MEMO

ARCADIS Design & Consultancy for natural and built assets

To:
Edgar Iniguez
Contracting Officer Representative
IBWC

Copies:
Padinare Unnikrishna (USIBWC)
Armando Flores (Arcadis)

Arcadis U.S., Inc.
10352 Plaza Americana Drive
Baton Rouge
Louisiana 70816
Tel 225 292 1004
Fax 225 218 9677

From:

Kirk Lowery, P.E.

Date:

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Arcadis Project No.:

LA003315.0000

Subject:
December 2016 Summary Report of Inclinometer Readings
Remediation Design of Levee Floodplain Failure within the
Upper Brownsville Levee Reach Lower Rio Grande Flood
Control Project – IBM15D0001 – IBM15T0015

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1. Introduction

Arcadis U.S., Inc. (Arcadis), is pleased to submit this summary technical memorandum including data charts of the slope inclinometer readings at the IBWC site. The baseline readings for the new inclinometers, Arc-1, Arc-2, Arc-3 and Arc-4, were taken in June 2016 and the sixth set of readings were measured on December 22, 2016. These inclinometers will be measured every month until June of 2017.

Readings for the existing inclinometers, I-32, I-33 and I-34, were not made when Arcadis visited the site December 22, 2016. During the June readings, the inclinometer probe had difficulty passing certain depths and when Arcadis passed those depths retrieving the inclinometer probe was problematic. Arcadis plans to periodically read these inclinometers, but not to attempt to pass the probe through the constricted area of the pipe and possibly lose/abandon the probe. Since the readings could not be measured for the existing inclinometers, in December 2016, Arcadis measured the depth range in which the inclinometer probe could not pass through the constricted area of the pipe and are as follows:

I-32 (Top of the Levee): Depth Range: 32 feet

I-33 (Toe of the Levee): Depth Range: 38 feet to 39 feet

I-34 (Below Toe of Levee): Depth Range: 30 feet to 31 feet

The readings for each inclinometer are reflected in the graphical displays provided in Attachment A. Attachment A includes both incremental and cumulative displacement plots. Attachment B shows the inclinometer locations on a Google Map.

The incremental displacement plot compares the mean deviation data to the baseline survey file. This plot reveals the exact depth where displacements are actually occurring. The cumulative displacement is the sum of the displacements from the base of the borehole. This plot shows the change in the position of the casing from the first set of readings.

The A-axis charts in the displacement plots show displacements in the plane perpendicular to the levee while the B-axis charts show displacements in the plane parallel with the levee. A positive reading in the A-axis chart indicates displacement to the west heading toward the Rio Grande River, and a positive reading in the B-axis chart indicates displacement to the north heading toward the Gateway Bridge.

2. Digitilt AT Inclinometer

Digitilt AT system was used to survey the inclinometers. The system components include an inclinometer probe, control cable, a Bluetooth reel and the Digitilt Reader app for certified Android-based tablet computer. The equipment is shown in Figure 1.

Figure 1: Digitilt AT System Components.

3. December 2016 Inclinometers Assessment

The depth of the casing restriction for the USACE installed inclinometers, I-32, I-33 and I-34 appears to be the same depth as the previous readings.

Data collected on December 22, 2016 followed the same trend as the baseline reading measured in June 2016. The monthly displacement plots recorded between July through December are presented in Attachment A. Data comparisons for each inclinometer are described below:

Inclinometer Arc-1: The base readings for inclinometer Arc-1 were collected on June 22, 2016. The Arc-1 cumulative plot in the A-Axis direction shows a slight progressive movement starting at depths between 28 and 30 feet. This depth corresponds with the interpreted Alluvium/Pleistocene interface presented in Figure 2 of Arcadis' December 2, 2016 *Draft Geotechnical Assessment Report*. This inclinometer will continue to be monitored on the normally scheduled frequency to determine if there is any increase in cumulative displacements.

Inclinometer Arc-2: The base readings for inclinometer Arc-2 were collected on June 17, 2016. The Arc-2 cumulative and incremental displacement does not show any sign of movement on the plane perpendicular to the levee nor on the plane parallel to the levee. Although the cumulative plot in the A-Axis direction shows a slight displacement at depths between 40 and 42 feet, this displacement is not progressive. This displacement could have been caused during the curing of the grout or some other environmental factor after the initial reading.

Inclinometer Arc-3: The base readings for inclinometer Arc-3 were collected on June 17, 2016. The Arc-3 cumulative and incremental displacement does not show any sign of movement on the plane perpendicular to the levee nor on the plane parallel to the levee.

Inclinometer Arc-4: The base readings for inclinometer Arc-4 were collected on June 22, 2016. The Arc-4 cumulative and incremental displacement does not show any sign of movement on the plane perpendicular to the levee nor on the plane parallel to the levee.

ATTACHMENTS:
A – Inclinometer Plots
B – Inclinometer Location Map

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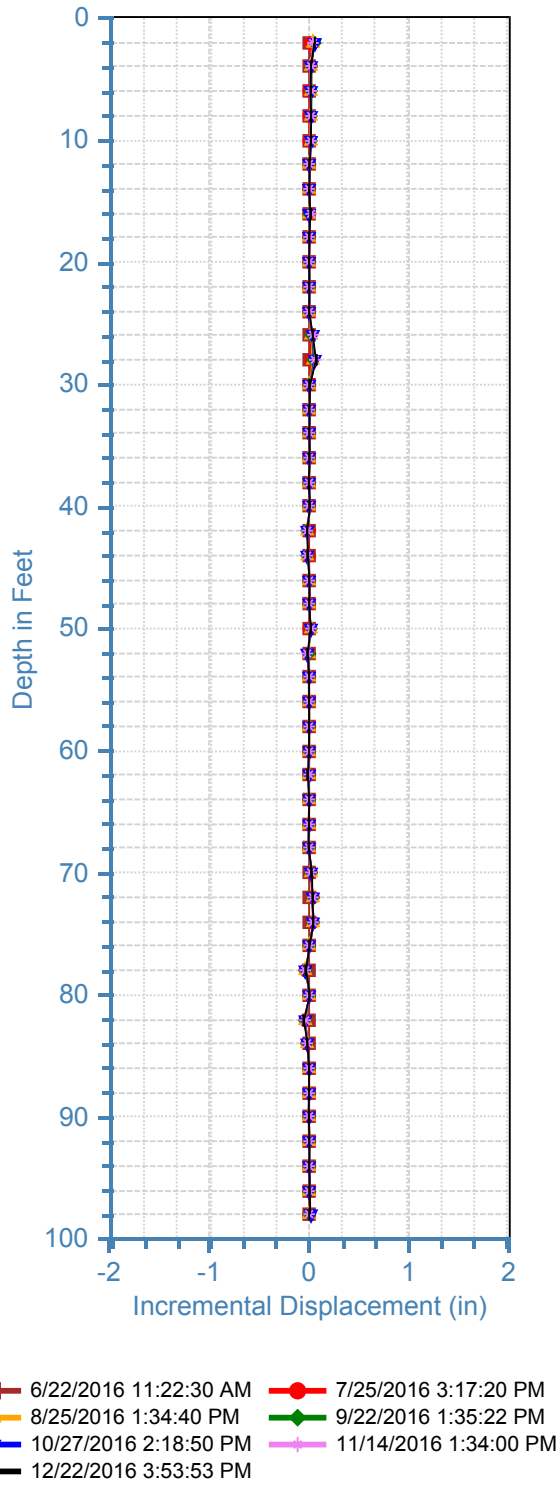
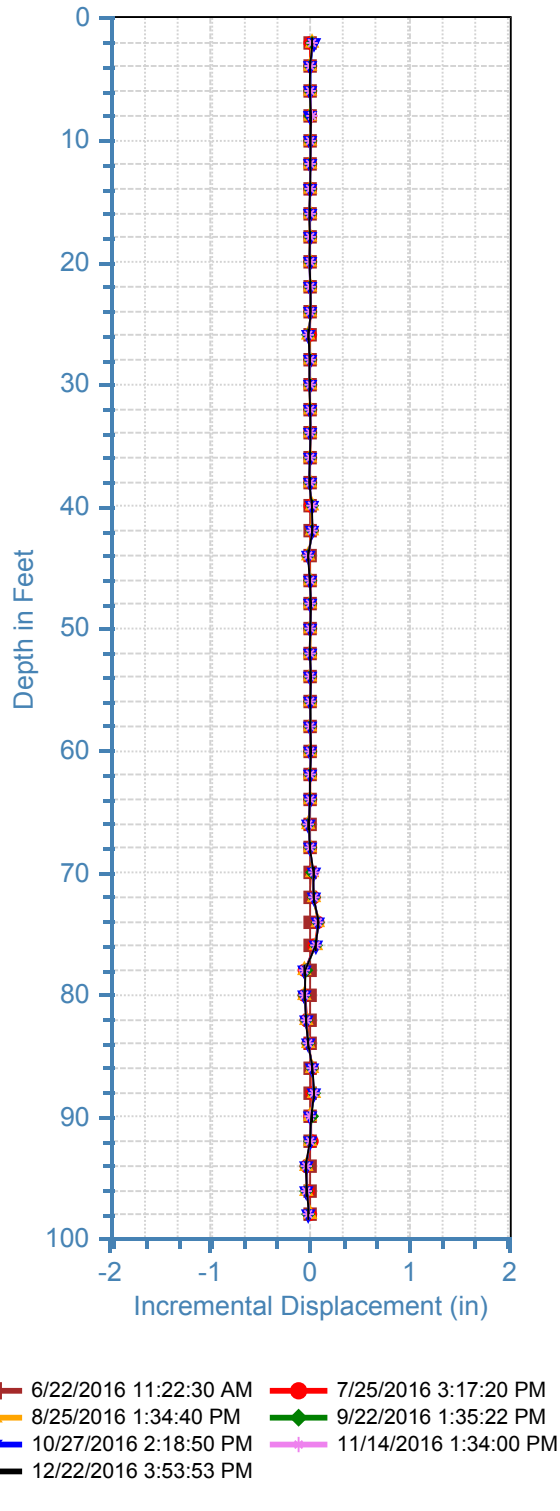
ATTACHMENT A

INCLINOMETER PLOTS

IBWC Arc-1 A - Axis



IBWC Arc-1 B - Axis



Base reading on 6/22/2016

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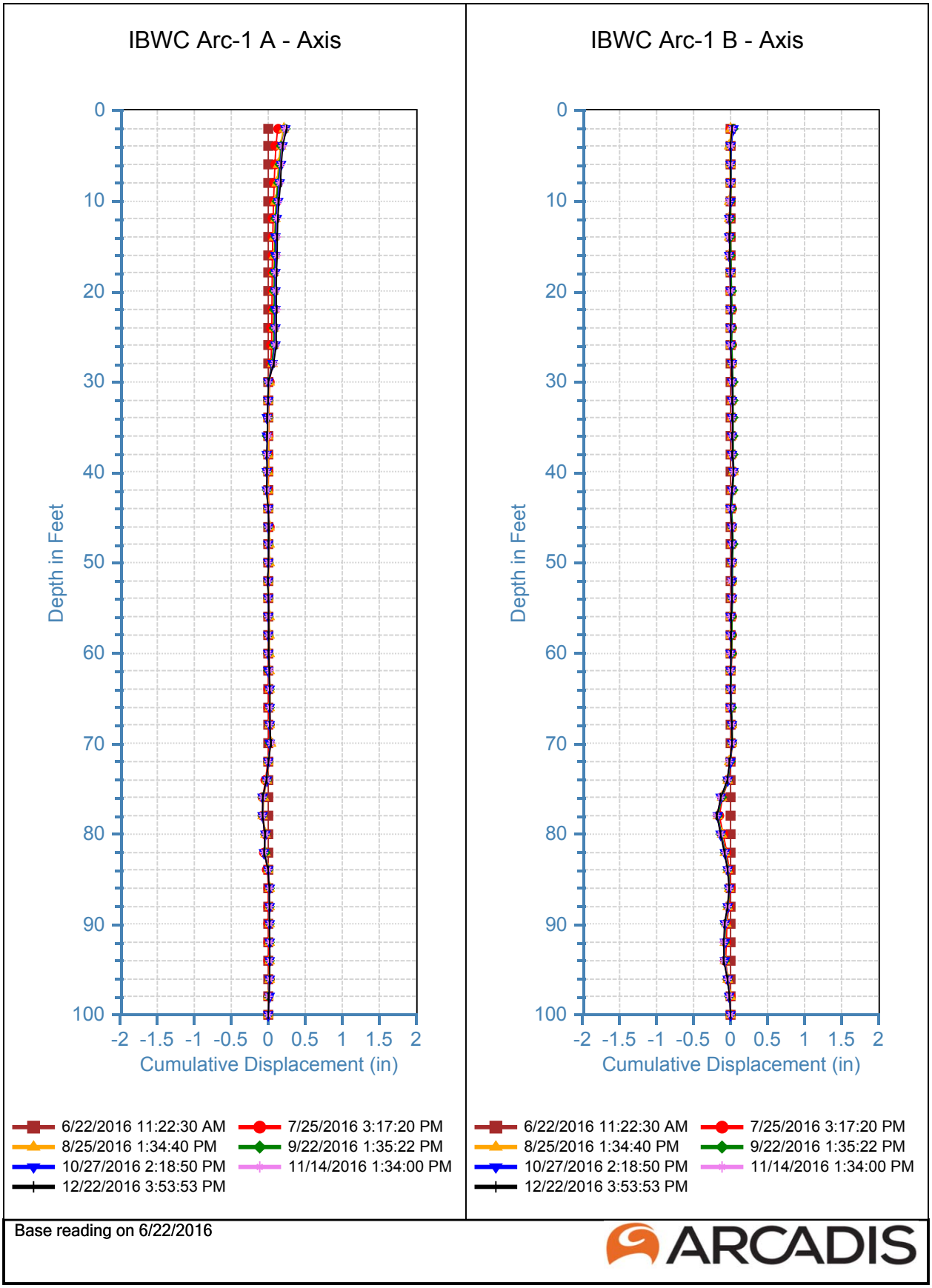

Base reading on 6/22/2016

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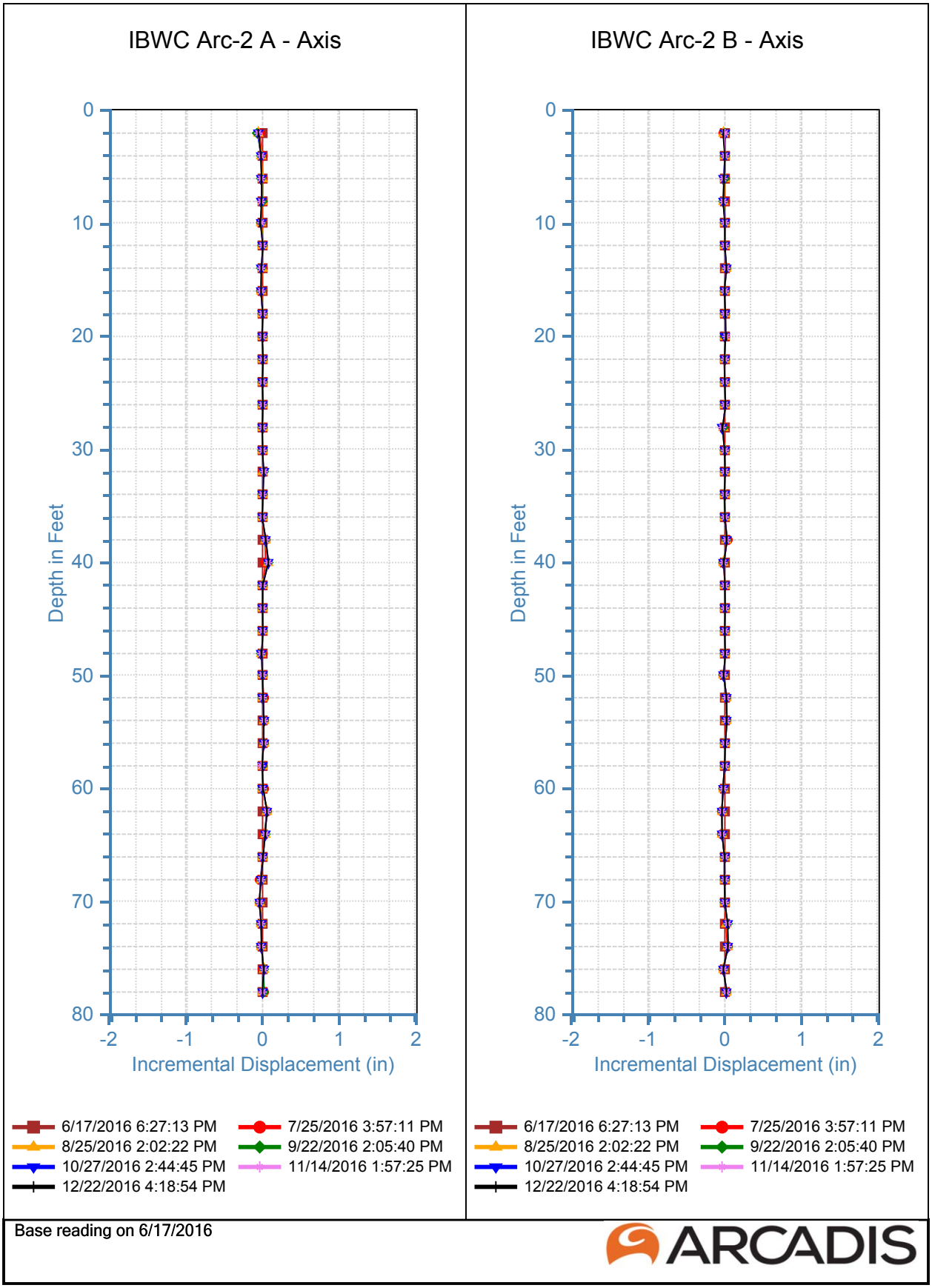

Base reading on 6/17/2016

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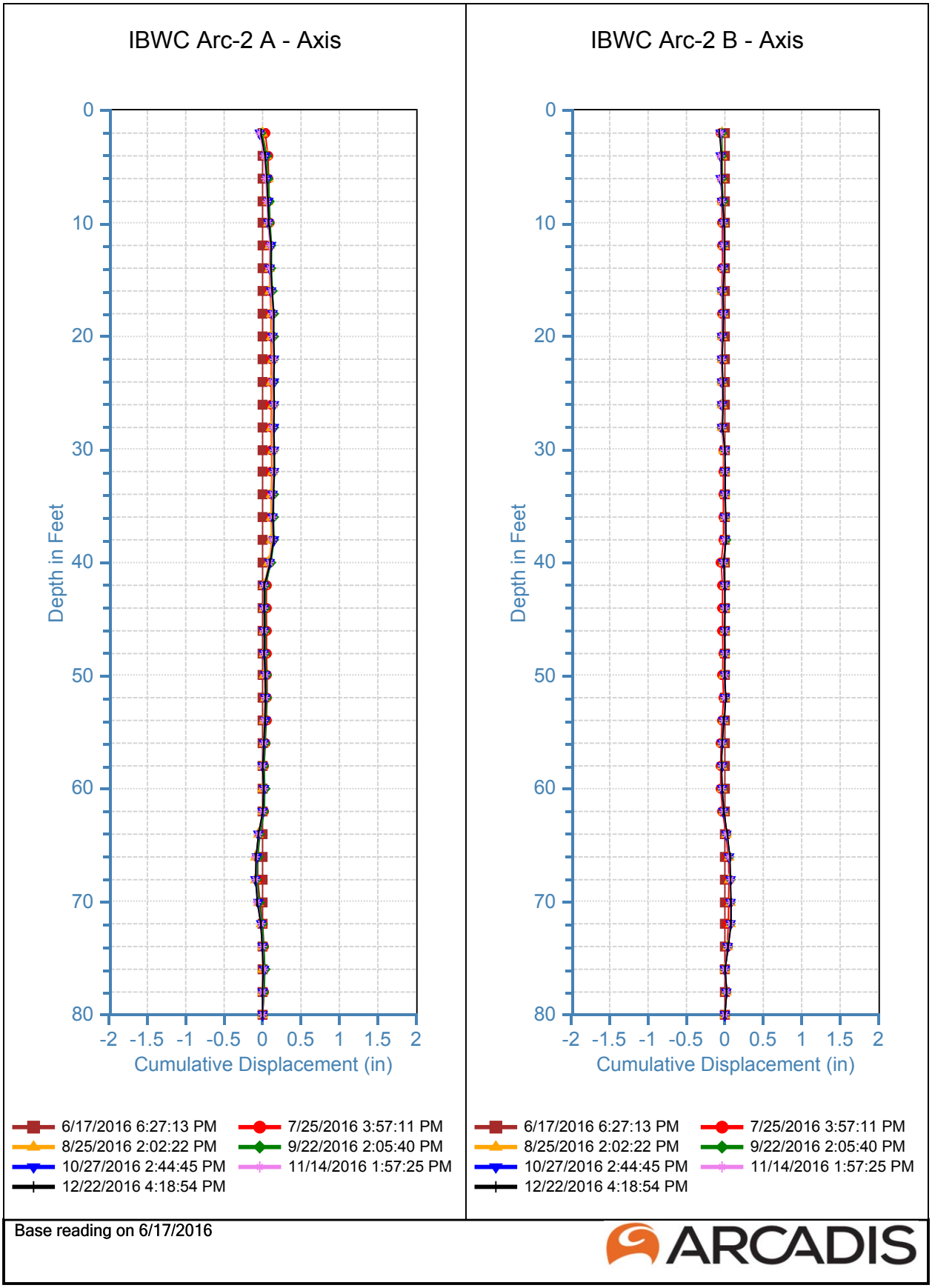

Base reading on 6/17/2016

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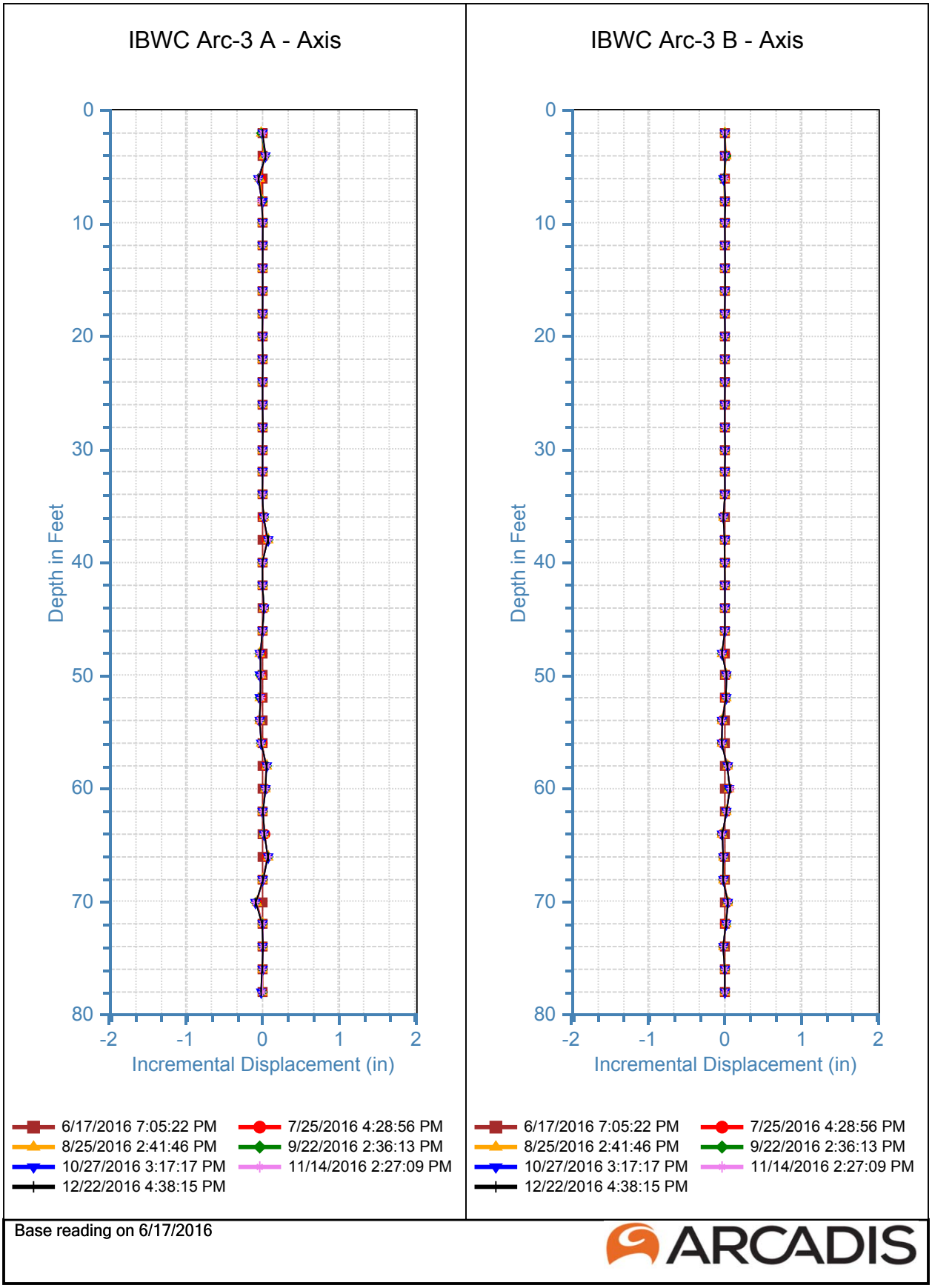

Base reading on 6/17/2016

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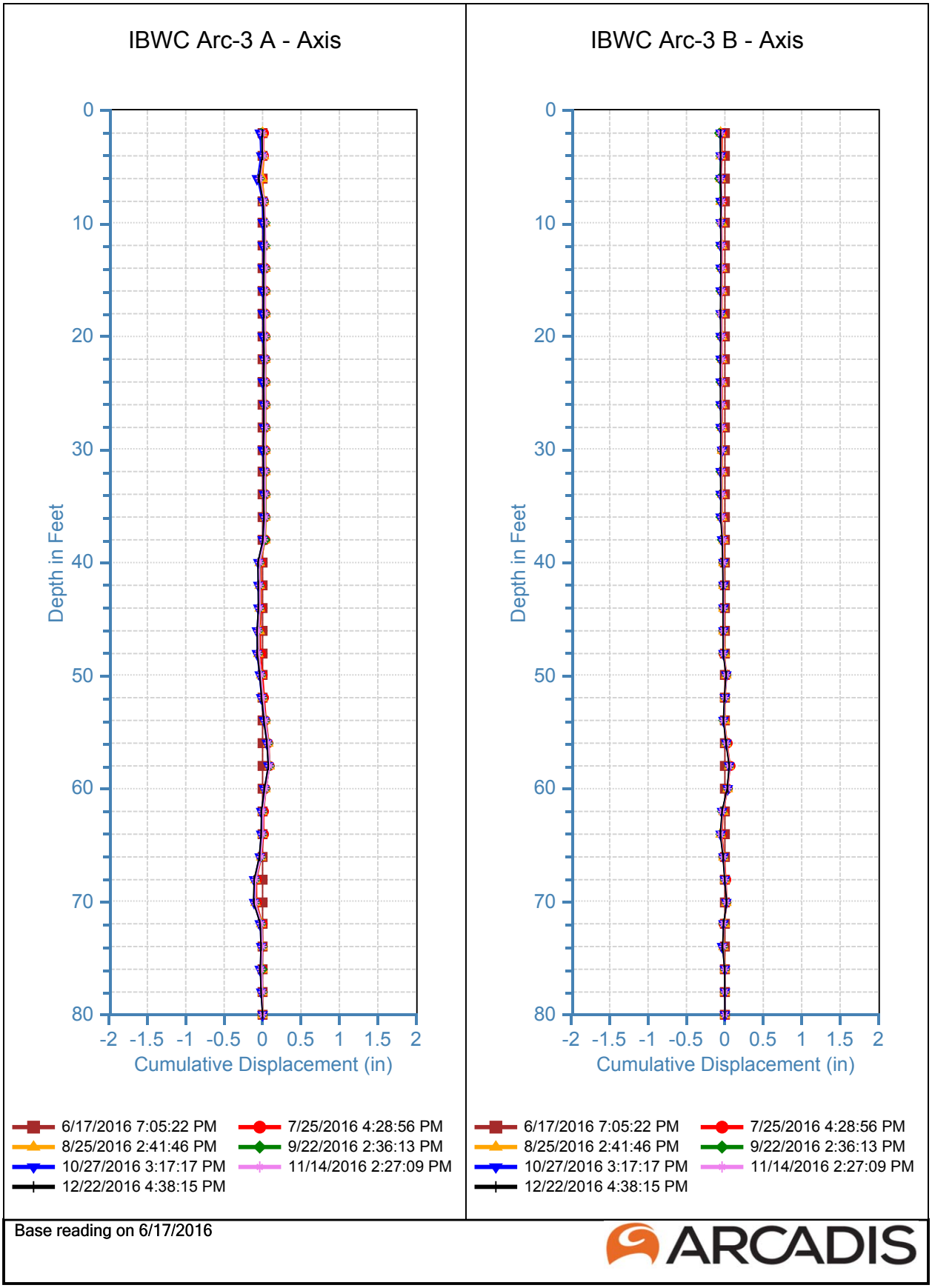

Base reading on 6/17/2016

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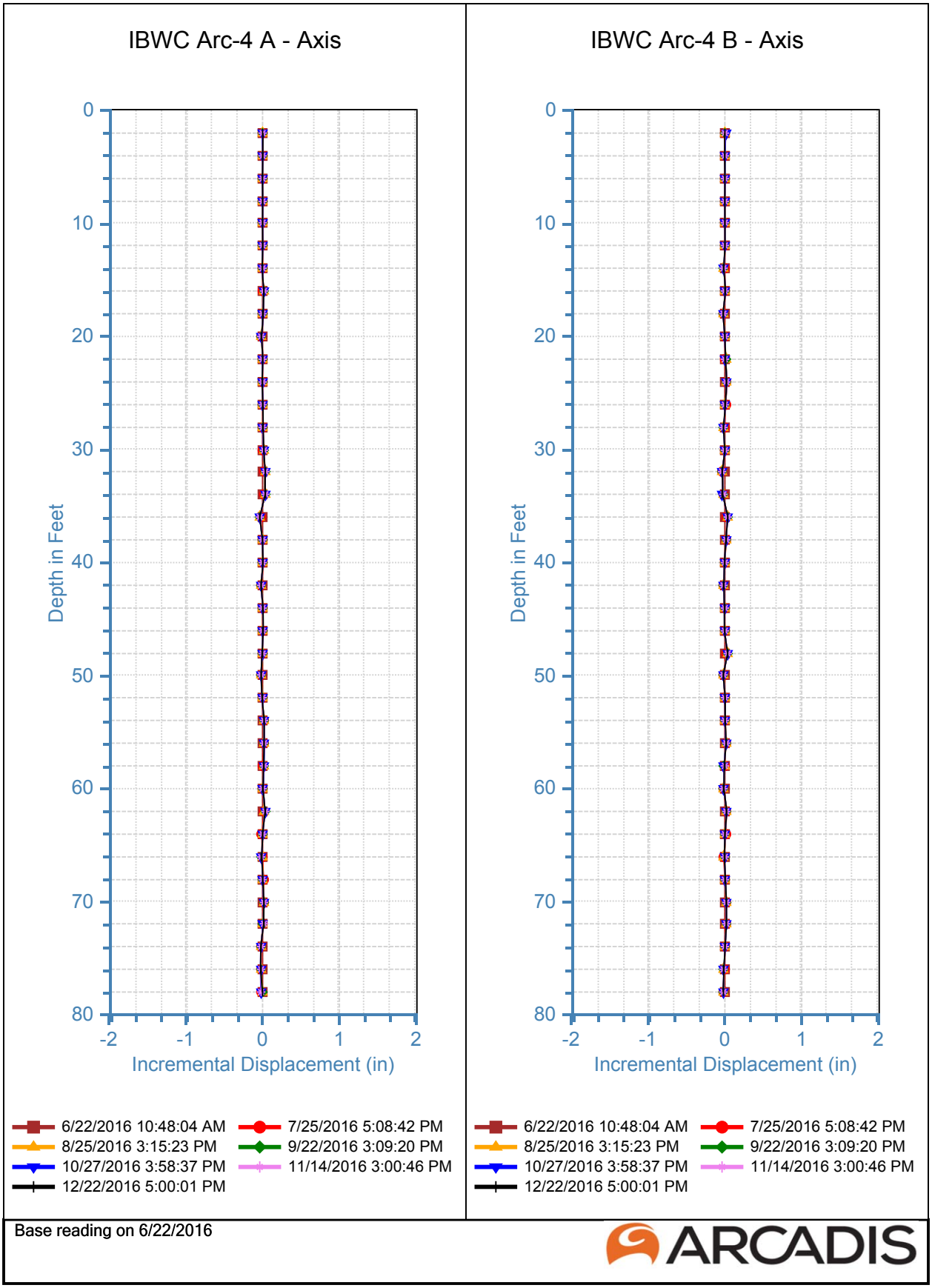

Base reading on 6/22/2016

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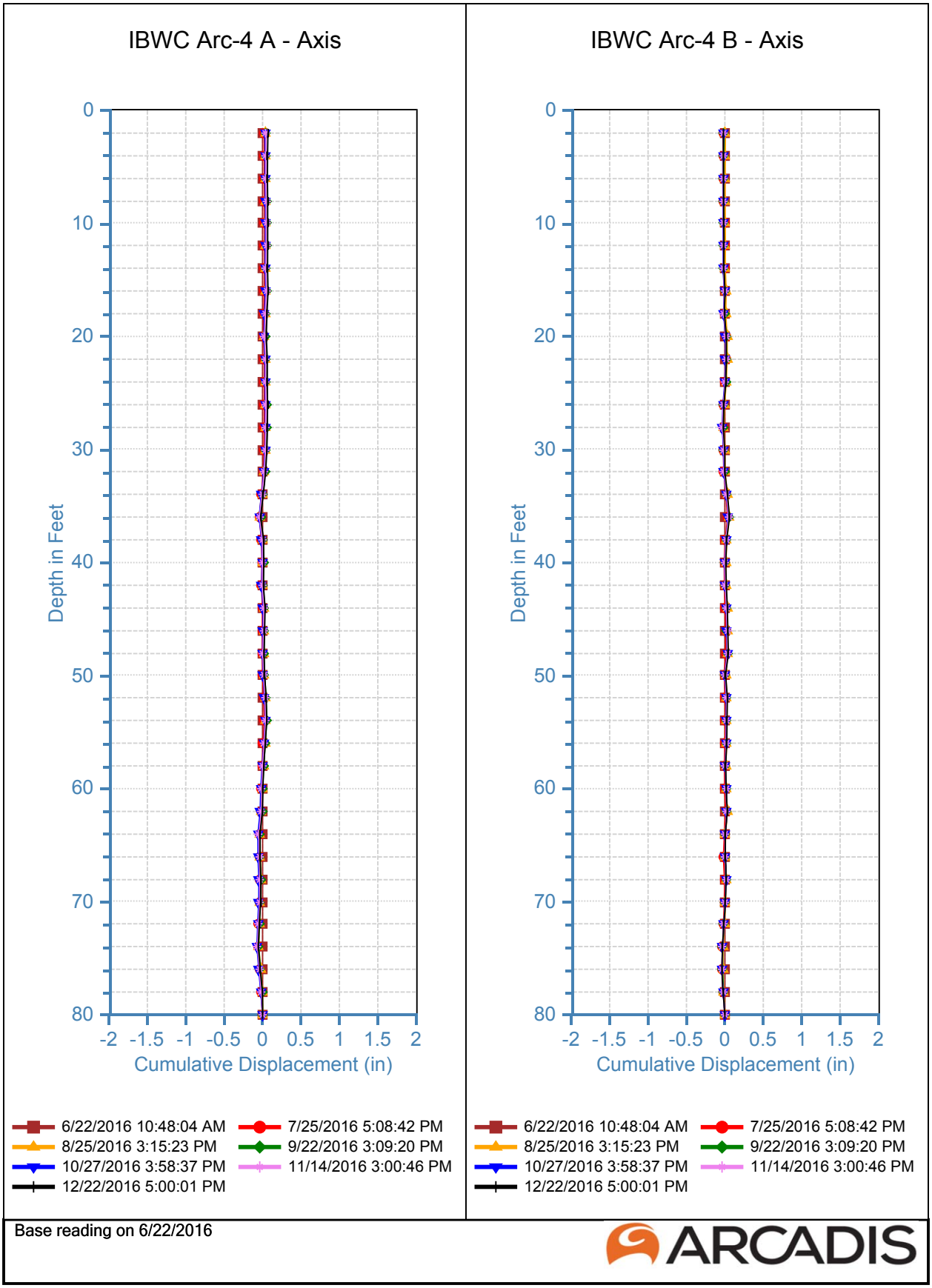

Base reading on 6/22/2016

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ATTACHMENT B

INCLINOMETER LOCATION MAP

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DECEMBER 2016 SUMMARY REPORT OF INCLINOMETER READINGS

REMEDIATION DESIGN OF LEVEE FLOODPLAIN FAILURE WITHIN THE UPPER BROWNSVILLE LEVEE REACH LOWER RIO GRANDE FLOOD CONTROL PROJECT

INCLINOMETER LOCATION

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ATTACHMENT **B**