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March 25, 2014

Mr. Jason Wise, P.E.
ODOT District 12 Geotechnical Engineer
Ohio Department of Transportation
5500 Transportation Boulevard
Garfield Heights, Ohio 44125-5396

Re: January 2014 Quarterly Report
CUY-90-15.24 Slope Monitoring
PID 76117
EDP Project No. 062943.00

Dear Mr. Wise:

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,

SOIL AND MATERIALS ENGINEERS, INC.

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

Attachments

Distribution via e-mail:
Mr. Jason Wise, P.E., District 12 Geotechnical Engineer
Chris Merklin, P.E., Director of Geotechnical Engineering

JANUARY 2014 QUARTERLY REPORT

CUY-90-15.24 SLOPE MONITORING
PID 76117
CLEVELAND, OHIO
SME PROJECT NO. 062943.00

MARCH 25, 2014

Soil and Materials Engineers, Inc.
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INTRODUCTION

Instrument readings and interpretations for January 2014 are presented in this report. Readings for this report were obtained between January 9 and 23, 2014. The format of this report is changed from prior reports in that all figures showing the arrangement of instrumentation and photos of the aggregate stockpiles have been moved to Appendix A. Plots of any readings discussed in the report are included in Appendix B. Because of the scheduled demolition of the existing bridge, expansion joint and truss spacing measurements are no longer taken and those sections are omitted. We read the tiltmeters this quarter but expect that they will be lost in the near future as demolition of the bridge continues.

PIEZOMETERS

This quarter's readings show little change in the piezometer readings. In the discussion that follows, we group the locations into those where we saw virtually no change, those where the total head is continuing to change at an approximately constant rate, and those where pneumatic piezometers are installed. Three locations of special note are discussed separately.

P-001, P-008, B-05-03, B-05-04.
Average total heads in the piezometers at these locations have remained nearly constant for at least the past six months. In some cases we have seen daily changes of about one foot up or down in the total heads, but the underlying average trend has been virtually constant.

P-002, P-004, B-05-02, B-05-11.
These are locations where the total head in one or both piezometers has continued to increase at a nearly constant rate for at least the past 12 months.

P-003. In late July 2013, this location was covered with fill to create a pad for one of the erection cranes. We have no data for this location since July 16. We anticipate that as the CCG1 contract is winding down, this fill will be removed. We could be on site when that occurs to assist the contractor and perhaps save these instruments. Seven piezometers and an inclinometer are installed at this location.

B-05-07. Piezometers at this location were damaged by construction on or about October 9, 2013. We discovered this on October 16 when we arrived on site to take the annual readings. Both miniloggers were damaged beyond repair, and the piezometer cables were torn off. We dug to expose the ends of the cables and checked for response from the piezometers, but there was none. We installed three new RST piezometers on December 14, 2013 A multi-channel logger was installed immediately to monitor grout pressures as the grout set. When we returned to retrieve data in January, we found the logger partially filled with water and ice. We removed, cleaned, and dried the logger but it did not respond and we were unable to retrieve any data. We checked and verified that the protective cover was properly drained and installed a new multi-channel logger on January 21, 2014. We also took a manual reading at that time. Prior to installing the new multi-channel logger we replaced the foam seal on the damaged logger's

enclosure with caulk and tested the seal by submerging it in a water bath for several days. We also replaced the seal on the replacement logger to make it more water tight. The plot included in the appendix shows data prior to the piezometers being lost, along with the data points from our January 21, 2014, manual readings with the replacement logger.

B-05-13. This location on the east side of the river has been inaccessible since July 2012 when fill was placed over the instruments to create a pad for one of the erection cranes. Two piezometers and an inclinometer are installed at this location. As with P-003, if we are on site when the fill is removed, we may be able to assist the contractor and save these instruments.

Pneumatic piezometers B-101, B-105, and B-303.
Five pneumatic piezometers are installed at the three locations listed in the heading. Two are installed at B-101 and B-105, and one is installed at B-303. Three of the five piezometers indicate no change in total head this past quarter. Of the two remaining piezometers, the shallow piezometer at B-101 indicates about a six inch drop in total head, and the deep piezometer at B-105 indicates a six inch increase in total head. These changes are within the range of changes that have been recorded during the last year. The pneumatic piezometers have generally been indicating a gradual decrease in total head since about July 2009.

INCLINOMETERS

This quarter we took inclinometer readings with both our DGSI and new RST inclinometer probes. Next quarter's report will transition to the RST readings and plots. Where zone plots have been kept, we will continue to maintain those plots.

Inclinometer surveys for I-001, I-002, I-003, B-05-03, B-05-04, B-05-11, B-101, B-102, B-105A, and B-203 show no change or negligible change in displacement this quarter. In a few instances, where movement has been occurring, the trend continued for the quarter, but movements were not significant. The remaining inclinometer surveys are discussed below.

I-004. The inclinometer survey for this location indicates significant negative A and B-axis displacement at the top of the slope tube. We saw no indication of such movement in the field and cannot explain this apparent displacement. We note, however, that these readings were taken on an extremely cold day such that the equipment was freezing almost immediately as it was being pulled to the top of the slope tube. The apparent displacement may have been due to the wheels on the inclinometer freezing, or the technician inadvertently pulling laterally on the slope tube.

I-008. This quarter we again see an increase in A-axis displacement in the depth interval from 48 to 52 feet at I-008. This was the largest quarterly increase since January 2013. We also see a slight increase is B-axis displacement in this depth range. A second zone of movement is occurring at this location from 88 to 90 feet. We have seen approximately equal, but slight increases in the displacement in each of the last three quarters.

I-010. The inclinometer tube at I-010 was included in monthly readings through December 2013. The plot for this location in this quarter's report is presented in the new format for the RST equipment. We took the new baseline readings on December 24, 2013, with the December monthly readings. The plot shows slight negative B-axis displacement above approximately the 50 foot depth. This is probably due to the lower accuracy of the B-axis readings. Apparent displacement at the top of the tube may be due to weather conditions.

B-05-02. The inclinometer tube at B-05-02 was also included in the monthly readings through December 2013. This quarter's plot is presented in the new RST format referenced to the December 24, 2013 baseline readings. We will continue posting readings to the zone plots which have been maintained for this location since 2006. The plot of the January inclinometer readings indicates negative A-axis displacement in Zone 2 at approximately 97 to 105 feet. From the zone plot, this appears to be a "correction" since the displacement has now returned to the July 2012 value. Plots for Zones 1 and 3 show only slight, virtually negligible, displacements.

B-05-07. The protective cover and upper part of the inclinometer tube were damaged by the construction on or about October 9, 2013. On October 16, 2013, we found a short section of slope tube and the protective cover broken off, and the slope tube blocked. On December 4, 2013, with assistance from Independence Excavating, we excavated and exposed the top of the tube. We placed a large section of pipe around the tube to protect it, and installed an extension. Assuming, as is usually the case, that the blockage was in the upper part of the tube, our drill crew attempted to flush the tube with a water stream. This occurred on December 13, 2013, and was successful in clearing the tube to a depth of about 30 feet where the blockage seemed to be solid. ODOT used a camera to examine the blockage, and on a second attempt on January 17, 2014, we were able to clear the tube to a greater depth using a high pressure water jet. A third attempt on January 20, 2014, also using a high pressure water jet, was successful in clearing the tube nearly to the bottom. We used the inclinometer probe to verify that the grooves inside the tube had not damaged. The instrument tracked properly along the full depth of the tube.

Because of the frozen conditions, the excavation has not been backfilled. We will coordinate with Independence Excavating to complete the backfilling in late March after the ground has thawed. We will then cut the extension to proper length, install a new protective cover, and take new baseline readings.

B-05-13. This location on the east side of the river has been covered and inaccessible since July 2012.

TILTMETERS

Figure 1 in Appendix A shows the location and direction of positive rotation for each of the tiltmeters.

Changes in Tiltmeters 3, 4, 5, and 6 were negligible this quarter. Readings at these four locations have remained virtually constant since July 2011.

We saw a relatively large negative change at Tilt 1 in July 2013. The October reading changed little from July. With this quarter's reading, we again saw a negative change, although that change is significantly less than what occurred in July. From July 2011 through April 2013, we had seen some variation but little net change in readings at this location. In earlier years, the readings had been positive by an amount nearly identical to the recent negative readings.

Readings at Tilt 2 and 7 indicate virtually no change from last quarter. Tilt 8 continues to trend along the neutral axis with a slight decrease toward the axis this quarter.

STABILIZATION STRUCTURE

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

Load Cells

All load cells remained constant except for seasonal variations. Average loads are within a few kips of last quarter's averages. Gauges 2 and 3 on Load Cell 8 continue to record erroneous data intermittently. About 17% of the data for these gauges appeared to be valid this quarter; but including these data results in an average load about 50 kips lower than the load that appears to be normal for this load cell. The average load for this load cell excluding the data for these gauges is reported in Table 2 below. If these intermittent "valid" readings continue to be recorded, these gauges should be considered failed and dropped from the calculations. Gauge 4 on Load Cell 1 was recording intermittently last quarter but gave only one erroneous data point this quarter. Table 1 shows which gauges were active in each of the load cells this quarter. A plot of the load cell data is included in Appendix B.

Table 1. Active gauges (indicated by check mark) in load cells on the four instrumented anchors.

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

Anchors

With the exception of an occasional errant data point, loads recorded for all active strandmeters on the instrumented anchors remained nearly constant this quarter. Plots of strandmeter loads indicate slight seasonal variation on some strandmeters. These variations correspond to the variations in the loads on the load cells. Average loads this quarter for the load cells and active strandmeters are listed in Table 2. We also report the percent change in load from last quarter. Strandmeter gauges that have failed are indicated by an "×" in the table. Since there is nothing of note shown in the plots, they are omitted from this report.

Table 2. Average strandmeter loads and % change from last quarter, tension loads are positive.

Anchor	Load Cell (kips)	Strandmeter (kips)				
		1	2	3	4	5
1	466	-10.1	×	+/- 0	×	1953
% change		0	×	0	×	+0.8
8	373	25.4	65.2	-176	×	×
% change		-4.8	0	+0.1	×	×
9	473	-18.4	8.2	2.3	194.3	770.7
% change		-3.2	0	-21.7	0	-0.1
17	364	-37.8	×	-25.4	×	231.6
% change		+6.2	×	+1.6	×	0

Driven piles
Axial loads and bending moments in the driven piles remained consistent with past readings this quarter. The only changes are attributed to the usual seasonal variations.

Tiebeams General
Data for the tiebeams was erratic and indecipherable from August 2012 through July 2013 apparently due to construction disturbance. Since July 2013, the quality of the data has improved although erroneous data points are more frequent than they had been prior to August 2012. In some cases as much as 30% of the data on the anchor side and 48% of the data on the drilled pier side is invalid. With these obviously invalid data points deleted, the underlying trends become clear. Because of the amount of erratic data, none of the tiebeam plots have been included in the appendix.

Tiebeams Anchor Side
Axial loads in the tiebeams on the anchor side vary during the season with loads generally reaching a seasonal high in March and then dropping to the seasonal low in October. Changes recorded this quarter are consistent with the changes that have occurred in the past, although loads have generally been trending upward since 2010-11. With the exception of Tiebeam 1, the axial loads this quarter are about 5% greater than they were at the same time in 2011.

Data for Tiebeam 1 reflects the seasonal change, but in this case, the axial load increased about 15 kips since last July. Loads in the remaining tiebeams were about the same at the end of this quarter as they were in July.

With the exception of Tiebeam 1, the bending moments at the anchor end of the tiebeams varied only slightly with the season with the variations consistent with past years. The data indicates about a 5% decrease (1.3 kip-ft) in the strong axis bending moment, and 24% increase (0.7 kip-ft) in weak axis bending moment in Tiebeam 1.

Tiebeams Drilled Pier Side

On the drilled pier side, seasonal high readings are recorded in January and February and the seasonal low readings are recorded in July and August. This is slightly out of phase with anchor side. Readings at the end of the quarter should be about equal to the season high readings. For Tiebeams 12, 13, and 26, the current readings are consistent with the readings in 2012. For Tiebeams 1 and 14, the current readings are about 15 kips (33%) and 6 kips (4%) higher, respectively, than in 2012. It is difficult to compare anything to the readings at this time in 2013 because there was virtually no valid data recorded during this time that year. The average readings indicate a gradual increase in load. However, the average is heavily influenced by Tiebeams 1 and 14 which may be inaccurate.

We still have a significant amount of invalid data being recorded for the bending moments at the drilled pier end of the tiebeams. The general trend seems to indicate a gradual increase in both strong axis and weak axis bending. The magnitude of the moments is relatively small so a change of even one or two kip-feet appears significant.

Drilled Piers

Comparing axial loads and bending moments for the one-year average to the average for this quarter shows a relatively large change in Pier 1. Axial load changed along virtually the entire shaft length. Bending moments changed only in the top 40 feet. Although such changes are normal, changes this quarter were greater than we have generally seen for a single quarter in the past. Plots of axial load and bending moment vs. time are included for gauges at 16 and 58 feet. These are representative plots showing the seasonal variation in axial load and bending moment that occurs along the shaft. The plots show that the trend toward increasing axial load and bending moment is continuing. We question the magnitude of these loads, which seem extremely high, but the trends and variations in the loads seem to make sense. We note that the seasonal increase in axial load at 58 feet is significantly greater than in past years. Plots for Pier 1 are included in Appendix B.

Changes in Pier 9 were negligible this quarter and those plots are not included.

Drilled Pier Inclinometers P-1, 3, 8, 9N, 10 and 17

We have been commenting on the apparent lateral displacements near the bottom of Pier 1 for some time. The greatest change was in the B-axis direction this quarter. We see virtually no change in the A-axis displacements. The plot for Pier 1 is included in Appendix B.

Changes in the inclinometer surveys for the remaining piers were negligible this this quarter.

AGGREGATE STOCKPILES

We observed and photographed the aggregate stockpiles on January 21, 2014, from vantage points consistent with prior reports as depicted in Figures 4 and 5 in Appendix A. At that time, we estimated that the two larger piles near the east fence were approximately 7 to 8 feet high covering about 35 to 40% of the property. The toe of the closest pile was about 5 feet from the

east fence line. The stockpiles that were in place last quarter remained virtually unchanged this quarter.

This completes the January 2014 quarterly report for the CUY-90-15.24 Slope Monitoring Project, ODOT PID 76117.

Report prepared by:

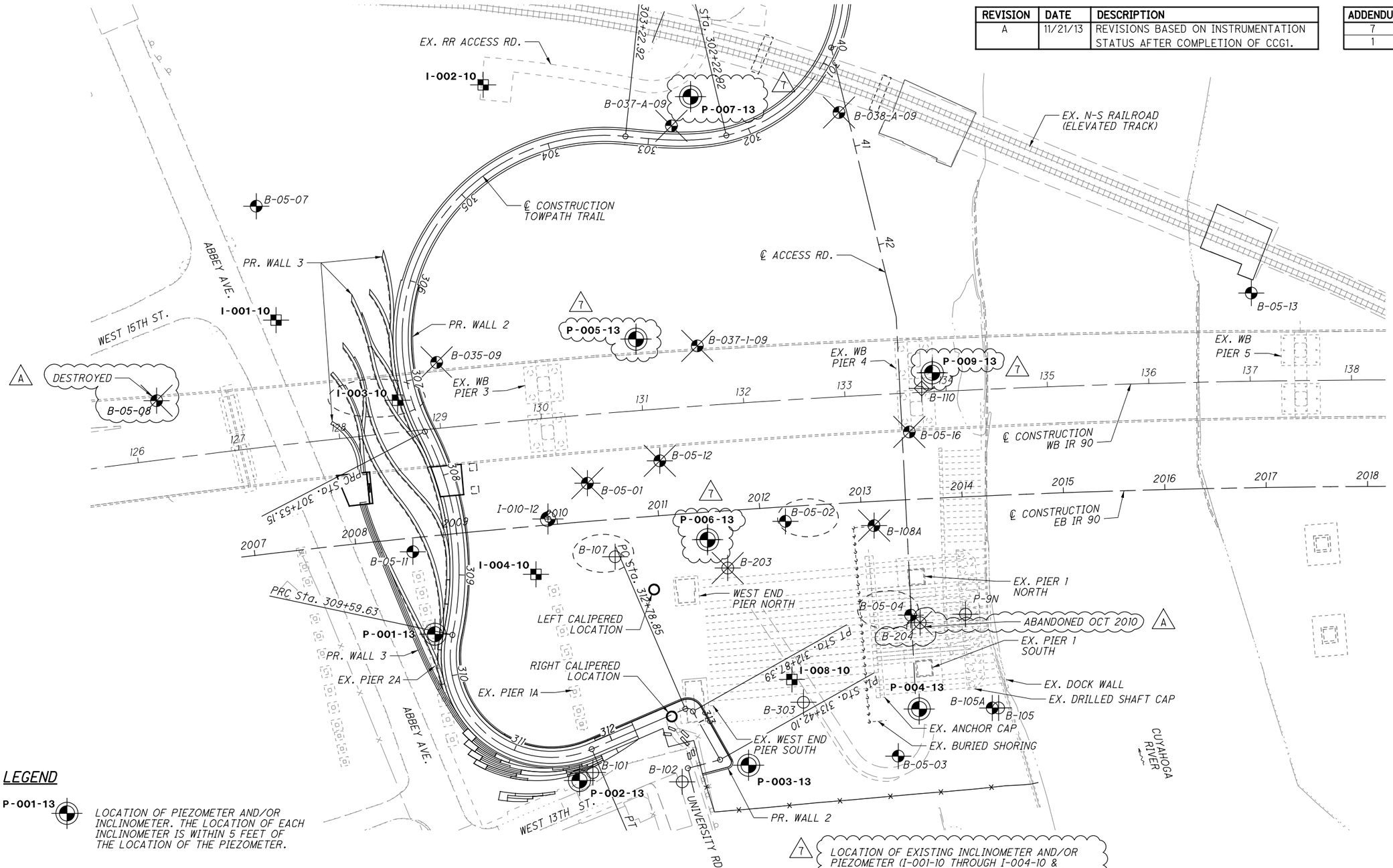
Alan J. Esser, P.E., D.GE
Principal Consultant

Report reviewed by:

Seth Molenaar
Material Specialist

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



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

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).

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.

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 - Revision A.dgn 11/21/2013 8:08:35 AM csteck

8

APPENDIX A
ARRANGEMENT OF INSTRUMENTATION

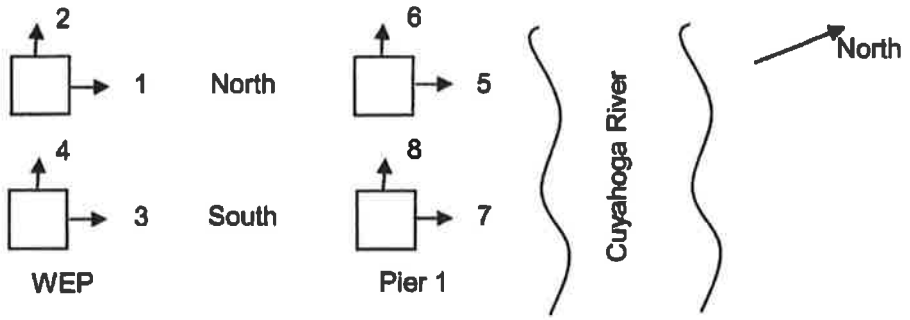


Figure 1. Tiltmeter locations with arrows showing the direction of positive tilt.

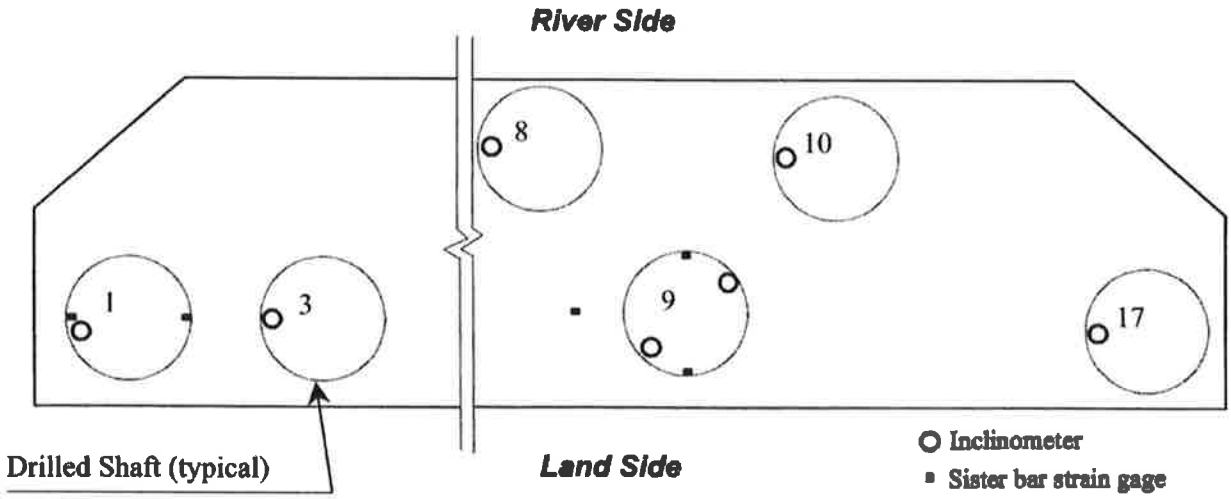


Figure 2. Pier cap with the location of inclinometers and strain gauges.

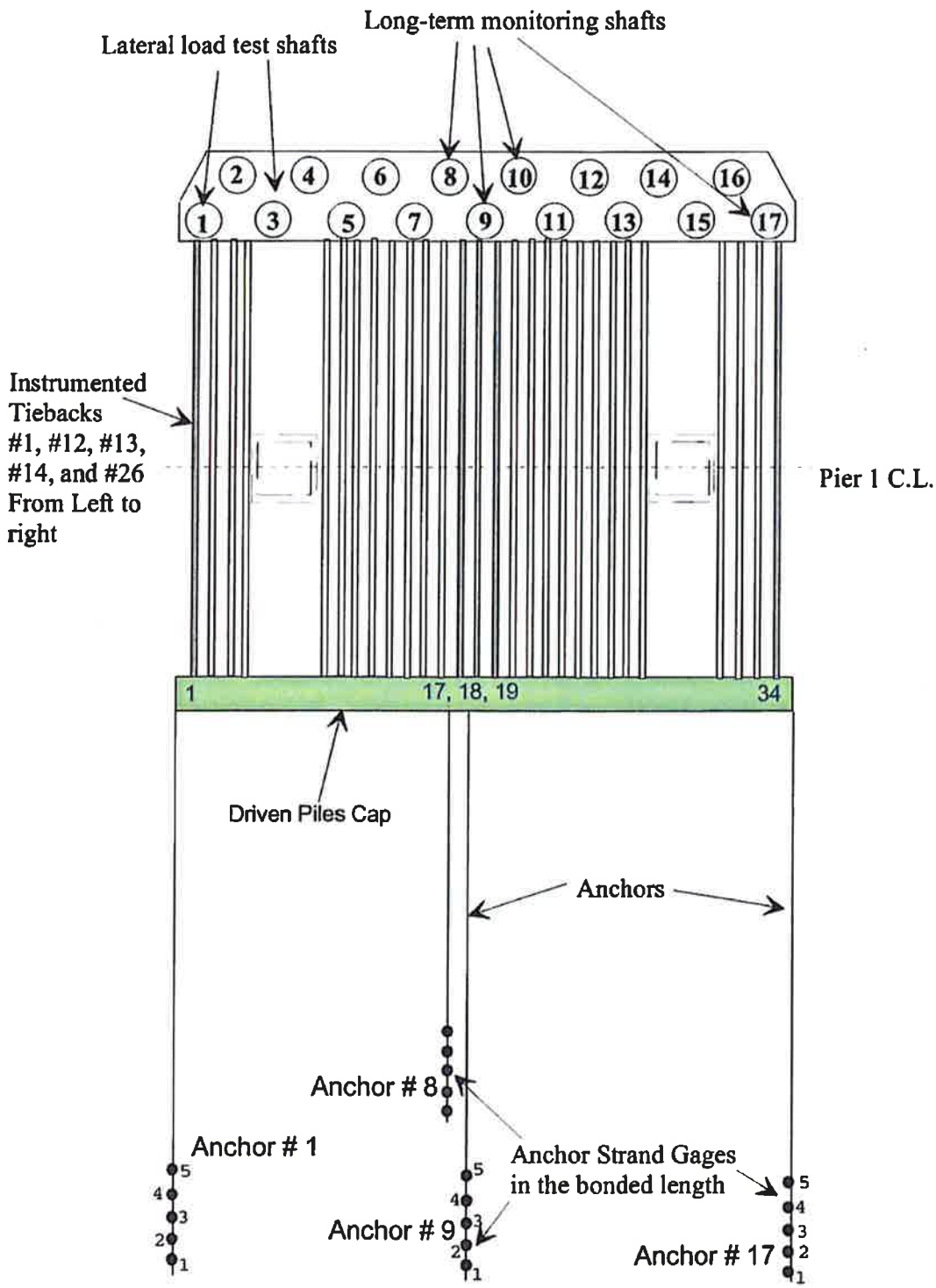


Figure 3. Plan of the stabilization system showing the locations of the instrumented foundation elements.

Figure 4. Aggregate stockpile east of the ODOT right-of-way (January 21, 2014).

Figure 5. Aggregate stockpile near ODOT's east right-of-way fence (January 21, 2014).

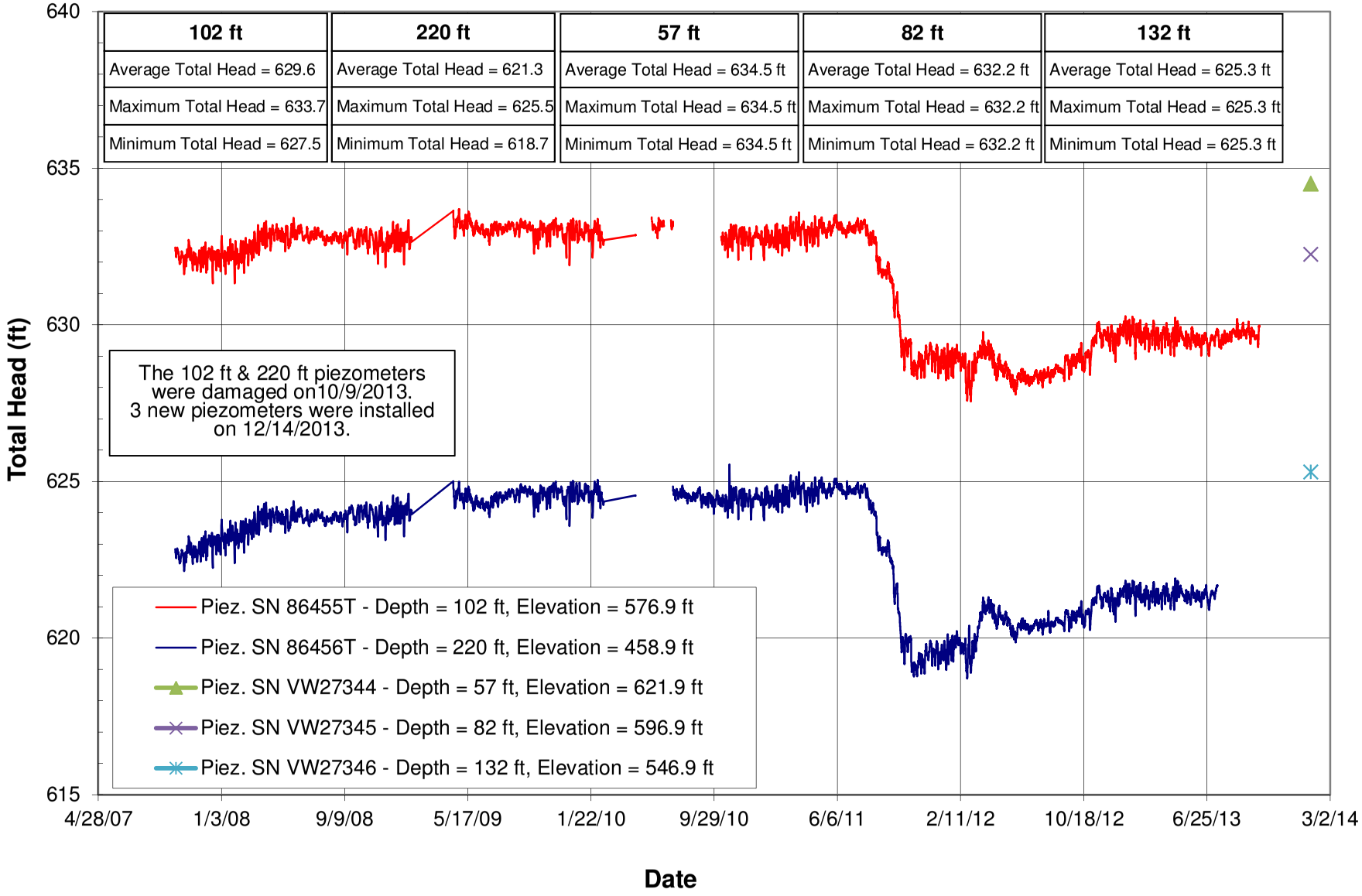
APPENDIX B

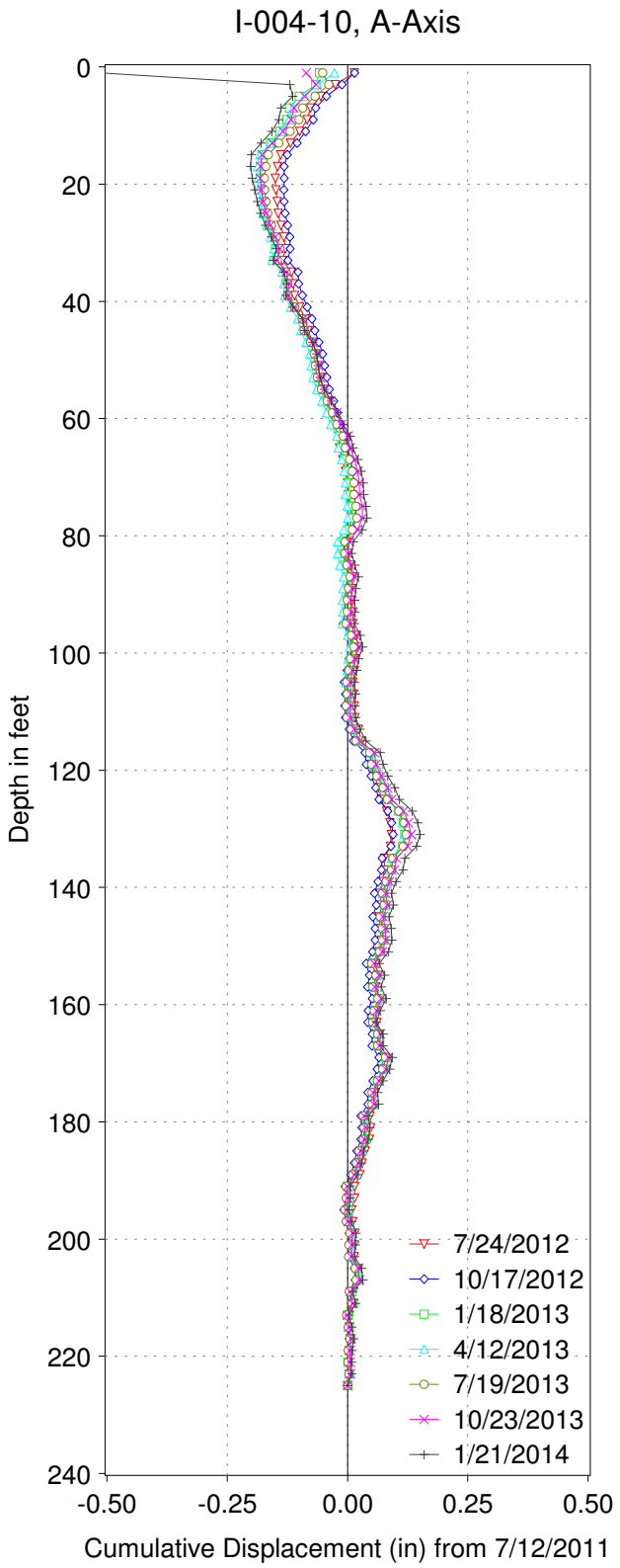
PLOTS OF INSTRUMENT READINGS
DISCUSSED IN THE REPORT

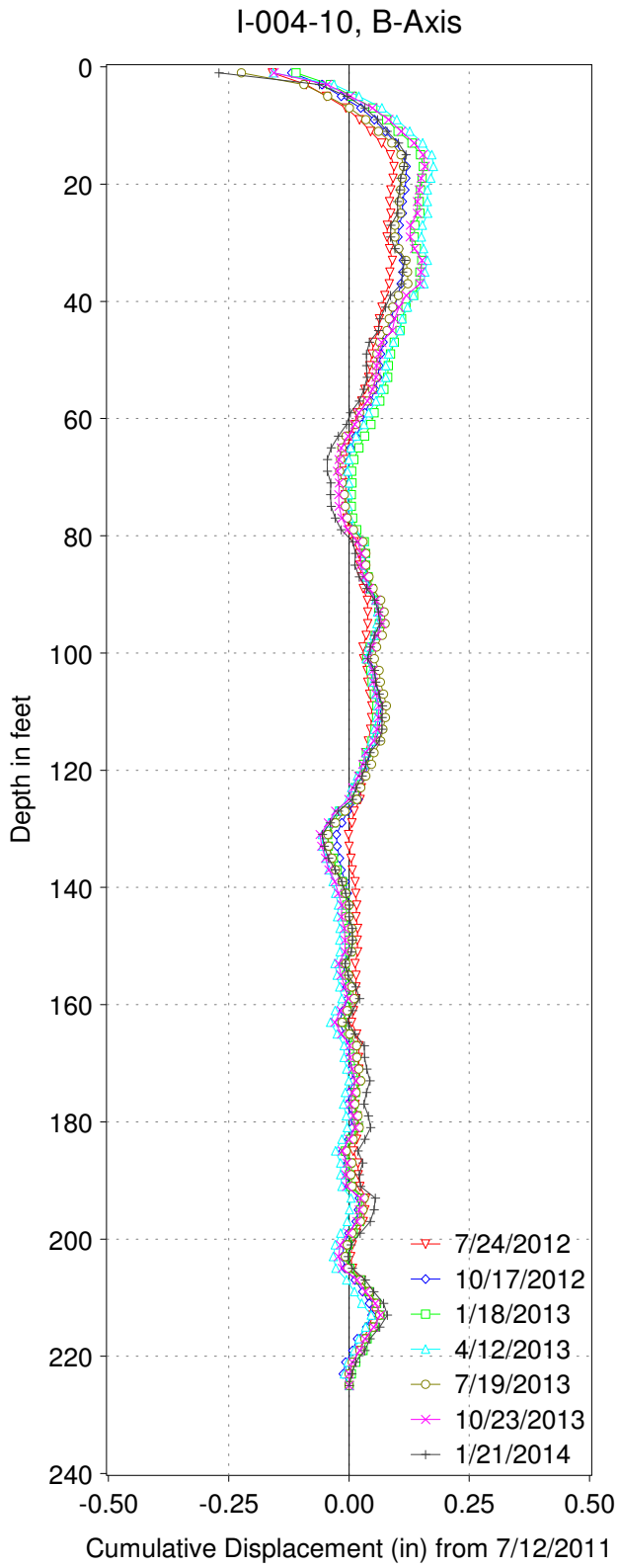
B-05-07 VW Piezometer Readings

Ground surface elevation = 678.9 ft

102 ft	220 ft	57 ft	82 ft	132 ft
Average Total Head = 629.6	Average Total Head = 621.3	Average Total Head = 634.5 ft	Average Total Head = 632.2 ft	Average Total Head = 625.3 ft
Maximum Total Head = 633.7	Maximum Total Head = 625.5	Maximum Total Head = 634.5 ft	Maximum Total Head = 632.2 ft	Maximum Total Head = 625.3 ft
Minimum Total Head = 627.5	Minimum Total Head = 618.7	Minimum Total Head = 634.5 ft	Minimum Total Head = 632.2 ft	Minimum Total Head = 625.3 ft

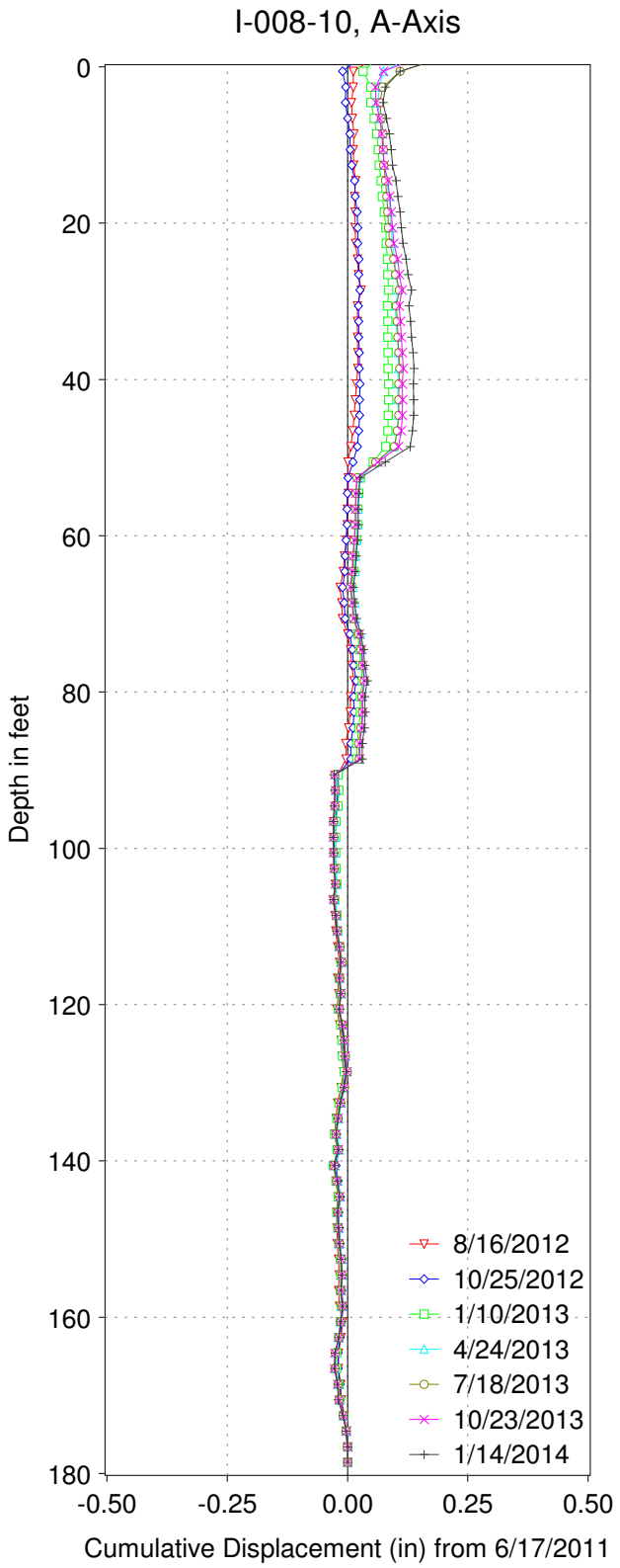


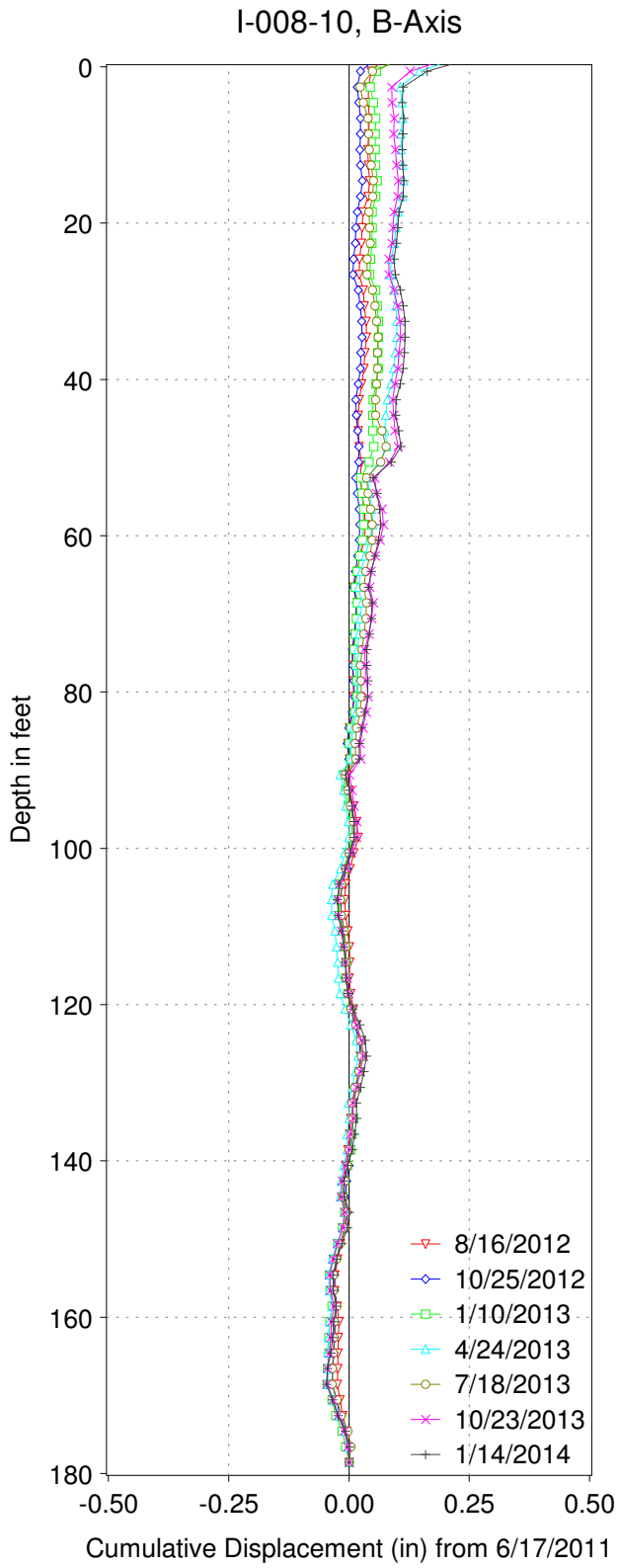




CUY-90-15.24
PID 76117
SME Project# 062943.00
Reading Date: 1/21/2014

Soil and Materials Engineers, Inc.





CUY-90-14.92
PID 76117
SME Project#: 062943.00
Readin Date: 1/14/2014

Soil and Materials Engineers, Inc.

RST Instruments Ltd.

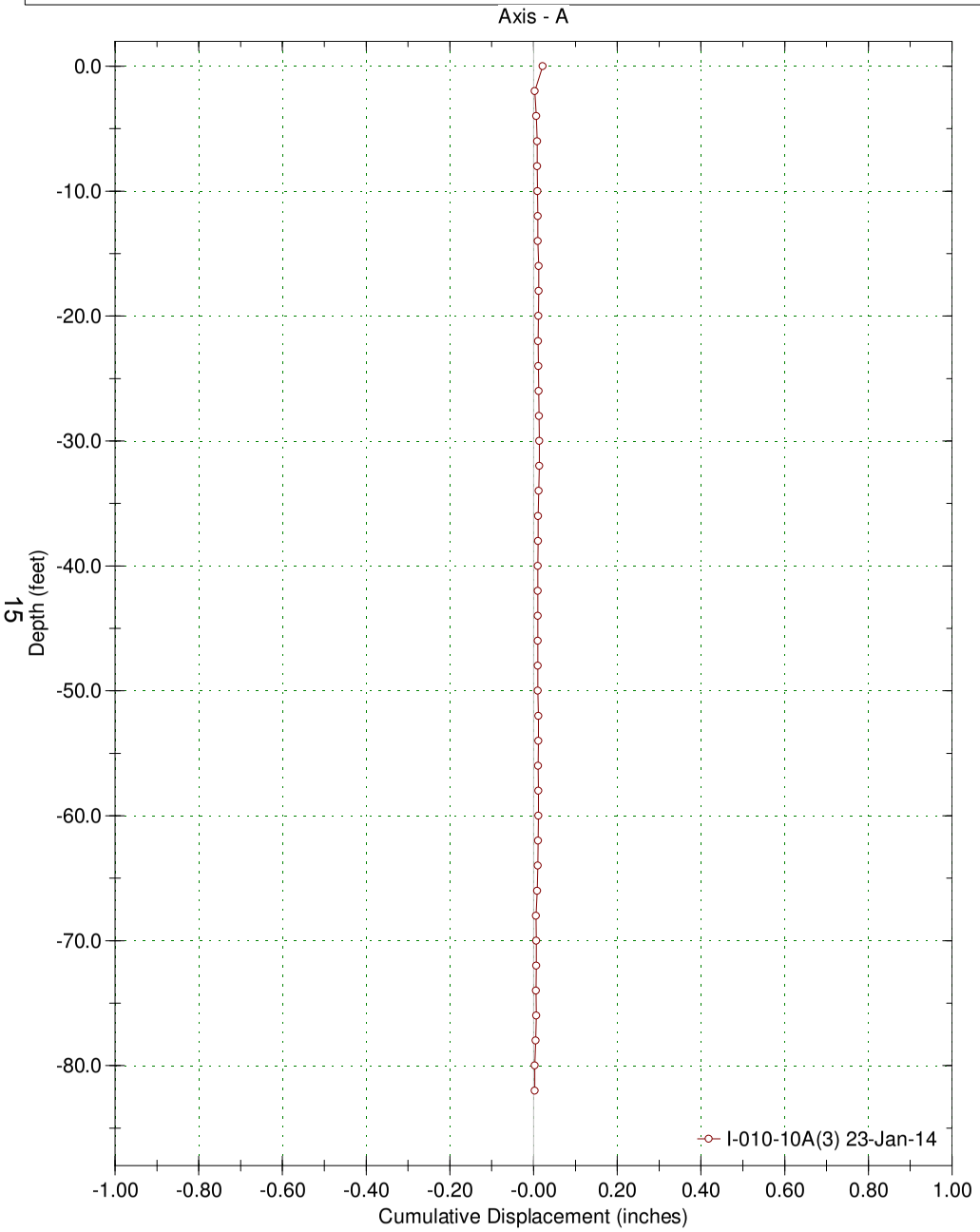
CUMULATIVE DISPLACEMENT

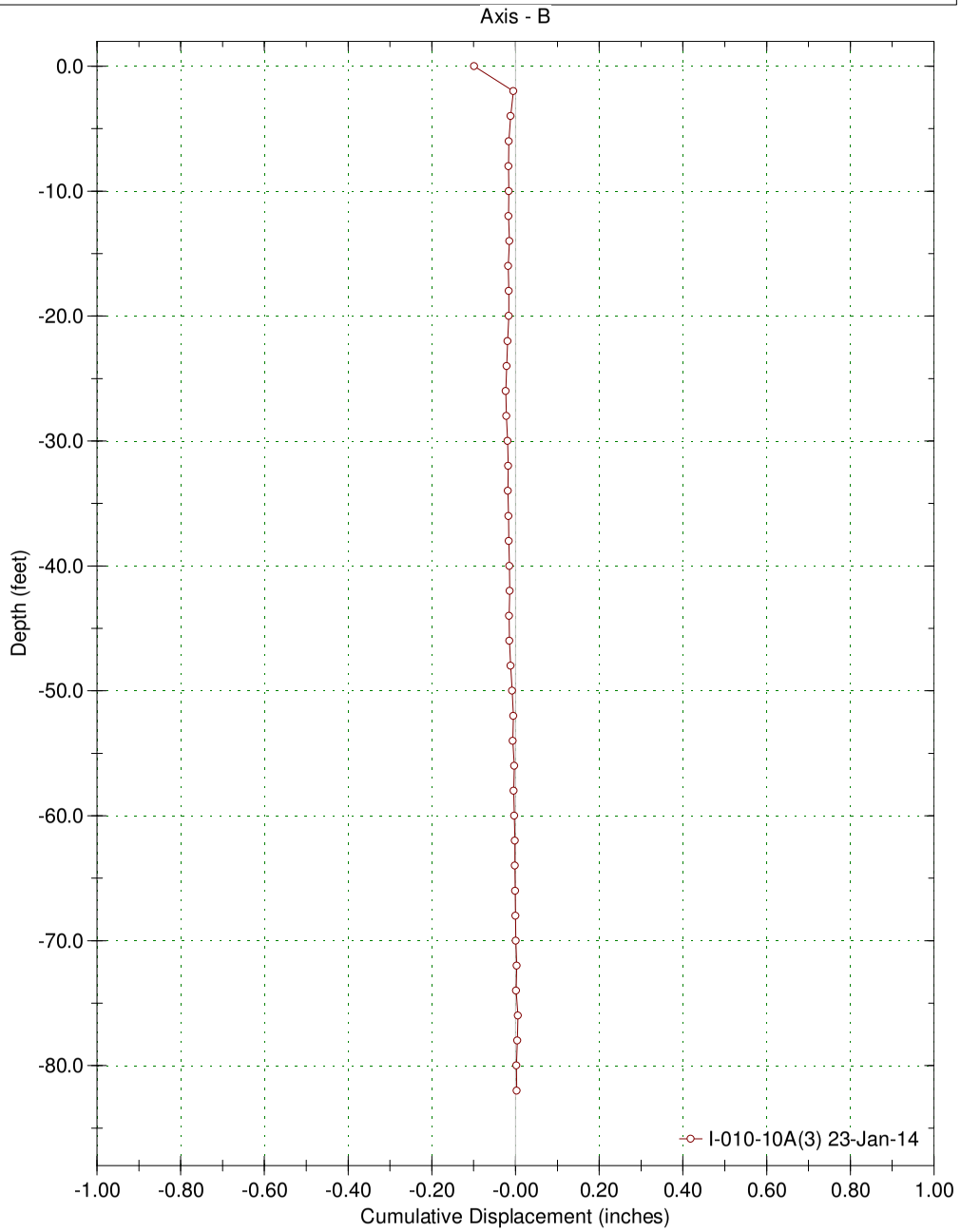
Inclinalysis v. 2.47.0

Borehole : I-010-10A
Project : CUY-90-15-24
Location : Cleveland, Ohio
Northing : 663521.502
Easting : 2190199.424
Collar :

Soil and Materials Engineers, Inc.

Spiral Correction : N/A
Collar Elevation : 2.0 feet
Borehole Total Depth : 84.0 feet
A+ Groove Azimuth :
Base Reading : 2013 Dec 24 08:05
Applied Azimuth : 0.0 degrees





RST Instruments Ltd.

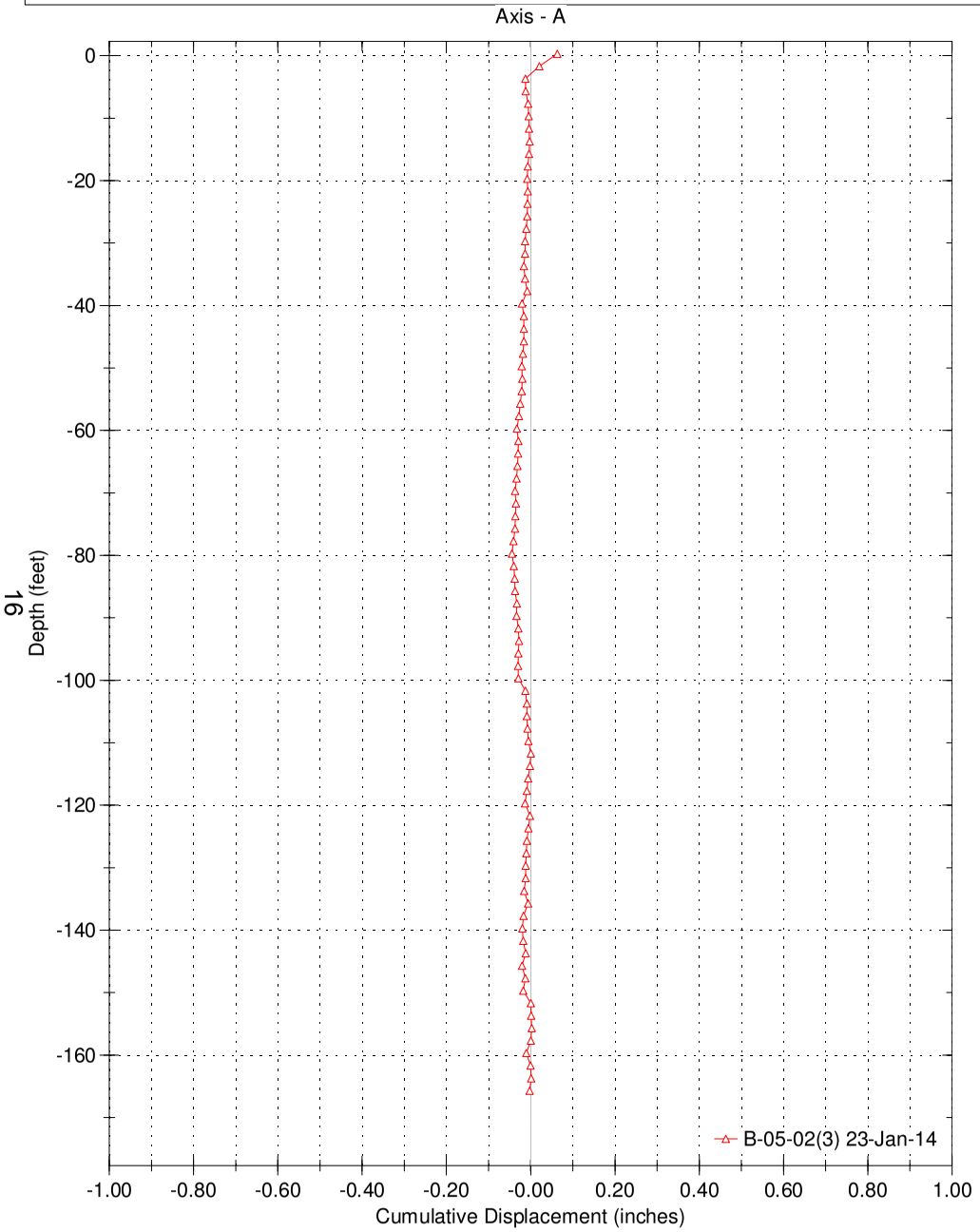
CUMULATIVE DISPLACEMENT

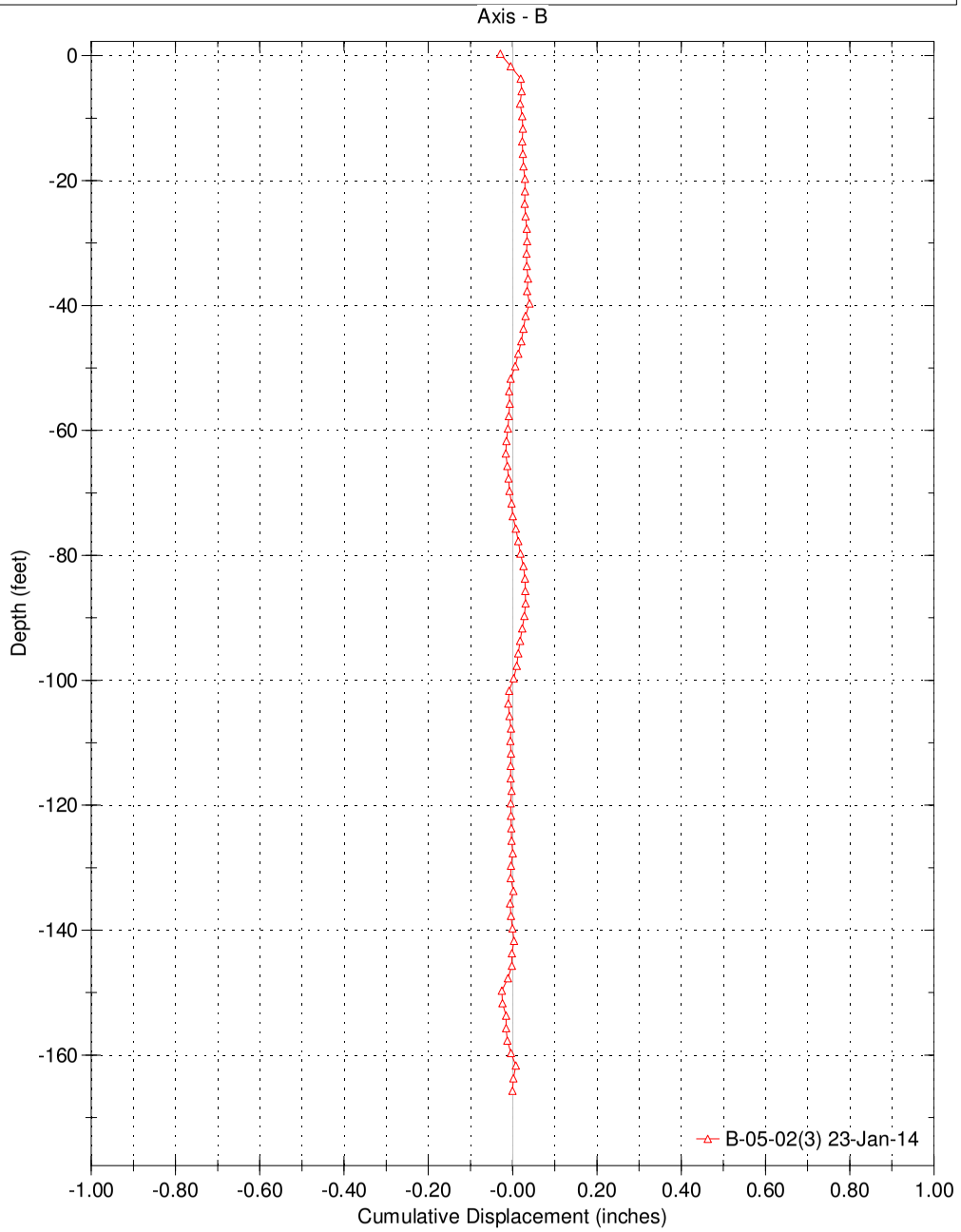
Inclinalysis v. 2.47.0

Borehole : B-05-02A
Project : CUY-90-15-24
Location : Cleveland, Ohio
Northing : 663737.939
Easting : 2190289.081
Collar :

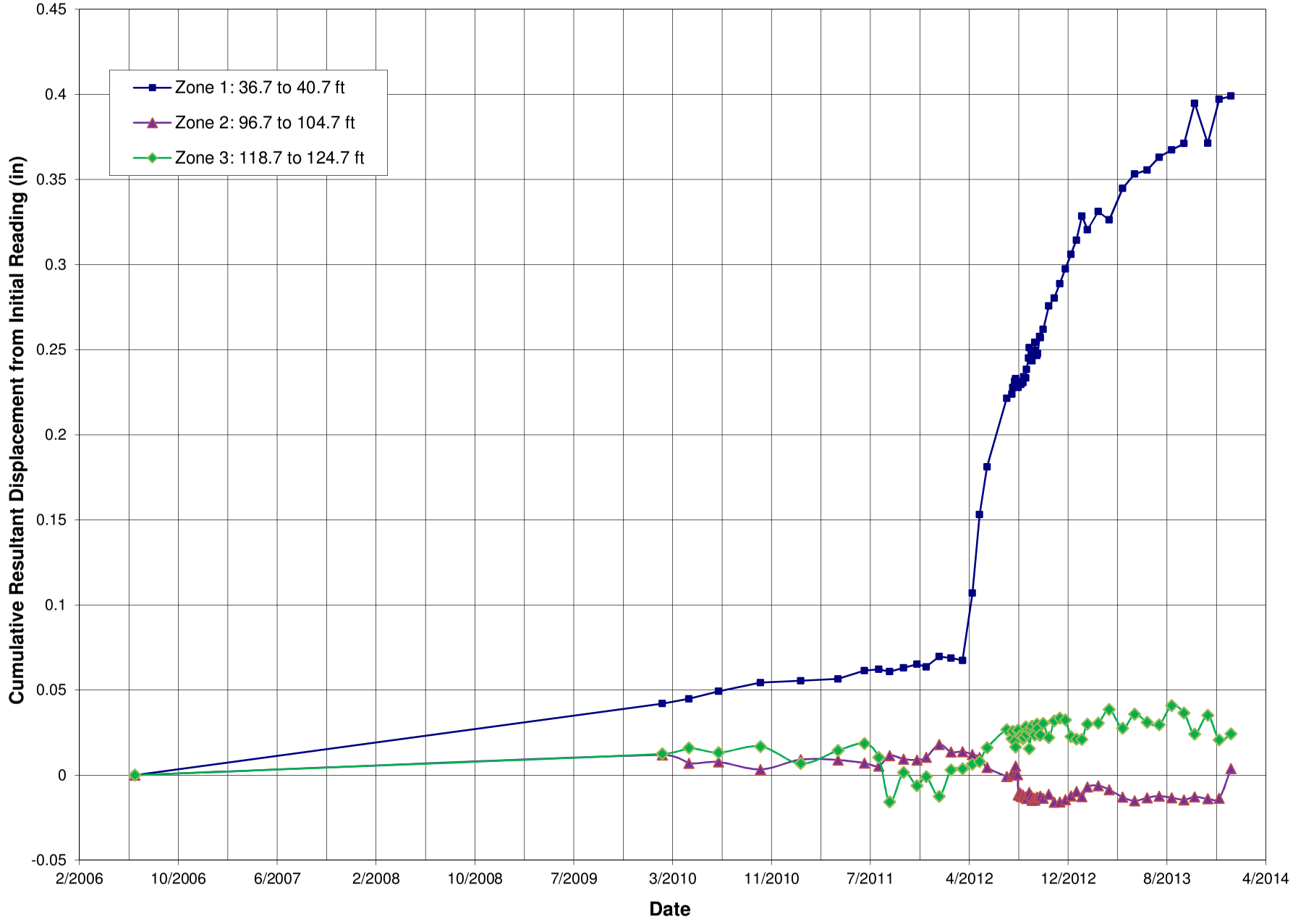
Soil and Materials Engineers, Inc.

Spiral Correction : N/A
Collar Elevation : 2.3 feet
Borehole Total Depth : 168.0 feet
A+ Groove Azimuth :
Base Reading : 2013 Dec 24 11:12
Applied Azimuth : 0.0 degrees

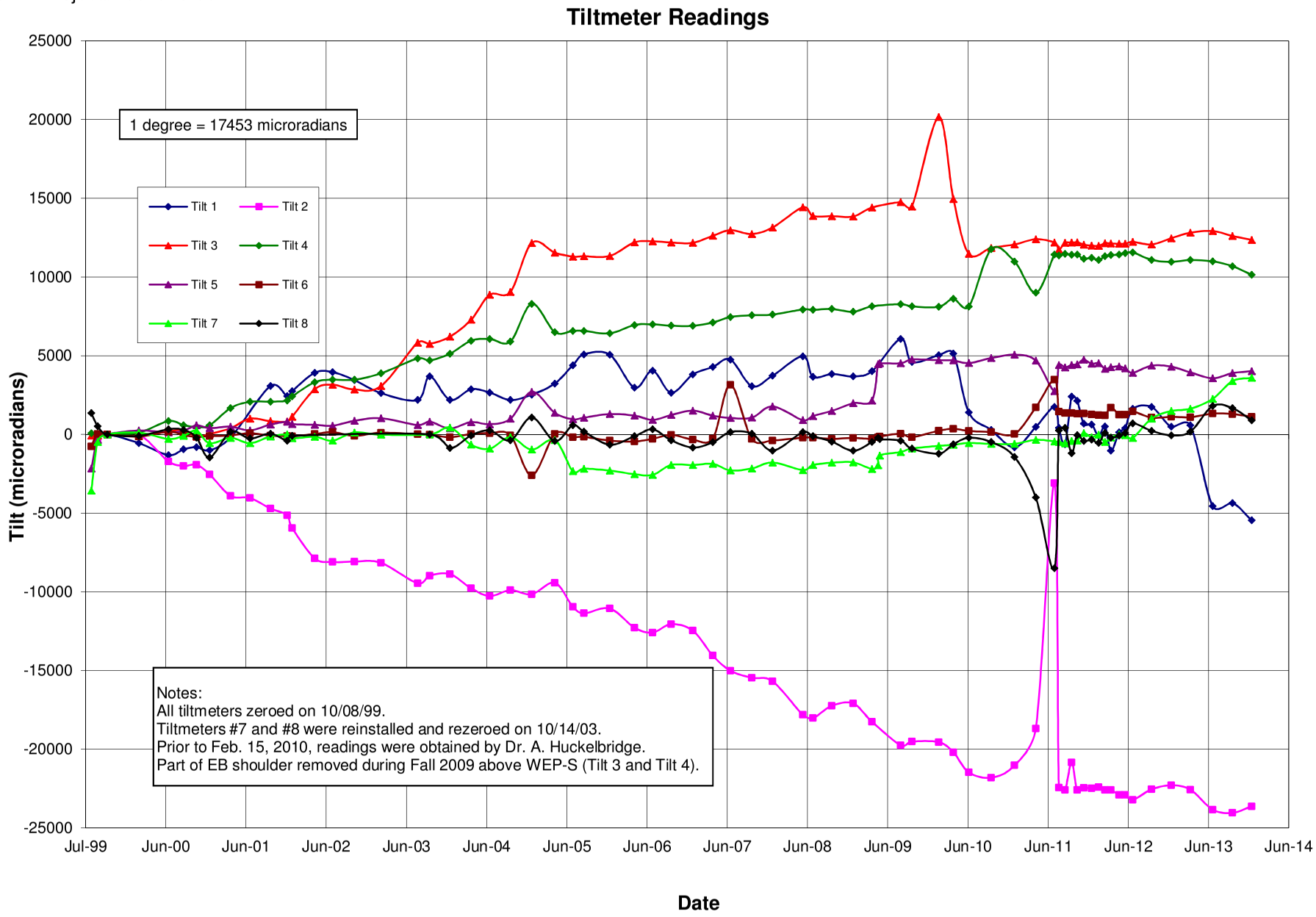




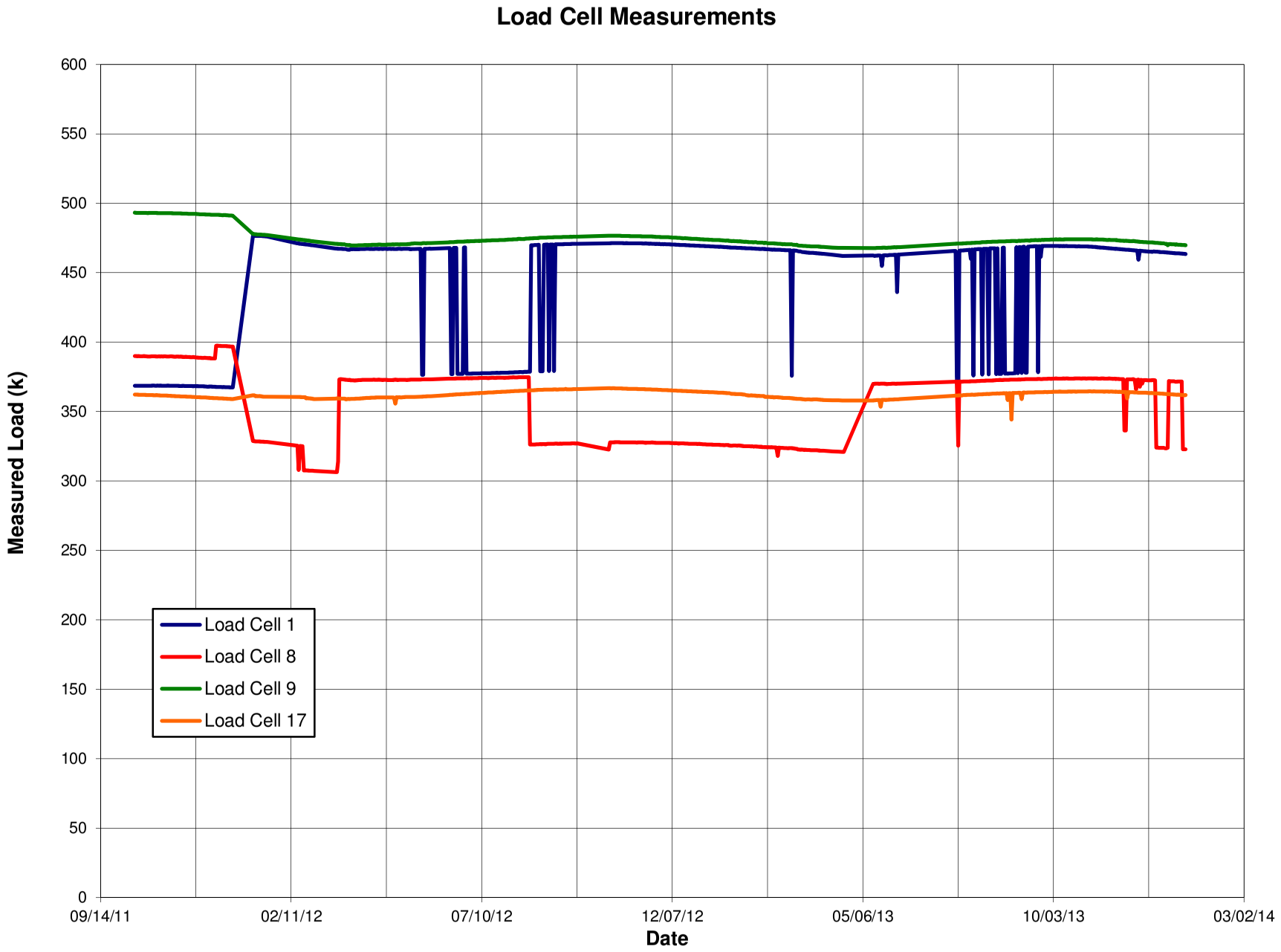
CUY-90-15.24
PID 76117
SME Project#: 062943.00



CUY-90-15.24 Slope Monitoring
PID 76117
Cleveland, Ohio
SME Project#: 062943.00



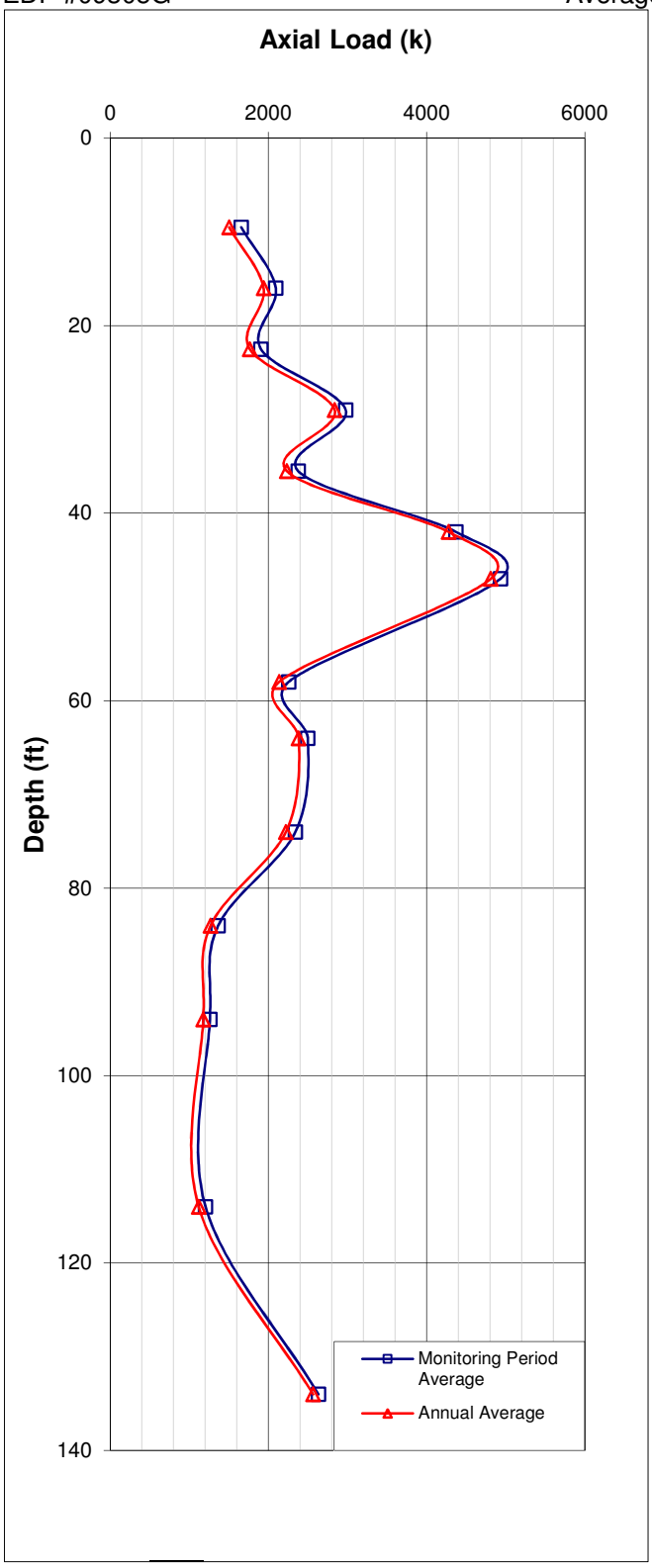
CUY-90-15.24 Slope Monitoring
PID #76177
EDP #09305G

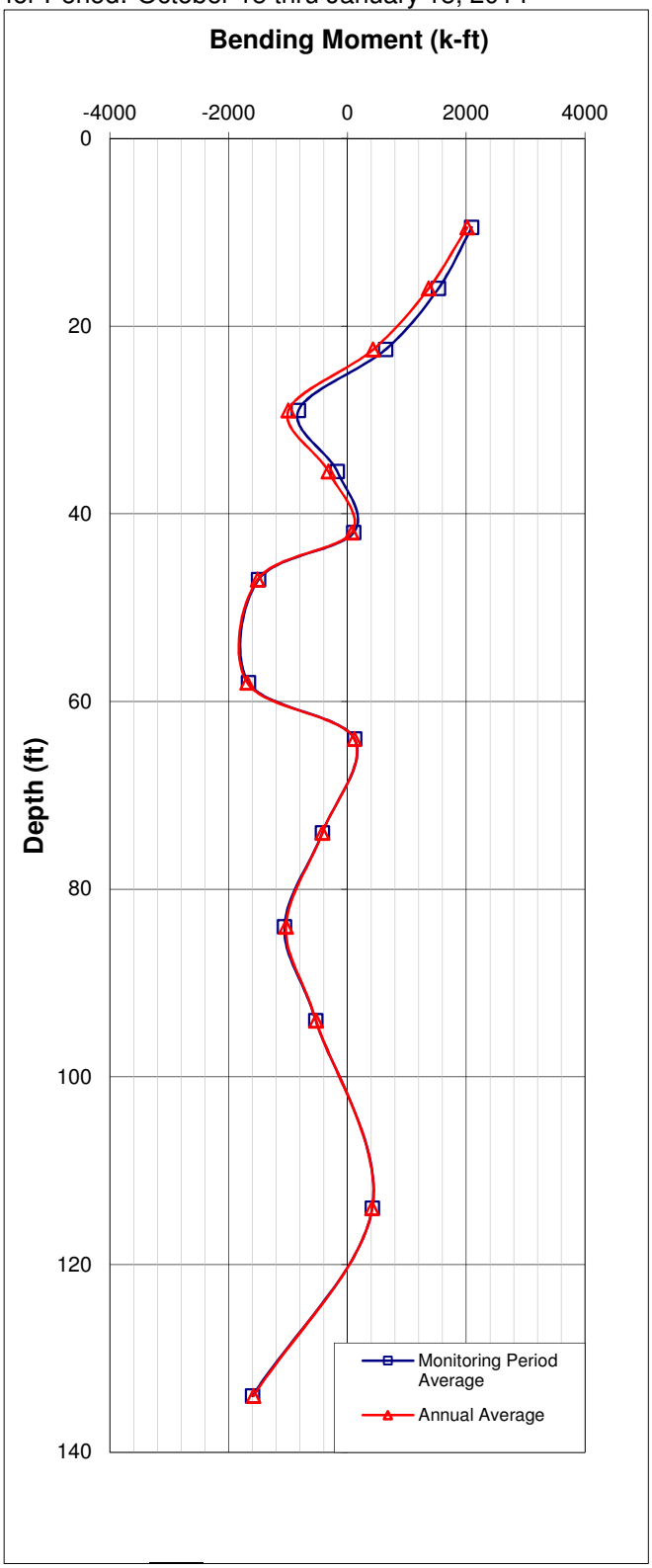


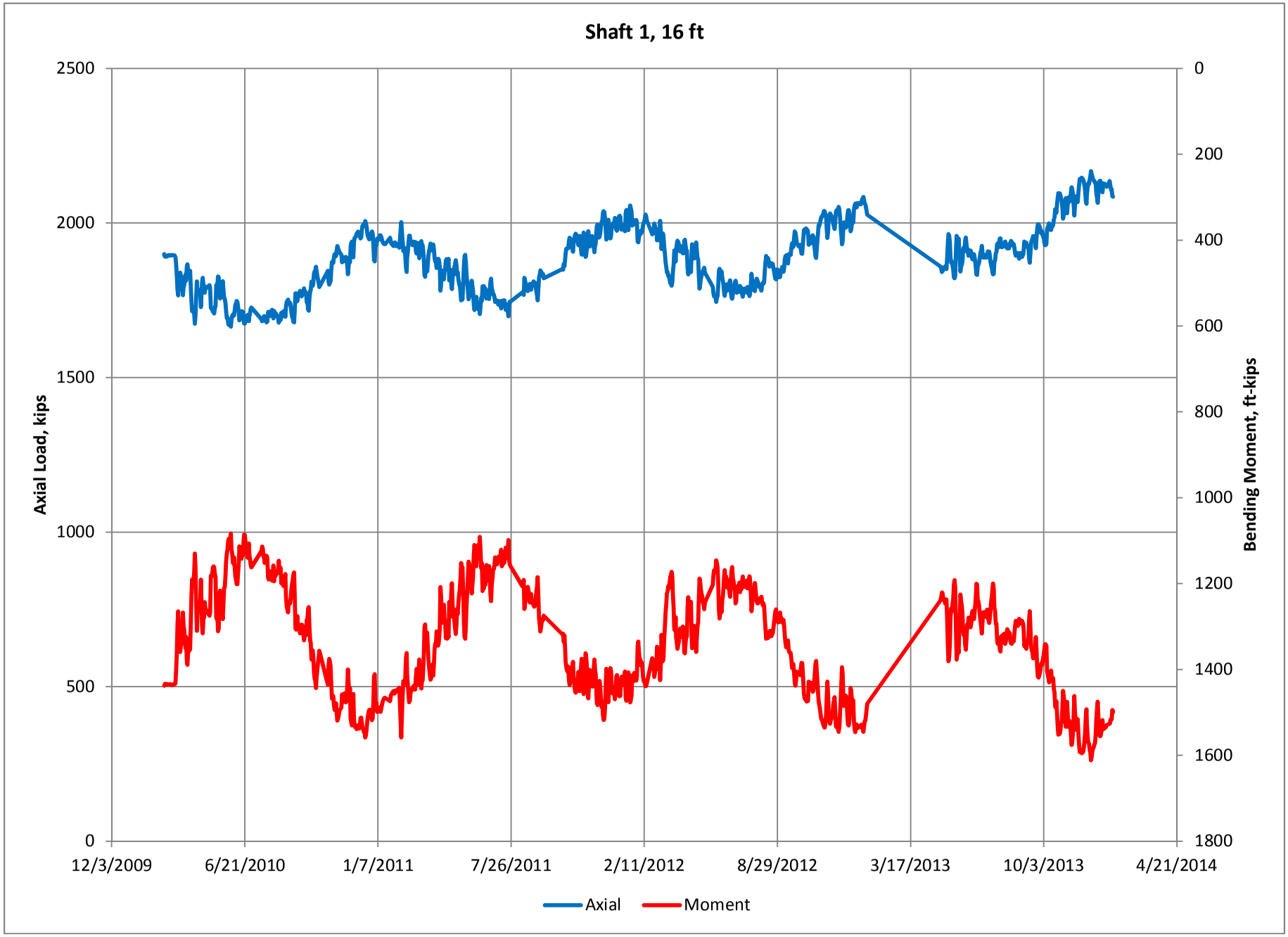
CUY-90-15.24 Slope Monitoring

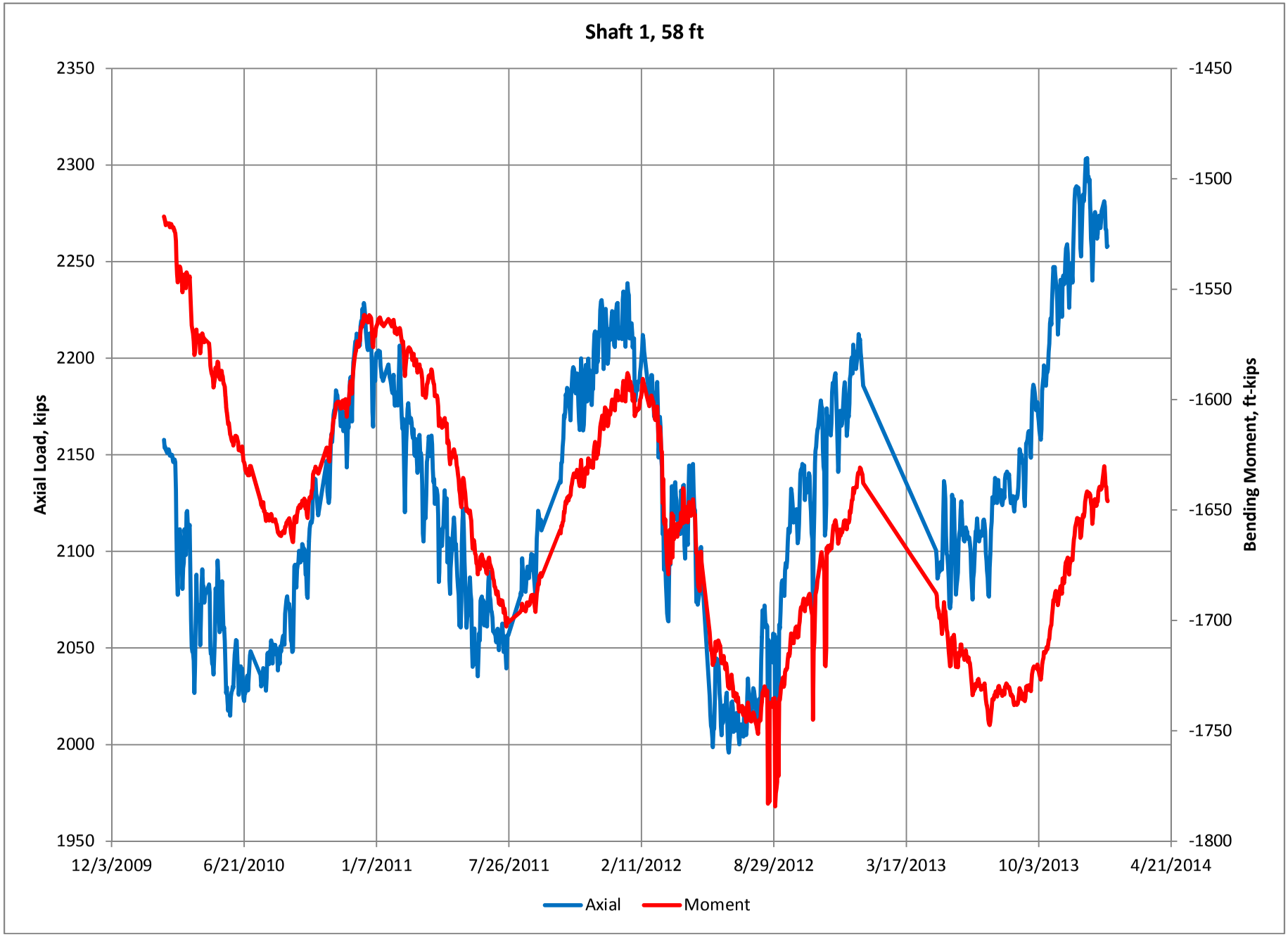
PID 76117
Cleveland, Ohio
EDP #09305G

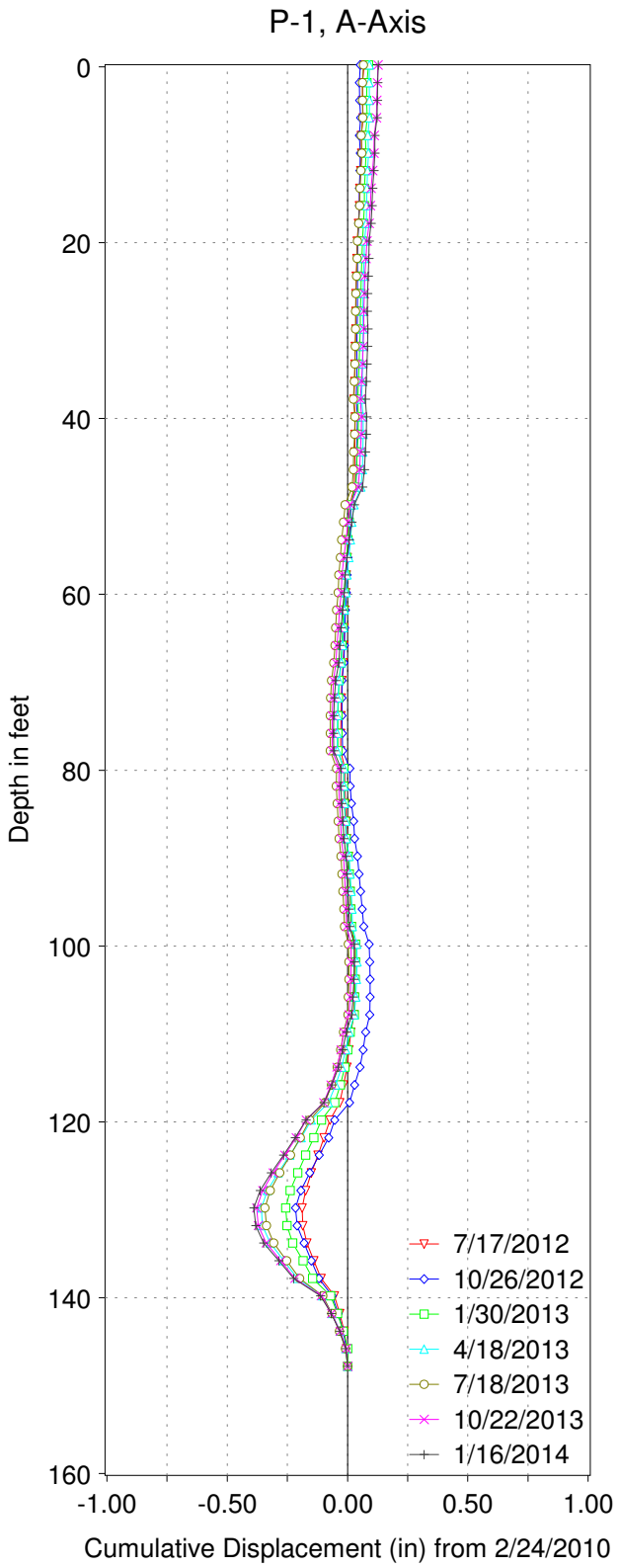
Drilled Shaft #1
(Weak Axis Bending)
Average for Period: October 15 thru January 15, 2014

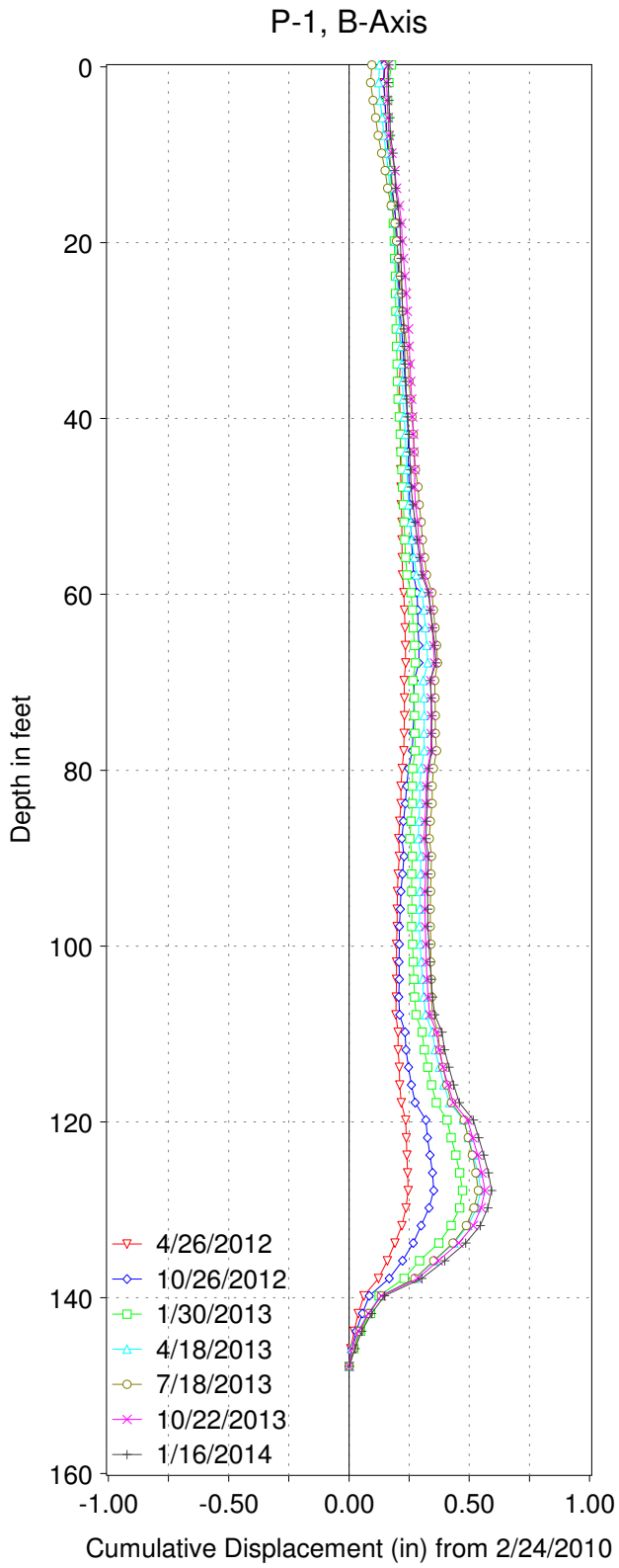





Shaft 1, 16 ft
Axial Load, kips
Bending Moment, ft-kips
2500
2000
1500
1000
500
0
0
200
400
600
800
1000
1200
1400
1600
1800
12/3/2009
6/21/2010
1/7/2011
7/26/2011
2/11/2012
8/29/2012
3/17/2013
10/3/2013
4/21/2014
Axial
Moment


Shaft 1, 58 ft
Axial Load, kips
Bending Moment, ft-kips
2350
2300
2250
2200
2150
2100
2050
2000
1950
-1450
-1500
-1550
-1600
-1650
-1700
-1750
-1800
12/3/2009
6/21/2010
1/7/2011
7/26/2011
2/11/2012
8/29/2012
3/17/2013
10/3/2013
4/21/2014
Axial
Moment





CUY-90-15.24
PID 76117
SME Project#: 062943.00
Reading Date: 1/16/2014

Soil and Materials Engineers, Inc.