THURBER ENGINEERING LTD.

July 28, 2022 File No.: 32121

Alberta Transportation
Provincial Building
9621-96 Avenue
Peace River, Alberta
T8S 1T4

Attention: Mr. Max Shannon

ALBERTA TRANSPORTATION GRMP (CON0022164)
PEACE REGION (PEACE RIVER DISTRICT)
INSTRUMENTATION MONITORING RESULTS – SPRING 2022

SECTION C

SITE PH006: HWY 697:02, TOMPKINS LANDING

Dear Mr. Shannon:

This report provides the results of the annual geotechnical instrumentation monitoring for the above-mentioned site as part of Alberta Transportation's Geohazard Risk Management Program (GRMP) for Peace Region – Peace River District (CON0022164).

It is a condition of this letter report that Thurber's performance of its professional services will be subject to the attached Statement of Limitations and Conditions.

1. FIELD PROGRAM AND INSTRUMENTATION STATUS

Four slope inclinometers (SI-1, SI-5, SI-12, and SI-13) and one pneumatic piezometer (PN02-3) were read at the Hwy 697:02 Tompkins Landing site on June 16, 2022, by Mr. Niraj Regmi, G.I.T., and Mr. Jayden Del Cid, both of Thurber Engineering Ltd. SI-1 and SI-12 have been damaged by a mower during the spring of 2020 readings, and SI-12 was also found to have sheared at 7.9 m since the spring of 2021 readings. SI-1 was still readable from the ground surface.

The SIs were read using two RST Digital Inclinometer probes with 2 ft. wheelbases and RST Pocket PC readouts. Inclinometer reading depths were defined as per cable markings with respect to the top of the inclinometer casing. The pneumatic piezometers were read using an RST C108 pneumatic piezometer readout.

2. DATA PRESENTATION

2.1 General

Zones of new movement were not observed in the SIs since the last set of readings in the spring of 2021.

SI plots with A and B directions are presented in Appendix A and are summarized below. Where movement has been recorded, the resultant plot (X direction, if applicable) and a rate of movement have also been provided. The pneumatic piezometer readings are summarized below and are also plotted in Appendix A. The SI and piezometer readings summary tables also include instruments not presently included in the GRMP program, for reference.

2.2 Zones of Movement

Zones of movement are summarized in Table PH006-1 at the end of this report. This table also provides a historical account of the total movement, the depth of movement and the maximum rate of movement that has occurred at this site since the initialization of the slope inclinometers.

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TABLE PH006-1
SPRING 2022 – HWY 697:02, TOMPKINS LANDING
SLOPE INCLINOMETER INSTRUMENTATION READING SUMMARY

Date Monitored: June 16, 2022

INSTRUMENT #	DATE INITIALIZED	TOTAL CUMULATIVE RESULTANT MOVEMENT AND DEPTH OF MOVEMENT TO DATE (mm)	MAXIMUM RATE OF MOVEMENT (mm/yr)	CURRENT STATUS OF SI	DATE OF PREVIOUS READING	INCREMENTAL MOVEMENT SINCE PREVIOUS READING (mm)	CURRENT RATE OF MOVEMENT (mm/yr)	CHANGE IN RATE OF MOVEMENT SINCE PREVIOUS READING (mm/yr)
SI-1	Aug. 21, 1990	No discernible movement	N/A	Operational	July 12, 2021	N/A	N/A	N/A
SI-2	*Aug. 21, 1990*	*Not Known*	*Not Known*	*Destroyed (2004)*	*May 24, 2004*	*N/A*	*N/A*	*N/A*
SI-5	Apr. 28, 1996	76.8 mm over 0.1 m to 2.6 m depth in 106° direction	16.0 mm/yr in May 1998	Operational	July 12, 2021	2.2	2.4	2.6
		325.1 mm over 2.6 m to 11.1 m depth in 106° direction	101.0 mm/yr in May 1998			17.5	18.8	9.5
SI-12	*April 11, 1998*	*53.4 mm over 6.7 m to 8.5 m depth in 100° direction*	*28.0 mm/yr in Oct. 1998*	*Sheared at 7.9 m (2022)*	*July 12, 2021*	*N/A*	*N/A*	*N/A*
		14.6 mm over 11.5 m to 12.8 m depth in 100° direction	*8.4 mm/yr in Oct. 1998*			*N/A*	*N/A*	*N/A*
SI-13	Oct. 2, 1998	282.0 mm over 1.7 m to 14.5 m depth in 114° direction	64.5 mm/yr in October 2020	Operational	July 12, 2021	26.7	28.8	18.9

Drawing 32121-PH006 in Appendix A provides a sketch of the approximate locations of the monitoring instrumentation for this site.

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TABLE PH006-1 – CONTINUED…
SPRING 2022 – HWY 697:02, TOMPKINS LANDING
SLOPE INCLINOMETER INSTRUMENTATION READING SUMMARY

Date Monitored: June 16, 2022

INSTRUMENT #	DATE INITIALIZED	TOTAL CUMULATIVE RESULTANT MOVEMENT AND DEPTH OF MOVEMENT TO DATE (mm)	MAXIMUM RATE OF MOVEMENT (mm/yr)	CURRENT STATUS OF SI	DATE OF PREVIOUS READING	INCREMENTAL MOVEMENT SINCE PREVIOUS READING (mm)	CURRENT RATE OF MOVEMENT (mm/yr)	CHANGE IN RATE OF MOVEMENT SINCE PREVIOUS READING (mm/yr)
SI02-1	*Sept. 25, 2002*	*45.4 mm over 13.4m to 15.8m depth in 74° direction*	*38 mm/yr between May and Oct. 2006*	*Destroyed (2007)*	*Oct. 6, 2007*	*N/A*	*N/A*	*N/A*
SI02-2	*Sept. 25, 2002*	*4.1 mm over 8.5 m to 11.6 m depth in 93° direction*	*2.8 mm/yr Between Sept. 2003 and May 2004*	*Sheared Off at 2.8 m (2004)*	*Oct. 13, 2004*	*N/A*	*N/A*	*N/A*
SI02-3	*Sept. 25, 2002*	*28.8 mm over 20.5 m to 21.9 m depth in 71° direction*	*9.3 mm/yr between Oct. 2007 and May, 2008*	*Sheared Off at 21.0 m (2008)*	*May 26, 2008*	*N/A*	*N/A*	*N/A*
SI02-4	*Sept. 25, 2002*	*44.5 mm over 12.8 m to 14.0 m depth in 99° direction*	*31.2 mm/yr between May and Oct. 2005*	*Sheared Off at 13.1 m (2006)*	*May 24, 2006*	*N/A*	*N/A*	*N/A*
SI02-5	*Sept. 25, 2002*	*109.1 mm over 17.1 m to 18.9 m depth in 90° direction*	*99.7 mm/yr between May and Oct. 2006*	*Sheared Off at 17.1 m (2007)*	*Oct. 6, 2007*	*N/A*	*N/A*	*N/A*

Drawing 32121-PH006 in Appendix A provides a sketch of the approximate locations of the monitoring instrumentation for this site.

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TABLE PH006-2
SPRING 2022 – HWY 697:02, TOMPKINS LANDING
PNEUMATIC PIEZOMETER INSTRUMENTATION READING SUMMARY

Date Monitored: June 16, 2022

INSTRUMENT #	DATE INITIALIZED	TIP DEPTH (m)	GROUND ELEV. (m)	CURRENT STATUS	HIGHEST MEASURED WATER LEVEL BGS (m)	MEASURED PORE PRESSURE (kPa)	CURRENT WATER LEVEL BGS (m)	PREVIOUS WATER LEVEL BGS (m)	CHANGE IN WATER LEVEL SINCE PREVIOUS READING (m)
PN02-1 (27707)	*May 26, 2003*	*11.0*	*N/A*	*Destroyed (2008)*	*1.28 on May 26, 2008*	*N/A*	*N/A*	*1.28 (May 26, 2008)*	*N/A*
PN02-3 (27708)	May 26, 2003	20.0	N/A	Active	4.81 on Oct. 15, 2006	132.8	6.46	7.11	0.65
PN02-4 (27709)	*May 26, 2003*	*15.8*	*N/A*	*Damaged (2006)*	*14.02 on May 26, 2003*	*N/A*	*N/A*	*15.55 (Oct. 25, 2005)*	*N/A*
PN02-5 (27706)	*May 26, 2003*	*20.7*	*N/A*	*Damaged (2021)*	*10.99 on June 15, 2020*	*N/A*	*N/A*	*10.99 (June 15, 2020)*	*N/A*

Drawing 32121-PH006 in Appendix A provides a sketch of the approximate locations of the monitoring instrumentation for this site.

Notes:
PN - pneumatic piezometer.
BGS - below ground surface.

3. INTERPRETATION OF MONITORING RESULTS

Slope inclinometer SI-1 continued to show no discernible movement. Both movement zones in SI-5 showed rapid movement shortly after initialization and then have remained relatively constant since at a much slower rate. SI-5 showed a rate of movement of 2.4 mm/yr over 0.1 m to 2.6 m depth, compared to the overall average rate (since initialization) of 3.0 mm/year. The lower zone at SI-5, 2.6 m to 11.1 m depth, had a rate of movement of 18.8 mm/yr since the spring of 2021 readings. The overall rate (since installation in 1996) over this zone is 12.7 mm/year which includes the initial rapid movement. The trend since 2007 is 9.0 mm/yr; however, the rate of movement has accelerated starting in 2019 to 13.9 mm/yr. Slope inclinometer SI-13 showed a rate of movement of 28.8 mm/yr over 1.7 m to 14.5 m depth compared to the overall rate of 11.2 mm/year. From installation in 1998 to the spring of 2020, the overall movement rate was 10.4 mm/yr. Since the fall of 2020, the overall rate has accelerated to 27.9 mm/yr. This pattern of accelerated movement is similar to the pattern observed in SI-5.

Based on previous instrument readings and site observations, it appears that the three operational SIs at this site are installed too shallow to fully intercept the main slip surface of the slide but are, nonetheless, moving and significantly within the overall slide blocks.

The groundwater level increased in pneumatic piezometer PN02-3 by 0.65 m since the spring of 2021 readings which is a reversal in the overall trend of decreasing water level that had occurring since 2011 although the readings are within the historical range. Pneumatic piezometer readings are summarized in Table PH006-2 in this report and are plotted on in Figure PH006-1 in Appendix A.

4. RECOMMENDATIONS

4.1 Future Work

The instruments should be read again during the spring of 2023.

4.2 Instrumentation Repairs

SI-1 should be repaired during the next reading cycle. SI-12 is sheared off at 7.9 m below ground surface and should be removed from future readings. PN02-5 is also damaged; however, this instrument would require mechanical excavation to splice on a new section of pneumatic line so it may not be economical to repair this instrument at this time.

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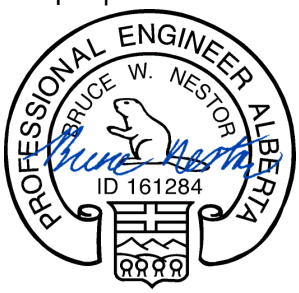
5. CLOSURE

We trust this report meets your requirements at present. If you have any questions, please contact the undersigned at your convenience.

Yours very truly,
Thurber Engineering Ltd.
Tarek Abdelaziz, Ph.D., P. Eng.
Principal | Senior Geotechnical Engineer



July 29, 2022

PERMIT TO PRACTICE
THURBER ENGINEERING LTD.
RM SIGNATURE: _____
RM APEGA ID #: 91085
DATE: July 29, 2022
PERMIT NUMBER: P005186
The Association of Professional Engineers and Geoscientists of Alberta (APEGA)

Bruce Nestor, P.Eng.
Geotechnical Engineer
/jf

Attachments:

- Statement of Limitations and Conditions
- Appendix A
  - Field Inspector's report
  - Site Plan Showing Approximate Instrument Locations (Drawing No.32121-PH006)
  - SI Reading Plots
  - Figure PH006-1 (Piezometric Depths)

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STATEMENT OF LIMITATIONS AND CONDITIONS

1. STANDARD OF CARE

This Report has been prepared in accordance with generally accepted engineering or environmental consulting practices in the applicable jurisdiction. No other warranty, expressed or implied, is intended or made.

2. COMPLETE REPORT

All documents, records, data and files, whether electronic or otherwise, generated as part of this assignment are a part of the Report, which is of a summary nature and is not intended to stand alone without reference to the instructions given to Thurber by the Client, communications between Thurber and the Client, and any other reports, proposals or documents prepared by Thurber for the Client relative to the specific site described herein, all of which together constitute the Report.

IN ORDER TO PROPERLY UNDERSTAND THE SUGGESTIONS, RECOMMENDATIONS AND OPINIONS EXPRESSED HEREIN, REFERENCE MUST BE MADE TO THE WHOLE OF THE REPORT. THURBER IS NOT RESPONSIBLE FOR USE BY ANY PARTY OF PORTIONS OF THE REPORT WITHOUT REFERENCE TO THE WHOLE REPORT.

3. BASIS OF REPORT

The Report has been prepared for the specific site, development, design objectives and purposes that were described to Thurber by the Client. The applicability and reliability of any of the findings, recommendations, suggestions, or opinions expressed in the Report, subject to the limitations provided herein, are only valid to the extent that the Report expressly addresses proposed development, design objectives and purposes, and then only to the extent that there has been no material alteration to or variation from any of the said descriptions provided to Thurber, unless Thurber is specifically requested by the Client to review and revise the Report in light of such alteration or variation.

4. USE OF THE REPORT

The information and opinions expressed in the Report, or any document forming part of the Report, are for the sole benefit of the Client. NO OTHER PARTY MAY USE OR RELY UPON THE REPORT OR ANY PORTION THEREOF WITHOUT THURBER'S WRITTEN CONSENT AND SUCH USE SHALL BE ON SUCH TERMS AND CONDITIONS AS THURBER MAY EXPRESSLY APPROVE. Ownership in and copyright for the contents of the Report belong to Thurber. Any use which a third party makes of the Report, is the sole responsibility of such third party. Thurber accepts no responsibility whatsoever for damages suffered by any third party resulting from use of the Report without Thurber's express written permission.

5. INTERPRETATION OF THE REPORT

a) Nature and Exactness of Soil and Contaminant Description: Classification and identification of soils, rocks, geological units, contaminant materials and quantities have been based on investigations performed in accordance with the standards set out in Paragraph 1. Classification and identification of these factors are judgmental in nature. Comprehensive sampling and testing programs implemented with the appropriate equipment by experienced personnel may fail to locate some conditions. All investigations utilizing the standards of Paragraph 1 will involve an inherent risk that some conditions will not be detected and all documents or records summarizing such investigations will be based on assumptions of what exists between the actual points sampled. Actual conditions may vary significantly between the points investigated and the Client and all other persons making use of such documents or records with our express written consent should be aware of this risk and the Report is delivered subject to the express condition that such risk is accepted by the Client and such other persons. Some conditions are subject to change over time and those making use of the Report should be aware of this possibility and understand that the Report only presents the conditions at the sampled points at the time of sampling. If special concerns exist, or the Client has special considerations or requirements, the Client should disclose them so that additional or special investigations may be undertaken which would not otherwise be within the scope of investigations made for the purposes of the Report.

b) Reliance on Provided Information: The evaluation and conclusions contained in the Report have been prepared on the basis of conditions in evidence at the time of site inspections and on the basis of information provided to Thurber. Thurber has relied in good faith upon representations, information and instructions provided by the Client and others concerning the site. Accordingly, Thurber does not accept responsibility for any deficiency, misstatement or inaccuracy contained in the Report as a result of misstatements, omissions, misrepresentations, or fraudulent acts of the Client or other persons providing information relied on by Thurber. Thurber is entitled to rely on such representations, information and instructions and is not required to carry out investigations to determine the truth or accuracy of such representations, information and instructions.

c) Design Services: The Report may form part of design and construction documents for information purposes even though it may have been issued prior to final design being completed. Thurber should be retained to review final design, project plans and related documents prior to construction to confirm that they are consistent with the intent of the Report. Any differences that may exist between the Report's recommendations and the final design detailed in the contract documents should be reported to Thurber immediately so that Thurber can address potential conflicts.

d) Construction Services: During construction Thurber should be retained to provide field reviews. Field reviews consist of performing sufficient and timely observations of encountered conditions in order to confirm and document that the site conditions do not materially differ from those interpreted conditions considered in the preparation of the report. Adequate field reviews are necessary for Thurber to provide letters of assurance, in accordance with the requirements of many regulatory authorities.

6. RELEASE OF POLLUTANTS OR HAZARDOUS SUBSTANCES

Geotechnical engineering and environmental consulting projects often have the potential to encounter pollutants or hazardous substances and the potential to cause the escape, release or dispersal of those substances. Thurber shall have no liability to the Client under any circumstances, for the escape, release or dispersal of pollutants or hazardous substances, unless such pollutants or hazardous substances have been specifically and accurately identified to Thurber by the Client prior to the commencement of Thurber's professional services.

7. INDEPENDENT JUDGEMENTS OF CLIENT

The information, interpretations and conclusions in the Report are based on Thurber's interpretation of conditions revealed through limited investigation conducted within a defined scope of services. Thurber does not accept responsibility for independent conclusions, interpretations, interpolations and/or decisions of the Client, or others who may come into possession of the Report, or any part thereof, which may be based on information contained in the Report. This restriction of liability includes but is not limited to decisions made to develop, purchase or sell land.

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ALBERTA TRANSPORTATION GRMP (CON0022164)
PEACE REGION (PEACE RIVER DISTRICT)
INSTRUMENTATION MONITORING RESULTS

SPRING 2022

APPENDIX A
DATA PRESENTATION

SITE PH006: HWY 697:02, TOMPKINS LANDING

ALBERTA TRANSPORTATION
PEACE REGION (PEACE RIVER DISTRICT)
INSTRUMENTATION MONITORING FIELD SUMMARY (PH006)
SPRING 2022

Location:	Tompkins Landing (HWY 697:02 C1 17.451)	**Readout:**	
File Number:	32121	**Extension:**	3.34"
Probe:	RST set 5R & 8R	**Temp:**	23
Cable:	RST set 5R & 8R	**Read by:**	NKR/JD

SLOPE INCLINOMETER (SI) READINGS

SI#	GPS Location (UTM 11)		Date	Stickup (m)	Depth from top of casing (ft)	Magn. North A+ Groove	Current Bottom Depth Readings				Probe/ Reel #	Remarks
	Easting (m)	Northing (m)					A+	A-	B+	B-		
SI-1	491173.98	6425582.21	16-Jun-22	0.85	36 to 2	83	1099	-1082	-1096	1082	5R/5R	*
SI-5	491205.48	6425567.22	16-Jun-22	1.10	38 to 2	94	1416	-1401	-880	886	8R/8R	**
SI-12	491200.51	6425541.29	16-Jun-22	0.66	48 to 2	83	-880	-509	456	430	8R/8R	Casing break at 26 ft probe wont go down*
SI-13	491191.55	6425500.45	16-Jun-22	0.70	48 to 2	55	701	-693	224	-219	8R/8R	

PNEUMATIC PIEZOMETER READINGS

PN#	GPS Location (UTM 11)		Date	Reading (kPa)	Identification Number
	Easting (m)	Northing (m)			
PN02-3	491129.53	6425541.45	16-Jun-22	132.8	27708
PN02-5	491201.52	6425541.29	16-Jun-22	95.2*	27706

INSPECTOR REPORT

** SI-5 - Stop 6 inches below 38 feet when lowering the probe, otherwise the probe may get stuck.

* Broken flush to ground by lawnmower. SI-1 read from 36ft from the ground. SI-12 read from 46ft. Need Repair

PN02-5 Broken by lawn mower, Pn airline pinched inside casing protector , and casing protector is sunk 4 ft in the ground - skip in Spring 2022

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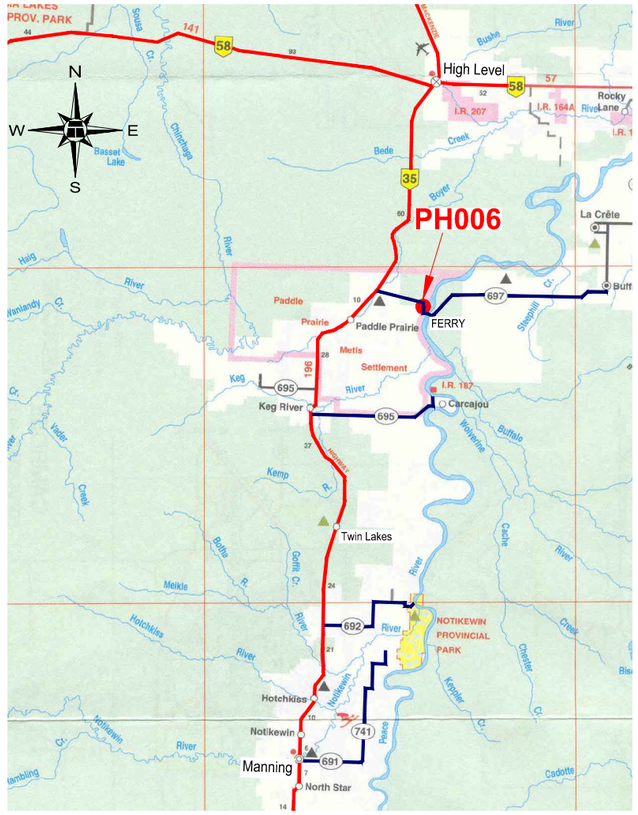


SITE MAP
NOT TO SCALE

LEGEND :

SI-1
SLOPE INCLINOMETER INSTALLED BEFORE 2002

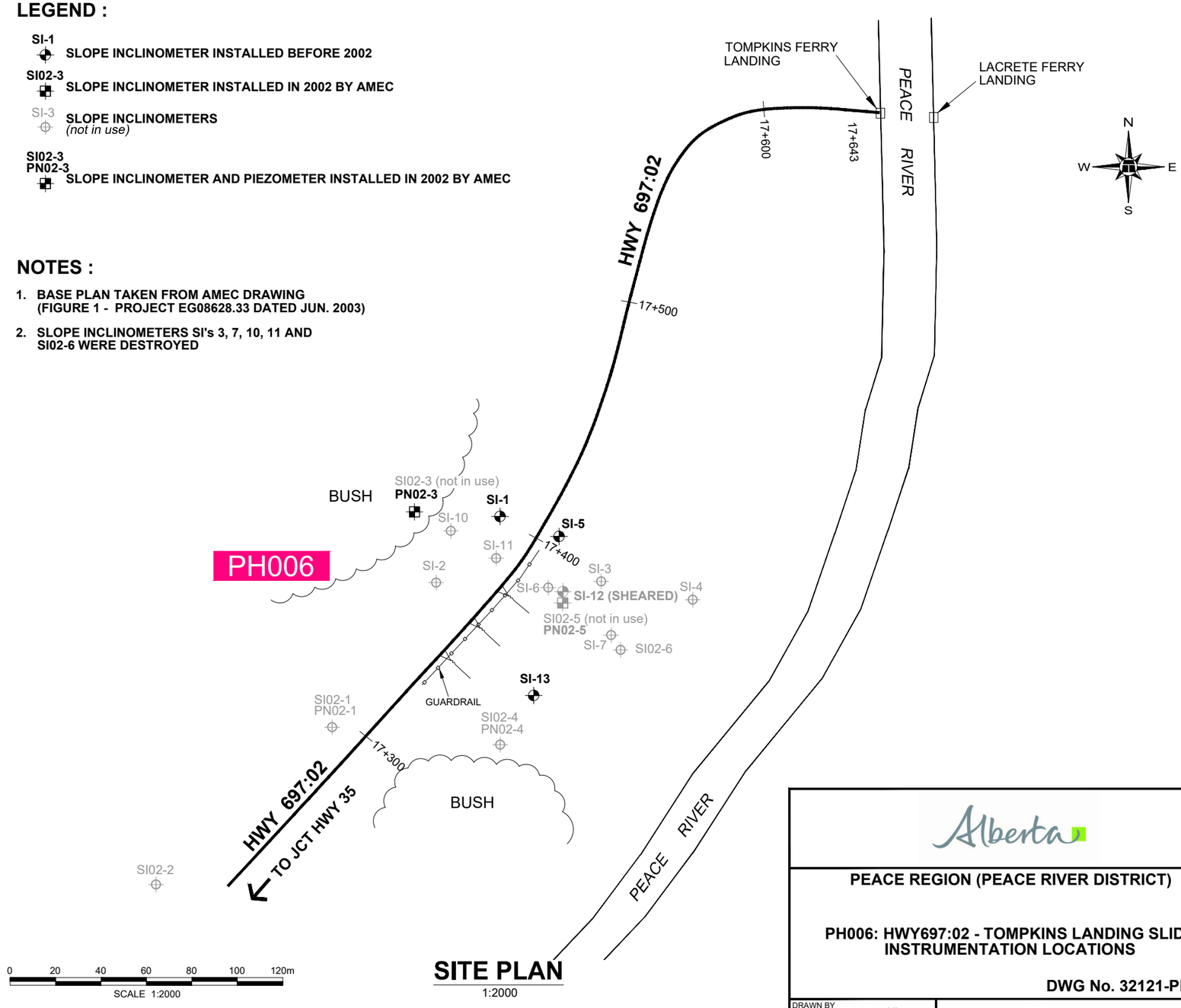
SI02-3
SLOPE INCLINOMETER INSTALLED IN 2002 BY AMEC

SI-3
SLOPE INCLINOMETERS
(not in use)

SI02-3
PN02-3
SLOPE INCLINOMETER AND PIEZOMETER INSTALLED IN 2002 BY AMEC

NOTES :

1. **BASE PLAN TAKEN FROM AMEC DRAWING (FIGURE 1 - PROJECT EG08628.33 DATED JUN. 2003)**
2. **SLOPE INCLINOMETERS SI's 3, 7, 10, 11 AND SI02-6 WERE DESTROYED**



SITE PLAN
1:2000

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PEACE REGION (PEACE RIVER DISTRICT)

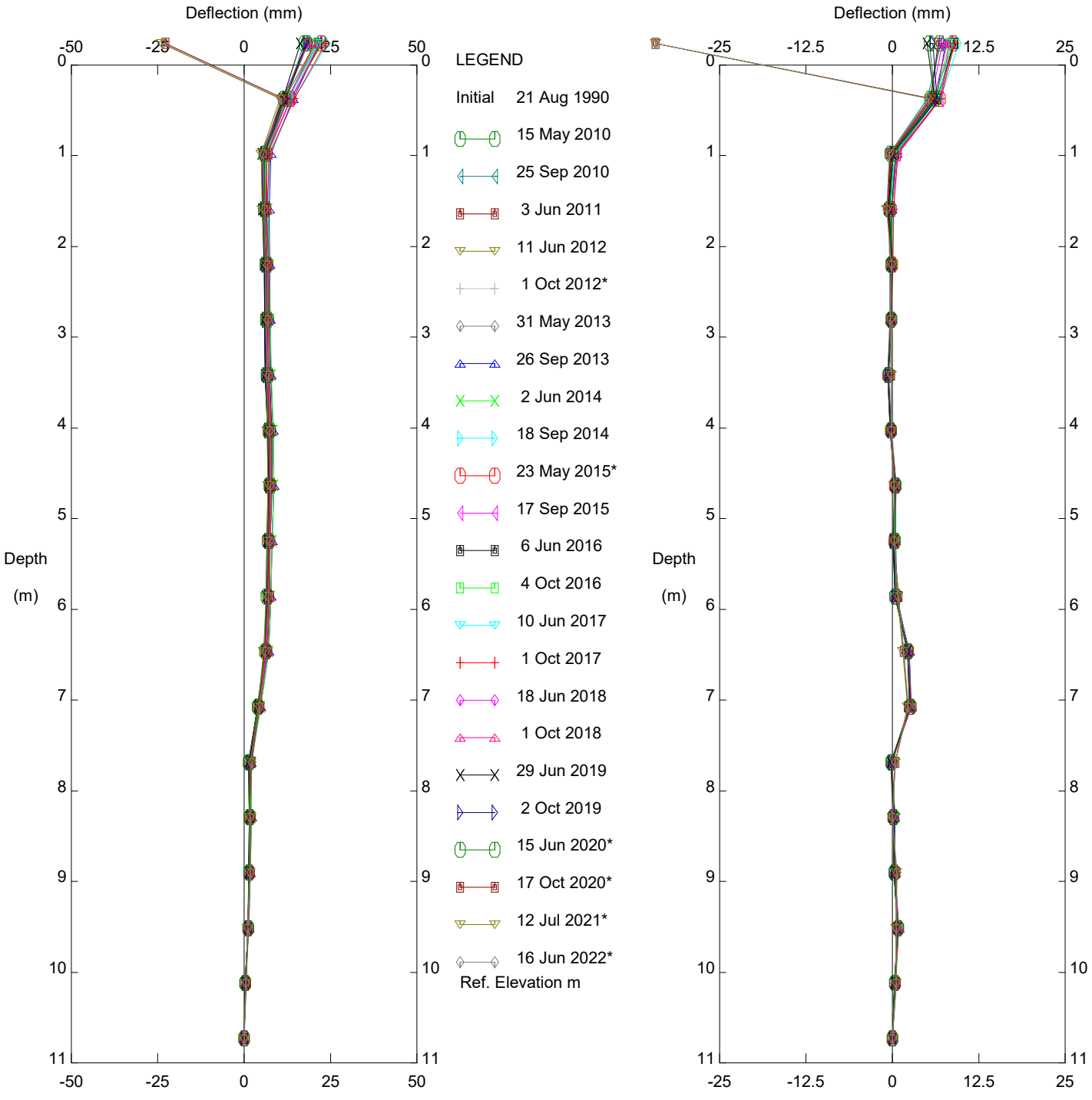
PH006: HWY697:02 - TOMPKINS LANDING SLIDE INSTRUMENTATION LOCATIONS

DWG No. 32121-PH006

DRAWN BY	ML
DESIGNED BY	BWN
APPROVED BY	DWP
SCALE	AS SHOWN
LAST UPDATED	JULY 2022
FILE No.	32121

THURBER ENGINEERING LTD.

Thurber Engineering Ltd.



Cumulative Deflection

Direction A

Incremental Deflection

Direction A

HWY 697:02 - STA. 17+360, Inclinometer SI-1

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Sets marked * include zero shift and/or rotation corrections.

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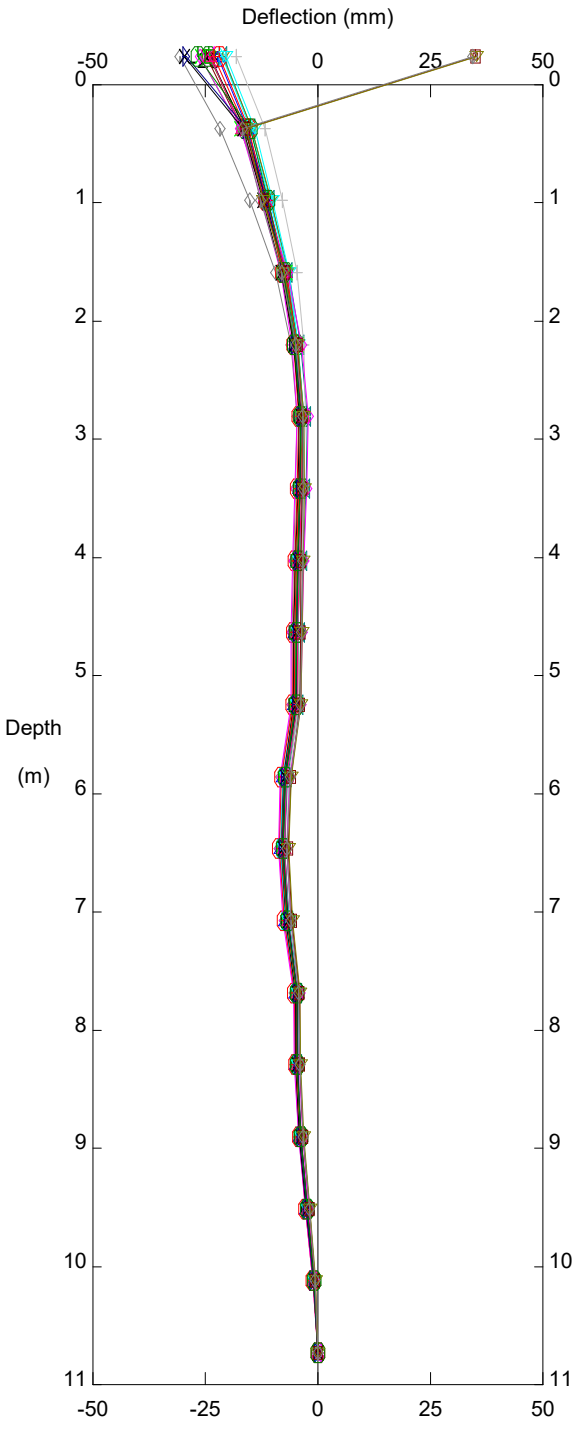

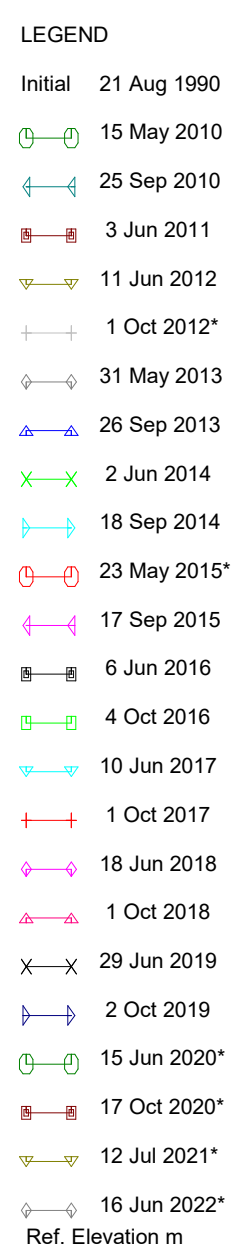

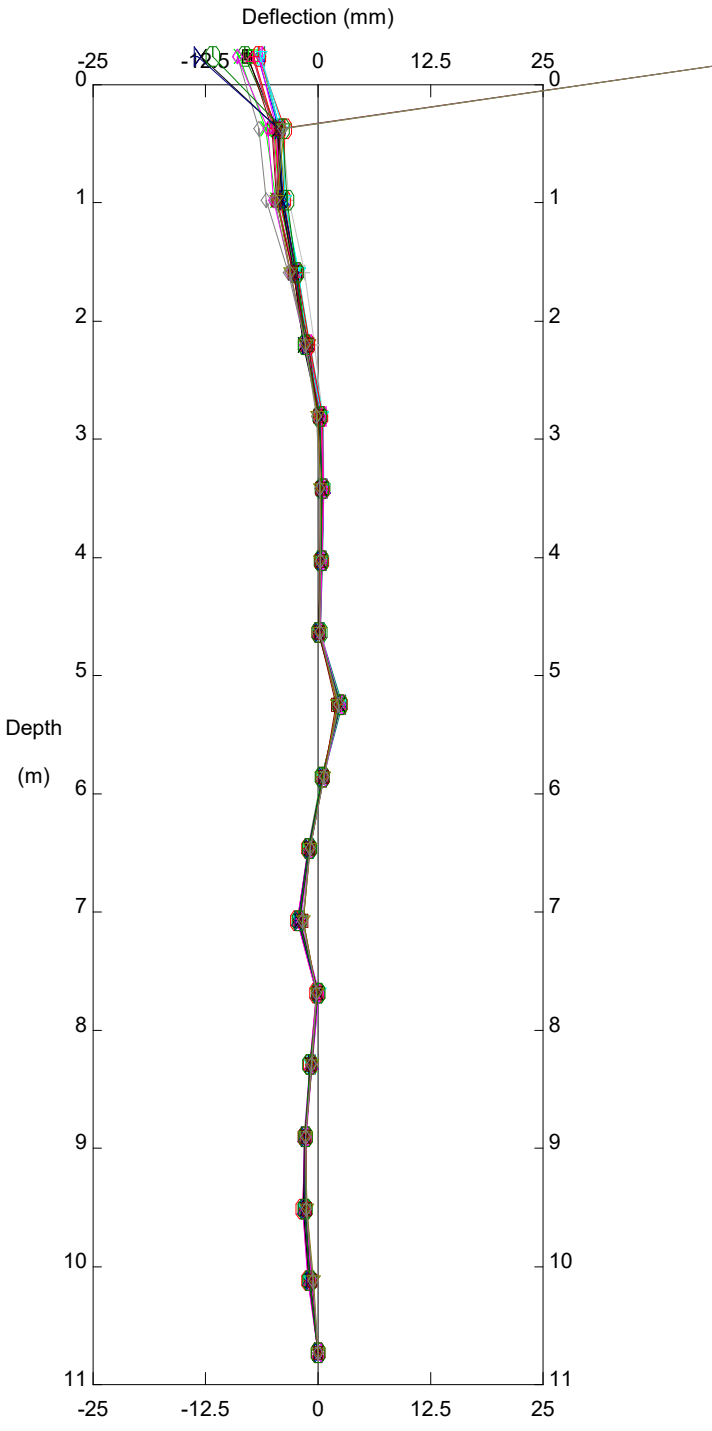

Cumulative Deflection

Direction B

Incremental Deflection

Direction B

HWY 697:02 - STA. 17+360, Inclinometer SI-1

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Sets marked * include zero shift and/or rotation corrections.

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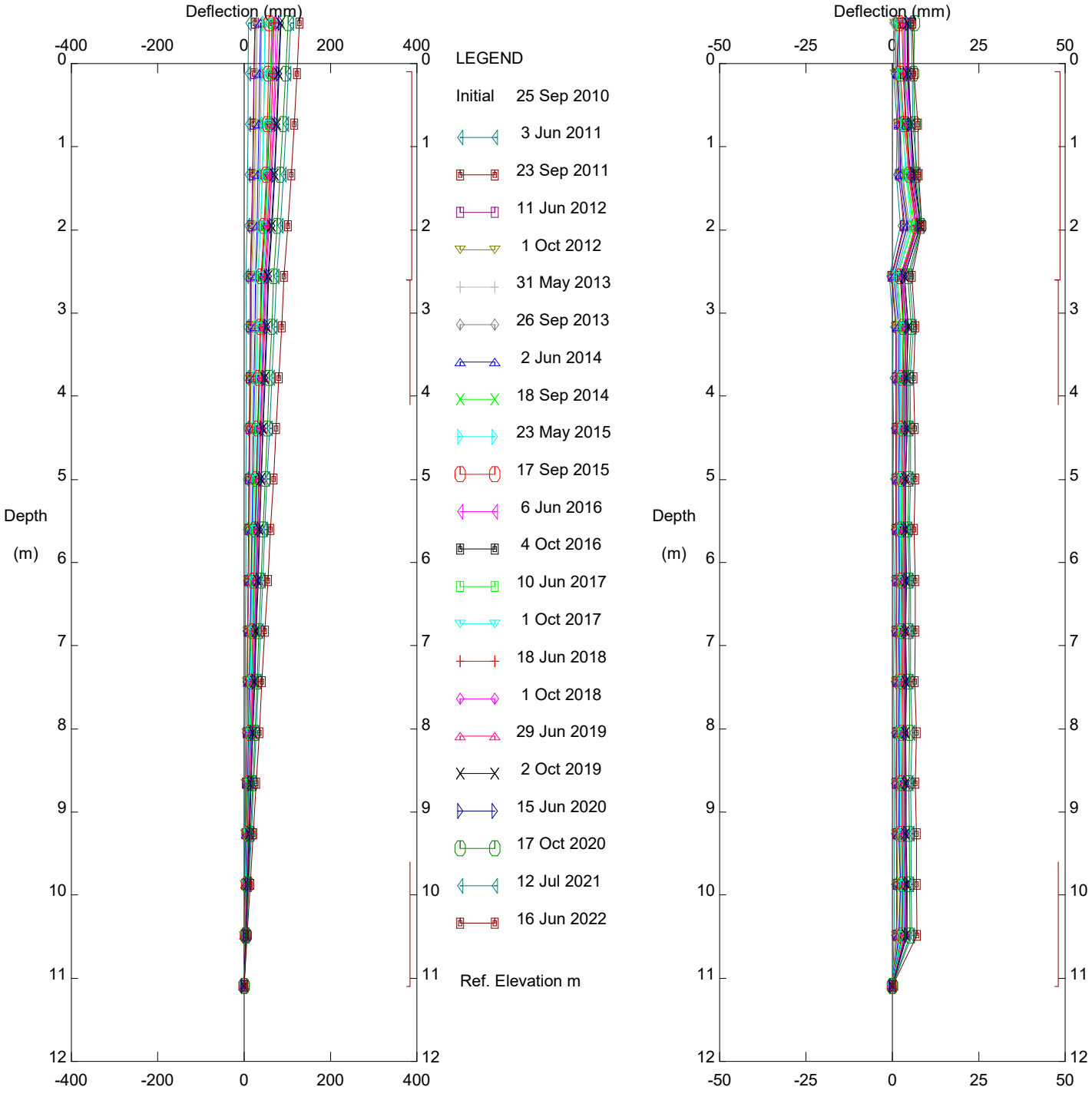

Cumulative Deflection

Direction A

Incremental Deflection

Direction A

HWY 697:02 - STA. 17+360, Inclinometer SI-5

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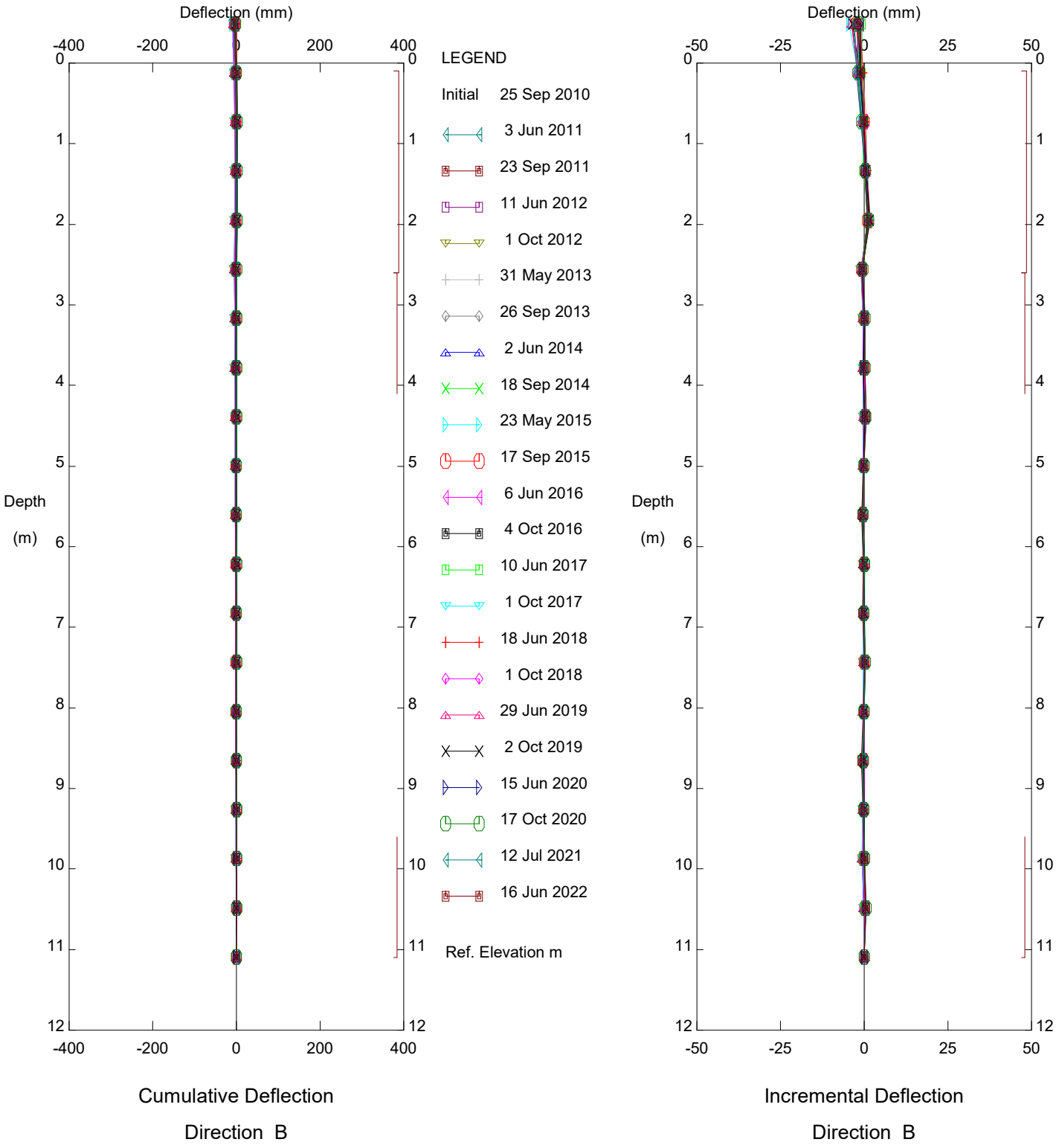

Cumulative Deflection

Direction B

Incremental Deflection

Direction B

HWY 697:02 - STA. 17+360, Inclinometer SI-5

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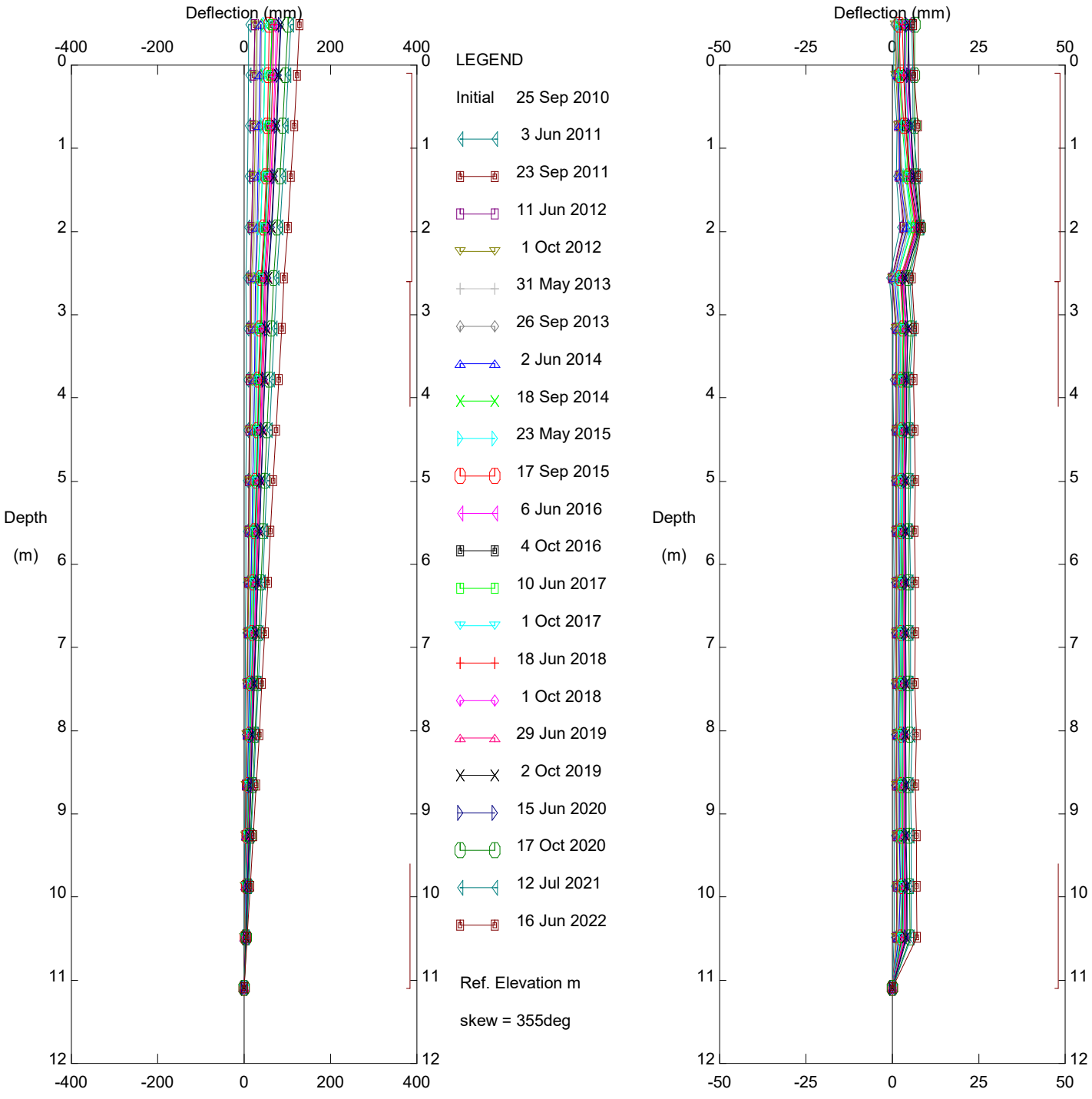

Cumulative Deflection

Direction X

Incremental Deflection

Direction X

HWY 697:02 - STA. 17+360, Inclinometer SI-5

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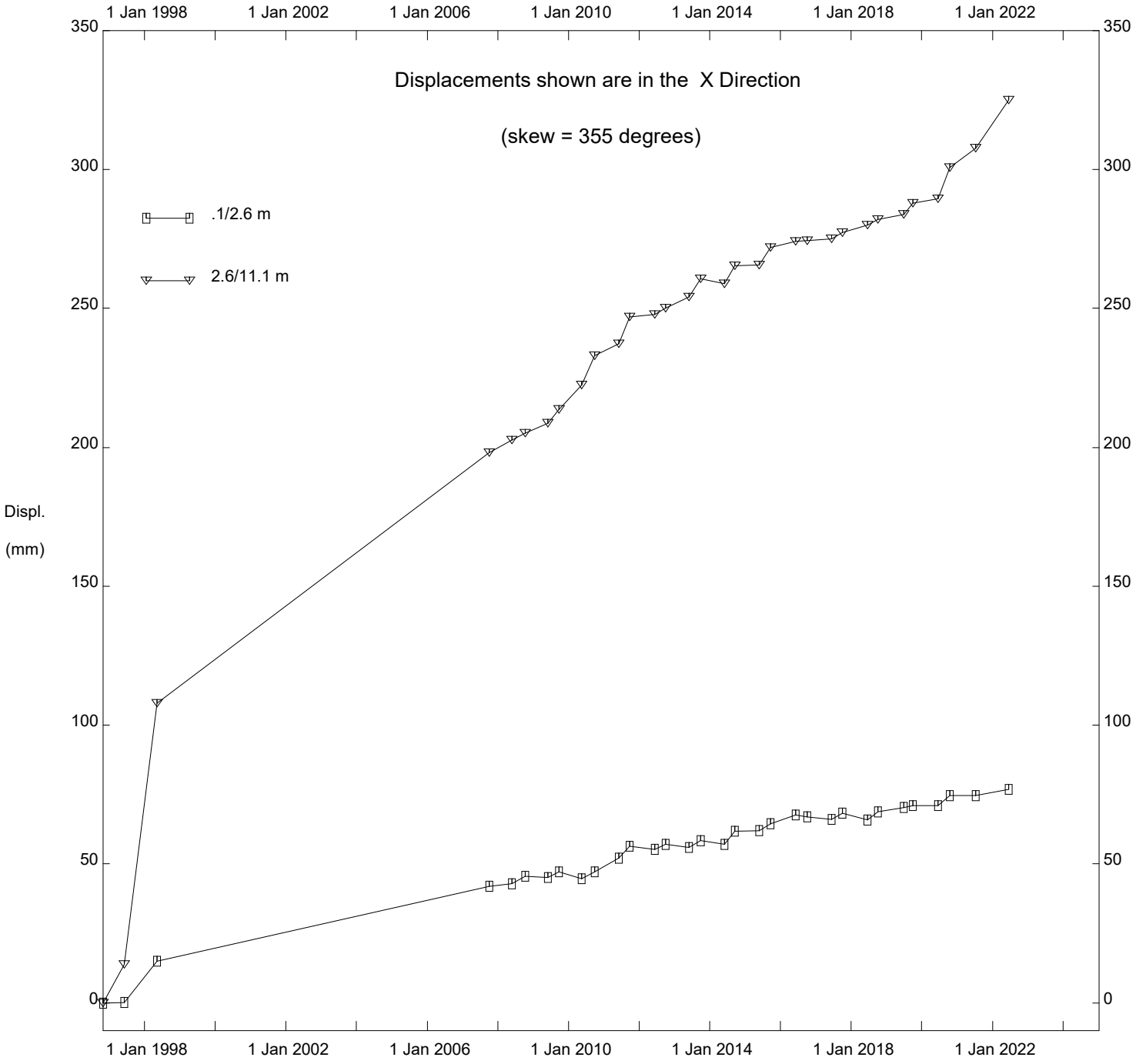
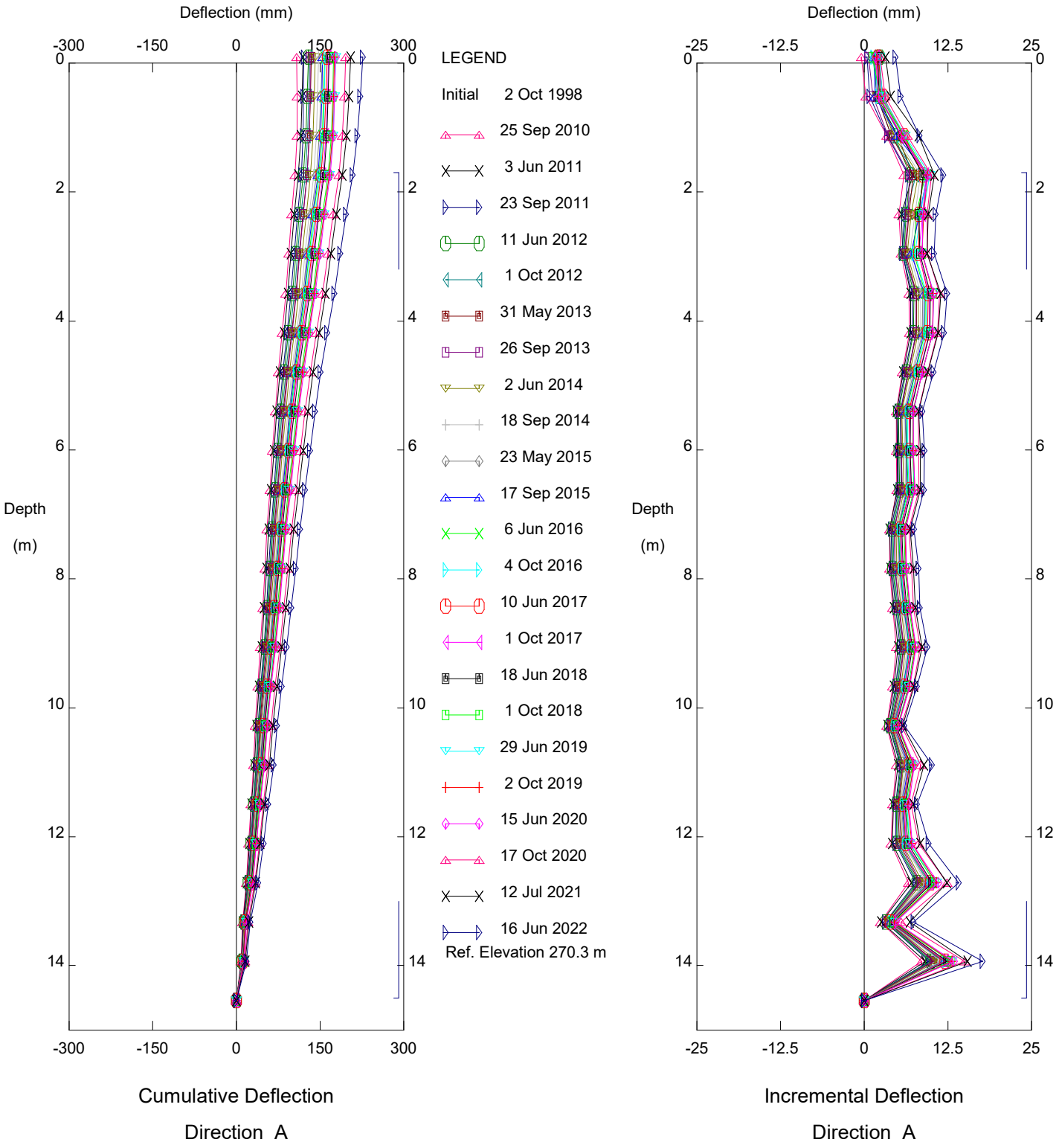
Thurber Engineering Ltd.



HWY 697:02 - STA. 17+360, Inclinometer SI-5

Alberta Transportation

Thurber Engineering Ltd.



Cumulative Deflection

Direction A

Incremental Deflection

Direction A

HWY 697:02 - STA. 17+360, Inclinometer SI-13

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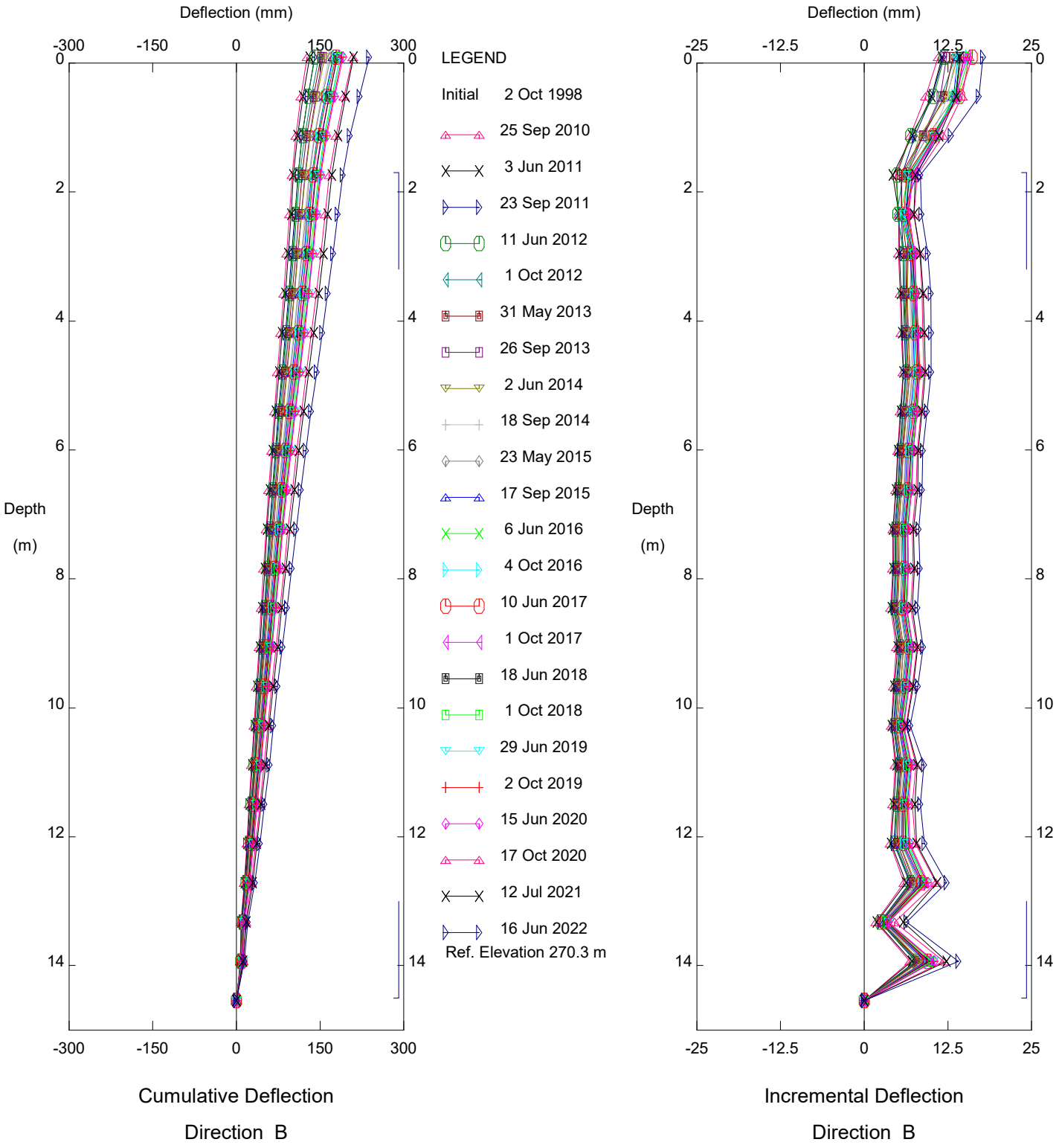
Thurber Engineering Ltd.



Cumulative Deflection

Direction B

Incremental Deflection

Direction B

HWY 697:02 - STA. 17+360, Inclinometer SI-13

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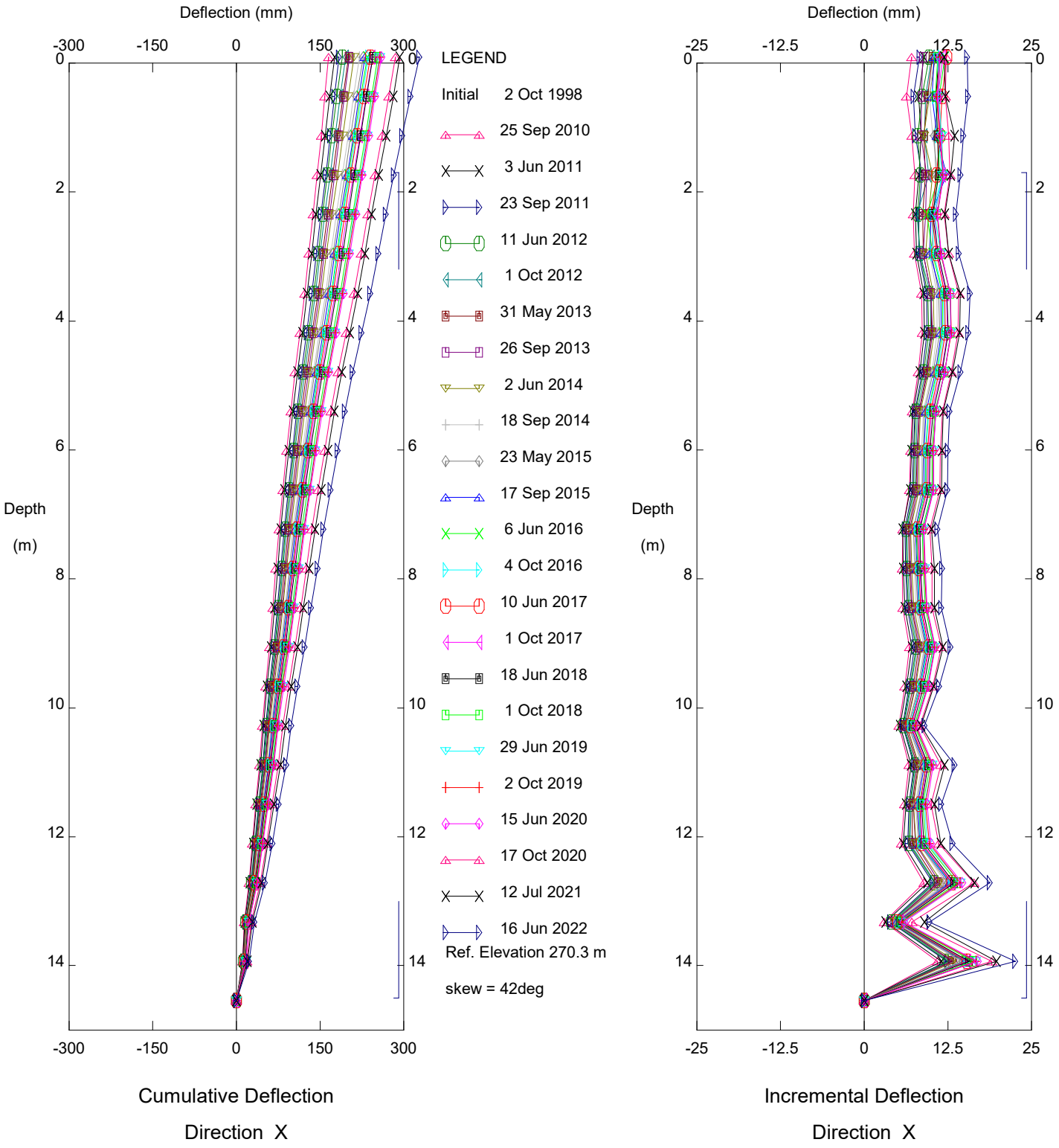
Thurber Engineering Ltd.



Cumulative Deflection

Direction X

Incremental Deflection

Direction X

HWY 697:02 - STA. 17+360, Inclinometer SI-13

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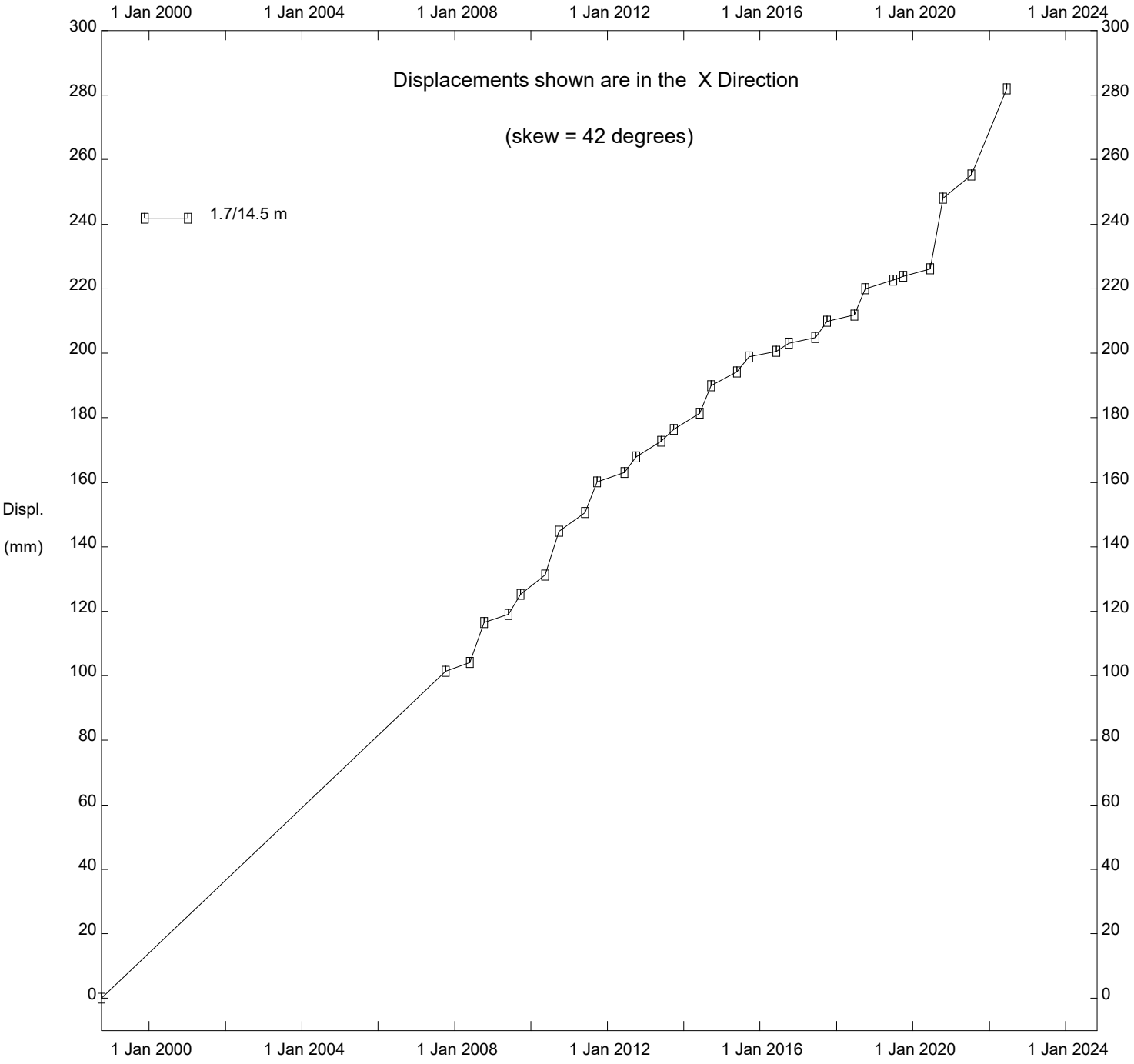
Thurber Engineering Ltd.



HWY 697:02 - STA. 17+360, Inclinometer SI-13

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FIGURE PH006-1
PIEZOMETER DATA FOR HWY 697:02 TOMPKINS LANDING