

Residential Development on land at Pilch Lane, Sefton, Liverpool:

Noise Assessment

Breck Developments Ltd

1 July 2026

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EXECUTIVE SUMMARY

The results of noise measurement surveys and desk-based assessment of noise are presented, with respect to the proposed construction of a new residential property at Pilch Lane, Sefton.

The assessment has shown that the site is principally affected by traffic noise from Pilch Lane.

The assessment shows that concludes that, on all facades directly or obliquely facing Pilch Lane, windows will need to remain closed in order to achieve the BS 8233 guideline values.

The assessment also shows that for Plots 1 to 4 and 22 to 35, up-rated glazing is required to achieve guideline levels with windows closed.

Consequently, alternative means of providing sufficient levels of ventilation will be required.

The assessment concludes that, with the provision of up-rated glazing, where recommended, and suitable alternative ventilation, noise need not be a reason for refusal of planning permission.

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1. INTRODUCTION

- 1.1. Echo Acoustics was commissioned by Breck Developments Ltd to undertake an assessment of noise affecting the proposed residential development of land at Pilch Lane, Sefton.
- 1.2. The land, which is currently occupied by a derelict cleared, is located in a principally residential location with Pilch Lane forming its north-eastern boundary, St Mary Margaret's RC Church on its north-western boundary, established residential houses on its south-eastern boundary and open land on its south-western boundary, beyond which is further established residential housing. There are no significant commercial or industrial uses in the immediate vicinity.
- 1.3. The ambient noise situation is dominated during both the day and night time by traffic noise from Pilch lane and the surrounding area, potentially including minor contributions of distant traffic noise from the western end of the M62 which is approximately 500 metres to the south, beyond an area of relatively dense housing.
- 1.4. The site area, in the context of its surroundings, is presented in Figure 1.

Figure 1: Site location and surroundings



1.5. The proposals comprise the construction of 35 new houses, as presented in Figure 2.

Figure 2: Proposed development layout (drawing: P01 - Pilch Lane / Proposed Site Layout, Rev D)



- 1.6. This report presents the results of a noise measurement survey and a desk-based assessment of environmental (traffic/transport) noise affecting the site, with respect to its use for residential development. Where appropriate, recommendations for suitable noise control and mitigation measures are discussed.
- 1.7. A glossary of acoustic terminology is provided at Appendix A.

2. GUIDANCE

Noise – national policy guidance

- 2.1 Planning policies are set at both a national and local level. With respect to national policy, assessment of the suitability of a site for residential development is guided by the National Planning Policy Framework (NPPF), issued in March 2012 and amended in 2018, 2019, 2023 and 2024.
- 2.2 With regard to noise, the NPPF (“the Framework”) does not provide specific noise policies or defined noise limits but, rather, is intended to enable the planning system to support the Government’s aims and objectives with respect to sustainable development and *“provides a framework within which locally-prepared plans can provide for housing and other development in a sustainable manner”*.
- 2.3 None of the current local or national planning policies preclude recreational development of the site for residential use.
- 2.4 The National Planning Policy Framework does state that *“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”*.
- 2.5 Additional national planning guidance is provided in the Government’s Noise Policy Statement for England (NPSE – “the Noise Policy”), to which the Framework makes specific reference as the main source of national guidance specifically on planning and noise.
- 2.6 The Noise Policy has a long term vision 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”*. The vision is supported by three key aims intended to promote sustainable development with respect to noise so that *“Through the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development:*
 - *avoid significant adverse impacts on health and quality of life;*
 - *mitigate and minimise adverse impacts on health and quality of life; and*
 - *where possible, contribute to the improvement of health and quality of life”*.
- 2.7 Health is defined by the World Health Organisation as *“a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity, and recognises the enjoyment of the highest attainable standard of health as one of the fundamental rights of every human being”* and the Noise Policy makes *“a distinction between ‘quality of life’ which is a subjective measure that refers to people’s emotional, social and physical well being and ‘health’ which refers to physical and mental well being”*.
- 2.8 However, the Noise Policy recognises that it is not currently possible to define a single objective noise level having specific effects on people, hence the emphasis on “promoting” improvements to health and quality of life through effective management of noise, considered in the context of the wider environment and factors other than noise.
- 2.9 Additional guidance is given in the Planning Practice Guidance Note (PPG) on noise, issued in March 2014, alongside the NPPF and updated in 2018 and July 2019. This provides advice

on how planning can manage potential noise impacts in new development. The PPG suggests the following noise exposure hierarchy, based on average responses to noise.

Table 1: PPG noise exposure and response hierarchy

Perception	Examples of outcomes	Increasing effect level	Action
<i>No Observed Effect Level (NOEL)</i>			
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
<i>Lowest Observed Adverse Effect Level (LOAEL)</i>			
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 some reported 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
<i>Significant Observed Adverse Effect Level (SOAEL)</i>			
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

- 2.10 Beyond this, however, the guidance is relatively generic. It avoids specifying ‘acceptable’ environmental noise levels as the acceptability of a source of is both subjective and context-dependant.

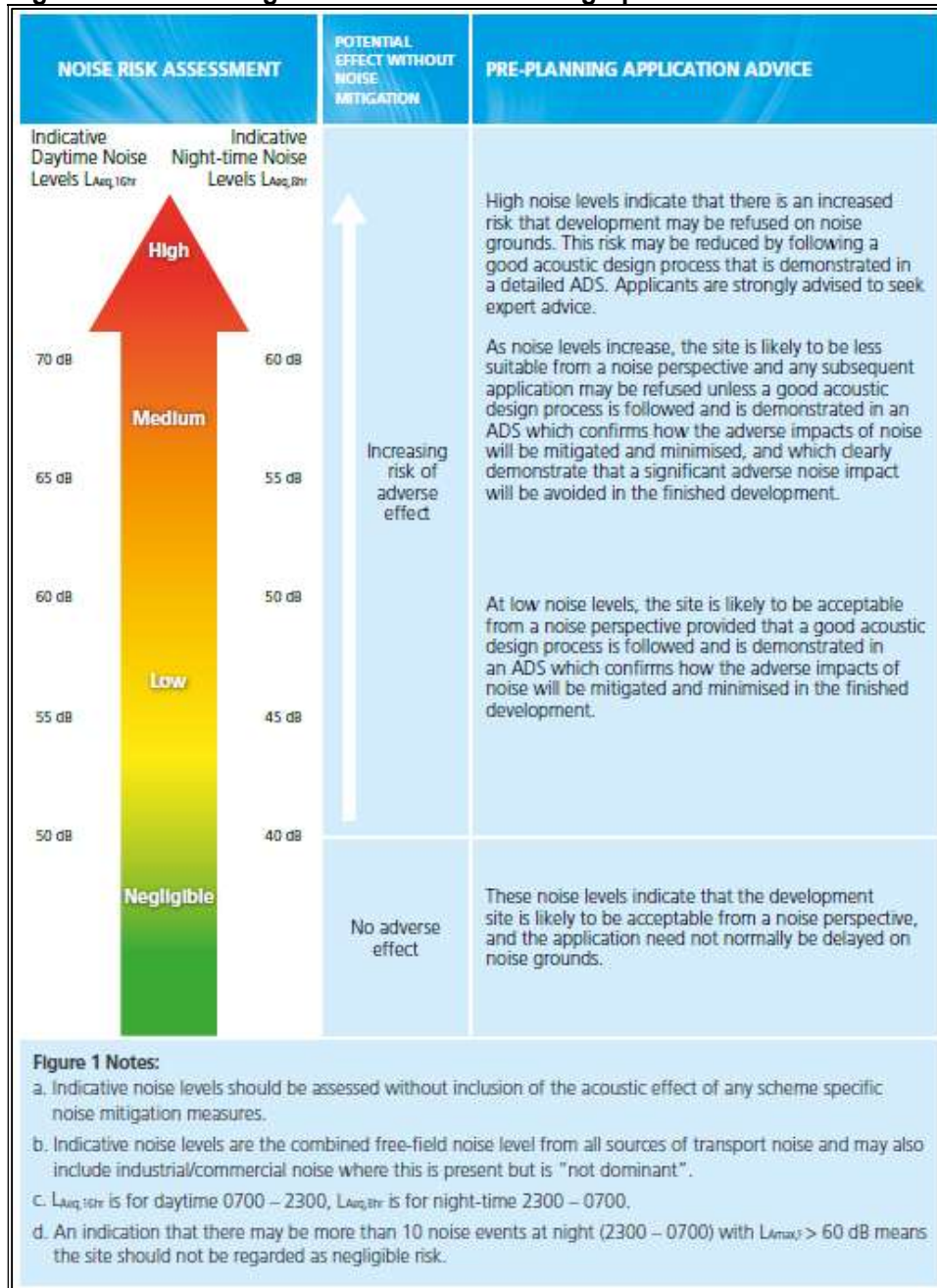
Noise – technical guidance

External environmental noise aspects

- 2.11 In May 2017, a Working Group consisting of representatives of the Association of Noise Consultants (ANC), Institute of Acoustics (IOA) and Chartered Institute of Environmental Health (CIEH) produced a Professional Practice Guidance (Pro PG) document¹. The guidance was produced “*to provide practitioners with guidance on a recommended approach to the management of noise within the planning system in England*” and “*which encourages better acoustic design for new residential development and aims to protect people from the harmful effects of noise*”. Its primary aim is “*to assist the delivery of sustainable development by promoting good health and wellbeing through the effective management of noise. It seeks to do that through encouraging a good acoustic design process in and around proposed new residential development having regard to national policy on planning and noise*”.
- 2.12 The guidance identifies that “*Good acoustic design is about more than the numbers. It is a holistic design process that creates places that are both comfortable and attractive to live in, where acoustics is considered integral to the living environment.*
- Good acoustic design can involve, for example, careful site layouts and better orientation of rooms within dwellings. Good acoustic design does not mean “gold plating” or significantly increasing costs. This guidance seeks to encourage and promote design outcomes that are proportionate and reasonable in the particular circumstances of each development site*”.
- 2.13 It should be noted that the Pro PG “*does not constitute an official government code of practice and neither replaces nor provides an authoritative interpretation of the law or government policy on which users should take their own advice as appropriate*”.
- 2.14 The guidance “*advocates a systematic, proportionate, risk based, 2-stage, approach. The approach encourages early consideration of noise issues, facilitates straightforward accelerated decision making for lower risk sites, and assists proper consideration of noise issues where the acoustic environment is challenging*”. The two sequential stages are:
- Stage 1 – an initial noise risk assessment of the proposed development site; and
 - Stage 2 – a systematic consideration of four key elements.
- 2.15 Figure 1 of the guidance provides a useful graphical overview of the Stage 1 risk assessment considerations, reproduced as Figure 3.

¹ ANC, IOA & CIEH (2017) *Pro PG: Planning & Noise Professional Practice Guidance on Planning & Noise: New Residential Development*

Figure 3: Pro PG Stage 1 risk assessment infographic



2.16 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*”.

2.17 “*The approach is underpinned by the preparation and delivery of an “Acoustic Design Statement” (ADS). An ADS for a site assessed as high risk should be more detailed than for a site assessed as low risk. An ADS should not be necessary for a site assessed as negligible risk.*”

- 2.18 With respect to the assessment of external environmental noise affecting residential amenity, both within private outdoor amenity spaces and within habitable rooms, **BS 8233:2014 Guidance on sound insulation and noise reduction for buildings** gives recommendations for external and internal noise levels for residential dwellings in order to protect residential amenity, based on health-based research, as follows.
- 2.19 Table 4 at Section 7.7.2 of the Standard suggests the following guideline internal noise levels in habitable rooms:
- Living rooms during the day 35 dB $L_{Aeq,16hour}$
 - Dining rooms during the day 40 dB $L_{Aeq,16hour}$
 - Bedrooms during the day 35 dB $L_{Aeq,16hour}$
 - Bedrooms during the night 30 dB $L_{Aeq,8hour}$
- 2.20 These values can be taken to be broadly equivalent with the LOAEL in the PPG. Note that these are not specific criteria or 'target' noise levels, merely indicative recommendations which will be context-dependant. However, most Local Authorities tend to apply the recommended noise levels as strict criteria.
- 2.21 In most standard modern buildings, the walls and roof provide relatively high levels of sound insulation of greater than 40 dB; the weakest part of a building facade, with respect to noise, is generally the windows. Modern construction methods for new residential properties incorporate standard thermal double-glazing which, the standard suggests, will provide approximately 33 dB R_w of sound attenuation when closed. The standard does not specifically give sound attenuation values for partially open windows, although the worked example (G.1) at Annex G of the Standard indicates that a partially open window would provide 15 dB of sound attenuation; more recent guidance¹ suggests that a value of 13 dB is more realistic.
- 2.22 For calculation of noise ingress through a closed window, this requires that the external measured/calculated sound pressure level is a 'façade' level i.e. subject to the addition of façade-reflected sound energy; this requires the addition of 3 dB to any measured/calculated 'free-field' levels.
- 2.23 With regard to night time maximum (L_{AFmax}) noise levels, BS 8233 (Note 4) states the following:
- 2.24 *"Regular individual noise events (for example, scheduled aircraft or passing trains) can cause sleep disturbance. A guideline value may be set in terms of SEL or $L_{Amax,F}$, depending on the character and number of events per night. Sporadic noise events could require separate values".*
- 2.25 Other recent guidance¹ states "... it is considered that if, in bedrooms at night, the $L_{Amax,F}$ from individual noise events (from all sources) would not normally exceed 45dB more than 10 times a night, then this represents a reasonable threshold below which the effects of individual noise events on sleep can be regarded as negligible". Consequently, the 10th highest measured night time maximum noise level is used.

Ventilation/overheating

- 2.26 The assessment makes reference to 2 Approved Documents issued under the Building Regulations 2010; Approved Document F ('ADF') "Ventilation" and Approved Document O ('ADO') "Overheating". Whilst, technically, these are intended to be dealt with at Building Control stage of Development, the provision of ventilation and prevention of overheating affect the design and specification of noise mitigation measures such as glazing and so are, increasingly, referenced at the Planning stage of Development.

2.27 ADF describes three types of ventilation provision and associated ventilation rates for dwellings, summarised in Table 2.

Table 2: ADF ventilation types

Type of ventilation	Definition in ADF	Location/reason for ventilation	Required
Whole Dwelling Ventilation [Note 1]	Whole building ventilation (general ventilation) is nominally continuous ventilation of rooms or spaces at a relatively low rate to dilute and remove pollutants and water vapour not removed by operation of extract ventilation, purge ventilation or infiltration, as well as supplying outdoor air into the building. For an individual dwelling this is referred to as "whole dwelling ventilation".	To provide fresh air to the building and to dilute and disperse residual water vapour not dealt with by extract ventilation as well as removing other pollutants which are released throughout the building.	Continuously
Extract Ventilation	Extract ventilation is the removal of air directly from a space or spaces to the outside. Extract ventilation may be provided by natural means (e.g. by passive stack ventilation) or by mechanical means (e.g. by an extract fan or central system).	From rooms where most water vapour and/or pollutants are released, e.g. due to activities such as cooking or bathing. This is to minimise their spread to the rest of the building.	Continuously or intermittently
Purge Ventilation	Purge ventilation is manually controlled ventilation of rooms or spaces at a relatively high rate to rapidly dilute pollutants and / or water vapour. Purge ventilation may be provided by natural means (e.g. an openable window) or by mechanical means (e.g. a fan).	Throughout the building to aid removal of high concentrations of pollutants and water vapour released from occasional activities such as painting and decorating or accidental releases such as smoke from burnt food or spillage of water.	Occasionally

2.28 To achieve suitable levels of ventilation, ADF provides details of four template 'Systems' which comply with the ventilation requirements for new dwellings and can be adopted to demonstrate compliance, presented in Table 3.

Table 3: ADF template ventilation systems

Ventilation system	Provision with ADF system / purpose		
	Whole dwelling ventilation	Extract ventilation	Purge ventilation
System 1: Background ventilators and intermittent extract fans	Background ventilators (trickle vents)	Intermittent extract fans	Typically provided by opening windows
System 2: Passive stack ("natural")	Background ventilators (trickle vents) and passive stack ventilation	Continuous via passive stack	Typically provided by opening windows
System 3: Continuous mechanical extract (MEV)	Continuous mechanical extract – minimum low rate Trickle vents provide inlet air	Continuous mechanical extract – minimum high rate Trickle vents provide inlet air	Typically provided by opening windows
System 4: Continuously mechanical supply and extract with heat recovery (MVHR)	Continuous mechanical supply and extract – minimum low rate	Continuous mechanical supply and extract – minimum high rate	Typically provided by opening windows

2.29 ADO addresses the need to prevent overheating, the focus being on thermal 'comfort' of occupants.

2.30 Requirement 01 of ADO states that:

"(1) Reasonable provision must be made in respect of a dwelling, institution or any other building containing one or more rooms for residential purposes, other than a room in a hotel ("residences") to-

(a) limit unwanted solar gains in summer;

(b) provide an adequate means to remove heat from the indoor environment.

(2) In meeting the obligations in paragraph (1)-

(a) account must be taken of the safety of any occupant, and their reasonable enjoyment of the residence; and

(b) mechanical cooling may only be used where insufficient heat is capable of being removed from the indoor environment without it".

2.31 With respect to categorising residential buildings, the document provides a "Simplified method" under which this site would be categorised as being a *"moderate risk location"* for overheating; this applies to all properties in *"England, excluding high risk parts of London in (b)"*.

"a. 'Moderate risk' location – England, excluding high risk parts of London in (b).

b. 'High risk' location – urban and some suburban parts of London..."

2.32 Paragraph 1.4 discusses cross-ventilation i.e. ventilation provided by windows on opposing facades, but notes that *"A multi-occupancy residential building should not be categorised as*

having or not having cross-ventilation. Each residential unit, shared communal room and common space should be categorised separately”.

2.33 Section 1 of ADO goes on to specify means of “limiting solar gain” and “removing excess heat” by controlling the proportion of glazing, relative to floor area, the use of shutters, glazing with an appropriate g-value or shading/overhangs etc and the provision of ventilation opening with a specific “free area”.

2.34 The significance of referencing ADO is demonstrated in Section 2 of the document:

“2.10 Excess heat should be removed from the residential building by any of the following means.

a. Opening windows (the effectiveness of this method is improved by cross-ventilation).

b. Ventilation louvres in external walls.

c. A mechanical ventilation system.

d. A mechanical cooling system

2.11 The building should be constructed to meet requirement O1 using passive means as far as reasonably practicable. It should be demonstrated to the building control body that all practicable passive means of limiting unwanted solar gains and removing excess heat have been used first before adopting mechanical cooling. Any mechanical cooling (air-conditioning) is expected to be used only where requirement O1 cannot be met using openings”.

2.35 In other words, any requirement for windows to remain closed to achieve suitable (guideline) internal noise conditions, may affect the overheating/cooling strategy and, subsequently, the design of the building(s). This is clarified further on in Section 2 where it is stated that:

2.36 *“In the Secretary of State’s view, requirement O1(2)(a) is met in a new residential building if the building’s overheating mitigation strategy for use by occupants takes account of all of the following.*

a. Noise at night – paragraphs 3.2 to 3.4.

b. Pollution – paragraph 3.5.

c. Security – paragraphs 3.6 and 3.7.

d. Protection from falling – paragraphs 3.8 to 3.10.

e. Protection from entrapment – paragraph 3.11”.

2.37 Section 3 of ADO provides the following noise-specific guidance:

“Noise

3.2 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).

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

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

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

- 2.38 Alongside this, in January 2020, the Institute of Acoustics and the Association of Noise Consultants published the *ACOUSTICS VENTILATION AND OVERHEATING: Residential Design Guide* (“AVO Guide”).
- 2.39 This document “...provides an approach as to how the competing aspects of thermal and acoustic comfort can be managed...” and “...provides an integrated approach to sustainable design for both thermal and acoustic comfort in our work and living spaces”. Additionally, “Application of the AVO Guide is intended to demonstrate good acoustic design as described in the ProPG: Planning & Noise, May 2017 (‘ProPG’), when considering internal noise level guidelines”.
- 2.40 This provides a Level 1 risk assessment, which is essentially the ProPG Stage 1 risk assessment with a further detailed Level 2 assessment if internal levels, with windows open, exceed 50 dB $L_{Aeq, 16h}$ during the day time, 42 dB $L_{Aeq, 8h}$ and 65 dB L_{Amax} during the night, as presented in Figure 4. Below these levels, a Level 2 assessment is optional.

Figure 4: AVO Level 2 assessment requirement guidance

Internal ambient noise level [Note 2]			Examples of Outcomes [Note 5]	
$L_{Aeq,T}$ [Note 3] during 07:00 – 23:00 [Note 6]	$L_{Aeq, 8h}$ during 23:00 – 07:00	Individual noise events during 23:00 – 07:00 [Note 4]		
> 50 dB	> 42 dB	Normally exceeds 65 dB $L_{AF,max}$	Noise causes a material change in behaviour e.g. having to keep windows closed most of the time	Avoiding certain activities during periods of intrusion. 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.
 Increasing noise level			Increasing likelihood of impact on reliable speech communication during the day or sleep disturbance at night	At higher noise levels, more significant behavioural change is expected and may only be considered suitable if occurring for limited periods. As noise levels increase, small behaviour changes are expected e.g. turning up the volume on the television; speaking a little more loudly; having to close windows for certain activities, for example ones which require a high level of concentration. Potential for some reported sleep disturbance. Affects the acoustic environment inside the dwelling such that there is a perceived change in quality of life. At lower noise levels, limited behavioural change is expected unless conditions are prevalent for most of the time. [Note 8]
			Noise can be heard, but does not cause any change in behaviour	Noise can be heard, but does not cause any change in behaviour, attitude, or other physiological response [Note 9]. Can slightly affect the acoustic character of the area but not such that there is a perceived change in the quality of life.
≤ 35 dB	≤ 30 dB	Do not normally exceed $L_{AF,max}$ 45 dB more than 10 times a night		

- 2.41 AVO suggests that “a Level 2 assessment is not required in situations where it is expected that reasonable internal conditions, described in ProPG as BS 8233 levels relaxed by up to 5 dB, will be achieved”, with windows open.

3 METHODOLOGY

- 3.1 The assessment incorporated an environmental noise measurement survey comprising the use of a single sound level meter placed at the site boundary with Pilch Lane, approximately 5 metres from the edge of the road.
- 3.2 The measurement position is shown in Figures 5 and 6.

Figure 5: Measurement position

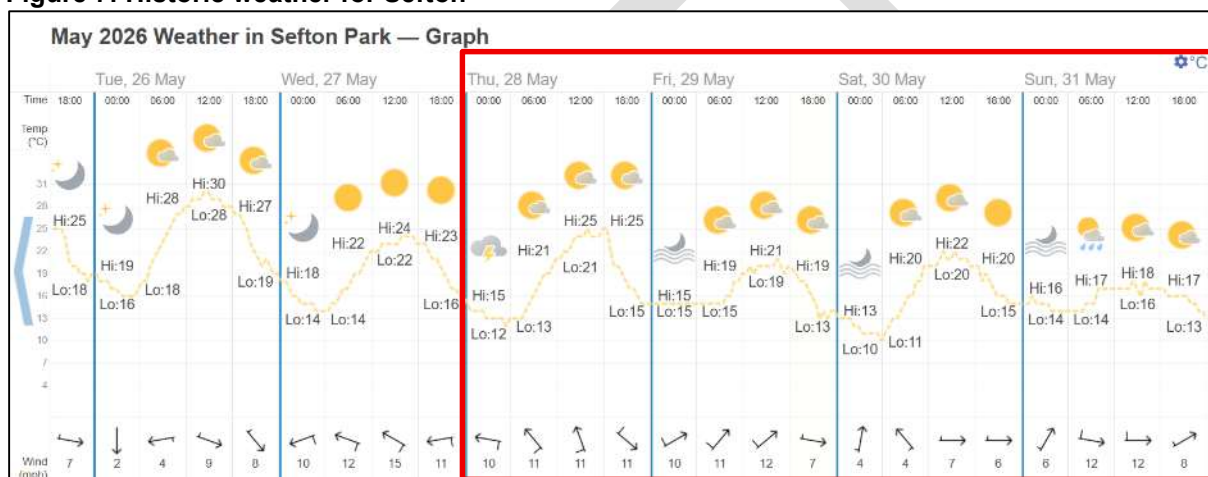


Figure 6: Meter in position (microphone circled)



- 3.3 The data gathered were 1-second and 5-minute broadband noise levels and 1/3rd octave band frequency data, between 9:35 am on Thursday 28 May and 1:00 pm on Sunday 31 May 2026. The meter also made a continuous audio recording throughout the survey.
- 3.4 The survey was carried out in accordance with the requirements of BS 7445-2:1991 *Description and measurement of environmental noise - Guide to the acquisition of data pertinent to land use*.
- 3.5 The meter used was an Nti XL2 Class 1 (IEC 61672:2013) integrating averaging sound level meter with the microphone mounted on a tripod at a height of approximately 1.3 metres above ground level, protected by a proprietary wind/weather shield. The meter was field-calibrated before and after the survey, with no significant variation in calibration level observed.
- 3.6 The weather during the survey was warm and dry throughout with wind variable in strength and direction. Conditions, generally, were suitable for undertaking noise measurements.

Figure 7: Historic weather for Sefton²



² <https://www.timeanddate.com/weather/@2638249/historic?month=5&year=2026> (accessed 10/6/2026)

4 DATA, RESULTS, ASSESSMENT & DISCUSSION

Environmental survey results

- 4.1 The recorded environmental measurement data, rounded to the nearest whole integer, for the day time (7:00am to 11:00pm) and night time (11:00pm to 7:00am) periods, are summarised in Table 4 with the overall data presented at the bottom of the Table; the overall values were calculated by consolidating all the day and night time data into 2 complete data sets and deriving the modal 90th percentile (L_{A90}), average equivalent continuous (L_{Aeq}) and 10th highest maximum (L_{Amax}) levels for each consolidated data set.

Table 4: Measurement data (environmental/traffic)

Day	Period	Measured noise (dB)	
		L_{Aeq}	L_{AFmax}
Thurs	Day	67	-
	Night	61	79
Fri	Day	68	-
	Night	60	80
Sat	Day	67	-
	Night	60	79
Sun	Day	65	-
Overall	Day	67	-
	Night	61	79

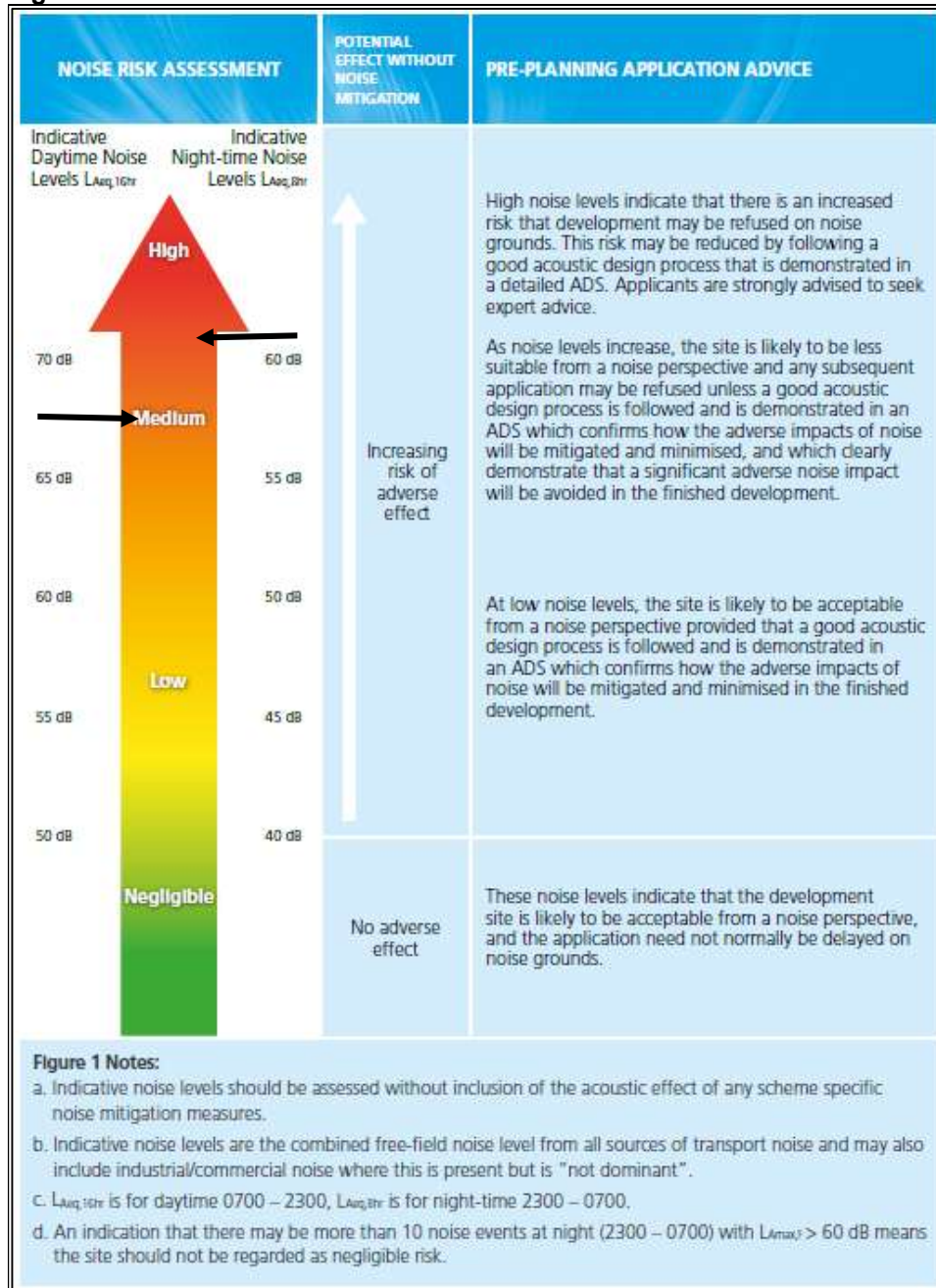
* 10th highest

- 4.2 The full 1-second and 5-minute data are too numerous to present in this report but are available on request, as are the audio recordings.
- 4.3 The data show good correlation between the various weekday and weekend periods, indicative of relatively consistent traffic movement on the road.
- 4.4 The measurement position was approximately commensurate with the front facades of the properties closest to the road, namely Plots 1 to 4.

ProPG risk assessment

- 4.5 The data in Table 4 show that the front of the properties, as indicated in Figure 8, will be at a medium risk from noise during the day and a medium to high high risk during the night. As a result of this, further detailed assessment is required.
- 4.6 This is taken to be the ADS for this development.

Figure 8: ProPG risk assessment



BS 8233 external assessment – environmental/traffic noise

- 4.7 The current layout shows that the rear gardens of Plots 1 to 4 will be largely screened from the road by the houses. Where the sides of the gardens are exposed i.e. Plots 1 and 4, the gardens will be protected by a 1.8 metre garden boundary fence, providing approximately 10 dB of noise reduction. Additionally, the closest parts of the gardens will be approximately 20 metres from the edge of the road; the day time data in Table 4 must be adjusted for the additional distance. The results of this are presented in Table 5.

Table 5: Distance and screening adjusted day time rear garden levels

Period	Calculated noise (dB)	
	L_{Aeq}	L_{AFmax}
Day	53	-

- 4.8 The data in Table 5 show that rear garden levels, in the properties closest to the road, will be within the range of 50 to 55 dB $L_{Aeq, 16h}$ suggested by BS 8233.
- 4.9 No additional mitigation measures will be required.

BS 8233 internal assessment

- 4.10 External walls are expected to be of a brickwork/cavity/blockwork construction. The sound insulation performance of such a construction is typically in the region of 45 to 55 dB R_W+C_{tr} .
- 4.11 Standard double glazing typically provides a sound insulation performance in the region of 25 to 30 dB R_W+C_{tr} whilst 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} . The glazing is expected to be the weakest element with regard to the building envelope sound insulation (excluding ventilator units).
- 4.12 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), particularly where low frequency sound energy from diesel engines is present.
- 4.13 The acoustic performance of a particular construction may differ slightly between manufacturers and therefore the sound insulation performance should be verified where possible.
- 4.14 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.
- 4.15 BS 8233 allows for a 'simple' calculation of noise break-in through a closed and partially-open window, respectively, using the single-figure time-averaged noise levels (Table 5), assuming 33 dB R_W of attenuation through a closed window and 13 dB of attenuation through a partially-open window. For the 'closed window' situation, more detailed calculations, using octave-band frequency data, are recommended where the calculated internal noise levels are within 5 dB of the BS 8233 guideline values.
- 4.16 The simple calculation of noise break-in, using the data in Table 4, are presented in Table 6, the 'closed window' calculations using data adjusted from 'free-field' to 'façade' by the addition of 3 dB.

Table 6: BS 8233 simple noise break-in calculations

Period	Calculated noise (dB)	
	L_{Aeq}	L_{AFmax}
Windows closed		
Day	40	-
Night	34	52
Windows open		
Day	54	-
Night	48	66

- 4.17 The data show that, with windows closed, ambient (L_{Aeq}) internal noise levels will be :
- Suitable for dining areas.
 - 5 dB greater than the BS 8233 guideline value for living rooms and bedrooms used during the day.
 - 4 dB greater than the BS 8233 guideline value for bedrooms at night.
- 4.18 Night time maximum (L_{Amax}) internal noise levels, with windows, are calculated to be:
- 7 dB greater than the BS 8233 guideline value for bedrooms at night.
- 4.19 Detailed frequency-related calculation of internal noise were undertaken for these rooms.
- 4.20 The current layout shows that Plots 1 to 4 will have a ground floor living room and first floor bedroom on the front façade of the properties (House Type C) whilst Plots 22 to 35, maisonettes (House Type P) will have only bedrooms on the facades facing Pilch Lane.
- 4.21 Habitable rooms with windows on the rear facades will be subject to levels significantly below the BS 8233 guideline values. No additional calculations are required for this aspect.
- 4.22 The detailed calculation of noise break-in through a closed window uses octave-band frequency data and include the provision of an acoustically-attenuating trickle ventilation unit, providing 42 dB $D_{n,e,W}$ (41 dB $D_{n,e,W} + C_{tr}$) of sound attenuation, when open.
- 4.23 The calculations take into account the typical sound insulation performance of each building element, surface area and internal room dimensions.
- 4.24 Standard thermal double glazing consisting of 4 mm glass / 12 mm cavity / 4 mm glass was assumed for habitable rooms. The measured octave band sound levels and the typical reverberation time for a habitable room were assumed.
- 4.25 Figures 9 to 14 present the closed-window detailed calculation results for the Type C properties (Plots 1 to 4) whilst Figures 12 to 14 present the detailed calculation results for the Type P properties (Plots 22 to 35) for bedrooms only.

Figure 9: Type C, day time internal noise level in living room

Title: Plot 1-4 Lounge_day Noise Break In (ISO 12354-3)												
Formula/Comment	Single Value		63	125	250	500	1000	2000	4000	8000	Rw	(C,C _{tr})
			25.2	28.2	24.7	32.1	37.5	40.3	37.3			
L _{in}				36.5	39.9	32.4	30.5	21.3	13.3			
Materials												
4mm glass/12 - 20 mm cavity/4mm glass	1.8		18.0	21.0	17.0	25.0	35.0	37.0	31.0		29	(-1,-4)
Brickwork wall	17.9		37.0	40.0	44.0	45.0	51.0	56.0	60.0		51	(-1,-4)
L _{out,s}												
L _{out,2m}	Add Element			64.7	64.7	64.5	68.1	61.6	50.6	74.5	75	
L _{out,free field}				61.7	61.7	61.5	65.1	58.6	47.6	71.5	72	
Element 1			25.2	28.2	24.7	32.1	37.5	40.3	37.3			
Plane façade	ΔL _{fs} 19.7		0.0	0.0	0.0	0.0	0.0	0.0	0.0			
Visible	X _{fs} 0.0		25.2	28.2	24.7	32.1	37.5	40.3	37.3			
L _{p,out,2m}				64.7	64.7	64.5	68.1	61.6	50.6	74.5	75	
L _{p,in}				36.5	39.9	32.4	30.5	21.3	13.3		39	dBA

Figure 10: Type C, day time internal noise level in bedroom

Title: Plot 1-4 Bedroom_day Noise Break In (ISO 12354-3)												
Formula/Comment	Single Value		63	125	250	500	1000	2000	4000	8000	Rw	(C,C _{tr})
			24.1	27.1	23.6	31.0	37.1	39.8	36.4			
L _{in}				37.6	41.1	33.4	30.9	21.7	14.2			
Materials												
4mm glass/12 - 20 mm cavity/4mm glass	2.4		18.0	21.0	17.0	25.0	35.0	37.0	31.0		29	(-1,-4)
Brickwork wall	18.7		37.0	40.0	44.0	45.0	51.0	56.0	60.0		51	(-1,-4)
L _{out,s}												
L _{out,2m}	Add Element			64.7	64.7	64.5	68.1	61.6	50.6	74.5	75	
L _{out,free field}				61.7	61.7	61.5	65.1	58.6	47.6	71.5	72	
Element 1			24.1	27.1	23.6	31.0	37.1	39.8	36.4			
Plane façade	ΔL _{fs} 21.1		0.0	0.0	0.0	0.0	0.0	0.0	0.0			
Visible	X _{fs} 0.0		24.1	27.1	23.6	31.0	37.1	39.8	36.4			
L _{p,out,2m}				64.7	64.7	64.5	68.1	61.6	50.6	74.5	75	
L _{p,in}				37.6	41.1	33.4	30.9	21.7	14.2		40	dBA

Figure 11: Type C, night time internal noise level in bedroom

Title: Plot 1-4 Bedroom_night Noise Break In (ISO 12354-3)												
Formula/Comment	Single Value		63	125	250	500	1000	2000	4000	8000	Rw	(C,C _{tr})
			24.1	27.1	23.6	31.0	37.1	39.8	36.4			
L _{in}				29.9	35.0	27.2	24.9	15.9	7.2			
Materials												
4mm glass/12 - 20 mm cavity/4mm glass	2.4		18.0	21.0	17.0	25.0	35.0	37.0	31.0		29	(-1,-4)
Brickwork wall	18.7		37.0	40.0	44.0	45.0	51.0	56.0	60.0		51	(-1,-4)
L _{out,s}												
L _{out,2m}	Add Element			57.0	58.6	58.3	62.0	55.8	43.6	67.1	68	
L _{out,free field}				54.0	55.6	55.3	59.0	52.8	40.6	64.1	65	
Element 1			24.1	27.1	23.6	31.0	37.1	39.8	36.4			
Plane façade	ΔL _{fs} 21.1		0.0	0.0	0.0	0.0	0.0	0.0	0.0			
Visible	X _{fs} 0.0		24.1	27.1	23.6	31.0	37.1	39.8	36.4			
L _{p,out,2m}				57.0	58.6	58.3	62.0	55.8	43.6	67.1	68	
L _{p,in}				29.9	35.0	27.2	24.9	15.9	7.2		34	dBA

Figure 12: Type P, day time internal noise level in bedroom

Title: Plot 22-35 Bedroom_day Noise Break In (ISO 12354-3)												
Formula/Comment	Single Value		63	125	250	500	1000	2000	4000	8000	Rw	(C, C _{tr})
L _{in}			24.8	27.8	24.1	31.5	36.5	39.3	36.4			
			36.9	40.6	33.0	31.5	22.3	14.2				
Materials												
4mm glass/12 - 20 mm cavity/4mm glass	1.6		18.0	21.0	17.0	25.0	35.0	37.0	31.0		29	(-1,-4)
Brickwork wall	5.6		37.0	40.0	44.0	45.0	51.0	56.0	60.0		51	(-1,-4)
L _{out,s}												
L _{out,2m}	Add Element			64.7	64.7	64.5	68.1	61.6	50.6	74.5	75	
L _{out,free field}				61.7	61.7	61.5	65.1	58.6	47.6	71.5	72	
Element 1			24.8	27.8	24.1	31.5	36.5	39.3	36.4			
Plane façade	ΔL _{fs}	7.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0			
Visible	X _{fs}	0.0	24.8	27.8	24.1	31.5	36.5	39.3	36.4			
L _{p,out,2m}				64.7	64.7	64.5	68.1	61.6	50.6	74.5	75	
L _{p,in}				36.9	40.6	33.0	31.5	22.3	14.2		40	dBA

Figure 13: Type P, night time internal noise level in bedroom

Title: Plot 22-35 Bedroom_night Noise Break In (ISO 12354-3)												
Formula/Comment	Single Value		63	125	250	500	1000	2000	4000	8000	Rw	(C, C _{tr})
L _{in}			24.8	27.8	24.1	31.5	36.5	39.3	36.4			
				29.3	34.5	26.8	25.5	16.5	7.3			
Materials												
4mm glass/12 - 20 mm cavity/4mm glass	1.6		18.0	21.0	17.0	25.0	35.0	37.0	31.0		29	(-1,-4)
Brickwork wall	5.6		37.0	40.0	44.0	45.0	51.0	56.0	60.0		51	(-1,-4)
L _{out,s}												
L _{out,2m}	Add Element			57.0	58.6	58.3	62.0	55.8	43.6	67.1	68	
L _{out,free field}				54.0	55.6	55.3	59.0	52.8	40.6	64.1	65	
Element 1			24.8	27.8	24.1	31.5	36.5	39.3	36.4			
Plane façade	ΔL _{fs}	7.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0			
Visible	X _{fs}	0.0	24.8	27.8	24.1	31.5	36.5	39.3	36.4			
L _{p,out,2m}				57.0	58.6	58.3	62.0	55.8	43.6	67.1	68	
L _{p,in}				29.3	34.5	26.8	25.5	16.5	7.3		34	dBA

4.26 Figures 9 to 11 broadly concur with the simple calculations, and show that, with windows closed, ambient (L_{Aeq}) internal noise levels will be:

- 4 dB greater than the BS 8233 guideline value for living rooms used during the day (Plots 1 to 4).
- 5 dB greater than the BS 8233 guideline value for bedrooms used during the day (Plots 1 to 29).
- 4 dB greater than the BS 8233 guideline value for bedrooms at night (Plots 1 to 29). However, the night time maximum noise level (Table 6) is 7 dB greater than the BS 8233 guideline value.

4.27 Consequently, for Plots 1 to 4, living room windows on the 'front' façade will need to be upgraded to provide 33 dB R_W (37 dB R_W + C_{tr}) of sound insulation, when closed.

4.28 Bedroom windows on the 'front' façade of Plots 1 to 29 will need to be upgraded to provide 36 dB R_W (40 dB R_W + C_{tr}) of sound insulation, when closed due to the elevated maximum noise levels.

- 4.29 The calculations include the provision of an acoustically-attenuating trickle ventilation unit, providing 41 dB $D_{n,e,W} + C_{tr}$ of sound attenuation, when open.
- 4.30 With respect to the houses set further back from the road, it was determined that, beyond 25 metres from the edge of the road, internal noise levels in habitable rooms, with windows closed, would be at, or below, the BS 8233 guideline levels. Consequently, for the properties beyond the first row, standard thermal glazing would provide sufficient protection from the noise of vehicle moving on Pilch Lane.
- 4.31 With windows open, the data in Table 6 show that both ambient (L_{Aeq}) and night time maximum (L_{Amax}) internal noise levels in all habitable rooms facing Pilch Lane will be significantly in excess of the BS 8233 guideline values; it was calculated that this would apply up to a distance of approximately 190 metres, beyond which internal noise levels would be at an acceptable level (the site is approximately 80 metres wide). Given the relatively open nature of the site, this would most likely apply to all habitable rooms on facades directly or obliquely facing Pilch Lane i.e. western, northern and eastern facades.
- 4.32 Consequently, habitable room windows on all facades directly, or obliquely, facing Pilch Lane would need to remain closed to achieve the guideline values.
- 4.33 BS 8233 states that 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 resulting internal noise level.
- 4.34 BS 8233 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".
- 4.35 It may, therefore, be necessary to consider **alternative means of ventilation for all habitable rooms on facades directly, or obliquely, facing Pilch Lane.**
- 4.36 Habitable rooms on facades facing away from Pilch Lane, may open windows for ventilation; the mass of the houses themselves providing at least 25 dB of sound attenuation.

5 VENTILATION & NOISE MITIGATION

Approved Document F, Volume 1: Dwellings

- 5.1 Approved Document F (Volume 1: Dwellings) provides guidance on how to comply with Part F of Schedule 1 to the Building Regulations 2010 and came into effect on 15th June 2022.
- 5.2 The aim of the document is to protect the health of occupants within a dwelling by providing adequate ventilation. Without adequate ventilation, mould and internal air pollution may become hazardous to health.
- 5.3 The ventilation strategy has not yet been established; the ventilation systems in ADF, applicable to all the residential units, are examples of systems that comply with the Building Regulations. Other ventilation systems may be acceptable if they can be shown to meet an equal level of performance.
- 5.4 The ventilation strategy in ADF relies on a combination of all of the following:
- a) Extract ventilation from rooms where water vapour or pollutants are likely to be released (e.g. bathrooms, WC's, kitchens and utility rooms), to minimise their spread to the rest of the building. Ventilation fans may be either intermittent operation or continuous operation.
 - b) Whole dwelling ventilation to provide fresh air to the building and to dilute, disperse and remove water vapour and pollutants not removed by extract ventilation.
 - c) Purge ventilation to remove high concentrations of pollutants and water vapour. Purge ventilation is used intermittently and required only for pollutants produced by occasional activities (e.g. fumes from painting).
- 5.5 With regard to whole dwelling ventilation, supply air for the dwellings should be delivered by either continuous supply fans or background ventilator units.
- 5.6 The minimum whole dwelling ventilation rate for the supply of air to the habitable rooms in a dwelling should meet a minimum rate of 0.3 litres per second per m² of internal floor area and also a minimum rate (l/s) determined by the number of bedrooms, as specified in Table 1.3 of the document.
- 5.7 The document also provides minimum standards for purge ventilation for rapidly diluting indoor air pollutants and extracting water vapour where necessary in habitable rooms. For domestic-type buildings, Part O (overheating) may require a higher standard in order to remove excess heat.

Acoustically rated ventilator units

- 5.8 The assessed internal levels included the use of a manually controlled, acoustically attenuating, trickle ventilator. These are typically located over the window frames, within the window frames or just above the glass. Background ventilators are intended to normally be left open.
- 5.9 Ventilation should be controllable; controls may be either manual (i.e. operated by the occupant) or automatic. Background ventilators should be at least 1700 mm above floor level, to reduce cold draughts, but still be easy for the occupant to reach.
- 5.10 Installing a background ventilator directly through a wall that provides the equivalent areas described in Approved Document F can also be an acceptable route to compliance.
- 5.11 For guidance, example manufacturers of acoustically-rated ventilator units include:

- [EHA² | Aereco](#)
- [2500EA/5000EA AC1 \(greenwood.co.uk\)](#)
- [glazed in acoustic vents - Airvent DGL SUPER \(brookvent.co.uk\)](#)

- 5.12 The minimum 'equivalent area' of background ventilators for natural ventilation should follow the guidance in Table 1.7 of Approved Document F for each room type.
- 5.13 Bathrooms, toilets, utility rooms and circulation areas do not require sound attenuating ventilator units. Standard (non-acoustic) trickle vents may be fitted to achieve the required equivalent area.
- 5.14 It should be noted that a window with a 'night-latch' position is not adequate for background ventilation, due to the risk of draughts, security issues and the difficulty of measuring the equivalent area.

Mechanically assisted ventilation

- 5.15 Potentially, the only option with regard to ventilating and cooling habitable rooms in the properties, whilst achieving a high level of facade sound insulation, would be to use some form of continuous mechanical extraction, Type 3 and 4 Systems within ADF.
- 5.16 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).
- 5.17 Such systems can also be supplied with a 'boost' function in order to reduce the need to open windows for purge ventilation.
- 5.18 Particular attention should be paid to the construction of bedroom ceilings and the mounting of any motor units in order to minimise the noise transmission into adjacent rooms including noise from ducts and also considering 'cross-talk' i.e. the transmission of occupant noise between dwellings through ventilation ducting.
- 5.19 It is recommended that a double-boarded ceiling/partitioning construction and/or acoustically enhanced loft/cavity-hatch is used where there is a loft/cavity mounted motor/control unit.

Noise from mechanical systems (comments within Approved Document F)

- 5.20 With regard to noise from mechanical systems, page 6 of Approved Document F 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 $L_{Aeq,1min}$ 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 proportion of the fluctuating level should be considered as 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.

Overheating assessment (AD(O))

4.37 Section 3 of ADO suggests that:

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

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

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

4.38 The data in Table 6 indicate that this applies all bedroom on western, northern and eastern facades of the properties.

AVO

4.39 The ProPG/AVO Level 1 assessment shows that the habitable rooms with windows facing Manchester Road are at a medium risk from noise during the day and a high risk during the night.

4.40 The AVO suggests that, where a site is at a high risk from noise, a Level 2 assessment may be required. This requires data from a SAP assessment or TM59 overheating assessment; this information is not currently available and can be undertaken at a later stage, potentially through the use of a suitably-worded planning condition requiring this be undertaken prior to submission of the ventilation design to the Building Control Authority.

6 CONCLUSION

- 6.1 The assessment has shown that the site is principally affected by traffic noise from Pilch Lane.
- 6.2 The assessment concludes that, with respect to the Pro-PG, the front facades of Plots 1 to 4 and 22 to 35 will be at a medium risk from noise during the day and a medium to high risk during the night whilst, to the rear, the risk is negligible to low during the day and low during the night time.
- 6.3 External garden/patio areas are shown to be suitably protected from traffic noise, during the day time, by the buildings themselves and by garden boundary fencing.
- 6.4 Internal noise levels on the northern (front) facades of Plots 1 to 4 and 22 to 35, with windows open, are calculated to be greater than the BS 8233 guideline values. Consequently, windows will need to remain closed in order to achieve the BS 8233 guideline values. It was calculated that this would apply to the western, northern and eastern facades of all properties within the development where directly, or obliquely facing Pilch Lane.
- 6.5 Internal noise levels on the northern (front) facades of Plots 1 to 4 and 22 to 35, with windows closed, are calculated to be greater than the BS 8233 guideline values; up-rated glazing specifications are recommended.
- 6.6 Habitable rooms on the rear (southern) facades of these Plots, and properties beyond the first row of houses, will be suitably protected from traffic noise with standard thermal double-glazing and may also use openable windows for ventilation.
- 6.7 Where windows need to remain closed to achieve the guideline levels, alternative means of providing sufficient levels of ventilation will be required. This is likely to be a type 3 or 4 system as defined in ADF.
- 6.8 With respect to overheating, the guidance in ADO indicates that the western, northern and eastern facade bedroom windows are likely to remain closed at night. A detailed overheating assessment will be required but this has not yet been carried out. Thus, whilst the data suggest a Level 2 AVO assessment is required for these rooms, this can not be completed until the detailed SAP/thermal modelling has been conducted. It is suggested that the provision of the Level 2 AVO assessment can be achieved through the use of a suitably-worded planning condition.
- 6.9 The assessment concludes, therefore, that with the provision of up-rated glazing, where recommended, and suitable alternative ventilation, noise need not be a reason for refusal of planning permission.

APPENDIX A

Glossary of acoustic terms

Ambient noise: the noise from all sources, both near and far, at any given time. Conventionally defined using the A-weighted equivalent continuous noise level (L_{Aeq}) [see below].

Background noise level (dB L_{A90}): In the UK, the 90th percentile noise level (L_{A90}) is generally used to define 'background' noise. This is a statistical parameter describing the noise level that is exceeded for 90% of the measurement or assessment time. Its value lies in the fact that it is a statistical value, towards the lower end of a measured range of data, and which is relatively 'stable' i.e. not adversely affected by occasional high-energy noise events.

Decibel (dB): a unit of level derived from the logarithm of the ratio between the value of a quantity and a reference value. It is used to describe the level of many different quantities. For sound pressure level the reference quantity is 20 micro-Pascals (μPa), the threshold of normal hearing is in the region of 0 dB, and 140 dB is the threshold of pain. A change of 1 dB is only perceptible under controlled conditions.

dB(A) / A-weighting: decibels measured on a sound level meter incorporating a frequency weighting (A weighting) which differentiates between sounds of different frequency (pitch) in a similar way to the human ear. Measurements in dB(A) broadly agree with people's assessment of loudness. A change (in steady noise) of 3 dB(A) is the minimum perceptible under normal conditions and a change of 10 dB(A) corresponds roughly to halving or doubling the *loudness* of a sound. The background noise level in a living room may be about 30 dB(A); normal conversation about 60 dB(A) at 1 metre; heavy road traffic about 80 dB(A) at 10 metres; the level near a pneumatic drill about 100 dB(A).

$L_{Aeq,T}$: the equivalent continuous sound level - the sound level of a notionally steady sound having the same energy as a fluctuating sound over a specified measurement period (T). L_{Aeq} is used to describe many types of noise and can be measured directly with an integrating sound level meter.

L_{Amax} : the maximum single-event noise level attained during a measurement period.

Noise: any audible sound. Often defined as unwanted sound. Can be damaging to hearing if it is too loud or can be just annoying if it interferes with the normal enjoyment of others.

Sound / sound pressure: a fluctuation in air pressure over the static ambient pressure.

Sound pressure level: the sound pressure relative to a standard reference pressure of 20 μPa (20×10^{-6}) on the decibel scale.