THURBER ENGINEERING LTD.

July 26, 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 PH045: HWY 35:08, MEIKLE RIVER (km 26.2 PILE WALL)

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

Repairs were carried out at the Hwy 35:08 Meikle River Pile Wall site in 2016 after the spring instrument readings. The repairs consisted of installing steel H-piles and timber lagging against the downslope side of the wall to retain fillcrete placed to fill the voids that had developed under and behind (upslope) of the pile wall.

Three slope inclinometers (SI-49, 50 and 51) were read at the Meikle River Pile Wall site on June 16, 2022 by Mr. Niraj Regmi, G.I.T., and Mr. Jayden Del Cid, both of Thurber Engineering Ltd.

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 casings.

2. DATA PRESENTATION

2.1 General

SI plots for A and B directions are included in in Appendix A. Where movement has been recorded the resultant plot (X direction, if applicable) and rate of movement have also been provided.

2.2 Zones of Movement

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

Zones of movements are summarized in Table PH045-1 below. Table PH045-1 also provides a historical account of the total movement, the depth of movement and the maximum rate of movement that has occurred in the SIs since initialization.

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TABLE PH045-1
SPRING 2022 – MEIKLE RIVER (KM 26.2 PILE WALL)
SLOPE INCLINOMETER INSTRUMENTATION READING SUMMARY

Date Monitored: June 16, 2022

INSTRUMENT #	DATE INITIALIZED	TOTAL CUMULATIVE RESULTANT MOVEMENT AT NOTED DEPTH SINCE INITIAL READING (mm)	MAXIMUM RATE OF MOVEMENT (mm/yr)	CURRENT STATUS	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-49	Dec. 15, 1997	155.3 mm over 1.5 m to 14.3 m depth in 216° direction	15.2 mm/y In June 1999	Operational	July 12, 2021	5.4	5.7	0.9
SI-50	Dec. 15, 1997	160.0 mm over 1.7 m to 13.9 m depth in 241° direction	14.2 mm/yr in Sept. 2011	Operational	July 12, 2021	4.1	4.4	1.5
SI-51	Dec. 15, 1997	73.3 mm over 1.8 m to 12.2 m depth in 267° direction	48.8 mm/yr In May 1998	Operational	July 12, 2021	2.6	2.8	6.9

Drawing 32121-PH045 in Appendix A provides a sketch of the approximate location of the monitoring instrumentation for this site.

3. INTERPRETATION OF MONITORING RESULTS

Slope inclinometers SI-49, 50, and 51 were installed inside the pile wall along the shoulder of the highway. The movement zones for the slope inclinometers installed in the piles are defined over the length of the pile and waler.

Since the spring of 2021 readings, slope inclinometer SI-49 showed a rate of movement of 5.7 mm/yr over 1.5 m to 14.3 m depth with a total cumulative deflection to date of 155.3 mm. Although this rate is slightly slower than overall rate (since initialization) of 6.3 mm/year, the trend has been steady. SI-50 showed a rate of movement of 4.4 mm/yr over 1.7 m to 13.9 m depth since the spring of 2021 readings with a total cumulative movement to date of 160.0 mm. This rate is slower than the overall rate of 6.5 mm/year but there are indications that the movement rate has accelerated slightly since Spring 2020. SI-51 showed a rate of movement of 2.8 mm/yr since the spring of 2021 readings with a total cumulative movement to date of 73.3 mm. The rate of movement had been negative over the last two cycles which has also happened in the past. The trend in this inclinometer appears to be inconsistent.

Overall, the movement pattern at SI-49 appears to have been unaffected by the repairs undertaken in 2016. SI-50 showed a marked reduction in movement rate and SI-51 is somewhat inconclusive due to the irregular movement trends.

4. RECOMMENDATIONS

4.1 Future Work

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

4.2 Instrumentation Repairs

No instrumentation repairs are required at this time.

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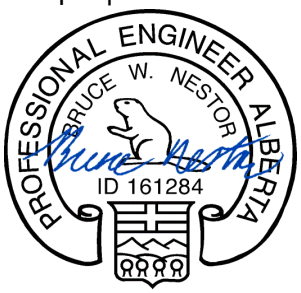
5. CLOSURE

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-PH045)
  - SI Reading Plots

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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 PH045: HWY 35:08, MEIKLE RIVER (km 26.2 PILE WALL)

ALBERTA TRANSPORTATION
PEACE REGION (PEACE RIVER DISTRICT)
INSTRUMENTATION MONITORING FIELD SUMMARY (PH045)
SPRING 2022

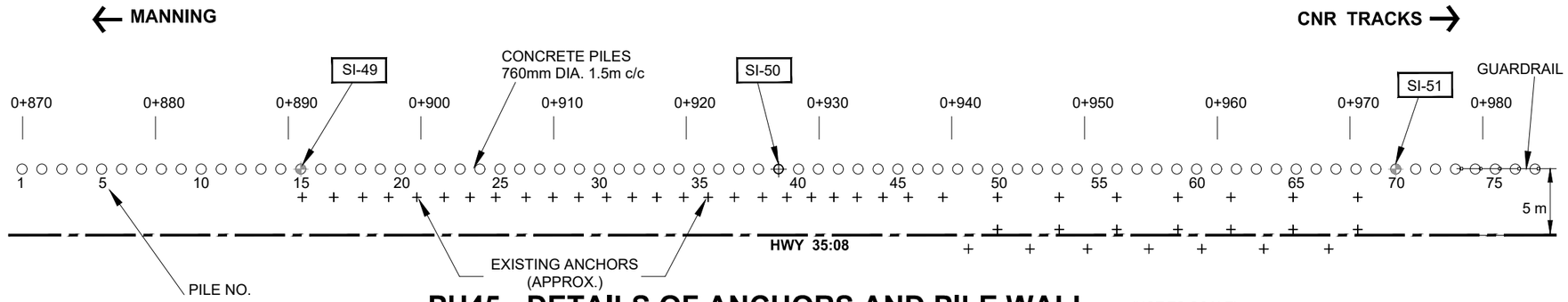
Location:	Meikle River Retaining Wall (HWY 35:08 C1 26.266)	**Readout:**	
File Number:	32121	**Casing Size:**	3.34
Probe:	RST set 5R & 8R	**Temp:**	23
Cable:	RST set 5R & 8R	**Read by:**	NKR/JD

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-49	467580.75	6333080.85	16-Jun-22	0.37	78 to 2	215°	111	-99	90	-86	8R/8R	
SI-50	467545.56	6333099.72	16-Jun-22	0.10	76 to 2	225°	80	-63	238	-232	8R/8R	**
SI-51	467545.72	6333120.09	16-Jun-22	0.00	70 to 2	145°	175	-219	-312	280	5R/5R	*

INSPECTOR REPORT ON

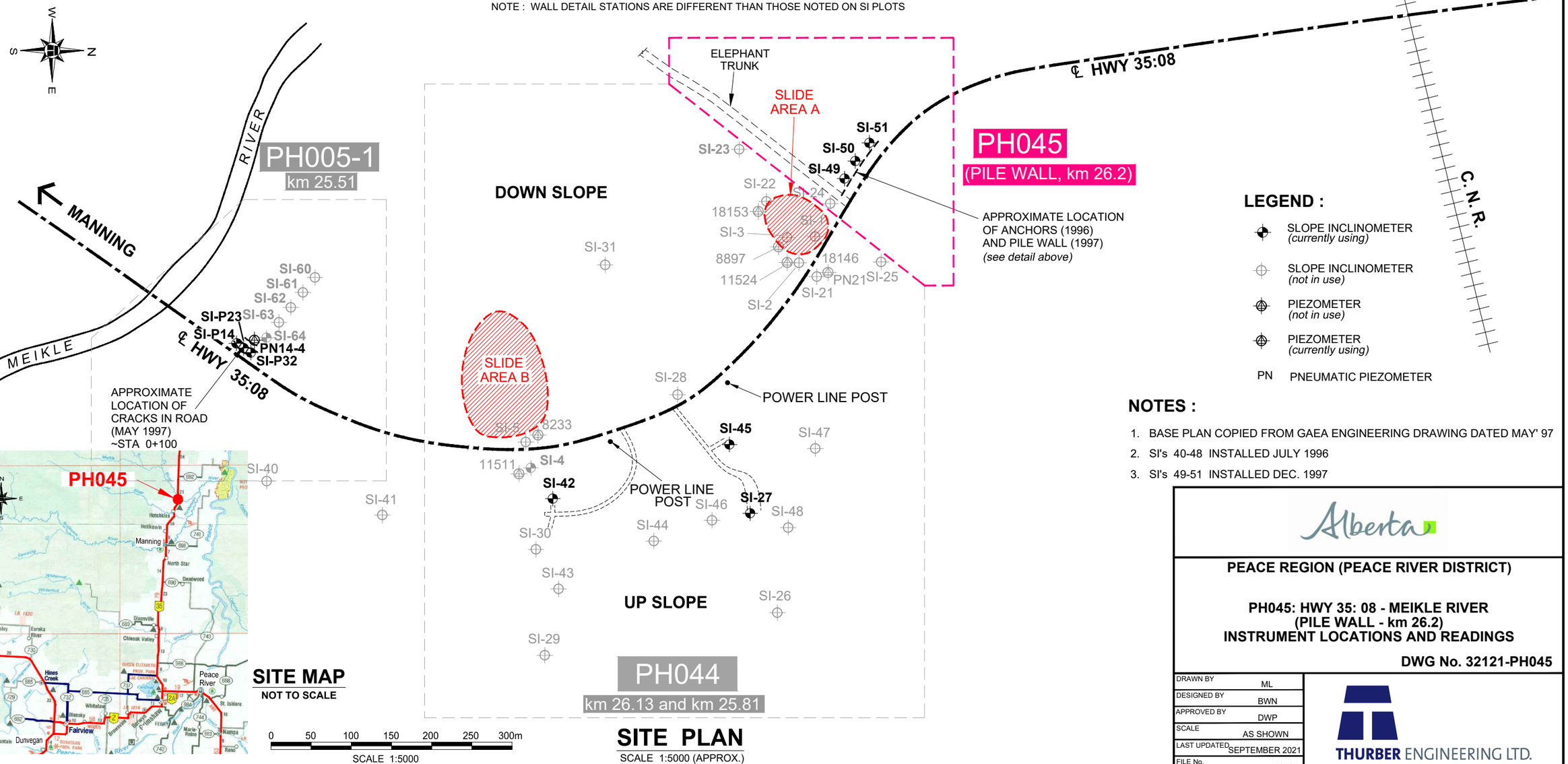
* SI-51 probe comes to surface not in grooves, may be damaged at 2 feet depth. Top of casing damaged
** SI-50 - top of SI slightly damaged

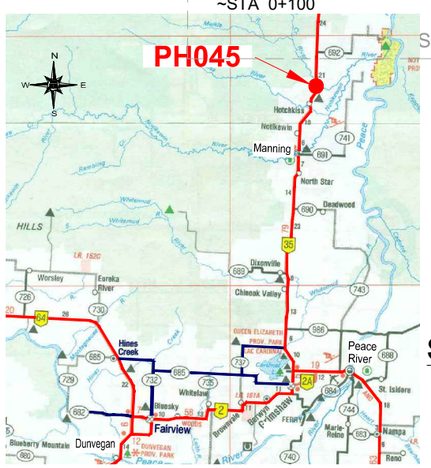


PH45 - DETAILS OF ANCHORS AND PILE WALL

(NOT TO SCALE)

NOTE : WALL DETAIL STATIONS ARE DIFFERENT THAN THOSE NOTED ON SI PLOTS





SITE MAP
NOT TO SCALE

0 50 100 150 200 250 300m
SCALE 1:5000

SITE PLAN
SCALE 1:5000 (APPROX.)

LEGEND :

- SLOPE INCLINOMETER *(currently using)*
- SLOPE INCLINOMETER *(not in use)*
- PIEZOMETER *(not in use)*
- PIEZOMETER *(currently using)*
- PN PNEUMATIC PIEZOMETER

NOTES :

1. BASE PLAN COPIED FROM GAEA ENGINEERING DRAWING DATED MAY' 97
2. SI's 40-48 INSTALLED JULY 1996
3. SI's 49-51 INSTALLED DEC. 1997

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PEACE REGION (PEACE RIVER DISTRICT)

PH045: HWY 35: 08 - MEIKLE RIVER
(PILE WALL - km 26.2)
INSTRUMENT LOCATIONS AND READINGS

DWG No. 32121-PH045

DRAWN BY	ML
DESIGNED BY	BWN
APPROVED BY	DWP
SCALE	AS SHOWN
LAST UPDATED	SEPTEMBER 2021
FILE No.	32121

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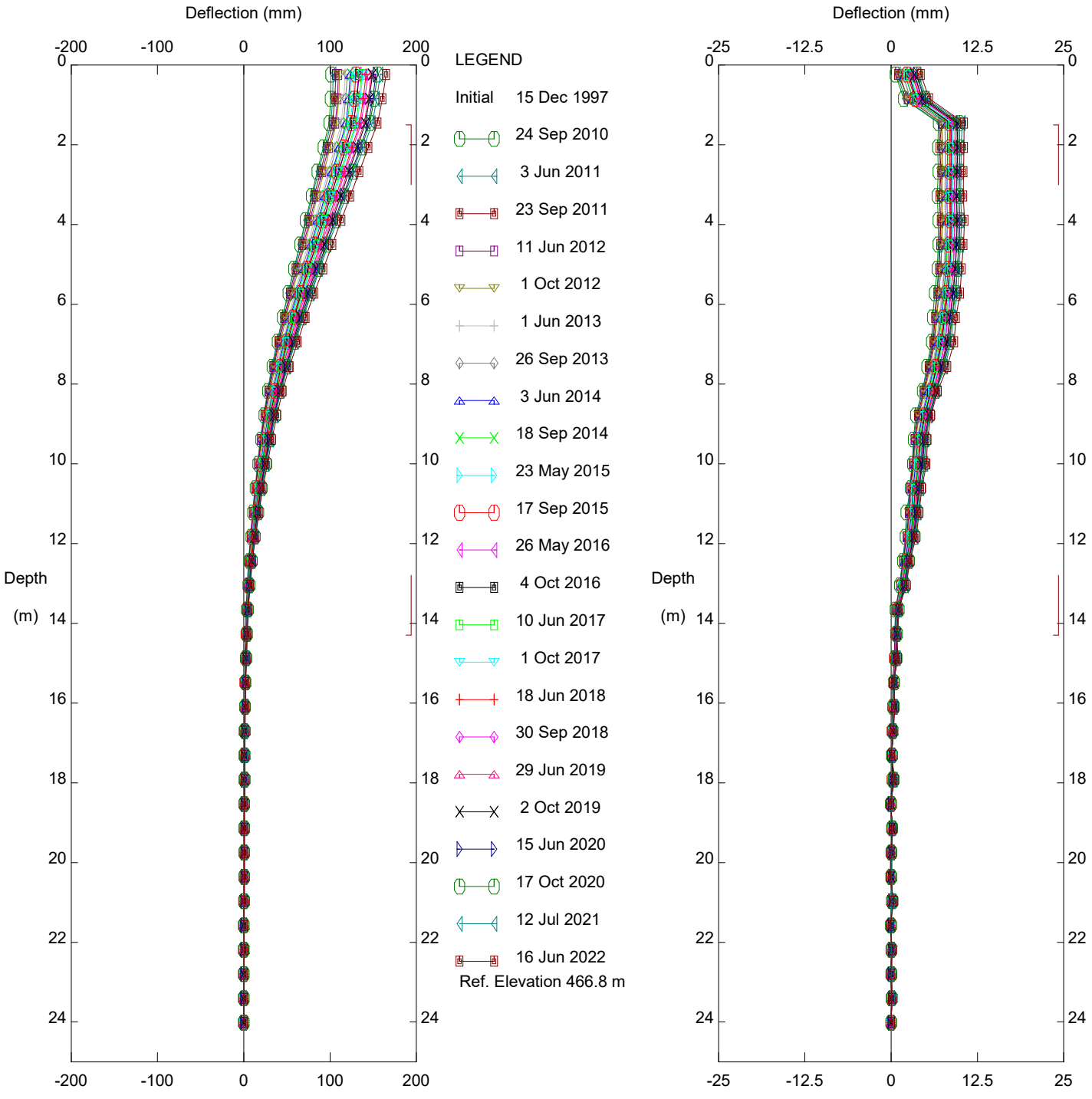

Cumulative Deflection

Direction A

Incremental Deflection

Direction A

HWY 35:08 (PH045), Inclinometer SI-49

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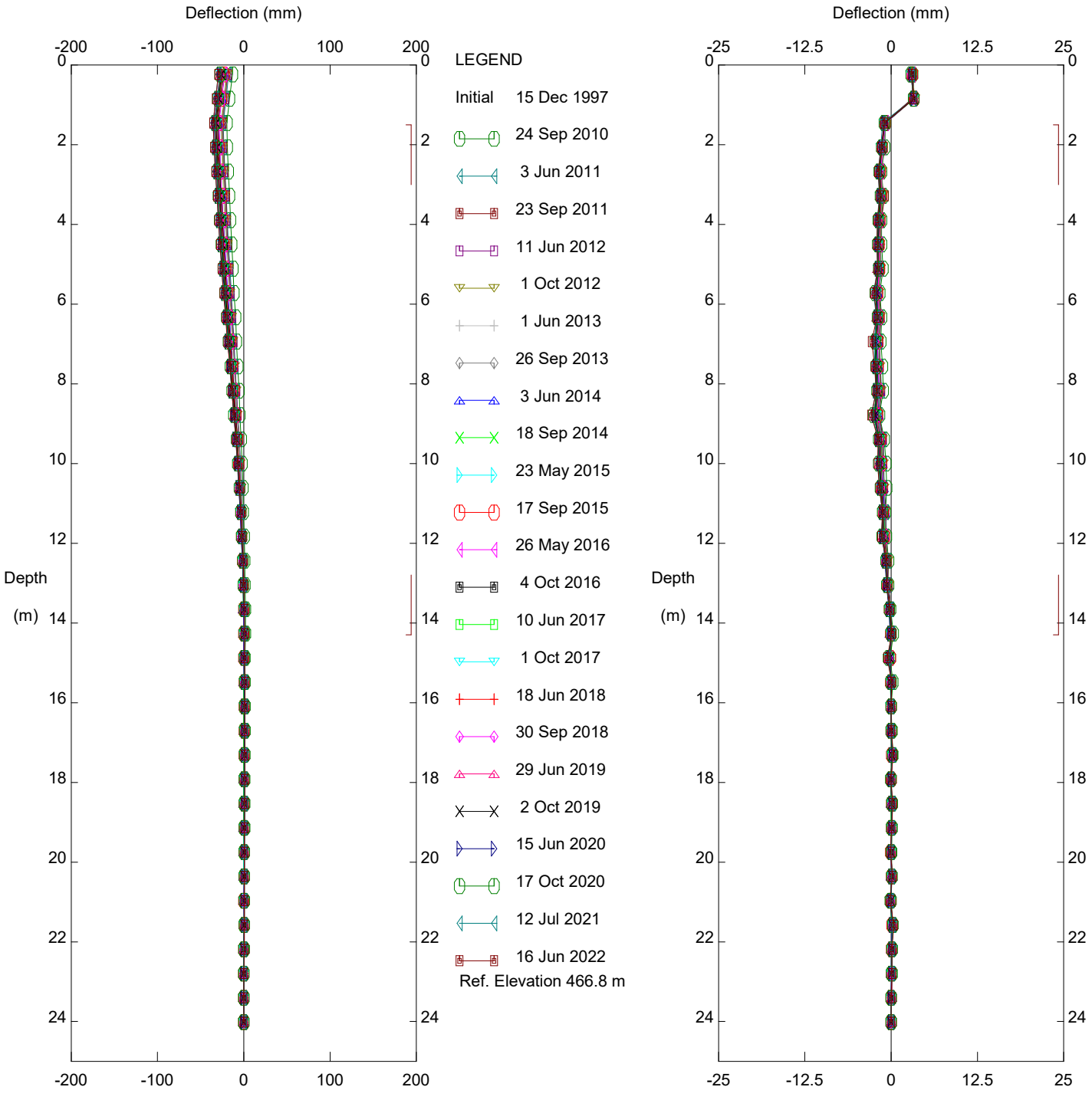

Cumulative Deflection

Direction B

Incremental Deflection

Direction B

HWY 35:08 (PH045), Inclinometer SI-49

Alberta Transportation

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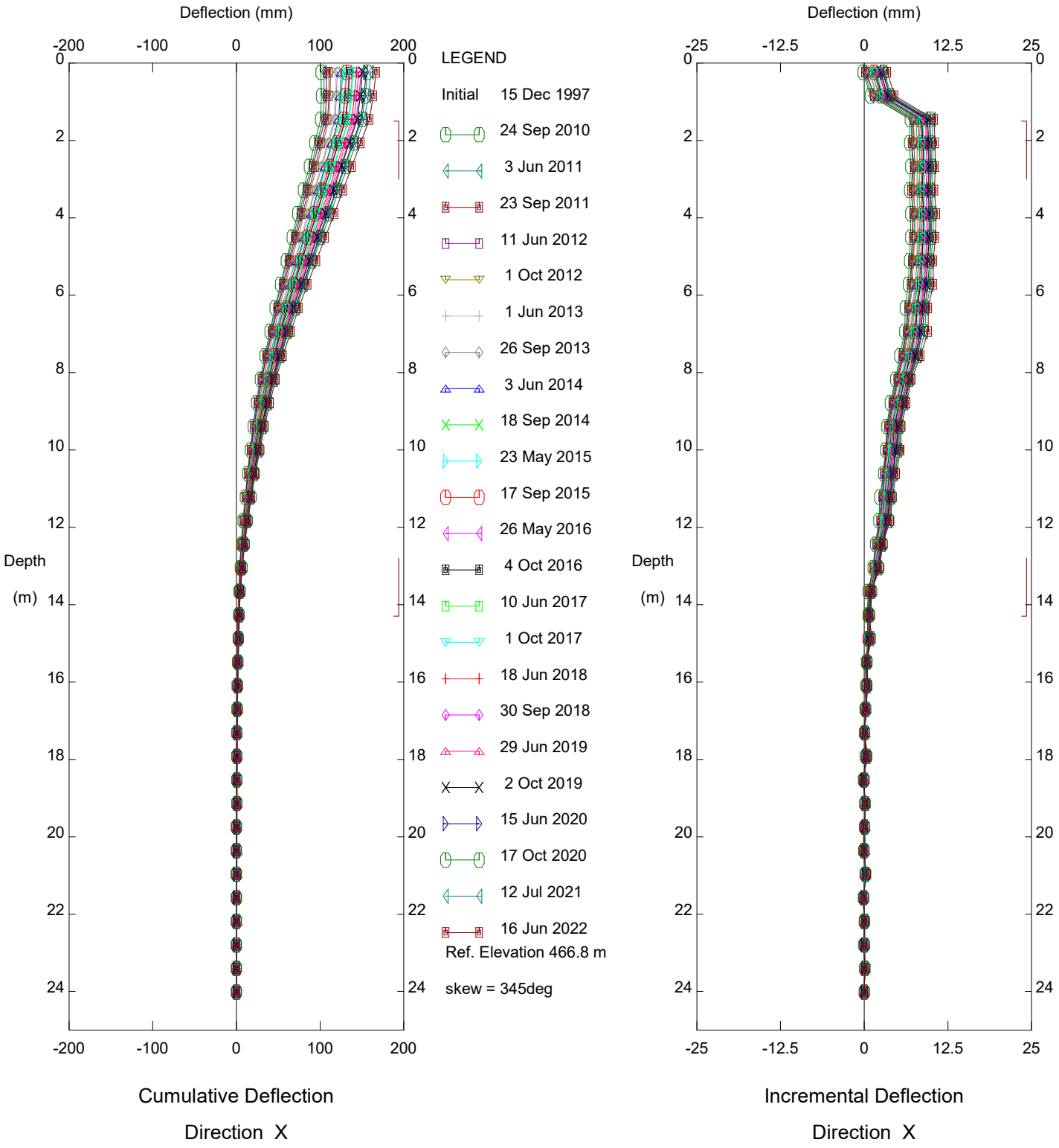
Thurber Engineering Ltd.



Cumulative Deflection

Direction X

Incremental Deflection

Direction X

HWY 35:08 (PH045), Inclinometer SI-49

Alberta Transportation

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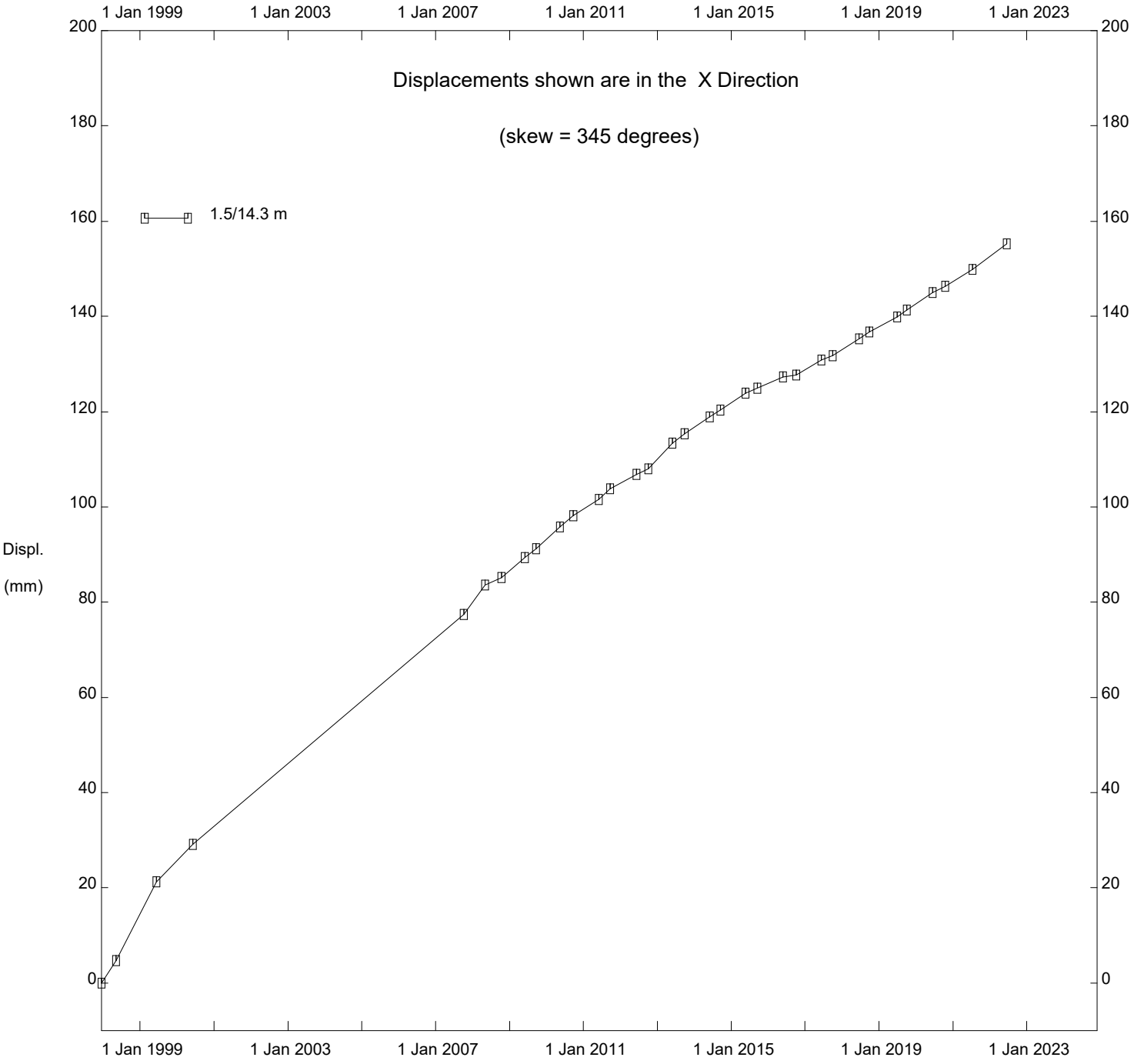

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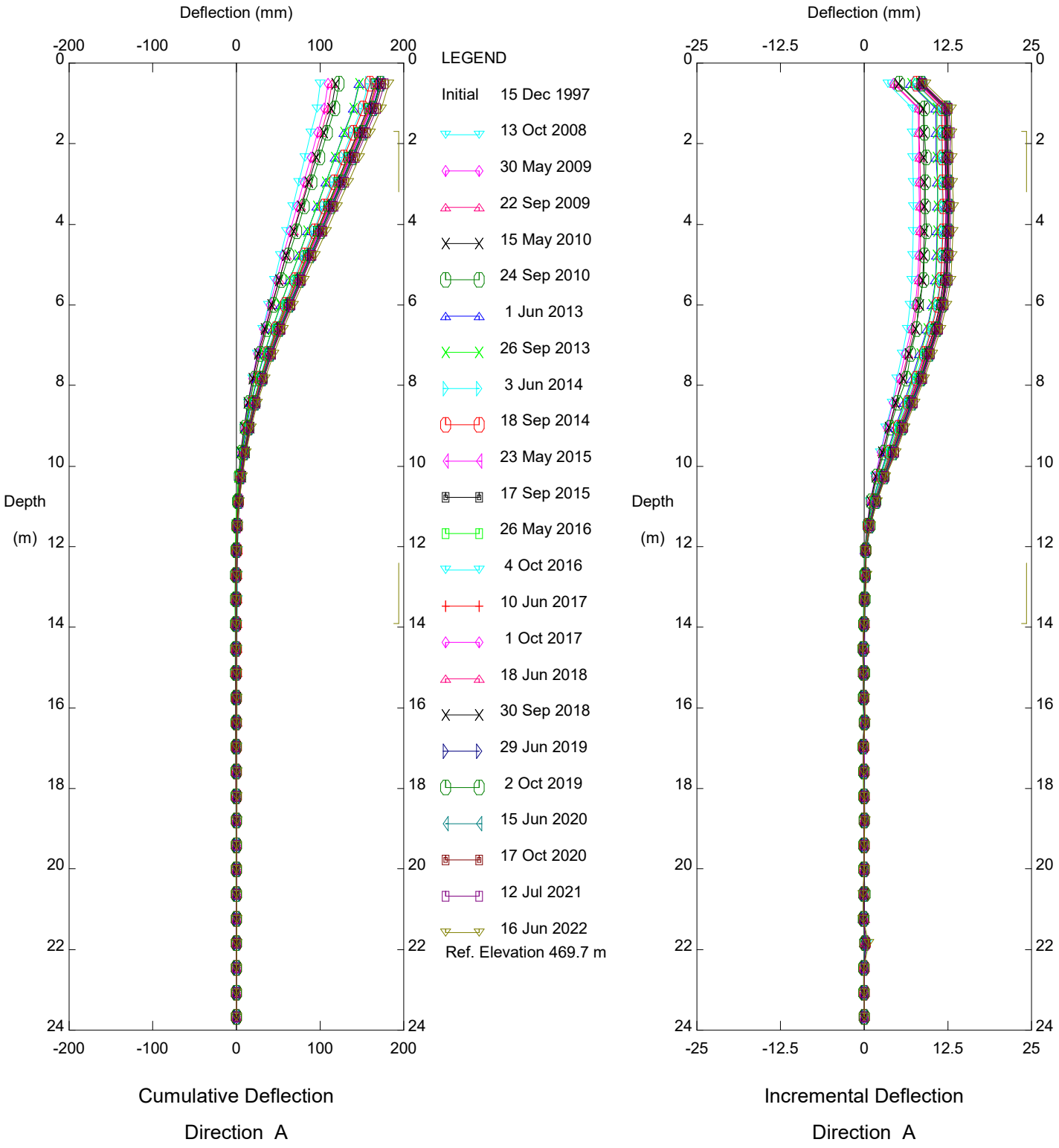
Thurber Engineering Ltd.



Cumulative Deflection

Direction A

Incremental Deflection

Direction A

HWY 35:08 (PH045), Inclinometer SI-50

Alberta Transportation

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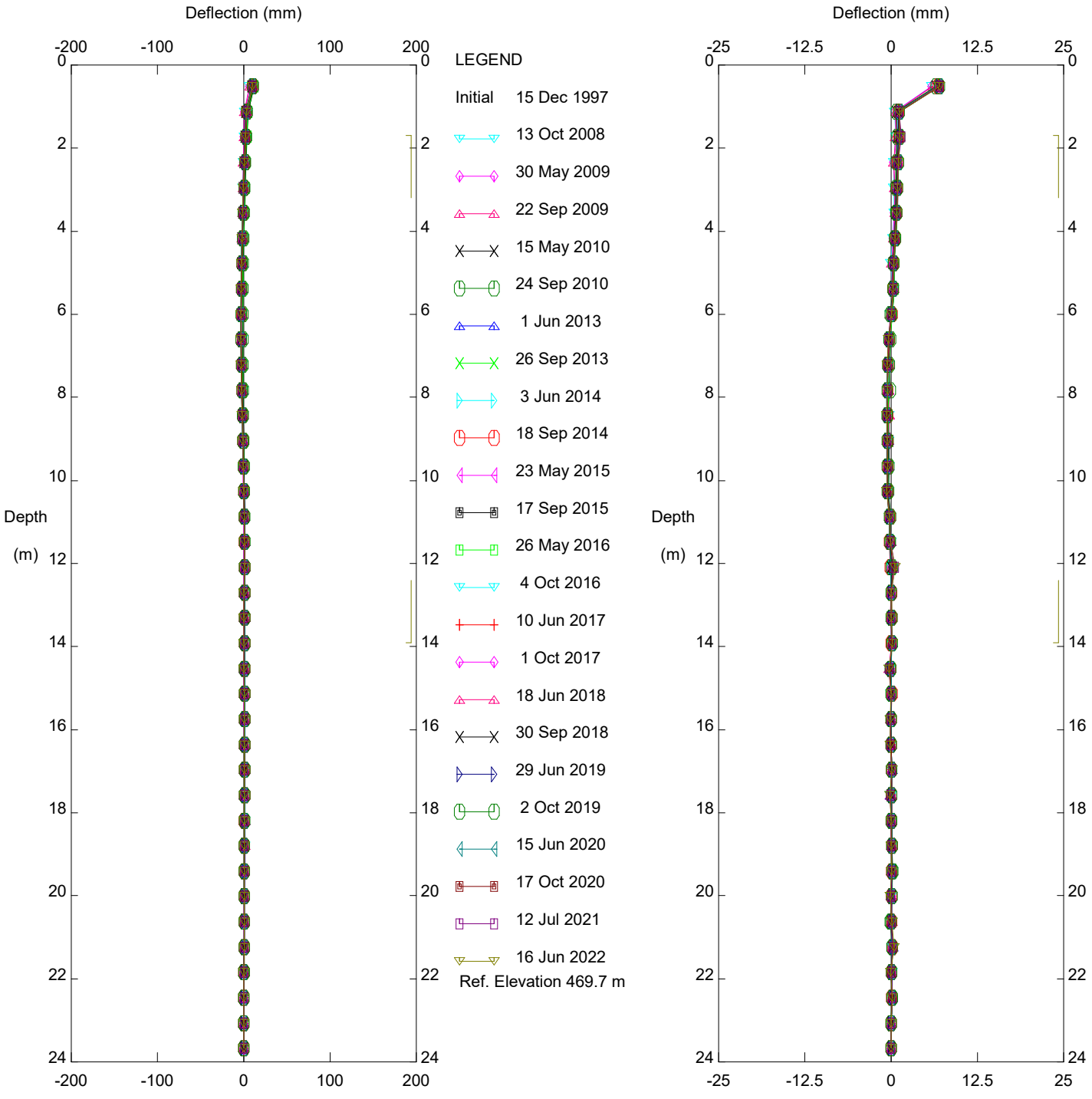

Cumulative Deflection

Direction B

Incremental Deflection

Direction B

HWY 35:08 (PH045), Inclinometer SI-50

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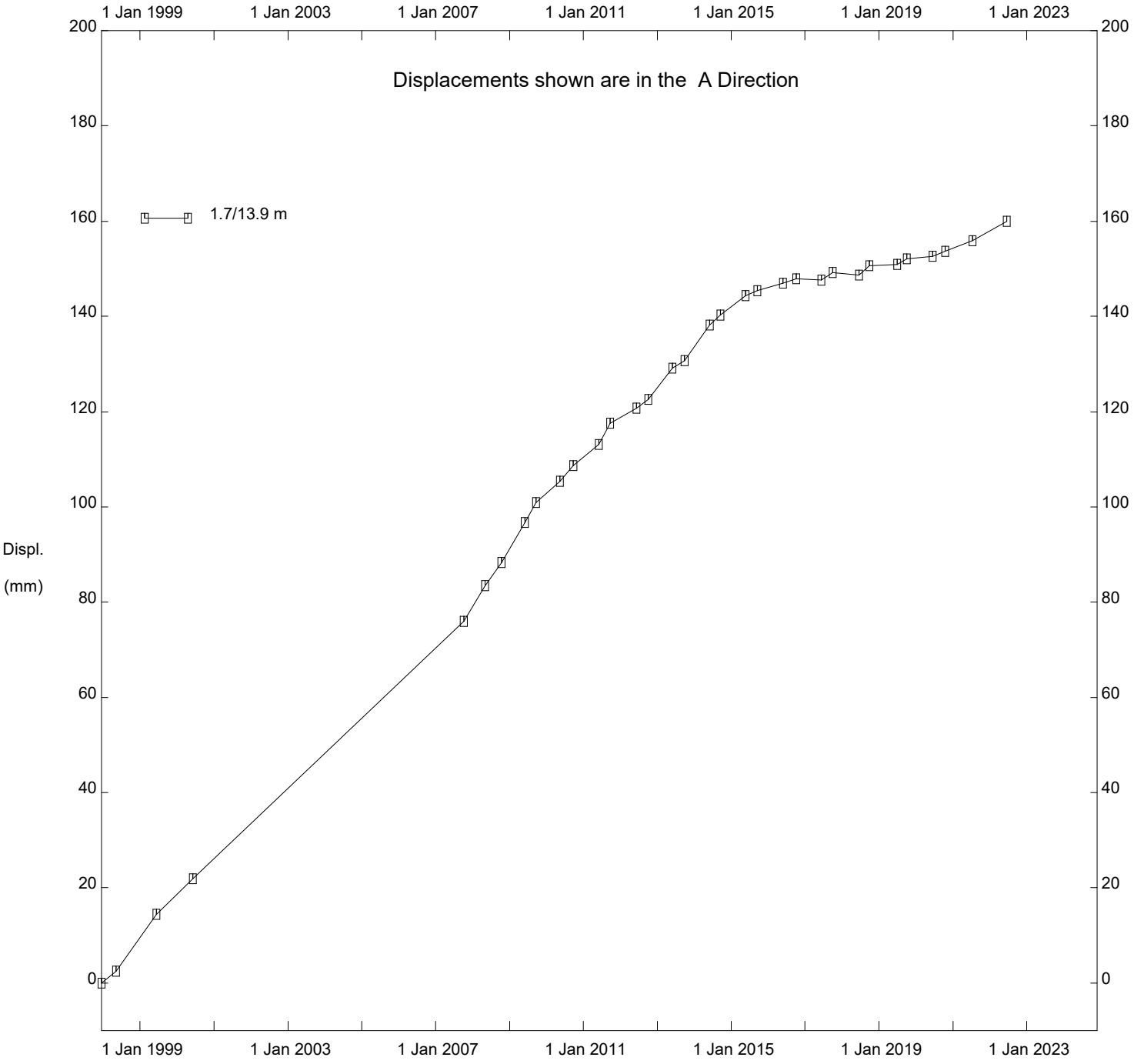

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Alberta Transportation

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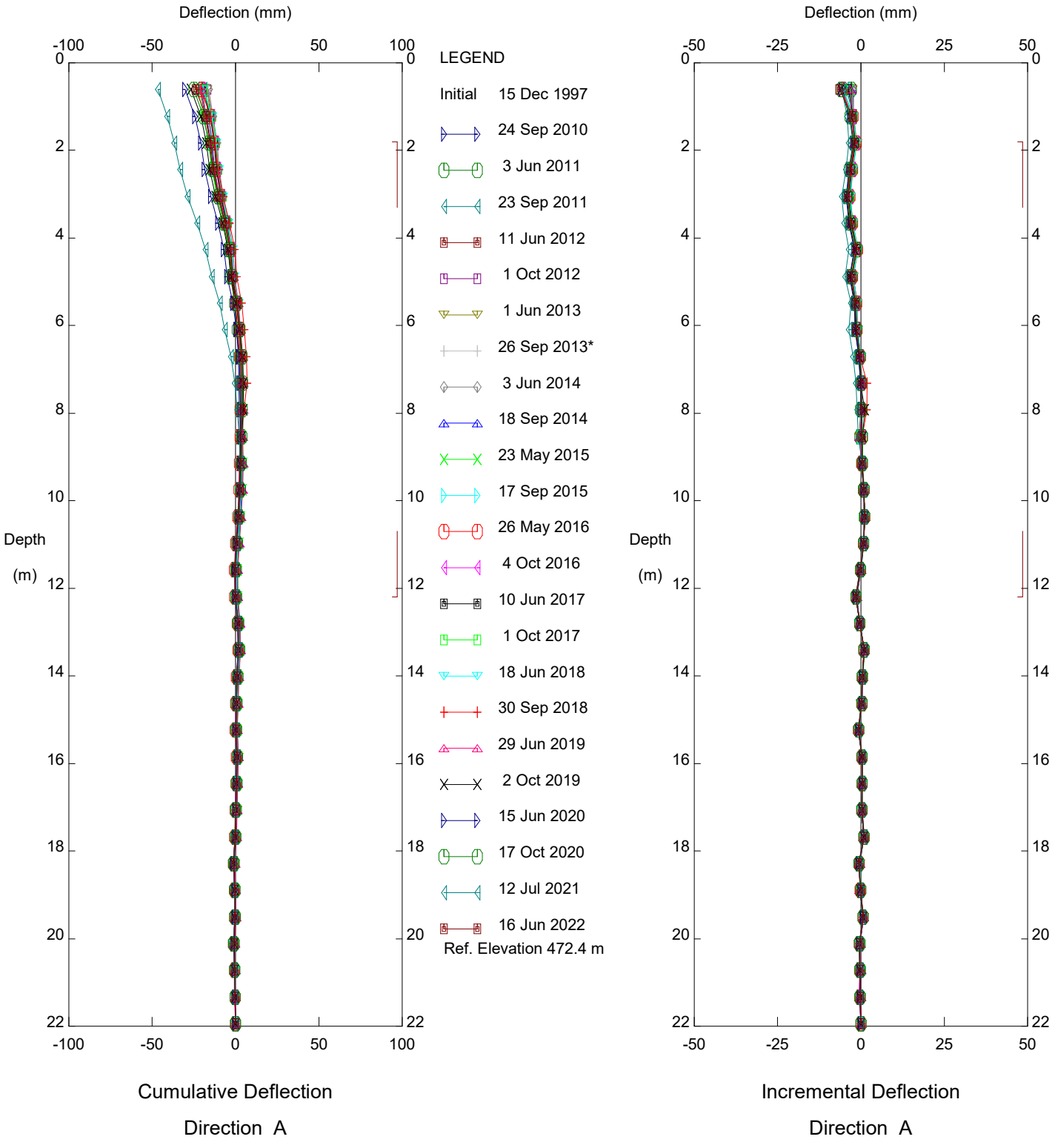

Cumulative Deflection

Direction A

Incremental Deflection

Direction A

HWY 35:08 (PH045), Inclinometer SI-51

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

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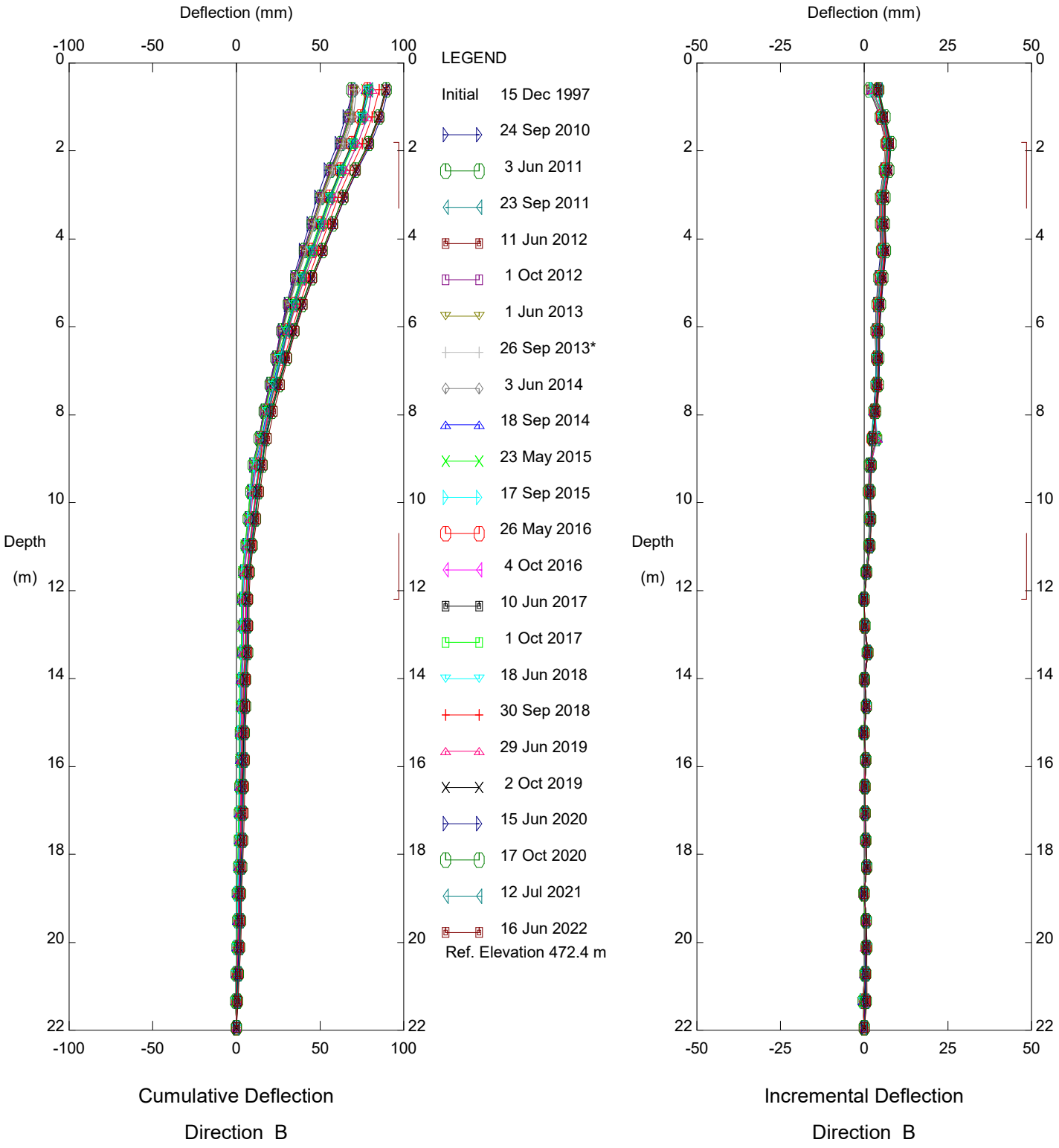
Thurber Engineering Ltd.



Cumulative Deflection

Direction B

Incremental Deflection

Direction B

HWY 35:08 (PH045), Inclinometer SI-51

Alberta Transportation

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

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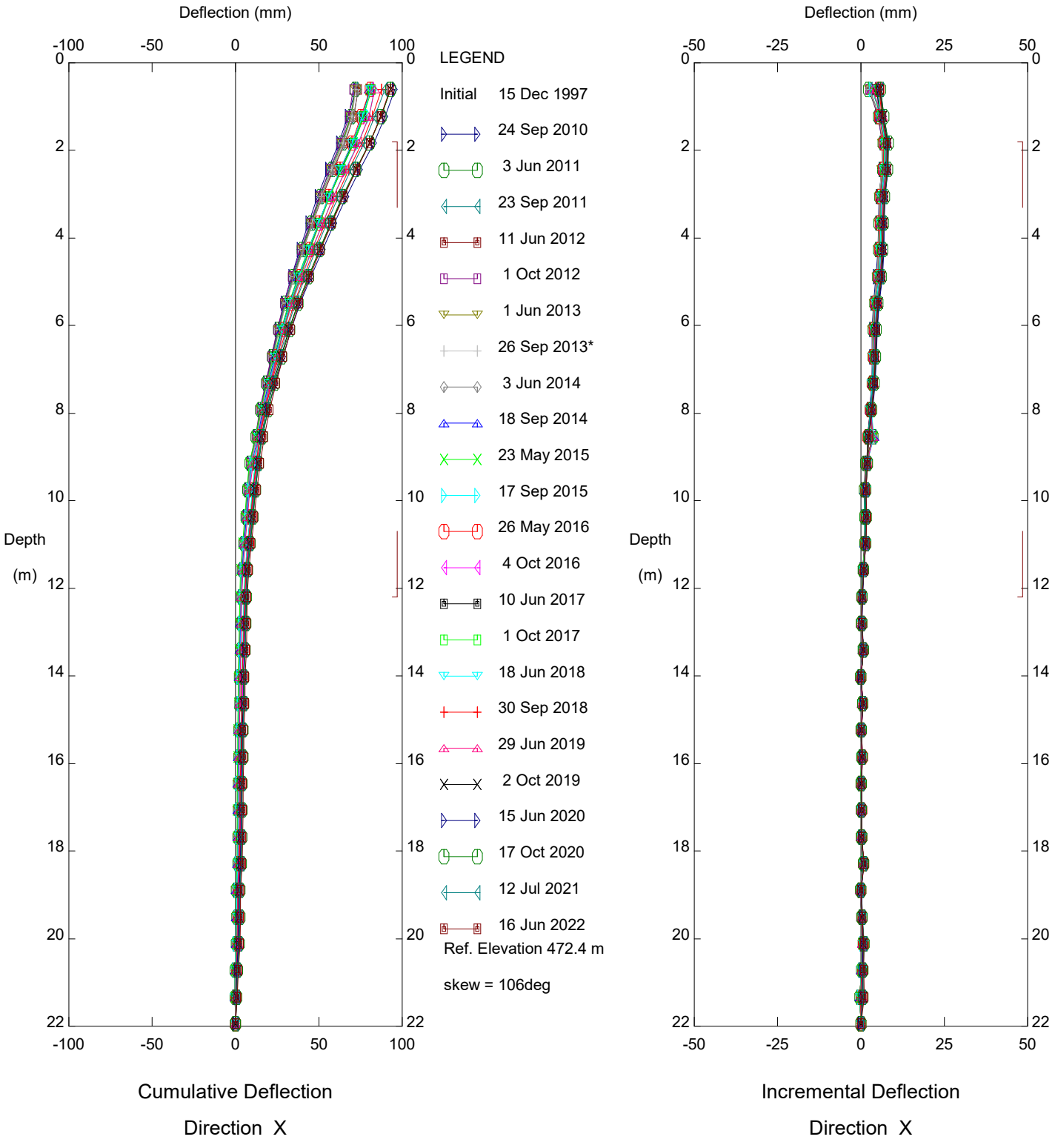

Cumulative Deflection

Direction X

Incremental Deflection

Direction X

HWY 35:08 (PH045), Inclinometer SI-51

Alberta Transportation

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

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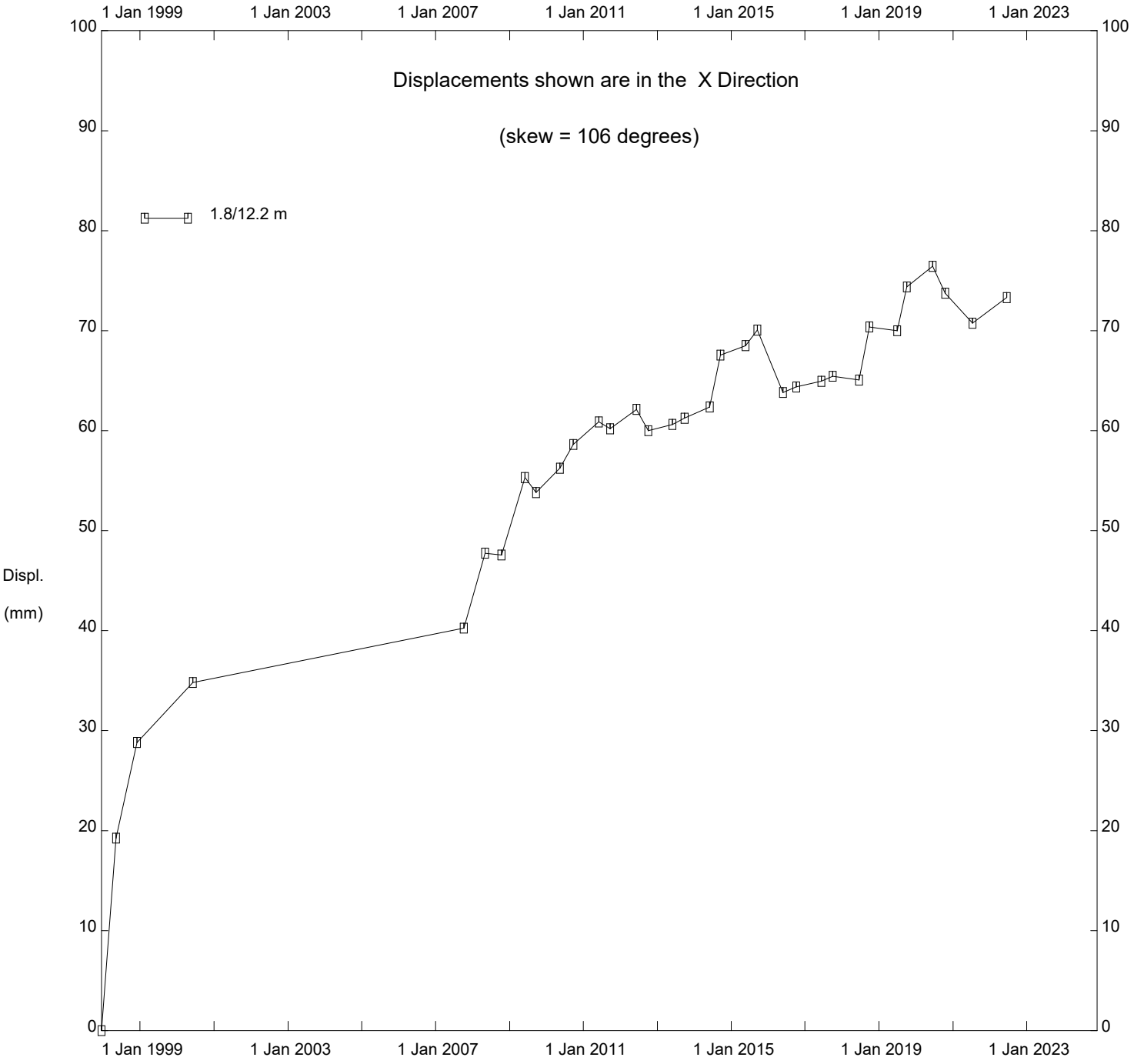

HWY 35:08 (PH045), Inclinometer SI-51

Alberta Transportation