

ALBERTA TRANSPORTATION AND
ECONOMIC CORRIDORS GRMP
GRANDE PRAIRIE REGION –
(GRANDE PRAIRIE NORTH)
INSTRUMENTATION MONITORING - SPRING 2024



Site Number	Location	Name	Hwy	km
PH037	Station 1+250 to 2+000	Dunvegan South	2:68	Km 15.7
Legal Description: 4-7-80-4 W6		UTM Co-ordinates		
		11U E 398593.62	N	6197597.09

Current Monitoring:	28-May-2024	Previous Monitoring	16-Oct-2023
Instruments Read By:	Mr. Niraj Regmi, G.I.T and Mr. Nixon Mationg, of Thurber		

Instruments Read During This Site Visit			
Slope Inclinometers (SIs): SI54 SI56 SI59 SI09 1 SI18-4 SI18-7 SI18-9	Pneumatic Piezometers (PN): SI55 SI58 SI61 SI09-7 SI18-5 SI18-8 SI18-10	Vibration Wire Piezometers (VW): PN18-1, PN18-2, PN18-3, PN18-4, PN18-5B, PN18-6A, PN18-7A, PN18-7B, PN18-7C, PN18-8A, PN18-8B, PN18-9A, PN18-9B, PN18-9C, PN18-10A, PN18-10B, PN18-12B, PN18-13A, PN18-13B, PN18-14A and PN18-14B	Standpipe Piezometers (SP): SP09-6 SP09-8
Load Cell (LC): N/A	Strain Gauges: N/A	SAAs: N/A	Others:

Readout Equipment Used			
Slope Inclinometers: Two RST Digital Inclinometer probes with 2 ft wheelbases and RST Pocket PC readouts	Pneumatic Piezometers: RST C108 pneumatic piezometer readout	Vibration Wire Piezometers:	Standpipe Piezometers: Heron dipmeter
Load Cell:	Strain Gauges:	SAAs:	Others:
Note			

Discussion	
Zones of New Movement:	None
Interpretation of Monitoring Results:	<p>Since the site is very large, to assist with interpretation the slope indicator results have been grouped into three zones: South, Middle and North. Slope indicators are listed moving from south to north within each zone; offsets to the west represent SIs downslope of the highway while east offsets represent SIs upslope of the highway.</p> <p>South third of site:</p> <p>Slope indicator SI18-7 is located just west of the highway and showed a rate of movement of 13.4 mm/yr along a distinct shear plane over 9.1 m to 11.6 m depth. This movement rate has been steady since the SI was installed in 2018.</p> <p>SI18-4 is located in the cut slope above the highway and shows no discernible movement throughout.</p>

SI18-5 is located just east of the highway and shows a rate of movement of 7.1 mm/yr over a distinct shear zone between 17.2 m to 20.3 m depth. This movement rate has been steady since the SI was installed in 2018.

SI09-7 is located about 90 m west of the highway and has several zones of movement. No discernible movement were measured over the past two years over the shear zone between 3.9 m to 6.3 m depth and the total movement since 2009 is about 8 mm. A rate of movement of 0.6 mm/yr was measured over 18.5 m to 20.3 m depth. This rate of movement has been steady since 2009 and total recorded movements are about 7.5 mm.

SI-59 showed a rate of movement of 6.3 mm/yr over 1.0 m to 7.1 m depth. This SI is in the highway east ditch near the assumed backscarp of the landslide that is affecting the highway and has moved 177.6 mm over this depth zone, since it was first installed in 1994. A subtle shear zone at 13 m depth may be present.

Middle third of site:

SI18-8 is located just west of the highway and showed a rate of movement of 3.4 mm/yr along a distinct shear plane over 14.5 m to 16.3 m depth. This movement rate has held steady since 2018 and total movement to date is about 22 mm.

SI-58 is located about 100 m east of the highway and showed a rate of movement of 2.0 mm/yr over 0.5 m to 3.6 m depth. The movement pattern at SI-58 is tilting with no well defined shear zone.

SI-56 is located just east of the highway and showed a rate of movement of 5.0 mm/yr over 0 m to 2.7 m depth. There are several subtle zones of movement deeper in SI-56 with movement rates less than 0.5 mm/yr.

SI-55 is located about 20 m west the highway and showed a rate of movement of 0.6 mm/yr over 1.3 m to 4.3 m depth over a non specific shear zone. This rate of movement has been relatively consistent since 2016.

SI18-9 is located about 35 m west of the highway and showed a rate of movement of 2.7 mm/yr along a well-defined shear plane over 20.1 m to 22.0 m depth.

North third of site:

SI18-10 is located just west of the highway and showed a rate of movement of 17.2 mm/yr over 0 m to 3.0 m depth and a rate of movement of 1.6 mm/yr over 21.3 m to 23.2 m depth. The upper shear zone is tilting while the lower zone is a slowly developing distinct shear.

Slope inclinometer SI-54 is located about 70 m east of the highway and showed a rate of movement of 29.0 mm/yr over 0 m to 1.7 m depth, which corresponds to an increase in rate of movement of 53.9 mm/yr since the fall of 2023 readings. Of more significance with this slope indicator is the lack of observed shear zones below the near ground surface movement zone.

SI09-1 is located just west of the highway and showed a rate of movement of 3.6 mm/yr over 0.3 m to 7.0 m, and rates of movement of 0.6 mm/yr, and 0.3 mm/yr at depths between 7.0 m to 13.1 m, and 13.1 m to 14.9 m, respectively, since the fall of 2023 readings.

SI-61 is located just west of the highway and just north of SI09-1; it showed a rate of movement of 0.7 mm/yr over 3.6 m to 10.3 m depth. The pattern of movement at SI-61 is best described as a bulge which is unusual for this site.

	<p>Standpipe piezometer SP09-6 was dry during the spring of 2024 readings. SP09 8 continued to be dry.</p> <p>Most of the pneumatic piezometers except for PN18-6A generally showed relatively small changes in groundwater level compared to the fall of 2023, ranging from a decrease of 0.18 m in PN18-8A to an increase of 0.19 m in PN18-9B. PN18-6A showed a groundwater elevation of 437.95 m, the highest measured in the instrument and corresponding to an increase in water level 0.87 m since the fall of 2023 readings.</p>
Future Work:	The instruments should be read again in the fall of 2024.
Instrumentation Repairs:	No instrument repairs are required at this time.
Additional Comments:	

Attachments:

- Table PH037-1 Spring 2024 – HWY 2:68 Dunvegan South, Slope Inclinometer Reading Summary
- Table PH037-2 Spring 2024 – HWY 2:68 Dunvegan South, Standpipe Piezometer Reading Summary
- Table PH037-3 Spring 2024 – HWY 2:68 Dunvegan South, Pneumatic Piezometer Reading Summary
- Statement of Limitations and Conditions
- APPENDIX A - PH037-1 SPRING 2024
 - Field Inspector's Report
 - Site Plan Showing Approximate Instrument Locations (Drawing No. 32123-PH037-1 and 32123-PH037-2)
 - SI Reading Plots
 - Figure PH037-1 (Standpipe Piezometric Elevations)
 - Figure PH037-2 (Standpipe Piezometric Depths)
 - Figure PH037-3 (Pneumatic Piezometric Elevations)
 - Figure PH037-4 (Pneumatic Piezometric Depths)

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.
Roger Skirrow, M.Sc., P. Eng.
Senior Geotechnical Engineer

Lucas Green, P.Eng.
Geotechnical Engineer



Table PH037-1: Spring 2024 – HWY 2:68 Dunvegan South Slope Inclinometer Instrumentation Reading Summary

Date Monitored: May 28, 2024

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)	RATE OF MOVEMENT (mm/yr)	CHANGE IN RATE OF MOVEMENT SINCE PREVIOUS READING (mm/yr)
SI-54	Mar. 6 1995	131.6 mm over 0.0 m to 1.7 m depth in 291° direction	36.1 mm/yr in March 1995	Operational	October 16, 2023	17.9	29.0	53.9
SI-55	Aug. 27, 1992	57.6 mm over 1.3 m to 4.3 m depth in 281° direction	17.4 mm/yr in October 2021	Operational	October 16, 2023	0.4	0.6	-2.2
SI-56	Aug. 26 1992	70.0 mm over 0.0 m to 2.7 m depth in 12° direction	21.5 mm/yr in October 1998	Operational	October 16, 2023	3.1	5.0	5.4
SI-57	Aug. 26, 1992	193.3 mm over 0.0 m to 2.3 m depth in 283° direction	44.2 mm/yr in October 1998	Sheared at 3.7 m	September 19, 2015	N/A	N/A	N/A
SI-58	Aug. 26, 1992	154.1 mm over 0.5 m to 3.6 m depth in 270° direction	41.7 mm/yr in October 1998	Operational	October 16, 2023	3.1	2.0	-7.7
SI-59	Aug. 26, 1992	177.6 mm over 1.0 m to 7.1 m depth in 300° direction	16.4 mm/yr in March 1995	Operational	October 16, 2023	3.9	6.3	3.9

Drawings 32123-PH037-1 and 32123-PH037-2 in Appendix A provide sketches of the approximate locations of the monitoring instrumentation for this site.



Table PH037 -1 – Continued... Spring 2024 – HWY 2:68 Dunvegan South Slope Inclinator Instrumentation Reading Summary

Date Monitored: May 28, 2024

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)	RATE OF MOVEMENT (mm/yr)	CHANGE IN RATE OF MOVEMENT SINCE PREVIOUS READING (mm/yr)
SI-61	Mar. 2, 1995	24.3 mm over 3.6 m to 10.3 m depth in 185° direction	7.2 mm/yr in October 1997	Operational	October 16, 2023	0.4	0.7	1.6
SI-62	Mar. 2, 1995	98.4 mm over 4.1 m to 10.8 m depth in 321° direction	43.8 mm/yr in October 2017	Sheared at 10.8 m below ground surface	July 4, 2019	N/A	N/A	N/A
		82.7 mm over 7.8 m to 10.8 m depth in 321° direction	38.7 mm/yr in October 2017			N/A	N/A	N/A
SI-66	Jan. 21, 1993	54.7 mm over 0.6 m to 6.7 m depth in 330° direction	10.4 mm/yr in June 1994	Sheared at 4.3 m	September 25, 2011	N/A	N/A	N/A
SI09-1	Sept. 30, 2009	48.5 mm over 0.3 m to 7.0 m depth in 216° direction	15.7 mm/yr in November 2009	Operational	October 16, 2023	2.2	3.6	6.4
		21.4 mm over 7.0 m to 13.1 m depth in 216° direction	4.0 mm/yr in September 2015			0.4	0.6	-0.3
		5.1 mm over 13.1 m to 14.9 m depth in 216° direction	1.0 mm/yr in September 2014			0.2	0.3	<0.1
SI09-2	Sept. 30, 2009	No discernible movement	No discernible movement	Broken at 0.3 mBGS	May 25, 2015	N/A	N/A	N/A

Drawings 32123-PH037-1 and 32123-PH037-2 in Appendix A provide sketches of the approximate locations of the monitoring instrumentation for this site.

Table PH037 -1 – Continued... Spring 2024 – HWY 2:68 Dunvegan South Slope Incliner Instrumentation Reading Summary

Date Monitored: May 28, 2024

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)	RATE OF MOVEMENT (mm/yr)	CHANGE IN RATE OF MOVEMENT SINCE PREVIOUS READING (mm/yr)
SI09-4	Sept. 30, 2009	33.3 mm over 23.8 m to 26.3 m depth in 250° direction.	10.6 mm/yr in November 2009	Sheared at 24.4 m	September 19, 2014	N/A	N/A	N/A
SI09-5	Sept. 30, 2009	40.3 mm over 24.9 m to 27.3 m depth in 270° direction	10.3 mm/yr in June 2011	Sheared at 26.1 m	September 19, 2014	N/A	N/A	N/A
SI09-7	Sept. 30, 2009	8.0 mm over 3.9 m to 6.3 m depth in 311° direction	5.3 mm/yr in September 2011	Operational	October 16, 2023	No discernible movement	N/A	-0.7
		5.4 mm over 18.5 m to 20.3 m depth in 286° direction	1.1 mm/y in October 2017			0.4	0.6	0.1
SI09-9	Sept. 30, 2009	34.2 mm over 12.0 m to 15.1 m depth in 240° direction	8.7 mm/yr in May 2010	Sheared at 13.3 mBGS	May 25, 2015	N/A	N/A	N/A
SI18-4	February 12, 2018	No discernible movement	N/A	Operational	October 16, 2023	N/A	N/A	N/A
SI18-5	February 16, 2018	43.9 mm over 17.2 m to 20.3 m depth in 303° direction	10.5 mm/yr in April 2018	Operational	October 16, 2023	4.4	7.1	0.7

Drawings 32123-PH037-1 and 32123-PH037-2 in Appendix A provide sketches of the approximate locations of the monitoring instrumentation for this site.



Table PH037 -1 – Continued... Spring 2024 – HWY 2:68 Dunvegan South Slope Inclinator Instrumentation Reading Summary

Date Monitored: May 28, 2024

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)	RATE OF MOVEMENT (mm/yr)	CHANGE IN RATE OF MOVEMENT SINCE PREVIOUS READING (mm/yr)
SI18-6	February 15, 2018	42.6 mm over 32.1 m to 35.1 m depth in 307° direction	12.6 mm/yr in October 2020	Sheared off at 34.7 m depth	October 5, 2022	N/A	N/A	N/A
SI18-7	February 21, 2018	76.8 mm over 9.1 m to 11.6 m depth in 269° direction	17.2 mm/yr in April 2018	Operational	October 16, 2023	10.2	13.4	1.0
SI18-8	February 12, 2018	21.7 mm over 14.5 m to 16.3 m depth in 266° direction	5.1 mm/yr in April 2018	Operational	October 16, 2023	2.1	3.4	>-0.1
SI18-9	April 25, 2018	17.0 mm over 20.1 m to 22.0 m depth in 287° direction	3.2 mm/yr in October 2018	Operational	October 16, 2023	1.7	2.7	-0.3
SI18-10	March 14, 2018	180.5 mm over 0.0 m to 3.0 m depth in 344° direction	675.3 mm/yr in June 2018	Operational	October 16, 2023	10.6	17.2	37.7
		10.6 mm over 21.3 m to 23.2 m depth in 319° direction	3.1 mm/yr in October 2021			1.0	1.6	-0.6
SI18-11	February 21, 2018	41.4 mm over 0.1 m to 6.2 m depth in 332° direction	280.1 mm/yr in April 2018	Sheared at 2.4 m depth	April 25, 2018	N/A	N/A	N/A

Drawings 32123-PH037-1 and 32123-PH037-2 in Appendix A provide sketches of the approximate locations of the monitoring instrumentation for this site.



Table PH037 -2: Spring 2024 – HWY 2:68 Dunvegan South Standpipe Piezometer Instrumentation Reading Summary

Date Monitored: May 28, 2024

INSTRUMENT #	DATE INITIALIZED	TIP DEPTH (m)	GROUND ELEV. (m)	CURRENT STATUS	HIGHEST MEASURED WATER LEVEL BGS (m)	MEASURED WATER LEVEL BGS (m)	PREVIOUS READING (m)	CHANGE IN WATER LEVEL SINCE PREVIOUS READING (m)
SP09-6	September 30, 2009	26.56	N/A	Active	26.21 on June 22, 2022	Dry	26.46	N/A
SP09-8	September 30, 2009	11.61	N/A	Active	N/A	Dry	Dry	N/A

Drawings 32123-PH037-1 and 32123-PH037-2 in Appendix A provide sketches of the approximate locations of the monitoring instrumentation for this site.

Table PH037-3: Spring 2024 – HWY 2:68 Dunvegan South Pneumatic Piezometer Instrumentation Reading Summary

Date Monitored: May 28, 2024

INSTRUMENT #	DATE INITIALIZED	TIP ELEV. (m)	GROUND ELEV. (m)	CURRENT STATUS	HIGHEST MEASURED WATER ELEVATION (m)	MEASURED PORE PRESSURE (kPa)	CURRENT WATER ELEVATION (m)	PREVIOUS WATER ELEVATION (m)	CHANGE IN WATER LEVEL SINCE PREVIOUS READING (m)
PN18-1	February 9, 2018	485.20	517.20	Operational	485.83 on June 9, 2018	4.7	485.68	485.79	-0.1
PN18-2	February 11, 2018	485.01	503.30	Operational	485.58 on June 9, 2018	4.8	485.50	485.50	0
PN18-3	February 11, 2018	461.96	490.00	Operational	462.56 on June 21, 2022	3.5	462.32	462.30	0.02
PN18-4	February 11, 2018	453.41	480.00	Operational	453.89 on June 21, 2020	3.5	453.77	453.88	-0.11
PN18-5A	February 17, 2018	450.55	460.30	Malfunctioning	452.21 on July 4, 2019	N/A	N/A	452.21 (July 4, 2019)	N/A
PN18-5B	February 17, 2018	432.26	460.30	Operational	432.65 on June 9, 2018	1.9	432.45	432.43	0.02
PN18-6A	February 19, 2018	436.96	446.10	Operational	437.95 on May 28, 2024	9.7	437.95	437.08	0.87
PN18-6B	February 19, 2018	388.19	446.10	Malfunctioning	389.03 on March 14, 2018	N/A	N/A	388.31 (Oct. 22, 2021)	N/A
PN18-7A	February 23, 2018	454.35	464.10	Operational	454.78 on June 9, 2018	2.9	454.65	454.69	-0.04
PN18-7B	February 23, 2018	447.64	464.10	Operational	448.13 on June 9, 2018	3.3	447.98	448.02	-0.04
PN18-7C	February 23, 2018	438.19	464.10	Operational	438.60 on June 21, 2020	3.0	438.50	438.56	-0.06
PN18-8A	February 22, 2018	444.50	450.60	Operational	445.16 on June 18, 2022	4.3	444.94	445.12	-0.18

Drawings 32123-PH037-1 and 32123-PH037-2 in Appendix A provide sketches of the approximate locations of the monitoring instrumentation for this site.



Table PH037-3 – Continued...Spring 2024 – HWY 2:68 Dunvegan South Pneumatic Piezometer Instrumentation Reading Summary

Date Monitored: May 28, 2024

INSTRUMENT #	DATE INITIALIZED	TIP ELEV. (m)	GROUND ELEV. (m)	CURRENT STATUS	HIGHEST MEASURED WATER ELEVATION (m)	MEASURED PORE PRESSURE (kPa)	CURRENT WATER ELEVATION (m)	PREVIOUS WATER ELEVATION (m)	CHANGE IN WATER LEVEL SINCE PREVIOUS READING (m)
PN18-8B	February 22, 2018	429.26	450.60	Operational	429.70 on Oct. 22, 2021	2.4	429.50	429.54	-0.04
PN18-9A	February 19, 2018	433.18	440.80	Operational	440.88* on June 21, 2020	4.7	433.66	433.60	0.06
PN18-9B	February 19, 2018	418.24	440.80	Operational	419.65 on June 21, 2020	3.0	418.55	418.36	0.19
PN18-9C	February 19, 2018	383.19	440.80	Operational	383.72 on June 9, 2018	1.1	383.30	383.30	0
PN18-10A	February 21, 2018	433.56	442.70	Operational	434.06 on June 9, 2018	2.8	433.85	433.98	-0.13
PN18-10B	February 21, 2018	410.54	442.70	Operational	410.96 on June 9, 2018	2.6	410.81	410.88	-0.07
PN18-11A	March 14, 2018	412.85	425.80	Destroyed	413.20 on April 25, 2018	N/A	N/A	413.20 (Apr. 25, 2018)	N/A
PN18-11B	March 14, 2018	392.73	425.80	Destroyed	393.78 on April 25, 2018	N/A	N/A	393.78 (Apr. 25, 2018)	N/A
PN18-12A	February 17, 2018	435.90	442.00	Malfunctioning	438.15 on June 9, 2018	N/A	N/A	435.95 (July 2, 2019)	N/A
PN18-12B	February 17, 2018	422.19	442.00	Operational	422.68 on June 9, 2018	3.4	422.54	422.44	0.10
PN18-13A	February 15, 2018	430.36	439.50	Operational	430.92 on June 9, 2018	2.4	430.60	430.65	-0.05
PN18-13B	February 15, 2018	413.59	439.50	Operational	414.08 on June 9, 2018	2.5	413.84	413.92	-0.08

Drawings 32123-PH037-1 and 32123-PH037-2 in Appendix A provide sketches of the approximate locations of the monitoring instrumentation for this site.

* Indicates above-ground (artesian) groundwater level



Table PH037-3- Continued...Spring 2024 – HWY 2:68 Dunvegan South Pneumatic Piezometer Instrumentation Reading Summary

Date Monitored: May 28, 2024

INSTRUMENT #	DATE INITIALIZED	TIP ELEV. (m)	GROUND ELEV. (m)	CURRENT STATUS	HIGHEST MEASURED WATER ELEVATION (m)	MEASURED PORE PRESSURE (kPa)	CURRENT WATER ELEVATION (m)	PREVIOUS WATER ELEVATION (m)	CHANGE IN WATER LEVEL SINCE PREVIOUS READING (m)
PN18-14A	February 15, 2018	424.29	434.50	Operational	425.77 on March 14, 2018	3.2	424.62	424.61	0.01
PN18-14B	February 15, 2018	407.98	434.50	Operational	408.37 on October 4, 2018	2.2	408.20	408.19	0.01

Drawings 32123-PH037-1 and 32123-PH037-2 in Appendix A provide sketches of the approximate locations of the monitoring instrumentation for this site.



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.

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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.



THURBER ENGINEERING LTD.

**ALBERTA TRANSPORTATION AND ECONOMIC CORRIDORS GRMP (CON0022165)
PEACE REGION (GRANDE PRAIRIE DISTRICT – NORTH)
INSTRUMENTATION MONITORING RESULTS**

SPRING 2024

**APPENDIX A
DATA PRESENTATION**

SITE PH037: HWY 2:68, DUNVEGAN SOUTH

**ALBERTA TRANSPORTATION AND ECONOMIC CORRIDORS
PEACE REGION (GRANDE PRAIRIE - NORTH DISTRICT)
INSTRUMENTATION MONITORING FIELD SUMMARY (PH037)
SPRING 2024**

Location: Dunvegan South (HWY 2:68 C1 15.674) File Number: 32123 Probe: RST SI Sets 5R & 8R Cable: RST SI Sets 5R & 8R	Readout: RST Extension: 3.34"/2.75" Ø Temp: 26 Read by: NKR/NRM
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SLOPE INCLINOMETER (SI) READINGS

SI#	GPS Location (UTM 11)		Date	Stickup (m)	Depth from top of casing (ft)	Magn. North A+ Groove degree	Current Bottom Depth Readings				Probe/ Reel #	Size (")	Remarks
	Easting (m)	Northing (m)					A+	A-	B+	B-			
SI-54	398593.62	6197597.09	28-May-24	0.73	62 to 2	5	229	-218	-590	578	5R/5R	FILL	***
SI-55	398503.91	6197504.55	28-May-24	0.56	66 to 2	15	-25	41	-1176	1172	8R/8R	FILL	***
SI-56	398540.17	6197496.24	28-May-24	0.91	76 to 2	350	1341	-1334	-973	971	8R/8R	FILL	***
SI-58	398626.26	6197479.42	28-May-24	0.71	64 to 2	0	-381	393	-466	452	5R/5R	FILL	***
SI-59	398528.72	6197362.90	28-May-24	0.87	76 to 2	40	167	-159	-806	800	8R/8R	FILL	
SI-61	398521.45	6197719.36	28-May-24	0.67	62 to 2	345	96	-82	-942	926	5R/5R	FILL	*
SI09-1	398520.28	6197714.60	28-May-24	0.92	108 to 2	235	-129	136	477	-492	5R/5R	FILL	
SI09-7	398423.87	6197337.20	28-May-24	1.00	108 to 2	270	-320	325	-63	63	5R/5R	FILL	
SI18-4	398582.00	6197288.00	28-May-24	0.89	94 to 2	302	430	-420	-45	36	8R/8R	FILL	
SI18-5	398525.00	6197321.00	28-May-24	0.76	98 to 2	280	166-	157	381	-392	5R/5R	FILL	
SI18-7	398495.00	6197264.00	28-May-24	0.91	132 to 2	238	468	-515	-759	741	8R/8R	FILL	
SI18-8	398509.00	6197461.00	28-May-24	1.06	110 to 2	260	-1695	1642	1152	-1185	8R/8R	FILL	
SI18-9	398491.00	6197515.00	28-May-24	0.90	188 to 2	266	188	-172	219	-222	8R/8R	FILL	
SI18-10	398518.00	6197582.00	28-May-24	0.92	110 to 2	268	249	-241	275	-292	5R/5R	FILL	

INSPECTOR REPORT

*SI-61 Hard to pull from 26-24 ft, use dummy probe *** Slope Direction is 270 degree

**ALBERTA TRANSPORTATION AND ECONOMIC CORRIDORS
PEACE REGION (GRANDE PRAIRIE - NORTH DISTRICT)
INSTRUMENTATION MONITORING FIELD SUMMARY (PH037)
SPRING 2024**

Location: Dunvegan South (HWY 2:68 C1 15.674)	Readout: RST PN C108 Unit 4
File Number: 32123	Temp: 29
	Read by: NKR/NRM

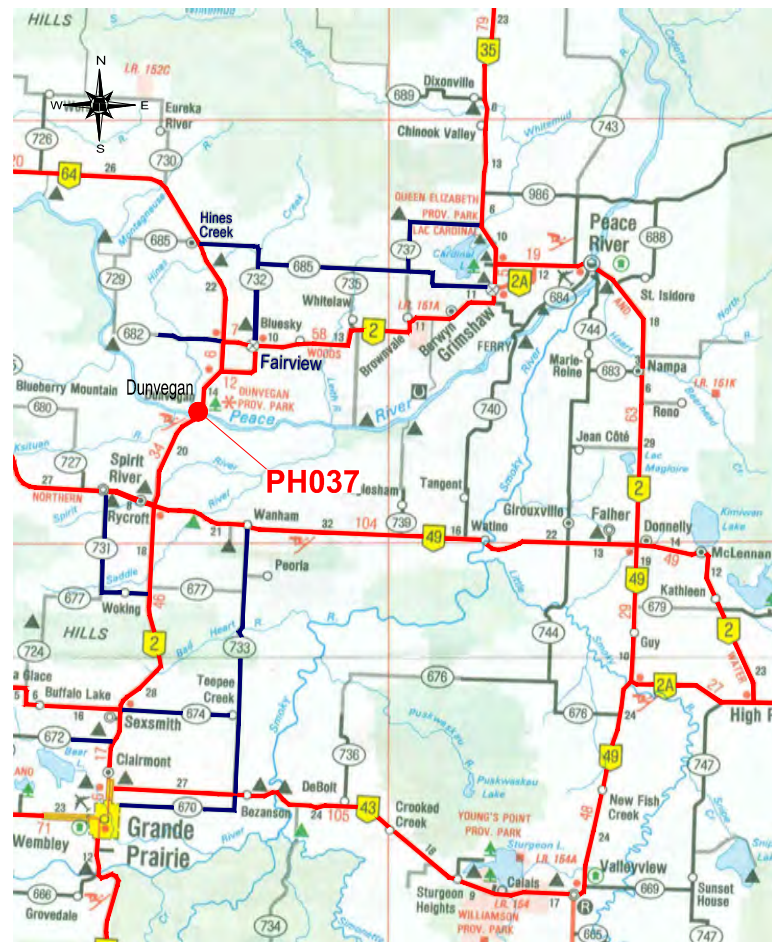
STANDPIPE PIEZOMETER READINGS

SP#	GPS Location (UTM 11)		Date	Stick-up (m)	Reading below top of casing (m)	Bottom Pipe Depth (below top of casing (m))
	Easting (m)	Northing (m)				
SP09-6	398501.99	6197268.45	28-May-24	1.04	DRY	27.60
SP09-8	398461.37	6197336.32	28-May-24	0.69	DRY	12.30

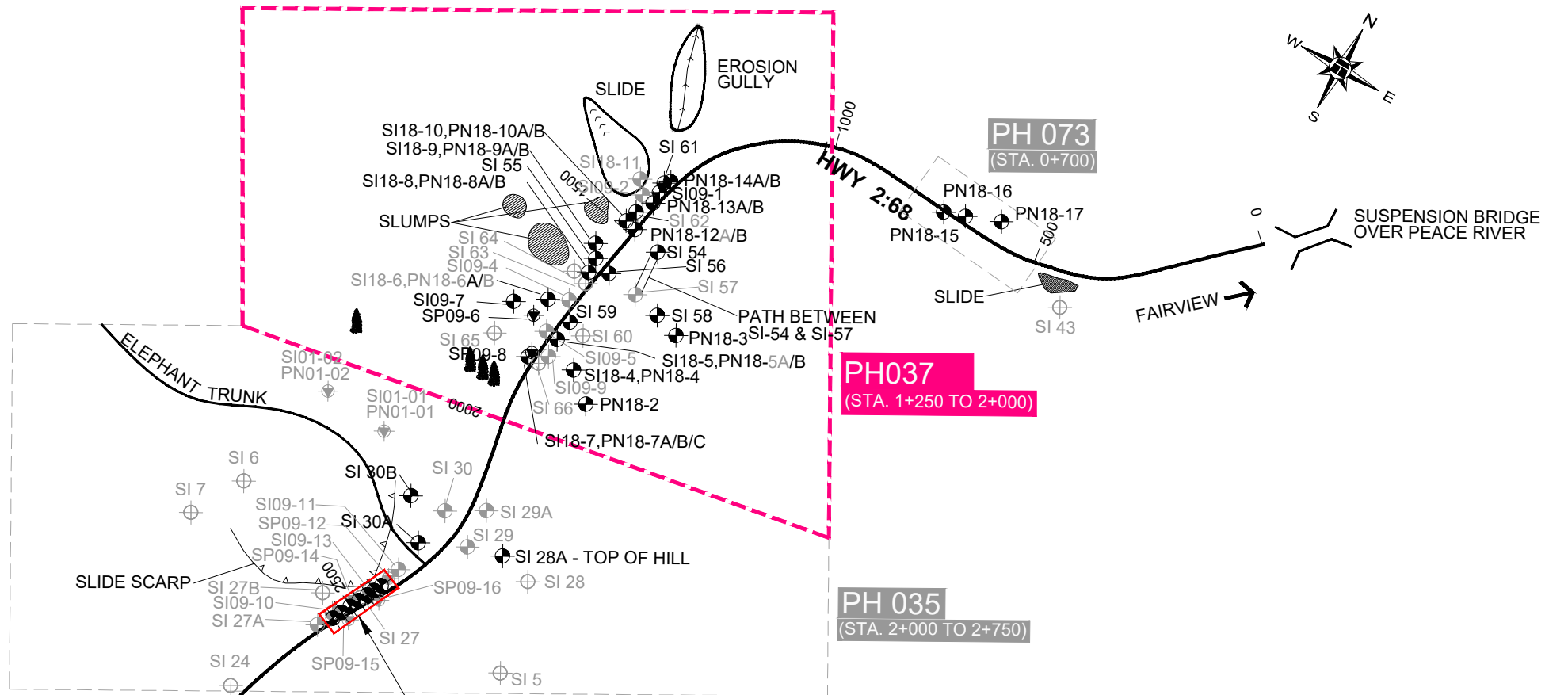
PNEUMATIC PIEZOMETER READINGS

PN#	GPS Location (UTM 11)		Date	Reading (kPa)	Identification Number
	Easting (m)	Northing (m)			
PN18-1	398691	6196979	26-May-24	4.7	37810
PN18-2	398636	6197245	26-May-24	4.8	37818
PN18-3	398661	6197458	26-May-24	2.9	37815
PN18-4	398582	6197288	28-May-24	3.5	37821
PN18-5B	398525	6197321	28-May-24	1.9	37817
PN18-6A	398470	6197377	28-May-24	9.7	37819
PN18-7A	398495	6197264	28-May-24	2.9	37826
PN18-7B	398495	6197264	28-May-24	3.3	37813
PN18-7C	398495	6197264	28-May-24	3	37807
PN18-8A	398509	6197461	28-May-24	4.3	37830
PN18-8B	398509	6197461	28-May-24	2.4	37811
PN18-9A	398491	6197515	28-May-24	4.7	37825
PN18-9B	398491	6197515	28-May-24	3	37808
PN18-9C	398491	6197515	28-May-24	1.1	37805
PN18-10A	398518	6197582	28-May-24	2.8	37827
PN18-10B	398518	6197582	28-May-24	2.6	37812
PN18-12B	398541	6197577	28-May-24	3.4	37820
PN18-13A	398544	6197638	28-May-24	2.4	37828
PN18-13B	398544	6197638	28-May-24	2.5	37814
PN18-14A	398551	6197690	28-May-24	3.2	37822
PN18-14B	398551	6197690	28-May-24	2.2	37816

INSPECTOR REPORT



SITE MAP
NOT TO SCALE



LEGEND :

- STANDPIPE PIEZOMETER**
- SLOPE INCLINOMETER CURRENTLY WORKING**
- SLOPE INCLINOMETER NOT IN USE**

NOTES :

1. BASE PLAN WAS TAKEN FROM GAEA ENGINEERING REPORT
2. FEATURE LOCATIONS ARE APPROXIMATE.
3. PREVIOUS OBSERVATIONS SHOWN IN BLACK

FOR PH035-1 PILE WALL INSTRUMENTS (SI11-1, SI11-2, SI11-3, SI11-4, SI18-P24, SI18-P39, SI18-P53, SI18-P71, SI18-P89, SI18-P107, VC1722-VC1724, VC2022, VC2031-2043 AND VC2072) REFER TO DWG NO. 32123-PH035-2

APPROXIMATE LOCATION OF OLD ALIGNMENT (PRIOR TO 92/93)

GRANDE PRAIRIE



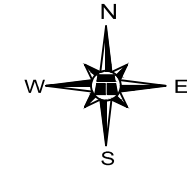
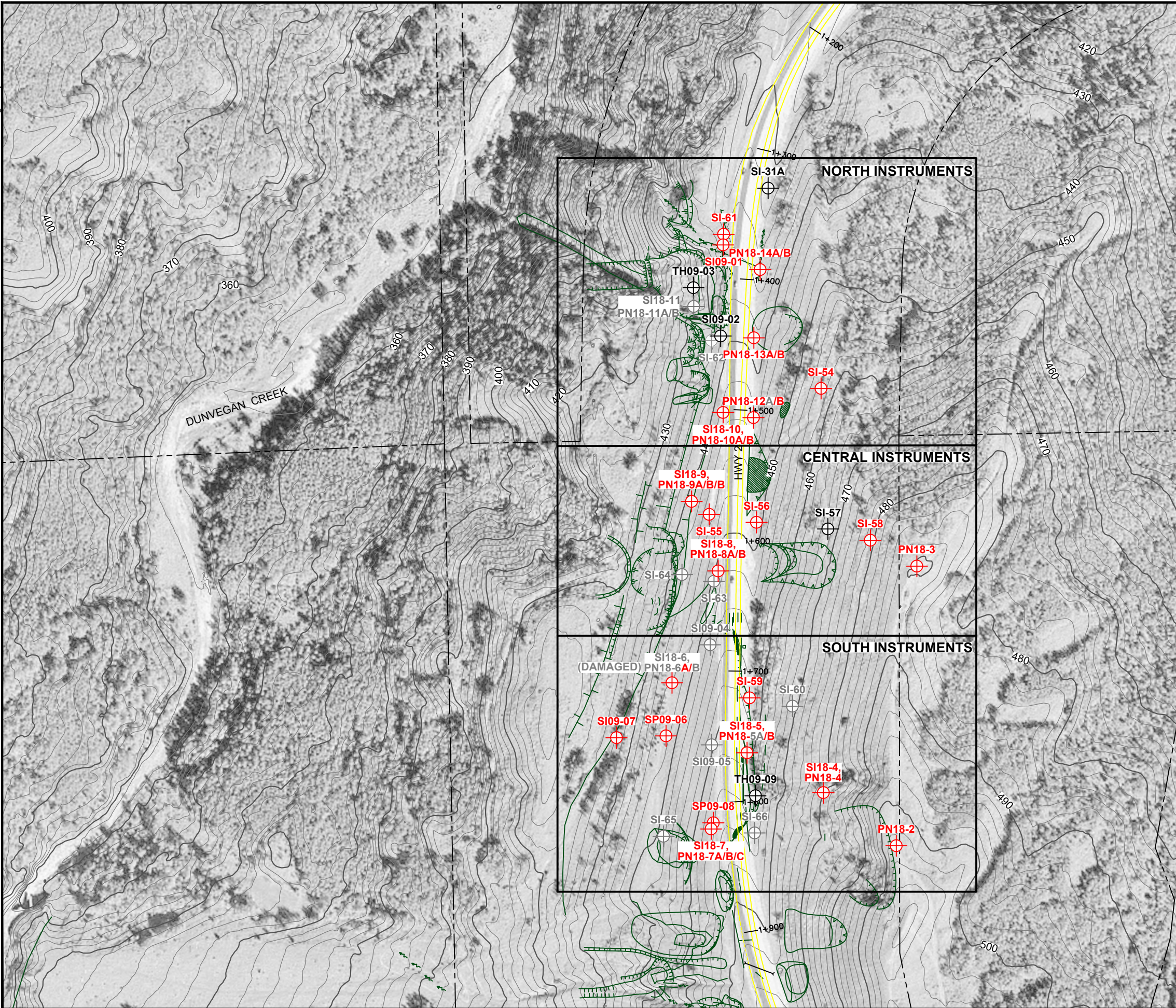
**PEACE REGION
(GRANDE PRAIRIE DISTRICT NORTH)**
**PH037: DUNVEGAN SOUTH
INSTRUMENTATION LOCATIONS**

DWG No. 32123-PH037-1



DRAWN BY	ML
DESIGNED BY	BWN
APPROVED BY	DWP
SCALE	N. T. S.
DATE	JULY 2024
FILE No.	32123



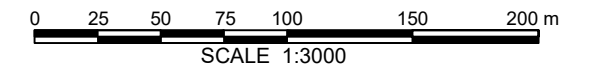
H:\32000\32123 AT GRMP Grande Prairie District North 2021-2025\CAD\2024 INSTRUMENTS\32123-PH037-2.dwg - Layout1 - Jul. 15, 2024



LEGEND

-  INSTRUMENT LOCATIONS
-  INSTRUMENT NOT IN USE
- SI SLOPE INCLINOMETER
- PN PNEUMATIC PIEZOMETER
- SP STANDPIPE PIEZOMETER

NOTE:
PN18-1 IS SHOWN ON DRAWING PH037-1-1.



BASE PLAN PROVIDED BY



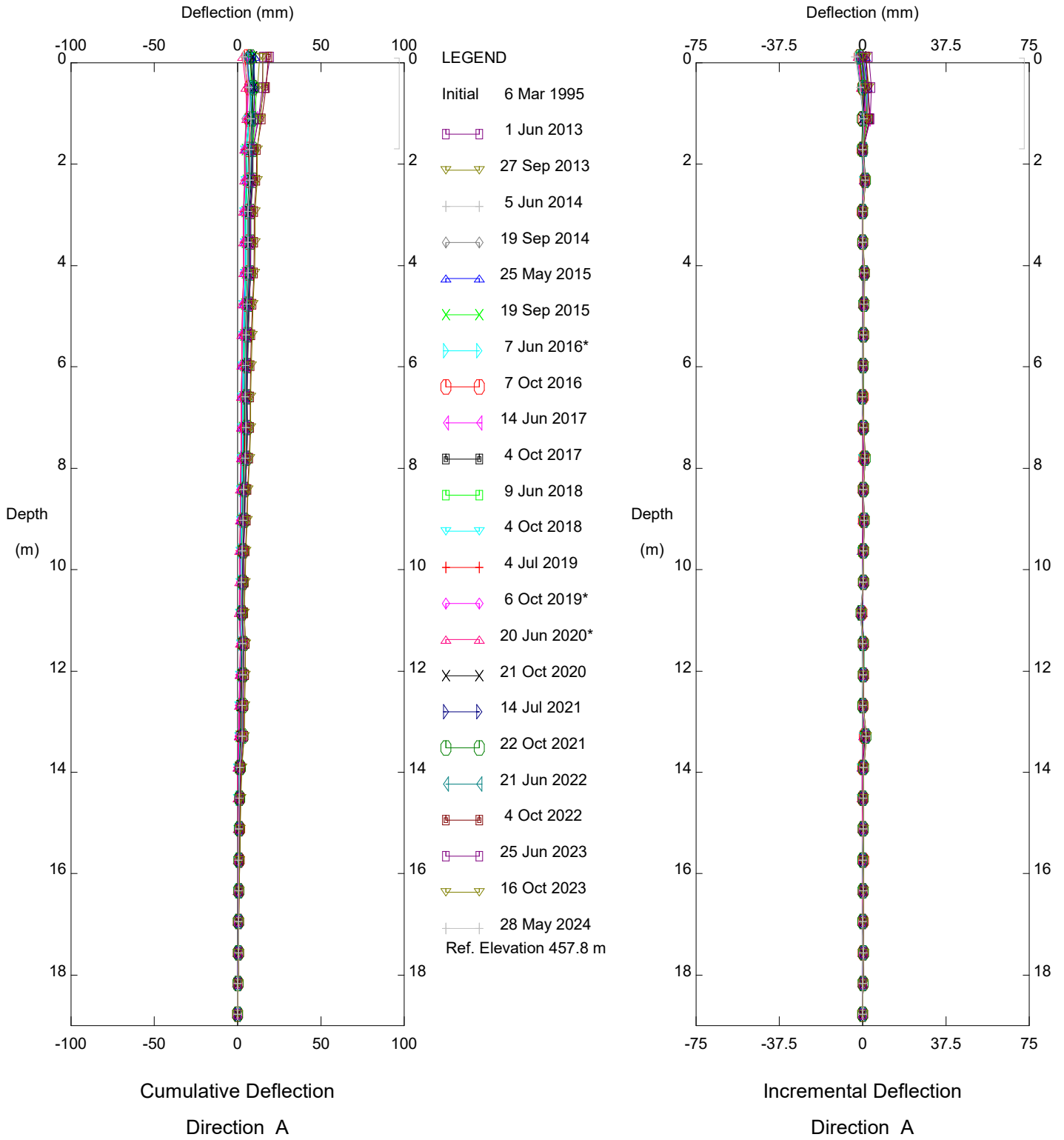
**PEACE REGION
(GRANDE PRAIRIE DISTRICT NORTH)**
**PH037: DUNVEGAN SOUTH
INSTRUMENTATION LOCATIONS**

DWG No. 32123-PH037-2

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DESIGNED BY	BWN
APPROVED BY	DWP
SCALE	1:3000
DATE	JULY 2024
FILE No.	32123



Thurber Engineering Ltd.

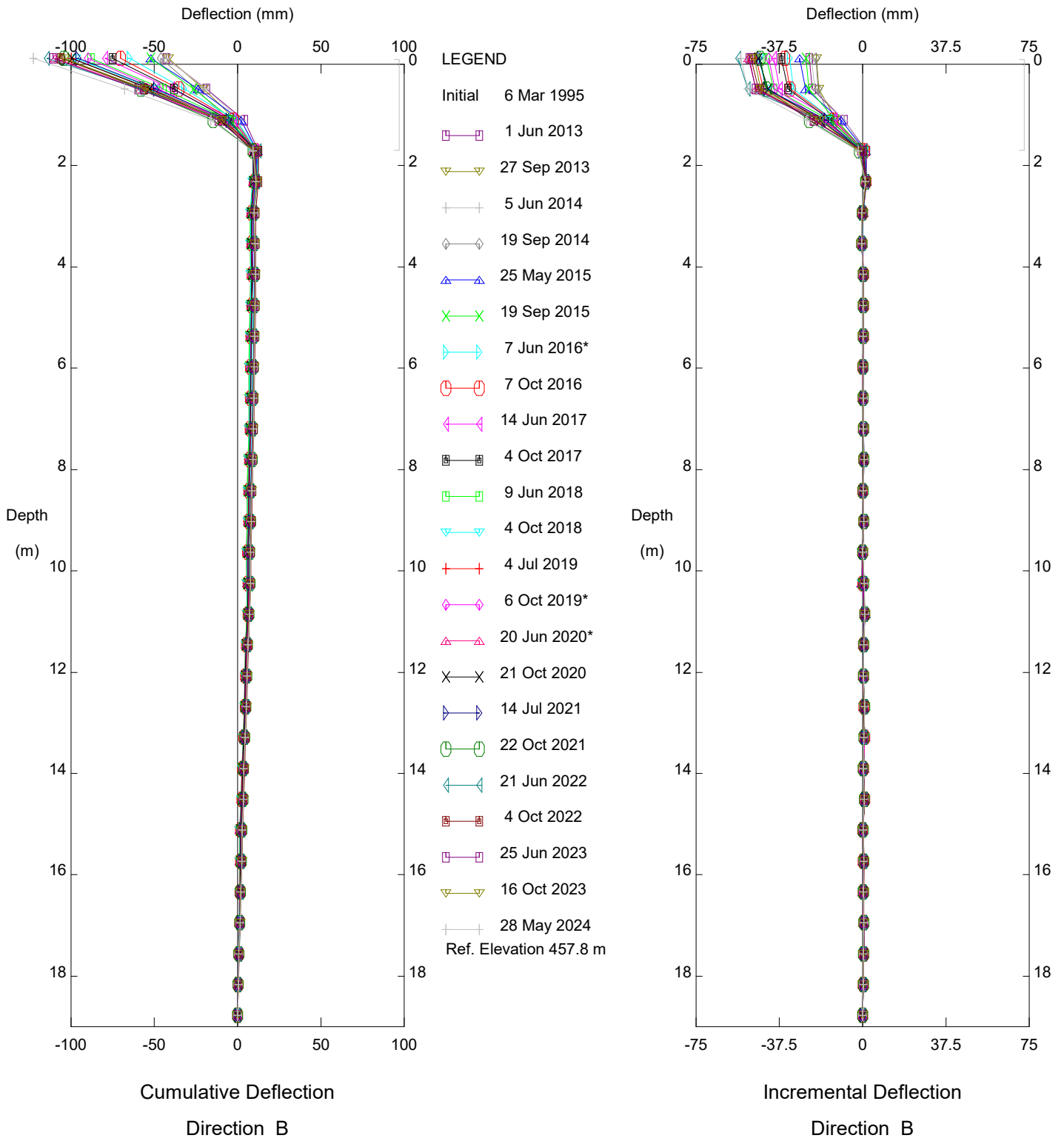


HWY 2:68 (PH037), Inclinometer SI-54

Alberta Transportation

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

Thurber Engineering Ltd.

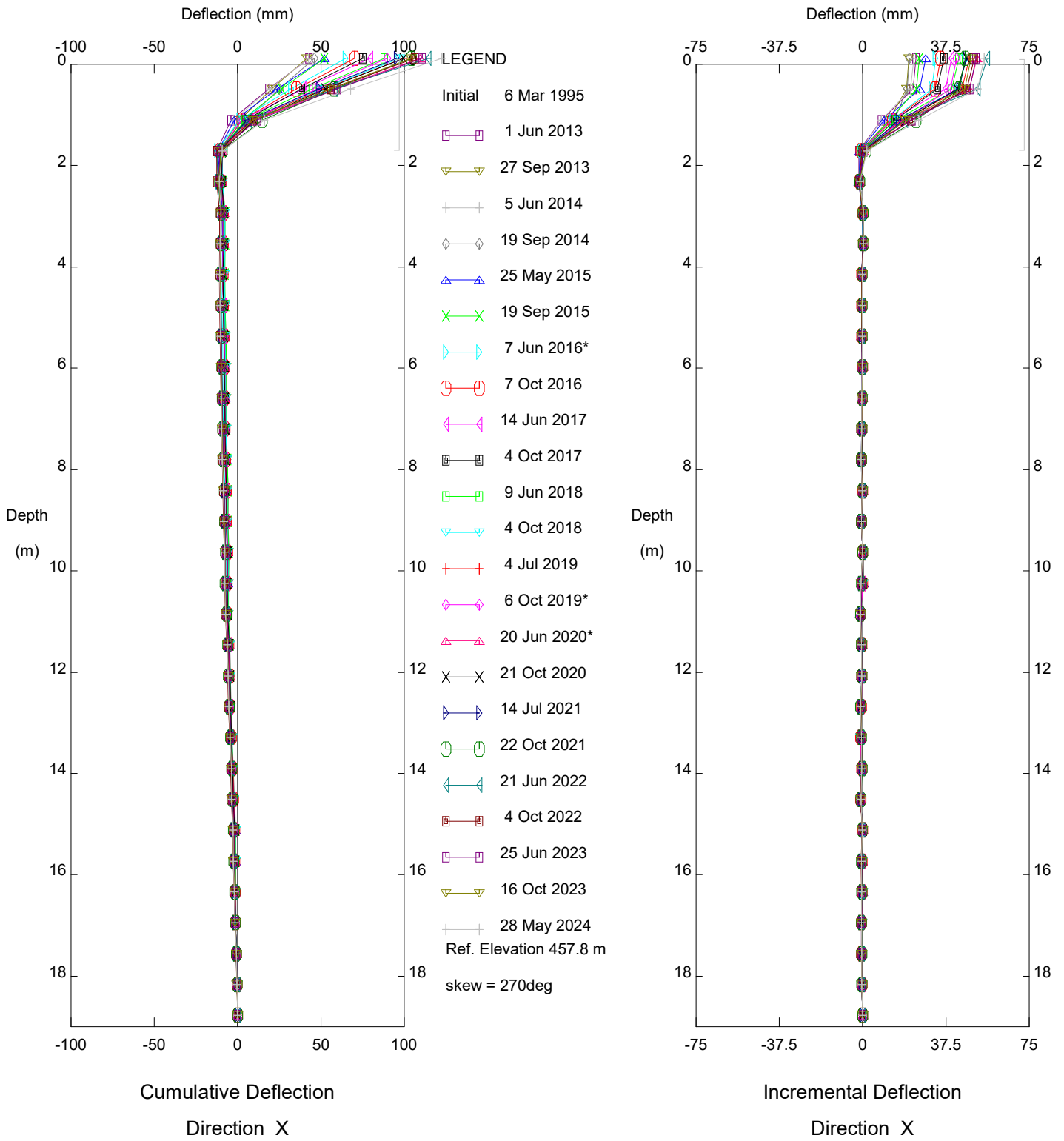


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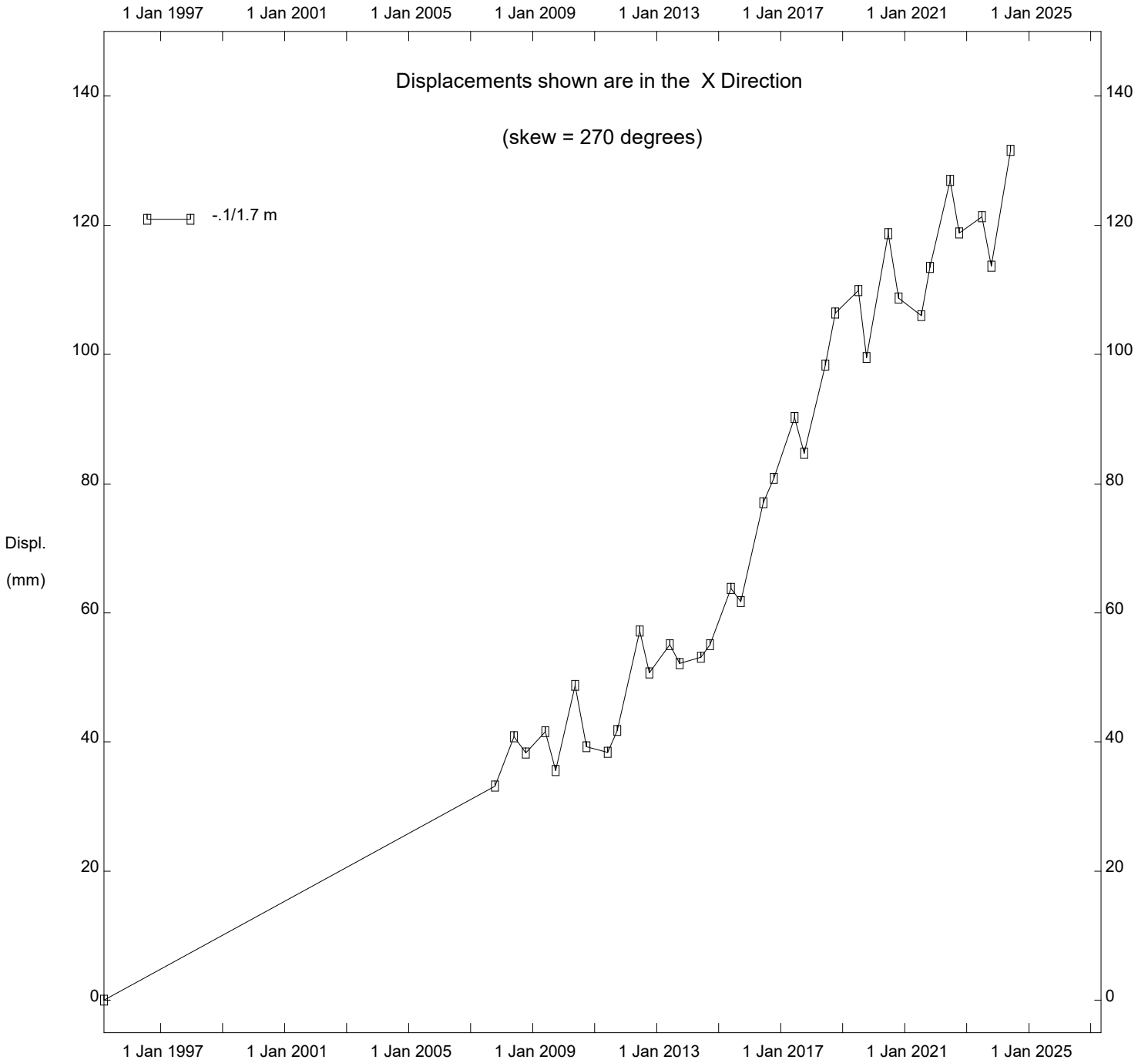


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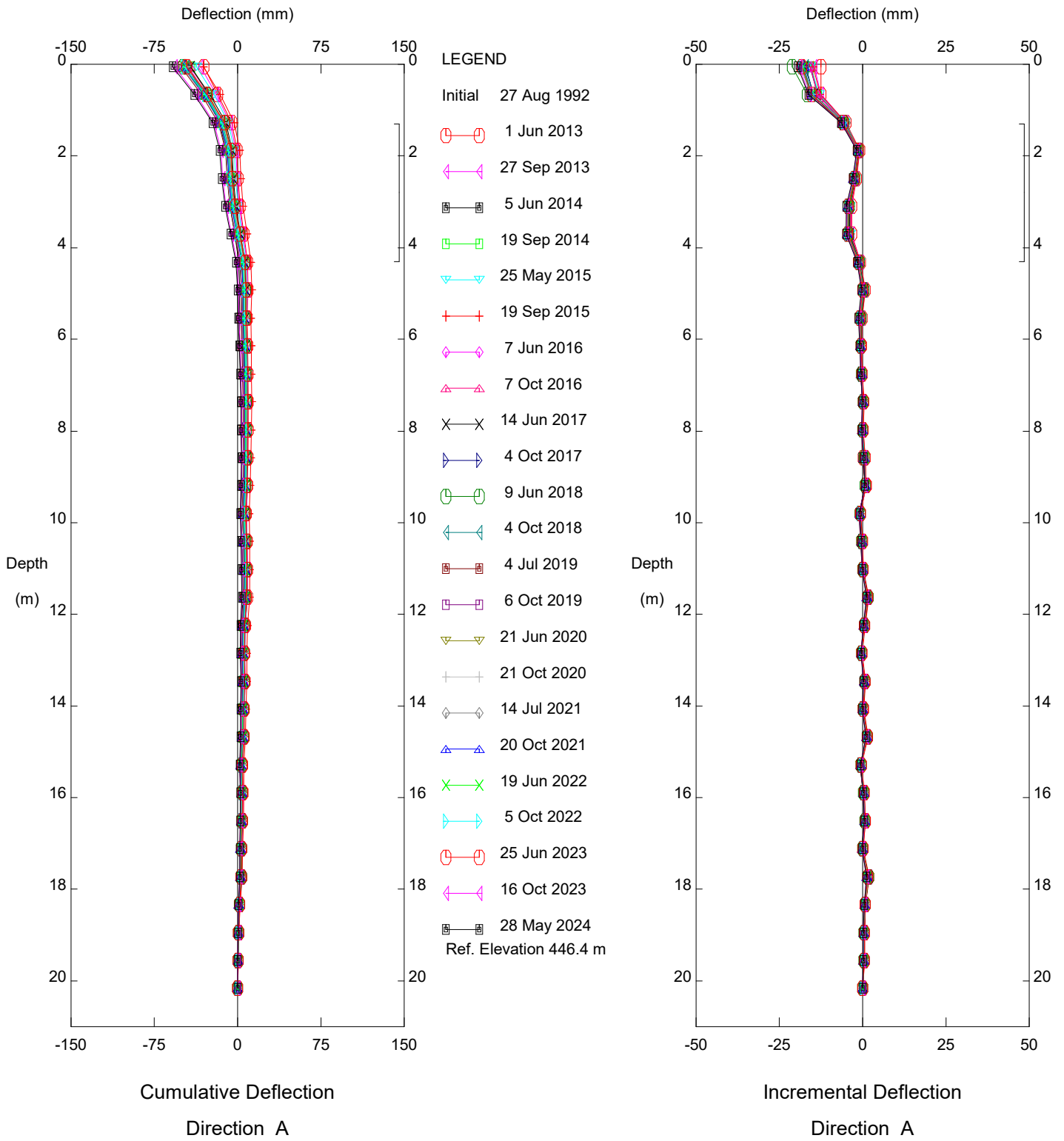
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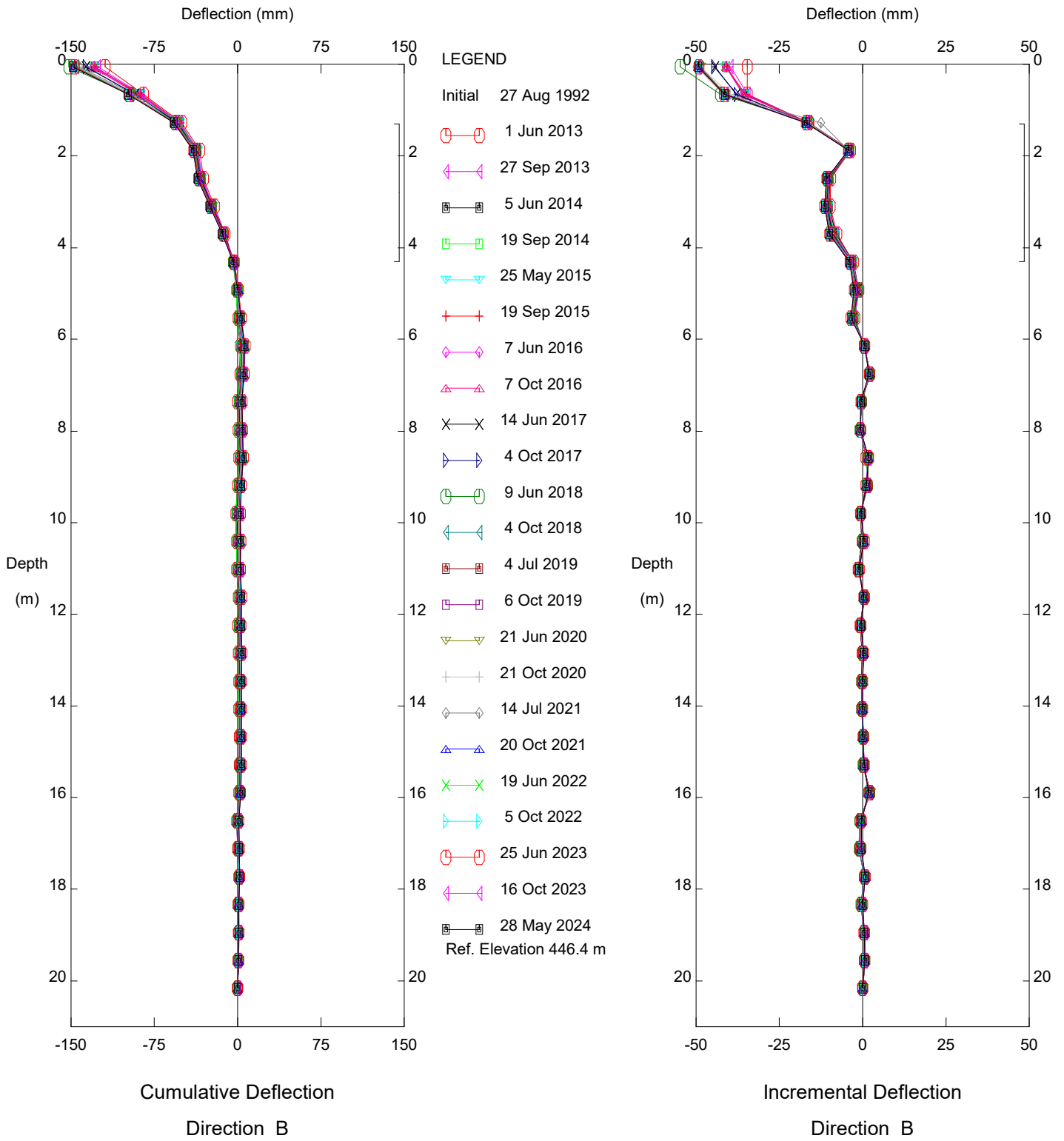
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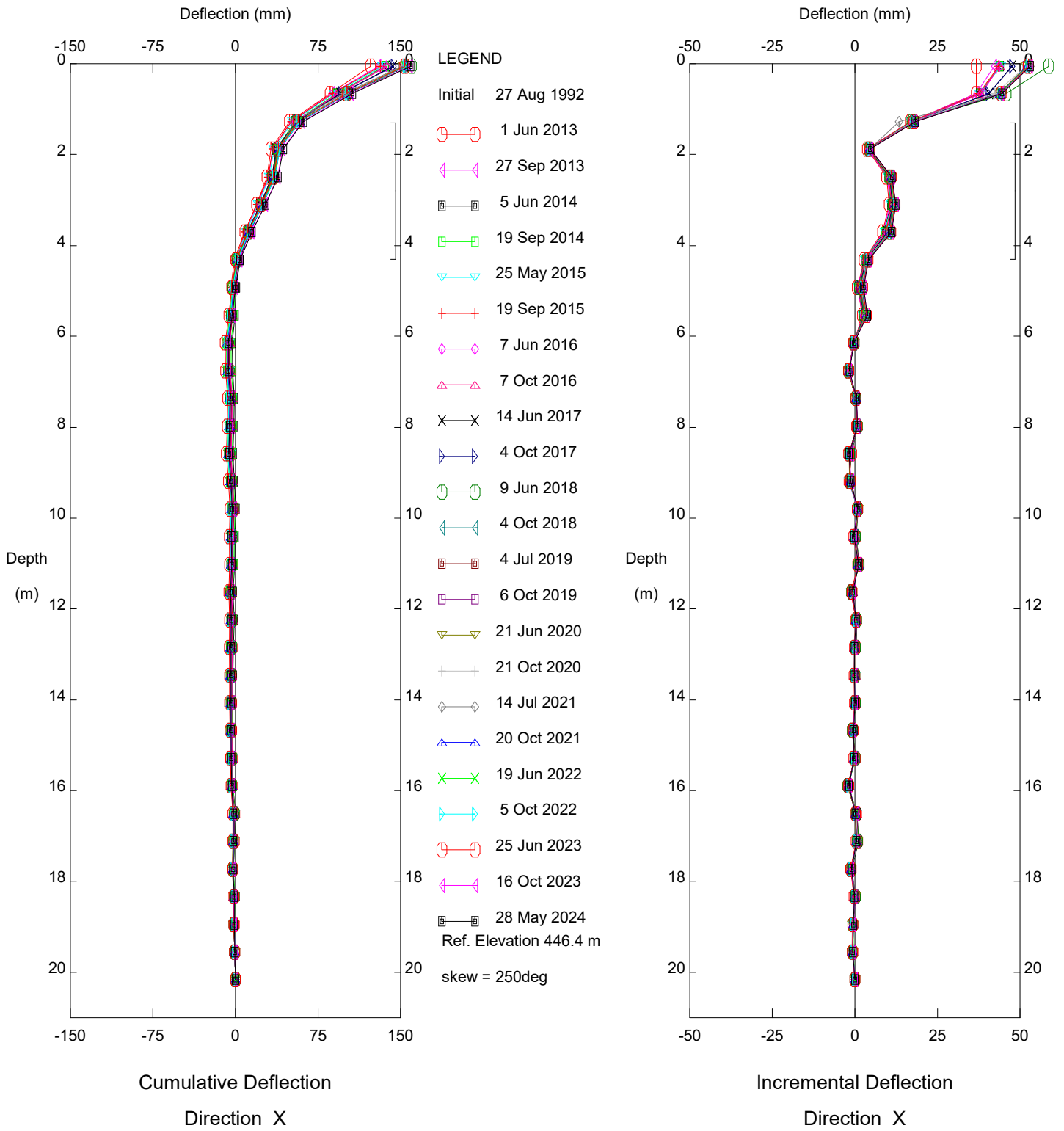
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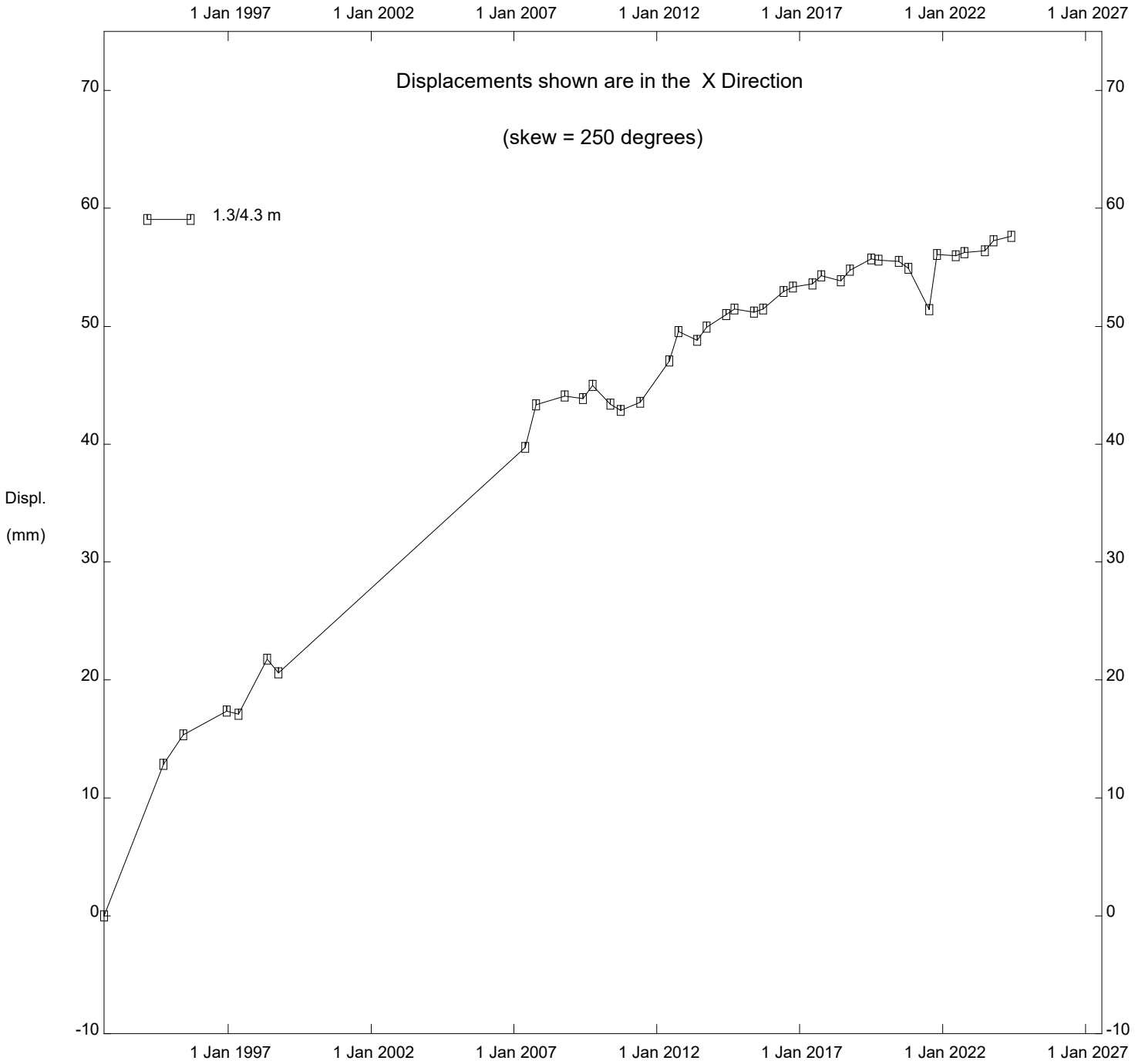
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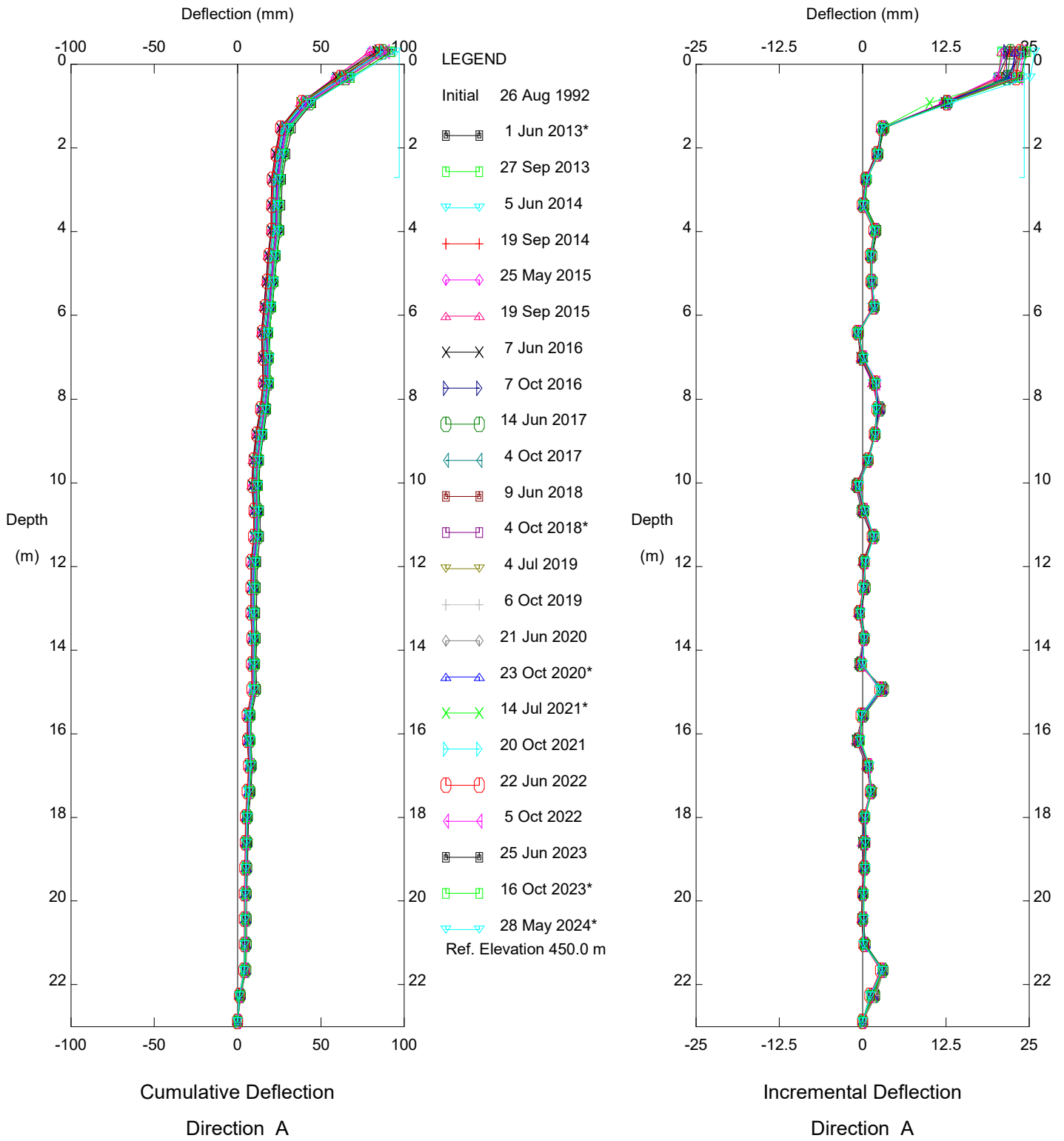
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Alberta Transportation

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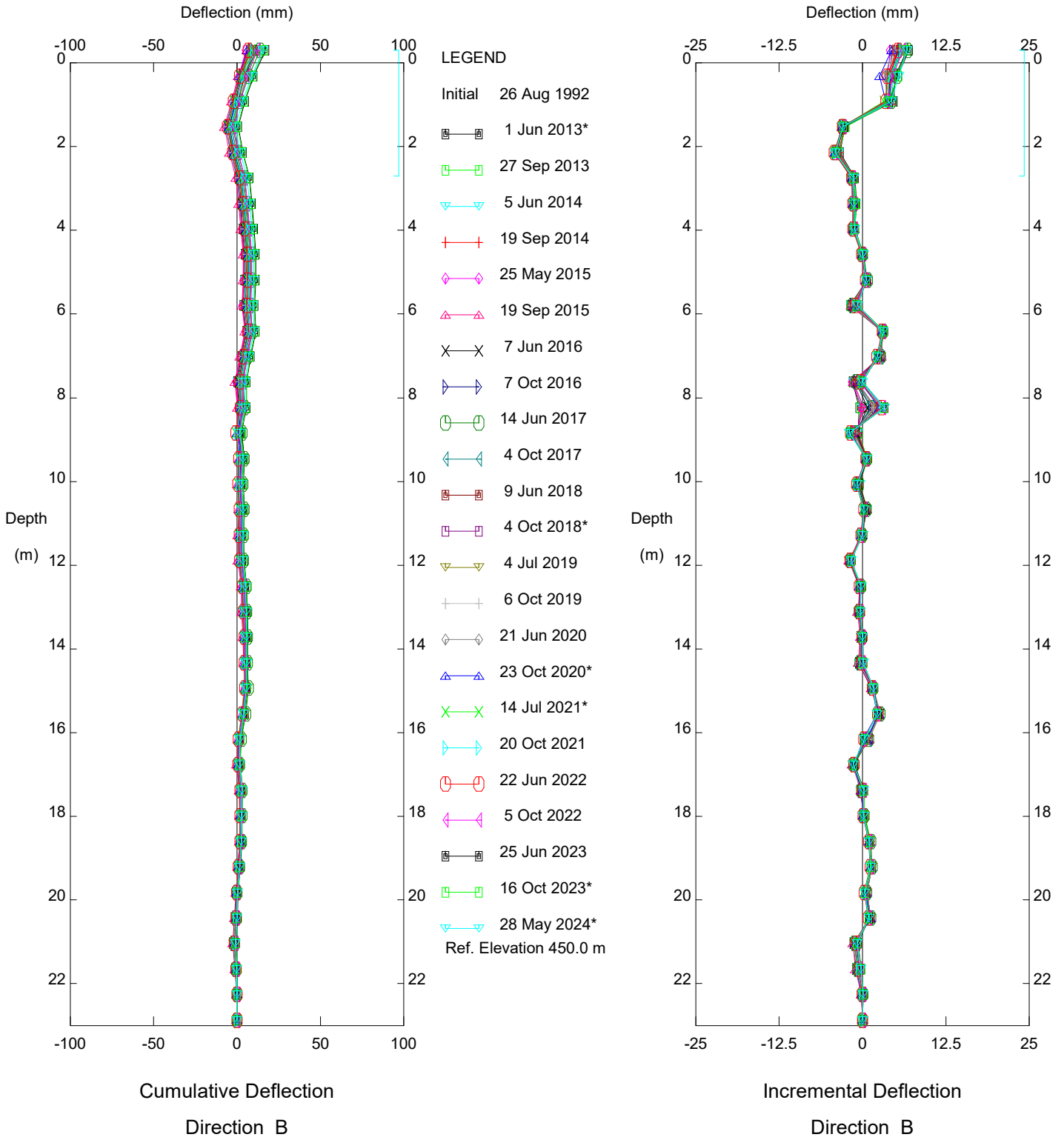


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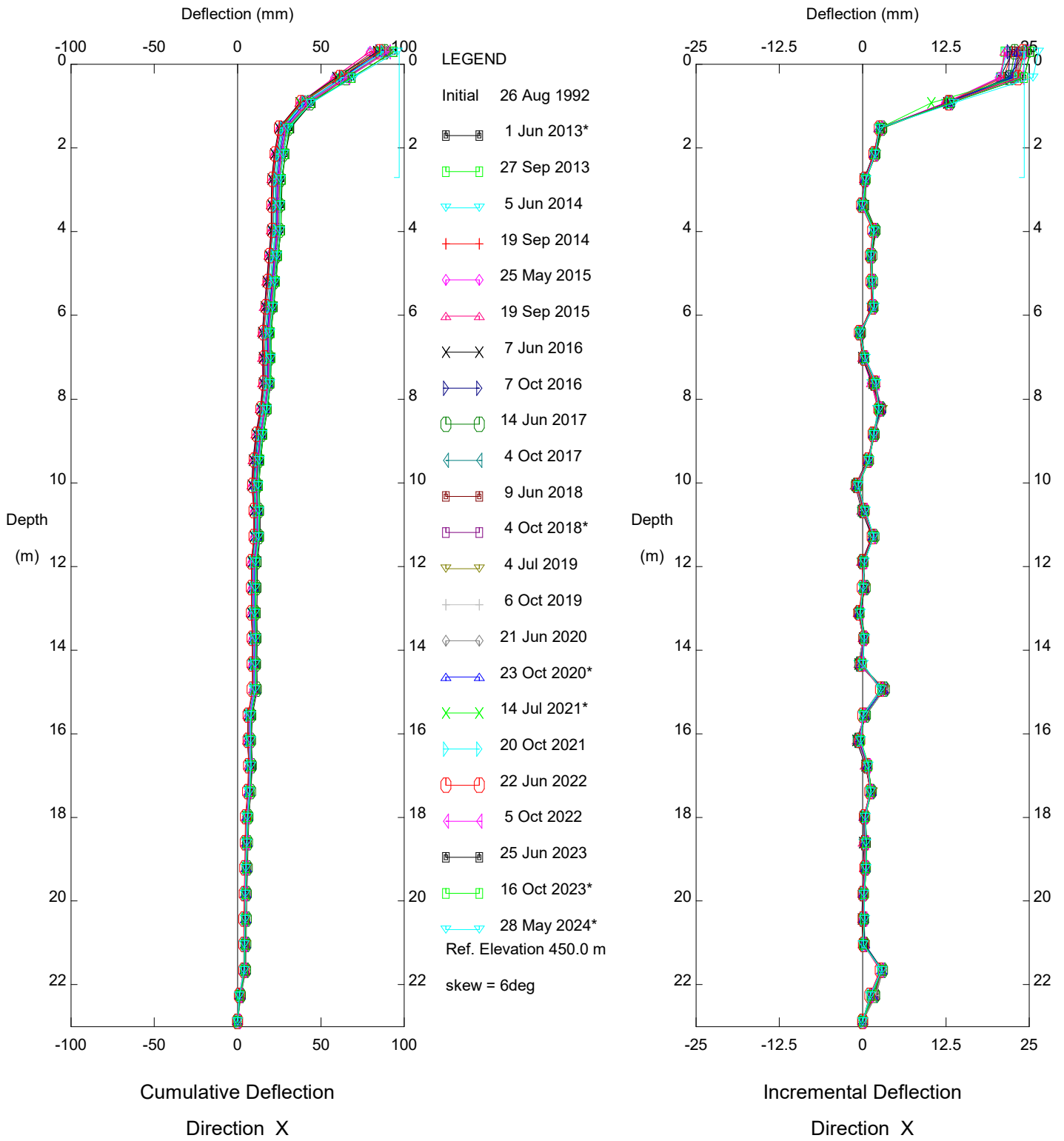


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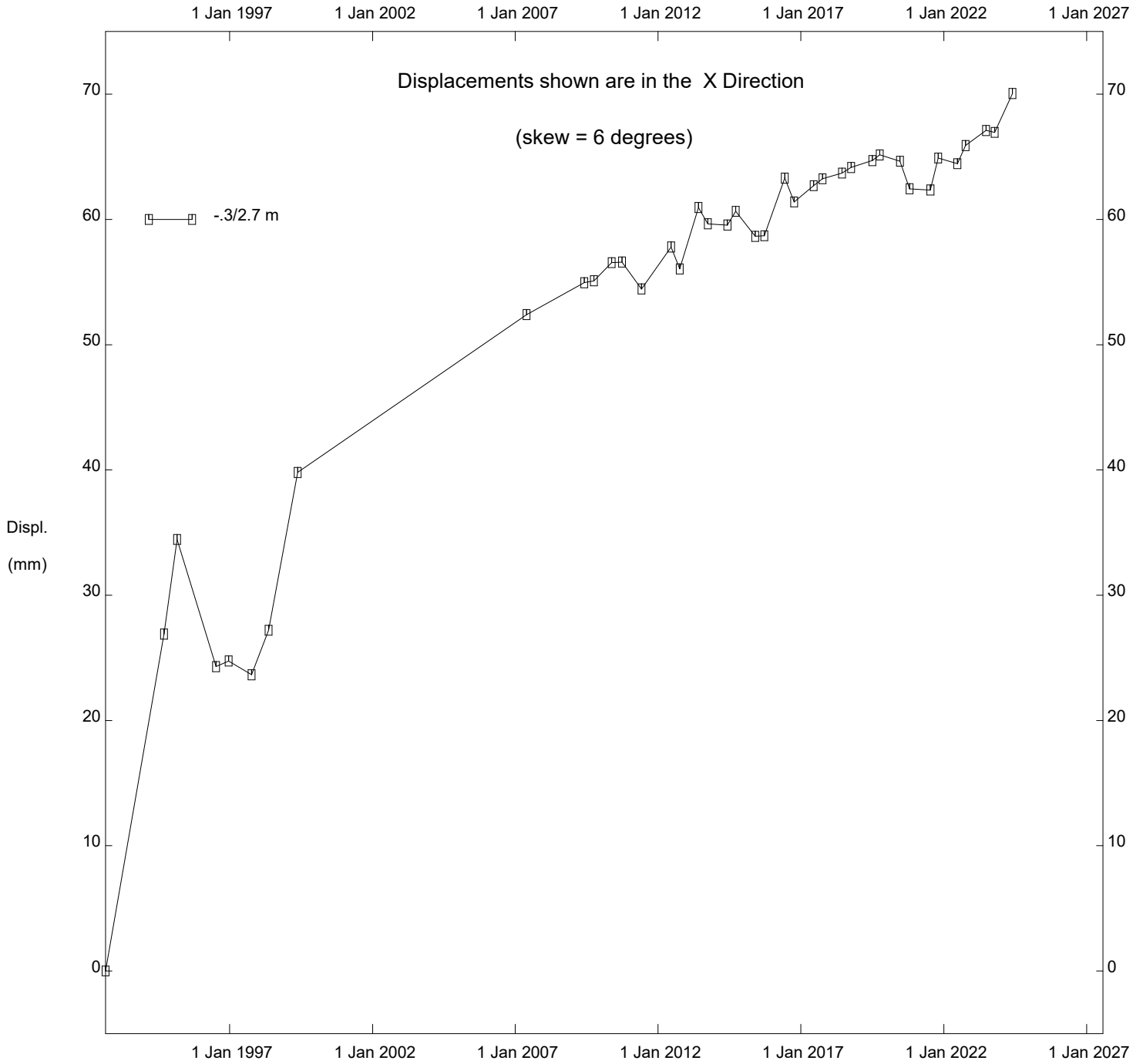


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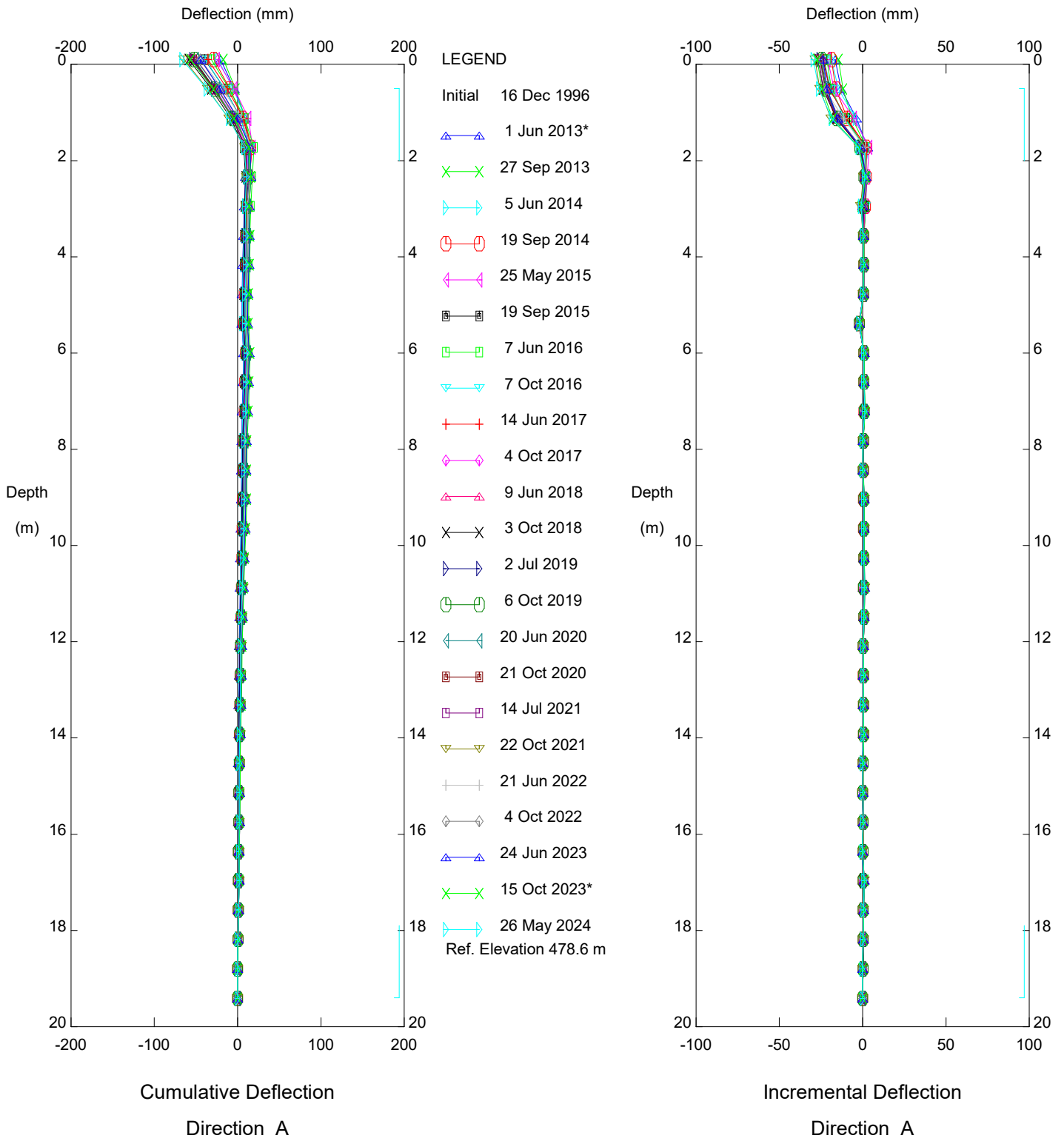
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Alberta Transportation

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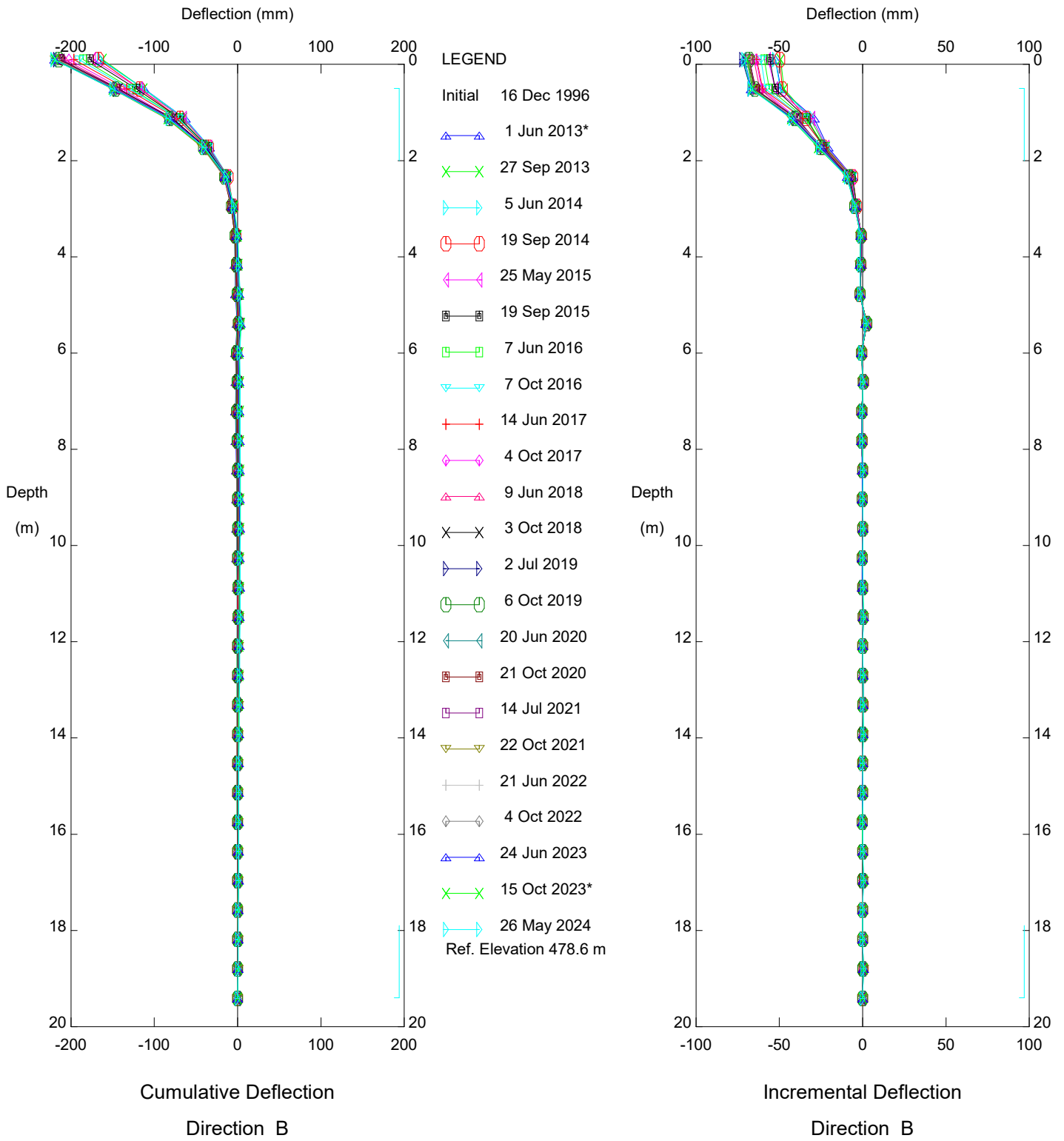


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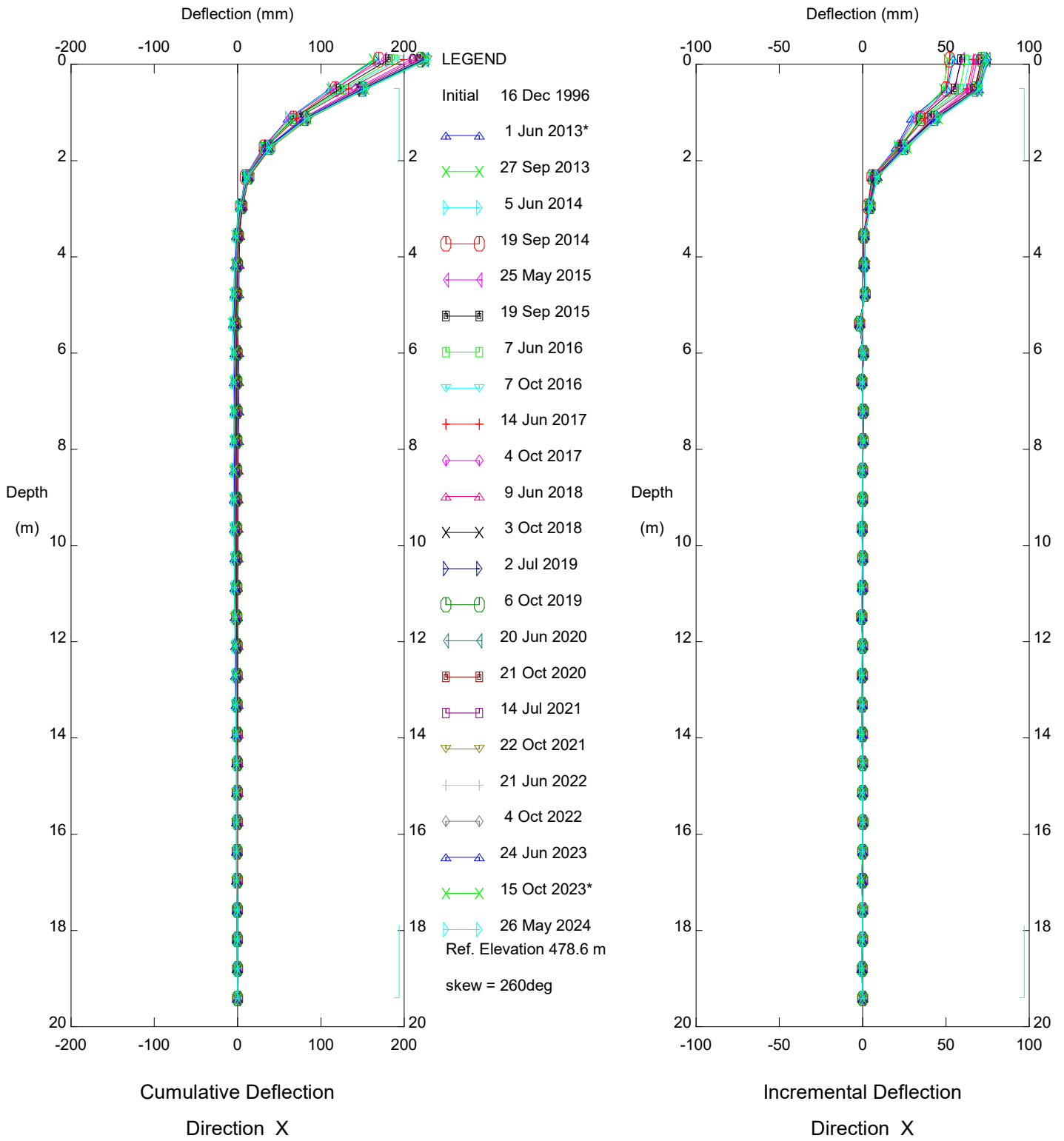


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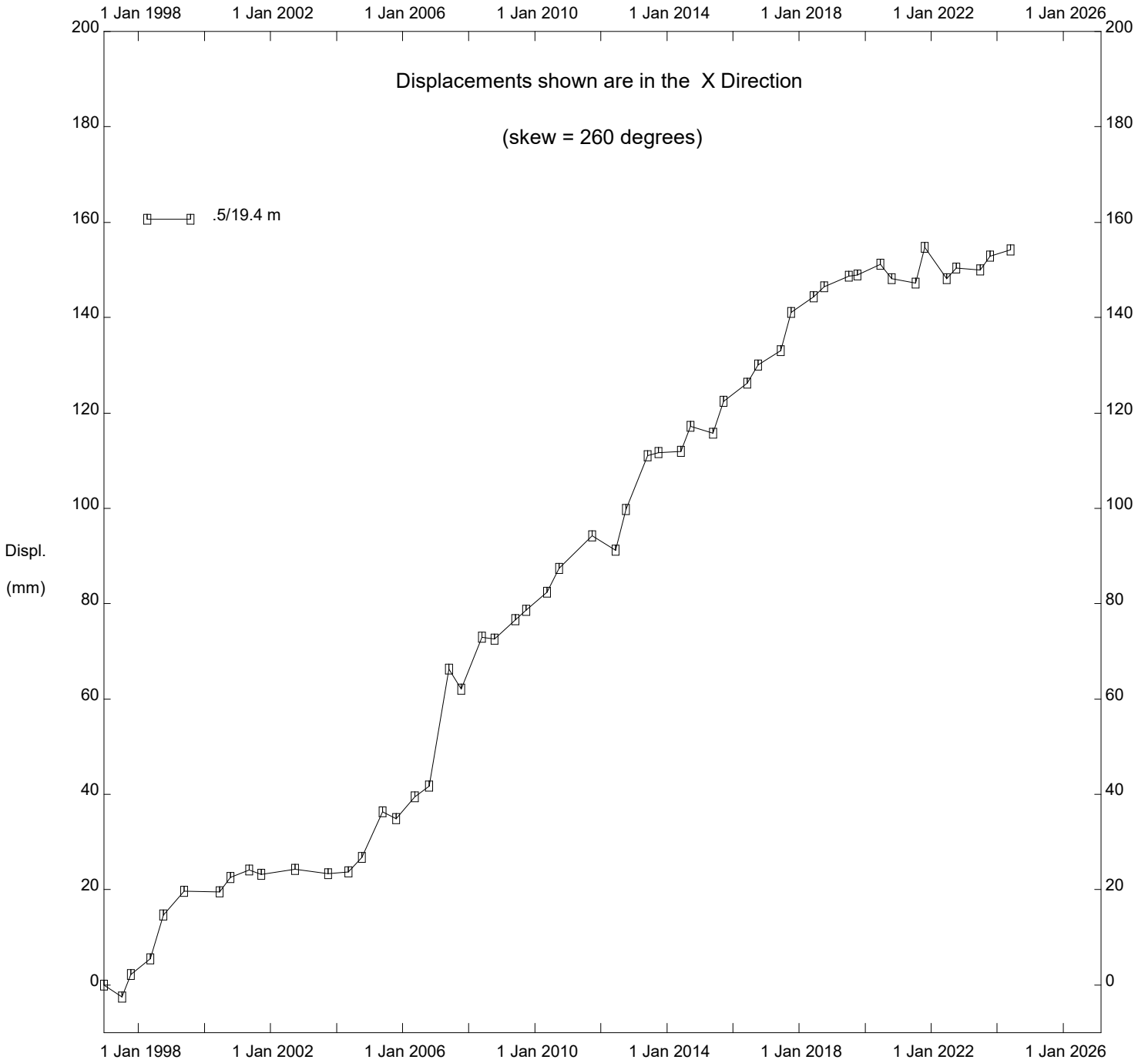


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Alberta Transportation

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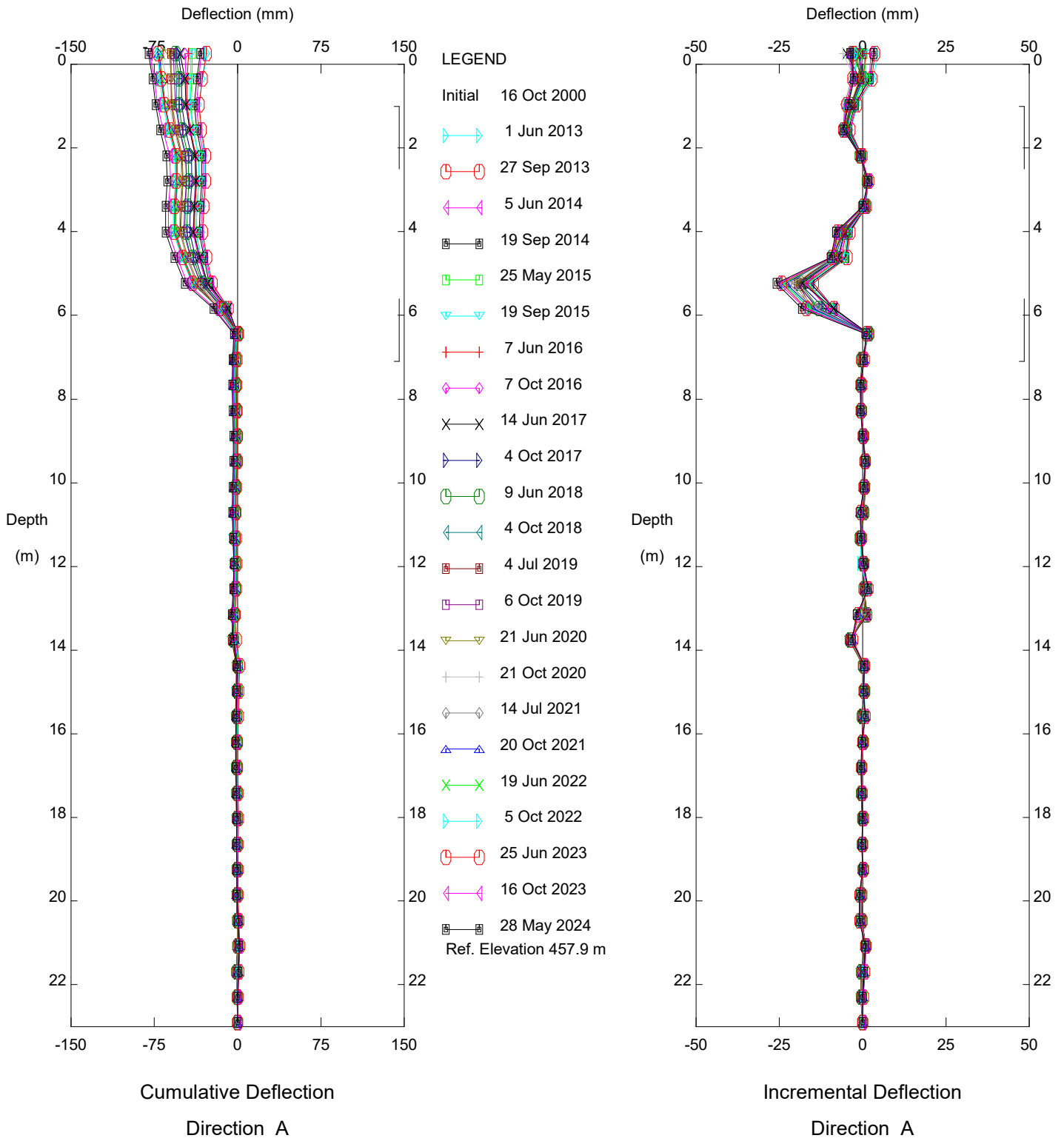
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Alberta Transportation

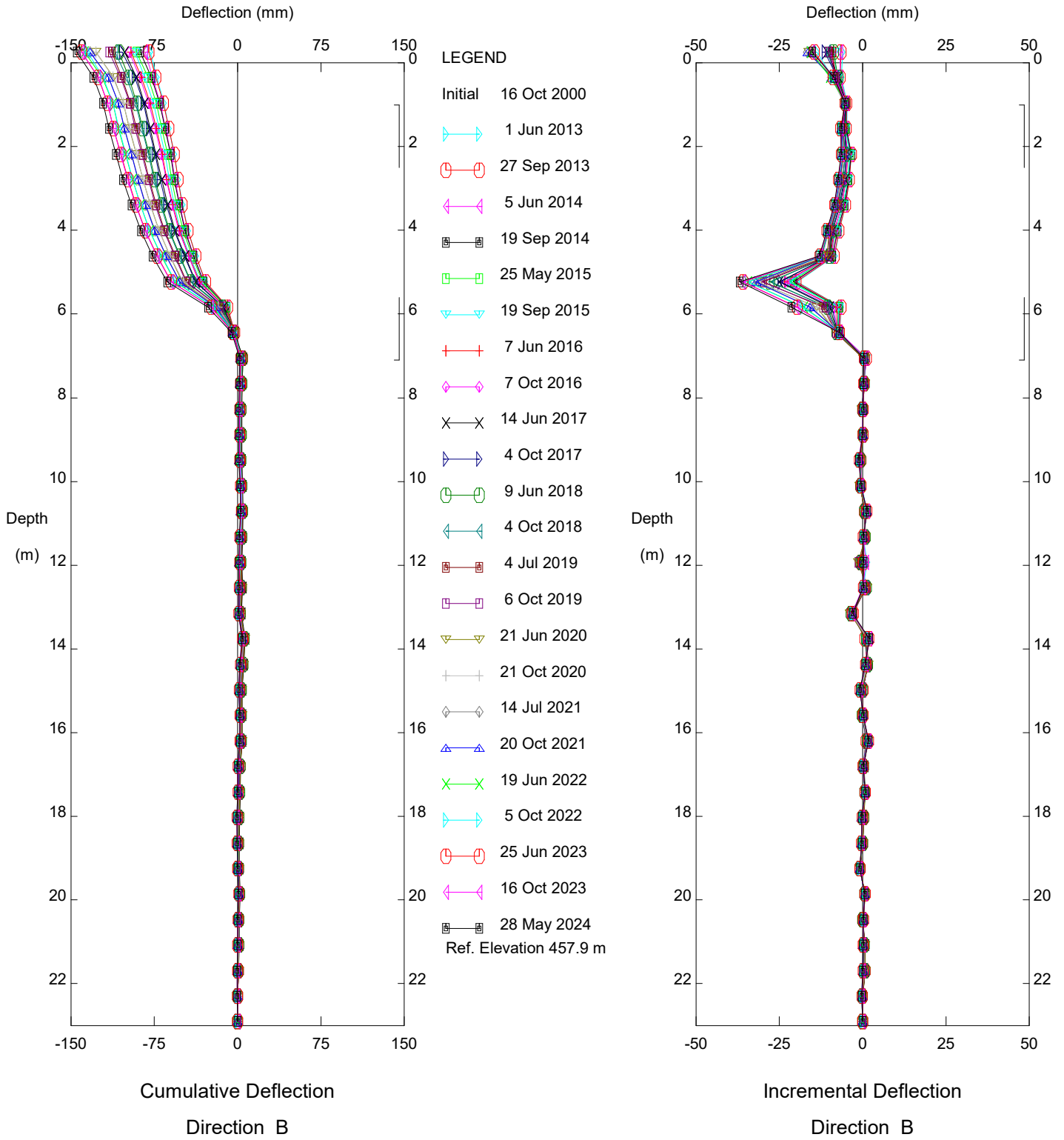
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Alberta Transportation

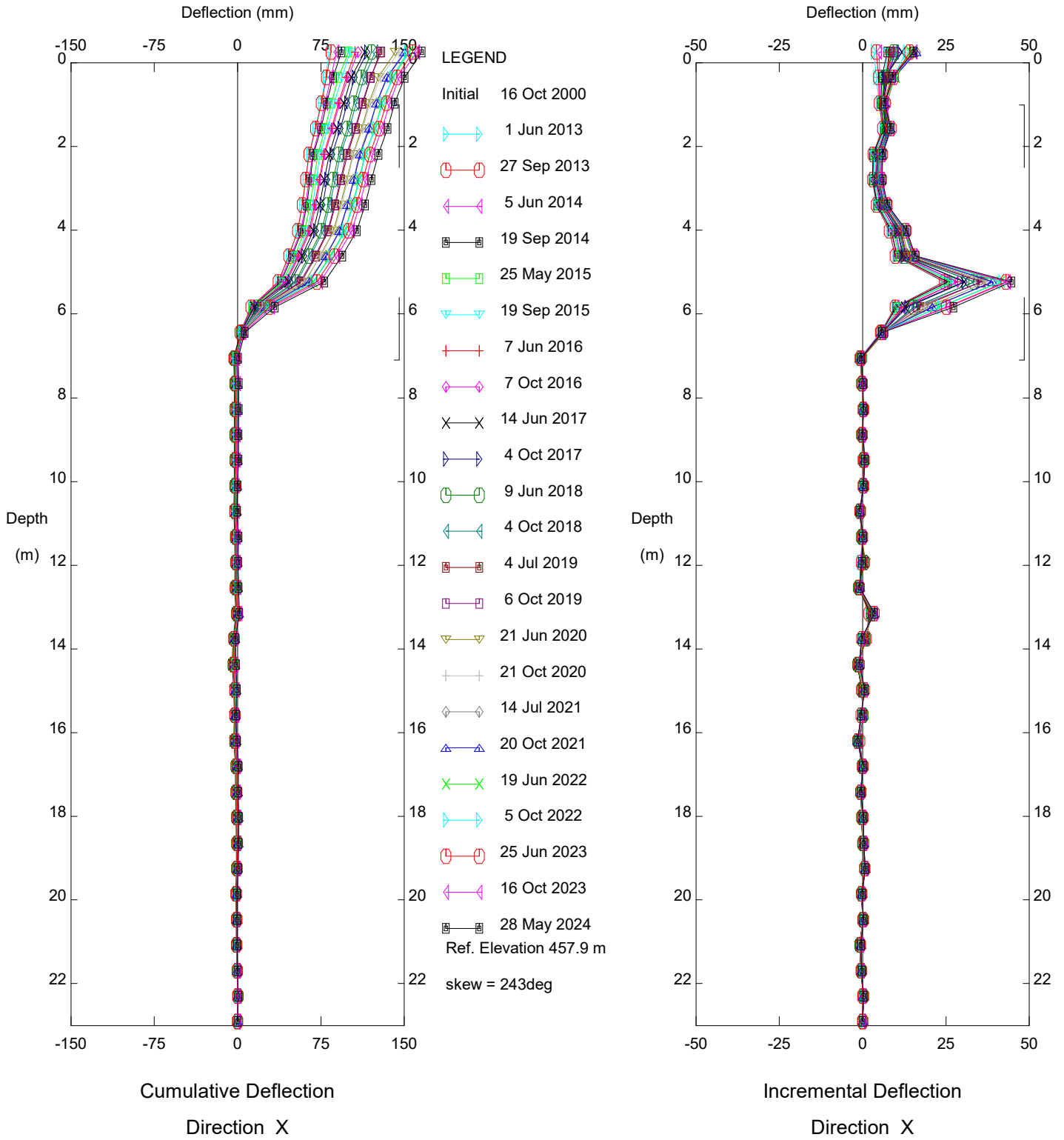
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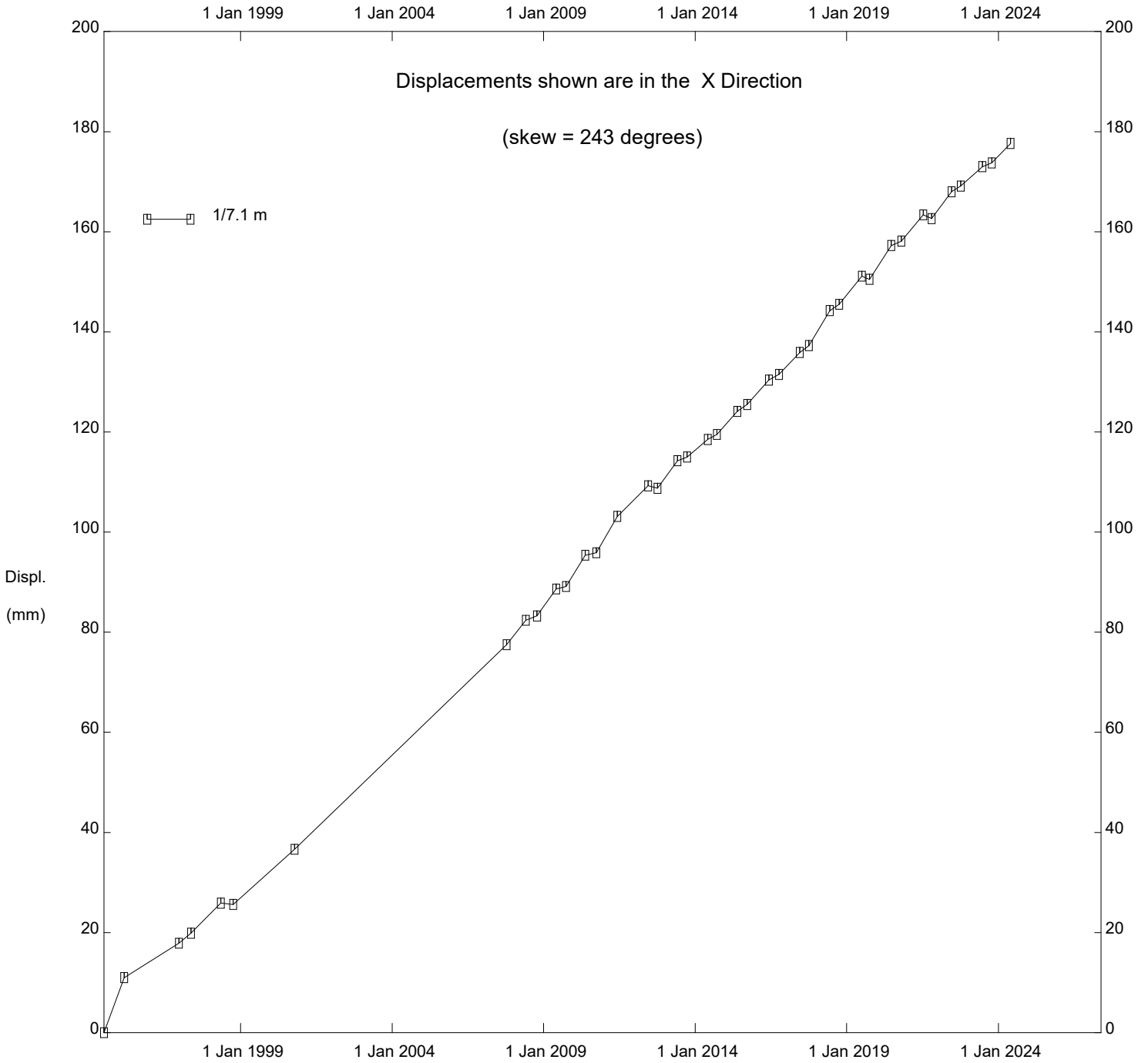
Alberta Transportation

Thurber Engineering Ltd.



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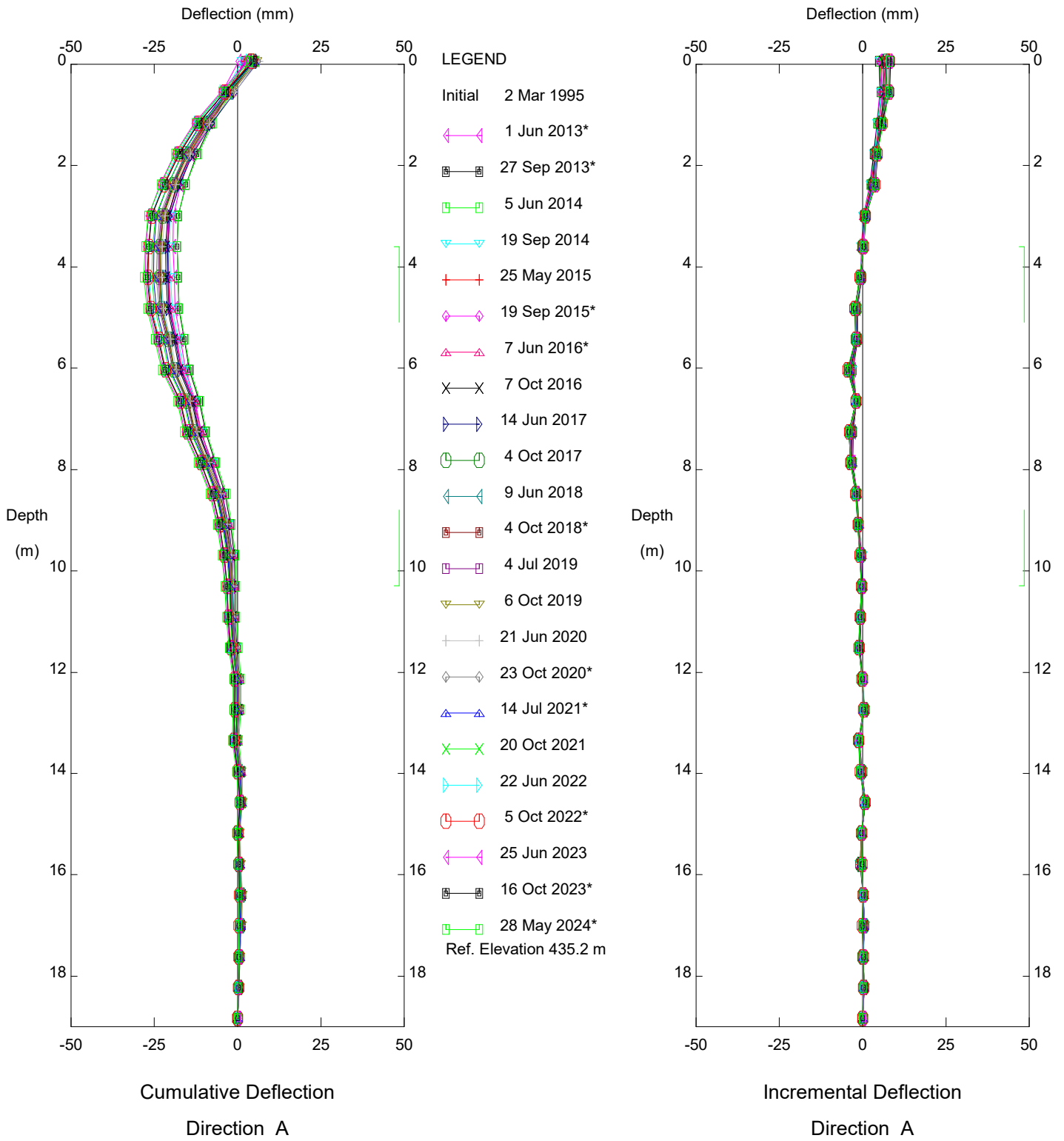
Alberta Transportation



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Alberta Transportation

Thurber Engineering Ltd.

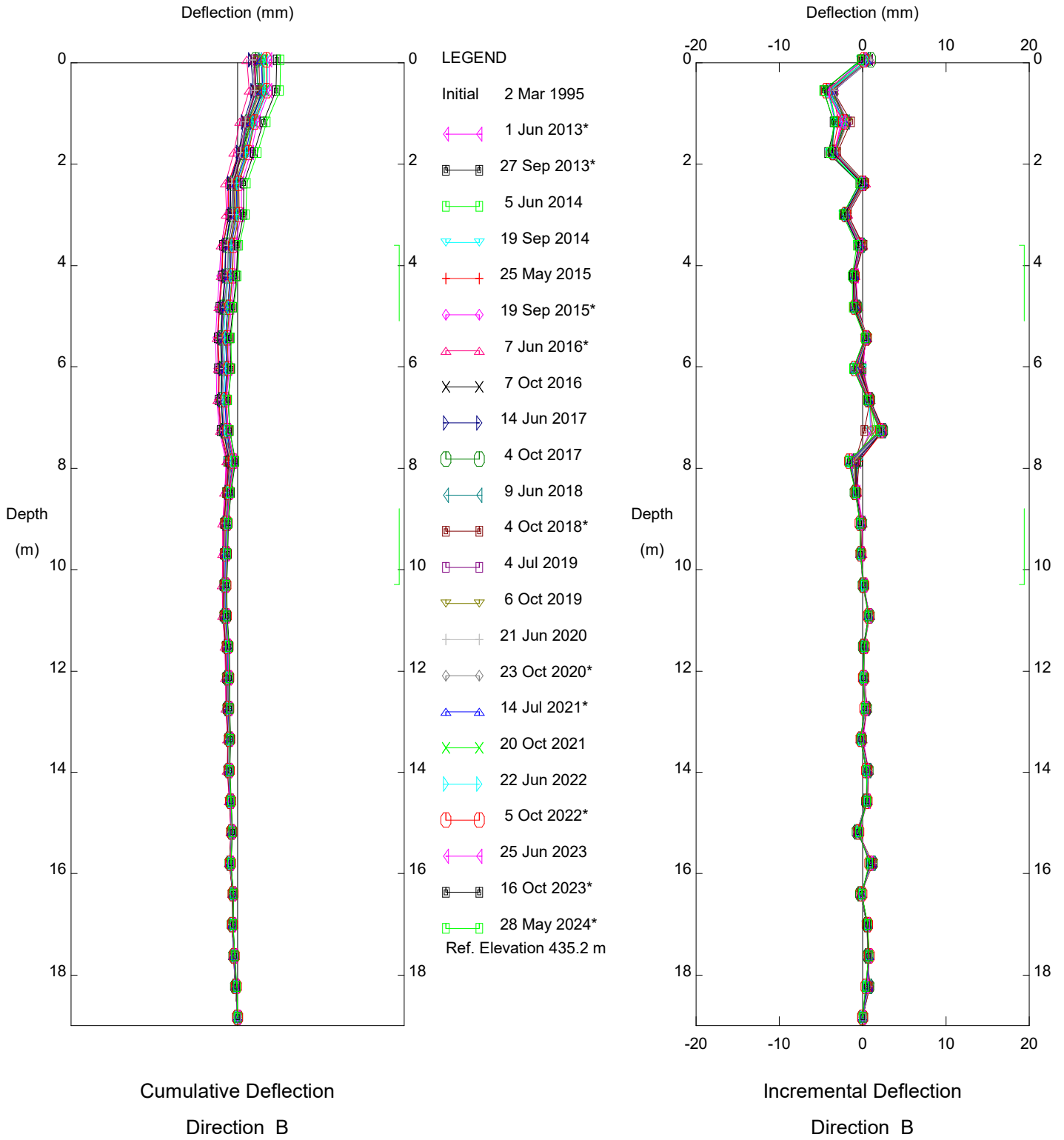


HWY 2:68 (PH037), Inclinometer SI-61

Alberta Transportation

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Thurber Engineering Ltd.

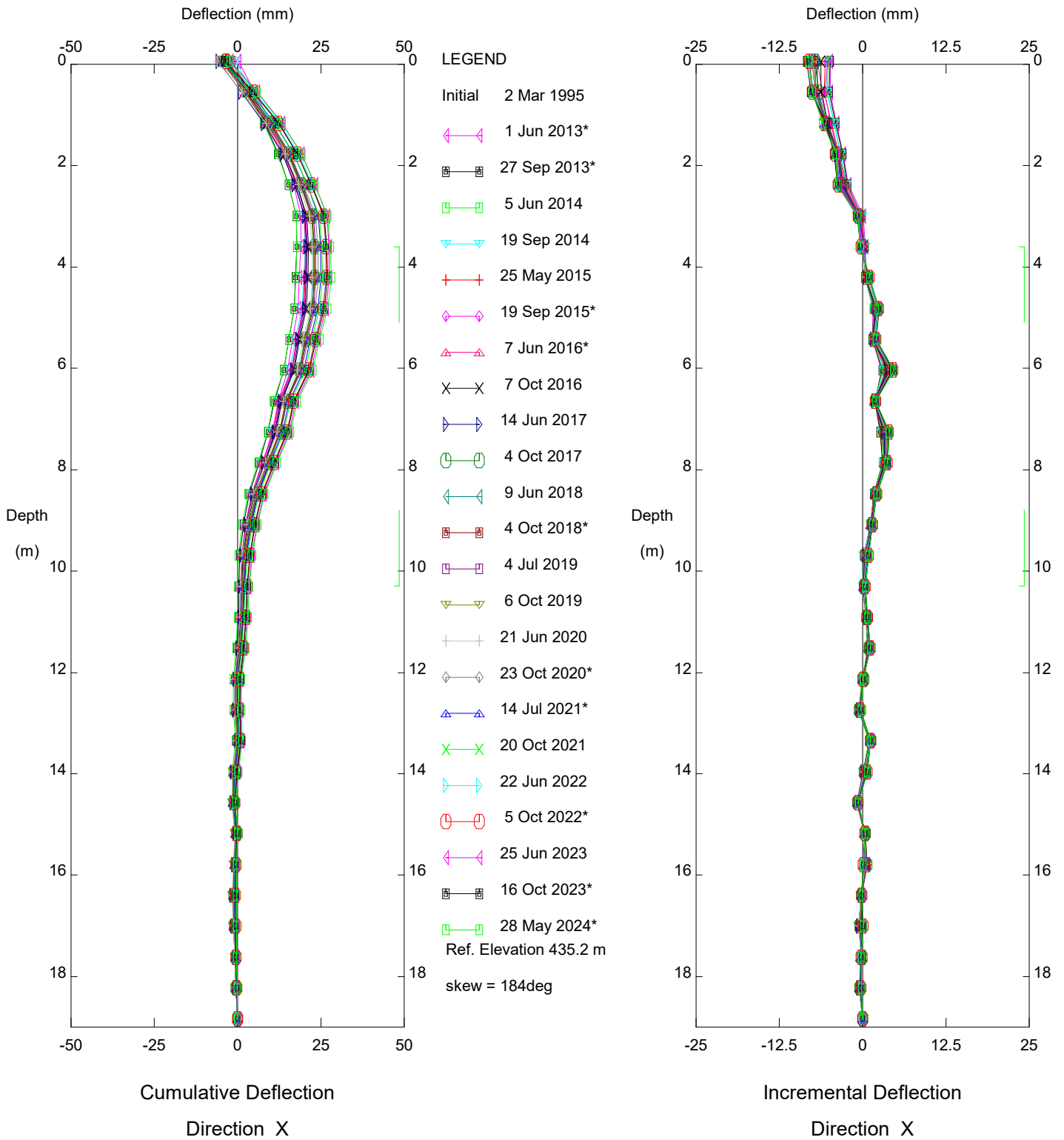


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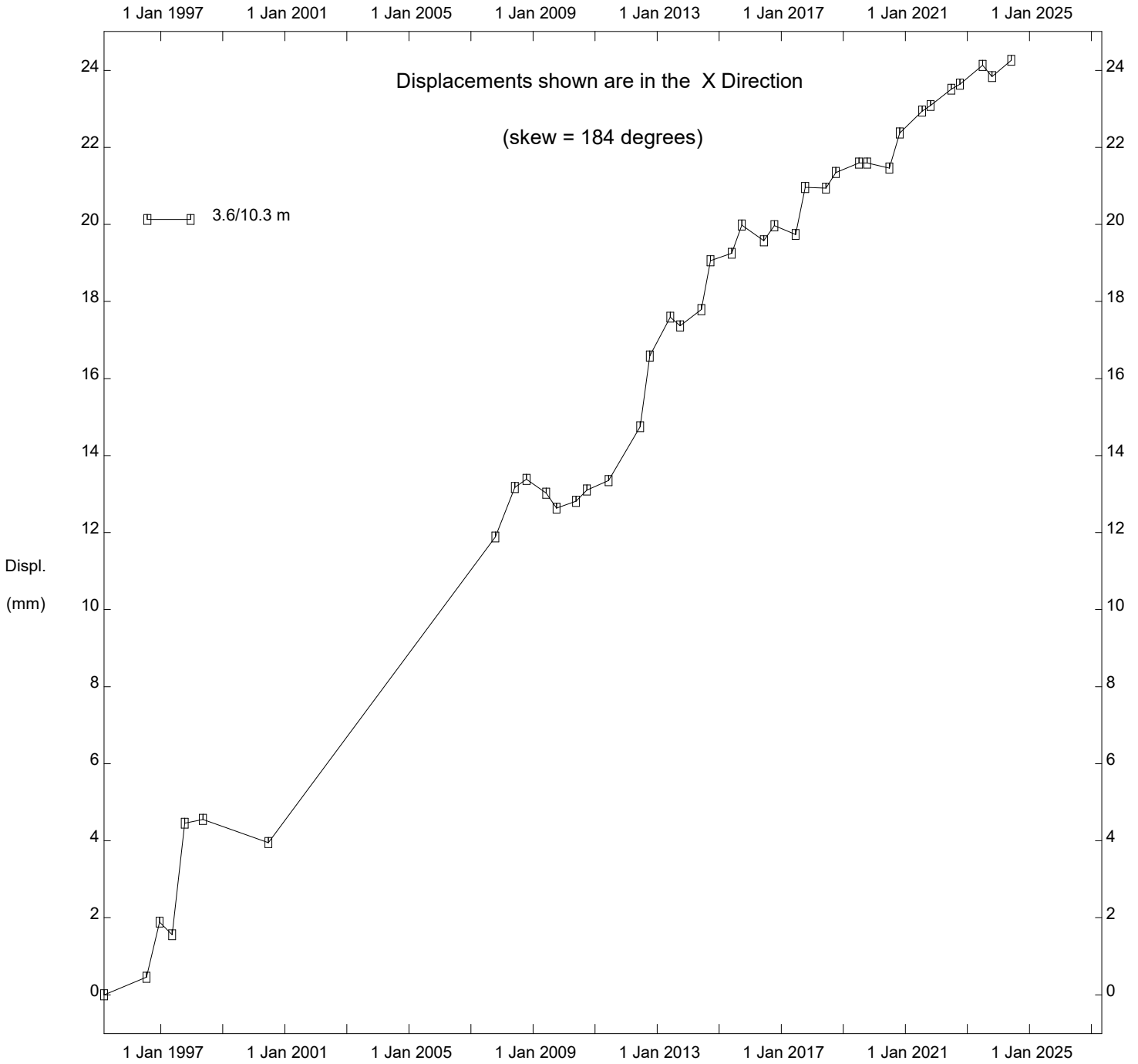


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Alberta Transportation

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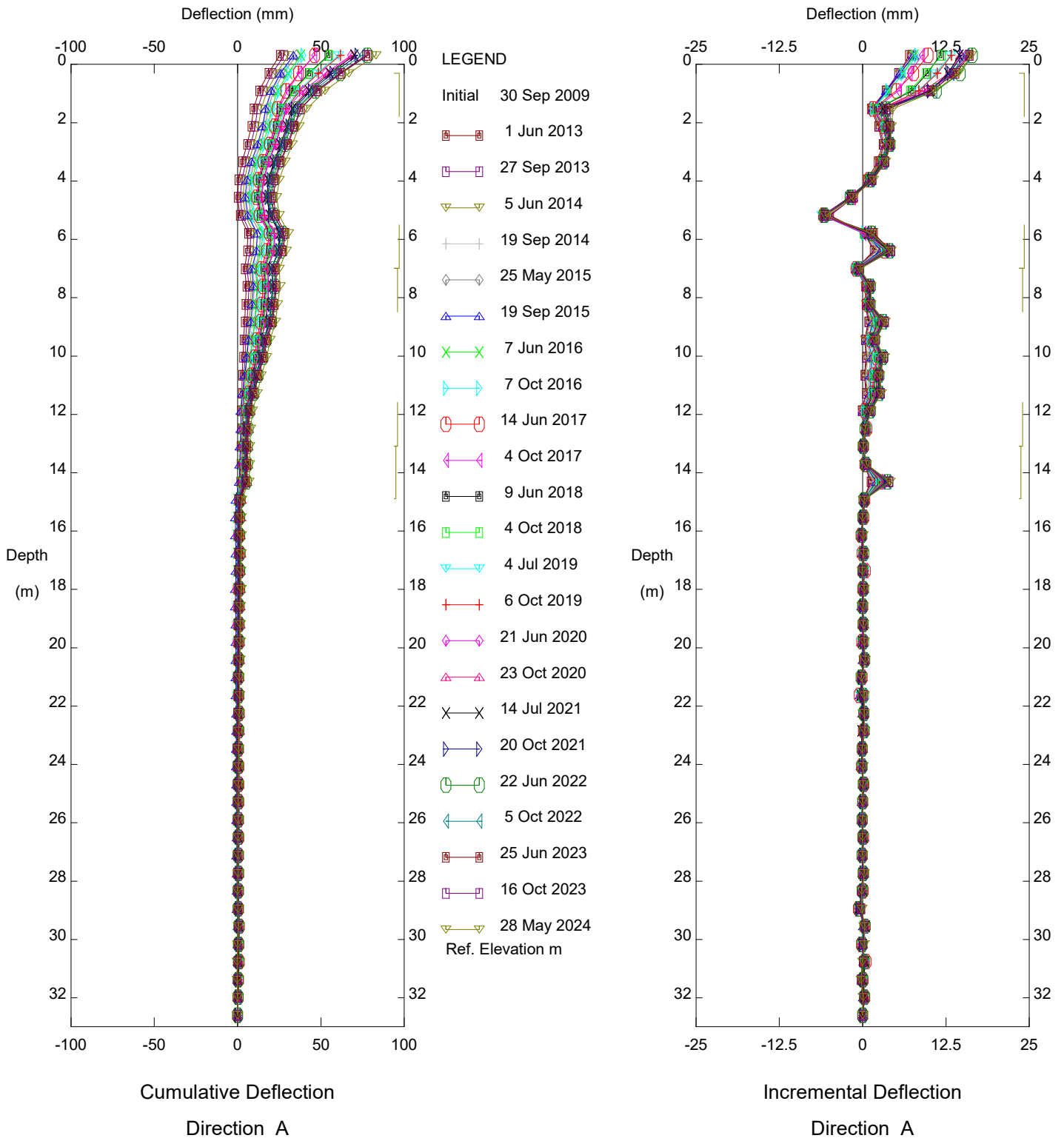
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Alberta Transportation

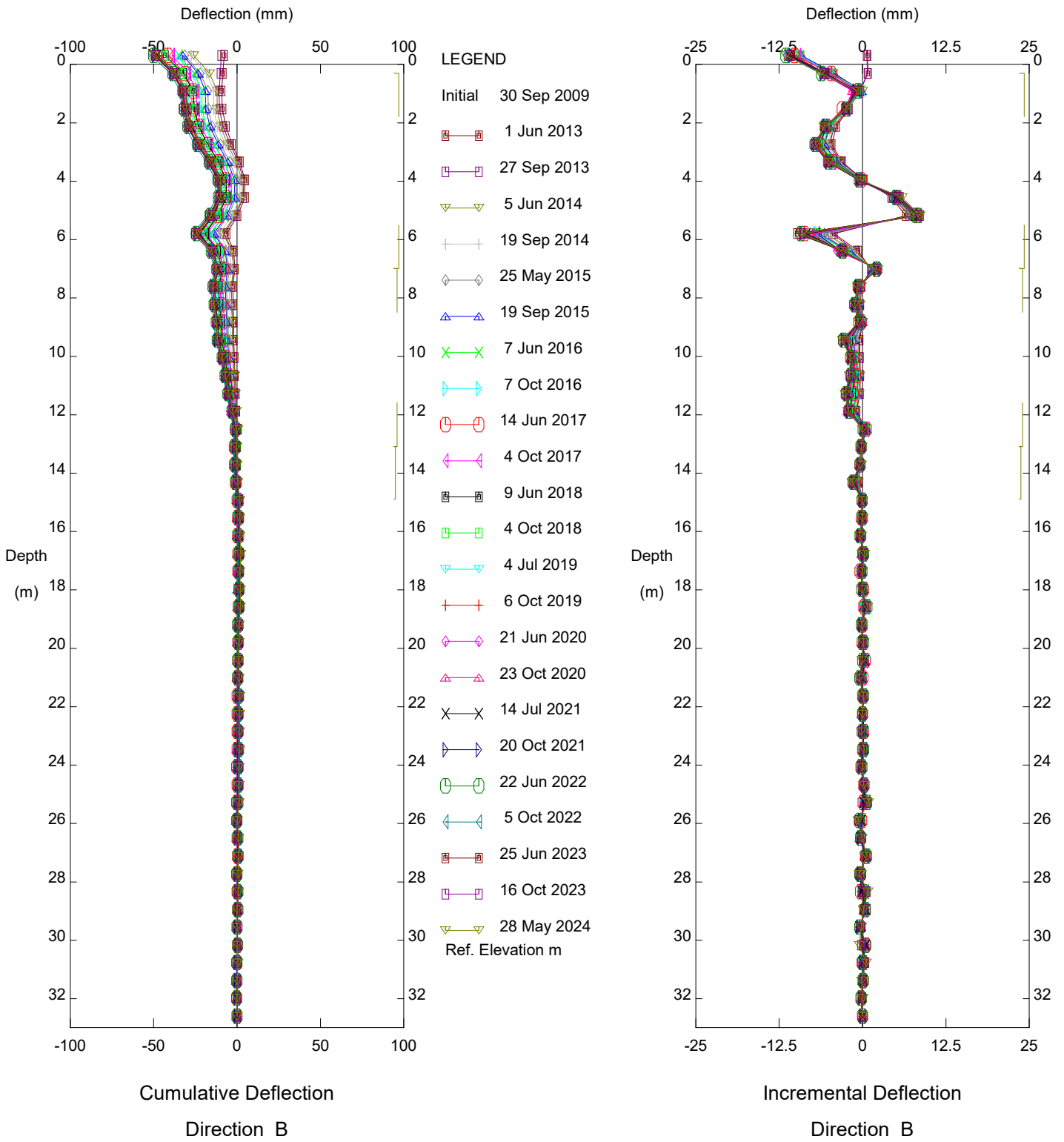
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HWY 2:68 (PH037), Inclinometer SI09-1

Alberta Transportation

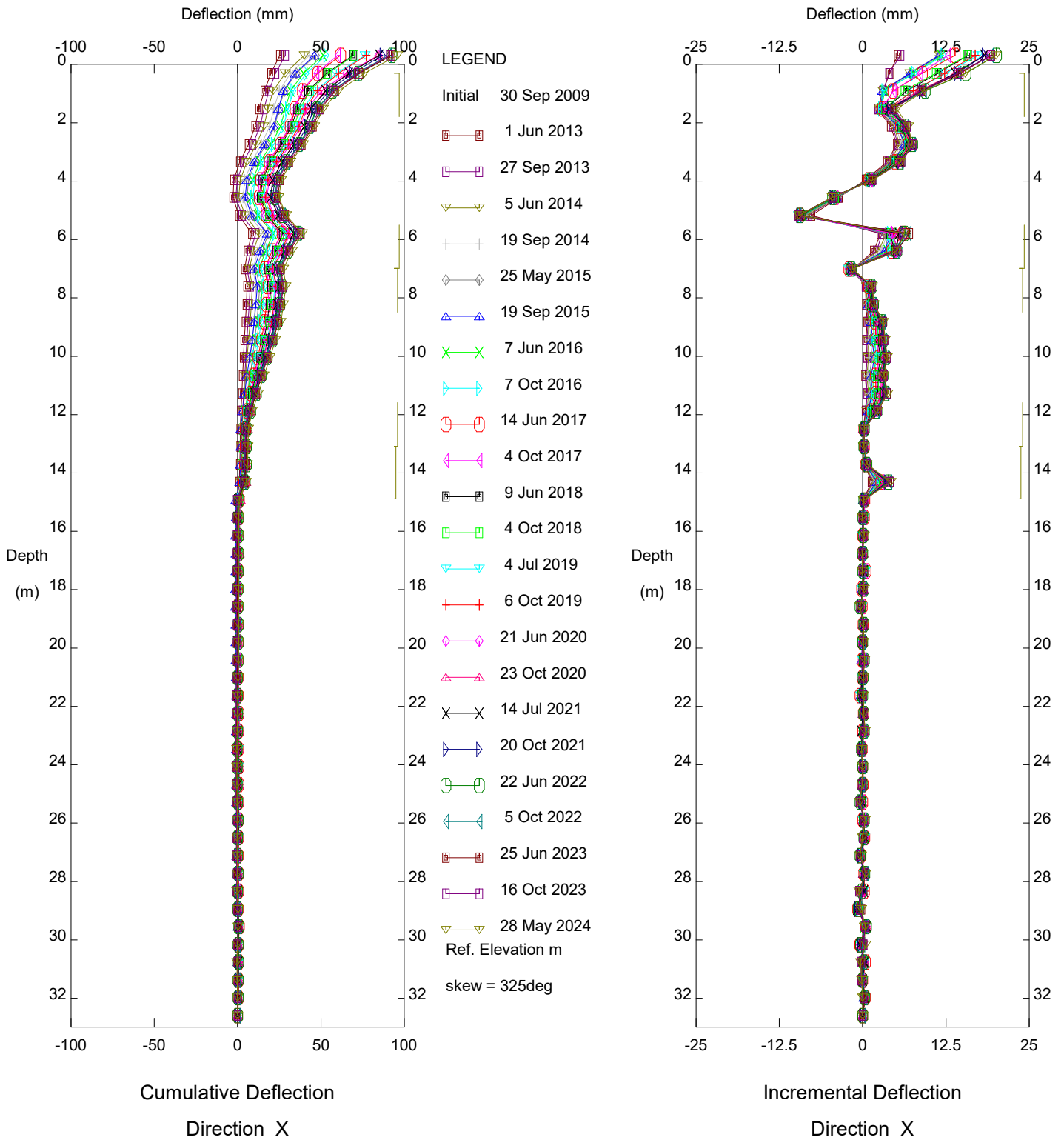
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Alberta Transportation

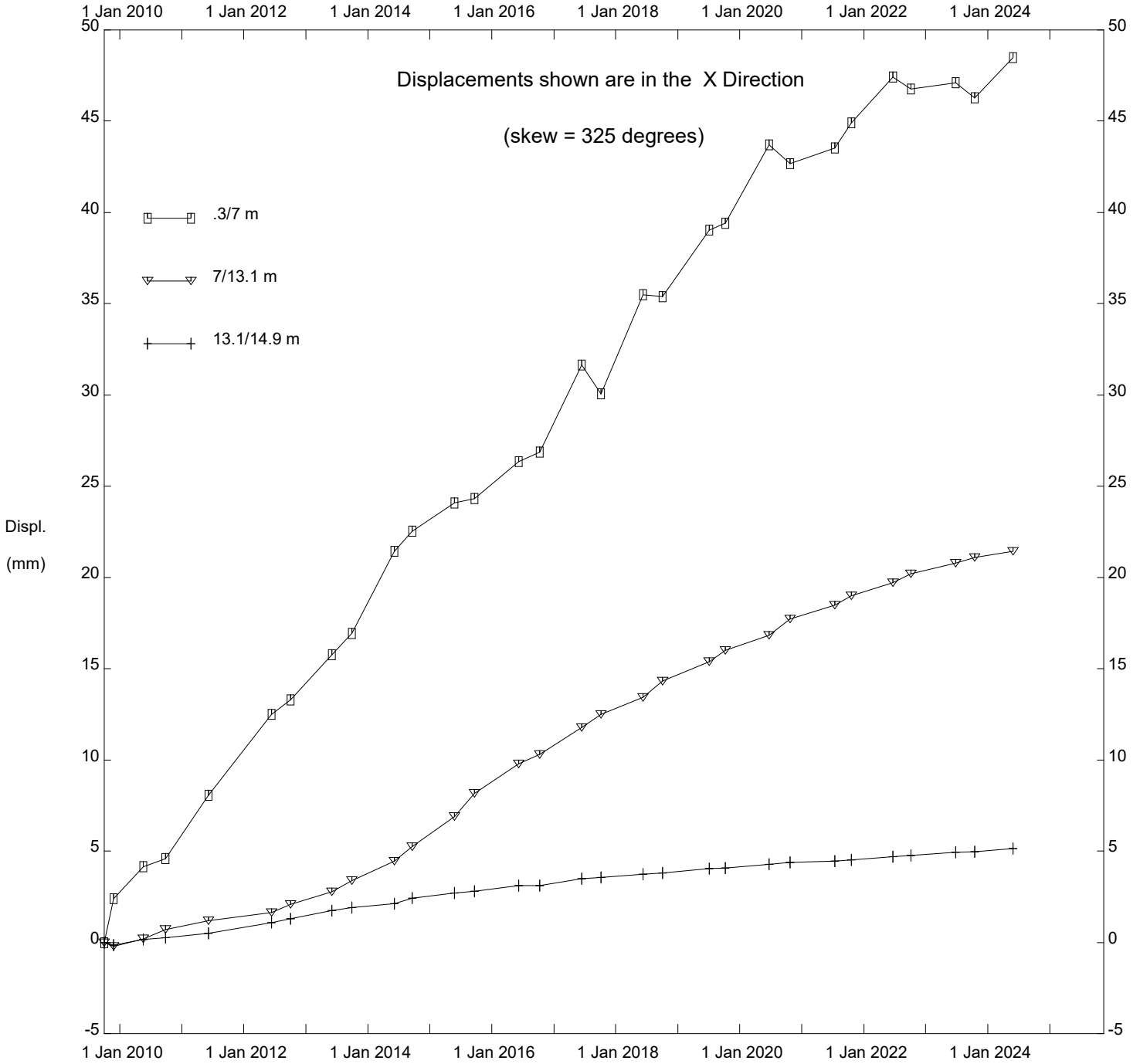
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Alberta Transportation

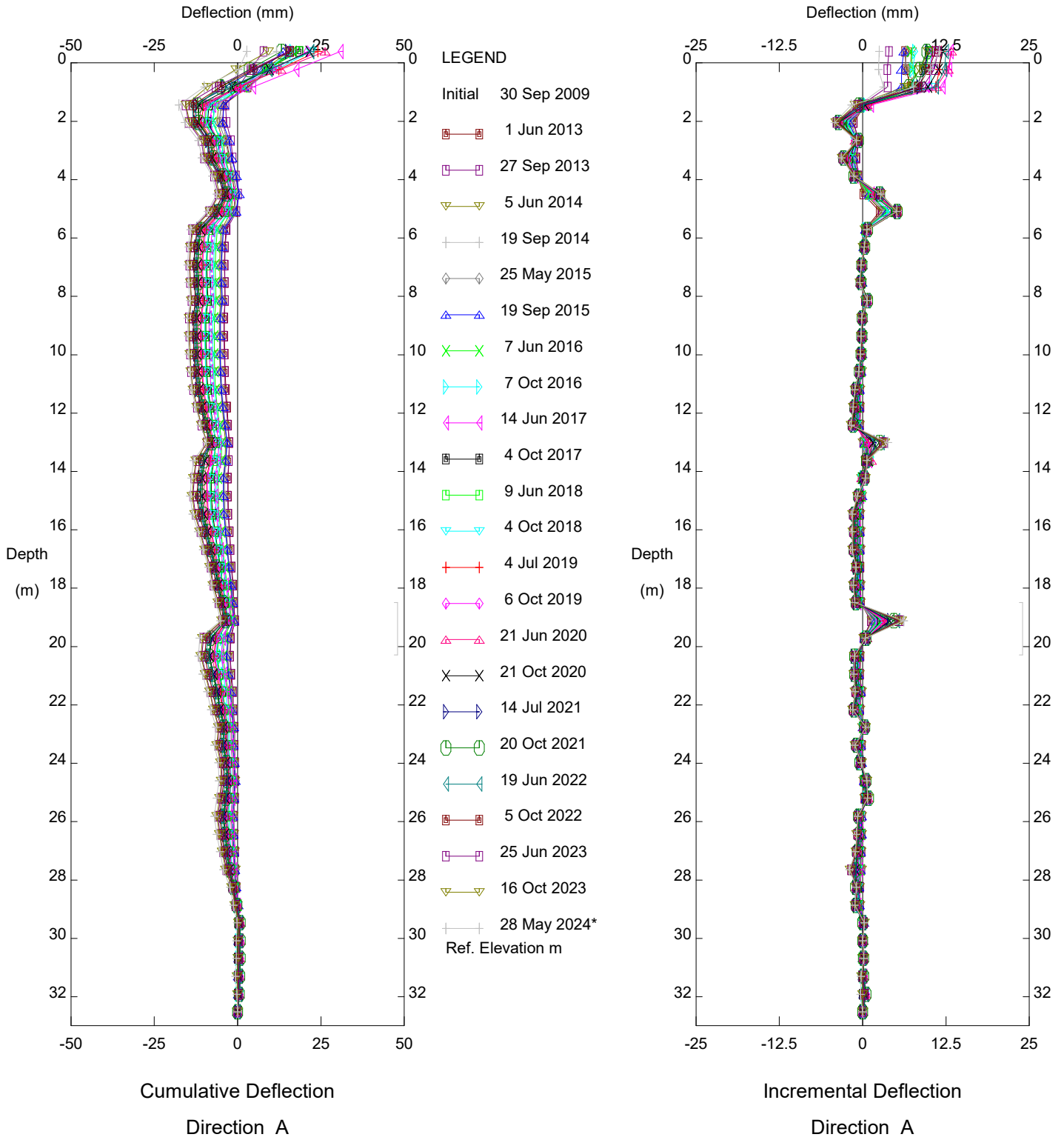
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Alberta Transportation

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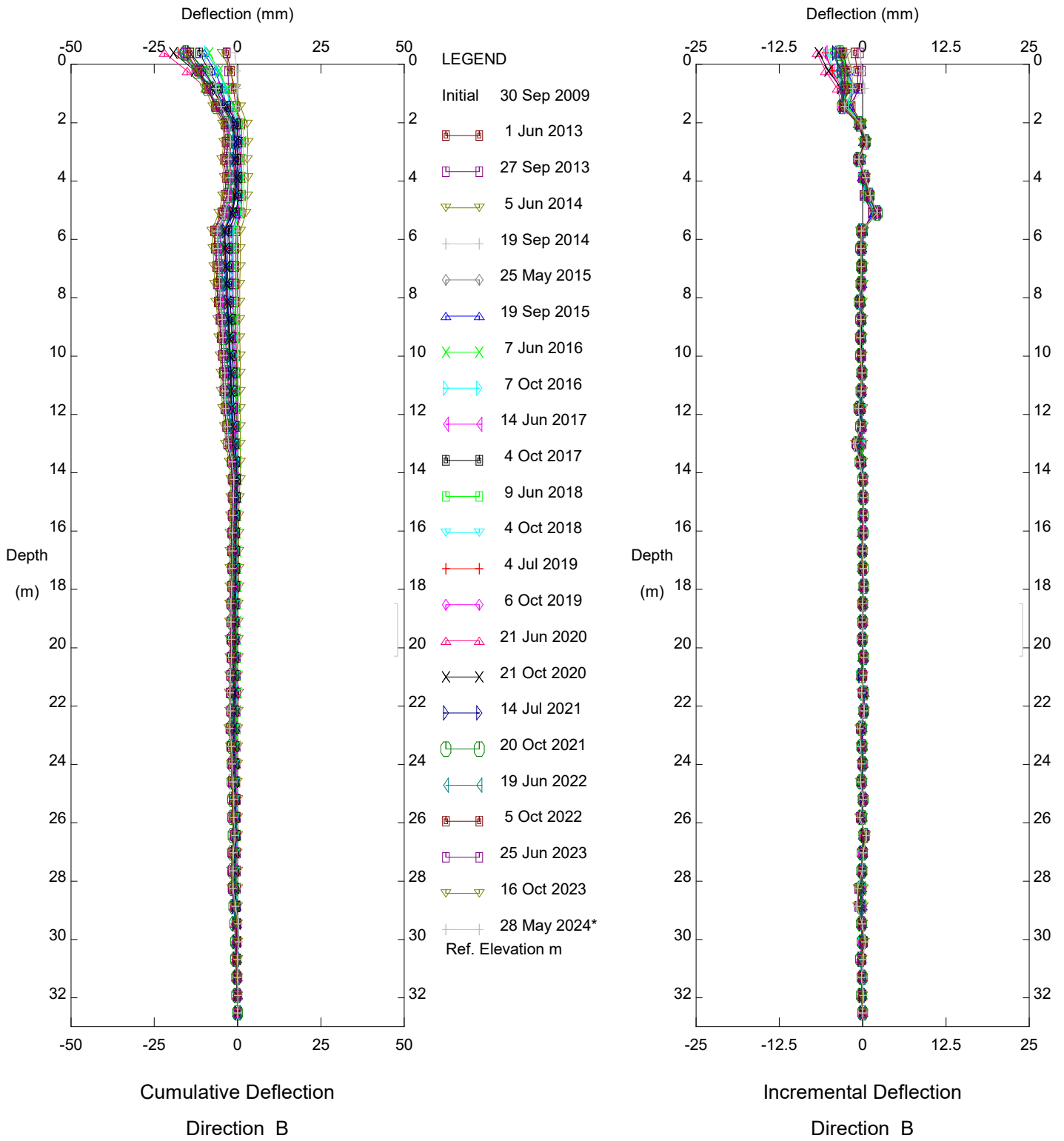


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Alberta Transportation

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Thurber Engineering Ltd.

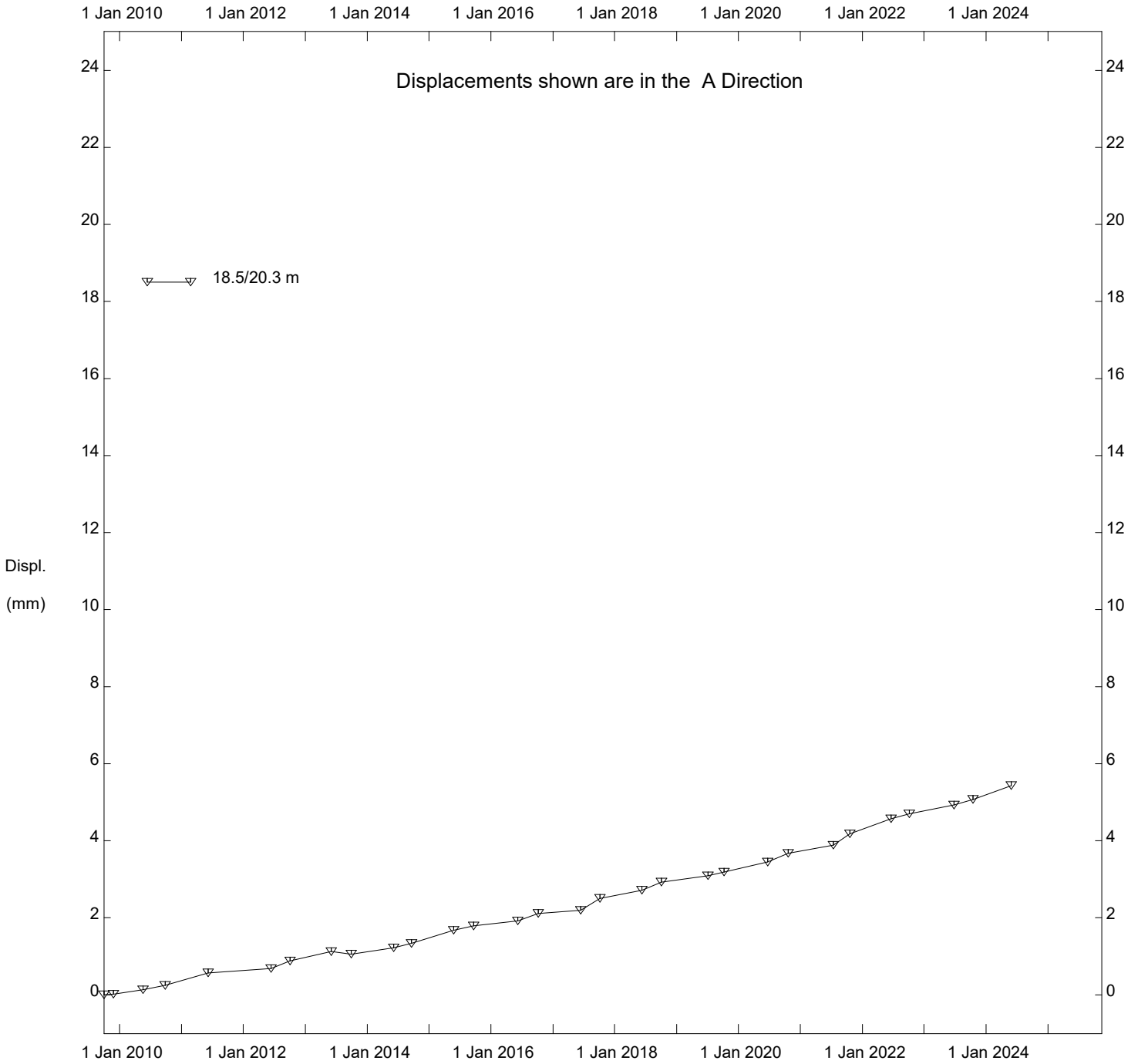


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Alberta Transportation

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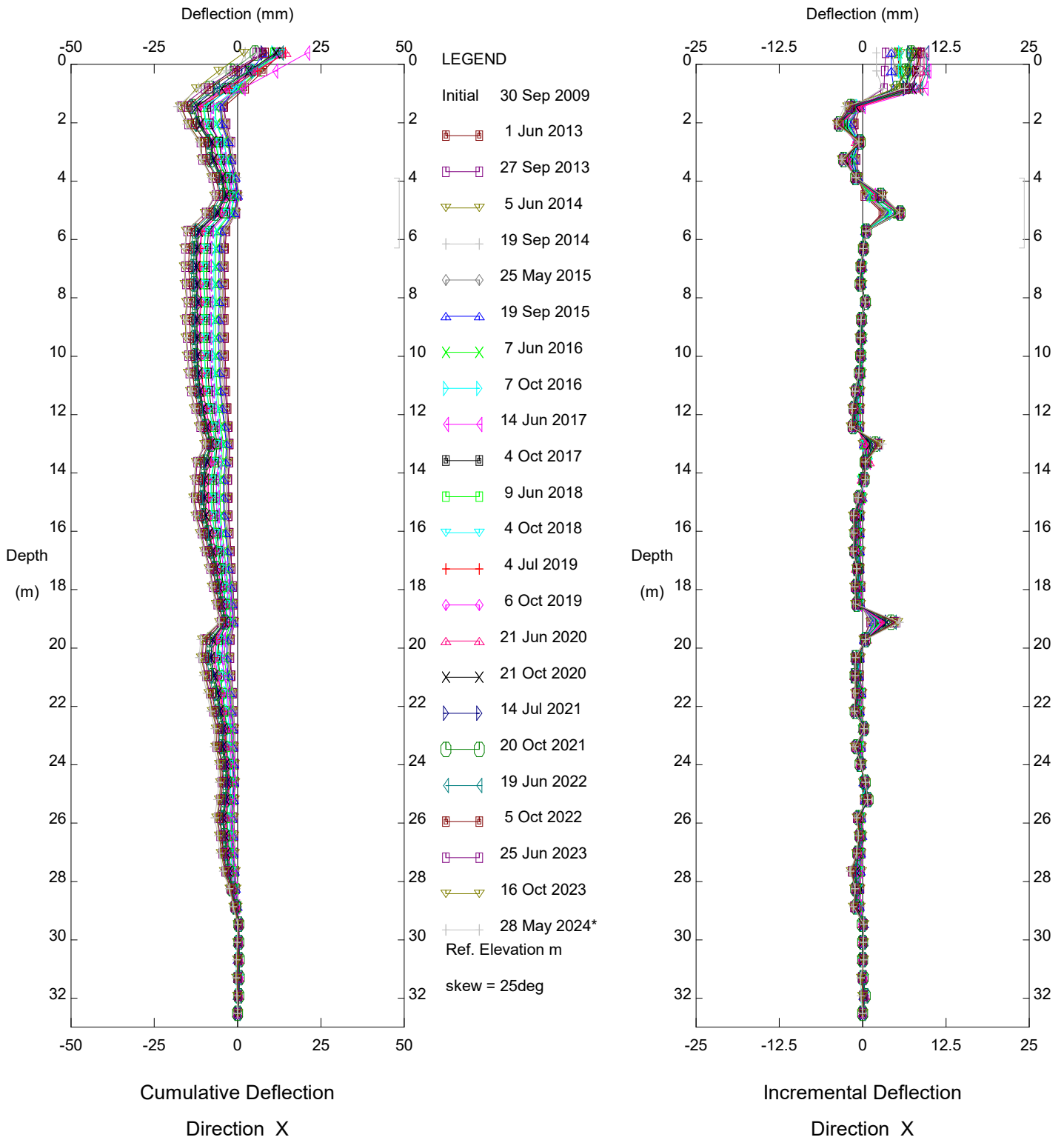
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Alberta Transportation

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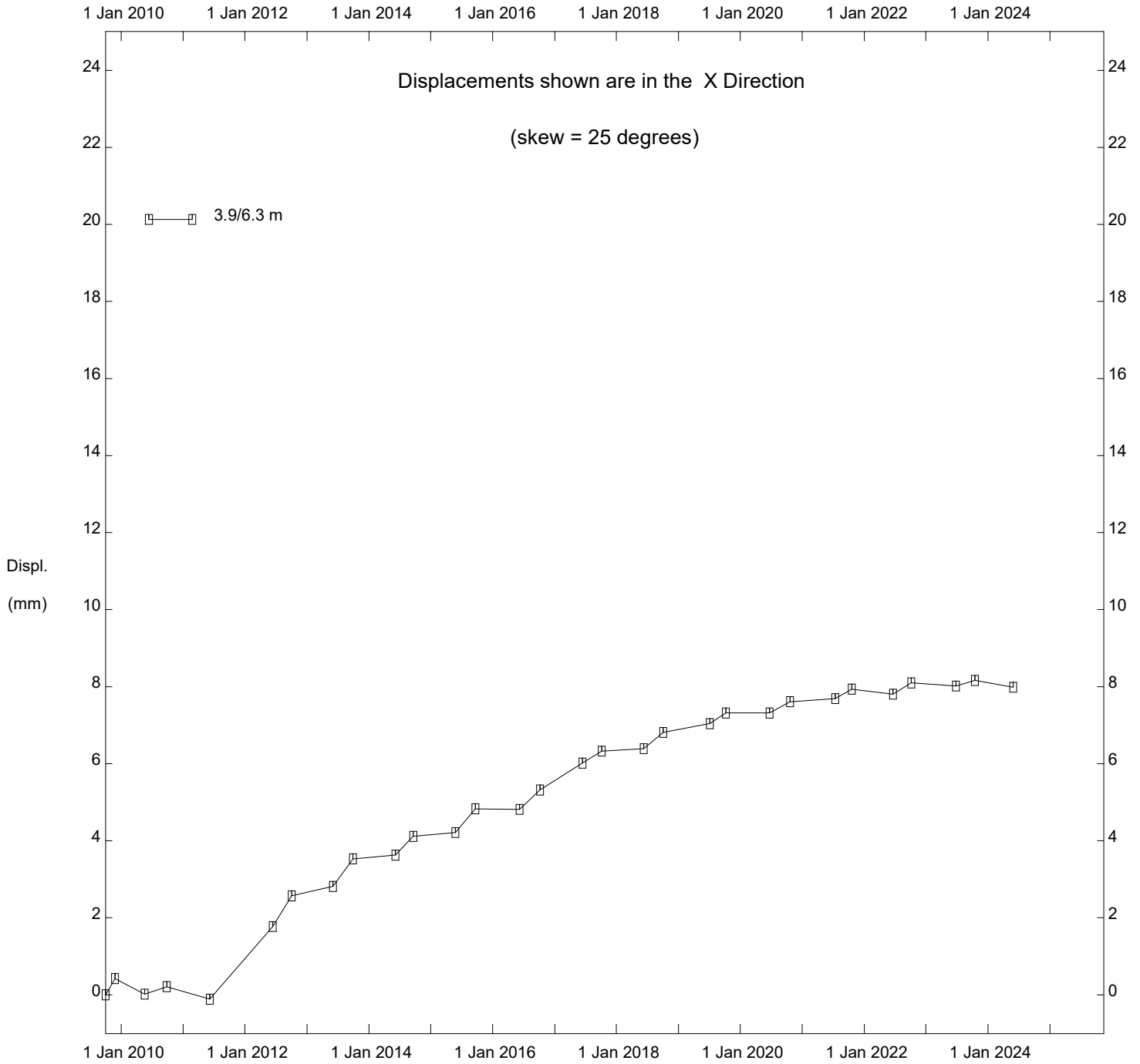


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Alberta Transportation

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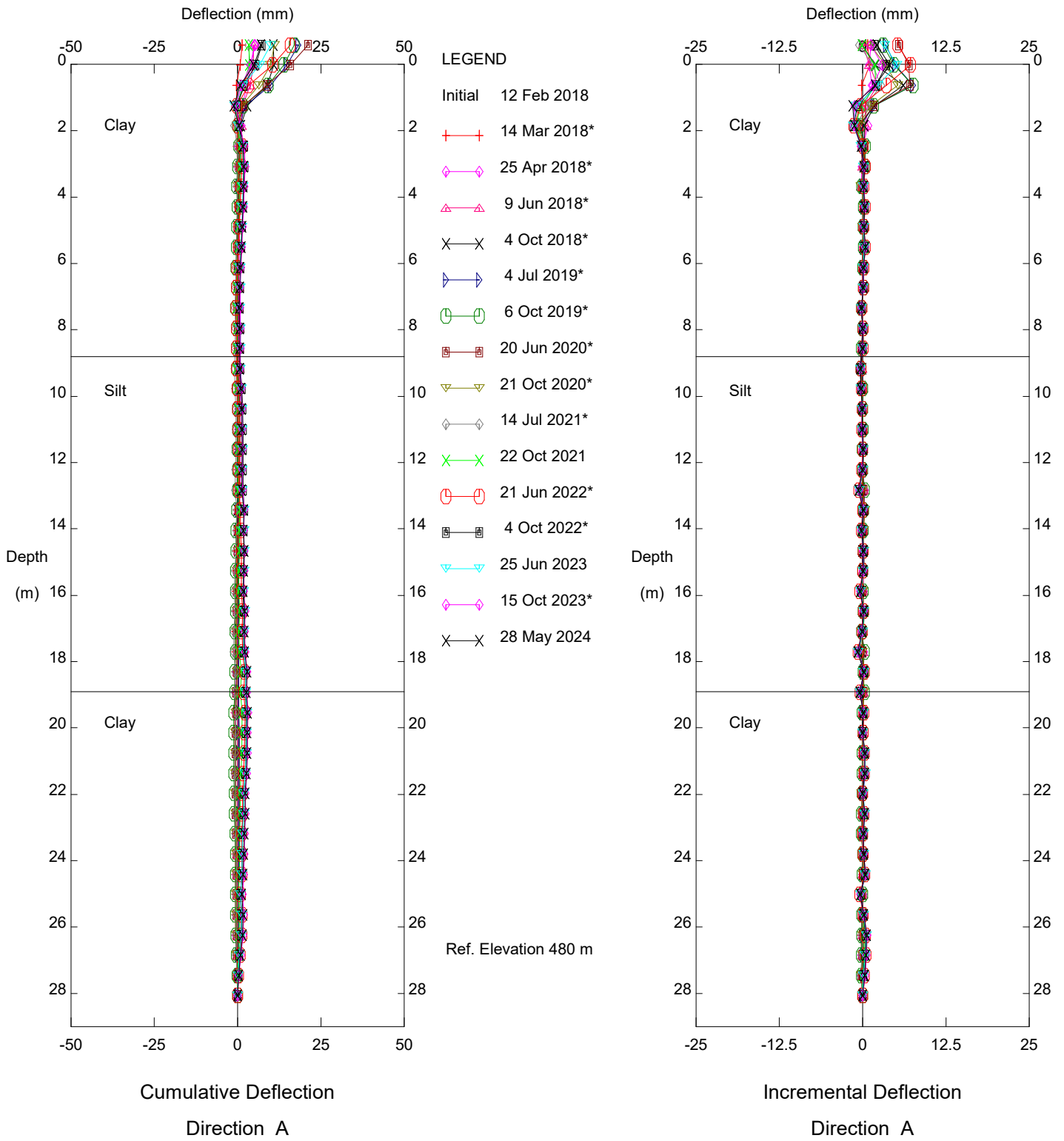
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Alberta Transportation

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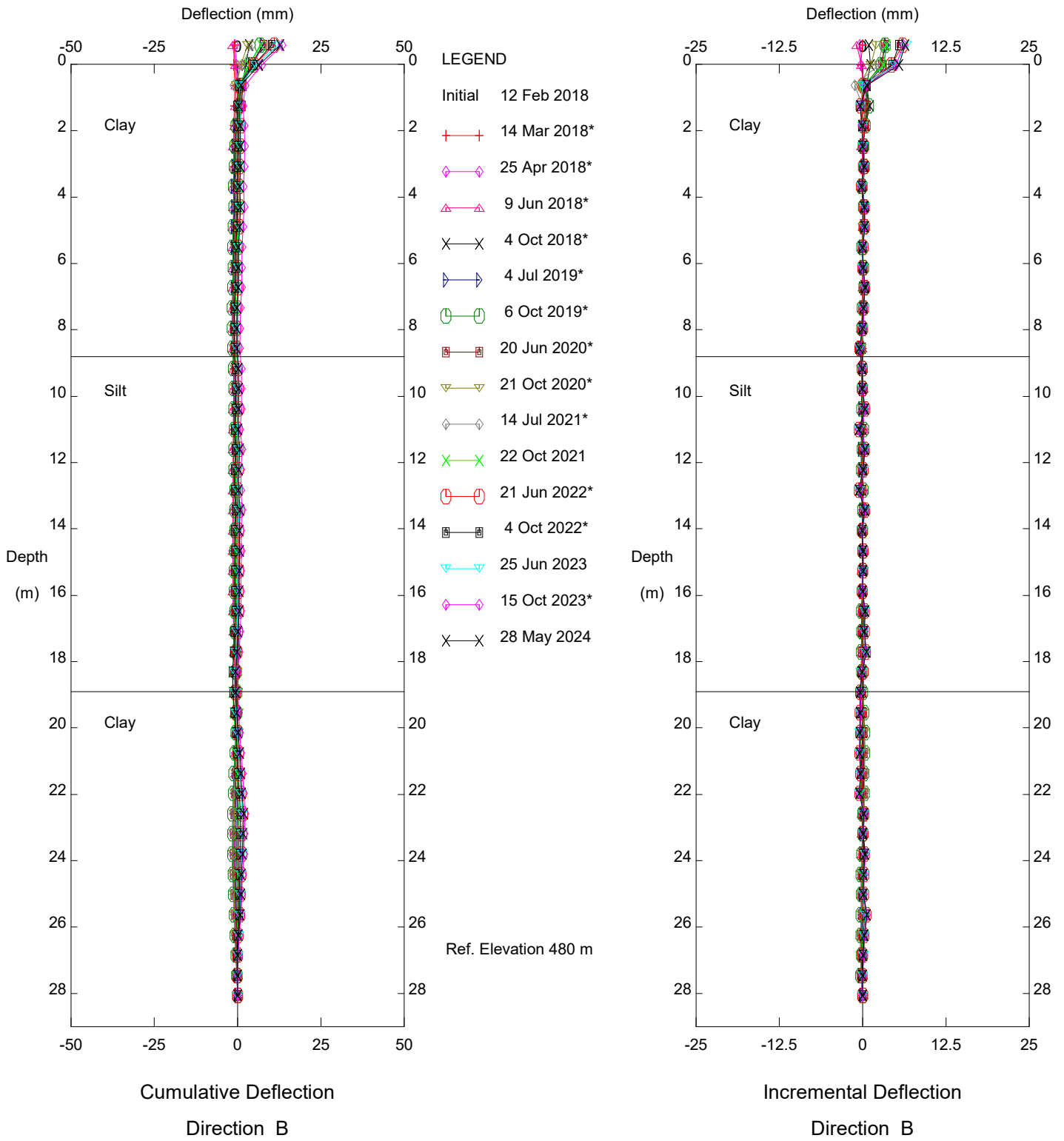


HWY 2:68 (PH037), Inclinometer SI18-4

Alberta Transportation

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Thurber Engineering Ltd.

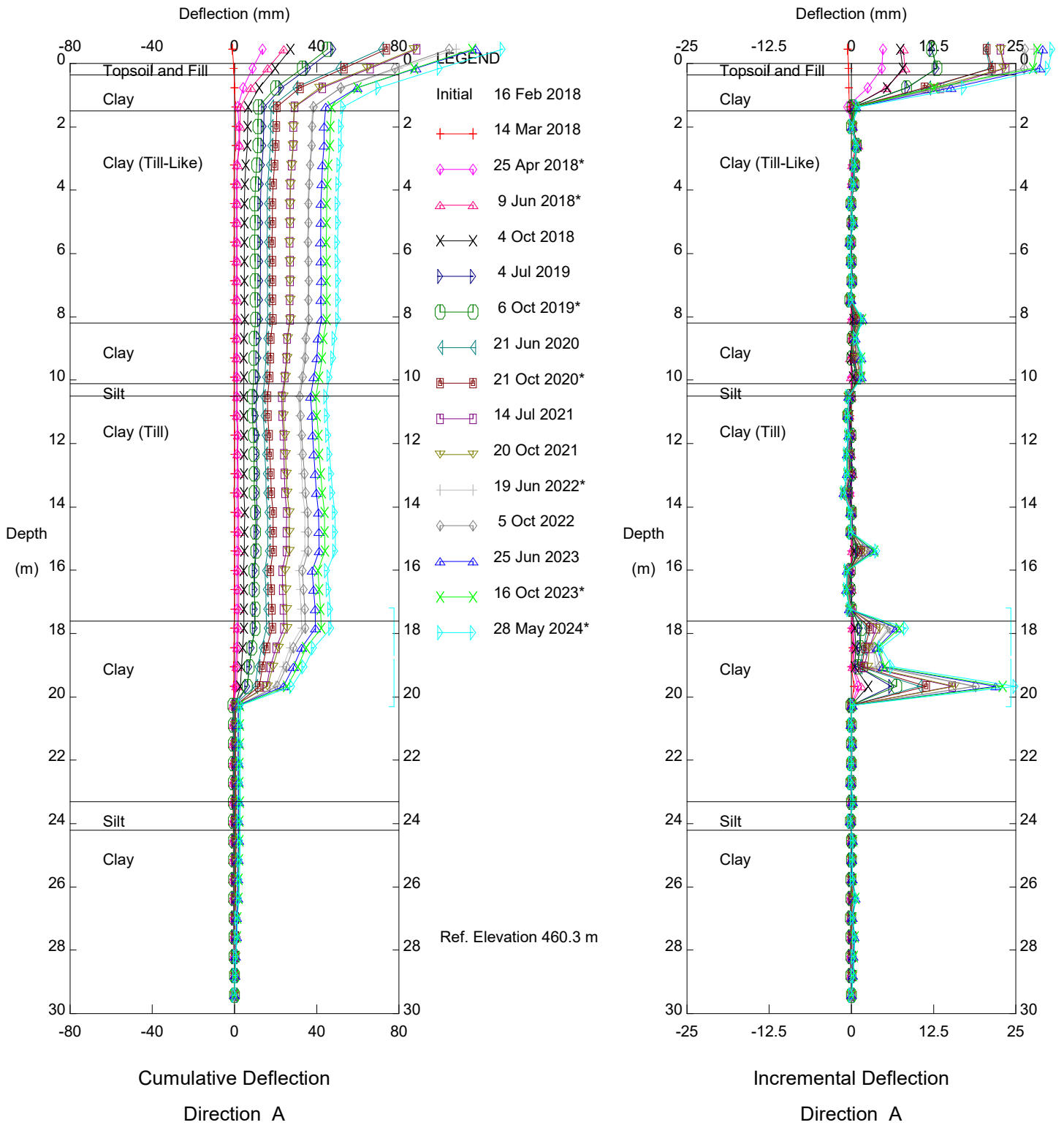


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Alberta Transportation

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Thurber Engineering Ltd.

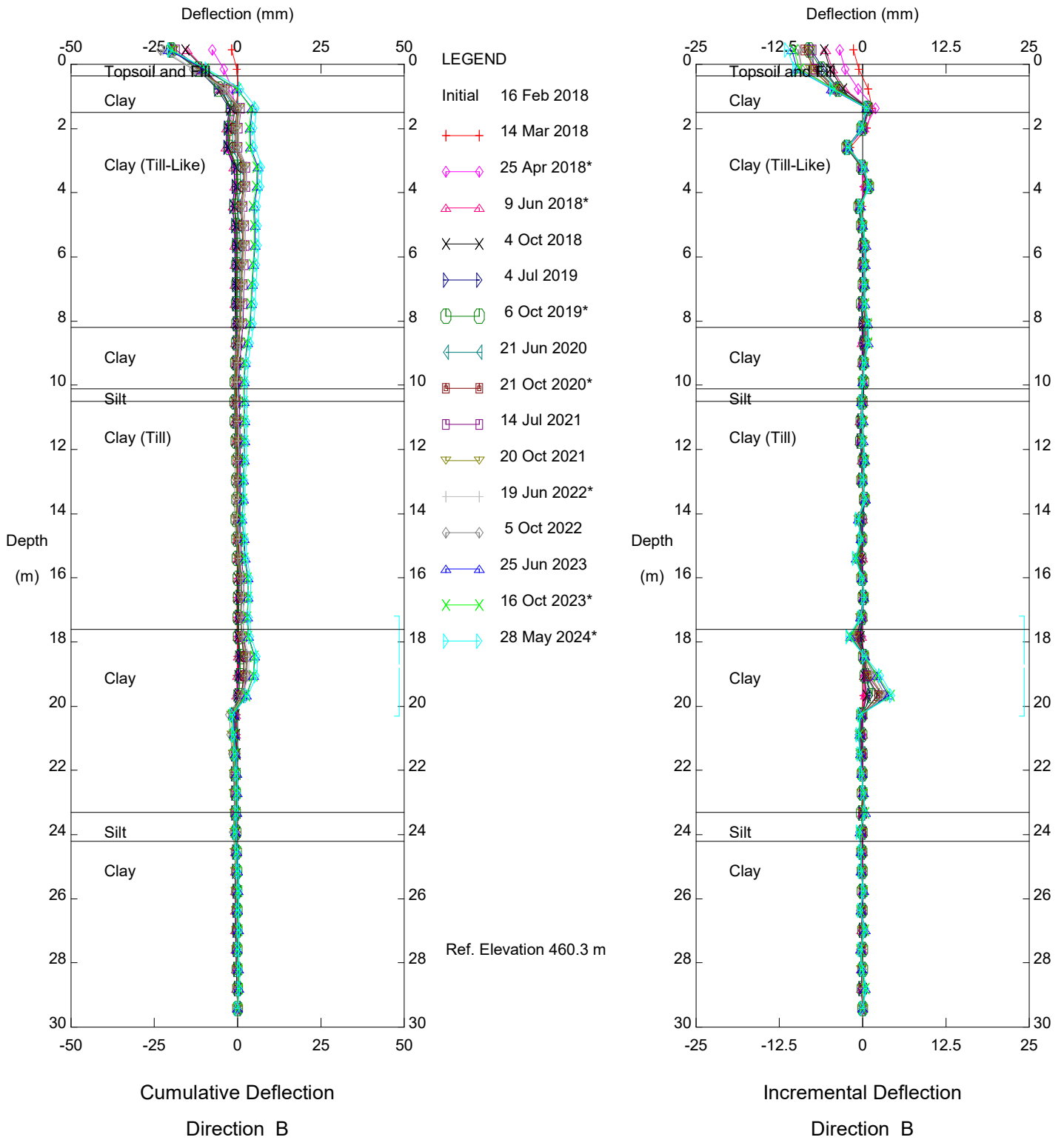


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Alberta Transportation

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Thurber Engineering Ltd.

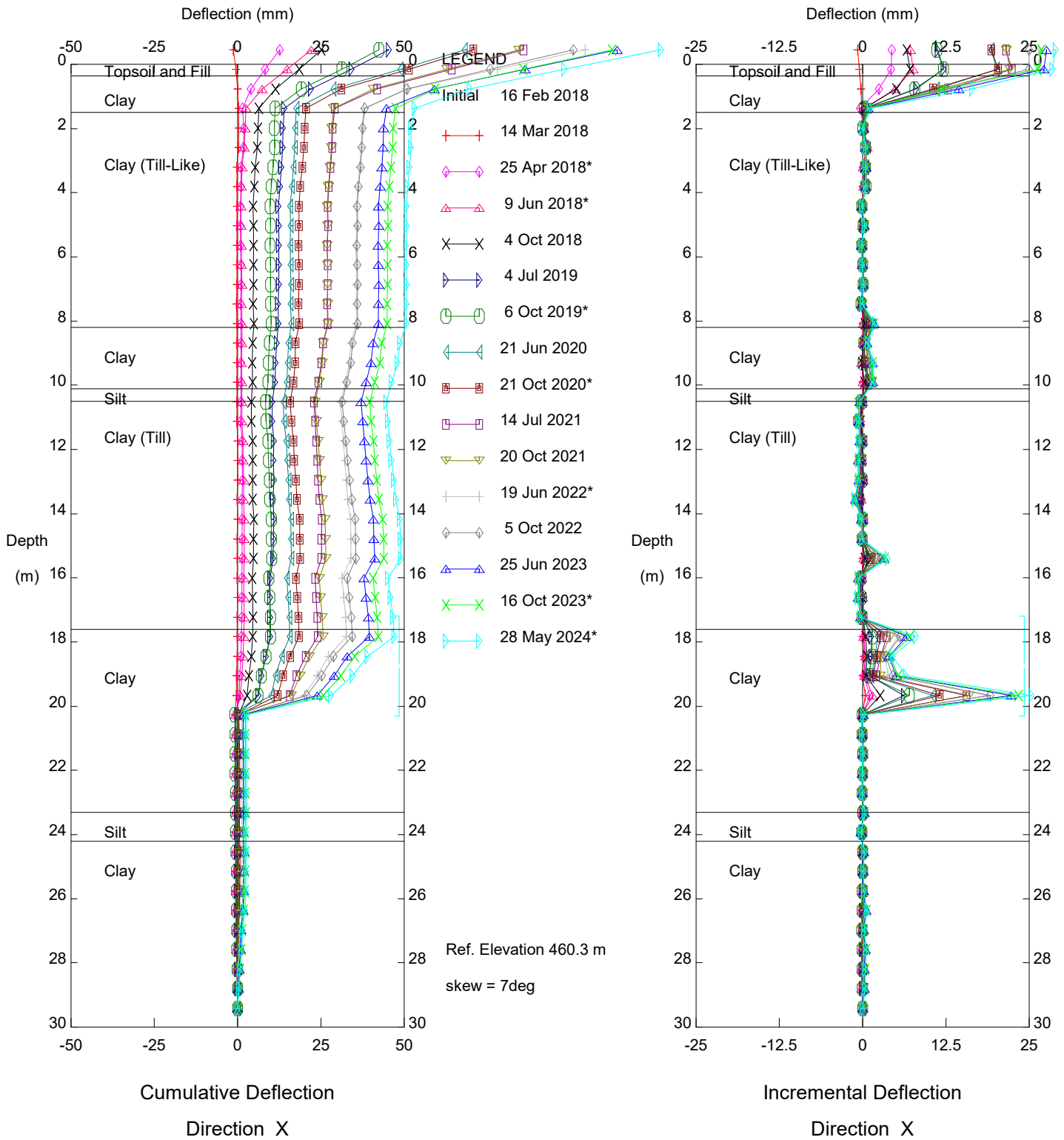


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Alberta Transportation

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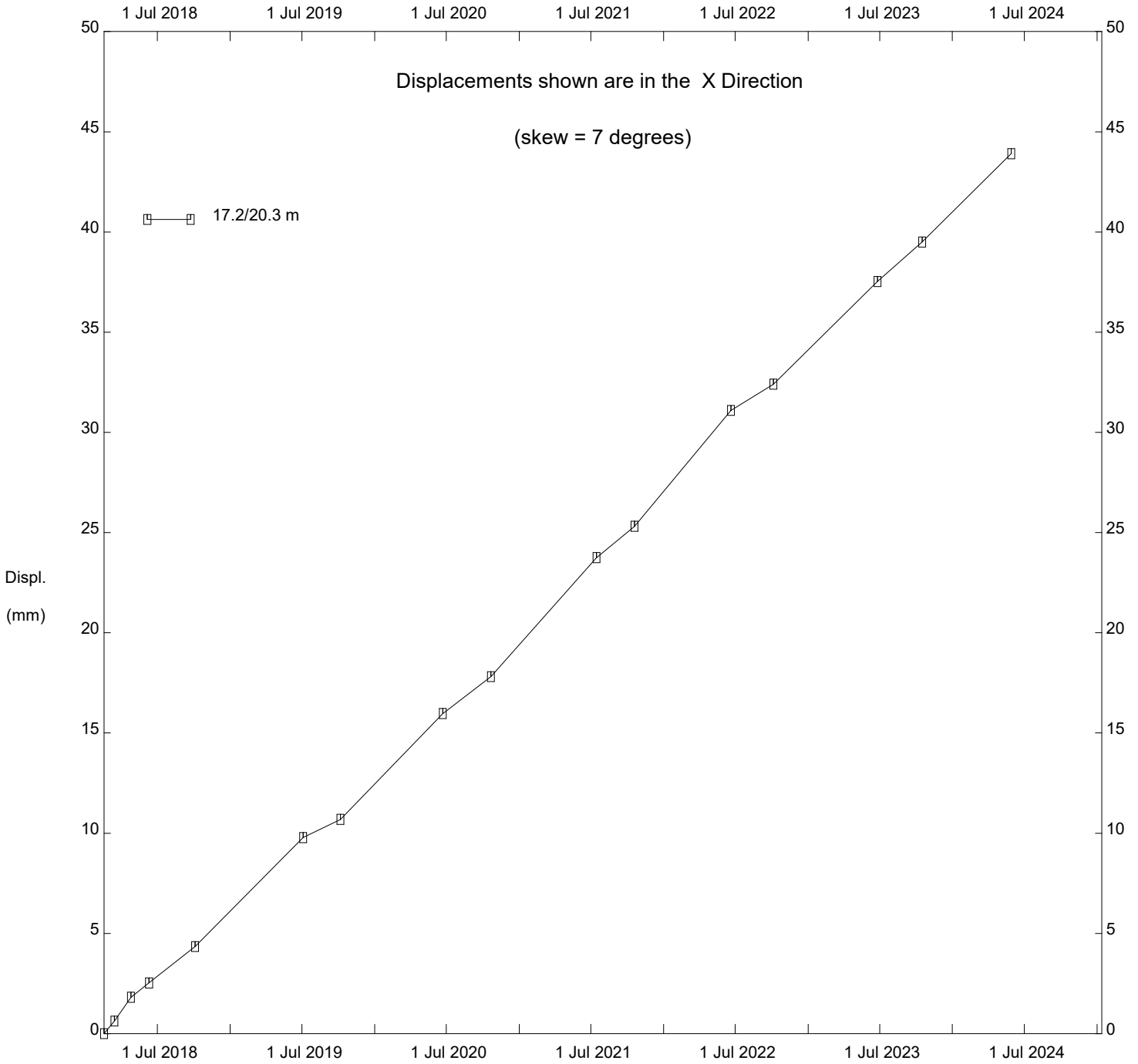


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Alberta Transportation

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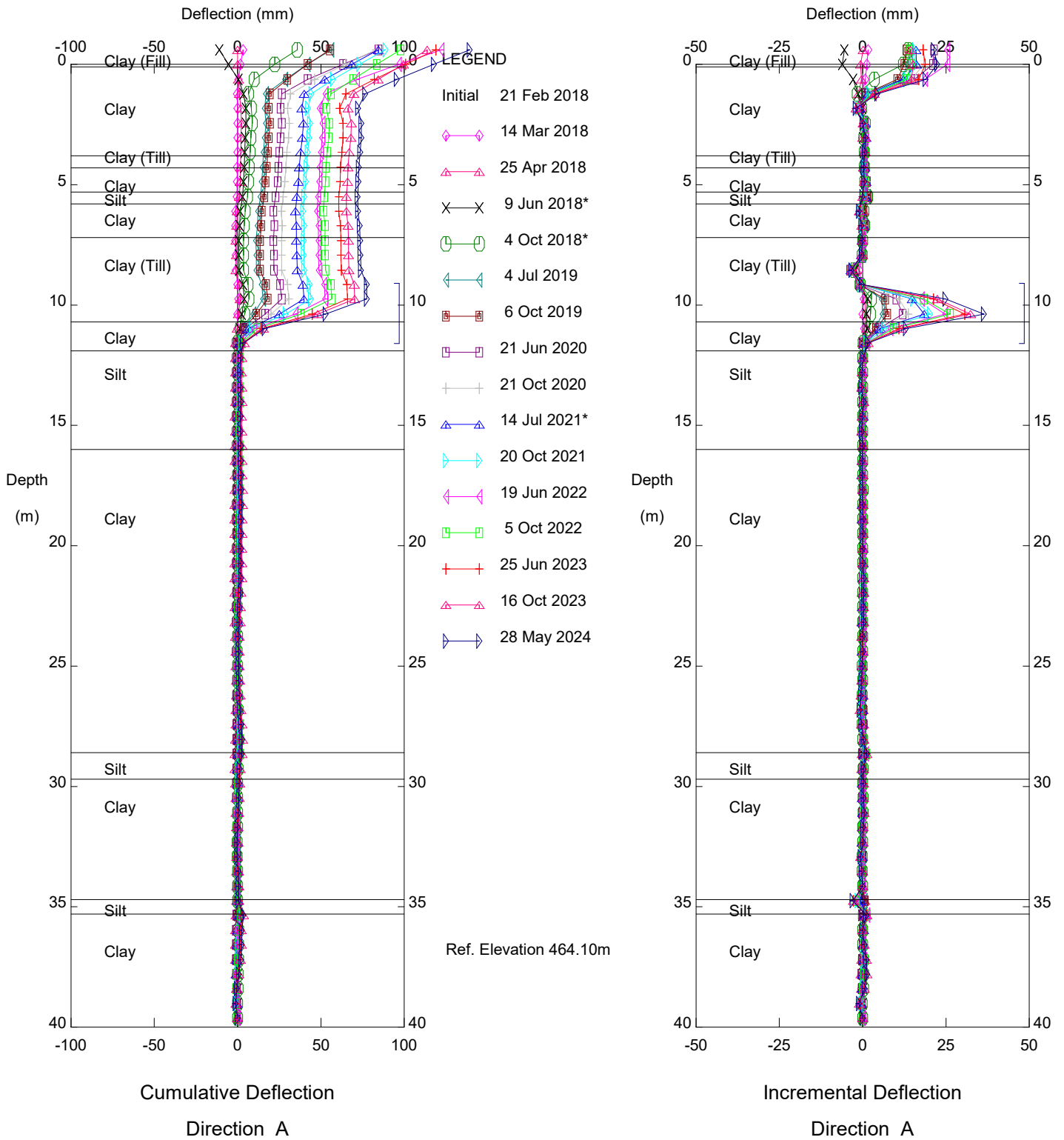
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Alberta Transportation

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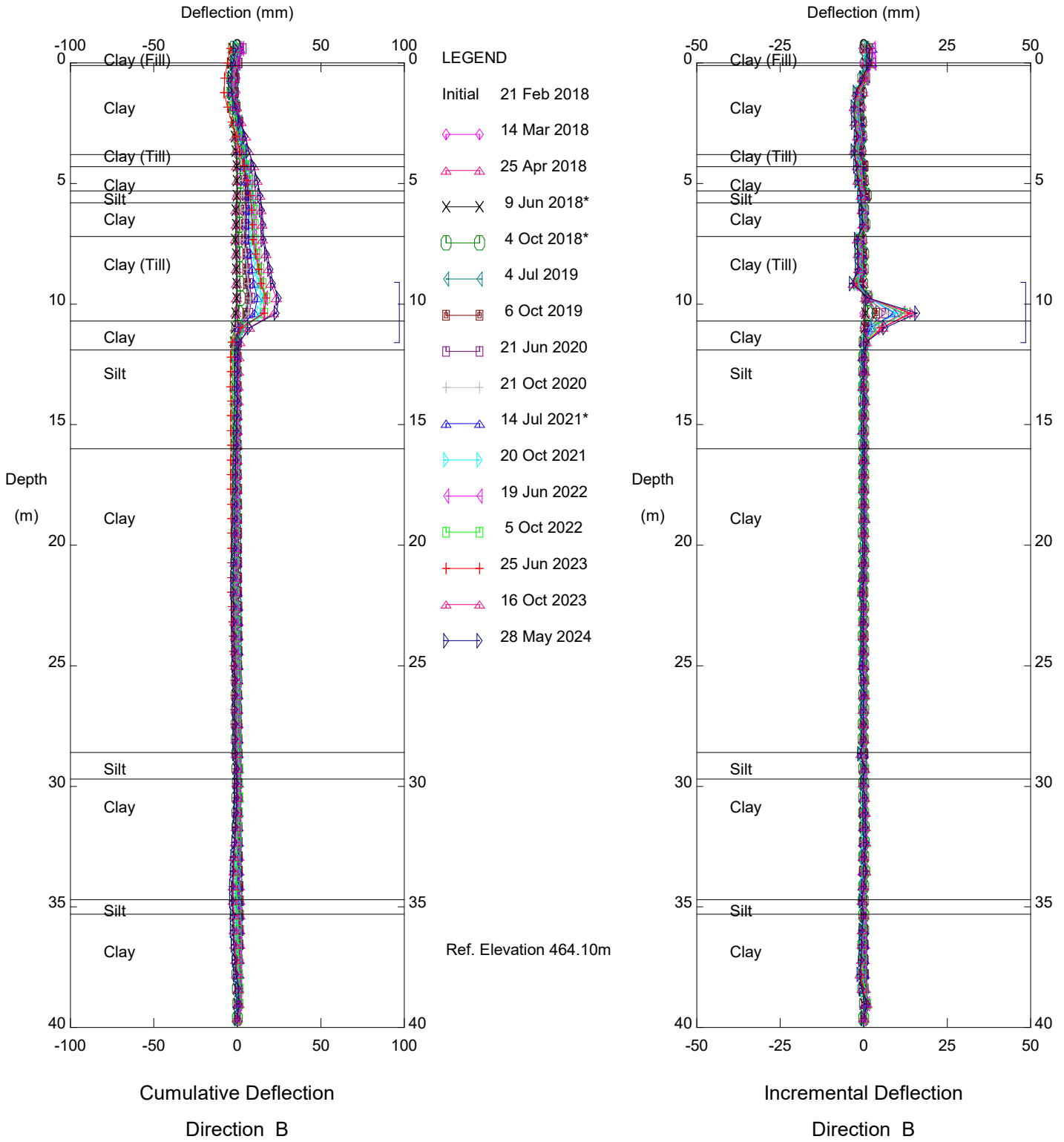


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Alberta Transportation

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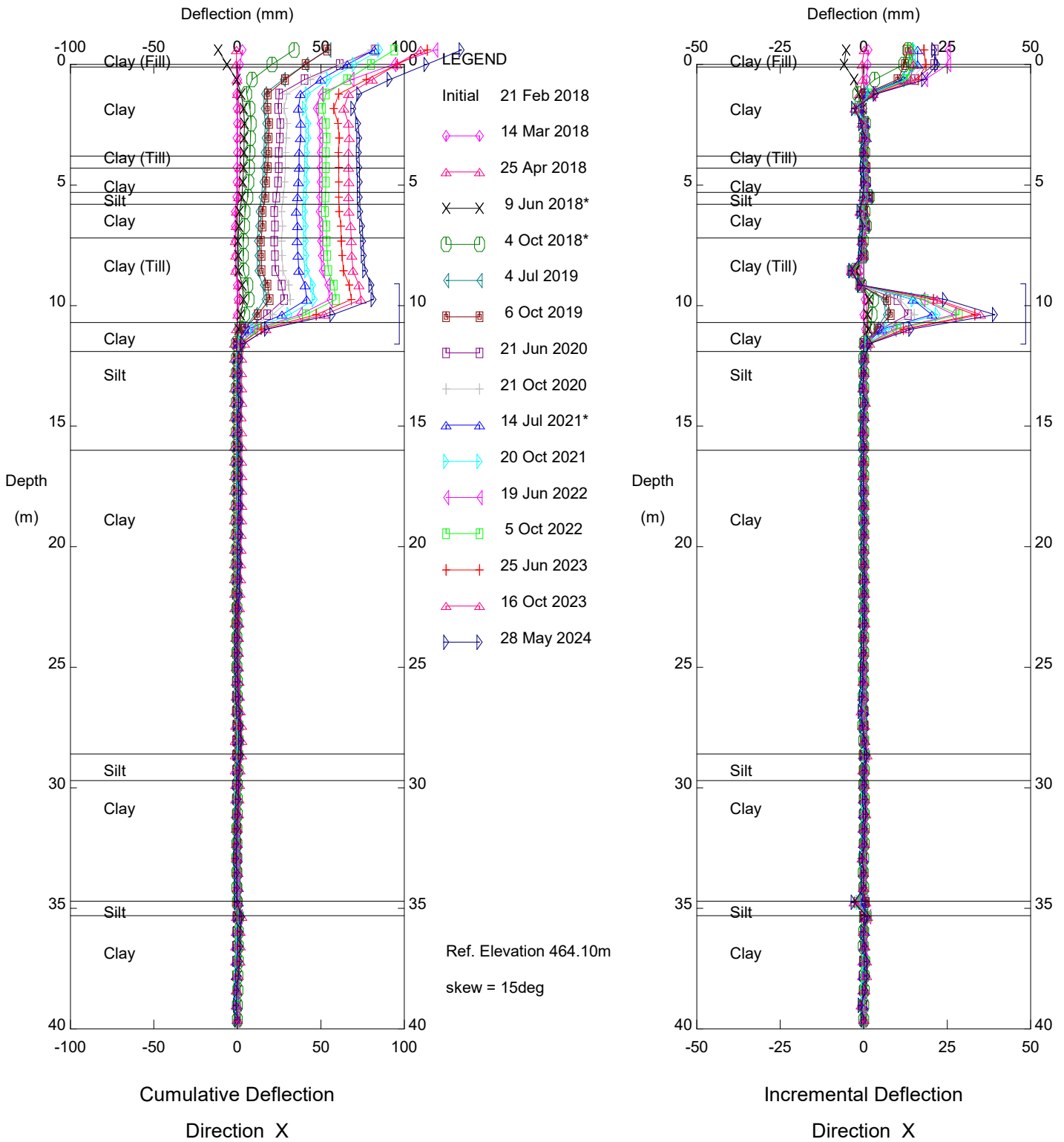


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Alberta Transportation

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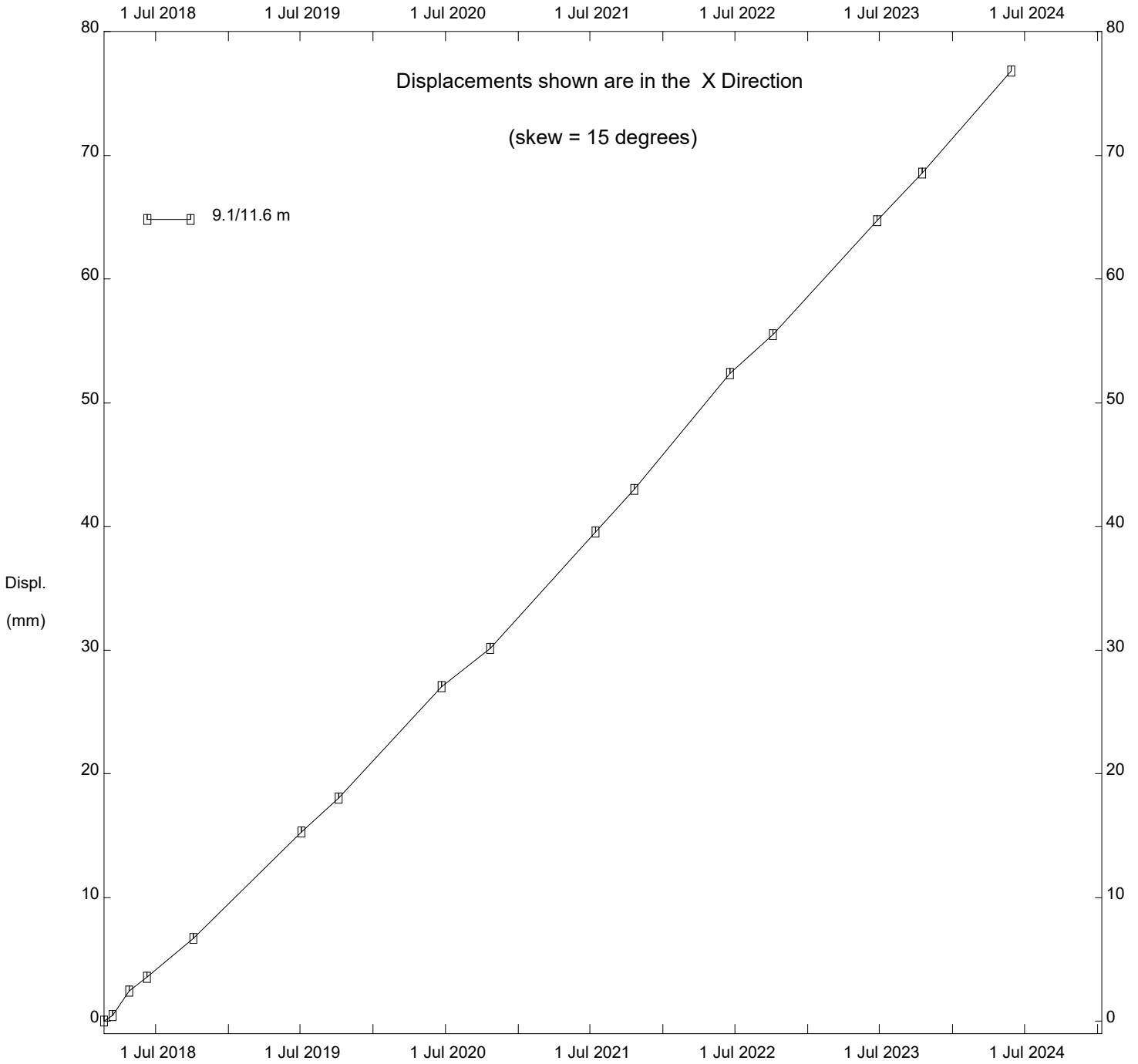


HWY 2:68 (PH037), Inclinometer SI18-7

Alberta Transportation

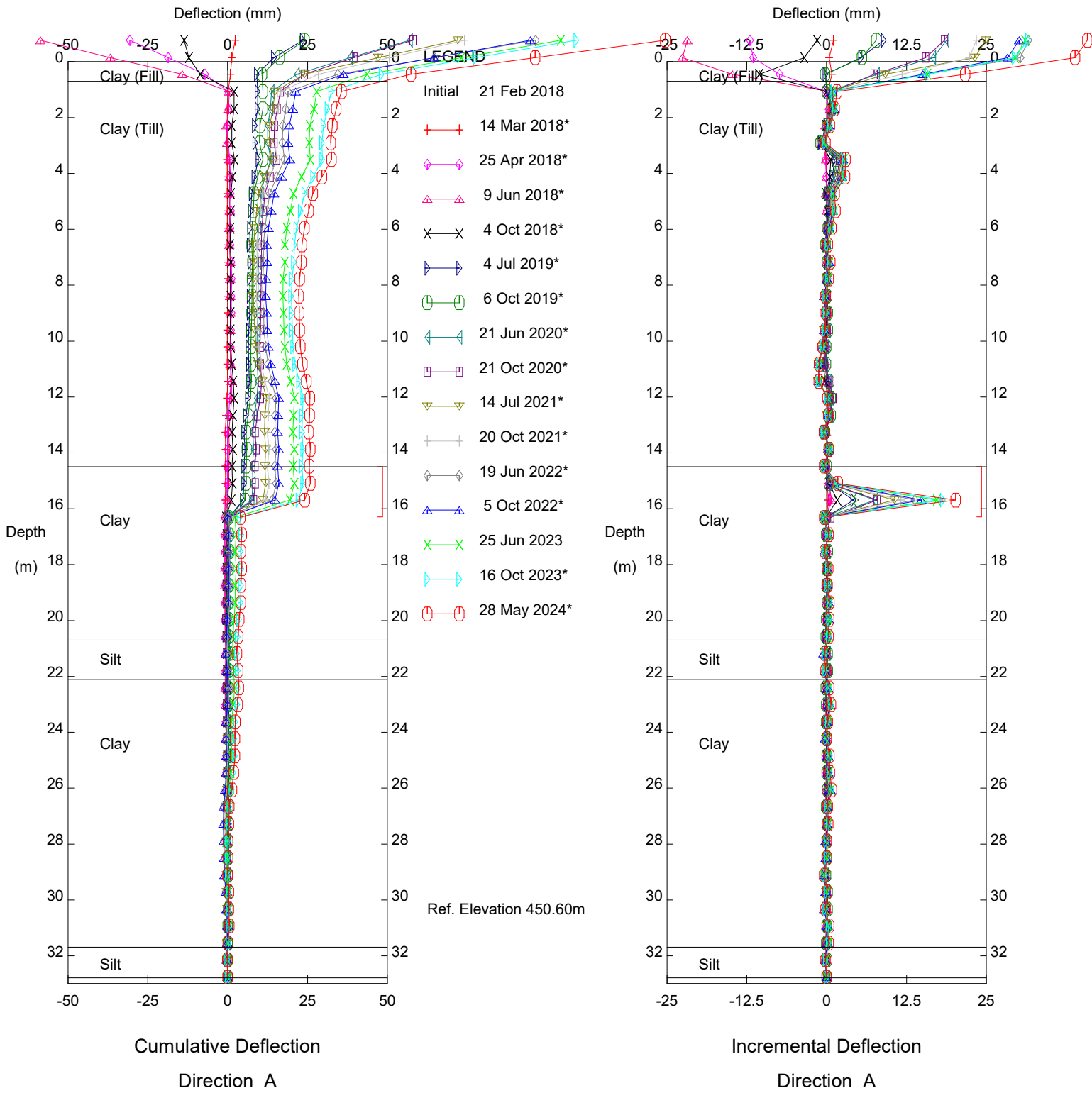
Sets marked * include zero shift and/or rotation corrections.

Thurber Engineering Ltd.



HWY 2:68 (PH037), Inclinator SI18-7

Alberta Transportation

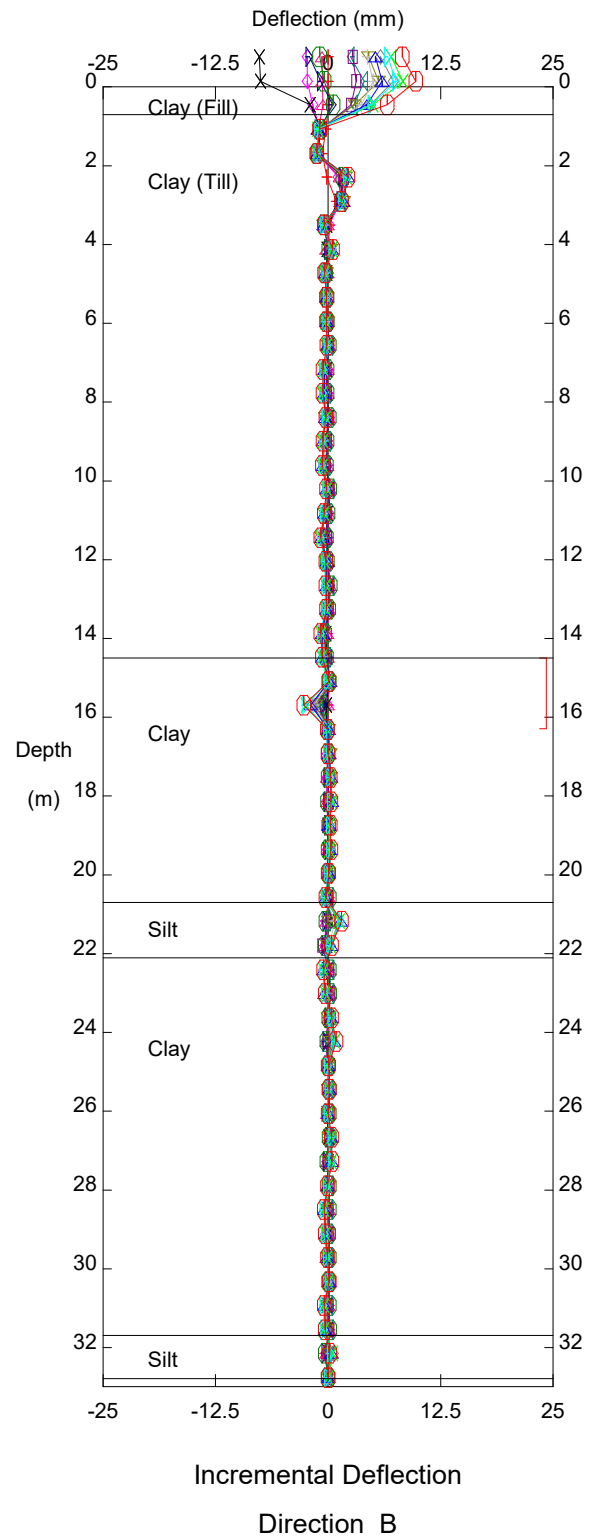
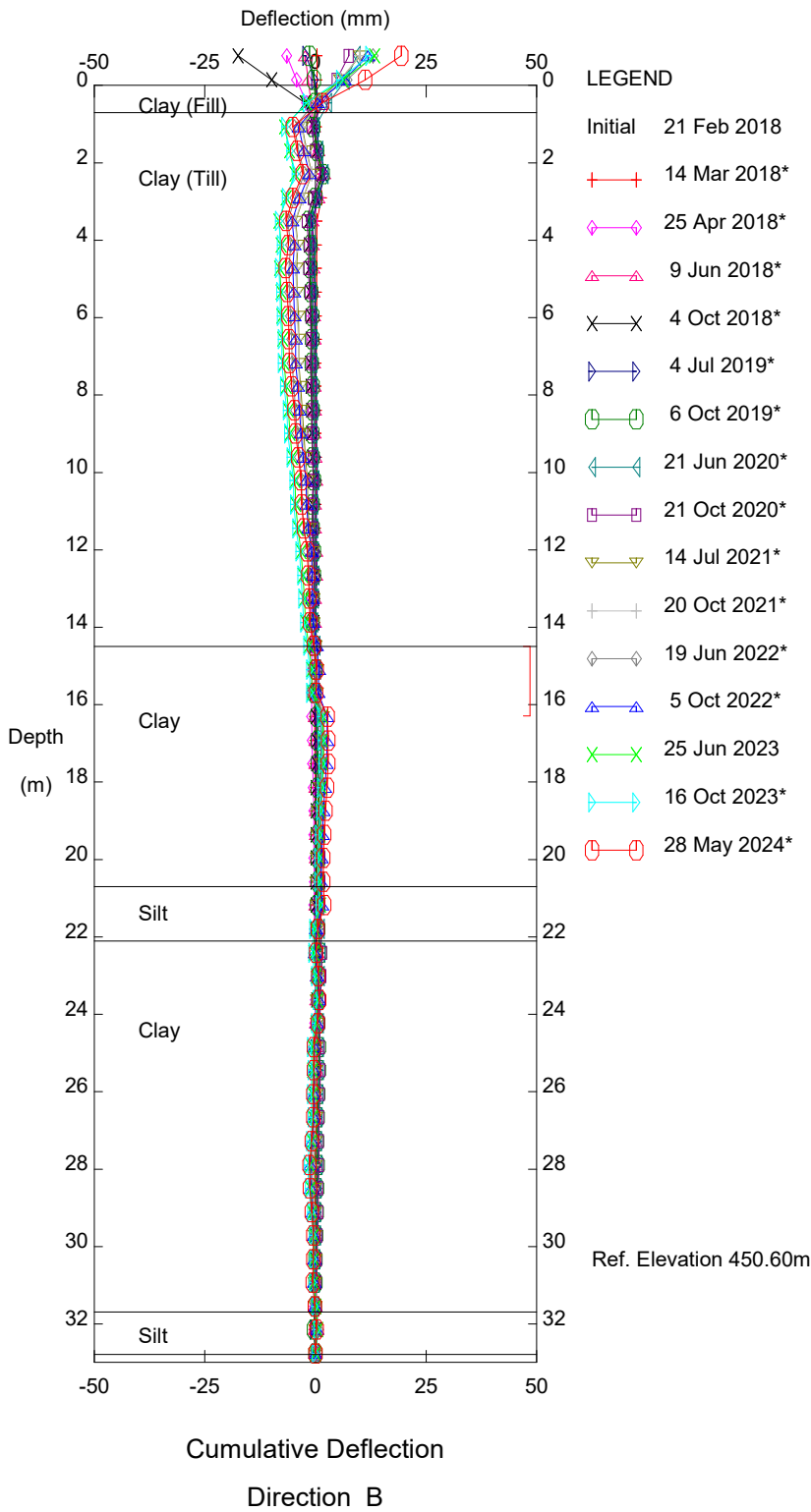


HWY 2:68 (PH037), Inclinometer SI18-8

Alberta Transportation

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

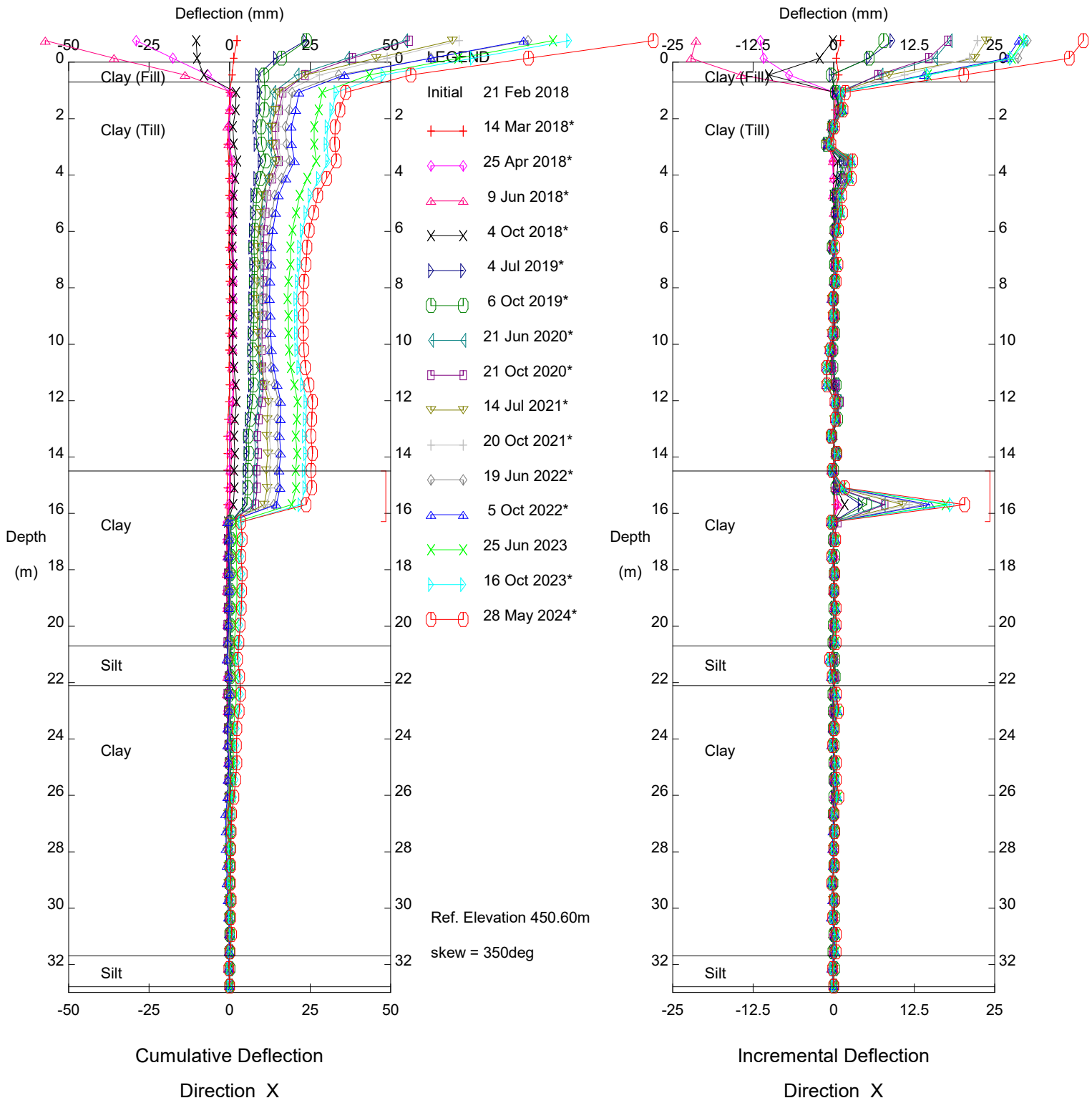
Thurber Engineering Ltd.



HWY 2:68 (PH037), Inclinator SI18-8

Alberta Transportation

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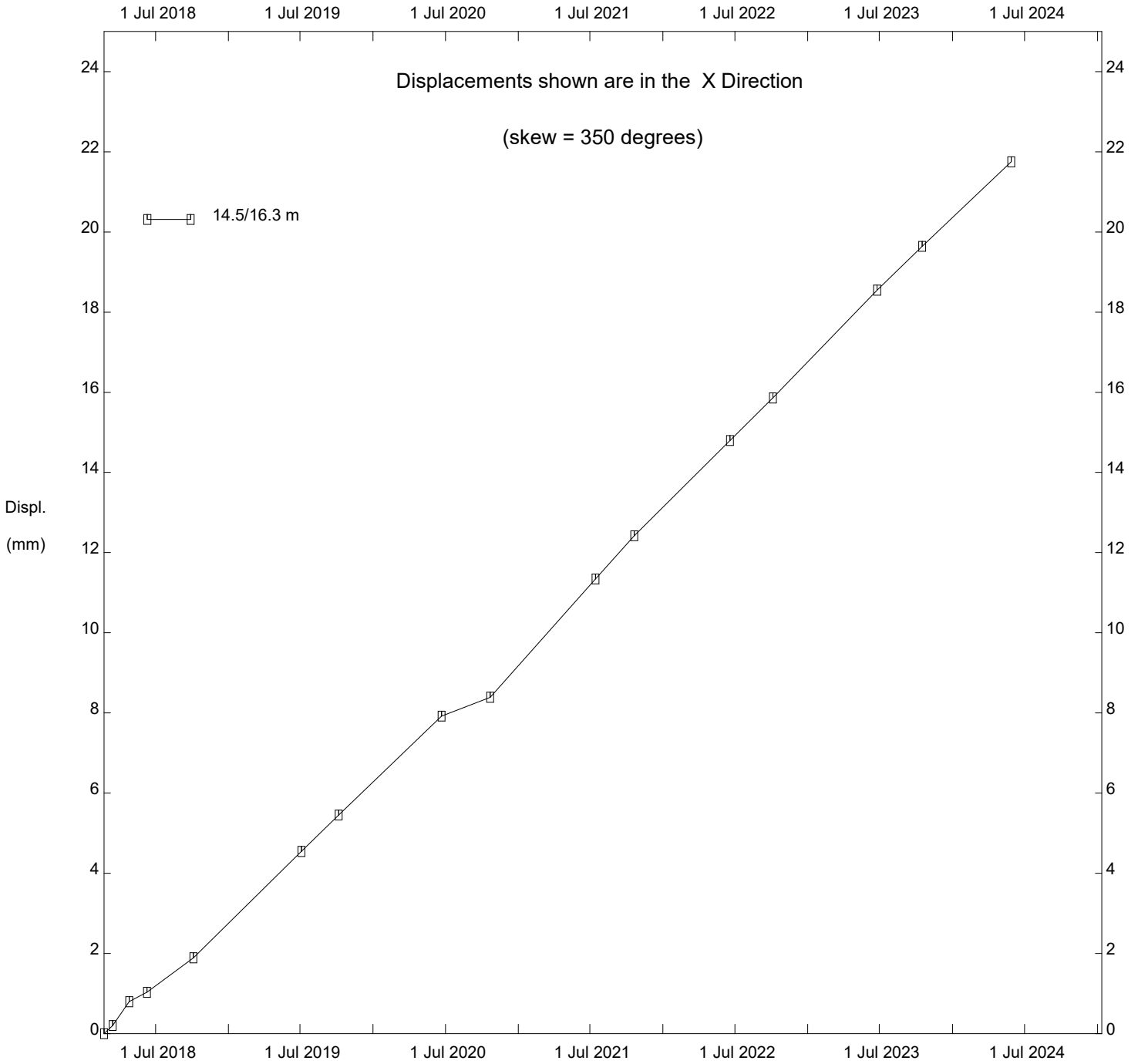


HWY 2:68 (PH037), Inclinometer SI18-8

Alberta Transportation

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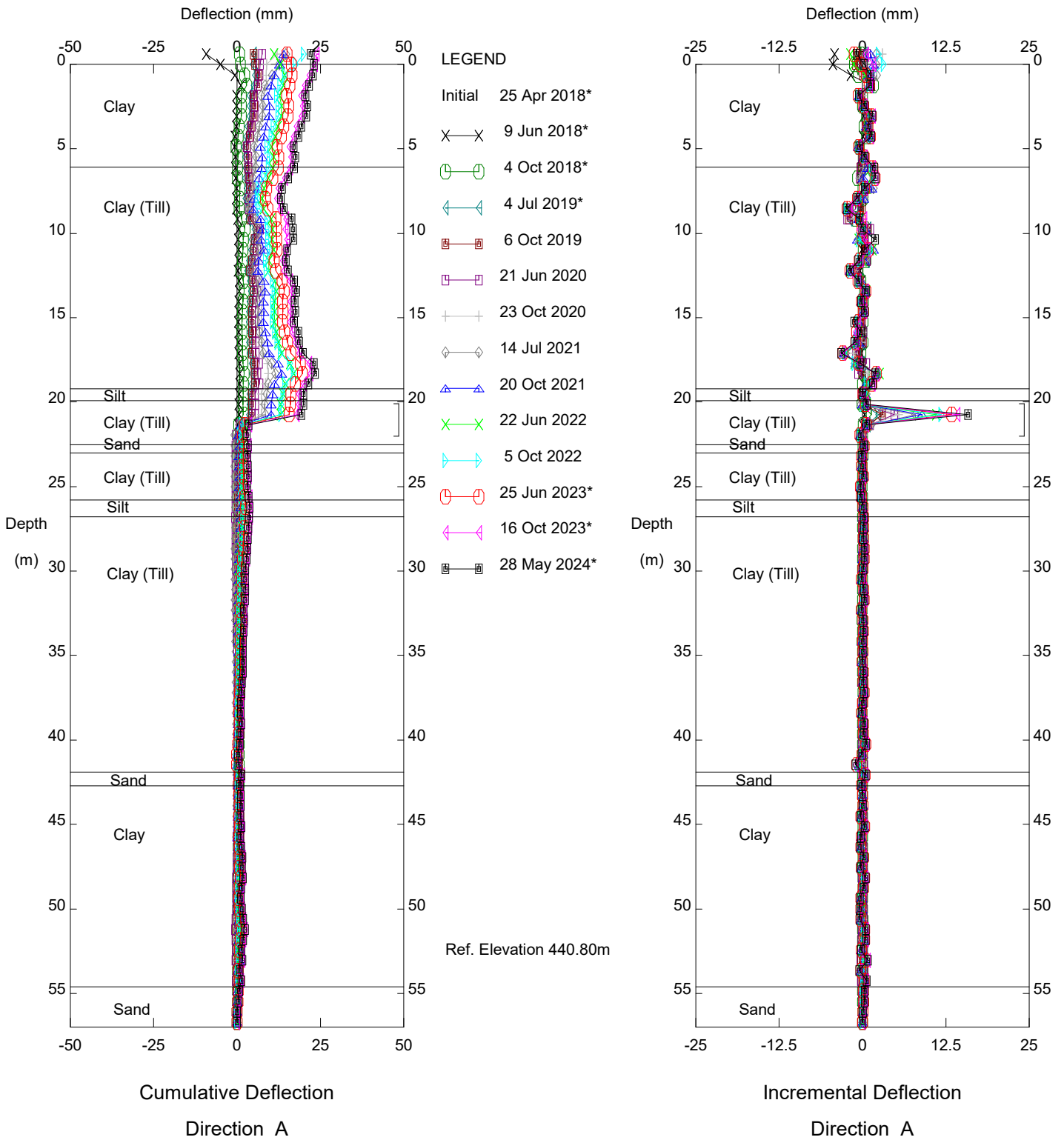
Thurber Engineering Ltd.



HWY 2:68 (PH037), Inclinator SI18-8

Alberta Transportation

Thurber Engineering Ltd.

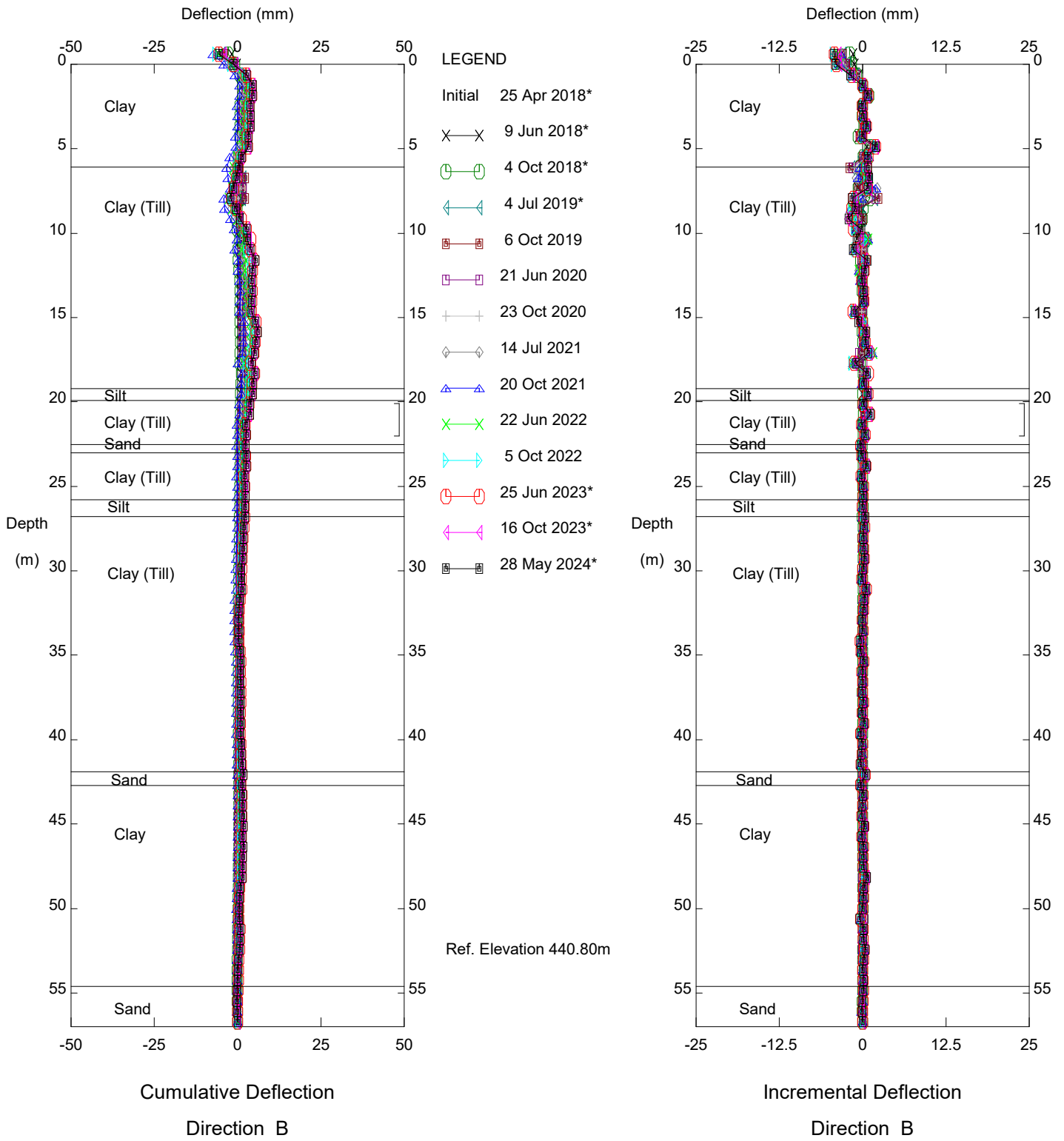


HWY 2:68 (PH037), Inclinometer SI18-9

Alberta Transportation

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

Thurber Engineering Ltd.

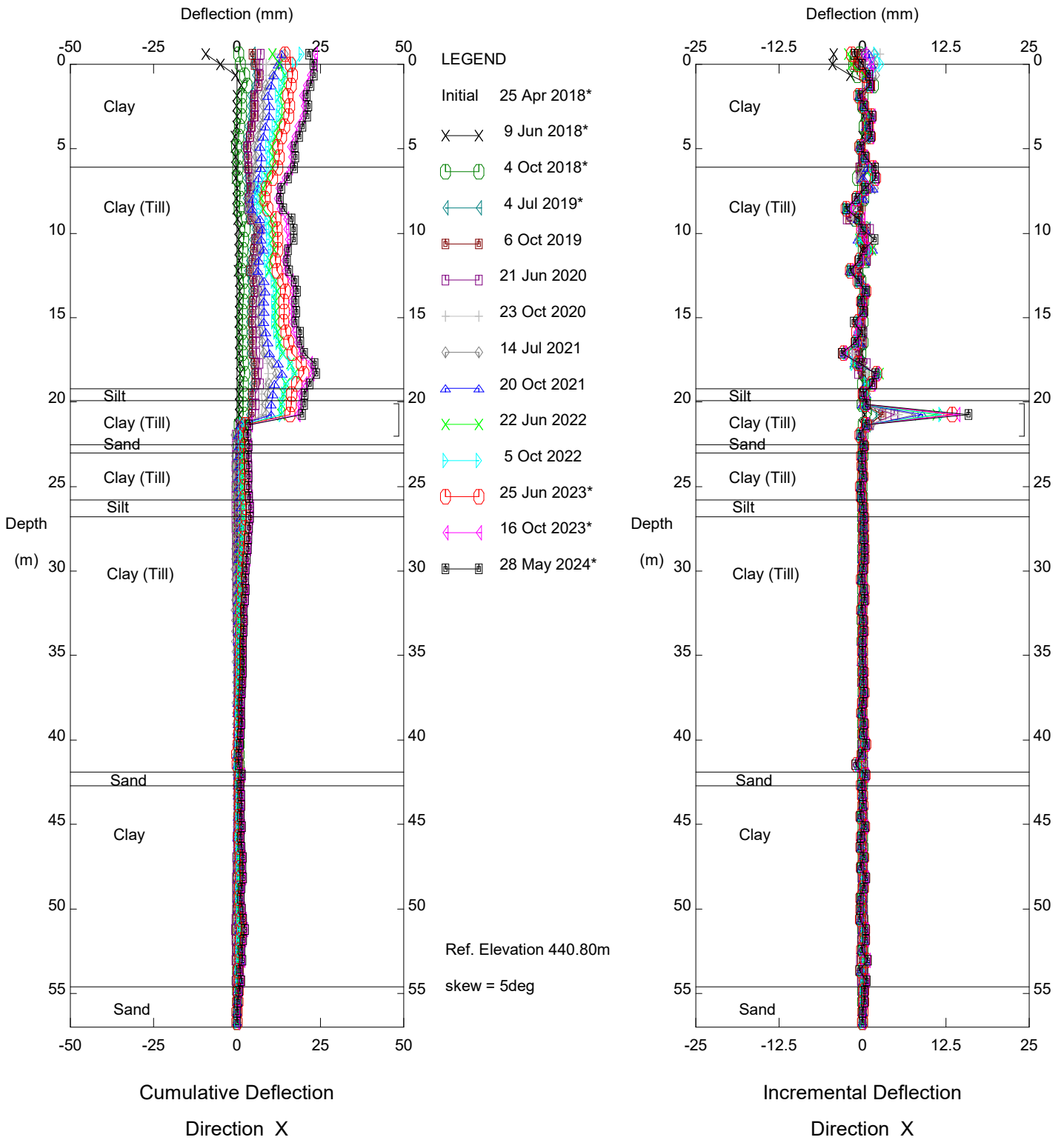


HWY 2:68 (PH037), Inclinometer SI18-9

Alberta Transportation

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

Thurber Engineering Ltd.

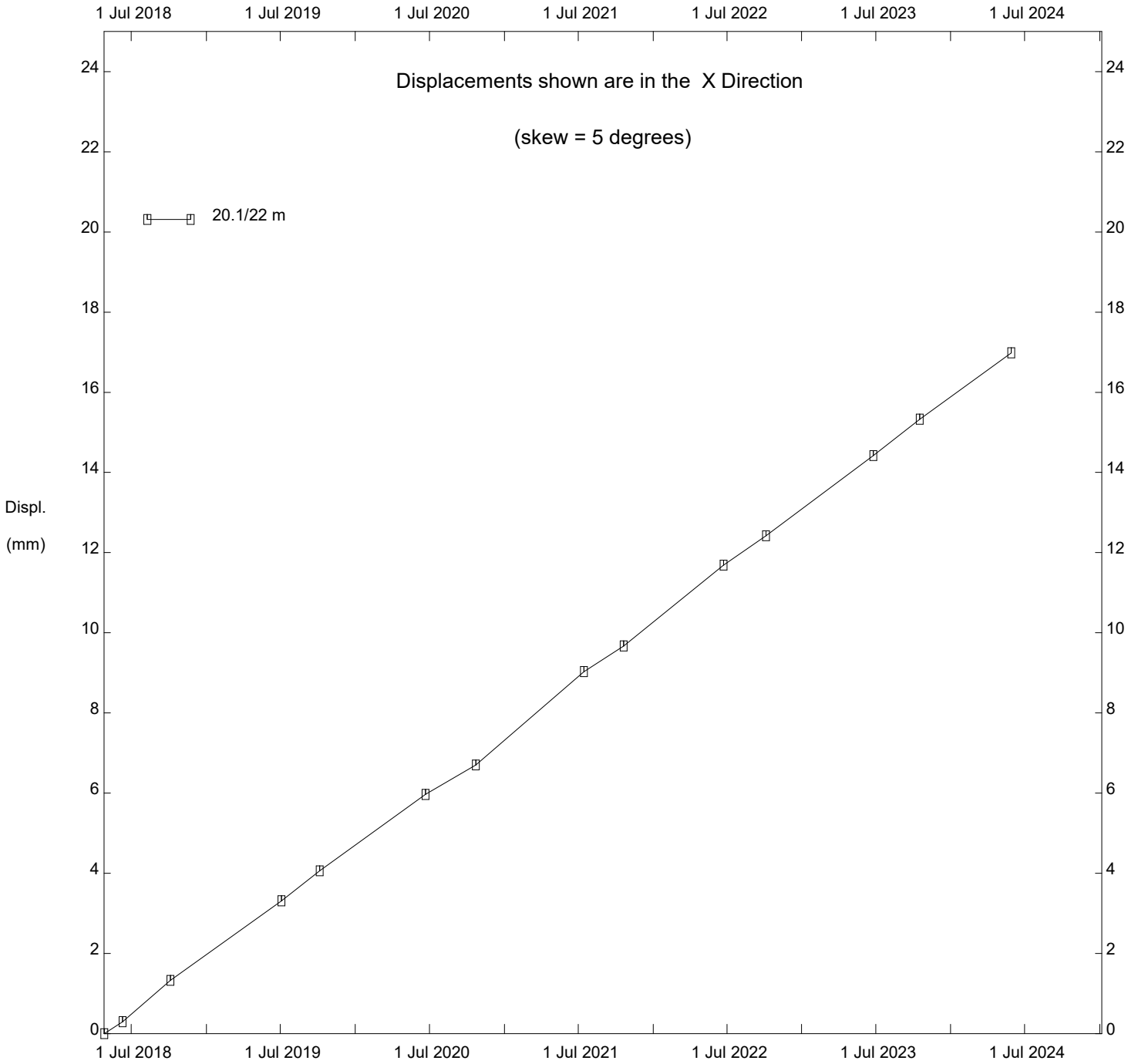


HWY 2:68 (PH037), Inclinometer SI18-9

Alberta Transportation

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

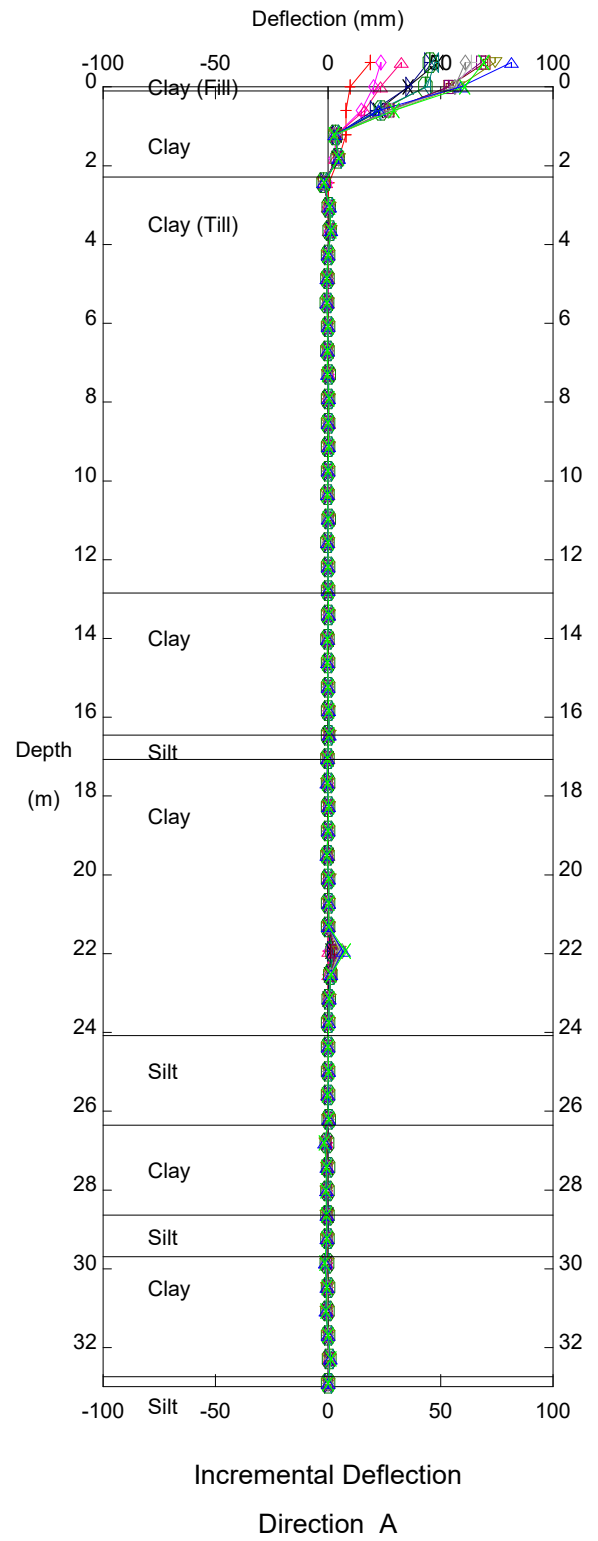
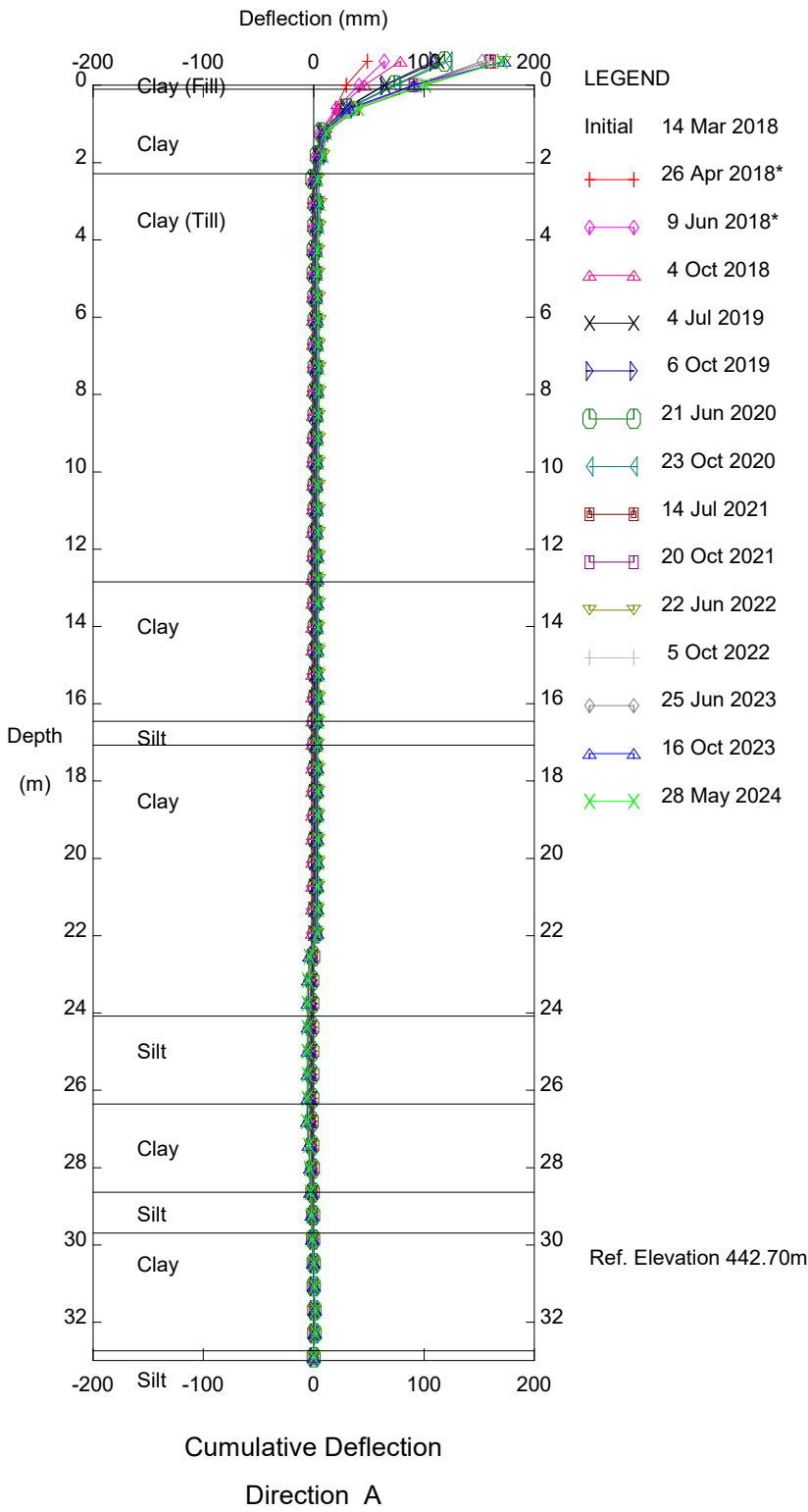
Thurber Engineering Ltd.



HWY 2:68 (PH037), Inclinator SI18-9

Alberta Transportation

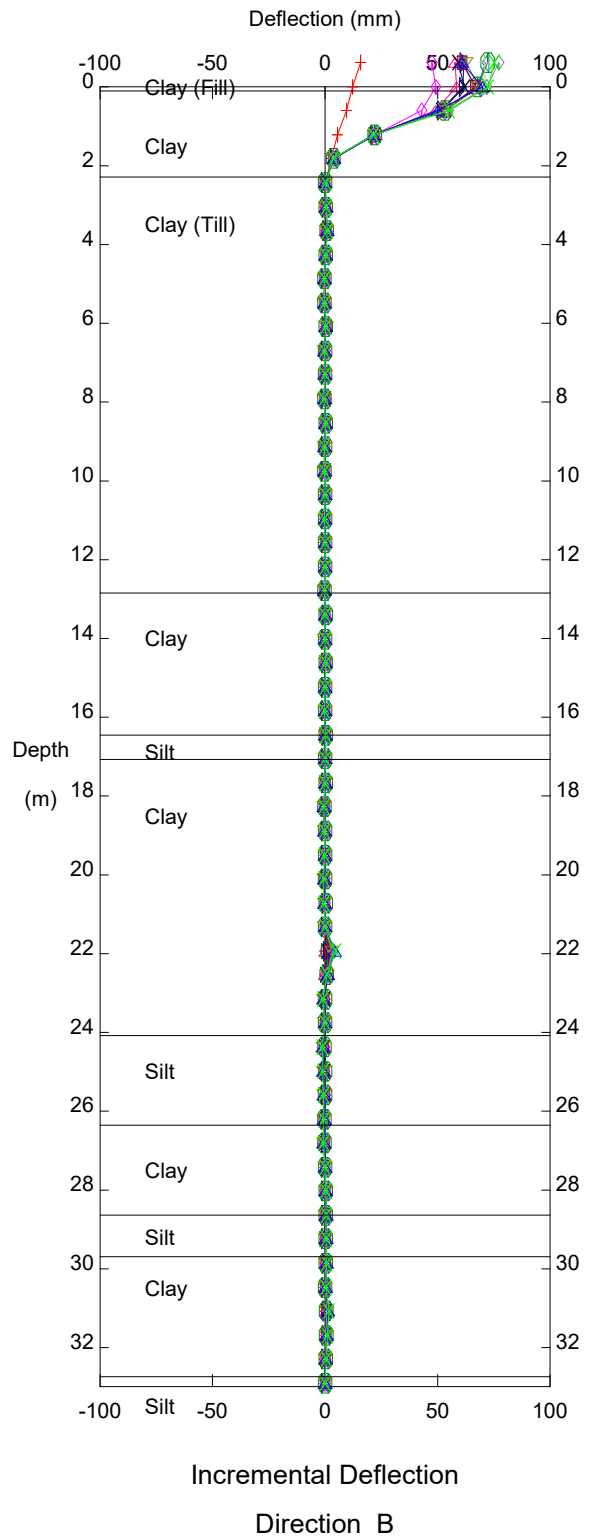
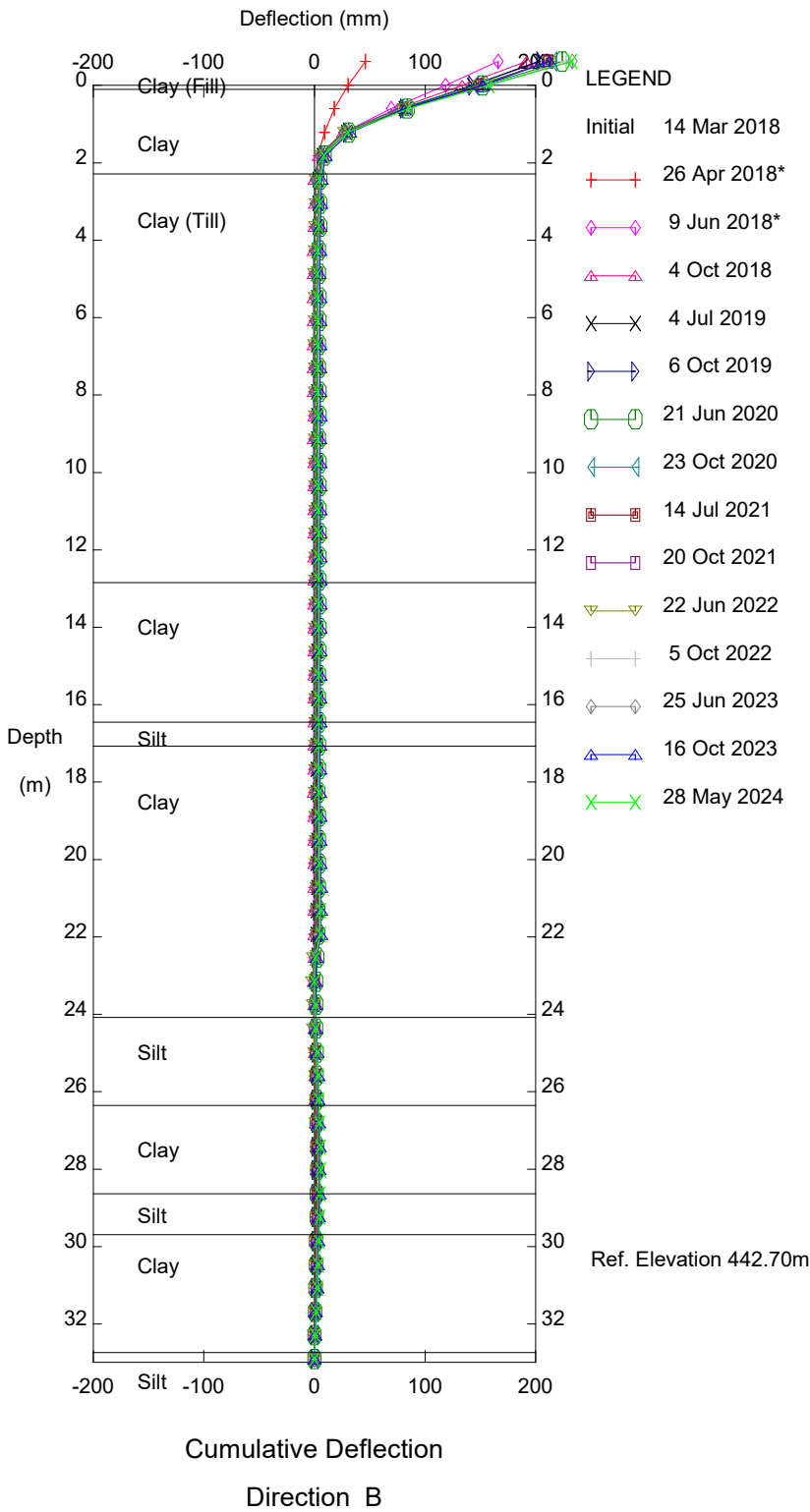
Thurber Engineering Ltd.



HWY 2:68 (PH037), Inclinator SI18-10

Alberta Transportation

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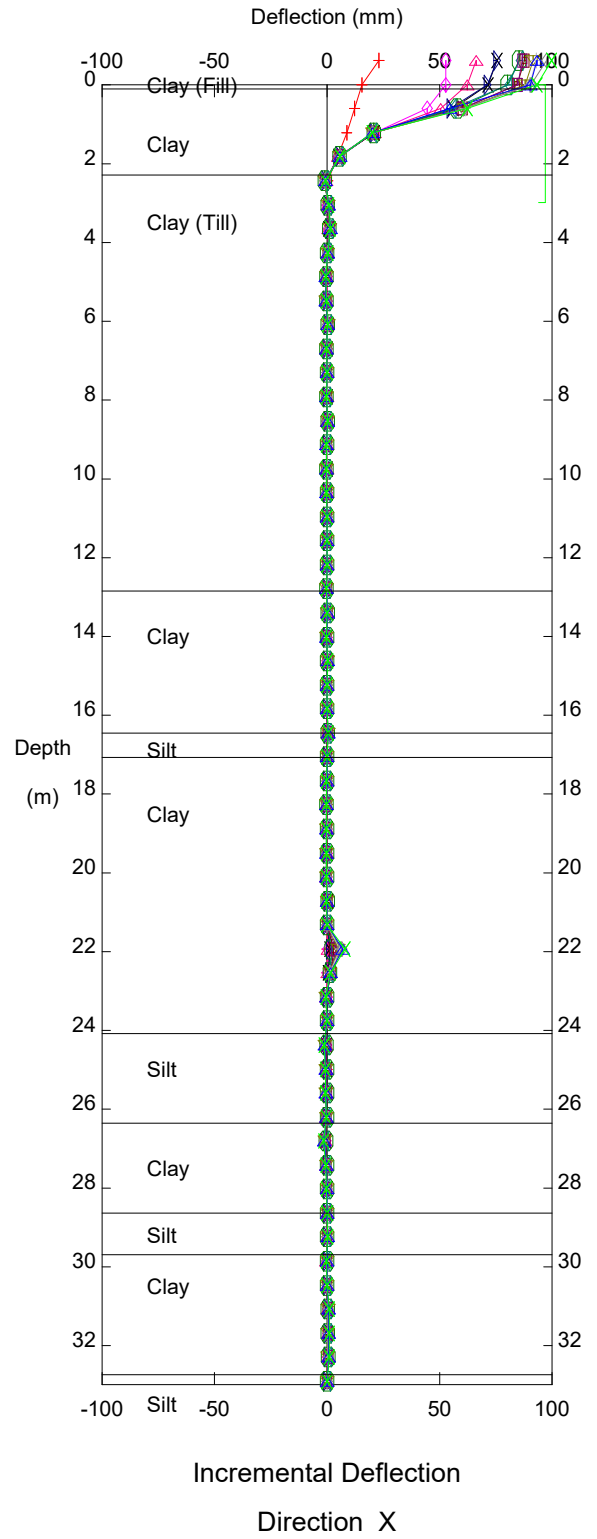
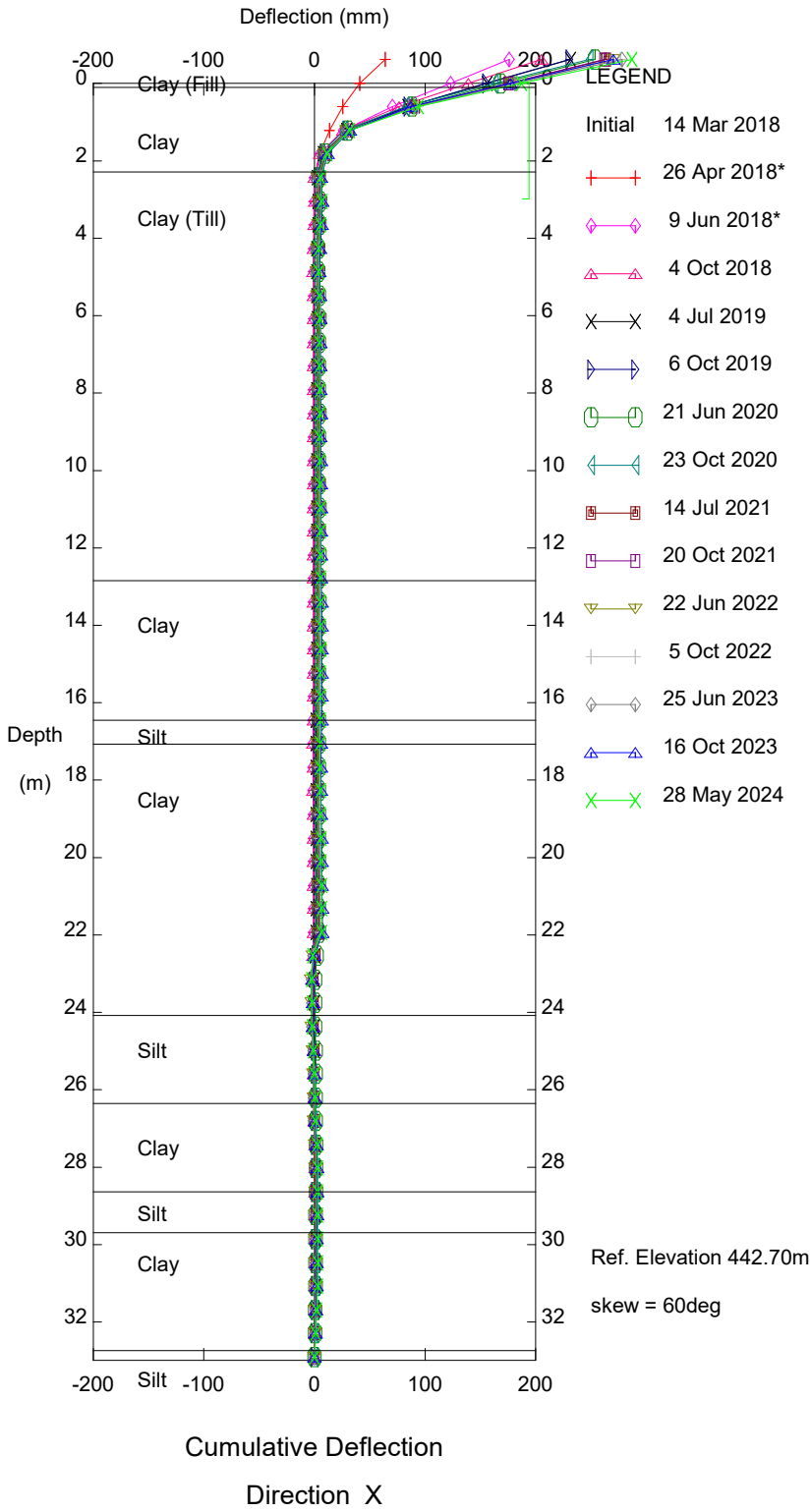


HWY 2:68 (PH037), Inclinometer SI18-10

Alberta Transportation

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

Thurber Engineering Ltd.

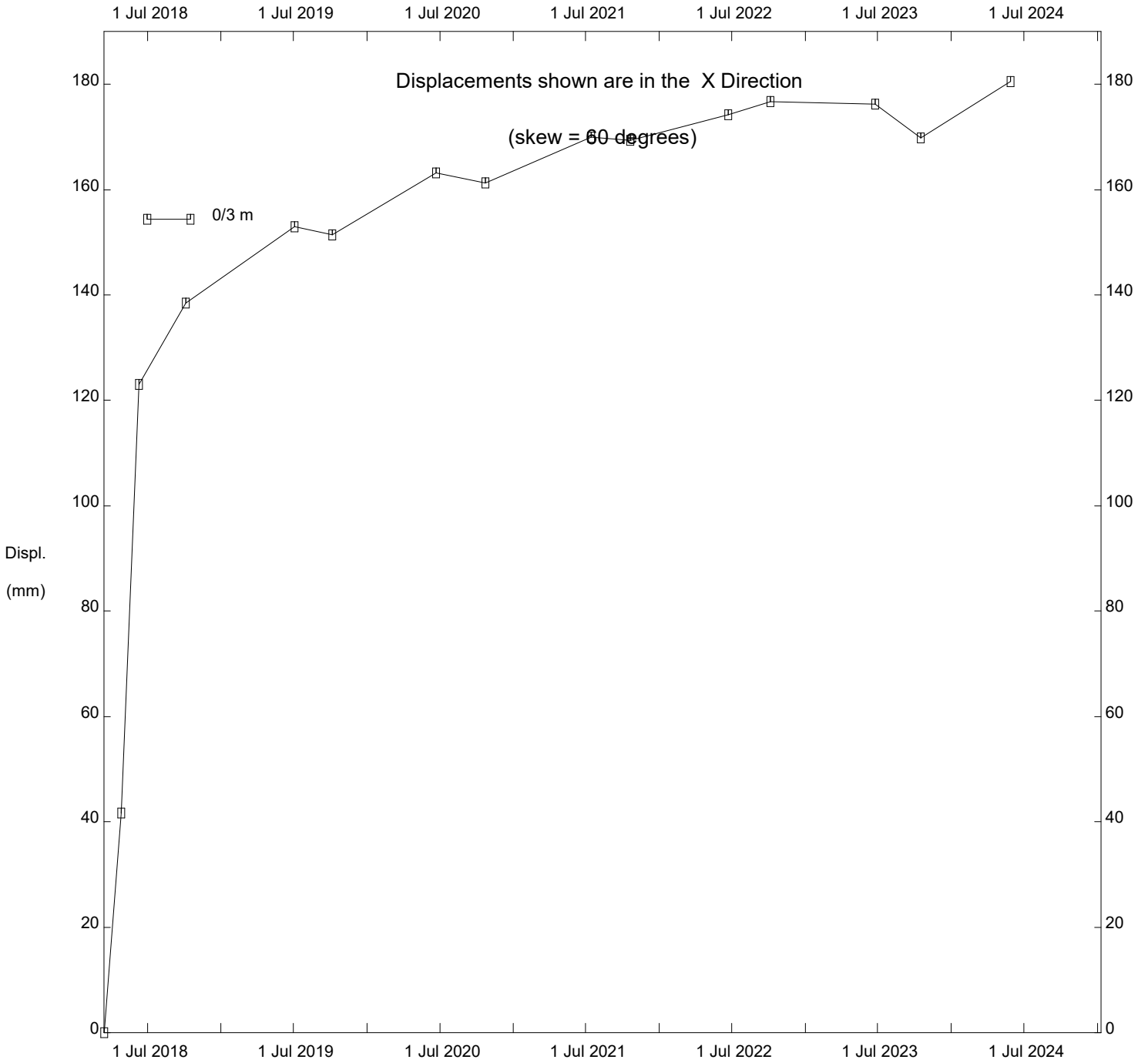


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Alberta Transportation

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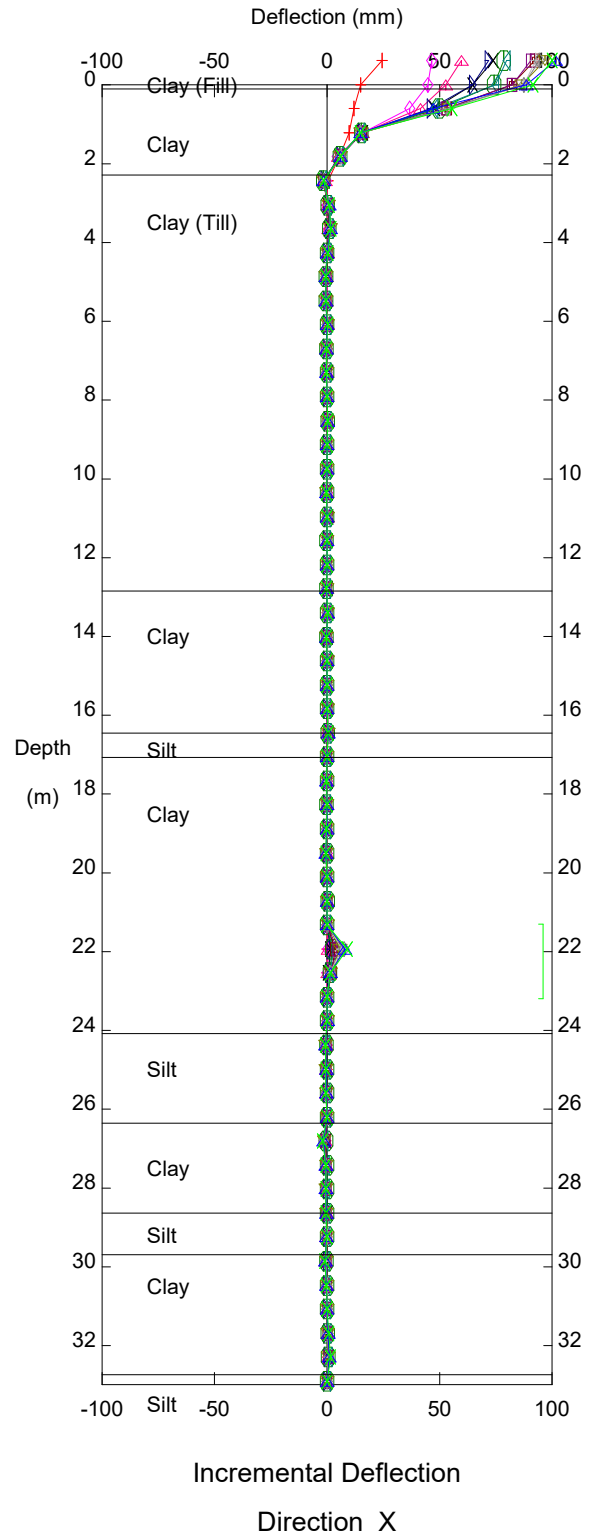
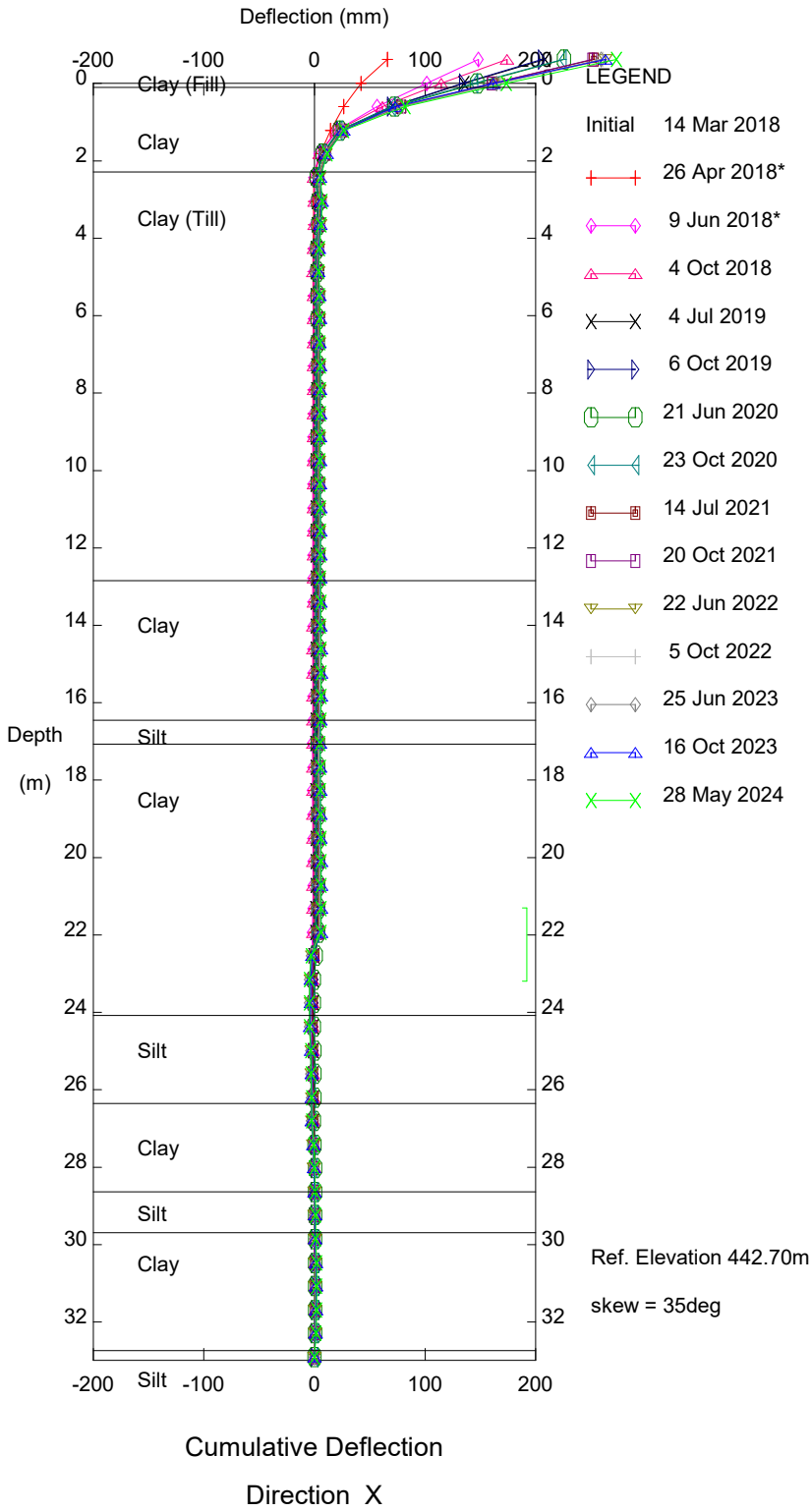
Thurber Engineering Ltd.



HWY 2:68 (PH037), Inclinator SI18-10

Alberta Transportation

Thurber Engineering Ltd.

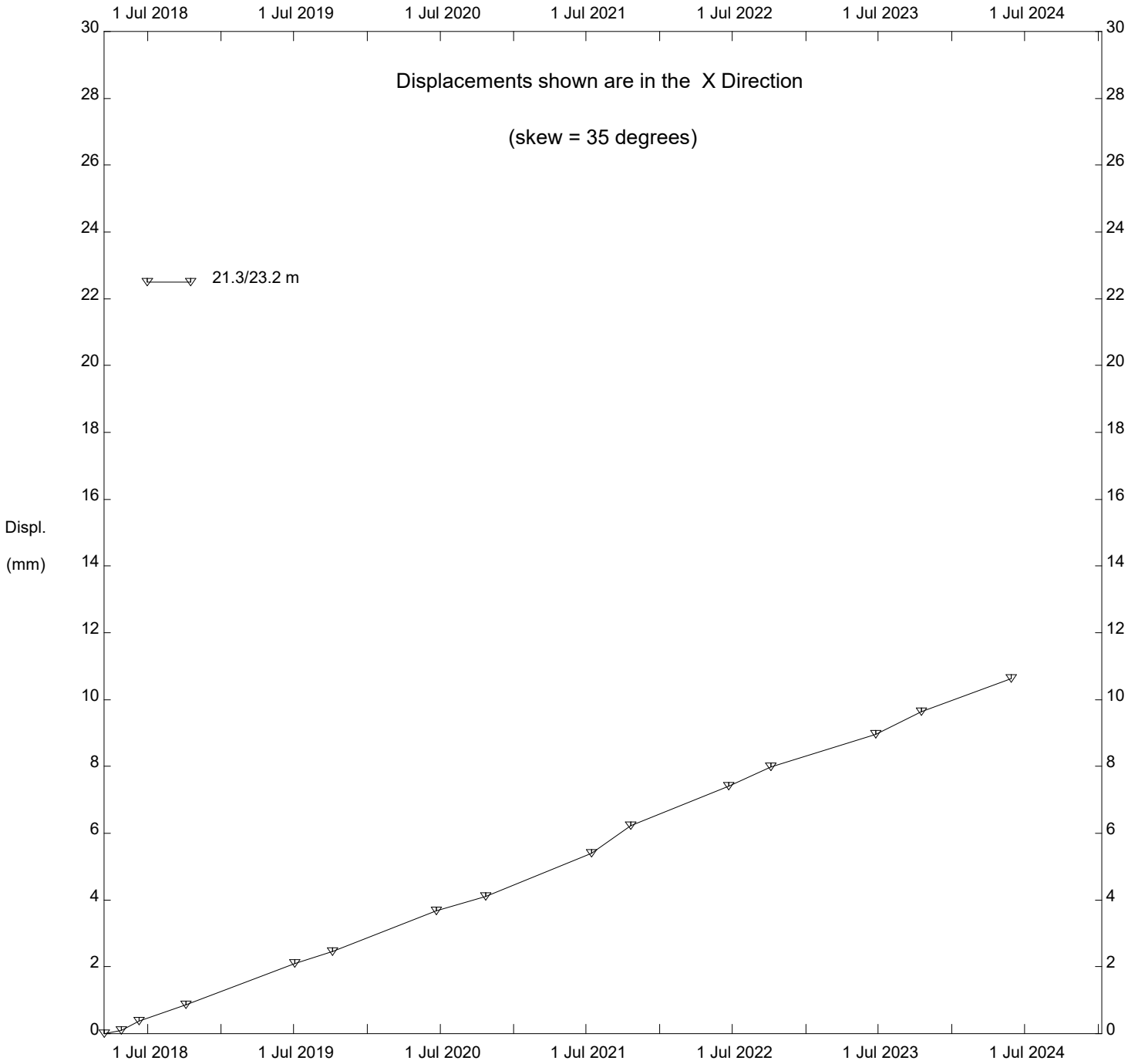


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Alberta Transportation

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

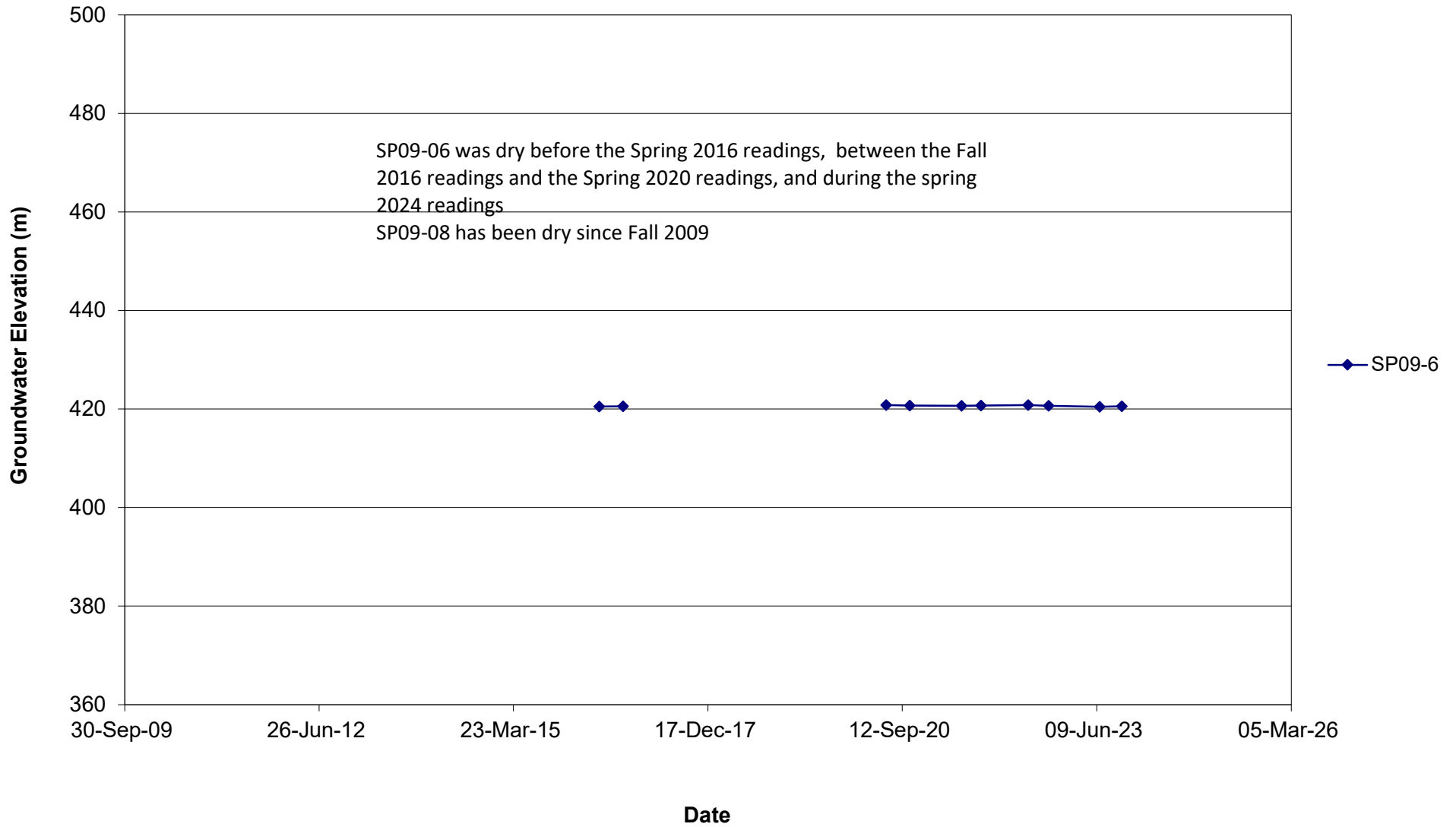
Thurber Engineering Ltd.



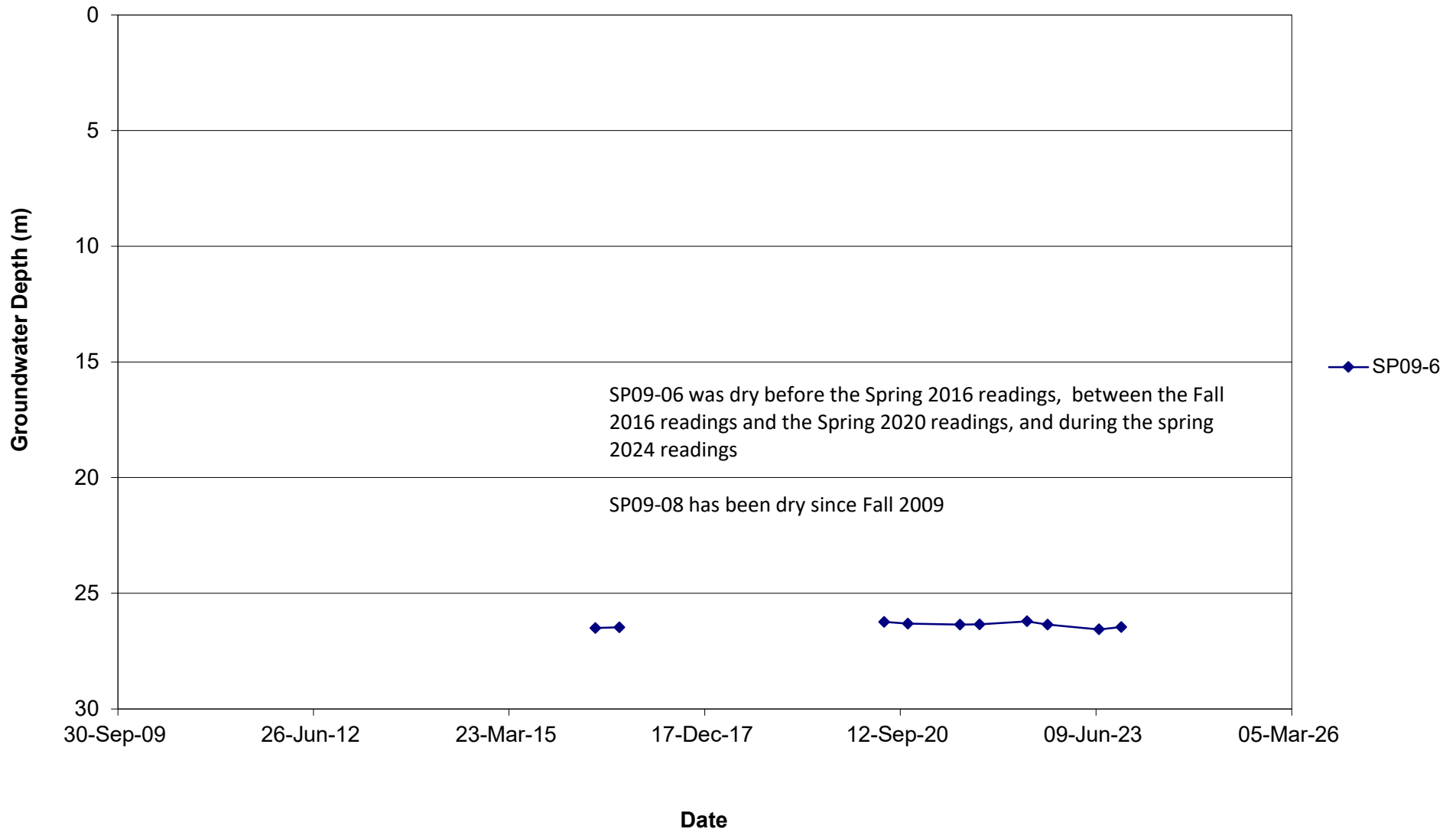
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Alberta Transportation

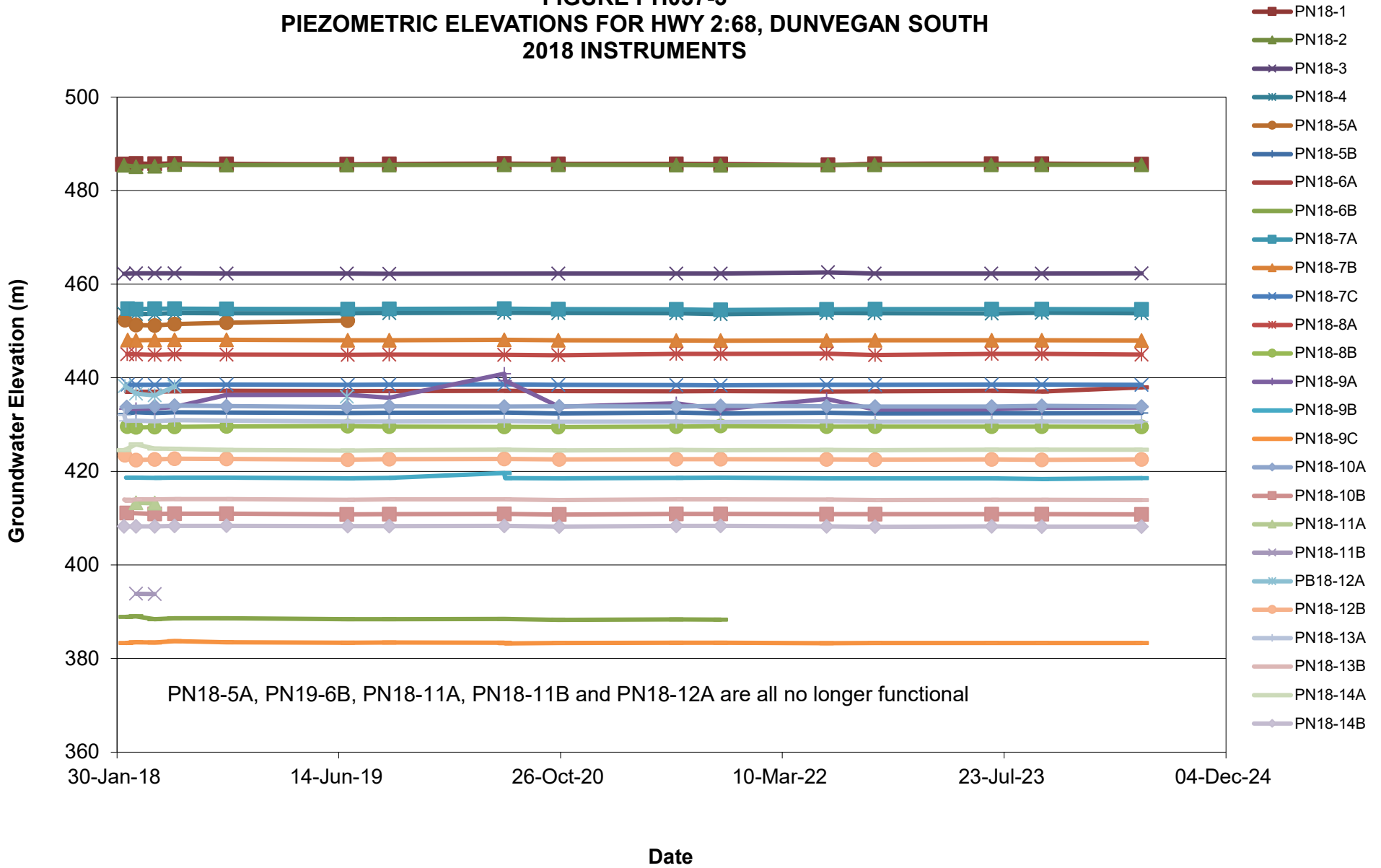
**FIGURE PH037-1
PIEZOMETRIC ELEVATIONS FOR HWY 2:68, DUNVEGAN SOUTH
2009 INSTRUMENTS**



**FIGURE PH037-2
PIEZOMETRIC DEPTHS FOR HWY 2:68, DUNVEGAN SOUTH
2009 INSTRUMENTS**



**FIGURE PH037-3
PIEZOMETRIC ELEVATIONS FOR HWY 2:68, DUNVEGAN SOUTH
2018 INSTRUMENTS**



**FIGURE PH037-4
PIEZOMETRIC DEPTHS FOR HWY 2:68, DUNVEGAN SOUTH
2018 INSTRUMENTS**

