

**Assessment of the Existing Noise Climate in the Vicinity of the
Proposed Residential Development at 3 Maclure Road,
Rochdale**

Report Prepared for:

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1.0 Summary

Planning consent is being sought to permit the conversion and extension of the existing commercial office building, currently occupied by R. B. Smedley Insurance Brokers, located at 3 Maclure Road in Rochdale, to form a new eight bedroom house in multiple occupation (HMO) with accommodation arranged over two floors.

In support of the application for planning permission, Druk Limited was commissioned to undertake an assessment of the existing noise climate in the vicinity of the proposed residential development at 3 Maclure Road in Rochdale. Using data from the existing noise climate assessment, calculations will be undertaken to assess the likely internal noise climate within the proposed residential accommodation, resulting from external noise break-in.

The existing noise climate in the vicinity of the proposed development at 3 Maclure Road in Rochdale was regarded as being essentially urban in nature and character and was subject to noise contributions primarily from road traffic. Some intermittent noise contributions, during 'normal' working hours only, from the U R Auto Care and Stop and Go indoor car wash which, were audible but generally only during the infrequent lulls in the road traffic.

As the results from the noise survey highlighted that the existing noise climate was quite variable, the assessment of the likely internal sound levels within the proposed accommodation will be undertaken using the 90th percentile values of the measured L_{Aeq} and L_{Amax} sound levels. The use of the 90th percentile values should ensure that the recommendation contained within the Planning and Noise: Professional Guidance on Planning and Noise (ProPG) document, namely: to deliver "*the optimum acoustic outcome for a particular site*" without resorting to "*overdesign or gold plating*", would be achieved.

Applying representative sound levels from the existing noise climate survey and combining these with the stated assumptions relating to the sound insulation of the façade elements, calculations have been undertaken to evaluate the likely internal noise climate within the proposed accommodation. The calculations have demonstrated that the sound insulation of the façade elements of the proposed development would be sufficient to secure that the break-in noise levels would not exceed the adopted design guide values. Despite this it is recommended that alternative ventilation would be required in order to permit the internal spaces to be adequately ventilated without having to rely on opening windows.

As a consequence, it is suggested the sound insulation of the proposed façade elements detailed within this report, combined with the proposed alternative ventilation provision, would be sufficient to limit the ingress of external noise to the proposed residential accommodation in compliance with the adopted design guidance. The proposed mitigation measures would also comply with the requirement contained within the ProPG document which requires that the acoustic design statement "*confirms how the adverse impacts of noise will be mitigated and minimised, and which clearly demonstrate that a significant adverse noise impact will be avoided in the finished development*".

The results of the assessment also indicate that with respect to the proposed development, the requirements of paragraph 187 of the NPF, namely: *“Planning policies and decisions should ensure that new development can be integrated effectively with existing businesses and community facilities... Existing businesses and facilities should not have unreasonable restrictions placed on them as a result of development permitted after they were established.”* Similarly, the assessment also indicates that the proposed development would comply with the long term vision of the NPPF, namely: the avoidance of significant adverse impacts on health and quality of life and the mitigation and minimisation of adverse impacts on health and quality of life.

As a consequence, it is suggested that based on the assessments contained within this report, the existing noise climate in the vicinity of 3 Maclure Road should not be regarded as an impediment to the granting of planning permission, with respect to the proposed residential development.

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2.0 Introduction

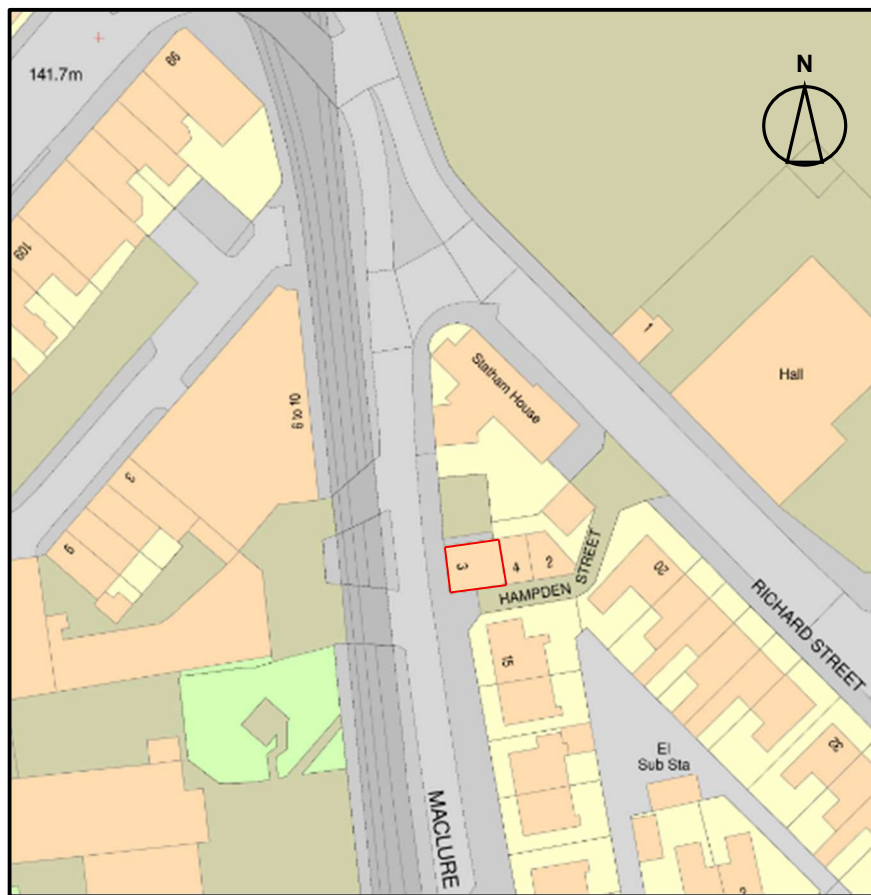
Planning consent is being sought to permit the conversion and extension of the existing commercial office building, currently occupied by R. B. Smedley Insurance Brokers, located at 3 Maclure Road in Rochdale to form a new eight bedroom house in multiple occupation (HMO) with accommodation arranged over two floors.

In support of the application for planning permission, Druk Limited was commissioned to undertake an assessment of the existing noise climate in the vicinity of the proposed residential development at 3 Maclure Road in Rochdale. Using data from the existing noise climate assessment, calculations will be undertaken to assess the likely internal noise climate within the proposed residential accommodation, resulting from external noise break-in.

3.0 Site Description

The proposed residential accommodation would be formed from the conversion and extension of the existing commercial office building located at 3 Maclure Road in Rochdale (figure 1 and photograph 1 overleaf). To the North of the proposed development is an existing residential accommodation building - Statham House - (photograph 2 overleaf) with the junction of Maclure Road and Richard Street and the proposed new Rochdale Sixth Form and Hopwood Hall College (photograph 3 overleaf) beyond. To the South of the proposed development is Hampden Street, with the existing residential dwellings (photograph 1 overleaf) on Maclure Road and the St John the Baptist Church and primary school beyond (photograph 4 overleaf). Immediately to the West of the proposed development is Maclure Road itself, incorporating the tram lines, with the U R Auto Care building, Stop and Go car wash and the Phantom Lounge providing deserts and shisha beyond (photograph 5 overleaf). To the East of the proposed development are existing residential dwellings on Hampden Street with Richard Street beyond.

Figure 1. Site of the proposed residential development, 3 Maclure Road in Rochdale (edged in red)



Photograph 1. Existing commercial office building at 3 Maclure Road, Rochdale (looking East)



Photograph 2. Statham House to the North of the proposed development site



Photograph 3. Site of the proposed new Rochdale Sixth Form and Hopwood Hall College (looking North East)



Photograph 4. St John the Baptist Church and primary school (looking South West)



Photograph 5. U R Auto Care, Stop and Go car wash and the Phantom Lounge (looking West)



4.0 Assessment Criteria

As planning permission is currently being sought for the proposed development, no planning conditions currently exist. Consequently, the principal aim of this report will be to evaluate the potential suitability of the proposed development site for residential use, with respect to the prevailing noise climate in the immediate vicinity. With reference to these aims, the proposed development will be assessed with reference to the guidance contained within: the National Planning Policy Framework (NPPF), the Noise Policy Statement for England (NPSE) and the National Planning Practice Guidance (NPPG), British Standard (BS) 8233:2014 "Guidance on sound insulation and noise reduction for buildings", the Planning and Noise: Professional Guidance on Planning and Noise (ProPG), May 2017, document and the guidance contained within the Acoustics, Ventilation and Overheating - Residential Design Guide.

4.1 National Planning Policy Framework (NPPF), the Noise Policy Statement for England (NPSE) and the National Planning Practice Guidance (NPPG)

The National Planning Policy Framework (NPPF), the Noise Policy Statement for England (NPSE), originally released in 2010, and the National Planning Practice Guidance (NPPG) do not provide quantitative criteria for assessment purposes. Instead, the documents detail general policy aims, statements as well as providing some guidance on how certain situations can be interpreted.

The main statement on noise contained within the revised NPPF, issued in December 2023, is to be found in paragraph 185:

- 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 impact 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; and*
 - c) limit the impact of light pollution from artificial light on local amenity, intrinsically dark landscapes and nature conservation.*

In addition, paragraph 187 of the NPPF is also relevant and states:

- 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.

The long term vision of the NPPF also refers to the NPSE and, as such, details the following aims:

'Through the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development:

- Avoid significant adverse impacts on health and quality of life*
- Mitigate and minimise adverse impacts on health and quality of life and*
- Where possible, contribute to the improvement of health and quality of life.*

In order to reflect these objectives, the NPSE referenced concepts utilised by the World Health Organisation, which in turn employed concepts from toxicology and applied them to noise impacts. These concepts are:

- NOEL – No Observed Effect Level. In simple terms, below this level, there is no detectable effect on health and quality of life due to the noise.
- LOAEL – Lowest Observed Adverse Effect Level. This is the level above which adverse effects on health and quality of life can be detected.
- SOAEL – Significant Observed Adverse Effect Level. This is the level above which significant adverse effects on health and quality of life occur.

SOAEL is clearly something the policy seeks to avoid in aim 1. Aim 2 represents situations between SOAEL and LOAEL, and seeks to minimise and mitigate the possible effects.

It should be borne in mind that neither the NPPF or the NPSE detail specific acoustic criteria for new residential developments. Despite this, the documents do require a consideration of the possible effect that the existing noise climate may have on a proposed development and the effect that a proposed development may have on the pre-existing noise climate.

The NPPG section on noise adds some further detail, much of it reproducing the NPPF and NPSE, but some useful qualitative guidance is provided in the noise exposure hierarchy table and this is reproduced in table 1 overleaf.

Table 1. Noise exposure hierarchy table

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

The NPPG also highlights that the subjective nature of noise means that there is not a simple relationship between noise levels and the possible impact on those affected. It recognises that any effects will depend on how various factors combine in any particular situation, including absolute noise levels and how they may compare with the underlying background noise, the impulsiveness or intermittence pattern of the noise, its spectral content, and the time of day. It discusses in very general terms the issues to consider

when introducing noise sources to existing noise sensitive area, new residential development in areas affected by existing noise sources (most of which have their own specific guidance, such as BS 4142, BS 8233, etc.) and the potential impact on wildlife.

4.2 BS 8233:2014 “Guidance on Sound Insulation and Noise Reduction for Buildings”

BS 8233:2014 draws together research and best practice relating to building design, providing guidance to facilitate the development of buildings that have internal noise environments that are consistent with and appropriate for their intended use. The Standard states that the guidance it contains is applicable to the design of new buildings, or refurbished buildings undergoing a change of use and as such it is deemed applicable to this proposal.

The British Standard highlights methods for the control of noise from a number of sources including external noise and building services etc., as well as evaluating the effect that noise from these sources may have on the acoustics of the internal spaces. With reference to the design guidance relating to the internal noise climate of dwelling houses flats and rooms in residential use, it is suggested that the guidance is applicable to 'anonymous' noise without a 'specific' character, and this is typically the situation where road traffic type noise or similar transportation noise is the dominant or principal contributor to the existing noise climate. This being the case BS 8233:2014 indicates that it would be desirable for the internal noise levels, resulting from the break-in of external noise, not to exceed the guide values detailed within table 4 of section 7.7.2. The main elements of the guidance contained within table 4 of section 7.7.2 of BS 8233:2014 are reproduced in table 2 below.

Table 2. Indoor ambient noise levels for dwellings (reproduced from table 4 of BS8233:2014)

Activity	Location	0700 to 2300	2300 to 0700
Resting	Living room	35dB L_{Aeq} , 16 hour	-
Dining	Dining room/area	40dB L_{Aeq} , 16 hour	-
Sleeping (daytime resting)	Bedroom	35dB L_{Aeq} , 16 hour	30dB L_{Aeq} , 8 hour

It should also be noted that BS8233:2014 applies the frequently quoted 'rule of thumb' that where a window is partially open for ventilation purposes etc., the sound levels just outside the window will be around 15dB higher than the levels just inside the window.

In addition to the internal noise design guidance detailed above, supplementary notes 4, 5 and 7 to table 4 of section 7.7.2 are deemed appropriate to this assessment and state the following:

Note 4. *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.*

Note 5. *If relying on closed windows to meet the guide values, there needs to be an appropriate alternative ventilation that does not compromise the façade insulation or the resulting sound level.*

Note 7. *Where development is considered as necessary or desirable, despite external noise levels above WHO guidelines, the internal target levels may be relaxed by up to 5dB and reasonable internal conditions still achieved.*

4.3 Planning and Noise: Professional Guidance on Planning and Noise (ProPG)

This document was published in May 2017 and was produced jointly by representatives of the Chartered Institute of Environmental Health (CIEH), the Institute of Acoustics (IoA) and the Association of Noise Consultants (ANC). The ProPG document seeks to provide guidance on and complement the wider aims contained within the Noise Policy Statement for England (NPSE) and the additional guidance contained within the National Planning Policy Framework (NPPF). In addition, the ProPG document acknowledges the contribution made by existing guidance contained within both the World Health Organisations (WHO) "Guidelines for Community Noise" and (BS) 8233:2014 "Guidance on sound insulation and noise reduction for buildings".

The ProPG document guidance is restricted to the consideration of new residential developments and the potential implications for these developments arising from predominantly airborne noise that typically emanates from transportation noise sources. Despite this and although the proposal considered within this report relates to the proposed conversion of an existing building, the initial assessment principles contained within the ProPG document are considered pertinent to this scheme and as such the guidance will be adopted here.

The document utilises a risk assessment based two stage approach to: Stage 1 - undertake an "initial noise risk assessment of the proposed development site" and Stage 2 - undertake a "systematic consideration of four key elements". With reference to the four key elements of the systematic assessment, these are defined as:

- 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".

It should however be remembered that the Stage 1 'noise risk categories' are categories designed for the initial assessment of the noise exposure of a site and for the categorisation of the prevailing noise climate with reference to the proposed development.

With reference to Stage 1, the requirement to undertake a noise risk assessment of the proposed development site, the site 'risk' category boundaries are described with reference to the external free field noise levels that would affect a proposed development and these are contained within figure 1 of Section 2 of the document. Whilst the ProPG document does not attribute specific noise levels to the 'risk' categories, an interpretation of the noise levels presented within figure 1 of the ProPG document is contained in table 3 overleaf. Again, the guidance relates primarily to 'anonymous' type noise.

Table 3. Level 1 assessment 'risk' boundary noise levels (derived from figure 1 of the ProPG document)

Indicative noise levels		Noise 'risk' assessment
Daytime (07:00 - 23:00) $L_{Aeq, 16 \text{ hour}}$	Night time (23:00 - 07:00) $L_{Aeq, 8 \text{ hour}}$	
$\leq 50\text{dB}$	$\leq 40\text{dB}$	Negligible
$> 50 \text{ and } \leq 63\text{dB}$	$> 40 \text{ and } \leq 53\text{dB}$	Low
$> 63 \text{ and } \leq 68\text{dB}$	$> 53 \text{ and } \leq 58\text{dB}$	Medium
$> 68\text{dB}$	$> 58\text{dB}$	High

The guiding principle of the ProPG document with reference to the existing noise climate is that once the potential impact on a development has been quantified, good acoustic design should be implemented to mitigate the potential effects that the existing noise climate may have on the proposed resident of any new residential development. In this case the good design principle relates to both the internal acoustic environment within dwellings and any external amenity areas serving those dwellings. With reference to good acoustic design Pro PG does recognise that this does not mean "overdesign or gold plating", but it does mean delivering "the optimum acoustic outcome for a particular site".

With respect to the internal noise level guidelines, ProPG makes reference to the guidance contained within table 4 of section 7.7.2BS 8233:2014, reproduced in section 4.2 above. Whilst recognising that it is preferable to achieve the internal noise guidelines ProPG does, at paragraph 2.30, recognise that national planning and noise policy does not always require that these levels are achieved. This is particularly the case where to do so would "disproportionately increase the cost of the development".

Remaining with the issue of internal noise level guidance and the proposed levels for individual noise events, expressed as an L_{max} , the guidance contained within Appendix A of the ProPG is instructive. The Appendix contains a short summary of research into the effects of individual noise events and the effect that these can have on sleep. In the light of this summary the document, at paragraph A.20, states the following, "...therefore, 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 events on sleep can be regarded as negligible".

The potential impact of ventilation on the acoustic integrity of the façade of a dwelling is also addressed by the ProPG document. The document suggests that good acoustic design should be used to achieve the internal design targets in noise sensitive rooms with windows open. Here it is assumed that this relates to windows partially open for ventilation purposes. Despite this it also recognises the limitations of acoustic design and highlights that internal noise levels may only be achievable with window closed in certain environments such as urban areas or sites adjacent to transportation noise sources. In these situations, it is suggested that internal noise levels are assessed with windows closed but with any façade openings used for ventilation purposes in their open position. Finally, and with reference to ventilation ProPG at paragraph 2.35 states

that "*internal noise level guidance are generally not applicable under purge ventilation conditions*".

4.4 Acoustics, Ventilation and Overheating - Residential Design Guide

There is an increasing recognition that in addition to securing an acceptable internal noise climate, there needs to be a degree of integration between acoustic design and the requirement to address both the ventilation and thermal comfort of a dwelling. Typically, achieving a good internal acoustic environment has been achieved by requiring dwelling windows to remain closed, but most ventilation and overheating assessments look to the ability to open windows to permit both adequate ventilation and the management of the internal thermal environment. In many locations, particularly urban environments, it is recognised that opening windows will typically have negative impacts on the internal acoustic environment within a dwelling.

In an attempt to provide additional guidance on the interplay between suitable ventilation to address potential overheating within a noisy environment, the "Acoustics Ventilation and Overheating Residential Design Guidance", hereafter referred to as the AVO Guide, has been formulated by the Association of Noise Consultants (ANC). This comprehensive document seeks to strike a balance between the, often competing, requirements relating to both good acoustic conditions within a residential dwelling and the provision of ventilation to mitigate potential overheating.

In its simplest form the AVO Guide provides for a two-stage assessment procedure. The first stage, level 1, may be considered as a 'site risk' assessment and is based on an evaluation of the external noise levels to which a residential dwelling may be exposed. It should however be borne in mind that the 'site risk' relates to the categorisation of the prevailing noise climate. A level 2 assessment seeks to assess the potential adverse effects that may result and would be based on a combination of the internal ambient noise levels the duration, times and the frequency when open windows would be required etc.

Typically, where level 1 assessment reveals that a proposed development is within a 'medium' or 'high' risk category, with respect to the existing noise climate, it is suggested that a Level 2 assessment should be carried out. Such an assessment would evaluate the likely internal noise levels for an overheating condition and the associated risk of adverse effect. It is anticipated that a level 2 assessment would consider elements including: the duration over which additional ventilative cooling may be required and the degree of window opening that would 'control' the potential overheating etc. Both of these elements would typically be considered in a CIBSE TM 59 assessment, conducted by other parties, and so would be considered to be beyond the remit of this report.

With reference to a level 1 assessment, the various site 'risk' categories have been described according to the external free field noise levels that are likely to affect a proposed development and these are detailed in table 3.2 of the Guide. Although the AVO Guide does not attribute specific noise levels to the various 'risk' categories, an interpretation of the noise levels presented within table 3.2 of the AVO Guide and the likely 'risk' categories to which they correspond, is produced in table 4 overleaf. It must be remembered that the guide values presented within table 4 are guideline values to

be employed during an initial assessment and again relate primarily to 'anonymous' type noise.

Table 4. Level 1 assessment 'risk' boundary noise levels (derived from table 3.2 of the AVO Guide)

External free - field noise level at façade		
Daytime (07:00 - 23:00) $L_{Aeq, 16 \text{ hour}}$	Night time (23:00 - 07:00) $L_{Aeq, 8 \text{ hour}}$	Level 1 'risk' category
$\leq 52\text{dB}$	$\leq 47\text{dB}$	Negligible
$> 52 \text{ and } \leq 57\text{dB}$	$> 47 \text{ and } \leq 52\text{dB}$	Low
$> 57 \text{ and } \leq 62\text{dB}$	$> 52 \text{ and } \leq 55\text{dB}$	Medium
$> 62\text{dB}$	$> 55\text{dB}$	High

Note 4. Where 78dB L_{AFmax} is normally exceed during the night time period a level 2 assessment is recommended.

The guidance also recognises that there may be instances where occupants may 'trade' the internal acoustic environment by accepting higher noise levels for a period of time in order to maintain control over the thermal environment.

The document relates primarily to residential developments that are subject to airborne noise from transportation noise sources. Despite its focus on new residential dwellings, predominantly flats and houses, the AVO Guide does suggest that it may also be applicable to other forms of residential dwellings such as care homes and residential institutions. Although the document's focus is primarily on new residential dwellings rather than the conversion of an existing building as is the case here, the initial assessment principles contained within the AVO Guide are considered pertinent to this scheme and as such the guidance will be adopted here.

The potential implications of opening windows on the internal acoustic environment and the possible outcomes for the occupants of the ventilated spaces are summarised in table 5 overleaf, which combines the guidance contained within table 3.3 and figures B-2 and B-3 from the AVO Guide.

In essence the higher the external noise level the more likely it is that the internal noise levels would exceed the guide values detailed within BS 8233:2014. As a consequence, it is more than likely that additional or alternative ventilation requirements will be required in order to effectively ventilate the internal spaces, in all but purge ventilation conditions, without prejudicing the façade sound insulation. It must however be remembered that where alternative mechanical ventilation is specified, the emission of noise from such systems must not lead to an unnecessary increase in the internal noise climate. The likelihood for potential adverse outcomes increases with the duration of exposure to noise, with shorter potential exposures resulting in a lower risk of adverse outcomes.

Table 5. Guidelines for a level 2 assessment (derived from table 3.3 and figures B.2 and B.3 of the AVO Guide)

Internal ambient noise level (from road traffic noise)			Potential outcome
$L_{Aeq,T}$ during 07:00 - 23:00	$L_{Aeq,T}$ during 23:00 - 07:00	Individual noise events, L_{AFmax} , during 23:00 - 07:00	
≤ 35 dB	≤ 30 dB	45dB not normally exceeded more than 10 times a night	LOAEL: Noise can be heard but does not cause any change in behaviour
> 35 and ≤ 40 dB	> 30 and ≤ 35 dB	Increasing adverse effect	Increasing adverse effect
> 40 and ≤ 50 dB	> 35 and ≤ 42 dB		
> 50 dB	> 42 dB	Normally exceeds 65dB	Exceeds SOAEL: Noise causes a material change in behaviour, e.g. keeping windows closed

In essence the higher the external noise level the more likely it is that the internal noise levels would exceed the guide values detailed within BS 8233:2014. As a consequence, it is more than likely that additional or alternative ventilation requirements will be required in order to effectively ventilate the internal spaces, in all but purge ventilation conditions, without prejudicing the façade sound insulation. It must however be remembered that where alternative mechanical ventilation is specified, the emission of noise from such systems must not lead to an unnecessary increase in the internal noise climate. The likelihood for potential adverse outcomes increases with the duration of exposure to noise, with shorter potential exposures resulting in a lower risk of adverse outcomes.

4.5 Approved Document O (ADO) - Overheating

The guidance relating to the limitation of unwanted solar gains in summer in addition to providing an 'adequate means' of removing heat from the indoor environment, are contained within Approved Document O (ADO) of the Building Regulations 2010 which came into effect in June 2022. It must however be borne in mind that these requirements relate to new residential buildings only. Despite this, it is accepted that the proposed development at 3 Maclure Road will incorporate both existing (repurposed) and new elements. As such the guidance contained within ADO will be applied to both elements of the proposed development, although with reference to the existing building element, the guidance may be regarded as 'good practice' guidance rather than a mandatory consideration.

Paragraph 2.10 of ADO indicates that the removals of excess heat from the interior spaces of applicable buildings may be achieved by the following methods:

- Opening windows
- Ventilation louvres in external walls
- A mechanical ventilation system
- A mechanical cooling system.

With reference to the use of open windows to remove excess heat, section 3 of ADO considers the situation where the external noise climate is 'noisy' enough to discourage

the opening of windows, as this would lead to potentially unacceptable high internal noise levels. In this respect, paragraphs 3.2 and 3.3 of ADO refer to noise within “bedrooms at night” and in this respect Section 3.3 of ADO states 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).

With reference to the above noise levels, ADO indicates that where the opening of windows to remove excess heat would result in the above noise levels being exceeded, an overheating mitigation strategy must be implemented. However, in the case of mechanical cooling, requirement 02(b) of ADO states that this should only be applied where “sufficient heat cannot be removed from the indoor environment without it”.

Immediately it can be seen that the suggested indoor noise levels within bedrooms during the night time period detailed within Section 3.3 of ADO, are higher than the guide values for the same environment detailed within BS 8233:2014. This being the case, where an alternative ventilation strategy is considered appropriate, this will be based on securing internal noise levels in compliance with the guide values contained within BS 8233:2014.

4.6 Sound Insulation of a Partially Open Window

With respect to the level of sound insulation provided by a partially open window, assessments as to the level of sound insulation offered can and do vary. As previously stated BS8233:2014 applies the 'rule of thumb' that a window partially open for ventilation purposes, will provide around 15dB sound insulation. In this case it is suggested that the sound levels just outside the window will be around 15dB higher than the levels just inside the window.

In addition to the 15dB quoted within BS 8233:2014, commonly cited sound insulation values relating to the sound insulation provided by a partially open window include the Acoustics, Ventilation and Overheating - Residential Design Guide (AVO Guide) formulated by the Association of Noise Consultants (ANC), which suggests that a partially open window would provide a sound insulation value of around 13dB. Additional data presented by Søndergaard & Egedal (2016) suggested that a top hung window with an opening equivalent to 0.35m², would provide a sound insulation value of around 9dB R_w . With reference to the Søndergaard & Egedal (2016) findings this, in our experience, appears to be a little pessimistic about the potential sound insulation provided by a partially open window. Despite this, the degree of window opening will play a role in determining the sound insulation. It is however accepted that a partially open window would be expected to provide more sound insulation than would a fully open window.

5.0 Survey Details

5.1 Survey Times and Personnel

The noise survey to evaluate the existing noise climate in the vicinity of the proposed residential development was undertaken between 10:40 hours on Tuesday 13th January to 10:40 hours on Wednesday 14th January 2026. The existing noise climate survey was conducted by Mr. R Smith of Druk Limited and was attended between 11:00 – 12:00 hours on the 13th January, but unattended for the remainder of the survey. Despite the fact that the majority of the noise survey was unattended, simultaneous audio recordings were made throughout the 24 hour survey. These audio recordings were subsequently interrogated to obtain a 'picture' of the existing noise climate and to identify any events that were regarded as being significant.

5.2 Weather

At the commencement and conclusion of the existing noise climate survey the weather conditions were as follows:

Tuesday 13th January 2026

All surfaces were wet, cloud cover was 100%, the temperature was approximately 8°C, the wind speed was approximately 0.8m/s from a North Easterly direction and the barometric pressure was approximately 984mb.

Wednesday 14th January 2026

All surfaces were dry, cloud cover was approximately 20%, the temperature was approximately 5°C, the wind speed was approximately 0.5m/s from a Northerly direction and the barometric pressure was approximately 989mb.

5.3 Equipment

The noise survey was conducted using the equipment detailed in the table 6 below. The sound level meter was field calibrated before, after and during the survey as necessary, during which time no significant deviation in the calibrated levels was observed.

Table 6. Equipment used during the existing noise climate survey

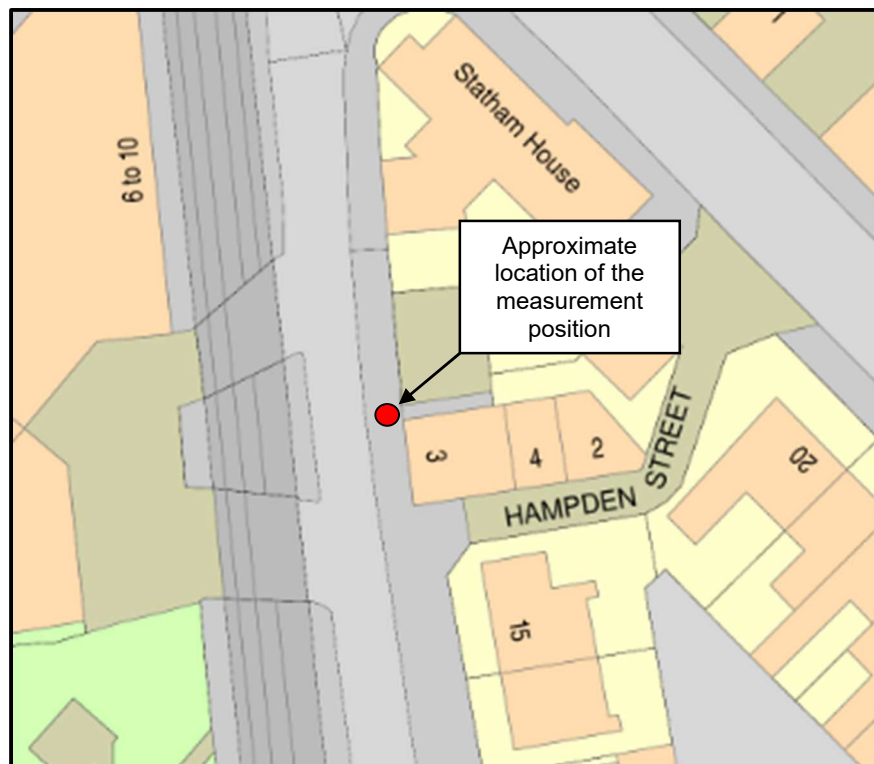
Equipment description	Manufacturer	Model number	Serial number
Acoustic calibrator	Norsonic AS	Nor 1251	31522
Sound level meter	NTI Audio	XL2-TA	A2A-23832-E1
Microphone pre-amplifier	NTI Audio	MA220	141157
Microphone	NTI Audio	M2230	A26843
Microphone weather protection enclosure	NTI Audio	WP30	-

5.4 Measurement Procedure

The location of the proposed residential development suggested that the principal contributors to the existing noise climate would be road traffic and trams on Maclure Road and this proved to be the case. In addition, the survey highlighted that some additional sound contributions were intermittently audible from activity within the U R Auto Care and Stop and Go car wash buildings. However, these contributions were only primarily audible in the measurement position during the lulls in the road traffic. With reference to the presence of hospitality venues or venues associated with the night time economy, the only venue of this type was the Phantom Lounge to the West of the proposed development. Despite this, the Phantom Lounge describes itself as a shisha and dessert venue where alcoholic drinks are not served. Consequently, although the premises are typically open from the late afternoon until the early night time period, it is suggested that the potential for disturbance from the premises, resulting from rowdy behaviour etc., would be minimal.

As the residential accommodation within the proposed development will have windows on the front (Maclure Road) elevation, the measurements of the existing noise climate were obtained from a single position on the front elevation of the existing building. The approximate location of the measurement position is detailed on figure 2 below.

Figure 2. Approximate location of the measurement position



In the measurement position the sound level meter microphone was placed within a weather protection enclosure and extended on a boom from a first floor window on the Maclure Road elevation of the existing building. In this position the microphone was approximately 0.75 metres from the existing front façade of the building and approximately 4.5 metres above ground level.

Throughout the survey all measurements were made with the 'fast' time weighting engaged, the measurement time interval was 5 minutes and simultaneous audio recordings were made.

6.0 Noise Survey Results

The existing noise climate in the vicinity of the proposed development was regarded as being essentially urban in nature and character and was subject to noise contributions primarily from road traffic (cars, vans and trams on Maclure Road) and some intermittent noise contributions from the U R Auto Care and Stop and Go indoor car wash which, for the majority of the time, were largely only clearly audible during the infrequent lulls in the road traffic.

6.1 Qualitative Assessment

During the daytime period the principal contributors to the existing noise climate in the vicinity of 3 Maclure Road were road traffic, comprising mainly cars, vans and trams, on Maclure Road itself and intermittent noise contributions from the U R Auto Care and Stop and Go indoor car wash. With reference to the road traffic, during the attended element of the noise survey the majority of the road traffic comprised private cars although some light goods vehicles were also noted. With reference to the trams, these did appear to be quite frequent and it was not uncommon for the trams to sound their horns as they picked up speed along Maclure Road. The audio recording indicated that the volume of traffic appeared to remain relatively steady throughout the period between approximately 10:40 - 21:30 hours, followed by a slow reduction in traffic noise from around 22:00 hours.

Turning to the emission of sound from the U R Auto Care and Stop and Go indoor car wash. With reference to the U R Care, some very intermittent sound associated with the use of air powered impact tools was infrequently just audible and, with respect to the Stop and Go car wash, the emission of sound related to the intermittent operation of the jet wash within the main building itself. At no time during the attended section of the noise survey, were any vehicles washed outside on the forecourt. As stated, the sound from both these businesses was only intermittently audible during the relative lulls in the road traffic and were not, at any time, thought to be particularly intrusive with reference to the existing noise climate. Indeed, combining the audio recordings with the measured noise levels for periods during which sound from these sources were both present and absent, it appeared that although intermittently audible, the sound from these sources did not have an effect on the measured sound levels. Despite this, a more extensive assessment of the sound emission from both these sources will be conducted in Section 6.4 below.

Additional daytime noise sources, audible from the interrogation of the simultaneous audio recordings, included intermittent contributions from voices, occasional non-tram vehicle horns sounding and birdsong.

During the late evening and night time period, the principal contributor to the existing noise climate was again road traffic on Maclure Road, but during this time the audio recordings indicated that the volume of traffic, both cars and trams, continued to decline, from around 22:00 hours, until around 03:00 hours. After this point, a slow but

steady increase in traffic noise was apparent from around 05:15 hours on, with the audio recordings suggesting that the first tram on the day passed the measurement position at around 05:45 – 05:50 hours. During this period additional noise sources audible from the recordings included very occasional voices and from around 06:30 – 07:00 hours, birdsong.

As detailed in Sections 3 and 5.4 above, the only hospitality venue in the immediate vicinity of the proposed development was the Phantom Lounge at 6 – 10 Maclure Road. Published opening times suggest that the venue is nominally open between 17:00 – 01:00 hours, although reports obtained from various internet sources indicate that this is more typically open between 16:00 – 23:00 hours. Interrogation of the audio recordings indicated that no music or other sources of noise that could have been associated with the operation of the venue, were audible in the measurement position. Bearing in mind the fact that the venue does not serve alcohol and instead, according to published sources, provides shisha, desserts and mocktails in an environment where background music is played, it is suggested that this would be a very much quieter venue than would be the case for a pub or bar.

Despite this, a visit was made to the area to assess what effect the operation of the Phantom Lounge may have on the existing noise climate. This visit was made between 22:00 – 23:00 hours on Friday 16th January 2026, with Friday evening typically being a busy period for most hospitality venues. At this time the venue was not particularly busy with the clientele comprising approximately 10 – 15 customers. The qualitative assessment was that the environment appeared to be very relaxed and convivial and absolutely no sound, in the form of music or voices, could be heard either directly outside the venue or directly outside 3 Maclure Road. In addition, it was not possible to hear any external plant noise, either air handling or refrigeration equipment, that may have served the Phantom Lounge or any other premises in the immediate vicinity of 3 Maclure Road. As a consequence, it is suggested that, based on the evidence obtained from the noise survey and the site visit, the operation of the Phantom Lounge would not have an effect on the existing noise climate of the proposed development at 3 Maclure Road.

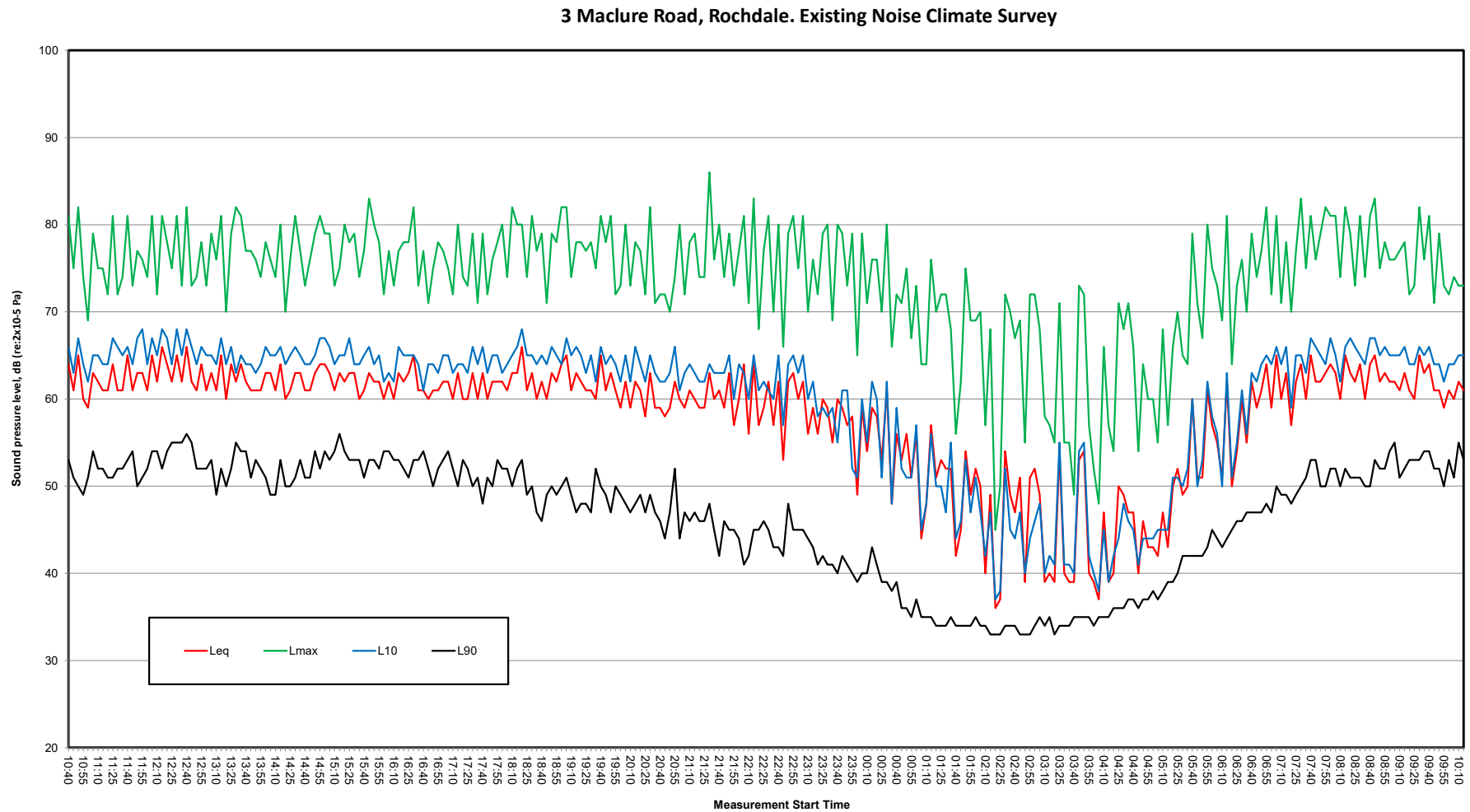
6.2 Overall Results and Discussion

By virtue of the significant amount of measured noise data collected from the measurement position during the noise survey, table 7 and graph 1 overleaf contain summaries of the noise data from the 24 hour noise survey. A summary of the measured noise data are presented in Appendix 1.

Table 7. Measured sound level summary, existing noise climate survey, Maclure Road, Rochdale

	$L_{Aeq,T}$	$L_{Amax,T}$	$L_{A10,T}$	$L_{A90,T}$
Standard deviation, daytime period	2.00	3.74	1.74	3.08
Standard deviation, night time period	7.26	8.61	7.58	4.31
Mean (log), daytime period	62	78	65	51
Mean (log), night time period	55	74	56	40
Modal value, daytime period	61	81	65	52
Modal value, night time period	49	72	51	34
Maximum value daytime period	66	86	68	56
Minimum value daytime period	53	66	57	41
Maximum value night time period	64	82	65	48
Minimum value night time period	36	45	37	33

Graph1. Measured sound level summary, existing noise climate, Maclure Road, Rochdale



As can be seen from table 7 and graph 1, the noise climate during the daytime period was steadier than was the case through the night time period. Despite this, the noise climate in the measurement position demonstrated the 'typical' pattern with higher noise levels during the day, reducing during the late evening to a relatively steady plateau during the 'dead' of night before increasing again in the early morning.

Overall, the noise climate in this position was regarded as being representative of an urban location adjacent to mainly transportation noise sources, with the mean (log) daytime and night time L_{Aeq} levels being 62 and 55dB respectively. These levels would equate to a 'low' and 'medium' noise 'risk' assessment respectively during both the day and night time periods under the ProPG scheme. With reference to an assessment under the AVO scheme, the mean levels would equate to a 'medium' noise 'risk' assessment respectively for both the day and night time periods.

An initial assessment of the obtained sound levels and their potential interaction with the ventilation of the internal spaces, will be undertaken. Comparing the calculated mean (log) L_{Aeq} values for the daytime period, it can be seen that assuming the 13dB 'rule of thumb' for the sound reduction provided by a partially open window, suggested in the AVO guide, the guide value for internal noise detailed within BS 8233:2014 would be exceeded. Repeating the exercise and adopting the mean (log) L_{Aeq} values for the night time period and applying the same assumption relating the sound insulation provided by a partially open window, the guide value for internal noise detailed within BS 8233:2014 would again be exceeded within the bedrooms.

Turning to the guide values contained within ADO, although in this instance the guide values have been adopted for comparative purposes only with respect to the existing building, it is suggested that under the partially open windows scenario the 40dB $L_{Aeq,T}$ value for bedrooms at night would be exceeded. With reference to the L_{Amax} noise climate, the ADO guide states that 55dB L_{Amax} should not to be exceeded within bedrooms on more than 10 occasions during the night time period. The results from the noise survey suggest that this guide value would also be exceeded.

Remaining with the L_{Amax} noise climate, the guidance contained within the ProPG document, namely that providing the internal level within a bedroom does not exceed 45dB more than 10 times per night within a bedroom "*then this represents a reasonable threshold below which the events on sleep can be regarded as negligible*" will be applied. In this case and applying the mean L_{Amax} value from the night time period (74dB(A)), it is suggested that the L_{Amax} noise climate would also exceed this guidance.,

Consequently, the foregoing 'initial' assessment indicates that a ventilation strategy relying on opening windows, may not be appropriate in terms of securing compliance with the internal noise level guide values detailed within BS8233:2014 or the advice contained within ADO. Therefore, an alternative ventilation strategy should be considered and this issue will be revisited in a subsequent section of this report.

6.3 Commercial Sound Emission Evaluation

As previously indicated, although the emission of sound from both the U R Auto Care and Stop and Go car wash enterprises was intermittently audible in the measurement position, the emitted sound did not appear to have a significant effect on the measured

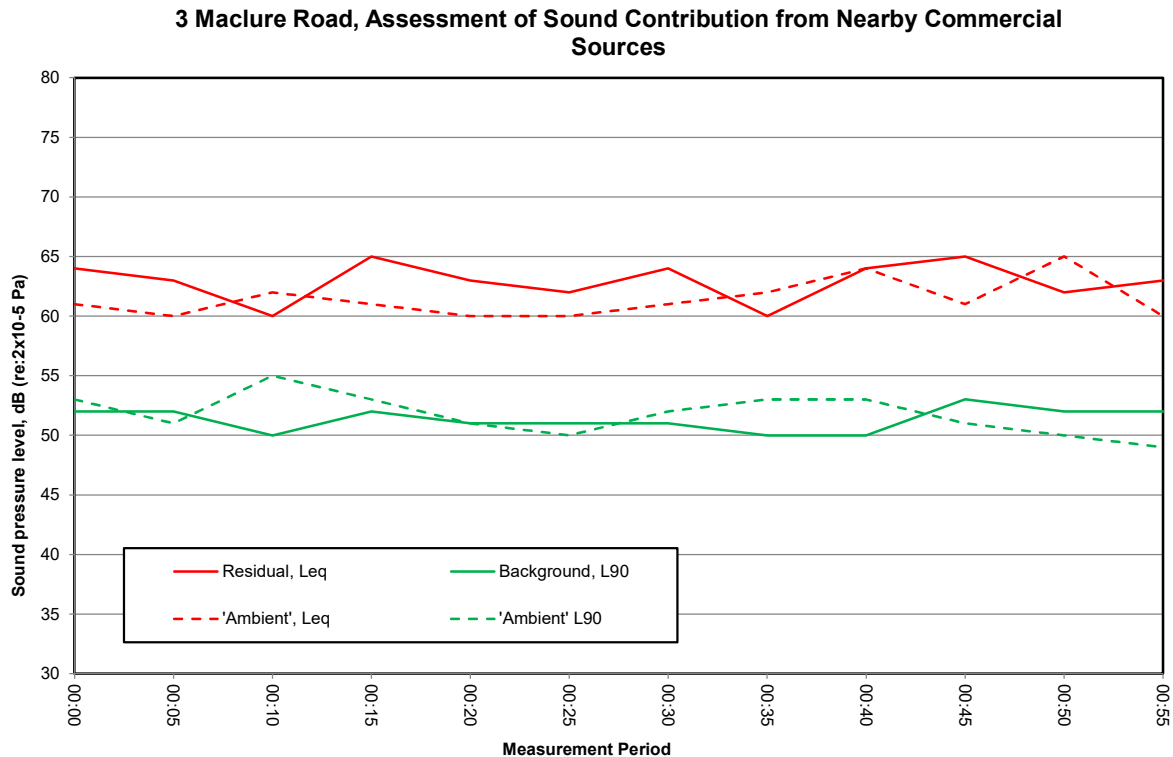
noise levels. Despite this, a more quantitative basic assessment of the sound emitted from both locations will be undertaken.

Reference to both the audio recordings and published information indicate that U R Auto Care does not open until 09:00 hours and the Stop and Go car wash does not open until 10:00 hours. This being the case, a comparison of the noise climate at 3 Maclure Road during periods when neither businesses were operating and a period when both businesses were operating, will be undertaken. For the purposes of this assessment the one-hour period between 08:00 – 09:00 hours on the 14th January, when neither businesses were operating, will be compared with a one-hour period between 10:00 – 11:00 hours, when both businesses were operating. With respect to the period during which both businesses were operating, this represents an amalgam of the levels measured between 10:40 – 11:00 hours on the 13th January and between 10:00 – 10:40 hours on the 14th January. The results of both these basic evaluations are presented in table 8 and graph 2 below and overleaf.

Table 8. Comparison of the existing noise climate with and without contributions for the commercial premises

Measured sound levels in the absence of the commercial contribution			Measured sound levels in the presence of the commercial contribution		
Measurement start time	Residual L_{Aeq} 5mins	Background L_{A90} , 5mins	Measurement start time	'Ambient' L_{Aeq} 5mins	'Ambient' L_{A90} , 5mins
08:00	64	52	10:00	61	53
08:05	63	52	10:05	60	51
08:10	60	50	10:10	62	55
08:15	65	52	10:15	61	53
08:20	63	51	10:20	60	51
08:25	62	51	10:25	60	50
08:30	64	51	10:30	61	52
08:35	60	50	10:35	62	53
08:40	64	50	10:40	64	53
08:45	65	53	10:45	61	51
08:50	62	52	10:50	65	50
08:55	63	52	10:55	60	49
Standard deviation	1.68	0.98	Standard deviation	1.62	1.71
Mean (log)	63	51	Mean (log)	62	52

Graph 2. Comparison of the existing noise climate with and without contributions for the commercial premises



The headings within table 8 use the term 'ambient' L_{Aeq} and L_{A90} which have been used to indicate that the levels under these headings relate to the condition during which both businesses were operating. As can be seen from both table 8 and graph 2 above, the mean L_{Aeq} and L_{A90} levels for the periods lacking and including the potential sound contributions for the businesses are 63 and 51dB and 62 and 52dB respectively. These results indicate that the sound levels from both periods are similar enough to each other to suggest that the emission of sound from the two businesses did not appear to have an effect on the existing noise climate. In such a situation where a source of sound is audible but does not appear to affect the existing noise climate, the additional source of sound may be in the region of 10dB below the existing levels. Additionally, it is suggested that results presented above would indicate that it is not possible to disaggregate any contribution that the operation of the businesses may have had on the existing noise climate. This finding would support the contention proposed in Section 6.1 above.

This being the case it is suggested that the need for a more specific assessment of the emission of sound from the two businesses, perhaps using the principles of BS 4142:2014+A1:2019, would not be necessary. Indeed, it is further suggested that an assessment using the principles of BS 4142:2014+A1:2019 would not provide any additional data that would enhance or supplement the validity of the findings or analysis of the existing noise climate and its potential effect on the proposed development.

7.0 Noise Transmission Calculations

The subsequent assessment of the potential internal noise levels within the proposed development will be assessed using the measured levels from the noise survey. The subsequent calculations of the likely internal noise levels within the bedrooms contained within the proposed development will be conducted using representative sound levels from the noise survey.

With reference to the existing noise climate, the results presented within table 7 and graph 1 above, indicate that the existing noise climate was quite variable. Consequently, it is suggested that to use the highest measured noise levels, influenced by a number of short duration but relatively noisy events, as the basis for the subsequent calculations would be to overstate the noise climate situation for the vast majority of the time. With this in mind the assessment of the likely internal levels within the proposed development will be undertaken using the 90th Percentile value of the measured L_{Aeq} and L_{Amax} levels from the survey. The use of the 90th percentile values should ensure what ProPG states as being the requirement to deliver "*the optimum acoustic outcome for a particular site*" without resorting to "*overdesign or gold plating*" would be achieved.

As the existing noise climate was dominated by noise that predominantly lacked specific character and so was regarded as being 'anonymous' in nature, the assessment of the likely internal noise levels within the proposed development will be undertaken with reference to the design guide values detailed within BS 8233:2014 and reproduced in table 2 above. The sound levels used in the subsequent assessments are as detailed in table 9 below.

Table 9. Calculated sound levels used in the assessment

OBCF, Hz*	63	125	250	500	1k	2k	4k	8k	Overall, dB(A)
Daytime, L_{Aeq} , (90 th percentile value)	68	66	58	57	60	59	52	45	64
Night time, L_{Aeq} , (90 th percentile value)	65	61	54	53	56	54	47	39	60
Night time, L_{Amax} , (90 th percentile value)	86	83	74	71	73	72	67	62	78

With reference to the bedroom on the Hampden Street elevation that is approximately 7 metres from Maclure Road, the calculations for the bedroom on this elevation have been undertaken using sound levels incorporating a suitable distance correction. This distance correction applied a conservative 'line source' assumption.

The sound insulation provided by a building envelope is calculated from the sound insulation provided by the various façade elements, such as the glazing, external walls etc., and the areas they cover. In the majority of cases, it is the glazing and ventilation provision that can be considered as the 'weak' links acoustically, therefore increasing the sound insulation of these elements will improve the overall sound insulation of the façade. The result of the calculation is a composite sound insulation value for the whole façade.

The following assessment of the likely internal noise levels within the permitted dormer bungalow has been undertaken according to the room and façade dimensions detailed on the drawings issued by the Northern Design Partnership of Oldham. To facilitate the calculations, the following assumptions have been employed:

- The reverberation times within the rooms would be 0.5 seconds.
- The floor to ceiling height will be approximately 2.4 metres.
- The calculations have been produced assuming the windows would be closed but with the ventilation openings would be open.
- The sound levels detailed in table 8 above would be equally incident upon the bedrooms on the front elevation of the proposed development.
- An appropriate distance correction has been applied to the bedroom on the Hampden Street elevation.

7.1 Construction Specification

The proposed development will comprise two external wall constructions. The existing element will be of traditional solid masonry construction with an overall depth of around 250 -275mm. The proposed extension will be of cavity masonry construction of the following basic composition: an external brick leaf, a 75 - 100mm cavity and a 100mm thick aggregate block inner leaf lined with one layer of 12.5mm plasterboard on adhesive dabs. Test results for similar constructions suggest that external walls of this type should provide an overall sound insulation of around 50 and 52dB R_w respectively, with the octave band sound insulation values being as detailed in table 10 below.

Table 10. Masonry Cavity Wall Construction, Octave Band Sound Insulation Values

OBCF, Hz*	125	250	500	1k	2k	4k	Overall, R_w dB(A)
Solid masonry wall sound insulation, dB	41	45	49	57	61	62	50
Cavity masonry wall sound insulation, dB	38	42	51	59	63	63	52

* Octave Band Centre Frequency

Glazing

The suggested glazing would be of the sealed unit type and would be of the following nominal specifications: 4mm pane - 12 to 20mm cavity - 4mm pane and 6mm pane - 12 to 20mm cavity – 6.8mm pane. Laboratory test data obtained from Pilkington Glass indicate that these configurations should provide a sound insulation values of around 29dB and 40dB R_w respectively. The octave band sound insulation values are as detailed in table 11 overleaf. Alternative glazing configurations would be acceptable providing the sound insulation performances are at least equivalent to the specifications detailed in table 11 overleaf.

Table 11. Glazing, octave band sound insulation values

OBCF, Hz*	125	250	500	1k	2k	4k	Overall, R_w (C_{tr}) dB
4mm, 12 - 20mm, 4mm	21	17	25	35	37	31	29 (-4)
6mm, 16mm, 6.8mm	21	28	37	48	48	54	40 (-6)

* Octave Band Centre Frequency

An indication of the location of the various glazing types is contained within Appendix 3

Ventilation

The initial assessments will be undertaken assuming the provision of input air via window frame mounted 'background' (trickle) ventilators. In this case the selected window frame mounted background ventilators of the Titan SFXSA V75/C50 and V50/standard canopy types. Laboratory test data indicates that the Titan window frame mounted ventilators should provide sound insulation values of 42 and 38dB $D_{n,e,w}$ in their open positions. The octave band sound insulation values for the selected ventilators are detailed in table 12 below. Alternative ventilator configurations would be acceptable providing the sound insulation performance of the units is at least equivalent to the specification detailed in table 12 below. An indication of the location of the ventilator types is contained within Appendix 3.

Table 12. Background ventilation, octave band sound insulation values

OBCF, Hz*	125	250	500	1k	2k	4k	Overall, $D_{n,e,w}$ dB
Titan SFXSA V75/C50	40	37	34	43	50	53	42
Titan SFXSA V50/standard canopy	34	37	35	36	41	42	38

* Octave Band Centre Frequency.

7.2 Calculation Results and Discussion

Calculations have been performed for the bedrooms and the dining living area within the proposed development. The calculations have been undertaken assuming that the windows would remain closed but the background ventilation provision would be in the open position. It should however be remembered that this does not suggest that the windows may not be opened or should be unopenable, but that where windows are open it is possible that the adopted noise guide criteria will be exceeded.

The results of the break-in noise calculations, including the assumptions relating to the proposed façade elements detailed above, are presented with reference to the design guidance contained within section 4.0 above, in tables 13 – 21 overleaf. For the purpose of the calculations, the bedrooms have been assigned the numbers detailed within the figures contained within Appendix 3. Full calculation data are available in Appendix 2.

Table 13. Calculated internal sound levels, ground floor bedroom 1

Location	Design target, daytime, dB L_{Aeq}	Calculated level, daytime, dB L_{Aeq}	Design target, night time, dB L_{Aeq}	Calculated levels, night time, dB L_{Aeq} and (L_{Amax})
Bedroom 1	35	29	30	24 (45)

Table 14. Calculated internal sound levels, ground floor bedroom 2

Location	Design target, daytime, dB L_{Aeq}	Calculated level, daytime, dB L_{Aeq}	Design target, night time, dB L_{Aeq}	Calculated levels, night time, dB L_{Aeq} and (L_{Amax})
Bedroom 2	35	29	30	25 (45)

Table 15. Calculated internal sound levels, ground floor bedroom 3

Location	Design target, daytime, dB L_{Aeq}	Calculated level, daytime, dB L_{Aeq}	Design target, night time, dB L_{Aeq}	Calculated levels, night time, dB L_{Aeq} and (L_{Amax})
Bedroom 3	35	27	30	24 (45)

Table 16. Calculated internal sound levels, first floor bedroom 4

Location	Design target, daytime, dB L_{Aeq}	Calculated level, daytime, dB L_{Aeq}	Design target, night time, dB L_{Aeq}	Calculated levels, night time, dB L_{Aeq} and (L_{Amax})
Bedroom 4	35	29	30	25 (45)

Table 17. Calculated internal sound levels, first floor bedroom 5

Location	Design target, daytime, dB L_{Aeq}	Calculated level, daytime, dB L_{Aeq}	Design target, night time, dB L_{Aeq}	Calculated levels, night time, dB L_{Aeq} and (L_{Amax})
Bedroom 5	35	29	30	24 (45)

Table 18. Calculated internal sound levels, first floor bedroom 6

Location	Design target, daytime, dB L_{Aeq}	Calculated level, daytime, dB L_{Aeq}	Design target, night time, dB L_{Aeq}	Calculated levels, night time, dB L_{Aeq} and (L_{Amax})
Bedroom 6	35	28	30	24 (44)

Table 19. Calculated internal sound levels, first floor bedroom 7

Location	Design target, daytime, dB L_{Aeq}	Calculated level, daytime, dB L_{Aeq}	Design target, night time, dB L_{Aeq}	Calculated levels, night time, dB L_{Aeq} and (L_{Amax})
Bedroom 7	35	29	30	25 (45)

Table 20. Calculated internal sound levels, first floor bedroom 8

Location	Design target, daytime, dB L_{Aeq}	Calculated level, daytime, dB L_{Aeq}	Design target, night time, dB L_{Aeq}	Calculated levels, night time, dB L_{Aeq} and (L_{Amax})
Bedroom 8	35	24	30	22 (44)

Table 21. Calculated internal sound levels, ground floor dining/living area

Location	Design target, daytime, dB L_{Aeq}	Calculated level, daytime, dB L_{Aeq}	Design target, night time, dB L_{Aeq}	Calculated levels, night time, dB L_{Aeq} and (L_{Amax})
Dining/living area	35	34	-	-

As can be seen from tables 13 - 21 above, based on the stated assumptions relating to the sound insulation of the proposed façade elements, under the windows closed but ventilation openings open scenario and employing the adopted sound levels detailed in table 9 above, the calculated internal noise levels within the proposed bedrooms and dining/living area would not exceed the adopted design guide levels.

With respect to the proposed residential accommodation, the foregoing sections recognise that a partially open window for general ventilation, other than purge ventilation purposes, would result in an increase in the internal noise levels such that they would exceed the adopted design guide values. With this in mind it is recommended that alternative ventilation provision to permit the ventilation of the internal spaces without having to open the windows is provided.

The use of an alternative ventilation strategy would also comply with the guidance contained within the Planning and Noise: Professional Guidance on Planning and Noise (ProPG document), published jointly by representatives of the Chartered Institute of Environmental Health (CIEH), the Institute of Acoustics (IoA) and the Association of Noise Consultants (ANC) in May 2017. The ProPG document at paragraph 2.34, states: *"Where the LPA 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. In such circumstances, internal noise levels can be assessed with windows closed but with any façade openings used to provide "whole building ventilation" in accordance with Building Regulations Approved Document F (e.g. trickle ventilation) in the open position".* In this situation it is suggested that alternative ventilation would permit the internal spaces to be adequately ventilated without having to rely on opening windows.

With reference to the alternative ventilation options, the strategy could take the form of either a system 3 or system 4 provision as summarised in Approved Document F (ADF). In this case System 3 typically relates to a continuous mechanical extraction (MEV) system which operates to remove air from the building with the 'make-up' air being drawn in via background ventilators etc. Often, this type of alternative ventilation is provided by a range of different strategies although decentralised mechanical extract ventilation units (dMEVs) in habitable rooms are a popular choice as they combine low energy consumption with low sound emission levels. System 4 refers to a fully mechanical system incorporating heat recovery and is typically used in noisy environments etc. Bearing in mind the obtained noise levels from the 24 hour survey and the calculated results summarised in table 12 above, it is suggested that alternative ventilation of the type 3 format would be more appropriate than a type 4 system in this situation.

With reference to an alternative ventilation strategy, the requirement to ventilate to internal spaces would need to be carefully considered as the benefit to the occupants should be balanced with the possible disincentives to use, such as the perceived complexity of the installation and running costs. In addition, it should be borne in mind that many local authorities require that any ventilation system can achieve an exchange rate of four air changes per hour, although it would be prudent to discuss this with the Local Planning Authority at the earliest opportunity.

In addition, it is strongly recommended that the emission of sound from the alternative ventilation system is adequately controlled to ensure that this element does not detrimentally affect the internal noise climate. It is also essential that the occupants must also be provided with the option to open windows as they choose. Whichever system is installed, it is recommended that the advice of a suitably qualified/experienced ventilation engineer, to design an appropriate system, is obtained. Again, it would be prudent to discuss any ventilation proposals with the Local Planning Authority.

As a consequence of the foregoing, it is suggested the sound insulation of the proposed façade elements detailed within this report, combined with the proposed alternative ventilation provision, would be sufficient to limit the ingress of external noise to the proposed residential accommodation in compliance with the adopted design guidance. The proposed mitigation measures would also comply with the requirement contained within the ProPG document which requires that the acoustic design statement *"confirms how the adverse impacts of noise will be mitigated and minimised, and which clearly*

demonstrate that a significant adverse noise impact will be avoided in the finished development”.

The results of the above assessment also indicate that with respect to the proposed development, the requirements of paragraph 187 of the NPF, namely: *“Planning policies and decisions should ensure that new development can be integrated effectively with existing businesses and community facilities... Existing businesses and facilities should not have unreasonable restrictions placed on them as a result of development permitted after they were established.”* Similarly, the assessment also indicates that the proposed development would comply with the elements contained within the long term vision of the NPPF.

As a result, it is suggested that based on the above assessments, the existing noise climate should not be regarded as an impediment to the granting of planning permission with respect to the proposed residential development.

8.0 Conclusion

The existing noise climate in the vicinity of the proposed development at 3 Maclure Road in Rochdale was regarded as being essentially urban in nature and character and was subject to sound contributions primarily from road traffic and some intermittent sound contributions from the U R Auto Care and Stop and Go indoor car wash which, for the majority of the time, were largely only clearly audible during the infrequent lulls in the road traffic.

Applying the obtained sound levels from the existing noise climate survey and combining these with the stated assumptions relating to the sound insulation of the façade elements, the calculations have demonstrated that the sound insulation of the façade elements of the proposed development would be sufficient to secure that the break-in noise levels would not exceed the adopted design guide values. Despite this it is suggested that alternative ventilation would be required in order to permit these spaces to be adequately ventilated without having to rely on opening windows.

As a consequence, it is suggested the sound insulation of the proposed façade elements detailed within this report, combined with the proposed alternative ventilation provision, would be sufficient to limit the ingress of external noise to the proposed residential accommodation in compliance with the adopted design guidance. The proposed mitigation measures would also comply with the requirement contained within the ProPG document which requires that the acoustic design statement *“confirms how the adverse impacts of noise will be mitigated and minimised, and which clearly demonstrate that a significant adverse noise impact will be avoided in the finished development”*.

The results of the above assessment also indicate that with respect to the proposed development, the requirements of paragraph 187 of the NPF, namely: *“Planning policies and decisions should ensure that new development can be integrated effectively with existing businesses and community facilities... Existing businesses and facilities should not have unreasonable restrictions placed on them as a result of development permitted after they were established.”* Similarly, the assessment also indicates that the proposed

development would comply with the elements contained within the long term vision of the NPPF.

As a result of the foregoing, it is suggested that based on the above assessments, the existing noise climate should not be regarded as an impediment to the granting of planning permission with respect to the proposed residential development.

Appendix 1: Existing Noise Climate Survey, Measured Sound Levels (façade corrected)Measured sound levels, 13th - 14th January 2026

Start Time	L _{Aeq} 5mins	L _{Amax} , 5mins	L _{A10} , 5mins	L _{A90} , 5mins
10:40	64	81	66	53
10:45	61	75	63	51
10:50	65	82	67	50
10:55	60	74	64	49
11:00	59	69	62	51
11:05	63	79	65	54
11:10	62	75	65	52
11:15	61	75	64	52
11:20	61	72	64	51
11:25	64	81	67	51
11:30	61	72	66	52
11:35	61	74	65	52
11:40	65	81	66	53
11:45	61	73	64	54
11:50	63	77	67	50
11:55	63	76	68	51
12:00	61	74	64	52
12:05	65	81	67	54
12:10	62	72	65	54
12:15	66	81	68	52
12:20	64	78	67	54
12:25	62	75	64	55
12:30	65	81	68	55
12:35	62	73	65	55

Start Time	L _{Aeq} 5mins	L _{Amax} , 5mins	L _{A10} , 5mins	L _{A90} , 5mins
12:40	66	82	68	56
12:45	62	73	66	55
12:50	61	74	64	52
12:55	64	78	66	52
13:00	61	73	65	52
13:05	63	79	65	53
13:10	61	76	64	49
13:15	65	81	67	52
13:20	60	70	64	50
13:25	64	79	66	52
13:30	62	82	63	55
13:35	64	81	65	54
13:40	62	77	64	54
13:45	61	77	64	51
13:50	61	76	63	53
13:55	61	74	64	52
14:00	63	78	66	51
14:05	63	76	65	49
14:10	61	74	65	49
14:15	64	80	66	53
14:20	60	70	64	50
14:25	61	76	65	50
14:30	63	81	66	51
14:35	63	77	65	53

Start Time	L _{Aeq} 5mins	L _{Amax} , 5mins	L _{A10} , 5mins	L _{A90} , 5mins
14:40	61	73	64	51
14:45	61	76	64	51
14:50	63	79	65	54
14:55	64	81	67	52
15:00	64	79	67	54
15:05	63	79	66	53
15:10	61	73	64	54
15:15	63	75	65	56
15:20	62	80	65	54
15:25	63	78	67	53
15:30	63	79	64	53
15:35	60	74	64	53
15:40	61	77	65	51
15:45	63	83	66	53
15:50	62	80	64	53
15:55	62	78	65	52
16:00	60	72	62	54
16:05	62	77	63	54
16:10	60	73	62	53
16:15	63	77	66	53
16:20	62	78	65	52
16:25	63	78	65	51
16:30	65	82	65	53
16:35	61	73	64	53

Start Time	L _{Aeq} 5mins	L _{Amax} , 5mins	L _{A10} , 5mins	L _{A90} , 5mins
16:40	61	77	61	54
16:45	60	71	64	52
16:50	61	75	64	50
16:55	61	78	63	52
17:00	62	77	65	53
17:05	62	75	65	54
17:10	60	72	63	52
17:15	63	80	64	50
17:20	60	74	64	53
17:25	60	73	63	52
17:30	63	79	66	50
17:35	60	71	64	51
17:40	63	79	66	48
17:45	60	72	63	51
17:50	62	76	65	50
17:55	62	78	65	53
18:00	62	80	63	52
18:05	61	74	64	52
18:10	63	82	65	50
18:15	63	80	66	52
18:20	66	80	68	53
18:25	61	74	65	49
18:30	63	81	65	50
18:35	60	77	64	47

Start Time	L _{Aeq} 5mins	L _{Amax} , 5mins	L _{A10} , 5mins	L _{A90} , 5mins
18:40	62	79	65	46
18:45	60	71	64	49
18:50	63	79	66	50
18:55	62	78	65	49
19:00	64	82	64	50
19:05	65	82	67	51
19:10	61	74	65	49
19:15	63	78	66	47
19:20	62	78	65	48
19:25	61	77	63	48
19:30	61	78	65	47
19:35	60	75	62	52
19:40	65	81	66	50
19:45	61	78	64	49
19:50	63	81	65	47
19:55	61	72	64	50
20:00	59	73	62	49
20:05	62	80	65	48
20:10	59	73	62	47
20:15	62	78	66	48
20:20	61	77	64	49
20:25	58	72	62	47
20:30	63	82	65	49
20:35	59	71	63	47

Start Time	L _{Aeq} 5mins	L _{Amax} , 5mins	L _{A10} , 5mins	L _{A90} , 5mins
20:40	59	72	62	46
20:45	58	72	62	44
20:50	59	70	63	47
20:55	62	74	66	52
21:00	60	80	61	44
21:05	59	72	63	47
21:10	61	78	64	46
21:15	60	79	63	47
21:20	59	74	62	46
21:25	59	74	62	46
21:30	63	86	64	48
21:35	60	76	63	45
21:40	61	80	63	42
21:45	59	74	63	46
21:50	63	79	65	45
21:55	57	73	60	45
22:00	60	77	64	44
22:05	64	81	63	41
22:10	56	71	60	42
22:15	64	83	65	45
22:20	57	68	61	45
22:25	59	77	62	46
22:30	62	81	61	45
22:35	57	70	60	43

Start Time	L _{Aeq} 5mins	L _{Amax} , 5mins	L _{A10} , 5mins	L _{A90} , 5mins
22:40	62	80	65	43
22:45	53	66	57	42
22:50	62	79	64	48
22:55	63	81	65	45
23:00	60	75	63	45
23:05	62	81	65	45
23:10	56	70	60	44
23:15	59	76	62	43
23:20	56	72	58	41
23:25	60	79	59	42
23:30	59	80	58	41
23:35	55	69	59	41
23:40	60	80	55	40
23:45	59	79	61	42
23:50	57	73	61	41
23:55	58	79	52	40
00:00	49	65	51	39
00:05	59	79	60	40
00:10	54	71	55	40
00:15	59	76	62	43
00:20	58	76	60	41
00:25	53	70	51	39
00:30	61	80	62	39
00:35	48	66	48	38

Start Time	L _{Aeq} 5mins	L _{Amax} , 5mins	L _{A10} , 5mins	L _{A90} , 5mins
00:40	56	72	59	39
00:45	53	71	52	36
00:50	56	75	51	36
00:55	51	67	51	35
01:00	56	73	57	37
01:05	44	64	45	35
01:10	48	64	48	35
01:15	57	76	56	35
01:20	51	70	50	34
01:25	53	72	50	34
01:30	52	72	47	34
01:35	52	68	55	35
01:40	42	56	44	34
01:45	45	62	46	34
01:50	54	75	53	34
01:55	49	69	47	34
02:00	52	69	51	35
02:05	50	70	47	34
02:10	40	57	42	34
02:15	49	68	47	33
02:20	36	45	37	33
02:25	37	50	38	33
02:30	54	72	52	34
02:35	49	70	45	34

Start Time	L _{Aeq} 5mins	L _{Amax} , 5mins	L _{A10} , 5mins	L _{A90} , 5mins
02:40	47	67	44	34
02:45	51	69	47	33
02:50	39	55	40	33
02:55	51	72	44	33
03:00	52	72	46	34
03:05	49	68	48	35
03:10	39	58	40	34
03:15	40	57	42	35
03:20	39	55	41	33
03:25	54	71	55	34
03:30	40	55	41	34
03:35	39	55	41	34
03:40	39	49	40	35
03:45	53	73	54	35
03:50	54	72	55	35
03:55	40	57	42	35
04:00	39	52	40	34
04:05	37	48	38	35
04:10	47	66	45	35
04:15	39	57	39	35
04:20	40	54	42	36
04:25	50	71	44	36
04:30	49	68	48	36
04:35	47	71	46	37

Start Time	L _{Aeq} 5mins	L _{Amax} , 5mins	L _{A10} , 5mins	L _{A90} , 5mins
04:40	47	66	45	37
04:45	40	54	41	36
04:50	46	64	44	37
04:55	43	60	44	37
05:00	43	60	44	38
05:05	42	55	45	37
05:10	47	68	45	38
05:15	43	57	45	39
05:20	50	66	51	39
05:25	52	70	51	40
05:30	49	65	50	42
05:35	50	64	52	42
05:40	60	79	60	42
05:45	51	71	50	42
05:50	51	67	53	42
05:55	61	80	62	43
06:00	57	75	58	45
06:05	55	73	56	44
06:10	51	69	50	43
06:15	62	81	63	44
06:20	50	64	51	45
06:25	54	73	55	46
06:30	60	76	61	46
06:35	55	70	56	47

Start Time	L _{Aeq} 5mins	L _{Amax} , 5mins	L _{A10} , 5mins	L _{A90} , 5mins
06:40	62	79	63	47
06:45	59	74	62	47
06:50	61	77	64	47
06:55	64	82	65	48
07:00	59	72	64	47
07:05	65	81	66	50
07:10	60	71	64	49
07:15	63	78	66	49
07:20	57	70	59	48
07:25	62	77	65	49
07:30	64	83	65	50
07:35	60	75	63	51
07:40	65	81	67	53
07:45	62	76	66	53
07:50	62	79	65	50
07:55	63	82	64	50
08:00	64	81	67	52
08:05	63	81	65	52
08:10	60	74	62	50
08:15	65	82	66	52
08:20	63	79	67	51
08:25	62	73	66	51
08:30	64	81	65	51
08:35	60	74	64	50

Start Time	L _{Aeq} 5mins	L _{Amax} , 5mins	L _{A10} , 5mins	L _{A90} , 5mins
08:40	64	81	67	50
08:45	65	83	67	53
08:50	62	75	65	52
08:55	63	78	66	52
09:00	62	76	65	54
09:05	62	76	65	55
09:10	61	77	65	51
09:15	63	78	66	52
09:20	61	72	64	53
09:25	60	73	64	53
09:30	65	82	66	53
09:35	63	76	65	54
09:40	64	81	66	54
09:45	61	71	64	52
09:50	61	79	64	52
09:55	59	73	62	50
10:00	61	72	64	53
10:05	60	74	64	51
10:10	62	73	65	55
10:15	61	73	65	53
10:20	60	73	63	51
10:25	60	72	63	50
10:30	61	74	64	52
10:35	62	75	65	53

Appendix 2: Break-in Noise Calculations

Ground floor bedroom 1														
L _{Aeq} Assessment, daytime														
Bedroom 1 - gable														
* Octave Band Centre Frequency, Hz			dB(A)	31.5*	63*	125*	250*	500*	1k*	2k*	4k*	8k*	16k*	
A	90th %ile L _{eq}		64	66	68	66	58	57	60	59	52	45	39	
B	Exposed façade, m ²	8		9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	
C	Volume of receiving room, m ³	29.8												
D	Reverb Time, seconds			0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	
E	10 x Log(RT60/(0.163 x V))			-9.9	-9.9	-9.9	-9.9	-9.9	-9.9	-9.9	-9.9	-9.9	-9.9	
F	Composite SRI			28.0	33.0	38.0	42.0	50.0	58.0	62.0	62.0	67.0	67.0	
G	A + B + E - F		15	37.4	34.1	27.5	15.0	6.4	1.2	-3.6	-10.7	-22.9	-28.9	
H	K = 3			3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
I														
J	Calculated internal noise level		18	40.4	37.1	30.5	18.0	9.4	4.2	-0.6	-7.7	-19.9	-25.9	
Glazing:		-												
Ventilator type:		-												
Bedroom 1 - front elevation														
* Octave Band Centre Frequency, Hz			dB(A)	31.5*	63*	125*	250*	500*	1k*	2k*	4k*	8k*	16k*	
A	90th %ile L _{eq}		64	66	68	66	58	57	60	59	52	45	39	
B	Exposed façade, m ²	7.1		8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	
C	Volume of receiving room, m ³	29.8												
D	Reverb Time, seconds			0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	
E	10 x Log(RT60/(0.163 x V))			-9.9	-9.9	-9.9	-9.9	-9.9	-9.9	-9.9	-9.9	-9.9	-9.9	
F	Composite SRI			17.7	22.7	27.7	34.4	43.2	53.6	54.4	58.9	64.5	66.8	
G	A + B + E - F		24	47.2	43.8	37.2	22.0	12.6	5.1	3.4	-8.1	-20.9	-29.2	
H	K = 3			3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
I														
J	Calculated internal noise level		27	50.2	46.8	40.2	25.0	15.6	8.1	6.4	-5.1	-17.9	-26.2	
K	Number of ventilators	1												
L	Ventilator D _{n,e}				35	40	37	34	43	50	53	63		
M	L _{Aeq} - D _{n,e} + 10*log(10) - B				34.4	27.8	22.3	24.7	18.5	10.7	0.7	-16.6		
N	Internal room noise level, vent open		29		47.1	40.5	26.9	25.2	18.9	12.1	1.7	-14.2		
Glazing:		6mm, 16mm, 6.8mm												
Ventilator type:		TitanV75/C50												
			Combined sound level, dB(A)	29										
L _{Aeq} Assessment, night time														
Bedroom 1 - gable														
* Octave Band Centre Frequency, Hz			dB(A)	31.5*	63*	125*	250*	500*	1k*	2k*	4k*	8k*	16k*	
A	90th %ile L _{eq}		60	57	65	61	54	53	56	54	47	39	29	
B	Exposed façade, m ²	8		9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	
C	Volume of receiving room, m ³	29.8												
D	Reverb Time, seconds			0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	
E	10 x Log(RT60/(0.163 x V))			-9.9	-9.9	-9.9	-9.9	-9.9	-9.9	-9.9	-9.9	-9.9	-9.9	
F	Composite SRI			28.0	33.0	38.0	42.0	50.0	58.0	62.0	62.0	67.0	67.0	
G	A + B + E - F		10	28.0	30.8	22.3	11.0	1.9	-3.0	-8.5	-15.9	-29.1	-38.6	
H	K = 3			3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
I														
J	Calculated internal noise level		13	31.0	33.8	25.3	14.0	4.9	0.0	-5.5	-12.9	-26.1	-35.6	
Glazing:		-												
Ventilator type:		-												

Bedroom 1 - front elevation															
* Octave Band Centre Frequency, Hz				dB(A)	31.5*	63*	125*	250*	500*	1k*	2k*	4k*	8k*	16k*	
A	90th %ile L_{eq}	7.1	60	57	65	61	54	53	56	54	47	39	29		
B	Exposed façade, m ²			8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5		
C	Volume of receiving room, m ³			29.8											
D	Reverb Time, seconds			0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	
E	10 x Log(RT60/(0.163 x V))			-9.9	-9.9	-9.9	-9.9	-9.9	-9.9	-9.9	-9.9	-9.9	-9.9		
F	Composite SRI			17.7	22.7	27.7	34.4	43.2	53.6	54.4	58.9	64.5	66.8		
G	A + B + E - F	19		37.8	40.5	32.0	18.0	8.1	0.9	-1.5	-13.3	-27.1	-38.9		
H	K = 3			3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		
I															
J	Calculated internal noise level	1	22	40.8	43.5	35.0	21.0	11.1	3.9	1.5	-10.3	-24.1	-35.9		
K	Number of ventilators														
L	Ventilator $D_{n,e}$														
M	$L_{Aeq} - D_{n,e} + 10 \cdot \log(10) - B$														
N	Internal room noise level, vent open		24												
Glazing: 6mm, 16mm, 6.8mm															
Ventilator type: TitanV75/C50															
Combined sound level, dB(A)				24											
<u>L_{Amax} Assessment, night time</u>															
Bedroom 1 - gable															
* Octave Band Centre Frequency, Hz				dB(A)	31.5*	63*	125*	250*	500*	1k*	2k*	4k*	8k*	16k*	
A	90th %ile L_{max}	8	78	76	86	83	74	71	73	72	67	62	53		
B	Exposed façade, m ²			9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	
C	Volume of receiving room, m ³			29.8											
D	Reverb Time, seconds			0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	
E	10 x Log(RT60/(0.163 x V))			-9.9	-9.9	-9.9	-9.9	-9.9	-9.9	-9.9	-9.9	-9.9	-9.9		
F	Composite SRI			28.0	33.0	38.0	42.0	50.0	58.0	62.0	62.0	67.0	67.0		
G	A + B + E - F	31		46.9	52.3	43.7	31.0	19.9	14.1	9.0	4.3	-6.1	-14.8		
H	K = 3			3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		
I															
J	Calculated internal noise level		34	49.9	55.3	46.7	34.0	22.9	17.1	12.0	7.3	-3.1	-11.8		
Glazing: -															
Ventilator type: -															
Bedroom 1 - front elevation															
* Octave Band Centre Frequency, Hz				dB(A)	31.5*	63*	125*	250*	500*	1k*	2k*	4k*	8k*	16k*	
A	90th %ile L_{max}	7.1	78	76	86	83	74	71	73	72	67	62	53		
B	Exposed façade, m ²			8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	
C	Volume of receiving room, m ³			29.8											
D	Reverb Time, seconds			0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	
E	10 x Log(RT60/(0.163 x V))			-9.9	-9.9	-9.9	-9.9	-9.9	-9.9	-9.9	-9.9	-9.9	-9.9		
F	Composite SRI			17.7	22.7	27.7	34.4	43.2	53.6	54.4	58.9	64.5	66.8		
G	A + B + E - F	40		56.7	62.1	53.5	38.1	26.1	18.0	16.1	6.8	-4.1	-15.1		
H	K = 3			3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		
I															
J	Calculated internal noise level	1	43	59.7	65.1	56.5	41.1	29.1	21.0	19.1	9.8	-1.1	-12.1		
K	Number of ventilators														
L	Ventilator $D_{n,e}$														
M	$L_{Aeq} - D_{n,e} + 10 \cdot \log(10) - B$														
N	Internal room noise level, vent open		44												
Glazing: 6mm, 16mm, 6.8mm															
Ventilator type: TitanV75/C50															
Combined sound level, dB(A)				45											

Ground floor bedroom 2														
<u>L_{Aeq} Assessment, daytime</u>														
Bedroom 2 - front elevation														
* Octave Band Centre Frequency, Hz			dB(A)	31.5*	63*	125*	250*	500*	1k*	2k*	4k*	8k*	16k*	
A	90th %ile L _{eq}		64	66	68	66	58	57	60	59	52	45	39	
B	Exposed façade, m ²	6.6		8.2	8.2	8.2	8.2	8.2	8.2	8.2	8.2	8.2	8.2	
C	Volume of receiving room, m ³	23.2												
D	Reverb Time, seconds			0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	
E	10 x Log(RT60/(0.163 x V))			-8.8	-8.8	-8.8	-8.8	-8.8	-8.8	-8.8	-8.8	-8.8	-8.8	
F	Composite SRI			17.4	22.4	27.4	34.1	43.0	53.4	54.1	58.7	64.3	66.8	
G	A + B + E - F		25	48.2	44.9	38.3	23.1	13.6	6.0	4.5	-7.1	-20.0	-28.4	
H	K = 3			3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
I														
J	Calculated internal noise level		28	51.2	47.9	41.3	26.1	16.6	9.0	7.5	-4.1	-17.0	-25.4	
K	Number of ventilators	1												
L	Ventilator D _{n,e}				35	40	37	34	43	50	53	63		
M	L _{Aeq} - D _{n,e} + 10*log(10) - B				34.7	28.1	22.6	25.0	18.8	11.0	1.0	-16.3		
N	Internal room noise level, vent open		29		48.1	41.5	27.7	25.6	19.2	12.6	2.2	-13.6		
Glazing:		6mm, 16mm, 6.8mm												
Ventilator type:		TitanV75/C50												
<u>L_{Aeq} Assessment, night time</u>														
Bedroom 2 - front elevation														
* Octave Band Centre Frequency, Hz			dB(A)	31.5*	63*	125*	250*	500*	1k*	2k*	4k*	8k*	16k*	
A	90th %ile L _{eq}		60	57	65	61	54	53	56	54	47	39	29	
B	Exposed façade, m ²	6.6		8.2	8.2	8.2	8.2	8.2	8.2	8.2	8.2	8.2	8.2	
C	Volume of receiving room, m ³	23.2												
D	Reverb Time, seconds			0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	
E	10 x Log(RT60/(0.163 x V))			-8.8	-8.8	-8.8	-8.8	-8.8	-8.8	-8.8	-8.8	-8.8	-8.8	
F	Composite SRI			17.4	22.4	27.4	34.1	43.0	53.4	54.1	58.7	64.3	66.8	
G	A + B + E - F		20	38.8	41.6	33.1	19.1	9.2	1.9	-0.4	-12.4	-26.2	-38.2	
H	K = 3			3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
I														
J	Calculated internal noise level		23	41.8	44.6	36.1	22.1	12.2	4.9	2.6	-9.4	-23.2	-35.2	
K	Number of ventilators	1												
L	Ventilator D _{n,e}				35	40	37	34	43	50	53	63		
M	L _{Aeq} - D _{n,e} + 10*log(10) - B				31.4	22.9	18.6	20.6	14.7	6.1	-4.2	-22.4		
N	Internal room noise level, vent open		25		44.8	36.3	23.7	21.1	15.1	7.7	-3.1	-19.8		
Glazing:		6mm, 16mm, 6.8mm												
Ventilator type:		TitanV75/C50												
<u>L_{Amax} Assessment, night time</u>														
Bedroom 2 - front elevation														
* Octave Band Centre Frequency, Hz			dB(A)	31.5*	63*	125*	250*	500*	1k*	2k*	4k*	8k*	16k*	
A	90th %ile L _{max}		78	76	86	83	74	71	73	72	67	62	53	
B	Exposed façade, m ²	6.6		8.2	8.2	8.2	8.2	8.2	8.2	8.2	8.2	8.2	8.2	
C	Volume of receiving room, m ³	23.2												
D	Reverb Time, seconds			0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	
E	10 x Log(RT60/(0.163 x V))			-8.8	-8.8	-8.8	-8.8	-8.8	-8.8	-8.8	-8.8	-8.8	-8.8	
F	Composite SRI			17.4	22.4	27.4	34.1	43.0	53.4	54.1	58.7	64.3	66.8	
G	A + B + E - F		41	57.7	63.1	54.5	39.1	27.1	18.9	17.1	7.8	-3.2	-14.4	
H	K = 3			3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
I														
J	Calculated internal noise level		44	60.7	66.1	57.5	42.1	30.1	21.9	20.1	10.8	-0.2	-11.4	
K	Number of ventilators	1												
L	Ventilator D _{n,e}				35	40	37	34	43	50	53	63		
M	L _{Aeq} - D _{n,e} + 10*log(10) - B				53.0	44.4	38.7	38.5	31.7	23.7	15.9	0.5		
N	Internal room noise level, vent open		45		66.3	57.7	43.7	39.1	32.1	25.2	17.1	3.2		
Glazing:		6mm, 16mm, 6.8mm												
Ventilator type:		TitanV75/C50												

Ground floor bedroom 3														
L _{Aeq} Assessment, daytime														
Bedroom 3 - gable														
* Octave Band Centre Frequency, Hz														
				dB(A)	31.5*	63*	125*	250*	500*	1k*	2k*	4k*	8k*	16k*
A	90th %ile L _{eq}		60		63	64	62	53	53	55	55	48	41	37
B	Exposed façade, m ²	7.3			8.6	8.6	8.6	8.6	8.6	8.6	8.6	8.6	8.6	8.6
C	Volume of receiving room, m ³	23.9												
D	Reverb Time, seconds				0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
E	10 x Log(RT60/(0.163 x V))				-8.9	-8.9	-8.9	-8.9	-8.9	-8.9	-8.9	-8.9	-8.9	-8.9
F	Composite SRI				17.8	22.8	27.8	34.5	43.3	53.6	54.5	59.0	64.5	66.8
G	A + B + E - F		20		44.6	40.4	34.1	18.6	9.0	1.6	-0.1	-11.2	-23.4	-29.8
H	K = 3				3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
I														
J	Calculated internal noise level		23		47.6	43.4	37.1	21.6	12.0	4.6	2.9	-8.2	-20.4	-26.8
K	Number of ventilators	1												
L	Ventilator D _{n,e}					29	34	37	35	36	41	42	51	
M	L _{Aeq} - D _{n,e} + 10*log(10) - B					35.9	29.5	17.8	19.0	20.8	15.1	7.4	-8.2	
N	Internal room noise level, vent open		27		44.1	37.8	23.1	19.8	20.9	15.3	7.5	-8.0		
Glazing: 6mm, 16mm, 6.8mm														
Ventilator type: TitanV50/standard canopy														
L _{Aeq} Assessment, night time														
Bedroom 3 - gable														
* Octave Band Centre Frequency, Hz														
				dB(A)	31.5*	63*	125*	250*	500*	1k*	2k*	4k*	8k*	16k*
A	90th %ile L _{eq}		57		53	61	61	50	49	52	52	44	36	26
B	Exposed façade, m ²	7.3			8.6	8.6	8.6	8.6	8.6	8.6	8.6	8.6	8.6	8.6
C	Volume of receiving room, m ³	23.9												
D	Reverb Time, seconds				0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
E	10 x Log(RT60/(0.163 x V))				-8.9	-8.9	-8.9	-8.9	-8.9	-8.9	-8.9	-8.9	-8.9	-8.9
F	Composite SRI				17.8	22.8	27.8	34.5	43.3	53.6	54.5	59.0	64.5	66.8
G	A + B + E - F		18		35.2	37.6	32.7	15.3	5.0	-2.2	-3.3	-15.0	-29.2	-40.9
H	K = 3				3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
I														
J	Calculated internal noise level		21		38.2	40.6	35.7	18.3	8.0	0.8	-0.3	-12.0	-26.2	-37.9
K	Number of ventilators	1												
L	Ventilator D _{n,e}					29	34	37	35	36	41	42	51	
M	L _{Aeq} - D _{n,e} + 10*log(10) - B					33.1	28.2	14.4	15.0	17.1	11.9	3.6	-14.0	
N	Internal room noise level, vent open		24			41.4	36.4	19.8	15.8	17.2	12.1	3.7	-13.7	
Glazing: 6mm, 16mm, 6.8mm														
Ventilator type: TitanV50/standard canopy														
L _{Amax} Assessment, night time														
Bedroom 3 - gable														
* Octave Band Centre Frequency, Hz														
				dB(A)	31.5*	63*	125*	250*	500*	1k*	2k*	4k*	8k*	16k*
A	90th %ile L _{max}		75		74	82	84	72	68	70	68	65	59	51
B	Exposed façade, m ²	7.3			8.6	8.6	8.6	8.6	8.6	8.6	8.6	8.6	8.6	8.6
C	Volume of receiving room, m ³	23.9												
D	Reverb Time, seconds				0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
E	10 x Log(RT60/(0.163 x V))				-8.9	-8.9	-8.9	-8.9	-8.9	-8.9	-8.9	-8.9	-8.9	-8.9
F	Composite SRI				17.8	22.8	27.8	34.5	43.3	53.6	54.5	59.0	64.5	66.8
G	A + B + E - F		41		55.9	58.7	55.4	37.5	24.8	16.2	13.3	5.3	-6.0	-15.9
H	K = 3				3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
I														
J	Calculated internal noise level		44		58.9	61.7	58.4	40.5	27.8	19.2	16.3	8.3	-3.0	-12.9
K	Number of ventilators	1												
L	Ventilator D _{n,e}					29	34	37	35	36	41	42	51	
M	L _{Aeq} - D _{n,e} + 10*log(10) - B					54.2	50.9	36.6	34.8	35.5	28.4	23.9	9.2	
N	Internal room noise level, vent open		45			62.5	59.1	42.0	35.6	35.6	28.7	24.0	9.4	
Glazing: 6mm, 16mm, 6.8mm														
Ventilator type: TitanV50/standard canopy														

First floor bedroom 4														
L _{Aeq} Assessment, daytime														
Bedroom 4 - gable														
* Octave Band Centre Frequency, Hz			dB(A)	31.5*	63*	125*	250*	500*	1k*	2k*	4k*	8k*	16k*	
A	90th %ile L _{eq}		64	66	68	66	58	57	60	59	52	45	39	
B	Exposed façade, m ²	9.3		9.7	9.7	9.7	9.7	9.7	9.7	9.7	9.7	9.7	9.7	
C	Volume of receiving room, m ³	29.1												
D	Reverb Time, seconds			0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	
E	10 x Log(RT60/(0.163 x V))			-9.8	-9.8	-9.8	-9.8	-9.8	-9.8	-9.8	-9.8	-9.8	-9.8	
F	Composite SRI			28.0	33.0	38.0	42.0	50.0	58.0	62.0	62.0	67.0	67.0	
G	A + B + E - F		15	38.1	34.8	28.2	15.7	7.1	1.9	-2.9	-9.9	-22.2	-28.2	
H	K = 3			3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
I														
J	Calculated internal noise level		18	41.1	37.8	31.2	18.7	10.1	4.9	0.1	-6.9	-19.2	-25.2	
Glazing:		-												
Ventilator type:		-												
Bedroom 4 - front elevation														
* Octave Band Centre Frequency, Hz			dB(A)	31.5*	63*	125*	250*	500*	1k*	2k*	4k*	8k*	16k*	
A	90th %ile L _{eq}		64	66	68	66	58	57	60	59	52	45	39	
B	Exposed façade, m ²	6.9		8.4	8.4	8.4	8.4	8.4	8.4	8.4	8.4	8.4	8.4	
C	Volume of receiving room, m ³	29.1												
D	Reverb Time, seconds			0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	
E	10 x Log(RT60/(0.163 x V))			-9.8	-9.8	-9.8	-9.8	-9.8	-9.8	-9.8	-9.8	-9.8	-9.8	
F	Composite SRI			17.6	22.6	27.6	34.3	43.1	53.5	54.3	58.8	64.4	66.8	
G	A + B + E - F		24	47.2	43.9	37.3	22.1	12.7	5.1	3.5	-8.0	-20.9	-29.2	
H	K = 3			3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
I														
J	Calculated internal noise level		27	50.2	46.9	40.3	25.1	15.7	8.1	6.5	-5.0	-17.9	-26.2	
K	Number of ventilators	1												
L	Ventilator D _{n,e}				35	40	37	34	43	50	53	63		
M	L _{Aeq} - D _{n,e} + 10*log(10) - B				34.5	27.9	22.4	24.8	18.6	10.8	0.8	-16.5		
N	Internal room noise level, vent open		29		47.2	40.6	27.0	25.3	19.0	12.2	1.8	-14.1		
Glazing:		6mm, 16mm, 6.8mm												
Ventilator type:		TitanV75/C50												
Combined sound level, dB(A)			29											
L _{Aeq} Assessment, night time														
Bedroom 4 - gable														
* Octave Band Centre Frequency, Hz			dB(A)	31.5*	63*	125*	250*	500*	1k*	2k*	4k*	8k*	16k*	
A	90th %ile L _{eq}		60	57	65	61	54	53	56	54	47	39	29	
B	Exposed façade, m ²	9.3		9.7	9.7	9.7	9.7	9.7	9.7	9.7	9.7	9.7	9.7	
C	Volume of receiving room, m ³	29.1												
D	Reverb Time, seconds			0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	
E	10 x Log(RT60/(0.163 x V))			-9.8	-9.8	-9.8	-9.8	-9.8	-9.8	-9.8	-9.8	-9.8	-9.8	
F	Composite SRI			28.0	33.0	38.0	42.0	50.0	58.0	62.0	62.0	67.0	67.0	
G	A + B + E - F		11	28.8	31.5	23.0	11.7	2.7	-2.2	-7.8	-15.1	-28.3	-37.9	
H	K = 3			3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
I														
J	Calculated internal noise level		14	31.8	34.5	26.0	14.7	5.7	0.8	-4.8	-12.1	-25.3	-34.9	
Glazing:		-												
Ventilator type:		-												

Bedroom 4 - front elevation														
* Octave Band Centre Frequency, Hz				dB(A)	31.5*	63*	125*	250*	500*	1k*	2k*	4k*	8k*	16k*
A	90th %ile L_{eq}		60	57	65	61	54	53	56	54	47	39	29	
B	Exposed façade, m ²	6.9		8.4	8.4	8.4	8.4	8.4	8.4	8.4	8.4	8.4	8.4	
C	Volume of receiving room, m ³	29.1												
D	Reverb Time, seconds			0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	
E	10 x Log(RT60/(0.163 x V))			-9.8	-9.8	-9.8	-9.8	-9.8	-9.8	-9.8	-9.8	-9.8	-9.8	
F	Composite SRI			17.6	22.6	27.6	34.3	43.1	53.5	54.3	58.8	64.4	66.8	
G	A + B + E - F		19	37.9	40.6	32.1	18.1	8.2	1.0	-1.4	-13.3	-27.0	-39.0	
H	K = 3			3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		
I														
J	Calculated internal noise level		22	40.9	43.6	35.1	21.1	11.2	4.0	1.6	-10.3	-24.0	-36.0	
K	Number of ventilators	1												
L	Ventilator $D_{n,e}$				35	40	37	34	43	50	53	63		
M	$L_{Aeq} - D_{n,e} + 10 \cdot \log(10) - B$				31.2	22.7	18.4	20.4	14.5	5.9	-4.4	-22.6		
N	Internal room noise level, vent open		24		43.9	35.4	23.0	20.9	14.8	7.3	-3.4	-20.3		
Glazing: 6mm, 16mm, 6.8mm														
Ventilator type: TitanV75/C50														
Combined sound level, dB(A)				25										
<u>L_{Amax} Assessment, night time</u>														
Bedroom 4 - gable														
* Octave Band Centre Frequency, Hz				dB(A)	31.5*	63*	125*	250*	500*	1k*	2k*	4k*	8k*	16k*
A	90th %ile L_{max}		78	76	86	83	74	71	73	72	67	62	53	
B	Exposed façade, m ²	9.3		9.7	9.7	9.7	9.7	9.7	9.7	9.7	9.7	9.7	9.7	
C	Volume of receiving room, m ³	29.1												
D	Reverb Time, seconds			0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	
E	10 x Log(RT60/(0.163 x V))			-9.8	-9.8	-9.8	-9.8	-9.8	-9.8	-9.8	-9.8	-9.8	-9.8	
F	Composite SRI			28.0	33.0	38.0	42.0	50.0	58.0	62.0	62.0	67.0	67.0	
G	A + B + E - F		32	47.7	53.1	44.5	31.8	20.6	14.8	9.8	5.0	-5.4	-14.1	
H	K = 3			3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		
I														
J	Calculated internal noise level		35	50.7	56.1	47.5	34.8	23.6	17.8	12.8	8.0	-2.4	-11.1	
Glazing: -														
Ventilator type: -														
Bedroom 4 - front elevation														
* Octave Band Centre Frequency, Hz				dB(A)	31.5*	63*	125*	250*	500*	1k*	2k*	4k*	8k*	16k*
A	90th %ile L_{max}		78	76	86	83	74	71	73	72	67	62	53	
B	Exposed façade, m ²	6.9		8.4	8.4	8.4	8.4	8.4	8.4	8.4	8.4	8.4	8.4	
C	Volume of receiving room, m ³	29.1												
D	Reverb Time, seconds			0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	
E	10 x Log(RT60/(0.163 x V))			-9.8	-9.8	-9.8	-9.8	-9.8	-9.8	-9.8	-9.8	-9.8	-9.8	
F	Composite SRI			17.6	22.6	27.6	34.3	43.1	53.5	54.3	58.8	64.4	66.8	
G	A + B + E - F		40	56.8	62.2	53.6	38.2	26.2	18.0	16.2	6.9	-4.1	-15.2	
H	K = 3			3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		
I														
J	Calculated internal noise level		43	59.8	65.2	56.6	41.2	29.2	21.0	19.2	9.9	-1.1	-12.2	
K	Number of ventilators	1												
L	Ventilator $D_{n,e}$				35	40	37	34	43	50	53	63		
M	$L_{Aeq} - D_{n,e} + 10 \cdot \log(10) - B$				52.8	44.2	38.5	38.3	31.5	23.5	15.7	0.3		
N	Internal room noise level, vent open		45		65.4	56.8	43.0	38.8	31.9	24.8	16.7	2.7		
Glazing: 6mm, 16mm, 6.8mm														
Ventilator type: TitanV75/C50														
Combined sound level, dB(A)				45										

First floor bedroom 5													
L _{Aeq} Assessment, daytime													
Bedroom 5 - front elevation													
* Octave Band Centre Frequency, Hz			dB(A)	31.5*	63*	125*	250*	500*	1k*	2k*	4k*	8k*	16k*
A	90th %ile L _{eq}	6.9 28	64	66	68	66	58	57	60	59	52	45	39
B	Exposed façade, m ²		8.4	8.4	8.4	8.4	8.4	8.4	8.4	8.4	8.4	8.4	8.4
C	Volume of receiving room, m ³												
D	Reverb Time, seconds		0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
E	10 x Log(RT60/(0.163 x V))		-9.6	-9.6	-9.6	-9.6	-9.6	-9.6	-9.6	-9.6	-9.6	-9.6	-9.6
F	Composite SRI		17.6	22.6	27.6	34.3	43.1	53.5	54.3	58.8	64.4	66.8	
G	A + B + E - F	24	47.4	44.1	37.5	22.3	12.8	5.3	3.7	-7.8	-20.7	-29.1	
H	K = 3		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
I													
J	Calculated internal noise level	1	27	50.4	47.1	40.5	25.3	15.8	8.3	6.7	-4.8	-17.7	-26.1
K	Number of ventilators												
L	Ventilator D _{n,e}				35	40	37	34	43	50	53	63	
M	L _{Aeq} - D _{n,e} + 10*log(10) - B				34.5	27.9	22.4	24.8	18.6	10.8	0.8	-16.5	
N	Internal room noise level, vent open		29		47.3	40.7	27.1	25.3	19.0	12.2	1.8	-14.0	
Glazing:		6mm, 16mm, 6.8mm											
Ventilator type:		TitanV75/C50											
L _{Aeq} Assessment, night time													
Bedroom 5 - front elevation													
* Octave Band Centre Frequency, Hz			dB(A)	31.5*	63*	125*	250*	500*	1k*	2k*	4k*	8k*	16k*
A	90th %ile L _{eq}	6.9 28	60	57	65	61	54	53	56	54	47	39	29
B	Exposed façade, m ²		8.4	8.4	8.4	8.4	8.4	8.4	8.4	8.4	8.4	8.4	8.4
C	Volume of receiving room, m ³												
D	Reverb Time, seconds		0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
E	10 x Log(RT60/(0.163 x V))		-9.6	-9.6	-9.6	-9.6	-9.6	-9.6	-9.6	-9.6	-9.6	-9.6	-9.6
F	Composite SRI		17.6	22.6	27.6	34.3	43.1	53.5	54.3	58.8	64.4	66.8	
G	A + B + E - F	19	38.0	40.8	32.3	18.3	8.4	1.1	-1.2	-13.1	-26.9	-38.8	
H	K = 3		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
I													
J	Calculated internal noise level	1	22	41.0	43.8	35.3	21.3	11.4	4.1	1.8	-10.1	-23.9	-35.8
K	Number of ventilators												
L	Ventilator D _{n,e}				35	40	37	34	43	50	53	63	
M	L _{Aeq} - D _{n,e} + 10*log(10) - B				31.2	22.7	18.4	20.4	14.5	5.9	-4.4	-22.6	
N	Internal room noise level, vent open		24		44.0	35.5	23.1	20.9	14.8	7.3	-3.4	-20.2	
Glazing:		6mm, 16mm, 6.8mm											
Ventilator type:		TitanV75/C50											
L _{Amax} Assessment, night time													
Bedroom 5 - front elevation													
* Octave Band Centre Frequency, Hz			dB(A)	31.5*	63*	125*	250*	500*	1k*	2k*	4k*	8k*	16k*
A	90th %ile L _{max}	6.9 28	78	76	86	83	74	71	73	72	67	62	53
B	Exposed façade, m ²		8.4	8.4	8.4	8.4	8.4	8.4	8.4	8.4	8.4	8.4	8.4
C	Volume of receiving room, m ³												
D	Reverb Time, seconds		0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
E	10 x Log(RT60/(0.163 x V))		-9.6	-9.6	-9.6	-9.6	-9.6	-9.6	-9.6	-9.6	-9.6	-9.6	-9.6
F	Composite SRI		17.6	22.6	27.6	34.3	43.1	53.5	54.3	58.8	64.4	66.8	
G	A + B + E - F	41	56.9	62.3	53.7	38.3	26.3	18.2	16.3	7.1	-3.9	-15.0	
H	K = 3		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
I													
J	Calculated internal noise level	1	44	59.9	65.3	56.7	41.3	29.3	21.2	19.3	10.1	-0.9	-12.0
K	Number of ventilators												
L	Ventilator D _{n,e}				35	40	37	34	43	50	53	63	
M	L _{Aeq} - D _{n,e} + 10*log(10) - B				52.8	44.2	38.5	38.3	31.5	23.5	15.7	0.3	
N	Internal room noise level, vent open		45		65.6	57.0	43.1	38.8	31.9	24.9	16.8	2.7	
Glazing:		6mm, 16mm, 6.8mm											
Ventilator type:		TitanV75/C50											

First floor bedroom 6													
L _{Aeq} Assessment, daytime													
Bedroom 6 - front elevation													
* Octave Band Centre Frequency, Hz			dB(A)	31.5*	63*	125*	250*	500*	1k*	2k*	4k*	8k*	16k*
A	90th %ile L _{eq}		64	66	68	66	58	57	60	59	52	45	39
B	Exposed façade, m ²	7.3		8.6	8.6	8.6	8.6	8.6	8.6	8.6	8.6	8.6	8.6
C	Volume of receiving room, m ³	25											
D	Reverb Time, seconds			0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
E	10 x Log(RT60/(0.163 x V))			-9.1	-9.1	-9.1	-9.1	-9.1	-9.1	-9.1	-9.1	-9.1	-9.1
F	Composite SRI			18.8	23.8	28.8	35.3	44.1	54.3	55.3	59.4	64.9	66.8
G	A + B + E - F		23	47.0	43.7	37.1	22.0	12.6	5.2	3.4	-7.7	-20.5	-28.4
H	K = 3			3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
I													
J	Calculated internal noise level		26	50.0	46.7	40.1	25.0	15.6	8.2	6.4	-4.7	-17.5	-25.4
K	Number of ventilators	1											
L	Ventilator D _{n,e}				35	40	37	34	43	50	53	63	
M	L _{Aeq} - D _{n,e} + 10*log(10) - B				34.3	27.7	22.2	24.6	18.4	10.6	0.6	-16.7	
N	Internal room noise level, vent open		28		46.9	40.3	26.8	25.1	18.8	12.0	1.7	-14.1	
Glazing:		6mm, 16mm, 6.8mm											
Ventilator type:		TitanV75/C50											
L _{Aeq} Assessment, night time													
Bedroom 6 - front elevation													
* Octave Band Centre Frequency, Hz			dB(A)	31.5*	63*	125*	250*	500*	1k*	2k*	4k*	8k*	16k*
A	90th %ile L _{eq}		60	57	65	61	54	53	56	54	47	39	29
B	Exposed façade, m ²	7.3		8.6	8.6	8.6	8.6	8.6	8.6	8.6	8.6	8.6	8.6
C	Volume of receiving room, m ³	25											
D	Reverb Time, seconds			0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
E	10 x Log(RT60/(0.163 x V))			-9.1	-9.1	-9.1	-9.1	-9.1	-9.1	-9.1	-9.1	-9.1	-9.1
F	Composite SRI			18.8	23.8	28.8	35.3	44.1	54.3	55.3	59.4	64.9	66.8
G	A + B + E - F		19	37.6	40.4	31.9	18.0	8.1	1.1	-1.5	-13.0	-26.7	-38.1
H	K = 3			3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
I													
J	Calculated internal noise level		22	40.6	43.4	34.9	21.0	11.1	4.1	1.5	-10.0	-23.7	-35.1
K	Number of ventilators	1											
L	Ventilator D _{n,e}				35	40	37	34	43	50	53	63	
M	L _{Aeq} - D _{n,e} + 10*log(10) - B				31.0	22.5	18.2	20.1	14.2	5.7	-4.7	-22.9	
N	Internal room noise level, vent open		24		43.6	35.1	22.8	20.6	14.6	7.1	-3.6	-20.3	
Glazing:		6mm, 16mm, 6.8mm											
Ventilator type:		TitanV75/C50											
L _{Amax} Assessment, night time													
Bedroom 6 - front elevation													
* Octave Band Centre Frequency, Hz			dB(A)	31.5*	63*	125*	250*	500*	1k*	2k*	4k*	8k*	16k*
A	90th %ile L _{max}		78	76	86	83	74	71	73	72	67	62	53
B	Exposed façade, m ²	7.3		8.6	8.6	8.6	8.6	8.6	8.6	8.6	8.6	8.6	8.6
C	Volume of receiving room, m ³	25											
D	Reverb Time, seconds			0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
E	10 x Log(RT60/(0.163 x V))			-9.1	-9.1	-9.1	-9.1	-9.1	-9.1	-9.1	-9.1	-9.1	-9.1
F	Composite SRI			18.8	23.8	28.8	35.3	44.1	54.3	55.3	59.4	64.9	66.8
G	A + B + E - F		40	56.5	61.9	53.3	38.0	26.1	18.1	16.0	7.2	-3.7	-14.3
H	K = 3			3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
I													
J	Calculated internal noise level		43	59.5	64.9	56.3	41.0	29.1	21.1	19.0	10.2	-0.7	-11.3
K	Number of ventilators	1											
L	Ventilator D _{n,e}				35	40	37	34	43	50	53	63	
M	L _{Aeq} - D _{n,e} + 10*log(10) - B				52.5	43.9	38.2	38.1	31.3	23.2	15.5	0.1	
N	Internal room noise level, vent open		44		65.2	56.6	42.9	38.6	31.7	24.6	16.6	2.7	
Glazing:		6mm, 16mm, 6.8mm											
Ventilator type:		TitanV75/C50											

First floor bedroom 7														
L _{Aeq} Assessment, daytime														
Bedroom 7 - front elevation														
* Octave Band Centre Frequency, Hz			dB(A)	31.5*	63*	125*	250*	500*	1k*	2k*	4k*	8k*	16k*	
A	90th %ile L _{eq}		64	66	68	66	58	57	60	59	52	45	39	
B	Exposed façade, m ²	6.1		7.9	7.9	7.9	7.9	7.9	7.9	7.9	7.9	7.9	7.9	
C	Volume of receiving room, m ³	24.5												
D	Reverb Time, seconds			0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	
E	10 x Log(RT60/(0.163 x V))			-9.0	-9.0	-9.0	-9.0	-9.0	-9.0	-9.0	-9.0	-9.0	-9.0	
F	Composite SRI			28.0	33.0	38.0	42.0	50.0	58.0	62.0	62.0	67.0	67.0	
G	A + B + E - F		14	37.1	33.7	27.1	14.6	6.0	0.8	-4.0	-11.0	-23.2	-29.2	
H	K = 3			3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
I														
J	Calculated internal noise level		17	40.1	36.7	30.1	17.6	9.0	3.8	-1.0	-8.0	-20.2	-26.2	
Glazing:		-												
Ventilator type:		-												
Bedroom 7 - gable														
* Octave Band Centre Frequency, Hz			dB(A)	31.5*	63*	125*	250*	500*	1k*	2k*	4k*	8k*	16k*	
A	90th %ile L _{eq}		64	66	68	66	58	57	60	59	52	45	39	
B	Exposed façade, m ²	8.6		9.3	9.3	9.3	9.3	9.3	9.3	9.3	9.3	9.3	9.3	
C	Volume of receiving room, m ³	24.5												
D	Reverb Time, seconds			0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	
E	10 x Log(RT60/(0.163 x V))			-9.0	-9.0	-9.0	-9.0	-9.0	-9.0	-9.0	-9.0	-9.0	-9.0	
F	Composite SRI			18.5	23.5	28.5	35.1	43.9	54.1	55.1	59.3	64.8	66.8	
G	A + B + E - F		25	48.1	44.8	38.2	23.0	13.6	6.2	4.4	-6.8	-19.6	-27.6	
H	K = 3			3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
I														
J	Calculated internal noise level		28	51.1	47.8	41.2	26.0	16.6	9.2	7.4	-3.8	-16.6	-24.6	
K	Number of ventilators	1												
L	Ventilator D _{n,e}				35	40	37	34	43	50	53	63		
M	L _{Aeq} - D _{n,e} + 10*log(10) - B				33.6	27.0	21.5	23.9	17.7	9.9	-0.2	-17.4		
N	Internal room noise level, vent open		29		47.9	41.3	27.3	24.6	18.2	11.8	1.4	-14.0		
Glazing:		6mm, 16mm, 6.8mm												
Ventilator type:		TitanV75/C50												
			Combined sound level, dB(A)	29										
L _{Aeq} Assessment, night time														
Bedroom 7 - front elevation														
* Octave Band Centre Frequency, Hz			dB(A)	31.5*	63*	125*	250*	500*	1k*	2k*	4k*	8k*	16k*	
A	90th %ile L _{eq}		60	57	65	61	54	53	56	54	47	39	29	
B	Exposed façade, m ²	6.1		7.9	7.9	7.9	7.9	7.9	7.9	7.9	7.9	7.9	7.9	
C	Volume of receiving room, m ³	24.5												
D	Reverb Time, seconds			0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	
E	10 x Log(RT60/(0.163 x V))			-9.0	-9.0	-9.0	-9.0	-9.0	-9.0	-9.0	-9.0	-9.0	-9.0	
F	Composite SRI			28.0	33.0	38.0	42.0	50.0	58.0	62.0	62.0	67.0	67.0	
G	A + B + E - F		10	27.7	30.4	21.9	10.6	1.6	-3.3	-8.9	-16.2	-29.4	-39.0	
H	K = 3			3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
I														
J	Calculated internal noise level		13	30.7	33.4	24.9	13.6	4.6	-0.3	-5.9	-13.2	-26.4	-36.0	
Glazing:		-												
Ventilator type:		-												

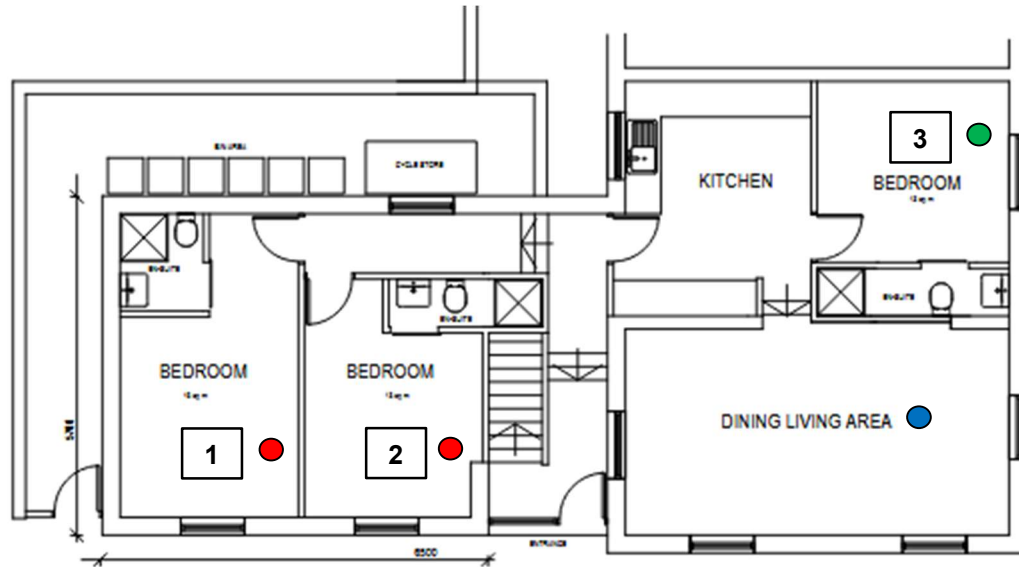
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First floor bedroom 8														
L _{Aeq} Assessment, daytime														
Bedroom 8 - gable														
* Octave Band Centre Frequency, Hz			dB(A)	31.5*	63*	125*	250*	500*	1k*	2k*	4k*	8k*	16k*	
A	90th %ile L _{eq} (dist corrected)	6	30	60	63	64	62	53	53	55	55	48	41	37
B	Exposed façade, m ²			7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8
C	Volume of receiving room, m ³													
D	Reverb Time, seconds													
E	10 x Log(RT60/(0.163 x V))													
F	Composite SRI	19			0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
G	A + B + E - F			43.5	39.3	33.0	17.5	7.8	0.3	-1.2	-12.6	-24.9	-31.6	
H	K = 3			3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
I														
J	Calculated internal noise level			22	46.5	42.3	36.0	20.5	10.8	3.3	1.8	-9.6	-21.9	-28.6
K	Number of ventilators	1												
L	Ventilator D _{n,e}													
M	L _{Aeq} - D _{n,e} + 10*log(10) - B													
N	Internal room noise level, vent open			24	42.6	36.3	22.7	21.2	15.0	8.1	-2.0	-17.4		
Glazing:				6mm, 16mm, 6.8mm										
Ventilator type:		TitanV75/C50												
L _{Aeq} Assessment, night time														
Bedroom 8 - gable														
* Octave Band Centre Frequency, Hz			dB(A)	31.5*	63*	125*	250*	500*	1k*	2k*	4k*	8k*	16k*	
A	90th %ile L _{eq} (dist corrected)	6	30	57	53	61	61	50	49	52	52	44	36	26
B	Exposed façade, m ²			7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8
C	Volume of receiving room, m ³													
D	Reverb Time, seconds													
E	10 x Log(RT60/(0.163 x V))													
F	Composite SRI	17			0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
G	A + B + E - F			34.2	36.6	31.6	14.2	3.8	-3.5	-4.4	-16.4	-30.6	-42.7	
H	K = 3			3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
I														
J	Calculated internal noise level			20	37.2	39.6	34.6	17.2	6.8	-0.5	-1.4	-13.4	-27.6	-39.7
K	Number of ventilators	1												
L	Ventilator D _{n,e}													
M	L _{Aeq} - D _{n,e} + 10*log(10) - B													
N	Internal room noise level, vent open			22	39.9	34.9	19.3	17.3	11.2	4.9	-5.8	-23.2		
Glazing:				6mm, 16mm, 6.8mm										
Ventilator type:		TitanV75/C50												
L _{Amax} Assessment, night time														
Bedroom 8 - gable														
* Octave Band Centre Frequency, Hz			dB(A)	31.5*	63*	125*	250*	500*	1k*	2k*	4k*	8k*	16k*	
A	90th %ile L _{max} (dist corrected)	6	30	75	74	82	84	72	68	70	68	65	59	51
B	Exposed façade, m ²			7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8
C	Volume of receiving room, m ³													
D	Reverb Time, seconds													
E	10 x Log(RT60/(0.163 x V))													
F	Composite SRI	39			0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
G	A + B + E - F			54.8	57.7	54.3	36.3	23.6	14.9	12.1	3.9	-7.5	-17.7	
H	K = 3			3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
I														
J	Calculated internal noise level			42	57.8	60.7	57.3	39.3	26.6	17.9	15.1	6.9	-4.5	-14.7
K	Number of ventilators	1												
L	Ventilator D _{n,e}													
M	L _{Aeq} - D _{n,e} + 10*log(10) - B													
N	Internal room noise level, vent open			44	61.0	57.6	41.5	37.0	29.6	21.4	14.6	0.0		
Glazing:				6mm, 16mm, 6.8mm										
Ventilator type:		TitanV75/C50												

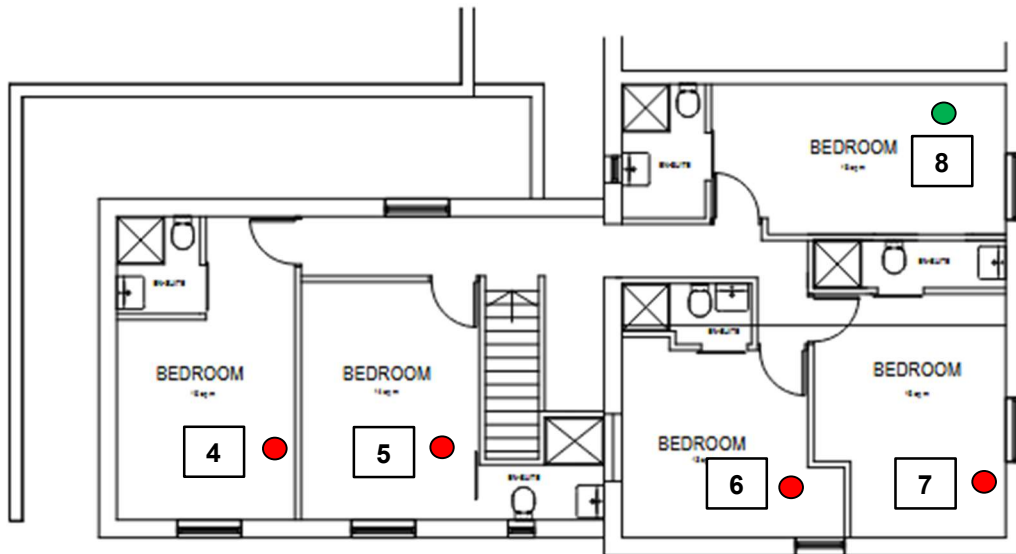
Ground floor Dining/living area														
L _{Aeq} Assessment, daytime														
Dining/living area - gable														
* Octave Band Centre Frequency, Hz			dB(A)	31.5*	63*	125*	250*	500*	1k*	2k*	4k*	8k*	16k*	
A	Measured L _{eq}	8.2	65	68	69	67	58	58	60	60	53	46	42	
B	Exposed façade, m ²			9.1	9.1	9.1	9.1	9.1	9.1	9.1	9.1	9.1	9.1	
C	Volume of receiving room, m ³			53.2										
D	Reverb Time, seconds				0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	
E	10 x Log(RT60/(0.163 x V))				-12.4	-12.4	-12.4	-12.4	-12.4	-12.4	-12.4	-12.4	-12.4	
F	Composite SRI			20.9	25.9	30.9	27.5	32.6	42.6	45.6	42.6	47.6	52.5	
G	A + B + E - F		24	43.5	39.3	33.0	27.6	21.7	14.7	10.9	7.1	-4.5	-13.5	
H	K = 3	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		
I														
J	Calculated internal noise level		1	27	46.5	42.3	36.0	30.6	24.7	17.7	13.9	10.1	-1.5	-10.5
K	Number of ventilators													
L	Ventilator D _{n,e}													
M	L _{Aeq} - D _{n,e} + 10*log(10) - B													
N	Internal room noise level, vent open					31		44.5	38.1	31.2	27.2	26.0	20.6	14.1
Glazing:				4mm, 16/20mm, 4mm										
Ventilator type:				TitanV50/standard canopy										
Dining/living area - front elevation														
* Octave Band Centre Frequency, Hz			dB(A)	31.5*	63*	125*	250*	500*	1k*	2k*	4k*	8k*	16k*	
A	Measured L _{eq}	15.6	65	68	69	67	58	58	60	60	53	46	42	
B	Exposed façade, m ²			11.9	11.9	11.9	11.9	11.9	11.9	11.9	11.9	11.9	11.9	
C	Volume of receiving room, m ³			53.2										
D	Reverb Time, seconds				0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	
E	10 x Log(RT60/(0.163 x V))				-12.4	-12.4	-12.4	-12.4	-12.4	-12.4	-12.4	-12.4	-12.4	
F	Composite SRI			21.2	26.2	31.2	27.9	32.9	42.9	45.9	43.0	48.0	52.9	
G	A + B + E - F		27	46.1	41.9	35.5	30.1	24.2	17.1	13.3	9.6	-2.0	-11.1	
H	K = 3	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		
I														
J	Calculated internal noise level		2	30	49.1	44.9	38.5	33.1	27.2	20.1	16.3	12.6	1.0	-8.1
K	Number of ventilators													
L	Ventilator D _{n,e}													
M	L _{Aeq} - D _{n,e} + 10*log(10) - B													
N	Internal room noise level, vent open					32		46.2	39.9	33.4	28.8	26.7	21.4	15.3
Glazing:				4mm, 16/20mm, 4mm										
Ventilator type:				TitanV50/standard canopy										
			Combined sound level, dB(A)	34										

Appendix 3: Internal layout and location of the proposed glazing and ventilation options

Ground floor plan



First floor plan



- 6mm - 16mm - 6.8mm sealed unit + Titan V75/C50 ventilator
- 6mm - 16mm - 6.8mm sealed unit + Titan V50/standard canopy
- 4mm - 12 - 20mm - 4mm sealed unit + Titan V50/standard canopy

Appendix 4: References

L.S. Søndergaard, R. Egeda. "Open windows with better sound insulation", DELTA Acoustics, Denmark, 2016.