

Please note the contents of these documents contain detailed descriptions and diagrams of Grenfell Tower. This could be upsetting for some.

This version of the document has therefore been created with any photographs of fire damage or the interior of the Tower removed to minimise the amount of potentially upsetting or distressing information within it. A copy of the original documents with photographs can be provided on request.

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The [Grenfell Health & Wellbeing Service](#) is a free and confidential local NHS service for children and adults affected by Grenfell. To talk to someone, you can get in touch by phone on 020 8637 6279 or by e-mail Grenfell.wellbeingservice@nhs.net.

This document and its contents have been prepared for the Ministry of Housing, Communities, and Local Government. For further information, please contact GrenfellTowerSite@communities.gov.uk

Grenfell Tower Monitoring

Automated Monitoring System

Annual Monitoring Report – From 1st January to 31st December 2020.

PC Monitoring Approval:

Revision:	Date:	Prepared by:	Reviewed by:	Comments:
00	20/01/2021			Initial submission
Signature				

Client Review:

Revision:	Date:	Reviewed by:	Comments:
Signature			

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1 Project Details

PC Monitoring have been instructed to monitor any movements of the structure of the Grenfell Tower undertaken during the propping and remedial works of the tower.

This annual report includes summary information for the Automated Monitoring regime captured between 01/01/2020 to 31/12/2020.

The location of the infrastructure that requires monitoring can be seen below in Fig 1.

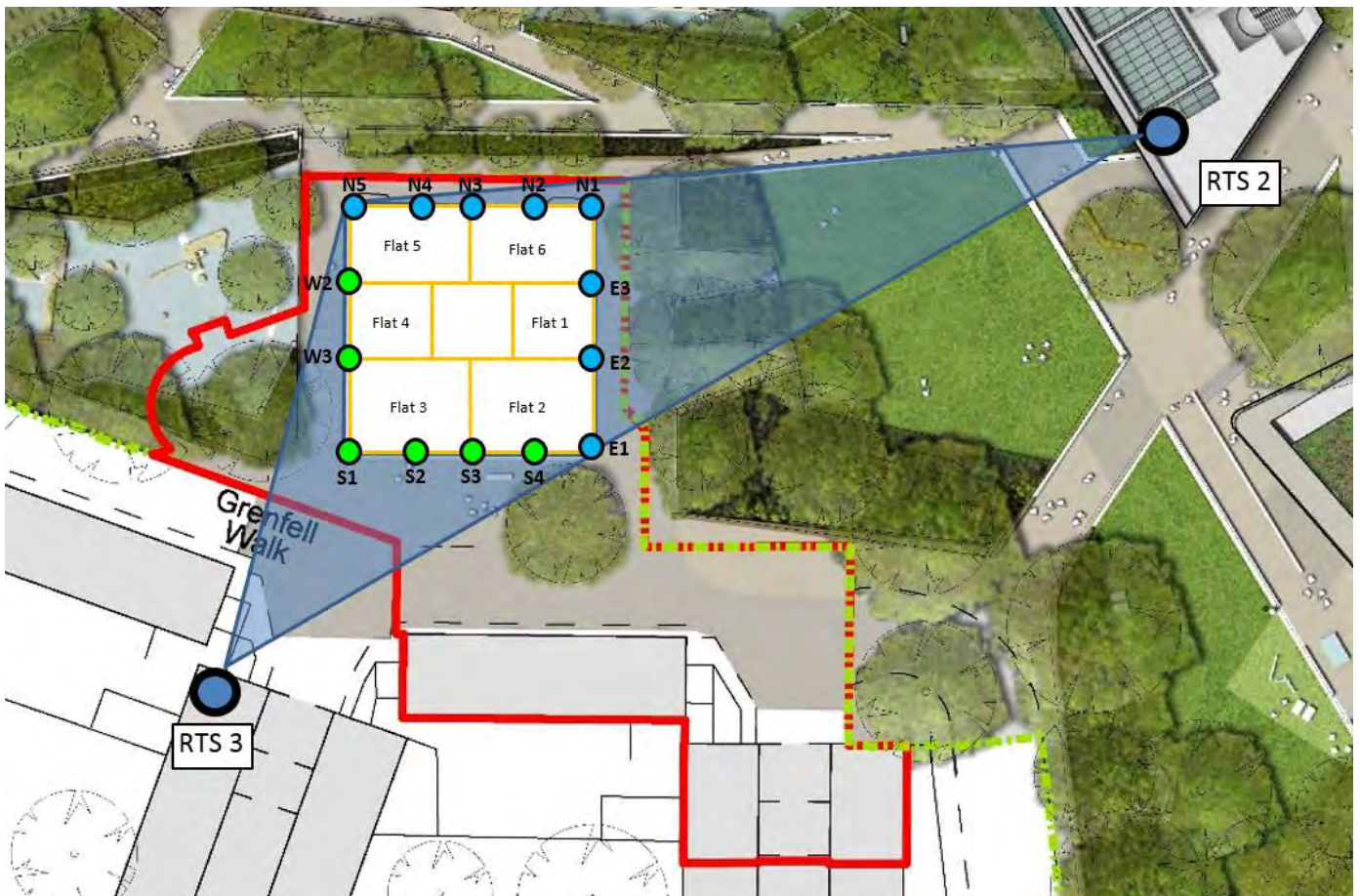


Figure 1 - Location of the monitoring arrays and automated total stations.

2 Monitoring System

External Structural instrumentation comprises of monitoring and reference prisms in conjunction with Automated Total Stations (ATS) and associated logging enclosures. Internal Structural Monitoring includes Distometer Measurement Sensors, and Tiltmeter Sensors. The monitored area contains Automated Total Station (ATS) Systems with monitoring points located at level 24 at the intersection of the column and floor slab on all sides of the building. The Distometer Nodes have been installed in two of the columns of the North façade, and the Tiltmeter Sensors in three different flats (floors 13th, 16th and 20th), being all connected to three Gateways located in specific places to allow the data interchange.

Please see below details for the Monitoring Automated System:

- 14 No. monitoring prisms have been installed within the Grenfell Tower Building Façades. The 14 prisms are located on the façades of Level 24 which are monitored by 2 No. Automated Total Stations (ATS) Systems.

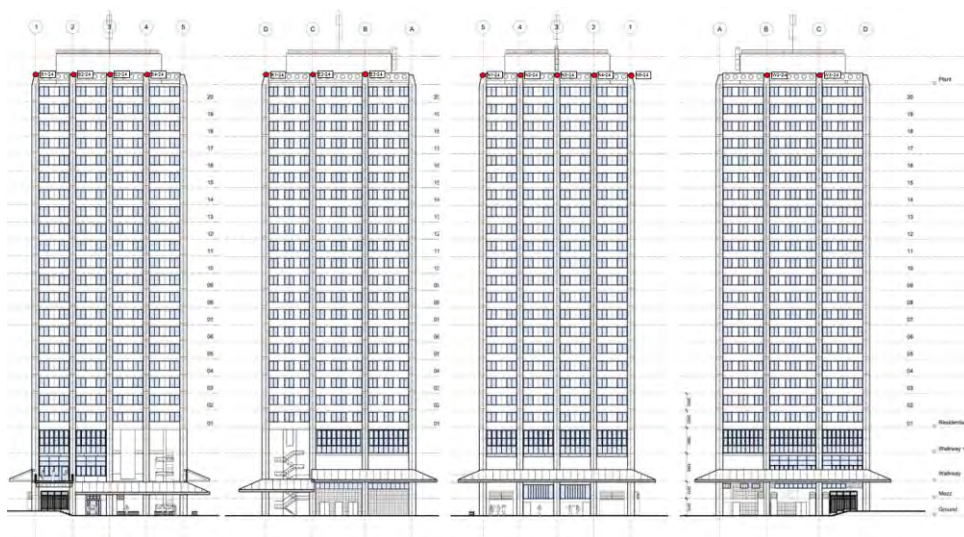


FIGURE 2 – GRENPELL TOWER MONITORING PRISMS ON FACADES

- 26 No. Distometer Nodes are located on Columns N4 & N5 on Levels 11-23, 9 No. Tiltmeters are located on Levels 13, 16 and 20. and 3 No. Gateways.
- 1 No. Weather station is location on top of the of the structure
- 26 No. Temperature and humidity sensors



Figure 3 - Grenfell Tower Internal Sensors

The purpose of this report is to summarise the monitoring data related to the Grenfell Tower activities recorded by the Automated Monitoring System and were downloaded from Maxwell. Please see the below image indicating the orientation of the X, Y and Z-axis.



Figure 4 - Grenfell Tower Orientation

3 Monitoring Period Summary

Please see below summary for the period that this report refers, regarding:

3.1 Data Trends

Plots of the data over this period revealed no visible trends apart from Atmospheric and temperature fluctuations.

3.2 Summary of key events

3.2.1 Site Activities

Scaffolding and monarflex adaptations were undertaken between March and April of 2019. During these works, a few monitoring prisms on Level 24 displayed spikes in the data which resulted in triggers being breached. The subsequent monitoring data for these affected prisms resumed to normal monitoring tolerances hereafter.

3.2.2 Temperature related offsets

An analysis of measured displacement of monitoring prisms at Grenfell Tower indicates a close correlation to measured atmospheric conditions. The recorded data from the project has been collated and used to quantify a temperature related displacement coefficient. An offset has been applied to minimise the effect of temperature variations on the monitoring data. See table 1 below for offsets applied to some Level 24 monitoring prisms.

TABLE 1 - TEMPERATURE OFFSETS

Target	Date	Offset X, m	Offset Y, m	Offset Z, m
N1_24	19/02/2020	0.0000	0.0074	0.0076
N2_24	19/02/2020	0.0003	0.0028	0.0071
N3_24	19/02/2020	0.0024	0.0024	-0.0001
N4_24	19/02/2020	0.0034	-0.0011	-0.0005
N5_24	19/02/2020	0.0032	0.0030	-0.0017
E2_24	19/02/2020	0.0002	0.0019	0.0027
E3_24	19/02/2020	0.0033	0.0029	0.0033

3.2.3 Banner related offsets

During June 2020, the banner was adjusted on site, resulting in knocks to certain prisms that required offsets. These can be seen in the table below.

TABLE 2 - BANNER OFFSETS

Target	Date	Offset X, m	Offset Y, m	Offset Z, m
N1_24	02/06/2020	0.0011	0.0028	0.0034
N2_24	02/06/2020	0.0026	0.0006	0.0053
N3_24	02/06/2020	0.0023	0.0032	0.0047
N4_24	02/06/2020	0.0045	-0.0038	0.0044
N5_24	02/06/2020	0.0014	0.0056	-0.0042
E2_24	02/06/2020	-0.0193	0.0021	-0.0017
E3_24	02/06/2020	0.0043	0.0009	0.0087
W2_24	02/06/2020	-0.0158	-0.0015	0.0245
W3_24	02/06/2020	-0.0207	0.0039	0.1840
E2_24	26/06/2020	-0.0467	0.0012	-0.0004
W2_24	26/06/2020	-0.0196	0.0023	0.0331
W3_24	26/06/2020	-0.0130	0.0070	0.0202

3.3 Trigger levels breached

Monitoring Prisms

Point ID	Date	Time	Trigger Level	Value Recorded (mm)	Cause
E1_24	20/02/2020	10:00	Red 12mm	12.1 (X,Y,Z Axis)	Test Alert
N1_24	20/02/2020	10:00	Red 12mm	-12.1 (X,Y,Z Axis)	Test Alert
E1_24	20/02/2020	11:00	Black 25mm	25.1 (X,Y,Z Axis)	Test Alert
N1_24	20/02/2020	11:00	Black 25mm	-25.1 (X,Y,Z Axis)	Test Alert
E3_24	22/06/2020	11:00	Black 25mm	30.1 (X Axis)	Banner Works
E2_24	26/06/2020	16:00	Black 25mm	46.7 (X-Axis)	Banner Works
W2_24	26/06/2020	16:00	Black 25mm	33.1 (Z-Axis)	Banner Works
W3_24	26/06/2020	16:00	Red 12mm	20.2 (Z-Axis)	Banner Works
N5_24	10/08/2020	17:00	Red 12mm	12.1 (Z-Axis)	
W3_24	10/08/2020	17:00	Red 12mm	12.5 (Z-Axis)	
W3_24	11/08/2020	12:00	Red 12mm	12.4 (Z-Axis)	
N5_24	11/08/2020	15:00	Red 12mm	13.1 (Z-Axis)	
S1_24	11/08/2020	15:00	Red 12mm	12.6 (Z-Axis)	
S1_24	12/08/2020	00:00	Red 12mm	12.3 (Z-Axis)	
N5_24	12/08/2020	13:00	Red 12mm	12.8 (Z-Axis)	
N5_24	13/08/2020	14:00	Red 12mm	12.2 (Z-Axis)	
E1_24	04/12/2020	Ongoing until 11/12/2020	Red 12mm	12.1 (Z-Axis)	
E3_24	08/12/2020	Ongoing until 09/12/2020	Red 12mm	12.1 (Z-Axis)	
E3_24	30/12/2020	Ongoing until 02/01/2021	Red 12mm	12.1 (Z-Axis)	
E1_24	28/12/2020	17:00	Red 12mm	12.1 (Z-Axis)	

N5_24	31/12/2020	Ongoing until 02/01/2021	Red 12mm	12.1 (Z-Axis)	
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Laser Distometers

Point ID	Date	Time	Trigger Level Exceeded	Cause
N4_21_D	07/01/2020	06:06	Amber 2.5mm	Maintenance
N4_20_D	07/01/2020	11:36	Amber 2.5mm	Maintenance
N4_16_D	07/01/2020	12:06	Amber 2.5mm	Condensation
N5_11_D	07/01/2020	12:06	Amber 2.5mm	Condensation
N5_21_D	07/01/2020	14:36	Amber 2.5mm	Condensation
N4_14_D	23/01/2020	16:00	Amber 2.5mm	Maintenance
N4_14_D	28/01/2020	13:00	Amber 2.5mm	Maintenance
N4_12_D	28/01/2020	13:00	Amber 2.5mm	Maintenance
N4_23_D	30/11/2020	10:00-11:00	Red 5mm	Knocked

Tiltmeters

Point ID	Date	Time	Trigger Level	Value Recorded (Degrees)	Cause

4 Monitoring Data

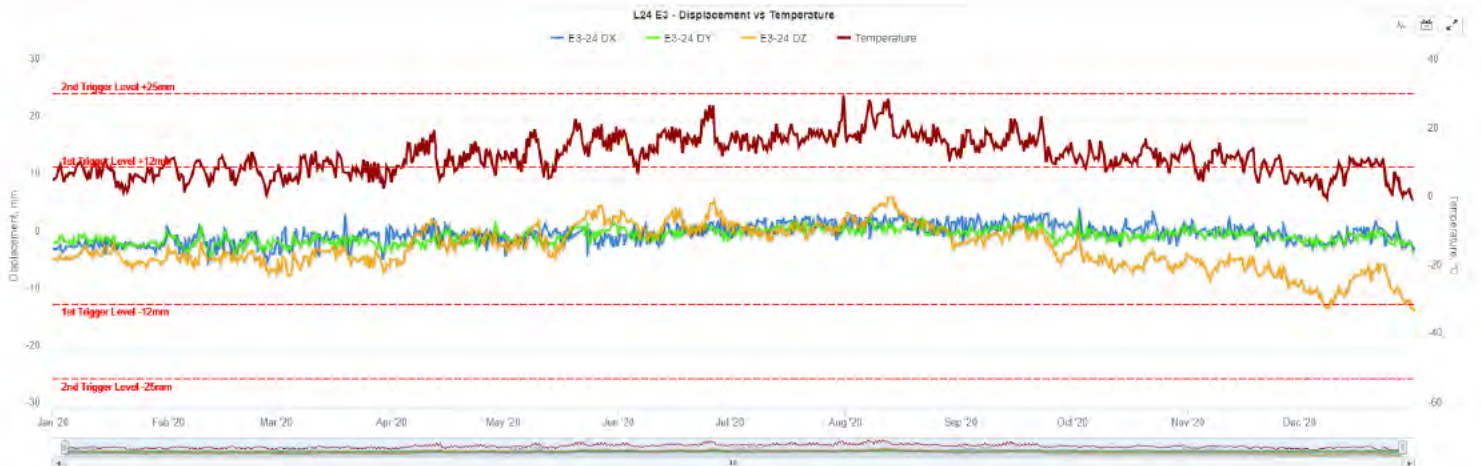
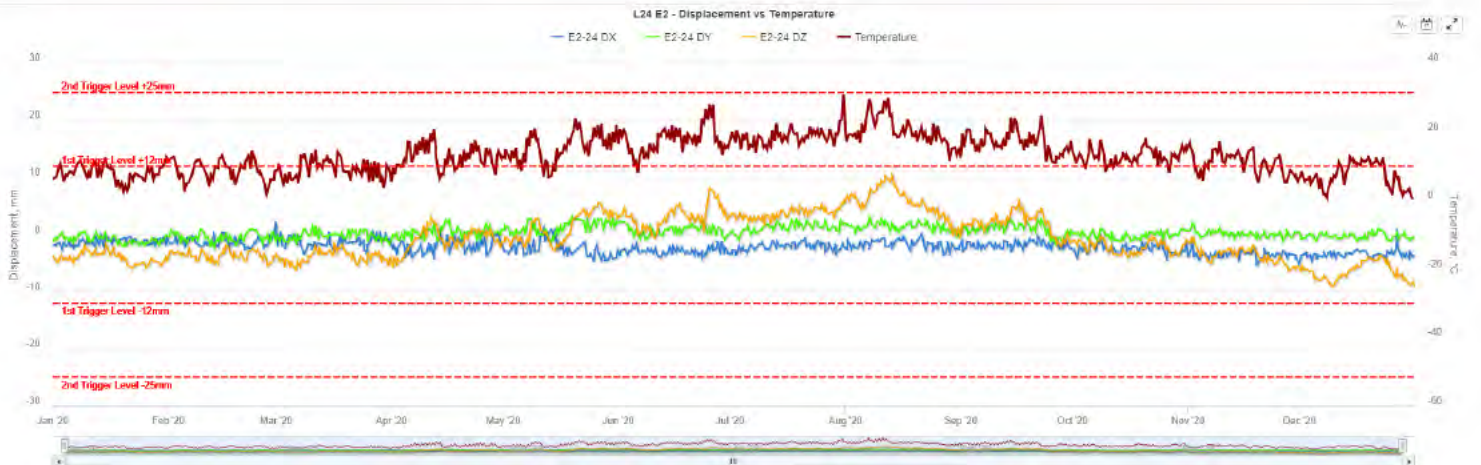
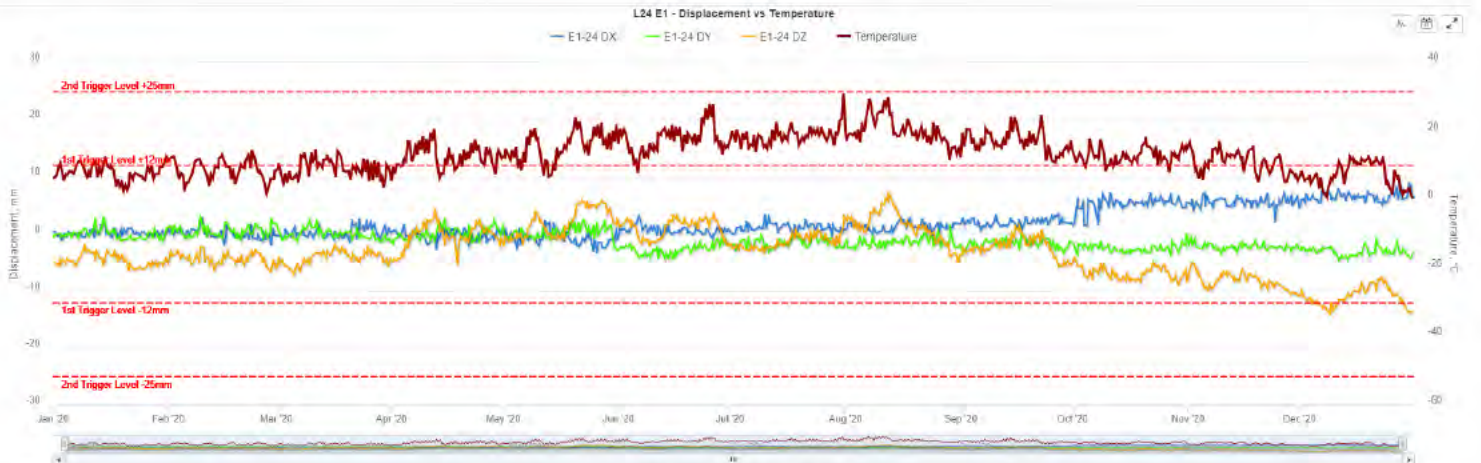
4 Monitoring Data

4.1 Grenfell Tower Monitoring Prisms

South and East Prism Location

Axis Directions

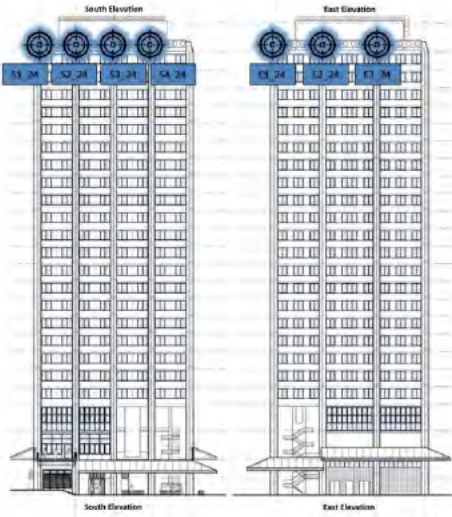
North and West Prism Location



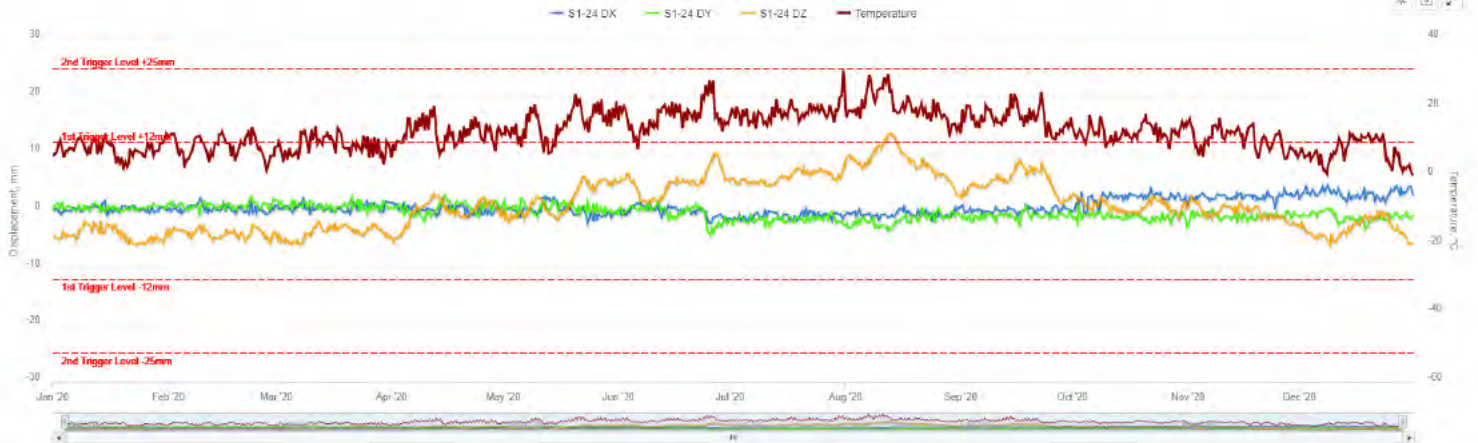
South and East Prism Location

Axis Directions

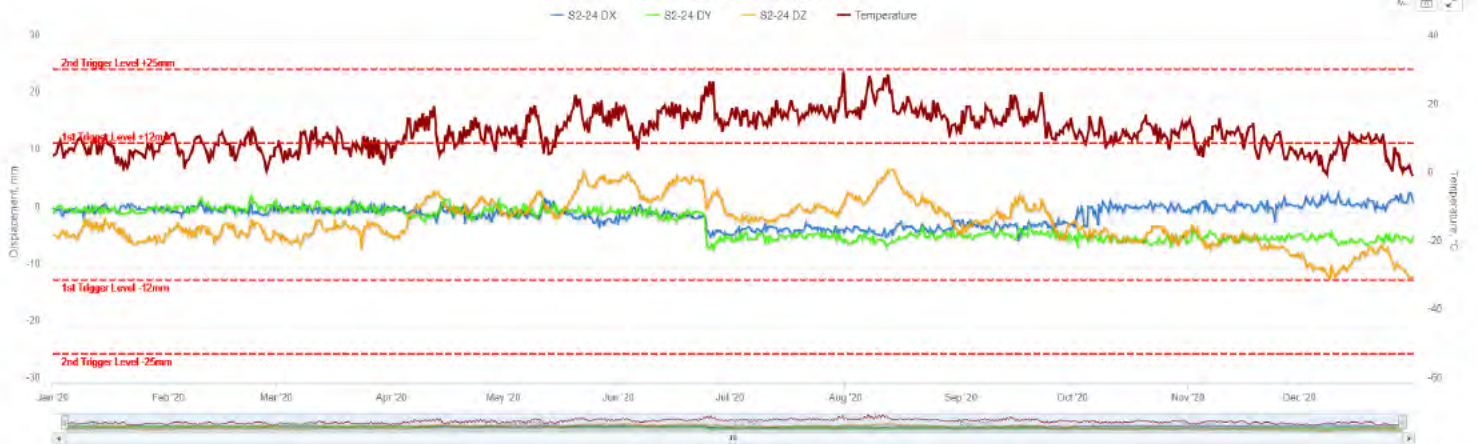
North and West Prism Location



L24 S1 - Displacement vs Temperature



L24 S2 - Displacement vs Temperature



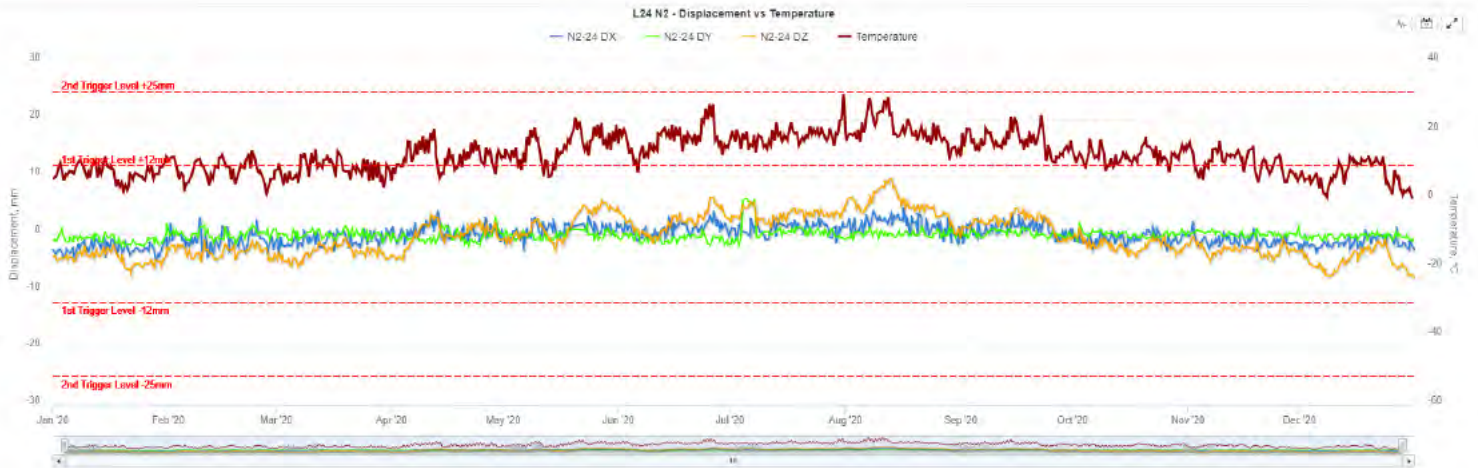
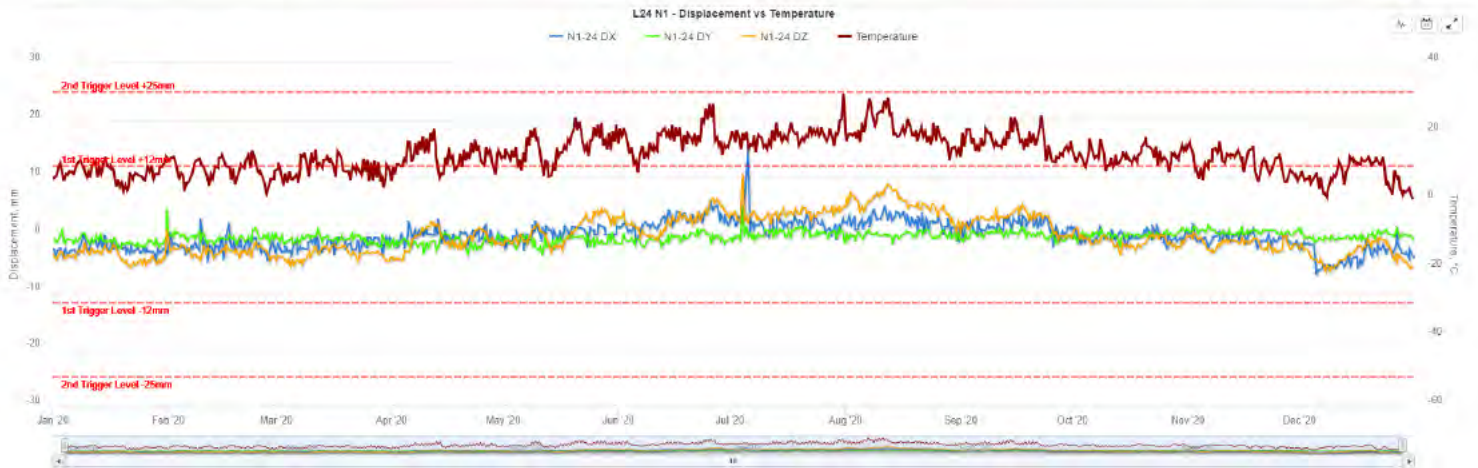
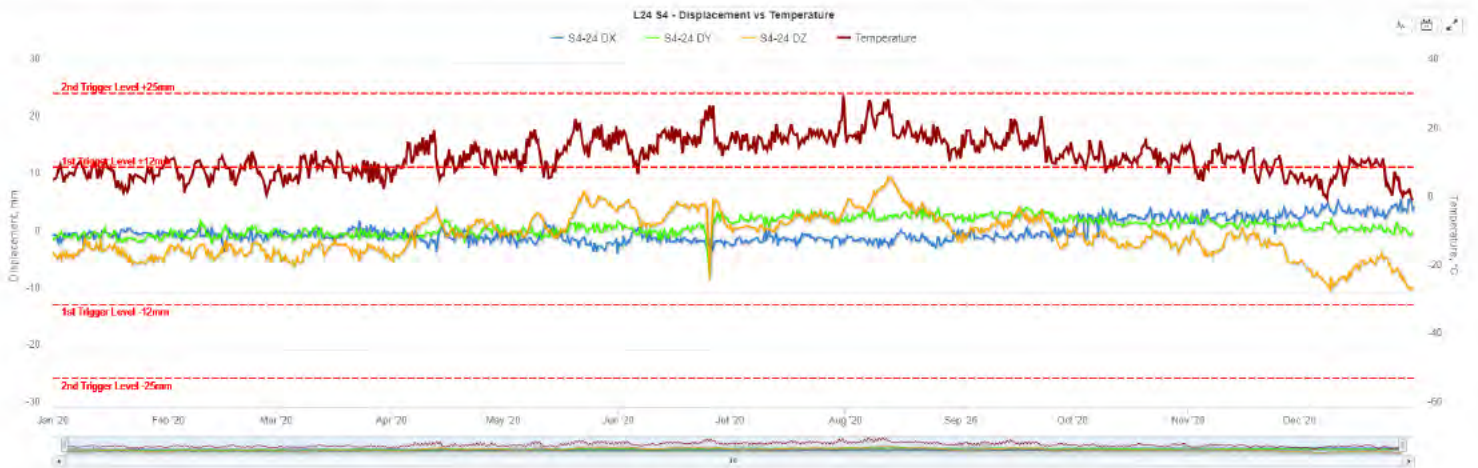
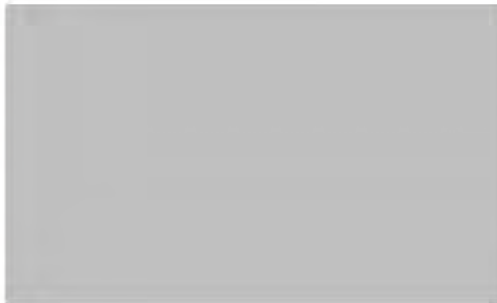
L24 S3 - Displacement vs Temperature



South and East Prism Location

Axis Directions

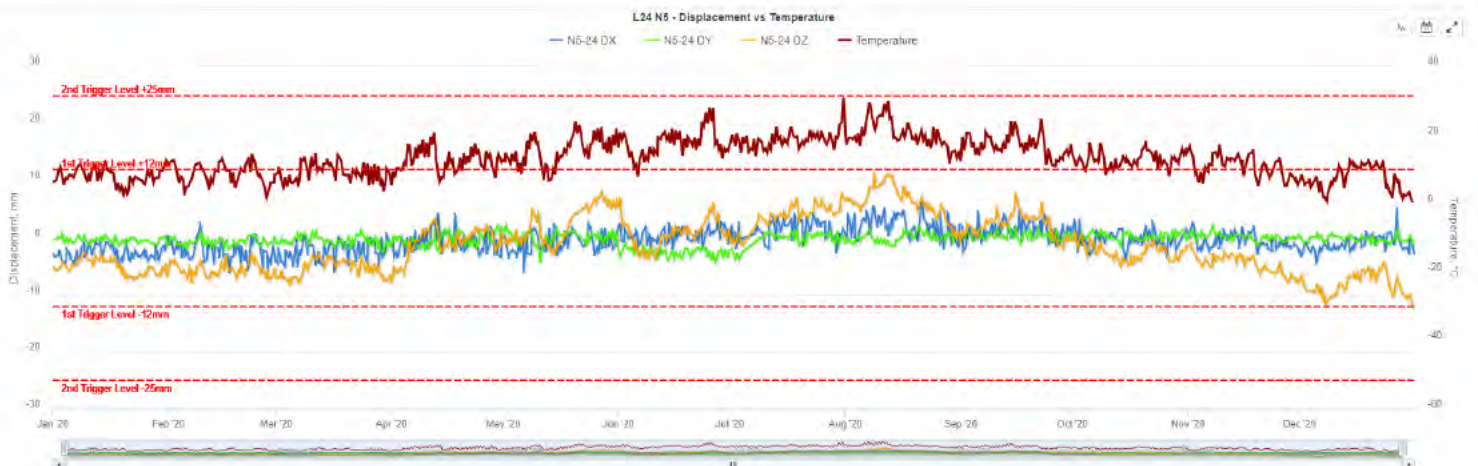
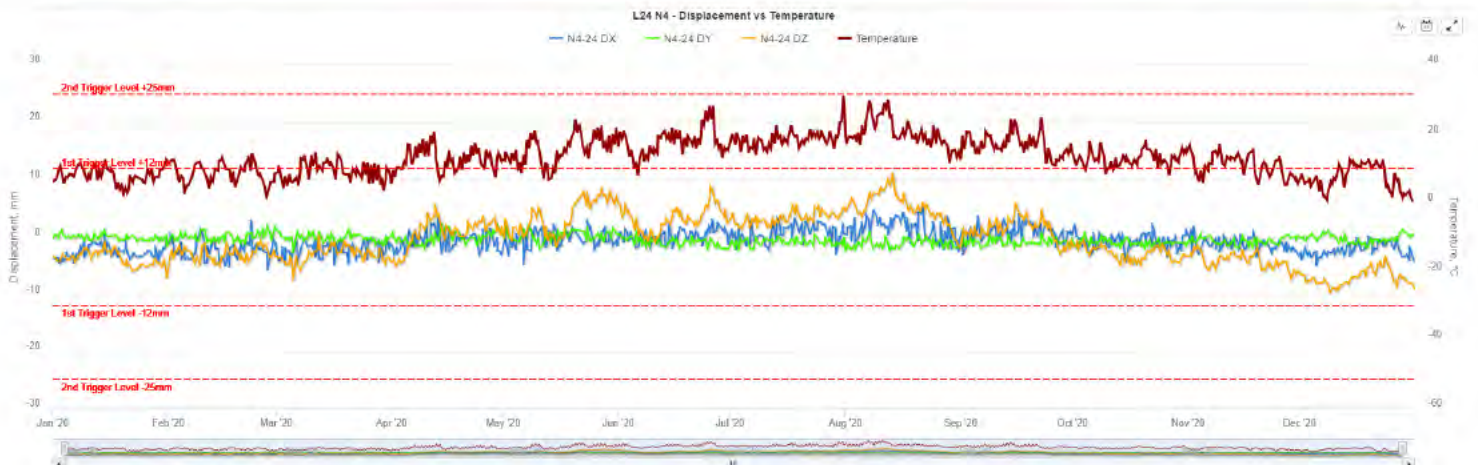
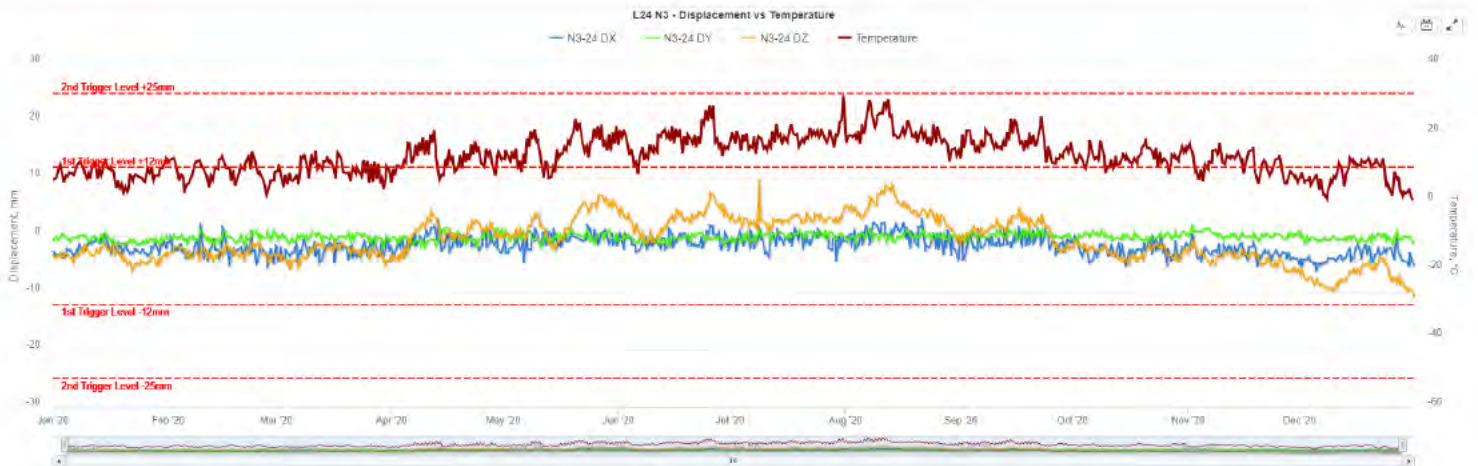
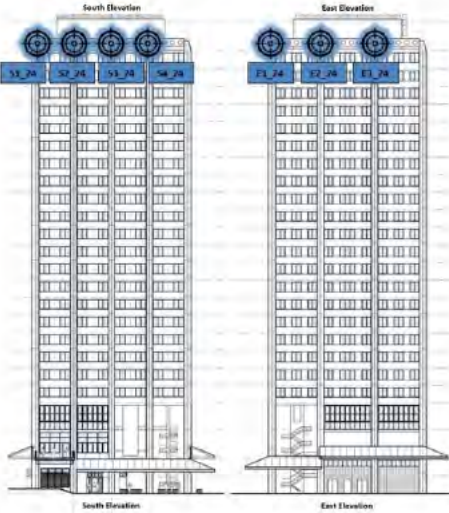
North and West Prism Location



South and East Prism Location

Axis Directions

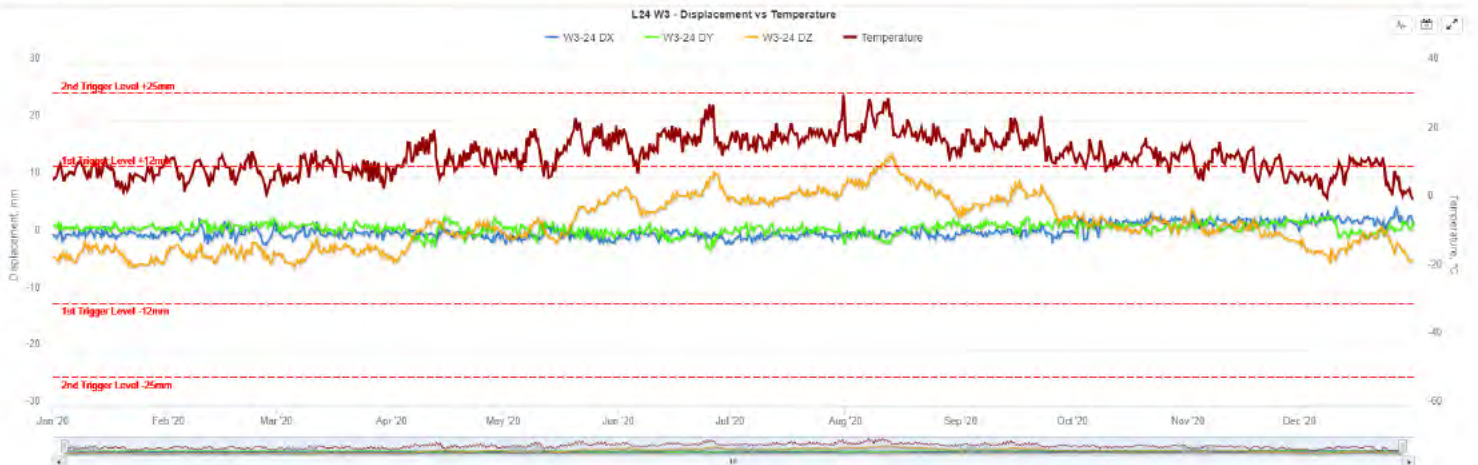
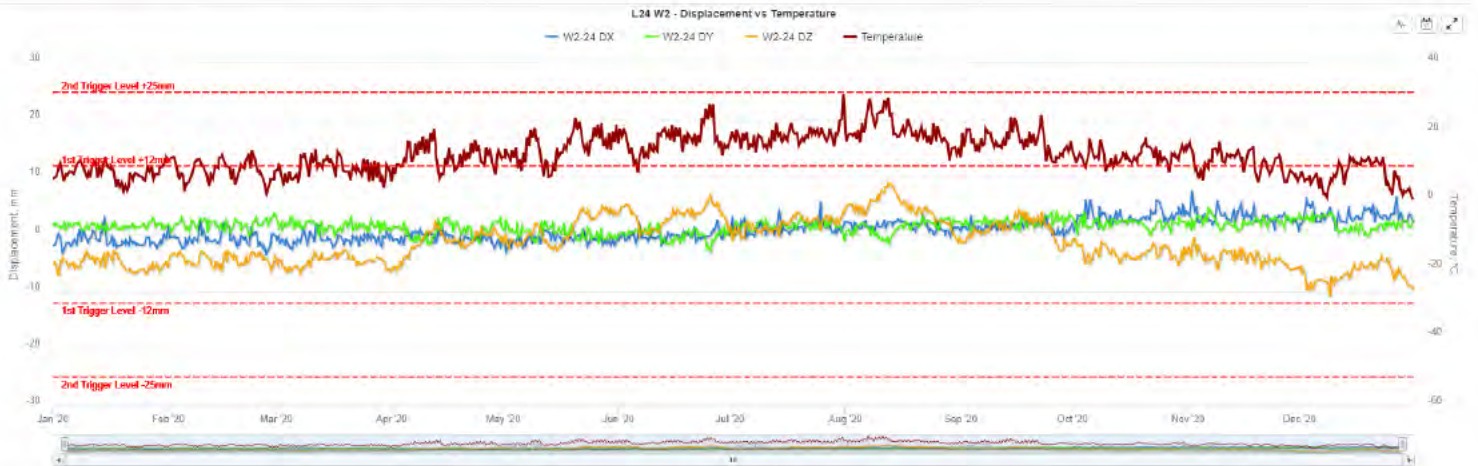
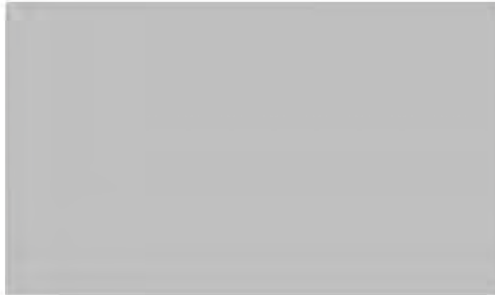
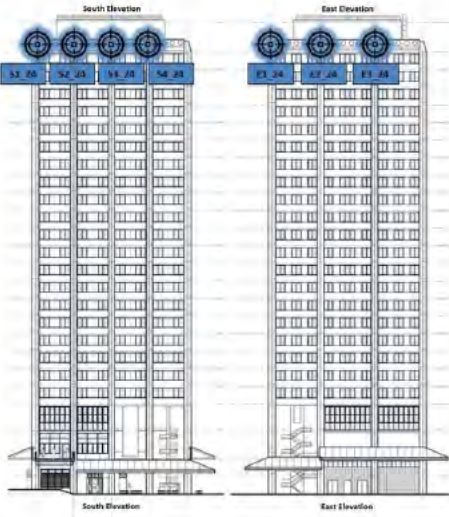
North and West Prism Location



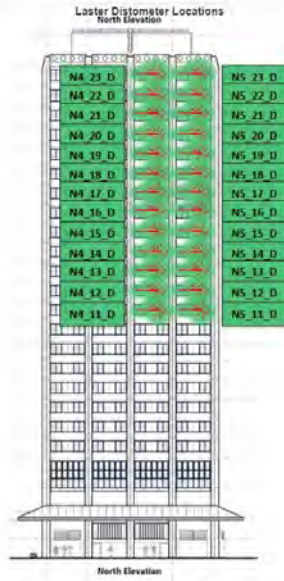
South and East Prism Location

Axis Directions

North and West Prism Location



4.2 Grenfell Tower Distometer Nodes



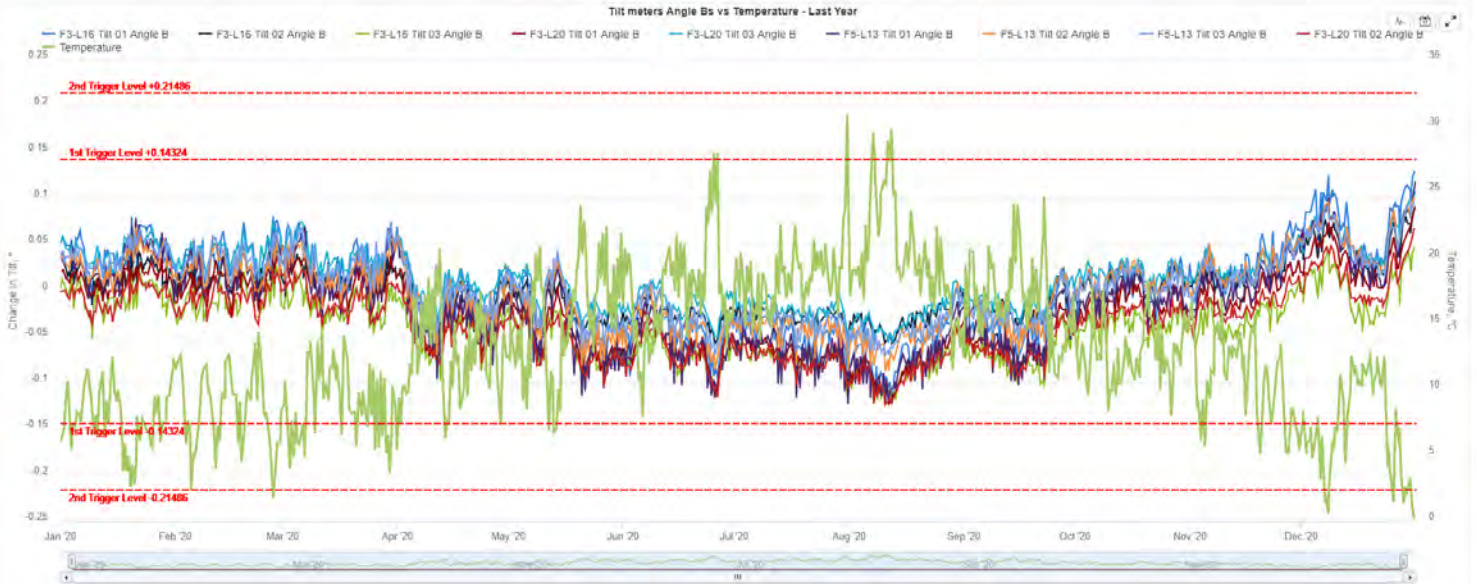
N4 Laser Distometers vs Temperature - Last Year



N5 Laser Distometers vs Temperature - Last Year

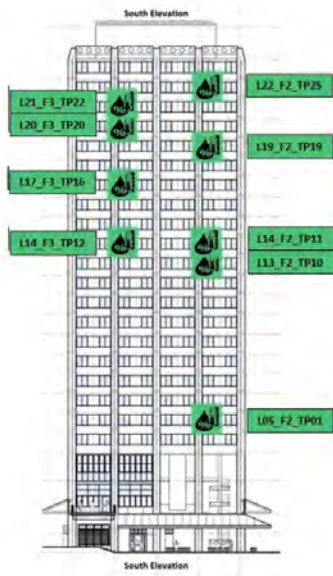


4.3 Grenfell Tower Tiltmeters



4.4 Grenfell Tower Temperature and Humidity Sensors

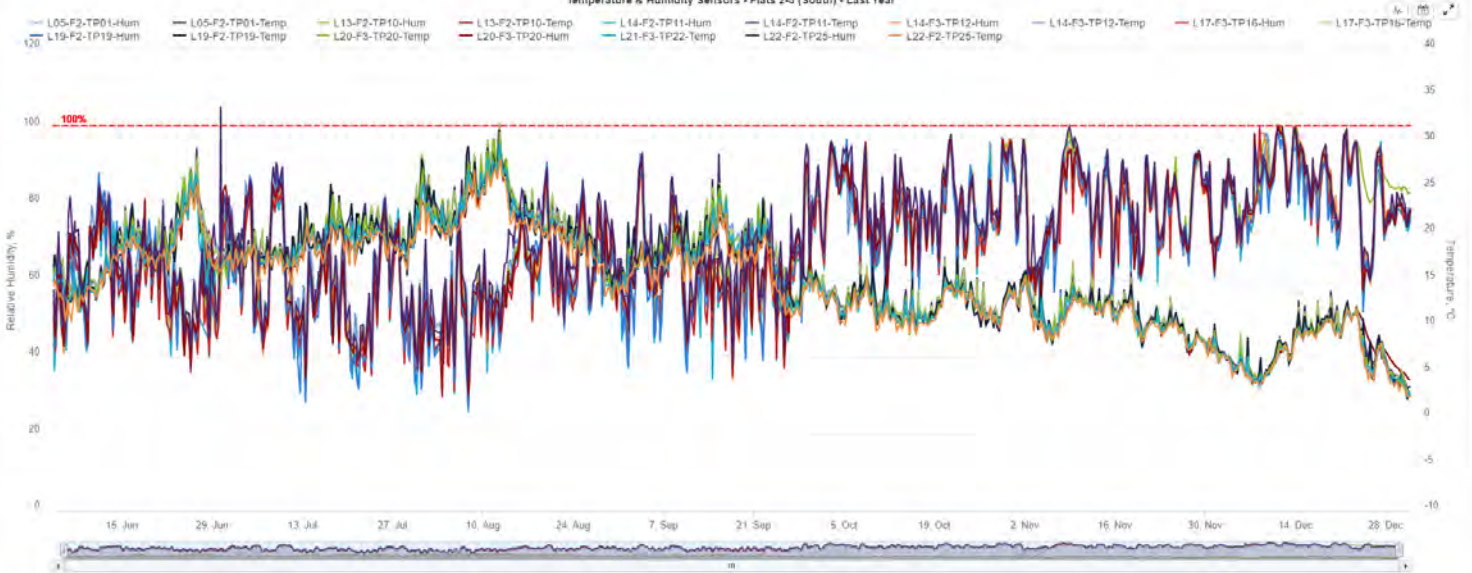
Temperature & Humidity Sensors Locations - South Elevation



Temperature & Humidity Sensors Locations - East Elevation



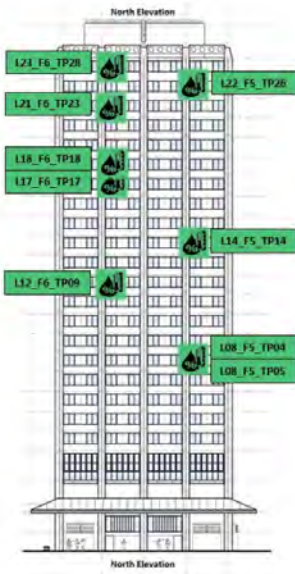
Temperature & Humidity Sensors - Flats 2-3 (South) - Last Year



Temperature & Humidity Sensors - Flat 1 (East) - Last Year



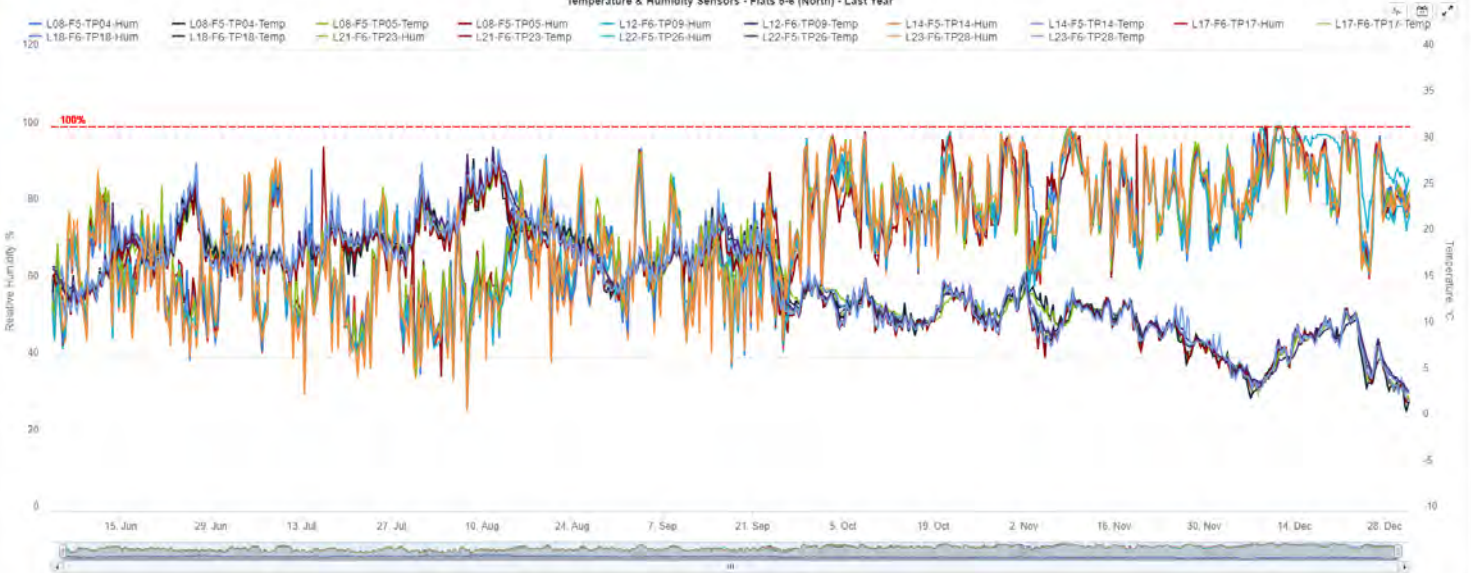
Temperature & Humidity Sensors Locations - North Elevation



Temperature & Humidity Sensors Locations - West Elevation



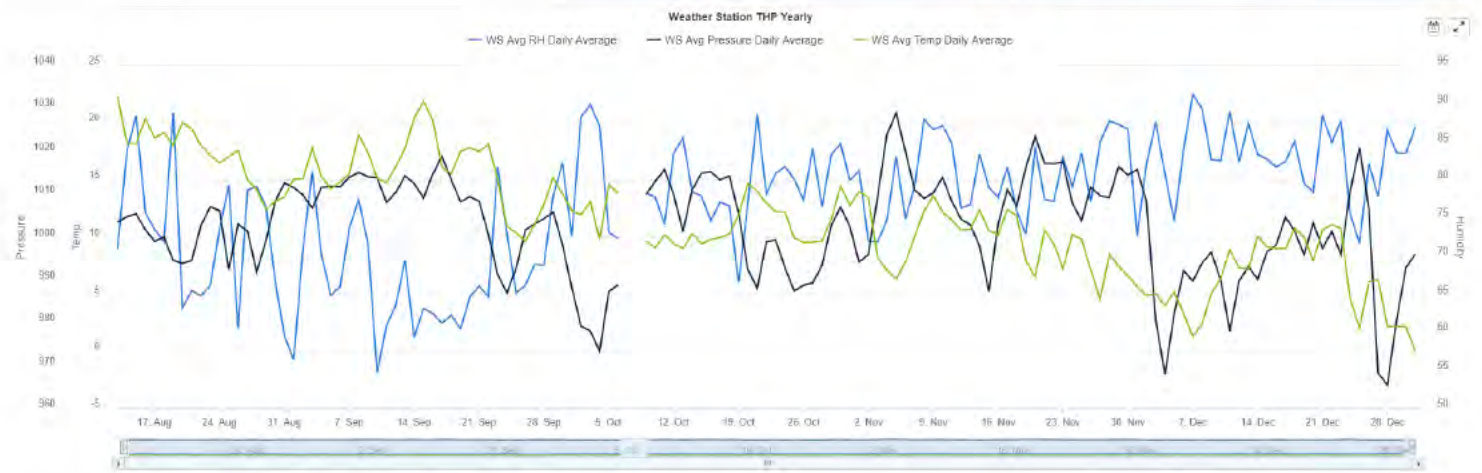
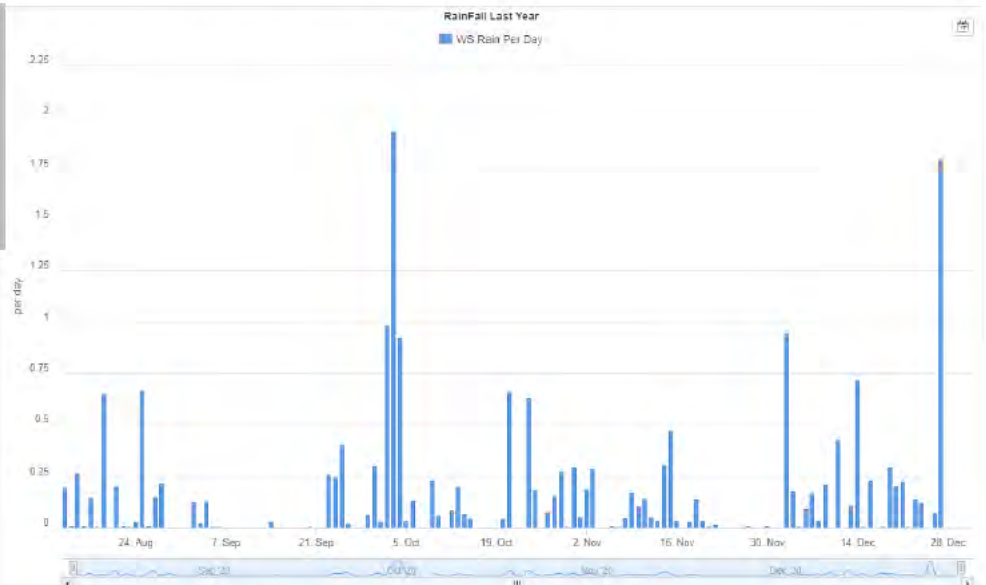
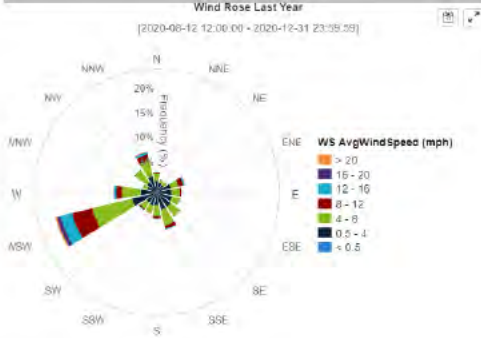
Temperature & Humidity Sensors - Flats 5-6 (North) - Last Year



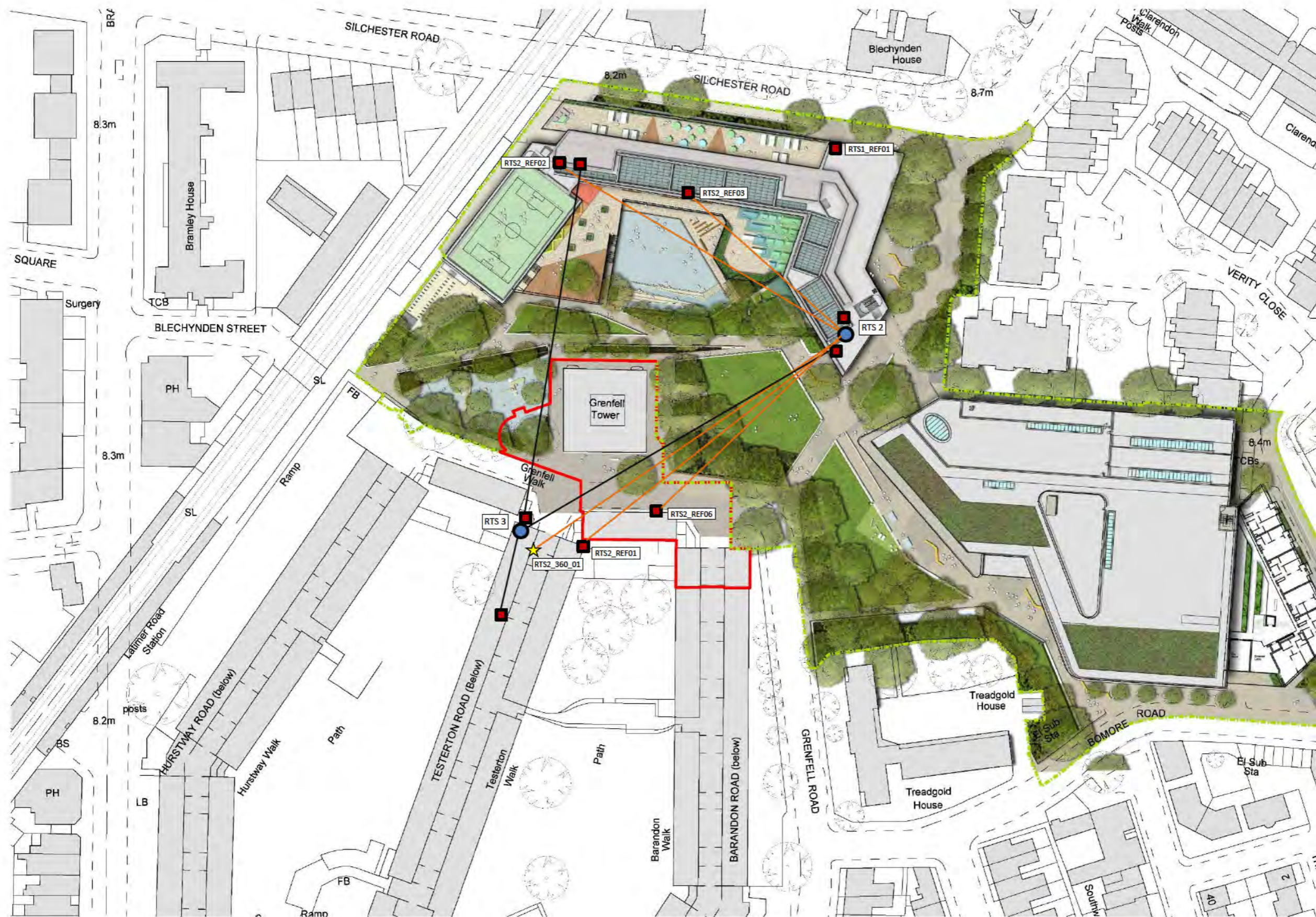
Temperature & Humidity Sensors - Flat 4 (West) - Last Year



4.5 Grenfell Tower Weather Station



5 Monitoring System Overview



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--- Current Boundary KALC
 --- Proposed Boundary Grenfell



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GRENELL TOWER REGENERATION PROJECT

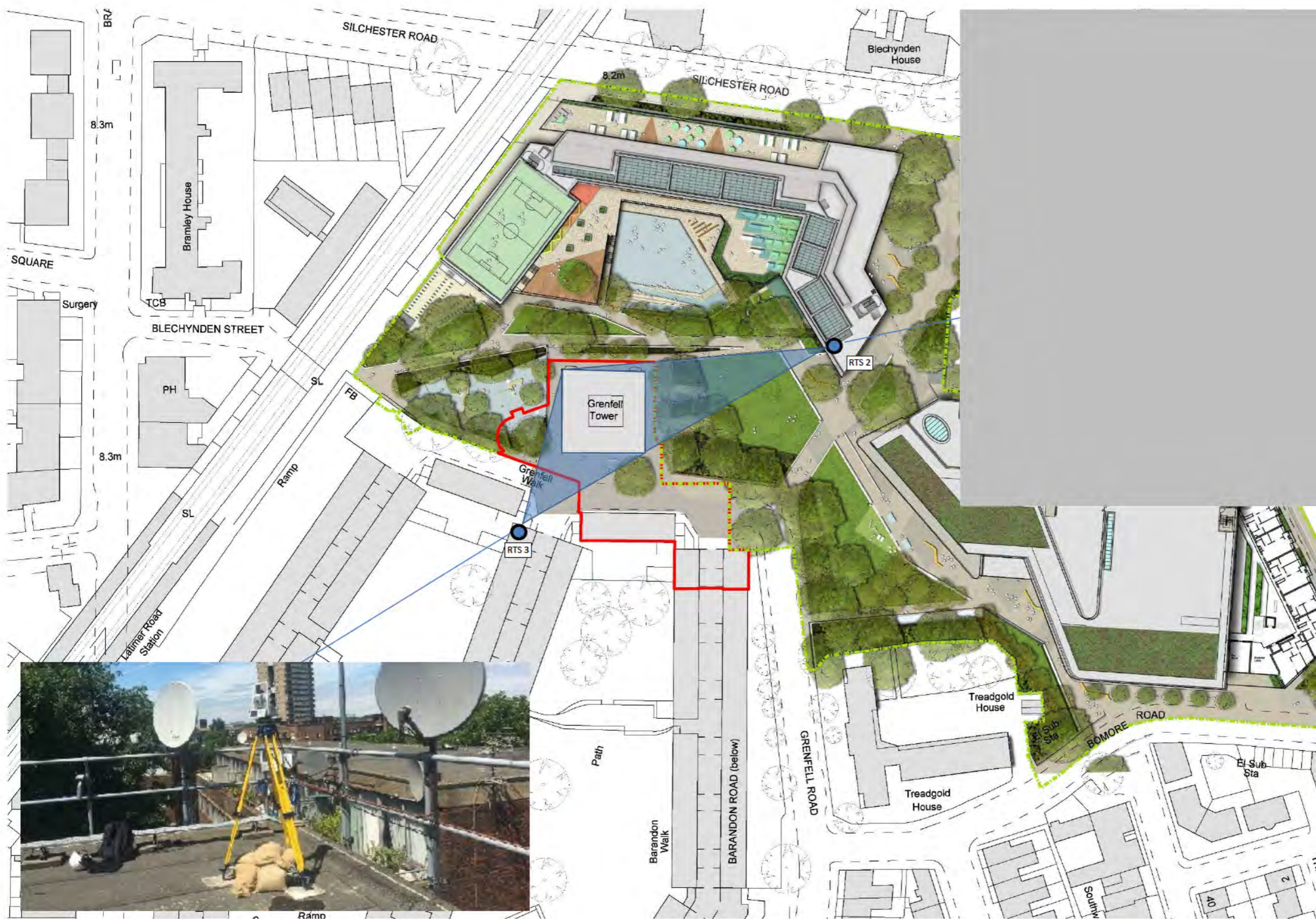
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 SCALE DATE
 1279 PL 003 01
 DWG NO REVISION CHECKED

Grenfell Tower Marked-up Drawing - Control
 Revision August 2018

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--- Current Boundary KALC

--- Proposed Boundary Grenfell



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GRENELL TOWER
 REGENERATION PROJECT

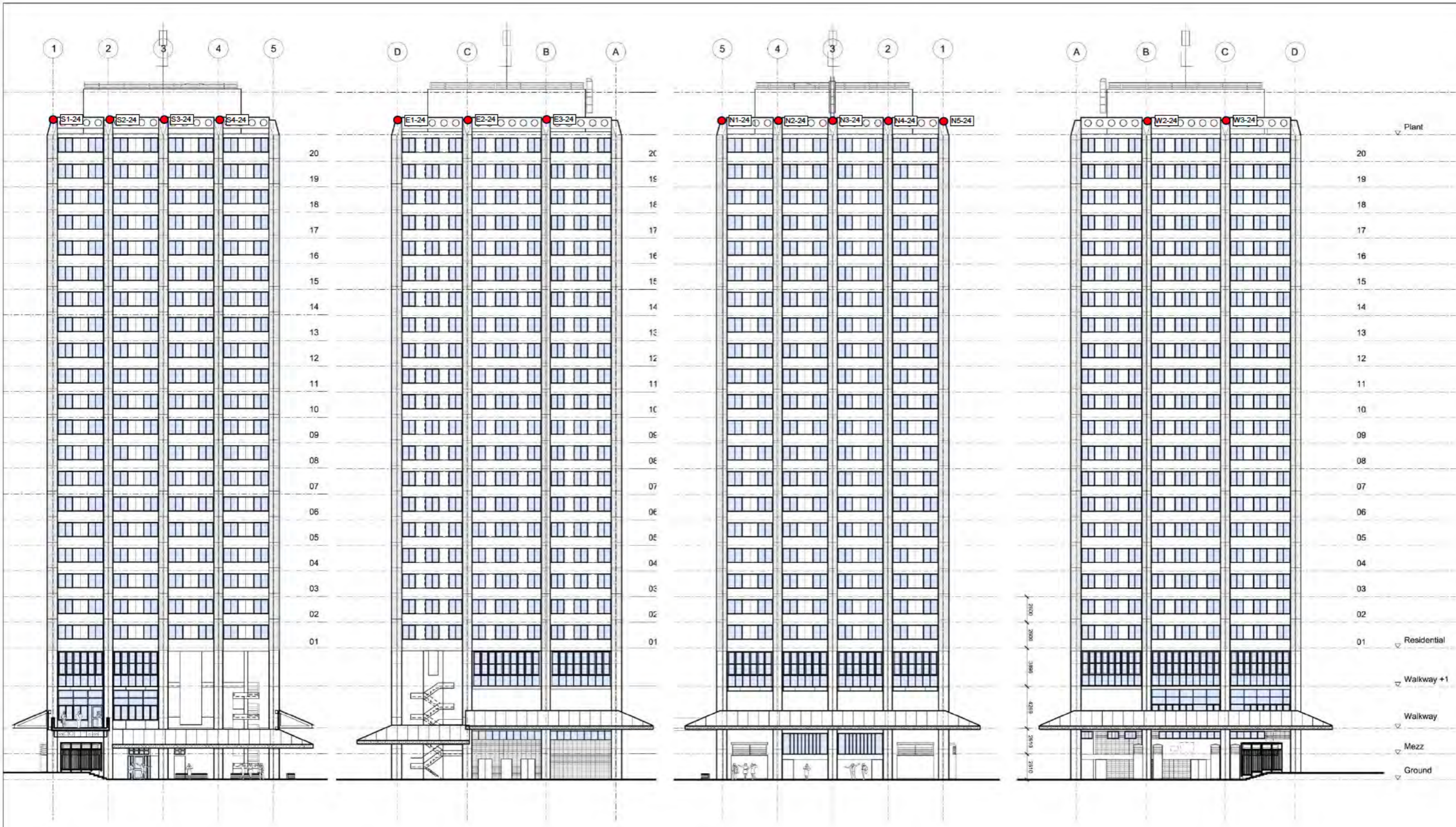
Proposed
 Site Plan

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Grenfell Tower Marked-up Drawing - Plan
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Key

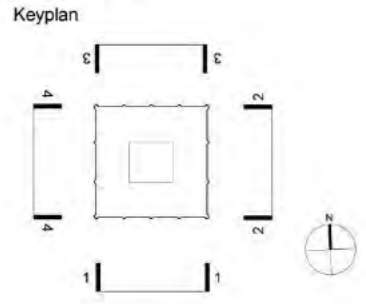
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- 07
- 06
- 05
- 04
- 03
- 02
- 01
- Plant
- Residential
- Walkway +1
- Walkway
- Mezz
- Ground

1 SOUTH ELEVATION
1:200

2 EAST ELEVATION
1:200

3 NORTH ELEVATION
1:200

4 WEST ELEVATION
1:200

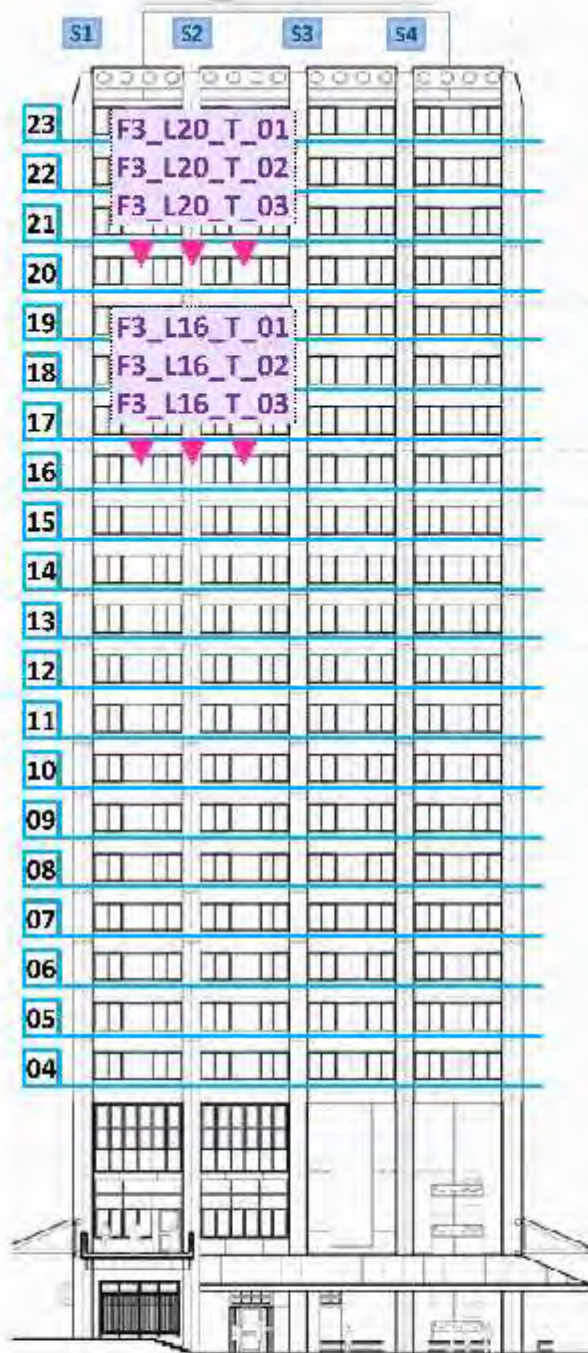


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GRENfell TOWER REGENERATION PROJECT	
EXISTING ELEVATIONS	
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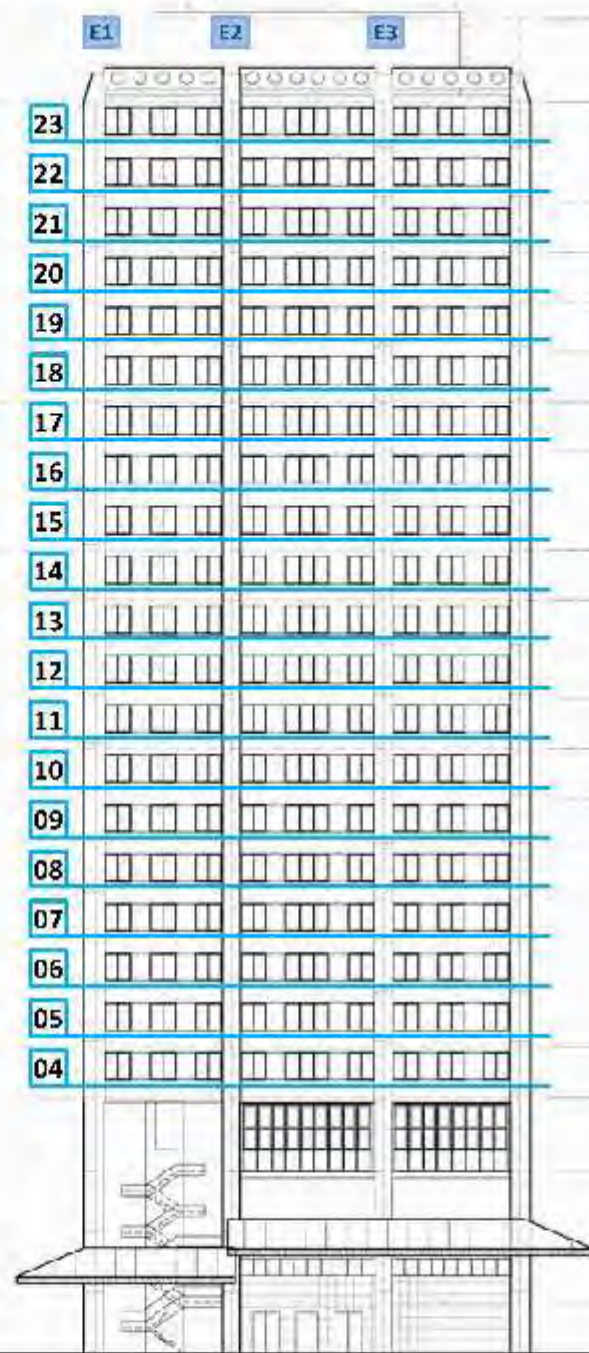
Grenfell Tower Marked-up Drawing - Elevation
Revision 3 - 20170626



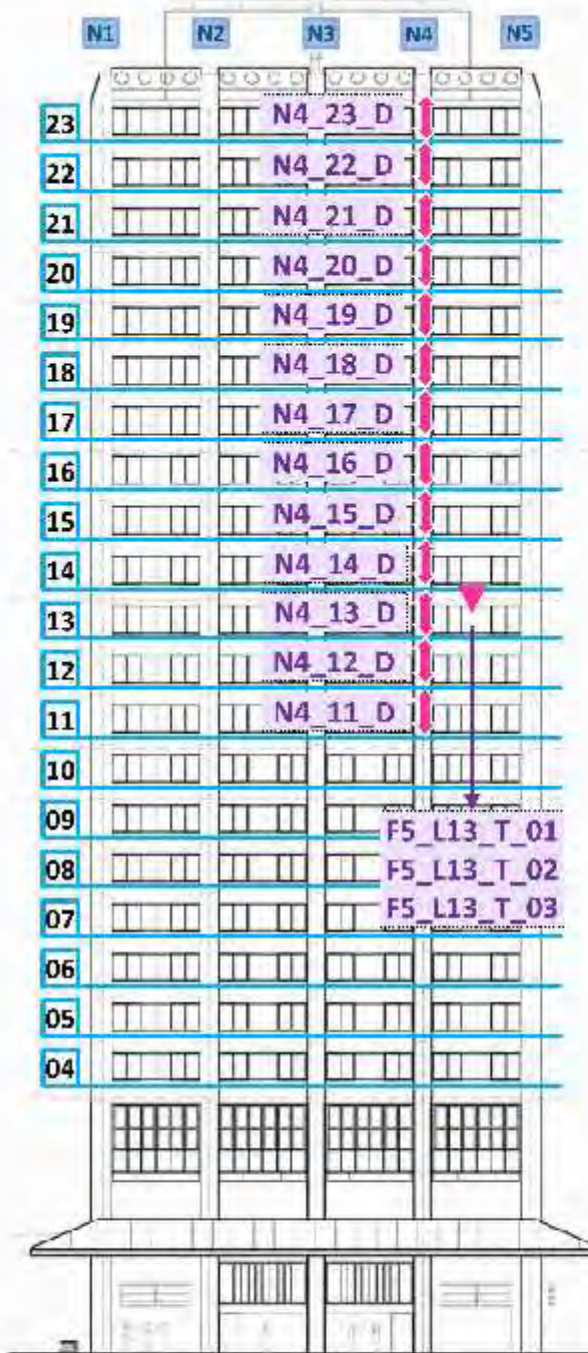
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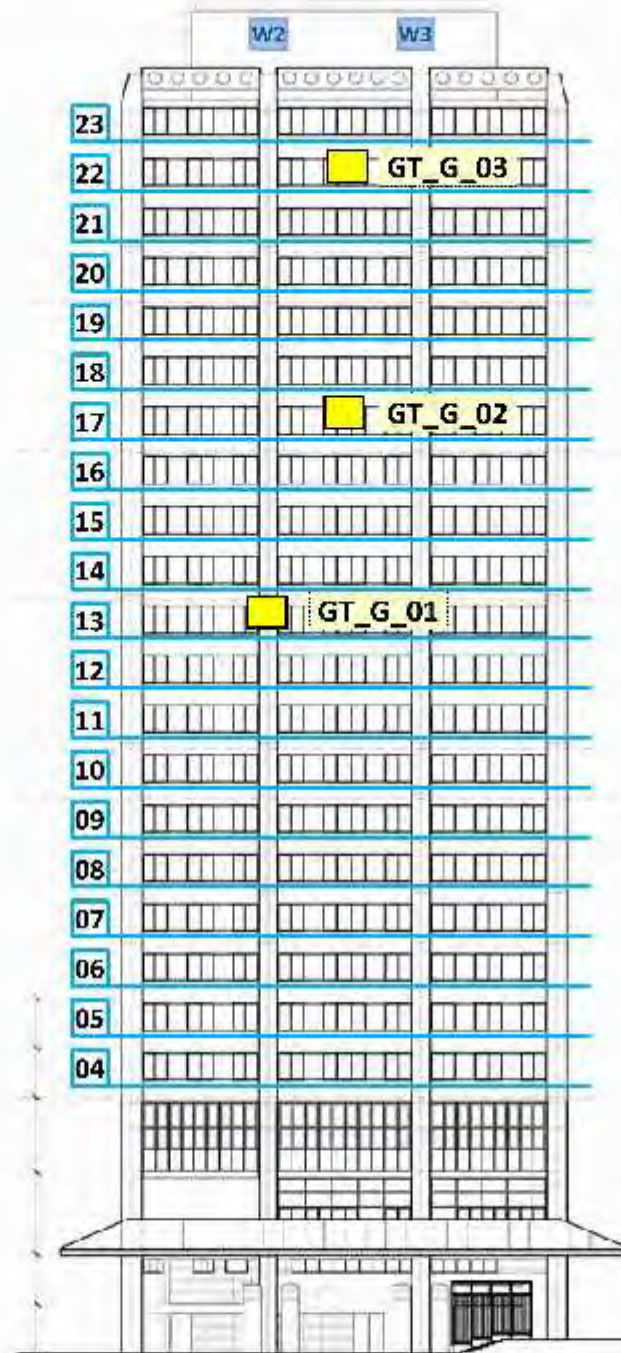
South Elevation



East Elevation



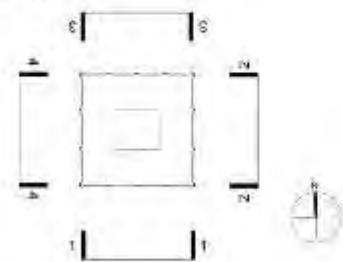
North Elevation



West Elevation

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1 SOUTH ELEVATION
1:200
Keyplan



2 EAST ELEVATION
1:200

3 NORTH ELEVATION
1:200

4 WEST ELEVATION
1:200

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Grenfell Tower Marked-up Drawing - Elevation

PC Monitoring
 Part of the Plowman Craven group

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GRENFELL TOWER REGENERATION PROJECT PROJECT EXISTING ELEVATIONS DRAWING 1:200@A1 SCALE DATE
DWG NO. REV NO. DATE