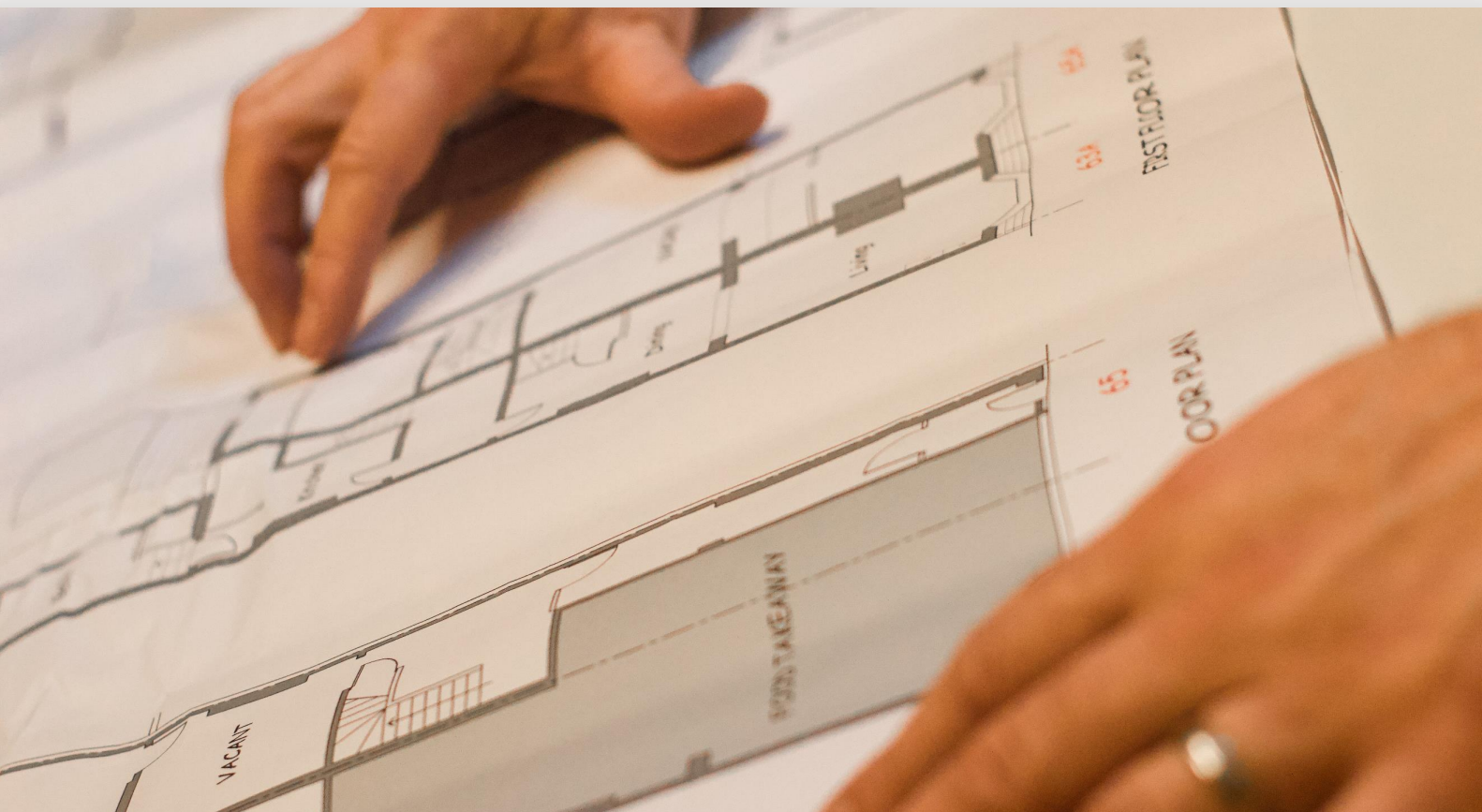


Donna McClurey

Land Adjacent to 40 High Street, Scunthorpe

Acoustic Assessment



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Acoustic Assessment

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Report Limitations

1. Introduction

Peninsular Acoustics (PA) has been commissioned by Donna McClurey (hereafter referred to as “the Client”), to undertake an acoustics assessment in support of planning application reference PA/2024/1198, submitted to North Lincolnshire Council, which proposes to erect a three-bedroom bungalow (hereafter referred to as “the Site”), on land adjacent to 40 High Street, Crowle, Scunthorpe DN17 4LD.

An acoustic glossary is provided in Appendix A to assist the reader.

1.1. Site Description

Existing Site

The Site, situated at the rear of 36 High Street, Crowle, is governed by North Lincolnshire Council. Currently, there are no existing structures on the Site, which previously served as a commercial location. Access to the site is shared with a residential dwelling to the north, utilising the same route. Adjacent to the west, on the corner of High Street, there's an Indian takeaway and to the immediate south, is an existing vehicle service and repair garage (Chapman Motors), accessible from Fieldside Road.

Development Proposals

Planning permission has been sought to erect a detached three-bedroom Chalet style bungalow.

An approximate redline boundary of the Site is presented in Figure 1.1 along with the approximate outline of the nearby vehicle service and repair garage (blue).

Figure 1.1: Approximate redline boundary and Chapman Motors site location

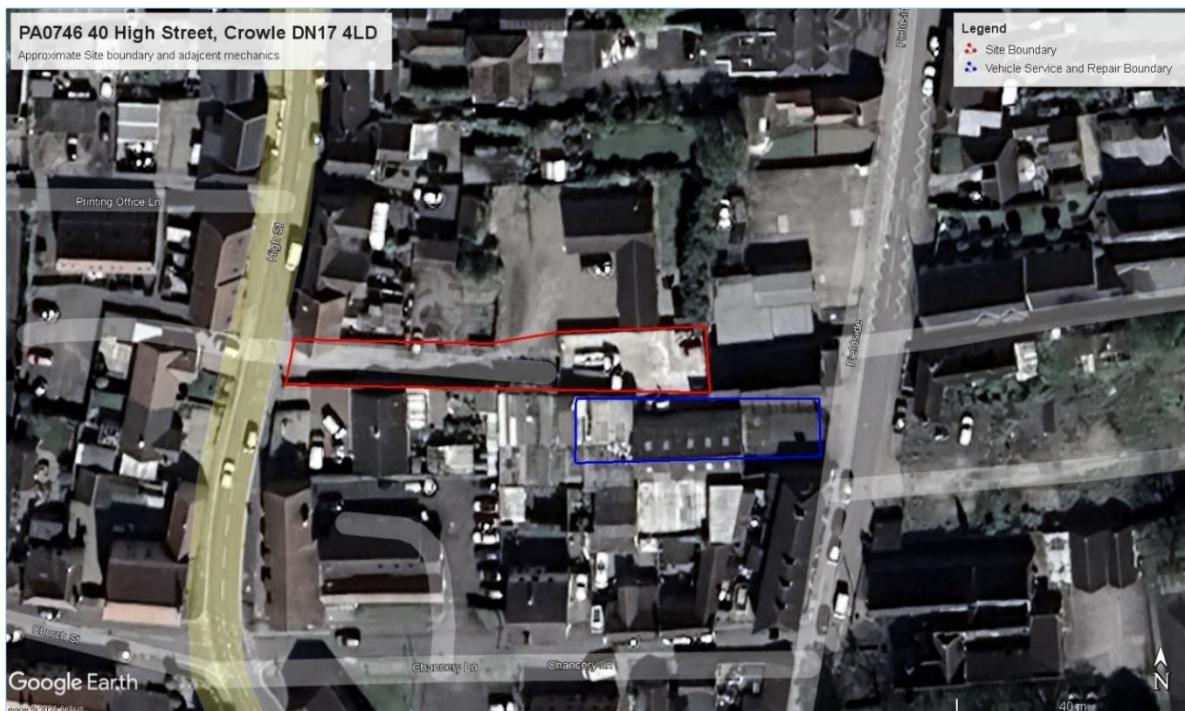
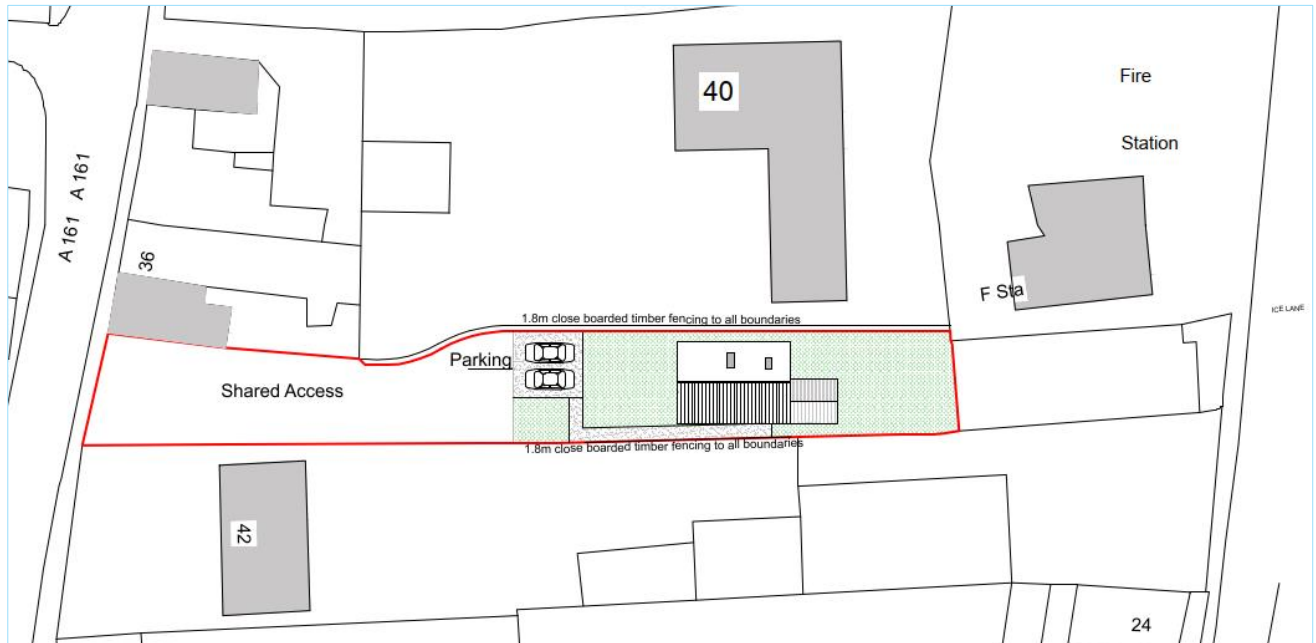


Figure 1.2: Proposed Site Plan



1.2. Scope of Works

The following scope of works has been undertaken:

- An unattended Environmental Sound Survey has been undertaken to determine prevailing acoustic conditions;
- Attended Sound Survey to capture activities associated with the adjacent car service and repair garage;
- Noise break-in calculations in accordance with BS EN ISO 12354-3¹ and BS 8233² have been undertaken to achieve internal noise levels whilst also considering whole-dwelling ventilation in accordance with AD-F³;
- BS 4142⁴ assessment undertaken to determine the impact from the nearby car garage. Where the initial impact assessment considering the excess of the rating level from the car garage is greater than the background sound level (i.e., where $L_{Ar,Tr}$ – representative $L_{A90,1hour} > 0$ dB), consider context in the impact assessment as per BS 4142 and provide any outline guidance to avoid significant adverse impact and minimise adverse impact as far as practically possible. One such measure would be to ensure that the feature-corrected industrial sound inside a dwelling is less than 35dB in the living rooms /bedrooms during the daytime and 30dB in bedrooms at night⁵; and
- Mitigation in the form of glazing and ventilation specifications and minimum sound reduction indices for non-glazed constructions has been provided.

¹ BS EN 12354-3:2000 'Building Acoustics. Estimation of acoustic performance in buildings from the performance elements. Airborne sound insulation against outdoor sound', 2000.

² BS 8233:2014 'Guidance on sound insulation and noise reduction for buildings.'

³ The Building Regulations 2010 'Approved Document F'.

⁴ BS 4142: 2014+A1: 2019 'Methods for rating and assessing industrial and commercial sound'.

⁵ As per example Condition 13 of the CIEH [Noise Management Guide: Technical Guidance Note 1](#)

2. Planning Policy and Guidance

Relevant national planning policy and guidance documents comprise:

- National Planning Policy Framework (2023);
- Noise Policy Statement for England (2010);
- BS 8233:2014 ‘*Guidance on sound insulation and noise reduction for buildings*’;
- WHO Guidelines for Community Noise (1999); and
- BS 4142: 2014+A1: 2019 ‘*Methods for rating and assessing industrial and commercial sound*’.

A summary of each of the above documents is provided in Appendix B.

2.1. Local Policy

Given no specific guidance relevant and relating to noise, the assessment has been based on the guidance of BS 8233 and the World Health Organisation (WHO) guidelines for community noise (1999).

2.2. BS8233:2014 Criteria

Internal acoustic targets have been informed by residential amenity within dwellings outlined in BS 8233.

Table 2.1: Indoor ambient noise levels for dwellings.

Activity	Location	07.00 to 23.00	23.00 to 07.00
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 $L_{Aeq,8hour}$

2.2.1. WHO Guidelines for Community Noise Criteria

BS 8233 does not give a definitive level for internal maximum noise levels or define an appropriate number of exceedances per night. However, the WHO guidelines state “*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. (Vallet & Vernet),*” therefore this will be considered as additional criteria as well as the aforementioned ambient sound levels from BS 8233.

2.3. BS 4142: 2014+A1: 2019

BS 4142 describes methods for rating and assessing industrial and/or commercial sound and includes, but is not limited to, the assessment of:

- Sound from industrial and manufacturing processes;
- Sound from fixed installations which comprise mechanical and electrical equipment;
- Sound from the (un)loading of goods and materials at industrial/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 on or around an industrial and/or commercial site.

The methods described in BS 4142 use outdoor sound levels to assess the likely effects of sound on people who are typically outside residential premises. Although indoor effects can be indicated where the façade composition is known. A summary of the approach set out in BS 4142 is set out below:

Establish or predict the specific sound level of the source(s) by considering both the ambient (includes the source to be assessed) and residual (excludes the source to be assessed but includes all remaining sources) sound level;

- Measure the representative background sound levels, typically by measuring close to the receptor location;
- Rate the specific sound level to account for any distinguishing characteristics (see below);
- Estimate the impact by subtracting the background sound level from the rating level; and
- Consider the initial estimate of impact, as determined above, in the context of the noise and its environment.

The specific sound level is rated to account for distinguishing characteristics by using penalties for tonality, impulsivity, intermittency, and other sound characteristics.

The character corrections are flexible according to whether the acoustic character is just perceptible at the noise receptor, or is clearly perceptible or highly perceptible, and range from 0 to 6 dB for tonal noise, 3 to 9 dB for impulsive noise, and 3 dB for other non-tonal/impulsive acoustic characteristics.

An initial estimate of impact of the specific sound is obtained by subtracting the background sound level from the rating level. Typically, the greater the difference, the greater the magnitude of 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;
- At differences lower than +5 dB a low impact is likely, depending on the context. The lower the rating level is to the measured background sound level, the less likely it is that the specific sound source will have an impact.

The results of the initial assessment should then be considered in light of all pertinent contextual factors.

3. Sound Surveys

3.1. Methodology and Equipment

An unattended Environmental Sound Survey has been undertaken between 12:00 on Tuesday 03rd and 12:00 Wednesday 04th December 2024 to establish prevailing acoustic conditions in the vicinity of the Site.

One sound level meter (SLM) was installed at the entry gate of the Site in free-field conditions. The unattended measurement position is described as follows:

- **Continuous Measurement 1 (CM1):** West perimeter of Site, circa 2m height.

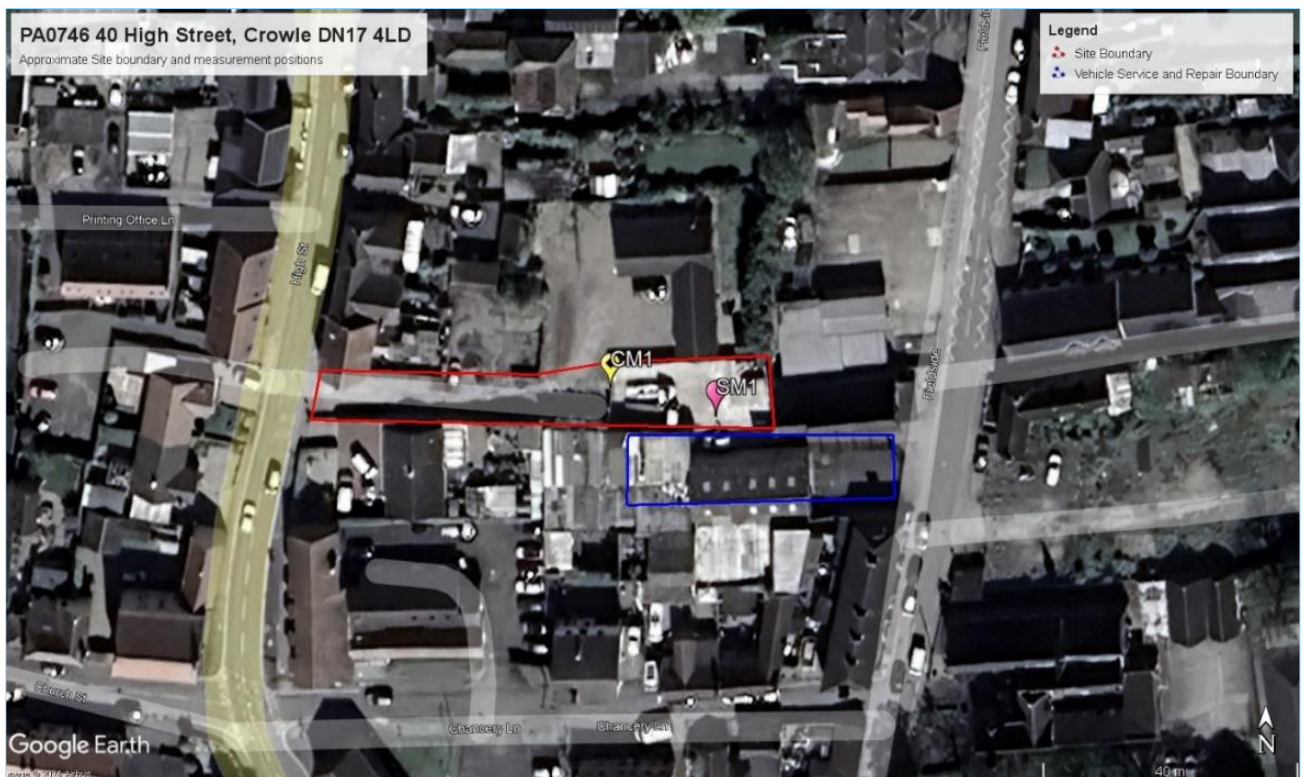
An attended survey was also conducted on the 3rd December between 14:00 and 16:15, at a position representative of the proposed dwelling to understand the potential impact on the Site from the car service and repair garage at the nearest point.

The attended measurement position is as follows:

- **Sample Measurement 1 (SM1):** Free-field conditions, circa 1.2m height and 5m from the garage shutter door entrance with the door opened. At a position representative of the rear façade of the proposed development.

The approximate measurement locations are shown in Figure 3.1.

Figure 3.1: Site Map: Approximate measurement locations



Measurements were taken using class 1 integrating/averaging SLMs housed, where appropriate, in environmental protection apparatus. The SLMs were field calibrated before and after the survey, using a Class 1 calibrator, with no significant drift in calibration noted.

The SLMs were setup to record A-weighted ambient, maximum and background sound levels at a minimum along with associated octave band spectra.

3.2. Survey Conditions and Observations

3.2.1. Meteorological Conditions

Weather conditions during installation and collection of equipment were dry with low wind speeds.

Historic weather data was monitored over the course of the survey which generally indicates suitable measurement conditions i.e., wind speeds of <5m/s and mostly dry.

Therefore, it can be concluded that there were no adverse meteorological conditions, and all measurement data is acceptable to inform the assessment.

3.2.2. Site Observations

The dominant source of noise observed impacting the proposed site is commercial noise from Chapmans Motor garage operating within the hours of 08:00 to 17:00. Machinery noise and car engine noise was observed on site as well as intermittent conversational noise between customers and employees at the garage. Noise levels at the west boundary (front) was dominated by road traffic noise coming from High Street. Noise levels at the east boundary (rear) consisted of lower levels of road traffic noise from Fieldside Road.

3.3. Results

3.3.1. Unattended Survey Results

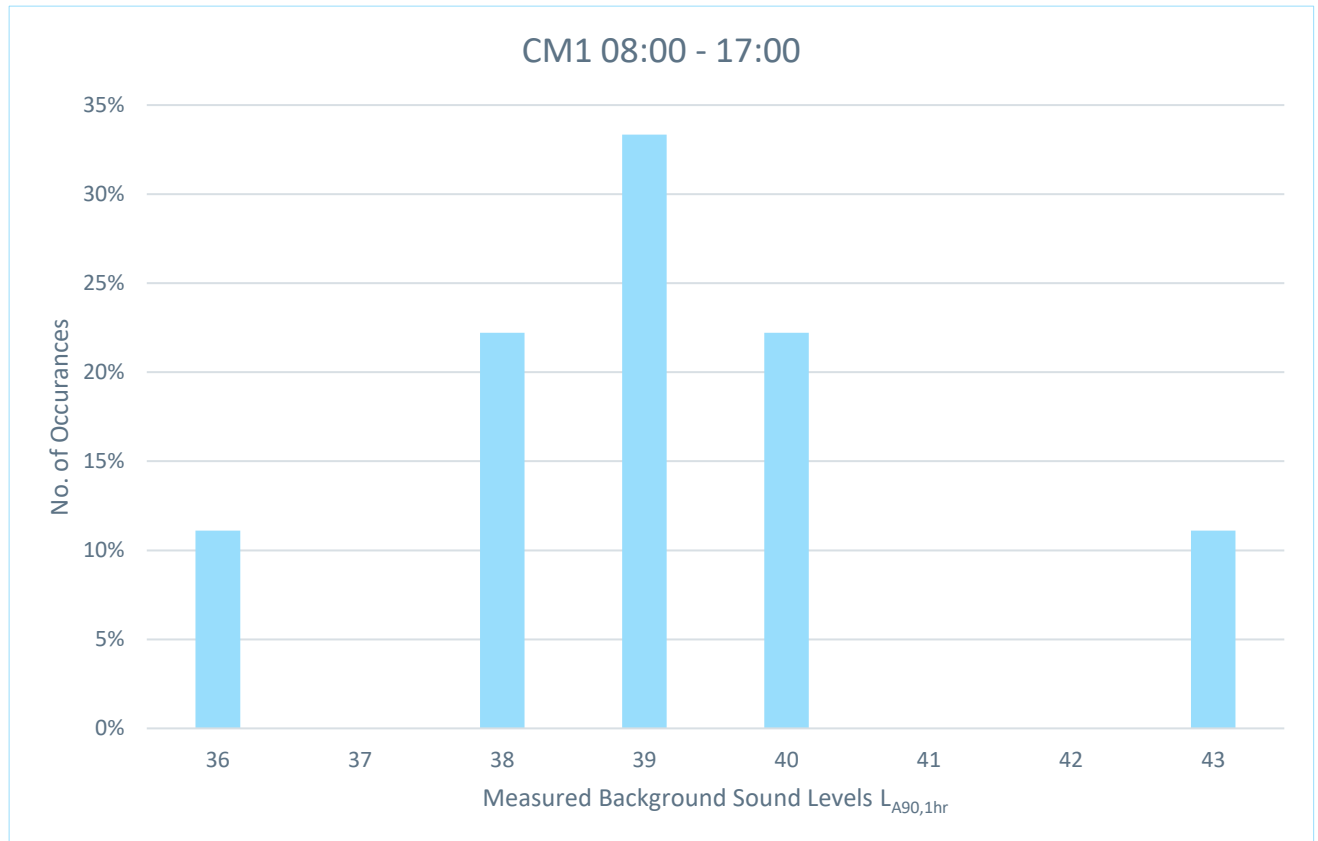
The measured daytime and night-time sound levels considered to be representative of the Site are presented in Table 3.1.

Table 3.1: Measured free field noise levels selected for assessment

Date	Position	Daytime Sound Level $L_{Aeq,16hr}$ dB	Night-time Sound Level	
			Ambient $L_{Aeq,8hr}$ dB	10th Highest $L_{AFmax,2min}$ dB
03 rd Dec (Tues)	CM1	48*	38	60
*Partial daytime measurements from 3 rd and 4 th December combined to form a complete 16hr measurement period.				

Chapman Motors operates typically between 08:00 and 17:00 therefore the background sound levels measured at CM1 during this period have been statistically analysed below:

Figure 3.2: Statistical analysis of background sound levels during Chapman Motors operating hours - CM1



3.3.2. Attended Survey Results

Ambient sound levels were measured in 5-minute intervals and have been logarithmically averaged to determine a typical hourly ambient sound level. The dominant source of noise at this position was the car garage and therefore the sound levels presented below are considered representative of this commercial activity.

Table 3.2: Measured ambient sound levels – SM1

Date	Measurement Position	$L_{Aeq,1hr}$ dB
03 rd Dec (14:00-15:00)	SM1	51
03 rd Dec (15:00-16:00)		61

Full time-histories of noise survey results are presented in Appendix C.

4. Facades Exposed to Industrial /Commercial Sound

The south façade of the proposed development is approximately 1m from the boundary between the Site and the neighbouring car garage, Chapman Motors. To ensure the car garage does not adversely impact on the amenity of the proposed residential dwelling a BS 4142 assessment has been undertaken for the daytime only since the garage is only operational during the daytime period.

The sample measurement position (SM1), shown in Figure 3.1 is photographed below. The position captured cars entering and leaving the car garage and the noise breaking out of the site through the open shutter door.

A 1.8m high close-boarded fence is proposed to be built along the Site boundary edge (in front of the microphone position photographed below) thereby shielding the proposed development from the industrial noise. For the acoustic barrier to perform as required, the barrier should have no holes or weaknesses in its structure. There should also be no gaps between the barrier and the ground to prevent sound passing underneath. It would be advisable to build a solid masonry wall in this section to be confident a reduction of at least 10 dB can be achieved.

Figure 4.1: Photograph of SM1 measurement position



4.1. Background

The distribution of background sound levels measured at CM1 is shown in Figure 3.2. To ensure a robust assessment the lowest measured level has been selected for assessment.

The selected background level is therefore 36 dB $L_{A90,1hr}$.

It should be noted the $L_{A90,15min}$ measurements have been arithmetically averaged to determine the $L_{A90,1hr}$ reference periods.

4.2. Rating Level

The highest hourly ambient level measured during the attended survey 61 dB $L_{Aeq,T}$.

Once an appropriate barrier has been constructed between the Site and the industrial noise source as discussed above in Section 4, a correction of -10 dB can be assumed at the façade of the proposed development and therefore the Specific Noise Level is determined as 51 dB $L_{Aeq,Tr}$.

Analysis of the third-octave band spectra from the attended survey in accordance with Annex C of BS 4142 indicated that no tonal features were present in the noise from the car garage at the measurement point. However, the noise was characterised as both intermittent and impulsive, leading to the application of a +5 dB penalty to the Specific Noise Level.

The Rating Level is therefore determined at 56 dB $L_{Ar,Tr}$.

4.3. Initial Noise Impact Assessment

The initial noise impact assessment (INIA) of industrial sound is presented below, showing the predicted sound pressure level externally of the proposed residential development, in line with the procedure outlined in BS 4142.

Table 4.1: BS 4142 INIA Assessment – Daytime

Parameter	Daytime Period
Specific Sound Level at Receptor [A]	51 dB $L_{Aeq,1hr}$
Acoustic Character Correction [B]	+ 5 dB (for Impulsivity and Intermittency)
Rating Level [C = A + B]	56 dB $L_{Ar,Tr}$
Background Sound Level [D]	36 dB $L_{A90,1hr}$
Rating over Background [E = C – D]	+20 dB
Initial Estimation of Impact	Significant Adverse Impact

The INIA assessment indicates that the impact of the industrial sound is significant therefore mitigation will be required.

4.4. Mitigation

The methodology which forms the overarching mitigation takes into consideration the feature correction penalties derived from the BS 4142 assessment. The feature corrections identified herein have been incorporated into the calculated internal noise levels to correct the sound for acoustic features. The resultant internal rating level can then be compared with the equivalent criteria if the sound was of anonymous nature.

Below is an illustrative calculation for assessing the impact of industrial noise on the residential dwelling. The ground floor areas, specifically the bedroom, kitchen, and living room, are potentially affected. The example focuses on Ground Floor Bed 3, being the closest habitable space to the noise source.

Full calculations are included in Appendix D.

Table 4.2: Example calculation process for façades subject to industrial noise exposure – Bedroom 3

Description	SRI	L _{Aeq}	BS 8233 Target
L_s (Specific Sound Level)	-	51 dB	-
SRI of Glazing	28 dB R _w + C _{tr}	-	-
SRI of Non-Glazed Elements	48 dB R _w + C _{tr}	-	-
SRI of Vent	32 dB D _{ne,w}	-	-
Resultant Internal L_{Aeq,T} in Bedroom	-	26 dB L _{Aeq,Tr}	-
Feature Corrected Internal Level L_{Ar} (+5 dB)	-	31 dB L _{Ar,T}	≤ 35 dB

The feature corrected internal noise level, as demonstrated in the above example meets the BS 8233 guidelines.

The following feature corrected internal noise levels have been calculated for the living room and kitchen areas in the same way:

- Kitchen = 27 dB L_{Ar,T}
- Living Room = 30 dB L_{Ar,T}

Both kitchen and living room areas also meet the guidelines for internal noise levels in accordance with BS 8233 with no further mitigation required.

4.5. Context

The proposed living area is situated on the opposite side of the dwelling from Chapman Motors, which means the building itself acts as a natural barrier, providing additional noise reduction to this area. Furthermore, the BS 4142 assessment focuses solely on the daytime period, when typically, no one is sleeping, thus the impact of noise in Bedroom 3 during these hours is less critical though still meets the recommended target of less than 35 dB L_{Aeq,16hr}. Additionally, the 16-hour outdoor amenity noise level measured at the CM1 position does not exceed 55 dB, therefore is circa 7 dB below the lower threshold recommended by BS8233, ensuring that the noise environment remains within acceptable limits.

5. Internal Noise Level Assessment

5.1. Calculation Input Parameters

Internal ambient noise levels have been calculated in accordance with BS EN ISO 12354-3 with example calculations provided in Appendix D.

Room Dimensions

Internal layout dimensions have been determined as per architectural drawings received from The Rural Architect, drawing no: 02Aa and 03B, dated March 2021.

Non-Glazed Elements

The exact specifications for the external wall and roof constructions are uncertain, therefore the sound reduction indices (R) for a typical new build with brick and block construction has been considered as a guide in conjunction with a timber roof construction as a worst-case assessment.

The non-glazed elements of the building envelope should achieve a minimum sound insulation performance of $R_w + C_{tr}$ 48 dB.

Glazing Specification

Based upon architectural drawings available, the calculations have been undertaken for each habitable space using the glazing specifications outlined in Table 5.1.

Table 5.1: Glazing specifications.

Reference	Min. Performance $R_w + C_{tr}$	Typical Glass Construction
A	28 dB	4mm panel 20mm air gap 4mm panel

Ventilation Strategy

Break-in calculations are based upon whole-dwelling ventilation in accordance with Approved Document F. Decentralised continuous mechanical extract ventilation (DMEV) should be used in kitchens and wet rooms, with each habitable room requiring a minimum equivalent area of 4,000 mm² for background ventilation.

Two trickle vents of min 2792mm² Equivalent Area per habitable space have been considered within the calculations.

*All ventilation details outlined in this report, should be reviewed by an AD-F ventilation specialist to confirm their suitability for your project.

5.2. Example Calculation: Anonymous Sound

An example calculation is presented below for the 1st Floor, Bedroom 1, which is considered to be the most exposed area of the Site to anonymous sound.

Table 5.2: Example break-in calculation input data

Parameter	Data	Comments
Room Dimensions	4.7m x 2.7 m x ~2.4m W x D x H	Based upon architectural drawings
Glazing Area	1.2m ²	Based upon architectural drawings
Facade Composition	Min 48 dB $R_w + C_{tr}$	Robust assumption for non-glazed elements.
Glazing Specification	28 dB $R_w + C_{tr}$	Standard 4/20/4 Double Glazing
Proposed Ventilation	32 dB $D_{n,e,w} + C_{tr}$	Standard direct path trickle ventilator

Based upon the assumptions listed above and the available architectural drawings, the calculated internal sound levels, for Bedroom 1 are:

- 27 dB $L_{Aeq,16hr}$;
- 16 dB $L_{Aeq,8hr}$; and
- 39 dB $L_{AFmax,2min}$.

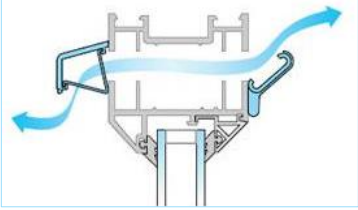
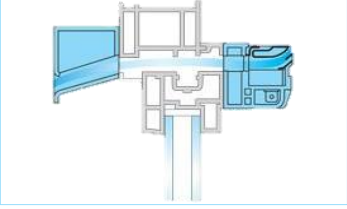
The results show compliance with all relevant criteria outlined in BS 8233 and WHO Guidelines.

5.3. Façade Mitigation Summary

Based upon the break-in calculations undertaken, mitigation measures have been prescribed to achieve sound levels in accordance with BS 8233.

The calculations indicate that for habitable rooms predominantly exposed to anonymous sound, standard double glazing and ventilators are sufficient. However, for Bedroom 3, which is subject to noise exposure predominantly from commercial noise sources, an enhanced ventilator is necessary to maintain acceptable daytime amenity.

Table 5.3: Mitigation Summary

Ref.	Glazing Requirements	AD-F Ventilation Requirements
A	4mm panel 20mm air gap 4mm panel Minimum 28 dB $R_w + C_{tr}$	<u>Standard Trickle Vent</u> Direct airpath trickle vent. Example for costing purposes only: Simons Slimline TTF 13mm [2no. vents per habitable room required]  Minimum $D_{n,e,w} + C_{tr} = 32$ dB
B		<u>Acoustically Rated Trickle Vent</u> Example for costing purposes only: Titon V25/Std. Canopy [2no. vents per habitable room required]  Minimum $D_{n,e,w} + C_{tr} = 34$ dB

Corresponding Locations

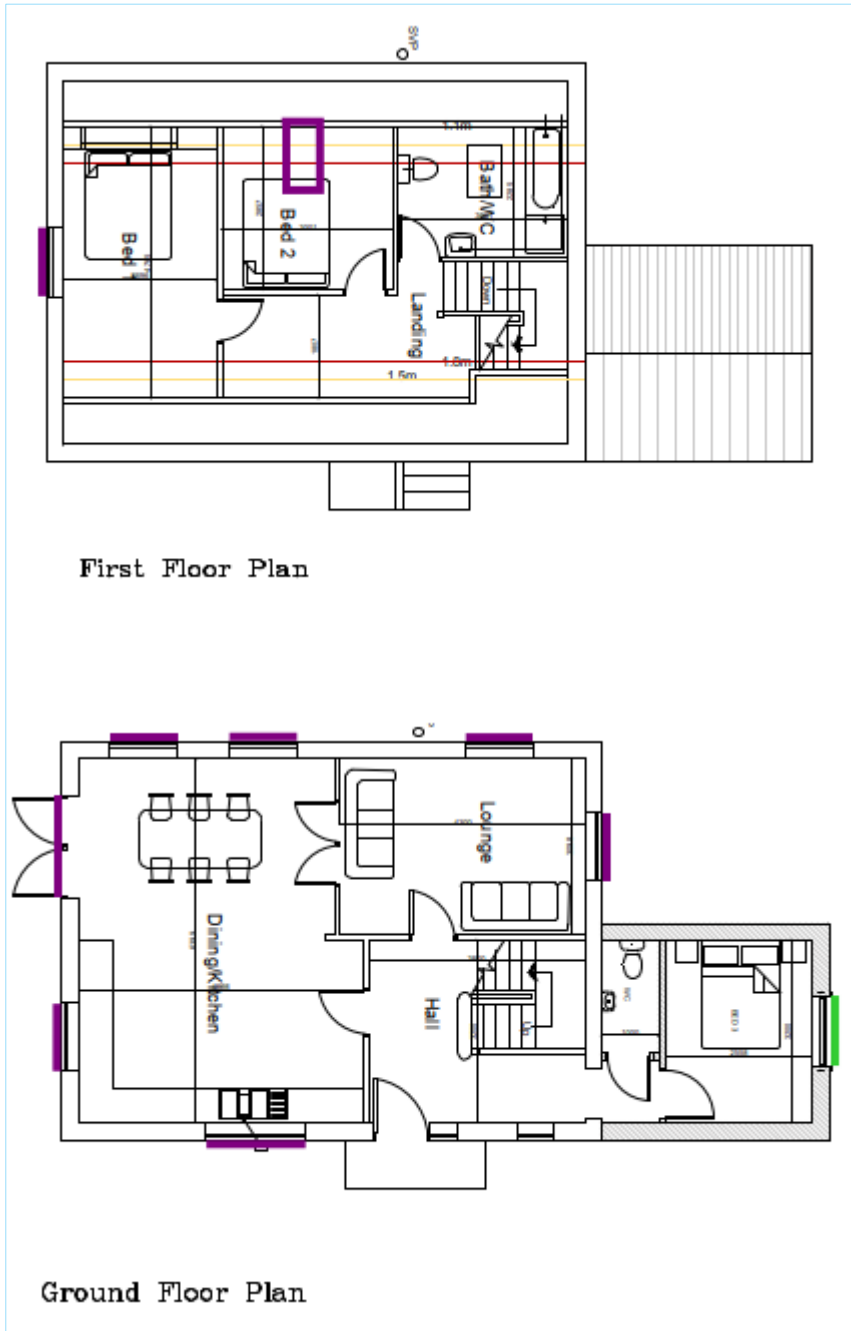
Reference A mitigation measures outlined above should be applied to habitable rooms in the following locations:

- **Ground Floor Dining /Kitchen;**
- **Ground Floor Lounge;**
- **First-Floor Bed 1; and**
- **First-Floor Bed 2**

Reference B mitigation measures should be applied in the following locations:

- **Ground Floor Bed 3**

Figure 5.1: Recommended glazing and ventilation performance locations - Ground and First Floor.



6. Outdoor Amenity Noise

BS 8233:2014 states that it is desirable for the steady state noise level in external amenity spaces (such as gardens or outdoor living areas) to be below 50 dB $L_{Aeq,16hour}$ to prevent 'moderate annoyance' with 55dB $L_{Aeq,16hour}$ regarded as an upper limit to prevent 'serious annoyance' for occupants.

The free-field ambient sound level measured at CM1 during the daytime was 48 dB $L_{Aeq,16hr}$ which is in line with the requirements of BS 8233 and therefore, no mitigation measures for the external amenity area are required.

7. Conclusions

Peninsular Acoustics has been commissioned by Donna McClurey to undertake an acoustics assessment in support of planning application which proposes to erect a three-bedroom bungalow on land adjacent to 40 High Street, Crowle, Scunthorpe DN17 4LD.

Peninsular Acoustics has conducted a noise assessment for the proposed development, based on both national and local policies. This assessment included both attended and unattended noise surveys, the outcomes of which suggest that the site is generally not at high risk from noise. Prevailing acoustic conditions surrounding the Site were measured as $L_{Aeq,16hr}$ 48 dB, $L_{Aeq,8hr}$ 38 dB, and the 10th highest night-time $L_{AFmax,2min}$ 60 dB.

However, a significant adverse impact due to nearby commercial activities was identified under the BS 4142 assessment. Despite this, an acceptable indoor noise environment can be achieved since a 1.8m high barrier is proposed between the commercial activities and the new dwelling (as detailed in the development proposals) along with recommended enhanced ventilators to areas most exposed (Bedroom 3).

Break in calculations have been undertaken which demonstrate that with the installation of appropriate glazing and ventilation systems, internal noise level standards outlined in BS 8233 and WHO Guidelines for Community Noise will be achieved whilst giving due consideration to the ventilation requirements of Approved Document F.

Noise levels in amenity areas have been assessed at 48 dB, aligning with the recommended lower thresholds specified in BS 8233 to ensure the proper enjoyment of these spaces.

The findings of this study confirm that, with the proposed development plans and the addition of suitable glazing and ventilation systems, the Site is appropriate for its intended purpose.

Limitations applicable to this report are contained in Appendix E.

Appendix A

Technical Terminology

Noise	Typically defined as unwanted, unpleasant or disturbing sound
Frequency (Hz)	The number of oscillations in acoustic pressure per second. It represents the ‘tone’ of the sound. Often determined in octave bands
Maximum sound pressure level (L_{Fmax})	The maximum or highest sound pressure level measured with a ‘fast’ time weighting
Equivalent continuous sound pressure level ($L_{eq,T}$)	The average of the total sound energy over a specified time period (T). L_{eq} represents the equivalent sound level that a fluctuating source would have compared to a steady source with the same total sound energy over a specific time period. Commonly used as a descriptor of human perception of sound over time.
‘A’ weighting	Frequency-dependent weighting based on the response of the human auditory system which has been found to correlate well with the subjective response to sound. Denoted by the use of the letter ‘A’. For example, dBA denotes an ‘A’ weighted sound level in decibels, or L_{Amax} denotes an ‘A’ weighted maximum sound pressure level.
Internal Ambient Noise Level (IANL)	The noise level within a room or enclosed space. Usually determined as an equivalent continuous sound pressure level over a specific time period ($L_{Aeq,T}$, dB)
Noise Rating (NR) curve	A single figure term used to reflect the spectral frequency content of noise. Although originally proposed to assess environmental noise, NR curves are now typically used to describe noise from mechanical ventilation systems in buildings.
$L_{night,outside}$	The incident external A-weighted long-term average sound level as defined in ISO 1996-2: 1987, determined over all the night periods of a year, in which the night is eight hours between 23:00 and 07:00.
AVO	Acoustics, Ventilation, Overheating (e.g. AVO Guide, AVO Group).
Overheating Strategy Overheating Condition	The situation where measures are in place to mitigate overheating to meet agreed compliance criteria.
Dynamic thermal modelling	A technique that can be used to simulate internal temperatures in dwellings before they are built
Ventilative cooling	Cooling by means of introducing external ambient temperature air at a high ventilation rate. Can be either passive (no fans) or mechanical (with fans).
Purge ventilation	Ventilation to aid removal of high concentrations of pollutants and water vapour released from occasional activities such as painting and decorating or accidental releases such as smoke from burnt food or spillage of water.
Mechanical cooling	Cooling by means of a refrigerant cycle. This would include ‘air conditioning’ systems and the use of fan coil units (FCUs).
MEV	Mechanical extract ventilation.
“Free area” as used in AD-O	Approved Document O uses the term “Minimum free area” that is required to be achieved by the Equivalent area of the window openings. AD-O provides the accepted definition of Equivalent area for the description of “free area”. The term “free area” is therefore avoided in this document to avoid further confusion.

Acoustic open area	The measurable, cross-sectional, geometric area of an opening. For a partially open window, this is considered to be the lesser of either the size of the hole in the window frame that is left by the opening light, or the combined cross-sectional area around the opening light through which air must pass to move from outside to inside. The area around a hinged opening light includes the triangular areas on the sides adjacent to the hinge, and the rectangular area on the side opposite the hinge. This should not be used for comparing the air-flow performance of elements because this will also be dependent on factors such as depth (length of air-path), surface roughness and tortuosity. Refer to reference 6 for further information.
Effective area, A_{eff}	Defined as the product of the free area and discharge coefficient, this is the preferred parameter for comparing the air-flow performance of elements. Refer to reference 6 for further information.
Equivalent area, A_{eq}	The area of a sharp-edged, circular orifice that gives the same flow rate as the actual opening at a given pressure-difference. In other words, the free-area of a notional circular hole made in an infinitely thin, infinite extent baffle that gives the same air-flow performance as the real opening. Used to describe the area of trickle vents in Approved Document F. Not to be confused with Effective area. Refer to reference 6 for further information.
Coefficient of Discharge, Cd	The ratio of the mass flow rate at the discharge end of the nozzle to that of an ideal nozzle which expands an identical working fluid from the same initial conditions to the same exit pressures.
$D_{n,e} / D_{n,e,w}$	The laboratory tested sound insulation of small building elements, normalised to an equivalent absorption area of 10m ² .
Façade level	The sound pressure level measured close to a building façade that includes contribution from both the incident sound and the sound reflected from the façade. Normally taken to be 3dB higher than the equivalent free-field level, when located at 1 metre from a façade.
Free-field level	A measured sound pressure level that is independent of any contributions due to reflections from nearby surfaces and is therefore representative of the direct path only.
R / R_w	The laboratory tested airborne sound insulation of a building element
Sound insulation	The capacity of a structure to prevent sound from reaching a receiving location. Sound energy is not necessarily absorbed; impedance mismatch, or reflection back toward the source, is often the principal mechanism
$L_{Ar,Tr}$	Specific sound level plus any adjustment for the characteristic features of the sound

Appendix B

Relevant National Policy and Guidance

National Planning Policy Framework

The 'National Planning Policy Framework' (NPPF) was published by central government in 2012 and replaces previous Planning Policy Guidance Notes. It does not replace the Noise Policy Statement (England) 2010 to which it refers. The Planning Practice Guidance (PPG) online resource for the NPPF was launched in March 2014 to assist practitioners with the content of the NPPF.

The NPPF includes a "*presumption in favour of sustainable development that is the basis for every plan, and every decision*". This is a very clear direction which may conflict with the application of existing local policies in development control decisions and will influence the eventual replacement of those policies.

To clarify this point, the PPG says "Where the development plan is absent, silent or the relevant policies are out of date [the NPPF] requires the application to be determined in accordance with the presumption in favour of sustainable development unless otherwise specified".

Also, "The NPPF represents up-to-date Government policy and must be taken into account where it is relevant to a planning application or appeal. If decision takers choose not to follow the NPPF, clear and convincing reasons for doing so are needed".

LPAs are therefore obliged to follow the NPPF unless they have up-to-date local policies that would justify a departure and, even then, the NPPF has 'material consideration' status. Where local policies conflict with one another, considerations shall be '*guided by the NPPF*'. Where local noise policies are dated, absent or in conflict it appears that national noise policy must take precedence.

The NPPF contains four aims as follows:

- Avoid noise from giving rise to significant adverse impacts on health and quality of life as a result of new development
- Mitigate and reduce to a minimum other adverse impacts on health and quality of life as a result of new development, including through the use of conditions
- Recognise that development will often create some noise and existing businesses wanting to develop in continuance of their business should not have unreasonable restrictions put on them because of changes in nearby land uses since they were established
- Identify and protect areas of tranquillity

The reference numbers 27 and 28 point respectively to the Explanatory Note to the Noise Policy Statement for England (NPSE) (see below) and the provisions of the Environmental Protection Act 1990 and other relevant law.

Noise Policy Statement for England

The 'Noise Policy Statement for England' (NPSE) was published in March 2010. The NPSE is the overarching statement of noise policy for England and applies to all forms of noise other than occupational noise, setting out the long-term vision of Government noise policy which 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.”

That vision is supported by the following aims which are reflected in three of the four aims for planning policies and decisions in paragraph 123 of the NPPF:

“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.”

The NPSE introduces the concepts of NOAEL, LOAEL and SOAEL in relation to the potential health implications of a noise/vibration effect, defined as follows:

- **“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.”

It is acknowledged, however, that it is not possible to have a single objective noise-based measure that defines SOAEL that is applicable to all sources of noise, in all situations. Consequently, the SOAEL is likely to be different for different noise sources, for different receptors and at different times. It is acknowledged that *“further research is required to increase our understanding of what may constitute a significant adverse impact on health and quality of life from noise.”*

BS8233:2014 / WHO Guidelines for COMMUNITY NOISE

Table 2.1 in Section 3 presents recommended internal noise levels for residential dwellings, as given in BS 8233:2014.

It is recommended that in order to provide a comfortable environment within habitable rooms, specifically bedrooms, the external building fabric be generally designed to achieve the internal night-time noise level of 30 dB(A) and daytime level of 35 dB(A).

The figures given above would be considered the LOAEL, and levels below the figures above would be considered the NOEL. Levels significantly greater than the figures given above would be considered the SOAEL and should be avoided.

BS 8233:2014 also recommends that individual noise events at night can be disturbing to sleep patterns, and that a guideline level should be set in terms of SEL or $L_{AF,max}$.

BS 8233 does not give a definitive level for internal maximum noise levels, or define an appropriate number of exceedances per night. However, the World Health Organisation's 'Guidelines for Community Noise' (1999) references a study by Vallet & Vernet, 1991, which concluded that "For a good sleep, it is believed that indoor sound pressure levels should not exceed approximately 45 dB $L_{AF,max}$ more than 10-15 times per night."

For the purposes of assessment, less than 10 exceedances per night would be considered the NOEL, with 15 exceedances considered the LOAEL. Numbers significantly in excess of this would be considered the SOAEL.

BS 8233 also states that it is desirable that the steady noise level in external amenity areas (such as gardens or outdoor living areas) does not exceed 50 dB $L_{Aeq,T}$, with 55 dB $L_{Aeq,T}$ being acceptable in noisier environments. This is in line with recommendations given in the WHO Guidelines for Community Noise.

However, in the period since the original issue of the WHO guidelines, the Government has set all English Local Planning Authorities specific five-year housing supply targets. This has placed greater emphasis on making efficient use of land resource earmarked for residential development. BS 8233:2014 recognises this, and states that it should be accepted that these values are not achievable in all circumstances where development would be otherwise desirable. The document goes on to suggest that in areas such as city centres, or urban areas adjoining the transport network, a compromise (between elevated external noise levels and ensuring development needs) is warranted.

On this basis, levels lower than 50 dB(A) will be considered the NOEL, levels above 50 dB(A) considered to be the LOAEL and levels above 55 dB(A) would be considered to be the SOAEL, but would be addressed on a case-by-case basis, and would not necessarily be considered a barrier to development.

7.1. BS 4142: 2014+A1: 2019

BS 4142 describes methods for rating and assessing industrial and/or commercial sound and includes, but is not limited to, the assessment of:

- Sound from industrial and manufacturing processes;
- Sound from fixed installations which comprise mechanical and electrical equipment;
- Sound from the (un)loading of goods and materials at industrial/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 on or around an industrial and/or commercial site.

The methods described in BS 4142 use outdoor sound levels to assess the likely effects of sound on people who are typically outside residential premises. Although indoor effects can be indicated where the façade composition is known. A summary of the approach set out in BS 4142 is set out below:

Establish or predict the specific sound level of the source(s) by considering both the ambient (includes the source to be assessed) and residual (excludes the source to be assessed but includes all remaining sources) sound level;

- Measure the representative background sound levels, typically by measuring close to the receptor location;
- Rate the specific sound level to account for any distinguishing characteristics (see below);
- Estimate the impact by subtracting the background sound level from the rating level; and
- Consider the initial estimate of impact, as determined above, in the context of the noise and its environment.

The specific sound level is rated to account for distinguishing characteristics by using penalties for tonality, impulsivity, intermittency, and other sound characteristics.

The character corrections are flexible according to whether the acoustic character is just perceptible at the noise receptor, or is clearly perceptible or highly perceptible, and range from 0 to 6 dB for tonal noise, 3 to 9 dB for impulsive noise, and 3 dB for other non-tonal/impulsive acoustic characteristics.

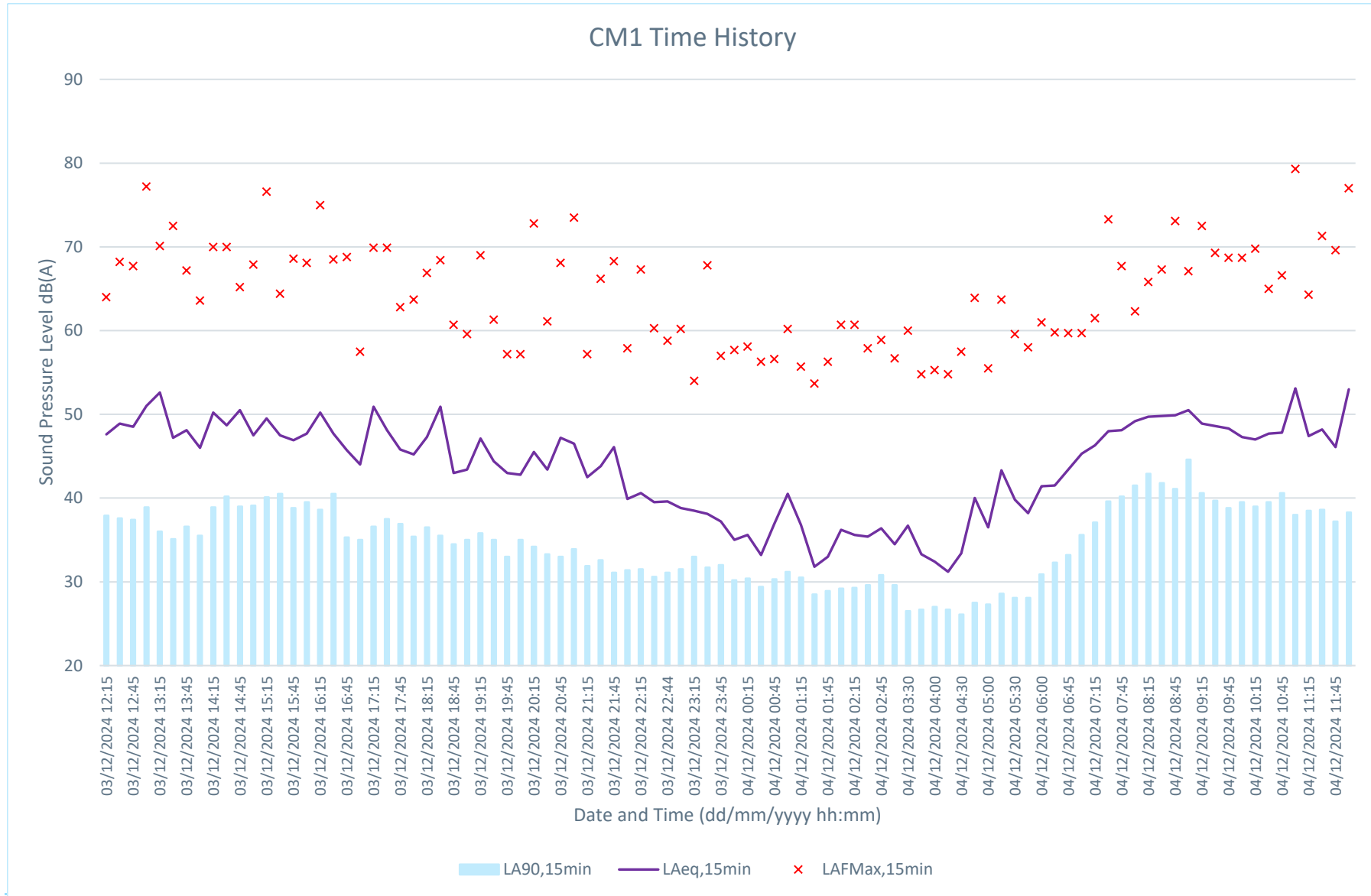
An initial estimate of impact of the specific sound is obtained by subtracting the background sound level from the rating level. Typically, the greater the difference, the greater the magnitude of impact.

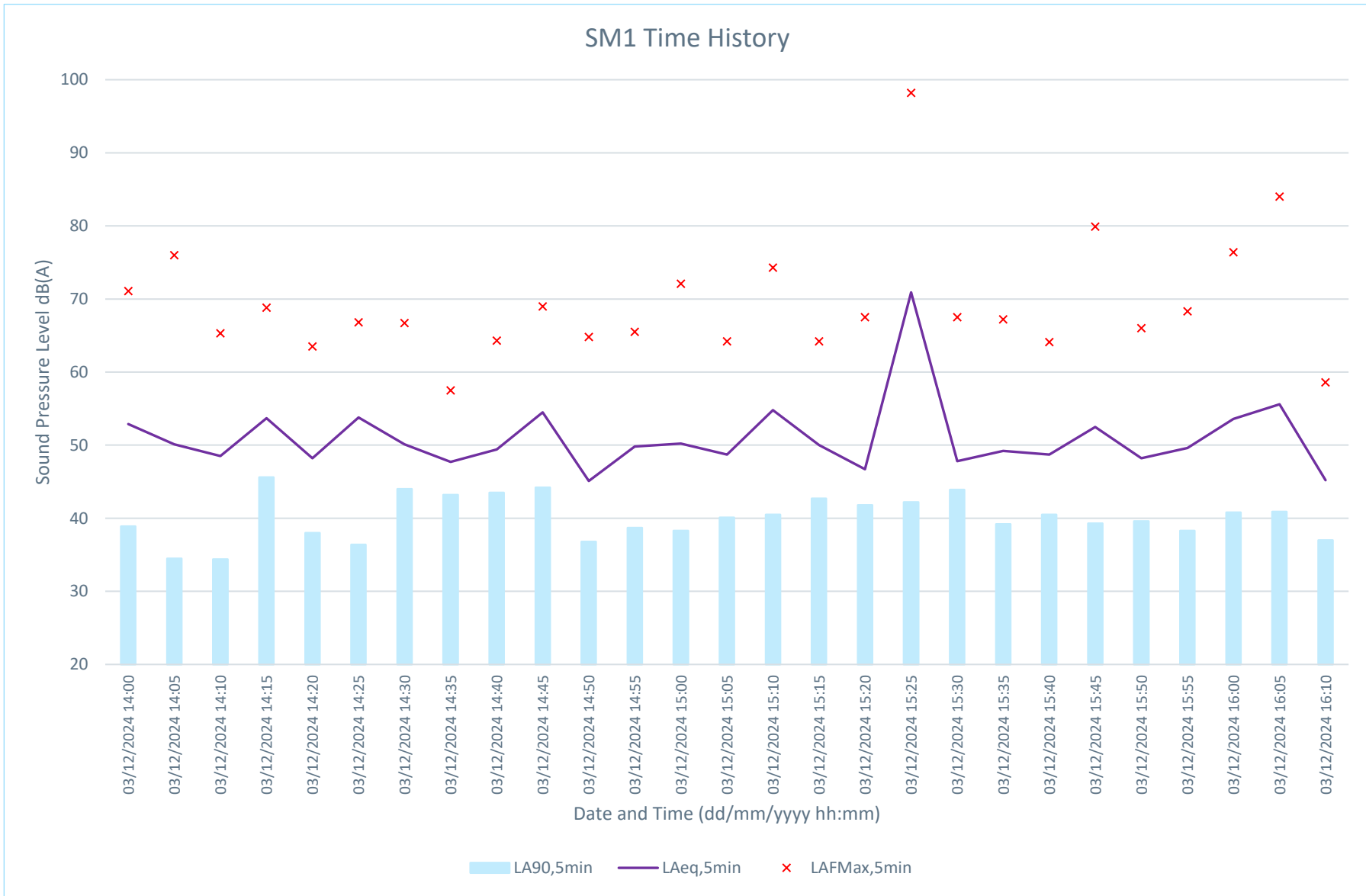
- A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context;
- A difference of around +5 dB is likely to be an indication of an adverse impact, depending on the context;
- At differences lower than +5 dB a low impact is likely, depending on the context. The lower the rating level is to the measured background sound level, the less likely it is that the specific sound source will have an impact.

The results of the initial assessment should then be considered in light of all pertinent contextual factors.

Appendix C

Time History





Appendix D

Example Noise Break in Calculation

Figure 7.1: 1st Floor Bedroom 1 – (Anonymous Sound) Daytime L_{Aeq,16hr}

Annex G BS8233 Calculations												
Calculation Set Up Using BS8233 Values												
Frequency Independent Terms												
Ao =	10	m ²	Reference absorbtion area									
H =	2.4	m	Height of the room									
W =	8.8	m	Width of the room									
Sf =	12.3	m ²	Total façade area of the room									
Swi =	1.2	m ²	Window area of room									
Sew =	11.1	m ²	External wall area									
Srr =	13	m ²	Ceiling area									
S =	25.3	m ²	Total surface are of elements through which sound enters the room (= Sf + Srr)									
d =	0.74	m	Depth of the room									
V =	15.6288	m ³	Room volume									
Frequency Dependent Terms												
				Octave Band Centre Frequency							R _w + C _{tr} or D _{n,e,w} + C _{tr}	
				63	125	250	500	1k	2k	4k	8k	
SRIs												
Parameter	Description	Construction										
Dn,e =	Insulation of trickle vent			32.5897	29.8897	30.1897	28.4897	27.4897	28.7897			29
Rwi =	SRI of window			21	20	33	42	46	39			28
Rew =	SRI of external wall			40	44	45	51	56	56			47
Rrr =	SRI of roof / ceiling			35	46	53	55	63	62			48
Absorption Coefficients												
carpet on underlay				0.08	0.24	0.57	0.69	0.71	0.73			
walls, painted and plastered				0.02	0.02	0.03	0.03	0.04	0.05			
double glazing				0.18	0.06	0.04	0.03	0.02	0.02			
ceiling	Armstrong Dune Supreme			0.4	0.45	0.55	0.6	0.5	0.45			
Total Absorption				area								
carpet on underlay			60.48	0	4.8384	14.5152	34.4736	41.7312	42.9408	44.1504	0	
walls, painted and plastered			44.592	0	0.89184	0.89184	1.33776	1.33776	1.78368	2.2296	0	
double glazing			1.2	0	0.216	0.072	0.048	0.036	0.024	0.024	0	
ceiling			60.48	0	24.192	27.216	33.264	36.288	30.24	27.216	0	
A from rev time (RT) or abs coeff (AC)?				RT								
A =	Equiv abs area of rec room (AC)			0.00	30.14	42.70	69.12	79.39	74.99	73.62	0.00	
RT					0.5	0.5	0.5	0.5	0.5	0.5		
A =	Equiv abs area of rec room (RT)			0.00	5.00	5.00	5.00	5.00	5.00	5.00	0.00	
A =	Equiv abs area of rec room			0.00	5.00	5.00	5.00	5.00	5.00	5.00	0.00	
TERM A	Leq,ff =	Leq ext ff	48.2 dB(A)		51	47	44	44	41	38		
TERM B	(Ao/S) * 10 ⁻¹ (-Dn,e / 10)			0	0.000218	0.000405	0.000378	0.00056	0.000705	0.000522	0	
TERM C	(Swi/S) * 10 ⁻¹ (-Rwi / 10)			0	0.000377	0.000474	2.38E-05	2.99E-06	1.19E-06	5.97E-06	0	
TERM D	(Sew/S) * 10 ⁻¹ (-Rew / 10)			0	4.39E-05	1.75E-05	1.39E-05	3.48E-06	1.1E-06	1.1E-06	0	
TERM E	(Srr/S) * 10 ⁻¹ (-Rrr / 10)			0	0.000162	1.29E-05	2.58E-06	1.62E-06	2.58E-07	3.24E-07	0	
TERM F	10 Log (B+C+D+E)			0	-30.9645	-30.4091	-33.7822	-32.4585	-31.5052	-32.7598	0	
TERM G	10 Log (S/A)			0	7.040449	7.040449	7.040449	7.040449	7.040449	7.040449	0	
TERM K	+3			3	3	3	3	3	3	3	3	
Leq,2	SPL in room	dB		0.0	29.9	27.0	20.6	21.9	19.4	15.6	0.0	
A-weighting					-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1
LAeq,2		dB(A)		0.0	13.8	18.4	17.4	21.9	20.6	16.6	0.0	
10 ⁻¹ (LAeq,2 / 10)					0	24.03122	68.60152	55.24775	153.8273	114.3093	45.78416	0
LAeq noise level in room =												26.6 dB(A)
dB(A) reduction =												21.6 dB(A)



Figure 7.2: 1st Floor Bedroom 1 - (Anonymous Sound) Night-time L_{Aeq,8hr}

Annex G BS8233 Calculations												
Calculation Set Up Using BS8233 Values												
Frequency Independent Terms												
Ao =	10	m ²	Reference absorption area									
H =	2.4	m	Height of the room									
W =	8.8	m	Width of the room									
Sf =	12.3	m ²	Total façade area of the room									
Swi =	1.2	m ²	Window area of room									
Sew =	11.1	m ²	External wall area									
Srr =	13	m ²	Ceiling area									
S =	25.3	m ²	Total surface area of elements through which sound enters the room (= Sf + Srr)									
d =	0.74	m	Depth of the room									
V =	15.6288	m ³	Room volume									
Frequency Dependent Terms												
Octave Band Centre Frequency												
			63	125	250	500	1k	2k	4k	8k	R _w + C _{tr} or D _{n,e,w} + C _{tr}	
Parameter	Description	Construction										
Dn,e =	Insulation of trickle vent		32.5897	29.8897	30.1897	28.4897	27.4897	28.7897			29	
Rwi =	SRI of window		21	20	33	42	46	39			28	
Rew =	SRI of external wall		40	44	45	51	56	56			47	
Rrr =	SRI of roof / ceiling		35	46	53	55	63	62			48	
Absorption Coefficients												
carpet on underlay			0.08	0.24	0.57	0.69	0.71	0.73				
walls, painted and plastered			0.02	0.02	0.03	0.03	0.04	0.05				
double glazing			0.18	0.06	0.04	0.03	0.02	0.02				
ceiling Armstrong Dune Supreme			0.4	0.45	0.55	0.6	0.5	0.45				
Total Absorption			area									
carpet on underlay			60.48	0	4.8384	14.5152	34.4736	41.7312	42.9408	44.1504	0	
walls, painted and plastered			44.592	0	0.89184	0.89184	1.33776	1.33776	1.78368	2.2296	0	
double glazing			1.2	0	0.216	0.072	0.048	0.036	0.024	0.024	0	
ceiling			60.48	0	24.192	27.216	33.264	36.288	30.24	27.216	0	
A from rev time (RT) or abs coeff (AC)?			RT									
A =	Equiv abs area of rec room (AC)		0.00	30.14	42.70	69.12	79.39	74.99	73.62	0.00		
RT			0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5		
A =	Equiv abs area of rec room (RT)		0.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	0.00	
A =	Equiv abs area of rec room		0.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	0.00	
TERM A	Leq,ff =	Leq ext ff	37.9 dB(A)	42	37	34	34	29	24			
TERM B	(Ao/S) * 10 ⁻¹ (-Dn,e / 10)		0	0.000218	0.000405	0.000378	0.00056	0.000705	0.000522	0		
TERM C	(Swi/S) * 10 ⁻¹ (-Rwi / 10)		0	0.000377	0.000474	2.38E-05	2.99E-06	1.19E-06	5.97E-06	0		
TERM D	(Sew/S) * 10 ⁻¹ (-Rew / 10)		0	4.39E-05	1.75E-05	1.39E-05	3.48E-06	1.1E-06	1.1E-06	0		
TERM E	(Srr/S) * 10 ⁻¹ (-Rrr / 10)		0	0.000162	1.29E-05	2.58E-06	1.62E-06	2.58E-07	3.24E-07	0		
TERM F	10 Log (B+C+D+E)		0	-30.9645	-30.4091	-33.7822	-32.4585	-31.5052	-32.7598	0		
TERM G	10 Log (S/A)		0	7.040449	7.040449	7.040449	7.040449	7.040449	7.040449	0		
TERM K	+3		3	3	3	3	3	3	3	3		
Leq,2	SPL in room	dB	0.0	20.9	16.4	10.6	11.9	7.9	1.1	0.0		
A-weighting			-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1		
LAeq,2		dB(A)	0.0	4.8	7.8	7.4	11.9	9.1	2.1	0.0		
10 ⁻¹ (LAeq,2 / 10)			0	2.987989	6.031872	5.508823	15.34289	8.146521	1.617174	0		
LAeq noise level in room =			16.0 dB(A)									
dB(A) reduction =			21.9 dB(A)									



Figure 7.3: 1st Floor Bedroom 1 – (Anonymous Sound) Night-time L_AF_{max}

Annex G BS8233 Calculations												
Calculation Set Up Using BS8233 Values												
Frequency Independent Terms												
Ao =	10	m ²	Reference absorption area									
H =	2.4	m	Height of the room									
W =	8.8	m	Width of the room									
Sf =	12.3	m ²	Total façade area of the room									
Swi =	1.2	m ²	Window area of room									
Sew =	11.1	m ²	External wall area									
Srr =	13	m ²	Ceiling area									
S =	25.3	m ²	Total surface area of elements through which sound enters the room (= Sf + Srr)									
d =	0.74	m	Depth of the room									
V =	15.6288	m ³	Room volume									
Frequency Dependent Terms												
Octave Band Centre Frequency												
			63	125	250	500	1k	2k	4k	8k	R _w + C _{tr} or D _{n,e,w} + C _{tr}	
Parameter	Description	Construction										
Dn,e =	Insulation of trickle vent		32.5897	29.8897	30.1897	28.4897	27.4897	28.7897			29	
Rwi =	SRI of window		21	20	33	42	46	39			28	
Rew =	SRI of external wall		40	44	45	51	56	56			47	
Rrr =	SRI of roof / ceiling		35	46	53	55	63	62			48	
Absorption Coefficients												
carpet on underlay			0.08	0.24	0.57	0.69	0.71	0.73				
walls, painted and plastered			0.02	0.02	0.03	0.03	0.04	0.05				
double glazing			0.18	0.06	0.04	0.03	0.02	0.02				
ceiling Armstrong Dune Supreme			0.4	0.45	0.55	0.6	0.5	0.45				
Total Absorption			area									
carpet on underlay			60.48	0	4.8384	14.5152	34.4736	41.7312	42.9408	44.1504	0	
walls, painted and plastered			44.592	0	0.89184	0.89184	1.33776	1.33776	1.78368	2.2296	0	
double glazing			1.2	0	0.216	0.072	0.048	0.036	0.024	0.024	0	
ceiling			60.48	0	24.192	27.216	33.264	36.288	30.24	27.216	0	
A from rev time (RT) or abs coeff (AC)?			RT									
A =	Equiv abs area of rec room (AC)		0.00	30.14	42.70	69.12	79.39	74.99	73.62	0.00		
RT			0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5		
A =	Equiv abs area of rec room (RT)		0.00	5.00	5.00	5.00	5.00	5.00	5.00	0.00		
A =	Equiv abs area of rec room		0.00	5.00	5.00	5.00	5.00	5.00	5.00	0.00		
TERM A	Leq,ff =	Leq ext ff	60.1 dB(A)	64	61	57	55	52	52			
TERM B	(Ao/S) * 10 ⁻¹ * (-Dn,e / 10)		0	0.000218	0.000405	0.000378	0.00056	0.000705	0.000522	0		
TERM C	(Swi/S) * 10 ⁻¹ * (-Rwi / 10)		0	0.000377	0.000474	2.38E-05	2.99E-06	1.19E-06	5.97E-06	0		
TERM D	(Sew/S) * 10 ⁻¹ * (-Rew / 10)		0	4.39E-05	1.75E-05	1.39E-05	3.48E-06	1.1E-06	1.1E-06	0		
TERM E	(Srr/S) * 10 ⁻¹ * (-Rrr / 10)		0	0.000162	1.29E-05	2.58E-06	1.62E-06	2.58E-07	3.24E-07	0		
TERM F	10 Log (B+C+D+E)		0	-30.9645	-30.4091	-33.7822	-32.4585	-31.5052	-32.7598	0		
TERM G	10 Log (S/A)		0	7.040449	7.040449	7.040449	7.040449	7.040449	7.040449	0		
TERM K	+3		3	3	3	3	3	3	3	3		
Leq,2	SPL in room	dB	0.0	43.2	40.6	33.5	32.9	30.2	29.7	0.0		
A-weighting			-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1		
LAeq,2		dB(A)	0.0	27.1	32.0	30.3	32.9	31.4	30.7	0.0		
10 ⁻¹ * (LAeq,2 / 10)			0	510.0267	1596.382	1061.276	1941.767	1391.631	1169.667	0		
LAeq noise level in room =			38.8 dB(A)									
dB(A) reduction =			21.2 dB(A)									



Figure 7.4: Ground Floor Bedroom 3 – (Industrial /Commercial Sound) Daytime LAeq,16hr

Annex G BS8233 Calculations											
Calculation Set Up Using BS8233 Values											
Frequency Independent Terms											
Ao =	10	m2	Reference absorption area								
H =	2.4	m	Height of the room								
W =	8.8	m	Width of the room								
Sf =	21.12	m2	Total façade area of the room								
Swi =	1.2	m2	Window area of room								
Sew =	19.92	m2	External wall area								
Srr =		m2	Ceiling area								
S =	21.12	m2	Total surface area of elements through which sound enters the room (= Sf + Srr)								
d =	0.91	m	Depth of the room								
V =	19.2192	m3	Room volume								
Frequency Dependent Terms											
Octave Band Centre Frequency											
			63	125	250	500	1k	2k	4k	8k	R _w + C _{tr} or D _{n,e,w} + C _{tr}
Parameter	Description	Construction									
Dn,e =	Insulation of trickle vent		32.8897	34.5897	33.2897	28.7897	33.7897	37.3897			31
Rwi =	SRI of window		21	20	33	42	46	39			28
Rew =	SRI of external wall		40	44	45	51	56	56			47
Rrr =	SRI of roof / ceiling										
Absorption Coefficients											
carpet on underlay			0.08	0.24	0.57	0.69	0.71	0.73			
walls, painted and plastered			0.02	0.02	0.03	0.03	0.04	0.05			
double glazing			0.18	0.06	0.04	0.03	0.02	0.02			
ceiling Armstrong Dune Supreme			0.4	0.45	0.55	0.6	0.5	0.45			
Total Absorption		area									
carpet on underlay		60.48	0	4.8384	14.5152	34.4736	41.7312	42.9408	44.1504	0	
walls, painted and plastered		45.408	0	0.90816	0.90816	1.36224	1.36224	1.81632	2.2704	0	
double glazing		1.2	0	0.216	0.072	0.048	0.036	0.024	0.024	0	
ceiling		60.48	0	24.192	27.216	33.264	36.288	30.24	27.216	0	
A from rev time (RT) or abs coeff (AC)?			RT								
A =	Equiv abs area of rec room (AC)		0.00	30.15	42.71	69.15	79.42	75.02	73.66	0.00	
RT			0.5	0.5	0.5	0.5	0.5	0.5	0.5		
A =	Equiv abs area of rec room (RT)		0.00	6.15	6.15	6.15	6.15	6.15	6.15	0.00	
A =	Equiv abs area of rec room		0.00	6.15	6.15	6.15	6.15	6.15	6.15	0.00	
TERM A	Leq,ff = Leq ext ff	50.6 dB(A)	42	38	46	49	37	32			
TERM B	(Ao/S) * 10 ⁻¹ (-Dn,e / 10)		0	0.000243	0.000165	0.000222	0.000626	0.000198	8.64E-05	0	
TERM C	(Swi/S) * 10 ⁻¹ (-Rwi / 10)		0	0.000451	0.000568	2.85E-05	3.58E-06	1.43E-06	7.15E-06	0	
TERM D	(Sew/S) * 10 ⁻¹ (-Rew / 10)		0	9.43E-05	3.75E-05	2.98E-05	7.49E-06	2.37E-06	2.37E-06	0	
TERM E	(Srr/S) * 10 ⁻¹ (-Rrr / 10)		0	0	0	0	0	0	0	0	
TERM F	10 Log (B+C+D+E)		0	-31.029	-31.1334	-35.5239	-31.9604	-36.9541	-40.1824	0	
TERM G	10 Log (S/A)		0	5.358086	5.358086	5.358086	5.358086	5.358086	5.358086	0	
TERM K	+3		3	3	3	3	3	3	3	3	
Leq,2	SPL in room	dB	0.0	19.3	15.5	18.5	25.9	8.8	0.2	0.0	
A-weighting			-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1	
LAeq,2		dB(A)	0.0	3.2	6.9	15.3	25.9	10.0	1.2	0.0	
10 ⁻¹ (LAeq,2 / 10)			0	2.101803	4.914926	33.83871	384.6154	10.09711	1.331614	0	
LAeq noise level in room =		26.4 dB(A)									
dB(A) reduction =		24.2 dB(A)									
Internal Noise Level with BS4142 feature corrections applied =		31.4 dB(A)									

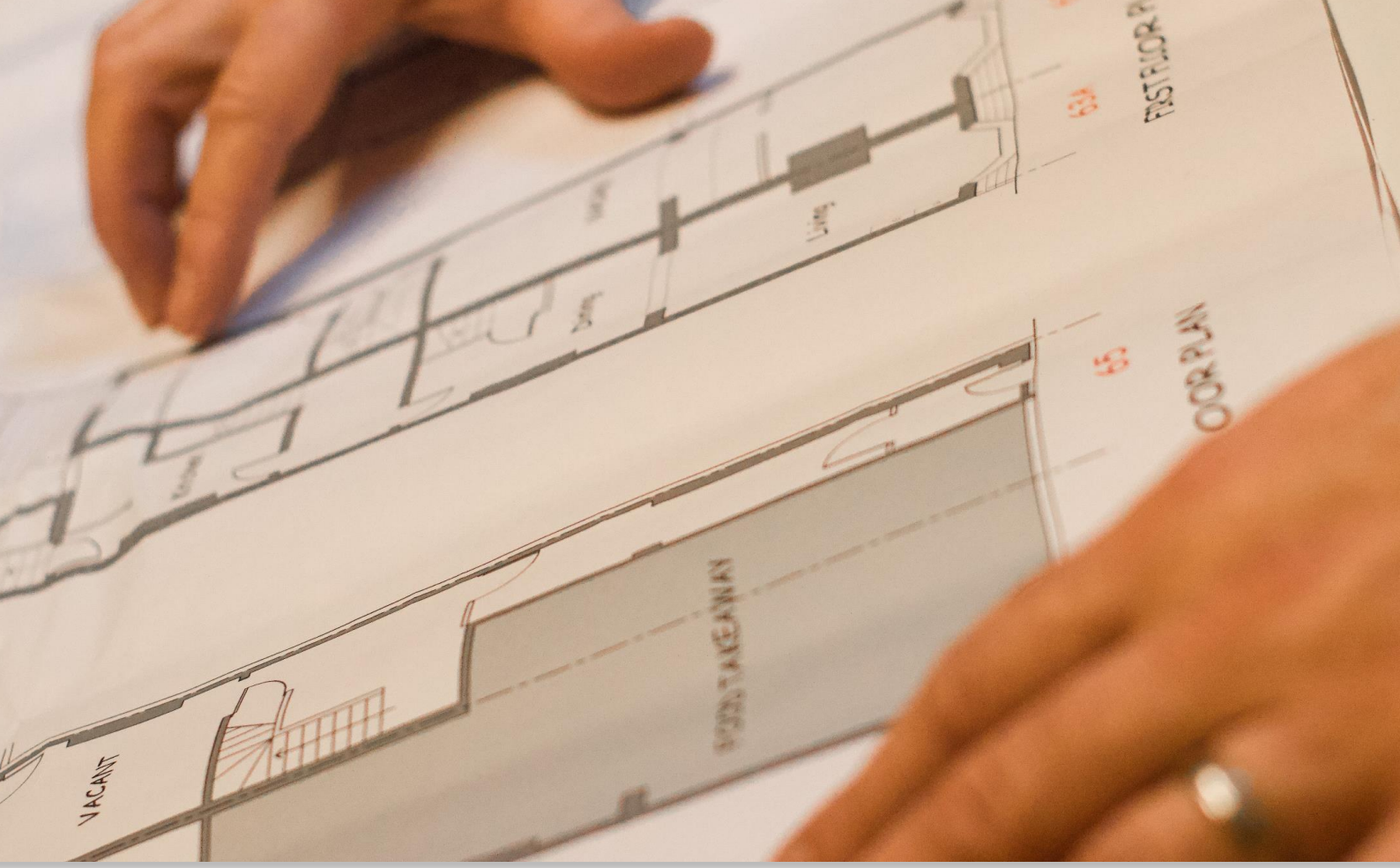


Appendix E

Report Limitations

This report has been prepared for the titled project or named part thereof and should not be used in whole or part and relied upon for any other project without the written authorisation of Peninsular Acoustics Limited. Peninsular Acoustics Limited accept no responsibility or liability for the consequences of this document if it is used for a purpose other than that for which it was commissioned. Persons wishing to use or rely upon this report for other purposes must seek written authority to do so from the owner of this report and/ or Peninsular Acoustics Limited and agree to indemnify Peninsular Acoustics Limited for any and all loss or damage resulting therefrom. Peninsular Acoustics Limited accepts no responsibility or liability for this document to any other party other than the person by whom it was commissioned.

The findings and opinions expressed are relevant to the dates of the site works and design drawings/specifications and should not be relied upon to represent conditions at substantially later dates. Opinions included therein are based on information gathered during the study and from our experience. If additional information becomes available which may affect our comments, conclusions or recommendations Peninsular Acoustics Limited reserve the right to review the information, reassess any new potential concerns and modify our opinions accordingly.



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