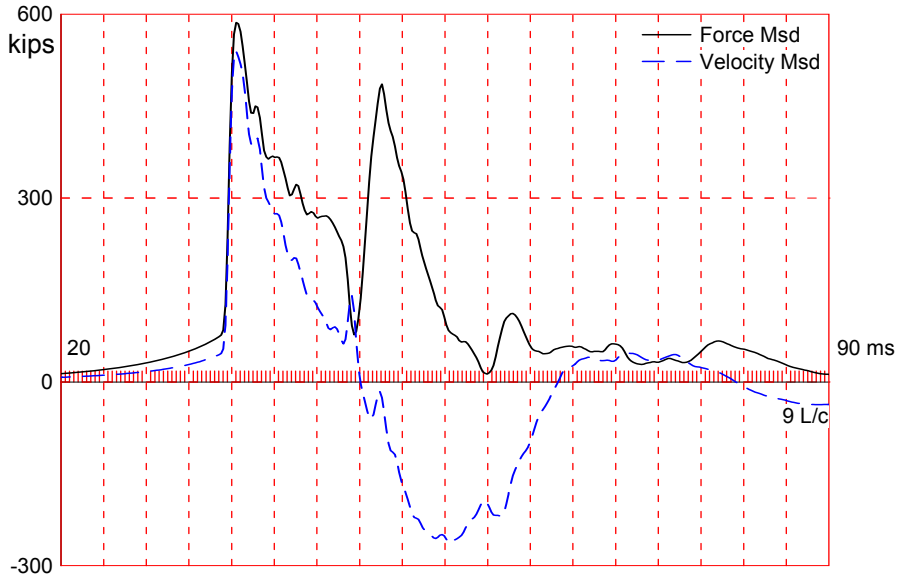
Depth ft	Area in^2	E-Modulus ksi	Spec. Weight lb/ft^3	Perim. ft
0.0	21.4	29992.2	492.000	4.70
92.0	21.4	29992.2	492.000	4.70

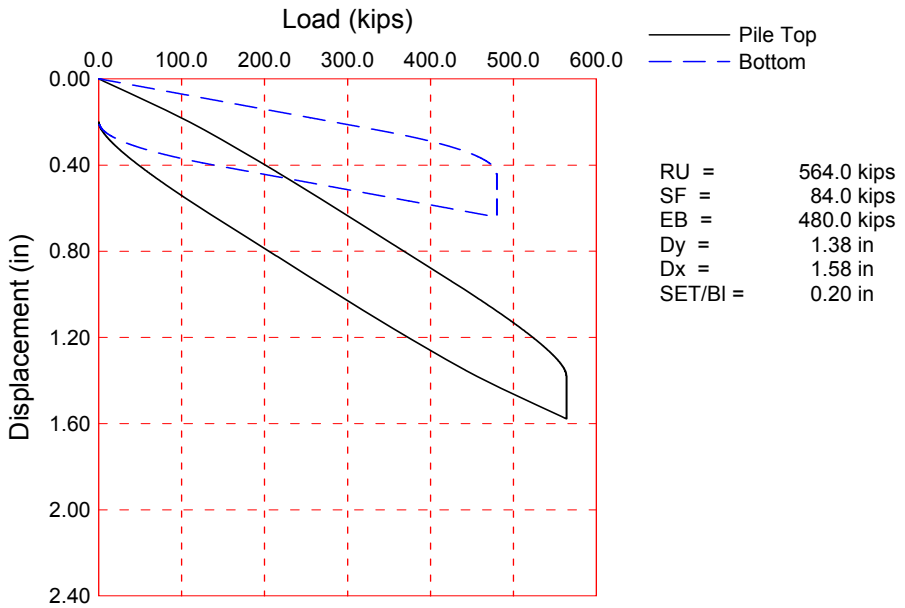
Toe Area 198.5 in^2

Segmnt Number	Dist. B.G. ft	Impedance kips/ft/s	Imped. Change %	Tension 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
12	39.4	38.20	0.00	0.00	0.000	-0.00	0.000	4.70	16807.9	0.010
16	52.6	38.20	0.00	0.00	0.000	-0.00	0.000	4.70	16807.9	0.000
28	92.0	38.20	0.00	0.00	0.000	-0.00	0.000	4.70	16807.9	0.000

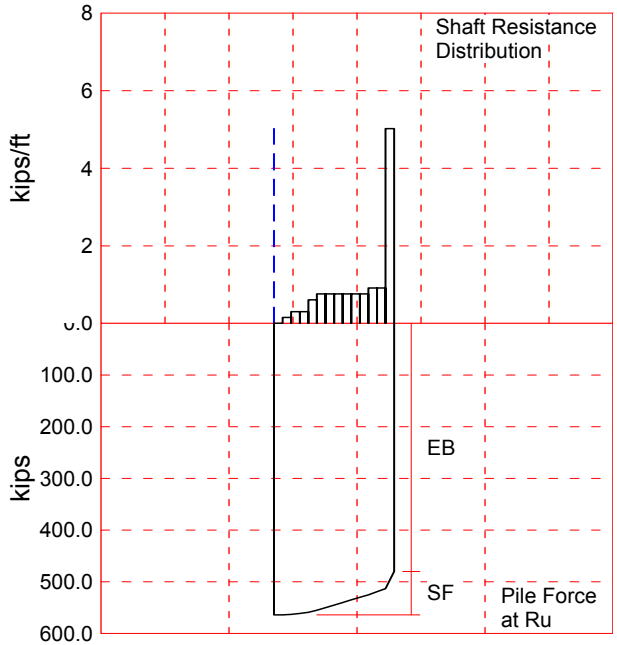
Wave Speed: Pile Top 16807.9, Elastic 16807.9, Overall 16807.9 ft/s
Pile Damping 1.00 %, Time Incr 0.195 ms, 2L/c 10.9 ms
Total volume: 13.672 ft^3; Volume ratio considering added impedance: 1.000







RU =	564.0 kips
SF =	84.0 kips
EB =	480.0 kips
Dy =	1.38 in
Dx =	1.58 in
SET/Bl =	0.20 in



Length b. Sensors	92.0 ft
Embedment	92.0 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	2.50
Top Compr. Stress	27.2 ksi
Max Compr. Stress	27.4 ksi
Max Tension Stress	-3.37 ksi
Avg. Shaft Quake	0.11 in
Toe Quake	0.34 in
Avg. Shaft Smith Dpg.	0.26 s/ft
Toe Smith Damping	0.03 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: 564.0; along Shaft 84.0; at Toe 480.0 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
				564.0				
1	6.6	6.6	0.0	564.0	0.0	0.00	0.00	0.00
2	13.1	13.1	1.0	563.0	1.0	0.15	0.03	0.26
3	19.7	19.7	2.0	561.0	3.0	0.30	0.06	0.26
4	26.3	26.3	2.0	559.0	5.0	0.30	0.06	0.26
5	32.9	32.9	4.0	555.0	9.0	0.61	0.13	0.26
6	39.4	39.4	5.0	550.0	14.0	0.76	0.16	0.26
7	46.0	46.0	5.0	545.0	19.0	0.76	0.16	0.26
8	52.6	52.6	5.0	540.0	24.0	0.76	0.16	0.26
9	59.1	59.1	5.0	535.0	29.0	0.76	0.16	0.26
10	65.7	65.7	5.0	530.0	34.0	0.76	0.16	0.26
11	72.3	72.3	5.0	525.0	39.0	0.76	0.16	0.26
12	78.9	78.9	6.0	519.0	45.0	0.91	0.19	0.26
13	85.4	85.4	6.0	513.0	51.0	0.91	0.19	0.26
14	92.0	92.0	33.0	480.0	84.0	5.02	1.07	0.26
Avg. Shaft			6.0			0.91	0.19	0.26
Toe			480.0				348.21	0.03

Soil Model Parameters/Extensions		Shaft	Toe
Quake	(in)	0.11	0.34
Case Damping Factor		0.57	0.38
Damping Type		Viscous	Smith
Unloading Quake	(% of loading quake)	100	34
Reloading Level	(% of Ru)	100	0
Unloading Level	(% of Ru)	46	
Resistance Gap (included in Toe Quake)	(in)		0.02

CAPWAP match quality = 2.50 (Wave Up Match) ; RSA = 0
Observed: Final Set = 0.20 in; Blow Count = 60 b/ft
Computed: Final Set = 0.17 in; Blow Count = 69 b/ft
Transducer F3(D815) CAL: 93.0; RF: 1.00; F4(F607) CAL: 93.6; RF: 1.00
A3(K3550) CAL: 360; RF: 1.09; A4(K2524) CAL: 360; RF: 1.09

max. Top Comp. Stress = 27.2 ksi (T= 36.2 ms, max= 1.010 x Top)
max. Comp. Stress = 27.4 ksi (Z= 19.7 ft, T= 37.1 ms)
max. Tens. Stress = -3.37 ksi (Z= 52.6 ft, T= 62.4 ms)
max. Energy (EMX) = 29.9 kip-ft; max. Measured Top Displ. (DMX)= 1.01 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	581.9	-22.2	27.2	-1.04	29.9	14.2	1.01
2	6.6	583.2	-23.0	27.2	-1.08	29.8	14.2	1.00
4	13.1	587.1	-24.1	27.4	-1.13	29.5	14.1	0.97
6	19.7	587.6	-24.3	27.4	-1.14	28.8	13.9	0.93
8	26.3	584.4	-24.1	27.3	-1.12	27.8	13.7	0.89
10	32.9	584.2	-25.0	27.3	-1.17	26.7	13.5	0.85
12	39.4	576.3	-48.3	26.9	-2.26	25.2	13.2	0.80
14	46.0	564.7	-68.5	26.4	-3.20	23.5	12.9	0.76
15	49.3	548.3	-71.1	25.6	-3.32	22.2	12.8	0.73
16	52.6	553.5	-72.2	25.9	-3.37	21.7	12.6	0.71
17	55.9	537.5	-65.0	25.1	-3.04	20.4	12.5	0.68
18	59.1	542.6	-60.0	25.3	-2.80	19.9	12.4	0.65
19	62.4	527.2	-53.1	24.6	-2.48	18.5	12.2	0.63
20	65.7	532.2	-54.5	24.9	-2.55	18.0	12.1	0.60
21	69.0	517.1	-51.7	24.2	-2.41	16.8	11.9	0.57
22	72.3	522.9	-56.4	24.4	-2.64	16.2	11.8	0.54
23	75.6	508.9	-52.5	23.8	-2.45	14.9	11.6	0.51
24	78.9	520.5	-52.9	24.3	-2.47	14.2	12.1	0.48
25	82.1	523.2	-47.7	24.4	-2.23	12.8	13.6	0.45
26	85.4	531.9	-47.2	24.8	-2.21	12.2	14.6	0.41
27	88.7	542.1	-39.0	25.3	-1.82	10.8	14.8	0.38
28	92.0	557.6	-36.0	26.0	-1.68	8.2	13.9	0.35
Absolute	19.7			27.4			(T =	37.1 ms)
	52.6				-3.37		(T =	62.4 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	550.2	492.7	435.2	377.7	320.2	262.7	205.2	147.7	90.2	32.6
RX	660.2	641.9	623.6	605.4	587.1	570.7	557.9	546.0	537.2	530.6
RU	550.2	492.7	435.2	377.7	320.2	262.7	205.2	147.7	90.2	32.6

RAU = 427.7 (kips); RA2 = 590.1 (kips)

Current CAPWAP Ru = 564.0 (kips); Corresponding J(RP)= 0.00; J(RX) = 0.55

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	35.97	542.3	582.9	592.6	1.01	0.20	0.20	30.0	595.3	1500

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
92.0	21.4	29992.2	492.000	4.70

Toe Area 198.5 in^2

Top Segment Length 3.29 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 0.195 ms, 2L/c 10.9 ms
Total volume: 13.672 ft^3; Volume ratio considering added impedance: 1.000