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May 25, 2017

David R. Lastovka, P.E.
ODOT District 12 Transportation Engineer
Ohio Department of Transportation
5500 Transportation Boulevard
Garfield Heights, Ohio 44125-5396

Re: April 2017 Quarterly Report
CUY-90-15.24 Slope Monitoring
PID 96504
EDP Project No. 069032.00

Dear Mr. Lastovka:

April Quarterly instrument readings for the CUY-90-15.24 Slope Monitoring project are presented in the attached report.

If you have any questions or comments regarding this report, please call.

Very truly yours,

SME

Alan J. Esser, P.E., D.GE
Chief Consultant

Attachments

Distribution via e-mail

APRIL 2017 QUARTERLY REPORT

CUY-90-15.24 SLOPE MONITORING
PID 96504
CLEVELAND, OHIO
SME PROJECT NO. 069032.00

MAY 25, 2017

SME
9375 Chillicothe Road
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TABLE OF CONTENTS

INTRODUCTION

Instrument readings and interpretations for April 2017 are presented in this report. Figures showing the arrangement of instrumentation are found in Appendix A. Plots of the data are included in Appendix B.

INSTRUMENTS READ MONTHLY

The following instruments are read and reported on a monthly schedule. Prior to March 2017, these instruments were read on a bi-monthly schedule.

Piezometers: P-001-13, P-002-13, P-003-10, P-003-13, P-004-13, P-009-13, B-05-02, B-05-A-03, B-05-04, B-05-A-11, and B-105-A.

Inclinometers: I-001-13, I-002-13, I-003-10, I-004-13, I-008-10, I-009-13, B-05-02, B-05-A-03, B-05-04, B-05-A-11, B-101, B-102, B-105-A, Pier 1, Pier 9N, and TGR I-4.

Refer to the bi-weekly and monthly reports for details and comments on those instruments. This report will only cover those instruments that are read quarterly.

PIEZOMETERS

P-001-10. Total head in both piezometers at P-001-10 fluctuated by about 1 foot this past quarter. Both piezometers show a net increase of about 0.8 feet since January 2017.

P-002-10. Total head in the shallow piezometer at P-002-10 increased by about 0.6 feet since January 2017. Total head in the deep piezometer fluctuated by about 0.5 feet this quarter with virtually no net change.

P-007-13. Total head in the shallow piezometer at P-007-13 increased by 0.7 feet this quarter. The datalogger for the deep piezometer failed to record this quarter. We replaced the battery, but it appears to be a faulty data logger. We are contacting RST to look into this issue further. In the meantime, we have replaced this datalogger with the datalogger from the shallowest piezometer at TGR P-3. A single reading taken in April 2017 shows a 0.5 foot decrease in total head since January 2017.

B-05-07. Pore pressure readings show a net increase of about 0.8 feet in total head in all piezometers this quarter, with fluctuations of about 1 foot in the middle and deep piezometers.

TGR P-3. Three piezometers are installed at this location. Due to final grading operations in the area of these instruments, total head in all three piezometers decreased in stages between October 2016 and January 2017. Starting in January 2017, total head in all three piezometers began to increase. Total head has increased by about 3 feet in the shallow piezometer and 5 feet in the middle piezometer. Total head in the deep piezometer increased during the first half of the quarter, then decreased in the second half for a net increase of 0.5 feet. The shallow piezometer is now only a couple of feet below grade and the datalogger was recording negative pore pressures. We moved the datalogger from this location to temporarily replace the malfunctioning datalogger at P-007-13.

INCLINOMETERS

I-001-10, I-002-10, B-05-07, and inclinometers is pier **P-3, P-8, P-10,** and **P-17.** Inclinometer readings at these locations indicate virtually no movement this quarter.

I-007-13. The inclinometer reading at this location shows displacement in the negative B-axis direction relative to the January 2017 reading. This quarter's reading plots between the July 2016 and April 2016 plots.

STABILIZATION STRUCTURE

The general arrangement of the stabilization structure and its instrumentation is shown in Figures 2 and 3 in Appendix A.

Load Cells

Seasonal variations are apparent in the plots for all the load cells with the usual decrease in load occurring during the winter months. The random spikes shown in the plots occur when one or more of the gages in the load cell fail to record. These spikes are occurring in all load cells with the exception of Load Cell 9. Gage 4 in Load Cell 1 failed from January 12 to March 14, 2017, then started recording again. Gage 3 in Load Cell 8 started intermittently giving erroneous readings after March 5, 2017. These erroneous readings were deleted to "clean up" the plots. Table 2 shows which gages were active in each of the load cells this quarter. A plot of the load cell data is included in Appendix B.

Table 2. Active gages (indicated by check mark) in load cells on the four instrumented anchors.

Load Cell	Gage					
	1	2	3	4	5	6
1	✓			✓	✓	✓
8	✓	✓	✓		✓	✓
9	✓	✓	✓	✓	✓	✓
17	✓	✓	✓	✓	✓	✓

Anchors

Loads recorded for most active strandmeters on the instrumented anchors remained virtually constant this quarter. The plot for Gage 5 on Anchor 1 indicates the continuing upward trend that has been ongoing since at least 2010. The magnitude of the load is obviously incorrect since it is unrealistically high and is more than four times the load indicated by the load cell. Average loads this quarter for the load cells and active strandmeters are listed in Table 3. We also report the percent change in load from last quarter. Strandmeter gages that have failed are indicated by an "×" in the table. Negative (compression) loads and loads in the individual gages that exceed the load indicated by the load cell are not possible. Assuming uniform load transfer from the anchor to the rock over the bond length, we should expect the load indicated by the strandmeters to increase progressively from Gage 1 to Gage 5 which is closest to the top end of the bond zone. Only a few of the data points listed in Table 3 seem to be valid.

Table 3. Average strandmeter loads and % change from last quarter, tension loads are positive.

Anchor	Load Cell (kips)	Strandmeter (kips)				
		1	2	3	4	5
1	438.2	-9.7	×	+/- 0	×	2144.8
% change		-1.1	×	0	×	1.7
8	308.8	29.1	67.2	-177.0	×	×
% change		1.4	2.5	-0.1	×	×
9	450.7	-18.66	8.49	2.66	193.49	784.77
% change		-3.3	0.6	5.1	-0.2	0.0
17	365.5	-41.1	×	-25.4	×	232.2
% change		-1.7	×	-0.1	×	0.1

Driven piles

Axial loads in all Driven Piles, except Pile 1, steadily increased from January through March, 2017. The large decrease for Pile 34 in January 2017 was caused by gage 1 working again after it had been malfunctioning since October 2016. Axial loads in Pile 1 steadily decreased from January through March 2017. In mid-March 2017, axial loads in all Driven Piles suddenly increased then decreased by large magnitudes. The axial load plot for Pile 1 shows the largest changes, increasing by 18 kips then decreasing by 76 kips. Following this event, axial loads remained nearly constant in Piles 1, 17, and 18, increased slightly in Pile 19, and continued a sharp decrease in Pile 34.

Strong axis bending moments in all of the driven piles decreased slightly through mid-March. Then in mid-March, the rate of change increased in all piles except Pile 1, which began to increase. The spikes shown in Piles 1 and 34 are caused by erroneous fluctuations in the gage readings. Average weak axis bending moments showed similar trends to the strong axis bending moments but at lower magnitudes.

Tiebeams General

Data for the tiebeams showed more erratic data than the previous quarter, but readings were still stable enough to see the underlying trends. A small amount of erratic data had to be deleted to “clean up” the plots.

Tiebeams Anchor Side

Axial loads at the anchor end of the tiebeams began to decrease in March 2017 following seasonal trends. From the downturn in mid-March to the end of this quarter, decreases in axial load range from 3 to 12 kips, with the largest decrease occurring in Tiebeam 1.

Strong axis bending moments in Tiebeams 1, 12, and 26 increased slightly until mid-March 2017, then began to decrease following the seasonal trend. The seasonal changes in Tiebeams 13 and 14 were barely noticeable. This year we see a small but noticeable change in Tiebeams 12 and 26. The seasonal variation has been more apparent in Tiebeam 1, which showed the largest increase in strong axis bending moment. Changes in weak axis bending moments were negligible for all tiebeams.

Tiebeams Drilled Pier Side

Seasonal changes are also seen in the axial loads in the tiebeams on the drilled pier side, which increased until March 2017, then began to decrease. This change is similar to the seasonal changes seen in the past except that the magnitude of variation in Tiebeams 1 and 26 is somewhat larger than in past years. Axial loads in the other tiebeams show seasonal changes similar to past years. There has been an upward trend in axial load in all tiebeams except Tiebeam 26 for the past 6 years. The axial load in Tiebeam 1 has been trending downward during this time.

Strong axis bending moments on the drilled pier side of Tiebeams 1, 12, 13, and 14 showed the typical seasonal changes with decreases starting this quarter. The strong axis bending moment in Tiebeam 14 decreased by 3 kip-feet, which is a larger change than previously seen. The plot for Tiebeam 26, shows a continued decrease in the strong axis bending moment until mid-March 2017, when it began to increase. Two gages are now malfunctioning on this end of Tiebeam 26, which is causing this unusual plot. We adjusted the calculations by using values for the companion gages on the opposite ends of the flange to compensate for the loss of these gages. This allows us to calculate bending moments. However, this introduces some error into the calculated moments which depends on the relative magnitude of the strong and weak axis moments. We are using the same type of correction to the data for Tiebeams 1 and 12.

Weak axis bending moments on the drilled pier side remained virtually constant, except for Tiebeam 26. The large increase shown on the plot for this tiebeam in February 2017 was caused by the second gage failing and a correction being applied to the calculation.

Drilled Piers

Plots of axial load and bending moment vs. time show the usual seasonal changes in both Piers. The axial load vs. time plots continue to show a gradual increase over time in both shafts at all depths except for depths at 84 feet and deeper in Shaft 1 where the axial load has remained relatively constant except for seasonal changes. The gage at 84 feet continues to intermittently record erroneous data, which has been deleted to “clean up” the plot.

Bending moments in Pier 1 show the largest seasonal changes at the top end of the pier. Moments are increasing below 35.5 feet. A similar trend occurs in Pier 9 where the seasonal changes in bending moments show the greatest variation at 50 feet and above.

AGGREGATE STOCKPILES

We observed and photographed the aggregate stockpiles on April 28, 2017. The photos are included in Appendix A as Figures 4 and 5. Only a small pile of aggregate remains closest to the right-of-way fence. This pile has not changed since January 2014. The pile is about 8 feet high and covers only a small area of the property.

This completes the April 2017 Quarterly report for the CUY-90-15.24 Slope Monitoring Project, ODOT PID 96504.

Report prepared by:

Brendan P. Lieske, P.E.
Project Engineer

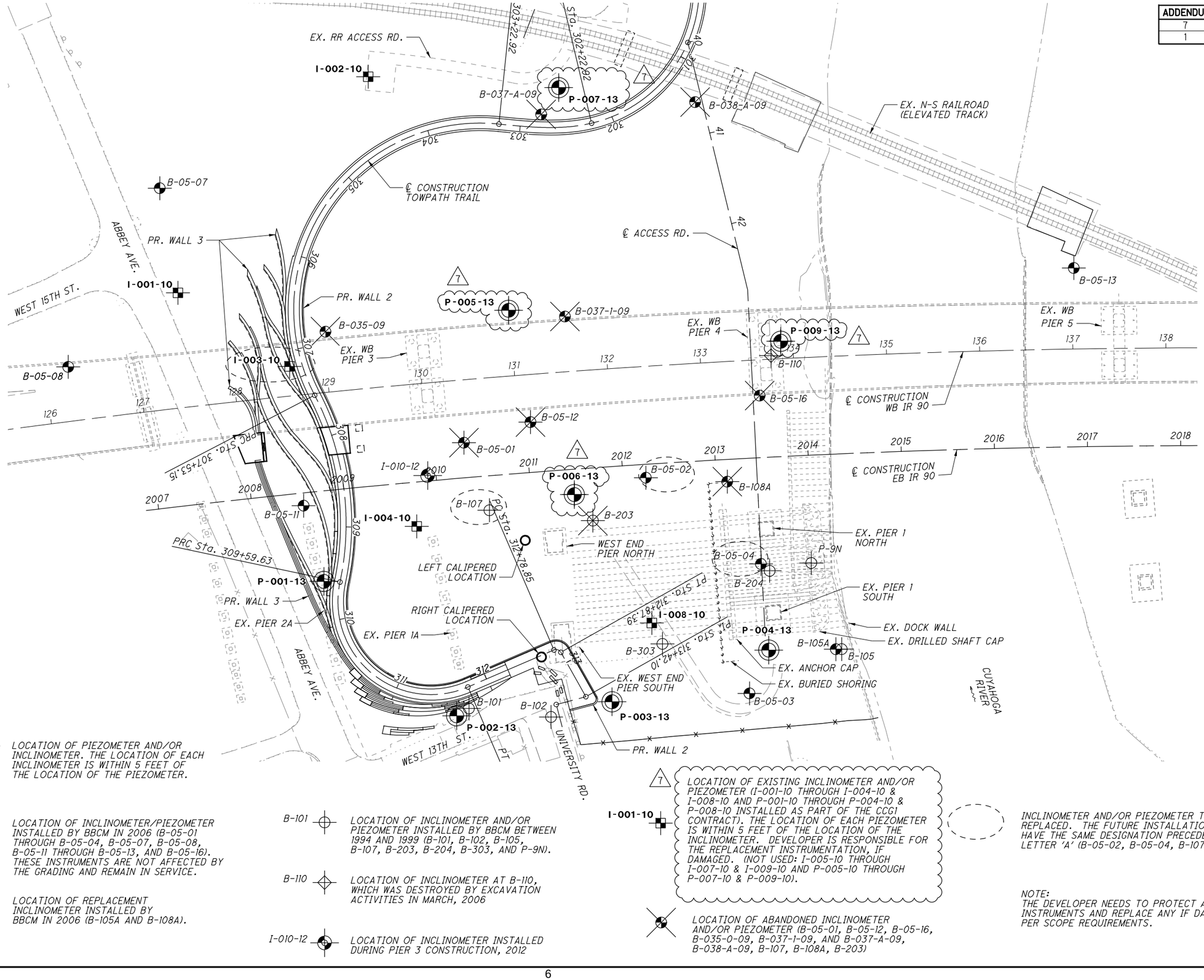
Report reviewed by:

Alan J. Esser, P.E., D.GE
Chief Consultant

APPENDIX A

ARRANGEMENT OF INSTRUMENTATION

ADDENDUM	DATE
7	8/2/13
1	4/16/13



LEGEND

P-001-13 — LOCATION OF PIEZOMETER AND/OR INCLINOMETER. THE LOCATION OF EACH INCLINOMETER IS WITHIN 5 FEET OF THE LOCATION OF THE PIEZOMETER.

B-05-01 — LOCATION OF INCLINOMETER/PIEZOMETER INSTALLED BY BBCM IN 2006 (B-05-01 THROUGH B-05-04, B-05-07, B-05-08, B-05-11 THROUGH B-05-13, AND B-05-16). THESE INSTRUMENTS ARE NOT AFFECTED BY THE GRADING AND REMAIN IN SERVICE.

B-105A — LOCATION OF REPLACEMENT INCLINOMETER INSTALLED BY BBCM IN 2006 (B-105A AND B-108A).

B-101 — LOCATION OF INCLINOMETER AND/OR PIEZOMETER INSTALLED BY BBCM BETWEEN 1994 AND 1999 (B-101, B-102, B-105, B-107, B-203, B-204, B-303, AND P-9N).

B-110 — LOCATION OF INCLINOMETER AT B-110, WHICH WAS DESTROYED BY EXCAVATION ACTIVITIES IN MARCH, 2006

I-010-12 — LOCATION OF INCLINOMETER INSTALLED DURING PIER 3 CONSTRUCTION, 2012

△7 **I-001-10** — LOCATION OF EXISTING INCLINOMETER AND/OR PIEZOMETER (I-001-10 THROUGH I-004-10 & I-008-10 AND P-001-10 THROUGH P-004-10 & P-008-10 INSTALLED AS PART OF THE CCGI CONTRACT). THE LOCATION OF EACH PIEZOMETER IS WITHIN 5 FEET OF THE LOCATION OF THE INCLINOMETER. DEVELOPER IS RESPONSIBLE FOR THE REPLACEMENT INSTRUMENTATION, IF DAMAGED. (NOT USED: I-005-10 THROUGH I-007-10 & I-009-10 AND P-005-10 THROUGH P-007-10 & P-009-10).

LOCATION OF ABANDONED INCLINOMETER AND/OR PIEZOMETER (B-05-01, B-05-12, B-05-16, B-035-0-09, B-037-1-09, AND B-037-A-09, B-038-A-09, B-107, B-108A, B-203)

INCLINOMETER AND/OR PIEZOMETER TO BE REPLACED. THE FUTURE INSTALLATION WILL HAVE THE SAME DESIGNATION PRECEDED BY LETTER 'A' (B-05-02, B-05-04, B-107, I-003-10)

NOTE:
THE DEVELOPER NEEDS TO PROTECT ALL THE INSTRUMENTS AND REPLACE ANY IF DAMAGED, PER SCOPE REQUIREMENTS.

HORIZONTAL SCALE IN FEET
0 25 50 100

DRAWN CDS CHECKED JN

INSTRUMENTATION PLAN
CUYAHOGA RIVER WEST BANK

CUY-90-14.90

1 / 4

61 / 93

P:\82119\geotechnical\sheets\82119ZP410 Addendum 7.dgn 8/2/2013 10:14:37 AM csteck

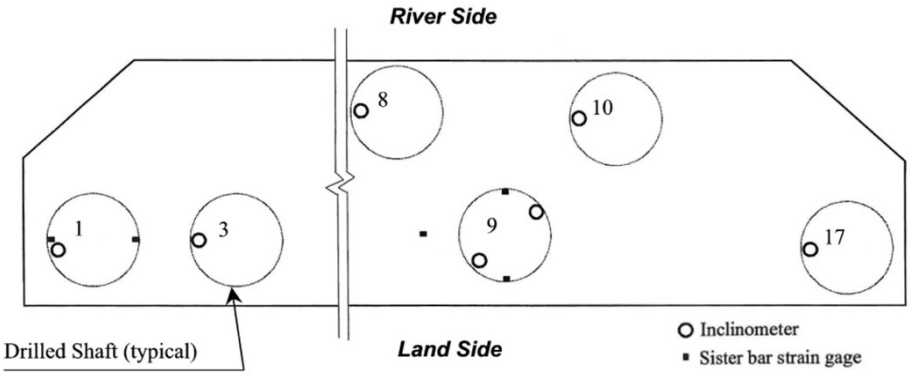


Figure 2. Pier cap with the location of inclinometers and strain gauges.

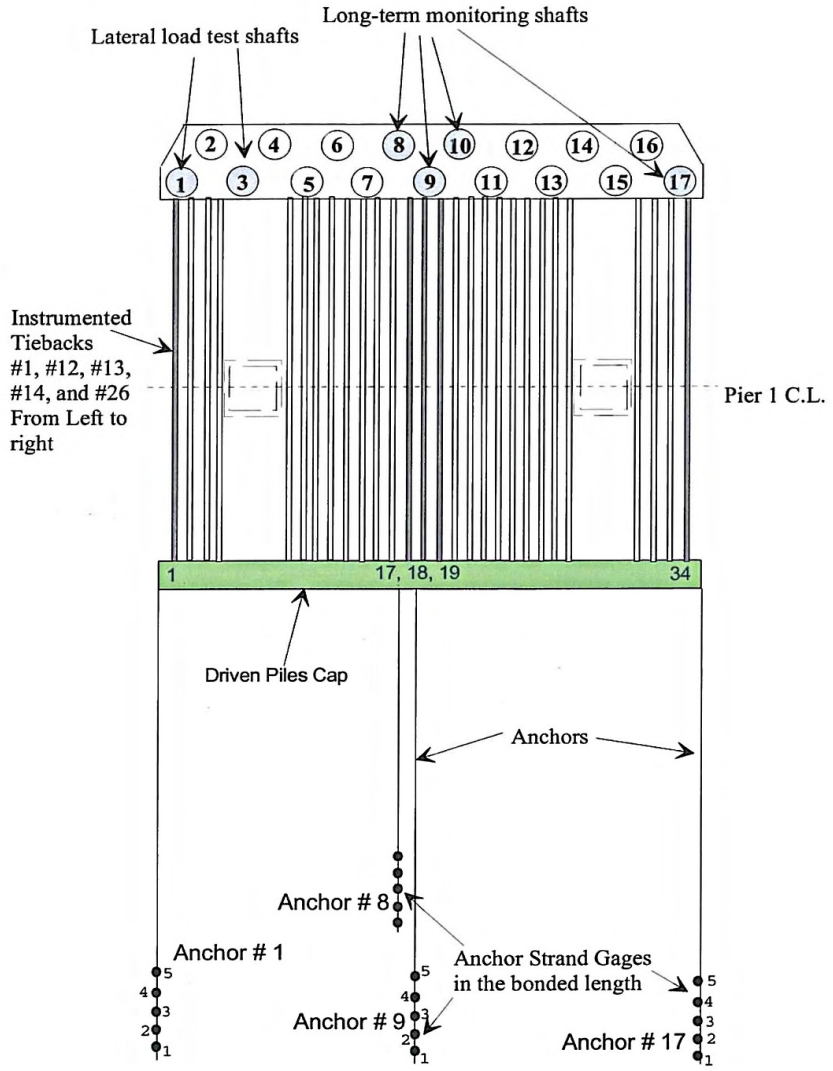


Figure 3. Plan of the stabilization system showing the locations of the instrumented foundation elements.

Figure 4. Aggregate stockpile east of the ODOT right-of-way (April 28, 2017).

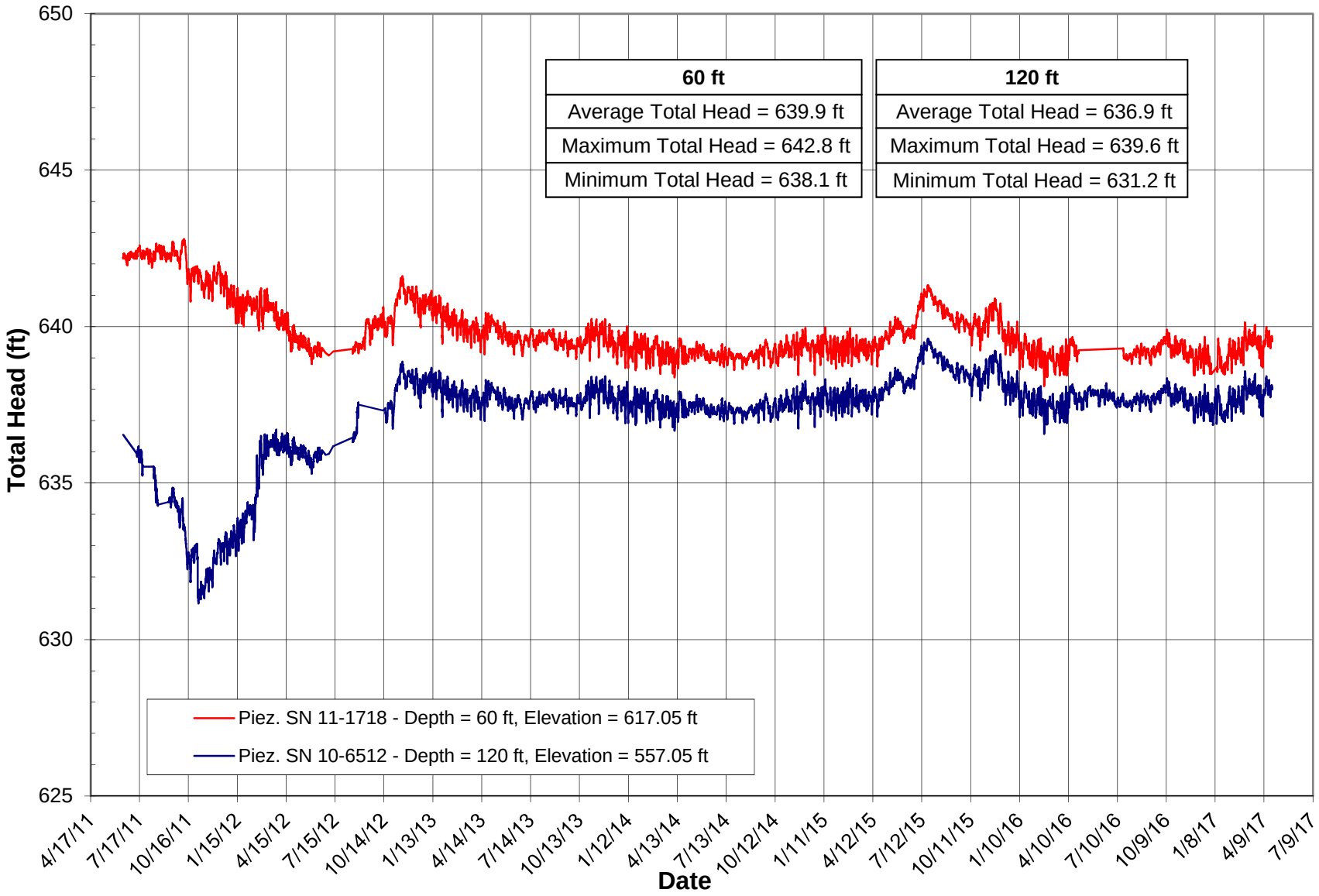
Figure 5. Aggregate stockpile near ODOT's east right-of-way fence (April 28, 2017).

APPENDIX B

PLOTS OF INSTRUMENT READINGS
DISCUSSED IN THE REPORT

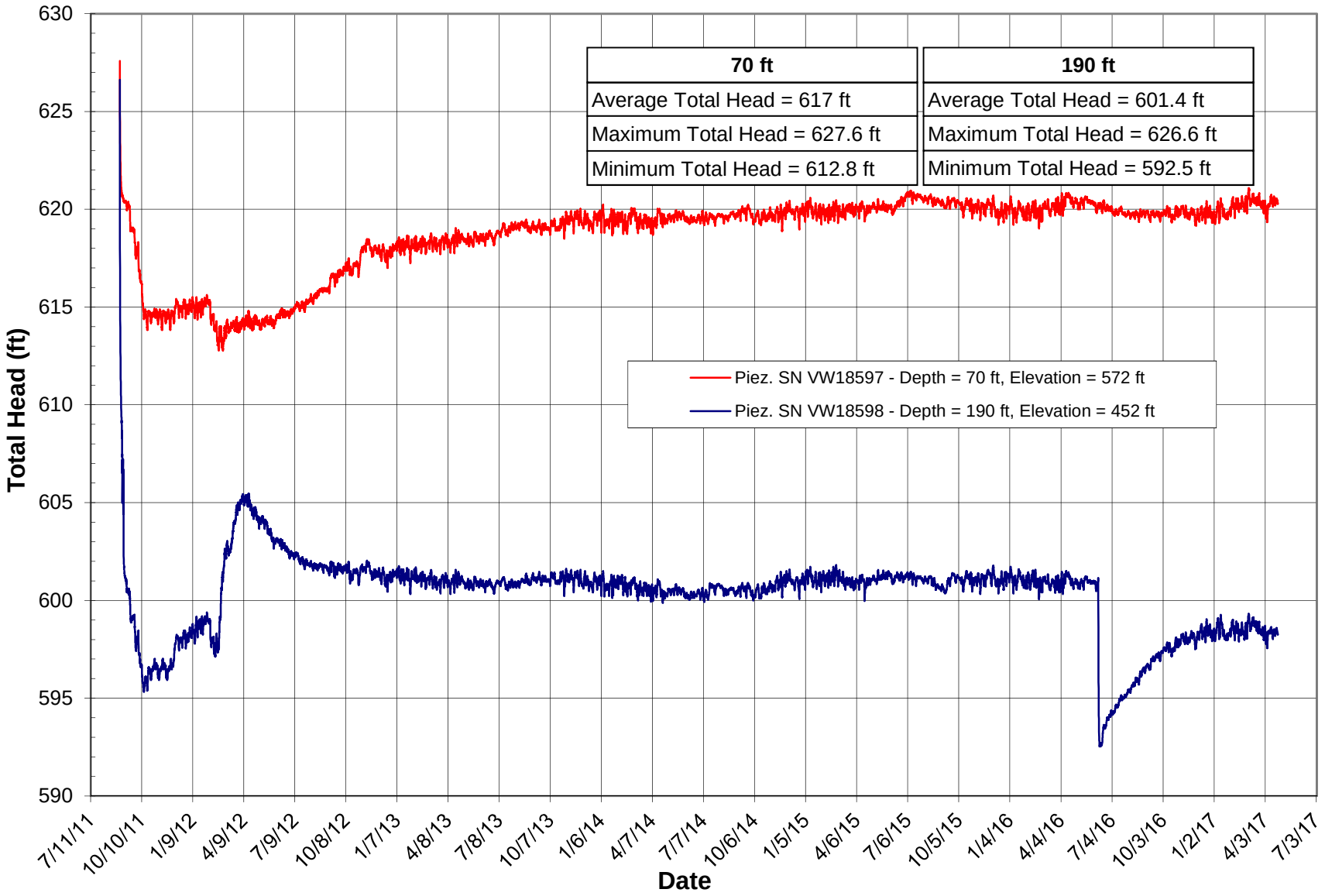
P-001-10 VW Piezometer Readings

Ground surface elevation = 677.05 ft



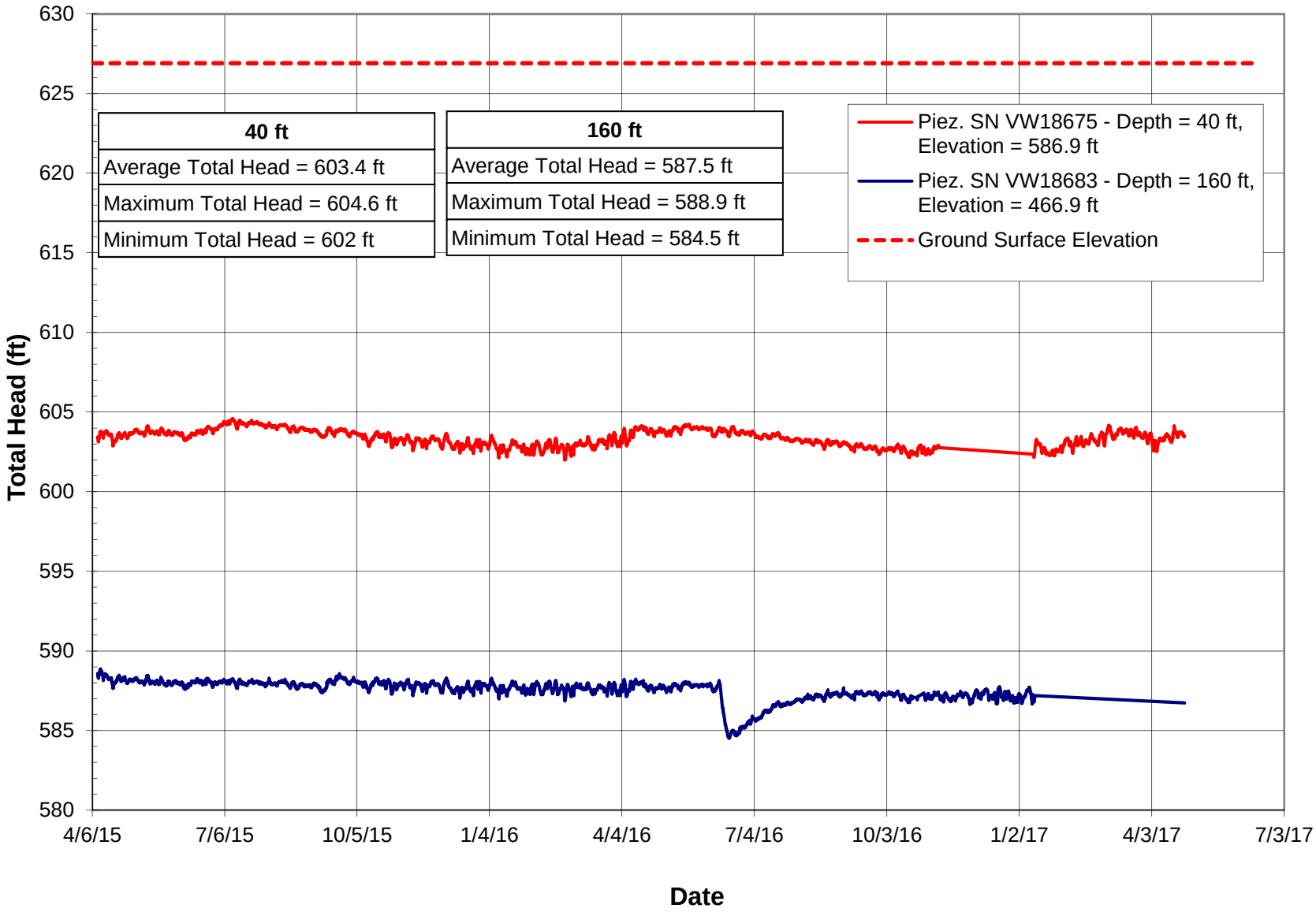
P-002-10 VW Piezometer Readings

Ground surface elevation = 644 ft



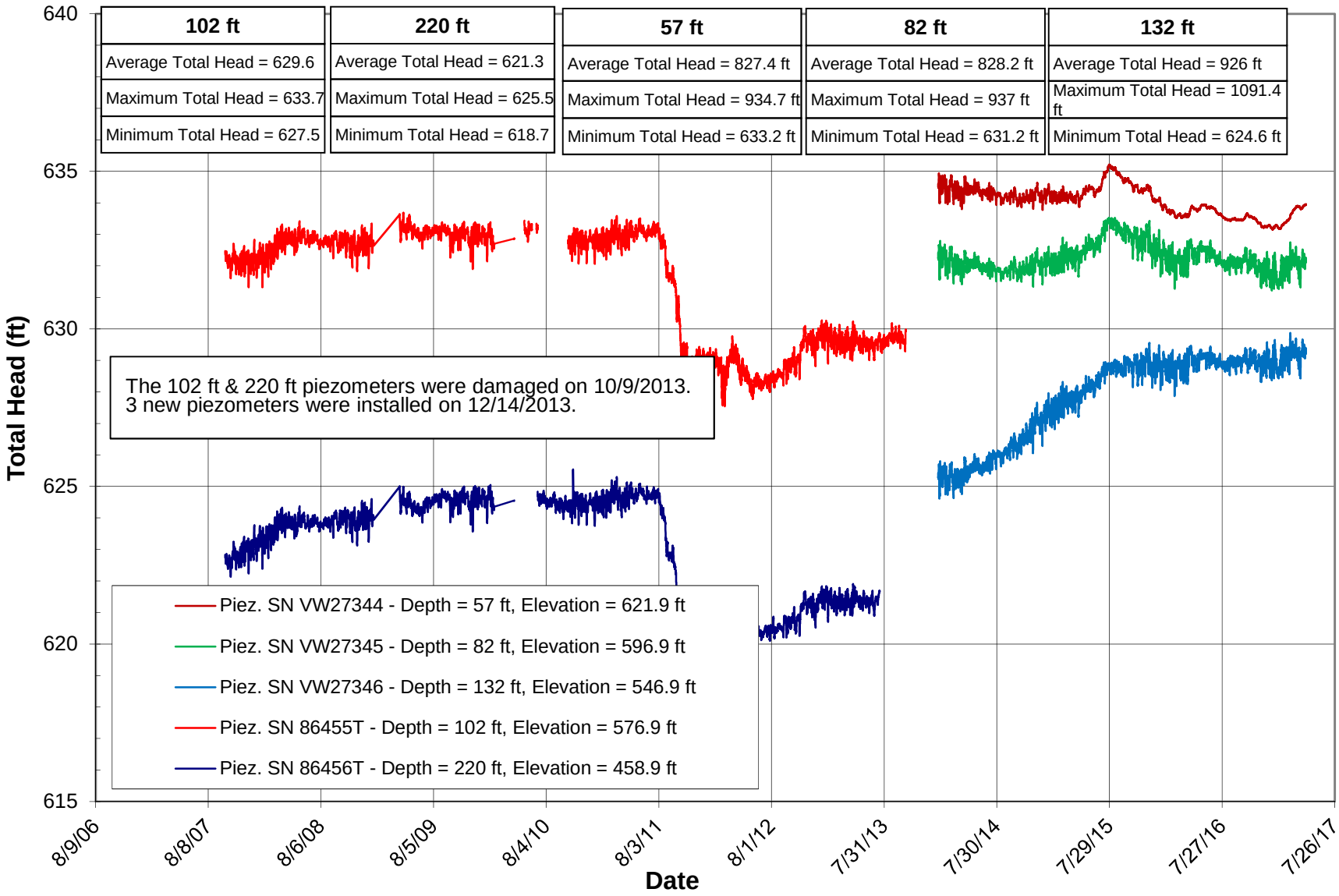
P-007-13 VW Piezometer Readings

Ground surface elevation = 626.9 ft



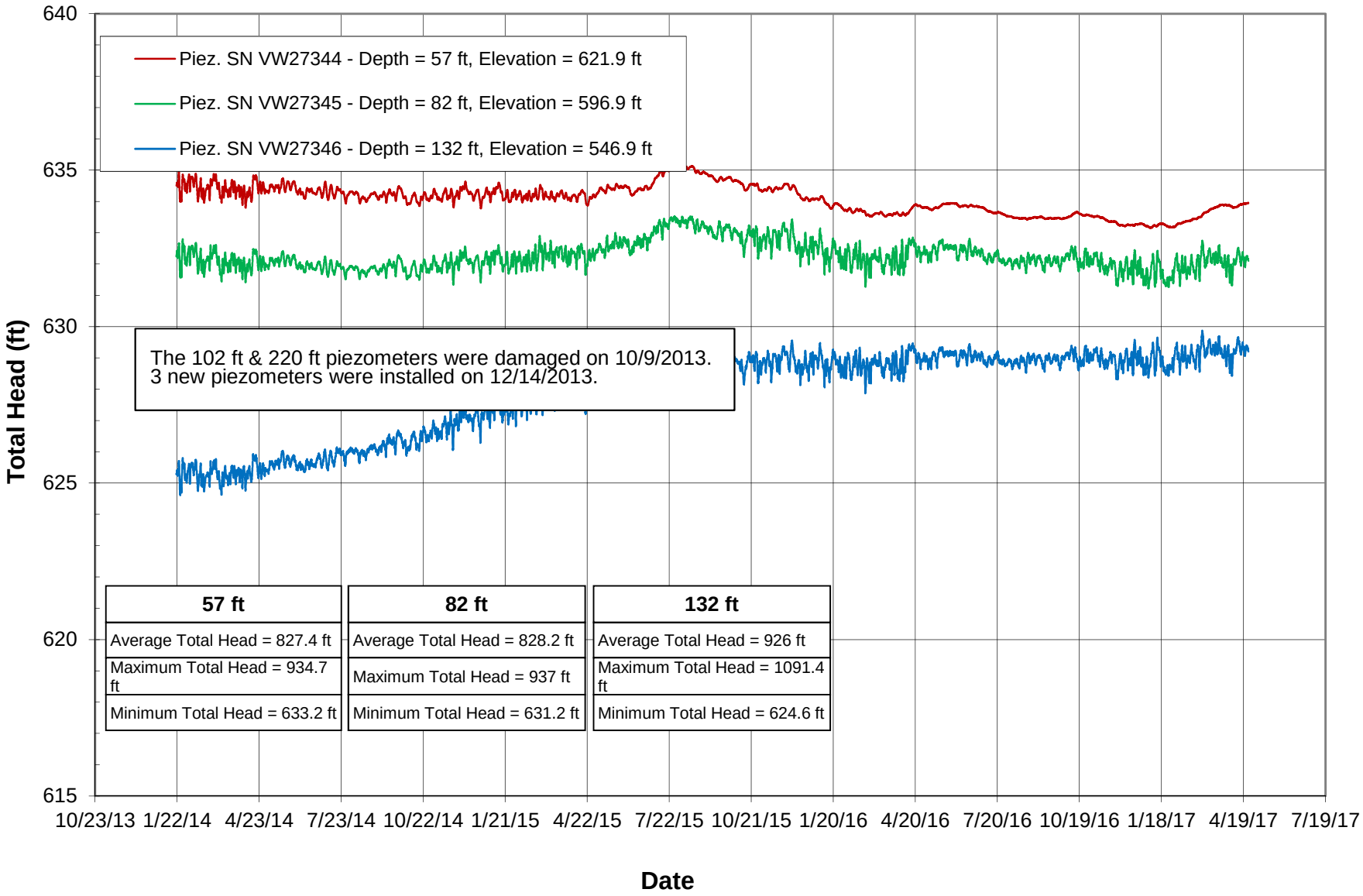
B-05-07 VW Piezometer Readings

Ground surface elevation = 678.9 ft



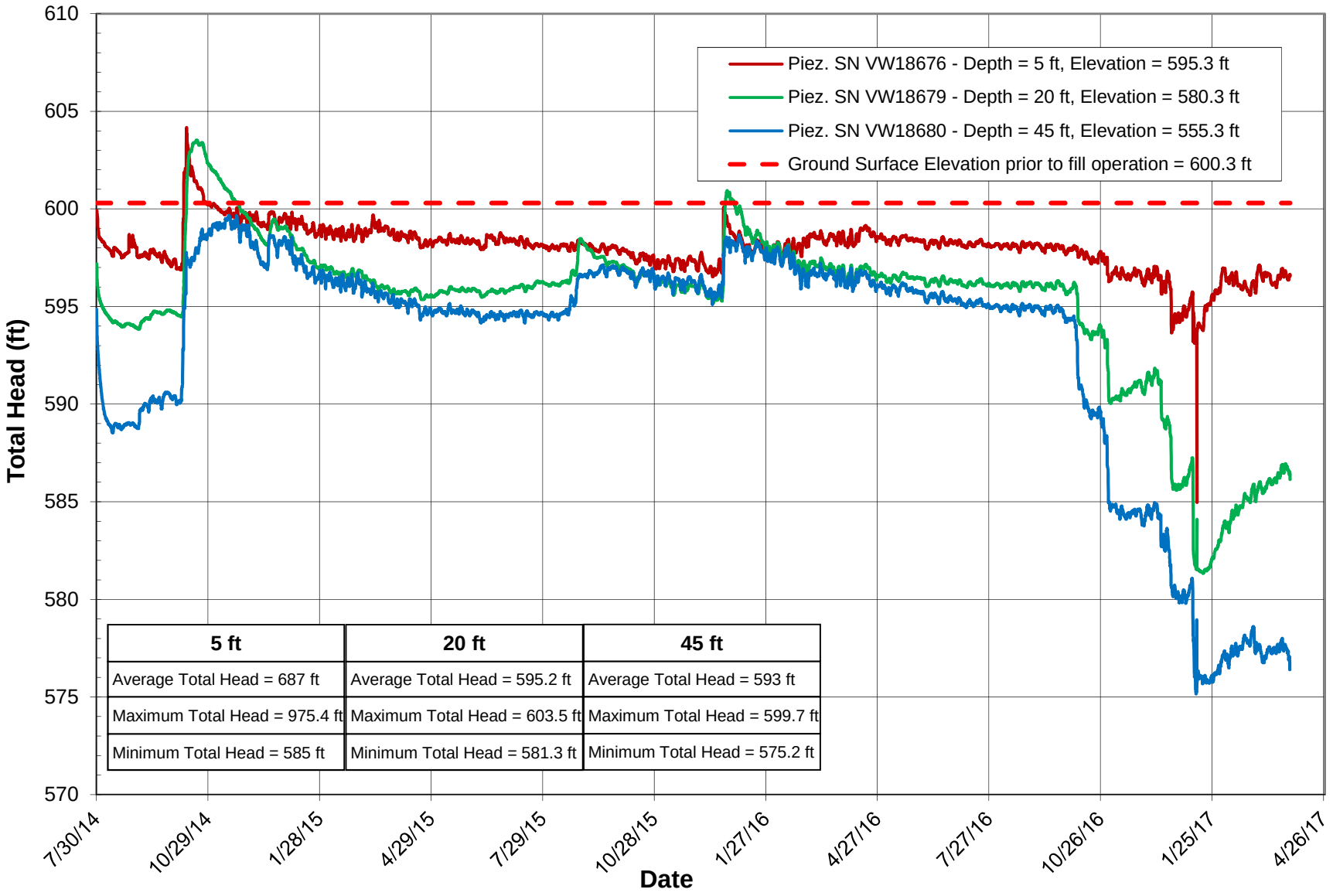
B-05-07 VW Piezometer Readings

Ground surface elevation = 678.9 ft



57 ft	82 ft	132 ft
Average Total Head = 827.4 ft	Average Total Head = 828.2 ft	Average Total Head = 926 ft
Maximum Total Head = 934.7 ft	Maximum Total Head = 937 ft	Maximum Total Head = 1091.4 ft
Minimum Total Head = 633.2 ft	Minimum Total Head = 631.2 ft	Minimum Total Head = 624.6 ft

TGR P-3 VW Piezometer Readings



5 ft	20 ft	45 ft
Average Total Head = 687 ft	Average Total Head = 595.2 ft	Average Total Head = 593 ft
Maximum Total Head = 975.4 ft	Maximum Total Head = 603.5 ft	Maximum Total Head = 599.7 ft
Minimum Total Head = 585 ft	Minimum Total Head = 581.3 ft	Minimum Total Head = 575.2 ft

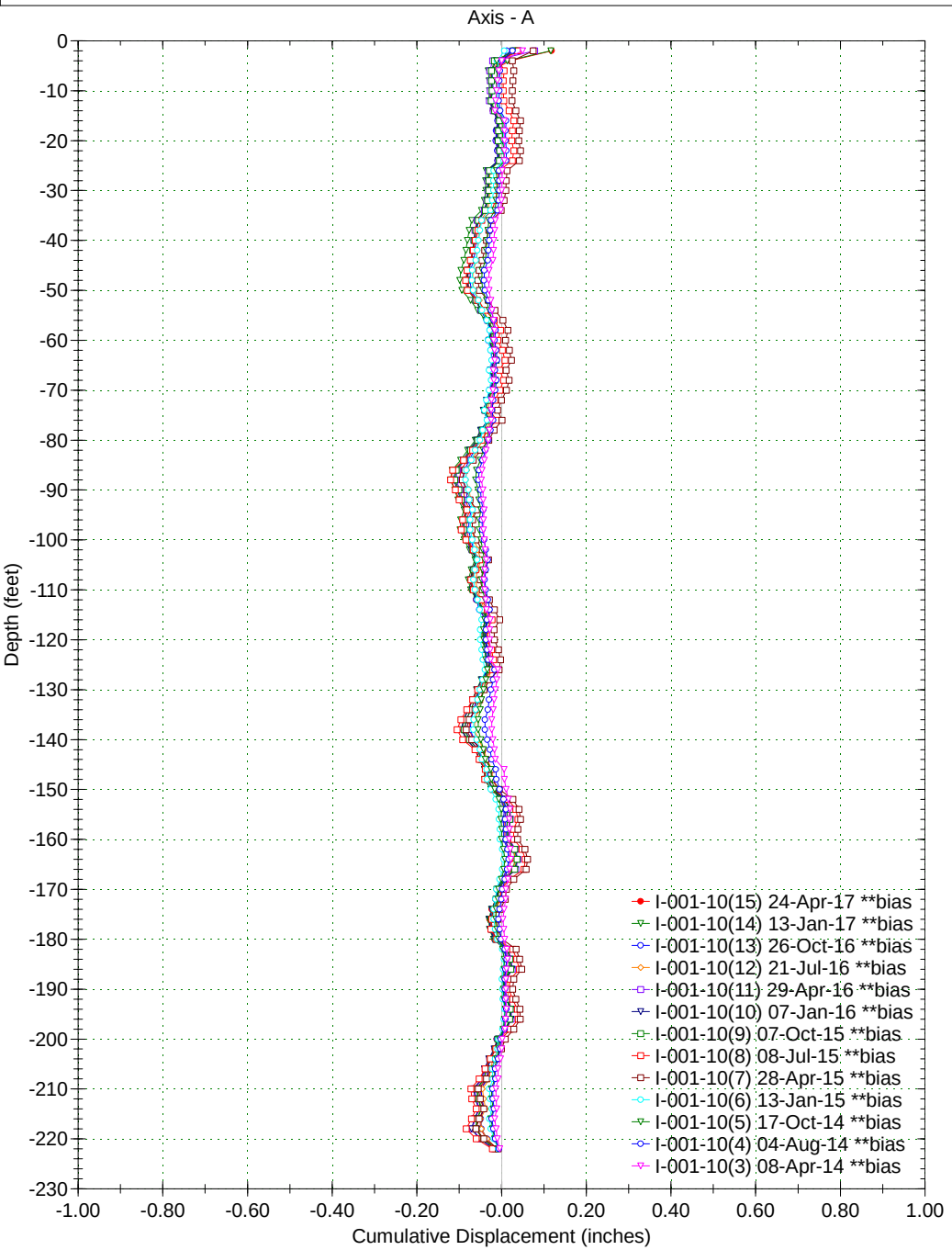
RST Instruments Ltd.

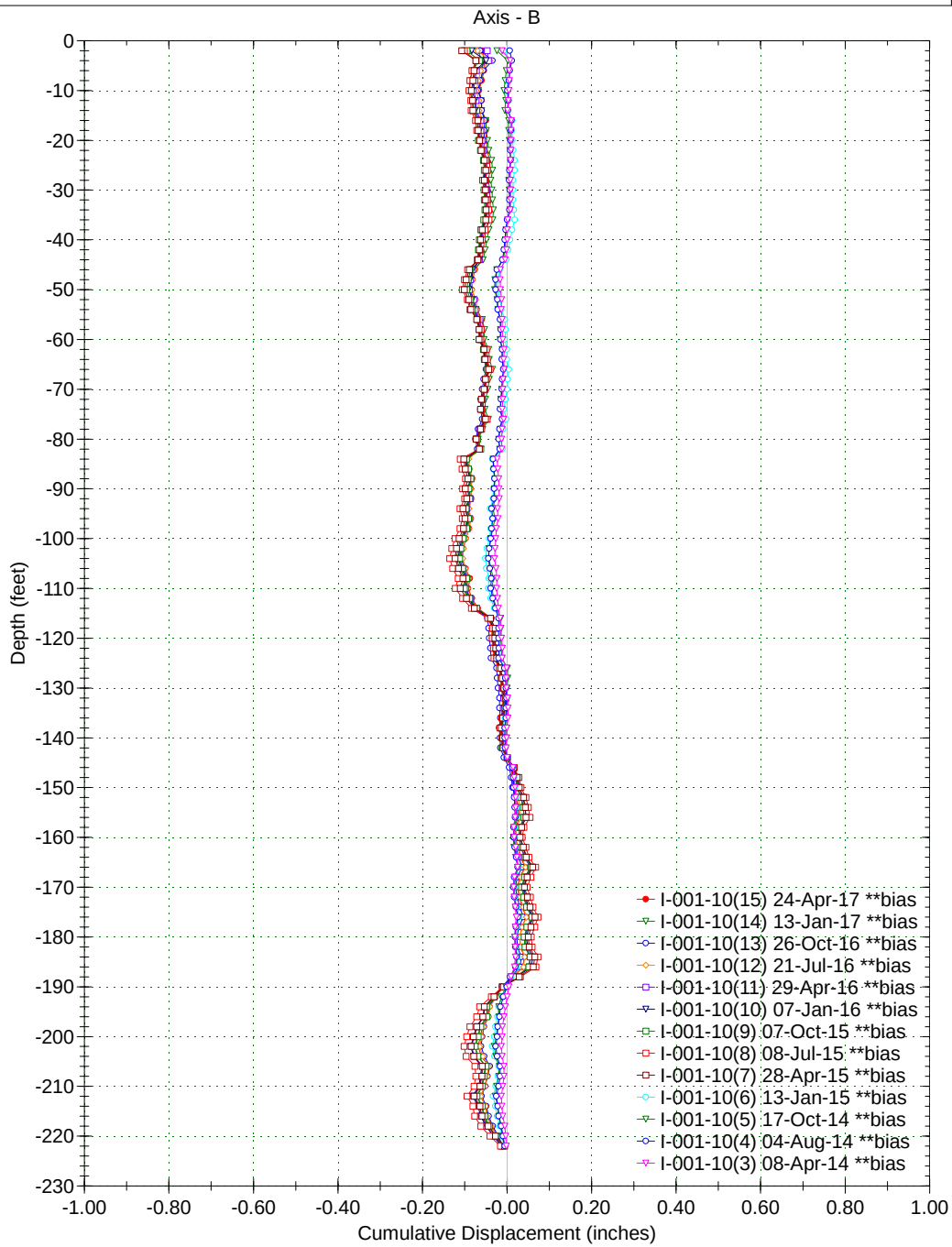
CUMULATIVE DISPLACEMENT

Inclinalysis v. 2.47.5

Borehole : I-001-10
Project : CUY-90-15-24
Location : Cleveland, Ohio
Northing : 663346.19
Easting : 2189917.266
Collar :

Spiral Correction : N/A
Collar Elevation : 0.0 feet
Borehole Total Depth : 222.0 feet
A+ Groove Azimuth :
Base Reading : 2014 Jan 10 07:36
Applied Azimuth : 0.0 degrees





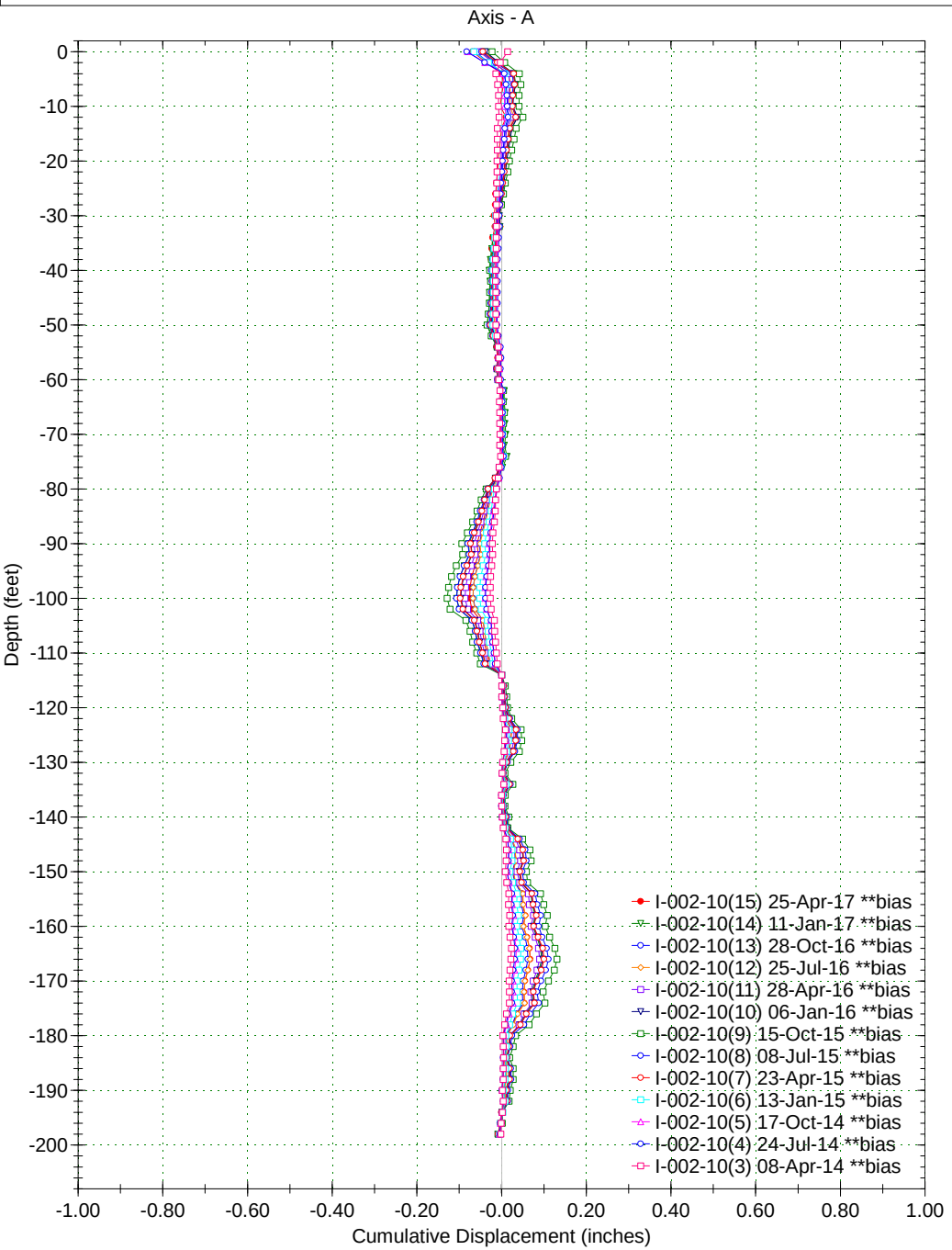
RST Instruments Ltd.

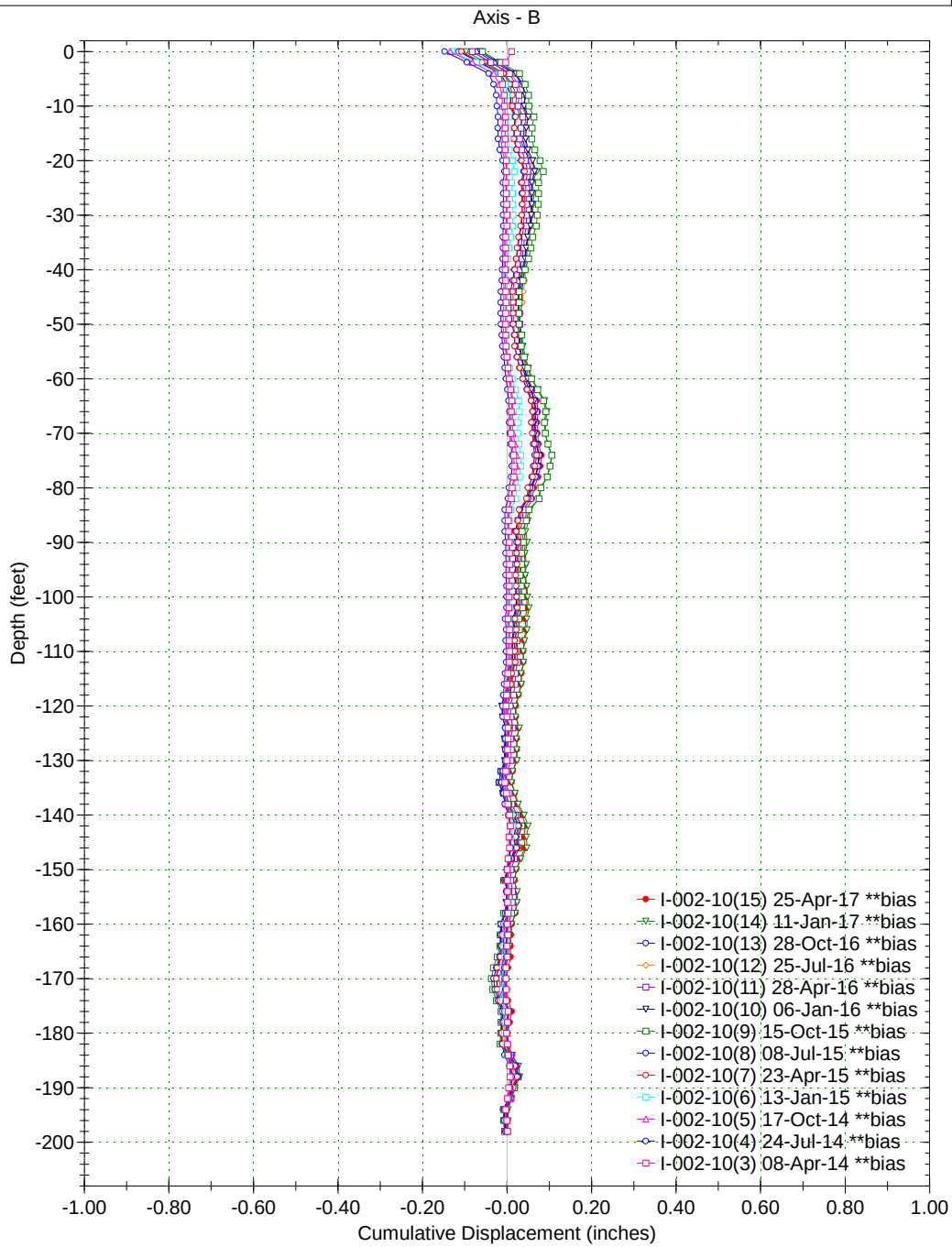
CUMULATIVE DISPLACEMENT

Inclinalysis v. 2.47.5

Borehole : I-002-10
Project : CUY-90-15-24
Location : Cleveland, Ohio
Northing : 663622.262
Easting : 2189778.413
Collar :

Spiral Correction : N/A
Collar Elevation : 2.0 feet
Borehole Total Depth : 200.0 feet
A+ Groove Azimuth :
Base Reading : 2014 Jan 09 09:59
Applied Azimuth : 0.0 degrees





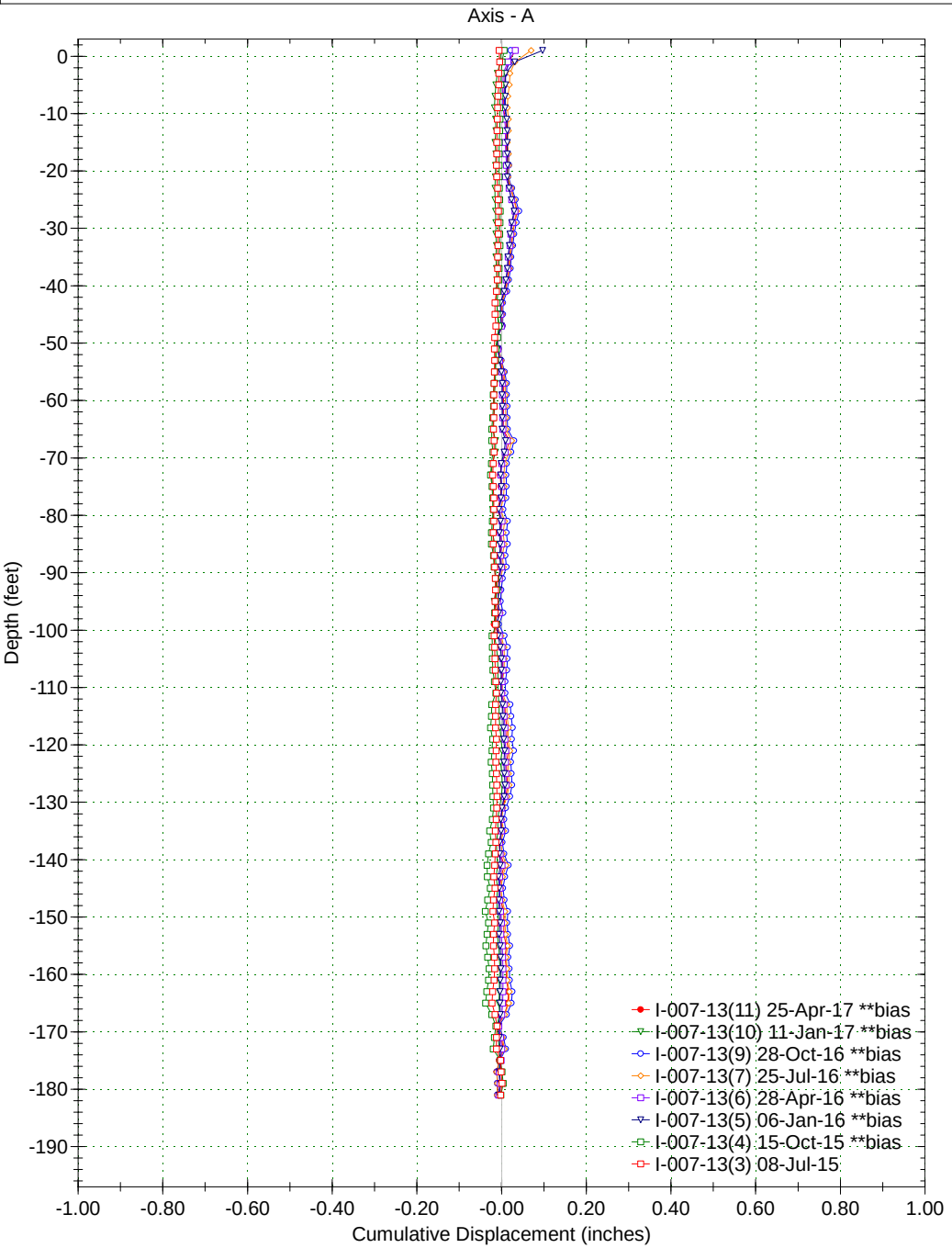
RST Instruments Ltd.

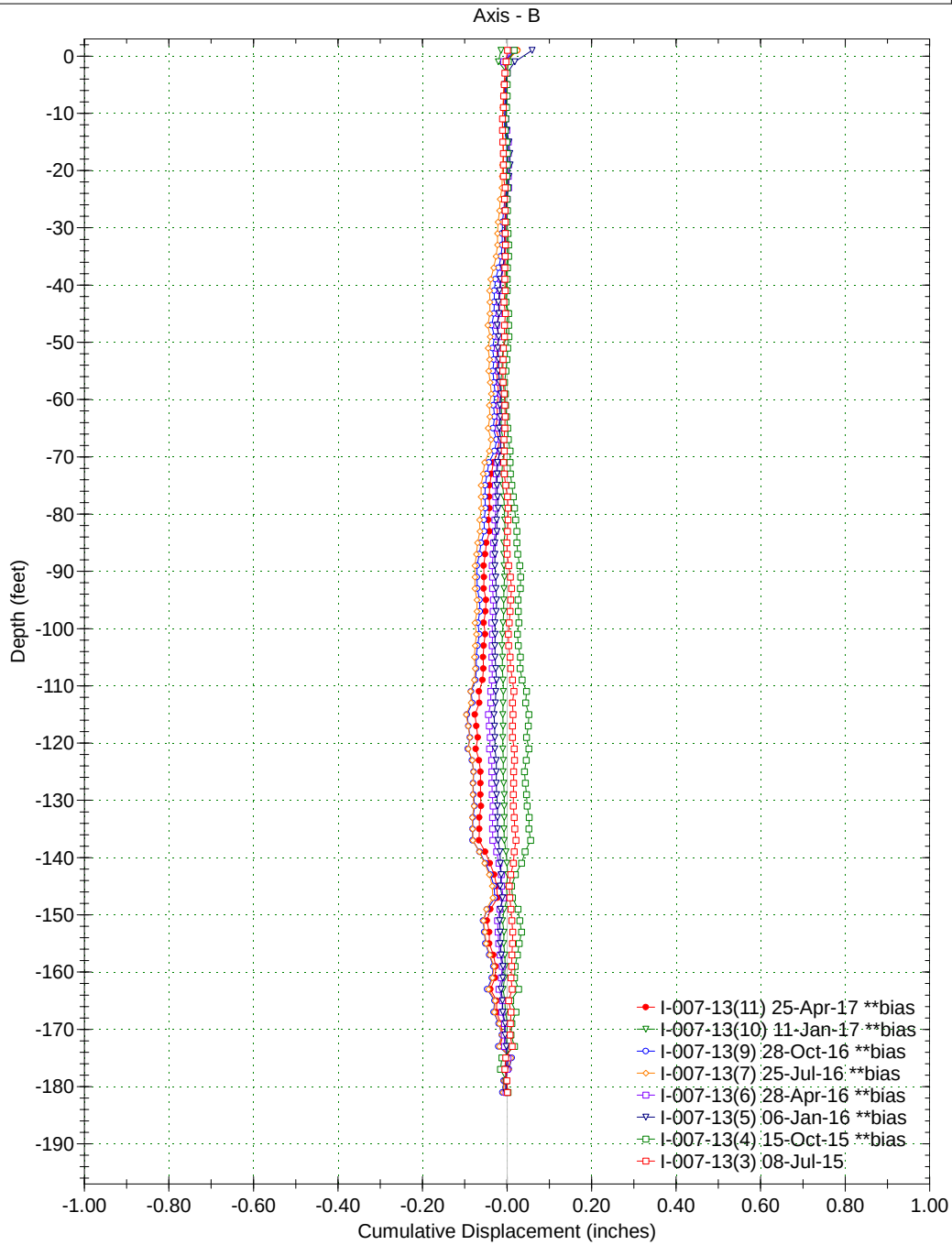
CUMULATIVE DISPLACEMENT

Inclinalysis v. 2.47.5

Borehole : I-007-13
Project : CUY-90-15-24
Location :
Northing :
Easting :
Collar :

Spiral Correction : N/A
Collar Elevation : 3.0 feet
Borehole Total Depth : 184.0 feet
A+ Groove Azimuth :
Base Reading : 2015 Apr 28 15:31
Applied Azimuth : 0.0 degrees





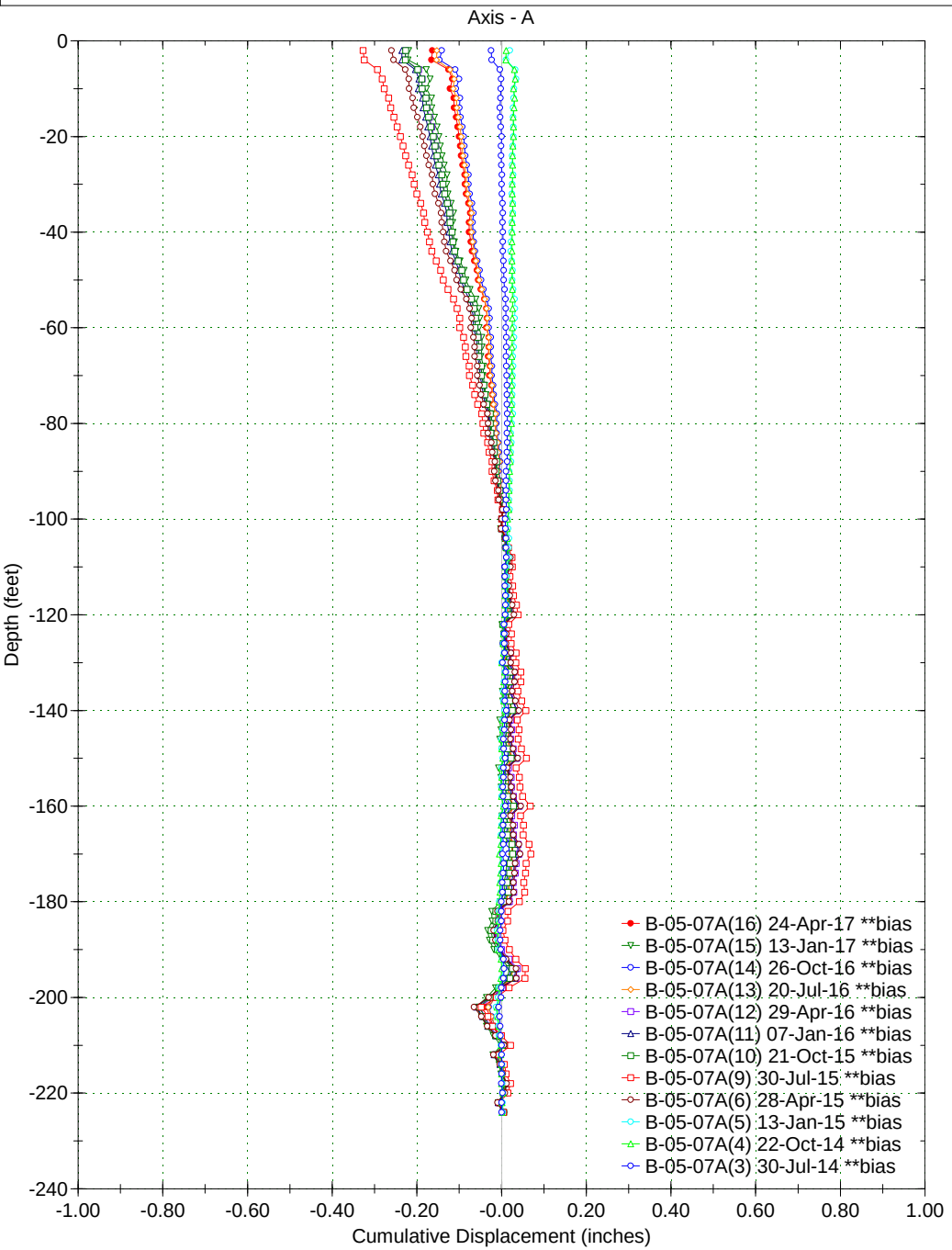
RST Instruments Ltd.

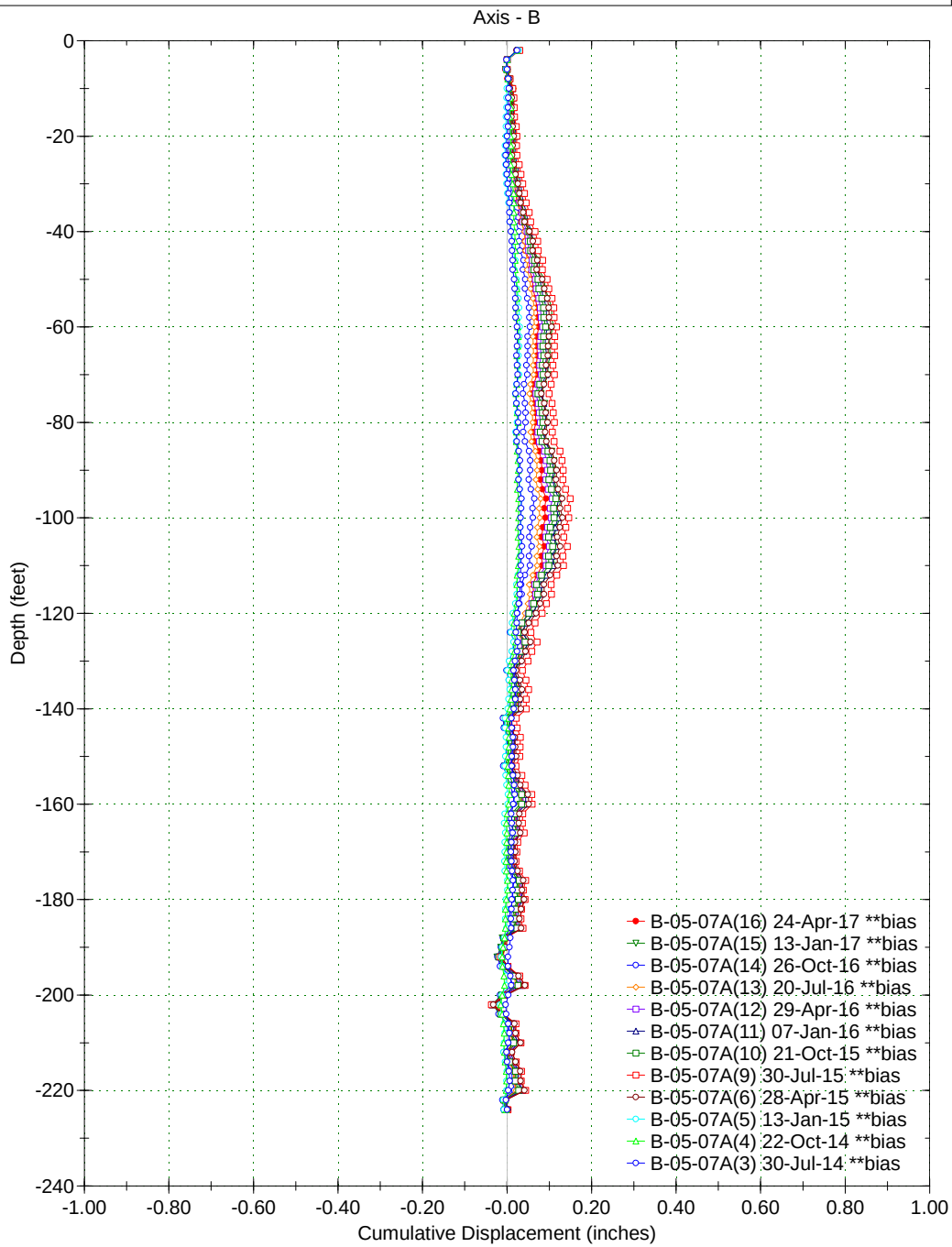
CUMULATIVE DISPLACEMENT

Inclinalysis v. 2.47.5

Borehole : B-05-07A
Project : CUY-90-15-24
Location : Cleveland, Ohio
Northing : 663369.991
Easting : 2189805.799
Collar :

Spiral Correction : N/A
Collar Elevation : 0.0 feet
Borehole Total Depth : 224.0 feet
A+ Groove Azimuth :
Base Reading : 2014 Apr 11 09:50
Applied Azimuth : 0.0 degrees





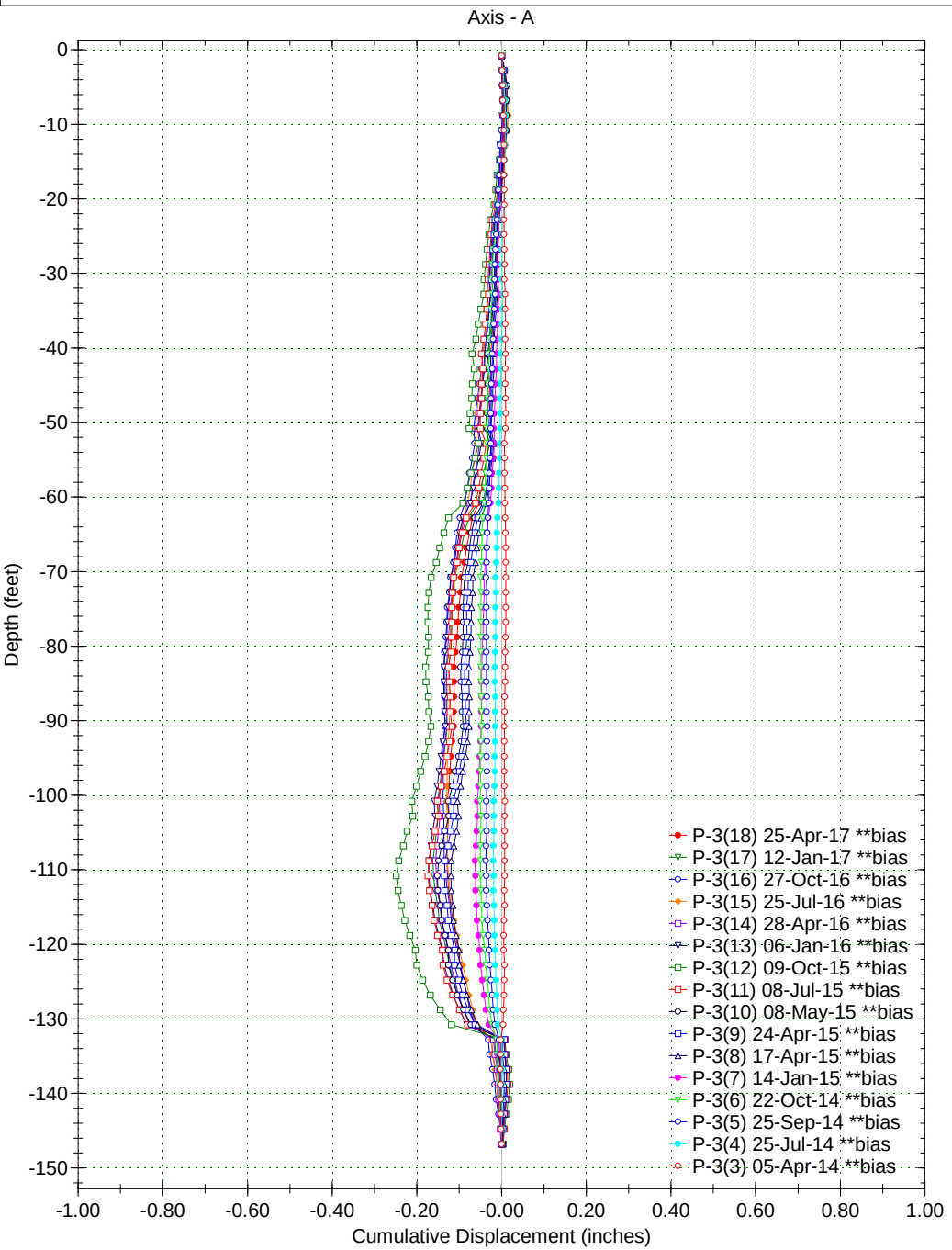
RST Instruments Ltd.

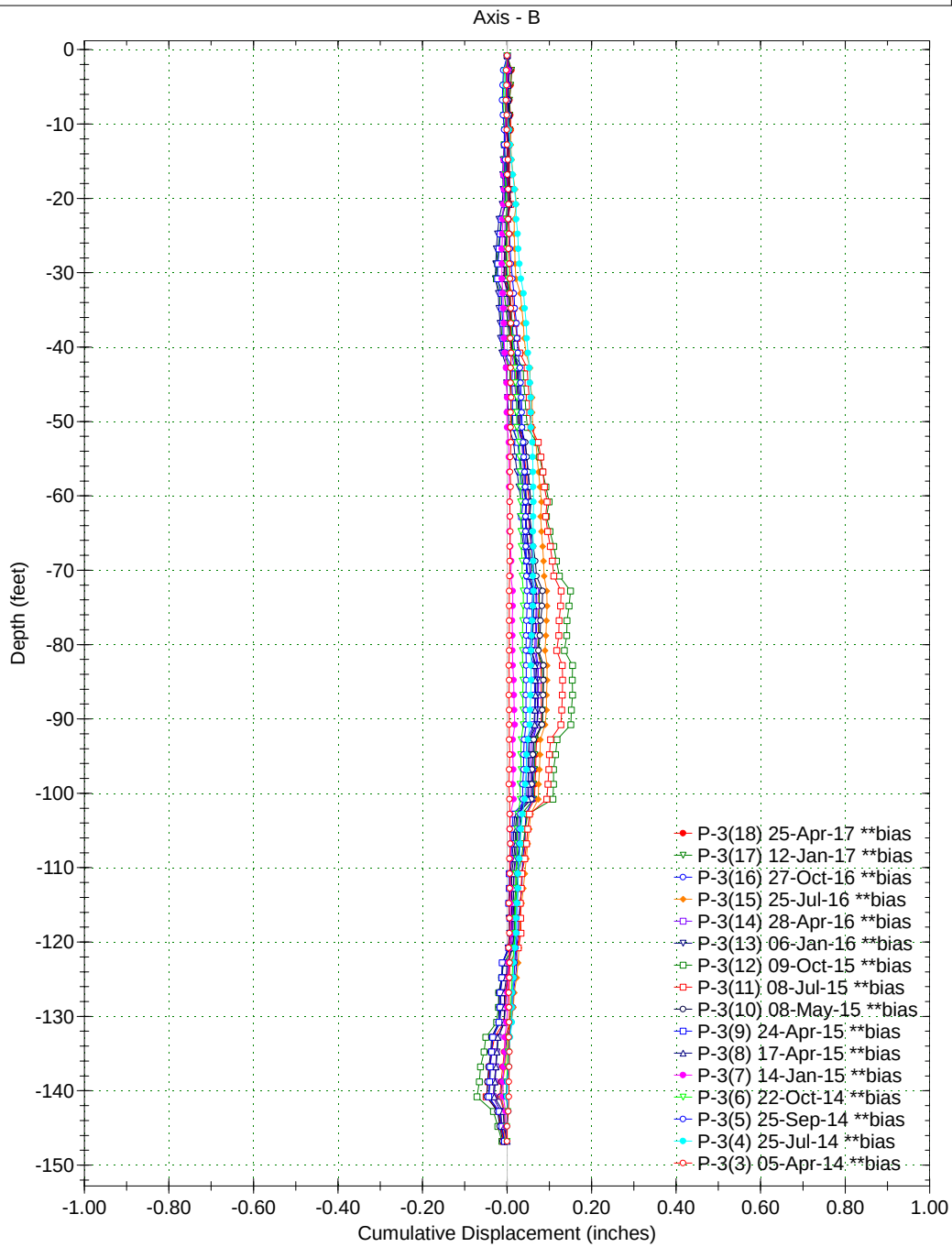
CUMULATIVE DISPLACEMENT

Inclinalysis v. 2.47.5

Borehole : P-3
Project : CUY-90-15-24
Location : Cleveland, Ohio
Northing :
Easting :
Collar :

Spiral Correction : N/A
Collar Elevation : 1.2 feet
Borehole Total Depth : 148.0 feet
A+ Groove Azimuth :
Base Reading : 2014 Jan 21 10:48
Applied Azimuth : 0.0 degrees





RST Instruments Ltd.

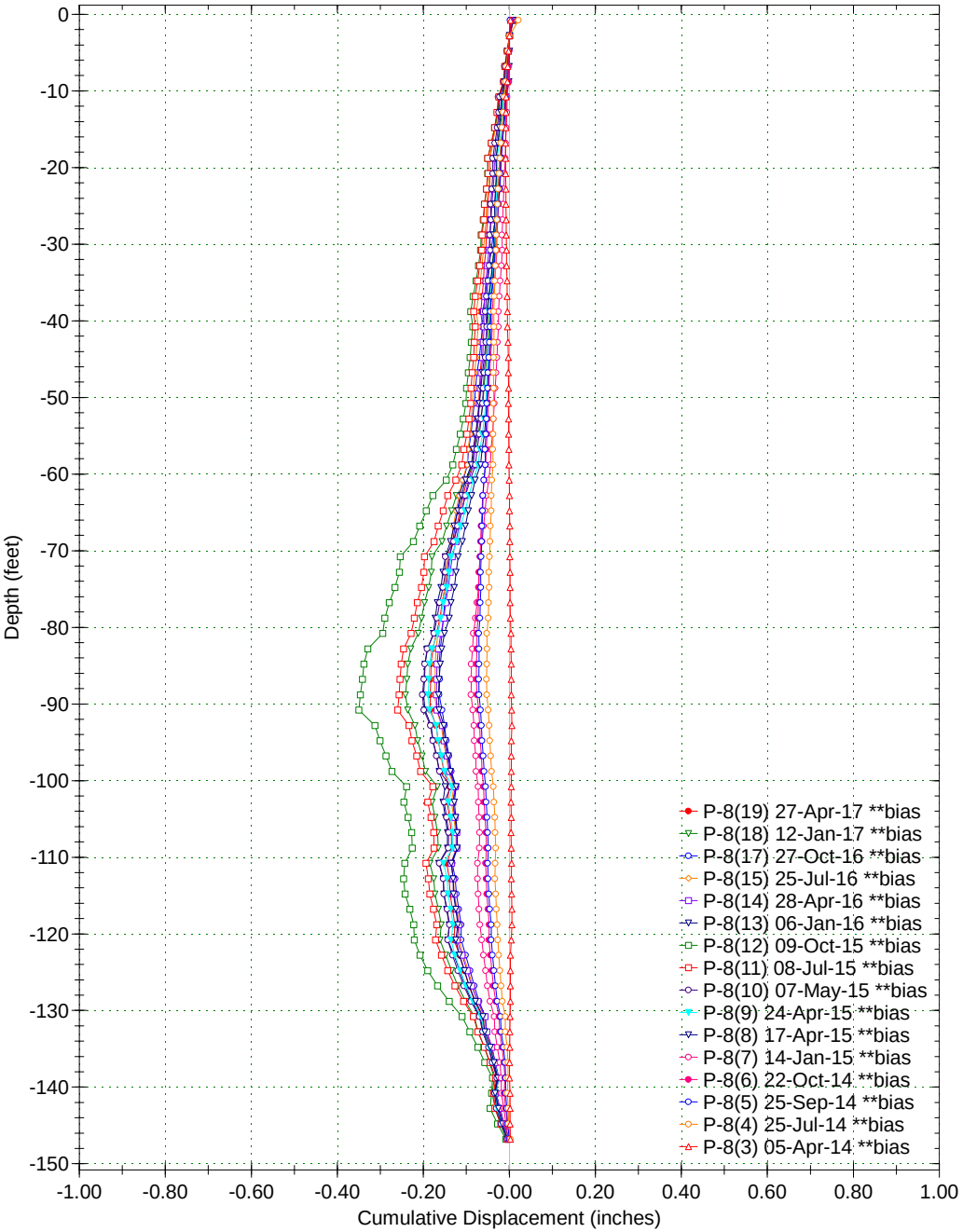
CUMULATIVE DISPLACEMENT

Inclinalysis v. 2.47.5

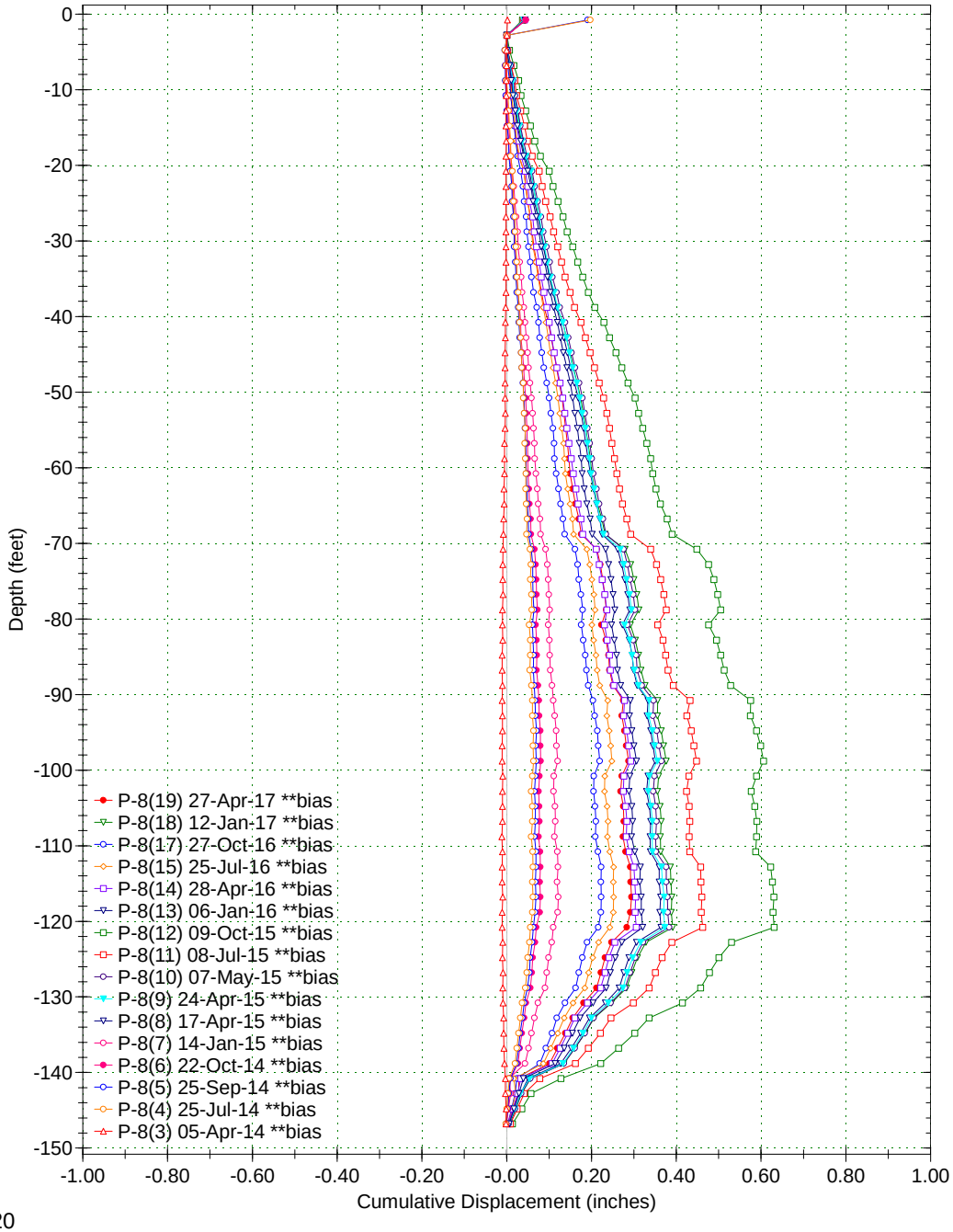
Borehole : P-8
Project : CUY-90-15-24
Location : Cleveland, Ohio
Northing :
Easting :
Collar :

Spiral Correction : N/A
Collar Elevation : 1.2 feet
Borehole Total Depth : 148.0 feet
A+ Groove Azimuth :
Base Reading : 2014 Jan 16 10:23
Applied Azimuth : 0.0 degrees

Axis - A



Axis - B



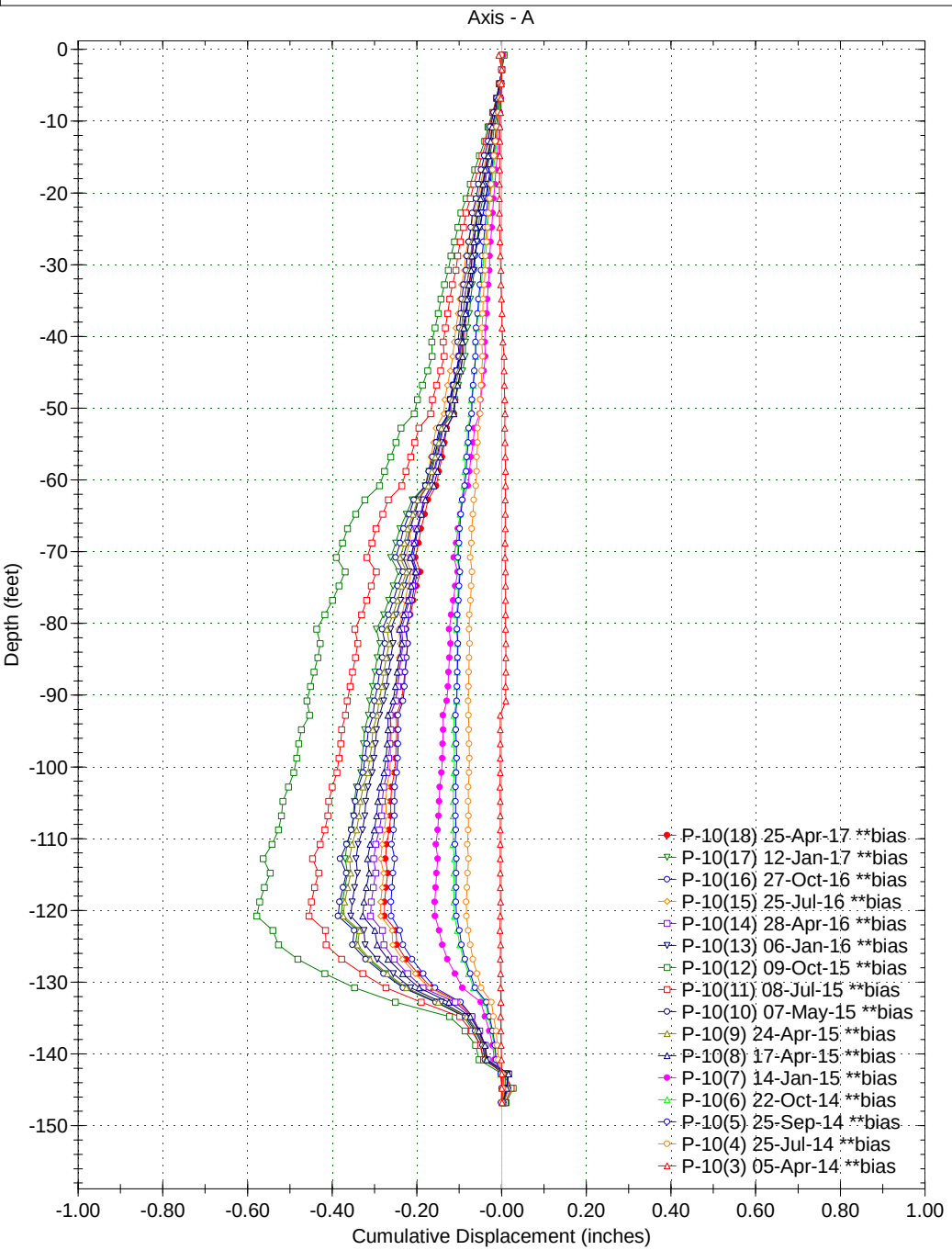
RST Instruments Ltd.

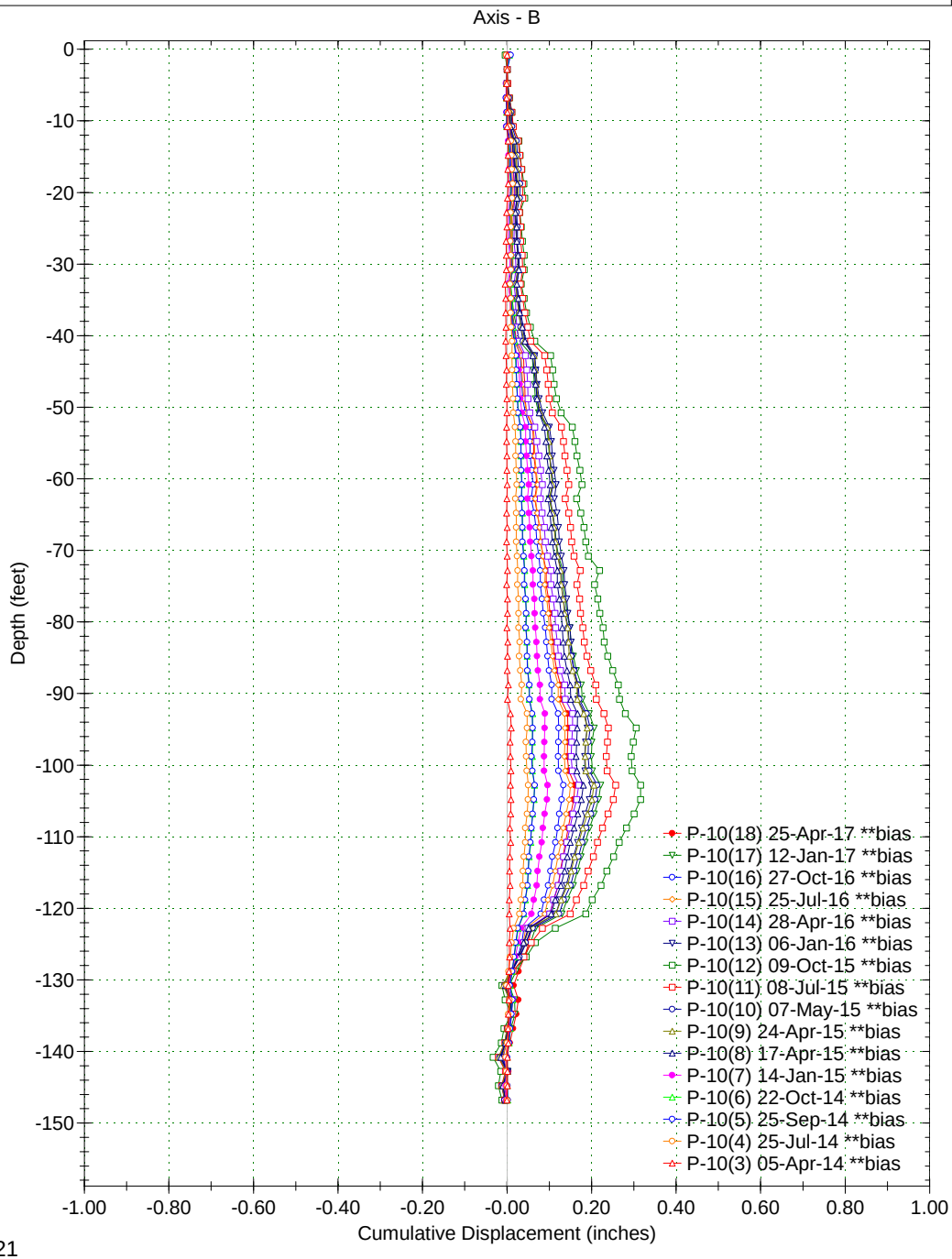
CUMULATIVE DISPLACEMENT

Inclinalysis v. 2.47.5

Borehole : P-10
Project : CUY-90-15-24
Location : Cleveland, Ohio
Northing :
Easting :
Collar :

Spiral Correction : N/A
Collar Elevation : 1.2 feet
Borehole Total Depth : 148.0 feet
A+ Groove Azimuth :
Base Reading : 2014 Jan 16 06:45
Applied Azimuth : 0.0 degrees





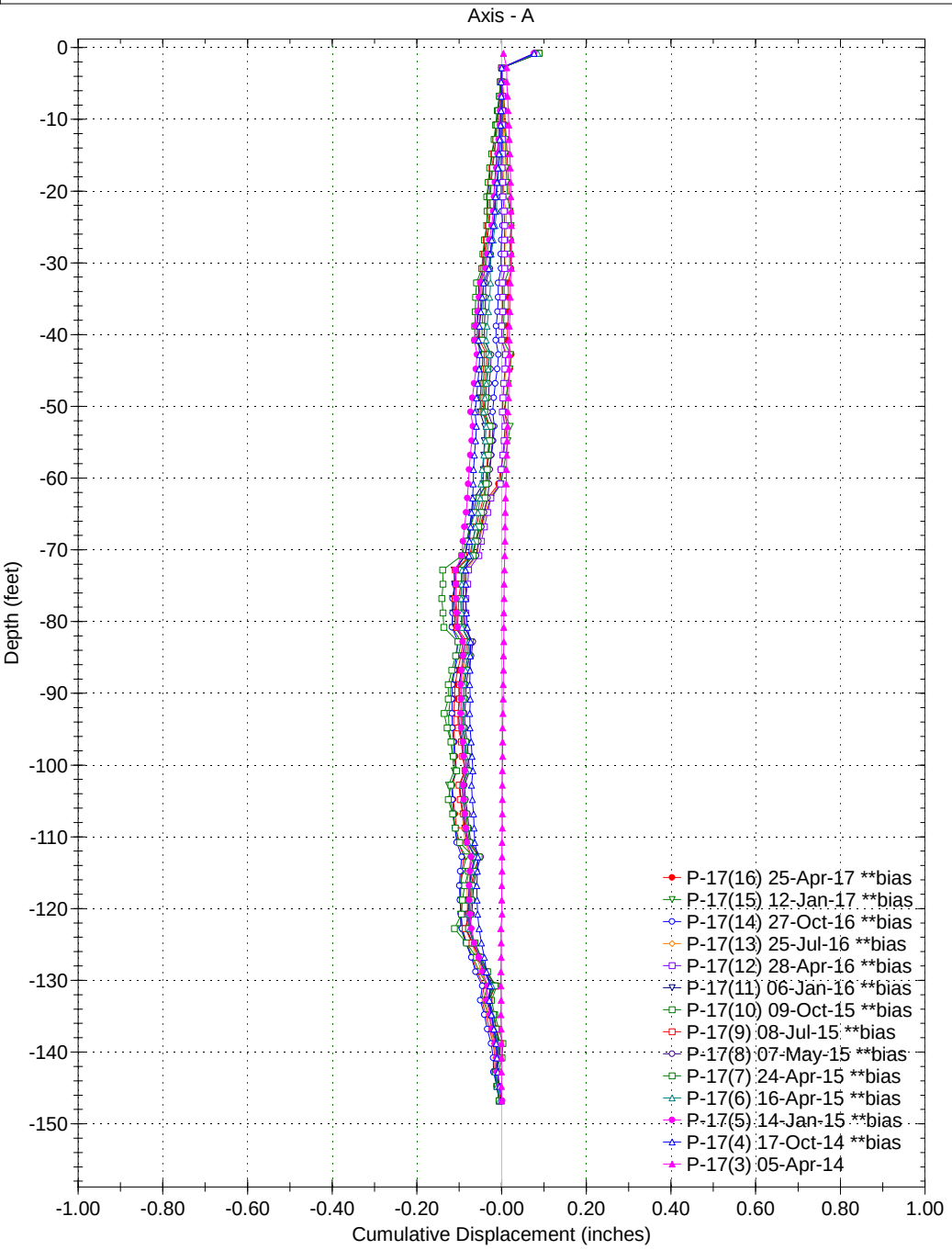
RST Instruments Ltd.

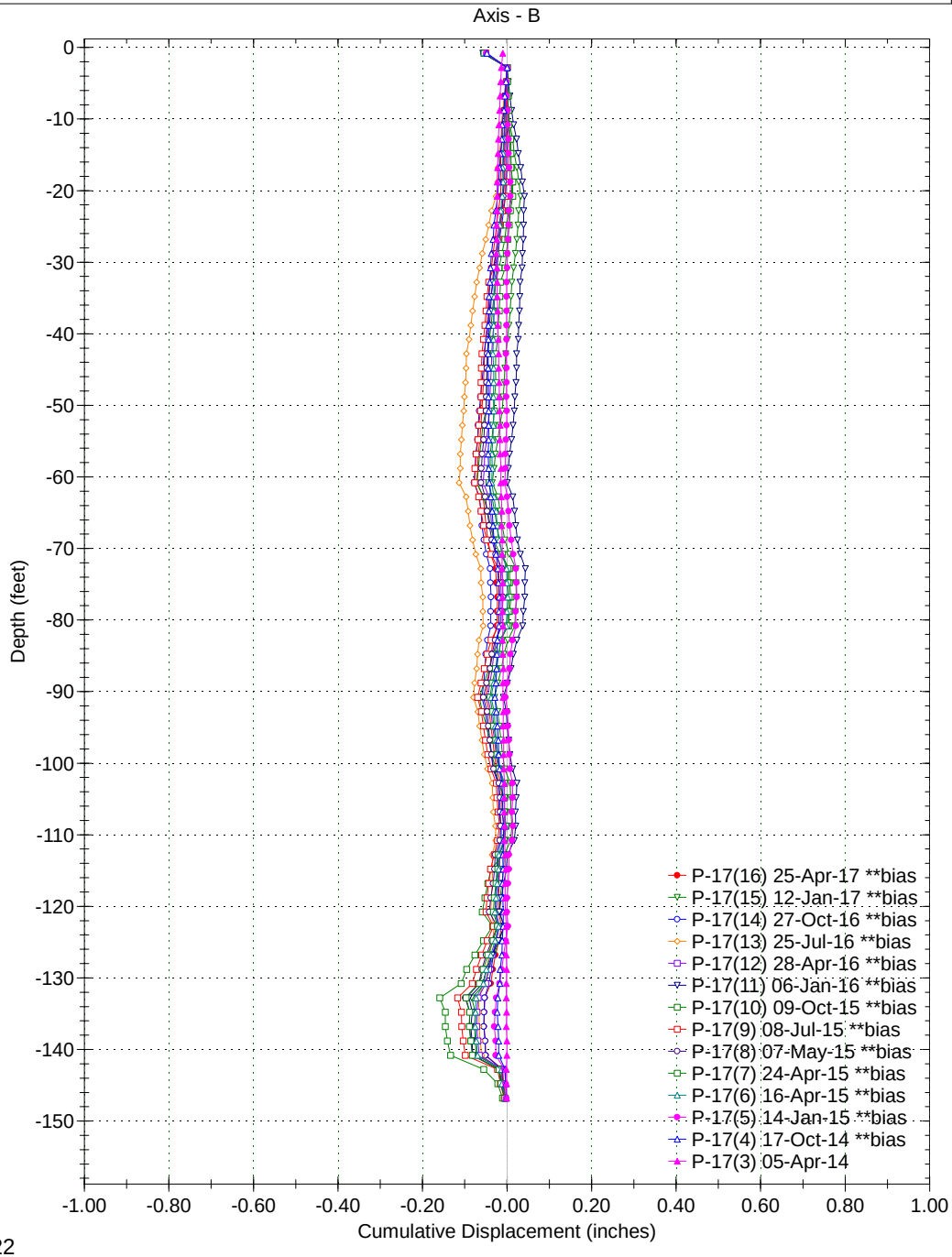
CUMULATIVE DISPLACEMENT

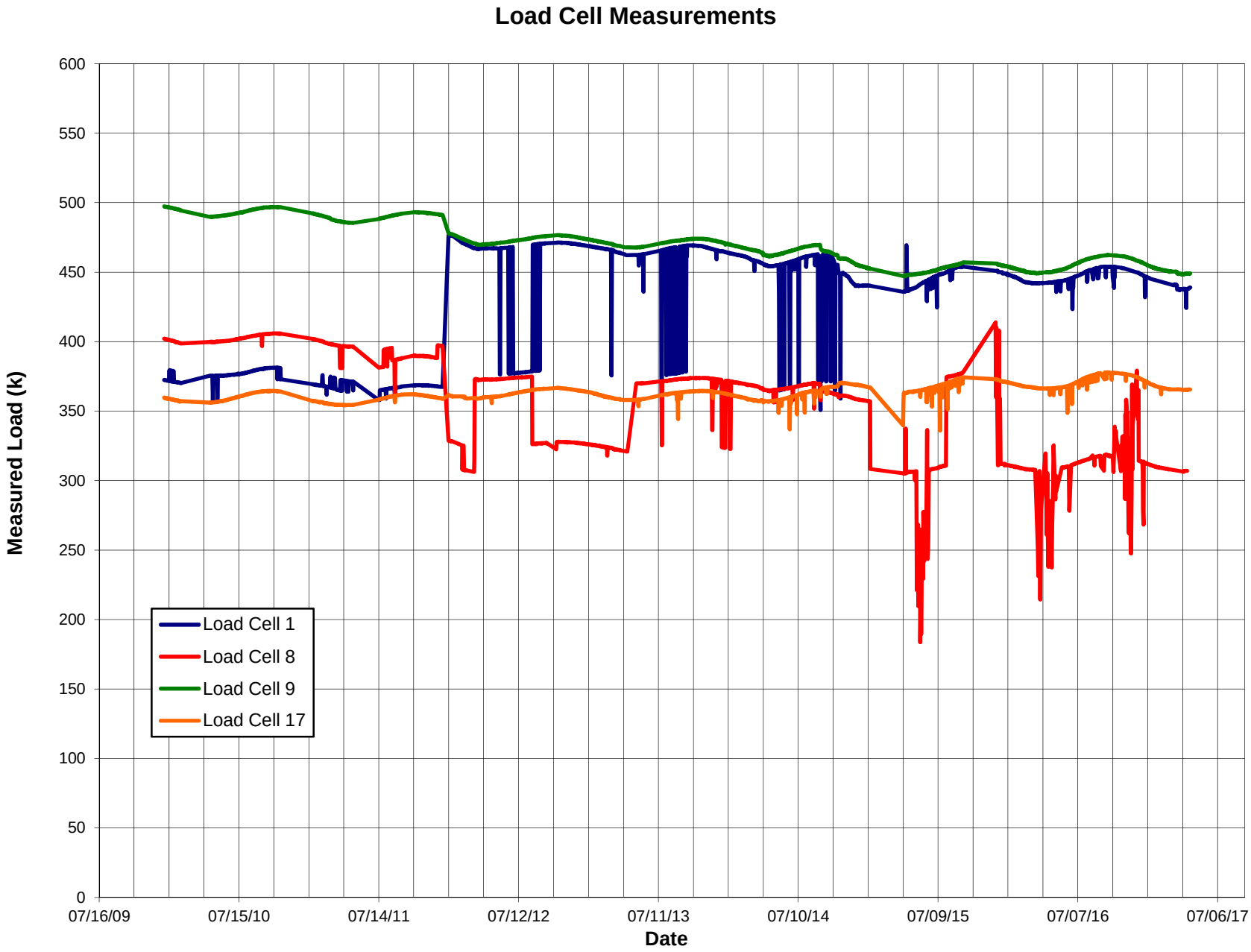
Inclinalysis v. 2.47.5

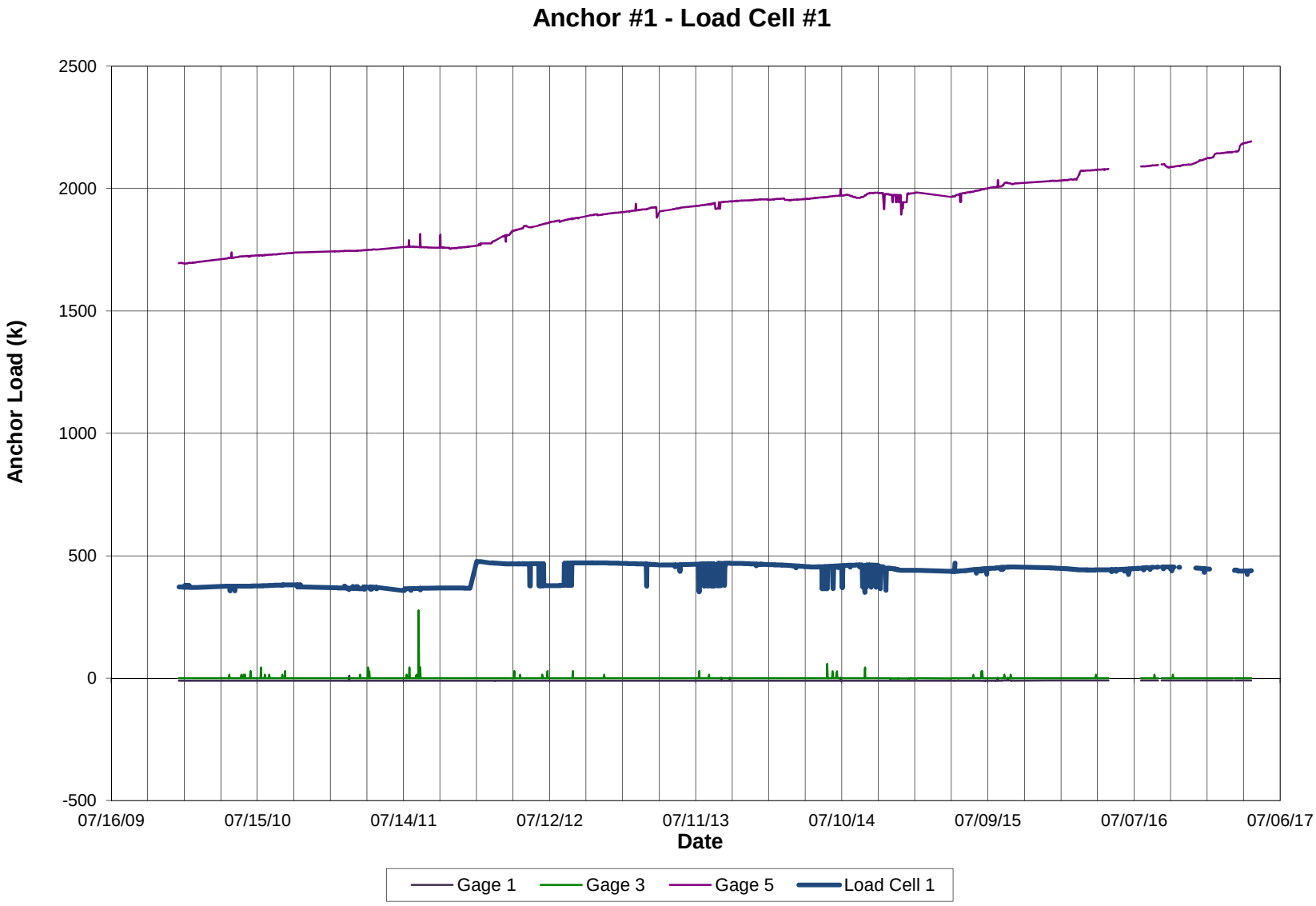
Borehole : P-17
Project : CUY-90-15-24
Location : Cleveland, Ohio
Northing :
Easting :
Collar :

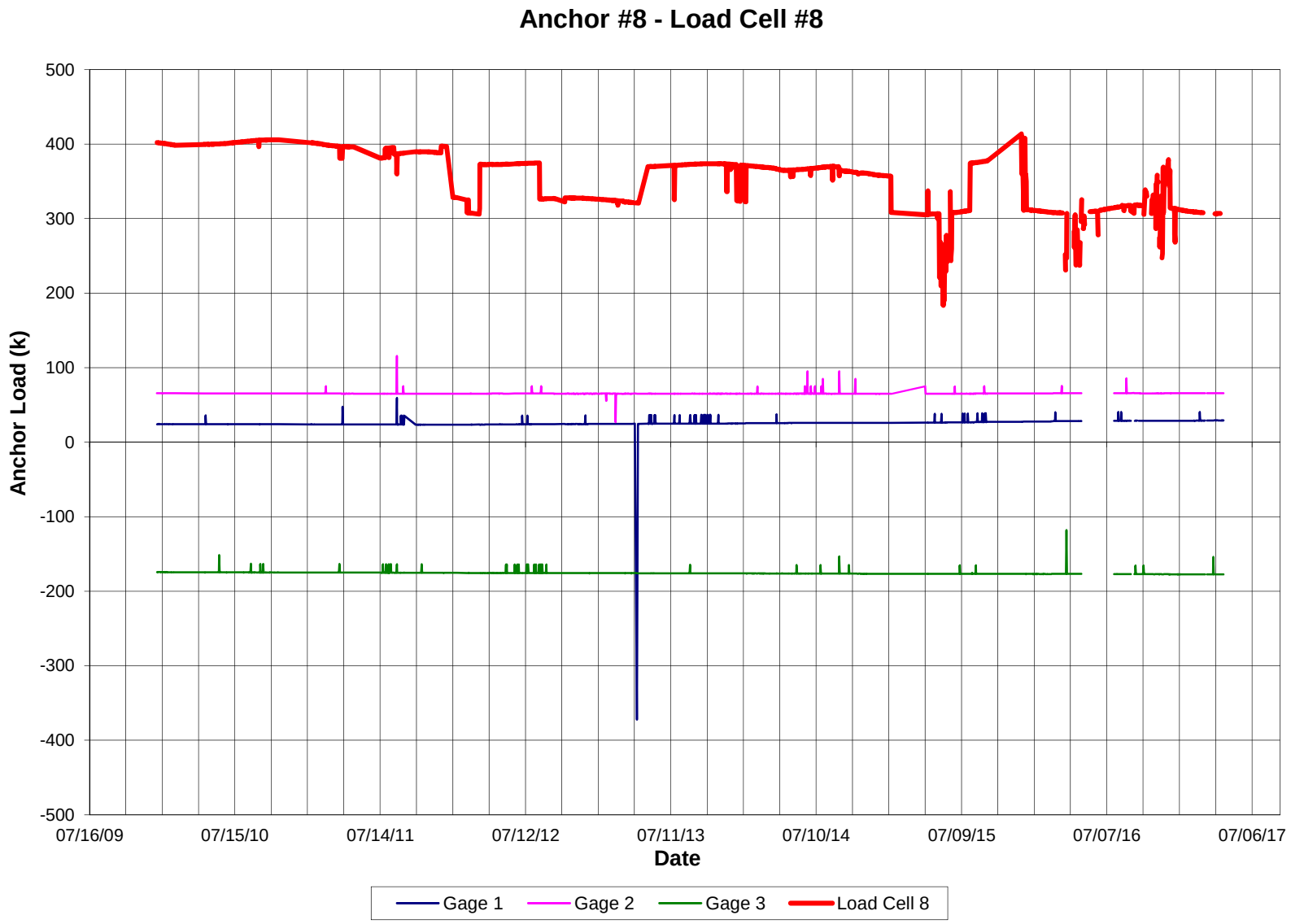
Spiral Correction : N/A
Collar Elevation : 1.2 feet
Borehole Total Depth : 148.0 feet
A+ Groove Azimuth :
Base Reading : 2014 Jan 15 12:02
Applied Azimuth : 0.0 degrees

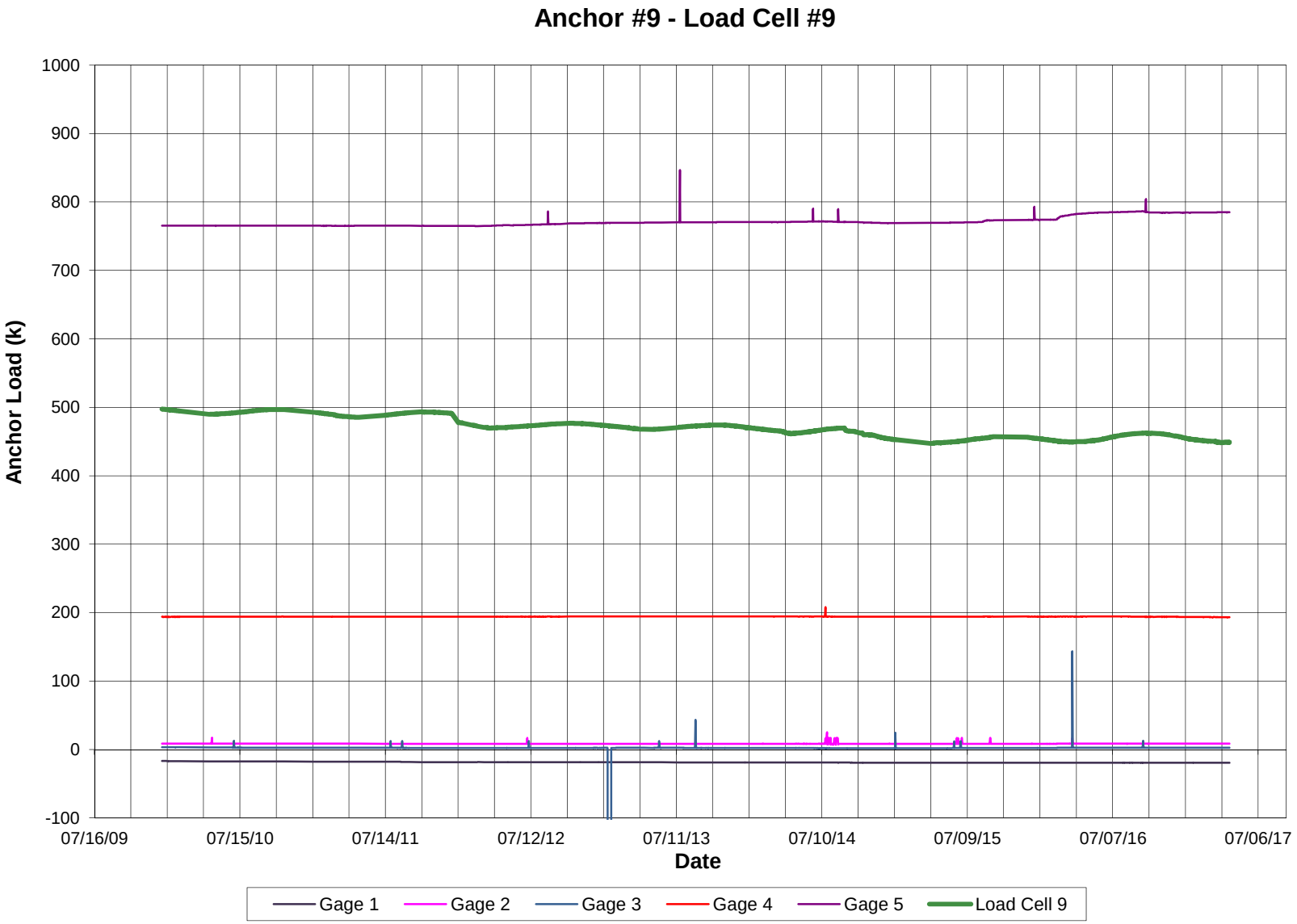


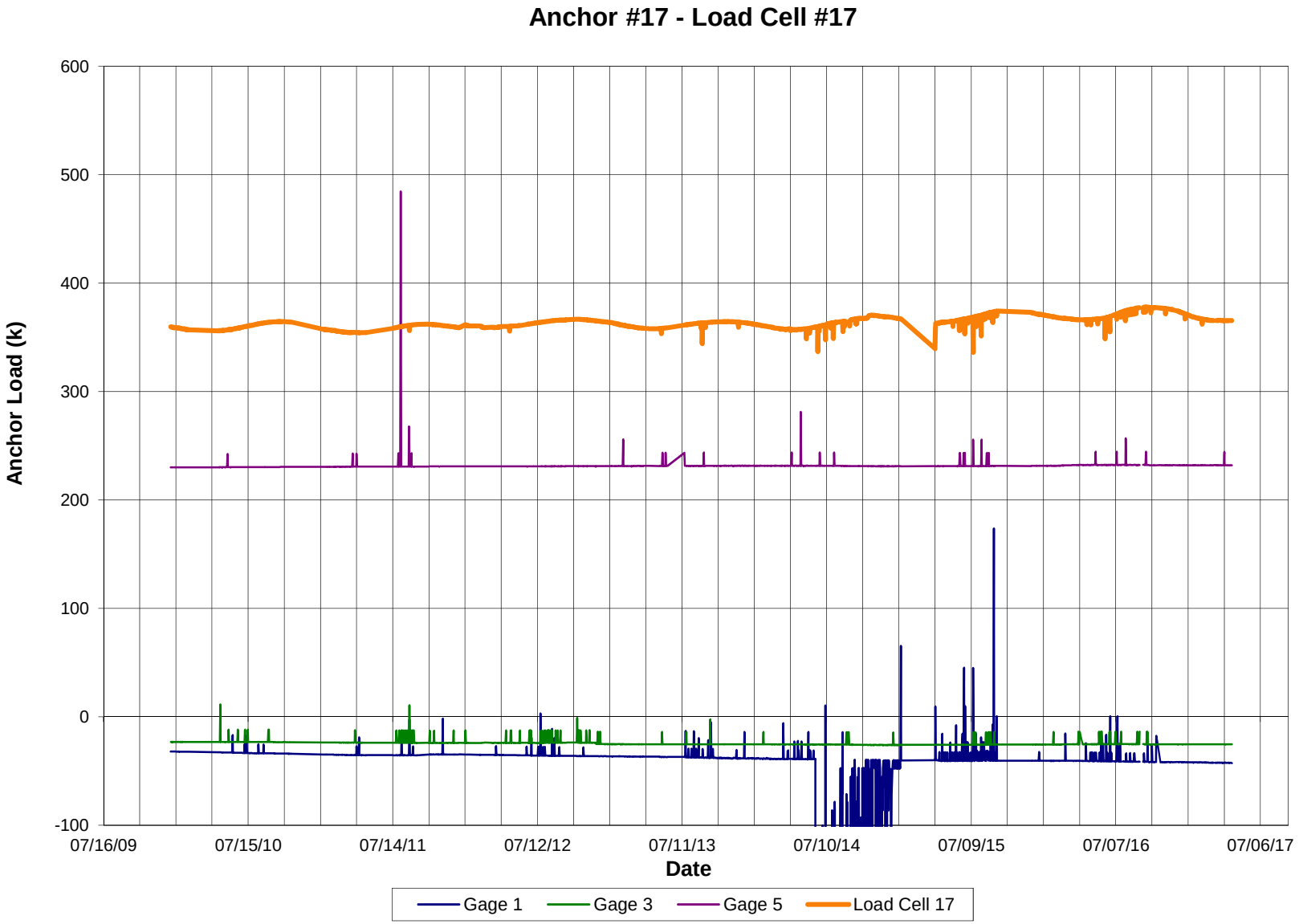



Load Cell Measurements
Measured Load (k)
600
550
500
450
400
350
300
250
200
150
100
50
0
07/16/09
07/15/10
07/14/11
07/12/12
07/11/13
07/10/14
07/09/15
07/07/16
07/06/17
Date
Load Cell 1
Load Cell 8
Load Cell 9
Load Cell 17

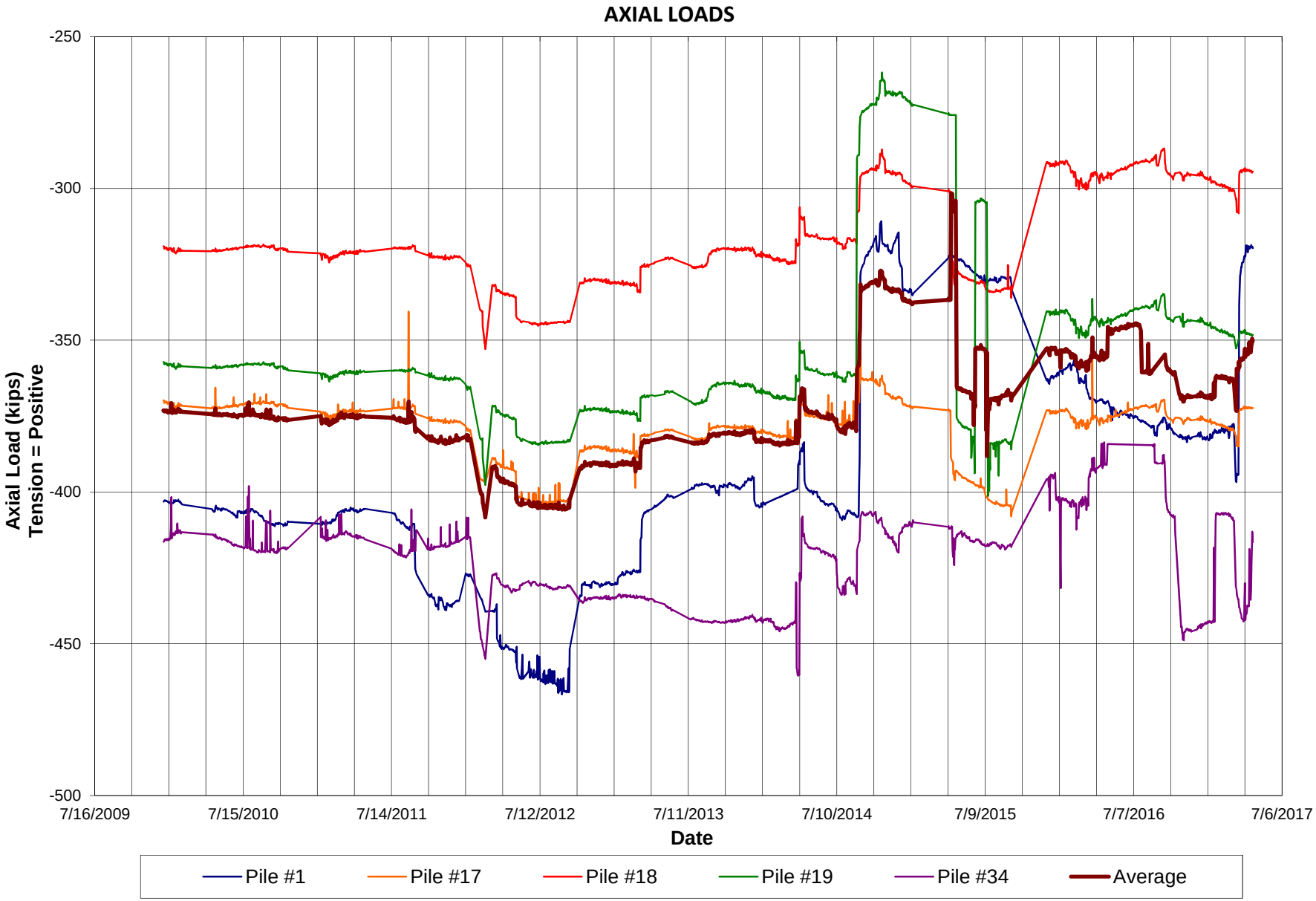

Anchor #1 - Load Cell #1
Anchor Load (k)
2500
2000
1500
1000
500
0
-500
07/16/09
07/15/10
07/14/11
07/12/12
07/11/13
07/10/14
07/09/15
07/07/16
07/06/17
Date
Gage 1
Gage 3
Gage 5
Load Cell 1


Anchor #8 - Load Cell #8
Anchor Load (k)
500
400
300
200
100
0
-100
-200
-300
-400
-500
07/16/09
07/15/10
07/14/11
07/12/12
07/11/13
07/10/14
07/09/15
07/07/16
07/06/17
Date
Gage 1
Gage 2
Gage 3
Load Cell 8


Anchor #9 - Load Cell #9
Anchor Load (k)
1000
900
800
700
600
500
400
300
200
100
0
-100
07/16/09
07/15/10
07/14/11
07/12/12
07/11/13
07/10/14
07/09/15
07/07/16
07/06/17
Date
Gage 1
Gage 2
Gage 3
Gage 4
Gage 5
Load Cell 9

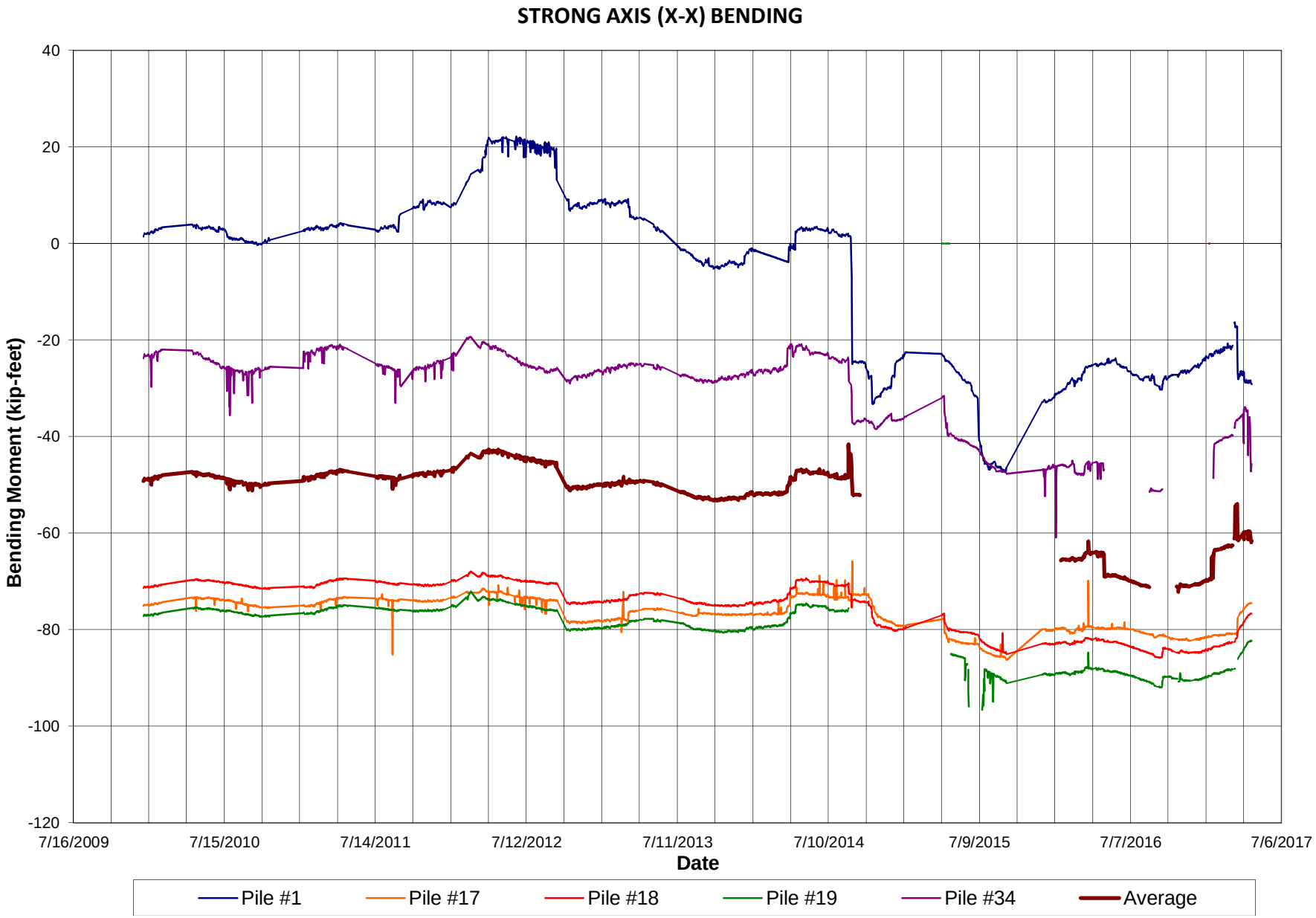

Anchor #17 - Load Cell #17
Anchor Load (k)
600
500
400
300
200
100
0
-100
07/16/09
07/15/10
07/14/11
07/12/12
07/11/13
07/10/14
07/09/15
07/07/16
07/06/17
Date
Gage 1
Gage 3
Gage 5
Load Cell 17

CUY-90-15.24 Slope Monitoring
Cleveland, Ohio
PID 96504
SME#: 069032.00



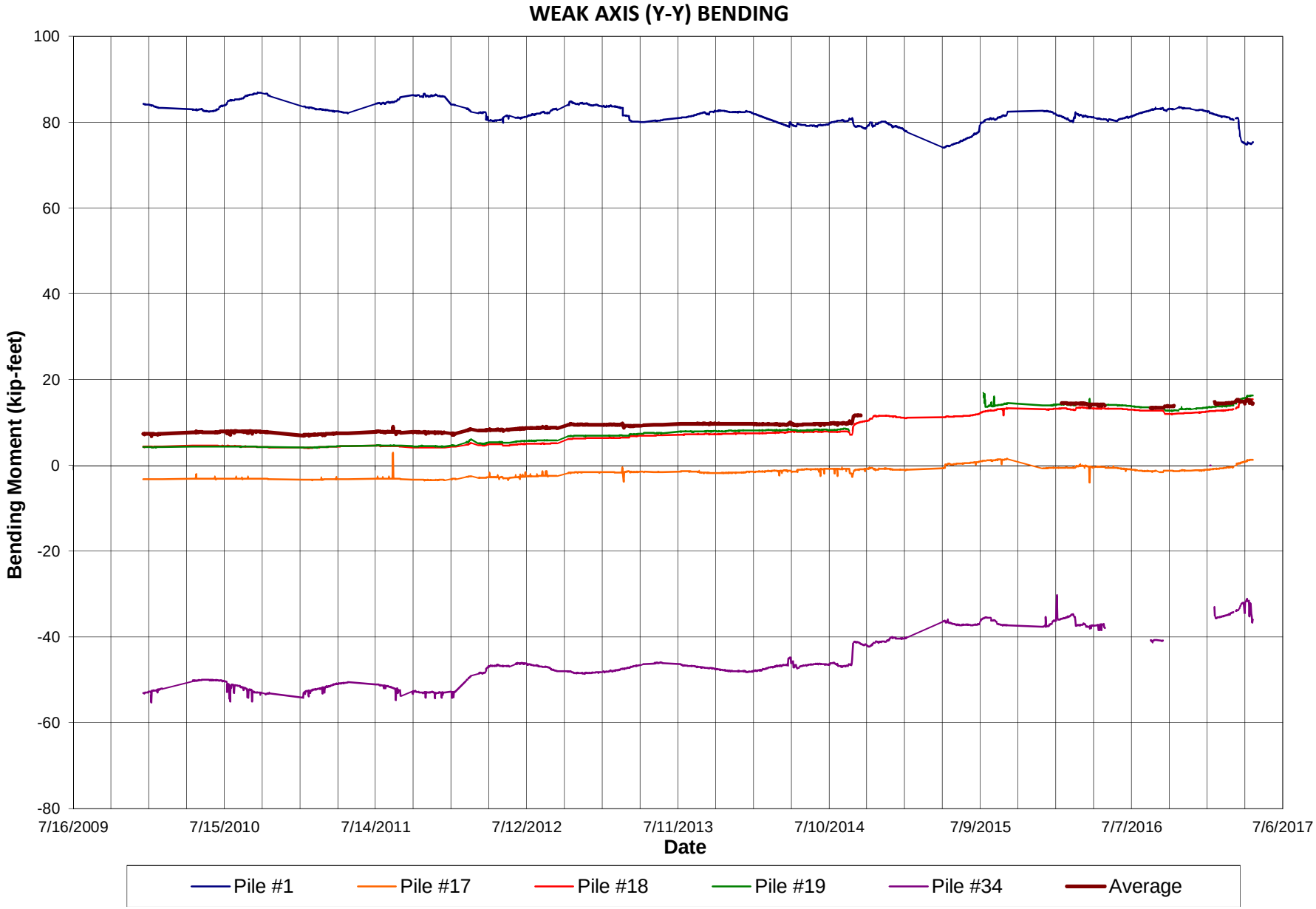
Driven Piles

CUY-90-15.24 Slope Monitoring
Cleveland, Ohio
PID 96504
SME#: 069032.00



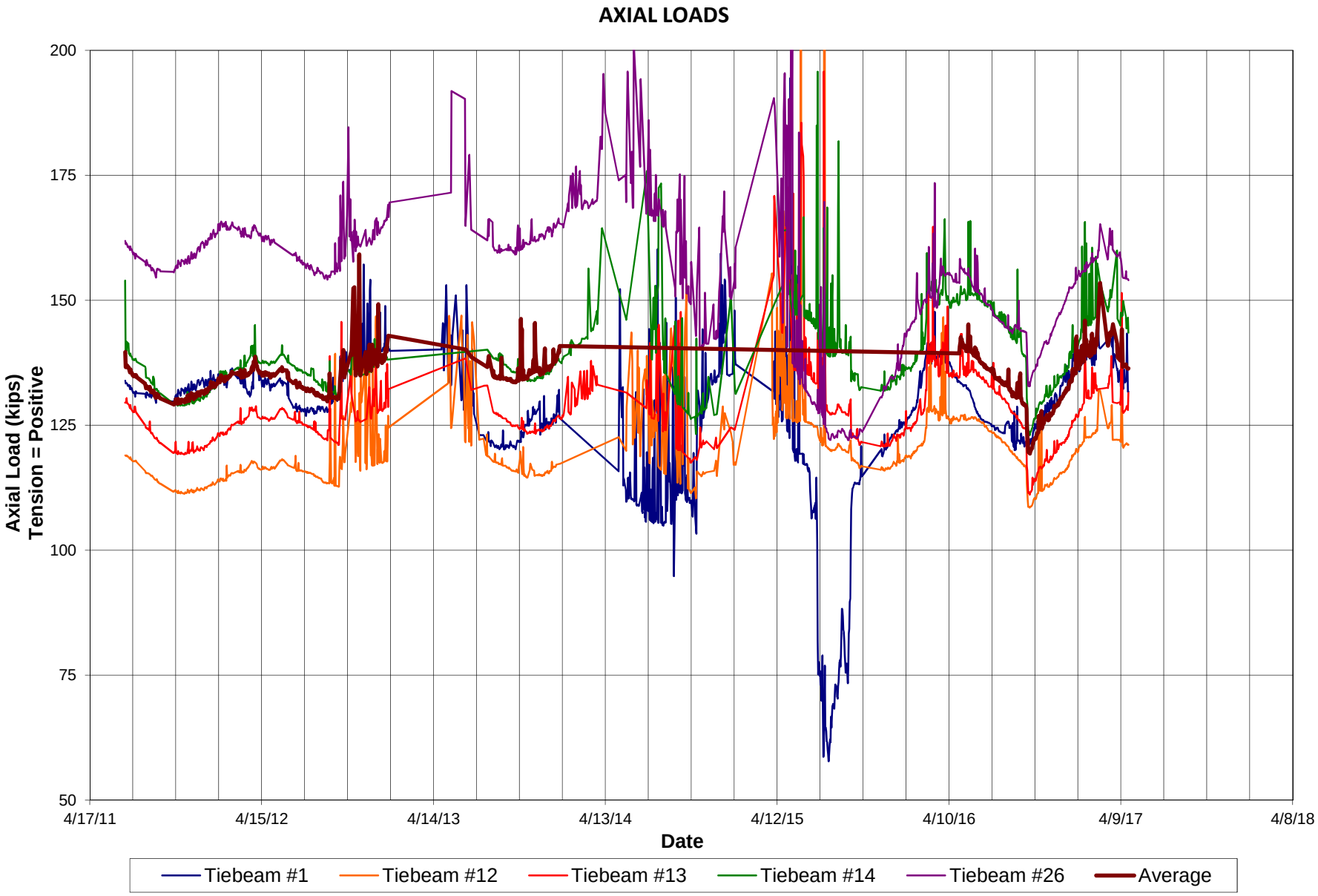
Driven Piles

CUY-90-15.24 Slope Monitoring
Cleveland, Ohio
PID 96504
SME#: 069032.00



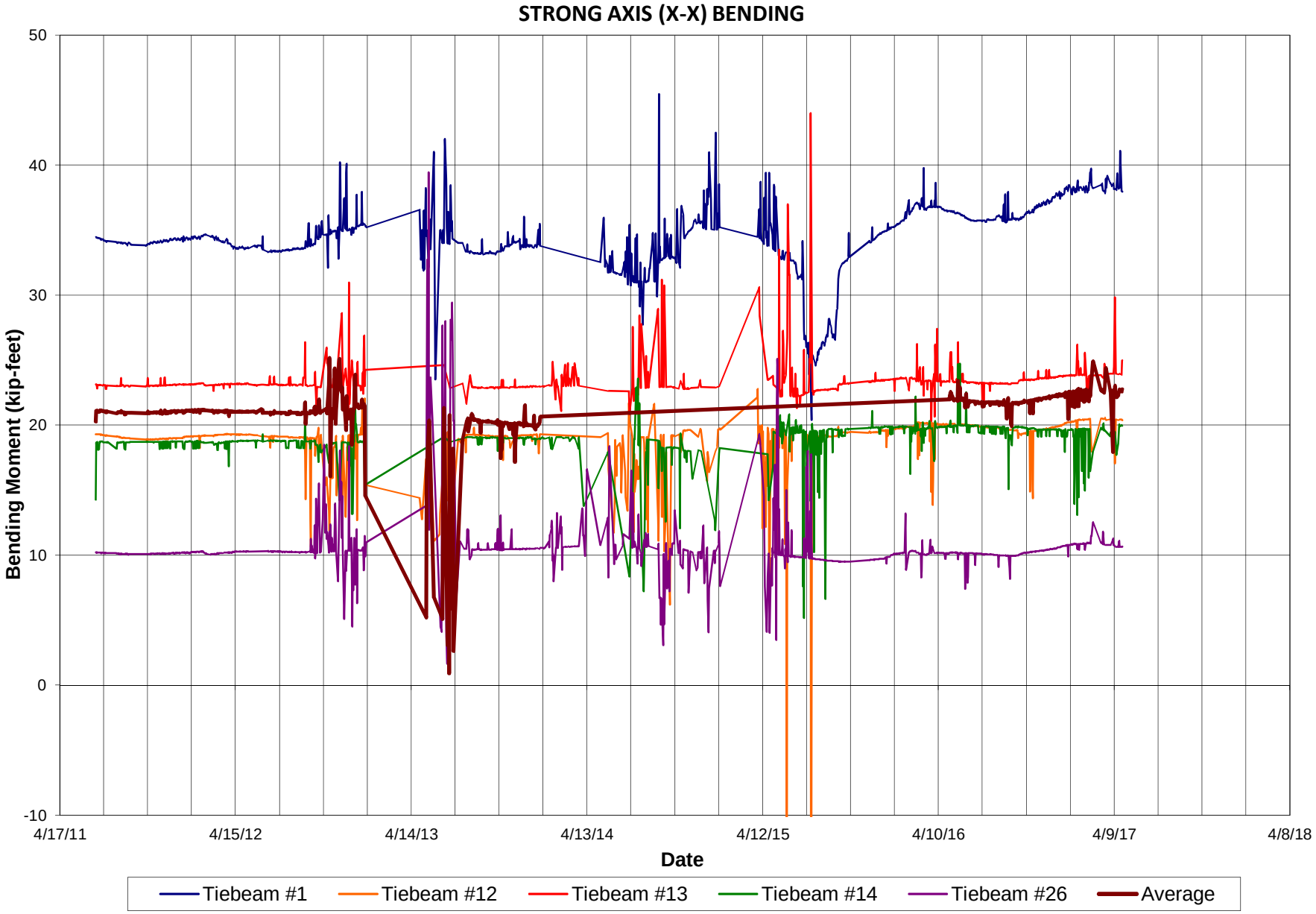
Driven Piles

CUY-90-15.24 Slope Monitoring
Cleveland, Ohio
PID 96504
SME#: 069032.00



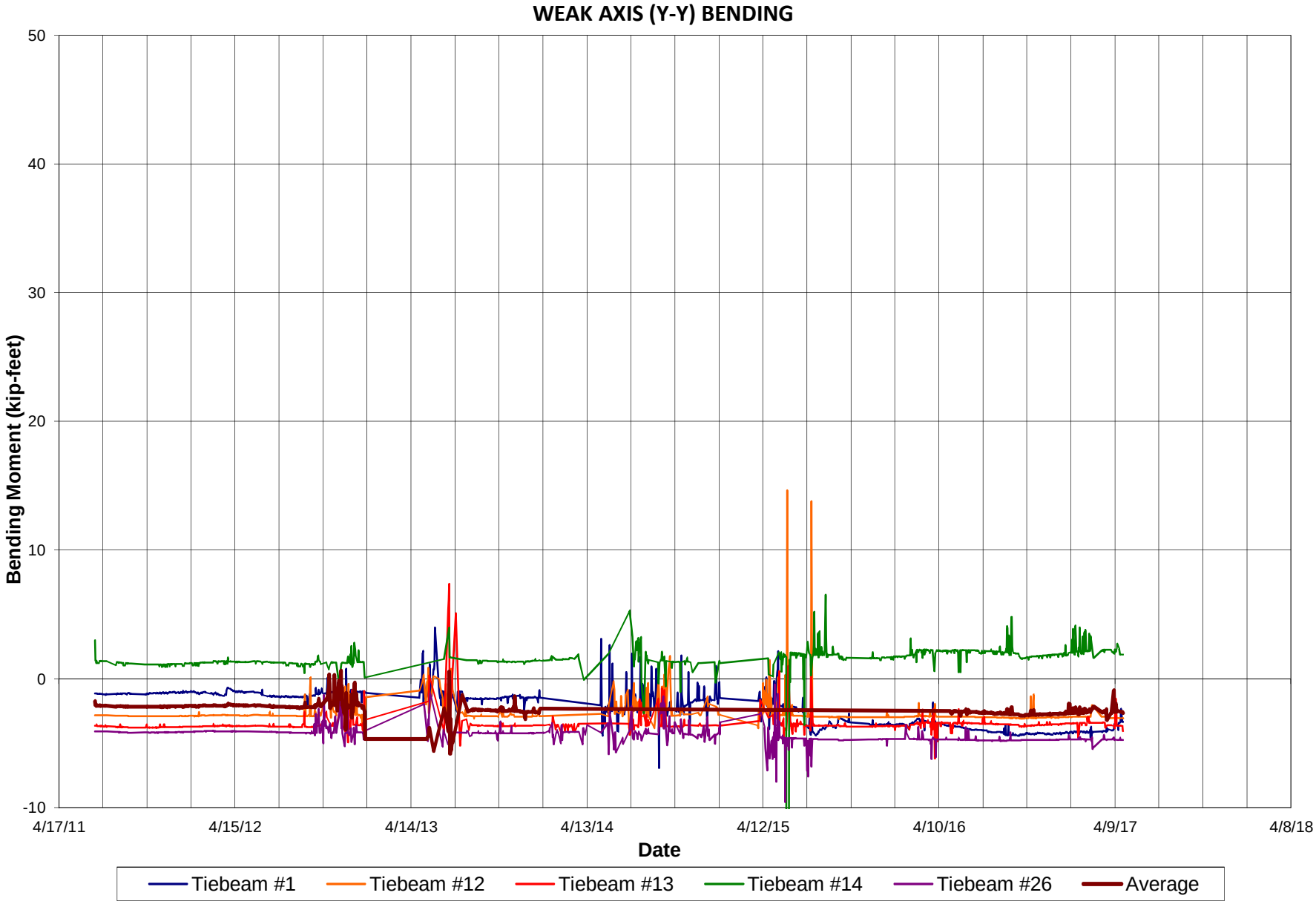
Tiebeams - Anchor Side

CUY-90-15.24 Slope Monitoring
Cleveland, Ohio
PID 96504
SME#: 069032.00



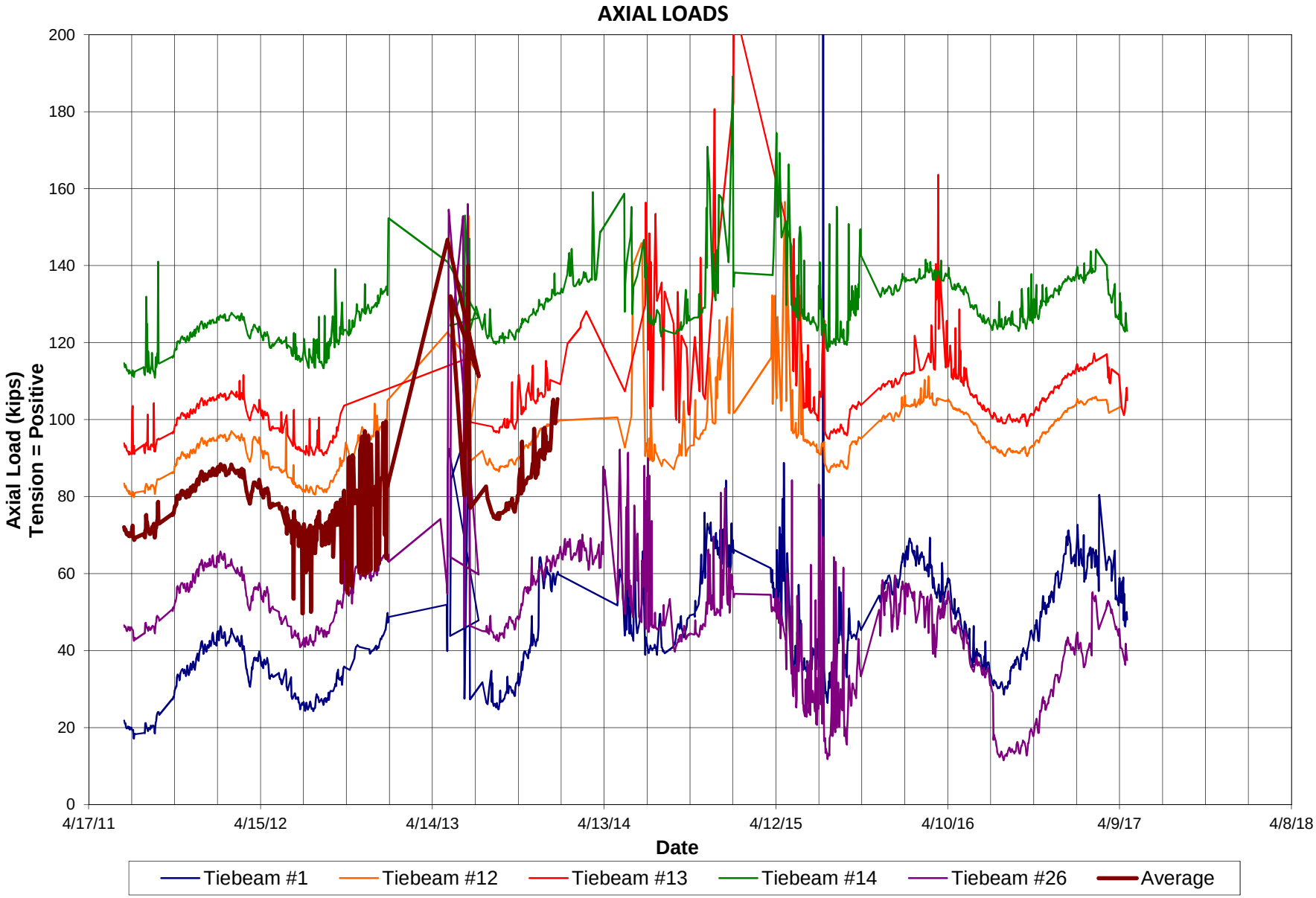
Tiebeams - Anchor Side

CUY-90-15.24 Slope Monitoring
Cleveland, Ohio
PID 96504
SME#: 069032.00



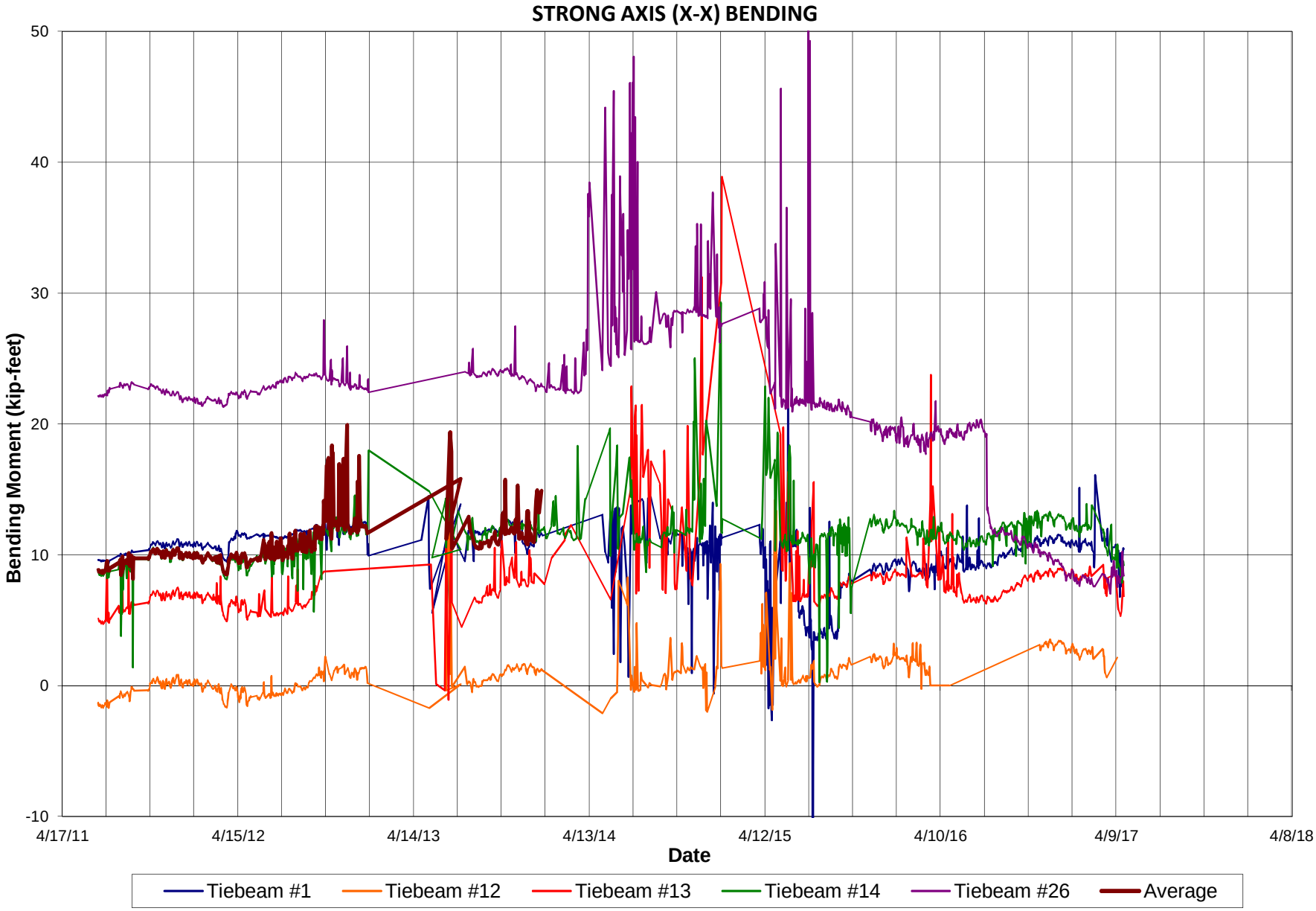
Tiebeams - Anchor Side

CUY-90-15.24 Slope Monitoring
Cleveland, Ohio
PID 96504
SME#: 069032.00



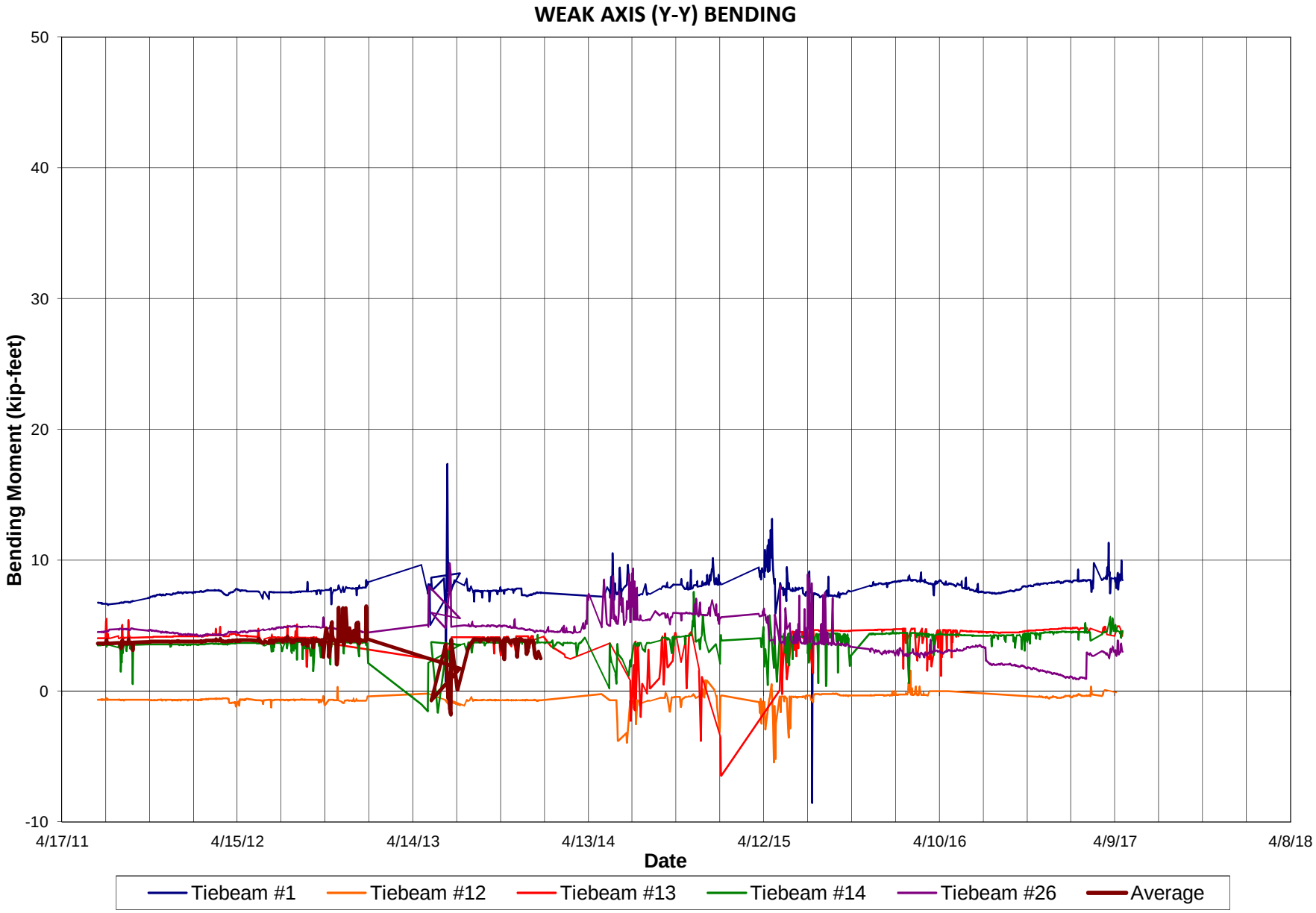
Tiebeams - Drilled Pier Side

CUY-90-15.24 Slope Monitoring
Cleveland, Ohio
PID 96504
SME#: 069032.00

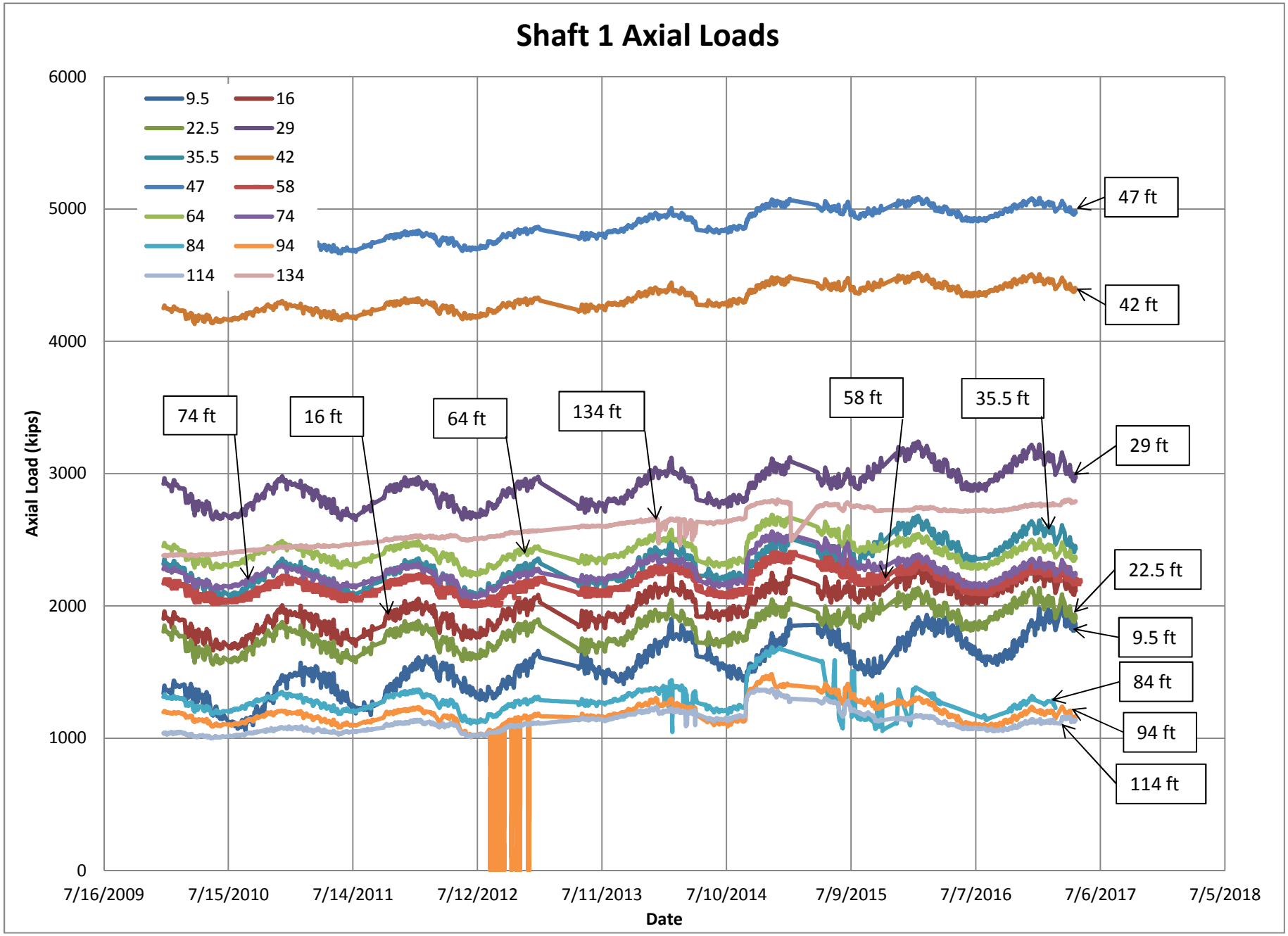


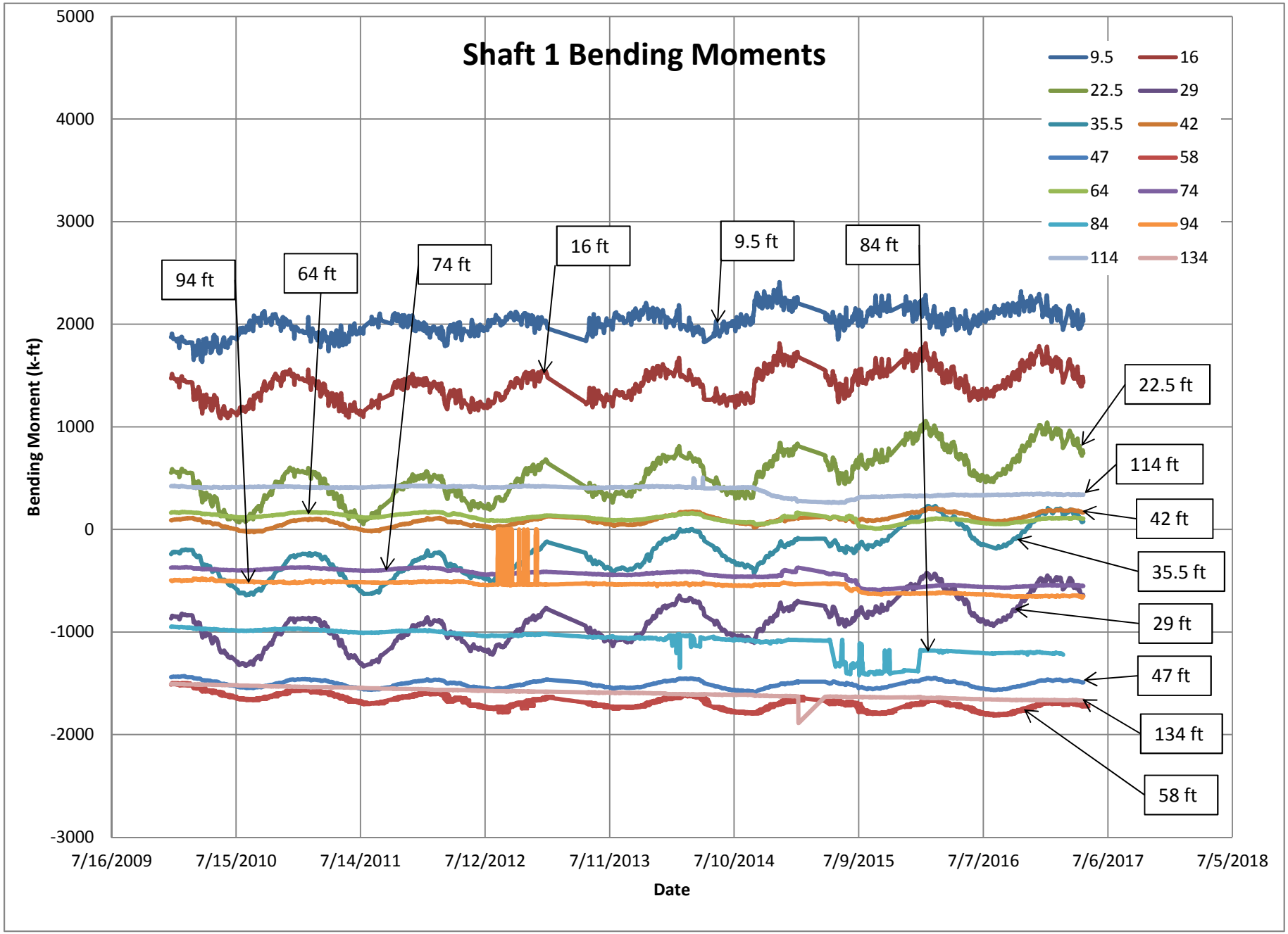
Tiebeams - Drilled Pier Side

CUY-90-15.24 Slope Monitoring
Cleveland, Ohio
PID 96504
SME#: 069032.00



Tiebeams - Drilled Pier Side


Shaft 1 Axial Loads
Axial Load (kips)
6000
5000
4000
3000
2000
1000
0
9.5
16
22.5
29
35.5
42
47
58
64
74
84
94
114
134
47 ft
42 ft
74 ft
16 ft
64 ft
134 ft
58 ft
35.5 ft
29 ft
22.5 ft
9.5 ft
84 ft
94 ft
114 ft
7/16/2009
7/15/2010
7/14/2011
7/12/2012
7/11/2013
7/10/2014
7/9/2015
7/7/2016
7/6/2017
7/5/2018
Date

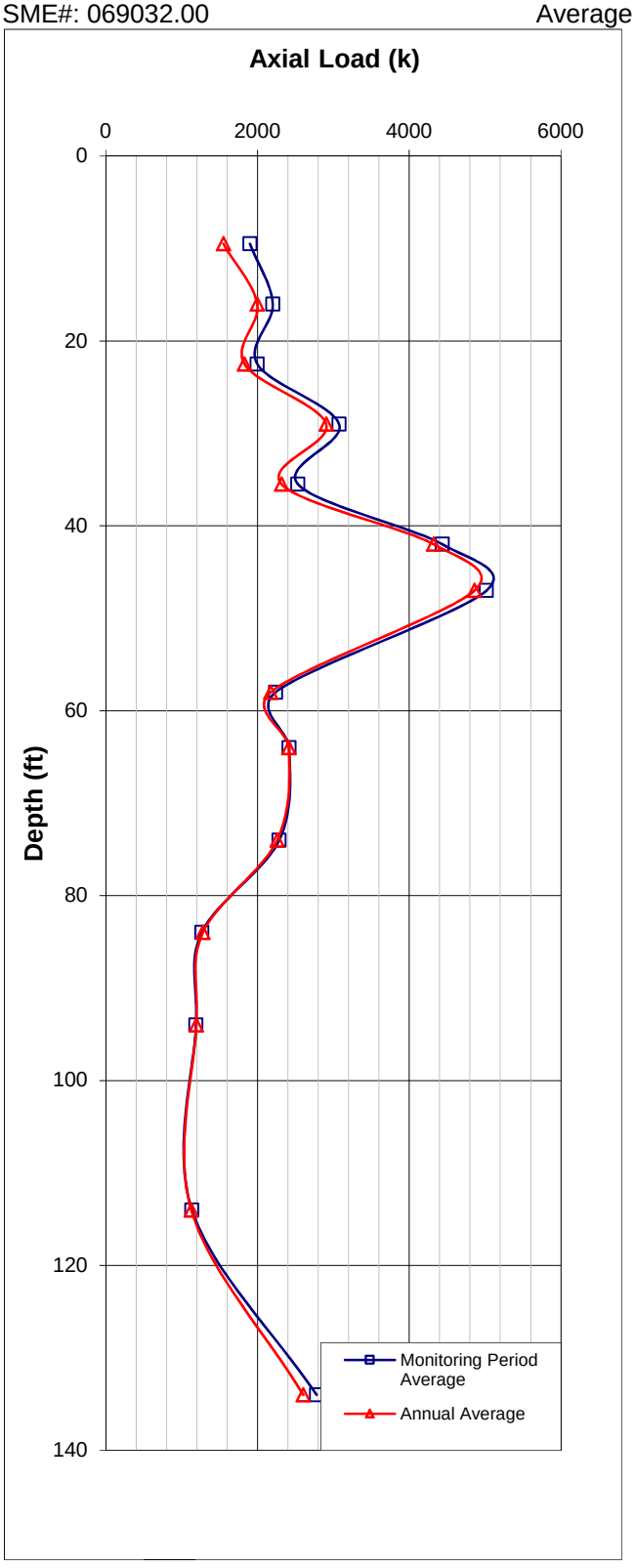

Shaft 1 Bending Moments
9.5
16
22.5
29
35.5
42
47
58
64
74
84
94
114
134
94 ft
64 ft
74 ft
16 ft
9.5 ft
84 ft
22.5 ft
114 ft
42 ft
35.5 ft
29 ft
47 ft
134 ft
58 ft
Bending Moment (k-ft)
5000
4000
3000
2000
1000
0
-1000
-2000
-3000
7/16/2009
7/15/2010
7/14/2011
7/12/2012
7/11/2013
7/10/2014
7/9/2015
7/7/2016
7/6/2017
7/5/2018
Date

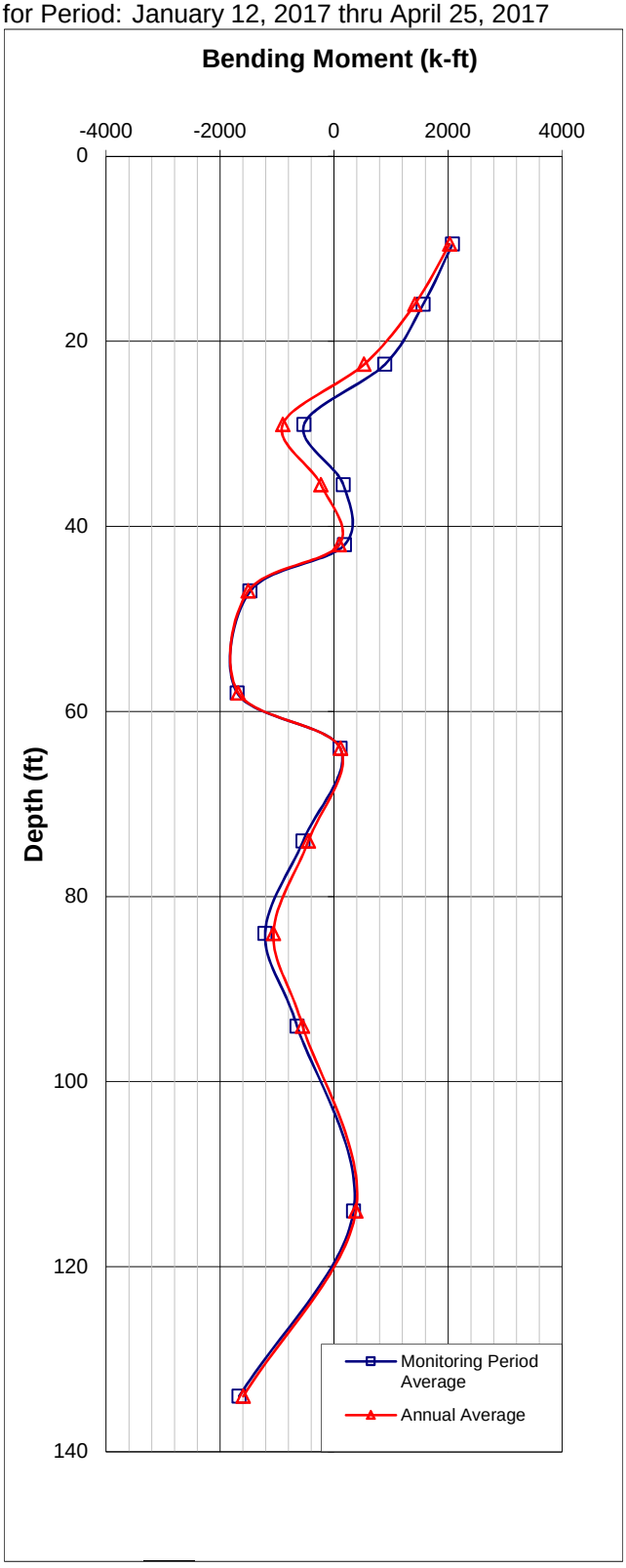
CUY-90-15.24 Slope Monitoring

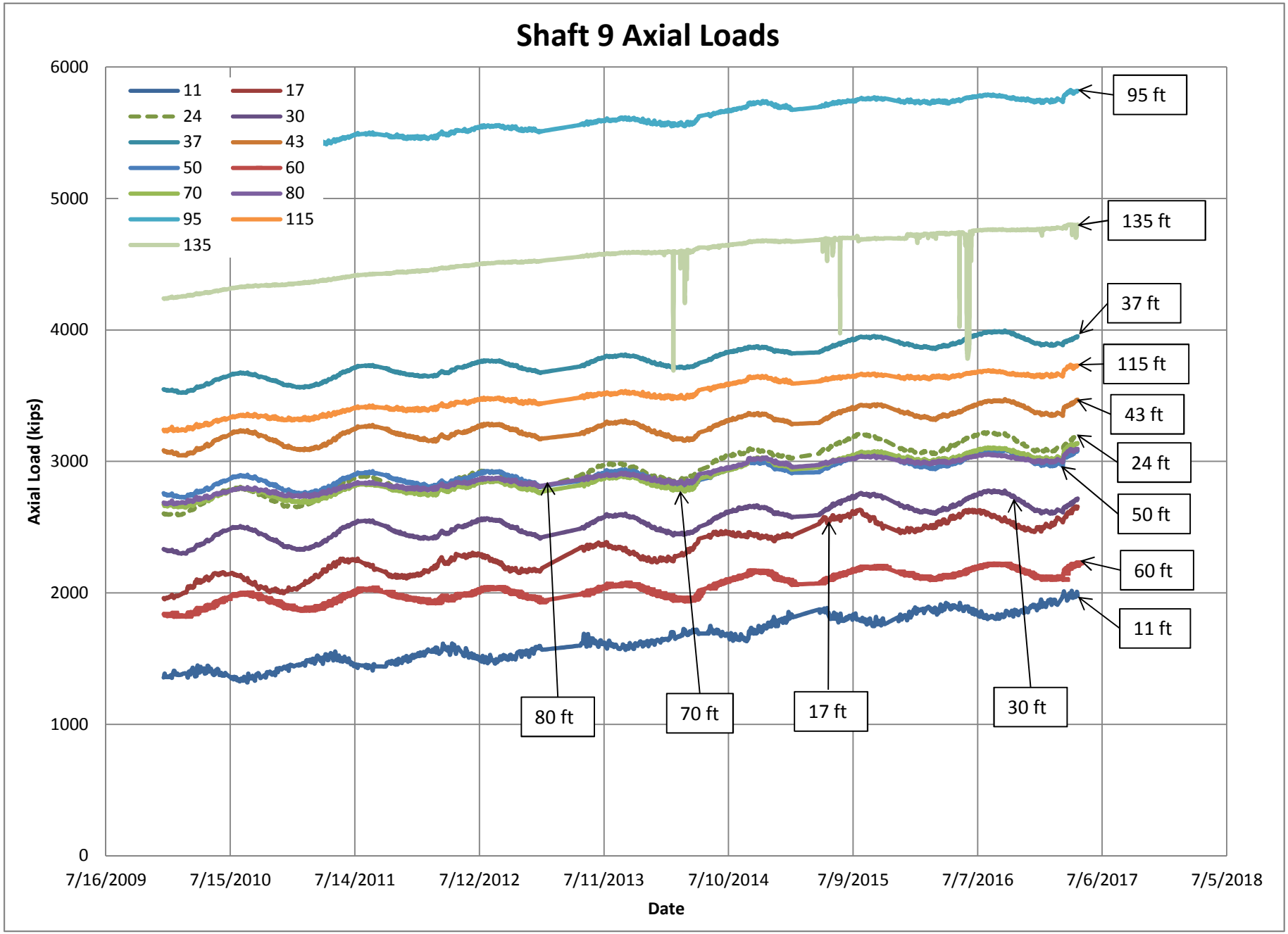
PID 96504 — Drilled Shaft #1

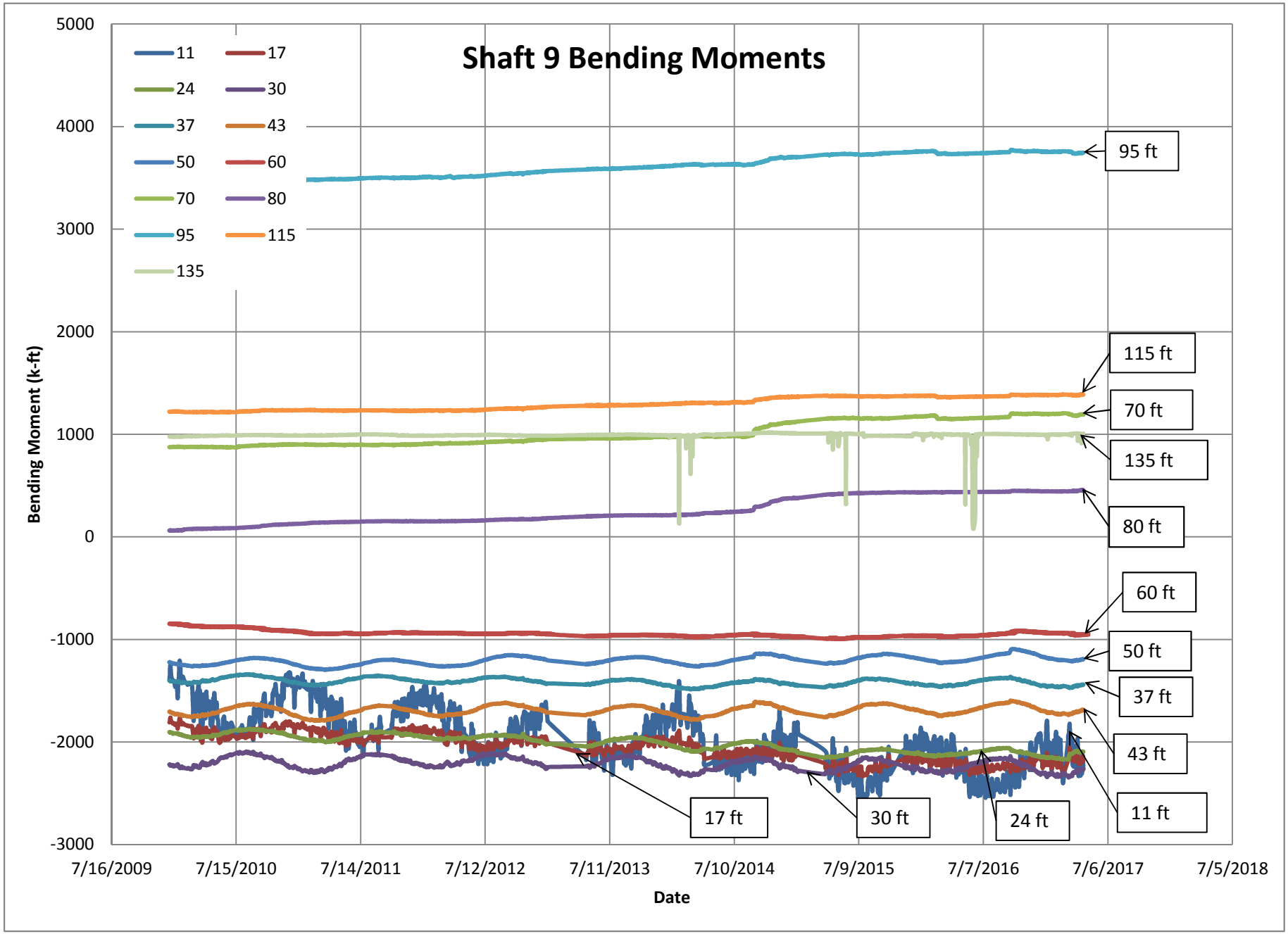
Cleveland, Ohio — (Weak Axis Bending)

SME#: 069032.00 — Average for Period: January 12, 2017 thru April 25, 2017






Shaft 9 Axial Loads
Axial Load (kips)
6000
5000
4000
3000
2000
1000
0
7/16/2009
7/15/2010
7/14/2011
7/12/2012
7/11/2013
7/10/2014
7/9/2015
7/7/2016
7/6/2017
7/5/2018
Date
11
17
24
30
37
43
50
60
70
80
95
115
135
95 ft
135 ft
37 ft
115 ft
43 ft
24 ft
50 ft
60 ft
11 ft
80 ft
70 ft
17 ft
30 ft


Shaft 9 Bending Moments
11
17
24
30
37
43
50
60
70
80
95
115
135
Bending Moment (k-ft)
5000
4000
3000
2000
1000
0
-1000
-2000
-3000
7/16/2009
7/15/2010
7/14/2011
7/12/2012
7/11/2013
7/10/2014
7/9/2015
7/7/2016
7/6/2017
7/5/2018
Date
95 ft
115 ft
70 ft
135 ft
80 ft
60 ft
50 ft
37 ft
43 ft
11 ft
17 ft
30 ft
24 ft

CUY-90-15.24 Slope Monitoring

PID 76117 — Drilled Shaft #9

Cleveland, Ohio — Strong Axis Bending

EDP #09305G — Average for Period: January 12, 2017 thru April 25, 2017