
KHALID HUSSAIN

NOISE IMPACT ASSESSMENT REPORT

62 YORKSHIRE STREET, ROCHDALE OL16 1JP

Client: Khalid Hussain

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1 INTRODUCTION

1.1 Overview

1.1.1 By instruction from Khalid Hussain ('the client'), NoiseAir was commissioned to undertake a noise impact assessment (NIA) to support a planning application proposing a change of use of 1st and 2nd floor from storage/ office to a 2no. bedroom flat at 62 Yorkshire Street, Rochdale OL16 1JP; herein referred to as the 'development site'.

1.1.2 General limitations with respect to this NIA are outlined in **Appendix A**.

1.2 Site Description

1.2.1 At the time of writing, the proposed development site is currently situated in a mixed-use area near Rochdale town centre with predominant land usage in the area comprising commercial use buildings.

1.2.2 The site is surrounded by commercial use buildings which primarily consist of retail stores.

1.2.3 The site lies on Yorkshire Street and is subject to pedestrian traffic noise which constitutes the primary noise source in the area.

1.2.4 A secondary noise source observed at the site is mechanical plant to the rear of the site.

1.2.5 **Figure 1** presents a site ariel photograph of the development site with respect to the local area and its context.

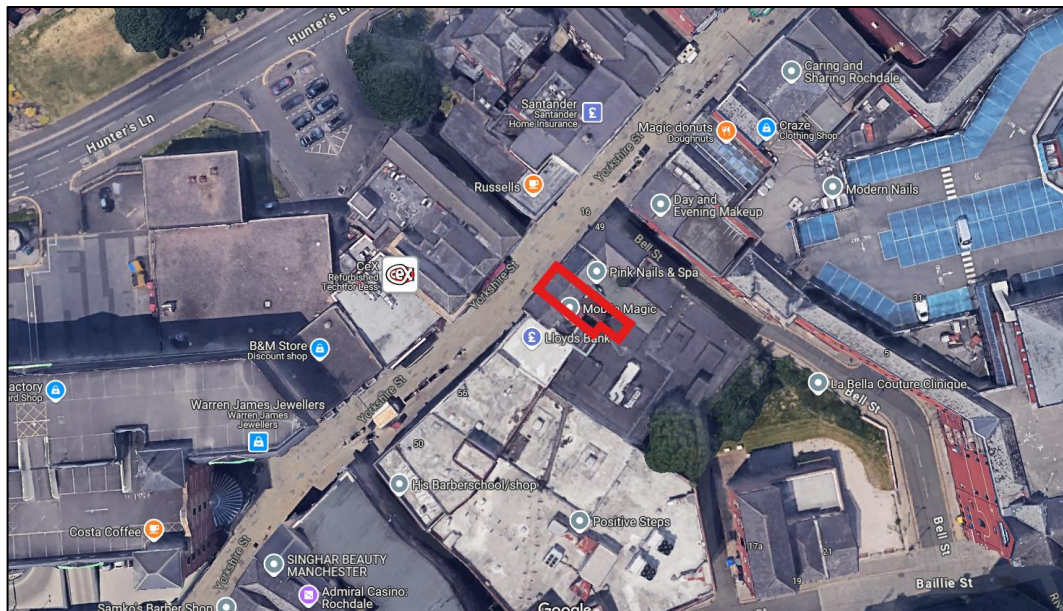


Figure 1: Site Ariel Photograph.

1.3 Development Proposals

1.3.1 At the time of writing, proposals outline the change of use of 1st and 2nd floor from storage/office to a 2no. bedroom flat the site. The proposed floor plans are shown below in **Figure 2**.

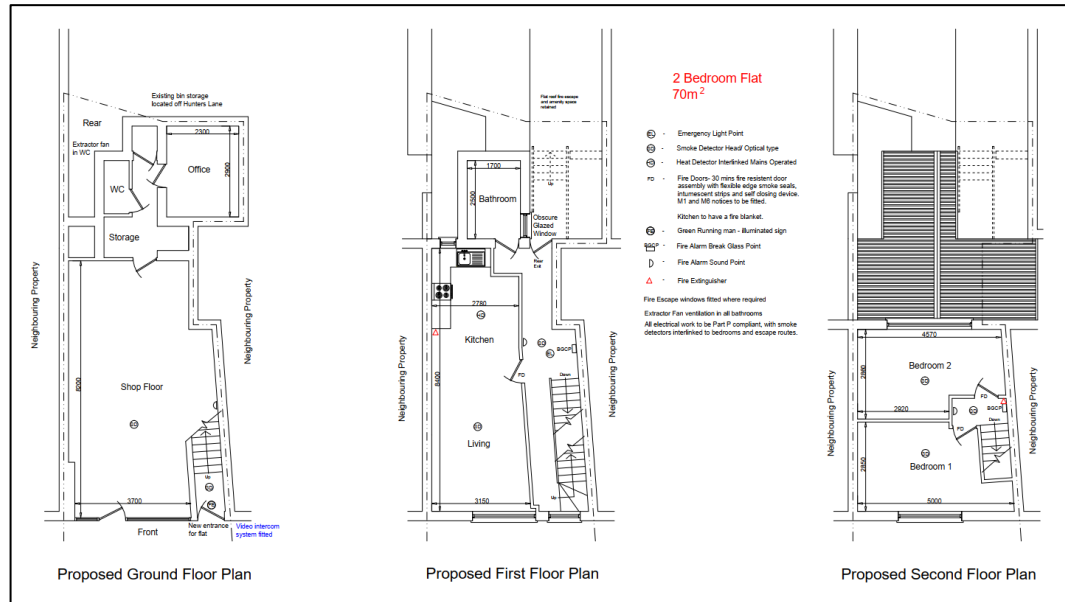


Figure 2: Proposed Floor Plans

2 ASSESSMENT METHODOLOGY AND SCOPE OF WORKS

2.1 National Planning Policy Framework [NPPF 2024]

- 2.1.1 The NPPF sets out the government's planning policies for England and how they are expected to be applied. It aims to achieve sustainable development; stating that planning policies and decisions should prevent unacceptable levels of noise pollution from new and existing development while affirming that National Policy Statements form part of the national planning policy framework and should be considered in planning decisions.

2.2 Noise Policy Statement for England (NPSE)

- 2.2.1 The Noise Policy Statement for England (NPSE), published in March 2010, states the long-term vision of Government noise policy is to "promote good health and a good quality of life through the effective management of noise within the context of Government policy on sustainable development".
- 2.2.2 The NPSE sets out the government's overall policy on noise within the context of sustainable development. It introduces three concepts for noise management: avoid significant adverse effects; mitigate and minimise adverse effects; and where possible, contribute to improvements in health and quality of life.
- 2.2.3 It also establishes a hierarchy of noise management actions: avoid; reduce; remedy; mitigate; compensate.
- 2.2.4 The NPSE also introduces the below categories with respect to 'adverse impacts'.

'NOEL – No Observed Effect Level

- This is the level below which no effect can be detected. In simple terms, below this level, there is no detectable effect on health and quality of life due to the noise.

LOAEL – Lowest Observed Adverse Effect Level

- This is the level above which adverse effects on health and quality of life can be detected.

SOAEL – Significant Observed Adverse Effect Level

- This is the level above which significant adverse effects on health and quality of life occur.'

- 2.2.5 The NPSE states that significant adverse effects on health and quality of life should be avoided. Where the impact lies somewhere between LOAEL and SOAEL, it requires that all reasonable steps are taken to mitigate and minimise the adverse effects of noise. In this regard, a certain degree of impact between LOAEL and SOAEL would be acceptable in

terms of planning policy, provided that the impact has been mitigated and minimised by design.

2.3 Planning Practice Guidance - Noise [PPG 2019]

2.3.1 PPG 2019 provides guidance on how noise should be considered in planning decisions. It was published in 2014 and updated in 2019. The document advises on how to avoid, mitigate, or minimise adverse effects of noise through good acoustic design and appropriate conditions or obligations.

2.3.2 **Table 1** summarises the noise exposure hierarchy outlined within the PPG.

Table 1: National Planning Practice Guidance noise exposure hierarchy		
Perception	Increasing Effect Level	Action
Not noticeable	No Observed Effect	No specific measures required
Noticeable and not intrusive	No Observed Adverse Effect	No specific measures required
Lowest Observed Effect Level		
Noticeable and intrusive	Observed Adverse Effect	Mitigate and reduce to a minimum
Significant Observed Effect Level		
Noticeable and disruptive	Significant Observed Adverse Effect	Avoid
Noticeable and very disruptive	Unacceptable Adverse Effect	Prevent

2.4 Scope of Works

2.4.1 The development site is located in a mixed-use area with pedestrian traffic noise on Yorkshire Street being the predominant source of noise in the area. Therefore, it is reasoned that the NIA should consider noise from pedestrian traffic primarily.

2.4.2 Noise from the nearby mechanical plant the associated A/C to the rear façade of the site has the potential to cause an adverse impact upon future residents at the site. Therefore, the scope of this assessment also includes consideration of mechanical plant noise from the A/C unit and other nearby mechanical plant.

2.5 Assessment Criteria

2.5.1 In order to achieve noise levels which are considered to be in alignment with the planning approaches and policies discussed in Section 2.1, it is considered that all efforts are made to ensure that future occupants are unlikely to be exposed to noise levels which might breach the LOEL criteria.

2.5.2 It should be noted however that planning guidance does not preclude development where the LOEL is likely to be breached in certain circumstances as long as reasonable efforts are made to mitigate and reduce such an effect.

2.5.1 There is potential for general ambient noise and noise from pedestrian traffic to impact future residents at the proposed dwellings. A noise impact assessment has been undertaken in accordance with BS 8233:2014 to assess the impact of road traffic noise. A summary of this is provided below.

2.5.1 Reference has also been made to BS 4142:2014+A1:2019 (BS 4142:2014) given the potential of adverse impact upon residents at the proposed dwellings due to mechanical plant noise. The BS 4142:2014 document and its assessment criteria are set out below.

2.6 British Standard 8233:2014 (BS 8233:2014)

2.6.1 British Standard 8233:2014 – *Guidance on sound insulation and noise reduction for buildings* (BS 8233) provides guidance on internal ambient noise levels, resulting from break-in of external environmental noise that should not be exceeded in various locations within dwellings.

2.6.2 Guidelines for buildings in terms of internal noise level are reported in **Table 2**.

Table 2: Summary of internal noise guidelines.			
Activity	Location	0700 – 2300 hours	2300 – 0700 hours
Resting	Living Room	35 dB $L_{Aeq,16hour}$	-
Dining	Dining room / area	40 dB $L_{Aeq,16hour}$	-
Sleeping (daytime resting)	Bedroom	35 dB $L_{Aeq,16hour}$	30 dB $L_{Aeq,8hour}$

2.6.3 The standard clarifies that these values are based on the existing guidelines issued by the World Health Organisation (WHO). In addition, it states that the internal noise levels may be relaxed by up to 5 dB whilst maintaining a reasonable living condition. Conversely, in terms of internal maximum levels to be achieved during the night, the standard does not recommend any limits for individual noise events. However, a guideline value may be set in terms of SEL or L_{AFmax} , depending on the type and the number of events per night.

2.6.4 Furthermore, BS 8233:2014 provides guidance on desirable noise levels in areas that are intended to be used for external amenity space, such as gardens, balconies and roof gardens which are intended to be used for relaxation. For these spaces it is desirable that the external noise level does not exceed 50 dB $L_{Aeq,T}$ up to a level of 55 dB $L_{Aeq,T}$ for noisier environments.

2.7 British Standard 4142:2014 (BS 4142:2014 + A1:2019)

- 2.7.1 British Standard 4142:2014 - Methods for rating and assessing industrial and commercial sound, sets the methodology for rating and assessing sound of an industrial and commercial nature, which includes sound from fixed installations such as mechanical and electrical plant and equipment.
- 2.7.2 In BS 4142:2014, a noise rating is determined and compared with the existing local background sound level based on several more cumulative acoustic feature corrections to apply where appropriate. For example, if the noise includes a distinguishable tone, impulse, intermittency or other readily distinguishable sound characteristic, then additional cumulative penalties individually ranging from 0 to 9 dB may be applied depending on the type of noise.
- 2.7.3 BS 4142:2014 seeks to determine a “representative” background sound level, stating that “...the objective is not simply to ascertain a lowest measured background sound level, but rather to quantify what is typical during particular time periods”.
- 2.7.4 The assessment of the impact depends upon the margin by which the rating level of the specific sound source exceeds the background sound level but also promotes a consideration of the context in which the sound occurs when making an assessment. BS 4142:2014 states that an initial estimate of the impact of the specific sound is made by subtracting the measured background sound level from the rating level, while considering the following points:
- 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; and,
 - 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.
- 2.7.5 Therefore, a BS 4142:2014 assessment may deduce a low impact where the specific sound level is below the background sound level.

3.2 Measured Sound Levels

- 3.2.1 The data shown in **Figure 4** and **Figure 5** details a level vs time graph of the recorded L_{Amax} , L_{Aeq} and L_{A90} sound levels over 15-minute time periods for the entire measurement duration at ML1 and ML2 respectively.
- 3.2.2 These levels represent the measured 'façade levels'. All further calculations and assessments incorporate a -3 dB façade correction to convert the values presented to equivalent free field levels.

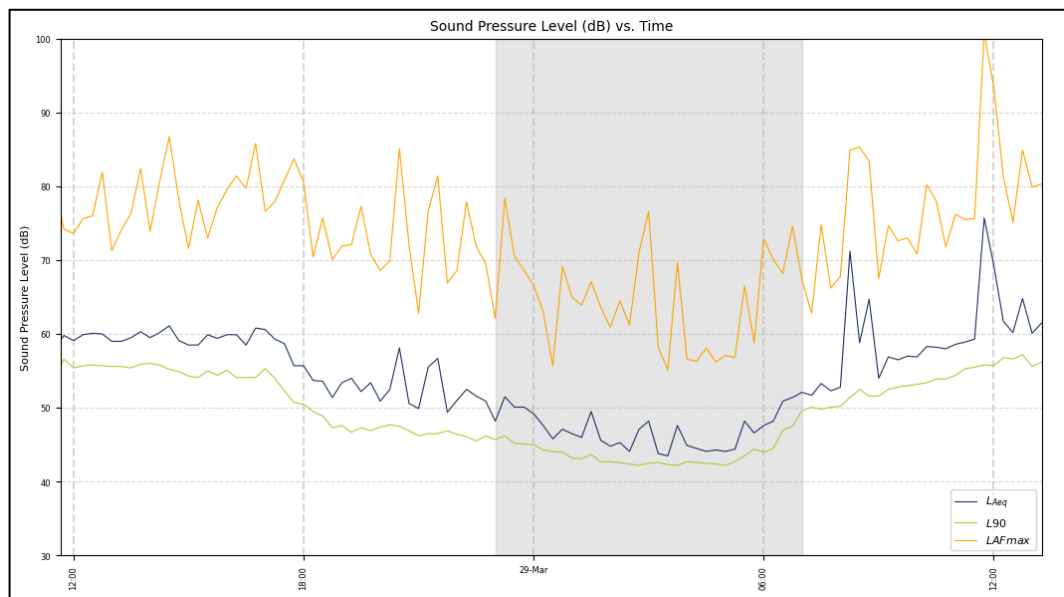


Figure 4: Level vs. time graph showing L_{Amax} , L_{Aeq} and L_{A90} sound levels – ML1

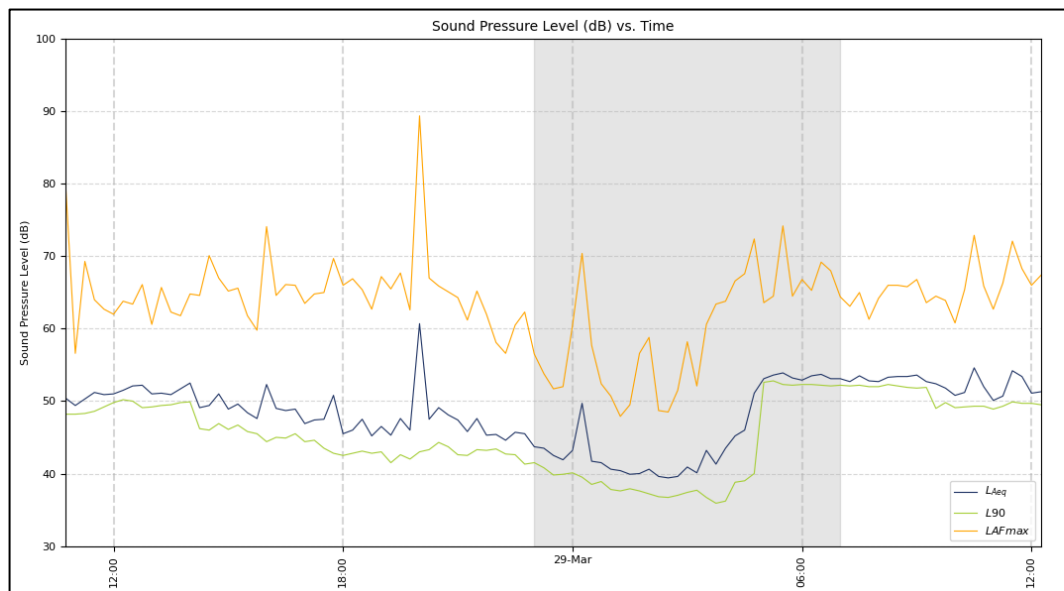


Figure 5: Level vs. time graph showing L_{Amax} , L_{Aeq} and L_{A90} sound levels – ML2

- 3.2.3 The results during the daytime and night-time periods are presented in **Table 4** below.

Table 4: Average Measured Daytime and Night-time Noise Levels (Equivalent Free-Field Levels)		
Monitoring Location	Time	Measured Noise Level
		dB $L_{Aeq,16hour}$ / dB $L_{Aeq,8hour}$ / dB $L_{Amax,15min}$
ML1	07:00-23:00	54.8 – 61.8
	23:00-07:00	44.6
	23:00-07:00	65.2*
ML2	07:00-23:00	47.2 – 49.6
	23:00-07:00	45.6
	23:00-07:00	61.5*
* $L_{max,15min}$ values exceeded more than 10 times per night		

3.3 Background Sound Levels

3.3.1 A histogram showing the $L_{A90,T}$ sound levels for the daytime at ML2 is presented in **Figure 6** and **Figure 7**. These histograms represent the background measurements excluding the operational hours of the mechanical plant.

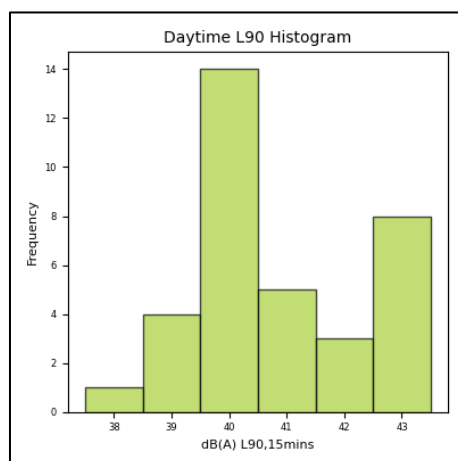


Figure 6: $L_{A90,15mins}$ at ML2 – Daytime.

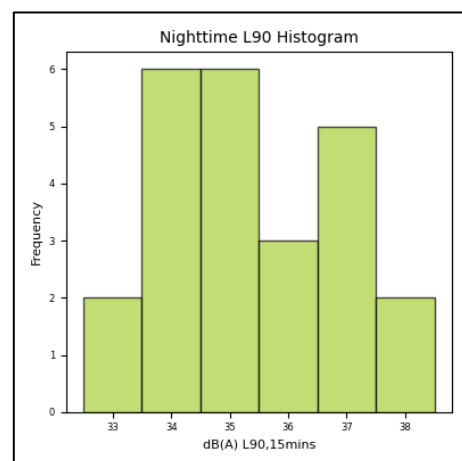


Figure 7: $L_{A90,15mins}$ at ML2 – Night-time.

3.3.2 For ML2, L_{A90} background sound levels of 40 dB (A) and 34 dB(A) have been adopted for daytime and night periods respectively

3.4 Ambient Sound Level

3.4.1 The highest measured ambient noise level from nearby plant to the receiver façade is 50.3 dB(A).

3.5 Residual Sound Level

3.5.1 The measured residual sound level at the receiver façade is 46.1 dB(A).

4 NOISE IMPACT ASSESSMENT

4.1 BS 8233:2014 Assessment of Daytime and Night-time Noise Levels in Living Rooms and Bedrooms

4.1.1 At the time of writing, plans indicate no external amenity at the development site. Therefore, only noise levels within noise sensitive rooms will be assessed.

4.1.2 The measured noise levels at the façades of the proposed building structures, as detailed in **Table 4** for the daytime and night-time period, together with the level of attenuation required in accordance with BS 8233: 2014, are presented in **Table 5**.

Table 5: Level of Attenuation Required to Achieve the Internal Noise Guideline Levels.				
Façade	Daytime ($L_{Aeq,16hours}$) / Night-Time ($L_{Aeq,8hours}$ / L_{Amax})	Worst Case Noise Level at the Façade of the Property (dB(A))	BS 8233:2014 Target Internal Level (dB(A))	Worst Case Level of Attenuation Required (dB(A))
Front	Daytime $L_{Aeq,16hours}$	62	35	27
	Night-Time $L_{Aeq,8hours}$	45	30	15
	Night-Time L_{Amax}	65	45	20

4.2 Building Envelope Performance – Windows Partially Open (Front Façade)

4.2.1 The sound performance requirements for bedrooms, living and dining rooms at the development during the daytime and night-time in rooms with windows closed are summarised in Section 5.

4.2.2 However, with windows partially open, the attenuation provided by the façade will be approximately 15 dB(A).

4.2.3 It should be noted that BS 8233:2014 advises that where development is desirable the recommended internal noise levels can typically be relaxed by up to 5 dB(A).

4.2.4 **Table 6** presents a summary of the calculated internal noise level when relying on partially open windows across the proposed development site.

Table 6: Summary of Internal Noise Levels with Windows Partially Open (based on a Partially Open Window Providing up to 15 dB(A) Attenuation).					
Facade	Room Type	Day / Night	Calculated Internal Level (dB)	Excess (dB(A))	Required Internal Levels Achieved (Yes / No)
Front	Living Room	Day	47	+12	No
	Bedroom	Night	30	0	Yes

4.2.5 Given the above, results demonstrate that internal noise criteria will generally be exceeded at the front façade during daytime periods when relying on a partially open window. Alternative ventilation will therefore be required.

- 4.2.6 Based on the results, the development should incorporate a sound insulation scheme which accommodates windows in the closed position, without compromising required ventilation to habitable areas. This may be in the form of passive ventilators. Specifications are available that are suitable to achieve the required internal design targets.

4.3 BS 4142:2014+A1:2019 Assessment for Nearby Mechanical Plant and Industrial Noise

Overview

- 4.3.1 A BS 4142:2014 assessment has been undertaken considering the impact of mechanical noise with respect to the future residents at the development site.

Specific Sound Level

- 4.3.2 The worst-case specific sound level measured at the building façade is calculated as:

$$10 \log \left(10^{\frac{L_{Aeq,Ambient}}{10}} - 10^{\frac{L_{Aeq,Residual}}{10}} \right)$$
$$10 \log \left(10^{\frac{50.3}{10}} - 10^{\frac{46.1}{10}} \right) = 48.2 \text{ dB}$$

- 4.3.3 Therefore, the worst-case specific sound level at the receiver façade is 48 dB which has been adopted for the subsequent assessment.

4.4 Background Sound Level

- 4.4.1 The L_{A90} background sound level of 40 dB(A) and 34 dB(A) has been adopted for daytime and night-time periods respectively.

Character Corrections

- 4.4.2 The following character corrections have been applied based on the noise characteristics produced by manufacturing in the warehouse units:

- **Tonality:** A +4 dB(A) correction for tonality has been applied.
- **Intermittency:** No correction for intermittency has been applied.
- **Impulsivity:** No correction for impulsivity has been applied.

Initial Assessment

- 4.4.3 The BS 4142:2014 initial assessment for the calculated noise breakout levels for all noise sources is presented in **Table 7** below.

Table 7: BS 4142:2014 Assessment to Determine the Likelihood of Adverse Impacts on the Worst Affected Noise Sensitive Receptors		
Quantity	Daytime	Night-time
Specific Sound Level	48	
Acoustic Feature Correction	+4	
Rating Level	52	
Background Sound Level dB L _{A90}	40	34
Excess of Rating Level over Background Sound Level	+12	+18
Initial Indication of Potential Impact	Significant Adverse Impact	

BS 4142:2014 Assessment and Context

- 4.4.4 The initial assessment indicates that the excess of rating level above the existing background sound level is +12 dB and +18 dB during daytime and night-time periods respectively. The initial assessment therefore indicates that a '**significant adverse impact**' is likely at the nearest NSRs.
- 4.4.5 The main source of mechanical plant noise is generated from the A/C Unit associated with the shop on the ground floor of the development site. It is noted that there is also a number of other mechanical plant units which lie in close proximity which might contribute to the specific noise level at receiver façades.
- 4.4.6 Façade insulation could potentially reduce the impact to adverse but is unlikely to reduce this to a low impact. Since the applicant owns the shop below with the air conditioning unit assessed, we would recommend that the unit is relocated to a less sensitive location and reassessed, or alternatively, removed and decommissioned.
- 4.4.7 In either scenario, a new survey may be necessary to determine the impact of other nearby plant that may become 'unmasked' as a result of moving or removing the air conditioning unit.
- 4.4.8 It should also be noted that the unit in question is located directly next to a proposed residential window. Due to the window in question being boarded up at the time of the survey, it was not available to use for noise monitoring. The impact at this window would be even greater than the assessment shown above if the air conditioning unit were to not be relocated or removed.

4.5 Mitigation

- 4.5.1 In order to mitigate mechanical plant noise to future residents, it is recommended that this A/C unit be relocated to a suitable position away from residential façades.

-
- 4.5.2 Alternatively, the A/C unit must be decommissioned and removed from the rear façade.
- 4.5.3 The relocation/removal of the A/C units will likely reduce the impact to the rear façade; however, it is recommended that additional noise monitoring is undertaken in order to determine the impact of the remaining mechanical plant in the local vicinity.

Uncertainty

- 4.5.4 Uncertainty of measurements can have a significant effect on the outcome and findings of an assessment and therefore such constraints are documented and discussed below.
- 4.5.5 The SLM used was a Norsonic Class 1 SLM, it is generally recognised that Class 1 SLM's offer an uncertainty of ± 1.0 dB. The instrumentation used for the survey has been calibrated by UKAS approved laboratories.
- 4.5.6 The sound levels measured (which include busier and quieter periods) are considered typical for the area.
- 4.5.7 Wind speeds during the survey visits were typically less than 5 ms^{-1} and the effect of wind generated noise is not considered to have a significant impact on this assessment.
- 4.5.8 Specific sound source levels were measured on site under favourable weather conditions.
- 4.5.9 It is therefore considered that, in this instance, the uncertainty of the calculations is not likely to have any influence on the outcome of the assessment.

4.6 Separating Walls/ Floors Between Retail Unit and Residential Use

- 4.6.1 The sound insulation performance of the separating walls and floors between the ground floor retail unit and residential development is covered by Approved Document E and under the jurisdiction of building control.
- 4.6.2 Approved Document E sets minimum criteria for sound insulation performance between adjacent residential dwellings. For other adjacencies, it states:

"The performance standards set out in Tables 1a and 1b are appropriate for walls, floors and stairs that separate spaces used for normal domestic purposes. A higher standard of sound insulation may be required between spaces used for normal domestic purposes and communal or non-domestic purposes. In these situations, the appropriate level of sound insulation will depend on the noise generated in the communal or non-domestic space. Specialist advice may be needed to establish if a higher standard of sound insulation is required and, if so, to determine the appropriate level"

-
- 4.6.3 Small retail units could produce higher levels of noise than typical domestic use. A higher level of insulation is therefore recommended to reduce the sound break-in to the residential flats above.
- 4.6.4 An uplift from 43 dB to 45 dB $D_{nT,w}+C_{tr}$ is recommended. This performance value is commonly secured by planning conditions for flats above retail units. Assuming a typical C_{tr} correction of about 5 dB the $D_{nT,w}$ would be around 50 dB which is reasonable.
- 4.6.5 This can be achieved with a standard mass upgrade to the existing ceiling and an independent high mass ceiling below following the detail in ADE Section 4 Floor Treatment 1 and wall flanking treatment if appropriate.

5 SOUND INSULATION SCHEME

5.1 Building Envelope Requirements – Windows Closed

- 5.1.1 Proposals for the development site at the time of writing outline residential use to the upper floors. Noise sensitive rooms are proposed to all facades of the property. Therefore, internal noise levels are required to not exceed 35 dB L_{Aeq} during the daytime hours in all rooms, 30 dB L_{Aeq} during the night-time in bedrooms and not typically exceed 45 dB L_{Amax} during the night-time hours in bedrooms.
- 5.1.2 When assessing sound levels in habitable areas of the proposed development, the sound attenuation provided by the overall building facade should be considered. To mitigate sound levels, the composition of the building facade can be designed to provide the level of attenuation required. Glazing is generally the building element which attenuates noise the least, so the proportion of glazing in a building facade is an important consideration when assessing overall sound attenuation. Additionally, any façade penetrations should also be considered such as for ventilation, e.g., trickle ventilation.
- 5.1.3 Based on the design details forwarded, worst case façade attenuation calculations have been undertaken in accordance with BS EN ISO 12354-3:2017.
- 5.1.4 It should be noted that the proposed sound insulation scheme is based on measured ambient noise levels to the front façade of the development. The rear façade experiences lower ambient noise levels overall, however it is impacted by noise from the A/C unit.
- 5.1.5 Once the A/C unit is relocated or decommissioned, it is likely that the sound insulation scheme will also be suitable at the rear façade.
- 5.1.6 **Table 8** presents a summary of the different elements for living rooms and bedrooms.

Table 8: Summary of Building Envelope Performance Requirements – Passive Ventilation				
Façade	Room Type	Wall R_w+C_{tr} (dB)	Glazing R_w+C_{tr} (dB)	Ventilation $D_{n,ew}+C_{tr}$ (dB) (2500EA)
Front	Living Room	47	30	35
	Bedrooms			

- 5.1.7 It should be noted that the acoustic performance values stated are for guidance and based on information provided at the time of writing, changes to location, size and orientation of rooms/ facades can have impacts on the calculated internal noise levels and subsequently the required acoustic performance criteria.
- 5.1.8 **Table 9** overleaf provides a typical example summary for each element type outlined in **Table 8** above.

Table 9: Summary of Building Element - Typical Examples		
Element Type	Acoustic Performance	Typical Example
Wall	47 dB R_w+C_{tr}	BS8233 Example - Brick and block external wall
Acoustic Slot Vent (Window)	Up to 35 dB $D_{ne,w}+C_{tr}$ (1 no. per room)	BS8233 Example - Sound attenuated trickle vent
Window	Up to 30 dB R_w+C_{tr}	10 mm pane, 12 mm air filled cavity, 4 mm pane

5.1.9 It should be noted that the examples provided in **Table 9** are for guidance only, however any adopted solution must achieve the acoustic performance values presented in **Table 8**.

5.2 Ventilation Requirements

5.2.1 It is recommended that the ventilation system proposed at the site should, as a minimum, comply with Building Regulations 2010 Approved Document F1 2021 Means of Ventilation and British Standard BS5925 1991: "Code of Practice for Ventilation Principles and Designing for Natural Ventilation". Acoustic ventilation is only recommended for noise sensitive rooms, which are bedrooms and living/ dining rooms.

5.2.2 As detailed in Section 5 of this report it is likely that noise levels in noise sensitive rooms within the proposed rooms will likely rely on the windows being in the closed position and therefore appropriate ventilation design should be completed.

5.2.3 The implementation of the recommended glazing would ensure that the required internal daytime and night-time noise limits are achieved.

5.2.4 It should be further noted that the glazing configurations within this report are for guidance only. Similar products to those used in NoiseAir calculations may achieve a similar level of sound reduction, however this should be verified by the manufacturer.

5.2.5 **Table 8** demonstrates that adequate noise levels can be achieved with passive ventilation.

6 CONCLUSIONS

6.1 Overview

- 6.1.1 By instruction from Khalid Hussain, NoiseAir was commissioned to undertake a noise impact assessment (NIA) to support a planning application proposing the construction of two new 3-bedroom detached houses.

6.2 Conclusions

- 6.2.1 Calculations show that to achieve a reasonable internal acoustic environment in habitable rooms as specified within BS 8233:2014, the building envelope constructions should be selected to meet the sound reduction index (SRI) values presented in **Table 8**.
- 6.2.2 With windows open, the recommended internal noise limit is likely to be exceeded a majority of the dwellings. However, **Table 8** demonstrates that adequate ventilation can be achieved with passive ventilation.
- 6.2.3 A BS 4142:2014 assessment has been undertaken in order to ascertain the likelihood of adverse impact due to noise from mechanical plant to future residents at the development site. The assessment indicates that a '**significant adverse impact**' is likely at the worst affected external facades.
- 6.2.4 It is recommended that the A/C unit to the rear of the site be relocated to a suitable position away from residential facades. Alternatively, the A/C unit must be decommissioned and removed from the rear façade.
- 6.2.5 Additional noise monitoring is required to determine the impact of the remaining mechanical plant in the local vicinity once the A/C unit is relocated/removed.

APPENDIX A - REPORT LIMITATIONS

This Report is presented to Khalid Hussain and may not be used or relied on by any other person or by the client in relation to any other matters not covered specifically by the scope of this report.

Notwithstanding anything to the contrary contained in the report, NoiseAir Limited is obliged to exercise reasonable skill, care and diligence in the performance of the services required by Khalid Hussain and NoiseAir shall not be liable except to the extent that it has failed to exercise reasonable skill, care and diligence, and this report shall be read and construed accordingly.

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Where assessments of works or costs identified in this report are made, such assessments are based upon the information available at the time and where appropriate are subject to further investigations or information which may become available.

Where / if estimates and projects are made within this report, are made based on reasonable assumptions as of the date of this report, such statements however by their very nature involve risks and uncertainties that could cause actual results to differ materially from the results predicted. NoiseAir Limited specifically does not guarantee or warrant any estimates or projects contained in this report.

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APPENDIX B – GLOSSARY

A-weighted sound pressure, p_A	Value of overall sound pressure, measured in pascals (Pa), after the electrical signal derived from a microphone has been passed through an A-weighting network. <i>NOTE: The A-weighting network modifies the electrical response of a sound level meter with frequency in approximately the same way as the sensitivity of the human hearing system.</i>
A-weighted sound pressure level, L_{pA}	Quantity of A-weighted sound pressure in decibels (dBA).
Acoustic environment	Sound from all sound sources as modified by the environment [BS ISO 12913-1:2013].
Ambient sound	Totally encompassing sound in a given situation at a given time, usually composed of sound from many sources near and far. <i>NOTE: The ambient sound comprises the residual sound and the specific sound when present.</i>
Ambient sound level, $L_a = L_{Aeq,T}$ (BS 4142:2014)	Equivalent continuous A-weighted sound pressure level of the totally encompassing sound in a given situation at a given time, usually from many sources near and far, at the assessment location over a given time interval, T <i>NOTE: The ambient sound level is a measure of the residual sound and the specific sound when present.</i>
Background sound	Underlying level of sound over a period, T, which might in part be an indication of relative quietness at a given location.
Background sound level, $L_{A90,T}$ (BS 4142:2014)	A-weighted sound pressure level that is exceeded by the residual sound at the assessment location for 90% of a given time interval, T, measured using time weighting F and quoted to the nearest whole number of decibels.
Break-in	Noise transmission into a structure from outside.
Break-out	Noise transmission from inside a structure to the outside.
Cross-talk	Noise transmission between one room and another room or space via a duct or other path.
C_{tr}	Correction term applied against the sound insulation single-number values (R_w , D_w , and $D_{nT,w}$) to provide a weighting against low frequency performance. <i>NOTE: The reference values used within the C_{tr} calculation are based on urban traffic noise.</i>
Equivalent continuous A-weighted sound pressure level, $L_{Aeq,T}$	Value of the A-weighted sound pressure level in decibels (dB) of a continuous, steady sound that, within a specified time interval, T, has the same mean-squared sound pressure as the sound under consideration that varies with time.
Equivalent continuous A-weighted sound pressure level, $L_{Aeq,T}$ (BS 4142:2014)	Value of the A-weighted sound pressure level in decibels of continuous steady sound that, within a specified time interval, $T = t_2 - t_1$, has the same mean-squared sound pressure as a sound that varies with time.
Equivalent sound absorption area of a room, A	Hypothetical area of a totally absorbing surface without diffraction effects, expressed in square metres (m ²), which, if it were the only absorbing element in the room, would give the same reverberation time as the room under consideration
Facade level	Sound pressure level 1 m in front of the façade. <i>NOTE: Facade level measurements of L_{pA} are typically 1 dB to 2 dB higher than corresponding free-field measurements because of the reflection from the facade.</i>
Free-field level	Sound pressure level away from reflecting surfaces. <i>NOTE: Measurements made 1.2 m to 1.5 m above the ground and at least 3.5 m away from other reflecting surfaces are usually regarded as free-field. To minimize the effect of reflections the measuring position has to be at least 3.5 m to the side of the</i>

	reflecting surface (i.e. not 3.5 m from the reflecting surface in the direction of the source). Estimates of noise from aircraft overhead usually include a correction of 2 dB to allow for reflections from the ground.
Impact sound pressure level, L_i	Average sound pressure level in a specific frequency band in a room below a floor when it is excited by a standard tapping machine or equivalent.
Indoor ambient noise	Noise in a given situation at a given time, usually composed of noise from many sources, inside and outside the building, but excluding noise from activities of the occupants. <i>NOTE: The location(s) within the room at which the ambient indoor noise is to be measured or calculated ought to be considered.</i>
Measurement time interval, T_m (BS 4142:2014)	Total time over which measurements are taken. <i>NOTE: This may consist of the sum of a number of non-contiguous, short-term measurement time intervals.</i>
Noise criteria	Numerical indices used to define design goals in a given space.
Noise rating, NR	Graphical method for rating a noise by comparing the noise spectrum with a family of noise rating curves.
Normalised impact sound pressure level, L_n	Impact sound pressure level normalized for a standard absorption area in the receiving room. <i>NOTE: Normalised impact sound pressure level is usually used to characterize the insulation of a floor in a laboratory against impact sound in a stated frequency band.</i>
Octave band	Band of frequencies in which the upper limit of the band is twice the frequency of the lower limit.
Percentile level, $L_{AN,T}$	A-weighted sound pressure level obtained using time-weighting "F," which is exceeded for N% of a specified time interval.
Reference time interval, T_r (BS 4142:2014)	Specified interval over which the specific sound level is determined. <i>NOTE: 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.</i>
Residual sound (BS 4142:2014)	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.
Residual sound level, $L_r = L_{Aeq,T}$ (BS 4142:2014)	Equivalent continuous A-weighted sound pressure level of the residual sound at the assessment location over a given time interval, T.
Rating level, L_{Ar,T_r}	Equivalent continuous A-weighted sound pressure level of the noise, plus any adjustment for the characteristic features of the noise. <i>NOTE: This is used in BS 7445 and BS 4142 for rating industrial noise, where the noise is the specific noise from the source under investigation.</i>
Reverberation time, T	Time that would be required for the sound pressure level to decrease by 60 dB after the sound source has stopped.
Sound exposure level, L_{AE}	Level of a sound, of 1 s duration, which has the same sound energy as the actual noise event considered.
Sound level difference, D	Difference between the sound pressure level in the source room and the sound pressure level in the receiving room.
Sound pressure, p	Root-mean-square value of the variation in air pressure, measured in pascals (Pa) above and below atmospheric pressure, caused by the sound.

Sound pressure level, L_p	Quantity of sound pressure, in decibels (dB).
Sound reduction index, R	Laboratory measure of the sound insulating properties of a material or building element in a stated frequency band.
Specific sound level, $L_s = L_{Aeq,T_r}$ (BS 4142:2014)	Equivalent continuous A-weighted sound pressure level produced by the specific sound source at the assessment location over a given reference time interval, T_r .
Specific sound source (BS 4142:2014)	Sound source being assessed.
Standardised impact sound pressure level, L'_{nT}	Impact sound pressure level normalized to a reverberation time in the receiving room of 0.5 s.
Standardised level difference, D_{nT}	Difference in sound level between a pair of rooms, in a stated frequency band, normalized to a reference reverberation time of 0.5 s for dwellings.
Ground borne noise	Audible noise caused by the vibration of elements of a structure, for which the vibration propagation path from the source is partially or wholly through the ground. <i>NOTE Common sources of ground-borne noise include railways and heavy construction work on adjacent construction sites.</i>
Structure-borne noise	Audible noise caused by the vibration of elements of a structure, the source of which is within a building or structure with common elements. <i>NOTE Common sources of structure-borne noise include building services plant, manufacturing machinery and construction or demolition of the structure.</i>
Third octave band	Band of frequencies in which the upper limit of the band is 2% times the frequency of the lower limit.
Weighted level difference, D_w	Single-number quantity that characterizes airborne sound insulation between rooms, but which is not adjusted to reference conditions. <i>NOTE Weighted level difference is used to characterize the insulation between rooms in a building as they are. Values cannot normally be compared with measurements made under other conditions (see BS EN ISO 717-1).</i>
Weighted normalised impact sound pressure level, $L'_{n,w}$	Single-number quantity used to characterize the impact sound insulation of floors over a range of frequencies.
Weighted sound reduction index, R_w	Single-number quantity which characterizes the airborne sound insulating properties of a material or
Weighted standardised impact sound pressure level $L'_{nT,w}$	Single-number quantity used to characterize the impact sound insulation of floors over a range of frequencies.
Weighted standardised level difference, $D_{nT,w}$	Single-number quantity that characterizes the airborne sound insulation between rooms.

Symbols

D_w	Weighted level difference (dB)
D_{nT}	Standardized level difference (dB)
$D_{nT,w}$	Weighted standardized level difference (dB)
L_{Amax}	Maximum noise level (dB)
$L_{Ar,Tr}$	Rating level (dB)
L_n	Normalised impact sound pressure level (dB)
L'_{nT}	Standardised impact sound pressure level (dB)
$L'_{nT,w}$	Weighted standardised impact sound pressure level (dB)
$L'_{n,w}$	Weighted normalised impact sound pressure level (dB)
L_p	Sound pressure level (dB)
L_{pA}	A-weighted sound pressure level (dB)
$L_{AN,T}$	Percentile level (dB)
L_{AE}	Sound exposure level (dB)
$L_{Aeq,T}$	Equivalent continuous A-weighted sound pressure level (dB)
p	Sound pressure (Pa)
p_A	A-weighted sound pressure (dB)
$p_{A(t)}$	Instantaneous A-weighted sound pressure (Pa)

R	Sound reduction index (dB)
R_w	Weighted sound reduction index (dB)
T	Time interval (also used for reverberation time) (s)
t_0	Reference time interval (s)

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