
MR NICK LOWE AND RICHARD HESMONDHALGH

NOISE IMPACT ASSESSMENT REPORT

**LAND AT CORNER OF CLOUGH STREET AND BOARSHAW
ROAD, MIDDLETON, M24 2WH**

Client: Mr Nick Lowe and Richard Hesmondhalgh

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1 INTRODUCTION

- 1.1.1 By instruction from Mr Nick Lowe And Richard Hesmondhalgh ('the client'), NoiseAir was commissioned to undertake a noise impact assessment (NIA) for a proposed mixed commercial and residential development at Land At Corner Of Clough Street And Boarshaw Road, Middleton M24 2WH, herein referred to as the 'development site'.
- 1.1.2 This noise report has been prepared in of a planning application and assesses the results of a noise survey carried out in accordance with current guidance and includes recommendations and mitigation as appropriate.
- 1.1.3 General limitations of this report are outlined in **Appendix A**.

1.2 Site Description

- 1.2.1 At the time of writing the development site is a small parcel of land located at the corner of Clough Street and Boarshaw Road. The development site is located in a mixed use area, however the wider locality is noted to be predominantly residential in use.
- 1.2.2 The development site fronts onto Boarshaw Road which is a single carriageway dual lane road typically accommodating cars and similar vehicles at low to medium speeds. Clough Street is a no through access street/ track which provides some off street parking for local residents and also parking for the The Hive Health Centre during the daytime hours during with the centre operates.
- 1.2.3 Immediately to the west of the development site a series of small commercial businesses operate such as an Indian takeaway, sandwich shop, hair and beauty premises and also a Chinese takeaway. The aforementioned Indian takeaway is immediately next to the development site, and it is noted that a kitchen extract flue is located to the rear of the premises directed upwards at first floor level. The Indian takeaway operates six days a week (all days except Tuesdays) typically from 17:00 to 23:00 hours.
- 1.2.4 On the opposite side of Boarshaw Road is located a Hand Carwash which is set back approximately 30 m from the road centreline. The hand car wash operates between 09:00 and 18:00 every day of the week.
- 1.2.5 **Figure 1** shows an aerial photograph of the development site with respect to the local area and its context.



Figure 1: Site aerial photograph.

1.3 Development Proposals

- 1.3.1 Proposals for the development site outline the construction of a two storey building. It is understood that the proposed building is to accommodate commercial unit(s) to the ground floor and residential units to the first floor.
- 1.3.2 Detail floor layouts are not available at the time of writing however is assumed that habitable rooms are likely to all facades, with windows to front, rear and east side facades. It is not considered that windows will be installed to the west facing façade.
- 1.3.3 The proposed site layout is presented in **Figure 2** below.

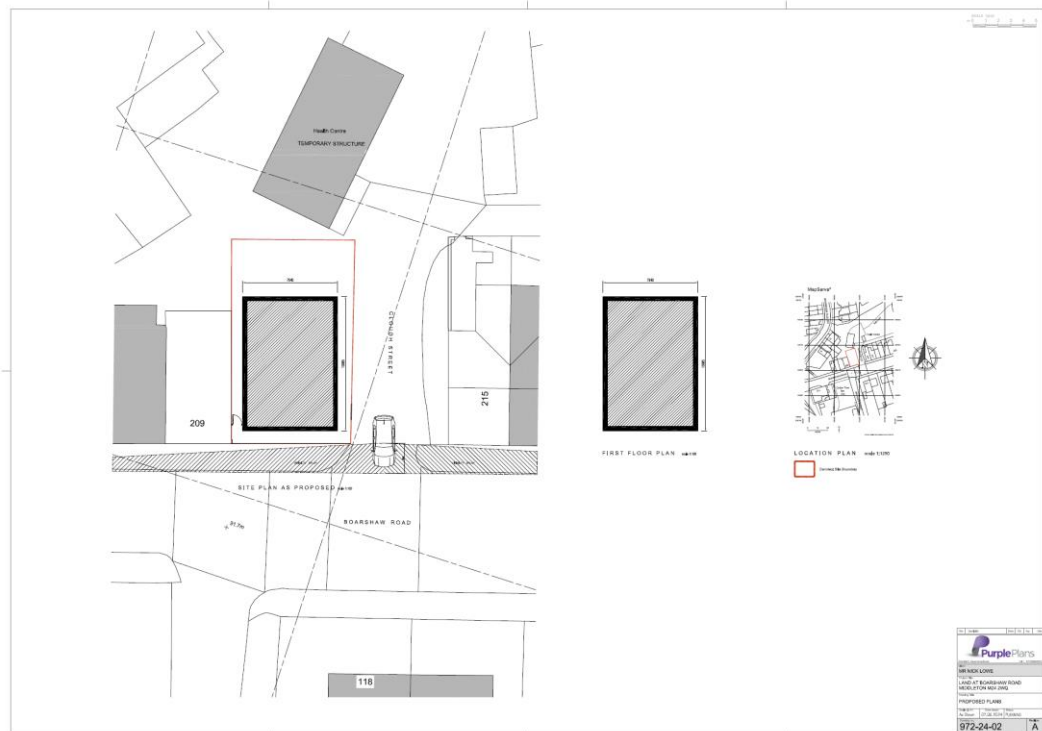


Figure 2: Proposed Site Layout.

2 ASSESSMENT METHODOLOGY AND SCOPE OF WORKS

2.1 Planning Guidance and Noise

2.1.1 This acoustic report has been prepared in support of a proposed planning application and therefore it is considered that reference should be made to the appropriate planning guidance documentation, specifically:

- National Planning Policy Framework (NPPF), 2023;
- Noise Policy Statement for England (NPSE), 2010;
- Planning Practice Guidance – Noise, 2019;

2.1.2 A summary of the relevant planning documentation and its relevance with respect to noise is provided below.

National Planning Policy Framework [NPPF 2023]

2.1.3 The NPPF was initially published in March 2012 with the most recent version updated in 2023. The NPPF sets out the Governments planning policies for England and how these are expected to be applied across a number of areas.

2.1.4 With respect to noise specifically, Section 15, Paragraph 170 of the NPPF 2023 states:

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

- *preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution or land instability. Development should, wherever possible, help to improve local environmental conditions such as air and water quality, taking into account relevant information such as river basin management plans;’*

2.1.5 The NPPF 2023 continues to state in Paragraph 180:

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

- *mitigate and reduce to a minimum potential adverse impacts resulting from noise from new development – and avoid noise giving rise to significant adverse impacts on health and the quality of life; and,*
- *identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason.*

Noise Policy Statement for England [NPSE 2010]

- 2.1.6 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*”.
- 2.1.7 This long-term vision is supported by the following aims; 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;
 - Where possible, contribute to the improvement of health and quality of life.
- 2.1.8 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’.*

- 2.1.9 The first aim of the NPSE states that significant adverse effects on health and quality of life should be avoided. The second aim refers to the situation where the impact lies somewhere between LOAEL and SOAEL, and it requires that all reasonable steps are taken to mitigate and minimise the adverse effects of noise. However, the requirement to mitigate and minimise the adverse effects of noise does not mean that such adverse effects cannot occur.

Planning Practice Guidance - Noise [PPG 2019]

- 2.1.10 The National Planning Practice Guidance (PPG) is a web-based resource, launched by the Department for Communities and Local Government (DCLG) in March 2014 to support the NPPF¹.
- 2.1.11 The PPG advises on how planning can manage potential noise impacts in new development. The guidance is regularly reviewed and updated and noise is listed as a specific category, the noise category was most recently updated in July 2019.
- 2.1.12 The PPG provides further detail about how the effect levels can be recognised. Above the NOEL noise becomes noticeable, however it has no adverse effect as it does not cause any change in behaviour or attitude. Once noise crosses the LOAEL threshold it begins to have an adverse effect and consideration needs to be given to mitigating and minimising those effects, taking account of the economic and social benefits being derived from the activity causing the noise.
- 2.1.13 Increasing noise exposure further might cause the SOAEL threshold to be crossed. If the exposure is above this level the planning process should be used to avoid the effect occurring by use of appropriate mitigation such as by altering the design and layout. Such decisions must be made taking account of the economic and social benefit of the activity causing the noise, but it is undesirable for such exposure to be caused.
- 2.1.14 At the highest extreme the situation should be prevented from occurring regardless of the benefits which might arise.
- 2.1.15 **Table 1** summarises the noise exposure hierarchy outlined within the PPG.

¹ <https://www.gov.uk/guidance/noise--2>

Table 1: National Planning Practice Guidance noise exposure hierarchy

Perception	Examples of Outcomes	Increasing Effect Level	Action
Not noticeable	No effect	No Observed Effect	No specific measures required
Noticeable and not intrusive	Noise can be heard, but does not cause any change in behaviour or attitude. Can slightly affect the acoustic character of the area but not such that there is a perceived change in the quality of life.	No Observed Adverse Effect	No specific measures required
Lowest Observed Effect Level			
Noticeable and intrusive	Noise can be heard and causes small changes in behaviour and/or attitude, e.g. turning up volume of television; speaking more loudly; where there is no alternative ventilation, having to close windows for some of the time because of the noise. Potential for non-awakening sleep disturbance. Affects the acoustic character of the area such that there is a perceived change in the quality of life.	Observed Adverse Effect	Mitigate and reduce to a minimum
Significant Observed Effect Level			
Noticeable and disruptive	The noise causes a material change in behaviour and/or attitude, e.g. avoiding certain activities during periods of intrusion; where there is no alternative ventilation, having to keep windows closed most of the time because of the noise. Potential for sleep disturbance resulting in difficulty in getting to sleep, premature awakening and difficulty in getting back to sleep. Quality of life diminished due to change in acoustic character of the area.	Significant Observed Adverse Effect	Avoid
Noticeable and very disruptive	Extensive and regular changes in behaviour and/or an inability to mitigate effect of noise leading to psychological stress or physiological effects, e.g. regular sleep deprivation/awakening; loss of appetite, significant, medically definable harm, e.g. auditory and non-auditory.	Unacceptable Adverse Effect	Prevent

2.2 Consultation and Scope of Works

2.2.1 The scope of the assessment includes consideration of noise at sensitive areas of the proposed development, i.e., proposed residential areas/ bedrooms, specifically in terms of the potential impact of local noise sources such as traffic noise and noise breakout from the neighbouring Indian takeaway extract and hand car wash. Consideration will also be given to potential noise transfer from the ground floor commercial use with respect to the proposed residential property and existing residents.

2.3 Assessment Criteria

2.3.1 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.

2.3.2 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.

2.3.3 It is therefore considered that the noise assessment and subsequent criteria should be undertaken in accordance with Pro-PG:2017 Planning and Noise, a summary of which is provided below.

2.3.4 In addition, it has also been identified that noise breakout from the adjacent Indian takeaway and hand car wash may cause adverse impact and should therefore be assessed in accordance with BS 4142:2014+A1:2019, a summary of which has been provided below also.

2.4 Pro-PG – Planning & Noise [Pro-PG:2017]

2.4.1 Pro-PG:2017 Planning and Noise provides professional practice guidance in relation to new residential development exposed to noise from transport sources. It provides practitioners with a recommended approach to the management of noise within the planning system in England.

2.4.2 The guidance reflects the Government's overarching National Planning Policy Framework, the Noise Policy Statement for England, and Planning Practice Guidance (including PPG-Noise) and draws on other authoritative sources of guidance. It provides advice for Local Planning Authorities and developers, and their professional advisers, on achieving good acoustic design in and around new residential developments.

2.4.3 Pro-PG:2017 adopts a two-stage approach to assessment:

- **Stage 1** – an initial noise risk assessment of the proposed development site; and,
- **Stage 2** – a systematic consideration of four key elements.

2.4.4 The four key elements to be undertaken in parallel during Stage 2 of the recommended approach are:

- **Element 1** – demonstrating a “Good Acoustic Design Process”;
- **Element 2** – observing internal “Noise Level Guidelines”;
- **Element 3** – undertaking an “External Amenity Area Noise Assessment”; and,
- **Element 4** – consideration of other relevant issues.

2.4.5 Internal noise level guidelines are set out in Figure 2 of Pro-PG:2017 which have been reproduced 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 $L_{Aeq,8hour}$ 45 dB L_{Amax}

2.4.6 There are multiple notes outlined within Pro-PG:2017 with respect to **Table 2** which should be considered in full however the main points for consideration are outlined below:

- The table provides recommended internal $L_{Aeq,T}$ target levels for overall noise in the design of a building. These are the sum total of structure-borne noise and airborne noise sources.
- The internal $L_{Aeq,T}$ target levels shown in the table are based on the existing guidelines issued by the World Health Organisation (WHO) and assume normal diurnal fluctuation in external noise.
- The internal $L_{Aeq,T}$ target levels are based on annual average data and do not have to be achieved in all circumstances. For example, it is normal to exclude occasional events, such as fireworks night or New Year's Eve.
- Regular individual noise events (for example, scheduled aircraft or passing trains) can cause sleep disturbance. In most circumstances in noise-sensitive rooms at night (e.g. bedrooms) good acoustic design can be used so that individual noise events do not normally exceed 45dB $L_{Amax,F}$ more than 10 times a night. However, where it is not reasonably practicable to achieve this guideline then the judgement of acceptability will depend not only on the maximum noise levels but also on factors such as the source, number, distribution, predictability and regularity of noise events.
- Designing the site layout and the dwellings so that the internal target levels can be achieved with open windows in as many properties as possible demonstrates good acoustic design. Where it is not possible to meet internal target levels with windows open, internal noise levels can be assessed with windows closed, however any façade openings used to provide whole dwelling ventilation (e.g. trickle ventilators) should be assessed in the "open" position and, in this scenario, the internal L_{Aeq} target levels should not normally be exceeded.
- Where development is considered necessary or desirable, despite external noise levels above WHO guidelines, the internal L_{Aeq} target levels may be relaxed by up to 5 dB and reasonable internal conditions still achieved.

-
- 2.4.7 The guidelines presented in **Table 2** reflect and extend current practice contained in BS 8233:2014.
- 2.4.8 In terms of external amenity noise assessment, Pro-PG:2017 again draws upon guidelines set presented by the WHO and also presented in BS 8233:2014.
- 2.4.9 BS 8233:2014 states that “the acoustic environment of external amenity areas that are an intrinsic part of the overall design should always be assessed and noise levels should ideally not be above the range 50 – 55 dB $L_{Aeq,16hr}$ ”. The standard continues... “These guideline values may not be achievable in all circumstances where development might be desirable. In such a situation, development should be designed to achieve the lowest practicable noise levels in these external amenity spaces but should not be prohibited.”
- 2.5 BS 4142:2014+A1:2019 – Methods for Rating and Assessing Industrial and Commercial Sound [BS 4142:2014]**
- 2.5.1 BS 4142:2014 provides methods for rating and assessing sound of an industrial / commercial nature, which includes sound from industrial and manufacturing processes, fixed services plant, sound generated by the unloading of goods and sound from mobile plant / vehicles associated with industrial / commercial premises (e.g., fork-lift trucks).
- 2.5.2 BS 4142:2014 uses various descriptors to assess the likelihood of adverse impact relating to proposed / existing industrial / commercial activities on existing or proposed noise-sensitive receivers.
- 2.5.3 The magnitude of impact is assessed by subtracting the measured background sound level at a location representative of the nearest noise-sensitive receiver, from the ‘rating level’ (the specific sound source to be introduced into the locality, corrected for acoustically distinguishing characteristics which may make it more subjectively prominent).
- 2.5.4 Typically, the greater the difference between the background and rating level, the greater the magnitude of impact, although BS 4142:2014 suggests that this should be considered in the context-of the site and surrounding being assessed.
- 2.5.5 As a guideline, BS 4142:2014 suggests that:
- A difference (between the background and rating level) of around +10 dB or more is likely to be indicative of significant adverse impact, depending on context.
 - A difference (between the background and rating level) of around +5 dB or more is likely to be indicative of adverse impact, depending on context.
-

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

2.5.6 BS 4142:2014 requires qualified engineering consultants and technical planning professionals (e.g., Environmental Health Officers) to use a combination of quantitative assessment techniques and rational qualitative judgments to come to a reasoned conclusion.

Definitions

2.5.7 BS 4142:2014 uses several specific terms to define the various levels used in assessments, as follows:

- Specific sound – the commercial / industrial noise source under consideration.
- Residual sound – the sound level at the noise-sensitive receivers in the absence of the specific sound.
- Ambient sound – the sound level at the noise-sensitive receivers in the presence of the specific sound (i.e., ambient = residual + specific).
- Background level - the sound pressure level which is exceeded by the residual sound for 90% of the measurement period.
- Rating level – the specific sound, corrected for acoustically distinguishing characteristics.

Background Sound Level

2.5.8 BS 4142:2014 suggests that the background level (LA90,T) should be considered as a range of levels and not an absolute value. Background sound measurements should be normally not less than 15 minutes, the suggestion is on obtaining a level for use in assessment that is representative of typical conditions at the noise-sensitive receivers.

2.5.9 An example methodology by which this typical value may be obtained is given in BS 4142:2014. The example suggests that where monitoring of LA90,15mins is undertaken during periods which represent when the specific noise will be operational. After obtaining a sequence of representative results, the mode average value is considered representative of the 'typical' background level and may be adopted for the assessment.

Specific Sound Level

- 2.5.10 BS 4142:2014 requires that the specific sound (LAeq,T) is obtained over a reference period of 1 hour (daytime) and 15 mins (at night). Ideally, where possible measurements should be taken of the ambient sound and residual sound at the assessment location, with these measurements used to accurately calculate the specific sound (ambient – residual = specific).
- 2.5.11 Where the source (specific sound) is not yet operational, it is permissible to measure the specific sound elsewhere (or to use known manufacturers' or library data) and then model the impact of this against the known background level.

Rating Level

- 2.5.12 Once the specific sound level has been determined, this should be corrected in terms of the need to consider the subjective prominence of the impact of the sound at noise-sensitive receptors.
- 2.5.13 BS 4142:2014 states that this is normally possible to carry out a subjective assessment of characteristics, based on the following correction guidelines:
- **Tonality:** +2 dB for a 'just perceptible' tone, +4 dB for 'clearly perceptible', +6 dB for 'highly perceptible' tones.
 - **Impulsivity:** +3 dB for 'just perceptible' impulsivity, +6 dB for 'clearly perceptible', rising to +9 dB for 'highly perceptible' impulsivity.
 - **Intermittency:** if the on / off-time of the specific sound is readily distinctive at the noise- sensitive receivers, +3 dB.
 - **Other sound characteristics:** up to +3 dB may be added for sound characteristics which are considered adverse to the receptor being clearly / highly perceptible. It should be noted that a correction for other sound characteristics is rare.
- 2.5.14 It should be noted that where one feature is clearly perceived as dominant, it may be applicable to correct for that feature only. Where multiple features are likely to affect perception and response, each should be added arithmetically.

3 ACOUSTIC SURVEY

3.1 Acoustic Survey Details

- 3.1.1 NoiseAir carried out fixed position attended noise monitoring on three separate monitoring episodes as outlined below.
- 3.1.2 General noise monitoring was undertaken at one monitoring locations (ML1), in addition a 'snap-shot' noise measurement was conducted at ML2 with respect to noise emissions from the neighbouring Indian takeaway kitchen extract, all positions are shown in **Figure 3** and **Table 3** below.



Figure 3: Site layout plan and noise monitoring locations.

Table 3: Summary of Noise Monitoring Locations				
Monitor Location Number	Location Description	Time Period Monitored		Attended or Unattended Monitoring
		Start	End/Duration	
ML1	To the west of the development site. Sound level meter microphone was mounted to the top of a car in free field conditions.	20:00	05:15	Attended
		15/10/24	16/10/24	
		16:30	23:00	Attended
		19/10/24	19/10/24	
		19:30	18:30	Attended
		22/10/24	22/10/24	
ML2	Snapshot measurement of the Indian takeaway kitchen extract. Sound level meter microphone was positioned 1 m from the kitchen extract discharge termination in free field conditions.	19:46 19/10/24	01:30	Attended

- 3.1.3 The monitor locations were positioned to be representative of the noise levels at the approximate location of the development site and so data from all locations will be used for the calibration of the 3D sound model.

3.1.4 The noise measurements were made using one Class 1, integrating sound level meter (SLM).

3.1.5 The acoustic equipment was calibrated to comply with Section 4.2 of BS7445-1:2003² before and after the noise monitoring periods.

3.1.6 Details of the SLMs and associated field calibration can be found in **Table 4** below;

Table 4: Summary of SLM's used for survey and associated field calibration			
SLM (Serial Number)	Preamp (Serial Number)	Microphone (Serial Number)	Calibrator (Serial Number)
NOR140 (1405015)	NOR1209 (14517)	NOR1225 (42327)	B&K4231 (2699086)

3.1.7 Calibration drift was measured at the start and end of each monitoring episode. The measured drift in each episode was within acceptable parameters (<0.5 dB).

3.1.8 The weather conditions were noted to be as outlined in **Table 5** during the site visits at the start the monitoring episodes.

Table 5: Summary of weather conditions noted at the start and end of the monitoring duration.			
	15 th October 2024	19 th October 2024	22 nd October 2024
Roads (Wet / Dry)	Dry	Dry	Dry
Temperature (°C)	14	10	14
Wind speed (ms ⁻¹)	Up to 3.8 ESE	Up to 1.9 SW	Up to 2.1 SW
Cloud Cover (Approx. %)	100	100	60
Humidity (%)	85	79	76

3.1.9 A-weighted³ L_{eq}⁴ and L_{AMax}⁵ noise levels were measured to comply with the requirements of Pro-PG:2017 and BS 4142:2014. A-weighted L₉₀⁶ were also measured to provide additional information.

3.1.10 Attending the development site provided opportunity for observations and detailed notes to be made of the significant noise sources which contribute to each of the measured levels.

² BS7445-2003 "Description and measurement of environmental noise – Part 1: Guide to quantities and procedures.

³ An electronic filter in a sound level meter which mimics the human ear's response to sounds at different frequencies under defined conditions.

⁴ Equivalent continuous noise level; the steady sound pressure which contains an equivalent quantity of sound energy as the time-varying sound pressure levels.

⁵ The instantaneous maximum noise level recorded for a measurement period.

⁶ The noise level which is exceeded for 90% of the measurement period.

ML1

Road Traffic Noise from Boarshaw Road: Regular vehicle noise was audible at ML1 from vehicles passing. Vehicles generally consisted of cars and vans. Noise from Boarshaw Road was intermittent with ambient noise from the local road network audible.

3.2 Measured Sound Levels – Noise Monitoring (ML1)

3.2.1 Data is shown in **Figure 4**, **Figure 5** and **Figure 6** detailing a level vs. time graph of the recorded L_{Amax} , L_{Aeq} and L_{A90} sound level over 15-minute time periods for ML1.

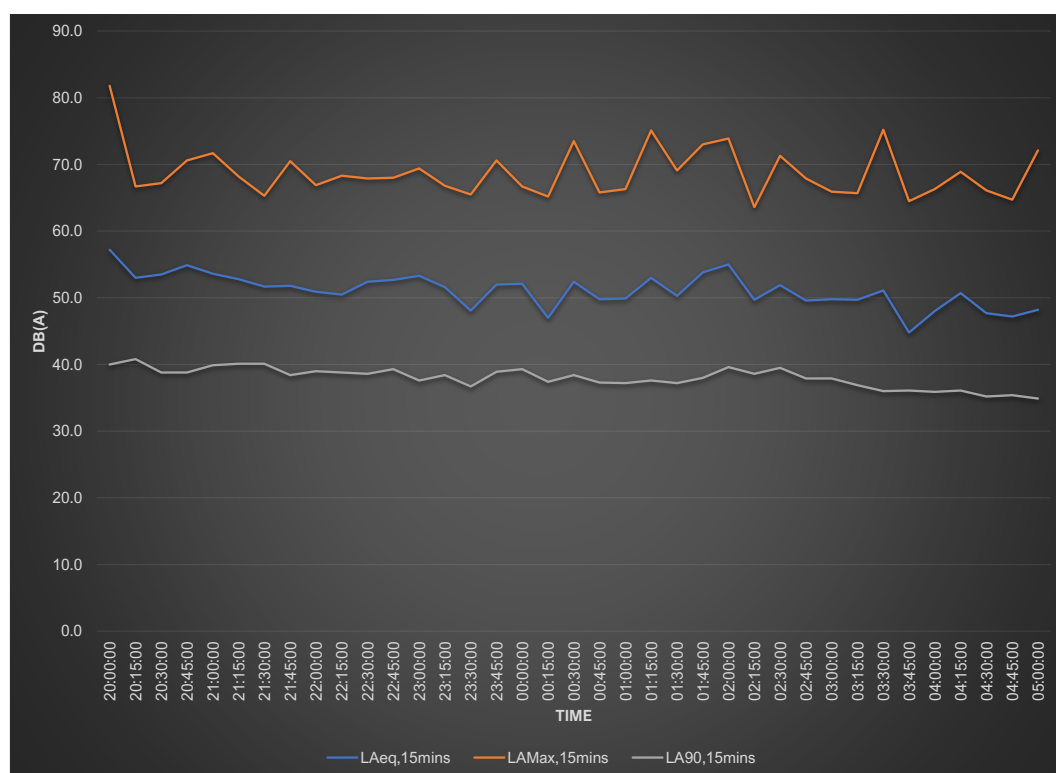


Figure 4: Level vs. time graph showing L_{Amax} , L_{Aeq} and L_{A90} sound levels – ML1 – Monitoring Episode 1.

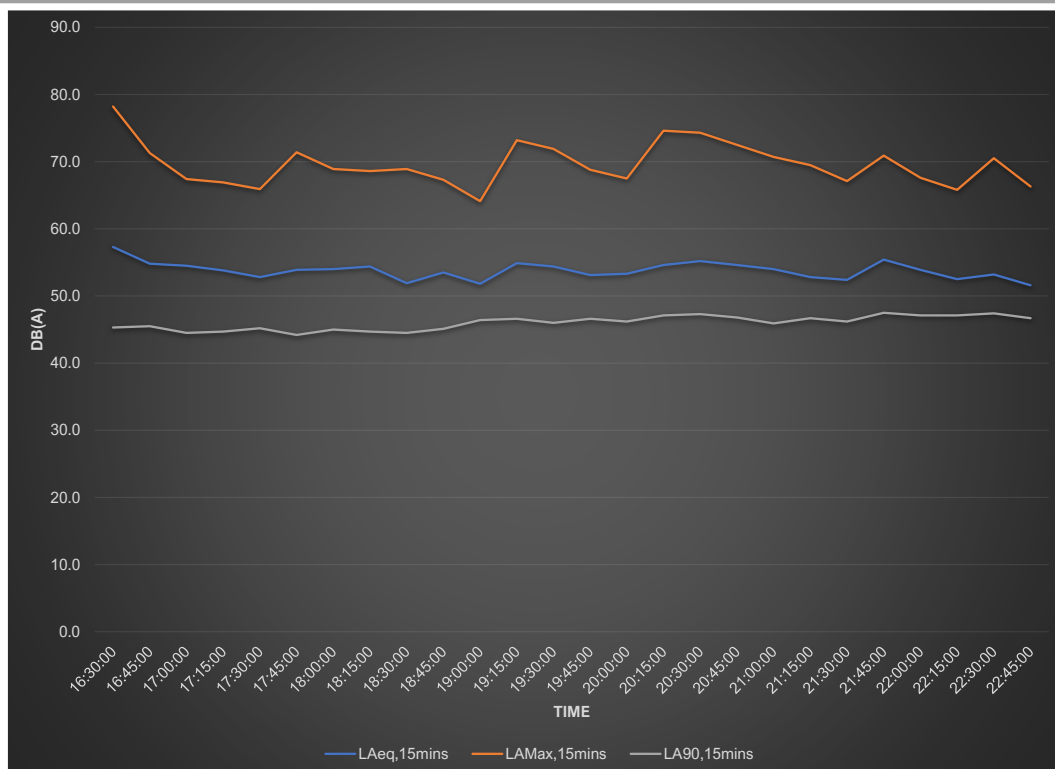


Figure 5: Level vs. time graph showing L_{Amax} , L_{Aeq} and L_{A90} sound levels – ML1 – Monitoring Episode 2.

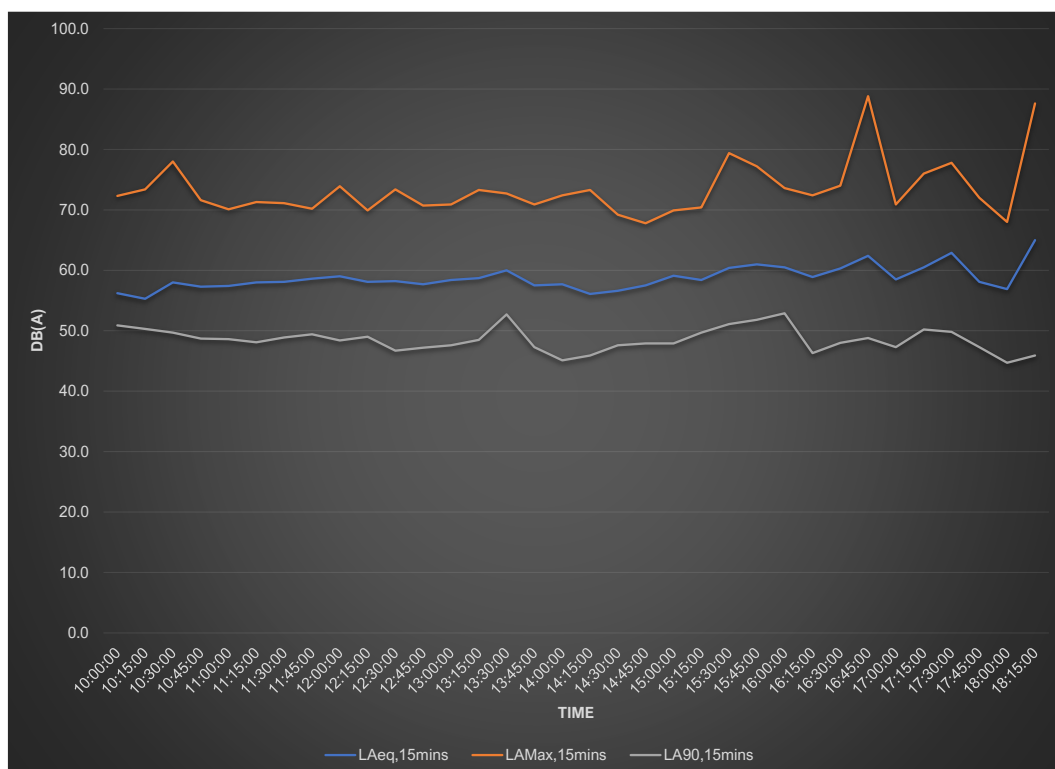


Figure 6: Level vs. time graph showing L_{Amax} , L_{Aeq} and L_{A90} sound levels – ML1 – Monitoring Episode 3.

3.2.2 The results for monitoring locations ML1 and ML2 during the daytime and night-time periods are presented in **Table 6**.

Table 6: Average Measured Daytime and Night-time Noise Levels				
Monitoring Location	Time	Measured Noise Level		
		dB L _{Aeq,T}	L _{A90,15mins}	dB L _{Afmax} *
ML1	Tuesday 15 th October 2024 20:00 to 23:00	53.3	38.4 – 40.8	-
ML1	Tuesday 15 th October 2024 23:00 to Tuesday 16 th October 2024 05:15	50.9	34.9 – 39.6	70
ML1	Saturday 19 th October 2024 16:30 to 23:00	54.0	44.2 – 47.5	-
ML1	Tuesday 22 nd October 2024 10:00 to 18:30	59.3	44.7 – 52.9	-
ML2	Saturday 19 th October 2024 19:46 (01:30)	58.6	-	-
* Maximum noise level exceeded more than 10 times.				

3.2.3 It was not possible to collect measurements from the hand car wash on the opposite side of Boarshaw Road given the distance away, the measured noise levels were not above the residual sound level at the development site and therefore typical noise levels measured from a similar hand car wash will be adopted for the 3D sound model. It is noted however that the noise emissions from the hand car wash were considered to be just audible/ audible at the development site given the differing noise character compared to the residual sound level which was predominantly traffic noise.

4 3D SOUND MODEL

4.1 Introduction

4.1.1 In order to accurately undertake an NIA with respect to the development proposals, it is considered that a 3D sound model should be utilised to calculate the noise levels at identified receptor locations.

4.2 3D Sound Model

4.2.1 A 3D sound model has been constructed in SoundPLAN™ to calculate the predicted sound pressure levels at selected potential receptor locations. The model uses the calculation method from ISO 9613-2:1996⁷ to account for the distance between the source and receiver and any screening or reflections provided by the surrounding buildings. The model is based on the proposals forwarded to NoiseAir at the time of writing.

4.2.2 The 3D noise model specifically includes the following noise sources outlined below.

- **Boarshaw and Boarshaw Clough** – Line Sources calibrated to on site measurements at ML1. Spectrum associated was set to that obtained at ML1 also.
- **Indian Takeaway Kitchen Extract** - one point source calibrated to noise measurements obtained at ML2.
- **Hand Car Wash** – Area source set to the noise emissions obtained by NoiseAir at a similar site, the sound pressure level was set to 58 dB(A) at 15 m.

4.2.3 A noise contour plot illustrating the propagation of sound from source to receptor during the day ($L_{Aeq,16hour}$), night time ($L_{Aeq,8hour}$) and night time L_{Amax} condition is given in **Figure 7**, **Figure 8** and **Figure 9** respectively.

⁷ ISO9613-2:1996 "Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method of calculation"

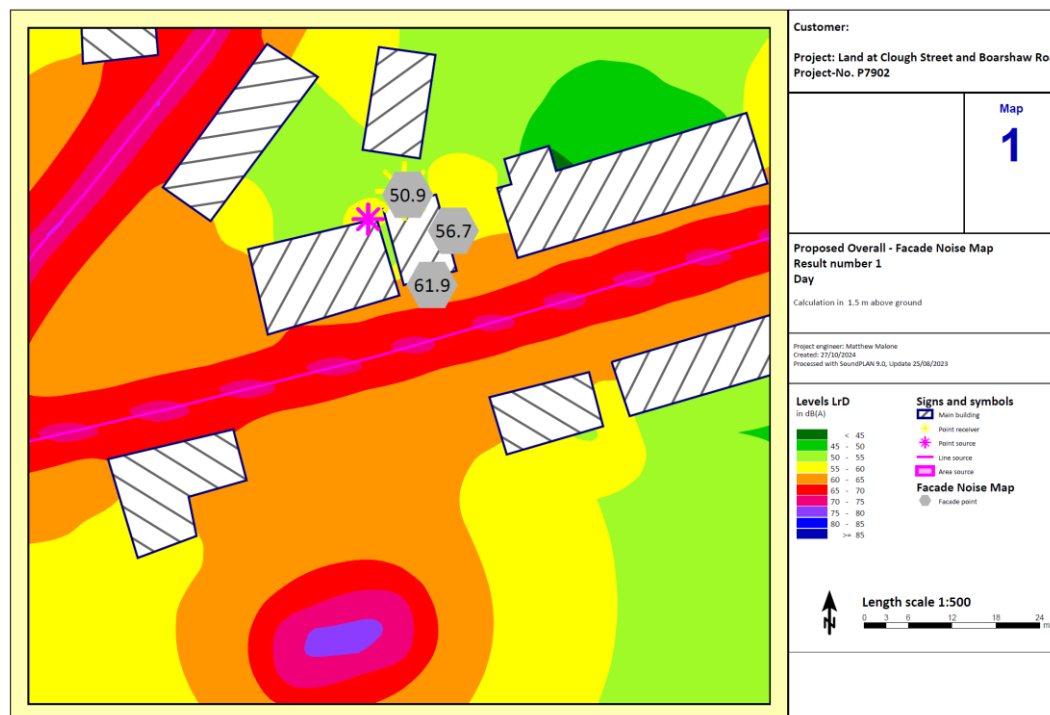


Figure 7: Noise contour plot illustration of the predicted propagation of sound to the proposed development during the daytime – $L_{Aeq,16hour}$.

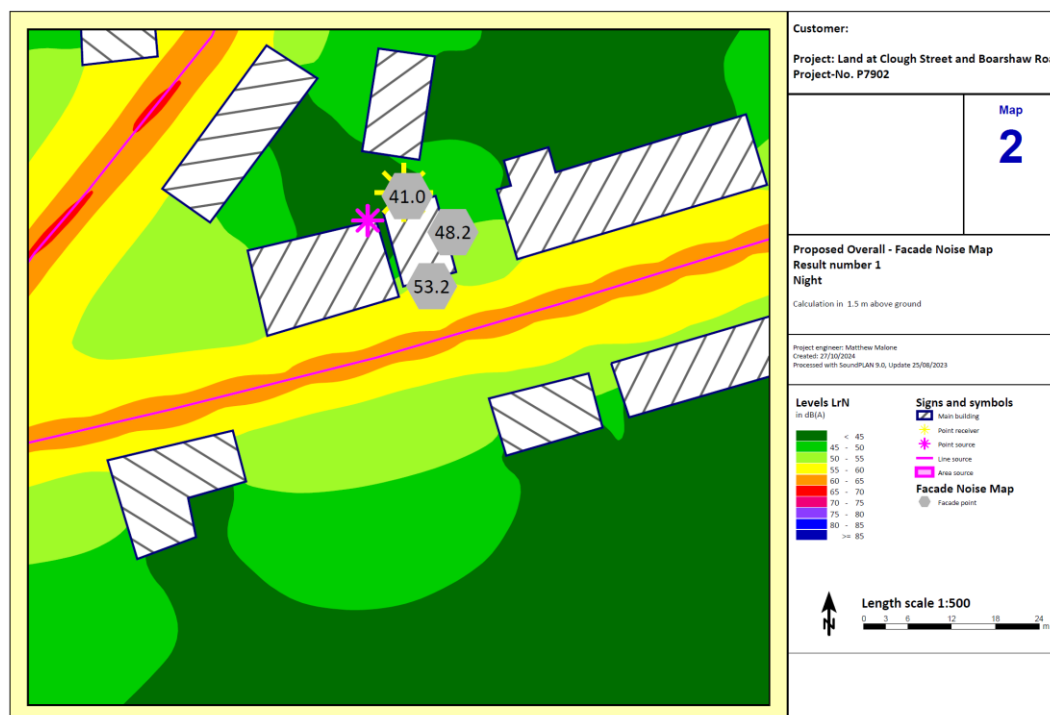


Figure 8: Noise contour plot illustration of the predicted propagation of sound to the proposed development during the night-time – $L_{Aeq,8hour}$.

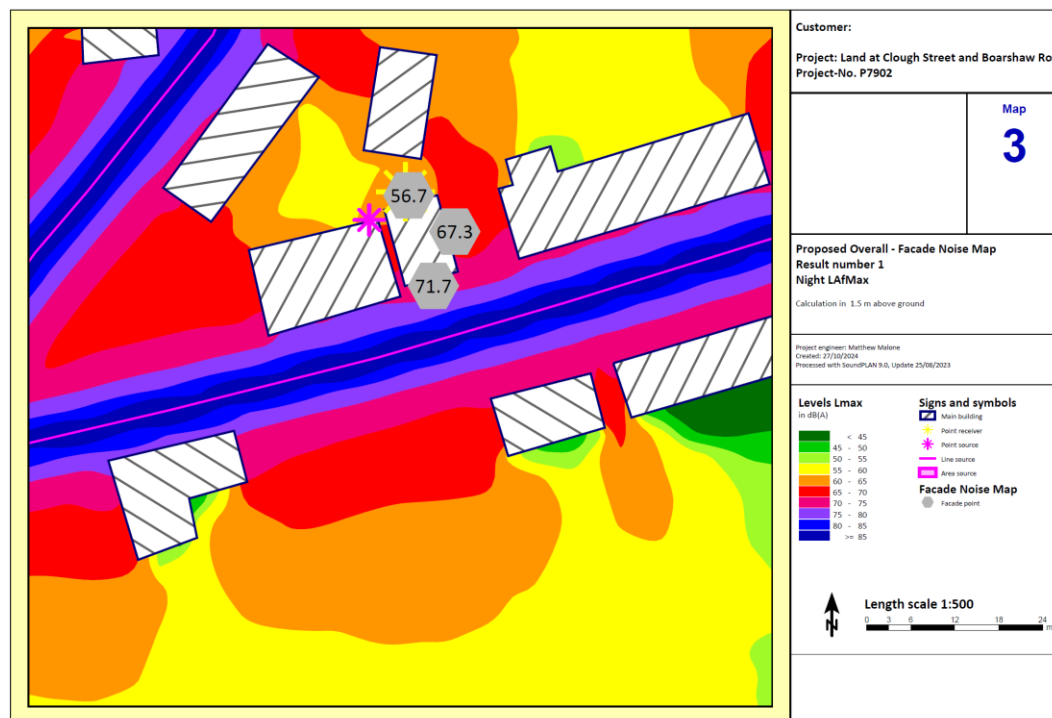


Figure 9 Noise contour plot illustration of the predicted propagation of sound to the proposed development during the night-time – L_{Amax}.

- 4.2.4 Additional noise models have also been constructed to demonstrate the significant noise propagation with respect to the neighbouring Indian takeaway kitchen extract and the hand car wash located on the opposite side of Boarshaw Lane and are presented in **Figure 10** and **Figure 11** below, respectively.

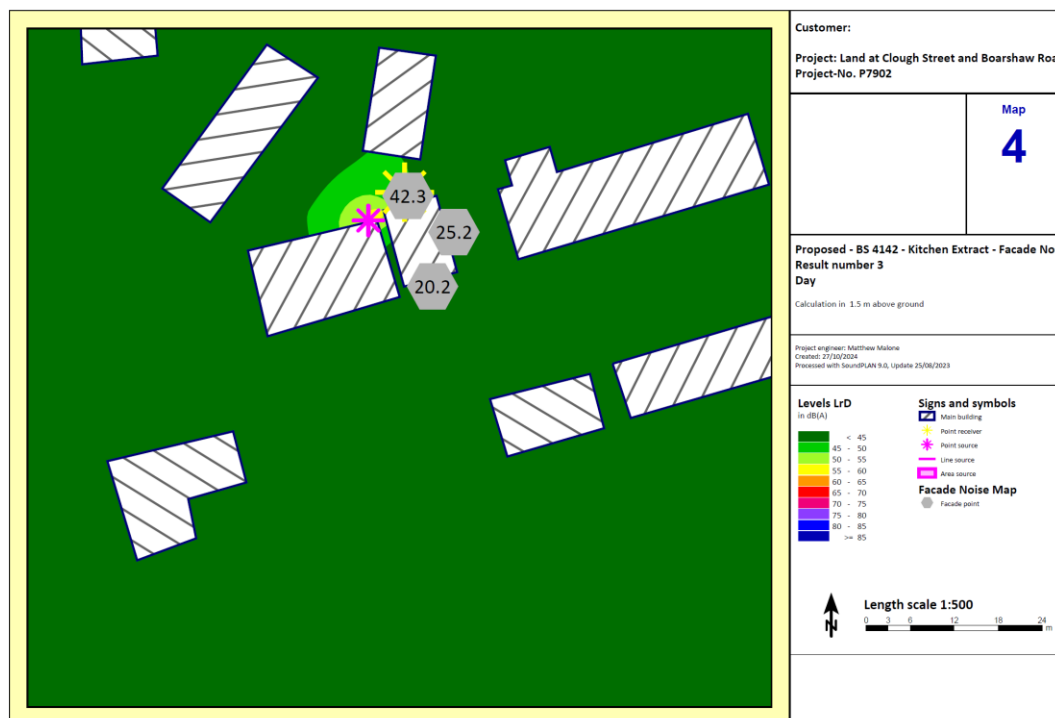


Figure 10 Noise contour plot illustration of the predicted propagation of sound to the proposed development from the Indian Takeaway Kitchen Extract – $L_{Aeq,T}$.

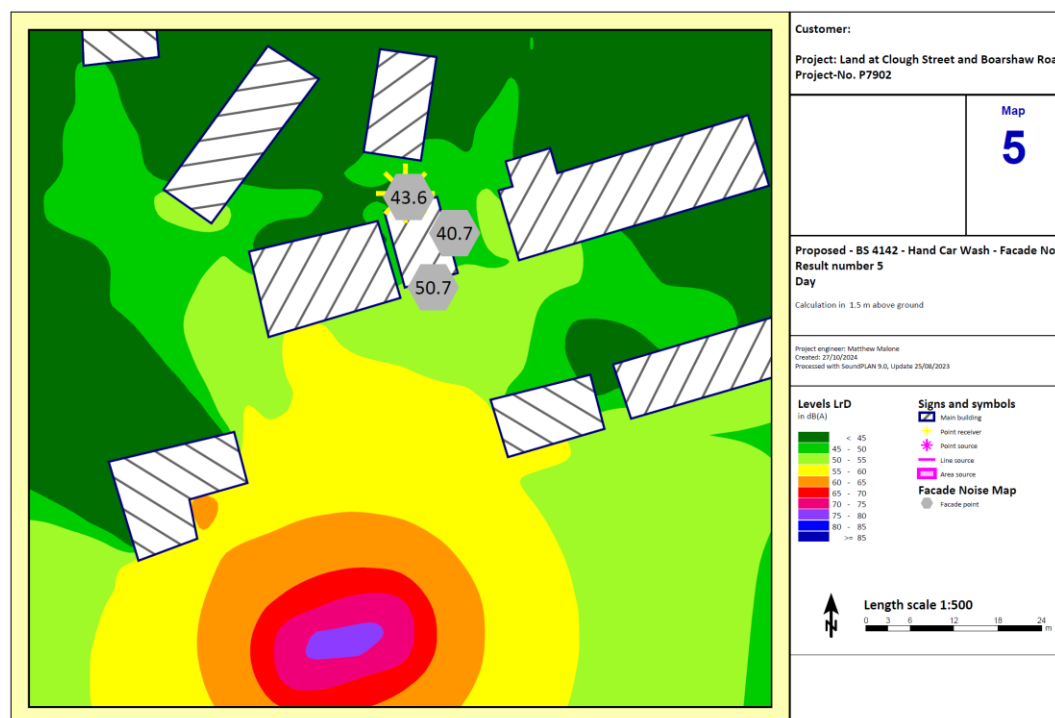


Figure 11 Noise contour plot illustration of the predicted propagation of sound to the proposed development from the Hand Car Wash – $L_{Aeq,T}$.

Table 7: Worst Case Predicted Façade Receptor Noise Levels for Each Façade Category					
Façade	dB L _{Aeq,16hours} Daytime	dB L _{Aeq,8hours} Night-Time	dB L _{Amax} , Night	BS 4142 Kitchen Extract dB L _{Aeq,T}	BS 4142 Hand Car Wash dB L _{Aeq,T}
Front (S)	62	53	72	20	51
Side (E)	57	48	67	25	41
Rear (N)	51	41	57	42	44

4.2.5 Garden/ amenity space noise levels have been calculated and are summarised in **Table 8**.

Table 8: Worst Case Predicted Garden/ Amenity Space Noise			
Façade	dB L _{Aeq,16hours} Daytime	BS 4142 Kitchen Extract dB L _{Aeq,T}	BS 4142 Hand Car Wash dB L _{Aeq,T}
Gardens – Rear	52	42	51

5 NOISE IMPACT ASSESSMENT

5.1 Pro-PG Stage 1 - Site Noise Risk Assessment

5.1.1 In accordance with Pro-PG 2017, a Site Noise Risk Assessment (SNRA) has been carried out. The SNRA assesses the initial risk of noise to have an adverse impact on a proposed development based on the overall measured/ calculated levels.

5.1.2 The results of the 3D noise model during the daytime and night-time periods are presented in **Table 9**, and have been compared to the information provided on Figure 1 of Pro-PG 2017.

Table 9: Stage 1 Risk Assessment of Noise Levels				
Façade Category	Daytime Noise Level (Figures in dB L _{Aeq})	Risk of Adverse Effect	Night-time Noise Level (Figures in dB L _{Aeq})	Risk of Adverse Effect
Front (S)	62	Low/ Medium	53	Low/ Medium
Side (E)	57	Low	48	Low
Rear (N)	51	Negligible/ Low	41	Negligible/ Low

5.1.3 ProPG:2017 states that:

“As noise levels increase, the site is likely to be less suitable from a noise perspective and any subsequent application may be refused unless a good acoustic design process is followed and is demonstrated in an ADS which confirms how the adverse impacts of noise will be mitigated and minimised, and which clearly demonstrate that a significant adverse noise impact will be avoided in the finished development.”

“At low noise levels, the site is likely to be acceptable from a noise perspective provided that a good acoustic design process is followed and is demonstrated in an ADS which confirms how the adverse impacts of noise will be mitigated and minimised in the finished development..”

5.1.4 The Site Noise Risk Assessment shows that local noise mitigation and good acoustic design will be required to ensure that the potential risk of the noise impact is minimised and guideline internal and external noise levels are achieved.

5.1.5 In accordance with Pro-PG:2017, a Stage 2 full noise assessment, which includes an acoustic design statement, is required to ensure future residents are protected and good acoustic design has been implemented.

5.2 Pro-PG Stage 2 Assessment

- 5.2.1 The results of the Pro-PG:2017 Stage 1: Initial Site Noise Risk Assessment shows that receptors at the proposed development for daytime and night-time are likely to be at a **‘Negligible/ Low’** to **‘Low/ Medium’** risk of experiencing an adverse noise impact, with no mitigation in place. However, an assessment against the criteria in WHO and BS 8233:2014 has been conducted with reference to the general sound levels at the site such that mitigation at the NSRs can be recommended.
- 5.2.2 This section forms the Stage 2 Acoustic Design Statement of Pro-PG:2017.

5.3 Assessment of Daytime Noise Levels in Outdoor Living Areas

- 5.3.1 At the time of writing, documentation provided shows outdoor amenity areas could be located to the rear of the development site, therefore, an assessment for this area has been conducted.
- 5.3.2 The analysis of the calculated levels indicates that the garden noise level is likely to be above the WHO guideline noise level of 50 dB(A) for people being moderately annoyed, but below the WHO guideline noise level of 55 dB(A) for people being seriously annoyed.
- 5.3.3 The aforementioned noise level does not include any allowance for a typical garden perimeter fence. It is considered that if a garden perimeter fence was to be installed and upgraded to an acoustic barrier the noise levels incident within the garden would be further reduced to the 50 dB(A) level for people being moderately annoyed. Given the suburban location such a noise level is considered appropriate for use.
- 5.3.4 We therefore recommend that a garden perimeter fence is adopted into the design and enhanced such that it performs as an acoustic barrier. The perimeter fence therefore should be constructed/ selected such that it has a surface density of not less than 10 kg/ m² and is imperforate.

5.4 Assessment of Daytime Noise Levels in Living Rooms and Bedrooms

- 5.4.1 The predicted noise levels at the façades of the proposed building structure, as detailed in and **Table 7** for the daytime and night-time period, together with the level of attenuation required in accordance with BS 8233: 2014, are presented in **Table 10**.

Table 10: 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 (S)	Daytime $L_{Aeq,16hours}$	62	35	27
	Night-Time $L_{Aeq,8hours}$	53	30	23
	Night-Time L_{Amax}	72	45	27
Side (E)	Daytime $L_{Aeq,16hours}$	57	35	22
	Night-Time $L_{Aeq,8hours}$	48	30	18
	Night-Time L_{Amax}	67	45	22
Rear (N)	Daytime $L_{Aeq,16hours}$	51	35	16
	Night-Time $L_{Aeq,8hours}$	41	30	11
	Night-Time L_{Amax}	57	45	12

5.5 BS 4142:2014 Assessment – Indian Takeaway Kitchen Extract

- 5.5.1 Based on the calculated sound levels presented the 3D sound model, a BS 4142:2014 assessment has been undertaken with respect to the noise breakout from the existing Indian takeaway kitchen extract neighbouring the development site. The Indian takeaway kitchen extract operates during the daytime up until 23:00 hours.

Background Sound Level

- 5.5.2 The measured background sound levels are presented within Section 3.3 of this report.
- 5.5.3 A daytime background L_{A90} sound level of 38 dB(A) has been adopted for this assessment.

Character Corrections

- 5.5.4 Based on the site observations during the acoustic survey, the following character corrections have been applied:
- **Tonality** – The kitchen extract was noted to generate modest tones however given the local noise climate specific tonal characteristics were assessed as being ‘just’ perceptible at the receptor location. Therefore, +2 dB has been applied for tonality.
 - **Impulsivity** – The noise breakout from the kitchen extract was not considered to be impulsive in nature and therefore no character correction has been applied; and,

- **Intermittency** – The kitchen extract was not observed to be intermittent in nature.

Initial Assessment

- 5.5.5 The BS 4142:2014 initial assessment based on the calculated noise breakout levels for the Indian takeaway kitchen extract is presented in **Table 11** with respect to the proposed development.

Table 11: BS 4142:2014 Assessment to Determine the Likelihood of Adverse Impacts on at the Proposed Development – Indian Takeaway Kitchen Extract.	
Quantity	Sound level dB(A)
	Daytime
Typical Background Sound Level, dB L _{A90}	38
Specific sound level calculated by SoundPlan™	42
Acoustic feature correction for tonality.	+2
Rating Level	44
Excess of Rating Level over Background Sound Level	+6

BS 4142:2014 Assessment and Context

- 5.5.6 The calculated excess of the rating level over the background marginally exceeds the BS 4142 threshold indicating an Adverse Impact. Considering the context the kitchen extract noise emissions are considered to be at a low absolute level and only marginally exceeding the background sound level, which is likely to lessen the impact.
- 5.5.7 The BS 4142 rating level is calculated to the external façade of the proposed development and therefore, typically when the kitchen extract is operating 10-15 dB(A) additional attenuation is likely to be afforded by an open window which would likely reduce the internal noise levels comfortably within typical BS 8233 guidelines. When a resident closes their windows it is likely that the specific sound source will become inaudible.
- 5.5.8 Considering all elements of the assessment, it is likely that the kitchen extract will present as a **low impact** within habitable rooms of the proposed development. Within the proposed garden to the rear it is considered that the kitchen extract is also likely to present as a **low impact** given that the background sound level is likely to be a greater during the typical hours of use of a garden.

5.6 BS 4142:2014 Assessment – Hand Car Wash

5.6.1 Based on the calculated sound levels presented the 3D sound model, a BS 4142:2014 assessment has been undertaken with respect to the noise breakout from the existing hand car wash opposite the development site. The hand car wash operates during the daytime between until 09:00 to 18:00 hours.

Background Sound Level

5.6.2 The measured background sound levels are presented within Section 3.3 of this report.

5.6.3 A daytime background L_{A90} sound level of 45 dB(A) has been adopted for this assessment.

Character Corrections

5.6.4 Based on the site observations during the acoustic survey, the following character corrections have been applied:

- **Tonality** – The hand car wash has the potential to generate some tonal emissions however at the development site these were not considered dominant. Therefore no character correction has been applied for tonality.
- **Impulsivity** – The noise breakout from the hand car wash was not considered to be impulsive in nature and therefore no character correction has been applied; and,
- **Intermittency** – The hand car wash was intermittent in nature and therefore a +3 dB character correction has been applied to the assessment.

Initial Assessment

5.6.5 The BS 4142:2014 initial assessment based on the calculated noise breakout levels for the hand car wash is presented in **Table 11** with respect to the proposed development.

Table 12: BS 4142:2014 Assessment to Determine the Likelihood of Adverse Impacts on at the Proposed Development – Hand Car Wash.	
Quantity	Sound level dB(A)
	Daytime
Typical Background Sound Level, dB L_{A90}	45
Specific sound level calculated by SoundPlan™	51
Acoustic feature correction for tonality.	+3
Rating Level	54
Excess of Rating Level over Background Sound Level	+9

BS 4142:2014 Assessment and Context

- 5.6.6 The calculated excess of the rating level over the background exceeds the BS 4142 threshold indicating an Adverse Impact but is below the threshold which indicates a Significant Adverse Impact. Considering the context the hand car wash noise emissions are considered to be at a medium/ low absolute level. On site observations during the attended monitoring indicted long periods (over one hour) where noise emissions were not identifiable at the development site and therefore the perceived impact could be lessened.
- 5.6.7 The BS 4142 rating level is calculated to the front external façade of the proposed development and therefore, typically when the hand car wash is operating 10-15 dB(A) additional attenuation is likely to be afforded by an open window which would likely reduce the internal noise levels to within typical BS 8233 guidelines. When a resident closes their windows it is likely that the specific sound source will become inaudible.
- 5.6.8 Considering all elements of the assessment, it is likely that the kitchen extract will present as a **low impact** within habitable rooms of the proposed development.

Uncertainty

- 5.6.9 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.
- 5.6.10 The SLMs used were Norsonic Class 1 SLMs, it is generally recognised that Class 1 SLMs offer an uncertainty of ± 1.0 dB. The instrumentation used for the survey has been calibrated by UKAS approved laboratories.
- 5.6.11 The sound levels measured (which include busier and quieter periods) are considered typical for a suburban area.
- 5.6.12 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.
- 5.6.13 The specific noise level and therefore rated noise levels have been calculated using a 3D sound model, however, a conservative assessment of breakout noise levels has been undertaken.
- 5.6.14 It is therefore considered that, in this instance, the uncertainty of the calculations is likely to have minimal influence on the outcome of the assessment.

6 SOUND INSULATION SCHEME

6.1 Building Envelope Requirements – Windows Closed

- 6.1.1 Proposals for the development site at the time of writing outline residential use to the first floor.
- 6.1.2 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.
- 6.1.3 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 i.e., trickle ventilation.
- 6.1.4 Based on the design details forwarded, worst case façade attenuation calculations have been undertaken in accordance with BS EN ISO 12354-3:2017.
- 6.1.5 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 13**.

Table 13: Building Envelope Requirements			
Façade	Room Type	Estimated Building Façade Requirements ¹	
		With Passive Vents	Without Passive Vents
Front & Sides	Bedroom	Window – 38 dB R_w+C_{tr} ²	Window – 34 dB R_w+C_{tr} ²
		Passive Vent – 40 dB $D_{n,e,w}+C_{tr}$ ³	
	Living / Dining Room	Window – 38 dB R_w+C_{tr} ²	Window – 34 dB R_w+C_{tr} ²
		Passive Vent – 40 dB $D_{n,e,w}+C_{tr}$ ³	
Rear	Bedroom	Window – 32 dB R_w+C_{tr} ²	Window – 32 dB R_w+C_{tr} ²
		Passive Vent – 34 dB $D_{n,e,w}+C_{tr}$ ³	
	Living / Dining Room	Window – 32 dB R_w+C_{tr} ²	Window – 32 dB R_w+C_{tr} ²
		Passive Vent – 34 dB $D_{n,e,w}+C_{tr}$ ³	
¹ Wall construction assumed to be not less than 55 dB R_w+C_{tr} , roof construction assumed to be not less than 47 dB R_w+C_{tr} . Calculations have been conducted in accordance with BS EN ISO 12354-3:2017 methodology. Typical room is assumed as worst case corner room with three exposed facades (two sides and roof). ² Window area assumed to be not more than 2.5 m ² per room. ³ Up to 1 no. passive vent per room.			

- 6.1.6 **Table 14** below outlines typical examples for the building elements considered in **Table 13**. It should be noted that the typical examples presented in **Table 14** are for information only and specialist manufacturer design/ advice should be sought. Alternative options to those outlined in **Table 14** can be considered however the performance criteria should be confirmed.

Table 14: Summary Examples of Building Envelope Performance Elements.		
Walls	55 R_w+C_{tr}	Typical Example: Concrete / Brick exterior wall with min. 100 mm insulated (60 kg / m ³ rockwool) cavity constructed with timber studwork and resilient bars with min. 10 mm plasterboard lining (2 layers).
Glazing	32 R_w+C_{tr}	Typical Example: Double glazed laminated unit with pane of 10 mm – 6-16 mm air filled cavity – pane of 6 mm.
	34 R_w+C_{tr}	Typical Example: Double glazed unit with laminated pane of 8 mm – 16 mm argon filled cavity – pane of 8.8 mm Pilkington Optiphon.
	38 R_w+C_{tr}	Typical Example: Double glazed unit with laminated pane of 10 mm – 16 mm argon filled cavity – pane of 8.8 mm Pilkington Optiphon.
Window Trickle Vent	32 $D_{n,e,w}+C_{tr}$	Typical Example – Titon Trickle Vent TA5220 (SF Xtra Vent) + TA5005 (SF 418) 2500EA.
	40 $D_{n,e,w}+C_{tr}$	Typical Example – Titon Trickle TA5225 (V75) + TA5204 (C50) 2500EA.
Wall Passive Vent	52 $D_{n,e,w}+C_{tr}$	Typical Example – Greenwood MA3051 Air Vent.

- 6.1.7 The glazing element typical examples outlined in **Table 14** are based on the performance of the glazing panes only, advice should be sought from the manufacturer at detailed design stage to ensure that the window framing does not undermine the overall performance requirement recommended in **Table 13**.
- 6.1.8 Building envelope performance elements outlined in **Table 13** and **Table 14** are based on the information provided at the time of writing and assumptions based on typical

requirements for such projects. The building envelope final design should be confirmed through detailed design at the appropriate stage including the consultation of specialist manufacturers to confirm individual building element performance.

6.2 Building Envelope Performance – Windows Open

- 6.2.1 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 6.1.
- 6.2.2 However, with windows open, the attenuation provided by the façade will be approximately 10-15 dB(A). This would potentially allow the recommended internal noise limit to be exceeded some rooms at the development.
- 6.2.3 Facades where rooms are likely to achieve acceptable internal noise levels with windows partially open are presented in **Table 15**.

Table 15: Summary of Facades where rooms are likely to achieve acceptable internal noise levels with windows partially open providing min 15 dB attenuation.				
Façade	Room Type	Day / Night	Yes / No	Excess (dB)
Front (S)	Living Room / Bedroom	Day	No	+12
	Bedroom	Night	No	+12
Side (E)	Living Room / Bedroom	Day	No	+7
	Bedroom	Night	No	+7
Rear (N)	Living Room / Bedroom	Day	Yes	+1
	Bedroom	Night	No	-

- 6.2.4 **Table 15** also shows the level of likely exceedance of internal noise levels allowing for up to 15 dB(A) attenuation across a partially open window. It is considered that in many circumstances, such as urban / sub-urban developments, an exceedance of up to 5 dB(A) in accordance with BS8233:2014 is likely to be acceptable to future residents and therefore is unlikely to breach the LOEL criteria discussed in Section 2 of this report.
- 6.2.5 Where exceedances are likely to be greater than +5 dB, on occasions this may be acceptable to a resident, but when quiet conditions are required, the resident should be able to close the windows whilst maintaining adequate ventilation. Some form of acoustic ventilation would therefore need to be installed in the apartments located at the site, ventilation is to be designed by others.

6.3 Acoustic Ventilation Requirements

- 6.3.1 It is recommended that the acoustic ventilation proposed at the site should, as a minimum, comply with Building Regulations 2022 Approved Document F1 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.
- 6.3.2 Where a passive ventilation system is incorporated into the design, ventilators should be acoustically treated for habitable rooms to all facades. Ventilation openings to these rooms should match or exceed the minimum values set out in **Table 13** and **Table 14**.
- 6.3.3 The implementation of the recommended glazing together with appropriate acoustic ventilation would ensure that the required internal daytime and night-time noise limits are achieved.
- 6.3.4 It should be further noted that the glazing and ventilation 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.
- 6.3.5 As detailed in Section 6.2, it is likely that noise levels in noise sensitive rooms within some of the proposed dwellings will likely rely on the windows being in the closed position and therefore appropriate ventilation design should be completed. It is likely that a passive ventilation system can be adopted at the development site. Basic acoustic requirements for any passive ventilation which may be installed are outlined in Section 6.1 however it should be noted that ventilation requirements for future occupants of the proposed development are outside the scope of this report.
- 6.3.6 Where a mechanical ventilation system is installed within habitable rooms at the development site, the cumulative ambient noise breakout within any room should not exceed NR20.

6.4 Internal Noise Transmission between the Ground Floor Commercial and First Floor Residential Dwelling(s)

- 6.4.1 Proposals for the development site outline the inclusion of a commercial premises to the ground floor. Given the proposed residential use to the upper floor it is considered that appropriate sound insulation should be included within the building structure to minimise any potential future noise transmission related issues.

6.4.2 At the time of writing the precise use of the proposed ground floor is not known, it is considered that under planning use class E the most likely use would be a fast food restaurant or similar which could have background music. Typical sound levels in such a premises can typically be around 75 dB(A).

6.4.3 We would therefore recommend that the separating floor of the proposed building structure be designed to achieve a sound transmission performance of not less than $D_{nT,w} + C_{tr}$ 50 dB.

6.5 Plant Noise Limits

6.5.1 Given the uncertainty as to the detail of the end use of the proposed ground floor commercial premises it is considered that additional mechanical plant or extract may be installed in the future, for example, as part of a new kitchen system installed as part of a new takeaway restaurant.

6.5.2 It is therefore considered that plant noise limits are set as a planning condition to ensure that any future new mechanical plant is designed such that noise emissions are within acceptable levels.

This report presents a series of background sound levels in Section 3.3. We recommend that any future mechanical plant (or similar) installed at the development site should be assessed in accordance with BS 4142:2014+A1:2019 to ensure that the rated noise level does not exceed the measured background sound level of 35 dB L_{A90} during the night-time and 38 dB L_{A90} during the daytime.

7 CONCLUSIONS

- 7.1.1 NoiseAir has carried out a noise impact assessment with respect to the proposed mixed use development to be located at Land At Corner Of Clough Street And Boarshaw Road, Middleton M24 2WH. Proposals for the development site outline the construction of a two storey building with commercial unit(s) to the ground floor and residential units to the first floor.
- 7.1.2 The development site is affected by three main noise sources; local traffic, a kitchen extract flue and a hand car wash premises. Assessment of noise has been undertaken through attended monitoring over three monitoring episodes, the data from which has been used to calibrate a 3D sound model.
- 7.1.3 The results of the noise survey and initial site noise risk assessment outline the following in accordance with Pro-PG:2017:
- Proposed receptors of the development are at a '**Low/ Medium**' risk of adverse effect at the front façade of the proposed building structure;
 - Proposed receptors of the development are at a '**Low**' risk of adverse effect at the side (E) façade of the proposed building structure; and,
 - Proposed receptors of the development are at a '**Negligible/ Low**' risk of adverse effect at the rear façade of the proposed building structure.
- 7.1.4 A BS 4142:2014 assessment has been undertaken with respect to noise breakout from the neighbouring Indian takeaway kitchen extract and hand car wash on the opposite side of Boarshaw Road. For both noise sources the noise emissions are considered to present a **low impact**, when considering the local context.
- 7.1.5 Building performance requirements with windows closed are based around two design categories as presented in **Table 13** of this report.
- 7.1.6 The rear facade to the proposed building structure is likely to have acceptable internal noise levels with windows in the partially open position, however the remaining habitable rooms are likely to rely on windows in the closed position.
- 7.1.7 On occasions, this may be acceptable to a resident, but when quiet conditions are required, the resident should be able to close the windows whilst maintaining adequate ventilation. Some form of acoustic ventilation would therefore need to be installed in the dwellings, likely in the form of a passive ventilation system.

APPENDIX A - REPORT LIMITATIONS

This Report is presented to Mr Nick Lowe And Richard Hesmondhalgh 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 Mr Nick Lowe And Richard Hesmondhalgh 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.

This report has been prepared by NoiseAir Limited. No individual is personally liable in connection with the preparation of this report. By receiving this report and acting on it, the client or any other person accepts that no individual is personally liable whether in contract, tort, for breach of statutory duty or otherwise.

The conclusions and recommendations contained in this report are based upon information provided by others and upon the assumption that all relevant information has been provided by those parties from who it has been requested and that such information is accurate. Information obtained by NoiseAir Limited has not been independently verified by NoiseAir Limited unless otherwise stated in the report and should be treated accordingly.

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.

DISCLAIMER- This report was prepared by NoiseAir Limited. The material in it contains NoiseAir Limited best judgment in light of the information available at the time of preparation of this report. Any use which a third party makes of this report, or any reliance on, or decisions based on it are the responsibility of such third parties. NoiseAir Limited accept no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions taken based on this report.

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, $L_a = L_{Aeq,T}$ (BS4142:2014)	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, $L_{A90,T}$ (BS4142:2014)	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, $L_{Aeq,T}$ (BS4142:2014)	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 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.</i>

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 (BS4142:2014)	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 (BS4142:2014)	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 (BS4142:2014)	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, $L_r = L_{Aeq,T}$ (BS4142:2014)	Equivalent continuous A-weighted sound pressure level of the residual sound at the assessment location over a given time interval, T .
Rating level, L_{A,r,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, that 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, $L_s = L_{Aeq,T_r}$ (BS4142:2014)	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 (BS4142:2014)	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.
Groundborne 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)
$L_{Ar,Tt}$	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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