ACOUSTICS CENTRAL

The Gaiety, 195 - 197 City Road, Cardiff

Planning Noise Report

20231205-0 R1

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The Gaiety, 195 - 197 City Road, Cardiff

Planning Noise Report

20231205-0 R1

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Executive Summary

Planning permission is being sought for the construction of a residential development at the location of the former Gaiety Bingo Hall at 195 - 197 City Road in Cardiff. The development will comprise 63 flats over 8 storeys, with some commercial use space on the ground floor.

To support the application, it will need to be demonstrated to the satisfaction of the local planning authority that the following have been sufficiently addressed:

- The control of noise from environmental sources to future habitable rooms formed as part of the development,
- The control of noise from environmental sources to external amenity space formed as part of the development,
- The control of noise from commercial use on the ground floor to residences above,
- The control of atmospheric-side noise emissions from any mechanical services plant installed as part of the development to existing sensitivities within the vicinity.

Following an environmental noise survey carried out at the development site, ambient and transient noise levels from environmental sources incident on the development have been quantified, along with existing background noise levels within the vicinity of the site.

Based on the measured external noise levels, we calculate that there will be external amenity areas available to future occupants of the site where noise levels are in-line with those set out in BS 8233, i.e. 50dB – 55dB L_{Aeq}. In light of this, no specific acoustic mitigation measures to control noise to external amenity areas are expected to be necessary.

Based on the measured noise levels and architectural proposals for the façade, sound reduction indices for the windows and vents have been determined as necessary to provide an appropriate internal noise climate for residential use.

By comparing the required sound reduction indices with available test data, examples of configurations and elements capable of providing the necessary performance have been given. This is expected to demonstrate the suitability of the site for residential use from a noise perspective.

In addition to noise from external sources, consideration needs to be given to noise transferring from the commercial use on the ground floor to the proposed residences above.

Owing to the nature of the source, adopting more stringent targets of 25 dB L_{Aeq} and NR 20 is expected to be appropriate. Using this as a basis, along with typical noise levels from commercial activities, sound insulation requirements for the separating floor have been derived.

Using the measured background noise levels, noise limits for mechanical services plant installed as part of the development have been established.

The specifics of the mechanical services scheme to be employed at the site are not known at this stage of development. However, it is expected that an appropriate scheme of mitigation will be capable of controlling noise from any proposed plant to within the established limits.

It is therefore expected to be appropriate to attach a condition to planning permission to require a plant noise assessment to be carried out at the appropriate stage of development, once more details regarding the mechanical services scheme are available, and an example of the type of condition has been given.

ACOUSTICS CENTRAL

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1 Introduction

1.1 Planning permission is being sought for the construction of a residential development at the location of the former Gaiety Bingo Hall at 195 - 197 City Road in Cardiff. The development will comprise 63 flats over 8 storeys, with some commercial use space on the ground floor.

1.2 To support the application, it will need to be demonstrated to the satisfaction of the local planning authority that the following have been sufficiently addressed:

- The control of noise from environmental sources to future habitable rooms formed as part of the development,
- The control of noise from environmental sources to external amenity space formed as part of the development,
- The control of noise from commercial use on the ground floor to residences above,
- The control of atmospheric-side noise emissions from any mechanical services plant installed as part of the development to existing sensitivities within the vicinity.

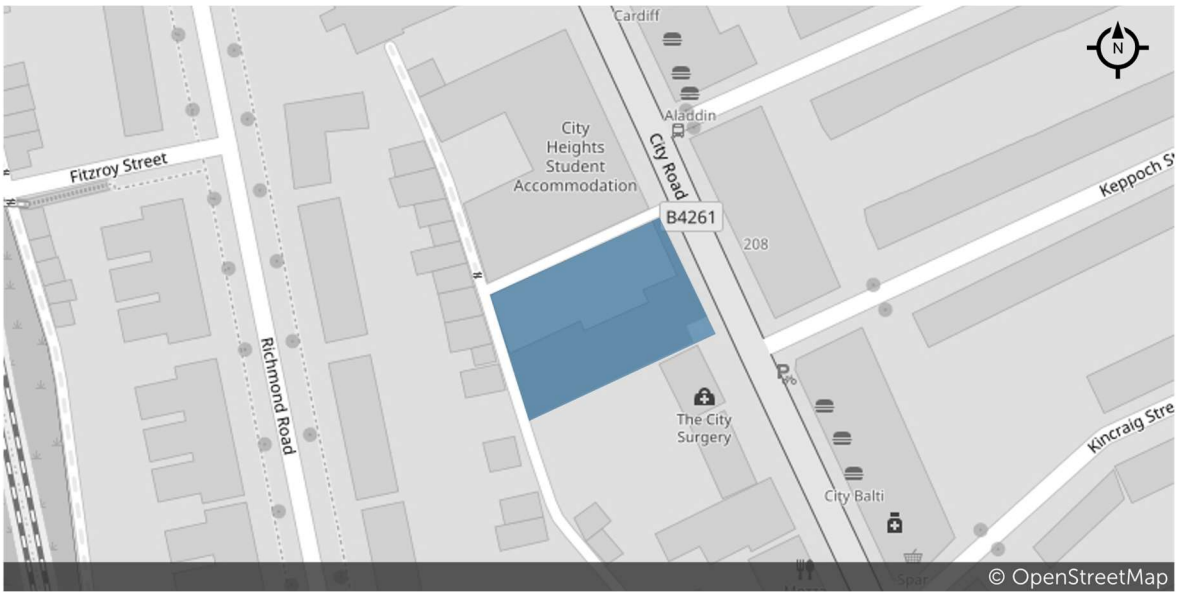
1.3 This report sets out the methodology and results of an environmental noise survey undertaken at the development site, the assessments undertaken to address the above, and any conclusion and recommendations arising.

1.4 The report is necessarily technical in nature, however every effort has been made to make it as clear as possible. In this regard, the Glossary of Acoustics Terms attached as Appendix A gives further explanation on relevant acoustics terminology used within the report.

2 Project Description

2.1 Location

2.1.1 The site is located at 195 - 199 City Road in Cardiff, CF24 3JD, and is indicated on Figure F1 below.



F1 Site Plan

2.2 Proposals

2.2.1 The proposed development would see the former bingo hall currently located on the site demolished, and a new seven-storey student residential building constructed in its place, with a single commercial unit at ground floor.

2.3 Site Context

2.3.1 The buildings to the west of the site on the opposite side of the rear access road are residential in nature. The neighbouring buildings to the north and south of the site incorporate commercial use at ground floors, with residential use for the remainder of the buildings, as do those on the opposite side of City Road to the east.

2.4 Noise Climate

2.4.1 The general ambient noise climate is predominantly controlled by traffic on City Road. Additional sources include noise from plant serving the neighbouring buildings, and infrequent vehicles on the rear access road.

3 Guidance and Standards

3.1 General

3.1.1 In order to support the planning application for the development, it is expected to be necessary to demonstrate to the local planning authority that the following have been suitably considered:

- The control of noise from environmental sources to future habitable rooms formed as part of the development,
- The control of noise from environmental sources to external amenity space formed as part of the development,
- The control of noise from commercial use on the ground floor to residences above,
- The control of atmospheric-side noise emissions from any mechanical services plant installed as part of the development to existing sensitivities within the vicinity.

3.1.2 With regards to assessing the impact of the existing environmental sources on the internal habitable spaces and any external amenity areas, as well as the impact of the commercial on the residential elements of the development, British Standard 8233[1] contains relevant guidance. As such, the relevant sections of BS 8233 are summarised below.

3.1.3 With regards to the issue of the impact of noise generated by any fixed plant installed as part of the development, British Standard 4142 contains relevant guidance. As such, the relevant sections of BS 4142 are also summarised.

3.2 External / Internal Noise Climate for Residential Use

3.2.1 British Standard BS 8233 is the relevant national guidance document detailing suitable external and internal noise levels within residences, and the relevant parts of the standard are detailed below.

External Noise Levels

3.2.2 With regards to appropriate external noise levels, BS 8233 states the following:

"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."

3.2.3 As such, the aim is to provide external amenity areas where noise levels do not exceed 55dB L_{Aeq}. However, as the above makes clear where this may not be possible, such as in urban areas

[1] BS 8233:2014 - Guidance on sound insulation and noise reduction for buildings

adjoining the strategic transport network, the aim will be to achieve the lowest practicable levels in external amenity spaces.

Internal Noise Levels

3.2.4 With regards to internal noise levels within sensitive rooms of residences (i.e. living rooms during the day and bedrooms during the night) BS 8233 sets out the levels given in the table below.

Activity	Location	07:00 to 23:00	23:00 to 07:00
Resting	Living Room	35 dB L_{Aeq}	-
Dining	Dining room/ area	40 dB L_{Aeq}	-
Sleeping (daytime resting)	Bedroom	35 dB L_{Aeq}	30 dB L_{Aeq}

T1 Indoor ambient noise levels for dwellings

3.2.5 Note 7 to the above table states:

"Where development is considered necessary or desirable, despite external noise levels above WHO guidelines, the internal target levels may be relaxed by up to 5 dB and reasonable internal conditions still achieved.".

3.2.6 As such, facades with noise levels incident in excess of WHO values (55dB $L_{Aeq,16h}$ during the daytime, 45dB $L_{Aeq,8h}$ during the night-time) designed to achieve internal levels of 40dB in living Room during the daytime and 35dB in Bedrooms during the night-time will still provide reasonable internal conditions for resting and sleeping with windows partially open for ventilation purposes.

3.2.7 Note 4 to the above tables states:

"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."

3.2.8 This allows the transient element of the noise climate to be considered in the context of the location, however no absolute quantitative targets are provided.

3.2.9 Previously, criteria took the form of 45dB $L_{AF,max}$ not being regularly exceeded, and the WHO study that derived the 45dB $L_{Amax,F}$ night time noise standard did so on the basis of 10 to 15 occurrences per night. On this basis, demonstration that $L_{Amax,F}$ values for typical intermittent noise events are not expected to exceed 45dB in bedrooms for than 10-15 times per night is expected to demonstrate suitable conditions for residential use.

Noise Transfer from Non-Residential Uses

3.2.10 It should be noted that the indoor ambient noise levels set out in BS 8233 are relevant where the source is of an anonymous nature, such as road traffic noise. When this is not the case, additional consideration may be required, such as lowering the noise targets.

3.2.11 With regards to the transfer of noise from the commercial use on the ground floor to the proposed residences above, as this is not an anonymous source there is the potential to give rise to a higher level of disturbance than from environmental noise.

3.2.12 To address this, we recommend adopting a more stringent target of 25 dB L_{Aeq} and L_{eq} NR 20 for this noise source. With regards to the latter, there is precedent of this being considered appropriate for use where there is a likelihood of a non-anonymous noise source incident on a residential premises[2].

3.2.13 Furthermore, where there is a concern of a disproportionate amount of energy at one part of the frequency spectrum – e.g. noise with a distinct frequency character, the use of an NR criterion is seen as a good solution. This is because the NR calculation process penalises a greater proportion of energy at any part of the spectrum as it is the closest point at any frequency to the criterion curve that determines the entire NR value. This is different from the L_{Aeq} calculation procedure for example, which could allow higher energy at one part of the spectrum to be compensated by less energy at other parts.

3.2.14 Taking the above into consideration, meeting the proposed criteria of 25 dB L_{Aeq} and NR 20 from ground floor commercial use is expected to demonstrate a suitable internal noise climate to support residential use.

3.3 Impact of Noise from Fixed Plant on Surroundings

3.3.1 When assessing the significance of noise from any fixed plant installed as part of the development on noise existing sensitive residential premises, British Standard 4142 contains relevant guidance.

3.3.2 BS 4142:2014 – "*Methods for rating and assessing industrial and commercial sound*" describes a method for assessing whether noise from factories, industrial premises, fixed installations, sources of industrial nature and commercial premises is likely to give rise to complaints.

3.3.3 Under the BS 4142 procedure, a noise rating level is calculated for the source at a receiver location (normally an existing residence or other sensitive premises). This rating level takes the predicted noise level at that location and adds various penalties for acoustic features expected to increase the significance of the source, such as tonality, impulsivity and intermittency.

3.3.4 The initial estimate of the impact of the specific sound is then calculated by comparing the measured background sound level with the rating level, and observing the following principles:

- Typically, the greater this difference, the greater the magnitude of the impact.
- A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context.
- A difference of around +5 dB is likely to be an indication of an adverse impact, depending on the context.

3.3.5 The lower the rating level is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact or a significant adverse impact. Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending on the context.

[2] Appeal Ref: APP/P4605/A/07/2039953 - 134, 139, 140, 141 Bromsgrove Road, Unity House and The Armouries site, Birmingham B5 6RG

Terminology

3.3.6 BS 4142 contains specific terminology which it's helpful to summarise here. In addition, Appendix A presents a Glossary of Acoustics Terms.

- **Specific sound, L_s (L_{Aeq})**: sound from the source being assessed – in this case the extract plant. The specific sound level is measured and reported using the L_{Aeq} index.
- **Residual sound (L_{Aeq})**: ambient sound remaining at the assessment location when the specific sound source is suppressed to such a degree that it does not contribute to the ambient sound. The residual sound level is also measured and reported using the L_{Aeq} index.
- **Ambient sound (L_{Aeq})**: totally encompassing sound in a given situation at a given time, usually composed of sound from many sources near and far. This includes the specific sound. The ambient sound level is also measured and reported using the L_{Aeq} index.
- **Background sound (L_{A90})**: this is the sound pressure level that is exceeded by the residual sound at the assessment location for 90% of a given time interval. It's used to indicate the underlying noise levels in the absence of more transient sources, and is measured and reported using the L_{A90} index.
- **Refence Time Interval, T_r**: this is the duration used when determining a Rating Level (see below). This is 1 h during the day from 07:00 h to 23:00 h and a shorter period of 15 min at night from 23:00 h to 07:00 h.
- **Rating level, $L_{Ar,Tr}$**: The rating level is the specific sound once any adjustments for the characteristic features of the sound that result in an increased likelihood of disturbance (such as tonality, impulsivity, intermittency etc.) have been taken into account. It should be noted that these adjustments are as heard at the receiver, and not simply a consequence of the plant operating sound levels and conditions. As the adjustments increase the rating level, these can be thought of as penalties. As such, the rating level is the specific sound level with penalties applied.

4 Environmental Noise Survey

4.1 General

4.1.1 In order to quantify the noise levels across the site, an environmental noise survey was carried out. The survey took place between 11h00 on Tuesday 30th of January and 11h00 on Thursday the 1st February 2024.

4.2 Guidance and Standards

4.2.1 The survey instrumentation, methodology and reporting of results has been carried out following guidance contained within British Standard 7445-1:2003 - *'Description and measurement of environmental noise - Part 1: Guide to quantities and procedures'*.

4.3 Measurement Positions

4.3.1 Measurements were made using 2no. unattended noise monitors located at the front (MP1) and rear (MP2) of the site. The following figure illustrates the locations of the measurement positions, and a description is given below the figure.

F2 Site plan indicating the location of the noise survey measurement position

MP1 The sound level meter microphone was fixed to the top of a pole secured to the site hoarding along the front of the site at height of approximately 3m above ground level to have an unobstructed view of the road. This position was approximately 3m back from the kerb of City Road. The primary purpose of this position was to quantify the environmental noise that will be incident on the proposed facades, as well as quantifying background noise levels residences within the vicinity are exposed to.

MP2 The sound level meter microphone was fixed to the top of a pole at approximately 3m above ground level on the rear site boundary. The primary purpose of this position was to quantify any environmental noise that will be incident on the proposed facades towards the rear of the site, as well as quantifying background noise levels residences within the vicinity are exposed to.

4.4 Noise Monitoring Equipment

4.4.1 All noise measurements were made with the equipment detailed in the following table.

Item	Manufacturer	Type
Sound Level Analyser	NTi	XL2-TA
Acoustic Calibrator	Castle	GA611

T2 Equipment used during internal noise measurements

4.4.2 The sound level analyser presented in the above table conform to the Type 1 specification as given in BS EN 61672-1:2003 - *'Electroacoustics - Sound level meters - Part 1: Specifications'*. The calibrator presented in the above table conforms to the Class 1 specification as specified in IEC 60942:2003 – *'Electroacoustics - Sound calibrators'*.

Traceable Calibration

4.4.3 The measurement instrumentation, including sound level analyser, preamplifier and microphone has undergone traceable calibration by either a competent laboratory or the equipment manufacturer within the last two years.

4.4.4 The acoustic calibrator has undergone traceable calibration by either a competent laboratory or the equipment manufacturer within the last year. The calibration certificates for the above equipment can be provided on request.

4.4.5 The noise measurement equipment was calibrated before and after the survey to ensure a consistent and acceptable level of accuracy is maintained. No significant drift (greater than 0.2dB) was noted to have occurred.

4.5 Data Recorded

4.5.1 Noise data was recorded in all relevant indices, including L_{Aeq}, L_{A90}, and $L_{AMax,F}$[3]. See attached Appendix A for an explanation of noise units used.

4.5.2 Octave band data for each of the above indices was also recorded, the filters for which met the requirements of BS EN 61260:1996, Class 1.

4.5.3 Noise data was recorded over consecutive 15-minute periods during the unattended measurements.

[3] Maximum A-weighted sound pressure level using time-weighting "F" and "S". As stated in BS EN 61672–1:2003 Design-goal time constants are 0,125 s for time-weighting F (Fast) and 1 s for time weighting S (Slow).

4.5.4 Audio recordings were also made throughout the duration of the survey for the purposes of reviewing any noise events potentially atypical of the general noise climate.

4.6 Meteorological Conditions

4.6.1 During the survey, temperatures were generally cold, ranging between 8 °C during the day to 1 °C during the night. Wind speeds were generally low, being generally below 5 m/s. Conditions were dry at the commencement and termination of the unattended measurements, and no precipitation was reported on public weather information. Skies ranged from being clear to cloudy.

4.7 Results

4.7.1 The attached time-history figures TH1-TH4 present the unattended noise levels measured at MP1 and MP2.

Ambient & Transient Noise

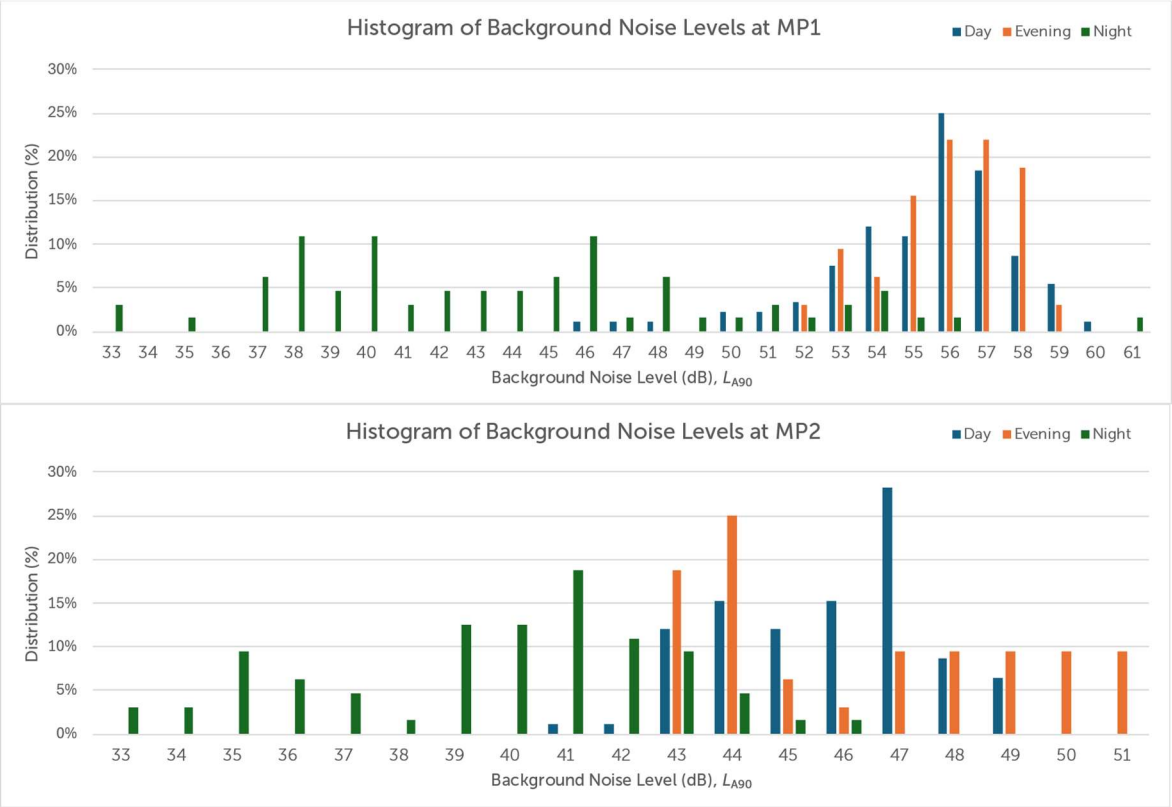
4.7.2 A summary of the ambient (L_{Aeq}) and transient (L_{AMax}) results is presented in the following table.

Period / Index	MP1	MP2
Daytime Ambient, $L_{Aeq,16h}$	67.5 dB	53.3 dB
Night-time Ambient, $L_{Aeq,8h}$	64.4 dB	47.4 dB
Night-time Transient, $L_{AFMax,10th\ Highest}$	82.6 dB – 83.2 dB	62.9 dB – 64.0 dB

T3 Summary of Ambient & Transient Noise Survey Results

Background Noise Levels

4.7.3 The following figures present histograms of the background noise levels measured at MP1 and MP2 during the day (07h00-19h00), evening (19h00-23h00) and night-time (23h00-07h00) periods.



F3 Histograms of background noise levels at MP1 and MP2 during the day, evening and night.

4.8 Mechanical Services Noise Limits

4.8.1 As detailed in section 3.3, the current version of BS 4142 addresses the issue of the likelihood of creating an adverse impact. The guidance states that where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending on the context.

4.8.2 On this basis, the limits for the rating level calculated as per methodology set out in BS 4142 to apply at 1m from noise sensitive premises within the vicinity of the plant locations are as shown in the following table.

Location	Rating Level Limits, $L_{Ar,Tr}$ dB		
	Day (07h00 – 19h00)	Evening (19h00 – 23h00)	Night (23h00 – 07h00)
Residences Fronting on to City Road	52	52	37
Residences at Rear	43	43	35

T4 Rating Noise Limits for Fixed Plant Installed as part of the Development

4.8.3 It is worth reiterating that plant that is tonal, impulsive, intermittent, or has other features that distinguish it from the general noise climate as heard at the receiver locations will need to be adequately penalised when determining the rating level in accordance with methodology set out in BS 4124.

5 External Noise in Amenity Spaces

5.1 As discussed in Section 3.2, BS 8233 sets out the aim for external amenity spaces which is to provide noise levels at or below 55dB L_{Aeq}, whilst recognising that this may not be possible in higher noise areas where development is desirable, such as city centres or urban areas adjoining the strategic transport network.

5.2 As shown in Table T3, in this case external levels were measured to be around 68 dB $L_{Aeq,16h}$ at the parts of the site exposed to the highest noise levels, falling to 53 dB $L_{Aeq,16h}$ at more sheltered parts of the site away from City Road.

5.3 Taking this into account, along with the proposed building layout which includes external areas screened from the road, meeting the aims of BS 8233 to provide external amenity areas with noise levels at or below 55dB L_{Aeq} is expected to be feasible.

6 Internal Noise Levels

6.1 General

6.1.1 In order to determine the acoustic specification for elements forming the building façade, a noise break-in assessment has been undertaken. In principle, this starts with the measured external noise levels at the site, takes an allowance for the various elements forming the façade, and compares the resultant levels with the internal noise criteria set out in Section 3.2.

6.1.2 The procedure used to carry out the break-in assessment is presented in Paragraph 2.1 of Annex G of BS 8233.

6.1.3 For the purposes of this assessment, it is assumed that the glazing, along with any penetrations required for ventilation will form the weakest elements of the façade. These will therefore dictate the achievable sound reduction from the building envelope. This is a reasonable assumption if the external walls were to incorporate masonry elements for example, or use cladding, curtain walling etc. and appropriate internal linings with a high sound reduction index.

6.2 Glazing and Ventilation

6.2.1 Being both typically weaker in terms of sound insulation than non-glazed elements of the external wall, noise breaking-in through the glazing and ventilation needs to be considered as a whole.

6.2.2 The ventilation strategy has not been confirmed at this stage, and as such an allowance for ventilation to be provided by passive means has been included within our assessment. Based on the external noise levels set out in Table T3, opening windows – even partially – will cause internal noise levels to exceed the criteria set out in Section 3.2. As such, any natural ventilation will need to be provided by acoustically attenuating natural vents.

6.2.3 In order to determine the acoustic specification for the glazed and ventilation elements, various configurations have been assessed. Calculations undertaken as part of this to are presented on the attached Calculation Sheets CS1 – CS6.

6.2.4 Based on the attached calculations, sound insulation requirements for two types of glazing and two types of vent have been established. The locations for the two types are identified in the following figure, and the acoustic requirements for each of these are set out subsequently.

F4 Proposed First Floor Layout Illustrating Locations of Different Glazing and Ventilation Requirements

Glazing

6.2.5 The following table presents the octave band sound reduction indices required by the glazing in windows at any location on the site.

	Sound Reduction Index (dB) at Octave band with Centre Frequency (Hz)						
	125	250	500	1k	2k	4k	R'_w
Glazing Type A	25	27	38	48	47	55	41
Glazing Type B	20	18	28	38	34	38	31

T5 Sound reduction performance required for windows to habitable rooms

6.2.6 The sound reduction performance figures quoted above are valid for the building glazing elements taken as a whole and in their installed condition. The specification therefore applies to the glass, the frames or mullions, all seals on any openable part of the system and any openings in the frames required for ventilation purposes. This list is not exhaustive: no part of the glazed element shall cause the above figures not to be achieved.

6.2.7 Based on published glazing manufacturers' data, the following glazing and airspace configurations are expected to be capable of providing the required sound reduction indices for the indicated glazing types:

- Glazing Type A – 6/ 16 /8.8: 6mm pane, 16mm airspace, 8.8mm acoustically laminated pane.
- Glazing Type B – 6/ 16 /6: 6mm pane, 16mm airspace, 6mm pane.

Ventilation

6.2.8 On the assumption a single vent is required to habitable rooms within the development, the following table presents the octave band element normalised level differences for the vents.

	Element Normalised Level Difference (D_{ne}, dB) at Octave band with Centre Frequency (Hz)						
	125	250	500	1k	2k	4k	$D_{n,e,w}$
Vent Type A	42	43	43	49	64	64	49
Vent Type B	35	35	34	36	34	34	35

T6 Acoustic performance of vents to habitable rooms

6.2.9 Based on data presented in the draft version of Approved Document E, the following trickle vents are expected to be capable of providing the required element normalised level differences:

- Vent Type A – Passive attenuated in-wall ventilator.
- Vent Type B –Trickle vent with direct air path

6.2.10 Ultimately any vent capable of meeting the above performance requirements may be used.

Resultant Levels

6.2.11 By using the above configuration, we calculate internal noise levels during the day of ≤35 dB $L_{Aeq,16h}$, and during the night of ≤30 dB $L_{Aeq,8h}$, in line with the recommendations of BS 8233 as appropriate for residential use.

6.2.12 In addition to general ambient levels, it is also important to consider the effects of high transient noise levels during the night, which is the purpose of the L_{AMax} noise index.

6.2.13 By using $L_{Max,F}$ spectra with A-weighted levels equal to the values given previously in Table T3, internal $L_{Amax,F}$ values have been calculated to have 10th highest value of ≤45 dB $L_{Amax,F}$, As such, internal $L_{Amax,F}$ values are not expected to exceed 45dB more than 10 times per night, meaning the noise from transient events is in line with the guidance set out in BS 8233.

6.2.14 As such, using façade elements with sound reduction values presented in this section is expected to provide sufficient protection from general ambient levels, as well as transient noise levels during the night. This is expected to demonstrate the suitability of the site for residential use from a noise perspective.

7 Noise Transfer

7.1 General

7.1.1 As set out in Section 3.1, it is expected to be necessary to demonstrate that due consideration has given to the control of noise from commercial use on the ground floor to residences above.

7.1.2 In order to address this, and determine any measures necessary to control noise transfer between the commercial and residential elements of the project, a noise transfer assessment has been carried out.

7.1.3 In principle, this starts with provisional internal noise levels from operation of the commercial element, and determines the sound reduction required by the separating elements by comparing the resultant levels with the proposed criteria in this case 25 dB L_{Aeq} and NR 20.

7.2 Operational Noise Levels

7.2.1 For the purposes of the assessment, reverberant[4] sound pressure levels as presented in the following table have been assumed within the commercial area. To ensure a worst-case assessment, these are based on higher noise level generating non-domestic premises, such as a restaurant, and are therefore expected to form an appropriate basis to facilitate this assessment.

	Reverberant Sound Pressure Level, L_{PRev} (dB) at Octave band with Centre Frequency (Hz)								
	63	125	250	500	1k	2k	4k	8k	A
Commercial Area	65	73	71	75	73	69	62	56	77

T7 Highest expected noise levels from operation of the Commercial Area

7.3 Transfer Assessment

7.3.1 Based on the above source noise levels, noise transfer calculations have been undertaken to determine the level of sound insulation needed to be provided by the separating floor to meet the internal noise criteria.

	Apparent Sound Reduction Index, R' (dB) at Octave band with Centre Frequency (Hz)								
	63	125	250	500	1k	2k	4k	8k	R'_W
Separating Floor Construction	35	40	45	52	59	63	67	67	56

T8 Sound Reduction Indices Required by Separating Floor

[4] Reverberant Field – This represents noise that undergoes multiple reflections from surfaces on the room boundary before arriving at the receiver. Reverberant field noise levels are assumed to be the same at all locations within the space, and as such are irrespective of distance from the sources. The level of reverberant noise is proportional to the amount of acoustic absorption present in the space.

7.3.2 The noise transfer calculation undertaken as part of the assessment is presented in that attached Noise Transfer Calculation Sheet NTCS1. The resultant noise levels are summarised in the following table.

	Reverberant Sound Pressure Level, L_{PRev} (dB) at Octave band with Centre Frequency (Hz)									
	63	125	250	500	1k	2k	4k	8k	A	NR
1st Floor Bedroom	29	34	27	24	15	7	-4	-10	24	20

T9 Calculated resultant noise levels

7.3.3 As the above shows, by using a separating floor construction which provides the apparent sound reduction indices set out in Table T8, the proposed criteria of 25 dB L_{Aeq} and NR 20 are expected to be met.

8 Mechanical Services Noise

8.1 As set out in Section 3, it will be important to ensure noise from mechanical services plant installed as part of the development is suitably controlled such that it does not give rise to a significant adverse impact on existing residents within the vicinity.

8.2 To this end, existing background noise levels at the site have been quantified, which would be used to form the basis of a BS 4142 assessment (described in Section 3.3). These are set out below.

Location	Rating Level Limits, dB		
	Day (07h00 – 19h00)	Evening (19h00 – 23h00)	Night (23h00 – 07h00)
Residences Fronting on to City Road	52	52	37
Residences at Rear	43	43	35

T10 Rating Noise Limits for Fixed Plant Installed as part of the Development

8.3 Given the current stage of development, specific details regarding any plant to be installed as part of the development are not known. However, it is expected that an appropriate scheme of mitigation will be capable of controlling noise from proposed plant to within the limits set out in the table above.

8.4 It is therefore expected to be appropriate to attach a condition to planning permission to require a plant noise assessment to be carried out at the appropriate stage of development, once more details regarding the mechanical services scheme are available. An example of the type of condition is given below:

"Noise arising from mechanical services plant installed as part of the development shall not give rise to a rating level higher than the existing representative background sound levels (given in terms of $L_{A90,15min}$) at the nearest noise-sensitive premises. The measurements, assessment and reporting shall be carried out according to BS 4142:2014. To demonstrate that this will be achieved, a noise assessment prepared by a suitably qualified acoustician must be submitted to and approved by the local planning authority prior to operation of the mechanical services plant".

9 Conclusions

9.1 Following an environmental noise survey carried out at the development site, ambient and transient noise levels from environmental sources incident have been quantified, along with existing background noise levels within the vicinity of the site.

9.2 Based on the measured external noise levels, we calculate that there will be external amenity areas available to future occupants of the site where noise levels are in-line with those set out in BS 8233, i.e. 50dB – 55dB L_{Aeq}. In light of this, no specific acoustic mitigation measures to control noise to external amenity areas are expected to be necessary.

9.3 Based on the measured noise levels and architectural proposals for the façade, sound reduction indices for the windows and vents have been determined as necessary to provide an appropriate internal noise climate for residential use.

9.4 By comparing the required sound reduction indices with available test data, examples of configurations and elements capable of providing the necessary performance have been given. This is expected to demonstrate the suitability of the site for residential use from a noise perspective.

9.5 In addition to noise from external sources, consideration needs to be given to noise transferring from the commercial use on the ground floor to the proposed residences above.

9.6 Owing to the nature of the source, adopting more stringent targets of 25 dB L_{Aeq} and NR 20 is expected to be appropriate. Using this as a basis, along with typical noise levels from commercial activities, sound insulation requirements for the separating floor have been derived.

9.7 Using the measured background noise levels, noise limits for mechanical services plant installed as part of the development have been established.

9.8 The specifics of the mechanical services scheme to be employed at the site are not known at this stage of development. However, it is expected that an appropriate scheme of mitigation will be capable of controlling noise from any proposed plant to within the established limits.

9.9 It is therefore expected to be appropriate to attach a condition to planning permission to require a plant noise assessment to be carried out at the appropriate stage of development, once more details regarding the mechanical services scheme are available, and an example of the type of condition has been given.

Figure 20231205-0 R1 TH1

Noise Levels Recorded at Position MP1, 30 January 2024

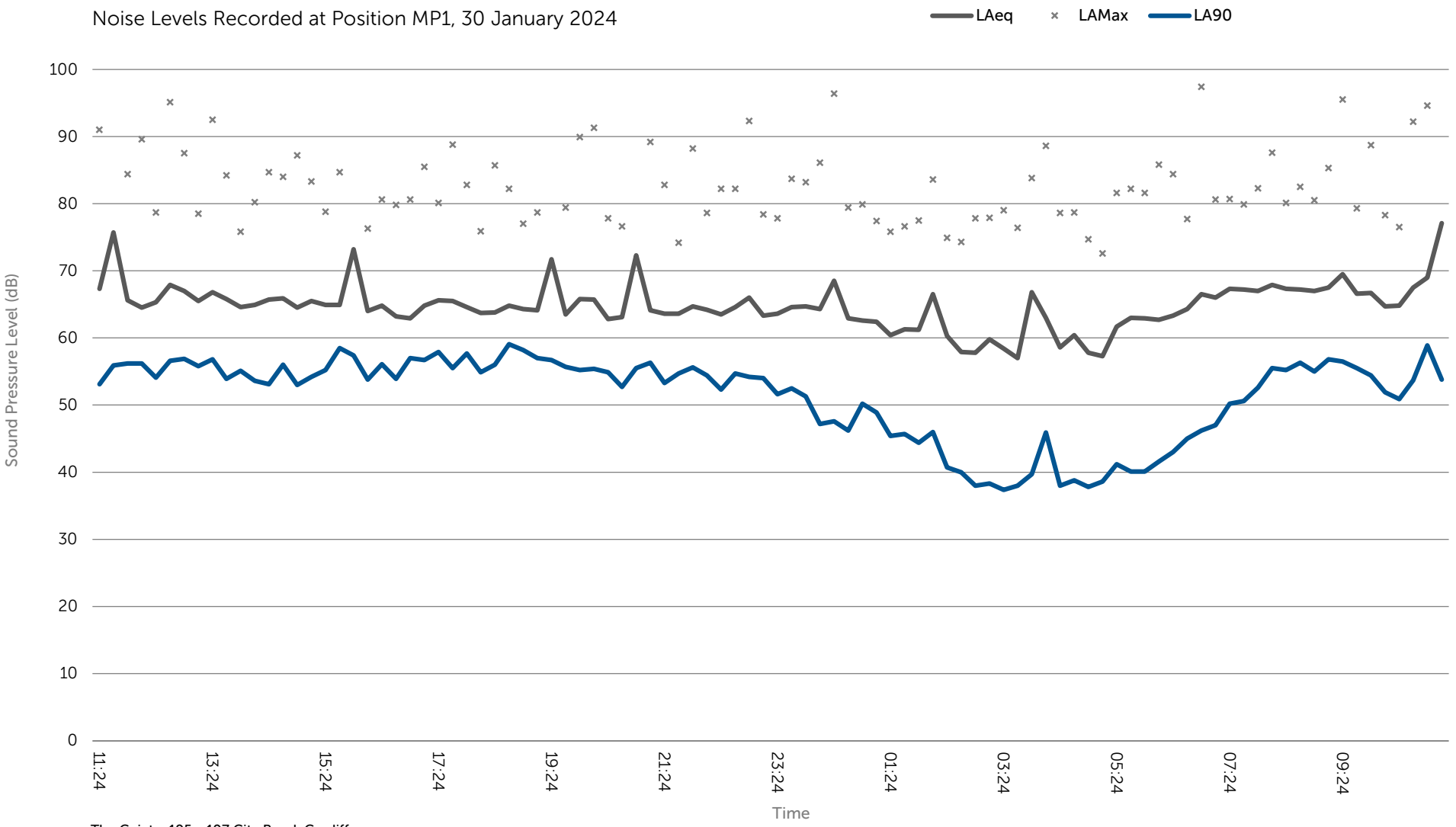


Figure 20231205-0 R1 TH2

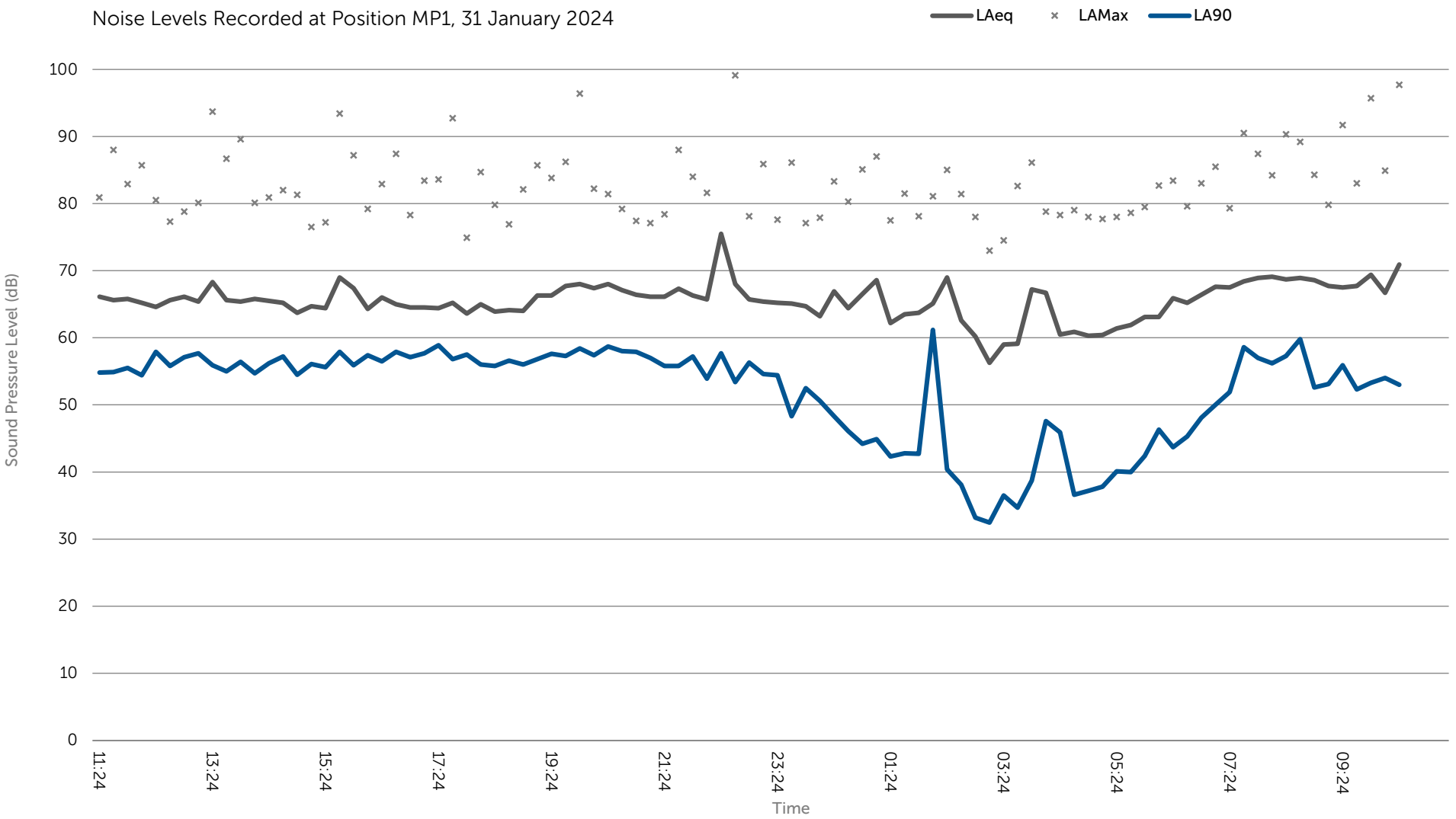


Figure 20231205-0 R1 TH3

Noise Levels Recorded at Position MP2, 30 January 2024

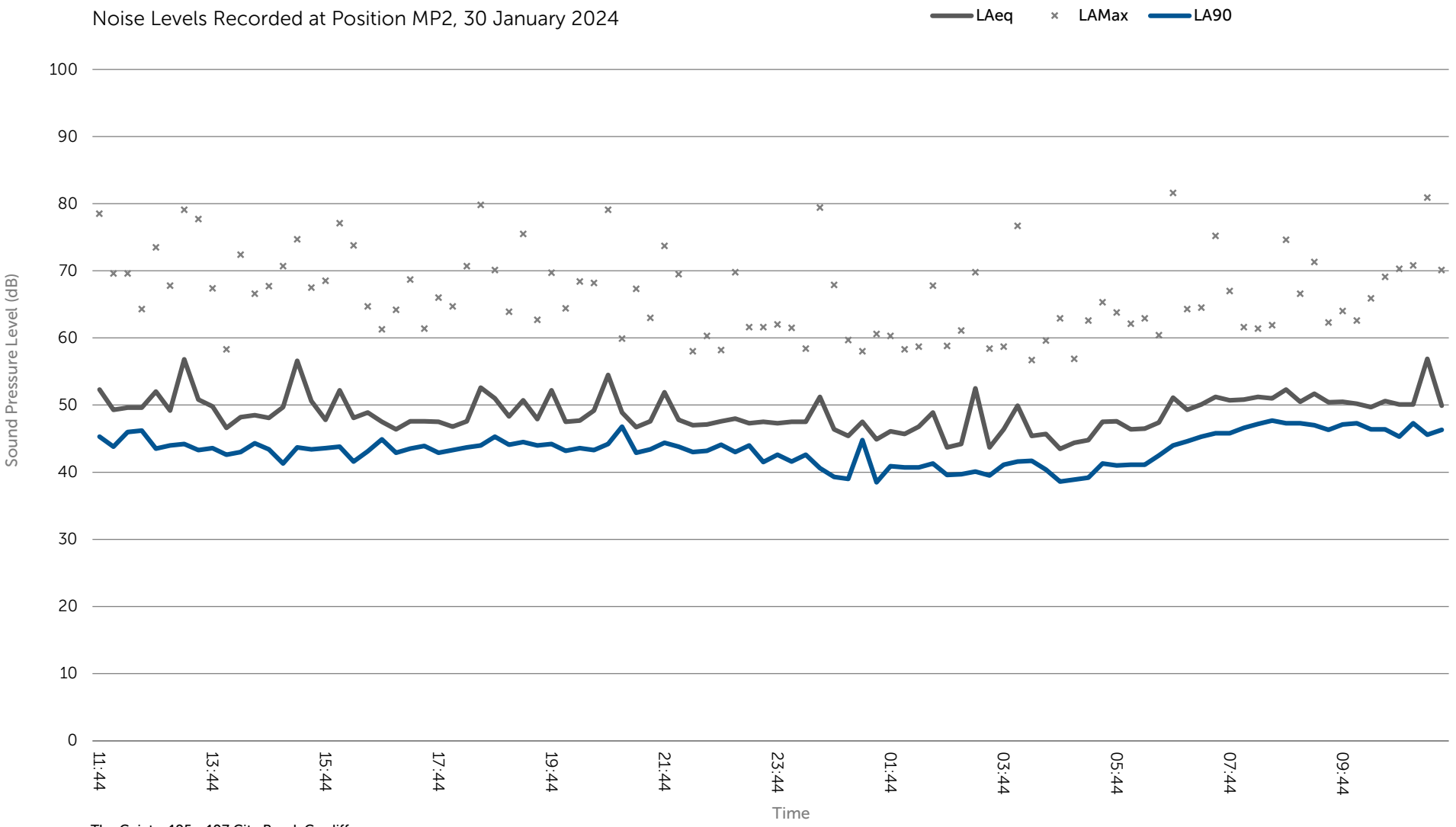
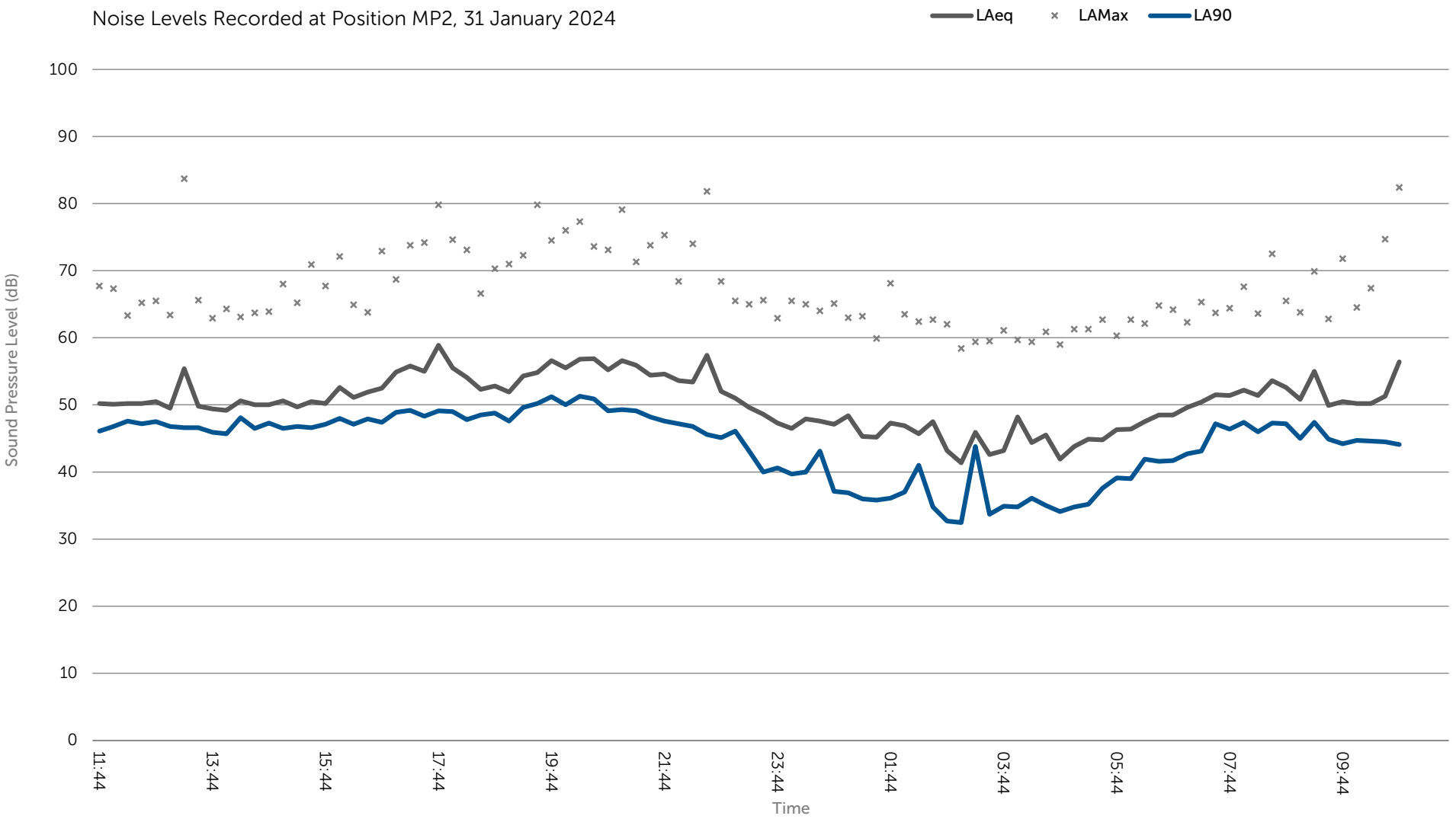


Figure 20231205-0 R1 TH4

Noise Levels Recorded at Position MP2, 31 January 2024



Calculation Sheet

MP1 Day to Front Bedroom Day

		Octave Band Centre Frequency (Hz)								
		63	125	250	500	1k	2k	4k	8k	
Noise Source										
Noise Source - MP1 Day										
Noise Levels		68.8	63.6	60.8	59.9	63.2	61.7	56.4	52.5	67.4 dBA
Composite SRI										
Facade Width (m)	3.2									
Facade Height (m)	2.3									
Main Element - EW-01										
SRI		36	40	44	45	51	56	56	56	Rw 51
Window Width (m)	2.0									
Window Height (m)	2.0									
No. of Windows (no)	1.0									
Glazed Element - GL-01										
SRI		22	25	27	38	48	47	55	55	Rw 41
No. of Vents (no)	1.0									
Vent - VE-01										
Dne		40	42	43	43	49	64	64	64	Dnew 49
		-24.3	*-27.3*	*-29.3*	*-37.7*	*-45.3*	*-49.0*	*-54.7*	*-54.7*	
10 log (S/A)										
Internal Receiver - Front Bedroom Day										
		-1.2	*-1.2*	*-1.2*	*-1.2*	*-1.2*	*-1.2*	*-1.2*	*-1.2*	
+3										
		3.0	*3.0*	*3.0*	*3.0*	*3.0*	*3.0*	*3.0*	*3.0*	
Internal Receiver Noise										
Internal Receiver Noise - Front Bedroom Day										
Reverberant Field, LPrev		46.3	38.1	33.3	24.0	19.7	14.5	3.6	-0.3	29.1 dBA

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Calculation Sheet

MP1 Night to Front Bedroom Night

		Octave Band Centre Frequency (Hz)								
		63	125	250	500	1k	2k	4k	8k	
Noise Source										
Noise Source - MP1 Night										
Noise Levels		62.9	58.5	58.0	57.5	59.6	56.6	53.9	53.7	63.8 dBA
Composite SRI										
Facade Width (m)	3.2									
Facade Height (m)	2.3									
Main Element - EW-01										
SRI		36	40	44	45	51	56	56	56	Rw 51
Window Width (m)	2.0									
Window Height (m)	2.0									
No. of Windows (no)	1.0									
Glazed Element - GL-01										
SRI		22	25	27	38	48	47	55	55	Rw 41
No. of Vents (no)	1.0									
Vent - VE-01										
Dne		40	42	43	43	49	64	64	64	Dnew 49
		-24.3	*-27.3*	*-29.3*	*-37.7*	*-45.3*	*-49.0*	*-54.7*	*-54.7*	
10 log (S/A)										
Internal Receiver - Front Bedroom Night										
		-1.2	*-1.2*	*-1.2*	*-1.2*	*-1.2*	*-1.2*	*-1.2*	*-1.2*	
+3										
		3.0	*3.0*	*3.0*	*3.0*	*3.0*	*3.0*	*3.0*	*3.0*	
Internal Receiver Noise										
Internal Receiver Noise - Front Bedroom Night										
Reverberant Field, LPrev		40.4	33.0	30.5	21.6	16.1	9.4	1.1	0.9	25.5 dBA

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Calculation Sheet

MP1 Night Max to Front Bedroom Night Max

		Octave Band Centre Frequency (Hz)								
		63	125	250	500	1k	2k	4k	8k	
Noise Source										
Noise Source - MP1 Night Max										
Noise Levels		85.3	78.6	78.3	75.7	76.7	75.5	74.3	72.8	82.4 dBA
Composite SRI										
Facade Width (m)	3.2									
Facade Height (m)	2.3									
Main Element - EW-01										
SRI		36	40	44	45	51	56	56	56	Rw 51
Window Width (m)	2.0									
Window Height (m)	2.0									
No. of Windows (no)	1.0									
Glazed Element - GL-01										
SRI		22	25	27	38	48	47	55	55	Rw 41
No. of Vents (no)	1.0									
Vent - VE-01										
Dne		40	42	43	43	49	64	64	64	Dnew 49
		-24.3	*-27.3*	*-29.3*	*-37.7*	*-45.3*	*-49.0*	*-54.7*	*-54.7*	
10 log (S/A)										
Internal Receiver - Front Bedroom Night Max										
		-1.2	*-1.2*	*-1.2*	*-1.2*	*-1.2*	*-1.2*	*-1.2*	*-1.2*	
+3										
		3.0	*3.0*	*3.0*	*3.0*	*3.0*	*3.0*	*3.0*	*3.0*	
Internal Receiver Noise										
Internal Receiver Noise - Front Bedroom Night Max Reverberant Field, LPrev		62.8	53.1	50.8	39.8	33.2	28.3	21.5	20.0	45.3 dBA

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Calculation Sheet

MP2 Day to Rear Bedroom Day

		Octave Band Centre Frequency (Hz)								
		63	125	250	500	1k	2k	4k	8k	
Noise Source										
Noise Source - MP2 Day										
Noise Levels		61.3	52.5	49.5	48.3	48.1	45.2	38.8	32.5	52.3 dBA
Composite SRI										
Facade Width (m)	3.2									
Facade Height (m)	2.3									
Main Element - EW-01										
SRI		36	40	44	45	51	56	56	56	Rw 51
Window Width (m)	2.0									
Window Height (m)	2.0									
No. of Windows (no)	1.0									
Glazed Element - GL-02										
SRI		18	20	18	28	38	34	38	38	Rw 31
No. of Vents (no)	1.0									
Vent - VE-02										
Dne		35	35	35	34	36	34	31	28	Dnew 35
		-20.4	*-22.3*	*-20.4*	*-28.5*	*-33.7*	*-31.2*	*-29.3*	*-26.5*	
10 log (S/A)										
Internal Receiver - Rear Bedroom Day										
		-0.8	*-0.8*	*-0.8*	*-0.8*	*-0.8*	*-0.8*	*-0.8*	*-0.8*	
+3										
		3.0	*3.0*	*3.0*	*3.0*	*3.0*	*3.0*	*3.0*	*3.0*	
Internal Receiver Noise										
Internal Receiver Noise - Rear Bedroom Day										
Reverberant Field, LPrev		43.1	32.4	31.3	22.0	16.6	16.2	11.7	8.2	26.8 dBA

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Calculation Sheet

MP2 Night to Rear Bedroom Night

		Octave Band Centre Frequency (Hz)								
		63	125	250	500	1k	2k	4k	8k	
Noise Source										
Noise Source - MP2 Night										
Noise Levels		54.6	47.1	46.0	44.7	43.4	38.1	30.1	23.7	47.3 dBA
Composite SRI										
Facade Width (m)	3.2									
Facade Height (m)	2.3									
Main Element - EW-01										
SRI		36	40	44	45	51	56	56	56	Rw 51
Window Width (m)	2.0									
Window Height (m)	2.0									
No. of Windows (no)	1.0									
Glazed Element - GL-02										
SRI		18	20	18	28	38	34	38	38	Rw 31
No. of Vents (no)	1.0									
Vent - VE-02										
Dne		35	35	35	34	36	34	31	28	Dnew 35
		-20.4	*-22.3*	*-20.4*	*-28.5*	*-33.7*	*-31.2*	*-29.3*	*-26.5*	
10 log (S/A)										
Internal Receiver - Rear Bedroom Night										
		-0.8	*-0.8*	*-0.8*	*-0.8*	*-0.8*	*-0.8*	*-0.8*	*-0.8*	
+3										
		3.0	*3.0*	*3.0*	*3.0*	*3.0*	*3.0*	*3.0*	*3.0*	
Internal Receiver Noise										
Internal Receiver Noise - Rear Bedroom Night										
Reverberant Field, LPrev		36.4	27.0	27.8	18.4	11.9	9.1	3.0	-0.6	22.2 dBA

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Calculation Sheet

MP2 Night Max to Rear Bedroom Night Max

		Octave Band Centre Frequency (Hz)								
		63	125	250	500	1k	2k	4k	8k	
Noise Source										
Noise Source - MP2 Night Max										
Noise Levels		74.6	66.2	59.9	62.2	60.7	56.7	51.9	47.7	65 dBA
Composite SRI										
Facade Width (m)	3.2									
Facade Height (m)	2.3									
Main Element - EW-01										
SRI		36	40	44	45	51	56	56	56	Rw 51
Window Width (m)	2.0									
Window Height (m)	2.0									
No. of Windows (no)	1.0									
Glazed Element - GL-02										
SRI		18	20	18	28	38	34	38	38	Rw 31
No. of Vents (no)	1.0									
Vent - VE-02										
Dne		35	35	35	34	36	34	31	28	Dnew 35
		-20.4	*-22.3*	*-20.4*	*-28.5*	*-33.7*	*-31.2*	*-29.3*	*-26.5*	
10 log (S/A)										
Internal Receiver - Rear Bedroom Night Max										
		-0.8	*-0.8*	*-0.8*	*-0.8*	*-0.8*	*-0.8*	*-0.8*	*-0.8*	
+3										
		3.0	*3.0*	*3.0*	*3.0*	*3.0*	*3.0*	*3.0*	*3.0*	
Internal Receiver Noise										
Internal Receiver Noise - Rear Bedroom Night Max Reverberant Field, LPrev		56.4	46.1	41.7	35.9	29.2	27.7	24.8	23.4	39.1 dBA

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Calculation Sheet

MP1 Night to Side Bedroom Night

		Octave Band Centre Frequency (Hz)								
		63	125	250	500	1k	2k	4k	8k	
Noise Source										
Noise Source - MP1 Night										
Noise Levels		62.9	58.5	58.0	57.5	59.6	56.6	53.9	53.7	63.8 dBA
Angle of View										
New Angle ()	90.0									
Original Angle ()	180.0									
		-3.0	*-3.0*	*-3.0*	*-3.0*	*-3.0*	*-3.0*	*-3.0*	*-3.0*	
Line Source Distance Loss										
Start Distance (m)	6.0									
End Distance (m)	22.0									
		-5.6	*-5.6*	*-5.6*	*-5.6*	*-5.6*	*-5.6*	*-5.6*	*-5.6*	
Composite SRI										
Facade Width (m)	3.2									
Facade Height (m)	2.3									
Main Element - EW-01										
SRI		36	40	44	45	51	56	56	56	Rw 51
Window Width (m)	2.0									
Window Height (m)	2.0									
No. of Windows (no)	1.0									
Glazed Element - GL-02										
SRI		18	20	18	28	38	34	38	38	Rw 31
No. of Vents (no)	1.0									
Vent - VE-02										
Dne		35	35	35	34	36	34	31	28	Dnew 35
		-20.4	*-22.3*	*-20.4*	*-28.5*	*-33.7*	*-31.2*	*-29.3*	*-26.5*	
10 log (S/A)										
Internal Receiver - Side Bedroom Night										
		-1.2	*-1.2*	*-1.2*	*-1.2*	*-1.2*	*-1.2*	*-1.2*	*-1.2*	
+3										
		3.0	*3.0*	*3.0*	*3.0*	*3.0*	*3.0*	*3.0*	*3.0*	

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	Octave Band Centre Frequency (Hz)								
	63	125	250	500	1k	2k	4k	8k	
Internal Receiver Noise									
Internal Receiver Noise - Side Bedroom Night									
Reverberant Field, LPrev	35.7	29.4	30.8	22.2	19.1	18.6	17.7	20.4	27.9 dBA

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Calculation Sheet

Commercial to Residential Bedroom

		Octave Band Centre Frequency (Hz)									
		63	125	250	500	1k	2k	4k	8k		
Source Room											
Source Room - Commercial											
Total LPrev (dB)		63	73	71	75	73	69	62	56	77 dBA	NR 73
-R											
Separating Element - PW-01											
		-35.0	*-40.0*	*-45.0*	*-52.0*	*-59.0*	*-63.0*	*-67.0*	*-67.0*		
+10 log (S)											
Width (m)	3.2										
Length (m)	4.1										
		11.1	*11.1*	*11.1*	*11.1*	*11.1*	*11.1*	*11.1*	*11.1*		
-10log(A)											
Receive Room - Transfer Bedroom											
		-10.5	*-10.5*	*-10.5*	*-10.5*	*-10.5*	*-10.5*	*-10.5*	*-10.5*		
Receive Room											
Receive Room - Transfer Bedroom											
Reverberant Field, LPrev		29	34	27	24	15	7	-4	-10	24 dBA	NR 20

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Appendix A

Glossary of Acoustics Terms – Noise Levels

Single Figures and Spectra

Generally speaking, the human ear is capable of hearing noise within the frequency range 20Hz to 20kHz. To make handling of data more meaningful and manageable, the range is often divided into 'bands', each of which covers a specific part.

For most acoustics applications, either octave or third-octave bands are used. Each band has a specific centre frequency which is used to identify it. When reported, the band centre frequency is given, along with the associated noise level, e.g. 63dB L_{eq} at 500Hz.

Noise levels can also be reported as single figure values where all energy contained within the measured frequency range is summed to provide a single figure. However, as the human ear does not hear noise at different frequencies with equal loudness, a weighting curve is often applied to levels before summing to account for this fact.

The most common curve is the A-weighting curve, and its use is denoted by including the letter 'A' with either the index e.g. 63dB L_{Aeq}, or with the decibel suffix (if the index is described elsewhere), e.g. 63dBA. 'B' and 'C' weighting curves may also be applied, depending on the application. A 'Z' is used to indicate a single figure where no weighting has been applied, e.g. 63dB L_{Zeq}.

Noise Level Indices

Noise level measurements can be made and reported in a variety of indices. The index is reported using the letter *L* to indicate Level, followed by, for example, abbreviations to represent the specifics of the index, and time intervals where applicable. The most commonly used are given below.

$L_{eq,T}$, (dB) - Equivalent Continuous Sound Pressure Level

The $L_{eq,T}$ value is the sound pressure level in decibels of a continuous steady sound that within a specified time interval, T, has the same mean-squared sound pressure as a sound that varies with time. It is often used as a descriptor of the **ambient noise climate**, and commonly seen as a single A-weighted figure $L_{Aeq,T}$.

L_{max}, (dB) - Maximum Sound Pressure Level

The L_{max} value is the highest recorded sound pressure level in decibels averaged across a specified time constant during a noise measurement of certain duration. Two time constants are used, Fast and Slow, where the time constants are 0.125s and 1s respectively. The time constant is denoted in the index, $L_{max,F}$ for Fast and $L_{max,S}$ for Slow. It is often used to identify transient events that have a high-level relative to the ambient noise climate, and commonly seen as a single A-weighted figure L_{Amax}.

$L_{10,T}$, (dB) - Equivalent Continuous Sound Pressure Level

The $L_{10,T}$, value is the sound pressure level in decibels that is exceeded for 10% of a given time interval, T. It is often used as a measurement of noise from transportation sources such as road and rail. It is commonly seen as a single A-weighted figure $L_{A10,T}$.

$L_{90,T}$, (dB) - Equivalent Continuous Sound Pressure Level

The $L_{90,T}$, value is the sound pressure level in decibels that is exceeded for 90% of a given time interval, T. It is often used as a descriptor of the **background noise climate**, and commonly seen as a single A-weighted figure $L_{A90,T}$.

Appendix B

Document Naming and Version Control Policy

All documents are issued with a unique number which comprises the principle 8-digit project and 1-digit subsection numbers, for example 20151203-0, and a reference indicting iteration of document type, for example R1 for Report 1, M2 for Memorandum 2 etc.

All documents employ version control through the use of a unique version number. The version numbers employ two levels of hierarchy, and use the format illustrated below:

V 1 . 2

Major Minor

Major

A major revision occurs when the report is revised to reflect significant changes in design strategy. For example, wide scale changes to building footprint or general arrangements, changes to principle construction type (e.g. masonry to lightweight), reselection of mechanical services plant etc. A change in strategy that takes place within the same RIBA work stage for example will prompt a major revision to a document.

Minor

A minor revision occurs when the report is revised to reflect minor changes to the design implementation. For example a change in the type of natural vent, extract fan, surface finish etc. to be used, on the project. Minor revisions will also occur when there is a change in wording of the report text.

Reporting

The Document History and Version Control table on the second page of each report identifies the versions through which the document has moved, along with the date, author that produced the version, and a description of its purpose or change.

Electronic File Naming

Reports issued electronically use the following format:

2012xxxx	-	x	Rx	Noise Assessment Report	v1.0	yyyy.mm.dd.pdf
Project Number		Subsection	Report Number	Report Name	Version	Date File Extension

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