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April 11, 2017

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

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

Dear Mr. Lastovka:

January 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

cosign

Attachments

Distribution via e-mail

JANUARY 2017 QUARTERLY REPORT

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

APRIL 11, 2017

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9375 Chillicothe Road
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TABLE OF CONTENTS

INTRODUCTION

Instrument readings and interpretations for January 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. Labels like P-001-13 for the piezometers and I-001-13 for the inclinometer at that same location are used for all recently installed instruments. For earlier instruments, a label like B-101, is used for both the piezometers and inclinometers at the same location.

INSTRUMENTS READ MONTHLY

Critical instruments are those that are judged to provide a clearer picture of slope performance. The following instruments were read and reported on a bi-weekly schedule. Effective in March 2017, this was reduced to a 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 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 decreased by almost 1 foot since October 2016. The net decrease indicated by the pore pressure readings is less than 0.5 feet in both piezometers.

P-002-10. Total head in the deep piezometer at P-002-10 continued to increase this quarter with about 1 foot of change this quarter. The total head in this piezometer has increased by about 6.5 feet since June 12, 2016. Total head in the shallow piezometer at this location has fluctuated by about 1 foot this quarter with virtually no net change.

P-007-13. Total head in both piezometers at P-007-13 fluctuated by about 1 foot but show virtually no net change. The datalogger for the shallow piezometer failed to record during the second half of the quarter. It appears this was caused by a faulty battery. We replaced the battery and the data logger appears to be working properly.

B-05-07. Three piezometers were reinstalled at this location after the original piezometers were lost to the construction. Pore pressures in the shallow and middle piezometers continued the downward trend that began in July 2015. Total head in the deep piezometer shows virtually no change in total head during this quarter.

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 has decreased in stages since October 2016. Total head has decreased by about 20 feet in the deep piezometer, 14.4 feet in the middle piezometer, and 12.6 feet in the shallow piezometer.

INCLINOMETERS

I-001-10, I-002-10, I-007-13, B-05-07, and inclinometers is pier **P-3, P-17.** Inclinometer readings at these locations indicate virtually no movement this quarter.

P-8. The displacement plot for this quarter falls between the October 2015 and October 2016 plots. The October 2015 plot shows the maximum displacement for the group of readings selected for plotting which covers the period since April 2014.

P-10. Like the plot for P-8, the displacement plot for this pier falls between the October 2015 and October 2016 plots. The October 2015 plot also shows the maximum displacement since April 2014.

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 plots for all load cells indicate a slight upward trend throughout 2016. The many spikes shown in the plot for Load Cell 8 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. 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	411.8	-9.8	×	+/- 0	×	2108.7
% change		0.0	×	0	×	0.8
8	316.8	28.7	65.6	-177.2	×	×
% change		-1.3	-0.5	0.3	×	×
9	458.2	-19.30	8.45	2.53	193.81	784.51
% change		0.2	-0.3	-6.2	-0.1	-0.2
17	373.7	-41.8	×	-25.4	×	232.1
% change		4.2	×	2.9	×	-0.3

Driven piles

Axial loads in all driven piles except Pile 34 increased by 1 kip or less this quarter. The axial load plot for Pile 34 shows a large increase, about 30 kips, during the last week of October 2016. This was likely caused by gage failures. From the end of October 2016 to the end of the quarter, gages 2, 3, and 4 appear to have worked properly. Based on data from these three gages, axial loads in Pile 34 decreased by 2 kips this quarter.

Strong axis bending moments in all of the driven piles decreased slightly this quarter. The greatest decrease, 3.7 kip-feet, occurred in Pile 1. Strong axis bending moments for Pile 34 could not be calculated due to the failure of Gage 1. Seasonal variations are apparent in the data.

Average weak axis bending moments in Piles 17, 18, and 19 increased by less than 1 kip-foot this quarter. The weak axis bending moment in Pile 1 decreased by about 1.5 kip-feet. Weak axis bending moments for Pile 34 could not be calculated due to the failure of Gage 1.

Tiebeams General

Data for the tiebeams continued to be stable this quarter, with fewer gage failures than seen in the past. A relatively 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 typically increase during the November-January quarter and we see that increase again this year. However, the magnitude of the increases were greater this year than in previous years. Since the beginning of October 2016, the axial loads increased by 12 to 21 kips, with the largest increase occurring in Tiebeam 26.

Strong axis bending moments also increased this quarter. The seasonal change in Tiebeams 13, 14, and 26 were barely noticeable in prior years. This year we see a small but noticeable increase in Tiebeams 13 and 26. The seasonal variation has been more apparent in Tiebeam 1. The largest increase in strong axis bending moment occurred in Tiebeam 1. 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 throughout this quarter. Axial loads in Tiebeams 1 and 26 show the largest increases

from September 2016 to January 2017 of 32 kips and 27 kips, respectively. Axial loads in the other tiebeams show seasonal changes similar to past years, with increases ranging from 8 to 13 kips this quarter.

Strong axis bending moments on the drilled pier side of Tiebeams 1, 13, and 14 exhibited the usual seasonal changes with increases of less than 1 kip-foot this quarter. The plot for Tiebeam 26, indicates that the strong axis bending moment decreased by about 12 kip-feet since July 2016. The majority of this decrease, about 8 kip feet, which occurred in July, was due to a gauge failure. We adjusted the calculations by using values for the companion gauge on the opposite end of the flange to compensate for the loss of this gauge. 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.

Weak axis bending moments on the drilled pier side increased by about 1 kip-foot in Tiebeam 1 with a corresponding decrease of about 1 kip-foot in Tiebeam 26. Weak axis bending moments for the other tiebeams remained virtually constant. Bending moments were not calculated for Tiebeam 12 due to a gage failure. An adjustment similar to what was done for Tiebeam 26 will be made in the future.

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.

Bending moments in Pier 1 show the largest seasonal changes at the top end of the pier. Moments are decreasing at 29 and 35.5 feet, and are increasing at 22.5 feet and above, and at 58 feet and below. 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 January 12, 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 January 2017 Quarterly report for the CUY-90-15.24 Slope Monitoring Project, ODOT PID 96504.

Report prepared by:

Brendan P. Lieske, P.E.
Senior Staff Engineer

cosign

Report reviewed by:

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

cosign

APPENDIX A

ARRANGEMENT OF INSTRUMENTATION

REVISION	DATE	DESCRIPTION
A	11/21/13	REVISIONS BASED ON INSTRUMENTATION STATUS AFTER COMPLETION OF CCG1.

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

HORIZONTAL SCALE IN FEET
0 25 50 100

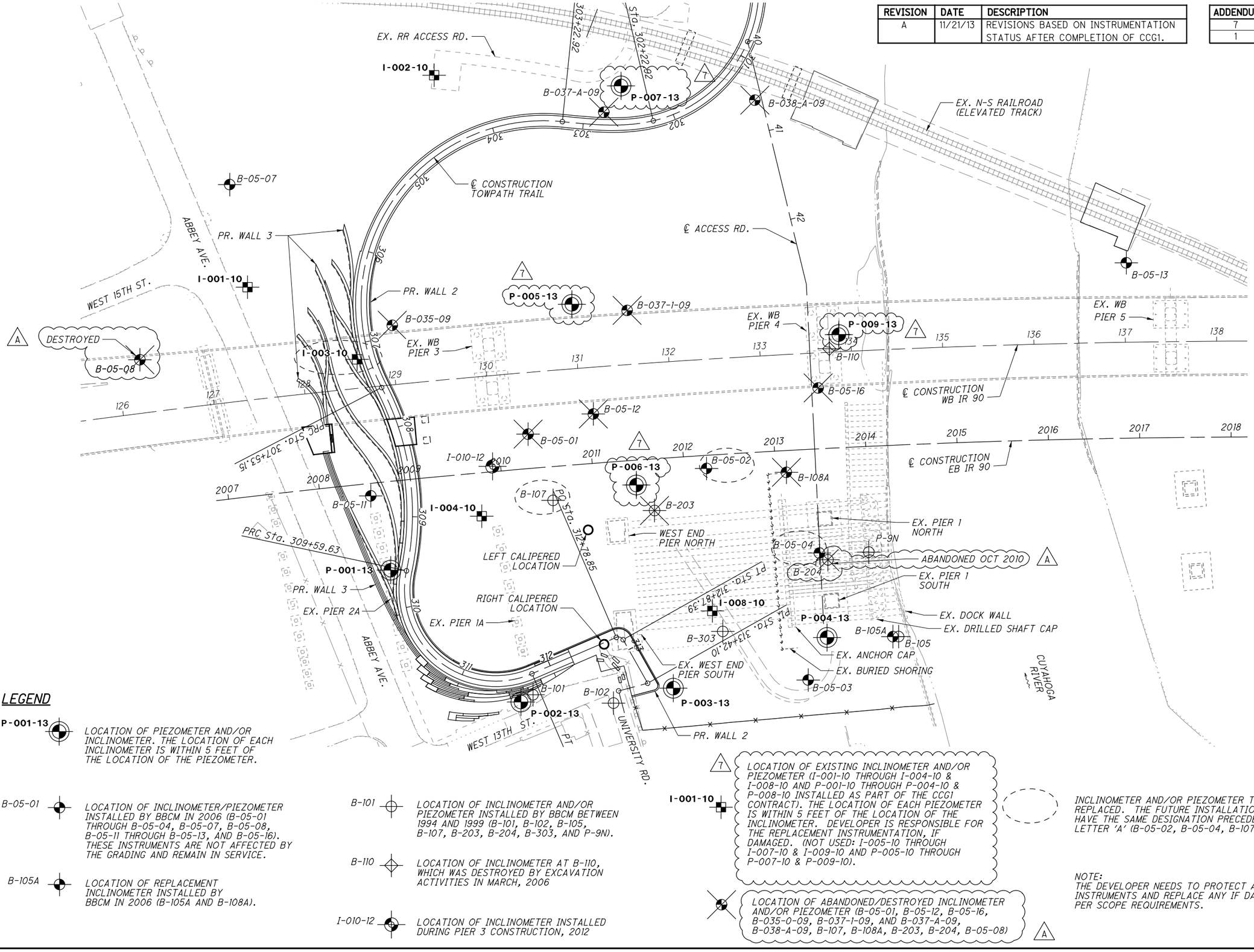
DRAWN CDS CHECKED JN

INSTRUMENTATION PLAN
CUYAHOGA RIVER WEST BANK

CUY-90-14.90

1 / 4

61 / 93



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 CCG1 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).

△A — LOCATION OF ABANDONED/DESTROYED 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, B-204, B-05-08)

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.

P:\82119\geotechnical\sheets\82119ZP410 Addendum 7 - Revision A.dgn 11/21/2013 8:08:35 AM csteck

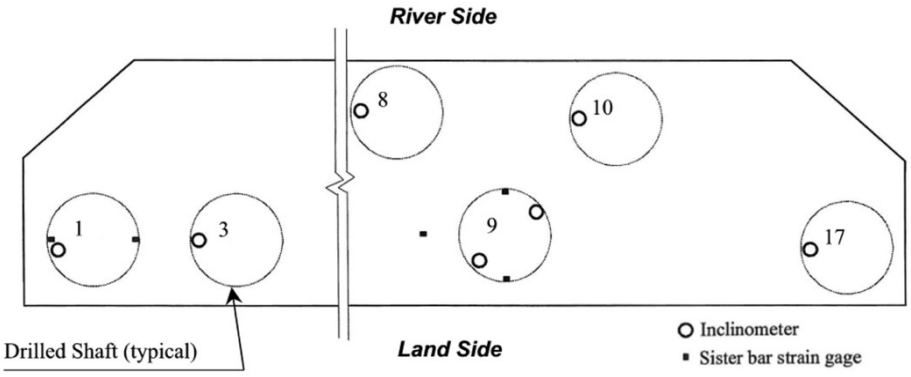


Figure 2. Pier cap with the location of inclinometers and strain gauges.

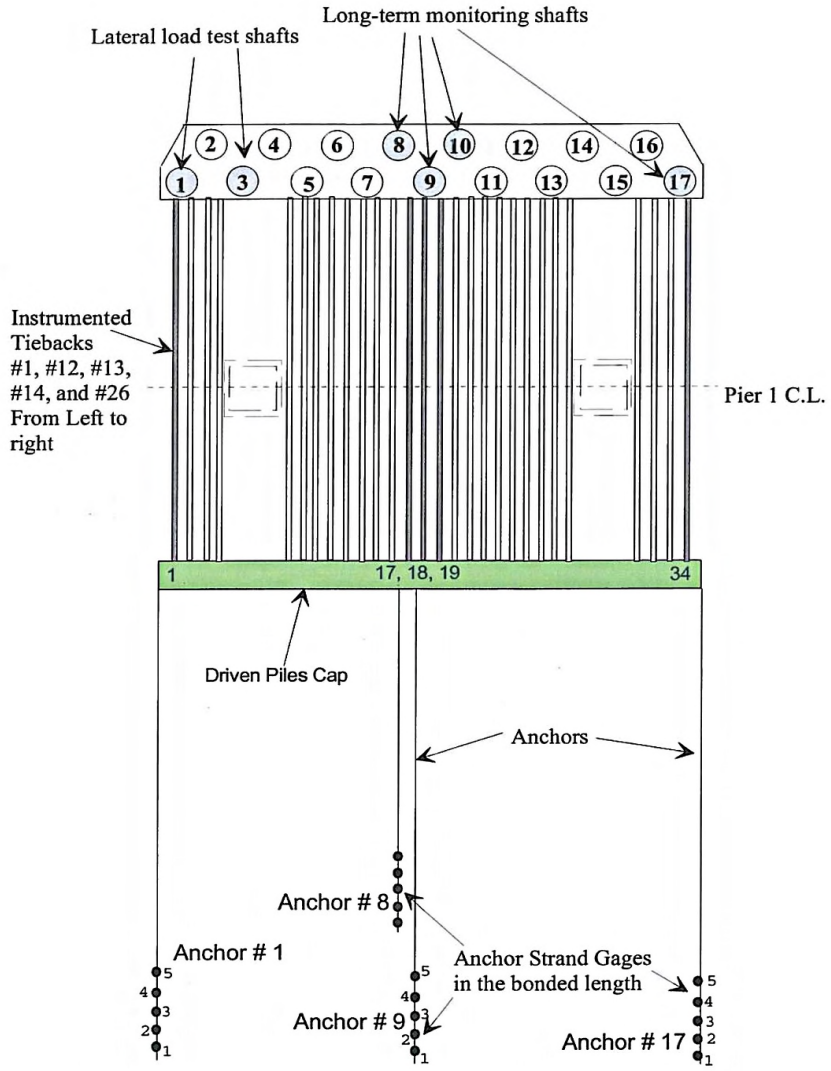


Figure 3. Plan of the stabilization system showing the locations of the instrumented foundation elements.

Figure 4. Aggregate stockpile east of the ODOT right-of-way (January 12, 2017).

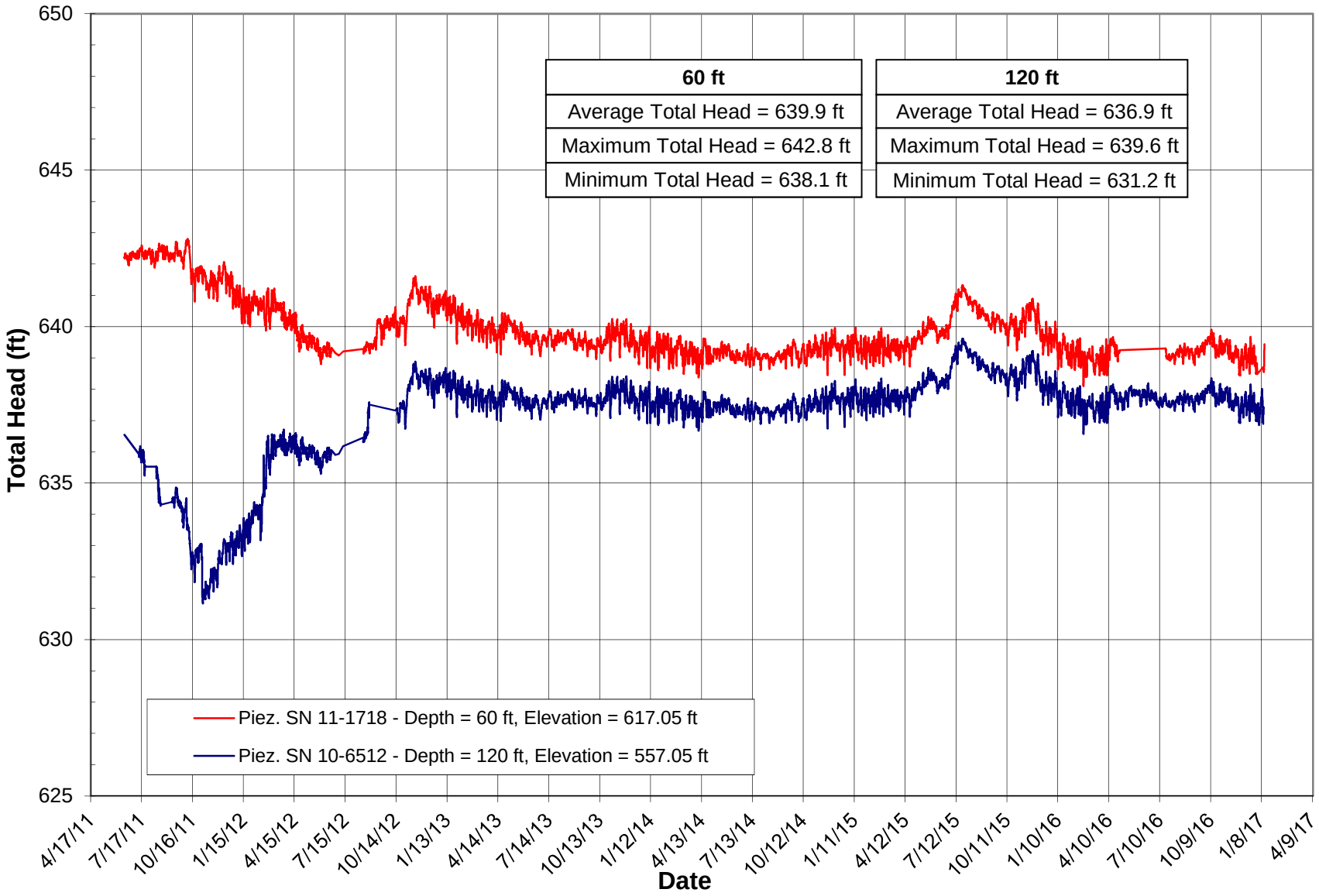
Figure 5. Aggregate stockpile near ODOT's east right-of-way fence (January 12, 2017).

APPENDIX B

PLOTS OF INSTRUMENT READINGS
DISCUSSED IN THE REPORT

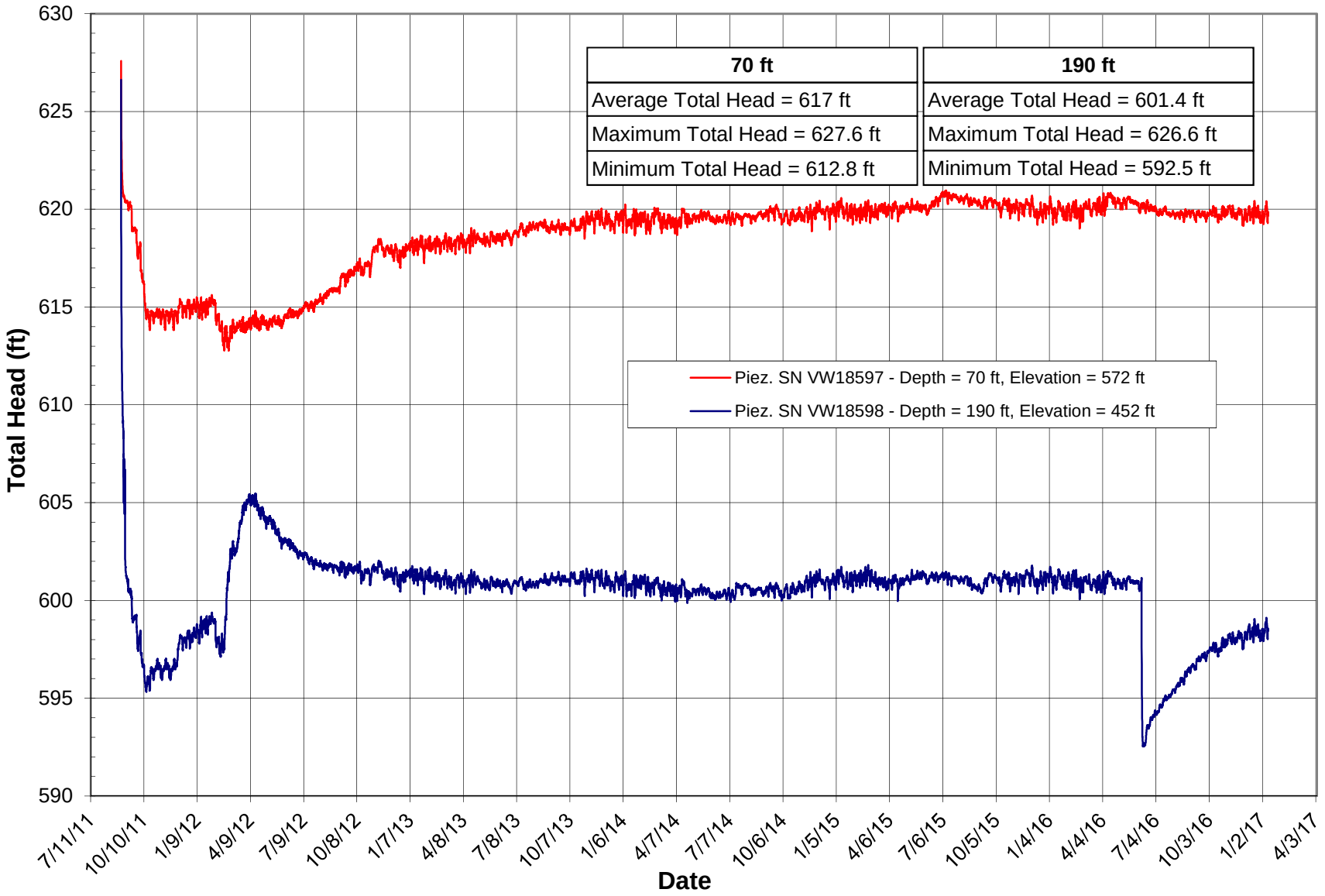
P-001-10 VW Piezometer Readings

Ground surface elevation = 677.05 ft



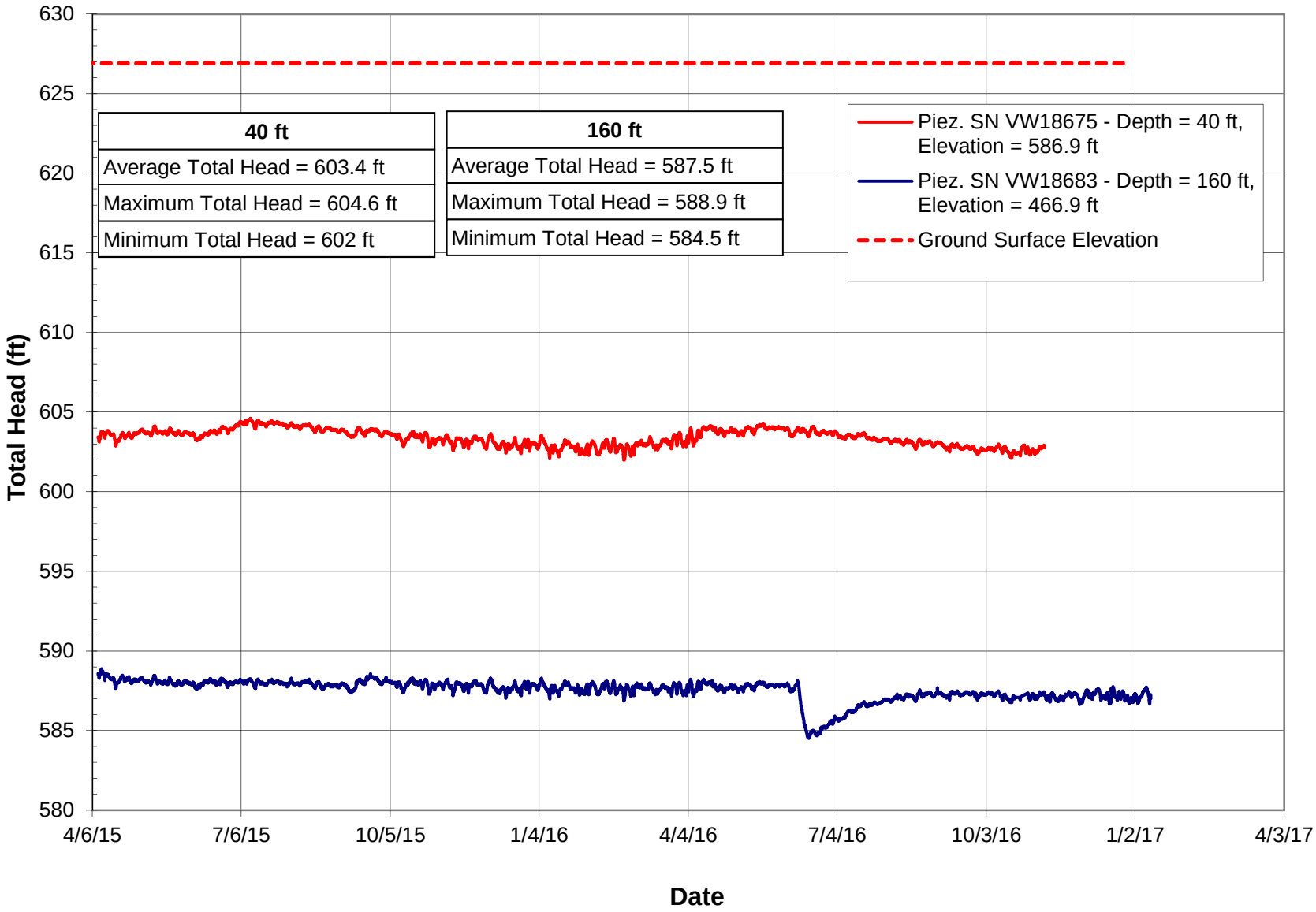
P-002-10 VW Piezometer Readings

Ground surface elevation = 644 ft



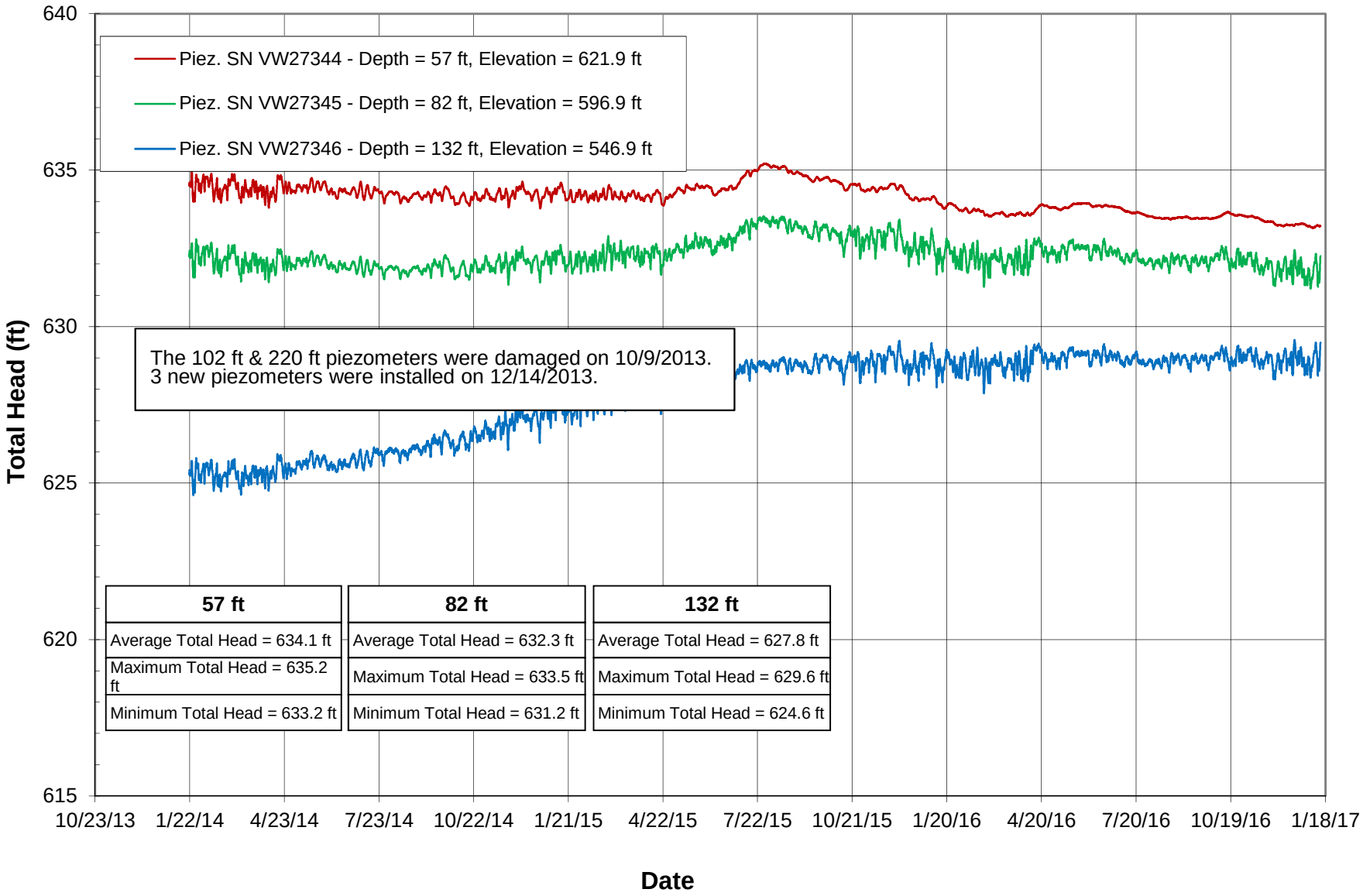
P-007-13 VW Piezometer Readings

Ground surface elevation = 626.9 ft



B-05-07 VW Piezometer Readings

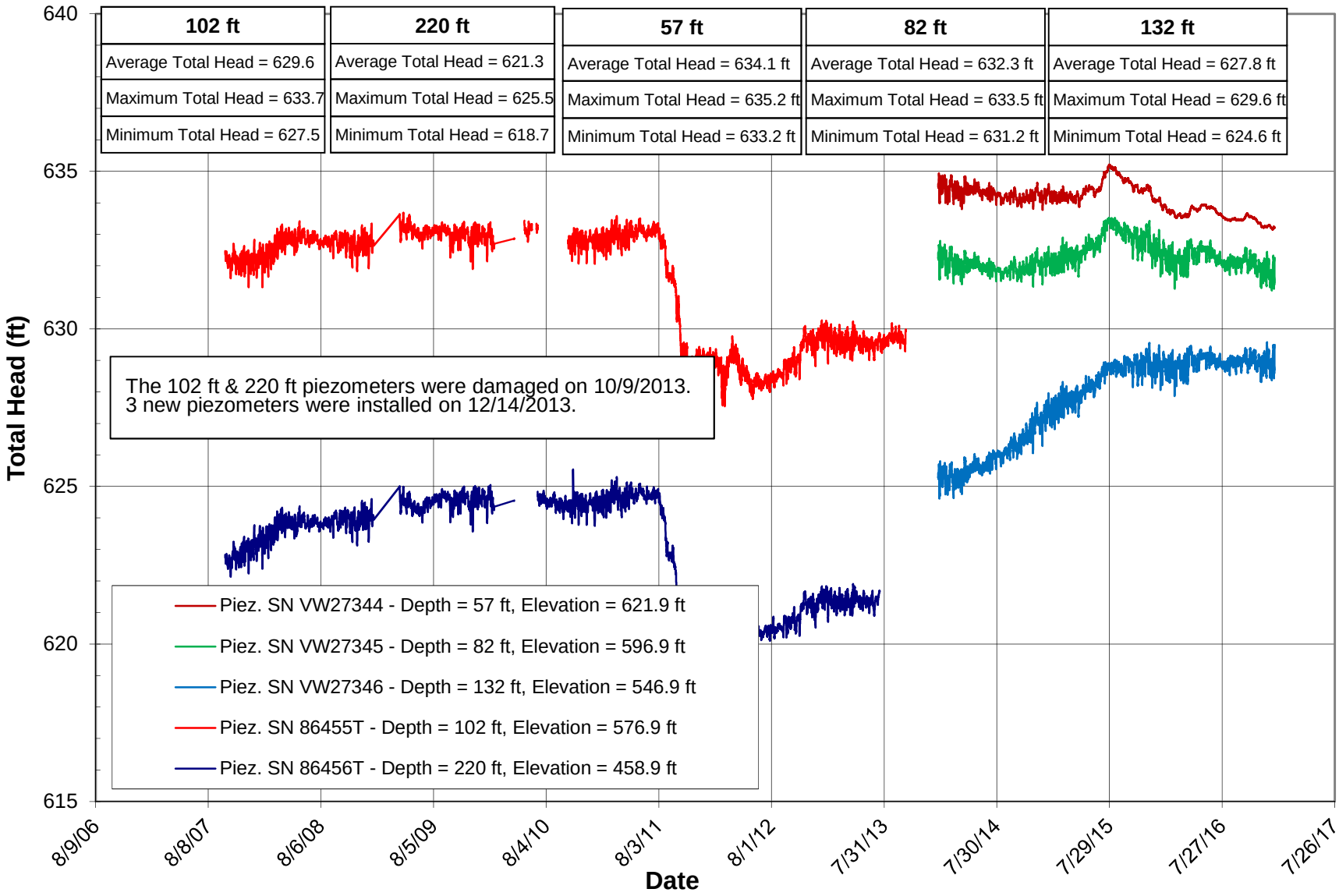
Ground surface elevation = 678.9 ft



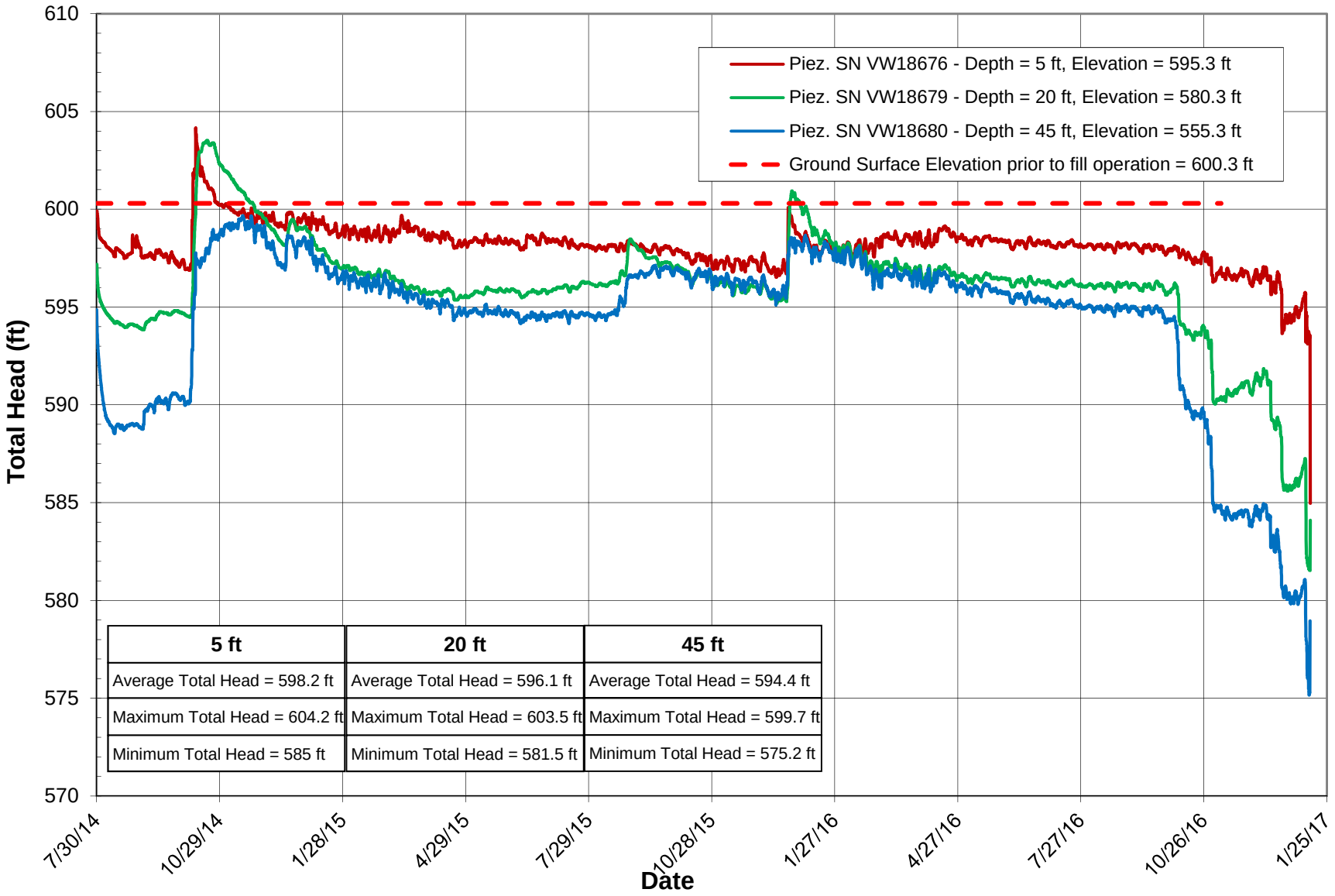
57 ft	82 ft	132 ft
Average Total Head = 634.1 ft	Average Total Head = 632.3 ft	Average Total Head = 627.8 ft
Maximum Total Head = 635.2 ft	Maximum Total Head = 633.5 ft	Maximum Total Head = 629.6 ft
Minimum Total Head = 633.2 ft	Minimum Total Head = 631.2 ft	Minimum Total Head = 624.6 ft

B-05-07 VW Piezometer Readings

Ground surface elevation = 678.9 ft



TGR P-3 VW Piezometer Readings



5 ft	20 ft	45 ft
Average Total Head = 598.2 ft	Average Total Head = 596.1 ft	Average Total Head = 594.4 ft
Maximum Total Head = 604.2 ft	Maximum Total Head = 603.5 ft	Maximum Total Head = 599.7 ft
Minimum Total Head = 585 ft	Minimum Total Head = 581.5 ft	Minimum Total Head = 575.2 ft

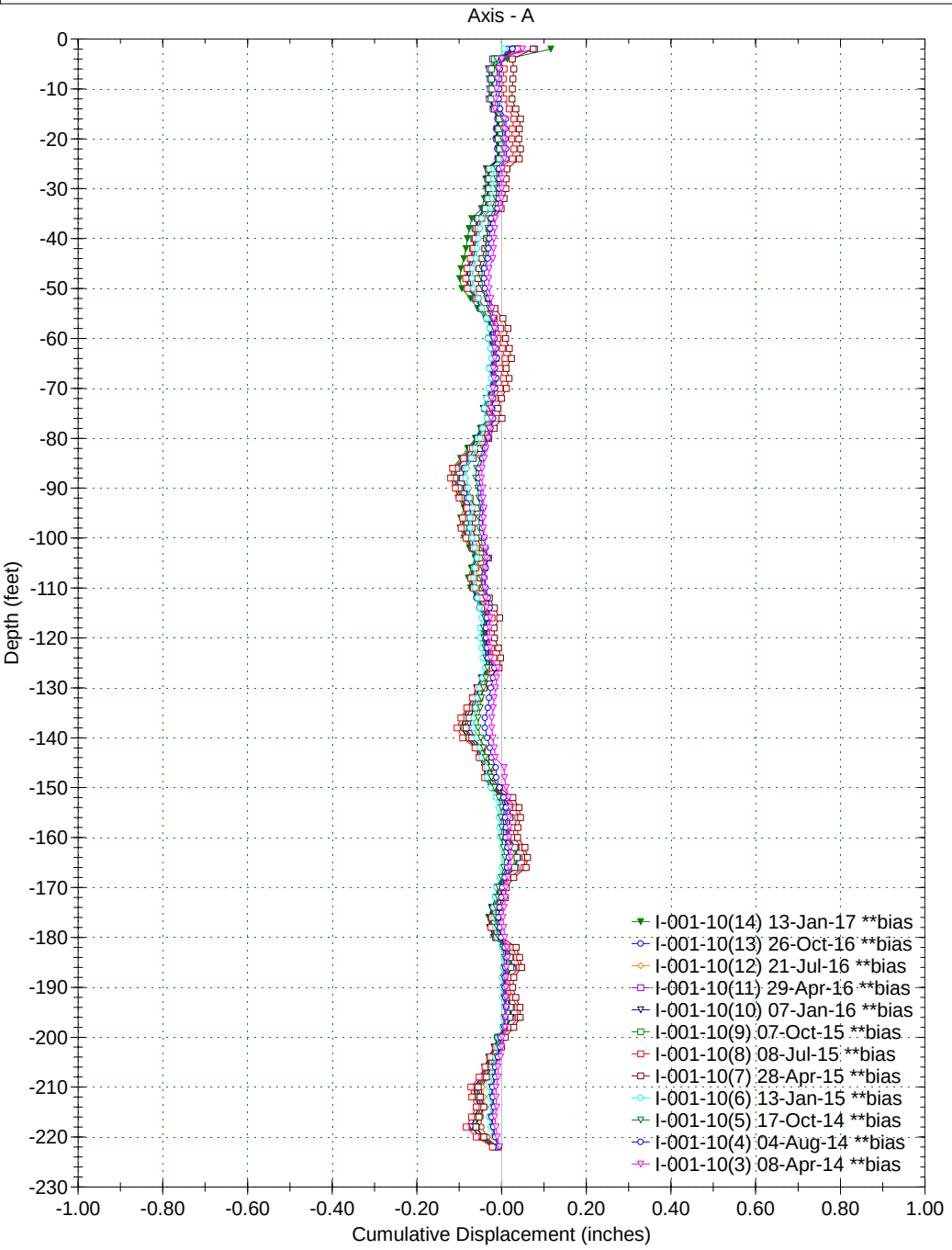
RST Instruments Ltd.

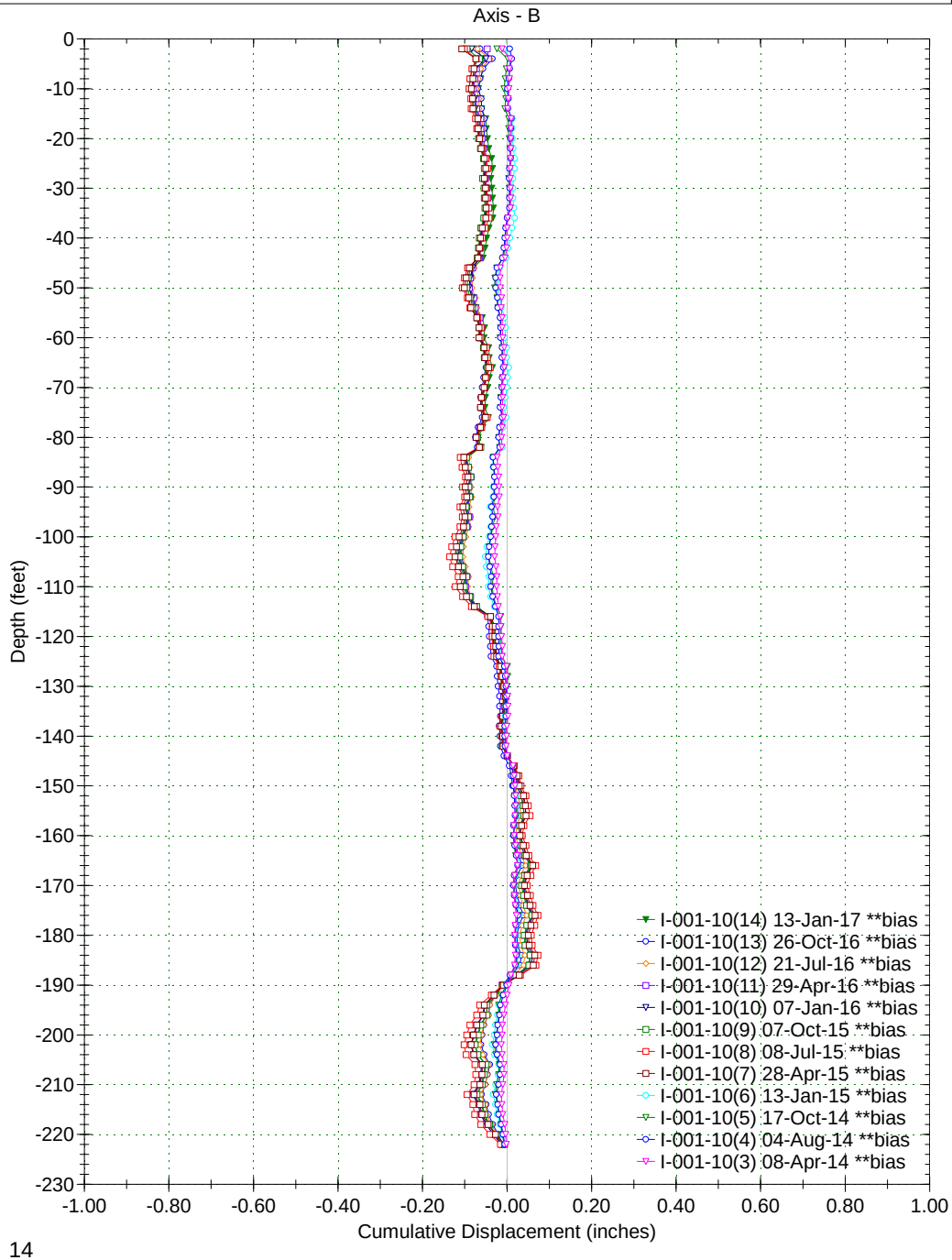
CUMULATIVE DISPLACEMENT

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





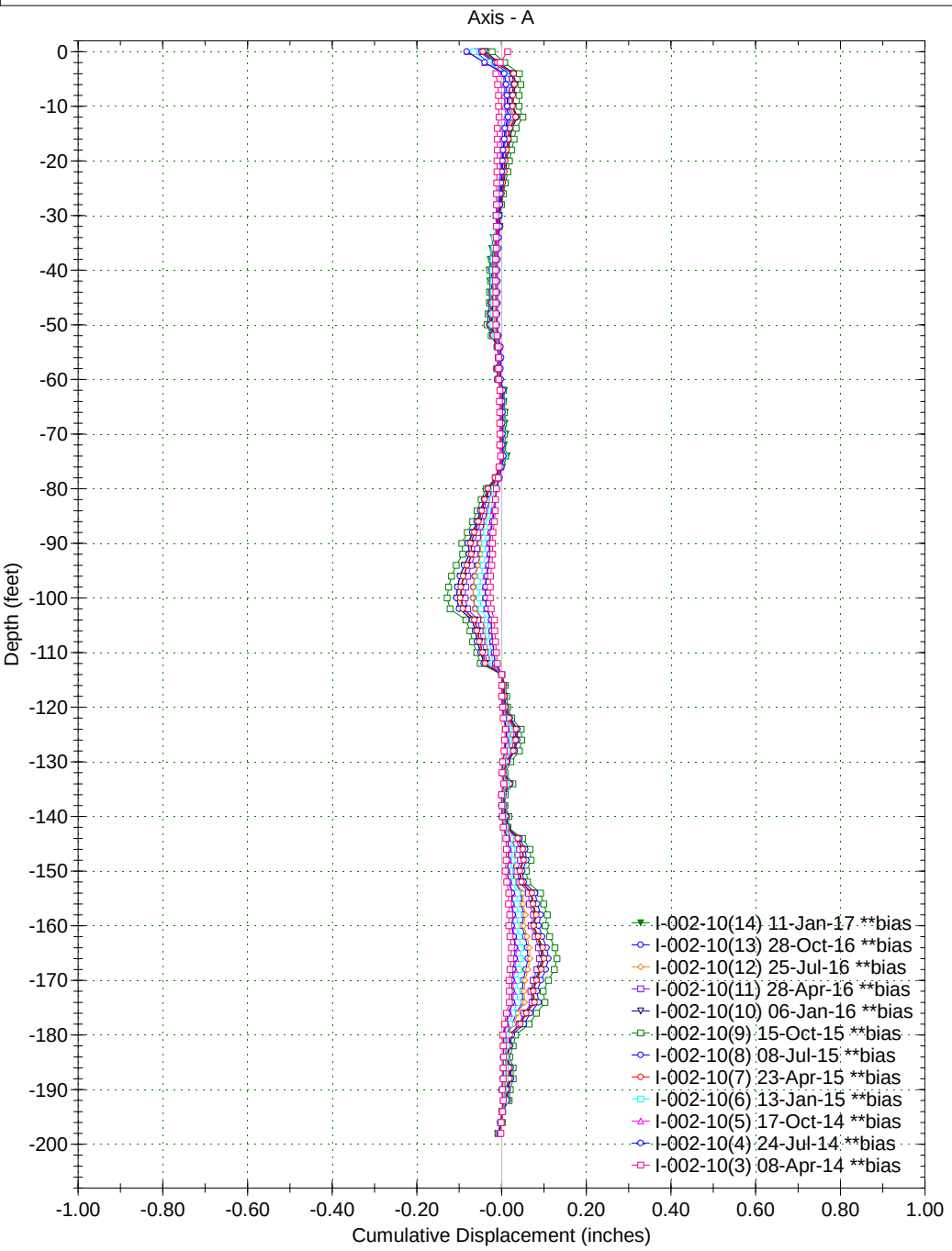
RST Instruments Ltd.

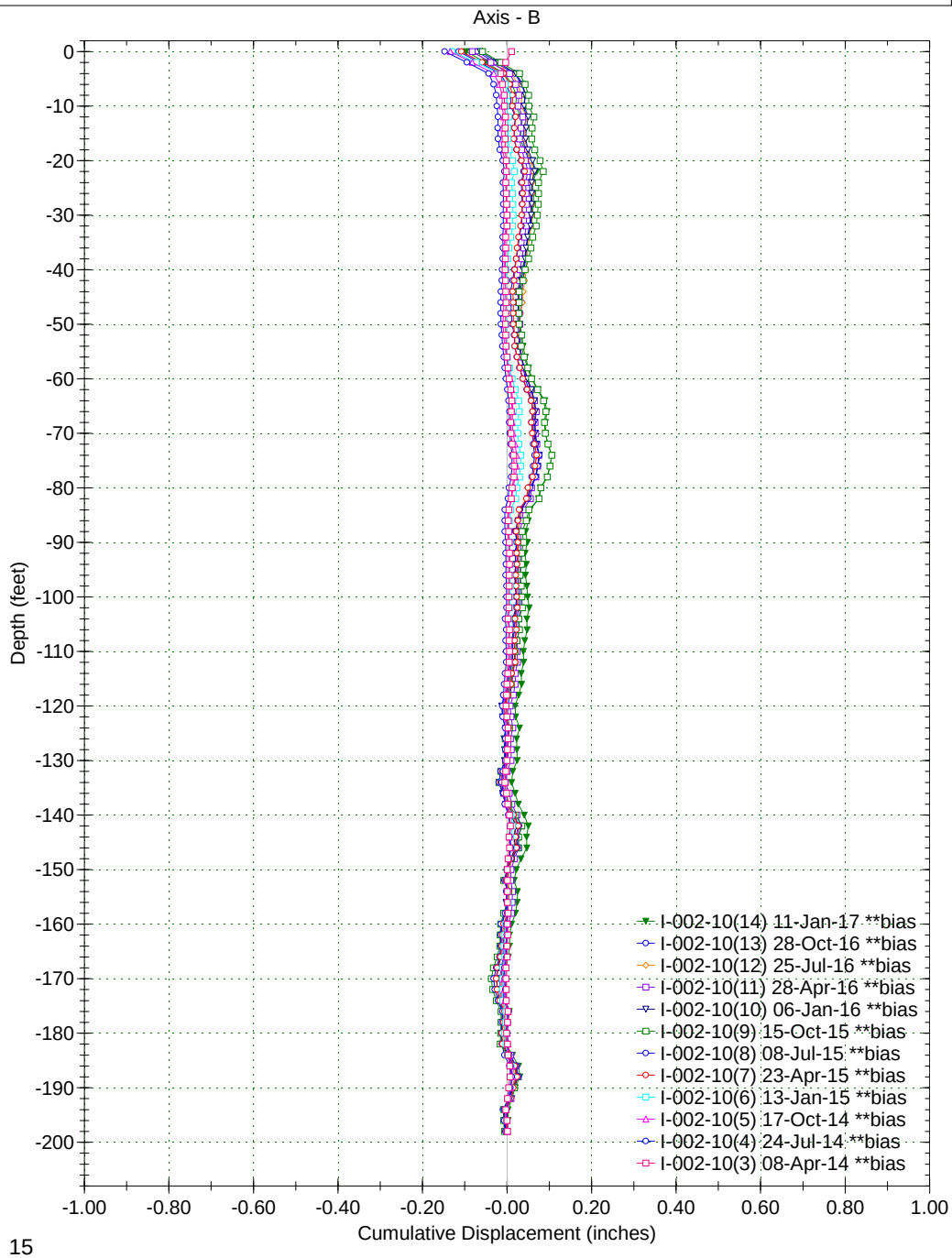
CUMULATIVE DISPLACEMENT

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





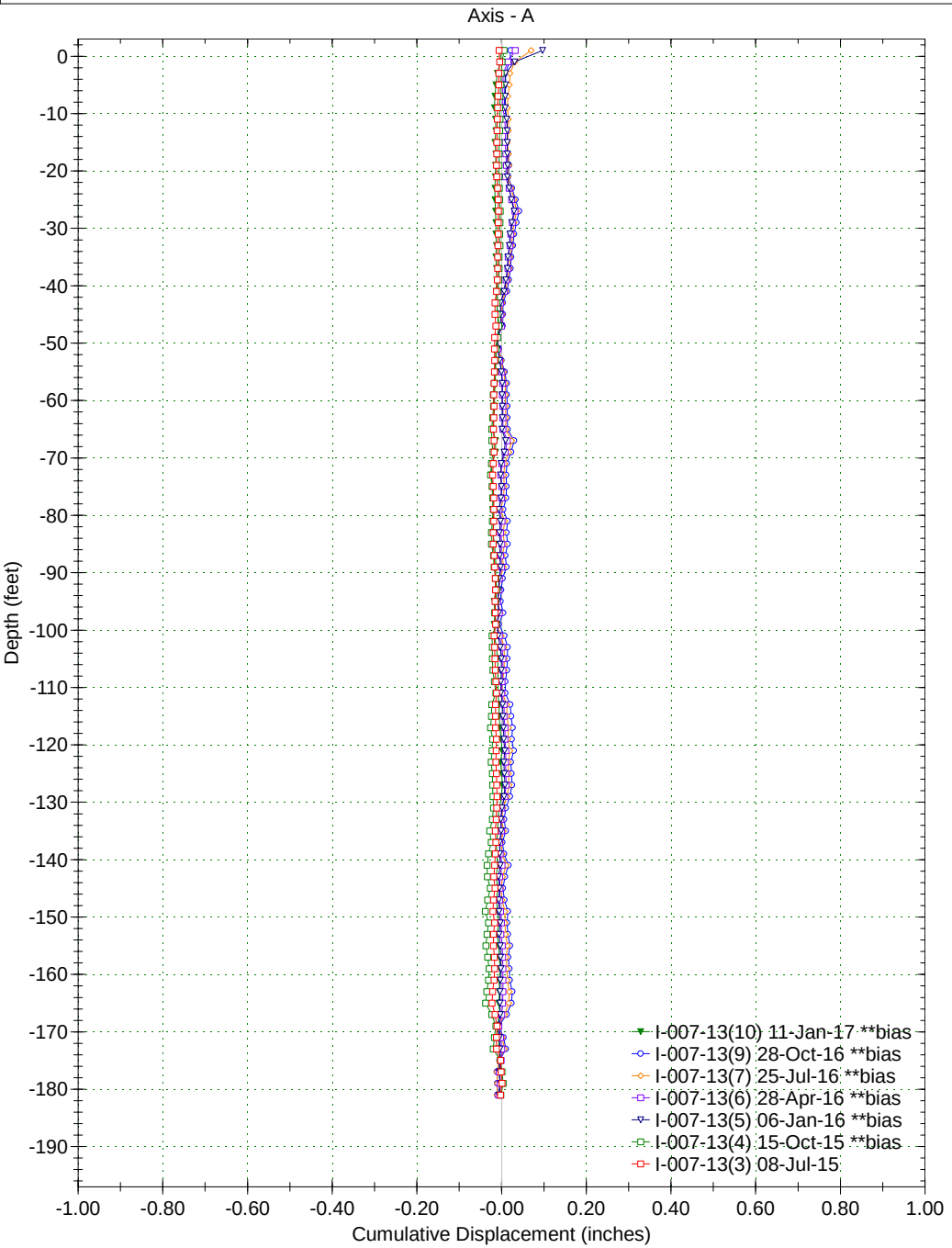
RST Instruments Ltd.

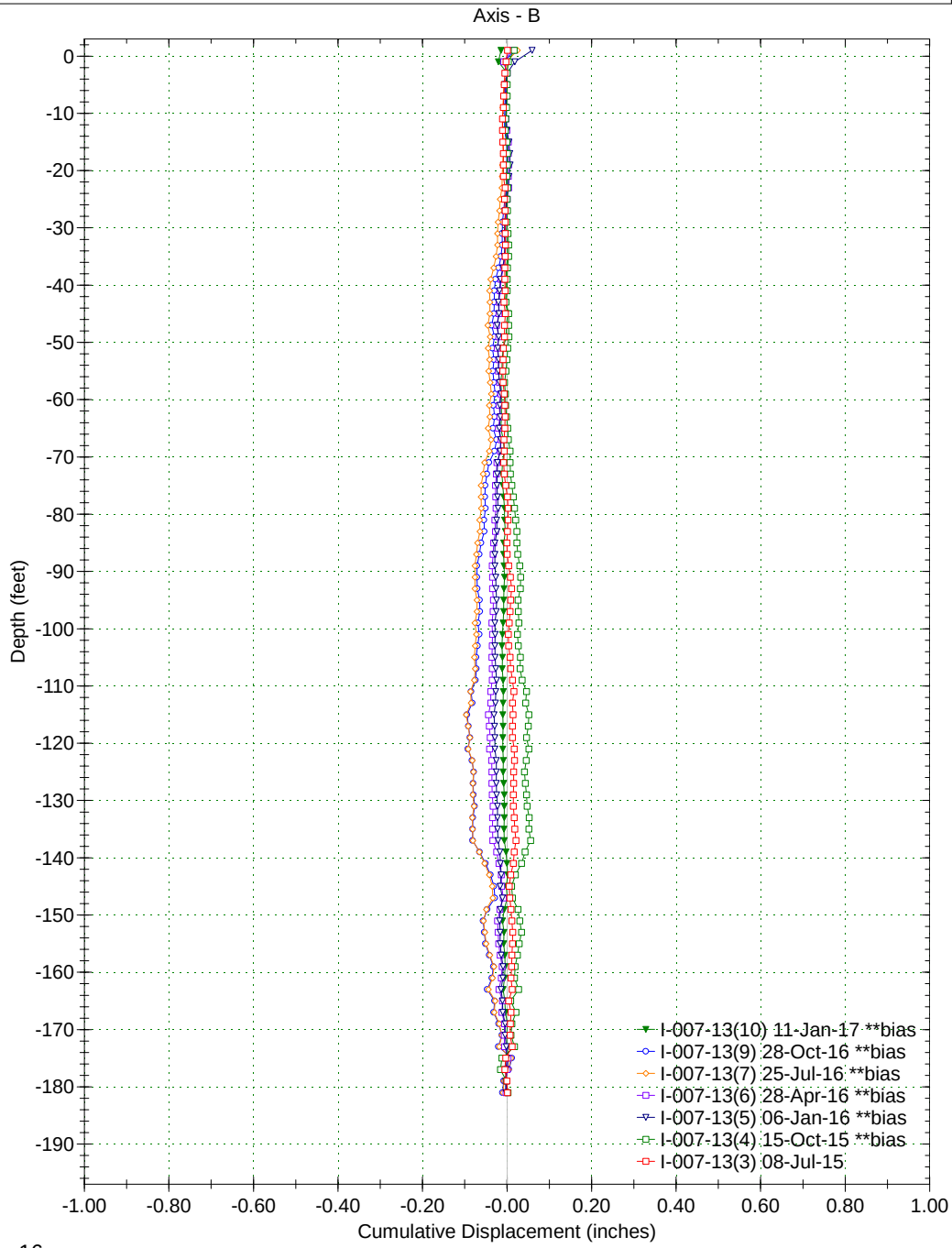
CUMULATIVE DISPLACEMENT

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





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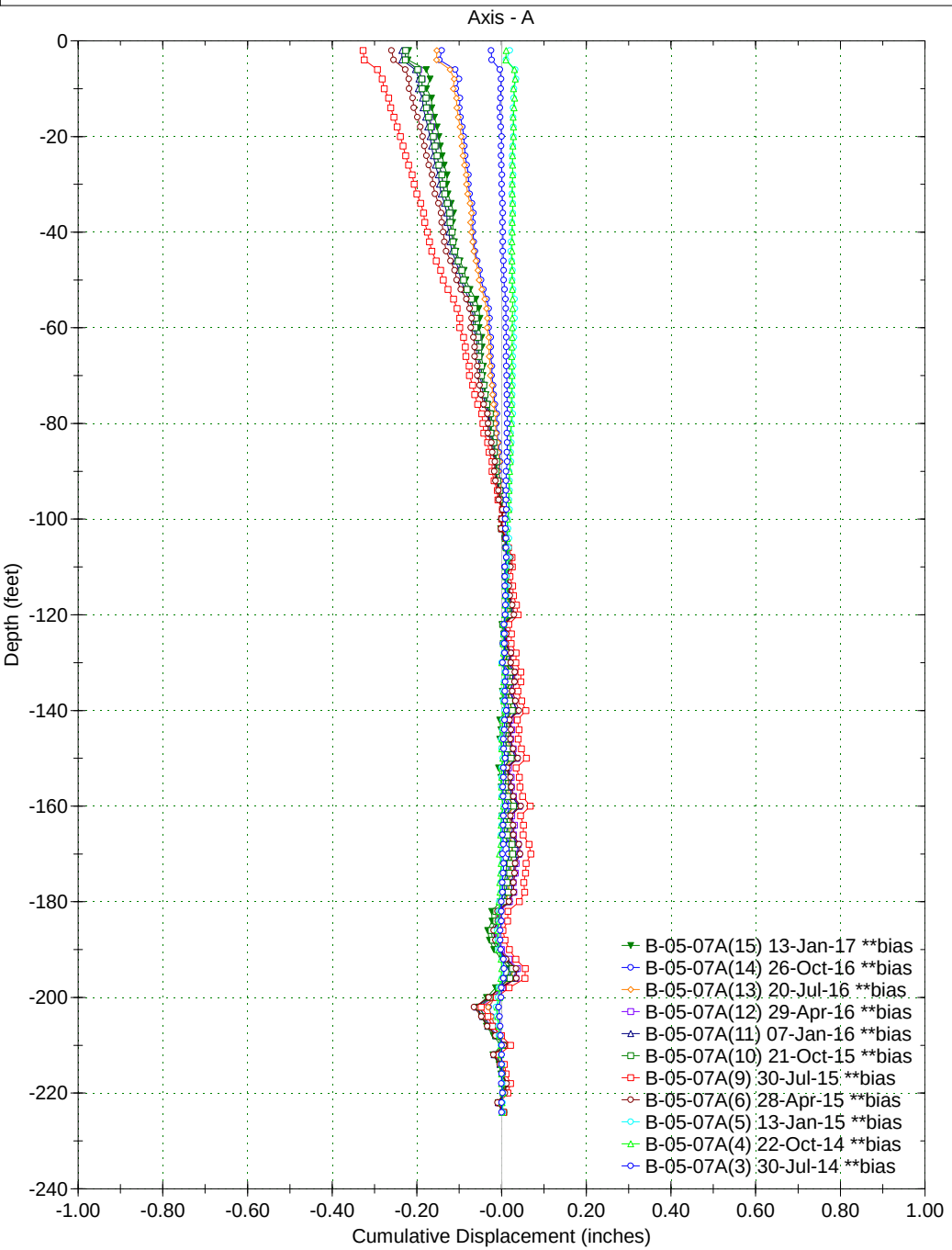
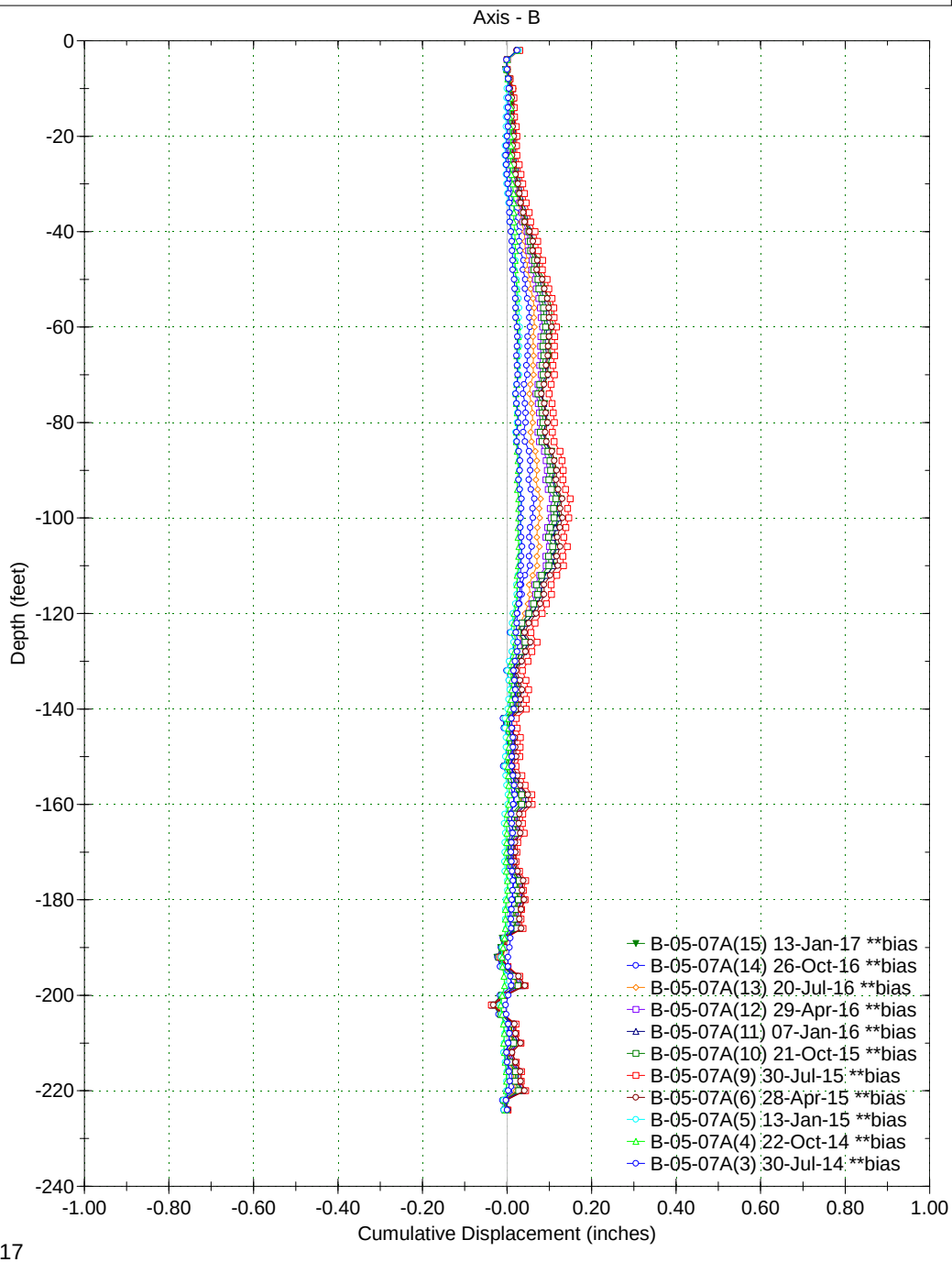
CUMULATIVE DISPLACEMENT

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





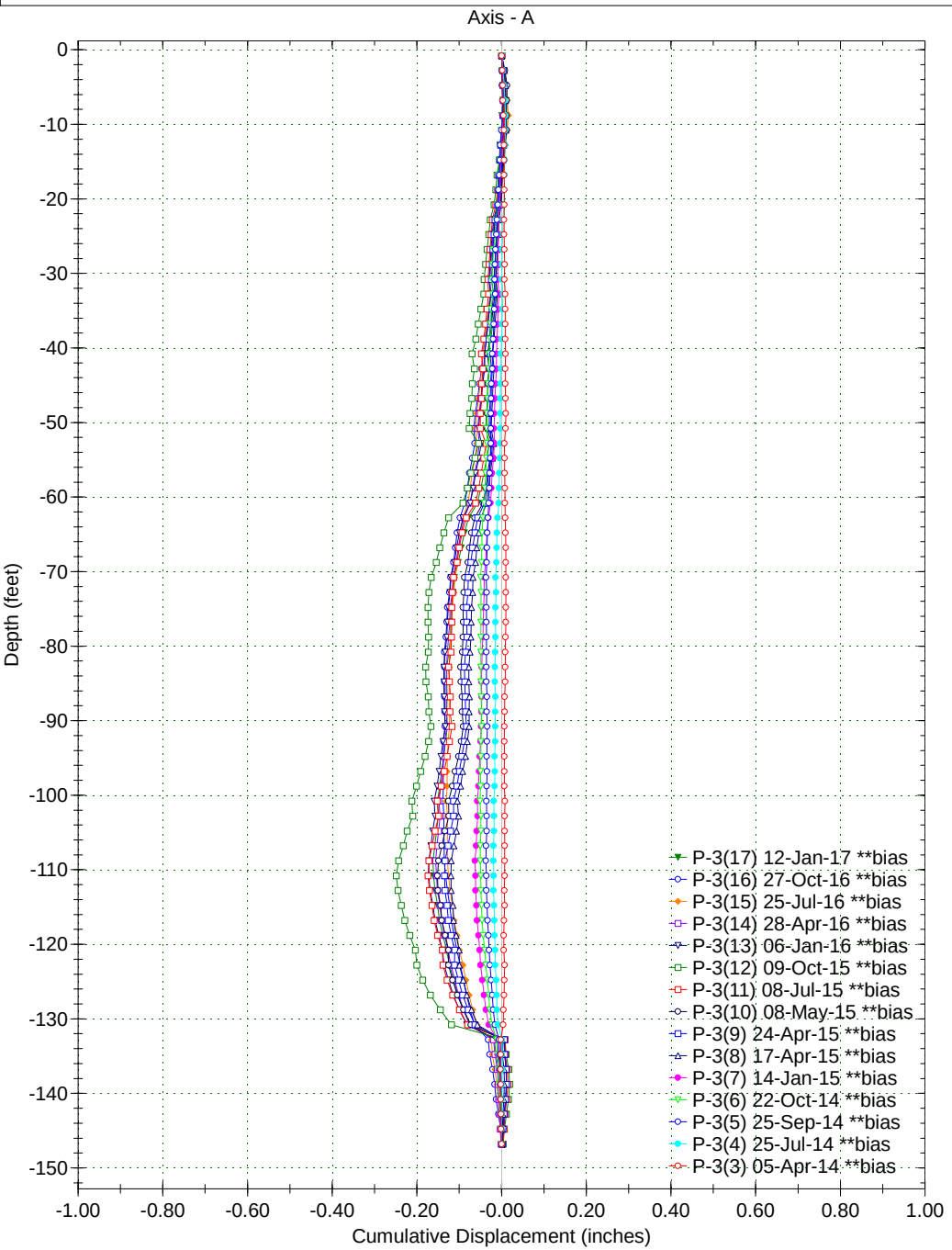
RST Instruments Ltd.

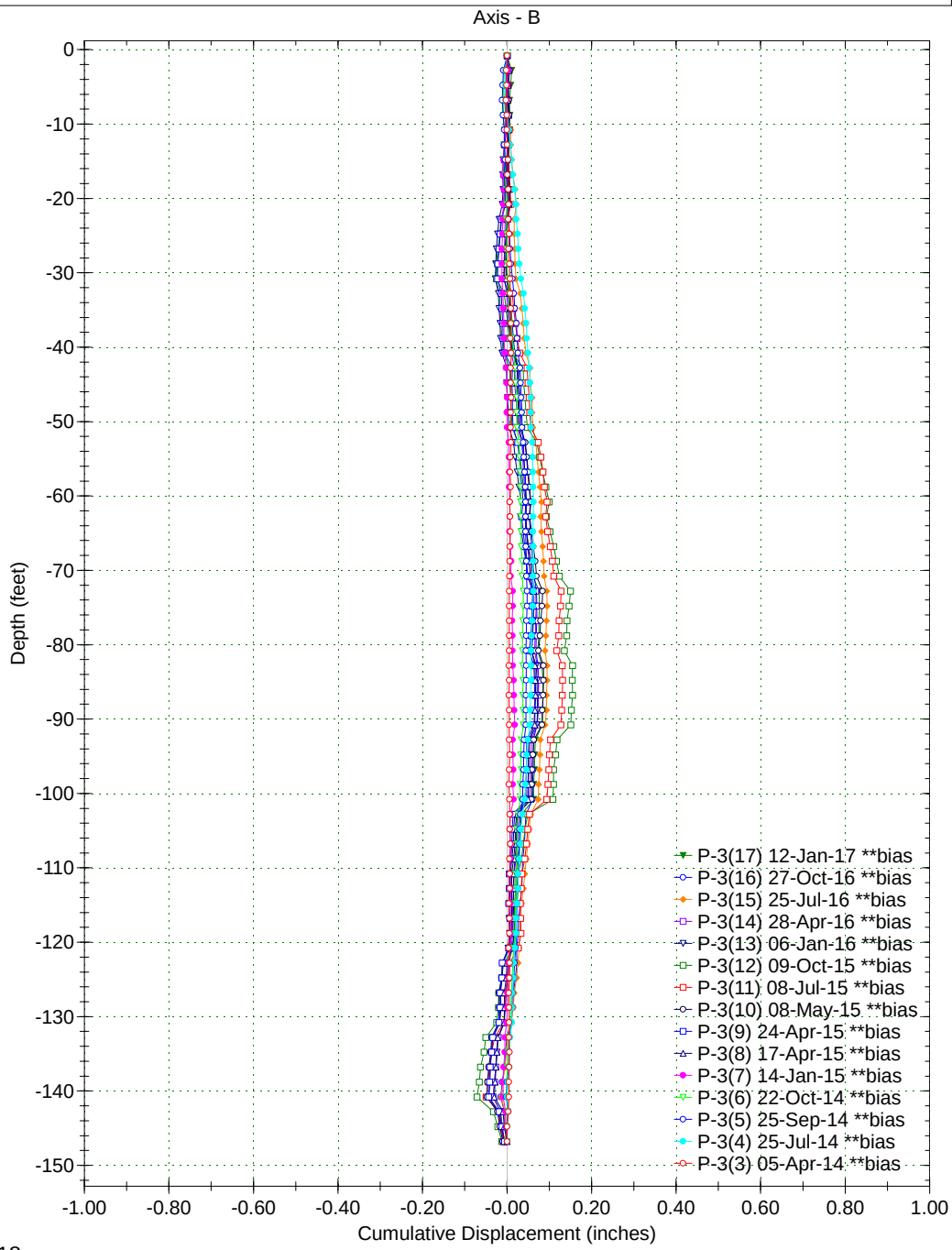
CUMULATIVE DISPLACEMENT

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





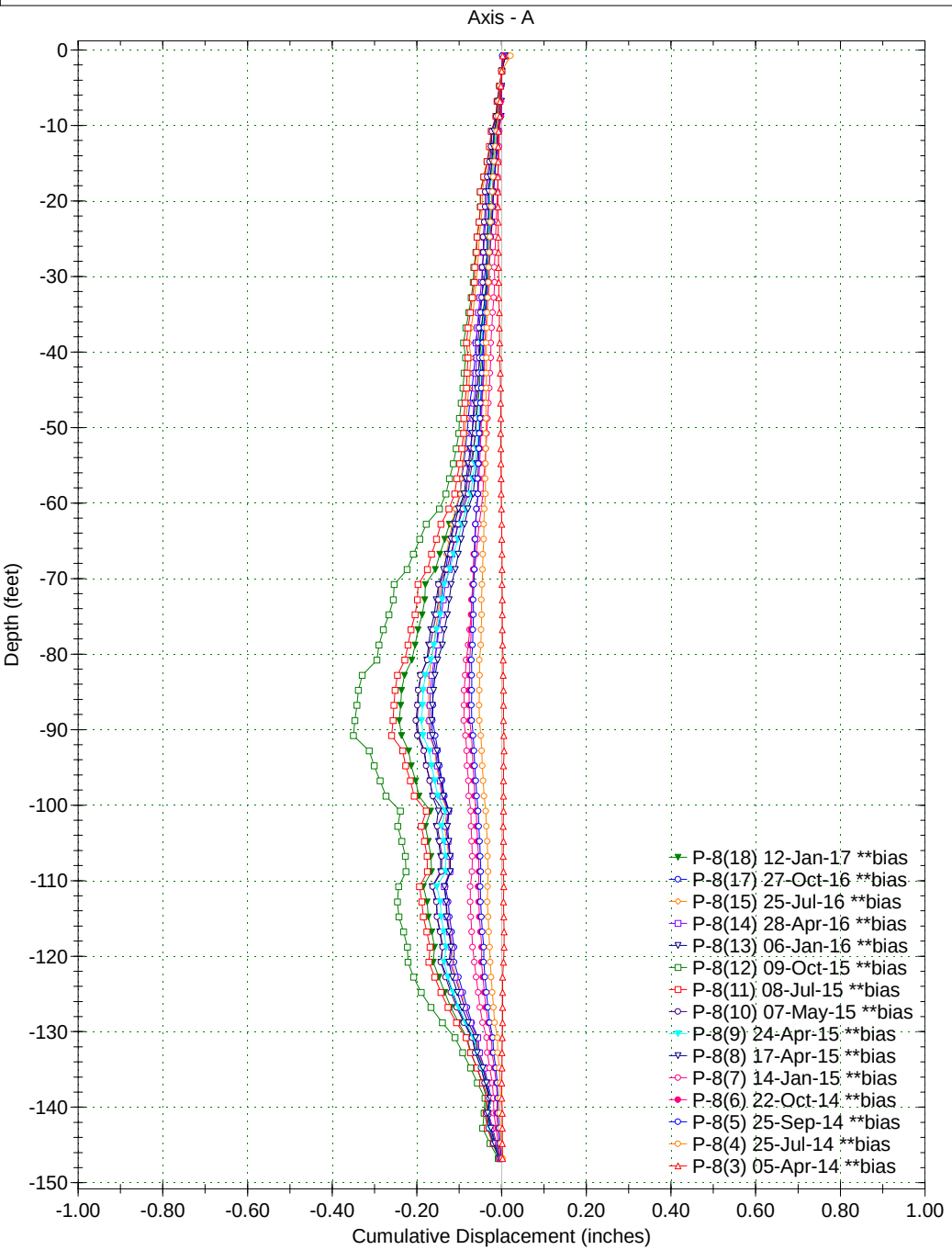
RST Instruments Ltd.

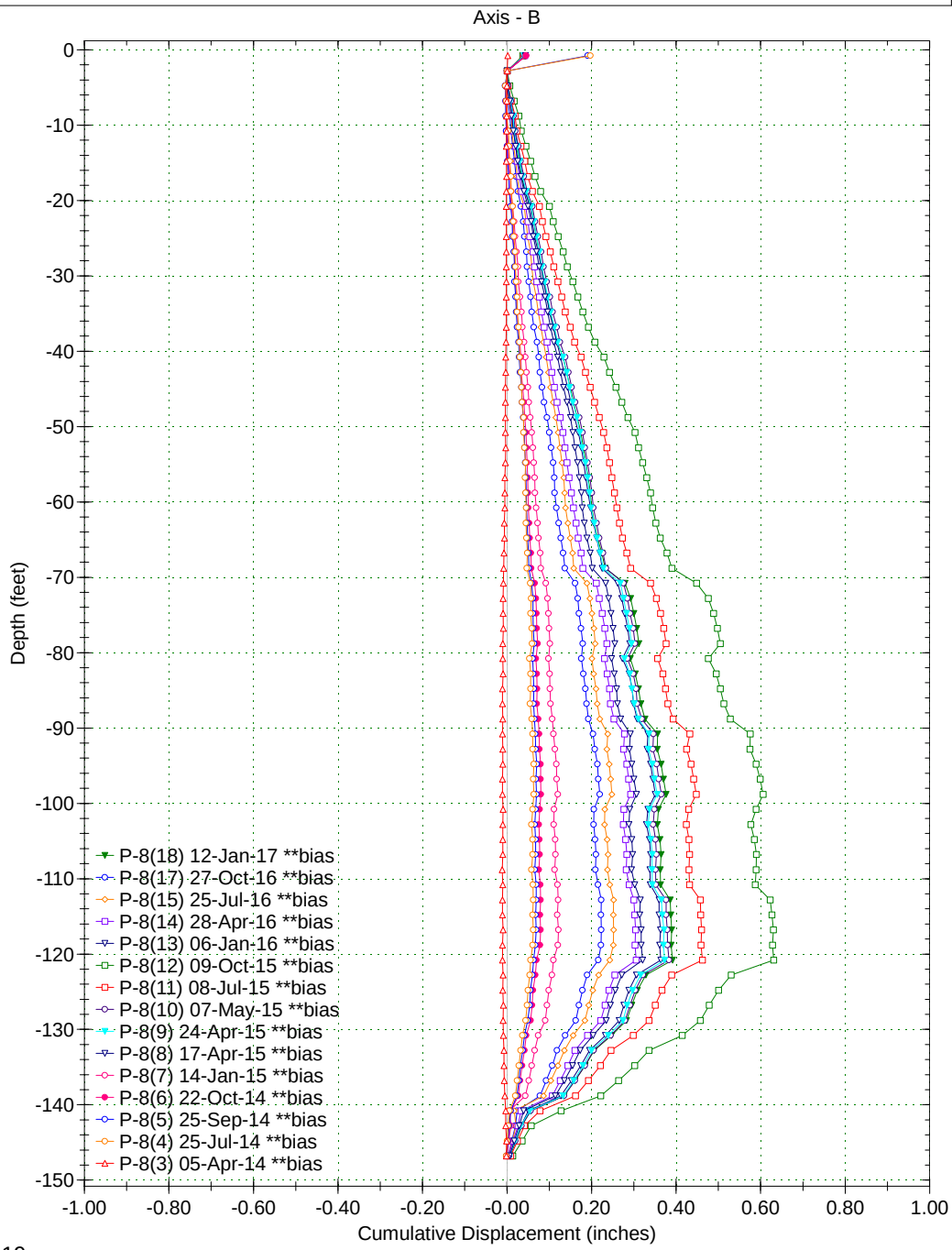
CUMULATIVE DISPLACEMENT

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





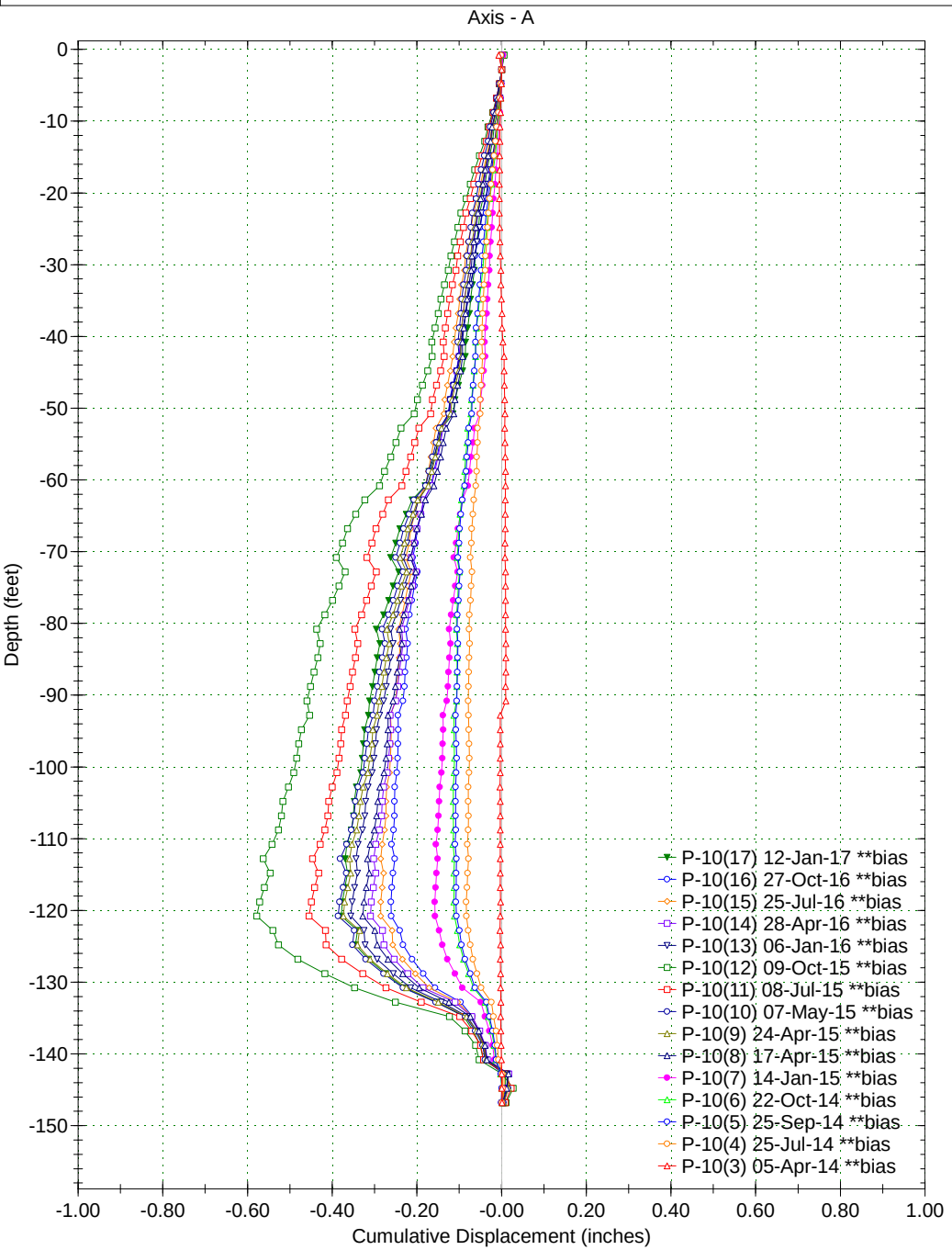
RST Instruments Ltd.

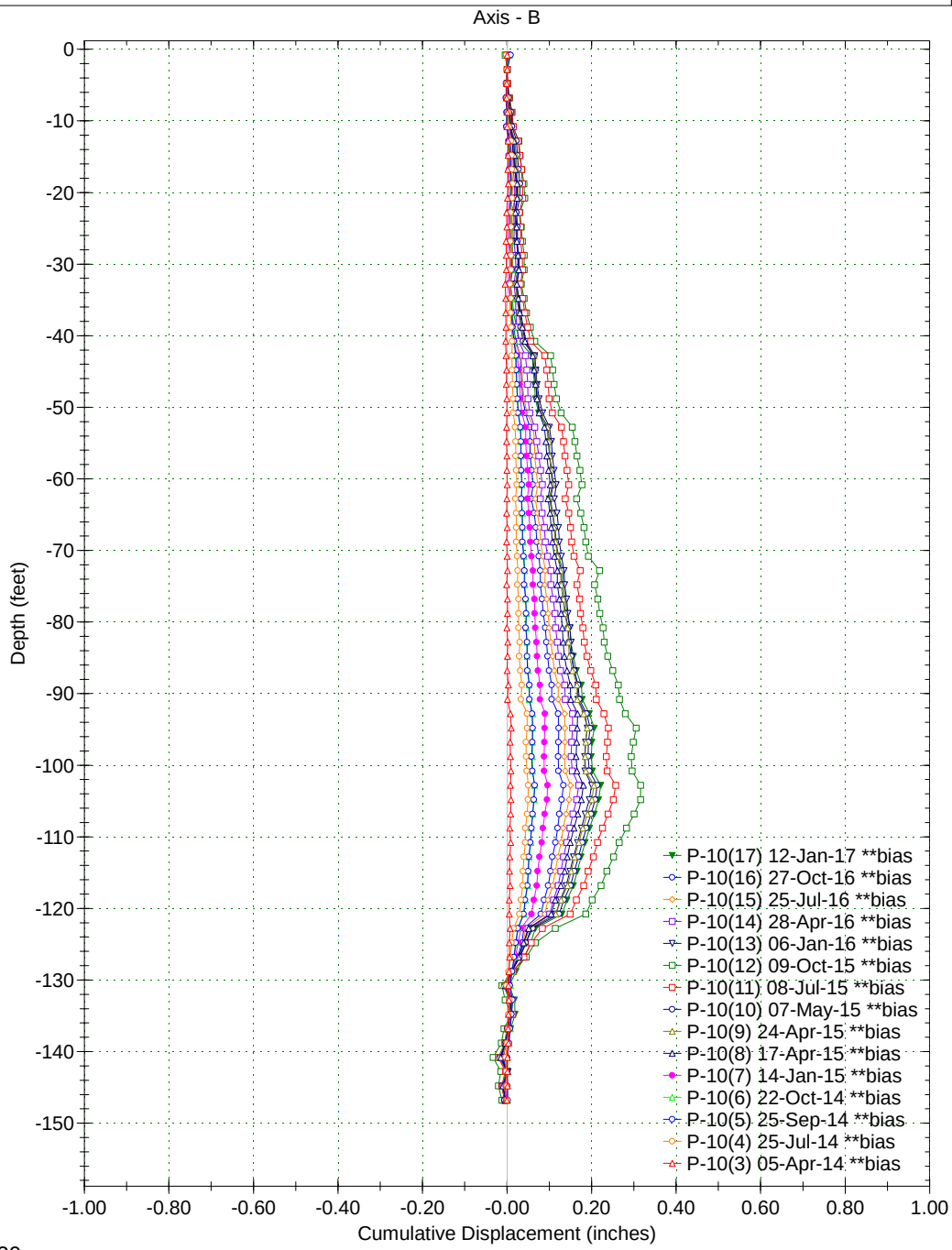
CUMULATIVE DISPLACEMENT

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





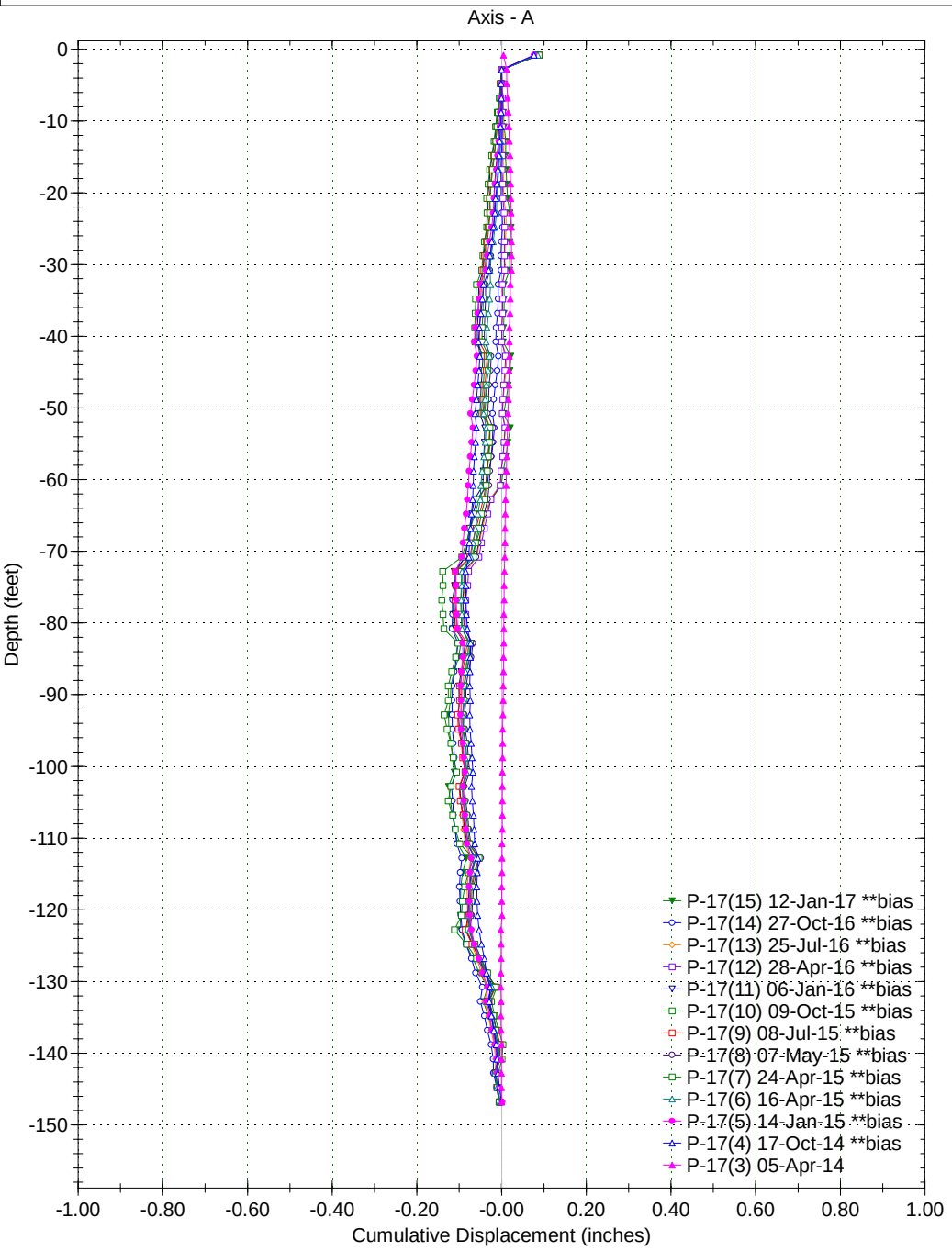
RST Instruments Ltd.

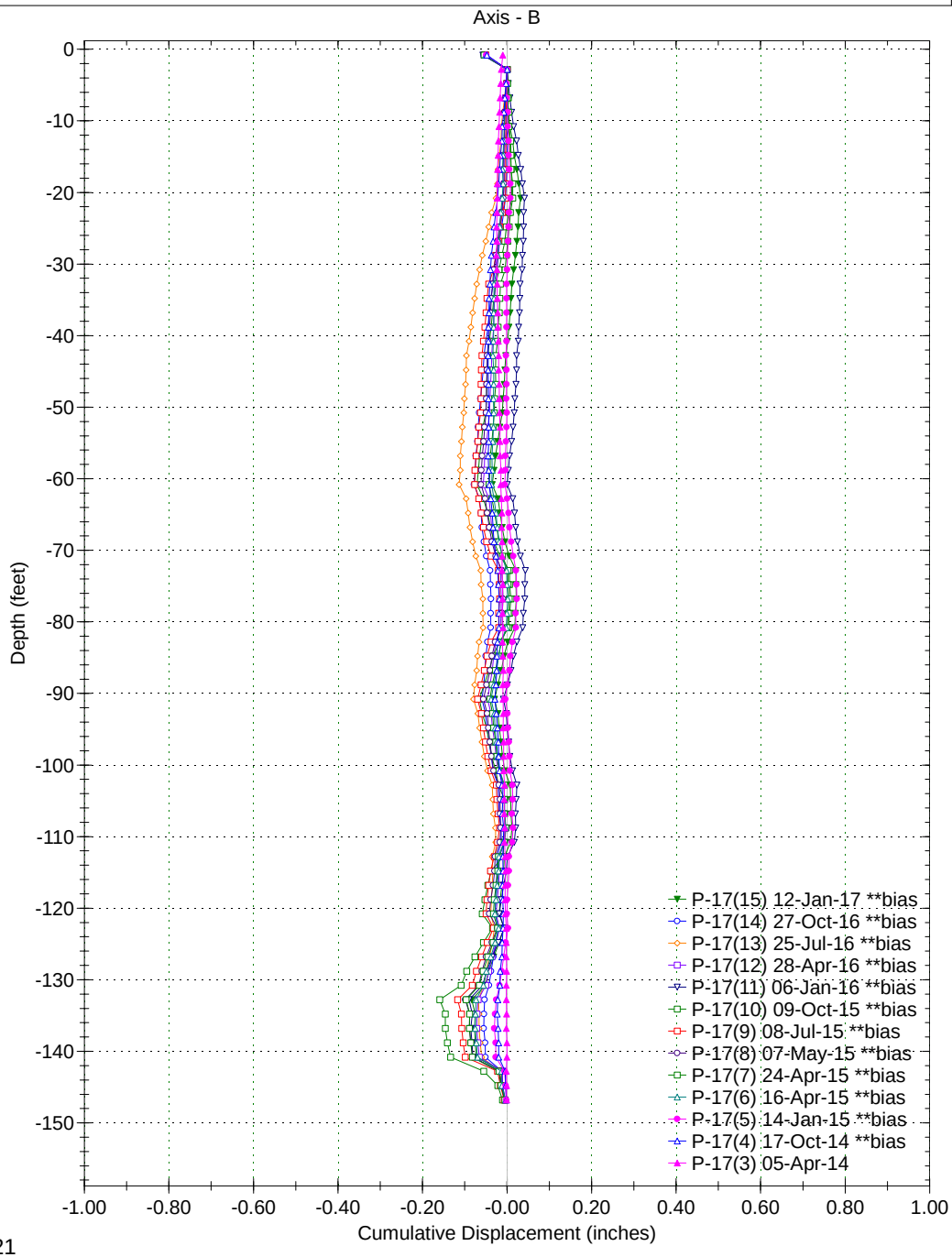
CUMULATIVE DISPLACEMENT

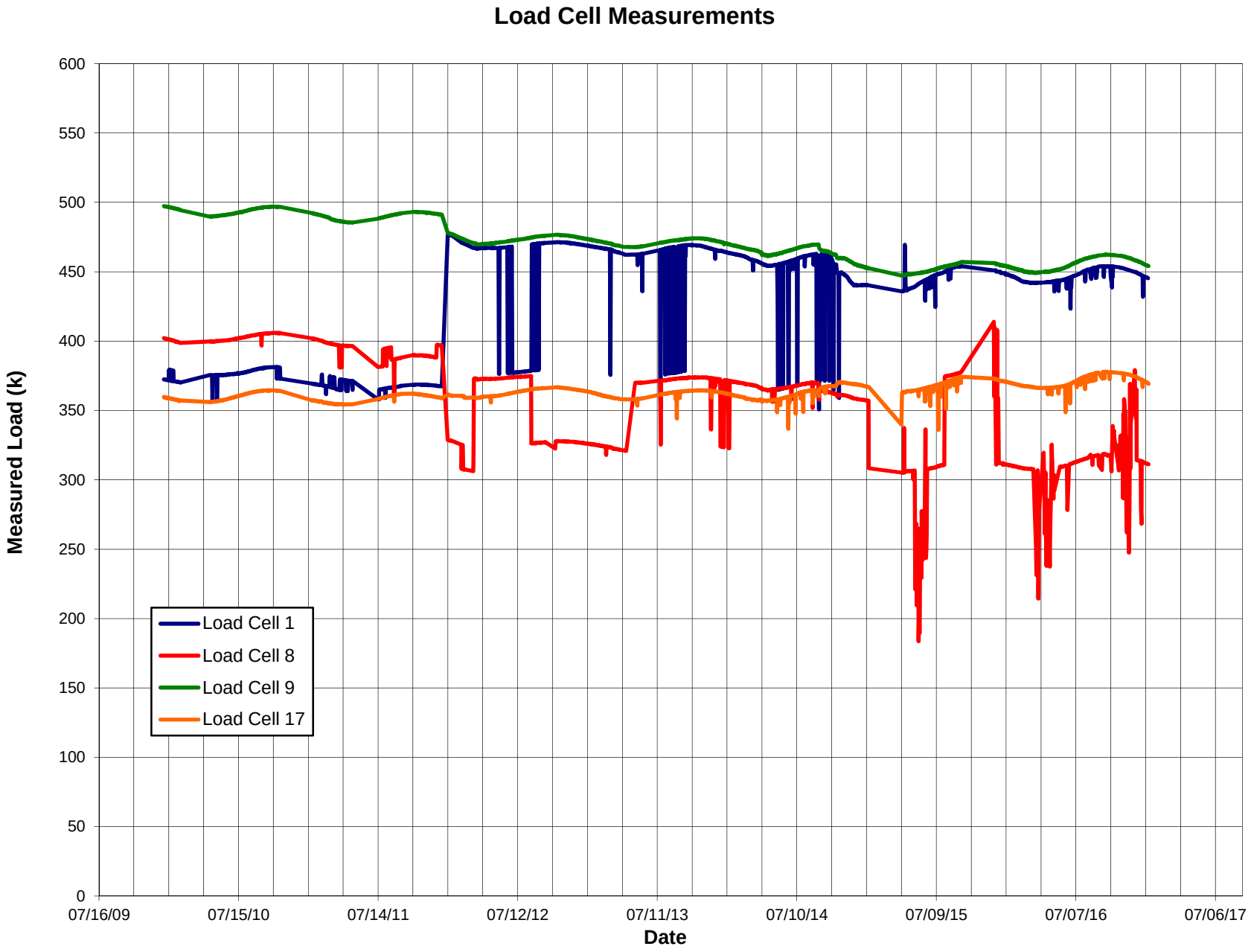
Inclinalysis v. 2.47.5

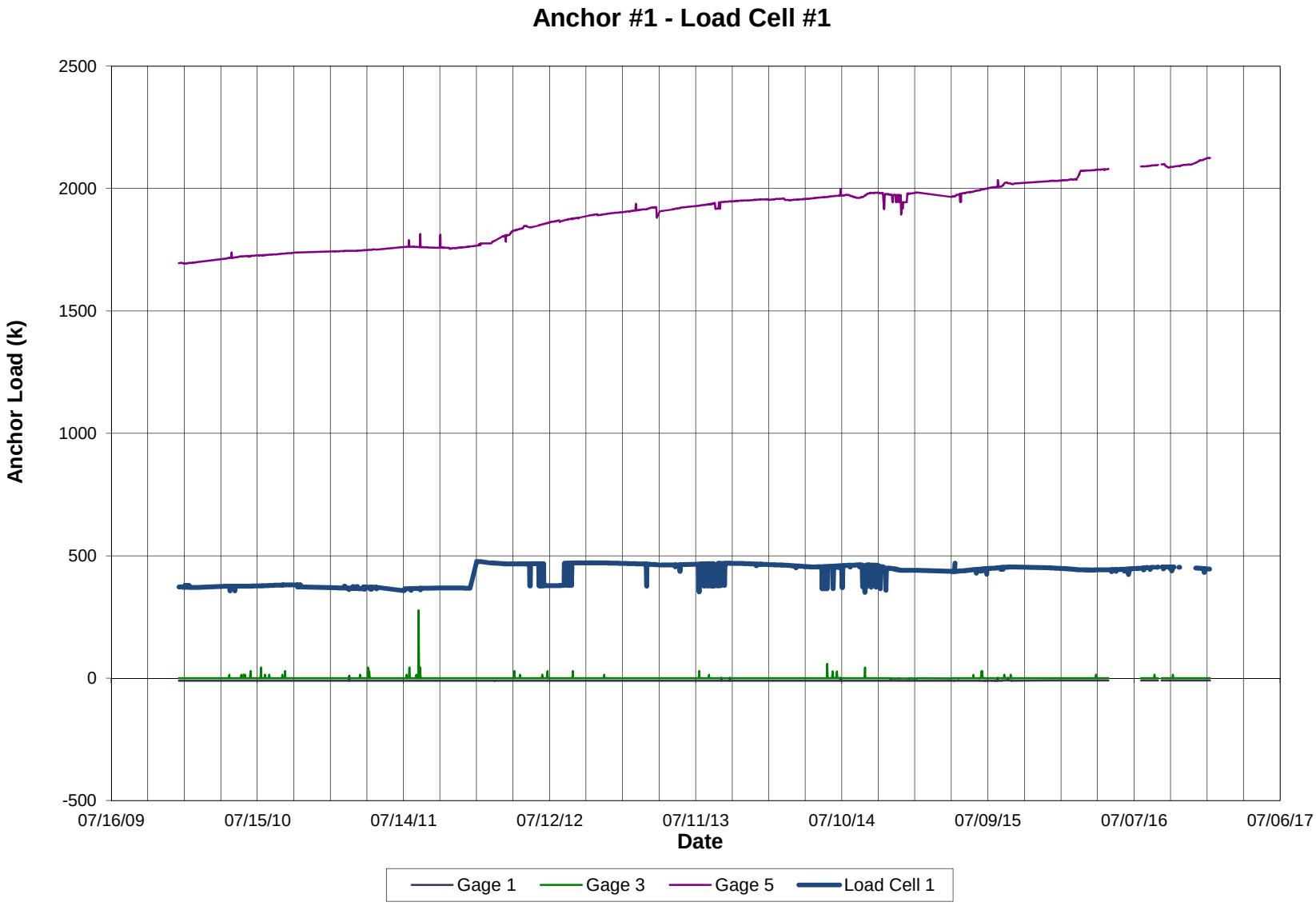
Borehole : P-17
Project : CUY-90-15-24
Location : Cleveland, Ohio
Northing :
Easting :
Collar :

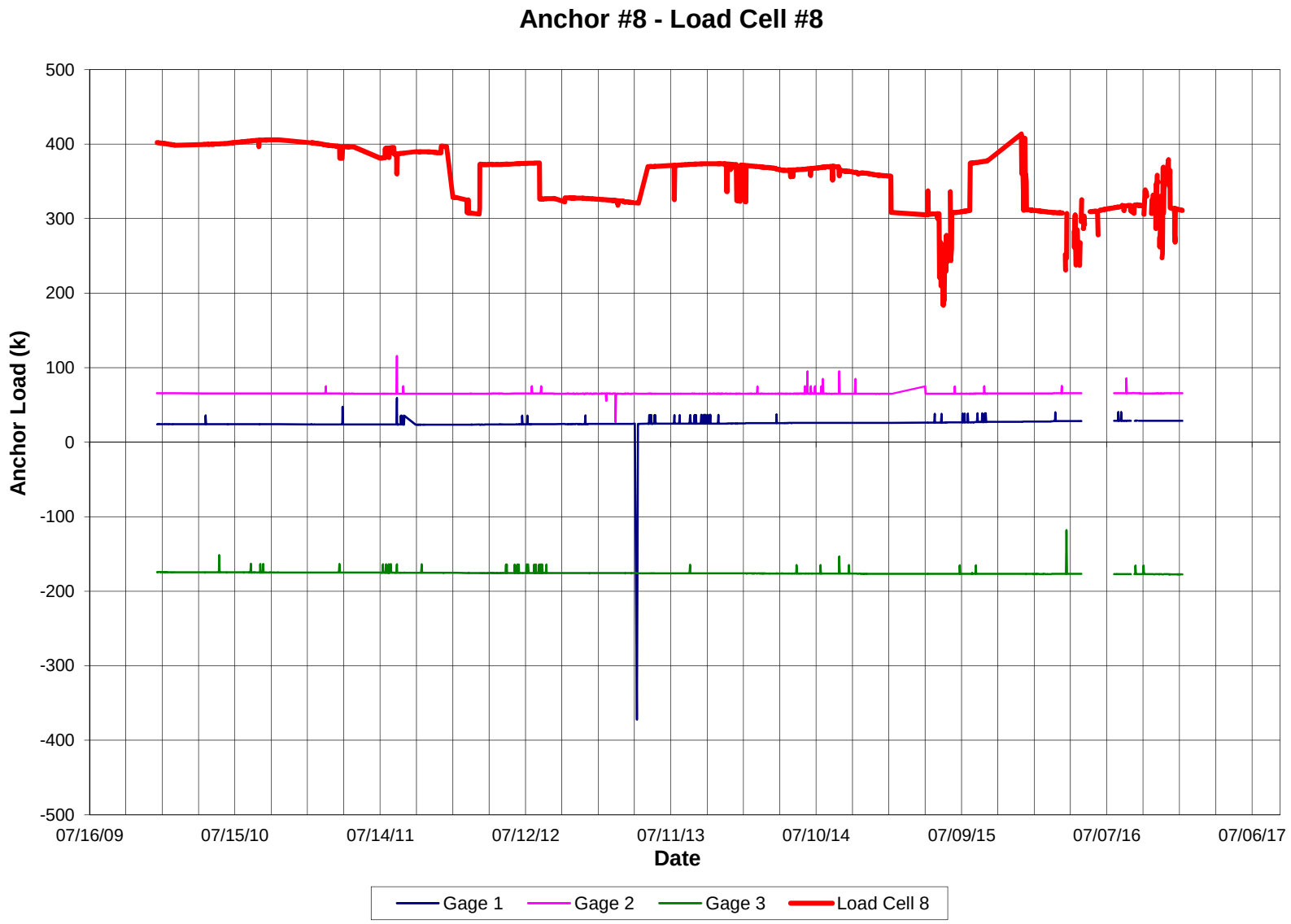
Spiral Correction : N/A
Collar Elevation : 1.2 feet
Borehole Total Depth : 148.0 feet
A+ Groove Azimuth :
Base Reading : 2014 Jan 15 12:02
Applied Azimuth : 0.0 degrees

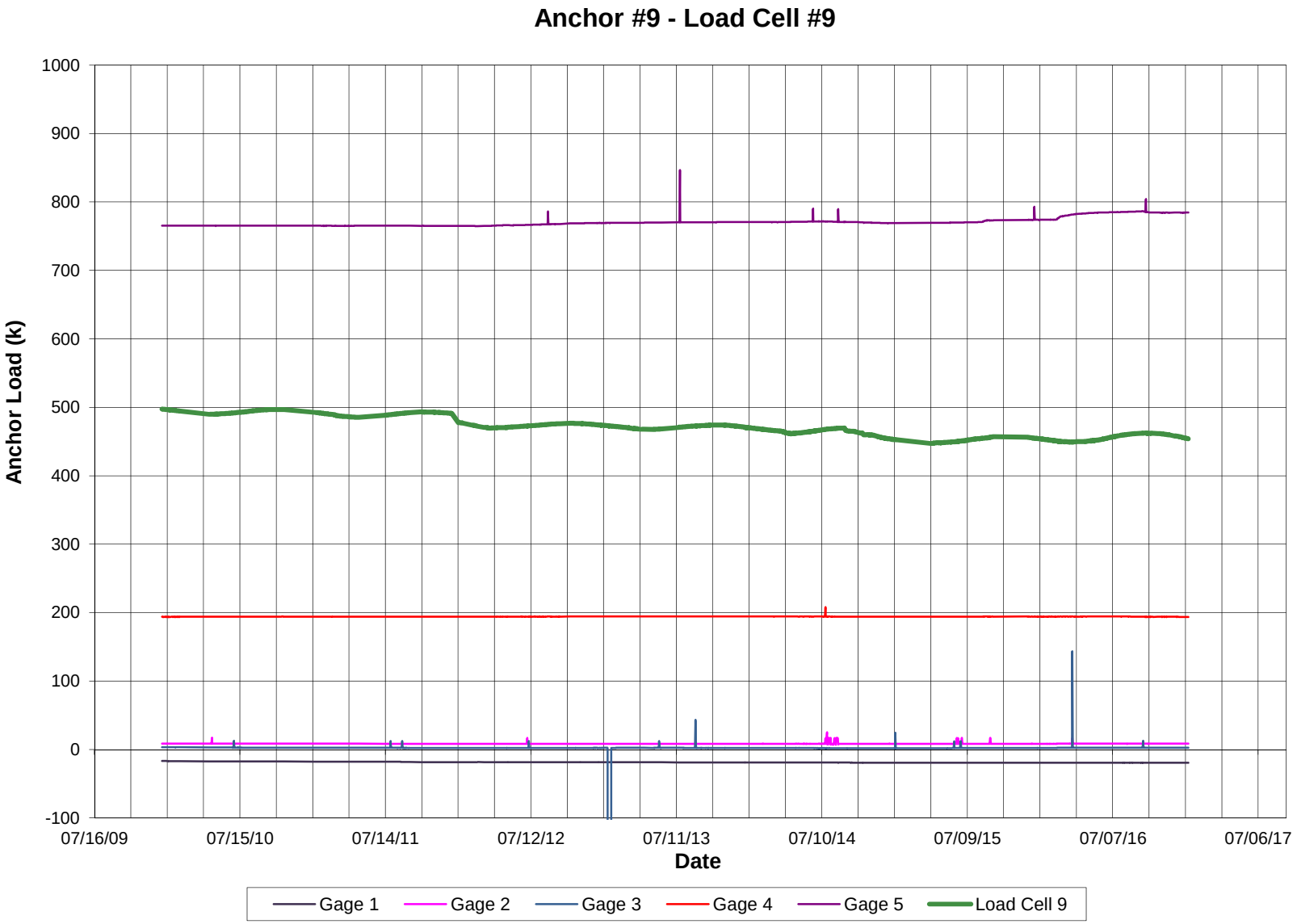


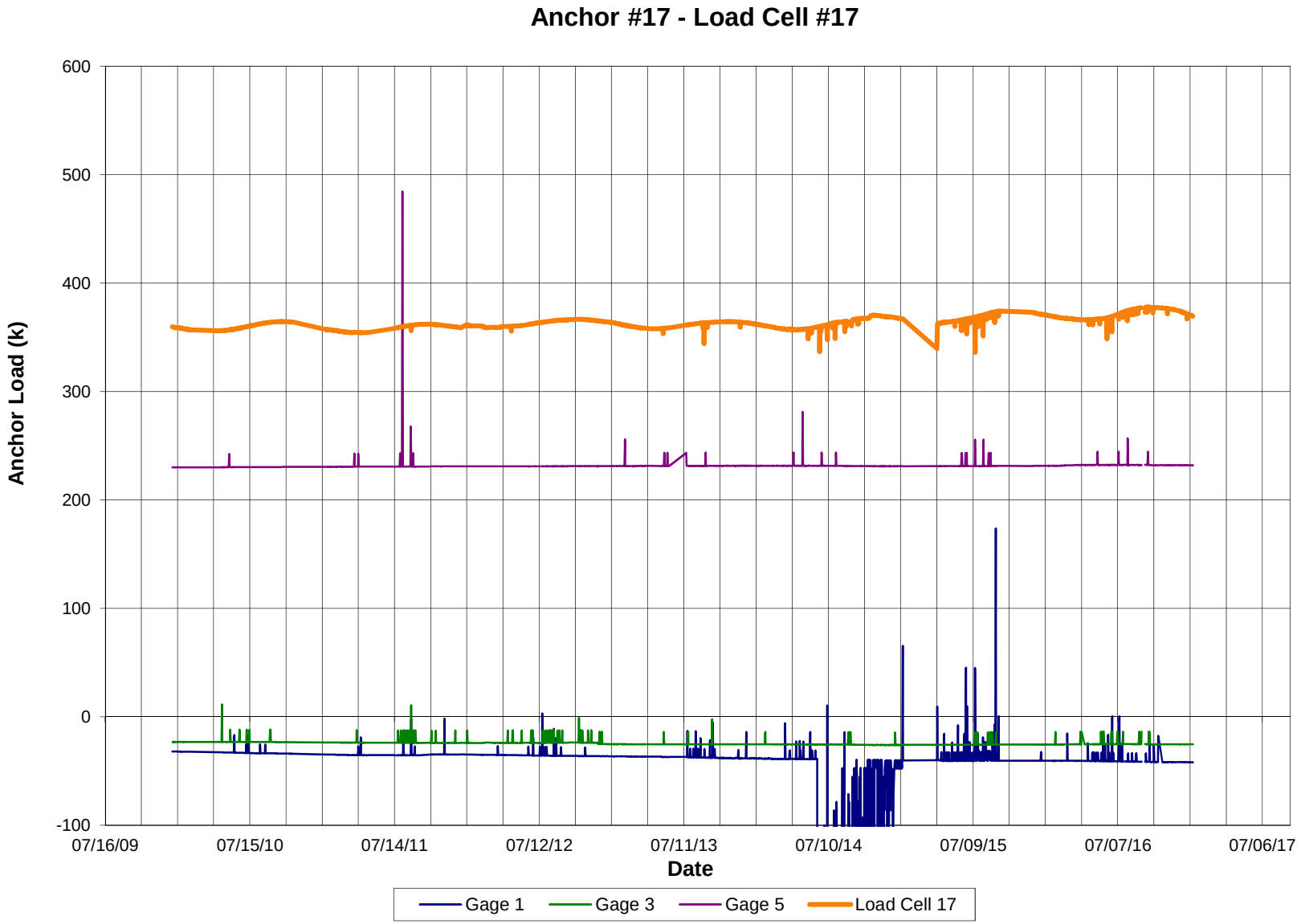



Load Cell Measurements
Measured Load (k)
600
550
500
450
400
350
300
250
200
150
100
50
0
07/16/09
07/15/10
07/14/11
07/12/12
07/11/13
07/10/14
07/09/15
07/07/16
07/06/17
Date
Load Cell 1
Load Cell 8
Load Cell 9
Load Cell 17

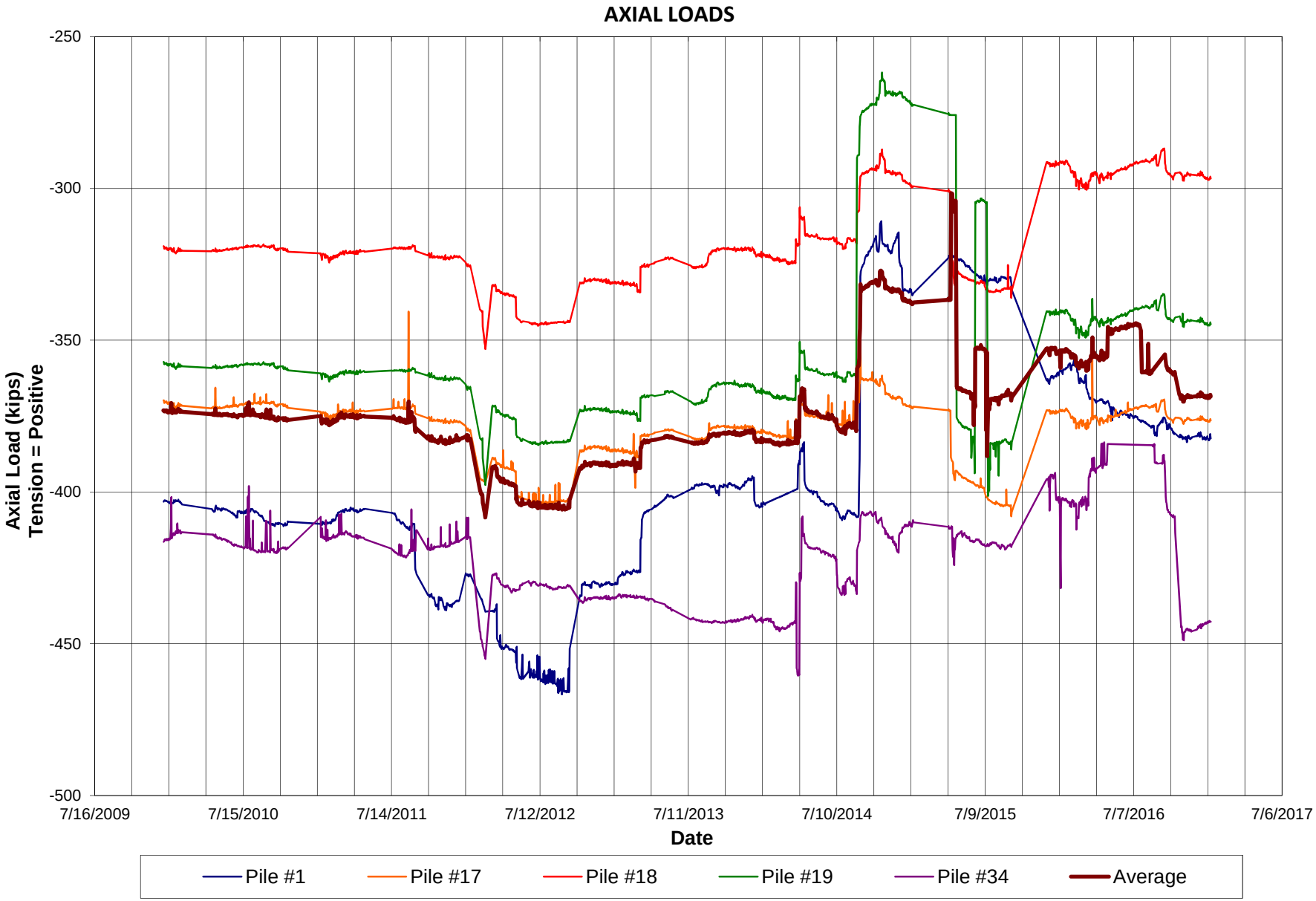

Anchor #1 - Load Cell #1
Anchor Load (k)
2500
2000
1500
1000
500
0
-500
07/16/09
07/15/10
07/14/11
07/12/12
07/11/13
07/10/14
07/09/15
07/07/16
07/06/17
Date
Gage 1
Gage 3
Gage 5
Load Cell 1


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

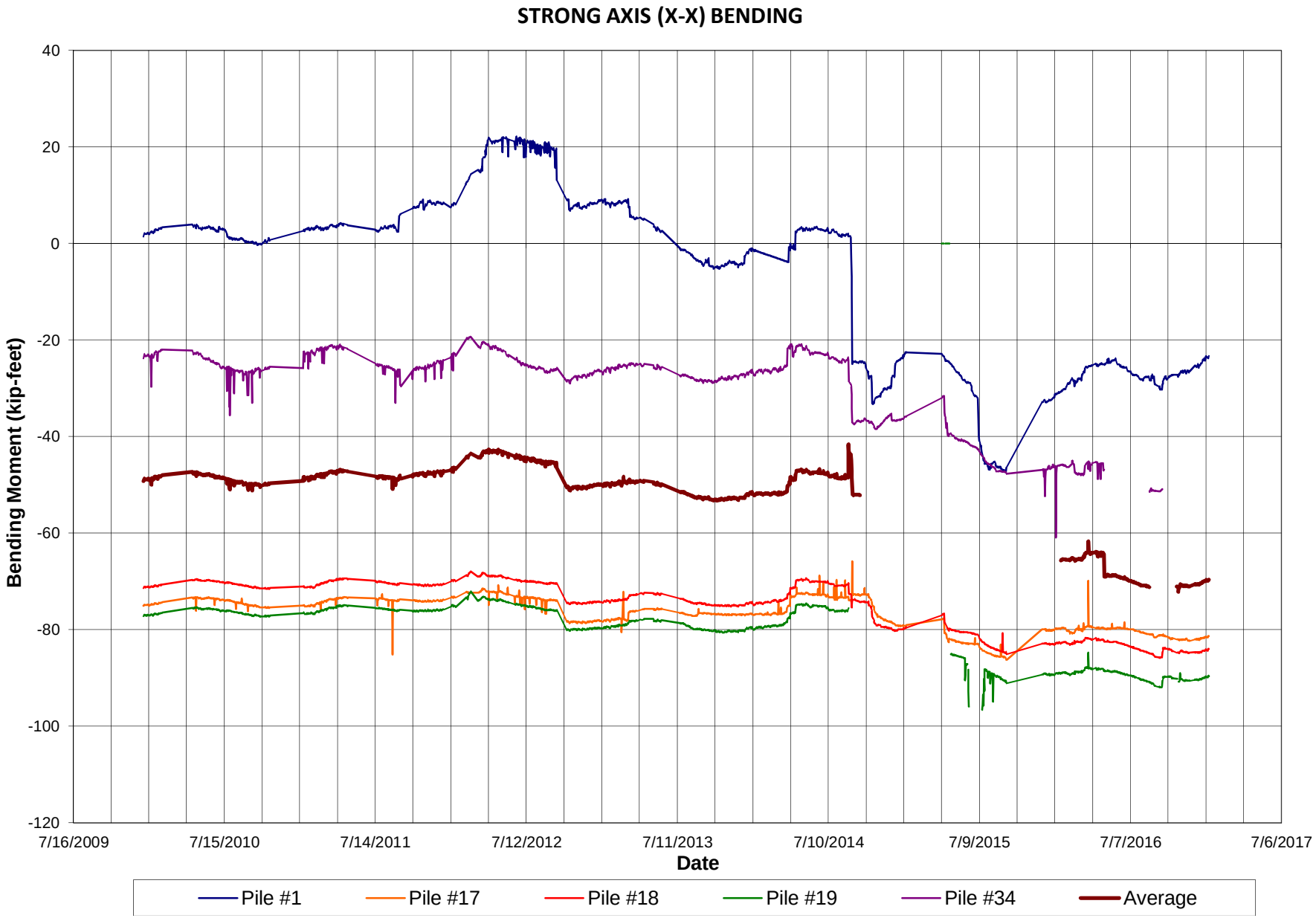

Anchor #17 - Load Cell #17
Anchor Load (k)
600
500
400
300
200
100
0
-100
07/16/09
07/15/10
07/14/11
07/12/12
07/11/13
07/10/14
07/09/15
07/07/16
07/06/17
Date
Gage 1
Gage 3
Gage 5
Load Cell 17

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



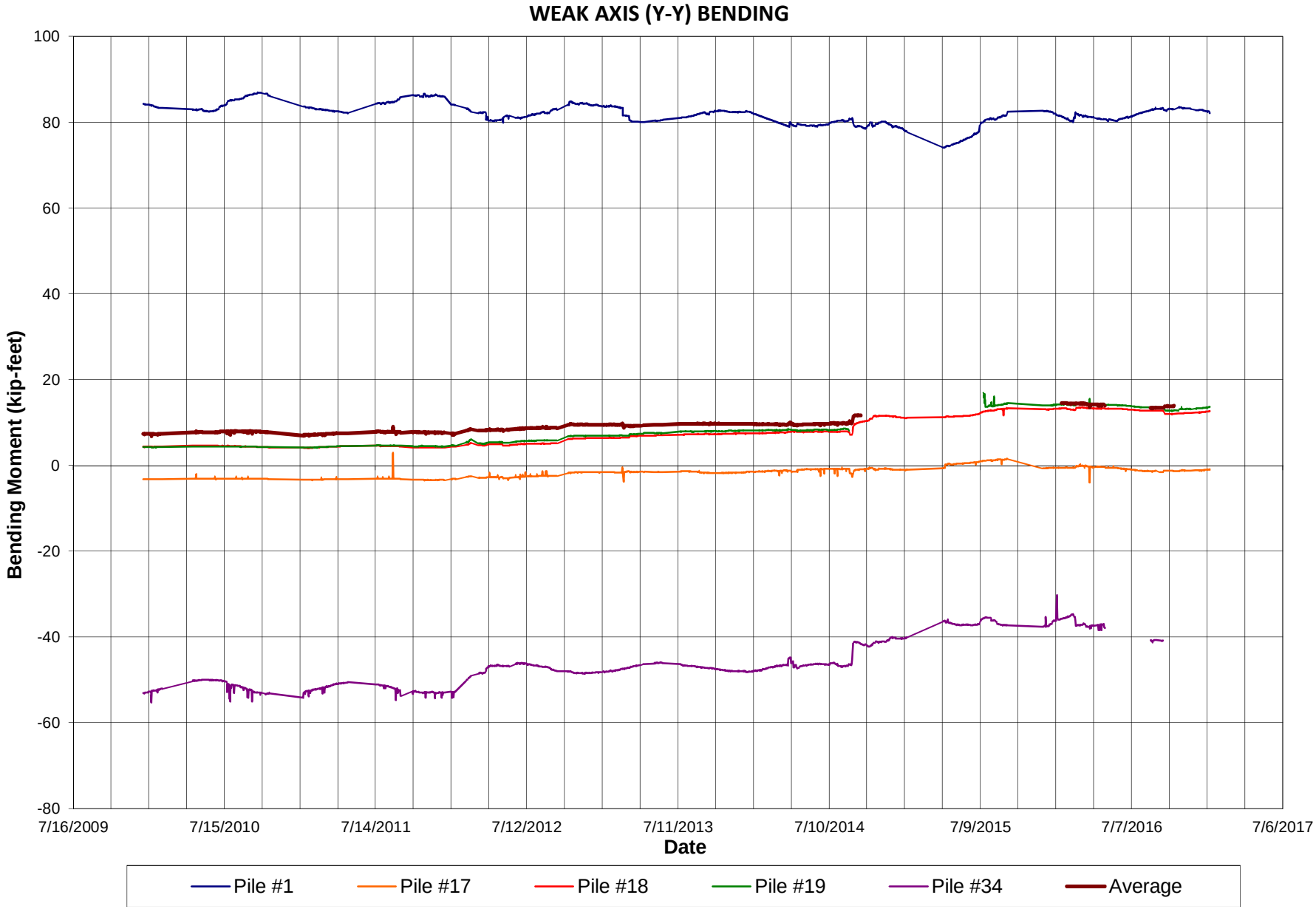
Driven Piles

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



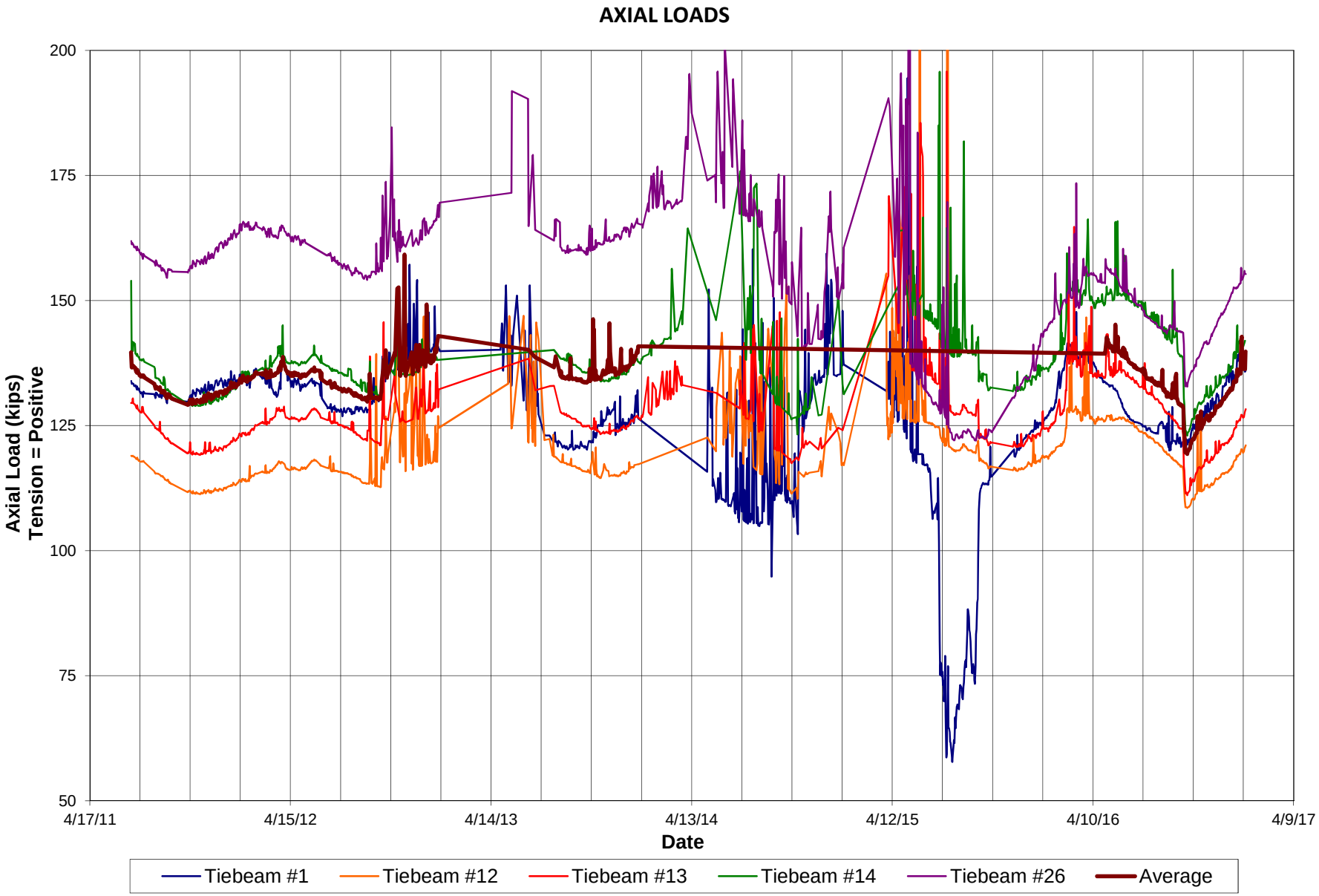
Driven Piles

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



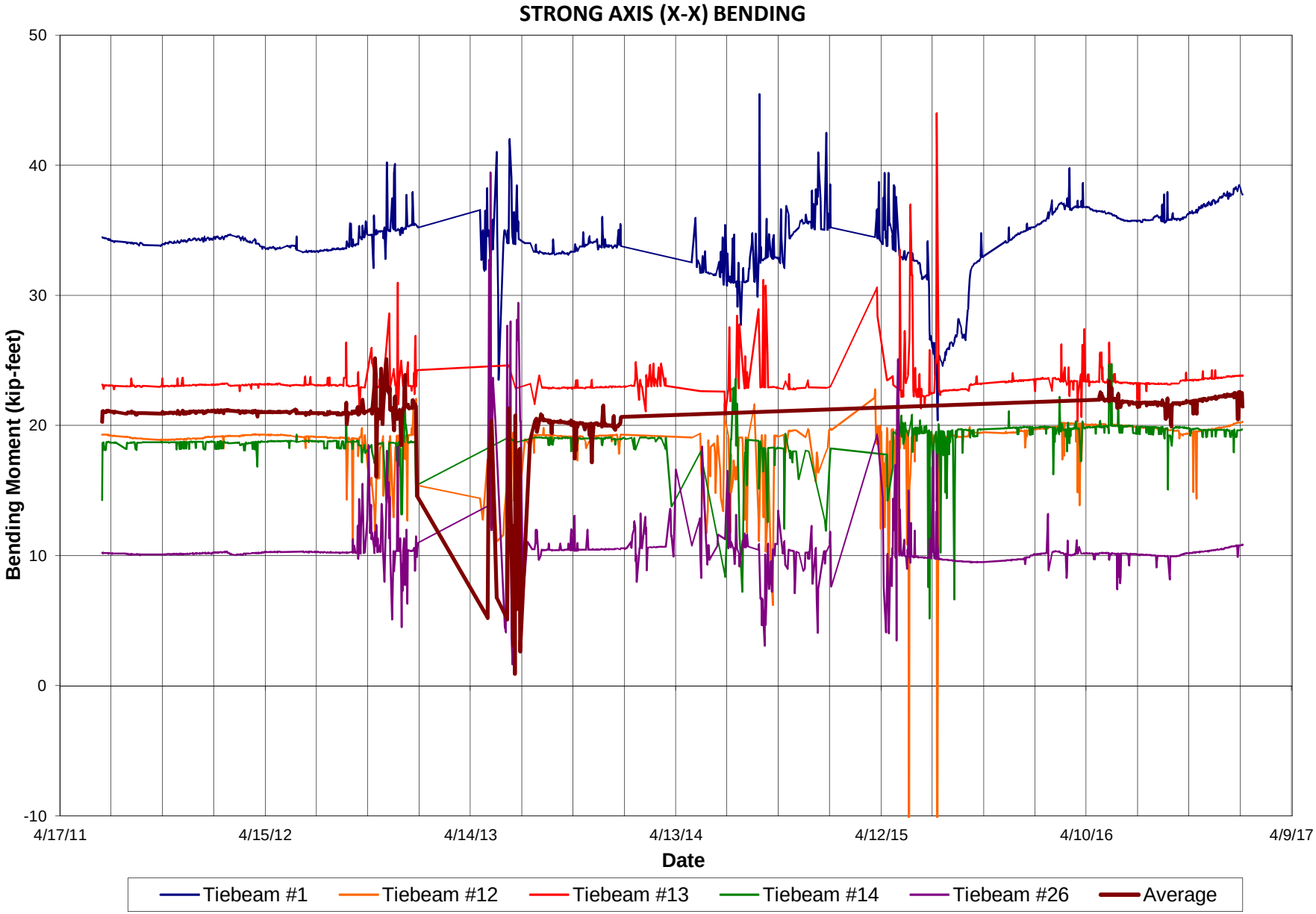
Driven Piles

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



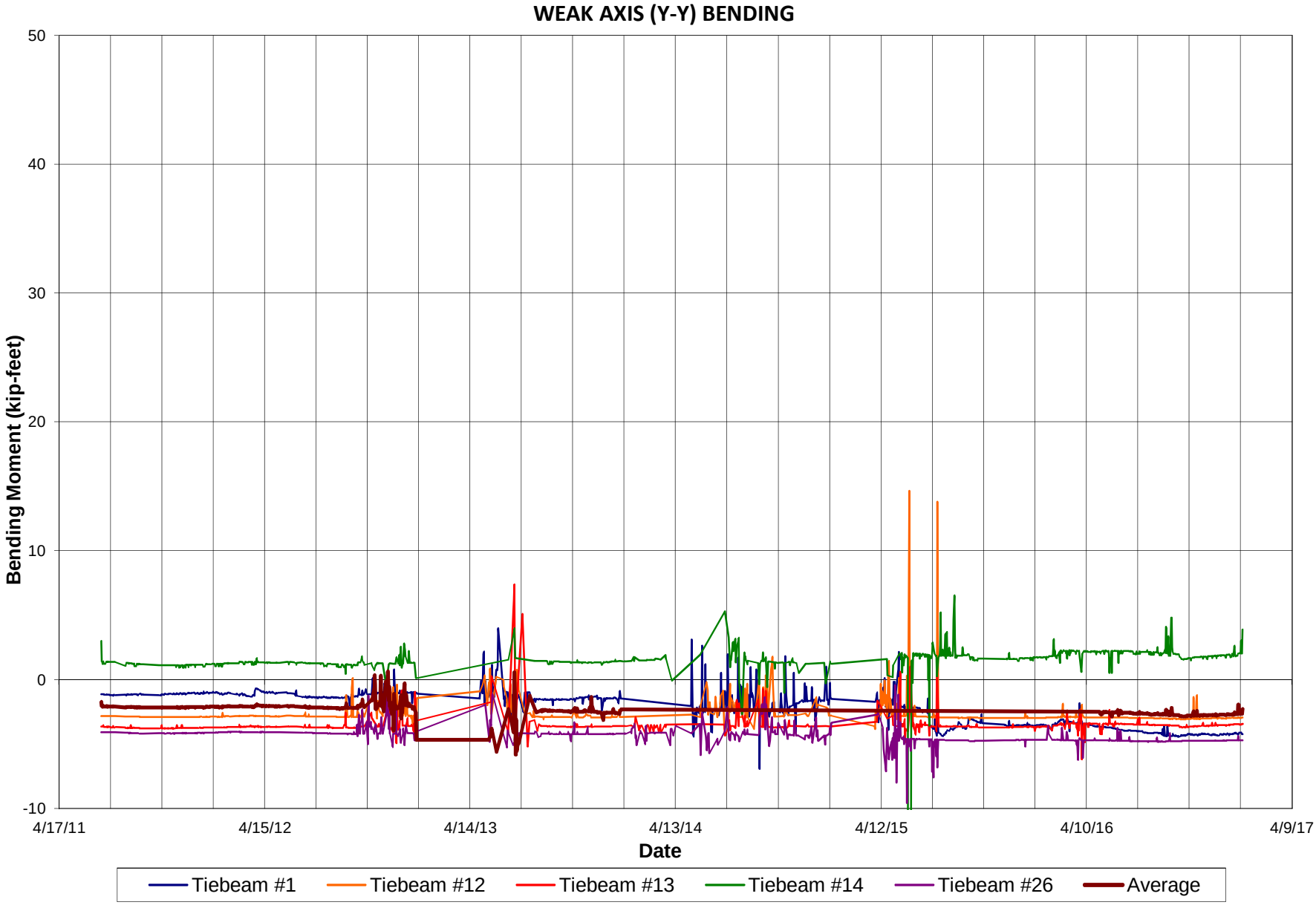
Tiebeams - Anchor Side

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



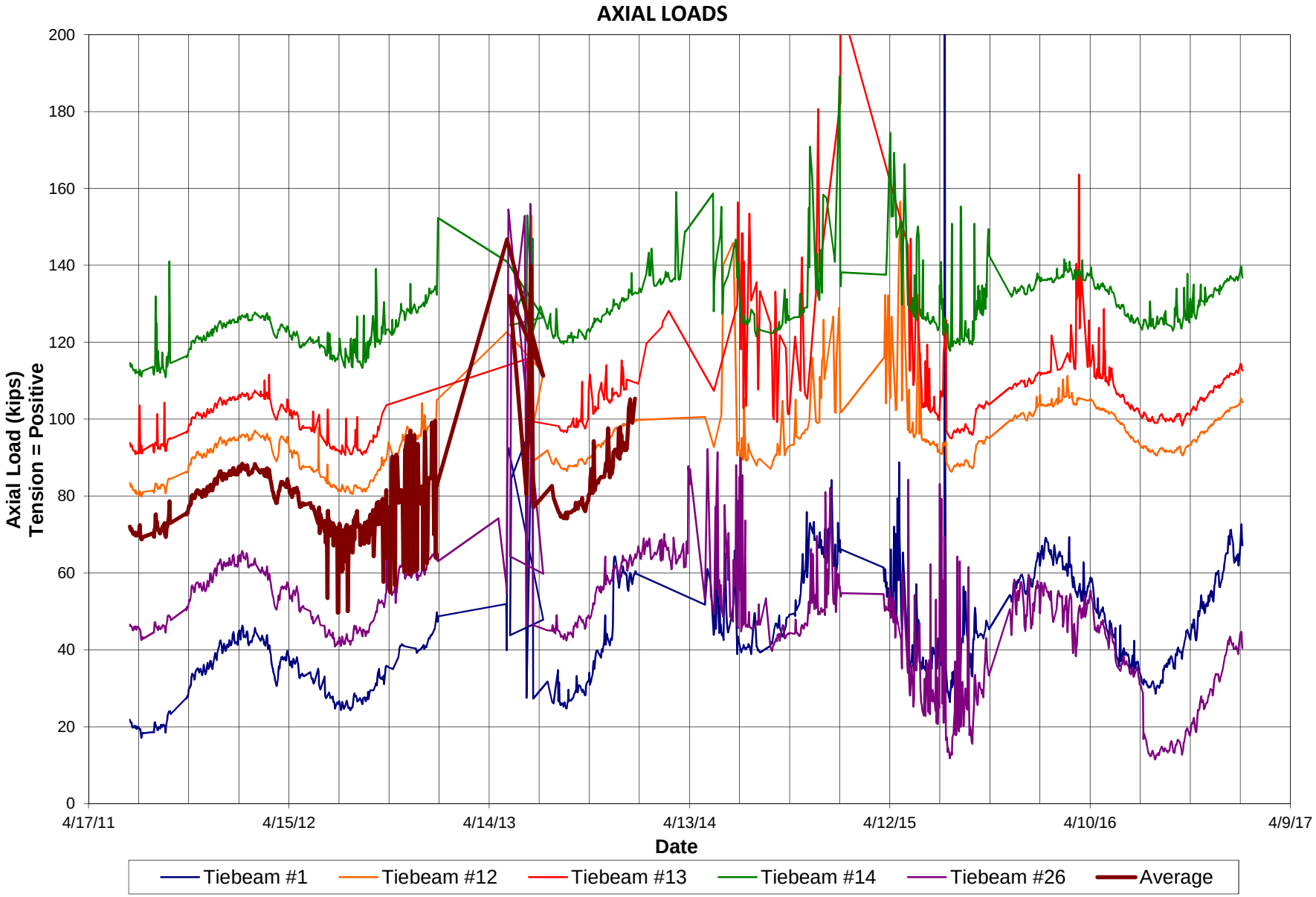
Tiebeams - Anchor Side

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



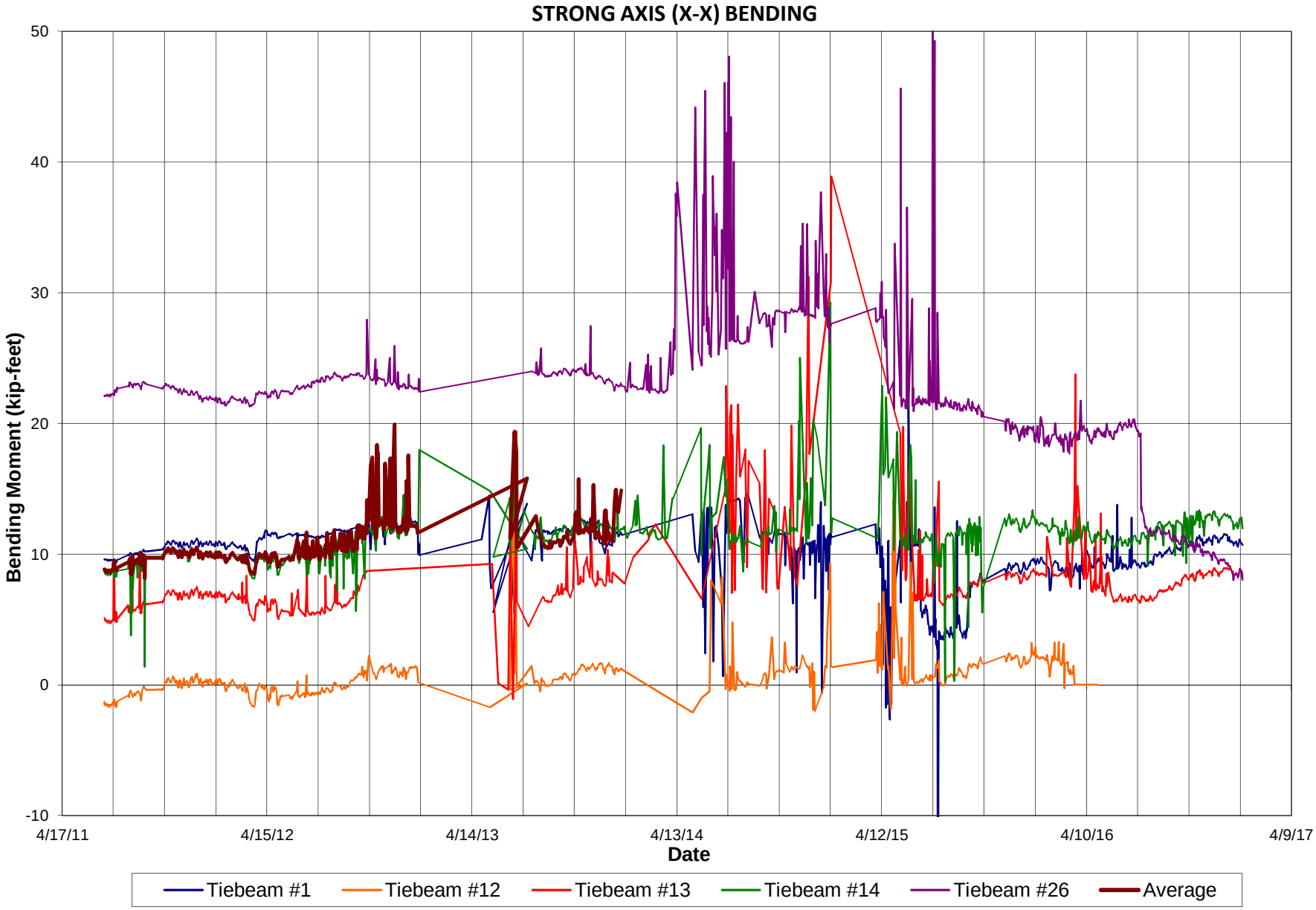
Tiebeams - Anchor Side

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



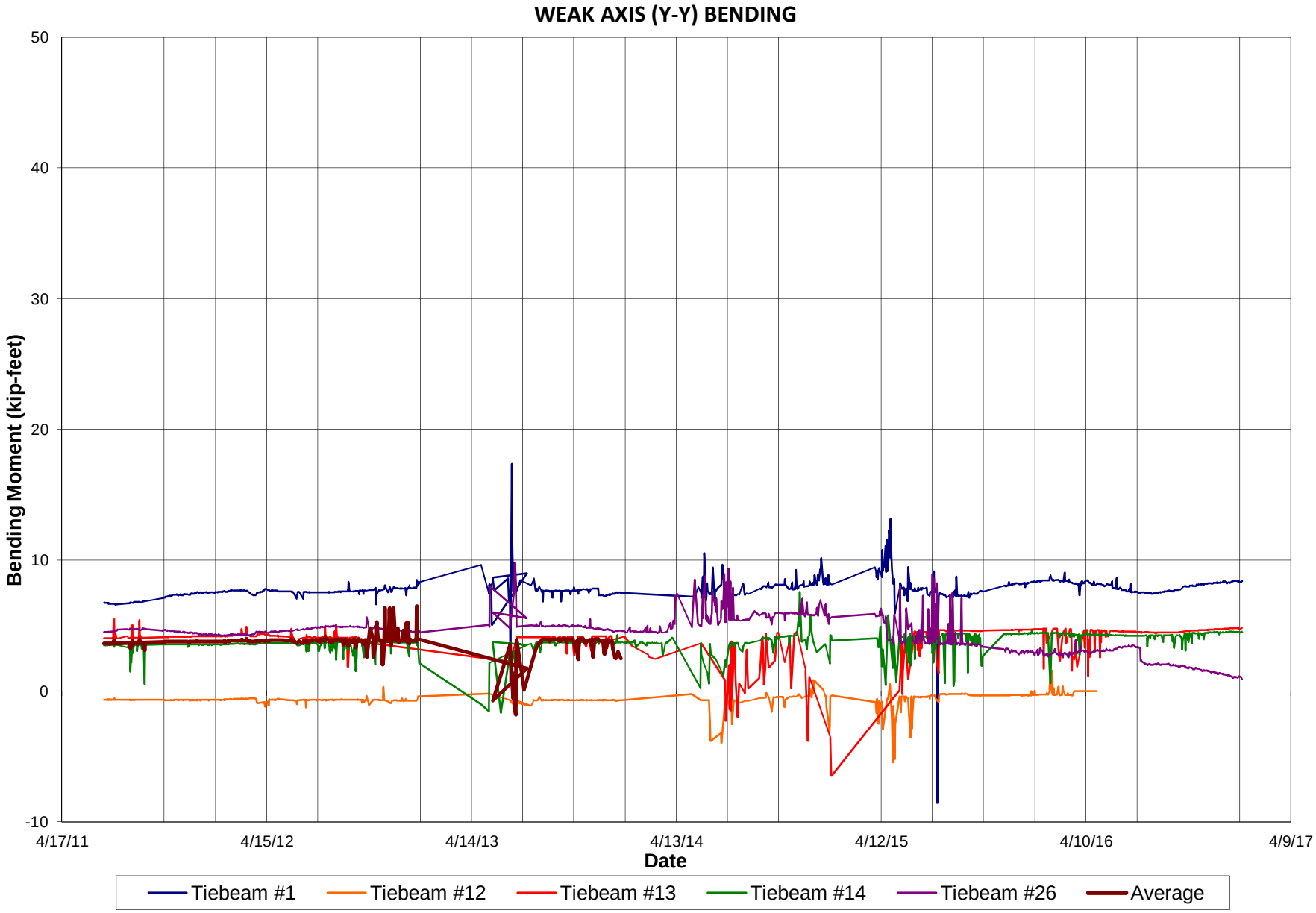
Tiebeams - Drilled Pier Side

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

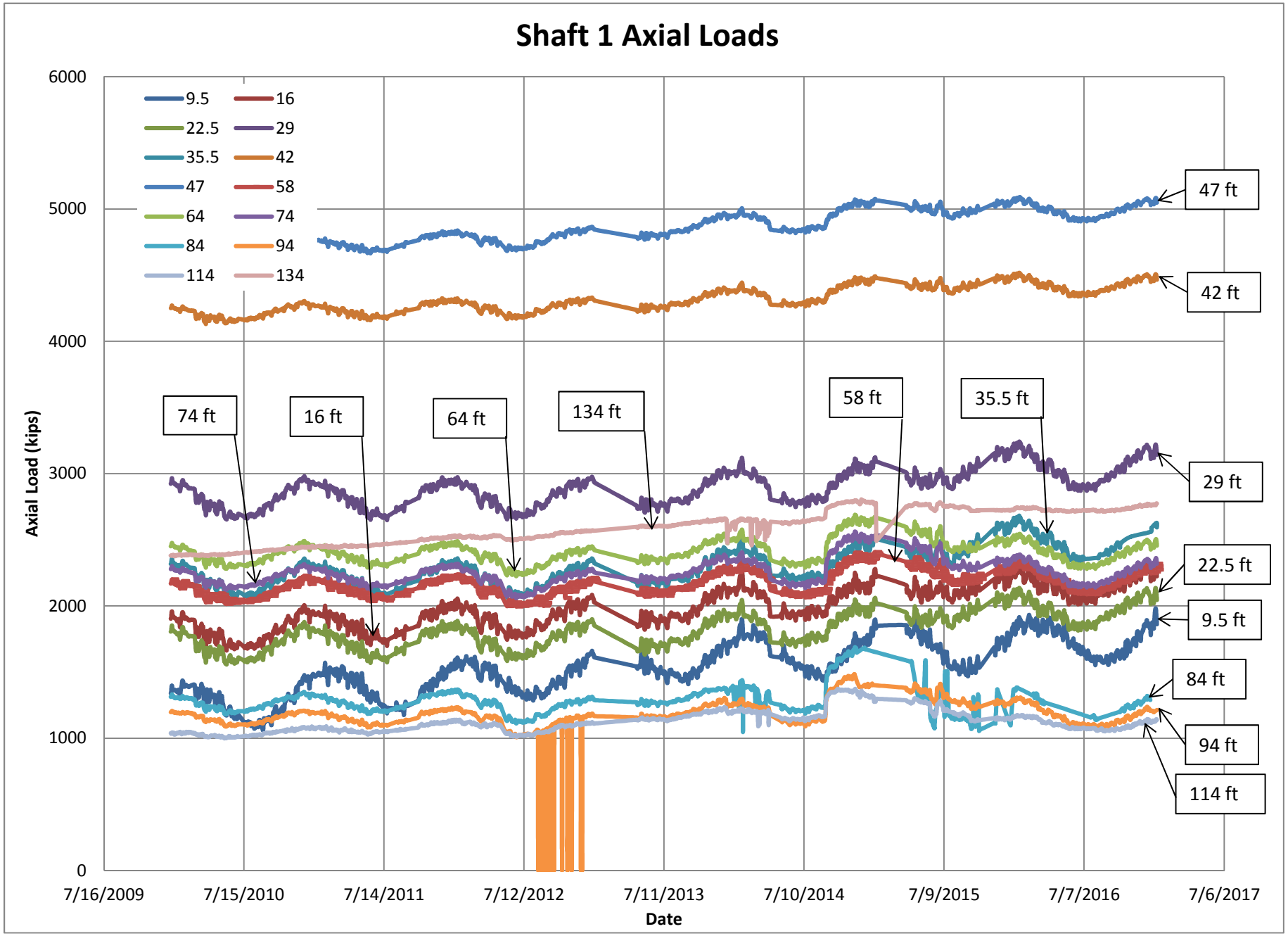


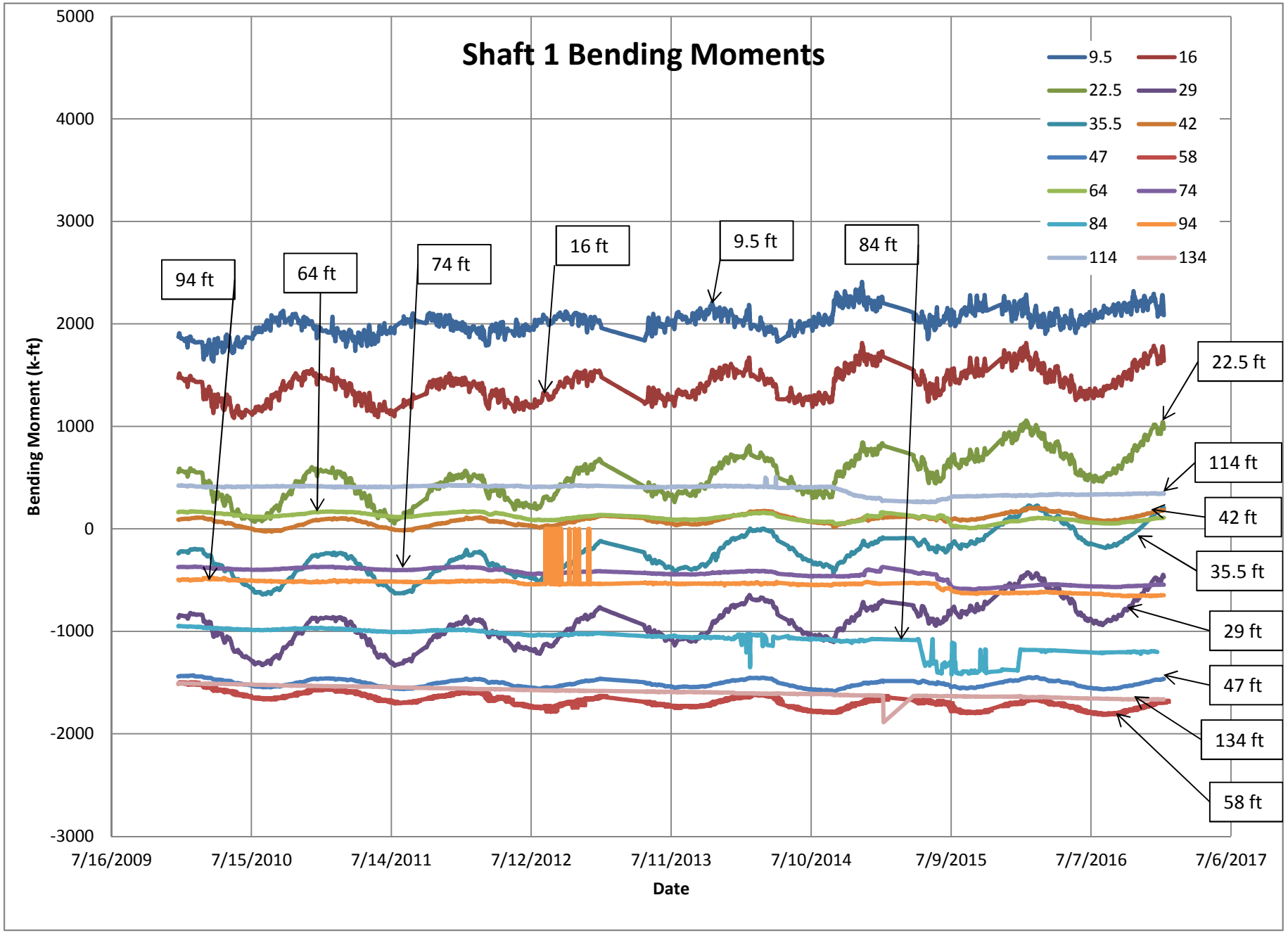
Tiebeams - Drilled Pier Side

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
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
Date
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

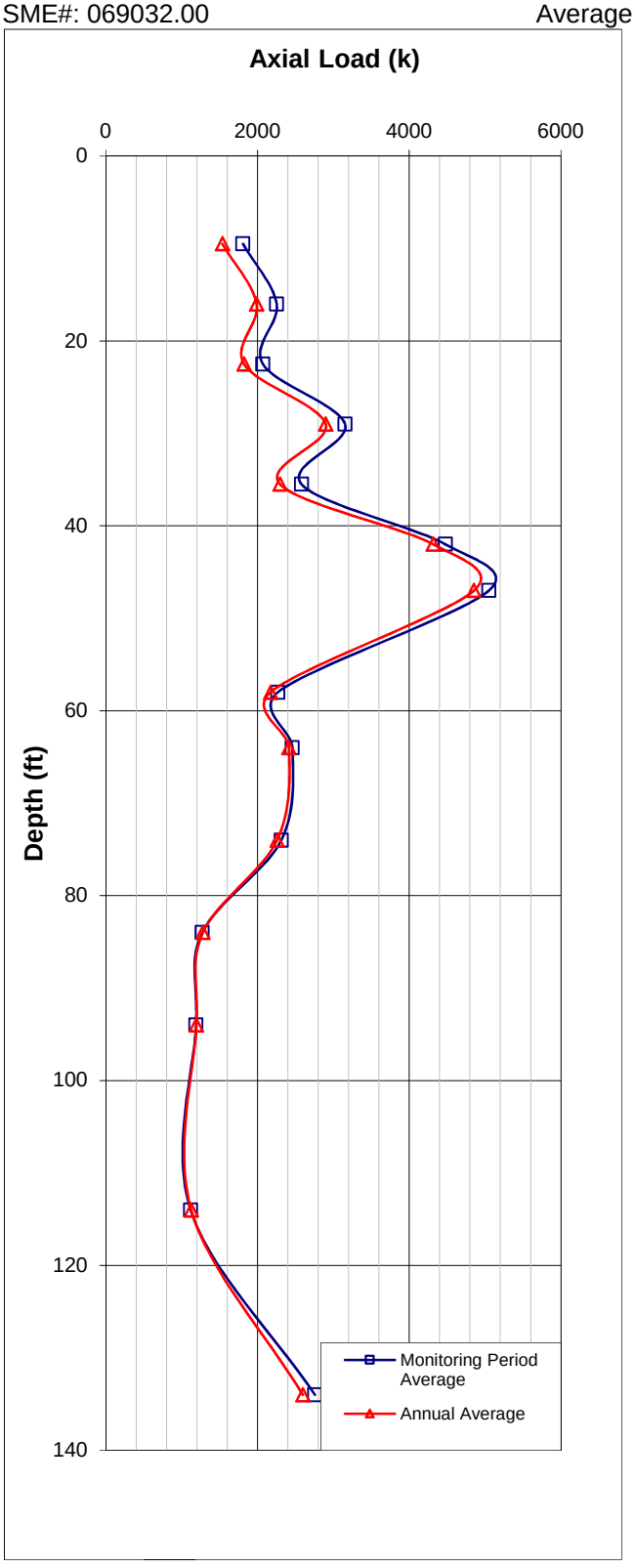

Shaft 1 Bending Moments
9.5
16
22.5
29
35.5
42
47
58
64
74
84
94
114
134
94 ft
64 ft
74 ft
16 ft
9.5 ft
84 ft
22.5 ft
114 ft
42 ft
35.5 ft
29 ft
47 ft
134 ft
58 ft
Bending Moment (k-ft)
5000
4000
3000
2000
1000
0
-1000
-2000
-3000
7/16/2009
7/15/2010
7/14/2011
7/12/2012
7/11/2013
7/10/2014
7/9/2015
7/7/2016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

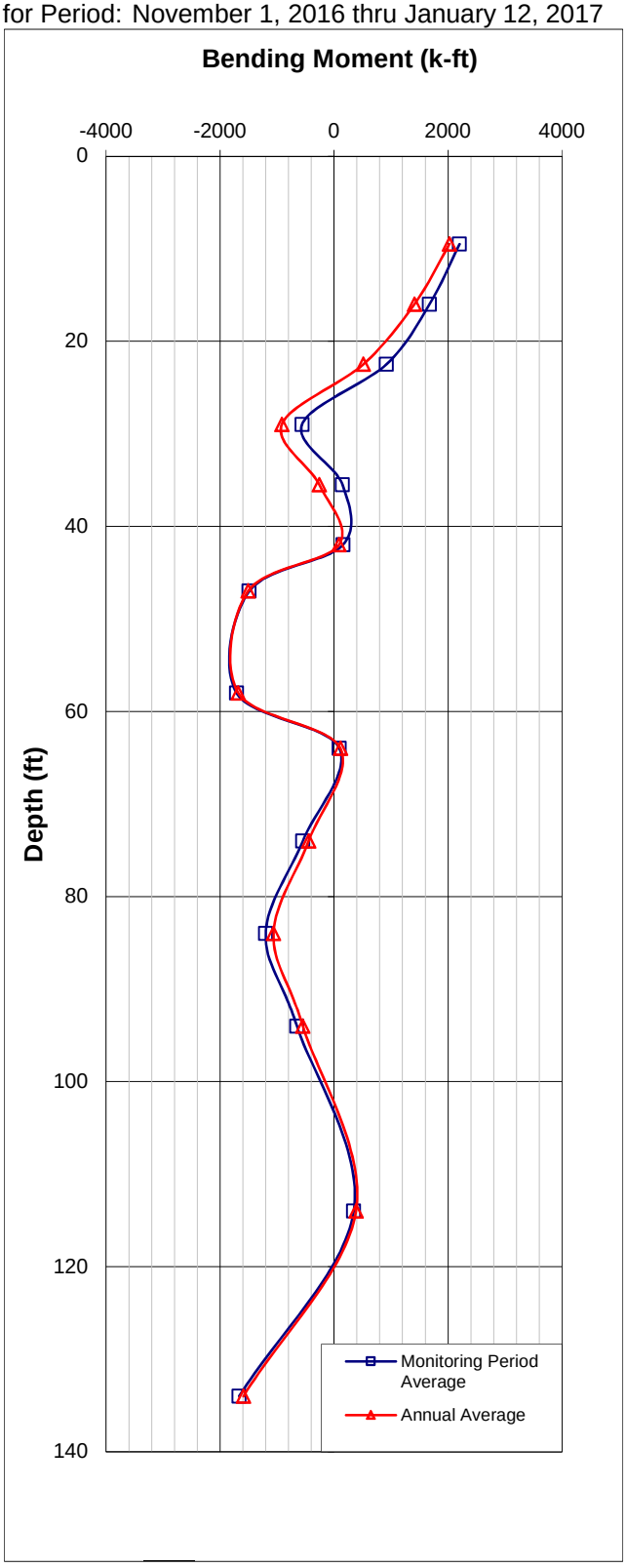
CUY-90-15.24 Slope Monitoring

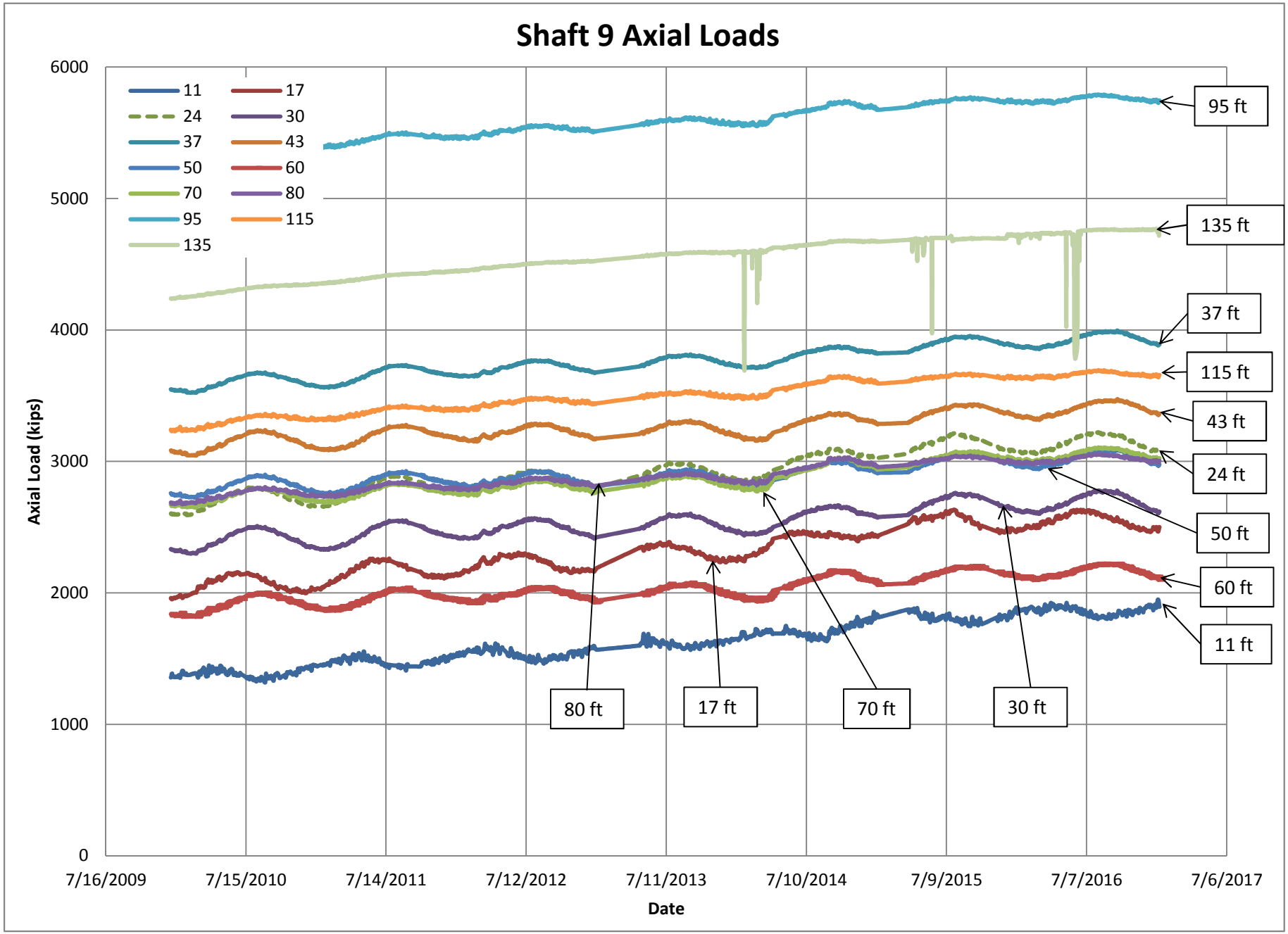
PID 96504 — Drilled Shaft #1

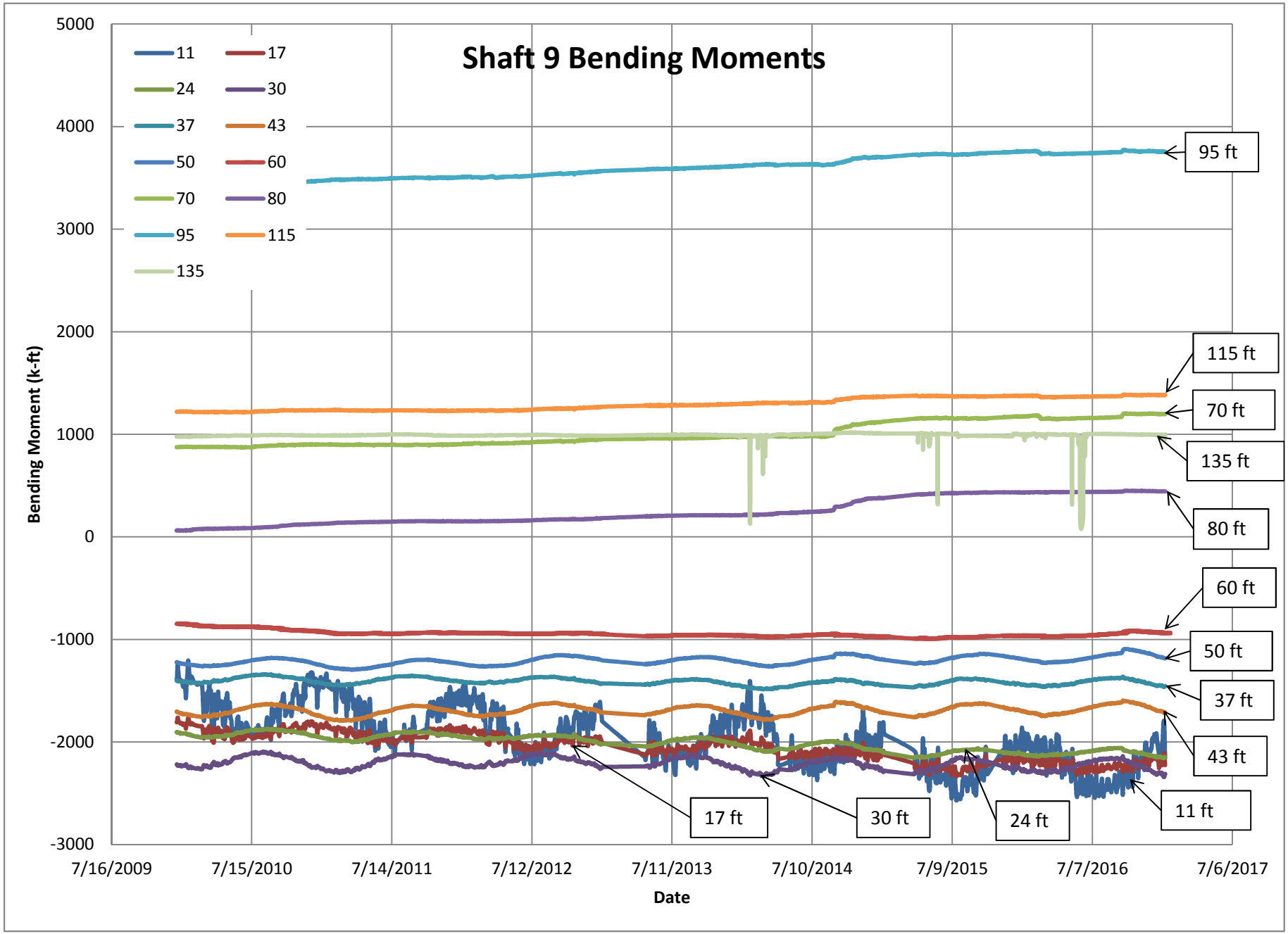
Cleveland, Ohio — (Weak Axis Bending)

SME#: 069032.00 — Average for Period: November 1, 2016 thru January 12, 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
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
17 ft
70 ft
30 ft


Shaft 9 Bending Moments
11
17
24
30
37
43
50
60
70
80
95
115
135
5000
4000
3000
2000
1000
0
-1000
-2000
-3000
Bending Moment (k-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
Date
95 ft
115 ft
70 ft
135 ft
80 ft
60 ft
50 ft
37 ft
43 ft
11 ft
24 ft
30 ft
17 ft

CUY-90-15.24 Slope Monitoring

PID 76117 — Drilled Shaft #9

Cleveland, Ohio — Strong Axis Bending

EDP #09305G — Average for Period: November 1, 2016 thru January 12, 2017