Ref: 2151.Rep.AAR.Rev1

19 November 2025

blackbird acoustics
[redacted]
W: www.blackbird-acoustics.co.uk/
A: Forest Hill, London SE23

Chris Lambourn
RG Group
[redacted]

Dear Chris

RGRE, PBSA, Plot H, Charles Street, Manchester M1 7AR
Acoustic Assessment Report – Revision 1

Planning permission is being sought for the re-development of the current multi-storey car park on Charles Street in Manchester to build student accommodation (PBSA) on behalf of RGRE with ancillary communal amenity spaces, commercial uses, and landscaping. Blackbird Acoustics Limited (BAL) have been appointed by RGRE to supply acoustic input to the project at the planning application stage, through design and build stages, up to commissioning and handover. Blackbird Acoustics have undertaken baseline environmental noise 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, 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 15:15 hours on Friday 4th to 13:20 hours on Tuesday 8th July 2025.

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, in the free-field.

Position 1 – North – Rail:	Rear of Site overlooking elevated railway tracks, 9.3m above ground level, circa 3rd floor, ~0.5m above tracks with direct line-of-sight [///august.museum.rank]
Position 2 – South-East – Sackville St:	Corner of site overlooking Sackville and Charles Streets, 5.6m above ground, circa 2nd floor [///chef.same.lease]
Position 3 – South-West – Charles St:	Corner of Site overlooking Charles St towards Princess St, opposite Echoes Day Nursery, 7.8m above ground, circa 2nd floor [///issue.prop.vibrates]

Site Plan 1 – Site Plan indicating Measurement Positions

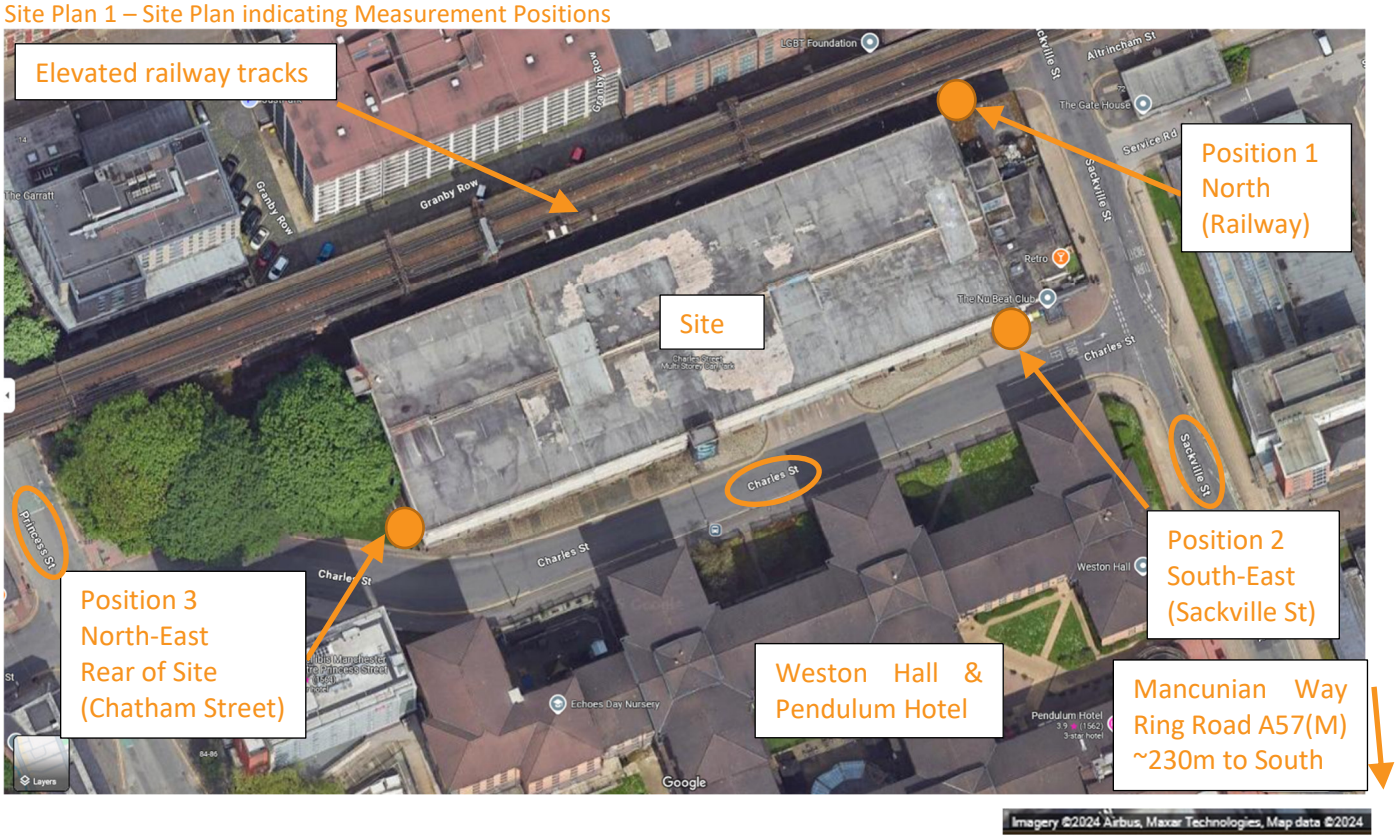


Image courtesy of Google Maps

The measured levels are summarised below;

Table 1 – Summary of Measured Noise Levels

Measurement Period	Pos 1 – North (Railway)			Pos 2 – South-East (Sackville St)			Pos 3 – South-West (Charles St)		
	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)	46	65	-	47	61	-	48	61	-
Night-time (23:00 – 07:00 hours)	41	62	82	43	58	75	43	58	78

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

It should be noted that noise levels at all Measurement Positions were dominated by local road traffic movements along the immediately adjacent Sackville (east) and Charles (south) Streets, and the other local roads, including Princess Street (west) and the Mancunian Way Ring Road A58(M), which is approximately 230m to the south of the site. Traffic is fairly consistent and prevalent in the vicinity, although quieter periods occur during the daytime with congestion during rush hour periods. Road traffic movements along the elevated A58(M) contribute to the prevailing background levels. Road sweeping machines were present around the site, on and off throughout the day. Vehicles of all types were present, i.e. cars, motorbikes, vans, buses, lorries, etc.

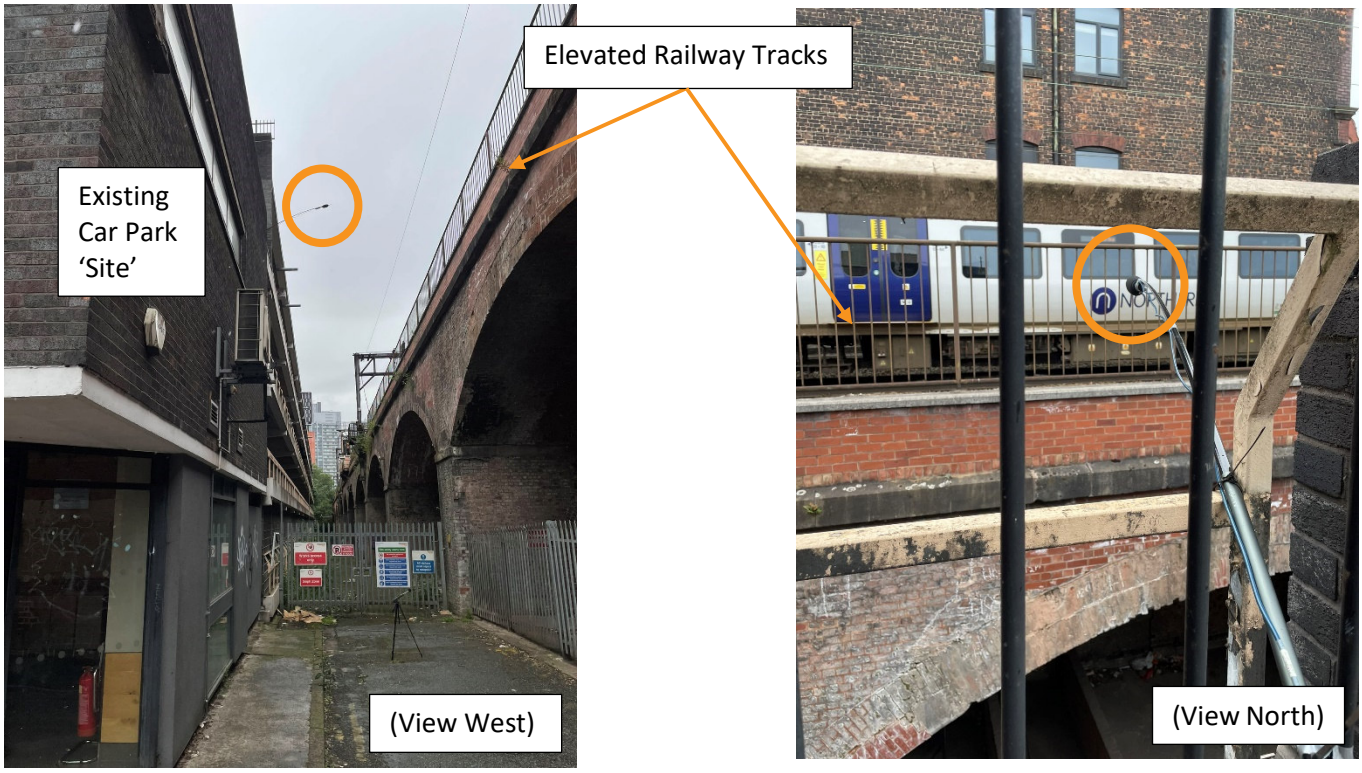
Rail traffic movements along the elevated railway tracks running the length of the northern boundary also heavily influenced the noise environs. Both passenger and freight trains use the tracks with movements generally quite slow, as the trains travel between stations, with Manchester Oxford Road station to the west of site and Manchester Piccadilly station to the east. Low frequency rumble ('boomy') noise was present on site due to re-radiated noise off the arches supporting the elevated tracks, particularly for faster moving trains.

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

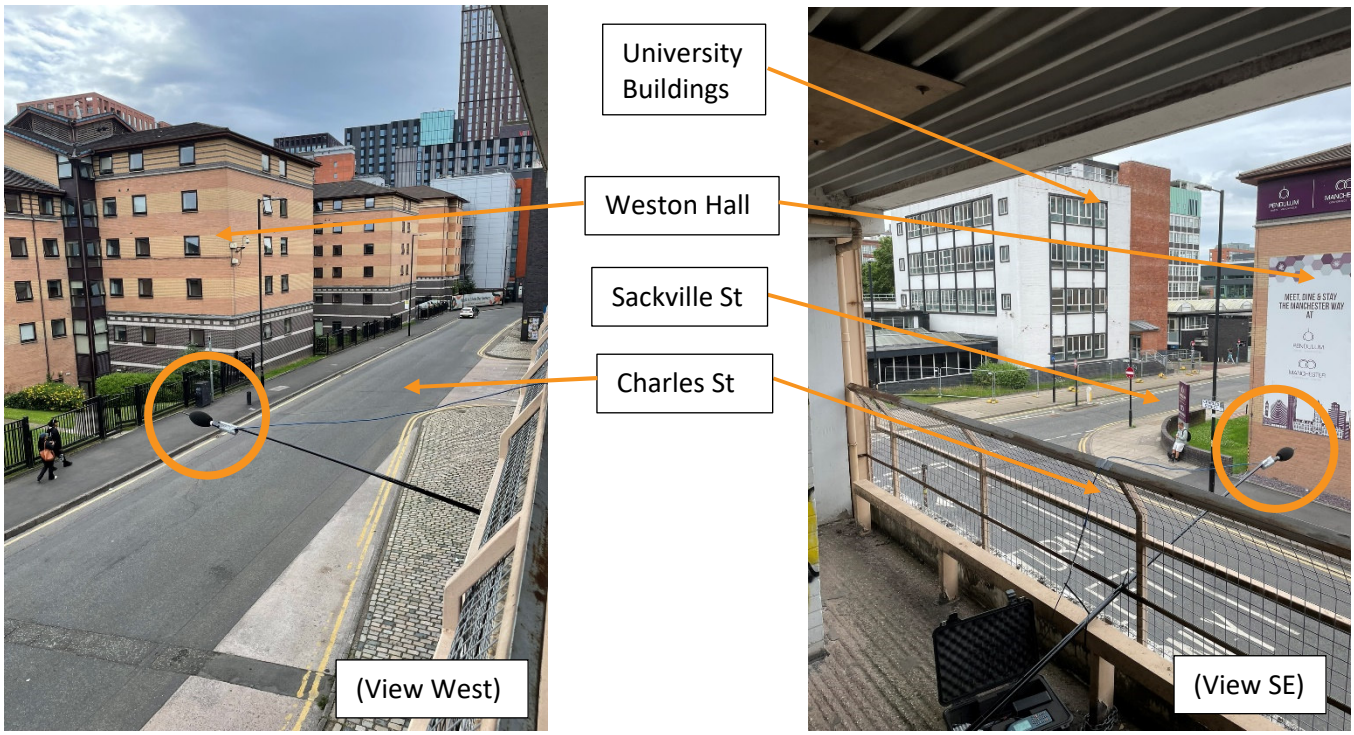
- Graphs 1 - 6 indicate the L_{eq} and L_{max} & L_{90} overall dBA value time-histories measured at each position.
- Graphs 7 - 9 indicate the spectral noise levels, which will be used in the assessment of the glazing specs.
- Graphs 10 - 12 indicate the L_{90} histograms used to derive the "typical 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.

Photos of the measurement positions are as follows;

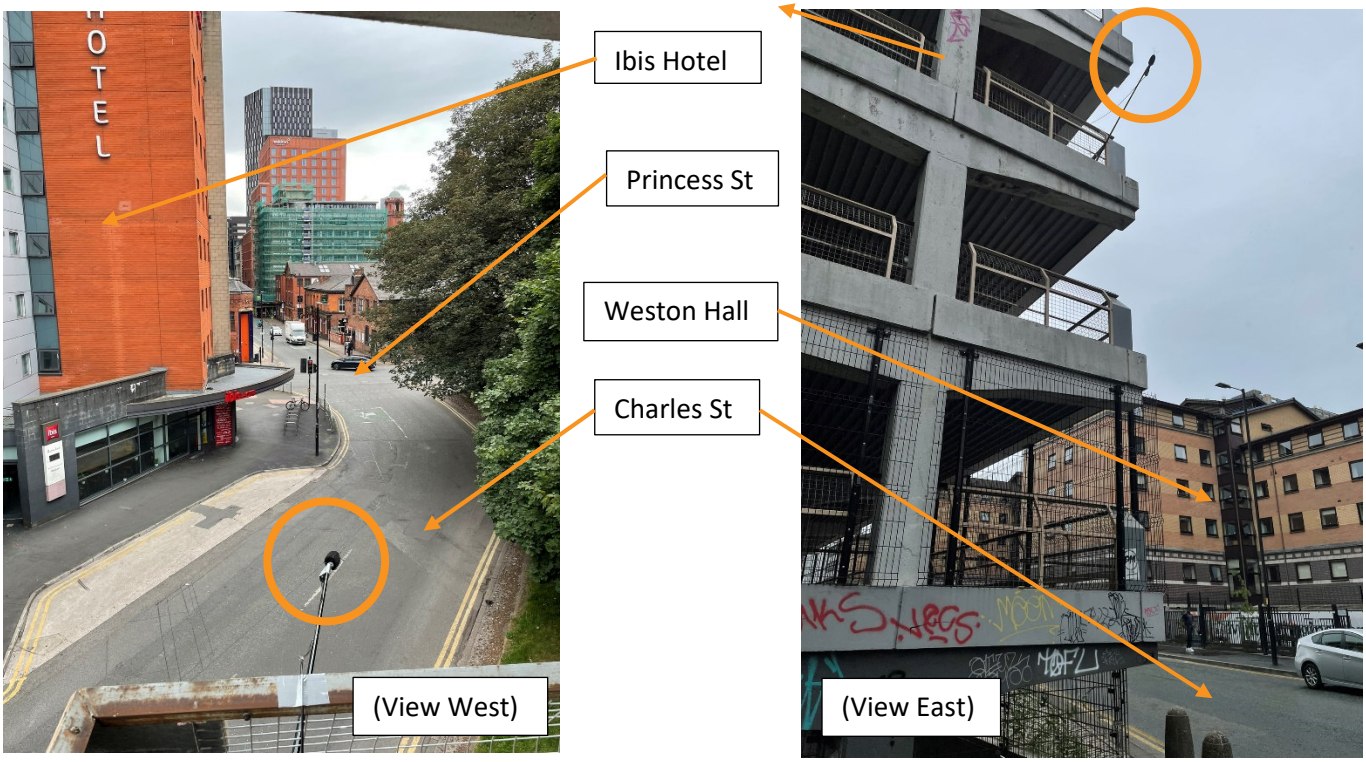
Position 1 – North – Railway Tracks



Position 2 – South-East – Sackville Street



Position 3 – South-West – Charles Street



"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.

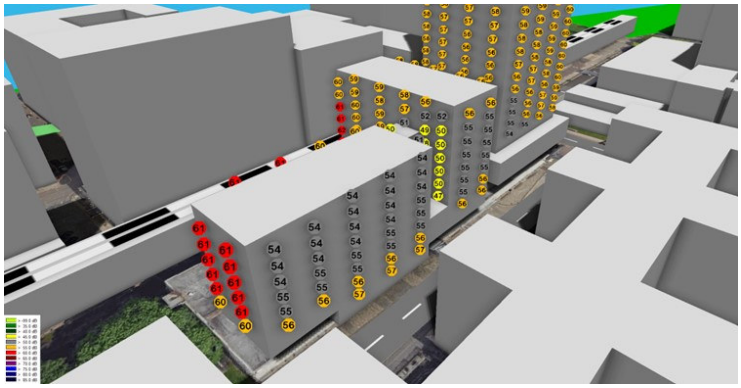
Computer Modelling

In order to predict the noise levels at the different façades with increasing height an acoustic model of the development and surrounding buildings has been generated using the CadnaA platform.

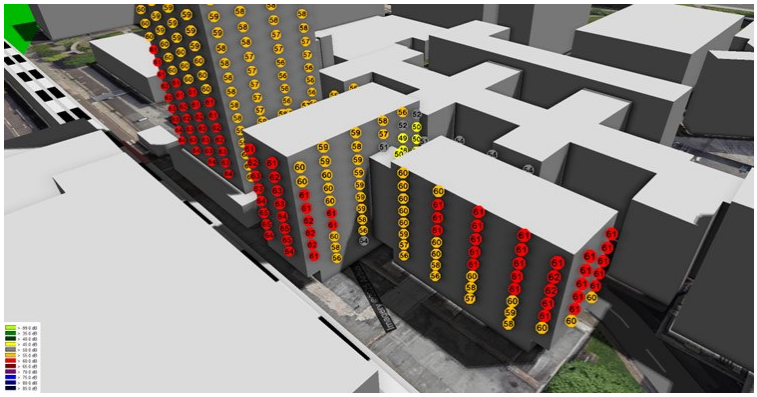
The model allows the various sound sources, which in this case are the main surrounding roads (including the elevated Mancunian Way Ring Road A58(M), 230m to the south of site) & railway lines, to be calibrated according to the noise levels measured on-site. The proposed building is subsequently built into the model and calculations using the methodology outlined in ISO9613-2: 1996 are undertaken to predict façade incident noise levels at all floor heights and to produce noise contours for the site and surrounding area.

The below Figures illustrate the predicted (worst case elevation) façade noise levels.

Figures 1 & 2 – Daytime L_{Aeq} Levels
View from South-West



View from North-West



Figures 3 & 4 – Daytime L_{Aeq} Levels
View from South-East (tower)



View from North-West (tower)



Figures 5 & 6 – Night-time L_{Aeq} Levels
View from South-West



View from North-West



Figures 7 & 8 – Night-time L_{Aeq} Levels

View from South-East (tower)



View from North-West (tower)



Spectral noise levels have been predicted at various façade locations using the CadnaA model and these have been used in the below analyses to specify the required glazing and ventilation configurations to ensure suitable internal noise levels are achieved in the completed 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 2 – 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 – North (Railway)	Pos 2 – South-East (Sackville St)	Pos 3 – South-West (Charles St)
Daytime (07:00 – 23:00 hours)	41	42	43
Night-time (23:00 – 07:00 hours)	36	38	37

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.

Own Development Noise Sensitive Receptors

Where the nearest noise sensitive receptors to the plant locations or ventilation ductwork grilles/louvres are the 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 own development receptors should be below the levels detailed in Table 3 below.

Table 3 – Proposed Plant Noise Emission Criteria at Own Development Receptors

Time Period	Plant Noise Emission Criterion (dBA) at Nearest *Own Development* 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 56 and 60 dB L_{Aeq} for emergency plant affecting Receptors, Existing & Own-Development respectively.

Summary of Assessment Criteria

Therefore, all future design advice will be based upon achievement of the plant noise limits stated in both Tables 2 & 3 above, as summarised below in Table 4.

Table 4 – Summary of Proposed Plant Noise Emission Criteria

Time Period	Plant Noise Emission Criterion (dBA) at Nearest Noise Sensitive Receptor (Relevant Location)				
	Existing Receptor			*Own Dev Receptor*	Emergency Plant at Receptors – *Exist/OwnDev*
	Pos 1 – North (Railway)	Pos 2 – SE (Sackville St)	Pos 3 – SW (Charles St)	All façades	
Daytime (07:00 – 23:00 hours)	41	42	43	45	56 / 60
Night-time (23:00 – 07:00 hours)	36	38	37	40	–

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.

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 condensers to serve amenity rooms (Level 3 Tower Plantroom)
- Air Source Heat Pumps (ASHPs) for domestic hot water and heating (Level 38 roof of Tower)
- Mechanical Ventilation with Heat Recovery (MVHR) units – all floor levels (PBSA)
- Centralised AHU (Level 3 Tower Plantroom) to serve amenity spaces
- Cleaner's store, toilet and laundry Extract Fans (EFs)
- AOV mechanical extract fans on relative rooftops
- Heating plantroom including pumps (Level 3 Tower Plantroom)
- Cold water tankroom including pumps (Level 3 Tower Plantroom)
- Emergency generator (Level 3 Tower Plantroom)

The ducted fan systems (MVHR, HRU, AHU 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 & condenser 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 (~3dB for Top Pod only kit). 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 (or more) 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:

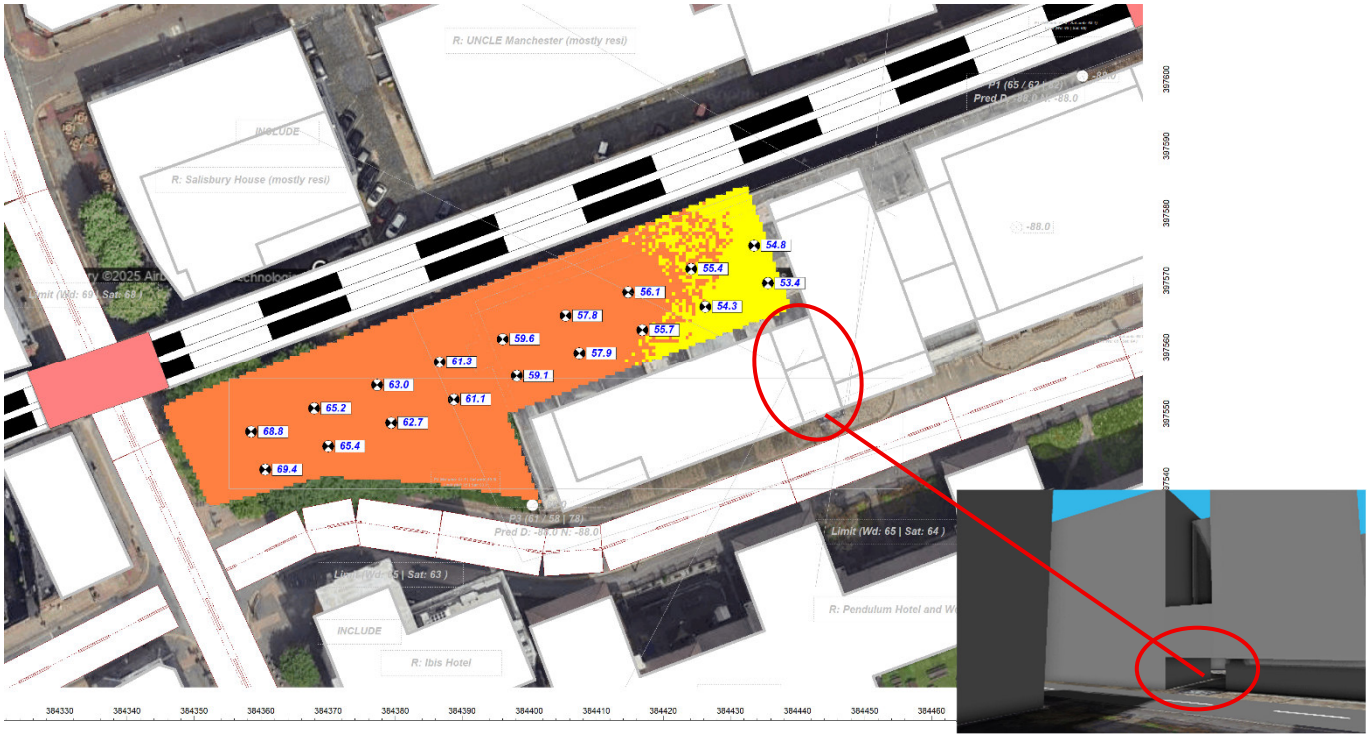
Gardens/Balconies/Terraces	Daytime (07:00-23:00 hours)	< 55dB L_{Aeq} if practicable

Assessment

Ground Floor / Level 00 – External Amenity



The above circled zone is the main external amenity space for the students. The predicted noise levels within this space have been assessed as part of the Cadna noise model (including the 'cut through' from Charles St at ground level)– see screenshot below:



As can be seen from the contour plot above, noise levels in the external amenity space are dominated by traffic movements along Princess Street (to the west of site) with noise levels dropping off as you move (eastwards) into the space. There is very little we can do in terms of possible mitigation to noise levels (i.e. a fence), as this new public space is proposed to be "open" to allow flow and open up the arches and Altrincham Street, etc. However, the more protected parts of the space, i.e. in the north-east corner, should allow for some space to be at or around the target criterion of 55dBA and therefore offers the students (and public) some quieter zones in which to enjoy the outside space.

There are no other external amenity spaces for the students, i.e. all of the roof level "terraces" are not accessible to students.

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 5 below.

Table 5 – 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 6 – 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, BREEAM and BCO, etc. and the Unite Turnkey Spec. It is considered appropriate to design to the following criteria, assuming daytime use only;

Common Room / Quiet Study / Office	35-40dB L_{Aeq}
Amenity Room / Social Space / Lounge	40dB L_{Aeq}
Circulation / Corridor / Stairwell / Lobby	45dB L_{Aeq}
WC / Store / Gym	45dB L_{Aeq}
Commercial / Retail Unit	45-50dB 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*), and the use of a lightweight cladding system, likely comprising as follows, or very similar;

- 20mm Brick slip or metal composite lightweight cladding or concrete panels
- 100mm Rockwool Duo Slab thermal insulation
- 12mm cement particle sheathing board (typically omitted in the case of concrete panels)
- 200mm Metal studwork or similar, i.e. SFS or Metsec
- Full-fill 200mm Rock or mineral wool infill between studwork
- 2x 12.5mm plasterboard internally

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

* Typically trickle ventilators may be required for larger clusters (8-bed or more) to the shared kitchen/dining/living rooms due to the possible flow rates from the units. In addition, sometimes make-up air is required where using purge overheating fans. However, on this scheme it is understood neither of these matters are relevant and therefore there are no trickle ventilators required to the development.

Further to the noise surveying and computer modelling discussed above, the required performance of the curtain walling and glazing has been calculated. 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 7 – 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	23	27	29	36	41	42	52	52	39
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 8 to prove commensurate with achieving the sound insulation performance specifications detailed above in Table 7.

Table 8 –Guidance Configurations for Glazing

Glazing Type	Configuration
G1	High-spec PVB acoustic-laminated double glazing, i.e. 10/16/6.4 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.

Façade Zones & Applicable Glazing Types

Due to the differing noise sources around the site, five glazing zones have been defined, as indicated in Table 9 below and the attached Façade Zoning Plan 2151/FZP.

Table 9 – Façade Zones & Glazing Types

Façade Zone	Floor Levels	Room Type	Glazing Type
1 – North-West Façade, Railway	Lower Floors Ground to 9th Floor	Bedrooms/Studios	G1
		Living Room / Kitchens	G2
		All Other Room Types *	G2
	Middle Floors 10th – 19th Floors	Bedrooms/Studios	G3
		Living Room / Kitchens	G4
		All Other Room Types *	G4
	Upper Floors 20th – 37th Floors	Bedrooms/Studios	G4
		Living Room / Kitchens	G4
		All Other Room Types *	G4
2 – North-East Façade, Sackville St	Lower Floors Ground to 14th Floor	Bedrooms/Studios	G1
		Living Room / Kitchens	G2
		All Other Room Types *	G2
	Upper Floors 15th – 37th Floors	Bedrooms/Studios	G3
		Living Room / Kitchens	G4
		All Other Room Types *	G4

Façade Zone	Floor Levels	Room Type	Glazing Type
3 – South-West and South-East Façades of Tower Block	Lower Floors Ground to 19th Floor	Bedrooms/Studios	G4
		Living Room / Kitchens	G4
		All Other Room Types *	G4
	Upper Floors 20th – 37th Floors	Bedrooms/Studios	G3
		Living Room / Kitchens	G4
		All Other Room Types *	G4
4 – West Façades of Lower L-Block	All Floor Levels Ground to 9th Floor	Bedrooms/Studios	G3
		Living Room / Kitchens	G4
		All Other Room Types *	G4
5 – All Other Façades, i.e. South Charles St and North of L-Block	All Floor Levels Ground to 9th Floor	Bedrooms/Studios	G4
		Living Room / Kitchens	G4
		All Other Room Types *	G4

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

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 (amenity) 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 $D_{n,f,w}$. Where curtain walling spans a staircore vertical run it is typical to omit the flanking spec. Allowance can be made for the proposed drywall inner lining.

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.

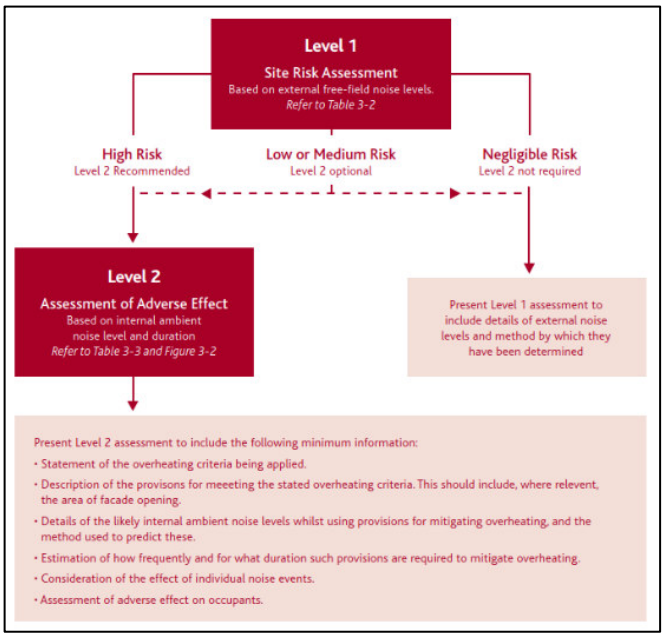
This implies the following limiting external free-field levels above which external noise precludes the use of the simplified method, and dynamic thermal modelling should be used to demonstrate compliance.

Table 10 – 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} = 65 / 61/ 61 dB
Night-time L_{Aeq} = 62 / 58 / 58 dB
Typical Night-time $L_{Amax,f}$ = 82 / 75 / 78 dB

In addition, please refer to the CadnaA noise model screenshots of the Daytime and Night-time L_{eq} levels in Figures 1-4 and 5-8 (respectively) on Page 5 above. The daytime L_{eq} noise levels on the façades, taken from the aforementioned figures, are summarised as follows:

- Northern Railway façade – 65dBA (at bedrooms on main façade, in worst case), reducing to 56dBA at top level of tower
- Eastern Sackville St façade – 64dBA (at low level), reducing to 60-62dBA at top of tower
- Southern Charles St façade – 54-57dBA

The night-time L_{eq} levels are summarised as follows:

- Northern Railway façade – 62dBA (at bedrooms on main façade, in worst case), reducing to 52dBA at top level of tower
- Eastern Sackville St façade – 61dBA (at low level), reducing to 57dBA at top of tower
- Southern Charles St façade – 51-54dBA

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 (worst-case) northern Railway façade, especially, 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 railway façade. Actually, this is also the case for all other façades and floor levels throughout the development, based upon the Cadna noise model predicted façade noise levels.

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 Railway façade (worst-case) would be approximately 50dB L_{Aeq} (night-time) and 70dB L_{Amax}, which significantly exceed the requirements of ADO (40dB and 55dB respectively).

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 Railway façade (worst-case) of approximately 56dB L_{Aeq} (night-time) and 73dB L_{Amax}, which significantly exceed the requirements of ADO (40dB and 55dB respectively). Even in the best-case (high level of the lower blocks along Charles St), the resulting internal levels will be approximately 42dB L_{Aeq} (night-time) and 63dB L_{Amax} and thus are likely to exceed the ADO requirements.

The outcomes are obviously even worse if the more stringent out-to-in level difference of 4dBA is assumed, as per the "high" risk category, which it is understood central Manchester M1 post codes should ideally adopt in the assessment.

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 any façade or floor level throughout the development under current guidance requirements, and alternative means of mitigating overheating is required.

A full overheating assessment should be carried out by the design team to assess the risk of potential overheating scenarios. It is important to consider the frequency of occurrence of the overheating condition and also consider the other impacts involved with any suggested mitigation measures, i.e. sustainability, embodied and operational carbon, etc. Other means of mitigation should be investigated first, e.g. increased G-values, fabric-first approach, 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 this would not even assist the matter on the quieter façade areas.

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 (i.e. all locations), windows will be openable during the daytime for heat purge but closed during the night-time with a slightly boosted flow rate to the MVHR system.

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

Note: It is understood that bedrooms at 1st to 3rd floor levels on the northern (railway) façade of the low-level L-shaped blocks (to the west of site) require the windows to be shut at all times due to Air Quality issues and therefore a purge fan is proposed to combat overheating (as windows cannot be opened during the daytime), however no trickle ventilators are required, i.e. sufficient make-up air can be drawn through the standard MVHR system (negative pressure).

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 11 – 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-Residential to PBSA Separation

3No. commercial units are proposed at Ground floor level, as well as Lounges for the students. In addition, various other amenity spaces are proposed at 1st floor level within the tower, including a gym, health & wellbeing centre, private dining, and co-working space. 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 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 areas comprise concrete cast in-situ transfer slabs of minimum thickness 225mm.

An assessment (back-calculation) has been undertaken – see Table 12 below – to consider potential airborne noise transfer from activities within the units impacting the spaces above. 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 potentially thicker (due to transfer slabs). 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 12 – 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 Student Room (above)	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

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 8 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 nearby receptors on the opposite side of the road, on the assumption of the 83dBA Limiting Level in Table 12, as the potential source noise level in the commercial unit. The modelling indicates a level of approximately 35dB L_{Aeq} at the façade of the receptors due to break-out from the retail frontage. This should then be compared against the otherwise prevailing (traffic) noise level of 61dBA during the daytime (see Positions 2 & 3, Table 1 above). The predicted level is some 25dB+ below the traffic noise levels and will therefore not be audible or have any impact at the receptors.

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.

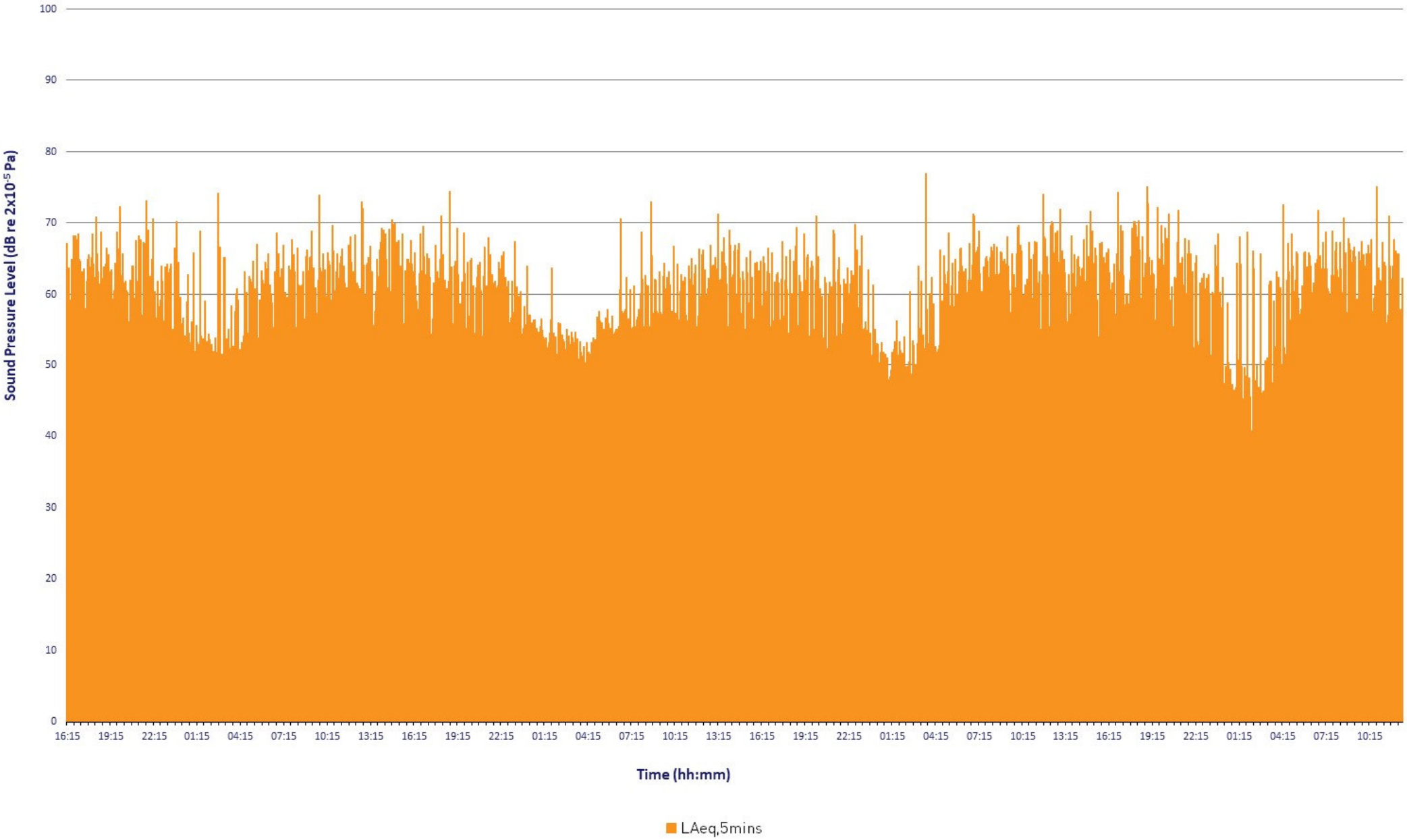
RGRE, PBSA, Plot H, Charles Street, Manchester

L_{Aeq} Time History (5-mins)

Measurement Position 1 (North - Railway), Friday 4th to Tuesday 8th July 2025

Project: 2151

Graph 1



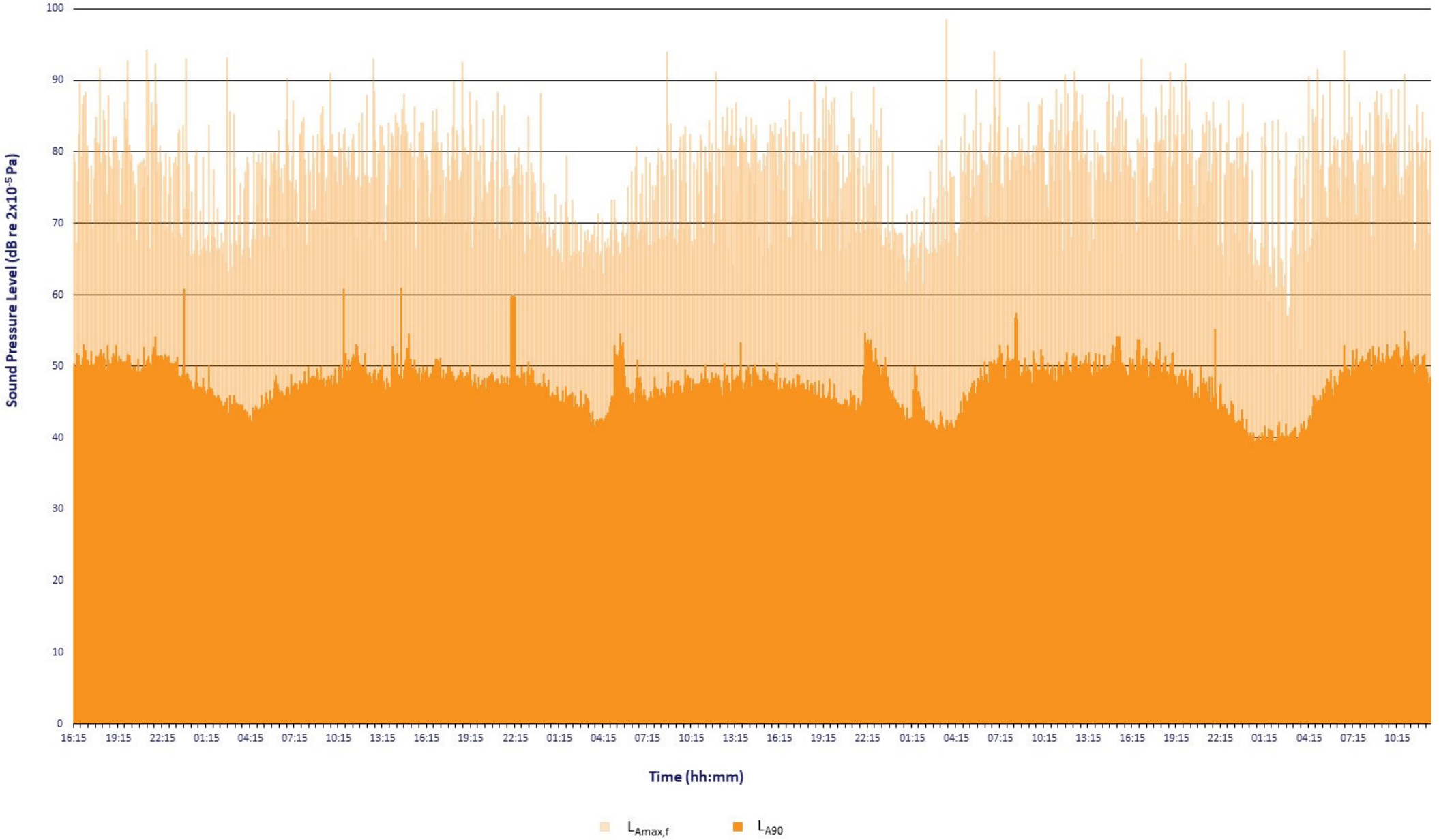
RGRE, PBSA, Plot H, Charles Street, Manchester

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

Measurement Position 1 (North - Railway), Friday 4th to Tuesday 8th July 2025

Project: 2151

Graph 2



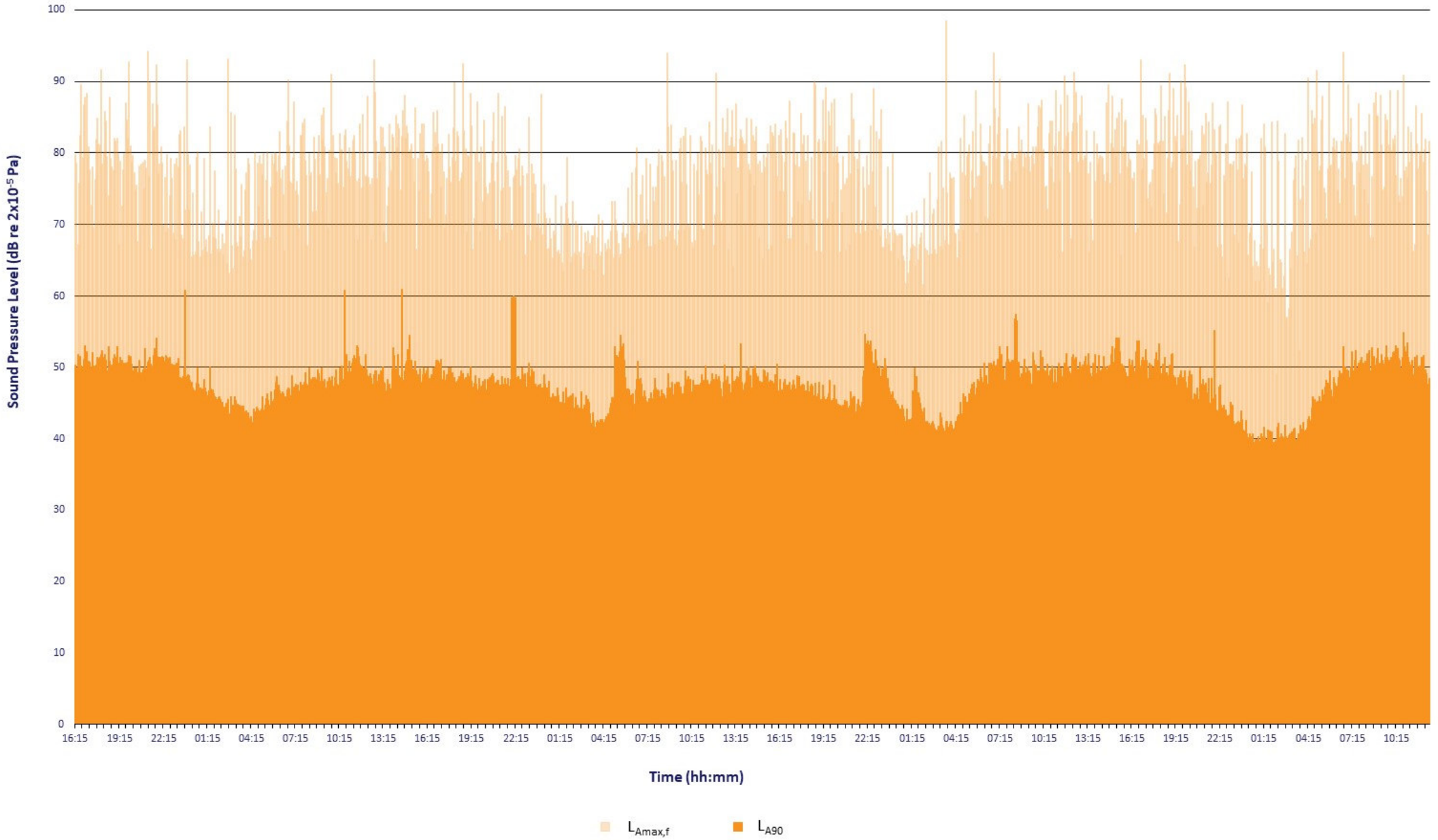
RGRE, PBSA, Plot H, Charles Street, Manchester

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

Measurement Position 1 (North - Railway), Friday 4th to Tuesday 8th July 2025

Project: 2151

Graph 2



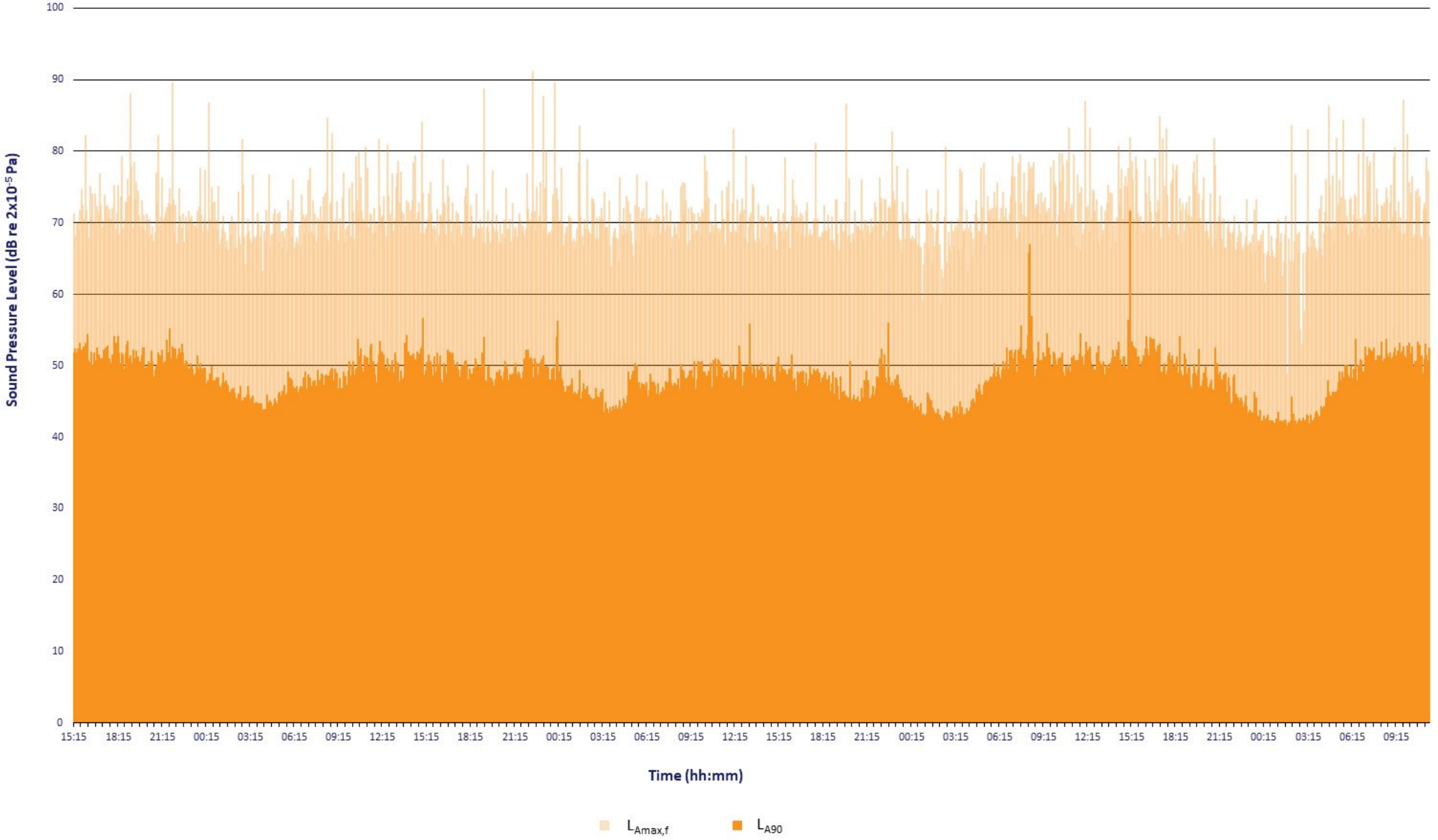
RGRE, PBSA, Plot H, Charles Street, Manchester

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

Measurement Position 2 (South-East - Sackville St), Friday 4th to Tuesday 8th July 2025

Project: 2151

Graph 4



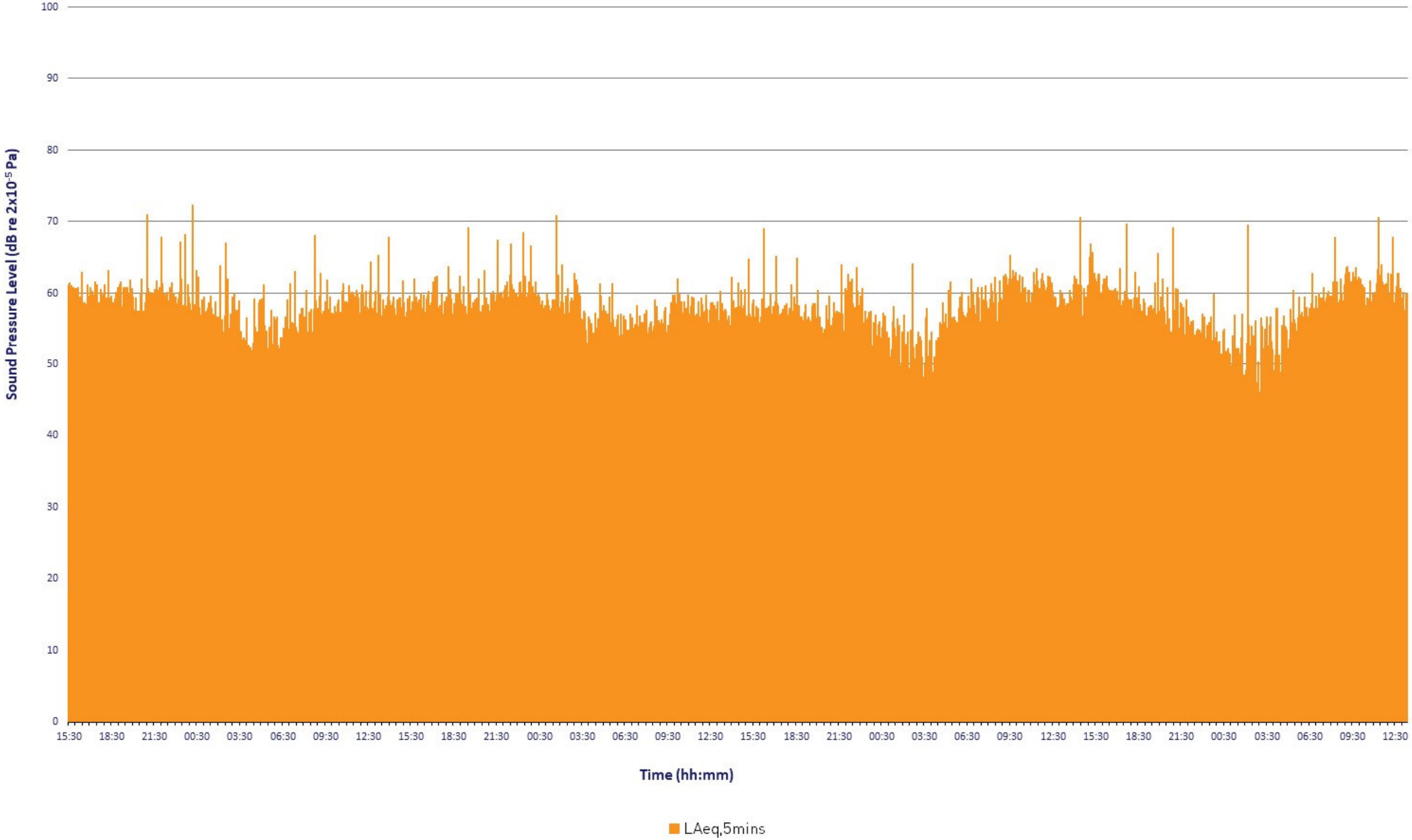
RGRE, PBSA, Plot H, Charles Street, Manchester

L_{Aeq} Time History (5-mins)

Measurement Position 3 (South-West - Charles St), Friday 4th to Tuesday 8th July 2025

Project: 2151

Graph 5



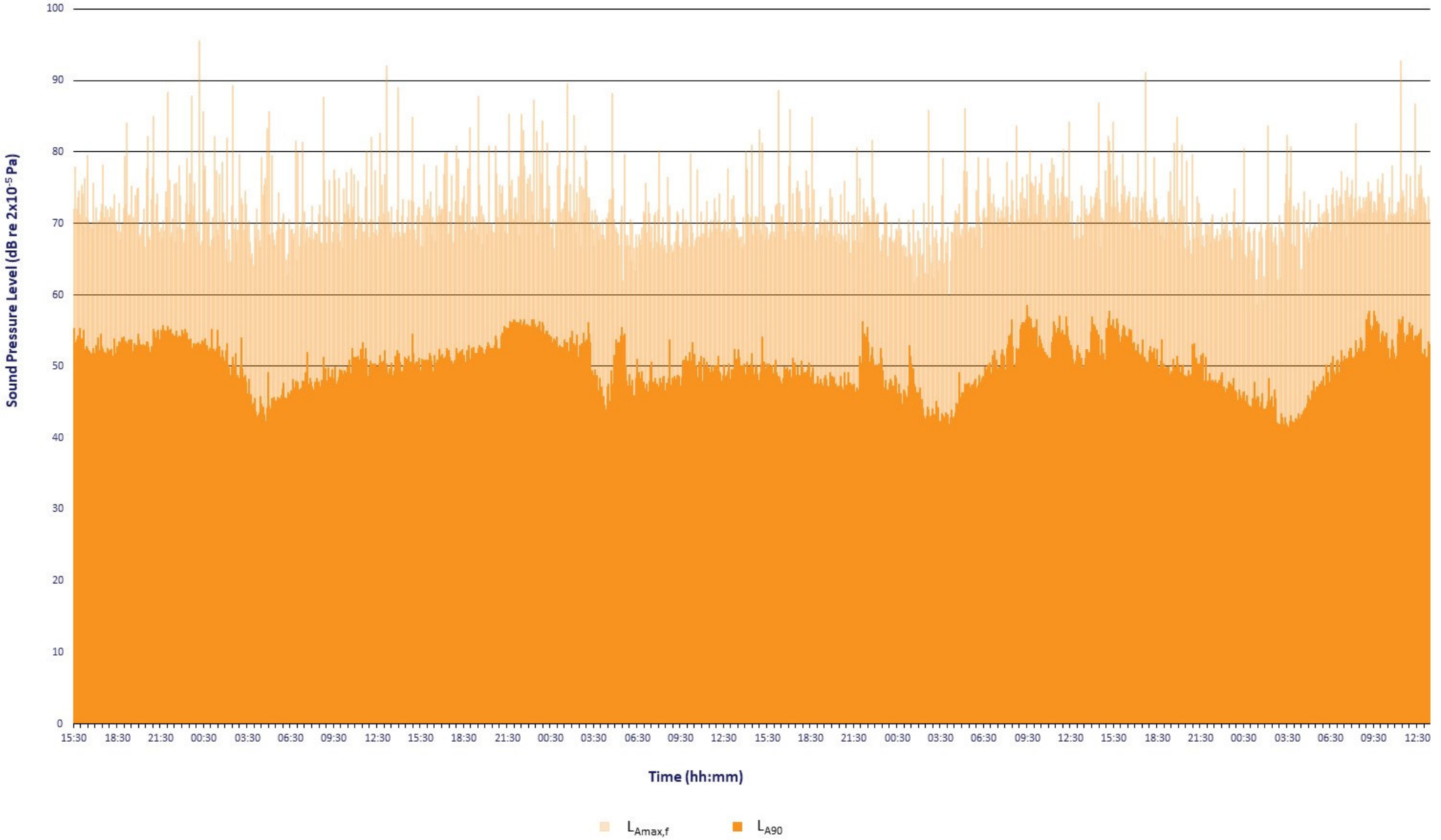
RGRE, PBSA, Plot H, Charles Street, Manchester

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

Measurement Position 3 (South-West - Charles St), Friday 4th to Tuesday 8th July 2025

Project: 2151

Graph 6



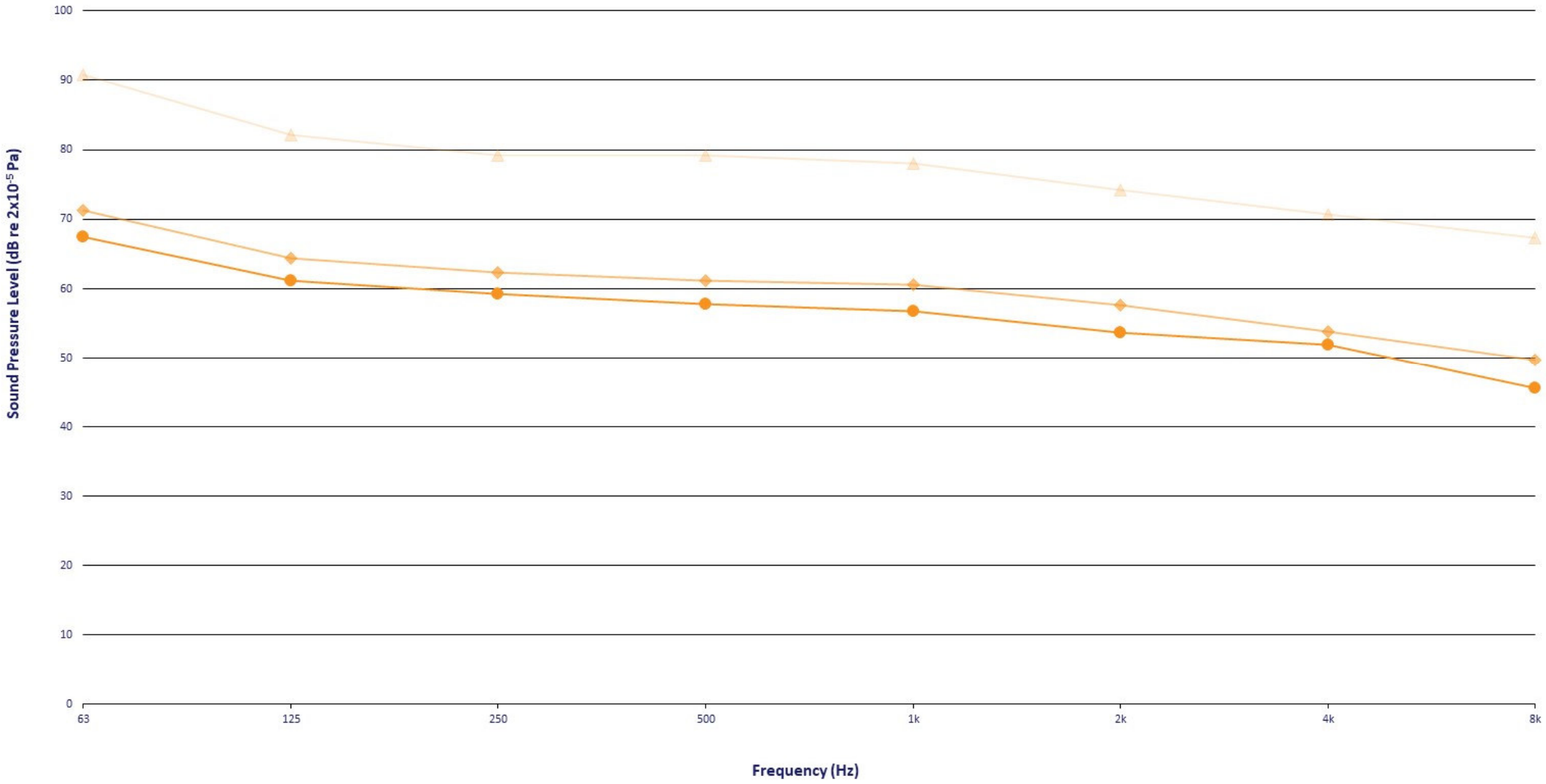
RGRE, PBSA, Plot H, Charles Street, Manchester

Spectral Noise Levels

Measurement Position 1 (North - Railway), Friday 4th to Tuesday 8th July 2025

Project: 2151

Graph 7



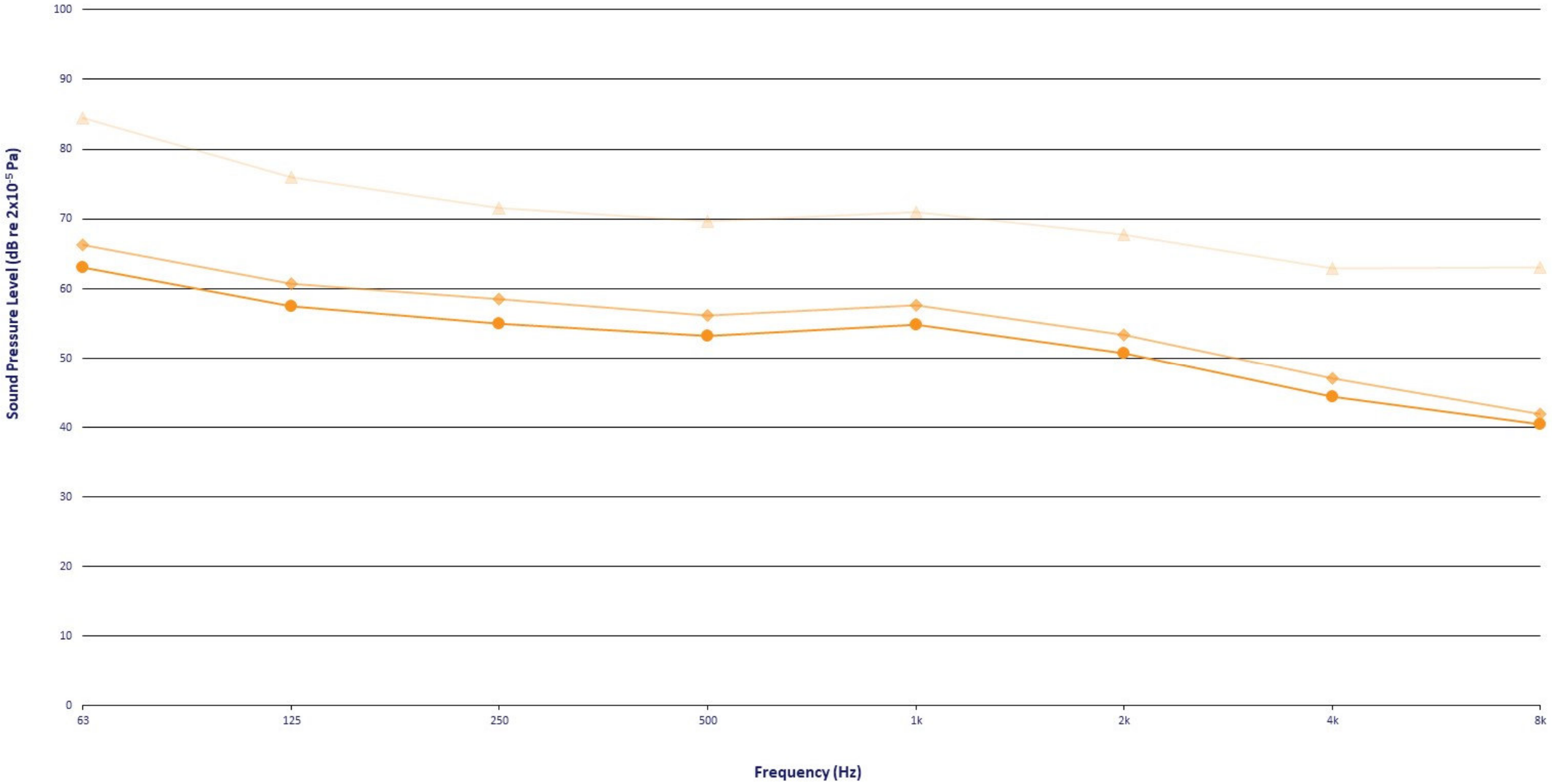
RGRE, PBSA, Plot H, Charles Street, Manchester

Spectral Noise Levels

Measurement Position 2 (South-East - Sackville St), Friday 4th to Tuesday 8th July 2025

Project: 2151

Graph 8



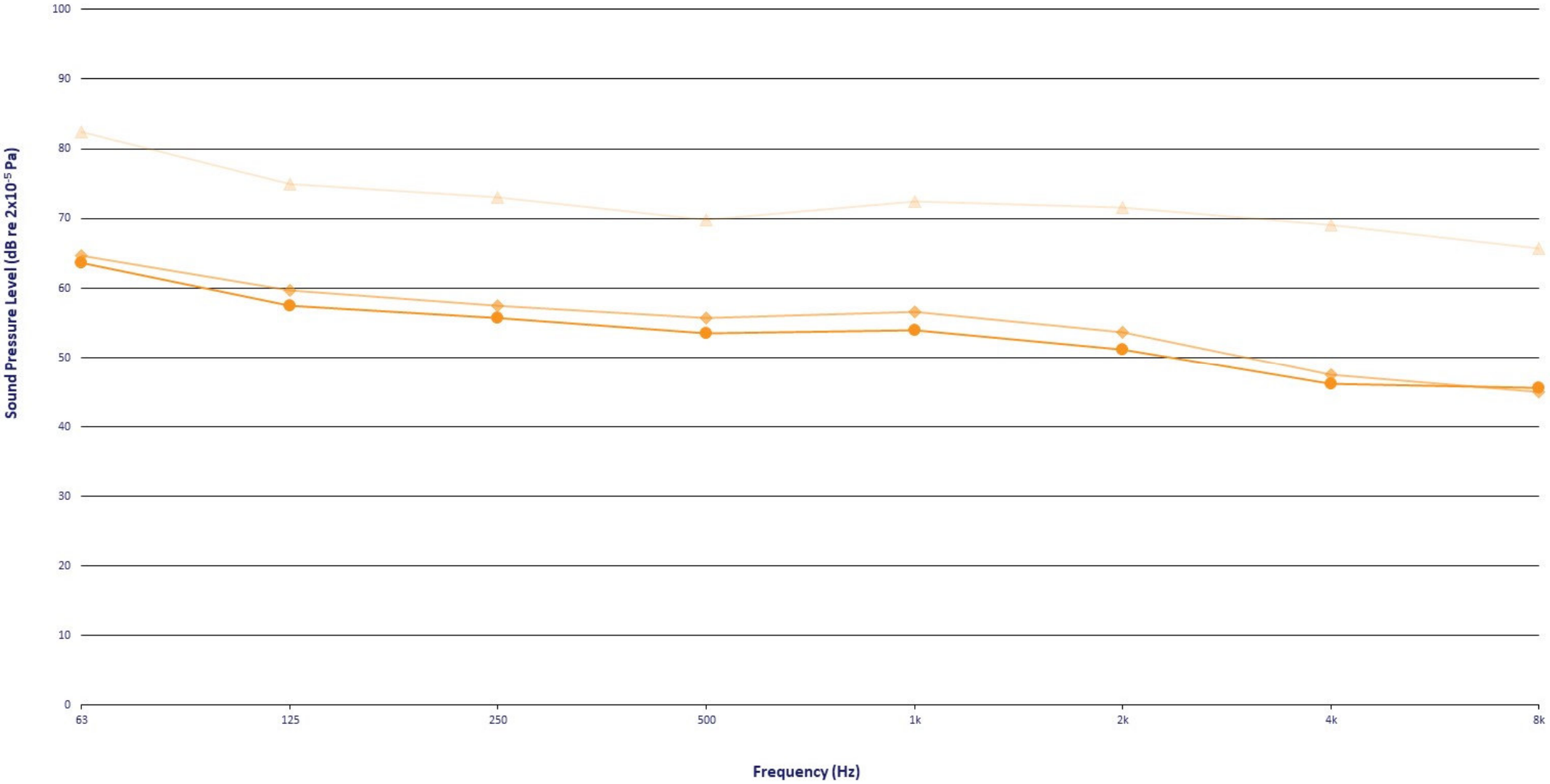
RGRE, PBSA, Plot H, Charles Street, Manchester

Spectral Noise Levels

Measurement Position 3 (South-West - Charles St), Friday 4th to Tuesday 8th July 2025

Project: 2151

Graph 9



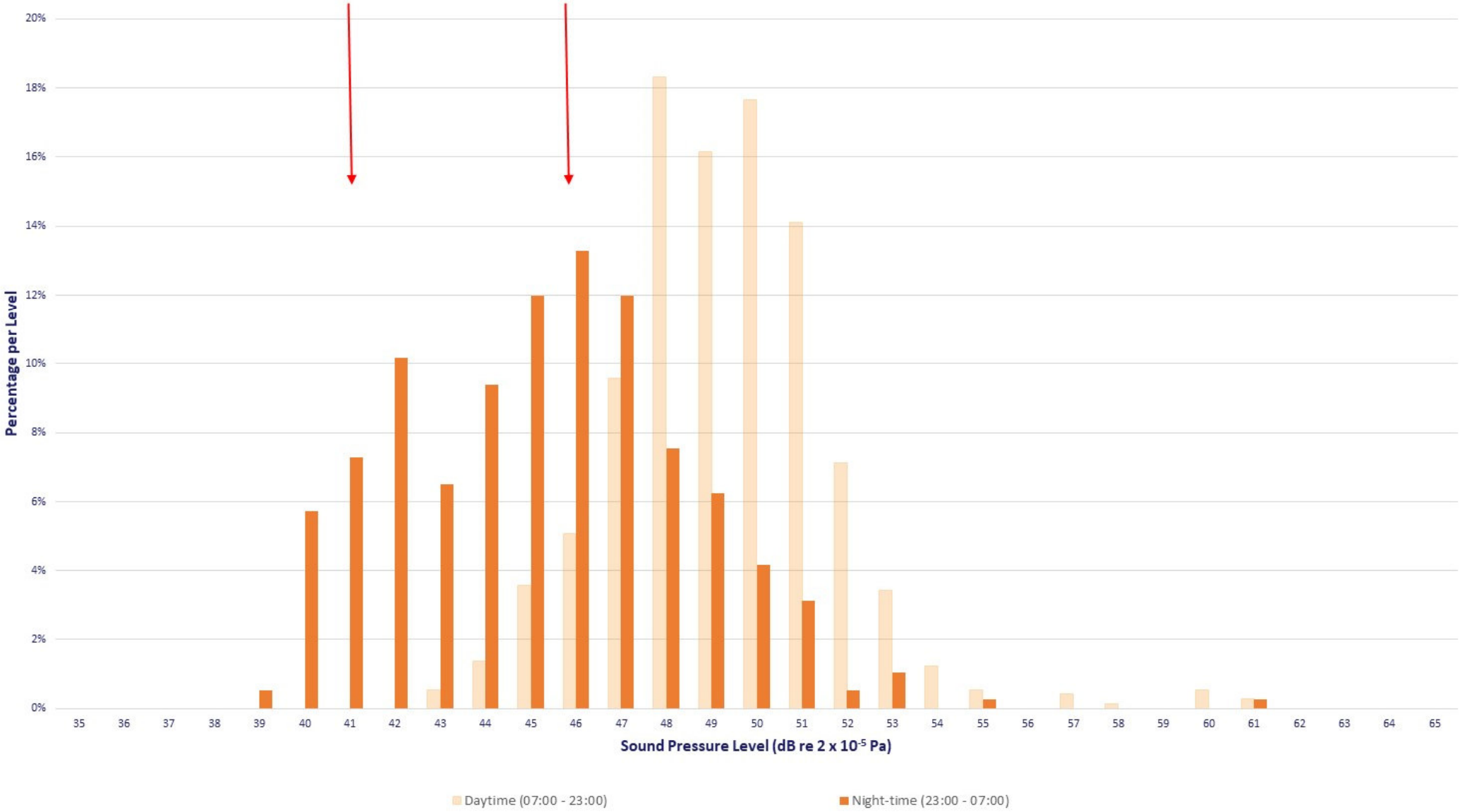
RGRE, PBSA, Plot H, Charles Street, Manchester

$L_{A90,5\ minutes}$ Histogram

Measurement Position 1 (North - Railway), Friday 4th to Tuesday 8th July 2025

Project: 2151

Graph 10



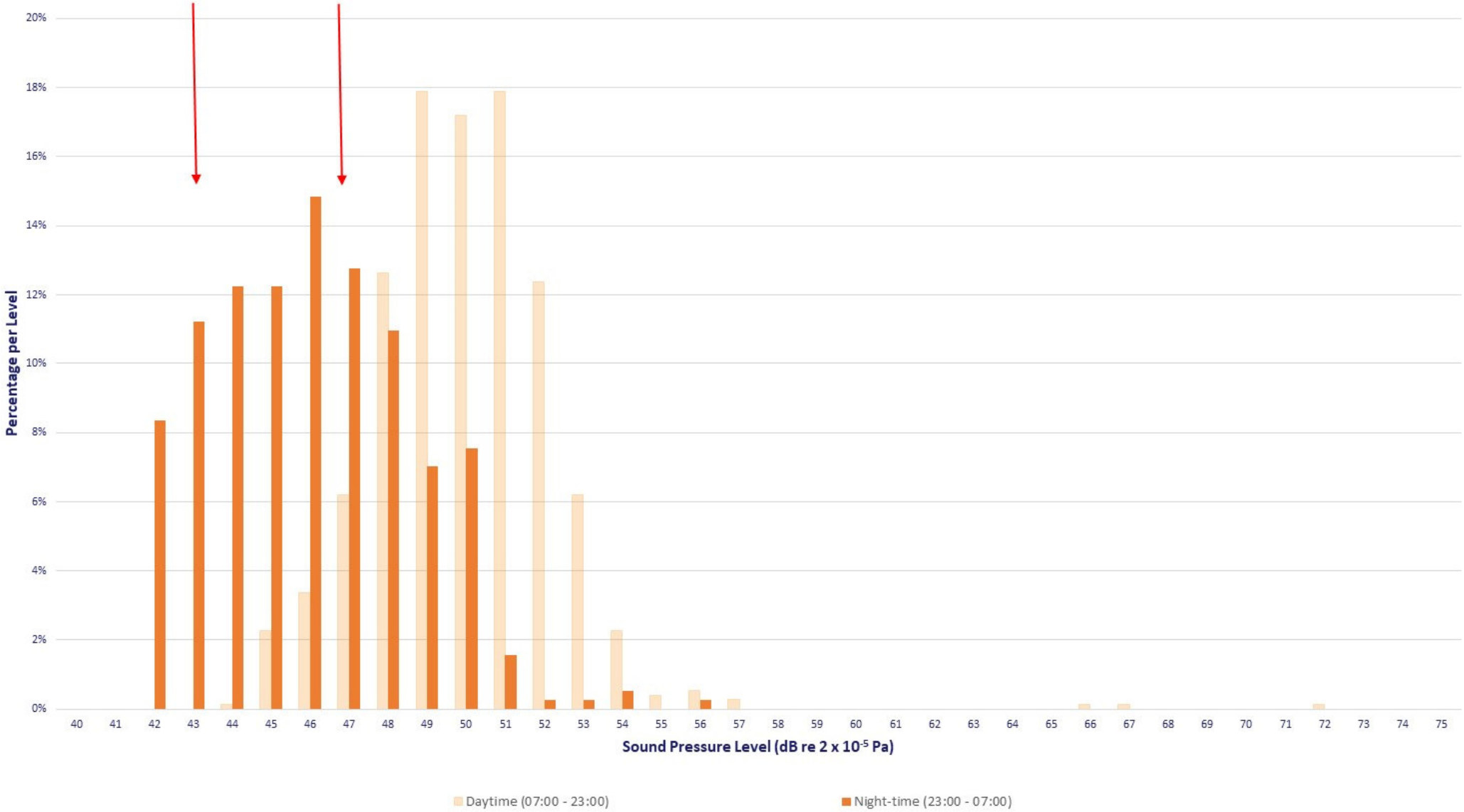
RGRE, PBSA, Plot H, Charles Street, Manchester

$L_{A90,5\ minutes}$ Histogram

Measurement Position 2 (South-East - Sackville St), Friday 4th to Tuesday 8th July 2025

Project: 2151

Graph 11



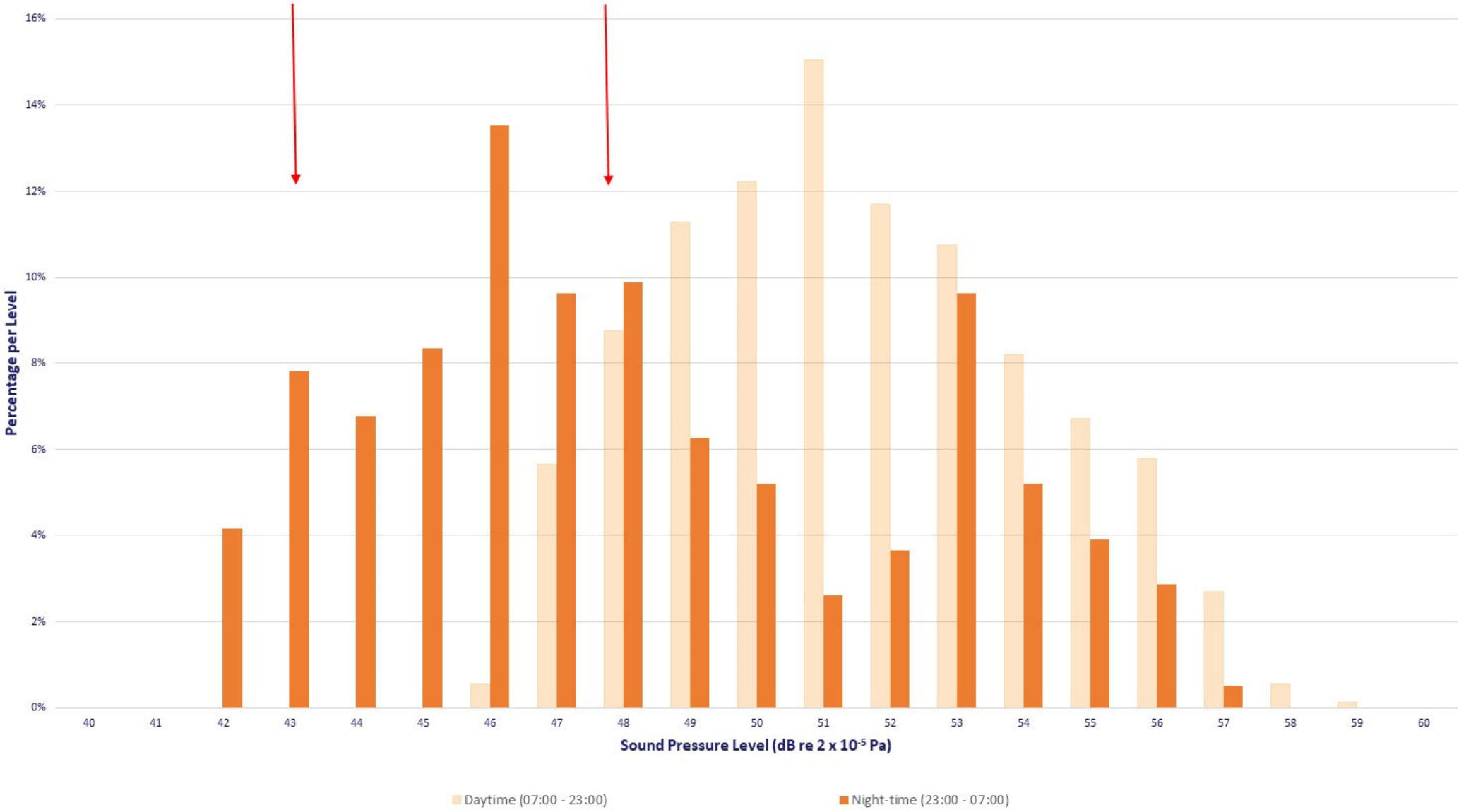
RGRE, PBSA, Plot H, Charles Street, Manchester

$L_{A90,5\ minutes}$ Histogram

Measurement Position 3 (South-West - Charles St), Friday 4th to Tuesday 8th July 2025

Project: 2151

Graph 12



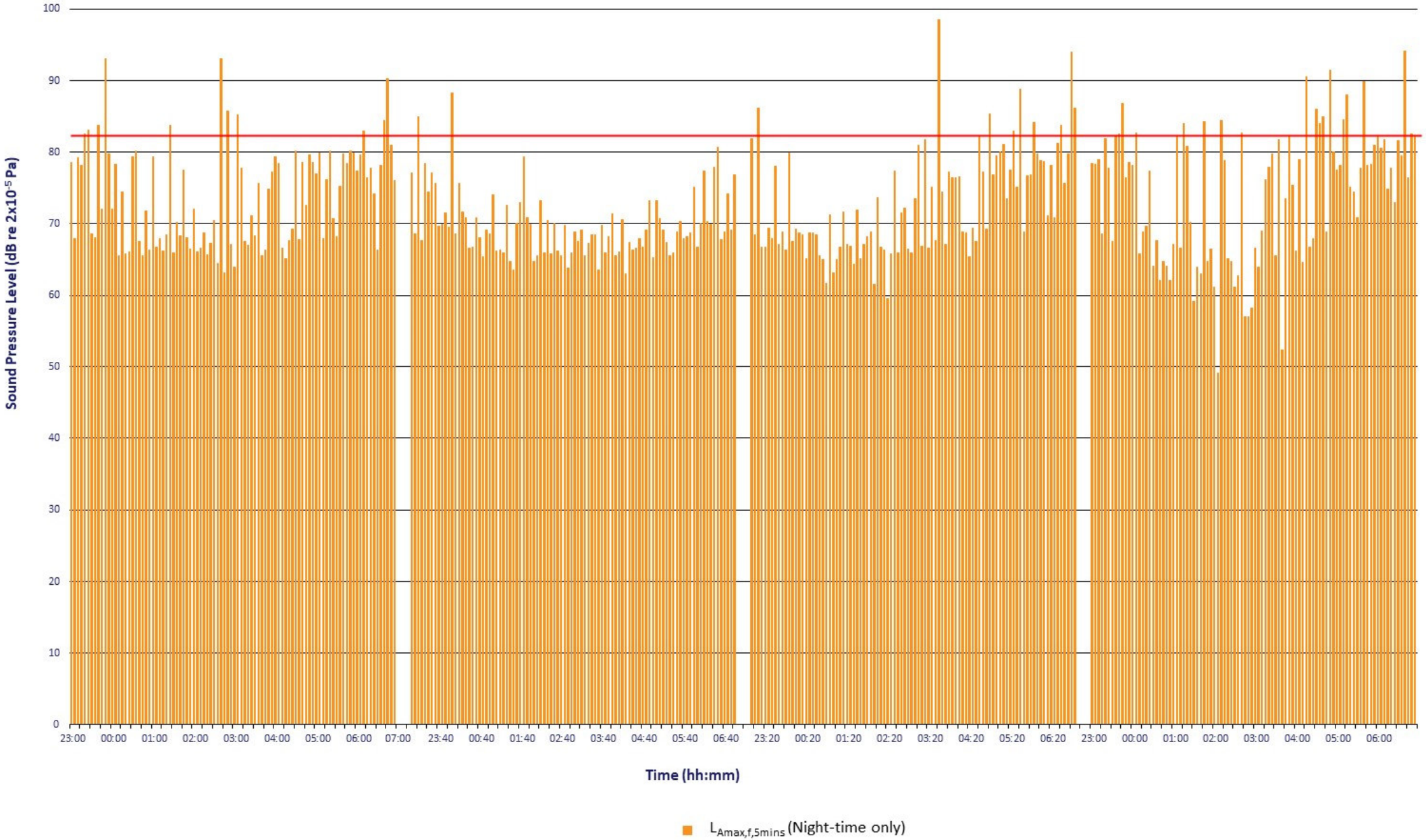
RGRE, PBSA, Plot H, Charles Street, Manchester

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

Measurement Position 1 (North - Railway), Friday 4th to Tuesday 8th July 2025

Project: 2151

Graph 13



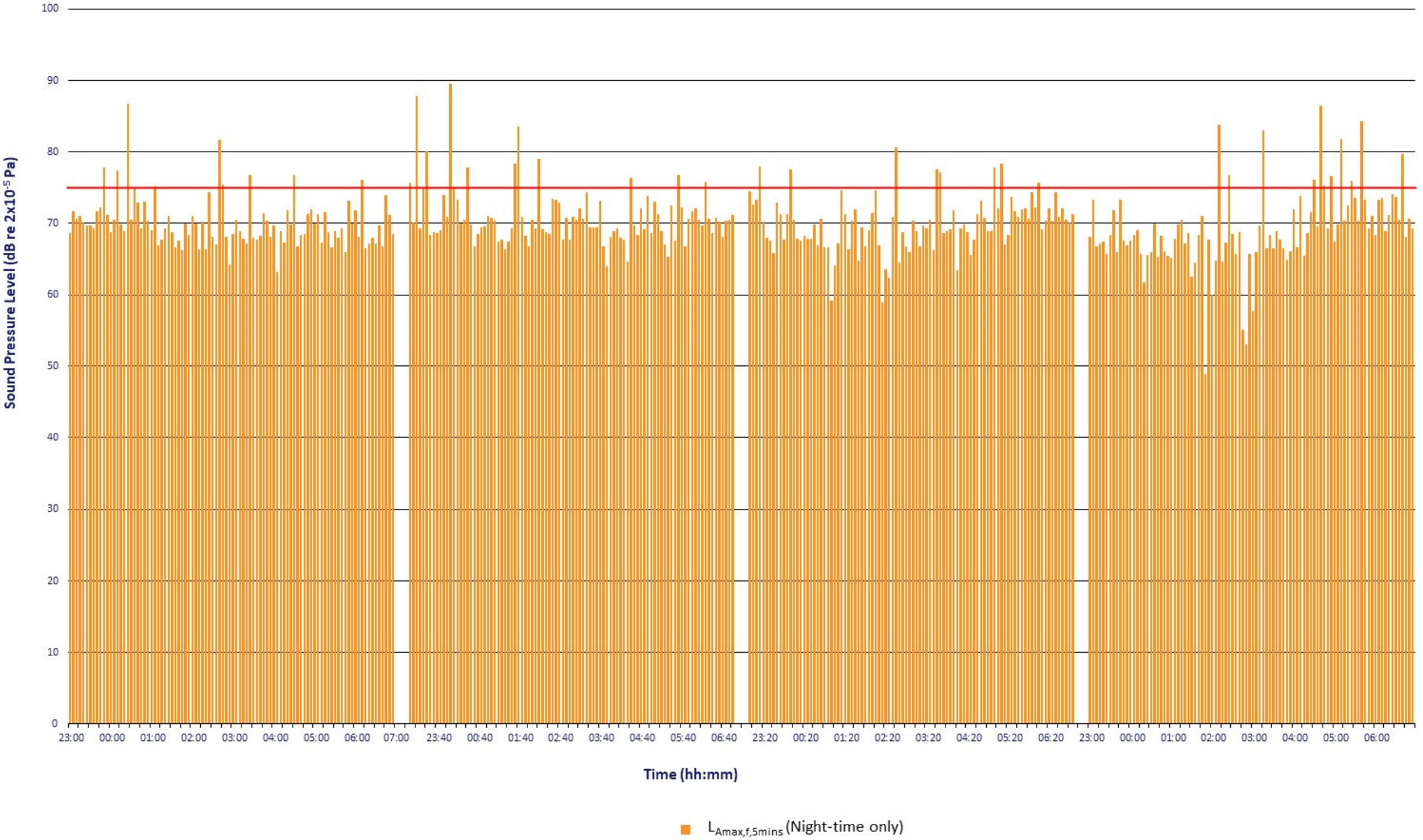
RGRE, PBSA, Plot H, Charles Street, Manchester

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

Measurement Position 2 (South-East - Sackville St), Friday 4th to Tuesday 8th July 2025

Project: 2151

Graph 14



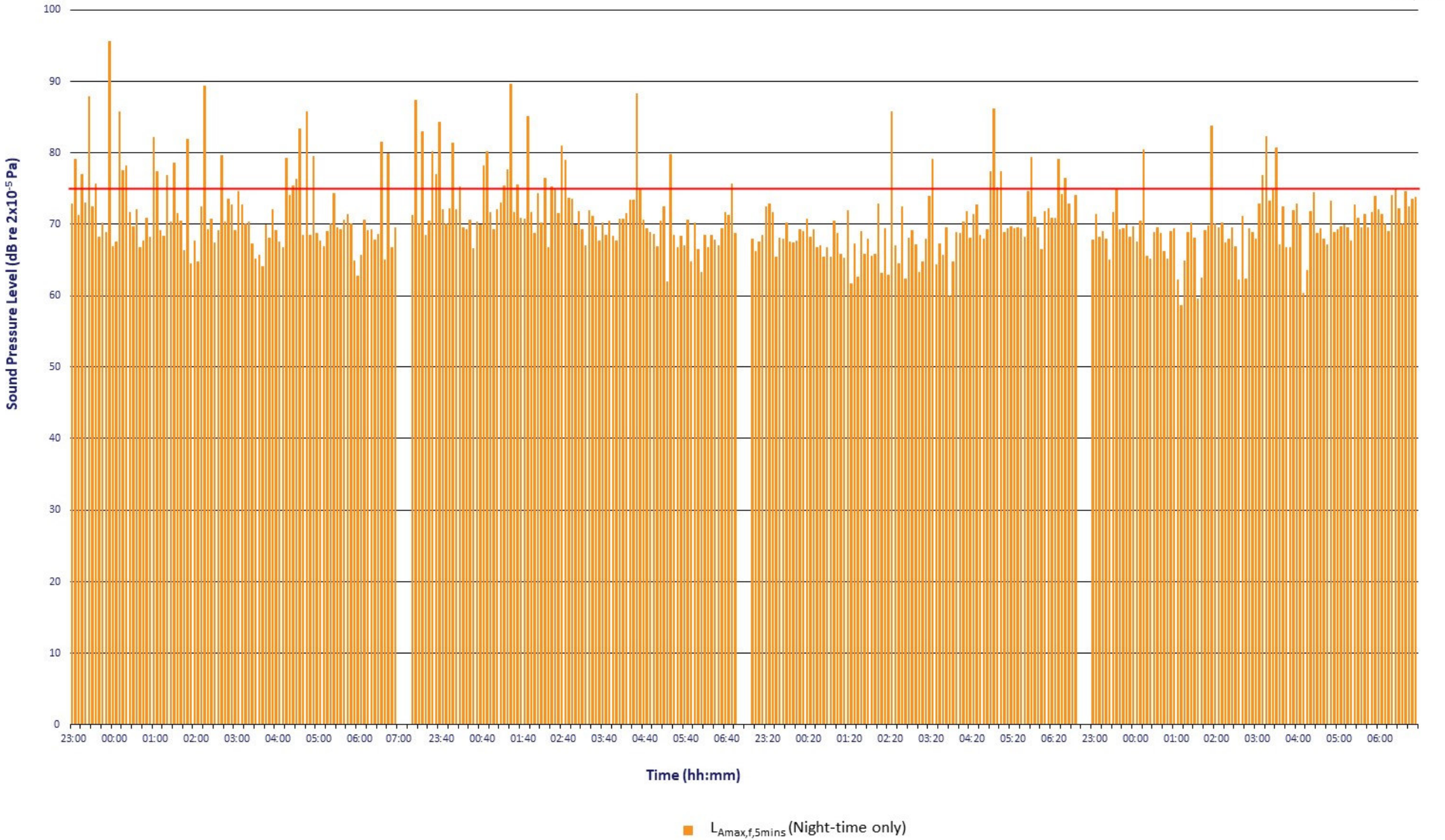
RGRE, PBSA, Plot H, Charles Street, Manchester

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

Measurement Position 3 (South-West - Charles St), Friday 4th to Tuesday 8th July 2025

Project: 2151

Graph 15



North-West Railway Façade



South-East Charles St Façade

Key:

Zone 1 – NW Façade (Railway)

Zone 2 – NE Façade of Tower (Sackville St)

Zone 3 – SW & SE Façades of Tower

Zone 4 – West Façades of Lower L-Block

Zone 5 – All other Façades, i.e. South/Charles St & North Façade of L-Block (unmarked)

To be fully developed at Detailed Design Stage.

RGRE, Plot H, Charles Street, Manchester – Façade Zoning Plan
(Typical Floor Plan, Level 04-05, shown)

Plan 2151/FZP

blackbird acoustics