389 MANOR ROAD, RICHMOND

Acoustic Assessment Report

Reference: 11695.RP02.AAR.1
Prepared: 12 May 2023
Revision Number: 1

Taylor Wimpey West London

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Revision	Comment	Date	Prepared By	Approved By
0	First issue of report	6 May 2022	Daniel Flood	Alex J Wyatt
1	Minor Updates to LA policy	12 May 2023	Helen Sheldon	Andrew Heath

Terms of contract:

RBA Acoustics Ltd has prepared this report in accordance with our Scope of Work 11695/ACB dated 13 February 2022. RBA Acoustics Ltd shall not be responsible for any use of the report or its contents for any purpose other than that for which it was provided. Should the Client require the distribution of the report to other parties for information, the full report should be copied. No professional liability or warranty shall be extended to other parties by RBA Acoustics Ltd without written agreement from RBA Acoustics Ltd.

The recommendations within this report relate to acoustics performance only and will need to be integrated within the overall design by the lead designer to incorporate all other design disciplines such as fire, structural integrity, setting out, etc. Similarly, any sketches appended to this report illustrate acoustic principles only and again will need to be developed into full working drawings by the lead designer to incorporate all other design disciplines.

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1.0 INTRODUCTION

A new residential-led, mixed-use development is proposed at the site of the existing Homebase store located at 389 Manor Road, Richmond. The development consists of 4 residential blocks ranging from 3 to 10 storeys high. Several of these blocks will contain commercial/community spaces at ground floor level.

The site is bordered to the north-west by the District and Overground North London lines, which run between Kew Gardens and Richmond. Meanwhile, the southern site boundary is bordered by the South Western Railway Waterloo to Reading line. The eastern site boundary is bordered by Manor Road.

An assessment has been carried out in relation to the noise levels likely to be incident on the proposed building façades to provide acoustic performance specifications, such that acceptable internal noise criteria can be achieved. Additional assessments concerning external amenity spaces and the sound insulation performance of constructions separating commercial from residential units has also been undertaken.

Additionally, LBRuT have published their Regulation 19 Plan. Policy 46 introduces a requirement for development proposals to comply with the agent of change principles set out in Policy D13 of the London Plan and achieve compliance with Policy D14 of the London Plan. Noting the context, Policy D13 is not applicable to the Site. The proposal has been designed to achieve compliance with Policy D14 of the London Plan and no further changes are therefore required to comply with emerging policy.

This report details the results of the noise survey and sets out the acoustic performance requirements of the external building fabric elements. In addition, suitable plant noise emission criteria have also been developed based upon the survey results and the likely requirements of the Local Authority.

2.0 ENVIRONMENTAL NOISE SURVEY

2.1 Survey Methodology

Monitoring of the prevailing background noise was undertaken over the following period:

12:30 hours Thursday 17 March to 13:00 hours Monday 21 March 2022

As the survey was unattended it is not possible to comment with certainty regarding meteorological conditions throughout the entire survey period. However, based on observations during the site visits and weather reports for the area, conditions were generally considered suitable for obtaining representative noise measurements, being predominantly dry with little wind.

Measurements were made of the L_{A90}, L_{Amax} and L_{Aeq} noise levels over sample periods of 15 minutes.

2.2 Measurement Locations

To determine the existing noise climate around the site, measurements were undertaken at the following locations.

Measurement Position One – North Site Boundary

Measurements were undertaken along the northern site boundary, overlooking the District and Overground Railway Lines. The microphone was mounted to a pole, attached to fencing, and positioned at a height of 3m above ground level. The main noise source at this location was noise from the District and Overground Railway Lines, located at an approximate distance of 12m.

Measurement Position Two – South Site Boundary

Measurements were undertaken along the southern site boundary, overlooking the South Western Railway Line. The microphone was mounted to a pole, attached to fencing, and positioned at a height of 3m above ground level. The main noise source at this location was noise from the South Western Railway Line, located at an approximate distance of 6m.

Measurement Position Three – East Site Boundary

Measurements were undertaken along the eastern site boundary, overlooking Manor Road. The level crossing with the South Western Railway Line is located further to the south. The microphone was mounted to a pole, attached to fencing, and positioned at a height of 3m above ground level. The main noise source at this location was noise from Manor Road, located at distance of 5m. Noise from the South Western Railway Line also contributed, which is located approximately 20m from the measurement position.

The measurement positions are illustrated on the Site Plan attached as Figure 1 in Appendix E. Photos of the positions are shown in Figures 2-4.

2.3 Instrumentation

For information regarding the equipment used for the measurements please refer to Appendix C attached.

The sound level meters were calibrated both prior to and on completion of the surveying with no significant calibration drifts observed.

2.4 Results

The measured L_{Aeq}, L_{A90} and $L_{Amax,f}$ 15-minute period levels are shown as time-histories on the attached Graphs 1-2, 4-5, 7-8 in Appendix E. The averaged daytime and night-time L_{Aeq} noise levels are summarised in Table 1 below. Also shown are the typical $L_{Amax,f}$ noise levels, based upon the 90th percentile of 5-minute intervals during the night-time periods, for each measurement position.

Table 1 – Measured L_{Aeq} and Typical $L_{Amax,f}$ Noise Levels

Measurement Position	Averaged $L_{Aeq, period}$ Noise Level (dB)		Typical $L_{Amax,f}$ Noise Level (dB)
	Daytime (07:00-23:00 hrs)	Night-time (23:00-07:00 hrs)	Night-time (23:00-07:00 hrs)
Position 1 – North	64	58	81
Position 2 – South	65	60	83
Position 3 – East	64	59	79

The typical-lowest background noise levels ($L_{A90, 15mins}$) at each measurement position are summarised in Table 2 below. The "typical-lowest" background noise levels have been determined statistically as the lowest rounded $L_{A90, 15mins\ level}$ which occurs for at least 10% of the assessment period. These have been based on the histograms presented in Graphs 3, 6 and 9 attached in Appendix E.

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. However, we generally consider that designing to the most-commonly occurring $L_{A90, 15mins}$ period is not sufficient during those slightly quieter periods. Therefore the "typical-lowest" background noise levels are considered to provide a more representative value.

Table 2 – Measured Typical-Lowest $L_{A90, 15mins}$ Noise Levels

Measurement Position	Typical-Lowest $L_{A90, 15mins}$ Noise Level during period (dB)	
	Daytime (07:00-23:00 hrs)	Night-time (23:00-07:00 hrs)
Position 1 – North	39	34
Position 2 – South	40	38
Position 3 – East	45	34

3.0 NOISE MODELLING

In order to predict the noise levels at the different façades with varying heights, an acoustic model of the proposed site, including all proposed buildings and existing surroundings has been generated using the CadnaA platform.

The model allows the various sound sources, which are the main surrounding roads and railway lines, to be calibrated according to on-site measurements (reference Section 2.4). The proposed buildings are subsequently built into the model and calculations using the methodology outlined in ISO9613 are undertaken to predict façade incident noise levels at all floor heights and to produce noise contours for the site and surrounding area.

The attached Figures 5 and 6 (in Appendix E) illustrate the Daytime and Night-time contour plots of noise levels across the development site, respectively. The attached Figures 7, 8 and 9 show 3D image views of elevations of the proposed development.

4.0 EXTERNAL BUILDING FABRIC AND EXTERNAL AMENITY CRITERIA

This section outlines typical assessment criteria in terms of the relevant standards.

Residential Criteria

4.1 Local Authority Criteria

The London Borough of Richmond-upon-Thames has imposed the following conditions relating to the external building façade and external amenity areas. The second part of the condition is discharged by commissioning testing.

Planning Condition 32 – Noise Protection – Residential

1. Prior to occupation of any residential unit hereby approved, an Acoustic Report shall be submitted to and approved in writing by the Local Planning Authority, to include the following details:

a. *Specification details for the building façade, glazing and ventilation elements of the development to demonstrate that they achieve suitable internal ambient noise levels, in line with the requirements of LBRuT and BS8233, as set out in Table 1 of the Revised Noise and Vibration Impact Assessment Rev08. Where acoustically attenuated ventilation is required and there is evidence of adverse air quality impact to occupants, mechanical ventilation will be required. Where whole house ventilation is provided then acoustically treated inlets and outlets should ideally be located away from the façade(s) most exposed to noise (and any local sources of air pollution).*

b. *Specification details demonstrating that the design and layout of the development is constructed so as to protect amenity spaces (including gardens, balconies and terraces) against externally generated transportation noise sources including road, rail and aircraft, so as to achieve 50dB(A) LAeq,16 hours with a maximum limit of 55dB(A) LAeq,16hour, where possible. Robust justification will be required where the above limits cannot be achieved.*

2. Prior to occupation of the development, a commissioning acoustic test and report shall be undertaken and submitted to and approved in writing by the Local Planning Authority in order to demonstrate that internal noise levels achieve those detailed within the Acoustic Report. Where further mitigation is required, details of such shall be submitted to and approved in writing by the Local Planning Authority with the corresponding commissioning acoustic test and report and implemented in full and retained as approved. The development shall not be implemented other than in accordance with be approved scheme, which shall be implemented in full prior to the first occupation of any specific building to which the scheme relates and the first use of any external space. The scheme shall thereafter be retained as approved.

REASON: In order to safeguard the amenities of neighbouring residents.

4.2 British Standard 8233:2014

BS 8233:2014 *Guidance on Sound insulation and noise reduction for buildings* draws on the results of research and experience to provide information on achieving internal acoustic environments appropriate to their functions. The noise level values given are in terms of an average (L_{Aeq}) level.

The standard advises internal ambient noise levels for achieving suitable resting and sleeping conditions within residential properties, as set out in Table 3 below.

Table 3 – BS 8233:2014 Residential Criteria

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

Although generally no specific numerical requirement is set in terms of an L_{Amax} noise level, BS 8233:2014 does provide the following guidance with regards individual noise events:

> *Regular individual noise events (for example, scheduled aircraft or passing trains) can cause sleep disturbance. A guideline value may be set in terms of SEL or $L_{Amax,f}$ depending on the character and number of events per night. Sporadic noise events could require separate values.*

Guidance provided in the World Health Organisation's Guidelines for Community Noise further refines the requirements for individual noise events as outlined below. However, Table H.3 of BS 8233:2014 does state a range of 45-55dB L_{Amax} for hotel bedrooms during the night-time period.

4.3 World Health Organisation Guidelines

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*". RBA therefore make reference 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 document.

Table 4 – Guideline Values for Community Noise

Specific Environment	Critical Health Effect(s)	L_{Aeq} (dB)	Time Base (hours)	$L_{Amax,f}$ (dB)
Outdoor living area	Serious annoyance, daytime and evening	55	16	-
	Moderate annoyance, daytime and evening	50	16	-
Dwelling, indoors	Speech intelligibility and moderate annoyance, daytime and evening	35	16	-
Inside bedrooms	Sleep disturbance, night-times	30	8	45
Outside bedrooms	Sleep disturbance, window open (outdoor values)	45	8	60

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 L_{Amax} 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.

Non-Residential Criteria

The following sections pertain to the non-residential usages.

4.4 British Standard 8233:2014

Ultimately the design criterion for non-residential spaces will depend on the end user activity. Hence, we outline criteria for these areas based on the guidance within BS 8233:2014. The standard advises the following internal ambient noise levels (L_{Aeq}) for the given activity and conditions for work requiring concentration within offices.

Table 5 – BS 8233:2014 Non-Residential Criteria

Activity	Location	Design Range $L_{Aeq,T}$ (dB)
Speech or Telephone Communications	Department Store	50-55
	Corridor, Circulation Space	45-55
Study and Work Requiring Concentration	Staff/Meeting Room, Training Room	35-45
	Executive Office	35-40

The standard also advises that noise levels should be within the range of 45-50 dBA within open plan offices where acoustic privacy is important.

Further guidance on proposed noise levels within non-domestic buildings is given below. Please note, a range is provided as exact uses / end users are yet to be determined.

Table 6 – BS 8233:2014 Non-domestic buildings Criteria

Room	Design range dB $L_{Aeq,T}$
Department Store, cafeteria, Kitchen, canteen	50-55
Restaurant	40-55
Open plan office	45-50
Public house	40-45

4.5 Summary

Residential Areas

The project criteria adopted for Bedrooms and Studios are therefore as follows:

Night-time (23:00 – 07:00)	30dB L_{Aeq} and typically < 45dB $L_{Amax,f}$ *
Daytime (07:00 – 23:00)	35dB L_{Aeq}

* 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 in the region of 45-55dBA could be considered acceptable.

Appropriate criteria for Living/Dining/Kitchen Rooms are as follows:

Daytime (07:00 – 23:00)	35dB L_{Aeq}

Non-Residential Areas

BREEAM Hea 05 refers to the guidelines contained in BS8233, reproduced above, for non-residential areas.

Although some of the above standard guidance does not specifically outline the time periods over which these criteria should be considered suitable, in the case of BS 8233:2014, it does note the time period should be appropriate for the activity involved. Currently proposed hours of operation are not known for the commercial units and the relevant time period has therefore been assumed.

Based on guidance from BS8233:2014 we consider it appropriate to design to the following criteria:

Residential Lobby	Daytime (07:00 – 23:00 hours)	45dB L_{Aeq}
Community Space / Amenity	Daytime (07:00 – 23:00 hours)	40-45dB L_{Aeq}
Office Spaces	Office hours (08:00 – 20:00 hours)	40-45dB L_{Aeq}
Retail/Commercial units	Opening hours (08:00 – 23:00 hours)	50dB L_{Aeq}

External Amenity Areas

Outdoor Living Areas	Daytime (07:00-23:00 hours)	50-55dB L_{Aeq}

5.0 EXTERNAL BUILDING FABRIC ASSESSMENT

5.1 Background

Analyses of the external building fabric have been undertaken in order to ascertain the required acoustic performance of the glazing and other external fabric elements to achieve the project criteria stated within Section 4.5 above.

5.2 Assumptions

Our external building fabric analyses have assumed the following:

(a) Drawings

The assessment has been based on the latest drawings (plans and elevations) provided by Assael Architects.

(b) Noise Levels

The assessment has been based on the measured levels detailed in Section 2.4 and the predicted noise levels, from the CadnaA noise model, as detailed in Section 3.0 above.

(c) Room Absorption

The bedrooms are assumed to be acoustically "soft" with curtains and other soft furnishings. For the purposes of our analyses, we have assumed the absorption coefficients detailed in Table 7.

Table 7 – Bedroom Absorption Coefficients

Absorption Coefficient (α) at Octave Band Centre Frequency (Hz)							
63	125	250	500	1k	2k	4k	8k
0.15	0.18	0.25	0.27	0.31	0.32	0.32	0.32

The living room / kitchens are assumed to be less acoustically absorptive (with a hard floor finish, although with furnishings). For the purposes of our analyses, we have assumed the following absorption coefficients.

Table 8 – Living Room / Kitchen Absorption Coefficients

Absorption Coefficient (α) at Octave Band Centre Frequency (Hz)							
63	125	250	500	1k	2k	4k	8k
0.15	0.18	0.20	0.22	0.22	0.22	0.23	0.27

(d) External Wall

External non-glazed areas are understood to be of light-weight construction with brick outer leaf;

- Brickwork
- Cavity with thermal insulation
- Minimum 10mm Cement Particle Board (sheathing)
- Metsec type metal framing with Rockwool infill
- 2x layers of 12.5mm dense plasterboard internally

As such, we have assumed the following sound reduction indices (equating to an overall R_W of 58dB) for all non-glazed façade areas comprising the above construction:

Table 9 – Non-Glazed SRIs

Assumed Sound Reduction Index (dB) at Octave Band Centre Frequency (Hz)							
63	125	250	500	1k	2k	4k	8k
35	42	48	53	63	70	74	74

Should the proposals for non-glazed areas change, it is critical we are informed at the earliest opportunity as this could have a significant impact on the sound insulation performance requirements of the glazing systems.

(e) Ventilation

A "whole-house" mechanical ventilation (WHMV – Approved Document F System 4) system is proposed throughout the development.

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.

Table 10 – MVHR Internal Noise Level Criteria

Area / Room	Criteria for Mechanical Services L_{eq}	
	Trickle/Background	Boost/Purge
Bedrooms / Studios	NR25	NR30
Kitchen / Dining / Living Rooms	NR30	NR35
Common corridors and circulation areas	NR40	NR45

It should be noted the WHMV provides background trickle ventilation only. We understand windows are to be openable to provide purge/rapid ventilation. During those periods where windows are opened for purge/rapid ventilation, noise levels will naturally be increased internally.

5.3 Specification & Guidance Constructions

Appendix B attached details the sound reduction performance specification for the glazed elements of the external building fabric.

The glazing performance specifications apply to the glazing package as a whole, inclusive of glazing, louvres, spandrel panels, framing, opening lights, doors, seals, etc. The performance of the glazing system will depend on many factors, such as the glazing configuration, size of window panels, quality of framing, quality of sealing, etc.

For guidance purposes we would typically expect the following glazing configurations detailed below to prove commensurate with achieving the sound insulation performance specifications detailed within Appendix B.

Please note – *The glazing configurations described in Table 11 are given for costing purposes only. All window systems should be capable of meeting the performance specifications shown in Appendix B, with laboratory test certificates being made available in support of the quoted performance. Glazing proposals which simply reflect the guidance constructions indicated in this report will not, in isolation, be sufficient evidence that a window configuration will meet the performance specification.*

For guidance purposes RBA would typically expect the following glazing configurations to prove commensurate with achieving the sound insulation performance specifications detailed within Appendix C.

Table 11 – Glazing Guidance Constructions

Glazing Type	Glazing Configuration
G1	High performance laminated double glazing comprising 10mm glass / 12mm cavity / 8.4mm acoustically laminated PVB glass
G2	Medium performance laminated double glazing, e.g. 10mm glass/ 12mm cavity / 6.4mm acoustically laminated PVB glass
G3	Medium specification double glazing, e.g. 10mm glass/ 12mm cavity / 4mm glass
G4	Standard thermal double glazing with differing pane thicknesses, e.g. 4mm glass / 12mm cavity/ 6mm glass

5.4 Applicable Zoning

Due to the differences in the prevailing noise climate around the site, four primary glazing zones have been defined, as indicated on the façade zoning plans provided in Figures 10 to 14 in Appendix E attached.

Table 12 – Applicable Façade Zoning and Specifications

Façade Zone	Room Type	Glazing Type
Zone 1	Bedroom / Studio	G1
	Living/Dining/Kitchen Room *	G2
Zone 2	Bedroom / Studio	G2
	Living/Dining/Kitchen Room *	G3
Zone 3	Bedroom / Studio	G3
	Living/Dining/Kitchen Room *	G4
Zone 4	Bedroom / Studio	G4
	Living/Dining/Kitchen Room *	
	Residential Lobby / Commercial	

* Note – Living/Dining/Kitchen also covers all other room types, e.g. corridors, hallways, bathrooms, etc.

5.5 Flanking Specification

RBA also advise on the flanking specification for any curtain walling or continuous glazing systems proposed.

Flanking Performance Specification

The previous sections relate to external noise intrusion through the façade, including any curtain walling, to internal areas. Curtain walling systems can also compromise the sound insulation performance of separating walls and floors. It is therefore important that an additional specification for the curtain walling package be introduced, achievement of which will limit the amount of sound transfer across separating wall and floor lines through the curtain walling system. A flanking performance specification is attached within Appendix B – Section 2.0.

Achievement of the specification can be demonstrated by laboratory acoustic testing in general accordance with BS EN ISO 10848-2:2017. This can be a complex and costly testing procedure and therefore the supplier may, following tender reviews, be allowed to demonstrate by other means that the specification can be achieved. This is reflected in the specification wording within Appendix B.

The specification should also be introduced within the tender documentation for any other packages which could affect the transmission of flanking sound at separating wall and floor lines.

It is likely insulated double/split mullions and transoms will be required in order to achieve the flanking specification; these can have a large impact on the design of any curtain walling system and should be investigated at the earliest opportunity to ensure the specification is achieved.

5.6 Commissioning Testing

In order to discharge Part 2 of Planning Condition 32, commissioning is required. This will involve measurement of noise levels internally within residential units at the potential worst affected plots. This exercise will be undertaken by RBA Acoustics at completion with a full report issued to the Local Authority in order to discharge the condition.

6.0 EXTERNAL AMENITY ASSESSMENT

RBA Acoustics have also undertaken an assessment of external noise levels in the ground and rooftop amenity spaces of the proposed development, as well as the balconies. In line with BS 8233: 2014, WHO Guidelines and Planning Condition 32 1) b, which is presented in Section 4.0, the proposed target is an external level of 50-55 dBA $L_{eq,16hour}$ during the daytime.

Further to the guidance contained in Section 4.0, BS8233:2014 outlines the following guidance in relation to external noise in amenity areas.

> *"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 50 dB $L_{Aeq,T,}$ with an upper guideline value of 55 dB $L_{Aeq,T}$ which would be acceptable in noisier environments. However, it is also recognized 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.*
>
> *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 55 dB $L_{Aeq,T}$ or less might not be possible at the outer edge of these areas but should be achievable in some areas of the space."*

6.1 Rooftop Amenity Spaces

It is understood there are five proposed rooftop amenity areas, which are as follows:

- Block A – Fourth Floor (East elevation)
- Block A – Fourth Floor (South elevation)
- Block B – Eleventh Floor
- Block C – Seventh Floor
- Block D – Fourth Floor

From discussions with the Design Team, it is understood that a 1.2m parapet wall is proposed for the Block B rooftop space, which has been incorporated into the noise model. Meanwhile, the perimeter treatment for Blocks A, C and D is for an upstand with open railing. As such, this upstand is not expected to provide any acoustic screening. In order to provide the Design Team with options, the external areas of Blocks A, C, and D have been modelled with and without a 1.2m high, solid glass balustrade.

The location of rooftop amenity spaces is shown in Figure 15, with the results of the modelling exercise presented in Figures 16-20, attached in Appendix E.

Figure 16 shows the predicted noise levels in the north-eastern rooftop amenity space of Block A. Without additional screening provided by a 1.2m glass balustrade, the noise levels are just within the 55dB L_{Aeq} criterion, albeit a very small section close to roof edge marginally exceeds this. The adoption of a 1.2m high balustrade will lower noise levels, such that the 55dB L_{Aeq} criterion is comfortably achieved throughout.

Figure 17 shows the noise levels predicted within the Block A southern rooftop amenity space to comfortably achieve the 55dB L_{Aeq} criterion, without a balustrade. The adoption of a balustrade will see lower noise levels, though due to lack of direct sources, the improvement is marginal.

Figure 18 shows the noise levels predicted within the Block B amenity space, with the 1.2m parapet wall, which are comfortably below the 55dB L_{Aeq} criterion, generally achieving < 50dB.

Figure 19 shows the noise levels predicted within the Block C amenity space. Without any screening to this area the 55dB L_{Aeq} criterion is expected to be achieved. If lower noise levels are desired in this area, the adoption of a 1.2m balustrade to both the north and south boundary will see the noise levels in the majority of this area fall comfortable below 50dB L_{Aeq}.

Figure 20 shows the noise levels predicted within the Block D rooftop amenity space. Without any screening the noise levels are predicted to achieve the 55dB L_{Aeq} criterion. If lower noise levels are desired, the adoption of a 1.2m balustrade reduces noise levels further, such that the majority of this space is below 50dB L_{Aeq}.

6.2 Ground Floor Amenity Spaces

The layout of the ground floor amenity spaces can be seen in Figure 22 attached in Appendix E. From discussions with the Design Team, it is understood a brick wall is proposed for the southern site boundary. This has been modelled as 2m high.

Based on the results of this model, a scenario with a 2m high wall/fence around the basketball court has also been modelled. Predicted noise levels for both of these iterations can be seen in Figures 22 & 23. The contour grid/receiver height is 1.5m above Ground level.

As can be seen in Figure 22, the results indicate that GF Amenity areas 1-3 comfortably achieve the 55dB L_{Aeq} criterion. Some sections of GF Amenity 4 exceed the 55dB L_{Aeq} criterion by 1dB, however this is a marginal exceedance and should be considered acceptable. Meanwhile other parts of this area comply. Due to being surrounded by the outer areas of Block A, the noise levels in GF Amenity 5 fall substantially below the criterion. Without screening from the District and Overground Railway Lines, predicted noise levels within the basketball court are expected to exceed the criterion by more than 10dB.

Figure 23 presents noise levels in the basketball court if a 2m high wall is adopted along the western/north-west site boundary. Predicted levels are significantly lower at 55-56dBA. Though this surpasses the criterion, an exceedance of 1dB is marginal and should be considered acceptable.

6.3 Balconies

With regards to balconies specifically, the results of modelling indicate that the balconies on the façades overlooking the District and Overground Railway Lines towards the north-west and the those overlooking Manor Road exceed the 55dB L_{Aeq} criterion, by a margin of 4-11dB and 3-8dB respectively. The areas of the southern façade closest to the railway line are also predicted to exceed the criterion, but by a lesser margin.

As displayed in Figures 24-28, predicted noise levels for those areas set further back from the surrounding noise sources, and those overlooking the 'inner' part of the development, generally comply with the 55dB L_{Aeq} criterion, or only marginally exceed it.

Proposals currently make provision for a 1.2m high open steel railing. As such, these are not expected to provide any acoustic screening.

Implementing a 1.5m balustrade around the balcony would likely give losses of approximately 1-2dB, which is considered a negligible improvement. Resultant noise levels in areas overlooking the major noise sources would still exceed the "ideal" target criterion detailed in BS8233:2014 and WHO.

However, these balconies are considered more *for uses such as drying washing or growing pot plants* and therefore it is believed these noise limits should not be imposed upon these small balconies. The development design offsets this with generous provisions of alternative external amenity areas via rooftop terraces and the ground floor areas mentioned above, which do comply with the project criterion.

Guidance given in BS 8233: 2014 (see above) states that a target of 55dB ($L_{Aeq,T}$) in these spaces is 'acceptable', however in *"urban areas adjoining the strategic transport network... development should be designed to achieve the lowest practicable levels in these external amenity spaces but should not be prohibited*". The guidance also states that specifying target noise limits on small balconies is *"not necessarily appropriate"* and that the above target of 55dB should only be applied to *"larger balconies, roof gardens and terraces, which might be intended to be used for relaxation".*

Given the alternative offerings available to future residents by means of the ground floor gardens and rooftop terraces, it is considered the "standard" solution to balconies would be adequate.

6.4 Commissioning Testing

In order to discharge Part 2 of Planning Condition 32, commissioning is required. This will involve measurement of noise levels externally within rooftop terrace areas and ground floor amenity spaces. This exercise will be undertaken by RBA Acoustics at completion with a full report issued to the Local Authority in order to discharge the condition.

7.0 NOISE TRANSFER FROM COMMERCIAL TO RESIDENTIAL AREAS

7.1 Local Authority Criteria

The London Borough of Richmond-upon-Thames has imposed the following condition relating to noise transmission from commercial to residential units. The second part of the condition is to be discharged by commissioning testing.

Planning Condition 33 - Noise Transmission from Commercial Use to Noise Sensitive Receiver

1. Prior to the occupation of any of the commercial units hereby approved, a Sound Insulation Scheme for the sound insulation of party wall/floor/ceiling between commercial units and any structurally adjoining residential properties, shall be submitted to and approved in writing by the Local Planning Authority. The sound insulation scheme shall ensure that suitable airborne and impact sound insulation performances, and/or appropriate operational noise limits within the retail units, are provided such that LBRuT's required internal ambient noise levels for dwellings, as set out in Table 1 of the Revised Noise and Vibration Impact Assessment Rev08, are not exceeded within all residential properties. A high level of airborne and impact sound insulation, often only achievable by complex design methods that structurally isolate the noise generating and noise sensitive premises, will be required in situations such as where music and dancing or gym or health and fitness activities adjoin a residential use. Each case will take into account the specific circumstances of the proposed development, and the examples limits in Table 1 of the Revised Noise and Vibration Impact Assessment Rev08. In such situations, a scheme including the following information should be submitted to and approved by the Local Planning Authority prior to occupation;

i. Establish the noise and vibration transfer paths from source to noise sensitive receiver
ii. Establish the potential airborne and impact noise and vibration transfer magnitudes from source to noise sensitive receiver.
iii. Design sound isolation and insulation treatment such as a floating floor and wall treatment which mitigates and minimises adverse noise and vibration effects and is appropriate for the types of activity being undertake within the proposed development.
iv. Undertake post completion testing to demonstrate how noise and vibration has been controlled adequately.

2. Prior to the occupation of the commercial units hereby approved, a commissioning test assessment demonstrating compliance with the requirements of part (1) above shall be submitted to and approved by the Local Planning Authority. The assessment should make use of sound insulation tests and proposed operational sound levels within retail units. The sound insulation test shall be carried out in accordance with the methodology described in Annex B of the Building Regulations 2010 Approved Document E- Resistance to the passage of sound. The scheme approved by the Local Planning Authority shall be fully implemented in accordance with the approved details before the commercial use, hereby permitted, commences. No alteration to the party wall / floor / ceiling which undermines the sound insulation integrity shall be undertaken without the grant of further specific consent of the Local Planning Authority.

7.2 Proposed Constructions

Separating Floors

The separating floors between the commercial units (at Ground floor) and the residential flats above (at 1st floor) are proposed to comprise:

- 20mm Floor finishes
- 75mm floating screed
- Minimum 225mm thick, cast in-situ, full density, concrete slab
- * Ceiling to tenant's spec (tbc – see below)

Separating Walls

The proposed layouts are generally well planned, such that the commercial units only adjoin non-residential usages, such as communal stairwells, cores, bin store, cycle store, entrance halls and substation, i.e. less noise sensitive areas.

There is one location in Core AC of Block A where a commercial unit is directly adjacent to a residential flat. The proposed build-up for this wall is as follows:

- 140mm blockwork
- 10mm independence gap
- 50mm Stud with Rockwool infill
- 2 layers of 15mm dense plasterboard (e.g. BG SoundBloc or similar)
- Skim plaster finish

External Walls (Flanking)

The external walls are understood to comprise the following:

- 103mm brickwork
- 220mm cavity, full fill insulation
- 10mm Cement Particle Board
- 90mm SFS type framing with full fill Rockwool insulation
- 2 layers of 12.5mm dense plasterboard (e.g. BG SoundBloc or similar)

7.3 Discussion

Based upon similar constructions utilised on previous projects and significant testing results, we would anticipate an airborne sound insulation performance in the region of $D_{nT,w} + C_{tr}$ 50–55dB across the separating floors. These performances are some 5–10dB in excess of the minimum requirements of Approved Document E. An impact sound transmission performance in the region of 50dB $L'_{nT,w}$ is also likely, not that this is relevant when considering non-residential usages below residential areas, as per Approved Document E guidance.

An airborne sound insulation performance in the region of $D_{nT,w} + C_{tr}$ 50dB+ across the separating walls is also anticipated.

These predicted performances are a noticeable improvement on the standard constructions employed in many new-build developments and should be considered acoustically acceptable in reducing any potential noise transfer between these differing usage spaces in most cases, i.e. offices, shops, supermarket and other low source noise spaces.

The above anticipated performances are in compliance with Planning Condition 33 and should therefore be considered acceptable as a good starting basis.

7.4 Tenancy Lease Clauses

The commercial units will be handed over to a tenant as a typical "shell & core" base-build fit-out, i.e. the tenant will be responsible for the fitting out of the unit, including installation of a floor, ceiling & wall linings.

The design of the internal fit-out will need to ensure that no noise nuisance effects are realised within the adjacent residential accommodation during the operation of the units. However, information on the operational noise levels within the units is unknown at this stage of the development, as it will depend on the tenant and their desired environment and usage.

Based upon experience gained from previous similar projects it is anticipated a minimum of a standard plasterboard ceiling (MF grid with one layer of plasterboard and a minimum 100mm void) would likely be installed within the units, which would ensure further improvements to the performance of the separating floor is achieved, such that noise transfer is generally not an issue in the future for most usages.

It is typical for appropriate wording to be introduced within the Agreement for Lease with the Tenant to protect the residences, as follows;

"It is the Tenant's responsibility to install an appropriate ceiling throughout the commercial space, such that a minimum performance of $D_{nT,w}$ 65dB+ and $D_{nT,w}$ + C_{tr} 50dB+ is achieved across the separating floor (and separating wall) between the commercial space and the residential accommodation above at First floor level (and adjacent in Block A specifically). The base-build concrete transfer slab and blockwork walls offer a very good basis to achieve this performance value, but additional works may be needed. It is expected a standard plasterboard ceiling comprising a single layer of plasterboard suspended via an MF grid with a void of at least 100mm will be required, as a minimum, but this would need to be confirmed by means of sound insulation testing at completion of the Tenant's fit-out works to show typical operational noise levels within the adjacent residential areas will be kept to a level of NR15 or lower (on an L_1 basis)."

To cover any potential noisier usage, i.e. A3 and/or D1/D2 Class Use, and the potential for loud (amplified) music to be played in the commercial space or higher patron noise levels, we would advise the following additional wording to be introduced within the Agreement for Lease should this be the case:

"The tenant, when fitting out the unit, is to ensure that adequate sound insulation is provided to suit their intended use, to ensure the avoidance of a noise nuisance to other occupiers within the building. The tenant shall control noise emissions from the Leased Area at all times to prevent disturbance to others and shall comply with any additional noise emission limits or restrictions on operating hours imposed by the Local Authority and/or licensing authority.

Activity noise levels within the commercial space shall generally not exceed 80dBA, 75dB/octave L_1 during daytime hours and 5dB lower for night-time. Any loudspeakers shall not be rigidly connected to the structure, but shall be mounted on non-party structures via resilient brackets.

The tenant will be responsible for additional sound insulation measures if higher noise levels are anticipated or desired. In such cases:

(a) Additional sound insulation measures shall be designed such that activity noise is generally inaudible within residential units (<NR20 L_1 during daytime hours and <NR15 L_1 in the night-time). It may be necessary to install an upgraded ceiling comprising, for example, three layers of 15mm dense plasterboard on resilient hangers with mineral wool in the void, which should be a minimum of 300mm – dependent on the anticipated operational noise levels within the commercial space. Additional linings to walls and structural columns may also be required. In addition, noise break-out via the façade to external areas needs to be considered to ensure no noise nuisance is created to the nearby residential units. A suitably qualified Acoustic Consultant should be commissioned to assist in the assessment and design of any necessary measures.

(b) Details of typical/desired operational noise levels and the proposed additional sound insulation measures should be forwarded to The Landlord for approval before implementation.

(c) Following implementation of any additional sound insulation measures, acoustic tests shall be undertaken within the residential units above and adjacent to demonstrate their effectiveness. The Landlord reserves the right to impose further noise limits if required."

7.5 Commissioning – Future Assessment

As described in Section 7.1, Planning Condition 33 Part 2 requires commissioning testing in order to be discharged. The testing will determine the actual performance of the separating constructions and will be used as the basis for setting maximum permissible noise limits for the commercial spaces. This information can then be used to update the above stated tenancy agreements. This exercise will be undertaken by RBA Acoustics at completion with a full report issued to the Local Authority in order to discharge the condition.

8.0 PLANT NOISE EMISSION CRITERIA

8.1 Local Authority Criteria

The London Borough of Richmond-upon-Thames has imposed the following condition relating to building services plant noise. Once again, the second part of the condition is to be discharged by commissioning testing.

Planning Condition 34 – Building Services Plant Noise Control Condition

1. Prior to occupation of the relevant phase of development, a scheme for building services plant including heating, ventilation and air conditioning (HVAC) and kitchen extraction plant to which the application refers within that relevant phase, shall be submitted to and approved in writing by the Local Planning Authority which demonstrates that the following noise design requirements can be complied with and shall thereafter be retained as approved

i. The cumulative measured or calculated rating level of noise emitted from the mechanical services plant including heating, ventilation and air conditioning (HVAC) and kitchen extraction plant to which the application refers, shall be 5dB(A) below the existing background noise level, at all times that the mechanical system etc operates. The measured or calculated noise levels shall be determined at the boundary of the nearest ground floor noise sensitive premises or 1 meter form the facade of the nearest first floor (or higher) noise sensitive premises, and in accordance to the latest British Standard 4142; An alternative position for assessment /measurement may be used to allow ease of access, this must be shown on a map and noise propagation calculations detailed to show how the design criteria is achieved.

ii. The plant shall be isolated on adequate proprietary anti-vibration mounts to prevent the structural transmission of vibration and regenerated noise within adjacent or adjoining premises, and these shall be so maintained thereafter.

2. A commissioning acoustic test and report shall be undertaken within 2 weeks of mechanical services commissioning, in order to demonstrate that the above has been achieved. Where further mitigation is required, the report shall provide details of such shall and timetable for implementation. The Report and results of the test shall be submitted to and approved in writing by the Local Planning Authority within 28 days of such test. The development shall not be implemented other than in accordance with be approved scheme and retained as approved.

REASON: In order to safeguard the amenities of neighbours and future occupiers of the development.

8.2 BREEAM Pol 05 Criteria

Pol 05 in the BREEAM, UK New Construction document requires consideration be given to the atmospheric emissions from new items of plant. One Credit is available following on from the below:

1. 1 There are no noise-sensitive areas within the assessed building or within 800m radius of the assessed site.

OR

2. Where there are noise-sensitive areas within the assessed building or noise-sensitive areas within 800m radius of the assessed site, a noise impact assessment compliant with BS4142:2014(228) is commissioned. Noise levels must be measured or determined for:
    a. Existing background noise levels:
        i. at the nearest or most exposed noise-sensitive development to the proposed assessed site
        ii. including existing plant on a building, where the assessed development is an extension to the building
    b. Noise rating level from the assessed building.
3. The noise impact assessment must be carried out by a suitably qualified acoustic consultant.
4. The noise level from the assessed building, as measured in the locality of the nearest or most exposed noise sensitive development, must be at least 5dB lower than the background noise throughout the day and night.

As can be seen from the above in Section 8.1, the Local Authority criteria requires a level of 5dB below background noise levels, which is in line with the BREEAM requirement. As such achieving the criterion required by London Borough of Richmond-upon-Thames will also ensure the development is eligible for this BREEAM credit by default.

8.3 Criteria at Closest Existing Residential Receptors

On the basis of measured noise levels detailed in Table 2 in Section 2.4 and the Local Authority requirements, proposed noise limits are therefore as follows:

Table 13 – Plant Noise Emission Limits to Nearest *Existing* Receptors

Relevant Measurement Position	L_{Aeq} Noise Level limit of all operating plant (dB) at 1m from the nearest *existing* noise sensitive façade	
	Daytime (07:00-23:00 hrs)	Night-time (23:00-07:00 hrs)
Position 1 – North	34	29
Position 2 – South	35	33
Position 3 – East	40	29

In line with BS 4142: 2014, 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.

It should be noted that the above requirements are applied at the nearest residential adjacencies and alternative criteria should be incorporated if there are also commercial properties affected by the proposed plant installations.

8.4 Proposed Development Receptors

Where the nearest noise sensitive receptors to the plant locations are the windows of the residences that form part of the proposed 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 flats (namely, the bedrooms) in the event of partially open windows. BS 8233:2014 provides guidance on suitable internal noise levels of 35dB $L_{Aeq,16hr}$ (daytime) and 30dB $L_{Aeq,8hr}$ (night-time) – see Section 4.0 above for further information. A level of 5dB below these internal noise criteria is targeted.

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 nearest proposed development receptors should be below the levels detailed in Table 14 below.

Table 14 – Plant Noise Emission Limits to *Own Development* Receptors

Position	L_{Aeq} Noise Level limit of all operating plant (dB) at 1m from the nearest *proposed* Receptor	
	Daytime (07:00 – 23:00 hours)	Night-time (23:00 – 07:00 hours)
All Own Development Windows	45	40

In line with BS 4142, 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 in Table 14.

8.5 Emergency Plant

As emergency plant will only operate 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. Given that testing will only occur during daytime hours, this therefore sets a noise limit of 50dB L_{Aeq} for emergency plant.

8.6 Future Assessment

At this stage of the design, plant selections have not been made. However, the future plant installations do have the potential to impact on the proposed receptors associated with the Manor Road development itself, but also any existing neighbouring noise sensitive properties.

It is understood that provision has been made for plant installation at roof level. A full plant noise assessment (PNA) report will be prepared and issued to the Local Authority during the detailed design stage and will be suitable to discharge the relevant Planning Condition (34) imposed on the development.

In addition, commissioning at completion will be undertaken by RBA Acoustics with a full report issued to the Local Authority to discharge Part 2 of Planning Condition 34.

9.0 CONCLUSION

RBA Acoustics have undertaken noise monitoring at the proposed development site of the existing Homebase site at 389 Manor Road, Richmond. The measured noise levels are presented within this report. A CadnaA noise model has been created for the proposed development site. The resultant noise levels have been used in the assessment of the glazing requirements to ensure suitable internal noise levels are achieved at the proposed development with reference to BS 8233, WHO and the Local Authority's requirements. General guidance configurations have been suggested for the glazing constructions that should be capable of achieving the required specifications detailed within Appendix B. The CadnaA model has also been utilised to assess predicted noise levels in proposed external amenity spaces.

Analysis of proposed constructions separating commercial from residential units has been undertaken, to ensure Local Authority requirements can be achieved, with suitable wording for tenancy lease agreements supplied.

Finally, suitable plant noise emission criteria have also been developed based upon the survey results and the requirements of the Local Authority.

Appendix A – Acoustic Terminology

dB	Decibel - Used as a measurement of sound pressure level. It is the logarithmic ratio of the noise being assessed to a standard reference level.
dB(A)	The human ear is more susceptible to mid-frequency noise than the high and low frequencies. To take account of this when measuring noise, the 'A' weighting scale is used so that the measured noise corresponds roughly to the overall level of noise that is discerned by the average human. It is also possible to calculate the 'A' weighted noise level by applying certain corrections to an un-weighted spectrum. The measured or calculated 'A' weighted noise level is known as the dB(A) level. Because of being a logarithmic scale noise levels in dB(A) do not have a linear relationship to each other. For similar noises, a change in noise level of 10dB(A) represents a doubling or halving of subjective loudness. A change of 3dB(A) is just perceptible.
L_{Aeq}	The level of notional steady sound which, over a stated period of time, would have the same A-weighted acoustic energy as the A-weighted fluctuating noise measured over that period.
L_{An} (e.g. L_{A10}, L_{A90})	If a non-steady noise is to be described, it is necessary to know both its level and the degree of fluctuation. The L_n indices are used for this purpose, and the term refers to the level exceeded for n% of the time, hence L_{10} is the level exceeded for 10% of the time and as such can be regarded as the 'average maximum level'. Similarly, L_{90} is the average minimum level and is often used to describe the background noise.
$L_{max,T}$	The instantaneous maximum sound pressure level which occurred during the measurement period, T. It is commonly used to measure the effect of very short duration bursts of noise, such as for example sudden bangs, shouts, car horns, emergency sirens etc. which audibly stand out from the general level of, say, traffic noise, but because of their very short duration, maybe only a very small fraction of a second, may not have any effect on the L_{eq} value.

Appendix B – External Building Fabric Acoustic Specification

External facade constructions and components, such as brise soleil, grilles, ventilators, curtain walling systems or other architectural features, are not to give rise to intrusive whistling, creaking, rattling or other noises as a result of wind or other climatic effects.

The Contractor shall take reasonable precautions to avoid unwanted noise including creaking, rattling, and whistling being generated by the Contractors works when subject to environmental conditions (including wind) and thermal expansion over the life of the façade.

1.0 Window Sound Insulation Performance

Glazed units (inclusive of glazing, louvres, timber panels, spandrel panels, infill panels, framing, opening lights, balcony/terrace doors, seals, etc. as appropriate) should achieve the following minimum sound reduction indices as tested in general accordance with BS EN ISO 10140-2:2010:

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	23	27	29	36	41	42	52	52	39
G3	21	25	22	33	40	42	44	44	36
G4	19	23	22	27	38	40	41	41	33

Note: R_w is the "overall weighted sound reduction index" tested in a laboratory.

N.B. as the internal noise criteria are expressed in dBA terms, other frequency-specific performance levels may ultimately prove acoustically acceptable. Test data for representative samples of all glazing systems shall be submitted to RBA Acoustics for approval to demonstrate compliance with the above performance specifications.

2.0 Acoustic Flanking Specification

Extent

There is potential for any curtain walling or continuous system to transmit sound across the separating floors and walls, and to undermine the sound insulation performance.

The following specifications should therefore be introduced within the tender documentation to ensure the system components are adequately designed to control flanking sound transmission.

The following specifications apply to all curtain walling or continuous elements between residential units and, if applicable, between residential units and commercial areas. Between non-residential areas (e.g. commercial to commercial) a reduced performance of 50 dB $D_{n,f,w}$ is typically acceptable.

With regard to potential flanking through cladding panels, the specifications are commensurate with achieving relatively high sound insulation levels. Achievement of the specifications 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/twin insulated mullions and transoms are included.

Horizontal Flanking at Separating Wall Lines

The curtain walling/continuous system shall achieve a horizontal weighted normalised flanking level difference of at least 60 dB $D_{n,f,w}$ when tested in general accordance with BS EN ISO 10848:2017 or subsequent versions (the methodology amended accordingly).

The supplier shall demonstrate by the provision of previous test reports (and comparative calculations if required) that the specification can be achieved. The Client, however, reserves the right to insist on laboratory acoustic testing if any doubts remain as to the flanking performance of the system.

The curtain walling system shall provide suitable surfaces against which a good acoustic seal can be made with future separating walls.

Vertical Flanking at Separating Floor Lines

The curtain walling system shall achieve a vertical weighted normalised flanking level difference of 60 dB $D_{n,f,w}$ when tested in general accordance with BS EN ISO 10848:2017 or subsequent versions (the methodology amended accordingly).

The supplier shall demonstrate by the provision of previous test reports (and comparative calculations if required) that the specification can be achieved. The Client, however, reserves the right to insist on laboratory acoustic testing if any doubts remain as to the flanking performance of the system.

The curtain walling system shall provide suitable surfaces against which a good acoustic seal can be made with future separating floors.

Appendix C – Instrumentation

The following equipment was used for the measurements

Manufacturer	Model Type	Serial No.	Calibration	
			Certificate No.	Valid Until
Norsonic Type 1 Sound Level Meter	Nor140	1407476	U39224	19 October 2023
Norsonic Pre Amplifier	1209	22340		
Norsonic ½" Microphone	1225	358242	39223	
Norsonic Sound Calibrator	1255	125525265	U39222	19 October 2023
Norsonic Type 1 Sound Level Meter	Nor140	1407477	U39227	19 October 2023
Norsonic Pre Amplifier	1209	22341		
Norsonic ½" Microphone	1225	358196	39226	
Norsonic Sound Calibrator	1255	125525259	U39225	19 October 2023
Norsonic Type 1 Sound Level Meter	Nor140	1407793	4712338926	9 December 2023
Norsonic Pre Amplifier	1209	23228		
Norsonic ½" Microphone	1225	468954		3 December 2023
Norsonic Sound Calibrator	1255	125525796	Cal 022-2021-14779	8 December 2023

Appendix D – CDM Considerations

The likelihood the harm will occur can be assessed by applying an indicative score (from 1 to 5) as follows:

1 – Remote (almost never)
2 – Unlikely (occurs rarely)
3 – Possible (could occur, but uncommon)
4 – Likely (recurrent but not frequent)
5 – Very likely (occurs frequently)

The severity of harm can be assessed by applying an indicative score (from 1 to 5) as follows:

1 – Trivial (e.g. discomfort, slight bruising, self-help recovery)
2 – Minor (e.g. small cut, abrasion, basic first aid need)
3 – Moderate (e.g. strain, sprain, incapacitation > 3 days)
4 – Serious (e.g. fracture, hospitalisation > 24 hrs, incapacitation > 4 weeks)
5 – Fatal (single or multiple)

The rating value is obtained by multiply the two scores and is then used to determine the course of action.

Rating Bands (Severity x Likelihood)		
Low Risk (1 – 8)	Medium Risk (9 -12)	High Risk (15 – 25)
May be ignored but ensure controls remain effective	Continue, but implement additional reasonably practicable controls where possible	Avoidance action is required; therefore, alternative design solutions must be examined. Activity must not proceed until risks are reduced to a low or medium level

The following hazards pertinent to our design input have been identified and control measures suggested:

Hazard	Risk Of	At Risk	Rating			Control Measures	Controlled		
			L	S	R		L	S	R
Acoustic glazing - weight	Strain of neck, limbs or back. Fall from height.	Contractors	3	5	15	Provide sufficient manpower, lifting gear and structural support	1	5	5

L: Likelihood S: Severity R: Rating

Appendix E – Graphs and Figures

Manor Road, Richmond

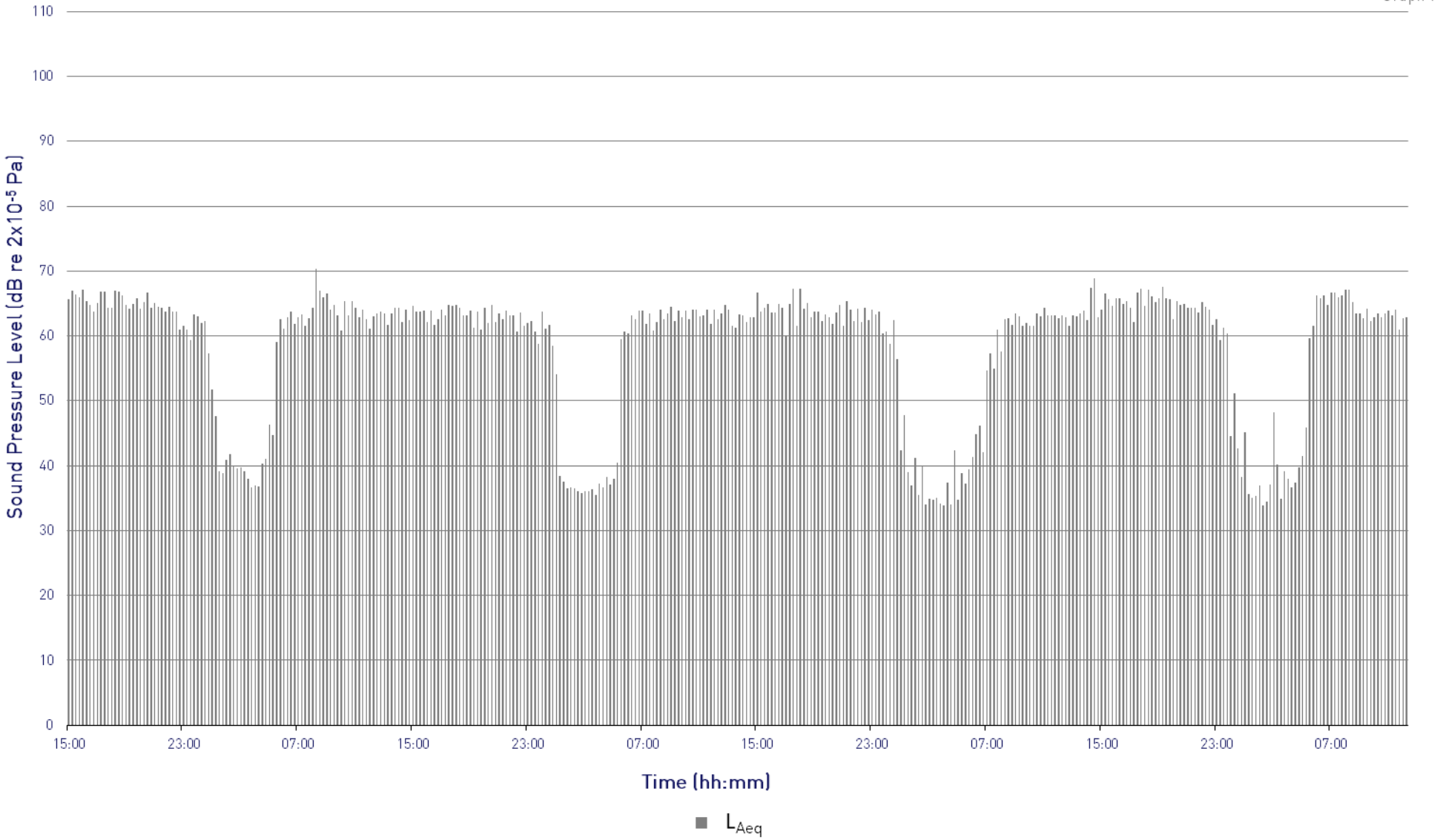
L_{Aeq} Time History 17-21 March 2022

Position 1 - North Site Boundary

RBA ACOUSTICS

Project: 11695

Graph 1



Manor Road, Richmond

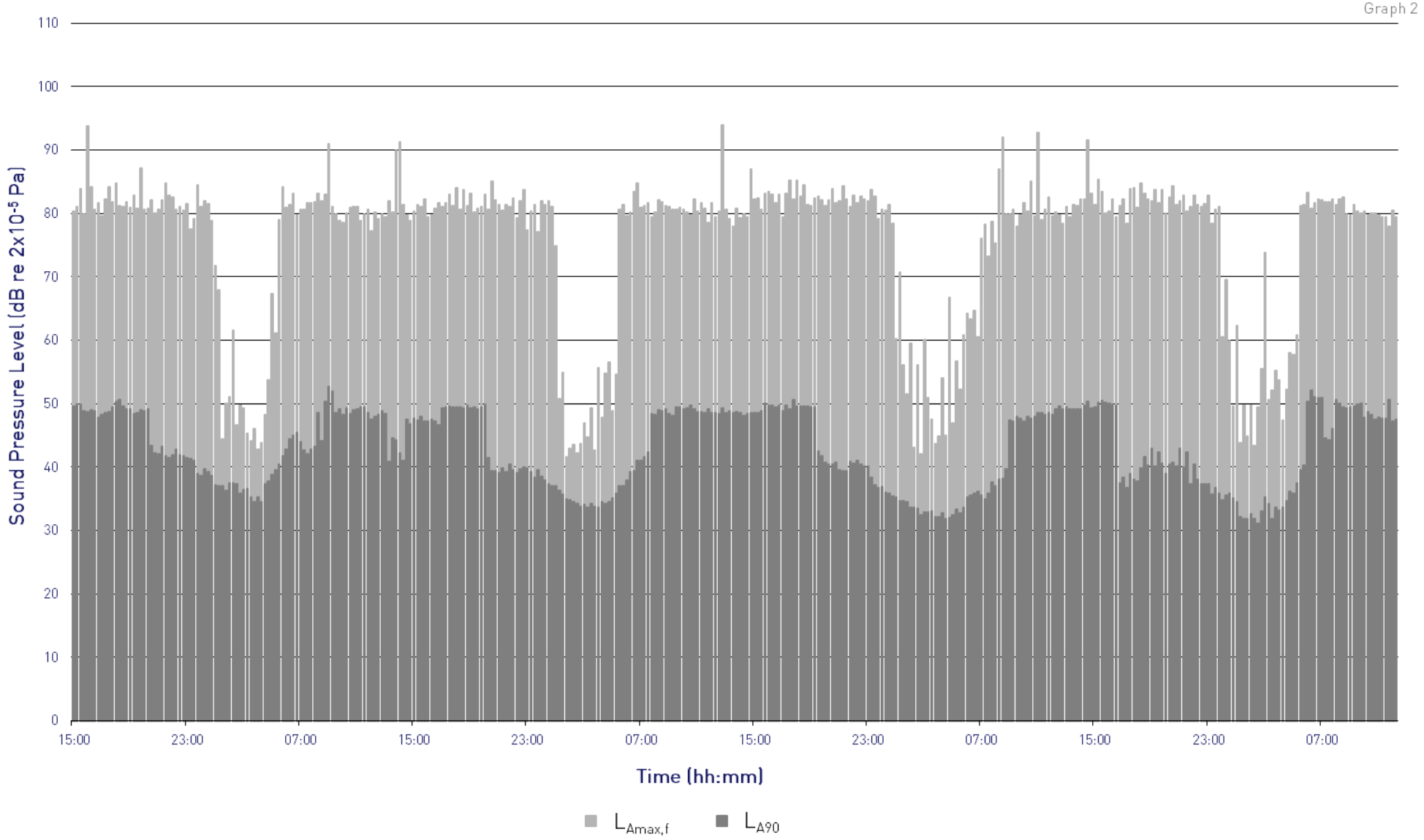
$L_{Amax,f}$ and L_{A90} Time History 17-21 March 2022

Position 1 - North Site Boundary

RBA ACOUSTICS

Project: 11695

Graph 2



Manor Road, Richmond

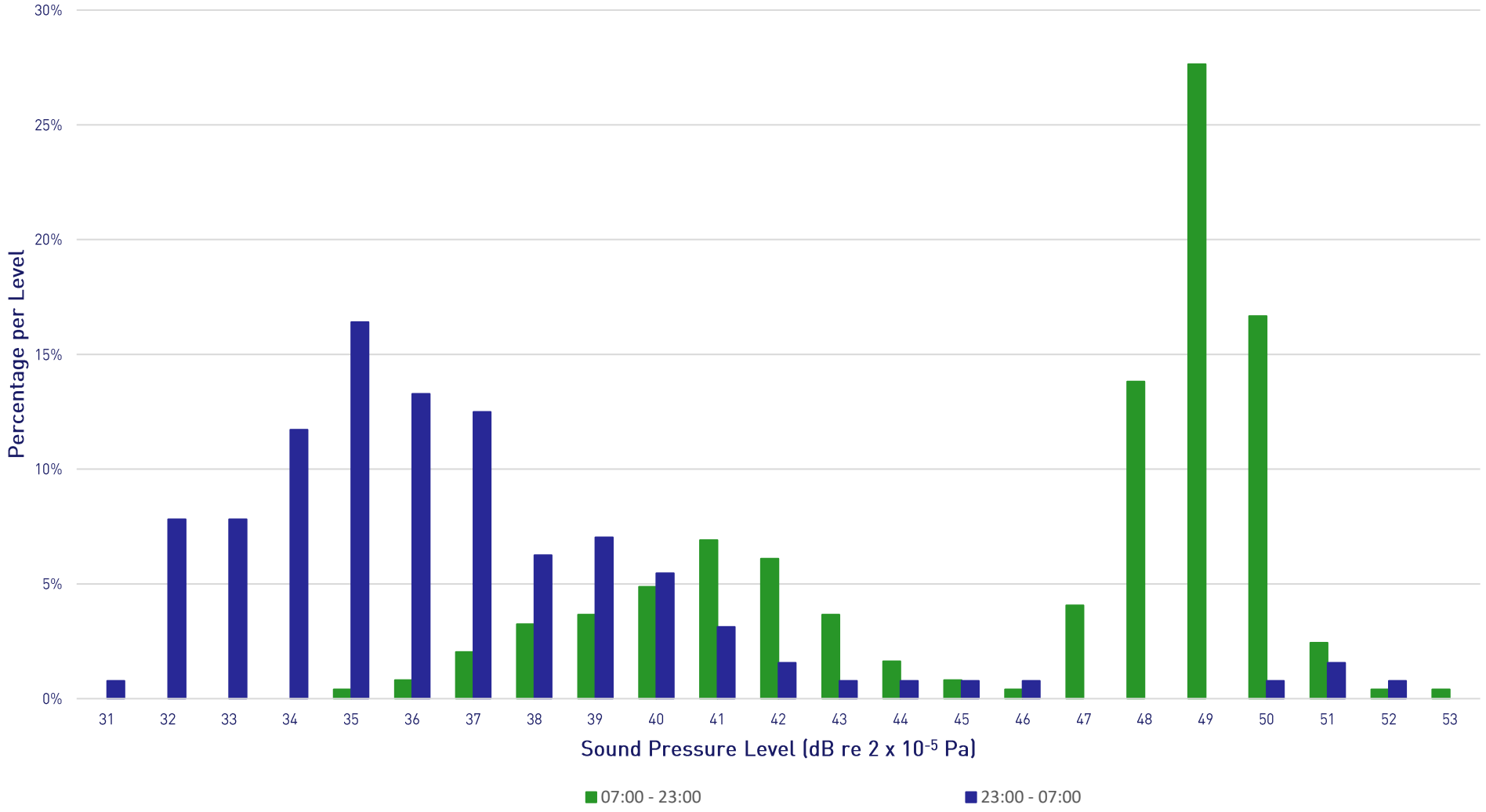
$L_{A90,15\ minutes}$ Histogram

Position 1 - North Site Boundary

RBA ACOUSTICS

Project: 11695

Graph 3



Monor Road, Richmond

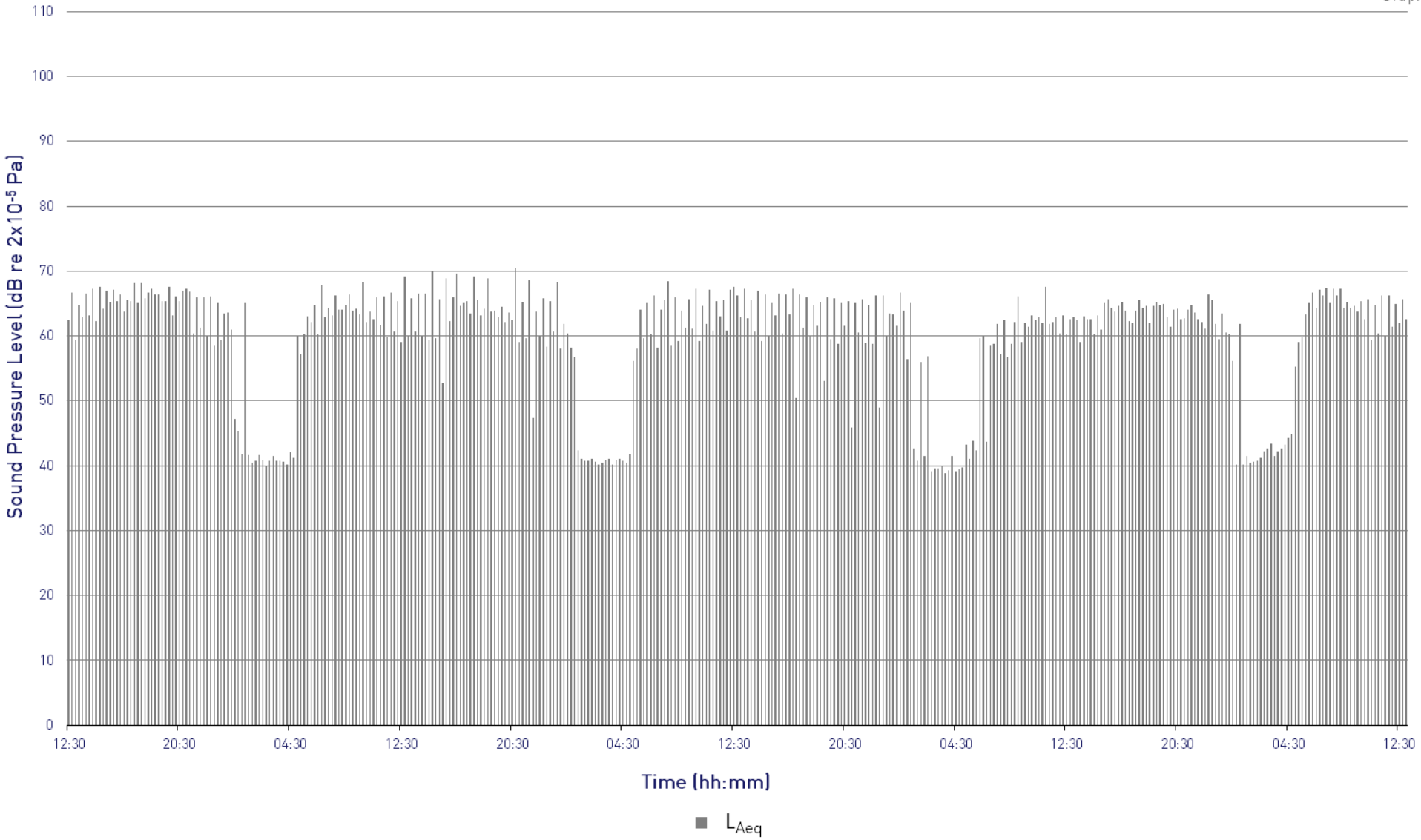
L_{Aeq} Time History 17-21 March 2022

Position 2 - South Site Boundary

RBA ACOUSTICS

Project: 11695

Graph 4



Monor Road, Richmond

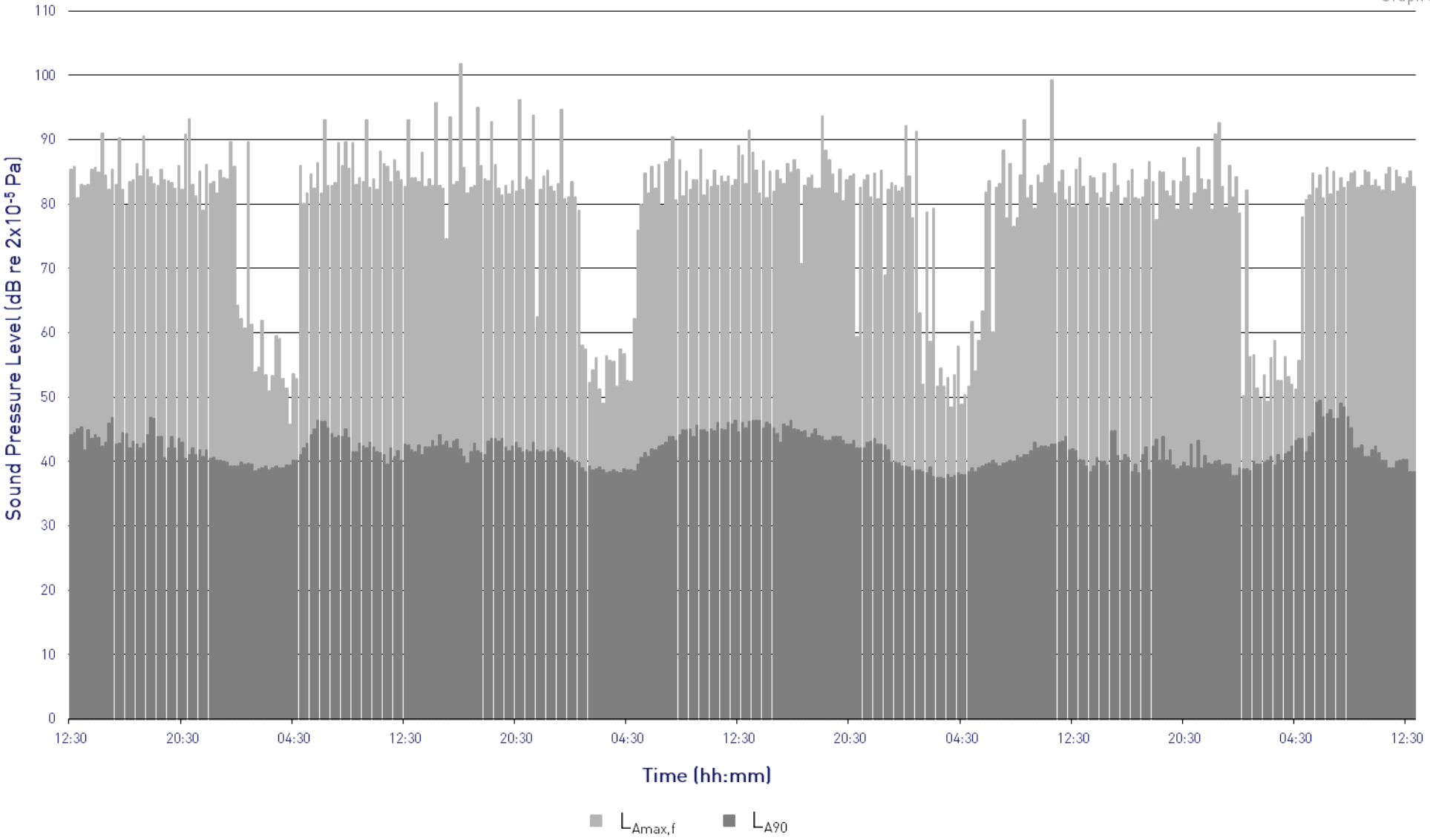
$L_{Amax,f}$ and L_{A90} Time History 17-21 March 2022

Position 2 - South Site Boundary

RBA ACOUSTICS

Project: 11695

Graph 5



Monor Road, Richmond

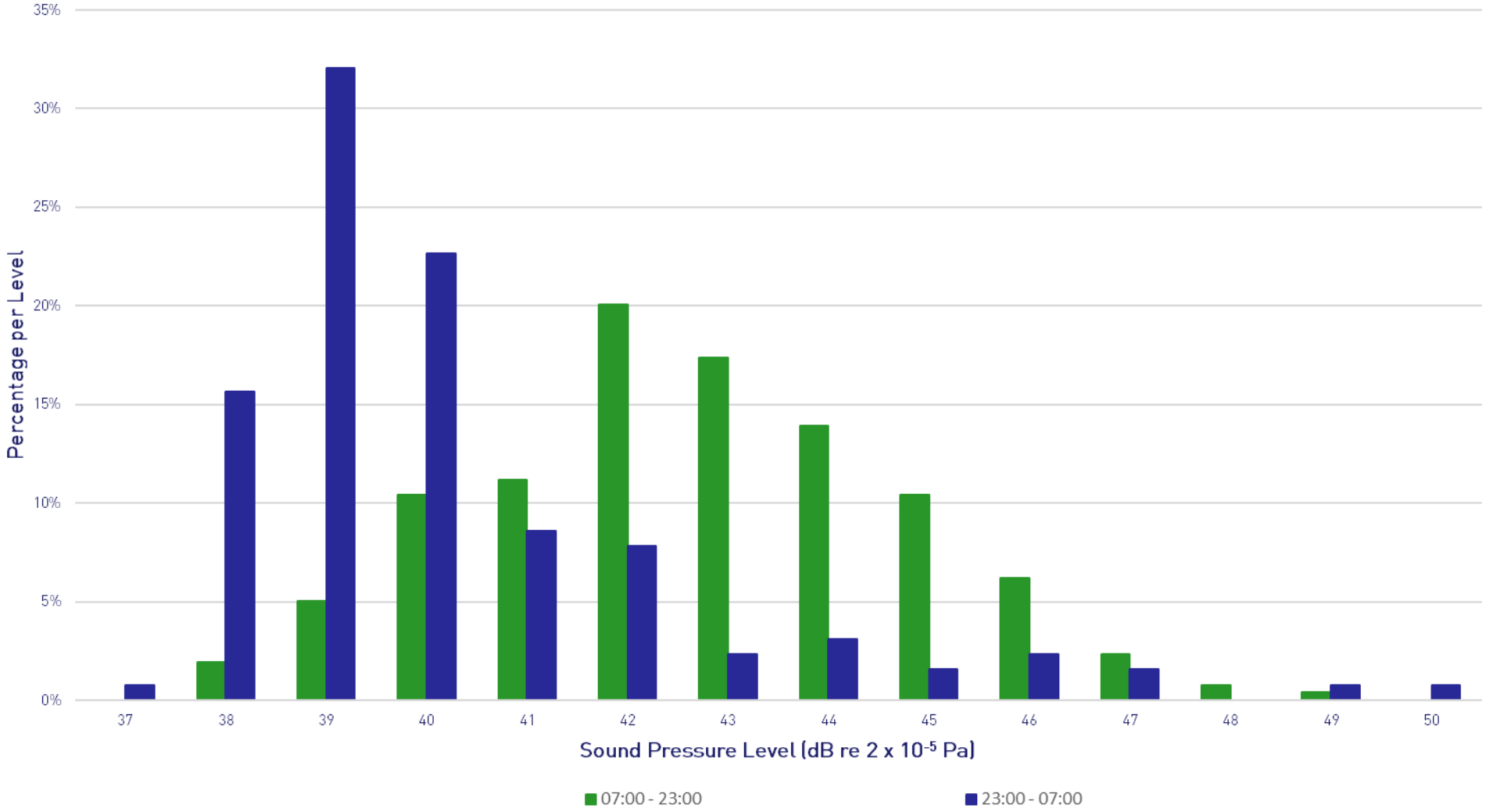
$L_{A90,15\ minutes}$ Histogram

Position 2 - South Site Boundary

RBA ACOUSTICS

Project: 11695

Graph 6



Manor Road, Richmond

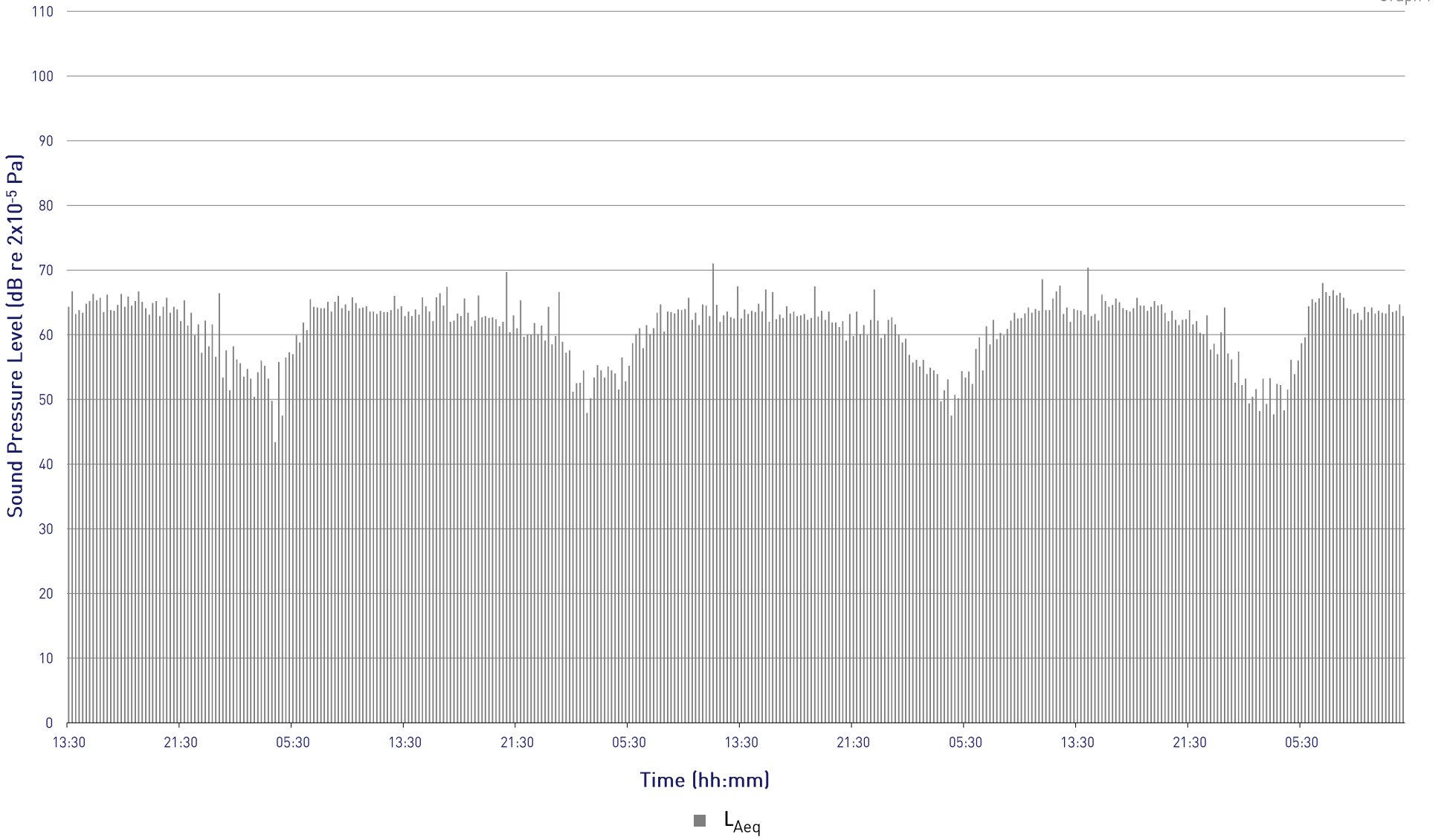
L_{Aeq} Time History 17-21 March 2022

Position 3 - East Site Boundary (Manor Road)

RBA ACOUSTICS

Project: 11695

Graph 7



Manor Road, Richmond

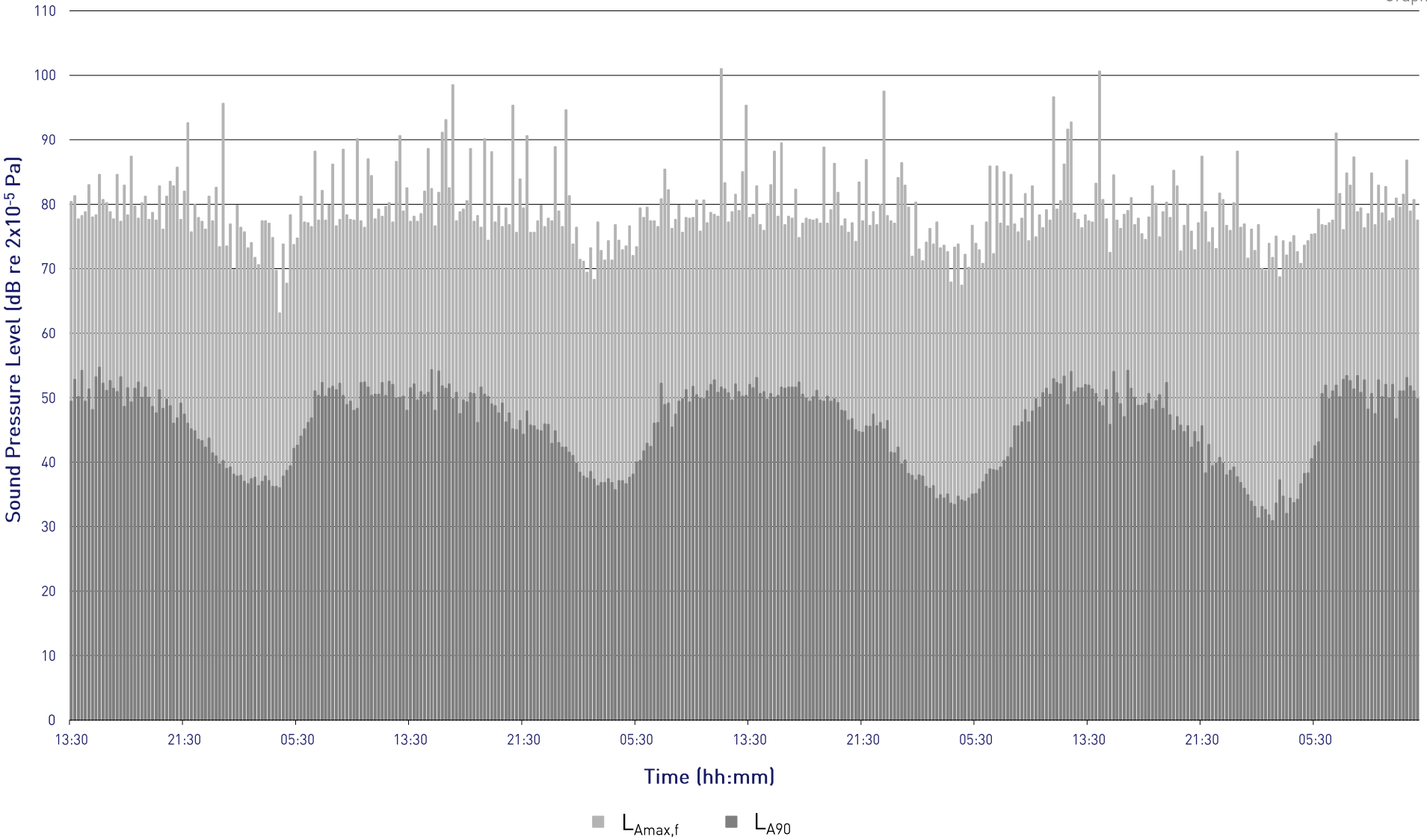
$L_{Amax,f}$ and L_{A90} Time History 17-21 March 2022

Position 3 - East Site Boundary (Manor Road)

RBA ACOUSTICS

Project: 11695

Graph 8



Manor Road, Richmond

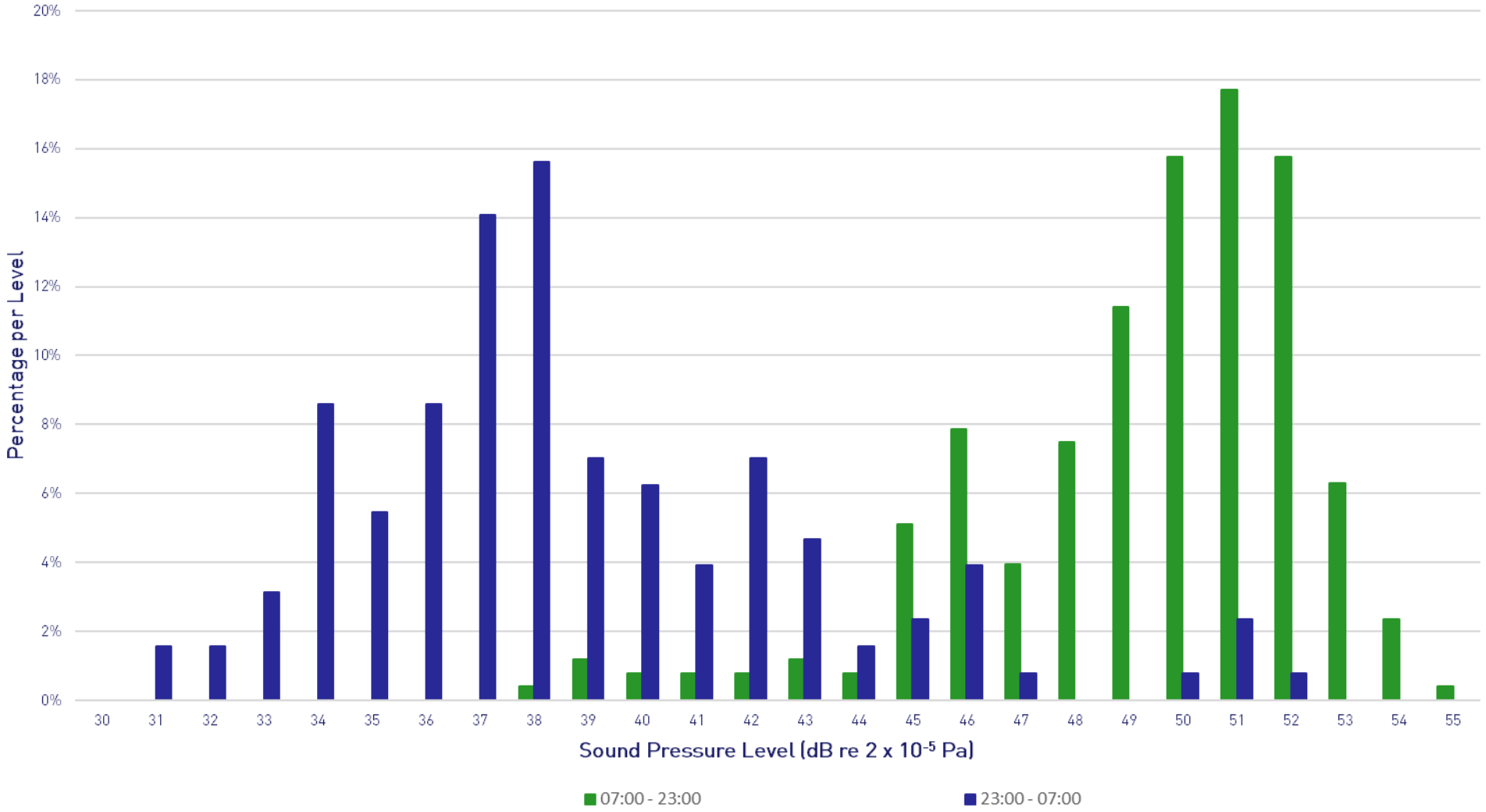
$L_{A90,15\ minutes}$ Histogram

Position 3 - East Site Boundary (Manor Road)

RBA ACOUSTICS

Project: 11695

Graph 9



389 Manor Road, Richmond
Existing Site Plan Showing Measurement Positions
Project 11695

Figure 1
12 May 2023
Not to Scale

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389 Manor Road, Richmond
Photograph Showing Noise Measurement Position 1
Project 11695

Figure 2
12 May 2023
Not to Scale

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389 Manor Road, Richmond
Photograph Showing Noise Measurement Position 2
Project 11695

Figure 3
12 May 2023
Not to Scale

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389 Manor Road, Richmond
Photograph Showing Noise Measurement Position 3
Project 11695

Figure 4
12 May 2023
Not to Scale

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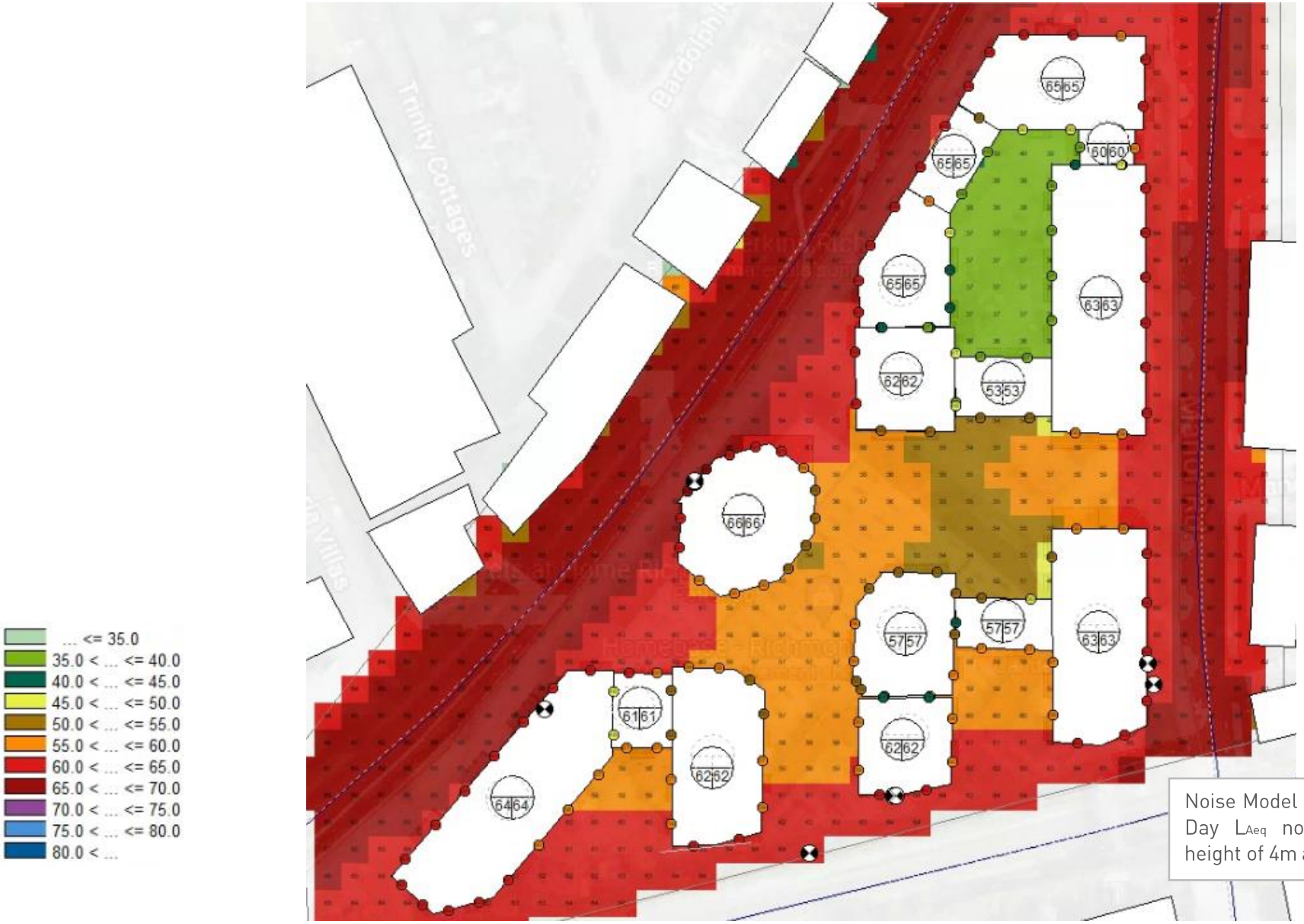

Noise Model Grid showing the Day L_{Aeq} noise levels at a height of 4m above ground

389 Manor Road, Richmond
Grid View from CadnaA Model – Day L_{Aeq}
Project 11695

Figure 5
12 May 2023
Not to Scale

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