JOSTEC

BUILDING REGULATIONS COMPLIANCE SERVICES

REPORT TITLE: BS4142:2014-A1:2019 AND BS8233:2014 ASSESSMENT OF 175 ARLINGTON ROAD, CAMDEN, LONDON, NW1 7EY

REPORT REFERENCE: 24660

ISSUED TO: NOVISPACE

ISSUED BY: JAMES FLITTON

DATE: 06 November 2024

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1.0 Introduction

1.0.1 This report has been commissioned to determine the noise impact of proposed air conditioning units on the surrounding buildings as well as the internal noise levels of the proposed building extension and existing facades.

1.0.2 The assessment has been conducted in line with the BS4142:2014 to assess the proposed plant noise with a BS8233:2014 assessment to determine recommendations of acoustic performance of glazing and, if required, ventilation proposals in order for the future dwelling to meet all necessary criteria.

2.0 Site Details

2.0.1 The site is located on the corner area of Arlington Road and Parkway in Camden, London.

2.0.2 There are three air conditioning (AC) units that have been proposed to be added to the rooftop and ground floor of the development. These units will form the basis of the BS4142:2014 assessment. The rest of the noise impact will be assessed as part of the BS8233 section of the report.

2.0.3 The main noise sources in the area are the passing traffic immediately along Arlington Road, as well as along Parkway for the facades to the rear, although this will be partially shielded by the surrounding structure.

2.0.4 The proposed development is in a predominantly residential area with restaurants/cafes and retail units at ground-level. There is also a Mecca Bingo hall opposite the proposed development although there was no breakout noise deemed likely to affect the proposed new development at 175 Arlington Road. The rear of the building may also be affected by the playground area from Cavendish school.

2.1 Location of Monitors

2.1.1 Measurements were made in 15 minute periods, on 1 second averaging, to allow for the removal of anomalies and increased accuracy. The data was averaged into L_{Aeq1hr} daytime and $L_{Aeq15min}$ night-time with data also recorded for L_{AMax} in both day and night periods for the BS4142:2014 assessment. The results were also averaged into L_{Aeq_16hr} daytime and L_{Aeq_8hr} night-time for the BS8233 section of the assessment.

2.1.2 The monitoring was conducted using 2 x Type 1 Svantek sound level meters with batteries and outdoor microphone protection. Measurement data from the front of the building was

taken on a previous assessment so that has been reused for this investigation as there have been no significant changes to the area to affect the soundscape.

2.1.3 The noise locations were chosen based on the proximity to the closest NSR.

Figure 1

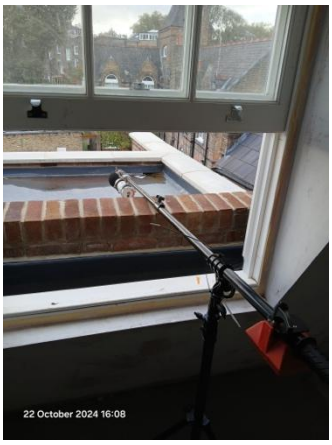


Figure 2

2.1.4 All measurements were taken after a field calibration was undertaken to ensure accuracy and repeatability of measurements. Calibration was also checked post measurements for drift to validate the data taken.

2.1.5 Further data such as wind speed, wind direction, rainfall intensity, temperature and cloud cover were all recorded at the beginning and end of the assessment at the monitoring location.

2.1.6 Any anomalies (such as noise by the engineer during setup and collection of the kit) were removed from the survey for a true reflection of the ambient levels in the vicinity. This was done by recording audio throughout the survey at each location and listening back through the files during the analysis process to confirm what was recorded manually during the survey.

2.2 Plan Views of Site with Designated Work Areas

Figure 3

Key

= Monitoring Position for Noise Assessment

2.3 Proposed Floor Plans

Figure 4

3.0 Legislation

3.0.1 The National Planning Policy Framework (NPPF) sets out the Government's economic, environmental and social planning policies for England and "these policies articulate the Government's vision of sustainable development." In respect of noise, Paragraph 174 of the NPPF states the following:

"Planning policies and decisions should contribute to and enhance the natural and local environment by:

e) preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution...."

Paragraph 185 goes on to mention:

"Planning policies and decisions should also ensure that new development is appropriate for its location taking into account the likely effects (including cumulative effects) of pollution on health, living conditions and the natural environment, as well as the potential sensitivity of the site or the wider area to impacts that could arise from the development. In doing so they should:

a) mitigate and reduce to a minimum potential adverse impacts resulting from noise from new development – and avoid noise giving rise to significant adverse impacts on health and the quality of life;

b) identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason;"

3.0.2 The NPPF reinforces the March 2010 DEFRA publication, "Noise Policy Statement for England" (NPSE), which states three policy aims, as follows:

"Through the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development:

- avoid significant adverse impacts on health and quality of life;
- mitigate and minimise adverse impacts on health and quality of life;
- and where possible, contribute to the improvement of health and quality of life."

3.0.3 Together, the first two aims require that no significant adverse impact should occur and that, where a noise level which falls between a level which represents the lowest observable adverse effect and a level which represents a significant observed adverse effect, then according to the explanatory notes in the statement:

> "... all reasonable steps should be taken to mitigate and minimise adverse effects on health and quality of life whilst also taking into consideration the guiding principles of sustainable development. This does not mean that such effects cannot occur."

3.0.4. It is possible to apply objective standards to the assessment of noise and the effect produced by the introduction of a certain noise source may be determined by several methods, as follows:

- The effect may be determined by reference to guideline noise values. British Standard (BS) 8233:2014 and World Health Organisation (WHO) "Guidelines for Community Noise" contain such guidelines.
- Another method is to compare the resultant noise level against the background noise level (L_{A90}) of the area. This is the method employed by BS 4142:2014 to determine the likelihood of complaint from noise of an industrial nature. It is best suited to the assessment of steady or pseudo-steady noise.

3.0.5 British Standard 8233:2014 is principally intended to assist in the design of new dwellings; however, the Standard does state that it may be used in the assessment of noise from new sources being brought to existing dwellings.

3.0.6 The WHO guideline values are appropriate to what are termed "critical health effects". This means that the limits are at the lowest noise level that would result in any psychological or physiological effect.

The WHO/BS 8233 guideline noise values are summarised in the following table:

Table 1

Guidance Document	L_{AeqT}	L_{AMax}	Outcome
World Health Organisation "Community Noise 2000"	55dB		Serious annoyance, daytime and evening. (Continuous noise, outdoor living areas)
	50dB		Moderate annoyance, daytime and evening. (Continuous noise, outdoor living areas).
	35dB		Moderate annoyance, daytime and evening. (Continuous noise, dwellings, indoors)
	30dB		Sleep disturbance, night-time (indoors)

		60dB	Sleep disturbance, windows open at night. (Noise peaks outside bedrooms, external level).
		45dB	Sleep disturbance at night (Noise peaks inside bedrooms, internal level)
BS 8233:2014 "Sound Insulation and noise reduction for buildings"	55dB		Upper limit for external steady noise. (gardens and patios).
	50dB		Desirable limit for external steady noise. (gardens and patios).
	L_{Aeq} 16 hours = 35 dB		Resting, living room day. (Internal – steady noise)
	L_{Aeq} 16 hours = 40 dB		Dining, dining room day. (Internal – steady noise)
	L_{Aeq} 16 hour = 35 dB		Sleeping, bedroom day (Internal – steady noise)
	L_{Aeq} 8 hours = 30 dB		Sleeping, bedroom day (Internal – steady noise)

3.0.7 For L_{AeqT} criteria the time base (T) given in the documents is 16 hours for daytime limits and 8 hours for night time limits. All surveys are conducted on 1 hour daytime and 15 minute night values – based on 1 second readings on a Type 1 sound level meter. The readings are taken every 5 mins for noise to allow the elimination of erroneous data if required.

3.0.8 The WHO guidelines are also concerned with the L_{AMax} for night-time sleep disturbance. The guideline states:

> "For a good sleep, it is believed that indoor sound pressure levels should not exceed approximately 45 dB L_{AFmax} more than 10-15 times per night"

3.0.9 On this basis, for the purpose of assessing night-time L_{AFmax} noise events, it is considered appropriate to adopt the 10th highest L_{AFmax} noise event occurring in a typical night-time (23:00 – 07:00) period.

3.0.10 Audio recordings are taken throughout the measurements to allow for further assessments on high levels. Listening to the audio and performing tonal analysis will allow anomalies to be removed from the data, if required.

3.1 Local Authority Criteria

3.1.1 The Camden Local Plan 2017 makes references to the impact of noise generating sources. Section 4.14 says;

*"**Air quality, noise and neighbourhood amenity** – Policies CC4 Air quality, A1 Managing the impact of development, and A3 Biodiversity recognise that development can have a significant effect upon the amenity, health and wellbeing of those who live, work and visit the borough. We will only grant permission for development that does not cause harm to amenity or/and would cause harm to air quality unless appropriate mitigation measures are adopted."*

3.1.2 Policy A4 Noise and Vibration goes further to explain the policy of noise management within the area. Section 6.84 illustrates that the policy *"seeks to ensure that noise and vibration is appropriately considered at the design stage and that noise sensitive uses are not negatively impacted by noise and vibration or that existing uses (such as music venues, theatres and some employment uses) are not unduly restricted through the introduction of nearby noise sensitive uses".*

3.1.3 Policy A4 also states *"We will not grant planning permission for:*

a. *development likely to generate unacceptable noise and vibration impacts; or*
b. *development sensitive to noise in locations which experience high levels of noise, unless appropriate attenuation measures can be provided and will not harm the continued operation of existing uses."*

3.1.4 Appendix 3: Noise Thresholds displays the criteria by wish all noise sources must abide:

Camden's thresholds for noise and vibration evaluate noise impact in terms of various 'effect levels' described in the National Planning Policy Framework and Planning Practice Guidance:

- *NOEL – No Observed Effect Level*
- *LOAEL – Lowest Observed Adverse Effect Level*
- *SOAEL – Significant Observed Adverse Effect Level*

Three basic design criteria have been set for proposed developments, these being aimed at guiding applicants as to the degree of detailed consideration needed to be given to noise in any planning application. The design criteria outlined below are defined in the corresponding noise tables. The values will vary depending on the context, type of noise and sensitivity of the receptor:

- *Green – where noise is considered to be at an acceptable level.*

- *Amber – where noise is observed to have an adverse effect level, but which may be considered acceptable when assessed in the context of other merits of the development.*
- *Red – where noise is observed to have a significant adverse effect."*

3.2 BS4142:2014 +A1 (2019)

3.2.1 The London City plan also makes reference to the measurement procedure used for BS41421:2014 as the best method.

3.2.2 Noise effects on residential properties due to the current operational hours and extended hours have been assessed according to the guidance in BS 4142:2014. This standard primarily provides a numerical method by which to determine the significance of sound of an industrial nature (i.e. the 'specific sound' from the proposed development) at residential sensitive receptors.

3.2.3 The specific sound level may then be corrected for the character of the sound (e.g. perceptibility of tones and/or impulses), if appropriate, and it is then termed the 'rating level', whether or not a rating penalty is applied. The 'residual sound' is defined as the 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.

3.2.4 According to BS 4142:2014, the background sound levels adopted for the assessment should be representative of the periods being assessed. The standard recommends that the background sound level should be collected from continuous measurements of normally not less than 15-minute intervals. However, the Standard states that there is no 'single' background sound level that can be derived from such measurements. It is particularly difficult to determine what is 'representative' of the night-time period because it can be subject to a wide variation in background sound levels between the shoulder night periods.

3.2.5 The method chosen for this section of the report is to use the data collected at the nearest NSR for the day and night periods to provide the ambient and background noise levels. The mode $L_{Aeq\_1hr(Day)}$ and $L_{Aeq\_15min(Night)}$ value will then be used for each time period over the course of the measurement as the most appropriate way of creating a representative value.

3.2.6 The specific sound levels have been determined separately in terms of the L_{Aeq1hr} during the daytime $L_{Aeq15min}$ during the night-time. Daytime is typically between 07:00 and 23:00 hours and night-time is typically between 23:00 and 07:00 hours, so these periods have been adopted for this assessment.

3.2.7 At each of the most likely sensitive receptor locations, the rating level has been determined from the predicted specific sound level. Where it has considered it to be appropriate, a rating penalty has been applied for tonality, impulsivity and/or intermittent specific sounds as described in the commentary to paragraph 9.2 of BS4142:2014. This has been applied with consideration for the main sound sources from site that contribute to the level of specific sound at the receptor location.

3.2.8 As per the requirements of the standard, an initial estimate of the impact of the specific sound has been obtained by subtracting the measured background sound level from the rating level of the specific sound. Table 2 provides the initial evaluation of impact following this method.

Table 1

Magnitude	Difference Between rating Level and Background Level	Comments
High	+10dB	Significant Adverse impact Likely
Medium	+5 to +10dB	Adverse impact Likely
Low	0 to +5 dB	Low Chance of Adverse Impact
Negligible	Less than 0dB	Low Chance of Adverse Impact
No Change	-10 dB	No adverse impact

3.2.9 Following the initial evaluation of impact, the context of the sound has also been considered, which is a key requirement of the Standard. In evaluation of the context, the following factors have been considered:

- the absolute level of the sound;
- the character and level of the residual sound compared to the character and level of the specific sound and
- 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.

4.0 Results

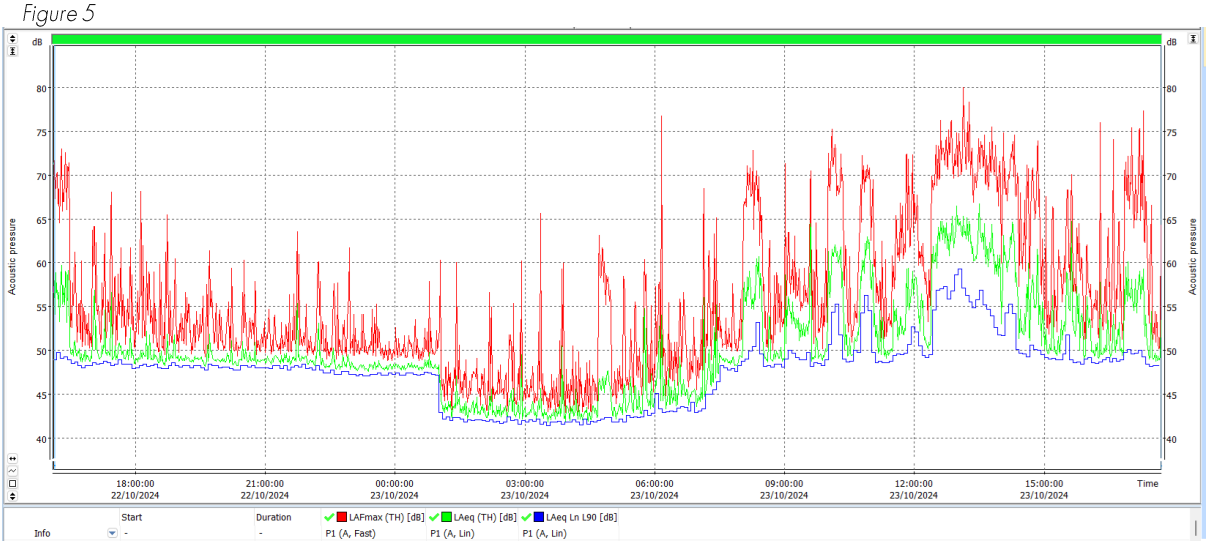
4.1 – Rear, Second-floor

16.20pm 22/10/24 – 17.42pm 23/10/24

Table 2

Time Period	Start Date/Time	L_{Amax} (10th Highest)	L_{Aeq1hr} (Mode)	$L_{Aeq15min}$ (Mode)	L_{A90}
Day (0700-2300)	16.20pm 22/10/24		53.6dBA		48.5dBA
Night (2300-0700)	23.00pm 22/10/24	58.5dBA		45.3dBA	43.4dBA

Figure 5



Comments

Steady background with passing traffic noise audible. Audible industrial noise inactive from 1am to 7am.

**based on Appendix C*

Time Period	Cloud Cover	Temperature (Celcius)	Prescence of fog/snow/ice	Wind Speed (m/s)	Wind Direction
Installation	5	18	No	0.2	NW
Collection	7	12	No	1.8	N

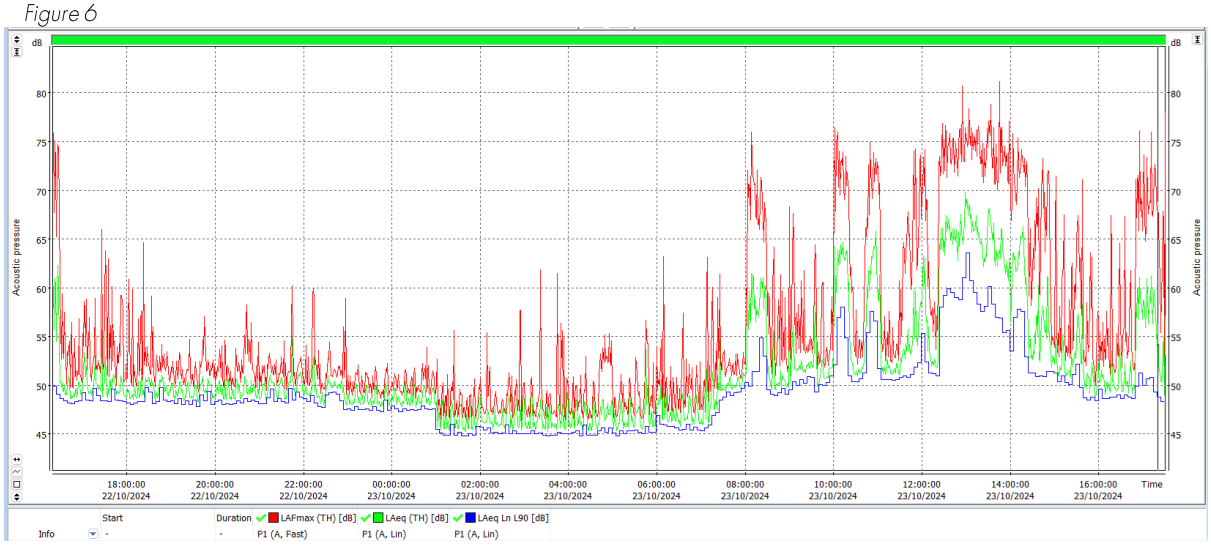
4.2 – Garden Area

16.34pm 22/10/24 – 17.31pm 23/10/24

Table 3

Time Period	Start Date/Time	L_{Amax} (10th Highest)	L_{Aeq1hr} (Mode)	$L_{Aeq15min}$ (Mode)	L_{A90}
Day (0700-2300)	16.34pm 22/10/24		54.4dBA		49.9dBA
Night (2300-0700)	23.00pm 22/10/24	55.4dBA		47.4dBA	45.8dBA

Figure 6



Comments

Steady background with passing traffic noise audible. Some bird noise causing spikes. Audible industrial noise inactive from 1am to 7am.

**based on Appendix C*

Time Period	Cloud Cover	Temperature (Celcius)	Prescence of fog/snow/ice	Wind Speed (m/s)	Wind Direction
Installation	5	18	No	0.2	NNW
Collection	7	12	No	0.2	NW

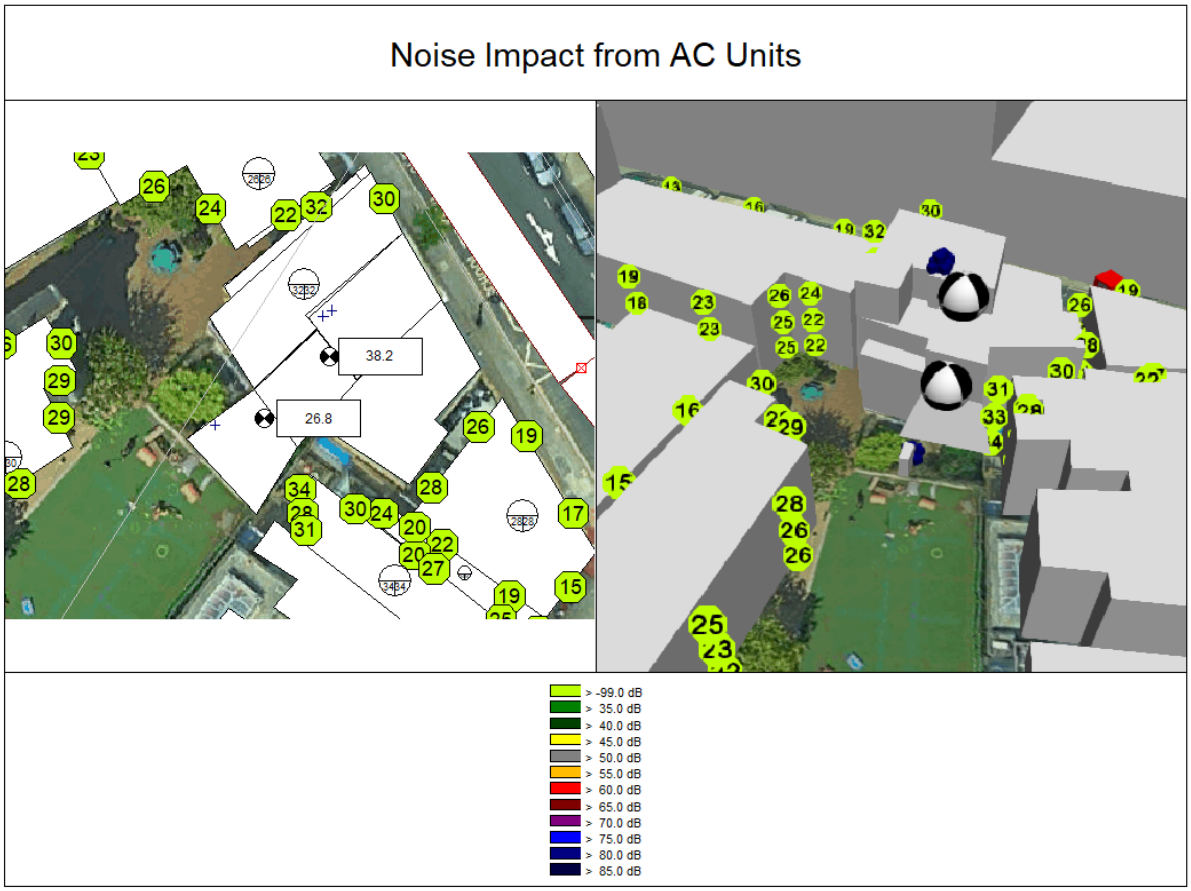
5.0 Analysis of Results

5.1 Calculated Results

5.1.1 The specific noise level of the air conditioning units to the rear of the proposed site can be calculated by using the manufacturer's data that is provided on their technical data sheets and entering this into the CadnaA noise modelling software. As the technical data sheets do not provide full octave-band data, in accordance with ISO9613-2, the 500Hz band has been used with the provide sound power data. This is at a value of 63dBA Lw.

5.1.2 Figure 7 below shows the noise impact for the addition of the three AC units post construction of the additional floor and extension to the rear.

Figure 7



5.1.3 The model shows that the predicted noise impact from the proposed units produces a level of 38dbA at the nearest Noise Sensitive Receptor (NSR) façade and then 34dBA at

the next. 38dBA has therefore been used in the assessment in table 4 below to determine the likelihood of adverse impact from the units. All other NSR points around the proposed development at lower in impact level and are therefore considered to not be producing any Adverse impact.

Table 4

Measurement Type	*Parameter*	*Result*	*Comment*
Day			
Ambient sound	L_{Aeq}	**54dBA**	**Measured at NSR-Source present**
Residual sound level	L_{Aeq1hr}	**54dBA**	**Original Assessment**
Background sound level	L_{A901hr}	**49dBA**	**Measured at NSR-Source present**
Specific Sound Level	L_{Aeq1hr}	**38dBA**	**Calculated**
Acoustic Feature Correction	**dBA**	**+3**	**No tonal or impulsive features expected but possibly intermittent**
Rating Level	**dBA**	**41dBA**	
Difference of Background vs Rating level	**dBA**	**-4dB**	
BS4142:2014 Classification			**Low Chance of Adverse impact**
Night			
Ambient sound	L_{Aeq}	**45dBA**	**Measured at NSR-Source present**
Residual sound level	$L_{Aeq15mins}$	**45dBA**	**Original Assessment**
Background sound level	$L_{A9015mins}$	**43dBA**	**Measured at NSR**
Specific Sound Level	$L_{Aeq15mins}$	**38dBA**	**Calculated**
Acoustic Feature Correction	**dBA**	**+3**	**No tonal or impulsive features expected but possibly intermittent**
Rating Level	**dBA**	**41dBA**	
Difference of Background vs Rating level	**dBA**	**-2dB**	
BS4142:2014 Classification			**Low Chance of Adverse impact**

5.2 Discussion of Levels

5.2.1 The specific noise level of the air handling units to the rear of the building are below the required levels, in accordance with BS4142:2014, for there to be anything more than a low chance of adverse impact on the proposed new dwellings.

5.3 BS8233:2014 Assessment

5.3.1 The values measured have been used to examine the required glazing specification for the new extension to the rear of the proposed development and also the additional top floor. Table 5 below provides the linear calculations for the glazing and ventilation strategy.

Table 5 – linear assessment values

Location	L_{AeqT} (16hr Day & 8hr Night)	L_{AMax}	BS8233 & WHO Internal noise	BS8233 & WHO External Noise	Difference to L_{Aeq} (internal/external)	Difference to Max (internal)
Top/2nd Floor						
Day (0700-2300)	54dBA		35dBA	55dBA	(+19dBA/ -1dBA)	-
Night (2300-0700)	45dBA	59dBA (10th Highest)	30dBA (45dBA L_{AMax})	(60dBA L_{AMax})	(+15dBA)	(+14dBA)
First/Ground Floor						
Day (0700-2300)	54dBA		35dBA	55dBA	(+19dBA/ -1dBA)	-
Night (2300-0700)	47dBA	55dBA (10th Highest)	30dBA (45dBA L_{AMax})	(60dBA L_{AMax})	(+17dBA)	(+10dBA)

5.4 Observations and Further Discussions

5.4.1 The measured L_{Aeq} values for both the day and the night periods are shown in table 5. The day period at the top of the proposed property is 19dBA above the limit for indoor noise levels. The day period at the ground and first-floor levels of the property will also be 19dBA above the limit for indoor noise levels.

5.4.2 The night value at the top is 15dBA above the recommended value for internal noise to prevent sleep disturbance. The first and ground-floor levels of the property are 17dBA above the values required for internal noise.

5.4.3 BS8233 assumes that a standard double-glazed window will provide up to 15dB reduction when open (with some council guidelines leaning on the side of caution and assuming a 10dB reduction). Either option would mean that any glazed window in the building cannot be relied upon as the source of ventilation without the chance of sleep disturbance being had by the inhabitants of the proposed dwellings to the front of the building. Trickle/acoustic vents will therefore be required at all levels of the property; to reduce the need to open windows to ventilate.

5.4.4 The L_{AMax} value to prevent the likelihood of sleep disturbance is set at 60dBA external and 45dBA internal. Based on the highest value from the tenth-highest daily value measured during the week the reading for $L_{AMax\ night}$ at the top of the property was 59dBA. This value is 14dB above the required value externally for sleep disturbance. The $L_{AMax\ \_night}$ at the ground floor of the property was just 10dB above the recommended levels.

5.4.5 These figures will now be checked against the calculation methodology in BS8233 annex G to provide exact specifications in section 6.

5.5 BS8233 Calculation Sheet

Figure 8 – BS8233:2014 Annex G Calculation, Second/Top Floor

		Overall dBA	Octave Band Frequency (Hz)					
Time Period			125	250	500	1000	2000	4000
Leq,ff	Daytime	54.4	40	45	47	49	48	46

Room Details	**(m)**
Height	2.2
Width	3.5
Length	2.6
Sample Room Volume	20.02
Sample Room Surface Area	26.84

Element	**Area/No.of**	**Element Specification**
External Wall	7.7	Traditional brick and block with ties and insulation
Windows	3	4 mm / (6 - 16 mm) / 4 mm Pilkington
Ceiling	9.1	
Ventilation	1	Standard non-acoustic trickle ventilator typically ≥ Dn,e,w 30dB

Element SRI

		Octave Band Frequency (Hz)						Single Figure Rating
Element	**Area/No.of**	125	250	500	1000	2000	4000	
Walls	4	47	49	49	58	68	79	57
Windows	1	21	17	25	35	37	31	29
Ceiling	1	28	34	40	45	49	52	
Ventilation (Dn,e)	1	30	30	30	30	30	28	30

Overal Sound Reduction

Calculated Internal SPL

	Overall	Octave Band Frequency (Hz)					
		125	250	500	1000	2000	4000
Leq,2	27.3	4.6	18.5	19.9	20.8	20.4	21.1
Limit	35						
Value under limit	7.7						

Figure 9 – BS8233:2014 Annex G Calculation, Ground/First Floor

		Overall dBA	Octave Band Frequency (Hz)					
Time Period			**125**	**250**	**500**	**1000**	**2000**	**4000**
Leq,ff	Daytime	53.6	39	43	45	49	47	46

Room Details	**(m)**
Height	2.2
Width	3.5
Length	2.6
Sample Room Volume	20.02
Sample Room Surface Area	26.84

Element	**Area/No.of**	**Element Specification**
External Wall	7.7	Traditional brick and block with ties and insulation
Windows	3	4 mm / (6 - 16 mm) / 4 mm Pilkington
Ceiling	9.1	
Ventilation	1	Standard non-acoustic trickle ventilator typically ≥ Dn,e,w 30dB

Element SRI

		Octave Band Frequency (Hz)						Single Figure Rating
Element	**Area/No.of**	**125**	**250**	**500**	**1000**	**2000**	**4000**	
Walls	**4**	47	49	49	58	68	79	57
Windows	1	21	17	25	35	37	31	29
Ceiling	1	28	34	40	45	49	52	
Ventilation (Dn,e)	1	30	30	30	30	30	28	30

Overal Sound Reduction

Calculated Internal SPL

	Octave Band Frequency (Hz)					
	Overall	**125**	**250**	**500**	**1000**	**2000**	**4000**
Leq,2	26.5	3.6	16.5	17.9	20.8	19.4	21.1
Limit	35						
Value under limit	8.5						

6.0 Glazing and Ventilation Recommendations

6.1 External Walls

6.1.1 External walls of the proposed building are understood to be traditional 9" brick:

Table 6

Description	Octave Band Centre Frequency (Hz) Sound Reduction Index *R* dB					
	125	250	500	1k	2k	4k
Traditional solid 9" brick & block with cavity	39	44	51	58	63	68

6.2 Glazing

6.2.1 The glazing for the proposed site does not require any specialist glazing. An example suitable double-glazing product for noise reduction to the property is shown in table 7.

Table 7

Description	Location	Octave Band Centre Frequency (Hz) Sound Reduction Index *R* dB						Rw (C; Ctr)
		125	250	500	1k	2k	4k	
Pilkington 6 mm / (6 - 16 mm) / 4 mm	All Glazing	21	17	25	35	37	31	29 (-1,-4)

6.3 Ventilation

6.3.1 It is anticipated that a basic ventilation system will be needed to be incorporated into the scheme design to reduce the impact of the noise levels, such that residents of the properties are able to have background ventilation without necessarily needing to open windows. Table 8 provides suitable specification for a basic non-acoustic system that has been used in the Annex G Calcualtions

Table 8

Description	Octave Band Centre Frequency (Hz) Sound Reduction Index $D_{n,e}$ dB					
	125	250	500	1k	2k	4k
Standard non-acoustic trickle ventilator typically ≥ $D_{n,e,w}$ 30dB	30	30	30	30	30	28

7.0 Conclusion

7.0.1 The use of the suggested configuration specification will allow the proposed site to meet the regulations for acoustic performance in accordance with BS8233:2014.

7.0.2 The proposed plant noise to the rooftop and rear of the property, accompanied by the proposed glazing and ventilation plan, will also mean that the site fully conforms to the specified standards. This also includes adverse impact of noise, in accordance with BS4142:2014, to all surrounding NSRs properties.

7.0.3 The noise impact from the nearby school playground was also deemed to be negligible. The was a slight increase in noise levels when the children were out during break times, but they variation in noise level was well below the 7-8dB buffer that is provided by the suggested glazing and ventilation strategy.

7.0.4 If the rear ground-floor level is used as an outdoor amenity space it will fall below the limit of 55dBA L_{Aeq_16hr} and the desirable level of 50dBA L_{Aeq_16hr} both in the current state and also once the construction work has been completed.

8.0 Credentials

Name	Title	Credentials
James Flitton BSc AMIOA	Acoustic Consultant	CSCS Professionally Qualified person
		Associate Member Institute of Acoustics
		Diploma in Acoustics and Noise Control
		Affiliate Member of IDE
		Affiliate Member of IOR
Signed		

Appendix A – Acoustic Terminology

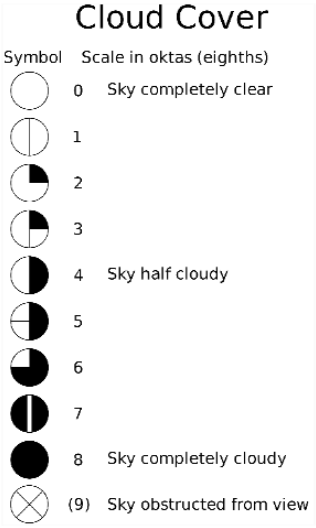
Parameter	Description
Ambient Noise Level	The totally encompassing sound in a given situation at a given time, usually composed of a sound from many sources both distant and near ($L_{Aeq,T}$).
Decibel (dB)	A scale for comparing the ratios of two quantities, including sound pressure and sound power. The difference in level between two sounds s1 and s2 is given by 20 log10 (s1/s2). 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. The threshold of normal hearing is in the region of 0 dB and 140 dB is the threshold of pain. A change of 1 dB is only perceptible under controlled conditions.
dB(A), L_{Ax}	Decibels measured on a sound level meter incorporating a frequency weighting (A weighting) which differentiates between sounds of different frequency (pitch) in a similar way to the human ear. Measurements in dB(A) broadly agree with people's assessment of loudness. A change of 3 dB(A) is the minimum perceptible under normal conditions, and a change of 10 dB(A) corresponds roughly to halving or doubling the loudness of a sound. The background noise in a living room may be about 30 dB(A); normal conversation about 60 dB(A) at 1 metre; heavy road traffic about 80 dB(A) at 10 metres; the level near a pneumatic drill about 100 dB(A).
Fast Time Weighting	Setting on sound level meter, denoted by a subscript F, that determines the speed at which the instrument responds to changes in the amplitude of any measured signal. The fast time weighting can lead to higher values than the slow time weighting when rapidly changing signals are measured. The average time constant for the fast response setting is 0.125 (1/8) seconds.
Free-field	Sound pressure level measured outside, far away from reflecting surfaces (except the ground), usually taken to mean at least 3.5 metres
Façade	Sound pressure level measured at a distance of 1 metre in front of a large sound reflecting object such as a building façade.
$L_{Aeq,T}$	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 recorded during a noise event with a period T. L_{max} is sometimes used for the assessment of occasional loud noises, which may have little effect on the overall Leq noise level but will still affect the noise environment. Unless described otherwise, it is measured using the 'fast' sound level meter response.
$L_{10,T}$	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. $L_{A10,18h}$ is the A – weighted arithmetic average of the 18 hourly $L_{A10,1h}$ values from 06:00-24:00.
$L_{90,T}$	A noise level index. The noise level exceeded for 90% of the time over the period T. Generally used to describe background noise level.

Appendix B – Survey Instrumentation

- Svantek Class 1 noise monitoring station model 307A & 971 with integrated preamplifier plus microphones in weatherproof outdoor environmental kits and tripod arrangement

- Svantek calibrator (UKAS-certified)

Appendix C – Weather Conditions Chart Used

Weather Conditions				
Measurement Location	**Date/Time**	**Description**	**Beginning of Survey**	**End of Survey**
		Temperature:		
		Precipitation:		
		Cloud cover (oktas - see guide)		
		Presence of fog/snow/ice		
		Presence of damp roads/wet ground		
		Wind Speed (m/s)		
		Wind Direction		
		Conditions that may cause temperature inversion (i.e. calm nights with no cloud)		

Appendix D – BS8233:2014 Annex G Calc Sheet

		Octave Band Frequency (Hz)					
		125	250	500	1000	2000	4000
Leq,ff	A	39	43	45	49	47	46
Dn,e		30	30	30	30	30	28
$\frac{Ao}{S}10^{\frac{-Dn,e}{10}}$	B	0.00060	0.00060	0.00060	0.00060	0.00060	0.00094
Rwi		21	17	25	35	37	31
$\frac{Swi}{Sf}10^{\frac{-Rwi}{10}}$	C	0.00309	0.00777	0.00123	0.00012	0.00008	0.00031
Rew		47	49	49	58	68	79
$\frac{Sew}{Sf}10^{\frac{-Rew}{10}}$	D	0.00001	0.00001	0.00001	0.00000	0.00000	0.00000
Rrr		28	34	40	45	49	52
$\frac{Srr}{Sf}10^{\frac{-Rrr}{10}}$	E	0.00187	0.00047	0.00012	0.00004	0.00001	0.00001
10log10(B+C+D+E)	F	-22.5	-20.5	-27.1	-31.2	-31.6	-29.0
A (furnished)		11	14	16	16	15	14
$Log10\frac{S}{A}$		0.2	0.1	0.0	0.0	0.0	0.1
Leq,2	A+F+G+3	19.6	25.5	20.9	20.8	18.4	20.1
A-weighting		-16	-9	-3	0	1	1
LAeq,2		3.6	16.5	17.9	20.8	19.4	21.1
Total	26.5						

		Octave Band Frequency (Hz)					
		125	250	500	1000	2000	4000
Leq,ff	A	40	45	47	49	48	46
Dn,e		30	30	30	30	30	28
$\frac{Ao}{S}10^{\frac{-Dn,e}{10}}$	B	0.00060	0.00060	0.00060	0.00060	0.00060	0.00094
Rwi		21	17	25	35	37	31
$\frac{Swi}{Sf}10^{\frac{-Rwi}{10}}$	C	0.00309	0.00777	0.00123	0.00012	0.00008	0.00031
Rew		47	49	49	58	68	79
$\frac{Sew}{Sf}10^{\frac{-Rew}{10}}$	D	0.00001	0.00001	0.00001	0.00000	0.00000	0.00000
Rrr		28	34	40	45	49	52
$\frac{Srr}{Sf}10^{\frac{-Rrr}{10}}$	E	0.00187	0.00047	0.00012	0.00004	0.00001	0.00001
10log10(B+C+D+E)	F	-22.5	-20.5	-27.1	-31.2	-31.6	-29.0
A (furnished)		11	14	16	16	15	14
$Log10\frac{S}{A}$		0.2	0.1	0.0	0.0	0.0	0.1
Leq,2	A+F+G+3	20.6	27.5	22.9	20.8	19.4	20.1
A-weighting		-16	-9	-3	0	1	1
LAeq,2		4.6	18.5	19.9	20.8	20.4	21.1
Total	27.3						

Appendix E – CadnaA Calculations

Receiver
Name: First Floor
ID:
X: 30698030.9[illegible]m
Y: 5713591.6[illegible]m
Z: 6.00 m

Point Source, ISO 9613, Name: "AC Unit", ID: ""																				
Nr.	X	Y	Z	Refl.	DEN	Freq.	Lw	I/a	Optime	K0	Di	Adiv	Aatm	Agr	Afol	Ahous	Abar	Cmet	RL	Lr
	(m)	(m)	(m)			(Hz)	dB(A)	dB	dB	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	dB(A)
4	30698027.68	5713591.23	0.50	0	DEN	500	63.0	0.0	0.0	0.0	0.0	27.1	0.0	0.8	0.0	0.0	9.8	0.0	0.0	25.3

Point Source, ISO 9613, Name: "AC Unit", ID: ""																				
Nr.	X	Y	Z	Refl.	DEN	Freq.	Lw	I/a	Optime	K0	Di	Adiv	Aatm	Agr	Afol	Ahous	Abar	Cmet	RL	Lr
	(m)	(m)	(m)			(Hz)	dB(A)	dB	dB	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	dB(A)
5	30698034.76	5713598.36	11.50	0	DEN	500	63.0	0.0	0.0	0.0	0.0	30.6	0.0	0.0	0.0	0.0	12.6	0.0	0.0	19.8

Point Source, ISO 9613, Name: "AC Unit", ID: ""																				
Nr.	X	Y	Z	Refl.	DEN	Freq.	Lw	I/a	Optime	K0	Di	Adiv	Aatm	Agr	Afol	Ahous	Abar	Cmet	RL	Lr
	(m)	(m)	(m)			(Hz)	dB(A)	dB	dB	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	dB(A)
6	30698035.33	5713598.74	11.50	0	DEN	500	63.0	0.0	0.0	0.0	0.0	31.0	0.0	0.0	0.0	0.0	15.1	0.0	0.0	16.9

Receiver
Name: 2nd Floor
ID:
X: 30698035.2[illegible]m
Y: 5713595.6[illegible]m
Z: 10.00 m

Point Source, ISO 9613, Name: "AC Unit", ID: ""																				
Nr.	X	Y	Z	Refl.	DEN	Freq.	Lw	I/a	Optime	K0	Di	Adiv	Aatm	Agr	Afol	Ahous	Abar	Cmet	RL	Lr
	(m)	(m)	(m)			(Hz)	dB(A)	dB	dB	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	dB(A)
1	30698034.76	5713598.36	11.50	0	DEN	500	63.0	0.0	0.0	0.0	0.0	20.8	0.0	0.0	0.0	0.0	5.5	0.0	0.0	36.6

Point Source, ISO 9613, Name: "AC Unit", ID: ""																				
Nr.	X	Y	Z	Refl.	DEN	Freq.	Lw	I/a	Optime	K0	Di	Adiv	Aatm	Agr	Afol	Ahous	Abar	Cmet	RL	Lr
	(m)	(m)	(m)			(Hz)	dB(A)	dB	dB	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	dB(A)
2	30698035.33	5713598.74	11.50	0	DEN	500	63.0	0.0	0.0	0.0	0.0	21.7	0.0	0.0	0.0	0.0	8.5	0.0	0.0	32.8

Point Source, ISO 9613, Name: "AC Unit", ID: ""																				
Nr.	X	Y	Z	Refl.	DEN	Freq.	Lw	I/a	Optime	K0	Di	Adiv	Aatm	Agr	Afol	Ahous	Abar	Cmet	RL	Lr
	(m)	(m)	(m)			(Hz)	dB(A)	dB	dB	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	dB(A)
3	30698027.68	5713591.23	0.50	0	DEN	500	63.0	0.0	0.0	0.0	0.0	33.2	0.0	2.0	0.0	0.0	13.8	0.0	0.0	14.0

Appendix F – Air Conditioning Units Technical Data Sheet

Item			Model	SRK71ZR-W	
				Indoor unit SRK71ZR-W	Outdoor unit SRC71ZR-W
Power source				1 Phase, 220 - 240V, 50Hz / 220V, 60Hz	
Operation data	Nominal cooling capacity (range)		kW	7.1 (2.3 (Min.) - 7.8 (Max.))	
	Nominal heating capacity (range)		kW	8.0 (2.0 (Min.) - 10.8 (Max.))	
	Heating capacity (H2)		kW	—	
	Power consumption	Cooling	kW	1.93 (0.48 - 2.4)	
		Heating		1.95 (0.4 - 3.6)	
		Heating (H2)		—	
	Max power consumption			3.65	
	Running current	Cooling	A	9.0 / 8.6 / 8.2 (220/ 230/ 240 V)	
		Heating		9.1 / 8.7 / 8.4 (220/ 230/ 240 V)	
	Inrush current, max current			9.1 / 8.7 / 8.4 (220/ 230/ 240 V) Max. 17	
	Power factor	Cooling	%	98	
		Heating		97	
	EER	Cooling		3.68	
	COP	Heating		4.10	
		Heating (H2)		—	
	Sound power level	Cooling	dB(A)	57	63
		Heating		60	63
	Sound pressure level	Cooling		Hi: 44 Me: 41 Lo: 37 ULo: 25	53
		Heating		Hi: 46 Me: 39 Lo: 35 ULo: 28	51
	Silent mode sound pressure level			—	Cooling:45 / Heating:41
Exterior dimensions (Height x Width x Depth)			mm	339 x 1197 x 262	750 x 880(+88) x 340
Exterior appearance (Munsell color)				Fine snow (8.0Y 9.3/0.1) near equivalent	Stucco white (4.2Y 7.5/1.1) near equivalent
Net weight			kg	15.5	56
Compressor type & Q'ty				—	RMT5118SBP2 (Twin rotary type) x 1
Compressor motor (Starting method)			kW	—	1.40 (Inverter driven)
Refrigerant oil (Amount, type)			ℓ	—	0.675 (DIAMOND FREEZE MB75)
Refrigerant (Type, amount, pre-charge length)			kg	R32 1.5 in outdoor unit (incl. the amount for the piping of 15m)	
Heat exchanger				Louver fins & inner grooved tubing	M fins & inner grooved tubing
Refrigerant control				Capillary tubes + Electronic expansion valve	
Fan type & Q'ty				Tangential fan x 1	Propeller fan x 1
Fan motor (Starting method)			W	56 x1 (Direct drive)	86 x1 (Direct drive)
Air flow		Cooling	m^3/min	Hi: 20.5 Me: 18.6 Lo: 16.2 ULo: 10.4	55
		Heating		Hi: 25.0 Me: 19.8 Lo: 17.3 ULo: 13.3	43.5
Available external static pressure			Pa	0	0
Outside air intake				Not possible	—
Air filter, Quality / Quantity				Polypropylene net (washable) x 2	—
Shock & vibration absorber				Rubber sleeve (for fan motor)	Rubber sleeve (for fan motor & compressor)
Electric heater				—	—
Operation control	Remote control			Wireless remote control	
	Room temperature control			Microcomputer thermostat	
	Operation display			RUN: Green , TIMER: Yellow , HI POWER: Green ,3D AUTO: Green	
Safety equipments				Compressor overheat protection, Overcurrent protection, Frost protection, Serial signal error protection, Indoor fan motor error protection, Heating overload protection(High pressure control), Cooling overload protection	
Installation data	Refrigerant piping size (O.D)		mm	Liquid line: Φ6.35 (1/4")	Gas line: Φ15.88 (5/8")
	Connecting method			Flare connection	Flare connection
	Attached length of piping		m	Liquid line : 0.78 / Gas line : 0.72	—
	Insulation for piping			Necessary (Both sides), independent	
	Refrigerant line (one way) length		m	Max.30	
	Vertical height diff. between O.U. and I.U.		m	Max.20 (Outdoor unit is higher) / Max.20 (Outdoor unit is lower)	
	Drain hose			Hose connectable (VP 16)	Holes φ20 x 3 pcs
Drain pump, max lift height			mm	—	—
Recommended breaker size			A	20	
L.R.A. (Locked rotor ampere)			A	9.1 / 8.7 / 8.4 (220/ 230/ 240 V)	
Interconnecting wires		Size x Core number		1.5mm² x 4 cores (Including earth cable) / Terminal block (Screw fixing type)	
IP number				IPX0	IPX4
Standard accessories				Mounting kit, Clean filter (Allergen clear filter x 1, Photocatalytic washable deodorizing filter x 1)	
				Interface kit (SC-BIKN-E, SC-BIKN2-E)	