



on behalf of

IQ STUDENT ACCOMMODATION LTD

for the site at

ECHO STREET, MANCHESTER

REPORT DATE: **MARCH 2023**

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Summary

A noise assessment has been undertaken to determine the impact of existing noise on the future residents of the proposed development.

The assessment has identified that noise from the existing railway line to the south of the site requires mitigation. The impact of the future improvements has also been assessed, however, the changes have not been assessed to require additional mitigation measures beyond those proposed. Mitigation in the form of acoustic glazing and ventilation strategies have been proposed for the site, with different facades requiring different extents of acoustic mitigation.

Surveyed vibration levels indicate that there is less than a low probability of adverse comment from vibration due to the railway.

This standalone assessment supports EQSM3015_ES_VI_Chapter 12_Noise and Vibration Assessment.

Record of changes

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Date	March 2023	Date	March 2023

Version	Date	Change	Initials
1	March 2023	-	JM

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1 Introduction

- 1.1 Miller Goodall Ltd has, on behalf of iQ Student Accommodation Ltd, undertaken a noise assessment in respect of the impact of noise from a variety of transport sources around the Site, including road and rail traffic. This document provides a stand-alone assessment of the impact of the existing noise and vibration sources on future receptors on the Site. The full Environmental Impact Assessment (EIA) and Environmental Statement (ES), Chapter 12 includes a noise assessment for the impact of the development on existing residents around the site.

2 Site Description

- 2.1 The Site is located within Manchester City Centre. Student accommodation and commercial premises are located to the north of the Site. The A6 is the closest A-road to the Site and is located approximately 50 m east of the Site. The railway line between Manchester Piccadilly and Manchester Oxford Road stations is located to the south of the Site. Vimto Park is located to the west of the Site. Full details of the site are provided within the ES.
- 2.2 In relation to noise the key issue is the close proximity of a variety of transport sources to the Site, including the Manchester, South Junction and Altrincham railway viaduct. The site is also in close proximity to Piccadilly Railway Station, London Road (A6) and Mancunian Way (A57).

3 Proposed Development

- 3.1 The Proposed Scheme is the development of purpose-built student accommodation (sui generis) comprising 3 interlinked tower blocks with intermediary linking block buildings, associated amenity space and external landscaping. There will be 1,224 student accommodation units and the Proposed Scheme will be car-free and provide no on-site car parking. As part of improvements to the public realm, there will be a reconfiguration of the existing on-street public parking bays on Granby Row and their number will reduce from thirteen to eight. Two of the spaces will be wheelchair-accessible spaces. The spaces will remain as pay and display. Cycle parking for the Proposed Scheme will be provided within a secure and covered cycle store. 313 long-stay cycle spaces will be provided. Short-stay cycle spaces will also be provided with Sheffield stands within the public realm.

- 3.2 The building is being proposed as an all-electric building, with wall mounted electric panel heaters and high levels of insulation. The communal areas at ground floor level will be served by an air source heat pump simultaneous heating and cooling Variable Refrigerant Volume system. The escape lobby and corridor areas will be served by a wet heating system to be compliant with BS7671 Requirements for Electrical Installations. The heat for the wet system will be generated via an air source heat pump technology with distribution pipework.
- 3.3 The only combustion equipment as part of the Proposed Scheme will be the diesel generator and pumps located within the basement. This will be for emergency use and tested on a monthly basis (exhausts will terminate at basement level).
- 3.4 Full details of the proposed development are provided within the ES Chapter.

4 Policy Context

- 4.1 All the policy context has been provided within **Appendix 12.2_Standards and Guidance**. The key policy documents are:
- Noise Policy Statement for England
 - National Planning Policy Framework
 - Planning Practice Guidance – Noise
- 4.2 The key acoustic standards and guidance are also detailed in **IQSM3015_ES_V1_Appendix 12.2_Standards and Guidance_V1_09032023**, the key acoustic standards and guidance are:
- BS 8233:2014 Guidance on Sound Insulation and Noise Reduction for Buildings
 - BS 4142: 2014 'Methods for rating and assessing industrial and commercial sound'
 - World Health Organisation (WHO) Guidelines for Community Noise 1999
 - ProPG – Noise and Planning.

5 Measurement of Existing Background Noise Sources

- 5.1 Several noise surveys have been completed, as summarised below.
- 11th May 2017: Attended measurements of individual train pass-bys at different heights on the south elevation and 30 minute attended measurements of weekday, daytime ambient noise levels at different heights on west and east facing elevations of the now demolished Chandos Hall building.

- 11th – 15th May 2017: Continuous unattended noise logging at 2 heights (5th and 11th floors) on the south facing elevation of the now demolished Chandos Hall building. Included weekday and weekend periods.
- 6th – 10th July 2017: Continuous unattended noise logging 1 m from the east and west facing elevations of the now demolished Chandos Hall building. Included weekday and weekend periods.
- 2nd – 8th February 2023: Continuous unattended noise logging 1 m from the north east and south facing boundaries of the Site. Included weekday and weekend periods.

5.2 Noise measurements were undertaken in accordance with BS 7445-1: 2003 by Colin Foster and Michael Rickard, Jo Miller and James Sharpe of Miller Goodall Ltd.

5.3 All instrumentation used during the surveys was fully calibrated and traceable to UKAS standards and satisfy the requirements for Class 1 instruments described in BS EN 61672-1:2013. Details of the equipment used are shown in Table 12.1.1, below. The calibration of the sound level meters was checked before and after measurements with negligible deviation (<0.1 dB).

Table 12.1.1: Noise monitoring equipment

Equipment Description	Type Number	Manufacturer	Serial No.	Date Calibrated	Calibration Certification Number
Class 1 ^{[1],[2]} Integrating Real Time 1/3 Octave Sound Analyser	NOR 140	Norsonic	1406815	12/01/17	474629844
Class 1 ^{[1],[2]} Integrating Real Time 1/3 Octave Sound Analyser	NOR 140	Norsonic	1406017	22/05/15 23/05/17	U18820 03238/2
Class 1 Calibrator ³	Type 4231	Brüel & Kjær	2478249	25/07/16 18/05/17	02817/1 03238/1
Class 1 Calibrator ^[3]	NOR 1251	Norsonic	34123	05/07/17	02777/1

¹ IEC 61672-1 (2002) Electroacoustics – Sound level meters Part 1: Specifications

² IEC 61260 (1995) Electroacoustics – Octave-band and fractional-octave-band filters

³ IEC 60942 (2003) Electroacoustics – Sound calibrators

Outdoor microphone housing	NOR 1217	Norsonic	12175738	N/a	N/a
Outdoor microphone housing	NOR 1217	Norsonic	12175146	N/a	N/a
Class 1 ^{[1],[2]} Integrating Real Time 1/3 Octave Sound Analyser	NTi XL2-TA	NTi Audio	A2A-11111-E0	01/09/2022	UK-22-087
Microphone	NTi MC230A	NTi Audio	A14423	01/09/2022	UK-22-087
Class 1 Calibrator ^[3]	CAL 200	Larson Davies	14154	10/10/2023	05964/1
Class 1 ^{[1],[2]} Integrating Real Time 1/3 Octave Sound Analyser	NTi XL2-TA	NTi Audio	A2A-15860-E0	01/03/2021	05145/1
Microphone	NTi MC230A	NTi Audio	A16445	01/03/2021	05145/1

5.4 The meteorological conditions at the time of the attended noise measurements on 11th May 2017 and 2nd February 2023 were noted by the engineers and were considered suitable for reliable noise readings, with no rain and low wind speeds.

5.5 During the unattended long term noise logging in May and July (2017) and February 2023, the meteorological conditions were determined by reviewing data from nearby met stations, as published on the Weather Underground website (www.wunderground.com). Full details of the weather during the surveys are held on record and may be supplied on request.

5.6 There were periods during the unattended measurements taken between 11th – 15th May when adverse meteorological weather conditions may have influenced the results. In particular, the possible influence due to rainfall was determined as follows:

- 10:00 – 14:30 on 12/07/2017: approx. 0.5 – 2 mm/hr; Data still considered useable
- 02:30 – 06:00 on 14/07/2017 approx. 0.5 – 4.5 mm/hr; Data still considered useable
- 07:00 onwards on 15/07/2017 approx. >3 mm/hr; Data excluded from analysis

5.7 The weather for the 6 – 10 July 2017 and 2 – 8 February 2023 monitoring periods were considered suitable for reliable readings. There was no rainfall for the whole period and wind speeds remained light throughout, generally from a west/south westerly direction.

5.8 The noise sources which were audible at the measurement locations are summarised in Table 12.1.2.

Table 12.1.2: Description of noise sources affecting the site

Measurement Locations	Noise Sources
South facing elevation (overlooking railway)	Railway noise dominant. Train pass-bys are all quite slow, due to proximity of Piccadilly Station. Mixture of diesel (louder) and electric (quieter) trains. Occasional diesel freight trains during day and night. Occasional horns. Rail squeal often audible, due to track curve near Piccadilly, though not directly adjacent to Chandos Hall. Distant general road traffic hum dominant in between train movements. At upper levels the rail noise reduces a little and traffic hum becomes more noticeable. Some noise at higher floors from fixed M&E plant on rooftops of University buildings.
East facing elevation (facing towards Piccadilly station)	Distant general road traffic hum dominant. Ambient noise levels are higher at the upper floors of the existing building where there is a direct line of sight to Piccadilly station taxi drop off/ interchange area. Some playground noise from existing nursery audible at lowest floors. Rail noise audible but not significant.
West facing elevation (facing towards Vimto Park)	Distant general road traffic hum dominant. Louder at higher floors of the existing building. Subjectively lower noise levels than east facing elevation. Rail noise audible but not significant.
MP1 facing railway line	Railway noise dominant. Train pass-bys are all quite slow, due to proximity of Piccadilly Station. Mixture of diesel (louder) and electric (quieter) trains. Occasional diesel freight trains during day and night. Horns from railway occasionally. Occasional rail noise squeal, due to track curve near Piccadilly, though not directly adjacent to Chandos Hall. Distant general road traffic hum dominant in between train movements.
MP2	Railway noise evident at this position but not always dominant. Noise from general road traffic on Granby Row and the A6 and surrounding road network more dominant.

- 5.9 The noise loggers were set up to make audio recordings whenever a certain threshold value was exceeded and these recordings were then replayed during the analysis stage to establish the source of the higher noise events.
- 5.10 There was no noise, including amplified music, from entertainment premises such as pubs or clubs audible on any of the loggers. We understand that there are no pubs or clubs near enough to the site to have any influence on the ambient, maximum or background noise levels.

6 Monitoring Results

- 6.1 The results of the attended measurements undertaken on 11th May 2017 are given in Tables A1 – A3 of Appendix 1. Spectral data is held on file and may be supplied on request.
- 6.2 Time history charts for the unattended noise monitoring undertaken 1 m from the 5th and 13th floors of the southern facing elevation are provided in Figures A1 and A2 of Appendix 2 of this respectively.
- 6.3 Time history charts for the unattended noise monitoring undertaken 1 m from the 6th floors of the east and west facing elevations are provide in Figures A3 and A4 of Appendix 2, of this document respectively.
- 6.4 Time history charts for the unattended noise monitoring undertaken at location MPI in 2023 are provide in Figure A5 of Appendix 2.
- 6.5 Time history charts for the unattended noise monitoring undertaken at location MP2 in 2023 are provide in Figure A6 of Appendix 2.
- 6.6 Based on the survey work undertaken, as summarised above, the 2017 day and night time L_{Aeq} environmental noise levels at different locations around the exterior of the now demolished Chandos Hall, and subsequently, at ground level after Chandos Hall was demolished (2023), have been derived and are presented in Table 12.1.4 and 12.1.5 below.
- 6.7 Each measurement period consisted of sequential 1 second samples which therefore allowed the variation in noise level over time to be assessed. This data was subsequently used to determine a 'typical' L_{AFmax} noise level and octave band spectrum based on the 98th percentile of individual 1 minute L_{AFmax} measurements. The typical night time L_{AFmax} time are also presented in Tables 12.1.4. and 12.1.5 below.
- 6.8 The following observations may be made by inspection of the measurement data:

- The highest maximum noise levels occur during train pass-bys on lower floors of the south facing elevation. The maximum noise levels on this elevation reduce with height, being approximately 6 dB lower at 15th floor than at 2nd floor.
- On the south facing elevation, the L_{Aeq} remains reasonably constant irrespective of changes in height.
- Environmental noise levels are slightly higher on the east facing elevation (facing Piccadilly) than the west (facing Vimto Park)
- The measurements taken at MP1 and MP2 in 2023 are fairly consistent with the previous measurements taken in 2017.

Table 12.1.4: External noise levels derived from unattended measurements at existing Chandos Hall (2017)

Location	Descriptor	Sound Pressure Level, dB								dBA
		in Octave Band Centre Frequency, Hz								
		63	125	250	500	1k	2k	4k	8k	
Southern elevation 2 nd Floor	Day L_{eq}	73.4	64.5	64.2	62.1	61.8	58.3	58.7	53.7	66.8
	Night L_{eq}	68.3	61.1	61.6	59.1	58.3	54.5	58.5	52.9	64.4
	*Typical Night L_{Max}	91.6	79.7	81.7	78.4	77.5	74.3	75.6	73.4	83.3
Southern elevation 5 th Floor	Day L_{eq}	72.4	63.5	63.2	61.1	60.8	57.3	57.7	52.7	65.8
	Night L_{eq}	67.3	60.1	60.6	58.1	57.3	53.5	57.5	51.9	63.4
	*Typical Night L_{Max}	90.6	78.7	80.7	77.4	76.5	73.3	74.6	72.4	82.3
Southern elevation 13 th Floor	Day L_{eq}	71.5	64.7	62.3	60.9	62.1	56.3	51.2	45.3	65.2
	Night L_{eq}	67.0	60.8	59.2	57.9	59.1	53.7	51.4	44.8	62.5
	*Typical Night L_{Max}	88.6	78.5	74.6	74.8	72.5	70.1	68.0	62.8	77.9
Eastern elevation 5 th Floor	Day L_{eq}	68.8	61.4	59.0	58.1	58.4	54.0	51.0	46.2	62.3
	Night L_{eq}	63.8	57.9	56.1	55.6	55.3	49.8	47.1	42.4	59.0
	*Typical Night L_{Max}	84.6	75.3	72.9	74.1	71.9	68.6	66.7	60.1	76.8
Western elevation 5 th Floor	Day L_{eq}	67.6	61.9	56.8	56.1	55.9	51.6	48.0	44.6	60.0
	Night L_{eq}	61.8	57.7	52.9	52.6	51.6	46.3	41.2	36.3	55.5
	*Typical Night L_{Max}	81.9	74.5	70.3	71.5	69.6	66.4	62.2	57.3	74.3

Table 12.1.5: External noise levels derived from unattended measurements at MP1 and MP2 (2023)

Location	Descriptor	Sound Pressure Level, dB								dBA
		in Octave Band Centre Frequency, Hz								
		63	125	250	500	1k	2k	4k	8k	
MP1 – Southern elevation 3.8m from ground level (37m)	Day L_{eq}	65.9	60.1	57.5	57.1	53.9	48.3	41.4	34.6	58.4
	Night L_{eq}	63.2	58.3	54.5	51.6	50.7	45.1	38.4	32.8	54.7
	*Typical Night L_{Max}	80.7	73.8	73.2	69.4	68.1	65	60.6	53.6	72.4
MP2 – north eastern elevation – 2.5m from ground level (39m)	Day L_{eq}	65.7	61.7	59.2	59.4	55.2	50.4	44.1	36.5	74.4
	Night L_{eq}	61.8	58	55.3	55.1	51.5	46.2	39.9	32.3	69.6
	*Typical Night L_{Max}	81.3	73.8	74.7	70.1	68	64.4	61	53.7	74.3

- *Typical Night L_{Max} is the 98th percentile of the $L_{Max,1min}$ measurements for the whole night time period (23:00 – 07:00)
- All values are façade reflected sound pressure levels in dB re 20 µPa for 2017 and free-field for 2023.

7 Determination of the Background Sound Levels

- 7.1 The results obtained during the noise survey were further analysed in order to determine the typical background sound levels at surrounding noise sensitive receptors.
- 7.2 It is considered reasonable to assume that the measurements taken at the 6th floor of the east and west facing elevations of the now demolished Chandos Hall building are representative of the background sound levels immediately outside the existing student residences within Lambert House on Granby Row, located approximately 20 m to the north.
- 7.3 Representative Background Sound Levels were derived for two time periods of interest, as follows.
- Day time 07:00hrs to 23:00hrs; and
 - Night time 23:00hrs to 07:00hrs.
- 7.4 The background sound levels for the day time assessment periods were derived using statistical analysis of the measured $L_{A90,1\text{hour}}$ levels, whereas for the night time a statistical analysis of the measured $L_{A90,15\text{minute}}$ levels was undertaken. This is in line with BS4142:2014 which recommends a 15 minute assessment period for the night time and a 1 hour assessment period for the day time.
- 7.5 The results of the analysis are presented in **Figures 12.1.1 and 12.1.2** below. The values were as measured 1 m from the existing east and west facades of Chandos Hall therefore include a façade reflection, therefore 3 dB has been removed to obtain free field measurements.
- 7.6 The results of the analysis for MP1 and MP2 from 2023 are presented in **Figures 12.1.3 and 12.1.4** below. The values were as measured free-field and therefore no correction has been made.

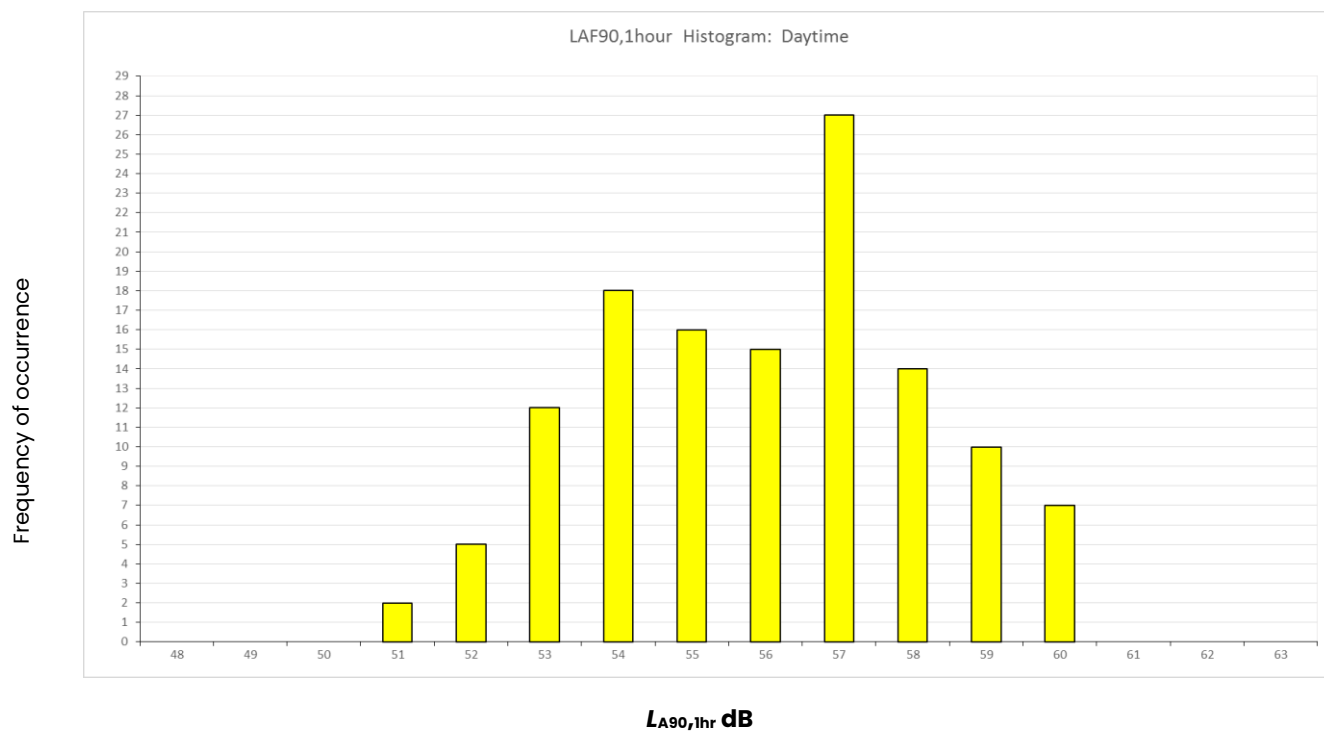
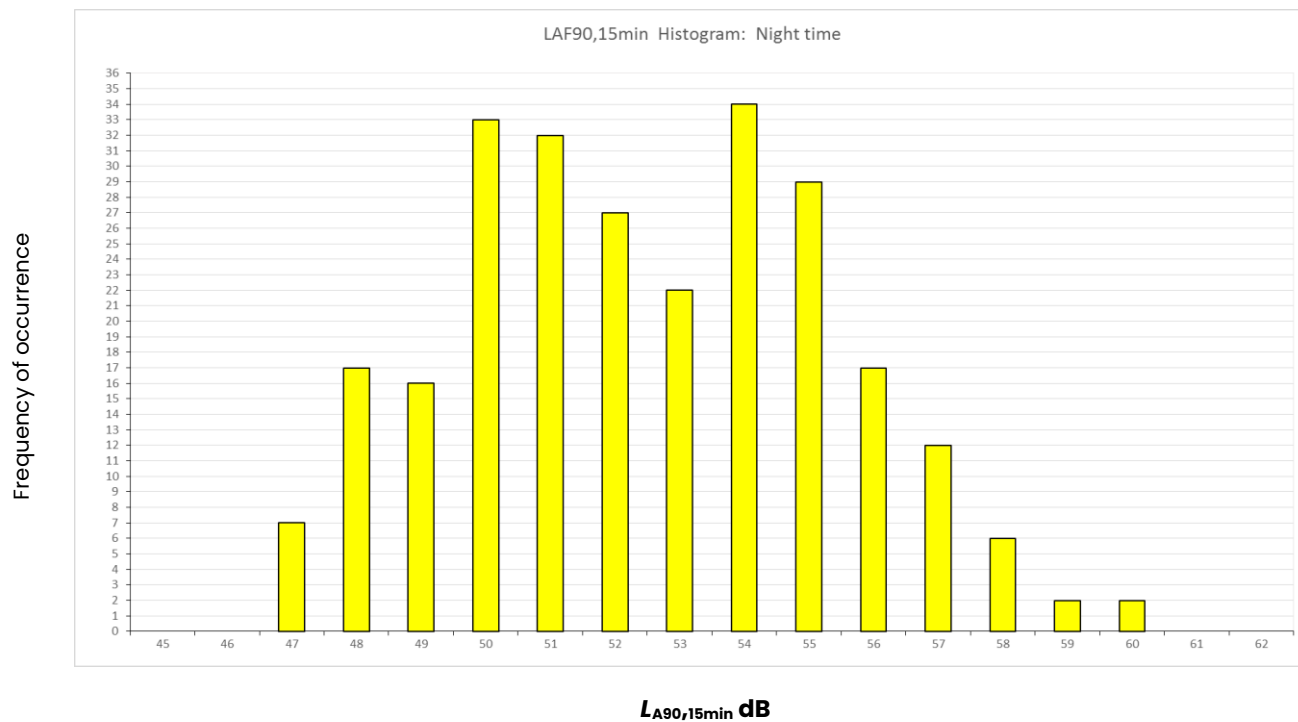
Figure 12.1.1: Day time Background Sound Level Histogram – 07:00hrs to 23:00hrs**Figure 12.1.2: Night time Background Sound Level Histogram – 23:00hrs to 07:00hrs**

Figure 12.1.3: Day time Background Sound Level Histogram – 07:00hrs to 23:00hrs – MP2 (2023)

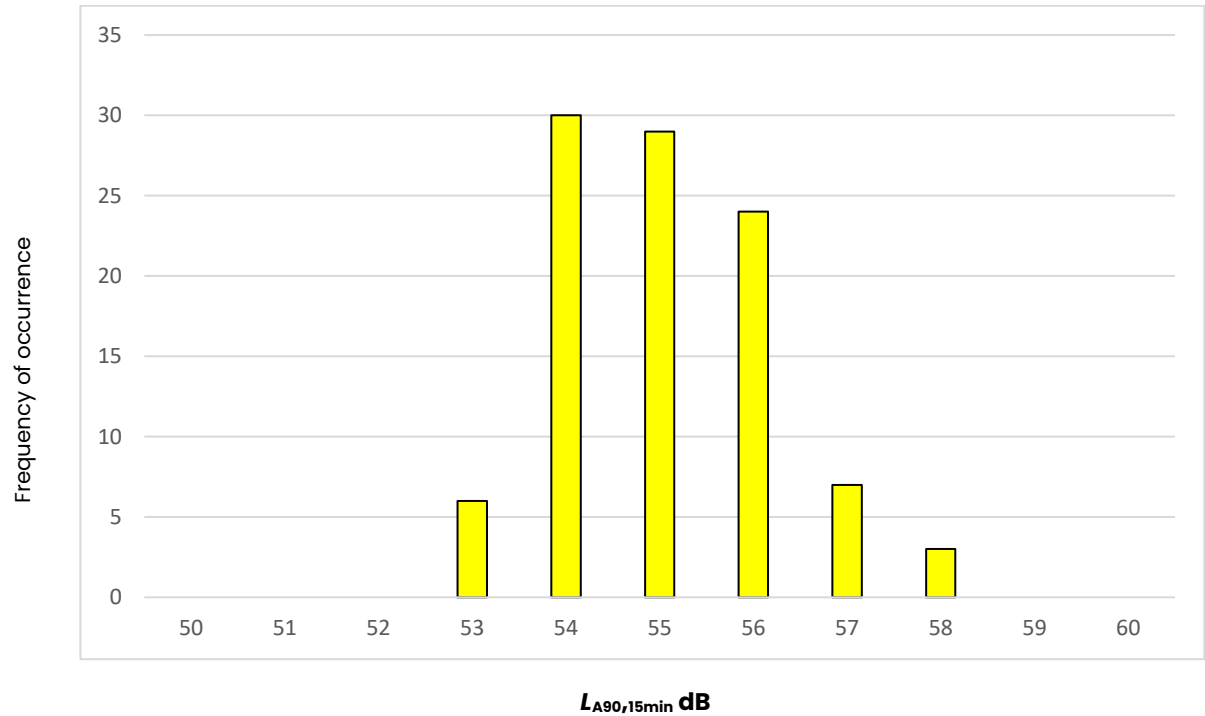
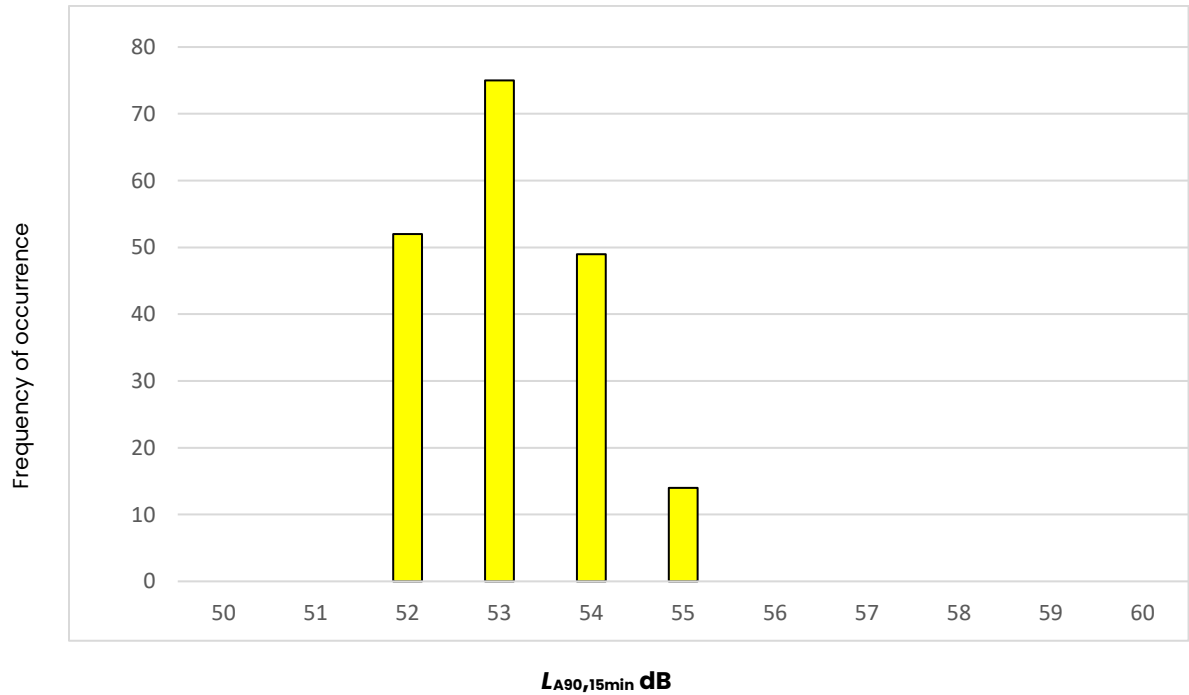


Figure 12.1.3: Night time Background Sound Level Histogram – 23:00hrs to 07:00hrs



7.7 The typical representative background sound level for the daytime period was taken to be the most frequently occurring (modal) value of the measured background sound levels for the period of interest.

7.8 The free-field representative background sound levels (-3 dB for façade correction) for the nearest residences, which are currently those student dwellings located on Granby Row are as follows:

- Day time 54 dB $L_{A90,1\text{hour}}$
- Night time 47 dB $L_{A90,15\text{ mins}}$

7.9 The free-field representative background sound levels from the 2023 survey for the nearest residences, which are currently those student dwellings located on Granby Row are as follows:

- Day time 54 dB $L_{A90,1\text{hour}}$
- Night time 53 dB $L_{A90,15\text{ mins}}$

7.10 As a result of the differences in the night-time background surveys, the lower background sound levels will be used within assessment.

8 Vibration Measurements

8.1 Vibration measurements were undertaken in August 2018 and February 2023. The surveys were undertaken within the basement of the now demolished Chandos Hall building over a 72-hour period (2018) and at MPI on the base of the foundation for the new Site (2023). As the vibration is considered to primarily affect the vertical (z-axis), the results for this axis only have been reported. The results of the measurements are provided in **Table 12.1.6** below.

Table 12.1.6: Summary of Vibration Measurements

Date	Day (0700 – 2300) VDV (m.s ^{-1.75}); z-axis	Night (2300 – 0700) VDV (m.s ^{-1.75}); z-axis
17 th August 2018	0.010*	0.010
18 th August 2018	0.007	0.004
19 th August 2018	0.007	0.016
20 th August 2018	0.012*	N/A
10 th February 2023	NA	0.037

11 th February 2023	0.039	0.023
12 th February 2023	0.026	0.030
13 th February 2023	0.039	0.037
14 th February 2023	0.040	0.039
15 th February 2023	0.041	0.038

** Data for daytime calculated for 16-hour assessment period from partial measurement.*

- 8.2 The measured vibration levels within the now demolished Chandos Hall building show that vibration levels are below the threshold for 'low probability of adverse comment' according to criteria set down in BS6472-1⁴], determined as 0.2 to 0.4 m.s^{-1.75} for the daytime and 0.1 to 0.2 m.s^{-1.75} for the night-time. Measured levels in 2023 are slightly higher than the 2017 survey, however, they are still below the threshold for 'low probability of adverse comment'.

⁴ BSI Standards Publications (2008). BS6472: 2008. Available at <https://vdocument.in/bs-6472-1-2008-vibration-sources.html?page=1> [Accessed:06/03/2023].

9 Impact of Existing and Future Noise Sources on the Development

9.1 Introduction

- 9.1.1 Detailed calculations have been undertaken in order to determine the sound insulation performances required of the external building envelope (glazing and solid elements) in order to ensure that dwellings within the Site will satisfy relevant acoustic criteria.
- 9.1.2 It is proposed that noise from the development is controlled to 30 dB L_{Aeq} in bedrooms at night and 35 dB L_{Aeq} in habitable rooms during the day. This is in line with the recommended levels advised in BS 8233 for both daytime and night-time noise and the recommended night-time noise level within bedrooms suggested by WHO. It is also proposed that noise from individual events such as vehicle pass-bys does not regularly exceed an indoor level of 45 dB L_{AFmax} .
- 9.1.3 The external noise levels impacting upon the proposed building have been predicted by using a combination of measured data and data obtained from a computer modelling exercise, utilising CadnaA.
- 9.1.4 It was assumed that the noise levels which will impact on the east and west facing elevations of the new building will be identical to the noise levels derived from the measurements on the east and west facing elevations of the now demolished Chandos Hall building (See **Table 12.1.3**).
- 9.1.5 It was not possible to undertake measurements on the north facing elevation of the now demolished Chandos Hall building. However, it has been assumed that the noise levels on this elevation were no higher than those measured on the east and west facing elevations of the existing building. Measurements from 2023 at MP2 have supplemented with the 2017 data for the predictions of internal noise ingress.
- 9.1.6 The new building is significantly different to the now demolished Chandos Hall building in its extent along Granby Row and the railway line and therefore a computer model was used to predict the maximum noise levels impacting upon the extended south elevation, caused by the railway.

- 9.1.7 The main impact to the future noise levels will be as a result of the Northern Hub rail alterations. Network Rail (NR) have prepared an EIA for the improvement of the section of railway to the south of the PDS. This improvement includes the extension and electrification of the railway line. The EIA, dated December 2014 has detailed predictions of operation noise associated with the modification of the line. The scope of the assessment was:
- Effects of change in airborne noise levels (day and night time $L_{Aeq,T}$ and L_{Amax}) arising from changes in railway traffic flows, speeds and revised alignment.
 - Effects from a change in level of perceptible vibration arising from changes in railway traffic flows speeds and the revised alignment.
 - Effects of airborne noise from idling trains; and
 - Effects of structure borne noise arising from changes in railway traffic flows, speeds and the revised alignment.
- 9.1.8 The assessment concluded that for buildings located close to the railway line the dominant internal noise would result from the high external airborne noise levels and therefore the transfer or structure borne noise from the railway was not a significant issue.
- 9.1.9 The assessment provided predicted levels of noise for 3 facades of the Site, south, west and east, for floors 1 to 6. This data has been assessed in relation to the future noise sources impacting on the Site. The only perceptible change in noise levels are as a result of daytime L_{Aeq} levels, which are predicted to increase by up to 3.5 dB on the east elevation. The increases of the L_{Amax} levels however are around 3 dB. The main noise index which is 'driving' the glazing specification is the L_{Amax} levels, changes to the railway line have not impacted on the L_{Amax} for the Site and therefore future assessments of the line are assumed to be as measured during the assessment.

9.2 Computer Modelling

- 9.2.1 The external noise levels from maximum noise events associated with the railway were predicted using the CadnaA noise modelling package. The specific modelling parameters are provided with **IQSM3015_ES_V1_Appendix 12.4 Modelling of Existing Noise Sources**
- 9.2.2 Noise level receptor points were incorporated into the CadnaA model at the noise survey measurement locations of the now demolished Chandos Hall building (2017 survey) and MPI (2023 survey) to calibrate the model using the measured octave band L_{Fmax} noise levels. The modelled results agreed with the measured results to within around ± 3 dB L_{AFmax} , with the exception of floor 2 of the West elevations, which predicts 5 dB higher.
- 9.2.3 Screen shots from the model have not been provided, but are available on request.
- 9.2.4 The noise modelling indicates that the proposed units which will be located within the recesses where the building outline steps in on the southern elevations will benefit from self-shielding from the building itself, which will reduce the external noise levels. The north elevation has been based on the measured values from the east and west elevations.

9.3 Proposed Ventilation Strategy

- 9.3.1 The proposed strategy will utilise mechanical ventilation for Building Regulations Part F compliance. A detailed study has been carried out to assess the internal temperatures against CIBSE Technical Memorandum 59 (TM59) design methodology for the assessment of overheating risk in domestic buildings.
- 9.3.2 The assessment factors in thermal sources from occupants, lighting and small power, as well as from external sources, with solar gains and external air temperatures. This method of assessment is referred to as the Dynamic Simulation Method (DSM). The assessment indicated that the spaces required mechanical ventilation to mitigate the risk of overheating. This is due to the window not being open due to the noise levels in the surrounding area. All of the space will be ventilated using highly efficient heat recovery mechanical ventilation units in each accommodation space with local control.
- 9.3.3 Mechanical ventilation with heat recovery (MVHR) with ducted supply and extract to each apartment will provide the background ventilation (as opposed to trickle vents) and the enhanced 'boost' ventilation in excess of the Building Regulations Part F Whole Dwelling Ventilation Rates.

- 9.3.4 The proposed strategy is to run the MVHR units continuously at the enhanced 'boost' rates to assist with summertime overheating control and therefore limit the window opening times required throughout the daytime.
- 9.3.5 Thermal comfort analysis will be carried out to assess what elevated ventilation rates will be required (within the limits of a residential MVHR unit) to meet the summertime overheating criteria on the assumption that windows will be shut overnight (between 11pm and 7am) to maintain internal noise levels within each bedroom. As part of the thermal comfort analysis, solar control glazing requirements (glazing G-values) will be determined to further assist with reducing heat gains within each apartment.

9.4 Predicted Internal Noise Levels Assessed to BS 8233 Criteria

- 9.4.1 In order to assess the sound insulation requirements of the glazing, noise ingress calculations were undertaken based on the methodology in BS EN 12354-3.
- 9.4.2 The dimensions of the solid and glazed façade elements and internal room volumes were taken from the latest floor plans. It is assumed that the rooms will have 'normal' internal surface finishes e.g. carpeted with curtains etc.
- 9.4.3 The sound insulation performance of the solid part of the façade were determined by using specialist acoustic modelling software (Insul), based on the following construction detail, as supplied by the Architect:
- The large majority of the solid (non-glazed) parts of the external walls will be Type EXT-TYPE01 (Brick Tile Rainscreen Cladding). The link sections will be Type EXT-TYPE05 (Cladding System – Glass Reinforced Concrete Panels). As shown on the architectural drawings, both types are essentially triple cavity walls incorporating a weather defence sheathing board and 2x12.5 mm plasterboard internal linings. The cavity between sheathing board and internal plasterboard lining is 100 mm, fully filled with mineral wool insulation. The cavity between sheathing board and external finish is at least 295 mm, filled with 200 mm mineral wool insulation.

9.4.4 The sound insulation requirements of the external building envelope are shown graphically in Figure A7 in Appendix 3. The sound insulation performances required of the solid and glazed elements on the south facing elevations are detailed in Table 12.1.7.

Table 12.1.4: Minimum acoustic performance of solid and glazed elements

	Sound Reduction Index, dB at Octave Band Centre Frequency, Hz								R_w dB	C_{tr} dB	$R_w + C_{tr}$ dB	Typical glazing type
	63	125	250	500	1k	2k	4k	8k				
Solid element	24	46	51	56	60	57	60	60	58	-3	55	n/a
Glazing Type 1	18	24	22	29	39	33	38	38	32	-3	29	6 / 12 / 6
Glazing Type 2	33	26	33	36	42	45	52	52	41	-5	36	Glazing to be confirmed

9.4.5 It can be seen that the majority of the façade, including all of the north, west and east elevations may utilise glazing with a relatively low acoustic performance. However, the southern elevation is impacted significantly by the railway line and particularly the occasional L_{Amax} values caused by heavy diesel movements during the night-time which have resulted in higher acoustic requirements for a small number of flats.

9.4.6 The requirements have been derived for the fifth floor. On the south elevation the acoustic requirements become less onerous with height, as the distance to the railway line increases. It may therefore be possible to downgrade the stated acoustic performances at the upper storeys of the south elevation. Further modelling and calculation work will be needed to establish the full extent of the glazing specifications for all floors. The final detail would form part of a reserved matters application and Stage 3/4 design.

9.5 Conclusion

- 9.5.1 A noise assessment has been undertaken to determine the impact of existing noise on the future residents of the proposed development, this assessment forms a technical appendix to the full IQSM3015_ES_Chapter 12.
- 9.5.2 The assessment has assessed the existing noise sources and with a combination of measurement and prediction, identified the impact of noise and identified the necessary mitigation measures required to achieve internal noise criteria for the development.
- 9.5.3 The assessment has identified that noise from the existing railway line to the south of the site requires mitigation. The impact of the future improvements has also been assessed, however, the changes have not been assessed to require additional mitigation measures beyond those proposed. Mitigation in the form of acoustic glazing and ventilation strategies have been proposed for the site, with different facades requiring different extents of acoustic mitigation.
- 9.5.4 Surveyed vibration levels indicate that there is less than a low probability of adverse comment from vibration due to the railway.
- 9.5.5 Internal sound insulation measures will be finalised to control the internal noise impact from internal commercial and amenity space uses.

Appendices

Appendix 1: Measurement Data: Attended Measurements, 11th May 2017

Table A1: Attended Train Measurements, 5th Floor South Facing Elevation, 11th May 2017

Description	Start Time	Elapsed Time (min:sec)	L_{Aeq} (dB)	L_{AFmax} (dB)	L_{AFmin} (dB)	L_{AE} (dB)	L_{AF1} (dB)	L_{AF10} (dB)	L_{AF90} (dB)	L_{AF99} (dB)
3 carriage modern diesel, from Picc, simultaneous 2 car to Picc	11:53	0:21	74.5	80.6	58.5	87.9	80.3	79.8	59.5	58.8
2 carriage to Picc, inc horn	12:08	0:10	68.6	75.5	61.3	78.6	75.2	73	62.1	61.5
3 car, from Picc, Diesel	12:11	0:20	71.4	76.7	60.9	84.4	76.4	75.4	61.8	61
4 car, from Picc, diesel, Edinburgh train	12:16	0:12	70.5	73.7	61.1	81.3	73.4	73	62.9	61.3
2 car, pacer, to Picc, diesel	12:19	0:11	70.9	76.1	59.7	81.7	75.9	75.2	60.5	59.8
4 car, pacer, from Picc	12:22	0:23	73.1	78.6	60.9	86.8	78.5	77.8	61.8	61.3
diesel freight engine, no car, from Picc	12:25	0:21	64.9	70.2	61.1	78.3	69.5	68	61.8	61.2
4 car, electric, to Picc, transpennine express	12:26	0:14	67.2	72.5	59.7	78.8	72.3	70.6	60.7	59.9
3 car, diesel, to Picc	12:54	0:18	69.5	73.4	59.6	82.1	73	72.5	61.2	59.8
2 car, diesel, from Picc	13:02	0:13	70.7	73.1	66	82	73	72.5	66.6	66.1
6 car, diesel, to Picc	13:05	0:25	75.4	79.1	64.3	89.5	78.9	78.5	67.4	65.1
2 car, pacer, diesel, from Picc	13:09	0:22	75	82.4	59.9	88.5	82.4	81	61.2	60.2
3 car, diesel, from Picc	13:14	0:17	70.8	74.6	61.5	83.1	74.4	73.8	63.2	61.7
3 car, diesel, to Picc, Scarborough	13:15	0:16	71.4	74.9	62.1	83.7	74.7	74.1	63.3	62.2
4 car, electric, from Picc	13:18	0:16	70	74.4	61.5	82.3	73.9	73.2	62.1	61.7
4 car, diesel, to Picc	13:26	0:15	75	81.1	60.3	87	81	80.1	62.4	60.9

freight train, 33 car, diesel, to Picc	13:33	2:18	71.5	80.7	62.3	92.9	79.7	74.8	65.8	62.9
4 car, electric, to Picc simultaneous 4 car, diesel, from Picc	13:39	0:32	76.2	83.6	59.6	91.3	83.3	82.6	61.5	60.2
4 car diesel, to Picc, E.Midlands train	13:43	0:15	76.3	81.9	60.9	88.1	81.7	80.2	62.1	61.1
6 car diesel, from Picc	13:46	0:25	71.5	75.4	60.5	85.5	74.8	74.2	62.4	60.7
4 car, diesel, from Picc	13:49	0:17	72.3	75.8	63.9	84.6	75.6	75.1	65	64.2
4 car, electric, from Picc	14:03	0:10	75.6	85.8	60.2	86	84.8	82	61.1	60.6

All values are façade reflected sound pressure levels in dB re 20 µPa

Table A2: Attended Train Measurements, 2nd Floor South Facing Elevation, 11th May 2017

Description	Start Time	Elapsed Time (min:sec)	L_{Aeq} (dB)	L_{AFmax} (dB)	L_{AFmin} (dB)	L_{AE} (dB)	L_{AF1} (dB)	L_{AF10} (dB)	L_{AF90} (dB)	L_{AF99} (dB)
3 car, diesel, from Picc	14:10	0:10	77	82.9	58.6	87.1	82.8	81.9	60.7	59
4 car, electric, from Picc, Edinburgh	14:18	0:11	66.1	70.6	57.9	76.7	70	68.3	59.4	58.1
2 car, pacer, diesel, to Picc	14:19	0:14	70.5	76.5	58.3	82.1	76.4	75.3	59.2	58.4
diesel, freight engine, slow, no car	14:20	0:23	65	70.2	58.1	78.8	68.9	68.1	60.4	58.6
4 car, electric, to Picc	14:26	0:17	63.2	66.5	57.7	75.6	66	65.3	58.7	58.1
33 car, freight, diesel, to Picc	14:31	2:16	71.5	86.6	58.4	92.9	85.1	72.7	61.1	60.3
2 car, diesel, from Picc	14:38	0:16	70.9	76.7	60	83.1	76.5	75.9	60.6	60.2
3 car, diesel, to Picc	14:51	0:13	69.6	75.2	58.6	80.8	74.2	73.6	59.5	58.7
2 car, diesel, from Picc	14:54	0:15	76.8	84.1	61.3	88.8	83.1	82.2	62.6	61.5
4 car, diesel, to Picc, pacer	14:57	0:21	70	81.7	60.5	83.3	75.2	72.3	61.3	60.7
4 car, electric, from Picc	14:58	0:17	70.1	78.2	59.2	82.4	77.3	75.3	60.2	59.4

2 car, diesel, to Picc	15:01	0:17	76	83.2	60.4	88.3	83	80.3	62.2	60.7
4 car, diesel, from Picc	15:03	0:20	71.6	84.5	59.2	84.8	81.4	74.5	60.9	59.4
2 car, diesel, to Picc (missed most of it)	15:06	0:8	63.2	71.8	58.8	72.8	-	64.9	60.3	58.8
4 car, diesel, from Picc	15:08	0:9	72	81.8	59.8	81.8	-	74.1	61.3	60.1
3 car, diesel (Scarborough) to Picc	15:09	0:28	71.1	79.1	58.1	85.7	77.6	75.3	60.5	58.3
4 car, electric, from Picc	15:15	0:18	64.6	68.9	58.7	77.2	68.2	67	59.4	58.9
4 car, diesel, to Picc	15:17	0:12	73.4	77.1	63.1	84.3	77	76.5	64.7	63.2

All values are façade reflected sound pressure levels in dB re 20 µPa

Table A3: Attended Measurements, East and West Facing Elevations, 11th May 2017

Description	Start Time	Elapsed Time (min:sec)	L_{Aeq} (dB)	L_{AFmax} (dB)	L_{AFmin} (dB)	L_{AE} (dB)	L_{AF1} (dB)	L_{AF10} (dB)	L_{AF90} (dB)	L_{AF99} (dB)
13 th floor, West facing	11:31	30:0	63.1	78.4	56.3	95.6	72.7	65.0	59.3	58.3
13 th floor, East facing	12:04	30:0	65.3	81.4	60.6	97.8	70.5	66.6	63.2	62.0
5 th floor, West facing	12:48	30:0	61.1	77.5	55.2	93.6	70.1	62.7	57.4	56.4
5 th floor, East facing	13:23	30:0	65.6	84.5	58.2	98.1	75.5	67.6	60.9	59.6
2 nd floor, West facing	13:58	30:0	58.7	76.4	53.6	91.3	67.4	60.3	55.5	54.5
2 nd floor, East facing	14:34	30:0	61.9	82.6	55.7	94.5	70.9	63.7	58.1	56.8

All values are façade reflected sound pressure levels in dB re 20 µPa

Appendix 2: Time History Charts

Figure A1: Time History, Unattended Noise Monitoring, 5th Floor South Facing Elevation (2017)

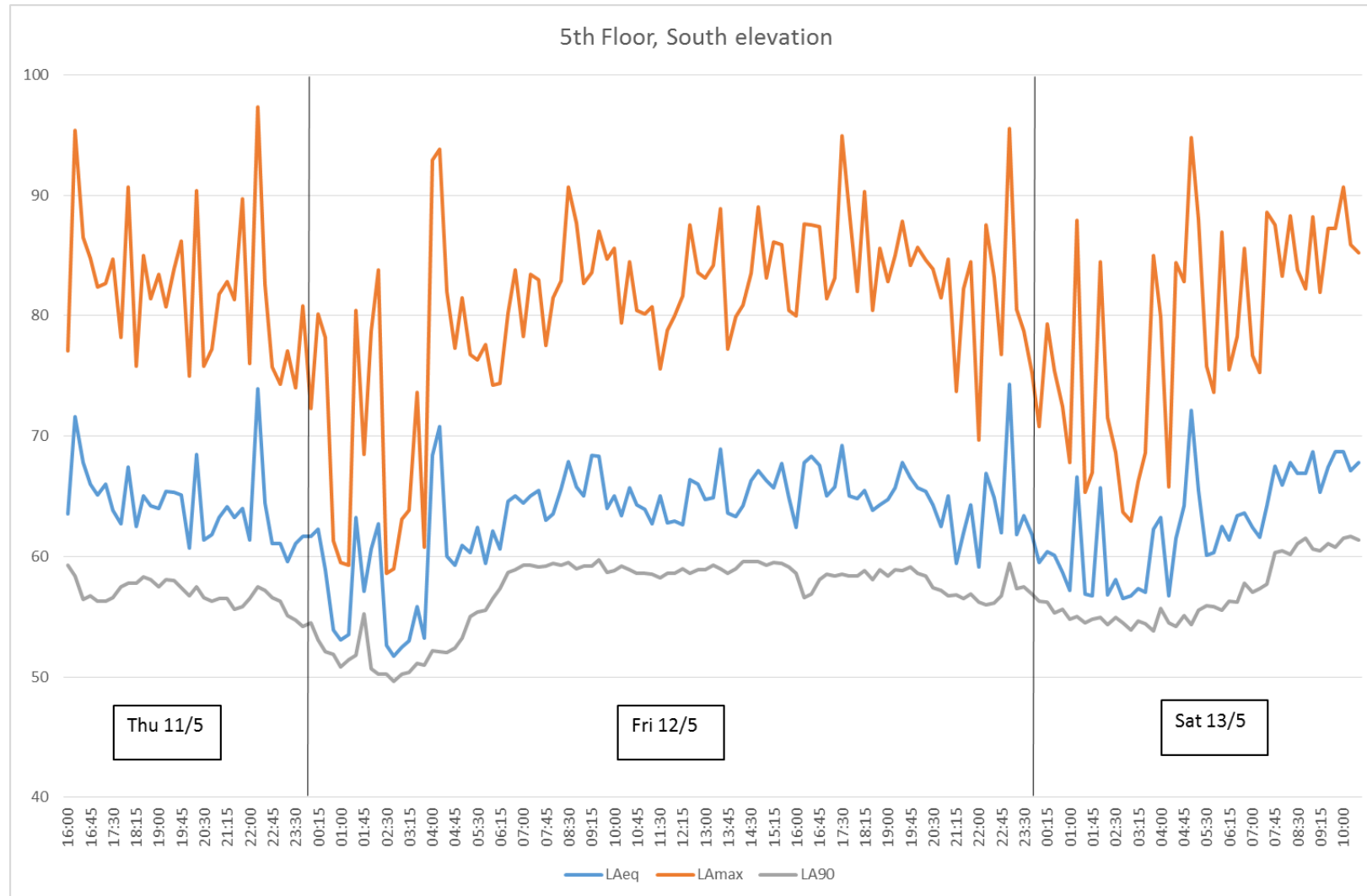


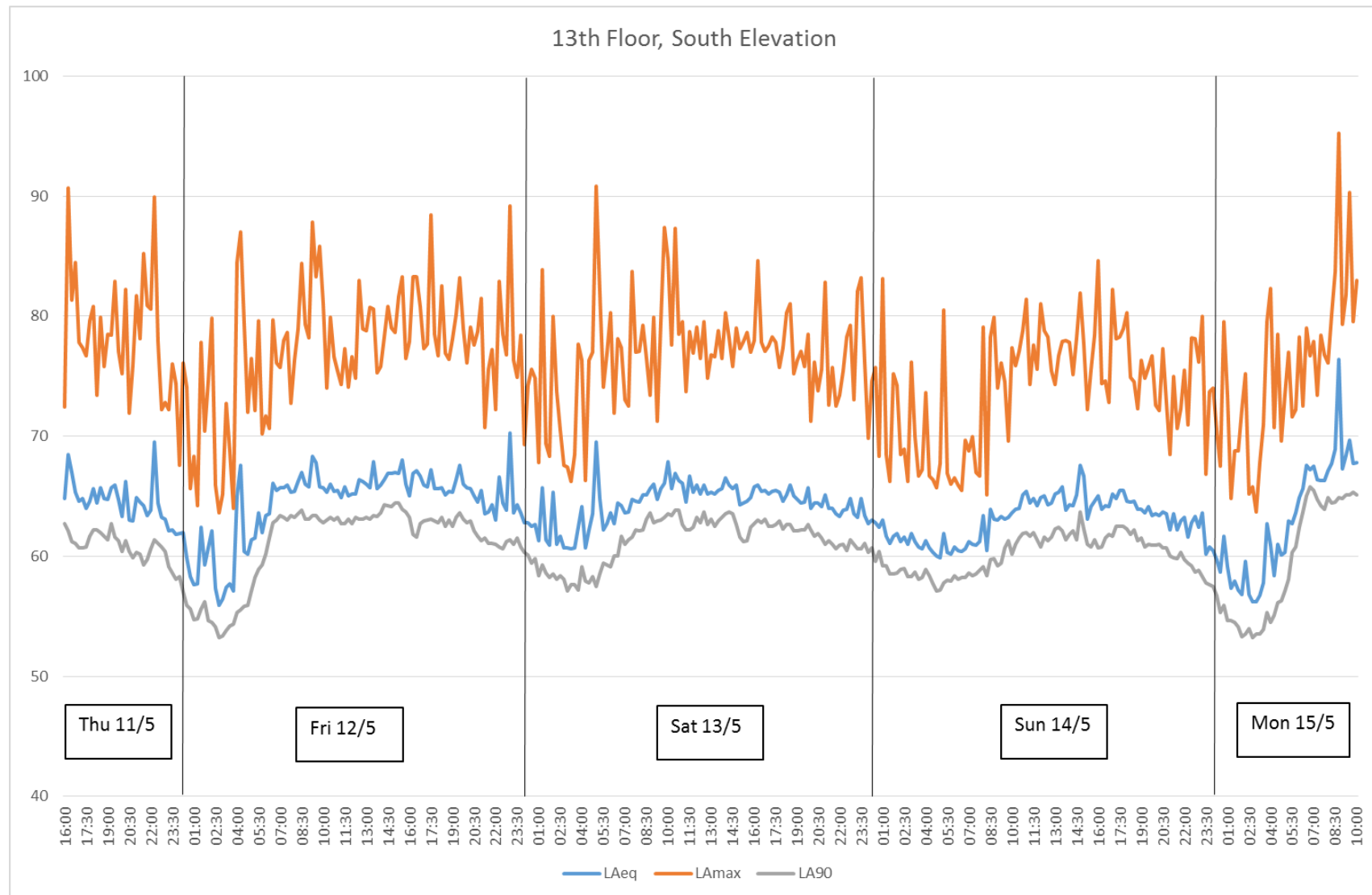
Figure A2: Time History, Unattended Noise Monitoring, 13th Floor South Facing Elevation (2017)

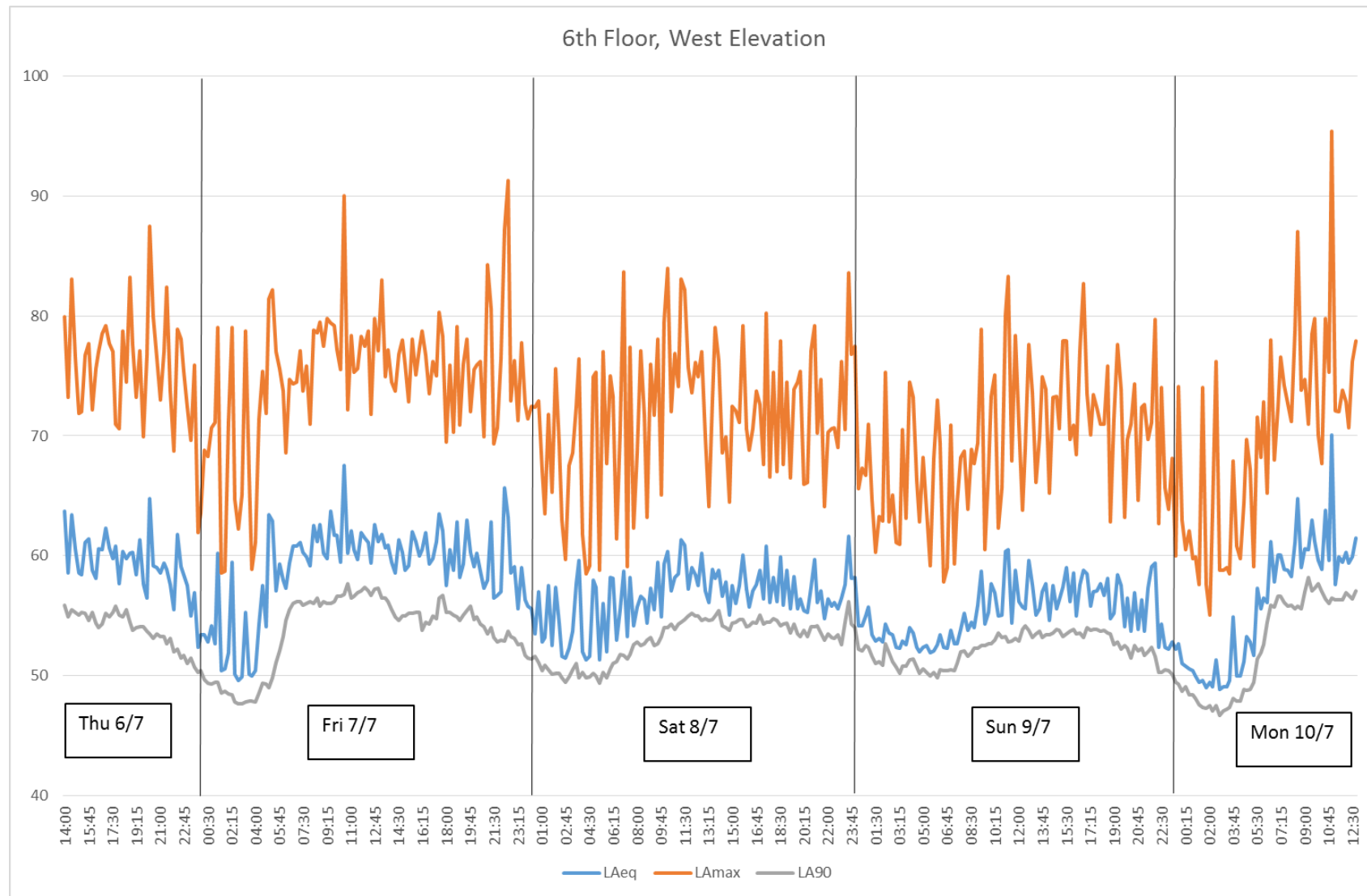
Figure A3: Time History, Unattended Noise Monitoring, 6th Floor West Facing Elevation (2017)

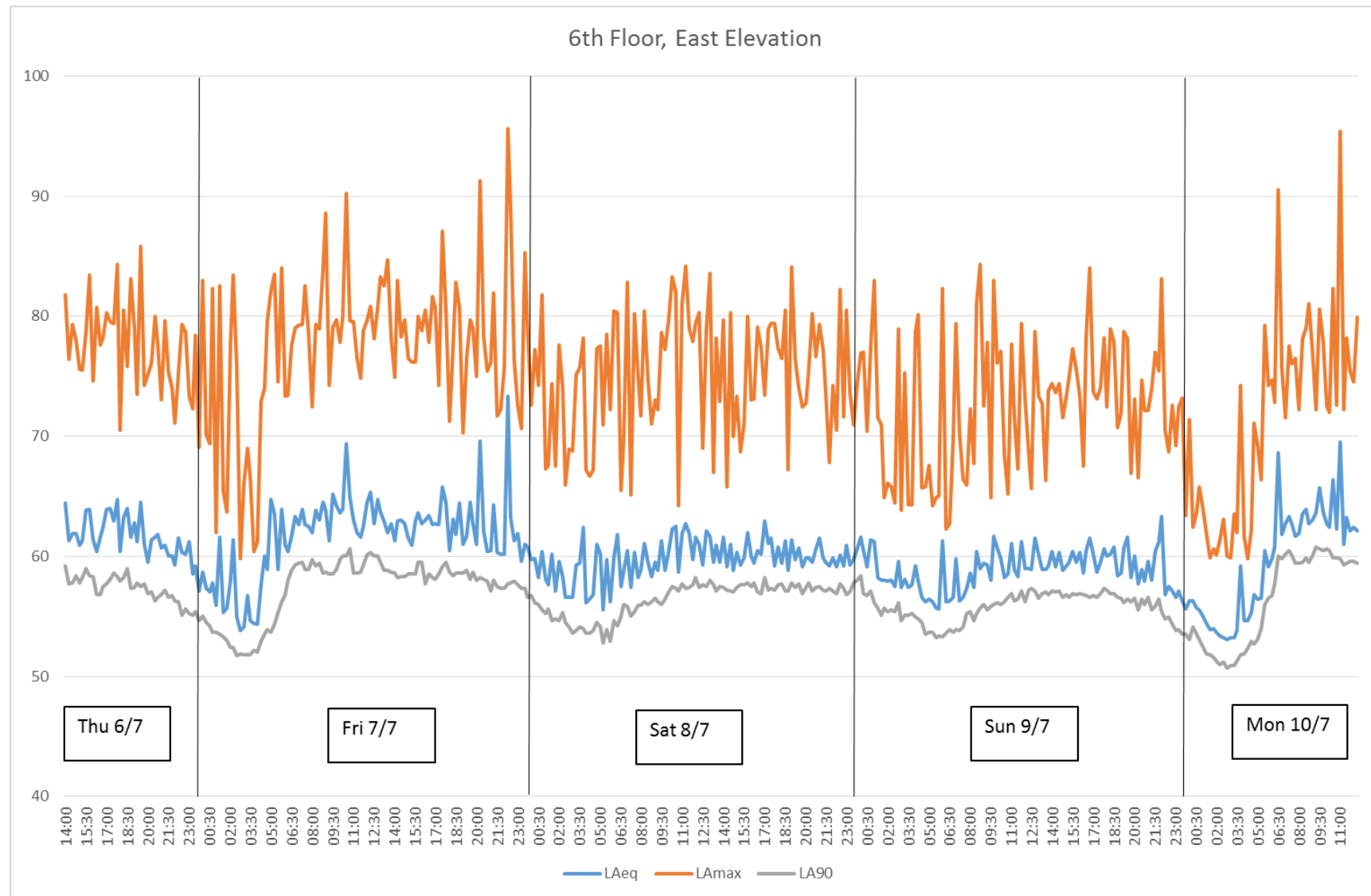
Figure A4: Time History, Unattended Noise Monitoring, 6th Floor East Facing Elevation (2017)

Figure A5: Time History, Unattended Noise Monitoring, MPI (2023)

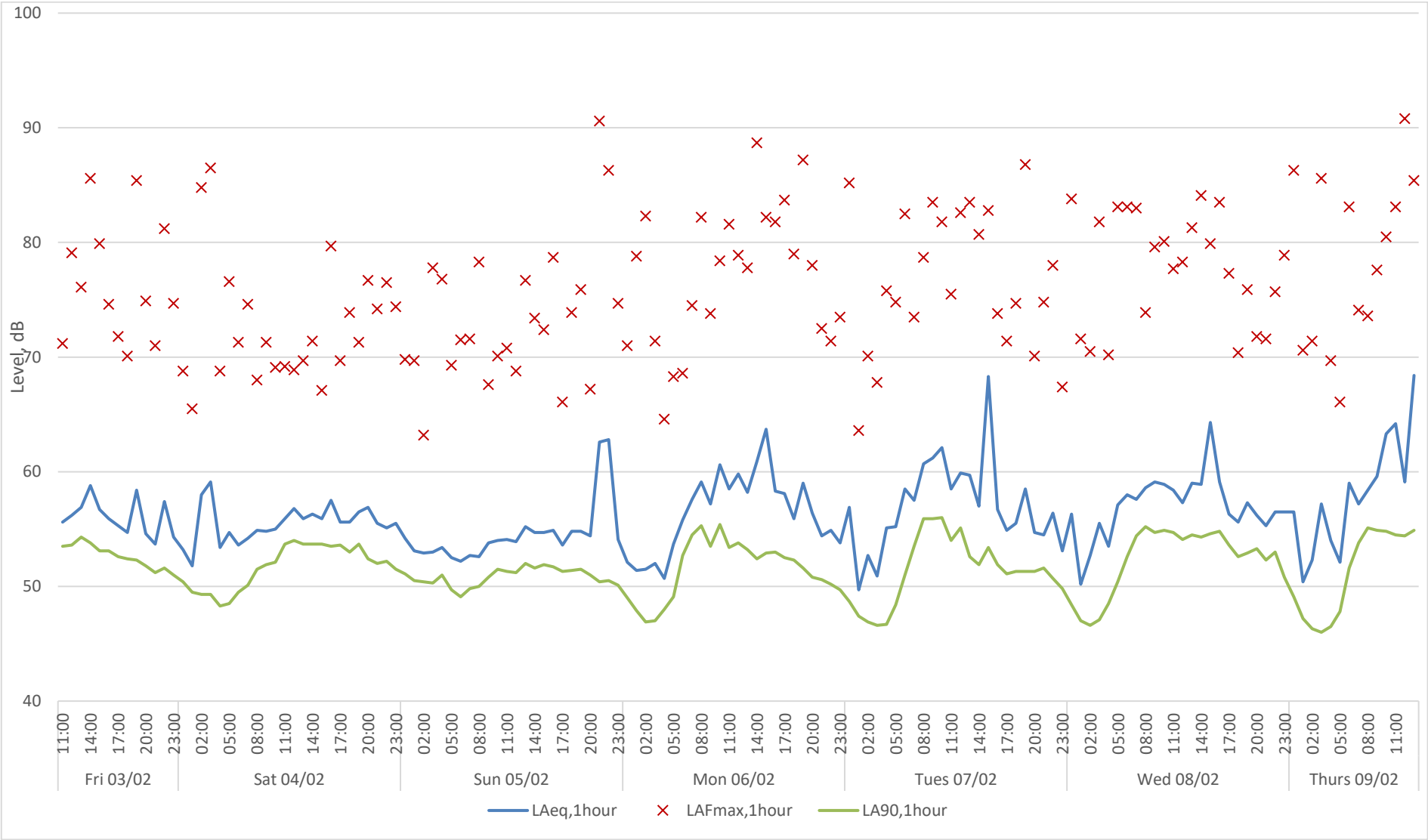
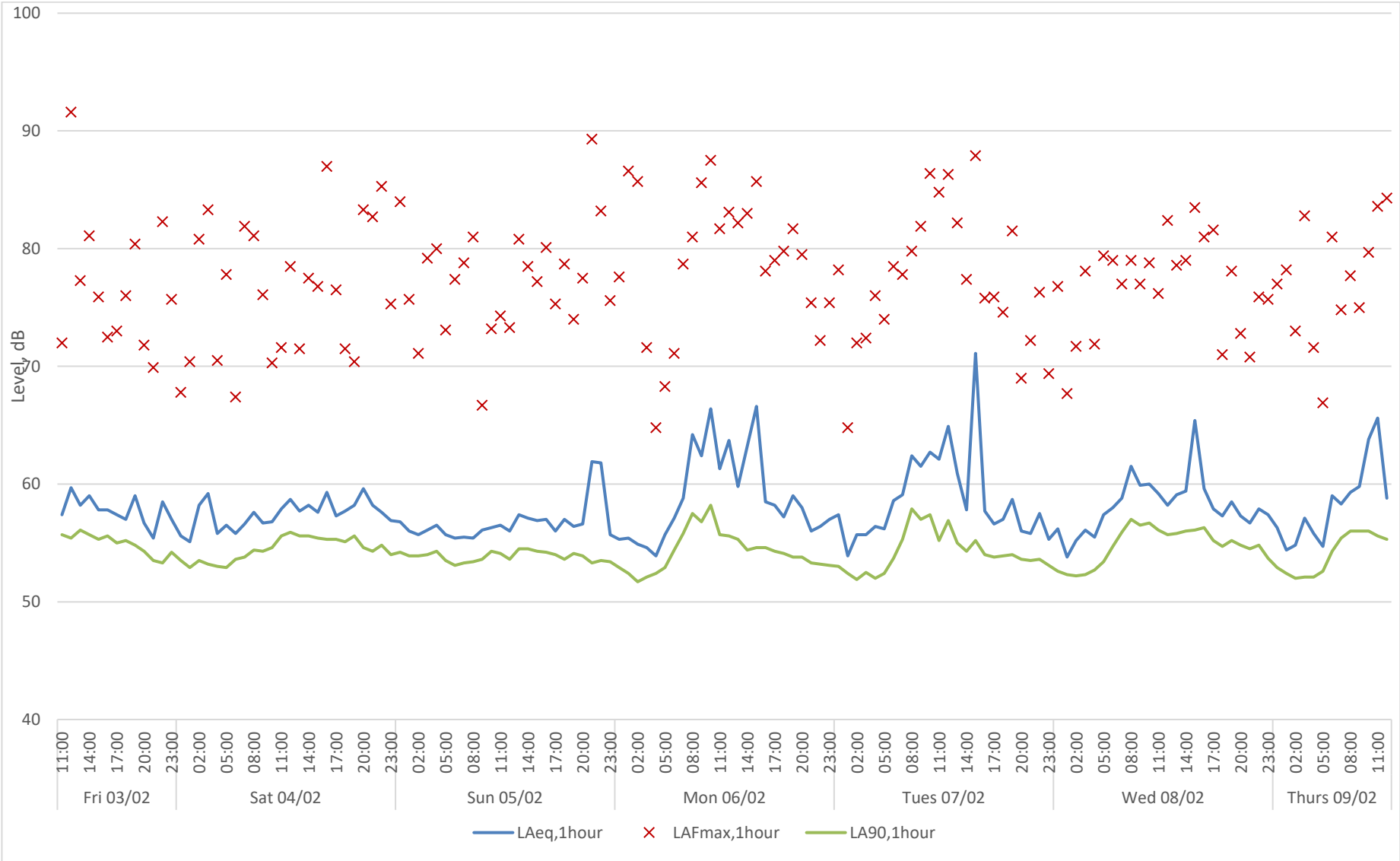


Figure A6: Time History, Unattended Noise Monitoring, MP2 (2023)



Appendix 3: Sound Insulation Requirements

Figure A7: Sound Insulation Requirements of Glazing (5th Floor)



Glossary of Terms

- Decibel (dB)** The unit used to quantify sound pressure levels; it is derived from the logarithm of the ratio between the value of a quantity and a reference value. It is used to describe the level of many different quantities. For sound pressure level the reference quantity is 20 μPa , the threshold of normal hearing is in the region of 0 dB, and 140 dB is the threshold of pain. A change of 1 dB is usually only perceptible under controlled conditions.
- dB L_A** Decibels measured on a sound level meter incorporating a frequency weighting (A weighting) which differentiates between sounds of different frequency (pitch) in a similar way to the human ear. Measurements in dB L_A broadly agree with an individual's assessment of loudness. A change of 3 dB L_A is the minimum perceptible under normal conditions, and a change of 10 dB L_A corresponds roughly to halving or doubling the loudness of a sound. The background noise level in a living room may be about 30 dB L_A ; normal conversation about 60 dB L_A at 1 meter; heavy road traffic about 80 dB L_A at 10 meters; the level near a pneumatic drill about 100 dB L_A .
- $L_{A90,T}$** The A weighted noise level exceeded for 90% of the specified measurement period (T). In BS 4142: 1997 it is used to define background noise level.
- $L_{Aeq,T}$** The equivalent continuous sound level. The sound level of a notionally steady sound having the same energy as a fluctuating sound over a specified measurement period (T). $L_{Aeq,T}$ is used to describe many types of noise and can be measured directly with an integrating sound level meter.
- R_w** Single number rating used to describe the sound insulation of building elements and is defined in BS EN ISO 10140-2: 2010 (formerly BSEN ISO 140-3:1995). It is derived by measurement under laboratory conditions and does not take into account the effects of flanking transmissions.
- $D_{nT,w}$** The weighted standardized level difference is a single figure rating used to describe the sound insulation of a construction separating two rooms, for example a wall or floor, and is defined in BS EN ISO 16283-1:2014 (formerly BSEN ISO 140-4:1998). It is derived by measurement of an in-situ construction and therefore takes into account the effects of flanking transmissions, workmanship etc.
- C_{tr}** A single-number spectrum adaptation term used to characterise the sound insulation rating with respect to urban traffic. It is defined in ISO 717-1:2013.

