
Proposed Residential Development Entwisle Road, Rochdale

Noise Assessment Report



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Signature	

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Contents

Section	Page
1. Introduction	4
2. Assessment Guidance & Criteria	5
National Planning Policy Framework	5
Noise Policy Statement for England	5
Professional Practice Guidance on Planning & Noise (2017)	6
British Standard 8233:2014: Guidance on sound insulation and noise reduction for buildings	9
World Health Organisation: Guidelines for community noise (1999)	10
3. Environmental Noise Survey	11
Survey methodology	11
Survey equipment	11
Weather conditions	12
Subjective observations of the acoustic environment	12
Measured indices	12
Results summary	13
4. Assessment & Discussion	14
Initial site noise risk assessment	14
Building envelope construction and acoustic performance	14
Noise ingress with windows closed	15
Noise ingress with windows open	17
Ambient sound level in outdoor living areas	19
5. Ventilation & Noise Mitigation	20
Acoustically rated ventilator units	20
Mechanically assisted ventilation	20
Building Regulations 2010: Approved Document F (Ventilation)	21
6. Conclusion	22

List of Tables, Figures & Appendices

Table 2.1 - ProPG internal noise level guidelines	8
Table 2.2 - Indoor ambient noise levels for dwellings	9
Table 3.1 - Summary of continuously measured sound pressure levels	13
Table 4.1 - Noise ingress calculation results (open-plan living/dining room)	15
Table 4.2 - Noise ingress calculation results (bedroom 1)	16
Table 4.3 - Noise ingress calculation results (master bedroom)	16
Figure 2.1 - Initial site noise risk assessment	7
Figure 3.1 - Site location and survey measurement position	11
Figure 3.2 - Graph showing results of continuous sound level monitoring	13
Appendix A - Site plan, floor plans and elevations	23
Appendix B - Equipment calibration certificates	30
Appendix C - Assessment terminology	34

1. Introduction

- 1.1 RS Acoustic Engineering Ltd has been appointed by Step Places to undertake a noise assessment with regard to a proposed residential development on vacant land adjacent to Entwisle Road, Rochdale, OL16.
- 1.2 The current proposals are to construct four three-storey dwellings with associated car parking and outdoor living space. Site access will be via Entwisle Road.
- 1.3 There are neighbouring terraced dwellings to the east and also dwellings to the north east off Ramsey Place and Ramsey Terrace.
- 1.4 The most notable and consistent source of noise at the site is road traffic on Entwisle Road to the south. Road traffic on Molesworth Street (A671) to the south west also contributes to the existing background noise. Intermittent noise associated with nearby commercial premises was generally masked by traffic related noise and was considered negligible during the site visits.
- 1.5 A noise assessment has been undertaken taking into consideration the guidance contained within British Standard (BS) 8233:2014 *Guidance on sound insulation and noise reduction for buildings* and also within the Professional Practice Guidance document (ProPG) *Planning and Noise*.
- 1.6 The guidance given within Approved Document F (Ventilation) and Approved Document O (Overheating) has also been taken into consideration.
- 1.7 This assessment is based on the results of an environmental noise survey undertaken at the site in September 2023. A noise survey was previously conducted at the site in May 2019, however it was considered prudent to undertake up-to-date measurements for the proposed scheme.
- 1.8 The measured sound level data has been used to determine the acoustic performance requirements for the building envelope construction and to determine whether it will be suitable to naturally ventilate habitable rooms via opening windows alone.
- 1.9 An assessment of noise intrusion through the building envelope with windows open and closed has been undertaken and the resulting sound levels determined.
- 1.10 An assessment of ambient noise within outdoor living areas also been undertaken to determine whether additional noise mitigation measures are required for the development.
- 1.11 The survey and assessment was conducted by Mr Ryan Swales (BSc(Hons), MIOA), Principal Acoustic Consultant and Member of the Institute of Acoustics.
- 1.12 The results of the noise survey have been presented, along with the assessment criteria and a discussion of the results with respect to the appropriate guidance and targets.
- 1.13 Recommendations regarding sound insulation, ventilation and noise mitigation are also provided within the report.

2. Assessment Guidance & Criteria

National Planning Policy Framework

- 2.1 The latest Planning Policies are included in the National Planning Policy Framework (NPPF) published by the Department for Communities and Local Government (first published March 2012) and updated in July 2021.
- 2.2 The planning policies which relate specifically to noise were updated in July 2021 and are presented in paragraphs 174, 185 and 187 of the document:

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

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

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

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

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

187. Planning policies and decisions should ensure that new development can be integrated effectively with existing businesses and community facilities (such as places of worship, pubs, music venues and sports clubs). Existing businesses and facilities should not have unreasonable restrictions placed on them as a result of development permitted after they were established. Where the operation of an existing business or community facility could have a significant adverse effect on new development (including changes of use) in its vicinity, the applicant (or ‘agent of change’) should be required to provide suitable mitigation before the development has been completed.

Noise Policy Statement for England

- 2.3 The terms ‘significant adverse’ and ‘adverse’ in the NPPF above, are references to the Noise Policy Statement for England (NPSE), published by DEFRA in March 2010.
- 2.4 The first aim of the NPSE is to *Avoid significant adverse impacts on health and quality of life from environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development.*
- 2.5 The second aim is to *Mitigate and minimise adverse impacts on health and quality of life from environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development.*
- 2.6 The third aim is to *Where possible, contribute to the improvement of health and quality of life through the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development.*

- 2.7 Further to the above, the Governments Planning Practice Guidance document updated in July 2019 states:

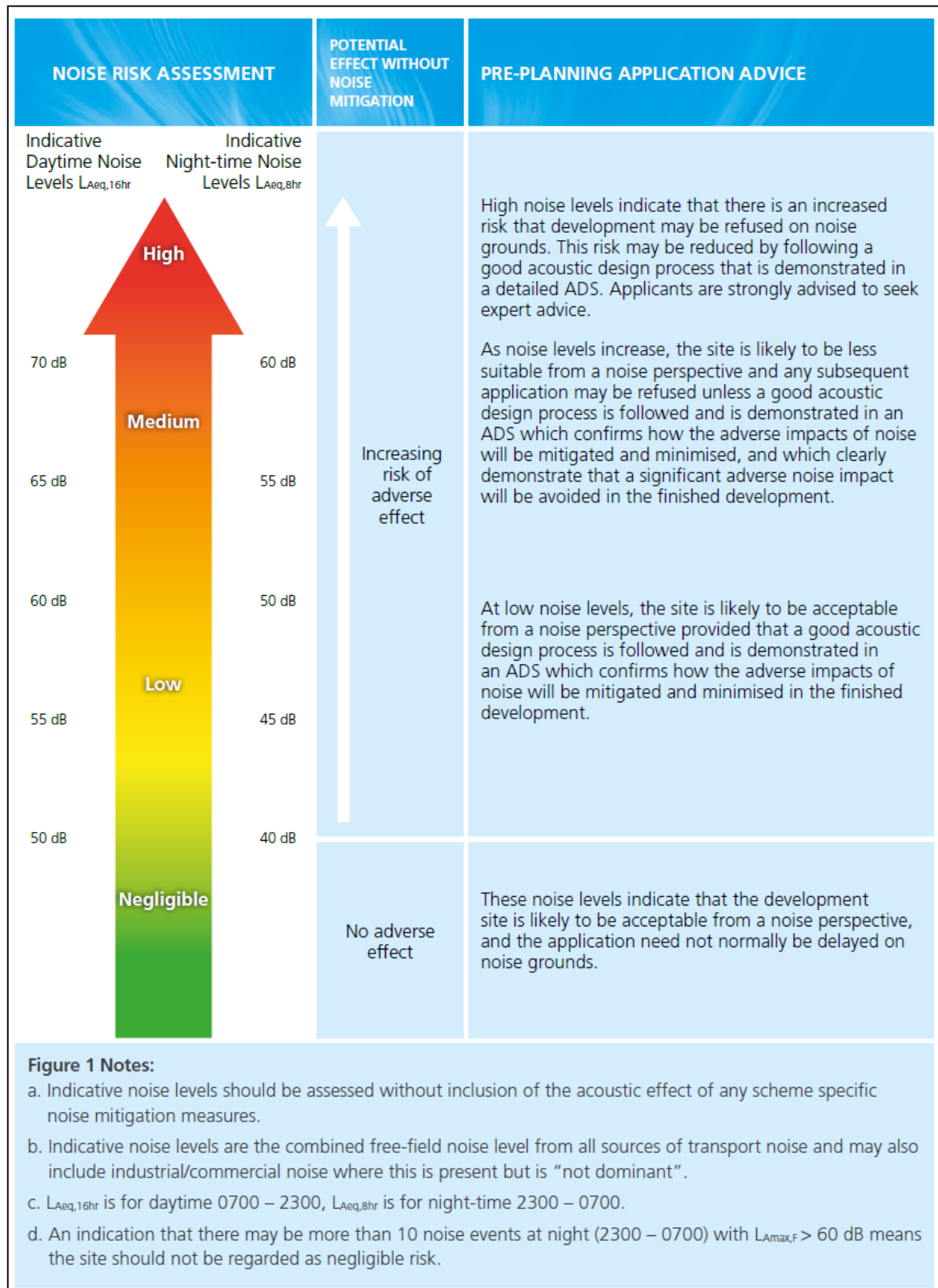
Noise needs to be considered when development may create additional noise, or would be sensitive to the prevailing acoustic environment (including any anticipated changes to that environment from activities that are permitted but not yet commenced). When preparing plans, or taking decisions about new development, there may also be opportunities to make improvements to the acoustic environment. Good acoustic design needs to be considered early in the planning process to ensure that the most appropriate and cost-effective solutions are identified from the outset.

- 2.8 In addition, the guidance indicates that, whilst noise can override other planning concerns, it is important to look at noise in the context of the wider characteristics of a development proposal, its likely users and its surroundings, as these can have an important effect as to whether or not noise is likely to pose a concern.

Professional Practice Guidance on Planning & Noise (2017)

- 2.9 Professional Practice Guidance on Planning and Noise (ProPG) has been produced in order to provide practitioners with guidance on a recommended approach to the management of noise within the planning system in England.
- 2.10 The NPPF encourages improved standards of design. This guidance document encourages better acoustic design for new residential development and aims to protect people from the harmful effects of noise.
- 2.11 The scope of ProPG is restricted to the consideration of new residential development that will be exposed predominantly to airborne noise from transportation sources.
- 2.12 The document states that an initial noise risk assessment of the proposed development site should be conducted by a competent noise practitioner at the earliest opportunity, before any planning application is submitted. The noise risk assessment should provide an indication of the likely risk of adverse effects from noise were no subsequent mitigation to be included as part of the development proposal. It should indicate whether the proposed site is considered to pose a negligible, low, medium or high risk from a noise perspective.
- 2.13 The risk assessment should not include the impact of any new or additional mitigation measures that may subsequently be included in development proposals for the site and proposed as part of a subsequent planning application.
- 2.14 The risk assessment may be based on measurement or prediction (or a combination) as appropriate and should aim to describe noise levels over a typical 24-hour day, either now or in the foreseeable future.
- 2.15 It is important that the assessment of noise risk at a proposed residential development site is not the basis for the eventual recommendation to the decision maker. The recommended approach is intended to give the developer, the noise practitioner and the decision maker an early indication of the likely initial suitability of the site for new residential development from a noise perspective and the extent of the acoustic issues that would be faced.
- 2.16 Figure 2.1 overleaf summarises the initial site noise risk assessment.

Figure 2.1 - Initial site noise risk assessment



Internal noise level guidelines

- 2.17 The recommended ProPG internal noise level guidelines are presented in Table 2.1. The guidelines reflect and extend current practice contained within BS 8233:2014.

Table 2.1 - ProPG internal noise level guidelines

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 $L_{Aeq,8hour}$ 45 dB $L_{Amax,F}$

- 2.18 Where the local planning authority accepts that there is a justification that the internal target noise levels can only be practically achieved with windows closed, which may be the case in urban areas and at sites adjacent to transportation noise sources, special care must be taken to design the accommodation so that it provides good standards of acoustics, ventilation and thermal comfort without unduly compromising other aspects of the living environment.
- 2.19 In such circumstances, internal noise levels can be assessed with windows closed but with any façade openings used to provide “*whole dwelling ventilation*” in accordance with Building Regulations Approved Document F (e.g. trickle ventilators) in the open position.
- 2.20 It should also be noted that the internal noise level guidelines are generally not applicable under “*purge ventilation*” conditions as defined by Building Regulations Approved Document F, as this should only occur occasionally (e.g. to remove odour from painting and decorating or from burnt food).

External noise and amenity areas

- 2.21 The ProPG external amenity area noise assessment reflects and extends the advice contained within BS 8233:2014 and is summarised as follows:
- (i) *If external amenity spaces are an intrinsic part of the overall design, the acoustic environment of those spaces should be considered so that they can be enjoyed as intended.*
 - (ii) *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 $L_{Aeq,16hr}$.*
 - (iii) *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.*
 - (iv) *Whether or not external amenity spaces are an intrinsic part of the overall design, consideration of the need to provide access to a quiet or relatively quiet external amenity space forms part of a good acoustic design process.*
 - (v) *Where, despite following a good acoustic design process, significant adverse noise impacts remain on any private external amenity space (e.g. garden or balcony) then that impact may be partially off-set if the residents are provided, through the design of the development or the planning process, with access to:*
 - *a relatively quiet facade (containing openable windows to habitable rooms) or a relatively quiet externally ventilated space (i.e. an enclosed balcony) as part of their dwelling; and/or*

- a relatively quiet alternative or additional external amenity space for sole use by a household, (e.g. a garden, roof garden or large open balcony in a different, protected, location); and/or
- a relatively quiet, protected, nearby, external amenity space for sole use by a limited group of residents as part of the amenity of their dwellings; and/or
- a relatively quiet, protected, publically accessible, external amenity space (e.g. a public park or a local green space designated because of its tranquillity) that is nearby (e.g. within a 5 minutes walking distance). The local planning authority could link such provision to the definition and management of Quiet Areas under the Environmental Noise Regulations.

British Standard 8233:2014: Guidance on sound insulation and noise reduction for buildings

2.22 BS 8233 provides guidance regarding acoustic criteria and noise levels appropriate for various types of space that have different functions.

2.23 With regard to dwellings, appropriate internal ambient sound levels are given in Table 2.2 for bedrooms, living rooms and dining rooms. The guidelines take into consideration the effect of internal noise on sleep and also the effect of noise on resting, listening and communicating.

Table 2.2 - 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 $L_{Aeq,8hour}$

2.24 Note 7 of the standard states the following:

Where development is considered necessary or desirable, despite external noise levels above WHO guidelines, the internal target levels may be relaxed by up to 5 dB and reasonable internal conditions still achieved.

2.25 Note 5 also states:

If relying on closed windows to meet the guide values, there needs to be appropriate alternative ventilation that does not compromise the facade insulation or the resulting noise level. If applicable, any room should have adequate ventilation (e.g. trickle ventilators should be open) during assessment.

2.26 With regard to outdoor living areas (gardens), the following guidance is given:

For traditional external areas that are used for amenity space, such as gardens and patios, it is desirable that the external noise level does not exceed 50 dB $L_{Aeq,T}$, with an upper guideline value of 55 dB $L_{Aeq,T}$ which would be acceptable in noisier environments. However, it is also recognised that these guideline values are not achievable in all circumstances where development might be desirable. In higher noise areas, such as city centres or urban areas adjoining the strategic transport network, a compromise between elevated noise levels and other factors, such as the convenience of living in these locations or making efficient use of land resources to ensure development needs can be met, might be warranted. In such a situation, development should be designed to achieve the lowest practicable levels in these external amenity spaces, but should not be prohibited.

World Health Organisation: Guidelines for community noise (1999)

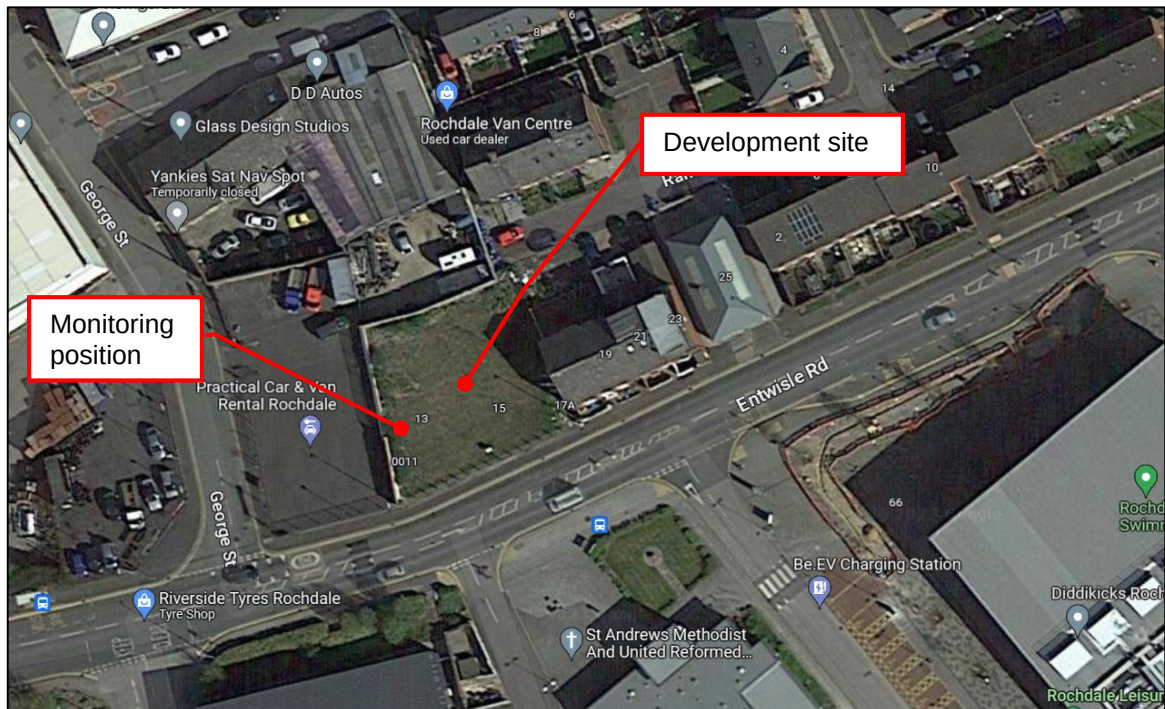
- 2.27 To help avoid sleep disturbance within bedrooms, this historical guidance document recommends that the night-time internal ambient sound level should not exceed 30 dB $L_{Aeq,T}$ and the maximum sound level should not typically exceed 45 dB $L_{AFmax,T}$.
- 2.28 The corresponding values directly outside of bedroom windows are therefore 45 dB $L_{Aeq,8hour}$ and 60 dB $L_{AFmax,T}$. This is based on the assumption that a partially open window provides approximately 15 dB of sound attenuation (from external noise).
- 2.29 With regard to sleep disturbance and maximum L_{AFmax} sound levels, the study undertaken by Vallet & Vernet (1991) suggests that for good sleep, indoor sound pressure levels should not exceed approximately 45 dB L_{Amax} more than 10-15 times per night.

3. Environmental Noise Survey

Survey methodology

- 3.1 Continuous sound level monitoring was conducted over a 38-hour period near to the western boundary line, directly adjacent to Entwisle Road. The microphone was tripod mounted at a height of approximately 1.5 metres from the ground and approximately 12 metres from the kerbside.
- 3.2 Measurements were conducted from approximately 21:30 hours on Monday 25th through to 11:30 hours on Wednesday 27th September 2023.
- 3.3 A measurement interval of 2-minutes was used during the survey and measurements were considered to be subject to sound reflections from an adjacent wall (as opposed to free field). Octave band and A-weighted broadband sound pressure levels were recorded during the survey.
- 3.4 The site location, surrounding area and survey measurement position are shown in Figure 3.1. The proposed site plan is presented in Appendix A.

Figure 3.1 - Site location and survey measurement position (source: Google Earth)



Survey equipment

- 3.5 The survey was conducted using the following Class-1 specification equipment:
 - Brüel & Kjaer 2250-Light data logging sound level meter, microphone type 4189 and pre-amplifier type ZC0032.
 - CEL-120/1 Acoustic calibrator.
- 3.6 Calibration of the sound level meter and microphone used for the measurements are traceable to UKAS accredited laboratories (calibration certificates are presented in Appendix B).
- 3.7 The calibration of both sound level meter and microphone was checked using a 1 kHz tone at 94 dB prior to and following the measurements performed. Calibration drift was less than 0.1 dB.

Weather conditions

- 3.8 The weather conditions during the survey were generally dry and fine with sunny intervals and intermittent light cloud cover. There was the occasional light breeze and wind speed measurements were between 0.8 and 2.2 m/s⁻¹.
- 3.9 There was a brief light shower on Tuesday afternoon and the air temperature during the survey ranged between 9°C and 19°C. The overall weather conditions were considered to be suitable to obtain representative measurements.

Subjective observations of the acoustic environment

- 3.10 The dominant source of noise at the site is passing road traffic on Entwisle Road (B6266).
- 3.11 Road traffic on Molesworth Street (A671) to the south west is also audible and contributes to the existing background noise at the site.
- 3.12 Intermittent noise from vehicle movements on George Street, Ramsey Street and Ramsey Place also contribute to the existing ambient noise climate, however subjectively the noise is negligible when considering the noise from road traffic on Entwisle Road.
- 3.13 There is a Practical Car & Van rental centre located immediately west of the site which shares a common boundary. During the survey, operational noise associated with the premises was insignificant and was mainly due to customers arriving, parking up and viewing vehicles.
- 3.14 To the north of the site adjacent to Ramsey Street is D.D Auto's and Custom Car Respray and Bodywork. The various roller shutters and access doors are north facing and intermittent operational noise is clearly audible when positioned on Ramsey Street. However, operational noise was inaudible when positioned on the development site.
- 3.15 There is an Aldi supermarket to the south on the opposite side of Entwisle Road. The delivery/service yard is adjacent to the southern elevation of the building and therefore screened from the development site. HGV delivery related noise was inaudible at the development site.
- 3.16 Rochdale Leisure Centre is located to the south east of the site on the opposite side of Entwisle Road. The main source of noise associated with the premises was vehicles arriving/departing.
- 3.17 St Andrews Methodist and United Reformed Church is located between Aldi and Rochdale Leisure Centre. During the site visits, activity noise associated with the church was negligible.
- 3.18 During the site visits, there was no audible building services plant noise at the site (from condenser units, extract fans, generators etc).
- 3.19 Distant tram noise was just audible during the daytime and a number of high altitude aircraft flyovers were also noted during the survey.

Measured indices

- 3.20 Although a wide range of statistical sound level data was recorded during the survey, the L_{Aeq} and L_{AFmax} indices are of most interest for this assessment:
- $L_{Aeq,T}$ - The A-weighted equivalent continuous sound pressure level over a period of time, T. Representative of the 'average' sound pressure level over a given period (commonly used to describe the 'ambient' sound level).
 - $L_{AFmax,T}$ - The A-weighted 'maximum' sound pressure level that occurred during a given period, T (commonly used for the assessment of occasional loud noises).
- 3.21 Sound pressure level measurements are taken with an A-weighting (denoted by a subscript 'A', e.g. L_{Aeq}) to approximate the frequency response of the human ear.

Results summary

- 3.22 Table 3.1 presents a summary of the continuously measured ambient sound pressure levels. Measured values have been rounded to the nearest whole number.

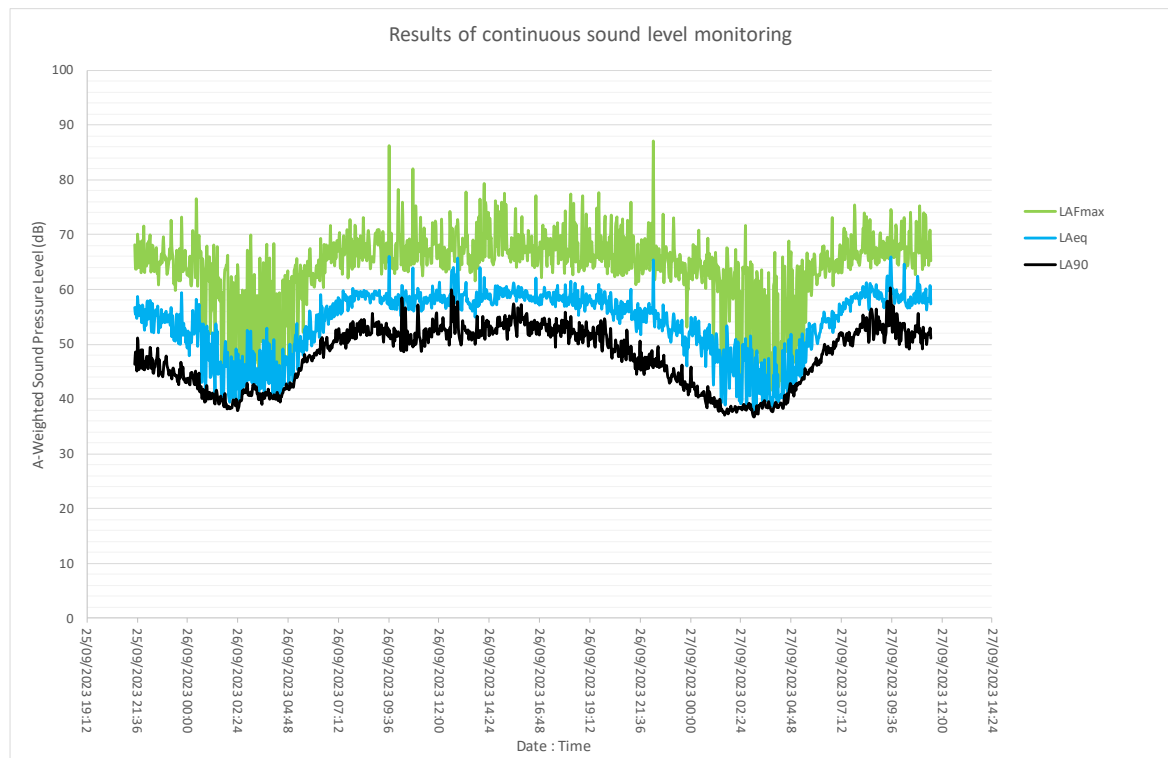
Table 3.1 - Summary of continuously measured sound pressure levels

Date	Period	Duration, T (hours)	$L_{Aeq,T}$ dB	10 th Highest ¹ $L_{AFmax,T}$ dB	15 th Highest ² $L_{AFmax,T}$ dB
Monday 25/09/2023	Daytime (21:30-23:00)	1.5	56	---	---
	Night-time (23:00-07:00)	8	51	69	68
Tuesday 26/09/2023	Daytime (07:00-23:00)	16	58	---	---
	Night-time (23:00-07:00)	8	50	68	67
Wednesday 27/09/2023	Daytime (07:00-11:30)	4.5	59	---	---

¹The 10th highest value from 240 measurement periods. ²The 15th highest value from 240 measurement periods.

- 3.23 The daytime ambient sound pressure level was 58 dB $L_{Aeq,16hour}$ and the night-time ambient sound pressure level was 50 to 51 dB $L_{Aeq,8hour}$.
- 3.24 The ambient and background sound levels are presented graphically in Figure 3.2. Additional tabulated survey data can be made available upon request.

Figure 3.2 - Graph showing results of continuous sound level monitoring



4. Assessment & Discussion

Initial site noise risk assessment

- 4.1 The initial noise risk assessment provides an indication of the likely risk of adverse effects from noise were no subsequent mitigation included as part of the development proposal.
- 4.2 The survey results indicate that the development site is Low Risk for the daytime and night-time period.

Building envelope construction and acoustic performance

- 4.3 The external wall construction is expected to consist of a brickwork outer leaf, timber frame, insulation between studs and a plasterboard inner leaf. The sound insulation performance of the wall construction is approximately 48 to 51 dB R_w+C_{tr} .
- 4.4 The flat roof construction is expected to consist of a single ply membrane, timber deck, timber joists, insulation and plasterboard ceiling. The sound insulation performance of the wall construction is approximately 41 to 44 dB R_w+C_{tr} .
- 4.5 Standard double glazing typically provides a sound insulation performance in the region of 25 to 30 dB R_w+C_{tr} .
 - 6 mm glass / 16 mm - 20 mm cavity / 4 mm glass (28 - 30 dB R_w+C_{tr})
 - 6 mm glass / 16 mm - 20 mm cavity / 6 mm glass (27 - 29 dB R_w+C_{tr})
 - 4 mm glass / 16 mm - 20 mm cavity / 4 mm glass (25 - 27 dB R_w+C_{tr})
- 4.6 Laminated (acoustic) double glazing as is commonly used within dwellings provides a sound insulation performance in the region of 31 to 37 dB R_w+C_{tr} .
 - 6 mm glass / 16 mm - 20 mm cavity / 10.8 mm acoustic laminate (35 - 37 dB R_w+C_{tr})
 - 6 mm glass / 16 mm - 20 mm cavity / 8.8 mm acoustic laminate (33 - 35 dB R_w+C_{tr})
 - 6 mm glass / 16 mm - 20 mm cavity / 6.8 mm acoustic laminate (31 - 33 dB R_w+C_{tr})
- 4.7 As an example, Pilkington Optiphon is a high performing acoustic laminate that can be used within residential double glazed systems.
 - www.pilkington.com/en-gb/uk/products/product-categories/noise-control/pilkington-optiphon/
- 4.8 With regard to the building envelope sound insulation of each property, the glazing is expected to be the weakest element in terms of acoustic performance (excluding any ventilator units).
- 4.9 With standard double glazing, the composite sound insulation of the building envelope is expected to be in the region of 28 to 32 dB R_w+C_{tr} . The composite performance will notably increase with acoustically laminated glazing installed.
- 4.10 The quantity R_w is the weighted sound reduction index expressed in dB. It is a single number quantity for rating airborne sound insulation. The ' C_{tr} ' term is added to the single number rating R_w to take account of the characteristics of particular sound spectra (e.g. road traffic).
- 4.11 The acoustic performance of a particular construction may differ slightly between manufacturers and therefore the sound insulation performance should be verified where possible.
- 4.12 To achieve the optimum performance, external windows should be well sealed around the frame when installed. Large gaps between the frame and the brickwork and poorly sealed frames can notably reduce performance.

Noise ingress with windows closed

- 4.13 Table 4.1 presents the calculation results for the ground floor open-plan living room on the front elevation facing Entwisle Road (south facing elevation).
- 4.14 Standard double glazing consisting of 4 mm glass / 16 – 20 mm cavity / 4 mm glass has been assumed for the habitable room.
- 4.15 The calculations take into account the typical sound insulation performance of each building element, surface area and internal room dimensions. The floor plans and elevations are presented in Appendix A.
- 4.16 The measured 16-hour daytime ambient sound pressure level has been corrected by +3 dB in order to represent the southern façade line of the new dwellings (which are slightly closer to the road compared to the measurement position).
- 4.17 The measured octave band sound levels and the typical reverberation time for a habitable room have also been taken into consideration.

Table 4.1 - Noise ingress calculation results (open-plan living/dining room)

Site: Entwisle Road (Living/Dining Room)												
Noise Break In (ISO 12354-3)												
Formula/Comment	Single Value		63	125	250	500	1000	2000	4000	8000	Rw	(C,C _{tr})
L _{in}				28.9	25.0	33.0	43.0	45.0	39.0			
				37.1	36.0	23.0	15.0	6.0	5.0			
Materials												
4mm glass/16 - 20 mm cavity/4mm glass	3.1			21.0	17.0	25.0	35.0	37.0	31.0		29	(-1,-4)
Brickwork wall, timber frame, insulation, plasterboard	4.4			39.0	41.0	49.0	58.0	66.0	68.0		53	(-1,-5)
L _{out,s}												
L _{out,2m}	Add Element			66.0	61.0	56.0	58.0	51.0	44.0		61	
L _{out,free field}				63.0	58.0	53.0	55.0	48.0	41.0		58	
Element 1				28.9	25.0	33.0	43.0	45.0	39.0			
Plane façade	ΔL _{fs}	7.5		0.0	0.0	0.0	0.0	0.0	0.0			
Visible	X _{fs}	0.0		28.9	25.0	33.0	43.0	45.0	39.0			
L _{p,out,2m}				66.0	61.0	56.0	58.0	51.0	44.0		61	
L _{p,in}				37.1	36.0	23.0	15.0	6.0	5.0		29	dBA

- 4.18 The calculation results indicate a daytime internal sound level of approximately 29 dB L_{Aeq,16hour} with standard thermal double glazing.
- 4.19 The daytime sound level target of 35 dB L_{Aeq,16hour} will be easily achieved with windows closed.
- 4.20 Table 4.2 and 4.3 overleaf present the calculation results for the first and second floor bedrooms on the front elevation facing Entwisle Road.
- 4.21 Standard double glazing consisting of 6 mm glass / 16 – 20 mm cavity / 6.8 mm acoustically laminated glass has been assumed for the calculations.
- 4.22 The maximum L_{AFmax} internal sound level target will not be achieved within south facing bedrooms during the night-time with standard thermal double glazing.

Table 4.2 - Noise ingress calculation results (bedroom 1)

Site: Entwisle Road (Bedroom 1)												
Noise Break In (ISO 12354-3)												
Formula/Comment	Single Value		63	125	250	500	1000	2000	4000	8000	Rw	(C,C _{tr})
				27.0	28.1	38.0	46.0	47.2	56.0			
L _{in}				39.0	32.9	18.0	12.0	3.8	-12.0			
Materials												
6mm glass/16 - 20 mm cavity/6.8mm acou-lam	3.4			23.0	24.0	34.0	42.0	43.0	52.0		37	(-2,-6)
Brickwork wall, timber frame, insulation, plasterboard	7.2			39.0	41.0	49.0	58.0	66.0	68.0		53	(-1,-5)
L _{out,s}												
L _{out,2m}	Add Element			66.0	61.0	56.0	58.0	51.0	44.0		61	
L _{out,free field}				63.0	58.0	53.0	55.0	48.0	41.0		58	
Element 1				27.0	28.1	38.0	46.0	47.2	56.0			
Plane façade	ΔL _{fs}	10.6		0.0	0.0	0.0	0.0	0.0	0.0			
Visible	X _{fs}	0.0		27.0	28.1	38.0	46.0	47.2	56.0			
L _{p,out,2m}				66.0	61.0	56.0	58.0	51.0	44.0		61	
L _{p,th}				39.0	32.9	18.0	12.0	3.8	-12.0		27	dBA

Table 4.3 - Noise ingress calculation results (master bedroom)

Site: Entwisle Road (Master Bedroom)												
Noise Break In (ISO 12354-3)												
Formula/Comment	Single Value		63	125	250	500	1000	2000	4000	8000	Rw	(C,C _{tr})
				25.7	28.0	36.6	42.7	40.9	45.6			
L _{in}				40.3	33.0	19.4	15.3	10.1	-1.6			
Materials												
6mm glass/16 - 20 mm cavity/6.8mm acou-lam	3.4			23.0	24.0	34.0	42.0	43.0	52.0		37	(-2,-6)
Brickwork wall, timber frame, insulation, plasterboard	4.8			39.0	41.0	49.0	58.0	66.0	68.0		53	(-1,-5)
Single ply flat roof, insulation, plasterboard ceiling	13.3			31.0	37.0	42.0	46.0	43.0	47.0		44	(-1,-3)
L _{out,s}												
L _{out,2m}	Add Element			66.0	61.0	56.0	58.0	51.0	44.0		61	
L _{out,free field}				63.0	58.0	53.0	55.0	48.0	41.0		58	
Element 1				25.7	28.0	36.6	42.7	40.9	45.6			
Plane façade	ΔL _{fs}	21.5		0.0	0.0	0.0	0.0	0.0	0.0			
Visible	X _{fs}	0.0		25.7	28.0	36.6	42.7	40.9	45.6			
L _{p,out,2m}				66.0	61.0	56.0	58.0	51.0	44.0		61	
L _{p,th}				40.3	33.0	19.4	15.3	10.1	-1.6		28	dBA

- 4.23 The calculation results indicate a daytime internal sound level of approximately 27 to 28 dB L_{Aeq,16hour} with acoustically laminated double glazing.
- 4.24 The daytime sound level target of 35 dB L_{Aeq,16hour} will be easily achieved with windows closed.
- 4.25 Since the night-time L_{Aeq,8hour} sound level is approximately 7 to 8 dB lower than the daytime sound level, the night-time target of 30 dB L_{Aeq,8hour} will also be easily achieved.
- 4.26 With regard to the maximum L_{AFmax} internal sound level, for the majority of the night-time period the recommended target of 45 dB L_{AFmax} will also be achieved within bedrooms.
- 74 dB L_{AFmax,2min} – 33 dB R_w+C_{tr} = 41 dB L_{AFmax,5min} internally.

Noise ingress with windows open

- 4.27 The level of sound attenuation through an open window is dependent on the type and size of window, the extent of opening, the angle of sound incidence and the characteristics of the noise source in question.
- 4.28 It is considered reasonable to assume a sound attenuation performance of approximately 15 dBA for a partially open window. Partially open windows are expected to provide background ventilation only (as opposed to rapid/purge ventilation).
- 4.29 ProPG also acknowledges that the acoustic performance of the building envelope will be reduced to no more than 15 dBA when windows are opened for ventilation or cooling purposes.

South facing habitable rooms

- 4.30 Daytime façade sound pressure levels are expected to be approximately 61 dB $L_{Aeq,16hour}$ and night-time sound pressure levels approximately 53 to 54 dB $L_{Aeq,8hour}$.
- 4.31 When assessing noise ingress through an open window, it is appropriate to correct the façade sound level by approximately -3 dB to give an equivalent 'free-field' sound level.
- 4.32 The corresponding free-field sound pressure levels are therefore 58 dB $L_{Aeq,16hour}$ during the daytime and 50 to 51 dB $L_{Aeq,8hour}$ during the night-time.
- 4.33 With windows open, the resulting internal sound pressure level is expected to be approximately 43 dB $L_{Aeq,16hour}$ during the daytime and 35 to 36 dB $L_{Aeq,8hour}$ during the night-time.
- 58 dB $L_{Aeq,16hour}$ – 15 dB = 43 dB $L_{Aeq,16hour}$
 - 51 dB $L_{Aeq,8hour}$ – 15 dB = 36 dB $L_{Aeq,8hour}$
- 4.34 The ideal 35 dB $L_{Aeq,16hour}$ daytime and 30 dB $L_{Aeq,8hour}$ night-time sound level targets will therefore not be achieved with windows open.
- 4.35 BS 8233 states where occupants rely on closed windows to meet the internal noise limits, there needs to be appropriate 'alternative' ventilation that does not compromise the facade sound insulation or the resulting internal sound level.
- 4.36 The standard also provides the following comment with regard to ventilation:
- The Building Regulations' supporting documents on ventilation recommend that habitable rooms in dwellings have background ventilation. Where openable windows cannot be relied upon for this ventilation, trickle ventilators can be used and sound attenuating types are available. However, windows may remain openable for rapid or purge ventilation, or at the occupant's choice.*
- 4.37 It is therefore recommended that an alternative means of ventilation is provided to habitable rooms on the front south facing elevation.
- 4.38 A suitable mitigation measure would be to install good quality (acoustically treated) sound attenuating ventilator units to habitable rooms.
- 4.39 As an alternative to acoustic ventilator units, a mechanically assisted ventilation system could be installed within the new dwellings (e.g. PIV or MVHR system). Further guidance regarding ventilation products and systems are provided in Section 5.
- 4.40 Fully opening windows are appropriate for providing rapid or purge ventilation (e.g. to remove odour from painting and decorating or from burnt food). Bathrooms, toilets and circulation areas should not require specific noise mitigation.

North facing habitable rooms

- 4.41 Since the rear elevation faces away from road traffic on Entwisle Road, an alternative method of ventilation is deemed to be unnecessary.
- 4.42 The habitable rooms will be acoustically screened from passing road traffic and consequently the internal ambient sound level will be notably lower (10 to 15 dB lower). The daytime and night-time sound level targets will therefore be achieved with windows open.
- 4.43 Where required to satisfy Part F of the Building Regulations, standard (non-acoustic) hit-and-miss trickle vents could be used to provide background ventilation with windows closed.

Overheating and opening windows

- 4.44 With regard to noise at night and opening windows, Approved Document O (Overheating) states the following:

In locations where external noise may be an issue (for example, where the local planning authority considered external noise to be an issue at the planning stage), the overheating mitigation strategy should take account of the likelihood that windows will be closed during sleeping hours (11pm to 7am).

Windows are likely to be closed during sleeping hours if noise within bedrooms exceeds the following limits.

a. 40 dB $L_{Aeq,T}$, averaged over 8 hours (between 11pm and 7am).

b. 55 dB L_{AFmax} , more than 10 times a night (between 11pm and 7am).

- 4.45 The predicted internal sound levels are notably below these limits which indicates that occupants will open windows on both elevations during the night to help cool and remove excess heat from the bedroom.

Ambient sound level in outdoor living areas

- 4.46 With regard to outdoor living areas (gardens), BS 8233 provides the following guidelines:
- For traditional external areas that are used for amenity space, such as gardens and patios, it is desirable that the external noise level does not exceed 50 dB $L_{Aeq,T}$, with an upper guideline value of 55 dB $L_{Aeq,T}$ which would be acceptable in noisier environments. However, it is also recognised that these guideline values are not achievable in all circumstances where development might be desirable. In higher noise areas, such as city centres or urban areas adjoining the strategic transport network, a compromise between elevated noise levels and other factors, such as the convenience of living in these locations or making efficient use of land resources to ensure development needs can be met, might be warranted. In such a situation, development should be designed to achieve the lowest practicable levels in these external amenity spaces, but should not be prohibited.*
- 4.47 ProPG also states the following with regard to noise levels:
- 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 $L_{Aeq,16hr}$.*
- 4.48 The measured 16-hour daytime sound pressure level was 58 dB $L_{Aeq,16hour}$. The equivalent free-field sound pressure level is approximately 55 dB $L_{Aeq,16hour}$.
- 4.49 There are proposed terraces at 2nd floor level along the north facing elevation and there are also garden areas and car parking to the rear of the dwellings.
- 4.50 Taking into consideration the degree of acoustic screening from Entwisle Road once the dwellings are constructed, the resulting sound pressure level is expected to be below 50 dB $L_{Aeq,16hour}$ during the daytime period.
- 4.51 It is therefore anticipated that the recommended guideline value of 50 to 55 dB $L_{Aeq,16hour}$ will be achieved within the garden areas and roof terraces along the north facing elevation.

5. Ventilation & Noise Mitigation

Acoustically rated ventilator units

- 5.1 Manually controlled trickle ventilators (the most common type of background ventilators) can be located over the window frames, in window frames, just above the glass or directly through the wall.
- 5.2 Sound attenuating ventilator units can be installed to habitable rooms, in order to allow background ventilation whilst maintaining a high sound insulation performance from the facade.
- 5.3 With regard to the ground floor living room, the ventilator unit should provide a sound insulation performance of at least 30 dB $D_{n,e,w}$ in the open position.
- 5.4 With regard to the bedrooms on the front elevation, the ventilator unit should provide a sound insulation performance of at least 34 dB $D_{n,e,w}$ in the open position.
- 5.5 Where required to satisfy Part F of the Building Regulations, standard (non-acoustic) hit-and-miss trickle vents could be used to provide background ventilation with windows closed on the rear elevation.
- 5.6 Additional calculations and guidance regarding ventilator type and performance can be provided in due course if required.
- 5.7 Example manufacturers of acoustically-rated ventilator units include:
 - www.aereco.co.uk/products-and-systems/
 - www.greenwood.co.uk/acoustic
 - <http://brookvent.co.uk/product/airvent-sm-acoustic/>

Mechanically assisted ventilation

- 5.8 A further option with regard to ventilating and cooling habitable rooms whilst achieving a high facade sound insulation would be to use a mechanical ventilation system, such as a heat recovery system (MVHR) or positive input ventilation system (PIV).
- 5.9 Example suppliers of MVHR and PIV systems include:
 - www.nuaire.co.uk/residential/positive-input-ventilation
 - www.envirovent.com/specifier/products/heat-recovery-systems/
 - www.envirovent.com/specifier/products/positive-input-ventilation/
 - www.greenwood.co.uk/range/5/heat-recovery-mvhr.html
- 5.10 Appropriate dwelling ventilation rates will depend on the number of bedrooms within the dwelling and the anticipated occupancy rate (refer to Approved Document F for guidance).
- 5.11 Such systems can also be supplied with a 'boost' function in order to reduce the need to open windows for purge ventilation.
- 5.12 With a loft mounted motor and control unit, particular attention should be paid to the construction of bedroom ceilings and the mounting of the motor unit in order to minimise the noise transmission into adjacent rooms. It is commonplace for a double-boarded ceiling construction and acoustically enhanced loft-hatch to be used where there is a loft mounted motor/control unit.

Building Regulations 2010: Approved Document F (Ventilation)

- 5.13 The approved document supports Part F of Schedule 1 to the Building Regulations 2010 and came into effect on 15 June 2022.

Section 1: Ventilation provision

- 5.14 The aim of requirement F1(1) is to protect the health of occupants with the dwelling by providing adequate ventilation. Without adequate ventilation, mould and internal air pollution might become hazardous to health.
- 5.15 The document sets minimum standards for purge ventilation for rapidly diluting indoor air pollutants and extracting water vapour where necessary in habitable rooms in dwellings. For domestic-type buildings, Part O may require a higher standard than the guidance given in this document for purge ventilation to remove excess heat. In this case, the higher of the two standards should be followed.
- 5.16 With regard to noise (from mechanical systems), page 6 of the document states the following:

1.5 Mechanical ventilation systems, including both continuous and intermittent mechanical ventilation, should be designed and installed to minimise noise. This includes doing all of the following.

- a. Correctly sizing and jointing ducts.*
- b. Ensuring that equipment is appropriately and securely fixed, such as using resilient mountings where noise carried by the structure of the building could be a problem.*
- c. Selecting appropriate equipment, including following paragraph 1.6.*

1.6 For mechanical ventilation systems, fan units should be appropriately sized so that fans operating in normal background ventilation mode are not overly noisy. This might require fans to be sized so that they do not operate near maximum capacity when in normal background ventilation mode.

1.7 Account should be taken of outside noise when considering whether openable windows are appropriate for purge ventilation.

Note: Although there is no requirement to undertake noise testing, achieving the levels in the following guidance would ensure good acoustic conditions. The average A-weighted sound pressure level for a ventilator operating under normal conditions and not at boost rates should not exceed both of the following.

- a. 30 dB $L_{Aeq,T}^*$ for noise-sensitive rooms (e.g. bedrooms and living rooms) when a continuous mechanical ventilation system is running on its minimum low rate.*
- b. 45 dB $L_{Aeq,T}^*$ in less noise-sensitive rooms (e.g. kitchens and bathrooms) when a continuous operation system is running at the minimum high rate or an intermittent operation system is running.*

** The noise index $L_{Aeq,T}$ is used in BS 8233, where T is the duration of the measurement. If the noise from the sound source is steady (i.e. fluctuating by up to 3dB), a measuring time of 1 minute will be adequate and the $L_{Aeq, 1 \text{ min}}$ level will be similar to the dB(A) level used elsewhere. If the noise from the sound source fluctuates more than this, a longer measuring time (T) may be required, but the higher portion of the fluctuating level should be considered, and the sound may attract more attention due to the changes in level.*

Note: Methods for measuring the sound power level produced by the fan unit of decentralised extract ventilation, centralised extract ventilation and balanced mechanical ventilation with heat recovery systems are described in BS EN 13141.

6. Conclusion

- 6.1 The survey results indicate that the development site is Low Risk for the daytime and night-time period with no mitigation measures included within the scheme design.
- 6.2 Standard thermal double glazing and the proposed building envelope construction will provide sufficient sound insulation for the ground floor living room, kitchen/dining room and north facing bedrooms.
- 6.3 A suitable glazing construction would be 4 mm glass / 16 – 20 mm cavity / 4 mm glass. The unit should achieve a sound insulation performance of at least 29 dB R_w (≈ 25 dB $R_w + C_{tr}$).
- 6.4 Acoustically laminated double glazing is required for the bedrooms on the front elevation.
- 6.5 A suitable glazing construction would be 6 mm glass / 16 – 20 mm cavity / 6.8 mm laminated glass. The unit should achieve a sound insulation performance of at least 37 dB R_w (≈ 31 dB $R_w + C_{tr}$).
- 6.6 The internal daytime sound level target of 35 dB $L_{Aeq,16hour}$ and the night-time target of 30 dB $L_{Aeq,8hour}$ will be achieved with windows closed. The predictions indicate a notable improvement on the ideal sound level targets in all habitable rooms.
- 6.7 Should the local road traffic noise levels increase slightly in the future (i.e. due to an increase in traffic flow), the resulting internal sound levels would still easily satisfy the recommended design targets.
- 6.8 An alternative means of ventilation should be provided to the habitable rooms on the front elevation. Alternative ventilation may be in the form of sound attenuating ventilator units or alternatively a mechanically assisted ventilation system. It is appropriate for openable windows to provide rapid/purge ventilation.
- 6.9 It is anticipated that occupants will open bedroom windows during the night to help cool and remove excess heat from the bedroom since the predicted internal ambient sound levels are below the night-time limits stated in Approved Document O.
- 6.10 With regard to ambient noise within the rear gardens and upper floor terraces, it is anticipated that the daytime ambient sound level will generally be below 50 dB $L_{Aeq,16hour}$ without additional noise mitigation measures.
- 6.11 The identified mitigation measures are not particularly onerous and are typical for residential developments adjacent to transportation and commercial sources of noise. Changes to the site layout or floor layouts are considered unnecessary.

Appendix A

Site plan, floor plans and elevations

Figure A.1 - Existing site plan

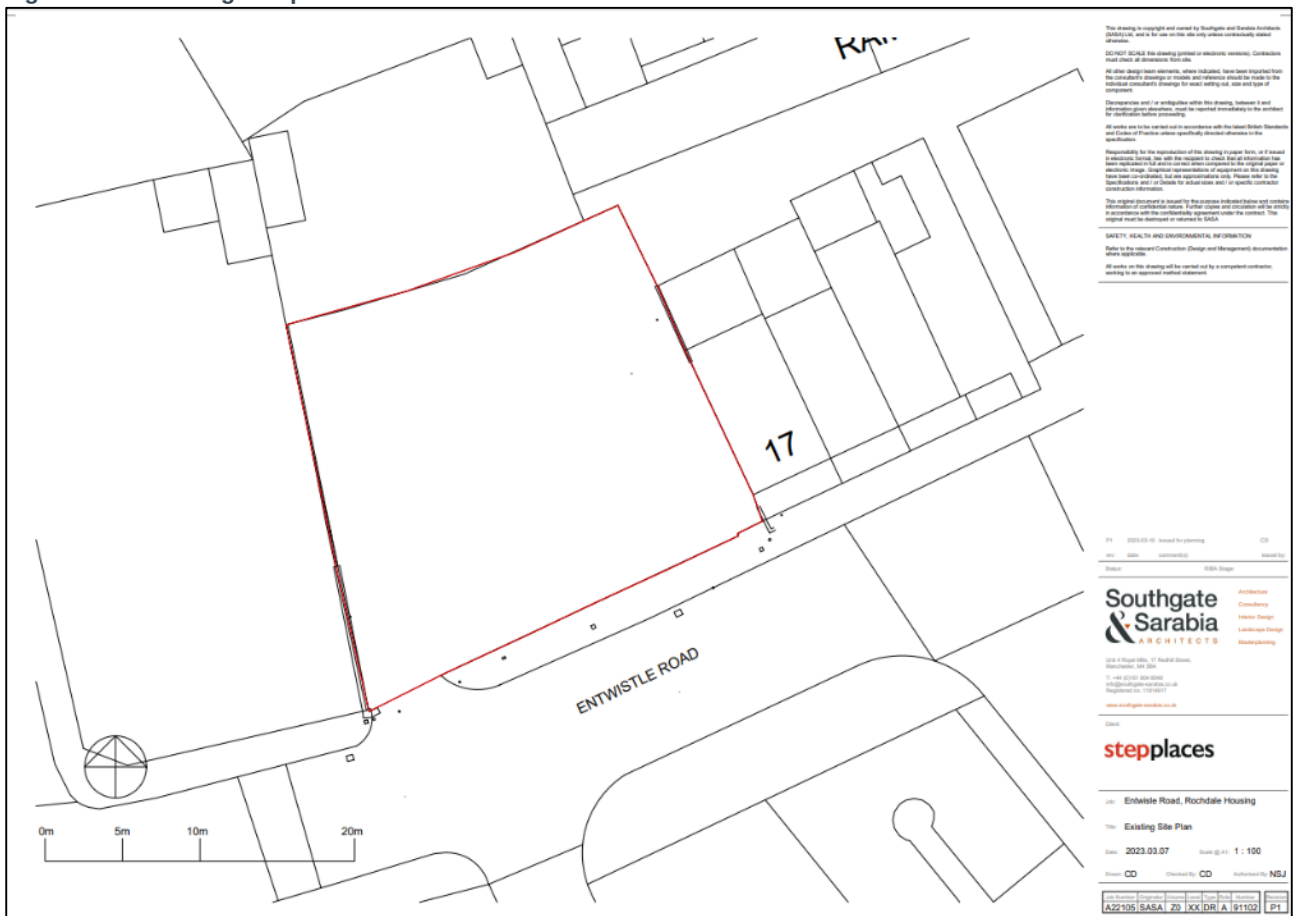


Figure A.2 - Proposed site plan



Figure A.3 - Proposed floor plans

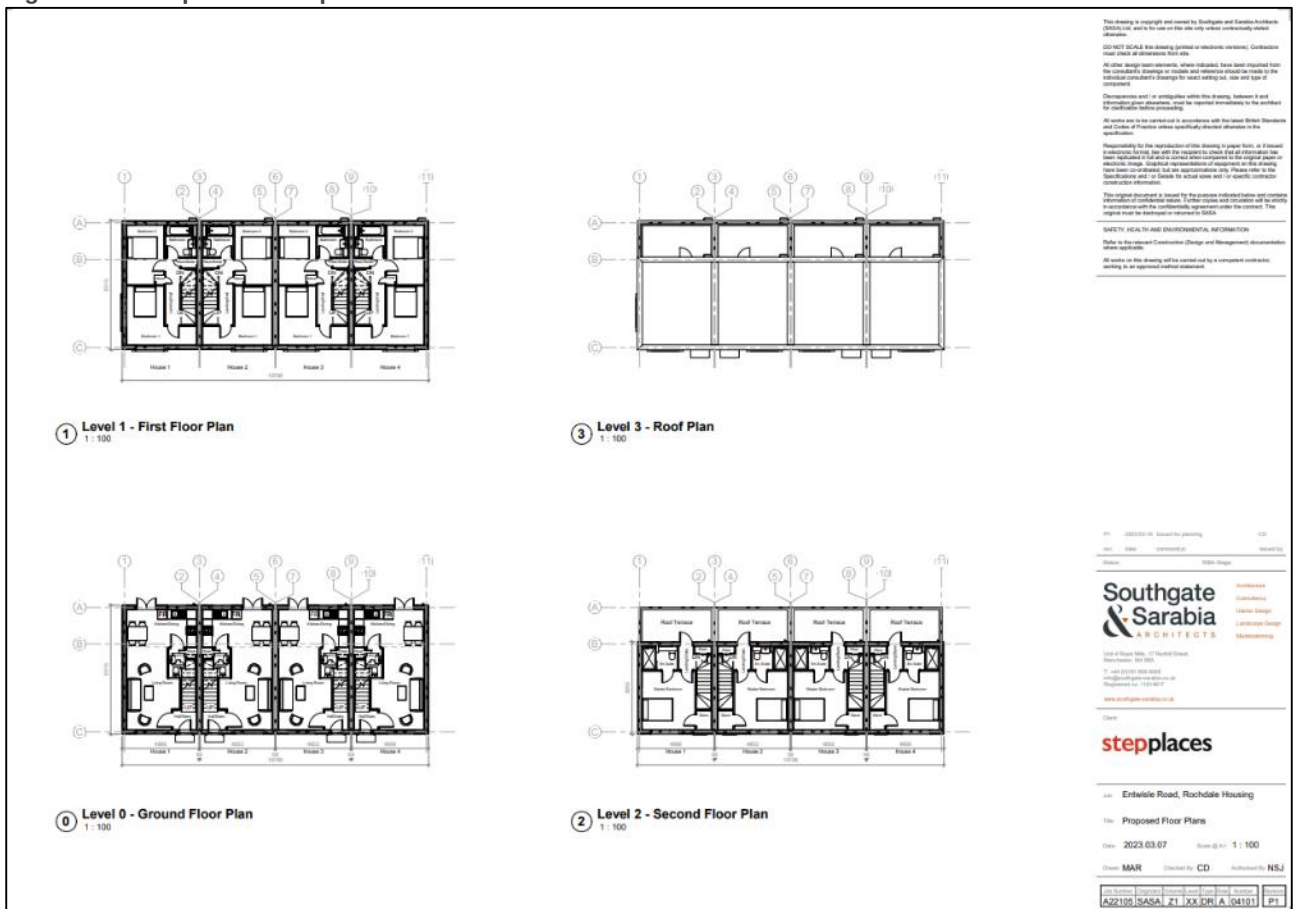


Figure A.4 - Proposed elevations

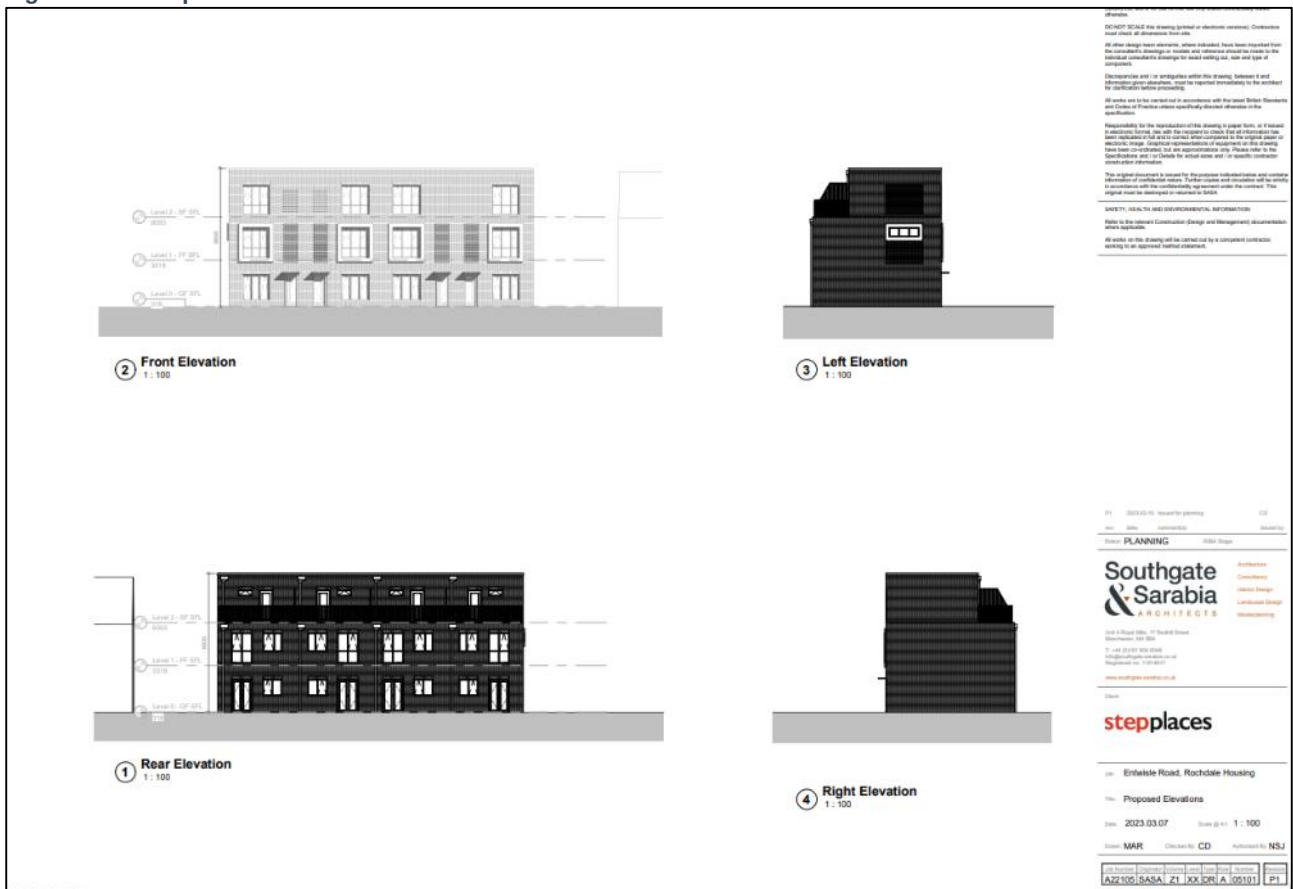


Figure A.5 - Proposed sections

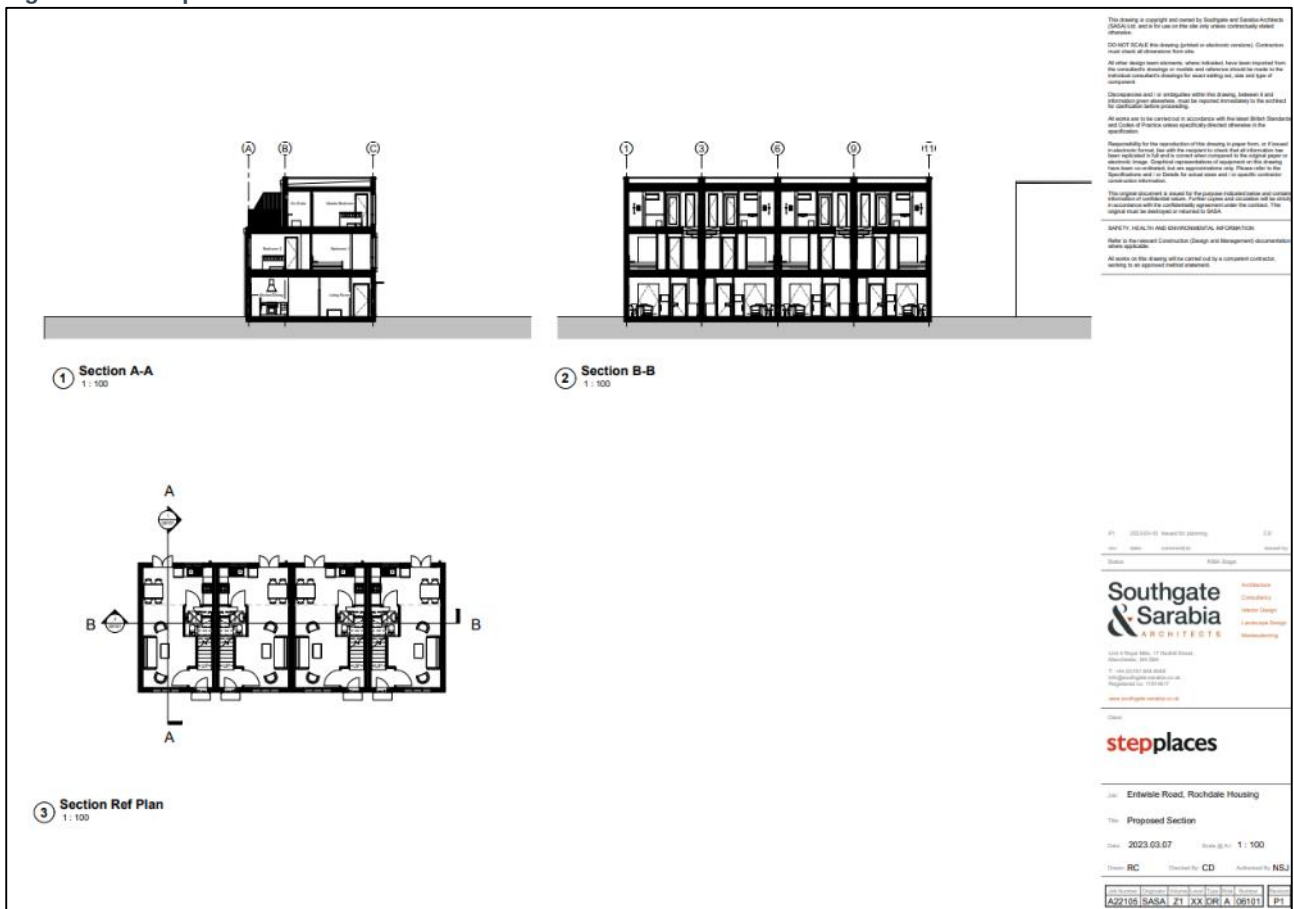


Figure A.6 - Proposed 3D Isometrics



Appendix B

Equipment calibration certificates

Certificate of Calibration

Issued by University of Salford (Acoustics Calibration Laboratory)
UKAS ACCREDITED CALIBRATION LABORATORY NO. 0801

Page 1 of 3

APPROVED SIGNATORIES

Claire Lomax [] Harry Bulger [x]
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University of
Salford
MANCHESTER

Certificate Number: 06067/1

Date of Issue: 25 January 2023

PERIODIC TEST OF A SOUND LEVEL METER to IEC 61672-3:2006

FOR:	RS Acoustic Engineering Ltd 76 Marple Road Stockport Cheshire SK2 5QH
FOR THE ATTENTION OF:	Ryan Swales
DATE RECEIVED:	10 January 2023
PERIODIC TEST DATE:	25 January 2023
LOCATION OF CALIBRATION:	Acoustic Calibration Laboratory, Newton G31, University of Salford
TEST PROCEDURE:	CTP12 (Laboratory Manual)

Sound Level Meter Details-

Manufacturer	B&K
Model	2250L
Serial number	2638934
Class	1
Hardware version: 2.0	Sound Level Meter Software: BZ7130 Version 3.1

Associated Items:-

Type	Manufacturer	Model	Serial Number
Microphone	B&K	4189	2643196
Preamplifier	B&K	ZC 0032	8938

Test Engineer (initial):	GP	Name:	Gary Phillips
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Results in this certificate relate only to instruments tested.

This certificate is issued in accordance with the laboratory accreditation requirements of the United Kingdom Accreditation Service. It provides traceability of measurement to the SI system of units and/or to the units of measurement realised at the National Physical Laboratory or other recognised national metrology institutes. This certificate may not be reproduced other than in full except with the prior written approval of the issuing laboratory.

Certificate of Calibration

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UKAS ACCREDITED CALIBRATION LABORATORY NO. 0801

Page 2 of 3

Certificate Number: 06067/1

Date of Issue: 25 January 2023

Procedures from IEC 61672-3: 2006 and TPS 49 Edition 2 June 2009 were used to perform the periodic tests.

The manufacturer's instruction manual was marked as follows: B&K 2250-L with mic 4950 BE 1774-11 June 2007 From hardware version 2.0.

Adjustment data used to adjust the sound levels indicated in response to the application of an electrostatic actuator to sound levels equivalent to those that would be indicated in response to plane, progressive sound waves were obtained from the manufacturer's instruction manual referred to in this certificate.

The sound level meter calibration check frequency is 1000 Hz, the reference sound pressure level is 94 dB. As this instrument only has a single range, this range is the reference level range.

The environmental conditions in the laboratory at the start of the test were:

Static pressure 102.702 kPa $\pm$ 0.013 kPa; air temperature 22.0 °C $\pm$ 0.3 °C; relative humidity 40.1 % $\pm$ 2.6 %.

The initial response of the instrument to application of the suitable laboratory sound calibrator was 93.8 dB (C). The instrument was then adjusted to indicate 94.0 dB (C).

This indication was obtained from the calibration certificate of the calibrator and information in the manufacturer's instruction manual specified in this certificate, when the instrument is configured as follows; Transd. Used 4189 (2643196), Sound Field Correction: Free-field, Windscreen Correction: None. The instrument was calibrated without a windscreen. Consult manufacturer's instructions if using a windscreen.

With the microphone installed the level of self-generated noise was:

A: 16.5 dB

With the microphone replaced by an electrical input device with a similar capacitance to the supplied microphone, the levels of self-generated noise were:

A: 13.1 dB

B: 12.3 dB

C: 13.9 dB

Z: 19.1 dB

The environmental conditions in the laboratory at the end of the test were:

Static pressure 102.458 kPa $\pm$ 0.013 kPa; air temperature 22.7 °C $\pm$ 0.3 °C; relative humidity 39.9 % $\pm$ 2.6 %.

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Certificate of Calibration

Issued by University of Salford (Acoustics Calibration Laboratory)
UKAS ACCREDITED CALIBRATION LABORATORY NO. 0801

Page 3 of 3

Certificate Number: 06067/1

Date of Issue: 25 January 2023

The sound level meter submitted for testing has successfully completed the class 1 periodic tests of IEC 61672-3:2006, for the environmental conditions under which the tests were performed. As public evidence was available, from an independent testing organization responsible for approving the results of pattern evaluation tests performed in accordance with IEC 61672-2:2003, to demonstrate that the model of sound level meter fully conformed to the requirements in IEC 61672-1:2002, the sound level meter submitted for testing conforms to the class 1 requirements of IEC 61672-1:2002.

The microphone corrections applied as specified in 12.6 of IEC 61672-3:2006 were obtained from a frequency response measured by this Laboratory using the electrostatic actuator method. This response in isolation is not covered by our UKAS accreditation.

Instruments used in the verification procedure were traceable to *National Standards*. The electrostatic actuator method was employed in the acoustical tests of a frequency weighting.

The uncertainty evaluation has been carried out in accordance with UKAS requirements. All measurement results are retained at the acoustic calibration laboratory for at least four years.

-----END OF CERTIFICATE-----

This certificate is issued in accordance with the laboratory accreditation requirements of the United Kingdom Accreditation Service. It provides traceability of measurement to the SI system of units and/or to the units of measurement realised at the National Physical Laboratory or other recognised national metrology institutes. This certificate may not be reproduced other than in full except with the prior written approval of the issuing laboratory.

Appendix C

Assessment terminology

Assessment terminology

Term	Description
dB (decibel)	The scale on which sound pressure level is expressed. It is defined as 20 times the logarithm of the ratio between the root-mean-square pressure of the sound field and a reference pressure ($2 \times 10^{-5} \text{Pa}$).
dB(A)	The most widely used weighting mechanism that best corresponds to the response of the human ear is the 'A'-weighting scale. This is widely used for environmental noise measurement, and the levels are denoted as dB(A) or L_{Aeq} , L_{A90} etc, according to the parameter being measured.
Acoustic environment	Sound from all sources as modified by the environment.
Ambient sound level	The totally encompassing sound in a given situation at a given time; it is usually composed of sound from many sources, near and far.
Equivalent continuous sound level - $L_{Aeq,T}$	The A-weighted equivalent continuous sound pressure level over a period of time, T. Representative of the 'average' sound pressure level over a given period (commonly used to describe the 'ambient' sound level).
Maximum sound level - $L_{AFmax,T}$	The A-weighted 'maximum' sound pressure level that occurred during a given period, T (commonly used for the assessment of intermittent loud noises).
Background sound level - $L_{A90,T}$	The sound pressure level that is exceeded for 90% of the measurement time interval, T. $L_{A90,T}$ is often used to describe the 'background' sound level.
Habitable room	Any room used or intended to be used for sleeping, cooking, living or eating purposes (enclosed spaces such as bath or toilet facilities, service rooms, corridors, laundries, hallways, utility rooms or similar spaces are excluded from this definition).
R_w	The weighted sound reduction index expressed in dB. A single number quantity for airborne sound insulation rating.
Free-field level	A sound field determined at a point away from reflective surfaces other than the ground with no significant contributions due to sound from other significant reflective surfaces. Generally as measured outside and away from buildings (>3.5metres).