



Work Area: SMM
Work Type: I&M
Originator Company: GEOCISA

C435 Farringdon Main Station

CRL Lead reviewer: [Redacted]
CRL Reviewer:

Monitoring Close-Out Report: Automated Total Station ATS02 and 3D Targets read by ATS02.

CRL Document Number: C435-BFK-C2-RGN-M123-51611

Supplier Document Number: N/A

Contract MDL reference C14.022

1. Contractor Document Submittal History:

Revision:	Date:	Prepared by:	Checked by:	Approved by:	Reason for Issue:
2.0	19-05-2016	[Redacted]	[Redacted]	[Redacted]	For acceptance
3.0	04-08-2016	[Redacted]	[Redacted]	[Redacted]	For acceptance

2a. Stakeholder Review Required? YES NO

Stakeholder submission required: LU NR DLR RIL LO Other: _____ Purpose of submission: For no objection For information

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"/>
			compliance with their contractual obligations and does not constitute ds or materials developed or selected by the designer/supplier.		<input type="checkbox"/>
		[Redacted]			<input type="checkbox"/>

11/11/2016

3. Acceptance by Crossrail:

Contents

A.	INTRODUCTION	3
B.	INSTRUMENTS	3
B.1	DESCRIPTION OF THE INSTRUMENTS	3
B.2	LOCATION OF THE INSTRUMENTS	4
C.	MOVEMENTS	5
C.1	MOVEMENTS RESULTING FROM CONSTRUCTION ACTIVITIES	5
C.1.1	Relevant Crossrail (BFK) Works	5
C.1.2	Resulting Movements	5
C.2	TRIGGER BREACHES	7
C.3	SIGNIFICANT ISSUES WITH THE INSTRUMENTATION	7
C.4	RESIDUAL RISKS	7
D.	CONCLUSIONS	7
APPENDIX A: DRAWINGS.		
APPENDIX B: GRAPHS.		
APPENDIX C: GLOSSARY.		

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 any.

Based on the above points, this close out report will provide justification for the decommissioning of the ATS02 and associated prisms.

B. INSTRUMENTS

B.1 Description of the Instruments

This Close-Out Report relates to the prisms read by ATS2. See Table 1 below for the details of the prisms read by ATS02.

Sensor	Location	Easting (m)	Northing (m)	Elevation (mATD)
C435-RP00201	70-77 Cowcross St	82047.96	36523.4266	121.7274
C435-RP00202	70-77 Cowcross St	82047.98	36523.4292	125.2338
C435-RP00203	70-77 Cowcross St	82046.91	36520.7305	133.6049
C435-RP00222	70-77 Cowcross St	82047.07	36520.1716	115.4679
C435-RP00223	70-77 Cowcross St	82038.85	36519.9938	115.5344
C435-RP00224	70-77 Cowcross St	82046.95	36520.1068	125.1058
C435-RP00225	70-77 Cowcross St	82038.78	36519.9502	125.1326
C435-RP00226	70-77 Cowcross St	82046.91	36520.7305	133.6045
C435-RP00227	70-77 Cowcross St	82038.79	36520.59	133.6045
C435-RP00228	67 Cowcross St	82016.04	36539.8603	119.8383
C435-RP00229	67 Cowcross St	82023.26	36540.2951	119.832
C435-RP00230	67 Cowcross St	82010.32	36539.4608	125.6977
C435-RP00231	67 Cowcross St	82016.05	36539.8282	125.6951
C435-RP00232	67 Cowcross St	82023.25	36540.2943	125.7141
C435-RP00233	Albion Courtyard	82082.38	36508.5675	114.9154
C435-RP00234	Albion Courtyard	82082.42	36508.6061	118.2593
C435-RP00235	Albion Courtyard	82082.41	36508.7125	127.9738
C435-RP00236	Albion Courtyard	82075.51	36509.4904	114.7826
C435-RP00237	Albion Courtyard	82075.46	36509.5507	118.292
C435-RP00238	Albion Courtyard	82075.67	36509.8241	127.9702
C435-RP00239	Albion Courtyard	82068.9	36510.5226	114.6171
C435-RP00240	Albion Courtyard	82068.92	36510.5464	118.2984

Sensor	Location	Easting (m)	Northing (m)	Elevation (mATD)
C435-RP00241	Albion Courtyard	82068.91	36510.627	127.9463
C435-RP00242	Albion Courtyard	82059.32	36512.2714	114.5379
C435-RP00243	Albion Courtyard	82059.35	36512.2928	118.3962
C435-RP00244	Albion Courtyard	82059.46	36512.5697	127.9677

Table 1: Details of the prisms read by ATS02.

The prisms reading by ATS02 installed on 63 Charterhouse St are shown in the following documents:

Drawings:

- C435-BFK-C2-DWG-M123-50045. Appendix A show ATS02 plan location.

Installation Reports:

- C435-BFK-C2-RGN-M123-50028. Installation report-3D targets read by AT02
- C435-BFK-C2-RGN-M123-50002. Installation Report-Automated Total Station 63 Charterhouse St (AST02)

B.2 Location of the Instruments

Prisms associated with ATS02 are located on the plan below highlighted in yellow.

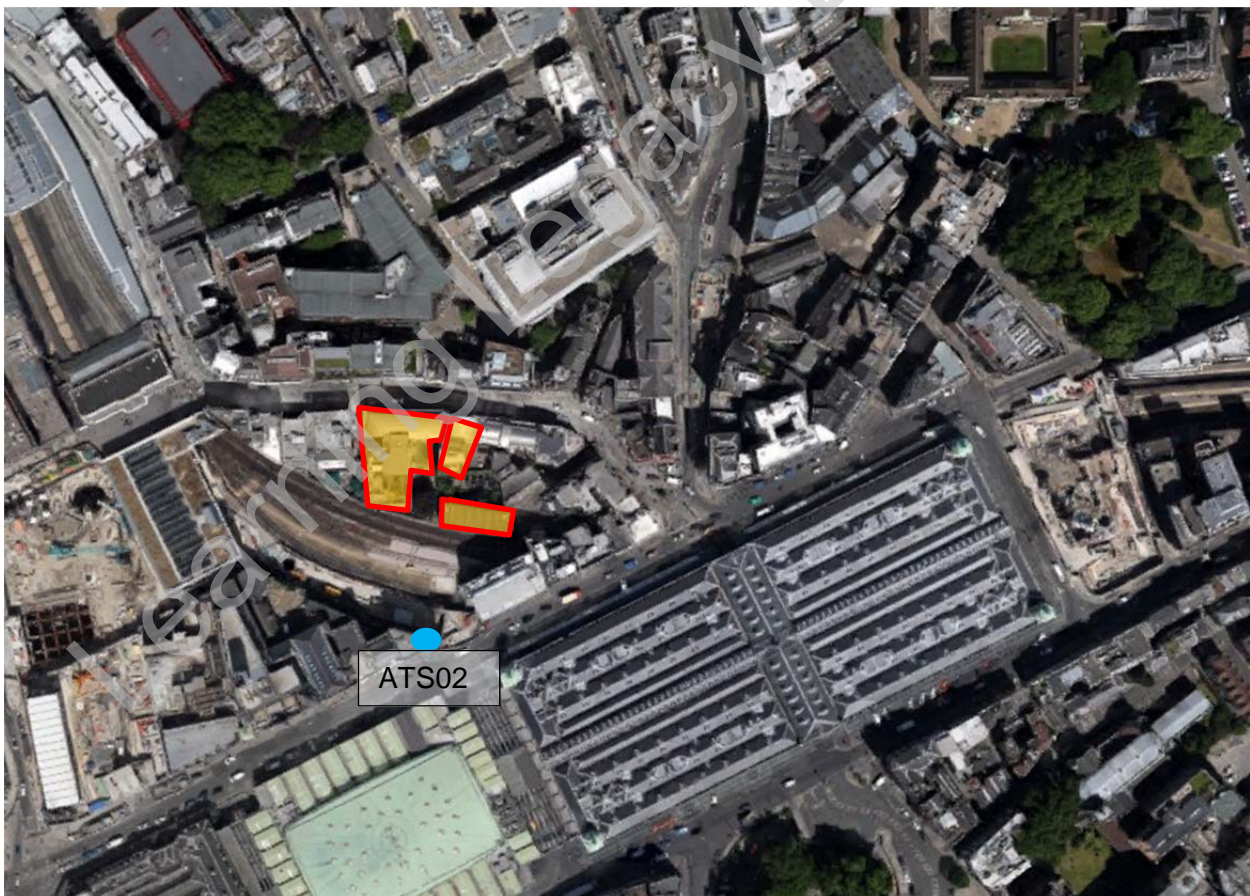


Figure 1 – Plan showing the Location of prisms read by ATS02

C. MOVEMENTS

C.1 Movements Resulting from Construction Activities

C.1.1 Relevant Crossrail (BFK) Works

The construction activities associated with these instruments are related to Crossrail tunneling works. See below Table 2 for dates.

Activity	Start Date	End Date
WB TBM	25/09/2013	08/10/2013
EB TBM	08/01/2014	22/01/2014
PTW	02/04/2014	17/07/2014
PTE	17/05/2014	06/08/2014
CP3a	26/05/2014	27/08/2014
CH1	10/02/2014	30/03/2014

Table 2 –Constructions activities

C.1.2 Resulting Movements

To analyse the result for the prisms will be separate by buildings:

- 67 Cowcross St.
- 70-77 Cowcross St
- Albion Courtyard.

- 67 Cowcross St

The monitoring data for 67 Cowcross St is shown in Appendix B.

- Compensation grouting episode from Butchers Ramp in September 2013 caused 2mm of heave.
- EB TBM caused 4-5mm of settlement between 09-01-2014 and 11-01-2014
- Residual settlement for EB TBM of 2mm.
- Concurrent grouting episodes in April 2014 caused 3-4mm of heave.
- PTE enlargement caused 18mm of settlement from 30-05-2014 to 27-06-2014
- Post PTE grouting episodes caused 2-3mm of heave.
- Between 28-07-2014 and 28-08-2014 CP3a caused 2-3mm of settlement.
- Residual settlement after CP3a caused 2mm.
- Maximum longitudinal displacement captured by the prisms was -8mm
- Maximum Transversal displacement captured by the prisms was 36mm.
- Maximum settlement at the end of the works was -22mm

- 70-77 Cowcross St

The monitoring data for 70-77 Cowcross St is shown in Appendix B.

- Compensation grouting from Butchers Ramp caused 2-3mm of heave in September 2014
- EB TBM caused 1-2mm of settlement from 10-01-2014 to 12-01-2014.
- CH1 excavation caused 2-3mm of settlement.
- Concurrent grouting caused maximum 10mm of heave in June 2015
- PTE construction caused 10-12mm maximum of settlement between 16-06-2014 and 13-07-2014
- Residual settlement after PTE caused 4mm maximum.
- Maximum longitudinal displacement captured by the prisms was -18mm
- Maximum Transversal displacement captured by the prisms was 20mm.
- Maximum settlement at the end of the works was -21mm

- Albion Courtyard

The result for the data for Albion Courtyard is shown in the Appendix B.

- Compensation grouting from Moorgate Spur 3 before the WB TBM caused 2-3mm of heave.
- WB TBM caused 4-5mm of settlement from 28-09-2013 to 29-09-2013
- Compensation grouting caused 2-3mm maximum of heave on 11th November 2013.
- Concurrent grouting caused 2-3mm of heave.
- PTW enlargement caused 8mm maximum of settlement between 10-06-2014 and 17-07-2014.
- Compensation grouting from Moorgate Spur 3 caused 4-5mm of heave on 23rd January 2015.
- Maximum longitudinal displacement captured by the prisms was 10mm
- Maximum Transversal displacement captured by the prisms was 15mm.
- Maximum settlement at the end of the works was -16mm

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 works. Green trigger is less (80%) that the predicted movement.

In this case, only 70-77 Cowcross St is inside the compensation Grouting Area. The other two buildings are outside. No triggers were been breached on the prisms read by ATS02.

C.3 Significant Issues with the Instrumentation

No issues.

C.4 Residual Risks

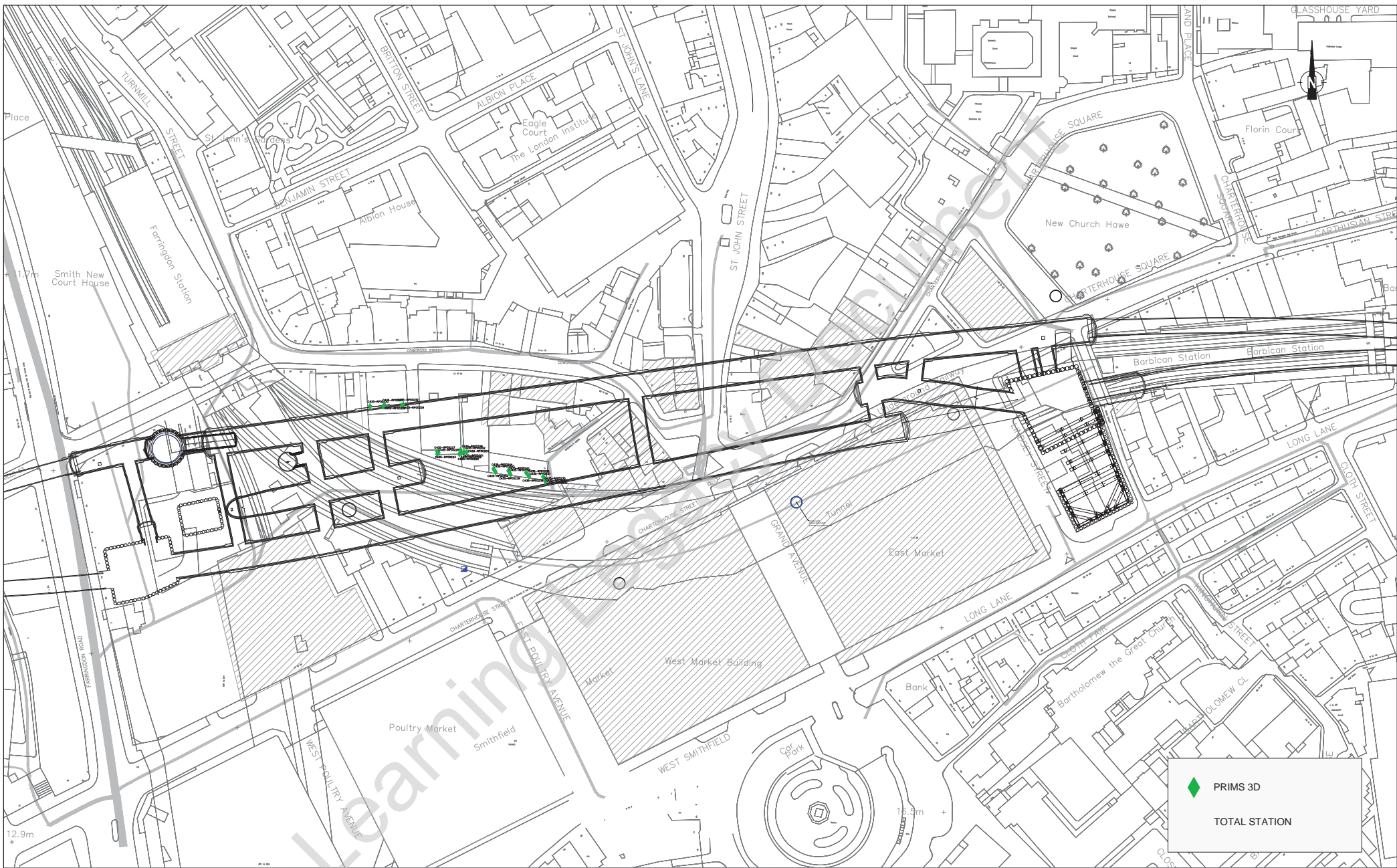
As per C435-PMI-00549 the Long Term Monitoring has been ceased by Contract C435 in this area. The last measurement carried out by C435 for these instruments was undertaken on 18-09-2015. Long term monitoring will be continued by Crossrail to review long term stability.

D. CONCLUSIONS

No triggers breached, monitoring stable. No residual risks remain. Long term monitoring to be completed by InSar/Crossrail.

APPENDIX A: DRAWINGS

Learning Legacy Document



Notes:

Rev.	Date	Description	By	Chkd	App	Auth
1	20-02-2014					



GEOCISA UK

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



Scale : @ A3

Contract : C435 I&M FARRINGDON

Originator : GEOCISA

Location : CROSSRAIL GENERAL

Title :
3D TARGETS INSTALLED FOR FARRINGDON STATION

Drg No : C435-BFK-C2-DWG-M123-50045

	PRIMS 3D
	TOTAL STATION

By :	
Chk :	
App :	
Auth :	

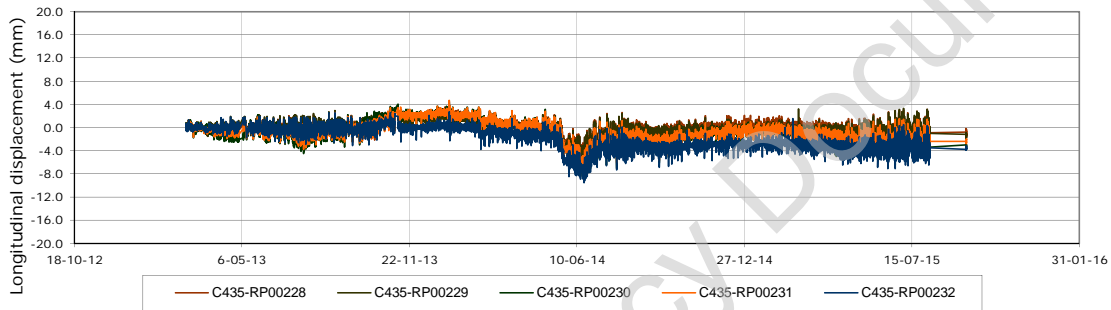
APPENDIX B: GRAPHS

Learning Legacy Document

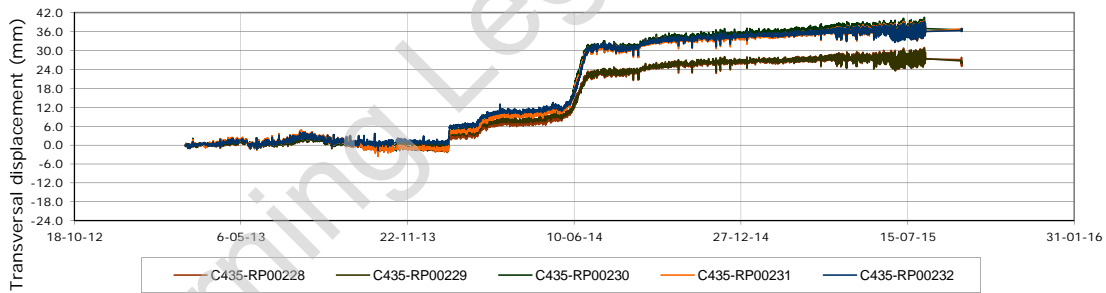
REPORT Automatic Prisms
 AREA Farringdon Station
 DEVICE 3D Target



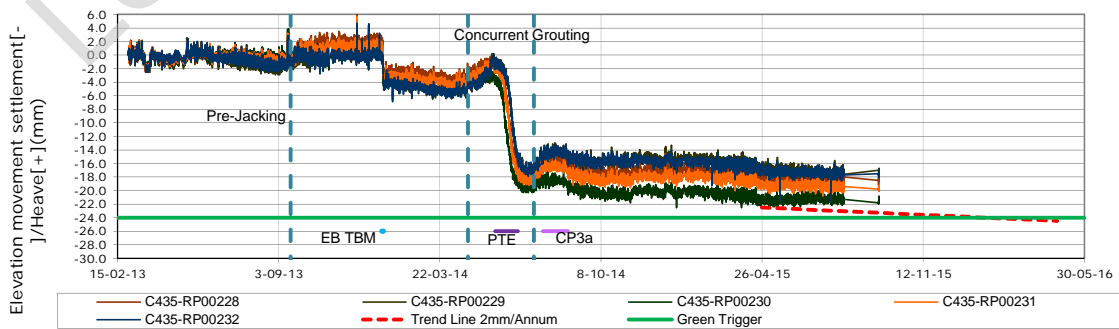
Building: 67 COWCROSS STREET



Building: 67 COWCROSS STREET



Building: 67 COWCROSS STREET



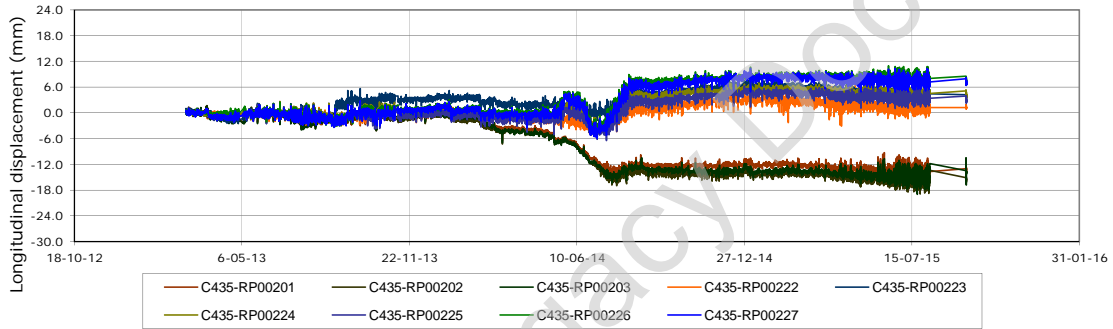
REMARKS:

REPORT
AREA
DEVICE

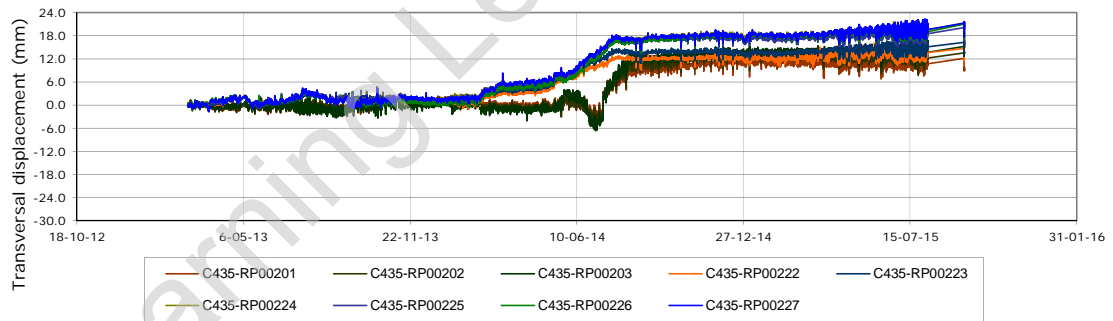
Automatic Prisms
Farringdon Station
3D Target



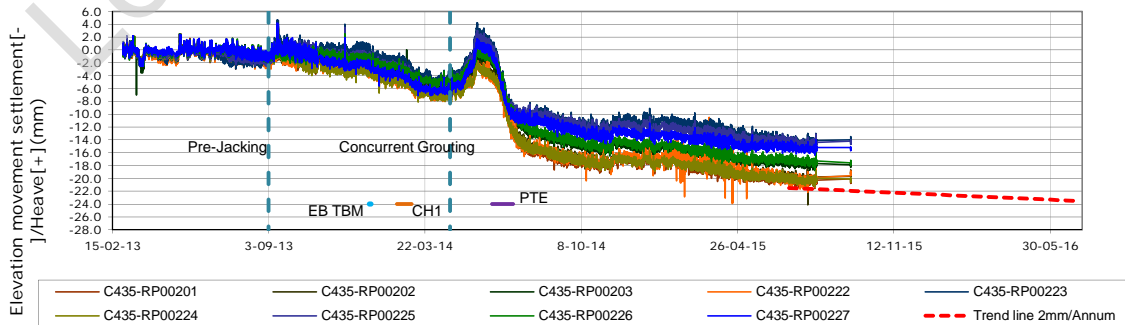
Building: 70-77 COWCROSS STREET



Building: 70-77 COWCROSS STREET



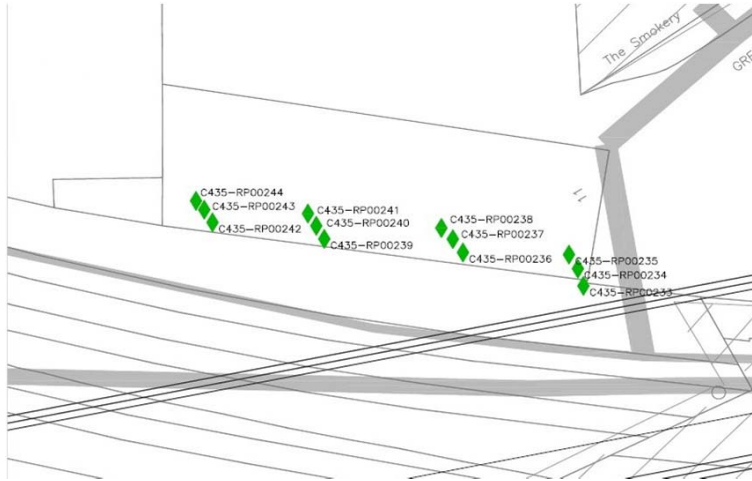
Building: 70-77 COWCROSS STREET



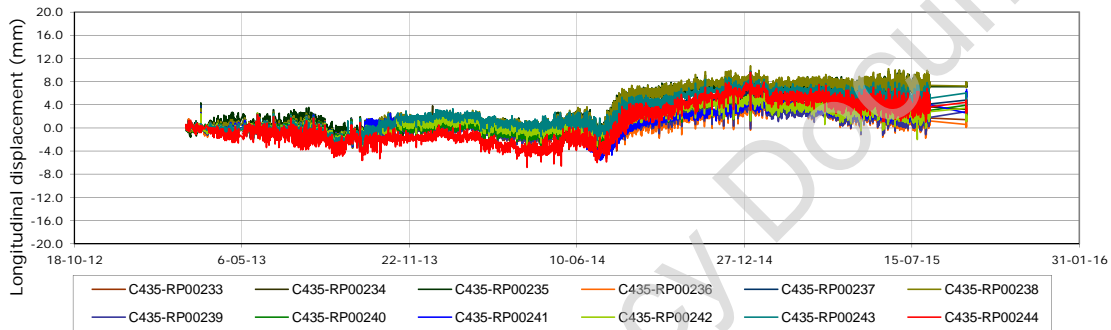
REMARKS:

REPORT
AREA
DEVICE

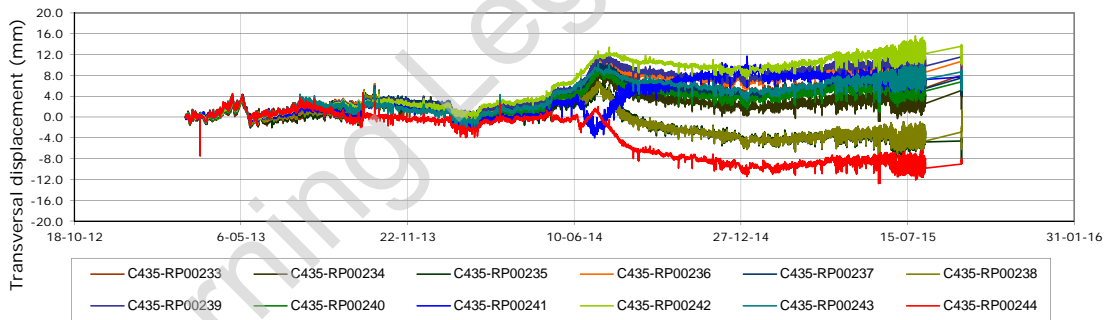
Automatic Prisms
Farringdon Station
3D Target



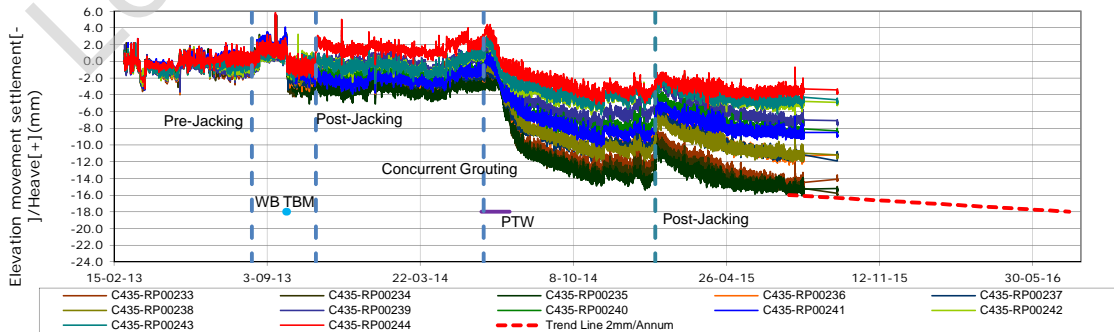
Building: ALBION COURTYARD, GREENHILLS RENTS



Building: ALBION COURTYARD, GREENHILLS RENTS



Building: ALBION COURTYARD, GREENHILLS RENTS



REMARKS:

[Empty box for 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 Stop Tunnel East
- RTE Running Tunnel East.
- ES Escalator
- TaM Tube a Manchette.

Learning Legacy Document