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Dear Asif

Unite/MMU, Cambridge Halls of Residence, Cavendish Street, Manchester M15 Acoustic Assessment Report – Revision 3

Planning permission is being sought for the re-development of the current Cambridge Hall site at the above address to re-build student accommodation (PBSA) on behalf of Unite Students and Manchester Metropolitan University (MMU) with ancillary communal amenity spaces, commercial and community uses, and landscaping. Blackbird Acoustics Limited (BAL) have been appointed by Unite/MMU to supply acoustic input to the project at the planning application stage. Blackbird Acoustics have undertaken environmental noise surveying (plus repeat surveying) at the site to establish the prevailing noise levels. This report details the findings of the noise surveying and provides a detailed assessment of the glazing performance requirements. In addition, the new Part O regarding overheating is discussed, as well as proposed mechanical services criteria, and assessments of potential noise break-out from retail spaces.

Noise Surveying

Blackbird Acoustics attended site to undertake environmental noise surveying of the prevailing noise levels at site. Noise monitoring was conducted over a full weekend period (due to its central city location) between 14:40 hours on Thursday 25th to 14:45 hours on Monday 29th July 2024.

The survey was undertaken in general accordance with BS 7445 and the ANC's Environmental Noise Measurement Guide. Weather conditions throughout the survey were conducive with obtaining representative noise measurements, being generally dry with light winds with periods of light rainfall occasionally. The measurements were made using Type 1 sound level meters, Norsonic 140s, which were calibrated both prior to and on completion of the surveying, with no significant calibration drifts observed. Calibration details available upon request.

Measurements were undertaken over 5-minute sample periods at the following positions, with microphones attached to booms at least 1.5m from the façade line at 2nd floor level, in the free-field.

Position 1 – North-West Façade:	Front of Site overlooking Cambridge Street.
Position 2 – South Façade:	End of site overlooking Boundary St W and The Salutation Pub.
Position 3 – North-East Façade:	Rear of Site overlooking Chatham Street and MMU's Cavendish Hall.

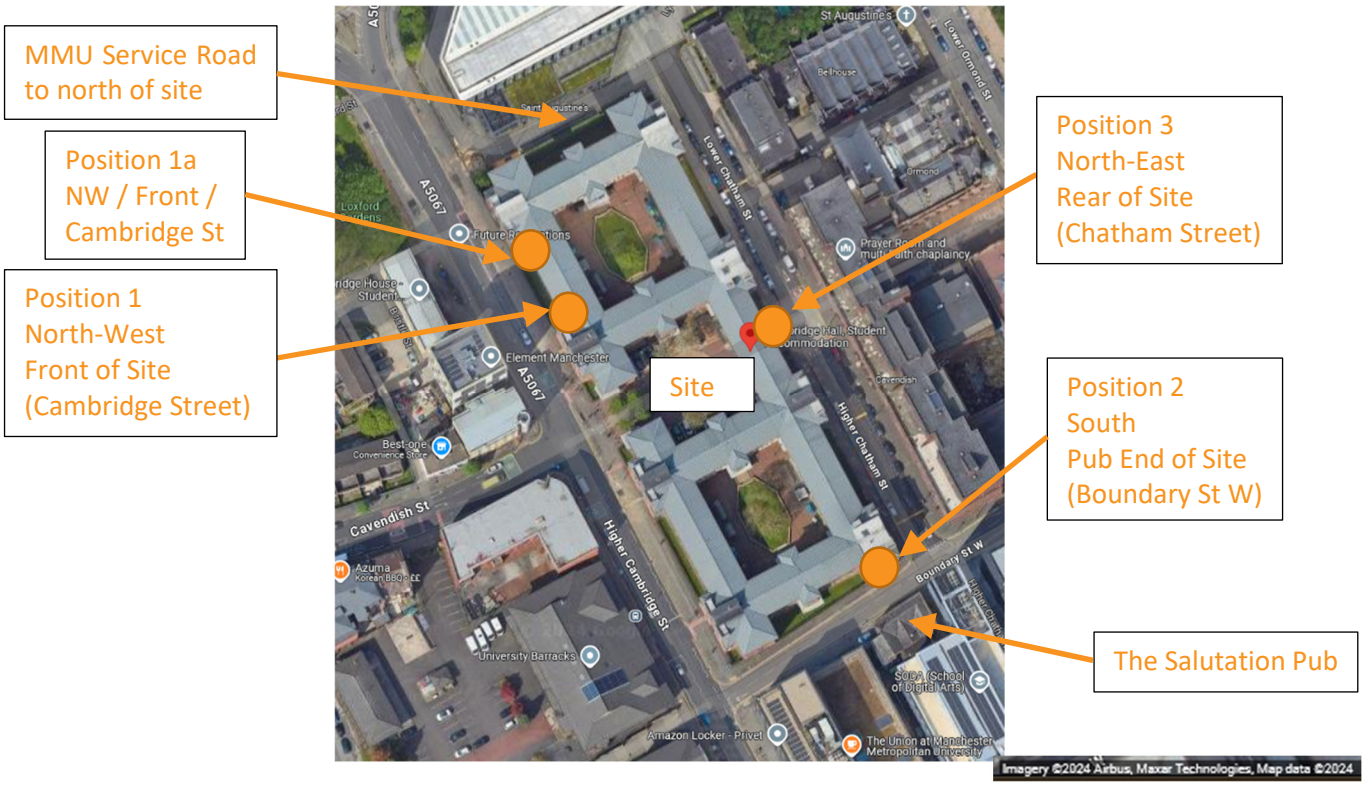


Image courtesy of Google Maps

The measured levels are summarised below;

Table 1 – Summary of Measured Noise Levels

Measurement Period	Pos 1 – North-West (Cambridge St - Front) *			Pos 2 – South (Boundary St W - Pub)			Pos 3 – North-East (Chatham St - Rear)		
	Typical Lowest L_{A90} (dB)	Period-Averaged L_{Aeq} (dB)	Typical Night L_{Afmax} (dB)	Typical Lowest L_{A90} (dB)	Period-Averaged L_{Aeq} (dB)	Typical Night L_{Afmax} (dB)	Typical Lowest L_{A90} (dB)	Period-Averaged L_{Aeq} (dB)	Typical Night L_{Afmax} (dB)
Daytime (07:00 – 23:00 hours)	57 *	66.6 *	-	44	55.2	-	50	56.2	-
Night-time (23:00 – 07:00 hours)	49 *	60.8 *	77.2 *	39	51.4	69.4	44	53.2	71.4

The typical night-time $L_{Amax,f}$ values are calculated from the 90th percentile of the 5-minute samples.

** Data at Position 1 is unfortunately limited due to an equipment malfunction halfway through the first night. Any data after 02:15hours on Friday 26th July has been excluded from our analyses. See Graphs 1 & 2 attached. The surveying at this position has been repeated and is discussed below.*

It should be noted that noise levels at all Measurement Positions were dominated by road traffic movements along the immediately adjacent A5067 (Cambridge Street) along the western boundary of the site, and the other adjacent local roads, including Boundary St W to the south of site and Chatham Street along the eastern boundary of site.

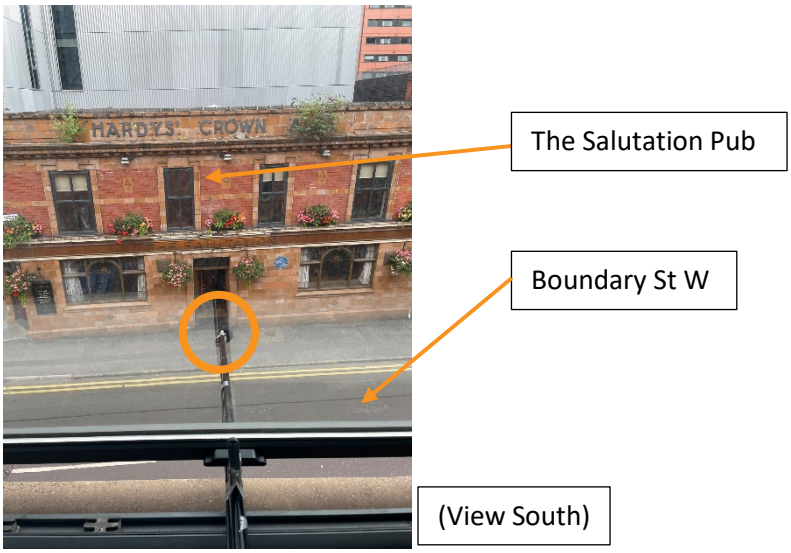
Other nearby roads in the immediate network contributed too, along with local pedestrian activities. Vehicles of all types were present, i.e. cars, motorbikes, vans, buses, lorries, etc. Activities from The Salutation Pub would have been covered during the weekend long survey at Position 2. The rear of the site is relatively quiet, whereas the main frontage to Cambridge Street is relatively loud.

The measured noise levels from the surveying are graphically represented in the attached Graphs;

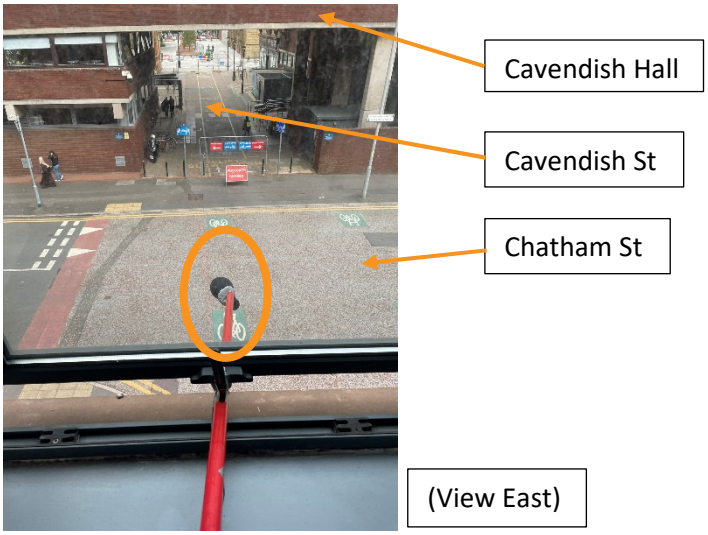
- Graphs 1 - 6 indicate the L_{eq} and L_{max} & L_{90} overall dBA value time-histories measured at each position.
- Graphs 7 - 9 indicate the spectral noise levels, which will be used in the assessment of the glazing specs.
- Graphs 10 - 12 indicate the L_{90} histograms used to derive the "typical lowest" values & thus plant noise criteria.
- Graphs 13 - 15 indicate the $L_{Amax,f,5mins}$ histograms for the night-time only, used to derive the "typical L_{max}" values.

Sample photos of some of the measurement positions are as follows;

Position 2 – South – Boundary St W overlooking The Salutation Pub



Position 3 – North-East – Rear of Site on Chatham St



Repeat Noise Surveying

Due to the meter malfunction at Position 1 overlooking Cambridge Street, a re-survey at this position was undertaken between 14:45 hours on Thursday 28th November to 13:00 hours on Monday 2nd December 2024. This is represented by Position 1a on the above plan. The microphone was hung out of a 3rd floor window, with the microphone approximately 0.7m from the façade line and thus a façade reflection correction of -3dB needs to be made to the measured levels to obtain the free-field levels. The weather was conducive with suitable measuring conditions. The meter used was a Casella 633C Class 1 SLM, calibrated before and after, set to 15-minutes sampling.

The measured levels have been façade reflection effect corrected and are summarised as free-field levels below;

Table 2 – Summary of Corrected Free-Field Noise Levels

Measurement Period	Pos 1a – North-West (Cambridge St - Front)		
	Typical Lowest L_{A90} (dB)	Period-Averaged L_{Aeq} (dB)	Typical Night L_{Afmax} (dB)
Daytime (07:00 – 23:00 hours)	58	65.0	-
Night-time (23:00 – 07:00 hours)	50	61.4	84.3

The typical night-time $L_{Amax,f}$ values are calculated from the 90th percentile of the 15-minute samples.

The measured noise levels are represented in attached Graphs 16-20. Note: Spectral levels are free-field.

Comparing the levels from the repeat survey (Table 2) with the levels in Table 1 at Position 1, it can be seen that the original brief snapshot (<24hrs) survey of levels is actually fairly reflective of the longer-term repeat surveying, i.e. ± 1-2dB on an L_{90} and L_{eq} basis; the biggest difference is in the Typical L_{max} level, which has increased.

"Typical-Lowest" Background Levels

When considering the existing background levels at a site, BS 4142:2014 "*Methods for Rating and Assessing Industrial and Commercial Sound*" recommends assessing to the "typical" measured $L_{A90,\ 15mins}$ background levels, BS 4142:2014 goes on to state:

> *In using the background sound level in the method for rating and assessing industrial and commercial sound it is important to ensure that values are reliable and suitably represent both the particular circumstances and periods of interest. For this purpose, the objective is not simply to ascertain a lowest measured background sound level, but rather to quantify what is typical during particular time periods.*

BS 4142:2014 suggests that statistical analysis is a suitable method to determine the "typical" background level. This can be carried out by calculating the level of the most-commonly occurring $L_{A90,\ 15mins}$ period during the proposed operating hours of equipment.

We generally consider that designing to the most-commonly occurring $L_{A90,\ 15mins}$ period is not sufficient during those slightly quieter periods. In our opinion, a more representative value would be the "typical-lowest" level, which can be determined statistically as the lowest rounded $L_{A90,\ 15mins}$ level which occurs for at least 10% of the assessment period.

The "typical-lowest" background noise levels ($L_{A90,\ 5mins}$) at the measurement positions are therefore summarised in the Table 1 above, based upon the L_{A90} histograms attached in Graphs 10 - 12. This data can be used to set plant noise emission criteria for use in the assessment of noise emissions from any proposed plant at the development.

Plant Noise Emissions Criteria

Local Authority Requirements

Manchester City Council's standard requirements in relation to fixed plant installations are outlined within Manchester City Council's Noise and Planning Guidance, which states that the noise assessment should be based on BS 4142:2014. It also states that:

> *"Externally mounted ancillary plant, equipment and servicing shall be selected and/or acoustically treated in accordance with a scheme designed so as to achieve a rating level of 5dB (L_{Aeq}) below the typical background (L_{A90}) noise level at the nearest noise sensitive location."*

To this end, in setting plant noise emissions criteria to a level -5dB below the otherwise prevailing typical-lowest background noise level, the following criteria would therefore be formulated.

Table 3 – Proposed Plant Noise Emission Criteria at Existing Receptors

Time Period	Plant Noise Emission Criterion (dBA) at Nearest *Existing* Noise Sensitive Receptor (Relevant Location)		
	Pos 1 – Front of Site (Cambridge Street)	Pos 2 – Salutation Pub (Boundary St W)	Pos 3 – Rear of Site (Chatham Street)
Daytime (07:00 – 23:00 hours)	52	39	45
Night-time (23:00 – 07:00 hours)	44	34	39

In line with BS 4142:2014+A1:2019, should the proposed plant be identified as having intermittent or tonal characteristics, a further penalty should be subtracted from any of the above proposed noise emission limits.

Unite Noise Sensitive Receptors

Where the nearest noise sensitive receptors to the plant locations or ventilation ductwork grilles/louvres are the Unite bedroom windows of our own development, we have developed more relevant criteria based on guidance from applicable industry standards.

We propose maximum emission limits that would result in acceptable internal noise levels in the bedrooms and studios in the event of partially open windows. BS 8233 provides guidance on suitable internal noise levels (see below). A level of -5dBA below the internal noise criterion is targeted, in line with MCC's general intent.

Based on the sound reduction given by a partially open window as outlined in BS 8233:2014, internal noise levels are anticipated to be approximately 15dB lower than external noise levels. We therefore propose that cumulative noise emissions from mechanical services plant to the Unite development receptors should be below the levels detailed in Table 4 below.

Table 4 – Proposed Plant Noise Emission Criteria at Unite Receptors

Time Period	Plant Noise Emission Criterion (dBA) at Nearest *Unite* Noise Sensitive Receptor
Daytime (07:00 – 23:00 hours)	45
Night-time (23:00 – 07:00 hours)	40

Should the proposed plant be identified as having intermittent or tonal characteristics, a further applicable penalty should be subtracted from any of the above proposed noise emission limits.

Emergency Plant

As emergency plant will be operating only in emergencies and during periodic testing, it is common to accept a relaxed noise limit for such noise. It is common to target a level of 10dB above the existing background level for such a limit. This is in line with other City Councils' standard requirements. Given that testing will only occur during daytime hours, this therefore sets worst-case noise limits of 67 - 54 - 60 dB L_{Aeq} for emergency plant affecting Receptors to the Front - South - Rear/Unite of site respectively.

Summary of Assessment Criteria

Therefore, all future design advice will be based upon achievement of the plant noise limits stated in both Tables 3 & 4 above, as summarised below in Table 5.

Table 5 – Summary of Proposed Plant Noise Emission Criteria

Time Period	Plant Noise Emission Criterion (dBA) at Nearest Noise Sensitive Receptor (Relevant Location)				
	Existing Receptor			***U**nite Receptor*	Emergency Plant at Receptors – F - S - R/U
	Pos 1 – **F**ront (Cambridge St)	Pos 2 – **S**outh /Pub (Boundary St W)	Pos 3 – **R**ear (Chatham St)	All façades	
Daytime (07:00 – 23:00 hours)	52	39	45	45	67 / 54 / 60
Night-time (23:00 – 07:00 hours)	44	34	39	40	–

Proposed Plant

The detailed design of the plant is yet to be finalised as the project is still at a very early design stage – this will be completed post grant of planning and a full plant noise assessment undertaken and a report issued to discharge any relevant imposed Planning Condition.

However, at this stage, it is understood the following items of plant are likely to be proposed;

- VRF Fan Coil Units (FCUs) internally and associated externally located condensers to serve amenity rooms
- Air Source Heat Pumps (ASHPs) for domestic hot water and heating
- Mechanical Ventilation with Heat Recovery (MVHR) units – all floor levels (PBSA)
- MVHR or Heat Recovery Units (HRUs) to amenity spaces
- Cleaner's store, toilet and laundry Extract Fans (EFs)
- AOV mechanical extract fans – rooftop
- Heating plantroom including pumps
- Cold water tankroom including pumps
- Emergency generator

The ducted fan systems (MVHR, HRU and EF) can be readily mitigated via the inclusion of suitably selected in-line attenuators, designed to meet the above criteria, dependent on the final selection and operating speed/duty/flow rates of the fan units. Over-attenuating the fan systems will be of benefit to "take them out of the equation", so as to allow more "head room" for the other larger items of plant, e.g. condensers and ASHPs, which tend to be more difficult to attenuate.

Suitably selected ASHP units can be procured, along with mitigation measures as required in order to meet the above criteria. The mitigation may be in the form of an attenuation package or kit, which typically achieves circa 8dB reduction with inlet side attenuators and a top pod attenuator to the vertical fan discharge. Alternatively, a full acoustic enclosure can typically achieve circa 12dB reduction. Night setback modes are usually available on most inverter driven units, and this can reduce source noise levels by around 3-5dBA depending on the manufacturer.

In addition to controlling the atmospheric and roomside noise transfer of the units, it is also important to consider the transfer of noise as vibration to any sensitive areas within the proposed building. To this end, it is advised the items of plant be mounted on suitable anti-vibration mountings, the specification of which will be confirmed at the full design stage in the Plant Noise Assessment Report.

External Amenity Levels

Guidance Documents

BS8233 outlines the following advice on design criteria for external amenity spaces:

> *"For traditional external areas that are used for amenity space, such as gardens and patios, it is desirable that the external noise level does not exceed 50dB $L_{Aeq,T}$, with an upper guideline value of 55dB $L_{Aeq,T}$ which would be acceptable in noisier environments. However, it is also recognised that these guideline values are not achievable in all circumstances where development might be desirable. In higher noise areas, such as city centres or urban areas adjoining the strategic transport network, a compromise between elevated noise levels and other factors, such as the convenience of living in these locations or making efficient use of land resources to ensure development needs can be met, might be warranted. In such a situation, development should be designed to achieve the lowest practicable levels in these external amenity spaces, but should not be prohibited.*

The following relates specifically to balconies and terraces:

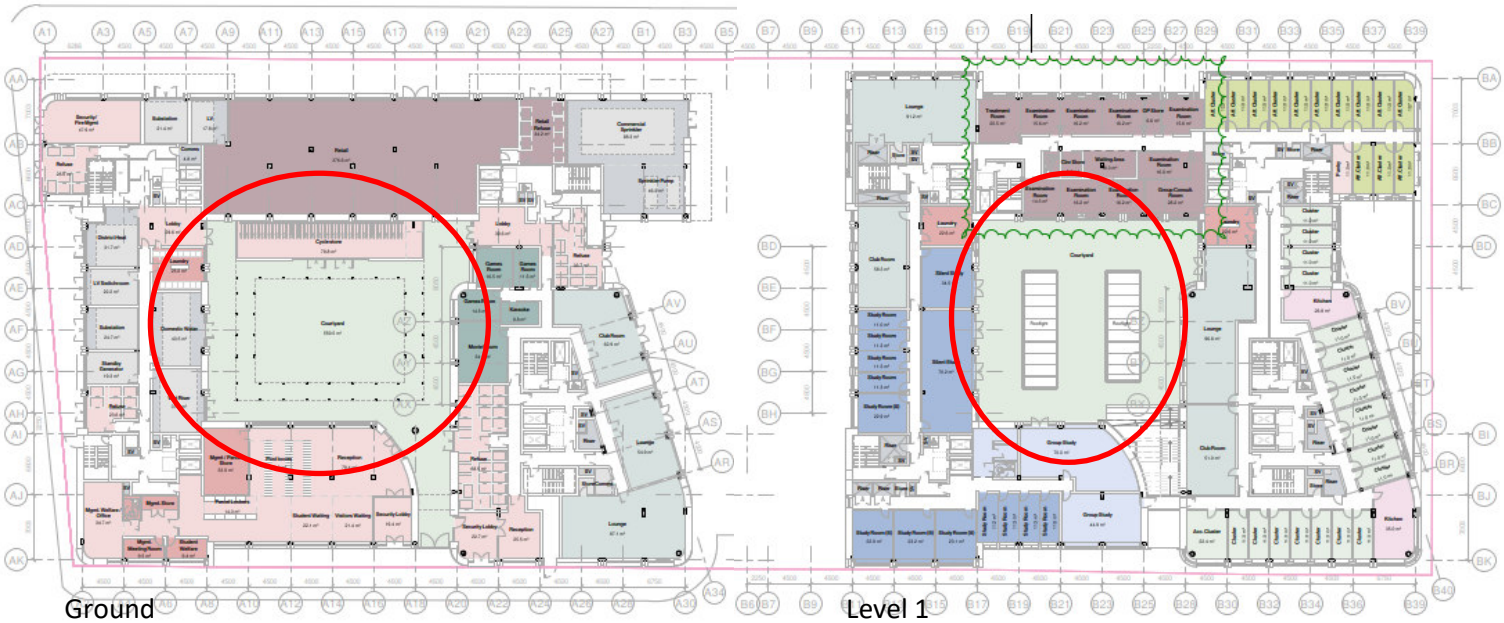
> *"Other locations, such as balconies, roof gardens and terraces, are also important in residential buildings where normal external amenity space might be limited or not available, i.e. in flats, apartment blocks, etc. In these locations, specification of noise limits is not necessarily appropriate. Small balconies may be included for uses such as drying washing or growing pot plants, and noise limits should not be necessary for these uses. However, the general guidance on noise in amenity space is still appropriate for larger balconies, roof gardens and terraces, which might be intended to be used for relaxation. In high-noise areas, consideration should be given to protecting these areas by screening or building design to achieve the lowest practicable levels. Achieving levels of 55dB $L_{Aeq,T}$ or less might not be possible at the outer edge of these areas, but should be achievable in some areas of the space."*

Appropriate criteria for any proposed external amenity areas are therefore as follows:

Gardens/Balconies/Terraces	Daytime (07:00-23:00 hours)	< 55dB L_{Aeq} if practicable Preferably < 50dB L_{Aeq}

Assessment

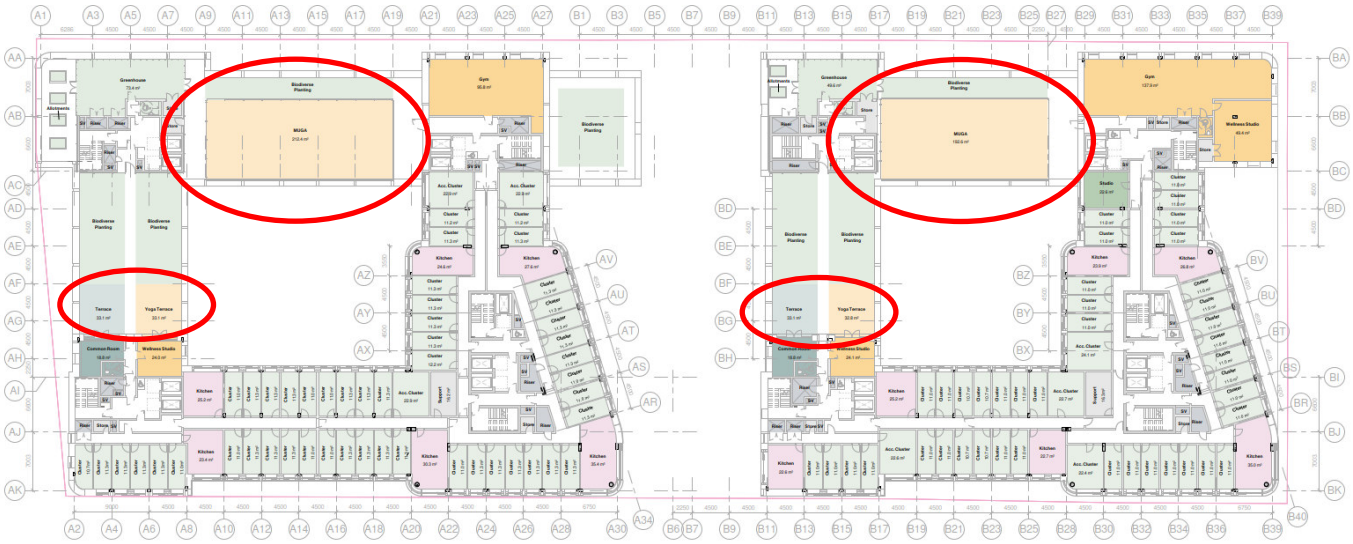
Ground/Level 1 – External Amenity



Ground Level 1

The two main external amenity spaces on the scheme are the ground/first floor central courtyards created by the form of the building. Noise levels within these spaces are anticipated to easily be below the target criterion of 55dBA L_{eq} due to natural screening by the building itself, especially from the noisier Cambridge Street. The landscape buffer on to Cambridge Street at the central spine of Cavendish Street is likely to be in excess of the criterion, but it is understood this is more of a 'buffer' than a place to relax and rest, so is not considered further. The central section is likely to be within criterion towards the rear of the space (towards Chatham St), but may be slightly in excess more towards Cambridge Street.

Level 7 – External Amenity



Any accessible roof terraces will be setback from the main frontages and at higher level up the building, so increased distance losses will be realised, plus the necessary solid glass balustrading required for security reasons ('safety screens') will act as partial barriers and also help reduce noise levels (barrier losses). It is therefore anticipated *at least* line-of-sight screening effects (-5dB) should be realised plus also distance loss corrections, as compared to the façade levels overlooking the roads (i.e. the surveyed noise levels). As can be seen from Table 1 above, the general daytime noise level recorded at Measurement Position 1 on the Cambridge Street frontage at 2nd floor level was 67 dBA L_{eq}, which is 12dB above the upper limit of 55dBA for external amenity spaces. Taking into account minimal screening and distance losses, it is anticipated noise levels within any proposed roof terrace should therefore be approaching the BS 8233 guidance target of 55dBA L_{eq} and more than likely meet this criterion for most of the terrace areas, i.e. those set further back from the main frontage and/or at higher floor levels.

Thus, it is anticipated that noise levels in the MUGA areas on the 7th floor roof should easily comply with the target criterion of 55dBA L_{eq} due to the distance and roof edge screening losses.

External Façade Design Criteria

Local Authority Requirements

Anonymous Noise Sources

Manchester City Council's requirements with regards to noise ingress into residential developments from anonymous noise sources (e.g. road and railway noise) are outlined within MCC's Noise and Planning Guidance document, which states the following criteria:

- *Bedrooms (night-time - 23:00 – 07:00)* *30dB L_{Aeq}*
  Individual noise events should not normally exceed 45dB $L_{Amax,f}$ by more than 15 times
- *Living Rooms (daytime - 07:00 – 23:00)* *35dB L_{Aeq}*
- *Gardens and terraces (daytime - 07:00 – 23:00)* *55dB L_{Aeq}*

Entertainment Noise Sources

Manchester City Council's requirements with regards to entertainment noise ingress into residential developments are outlined within MCC's Noise and Planning Guidance document, which states the following criteria:

> *Music noise levels in the 63Hz and 125Hz octave centre frequency bands (L_{eq}) should be controlled so as not to exceed (in habitable rooms) 47dB and 41dB (L_{eq}) respectively.*

It is understood Manchester City Council (MCC) typically stipulate that internal noise levels within residential units should comply with the guidance values stated within BS 8233 (as above). It is normal for these to be met with windows closed and other means of background/trickle ventilation, i.e. the proposed MVHR systems and trickle ventilators. The specification of the windows and glazing will therefore be assessed on this basis.

The matter of openable windows is relevant to the matter of overheating. This is now part of the Building Regulations under Approved Document O, for which the AVO guidance document produced by the IOA and ANC can be referred to, although is not statutory. See below section on Overheating.

BS 8233: 2014

BS 8233: 2014: "*Guidance on Sound Insulation and Noise Reduction for Buildings*" provides information on achieving appropriate internal acoustic environments. The standard advises internal ambient noise levels for achieving suitable resting and sleeping conditions within residential properties as set out in Table 6 below.

Table 6 – BS 8233:2014 Residential Criteria

Room Type	Daytime (07:00 to 23:00hrs) $L_{Aeq,16hour}$ (dB)	Night-time (23:00 to 07:00hrs) $L_{Aeq,8hour}$ (dB)
Bedrooms (Studios)	35	30
Living Rooms	35	--
Dining Rooms	40	--

World Health Organisation (WHO)

WHO (2018) "*Environmental Noise Guidelines for the European Region*" sets out to define "*recommended exposure levels for environmental noise in order to protect population health*". The guidance document relates specifically to external noise levels and recommends that "*all CNG [WHO (1999) Guidelines for Community Noise] indoor guideline values and any values not covered by the current guidelines (such as industrial noise and shopping areas) should remain valid*". We therefore refer to *Guidelines for Community Noise* for recommendations on internal noise levels.

Guidelines for Community Noise describes guideline levels that are "*essentially values for the onset of health effects from noise exposure*". A table of guideline values is included, relating to adverse health effects, defined as any temporary or long-term deterioration in physical, psychological, or social functioning that is associated with noise exposure. The following is an extract from Table 4.1: *Guideline values for community noise in specific environments*, as stated in the WHO (1999) document.

Table 7 – Guideline Values for Community Noise from WHO

Specific Environment	Critical Health Effect(s)	L_{Aeq} (dB)	Time Base (hours)	$L_{Amax,f}$ (dB)
Inside bedrooms	Sleep disturbance, night-times	30	8	45
Outside bedrooms	Sleep disturbance, window open (outdoor values)	45	8	60
Dwelling, indoors	Speech intelligibility and moderate annoyance, daytime and evening	35	16	-

With reference to maximum noise levels the following guidance is provided within the WHO guidance:

> *For a good sleep, it is believed that indoor sound pressure levels should not exceed approximately 45dB L_{Amax} more than 10-15 times per night (Vallet & Vernet 1991) and most studies show an increase in the percentage of awakenings at SEL values of 55-60 dBA (Passchier-Vermeer 1993; Finegold et al. 1994; Pearsons et al. 1995). For intermittent events that approximate aircraft noise, with an effective duration of 10-30s, SEL values of 55-60 corresponds to a LAmax value of 45dB. Ten to 15 of these events during an 8-hour night-time implies a $L_{Aeq, 8h}$ of 20-25dB. This is 10-15dB below the $L_{Aeq, 8h}$ or 30dB for continuous night-time noise exposure, and shows that intermittent character of noise must be taken into account when setting night-time noise limits for noise exposure. For example, this can be achieved by considering the number of noise events and the difference between the maximum sound pressure level and the background of these events.*

Therefore the frequency of occurrence of maximum noise events should not typically exceed 10-15 times in any night.

Summary of Adopted Project Criteria

The project criteria adopted are therefore as follows:

Bedrooms (Studios)	Night-time (23:00-07:00hrs)	30dB $L_{Aeq,8hr}$ & typically <45dB $L_{Amax,f}$ *
Bedrooms & Living Rooms	Daytime (07:00-23:00hrs)	35dB $L_{Aeq,16hr}$

** Under WHO, 10-15 occurrences during the night-time in excess of 45dBA are "allowable". The new 2014 version of BS 8233 states L_{max} levels 8233 states L_{max} levels in the region of 45-55dBA could be considered acceptable.*

Other Criteria

Design criteria for non-residential spaces, such as any commercial units and amenity spaces, are taken from industry standard guidance documents, such as BS 8233: 2014 and BCO, etc. and the Unite Turnkey Spec. It is considered appropriate to design to the following criteria, assuming daytime use only;

Amenity Rooms / Social Spaces	40dB L_{Aeq}
Common Room / Quiet Study	40dB L_{Aeq}
Circulation / Corridor / Stairwell / Lobby	45dB L_{Aeq}
WC / Store	45dB L_{Aeq}
Retail Unit	50dB L_{Aeq}
Marketplace	45-55dB L_{Aeq}

Façade Constructions – Glazing, Curtain Walling, External Wall, Ventilation

The acoustic performance requirements for the glazed windows have been assessed for the whole development. This has been based upon achievement of the above internal ambient noise level criteria, the project drawings from the architect, assumption of use of MVHR or mechanical fans throughout (i.e. no natural ventilation is proposed or that trickle vents are required, other than to larger shared kitchen/dining/living rooms and in the case of purge overheating fans), and the use of a lightweight cladding system, likely comprising as follows, or very similar;

- 20mm Brick slip or metal composite lightweight cladding
- 180mm Rockwool Duo Slab thermal insulation
- 12mm cement particle sheathing board
- 100mm Metal studwork or similar, i.e. SFS or Metsec
- Full-fill Rock or mineral wool infill between studwork
- 2x 12.5mm FireLine board internally

We have assumed an acoustic performance equating to an overall of R_w 50dB for all non-glazed areas of the above construction.

Further to the noise surveying and computer modelling discussed above, the required performance of the curtain walling and glazing has been calculated, as well as the performance for trickle ventilators (if they are required, dependent on the selected ventilation method to combat overheating). The following acoustic specifications have been developed, which are suitable to go to tender to suppliers.

Specification & Guidance Constructions

Glazing

Glazed units (inclusive of glazing, louvres, timber panels, spandrel panels, infill panels, framing, opening lights, balcony/terrace doors, seals, etc.) should achieve the following minimum sound reduction indices as tested in general accordance with BS EN ISO 140-3:1995:

Table 8 – Glazing Acoustic Specification

Glazing Type	Minimum Recommended Sound Reduction Index (dB) at Octave Band Centre Frequency (Hz)								R_W (dB)
	63	125	250	500	1k	2k	4k	8k	
G1	31	28	30	39	44	49	56	56	42
G2	22	26	27	34	40	38	46	46	38
G3	23	23	23	30	38	36	43	43	35
G4	17	21	20	27	37	36	41	41	32

Note: R_W is the laboratory tested "overall weighted sound reduction index."

Note: the internal noise criteria are expressed in overall dBA terms, so other frequency specific performance levels may be acceptable. Test data for representative samples of all glazing systems should be submitted to Blackbird Acoustics for approval to indicate compliance with the above performance specifications.

For initial guidance, we would anticipate the following glazing configurations detailed below in Table 9 to prove commensurate with achieving the sound insulation performance specifications detailed above in Table 8.

Table 9 –Guidance Configurations for Glazing

Glazing Type	Configuration
G1	High-spec PVB acoustic-laminated double glazing, i.e. 10/16/8.4 ac lam
G2	Medium-spec double glazing, i.e. 10/16/6
G3	Low-spec double glazing, i.e. 8/16/6
G4	Any thermal double glazing (low spec) with panes of differing thickness, e.g. 4/16/6

Note: It should be noted that due to non-acoustic reasons (security, thermal or structural purposes), the specifications may exceed that stated above in some locations.

Trickle Vents

Generally the development will be served by MVHR or HRU units (V0 spec) and therefore no natural ventilation via trickle ventilators is required. However, the ventilation units serving cluster flats can only service the bedrooms and bathroom pods with separate extract fans for the kitchen areas, for larger clusters, typically 8-bed or more. Therefore trickle ventilators are required to these LKD rooms for fresh air make-up.

In addition, the chosen mitigation measure to combat overheating in the PBSA on the west façade is the use of a separate mechanical "purge" fan to purge the heat during night-time periods. Therefore it is understood make-up air via trickle ventilators is required. The below details the necessary specifications for any required trickle ventilators.

Trickle ventilators (in their open state) should achieve the following minimum element-normalised level differences as tested in accordance with BS EN 20140-10:2021:

Table 10 – Trickle Ventilator Acoustic Specification

Ventilator Type	Minimum Recommended $D_{n,e}$ (dB) at Octave Band Centre Frequency (Hz)								$D_{n,e,W}$ (dB)
	63	125	250	500	1k	2k	4k	8k	
V0	MVHR / HRU								> 55
V1	35	39	40	44	49	53	64	64	48
V2	43	47	38	36	41	55	62	62	42
V3	36	40	37	35	37	44	65	65	39
V4	33	37	35	32	33	37	47	47	34
V5	22	28	31	34	33	31	31	31	33

Note: $D_{n,e,W}$ is the laboratory tested "overall weighted element normalised level difference."

Please note the above specifications assumes one trickle ventilator will be installed per room, i.e. a continuous mechanical extract system (ADF System 3) will be utilised. The specifications should be increased by a factor of 10Log(N) should N ventilators be required per room, i.e. increase by +3dB or +5dB respectively should two or three ventilators be required per room.

Note: the internal noise criteria are expressed in overall dBA terms, so other frequency specific performance levels may be acceptable. Test data for representative samples of all trickle ventilators in their open state should be submitted to Blackbird Acoustics for approval to indicate compliance with the above performance specification.

For initial guidance, we would anticipate the following trickle ventilator type detailed below in Table 11 to prove commensurate with achieving the sound insulation performance specification detailed above in Table 10.

Table 11 –Guidance Trickle Ventilator

Ventilator Type	Example Ventilator Type
V0	MVHR / HRU
V1	Very-High-specification, acoustically rated "through-the-frame" trickle ventilator, e.g. Renson Invisivent EVO AK Extreme, or similar
V2	High-specification, acoustically rated "through-the-frame" trickle ventilator, e.g. Renson Invisivent EVO AK Ultra, or similar
V3	Medium-specification, acoustically rated "through-the-frame" trickle ventilator, e.g. Renson Invisivent EVO AK High, or similar
V4	Low-specification, acoustically rated "through-the-frame" trickle ventilator, e.g. Renson Invisivent EVO AK Basic, or similar
V5	Any nominally-acoustically rated "through-the-frame" trickle ventilator

Façade Zones & Applicable Glazing Types

Due to the differing noise sources around the site, two glazing zones have been defined, as indicated in Table 12 below and the attached Façade Zoning Plan 2124/FZP.

Table 12 – Façade Zones & Glazing Types

Façade Zone	Floor Levels	Room Type	Glazing Type (Vent Type)
1 – West Façade, Cambridge Street Frontage and 'Wrap Arounds'	Lower Floors Ground to 6th Floor	Bedrooms/Studios	G1 (V0/V1)
		Living Room / Kitchens	G2 (V0/V3)
		All Other Room Types *	G1 (V0)
	Middle Floors 7th – 11th Floors	Bedrooms/Studios	G2 (V0/V2)
		Living Room / Kitchens	G3 (V0/V4)
		All Other Room Types *	G3 (V0)
	Upper Floors 12th Floor & above	Bedrooms/Studios	G3 (V0/V4)
		Living Room / Kitchens	G4 (V0/V5)
		All Other Room Types *	G4 (V0)
2 – All Other Side, Rear & Courtyard-Facing Façades	All Floor Levels	Bedrooms/Studios	G4 (V0/V4)
		Living Room / Kitchens	G4 (V0/V5)
		All Other Room Types *	G4 (V0)

** All other Room Types includes cluster & common corridors, amenity areas, study rooms, offices, lobbies and marketplace.*

The above glazing specs and façade zones are to be fully developed at the Detailed Design Stage following planning permission.

Acoustic Flanking Specification

The following section discusses a suitable flanking specification for any curtain walling or continuous glazing systems that may be proposed.

Flanking Performance Specification

The previous sections relate to external noise intrusion through any curtain walling systems to internal areas. Separating wall / floor and partitioning sound insulation performance can be compromised by curtain walling systems, which would result in potential future sound insulation problems and the failure to comply with project criteria and Building Regulations. It is therefore important to include an additional specification covering the curtain walling package, which aims to limit the amount of sound transfer across separating wall / floor and partitioning lines through the curtain walling system. A flanking performance specification follows below.

Achievement of the specification should ideally be demonstrated by laboratory acoustic testing in general accordance with BS EN ISO 10848-2:2006. This is undoubtedly a complex and costly testing procedure and therefore the supplier may – following tender reviews – be allowed to demonstrate by other means (provision of previous test reports and/or comparative calculations) that the specification can be achieved.

System components need to be appropriately designed. With regard to potential flanking through the panels, the specification is commensurate with relatively high sound insulation levels. Achievement of this specification will require careful consideration of the panel design, in particular the insulation type and construction make-up of the panel skin. In addition it is likely to be necessary to design the cladding such that double/split insulated mullions are included. This will have an impact on the design and style of any curtain walling system and should be explored at the earliest opportunity to ensure the specification is achieved. The curtain walling system shall provide suitable surfaces against which a good acoustic seal can be made with future separating walls/floors.

Extent

The following specifications apply to all curtain walling or continuous elements between residential units (PBSA) and, if applicable, between residential units and non-residential or commercial areas. Between non-residential areas (e.g. commercial to commercial, amenity to amenity, stairwells, etc.) it is standard practice to relax the specification to a value of 50dB $D_{n,f,w}$.

Flanking at Separating Wall/Floor Lines

The curtain walling/continuous system shall achieve both a horizontal and a vertical weighted normalised flanking level difference of 60dB $D_{n,f,w}$ when tested in general accordance with BS EN ISO 10848-2:2006 [previously BS EN 20140-9:1994] (the methodology amended accordingly).

Part O and Overheating

Approved Document O (ADO) is a statutory document and forms part of the Building Regulations. This came in to force for new sites commencing on site after June 2023. ADO's section on Noise states;

> *3.2 In locations where external noise may be an issue (for example, where the local planning authority considered external noise to be an issue at the planning stage), the overheating mitigation strategy should take account of the likelihood that windows will be closed during sleeping hours (11pm to 7am).*
>
> *3.3 Windows are likely to be closed during sleeping hours if noise within bedrooms exceeds the following limits.*
> *a. 40dB LAeq,T, averaged over 8 hours (between 11pm and 7am).*
> *b. 55dB LAFmax, more than 10 times a night (between 11pm and 7am).*
>
> *3.4 Where in-situ noise measurements are used as evidence that these limits are not exceeded, measurements should be taken in accordance with the Association of Noise Consultants' Measurement of Sound Levels in Buildings with the overheating mitigation strategy in use.*
>
> *NOTE: Guidance on reducing the passage of external noise into buildings can be found in the National Model Design Code: Part 2 – Guidance Notes (MHCLG, 2021) and the Association of Noise Consultants' Acoustics, Ventilation and Overheating: Residential Design Guide (2020).*

The joint IOA and ANC's "*Guide to Demonstrating Compliance with the Noise Requirements of Approved Document O July 2022*" states the following with regard to level differences through an open window;

4.1.7. Based on typical assumptions (see note below and Appendix A), the resulting outside-to-inside level difference for window openings necessary to satisfy the simplified method of AD-O are expected to be approximately 4 dB for 'high' risk locations and 9 dB for 'medium' risk locations.

The site is considered, in the worst case, to be in a 'medium' risk location (central Manchester) and therefore an approximate outside-to-inside level difference of 9dB can be expected.

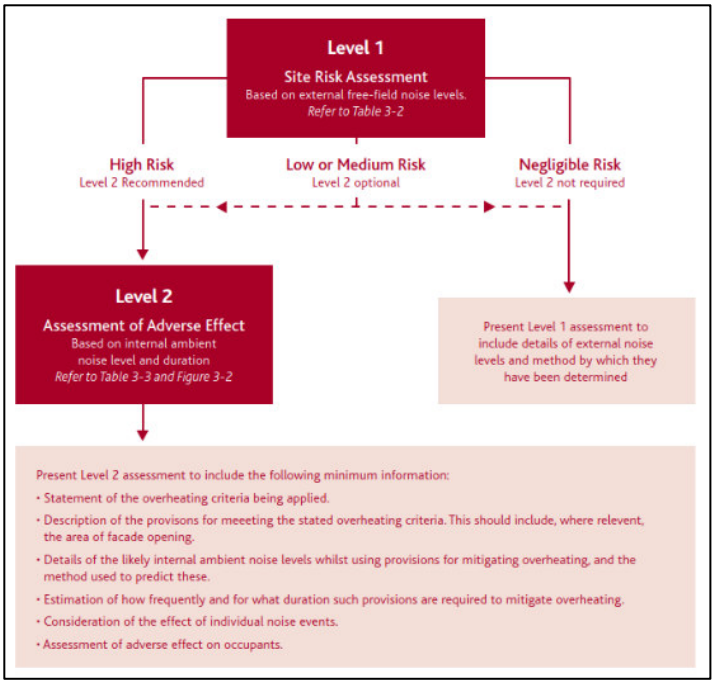
This implies the following limiting external free-field levels above which external noise precludes the use of the simplified method, and dynamic thermal modelling should be used to demonstrate compliance.

Table 13 – External Noise Levels Above Which the Simplified Method Cannot Be Used

Parameter	High Risk Location	Medium Risk Location
$L_{Aeq,8hr}$, averaged over 8 hours (between 11pm and 7am)	44 dB	49 dB
L_{AFmax}, more than 10 times a night (between 11pm and 7am)	59 dB	64 dB

ANC's AVO

The Association of Noise Consultants' "*Acoustics, Ventilation and Overheating – Residential Design Guide, January 2020*" was produced before ADO came into effect. The guide involves a two-level approach to addressing issues of overheating with respect to noise, as described below in the below assessment process.



A Level 1 assessment is based purely upon external noise levels incident upon the façade of the assessment building. The areas are categorised as Low, Medium, or High risk depending on the external noise levels incident upon the façade, as detailed below.

The categorisation of risk was based on a design intent to achieve the recommended internal ambient noise levels for dwellings provided in Table 4 of BS 8233: 2014 (i.e. Table 4 above), assuming a reduction of 13dB for a partially opened window and making an allowance of exceeding the criteria by 5dBA during overheating periods.

Table 3-2 Guidance for Level 1 site risk assessment of noise from transport noise sources [Note 1] relating to overheating condition

Risk category for Level 1 assessment [Note 5]	Potential Effect without Mitigation	Recommendation for Level 2 assessment
$L_{Aeq,\ T}$ [Note 3] during 07:00 - 23:00 / $L_{Aeq,\ 8hr}$ during 23:00 - 07:00 High: 65 dB / 55 dB Medium: 60 dB / 50 dB Low: 55 dB / 50 dB Negligible: 50 dB / 45 dB	Increasing risk of adverse effect	Recommended Optional
	Use of opening windows as primary means of mitigating overheating is not likely to result in adverse effect	Not required

The cut off values for external noise, whilst allowing opened windows to combat overheating, are therefore daytime L_{Aeq} of 53dB and a night-time value of 48dB.

Napier Window Research

The Building Performance Centre School of the Built Environment at Napier University produced a document referenced *NANR116: 'Open/Closed Window Research' Sound Insulation Through Ventilated Domestic Windows, April 2007*. For a variety of different noise sources, the research concluded a minimum out-to-in level difference of 12dBA.

Assessment

The results of the noise surveying are stated above in Table 1, but the relevant parameters are summarised as follows, for Positions 1 / 2 / 3 respectively;

Daytime L_{Aeq} = 67 / 55/ 56 dB
Night-time L_{Aeq} = 61 / 51 / 53 dB
Typical Night-time $L_{Amax,f}$ = 77 / 69 / 71 dB

With regard to the ANC's AVO Guidance, the threshold of negligible risk for a Level 1 assessment is considered to be 48dB L_{Aeq} night-time and 53dB L_{Aeq} daytime. The results of the noise surveying indicate the levels significantly exceed these thresholds on the main frontage (Cambridge Street façade) and therefore there is a 'high' risk associated with the 'use of opening windows as the primary means of mitigating overheating' and an 'increased risk of adverse effect'. Additionally, a Level 2 assessment is required. Therefore, on the basis of AVO, reliance on opening a window to combat overheating would not likely be deemed acceptable to the front façade.

However, conversely, noise levels within the central courtyards are anticipated to fall in the 'low' risk category and therefore the "*use of opening windows as primary means of mitigating overheating is not likely to result in adverse effect*". Whilst noise levels at Positions 2 & 3 (i.e. the side and rear facing façades) are in the 'medium' risk category.

On the basis of the assumed out-to-in level difference of 13dBA for an open window that the AVO guidance is based upon, or alternatively a slightly worse-case 12dBA as per the Napier research document, the resultant internal noise levels at lower floor level on the main fronting façade overlooking Cambridge Street would be approximately 49dB L_{Aeq} (night-time) and 65dB L_{Amax}, which significantly exceed the requirements of ADO (40dB and 55dB respectively). Whereas, using the measured levels at Positions 2 & 3 the resulting internal levels will be approximately 39 & 41dB L_{Aeq} (night-time) and 57 & 59dB L_{Amax} – thus the rear & end facing façades are likely to approximately comply with the ADO requirements, albeit marginally over the ideal criteria.

As per the ANC's guidance-on-ADO document, assuming the site is in the 'medium' risk category, an out-to-in level difference of 9dB can be expected from an open window. This would result in internal noise levels at lower floor level on the main fronting façade overlooking Cambridge Street would be approximately 52dB L_{Aeq} (night-time) and 68dB L_{Amax}, which significantly exceed the requirements of ADO (40dB and 55dB respectively). Whereas, using the measured levels at Positions 2 & 3 the resulting internal levels will be approximately 42 & 43dB L_{Aeq} (night-time) and 60 & 62dB L_{Amax} – thus end and rear facing façades are likely to slightly exceed the ADO requirements, in the worst case.

In the interests of minimising carbon (both embodied and operational – see below in terms of possible options, generally all mechanical), it is hoped that all parties agree that the protected/shielded rear facing façades are likely to *generally* be acceptable with reliance on an openable window to mitigate overheating with an associated low risk of adverse effect probable, given the marginal exceedances. In addition, it is understood PBSA tend to have around 25% occupancy during the summer months (due to term times), which are the worst affected months in terms of potential overheating. Operational management can ensure the longer term lets occupy rooms overlooking the central courtyards where noise levels are lower.

On the basis of the above analyses, it is considered that reliance on an opened window to help combat overheating would not be acceptable to the main Cambridge Street fronting bedrooms under current guidance requirements, and alternative means of mitigating overheating is required. However, end & rear facing façades (that are more shielded) are likely to be able to rely on openable windows and generally achieve suitable internal noise levels. See attached Overheating Zoning Plan 2124/OZP.

A full overheating assessment should be carried out by the design team to assess the risk of potential overheating scenarios. Other means of mitigation should be investigated first, e.g. increased G-values, fabric-first approach, if MVHRs are proposed perhaps increased ventilation rates, etc. to minimise the number of occurrences of overheating. If it can be found that windows can be kept closed during the critical night-time periods but opened during the daytime to help mitigate the heat, then the requirements of ADO will be met by default, which is the only statutory requirement.

If not, then other alternative means of mitigation might be considered necessary, such as attenuated ventilation panels adjacent to the windows, e.g. Monodraught ResiVent Zero or similar, which will have an effect on the appearance of the façades and would therefore become a planning matter and should be addressed at the earliest opportunity. These vent panels are understood to be optimal in terms of energy, carbon and lifetime costs, etc., but unfortunately there are usually too many implications on other elements (such as space, aesthetics & costs) and the overall acoustic performance is not sufficient for particularly noisy façades, so other means are typically adopted.

This could also be in the form of an attenuated façade, such as an acoustic louvre in front of the opening panel, but the overall reduction achieved in this configuration is typical fairly moderate (circa 3-5dB) and would only assist the end and rear facing façades to more readily achieve the criteria of ADO.

Alternatively a boosted or enhanced air flow rate MVHR system could be utilised, with or without a peak lopping coil (pre-tempered supply air), as required. Another solution might be to retain the standard flow MVHR units and supplement with a separate 'purge' mechanical vent per affected bedroom/studio. The preferred solution needs to be investigated by the Design Team.

The windows will have openable panels / side lights as necessary to meet the requirements for 'purge ventilation' (fumes/smells) anyway, and these give occupants full control of their environment.

Current Proposals

It is understood the current design proposals include the use of the standard MVHR for background/trickle ventilation and, where rooms are affected by noise in an overheating situation, windows will be openable during the daytime for heat purge but closed during the night-time with a separate mechanical purge extract fan supplied, in line with ADO.

All spaces currently allow for natural ventilation during the day, targeting the statutory requirements of Part O. If additional targets exist (e.g. AVO), cooling will need to be introduced to the scheme, which will obviously increase energy, carbon cost and spatial requirements.

The above matter of overheating and finalised solution for mitigation will be fully developed at the Detailed Design Stage following planning permission.

MVHR Systems

A "whole-house mechanical ventilation" (WHMV – Approved Document F System 4) system is generally proposed throughout the development. This comprises a low-speed encased fan within a fully ducted system with fresh air supply to the bedrooms and studios and extract from the kitchen and bathrooms ("wet rooms"). It is typical for the WHMV system to also have heat recovery (i.e. Mechanical Ventilation with Heat Recovery, MVHR) capabilities for increased SAP ratings.

External noise break-in to the rooms via the ventilation system will be negligible (when compared to the glazing) due to the fully ducted nature of the system. Atmospheric-side attenuators are generally not required to the system (in terms of noise break-in) due to the *relatively* low external noise levels at most façades.

Typically no internal noise issues arise providing the ductwork runs are planned and coordinated (not torturous), such that bends are minimised so as to reduce back pressure on the fan unit and regenerated noise in the ductwork.

The fan units are usually isolated internally and therefore no other resilient fixings are usually required, noting the ductwork run design comments made above.

The MVHR systems should be designed by the M&E Consultant and M&E Sub-Contractor / Supplier to achieve the following internal noise levels during operation. Manufacturer's installation guidelines should always be followed, and the manufacturer should confirm no vibration transfer will occur through the stud walls so as to create re-radiated structure-borne noise issues.

Table 14 – MVHR Internal Noise Level Criteria

Room Type	L_{eq} Criteria for Mechanical Services (MVHR and Fans) in Specific Ventilation 'Mode'		
	Trickle/Background	Boost	Purge / Overheating
Bedrooms & Studios	< NR25	< NR30	< NR35
Living / Dining Rooms	< NR30	< NR35	< NR40
Bathrooms / Kitchens	< NR35	< NR40	< NR45

Non-Resie to PBSA Separation

A Retail Unit and a Community GP unit are proposed at Ground & First floor levels on the main frontage on Cambridge Street. In addition, the 7th floor roof top external Sports MUGA areas are proposed. Adequate separation is required between these areas and their adjacencies, which include PBSA rooms, in the worst case. Detailed constructional designs will be worked up at the post-planning-grant, detailed design stage to ensure no noise nuisance is created. Mitigation measures are likely to be required, which might entail upgraded ceilings in the bedrooms below the Sports MUGA rooftop areas, a floating floor (see below) to the MUGA Sports areas, additional linings to first floor walls, and the prescription of suitable tenancy lease clauses regarding maximum permissible noise levels and the requirement to install additional measures in the case of anticipated higher source noise levels.

It is understood the proposed separating floors between the units and the vertically adjacent student areas comprise concrete cast in-situ transfer slabs varying from 225mm to 400mm thick, dependent on location.

An assessment (back-calculation) has been undertaken – see Table 14 below – to consider potential airborne noise transfer from activities within the units impacting the student accommodation above/below. A worst case assumption has been made in terms of the slab; data is taken from actual on-site testing of a 215mm thick concrete slab, whereas the slabs proposed will be at least 225mm, if not up to 400mm thick (to be finalised). Obviously where there is a thicker slab proposed, the sound insulation between spaces will be better, due to the additional mass. Noise break-through has been designed on an L_{eq} basis to NR15 or 25dBA, which is approximately 5-10dB below the otherwise (traffic noise break-in, MVHR noise, etc.) target noise level (30dBA or NR25 L_{eq}) within a bedroom during the worst case period at night-time (which is unlikely in reality – daytime use of units only). In other words, the calculation is very much worst case or pessimistic.

Table 14 – Example Back-Calculation to Limiting Source Level for a 215mm thick Concrete Slab

Parameter	Sound Level (dB) at Octave Band Centre Frequency (Hz)								dBA / NR
	63	125	250	500	1k	2k	4k	8k	
Unit – Internal Noise Limiting Level (L_{eq})	87	79	77	76	76	76	77	75	83 / 81
Standardised Level Difference of Separating Floor (Pessimistic, 215mm thk concrete)	40	43	48	54	58	60	65	65	-
Typical Reverberation Time within Student Rooms (seconds)	0.5	0.4	0.3	0.3	0.2	0.2	0.2	0.2	-
Resultant Noise Level within First Floor Student Rooms	46.8	35.0	26.5	19.0	15.0	12.3	8.5	6.5	26 / 16
Design Criterion (NR15)	47	35	26	19	15	12	9	7	26 / 15
Excess (+) / Shortfall (-)	0.2	0.0	-0.5	0.0	0.0	-0.3	0.5	0.5	-

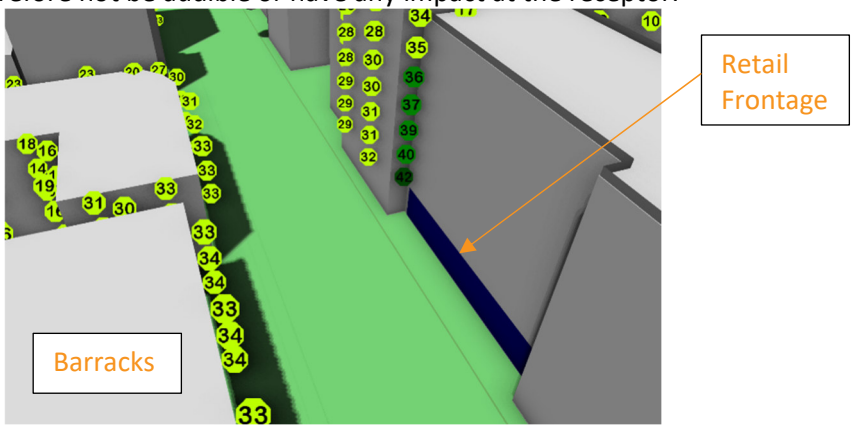
The resultant back-calculated limiting level is in the mid-70's across the frequency range and 83dBA overall. From our suite/database of typical source noise levels, the above limiting level is equivalent to, or represents typical noise levels from, the following types of space or 'event', as examples;

- Close to the main bar of a Wetherspoons on a Friday night.
- Disco night in a Function room at edge of room.
- Sports Centre Gymnasium or Fitness/Aerobics Studio
- TGI Fridays restaurant
- Noisy canteen & kitchen
- Noisy restaurant with music system
- Children's Soft Play
- Dolby surround sound home cinema sound system
- Forklift movements and Unloading of Trucks

The potential usages of the units are currently unknown, but from the above list you can see that most usages should be covered by default. As stated above, additional measures will be proposed, if deemed necessary, following finalised usages and an assessment at the detailed design stage.

Therefore it is anticipated that for most usages, the proposed transfer slab sections should be adequate. In the event that a prospective tenant wishes to be able to make more noise than the above suggested limiting level, this will be covered off via the inclusion of suitable tenancy lease clause wording to ensure that a noise nuisance is not created by any tenant in the adjacent noise sensitive areas, i.e. student bedrooms. This will put the onus on the tenant to provide any additional mitigation measures, such as suspended acoustic ceilings or column & wall linings, etc., as deemed necessary to achieve their projected source noise levels.

In addition to potential noise break-*through* to above, we have also assessed the potential for noise break-*out* through the façade to existing receptors. The lowest spec G4 glazing (see Table 9 above) has been assumed for the retail unit frontage in the assessment, although the glazing is likely to be much better performing than this due to size of panes, security and fire ratings, etc. resulting in a better/thicker configuration. Cadna noise modelling software has been used to assess the break-out levels at the University Barracks residences on the opposite side of Higher Cambridge Street, on the assumption of the 83dBA Limiting Level in Table 14, as the potential source noise level in the retail unit. The below screenshot indicates a level of 34dB L_{Aeq} at the façade of the Barracks due to break-out from the retail frontage. This should then be compared against the otherwise prevailing (traffic) noise level of 65dBA during the daytime (see Position 1a, Table 2 above). The predicted level is some 30dB below the traffic noise levels and will therefore not be audible or have any impact at the receptor.



The MUGA Sports pitches will require a suitable floating floor and early specialist design should be sought from a supplier, such as CDM Stravitec or Mason. Guidance is available from DEFRA. It is likely a sprung concrete, jack-up floating floor system or similar *might* be required, in the worst case.

In terms of noise break-out from the MUGA affecting nearby receptors, please see Heyda Acoustics's Technical Note on *MUGAs and Gyms Noise and Vibration Assessment*.

The above matter of sound separation and finalised solutions for mitigation will be fully developed at the Detailed Design Stage following planning permission.

We trust the above is clear and of assistance, but should you have any queries, please do not hesitate to contact the undersigned.

Yours sincerely,
For Blackbird Acoustics Limited

Alex J Wyatt
Director

Att.

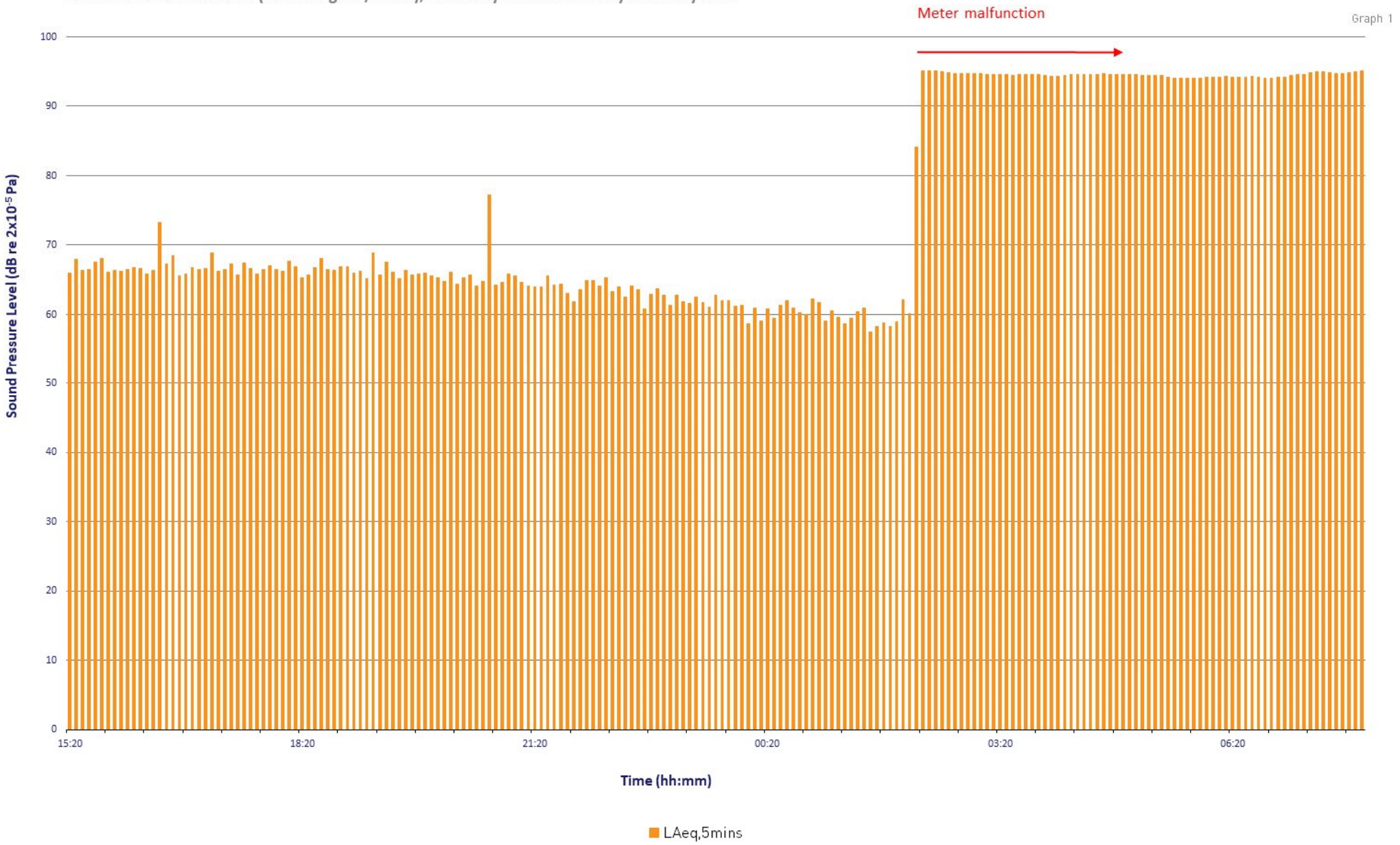
Unite/MMU, Cambridge Hall, Manchester

L_{Aeq} Time History (5-mins)

Measurement Position 1 (Cambridge St/Front), Thursday 25th to Monday 29th July 2024

Project: 2124

Graph 1



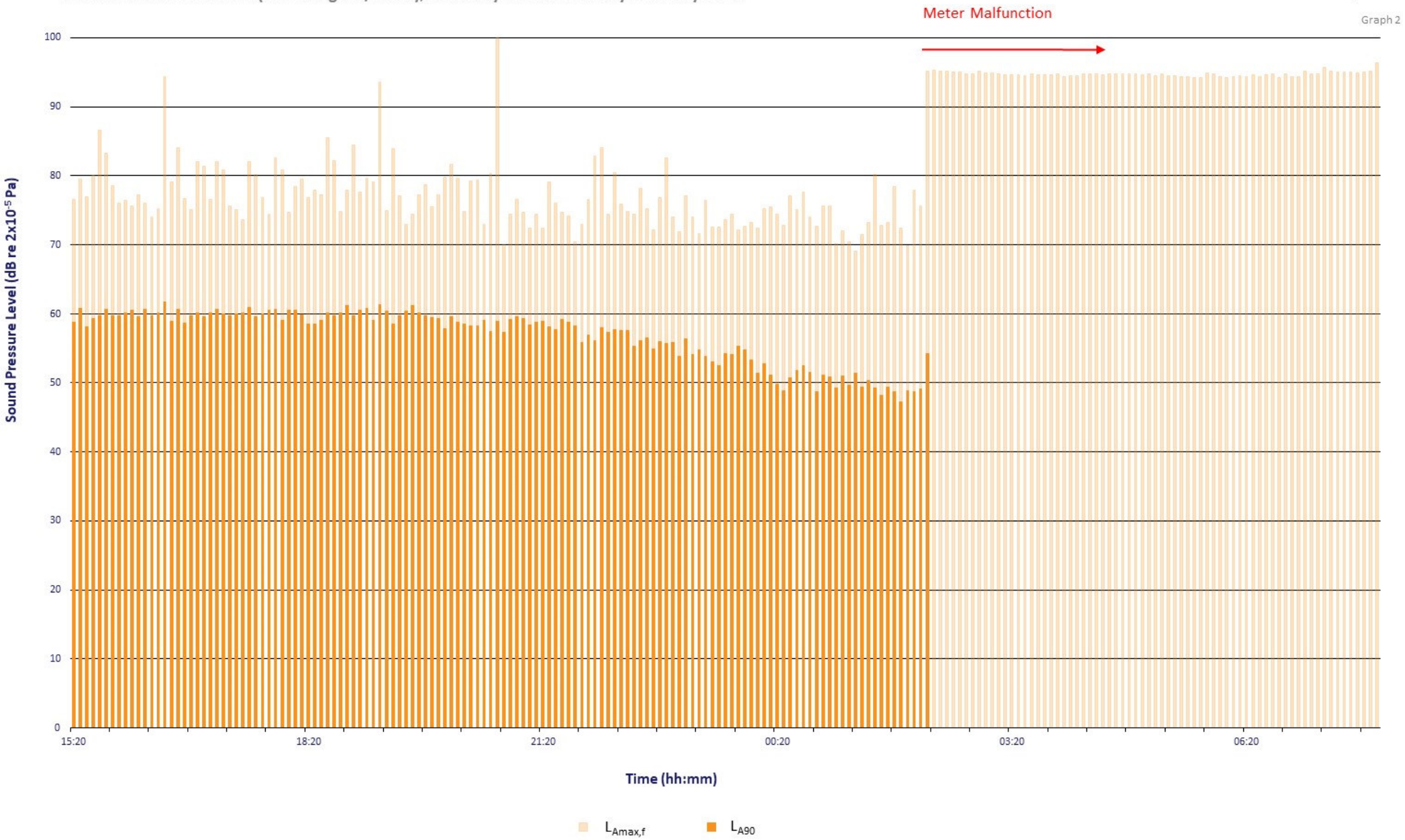
Unite/MMU, Cambridge Hall, Manchester

$L_{Amax,f}$ and L_{A90} Time History (5-mins)

Measurement Position 1 (Cambridge St/Front), Thursday 25th to Monday 29th July 2024

Project: 2124

Graph 2



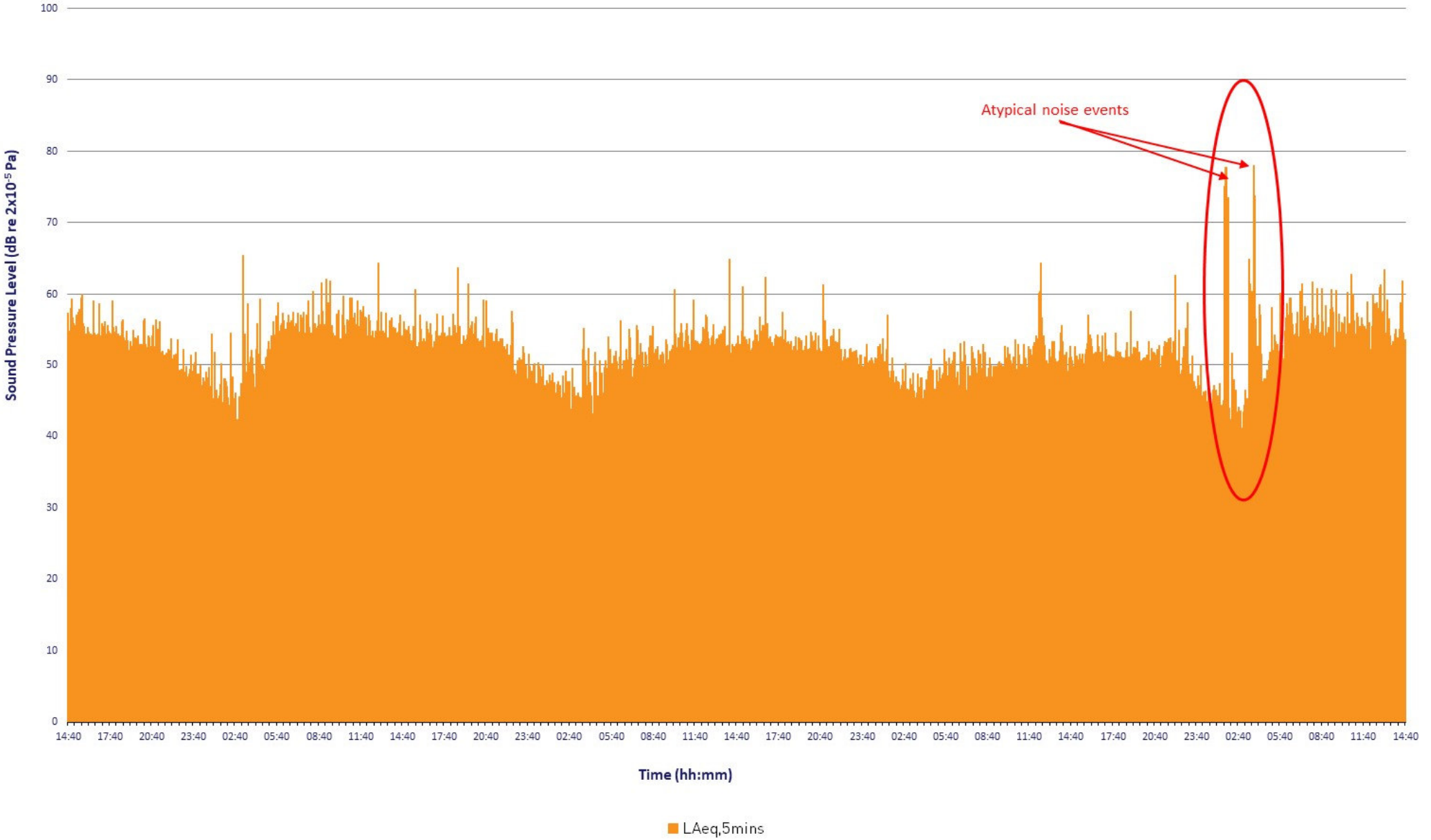
Unite/MMU, Cambridge Hall, Manchester

L_{Aeq} Time History (5-mins)

Measurement Position 2 (BSW/Pub), Thursday 25th to Monday 29th July 2024

Project: 2124

Graph 3



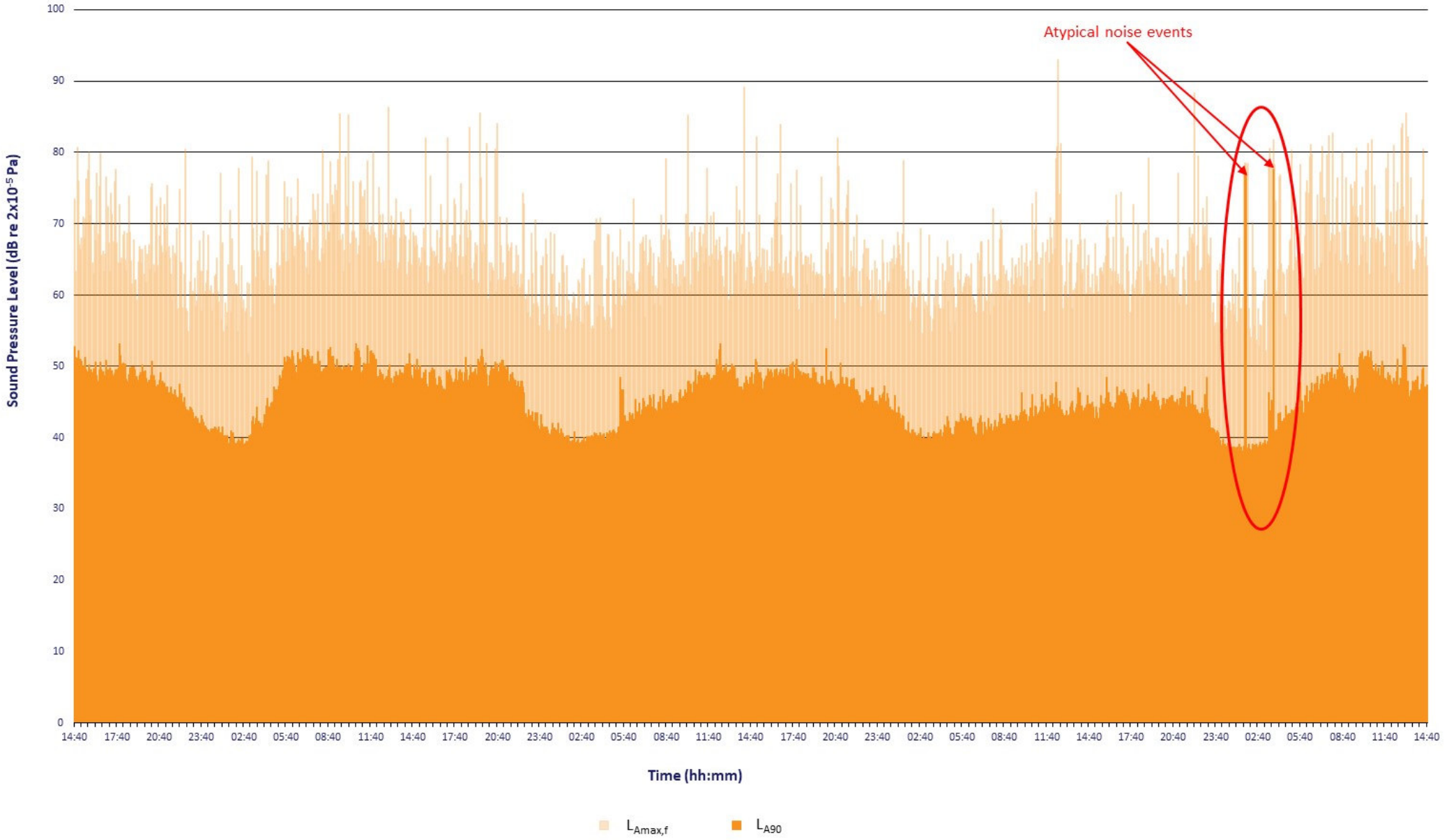
Unite/MMU, Cambridge Hall, Manchester

$L_{Amax,f}$ and L_{A90} Time History (5-mins)

Measurement Position 2 (BSW/Pub), Thursday 25th to Monday 29th July 2024

Project: 2124

Graph 4



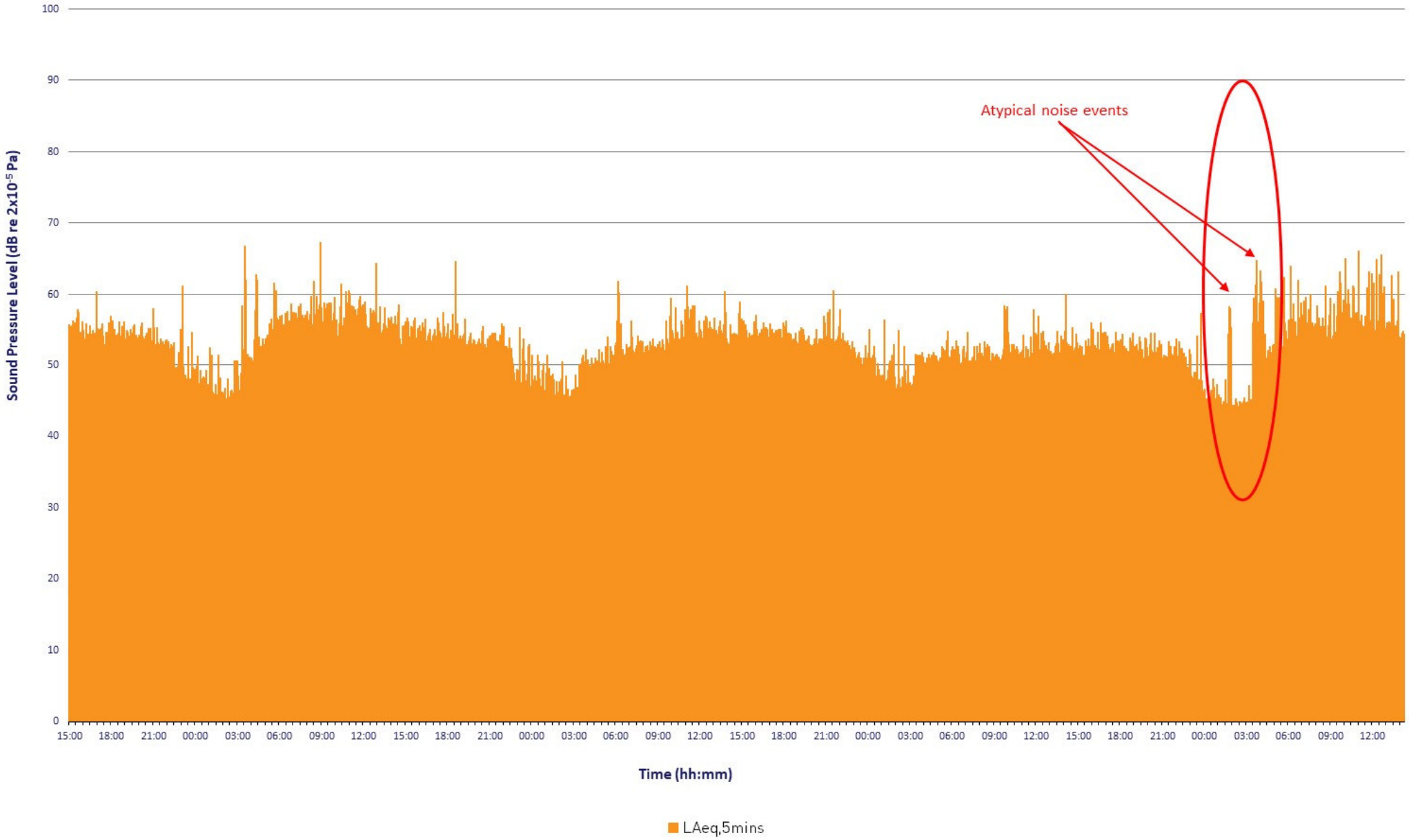
Unite/MMU, Cambridge Hall, Manchester

L_{Aeq} Time History (5-mins)

Measurement Position 3 (Chatham St/Rear), Thursday 25th to Monday 29th July 2024

Project: 2124

Graph 5



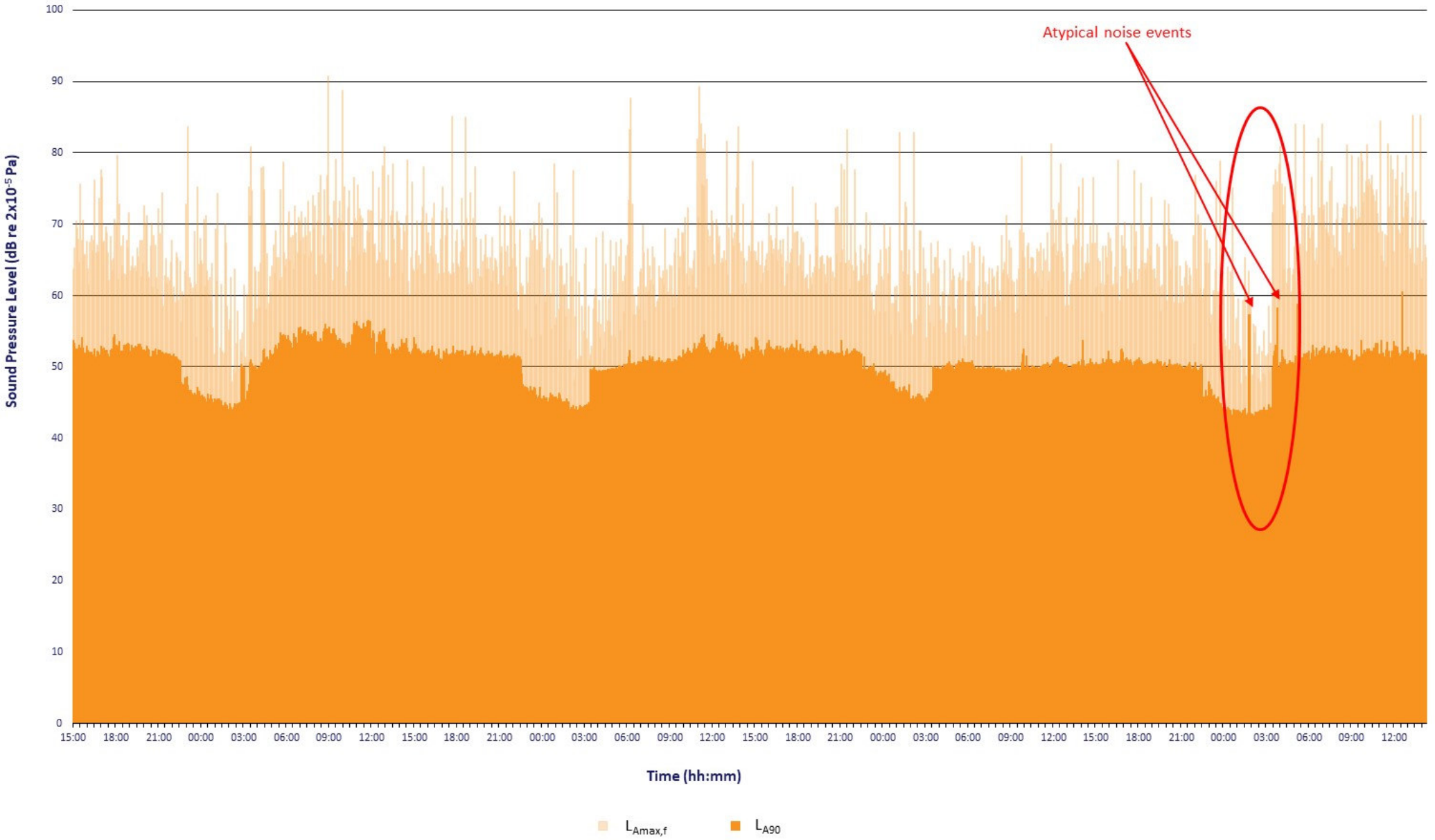
Unite/MMU, Cambridge Hall, Manchester

$L_{Amax,f}$ and L_{A90} Time History (5-mins)

Measurement Position 3 (Chatham St/Rear), Thursday 25th to Monday 29th July 2024

Project: 2124

Graph 6



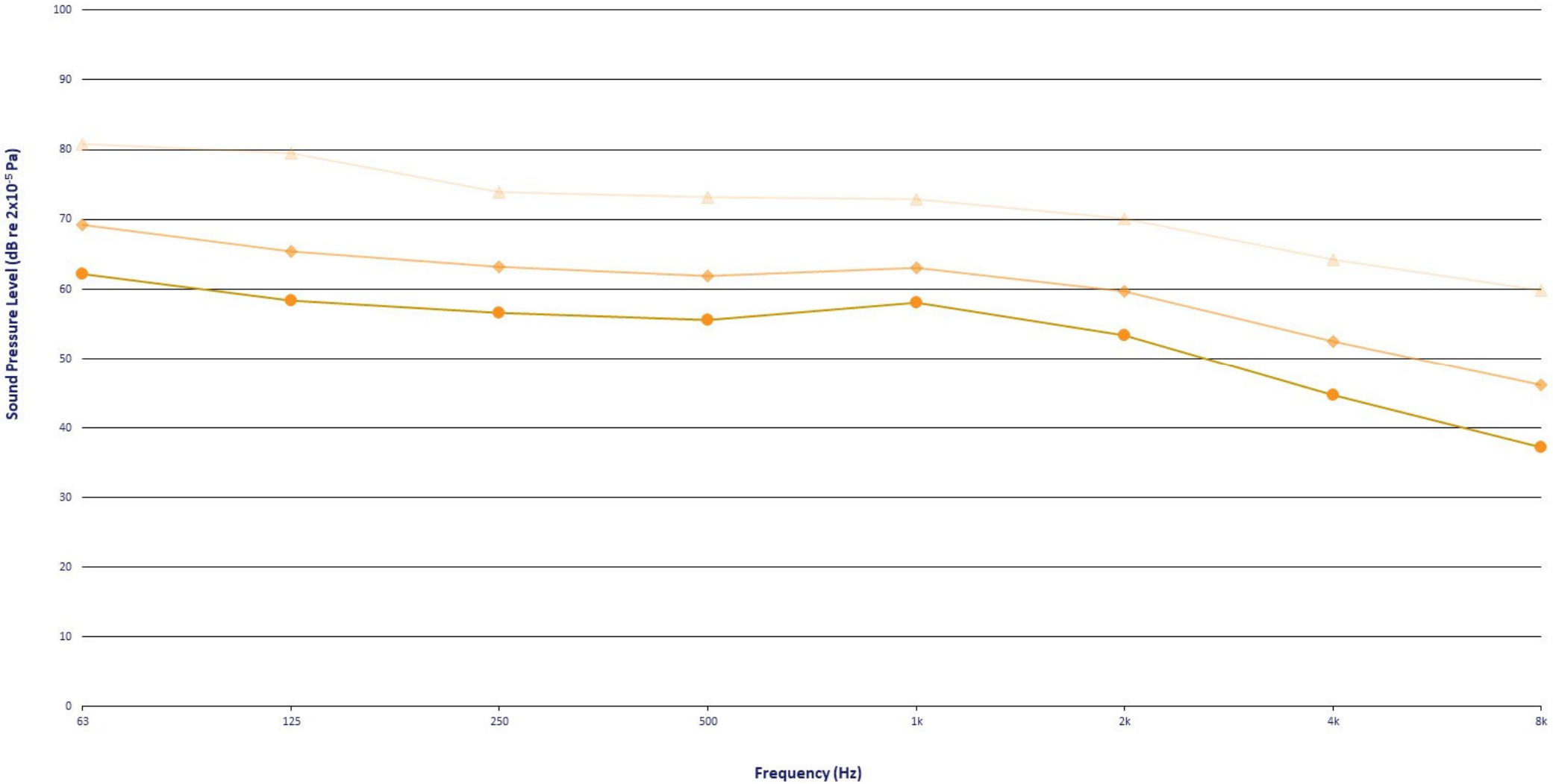
Unite/MMU, Cambridge Hall, Manchester

Spectral Noise Levels

Measurement Position 1 (Cambridge St/Front), Thursday 25th to Monday 29th July 2024

Project: 2124

Graph 7



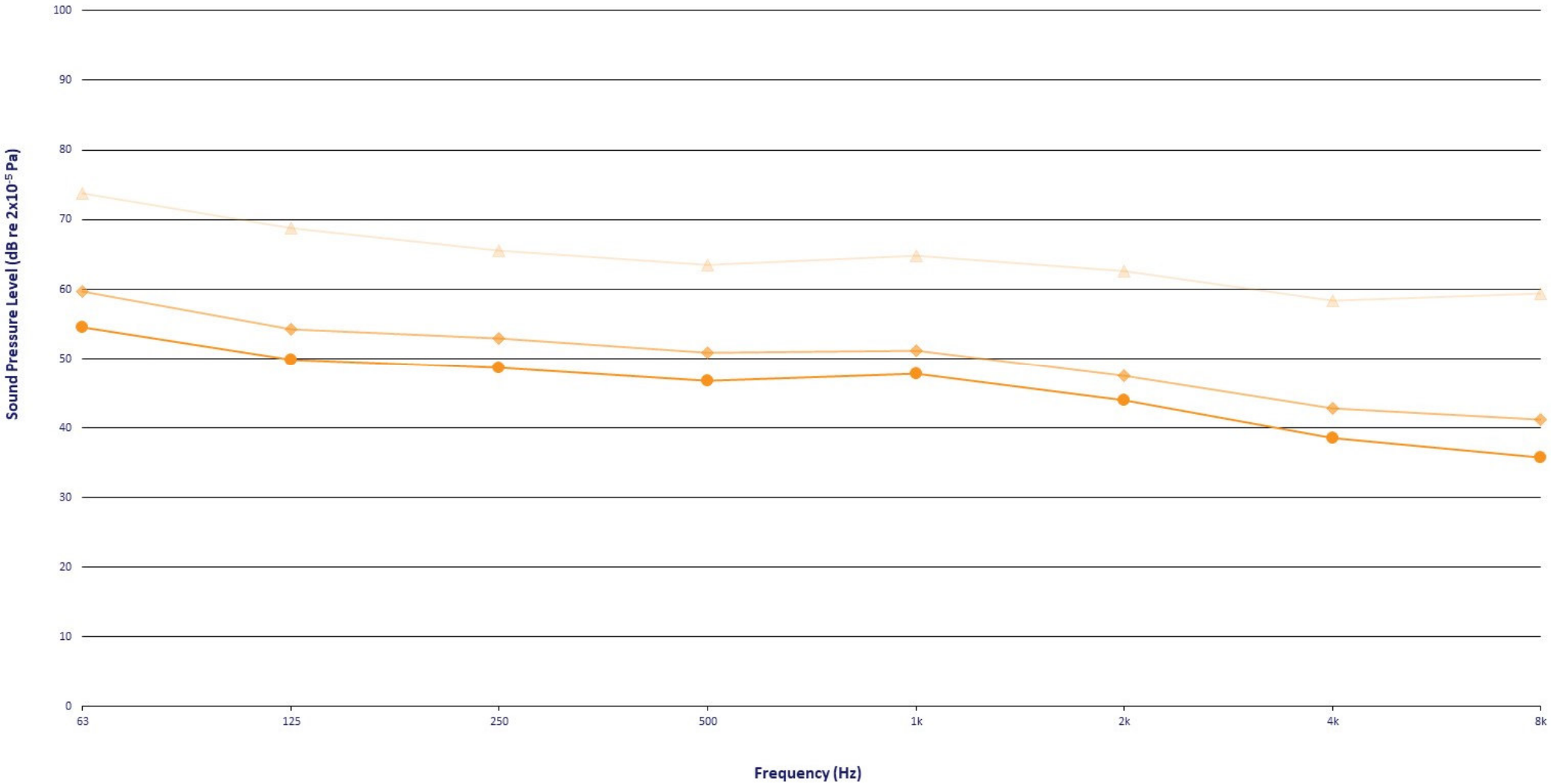
Unite/MMU, Cambridge Hall, Manchester

Spectral Noise Levels

Measurement Position 2 (BSW/Pub), Thursday 25th to Monday 29th July 2024

Project: 2124

Graph 8



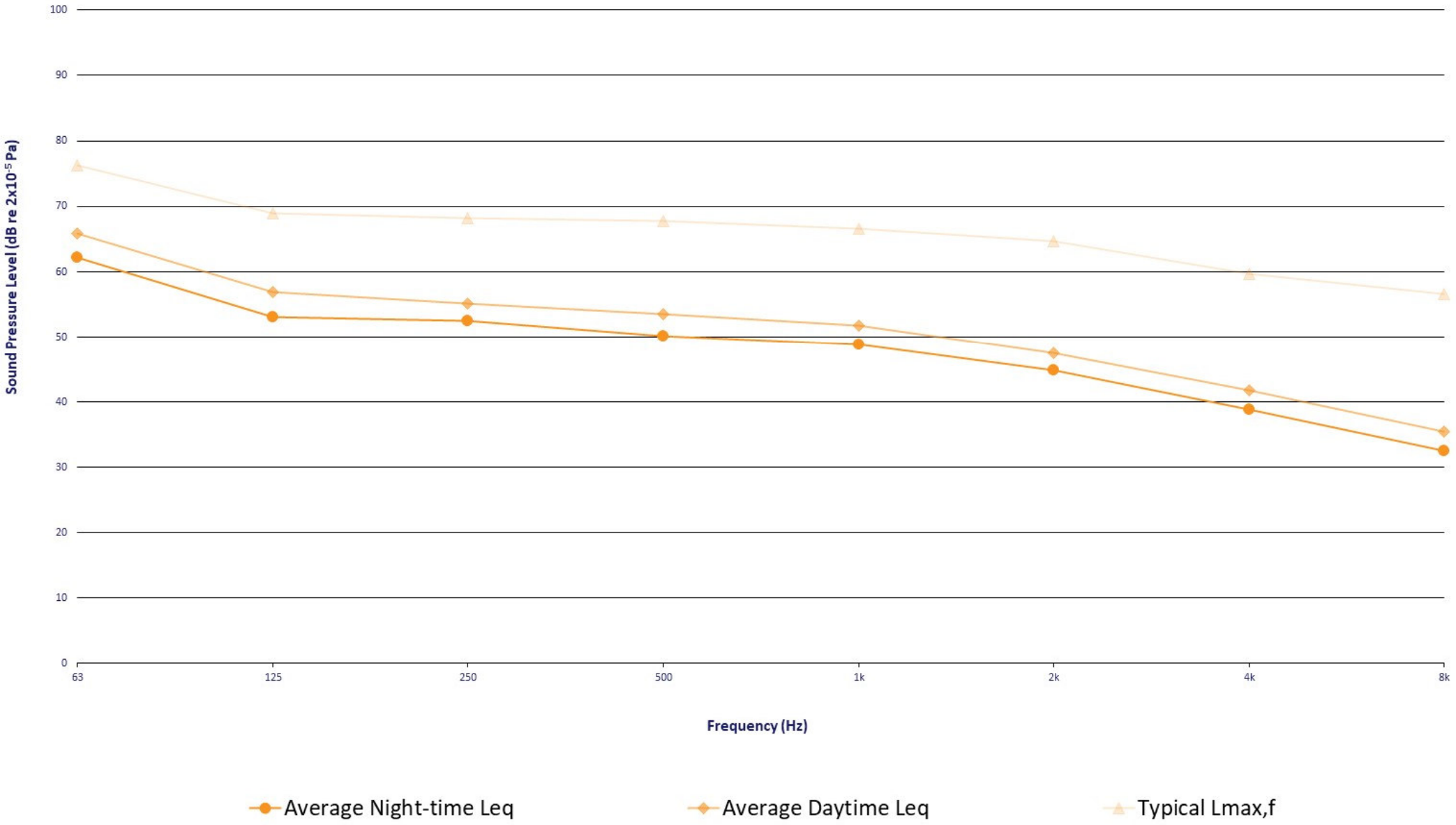
Unite/MMU, Cambridge Hall, Manchester

Spectral Noise Levels

Measurement Position 3 (Chatham St/Rear), Thursday 25th to Monday 29th July 2024

Project: 2124

Graph 9



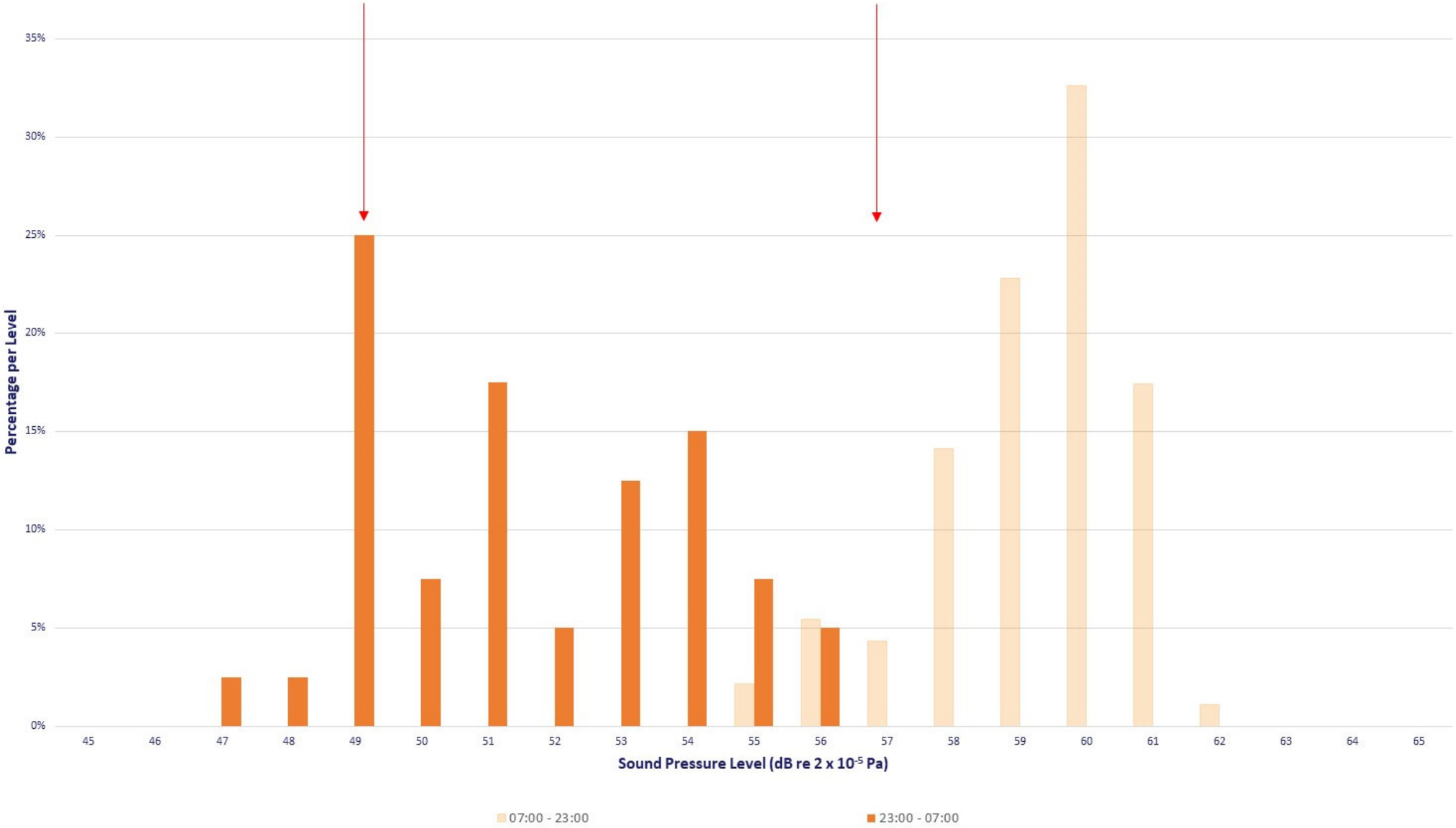
Unite/MMU, Cambridge Hall, Manchester

$L_{A90,5\ minutes}$ Histogram

Measurement Position 1 (Cambridge St/Front), Thursday 25th to Monday 29th July 2024

Project: 2124

Graph 10



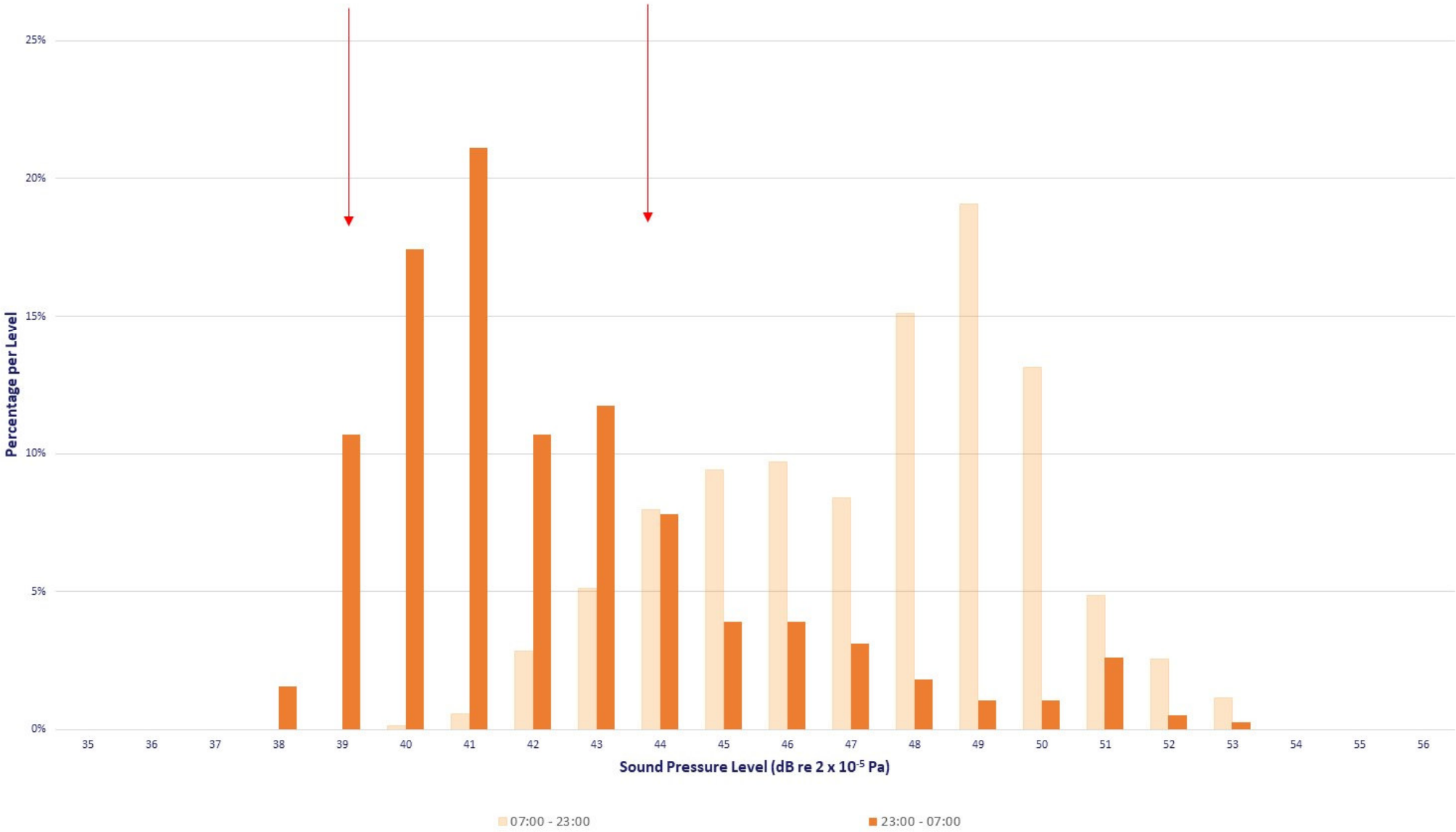
Unite/MMU, Cambridge Hall, Manchester

$L_{A90,5\ minutes}$ Histogram

Measurement Position 2 (BSW/Pub), Thursday 25th to Monday 29th July 2024

Project: 2124

Graph 11



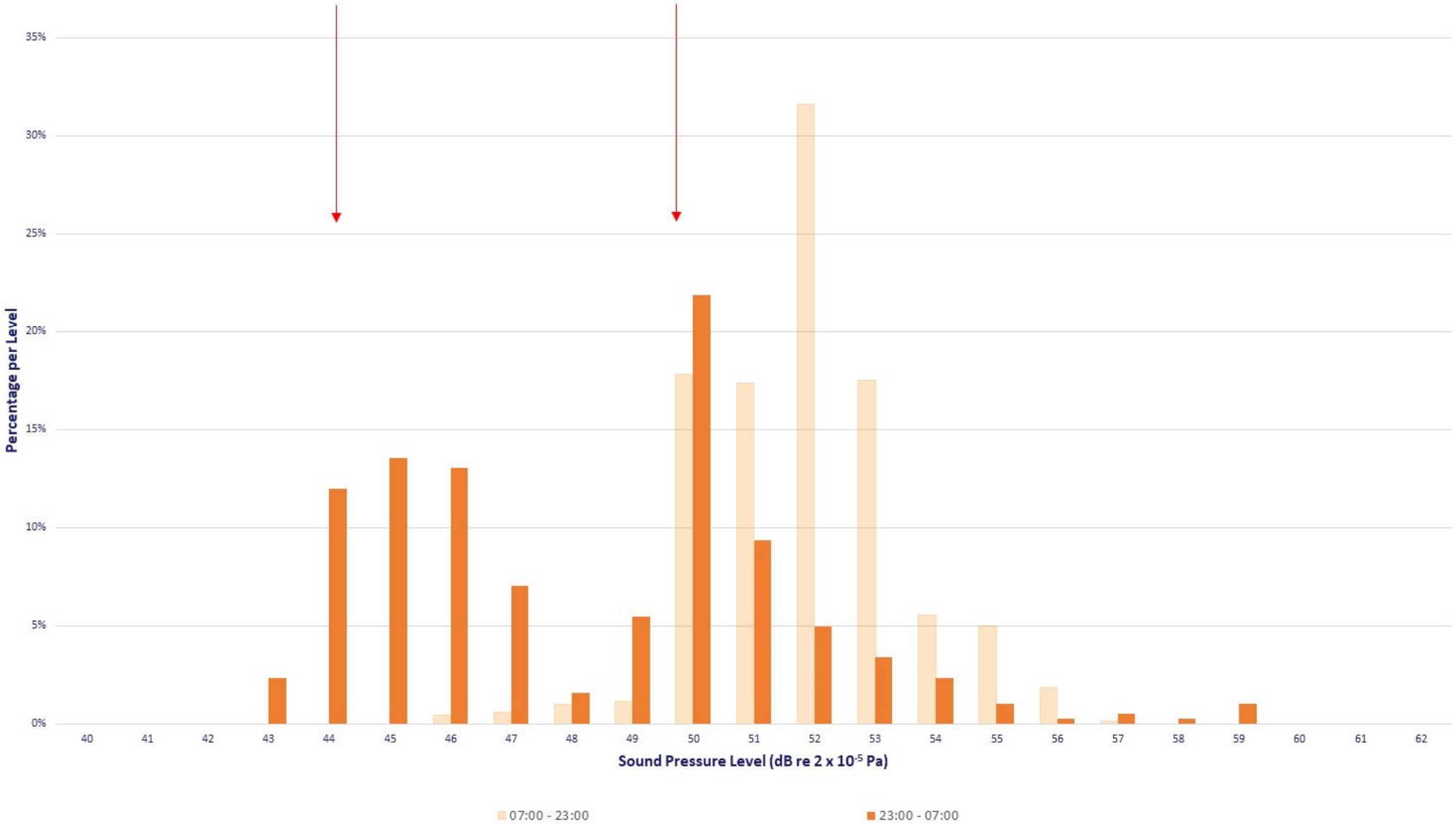
Unite/MMU, Cambridge Hall, Manchester

$L_{A90,5\ minutes}$ Histogram

Measurement Position 3 (Chatham St/Rear), Thursday 25th to Monday 29th July 2024

Project: 2124

Graph 12



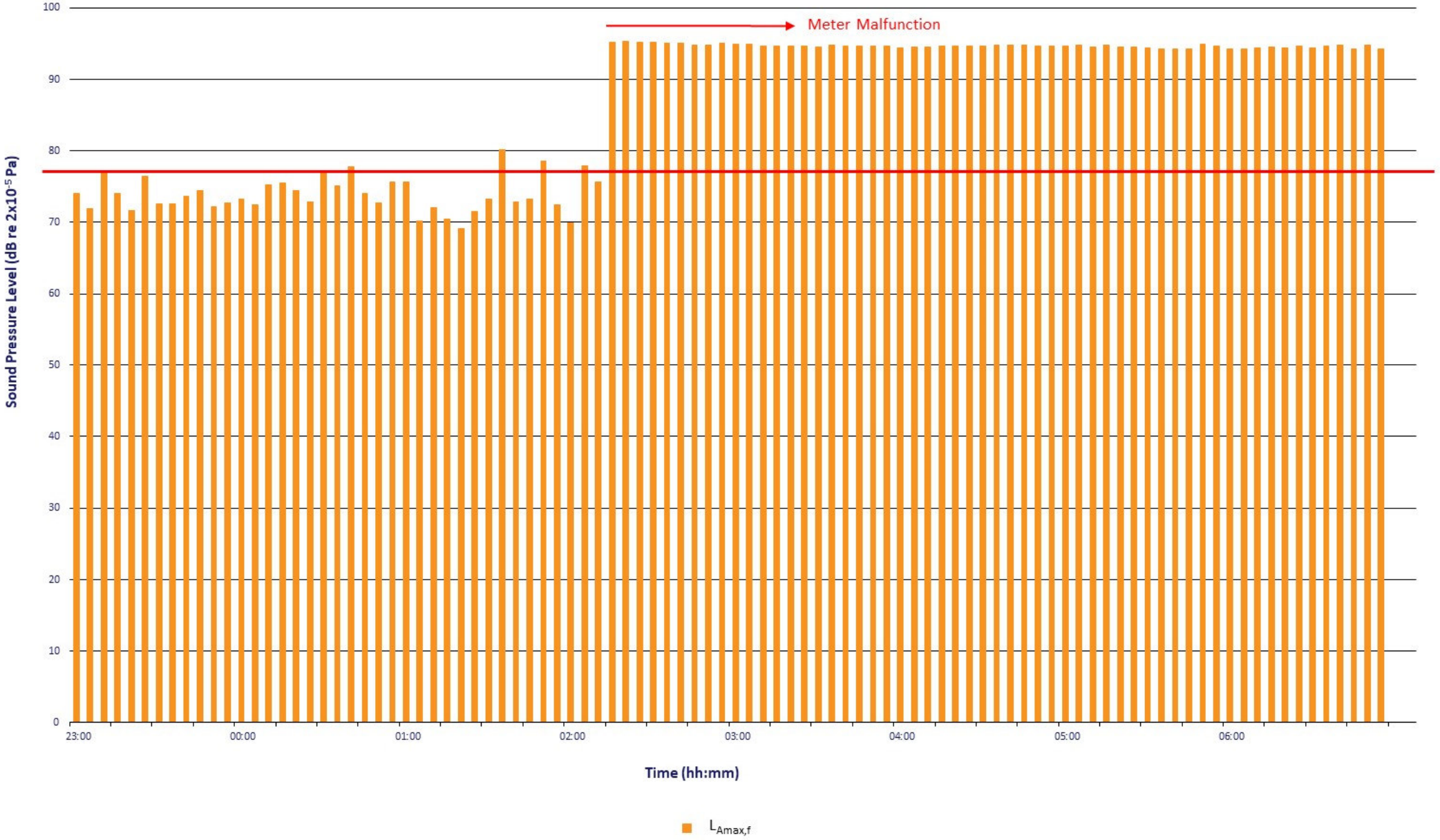
Unite/MMU, Cambridge Hall, Manchester

$L_{Amax,f}$ Time History - Night-Time Only (5-mins)

Measurement Position 1 (Cambridge St/Front), Thursday 25th to Monday 29th July 2024

Project: 2124

Graph 13



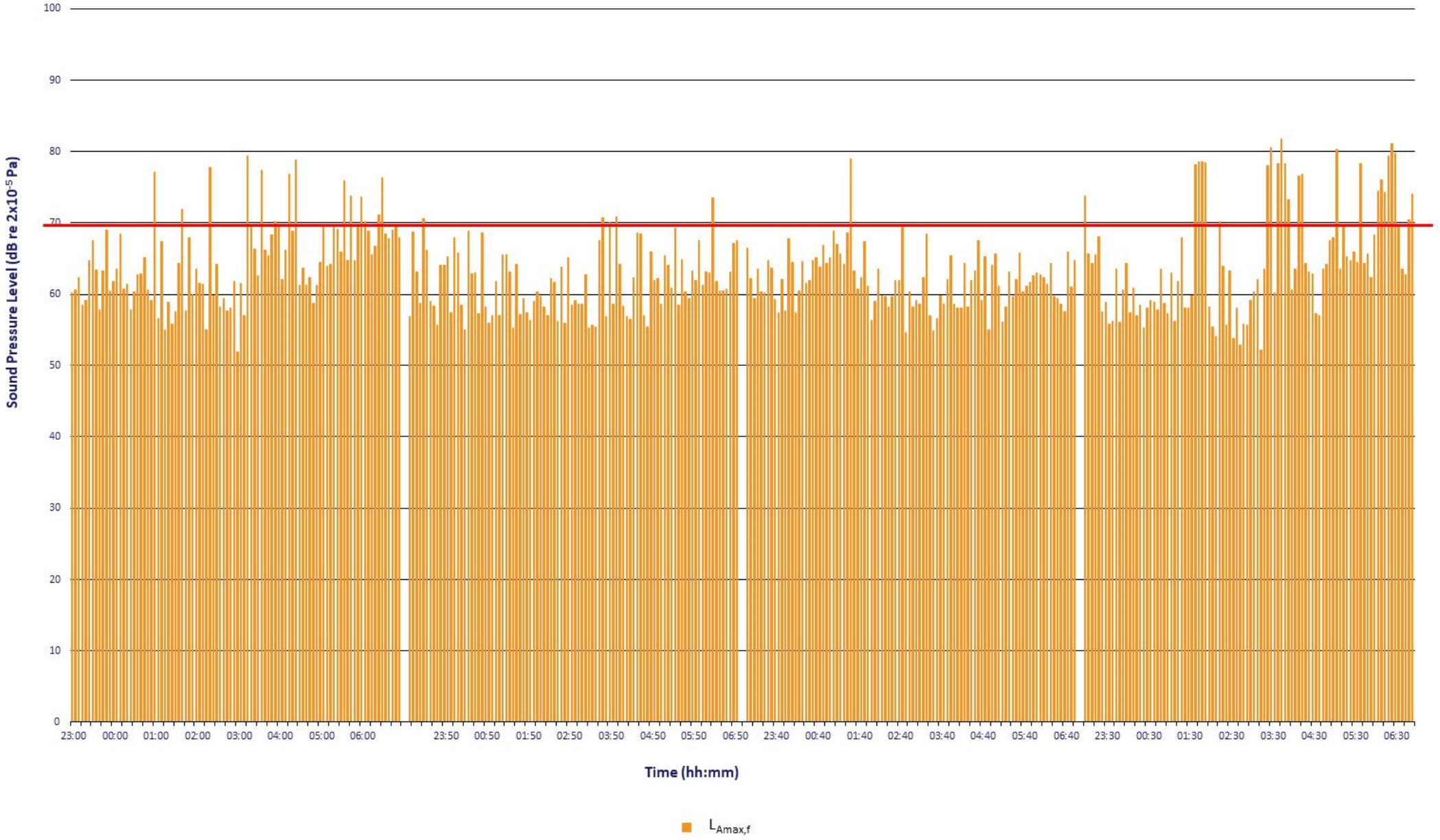
Unite/MMU, Cambridge Hall, Manchester

$L_{Amax,f}$ Time History - Night-Time Only (5-mins)

Measurement Position 2 (BSW/Pub), Thursday 25th to Monday 29th July 2024

Project: 2124

Graph 14



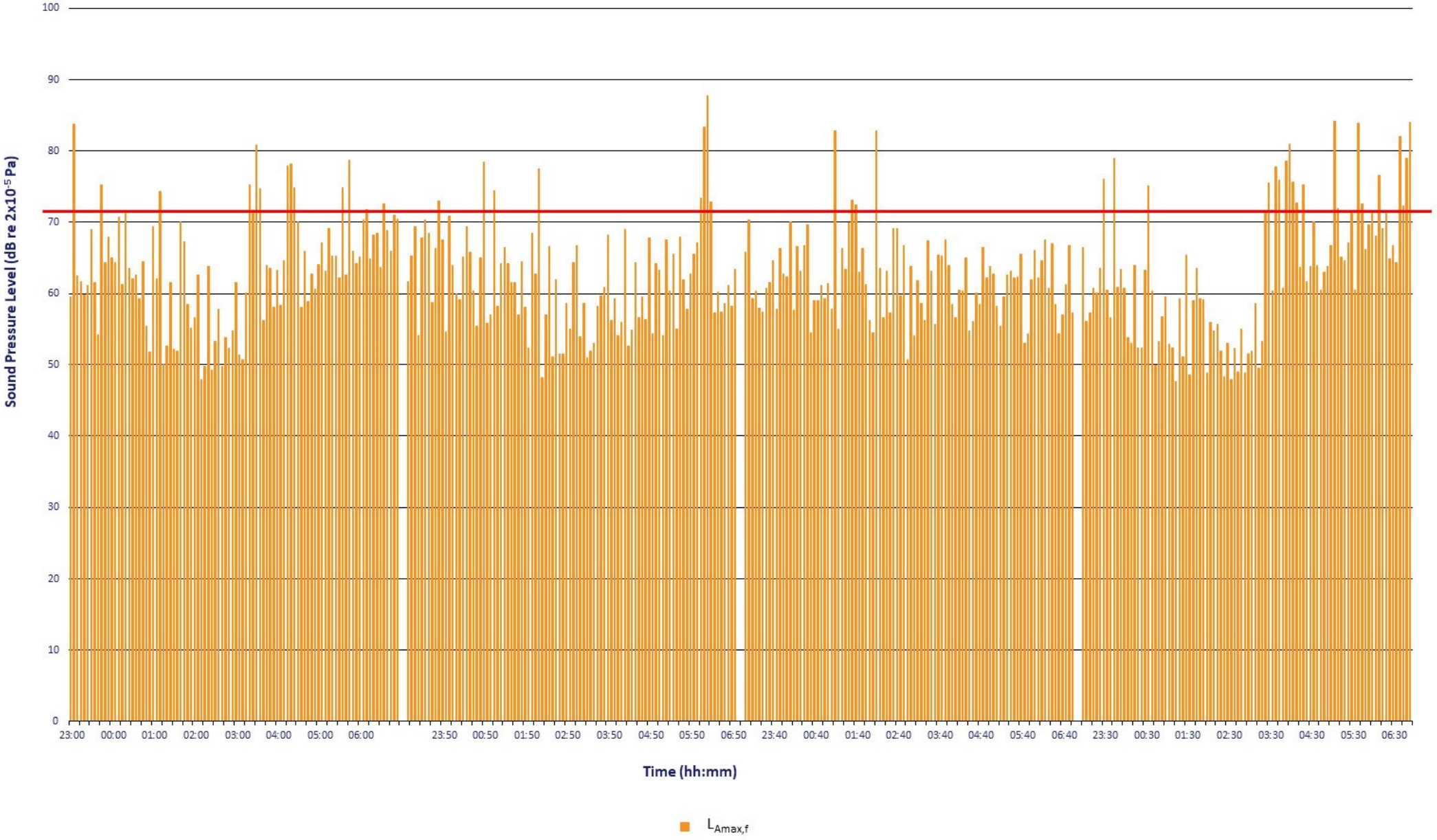
Unite/MMU, Cambridge Hall, Manchester

$L_{Amax,f}$ Time History - Night-Time Only (5-mins)

Measurement Position 3 (Chatham St/Rear), Thursday 25th to Monday 29th July 2024

Project: 2124

Graph 15



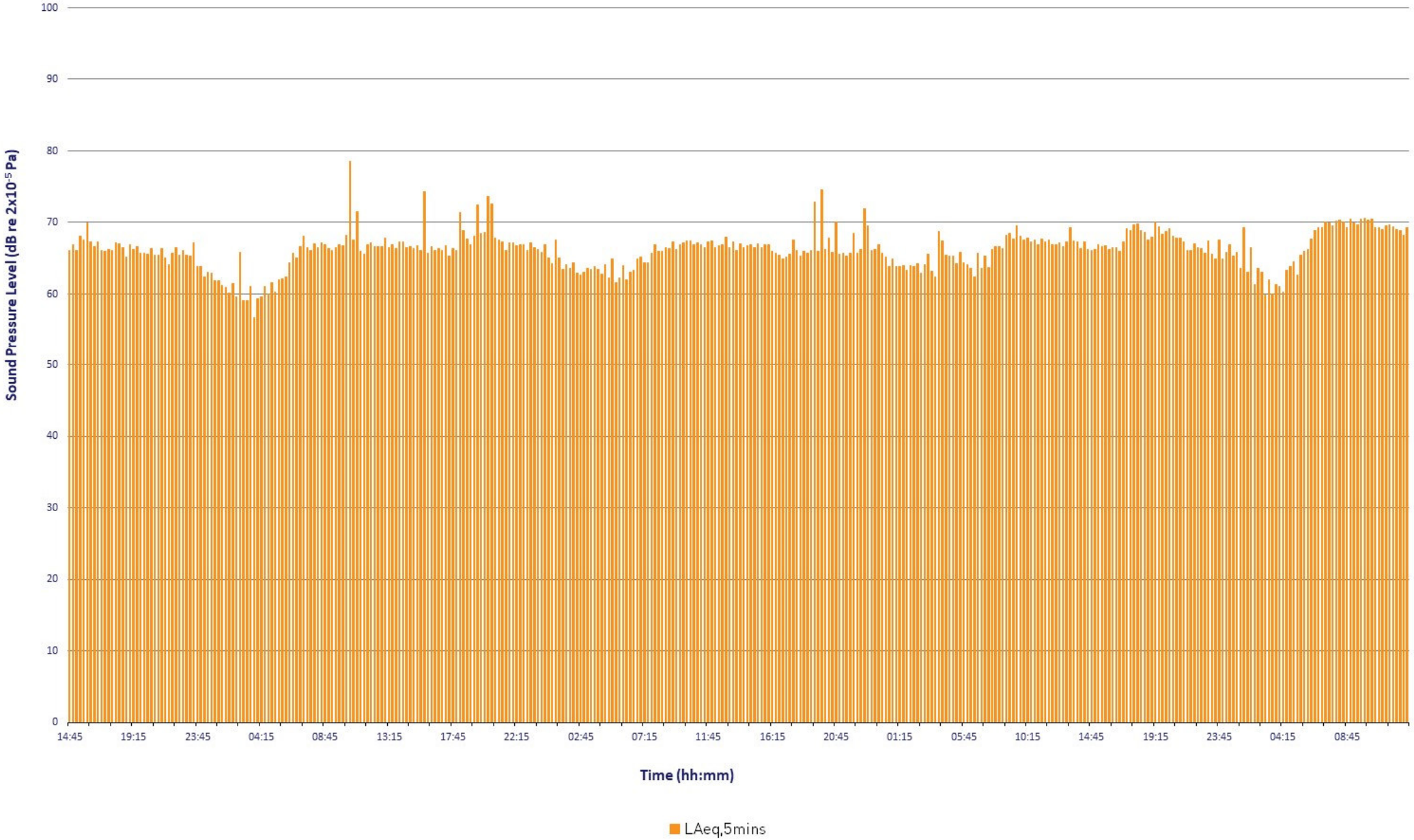
Unite/MMU, Cambridge Hall, Manchester

L_{Aeq} Time History (15-mins)

Measurement Position 1 (Cambridge St/Front), Thursday 28th November to Monday 2nd December 2024

Project: 2124

Graph 16



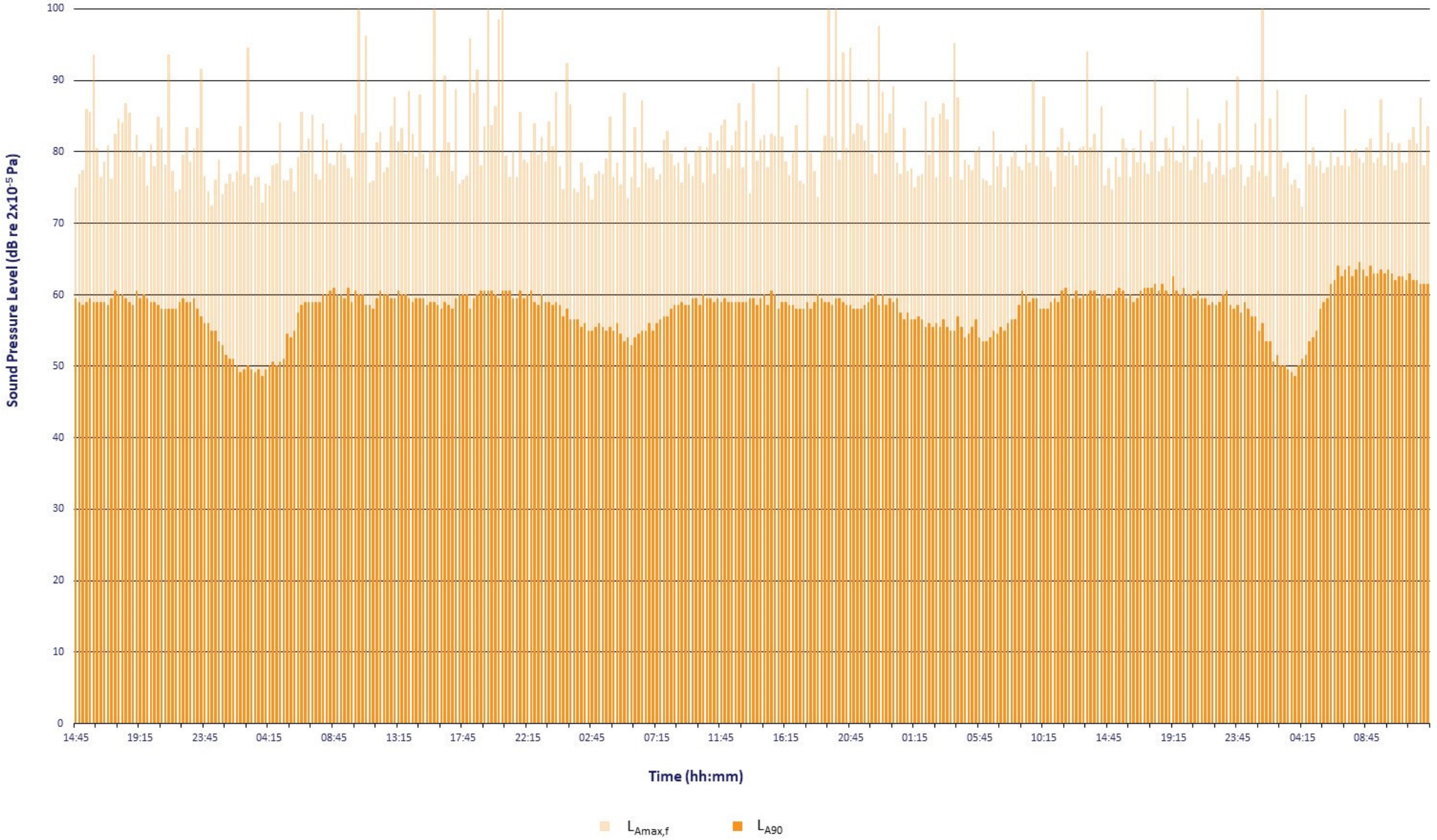
Unite/MMU, Cambridge Hall, Manchester

$L_{Amax,f}$ and L_{A90} Time History (15-mins)

Measurement Position 1 (Cambridge St/Front), Thursday 28th November to Monday 2nd December 2024

Project: 2124

Graph 17



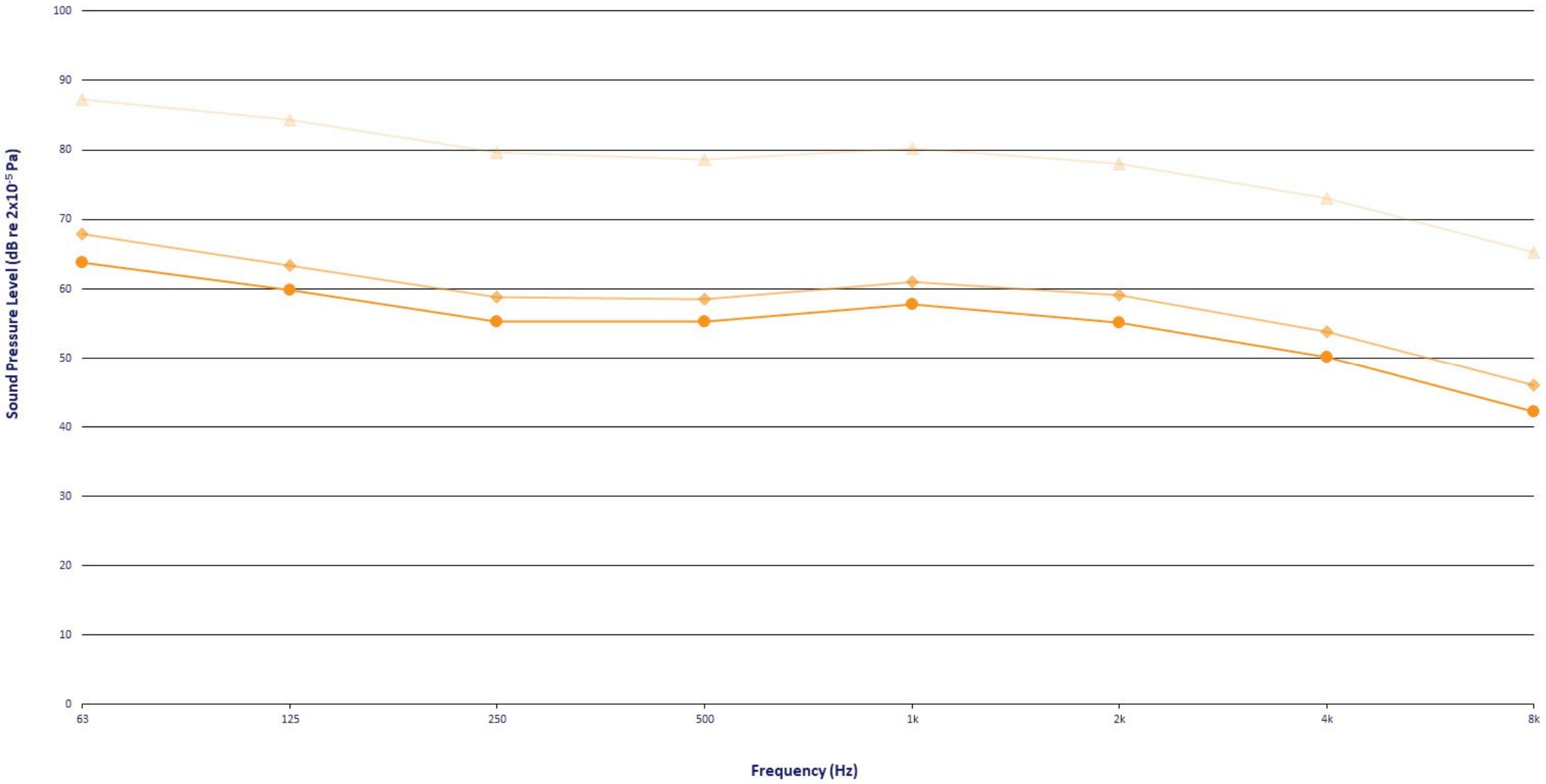
Unite/MMU, Cambridge Hall, Manchester

Spectral Noise Levels (Free-Field)

Measurement Position 1 (Cambridge St/Front), Thursday 28th November to Monday 2nd December 2024

Project: 2124

Graph 18



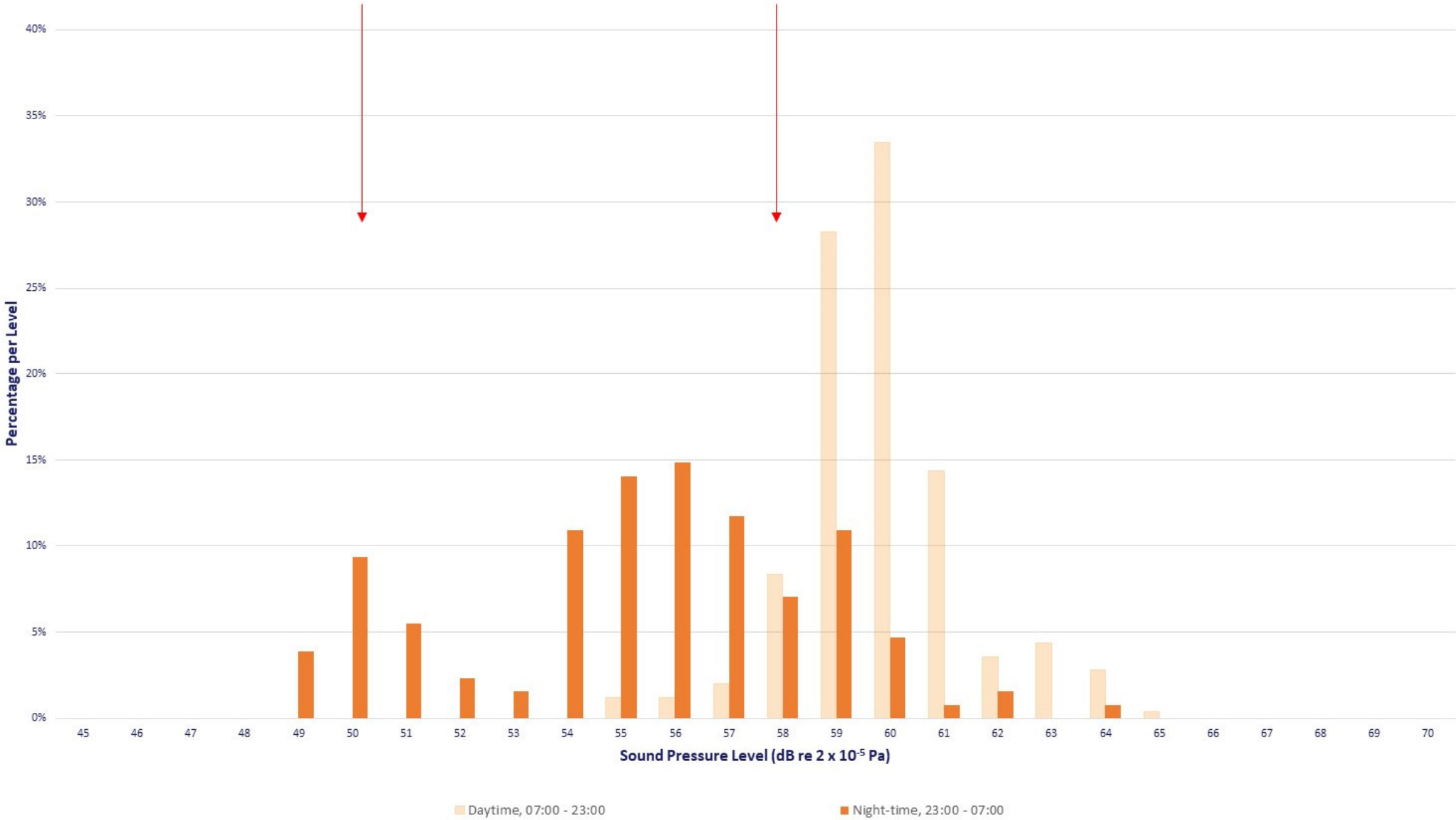
Unite/MMU, Cambridge Hall, Manchester

$L_{A90,15\ minutes}$ Histogram

Measurement Position 1 (Cambridge St/Front), Thursday 28th November to Monday 2nd December 2024

Project: 2124

Graph 19



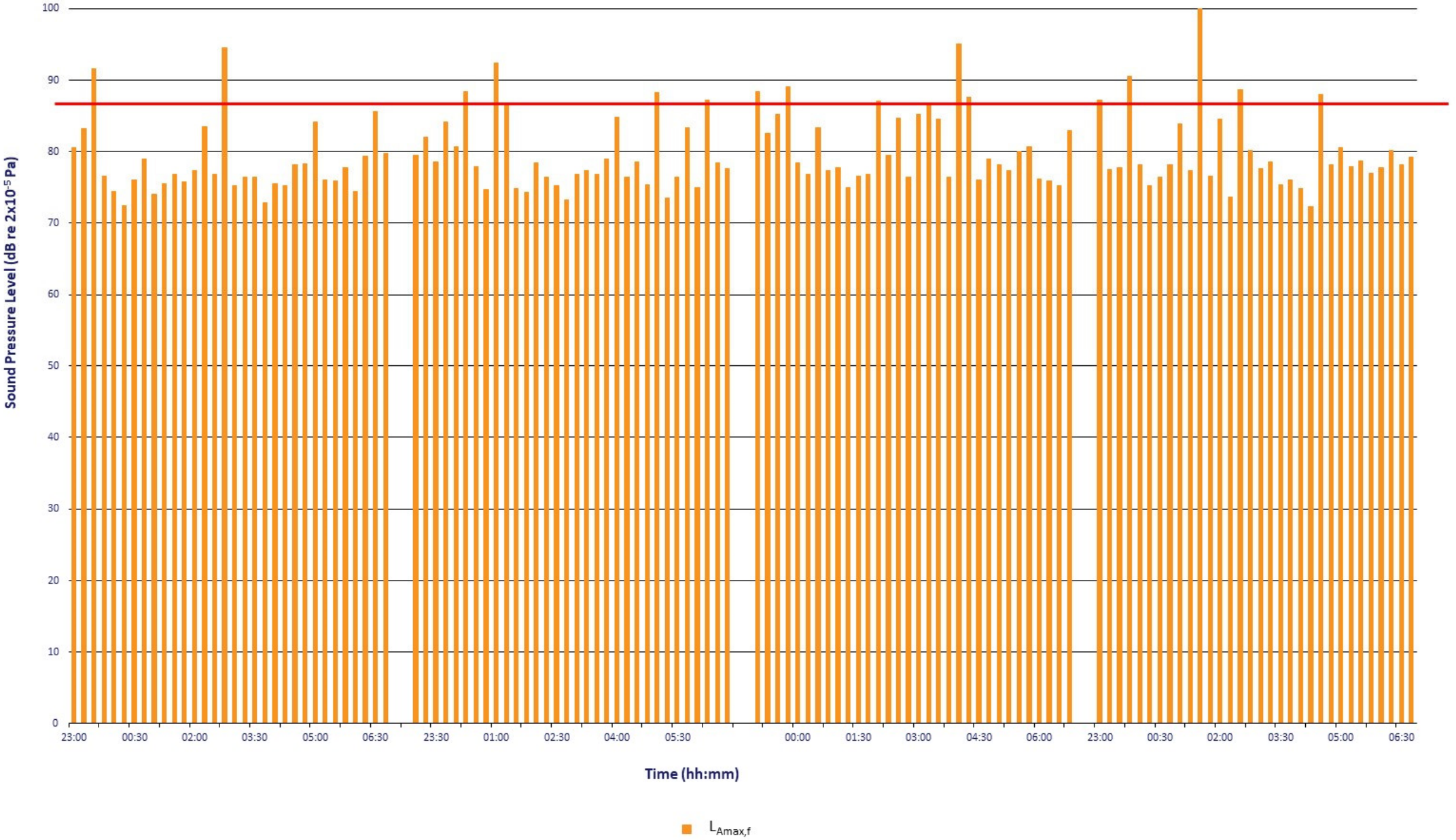
Unite/MMU, Cambridge Hall, Manchester

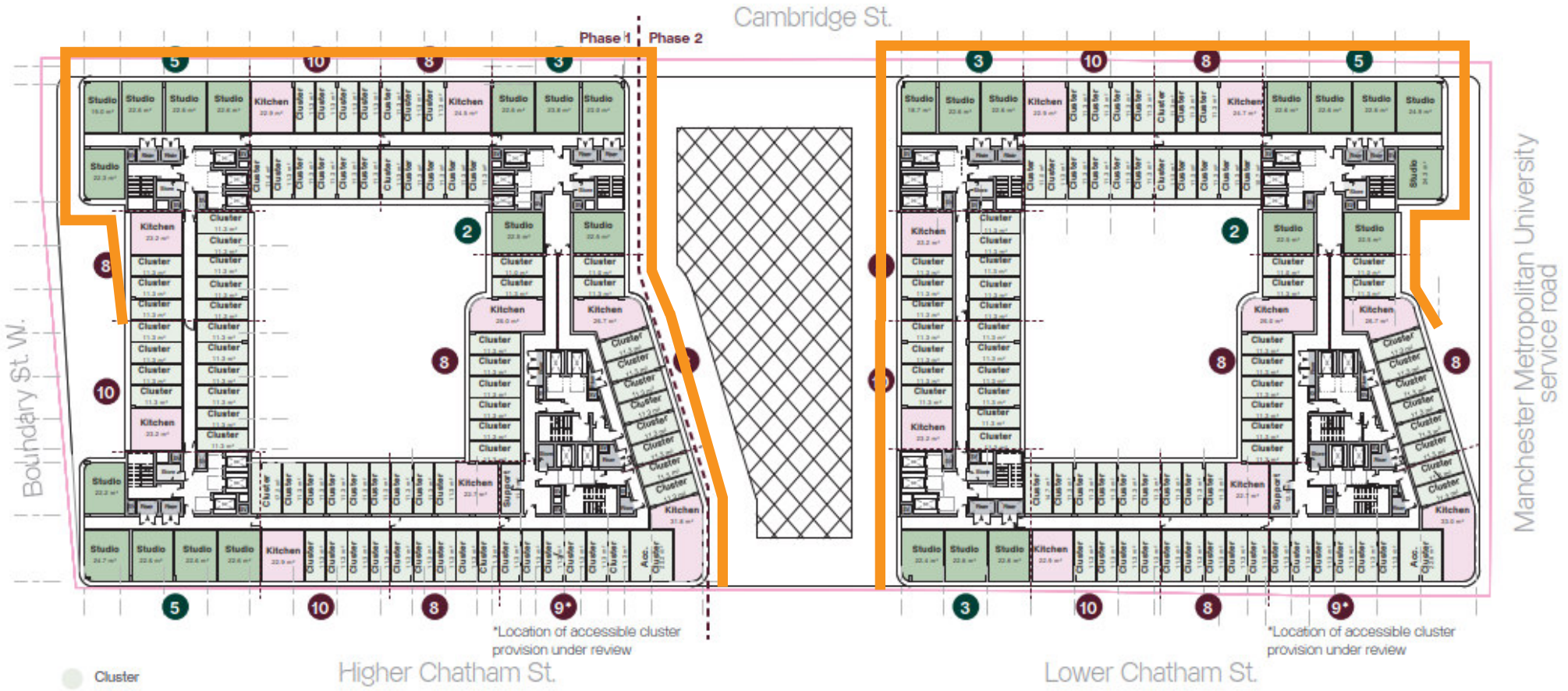
$L_{Amax,f}$ Time History - Night-Time Only (15-mins)

Measurement Position 1 (Cambridge St/Front), Thursday 28th November to Monday 2nd December 2024

Project: 2124

Graph 20





Key:

Zone 1 – West Façade
Cambridge Street
Ground up to Roof

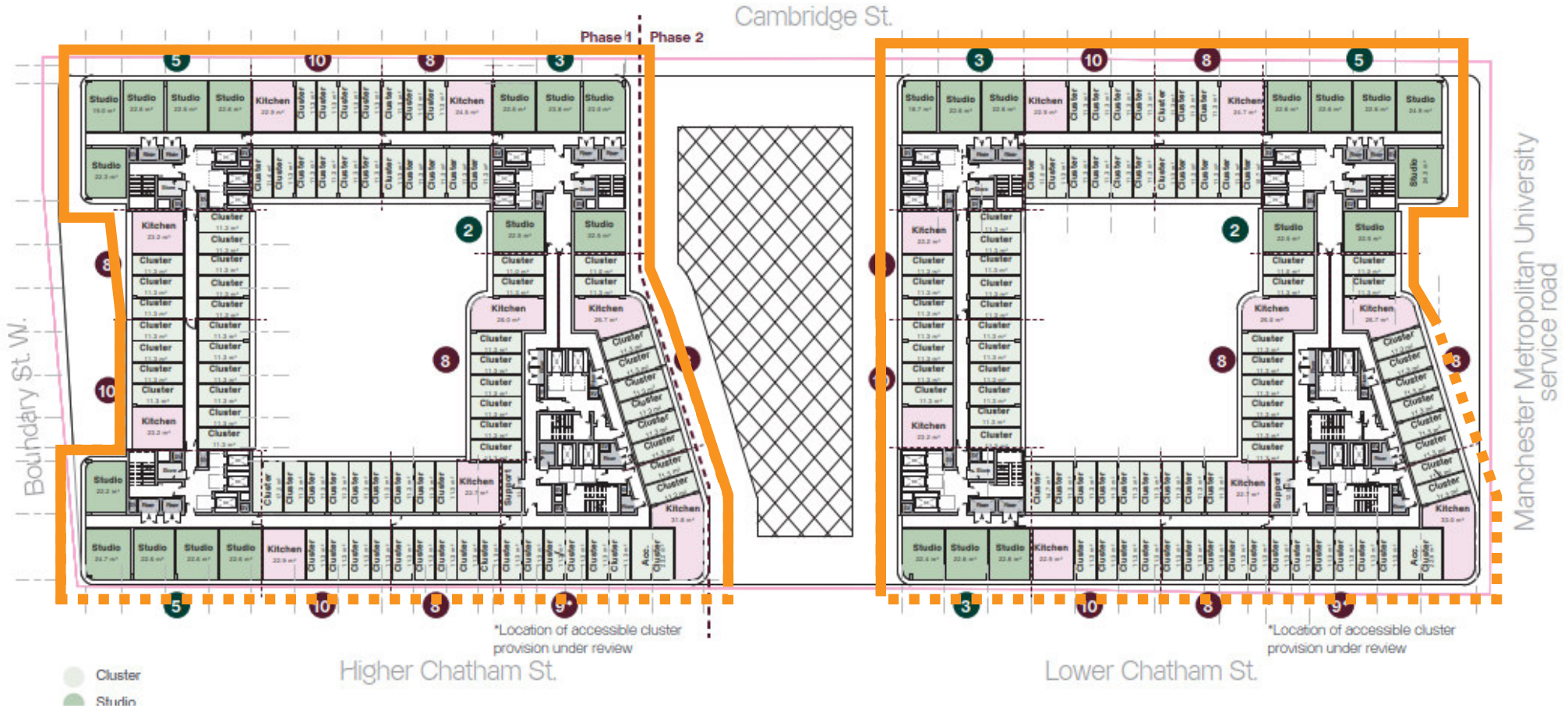
Zone 2 – All other Façades (unmarked)

To be fully developed at Detailed Design Stage.

Unite/MMU, Cambridge Hall – Façade Zoning Plan
(Typical Floor Plan, 2nd to 5th Floor)

Plan 2124/FZP

blackbird acoustics



Key:

High Risk Zone – Alternative Mitigation (purge) Required

Medium Risk Zone – Acoustic louvred panel option – TBC

Low Risk Zone (Internal Courtyards) – Rely on Openable Window (unmarked)

To be fully developed at Detailed Design Stage.

Unite/MMU, Cambridge Hall – Overheating Zoning Plan
(Typical Floor Plan, 2nd to 5th Floor)

Plan 2124/OZP

blackbird acoustics