SPT Automatic Hammer Energy Measurement Report

Drill Rig Model: Geoprobe 3100GT
Serial Number: 3100GT201001
Terracon Company Drill Rig Asset Number: GP#478
August 26, 2021

Prepared for:
Terracon Consultants, Inc.
Salt Lake City Exploration Services

Prepared by:
Terracon Consultants, Inc.
Exploration Services Group

August 26, 2021

Terracon Company
6949 S Highland Dr.
Midvale, UT 840047

Attn: Mr. Kristopher Powell
E: kristopher.powell@terracon.com

Re: SPT Automatic Hammer Energy Measurement Report
Drill Rig DR#478; GeoProbe 3100GT
Project Number: HWXX0500

Dear Mr. Kristopher Powell:

This report provides the Energy Transfer Ratio (ETR) for the SPT automatic hammer found on drill rig model 3100GT; Drill Rig Asset Number DR#478 (Serial Number: 3100GT201001).

Table 1: Hammer Measurement Summary

Drill Rig Model	Serial No.	Drill Rig Year	Drill Rig No.	Energy Transfer Ratio (ETR)	Hammer Efficiency Correction (C_E)
3100GT	3100GT201001	2020	DR#478	96.6% ± 4.3%	1.61

If you have any questions concerning this summary, or if we may be of further service, please contact us.

Sincerely,
Terracon Consultants, Inc.

James Smith
National Exploration Manager

Marie Maher, P.G.
Regional Exploration Manager

Attachments:
Exhibit A: Measurement Information
Exhibit B: PDA SPT Analyzer Results

Exhibit A
Measurement Information

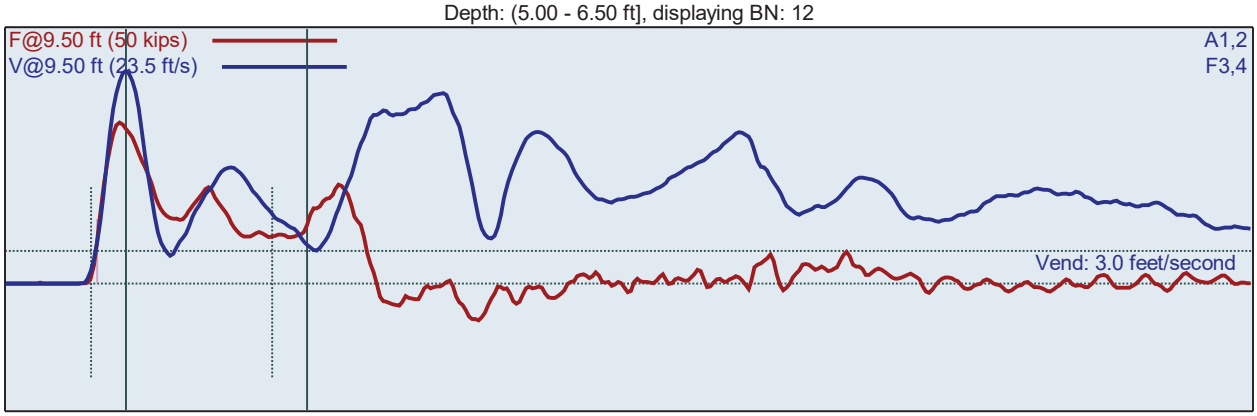
MEASUREMENT INFORMATION

ITEM	DESCRIPTION
Drill Rig Identification	Drill Rig Model: GP 3100GT Drill Rig Year: 2020 Drill Rig Asset No.: DR#478; Serial No. 3100GT201001
Drill Rig Owner	Terracon Salt Lake City, UT
Drill Rig Operator	Marshall Wayment; Terracon Salt Lake City Exploration
Testing Date	08/24/2021
Testing Location	Ogden project site
Boring Identification	B-1
Hammer Type	140 pounds (automatic)
Boring Method	Rotary Wash
Drill Rods	■ AWJ ■ 1 3/4” outside diameter ■ 3/16” wall thickness
Testing Equipment	■ 2 foot AWJ rod instrumented w/ 2 strain gauges and 2 accelerometers ■ Model SPT Analyzer™ (PDA)
ASTM Methods Used	**ASTM D1586**, Standard Test Method for Standard Penetration Test and Split-Barrel Sampling of Soils **ASTM D4633-16**, Standard Method for Energy Measurement for Dynamic Penetrometers
Personnel	Jim Smith – National Exploration Manager - Terracon Consultants, Inc.

Exhibit B
PDA SPT ANALYZER RESULTS

HW478 5-6.5
Jim Smith Test date: 8/24/2021
AR: 1.19 in^2 SP: 0.492 k/ft3
LE: 9.50 ft EM: 30000 ksi
WS: 16807.9 ft/s

Depth: (5.00 - 6.50 ft], displaying BN: 12



F3 : [454AWJ2] 204.95 PDICAL (1) FF1
F4 : [454AWJ1] 206.01 PDICAL (1) FF1

A1 (PR): [K4484] 361.048 mv/6.4v/5000g (1) VF1
A2 (PR): [K10492] 421.636 mv/6.4v/5000g (1) VF1

FMX: Maximum Force
VMX: Maximum Velocity
BPM: Blows/Minute

EFV: Maximum Energy
ETR: Energy Transfer Ratio - Rated

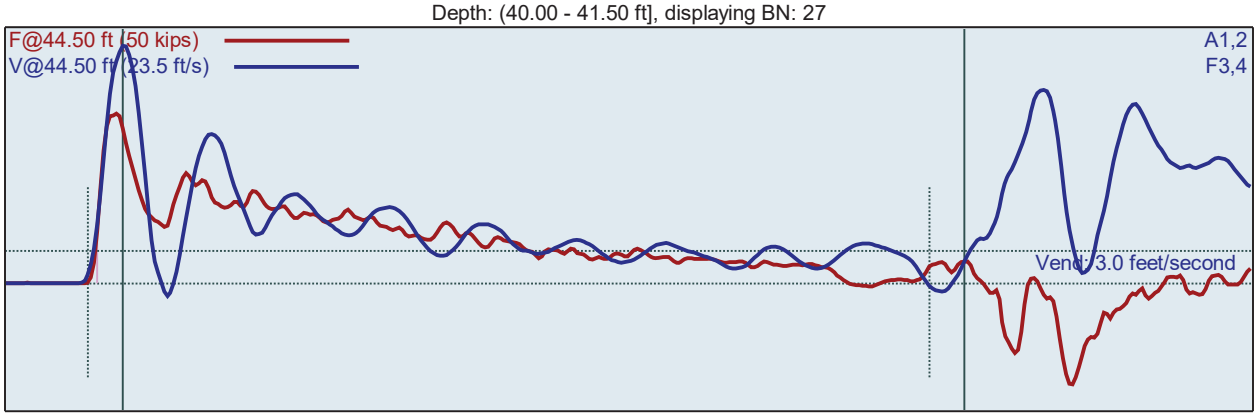
BL#	BC /6"	FMX kips	VMX ft/s	BPM bpm	EFV ft-lb	ETR %
1	2	33	20.1	1.9	353	100.7
2	2	34	21.0	47.8	338	96.4
3	5	36	22.3	48.3	337	96.3
4	5	36	22.6	48.5	318	90.9
5	5	36	22.7	48.3	320	91.4
6	5	34	21.2	48.6	325	92.9
7	5	35	21.9	48.2	311	88.8
8	7	34	21.5	48.2	345	98.7
9	7	34	21.1	48.4	331	94.7
10	7	34	21.6	48.4	340	97.1
11	7	34	21.5	48.4	340	97.0
12	7	31	19.6	48.6	321	91.8
13	7	34	21.8	48.0	309	88.4
14	7	31	19.2	48.5	305	87.0
Average		34	21.4	48.4	325	92.9
Std Dev		2	1.0	0.2	13	3.7
Maximum		36	22.7	48.6	345	98.7
Minimum		31	19.2	48.0	305	87.0

N-value: 12

Sample Interval Time: 18.59 seconds.

HW478 5-6.5
Jim Smith Test date: 8/24/2021
AR: 1.19 in^2 SP: 0.492 k/ft3
LE: 44.50 ft EM: 30000 ksi
WS: 16807.9 ft/s

Depth: (40.00 - 41.50 ft], displaying BN: 27



F3 : [454AWJ2] 204.95 PDICAL (1) FF1
F4 : [454AWJ1] 206.01 PDICAL (1) FF1

A1 (PR): [K4484] 361.048 mv/6.4v/5000g (1) VF1
A2 (PR): [K10492] 421.636 mv/6.4v/5000g (1) VF1

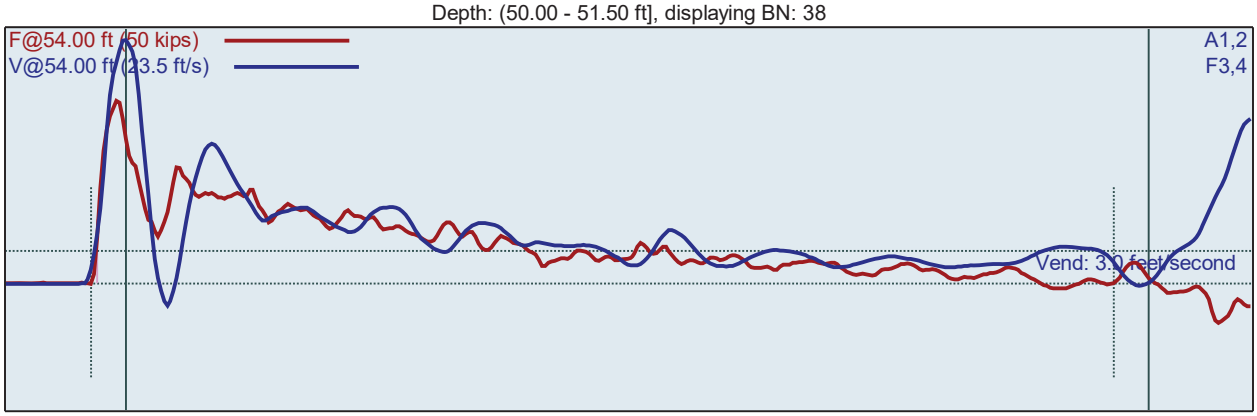
BL#	BC /6"	FMX kips	VMX ft/s	BPM bpm	EFV ft-lb	ETR %
15	5	35	22.1	1.9	339	96.9
16	5	34	21.5	48.0	339	97.0
17	5	35	22.3	48.2	341	97.5
18	5	35	22.3	48.2	346	98.8
19	5	34	22.0	48.4	347	99.2
20	5	36	22.5	48.3	343	98.0
21	5	33	21.2	48.3	331	94.6
22	5	35	22.2	48.6	334	95.4
23	5	35	22.2	48.3	344	98.2
24	5	32	21.2	48.3	338	96.5
25	5	33	21.3	48.3	343	97.9
26	5	34	22.0	48.3	342	97.6
27	5	33	21.9	48.4	349	99.6
28	5	33	22.0	47.9	346	99.0
29	5	32	21.4	48.6	345	98.6
	Average	34	21.8	48.3	341	97.5
	Std Dev	1	0.4	0.2	5	1.5
	Maximum	36	22.5	48.6	349	99.6
	Minimum	32	21.2	47.9	331	94.6

N-value: 10

Sample Interval Time: 19.94 seconds.

HW478 5-6.5
Jim Smith Test date: 8/24/2021
AR: 1.19 in^2 SP: 0.492 k/ft3
LE: 54.00 ft EM: 30000 ksi
WS: 16807.9 ft/s

Depth: (50.00 - 51.50 ft], displaying BN: 38



F3 : [454AWJ2] 204.95 PDICAL (1) FF1
F4 : [454AWJ1] 206.01 PDICAL (1) FF1

A1 (PR): [K4484] 361.048 mv/6.4v/5000g (1) VF1
A2 (PR): [K10492] 421.636 mv/6.4v/5000g (1) VF1

BL#	BC /6"	FMX kips	VMX ft/s	BPM bpm	EFV ft-lb	ETR %
30	1	36	23.1	28.3	397	113.5
31	4	33	21.2	47.3	340	97.2
32	4	32	21.2	48.0	357	102.0
33	4	30	20.4	48.7	332	94.7
34	4	32	20.8	6.5	336	96.1
35	6	32	20.9	47.9	352	100.5
36	6	32	21.0	48.0	356	101.8
37	6	35	22.2	48.1	371	106.0
38	6	36	22.4	7.2	362	103.5
39	6	31	20.7	47.5	345	98.7
40	6	32	21.1	48.2	352	100.6
	Average	33	21.2	39.7	350	100.1
	Std Dev	2	0.6	16.4	12	3.3
	Maximum	36	22.4	48.7	371	106.0
	Minimum	30	20.4	6.5	332	94.7

N-value: 10

Sample Interval Time: 28.75 seconds.

Summary of SPT Test Results

Project: HW478, Test Date: 8/24/2021

FMX: Maximum Force
VMX: Maximum Velocity
BPM: Blows/Minute

EFV: Maximum Energy
ETR: Energy Transfer Ratio - Rated

Instr. Length ft	Blows Applied /6"	**N Value**	**N60 Value**	Average FMX kips	Average VMX ft/s	Average BPM bpm	Average EFV ft-lb	Average ETR %
9.50	**2-5-7**	**12**	**19**	34	21.4	48.4	325	92.9
44.50	**5-5-5**	**10**	**16**	34	21.8	48.3	341	97.5
54.00	**1-4-6**	**10**	**16**	33	21.2	39.7	350	100.1
		Overall Average Values:		34	21.5	45.7	338	96.6
		Standard Deviation:		2	0.8	10.0	15	4.3
		Overall Maximum Value:		36	22.7	48.7	371	106.0
		Overall Minimum Value:		30	19.2	6.5	305	87.0

Certificate of Calibration

Pile Dynamics, Inc. certifies that the

Pile Driving Analyzer®, Model SPT

Serial Number: 4535 TB

was calibrated on 28 Apr 2020

using a PDA Calibration Box whose output was calibrated with test equipment traceable to NIST.

This certificate is valid for 2 years from above date.

SEAL OHIO

Tested by: MAP

Pile Dynamics, Inc.
30725 Aurora Road
Cleveland, Ohio 44139 USA

Accelerometer Calibration Certificate
Pile Dynamics, Inc.

Calibrated by Pile Dynamics, Inc.
Calibration performed on 21Apr2020

Serial No:	K4483	**Temperature:**	22.3 °C
Model:	PR	**Humidity:**	28%
Calibrated on:	Channel 3 on 8G 5061 LE		

Ref Acc 1:	65538! 1040 g's/volt	**Cal on:**	27Jan2020
Ref Acc 2:	64648! 984 g's/volt	**Cal on:**	27Jan2020

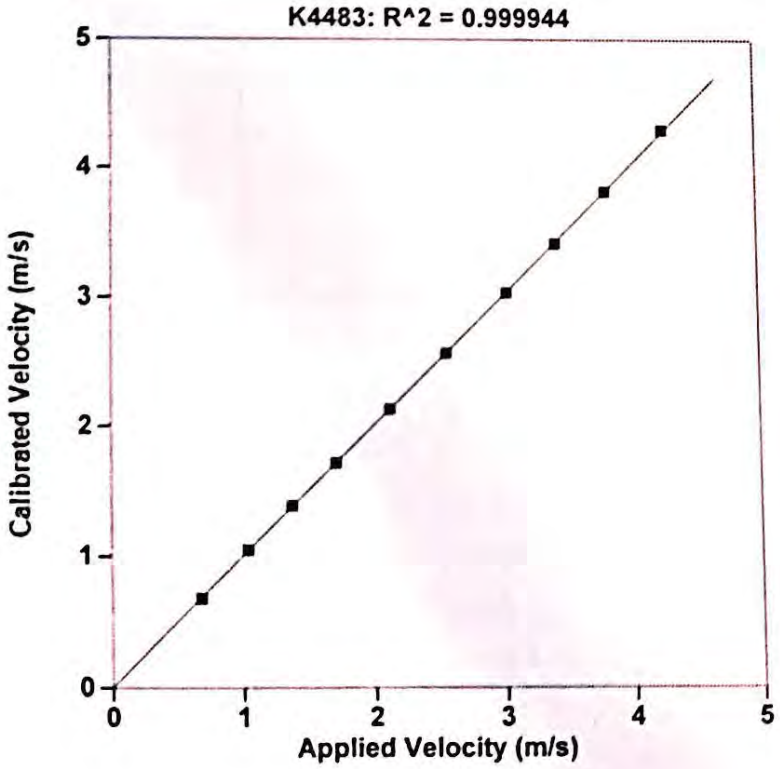
Reference accelerometer calibrations are traceable to the United States National Institute of Standards and Technology (NIST).

PDA CALIBRATION FACTOR

406.4 mv/5000g
(81.3 µv/g)
R^2: 0.999944 [Chip programmed]

Operator: Will

Signed



Reference Velocity	S/N K4483 Velocity
m/s	m/s
0.683	0.674
1.040	1.044
1.373	1.381
1.707	1.706
2.117	2.118
2.551	2.546
3.022	3.012
3.405	3.393
3.802	3.800
4.265	4.284

Maximum Acceleration: 932 g's

Date printed 21Apr2020, version 2020 30 148 -2 55

Accelerometer Calibration Certificate
Pile Dynamics, Inc.

Calibrated by Pile Dynamics, Inc.
Calibration performed on 21Apr2020

Serial No:	K4484	**Temperature:**	22.3 °C
Model:	PR	**Humidity:**	28%
Calibrated on:	Channel 3 on 8G 5061 LE		

Ref Acc 1:	65538! 1040 g's/volt	**Cal on:**	27Jan2020
Ref Acc 2:	64648! 984 g's/volt	**Cal on:**	27Jan2020

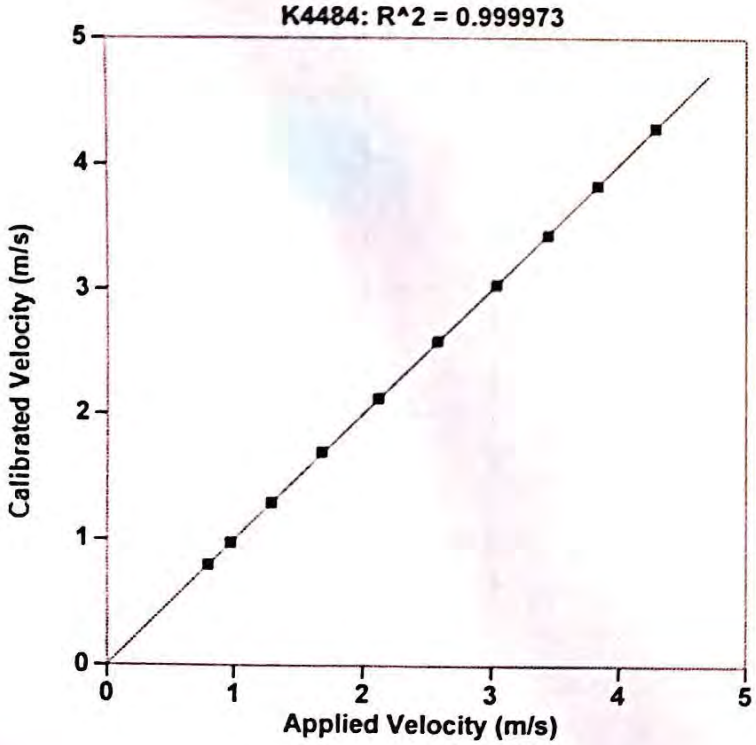
Reference accelerometer calibrations are traceable to the United States National Institute of Standards and Technology (NIST).

PDA CALIBRATION FACTOR

360.6 mv/5000g
(72.1 µv/g)
R^2: 0.999973 [Chip programmed]

Operator: Will

Signed



Reference Velocity	S/N K4484 Velocity
m/s	m/s
0.796	0.795
0.970	0.973
1.284	1.287
1.672	1.686
2.108	2.114
2.561	2.565
3.020	3.017
3.425	3.415
3.818	3.815
4.279	4.280

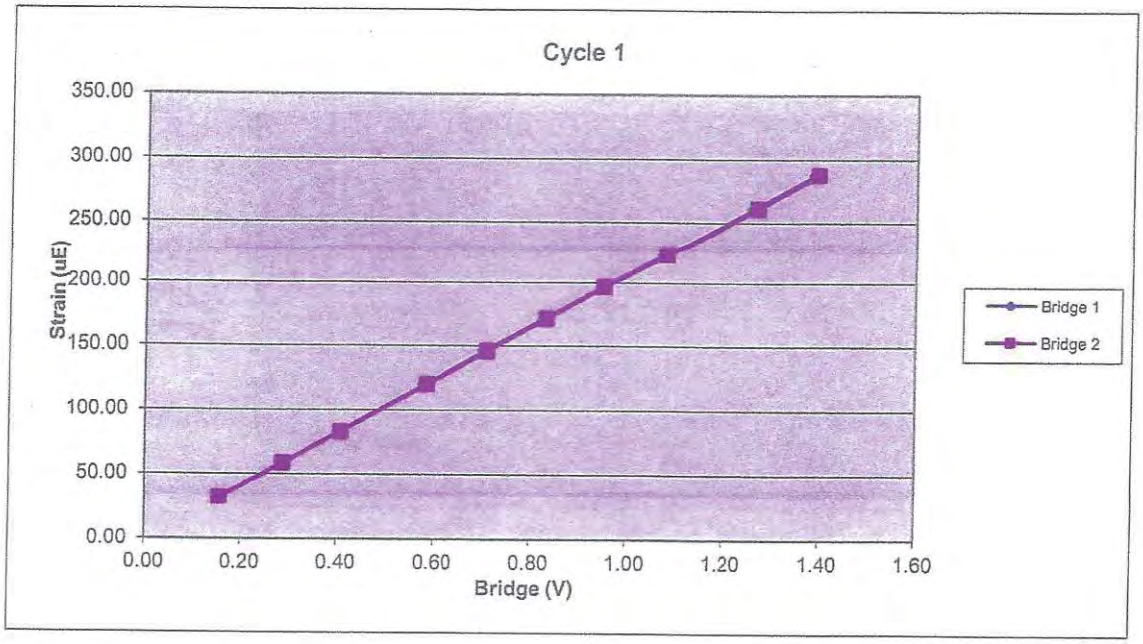
Maximum Acceleration: 929 g's

Date printed 21Apr2020, version 2020.30.148 -1.00

454AWJ		Cycle 1		
Sample	**Force (lb)**	**Strain (µE)**	**Bridge 1 (V)**	**Bridge 2 (V)**
1	0.00	0.00	0.00	0.00
2	1153.53	31.63	0.16	0.16
3	2093.88	57.97	0.29	0.29
4	2990.46	82.75	0.41	0.41
5	4284.16	120.39	0.58	0.59
6	5202.97	145.86	0.71	0.71
7	6105.31	170.75	0.83	0.83
8	6986.10	196.24	0.95	0.95
9	7932.30	222.59	1.08	1.08
10	9304.47	260.75	1.26	1.27
11	10225.13	287.34	1.39	1.40

Bridge 1		**Bridge 2**	
Force Calibration (lb/V)	**7362.08**	**Force Calibration (lb/V)**	**7328.67**
Offset	-6.54	Offset	-5.69
Correlation	0.999998	Correlation	0.999999
Strain Calibration (µE/V)	**207.43**	**Strain Calibration (µE/V)**	**206.49**
Offset	-1.13	Offset	-1.10
Correlation	0.999992	Correlation	0.999993

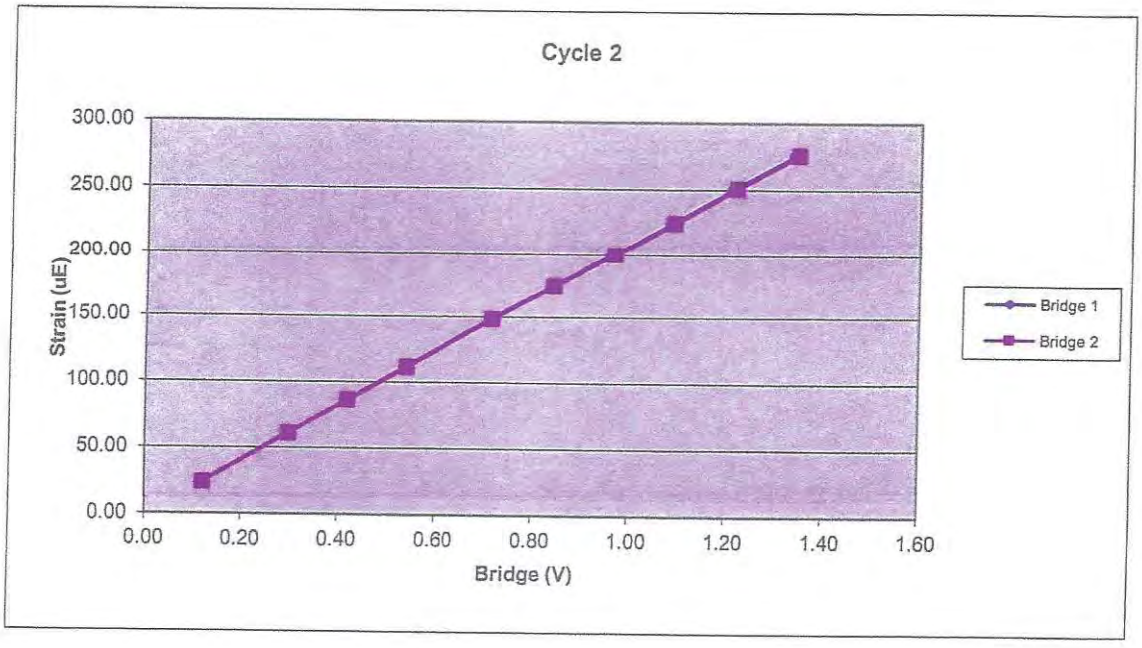
Force Strain Calibration	
EA (Kips)	**35490.57**
Offset	33.57
Correlation	0.999991



454AWJ		Cycle 2		
Sample	Force (lb)	Strain (µE)	Bridge 1 (V)	Bridge 2 (V)
1	0.00	0.00	0.00	0.00
2	888.69	24.00	0.12	0.12
3	2193.79	60.74	0.30	0.30
4	3081.21	86.17	0.42	0.42
5	3982.96	110.88	0.54	0.54
6	5270.82	147.67	0.72	0.72
7	6193.91	173.69	0.84	0.84
8	7114.18	198.87	0.97	0.97
9	8004.14	223.98	1.09	1.09
10	8947.32	250.47	1.21	1.22
11	9878.41	276.15	1.34	1.35

Bridge 1		Bridge 2	
Force Calibration (lb/V)	7367.04	Force Calibration (lb/V)	7325.70
Offset	0.06	Offset	6.30
Correlation	0.999999	Correlation	0.999998
Strain Calibration (µE/V)	206.72	Strain Calibration (µE/V)	205.56
Offset	-0.63	Offset	-0.45
Correlation	0.999993	Correlation	0.999990

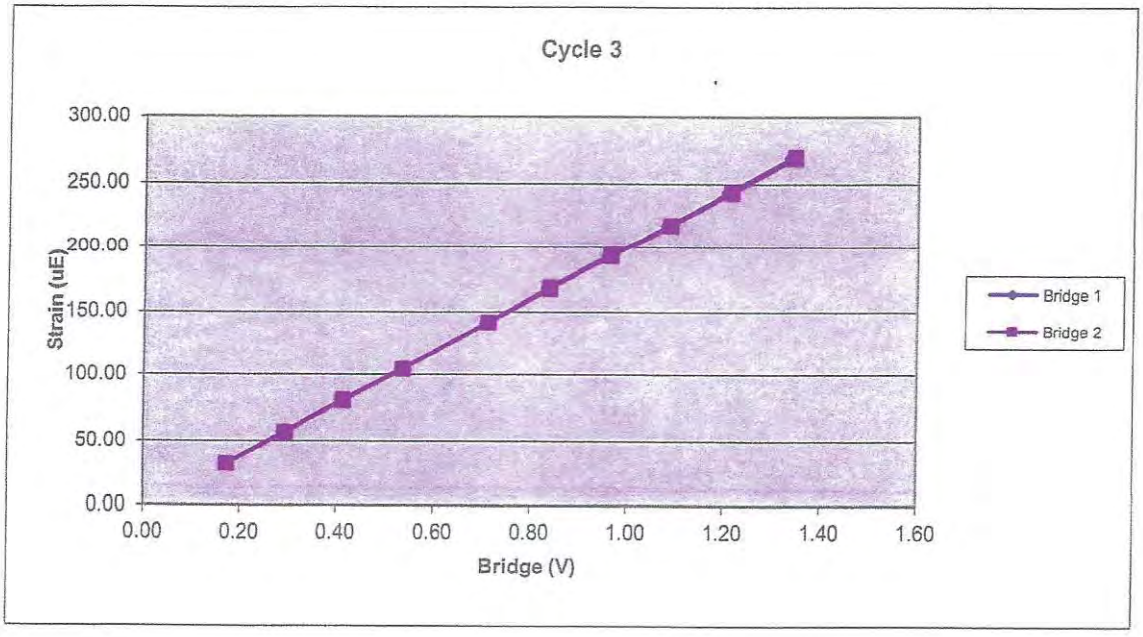
Force Strain Calibration	
EA (Kips)	35636.94
Offset	22.50
Correlation	0.999993



454AWJ		Cycle 3		
Sample	**Force (lb)**	**Strain (µE)**	**Bridge 1 (V)**	**Bridge 2 (V)**
1	0.00	0.00	0.00	0.00
2	1268.75	31.94	0.17	0.17
3	2146.81	56.31	0.29	0.29
4	3022.73	80.51	0.41	0.41
5	3931.11	104.49	0.54	0.54
6	5231.05	141.44	0.71	0.71
7	6149.95	167.25	0.84	0.84
8	7079.97	192.53	0.96	0.97
9	7969.83	217.47	1.08	1.09
10	8894.09	243.38	1.21	1.22
11	9844.29	268.74	1.34	1.35

Bridge 1		**Bridge 2**	
Force Calibration (lb/V)	**7364.10**	**Force Calibration (lb/V)**	**7325.64**
Offset	**-10.92**	Offset	**-6.55**
Correlation	**0.999999**	Correlation	**1.000000**
Strain Calibration (µE/V)	**203.86**	**Strain Calibration (µE/V)**	**202.80**
Offset	**-3.65**	Offset	**-3.53**
Correlation	**0.999981**	Correlation	**0.999984**

Force Strain Calibration	
EA (Kips)	**36121.46**
Offset	**120.99**
Correlation	**0.999985**



Bridge Excitation (V) 5
Shunt Resitor (ohm) 60.4k

Calibration Factors	454AWJ		
Bridge 1 (µE/V)	206.01	Bridge 2 (µE/V)	204.95
EA Factor (Kips)	35749.66	Area (in^2)	1.19

Calibrated by: _____
Calibrated Date: 9/14/2020

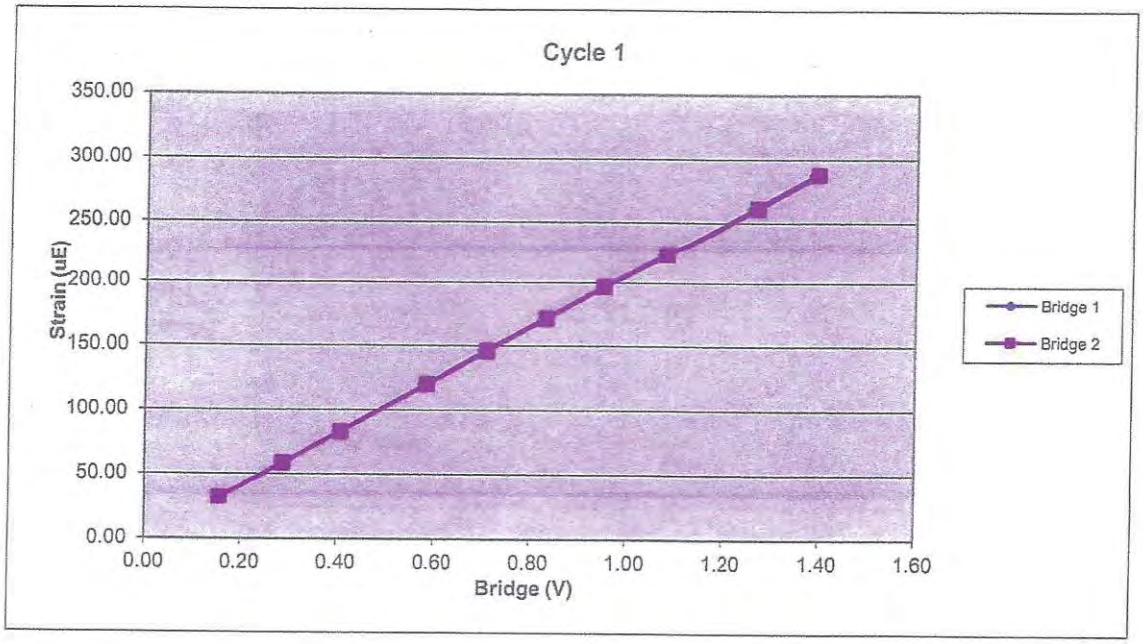
Pile Dynamics Inc
30725 Aurora Rd
Solon, OH 44139

Traceable to N.I.S.T.

454AWJ		Cycle 1		
Sample	**Force (lb)**	**Strain (µE)**	**Bridge 1 (V)**	**Bridge 2 (V)**
1	0.00	0.00	0.00	0.00
2	1153.53	31.63	0.16	0.16
3	2093.88	57.97	0.29	0.29
4	2990.46	82.75	0.41	0.41
5	4284.16	120.39	0.58	0.59
6	5202.97	145.86	0.71	0.71
7	6105.31	170.75	0.83	0.83
8	6986.10	196.24	0.95	0.95
9	7932.30	222.59	1.08	1.08
10	9304.47	260.75	1.26	1.27
11	10225.13	287.34	1.39	1.40

Bridge 1		**Bridge 2**	
Force Calibration (lb/V)	**7362.08**	**Force Calibration (lb/V)**	**7328.67**
Offset	-6.54	Offset	-5.69
Correlation	0.999998	Correlation	0.999999
Strain Calibration (µE/V)	**207.43**	**Strain Calibration (µE/V)**	**206.49**
Offset	-1.13	Offset	-1.10
Correlation	0.999992	Correlation	0.999993

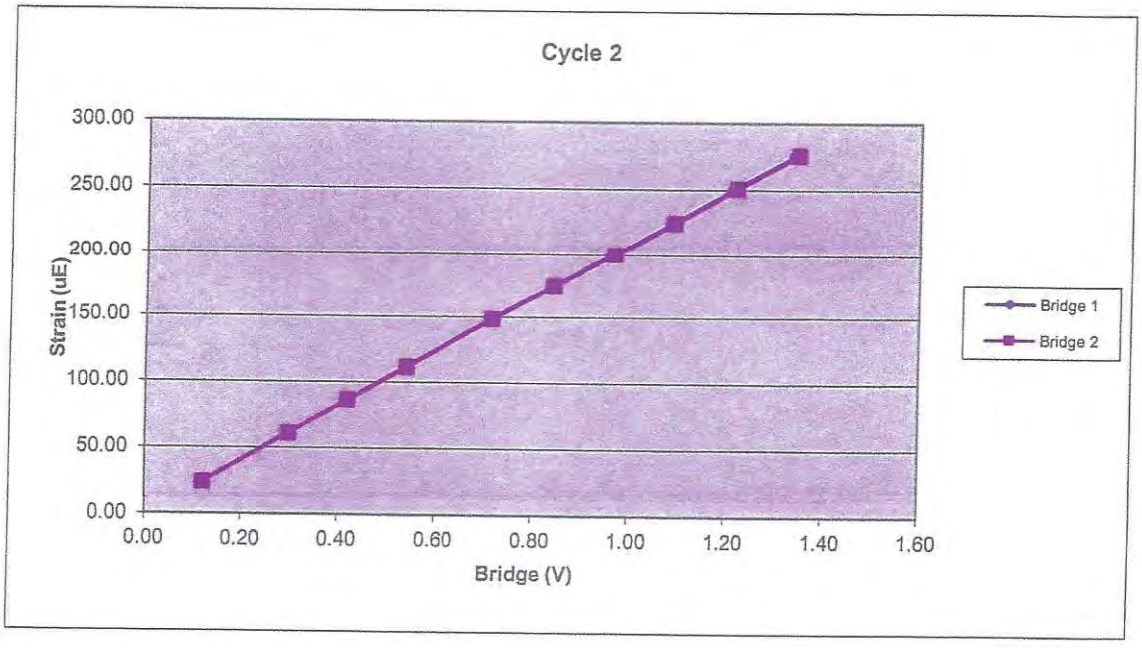
Force Strain Calibration	
EA (Kips)	**35490.57**
Offset	33.57
Correlation	0.999991



454AWJ		Cycle 2		
Sample	Force (lb)	Strain (µE)	Bridge 1 (V)	Bridge 2 (V)
1	0.00	0.00	0.00	0.00
2	888.69	24.00	0.12	0.12
3	2193.79	60.74	0.30	0.30
4	3081.21	86.17	0.42	0.42
5	3982.96	110.88	0.54	0.54
6	5270.82	147.67	0.72	0.72
7	6193.91	173.69	0.84	0.84
8	7114.18	198.87	0.97	0.97
9	8004.14	223.98	1.09	1.09
10	8947.32	250.47	1.21	1.22
11	9878.41	276.15	1.34	1.35

Bridge 1		Bridge 2	
Force Calibration (lb/V)	7367.04	Force Calibration (lb/V)	7325.70
Offset	0.06	Offset	6.30
Correlation	0.999999	Correlation	0.999998
Strain Calibration (µE/V)	206.72	Strain Calibration (µE/V)	205.56
Offset	-0.63	Offset	-0.45
Correlation	0.999993	Correlation	0.999990

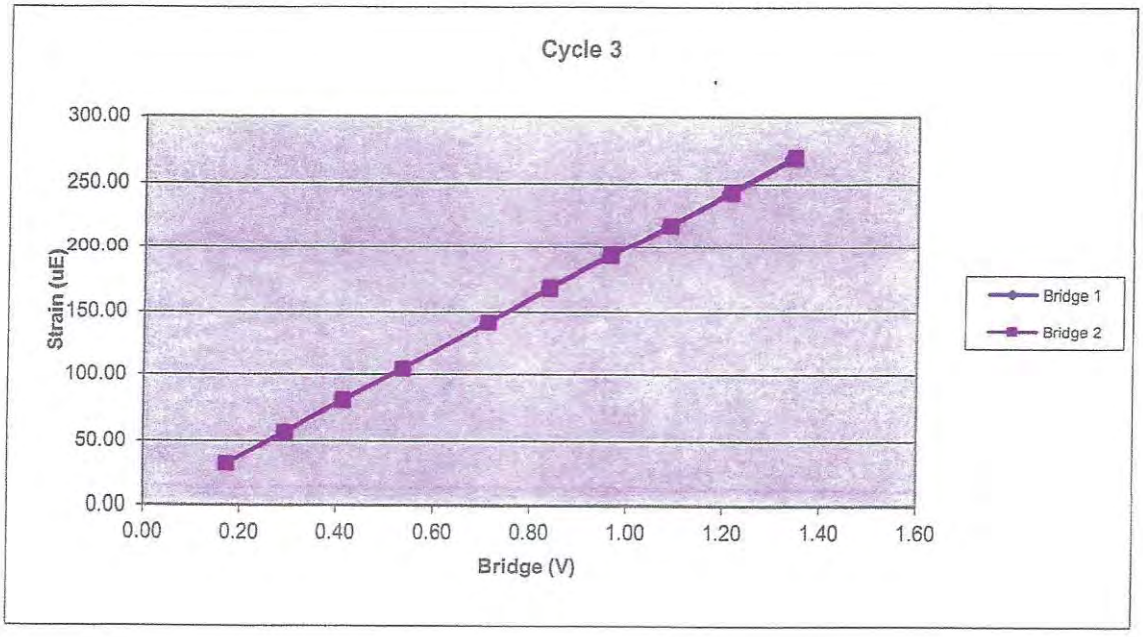
Force Strain Calibration	
EA (Kips)	35636.94
Offset	22.50
Correlation	0.999993



454AWJ		Cycle 3		
Sample	**Force (lb)**	**Strain (µE)**	**Bridge 1 (V)**	**Bridge 2 (V)**
1	0.00	0.00	0.00	0.00
2	1268.75	31.94	0.17	0.17
3	2146.81	56.31	0.29	0.29
4	3022.73	80.51	0.41	0.41
5	3931.11	104.49	0.54	0.54
6	5231.05	141.44	0.71	0.71
7	6149.95	167.25	0.84	0.84
8	7079.97	192.53	0.96	0.97
9	7969.83	217.47	1.08	1.09
10	8894.09	243.38	1.21	1.22
11	9844.29	268.74	1.34	1.35

Bridge 1		**Bridge 2**	
Force Calibration (lb/V)	**7364.10**	**Force Calibration (lb/V)**	**7325.64**
Offset	**-10.92**	Offset	**-6.55**
Correlation	**0.999999**	Correlation	**1.000000**
Strain Calibration (µE/V)	**203.86**	**Strain Calibration (µE/V)**	**202.80**
Offset	**-3.65**	Offset	**-3.53**
Correlation	**0.999981**	Correlation	**0.999984**

Force Strain Calibration	
EA (Kips)	**36121.46**
Offset	**120.99**
Correlation	**0.999985**



Bridge Excitation (V) 5
Shunt Resitor (ohm) 60.4k

Calibration Factors	454AWJ		
Bridge 1 (µE/V)	206.01	Bridge 2 (µE/V)	204.95
EA Factor (Kips)	35749.66	Area (in^2)	1.19

Calibrated by: _____
Calibrated Date: 9/14/2020

Pile Dynamics Inc
30725 Aurora Rd
Solon, OH 44139

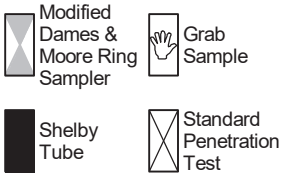
Traceable to N.I.S.T.

GENERAL NOTES

DESCRIPTION OF SYMBOLS AND ABBREVIATIONS
CRSA - HAFB SWEG Office ■ Hill Air Force Base, UT
Terracon Project No. 61225006

Terracon GeoReport

SAMPLING



WATER LEVEL

Water Initially Encountered

Water Level After a Specified Period of Time

Water Level After a Specified Period of Time

Cave In Encountered

Water levels indicated on the soil boring logs are the levels measured in the borehole at the times indicated. Groundwater level variations will occur over time. In low permeability soils, accurate determination of groundwater levels is not possible with short term water level observations.

FIELD TESTS

N	**Standard Penetration Test Resistance (Blows/Ft.)**
(HP)	**Hand Penetrometer**
(T)	**Torvane**
(DCP)	**Dynamic Cone Penetrometer**
UC	**Unconfined Compressive Strength**
(PID)	**Photo-Ionization Detector**
(OVA)	**Organic Vapor Analyzer**

DESCRIPTIVE SOIL CLASSIFICATION

Soil classification as noted on the soil boring logs is based Unified Soil Classification System. Where sufficient laboratory data exist to classify the soils consistent with ASTM D2487 "Classification of Soils for Engineering Purposes" this procedure is used. ASTM D2488 "Description and Identification of Soils (Visual-Manual Procedure)" is also used to classify the soils, particularly where insufficient laboratory data exist to classify the soils in accordance with ASTM D2487. In addition to USCS classification, coarse grained soils are classified on the basis of their in-place relative density, and fine-grained soils are classified on the basis of their consistency. See "Strength Terms" table below for details. The ASTM standards noted above are for reference to methodology in general. In some cases, variations to methods are applied as a result of local practice or professional judgment.

LOCATION AND ELEVATION NOTES

Exploration point locations as shown on the Exploration Plan and as noted on the soil boring logs in the form of Latitude and Longitude are approximate. See Exploration and Testing Procedures in the report for the methods used to locate the exploration points for this project. Surface elevation data annotated with +/- indicates that no actual topographical survey was conducted to confirm the surface elevation. Instead, the surface elevation was approximately determined from topographic maps of the area.

STRENGTH TERMS

RELATIVE DENSITY OF COARSE-GRAINED SOILS (More than 50% retained on No. 200 sieve.) Density determined by Standard Penetration Resistance		**CONSISTENCY OF FINE-GRAINED SOILS** (50% or more passing the No. 200 sieve.) Consistency determined by laboratory shear strength testing, field visual-manual procedures or standard penetration resistance		
Descriptive Term (Density)	**Standard Penetration or N-Value Blows/Ft.**	**Descriptive Term (Consistency)**	**Unconfined Compressive Strength Qu, (tsf)**	**Standard Penetration or N-Value Blows/Ft.**
Very Loose	0 - 3	Very Soft	less than 0.25	0 - 1
Loose	4 - 9	Soft	0.25 to 0.50	2 - 4
Medium Dense	10 - 29	Medium Stiff	0.50 to 1.00	4 - 8
Dense	30 - 50	Stiff	1.00 to 2.00	8 - 15
Very Dense	> 50	Very Stiff	2.00 to 4.00	15 - 30
		Hard	> 4.00	> 30

RELEVANCE OF SOIL BORING LOG

The soil boring logs contained within this document are intended for application to the project as described in this document. Use of these soil boring logs for any other purpose may not be appropriate.

UNIFIED SOIL CLASSIFICATION SYSTEM

Terracon GeoReport

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests [A]					Soil Classification	
					Group Symbol	Group Name [B]
Coarse-Grained Soils: More than 50% retained on No. 200 sieve	**Gravels:** More than 50% of coarse fraction retained on No. 4 sieve	**Clean Gravels:** Less than 5% fines [C]	Cu ≥ 4 and 1 ≤ Cc ≤ 3 [E]		GW	Well-graded gravel [F]
			Cu < 4 and/or [Cc<1 or Cc>3.0] [E]		GP	Poorly graded gravel [F]
		Gravels with Fines: More than 12% fines [C]	Fines classify as ML or MH		GM	Silty gravel [F, G, H]
			Fines classify as CL or CH		GC	Clayey gravel [F, G, H]
	Sands: 50% or more of coarse fraction passes No. 4 sieve	**Clean Sands:** Less than 5% fines [D]	Cu ≥ 6 and 1 ≤ Cc ≤ 3 [E]		SW	Well-graded sand [I]
			Cu < 6 and/or [Cc<1 or Cc>3.0] [E]		SP	Poorly graded sand [I]
		Sands with Fines: More than 12% fines [D]	Fines classify as ML or MH		SM	Silty sand [G, H, I]
			Fines classify as CL or CH		SC	Clayey sand [G, H, I]
Fine-Grained Soils: 50% or more passes the No. 200 sieve	**Silts and Clays:** Liquid limit less than 50	**Inorganic:**	PI > 7 and plots on or above "A"		CL	Lean clay [K, L, M]
			PI < 4 or plots below "A" line [J]		ML	Silt [K, L, M]
		Organic:	Liquid limit - oven dried	< 0.75	OL	Organic clay [K, L, M, N]
			Liquid limit - not dried			Organic silt [K, L, M, O]
	Silts and Clays: Liquid limit 50 or more	**Inorganic:**	PI plots on or above "A" line		CH	Fat clay [K, L, M]
			PI plots below "A" line		MH	Elastic Silt [K, L, M]
		Organic:	Liquid limit - oven dried	< 0.75	OH	Organic clay [K, L, M, P]
			Liquid limit - not dried			Organic silt [K, L, M, Q]
Highly organic soils:	Primarily organic matter, dark in color, and organic odor				PT	Peat

[A] Based on the material passing the 3-inch (75-mm) sieve.

[B] If field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.

[C] Gravels with 5 to 12% fines require dual symbols: GW-GM well-graded gravel with silt, GW-GC well-graded gravel with clay, GP-GM poorly graded gravel with silt, GP-GC poorly graded gravel with clay.

[D] Sands with 5 to 12% fines require dual symbols: SW-SM well-graded sand with silt, SW-SC well-graded sand with clay, SP-SM poorly graded sand with silt, SP-SC poorly graded sand with clay.

[E] $Cu = D_{60}/D_{10}$ $\quad Cc = \dfrac{(D_{30})^2}{D_{10} \times D_{60}}$

[F] If soil contains ≥ 15% sand, add "with sand" to group name.

[G] If fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.

[H] If fines are organic, add "with organic fines" to group name.

[I] If soil contains ≥ 15% gravel, add "with gravel" to group name.

[J] If Atterberg limits plot in shaded area, soil is a CL-ML, silty clay.

[K] If soil contains 15 to 29% plus No. 200, add "with sand" or "with gravel," whichever is predominant.

[L] If soil contains ≥ 30% plus No. 200 predominantly sand, add "sandy" to group name.

[M] If soil contains ≥ 30% plus No. 200, predominantly gravel, add "gravelly" to group name.

[N] PI ≥ 4 and plots on or above "A" line.

[O] PI < 4 or plots below "A" line.

[P] PI plots on or above "A" line.

[Q] PI plots below "A" line.