A Noise Assessment For Archway House, Reading

On behalf of Hermes Investment Management

January 2022

resound acoustics

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CONTENTS

1 INTRODUCTION 1
2 SITE DESCRIPTION 2
Existing Site Conditions 2
Proposed Site Conditions 2
3 GUIDANCE 3
General Permitted Development Order 3
British Standard 4142 3
ISO9613 7
4 ENVIRONMENTAL SOUND SURVEY 8
Sound Survey Method 8
Sound Survey Results 8
5 ASSESSMENT 11
6 CONCLUSION 13

Appendices

Appendix A Introduction to Noise and Glossary of Terminology
Appendix B Site Plans
Appendix C Monitoring Equipment
Appendix D Measurement Positions
Appendix E Full Survey Results

1 INTRODUCTION

1.1 Hermes Investment Management has appointed Resound Acoustics Limited to undertake a noise assessment for a proposed development at Archway House, Reading.

1.2 Hermes Investment Management wishes to convert a commercial building to residential use under Class MA of the General Permitted Development Order (GPDO); a noise assessment is required to consider the impact of commercial sources of noise in the area on potential occupants of the proposed development.

1.3 The noise climate at the site has been established by direct measurement and the suitability of the site for the proposed development considered against the requirements of the GPDO. Where necessary, mitigation measures have been recommended so that a noise climate suitable for the proposed development can be achieved.

1.4 Whilst reasonable efforts have been made to produce a report that is easy to understand, it is technical in nature. To assist the reader, an introduction to noise and an explanation of the terminology used in this report is contained in Appendix A.

2 SITE DESCRIPTION

Existing Site Conditions

2.1 The site is formed by the western half of Archway House, located above Archway Road in Caversham Reading.

2.2 The eastern half of Archway House is occupied by existing residential use. Gosbrook Road lies to the north, with commercial uses including an office and supermarket to the south. The servicing area for the supermarket is located approximately 35 metres from the site.

2.3 A site location plan is included as Figure B.1 in Appendix B.

2.4 The site was previously occupied by a chiropractor practice.

Proposed Site Conditions

2.5 Hermes Investment Management wishes to convert the second and third floors to residential use under Class MA of the General Permitted Development Order.

2.6 The building is to be retained with internal conversion proposed; the proposed residential layout is shown in the following Barton Willmore drawings:

- *Archway House – Proposed Second Floor Plan* (drawing number 26985-11012, dated October 2021);
- *Archway House – Proposed Third Floor Plan* (drawing number 26985-11013, dated October 2021).

2.7 These drawings are included as Figures B.2 and B.3 in Appendix B.

3 GUIDANCE

General Permitted Development Order

3.1 Permitted Development rights are a national grant of planning permission that allow certain building works and changes of use to be carried out without having to make a planning application.

3.2 Permitted Development rights are set out in the *Town and Country Planning (General Permitted Development) (England) Order 2015*, as amended.

3.3 Part 3 of Schedule 2 of the order sets out the permitted development for the change of use *Class MA – development consisting of a change of use of a building and any land within its curtilage from a use falling within Class E (commercial, business and service) of Schedule 2 to the Use Classes Order to a use falling within Class C3 (dwellinghouses) of Schedule 1 to that order*, along with prior approval conditions.

3.4 Paragraph MA.2 states:

> *"MA.2 – (1) Development under Class MA is permitted subject to the following conditions.*
>
> *(2) Before beginning development under Class MA, the developer must apply to the local planning authority for a determination as to whether the prior approval of the authority will be required as to –*
>
> *(d) impacts of noise from commercial premises on the intended occupiers of the development*

British Standard 4142

3.5 BS4142: 2014+A1: 2019: *Methods for rating and assessing industrial and commercial sound* describes a method for rating and assessing sound of an industrial or commercial nature, which includes:

- sound from industrial and manufacturing processes;
- sound from fixed installations which comprise mechanical and electrical plant and equipment;
- sound from the loading and unloading of goods and materials at industrial and/or commercial premises; and
- sound from mobile plant and vehicles that is an intrinsic part of the overall sound emanating from premises or processes, such as that from forklift trucks, or that from train or ship movements on or around an industrial and/or commercial site.

3.6 In a BS4142: 2014+A1: 2019 assessment, the industrial or commercial sound is assessed outside a dwelling or premises used for residential purposes. The procedure is to quantify the *"specific sound level"*, which is the measured or predicted level of sound from the source in question over a one hour period for the daytime and a 15 minute period for the night-time. Daytime is defined in the standard as 07:00 to 23:00 hours, and night-time as 23:00 to 07:00 hours.

3.7 The preferred method for determining the specific sound level is measurement. When measuring the specific sound level, the influence of other sound sources must be accounted for, and BS4142: 2014+A1: 2019 states that this can be done by first measuring the ambient sound level, which includes contributions from both the source under consideration and other sources in the area. Measurements should then be undertaken of the residual sound, which is the sound level where the specific source is supressed to such a degree that it does not contribute to the measured sound level.

3.8 The residual sound can then be logarithmically subtracted from the ambient sound level to obtain the specific sound level. Where it is not possible to measure the residual sound level at the same location as the ambient level, for example if the source under consideration operates continuously, then an alternative location where the residual sound is comparable may be used.

3.9 Alternatively, where it is not possible to determine the specific sound by measurement alone, for example, because the difference between the ambient and residual sound level is too small, the specific sound level may be determined by a combination of measurement and calculation. The standard states:

> *"NOTE In some cases, measurements can be supplemented by calculations. Calculations are often more reliable than a single short-term measurement when long-term averages are to be determined and in other cases where it is impossible to carry out measurements because of high residual sound levels. In case of the latter, it is sometimes convenient to carry out the measurements closer to the source and then use a calculation method to estimate the specific sound level at the assessment locations(s)."*

3.10 The specific sound level is converted to a rating level by adding penalties on a sliding scale to account for either potentially tonal or impulsive elements, using subjective judgement. The standard also sets out objective methods for determining the presence of tones or impulsive elements, but notes that these should be used where the subjective method is not sufficient.

3.11 The penalty for tonal elements is between 0dB and 6dB, and the standard notes:

> *"Subjectively, this can be converted to a penalty of 2 dB for a tone which is just perceptible at the noise receptor, 4 dB where it is clearly perceptible, and 6 dB where it is highly perceptible."*

3.12 The penalty for impulsive elements is between 0dB and 9dB, and the standard notes:

> *"Subjectively, this can be converted to a penalty of 3 dB for impulsivity which is just perceptible at the noise receptor, 6 dB where it is clearly perceptible, and 9 dB where it is highly perceptible."*

3.13 The standard also states that if a source has identifiable on/off conditions, a penalty may be applied for intermittency. The penalty for sources that have intermittent elements is stated as:

> *"If the intermittency is readily distinctive against the residual acoustic environment, a penalty of 3 dB can be applied."*

3.14 Where the specific sound features acoustic characteristics that are distinctive against the residual acoustic climate, but are not tonal, impulsive or intermittent in nature, a penalty of +3dB may be applied.

3.15 The background sound level is the L_{A90} of the residual sound, which is itself the sound remaining at the assessment location when the specific sound source being assessed is suppressed to such a degree that it does not contribute to the ambient sound.

3.16 The standard notes that the background sound level can include industrial and/or commercial sound in some circumstances:

> *"Since the intention is to determine a background sound level in the absence of the specific sound that is under consideration, it is necessary to understand that the background sound level can in some circumstances legitimately include industrial and/or commercial sounds that are present as separate to the specific sound."*

3.17 The standard states that the background sound level should be measured over a period of sufficient length to obtain a representative value. This should not normally be less than 15 minute intervals. The standard states that:

> *"A representative level ought to account for the range of background sound levels and ought not automatically to be assumed to be either the minimum or modal value."*

3.18 The initial assessment outcome results from a comparison of the rating level with the background sound level. The standard states:

> *"a) Typically, the greater this difference, the greater the magnitude of the impact.*
>
> *b) A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context.*
>
> *c) A difference of around +5 dB is likely to be an indication of an adverse impact, depending on the context.*
>
> *d) 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.*
>
> *NOTE 2 Adverse impacts include, but are not limited to, annoyance and sleep disturbance. Not all adverse impacts will lead to complaints and not every complaint is proof of an adverse impact."*

3.19 BS4142: 2014+A1: 2019 states that relevant contextual matters should be taken into account before reaching a final position on the assessment outcome. It is stated as important because:

> *"An effective assessment cannot be conducted without an understanding of the reason(s) for the assessment and the context in which the sound occurs/will occur. When making assessments and arriving at decisions, therefore, it is essential to place the sound in context."*

3.20 BS4142: 2014+A1: 2019 lists some of the contextual matters that might influence the assessment outcome:

> *"1) The absolute level of sound. For a given difference between the rating level and the background sound level, the magnitude of the overall impact might be greater for an acoustic environment where the residual sound level is high than for an acoustic environment where the residual sound level is low.*
>
> *Where background sound levels and rating levels are low, absolute levels might be as, or more, relevant than the margin by which the rating level exceeds the background. This is especially true at night.*
>
> *Where residual sound levels are very high, the residual sound might itself result in adverse impacts or significant adverse impacts, and the margin by which the rating level exceeds the background might simply be an indication of the extent to which the specific sound source is likely to make those impacts worse.*
>
> *2) The character and level of the residual sound compared to the character and level of the specific sound. Consider whether it would be beneficial to compare the frequency spectrum and temporal variation of the specific sound with that of the ambient or residual sound to assess the degree to which the specific sound source is likely to be distinguishable and will represent an incongruous sound by comparison to the acoustic environment that would occur in the absence of the specific sound. Any sound parameters, sampling periods and averaging time periods used to undertake character comparisons should reflect the way in which sound of an industrial and/ or commercial nature is likely to be perceived and how people react to it.*
>
> *NOTE 3 Consideration should be given to evidence on human response to sound and, in particular, industrial and/or commercial sound where it is available. A number of studies are listed in the "Effects on humans of industrial and commercial sound" portion of the "Further reading" list in the Bibliography.*
>
> *3) The sensitivity of the receptor and whether dwellings or other premises used for residential purposes will already incorporate design measures that secure good internal and/or outdoor acoustic conditions, such as:*
>
> *i) facade insulation treatment;*
> *ii) ventilation and/or cooling that will reduce the need to have windows open so as to provide rapid or purge ventilation; and*
> *iii) acoustic screening."*

3.21 In terms of the first of these contextual considerations, BS4142: 2014+A1: 2019 does not indicate how the initial estimate of impact should be adjusted when background and rating levels are low. However, it is considered that in this situation, the absolute levels may suggest a more acceptable outcome than would otherwise be suggested by the difference between the values.

3.22 BS4142: 2014+A1: 2019 does not define 'low' in the context of background sound levels nor rating levels. The note to the Scope of the 1997 version of BS4142 defined very low background sound levels as being less than about 30dB L_{A90}, and low rating levels as being less than about 35dB L_{Ar}. It is considered that these definitions provide a reasonable reference point for the definition of 'low' in the context of the current version of the standard.

3.23 It is also noted that the consideration of internal noise levels is not necessarily limited to those situations where background and rating levels are low; the contextual matters set out in BS4142: 2014+A1: 2019 are examples, and not an exhaustive, prescriptive list.

3.24 Other contextual matters that might be relevant, include:

- character of a particular neighbourhood;
- former uses at or close to a site;
- legitimacy of the industrial use, e.g. planning permissions or environmental permits;
- implementation of best practicable means for a given process or activity; or
- local convention or perceptions.

3.25 BS4142: 2014 + A1: 2019 requires uncertainties in the assessment to be considered, and where the uncertainty is likely to affect the outcome of the assessment, steps should be taken to reduce the uncertainty.

ISO9613

3.26 The noise levels generated by nearby commercial activities have been calculated using the proprietary noise modelling software CADNA, which implements the common European methods of noise prediction. In this instance, the noise predictions have been undertaken in general accordance with the noise prediction framework set out in ISO9613-2 *Acoustics – Attenuation of sound during propagation outdoors – Part 2 General method of calculation*.

3.27 The noise calculations are based on individual noise sources acting as either point sources, where the noise level reduces by 6dB for every doubling of distance, as line sources, where the noise level reduces by 3dB for every doubling of distance or plane sources, where the noise level reduces by between 0 and 6dB for every doubling of distance, depending on the dimensions of the plane source and the proximity of the receptor.

3.28 The model takes into account the distance between the sources and the receptors and the amount of attenuation due to atmospheric absorption. The model assumes downwind propagation, i.e. a wind direction that assists the propagation of noise from the source to all receptors.

3.29 The inherent uncertainty in ISO9613 is stated in the standard as being accurate to ±1dB for distances of up to 100 metres, or ±3dB for distances of between 100 metres and 1km, with an average height of propagation of up to 30 metres

4 ENVIRONMENTAL SOUND SURVEY

4.1 A survey was undertaken between Thursday 11th November 2021 and Monday 15th November 2021 to establish typical sound levels at the site.

4.2 The survey method and results are set out below.

Sound Survey Method

4.3 The measurements were undertaken between 13:30 hours on Thursday 11th November 2021 and 13:30 hours on Monday 15th November 2021.

4.4 The equipment used during the survey is summarised in Appendix C. The sound level meters were field-calibrated immediately before and after the measurements using the listed acoustic calibrators. No significant calibration drifts were found to have occurred.

4.5 All of the equipment had been calibrated by the manufacturer within the year preceding the survey.

4.6 Measurements were carried out at two positions, as shown in Figure D.1 in Appendix D and described as follows:

- Position 1: on the southern façade of the building, overlooking Archway Road; and
- Position 2: on the northern façade of the building, overlooking Gosbrook Road.

4.7 The measurements were taken at second floor height, with the microphones in façade conditions, i.e. 1 metre in front of the building façade.

Sound Survey Results

4.8 The weather during the survey was suitable for noise measurement, it being dry with winds of up to 5m/s.

4.9 The dominant sound sources at Position 1 were cars on Archway Road accessing the nearby supermarket. A heavy goods vehicle (HGV) delivery was observed at the servicing area for the supermarket when Resound Acoustics staff were attending the site at the start and end of the survey. Delivery vans were also observed parked in this area. However, noise from these sources was not measurable at the site above the residual acoustic climate.

4.10 The dominant sound source at Position 2 was road traffic on Gosbrook Road. Other sources included noise associated with a busy high street, such as pedestrians walking past and talking.

4.11 The sound survey results are summarised in Table 4.1 for Position 1 and Table 4.2 for Position 2, aggregated across the daytime (07:00 to 23:00 hours) and night-time (23:00 to 07:00 hours) periods. Full survey results are included in graphical form in Appendix E. Tabulated data for each position is available on request.

Table 4.1: Summary of measured noise levels at Position 1, façade dB

Location	Period	Duration, T	$L_{Aeq,T}$	$L_{A90,T}$ (1)	$L_{A10,T}$ (1)	L_{AFmax}
Thursday 11th November 2021	Day	9.5 hours	60.6	52.3	62.9	65.6 to 93.6
	Night	8 hours	53.9	43.7	52.6	54.1 to 85.9
Friday 12th November 2021	Day	16 hours	62.6	54.1	63.8	64.6 to 99.3
	Night	8 hours	54.8	44.3	55.0	58.4 to 83.0
Saturday 13th November 2021	Day	16 hours	60.9	52.6	62.6	66.9 to 88.8
	Night	8 hours	53.9	41.3	53.7	55.3 to 91.8
Sunday 14th November 2021	Day	16 hours	61.8	50.2	60.5	65.5 to 101.7
	Night	8 hours	52.0	38.9	52.8	54.4 to 79.9
Monday 15th November 2021	Day	6.5 hours	60.4	51.4	62.7	70.4 to 89.4

Note: (1) – The $L_{A90,T}$ and $L_{A10,T}$ values are the arithmetic means of the $L_{A90,1hour}$ and $L_{A10,1hour}$ measurements for each period.

Table 4.2: Summary of measured noise levels at Position 2, façade dB

Date	Period	Duration, T	$L_{Aeq,T}$	$L_{A90,T}$ (1)	$L_{A10,T}$ (1)	L_{AFmax}
Thursday 11th November 2021	Day	9.5 hours	67.9	58.1	68.5	74.2 to 103.0
	Night	8 hours	58.5	39.8	59.4	67.0 to 81.5
Friday 12th November 2021	Day	16 hours	71.1	60.3	69.6	73.5 to 111.4
	Night	8 hours	58.9	43.3	61.5	68.2 to 86.5
Saturday 13th November 2021	Day	16 hours	67.5	58.8	68.5	73.4 to 105.2
	Night	8 hours	58.6	41.1	59.9	68.0 to 94.2
Sunday 14th November 2021	Day	16 hours	67.4	56.8	67.6	72.2 to 106.4
	Night	8 hours	58.8	39.0	58.7	65.9 to 88.1
Monday 15th November 2021	Day	6.5 hours	67.5	60.2	69.7	76.1 to 100.6

Note: (1) – The $L_{A90,T}$ and $L_{A10,T}$ values are the arithmetic means of the $L_{A90,15min}$ and $L_{A10,15min}$ measurements for each period.

4.12 The key commercial sources observed at the site were vehicles in the servicing bay of the supermarket to the south-west of the site; this included HGV deliveries bringing stock to the store, and vans for home deliveries to customers.

4.13 The appropriate standard for assessing sound of this nature is British Standard 4142: 2014+A1: 2019, which requires representative background sound levels to be established. For the assessment, the distribution of L_{A90} values in the measurement data at Position 1 has been analysed and representative values determined. The analysis is based on the time history, the arithmetic mean, the modal value, and the 25% cumulative percentage point, i.e. the value that indicates the lowest 25% of the dataset.

4.14 BS4142: 2014+A1: 2019 states that daytime is typically taken to be between 07:00 and 23:00 and night-time between 23:00 and 07:00 hours. However, the standard notes that it is important to determine representative values for particular time periods of interest.

4.15 The delivery vehicle activities observed all occurred during the daytime period, and it is understood that the opening hours of the supermarket are 08:00 to 21:00 hours, which fall within the daytime period.

4.16 Although there may still be the potential for deliveries prior to 07:00 hours, which would be considered part of the night-time, the proposed layout plans do not locate any

bedrooms at the southern façade of the building, overlooking the supermarket servicing area.

4.17 Therefore, the analysis considers the daytime period, with the distribution of the background sound levels contained in Appendix E. Based on the distribution analysis contained in Figure E.3, a representative value of 47dB L_{A90} has been adopted.

5 ASSESSMENT

5.1 The key commercial sources observed at the site were delivery vehicles in the servicing bay of the supermarket to the south-west of the site. These sources were not measurable above the residual acoustic climate.

5.2 Therefore, the likely noise emissions have been calculated based on library data for delivery activities by HGVs and vans; the source data used is shown in Table 5.1.

Table 5.1: Typical delivery vehicle source noise levels, free-field dB

Source	Distance (metres)	L_{AE}	L_{AFmax}
HGV air brakes	10	77	81
HGV start up and pull away	10	76	74
HGV reversing alarm	10	82	73
HGV unload	10	70	79
Van start and pull away	10	70	70
Van reverse and park (inc alarm)	10	78	80
Van doors slam	10	57	68
Van loading	10	70	75

5.3 The daytime assessment period in BS4142: 2014+A1: 2019 is one hour; it has been assumed that the one hour assessment period includes a single HGV stock delivery, and four vans being loaded for delivery to customers. Each of these vehicle movements is assumed to give rise to each of the relevant noise-generating events in Table 5.1, to derive the overall vehicle noise emissions.

5.4 The noise levels generated by the activities have been calculated using the prediction framework set out in ISO9613 as implemented by the noise modelling software CADNA/A. The predicted noise levels from each source have been logarithmically summed to derive the overall noise levels from the site.

5.5 The delivery vehicle activities have been modelled as acoustic point sources, with the source heights set to match the item being modelled.

5.6 The topography on and around the site has been modelled using OS mapping and on-site observations. The ground at the site has been modelled as 100% acoustically hard. All buildings have been modelled as approximately 70% acoustically reflective.

5.7 The sound levels due to the delivery activities have been calculated at the southern façade of the building, at a location representing the proposed living rooms at both second and third floor levels.

5.8 To allow a direct comparison with the measured background sound levels, the predicted noise levels are façade levels.

5.9 The predicted values have been rounded to the nearest whole number to obtain predicted specific sound levels, as required by BS4142: 2014+A1: 2019.

5.10 BS4142: 2014+A1: 2019 also requires that the specific sound levels are corrected to account for any acoustic characteristics, with the judgement of acoustic characteristics made at the receptor, against the prevailing acoustic climate.

5.11 In this instance, the site is located in the centre of Caversham and is subject to high levels of road traffic noise that helps mask noise from the surrounding commercial uses.

5.12 On this basis, it is considered unlikely that specific characteristics associated with the servicing are likely to be clearly perceptible at the proposed properties. However, it is considered appropriate to apply some penalty due to the proximity of the servicing, and therefore a correction of +3dB has been applied to account for general characteristics associated with the servicing activities that may be perceptible at times above the existing acoustic climate.

5.13 The total acoustic character correction of +3dB has been added to the specific sound levels to obtain rating levels, which have been compared with the background sound levels as shown in Table 5.2. The background sound level is the representative value of 47dB L_{A90}, as set out in Section 4 of this report.

Table 5.2: BS4142 assessment, façade dB

Receptor	Period	Background Sound Level, L_{A90}	Rating Level, $L_{Ar,Tr}$ (1)	Difference
2nd floor	Day	47	46	-1
3rd floor	Day	47	46	-1

Note: (1) T is 1 hour for daytime.

5.14 It can be seen from Table 5.2 that the rating levels at the two assessment locations are predicted to be 1dB below the background sound levels. BS4142: 2014+A1: 2019 states that rating levels equal to or below the background sound level are indicative of a low impact.

5.15 BS4142: 2014+A1: 2019 requires that context is taken into account before arriving at the overall assessment outcome.

5.16 In this instance, the sources assessed are activities at the servicing area of the nearby supermarket; the assessment assumes a single HGV and four vans within any one hour period, which is considered a robust level of activity.

5.17 It is considered unlikely that this level of activity will occur throughout the day, and therefore, at other times, the impact will be less. On this basis, it is considered that the numerical assessment does not underestimate the impact, and overall a low impact is likely.

5.18 The uncertainty in the calculations has been reduced as far a practicable through the implementation of robust source data and a robust calculation process, and a robust level of activity at the servicing area that is unlikely to occur regularly throughout the day.

5.19 Uncertainty in the background sound level data has been reduced by measuring over a four day period including a weekend, to capture the likely most sensitive times.

6 CONCLUSION

6.1 Hermes Investment Management has appointed Resound Acoustics Limited to undertake a noise assessment for a proposed development at Archway House, Reading.

6.2 Hermes Investment Management wishes to convert a commercial building to residential use under Class MA of the General Permitted Development Order (GPDO); a noise assessment is required to consider the impact of commercial sources of noise in the area on potential occupants of the proposed development.

6.3 An assessment in accordance with British Standard 4142: 2014+A1: 2019 has shown that noise from servicing activities at a nearby supermarket, the key identifiable commercial source affecting the site, is unlikely to lead to an adverse impact.

6.4 On the basis of this assessment, it is considered that permission can be granted for the application.

Appendices

Appendix A – Introduction to Noise and Glossary of Terminology

Noise is defined as unwanted sound. The human ear is able to respond to sound in the frequency range 18Hz (deep bass) to 18,000Hz (high treble) and over the audible range of 0dB (the threshold of perception) to 140dB (the onset of pain). The ear does not respond equally to different frequencies of the same magnitude, but is more responsive to mid-frequencies than to lower or higher frequencies. To quantify noise in a manner that approximates the response of the human ear, a weighting (filtering) mechanism is used. This reduces the importance of lower and higher frequencies, approximating the response of the human ear.

Furthermore, the perception of noise may be determined by a number of other factors, which may not necessarily be acoustic. Noise can be perceived to be louder or more noticeable if the source of the noise is observed; e.g. roads, trains, factories, building sites etc. In general, the impact of noise depends upon its level, the margin by which it exceeds the background level, its character and its variation over a given period of time. In some cases, the time of day and other acoustic features such as tonality may be important, as may the disposition of the affected individual. Any assessment of noise should give due consideration to all of these factors when assessing the significance of a noise source. Various noise indices have been derived to describe the fluctuation of noise levels that vary over time. Usually, these noise indices relate to specific types of noise, and as such different noise indices are used to describe road traffic noise, background noise, construction noise, etc.

The weighting mechanism that best corresponds to the response of the human ear is the 'A'-weighting scale. This is widely used for environmental noise measurement and the levels are denoted as dB(A) or L_{Aeq}, L_{A10}, etc, according to the parameter being measured.

Noise is measured on the decibel scale, which is logarithmic rather than linear. As a result of this, a 3dB increase in sound level represents a doubling of the sound energy present. Judgement of sound is subjective, but as a general guide a 10dB(A) increase can be taken to represent a doubling of loudness, whilst an increase in the order of 3dB(A) is generally regarded as the minimum difference needed to perceive a change. Table A.1 sets out examples of noise levels typically experienced during everyday activities. Table A.2 sets out an explanation of the terminology used in this report.

Table A.1: Typical sound levels found in the environment

Sound Level	Location
0 to 10dB(A)	Threshold of hearing
10 to 20dB(A)	Broadcasting studio
20 to 30dB(A)	Quiet bedroom at night
30 to 40dB(A)	Living room during the day
40 to 50dB(A)	Typical office
50 to 60dB(A)	Inside a car
60 to 70dB(A)	Typical high street
70 to 90dB(A)	Inside a factory or noisy pub
100 to 110dB(A)	Burglar Alarm at 1m
110 to 130dB(A)	Pneumatic drill at 1m away
140dB(A)	Threshold of Pain

Table A.2: Terminology relating to noise and vibration

Sound Pressure	Sound, or sound pressure, is a fluctuation in air pressure over the static ambient pressure.
Sound Pressure Level (Sound Level)	The sound level is the sound pressure relative to a standard reference pressure of 20μPa ($20x10^{-6}$ Pascals) on a decibel scale.
Decibel (dB)	A scale for comparing the ratios of two quantities, including sound pressure and sound power. The difference in level between two sounds s_1 and s_2 is given by 20 $\log_{10}$ (s_1/s_2). The decibel can also be used to measure absolute quantities by specifying a reference value that fixes one point on the scale. For sound pressure, the reference value is 20μPa.
A-weighting, dB(A)	The unit of sound level, weighted according to the A-scale, which takes into account the increased sensitivity of the human ear at some frequencies.
Noise Level Indices	Noise levels usually fluctuate over time, so it is often necessary to consider an average or statistical noise level. This can be done in several ways, so a number of different noise indices have been defined, according to how the averaging or statistics are carried out.
$L_{Aeq,T}$	A noise level index called the equivalent continuous noise level over the time period T. This is the level of a notional steady sound that would contain the same amount of sound energy as the actual, possibly fluctuating, sound that was recorded.
$L_{max,T}$	A noise level index defined as the maximum noise level during the period T. L_{max} is sometimes used for the assessment of occasional loud noises, which may have little effect on the overall L_{eq} noise level but will still affect the noise environment. Unless described otherwise, it is measured using the 'fast' sound level meter response.
$L_{90,T}$ or Background Noise Level	A noise level index. The noise level exceeded for 90% of the time over the period T. L_{90} can be considered to be the "average minimum" noise level and is often used to describe the background noise.
$L_{10,T}$	A noise level index. The noise level exceeded for 10% of the time over the period T. L_{10} can be considered to be the "average maximum" noise level. Generally used to describe road traffic noise.
Free-field	Far from the presence of sound reflecting objects (except the ground), usually taken to mean at least 3.5 metres
Façade	At a distance of 1 metre in front of a large sound reflecting object such as a building façade.
Fast Time Weighting	An averaging time used in sound level meters. Defined in BS EN 61672.

Appendix B – Site Plans

Figure B.1: Site location plan

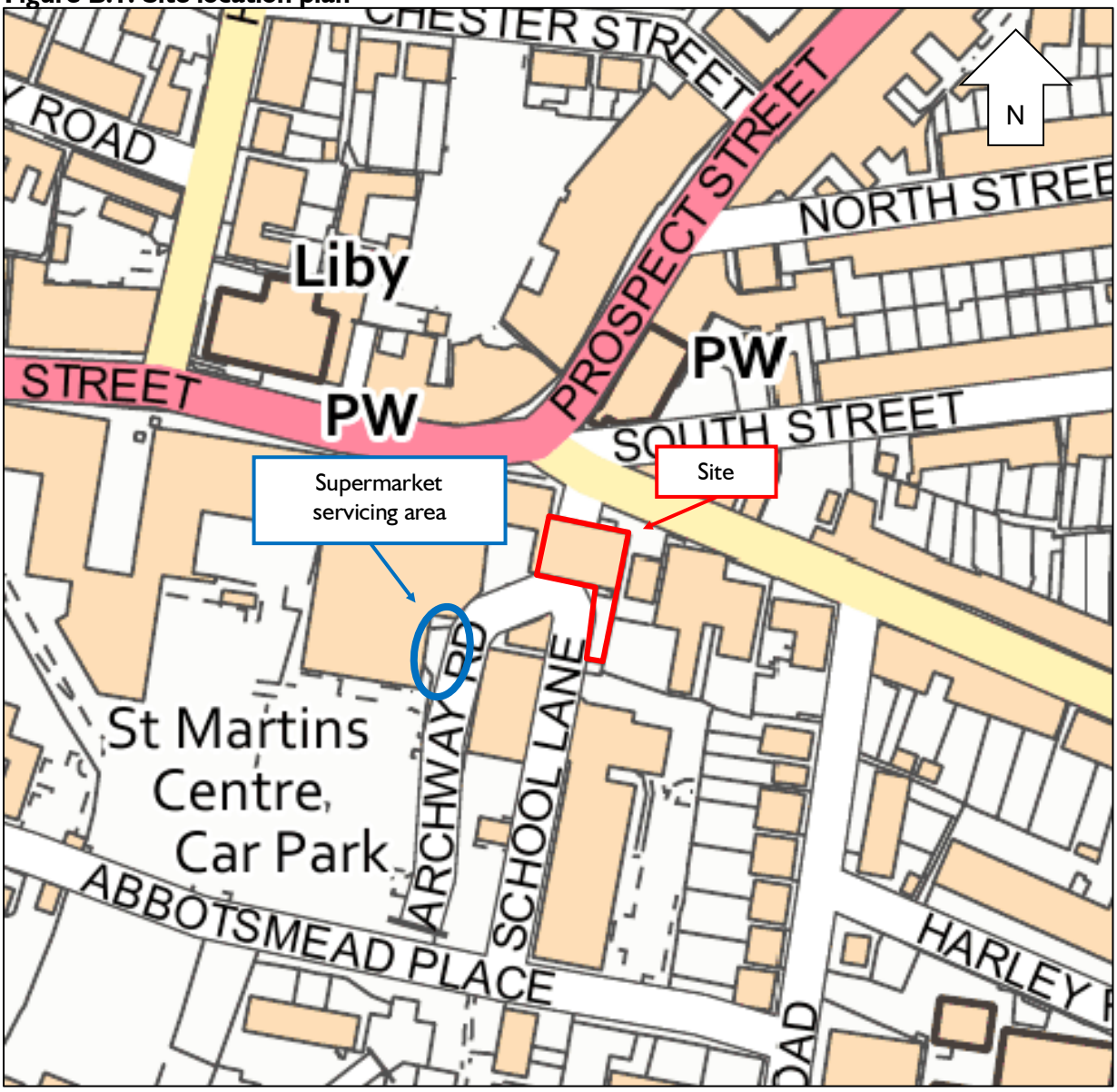

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Figure B.2: Proposed second floor plan

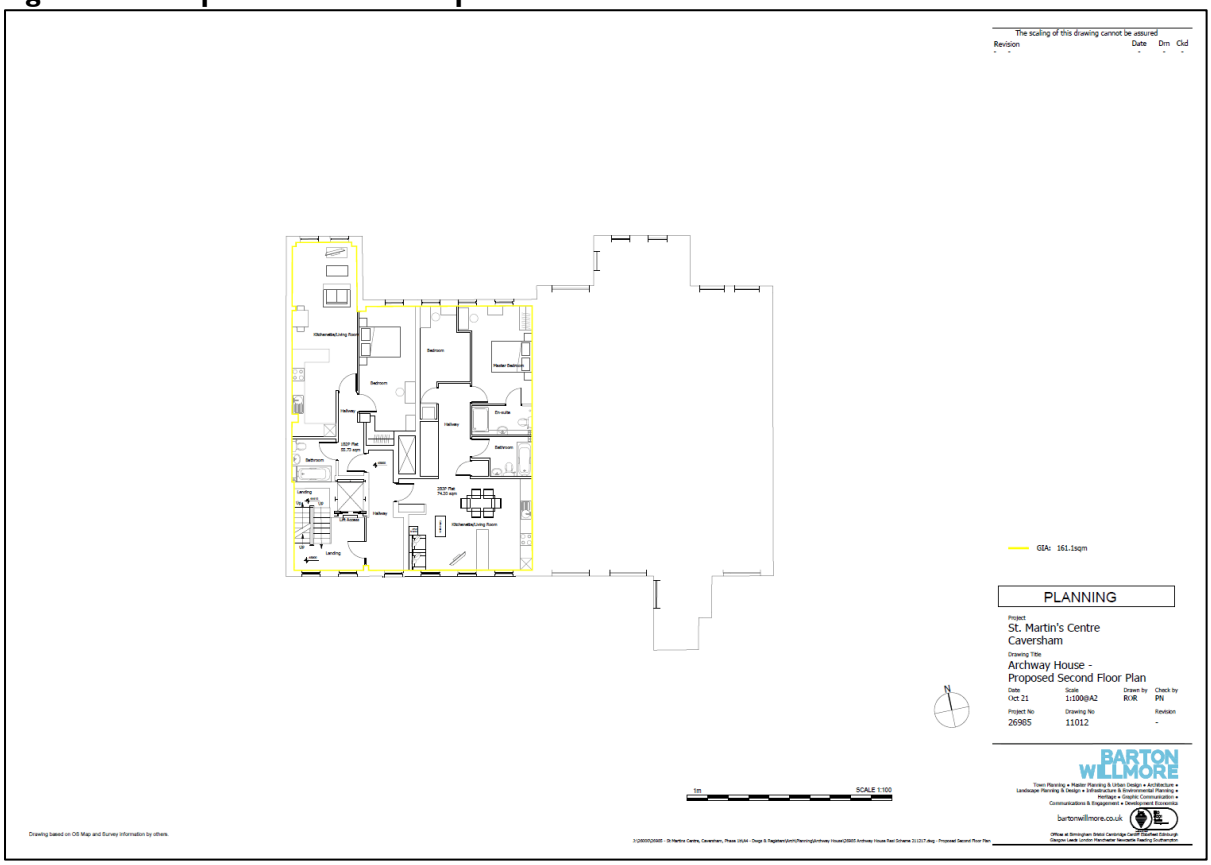
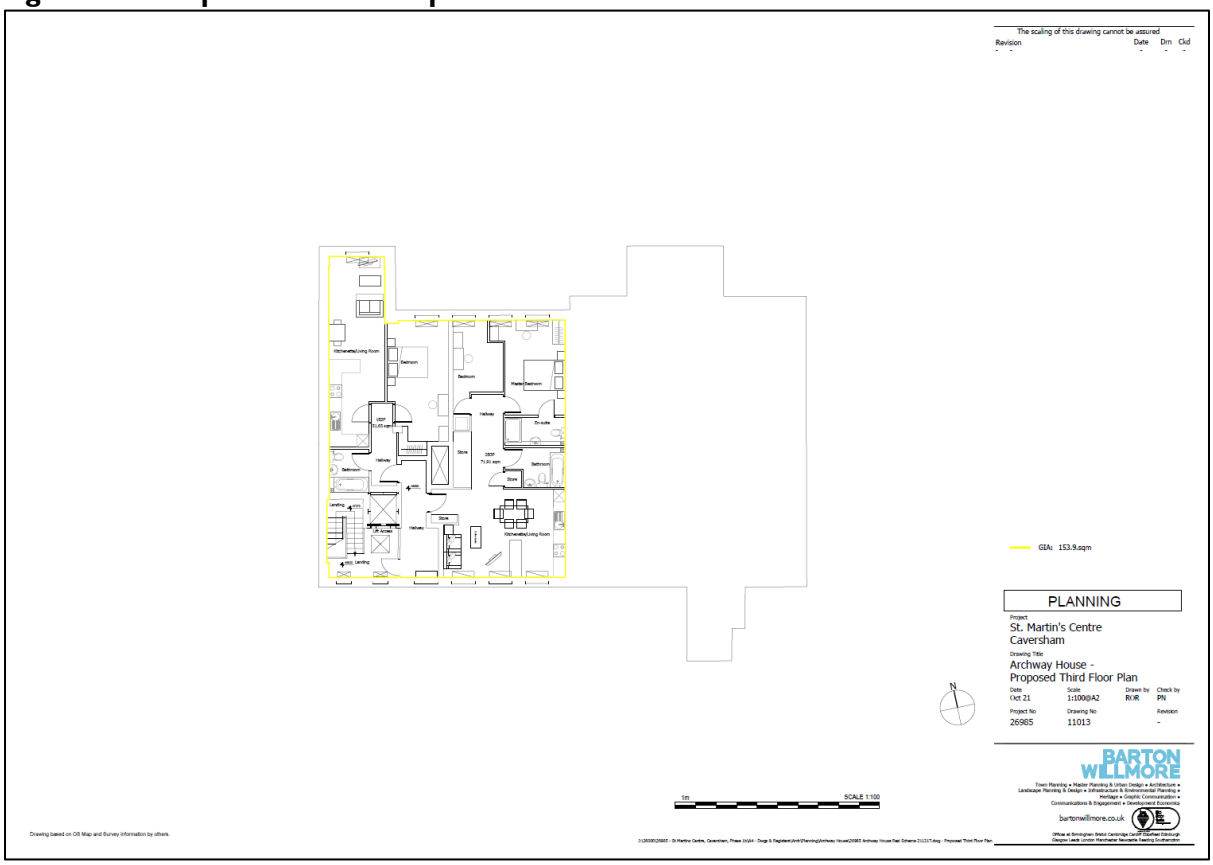


Figure B.3: Proposed third floor plan



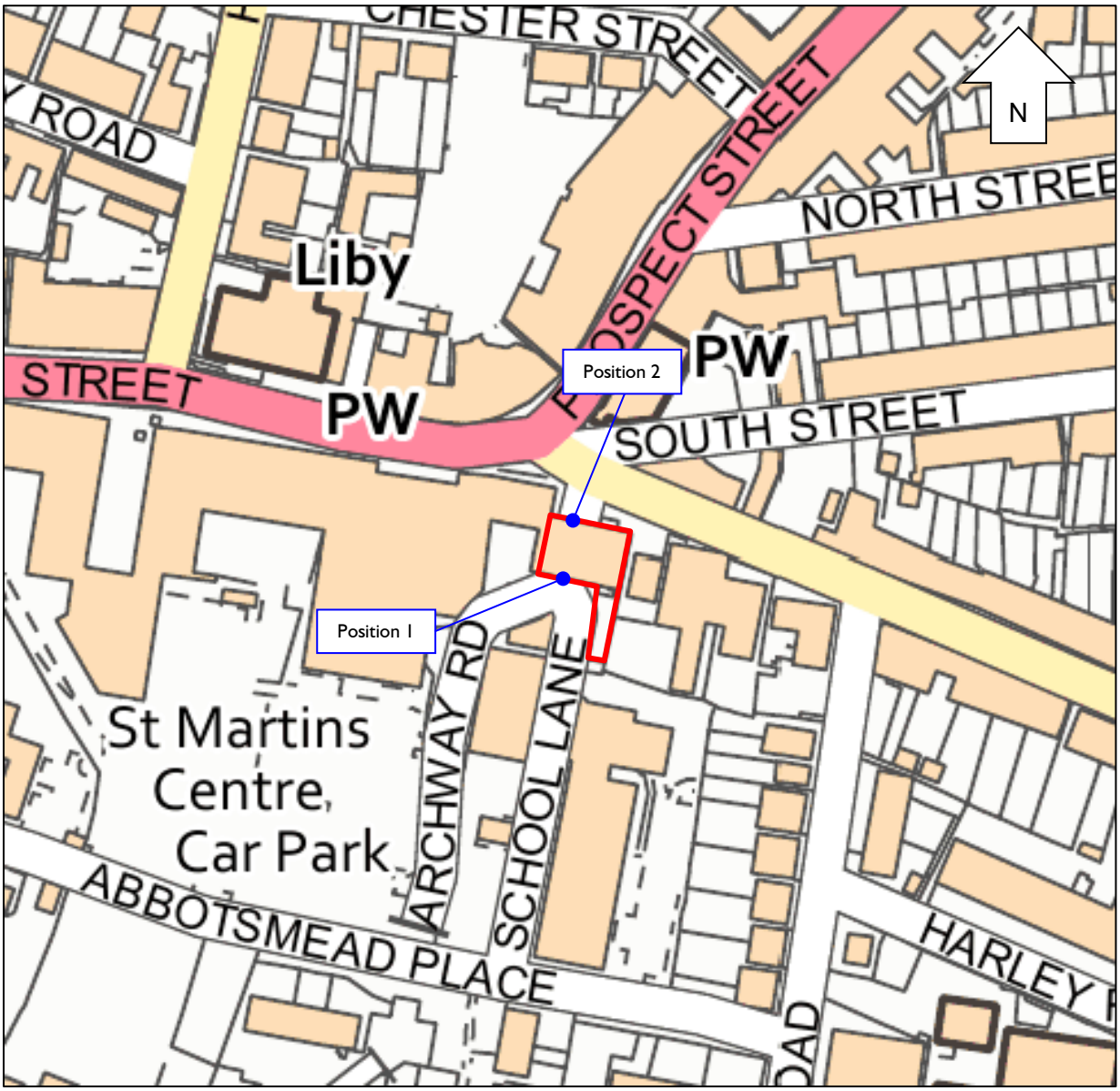
Appendix C – Monitoring Equipment

Table C.1: Noise monitoring equipment

Position(s)	Equipment	Serial Number	Calibration Date
1	01dB Fusion type 1 sound level meter	14026	15/06/2021
	01dB PRE22N pre-amplifier	2105017	
	Gras 40CD microphone	446532	
	Cirrus CR515 acoustic calibrator	96172	28/06/2021
2	01dB Fusion type 1 sound level meter	14025	15/06/2021
	01dB PRE22N pre-amplifier	2105013	
	Gras 40CD microphone	428433	
	Cirrus CR515 acoustic calibrator	96159	28/06/2021

Appendix D – Measurement Positions

Figure D.1: Measurement positions



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Appendix E – Full Survey Results

Figure E.1: Sound levels measured at Position 1, façade dB

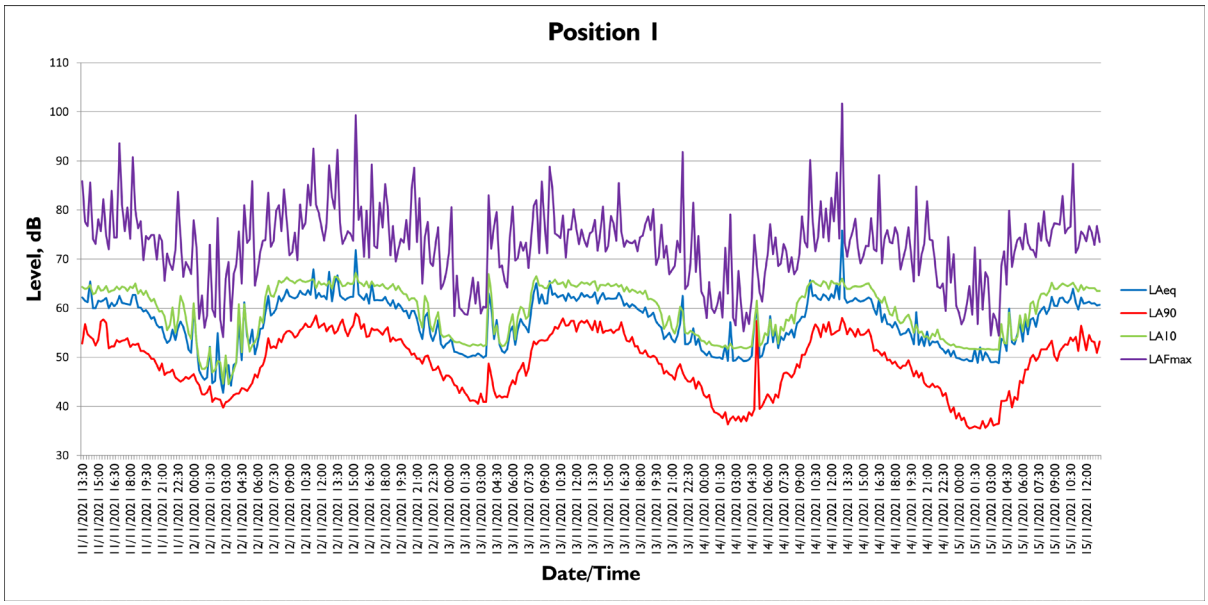


Figure E.2: Sound levels measured at Position 2, façade dB

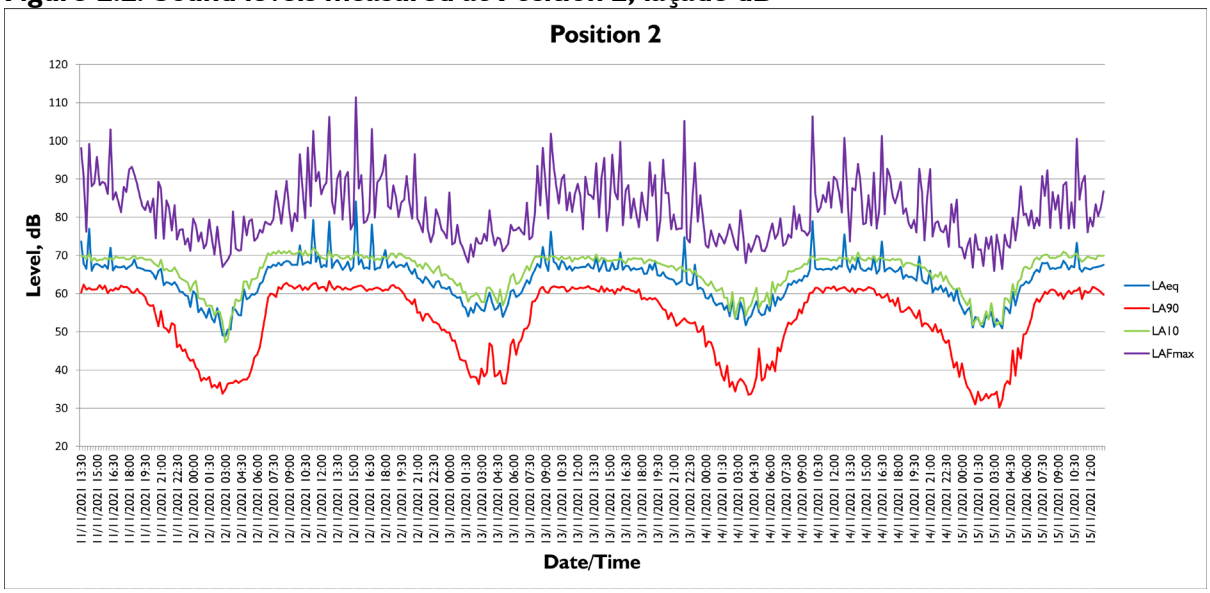
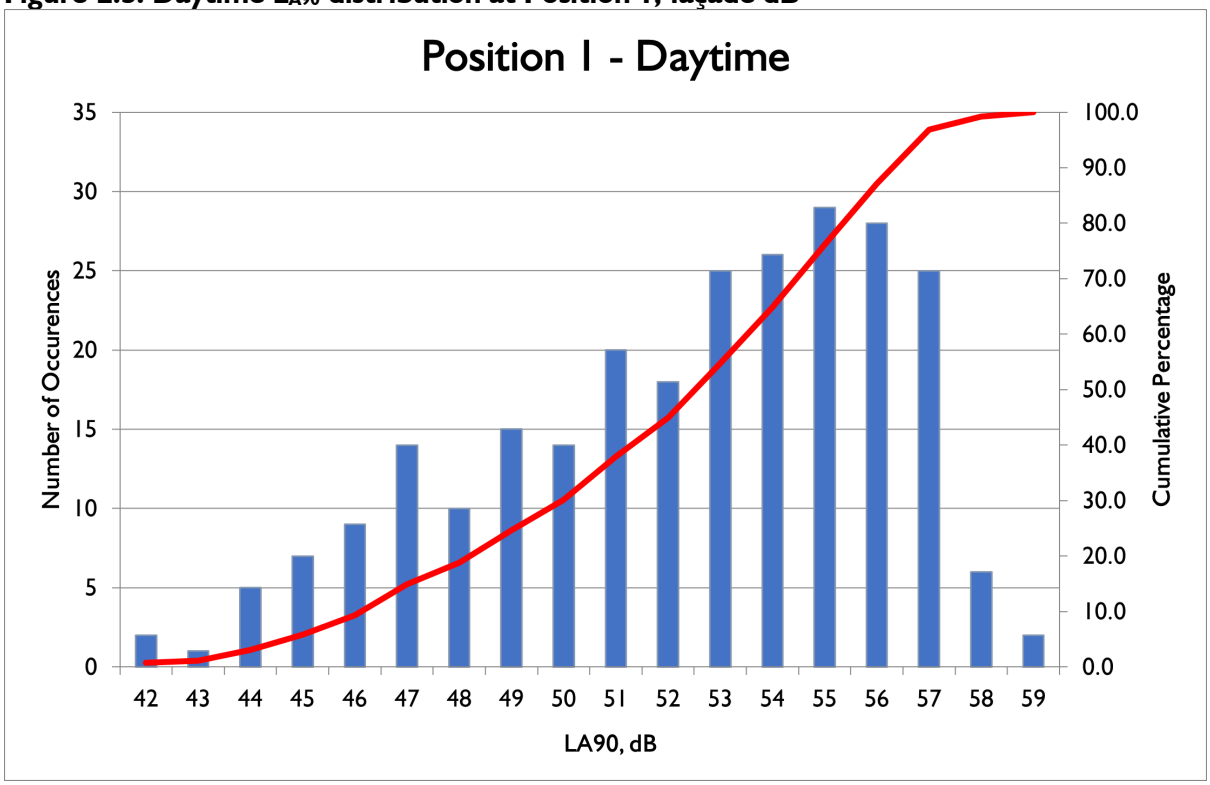


Figure E.3: Daytime L_{A90} distribution at Position 1, façade dB



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