



**THURBER** ENGINEERING LTD.

November 22, 2022

File No.: 32123

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

Attention: Mr. Ed Szmata

**ALBERTA TRANSPORTATION GRMP (CON0022165)  
PEACE REGION (GRANDE PRAIRIE DISTRICT – NORTH)  
INSTRUMENTATION MONITORING RESULTS – FALL 2022**

**SECTION C**

**SITE PH037: HWY 2:68, DUNVEGAN SOUTH**

Dear Mr. Szmata:

This report provides the results of the bi-annual geotechnical instrumentation monitoring for the above-mentioned site as part of Alberta Transportation's Geohazard Risk Management Program for Peace Region Grande Prairie District – North (CON0022165).

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**

Fifteen slope inclinometers (SI54, SI55, SI56, SI58, SI59, SI61, SI09-1, SI09-7, and SI18-4 to SI18-10), twenty-two pneumatic piezometers (PN18-1, PN18-2, PN18-3, PN18-4, PN18-5B, PN18-6A, PN18-6B, 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) and two standpipe piezometers (SP09-6 and SP09-8) were read at the Hwy 2:68 Dunvegan South (Station 1+250 to 2+000) site on October 5, 2022 by Mr. Niraj Regmi, G.I.T. and Mr. Kyle Crooymans, both of Thurber Engineering Ltd. PN18-6B was malfunctioning when it was read and no data could be obtained.

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. The pneumatic piezometers were read using an RST C108 pneumatic piezometer readout. A Heron dipmeter was used to read the standpipe piezometers.



## **2. DATA PRESENTATION**

### **2.1 General**

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

The slope inclinometer and piezometer summary tables also show readings for instruments deleted from the GRMP program, for future reference.

### **2.2 Zones of Movement**

No new zones of movement were observed since the spring of 2022 readings.

The zone of movement over 0.0 m to 1.9 m in SI18-4 was determined during the previous readings cycle to not represent an actual zone of movement. As such, this zone of movement has been removed.

Zones of movement are summarized in Table PH037-1 at the end of this report. This table also provides a historical account of the total movement that has occurred at this site since the initialization of the slope inclinometers, the depth of movement and the maximum rate of movement.



**TABLE PH037-1  
FALL 2022 – HWY 2:68 DUNVEGAN SOUTH  
SLOPE INCLINOMETER INSTRUMENTATION READING SUMMARY**

Date Monitored: October 4 and 5, 2022

<b>INSTRUMENT #</b>	<b>DATE INITIALIZED</b>	<b>TOTAL CUMULATIVE RESULTANT MOVEMENT AT NOTED DEPTH SINCE INITIAL READING (mm)</b>	<b>MAXIMUM RATE OF MOVEMENT (mm/yr)</b>	<b>CURRENT STATUS</b>	<b>DATE OF PREVIOUS READING</b>	<b>INCREMENTAL MOVEMENT SINCE PREVIOUS READING (mm)</b>	<b>RATE OF MOVEMENT (mm/yr)</b>	<b>CHANGE IN RATE OF MOVEMENT SINCE PREVIOUS READING (mm/yr)</b>
SI-54	Mar. 6 1995	118.8 mm over 0.0 m to 1.7 m depth in 292° direction	36.1 mm/yr in March 1995	Operational	June 21, 2022	No discernible movement	N/A	N/A
SI-55	Aug. 27, 1992	56.2 mm over 1.3 m to 4.3 m depth in 282° direction	17.4 mm/yr in October 2021	Operational	June 19, 2022	0.3	0.9	1.1
SI-56	Aug. 26 1992	65.9 mm over 0.0 m to 2.7 m depth in 13° direction	21.5 mm/yr in October 1998	Operational	June 22, 2022	1.4	5.1	5.7
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	151.2 mm over 0.5 m to 3.6 m depth in 271° direction	41.7 mm/yr in October 1998	Operational	June 21, 2022	2.9	10.0	21.0
SI-59	Aug. 26, 1992	169.1 mm over 1.0 m to 7.1 m depth in 301° direction	16.4 mm/yr in March 1995	Operational	June 19, 2022	1.2	4.0	-4.0

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...  
FALL 2022 – HWY 2:68 DUNVEGAN SOUTH  
SLOPE INCLINOMETER INSTRUMENTATION READING SUMMARY**

Date Monitored: October 4 and 5, 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)	RATE OF MOVEMENT (mm/yr)	CHANGE IN RATE OF MOVEMENT SINCE PREVIOUS READING (mm/yr)
SI-61	Mar. 2, 1995	23.6 mm over 3.6 m to 10.3 m depth in 186° direction	7.2 mm/yr in October 1997	Operational	June 22, 2022	0.1	0.4	-0.2
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 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	46.8 mm over 0.3 m to 7.0 m depth in 217° direction	15.7 mm/yr in November 2009	Operational	October 20, 2021	No discernible movement	N/A	N/A
		20.2 mm over 7.0 m to 13.1 m depth in 217° direction	4.0 mm/yr in September 2015			0.5	1.7	0.7
		4.8 mm over 13.1 m to 14.9 m depth in 217° direction	1.0 mm/yr in September 2014			0.1	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...  
FALL 2022 – HWY 2:68 DUNVEGAN SOUTH  
SLOPE INCLINOMETER INSTRUMENTATION READING SUMMARY**

Date Monitored: October 4 and 5, 2022

<b>INSTRUMENT #</b>	<b>DATE INITIALIZED</b>	<b>TOTAL CUMULATIVE RESULTANT MOVEMENT AT NOTED DEPTH SINCE INITIAL READING (mm)</b>	<b>MAXIMUM RATE OF MOVEMENT (mm/yr)</b>	<b>CURRENT STATUS</b>	<b>DATE OF PREVIOUS READING</b>	<b>INCREMENTAL MOVEMENT SINCE PREVIOUS READING (mm)</b>	<b>RATE OF MOVEMENT (mm/yr)</b>	<b>CHANGE IN RATE OF MOVEMENT SINCE PREVIOUS READING (mm/yr)</b>
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	8.1 mm over 3.9 m to 6.3 m depth in 312° direction	5.3 mm/yr in September 2011	Operational	June 19, 2022	0.3	1.0	1.2
		4.7 mm over 18.5 m to 20.3 m depth in 287° direction	1.1 mm/y in October 2017			0.1	0.5	-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	June 19, 2022	N/A	N/A	N/A
SI18-5	February 16, 2018	32.4 mm over 17.2 m to 20.3 m depth in 304° direction	10.5 mm/yr in April 2018	Operational	June 19, 2022	1.3	4.5	-4.2

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...  
FALL 2022 – HWY 2:68 DUNVEGAN SOUTH  
SLOPE INCLINOMETER INSTRUMENTATION READING SUMMARY**

Date Monitored: October 4 and 5, 2022

<b>INSTRUMENT #</b>	<b>DATE INITIALIZED</b>	<b>TOTAL CUMULATIVE RESULTANT MOVEMENT AT NOTED DEPTH SINCE INITIAL READING (mm)</b>	<b>MAXIMUM RATE OF MOVEMENT (mm/yr)</b>	<b>CURRENT STATUS</b>	<b>DATE OF PREVIOUS READING</b>	<b>INCREMENTAL MOVEMENT SINCE PREVIOUS READING (mm)</b>	<b>RATE OF MOVEMENT (mm/yr)</b>	<b>CHANGE IN RATE OF MOVEMENT SINCE PREVIOUS READING (mm/yr)</b>
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	Operational	June 19, 2022	0.6	1.9	-7.2
SI18-7	February 21, 2018	55.5 mm over 9.1 m to 11.6 m depth in 270° direction	17.2 mm/yr in April 2018	Operational	June 19, 2022	3.1	10.6	-3.5
SI18-8	February 12, 2018	15.9 mm over 14.5 m to 16.3 m depth in 267° direction	5.1 mm/yr in April 2018	Operational	June 19, 2022	1.1	3.6	0.0
SI18-9	April 25, 2018 (changed from Feb. 15, 2018)	12.4 mm over 20.1 m to 22.0 m depth in 288° direction	3.2 mm/yr in October 2018	Operational	June 22, 2022	0.7	2.6	-0.4
SI18-10	March 14, 2018	176.7 mm over 0.0 m to 3.0 m depth in 345° direction	675.3 mm/yr in June 2018	Operational	June 22, 2022	2.5	8.8	1.6
		8.0 mm over 21.3 m to 23.2 m depth in 320° direction	3.1 mm/yr in October 2021			0.6	2.0	0.3
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  
FALL 2022 – HWY 2:68 DUNVEGAN SOUTH  
STANDPIPE PIEZOMETER INSTRUMENTATION READING SUMMARY**

Date Monitored: October 4 and 5, 2022

<b>INSTRUMENT #</b>	<b>DATE INITIALIZED</b>	<b>TIP DEPTH (m)</b>	<b>GROUND ELEV. (m)</b>	<b>CURRENT STATUS</b>	<b>HIGHEST MEASURED WATER LEVEL BGS (m)</b>	<b>MEASURED WATER LEVEL BGS (m)</b>	<b>PREVIOUS READING (m)</b>	<b>CHANGE IN WATER LEVEL SINCE PREVIOUS READING (m)</b>
SP09-6	September 30, 2009	26.56	N/A	Active	26.21 on June 22, 2022	26.36	26.21	-0.15
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  
FALL 2022 – HWY 2:68 DUNVEGAN SOUTH  
PNEUMATIC PIEZOMETER INSTRUMENTATION READING SUMMARY**

Date Monitored: October 4 and 5, 2022

<b>INSTRUMENT #</b>	<b>DATE INITIALIZED</b>	<b>TIP ELEV. (m)</b>	<b>GROUND ELEV. (m)</b>	<b>CURRENT STATUS</b>	<b>HIGHEST MEASURED WATER ELEVATION (m)</b>	<b>MEASURED PORE PRESSURE (kPa)</b>	<b>CURRENT WATER ELEVATION (m)</b>	<b>PREVIOUS WATER ELEVATION (m)</b>	<b>CHANGE IN WATER LEVEL SINCE PREVIOUS READING (m)</b>
PN18-1	February 9, 2018	485.20	517.20	Operational	485.83 on June 9, 2018	5.4	485.75	485.51	0.24
PN18-2	February 11, 2018	485.01	503.30	Operational	485.58 on June 9, 2018	4.8	485.50	485.48	0.02
PN18-3	February 11, 2018	461.96	490.00	Operational	462.56 on June 21, 2022	3.0	462.27	462.56	-0.29
PN18-4	February 11, 2018	453.41	480.00	Operational	453.89 on June 21, 2020	3.6	453.78	453.86	-0.08
<i>PN18-5A</i>	<i>February 17, 2018</i>	<i>450.55</i>	<i>460.30</i>	<i>Malfunctioning</i>	<i>452.21 on July 4, 2019</i>	<i>N/A</i>	<i>N/A</i>	<i>452.21 (July 4, 2019)</i>	<i>N/A</i>
PN18-5B	February 17, 2018	432.26	460.30	Operational	432.65 on June 9, 2018	1.0	432.36	432.50	-0.14
PN18-6A	February 19, 2018	436.96	446.10	Operational	437.20 on October 4, 2018	1.4	437.10	437.05	0.05
<i>PN18-6B</i>	<i>February 19, 2018</i>	<i>388.19</i>	<i>446.10</i>	<i>Malfunctioning</i>	<i>389.03 on March 14, 2018</i>	<i>N/A</i>	<i>N/A</i>	<i>388.31 (Oct. 22, 2021)</i>	<i>N/A</i>
PN18-7A	February 23, 2018	454.35	464.10	Operational	454.78 on June 9, 2018	3.1	454.67	454.65	0.02
PN18-7B	February 23, 2018	447.64	464.10	Operational	448.13 on June 9, 2018	3.8	448.03	447.99	0.04
PN18-7C	February 23, 2018	438.19	464.10	Operational	438.60 on June 21, 2020	3.1	438.51	438.50	0.01
PN18-8A	February 22, 2018	444.50	450.60	Operational	445.16 on June 18, 2022	3.6	444.87	445.16	-0.29

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...  
FALL 2022 – HWY 2:68 DUNVEGAN SOUTH  
PNEUMATIC PIEZOMETER INSTRUMENTATION READING SUMMARY**

Date Monitored: October 4 and 5, 2022

<b>INSTRUMENT #</b>	<b>DATE INITIALIZED</b>	<b>TIP ELEV. (m)</b>	<b>GROUND ELEV. (m)</b>	<b>CURRENT STATUS</b>	<b>HIGHEST MEASURED WATER ELEVATION (m)</b>	<b>MEASURED PORE PRESSURE (kPa)</b>	<b>CURRENT WATER ELEVATION (m)</b>	<b>PREVIOUS WATER ELEVATION (m)</b>	<b>CHANGE IN WATER LEVEL SINCE PREVIOUS READING (m)</b>
PN18-8B	February 22, 2018	429.26	450.60	Operational	429.70 on Oct. 22, 2021	2.7	429.54	429.54	0.00
PN18-9A	February 19, 2018	433.18	440.80	Operational	440.88* on June 21, 2020	0.5	433.23	435.46	-2.23
PN18-9B	February 19, 2018	418.24	440.80	Operational	419.65 on June 21, 2020	2.5	418.49	418.49	0.00
PN18-9C	February 19, 2018	383.19	440.80	Operational	383.72 on June 9, 2018	1.3	383.32	383.28	0.04
PN18-10A	February 21, 2018	433.56	442.70	Operational	434.06 on June 9, 2018	2.7	433.84	433.90	-0.06
PN18-10B	February 21, 2018	410.54	442.70	Operational	410.96 on June 9, 2018	3.0	410.85	410.85	0.00
<i>PN18-11A</i>	<i>March 14, 2018</i>	<i>412.85</i>	<i>425.80</i>	<i>Destroyed</i>	<i>413.20 on April 25, 2018</i>	<i>N/A</i>	<i>N/A</i>	<i>413.20 (Apr. 25, 2018)</i>	<i>N/A</i>
<i>PN18-11B</i>	<i>March 14, 2018</i>	<i>392.73</i>	<i>425.80</i>	<i>Destroyed</i>	<i>393.78 on April 25, 2018</i>	<i>N/A</i>	<i>N/A</i>	<i>393.78 (Apr. 25, 2018)</i>	<i>N/A</i>
<i>PN18-12A</i>	<i>February 17, 2018</i>	<i>435.90</i>	<i>442.00</i>	<i>Malfunctioning</i>	<i>438.15 on June 9, 2018</i>	<i>N/A</i>	<i>N/A</i>	<i>435.95 (July 2, 2019)</i>	<i>N/A</i>
PN18-12B	February 17, 2018	422.19	442.00	Operational	422.68 on June 9, 2018	3.1	422.51	422.54	-0.03
PN18-13A	February 15, 2018	430.36	439.50	Operational	430.92 on June 9, 2018	2.3	430.59	430.68	-0.09
PN18-13B	February 15, 2018	413.59	439.50	Operational	414.08 on June 9, 2018	2.5	413.84	413.96	-0.12

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...**  
**FALL 2022 – HWY 2:68 DUNVEGAN SOUTH**  
**PNEUMATIC PIEZOMETER INSTRUMENTATION READING SUMMARY**

Date Monitored: October 4 and 5, 2022

<b>INSTRUMENT #</b>	<b>DATE INITIALIZED</b>	<b>TIP ELEV. (m)</b>	<b>GROUND ELEV. (m)</b>	<b>CURRENT STATUS</b>	<b>HIGHEST MEASURED WATER ELEVATION (m)</b>	<b>MEASURED PORE PRESSURE (kPa)</b>	<b>CURRENT WATER ELEVATION (m)</b>	<b>PREVIOUS WATER ELEVATION (m)</b>	<b>CHANGE IN WATER LEVEL SINCE PREVIOUS READING (m)</b>
PN18-14A	February 15, 2018	424.29	434.50	Operational	425.77 on March 14, 2018	2.3	424.52	424.56	-0.04
PN18-14B	February 15, 2018	407.98	434.50	Operational	408.37 on October 4, 2018	1.8	408.16	408.26	-0.10

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



### **3. INTERPRETATION OF MONITORING RESULTS**

Slope inclinometer SI-54 had no discernible movement over 0 m to 1.7 m depth since the spring of 2022 readings. SI-55 showed a rate of movement of 0.9 mm/yr over 1.3 m to 4.3 m depth. SI-56 showed a rate of movement of 5.1 mm/yr over 0 m to 2.7 m depth. SI-58 showed a rate of movement of 10.0 mm/yr over 0.5 m to 3.6 m depth. SI-59 showed a rate of movement of 4.0 mm/yr over 1.0 m to 7.1 m depth. This SI is in the highway ditch near the assumed backscarp of the landslide that is affecting the highway and has moved 169.1 mm over this depth zone, since it was first installed in 1994. SI-61 showed a rate of movement of 0.4 mm/yr over 3.6 m to 10.3 m depth.

SI09-1 showed no discernible movement, a rate of movement of 1.7 mm/yr and a rate of movement of 0.3 mm/yr over 0.3 m to 7.0 m depth, 7.0 m to 13.1 m depth and 13.1 m to 14.9 m depth, respectively, since the spring of 2022 readings. SI09-7 showed a rate of movement of 1.0 mm/yr over 3.9 m to 6.3 m depth and a rate of movement of 0.5 mm/yr over 18.5 m to 20.3 m depth.

SI18-4 continued to show no discernible movement. SI18-5 indicates a well-defined landslide shear zone showing a rate of movement of 4.5 mm/yr over 17.2 m to 20.3 m depth. SI18-6 also indicates a well-defined shear plane showing a rate of movement of 1.9 mm/yr over 32.1 m to 35.1 m depth. SI18-7 showed a rate of movement of 10.6 mm/yr along a shear plane over 9.1 m to 11.6 m depth. SI18-8 showed a rate of movement of 3.6 mm/yr along a well-defined shear plane over 14.5 m to 16.3 m depth. SI18-9 showed a rate of movement of 2.6 mm/yr along a well-defined shear plane over 20.1 m to 22.0 m depth. SI18-10 showed a rate of movement of 8.8 mm/yr over 0 m to 3.0 m depth and a rate of movement of 2.0 mm/yr over 21.3 m to 23.2 m depth.

Overall, the SIs installed in 2018 have shown relatively similar rates of movement for the past several reading cycles.

Standpipe piezometer SP09-6 showed a decrease in groundwater level of 0.15 m since the spring of 2022 readings. SP09-8 continued to be dry. The standpipe piezometer readings are summarized in Table PH037-2, and are plotted in Figure PH037-1 (by elevation) and in Figure PH037-2 (by depth below ground surface) in Appendix A.

Most of the pneumatic piezometers generally showed relatively small changes in groundwater level compared to the spring of 2022, ranging from a decrease of 2.23 m in PN18-9A to an increase of 0.24 m in PN18-1. The pneumatic piezometer readings are summarized in Table PH037-3, and are plotted in Figures PH037-3 (by elevation) and PH037-4 (by depth below ground surface) in Appendix A.

### **4. RECOMMENDATIONS**

#### **4.1 Future Work**

The instruments should be read again in the spring of 2023. PN18-6B has malfunctioned for two reading cycles in a row and should be removed from the reading program.



#### **4.2 Instrumentation Repairs**

No instrumentation repairs are required at this time.

#### **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.  
Don Proudfoot, M.Eng., P.Eng.  
Principal | Senior Geotechnical Engineer

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. 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)





## 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.



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

**FALL 2022**

**APPENDIX A  
DATA PRESENTATION**

**SITE PH037: HWY 2:68, DUNVEGAN SOUTH**

**ALBERTA TRANSPORTATION  
PEACE REGION (GRANDE PRAIRIE - NORTH DISTRICT)  
INSTRUMENTATION MONITORING FIELD SUMMARY (PH037)  
FALL 2022**

<b>Location:</b> Dunvegan South (HWY 2:68 C1 15.674) <b>File Number:</b> 32123 <b>Probe:</b> RST SI SET 5R and 8R <b>Cable:</b> RST SI SET 5R and 8R	<b>Readout:</b> <b>Extension:</b> 3.34"/2.75" Ø <b>Temp:</b> 2 <b>Read by:</b> NKR/KTC
---	---

**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 #	Remarks
	Easting (m)	Northing (m)					A+	A-	B+	B-		
SI-54	398593.62	6197597.09	04-Oct-22	0.73	62 to 2	5	233	-216	-582	589	5R/5R	***
SI-55	398503.91	6197504.55	05-Oct-22	0.56	66 to 2	15	-18	36	-1173	1178	8R/8R	***
SI-56	398540.17	6197496.24	05-Oct-22	0.91	76 to 2	350	1354	-1337	-965	975	8R/8R	***
SI-58	398626.26	6197479.42	04-Oct-22	0.71	64 to 2	0	-373	394	-462	467	5R/5R	***
SI-59	398528.72	6197362.90	05-Oct-22	0.87	76 to 2	40	167	-154	-798	803	8R/8R	
SI-61	398521.45	6197719.36	05-Oct-22	0.67	62 to 2	345	104	-88	-942	920	5R/5R	*
SI09-1	398520.28	6197714.60	05-Oct-22	0.92	108 to 2	235	-118	136	467	-485	5R/5R	
SI09-7	398423.87	6197337.20	05-Oct-22	1.00	108 to 2	270	-289	301	-85	64	5R/5R	
SI18-4	398582.00	6197288.00	04-Oct-22	0.89	94 to 2	302	407	-392	-43	49	8R/8R	
SI18-5	398525.00	6197321.00	05-Oct-22	0.76	98 to 2	280	160	-145	358	-379	5R/5R	
SI18-6	398470.00	6197377.00	05-Oct-22	0.54	198 to 2	280	-3	10	366	-493	5R/5R	*
SI18-7	398495.00	6197264.00	05-Oct-22	0.91	132 to 2	238	505	-513	-748	737	8R/8R	
SI18-8	398509.00	6197461.00	05-Oct-22	1.06	110 to 2	260	-1660	1677	1169	-1166	8R/8R	
SI18-9	398491.00	6197515.00	05-Oct-22	0.90	188 to 2	266	189	-171	227	-220	8R/8R	
SI18-10	398518.00	6197582.00	05-Oct-22	0.92	110 to 2	268	224	-209	262	-283	5R/5R	

**INSPECTOR REPORT**

*SI-61 Hard to pull from 26-24 ft, use dummy probe
*** Slope Direction is 270 degree
SI 18-6 Stiff at 114 ft, use dummy

**ALBERTA TRANSPORTATION  
PEACE REGION (GRANDE PRAIRIE - NORTH DISTRICT)  
INSTRUMENTATION MONITORING FIELD SUMMARY (PH037)  
FALL 2022**

**Location:** Dunvegan South (HWY 2:68 C1 15.674)  
**File Number:** 32123

**Readout:** RST PN C108 U  
**Temp:** 2  
**Read by:** KTC/NKR

**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	05-Oct-22	1.04	27.4	27.60
SP09-8	398461.37	6197336.32	05-Oct-22	0.69	DRY	12.30

**PNEUMATIC PIEZOMETER READINGS**

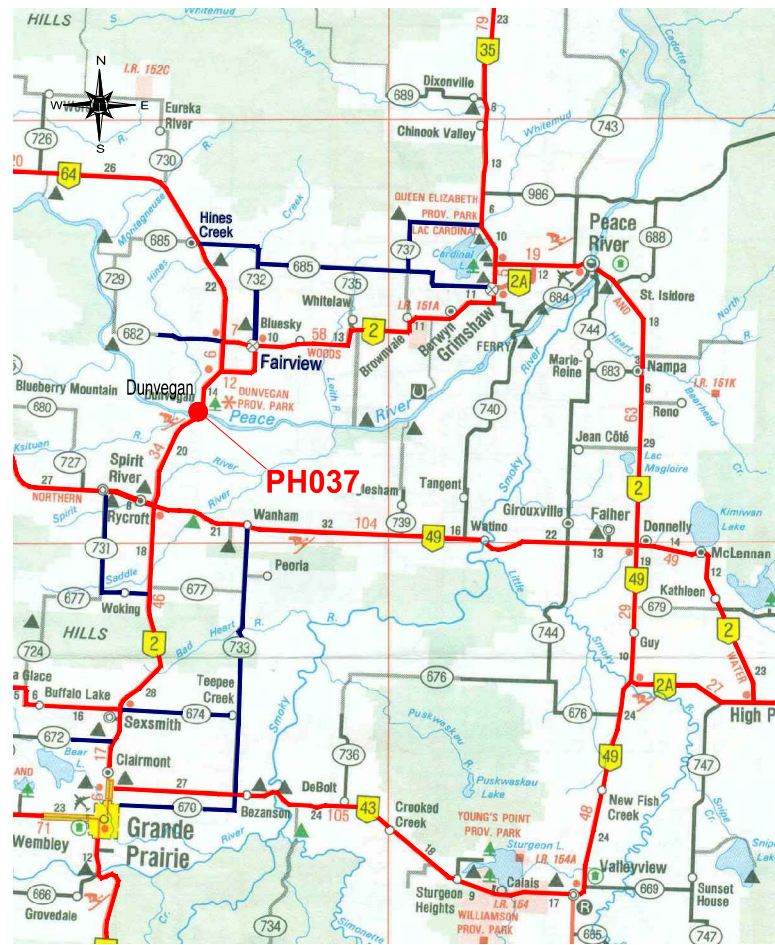
PN#	GPS Location (UTM 11)		Date	Reading (kPa)	Identification Number
	Easting (m)	Northing (m)			
PN18-1	398691	6196979	04-Oct-22	5.4	37810
PN18-2	398636	6197245	04-Oct-22	4.8	37818
PN18-3	398661	6197458	04-Oct-22	3	37815
PN18-4	398582	6197288	04-Oct-22	3.6	37821
PN18-5B	398525	6197321	05-Oct-22	1	37817
PN18-6A	398470	6197377	05-Oct-22	1.4	37819
PN18-6B	398470	6197377	05-Oct-22	No Reading	37806
PN18-7A	398495	6197264	05-Oct-22	3.1	37826
PN18-7B	398495	6197264	05-Oct-22	3.8	37813
PN18-7C	398495	6197264	05-Oct-22	3.1	37807
PN18-8A	398509	6197461	05-Oct-22	3.6	37830
PN18-8B	398509	6197461	05-Oct-22	2.7	37811
PN18-9A	398491	6197515	05-Oct-22	0.5*	37825
PN18-9B	398491	6197515	05-Oct-22	2.5	37808
PN18-9C	398491	6197515	05-Oct-22	1.3	37805
PN18-10A	398518	6197582	05-Oct-22	2.7	37827
PN18-10B	398518	6197582	05-Oct-22	3	37812
PN18-12B	398541	6197577	05-Oct-22	3.1	37820
PN18-13A	398544	6197638	05-Oct-22	2.3	37828
PN18-13B	398544	6197638	05-Oct-22	2.5	37814
PN18-14A	398551	6197690	05-Oct-22	2.3	37822
PN18-14B	398551	6197690	05-Oct-22	1.8	37816

**INSPECTOR REPORT**

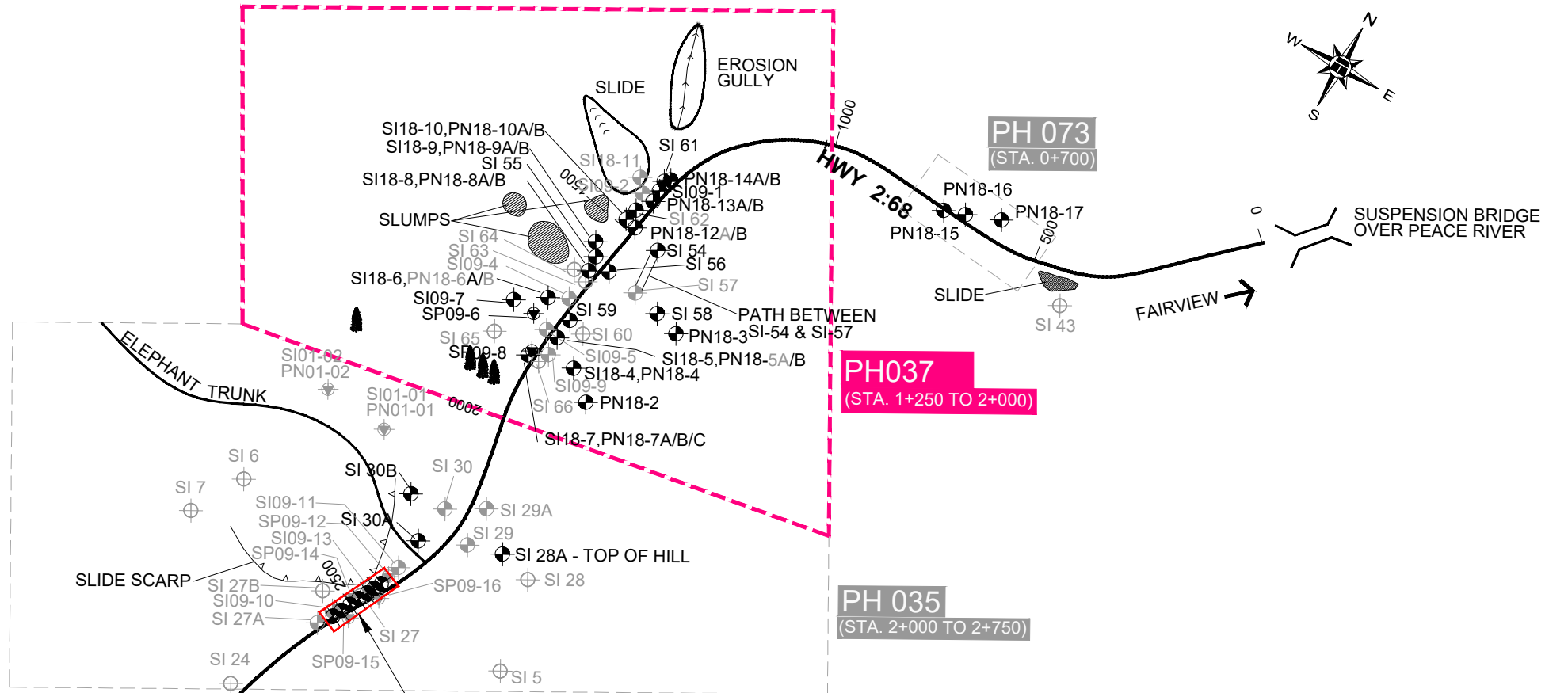
Attempt to read PN18-6B again in Fall 2022

\*Took 2 readings to confirm

H:\32000\32123 AT GRMP Grande Prairie District North 2021-2025\CAD\2022 INSTRUMENTS\32123-PH037-1.dwg - AT - Jul. 13. 2022



**SITE MAP**  
NOT TO SCALE

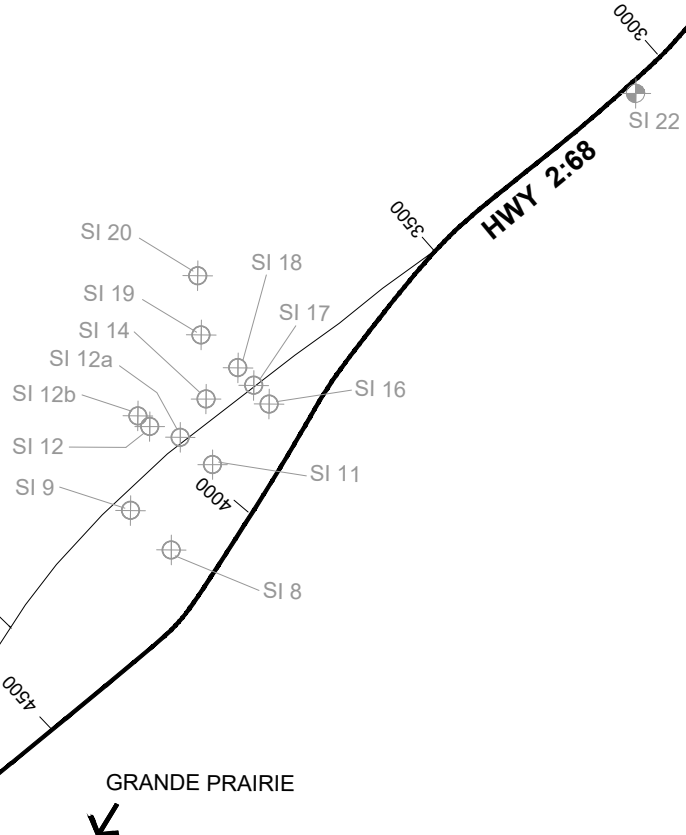


**LEGEND :**

- 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



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

GRANDE PRAIRIE

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



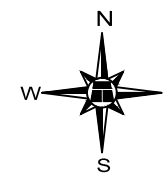
**PEACE REGION  
(GRANDE PRAIRIE DISTRICT NORTH)**  
**PH037: DUNVEGAN SOUTH  
INSTRUMENTATION LOCATIONS**

DWG No. 32123-PH037-1



DRAWN BY	ML
DESIGNED BY	BWN
APPROVED BY	DWP
SCALE	N. T. S.
DATE	JULY 2022
FILE No.	32123



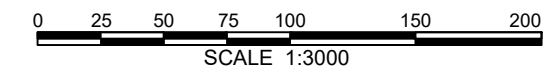




**LEGEND**

-  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

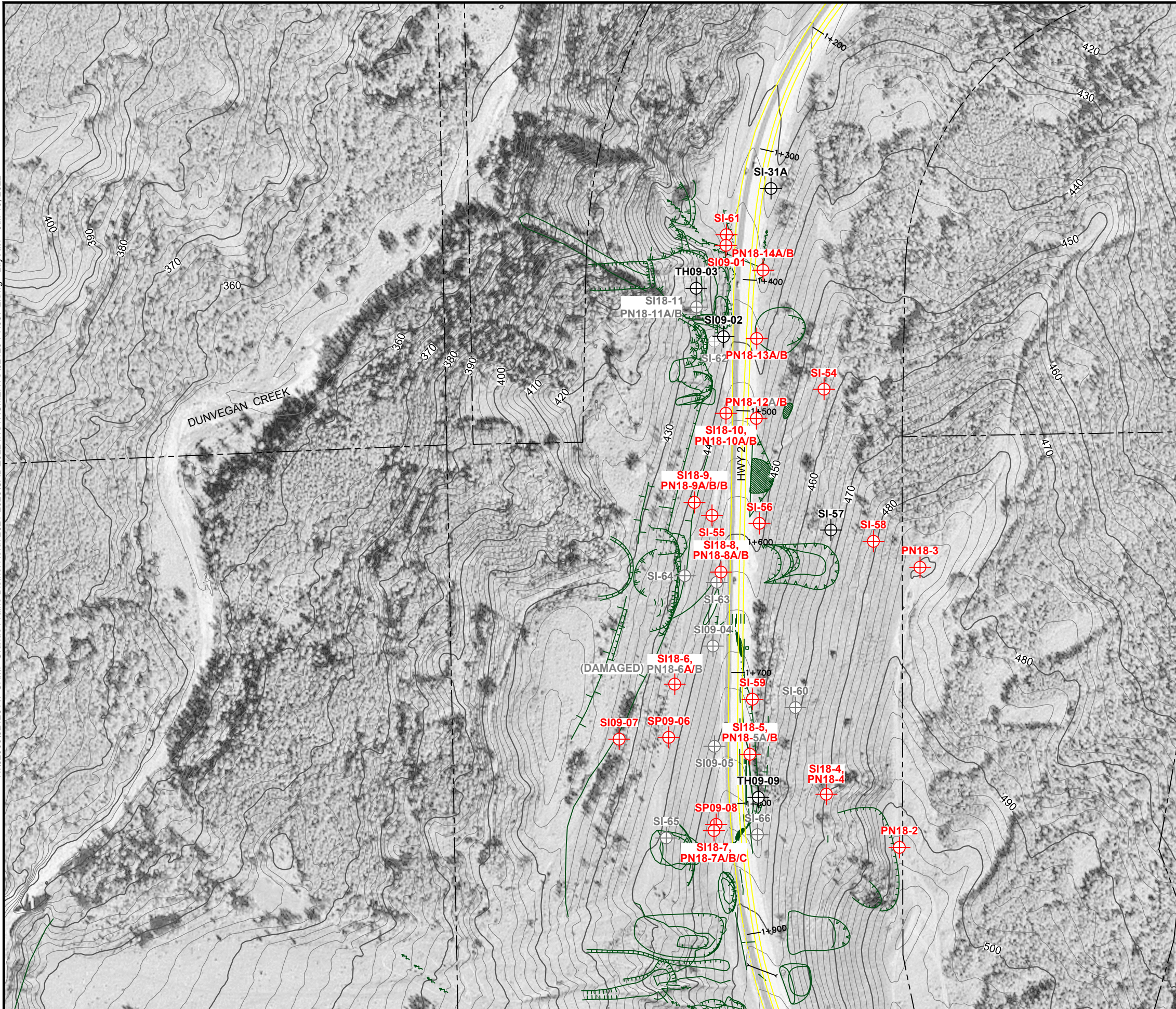


**PEACE REGION  
(GRANDE PRAIRIE DISTRICT NORTH)**

**PH037: DUNVEGAN SOUTH  
INSTRUMENTATION LOCATIONS**

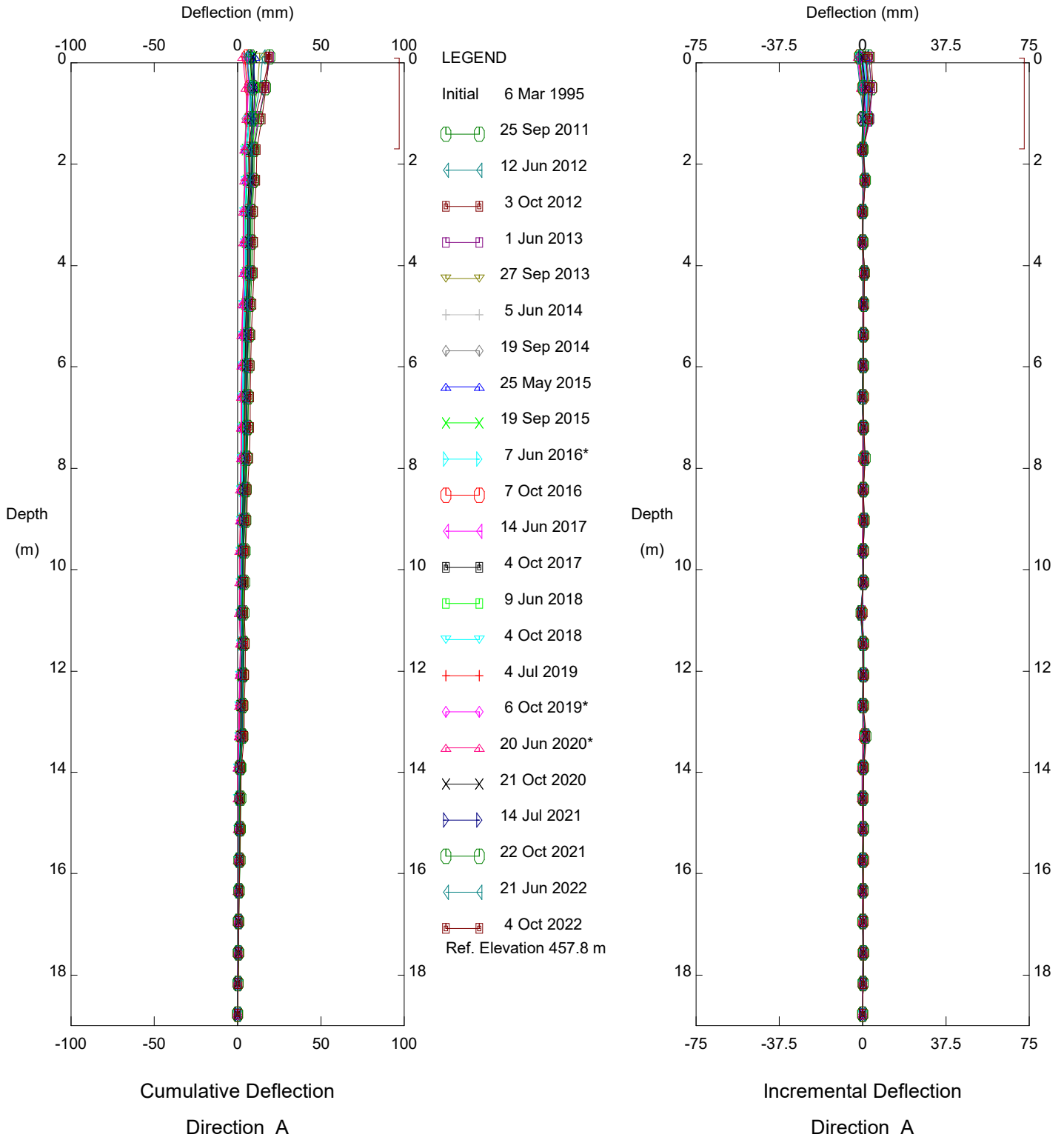
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DATE	JULY 2022
FILE No.	32123





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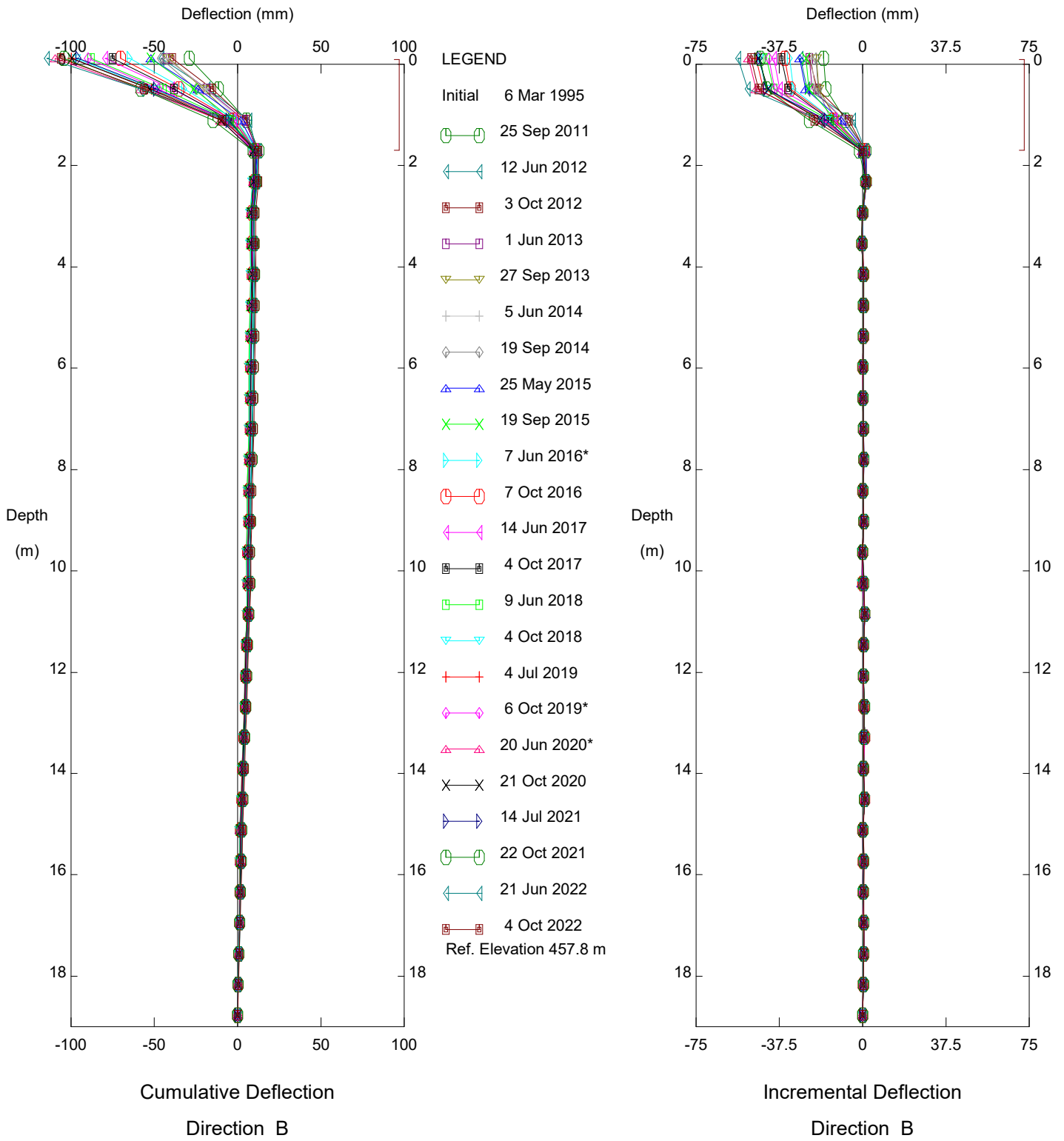


HWY 2:68 (PH037), Inclinometer SI-54

Alberta Transportation

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

Thurber Engineering Ltd.



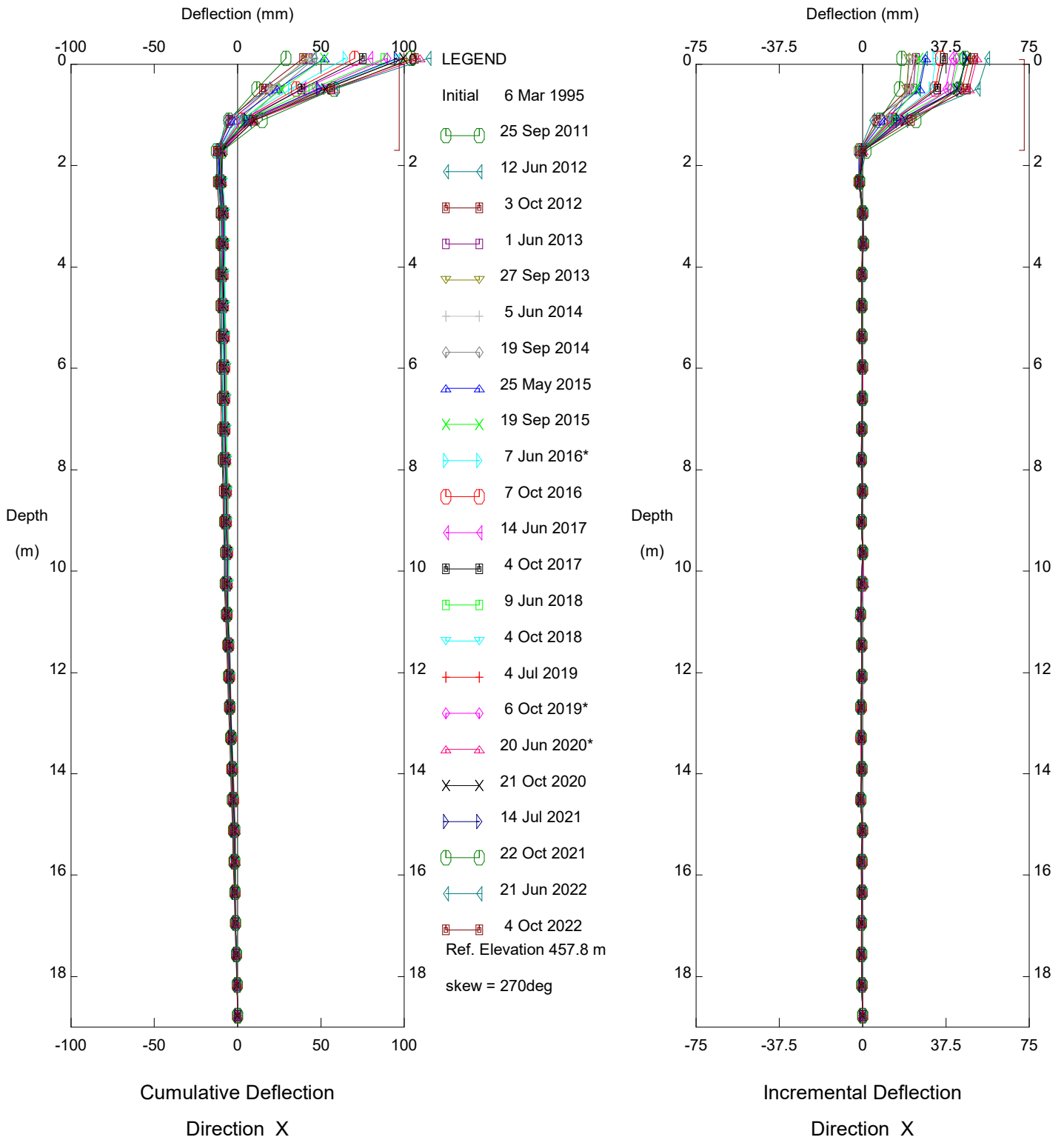
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Alberta Transportation

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



Thurber Engineering Ltd.

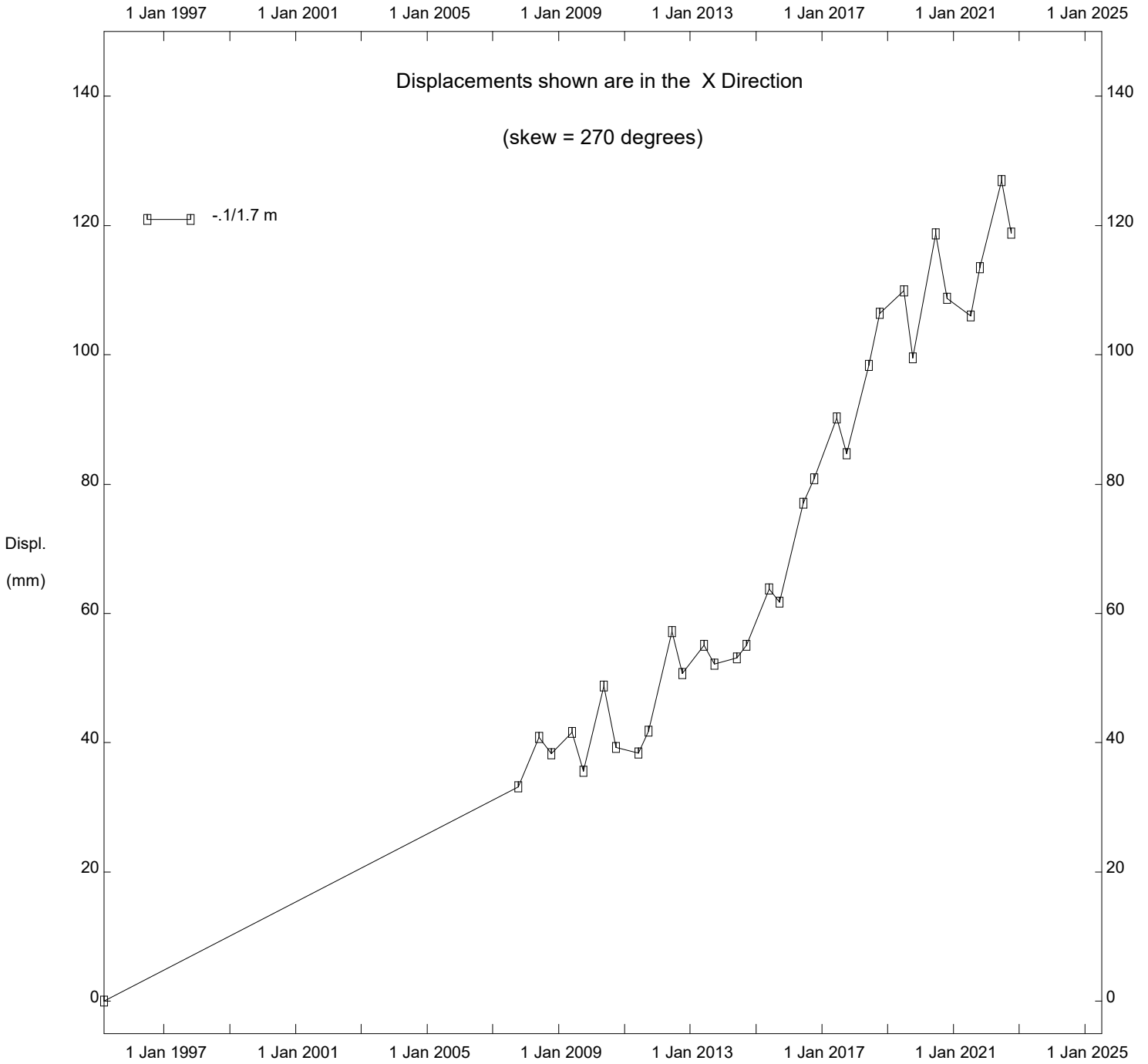


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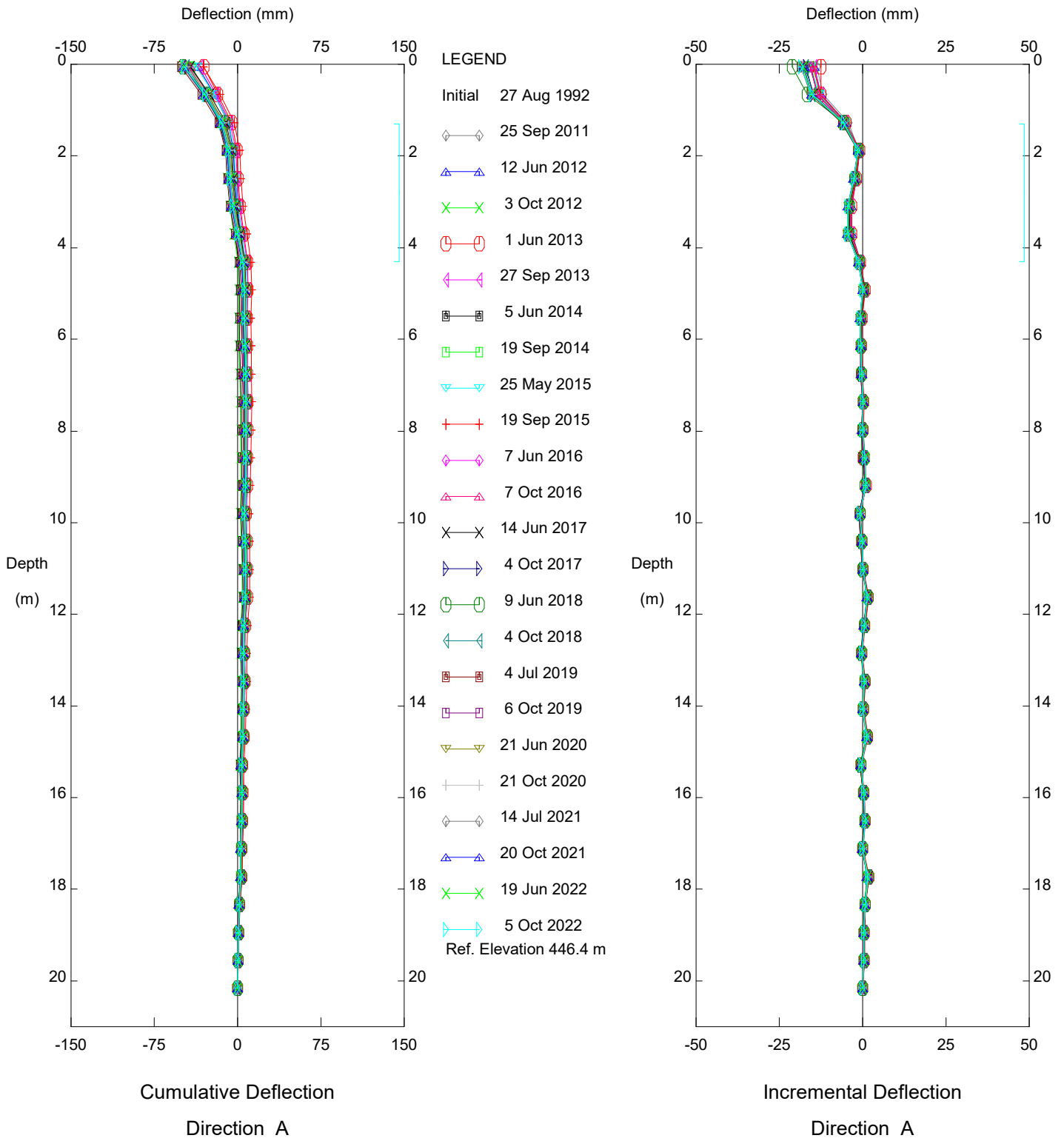
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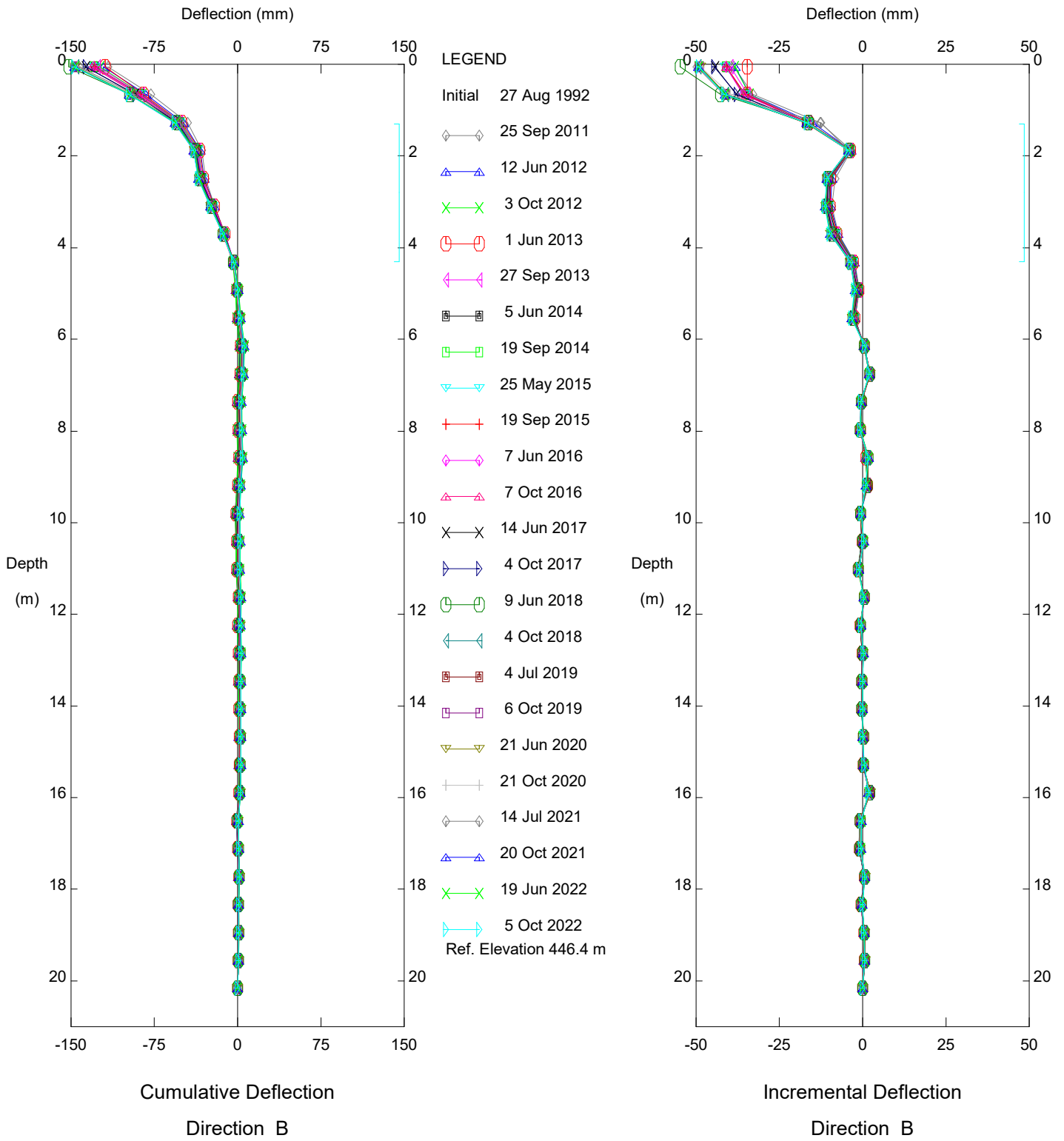
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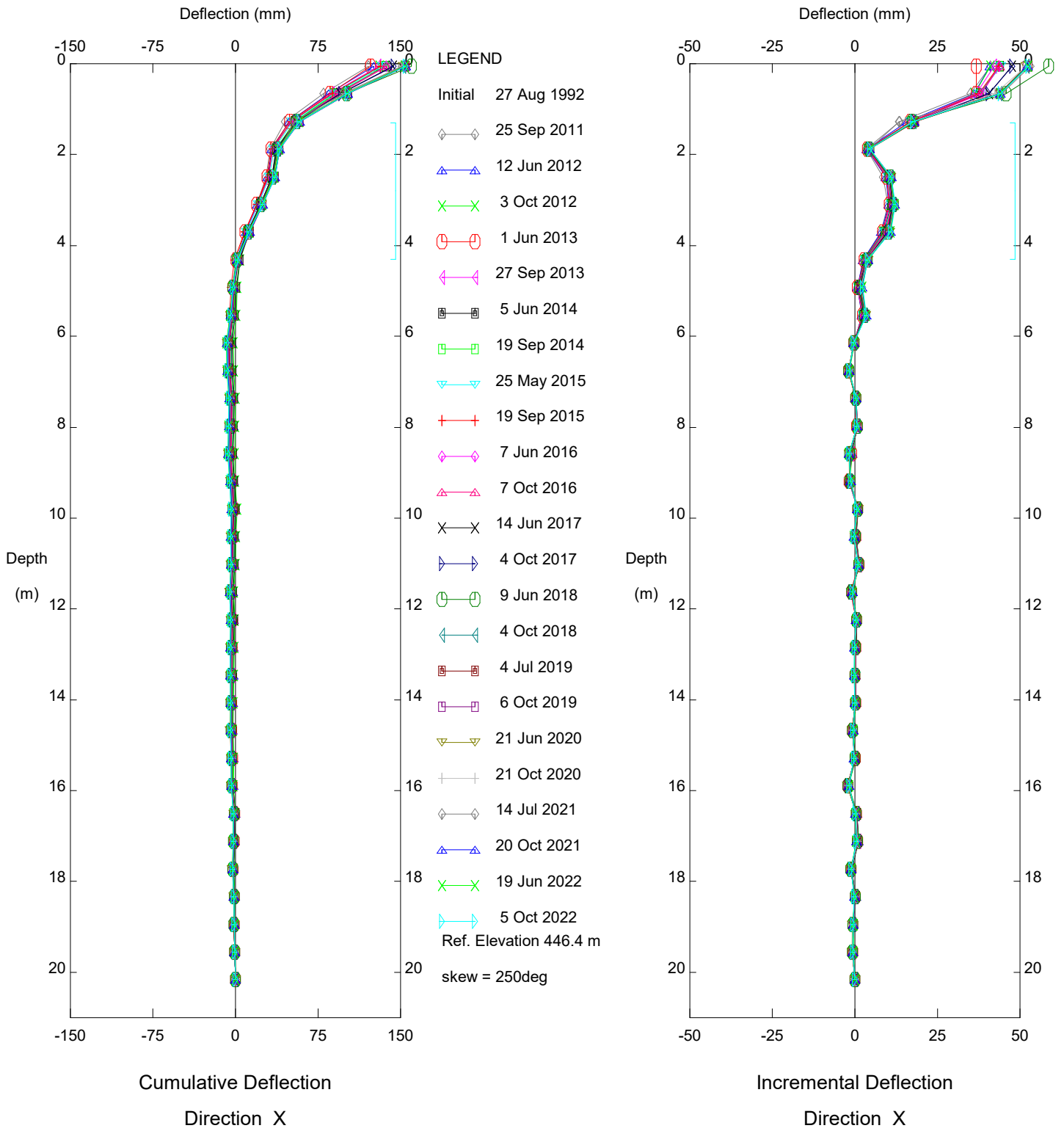
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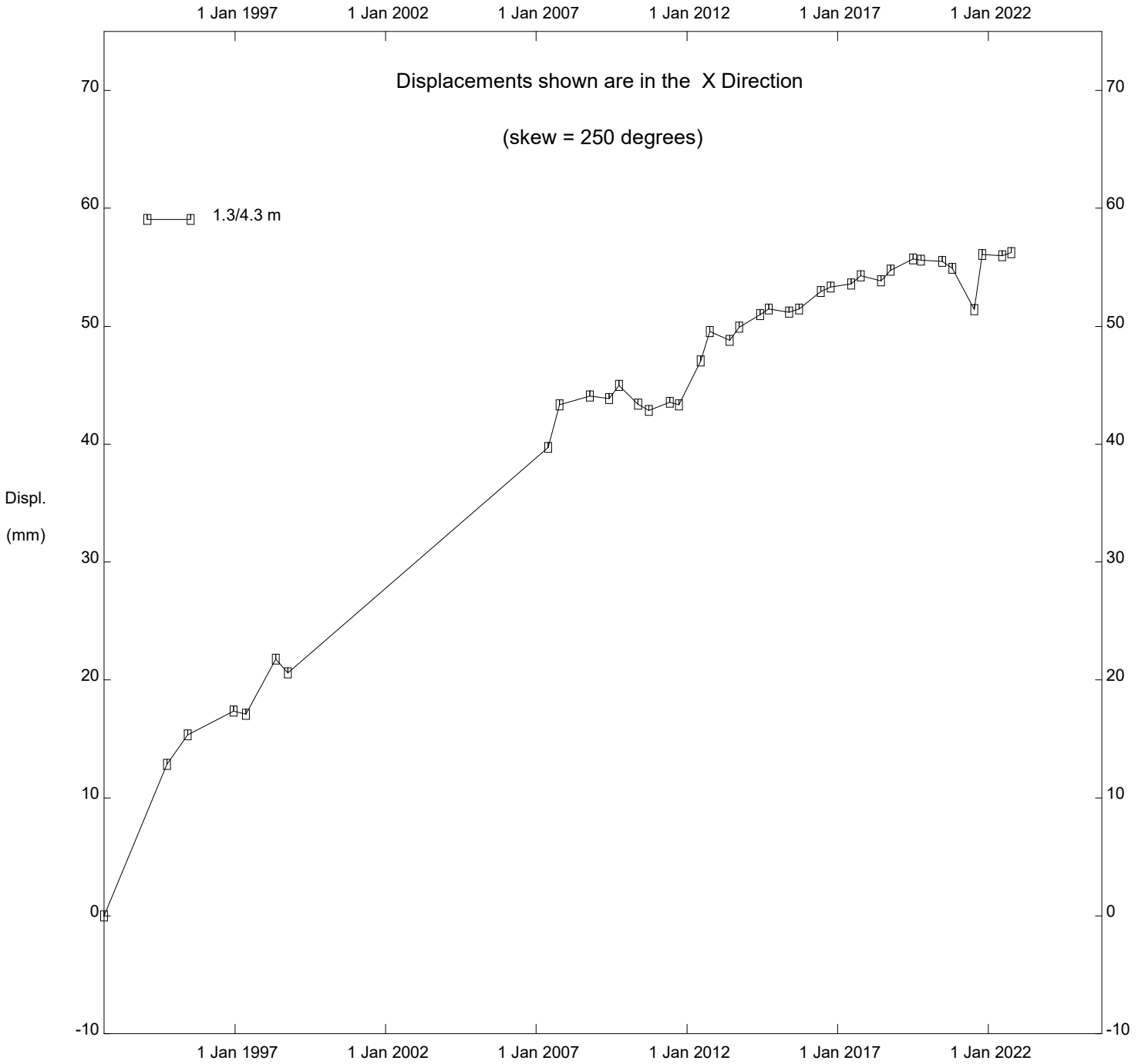
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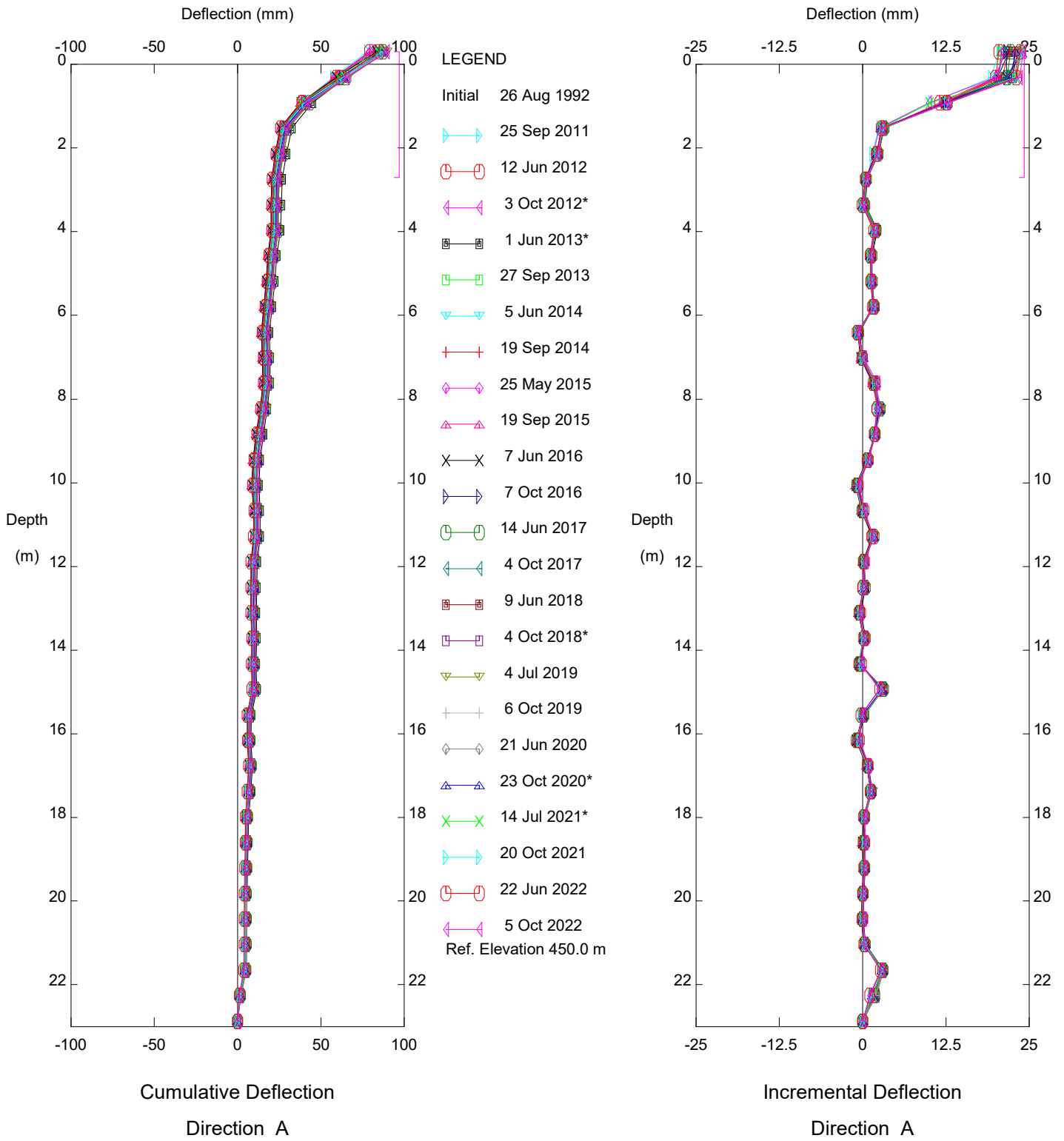
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Alberta Transportation

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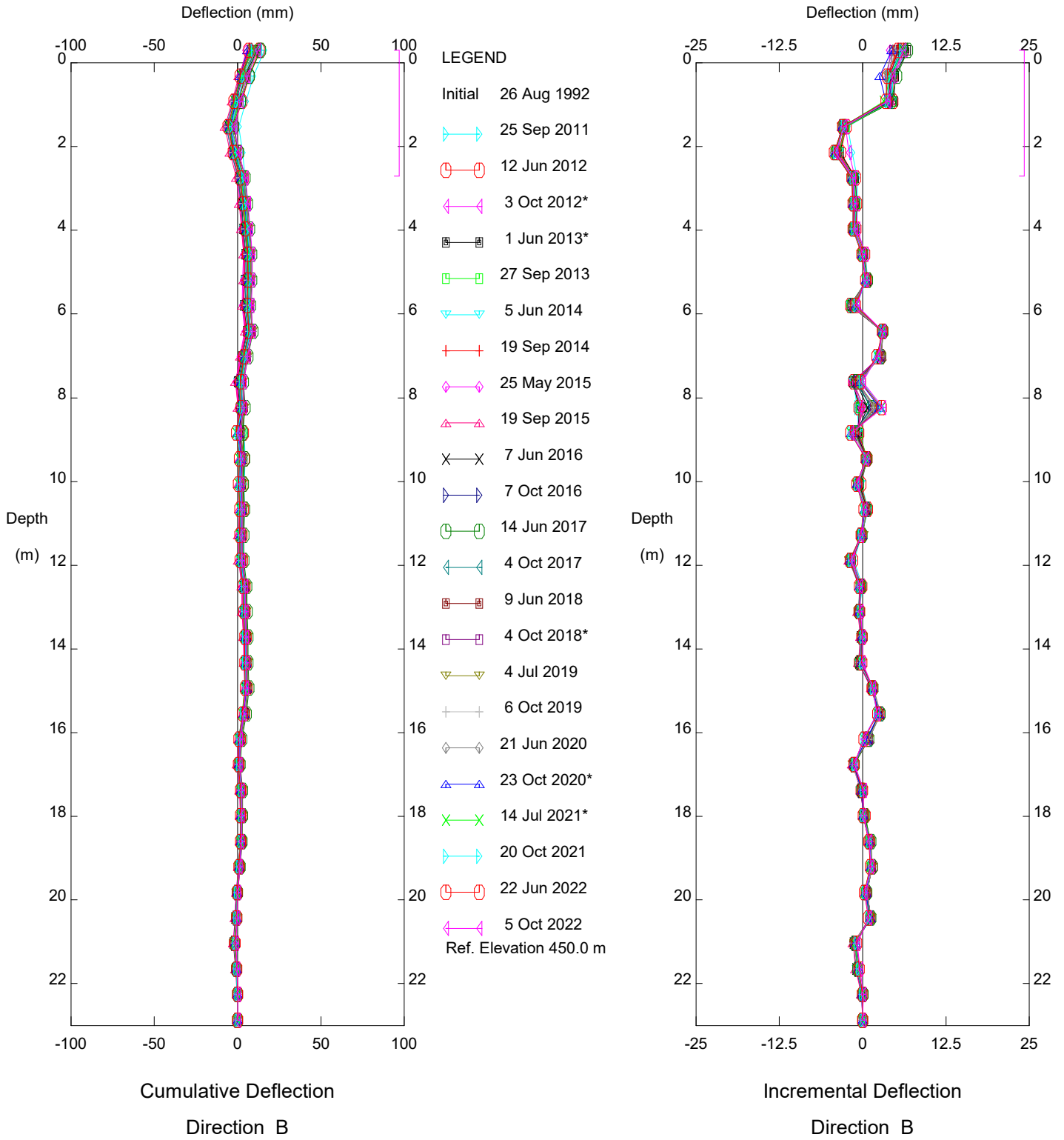


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Alberta Transportation

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

Thurber Engineering Ltd.



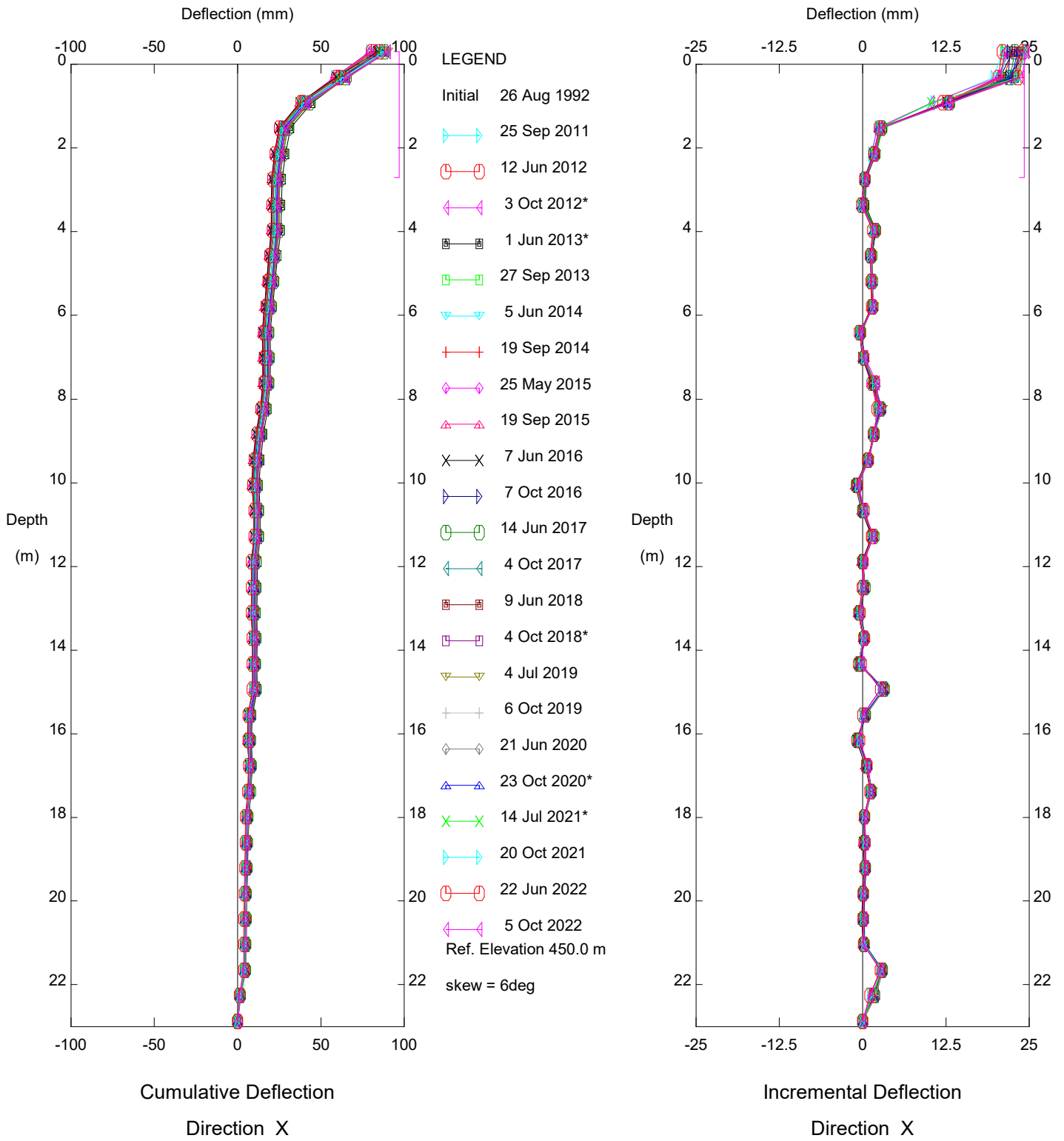
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Alberta Transportation

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



Thurber Engineering Ltd.

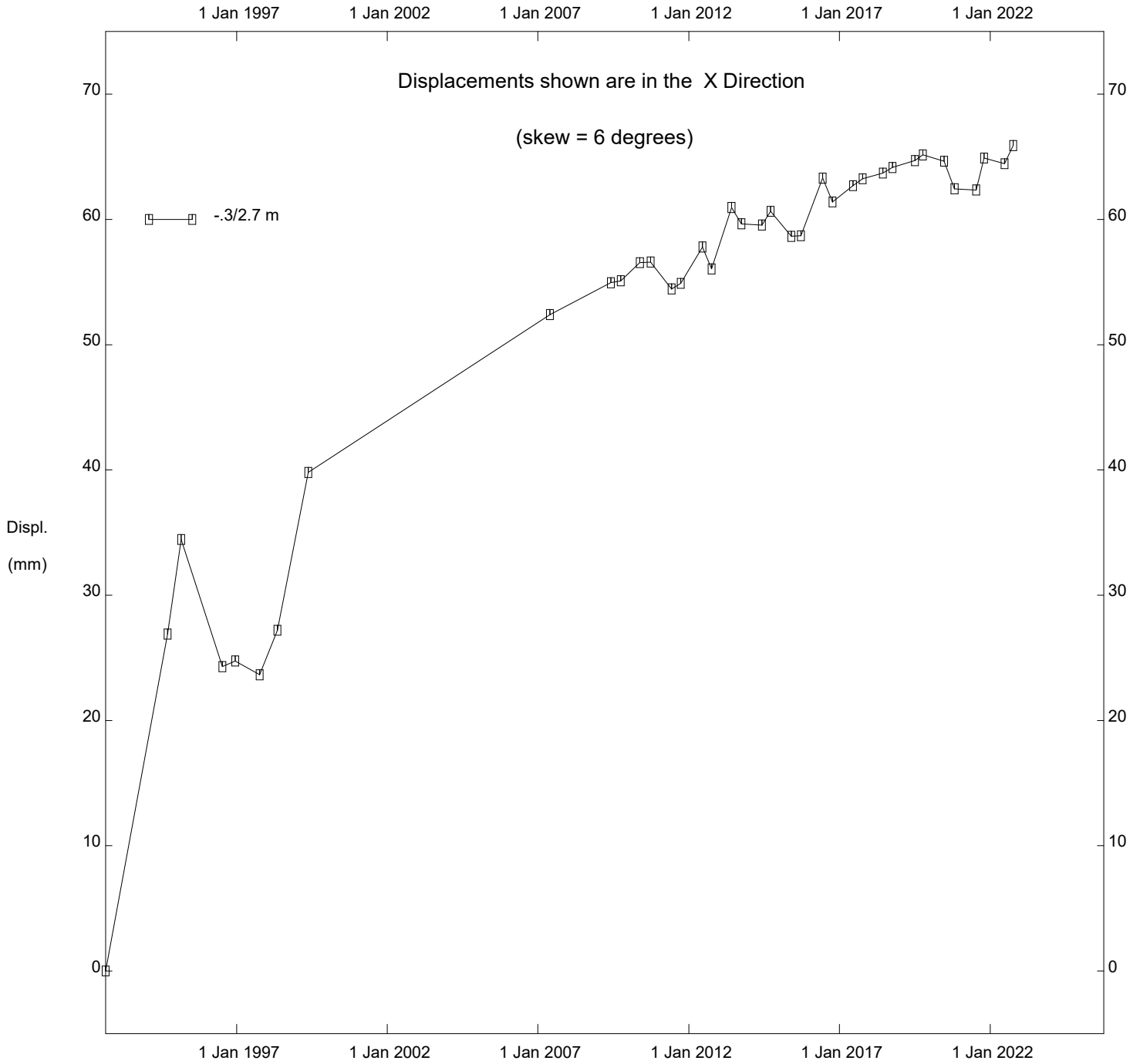


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Alberta Transportation

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

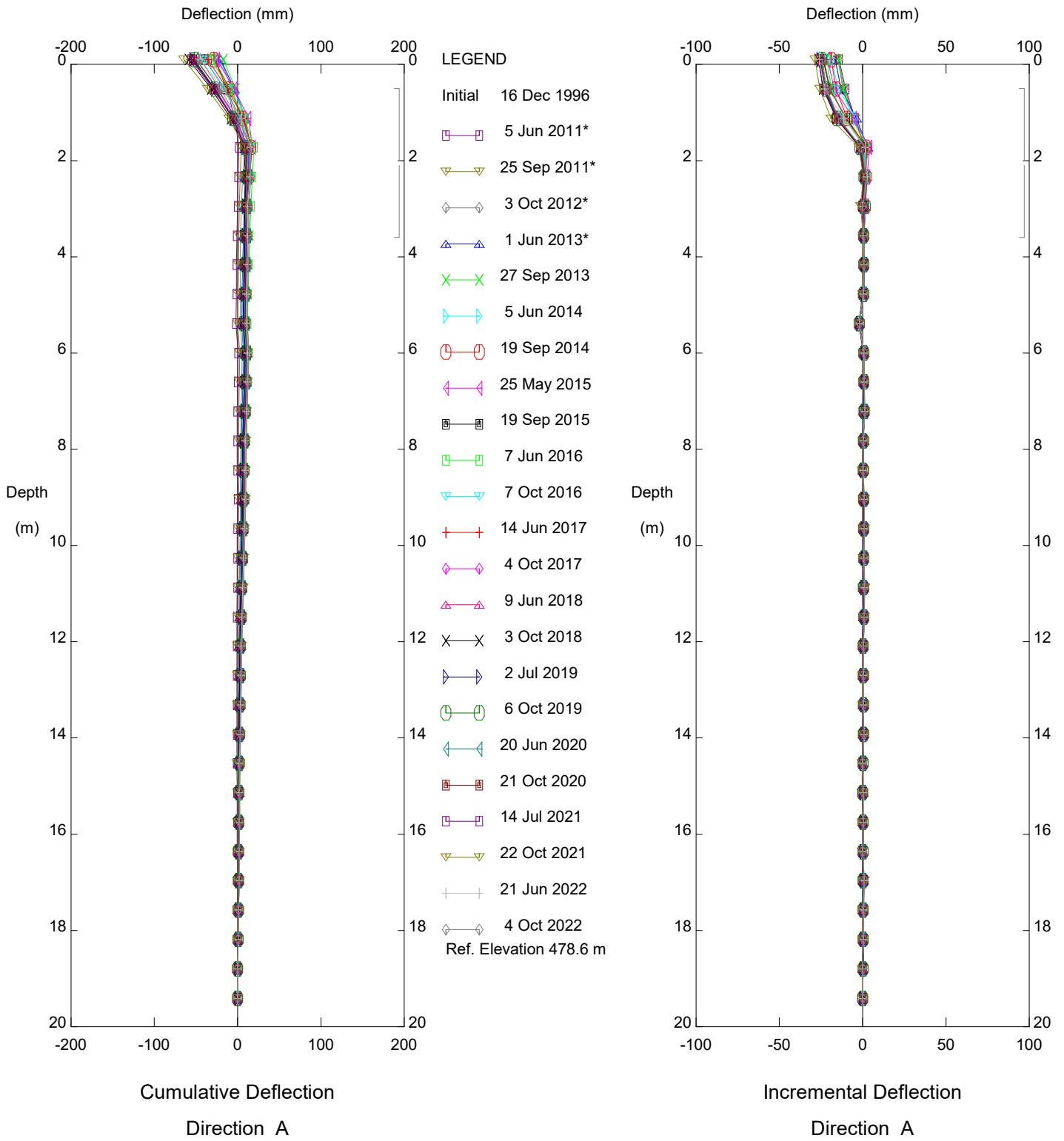
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Alberta Transportation

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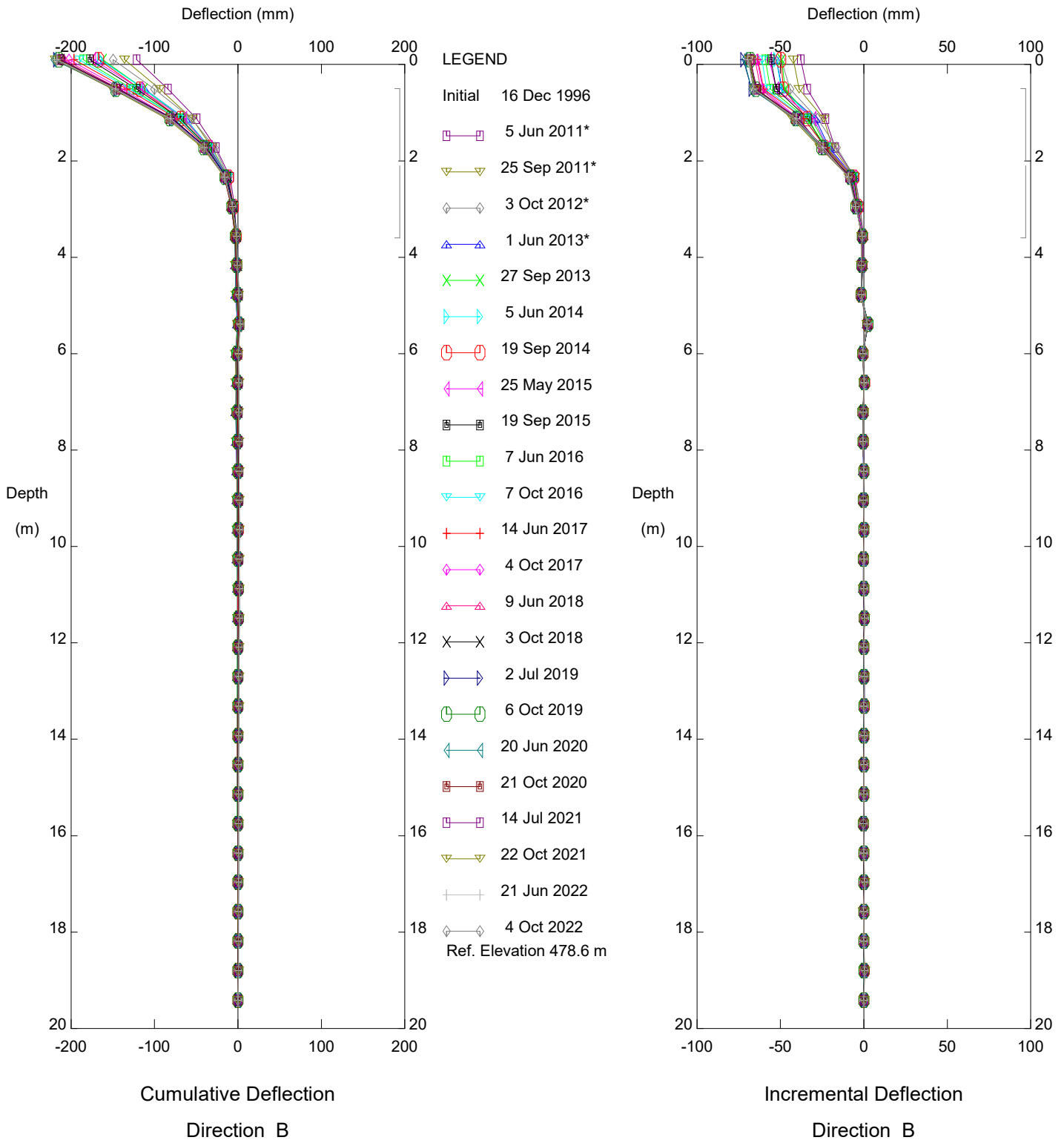


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Alberta Transportation

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

Thurber Engineering Ltd.

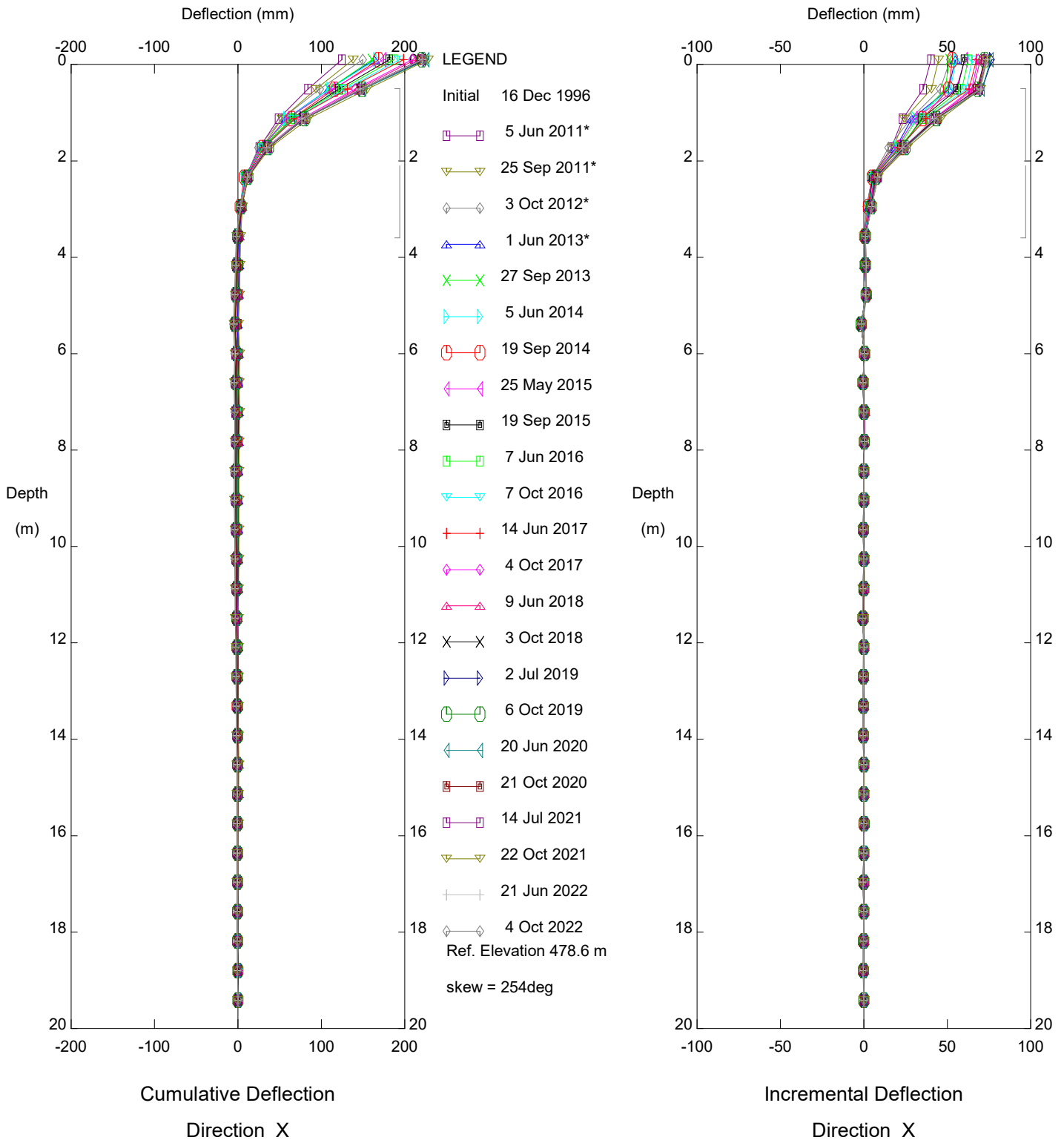


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Alberta Transportation

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

Thurber Engineering Ltd.

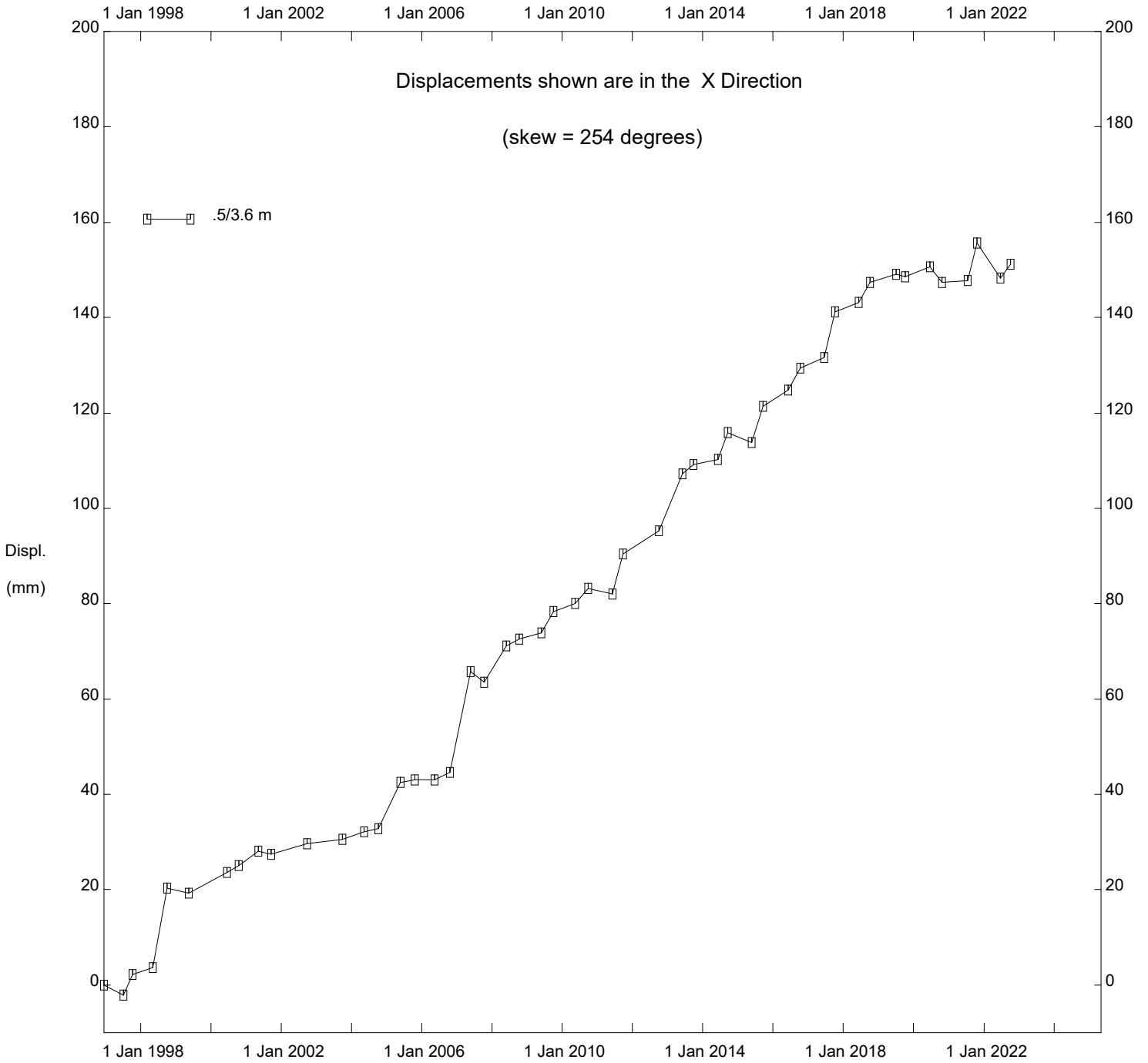


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Alberta Transportation

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

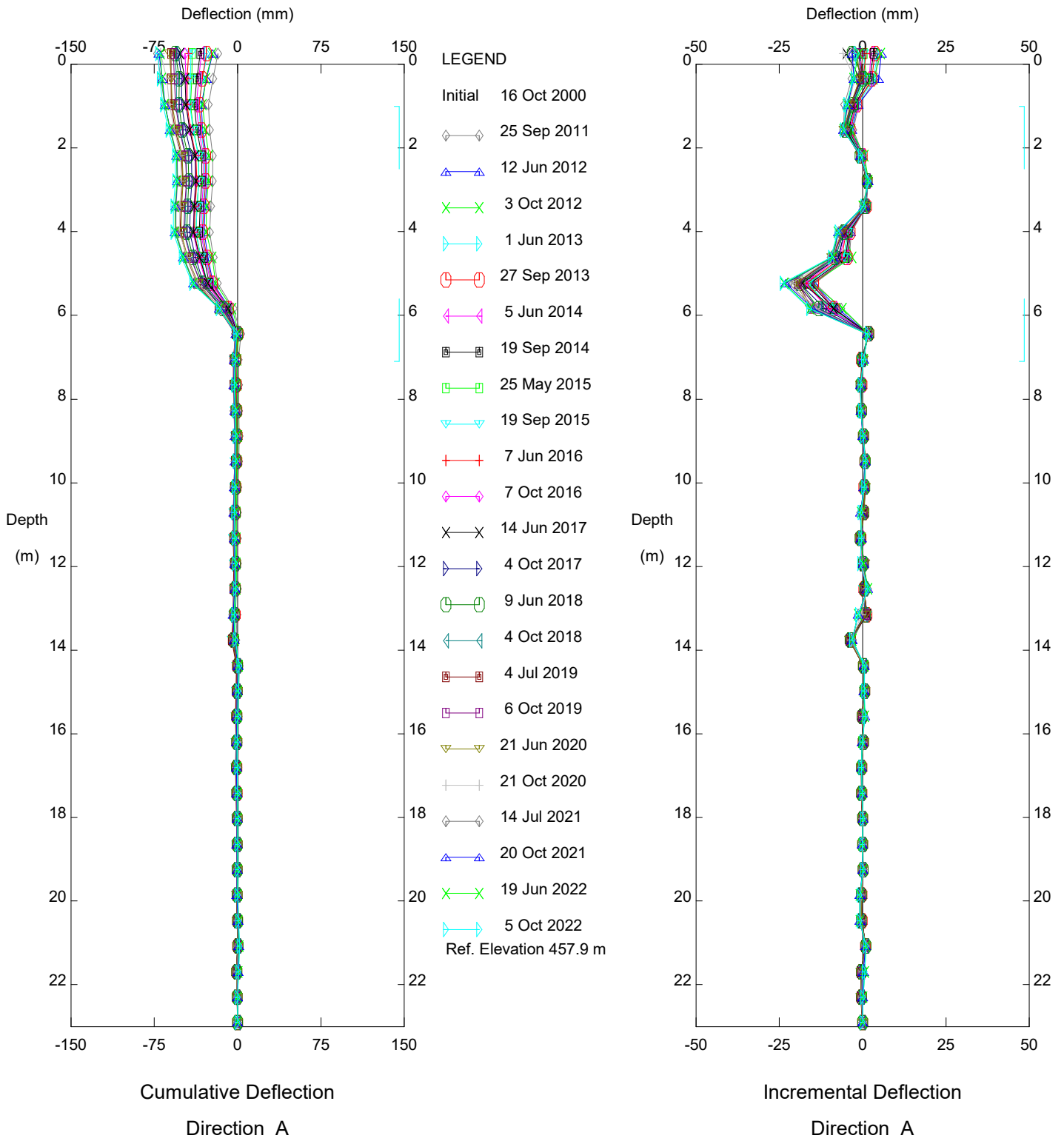
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Alberta Transportation

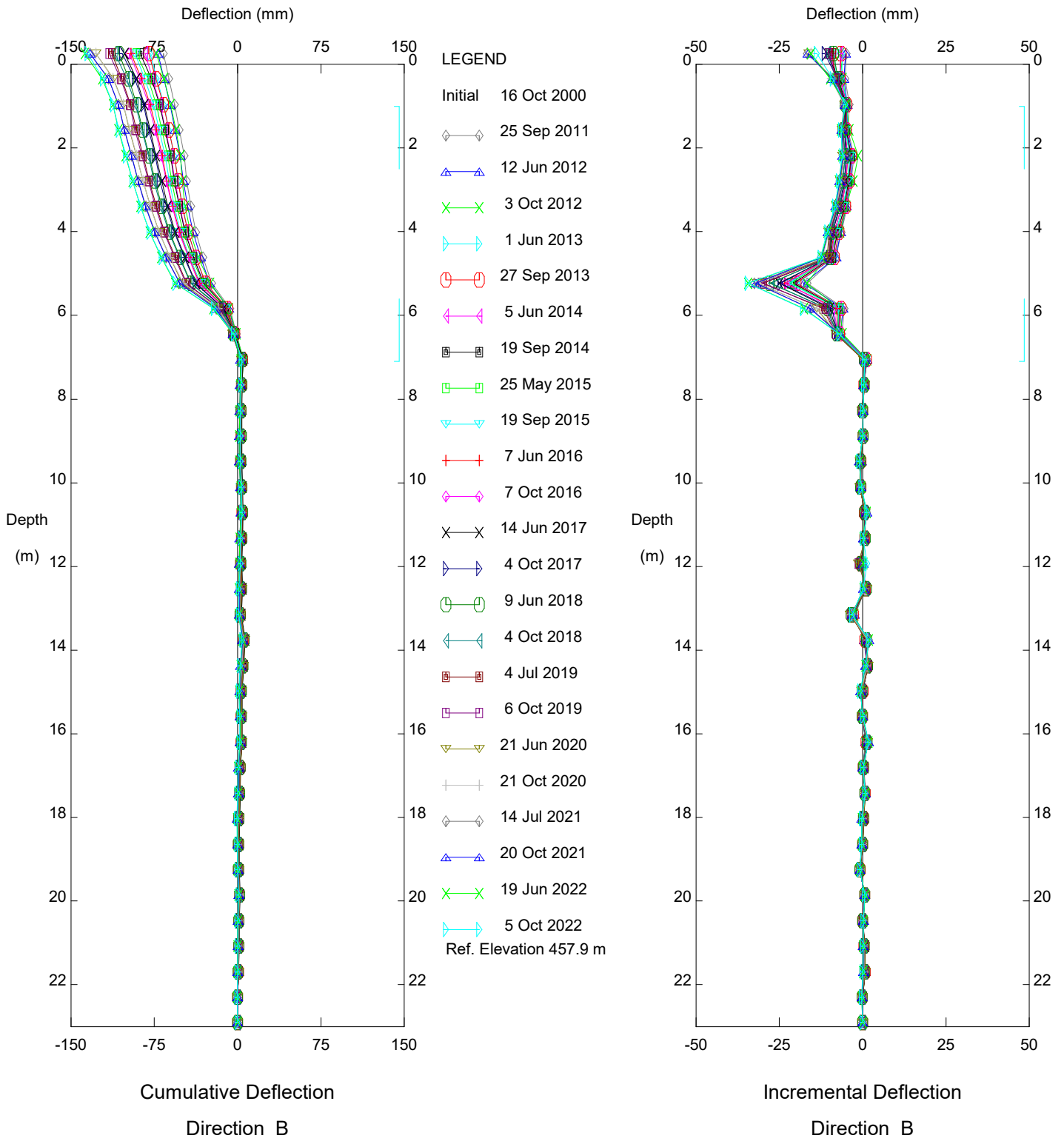
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HWY 2:68 (PH037), Inclinometer SI-59

Alberta Transportation

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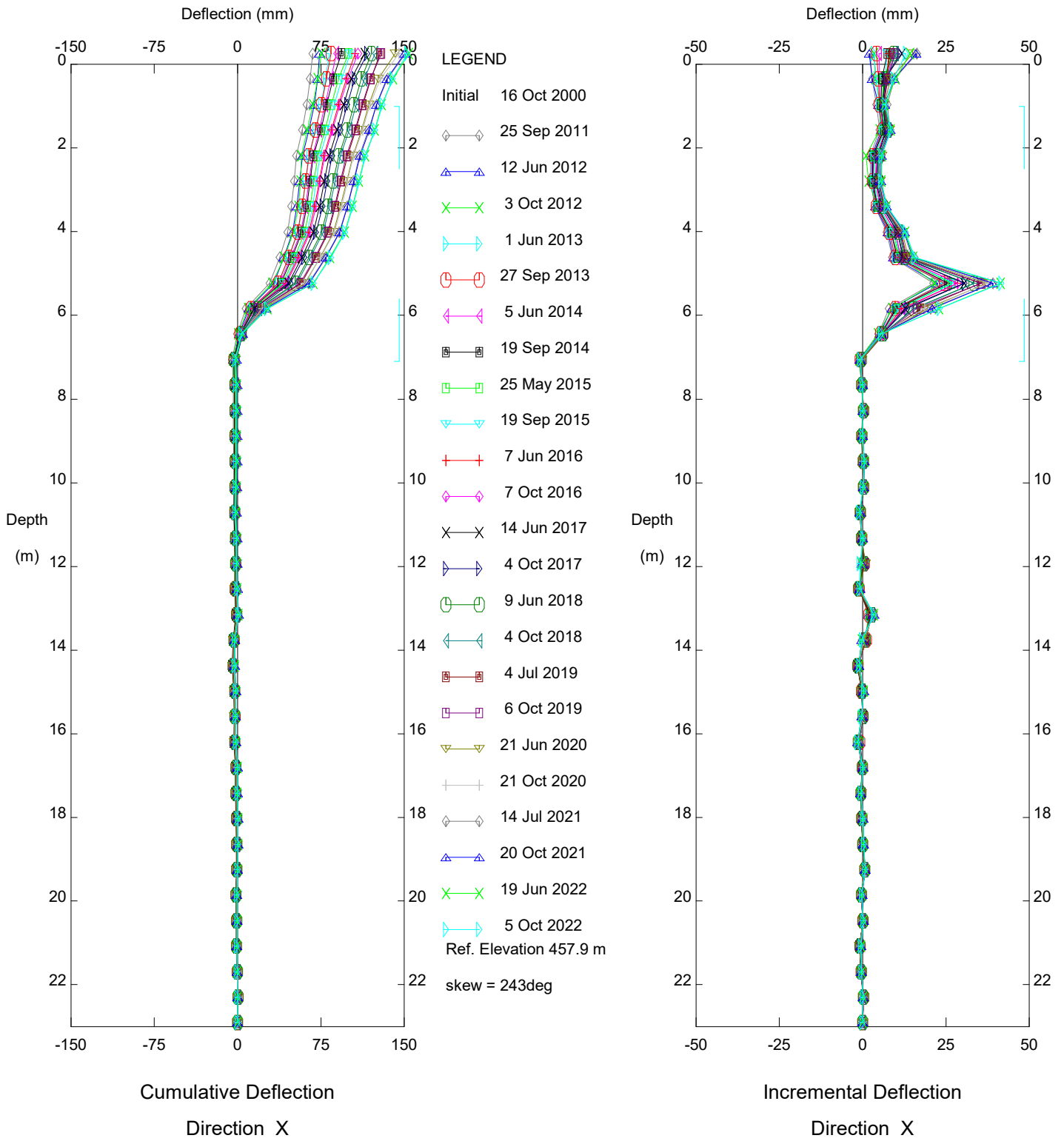


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Alberta Transportation

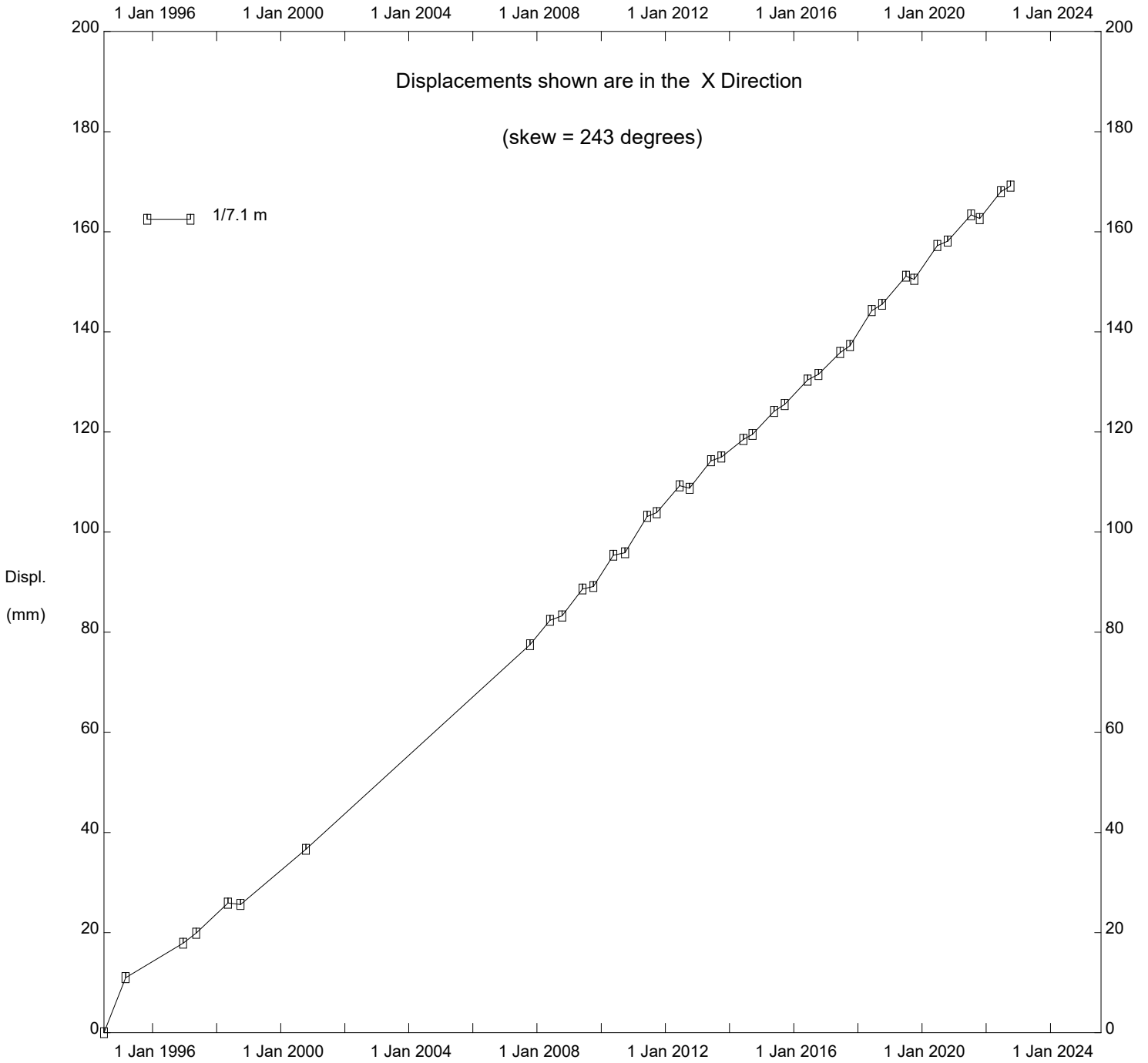


Thurber Engineering Ltd.



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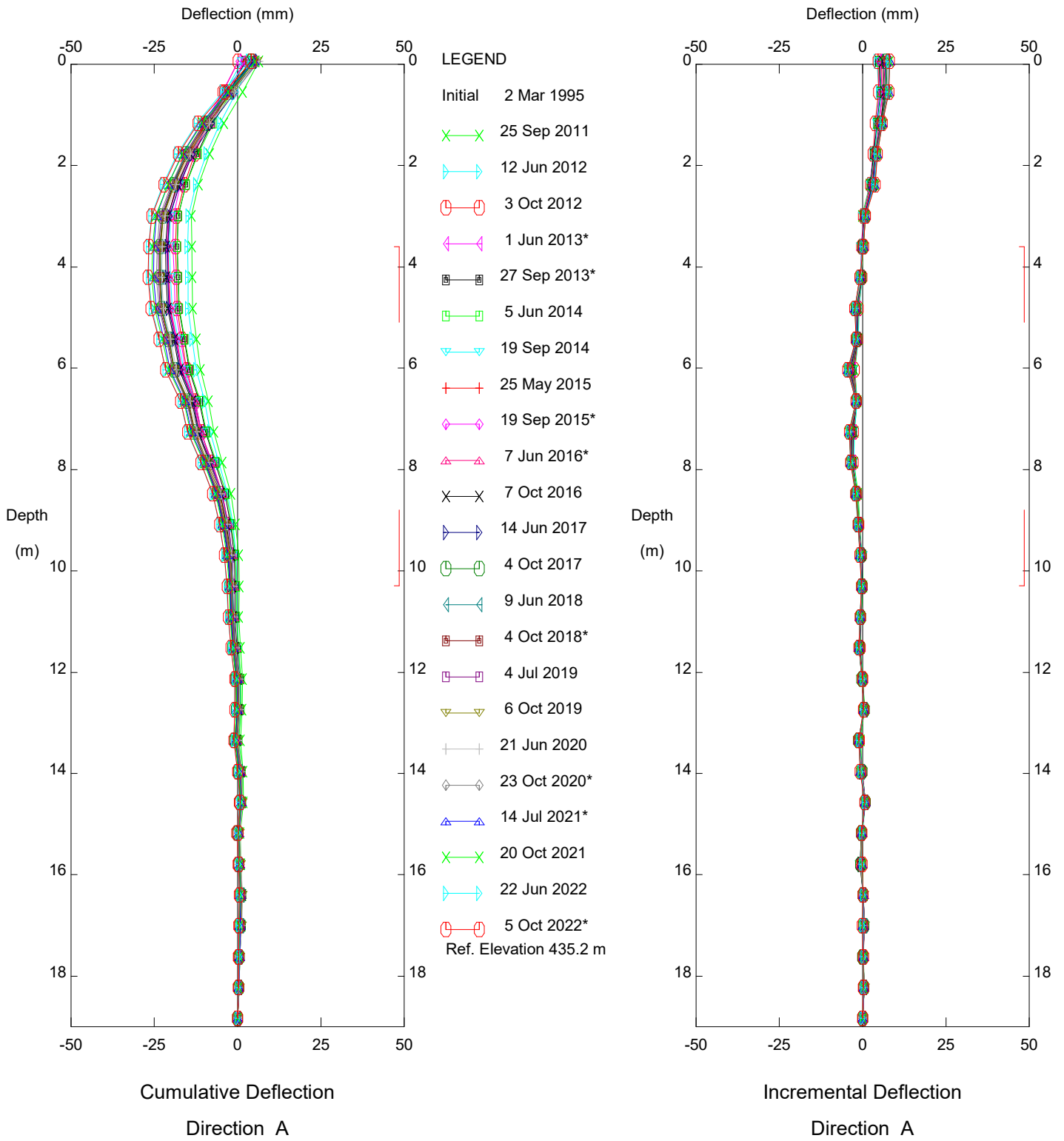
Alberta Transportation



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Alberta Transportation

Thurber Engineering Ltd.

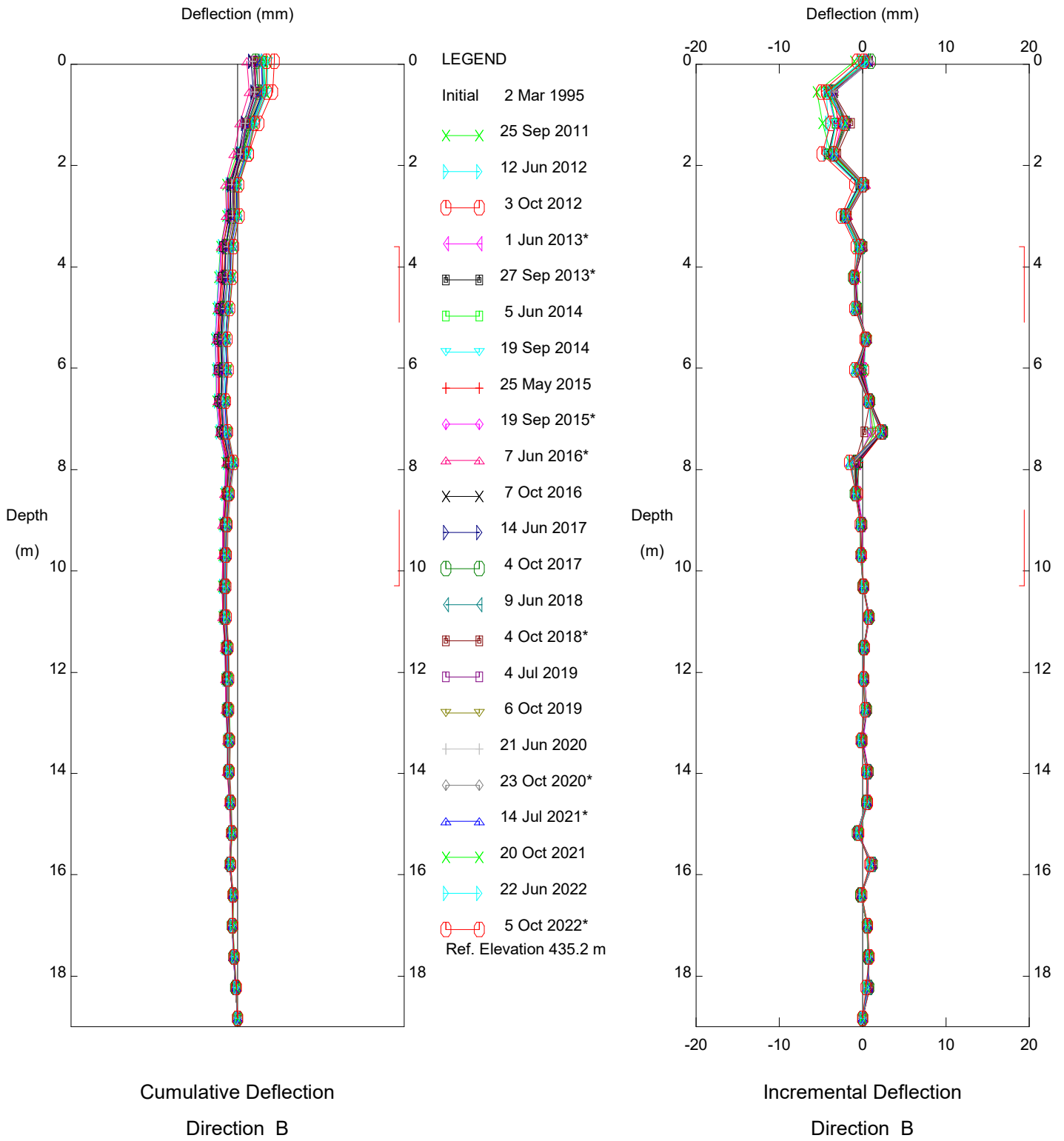


HWY 2:68 (PH037), Inclinometer SI-61

Alberta Transportation

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

Thurber Engineering Ltd.

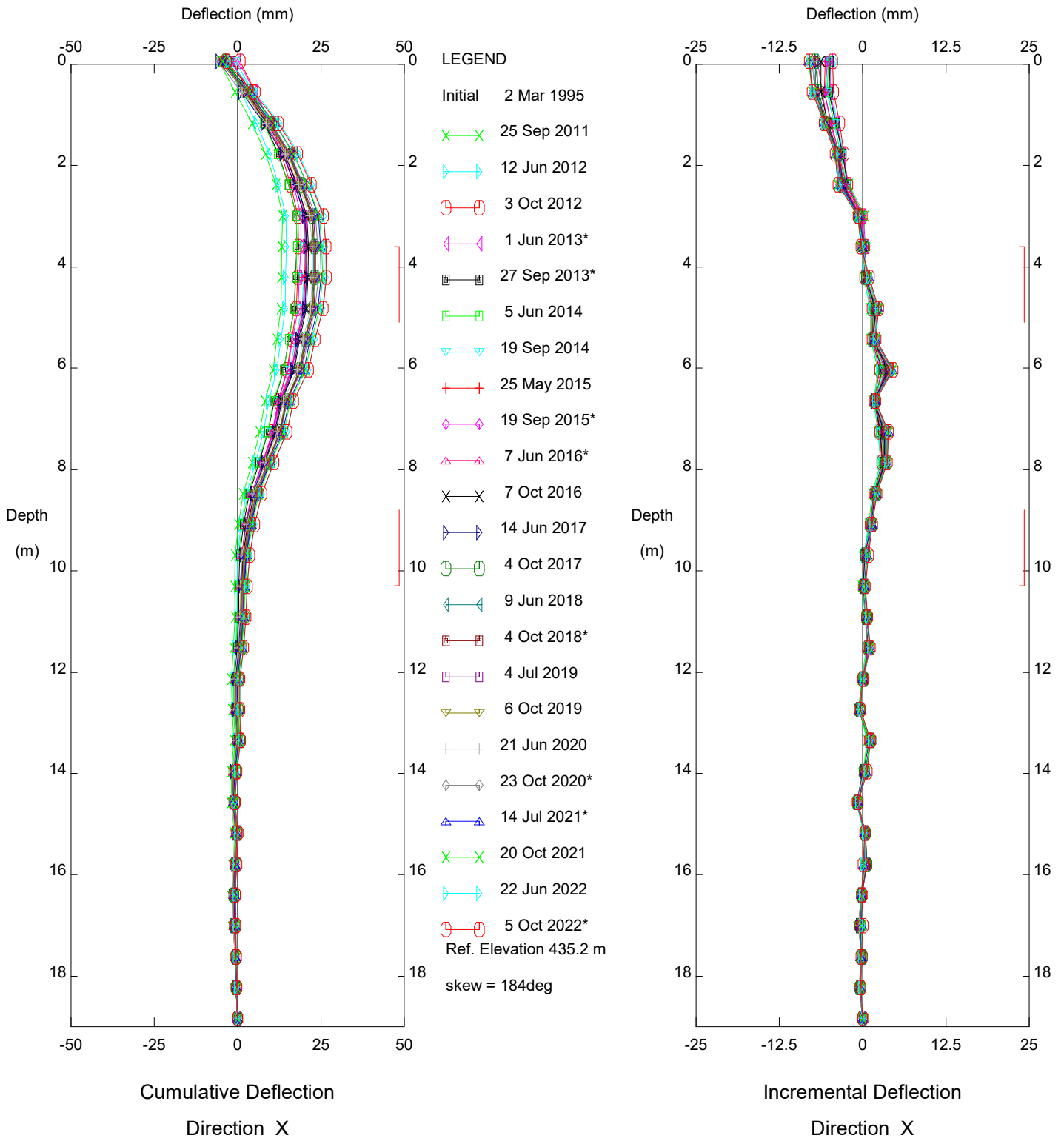


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Alberta Transportation

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

Thurber Engineering Ltd.

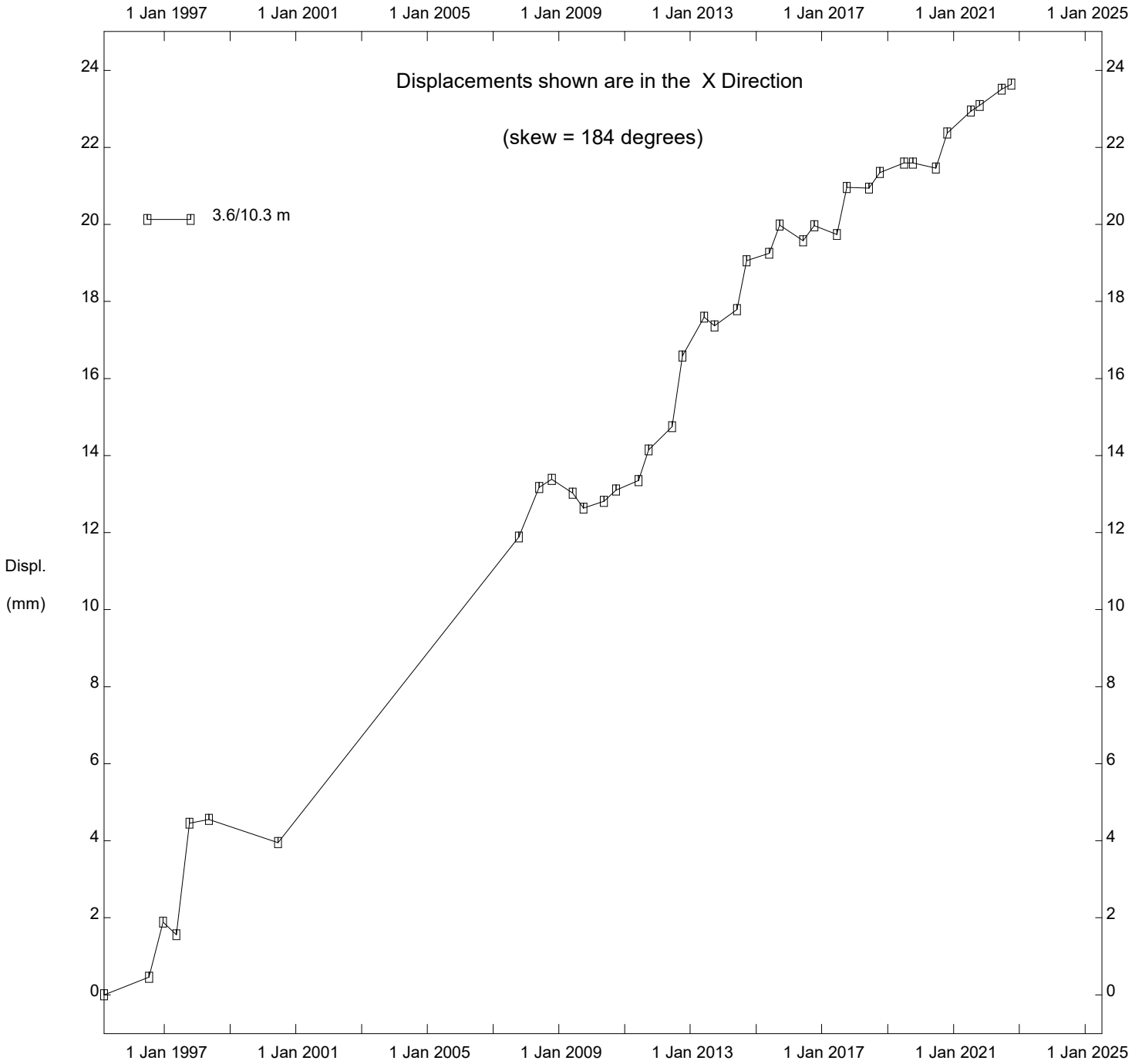


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Alberta Transportation

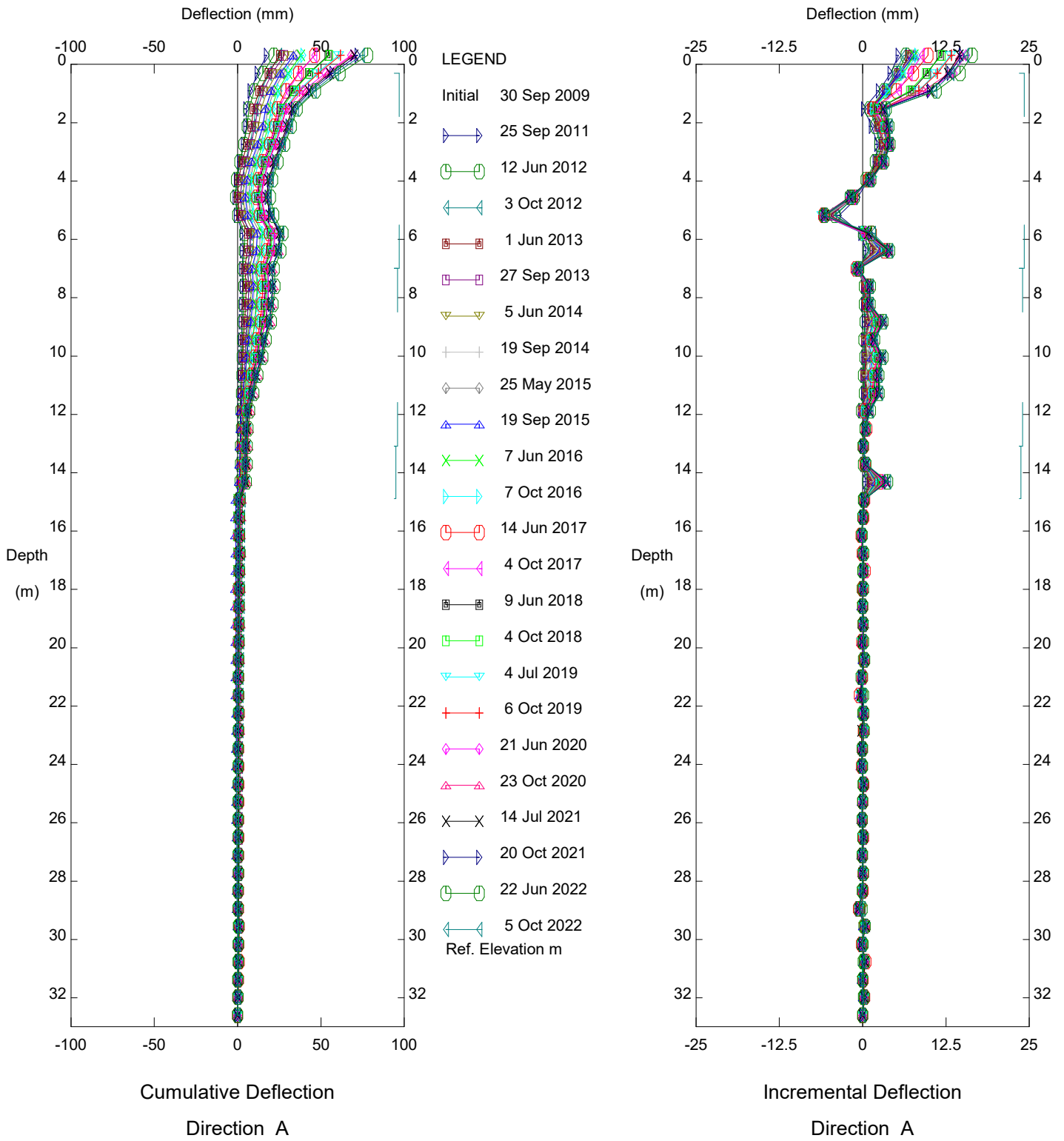
Sets marked \* include zero shift and/or rotation corrections.

Thurber Engineering Ltd.



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Alberta Transportation

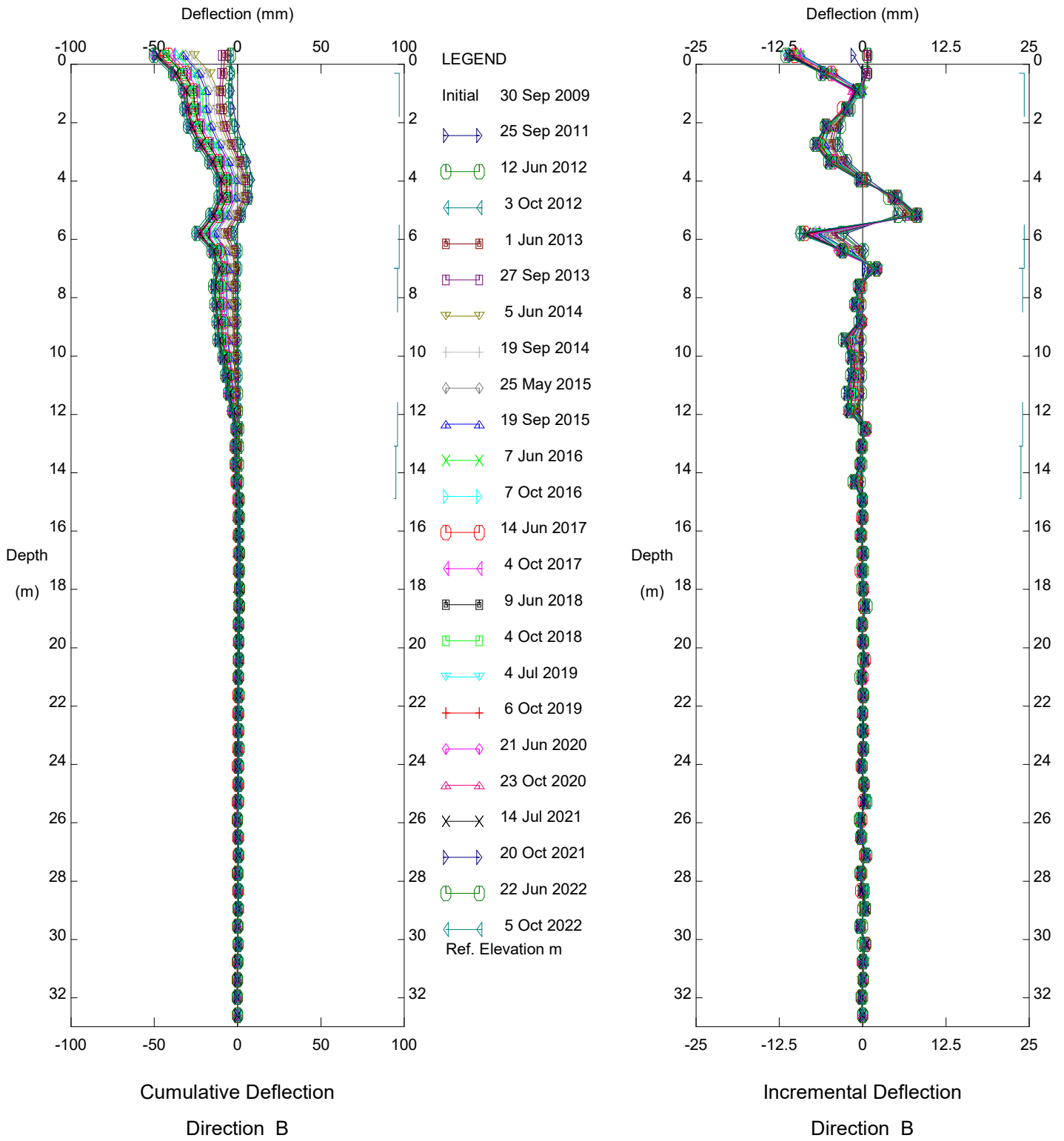


HWY 2:68 (PH037), Inclinometer SI09-1

Alberta Transportation



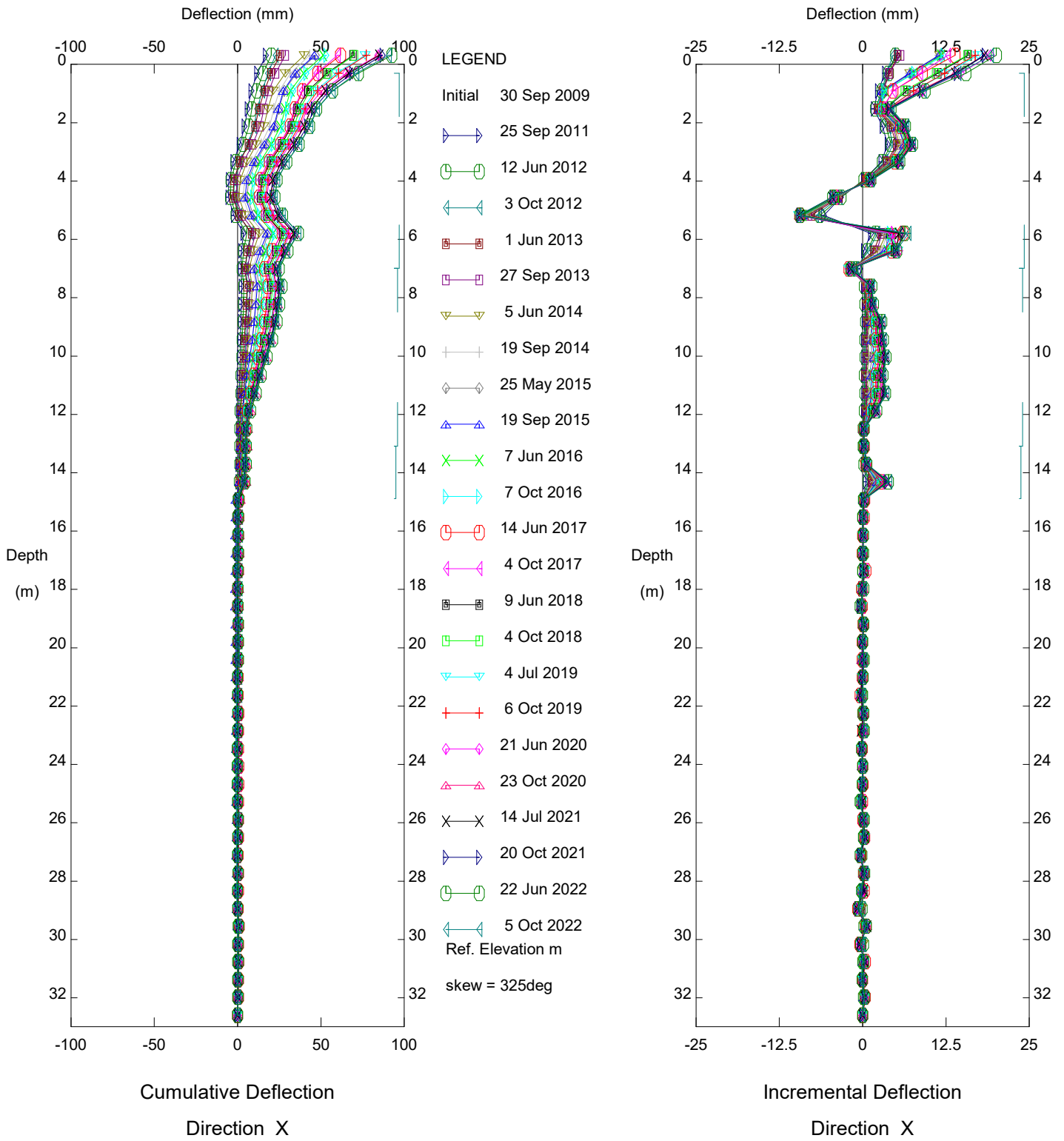
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Alberta Transportation

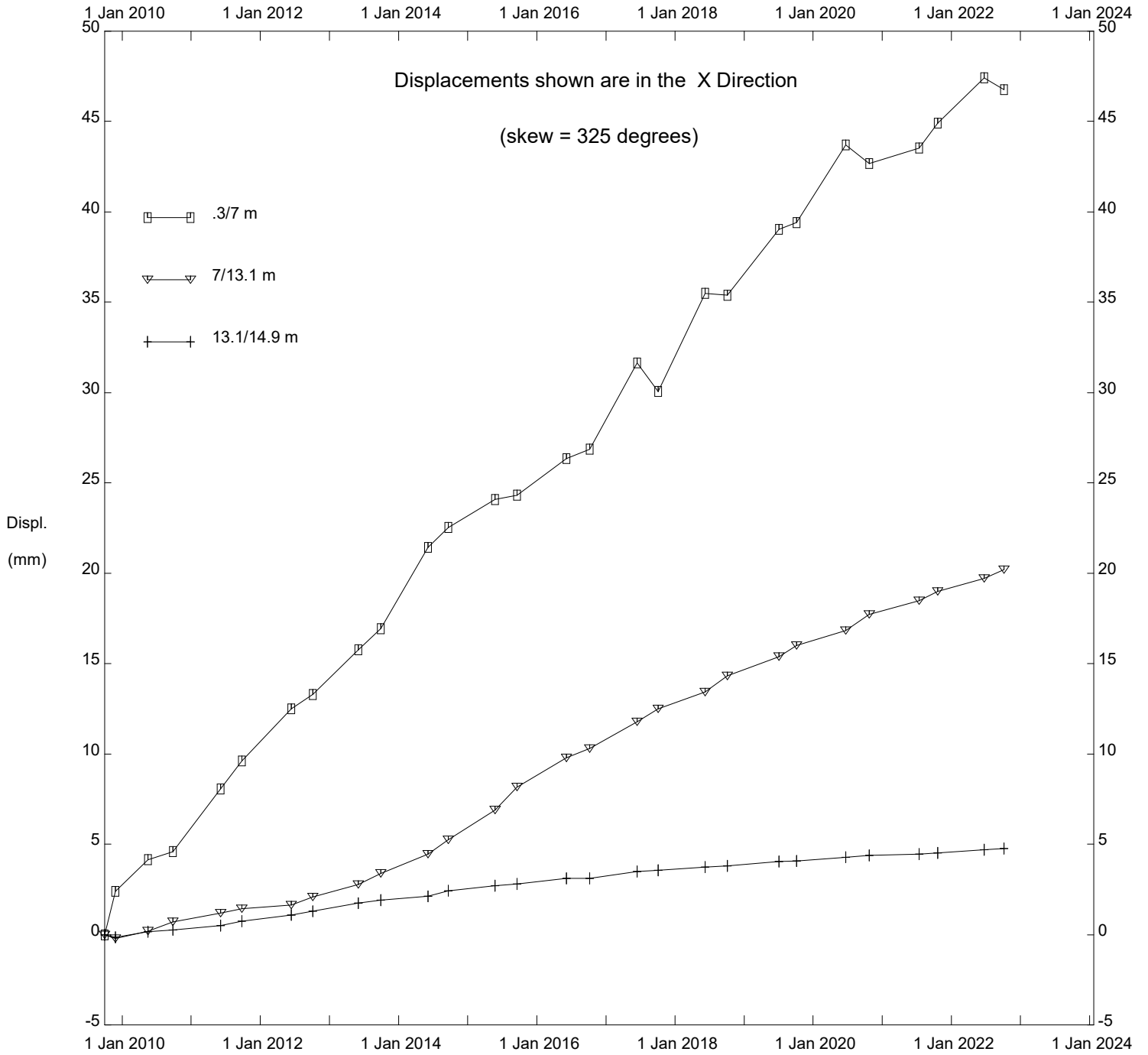
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HWY 2:68 (PH037), Inclinometer SI09-1

Alberta Transportation

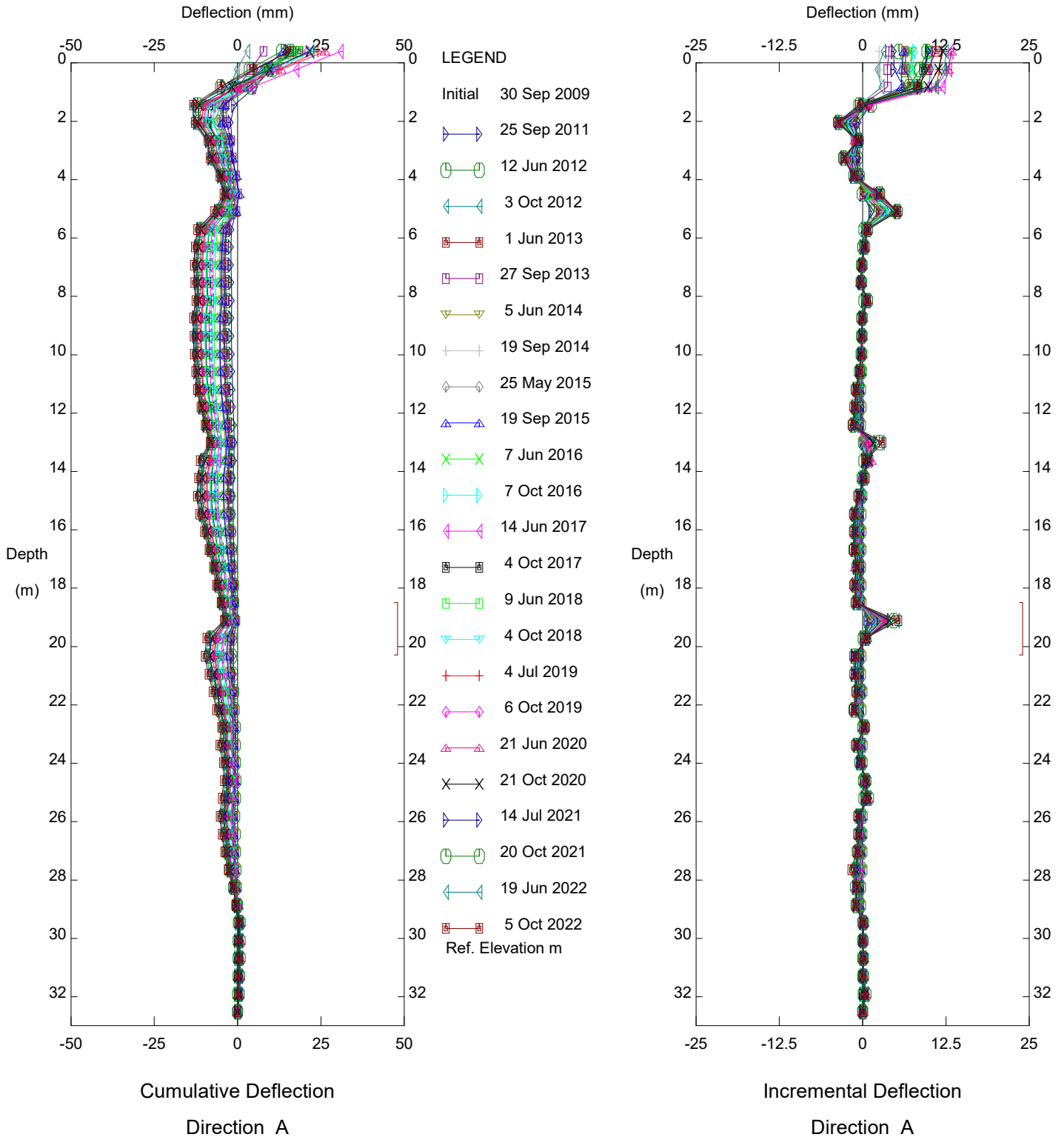
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Alberta Transportation

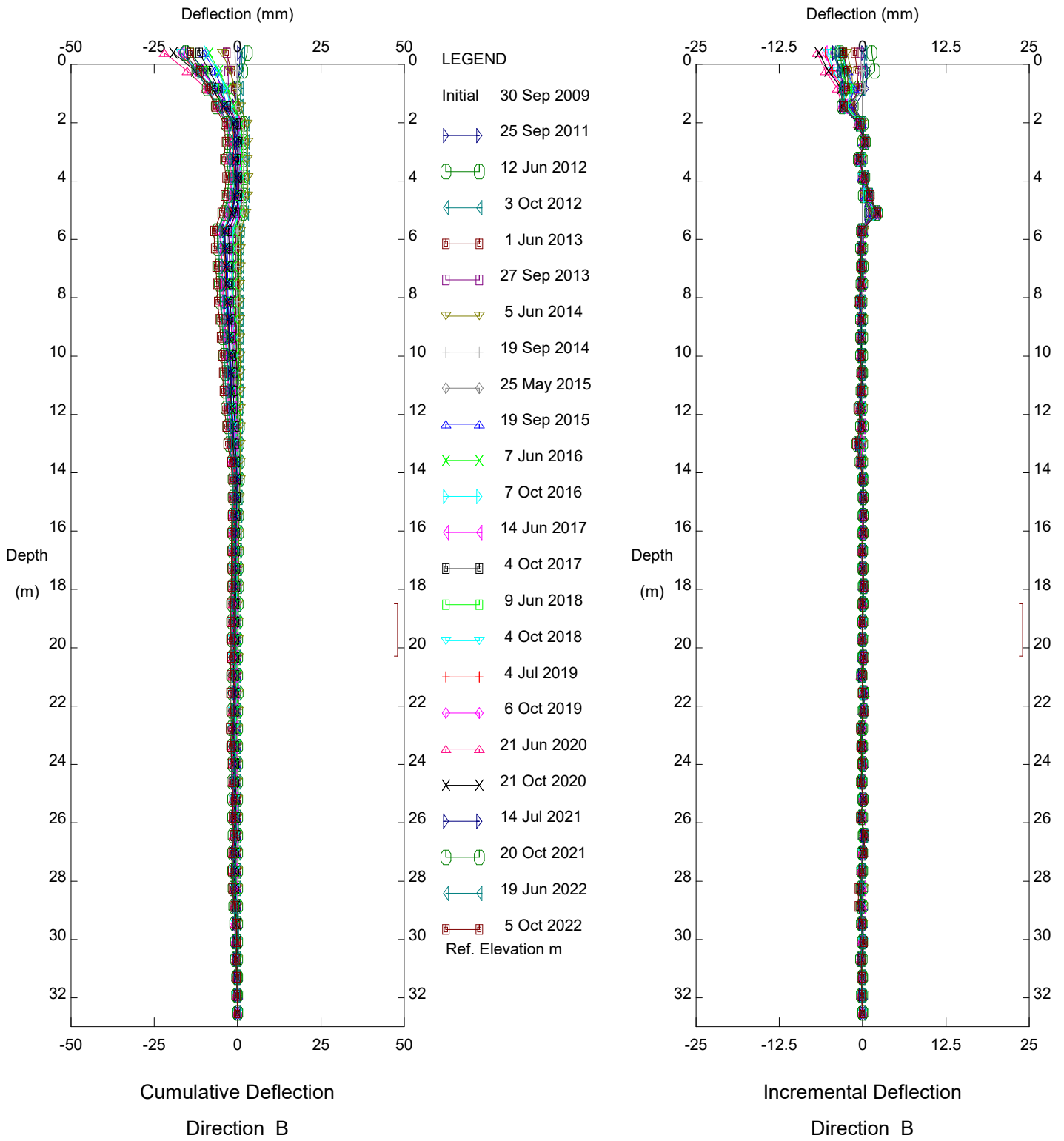
Thurber Engineering Ltd.



HWY 2:68 (PH037), Inclinator SI09-7

Alberta Transportation

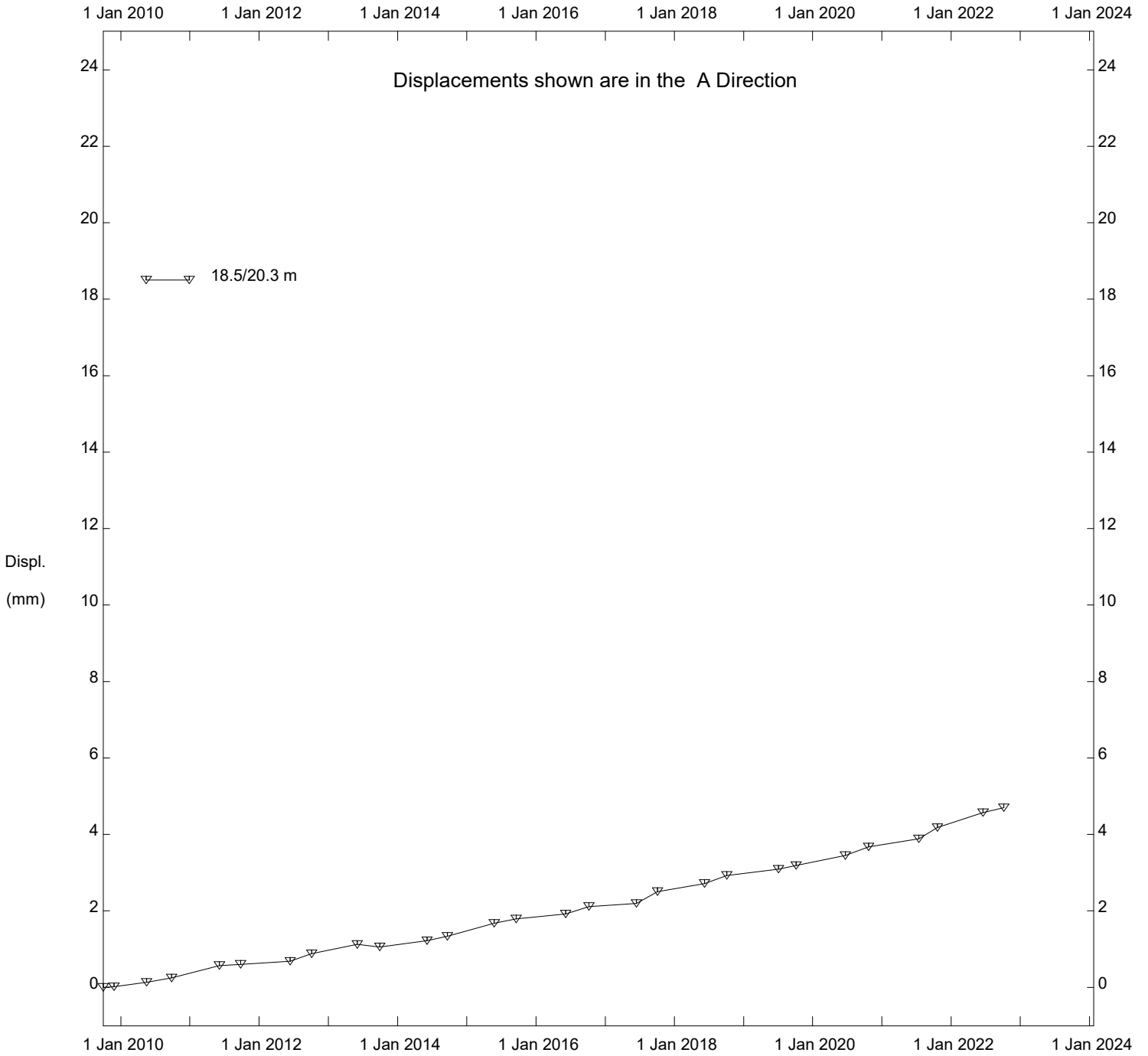
Thurber Engineering Ltd.



HWY 2:68 (PH037), Inclinometer SI09-7

Alberta Transportation

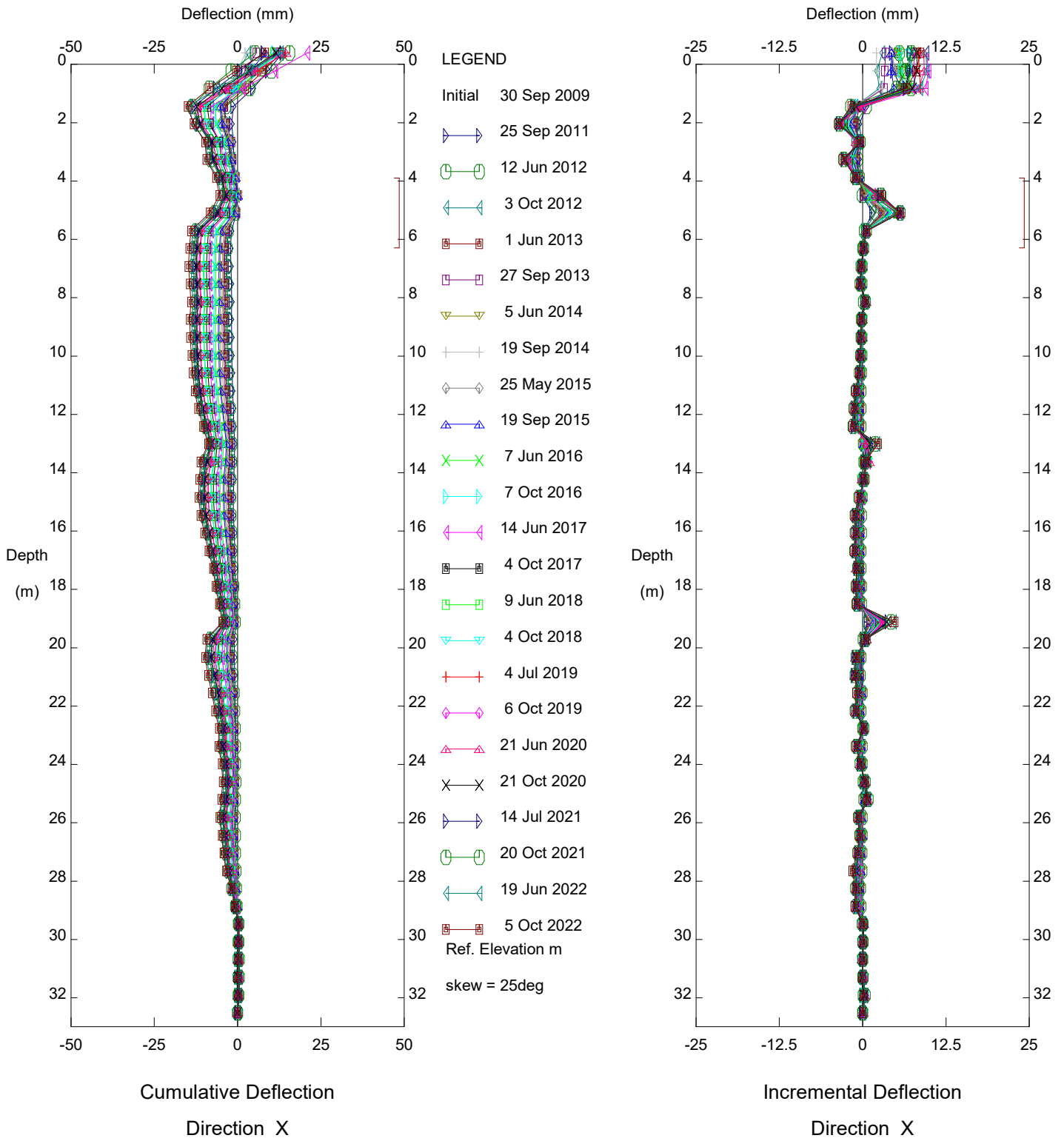
Thurber Engineering Ltd.



HWY 2:68 (PH037), Inclinator SI09-7

Alberta Transportation

Thurber Engineering Ltd.

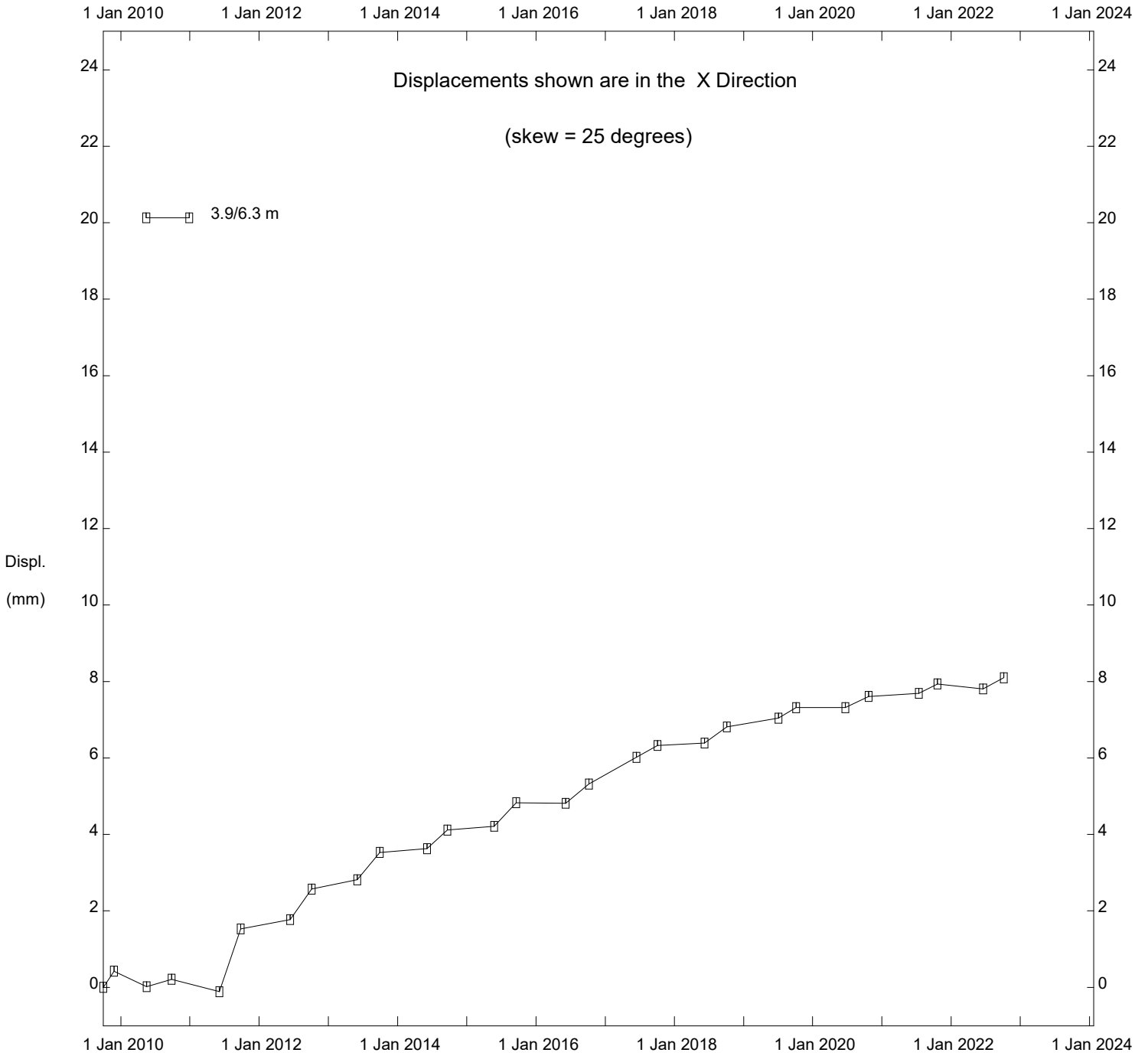


HWY 2:68 (PH037), Inclinator SI09-7

Alberta Transportation



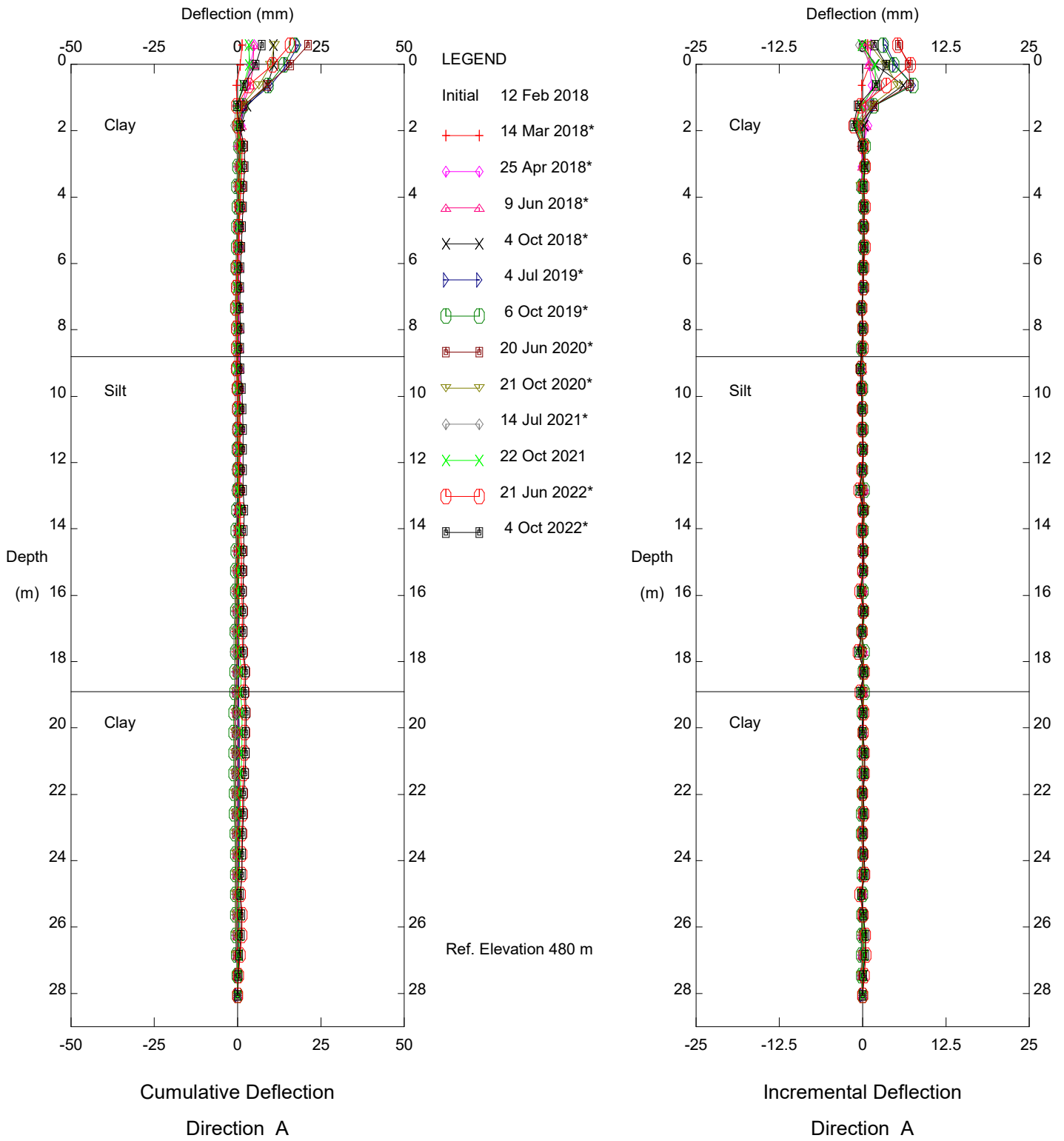
Thurber Engineering Ltd.



HWY 2:68 (PH037), Inclinator SI09-7

Alberta Transportation

Thurber Engineering Ltd.

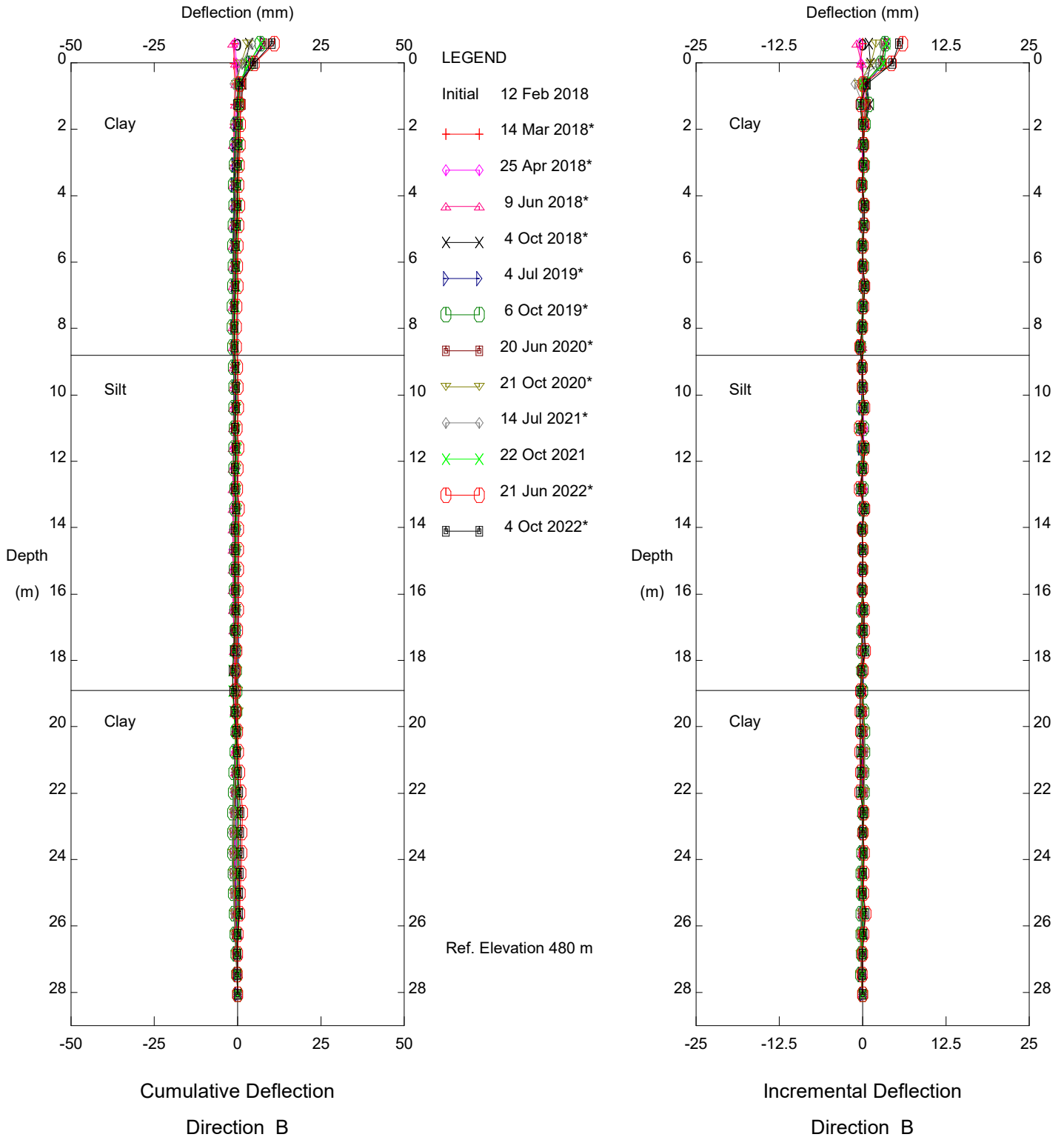


HWY 2:68 (PH037), Inclinometer SI18-4

Alberta Transportation

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

Thurber Engineering Ltd.

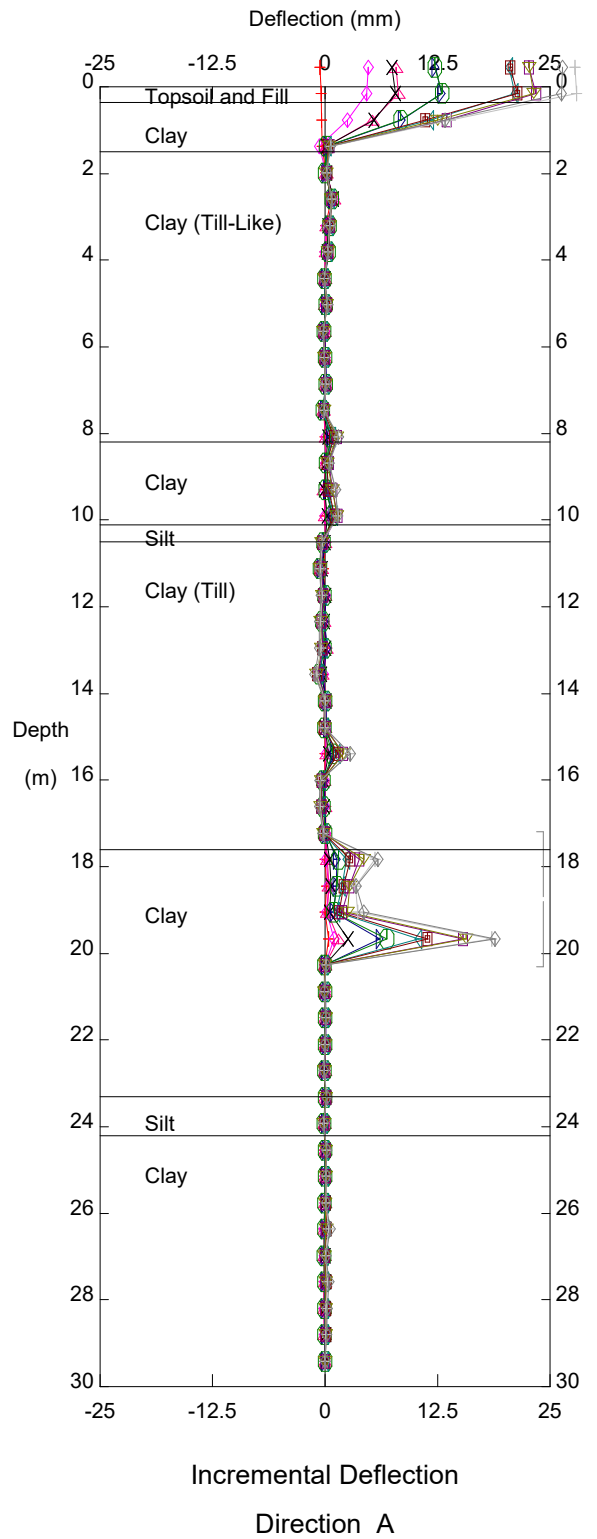
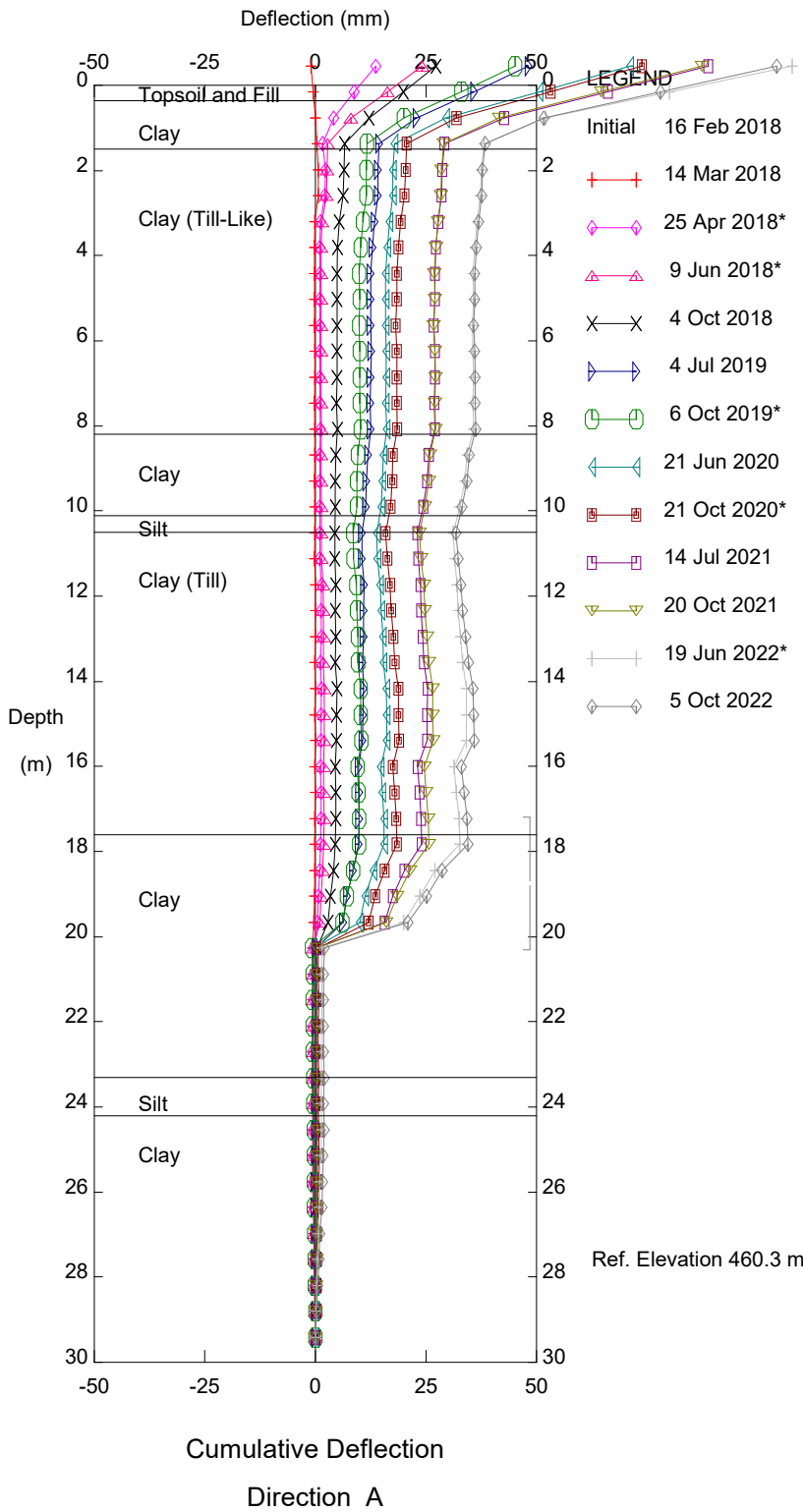


HWY 2:68 (PH037), Inclinometer SI18-4

Alberta Transportation

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

Thurber Engineering Ltd.

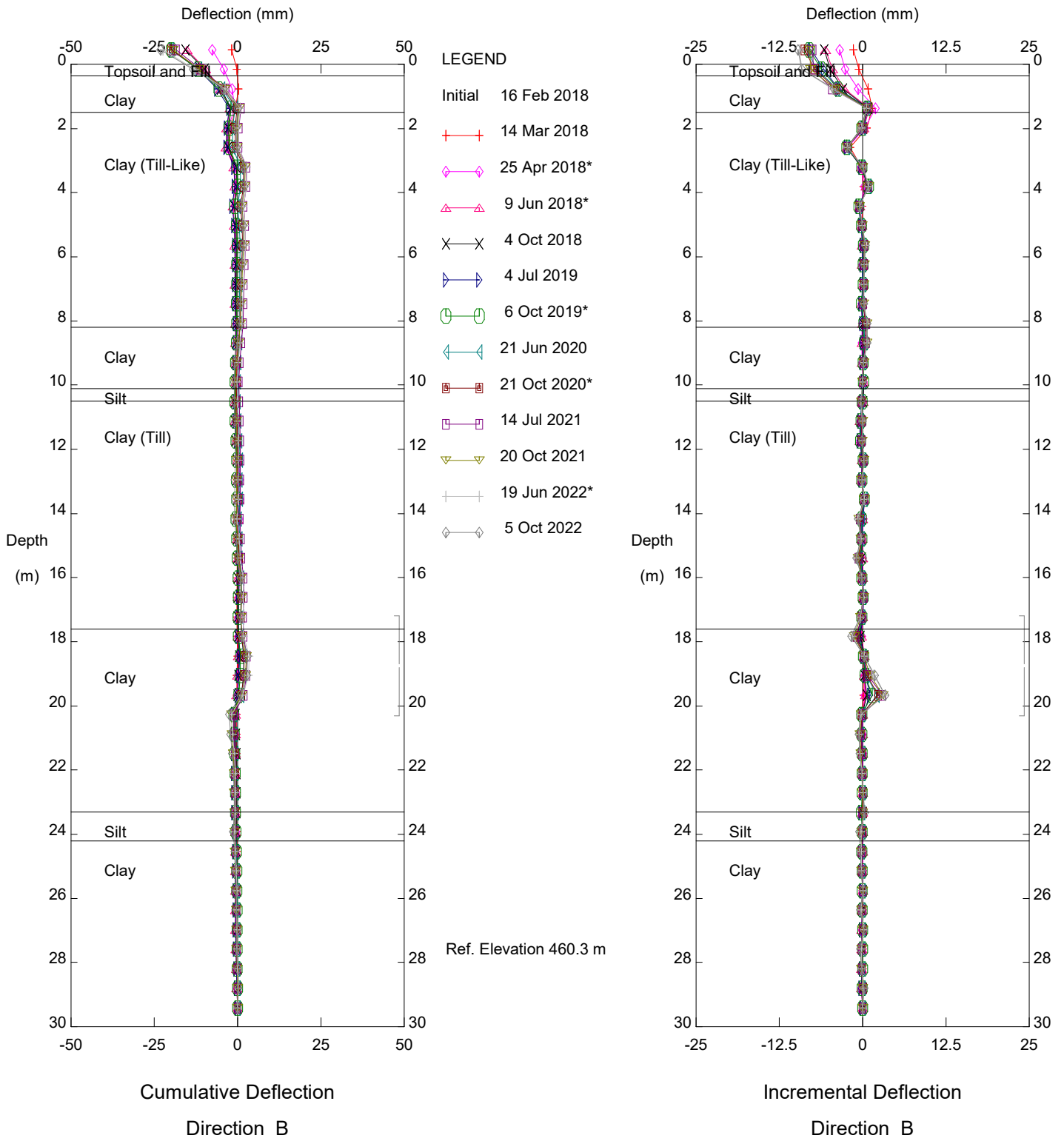


HWY 2:68 (PH037), Inclinator SI18-5

Alberta Transportation

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

Thurber Engineering Ltd.

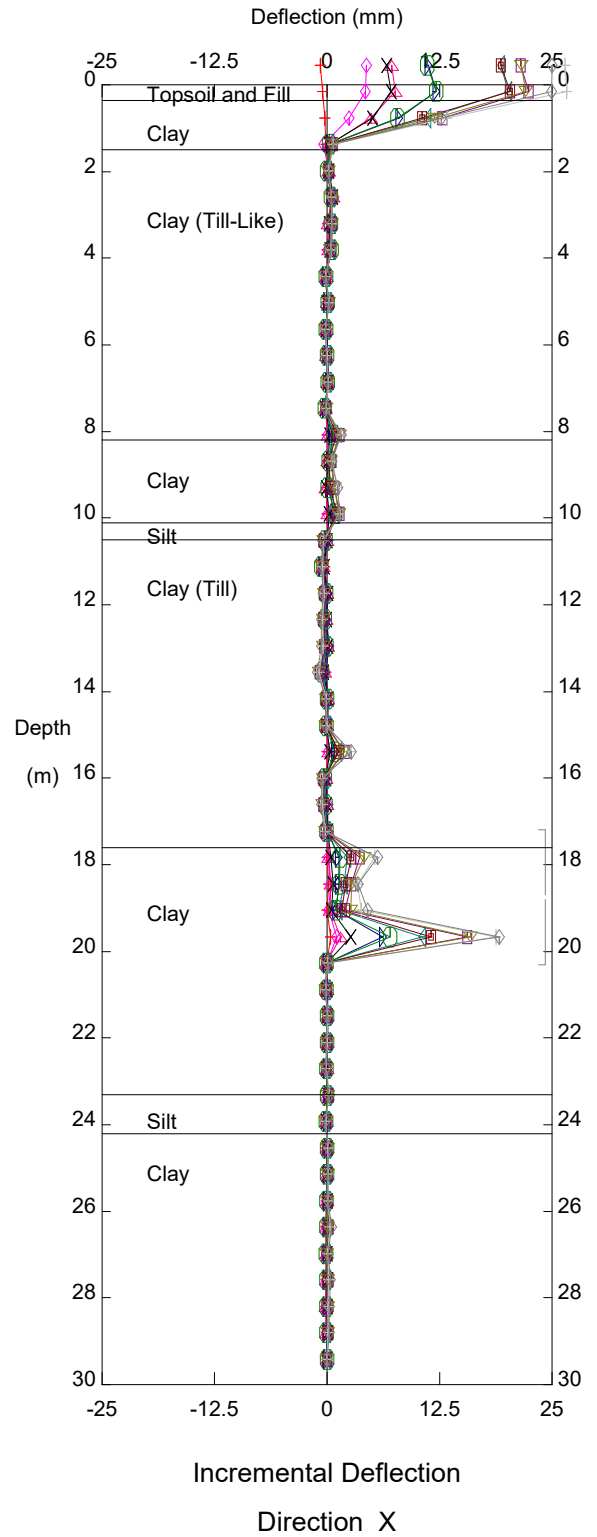
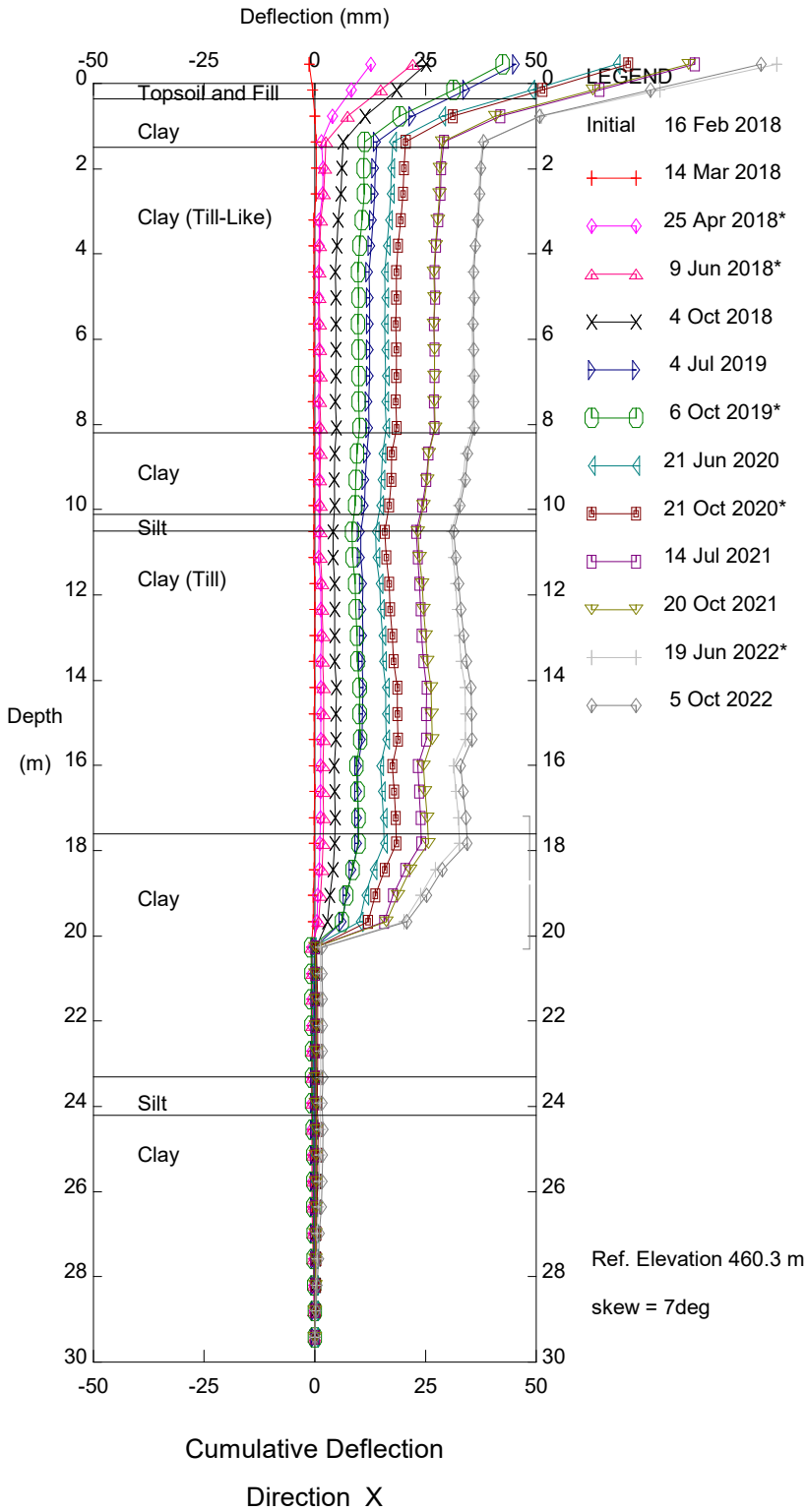


HWY 2:68 (PH037), Inclinometer SI18-5

Alberta Transportation

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

Thurber Engineering Ltd.

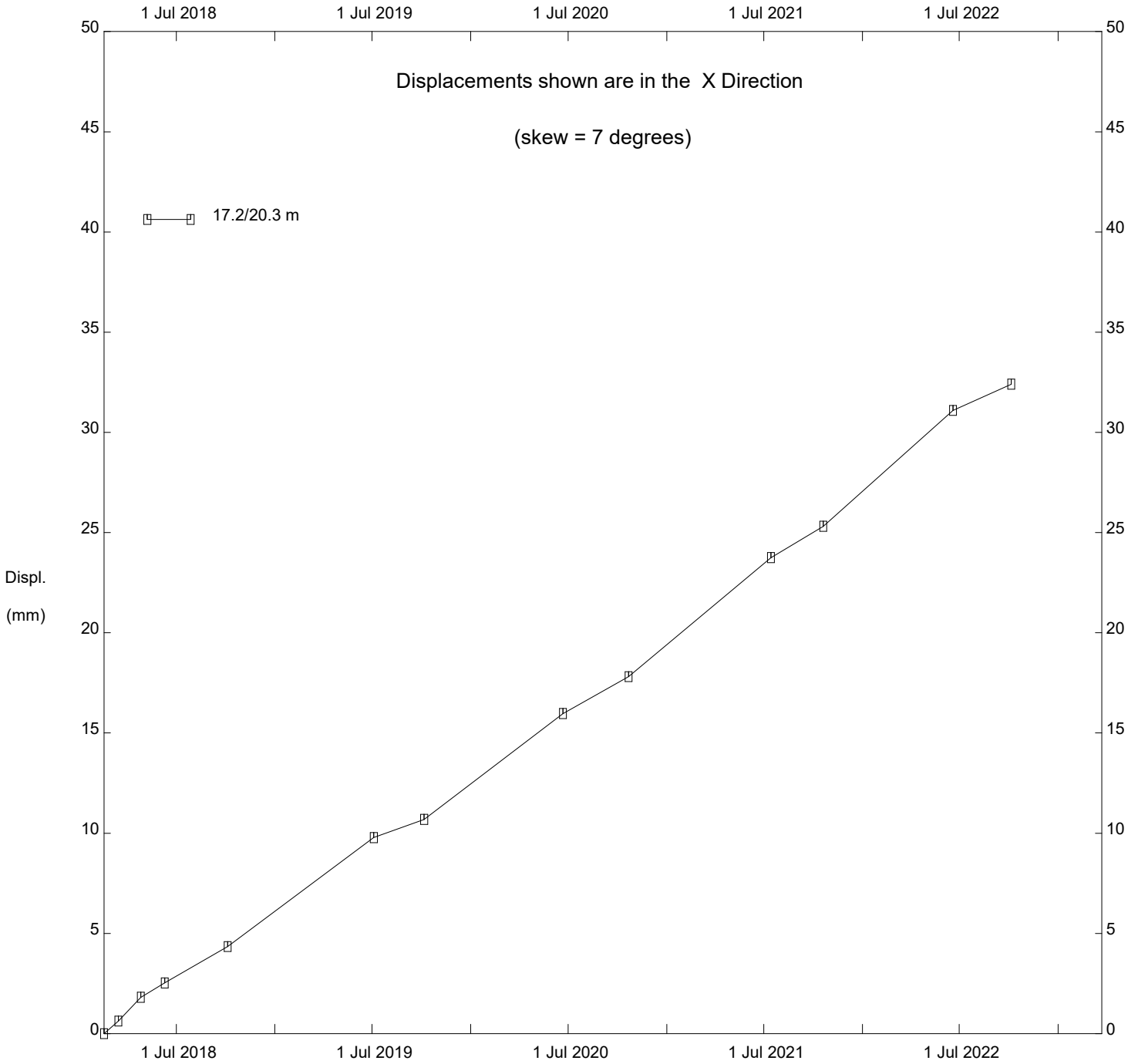


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Alberta Transportation

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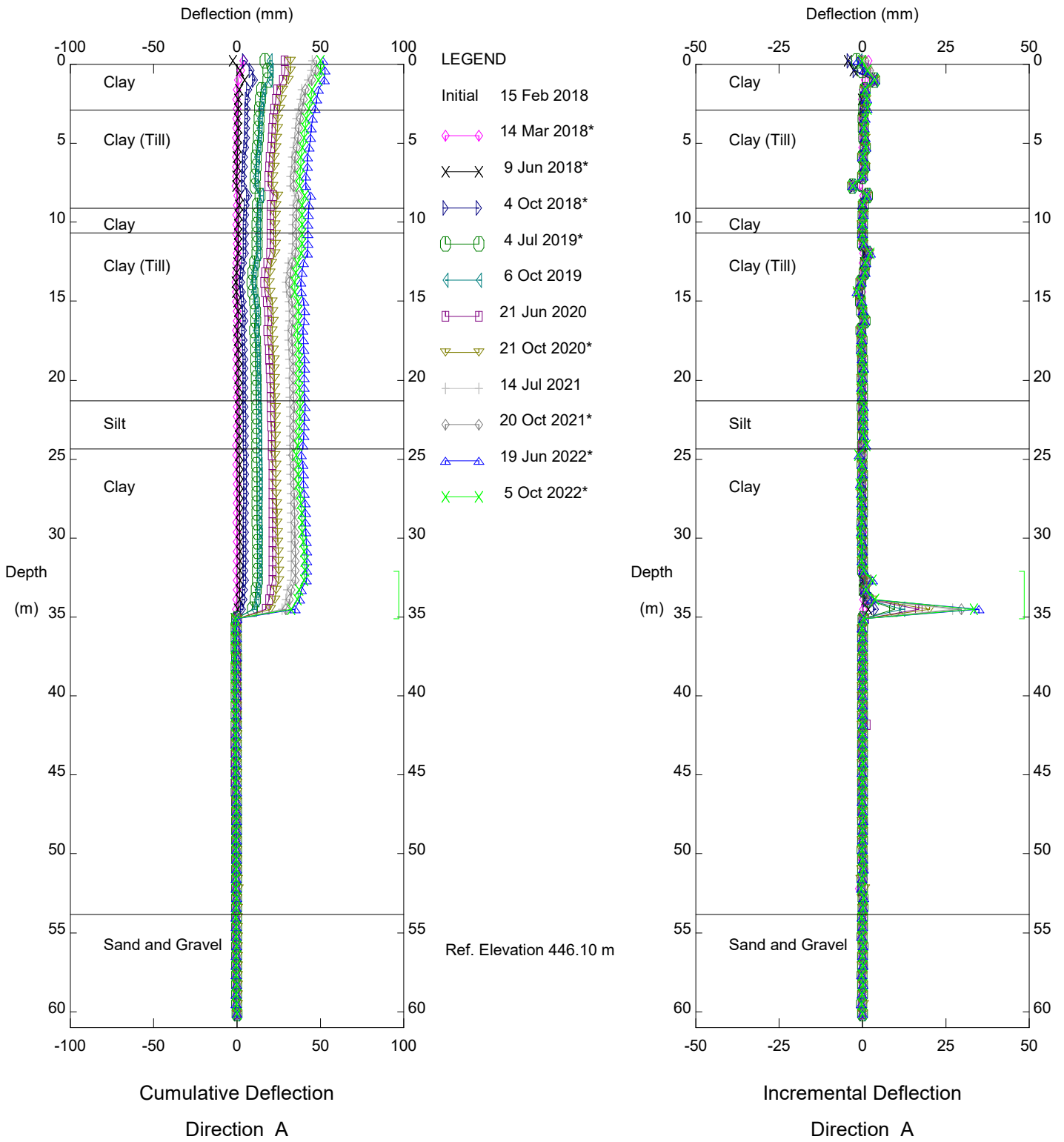
Thurber Engineering Ltd.



HWY 2:68 (PH037), Inclinator SI18-5

Alberta Transportation

Thurber Engineering Ltd.



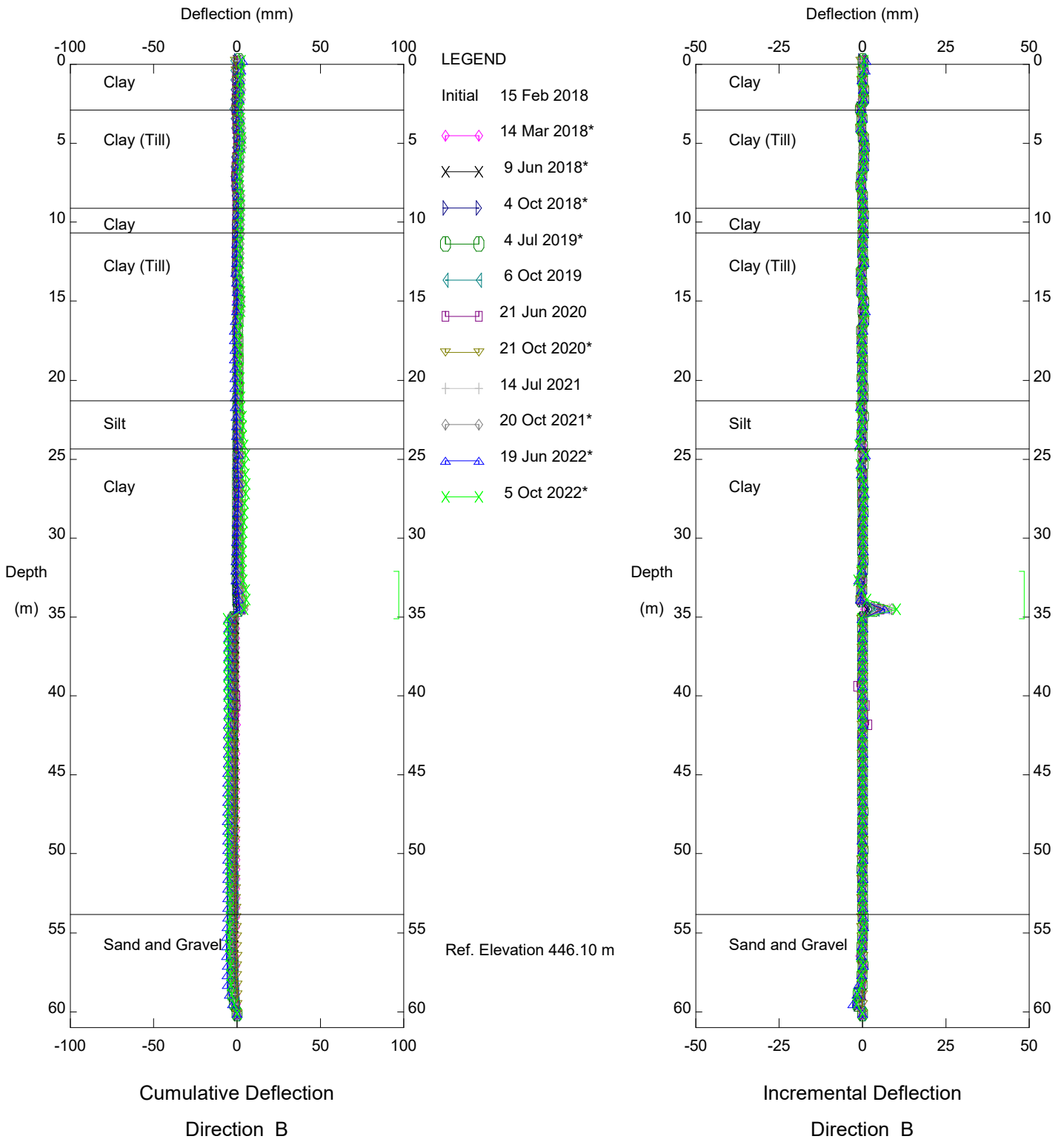
HWY 2:68 (PH037), Inclinometer SI18-6

Alberta Transportation

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



Thurber Engineering Ltd.

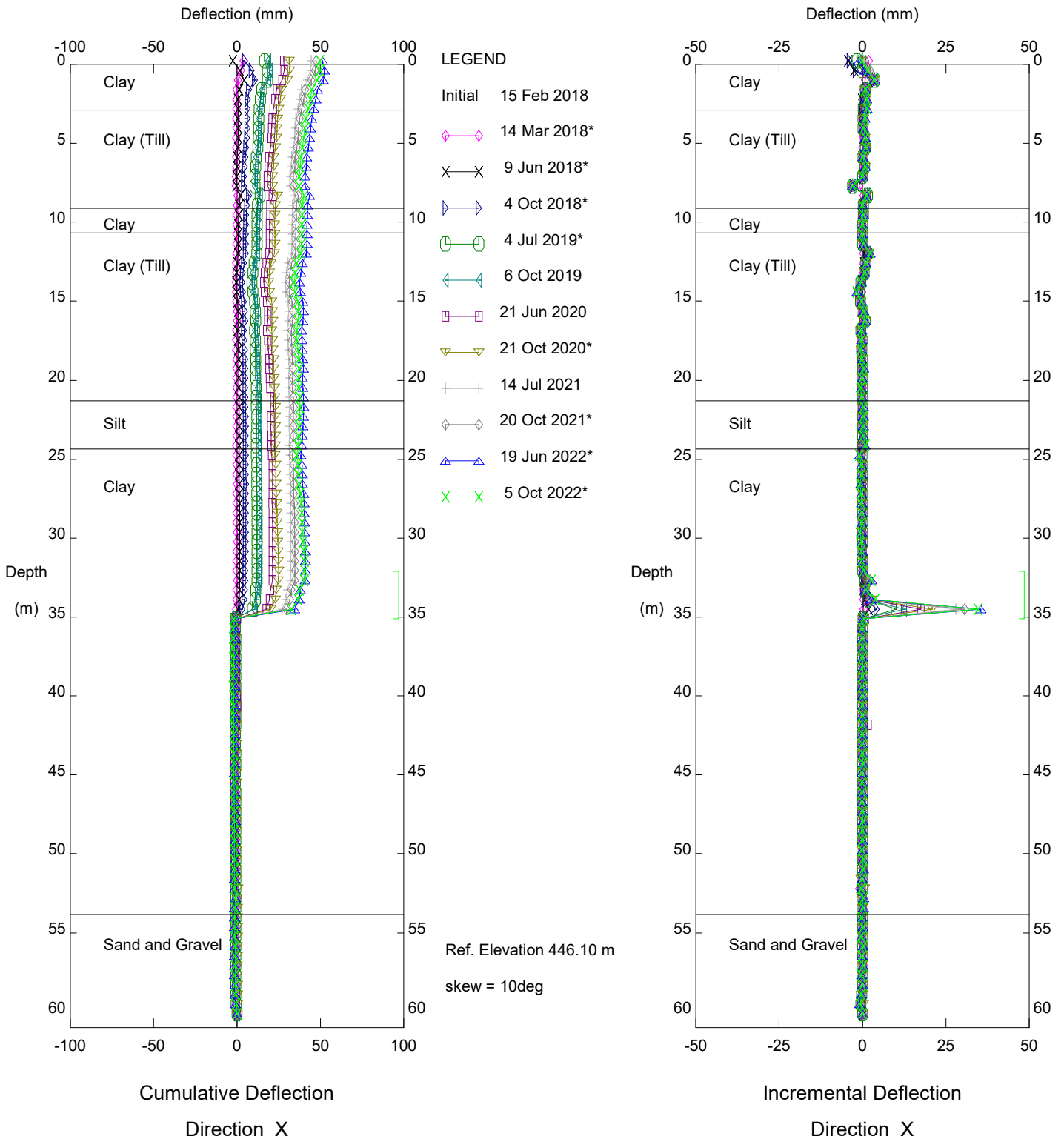


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Alberta Transportation

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

Thurber Engineering Ltd.

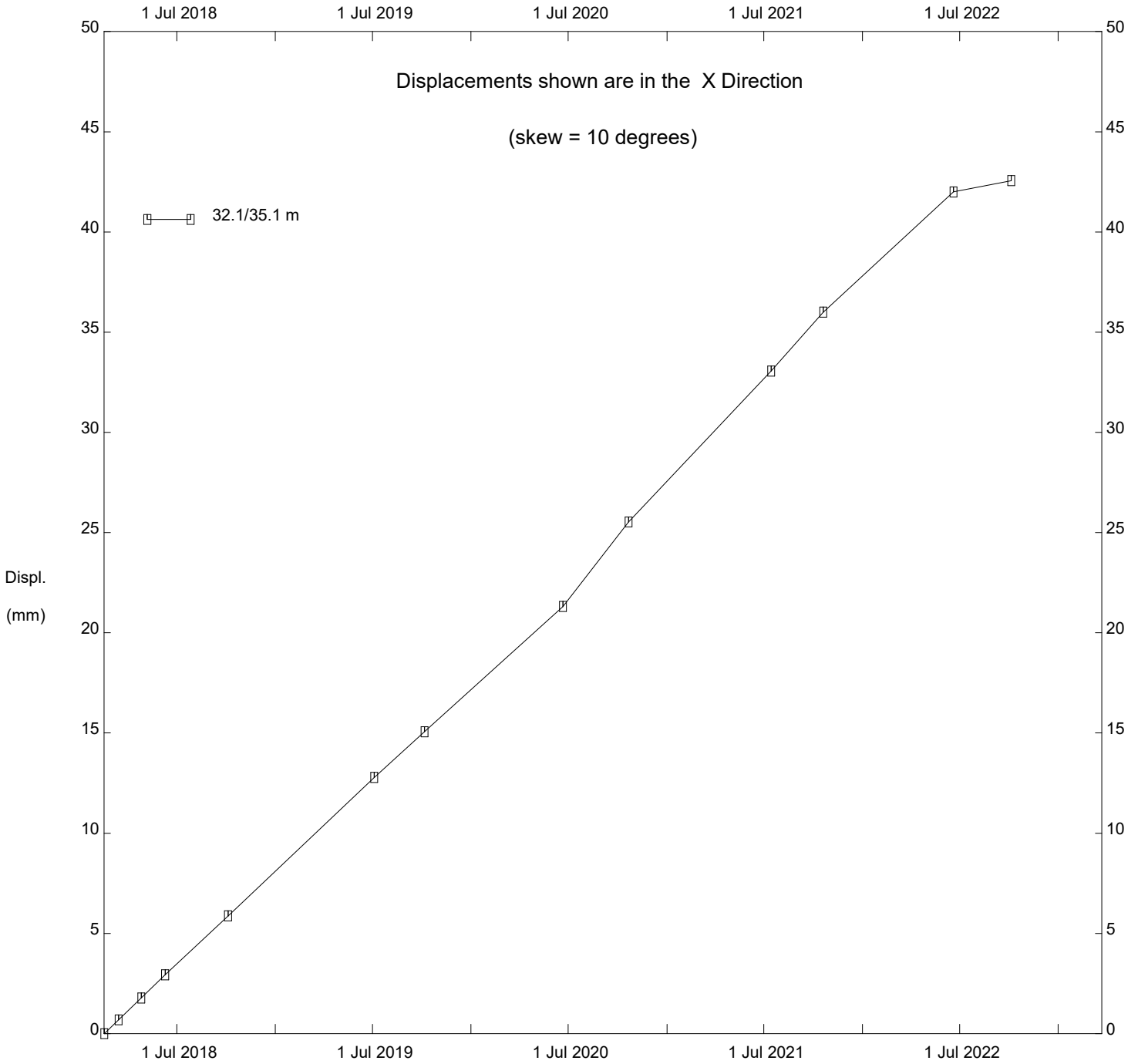


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Alberta Transportation

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

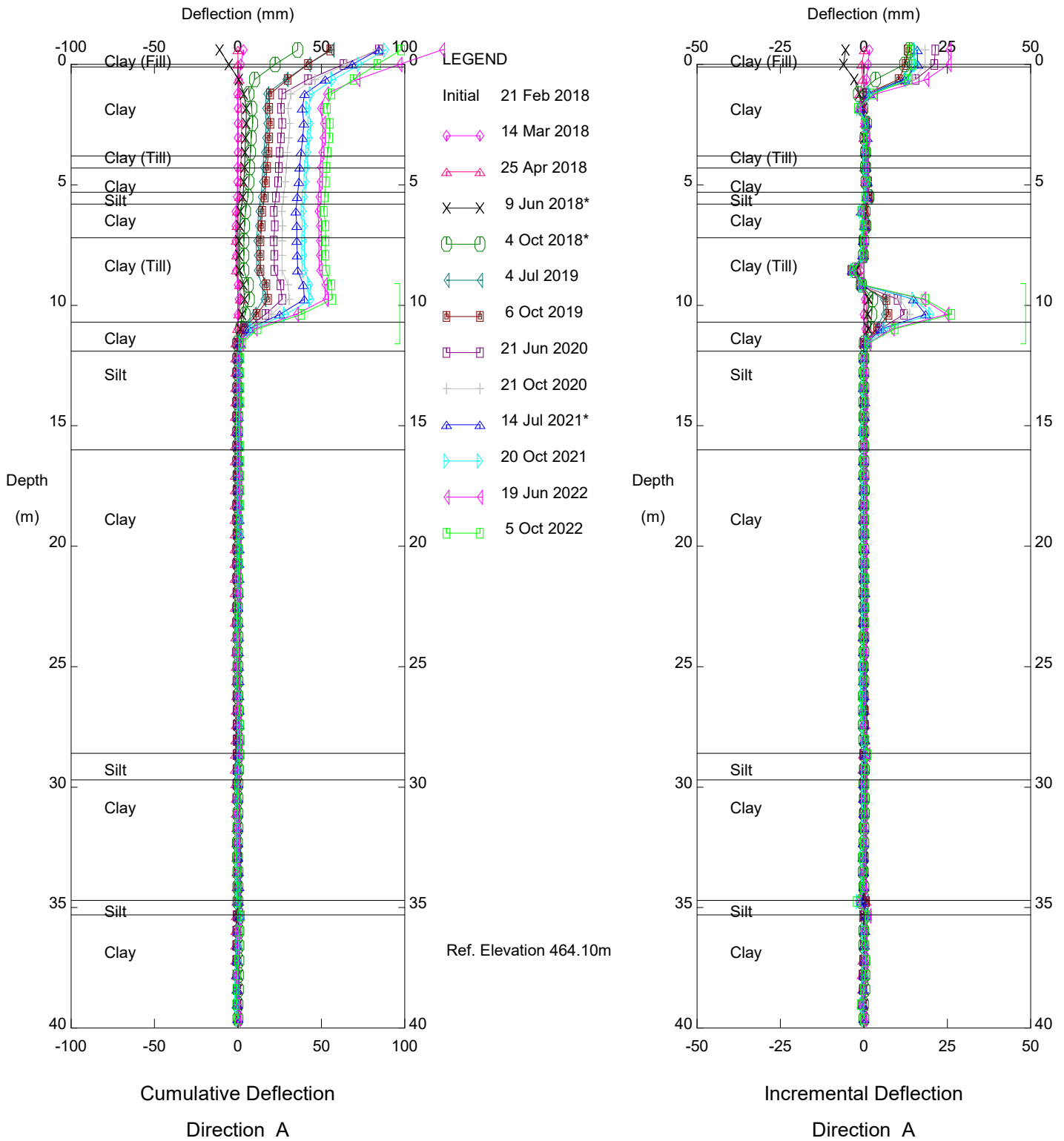
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Alberta Transportation

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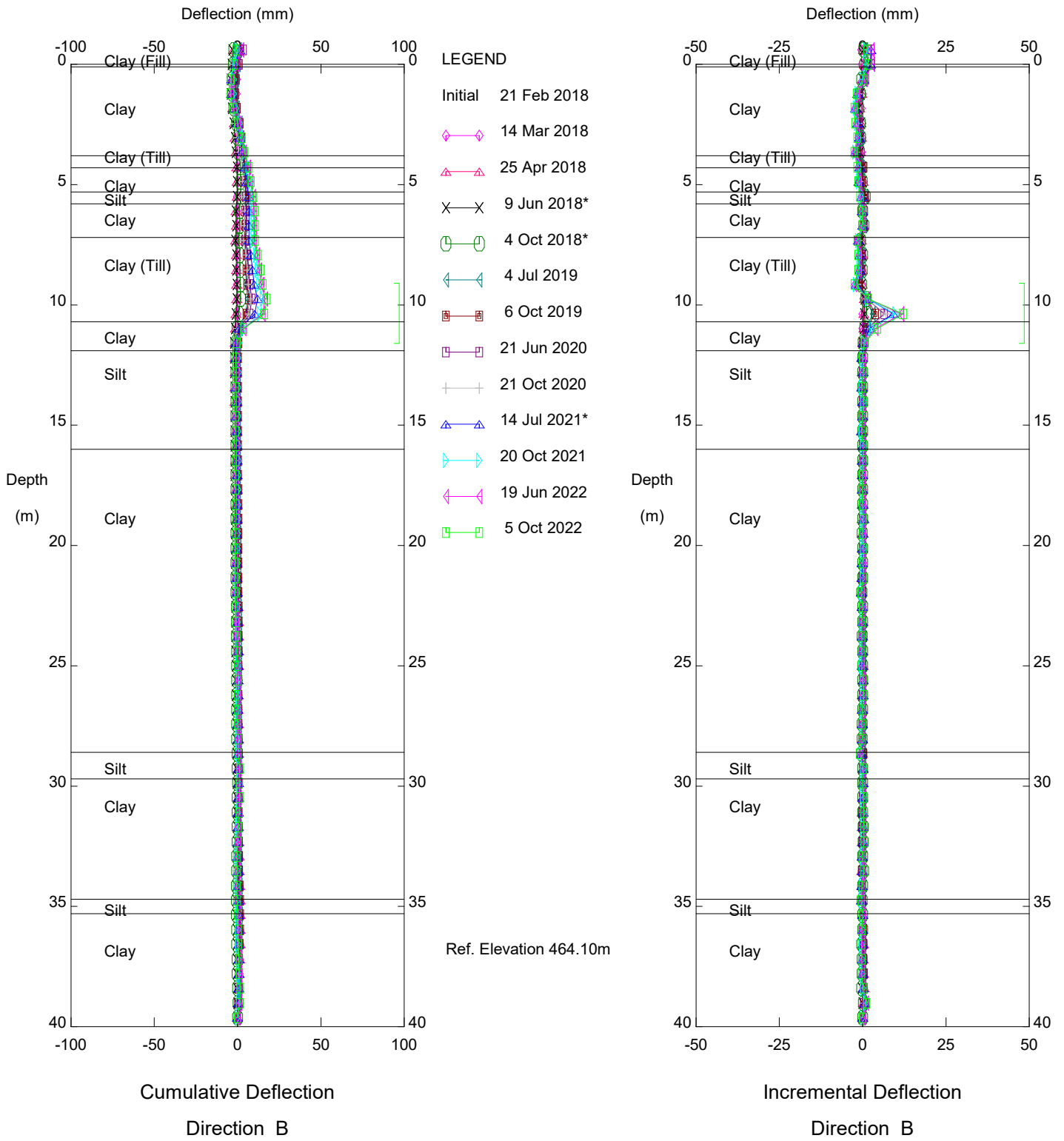


HWY 2:68 (PH037), Inclinometer SI18-7

Alberta Transportation

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

Thurber Engineering Ltd.

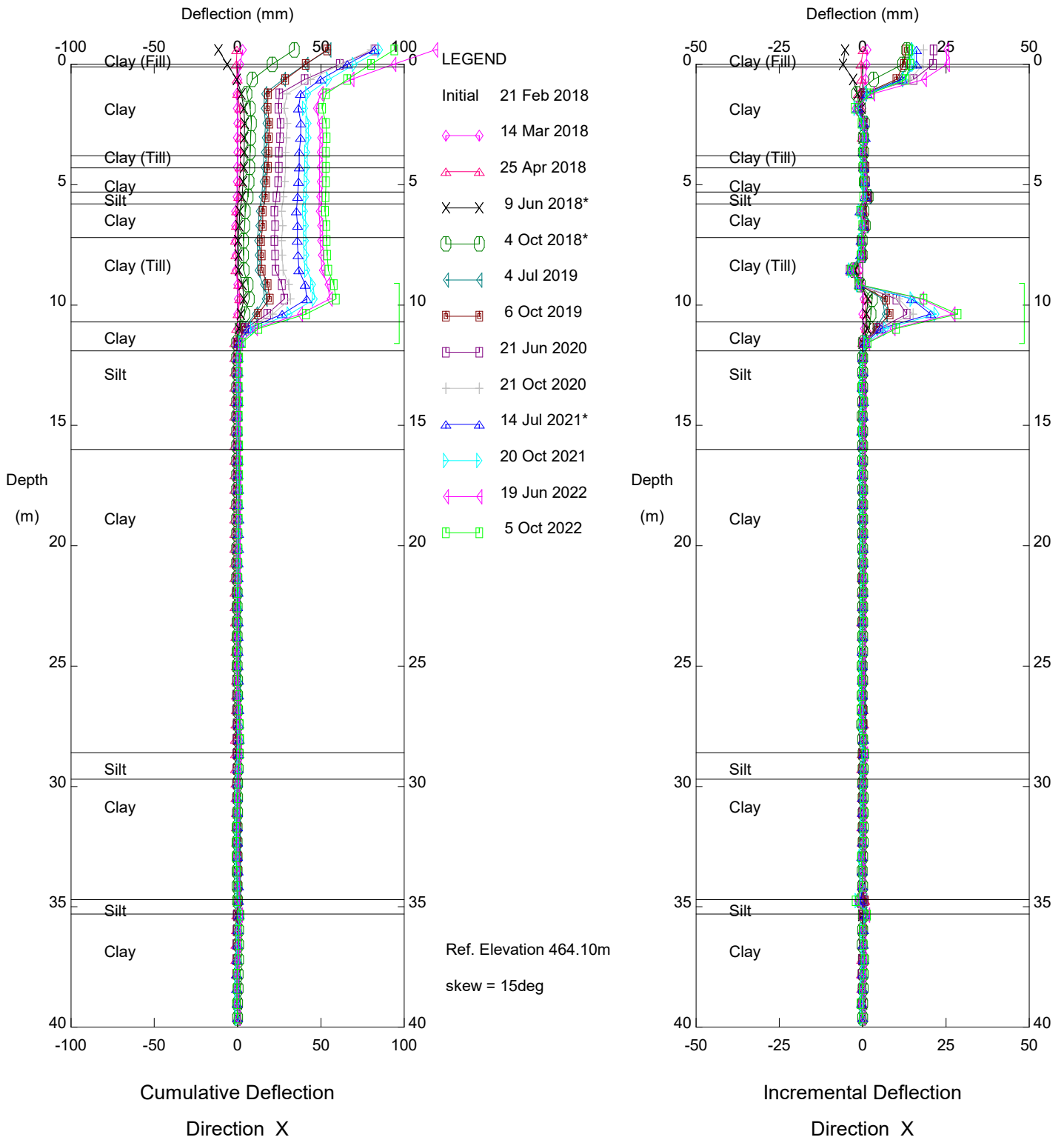


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Alberta Transportation

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Thurber Engineering Ltd.

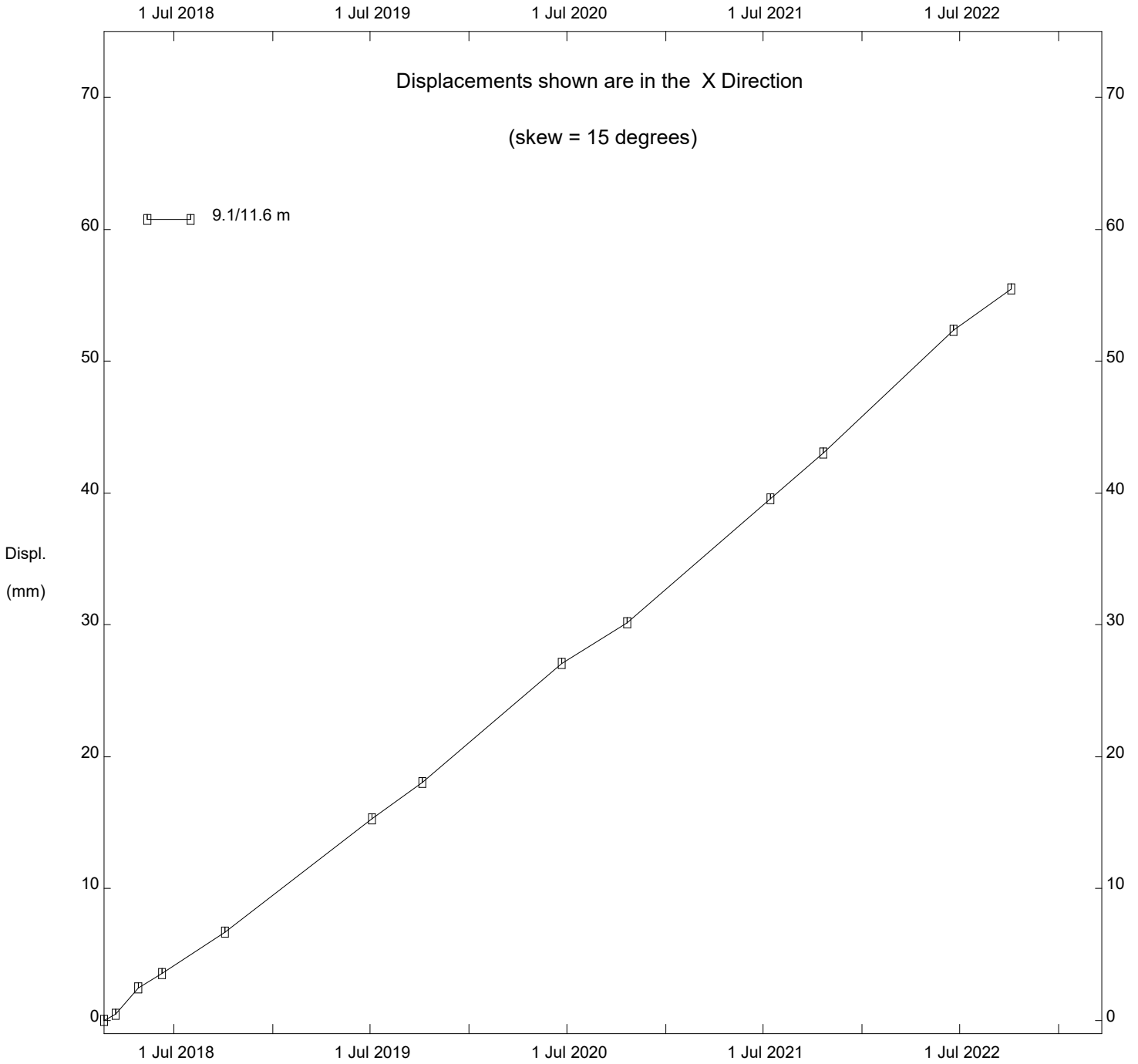


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Alberta Transportation

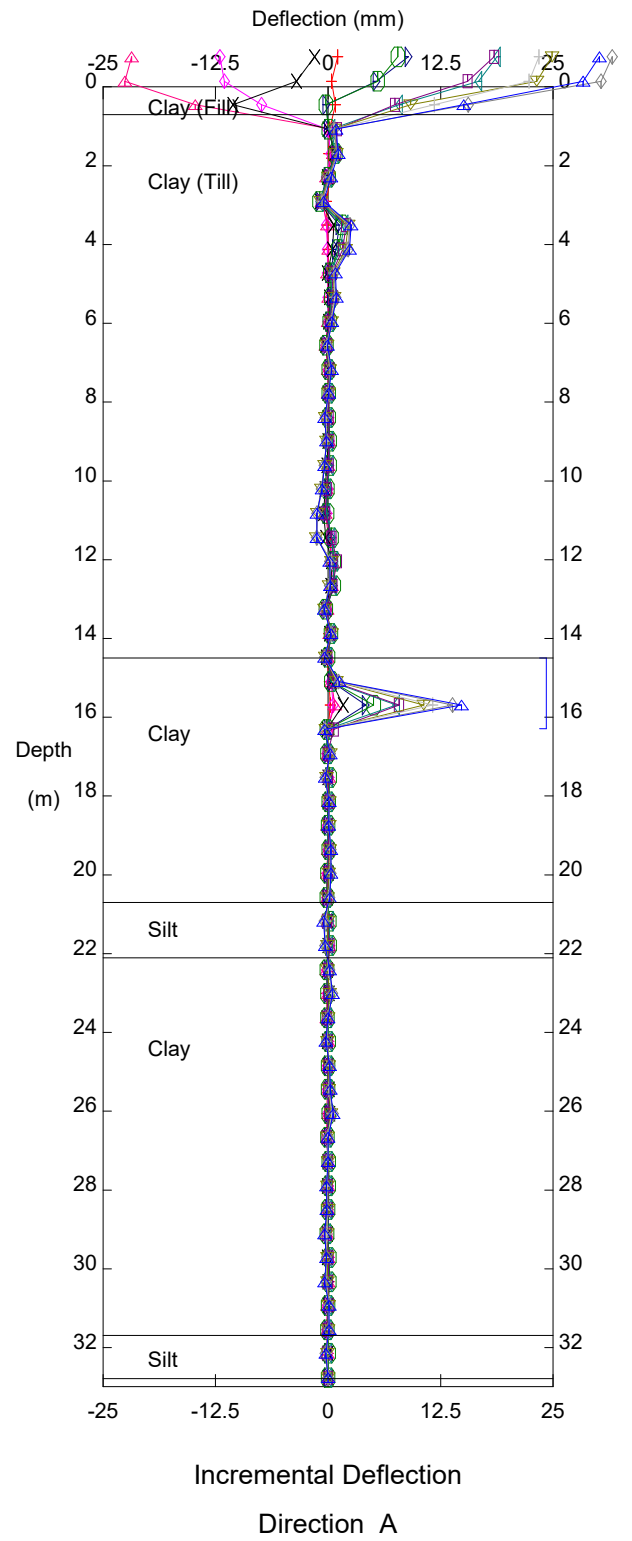
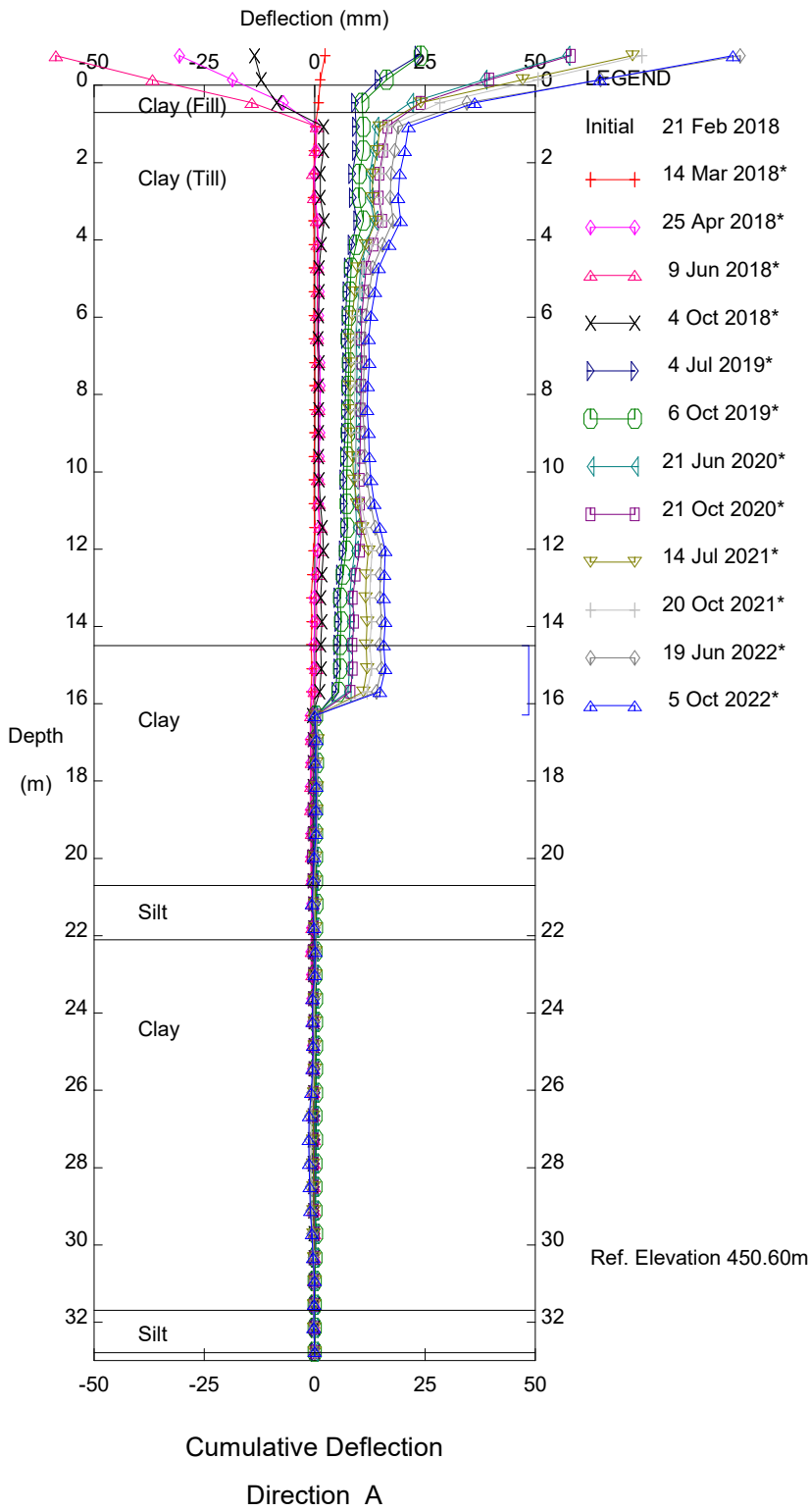
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Thurber Engineering Ltd.



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

Alberta Transportation



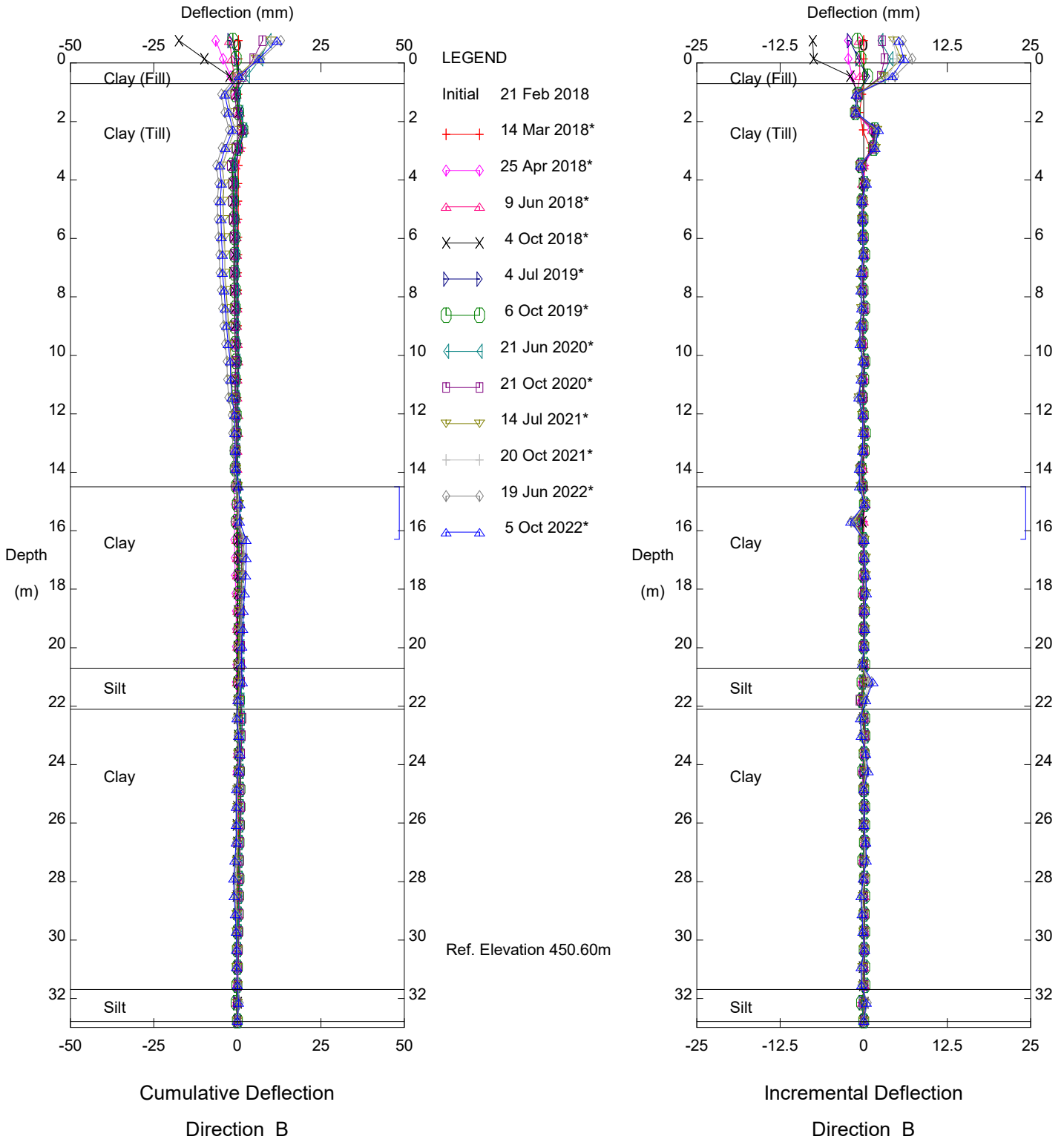
HWY 2:68 (PH037), Inclinator SI18-8

Alberta Transportation

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



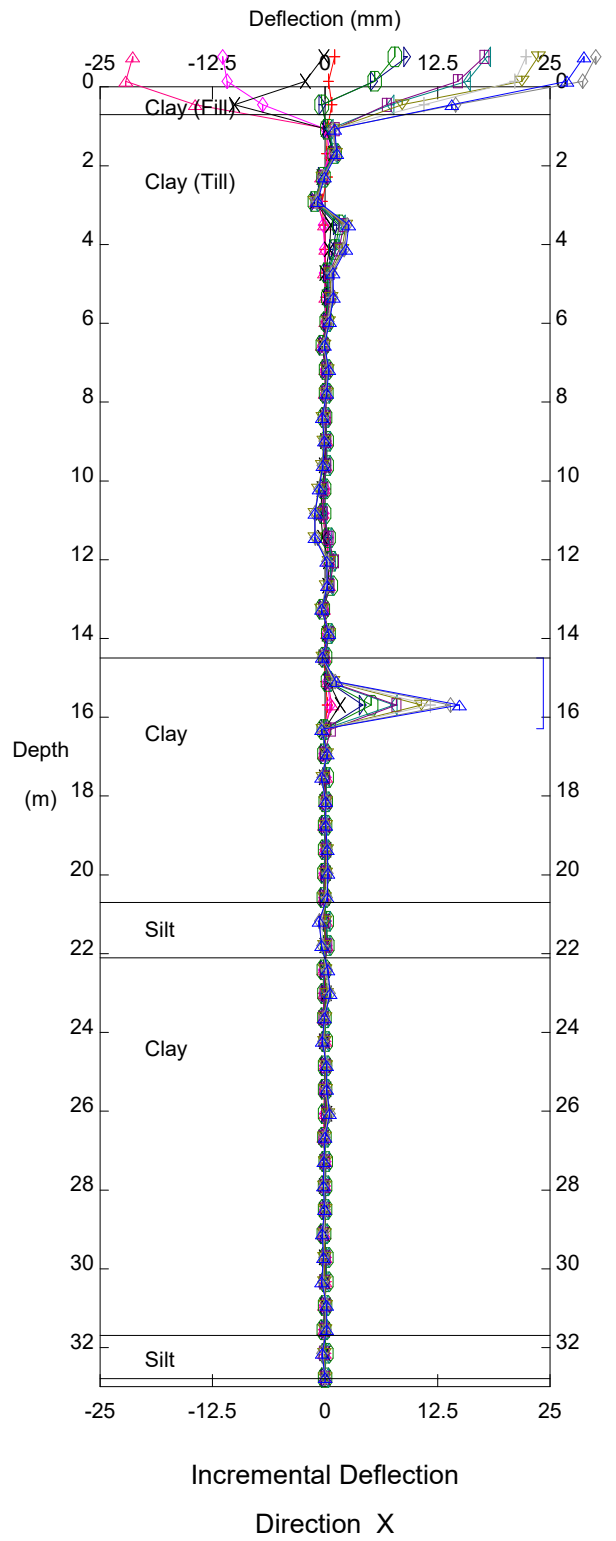
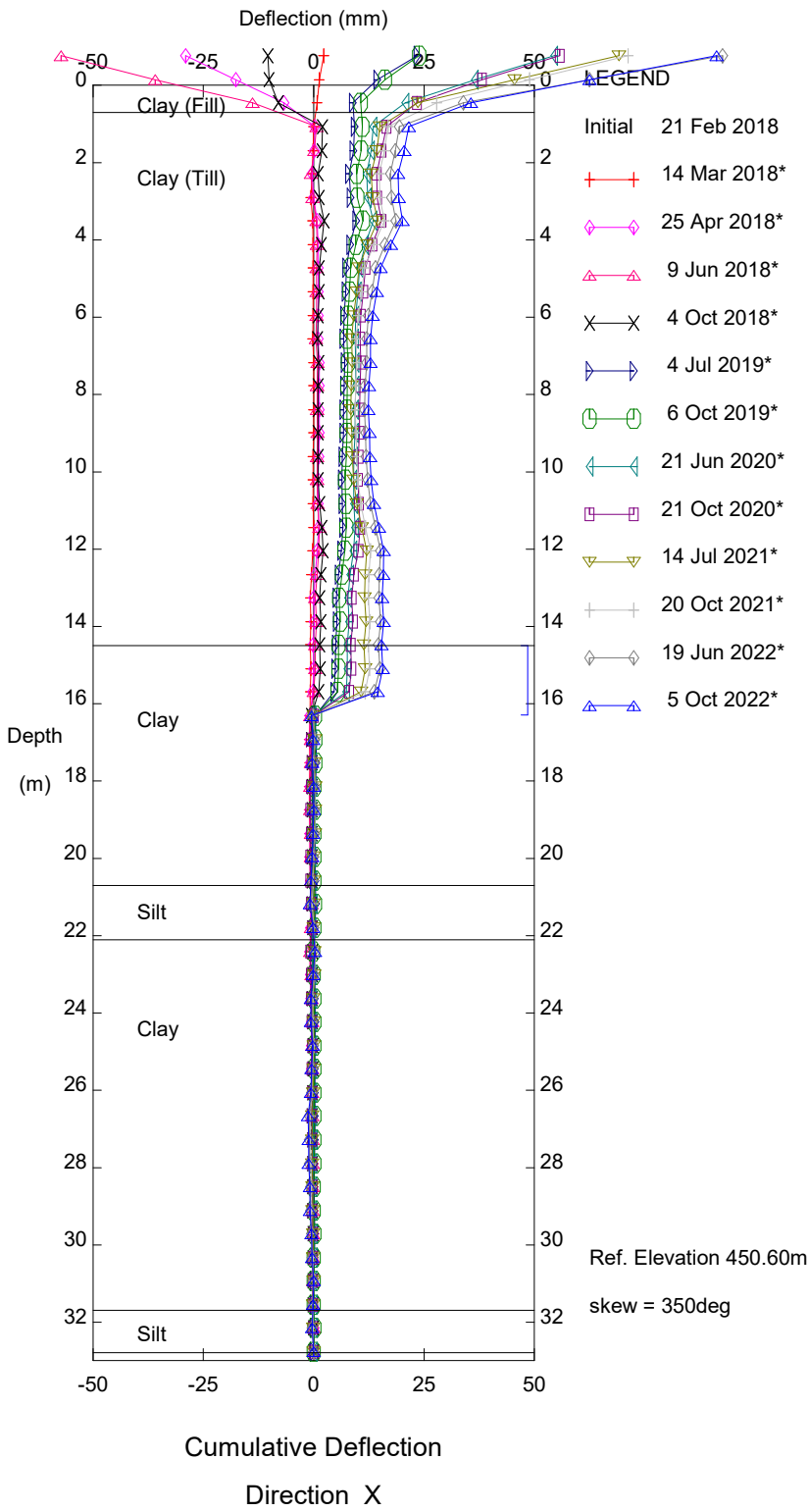
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Alberta Transportation

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

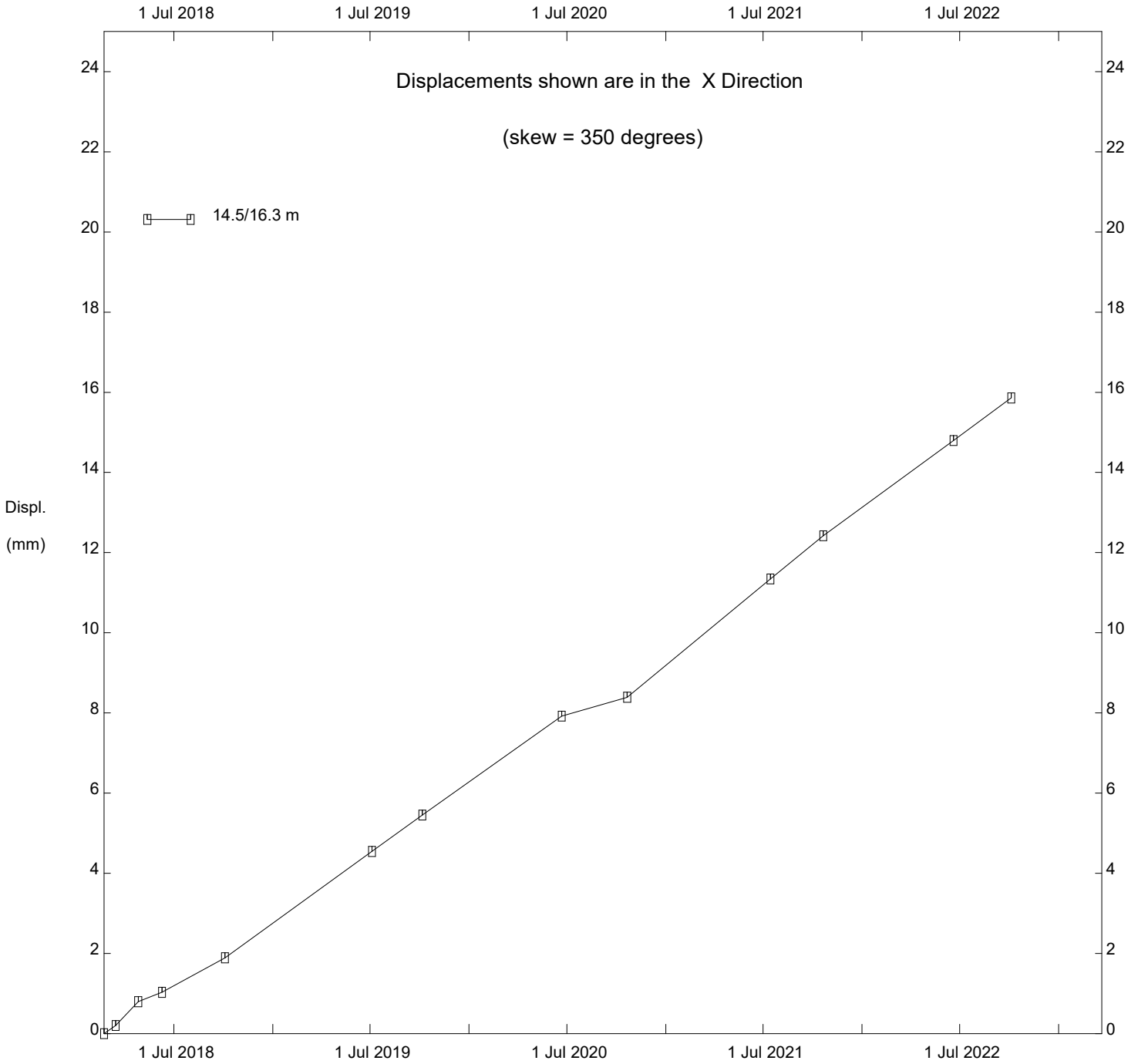


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Alberta Transportation

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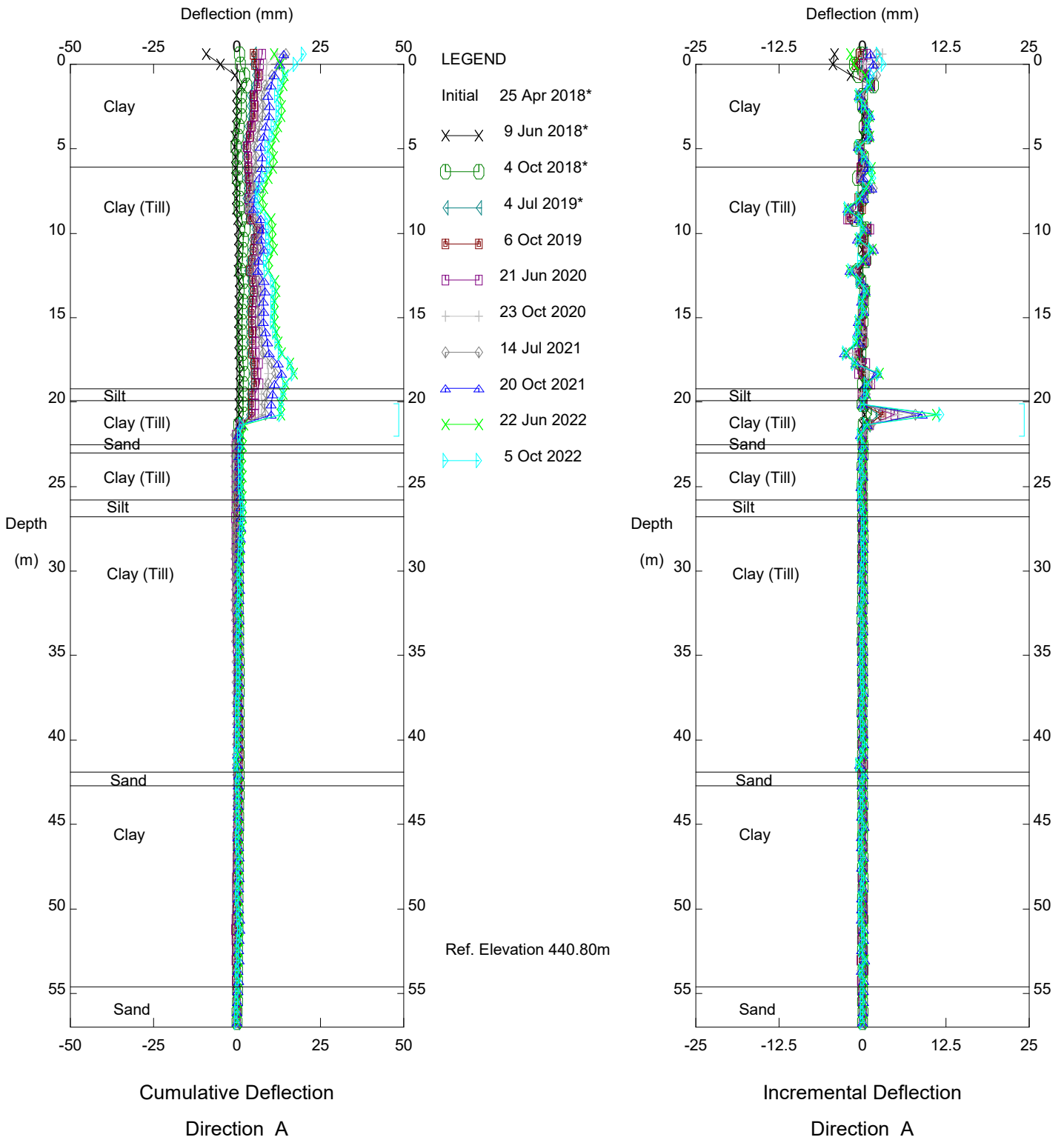
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Alberta Transportation

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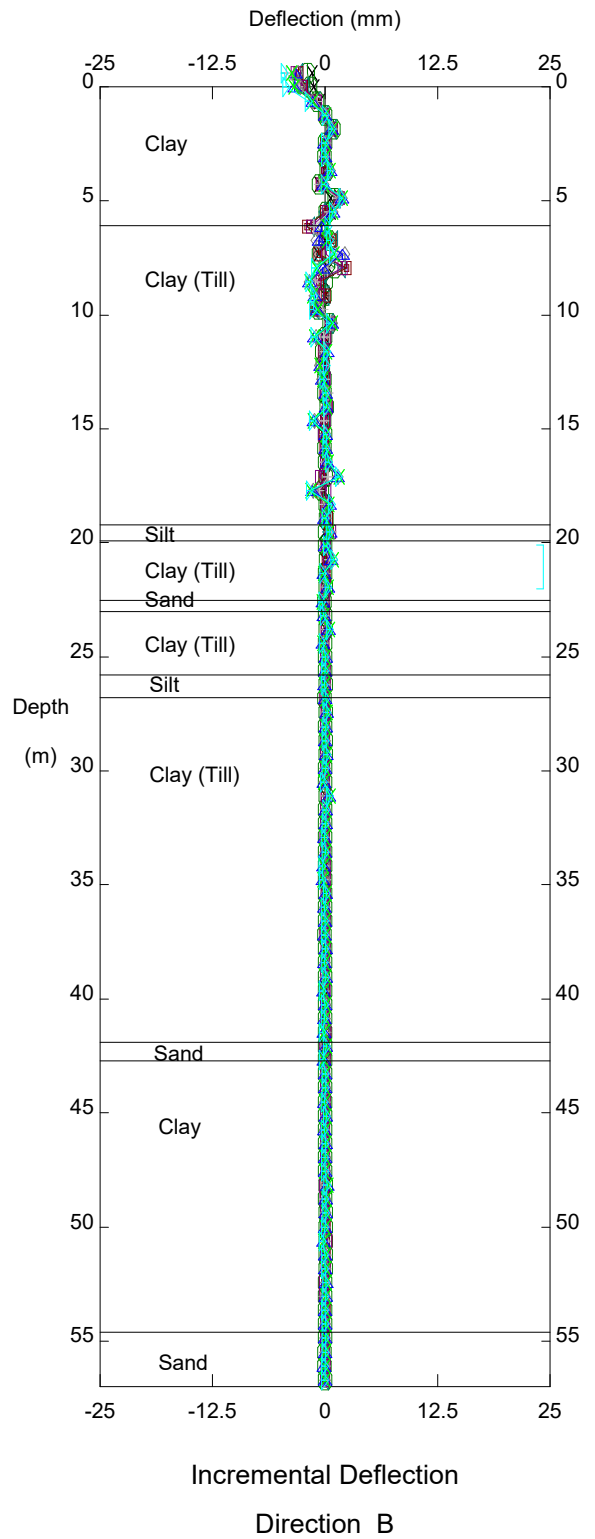
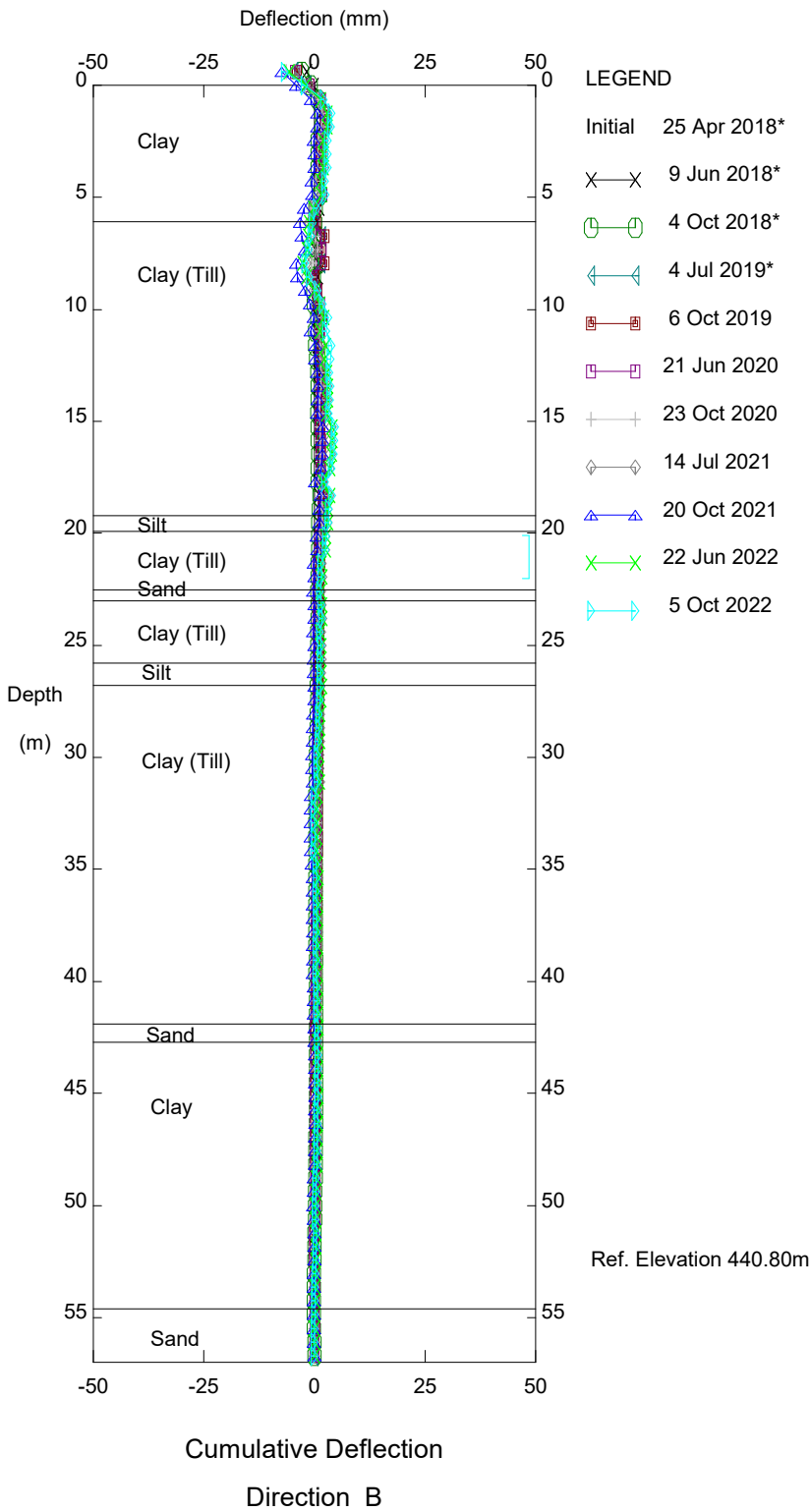


HWY 2:68 (PH037), Inclinometer SI18-9

Alberta Transportation

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

Thurber Engineering Ltd.

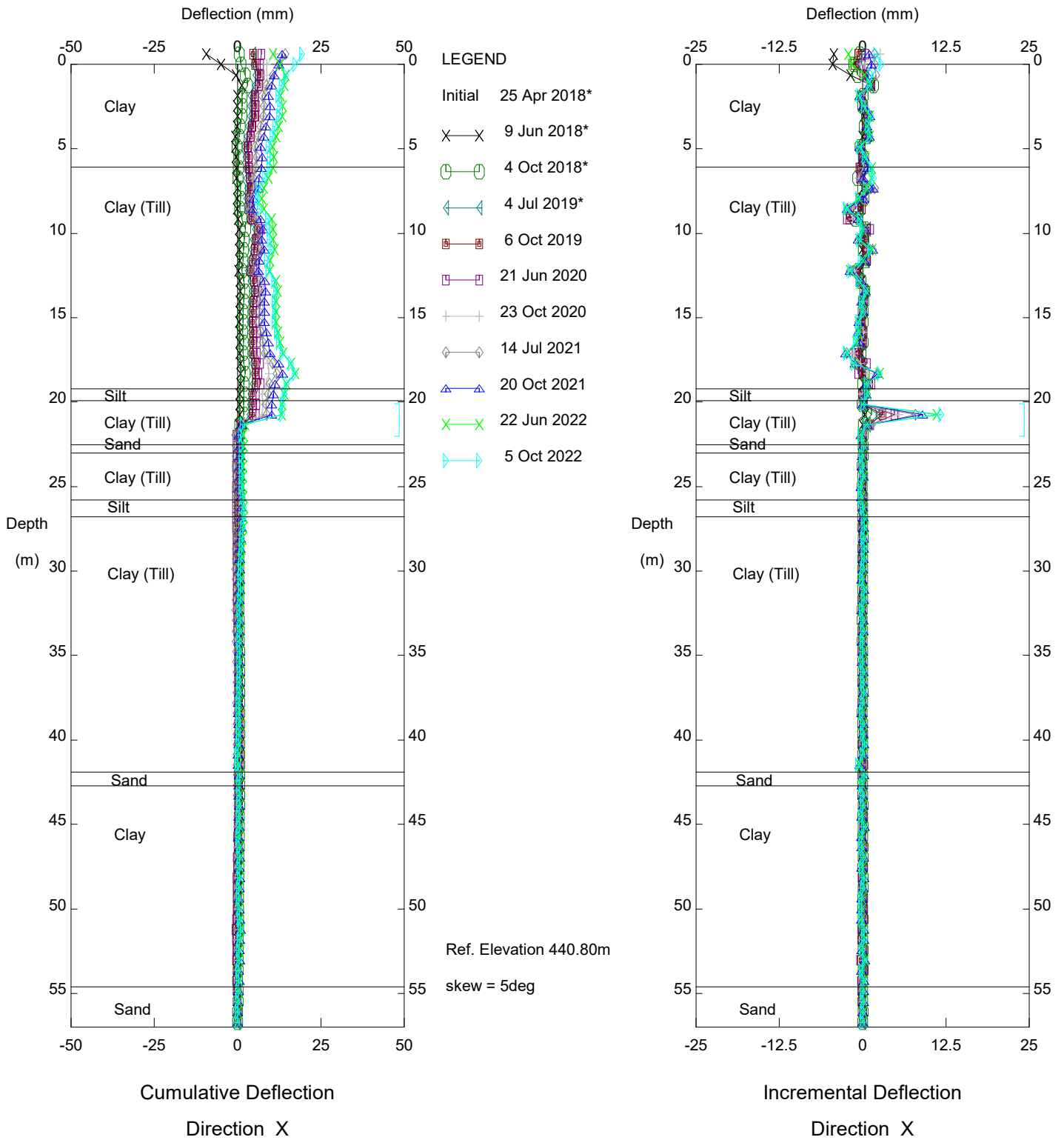


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Alberta Transportation

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

Thurber Engineering Ltd.

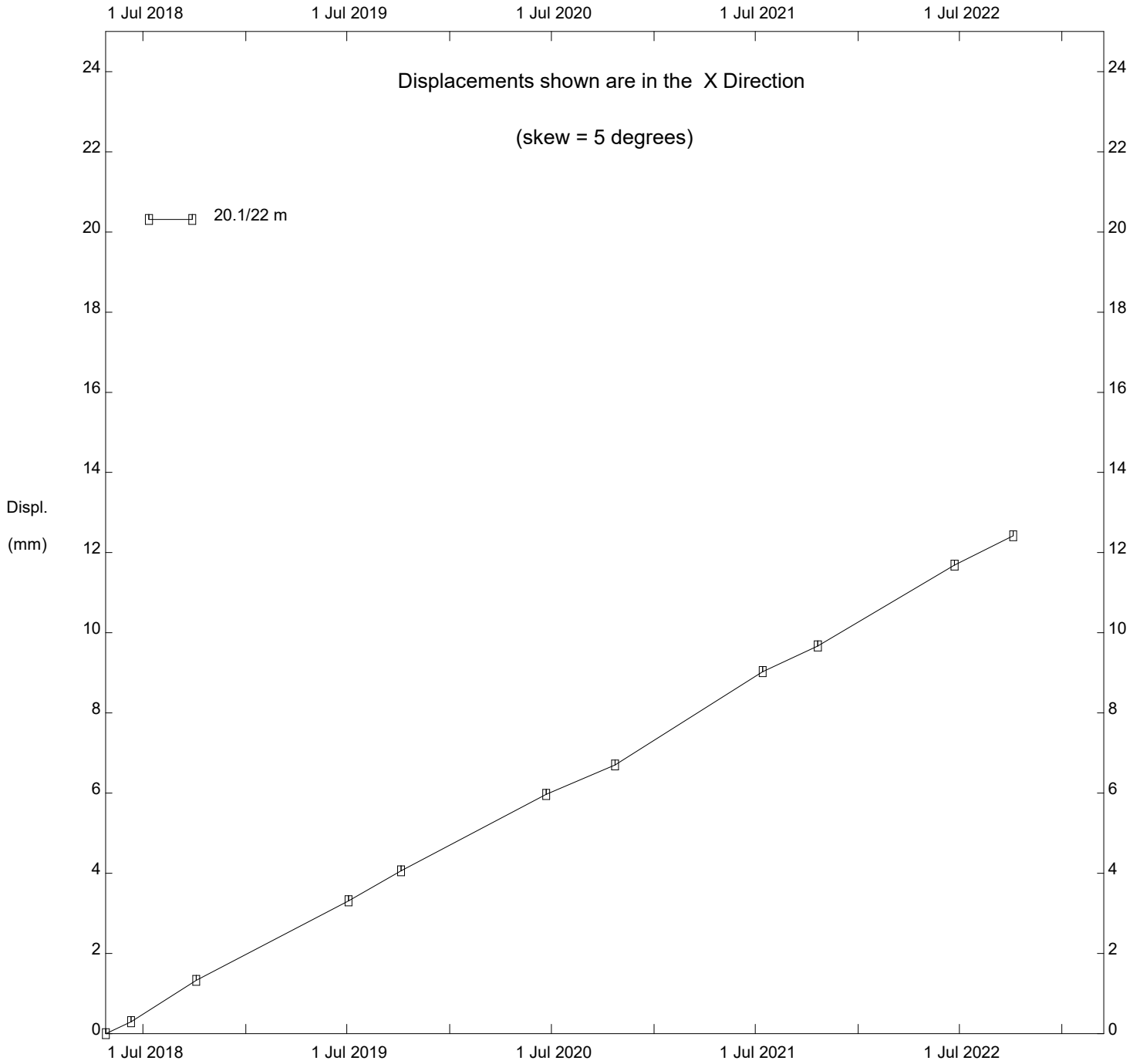


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Alberta Transportation

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

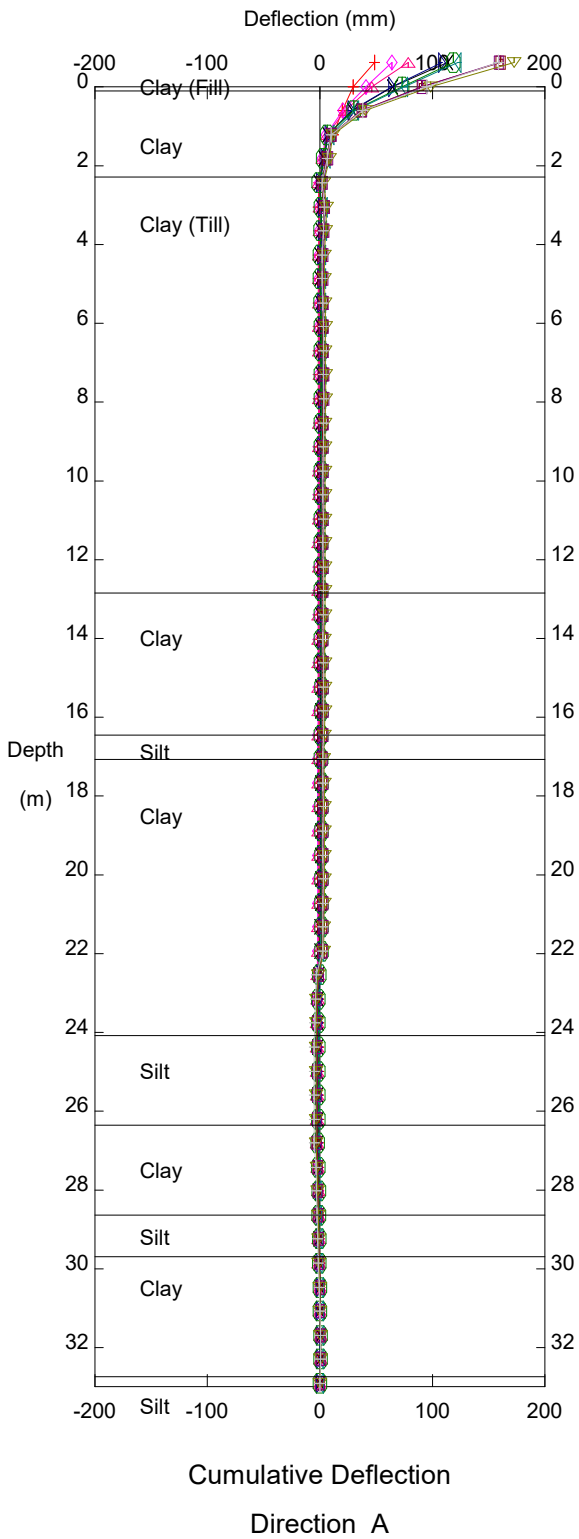
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Alberta Transportation

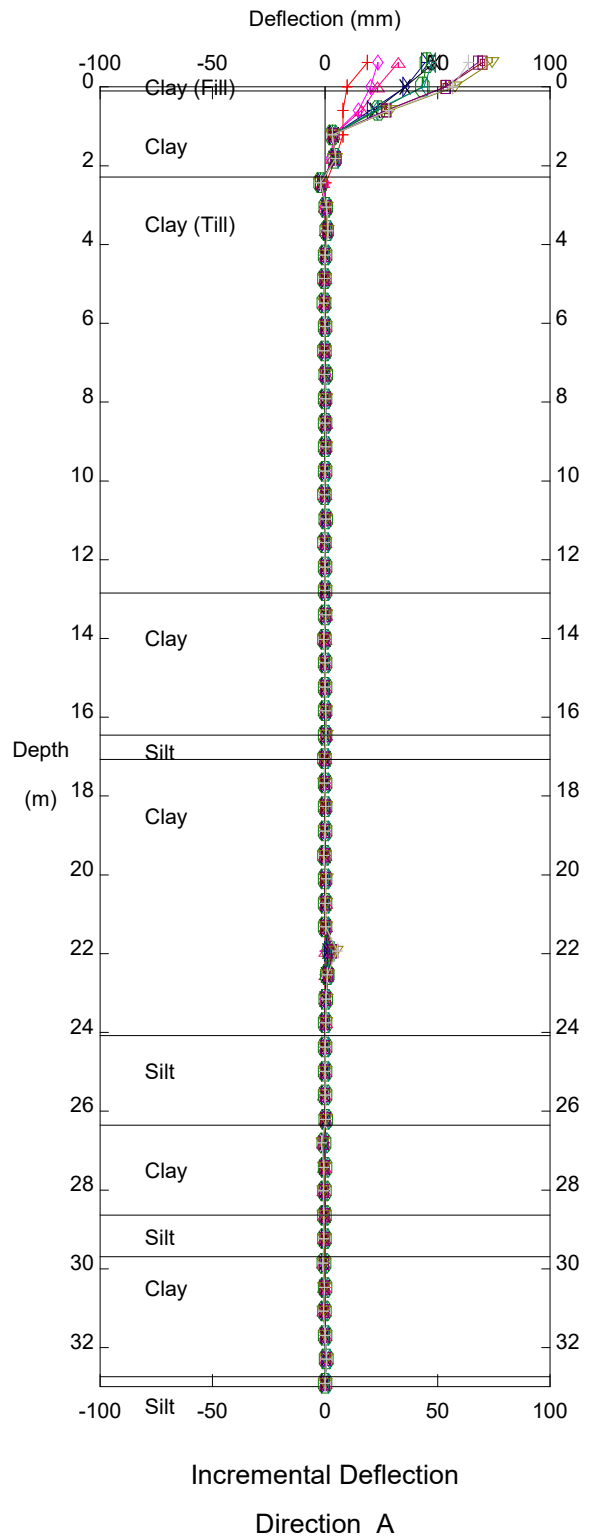
Thurber Engineering Ltd.



LEGEND

Initial	14 Mar 2018
+	26 Apr 2018*
◇	9 Jun 2018*
△	4 Oct 2018
X	4 Jul 2019
▷	6 Oct 2019
○	21 Jun 2020
◁	23 Oct 2020
◻	14 Jul 2021
◻	20 Oct 2021
▽	22 Jun 2022
+	5 Oct 2022

Ref. Elevation 442.70m

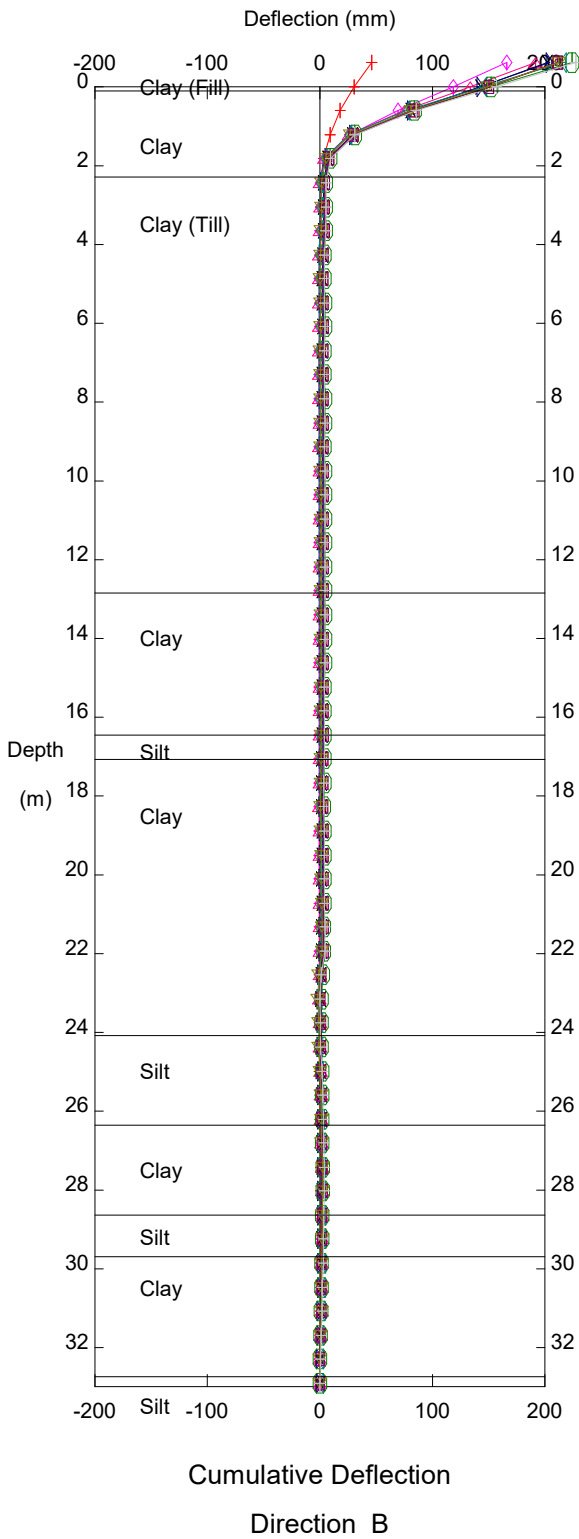


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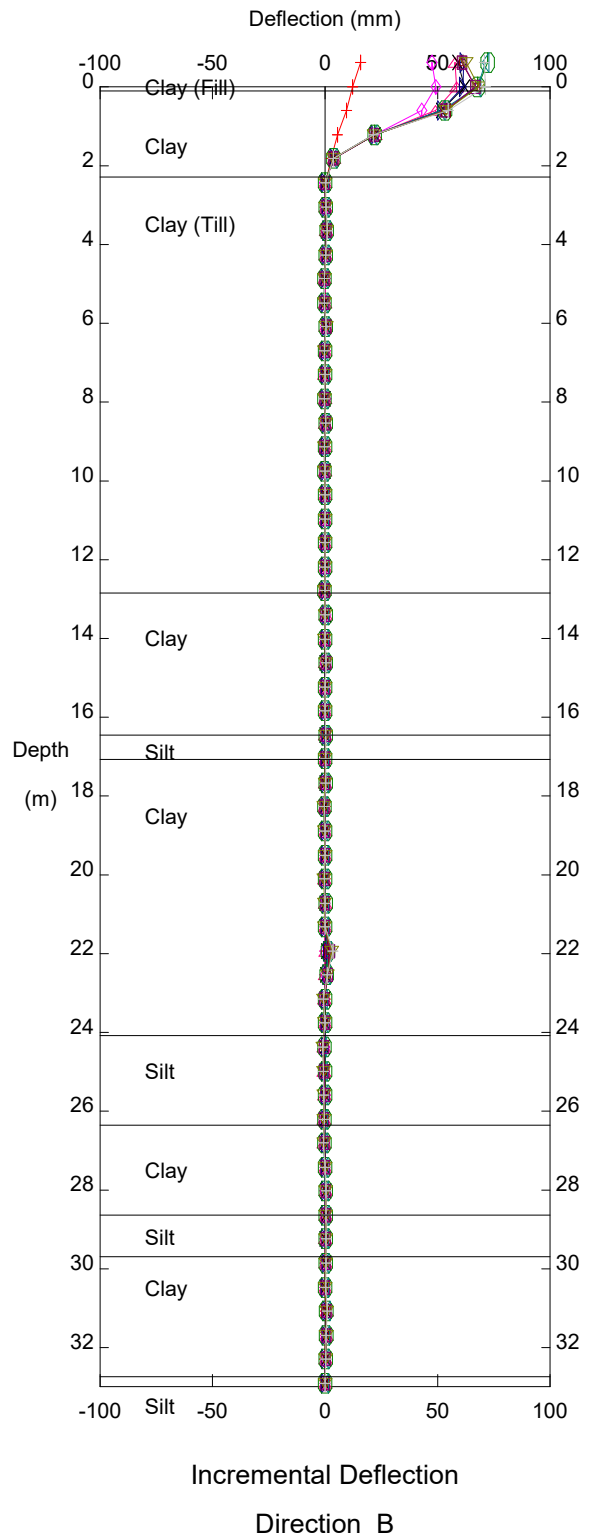
Alberta Transportation

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





Ref. Elevation 442.70m

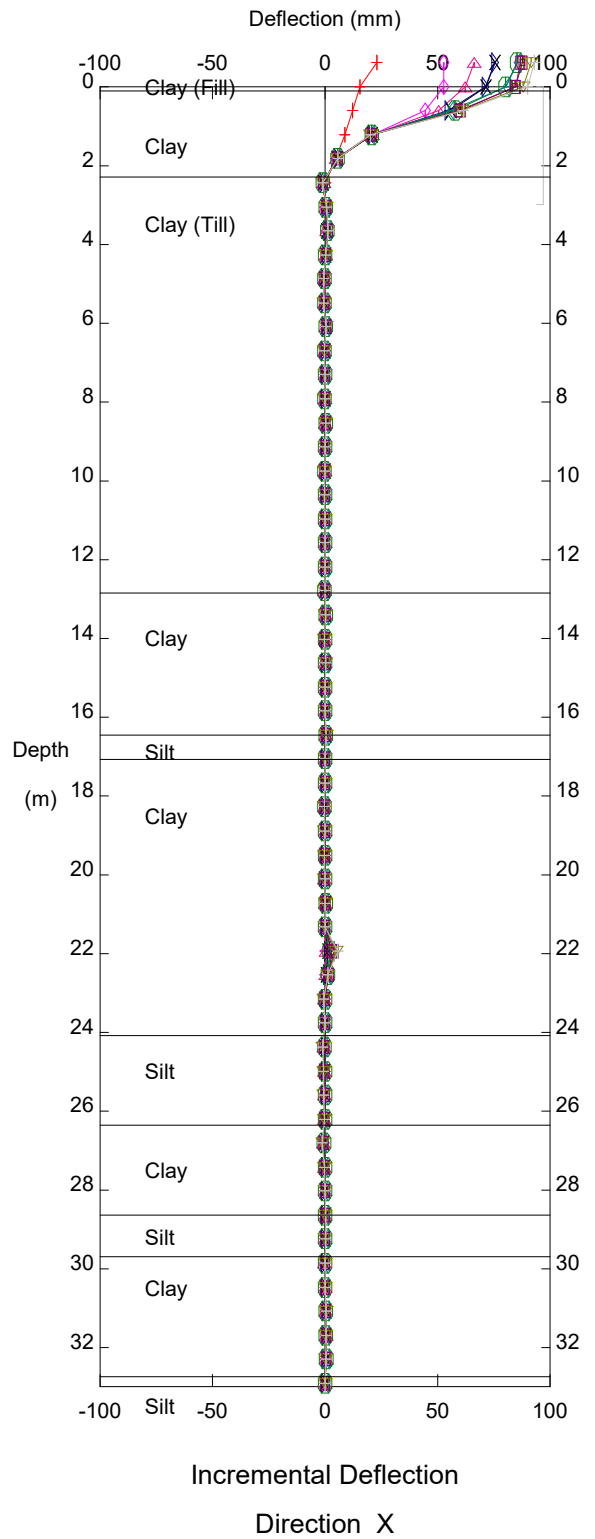
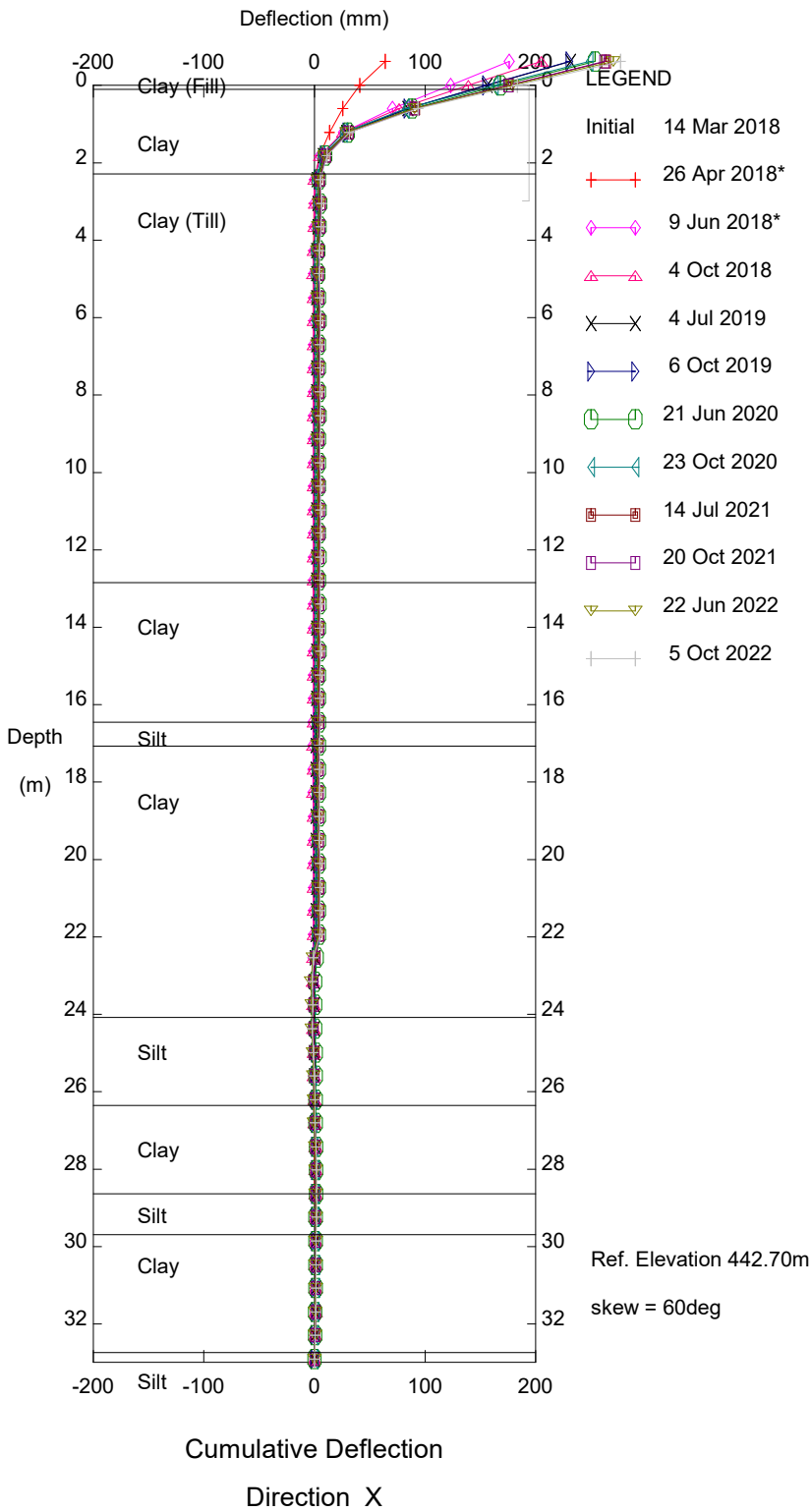


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Sets marked \* include zero shift and/or rotation corrections.

Thurber Engineering Ltd.

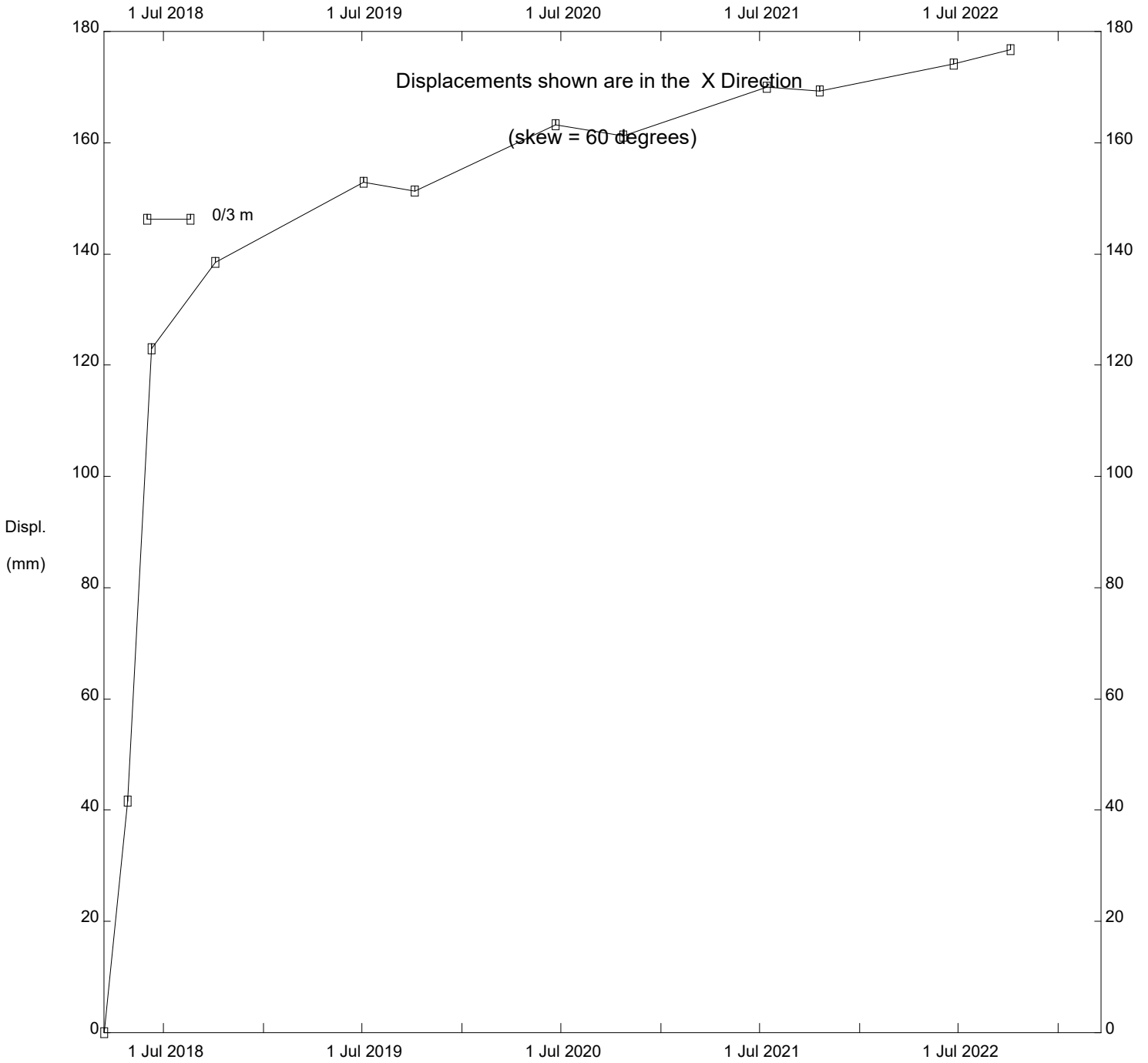


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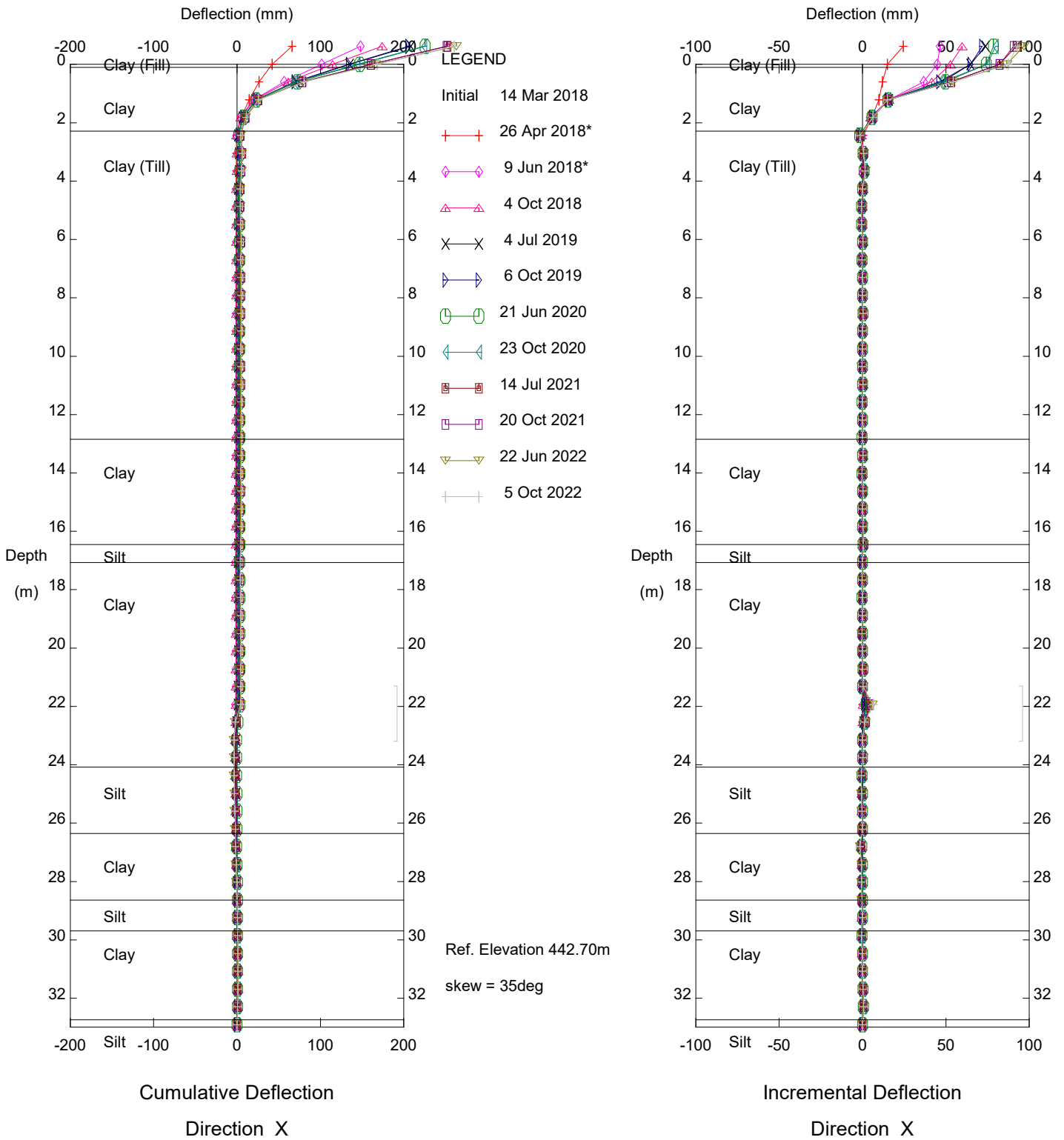
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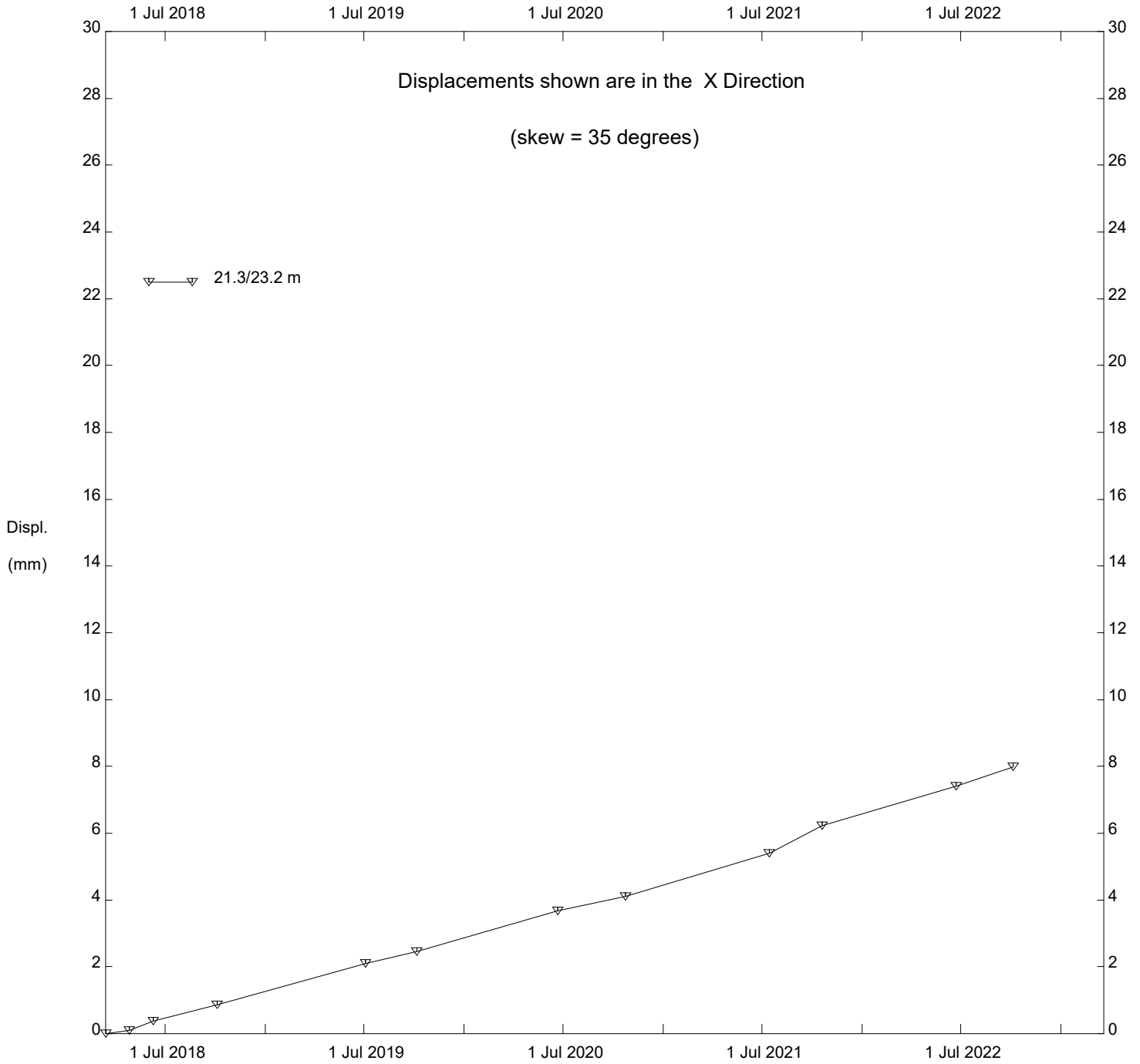


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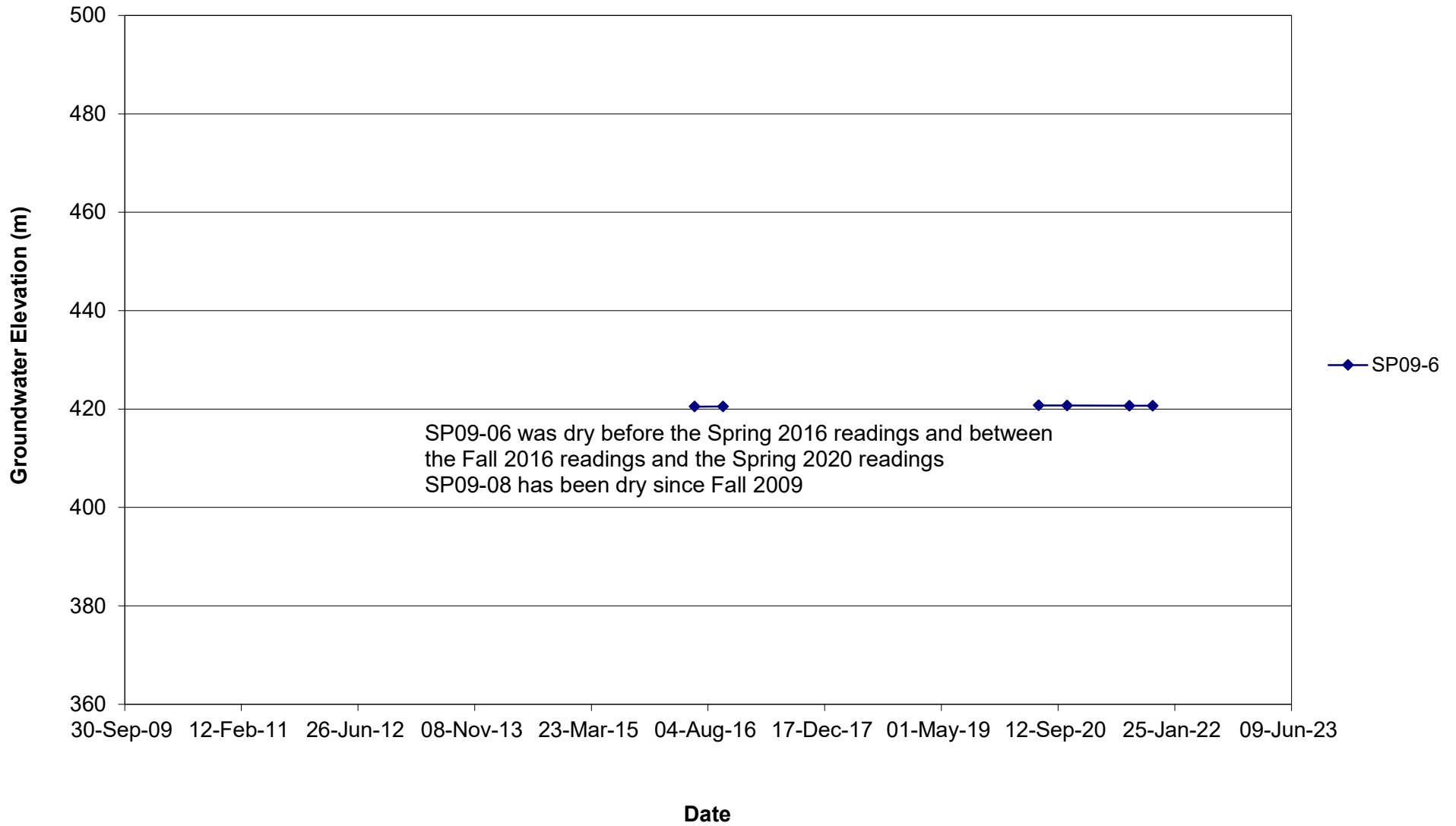
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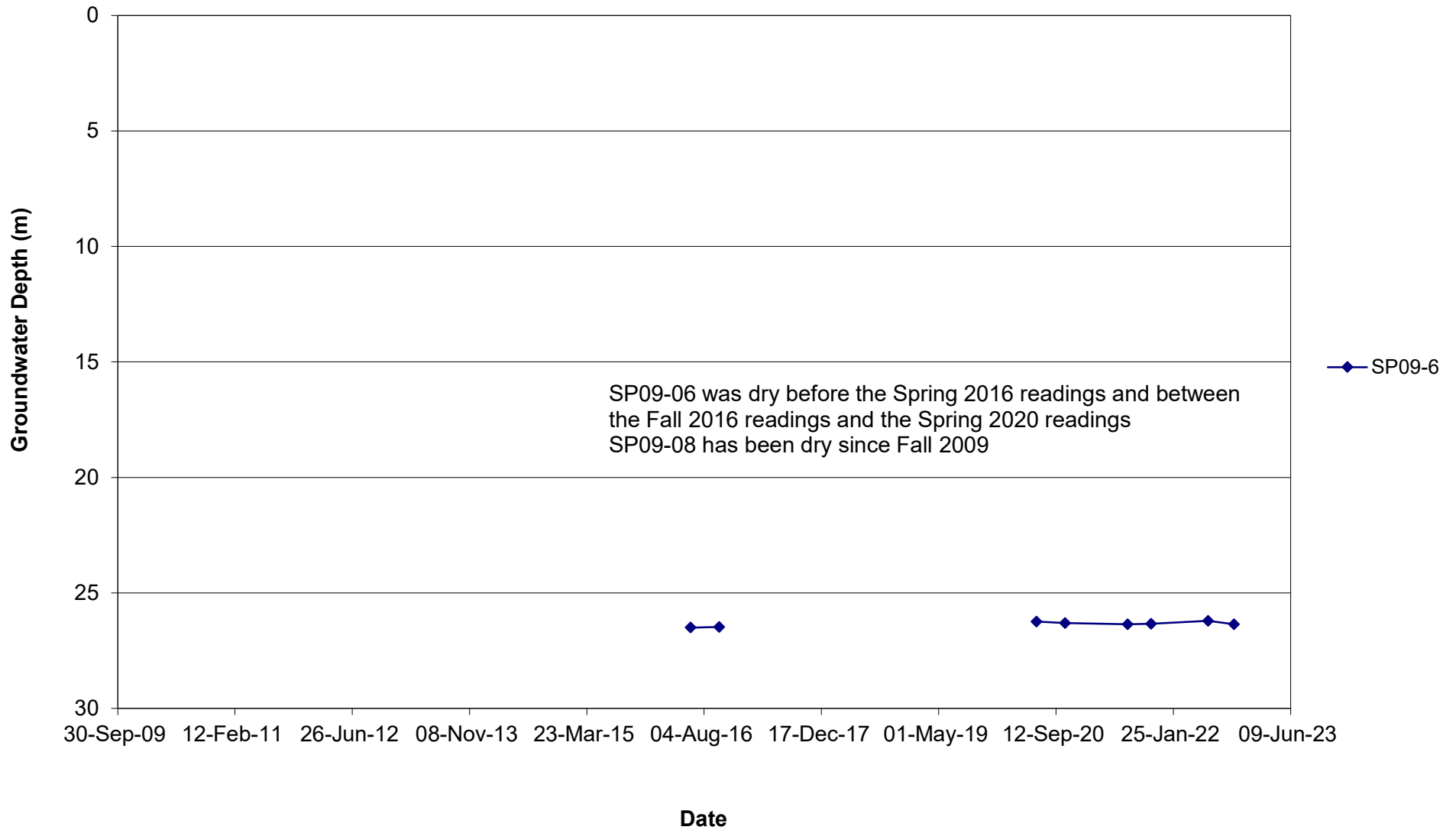
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Alberta Transportation

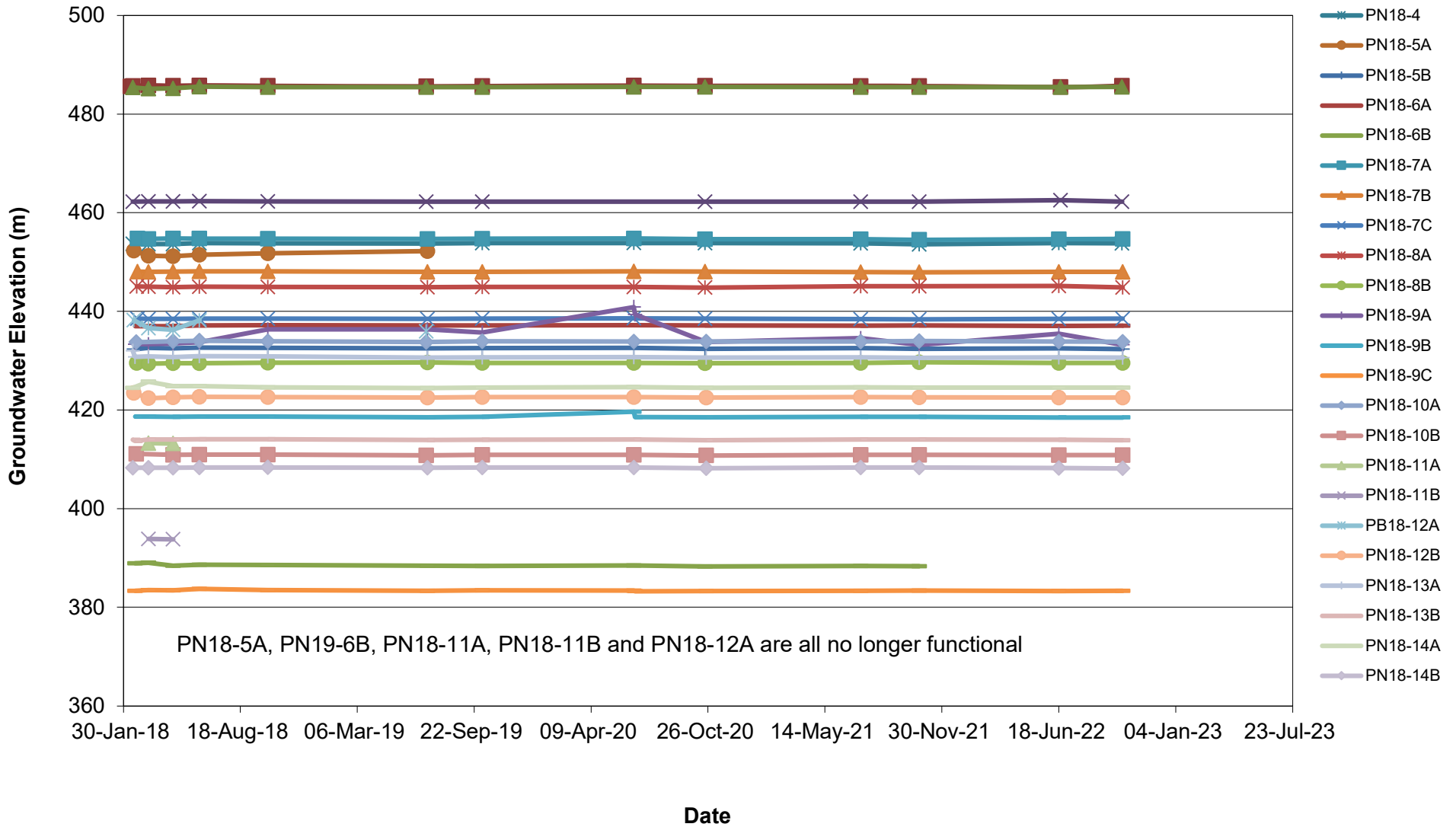
**FIGURE PH037-1  
PIEZOMETRIC ELEVATIONS FOR HWY 2:68, DUNVEGAN SOUTH  
2009 INSTRUMENTS**



**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**

