M e m o r a n d u m

Making Conservation a California Way of Life.

To: ALI EL-ZAYNAB
STRUCTURES REPRESENTATIVE
OFFICE OF STRUCTURE CONSTRUCTION

Date: November 15, 2019

File: 12-Ora-405-14.13
Bushard Street OC (Replace)
Bridge No. 55-1115
EA 12-0h1004
ID 1200000180

From: FOUNDATION TESTING AND INSTRUMENTATION
Office of Geotechnical Support
Division of Engineering Services

Subject: **REVIEW OF BUSHARD ABUTMENTS DRIVEN PILE PLAN**

Introduction

This memorandum presents a review of a Driven Pile Plan for the Bushard Street OC Abutments submitted by the design-build contractor OC 405 Partner JV Design Build Team. The plan consists primarily of Pile Dynamic Monitoring Report prepared by Earthspectives, Inc. (ES) on November 6, 2019. A copy of the Driven Pile Plan was received by this Office on November 14th and is attached to this memorandum.

The Pile Dynamic Monitoring Report includes dynamic monitoring results from Pile 97 at Abutment 3 and a bearing acceptance criteria (BAC) for production pile driving at Abutments 1 and 3. Subject piles are 24-inch diameter steel open-end pipe pile with a wall thickness of 0.5 inch (PP24x0.5).

Discussion

Earthspectives, Inc. (ES) conducted dynamic monitoring during initial driving of Pile 97 at Abutment 3 on October 18, 2019. The pile was driven to an approximate penetration depth of 70.75 feet, and approximate tip elevation of -45.00 feet. Two restrikes, both driving the pile an additional 0.25 feet, were conducted with 3-days of pile set without driving. The first restrike was conducted on October 21st and the second on October 24th. The ES report explains that the second restrike was conducted to confirm the findings of the first restrike and therefore was conducted with the same setup duration.

ES performed CAPWAP analyses on initial drive blows from approximate elevations -40 feet, and -45 feet. ES also performed CAPWAP analysis on one restrike blow. The CAPWAP analysis for the initial drive blow at approximate elevation -40 feet represents the production driving condition at the specified tip elevation (STE) of the Abutment wing wall piles. The CAPWAP analysis for the initial drive blow at approximate elevation -45 feet represents the production driving condition specified tip elevation (STE) of the Abutment piles. The CAPWAP analysis for the restrike blow represents the piles long-term setup condition. Results are included in the Driven Pile Plan.

CAPWAP results for the initial drive blow at approximate elevation -45 feet were used to develop the Bearing Acceptance Criteria (BAC) for all Abutment 1 and 3 production piles, including the retaining / wing wall production piles. The STE for both Abutment 1 and Abutment 3 production piles is -45 feet. The STE for retaining / wing wall production piles is -40 feet. The BAC is included in the Driven Pile Plan.

Review of Dynamic Monitoring Results and Bearing Acceptance Criteria

This Office offers the following review comments:

1. The BAC included in the Driven Pile Plan was derived from the initial drive blow at approximate elevation -45 feet. The plan indicates the BAC can be used at all Abutment production piles including Abutment 3 production piles (STE -45.0 feet) and all retaining / wing wall production piles (STE -40 feet). The Geotechnical Engineer of Record should verify this is an acceptable assumption. Refer to notes below Table 2 of the ES report.

2. The setup factor included in the Driven Pile Plan was derived from the initial drive blow at approximate elevation -45 feet and the restrike blow. The plan indicates the factor can be used all Abutment piles including Abutment 3 piles (STE -45.0 feet) and all retaining / wing wall piles (STE -40 feet). The Geotechnical Engineer of Record should verify this is an acceptable assumption. Refer to notes below Table 2 of the ES report.

3. The CAPWAP estimated ultimate total resistance for the initial drive blow at elevation -40 feet exceeds the nominal driving resistance (NDR) for the Abutment retaining / wing wall piles, as shown on the Pile Data Table of the Contract Plans.

4. The CAPWAP estimated ultimate total resistance for initial drive blow at elevation -45 feet does not achieve the NDR for either Abutment 1 or Abutment 3 piles. NDR is exceeded with consideration of the soil setup factor.

Recommendations

This Office recommends the Geotechnical Engineer of Record confirm assumptions identified in our comments 1 and 2.

If you have any questions regarding this review, please contact Jason Wahleithner at (916) 227-1000.

JASON WAHLEITHNER, P.E.
Senior Transportation Engineer
Foundation Testing and Instrumentation Branch
Office of Geotechnical Support

Attachment:
(1) Bushard Abutments Driven Pile Plan (Rev 001)

c: S. Amiri - OGDS (Email)
S. Kim - SC (Email)
L. Yamashiro - SC (Email)
C. Zachman – SC (Email)
Geodog

Bushard Abutments Driven Pile Plan

Rev 001

Submitted By:

OC 405 Partner JV Design Build Team

I-405 Improvement Design-Build Project

3100 Lake Center Drive 2nd Floor Santa Ana, CA 92704
www.oc405partners.com

PIN: 1200000180
EA-12-0H1004
OCTA Contract # C-5-3843

Pacific Infrastructure 405 Designers
I-405 Improvement Project

BUSHARD ABUTMENTS DRIVEN PILE PLAN
Rev 001

Received: 11/8/19

☒ No Exceptions Taken ☐ Revise as Noted
☐ Revise & Resubmit ☐ No Acceptable

☐ No exceptions taken to this document with respect to the design point of view and design assumptions.

This review is for general conformance with the design intent of the Construction Documents. The review and approval does not relieve the Design-Builder or Subcontractors of responsibility for Means and Methods or Safety Precautions

By: Jerko Kocijan Date: 11/12/2019

Submittal No.: OC405-SUB-SBR-W00327_20191107_Rev001_[OC405-SUB-SBR-W00327] Bushard Abutments Driven Pile Plan

OC 405 PARTNERS JOINT VENTURE

OHL USA, Inc. | Astaldi Construction Corp. Joint Venture

I-405 IMPROVEMENT PROJECT
(Contract C-5-3843)

Revision and Approval History

Revision	Date	Summary of Changes	Author	Approver
001	11/06/19	Initial submittal	Earthspectives	SS

Geotechnical Specialty Engineering

EARTHSPECTIVES

1920 E Warner Avenue, Suite 3-M
Santa Ana, California 92705

Phone : (949) 777-1270
FAX : (949) 777-1283

E-MAIL TRANSMITTAL

DATE: November 6, 2019 TIME: 1:57 PM

TRANSMITTED TO:

NAME: **Mr. Arturo Hernandez**
COMPANY: OC 405 Partners JV

FROM: Hossein K. Rashidi, Ph.D., P.E.

Number of pages: 33, including this transmittal page

SUBJECT: **Pile Dynamic Monitoring (PDA) Report**
Pile # 97 @ Abutment 3 of Bushard Street OC (Replace)
I-405 Improvement Project – SR73 to I605
CALTRANS EA # 120H1004
Orange County, California

MESSAGE:

Attached please find PDA plots and CAPWAP analysis results for end of initial drive (EOID) and the beginning of redrive (BOR) of pile # 97 @ Abutment 3 of Bushard Street OC, dynamically monitored at the subject project site on October 18, 21, and 24, 2019.

Pile # 97 @ Abutment 3 of Bushard Street OC was a 24 inch nominal diameter Steel Pipe Pile with a wall thickness of 0.5 inches (PP24X0.5) and a total length of approximately 82 ft (25 ft + 57 ft). It was driven with an APE D46-32 open ended single acting diesel hammer with a manufacturer's rated energy of approximately 107 kip-ft. Initial dynamic monitoring was performed on October 18, 28, 2019. PDA monitoring was performed during the impact driving of the second piece from 21 – 70.75 ft mark on the pile (tip elevation of approximately -45.25 ft at EOID).

This pile was then restriked on October 21&24, 2019, to capture the effect of long term soil set up on pile driving resistance. Second BOR on October 24, 2019, was just performed to validate the data obtained from first BOR.

PDA plots for EOID, BOR, and BOR2 attached to this report show CASE estimate of capacity, blow count/blow number, compression and tension stresses in steel, hammer transferred energy, and hammer stroke versus depth. Summary of Case estimate of ultimate downward capacities are provided in Table 1.

CAPWAP analyses were performed for one blow from initial drive (ID) at tip elevation -40 ft (specified tip elevation for wing wall piles), one blow from EOID, and one blow from early blows upon BOR. The CAPWAP performed for EOID is for tip elevation of -40 ft. CAPWAP results are also summarized in Table 1.

CAPWAP results indicate significant increase in driving resistance at BOR due to favorable effect of soil set up. The driving resistance increased from 553 kips at EOID to 990 kips at BOR, which corresponds to a set up factor of 1.79.

Table 2 provides a summary of the required vs estimated driving resistance based on the applied set up factor for each tip elevation at Abutment 1, Abutment 3, and all Abutment Wing Walls. The CAPWAP estimate of driving resistance during the initial drive at each tip elevation is listed in column 4. The estimated driving resistance after long term soil set up and using a set up factor of 1.79 is provided in Column 5.

PDA measurements indicate that the pile dynamically tested exhibited a maximum compressive stress of 29 ksi which is within the FHWA allowable maximum level of 45 ksi (assuming a yield stress of 50 ksi).

Hammer transferred energy was observed to reach an average of 44 kip-ft towards the end of initial drive. It can be noted that the average energy transfer was approximately 41% of the rated energy of the hammer which is within the commonly observed range of 35%+/-10%.

Therefore, it is our opinion that the piles at Abutment 1, Abutment 3, and all Abutment Wing Walls should have the required driving resistance, if driven to the specified tip elevations listed in Table 2 with termination blow counts recommended in the last column under a minimum hammer stroke of 7.5 ft.

We hope the above information satisfies the project needs at this time. Please call if you have any question or need more information.

Sincerely submitted for EarthSpectives,

Hossein Rashidi

Hossein K. Rashidi, PhD, PE
Principal Engineer

Enclosures:

1. PDA Plots for Pile # 97 at Abutment 3 (EOID, BOR, and BOR2)
2. CAPWAP Analysis Results for ID@-40 ft, ID@-45 ft, and BOR
3. Pile # 97 at Abutment 3 Driving Logs
4. Foundation Plan and Details
5. PDA Setup Sheet

TABLE 1 – Summary of PDA and CAPWAP Results at Abutment 3 of Bolsa Avenue OC

Pile No.	Driving Condition	Approximate Pile Penetration Length (ft)	Termination Blow Count (Blows/ft)	CASE Estimate of Ultimate Downward Capacity (Kips)	CAPWAP Estimate of Ultimate Toe Resistance (Kips)	CAPWAP Estimate of Ultimate Shaft Resistance (Kips)	CAPWAP Estimate of Ultimate Total Resistance (Kips)
Abutment 3 Pile 1	ID (Elev. -40 ft)	65.5	29	579	201	389	591
	ID (Elev. -45 ft)	70.75	21 for 9”	561	139	414	553
	BOR (Blow 4)	70.75	13,7,7 per inch	1187	82	908	990

ID = Initial Drive
EOID = End of Initial Drive
BOR = Beginning of Redrive - first
BOR2 = Beginning of Redrive – second

TABLE 2 – Summary of Required vs. Estimated Driving Resistance at Abutments and Abutment Wing Walls

Driving Location	Specified Tip Elevation (ft)	Required nominal Driving Resistance (kips)	CAPWAP Estimated Total Driving Resistance (kips)	Estimated Total Resistance with Set Up (kips)	Observed EOID Blow Count (Blows/ft)	Recommended Blow Count at EOID Under a Minimum Hammer Stroke of 7.5 ft (Blows/ft)
Abutment 1	-45	810	553	990(1)	28	25
Abutment 3	-45	680	553	990	28	22
Abutment 1 East (H=24”)	-40	500	591	1058(1&2)	29	20
Abutment 1 West (H=24”)	-40	370	591	1058(1&2)	29	18
Abutment 1 West (H=18”)	-40	350	591	1058(1&2)	29	18
Abutment 3 East (H=18”)	-40	290	591	1058(1&2)	29	16
Abutment 3 West (H=24”)	-40	370	591	1058(1&2)	29	18
Abutment 3 West (H=18”)	-40	350	591	1058(1&2)	29	18

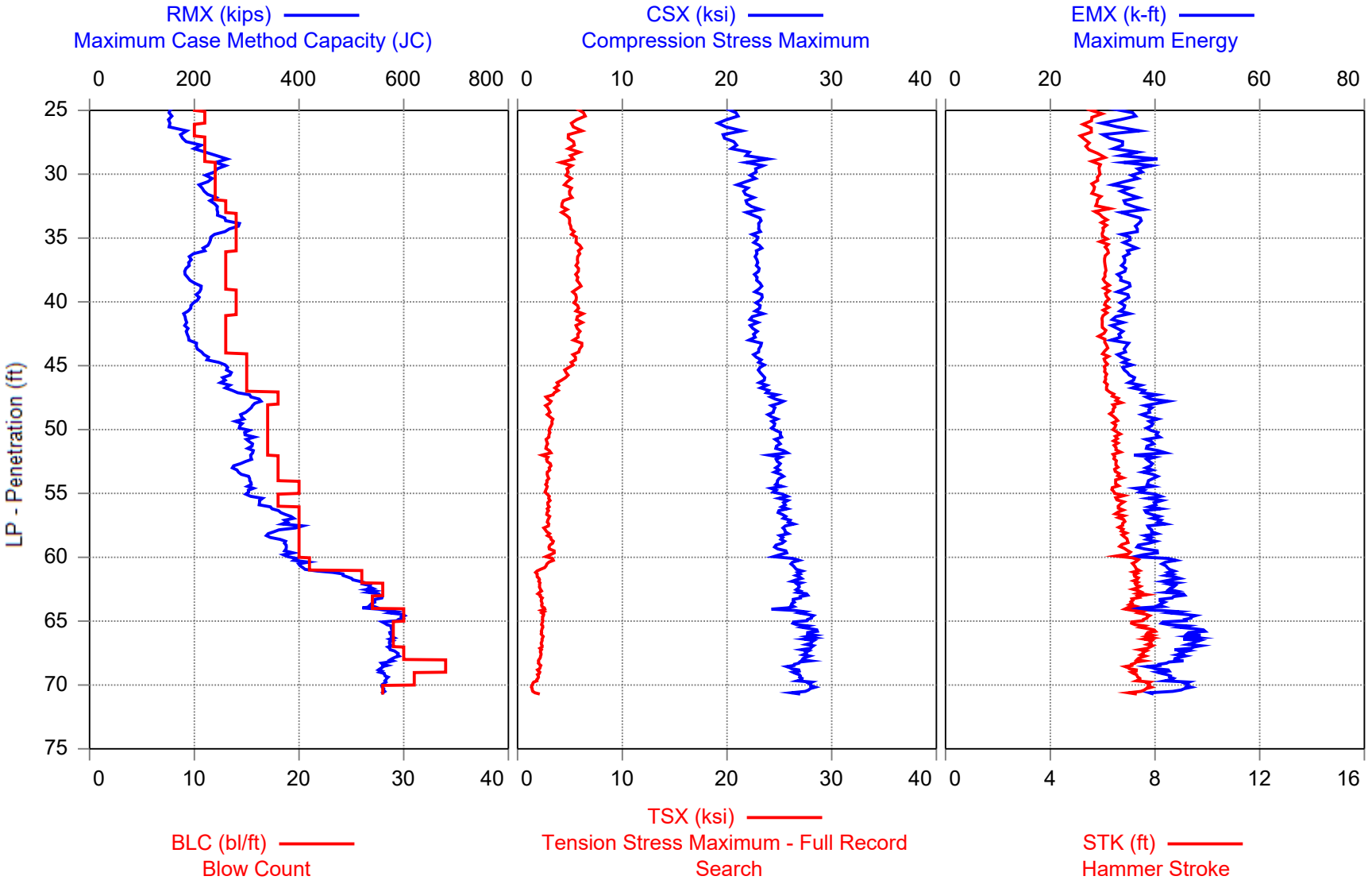
(1) Assuming the Set up factor can be applied from test pile to Abutment 1
(2) Assuming the same set up factor obtained at -45 ft tip elevation can be applied to tip elevation of -40 ft

EarthSpectives - PDIPLOT2 Ver 2017.2.58.3 - Case Method & iCAP® Results

Printed: 01-November-2019 **Test started: 18-October-2019**

OC405 WIDENING AT BUSHARD - ABUT 3 PILE 97 @ EOID

PP24X0.5", 82 FT, D46-32



OC405 WIDENING AT BUSHARD - ABUT 3 PILE 97 @ EOID PP24X0.5", 82 FT, D46-32
OP: US Date: 18-October-2019

AR: 36.91 in² SP: 0.492 k/ft³
LE: 78.00 ft EM: 30,000 ksi
WS: 16,807.9 f/s JC: 0.70

RMX: Maximum Case Method Capacity (JC) EMX: Maximum Energy
CSX: Compression Stress Maximum STK: Hammer Stroke
TSX: Tension Stress Maximum - Full Record Search BPM: Blows/Minute

BL#	Depth	BLC	TYPE	RMX	CSX	TSX	EMX	STK	BPM
	ft	bl/ft		kips	ksi	ksi	k-ft	ft	bpm
8	22.00	8	AV8	134	20.7	6.6	38.7	6.2	42
			MAX	184	28.9	9.0	70.9	8.8	51
			MIN	113	18.0	3.7	27.0	5.3	2
17	23.00	9	AV9	137	18.5	6.1	28.9	5.4	50
			MAX	147	19.8	7.0	34.0	5.8	51
			MIN	128	17.7	5.6	25.3	5.2	49
26	24.00	9	AV9	163	19.9	6.9	32.7	5.7	49
			MAX	186	20.9	7.6	35.4	5.9	51
			MIN	135	18.4	5.6	28.3	5.3	48
36	25.00	10	AV10	172	21.1	6.4	36.1	5.9	48
			MAX	187	22.7	7.3	39.9	6.4	50
			MIN	149	19.5	5.3	31.1	5.4	46
47	26.00	11	AV11	153	20.4	6.0	34.2	5.6	49
			MAX	168	22.3	7.3	39.3	6.2	52
			MIN	143	18.4	4.6	27.0	5.1	47
57	27.00	10	AV10	169	20.2	5.4	32.9	5.4	50
			MAX	217	22.2	6.8	39.0	6.0	52
			MIN	150	18.5	4.1	27.6	5.0	48
68	28.00	11	AV11	193	20.4	5.1	32.7	5.4	51
			MAX	229	21.8	6.0	35.4	5.7	52
			MIN	172	19.5	4.4	30.7	5.1	49
79	29.00	11	AV11	240	22.3	5.2	36.1	5.8	45
			MAX	278	26.3	6.6	48.1	6.8	51
			MIN	201	20.5	3.3	26.0	5.4	2
91	30.00	12	AV12	243	22.7	4.7	37.1	5.9	48
			MAX	270	24.1	5.6	41.5	6.3	50
			MIN	223	21.8	4.1	34.0	5.6	47
103	31.00	12	AV12	222	21.9	4.8	34.6	5.7	49
			MAX	243	23.6	5.7	38.2	6.1	51
			MIN	207	20.4	3.8	30.0	5.4	47
115	32.00	12	AV12	227	22.0	5.0	35.1	5.8	49
			MAX	253	23.4	6.0	39.3	6.1	50
			MIN	210	20.7	4.4	31.4	5.5	47
128	33.00	13	AV13	240	22.2	4.3	35.3	5.9	49
			MAX	258	25.5	5.9	44.1	6.7	50
			MIN	229	20.9	3.5	31.5	5.5	45

OC405 WIDENING AT BUSHARD - ABUT 3 PILE 97 @ EOID PP24X0.5", 82 FT, D46-32
OP: US Date: 18-October-2019

BL#	Depth ft	BLC bl/ft	TYPE	RMX kips	CSX ksi	TSX ksi	EMX k-ft	STK ft	BPM bpm
142	34.00	14	AV14	263	22.9	4.9	36.6	6.0	48
			MAX	292	24.3	5.6	39.6	6.3	49
			MIN	237	22.0	4.3	33.9	5.8	47
156	35.00	14	AV14	254	22.9	5.3	35.5	6.0	48
			MAX	289	23.7	6.1	38.0	6.3	49
			MIN	224	22.1	4.6	32.9	5.8	47
170	36.00	14	AV14	226	22.9	5.8	35.0	6.1	48
			MAX	234	24.4	6.8	39.6	6.5	49
			MIN	200	22.0	5.2	32.2	5.9	46
183	37.00	13	AV13	194	22.9	5.8	34.6	6.1	48
			MAX	211	24.1	6.6	37.4	6.5	49
			MIN	181	21.8	5.1	31.0	5.8	46
196	38.00	13	AV13	185	22.9	5.7	33.9	6.1	48
			MAX	194	23.6	6.2	35.5	6.3	48
			MIN	176	22.4	5.3	32.1	5.9	47
209	39.00	13	AV13	200	22.9	5.7	34.0	6.1	48
			MAX	214	23.7	6.2	36.5	6.3	48
			MIN	182	22.2	4.9	31.9	5.9	47
223	40.00	14	AV14	207	23.2	5.5	34.2	6.2	47
			MAX	223	24.7	6.5	38.3	6.6	49
			MIN	195	21.8	4.6	30.6	5.8	46
237	41.00	14	AV14	190	23.1	5.8	34.1	6.1	47
			MAX	203	24.1	6.5	37.0	6.4	48
			MIN	177	22.6	5.2	32.7	6.0	47
250	42.00	13	AV13	184	22.5	5.8	32.6	6.0	48
			MAX	189	23.6	6.7	35.6	6.3	49
			MIN	177	21.6	5.1	30.4	5.8	47
263	43.00	13	AV13	187	22.6	5.7	33.1	6.0	48
			MAX	194	24.2	6.7	37.4	6.5	49
			MIN	180	21.3	4.9	29.8	5.7	46
276	44.00	13	AV13	206	23.0	5.9	34.2	6.1	47
			MAX	221	23.9	6.7	36.6	6.4	49
			MIN	190	21.9	5.1	31.0	5.8	47
291	45.00	15	AV15	235	23.0	5.4	34.1	6.1	48
			MAX	268	24.5	6.6	38.5	6.5	49
			MIN	201	21.4	4.5	29.8	5.7	46
306	46.00	15	AV15	264	23.3	4.7	34.8	6.1	48
			MAX	287	24.1	5.2	37.4	6.3	48
			MIN	235	22.4	4.2	32.1	5.9	47

OC405 WIDENING AT BUSHARD - ABUT 3 PILE 97 @ EOID PP24X0.5", 82 FT, D46-32
OP: US Date: 18-October-2019

BL#	Depth ft	BLC bl/ft	TYPE	RMX kips	CSX ksi	TSX ksi	EMX k-ft	STK ft	BPM bpm
321	47.00	15	AV15	262	23.5	3.9	36.4	6.1	47
			MAX	281	24.5	4.5	39.0	6.4	49
			MIN	240	22.4	3.3	32.9	5.8	46
339	48.00	18	AV18	311	24.6	3.1	39.7	6.5	46
			MAX	335	25.9	3.5	43.6	6.9	47
			MIN	280	23.4	2.6	35.6	6.1	45
356	49.00	17	AV17	300	24.3	2.9	38.5	6.4	47
			MAX	313	24.9	3.1	40.3	6.5	47
			MIN	281	23.5	2.5	36.3	6.1	46
373	50.00	17	AV17	288	24.5	3.2	39.3	6.5	46
			MAX	302	25.5	3.7	42.2	6.7	47
			MIN	277	23.5	2.9	36.6	6.2	45
390	51.00	17	AV17	303	24.9	2.9	39.8	6.5	46
			MAX	328	25.8	3.3	42.5	6.8	47
			MIN	293	24.1	2.4	36.7	6.3	45
407	52.00	17	AV17	310	25.0	2.8	39.3	6.5	46
			MAX	337	26.0	3.3	42.4	6.8	48
			MIN	286	23.2	2.1	33.3	6.0	45
425	53.00	18	AV18	294	24.9	2.9	39.0	6.5	46
			MAX	318	26.1	3.4	42.6	6.8	47
			MIN	270	24.2	2.2	36.8	6.3	45
443	54.00	18	AV18	293	25.0	2.9	39.3	6.6	46
			MAX	311	26.1	3.3	42.7	6.8	47
			MIN	274	23.7	2.5	34.8	6.2	45
463	55.00	20	AV20	307	24.6	2.7	37.8	6.4	46
			MAX	324	25.7	3.0	41.6	6.8	47
			MIN	296	23.8	2.5	35.1	6.2	45
481	56.00	18	AV18	320	25.5	3.0	40.3	6.7	46
			MAX	344	27.3	3.2	46.1	7.1	47
			MIN	288	24.1	2.7	35.8	6.3	44
501	57.00	20	AV20	368	25.3	2.9	39.5	6.6	46
			MAX	394	26.8	3.3	44.0	7.1	47
			MIN	327	23.7	2.2	34.8	6.2	44
521	58.00	20	AV20	377	25.8	2.8	40.0	6.8	45
			MAX	412	26.6	3.1	43.0	7.0	46
			MIN	343	24.8	2.2	37.0	6.5	45
541	59.00	20	AV20	358	25.3	3.1	39.0	6.9	45
			MAX	397	26.5	3.7	42.6	7.1	46
			MIN	331	24.6	2.6	36.5	6.7	44
561	60.00	20	AV20	376	25.0	3.1	38.1	6.8	45

OC405 WIDENING AT BUSHARD - ABUT 3 PILE 97 @ EOID PP24X0.5", 82 FT, D46-32
OP: US Date: 18-October-2019

BL#	Depth	BLC	TYPE	RMX	CSX	TSX	EMX	STK	BPM
	ft	bl/ft		kips	ksi	ksi	k-ft	ft	bpm
			MAX	405	26.0	3.7	41.4	7.1	46
			MIN	360	23.9	2.5	34.1	6.5	44
582	61.00	21	AV21	403	26.4	2.9	42.4	7.3	44
			MAX	442	27.4	3.6	45.6	7.6	45
			MIN	379	25.3	1.9	38.7	6.9	43
608	62.00	26	AV26	488	26.8	1.9	43.2	7.3	44
			MAX	533	27.7	2.3	45.7	7.6	45
			MIN	428	25.7	1.3	40.0	7.0	43
636	63.00	28	AV28	538	27.0	2.1	43.7	7.4	43
			MAX	565	28.3	2.3	47.5	7.8	45
			MIN	514	25.7	1.8	39.8	6.9	42
663	64.00	27	AV27	543	26.4	2.3	41.3	7.1	44
			MAX	565	27.6	3.6	45.3	7.5	45
			MIN	489	25.2	1.9	32.3	6.7	43
693	65.00	30	AV30	585	27.2	2.4	44.2	7.5	42
			MAX	607	29.1	2.9	50.0	8.0	45
			MIN	539	21.6	2.2	27.5	6.8	2
722	66.00	29	AV29	572	27.5	2.3	45.5	7.6	43
			MAX	582	29.1	2.6	50.7	8.1	45
			MIN	551	25.6	2.2	39.4	6.9	41
751	67.00	29	AV29	576	28.0	2.3	47.6	7.8	42
			MAX	587	28.9	2.6	50.5	8.1	43
			MIN	566	26.9	2.2	44.3	7.5	42
781	68.00	30	AV30	582	27.5	2.2	45.1	7.5	43
			MAX	595	28.8	2.4	49.7	8.0	44
			MIN	566	26.6	2.0	41.6	7.1	42
815	69.00	34	AV34	562	26.6	2.1	41.6	7.2	44
			MAX	591	28.5	2.2	47.7	7.8	45
			MIN	548	25.3	1.8	37.5	6.8	42
846	70.00	31	AV31	564	27.2	1.8	43.6	7.4	43
			MAX	573	28.5	2.1	48.2	7.9	44
			MIN	553	26.2	1.4	40.2	7.1	42
867	70.75	28	AV21	561	27.5	1.5	43.7	7.5	43
			MAX	567	29.0	3.3	48.7	8.0	45
			MIN	555	25.6	1.1	37.1	6.8	42
			Average	361	24.7	3.6	39.1	6.6	46
			Maximum	607	29.1	9.0	70.9	8.8	52
			Minimum	113	17.7	1.1	25.3	5.0	2

Total number of blows analyzed: 867

BL#	Sensors
1-867	F3: [S492] 142.0 (1.00); F4: [S493] 143.0 (1.00); A3: [K11281] 420.0 (1.00); A4: [K11285] 363.0 (1.00)

Time Summary

Drive	1 minute 28 seconds	12:36 PM - 12:37 PM (10/18/2019) BN 1 - 74
Stop	13 minutes 19 seconds	12:37 PM - 12:50 PM
Drive	12 minutes 41 seconds	12:50 PM - 1:03 PM BN 75 - 663
Stop	3 minutes 42 seconds	1:03 PM - 1:07 PM
Drive	4 minutes 42 seconds	1:07 PM - 1:11 PM BN 664 - 867

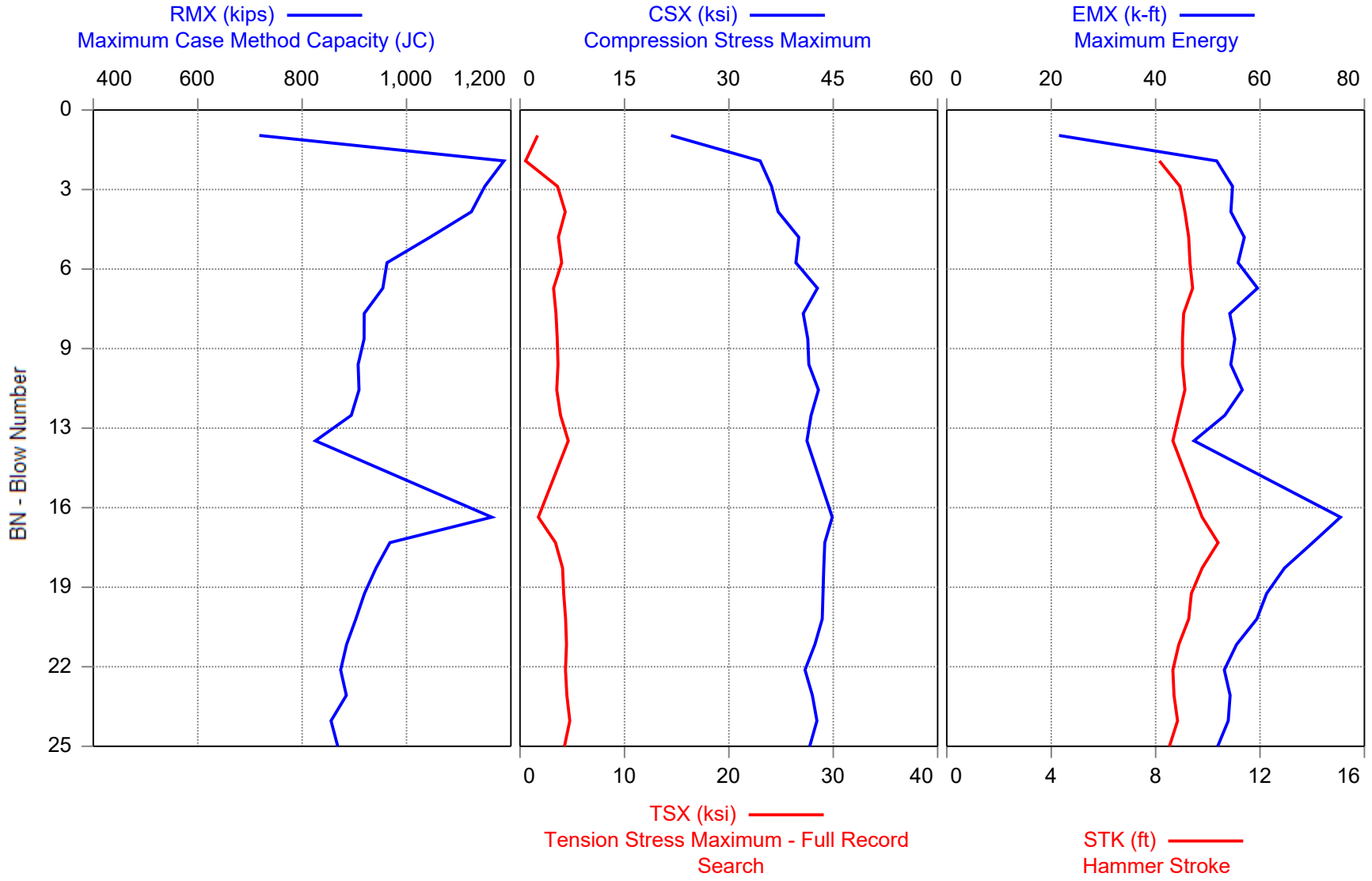
Total time [00:35:53] = (Driving [00:18:52] + Stop [00:17:01])

EarthSpectives - PDIPLOT2 Ver 2017.2.58.3 - Case Method & iCAP® Results

Printed: 01-November-2019 **Test started: 21-October-2019**

OC405 WIDENING AT BUSHARD - ABUT3 PILE 97 @ BOR

PP24X0.5", 82 FT, D46-32



OC405 WIDENING AT BUSHARD - ABUT3 PILE 97 @ BOR PP24X0.5", 82 FT, D46-32
OP: US Date: 21-October-2019

AR: 36.91 in² SP: 0.492 k/ft³
LE: 78.00 ft EM: 30,000 ksi
WS: 16,807.9 f/s JC: 0.70

RMX: Maximum Case Method Capacity (JC) EMX: Maximum Energy
CSX: Compression Stress Maximum STK: Hammer Stroke
TSX: Tension Stress Maximum - Full Record Search BPM: Blows/Minute

BL#	Depth ft	BLC bl/ft	TYPE	RMX kips	CSX ksi	TSX ksi	EMX k-ft	STK ft	BPM bpm
5	70.80	100	AV5	1,045	33.9	2.8	47.9	8.9	32
			MAX	1,187	40.1	4.3	57.0	9.3	41
			MIN	718	21.7	0.5	21.5	8.1	2
10	70.85	100	AV5	932	41.2	3.6	55.8	9.2	39
			MAX	963	42.7	4.0	59.5	9.4	39
			MIN	907	39.6	3.2	54.2	9.0	39
13	70.88	100	AV3	876	42.0	4.0	52.4	8.9	40
			MAX	909	42.9	4.6	56.6	9.1	40
			MIN	826	41.2	3.5	47.4	8.7	39
20	70.95	100	AV5	979	43.8	3.5	66.2	9.7	38
			MAX	1,163	44.9	4.4	75.4	10.4	39
			MIN	903	43.4	1.8	59.4	9.3	37
25	71.00	100	AV5	873	41.9	4.5	53.7	8.7	40
			MAX	885	42.6	4.8	55.5	8.9	41
			MIN	855	40.9	4.3	51.9	8.5	40
			Average	947	40.4	3.6	55.4	9.1	38
			Maximum	1,187	44.9	4.8	75.4	10.4	41
			Minimum	718	21.7	0.5	21.5	8.1	2

Total number of blows analyzed: 23

BL# Sensors

1-25 F3: [S492] 142.0 (1.00); F4: [S493] 143.0 (1.00); A3: [K11281] 420.0 (1.00); A4: [K11285] 363.0 (1.00)

Time Summary

Drive	19 seconds	3:45 PM - 3:45 PM (10/21/2019) BN 1 - 14
Stop	4 minutes 51 seconds	3:45 PM - 3:50 PM
Drive	15 seconds	3:50 PM - 3:50 PM BN 15 - 25

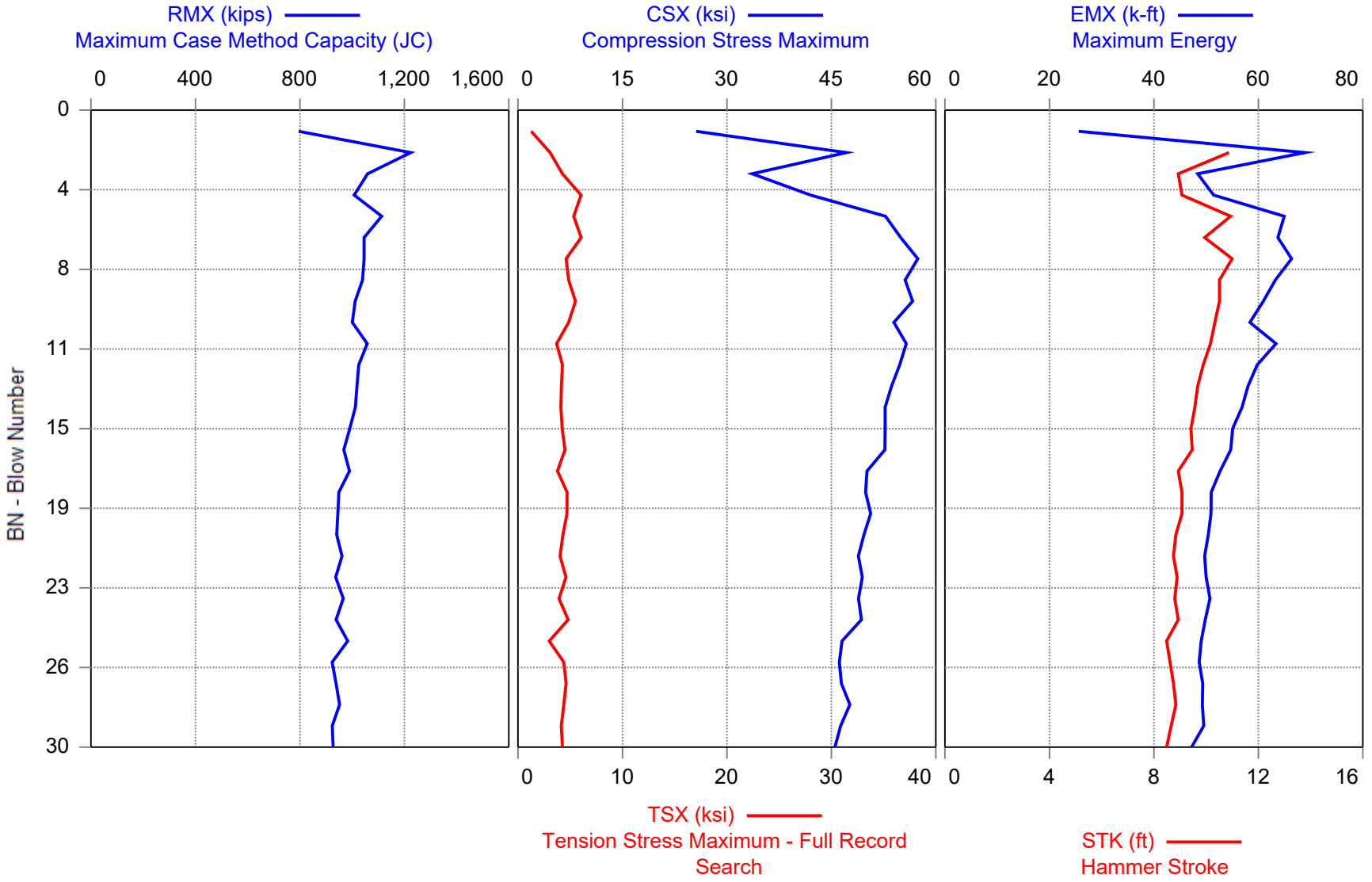
Total time [00:05:26] = (Driving [00:00:34] + Stop [00:04:51])

EarthSpectives - PDIPLOT2 Ver 2017.2.58.3 - Case Method & iCAP® Results

Printed: 01-November-2019 **Test started: 24-October-2019**

OC405 WIDENING AT BUSHARD - ABUT 3 PILE 97 @ BOR2

PP24X0.5", 82 FT, D46-32



OC405 WIDENING AT BUSHARD - ABUT 3 PILE 97 @ BOR2 PP24X0.5", 82 FT, D46-32
OP: US Date: 24-October-2019

AR: 36.91 in² SP: 0.492 k/ft³
LE: 78.00 ft EM: 30,000 ksi
WS: 16,807.9 f/s JC: 0.70

RMX: Maximum Case Method Capacity (JC) EMX: Maximum Energy
CSX: Compression Stress Maximum STK: Hammer Stroke
TSX: Tension Stress Maximum - Full Record Search BPM: Blows/Minute

BL#	Depth	BLC	TYPE	RMX	CSX	TSX	EMX	STK	BPM
	ft	bl/ft		kips	ksi	ksi	k-ft	ft	bpm
5	71.04	120	AV5	1,040	40.2	4.0	51.9	10.0	31
			MAX	1,224	52.8	6.0	68.9	10.9	40
			MIN	795	25.6	1.3	25.6	8.9	2
10	71.08	120	AV5	1,029	55.7	5.2	62.5	10.5	37
			MAX	1,046	57.4	6.1	66.4	11.0	38
			MIN	1,001	54.0	4.6	58.4	9.9	36
15	71.13	120	AV5	1,021	53.9	4.1	58.6	9.7	38
			MAX	1,058	55.8	4.2	63.4	10.2	39
			MIN	991	52.7	3.7	55.1	9.4	37
20	71.17	120	AV5	959	50.6	4.4	51.9	9.1	39
			MAX	990	52.7	4.7	54.7	9.5	40
			MIN	941	49.7	3.8	50.4	8.8	39
25	71.21	120	AV5	957	48.6	4.1	49.9	8.8	40
			MAX	983	49.4	4.8	50.7	8.9	41
			MIN	937	46.5	3.0	49.0	8.5	40
30	71.25	120	AV5	933	46.4	4.4	48.8	8.7	40
			MAX	952	47.6	4.6	49.5	8.8	41
			MIN	924	45.5	4.1	47.2	8.5	40
			Average	990	49.2	4.3	53.9	9.4	37
			Maximum	1,224	57.4	6.1	68.9	11.0	41
			Minimum	795	25.6	1.3	25.6	8.5	2

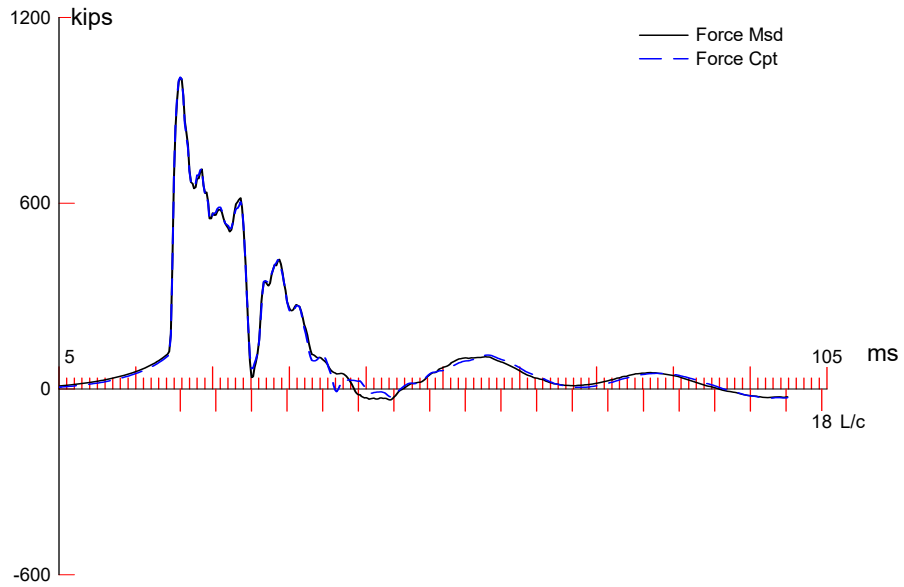
Total number of blows analyzed: 30

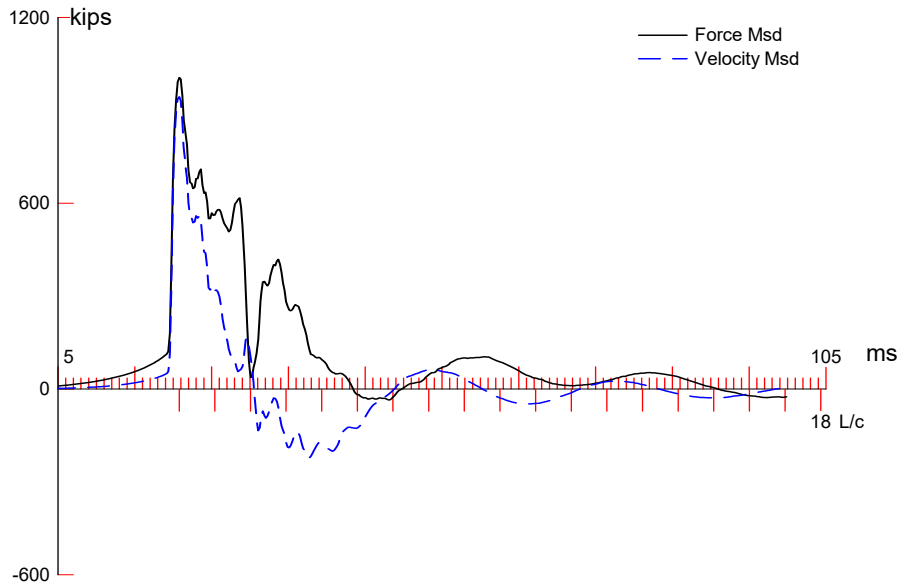
BL# Sensors

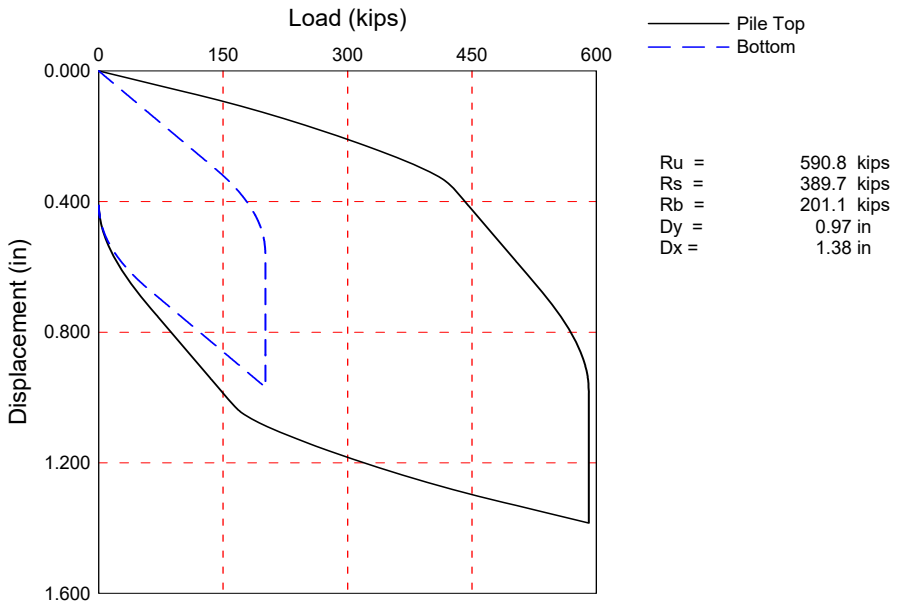
1-30 F3: [S492] 142.0 (1.00); F4: [S493] 143.0 (1.00); A3: [K11281] 420.0 (1.00);
A4: [K11285] 363.0 (1.00)

Time Summary

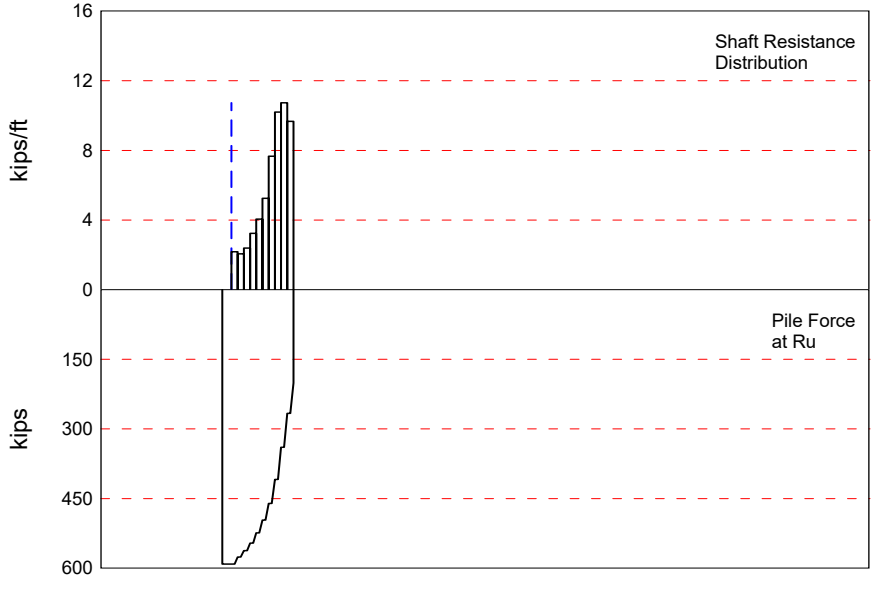
Drive 44 seconds 1:23 PM - 1:24 PM BN 1 - 30







Ru =	590.8 kips
Rs =	389.7 kips
Rb =	201.1 kips
Dy =	0.97 in
Dx =	1.38 in



CAPWAP SUMMARY RESULTS

Total CAPWAP Capacity: 590.8; along Shaft 389.7; at Toe 201.1 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
				590.8				
1	17.0	4.5	14.8	576.0	14.8	3.31	0.53	0.127
2	23.7	11.3	14.0	562.0	28.8	2.06	0.33	0.127
3	30.5	18.0	16.2	545.8	45.0	2.39	0.38	0.127
4	37.3	24.8	22.0	523.8	67.0	3.24	0.52	0.127
5	44.1	31.6	27.5	496.3	94.5	4.05	0.65	0.127
6	50.9	38.4	35.6	460.7	130.1	5.25	0.84	0.127
7	57.7	45.2	52.0	408.7	182.1	7.67	1.22	0.127
8	64.4	52.0	69.2	339.5	251.3	10.20	1.62	0.127
9	71.2	58.7	72.8	266.7	324.1	10.73	1.71	0.127
10	78.0	65.5	65.6	201.1	389.7	9.67	1.54	0.127
Avg. Shaft			39.0			5.95	0.95	0.127
Toe			201.1				64.01	0.075

Soil Model Parameters/Extensions		Shaft	Toe
Quake	(in)	0.063	0.429
Case Damping Factor		0.748	0.230
Damping Type			Smith
Unloading Quake	(% of loading quake)	82	100
Reloading Level	(% of Ru)	100	100
Unloading Level	(% of Ru)	48	
Resistance Gap (included in Toe Quake)	(in)		0.074
Soil Plug Weight	(kips)		0.12

CAPWAP match quality = 1.85 (Wave Up Match) ; RSA = 0
Observed: final set = 0.414 in; blow count = 29 b/ft
Computed: final set = 0.410 in; blow count = 29 b/ft

max. Top Comp. Stress = 27.3 ksi (T= 21.2 ms, max= 1.031 x Top)
max. Comp. Stress = 28.2 ksi (Z= 17.0 ft, T= 22.0 ms)
max. Tens. Stress = -1.48 ksi (Z= 30.5 ft, T= 46.8 ms)
max. Energy (EMX) = 45.3 kip-ft; max. Measured Top Displ. (DMX)= 0.80 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	1009.7	-32.0	27.3	-0.87	45.35	14.3	0.812
2	6.8	1013.0	-34.7	27.4	-0.94	45.31	14.2	0.806
4	13.6	1030.7	-40.9	27.9	-1.11	45.06	13.9	0.786
5	17.0	1041.1	-44.9	28.2	-1.22	44.83	13.8	0.772
6	20.3	1008.6	-40.0	27.3	-1.08	42.73	13.6	0.757
7	23.7	1019.8	-48.2	27.6	-1.31	42.43	13.5	0.741
8	27.1	991.6	-46.4	26.9	-1.26	40.53	13.3	0.725
9	30.5	1006.0	-54.6	27.2	-1.48	40.25	13.1	0.710
10	33.9	975.9	-50.0	26.4	-1.35	38.16	12.9	0.694
11	37.3	993.2	-51.8	26.9	-1.40	37.83	12.7	0.677
12	40.7	952.6	-39.7	25.8	-1.07	35.22	12.4	0.660
13	44.1	973.1	-39.7	26.4	-1.08	34.88	12.1	0.642
14	47.5	925.7	-23.3	25.1	-0.63	31.92	11.8	0.626
15	50.9	952.2	-24.4	25.8	-0.66	31.64	11.4	0.610
16	54.3	895.3	-8.3	24.2	-0.23	28.14	11.0	0.596
17	57.7	926.3	-13.2	25.1	-0.36	27.87	10.6	0.581
18	61.0	841.4	0.0	22.8	0.00	23.20	10.1	0.567
19	64.4	869.4	0.0	23.5	0.00	22.95	10.3	0.552
20	67.8	724.0	0.0	19.6	0.00	17.20	11.7	0.540
21	71.2	666.5	0.0	18.1	0.00	17.04	13.4	0.528
22	74.6	426.0	0.0	11.5	0.00	11.11	14.2	0.519
23	78.0	356.3	0.0	9.7	0.00	5.91	14.2	0.510
Absolute	17.0			28.2			(T =	22.0 ms)
	30.5				-1.48		(T =	46.8 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	422.5	433.3	444.0	454.8	465.5	476.2	487.0	497.7	508.4	519.2
RX	946.4	846.3	779.9	734.7	691.2	647.7	604.2	579.4	561.7	543.9
RU	946.4	846.3	746.2	646.1	546.0	445.9	345.8	245.7	145.6	45.4

RAU = 245.5 (kips); RA2 = 679.6 (kips)

Current CAPWAP Ru = 590.8 (kips); Corresponding J(RP)= 0.00; J(RX) = 0.65

VMX	TVP	VT1*Z	FT1	FMX	DMX	DFN	SET	EMX	QUS
ft/s	ms	kips	kips	kips	in	in	in	kip-ft	kips
14.36	20.98	126.2	189.0	1012.2	0.802	0.411	0.414	45.5	898.8

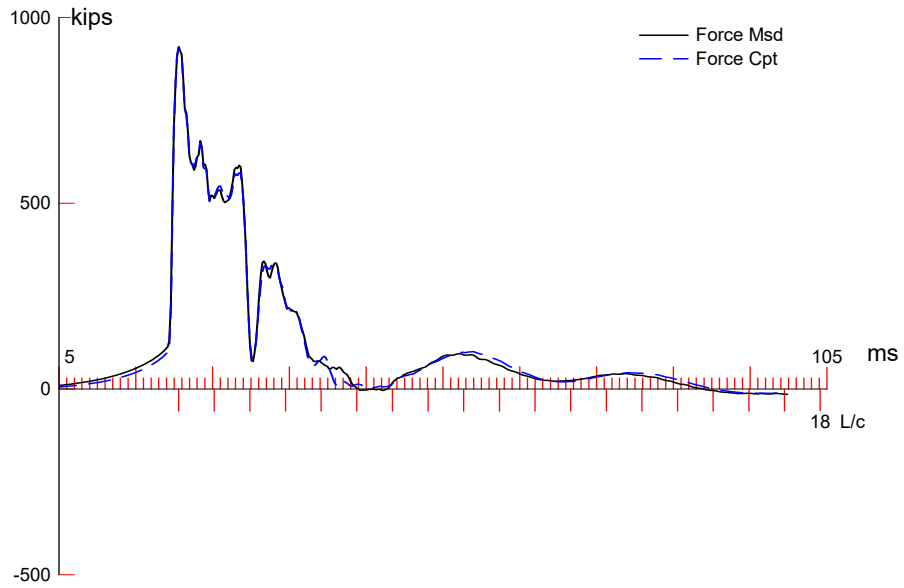
PILE PROFILE AND PILE MODEL

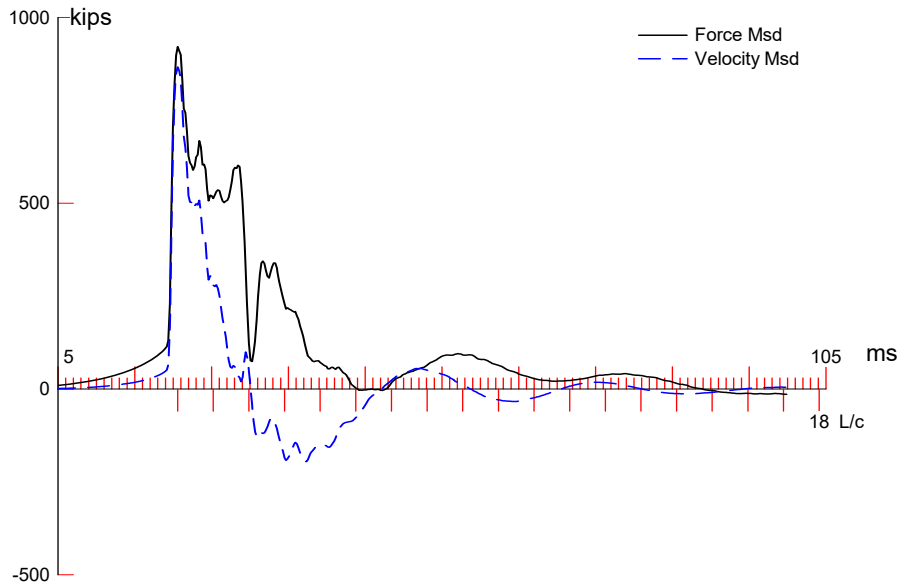
Depth ft	Area in^2	E-Modulus ksi	Spec. Weight lb/ft^3	Perim. ft
0.00	36.91	29992.2	492.000	6.283
78.00	36.91	29992.2	492.000	6.283

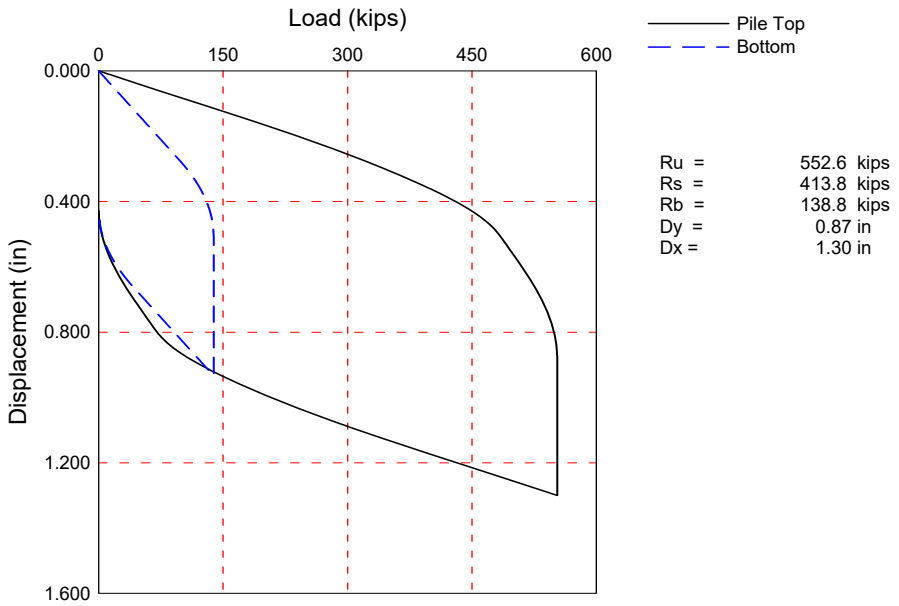
Toe Area 3.142 ft^2

Top Segment Length 3.39 ft, Top Impedance 65.89 kips/ft/s

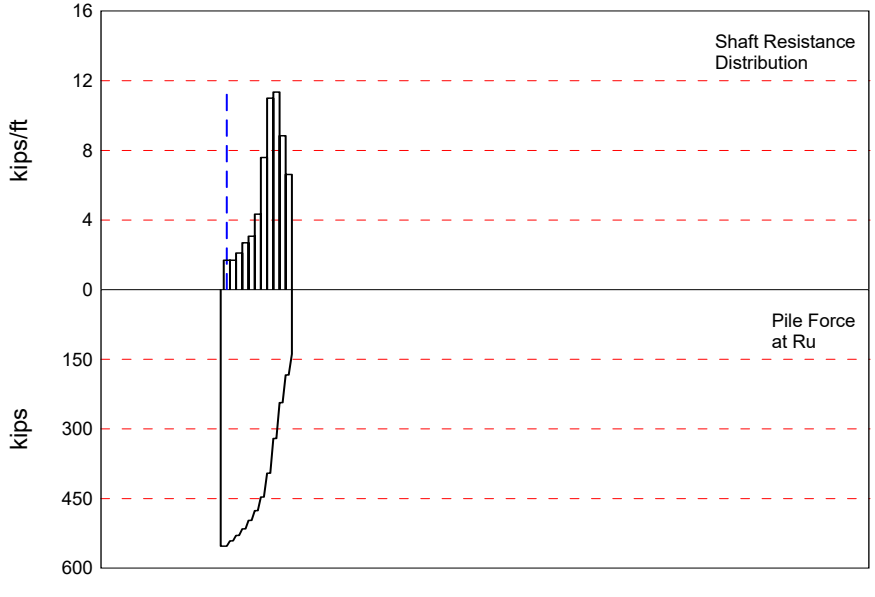
Pile Damping 1.0 %, Time Incr 0.202 ms, Wave Speed 16807.9 ft/s, 2L/c 9.3 ms







Ru =	552.6 kips
Rs =	413.8 kips
Rb =	138.8 kips
Dy =	0.87 in
Dx =	1.30 in



CAPWAP SUMMARY RESULTS

Total CAPWAP Capacity: 552.6; along Shaft 413.8; at Toe 138.8 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
				552.6				
1	10.2	2.8	11.5	541.1	11.5	4.14	0.66	0.138
2	17.0	9.6	11.5	529.6	23.0	1.70	0.27	0.138
3	23.7	16.3	14.3	515.3	37.3	2.11	0.34	0.138
4	30.5	23.1	18.3	497.0	55.6	2.70	0.43	0.138
5	37.3	29.9	20.8	476.2	76.4	3.07	0.49	0.138
6	44.1	36.7	29.4	446.8	105.8	4.33	0.69	0.138
7	50.9	43.5	51.5	395.3	157.3	7.59	1.21	0.138
8	57.7	50.3	74.6	320.7	231.9	11.00	1.75	0.138
9	64.4	57.0	77.0	243.7	308.9	11.35	1.81	0.138
10	71.2	63.8	60.0	183.7	368.9	8.85	1.41	0.138
11	78.0	70.6	44.9	138.8	413.8	6.62	1.05	0.138
Avg. Shaft			37.6			5.86	0.93	0.138
Toe			138.8				44.18	0.133

Soil Model Parameters/Extensions		Shaft	Toe
Quake	(in)	0.162	0.390
Case Damping Factor		0.864	0.279
Damping Type			Smith
Unloading Quake	(% of loading quake)	34	81
Reloading Level	(% of Ru)	100	100
Unloading Level	(% of Ru)	31	
Resistance Gap (included in Toe Quake)	(in)		0.046
Soil Plug Weight	(kips)		0.26

CAPWAP match quality = 1.66 (Wave Up Match) ; RSA = 0
Observed: final set = 0.429 in; blow count = 28 b/ft
Computed: final set = 0.388 in; blow count = 31 b/ft

max. Top Comp. Stress = 25.0 ksi (T= 21.0 ms, max= 1.017 x Top)
max. Comp. Stress = 25.4 ksi (Z= 10.2 ft, T= 21.4 ms)
max. Tens. Stress = -0.60 ksi (Z= 37.3 ft, T= 46.6 ms)
max. Energy (EMX) = 37.5 kip-ft; max. Measured Top Displ. (DMX)= 0.70 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	923.2	-11.7	25.0	-0.32	37.53	13.1	0.726
2	6.8	930.2	-12.3	25.2	-0.33	37.48	13.0	0.719
4	13.6	914.8	-17.7	24.8	-0.48	35.96	12.8	0.698
5	17.0	924.1	-19.3	25.0	-0.52	35.72	12.6	0.684
6	20.3	902.3	-15.3	24.4	-0.41	34.27	12.5	0.668
7	23.7	913.4	-17.1	24.7	-0.46	33.97	12.3	0.652
8	27.1	887.2	-17.1	24.0	-0.46	32.32	12.2	0.636
9	30.5	899.7	-21.8	24.4	-0.59	32.05	12.0	0.621
10	33.9	866.0	-19.3	23.5	-0.52	30.18	11.8	0.606
11	37.3	881.1	-22.3	23.9	-0.60	29.90	11.6	0.591
12	40.7	846.7	-16.1	22.9	-0.44	27.92	11.3	0.576
13	44.1	871.2	-16.7	23.6	-0.45	27.63	11.0	0.560
14	47.5	827.5	-5.6	22.4	-0.15	25.15	10.6	0.545
15	50.9	860.5	-6.8	23.3	-0.18	24.90	10.2	0.530
16	54.3	777.3	0.0	21.1	0.00	21.13	9.8	0.518
17	57.7	810.7	0.0	22.0	0.00	20.94	9.4	0.505
18	61.0	694.2	0.0	18.8	0.00	16.00	8.9	0.494
19	64.4	717.7	0.0	19.4	0.00	15.85	8.6	0.483
20	67.8	601.4	0.0	16.3	0.00	11.05	9.8	0.474
21	71.2	588.7	0.0	15.9	0.00	10.97	11.1	0.466
22	74.6	408.5	0.0	11.1	0.00	7.23	12.4	0.460
23	78.0	266.5	0.0	7.2	0.00	4.37	12.9	0.454
Absolute	10.2			25.4			(T =	21.4 ms)
	37.3				-0.60		(T =	46.6 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	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RX	974.2	888.8	803.4	718.0	657.3	623.8	592.1	560.4	528.8	497.1
RU	974.2	888.8	803.4	718.0	632.6	547.1	461.7	376.3	290.9	205.5

RAU = 196.0 (kips); RA2 = 628.0 (kips)

Current CAPWAP Ru = 552.6 (kips); Corresponding J(RP)= 0.00; J(RX) = 0.72

VMX	TVP	VT1*Z	FT1	FMX	DMX	DFN	SET	EMX	QUS
ft/s	ms	kips	kips	kips	in	in	in	kip-ft	kips
13.39	20.78	67.3	132.0	946.1	0.703	0.432	0.429	37.6	798.1

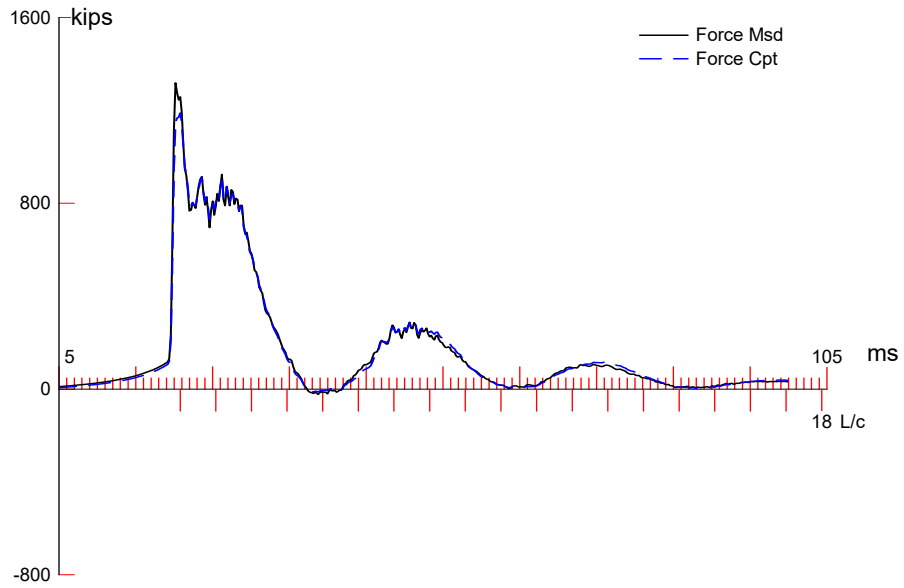
PILE PROFILE AND PILE MODEL

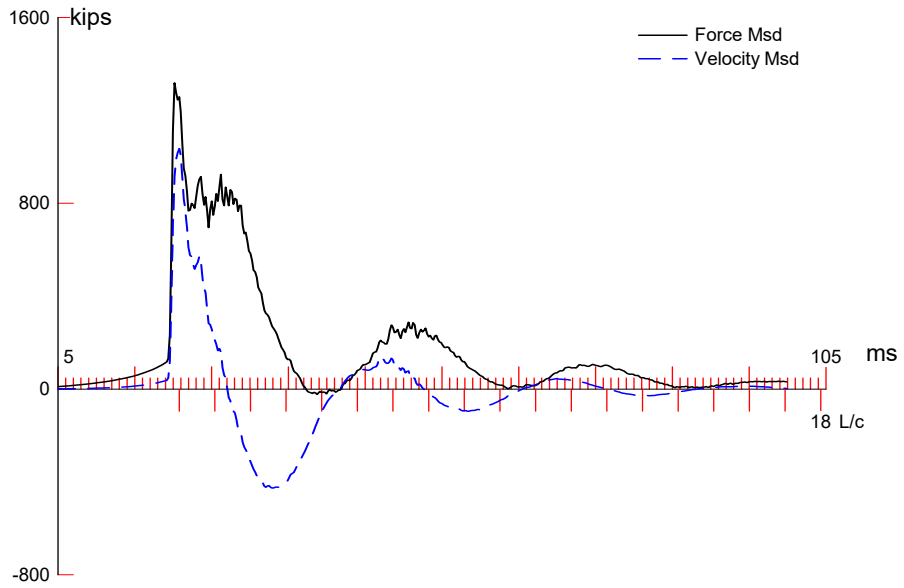
Depth	Area	E-Modulus	Spec. Weight	Perim.
ft	in^2	ksi	lb/ft^3	ft
0.00	36.91	29992.2	492.000	6.283
78.00	36.91	29992.2	492.000	6.283

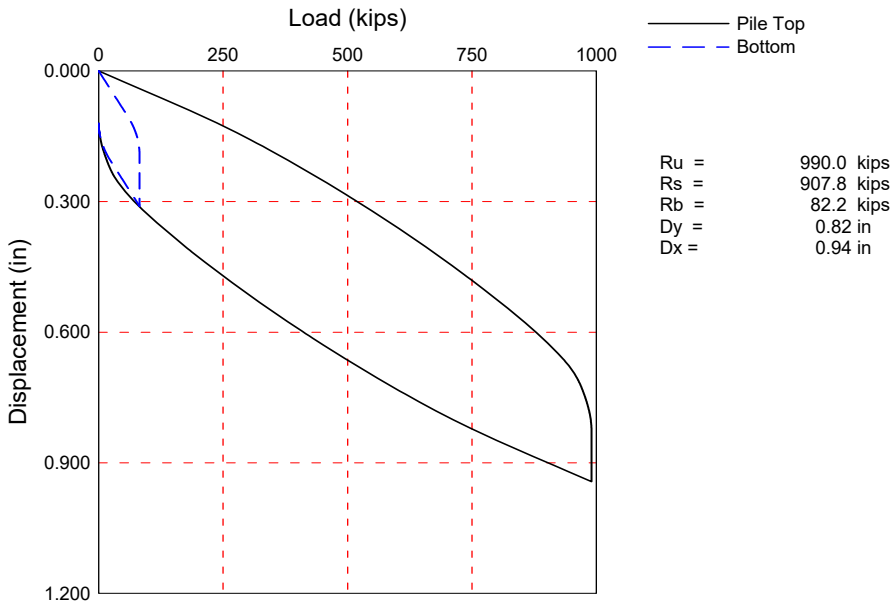
Toe Area 3.142 ft^2

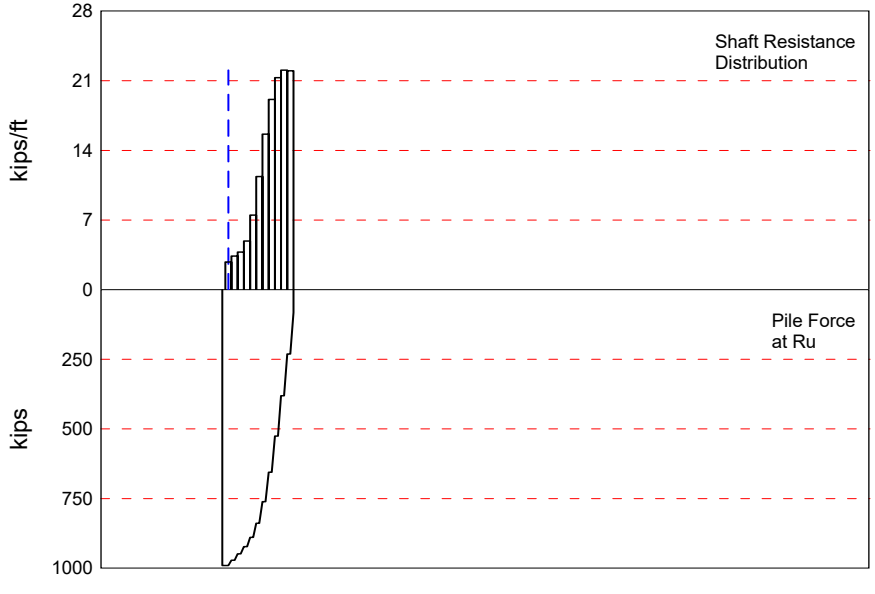
Top Segment Length 3.39 ft, Top Impedance 65.89 kips/ft/s

Pile Damping 1.0 %, Time Incr 0.202 ms, Wave Speed 16807.9 ft/s, 2L/c 9.3 ms









CAPWAP SUMMARY RESULTS

Total CAPWAP Capacity: 990.0; along Shaft 907.8; at Toe 82.2 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
				990.0				
1	10.2	3.0	18.9	971.1	18.9	6.38	1.01	0.194
2	17.0	9.7	22.9	948.2	41.8	3.38	0.54	0.194
3	23.7	16.5	25.7	922.5	67.5	3.79	0.60	0.194
4	30.5	23.3	33.2	889.3	100.7	4.89	0.78	0.194
5	37.3	30.1	50.9	838.4	151.6	7.50	1.19	0.194
6	44.1	36.9	77.1	761.3	228.7	11.37	1.81	0.194
7	50.9	43.7	106.0	655.3	334.7	15.63	2.49	0.194
8	57.7	50.4	129.7	525.6	464.4	19.12	3.04	0.194
9	64.4	57.2	144.5	381.1	608.9	21.30	3.39	0.194
10	71.2	64.0	149.7	231.4	758.6	22.07	3.51	0.194
11	78.0	70.8	149.2	82.2	907.8	22.00	3.50	0.194
Avg. Shaft			82.5			12.82	2.04	0.194
Toe			82.2				26.17	0.258

Soil Model Parameters/Extensions		Shaft	Toe
Quake	(in)	0.080	0.147
Case Damping Factor		2.668	0.322
Unloading Quake	(% of loading quake)	48	101
Reloading Level	(% of Ru)	100	100
Unloading Level	(% of Ru)	5	
Resistance Gap (included in Toe Quake)	(in)		0.003
Soil Plug Weight	(kips)		0.07

CAPWAP match quality = 1.60 (Wave Up Match) ; RSA = 0
Observed: final set = 0.120 in; blow count = 100 b/ft
Computed: final set = 0.082 in; blow count = 147 b/ft

max. Top Comp. Stress = 32.8 ksi (T= 21.2 ms, max= 1.034 x Top)
max. Comp. Stress = 33.9 ksi (Z= 10.2 ft, T= 21.6 ms)
max. Tens. Stress = -2.61 ksi (Z= 37.3 ft, T= 40.0 ms)
max. Energy (EMX) = 53.0 kip-ft; max. Measured Top Displ. (DMX)= 0.70 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	1211.7	-28.6	32.8	-0.77	52.96	16.5	0.707
2	6.8	1226.4	-44.6	33.2	-1.21	51.74	16.2	0.674
4	13.6	1193.8	-60.6	32.3	-1.64	46.44	15.5	0.608
5	17.0	1221.5	-72.5	33.1	-1.96	45.18	15.3	0.574
6	20.3	1152.5	-73.2	31.2	-1.98	40.90	14.8	0.540
7	23.7	1185.4	-84.2	32.1	-2.28	39.61	14.5	0.506
8	27.1	1115.5	-85.2	30.2	-2.31	35.62	14.0	0.474
9	30.5	1160.0	-93.3	31.4	-2.53	34.48	13.6	0.443
10	33.9	1079.1	-90.1	29.2	-2.44	30.38	13.0	0.411
11	37.3	1137.8	-96.4	30.8	-2.61	29.29	12.4	0.380
12	40.7	1021.6	-87.5	27.7	-2.37	24.67	11.7	0.350
13	44.1	1088.9	-93.5	29.5	-2.53	23.70	10.8	0.321
14	47.5	930.5	-79.0	25.2	-2.14	18.83	10.2	0.295
15	50.9	993.1	-83.2	26.9	-2.25	18.08	9.1	0.269
16	54.3	794.9	-61.5	21.5	-1.66	13.52	8.6	0.247
17	57.7	857.6	-65.9	23.2	-1.78	13.00	7.5	0.226
18	61.0	641.8	-42.7	17.4	-1.16	9.18	7.0	0.208
19	64.4	698.6	-46.2	18.9	-1.25	8.84	6.0	0.191
20	67.8	484.7	-19.5	13.1	-0.53	5.88	5.6	0.178
21	71.2	493.9	-19.7	13.4	-0.53	5.70	4.8	0.165
22	74.6	326.3	0.0	8.8	0.00	3.40	4.9	0.157
23	78.0	319.3	0.0	8.6	0.00	1.18	5.2	0.148
Absolute	10.2			33.9			(T =	21.6 ms)
	37.3				-2.61		(T =	40.0 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	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RX	1622.7	1551.5	1480.3	1409.0	1337.8	1266.6	1195.4	1124.2	1052.9	981.7
RU	1671.2	1604.8	1538.4	1472.0	1405.7	1339.3	1272.9	1206.5	1140.2	1073.8

RAU = 38.3 (kips); RA2 = 1006.6 (kips)

Current CAPWAP Ru = 990.0 (kips); Corresponding J(RP)= 0.00; J(RX) = 0.89

VMX	TVP	VT1*Z	FT1	FMX	DMX	DFN	SET	EMX	QUS
ft/s	ms	kips	kips	kips	in	in	in	kip-ft	kips
16.00	20.98	74.5	165.1	1368.8	0.698	0.108	0.120	54.4	1595.7

PILE PROFILE AND PILE MODEL

Depth	Area	E-Modulus	Spec. Weight	Perim.
ft	in^2	ksi	lb/ft^3	ft
0.00	36.91	29992.2	492.000	6.283
78.00	36.91	29992.2	492.000	6.283

Toe Area 3.142 ft^2

Top Segment Length 3.39 ft, Top Impedance 65.89 kips/ft/s

Pile Damping 1.0 %, Time Incr 0.202 ms, Wave Speed 16807.9 ft/s, 2L/c 9.3 ms

RELEASED FOR CONSTRUCTION
Jun 12, 2019

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
12,7	Ora,LA	22,73 405,605	R0.5/R0.7, R0.7/R3.8 R27.5/R27.8, R.3.5/24.2 0.0/1.2, 3.5/R1.6, R0.0/R1.2		

Khaled Allam — 04-03-19
REGISTERED CIVIL ENGINEER — DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER — KHALED ALLAM — No. C67110 — Exp. 9-30-20 — CIVIL — STATE OF CALIFORNIA

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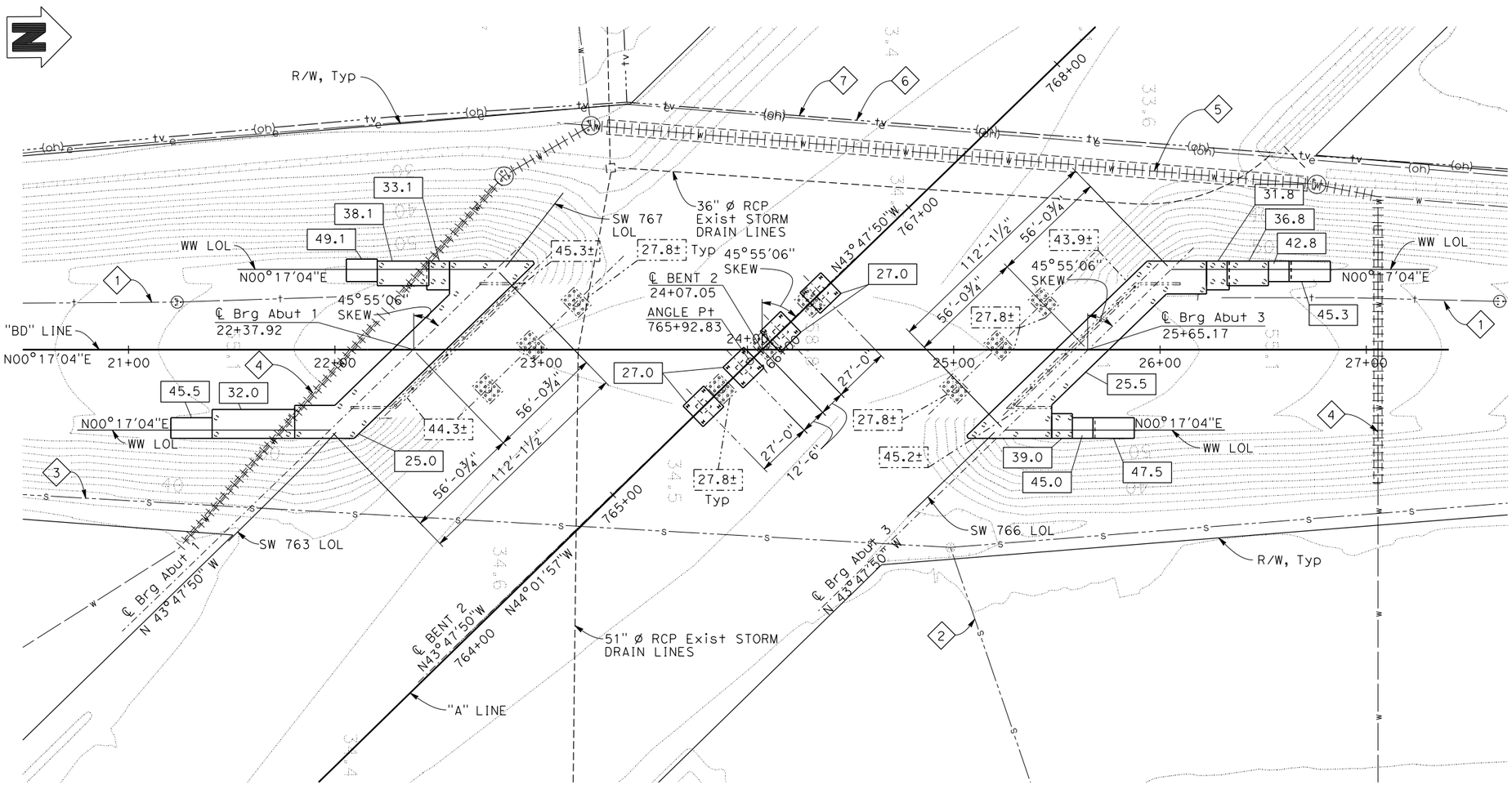
MOFFATT & NICHOL
3780 KILROY AIRPORT WAY
SUITE 600
LONG BEACH, CA 90806

ORANGE COUNTY
TRANSPORTATION AUTHORITY
550 SOUTH MAIN STREET
ORANGE, CA 92863



PLAN
1" = 30'

LEGEND:

◌	PP 24 X 0.5
I	HP 18x181 Steel Pile
XX.X	Bottom of Footing Elevation
XX.X±	Bottom of Existing Footing Elevation
----·----	Existing Structure
WWW	Bridge Removal

EXISTING UTILITIES

1. 6'-4" ø Conduits for Telephone Line (FRONTIER) (Relocate on Bridge)
2. 10" VCP Sewer (City of Fountain Valley) (Protect in Place)
3. 48" RCP Sewer (OCSD) (Protect in Place)
4. 12" Water in 20" Steel Casing (City of Fountain Valley) (Abandon prior to Bridge Construction and Relocate on Bridge)
5. 12" Water in 24" Steel Casing (City of Fountain Valley) (Abandon prior to Bridge Construction and Relocate on Bridge)
6. Spectrum CATV Overhead
7. SCE Overhead, 12 KV

NOTES:

A. All Piles not shown.

B. Locations of existing structure foundations are approximate.

C. For bridge removal, see "BRIDGE REMOVAL PLAN" sheet.

D. For utility information, see "ROADWAY PLANS".

E. For retaining & sound walls not shown, see "ROADWAY PLANS".

F. Elevation on existing structure as shown on these plans have been adjusted from the As-Built datum to NAVD88 datum by adding 1.8 feet.

G. For wing wall information, see "WING WALL DETAILS" sheets.

NOTE:
THE CONTRACTOR SHALL VERIFY ALL CONTROLLING FIELD DIMENSIONS BEFORE ORDERING OR FABRICATING ANY MATERIAL.

BR-17

Tarlo Hsu — GEOTECHNICAL PROFESSIONAL — 04/03/19 APPROVAL DATE

Feiruz Aberra
DESIGN OVERSIGHT
04/18/2019
SIGN OFF DATE

SCALE: AS SHOWN	VERT.DATUM NAVD88		HORZ.DATUM NAD83		
PHOTOGRAMMETRY AS OF:		ALIGNMENT TIES			
SURVEYED	BY M. Butcher	DRAFTED	BY M. Hakimi		
FIELD CHECKED	BY G. Arredondo	CHECKED	BY G. Arredondo		

DESIGN	BY A. Elsadek/ K. Allam	CHECKED	R. Alamir
DETAILS	BY F. Samson	CHECKED	R. Alamir
QUANTITIES	BY	CHECKED	

PREPARED FOR THE
STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

Alaedin Moubayed
PROJECT ENGINEER

BRIDGE NO.	55-1115
POST MILES	14.13

BUSHARD STREET OC (REPLACE)
FOUNDATION PLAN

FOUNDATION PLAN SHEET (ENGLISH) (REV. 03/14/12)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

UNIT: 4225
PROJECT NUMBER & PHASE: 12000001801
CONTRACT NO.: 12-0H1004

DISREGARD PRINTS BEARING EARLIER REVISION DATES →

REVISION DATES				SHEET	OF
08/31/17	06/18/18	11/27/18	04/03/19	6	61

FILE => 55-1115-e-fp101

PI405-DWG-SBR-000553

USERNAME => fsamson DATE PLOTTED => 11-APR-2019 TIME PLOTTED => 10:17

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
12,7	Ora,LA	22,73 405,605	R0.5/R0.7, R0.7/R3.8 R2.5/R2.8, R3.5/24.2 0.0/1.2, 3.5/R1.6, R0.0/R1.2		

RELEASED FOR CONSTRUCTION
Jun 12, 2019

Khaled Allam — 04-03-19
REGISTERED CIVIL ENGINEER — DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER
KHALED ALLAM
No. C67110
Exp. 9-30-20
CIVIL
STATE OF CALIFORNIA

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LONG BEACH, CA 90806

ORANGE COUNTY
TRANSPORTATION AUTHORITY
550 SOUTH MAIN STREET
ORANGE, CA 92863

PILE DATA TABLE

LOCATION	PILE TYPE	NOMINAL RESISTANCE (kips)		DESIGN TIP ELEVATION (ft)	SPECIFIED TIP ELEVATION (ft)	REQUIRED NOMINAL DRIVING RESISTANCE (kips)
		COMPRESSION	TENSION			
Abut 1	PP 24 x 0.5	810	N/A	-45 (a), N/A (b), -45 (c), -15 (d)	-45	810
BENT 2	HP 18 x 181	600	-80	-45 (a), -20 (b), -45 (c), -15 (d)	-45	750 (3)
Abut 3	PP 24 x 0.5	680	N/A	-45 (a), N/A (b), -45 (c), -15 (d)	-45	680

RETAINING/WINGWALL PILE DATA TABLE

LOCATION	PILE TYPE	NOMINAL RESISTANCE (kips)		DESIGN TIP ELEVATION (ft)	SPECIFIED TIP ELEVATION (ft)	REQUIRED NOMINAL DRIVING RESISTANCE (kips)
		COMPRESSION	TENSION			
Abut 1 East H = 24′	PP 24 x 0.5	430	N/A	-40 (a), N/A (b), -25 (c), -10 (d)	-40	500 (3)
Abut 1 West H = 24′	PP 24 x 0.5	260	-50	-40 (a), +8 (b), -25 (c), -10 (d)	-40	370 (3)
Abut 1 West H = 18′	PP 24 x 0.5	290	-30	-40 (a), +10 (b), -25 (c), -10 (d)	-40	350 (3)
Abut 3 East H = 18′	PP 24 x 0.5	180	-50	-40 (a), +2 (b), -8 (c), -10 (d)	-40	290 (3)
Abut 3 West H = 24′	PP 24 x 0.5	260	-50	-40 (a), +2 (b), -8 (c), -10 (d)	-40	370 (3)
Abut 3 West H = 18′	PP 24 x 0.5	290	-30	-40 (a), +9 (b), -8 (c), -10 (d)	-40	350 (3)

1. Design tip elevation is controlled by: (a) Compression, (b) Tension, (c) Settlement, (d) Lateral load.
2. The Specified Tip Elevation shall not be raised above the Design Tip Elevations for compression load, tension load, lateral load, and tolerable settlement.
3. The nominal driving resistance required is equal to the nominal resistance needed to support the factored loads under extreme event plus driving resistance from the penetrated soil layers susceptible to liquefaction, which do not contribute to the design resistance under extreme event.

SPREAD FOOTING DATA TABLE

SUPPORT LOCATION	SERVICE PERMISSIBLE NET CONTACT STRESS (SETTLEMENT) (ksf) (1)	STRENGTH/CONSTRUCTION FACTORED GROSS NOMINAL BEARING RESISTANCE φb = 0.55 (ksf)	EXTREME I EVENT FACTORED GROSS NOMINAL BEARING RESISTANCE φb = 0.8 (ksf)	EXTREME II EVENT FACTORED GROSS NOMINAL BEARING RESISTANCE φ b = 0.8 (ksf)
Abut 1 East WW (H = 10′)	>1.4	6.3	8.6	8.3
Abut 3 East WW (H = 12′)	>1.8	6.2	8.8	8.2
Abut 3 East WW (H = 10′)	>1.4	6.3	8.6	8.3
Abut 3 West WW (H = 12′)	>1.8	6.2	8.8	8.2
Abut 3 West WW (H = 10′)	>1.4	6.3	8.6	8.3
Abut 1 West WW (H = 8′)	>1.2	6.2	9.0	8.6

1. Service permissible net contact stress is greater than net service load.

BENCHMARK

BENCHMARK	NORTHING	EASTING	ELEV	DESCRIPTION
5087	2205805.50	6040706.252	---	PUNCHED 2" BRASS CAP, DOWN 0.8′ IN WELL MONUMENT
FV-50-70	---	---	26.622	3-¾" OCS ALUMINUM BENCHMARK DISK STAMPED "FV-50-70", SET IN THE SOUTHWEST CORNER OF A 4′ X 8′ CONCRETE CATCH BASIN

Survey control: Horizontal control for this survey is based on the California State Plane Coordinate System of 1983 (CCS83), Zone VI, NAD83, 1991.35 Epoch, on file in the Office of the Orange County Surveys. Vertical control datum is based on the North American Vertical Datum of 1988 per records on file in the office of the Orange County Surveyor. All coordinate and elevation values are US Survey Feet.

PI405-DWG-SBR-000553

Yelda Kazemi — 04/03/19
GEOTECHNICAL PROFESSIONAL — APPROVAL DATE

NOTE:
THE CONTRACTOR SHALL VERIFY ALL CONTROLLING FIELD DIMENSIONS BEFORE ORDERING OR FABRICATING ANY MATERIAL.

BR-17

Feiruz Aberra
DESIGN OVERSIGHT
04/18/2019
SIGN OFF DATE

SCALE: AS SHOWN	VERT.DATUM NAVD88	HORZ.DATUM NAD83			
PHOTOGRAMMETRY AS OF:		ALIGNMENT TIES			
SURVEYED	BY M. Butcher	DRAFTED	BY M. Hakimi		
FIELD CHECKED	BY G. Arredondo	CHECKED	BY G. Arredondo		

DESIGN	BY A. Elsadek / K. Allam	CHECKED R. Alamir	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION
DETAILS	BY F. Samson	CHECKED R. Alamir	
QUANTITIES	BY	CHECKED	

Alaedin Moubayed
PROJECT ENGINEER

BRIDGE NO.	55-1115
POST MILES	14.13

BUSHARD STREET OC (REPLACE)
FOUNDATION DATA

FOUNDATION PLAN SHEET (ENGLISH) (REV. 03/14/12)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

UNIT: 4225
PROJECT NUMBER & PHASE: 12000001801
CONTRACT NO.: 12-0H1004

DISREGARD PRINTS BEARING EARLIER REVISION DATES →

REVISION DATES				SHEET	OF
08/31/17	06/18/18	11/27/18	04/03/19	7	61

FILE => 55-1115-e-fpl02

USERNAME => fsamson DATE PLOTTED => 11-APR-2019 TIME PLOTTED => 11:11

RELEASED FOR CONSTRUCTION
Jun 12, 2019

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
12,7	Ora,LA	22,73 405,605	R0.5/R0.7, R0.7/R3.8 R2.5/R7.5, R.3.5/24.2 0.0/1.2, 3.5/R1.6, R0.0/R1.2		

Khaled Allam — 04-03-19
REGISTERED CIVIL ENGINEER — DATE

REGISTERED PROFESSIONAL ENGINEER — KHALED ALLAM — No. C67110 — Exp. 9-30-20 — CIVIL — STATE OF CALIFORNIA

PLANS APPROVAL DATE

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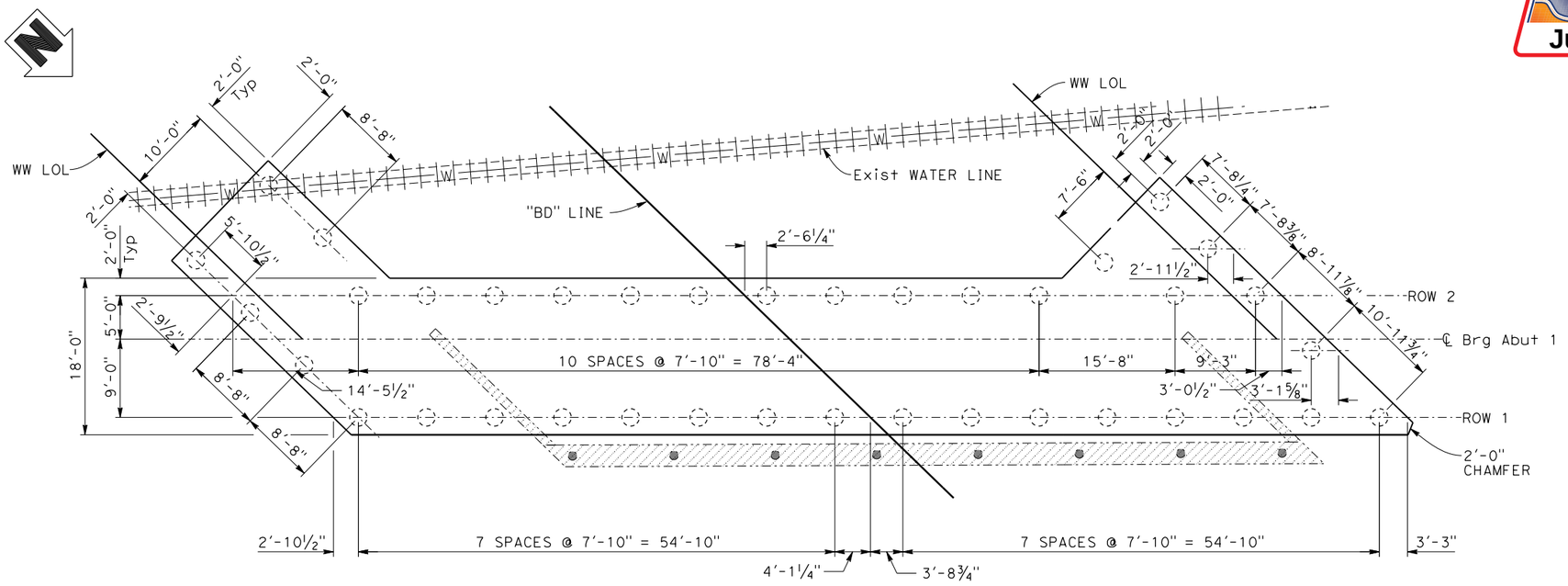
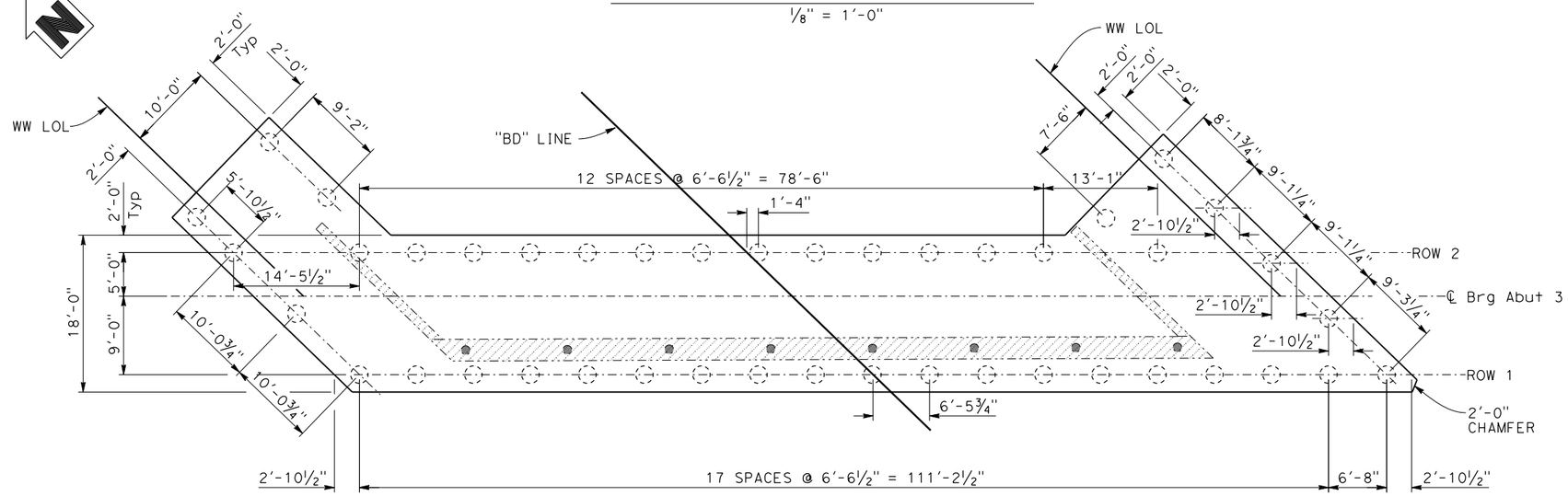
LONG BEACH, CA 90806

ORANGE COUNTY
TRANSPORTATION AUTHORITY
550 SOUTH MAIN STREET
ORANGE, CA 92863



ABUTMENT 1 FOOTING PLAN

⅛" = 1'-0"



ABUTMENT 3 FOOTING PLAN

⅛" = 1'-0"

LEGEND:

	PP 24 X 0.5
	Exist Concrete Pile
·····——	Existing Structure
———	New Structure
	Bridge Removal

NOTES:

A. Location of existing piles are approximate. In case of conflict of proposed piles with existing piles, the Contractor shall notify the Engineer immediately.

B. Identify and remove portions of existing piles and footings in conflict with the new construction. At a minimum, remove existing piles 3 feet below finished grade or 1 foot below new construction, whichever is lower.

NOTE:
THE CONTRACTOR SHALL VERIFY ALL CONTROLLING FIELD DIMENSIONS BEFORE ORDERING OR FABRICATING ANY MATERIAL.

BR-17

Feiruz Aberra
DESIGN OVERSIGHT
04/18/2019
SIGN OFF DATE

	BY	CHECKED
DESIGN	A. Elsadek/ K. Allam	R. Alamir
DETAILS	F. Samson	R. Alamir
QUANTITIES		

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

Alaedin Moubayed
PROJECT ENGINEER

BRIDGE NO. 55-1115
POST MILES 14.13

BUSHARD STREET OC (REPLACE)
ABUTMENT FOOTING AND PILE LAYOUT

DESIGN DETAIL SHEET (ENGLISH) (REV. 03/14/12)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

UNIT: 4225
PROJECT NUMBER & PHASE: 120000001801 CONTRACT NO.: 12-0H1004

DISREGARD PRINTS BEARING EARLIER REVISION DATES →

REVISION DATES				SHEET	OF
08/31/17	06/18/18	11/27/18	04/03/19	10	61

FILE => 55-1115-f-a01_1o3

Driving Record (Pipe Pile)

Project: OC 405 Widening
Caltrans EA No: 12-OH1004
Fugro Project No: 04.61170008

Rig No. 1
Sequence: 1
Date: 10/18/19
Bridge Name & No: Bushard (55-1115)
Abutment / Bent / Pier: Abut-3
Pile No: 97 (PDA)

Ft	No. of Blows	Notes	Ft	No. of Blows	Notes	Ft	No. of Blows	Notes
1			46	15		81		
2			47	15		82		
3			48	18		83		
4			49	17		84		
5			**50**	17		**85**		
6			51	17	S=6.5'	86		
7			52	19		87		
8			53	18		88		
9			54	18	S=6.5	89		
10			**55**	20		**90**		
11			56	18		91		
12			57	20	S=7	92		
13			58	20		93		
14			59	20		94		
15			**60**	20		**95**		
16			61	21	S=7'	96		
17			62	26		97		
18			63	28	S=7.5'	98		
19			64	27		99		
20			**65**	30		**100**		
21		Stop @ 8:32AM	66	29		101		
22	↓		67	29	S=7.5'	102		
23			68	30		103		
24			69	34	S=7'	104		
25	↓		**70**	31	S=7.5'	**105**		
26	11		71	2/9"	43/min	106		
27	10		72			107		
28	11		73			108		
29	11	12:46pm	74			109		
30	12		**75**			**110**		
31	12		76			111		
32	12		77			112		
33	13		78			113		
34	14		79			114		
35	14		**80**			**115**		
36	14		BOR 1 Data			BOR 2 Data		
37	13		Date:			Date:		
38	13		Time:			Time:		
39	13		In.	Blows	Notes	In.	Blows	Notes
40	14		1"			1"		
41	14		2"			2"		
42	13		3"			3"		
43	13		4"			4"		
44	13		5"			5"		
45	15		6"			6"		

PROJECT INFORMATION

Logged By: AGD
Pile Sub.: TIPCO
Weather Cond.: Sunny

REFERENCE

Drawing: Bushard OC Replace (4/3/19)
Production Pile: YES — Test Pile: YES
Nominal Capacity: 680k — Tip Elev.: -45'

INSTALLATION CRITERIA

Accepted:
Acceptance Crit.:
Batter: NO
Refusal Crit.:
Refused: NO — Depth:

PILE DATA

Type: STEEL PIPE — Length: 82' (57'+25')
Diameter: 24" — Heat No.: 89M2791
Wall Thickness: 0.5" — Tag No.: B-85545-E

HAMMER DATA

Make: APE — Model: D46-32
Rated Energy: 107 k-ft — Type: DIESEL
Rated Stroke: 10.5' — Ram Wt.: 10,141 lbs
Blows/Min: 37-52 — Hammer Wt.: 24,716 lbs
Hammer Cushion: ALUM/MICA — Thickness: 3.5"
Pile Cushion: — — Thickness: —

INSTALLATION DATA

Pre-drill Depth: — — Diameter: —
Deviation North: — — East: —
Plumb Check: YES — Direction: —
Initial Drive Start Time: 8:28AM — Stop Time: 8:35AM
Drive Start Time: 12:30PM — Stop Time: 12:55PM
PDA Performed: YES — Safety: YES
Drive Hammer Start Setting: 4 — End Setting: 4
Avg. Stroke - Last 4 ft: 7.5'
Soil Plug Depth: * — Elevation:

ELEVATIONS

Ground: ~25.5' — Pre-Excv:
Pile Butt: ~36.75' — Pile Tip: ~-45.25'

Signed:

Remarks: Pile cut at 25' from bottom; top section 57'
* Pile Top out of reach.

Driving Record (Pipe Pile)

Project: OC 405 Widening
Caltrans EA No: 12-OH1004
Fugro Project No: 04.61170008

Rig No. 1
Sequence: Sand 4
Date: 10/21/2019 and 10/24/2019
Bridge Name & No: Bushard Street (55-1115)
Abutment / Bent / Pier: Abutment 3
Pile No: 97

Ft	No. of Blows	Notes	Ft	No. of Blows	Notes	Ft	No. of Blows	Notes
1			46			81		
2			47			82		
3			48			83		
4			49			84		
5			50			85		
6			51			86		
7			52			87		
8			53			88		
9			54			89		
10			55			90		
11			56			91		
12			57			92		
13			58			93		
14			59			94		
15			60			95		
16			61			96		
17			62			97		
18			63			98		
19			64			99		
20			65			100		
21			66			101		
22			67			102		
23			68			103		
24			69			104		
25			70			105		
26			71			106		
27			72			107		
28			73			108		
29			74			109		
30			75			110		
31			76			111		
32			77			112		
33			78			113		
34			79			114		
35			80			115		
36			BOR 1 Data			BOR 2 Data		
37			Date: 10/21/2019			Date: 10/24/2019		
38			Time: 3:40 PM			Time: 1:15 PM		
39			In.	Blows	Notes	In.	Blows	Notes
40			1"	13		1"	12	
41			2"	7		2"	8	
42			3"	6		3"	10	(5)=45'-10"
43			4"			4"		
44			5"			5"		
45			6"			6"		

PROJECT INFORMATION

Logged By: HT
Pile Sub.: TIPCO
Weather Cond.: Sunny

REFERENCE

Drawing: Bushard Street OC (Replace) 4/3/19
Production Pile: Yes — Test Pile: Yes
Nominal Capacity: 680 K — Tip Elev.: -45'

INSTALLATION CRITERIA

Accepted:
Acceptance Crit.:
Batter: NO
Refusal Crit.:
Refused: NO — Depth: —

PILE DATA

Type: Pipe pile — Length: 82'
Diameter: 24" — Heat No.: 89M2791
Wall Thickness: 0.5" — Tag No.: B-8554E-E

HAMMER DATA

Make: APE — Model: D46-32
Rated Energy: 107 K-ft — Type: DIESEL
Rated Stroke: 10-5' — Ram Wt.: 10141 lbs
Blows/Min: 37-53 — Hammer Wt.: 24716 lbs
Hammer Cushion: ALUM/MICARTA — Thickness: 3½"
Pile Cushion: NONE — Thickness: —

INSTALLATION DATA

Pre-drill Depth: — — Diameter: —
Deviation North: — — East: —
Plumb Check: YES (TIPCO) — Direction: —
Vibration Start Time: — — Stop Time: —
Drive Start Time: — — Stop Time: —
PDA Performed: YES — Safety: YES
Drive Hammer Start Setting: 4 — End Setting: 4
Avg. Stroke - Last 4 ft: ~ 9-8'
Soil Plug Depth: Pile top too high — Elevation:

ELEVATIONS

Ground: ~ 25.5' — Pre-Excv: —
Pile Butt: ~ 36.25' — Pile Tip: ~ -45.75'

Signed: Kns for HT

Remarks:

PILE DYNAMIC ANALYSIS SETUP RECORD

Rev 2013-05-23

Structure Name Bushard Street OC — Test date 10/18/2019.

Dist-Co-Rte-PM 12/ORA/495 — Operator Umesh Siva / Hossein Rashidi

Bridge No. 55-1115 EA 12EH1004 EFIS ____ — Approx start time of test 11 am.

PIER/ BENT/ (ABUT) SW/ RW/ SignStruct/ CMS/ OH Sign/ Location/ other(circle one) No. or I 3 — Pile No. 97.

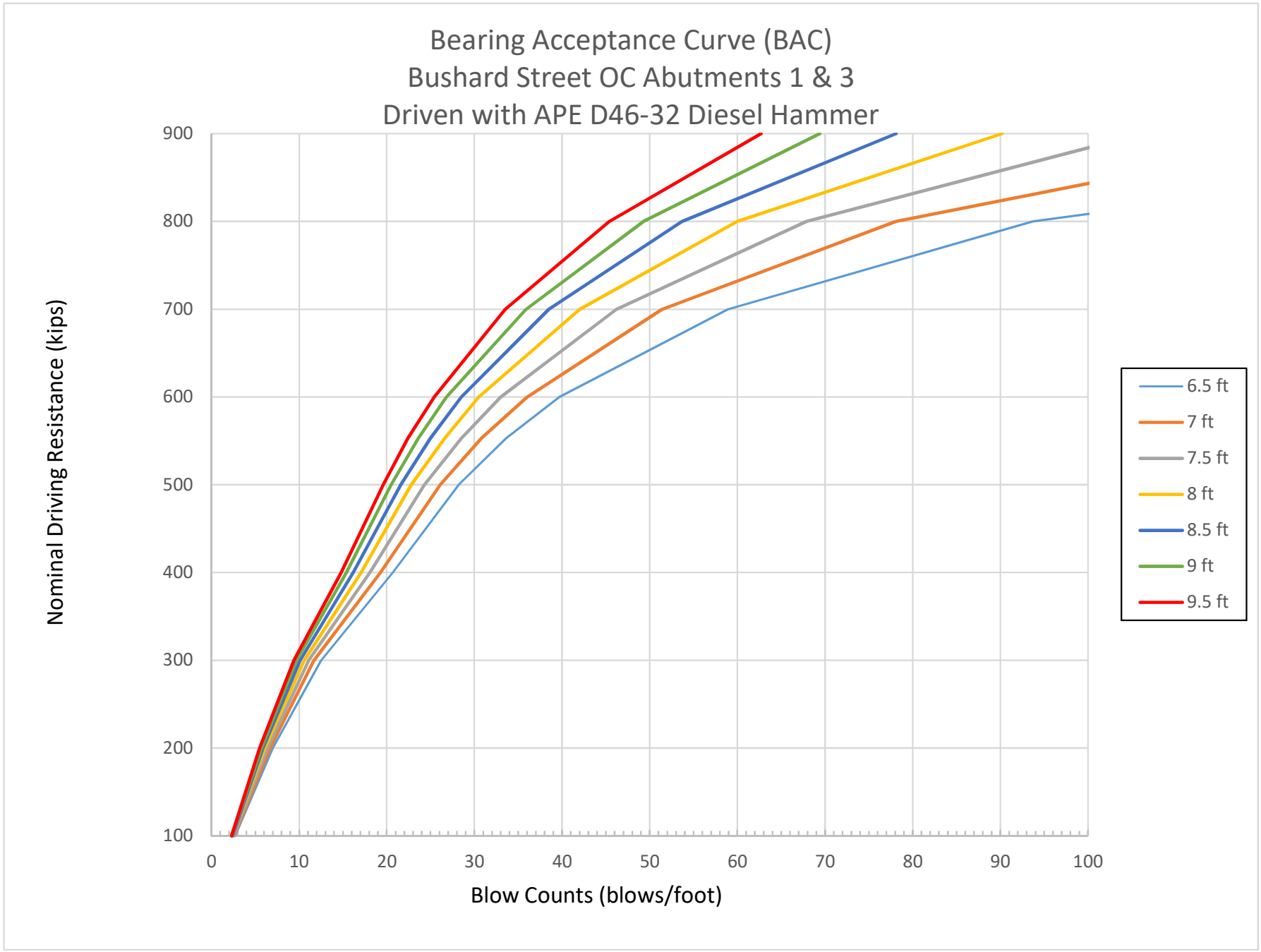
Remote gauges? NO — PDA No. 2 — Weather: Clear.

PDA INPUT:			PILE INFORMATION:	PDA GAUGES		
OPERATOR (OP)	US.		(CE)/ conical tip/ spider/ H/ square (circle one)		SERIAL NO.	CALIBR. CONST.
PROJECT (PJ)	Bushard.		DIAM / EDGE 24"	ACCELEROMETERS (square)		(velocity)
PILE/FILE NAME (PN)	Bushard-A3-P97-RS		WALL THICK 0.5"	A3 (green)	K11281	420
PROJ DESCRIP (PD)			CIRCUMF 6.28'	A4 (white)	K11285	363
DATE (DA)	10/18/2019.		ALLOW DRIV STRESS ~~45~~ KSI	STRAIN TRANSDUCERS (rectangle)		(force)
EFF LENGTH (LE)	78 ft.		NOM COMP RESIST 680.	F1 (yellow)		
X-SEC AREA (AR)	36.91		LENGTH 82 ft.	F2 (blue)		
ELAST MOD (EM)	~~[illegible]~~ 30,000		DIST PILE TOP TO GAGE 4 ft.	F3 (green)	8492	142
SPEC WT (SP)	.492 k/ft3		PILE DESCRIP PP24X0.5"	F4 (white)	5493	143
WAVE SPEED (WS)*	16,809.		CIRCULAR WELD / SPIRAL WELD (circle one)	CONNECTOR CABLE SERIAL NUMBERS		
CALC WAVE SP (WC)			DIST GAGE TO NRST WELD 6"	MAIN CABLES		
DAMP CONST (JC)	0.7		PEN AT BEGIN (LP) 21	PR		
Q1 CSX	JC values recommended by GRL for RMX methods:		PEN AT END 70.75	PE		
Q2 CSI			TIP EL AT BEGIN	4-WAY CONNECTOR CABLES (SPIDERS)		
Q3 TSX	minimum	0.3	TIP EL AT END -45.25.	PR		
Q4 BTA	clean sands	0.4 - 0.5	DIAGRAM	PE		
Q5 EMX	silty sands	0.5 - 0.7	(show gauge locations, reference points, North arrow)	HAMMER INFORMATION:		
Q6 ETR	silts	0.6 - 0.8		HAMMER APE D46-32.		
Q7 RX7	silty clays	0.7 - 0.9		SERIAL NO.		
Q8 RMX	clays	0.9		RATED ENERGY 107 Kft.		
Q9 STK				RAM WT		
LENGTH OF PEN (LP)				MAX DROP/STRK		
INCRMNT LENGTH (LI)	1 ft			HELMET WT		

NOTES

Fuel setting #1 = psi; FS #2 = psi; FS #3 = psi; FS #4 = ~~psi~~; FS #5 = psi

OPERATOR (OP) US.	TIME 3:30 pm.	PEN AT BEGIN (LP)	70.75
PILE NAME (PN) Bushard-A3-P97-RS	RESTRIKE NO. 1	PEN AT END	~~[illegible]~~ 80 ft
DATE (DA) 10/21/2019.		TIP EL AT BEGIN	-45.25
NOTES: Very hard driving.		TIP EL AT END	-45.50.
OPERATOR (OP) HKR.	TIME 1:00 pm.	PEN AT BEGIN (LP)	~~[illegible]~~ 80
PILE NAME (PN) Bushard-A3-P97-RS2	RESTRIKE NO. 2.	PEN AT END	~~[illegible]~~ 80.25
DATE (DA) 10/24/2019.		TIP EL AT BEGIN	-45.50
NOTES: Very Similar data		TIP EL AT END	-45.75.

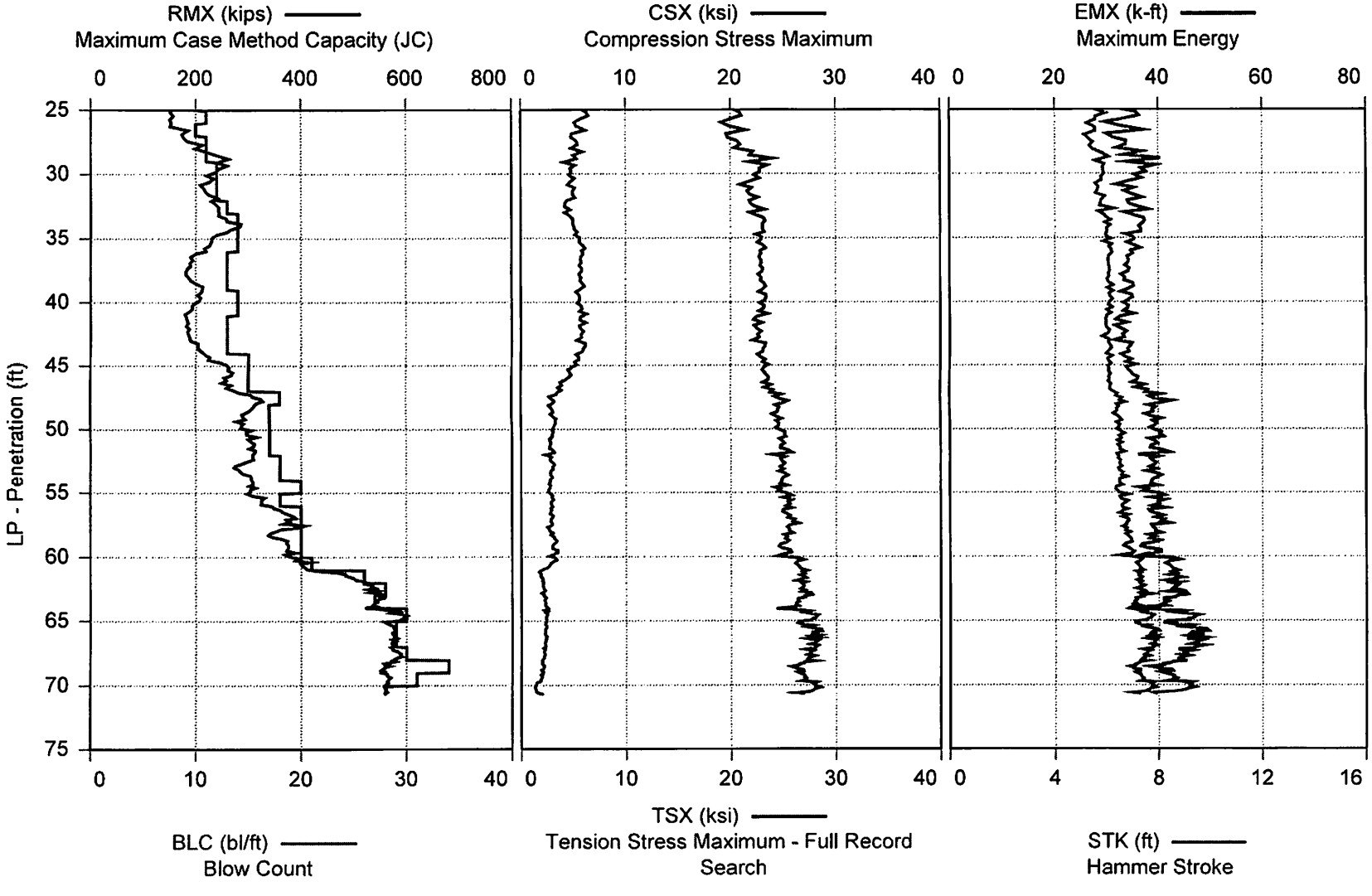

Bearing Acceptance Curve (BAC)
Bushard Street OC Abutments 1 & 3
Driven with APE D46-32 Diesel Hammer
Nominal Driving Resistance (kips)
900
800
700
600
500
400
300
200
100
0
10
20
30
40
50
60
70
80
90
100
Blow Counts (blows/foot)
6.5 ft
7 ft
7.5 ft
8 ft
8.5 ft
9 ft
9.5 ft

EarthSpectives - PDIPLOT2 Ver 2017.2.58.3 - Case Method & iCAP® Results

Printed: 01-November-2019 **Test started: 18-October-2019**

OC405 WIDENING AT BUSHARD - ABUT 3 PILE 97 @ EOID

PP24X0.5", 82 FT, D46-32



OC405 WIDENING AT BUSHARD - ABUT 3 PILE 97 @ EOID
PP24X0.5", 82 FT, D46-32
OP: US
Date: 18-October-2019

AR: 36.91 in²
SP: 0.492 k/ft³
LE: 78.00 ft
EM: 30,000 ksi
WS: 16,807.9 f/s
JC: 0.70

RMX: Maximum Case Method Capacity (JC)
EMX: Maximum Energy
CSX: Compression Stress Maximum
STK: Hammer Stroke
TSX: Tension Stress Maximum - Full Record Search
BPM: Blows/Minute

BL#	Depth ft	BLC bl/ft	TYPE	RMX kips	CSX ksi	TSX ksi	EMX k-ft	STK ft	BPM bpm
8	22.00	8	AV8	134	20.7	6.6	38.7	6.2	42
			MAX	184	28.9	9.0	70.9	8.8	51
			MIN	113	18.0	3.7	27.0	5.3	2
17	23.00	9	AV9	137	18.5	6.1	28.9	5.4	50
			MAX	147	19.8	7.0	34.0	5.8	51
			MIN	128	17.7	5.6	25.3	5.2	49
26	24.00	9	AV9	163	19.9	6.9	32.7	5.7	49
			MAX	186	20.9	7.6	35.4	5.9	51
			MIN	135	18.4	5.6	28.3	5.3	48
36	25.00	10	AV10	172	21.1	6.4	36.1	5.9	48
			MAX	187	22.7	7.3	39.9	6.4	50
			MIN	149	19.5	5.3	31.1	5.4	46
47	26.00	11	AV11	153	20.4	6.0	34.2	5.6	49
			MAX	168	22.3	7.3	39.3	6.2	52
			MIN	143	18.4	4.6	27.0	5.1	47
57	27.00	10	AV10	169	20.2	5.4	32.9	5.4	50
			MAX	217	22.2	6.8	39.0	6.0	52
			MIN	150	18.5	4.1	27.6	5.0	48
68	28.00	11	AV11	193	20.4	5.1	32.7	5.4	51
			MAX	229	21.8	6.0	35.4	5.7	52
			MIN	172	19.5	4.4	30.7	5.1	49
79	29.00	11	AV11	240	22.3	5.2	36.1	5.8	45
			MAX	278	26.3	6.6	48.1	6.8	51
			MIN	201	20.5	3.3	26.0	5.4	2
91	30.00	12	AV12	243	22.7	4.7	37.1	5.9	48
			MAX	270	24.1	5.6	41.5	6.3	50
			MIN	223	21.8	4.1	34.0	5.6	47
103	31.00	12	AV12	222	21.9	4.8	34.6	5.7	49
			MAX	243	23.6	5.7	38.2	6.1	51
			MIN	207	20.4	3.8	30.0	5.4	47
115	32.00	12	AV12	227	22.0	5.0	35.1	5.8	49
			MAX	253	23.4	6.0	39.3	6.1	50
			MIN	210	20.7	4.4	31.4	5.5	47
128	33.00	13	AV13	240	22.2	4.3	35.3	5.9	49
			MAX	258	25.5	5.9	44.1	6.7	50
			MIN	229	20.9	3.5	31.5	5.5	45

OC405 WIDENING AT BUSHARD - ABUT 3 PILE 97 @ EOID
PP24X0.5", 82 FT, D46-32
OP: US
Date: 18-October-2019

BL#	Depth ft	BLC bl/ft	TYPE	RMX kips	CSX ksi	TSX ksi	EMX k-ft	STK ft	BPM bpm
142	34.00	14	AV14	263	22.9	4.9	36.6	6.0	48
			MAX	292	24.3	5.6	39.6	6.3	49
			MIN	237	22.0	4.3	33.9	5.8	47
156	35.00	14	AV14	254	22.9	5.3	35.5	6.0	48
			MAX	289	23.7	6.1	38.0	6.3	49
			MIN	224	22.1	4.6	32.9	5.8	47
170	36.00	14	AV14	226	22.9	5.8	35.0	6.1	48
			MAX	234	24.4	6.8	39.6	6.5	49
			MIN	200	22.0	5.2	32.2	5.9	46
183	37.00	13	AV13	194	22.9	5.8	34.6	6.1	48
			MAX	211	24.1	6.6	37.4	6.5	49
			MIN	181	21.8	5.1	31.0	5.8	46
196	38.00	13	AV13	185	22.9	5.7	33.9	6.1	48
			MAX	194	23.6	6.2	35.5	6.3	48
			MIN	176	22.4	5.3	32.1	5.9	47
209	39.00	13	AV13	200	22.9	5.7	34.0	6.1	48
			MAX	214	23.7	6.2	36.5	6.3	48
			MIN	182	22.2	4.9	31.9	5.9	47
223	40.00	14	AV14	207	23.2	5.5	34.2	6.2	47
			MAX	223	24.7	6.5	38.3	6.6	49
			MIN	195	21.8	4.6	30.6	5.8	46
237	41.00	14	AV14	190	23.1	5.8	34.1	6.1	47
			MAX	203	24.1	6.5	37.0	6.4	48
			MIN	177	22.6	5.2	32.7	6.0	47
250	42.00	13	AV13	184	22.5	5.8	32.6	6.0	48
			MAX	189	23.6	6.7	35.6	6.3	49
			MIN	177	21.6	5.1	30.4	5.8	47
263	43.00	13	AV13	187	22.6	5.7	33.1	6.0	48
			MAX	194	24.2	6.7	37.4	6.5	49
			MIN	180	21.3	4.9	29.8	5.7	46
276	44.00	13	AV13	206	23.0	5.9	34.2	6.1	47
			MAX	221	23.9	6.7	36.6	6.4	49
			MIN	190	21.9	5.1	31.0	5.8	47
291	45.00	15	AV15	235	23.0	5.4	34.1	6.1	48
			MAX	268	24.5	6.6	38.5	6.5	49
			MIN	201	21.4	4.5	29.8	5.7	46
306	46.00	15	AV15	264	23.3	4.7	34.8	6.1	48
			MAX	287	24.1	5.2	37.4	6.3	48
			MIN	235	22.4	4.2	32.1	5.9	47

OC405 WIDENING AT BUSHARD - ABUT 3 PILE 97 @ EOID
PP24X0.5", 82 FT, D46-32
OP: US
Date: 18-October-2019

BL#	Depth ft	BLC bl/ft	TYPE	RMX kips	CSX ksi	TSX ksi	EMX k-ft	STK ft	BPM bpm
321	47.00	15	AV15	262	23.5	3.9	36.4	6.1	47
			MAX	281	24.5	4.5	39.0	6.4	49
			MIN	240	22.4	3.3	32.9	5.8	46
339	48.00	18	AV18	311	24.6	3.1	39.7	6.5	46
			MAX	335	25.9	3.5	43.6	6.9	47
			MIN	280	23.4	2.6	35.6	6.1	45
356	49.00	17	AV17	300	24.3	2.9	38.5	6.4	47
			MAX	313	24.9	3.1	40.3	6.5	47
			MIN	281	23.5	2.5	36.3	6.1	46
373	50.00	17	AV17	288	24.5	3.2	39.3	6.5	46
			MAX	302	25.5	3.7	42.2	6.7	47
			MIN	277	23.5	2.9	36.6	6.2	45
390	51.00	17	AV17	303	24.9	2.9	39.8	6.5	46
			MAX	328	25.8	3.3	42.5	6.8	47
			MIN	293	24.1	2.4	36.7	6.3	45
407	52.00	17	AV17	310	25.0	2.8	39.3	6.5	46
			MAX	337	26.0	3.3	42.4	6.8	48
			MIN	286	23.2	2.1	33.3	6.0	45
425	53.00	18	AV18	294	24.9	2.9	39.0	6.5	46
			MAX	318	26.1	3.4	42.6	6.8	47
			MIN	270	24.2	2.2	36.8	6.3	45
443	54.00	18	AV18	293	25.0	2.9	39.3	6.6	46
			MAX	311	26.1	3.3	42.7	6.8	47
			MIN	274	23.7	2.5	34.8	6.2	45
463	55.00	20	AV20	307	24.6	2.7	37.8	6.4	46
			MAX	324	25.7	3.0	41.6	6.8	47
			MIN	296	23.8	2.5	35.1	6.2	45
481	56.00	18	AV18	320	25.5	3.0	40.3	6.7	46
			MAX	344	27.3	3.2	46.1	7.1	47
			MIN	288	24.1	2.7	35.8	6.3	44
501	57.00	20	AV20	368	25.3	2.9	39.5	6.6	46
			MAX	394	26.8	3.3	44.0	7.1	47
			MIN	327	23.7	2.2	34.8	6.2	44
521	58.00	20	AV20	377	25.8	2.8	40.0	6.8	45
			MAX	412	26.6	3.1	43.0	7.0	46
			MIN	343	24.8	2.2	37.0	6.5	45
541	59.00	20	AV20	358	25.3	3.1	39.0	6.9	45
			MAX	397	26.5	3.7	42.6	7.1	46
			MIN	331	24.6	2.6	36.5	6.7	44
561	60.00	20	AV20	376	25.0	3.1	38.1	6.8	45

OC405 WIDENING AT BUSHARD - ABUT 3 PILE 97 @ EOID
PP24X0.5", 82 FT, D46-32
OP: US
Date: 18-October-2019

BL#	Depth ft	BLC bl/ft	TYPE	RMX kips	CSX ksi	TSX ksi	EMX k-ft	STK ft	BPM bpm
			MAX	405	26.0	3.7	41.4	7.1	46
			MIN	360	23.9	2.5	34.1	6.5	44
582	61.00	21	AV21	403	26.4	2.9	42.4	7.3	44
			MAX	442	27.4	3.6	45.6	7.6	45
			MIN	379	25.3	1.9	38.7	6.9	43
608	62.00	26	AV26	488	26.8	1.9	43.2	7.3	44
			MAX	533	27.7	2.3	45.7	7.6	45
			MIN	428	25.7	1.3	40.0	7.0	43
636	63.00	28	AV28	538	27.0	2.1	43.7	7.4	43
			MAX	565	28.3	2.3	47.5	7.8	45
			MIN	514	25.7	1.8	39.8	6.9	42
663	64.00	27	AV27	543	26.4	2.3	41.3	7.1	44
			MAX	565	27.6	3.6	45.3	7.5	45
			MIN	489	25.2	1.9	32.3	6.7	43
693	65.00	30	AV30	585	27.2	2.4	44.2	7.5	42
			MAX	607	29.1	2.9	50.0	8.0	45
			MIN	539	21.6	2.2	27.5	6.8	2
722	66.00	29	AV29	572	27.5	2.3	45.5	7.6	43
			MAX	582	29.1	2.6	50.7	8.1	45
			MIN	551	25.6	2.2	39.4	6.9	41
751	67.00	29	AV29	576	28.0	2.3	47.6	7.8	42
			MAX	587	28.9	2.6	50.5	8.1	43
			MIN	566	26.9	2.2	44.3	7.5	42
781	68.00	30	AV30	582	27.5	2.2	45.1	7.5	43
			MAX	595	28.8	2.4	49.7	8.0	44
			MIN	566	26.6	2.0	41.6	7.1	42
815	69.00	34	AV34	562	26.6	2.1	41.6	7.2	44
			MAX	591	28.5	2.2	47.7	7.8	45
			MIN	548	25.3	1.8	37.5	6.8	42
846	70.00	31	AV31	564	27.2	1.8	43.6	7.4	43
			MAX	573	28.5	2.1	48.2	7.9	44
			MIN	553	26.2	1.4	40.2	7.1	42
867	70.75	28	AV21	561	27.5	1.5	43.7	7.5	43
			MAX	567	29.0	3.3	48.7	8.0	45
			MIN	555	25.6	1.1	37.1	6.8	42
			Average	361	24.7	3.6	39.1	6.6	46
			Maximum	607	29.1	9.0	70.9	8.8	52
			Minimum	113	17.7	1.1	25.3	5.0	2

Total number of blows analyzed: 867

OC405 WIDENING AT BUSHARD - ABUT 3 PILE 97 @ EOID
OP: US
PP24X0.5", 82 FT, D46-32
Date: 18-October-2019

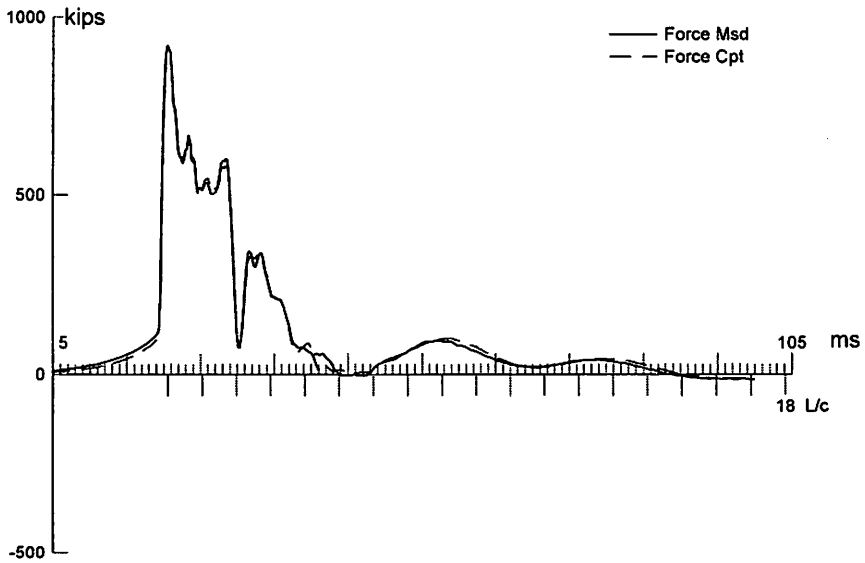
BL# Sensors

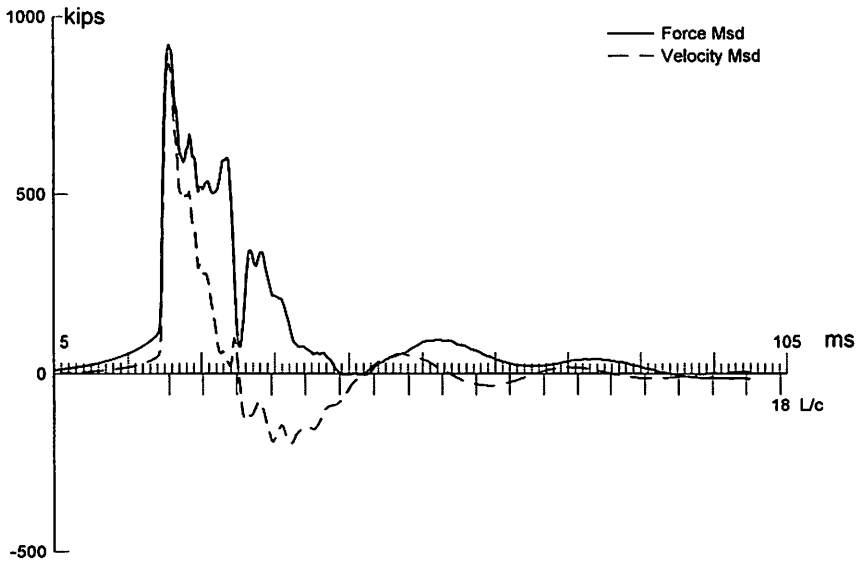
1-867 F3: [S492] 142.0 (1.00); F4: [S493] 143.0 (1.00); A3: [K11281] 420.0 (1.00); A4: [K11285] 363.0 (1.00)

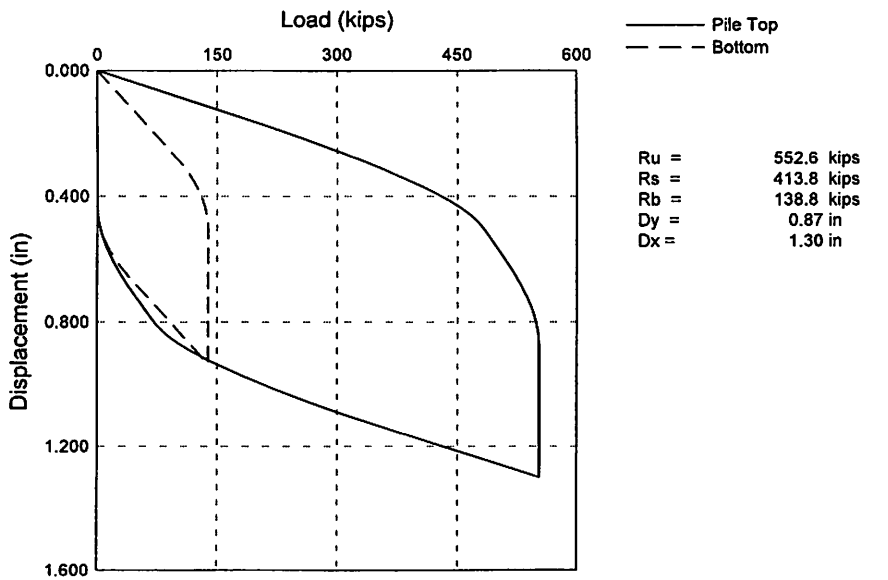
Time Summary

Drive	1 minute 28 seconds	12:36 PM - 12:37 PM (10/18/2019) BN 1 - 74
Stop	13 minutes 19 seconds	12:37 PM - 12:50 PM
Drive	12 minutes 41 seconds	12:50 PM - 1:03 PM BN 75 - 663
Stop	3 minutes 42 seconds	1:03 PM - 1:07 PM
Drive	4 minutes 42 seconds	1:07 PM - 1:11 PM BN 664 - 867

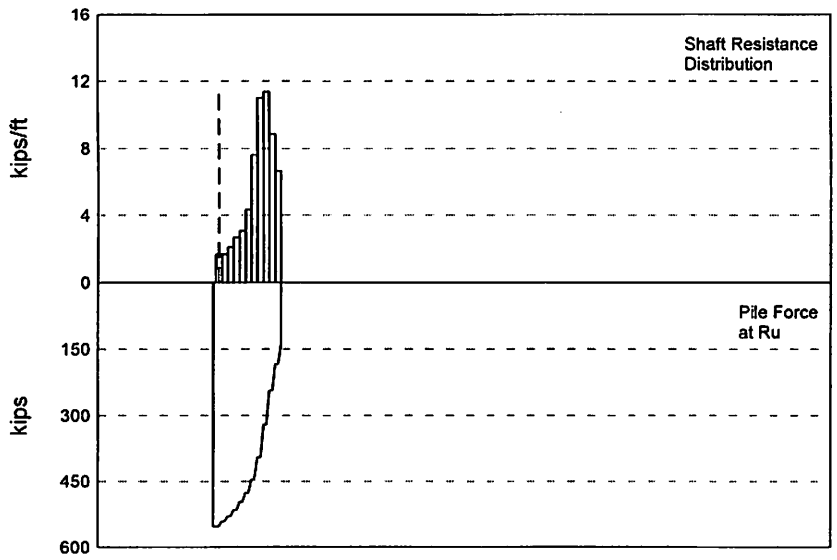
Total time [00:35:53] = (Driving [00:18:52] + Stop [00:17:01])







Ru =	552.6 kips
Rs =	413.8 kips
Rb =	138.8 kips
Dy =	0.87 in
Dx =	1.30 in



OC405 WIDENING AT BUSHARD; Pile: ABUT 3 PILE 97 @ EOID — Test: 18-Oct-2019 13:11:
PP24X0.5", 82 FT, D46-32; Blow: 863 — CAPWAP(R) 2006-3
EARTHSPECTIVES — OP: US

CAPWAP SUMMARY RESULTS

Shaft Resistance of 75%.

Total CAPWAP Capacity: 552.6; along Shaft 413.8; at Toe 138.8 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
				552.6				
1	10.2	2.8	11.5	541.1	11.5	4.14	0.66	0.138
2	17.0	9.6	11.5	529.6	23.0	1.70	0.27	0.138
3	23.7	16.3	14.3	515.3	37.3	2.11	0.34	0.138
4	30.5	23.1	18.3	497.0	55.6	2.70	0.43	0.138
5	37.3	29.9	20.8	476.2	76.4	3.07	0.49	0.138
6	44.1	36.7	29.4	446.8	105.8	4.33	0.69	0.138
7	50.9	43.5	51.5	395.3	157.3	7.59	1.21	0.138
8	57.7	50.3	74.6	320.7	231.9	11.00	1.75	0.138
9	64.4	57.0	77.0	243.7	308.9	11.35	1.81	0.138
10	71.2	63.8	60.0	183.7	368.9	8.85	1.41	0.138
11	78.0	70.6	44.9	138.8	413.8	6.62	1.05	0.138
Avg. Shaft			37.6			5.86	0.93	0.138
Toe			138.8				44.18	0.133

Soil Model Parameters/Extensions		Shaft	Toe
Quake	(in)	0.162	0.390
Case Damping Factor		0.864	0.279
Damping Type			Smith
Unloading Quake	(% of loading quake)	34	81
Reloading Level	(% of Ru)	100	100
Unloading Level	(% of Ru)	31	
Resistance Gap (included in Toe Quake)	(in)		0.046
Soil Plug Weight	(kips)		0.26

CAPWAP match quality = 1.66 (Wave Up Match) ; RSA = 0
Observed: final set = 0.429 in; blow count = 28 b/ft
Computed: final set = 0.388 in; blow count = 31 b/ft

max. Top Comp. Stress = 25.0 ksi (T= 21.0 ms, max= 1.017 x Top)
max. Comp. Stress = 25.4 ksi (Z= 10.2 ft, T= 21.4 ms)
max. Tens. Stress = -0.60 ksi (Z= 37.3 ft, T= 46.6 ms)
max. Energy (EMX) = 37.5 kip-ft; max. Measured Top Displ. (DMX)= 0.70 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	923.2	-11.7	25.0	-0.32	37.53	13.1	0.726
2	6.8	930.2	-12.3	25.2	-0.33	37.48	13.0	0.719
4	13.6	914.8	-17.7	24.8	-0.48	35.96	12.8	0.698
5	17.0	924.1	-19.3	25.0	-0.52	35.72	12.6	0.684
6	20.3	902.3	-15.3	24.4	-0.41	34.27	12.5	0.668
7	23.7	913.4	-17.1	24.7	-0.46	33.97	12.3	0.652
8	27.1	887.2	-17.1	24.0	-0.46	32.32	12.2	0.636
9	30.5	899.7	-21.8	24.4	-0.59	32.05	12.0	0.621
10	33.9	866.0	-19.3	23.5	-0.52	30.18	11.8	0.606
11	37.3	881.1	-22.3	23.9	-0.60	29.90	11.6	0.591
12	40.7	846.7	-16.1	22.9	-0.44	27.92	11.3	0.576
13	44.1	871.2	-16.7	23.6	-0.45	27.63	11.0	0.560
14	47.5	827.5	-5.6	22.4	-0.15	25.15	10.6	0.545
15	50.9	860.5	-6.8	23.3	-0.18	24.90	10.2	0.530
16	54.3	777.3	0.0	21.1	0.00	21.13	9.8	0.518
17	57.7	810.7	0.0	22.0	0.00	20.94	9.4	0.505
18	61.0	694.2	0.0	18.8	0.00	16.00	8.9	0.494
19	64.4	717.7	0.0	19.4	0.00	15.85	8.6	0.483
20	67.8	601.4	0.0	16.3	0.00	11.05	9.8	0.474
21	71.2	588.7	0.0	15.9	0.00	10.97	11.1	0.466
22	74.6	408.5	0.0	11.1	0.00	7.23	12.4	0.460
23	78.0	266.5	0.0	7.2	0.00	4.37	12.9	0.454
Absolute	10.2			25.4			(T =	21.4 ms)
	37.3				-0.60		(T =	46.6 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	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RX	974.2	888.8	803.4	718.0	657.3	623.8	592.1	560.4	528.8	497.1
RU	974.2	888.8	803.4	718.0	632.6	547.1	461.7	376.3	290.9	205.5

RAU = 196.0 (kips); RA2 = 628.0 (kips)

Current CAPWAP Ru = 552.6 (kips); Corresponding J(RP)= 0.00; J(RX) = 0.72

VMX	TVP	VT1*Z	FT1	FMX	DMX	DFN	SET	EMX	QUS
ft/s	ms	kips	kips	kips	in	in	in	kip-ft	kips
13.39	20.78	67.3	132.0	946.1	0.703	0.432	0.429	37.6	798.1

PILE PROFILE AND PILE MODEL

Depth	Area	E-Modulus	Spec. Weight	Perim.
ft	in^2	ksi	lb/ft^3	ft
0.00	36.91	29992.2	492.000	6.283
78.00	36.91	29992.2	492.000	6.283

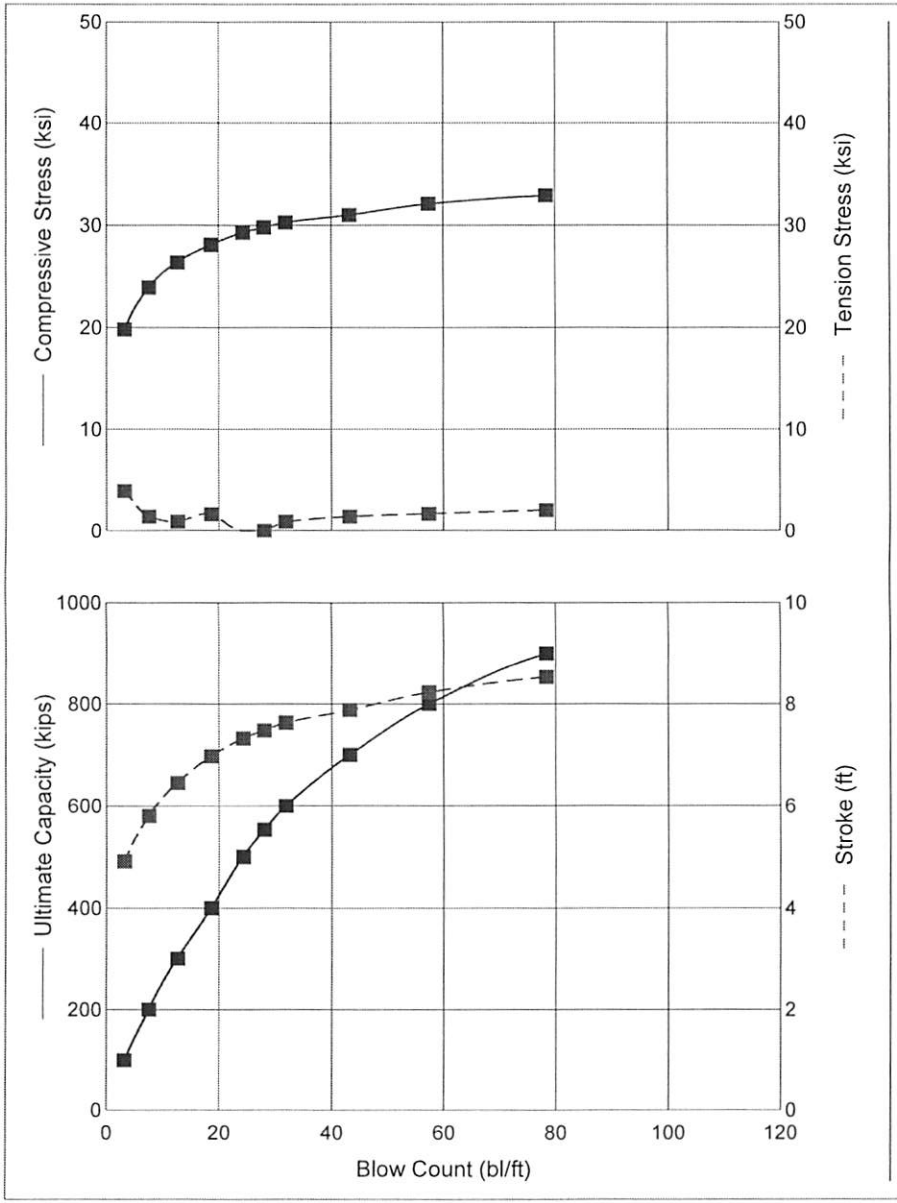
Toe Area 3.142 ft^2

Top Segment Length 3.39 ft, Top Impedance 65.89 kips/ft/s

Pile Damping 1.0 %, Time Incr 0.202 ms, Wave Speed 16807.9 ft/s, 2L/c 9.3 ms

EarthSpectives
OC405@BUSHARD, -45 FT TIP, D46-32

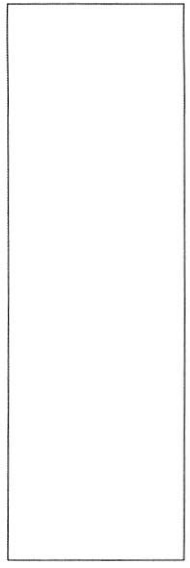
06-Nov-2019
GRLWEAP Version 2010



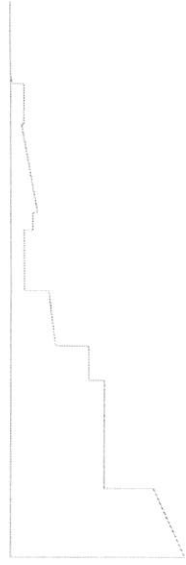
APE D 46-32

Ram Weight	10.14	kips
Efficiency	0.820	
Pressure	1377 (95%)	psi
Helmet Weight	3.90	kips
Hammer Cushion	113088	kips/in
COR of H.C.	0.800	
Skin Quake	0.100	in
Toe Quake	0.100	in
Skin Damping	0.100	s/ft
Toe Damping	0.150	s/ft
Pile Length	82.00	ft
Pile Penetration	70.75	ft
Pile Top Area	36.91	in2

Pile Model



Skin Friction Distribution



Res. Shaft = 75 %
(Proportional)

EarthSpectives
OC405@BUSHARD, -45 FT TIP, D46-32

06-Nov-2019
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Ultimate Capacity kips	Maximum Compression Stress ksi	Maximum Tension Stress ksi	Blow Count bl/ft	Stroke ft	Energy kips-ft
100.0	19.79	3.94	3.2	4.91	55.11
200.0	23.89	1.42	7.6	5.80	49.22
300.0	26.32	0.93	12.7	6.45	47.09
400.0	28.09	1.65	18.7	6.97	46.43
500.0	29.27	0.00	24.3	7.32	46.59
553.0	29.78	0.01	28.1	7.48	47.19
600.0	30.27	0.92	31.9	7.63	47.93
700.0	31.00	1.43	43.2	7.88	48.87
800.0	32.08	1.71	57.4	8.23	51.08
900.0	32.89	2.05	78.4	8.53	52.78

EarthSpectives
OC405@BUSHARD, -45 FT TIP, D46-32

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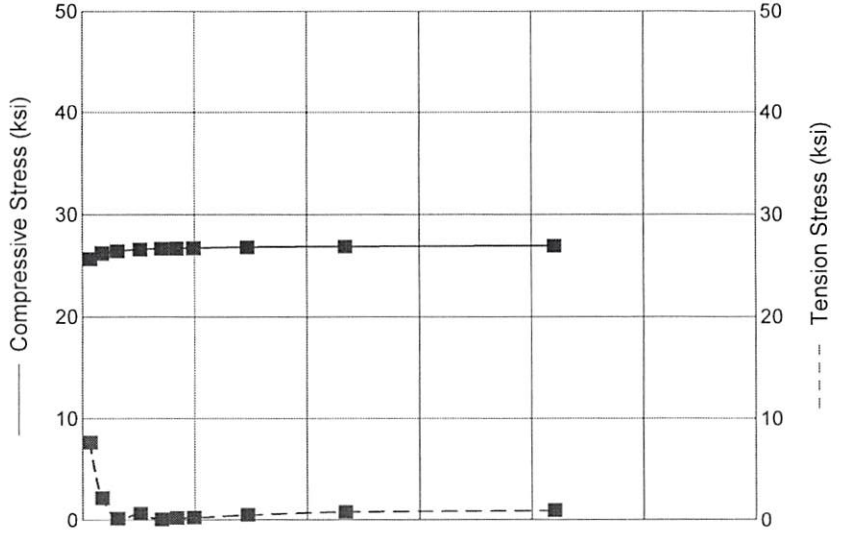
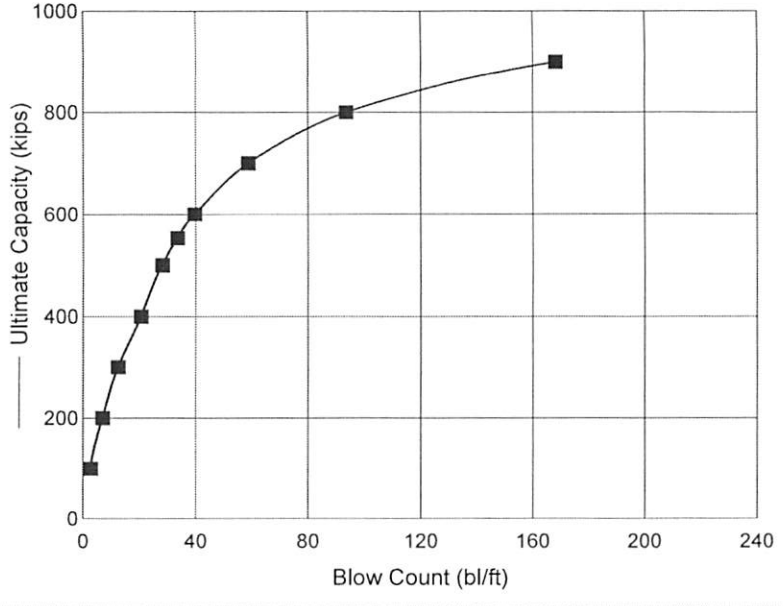
GRLWEAP Version 2010

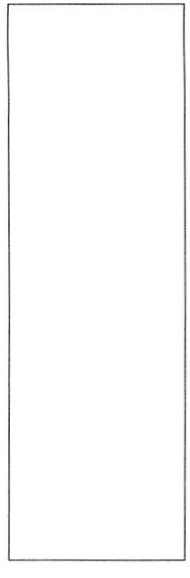




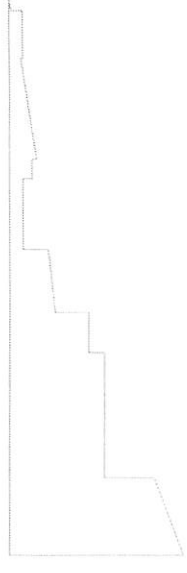
APE D 46-32

Stroke	6.50	ft
Ram Weight	10.14	kips
Efficiency	0.820	
Pressure	Variable	
Helmet Weight	3.90	kips
Hammer Cushion	113088	kips/in
COR of H.C.	0.800	
Skin Quake	0.100	in
Toe Quake	0.100	in
Skin Damping	0.100	s/ft
Toe Damping	0.150	s/ft
Pile Length	71.00	ft
Pile Penetration	70.50	ft
Pile Top Area	36.91	in2

Pile Model



Skin Friction Distribution



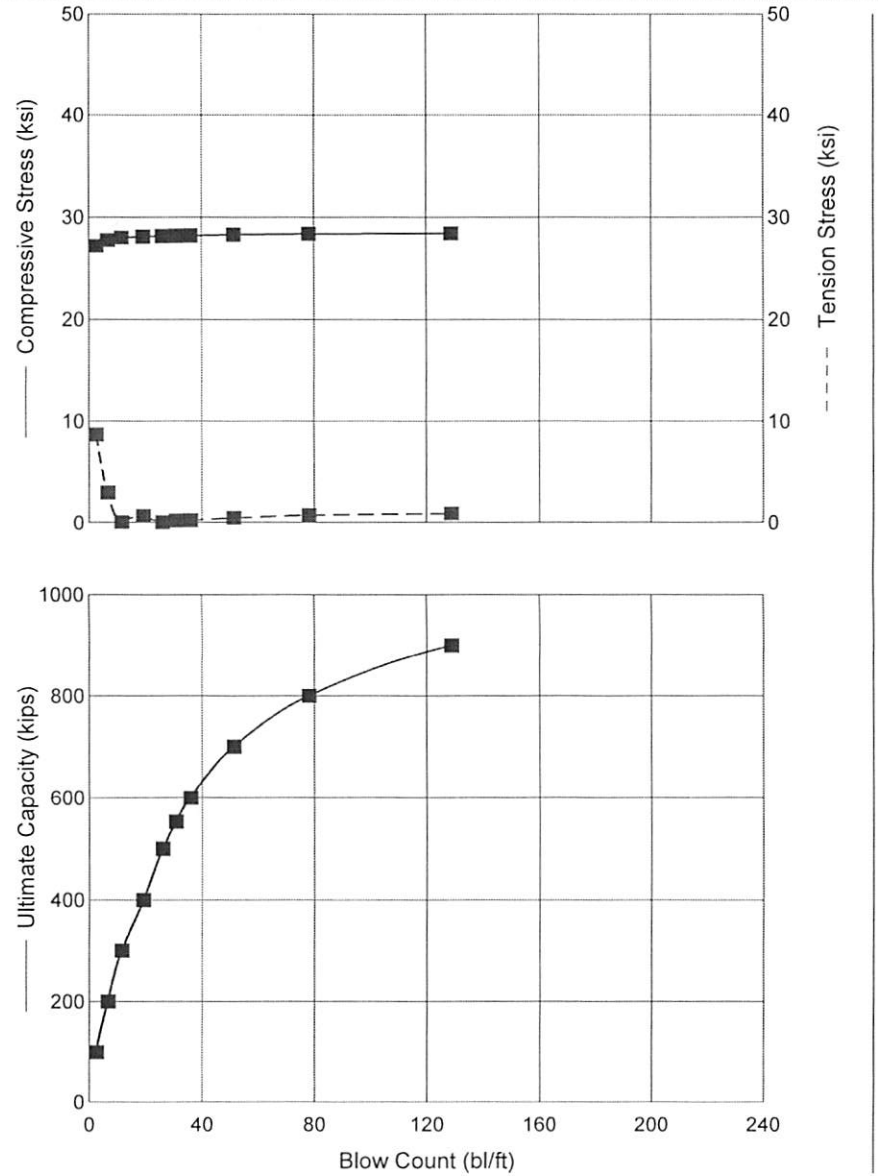
Res. Shaft = 75 %
(Proportional)

EarthSpectives 06-Nov-2019
OC405@BUSHARD, -45 FT TIP, D46-32 GRLWEAP Version 2010

Ultimate Capacity kips	Maximum Compression Stress ksi	Maximum Tension Stress ksi	Blow Count bl/ft	Stroke ft	Energy kips-ft
100.0	25.62	7.64	2.7	6.50	71.68
200.0	26.18	2.21	7.0	6.50	55.70
300.0	26.40	0.15	12.5	6.50	47.04
400.0	26.56	0.64	20.7	6.50	41.87
500.0	26.65	0.09	28.2	6.50	39.17
553.0	26.67	0.24	33.6	6.50	38.59
600.0	26.70	0.27	39.7	6.50	38.16
700.0	26.79	0.52	58.9	6.50	37.37
800.0	26.85	0.83	93.7	6.50	36.74
900.0	26.90	0.96	168.2	6.50	36.25

EarthSpectives
OC405@BUSHARD, -45 FT TIP, D46-32

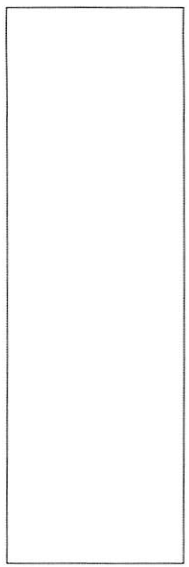
06-Nov-2019
GRLWEAP Version 2010



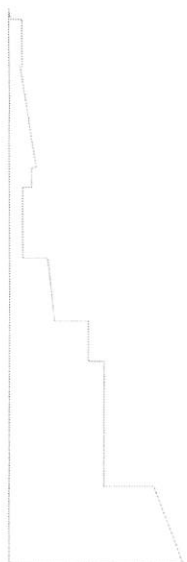
APE D 46-32

Stroke	7.00	ft
Ram Weight	10.14	kips
Efficiency	0.820	
Pressure	Variable	
Helmet Weight	3.90	kips
Hammer Cushion	113088	kips/in
COR of H.C.	0.800	
Skin Quake	0.100	in
Toe Quake	0.100	in
Skin Damping	0.100	s/ft
Toe Damping	0.150	s/ft
Pile Length	71.00	ft
Pile Penetration	70.50	ft
Pile Top Area	36.91	in2

Pile Model



Skin Friction Distribution



Res. Shaft = 75 %
(Proportional)

EarthSpectives 06-Nov-2019
OC405@BUSHARD, -45 FT TIP, D46-32 GRLWEAP Version 2010

Ultimate Capacity kips	Maximum Compression Stress ksi	Maximum Tension Stress ksi	Blow Count bl/ft	Stroke ft	Energy kips-ft
100.0	27.18	8.71	2.6	7.00	76.27
200.0	27.73	2.99	6.7	7.00	60.16
300.0	27.98	0.09	11.7	7.00	51.27
400.0	28.09	0.67	19.3	7.00	45.90
500.0	28.15	0.06	26.1	7.00	42.73
553.0	28.18	0.21	30.8	7.00	42.13
600.0	28.20	0.25	36.0	7.00	41.68
700.0	28.30	0.48	51.4	7.00	41.05
800.0	28.37	0.76	78.1	7.00	40.40
900.0	28.42	0.92	128.8	7.00	39.91

EarthSpectives
OC405@BUSHARD, -45 FT TIP, D46-32

06-Nov-2019
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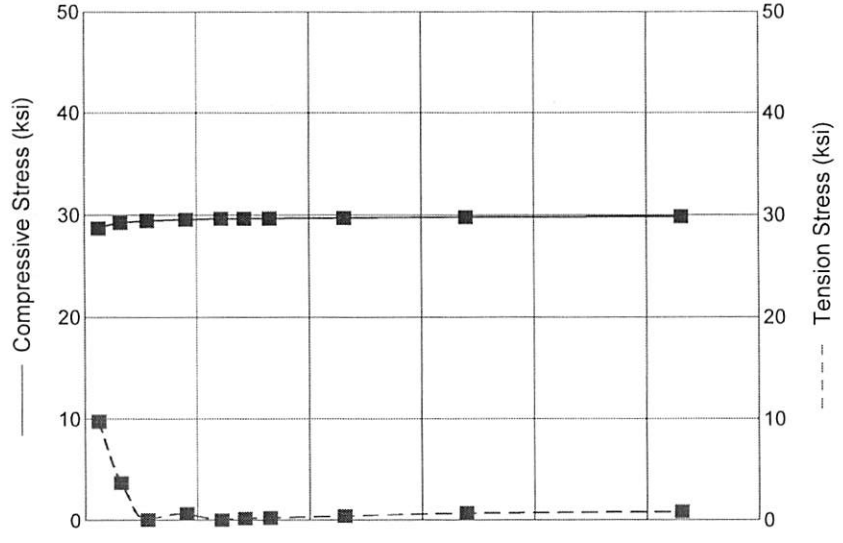
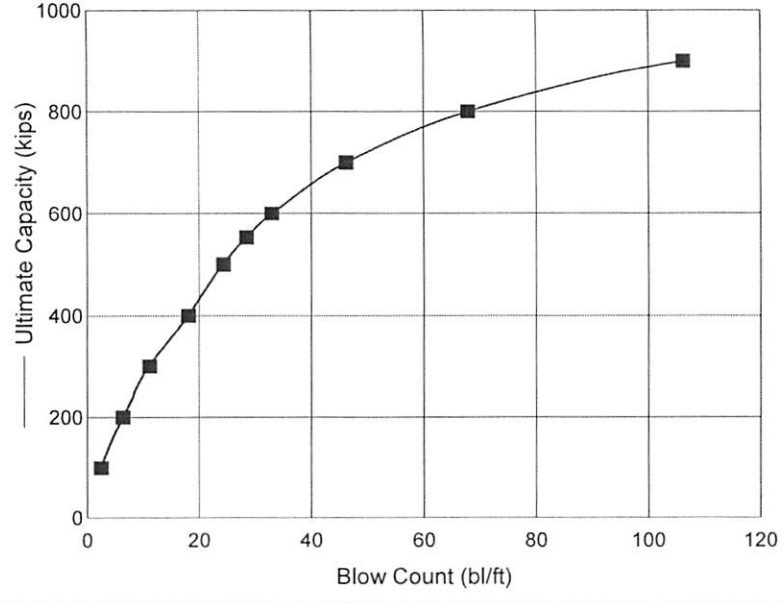
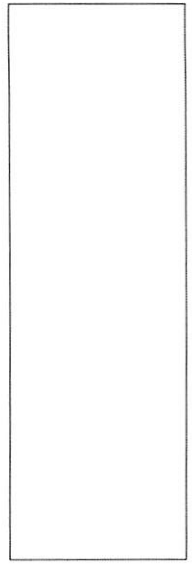




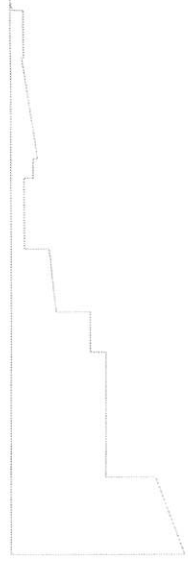
APE D 46-32

Stroke	7.50	ft
Ram Weight	10.14	kips
Efficiency	0.820	
Pressure	Variable	
Helmet Weight	3.90	kips
Hammer Cushion	113088	kips/in
COR of H.C.	0.800	
Skin Quake	0.100	in
Toe Quake	0.100	in
Skin Damping	0.100	s/ft
Toe Damping	0.150	s/ft
Pile Length	71.00	ft
Pile Penetration	70.50	ft
Pile Top Area	36.91	in2

Pile Model



Skin Friction Distribution



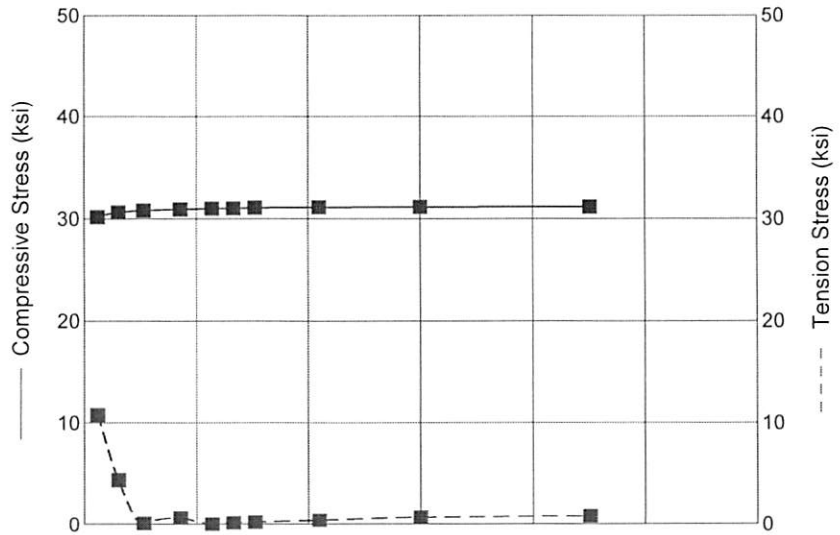
Res. Shaft = 75 %
(Proportional)

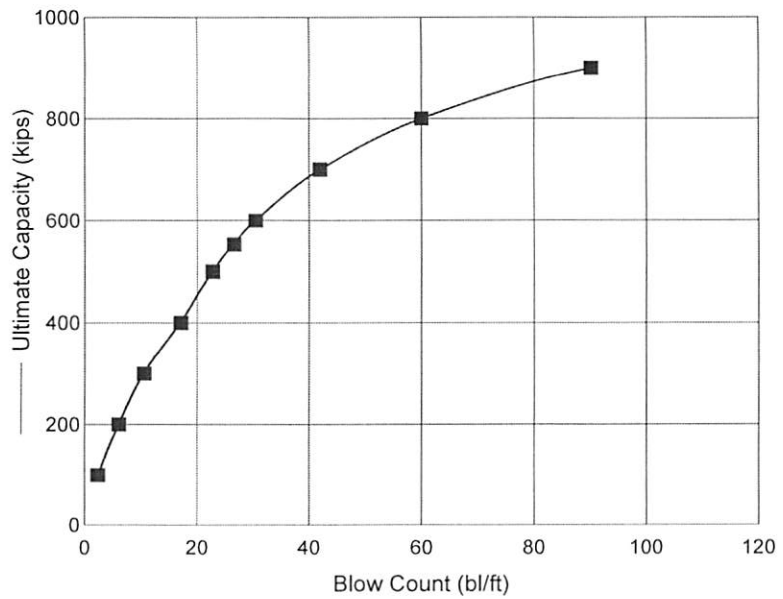
EarthSpectives 06-Nov-2019
OC405@BUSHARD, -45 FT TIP, D46-32 GRLWEAP Version 2010

Ultimate Capacity kips	Maximum Compression Stress ksi	Maximum Tension Stress ksi	Blow Count bl/ft	Stroke ft	Energy kips-ft
100.0	28.70	9.76	2.5	7.50	80.87
200.0	29.22	3.73	6.4	7.50	64.52
300.0	29.43	0.06	11.1	7.50	55.19
400.0	29.55	0.67	18.1	7.50	49.87
500.0	29.62	0.05	24.3	7.50	46.46
553.0	29.64	0.19	28.5	7.50	45.82
600.0	29.66	0.24	33.0	7.50	45.34
700.0	29.71	0.43	46.2	7.50	44.48
800.0	29.77	0.73	67.9	7.50	43.82
900.0	29.83	0.86	106.2	7.50	43.32

EarthSpectives
OC405@BUSHARD, -45 FT TIP, D46-32

06-Nov-2019
GRLWEAP Version 2010

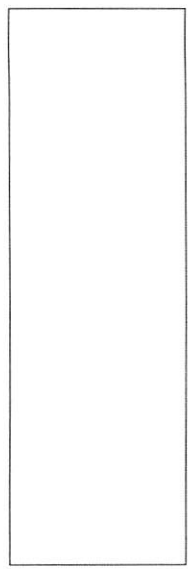




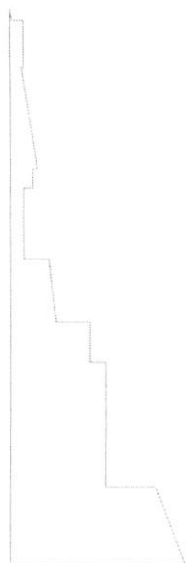
APE D 46-32

Stroke	8.00	ft
Ram Weight	10.14	kips
Efficiency	0.820	
Pressure	Variable	
Helmet Weight	3.90	kips
Hammer Cushion	113088	kips/in
COR of H.C.	0.800	
Skin Quake	0.100	in
Toe Quake	0.100	in
Skin Damping	0.100	s/ft
Toe Damping	0.150	s/ft
Pile Length	71.00	ft
Pile Penetration	70.50	ft
Pile Top Area	36.91	in2

Pile Model



Skin Friction Distribution



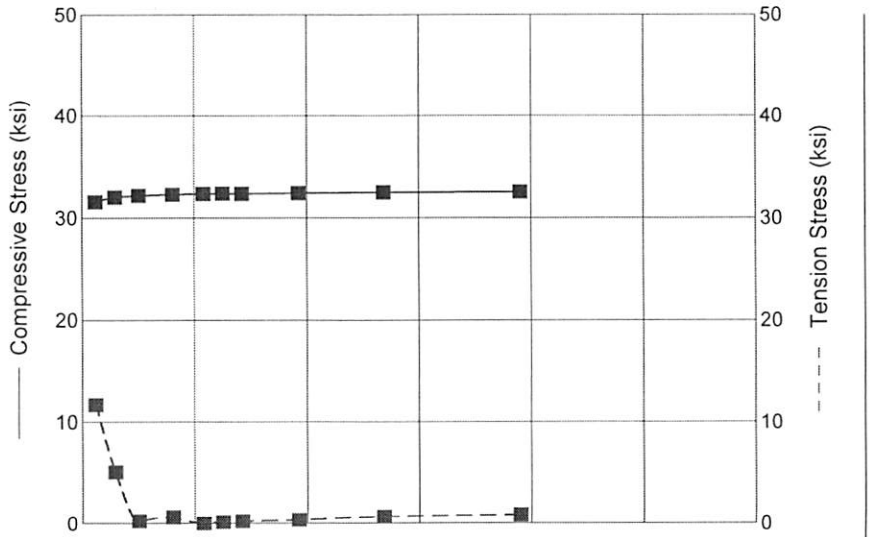
Res. Shaft = 75 %
(Proportional)

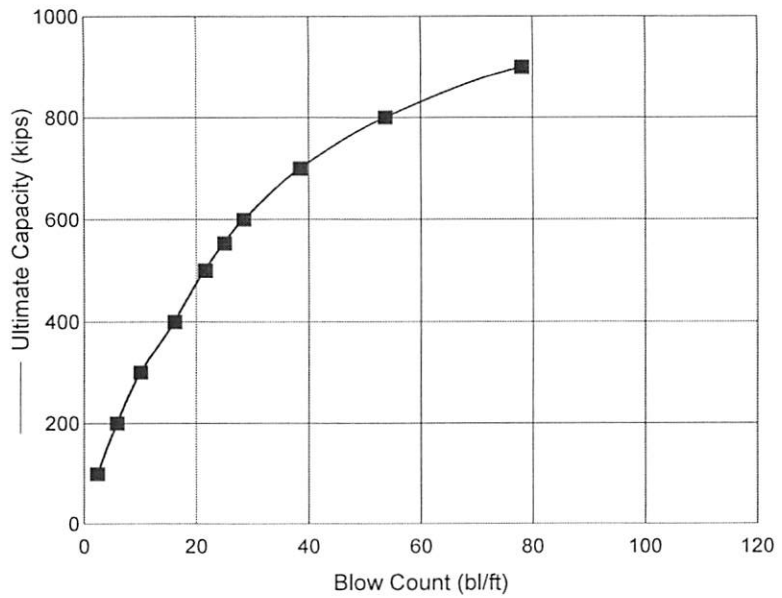
EarthSpectives 06-Nov-2019
OC405@BUSHARD, -45 FT TIP, D46-32 GRLWEAP Version 2010

Ultimate Capacity kips	Maximum Compression Stress ksi	Maximum Tension Stress ksi	Blow Count bl/ft	Stroke ft	Energy kips-ft
100.0	30.16	10.76	2.4	8.00	85.38
200.0	30.63	4.39	6.1	8.00	68.78
300.0	30.80	0.10	10.6	8.00	59.17
400.0	30.92	0.65	17.1	8.00	53.73
500.0	31.00	0.03	22.8	8.00	50.08
553.0	31.03	0.17	26.6	8.00	49.44
600.0	31.07	0.23	30.5	8.00	48.92
700.0	31.11	0.40	42.0	8.00	48.03
800.0	31.13	0.70	60.0	8.00	47.35
900.0	31.17	0.83	90.2	8.00	46.83

EarthSpectives
OC405@BUSHARD, -45 FT TIP, D46-32

06-Nov-2019
GRLWEAP Version 2010

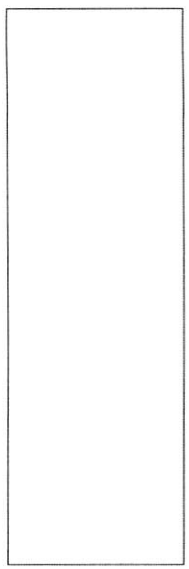




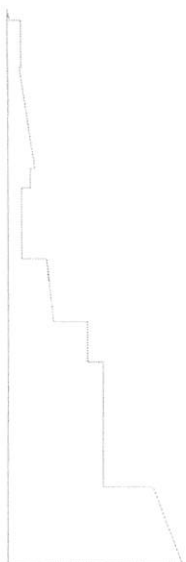
APE D 46-32

Stroke	8.50	ft
Ram Weight	10.14	kips
Efficiency	0.820	
Pressure	Variable	
Helmet Weight	3.90	kips
Hammer Cushion	113088	kips/in
COR of H.C.	0.800	
Skin Quake	0.100	in
Toe Quake	0.100	in
Skin Damping	0.100	s/ft
Toe Damping	0.150	s/ft
Pile Length	71.00	ft
Pile Penetration	70.50	ft
Pile Top Area	36.91	in2

Pile Model



Skin Friction Distribution



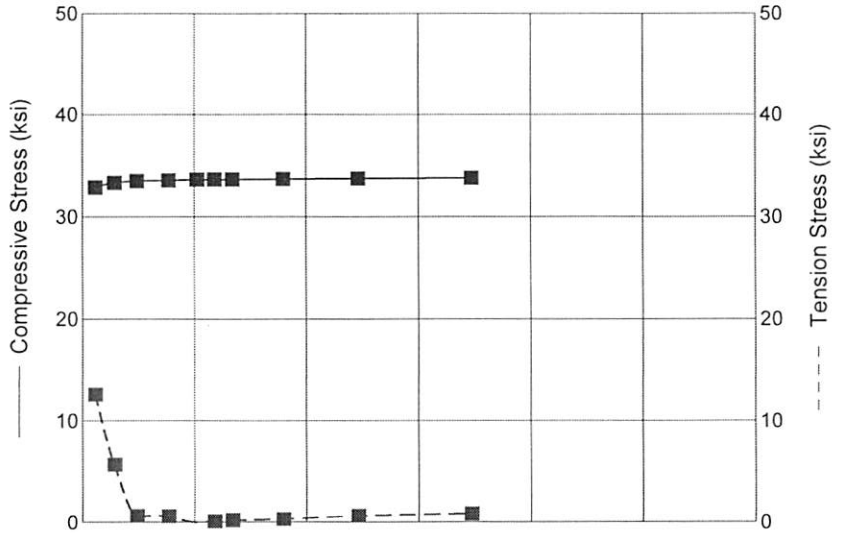
Res. Shaft = 75 %
(Proportional)

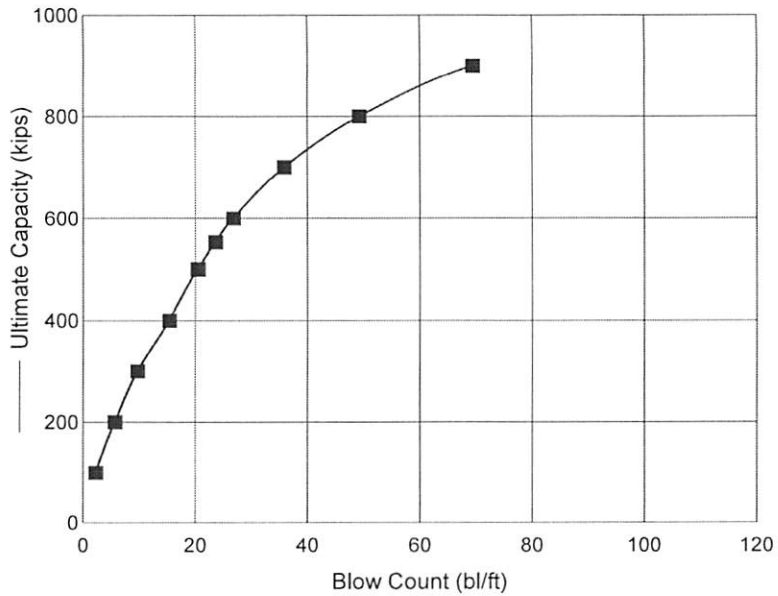
EarthSpectives 06-Nov-2019
OC405@BUSHARD, -45 FT TIP, D46-32 GRLWEAP Version 2010

Ultimate Capacity kips	Maximum Compression Stress ksi	Maximum Tension Stress ksi	Blow Count bl/ft	Stroke ft	Energy kips-ft
100.0	31.55	11.68	2.4	8.50	89.81
200.0	32.00	5.09	5.9	8.50	72.98
300.0	32.17	0.23	10.1	8.50	63.32
400.0	32.27	0.62	16.2	8.50	57.57
500.0	32.34	0.01	21.6	8.50	53.66
553.0	32.36	0.14	25.0	8.50	52.99
600.0	32.36	0.22	28.5	8.50	52.44
700.0	32.41	0.36	38.5	8.50	51.71
800.0	32.47	0.68	53.7	8.50	51.04
900.0	32.53	0.84	78.1	8.50	50.53

EarthSpectives
OC405@BUSHARD, -45 FT TIP, D46-32

06-Nov-2019
GRLWEAP Version 2010

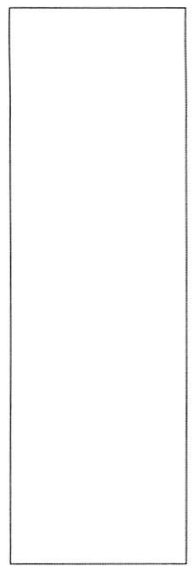




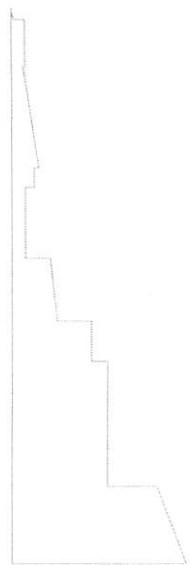
APE D 46-32

Stroke	9.00	ft
Ram Weight	10.14	kips
Efficiency	0.820	
Pressure	Variable	
Helmet Weight	3.90	kips
Hammer Cushion	113088	kips/in
COR of H.C.	0.800	
Skin Quake	0.100	in
Toe Quake	0.100	in
Skin Damping	0.100	s/ft
Toe Damping	0.150	s/ft
Pile Length	71.00	ft
Pile Penetration	70.50	ft
Pile Top Area	36.91	in2

Pile Model



Skin Friction Distribution



Res. Shaft = 75 %
(Proportional)

EarthSpectives 06-Nov-2019
OC405@BUSHARD, -45 FT TIP, D46-32 GRLWEAP Version 2010

Ultimate Capacity kips	Maximum Compression Stress ksi	Maximum Tension Stress ksi	Blow Count bl/ft	Stroke ft	Energy kips-ft
100.0	32.85	12.58	2.3	9.00	94.32
200.0	33.30	5.71	5.7	9.00	77.15
300.0	33.48	0.63	9.7	9.00	67.32
400.0	33.55	0.61	15.4	9.00	61.43
500.0	33.61	0.00	20.5	9.00	57.27
553.0	33.63	0.10	23.6	9.00	56.55
600.0	33.63	0.21	26.8	9.00	55.98
700.0	33.67	0.32	35.9	9.00	55.01
800.0	33.72	0.64	49.3	9.00	54.31
900.0	33.77	0.85	69.4	9.00	54.06

EarthSpectives
OC405@BUSHARD, -45 FT TIP, D46-32

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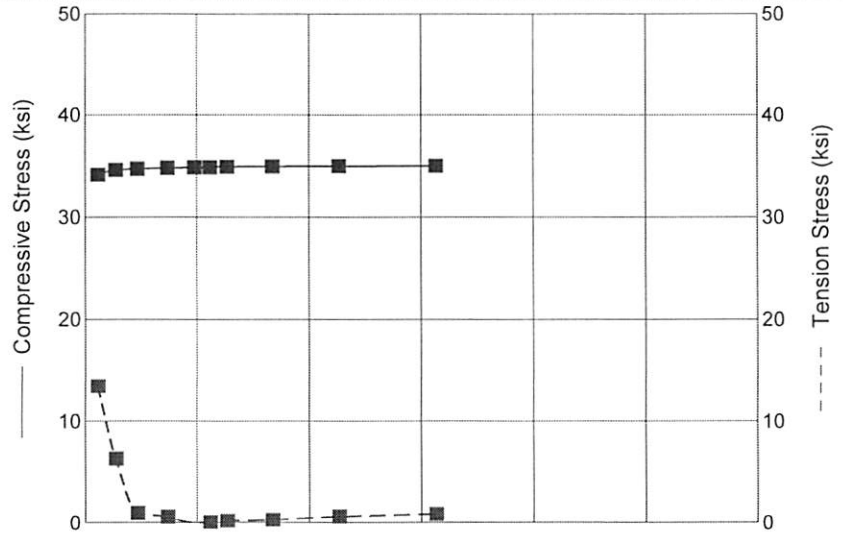
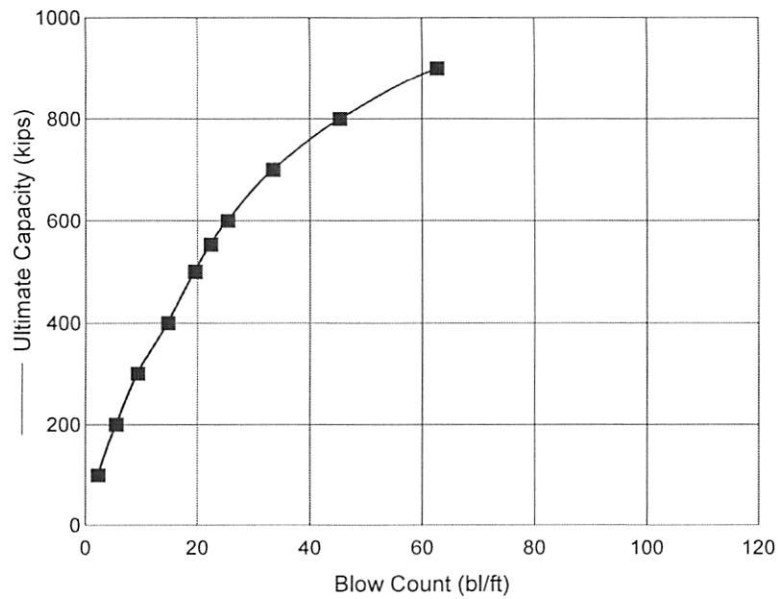
GRLWEAP Version 2010

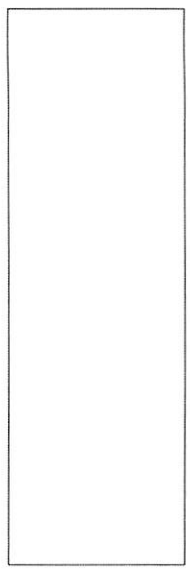




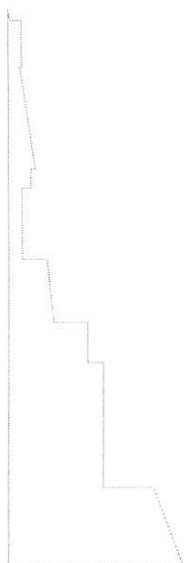
APE D 46-32

Stroke	9.50	ft
Ram Weight	10.14	kips
Efficiency	0.820	
Pressure	Variable	
Helmet Weight	3.90	kips
Hammer Cushion	113088	kips/in
COR of H.C.	0.800	
Skin Quake	0.100	in
Toe Quake	0.100	in
Skin Damping	0.100	s/ft
Toe Damping	0.150	s/ft
Pile Length	71.00	ft
Pile Penetration	70.50	ft
Pile Top Area	36.91	in2

Pile Model



Skin Friction Distribution



Res. Shaft = 75 %
(Proportional)

EarthSpectives
OC405@BUSHARD, -45 FT TIP, D46-32

06-Nov-2019
GRLWEAP Version 2010

Ultimate Capacity kips	Maximum Compression Stress ksi	Maximum Tension Stress ksi	Blow Count bl/ft	Stroke ft	Energy kips-ft
100.0	34.12	13.45	2.3	9.50	98.52
200.0	34.57	6.35	5.5	9.50	81.25
300.0	34.71	0.97	9.4	9.50	71.22
400.0	34.79	0.58	14.8	9.50	65.16
500.0	34.85	0.00	19.6	9.50	60.85
553.0	34.86	0.08	22.4	9.50	60.07
600.0	34.91	0.19	25.4	9.50	59.50
700.0	34.94	0.29	33.5	9.50	58.50
800.0	34.96	0.62	45.4	9.50	57.81
900.0	35.00	0.86	62.7	9.50	57.54