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Work Type: I&M
Originator Company: GEOCISA

C435 Farringdon Main Station

CRL Lead reviewer: [Redacted]
CRL Reviewer:

Monitoring Close-Out Report: Tiltmeters installed on West Wall on WTH site.

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This document has been reviewed by the following individual for coordination, compliance, integration and acceptance and is acceptable for transmission to the above stakeholder for the above stated purpose.

Sign: _____ Role: _____ Name: _____ Date: _____

Sign: _____ Role: _____ Name: _____ Date: _____

2b. Review by Stakeholder (if required):

Stakeholder Organisation	Job Title	Name	Signature	Date	Acceptance
					<input type="checkbox"/>
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					<input type="checkbox"/>

3. Acceptance by Crossrail:

compliance with their contractual obligations and does not constitute
ds or materials developed or selected by the designer/supplier.

[Redacted Signature]

18/11/2016

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A. INTRODUCTION

In line with the C122 – M&W Specification KX10 – Instrumentation & Monitoring C122-OVE-Z4-RSP-CR001-00007, this Close-Out Report aims to address the following points in relation to the instrumentation defined in Section B.

- Identify movements observed by the relevant instruments;
- Relate these movements to construction activities, where applicable;
- Identify trigger breaches that may have occurred;
- Demonstrate that the rate of change of the data is either in line with the required rate or such that residual risks are minimal;
- Identify any such residual risks should there be considered to be any.

Based on the above points, this close out report will provide justification for the decommissioning of the instruments.

B. INSTRUMENTS

B.1 Description of the Instruments

This Close-Out Report relates the tiltmeters installed on the Retaining wall west in WTH site, consisting of 13No biaxial tiltmeters (26 sensors). See Table 1 below with details.

Instrument	Easting (m)	Northing (m)	Elevation (mATD)
C430-EL00011	81902.242	36455.666	106.612
C430-EL00012	81902.242	36455.666	106.612
C430-EL00021	81900.764	36462.577	107.21
C430-EL00022	81900.764	36462.577	107.21
C430-EL00031	81900.692	36466.301	107.054
C430-EL00032	81900.692	36466.301	107.054
C430-EL00041	81899.571	36468.852	106.988
C430-EL00042	81899.571	36468.852	106.988
C430-EL00051	81899.341	36472.918	106.74
C430-EL00052	81899.341	36472.918	106.74
C430-EL00061	81898.214	36475.569	106.825
C430-EL00062	81898.214	36475.569	106.825
C430-EL00071	81898.001	36479.467	107.04
C430-EL00072	81898.001	36479.467	107.04
C430-EL00081	81896.48	36482.319	107.051
C430-EL00082	81896.48	36482.319	107.051
C430-EL00091	81895.322	36488.887	106.451
C430-EL00092	81895.322	36488.887	106.451
C430-EL00101	81894.161	36495.393	106.101
C430-EL00102	81894.161	36495.393	106.101
C430-EL00111	81893.555	36498.37	106.111
C430-EL00111	81893.555	36498.37	106.111
C430-EL00112	81892.201	36504.975	106.098

Instrument	Easting (m)	Northing (m)	Elevation (mATD)
C430-EL00121	81892.201	36504.975	106.098
C430-EL00122	81890.852	36511.563	106.246
C430-EL00131	81890.852	36511.563	106.246
C430-EL00132	81902.242	36455.666	106.612

Table 1: Details of the device installed on West Wall.

The tiltmeters installed on the retaining wall is shown in the following documents:

Drawings:

- MS64100-S-WTH-ELB-1. C430 Instrumentation & Monitoring.
- C435-BFK-C2-DWG-M123-50042. In ground devices installed for Farringdon Station.
- C435-BFK-C2-DWG-M123-50045. 3D Targets Installed for Farringdon Station.

Installation Report:

- C430-LOS-C-RGN-M123-50015. Installation Report-Asset Protection Inside Site Boundaries.

B.2 Location of the Instruments

The tiltmeters installed on the Retaining Wall is located on the plan below highlighted in yellow. The tiltmeters were installed by the C430.

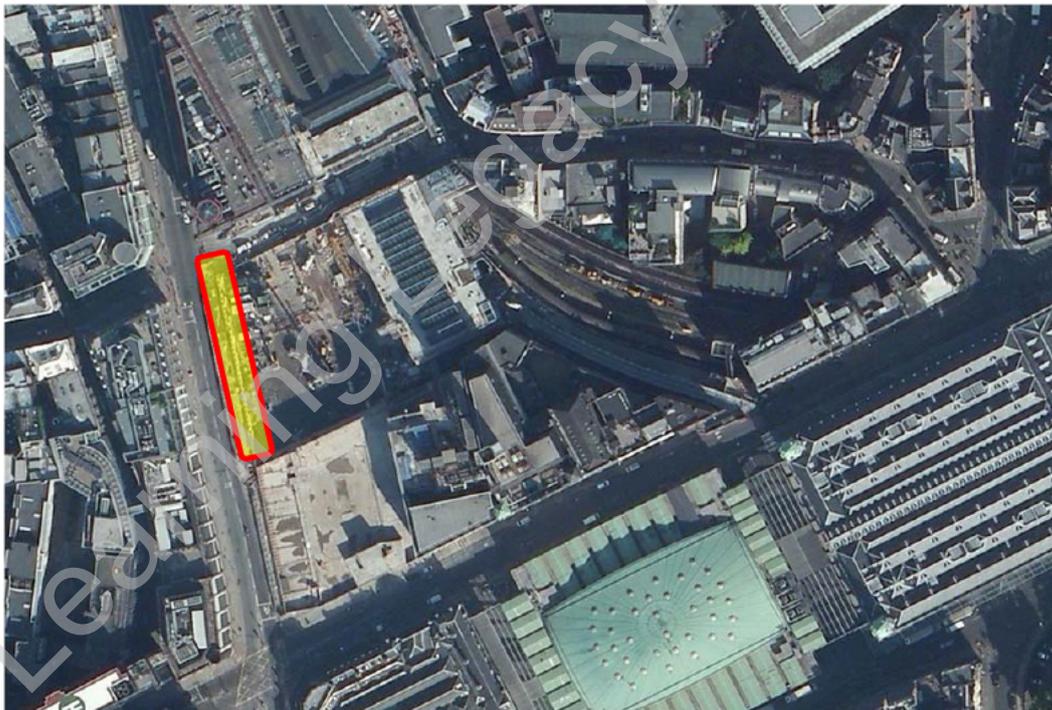


Figure 1 – Plan showing the Location for the Tiltmeters.

C. MOVEMENTS

C.1 Movements Resulting from Construction Activities

C.1.1 Relevant Crossrail (BFK) Works

The construction activities affecting these instruments are outlined in the Table 2 below.

Activity	Start Date	End Date
SHW-2 Excavation	08-05-2012	30-04-2013
WB TBM	10-09-2013	18-09-2013
EB TBM	14-12-2013	17-12-2013
STW3	05-01-2014	14-01-2014
STW1	24-04-2014	06-04-2014

Table 2 – Construction Activities associated to the Tiltmeters.

C.1.2 Resulting Movements

To analyse the result for the tiltmeters will be looked by groups:

- From C430-EL00011 to C430-EL00032.
- From C430-EL00041 to C430-EL00062.
- From C430-EL00071 to C430-EL00092.
- From C430-EL00101 to C430-EL00112.
- From C430-EL00121 to C430-EL00132.

The installation for the prisms to replace the defunct tiltmeters was done once the all tunnels and shaft construction were finished. The only movement that the prisms captured was the knocks during the works carried out on the retaining wall. The graphs for the prisms is shown in Appendix A looked by groups of arches.

1. From C430-EL00011 to C430-EL00032.

The monitoring data for these tiltmeters is shown in Appendix B.

- Less than 1mm/m caused by the WB TBM from 10-09-2013 to 18-09-2013 in A direction.
- Residual movement captured by C430-EL00011 caused 1mm/m of horizontal movement in A direction.
- No movement captured by the EB TBM from 14-12-2013 to 17-12-2013.
- STW3 caused maximum horizontal movement 2mm/m from 05-01-2014 to 14-01-2014 in B direction.
- Less than 1mm captured by the sensors during the STW1 construction from 06-04-2014 to 26-04-2014.
- Maximum horizontal movement -2mm/m in A and B direction.

2. From C430-EL00041 to C430-EL00062.

The monitoring data for these tiltmeters is shown in Appendix B.

- WB TBM caused maximum +1mm/m in A direction from 10-09-2013 to 18-09-2013.
- No movement during EB TBM.
- No movement during STW3 excavation.
- No movement during STW1 excavation.
- Maximum horizontal movement +1mm/m in A direction.

3. From C430-EL00071 to C430-EL00092.

The monitoring data for these tiltmeters is shown in Appendix B.

- WB TBM caused maximum -1mm/m in B direction from 10-09-2013 to 18-09-2013.
- EB TBM caused maximum -1mm/m in B direction from 14-12-2013 to 17-12-2013.
- No horizontal displacement during STW3 works.
- No movements during STW1 construction.
- Maximum horizontal displacement -1mm/m in B direction.

4. From C430-EL00101 to C430-EL00112.

The monitoring data for these tiltmeters is shown in Appendix B.

- WB TBM caused maximum 3mm/m in A direction from 10-09-2013 to 18-09-2013.
- EB TBM caused maximum 2mm/m in B direction from 14-12-2013 to 17-12-2013.
- No movement during the STW3 construction.
- No movement during the STW1 construction.
- Maximum horizontal displacement 3mm/m in A direction.

5. From C430-EL00121 to C430-EL00132.

The monitoring data for these tiltmeters is shown in Appendix B.

- WB TBM caused maximum 1mm/m in A direction from 10-09-2014 to 18-09-2014.
- No movement caused by EB TBM.
- No horizontal displacement captured during the STW3 construction.
- No movement captured by the tiltmeters during STW works.
- Maximum horizontal displacement 1.5mm/m.

C.2 Trigger Breaches

The Instrumentation and Monitoring Plan: Farringdon Station Ground Movement and Asset Protection C122-OVE-C2-RGN-M123-50013 outlines the triggers associated with the devices. No triggers have been defined for the instrument included in this report.

The Table 3 below shows the default alerts breached and Table 4 below with the default alerts breached by the prisms.

MONITORING GROUP (Location)	POINT ID	TYPE	DIRECTION	DATE OF LAST READING	LAST READING VALUE (mm)	TRIGGER LEVEL	
						WORST HISTORICAL STATUS	CURRENT STATUS
Retaining Wall.	C430-TU00011	TILTMETERS	HORIZONTAL DISPLACEMENT	28/08/2014 12:57	4.043	Clear	Clear
	C430-TU00012	TILTMETERS	HORIZONTAL DISPLACEMENT	28/08/2014 12:57	-0.288	Clear	Clear
	C430-TU00021	TILTMETERS	HORIZONTAL DISPLACEMENT	27/08/2014 22:48	-9.015	Default Alert	Clear
	C430-TU00022	TILTMETERS	HORIZONTAL DISPLACEMENT	27/08/2014 22:48	-0.792	Clear	Clear
	C430-TU00031	TILTMETERS	HORIZONTAL DISPLACEMENT	05/07/2014 11:14	-19.915	Default Alert	Default Alert
	C430-TU00032	TILTMETERS	HORIZONTAL DISPLACEMENT	27/08/2014 22:51	-1.96	Default Alert	Clear
	C430-TU00041	TILTMETERS	HORIZONTAL DISPLACEMENT	03/05/2013 13:13	0	Clear	Clear
	C430-TU00042	TILTMETERS	HORIZONTAL DISPLACEMENT	03/05/2013 13:12	13.701	Clear	Clear
	C430-TU00051	TILTMETERS	HORIZONTAL DISPLACEMENT	25/08/2014 05:04	16.321	Default Alert	Default Alert
	C430-TU00052	TILTMETERS	HORIZONTAL DISPLACEMENT	25/08/2014 05:04	1.529	Clear	Clear
	C430-TU00061	TILTMETERS	HORIZONTAL DISPLACEMENT	26/08/2014 09:53	-1.943	Default Alert	Clear
	C430-TU00062	TILTMETERS	HORIZONTAL DISPLACEMENT	25/08/2014 23:30	-6.263	Default Alert	Clear
	C430-TU00071	TILTMETERS	HORIZONTAL DISPLACEMENT	25/08/2014 05:04	-0.279	Clear	Clear
	C430-TU00072	TILTMETERS	HORIZONTAL DISPLACEMENT	25/08/2014 05:04	4.035	Default Alert	Clear
	C430-TU00081	TILTMETERS	HORIZONTAL DISPLACEMENT	25/08/2014 05:04	0.392	Clear	Clear
	C430-TU00082	TILTMETERS	HORIZONTAL DISPLACEMENT	25/08/2014 05:04	-2.272	Clear	Clear
	C430-TU00091	TILTMETERS	HORIZONTAL DISPLACEMENT	25/08/2014 10:56	-1.128	Clear	Clear
	C430-TU00092	TILTMETERS	HORIZONTAL DISPLACEMENT	25/08/2014 05:04	-5.34	Clear	Clear
	C430-TU00101	TILTMETERS	HORIZONTAL DISPLACEMENT	08/08/2014 11:13	-1.484	Clear	Clear
	C430-TU00102	TILTMETERS	HORIZONTAL DISPLACEMENT	08/08/2014 11:13	-1.605	Default Alert	Clear
	C430-TU00111	TILTMETERS	HORIZONTAL DISPLACEMENT	08/08/2014 12:24	-3.81	Default Alert	Clear
	C430-TU00112	TILTMETERS	HORIZONTAL DISPLACEMENT	08/08/2014 12:24	4.309	Default Alert	Clear
	C430-TU00121	TILTMETERS	HORIZONTAL DISPLACEMENT	07/04/2014 14:15	-7.74	Default Alert	Clear
	C430-TU00122	TILTMETERS	HORIZONTAL DISPLACEMENT	07/04/2014 14:15	-1.078	Clear	Clear
C430-TU00131	TILTMETERS	HORIZONTAL DISPLACEMENT	07/04/2014 14:15	-1.55	Clear	Clear	
C430-TU00132	TILTMETERS	HORIZONTAL DISPLACEMENT	07/04/2014 14:15	0.452	Clear	Clear	

Table 3 – Default alerts breached by the tiltmeters.

MONITORING GROUP (Location)	POINT ID	TYPE	DIRECTION	DATE OF LAST READING	LAST READING VALUE (mm)	TRIGGER LEVEL	
						WORST HISTORICAL STATUS	CURRENT STATUS
Farringdon Rd Retaining Wall	C435-RP052512	AUTOMATIC RP	Z	11/09/2015 02:00	-1.8	Clear	Clear
	C435-RP052522	AUTOMATIC RP	Z	25/05/2015 16:00	-1.9	Clear	Clear
	C435-RP052532	AUTOMATIC RP	Z	11/09/2015 02:00	-0.7	Clear	Clear
	C435-RP052552	AUTOMATIC RP	Z	11/09/2015 02:00	-0.6	Clear	Clear
	C435-RP052562	AUTOMATIC RP	Z	11/09/2015 05:00	1.5	Clear	Clear
	C435-RP052572	AUTOMATIC RP	Z	03/07/2015 10:00	-3	Clear	Clear
	C435-RP052582	AUTOMATIC RP	Z	11/09/2015 03:00	2.6	Clear	Clear
	C435-RP052592	AUTOMATIC RP	Z	11/09/2015 03:00	-2	Clear	Clear
	C435-RP052612	AUTOMATIC RP	Z	11/09/2015 05:00	-1.7	Clear	Clear
	C435-RP052622	AUTOMATIC RP	Z	01/06/2015 08:00	-2	Clear	Clear
	C435-RP052632	AUTOMATIC RP	Z	11/09/2015 05:00	-5.5	Clear	Clear
	C435-RP052642	AUTOMATIC RP	Z	11/09/2015 09:00	-1.3	Clear	Clear
	C435-RP052652	AUTOMATIC RP	Z	11/09/2015 09:00	3.7	Clear	Clear
	C435-RP052672	AUTOMATIC RP	Z	22/08/2015 08:00	-6.3	Clear	Clear
	C435-RP052682	AUTOMATIC RP	Z	28/06/2015 07:00	-0.6	Clear	Clear
	C435-RP052692	AUTOMATIC RP	Z	11/09/2015 09:00	-4.7	Clear	Clear
	C435-RP052702	AUTOMATIC RP	Z	16/07/2015 19:00	-3.4	Clear	Clear
	C435-RP052712	AUTOMATIC RP	Z	16/07/2015 19:00	-6.5	Clear	Clear
	C435-RP052722	AUTOMATIC RP	Z	11/09/2015 09:00	2.2	Clear	Clear
	C435-RP052732	AUTOMATIC RP	Z	11/09/2015 09:00	-6.4	Clear	Clear
	C435-RP052742	AUTOMATIC RP	Z	11/09/2015 09:00	1.5	Clear	Clear
	C435-RP052752	AUTOMATIC RP	Z	11/09/2015 09:00	-6.3	Clear	Clear
	C435-RP052762	AUTOMATIC RP	Z	11/09/2015 09:00	-6.1	Clear	Clear
	C435-RP052772	AUTOMATIC RP	Z	11/09/2015 09:00	-2.2	Clear	Clear
	C435-RP052792	AUTOMATIC RP	Z	11/09/2015 09:00	-4.1	Clear	Clear
	C435-RP052802	AUTOMATIC RP	Z	24/03/2015 09:00	0	Clear	Clear
	C435-RP052812	AUTOMATIC RP	Z	11/09/2015 09:00	-2.4	Clear	Clear
	C435-RP052822	AUTOMATIC RP	Z	11/09/2015 09:00	-3.9	Clear	Clear
	C435-RP052832	AUTOMATIC RP	Z	11/09/2015 09:00	-5.2	Clear	Clear
	C435-RP052842	AUTOMATIC RP	Z	25/05/2015 09:00	-4	Clear	Clear
	C435-RP052852	AUTOMATIC RP	Z	11/09/2015 10:00	-4.4	Clear	Clear
	C435-RP052882	AUTOMATIC RP	Z	11/09/2015 10:00	-13.6	Default Alert	Default Alert
	C435-RP052902	AUTOMATIC RP	Z	02/06/2015 10:00	4.5	Clear	Clear
	C435-RP052432	AUTOMATIC RP	Z	11/09/2015 10:00	-0.1	Clear	Clear
	C435-RP052442	AUTOMATIC RP	Z	11/09/2015 10:00	-0.8	Clear	Clear
	C435-RP052452	AUTOMATIC RP	Z	11/09/2015 06:00	-0.8	Clear	Clear
	C435-RP052462	AUTOMATIC RP	Z	11/09/2015 06:00	-2.8	Clear	Clear
	C435-RP052372	AUTOMATIC RP	Z	10/12/2015 19:00	-1.7	Clear	Clear
	C435-RP052382	AUTOMATIC RP	Z	08/06/2015 09:00	-7.1	Clear	Clear
	C435-RP052392	AUTOMATIC RP	Z	20/09/2015 08:00	-3.4	Clear	Clear
C435-RP052402	AUTOMATIC RP	Z	11/09/2015 10:00	13.2	Default Alert	Default Alert	
C435-RP052412	AUTOMATIC RP	Z	11/09/2015 06:00	-2.3	Clear	Clear	

Table 4 – Default alerts breached by the Prisms.

C.3 Significant Issues with the Instrumentation

These tiltmeters were affected by several issues. These issues were reporting in the following document:

- C435-NCR-001621. Western Ticket Hall Retaining Wall Tiltmeters.

See the Table 5 below with the prisms installed to replace the defunct Tiltmeters.

Instrument	Easting (m)	Northing (m)	Elevation (mATD)
C435-RP05251	81901.9563	36457.2503	109.4322
C435-RP05252	81902.3559	36455.3726	106.9241
C435-RP05253	81902.2667	36455.7338	109.3409
C435-RP05255	81901.6176	36458.9548	108.9875
C435-RP05256	81901.0165	36461.9696	107.2649
C435-RP05257	81900.9737	36462.1078	109.0047
C435-RP05258	81901.2874	36460.5719	109.3336
C435-RP05259	81900.6463	36463.7258	109.4374
C435-RP05261	81900.2997	36465.4637	109.0146
C435-RP05262	81899.6681	36468.6789	107.1611
C435-RP05263	81899.6689	36468.6074	108.9875
C435-RP05264	81899.9740	36467.0641	109.4769
C435-RP05265	81899.3131	36470.3606	109.5151
C435-RP05267	81899.0081	36471.8860	109.2508
C435-RP05268	81898.3073	36475.4083	106.9385
C435-RP05269	81898.3157	36475.3334	109.3789
C435-RP05270	81898.6390	36473.7279	109.5244
C435-RP05271	81898.0123	36476.8267	109.6686
C435-RP05272	81897.6925	36478.4833	106.7053
C435-RP05273	81897.6746	36478.5372	109.4118
C435-RP05274	81897.0097	36481.8377	106.9411
C435-RP05275	81896.9898	36481.9060	109.3174
C435-RP05276	81897.3410	36480.1530	109.7328
C435-RP05277	81896.6697	36483.4531	109.7892
C435-RP05279	81896.3337	36485.0975	109.3783
C435-RP05280	81895.6469	36488.4606	107.4262
C435-RP05281	81895.6410	36488.4697	109.5662
C435-RP05282	81896.0292	36486.5968	109.7349
C435-RP05283	81895.3233	36490.0412	109.8121
C435-RP05284	81895.0539	36491.6964	107.4125
C435-RP05285	81894.9569	36491.8084	109.4866
C435-RP05288	81894.6339	36493.4014	109.8575
C435-RP05290	81893.6478	36498.2817	106.8956
C435-RP05243	81892.5949	36503.3175	109.9686

Instrument	Easting (m)	Northing (m)	Elevation (mATD)
C435-RP05244	81892.9580	36501.5877	107.3000
C435-RP05245	81892.9791	36501.4571	108.9786
C435-RP05246	81893.3253	36499.7566	109.9234
C435-RP05237	81891.2193	36509.9579	110.0314
C435-RP05238	81891.6010	36508.1435	107.2315
C435-RP05239	81891.5995	36508.1377	108.8355
C435-RP05240	81891.8958	36506.7086	109.9800
C435-RP05241	81892.3281	36504.6257	109.1637

Table 5. Prisms installed to replace the defunct Tiltmeters

C.4 Residual Risks

The last measurement carried out for this device (Tiltmeters) on 27-08-2014.

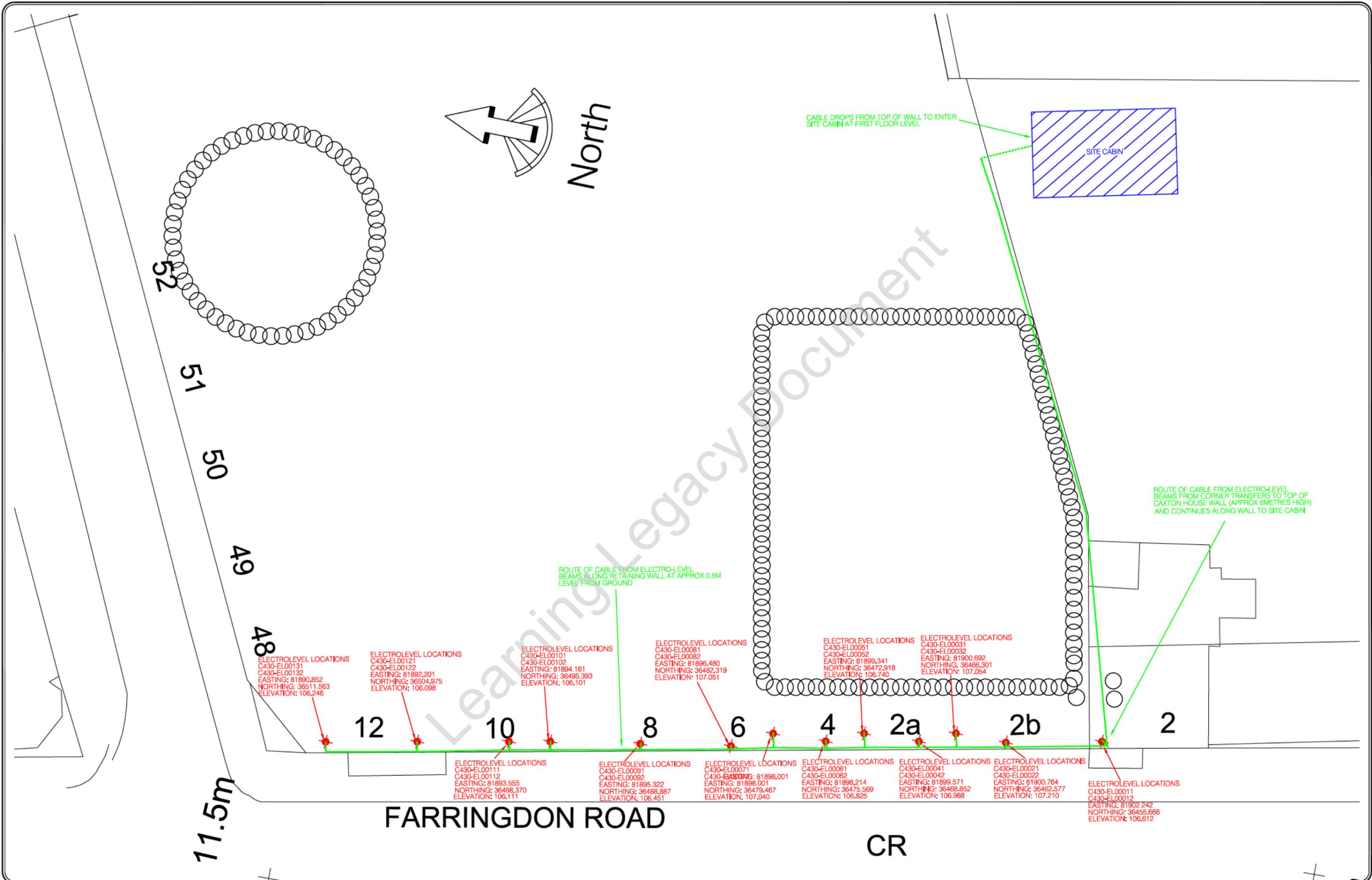
The last measurement carried out for the prisms on 11-09-2015

D. CONCLUSIONS

No triggers breached, monitoring stable. No residual risks remain.

APPENDIX A: DRAWINGS

Learning Legacy Document



ROUTE OF CABLE FROM ELECTRO-LEVEL BEAMS ALONG RETAINING WALL AT APPROX 0.5M LEVEL FROM GROUND

CABLE DROPS FROM TOP OF WALL TO ENTER SITE CABIN AT FIRST FLOOR LEVEL

ROUTE OF CABLE FROM ELECTRO-LEVEL BEAMS FROM CORNER TRANSFERS TO TOP OF CAXTON HOUSE WALL (APPROX 6METRES HIGH) AND CONTINUES ALONG WALL TO SITE CABIN

ELECTROLEVEL LOCATIONS
C430-EL00131
C430-EL00132
EASTING: 81890.852
NORTHING: 36511.563
ELEVATION: 106.246

ELECTROLEVEL LOCATIONS
C430-EL00121
C430-EL00122
EASTING: 81892.201
NORTHING: 36504.975
ELEVATION: 106.098

ELECTROLEVEL LOCATIONS
C430-EL00101
C430-EL00102
EASTING: 81894.161
NORTHING: 36495.393
ELEVATION: 106.101

ELECTROLEVEL LOCATIONS
C430-EL00081
C430-EL00082
EASTING: 81896.480
NORTHING: 36482.319
ELEVATION: 107.051

ELECTROLEVEL LOCATIONS
C430-EL00051
C430-EL00052
EASTING: 81899.341
NORTHING: 36472.918
ELEVATION: 106.740

ELECTROLEVEL LOCATIONS
C430-EL00031
C430-EL00032
EASTING: 81900.692
NORTHING: 36466.301
ELEVATION: 107.054

ELECTROLEVEL LOCATIONS
C430-EL00111
C430-EL00112
EASTING: 81893.555
NORTHING: 36498.370
ELEVATION: 106.111

ELECTROLEVEL LOCATIONS
C430-EL00091
C430-EL00092
EASTING: 81895.322
NORTHING: 36488.887
ELEVATION: 106.451

ELECTROLEVEL LOCATIONS
C430-EL00071
C430-EL00072
EASTING: 81898.001
NORTHING: 36479.467
ELEVATION: 107.040

ELECTROLEVEL LOCATIONS
C430-EL00061
C430-EL00062
EASTING: 81898.214
NORTHING: 36475.569
ELEVATION: 106.825

ELECTROLEVEL LOCATIONS
C430-EL00041
C430-EL00042
EASTING: 81899.571
NORTHING: 36468.852
ELEVATION: 106.988

ELECTROLEVEL LOCATIONS
C430-EL00021
C430-EL00022
EASTING: 81900.764
NORTHING: 36462.577
ELEVATION: 107.210

ELECTROLEVEL LOCATIONS
C430-EL00011
C430-EL00012
EASTING: 81902.242
NORTHING: 36455.666
ELEVATION: 106.612

FARRINGDON ROAD

CR

11.5m

52

51

50

49

48

12

10

8

6

4

2a

2b

2

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Phone: (+353) 21 4892704 Fax: (+353) 21 4368230
Email: cork@murphysurveys.ie

LEGEND

- Electro Level Beam Location Installed Vertically on Brick Retaining Walls
- Cable route of Electrolevel Beams to Site Cabin to Database Computers

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Drawn by: MSB Date: June 2012
Checked by: JCS Date: 20/07/12
Checked by: JCS Date: 09/08/12

Scale: 1:250 @ A3

Project: LAING O ROURKE STRABAG JOINT VENTURE

Client: LAING O ROURKE STRABAG JOINT VENTURE

Project: C430 - Instrumentation & Monitoring

Date: 03/08/2012 Scale: 1:250 @ A3

Description: ELECTROLEVEL BEAMS - WTH

Drawing Number: MSL4100-S-WTH-ELB-1

GEODATA

murphy
GLOBAL CONSULTING SURVEYORS

London Belfast Kildare Cork



Rev.	Date	Description	By	Chkd	App	Auth

Notes:

CROSSRAIL
BFK
Geocisa
 C/ Los Llanos de Jerez 10-12
 28823- MADRID
 www.geocisa.com

Contract : BORED TUNNELS (ALIGNMENT AND TRACK)		By :
Originator : OVE ARUP & PARTNERS LIMITED		Chk :
Location : CROSSRAIL GENERAL		App :
Title : IN GROUND DEVICES INSTALLED FOR FARRINGDON STATION		Auth :
Drg No : C435-BFK-C2-DWG-M123-50042	Rev :	Sult :
		Auth : Geocisa

\$Pby\$



Rev.	Date	Description	By	Chkd	App	Auth

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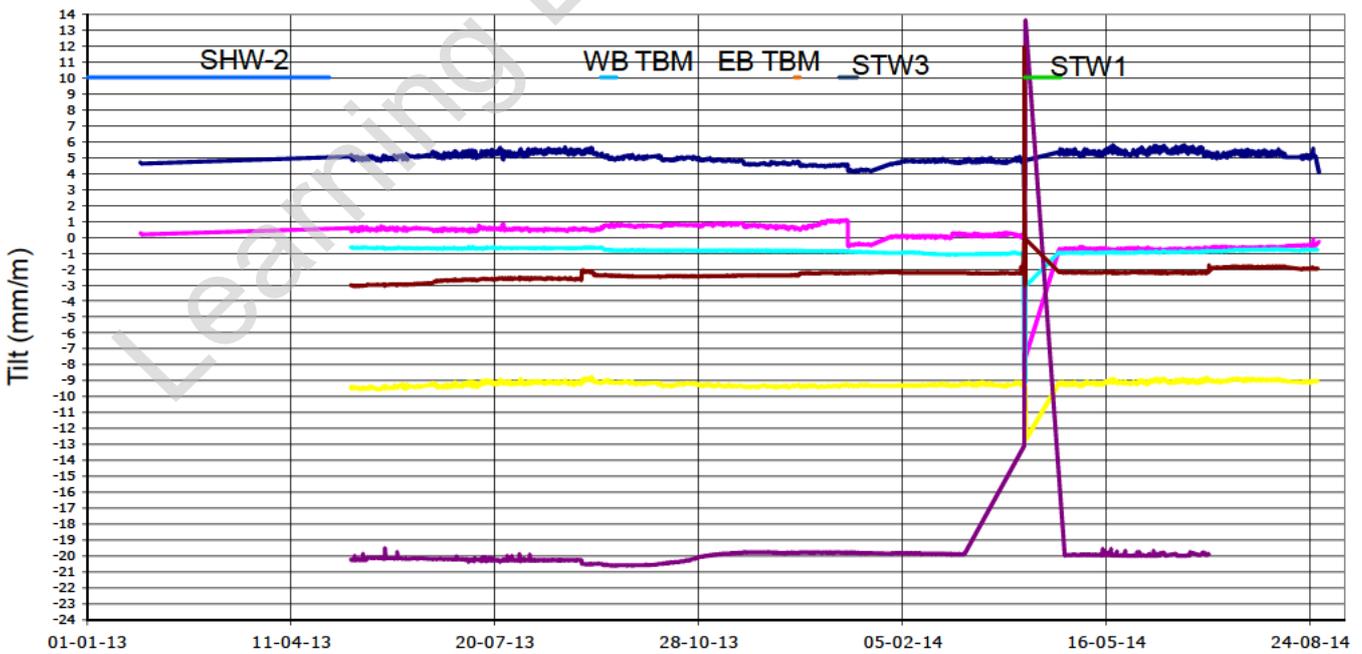
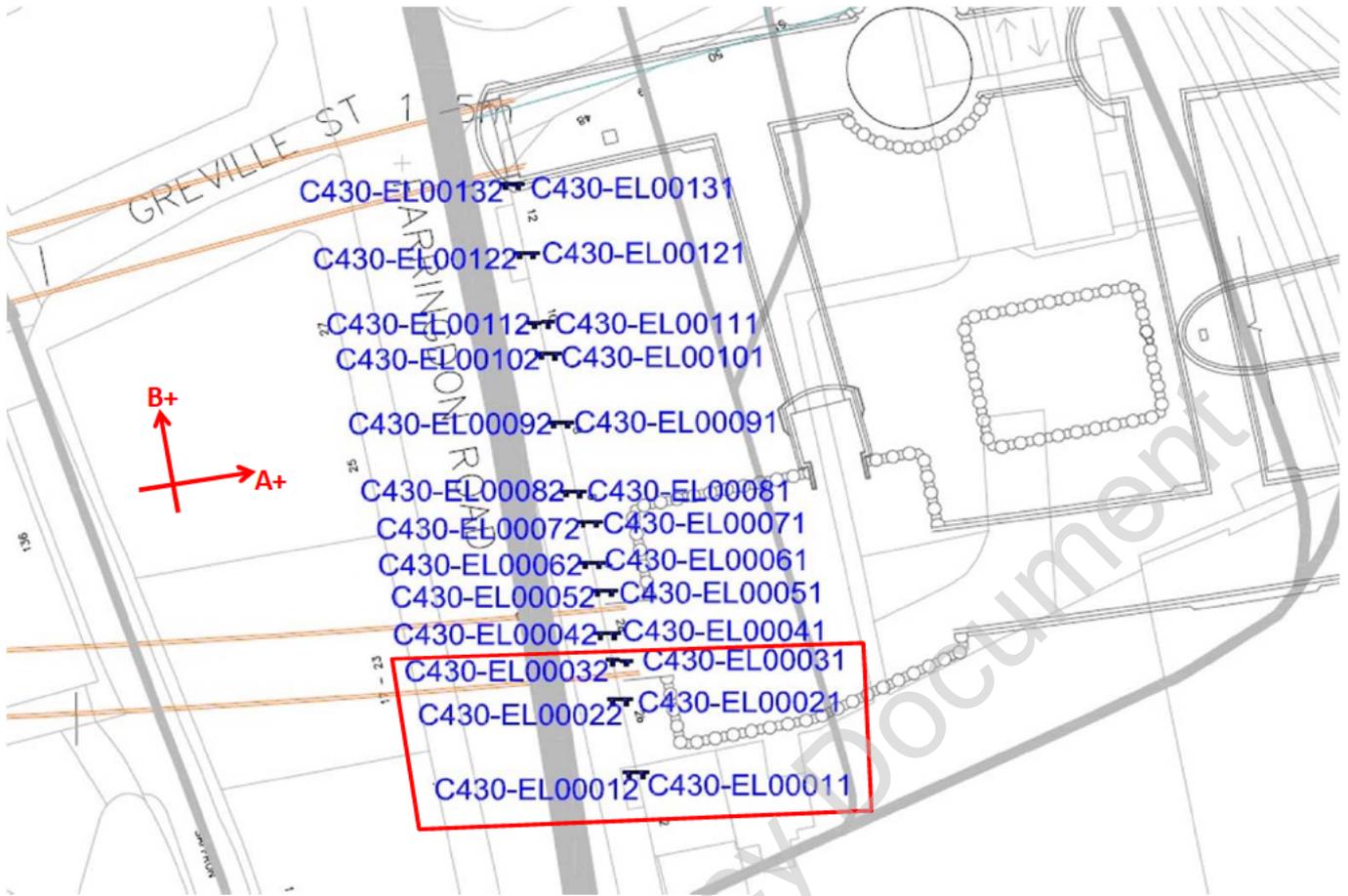
GEOCISA
C/ Los Llanos de Jerez 10-12
28823- MADRID
www.geocisa.com

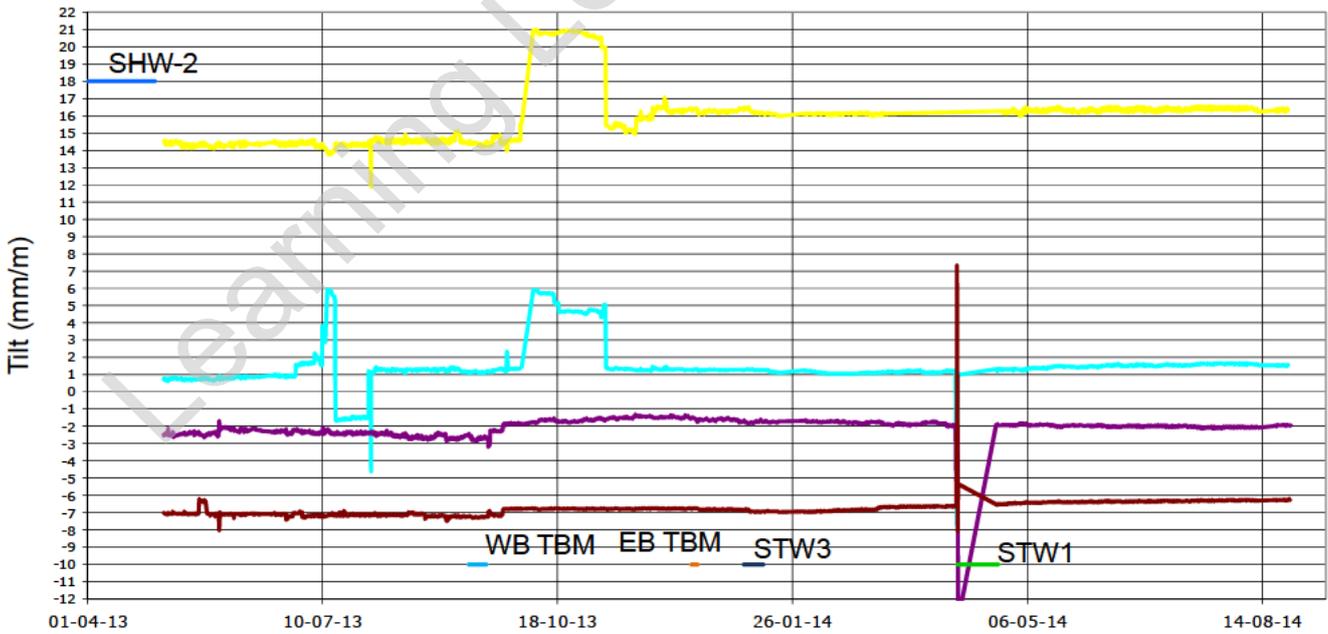
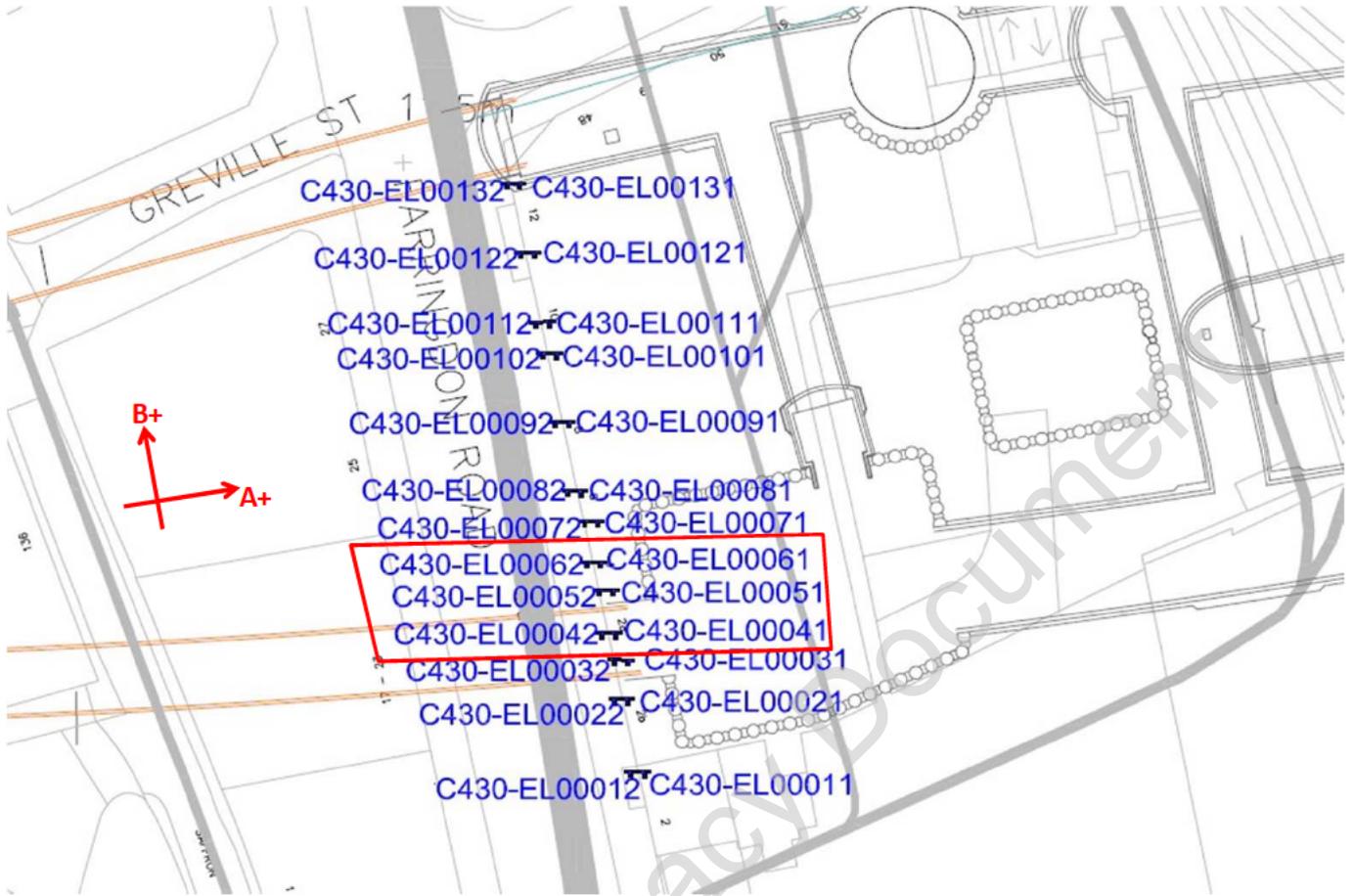
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Rev :	
Sult :	
Auth :	

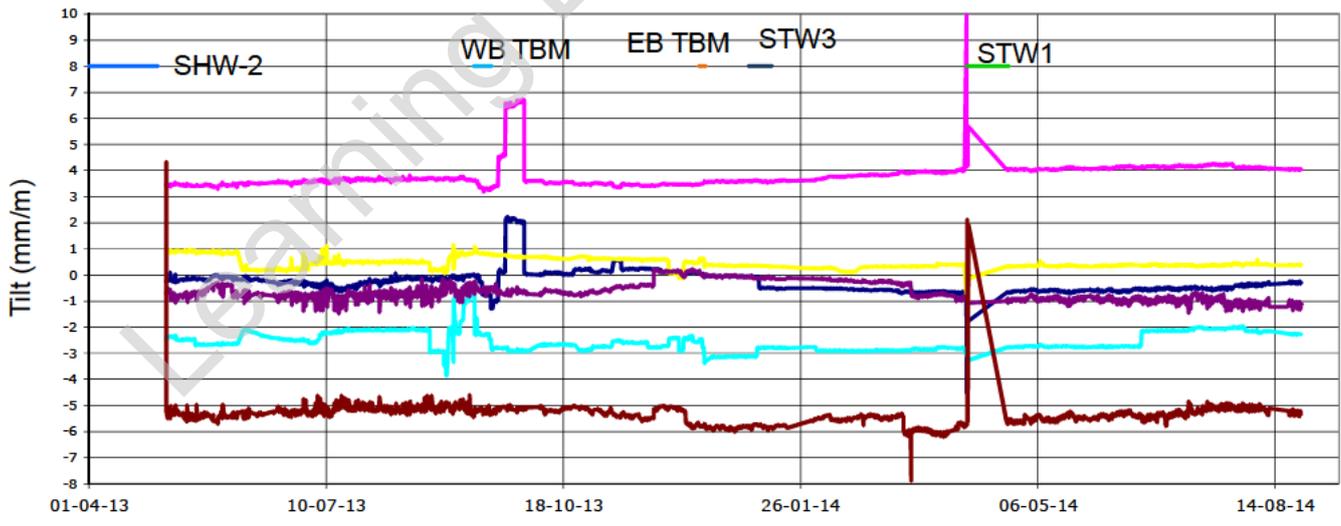
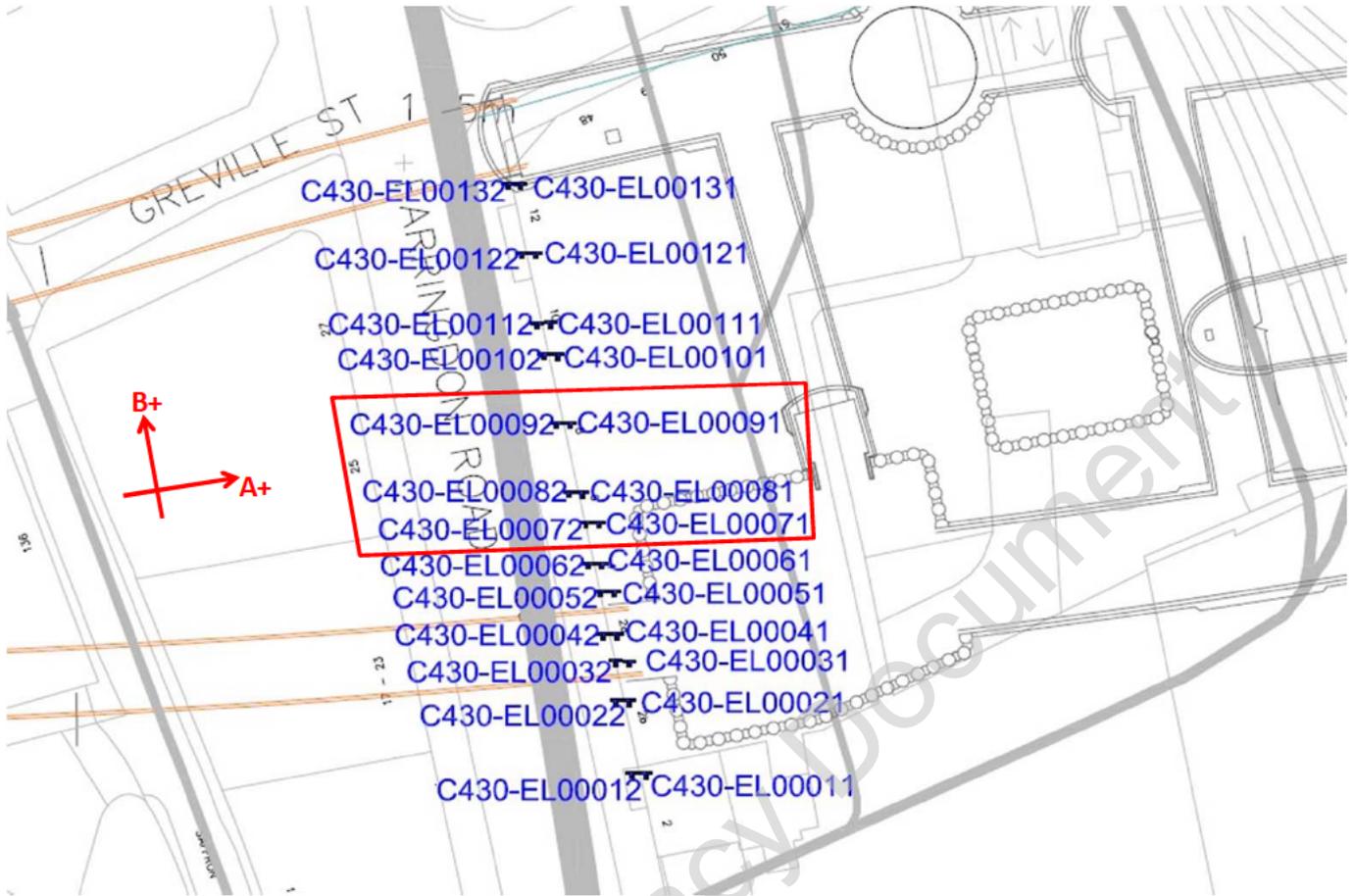
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APPENDIX B: GRAPHS

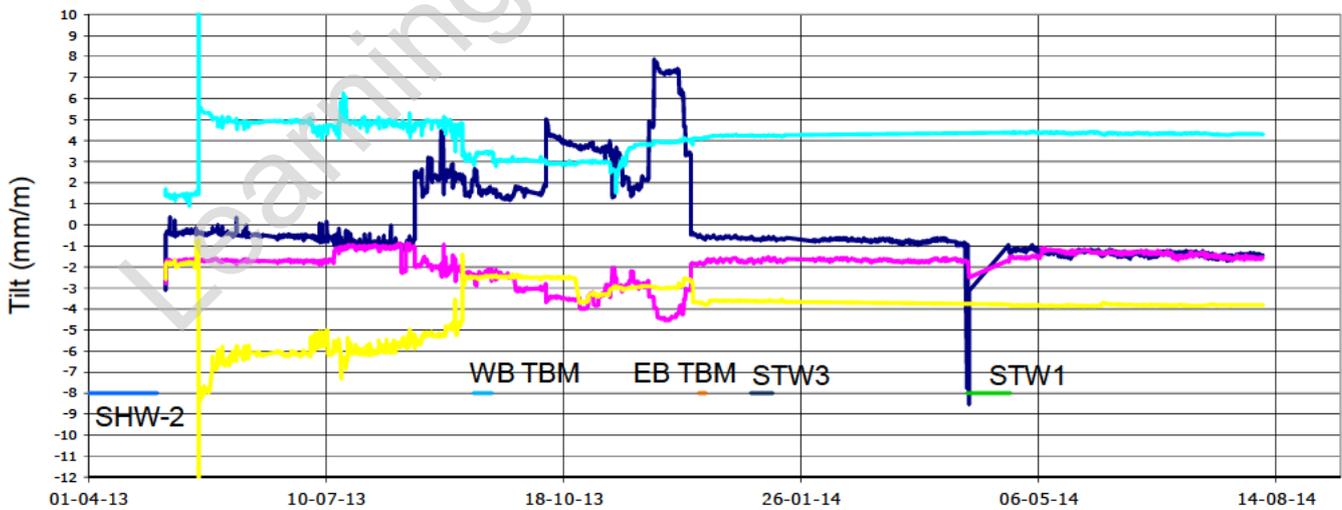
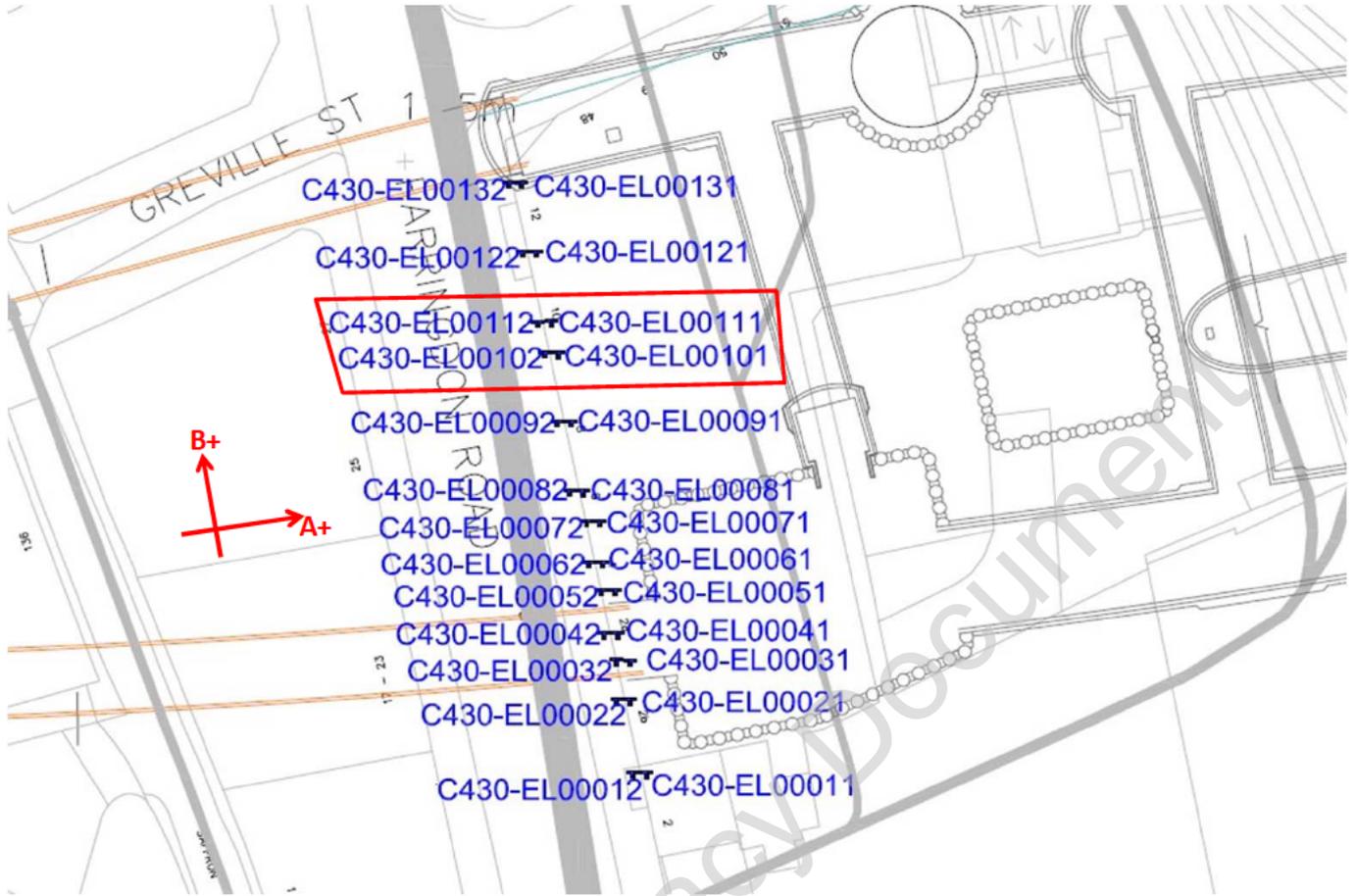
Learning Legacy Document

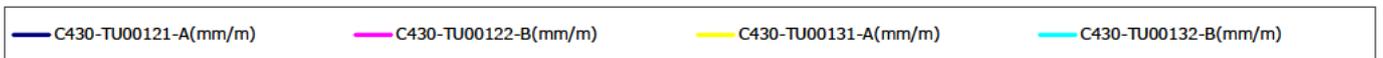
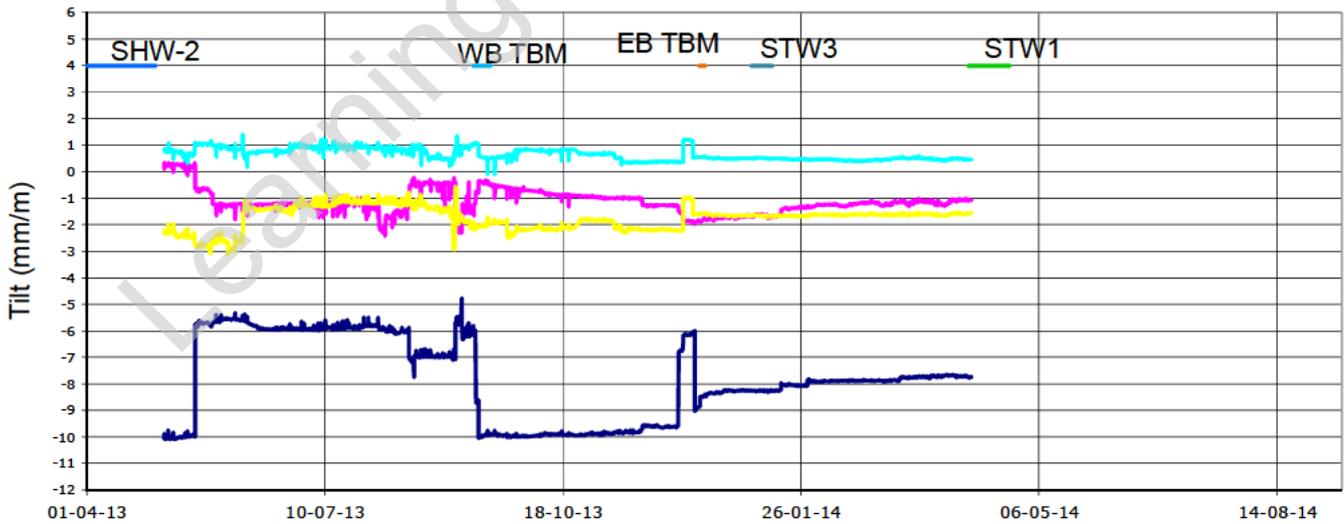
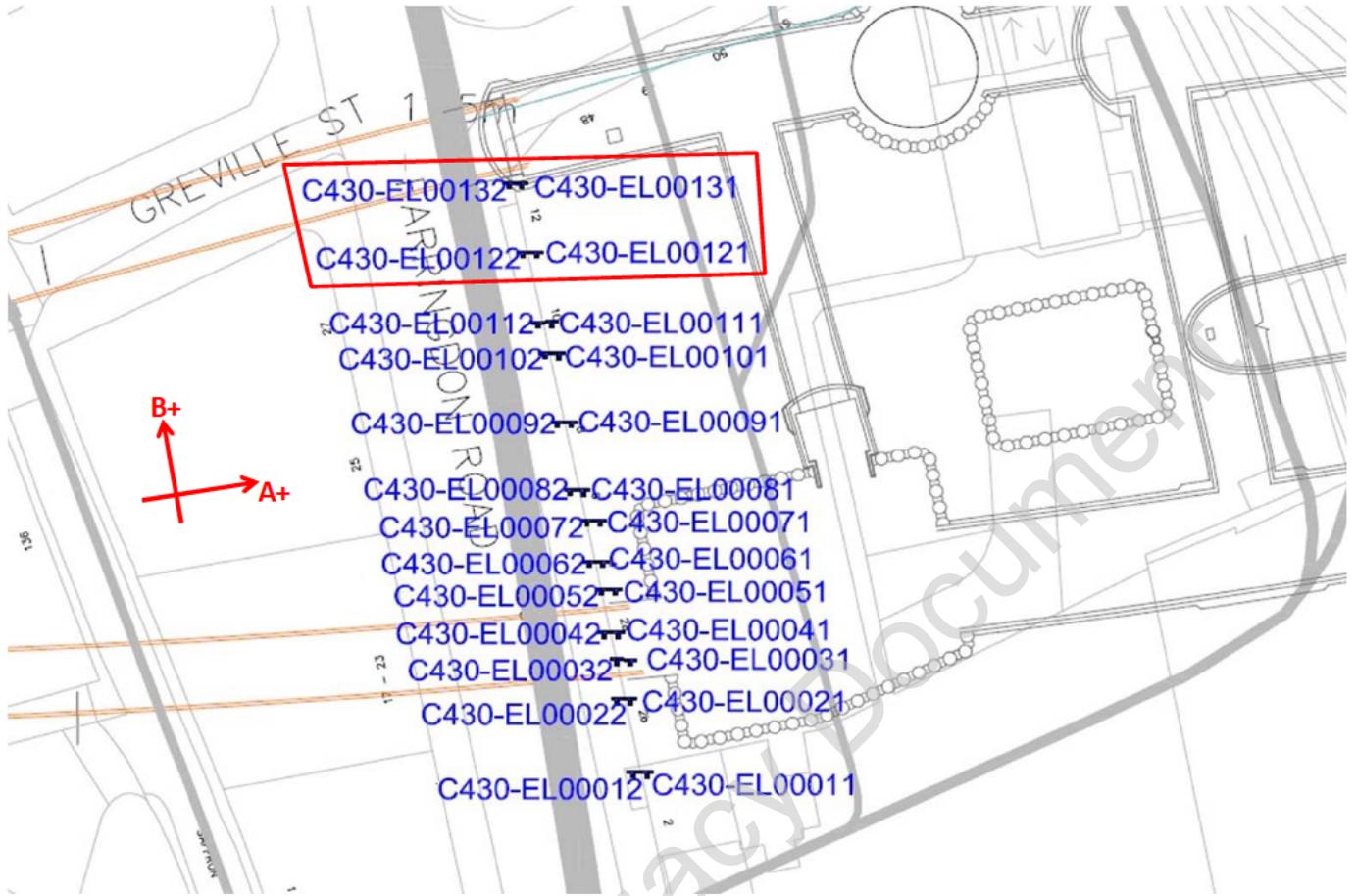




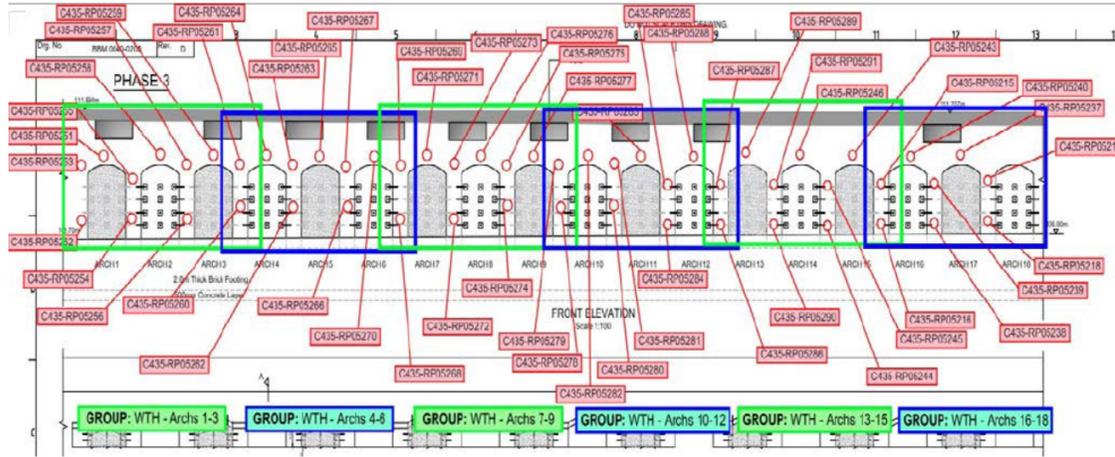


— C430-TU00071-A(mm/m)	— C430-TU00072-B(mm/m)	— C430-TU00081-A(mm/m)
— C430-TU00082-B(mm/m)	— C430-TU00091-A(mm/m)	— C430-TU00092-B(mm/m)

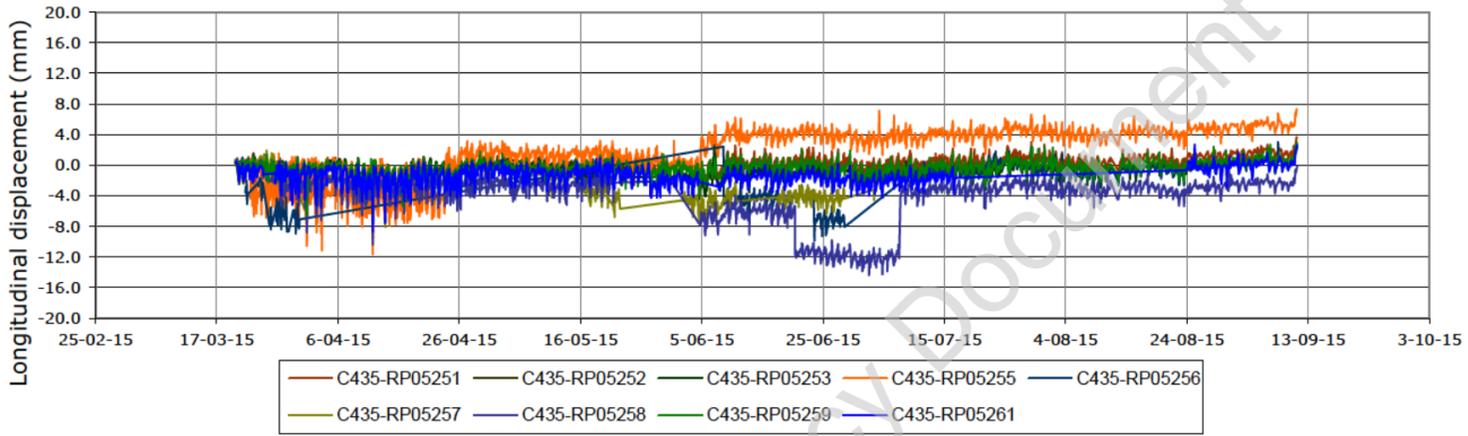




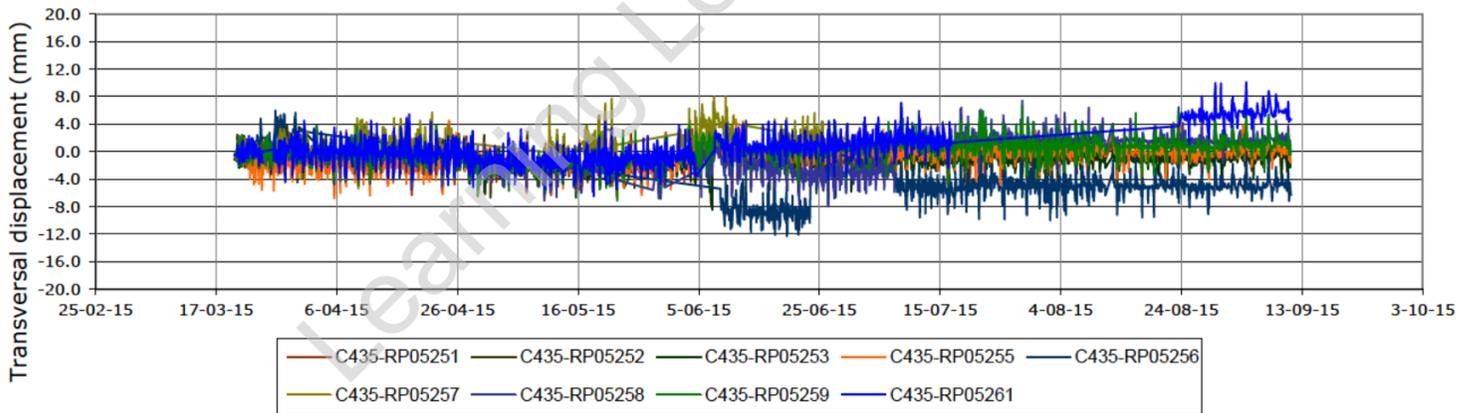
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 DEVICE 3D Target



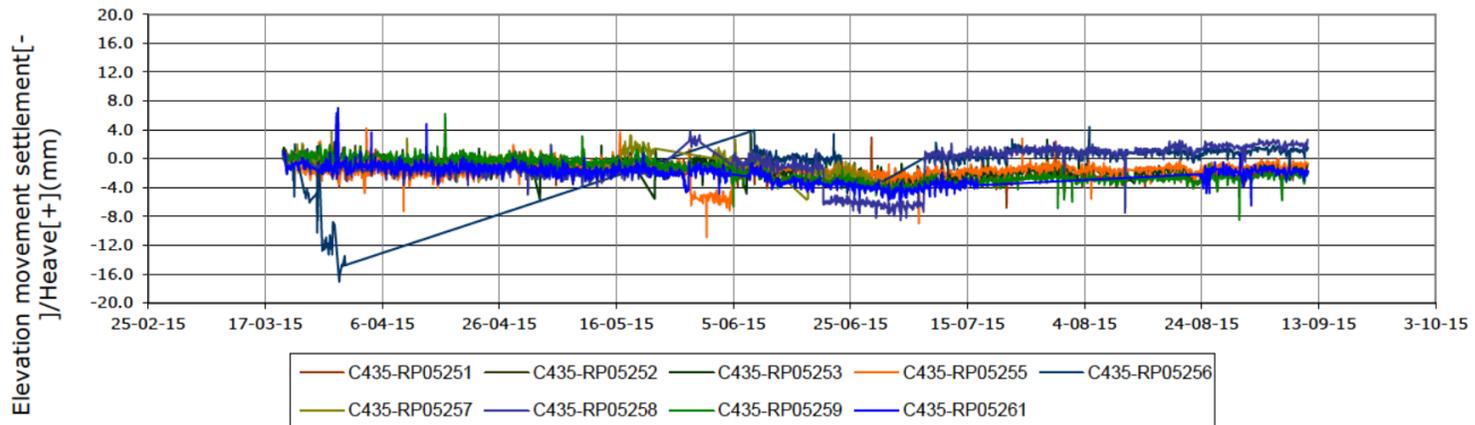
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Building: WTH - Archs 1-3

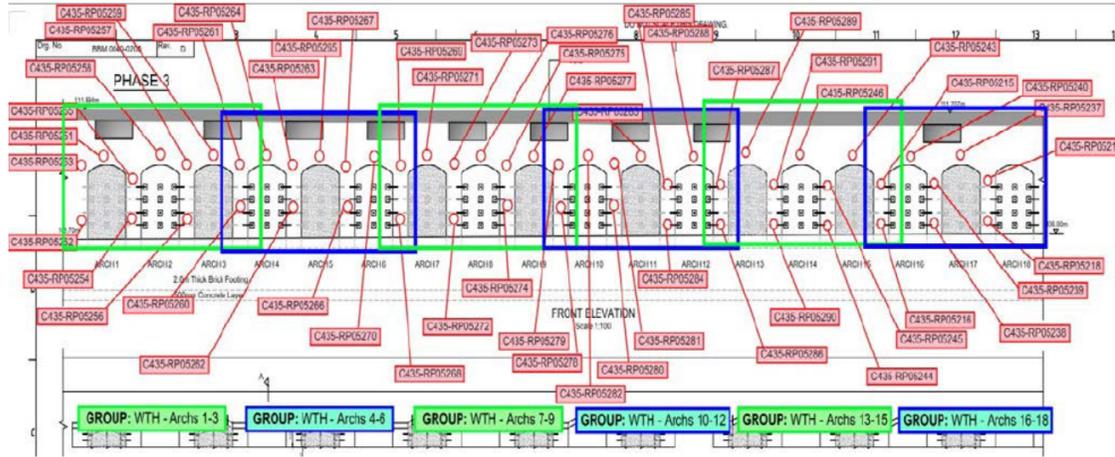


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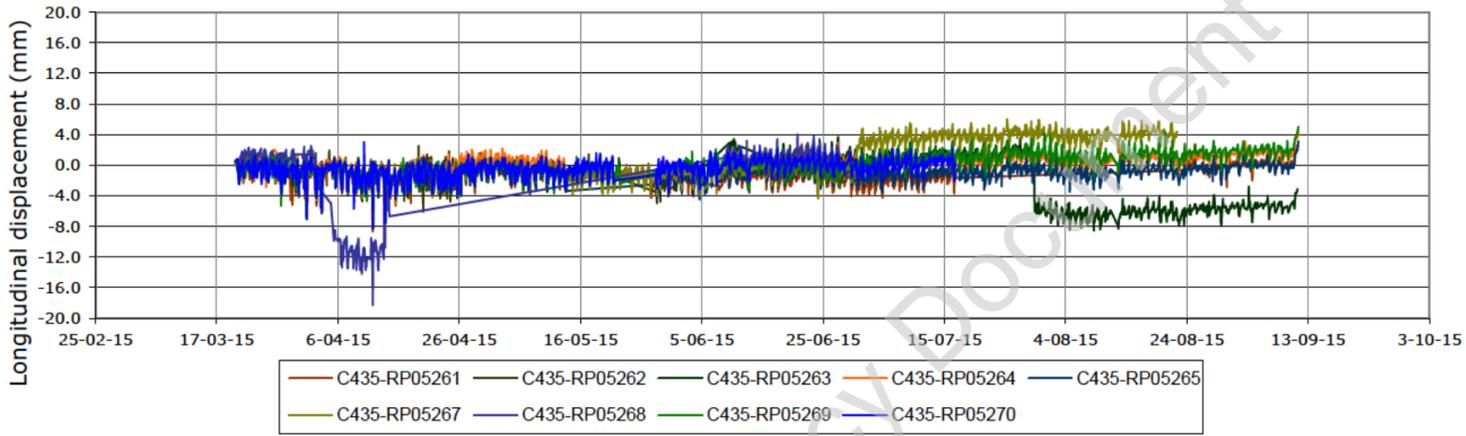


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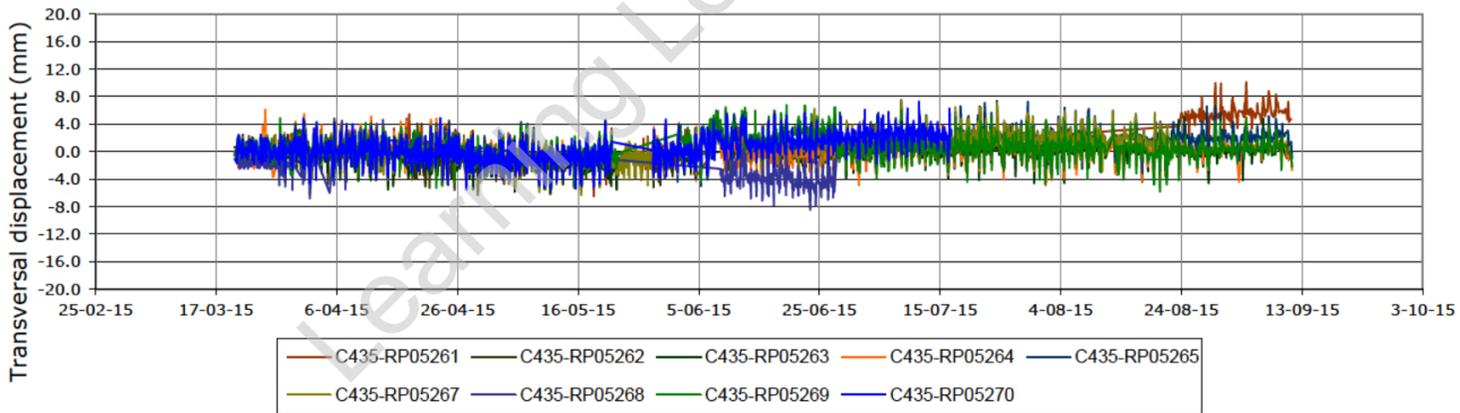
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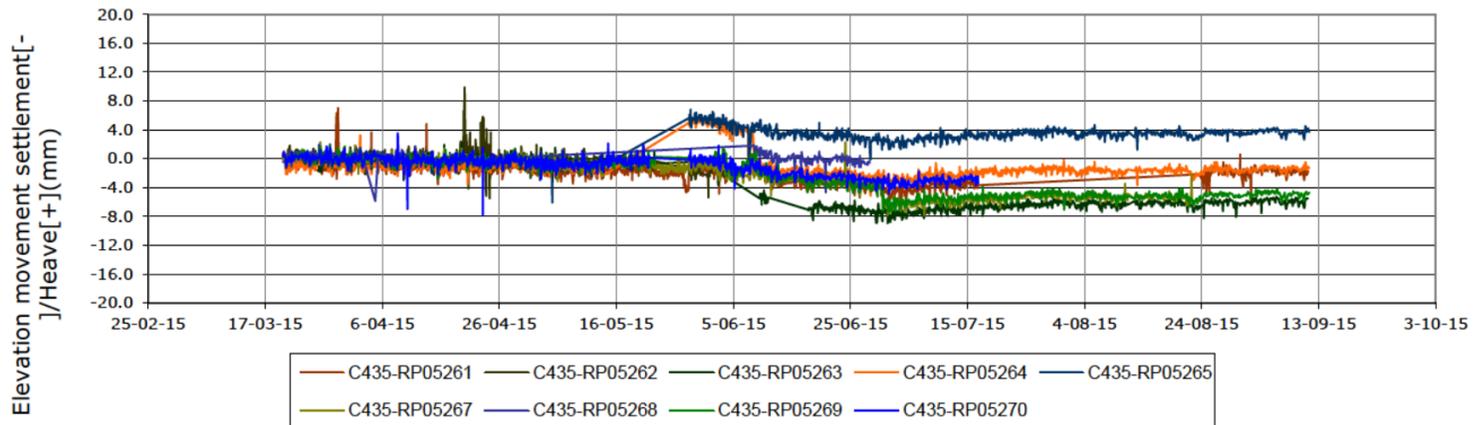
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Building: WTH - Archs 4-6

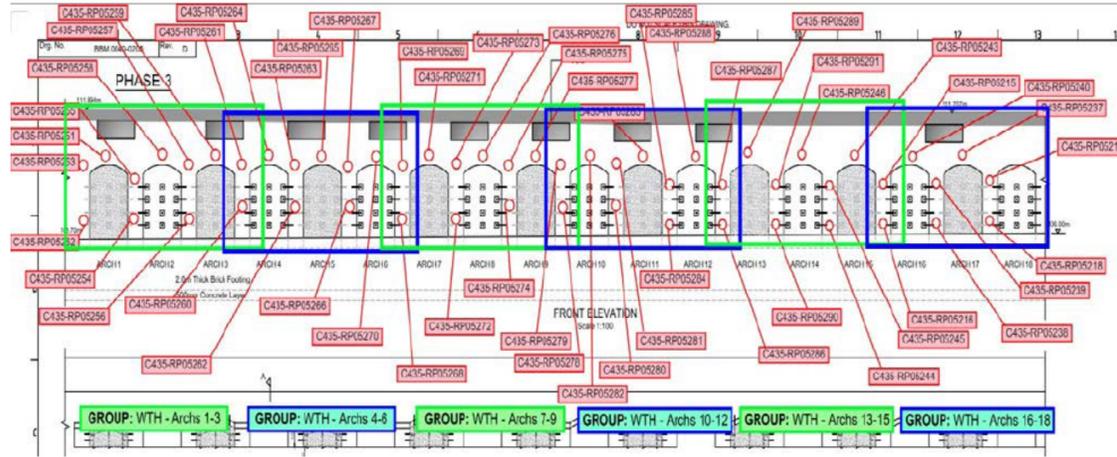


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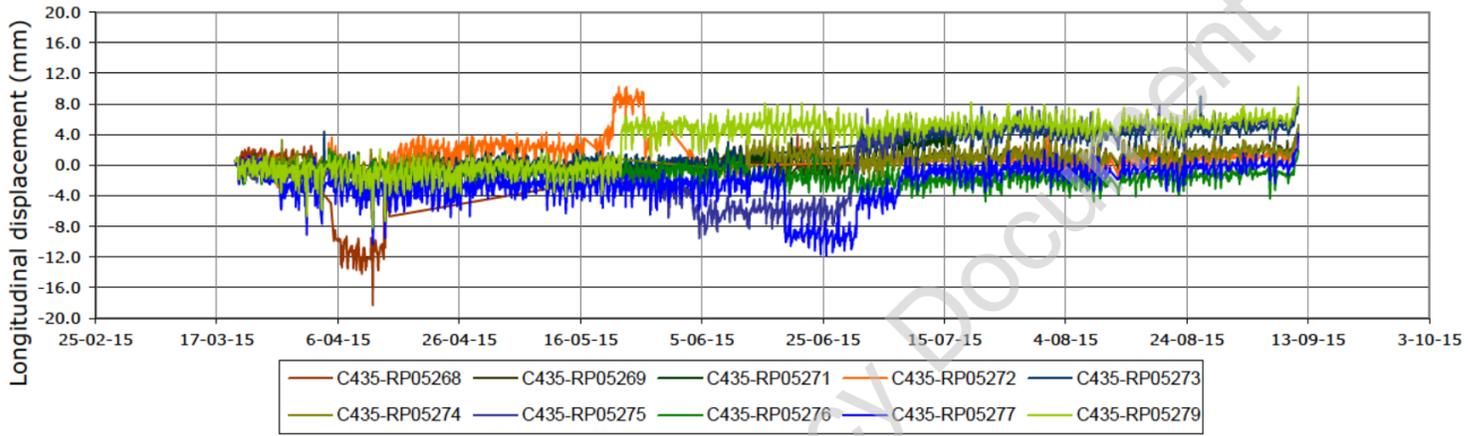


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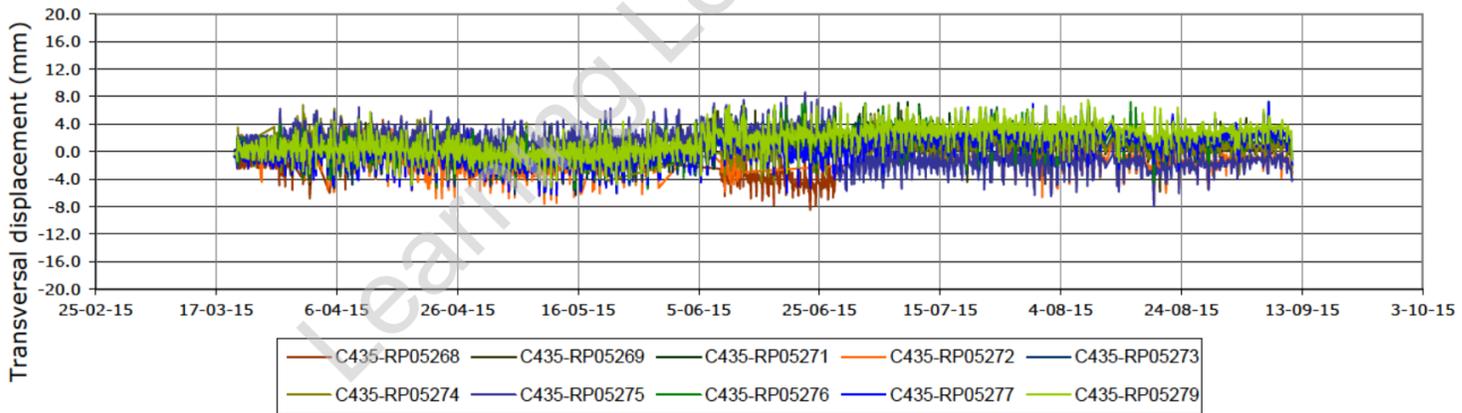
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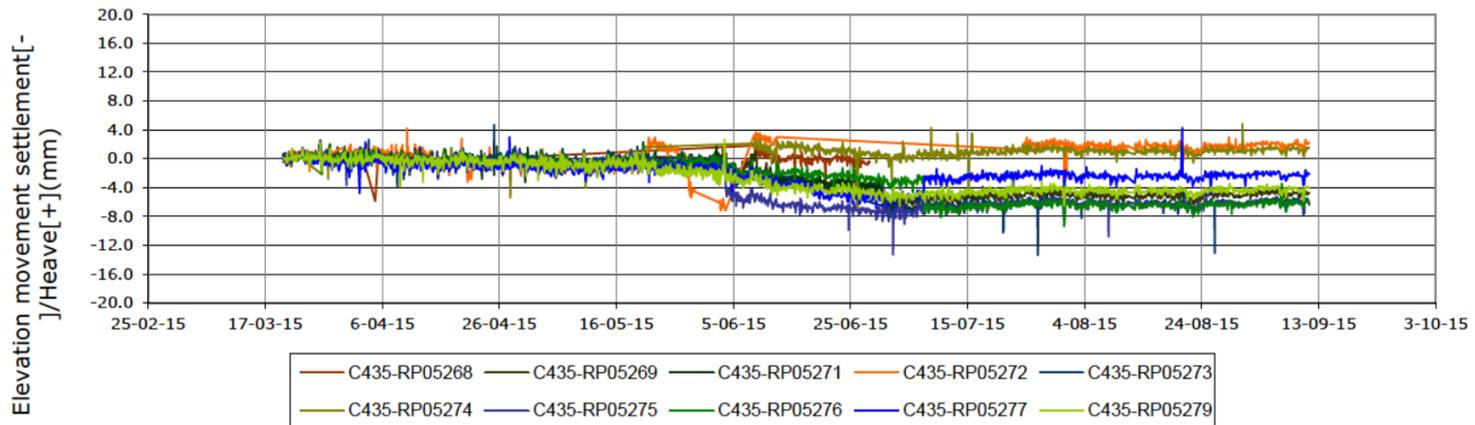
Building: WTH - Archs 7-9



Building: WTH - Archs 7-9

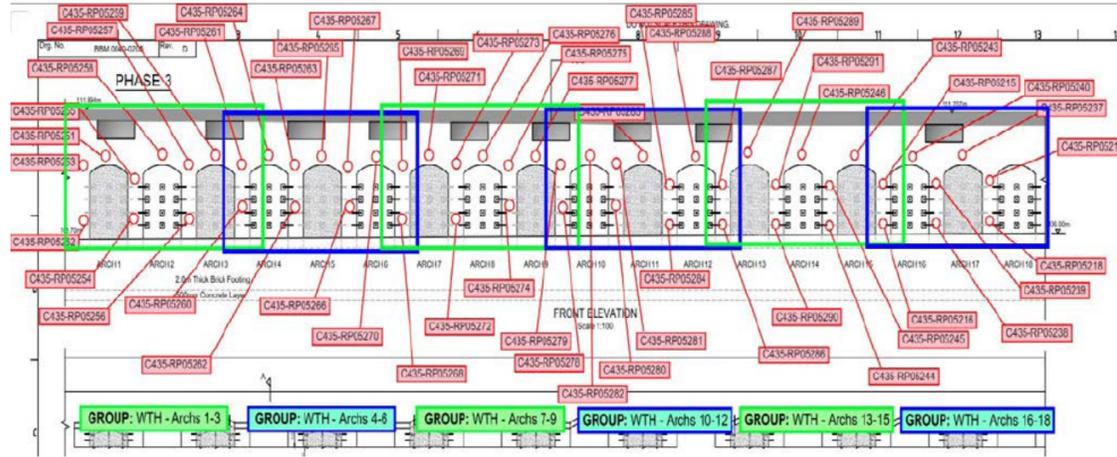


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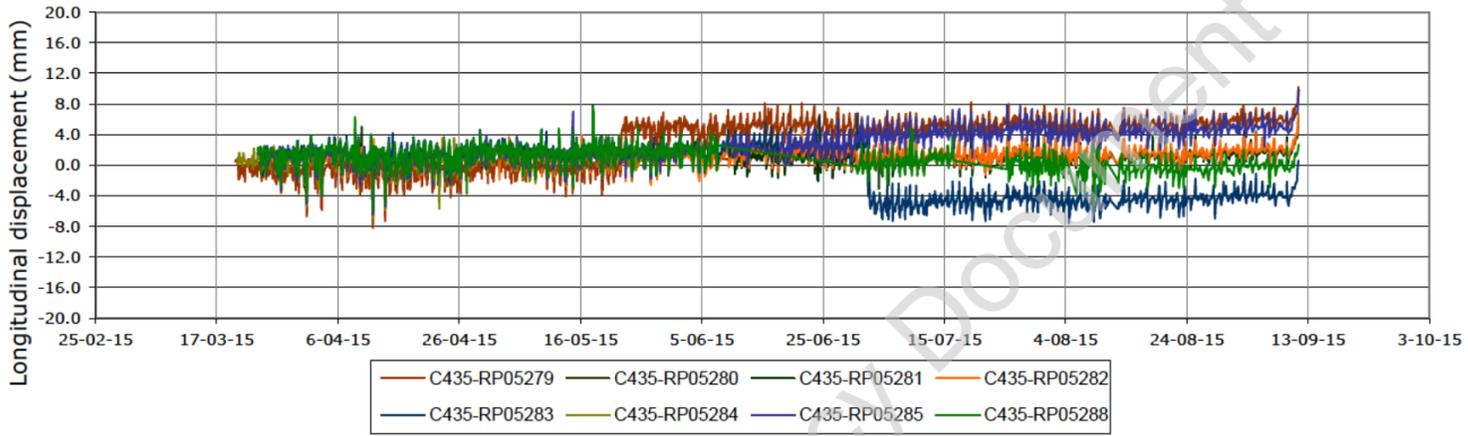


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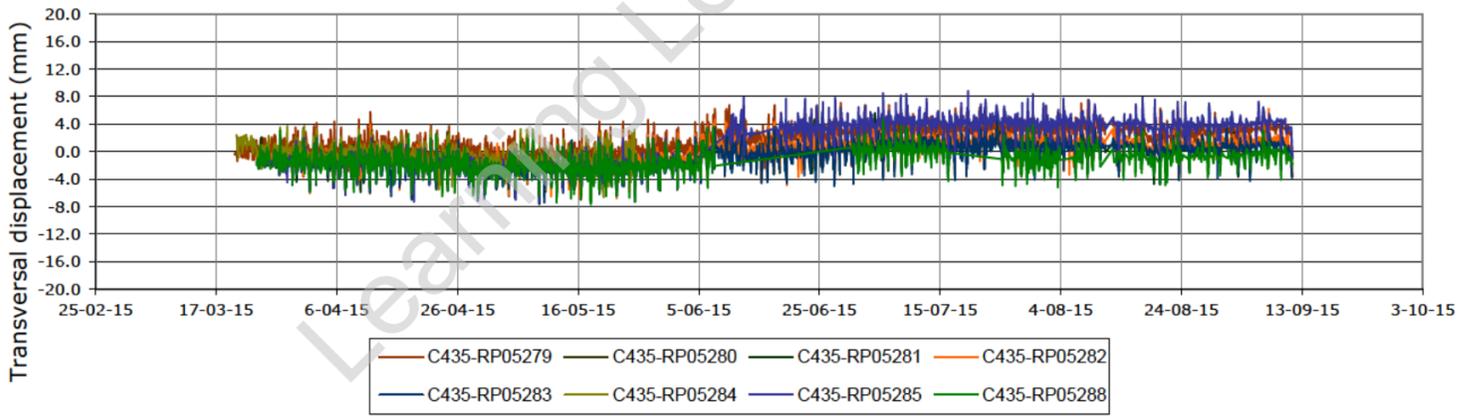
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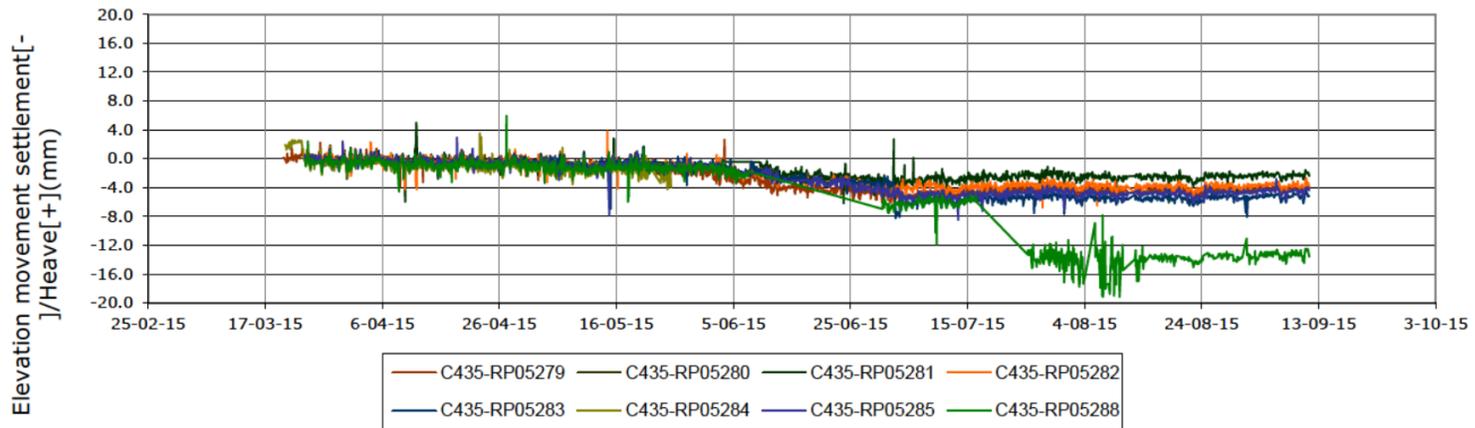
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Building: WTH - Archs 10-12

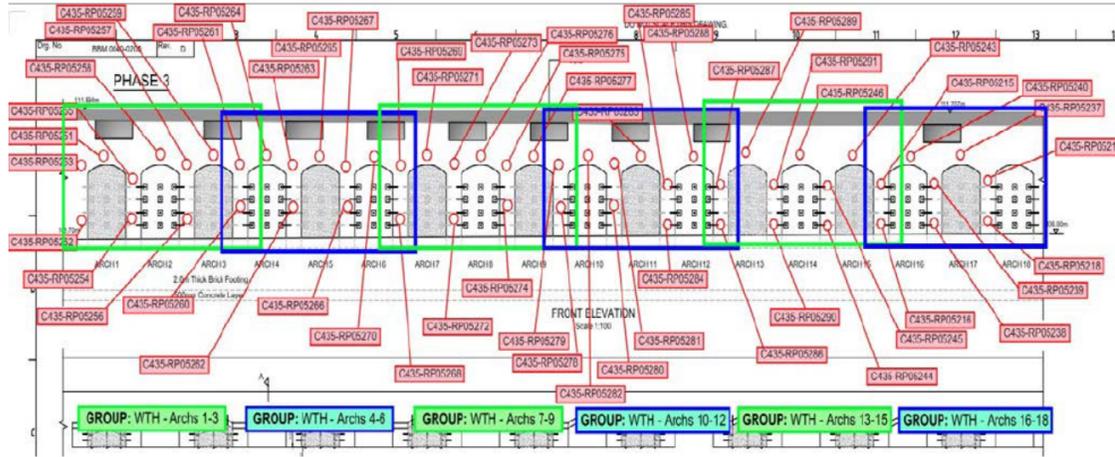


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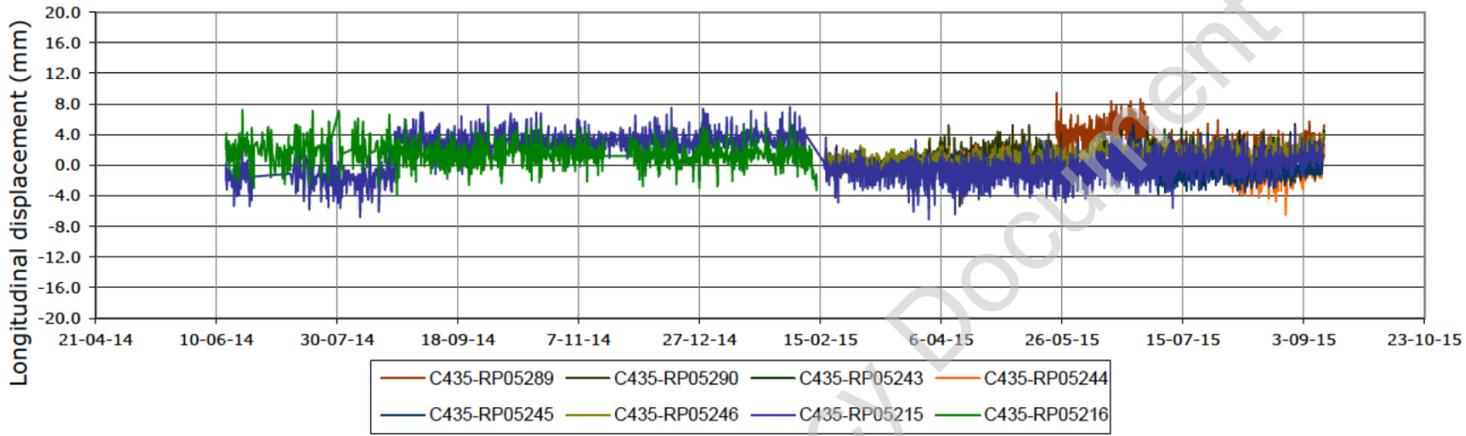


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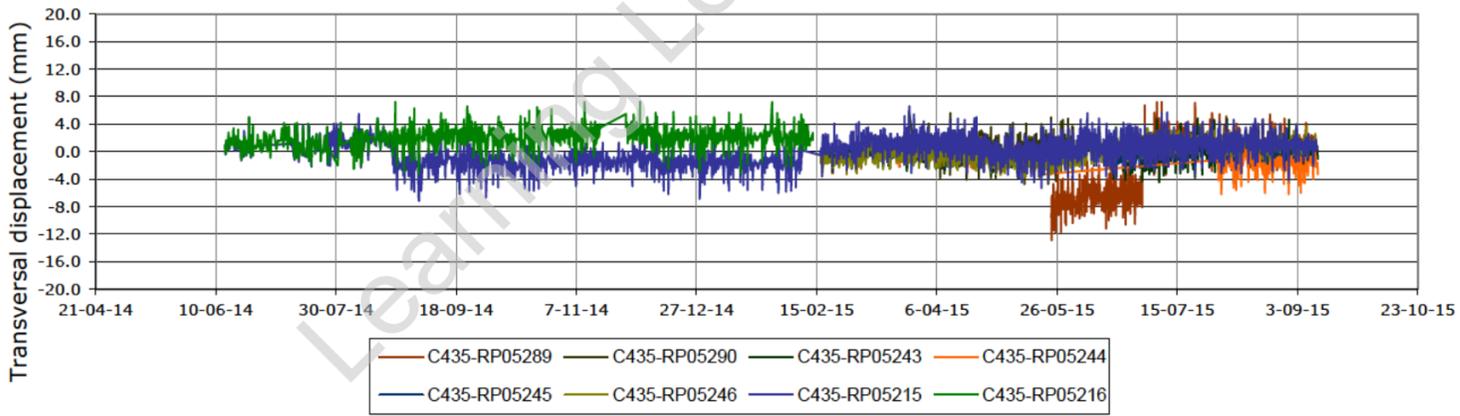
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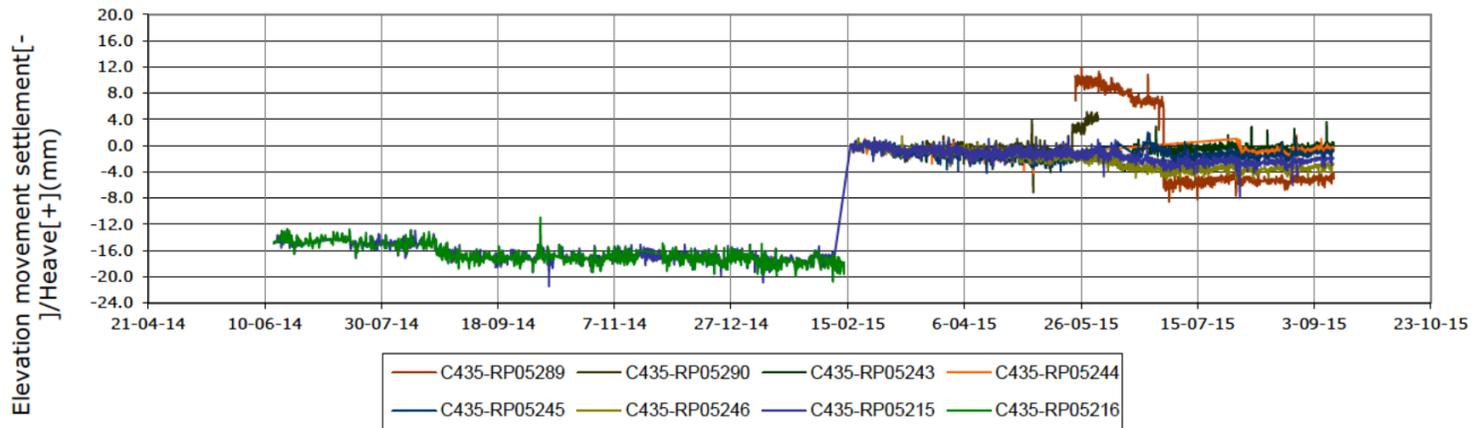
Building: WTH - Archs 13-15



Building: WTH - Archs 13-15

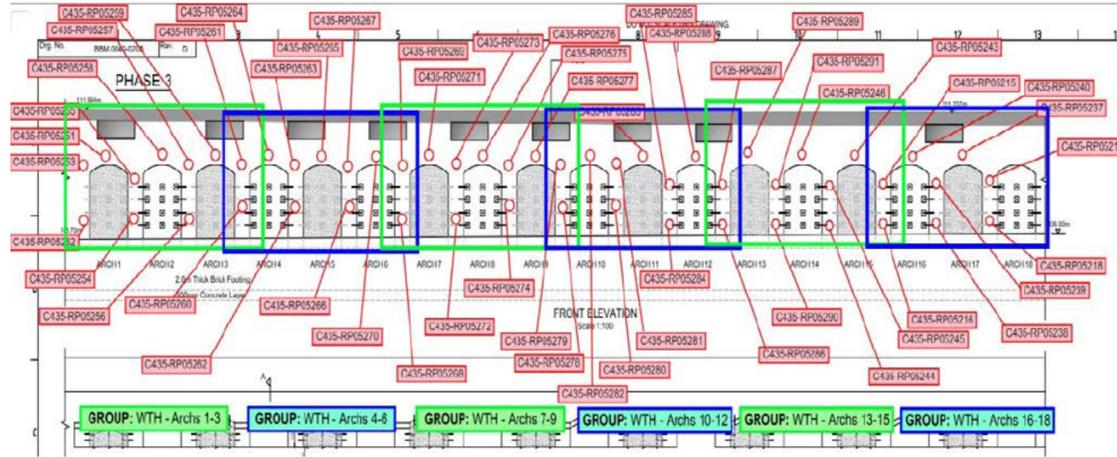


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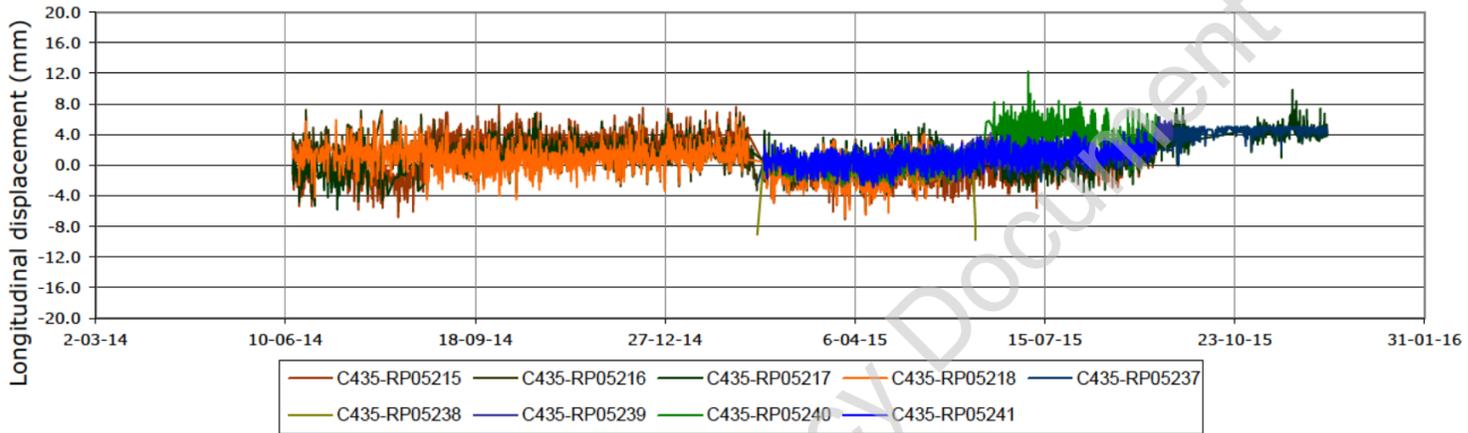


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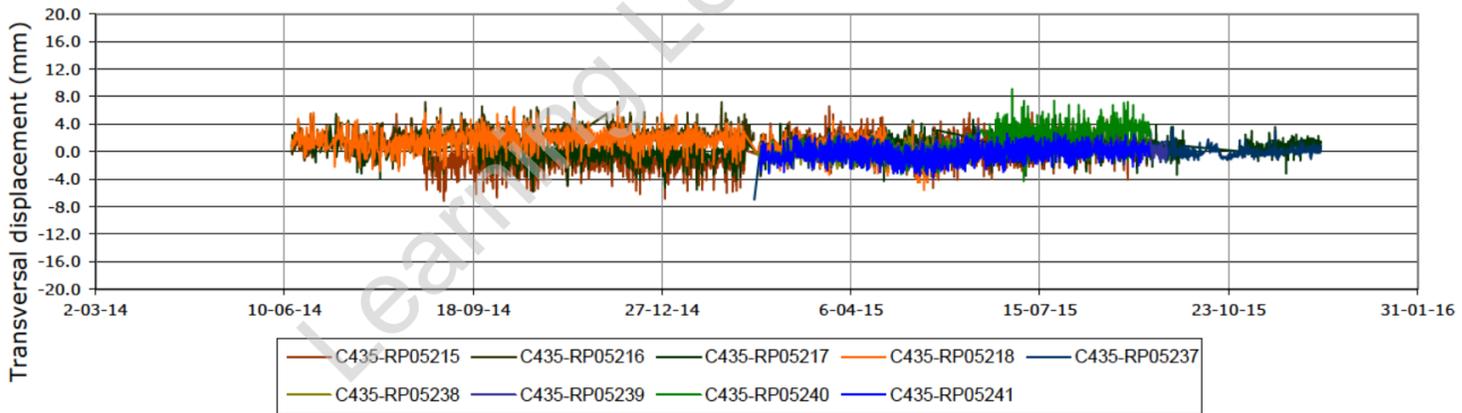
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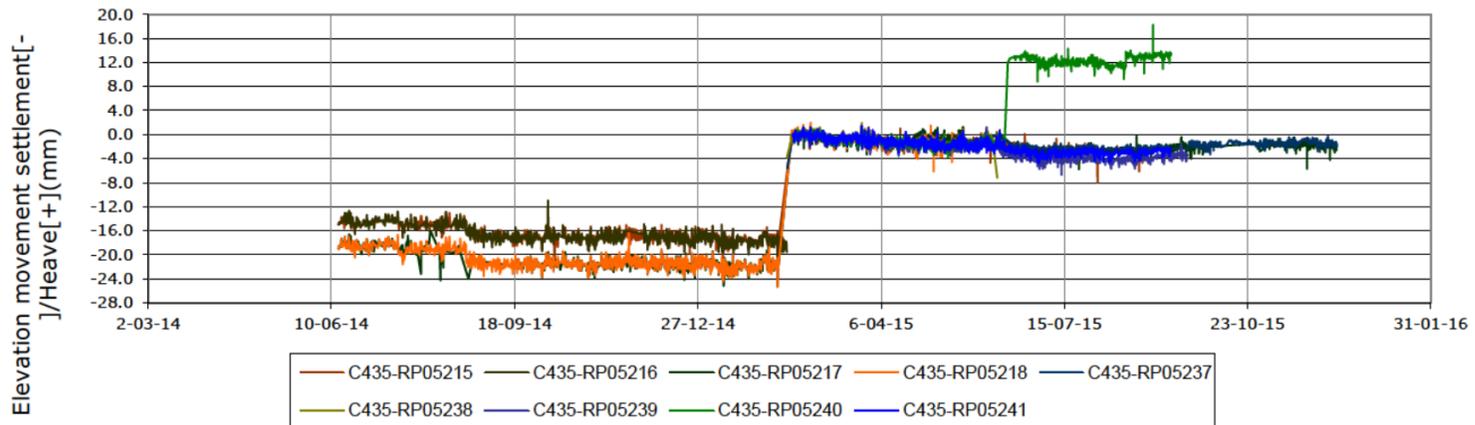
Building: WTH - Archs 16-18



Building: WTH - Archs 16-18



Building: WTH - Archs 16-18



REMARKS:

APPENDIX C: GLOSSARY

- ATS Automatic Total Station.
- ETH Eastern Ticket Hall.
- WB Westbound.
- TBM Tunnel Boring Machine.
- EB Eastbound.
- PTW Platform Tunnel West.
- PTE Platform Tunnel East.
- CP Cross passages.
- CH Concourse Hall.
- VA Ventilation Adit.
- STE Stub Tunnel East
- STW Stub Tunnel West.
- RTE Running Tunnel East.
- ES Escalator.
- TaM Tube a Manchette.
- WTH Western Ticket Hall.

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