

From: [Daly, Keith](#)
To: [Kevin Culbert \(Kevinc@americanconstco.com\)](#); ["vernonu@americanconstco.com"](#);
cc: [Green, Frank](#); [Degenhart, Mark](#); [Peppers, Nicki](#); [document.control](#);
Subject: Contract 8078 - Approved Pile Driving WEAP Analysis
Date: Tuesday, February 01, 2011 11:40:41 AM
Attachments: [8078 - Pile Driving WEAP Analysis.pdf](#)

Kevin/Vernon,

Please find attached Approved Pile Driving WEAP Analysis. Please let me know if you have any questions.

Thanks,

Keith Daly
Assistant Business Manager

Columbia River Crossing Project | <mailto:dalyk@columbiarivercrossing.org>
700 Washington St. Suite 300, Vancouver, WA 98660
office: 360.816.8870 | Office: 503.256.2726 Ext. 8870
Fax: 360.737.0294

8078

Robert Miner Dynamic Testing, Inc.

Dynamic Measurements and Analyses for Deep Foundations

January 25, 2011

Mr. Kevin Culbert
American Construction Company
1501 Taylor Way
Tacoma, Washington 98421

APPROVED

WASHINGTON STATE
DEPARTMENT OF TRANSPORTATION
BRIDGE AND STRUCTURES OFFICE
BY: CONSTRUCTION SUPPORT ENGINEER

Re: Wave Equation Analysis
PP24x0.50", APE D19-42 Hammer
PP48x1.00", APE D80-42 Hammer
Columbia River Crossing Temporary Pile Test Program
Clark County, WA

DATE

FEB - 1 2011

RMDT Job 11F03

Dear Sir,

At your request, we performed wave equation analyses for the project referenced above. The objectives of the analyses were prediction of axial pile stresses and penetration resistances during pile driving for specific soil resistance values. The following sections summarize data submitted to Robert Miner Dynamic Testing, Inc. (RMDT), program input, analyses made, results, and conclusions regarding certain aspects of pile driveability.

ANALYSIS DETAILS

Our analyses are primarily based on general project information provided by American Construction. Additional information used in our analyses was taken from GRLWEAP™ program data files or was based on our judgment.

Program: GRLWEAP™, Version 2005

Pile Details: We understand that the pile steel will be ASTM A252 Grade 3 (Fy=45 ksi) in all cases. The piles will be driven open-end and three will be 24"OD and three will be 48" OD. Selected pile details used in our analyses are tabulated below.

| Pile | Pile Size OD x Wall | Scheduled Length ft | Scheduled Tip Elevation ft | Analysis Soil Penetration ft | Scheduled Ultimate Resistance kips |
|---------|------------------------|---------------------------|-------------------------------------|---------------------------------------|---|
| A1 & A2 | PP24x0.50" | 81 | -60 | 35 | 180 |
| A3 & A4 | PP48x1.00" | 131 | -110 | 85 | 2000 |
| B1 | PP24x0.50" | 91 | -70 | 45 | 180 |
| B2 | PP48x1.00" | 96 | -75 | 50 | 2000 |

Mailing Address: P.O. Box 340, Manchester, WA, 98353, USA **Phone:** 360-871-5480
Location: 2288 Colchester Dr. E., Ste A, Manchester, WA, 98353 **Fax:** 360-871-5483

Soil and Foundation Design: Subsurface information provided to RMDT indicates that the piles will encounter non-cohesive granular soils, with sand predominating. At location B the specified tip elevations correspond with relatively high SPT N-values and the soils are thus potentially dense to very dense.

For the 24 and 48" OD piles the Scheduled Ultimate Bearing Capacity is 180 kips and 2000 kips, respectively. RMDT did not perform soil resistance calculations to compute any relation between soil resistance and length of pile penetration. Such static soil analyses were beyond the scope of this report. For further information on the soils and foundation design please refer to appropriate project documents. The soil parameters values used in our wave equation analyses are given below:

| | |
|----------------------------|---|
| Soil Quake (skin) | 0.10 inches |
| Soil Quake (toe) | 0.20 inches (open-end) |
| Soil Damping (skin) | 0.10 sec/ft |
| Soil Damping (toe) | 0.15 sec/ft |
| % Shaft Friction | 80 percent at Location A 50 percent for Pile B1 & 60 percent for Pile B2 |

Hammers: The proposed hammers are an APE D19-42 and APE D80-42 for the 24" and 48" OD piles, respectively. These hammers are open end diesel hammers with variable fuel supply. A summary of the hammer and driving system details is given below.

| Hammer | Maximum Rated Energy kip-ft | Ram Weight kips | Maximum Ram Stroke ft | Helmet Weight kips | Hammer Cushion Stiffness kip/inch |
|------------|--------------------------------|--------------------|--------------------------|-----------------------|--------------------------------------|
| APE D19-42 | 47 | 4.2 | 12.5 | 5.0 | 42,875 |
| APE D80-42 | 198 | 17.6 | 13.1 | 5.0 | 42,875 |

The analysis details for the helmet and cushion are approximate, and reflect use of leads sized to handle both pile sizes. For analysis of the D80-42 we adjusted the GRLWEAP hammer combustion pressure (fuel setting) so as to obtain a ram stroke of approximately 10 ft during hard driving. For the D19-42 relatively easy driving is expected and we reduced the combustion pressure to reflect a reduced fuel setting in the field.

Analysis Type: The WSDOT Standard Specifications require that GRLWEAP results for the required ultimate resistances yield penetration resistances below 100 BPF (blows per ft) and that computed axial stresses remain below 0.9 times the nominal material yield strength. Analyses for penetration resistance and driving stress are to be completed with a GRLWEAP

hammer efficiency of 0.72 and 0.84, respectively.

We completed Bearing Graph format analyses with a range of soil resistance values and the two required hammer efficiencies, 0.72 and 0.84 percent. Results for analyses with the lower and higher efficiencies are identified by "LO" and "HI" in the analysis title block. For each assigned axial soil resistance the GRLWEAP Bearing Graph results include the predicted penetration resistance in BPF, and the peak axial compressive stresses.

GRLWEAP RESULTS

The results of all analyses are summarized on attached pages in both graphical and tabular formats, including a summary of key program input. Appendix A contains further input and results which may be used for more detailed review of our analyses.

SUMMARY

The following results and opinions are based on the information provided to us, the results of our analyses, and our engineering judgement:

1) Piles A1, A2 and B1, PP24"x0.50", APE D19-42

- a) Bearing Graph analyses with a hammer efficiency of 0.72 yielded a penetration resistance of 20 BPF at Location A and 21 BPF at Location B for a 180 kip ultimate resistance with a ram stroke of approximately 6.5 to 7.0 ft.
- b) Bearing Graph analyses with a hammer efficiency of 0.84 yielded peak axial driving stresses below 20 ksi for all resistances up to 420 kips

2) Piles A3, A4 and B2, PP48"x1.00", APE D80-42

- a) Bearing Graph analyses for an ultimate resistance of 2000 kips and a hammer efficiency of 0.72 yielded a penetration resistance of 85 and 97 BPF for Locations A and B, respectively.
- b) Bearing Graph analyses with a hammer efficiency of 0.84 yielded peak axial driving stresses below 30 ksi for all resistances up to 2700 kips and strokes up to 10 ft
- c) It is our opinion that the slightly higher penetration resistance computed for Location B reflects our assumption that Location B will have relatively more end bearing. The damping parameter value assigned to end bearing is slightly larger than the value assigned to friction. However, we also consider it likely that the shaft damping will be less than the 0.10 inch/second value used in our analyses and we expect that field driveability will be easier than predicted here for the assumed axial resistances.

3. The WSDOT Standard Specifications require that GRLWEAP results for the required ultimate resistances yield penetration resistances below 100 BPF and that computed axial stresses remain below 0.9 times the nominal material yield strength. All GRLWEAP analysis for the proposed APE D19-42 and D80-42 satisfy these dual requirements. In our

opinion, these proposed hammers are suitable for the anticipated conditions and scheduled ultimate resistances. Our analyses and opinions reflect our expectation that the D80-42 will achieve a ram stroke height of approximately 10 ft during hard driving.

4. The GRLWEAP computed driving stresses do not include any stresses that result from local contact forces, eccentric loading or bending. Thus, total stresses may be higher than the GRLWEAP computed values. We recommend careful attention to preparation of the pile for driving and proper alignment of the hammer, striker plate, and pile during all driving.

ADDITIONAL CONSIDERATIONS

The analyses presented and discussed herein were completed for purposes of driveability analysis in the context of preconstruction hammer evaluation. Please note that the results calculated by the wave equation analysis program depend on a variety of hammer, pile and soil input parameters. Please also review the information that is given on the cover page for Appendix A . We attempted to base our analyses on our best interpretation of information provided to us for this work. However, actual field conditions, project requirements and hammer performance may vary from what we assumed and therefore driving stresses and blow counts may differ from these predictions. Soil setup during interruptions to driving, or soil conditions that cause actual resistances to exceed the stated resistances may cause harder driving than is predicted in these analyses. RMDT did not evaluate or predict any relation between tip elevation and soil resistance or tip elevation and driving resistance. Soil resistances assigned in wave equation analyses are ultimate resistance values and they must be reduced by an appropriate resistance factor or safety factor to compute a factored resistance or allowable load.

We enjoyed performing these analyses for you. If you or your client have any questions or if we can provide further assistance, please contact us.

Very truly yours,



Expires 02/27/ 11

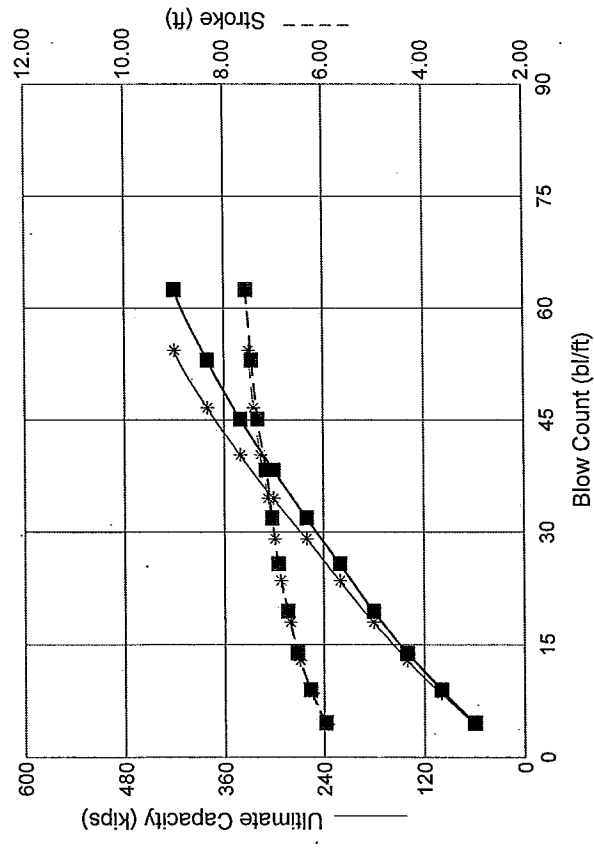
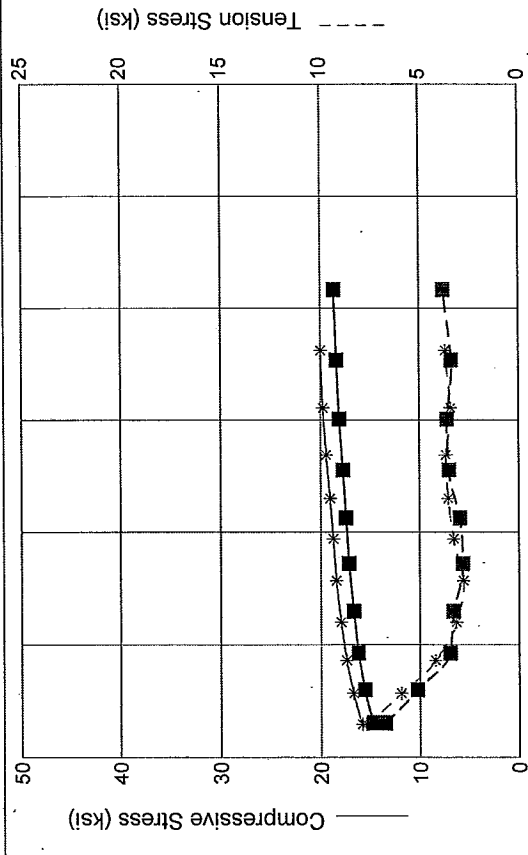
Andrew Banas, Staff Engineer
Robert Miner Dynamic Testing, Inc.

Robert Miner, P. E.
Robert Miner Dynamic Testing, Inc.

Robert Miner Dynamic Testing, Inc.

■ American, CRC Pile A1&A2, APE D19-42 LO

* American, CRC Pile A1&A2, APE D19-42 HI



| | ■ APE D 19-42 | * APE D 19-42 |
|------------------|---------------|-----------------------|
| Efficiency | 0.720 | 0.840 |
| Helmet | 5.00 | 5.00 kips |
| Hammer Cushion | 42875 | 42875 kips/in |
| Skin Quake | 0.100 in | 0.100 in |
| Toe Quake | 0.200 in | 0.200 in |
| Skin Damping | 0.100 sec/ft | 0.100 sec/ft |
| Toe Damping | 0.150 sec/ft | 0.150 sec/ft |
| Pile Length | 81.00 | 81.00 ft |
| Pile Penetration | 35.00 | 35.00 ft |
| Pile Top Area | 36.91 | 36.91 in ² |

Skin Friction Distribution

Pile Model

Skin Friction Distribution

Pile Model

Res. Shaft = 80 %
(Proportional)

Res. Shaft = 80 %
(Proportional)

| Ultimate Capacity kips | Maximum Compression Stress ksi | Maximum Tension Stress ksi | Blow Count bl/ft | Stroke ft | Energy kips-ft |
|---------------------------|-----------------------------------|-------------------------------|---------------------|--------------|-------------------|
| 60.0 | 14.70 | 6.78 | 4.6 | 5.96 | 19.60 |
| 100.0 | 15.59 | 5.13 | 9.0 | 6.27 | 18.05 |
| 140.0 | 16.23 | 3.46 | 13.9 | 6.53 | 17.43 |
| 180.0 | 16.71 | 3.28 | 19.5 | 6.72 | 17.20 |
| 220.0 | 17.17 | 2.81 | 25.8 | 6.91 | 17.00 |
| 260.0 | 17.45 | 2.96 | 31.9 | 7.03 | 16.81 |
| 300.0 | 17.75 | 3.50 | 38.3 | 7.15 | 16.78 |
| 340.0 | 18.10 | 3.60 | 45.1 | 7.32 | 17.15 |
| 380.0 | 18.37 | 3.37 | 53.0 | 7.44 | 17.39 |
| 420.0 | 18.62 | 3.77 | 62.5 | 7.55 | 17.58 |

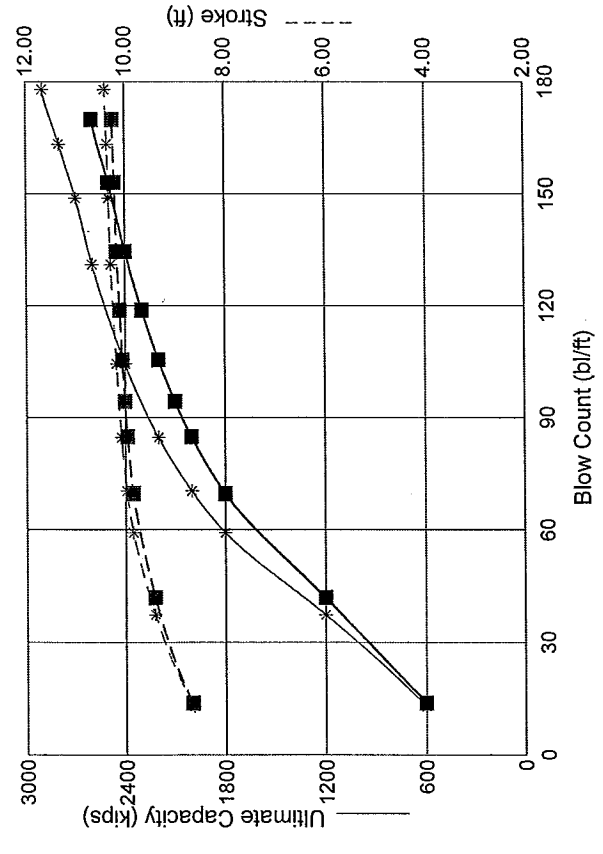
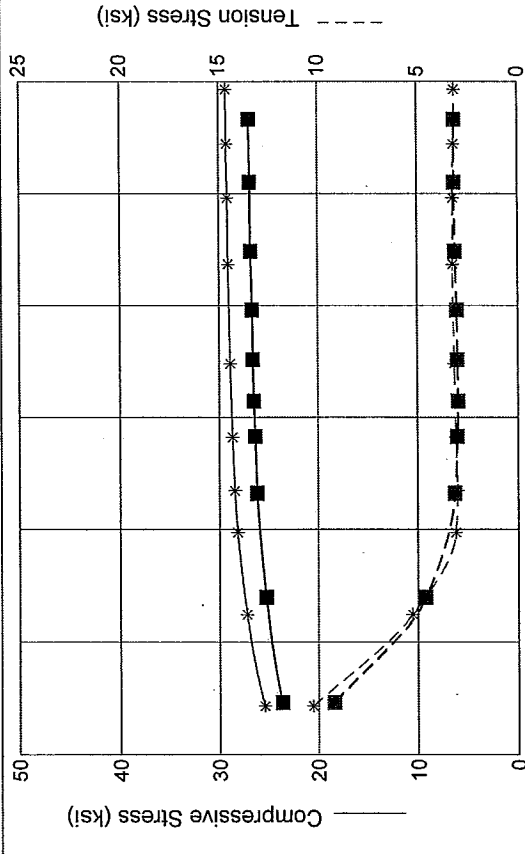
American, CRC Pile A1&A2, APE D19-42 HI

| Ultimate Capacity kips | Maximum Compression Stress ksi | Maximum Tension Stress ksi | Blow Count bl/ft | Stroke ft | Energy kips-ft |
|---------------------------|-----------------------------------|-------------------------------|---------------------|--------------|-------------------|
| 60.0 | 15.86 | 7.73 | 4.4 | 5.92 | 21.35 |
| 100.0 | 16.75 | 5.96 | 8.5 | 6.23 | 19.79 |
| 140.0 | 17.44 | 4.21 | 12.9 | 6.48 | 19.28 |
| 180.0 | 17.96 | 3.15 | 18.0 | 6.67 | 19.09 |
| 220.0 | 18.43 | 2.79 | 23.5 | 6.86 | 18.94 |
| 260.0 | 18.74 | 3.27 | 29.1 | 6.98 | 18.76 |
| 300.0 | 19.05 | 3.54 | 34.5 | 7.11 | 18.77 |
| 340.0 | 19.43 | 3.65 | 40.3 | 7.26 | 19.17 |
| 380.0 | 19.75 | 3.41 | 46.6 | 7.40 | 19.51 |
| 420.0 | 19.97 | 3.67 | 54.3 | 7.50 | 19.68 |

Robert Miner Dynamic Testing, Inc.

■ American, CRC Pile A3&A4, APE D80-42 LO

* American, CRC Pile A3&A4, APE D80-42 HI



| | ■ APE D 80-42 | * APE D 80-42 |
|-----------------------|---------------|----------------------------|
| Efficiency | 0.720 | 0.840 |
| Helmet Hammer Cushion | 5.00 42875 | 5.00 kips 42875 kips/in |
| Skin Quake | 0.100 in | 0.100 in |
| Toe Quake | 0.200 in | 0.200 in |
| Skin Damping | 0.100 sec/ft | 0.100 sec/ft |
| Toe Damping | 0.150 sec/ft | 0.150 sec/ft |
| Pile Length | 131.00 | 131.00 ft |
| Pile Penetration | 85.00 | 85.00 ft |
| Pile Top Area | 147.66 | 147.66 in ² |

| | ■ APE D 80-42 | * APE D 80-42 |
|----------------------------|---------------|---------------|
| Pile Model | [Diagram] | [Diagram] |
| Skin Friction Distribution | [Diagram] | [Diagram] |

Res. Shaft = 80 % (Proportional)

Res. Shaft = 80 % (Proportional)

| Ultimate Capacity kips | Maximum Compression Stress ksi | Maximum Tension Stress ksi | Blow Count bl/ft | Stroke ft | Energy kips-ft |
|---------------------------|-----------------------------------|-------------------------------|---------------------|--------------|-------------------|
| 600.0 | 23.66 | 9.20 | 13.9 | 8.66 | 79.36 |
| 1200.0 | 25.27 | 4.61 | 41.9 | 9.41 | 75.47 |
| 1800.0 | 26.16 | 3.14 | 69.7 | 9.85 | 78.73 |
| 2000.0 | 26.36 | 3.02 | 84.8 | 9.96 | 79.55 |
| 2100.0 | 26.47 | 2.98 | 94.3 | 10.01 | 79.96 |
| 2200.0 | 26.58 | 3.01 | 105.4 | 10.06 | 80.38 |
| 2300.0 | 26.64 | 3.03 | 118.8 | 10.11 | 80.67 |
| 2400.0 | 26.78 | 3.12 | 134.5 | 10.17 | 81.24 |
| 2500.0 | 26.85 | 3.15 | 153.1 | 10.21 | 81.56 |
| 2600.0 | 26.92 | 3.14 | 169.9 | 10.25 | 81.85 |

American, CRC Pile A3&A4, APE D80-42 HI

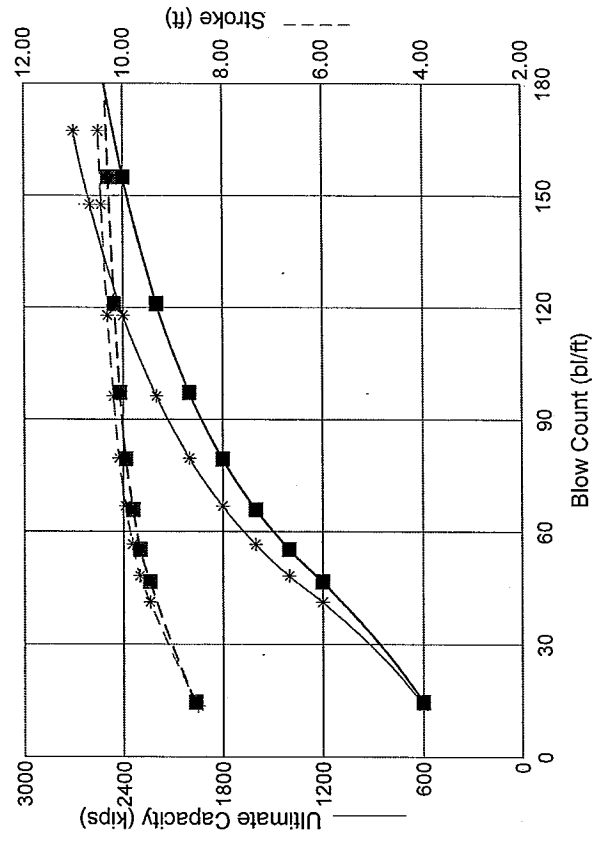
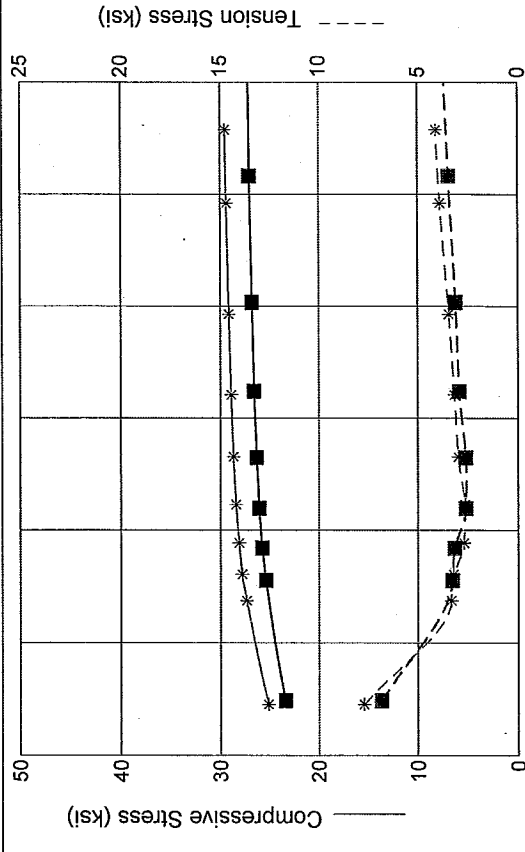
| Ultimate Capacity kips | Maximum Compression Stress ksi | Maximum Tension Stress ksi | Blow Count bl/ft | Stroke ft | Energy kips-ft |
|---------------------------|-----------------------------------|-------------------------------|---------------------|--------------|-------------------|
| 600.0 | 25.44 | 10.27 | 12.9 | 8.63 | 88.75 |
| 1200.0 | 27.21 | 5.28 | 37.3 | 9.41 | 85.73 |
| 1800.0 | 28.15 | 3.11 | 59.2 | 9.85 | 89.63 |
| 2000.0 | 28.42 | 3.01 | 70.3 | 9.98 | 90.85 |
| 2200.0 | 28.63 | 3.09 | 84.6 | 10.08 | 91.87 |
| 2400.0 | 28.85 | 3.15 | 104.3 | 10.18 | 92.78 |
| 2600.0 | 29.05 | 3.23 | 131.0 | 10.29 | 93.79 |
| 2700.0 | 29.12 | 3.22 | 148.8 | 10.33 | 94.15 |
| 2800.0 | 29.20 | 3.18 | 163.3 | 10.36 | 94.46 |
| 2900.0 | 29.25 | 3.13 | 177.9 | 10.40 | 94.77 |

| Ultimate Capacity kips | Maximum Compression Stress ksi | Maximum Tension Stress ksi | Blow Count bl/ft | Stroke ft | Energy kips-ft |
|---------------------------|-----------------------------------|-------------------------------|---------------------|--------------|-------------------|
| 60.0 | 14.79 | 7.02 | 4.9 | 6.03 | 19.42 |
| 100.0 | 15.55 | 5.19 | 9.6 | 6.32 | 17.92 |
| 140.0 | 16.10 | 3.60 | 15.2 | 6.55 | 17.38 |
| 180.0 | 16.55 | 2.84 | 21.2 | 6.73 | 17.17 |
| 220.0 | 16.92 | 2.13 | 28.4 | 6.89 | 16.99 |
| 260.0 | 17.20 | 2.92 | 35.7 | 7.01 | 16.90 |
| 300.0 | 17.51 | 3.25 | 43.1 | 7.16 | 16.98 |
| 340.0 | 17.79 | 3.21 | 51.5 | 7.29 | 17.28 |
| 380.0 | 18.04 | 3.05 | 61.7 | 7.41 | 17.55 |
| 420.0 | 18.26 | 3.49 | 74.4 | 7.53 | 17.78 |

American, CRC Pile B1, APE D19-42 HI

| Ultimate Capacity kips | Maximum Compression Stress ksi | Maximum Tension Stress ksi | Blow Count bl/ft | Stroke ft | Energy kips-ft |
|---------------------------|-----------------------------------|-------------------------------|---------------------|--------------|-------------------|
| 60.0 | 15.94 | 7.95 | 4.7 | 5.99 | 21.11 |
| 100.0 | 16.75 | 6.00 | 9.0 | 6.28 | 19.71 |
| 140.0 | 17.33 | 4.28 | 14.2 | 6.50 | 19.20 |
| 180.0 | 17.81 | 3.08 | 19.6 | 6.68 | 19.08 |
| 220.0 | 18.19 | 2.50 | 26.0 | 6.85 | 18.90 |
| 260.0 | 18.48 | 3.01 | 32.5 | 6.97 | 18.84 |
| 300.0 | 18.83 | 3.24 | 38.6 | 7.12 | 19.00 |
| 340.0 | 19.12 | 3.24 | 45.5 | 7.25 | 19.33 |
| 380.0 | 19.39 | 3.07 | 53.6 | 7.37 | 19.65 |
| 420.0 | 19.64 | 3.48 | 63.5 | 7.49 | 19.91 |

Robert Miner Dynamic Testing, Inc.
 ■ American, CRC Pile B2, APE D80-42 LO
 * American, CRC Pile B2, APE D80-42 HI



| | ■ APE | D 80-42 | * APE | D 80-42 |
|-----------------------|--------------|------------------------|--------------|---------------|
| Efficiency | 0.720 | 0.840 | | |
| Helmet Hammer Cushion | 5.00 | 5.00 kips | 42875 | 42875 kips/in |
| Skin Quake | 0.100 in | 0.100 in | 0.100 in | 0.100 in |
| Toe Quake | 0.200 in | 0.200 in | 0.200 in | 0.200 in |
| Skin Damping | 0.100 sec/ft | 0.100 sec/ft | 0.100 sec/ft | 0.100 sec/ft |
| Toe Damping | 0.150 sec/ft | 0.150 sec/ft | 0.150 sec/ft | 0.150 sec/ft |
| Pile Length | 96.00 | 96.00 ft | | |
| Pile Penetration | 50.00 | 50.00 ft | | |
| Pile Top Area | 147.66 | 147.66 in ² | | |

| Model | Diagram | Res. Shaft (%) |
|----------------------------|--|---------------------|
| Pile Model | [Diagram: Rectangular pile model] | 60 % (Proportional) |
| Skin Friction Distribution | [Diagram: Linear skin friction distribution] | 60 % (Proportional) |

| Ultimate Capacity kips | Maximum Compression Stress ksi | Maximum Tension Stress ksi | Blow Count bl/ft | Stroke ft | Energy kips-ft |
|---------------------------|-----------------------------------|-------------------------------|---------------------|--------------|-------------------|
| 600.0 | 23.40 | 6.83 | 14.6 | 8.55 | 80.01 |
| 1200.0 | 25.39 | 3.28 | 46.7 | 9.47 | 76.09 |
| 1400.0 | 25.77 | 3.17 | 55.3 | 9.67 | 76.80 |
| 1600.0 | 26.08 | 2.60 | 65.9 | 9.81 | 77.69 |
| 1800.0 | 26.33 | 2.60 | 79.4 | 9.95 | 78.21 |
| 2000.0 | 26.58 | 2.92 | 97.1 | 10.07 | 79.12 |
| 2200.0 | 26.79 | 3.11 | 121.0 | 10.18 | 80.03 |
| 2400.0 | 27.04 | 3.46 | 154.9 | 10.30 | 81.05 |
| 2600.0 | 27.23 | 3.85 | 201.4 | 10.41 | 81.89 |
| 2700.0 | 27.31 | 4.00 | 230.5 | 10.45 | 82.23 |

American, CRC Pile B2, APE D80-42 HI

| Ultimate Capacity kips | Maximum Compression Stress ksi | Maximum Tension Stress ksi | Blow Count bl/ft | Stroke ft | Energy kips-ft |
|---------------------------|-----------------------------------|-------------------------------|---------------------|--------------|-------------------|
| 600.0 | 25.14 | 7.72 | 13.6 | 8.50 | 89.23 |
| 1200.0 | 27.35 | 3.33 | 41.2 | 9.47 | 86.83 |
| 1400.0 | 27.81 | 3.23 | 48.2 | 9.68 | 87.63 |
| 1600.0 | 28.11 | 2.71 | 56.6 | 9.82 | 88.55 |
| 1800.0 | 28.41 | 2.64 | 66.8 | 9.96 | 89.39 |
| 2000.0 | 28.68 | 2.98 | 79.6 | 10.09 | 90.59 |
| 2200.0 | 28.89 | 3.17 | 96.2 | 10.20 | 91.63 |
| 2400.0 | 29.12 | 3.45 | 117.8 | 10.32 | 92.84 |
| 2600.0 | 29.37 | 3.89 | 147.6 | 10.44 | 94.07 |
| 2700.0 | 29.51 | 4.09 | 167.3 | 10.50 | 94.72 |

Appendix A

INFORMATION ON USE OF GRLWEAP RESULTS AND GRLWEAP PROGRAM OUTPUT

The GRLWEAP wave equation program uses mathematical models that describe motion and forces of hammer, driving system, pile and soil under the hammer action. Under certain conditions, the models only crudely approximate complex, dynamic behavior. Input parameter values are partially or completely intended to model normal situations. In particular, the hammer data file supplied with the program assumes that the hammer is in good working order. Thus, in some cases the data supplied with the program and data selected by RMDT may reflect conditions that differ significantly from actual field conditions. The GRLWEAP program authors and RMDT recommend prudent and informed use of the GRLWEAP results. Generally, aspects of the soil response and hammer performance should be verified by dynamic measurements and CAPWAP analyses, static load testing, or other suitable methods of analysis and inspection.

Driving stresses computed by the GRLWEAP program do not include bending or other local non-axial stresses, prestresses or residual fabrication stresses. Thus, inspection based on GRLWEAP results must account for those and any other sources of additional stress.

All GRLWEAP results, including those from Bearing Graph or Inspector's Graph analyses should be used in conjunction with observed blow counts and observed strokes. However, time dependent soil strength changes, such as "setup" or "relaxation" may alter the soil resistance and produce long term ultimate bearing capacity values that differ substantially from those expected based on observed blow counts and wave equation analysis. Also, hammer strokes, transfer energy and soil resistance may vary over the interval that the blows are counted, especially for restrikes or piles driven to rock. Inspection procedures should account for these sources of variation or uncertainty.

The GRLWEAP soil resistance values are ultimate values. They MUST be reduced by an appropriate factor of safety or resistance factor. The selection of such a factor is the responsibility of either the foundation engineer or the engineer directing field inspection. RMDT recommends that the factor reflect the quality of construction control, the variability of the site conditions, uncertainties in the loads, the nature of the structure, applicable codes, and other relevant factors.

Input File: C:\PJ\AMERICAN, CRC\A1&A2 LO.GWI
 Hammer File: C:\Program Files\PDI\GRLWEAP 2005\HAMMER2003.GW
 Hammer File Version: 2003 (8/28/2009)

Input File Contents

American, CRC Pile A1&A2, APE D19-42 LO
 OUT OSG HAM STR FUL PEL N SPL N-U P-D %SK ISM 0 PHI RSA ITR H-D MXT DEx
 6 0 571 0 1 0 0 0 0 0 80 0 0 0 0 0 0 0.000
 Pile g Hammer g Toe Area Pile Size Pile Type
 32.170 32.170 452.390 24.000 Pipe
 W Cp A Cp E Cp T Cp CoR ROut StCp
 5.000 490.000 175.0 2.000 0.920 0.010 0.0
 A Cu E Cu T Cu CoR ROut StCu
 0.000 0.0 0.000 0.000 0.000 0.0
 LPle APle EPle WPlle Peri Strg CoR ROut
 81.000 36.910 30000.000 492.000 6.283 36.000 0.850 0.010
 Manufac Hmr Name HmrType No Seg-s
 APE D 19-42 1 5
 Ram Wt Ram L Ram Dia MaxStrk RtdStrk Effic
 4.19 128.00 12.60 12.50 11.25 0.80
 IB. Wt IB. L IB.Dia IB CoR IB RO
 0.75 25.30 12.60 0.900 0.010
 CompStrk A Chamber V Chamber C Delay C Duratn Exp Coeff VolCStart Vol CEnd
 15.50 124.70 157.68 0.001 0.002 1.250 0.00 0.00
 P atm P1 P2 P3 P4 P5
 14.70 1710.00 1539.00 1385.00 1247.00 0.00
 Stroke Effic. Pressure R-Weight T-Delay Exp-Coeff Eps-Str Total-AW
 11.2500 0.7200 1539.0000 0.0000 0.0000 0.0000 0.0100 0.0000
 Qs Qt Js Jt Qx Jx Rati Dept
 0.100 0.200 0.100 0.150 0.000 0.000 0.000 0.000
 Research Soil Model: Atoe, Plug, Gap, Q-fac
 0.000 0.000 0.000 0.000
 Research Soil Model: RD-skn: m, d, toe: m, d
 0.000 0.000 0.000 0.000
 Res. Distribution
 Dpth Rskn Dpth Dpth
 0.00 0.00 35.00 35.00 0.00 0.00 0.00 0.00 0.00 0.00
 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00
 35.00 1.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00
 81.00 2.31 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00
 Rult
 60.0 100.0 140.0 180.0 220.0 260.0 300.0 340.0 380.0 420.0
 Diameter COGHammer WHammer ABatter Depth Sup Flag
 0.000 0.000 0.000 0.000 0.000 0

GRLWEAP: WAVE EQUATION ANALYSIS OF PILE FOUNDATIONS
 Version 2005
 English Units

American, CRC Pile A1&A2, APE D19-42 LO

| | | | | | |
|-------------------|----------------|------------------|----------|-------------|-----------------|
| Hammer Model: | D 19-42 | | Made by: | APE | |
| No. | Weight kips | Stiffn k/inch | CoR | C-Slk ft | Dampg k/ft/s |
| 1 | 0.838 | | | | |
| 2 | 0.838 | 141250.2 | 1.000 | 0.0100 | |
| 3 | 0.838 | 141250.2 | 1.000 | 0.0100 | |
| 4 | 0.838 | 141250.2 | 1.000 | 0.0100 | |
| 5 | 0.838 | 141250.2 | 1.000 | 0.0100 | |
| Imp Block | 0.754 | 71041.4 | 0.900 | 0.0100 | |
| Helmet | 5.000 | 42875.0 | 0.920 | 0.0100 | 6.0 |
| Combined Pile Top | | 27340.7 | | | |

HAMMER OPTIONS:

| | | | |
|--------------------|-----------|--------------------------|-----------|
| Hammer File ID No. | 571 | Hammer Type | OE Diesel |
| Stroke Option | FxdP-VarS | Stroke Convergence Crit. | 0.010 |
| Fuel Pump Setting | Maximum | | |

HAMMER DATA:

| | | | | | |
|----------------------|--------|---------|--------------------|--------|---------|
| Ram Weight | (kips) | 4.19 | Ram Length | (inch) | 128.00 |
| Maximum Stroke | (ft) | 12.50 | | | |
| Rated Stroke | (ft) | 11.25 | Efficiency | | 0.720 |
| Maximum Pressure | (psi) | 1710.00 | Actual Pressure | (psi) | 1539.00 |
| Compression Exponent | | 1.350 | Expansion Exponent | | 1.250 |
| Ram Diameter | (inch) | 12.60 | | | |
| Combustion Delay | (s) | 0.00100 | Ignition Duration | (s) | 0.00200 |

The Hammer Data Includes Estimated (NON-MEASURED) Quantities

HAMMER CUSHION

| | | |
|----------------------|-----------|---------|
| Cross Sect. Area | (in2) | 490.00 |
| Elastic-Modulus | (ksi) | 175.0 |
| Thickness | (inch) | 2.00 |
| Coeff of Restitution | | 0.9 |
| RoundOut | (ft) | 0.0 |
| Stiffness | (kips/in) | 42875.0 |

PILE CUSHION

| | | |
|----------------------|-----------|------|
| Cross Sect. Area | (in2) | 0.00 |
| Elastic-Modulus | (ksi) | 0.0 |
| Thickness | (inch) | 0.00 |
| Coeff of Restitution | | 0.0 |
| RoundOut | (ft) | 0.0 |
| Stiffness | (kips/in) | 0.0 |

PILE PROFILE:

Toe Area (in2) 452.390 Pipe Type Pipe
 Pile Size (inch) 24.000

| L b Top | Area | E-Mod | Spec Wt | Perim | Strength | Wave Sp | EA/c |
|---------|-------|--------|---------|-------|----------|---------|--------|
| ft | in2 | ksi | lb/ft3 | ft | ksi | ft/s | k/ft/s |
| 0.0 | 36.91 | 30000. | 492.0 | 6.3 | 36.000 | 16807. | 65.9 |
| 81.0 | 36.91 | 30000. | 492.0 | 6.3 | 36.000 | 16807. | 65.9 |

Wave Travel Time 2L/c (ms) 9.639

| Pile and Soil Model | | | | | | Total Capacity Rut | | | 60.0 | | |
|---------------------|--------|--------|-------|-------|------|--------------------|--------|-------|-------|-------|------|
| No. | Weight | Stiffn | C-Slk | T-Slk | CoR | Soil-S | Soil-D | Quake | LbTop | Perim | Area |
| | kips | k/in | ft | ft | | kips | s/ft | inch | ft | ft | in2 |
| 1 | 0.426 | 27341. | 0.010 | 0.000 | 0.85 | 0.0 | 0.100 | 0.100 | 3.38 | 6.3 | 36.9 |
| 2 | 0.426 | 27341. | 0.000 | 0.000 | 1.00 | 0.0 | 0.100 | 0.100 | 6.75 | 6.3 | 36.9 |
| 14 | 0.426 | 27341. | 0.000 | 0.000 | 1.00 | 0.1 | 0.100 | 0.100 | 47.25 | 6.3 | 36.9 |
| 15 | 0.426 | 27341. | 0.000 | 0.000 | 1.00 | 0.8 | 0.100 | 0.100 | 50.62 | 6.3 | 36.9 |
| 16 | 0.426 | 27341. | 0.000 | 0.000 | 1.00 | 1.7 | 0.100 | 0.100 | 54.00 | 6.3 | 36.9 |
| 17 | 0.426 | 27341. | 0.000 | 0.000 | 1.00 | 2.6 | 0.100 | 0.100 | 57.38 | 6.3 | 36.9 |
| 18 | 0.426 | 27341. | 0.000 | 0.000 | 1.00 | 3.5 | 0.100 | 0.100 | 60.75 | 6.3 | 36.9 |
| 19 | 0.426 | 27341. | 0.000 | 0.000 | 1.00 | 4.3 | 0.100 | 0.100 | 64.12 | 6.3 | 36.9 |
| 20 | 0.426 | 27341. | 0.000 | 0.000 | 1.00 | 5.2 | 0.100 | 0.100 | 67.50 | 6.3 | 36.9 |
| 21 | 0.426 | 27341. | 0.000 | 0.000 | 1.00 | 6.1 | 0.100 | 0.100 | 70.88 | 6.3 | 36.9 |
| 22 | 0.426 | 27341. | 0.000 | 0.000 | 1.00 | 7.0 | 0.100 | 0.100 | 74.25 | 6.3 | 36.9 |
| 23 | 0.426 | 27341. | 0.000 | 0.000 | 1.00 | 7.9 | 0.100 | 0.100 | 77.62 | 6.3 | 36.9 |
| 24 | 0.426 | 27341. | 0.000 | 0.000 | 1.00 | 8.8 | 0.100 | 0.100 | 81.00 | 6.3 | 36.9 |
| Toe | | | | | | 12.0 | 0.150 | 0.200 | | | |

10.215 kips total unreduced pile weight (g= 32.17 ft/s2)
 10.215 kips total reduced pile weight (g= 32.17 ft/s2)

PILE, SOIL, ANALYSIS OPTIONS:

| | | | |
|--------------------------------|-----------|-----------------------------|--------|
| Uniform pile | | File Segments: Automatic | |
| No. of Slacks/Splices | 0 | File Damping (%) | 1 |
| Pile Penetration (ft) | 35.00 | Pile Damping Fact. (k/ft/s) | 1.318 |
| % Shaft Resistance | 80 | | |
| Soil Damping Option | Smith | | |
| Max No Analysis Iterations | 0 | Time Increment/Critical | 160 |
| Output Time Interval | 1 | Analysis Time-Input (ms) | 0 |
| Output Level: Variable vs Time | | | |
| Gravity Mass, Pile, Hammer: | 32.170 | 32.170 | 32.170 |
| Output Segment Generation: | Automatic | | |

Rut= 60.0, Rtoe = 12.0 kips, Time Inc. =0.077 ms

| No | mxTForce | t | mxCForce | t | mxTStrss | t | mxCStrss | t | max V | t | max D | t | max Et |
|----|----------|----|----------|----|----------|----|----------|----|-------|----|-------|----|--------|
| | kip | ms | kip | ms | ksi | ms | ksi | ms | ft/s | ms | inch | ms | kip-ft |
| 1 | 0.0 | 0 | 535.8 | 2 | 0.00 | 0 | 14.52 | 2 | 12.14 | 12 | 2.736 | 76 | 19.60 |
| 2 | -121.6 | 12 | 536.3 | 3 | -3.29 | 12 | 14.53 | 3 | 11.61 | 12 | 2.735 | 76 | 19.66 |
| 3 | -200.0 | 12 | 537.2 | 3 | -5.42 | 12 | 14.55 | 3 | 10.84 | 12 | 2.734 | 76 | 19.74 |
| 4 | -235.0 | 11 | 537.7 | 3 | -6.37 | 11 | 14.57 | 3 | 10.18 | 13 | 2.733 | 76 | 19.82 |
| 5 | -247.5 | 11 | 537.9 | 3 | -6.71 | 11 | 14.57 | 3 | 9.77 | 13 | 2.732 | 76 | 19.90 |
| 6 | -250.2 | 11 | 538.6 | 3 | -6.78 | 11 | 14.59 | 3 | 9.51 | 13 | 2.731 | 76 | 19.98 |
| 7 | -249.6 | 11 | 539.0 | 4 | -6.76 | 11 | 14.60 | 4 | 9.28 | 13 | 2.729 | 76 | 20.05 |
| 8 | -246.0 | 11 | 539.2 | 4 | -6.66 | 11 | 14.61 | 4 | 8.99 | 14 | 2.728 | 75 | 20.13 |
| 9 | -239.2 | 11 | 539.9 | 4 | -6.48 | 11 | 14.63 | 4 | 8.64 | 14 | 2.727 | 75 | 20.21 |
| 10 | -228.5 | 10 | 540.0 | 4 | -6.19 | 10 | 14.63 | 4 | 8.84 | 10 | 2.725 | 75 | 20.29 |
| 11 | -214.3 | 10 | 540.5 | 4 | -5.81 | 10 | 14.64 | 4 | 9.06 | 10 | 2.724 | 75 | 20.37 |
| 12 | -200.2 | 10 | 540.9 | 5 | -5.42 | 10 | 14.66 | 5 | 9.23 | 10 | 2.722 | 75 | 20.45 |
| 13 | -191.4 | 36 | 541.0 | 5 | -5.19 | 36 | 14.66 | 5 | 9.36 | 10 | 2.723 | 71 | 20.53 |
| 14 | -182.3 | 36 | 542.0 | 5 | -4.94 | 36 | 14.68 | 5 | 9.50 | 9 | 2.723 | 72 | 20.60 |
| 15 | -170.0 | 9 | 542.7 | 5 | -4.61 | 9 | 14.70 | 5 | 9.74 | 9 | 2.725 | 72 | 20.55 |
| 16 | -155.0 | 9 | 542.2 | 6 | -4.20 | 9 | 14.69 | 6 | 10.11 | 9 | 2.726 | 72 | 20.23 |
| 17 | -134.8 | 9 | 540.7 | 6 | -3.65 | 9 | 14.65 | 6 | 10.53 | 9 | 2.727 | 72 | 19.62 |
| 18 | -111.9 | 9 | 537.3 | 6 | -3.03 | 9 | 14.56 | 6 | 10.90 | 9 | 2.727 | 72 | 18.71 |
| 19 | -93.3 | 9 | 531.8 | 6 | -2.53 | 9 | 14.41 | 6 | 11.19 | 8 | 2.727 | 72 | 17.49 |
| 20 | -83.5 | 18 | 519.4 | 6 | -2.26 | 18 | 14.07 | 6 | 11.50 | 8 | 2.726 | 72 | 15.96 |
| 21 | -74.8 | 18 | 489.8 | 6 | -2.03 | 18 | 13.27 | 6 | 12.04 | 8 | 2.726 | 72 | 14.11 |
| 22 | -62.6 | 18 | 429.4 | 7 | -1.70 | 18 | 11.63 | 7 | 12.81 | 8 | 2.725 | 73 | 11.91 |
| 23 | -44.1 | 28 | 329.0 | 7 | -1.19 | 28 | 8.91 | 7 | 13.65 | 7 | 2.725 | 73 | 9.37 |
| 24 | -15.5 | 28 | 186.6 | 7 | -0.42 | 28 | 5.06 | 7 | 14.22 | 7 | 2.724 | 73 | 8.01 |

(Eq) Strokes Analyzed and Last Return (ft):
 11.25 5.66 5.96 5.94

Max. Combustion Pressure 1539.0 psi

Rut= 100.0, Rtoe = 20.0 kips, Time Inc. =0.077 ms

| No | mxTForce | t | mxCForce | t | mxTStrss | t | mxCStrss | t | max V | t | max D | t | max Et. |
|----|----------|----|----------|----|----------|----|----------|----|-------|----|-------|----|---------|
| | kips | ms | kips | ms | ksi | ms | ksi | ms | ft/s | ms | inch | ms | kip-ft |
| 1 | 0.0 | 0 | 562.9 | 2 | 0.00 | 0 | 15.25 | 2 | 10.24 | 12 | 1.497 | 38 | 18.05 |
| 2 | -102.6 | 12 | 563.7 | 3 | -2.78 | 12 | 15.27 | 3 | 9.75 | 12 | 1.497 | 38 | 18.10 |
| 3 | -160.5 | 12 | 564.5 | 3 | -4.35 | 12 | 15.29 | 3 | 8.99 | 12 | 1.496 | 38 | 18.14 |
| 4 | -182.6 | 12 | 565.4 | 3 | -4.95 | 12 | 15.32 | 3 | 8.36 | 13 | 1.495 | 38 | 18.19 |
| 5 | -188.6 | 11 | 565.9 | 3 | -5.11 | 11 | 15.33 | 3 | 8.32 | 3 | 1.494 | 38 | 18.23 |
| 6 | -189.2 | 11 | 566.6 | 3 | -5.13 | 11 | 15.35 | 3 | 8.31 | 4 | 1.492 | 38 | 18.27 |
| 7 | -187.9 | 11 | 567.4 | 4 | -5.09 | 11 | 15.37 | 4 | 8.32 | 4 | 1.489 | 38 | 18.31 |
| 8 | -184.0 | 11 | 567.7 | 4 | -4.98 | 11 | 15.38 | 4 | 8.32 | 4 | 1.487 | 38 | 18.35 |
| 9 | -177.3 | 11 | 568.5 | 4 | -4.80 | 11 | 15.40 | 4 | 8.31 | 4 | 1.484 | 38 | 18.39 |
| 10 | -166.3 | 10 | 569.1 | 4 | -4.50 | 10 | 15.42 | 4 | 8.31 | 4 | 1.480 | 38 | 18.42 |
| 11 | -151.8 | 10 | 569.5 | 4 | -4.11 | 10 | 15.43 | 4 | 8.31 | 5 | 1.477 | 39 | 18.45 |
| 12 | -137.0 | 10 | 570.5 | 5 | -3.71 | 10 | 15.46 | 5 | 8.31 | 5 | 1.473 | 39 | 18.48 |
| 13 | -124.9 | 10 | 571.3 | 5 | -3.38 | 10 | 15.48 | 5 | 8.45 | 10 | 1.470 | 39 | 18.52 |
| 14 | -115.4 | 10 | 572.8 | 5 | -3.13 | 10 | 15.52 | 5 | 8.61 | 9 | 1.467 | 39 | 18.54 |
| 15 | -103.8 | 9 | 575.0 | 5 | -2.81 | 9 | 15.58 | 5 | 8.87 | 9 | 1.464 | 41 | 18.45 |
| 16 | -88.4 | 9 | 575.3 | 6 | -2.40 | 9 | 15.59 | 6 | 9.27 | 9 | 1.464 | 41 | 18.14 |
| 17 | -69.0 | 9 | 573.9 | 6 | -1.87 | 9 | 15.55 | 6 | 9.71 | 9 | 1.464 | 41 | 17.57 |
| 18 | -49.9 | 19 | 570.4 | 6 | -1.35 | 19 | 15.45 | 6 | 10.11 | 9 | 1.463 | 41 | 16.73 |
| 19 | -46.7 | 50 | 563.4 | 6 | -1.27 | 50 | 15.27 | 6 | 10.43 | 8 | 1.463 | 41 | 15.62 |
| 20 | -39.7 | 50 | 549.5 | 6 | -1.07 | 50 | 14.89 | 6 | 10.80 | 8 | 1.462 | 41 | 14.22 |
| 21 | -30.5 | 18 | 517.9 | 6 | -0.83 | 18 | 14.03 | 6 | 11.39 | 8 | 1.461 | 41 | 12.54 |
| 22 | -24.1 | 18 | 452.7 | 7 | -0.65 | 18 | 12.27 | 7 | 12.23 | 8 | 1.460 | 41 | 10.56 |
| 23 | -11.7 | 49 | 344.2 | 7 | -0.32 | 49 | 9.33 | 7 | 13.13 | 7 | 1.460 | 41 | 8.28 |
| 24 | -2.3 | 49 | 196.1 | 7 | -0.06 | 49 | 5.31 | 7 | 13.67 | 7 | 1.459 | 41 | 7.06 |

(Eq) Strokes Analyzed and Last Return (ft):
 11.25 5.95 6.27 6.24

Max. Combustion Pressure 1539.0 psi

Rut= 140.0, Rtoe = 28.0 kips, Time Inc. =0.077 ms

| No | mxTForce | t | mxCForce | t | mxTStrss | t | mxCStrss | t | max V | t | max D | t | max Et |
|----|----------|----|----------|----|----------|----|----------|----|-------|----|-------|----|--------|
| | kip | ms | kip | ms | ksi | ms | ksi | ms | ft/s | ms | inch | ms | kip-ft |
| 1 | 0.0 | 0 | 582.8 | 2 | 0.00 | 0 | 15.79 | 2 | 8.57 | 2 | 1.041 | 31 | 17.43 |
| 2 | -78.9 | 12 | 583.6 | 3 | -2.14 | 12 | 15.81 | 3 | 8.57 | 3 | 1.041 | 31 | 17.41 |
| 3 | -116.0 | 12 | 584.6 | 3 | -3.14 | 12 | 15.84 | 3 | 8.57 | 3 | 1.039 | 31 | 17.39 |
| 4 | -126.2 | 11 | 585.6 | 3 | -3.42 | 11 | 15.87 | 3 | 8.57 | 3 | 1.037 | 31 | 17.37 |
| 5 | -127.8 | 11 | 586.1 | 3 | -3.46 | 11 | 15.88 | 3 | 8.57 | 3 | 1.034 | 31 | 17.38 |
| 6 | -127.6 | 11 | 586.9 | 3 | -3.46 | 11 | 15.90 | 3 | 8.56 | 4 | 1.030 | 31 | 17.39 |
| 7 | -125.9 | 11 | 587.8 | 4 | -3.41 | 11 | 15.92 | 4 | 8.56 | 4 | 1.025 | 31 | 17.39 |
| 8 | -122.5 | 11 | 588.2 | 4 | -3.32 | 11 | 15.94 | 4 | 8.56 | 4 | 1.022 | 30 | 17.41 |
| 9 | -115.1 | 11 | 589.3 | 4 | -3.12 | 11 | 15.97 | 4 | 8.55 | 4 | 1.019 | 30 | 17.43 |
| 10 | -103.6 | 10 | 590.1 | 4 | -2.81 | 10 | 15.99 | 4 | 8.55 | 4 | 1.017 | 30 | 17.45 |
| 11 | -91.7 | 47 | 590.7 | 4 | -2.48 | 47 | 16.00 | 4 | 8.54 | 5 | 1.015 | 30 | 17.48 |
| 12 | -92.2 | 47 | 592.0 | 5 | -2.50 | 47 | 16.04 | 5 | 8.53 | 5 | 1.012 | 30 | 17.49 |
| 13 | -87.8 | 47 | 593.0 | 5 | -2.38 | 47 | 16.07 | 5 | 8.52 | 5 | 1.008 | 30 | 17.51 |
| 14 | -79.3 | 46 | 595.0 | 5 | -2.15 | 46 | 16.12 | 5 | 8.49 | 5 | 1.004 | 33 | 17.51 |
| 15 | -69.2 | 46 | 598.1 | 5 | -1.88 | 46 | 16.20 | 5 | 8.45 | 5 | 1.000 | 33 | 17.41 |
| 16 | -63.4 | 46 | 599.1 | 6 | -1.72 | 46 | 16.23 | 6 | 8.45 | 9 | 0.996 | 33 | 17.08 |
| 17 | -65.2 | 45 | 597.5 | 6 | -1.77 | 45 | 16.19 | 6 | 8.91 | 9 | 0.993 | 31 | 16.52 |
| 18 | -65.7 | 45 | 593.6 | 6 | -1.78 | 45 | 16.08 | 6 | 9.32 | 8 | 0.991 | 31 | 15.72 |
| 19 | -61.6 | 45 | 585.5 | 6 | -1.67 | 45 | 15.86 | 6 | 9.65 | 8 | 0.989 | 31 | 14.66 |
| 20 | -57.5 | 45 | 569.7 | 6 | -1.56 | 45 | 15.44 | 6 | 10.07 | 8 | 0.987 | 31 | 13.34 |
| 21 | -53.6 | 45 | 533.7 | 6 | -1.45 | 45 | 14.46 | 6 | 10.73 | 8 | 0.985 | 32 | 11.75 |
| 22 | -44.4 | 45 | 463.8 | 6 | -1.20 | 45 | 12.57 | 6 | 11.64 | 7 | 0.983 | 32 | 9.88 |
| 23 | -29.6 | 45 | 352.3 | 7 | -0.80 | 45 | 9.55 | 7 | 12.56 | 7 | 0.982 | 32 | 7.72 |
| 24 | -10.5 | 45 | 202.6 | 7 | -0.28 | 45 | 5.49 | 7 | 13.04 | 7 | 0.980 | 32 | 6.57 |

(Eq) Strokes Analyzed and Last Return (ft):
 11.25 6.18 6.53 6.50

Max. Combustion Pressure 1539.0 psi

Rut= 180.0, Rtoe = 36.0 kips, Time Inc. =0.077 ms

| No | mxTForce | t | mxCForce | t | mxTStrss | t | mxCStrss | t | max V | t | max D | t | max Et |
|----|----------|----|----------|----|----------|----|----------|----|-------|----|-------|----|--------|
| | kip | ms | kip | ms | ksi | ms | ksi | ms | ft/s | ms | inch | ms | kip-ft |
| 1 | 0.0 | 0 | 597.3 | 2 | 0.00 | 0 | 16.18 | 2 | 8.76 | 2 | 0.832 | 22 | 17.20 |
| 2 | -52.9 | 12 | 598.2 | 3 | -1.43 | 12 | 16.21 | 3 | 8.75 | 3 | 0.829 | 22 | 17.21 |
| 3 | -70.3 | 12 | 599.5 | 3 | -1.91 | 12 | 16.24 | 3 | 8.75 | 3 | 0.825 | 22 | 17.21 |
| 4 | -74.9 | 43 | 600.2 | 3 | -2.03 | 43 | 16.26 | 3 | 8.76 | 3 | 0.819 | 22 | 17.20 |
| 5 | -87.8 | 42 | 600.9 | 3 | -2.38 | 42 | 16.28 | 3 | 8.75 | 3 | 0.814 | 22 | 17.19 |
| 6 | -96.3 | 42 | 602.0 | 3 | -2.61 | 42 | 16.31 | 3 | 8.75 | 3 | 0.807 | 22 | 17.16 |
| 7 | -101.9 | 42 | 602.5 | 4 | -2.76 | 42 | 16.32 | 4 | 8.74 | 4 | 0.801 | 23 | 17.14 |
| 8 | -107.6 | 42 | 603.4 | 4 | -2.92 | 42 | 16.35 | 4 | 8.73 | 4 | 0.794 | 23 | 17.10 |
| 9 | -112.2 | 42 | 604.5 | 4 | -3.04 | 42 | 16.38 | 4 | 8.73 | 4 | 0.786 | 23 | 17.07 |
| 10 | -115.0 | 42 | 605.1 | 4 | -3.12 | 42 | 16.39 | 4 | 8.72 | 4 | 0.779 | 23 | 17.03 |
| 11 | -119.1 | 41 | 606.4 | 4 | -3.23 | 41 | 16.43 | 4 | 8.71 | 4 | 0.771 | 23 | 16.98 |
| 12 | -121.2 | 41 | 607.6 | 5 | -3.28 | 41 | 16.46 | 5 | 8.71 | 5 | 0.765 | 27 | 16.92 |
| 13 | -118.2 | 41 | 608.8 | 5 | -3.20 | 41 | 16.49 | 5 | 8.68 | 5 | 0.762 | 27 | 16.86 |
| 14 | -111.1 | 41 | 611.6 | 5 | -3.01 | 41 | 16.57 | 5 | 8.65 | 5 | 0.759 | 27 | 16.85 |
| 15 | -103.8 | 41 | 615.4 | 5 | -2.81 | 41 | 16.67 | 5 | 8.58 | 5 | 0.756 | 26 | 16.75 |
| 16 | -99.1 | 40 | 616.6 | 6 | -2.69 | 40 | 16.71 | 6 | 8.50 | 6 | 0.755 | 26 | 16.45 |
| 17 | -94.7 | 40 | 615.2 | 6 | -2.56 | 40 | 16.67 | 6 | 8.39 | 6 | 0.753 | 26 | 15.91 |
| 18 | -88.3 | 40 | 610.2 | 6 | -2.39 | 40 | 16.53 | 6 | 8.59 | 8 | 0.751 | 26 | 15.12 |
| 19 | -79.8 | 40 | 600.6 | 6 | -2.16 | 40 | 16.27 | 6 | 8.93 | 8 | 0.748 | 26 | 14.09 |
| 20 | -70.1 | 40 | 582.4 | 6 | -1.90 | 40 | 15.78 | 6 | 9.40 | 8 | 0.746 | 26 | 12.80 |
| 21 | -58.8 | 39 | 543.1 | 6 | -1.59 | 39 | 14.71 | 6 | 10.13 | 8 | 0.743 | 26 | 11.26 |
| 22 | -45.4 | 39 | 470.5 | 6 | -1.23 | 39 | 12.75 | 6 | 11.10 | 7 | 0.741 | 26 | 9.44 |
| 23 | -30.2 | 39 | 357.9 | 6 | -0.82 | 39 | 9.70 | 6 | 11.99 | 7 | 0.739 | 26 | 7.35 |
| 24 | -11.8 | 39 | 207.8 | 7 | -0.32 | 39 | 5.63 | 7 | 12.34 | 7 | 0.737 | 26 | 6.23 |

(Eq) Strokes Analyzed and Last Return (ft):
 11.25 6.39 6.72 6.69

Max. Combustion Pressure 1539.0 psi

Rut= 220.0, Rtoe = 44.0 kips, Time Inc. =0.077 ms

| No | mxTForce t | mxCForce t | mxTStrss t | mxCStrss t | max V | t max D | t max Et |
|----|------------|------------|------------|------------|-------|---------|----------|
| | kip | kip | ksi | ksi | ft/s | inch | kip-ft |
| 1 | 0.0 | 611.4 | 0.00 | 16.56 | 8.95 | 0.710 | 17.00 |
| 2 | -25.1 | 612.3 | -0.68 | 16.59 | 8.95 | 0.704 | 16.98 |
| 3 | -34.8 | 613.5 | -0.94 | 16.62 | 8.94 | 0.698 | 16.96 |
| 4 | -49.3 | 614.6 | -1.33 | 16.65 | 8.94 | 0.693 | 16.94 |
| 5 | -60.9 | 615.2 | -1.65 | 16.67 | 8.94 | 0.687 | 16.93 |
| 6 | -69.9 | 616.2 | -1.89 | 16.69 | 8.93 | 0.682 | 16.91 |
| 7 | -78.2 | 617.1 | -2.12 | 16.72 | 8.93 | 0.676 | 16.89 |
| 8 | -86.1 | 617.6 | -2.33 | 16.73 | 8.92 | 0.669 | 16.86 |
| 9 | -90.7 | 619.0 | -2.46 | 16.77 | 8.91 | 0.662 | 16.82 |
| 10 | -91.5 | 620.0 | -2.48 | 16.80 | 8.91 | 0.654 | 16.76 |
| 11 | -89.0 | 620.9 | -2.41 | 16.82 | 8.90 | 0.645 | 16.69 |
| 12 | -84.3 | 622.5 | -2.28 | 16.87 | 8.89 | 0.637 | 16.61 |
| 13 | -83.9 | 624.2 | -2.27 | 16.91 | 8.86 | 0.632 | 16.53 |
| 14 | -90.8 | 626.9 | -2.46 | 16.99 | 8.81 | 0.626 | 16.44 |
| 15 | -99.2 | 631.8 | -2.69 | 17.12 | 8.74 | 0.620 | 16.29 |
| 16 | -103.8 | 633.8 | -2.81 | 17.17 | 8.62 | 0.613 | 15.98 |
| 17 | -102.1 | 631.6 | -2.77 | 17.11 | 8.48 | 0.608 | 15.42 |
| 18 | -94.4 | 625.5 | -2.56 | 16.95 | 8.30 | 0.605 | 14.64 |
| 19 | -82.0 | 614.8 | -2.22 | 16.66 | 8.32 | 0.601 | 13.61 |
| 20 | -66.8 | 593.7 | -1.81 | 16.08 | 8.85 | 0.597 | 12.34 |
| 21 | -54.6 | 551.3 | -1.48 | 14.94 | 9.63 | 0.594 | 10.82 |
| 22 | -41.6 | 477.1 | -1.13 | 12.93 | 10.66 | 0.591 | 9.05 |
| 23 | -26.0 | 363.9 | -0.70 | 9.86 | 11.47 | 0.588 | 7.02 |
| 24 | -7.9 | 212.2 | -0.21 | 5.75 | 11.73 | 0.586 | 5.94 |

(Eq) Strokes Analyzed and Last Return (ft):
 11.25 6.57 6.91 6.88

Max. Combustion Pressure 1539.0 psi

Rut= 260.0, Rtoe = 52.0 kips, Time Inc. =0.077 ms

| No | mxTForce | t | mxCForce | t | mxTStrss | t | mxCStrss | t | max V | t | max D | t | max Et |
|----|----------|----|----------|----|----------|----|----------|----|-------|----|-------|----|--------|
| | kip | ms | kip | ms | ksi | ms | ksi | ms | ft/s | ms | inch | ms | kip-ft |
| 1 | 0.0 | 0 | 619.2 | 2 | 0.00 | 0 | 16.78 | 2 | 9.06 | 2 | 0.632 | 18 | 16.81 |
| 2 | -17.0 | 33 | 620.9 | 3 | -0.46 | 33 | 16.82 | 3 | 9.05 | 3 | 0.624 | 18 | 16.76 |
| 3 | -30.5 | 33 | 622.0 | 3 | -0.83 | 33 | 16.85 | 3 | 9.06 | 3 | 0.616 | 18 | 16.70 |
| 4 | -40.0 | 33 | 622.6 | 3 | -1.08 | 33 | 16.87 | 3 | 9.05 | 3 | 0.610 | 14 | 16.65 |
| 5 | -46.1 | 33 | 623.9 | 3 | -1.25 | 33 | 16.90 | 3 | 9.05 | 3 | 0.608 | 14 | 16.58 |
| 6 | -50.1 | 33 | 624.7 | 3 | -1.36 | 33 | 16.93 | 3 | 9.04 | 3 | 0.605 | 14 | 16.53 |
| 7 | -53.2 | 33 | 625.4 | 4 | -1.44 | 33 | 16.94 | 4 | 9.03 | 4 | 0.601 | 14 | 16.51 |
| 8 | -55.9 | 33 | 626.7 | 4 | -1.52 | 33 | 16.98 | 4 | 9.03 | 4 | 0.596 | 14 | 16.50 |
| 9 | -59.7 | 32 | 627.6 | 4 | -1.62 | 32 | 17.00 | 4 | 9.02 | 4 | 0.591 | 14 | 16.48 |
| 10 | -68.8 | 32 | 628.7 | 4 | -1.87 | 32 | 17.03 | 4 | 9.00 | 4 | 0.585 | 14 | 16.46 |
| 11 | -80.1 | 31 | 630.2 | 4 | -2.17 | 31 | 17.07 | 4 | 9.00 | 4 | 0.579 | 14 | 16.43 |
| 12 | -90.5 | 31 | 631.3 | 5 | -2.45 | 31 | 17.10 | 5 | 8.98 | 5 | 0.572 | 15 | 16.40 |
| 13 | -99.2 | 31 | 633.5 | 5 | -2.69 | 31 | 17.16 | 5 | 8.96 | 5 | 0.565 | 15 | 16.36 |
| 14 | -105.4 | 31 | 636.9 | 5 | -2.86 | 31 | 17.26 | 5 | 8.90 | 5 | 0.558 | 15 | 16.31 |
| 15 | -109.2 | 31 | 642.1 | 5 | -2.96 | 31 | 17.40 | 5 | 8.81 | 5 | 0.550 | 15 | 16.14 |
| 16 | -108.7 | 31 | 644.1 | 5 | -2.95 | 31 | 17.45 | 5 | 8.68 | 6 | 0.542 | 15 | 15.76 |
| 17 | -103.7 | 32 | 642.1 | 6 | -2.81 | 32 | 17.40 | 6 | 8.49 | 6 | 0.534 | 15 | 15.13 |
| 18 | -95.1 | 32 | 635.2 | 6 | -2.58 | 32 | 17.21 | 6 | 8.29 | 6 | 0.527 | 15 | 14.28 |
| 19 | -84.2 | 32 | 622.4 | 6 | -2.28 | 32 | 16.86 | 6 | 8.06 | 6 | 0.519 | 16 | 13.20 |
| 20 | -71.1 | 32 | 599.0 | 6 | -1.93 | 32 | 16.23 | 6 | 8.30 | 8 | 0.513 | 16 | 11.91 |
| 21 | -56.4 | 32 | 553.9 | 6 | -1.53 | 32 | 15.01 | 6 | 9.13 | 7 | 0.507 | 16 | 10.39 |
| 22 | -39.9 | 32 | 478.6 | 6 | -1.08 | 32 | 12.97 | 6 | 10.20 | 7 | 0.503 | 16 | 8.64 |
| 23 | -22.2 | 31 | 365.5 | 6 | -0.60 | 31 | 9.90 | 6 | 10.90 | 7 | 0.499 | 16 | 6.66 |
| 24 | -3.6 | 31 | 214.7 | 7 | -0.10 | 31 | 5.82 | 7 | 11.09 | 7 | 0.496 | 16 | 5.60 |

(Eq) Strokes Analyzed and Last Return (ft):
 11.25 6.74 7.03 7.01

Max. Combustion Pressure 1539.0 psi

Rut= 300.0, Rtoe = 60.0 kips, Time Inc. =0.077 ms

| No | mxTForce | t | mxCForce | t | mxTStrss | t | mxCStrss | t | max V | t | max D | t | max Et |
|----|----------|----|----------|----|----------|----|----------|----|-------|----|-------|----|--------|
| | kip | ms | kip | ms | ksi | ms | ksi | ms | ft/s | ms | inch | ms | kip-ft |
| 1 | 0.0 | 0 | 628.0 | 2 | 0.00 | 0 | 17.01 | 2 | 9.18 | 2 | 0.582 | 13 | 16.78 |
| 2 | -15.4 | 32 | 628.9 | 3 | -0.42 | 32 | 17.04 | 3 | 9.18 | 3 | 0.581 | 13 | 16.77 |
| 3 | -30.2 | 32 | 630.4 | 3 | -0.82 | 32 | 17.08 | 3 | 9.17 | 3 | 0.579 | 13 | 16.78 |
| 4 | -44.3 | 32 | 631.5 | 3 | -1.20 | 32 | 17.11 | 3 | 9.17 | 3 | 0.576 | 13 | 16.78 |
| 5 | -57.4 | 32 | 632.0 | 3 | -1.55 | 32 | 17.12 | 3 | 9.16 | 3 | 0.572 | 13 | 16.78 |
| 6 | -69.0 | 32 | 633.4 | 3 | -1.87 | 32 | 17.16 | 3 | 9.15 | 3 | 0.567 | 13 | 16.77 |
| 7 | -79.1 | 32 | 634.4 | 4 | -2.14 | 32 | 17.19 | 4 | 9.15 | 4 | 0.562 | 13 | 16.75 |
| 8 | -87.9 | 32 | 635.1 | 4 | -2.38 | 32 | 17.21 | 4 | 9.14 | 4 | 0.556 | 13 | 16.73 |
| 9 | -95.4 | 32 | 636.6 | 4 | -2.58 | 32 | 17.25 | 4 | 9.13 | 4 | 0.550 | 14 | 16.70 |
| 10 | -102.0 | 31 | 637.7 | 4 | -2.76 | 31 | 17.28 | 4 | 9.12 | 4 | 0.542 | 14 | 16.66 |
| 11 | -108.1 | 31 | 639.0 | 4 | -2.93 | 31 | 17.31 | 4 | 9.10 | 5 | 0.535 | 14 | 16.60 |
| 12 | -114.2 | 31 | 640.8 | 5 | -3.09 | 31 | 17.36 | 5 | 9.09 | 5 | 0.527 | 14 | 16.54 |
| 13 | -120.3 | 31 | 642.7 | 5 | -3.26 | 31 | 17.41 | 5 | 9.06 | 5 | 0.518 | 14 | 16.47 |
| 14 | -125.7 | 31 | 646.4 | 5 | -3.41 | 31 | 17.51 | 5 | 9.00 | 5 | 0.509 | 14 | 16.39 |
| 15 | -129.3 | 31 | 652.7 | 5 | -3.50 | 31 | 17.68 | 5 | 8.89 | 5 | 0.500 | 14 | 16.19 |
| 16 | -127.3 | 31 | 655.3 | 6 | -3.45 | 31 | 17.75 | 6 | 8.73 | 6 | 0.491 | 14 | 15.77 |
| 17 | -119.1 | 31 | 652.4 | 6 | -3.23 | 31 | 17.68 | 6 | 8.53 | 6 | 0.482 | 15 | 15.10 |
| 18 | -107.3 | 31 | 644.1 | 6 | -2.91 | 31 | 17.45 | 6 | 8.28 | 6 | 0.473 | 15 | 14.20 |
| 19 | -92.9 | 31 | 629.8 | 6 | -2.52 | 31 | 17.06 | 6 | 8.01 | 6 | 0.464 | 15 | 13.08 |
| 20 | -76.1 | 31 | 603.7 | 6 | -2.06 | 31 | 16.36 | 6 | 7.84 | 6 | 0.456 | 15 | 11.74 |
| 21 | -57.7 | 31 | 556.3 | 6 | -1.56 | 31 | 15.07 | 6 | 8.72 | 7 | 0.448 | 15 | 10.20 |
| 22 | -37.9 | 31 | 481.0 | 6 | -1.03 | 31 | 13.03 | 6 | 9.78 | 7 | 0.442 | 15 | 8.44 |
| 23 | -18.0 | 31 | 366.9 | 7 | -0.49 | 31 | 9.94 | 7 | 10.39 | 7 | 0.437 | 15 | 6.46 |
| 24 | -0.1 | 31 | 216.6 | 7 | 0.00 | 31 | 5.87 | 7 | 10.56 | 7 | 0.434 | 16 | 5.42 |

(Eq) Strokes Analyzed and Last Return (ft):
 11.25 6.90 7.15 7.13

Max. Combustion Pressure 1539.0 psi

Rut= 340.0, Rtoe = 68.0 kips, Time Inc. =0.077 ms

| No | mxTForce | t | mxCForce | t | mxTStrss | t | mxCStrss | t | max V | t | max D | t | max Et |
|----|----------|----|----------|----|----------|----|----------|----|-------|----|-------|----|--------|
| | kip | ms | kip | ms | ksi | ms | ksi | ms | ft/s | ms | inch | ms | kip-ft |
| 1 | 0.0 | 0 | 638.8 | 2 | 0.00 | 0 | 17.31 | 2 | 9.34 | 2 | 0.566 | 12 | 17.15 |
| 2 | -11.4 | 32 | 640.6 | 3 | -0.31 | 32 | 17.36 | 3 | 9.34 | 3 | 0.564 | 12 | 17.15 |
| 3 | -22.5 | 32 | 641.6 | 3 | -0.61 | 32 | 17.38 | 3 | 9.34 | 3 | 0.560 | 12 | 17.15 |
| 4 | -32.8 | 32 | 642.5 | 3 | -0.89 | 32 | 17.41 | 3 | 9.33 | 3 | 0.555 | 13 | 17.14 |
| 5 | -42.7 | 32 | 643.9 | 3 | -1.16 | 32 | 17.44 | 3 | 9.32 | 3 | 0.549 | 13 | 17.12 |
| 6 | -53.5 | 31 | 644.7 | 3 | -1.45 | 31 | 17.47 | 3 | 9.32 | 3 | 0.543 | 13 | 17.08 |
| 7 | -64.5 | 31 | 645.7 | 4 | -1.75 | 31 | 17.49 | 4 | 9.30 | 4 | 0.536 | 13 | 17.04 |
| 8 | -74.6 | 31 | 647.1 | 4 | -2.02 | 31 | 17.53 | 4 | 9.30 | 4 | 0.528 | 13 | 16.99 |
| 9 | -83.6 | 31 | 648.0 | 4 | -2.27 | 31 | 17.56 | 4 | 9.29 | 4 | 0.520 | 13 | 16.93 |
| 10 | -92.3 | 31 | 649.4 | 4 | -2.50 | 31 | 17.59 | 4 | 9.27 | 4 | 0.512 | 13 | 16.86 |
| 11 | -101.6 | 30 | 650.9 | 4 | -2.75 | 30 | 17.64 | 4 | 9.27 | 4 | 0.502 | 13 | 16.78 |
| 12 | -111.3 | 30 | 652.1 | 5 | -3.01 | 30 | 17.67 | 5 | 9.24 | 5 | 0.493 | 13 | 16.68 |
| 13 | -120.2 | 30 | 654.8 | 5 | -3.26 | 30 | 17.74 | 5 | 9.21 | 5 | 0.482 | 14 | 16.57 |
| 14 | -127.7 | 30 | 658.9 | 5 | -3.46 | 30 | 17.85 | 5 | 9.14 | 5 | 0.472 | 14 | 16.45 |
| 15 | -132.8 | 30 | 665.6 | 5 | -3.60 | 30 | 18.03 | 5 | 9.02 | 5 | 0.461 | 14 | 16.21 |
| 16 | -131.8 | 30 | 668.2 | 6 | -3.57 | 30 | 18.10 | 6 | 8.84 | 6 | 0.450 | 14 | 15.73 |
| 17 | -123.6 | 30 | 665.0 | 6 | -3.35 | 30 | 18.02 | 6 | 8.61 | 6 | 0.440 | 14 | 15.01 |
| 18 | -109.3 | 30 | 656.0 | 6 | -2.96 | 30 | 17.77 | 6 | 8.32 | 6 | 0.429 | 14 | 14.06 |
| 19 | -92.2 | 30 | 640.1 | 6 | -2.50 | 30 | 17.34 | 6 | 8.02 | 6 | 0.419 | 14 | 12.91 |
| 20 | -73.8 | 30 | 611.7 | 6 | -2.00 | 30 | 16.57 | 6 | 7.79 | 6 | 0.410 | 14 | 11.55 |
| 21 | -54.6 | 30 | 562.3 | 6 | -1.48 | 30 | 15.23 | 6 | 8.42 | 7 | 0.402 | 13 | 9.99 |
| 22 | -35.2 | 30 | 484.6 | 6 | -0.95 | 30 | 13.13 | 6 | 9.43 | 7 | 0.395 | 13 | 8.23 |
| 23 | -16.2 | 30 | 370.5 | 6 | -0.44 | 30 | 10.04 | 6 | 9.99 | 7 | 0.390 | 13 | 6.27 |
| 24 | 0.0 | 0 | 219.7 | 7 | 0.00 | 0 | 5.95 | 7 | 10.19 | 7 | 0.386 | 13 | 5.23 |

(Eq) Strokes Analyzed and Last Return (ft):
 11.25 7.05 7.32 7.30

Max. Combustion Pressure 1539.0 psi

Rut= 380.0, Rtoe = 76.0 kips, Time Inc. =0.077 ms

| No | mxTForce | t | mxCForce | t | mxTStrss | t | mxCStrss | t | max V | t | max D | t | max Et |
|----|----------|----|----------|----|----------|----|----------|----|-------|----|-------|----|--------|
| | kips | ms | kips | ms | ksi | ms | ksi | ms | ft/s | ms | inch | ms | kip-ft |
| 1 | 0.0 | 0 | 647.2 | 2 | 0.00 | 0 | 17.53 | 2 | 9.45 | 2 | 0.554 | 12 | 17.39 |
| 2 | -13.9 | 23 | 648.7 | 3 | -0.38 | 23 | 17.58 | 3 | 9.46 | 3 | 0.551 | 12 | 17.39 |
| 3 | -28.1 | 23 | 649.6 | 3 | -0.76 | 23 | 17.60 | 3 | 9.46 | 3 | 0.546 | 12 | 17.38 |
| 4 | -42.8 | 23 | 650.8 | 3 | -1.16 | 23 | 17.63 | 3 | 9.45 | 3 | 0.539 | 12 | 17.34 |
| 5 | -53.0 | 23 | 652.1 | 3 | -1.44 | 23 | 17.67 | 3 | 9.44 | 3 | 0.531 | 12 | 17.29 |
| 6 | -57.8 | 23 | 652.9 | 3 | -1.57 | 23 | 17.69 | 3 | 9.43 | 3 | 0.523 | 12 | 17.22 |
| 7 | -65.5 | 28 | 654.2 | 4 | -1.77 | 28 | 17.72 | 4 | 9.42 | 4 | 0.514 | 13 | 17.14 |
| 8 | -73.9 | 28 | 655.5 | 4 | -2.00 | 28 | 17.76 | 4 | 9.41 | 4 | 0.504 | 13 | 17.05 |
| 9 | -81.7 | 29 | 656.3 | 4 | -2.21 | 29 | 17.78 | 4 | 9.40 | 4 | 0.494 | 13 | 16.96 |
| 10 | -88.7 | 29 | 658.1 | 4 | -2.40 | 29 | 17.83 | 4 | 9.39 | 4 | 0.484 | 13 | 16.85 |
| 11 | -94.8 | 29 | 659.5 | 4 | -2.57 | 29 | 17.87 | 4 | 9.38 | 4 | 0.473 | 13 | 16.73 |
| 12 | -100.4 | 29 | 661.0 | 5 | -2.72 | 29 | 17.91 | 5 | 9.35 | 5 | 0.462 | 13 | 16.60 |
| 13 | -107.8 | 30 | 663.7 | 5 | -2.92 | 30 | 17.98 | 5 | 9.32 | 5 | 0.451 | 13 | 16.46 |
| 14 | -116.3 | 30 | 668.0 | 5 | -3.15 | 30 | 18.10 | 5 | 9.24 | 5 | 0.439 | 13 | 16.30 |
| 15 | -123.1 | 30 | 675.3 | 5 | -3.33 | 30 | 18.30 | 5 | 9.11 | 5 | 0.427 | 13 | 16.02 |
| 16 | -124.4 | 30 | 678.1 | 6 | -3.37 | 30 | 18.37 | 6 | 8.90 | 6 | 0.415 | 12 | 15.51 |
| 17 | -119.3 | 30 | 674.6 | 6 | -3.23 | 30 | 18.28 | 6 | 8.64 | 6 | 0.404 | 12 | 14.76 |
| 18 | -107.9 | 29 | 664.5 | 6 | -2.92 | 29 | 18.00 | 6 | 8.33 | 6 | 0.393 | 12 | 13.79 |
| 19 | -92.1 | 29 | 646.9 | 6 | -2.49 | 29 | 17.53 | 6 | 7.99 | 6 | 0.383 | 12 | 12.61 |
| 20 | -73.8 | 29 | 616.0 | 6 | -2.00 | 29 | 16.69 | 6 | 7.72 | 6 | 0.373 | 12 | 11.24 |
| 21 | -54.2 | 29 | 564.6 | 6 | -1.47 | 29 | 15.30 | 6 | 8.15 | 7 | 0.364 | 13 | 9.69 |
| 22 | -34.4 | 29 | 486.0 | 6 | -0.93 | 29 | 13.17 | 6 | 9.06 | 7 | 0.357 | 13 | 7.94 |
| 23 | -14.1 | 29 | 371.7 | 6 | -0.38 | 29 | 10.07 | 6 | 9.59 | 7 | 0.351 | 13 | 6.01 |
| 24 | 0.0 | 0 | 221.4 | 7 | 0.00 | 0 | 6.00 | 7 | 9.84 | 7 | 0.347 | 13 | 4.99 |

(Eq) Strokes Analyzed and Last Return (ft):
 11.25 7.20 7.44 7.43

Max. Combustion Pressure 1539.0 psi

Rut= 420.0, Rtoe = 84.0 kips, Time Inc. =0.077 ms

| No | mxTForce | t | mxCForce | t | mxTStrss | t | mxCStrss | t | max V | t | max D | t | max Et |
|----|----------|----|----------|----|----------|----|----------|----|-------|----|-------|----|--------|
| | kip | ms | kip | ms | ksi | ms | ksi | ms | ft/s | ms | inch | ms | kip-ft |
| 1 | 0.0 | 0 | 653.9 | 2 | 0.00 | 0 | 17.71 | 2 | 9.56 | 2 | 0.545 | 12 | 17.58 |
| 2 | -25.7 | 23 | 655.7 | 3 | -0.70 | 23 | 17.77 | 3 | 9.56 | 3 | 0.540 | 12 | 17.57 |
| 3 | -47.1 | 23 | 656.9 | 3 | -1.28 | 23 | 17.80 | 3 | 9.56 | 3 | 0.534 | 12 | 17.53 |
| 4 | -63.7 | 23 | 657.6 | 3 | -1.73 | 23 | 17.82 | 3 | 9.55 | 3 | 0.526 | 12 | 17.47 |
| 5 | -73.7 | 23 | 659.2 | 3 | -2.00 | 23 | 17.86 | 3 | 9.54 | 3 | 0.516 | 12 | 17.39 |
| 6 | -78.0 | 23 | 660.3 | 3 | -2.11 | 23 | 17.89 | 3 | 9.53 | 3 | 0.506 | 12 | 17.28 |
| 7 | -78.9 | 23 | 661.2 | 4 | -2.14 | 23 | 17.91 | 4 | 9.52 | 4 | 0.495 | 12 | 17.16 |
| 8 | -78.9 | 23 | 662.9 | 4 | -2.14 | 23 | 17.96 | 4 | 9.51 | 4 | 0.484 | 12 | 17.03 |
| 9 | -84.4 | 28 | 664.0 | 4 | -2.29 | 28 | 17.99 | 4 | 9.50 | 4 | 0.473 | 12 | 16.89 |
| 10 | -91.2 | 28 | 665.4 | 4 | -2.47 | 28 | 18.03 | 4 | 9.48 | 4 | 0.461 | 12 | 16.74 |
| 11 | -97.3 | 28 | 667.1 | 4 | -2.64 | 28 | 18.07 | 4 | 9.47 | 4 | 0.449 | 12 | 16.59 |
| 12 | -102.6 | 28 | 668.5 | 5 | -2.78 | 28 | 18.11 | 5 | 9.45 | 5 | 0.437 | 12 | 16.43 |
| 13 | -107.2 | 28 | 671.3 | 5 | -2.90 | 28 | 18.19 | 5 | 9.41 | 5 | 0.425 | 12 | 16.28 |
| 14 | -118.7 | 25 | 676.0 | 5 | -3.22 | 25 | 18.32 | 5 | 9.33 | 5 | 0.413 | 12 | 16.12 |
| 15 | -132.3 | 25 | 684.1 | 5 | -3.58 | 25 | 18.53 | 5 | 9.18 | 5 | 0.401 | 12 | 15.83 |
| 16 | -139.2 | 25 | 687.3 | 6 | -3.77 | 25 | 18.62 | 6 | 8.96 | 6 | 0.388 | 12 | 15.29 |
| 17 | -137.1 | 25 | 683.2 | 6 | -3.71 | 25 | 18.51 | 6 | 8.67 | 6 | 0.376 | 12 | 14.50 |
| 18 | -126.9 | 25 | 671.9 | 6 | -3.44 | 25 | 18.20 | 6 | 8.33 | 6 | 0.364 | 12 | 13.49 |
| 19 | -109.6 | 26 | 652.2 | 6 | -2.97 | 26 | 17.67 | 6 | 7.96 | 6 | 0.353 | 12 | 12.28 |
| 20 | -89.5 | 26 | 619.0 | 6 | -2.43 | 26 | 16.77 | 6 | 7.65 | 6 | 0.342 | 12 | 10.89 |
| 21 | -68.0 | 26 | 566.0 | 6 | -1.84 | 26 | 15.34 | 6 | 7.89 | 7 | 0.332 | 12 | 9.33 |
| 22 | -45.7 | 26 | 486.6 | 6 | -1.24 | 26 | 13.18 | 6 | 8.70 | 7 | 0.324 | 12 | 7.60 |
| 23 | -23.1 | 26 | 371.7 | 6 | -0.62 | 26 | 10.07 | 6 | 9.25 | 7 | 0.317 | 12 | 5.71 |
| 24 | -0.1 | 26 | 222.3 | 7 | 0.00 | 26 | 6.02 | 7 | 9.54 | 7 | 0.312 | 12 | 4.71 |

(Eq) Strokes Analyzed and Last Return (ft):
 11.25 7.33 7.55 7.54

Max. Combustion Pressure 1539.0 psi

| Rut | Bl Ct | Stroke (ft) | Ten Str | i | t | Comp Str | i | t | ENTHRU | Bl Rt | |
|-------|-------|-------------|---------|-------|----|----------|-------|----|--------|-------|------|
| kip | b/ft | down | up | ksi | | ksi | | | kip-ft | b/min | |
| 60.0 | 4.6 | 5.96 | 5.94 | -6.78 | 6 | 11 | 14.70 | 15 | 5 | 19.6 | 48.8 |
| 100.0 | 9.0 | 6.27 | 6.24 | -5.13 | 6 | 11 | 15.59 | 16 | 6 | 18.1 | 47.5 |
| 140.0 | 13.9 | 6.53 | 6.50 | -3.46 | 5 | 11 | 16.23 | 16 | 6 | 17.4 | 46.4 |
| 180.0 | 19.5 | 6.72 | 6.69 | -3.28 | 12 | 41 | 16.71 | 16 | 6 | 17.2 | 45.8 |
| 220.0 | 25.8 | 6.91 | 6.88 | -2.81 | 16 | 38 | 17.17 | 16 | 6 | 17.0 | 45.1 |
| 260.0 | 31.9 | 7.03 | 7.01 | -2.96 | 15 | 31 | 17.45 | 16 | 5 | 16.8 | 44.7 |
| 300.0 | 38.3 | 7.15 | 7.13 | -3.50 | 15 | 31 | 17.75 | 16 | 6 | 16.8 | 44.3 |
| 340.0 | 45.1 | 7.32 | 7.30 | -3.60 | 15 | 30 | 18.10 | 16 | 6 | 17.1 | 43.8 |
| 380.0 | 53.0 | 7.44 | 7.43 | -3.37 | 16 | 30 | 18.37 | 16 | 6 | 17.4 | 43.4 |
| 420.0 | 62.5 | 7.55 | 7.54 | -3.77 | 16 | 25 | 18.62 | 16 | 6 | 17.6 | 43.1 |

Input File: C:\PJ\AMERICAN, CRC\B2 LO.GWI
 Hammer File: C:\Program Files\PDI\GRLWEAP 2005\HAMMER2003.GW
 Hammer File Version: 2003 (8/28/2009)

Input File Contents

American, CRC Pile B2, APE D80-42 LO
 OUT OSG HAM STR FUL PEL N SPL N-U P-D %SK ISM 0 PHI RSA ITR H-D MXT DEx
 6 0 576 0 1 0 0 0 0 0 0 60 0 0 0 0 0 0 0 0 0 0 0 0.000
 Pile g Hammer g Toe Area Pile Size Pile Type
 32.170 32.170 1809.560 48.000 Pipe
 W Cp A Cp E Cp T Cp CoR ROut StCp
 5.000 490.000 175.0 2.000 0.920 0.010 0.0
 A Cu E Cu T Cu CoR ROut StCu
 0.000 0.0 0.000 0.000 0.000 0.0
 LPlE APlE EPlE WPlE Peri Strg CoR ROut
 96.000 147.660 30000.000 492.000 12.566 36.000 0.850 0.010
 Manufac Hmr Name HmrType No Seg-s
 APE D 80-42 1 5
 Ram Wt Ram L Ram Dia MaxStrk RtdStrk Efficy
 17.64 147.20 24.80 13.08 11.25 0.80
 IB. Wt IB. L IB.Dia IB CoR IB RO
 5.00 42.10 24.80 0.900 0.010
 CompStrk A Chamber V Chamber C Delay C Duratn Exp Coeff VolCStart Vol CEnd
 22.91 483.00 863.80 0.001 0.002 1.250 0.00 0.00
 P atm P1 P2 P3 P4 P5
 14.70 1410.00 1269.00 1142.00 1028.00 0.00
 Stroke Effic. Pressure R-Weight T-Delay Exp-Coeff Eps-Str Total-AW
 11.2500 0.7200 1481.0000 0.0000 0.0000 0.0000 0.0100 0.0000
 Qs Qt Js Jt Qx Jx Rati Dept
 0.100 0.200 0.100 0.150 0.000 0.000 0.000 0.000
 Research Soil Model: Atoe, Plug, Gap, Q-fac
 0.000 0.000 0.000 0.000
 Research Soil Model: RD-skn: m, d, toe: m, d
 0.000 0.000 0.000 0.000
 Res. Distribution
 Dpth Rskn Dpth Dpth
 0.00 0.00 50.00 50.00 0.00 0.00 0.00 0.00 0.00 0.00
 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00
 50.00 1.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00
 96.00 1.92 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00
 Rult
 600.0 1200.0 1400.0 1600.0 1800.0 2000.0 2200.0 2400.0 2600.0 2700.0
 Diameter COGHammer WHammer ABatter Depth Sup Flag
 0.000 0.000 0.000 0.000 0.000 0

GRLWEAP: WAVE EQUATION ANALYSIS OF PILE FOUNDATIONS
 Version 2005
 English Units

American, CRC Pile B2, APE D80-42 LO

| Hammer Model: D 80-42 | | Made by: APE | | | |
|-----------------------|----------------|------------------|-------|-------------|-----------------|
| No. | Weight kips | Stiffn k/inch | CoR | C-Slk ft | Dampg k/ft/s |
| 1 | 3.528 | | | | |
| 2 | 3.528 | 475831.8 | 1.000 | 0.0100 | |
| 3 | 3.528 | 475831.8 | 1.000 | 0.0100 | |
| 4 | 3.528 | 475831.8 | 1.000 | 0.0100 | |
| 5 | 3.528 | 475831.8 | 1.000 | 0.0100 | |
| Imp Block | 5.000 | 195813.4 | 0.900 | 0.0100 | |
| Helmet | 5.000 | 42875.0 | 0.920 | 0.0100 | 20.3 |
| Combined Pile Top | | 111513.9 | | | |

HAMMER OPTIONS:

| | | | |
|--------------------|-----------|--------------------------|-----------|
| Hammer File ID No. | 576 | Hammer Type | OE Diesel |
| Stroke Option | FxdP-VarS | Stroke Convergence Crit. | 0.010 |
| Fuel Pump Setting | Maximum | | |

HAMMER DATA:

| | | | | | |
|----------------------|--------|---------|--------------------|--------|---------|
| Ram Weight | (kips) | 17.64 | Ram Length | (inch) | 147.20 |
| Maximum Stroke | (ft) | 13.08 | | | |
| Rated Stroke | (ft) | 11.25 | Efficiency | | 0.720 |
| Maximum Pressure | (psi) | 1410.00 | Actual Pressure | (psi) | 1481.00 |
| Compression Exponent | | 1.350 | Expansion Exponent | | 1.250 |
| Ram Diameter | (inch) | 24.80 | | | |
| Combustion Delay | (s) | 0.00100 | Ignition Duration | (s) | 0.00200 |

The Hammer Data Includes Estimated (NON-MEASURED) Quantities

HAMMER CUSHION

| | | |
|----------------------|--------------------|---------|
| Cross Sect. Area | (in ²) | 490.00 |
| Elastic-Modulus | (ksi) | 175.0 |
| Thickness | (inch) | 2.00 |
| Coeff of Restitution | | 0.9 |
| RoundOut | (ft) | 0.0 |
| Stiffness | (kips/in) | 42875.0 |

PILE CUSHION

| | | |
|----------------------|--------------------|------|
| Cross Sect. Area | (in ²) | 0.00 |
| Elastic-Modulus | (ksi) | 0.0 |
| Thickness | (inch) | 0.00 |
| Coeff of Restitution | | 0.0 |
| RoundOut | (ft) | 0.0 |
| Stiffness | (kips/in) | 0.0 |

PILE PROFILE:

Toe Area (in2) 1809.560 Pile Type Pipe
 Pile Size (inch) 48.000

| L b Top | Area | E-Mod | Spec Wt | Perim | Strength | Wave Sp | EA/c |
|---------|--------|--------|---------|-------|----------|---------|--------|
| ft | in2 | ksi | lb/ft3 | ft | ksi | ft/s | k/ft/s |
| 0.0 | 147.66 | 30000. | 492.0 | 12.6 | 36.000 | 16807. | 263.6 |
| 96.0 | 147.66 | 30000. | 492.0 | 12.6 | 36.000 | 16807. | 263.6 |

Wave Travel Time 2L/c (ms) 11.424

| Pile and Soil Model | | | | | | | Total Capacity Rut (kips) | | | 600.0 | |
|---------------------|--------|---------|-------|-------|------|--------|---------------------------|-------|-------|-------|-------|
| No. | Weight | Stiffn | C-Slk | T-Slk | CoR | Soil-S | Soil-D | Quake | LbTop | Perim | Area |
| | kips | k/in | ft | ft | | kips | s/ft | inch | ft | ft | in2 |
| 1 | 1.670 | 111514. | 0.010 | 0.000 | 0.85 | 0.0 | 0.100 | 0.100 | 3.31 | 12.6 | 147.7 |
| 2 | 1.670 | 111514. | 0.000 | 0.000 | 1.00 | 0.0 | 0.100 | 0.100 | 6.62 | 12.6 | 147.7 |
| 14 | 1.670 | 111514. | 0.000 | 0.000 | 1.00 | 0.0 | 0.100 | 0.100 | 46.34 | 12.6 | 147.7 |
| 15 | 1.670 | 111514. | 0.000 | 0.000 | 1.00 | 1.9 | 0.100 | 0.100 | 49.66 | 12.6 | 147.7 |
| 16 | 1.670 | 111514. | 0.000 | 0.000 | 1.00 | 5.1 | 0.100 | 0.100 | 52.97 | 12.6 | 147.7 |
| 17 | 1.670 | 111514. | 0.000 | 0.000 | 1.00 | 8.2 | 0.100 | 0.100 | 56.28 | 12.6 | 147.7 |
| 18 | 1.670 | 111514. | 0.000 | 0.000 | 1.00 | 11.4 | 0.100 | 0.100 | 59.59 | 12.6 | 147.7 |
| 19 | 1.670 | 111514. | 0.000 | 0.000 | 1.00 | 14.5 | 0.100 | 0.100 | 62.90 | 12.6 | 147.7 |
| 20 | 1.670 | 111514. | 0.000 | 0.000 | 1.00 | 17.7 | 0.100 | 0.100 | 66.21 | 12.6 | 147.7 |
| 21 | 1.670 | 111514. | 0.000 | 0.000 | 1.00 | 20.8 | 0.100 | 0.100 | 69.52 | 12.6 | 147.7 |
| 22 | 1.670 | 111514. | 0.000 | 0.000 | 1.00 | 24.0 | 0.100 | 0.100 | 72.83 | 12.6 | 147.7 |
| 23 | 1.670 | 111514. | 0.000 | 0.000 | 1.00 | 27.2 | 0.100 | 0.100 | 76.14 | 12.6 | 147.7 |
| 24 | 1.670 | 111514. | 0.000 | 0.000 | 1.00 | 30.3 | 0.100 | 0.100 | 79.45 | 12.6 | 147.7 |
| 25 | 1.670 | 111514. | 0.000 | 0.000 | 1.00 | 33.5 | 0.100 | 0.100 | 82.76 | 12.6 | 147.7 |
| 26 | 1.670 | 111514. | 0.000 | 0.000 | 1.00 | 36.6 | 0.100 | 0.100 | 86.07 | 12.6 | 147.7 |
| 27 | 1.670 | 111514. | 0.000 | 0.000 | 1.00 | 39.8 | 0.100 | 0.100 | 89.38 | 12.6 | 147.7 |
| 28 | 1.670 | 111514. | 0.000 | 0.000 | 1.00 | 42.9 | 0.100 | 0.100 | 92.69 | 12.6 | 147.7 |
| 29 | 1.670 | 111515. | 0.000 | 0.000 | 1.00 | 46.1 | 0.100 | 0.100 | 96.00 | 12.6 | 147.7 |
| Toe | | | | | | 240.0 | 0.150 | 0.200 | | | |

48.432 kips total unreduced pile weight (g= 32.17 ft/s2)
 48.432 kips total reduced pile weight (g= 32.17 ft/s2)

PILE, SOIL, ANALYSIS OPTIONS:

| | | | |
|--------------------------------------|--------|-----------------------------|-------|
| Uniform pile | | File Segments: Automatic | |
| No. of Slacks/Splices | 0 | Pile Damping (%) | 1 |
| Pile Penetration (ft) | 50.00 | Pile Damping Fact. (k/ft/s) | 5.271 |
| % Shaft Resistance | 60 | | |
| Soil Damping Option | Smith | | |
| Max No Analysis Iterations | 0 | Time Increment/Critical | 160 |
| Output Time Interval | 1 | Analysis Time-Input (ms) | 0 |
| Output Level: Variable vs Time | | | |
| Gravity Mass, Pile, Hammer: | 32.170 | 32.170 | |
| Output Segment Generation: Automatic | | | |

Rut= 600.0, Rtoe = 240.0 kips, Time Inc. =0.087 ms

| No | mxTForce | t | mxCForce | t | mxTStrss | t | mxCStrss | t | max V | t | max D | t | max Et |
|----|----------|----|----------|----|----------|----|----------|----|-------|----|-------|----|--------|
| | kip | ms | kip | ms | ksi | ms | ksi | ms | ft/s | ms | inch | ms | kip-ft |
| 1 | 0.0 | 0 | 3441.5 | 2 | 0.00 | 0 | 23.31 | 2 | 12.77 | 2 | 1.033 | 32 | 80.01 |
| 2 | -504.1 | 13 | 3449.1 | 2 | -3.41 | 13 | 23.36 | 2 | 12.81 | 2 | 1.031 | 31 | 79.96 |
| 3 | -790.7 | 13 | 3455.8 | 2 | -5.35 | 13 | 23.40 | 2 | 12.79 | 3 | 1.028 | 31 | 79.87 |
| 4 | -923.7 | 13 | 3444.6 | 3 | -6.26 | 13 | 23.33 | 3 | 12.76 | 3 | 1.026 | 31 | 79.87 |
| 5 | -973.4 | 13 | 3455.0 | 3 | -6.59 | 13 | 23.40 | 3 | 12.76 | 3 | 1.024 | 31 | 79.86 |
| 6 | -976.8 | 13 | 3449.3 | 3 | -6.62 | 13 | 23.36 | 3 | 12.70 | 3 | 1.020 | 31 | 79.84 |
| 7 | -957.6 | 12 | 3444.6 | 3 | -6.48 | 12 | 23.33 | 3 | 12.70 | 3 | 1.015 | 31 | 79.85 |
| 8 | -935.0 | 12 | 3446.3 | 3 | -6.33 | 12 | 23.34 | 3 | 12.67 | 4 | 1.009 | 31 | 79.85 |
| 9 | -921.6 | 12 | 3434.3 | 4 | -6.24 | 12 | 23.26 | 4 | 12.61 | 4 | 1.003 | 31 | 79.84 |
| 10 | -913.8 | 12 | 3435.4 | 4 | -6.19 | 12 | 23.27 | 4 | 12.61 | 4 | 1.000 | 30 | 79.80 |
| 11 | -913.9 | 12 | 3432.2 | 4 | -6.19 | 12 | 23.24 | 4 | 12.56 | 4 | 0.998 | 30 | 79.72 |
| 12 | -912.5 | 11 | 3417.2 | 4 | -6.18 | 11 | 23.14 | 4 | 12.51 | 4 | 0.994 | 30 | 79.56 |
| 13 | -899.1 | 11 | 3422.7 | 5 | -6.09 | 11 | 23.18 | 5 | 12.49 | 5 | 0.992 | 29 | 79.53 |
| 14 | -874.0 | 11 | 3417.7 | 5 | -5.92 | 11 | 23.15 | 5 | 12.43 | 5 | 0.993 | 29 | 79.47 |
| 15 | -855.5 | 11 | 3409.6 | 5 | -5.79 | 11 | 23.09 | 5 | 12.38 | 5 | 0.992 | 29 | 79.23 |
| 16 | -859.9 | 11 | 3412.8 | 5 | -5.82 | 11 | 23.11 | 5 | 12.33 | 5 | 0.990 | 29 | 78.65 |
| 17 | -903.4 | 10 | 3401.0 | 5 | -6.12 | 10 | 23.03 | 5 | 12.24 | 5 | 0.986 | 29 | 77.77 |
| 18 | -965.0 | 10 | 3384.8 | 6 | -6.54 | 10 | 22.92 | 6 | 12.17 | 6 | 0.981 | 29 | 76.58 |
| 19 | -1008.8 | 10 | 3372.1 | 6 | -6.83 | 10 | 22.84 | 6 | 12.10 | 6 | 0.975 | 29 | 75.02 |
| 20 | -1005.5 | 10 | 3345.2 | 6 | -6.81 | 10 | 22.65 | 6 | 11.98 | 6 | 0.970 | 28 | 73.20 |
| 21 | -932.5 | 10 | 3316.9 | 6 | -6.31 | 10 | 22.46 | 6 | 11.88 | 6 | 0.967 | 28 | 71.02 |
| 22 | -774.5 | 10 | 3288.7 | 6 | -5.25 | 10 | 22.27 | 6 | 11.79 | 6 | 0.965 | 27 | 68.42 |
| 23 | -539.2 | 9 | 3247.0 | 6 | -3.65 | 9 | 21.99 | 6 | 11.66 | 7 | 0.964 | 27 | 65.36 |
| 24 | -375.1 | 9 | 3203.2 | 7 | -2.54 | 9 | 21.69 | 7 | 11.56 | 7 | 0.964 | 27 | 61.91 |
| 25 | -493.9 | 9 | 3146.5 | 7 | -3.34 | 9 | 21.31 | 7 | 11.56 | 7 | 0.964 | 27 | 58.17 |
| 26 | -627.8 | 9 | 3027.2 | 7 | -4.25 | 9 | 20.50 | 7 | 12.04 | 7 | 0.964 | 27 | 54.00 |
| 27 | -676.7 | 8 | 2743.4 | 7 | -4.58 | 8 | 18.58 | 7 | 13.99 | 8 | 0.964 | 27 | 49.34 |
| 28 | -541.1 | 8 | 2207.4 | 7 | -3.66 | 8 | 14.95 | 7 | 16.64 | 8 | 0.963 | 26 | 44.15 |
| 29 | -72.8 | 8 | 1403.4 | 7 | -0.49 | 8 | 9.50 | 7 | 17.95 | 8 | 0.962 | 26 | 41.38 |

(Eq) Strokes Analyzed and Last Return (ft):
 11.25 8.37 8.55 8.53

Max. Combustion Pressure 1481.0 psi

Rut= 1200.0, Rtoe = 480.0 kips, Time Inc. =0.087 ms

| No | mxTForce | t | mxCForce | t | mxTStrss | t | mxCStrss | t | max V | t | max D | t | max Et |
|----|----------|----|----------|----|----------|----|----------|----|-------|----|-------|----|--------|
| | kips | ms | kips | ms | ksi | ms | ksi | ms | ft/s | ms | inch | ms | kip-ft |
| 1 | 0.0 | 0 | 3737.8 | 2 | 0.00 | 0 | 25.31 | 2 | 13.84 | 2 | 0.617 | 18 | 76.09 |
| 2 | -120.7 | 13 | 3736.6 | 2 | -0.82 | 13 | 25.31 | 2 | 13.81 | 2 | 0.613 | 14 | 75.56 |
| 3 | -202.0 | 13 | 3748.0 | 2 | -1.37 | 13 | 25.38 | 2 | 13.84 | 3 | 0.607 | 14 | 75.30 |
| 4 | -235.7 | 13 | 3749.2 | 3 | -1.60 | 13 | 25.39 | 3 | 13.79 | 3 | 0.601 | 15 | 75.08 |
| 5 | -232.7 | 13 | 3742.0 | 3 | -1.58 | 13 | 25.34 | 3 | 13.78 | 3 | 0.596 | 15 | 74.95 |
| 6 | -205.1 | 12 | 3749.0 | 3 | -1.39 | 12 | 25.39 | 3 | 13.76 | 3 | 0.591 | 15 | 74.81 |
| 7 | -239.4 | 34 | 3738.7 | 3 | -1.62 | 34 | 25.32 | 3 | 13.68 | 3 | 0.585 | 15 | 74.63 |
| 8 | -274.6 | 34 | 3739.6 | 3 | -1.86 | 34 | 25.33 | 3 | 13.68 | 4 | 0.577 | 15 | 74.34 |
| 9 | -303.8 | 34 | 3738.1 | 4 | -2.06 | 34 | 25.32 | 4 | 13.63 | 4 | 0.568 | 15 | 73.92 |
| 10 | -327.2 | 34 | 3722.1 | 4 | -2.22 | 34 | 25.21 | 4 | 13.58 | 4 | 0.558 | 16 | 73.40 |
| 11 | -343.1 | 34 | 3729.6 | 4 | -2.32 | 34 | 25.26 | 4 | 13.56 | 4 | 0.547 | 16 | 72.82 |
| 12 | -378.4 | 32 | 3723.8 | 4 | -2.56 | 32 | 25.22 | 4 | 13.49 | 4 | 0.538 | 14 | 72.49 |
| 13 | -424.9 | 32 | 3714.1 | 5 | -2.88 | 32 | 25.15 | 5 | 13.45 | 5 | 0.530 | 14 | 72.17 |
| 14 | -459.1 | 33 | 3719.7 | 5 | -3.11 | 33 | 25.19 | 5 | 13.40 | 5 | 0.522 | 14 | 71.82 |
| 15 | -480.2 | 33 | 3716.7 | 5 | -3.25 | 33 | 25.17 | 5 | 13.29 | 5 | 0.513 | 14 | 71.31 |
| 16 | -483.9 | 33 | 3714.8 | 5 | -3.28 | 33 | 25.16 | 5 | 13.20 | 5 | 0.504 | 14 | 70.46 |
| 17 | -467.7 | 33 | 3708.9 | 5 | -3.17 | 33 | 25.12 | 5 | 13.09 | 5 | 0.494 | 14 | 69.20 |
| 18 | -434.8 | 33 | 3682.0 | 5 | -2.94 | 33 | 24.94 | 5 | 12.92 | 6 | 0.484 | 14 | 67.59 |
| 19 | -393.5 | 33 | 3658.2 | 6 | -2.66 | 33 | 24.77 | 6 | 12.76 | 6 | 0.474 | 14 | 65.64 |
| 20 | -376.9 | 34 | 3622.5 | 6 | -2.55 | 34 | 24.53 | 6 | 12.58 | 6 | 0.465 | 13 | 63.37 |
| 21 | -381.2 | 34 | 3567.5 | 6 | -2.58 | 34 | 24.16 | 6 | 12.35 | 6 | 0.455 | 13 | 60.79 |
| 22 | -360.9 | 34 | 3521.3 | 6 | -2.44 | 34 | 23.85 | 6 | 12.12 | 6 | 0.446 | 13 | 57.89 |
| 23 | -303.1 | 34 | 3457.7 | 6 | -2.05 | 34 | 23.42 | 6 | 11.89 | 7 | 0.437 | 13 | 54.68 |
| 24 | -214.0 | 34 | 3377.4 | 7 | -1.45 | 34 | 22.87 | 7 | 11.63 | 7 | 0.428 | 15 | 51.22 |
| 25 | -144.0 | 31 | 3291.2 | 7 | -0.98 | 31 | 22.29 | 7 | 11.46 | 7 | 0.421 | 15 | 47.57 |
| 26 | -135.7 | 35 | 3136.7 | 7 | -0.92 | 35 | 21.24 | 7 | 11.73 | 7 | 0.414 | 15 | 43.66 |
| 27 | -113.5 | 35 | 2823.0 | 7 | -0.77 | 35 | 19.12 | 7 | 13.21 | 8 | 0.408 | 15 | 39.40 |
| 28 | -57.7 | 35 | 2266.2 | 7 | -0.39 | 35 | 15.35 | 7 | 15.04 | 8 | 0.402 | 15 | 34.71 |
| 29 | 0.0 | 0 | 1533.8 | 8 | 0.00 | 0 | 10.39 | 8 | 15.46 | 8 | 0.397 | 15 | 32.20 |

(Eq) Strokes Analyzed and Last Return (ft):
 11.25 9.47 9.49

Max. Combustion Pressure 1481.0 psi

Rut= 1400.0, Rtoe = 560.0 kips, Time Inc. =0.087 ms

| No | mxTForce | t | mxCForce | t | mxTStrss | t | mxCStrss | t | max V | t | max D | t | max Et |
|----|----------|----|----------|----|----------|----|----------|----|-------|----|-------|----|--------|
| | kips | ms | kips | ms | ksi | ms | ksi | ms | ft/s | ms | inch | ms | kip-ft |
| 1 | 0.0 | 0 | 3783.3 | 2 | 0.00 | 0 | 25.62 | 2 | 13.99 | 2 | 0.582 | 14 | 76.80 |
| 2 | -34.4 | 28 | 3796.4 | 2 | -0.23 | 28 | 25.71 | 2 | 14.04 | 2 | 0.578 | 14 | 76.70 |
| 3 | -105.5 | 28 | 3803.3 | 2 | -0.71 | 28 | 25.76 | 2 | 14.01 | 2 | 0.571 | 14 | 76.47 |
| 4 | -111.7 | 28 | 3795.4 | 3 | -0.76 | 28 | 25.70 | 3 | 13.99 | 3 | 0.563 | 14 | 76.14 |
| 5 | -120.7 | 33 | 3805.7 | 3 | -0.82 | 33 | 25.77 | 3 | 13.98 | 3 | 0.555 | 14 | 75.79 |
| 6 | -168.9 | 31 | 3797.1 | 3 | -1.14 | 31 | 25.72 | 3 | 13.90 | 3 | 0.547 | 13 | 75.50 |
| 7 | -221.5 | 31 | 3797.5 | 3 | -1.50 | 31 | 25.72 | 3 | 13.91 | 3 | 0.540 | 13 | 75.23 |
| 8 | -265.1 | 31 | 3797.3 | 3 | -1.80 | 31 | 25.72 | 3 | 13.86 | 3 | 0.532 | 13 | 74.92 |
| 9 | -304.7 | 31 | 3781.3 | 4 | -2.06 | 31 | 25.61 | 4 | 13.80 | 4 | 0.524 | 13 | 74.58 |
| 10 | -344.2 | 32 | 3789.2 | 4 | -2.33 | 32 | 25.66 | 4 | 13.79 | 4 | 0.515 | 13 | 74.19 |
| 11 | -382.8 | 32 | 3783.4 | 4 | -2.59 | 32 | 25.62 | 4 | 13.72 | 4 | 0.506 | 14 | 73.79 |
| 12 | -418.0 | 32 | 3773.6 | 4 | -2.83 | 32 | 25.56 | 4 | 13.68 | 4 | 0.498 | 14 | 73.48 |
| 13 | -446.4 | 32 | 3778.1 | 4 | -3.02 | 32 | 25.59 | 4 | 13.64 | 5 | 0.490 | 14 | 73.13 |
| 14 | -463.7 | 32 | 3771.2 | 5 | -3.14 | 32 | 25.54 | 5 | 13.54 | 5 | 0.481 | 14 | 72.75 |
| 15 | -467.6 | 32 | 3773.9 | 5 | -3.17 | 32 | 25.56 | 5 | 13.48 | 5 | 0.472 | 14 | 72.19 |
| 16 | -454.7 | 33 | 3777.6 | 5 | -3.08 | 33 | 25.58 | 5 | 13.37 | 5 | 0.462 | 13 | 71.26 |
| 17 | -426.1 | 33 | 3758.0 | 5 | -2.89 | 33 | 25.45 | 5 | 13.20 | 5 | 0.452 | 13 | 69.92 |
| 18 | -390.0 | 31 | 3742.2 | 5 | -2.64 | 31 | 25.34 | 5 | 13.05 | 6 | 0.442 | 13 | 68.21 |
| 19 | -385.6 | 31 | 3710.8 | 6 | -2.61 | 31 | 25.13 | 6 | 12.86 | 6 | 0.432 | 13 | 66.16 |
| 20 | -362.2 | 31 | 3659.2 | 6 | -2.45 | 31 | 24.78 | 6 | 12.62 | 6 | 0.423 | 13 | 63.77 |
| 21 | -319.9 | 32 | 3616.1 | 6 | -2.17 | 32 | 24.49 | 6 | 12.38 | 6 | 0.413 | 13 | 61.04 |
| 22 | -276.8 | 34 | 3552.7 | 6 | -1.87 | 34 | 24.06 | 6 | 12.13 | 6 | 0.404 | 12 | 57.98 |
| 23 | -219.3 | 34 | 3475.7 | 6 | -1.49 | 34 | 23.54 | 6 | 11.83 | 6 | 0.394 | 12 | 54.61 |
| 24 | -186.2 | 30 | 3399.9 | 7 | -1.26 | 30 | 23.03 | 7 | 11.52 | 7 | 0.385 | 12 | 51.00 |
| 25 | -148.0 | 30 | 3296.5 | 7 | -1.00 | 30 | 22.32 | 7 | 11.32 | 7 | 0.378 | 12 | 47.23 |
| 26 | -100.5 | 30 | 3131.3 | 7 | -0.68 | 30 | 21.21 | 7 | 11.52 | 7 | 0.372 | 11 | 43.27 |
| 27 | -44.4 | 30 | 2811.3 | 7 | -0.30 | 30 | 19.04 | 7 | 12.83 | 7 | 0.367 | 11 | 38.97 |
| 28 | 0.0 | 0 | 2266.9 | 7 | 0.00 | 0 | 15.35 | 7 | 14.45 | 8 | 0.362 | 11 | 34.21 |
| 29 | 0.0 | 0 | 1558.4 | 8 | 0.00 | 0 | 10.55 | 8 | 14.67 | 8 | 0.357 | 11 | 31.66 |

(Eq) Strokes Analyzed and Last Return (ft):
 11.25 9.67 9.68

Max. Combustion Pressure 1481.0 psi

Rut= 1600.0, Rtoe = 640.0 kips, Time Inc. =0.087 ms

| No | mxTForce | t | mxCForce | t | mxTStrss | t | mxCStrss | t | max V | t | max D | t | max Et |
|----|----------|----|----------|----|----------|----|----------|----|-------|----|-------|----|--------|
| | kip | ms | kip | ms | ksi | ms | ksi | ms | ft/s | ms | inch | ms | kip-ft |
| 1 | 0.0 | 0 | 3831.0 | 2 | 0.00 | 0 | 25.94 | 2 | 14.20 | 2 | 0.555 | 14 | 77.69 |
| 2 | -51.3 | 28 | 3846.8 | 2 | -0.35 | 28 | 26.05 | 2 | 14.20 | 2 | 0.551 | 14 | 77.59 |
| 3 | -119.1 | 28 | 3842.5 | 2 | -0.81 | 28 | 26.02 | 2 | 14.16 | 3 | 0.545 | 14 | 77.38 |
| 4 | -127.2 | 28 | 3851.5 | 3 | -0.86 | 28 | 26.08 | 3 | 14.18 | 3 | 0.538 | 13 | 77.13 |
| 5 | -188.9 | 30 | 3850.9 | 3 | -1.28 | 30 | 26.08 | 3 | 14.12 | 3 | 0.531 | 13 | 76.89 |
| 6 | -244.4 | 31 | 3842.5 | 3 | -1.65 | 31 | 26.02 | 3 | 14.10 | 3 | 0.525 | 13 | 76.64 |
| 7 | -285.0 | 31 | 3849.0 | 3 | -1.93 | 31 | 26.07 | 3 | 14.08 | 3 | 0.517 | 13 | 76.36 |
| 8 | -312.1 | 31 | 3838.4 | 3 | -2.11 | 31 | 26.00 | 3 | 13.99 | 4 | 0.509 | 13 | 76.04 |
| 9 | -330.5 | 31 | 3838.4 | 4 | -2.24 | 31 | 26.00 | 4 | 13.99 | 4 | 0.501 | 13 | 75.66 |
| 10 | -345.4 | 31 | 3837.5 | 4 | -2.34 | 31 | 25.99 | 4 | 13.94 | 4 | 0.491 | 12 | 75.24 |
| 11 | -360.1 | 32 | 3822.1 | 4 | -2.44 | 32 | 25.88 | 4 | 13.87 | 4 | 0.482 | 12 | 74.77 |
| 12 | -373.2 | 32 | 3828.8 | 4 | -2.53 | 32 | 25.93 | 4 | 13.85 | 4 | 0.472 | 12 | 74.27 |
| 13 | -381.9 | 32 | 3824.4 | 4 | -2.59 | 32 | 25.90 | 4 | 13.78 | 5 | 0.462 | 12 | 73.76 |
| 14 | -384.4 | 32 | 3815.5 | 5 | -2.60 | 32 | 25.84 | 5 | 13.71 | 5 | 0.451 | 12 | 73.24 |
| 15 | -379.7 | 32 | 3828.3 | 5 | -2.57 | 32 | 25.93 | 5 | 13.63 | 5 | 0.441 | 12 | 72.55 |
| 16 | -362.5 | 32 | 3823.4 | 5 | -2.46 | 32 | 25.89 | 5 | 13.49 | 5 | 0.430 | 11 | 71.47 |
| 17 | -346.8 | 31 | 3810.9 | 5 | -2.35 | 31 | 25.81 | 5 | 13.33 | 5 | 0.419 | 11 | 69.93 |
| 18 | -339.1 | 31 | 3791.1 | 5 | -2.30 | 31 | 25.67 | 5 | 13.16 | 6 | 0.407 | 11 | 67.99 |
| 19 | -320.1 | 31 | 3747.6 | 6 | -2.17 | 31 | 25.38 | 6 | 12.92 | 6 | 0.397 | 12 | 65.79 |
| 20 | -291.8 | 29 | 3705.5 | 6 | -1.98 | 29 | 25.09 | 6 | 12.66 | 6 | 0.387 | 12 | 63.27 |
| 21 | -264.3 | 29 | 3648.1 | 6 | -1.79 | 29 | 24.71 | 6 | 12.40 | 6 | 0.378 | 10 | 60.50 |
| 22 | -229.8 | 30 | 3569.6 | 6 | -1.56 | 30 | 24.17 | 6 | 12.09 | 6 | 0.370 | 10 | 57.41 |
| 23 | -188.2 | 30 | 3497.7 | 6 | -1.27 | 30 | 23.69 | 6 | 11.74 | 6 | 0.361 | 10 | 53.97 |
| 24 | -143.4 | 30 | 3405.7 | 7 | -0.97 | 30 | 23.06 | 7 | 11.43 | 7 | 0.352 | 10 | 50.22 |
| 25 | -120.5 | 24 | 3288.0 | 7 | -0.82 | 24 | 22.27 | 7 | 11.17 | 7 | 0.345 | 11 | 46.36 |
| 26 | -108.3 | 23 | 3114.8 | 7 | -0.73 | 23 | 21.09 | 7 | 11.29 | 7 | 0.339 | 11 | 42.33 |
| 27 | -58.2 | 23 | 2797.3 | 7 | -0.39 | 23 | 18.94 | 7 | 12.46 | 7 | 0.333 | 11 | 37.94 |
| 28 | 0.0 | 0 | 2258.1 | 7 | 0.00 | 0 | 15.29 | 7 | 13.88 | 8 | 0.328 | 11 | 33.11 |
| 29 | 0.0 | 0 | 1582.1 | 8 | 0.00 | 0 | 10.71 | 8 | 13.96 | 8 | 0.322 | 11 | 30.51 |

(Eq) Strokes Analyzed and Last Return (ft):
 11.25 9.81 9.82

Max. Combustion Pressure 1481.0 psi

Rut= 1800.0, Rtoe = 720.0 kips, Time Inc. =0.087 ms

| No | mxTForce | t | mxCForce | t | mxTStrss | t | mxCStrss | t | max V | t | max D | t | max Et |
|----|----------|----|----------|----|----------|----|----------|----|-------|----|-------|----|--------|
| | kips | ms | kips | ms | ksi | ms | ksi | ms | ft/s | ms | inch | ms | kip-ft |
| 1 | 0.0 | 0 | 3872.8 | 2 | 0.00 | 0 | 26.23 | 2 | 14.32 | 2 | 0.535 | 14 | 78.21 |
| 2 | -63.6 | 28 | 3870.1 | 2 | -0.43 | 28 | 26.21 | 2 | 14.30 | 2 | 0.531 | 13 | 78.11 |
| 3 | -123.6 | 28 | 3886.3 | 2 | -0.84 | 28 | 26.32 | 2 | 14.32 | 2 | 0.525 | 13 | 77.94 |
| 4 | -135.0 | 30 | 3885.4 | 3 | -0.91 | 30 | 26.31 | 3 | 14.26 | 3 | 0.519 | 13 | 77.74 |
| 5 | -195.3 | 30 | 3882.3 | 3 | -1.32 | 30 | 26.29 | 3 | 14.27 | 3 | 0.513 | 13 | 77.53 |
| 6 | -238.9 | 30 | 3887.4 | 3 | -1.62 | 30 | 26.33 | 3 | 14.23 | 3 | 0.506 | 13 | 77.29 |
| 7 | -266.2 | 31 | 3874.2 | 3 | -1.80 | 31 | 26.24 | 3 | 14.17 | 3 | 0.499 | 13 | 77.01 |
| 8 | -278.5 | 31 | 3880.0 | 3 | -1.89 | 31 | 26.28 | 3 | 14.16 | 3 | 0.491 | 12 | 76.67 |
| 9 | -280.3 | 31 | 3876.2 | 4 | -1.90 | 31 | 26.25 | 4 | 14.09 | 4 | 0.482 | 12 | 76.27 |
| 10 | -276.5 | 31 | 3864.3 | 4 | -1.87 | 31 | 26.17 | 4 | 14.05 | 4 | 0.472 | 12 | 75.82 |
| 11 | -271.7 | 31 | 3870.2 | 4 | -1.84 | 31 | 26.21 | 4 | 14.02 | 4 | 0.463 | 12 | 75.34 |
| 12 | -271.5 | 29 | 3862.0 | 4 | -1.84 | 29 | 26.15 | 4 | 13.93 | 4 | 0.453 | 12 | 74.84 |
| 13 | -287.4 | 30 | 3857.3 | 4 | -1.95 | 30 | 26.12 | 4 | 13.90 | 5 | 0.442 | 12 | 74.33 |
| 14 | -319.3 | 25 | 3861.8 | 5 | -2.16 | 25 | 26.15 | 5 | 13.84 | 5 | 0.432 | 11 | 73.79 |
| 15 | -359.0 | 25 | 3858.9 | 5 | -2.43 | 25 | 26.13 | 5 | 13.70 | 5 | 0.421 | 11 | 73.06 |
| 16 | -382.9 | 25 | 3864.3 | 5 | -2.59 | 25 | 26.17 | 5 | 13.59 | 5 | 0.410 | 11 | 71.90 |
| 17 | -383.9 | 25 | 3852.5 | 5 | -2.60 | 25 | 26.09 | 5 | 13.42 | 5 | 0.399 | 11 | 70.26 |
| 18 | -362.2 | 25 | 3816.3 | 5 | -2.45 | 25 | 25.85 | 5 | 13.18 | 5 | 0.387 | 11 | 68.23 |
| 19 | -320.5 | 25 | 3786.3 | 6 | -2.17 | 25 | 25.64 | 6 | 12.96 | 6 | 0.377 | 10 | 65.93 |
| 20 | -277.2 | 29 | 3731.9 | 6 | -1.88 | 29 | 25.27 | 6 | 12.69 | 6 | 0.368 | 10 | 63.35 |
| 21 | -230.4 | 29 | 3662.7 | 6 | -1.56 | 29 | 24.81 | 6 | 12.36 | 6 | 0.360 | 10 | 60.45 |
| 22 | -188.6 | 27 | 3592.2 | 6 | -1.28 | 27 | 24.33 | 6 | 12.02 | 6 | 0.351 | 10 | 57.15 |
| 23 | -156.6 | 24 | 3499.4 | 6 | -1.06 | 24 | 23.70 | 6 | 11.67 | 6 | 0.341 | 10 | 53.47 |
| 24 | -144.0 | 23 | 3397.2 | 7 | -0.97 | 23 | 23.01 | 7 | 11.30 | 7 | 0.330 | 10 | 49.45 |
| 25 | -127.8 | 23 | 3277.7 | 7 | -0.87 | 23 | 22.20 | 7 | 10.97 | 7 | 0.320 | 10 | 45.24 |
| 26 | -96.6 | 23 | 3094.3 | 7 | -0.65 | 23 | 20.96 | 7 | 11.03 | 7 | 0.311 | 10 | 40.94 |
| 27 | -35.2 | 23 | 2772.4 | 7 | -0.24 | 23 | 18.78 | 7 | 12.09 | 7 | 0.304 | 11 | 36.44 |
| 28 | 0.0 | 0 | 2237.6 | 7 | 0.00 | 0 | 15.15 | 7 | 13.31 | 8 | 0.298 | 11 | 31.58 |
| 29 | 0.0 | 0 | 1601.3 | 8 | 0.00 | 0 | 10.84 | 8 | 13.27 | 8 | 0.291 | 11 | 28.95 |

(Eq) Strokes Analyzed and Last Return (ft):
 11.25 9.95 9.94

Max. Combustion Pressure 1481.0 psi

Rut= 2000.0, Rtoe = 800.0 kips, Time Inc. =0.087 ms

| No | mxTForce | t | mxCForce | t | mxTStrss | t | mxCStrss | t | max V | t | max D | t | max Et |
|----|----------|----|----------|----|----------|----|----------|----|-------|----|-------|----|--------|
| | kips | ms | kips | ms | ksi | ms | ksi | ms | ft/s | ms | inch | ms | kip-ft |
| 1 | 0.0 | 0 | 3904.2 | 2 | 0.00 | 0 | 26.44 | 2 | 14.42 | 2 | 0.521 | 11 | 79.12 |
| 2 | -64.0 | 28 | 3912.3 | 2 | -0.43 | 28 | 26.50 | 2 | 14.46 | 2 | 0.514 | 13 | 78.72 |
| 3 | -115.3 | 28 | 3924.0 | 2 | -0.78 | 28 | 26.57 | 2 | 14.44 | 2 | 0.509 | 13 | 78.36 |
| 4 | -120.6 | 28 | 3912.2 | 3 | -0.82 | 28 | 26.49 | 3 | 14.40 | 3 | 0.503 | 13 | 78.18 |
| 5 | -164.1 | 30 | 3925.2 | 3 | -1.11 | 30 | 26.58 | 3 | 14.40 | 3 | 0.498 | 13 | 77.98 |
| 6 | -197.1 | 30 | 3920.2 | 3 | -1.33 | 30 | 26.55 | 3 | 14.33 | 3 | 0.491 | 13 | 77.75 |
| 7 | -216.2 | 30 | 3915.5 | 3 | -1.46 | 30 | 26.52 | 3 | 14.32 | 3 | 0.484 | 12 | 77.45 |
| 8 | -221.0 | 30 | 3918.9 | 3 | -1.50 | 30 | 26.54 | 3 | 14.28 | 3 | 0.475 | 12 | 77.10 |
| 9 | -232.1 | 27 | 3905.6 | 4 | -1.57 | 27 | 26.45 | 4 | 14.20 | 4 | 0.466 | 12 | 76.69 |
| 10 | -232.9 | 26 | 3909.3 | 4 | -1.58 | 26 | 26.47 | 4 | 14.20 | 4 | 0.457 | 12 | 76.23 |
| 11 | -274.3 | 24 | 3906.4 | 4 | -1.86 | 24 | 26.46 | 4 | 14.13 | 4 | 0.447 | 12 | 75.74 |
| 12 | -306.2 | 24 | 3892.1 | 4 | -2.07 | 24 | 26.36 | 4 | 14.07 | 4 | 0.437 | 12 | 75.24 |
| 13 | -326.3 | 24 | 3900.1 | 4 | -2.21 | 24 | 26.41 | 4 | 14.04 | 5 | 0.427 | 11 | 74.72 |
| 14 | -366.1 | 25 | 3896.5 | 5 | -2.48 | 25 | 26.39 | 5 | 13.94 | 5 | 0.416 | 11 | 74.17 |
| 15 | -406.9 | 25 | 3898.7 | 5 | -2.76 | 25 | 26.40 | 5 | 13.83 | 5 | 0.405 | 11 | 73.40 |
| 16 | -430.0 | 25 | 3906.2 | 5 | -2.91 | 25 | 26.45 | 5 | 13.70 | 5 | 0.394 | 11 | 72.17 |
| 17 | -431.1 | 25 | 3885.1 | 5 | -2.92 | 25 | 26.31 | 5 | 13.49 | 5 | 0.382 | 11 | 70.46 |
| 18 | -410.9 | 25 | 3860.0 | 5 | -2.78 | 25 | 26.14 | 5 | 13.26 | 6 | 0.372 | 10 | 68.37 |
| 19 | -373.7 | 25 | 3818.6 | 6 | -2.53 | 25 | 25.86 | 6 | 13.01 | 6 | 0.362 | 10 | 65.99 |
| 20 | -328.4 | 24 | 3750.7 | 6 | -2.22 | 24 | 25.40 | 6 | 12.69 | 6 | 0.353 | 10 | 63.28 |
| 21 | -281.4 | 24 | 3689.1 | 6 | -1.91 | 24 | 24.98 | 6 | 12.32 | 6 | 0.344 | 10 | 60.20 |
| 22 | -234.5 | 24 | 3603.4 | 6 | -1.59 | 24 | 24.40 | 6 | 11.98 | 6 | 0.335 | 10 | 56.68 |
| 23 | -195.5 | 24 | 3500.5 | 6 | -1.32 | 24 | 23.71 | 6 | 11.59 | 6 | 0.324 | 10 | 52.75 |
| 24 | -159.6 | 23 | 3396.4 | 7 | -1.08 | 23 | 23.00 | 7 | 11.17 | 7 | 0.312 | 10 | 48.47 |
| 25 | -122.4 | 23 | 3265.1 | 7 | -0.83 | 23 | 22.11 | 7 | 10.81 | 7 | 0.299 | 10 | 43.96 |
| 26 | -71.0 | 23 | 3074.3 | 7 | -0.48 | 23 | 20.82 | 7 | 10.81 | 7 | 0.288 | 10 | 39.41 |
| 27 | 0.0 | 0 | 2747.5 | 7 | 0.00 | 0 | 18.61 | 7 | 11.73 | 7 | 0.279 | 11 | 34.73 |
| 28 | 0.0 | 0 | 2220.7 | 7 | 0.00 | 0 | 15.04 | 7 | 12.81 | 8 | 0.271 | 11 | 29.83 |
| 29 | 0.0 | 0 | 1624.2 | 8 | 0.00 | 0 | 11.00 | 8 | 12.71 | 8 | 0.264 | 11 | 27.18 |

(Eq) Strokes Analyzed and Last Return (ft):
 11.25 10.07 10.06

Max. Combustion Pressure 1481.0 psi

Rut= 2200.0, Rtoe = 880.0 kips, Time Inc. =0.087 ms

| No | mxTForce | t | mxCForce | t | mxTStrss | t | mxCStrss | t | max V | t | max D | t | max Et |
|----|----------|----|----------|----|----------|----|----------|----|-------|----|-------|----|--------|
| | kips | ms | kips | ms | ksi | ms | ksi | ms | ft/s | ms | inch | ms | kip-ft |
| 1 | 0.0 | 0 | 3940.0 | 2 | 0.00 | 0 | 26.68 | 2 | 14.57 | 2 | 0.519 | 11 | 80.03 |
| 2 | -56.2 | 27 | 3943.4 | 2 | -0.38 | 27 | 26.71 | 2 | 14.52 | 2 | 0.510 | 11 | 79.61 |
| 3 | -100.3 | 27 | 3950.9 | 2 | -0.68 | 27 | 26.76 | 2 | 14.56 | 2 | 0.501 | 10 | 79.16 |
| 4 | -114.8 | 50 | 3956.5 | 3 | -0.78 | 50 | 26.79 | 3 | 14.52 | 3 | 0.491 | 10 | 78.68 |
| 5 | -148.6 | 50 | 3944.3 | 3 | -1.01 | 50 | 26.71 | 3 | 14.49 | 3 | 0.485 | 13 | 78.25 |
| 6 | -177.8 | 50 | 3955.6 | 3 | -1.20 | 50 | 26.79 | 3 | 14.48 | 3 | 0.478 | 12 | 78.01 |
| 7 | -202.4 | 50 | 3947.9 | 3 | -1.37 | 50 | 26.74 | 3 | 14.40 | 3 | 0.470 | 12 | 77.71 |
| 8 | -224.1 | 50 | 3945.0 | 3 | -1.52 | 50 | 26.72 | 3 | 14.39 | 3 | 0.462 | 12 | 77.34 |
| 9 | -244.6 | 50 | 3946.7 | 4 | -1.66 | 50 | 26.73 | 4 | 14.34 | 4 | 0.453 | 12 | 76.92 |
| 10 | -266.4 | 24 | 3932.5 | 4 | -1.80 | 24 | 26.63 | 4 | 14.27 | 4 | 0.443 | 12 | 76.45 |
| 11 | -310.0 | 24 | 3937.5 | 4 | -2.10 | 24 | 26.67 | 4 | 14.25 | 4 | 0.434 | 12 | 75.97 |
| 12 | -342.8 | 24 | 3934.2 | 4 | -2.32 | 24 | 26.64 | 4 | 14.18 | 4 | 0.424 | 11 | 75.47 |
| 13 | -365.5 | 24 | 3921.5 | 4 | -2.48 | 24 | 26.56 | 4 | 14.12 | 5 | 0.413 | 11 | 74.94 |
| 14 | -391.2 | 25 | 3931.5 | 5 | -2.65 | 25 | 26.63 | 5 | 14.06 | 5 | 0.403 | 11 | 74.38 |
| 15 | -432.2 | 25 | 3935.0 | 5 | -2.93 | 25 | 26.65 | 5 | 13.93 | 5 | 0.392 | 11 | 73.58 |
| 16 | -456.6 | 25 | 3934.5 | 5 | -3.09 | 25 | 26.65 | 5 | 13.76 | 5 | 0.380 | 11 | 72.29 |
| 17 | -459.0 | 25 | 3924.8 | 5 | -3.11 | 25 | 26.58 | 5 | 13.58 | 5 | 0.369 | 10 | 70.52 |
| 18 | -442.6 | 25 | 3885.1 | 5 | -3.00 | 25 | 26.31 | 5 | 13.31 | 5 | 0.358 | 10 | 68.36 |
| 19 | -418.3 | 23 | 3843.8 | 6 | -2.83 | 23 | 26.03 | 6 | 13.00 | 6 | 0.349 | 10 | 65.89 |
| 20 | -382.5 | 24 | 3781.8 | 6 | -2.59 | 24 | 25.61 | 6 | 12.69 | 6 | 0.340 | 10 | 63.04 |
| 21 | -345.9 | 24 | 3695.4 | 6 | -2.34 | 24 | 25.03 | 6 | 12.32 | 6 | 0.331 | 10 | 59.77 |
| 22 | -296.7 | 24 | 3612.2 | 6 | -2.01 | 24 | 24.46 | 6 | 11.90 | 6 | 0.321 | 10 | 56.06 |
| 23 | -235.1 | 23 | 3505.8 | 6 | -1.59 | 23 | 23.74 | 6 | 11.47 | 6 | 0.309 | 10 | 51.88 |
| 24 | -175.3 | 23 | 3380.9 | 7 | -1.19 | 23 | 22.90 | 7 | 11.04 | 7 | 0.295 | 10 | 47.33 |
| 25 | -113.7 | 23 | 3243.3 | 7 | -0.77 | 23 | 21.96 | 7 | 10.67 | 7 | 0.281 | 10 | 42.57 |
| 26 | -42.1 | 23 | 3042.6 | 7 | -0.29 | 23 | 20.61 | 7 | 10.59 | 7 | 0.268 | 10 | 37.76 |
| 27 | 0.0 | 0 | 2724.6 | 7 | 0.00 | 0 | 18.45 | 7 | 11.38 | 7 | 0.257 | 10 | 32.92 |
| 28 | 0.0 | 0 | 2207.7 | 7 | 0.00 | 0 | 14.95 | 7 | 12.33 | 7 | 0.248 | 10 | 27.97 |
| 29 | 0.0 | 0 | 1648.0 | 8 | 0.00 | 0 | 11.16 | 8 | 12.16 | 8 | 0.239 | 11 | 25.29 |

(Eq) Strokes Analyzed and Last Return (ft):
 11.25 10.18 10.18

Max. Combustion Pressure 1481.0 psi

Rut= 2400.0, Rtoe = 960.0 kips, Time Inc. =0.087 ms

| No | mxTForce | t | mxCForce | t | mxTStrss | t | mxCStrss | t | max V | t | max D | t | max Et |
|----|----------|----|----------|----|----------|----|----------|----|-------|----|-------|----|--------|
| | kips | ms | kips | ms | ksi | ms | ksi | ms | ft/s | ms | inch | ms | kip-ft |
| 1 | 0.0 | 0 | 3968.6 | 2 | 0.00 | 0 | 26.88 | 2 | 14.70 | 2 | 0.518 | 10 | 81.05 |
| 2 | -46.4 | 50 | 3986.8 | 2 | -0.31 | 50 | 27.00 | 2 | 14.71 | 2 | 0.509 | 10 | 80.62 |
| 3 | -91.7 | 50 | 3983.6 | 2 | -0.62 | 50 | 26.98 | 2 | 14.66 | 3 | 0.499 | 10 | 80.16 |
| 4 | -134.7 | 50 | 3992.5 | 3 | -0.91 | 50 | 27.04 | 3 | 14.68 | 3 | 0.489 | 10 | 79.68 |
| 5 | -175.3 | 50 | 3992.8 | 3 | -1.19 | 50 | 27.04 | 3 | 14.62 | 3 | 0.479 | 10 | 79.19 |
| 6 | -213.1 | 50 | 3983.7 | 3 | -1.44 | 50 | 26.98 | 3 | 14.60 | 3 | 0.469 | 10 | 78.68 |
| 7 | -248.0 | 50 | 3991.2 | 3 | -1.68 | 50 | 27.03 | 3 | 14.57 | 3 | 0.459 | 12 | 78.13 |
| 8 | -282.1 | 50 | 3980.7 | 3 | -1.91 | 50 | 26.96 | 3 | 14.48 | 4 | 0.451 | 12 | 77.62 |
| 9 | -316.2 | 50 | 3980.8 | 4 | -2.14 | 50 | 26.96 | 4 | 14.48 | 4 | 0.442 | 12 | 77.19 |
| 10 | -349.0 | 50 | 3980.4 | 4 | -2.36 | 50 | 26.96 | 4 | 14.42 | 4 | 0.432 | 12 | 76.72 |
| 11 | -379.4 | 50 | 3964.7 | 4 | -2.57 | 50 | 26.85 | 4 | 14.35 | 4 | 0.422 | 12 | 76.23 |
| 12 | -406.7 | 50 | 3972.4 | 4 | -2.75 | 50 | 26.90 | 4 | 14.33 | 4 | 0.412 | 11 | 75.73 |
| 13 | -430.7 | 50 | 3968.5 | 4 | -2.92 | 50 | 26.88 | 4 | 14.25 | 5 | 0.402 | 11 | 75.20 |
| 14 | -451.0 | 50 | 3961.0 | 5 | -3.05 | 50 | 26.83 | 5 | 14.17 | 5 | 0.391 | 11 | 74.61 |
| 15 | -467.7 | 50 | 3978.2 | 5 | -3.17 | 50 | 26.94 | 5 | 14.07 | 5 | 0.380 | 11 | 73.78 |
| 16 | -482.3 | 23 | 3974.4 | 5 | -3.27 | 23 | 26.92 | 5 | 13.87 | 5 | 0.368 | 11 | 72.45 |
| 17 | -505.6 | 23 | 3959.9 | 5 | -3.42 | 23 | 26.82 | 5 | 13.64 | 5 | 0.357 | 10 | 70.61 |
| 18 | -510.6 | 23 | 3929.2 | 5 | -3.46 | 23 | 26.61 | 5 | 13.39 | 6 | 0.347 | 10 | 68.39 |
| 19 | -495.1 | 23 | 3867.6 | 6 | -3.35 | 23 | 26.19 | 6 | 13.07 | 6 | 0.338 | 10 | 65.80 |
| 20 | -456.1 | 23 | 3809.0 | 6 | -3.09 | 23 | 25.80 | 6 | 12.68 | 6 | 0.329 | 10 | 62.80 |
| 21 | -399.9 | 24 | 3723.4 | 6 | -2.71 | 24 | 25.22 | 6 | 12.30 | 6 | 0.319 | 10 | 59.35 |
| 22 | -347.1 | 24 | 3618.6 | 6 | -2.35 | 24 | 24.51 | 6 | 11.87 | 6 | 0.308 | 10 | 55.41 |
| 23 | -273.6 | 23 | 3510.8 | 6 | -1.85 | 23 | 23.78 | 6 | 11.41 | 6 | 0.295 | 10 | 51.02 |
| 24 | -191.0 | 23 | 3382.9 | 7 | -1.29 | 23 | 22.91 | 7 | 10.94 | 7 | 0.281 | 10 | 46.25 |
| 25 | -109.1 | 23 | 3231.2 | 7 | -0.74 | 23 | 21.88 | 7 | 10.51 | 7 | 0.266 | 10 | 41.24 |
| 26 | -20.1 | 23 | 3029.5 | 7 | -0.14 | 23 | 20.52 | 7 | 10.40 | 7 | 0.251 | 10 | 36.19 |
| 27 | 0.0 | 0 | 2696.6 | 7 | 0.00 | 0 | 18.26 | 7 | 11.06 | 7 | 0.238 | 10 | 31.17 |
| 28 | 0.0 | 0 | 2191.9 | 7 | 0.00 | 0 | 14.84 | 7 | 11.91 | 8 | 0.227 | 10 | 26.15 |
| 29 | 0.0 | 0 | 1674.4 | 8 | 0.00 | 0 | 11.34 | 8 | 11.75 | 8 | 0.217 | 11 | 23.44 |

(Eq) Strokes Analyzed and Last Return (ft):
 11.25 10.30 10.27

Max. Combustion Pressure 1481.0 psi

Rut= 2600.0, Rtoe = 1040.0 kips, Time Inc. =0.087 ms

| No | mxTForce | t | mxCForce | t | mxTStrss | t | mxCStrss | t | max V | t | max D | t | max Et |
|----|----------|----|----------|----|----------|----|----------|----|-------|----|-------|----|--------|
| | kip | ms | kip | ms | ksi | ms | ksi | ms | ft/s | ms | inch | ms | kip-ft |
| 1 | 0.0 | 0 | 4002.6 | 2 | 0.00 | 0 | 27.11 | 2 | 14.80 | 2 | 0.517 | 10 | 81.89 |
| 2 | -48.3 | 50 | 4002.9 | 2 | -0.33 | 50 | 27.11 | 2 | 14.76 | 2 | 0.507 | 10 | 81.45 |
| 3 | -95.7 | 50 | 4016.6 | 2 | -0.65 | 50 | 27.20 | 2 | 14.80 | 2 | 0.498 | 10 | 80.99 |
| 4 | -141.7 | 50 | 4018.5 | 3 | -0.96 | 50 | 27.21 | 3 | 14.74 | 3 | 0.488 | 10 | 80.51 |
| 5 | -185.8 | 50 | 4012.2 | 3 | -1.26 | 50 | 27.17 | 3 | 14.73 | 3 | 0.478 | 10 | 80.01 |
| 6 | -228.0 | 50 | 4020.0 | 3 | -1.54 | 50 | 27.22 | 3 | 14.70 | 3 | 0.468 | 10 | 79.48 |
| 7 | -268.6 | 49 | 4008.4 | 3 | -1.82 | 49 | 27.15 | 3 | 14.62 | 3 | 0.457 | 10 | 78.92 |
| 8 | -308.7 | 49 | 4011.7 | 3 | -2.09 | 49 | 27.17 | 3 | 14.62 | 3 | 0.446 | 10 | 78.30 |
| 9 | -349.2 | 49 | 4009.9 | 4 | -2.36 | 49 | 27.16 | 4 | 14.56 | 4 | 0.435 | 9 | 77.65 |
| 10 | -385.5 | 49 | 3995.1 | 4 | -2.61 | 49 | 27.06 | 4 | 14.50 | 4 | 0.423 | 9 | 76.98 |
| 11 | -417.9 | 49 | 4003.3 | 4 | -2.83 | 49 | 27.11 | 4 | 14.47 | 4 | 0.412 | 11 | 76.41 |
| 12 | -448.4 | 49 | 3996.8 | 4 | -3.04 | 49 | 27.07 | 4 | 14.39 | 4 | 0.402 | 11 | 75.90 |
| 13 | -477.8 | 50 | 3990.1 | 4 | -3.24 | 50 | 27.02 | 4 | 14.34 | 5 | 0.392 | 11 | 75.35 |
| 14 | -504.3 | 50 | 3997.5 | 5 | -3.42 | 50 | 27.07 | 5 | 14.27 | 5 | 0.381 | 11 | 74.71 |
| 15 | -526.9 | 50 | 3999.3 | 5 | -3.57 | 50 | 27.08 | 5 | 14.11 | 5 | 0.370 | 11 | 73.78 |
| 16 | -544.8 | 23 | 4005.8 | 5 | -3.69 | 23 | 27.13 | 5 | 13.95 | 5 | 0.358 | 10 | 72.40 |
| 17 | -567.8 | 23 | 3990.4 | 5 | -3.85 | 23 | 27.02 | 5 | 13.72 | 5 | 0.347 | 10 | 70.51 |
| 18 | -568.3 | 23 | 3944.3 | 5 | -3.85 | 23 | 26.71 | 5 | 13.41 | 5 | 0.337 | 10 | 68.21 |
| 19 | -548.0 | 23 | 3899.2 | 6 | -3.71 | 23 | 26.41 | 6 | 13.06 | 6 | 0.328 | 10 | 65.51 |
| 20 | -504.7 | 22 | 3822.3 | 6 | -3.42 | 22 | 25.89 | 6 | 12.69 | 6 | 0.319 | 10 | 62.35 |
| 21 | -441.2 | 24 | 3730.2 | 6 | -2.99 | 24 | 25.26 | 6 | 12.26 | 6 | 0.309 | 10 | 58.71 |
| 22 | -380.2 | 23 | 3627.6 | 6 | -2.57 | 23 | 24.57 | 6 | 11.79 | 6 | 0.297 | 10 | 54.59 |
| 23 | -298.3 | 23 | 3503.5 | 6 | -2.02 | 23 | 23.73 | 6 | 11.28 | 6 | 0.283 | 10 | 49.99 |
| 24 | -199.3 | 23 | 3362.7 | 7 | -1.35 | 23 | 22.77 | 7 | 10.80 | 7 | 0.268 | 10 | 45.03 |
| 25 | -99.9 | 23 | 3207.9 | 7 | -0.68 | 23 | 21.72 | 7 | 10.37 | 7 | 0.252 | 10 | 39.86 |
| 26 | 0.0 | 0 | 2996.6 | 7 | 0.00 | 0 | 20.29 | 7 | 10.19 | 7 | 0.236 | 10 | 34.65 |
| 27 | 0.0 | 0 | 2675.0 | 7 | 0.00 | 0 | 18.12 | 7 | 10.75 | 7 | 0.222 | 10 | 29.52 |
| 28 | 0.0 | 0 | 2172.6 | 7 | 0.00 | 0 | 14.71 | 7 | 11.54 | 7 | 0.210 | 10 | 24.46 |
| 29 | 0.0 | 0 | 1690.8 | 8 | 0.00 | 0 | 11.45 | 8 | 11.32 | 7 | 0.200 | 10 | 21.72 |

(Eq) Strokes Analyzed and Last Return (ft):
 11.25 10.41 10.38

Max. Combustion Pressure 1481.0 psi

Rut= 2700.0, Rtoe = 1080.0 kips, Time Inc. =0.087 ms

| No | mxTForce | t | mxCForce | t | mxTStrss | t | mxCStrss | t | max V | t | max D | t | max Et |
|----|----------|----|----------|----|----------|----|----------|----|-------|----|-------|----|--------|
| | kips | ms | kips | ms | ksi | ms | ksi | ms | ft/s | ms | inch | ms | kip-ft |
| 1 | 0.0 | 0 | 4012.1 | 2 | 0.00 | 0 | 27.17 | 2 | 14.84 | 2 | 0.516 | 10 | 82.23 |
| 2 | -48.6 | 50 | 4020.5 | 2 | -0.33 | 50 | 27.23 | 2 | 14.81 | 2 | 0.507 | 10 | 81.79 |
| 3 | -96.6 | 50 | 4021.4 | 2 | -0.65 | 50 | 27.23 | 2 | 14.82 | 2 | 0.497 | 10 | 81.32 |
| 4 | -143.5 | 49 | 4032.0 | 3 | -0.97 | 49 | 27.31 | 3 | 14.80 | 3 | 0.487 | 10 | 80.84 |
| 5 | -189.2 | 49 | 4020.5 | 3 | -1.28 | 49 | 27.23 | 3 | 14.75 | 3 | 0.477 | 10 | 80.34 |
| 6 | -233.6 | 49 | 4029.2 | 3 | -1.58 | 49 | 27.29 | 3 | 14.75 | 3 | 0.467 | 10 | 79.80 |
| 7 | -277.5 | 49 | 4025.8 | 3 | -1.88 | 49 | 27.26 | 3 | 14.68 | 3 | 0.456 | 10 | 79.23 |
| 8 | -322.2 | 49 | 4016.4 | 3 | -2.18 | 49 | 27.20 | 3 | 14.65 | 3 | 0.445 | 9 | 78.60 |
| 9 | -366.5 | 49 | 4022.2 | 4 | -2.48 | 49 | 27.24 | 4 | 14.61 | 4 | 0.434 | 9 | 77.94 |
| 10 | -406.4 | 49 | 4011.6 | 4 | -2.75 | 49 | 27.17 | 4 | 14.51 | 4 | 0.422 | 9 | 77.28 |
| 11 | -441.2 | 49 | 4010.7 | 4 | -2.99 | 49 | 27.16 | 4 | 14.51 | 4 | 0.412 | 8 | 76.74 |
| 12 | -471.6 | 49 | 4011.2 | 4 | -3.19 | 49 | 27.16 | 4 | 14.45 | 4 | 0.402 | 8 | 76.23 |
| 13 | -499.5 | 49 | 3997.9 | 4 | -3.38 | 49 | 27.08 | 4 | 14.35 | 5 | 0.391 | 8 | 75.65 |
| 14 | -526.1 | 49 | 4007.1 | 5 | -3.56 | 49 | 27.14 | 5 | 14.31 | 5 | 0.380 | 8 | 74.99 |
| 15 | -550.4 | 49 | 4016.2 | 5 | -3.73 | 49 | 27.20 | 5 | 14.17 | 5 | 0.367 | 8 | 74.03 |
| 16 | -568.0 | 23 | 4012.3 | 5 | -3.85 | 23 | 27.17 | 5 | 13.95 | 5 | 0.354 | 9 | 72.45 |
| 17 | -590.5 | 23 | 4002.9 | 5 | -4.00 | 23 | 27.11 | 5 | 13.74 | 5 | 0.343 | 10 | 70.38 |
| 18 | -589.5 | 23 | 3958.7 | 5 | -3.99 | 23 | 26.81 | 5 | 13.43 | 5 | 0.333 | 10 | 68.04 |
| 19 | -567.9 | 23 | 3904.7 | 6 | -3.85 | 23 | 26.44 | 6 | 13.05 | 6 | 0.324 | 10 | 65.28 |
| 20 | -524.2 | 22 | 3831.0 | 6 | -3.55 | 22 | 25.94 | 6 | 12.67 | 6 | 0.314 | 10 | 62.04 |
| 21 | -456.1 | 24 | 3729.2 | 6 | -3.09 | 24 | 25.26 | 6 | 12.23 | 6 | 0.304 | 9 | 58.32 |
| 22 | -391.3 | 23 | 3625.5 | 6 | -2.65 | 23 | 24.55 | 6 | 11.76 | 6 | 0.292 | 9 | 54.08 |
| 23 | -305.9 | 23 | 3500.8 | 6 | -2.07 | 23 | 23.71 | 6 | 11.25 | 6 | 0.278 | 9 | 49.39 |
| 24 | -203.2 | 23 | 3356.7 | 7 | -1.38 | 23 | 22.73 | 7 | 10.74 | 7 | 0.262 | 10 | 44.37 |
| 25 | -100.5 | 23 | 3193.6 | 7 | -0.68 | 23 | 21.63 | 7 | 10.28 | 7 | 0.246 | 10 | 39.13 |
| 26 | 0.0 | 0 | 2985.1 | 7 | 0.00 | 0 | 20.22 | 7 | 10.11 | 7 | 0.229 | 10 | 33.87 |
| 27 | 0.0 | 0 | 2656.0 | 7 | 0.00 | 0 | 17.99 | 7 | 10.62 | 7 | 0.215 | 10 | 28.72 |
| 28 | 0.0 | 0 | 2161.6 | 7 | 0.00 | 0 | 14.64 | 7 | 11.35 | 7 | 0.203 | 10 | 23.67 |
| 29 | 0.0 | 0 | 1695.7 | 8 | 0.00 | 0 | 11.48 | 8 | 11.11 | 7 | 0.192 | 10 | 20.95 |

Activated Capacity 2657.1 k
 (Eq) Strokes Analyzed and Last Return (ft):
 11.25 10.45 10.41

Max. Combustion Pressure 1481.0 psi

| Rut | Bl Ct | Stroke (ft) | Ten Str | i | t | Comp Str | i | t | ENTHRU | Bl Rt | |
|--------|-------|-------------|---------|-------|----|----------|-------|---|--------|-------|------|
| kips | b/ft | down | up | | | ksi | | | kip-ft | b/min | |
| 600.0 | 14.6 | 8.55 | 8.53 | -6.83 | 19 | 10 | 23.40 | 3 | 2 | 80.0 | 40.4 |
| 1200.0 | 46.7 | 9.47 | 9.49 | -3.28 | 16 | 33 | 25.39 | 4 | 3 | 76.1 | 38.3 |
| 1400.0 | 55.3 | 9.67 | 9.68 | -3.17 | 15 | 32 | 25.77 | 5 | 3 | 76.8 | 37.9 |
| 1600.0 | 65.9 | 9.81 | 9.82 | -2.60 | 14 | 32 | 26.08 | 4 | 3 | 77.7 | 37.7 |
| 1800.0 | 79.4 | 9.95 | 9.94 | -2.60 | 17 | 25 | 26.33 | 6 | 3 | 78.2 | 37.4 |
| 2000.0 | 97.1 | 10.07 | 10.06 | -2.92 | 17 | 25 | 26.58 | 5 | 3 | 79.1 | 37.2 |
| 2200.0 | 121.0 | 10.18 | 10.18 | -3.11 | 17 | 25 | 26.79 | 4 | 3 | 80.0 | 37.0 |
| 2400.0 | 154.9 | 10.30 | 10.27 | -3.46 | 18 | 23 | 27.04 | 5 | 3 | 81.1 | 36.8 |
| 2600.0 | 201.4 | 10.41 | 10.38 | -3.85 | 18 | 23 | 27.22 | 6 | 3 | 81.9 | 36.6 |
| 2700.0 | 230.5 | 10.45 | 10.41 | -4.00 | 17 | 23 | 27.31 | 4 | 3 | 82.2 | 36.6 |