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Work Type: I&M
Originator Company: GEOCISA UK

C435 Farringdon Main Station

CRL Lead reviewer: [Redacted]
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Monitoring Close-Out Report: Automated Total Station ATS 21 and 3D Targets read by ATS 21.

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Stakeholder submission required: LU NR DLR RIL LO Other: _____

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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"/>
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					<input type="checkbox"/>

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

3. Acceptance by Crossrail:

09/03/2016

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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 reports will provide justification for the decommissioning of the instruments.

B. INSTRUMENTS

B.1 Description of the Instruments

This Close-Out Report relates the Smithfield Market western parking area, consisting of 3D Targets read by ATS 21 and 1No. Automated Total Station (ATS 21) located at Smithfield Market Car Park. See table 1 below with details.

ATS 21 CODE	LOCATION	COORDINATES	
		X (m)	Y (m)
C435-AT00021	Smithfield Market Car Park	82155.13	36457.32

PRISM CODE	LOCATION	COORDINATES	
		X (m)	Y (m)
C435-RP02101	PARKING WEST MARKET	82,156.9971	36,467.8099
C435-RP02102	PARKING WEST MARKET	82,161.1712	36,458.6085
C435-RP02103	PARKING WEST MARKET	82,165.4258	36,451.1016
C435-RP02104	PARKING WEST MARKET	82,171.3010	36,438.6146
C435-RP02106	PARKING WEST MARKET	82,146.3517	36,451.3275
C435-RP02107	PARKING WEST MARKET	82,127.6561	36,446.8165
C435-RP02108	PARKING WEST MARKET	82,111.4847	36,438.8009

Table 1: Details 3D Targets read by ATS 21 and ATS 21.

*C435-RP02105 was installed but never read because of the lack of visual from any ATS.

At the moment, this area monitored by these prisms should be in a Long Term basis with readings every three months, but per C435-PMI-00549 Long Term has being ceased in this area, being the last measure carried out for these devices on 12/09/2015.

These prisms read by ATS 21 and the ATS 21 itself are shown in the following documents:

Drawings:

- C122-OVE-C2-DDA-CR001_Z-31531: Asset Protection I&M Ground Surface and In-Ground Farringdon Station C435
- C122-OVE-C2-DDA-CR001_Z-31532: Asset Protection I&M Buildings Farringdon Station C435

Installation Reports:

- C435-BFK-C2-RGN-M123-50020 Installation Report: Automated Total Station Installation at Smithfield Market Car Park (ATS 21)
- C435-BFK-C2-RGN-M123-50066 Installation Report of 3D Targets read by ATS 21

B.2 Location of the Instruments

As you can see from the Figure 1 below, the instruments described in Section B.1 are located at Smithfield West Market. A drawing showing the location of these devices can be found in the Appendix A.

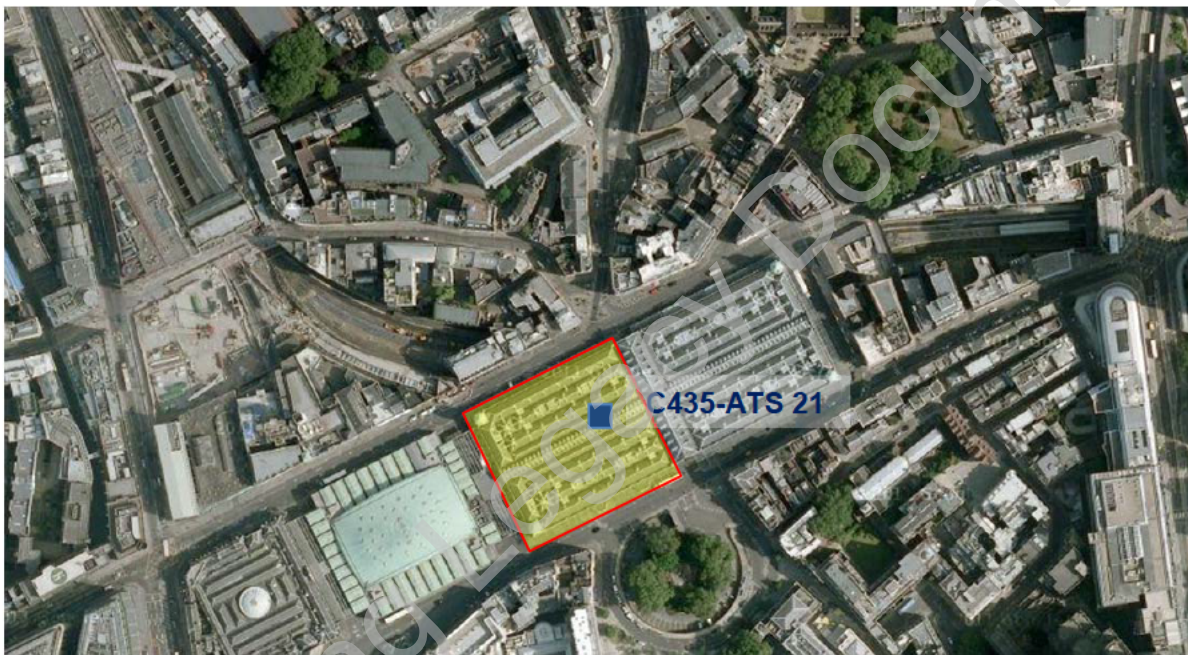


Figure 1 – Map showing the Location of ATS 21 and 3D Targets read by ATS 21.

C. MOVEMENTS

C.1 Movements Resulting from Construction Activities

C.1.1 Relevant Crossrail (BKF) Works

The construction activities associated with these instruments are related to Crossrail tunnelling works. In all cases, these comprise of the passage of a TBMs (C300) and a platform tunnel enlargement.

ACTIVITY	START DATE	END DATE
Moorgate Spur Shaft No. 1 TAM Installation	08/07/2013	20/08/2013
Moorgate Spur Shaft No. 1 Pre-Treatment works	19/08/2013	15/09/2013
Moorgate Spur Shaft No. 3 TAM Installation	19/07/2013	03/09/2013
Moorgate Spur Shaft No. 3 Pre-Treatment works	10/08/2013	15/08/2013
WB TBM passage	30/09/2013	04/10/2013
SCL-PTW enlargement	23/07/2014	26/09/2014

C.1.2 Resulting Movements

- Smithfield West Market:

The monitoring data for these prisms is presented in Appendix B.

This building where the prisms are installed was affected by WB TBM and PTW enlargement, specially the northern part of the building closer to the tunnel axis.

During WB TBM, the movement recorded by these devices was not significant, showing stability.

The maximum settlement captured on these prisms was caused by PTW Enlargement. During this work, around 2-3mm settlement was recorded, showing stable conditions from September 2014. From this date, the rate for the settlement has been less than 2mm per year.

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.

In this case, part of the building is in Moorgate Spur Shafts No.1 and No.3. ZOI, so the trigger values associated to this building are:

- DEFAULT ALERT (in any direction): 10mm

No triggers have been defined for the Automated Total Stations (ATS).

MONITORING GROUP (Location)	POINT ID	TYPE	DIRECTION	DATE OF LAST READING	LAST READING VALUE (mm)	TRIGGER LEVEL	
						WORST HISTORICAL STATUS	CURRENT STATUS
PARKING WEST MARKET	C435-RP02101	AUTOMATIC RP	Settlement	12/09/2015 06:00	1.6	Clear	Clear
	C435-RP02102	AUTOMATIC RP	Settlement	12/09/2015 06:00	1.7	Clear	Clear
	C435-RP02103	AUTOMATIC RP	Settlement	12/09/2015 06:00	2.4	Clear	Clear
	C435-RP02104	AUTOMATIC RP	Settlement	12/09/2015 06:00	2	Clear	Clear
	C435-RP02105	AUTOMATIC RP	Settlement	-	-	-	-
	C435-RP02106	AUTOMATIC RP	Settlement	12/09/2015 06:00	1.5	Clear	Clear
	C435-RP02107	AUTOMATIC RP	Settlement	12/09/2015 06:00	1.5	Clear	Clear
	C435-RP02108	AUTOMATIC RP	Settlement	12/09/2015 06:00	0.8	Clear	Clear
	C435-RP02101	AUTOMATIC RP	Transversal	12/09/2015 06:00	-1.2	Clear	Clear
	C435-RP02102	AUTOMATIC RP	Transversal	12/09/2015 06:00	-1.1	Clear	Clear
	C435-RP02103	AUTOMATIC RP	Transversal	12/09/2015 06:00	-0.2	Clear	Clear
	C435-RP02104	AUTOMATIC RP	Transversal	12/09/2015 06:00	-0.4	Clear	Clear
	C435-RP02105	AUTOMATIC RP	Transversal	-	-	-	-
	C435-RP02106	AUTOMATIC RP	Transversal	12/09/2015 06:00	1.4	Clear	Clear
	C435-RP02107	AUTOMATIC RP	Transversal	12/09/2015 06:00	2.3	Clear	Clear
	C435-RP02108	AUTOMATIC RP	Transversal	12/09/2015 06:00	1.4	Clear	Clear
	C435-RP02101	AUTOMATIC RP	Longitudinal	12/09/2015 06:00	2	Clear	Clear
	C435-RP02102	AUTOMATIC RP	Longitudinal	12/09/2015 06:00	0	Clear	Clear
	C435-RP02103	AUTOMATIC RP	Longitudinal	12/09/2015 06:00	-0.6	Clear	Clear
	C435-RP02104	AUTOMATIC RP	Longitudinal	12/09/2015 06:00	0.4	Clear	Clear
	C435-RP02105	AUTOMATIC RP	Longitudinal	-	-	-	-
	C435-RP02106	AUTOMATIC RP	Longitudinal	12/09/2015 06:00	-1.2	Clear	Clear
	C435-RP02107	AUTOMATIC RP	Longitudinal	12/09/2015 06:00	0.5	Clear	Clear
	C435-RP02108	AUTOMATIC RP	Longitudinal	12/09/2015 06:00	1.6	Clear	Clear

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C.3 Significant Issues with the Instrumentation

- 3D Target C435-RP02105 was installed but never read due to the lack of visual from any ATS.

C.4 Residual Risks

The rates of residual settlement for these 3D Targets have been determined and in all cases these rates are less than 2mm/year.

D. CONCLUSIONS

Following the WB TBMs passage, as well as the SCL enlargement of PTW and Compensation Grouting works carried out from the Moorgate Spur No.1 and No.3 shafts, no significant settlement has been recorded in the Parking of the West Market building.

On the other hand, the maximum horizontal movement in longitudinal and transversal directions has being of +2mm and +2.3mm for these 3D Targets, having been potentially affected by the temperature fluctuation recorded from the ATS 21 along these years

After the works, all devices do not show any significant movement, therefore these devices are considered stabilized.

At the moment, this area monitored by these prisms should be in a Long Term basis with readings every three months, but per C435-PMI-00549 Long Term has being ceased in this area, being the last measure carried out for these devices on 13/12/2015.

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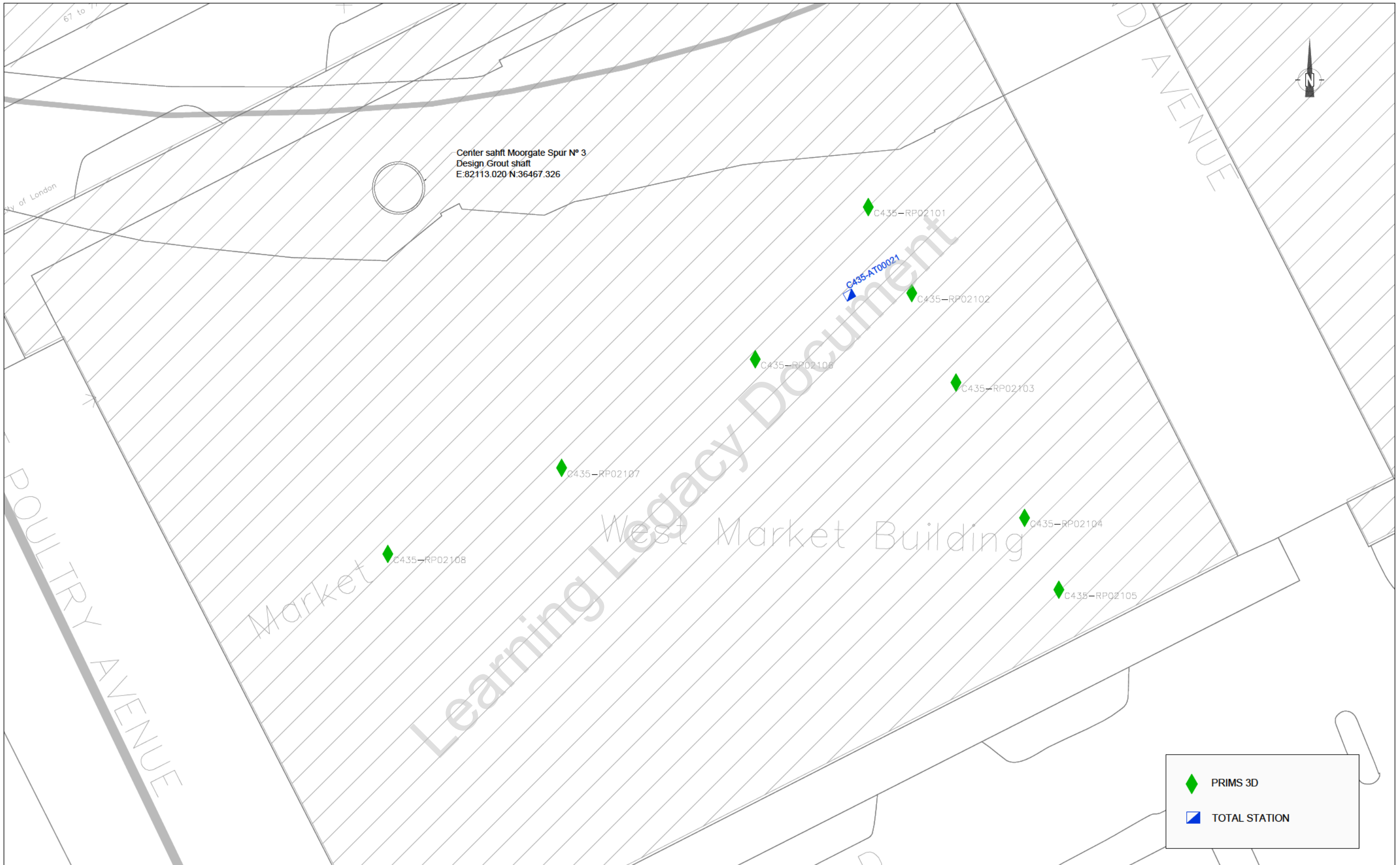
Close-Out Report – Automated Total Station ATS 21 and 3D
Targets read by ATS 21

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Appendix A: Drawings



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Rev.	Date	Description	By	Chkd	App	Auth
1	20-05-2013					

Notes:

 	GEOCISA UK C/ Los Llanos de Jerez 10-12 28823- MADRID www.geocisa.com	Contract : C435 I&M FARR NGDON	By :
		Originator : GEOCISA	Chk :
		Location : CROSSRAIL GENERAL	App :
		Title : 3D PRIMS ATS21	Auth :
Scale : @ A3	Drg No : C435-BFK-C2-RGN-M123-50066-IR-RP-ATS21	Rev :	Suit :

\$Pby\$



Close-Out Report – Automated Total Station ATS 21 and 3D
Targets read by ATS 21

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Appendix B: Graphs

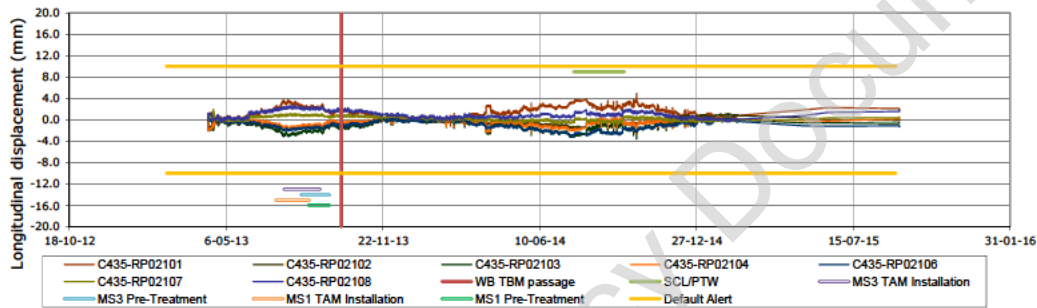


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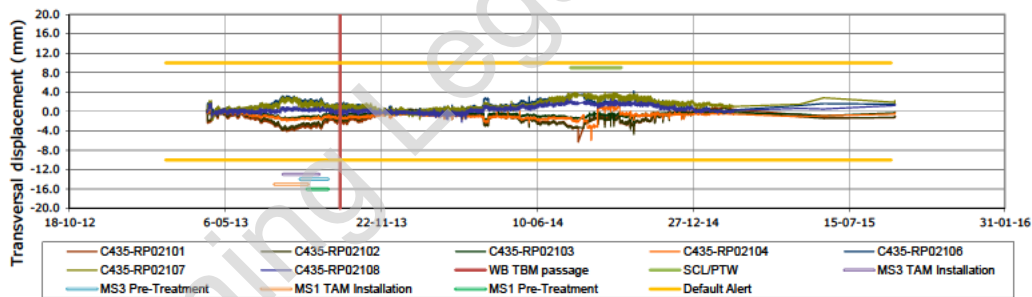
REPORT Automatic Prisms
 AREA Farrington Station
 DEVICE 3D Target



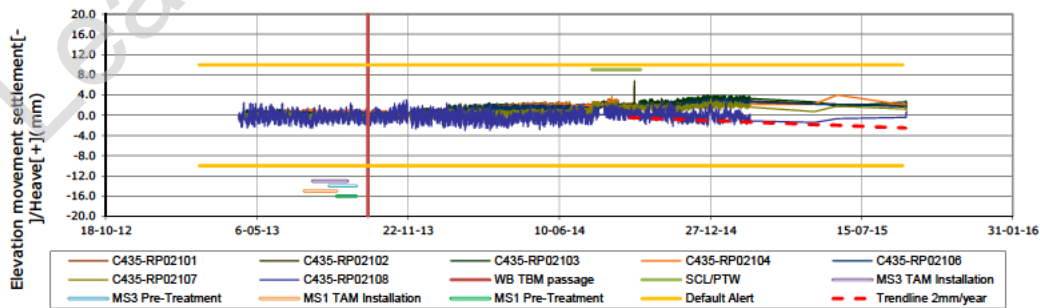
Building: PARKING WEST MARKET



Building: PARKING WEST MARKET



Building: PARKING WEST MARKET



REMARKS

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