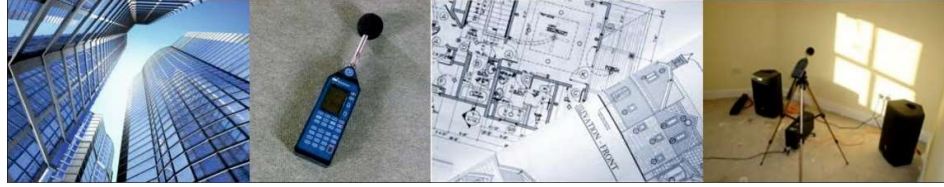


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**71 HIGH STREET
BOTLEY
SOUTHAMPTON
SO30 2ES**

ENVIRONMENTAL NOISE ASSESSMENT
CONDITION 13 OF APPLICATION F/23/96117
v.1 Draft for Discussion

Client:
STUDIO FIFTY FOUR

24 July 2024
Ref: M5633

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1. SUMMARY

- 1.1 An assessment of environmental noise has been undertaken for a new residential development at 71 High Street, Botley.
- 1.2 It is proposed that a three bedroom, two storey house be built on land between two existing residential properties.
- 1.3 The existing ambient noise climate affecting the site has been established by means of an attended hour environmental noise survey (Section 3). The survey data has been used to predict the daytime and night-time noise levels affecting each façade of the building.
- 1.4 Section 4 provides a description of the relevant national planning policies and defines the criteria which would commonly be applied to projects of this nature.
- 1.5 In order to comply with these requirements, the following replacement glazing and ventilation provisions have been recommended:

Glazing											
Frequency	Hz	63	125	250	500	1K	2K	4K	8K	Rw	Config.
Front, Living Rooms	dB	25	30	32	40	43	43	54	54	36	10/16/8.8
Front, Bedrooms	dB	35	31	35	40	42	49	55	55	39	12/16/8.8
Rear, Living Rooms & Bedrooms	dB	21	21	18	26	37	42	33	35	27	4 / 16 / 4
Vents											
Frequency	Hz	63	125	250	500	1K	2K	4K	8K	Dn,e,w	Vent Type
Front, Living Rooms	dB	40	41	42	37	43	46	40	40	42 (Open)	KIT EAR 5-35 42
Front, Bedrooms	dB	40	41	42	37	43	46	40	40	42 (Open)	Wall Vent.
Front, Living Rooms & Bedrooms	dB	40	39	35	35	31	32	35	40	32 (Open)	Simons FV

Table 1.1 – Proposed Glazing and Ventilation Types (Sound Insulation Performance, dB)

- 1.6 Section 5 also discusses the acoustic implications of providing higher rates of ventilation. Under the statutory requirements of Approved Document O, the front bedroom could not be ventilated at night using an open-window strategy to mitigate any overheating issues. This room will require an alternative approach.
- 1.7 Further comment has been made about the best practice guidelines for ventilation, and it is recommended that consideration is given to the provision of a mechanical solution to the Study (strongly recommended) and rear bedrooms (marginal).
- 1.8 With these provisions in place, the acoustic amenity of the new occupiers can be assured.

2. INTRODUCTION

- 2.1 An assessment of environmental noise has been undertaken at 71 High Street, Botley, on behalf of Studio Fifty Four architects.
- 2.2 The site lies on the main road through Botley, just outside the main commercial centre. The open parcel is located between two existing residential properties:



- 2.3 Planning consent has been granted for the construction of a three-bedroom, two-storey house (ref. F/23/96117).
- 2.4 Figures 1 – 2 provide details of the location and the proposed layouts.
- 2.5 Condition 13 of the consent states:

Prior to development above damp proof course (DPC), details of measures to protect future occupiers of the development from noise and air pollution associated with High Street have been submitted to, and agreed in writing by the Local Planning Authority. The agreed measures shall then be implemented and retained in full working order throughout the lifetime of the development.

- 2.6 Given the requirements of Condition 13, it will therefore be necessary to ensure the scheme provides sufficient protection for any prospective occupants of the new buildings

2.7 Ian Sharland Limited have been commissioned to investigate the current situation and this report will:

- (i) Describe a survey of ambient noise levels on the site.
- (ii) Confirm the required noise targets within the new dwellings, and hence the sound insulation performance required through the facades
- (iii) Describe a suitable form of construction to achieve this requirement
- (iv) Discuss the question of ventilation, and whether an open window strategy can be employed here.

3. SURVEY OF EXISTING NOISE LEVELS

- 3.1 The first step in determining the existing ambient noise level was to conduct a survey of noise affecting the site.
- 3.2 Owing to the open nature of the land, it was not possible to conduct a long-term unattended survey. Therefore, a short-form survey was conducted in accordance with the DoT Calculation of Road Traffic document
- 3.3 The survey was visited on Wednesday 17th July 2024, between 13.00 and 16.00
- 3.4 A Rion NL52 sound level meter was set up on the north-east boundary of the site, in line with the front façade of the proposed building. The microphone was set on a tripod, nom. 2.5m above ground level, to give an unobstructed view of the road traffic on the High Street.
- 3.5 The equipment was configured to measure 5-minute samples of the following acoustic parameters:
- | | |
|---------------------|---|
| L _{Aeq} | The A-weighted equivalent continuous sound pressure level which, over the sample period, contains the same acoustic energy as the time-varying signal being recorded. |
| L _{Amax,f} | The A-weighted maximum sound pressure level recorded during each sample period (as measured on fast response). |
| L _{A10} | A statistical parameter, representing the A-weighted noise level exceeded for 10% of each sample period. This measure is commonly used to describe the road traffic noise. |
| L _{A90} | A statistical parameter, representing the A-weighted noise level exceeded for 90% of each sample period. This gives a measure of the underlying noise, and is commonly used to describe the ambient background noise. |
- 3.6 The equipment was calibrated before and after the survey and showed no significant variance. Weather conditions during the survey were fine and dry, with a slight breeze
- 3.7 Figure 3 indicates the variation in overall noise level across the survey period at the monitoring position.
- 3.8 For the period of the survey, the 5 minute samples indicated a relatively steady level of noise from the traffic on the High Street (by far the most dominant noise source locally).
- 3.9 The results from this exercise are summarized in Table 3.1.

Period		Daytime L _{Aeq, 3hrs}	Daytime L _{A10, ave}	Typical Peak Levels L _{Amax, fast}
13.00 – 16.00	dB(A)	69.0	71.2	80 – 85

Table 3.1 – Summary of Measured Noise Levels, dB(A).

- 3.10 The Calculation of Road Traffic Noise document provides a means of converting the average 3-hour L₁₀ measurements to a standard 18hr value. In this instance, the formula yields a value of:

Day Time 70.2 dB(A) L_{A10, 0600 – 0000}.

- 3.11 The L_{Amax} levels shown in Table 3.2 are the typical peak values recorded during the 3 hour survey period. These exclude two of the 36 periods, where higher values were recorded. In all cases, the observed maxima were the result of road traffic.

- 3.12 The 2002 TRL report (PR/SE/451/02) 'Converting the UK traffic noise index LA10,18h to EU noise indices for noise mapping' details the method converting samples of day time samples of road traffic noise into the more usual parameters of L_{Aeq} 0700 – 2300 and L_{Aeq} 2300 – 0700. Using this relationship, the sampled noise would suggest day and night time noise levels (free field) of:

Day Time 68 dB(A) L_{Aeq, 0700 – 2300}

Night Time 59 dB(A) L_{Aeq, 2300 – 0700}

- 3.13 The significance of the measured noise levels will be discussed below.

4. ASSESSMENT OF NOISE LEVELS

4.1 National Planning Policy Framework (December 2023)

- 4.1.1 The National Planning Policy Framework (NPPF) sets out the Government's planning policies for England and how these should be applied. It provides a framework within which locally prepared plans for housing and other development can be produced.
- 4.1.2 Planning law requires that applications for planning permission be determined in accordance with the development plan, unless material considerations indicate otherwise. The National Planning Policy Framework must be considered in preparing the development plan and is a material consideration in planning decisions. Planning policies and decisions must also reflect relevant international obligations and statutory requirements.
- 4.1.3 The purpose of the planning system is to contribute to the achievement of sustainable development. At a very high level, the objective of sustainable development can be summarised as meeting the needs of the present without compromising the ability of future generations to meet their own needs.
- 4.1.4 Paragraphs 180, 191 & 193 of the NPPF states:

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

- (a) protecting and enhancing valued landscapes, sites of biodiversity or geological value and soils (in a manner commensurate with their statutory status or identified quality in the development plan);*
- (b) recognising the intrinsic character and beauty of the countryside, and the wider benefits from natural capital and ecosystem services – including the economic and other benefits of the best and most versatile agricultural land, and of trees and woodland;*
- (c) maintaining the character of the undeveloped coast, while improving public access to it where appropriate;*
- (d) minimising impacts on and providing net gains for biodiversity, including by establishing coherent ecological networks that are more resilient to current and future pressures;*
- (e) preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution or land instability. Development should, wherever possible, help to improve local environmental conditions such as air and water quality, taking into account relevant information such as river basin management plans; and*
- (f) remediating and mitigating despoiled, degraded, derelict, contaminated and unstable land, where appropriate.*

191. *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 minimum potential adverse impacts resulting from noise from new development – and avoid noise giving rise to significant adverse impacts on health and the quality of life^[1] ;*
- 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.*

193. *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.*

4.2 National Policy Statement for England (March 2010)

4.2.1 The document "Noise Policy Statement for England" sets out the following vision for on-going noise policy:

"Promote good health and quality of life through the effective management of noise within the context of Government policy on sustainable development."

4.2.2 This vision should be achieved through the following Noise Policy 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".*

4.2.3 To achieve these objectives the Noise Policy Statement sets out three noise levels to be defined by the assessor:

^[1] Refers here to the NPSE, discussed in Section 3.2 of this report.

- **NOEL** - No Observed Effect Level
This is the level below which no effect can be detected. In simple terms, below this level there is no detectable effect on health and quality of life due to the noise.
- **LOAEL** - Lowest Observed Adverse Effect Level
This is the level above which adverse effects on health and quality of life can be detected. Where levels lie between the LOAEL and SOAEL, the Statement requires that all reasonable steps should be taken to mitigate and minimise adverse effects on health and quality of life while also taking into account the guiding principles of sustainable development, as set out in the NPPF.
- **SOAEL** - Significant Observed Adverse Effect Level
This is the level above which significant adverse effects on health and quality of life occur. It notes, however, that "it is not possible to have a single objective noise-based measure that describes SOAEL that is applicable to all sources of noise in all situations. Consequently, the SOAEL is likely to be different for different noise sources, for different receptors and at different times".

4.2.4 Paragraph 2.7 states that "... the application of the NPSE should enable noise to be considered alongside other relevant issues and not to be considered in isolation. In the past, the wider benefits of a policy, development or other activity may not have been given adequate weight when assessing the noise implications".

4.2.5 This provides clear guidance that noise must not be considered in isolation but as part of the overall scheme, taking into account the overall sustainability and associated impacts of the proposed development; there is no benefit in reducing noise to an excessively low level if this creates or increases some other adverse impact. Similarly, it may be appropriate in some cases for noise to have an adverse impact if this is outweighed by the reduction or removal of some other adverse impact that is of greater significance to the development.

4.2.6 The Noise Policy Statement considers that noise levels above the SOAEL would be seen to have, by definition, significant adverse effects and would be considered unacceptable. Where the assessed noise levels fall between the LOAEL and the SOAEL noise levels, the Policy Statement requires that:

"all reasonable steps should be taken to mitigate and minimise adverse effects on health and quality of life while also considering the guiding principles of sustainable development.... This does not mean that such adverse effects cannot occur."

4.2.7 Where noise levels are below the LOAEL it is considered there will be no adverse effect. Once noise levels are below the NOEL there will be no observable change. An indication of the numerical definition of LOAEL may be derived from the following guidance.

4.3 Planning Practice Guide 'Noise' (July 2019)

4.3.1 The Ministry of Housing Communities and Local Government provided further guidance to support the NPPF. The section, Noise, published in July 2019, provides the following advice:

When is noise relevant to planning?

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

What are the observed effect levels?

- *Significant observed adverse effect level: This is the level of noise exposure above which significant adverse effects on health and quality of life occur.*
- *Lowest observed adverse effect level: this is the level of noise exposure above which adverse effects on health and quality of life can be detected.*
- *No observed effect level: this is the level of noise exposure below which no effect at all on health or quality of life can be detected.*

Although the word 'level' is used here, this does not mean that the effects can only be defined in terms of a single value of noise exposure. In some circumstances adverse effects are defined in terms of a combination of more than one factor such as noise exposure, the number of occurrences of the noise in a given time period, the duration of the noise and the time of day the noise occurs.

How can it be established whether noise is likely to be a concern?

At the lowest extreme, when noise is not perceived to be present, there is by definition no effect. As the noise exposure increases, it will cross the 'no observed effect' level. However, the noise has no adverse effect so long as the exposure does not cause any change in behaviour, attitude or other physiological responses of those affected by it. The noise may slightly affect the acoustic character of an area but not to the extent there is a change in quality of life. If the noise exposure is at this level no specific measures are required to manage the acoustic environment.

As the exposure increases further, it crosses the 'lowest observed adverse effect' level boundary above which the noise starts to cause small changes in behaviour and attitude, for example, having to turn up the volume on the television or needing to speak more loudly to be heard. The noise therefore starts to have an adverse effect and consideration needs to be given to mitigating and minimising those effects (taking account of the economic and social benefits being derived from the activity causing the noise).

Increasing noise exposure will at some point cause the 'significant observed adverse effect' level boundary to be crossed. Above this level the noise causes a material change

in behaviour such as keeping windows closed for most of the time or avoiding certain activities during periods when the noise is present. If the exposure is predicted to be above this level the planning process should be used to avoid this effect occurring, for example through the choice of sites at the plan-making stage, or by use of appropriate mitigation such as by altering the design and layout. While such decisions must be made taking account of the economic and social benefit of the activity causing or affected by the noise, it is undesirable for such exposure to be caused.

At the highest extreme, noise exposure would cause extensive and sustained adverse changes in behaviour and / or health without an ability to mitigate the effect of the noise. The impacts on health and quality of life are such that regardless of the benefits of the activity causing the noise, this situation should be avoided.

- 4.3.2 The table below summarises the noise exposure hierarchy, based on the likely average response:

Perception	Examples of Outcomes	Increasing Effect Level	Action
No Observed Effect Level			
<i>Not Present</i>	<i>No Effect</i>	<i>No Observed Effect</i>	<i>No specific measures required</i>
<i>Present and not intrusive</i>	Noise can be heard, but does not cause any change in behaviour, attitude or other physiological response. Can slightly affect the acoustic character of the area but not such that there is a change in the quality of life.	<i>No Observed Adverse Effect</i>	<i>No specific measures required</i>
Lowest Observed Adverse Effect Level			
<i>Present and intrusive</i>	Noise can be heard and causes small changes in behaviour, attitude or other physiological response, 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 small actual or perceived change in the quality of life.	<i>Observed Adverse Effect</i>	<i>Mitigate and reduce to a minimum</i>
Significant Observed Adverse Effect Level			
<i>Present and disruptive</i>	The noise causes a material change in behaviour, attitude or other physiological response, 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	<i>Significant Observed Adverse Effect</i>	<i>Avoid</i>
<i>Present and very disruptive</i>	Extensive and regular changes in behaviour, attitude or other physiological response and/or an inability to mitigate effect of noise leading to psychological stress, e.g. regular sleep deprivation/awakening; loss of appetite, significant, medically definable harm, e.g. auditory and non-auditory.	<i>Unacceptable Adverse Effect</i>	<i>Prevent</i>

Table 4.1 – Noise Exposure Hierarchy

4.3.3 The guidance further advises:

What factors influence whether noise could be a concern?

The subjective nature of noise means that there is not a simple relationship between noise levels and the impact on those affected. This will depend on how various factors combine in any particular situation.

These factors include:

- the source and absolute level of the noise together with the time of day it occurs. Some types and level of noise will cause a greater adverse effect at night than if they occurred during the day – this is because people tend to be more sensitive

to noise at night as they are trying to sleep. The adverse effect can also be greater simply because there is less background noise at night.

- for a new noise making source, how the noise from it relates to the existing sound environment.
- for non-continuous sources of noise, the number of noise events, and the frequency and pattern of occurrence of the noise.
- the spectral content of the noise (i.e. whether or not the noise contains particular high or low frequency content) and the general character of the noise (i.e. whether or not the noise contains particular tonal characteristics or other particular features), and
- the local arrangement of buildings, surfaces and green infrastructure, and the extent to which it reflects or absorbs noise.

More specific factors to consider when relevant include:

- the cumulative impacts of more than one source of noise.
- whether any adverse internal effects can be completely removed by closing windows and, in the case of new residential development, if the proposed mitigation relies on windows being kept closed most of the time (and the effect this may have on living conditions). In both cases a suitable alternative means of ventilation is likely to be necessary. Further information on ventilation can be found in the Building Regulations;
- In cases where existing noise sensitive locations already experience high noise levels, a development that is expected to cause even a small increase in the overall noise level may result in a significant adverse effect occurring even though little to no change in behaviour would be likely to occur.
- Noise Action Plans (where these exist), and, in particular the Important Areas identified through the process associated with the Environmental Noise Directive and corresponding regulations should be taken into account. Defra's website has information on Noise Action Plans and Important Areas. Local authority environmental health departments will also be able to provide information about Important Areas.
- the effect of noise on wildlife. Noise can adversely affect wildlife and ecosystems. Particular consideration needs to be given to the potential effects of noisy development on international, national and locally designated sites of importance for biodiversity.
- where external amenity spaces are an intrinsic part of the overall design, the acoustic environment of those spaces should be considered so that they can be enjoyed as intended.
- some commercial developments including restaurants, hot food takeaways, night clubs and public houses can have particular impacts, not least because activities are often at their peak in the evening and late at night. Local planning authorities will wish to bear in mind not only the noise that is generated within the premises but also the noise that may be made by customers in the vicinity.

When proposed developments could include activities that would be covered by the licensing regime, local planning authorities will need to consider whether the potential for adverse noise impacts will be addressed through licensing controls (including licence conditions). Local planning authorities should not however presume that licence conditions will provide for noise management in all instances and should liaise with the licensing authority.

Are there further considerations relating to mitigating the impact of noise on residential developments?

Noise impacts may be partially offset if residents have access to one or more of:

- a relatively quiet facade (containing windows to habitable rooms) as part of their dwelling.
- a relatively quiet external amenity space for their sole use, (e.g. a garden or balcony). Although the existence of a garden or balcony is generally desirable, the intended benefits will be reduced if this area is exposed to noise levels that result in significant adverse effects.
- a relatively quiet, protected, nearby external amenity space for sole use by a limited group of residents as part of the amenity of their dwellings; and/or
- a relatively quiet, protected, external publically accessible amenity space (e.g. a public park or a local green space designated because of its tranquillity) that is nearby (e.g. within a 5-minute walking distance).

4.3.4 The noise impact on residential developments may be partially off-set if the residents of those dwellings have access to:

- *a relatively quiet facade (containing windows to habitable rooms) as part of their dwelling, and/or;*
- *a relatively quiet external amenity space for their sole use, (e.g. a garden or balcony). Although the existence of a garden or balcony is generally desirable, the intended benefits will be reduced with increasing noise exposure and could be such that significant adverse effects occur, and/or;*
- *a relatively quiet, protected, nearby external amenity space for sole use by a limited group of residents as part of the amenity of their dwellings, and/or;*
- *a relatively quiet, protected, external publically accessible amenity space (e.g. a public park or a local green space designated because of its tranquillity) that is nearby (e.g. within a 5 minute walking distance).*

4.4 Eastleigh Borough Council Local Plan 2016 – 2032

4.4.1 The local authorities adopted Local Plan sets out the manner in which it will apply national planning guidance to the local area.

4.4.2 In respect of Pollution, including noise, the Plan advises:

5.49 Noise - The adverse effects of exposure to excessive noise and vibration on health and quality of life are well documented and recognised as a material planning consideration. The Council supports the approach of the Noise Policy Statement for England in relation to the effective control of noise within the context of sustainable development. Any proposals likely to generate noise (including demolition and construction noise) will be expected to take account of the impact of this on any noise sensitive population, including those using recreational areas. Similarly, in assessing proposals for noise sensitive development, the Council will expect the developer to take into account existing noise levels and foreseeable changes to these. In doing so, developers must avoid significant adverse noise impacts to residential amenities. Development proposals should ensure that they mitigate and minimise adverse noise impacts and, where possible, contribute to the improvement of health and quality of life. Where necessary, the Council will require a noise assessment which will be expected to:

- identify all significant sources of noise;*
- assess the likely short and long term impacts of noise generated or exposure to noise; and*
- propose noise protection measures.*

Wherever possible, developments should use site and building layout and design to manage levels of noise on development sites. Where acceptable internal noise levels cannot be met with open windows, alternative ventilation will be required. Where the development site is affected by air pollution in addition to noise, early consideration of the location of air ventilation inlets is recommended. The following standards will be used to assess the acceptability of development proposals affected by steady external noise sources:

In respect of the Solent and Southampton Water SPA and Ramsar sites and supporting habitat, construction noise should be kept below 69dBA max either alone or in combination with other developments (measured at the sensitive receptor which is the nearest point of the SPA/Ramsar or supporting habitat) during the bird overwintering period, or works timed so that they do not coincide with the wintering bird season. Natural England will provide advice on a case by case basis where construction noise exceeds 69dBA max

4.4.2 This approach is captured in Policy DM8 Pollution:

1. Development will not be permitted if it is likely to cause loss of amenity or impact on public health or other unacceptable environmental impacts through:
 - a. air pollution (including odours or particulate emissions);
 - b. pollution of surface, underground, coastal waters or other watercourses;
 - c. noise or vibration;
 - d. light intrusion, both generally and with respect to the South Downs National Park's status as an International Dark Night Skies reserve; or
 - e. land contamination.
2. Development susceptible to particular forms of pollution will not be permitted: a. where it will be adversely affected by such pollution, unless measures can be taken that adequately mitigate the polluting effects; or b. where it would inhibit existing economic or other activities giving rise to acceptable polluting effects.
3. Where a development site is known or suspected to be contaminated, before the site is developed the Borough Council will require the contamination to be remediated to a standard where as a minimum it cannot be defined as 'contaminated land' under Part IIA of the Environmental Protection Act 1990.

4.4.3 For residential developments, the particular targets to be applied, generally, are as follows:

Standards for Maximum Ambient Noise Levels (in spaces when they are unoccupied) for Dwellings Subject to Transport-Related Noise			
Living Area	Night-Time (2300-0700) LAeq, 8hr	Daytime (0700-2300) LAeq, 16hr	Additional Requirements
Bedrooms	30	35	1. Individual noise events must not normally exceed 45 dB LAmax (measured with fast time-weighting) during the night time. 2. Provision of suitable means of sound attenuating ventilation to allow for the fact that opening windows will render noise insulation ineffective.
Living Rooms	-	35	Provision of suitable means of sound attenuating ventilation to allow for the fact that opening windows will render noise insulation ineffective.
Gardens ^a	-	55	Balconies will need to meet the same standard unless it is clear that they are not intended to be an outdoor living area, for example due to their small size.

Note – Levels based on Table 4 of BS8233:2014 Guidance on sound insulation and noise reduction for buildings. Where development site affected by non-steady noise source, commercial or industrial noise, or noise that does not follow a typical diurnal pattern, the acceptability of noise levels will be determined on a case by case basis.

a – This standard applies to main gardens (usually rear gardens) only, but not communal gardens.

4.5 BS82:2014 Guidance on Sound Insulation and Noise Reduction for Buildings

- 4.5.1 There is much guidance on the levels of intrusive noise which would be considered acceptable within residential accommodation such as this. Typical advice is found in British Standard 82:2014 "Guidance on Sound Insulation and Noise Reduction for buildings". Following similar guidance in the 1999 World Health Organisation report "Guidelines for Community Noise", the Standard sets out the following limits for indoor ambient noise levels within living rooms and bedrooms of residential accommodation. This suggests:

Activity	Location	0700 - 2300	2300 - 0700
Resting	Living Room	35 dB(A) LAeq, 16 hr	-
Dining	Dining room/Area	40 dB(A) LAeq, 16 hr	-
Sleeping	Bedroom	35 dB(A) LAeq, 16 hr	30 dB(A) LAeq, 8 hr

Table 4.2 - BS82 Indoor Guideline Values

- 4.5.2 It is usually considered that an open window will provide a reduction of some 10-15 dB(A)¹. Therefore the 'good' internal standards quoted above would broadly equate to the following targets immediately outside the buildings:

Activity	Location	0700 - 2300	2300 - 0700
Resting	Living Room	48 dB(A) LAeq, 16 hr	-
Dining	Dining room/Area	53 dB(A) LAeq, 16 hr	-
Sleeping	Bedroom	48 dB(A) LAeq, 16 hr	43 dB(A) LAeq, 8 hr

Table 4.3 - BS82 Derived Facade Guideline Values

- 4.5.3 BS82 recognises that, where development is considered necessary or desirable, despite external noise levels above WHO guidelines, the internal target levels may be relaxed by up to 5 dB, and reasonable conditions will be achieved².
- 4.5.4 It should be noted that the levels quoted in BS82 are intended to reflect the acceptability of steady, continuous noise. Sources of intermittent and tonal noise may generate greater annoyance for a similar overall magnitude. Whilst BS82 does not explicitly state a correction for those circumstances, it may be appropriate to consider that the Good and Reasonable standards would be achieved with levels which are perhaps 5 dB lower than stated in the table above.
- 4.5.5 It is also noted that BS82 was written from a view of designing new buildings to protect occupants from existing noise sources. This does necessarily infer, however, that the acceptability of an occupant to an absolute level noise within a building will be different if the introduction of the noise source post-dates the construction of the building.

¹ Reference PPG24 Planning & Noise, which adopted a mid-range value of 13 dB(A)

² Note, the relaxation specified in BS82 must be read in conjunction with parallel guidance set out in Approved Document O.

4.6 World Health Organisation Guidelines

- 4.6.1 Further advice is provided in the 1999 WHO report "Guidelines for Community Noise".
- 4.6.2 This indicates that the steady noise level in external amenity areas, such as gardens or outdoor living areas should not exceed 55 dB(A) $L_{Aeq, t}$, and should preferably be designed below 50 dB(A) $L_{Aeq, t}$.
- 4.6.3 The document also provides guidance on the impact of peak noise levels on sleeping conditions. This suggests that levels above 45 dB(A) L_{Amax} inside a bedroom would be disturbing to sleep. With windows open, this would equate to a level of approximately 58 dB(A) L_{Amax} externally.

4.7 Approved Document O – Overheating

- 4.7.1 Approved Document O Overheating describes the means by which designers can protect the health and welfare of occupants of the building by reducing the occurrence of high indoor temperatures.
- 4.7.2 The scope of the Document applies to residential dwellings and institutions, and includes the following building types:

Title	Purpose for which the building is intended to be used
Residential (dwellings)	Dwellings, which includes both dwellinghouses and flats.
Residential (institutional)	Home, school or other similar establishment, where people sleep on the premises. The building may be living accommodation for the care or maintenance of any of the following. a. Older and disabled people, due to illness or other physical or mental condition. b. People under the age of 5 years.
Residential (other)	Residential college, hall of residence and other student accommodation, and living accommodation for children aged 5 years and older.

Table 4.4 – ADO Scope

- 4.7.3 In respect of the acoustic implications, the Document considers the acceptable limits for noise within bedrooms at night. This applies when the method of overheating control is active – whether that be an open window, passive vent or mechanical system. The noise limits are summarised below:
- a. 40dB $L_{Aeq, t}$, averaged over 8 hours (between 11pm and 7am).
 - b. 55dB $L_{Amax, f}$ more than 10 times a night (between 11pm and 7am).

- 4.7.4 Should an analysis of the external noise levels (for open windows/vents) indicate that these values will be exceeded, an alternative strategy should be adopted.

4.8 IOA/ANC Acoustics Ventilation and Overheating – Residential Design Guide

- 4.8.1 The Institute of Acoustic and Association of Noise Consultants have published the 'Acoustics Ventilation and Overheating – Residential Design Guide' (January 2020) to promote best practice in the design of residential buildings to control overheating in areas of high ambient noise.
- 4.8.2 When providing design targets inside the dwellings, the AVOG document advises that the internal noise standard of BS8233:2014 (as copied here in Table 5.1) should be achieved when providing adequate ventilation as defined in ADF. However, the document continues to propose that it is considered reasonable to allow higher levels of internal ambient noise from transport sources when higher rates of ventilation are required in relation to the overheating condition.
- 4.8.3 This proposition is based on the fact that overheating will occur for only part of the time, during which there will be a trade-off between acoustic and thermal conditions, given that residents would have some control over their environment (a principle well established in the field of thermal comfort).
- 4.8.4 The guide indicates that the sound level difference across a façade, with standard opening windows, would be 13 dB(A), but that this figure may be greater if windows are shielded by balconies.
- 4.8.5 BS8233:2014 states that, if internal noise levels are no more than 5 dB greater than the levels shown here in Table 4.2, this would be a 'reasonable' standard. Therefore, if external noise levels do not exceed the following values when windows are open, conditions should be considered wholly acceptable, and therefore the threshold between No and Low Observed Adverse Effect Levels:

Location	0700 - 2300	2300 - 0700
Living Room	53 dB(A) LAeq, 16 hr	-
Bedrooms	53 dB(A) LAeq, 16 hr	48 dB(A) LAeq, 8 hr

Table 4.5 – Proposed LOAEL Façade Noise Levels with Windows Open

- 4.8.6 To consider the upper limit, beyond which internal conditions should not be deemed acceptable, reference is made to issue of speech interference. With reference to the numerical values in BS8233 (see Table 4.6 above), the AVOG document adopts an internal daytime limit of 50 dB(A), which would then equate to an external limit of 63 dB(A) when windows are open.

4.8.7 At night, reference is made to the WHO Night Noise Guidelines, which developed the original WHO Guidelines for Community Noise report. This states that if external noise levels exceed 55 dB(A) L_{Aeq} , ‘adverse health effects occur frequently and a sizeable proportion of the population is highly annoyed and sleep disturbed’.

4.8.8 The table below therefore may be taken to represent the threshold for SOAEL:

Location	0700 - 2300	2300 - 0700
Living Room	63 dB(A) L_{Aeq} , 16 hr	-
Bedrooms	63 dB(A) L_{Aeq} , 16 hr	55 dB(A) L_{Aeq} , 8 hr

Table 4.6 – Proposed SOAEL Threshold Façade Noise Levels with Windows Open

5. PRIMARY RECOMMENDATIONS FOR FAÇADE DESIGN

5.1 Section 4.4.1 of this report has confirmed the British Standard guidance for internal noise levels within residential properties.

5.2 It is therefore recommended that all residential units be designed to achieve the following levels:

Living Rooms/Bedrooms: ≤ 35 dB(A) L_{Aeq} , 07.00 – 23.00
Bedrooms: ≤ 30 dB(A) L_{Aeq} , 23.00 – 07.00, and
 ≤ 45 dB(A) L_{Amax} , 23.00 – 07.00³

5.3 Table 5.1 below defines the predicted external façade noise levels, dB(A), and overall performance targets for the facades of the building. These figures are based initially on the targets of Para 5.2 and the measured free-field noise levels given in Para 3.10. For the rear elevation, they also reflect the increased distance to the road (compared to the survey position) and the self-screening of the new building.

	Predicted Façade Noise Levels			Target Reduction Across Facades	
Room Type	Living Rooms	Bedrooms		Living Rooms	Bedrooms
Elevation	L_{Aeq} , 16 hrs	L_{Aeq} , 8hrs	L_{Amax} , f	dB(A)	dB(A)
Front	71	62	85	36	40
Rear	51	42	65	16	20

Table 5.1 – Predicted Facade Noise Levels. dB(A)

5.4 External walls are understood to be a cavity masonry construction, with brick outer skin, and therefore of a high sound insulation performance

5.5 The critical elements are the form of glazing and the provision of ventilation.

5.6 Appendix 1 provides calculations to demonstrate that combination of glazing and background ventilation shown in Table 5.2 will achieve the target internal noise levels.

³ Excepting no more than 10 events per night.

Glazing											
Frequency	Hz	63	125	250	500	1K	2K	4K	8K	Dn,e,w	Config.
Front, Living Rooms	dB	25	30	32	40	43	43	54	54	36	10/16/8.8
Front, Bedrooms	dB	35	31	35	40	42	49	55	55	39	12/16/8.8
Rear, Living Rooms & Bedrooms	dB	21	21	18	26	37	42	33	35	27	4 / 16 / 4
Vents											
Frequency	Hz	63	125	250	500	1K	2K	4K	8K	Dn,e,w	Vent Type
Front, Living Rooms	dB	40	41	42	37	43	46	40	40	42 (Open)	KIT EAR 5-35 42
Front, Bedrooms	dB	40	41	42	37	43	46	40	40	42 (Open)	Wall Vent.
Front, Living Rooms & Bedrooms	dB	40	39	35	35	31	32	35	40	32 (Open)	Simons FV

Table 5.2 – Proposed Glazing and Ventilation Types (Sound Insulation Performance, R dB)

- 5.7 The assessment has concluded that a passive background ventilator will not be practicable for the bedroom on the front elevation of the building. For this room, it is recommended that a through-wall passive ventilator is located on the north-west elevation of the room. A possible solution here is a Rytons Super Acoustic Controllable AirCore AAC125HP.
- 5.8 At the rear of the building, noise levels are significantly lower in absolute terms, and a standard double glazing unit would be sufficient (27 dB $R_w + C_{tr}$), combined with 32 dB $D_{n,e,w}$ trickle ventilators where required.

6. DESIGN FOR VENTILATION (OVERHEATING MITIGATION)

- 6.1 The preferred means of countering overheating issues is usually to rely on open windows to provide the necessary ventilation.
- 6.2 Open windows do have an adverse impact on the acoustic integrity of the building construction, however, and ADO has therefore confirmed the maximum acceptable internal noise levels when windows are opened for this specific purpose.
- 6.3 To repeat Para.4.7.3 above, the limits of internal acceptable noise levels are:
- a. 40dB $L_{Aeq,t}$, averaged over 8 hours (between 11pm and 7am).
 - b. 55dB $L_{Amax,f}$ more than 10 times a night (between 11pm and 7am).
- 6.4 A review of the 8-hour average noise levels and the typical peak noise levels affecting the site confirms that the latter represents the more onerous criteria.
- 6.5 The question is then how the internal target of 55 dB(A) L_{Amax} equates to an external 'façade noise level', when the windows are open for the purposes of overheating.
- 6.6 At this point, it is necessary to explain the difference between free-field and façade noise levels. The former represents the sound level which would be recorded at a particular position, with no buildings (or other reflecting surfaces) nearby. The latter represents the sound level which would be recorded directly in front of a building. As such, it will include acoustic energy which passes the microphone and is then reflected back off the building, past the microphone again. The correction between two equivalent measurements is normally taken to be 3 dB (the façade value being the louder).
- 6.7 It is then necessary to consider the likely acoustic loss through the open window. Approved Document O provides a simplified estimate of 9 dB. This relates to properties in a 'medium risk' area for overheating, as would be the case in Botley. The loss is based on windows being set to an open area which is 4% of the floor area of the bedroom.
- 6.8 It is noted that this loss relates to the difference between the free-field noise level at the location and the resulting internal noise level. The difference between the façade noise level and resulting internal noise level would be some 12 dB.
- 6.9 This value approximates well with the guidance provided in PPG24 'Planning and Noise', which advised that a partially open window would provide a reduction between 10 and 15 dB(A).
- 6.10 The value quoted in Approved Document O is offered in a conservative manner, to allow for a safe, simplified assessment of conditions. The Document does allow for a more detailed assessment of acoustic loss.

- 6.11 In the first instance, reference is made here to the work by Napier University, and their much referenced report on the acoustic performance of windows, NANR116: 'Open/Closed Window Research - Sound Insulation Through Ventilated Domestic Windows', April 2007
- 6.12 To counter overheating, the windows require an open area of at least 4% of the floor area. A review of the block floor plans indicates that bedrooms have floor areas between 10m² and 15m². This indicates that the open area of the windows would need to be 0.4m² for the smallest bedrooms, and 0.6m² for the largest.
- 6.13 Assuming a side hung casement window, the Napier Report would indicate that the acoustic loss from outside (façade level) to inside would be 12 – 15 dB(A), for the openings here.
- 6.14 The final approach is to consider a 'first-principles' calculation of the loss through the window. This would reflect the open area, the sound reduction of the opening (zero) and the acoustic absorption of the room into which the sound is travelling.
- 6.15 Appendix 2 provides this calculation, based on the largest and the smallest of the bedrooms identified. Both calculations indicated an acoustic loss from outside (façade level) to inside of 13 dB(A).
- 6.16 The table below summarises the various results:

Source	Difference between façade sound level (road traffic) and resulting internal noise level
ADO Simplified	12 dB(A)
PPG24	10 – 15 dB(A)
Napier University NANR116 Study	12 – 15 dB(A)
First Principles Calculation	13 dB(A)

Table 6.1 – Acoustic Loss for Traffic Noise through 0.4m² – 0.6m² opening

- 5.17 It is therefore concluded that a reduction of 13 dB(A) would be a reasonable, safe prediction of the acoustic loss across this site.
- 5.18 This assessed loss, combined with the targets from ADO, gives the following external limits for openable windows to bedrooms at night:
- a. 53dB L_{Aeq,t}, averaged over 8 hours (between 11pm and 7am).
 - b. 68dB L_{Amax,f} more than 10 times a night (between 11pm and 7am).
- 5.19 Reference to predicted façade sound levels given in Table 5.1 confirms that the bedroom to the front of the building will be exposed to levels above this value. Therefore, an alternative to an open-window strategy of overheating mitigation will be required for this bedroom.

- 6.20 Options here would typically involve whole-dwelling mechanical heat recovery, or individual mechanical ventilation units serving the bedroom.
- 6.21 The means of ventilation should be designed by the energy assessor, and then checked by the acoustician for acoustic integrity (that is, it does not allow noise ingress through the ventilation system).
- 6.22 In respect of the ventilation to the living rooms, and the rear bedroom, reference is made to the (non-statutory) good practice guidance of the AVOG document (Para 4.8). Table 4.5, repeated below as Table 6.2, confirmed the recommended limits below which windows may be open for ventilation purposes, without adversely affecting the internal amenity:

Location	0700 - 2300	2300 - 0700
Living Room	53 dB(A) LAeq, 16 hr	-
Bedrooms	53 dB(A) LAeq, 16 hr	48 dB(A) LAeq, 8 hr ⁴

Table 6.2 – AVOG, Proposed LOAEL Façade Noise Levels with Windows Open

- 6.23 Reference to the predicted façade noise levels given in Table 5.1 confirms that the living room and study would experience noise levels above the 53 dB threshold, at the front of the building. The former could be ventilated by opening the doors on the rear elevation (where incident noise levels are below the threshold), but the Study may suffer internally from opening windows. Consideration of an alternative mechanical solution would therefore be appropriate.
- 6.24 The rear bedrooms would experience values of $L_{Aeq, 8hrs}$ which are below the recommended limit, but peak noise levels are a nominal 2 dB above the equivalent target. Consideration could also be given to adopting a mechanical solution here, but it is observed that the excess would be barely noticeably as louder than a level which is numerically compliant with the good practice guidance. The adverse impact of opening windows here would be minor.

⁴ It is taken that the equivalent peak noise target for bedrooms at night would be 63 dB $L_{Aeq, 2300 - 0700}$.

FIGURE 1 – SITE LOCATION PLAN

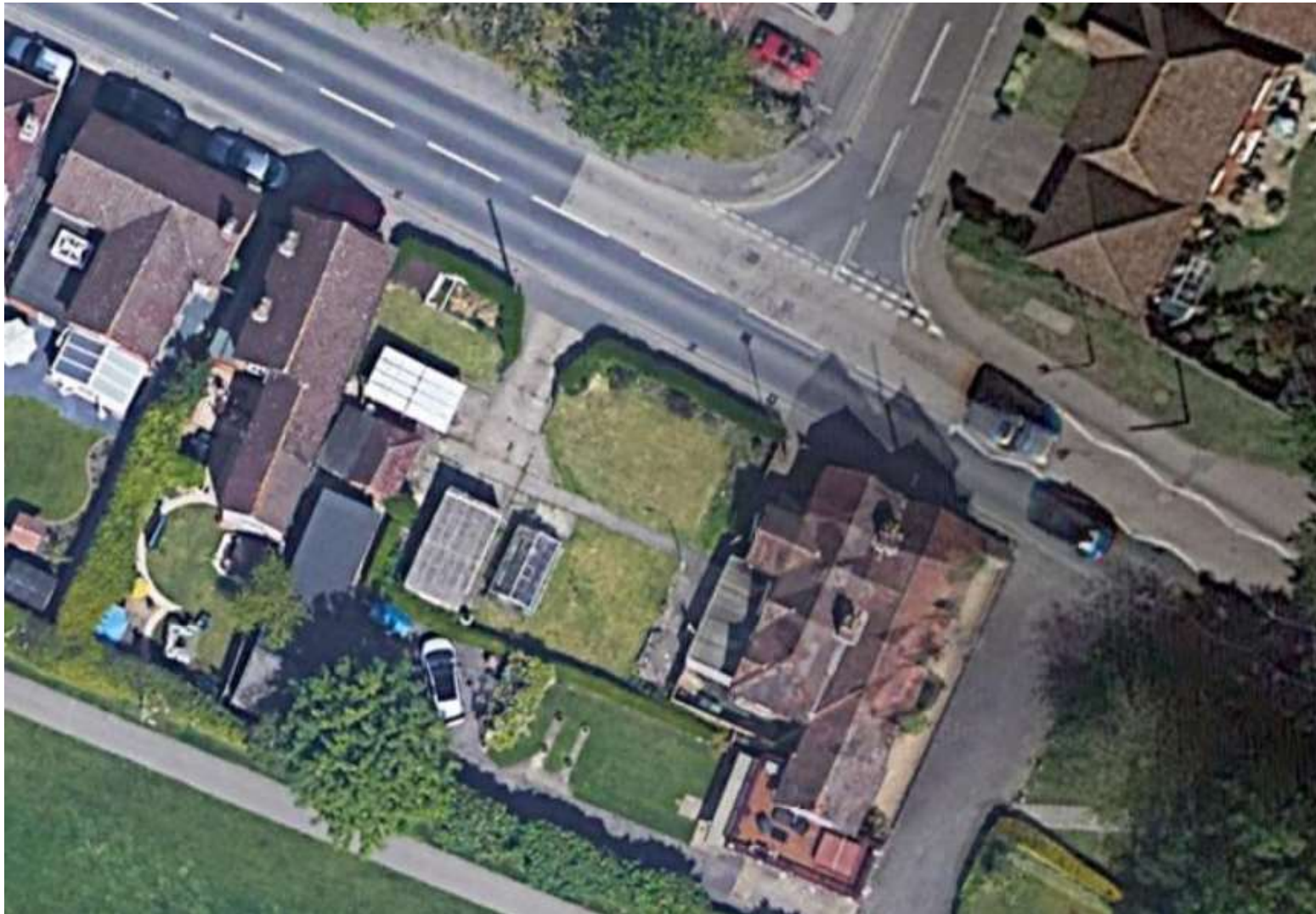
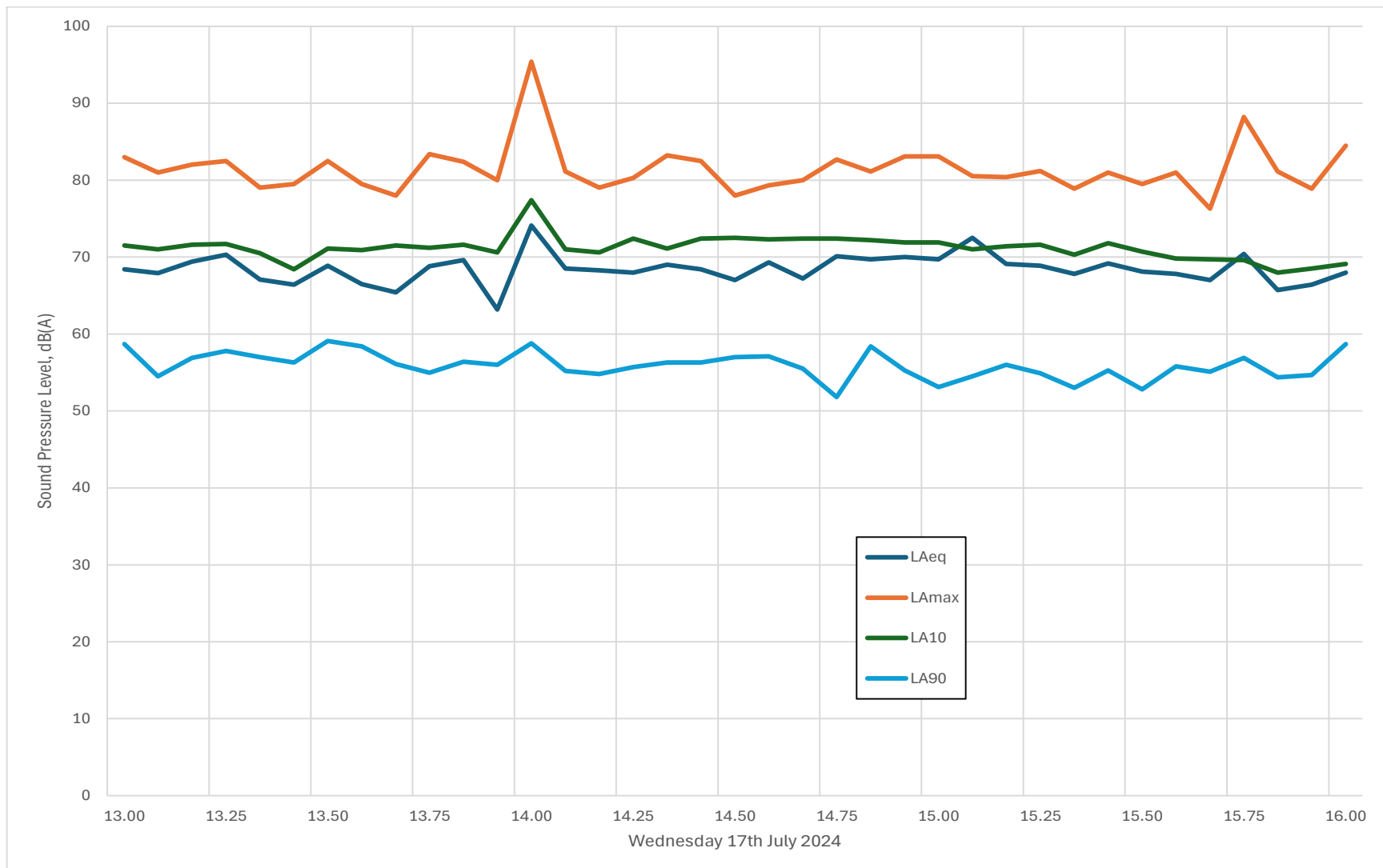


FIGURE 2 – PROPOSED FLOOR PLANS



FIGURE 3 – MEASURED NOISE LEVELS, 71 HIGH STREET



APPENDIX I: CALCULATION OF OUTSIDE TO INSIDE NOISE LEVELS

Front Elevation		Living Room								
Frequency	Hz	63	125	250	500	1K	2K	4K	8K	dB(A)
Façade Level Day, LAeq, 16 hrs	dB	75	75	72	69	66	56	46	40	71
SRI Glazing, 10/16/8.8, 36 Rw + Ctr	dB	25	30	32	40	43	43	54	54	
Area Correction, 3m2	dB	5	5	5	5	5	5	5	5	
Room Volume	m3	50	50	50	50	50	50	50	50	
Typ. Reverberation Time	s	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	
Room Absorption	m2	16	16	16	16	16	16	16	16	
Absorption Correction	dB	-12	-12	-12	-12	-12	-12	-12	-12	
Net SPL	dB	43	38	33	22	16	6	-15	-21	27
SRI Cavity Masonry External Wall	dB	38	43	45	43	52	62	65	65	
Area Correction, 25m2	dB	14	14	14	14	14	14	14	14	
Absorption Correction	dB	-12	-12	-12	-12	-12	-12	-12	-12	
Net SPL	dB	39	34	29	28	16	-4	-17	-23	27
Trickle Vents										
Proposed, 42 dB Dn,e,w	dB	40	41	42	37	43	46	40	40	
Absorption Correction ref 10m2	dB	-2	-2	-2	-2	-2	-2	-2	-2	
Net SPL	dB	33	32	28	30	21	8	4	-2	29
Tolerance on Calculation	dB	3	3	3	3	3	3	3	3	
Predicted LAeq, 16 hrs	dB	47	42	38	35	26	13	7	1	35
Front Elevation		Bedroom								
Frequency	Hz	63	125	250	500	1K	2K	4K	8K	dB(A)
Façade Level Day, LAeq, 8 hrs	dB	66	66	63	60	57	47	37	31	62
Façade Level Night, LAmax	dB	85	81	78	80	82	80	67	58	85
SRI Glazing, 12/16/8.8, 39 Rw + Ctr	dB	35	31	35	40	42	49	55	55	
Area Correction, 3m2	dB	7	7	7	7	7	7	7	7	
Room Volume	m3	30	30	30	30	30	30	30	30	
Typ. Reverberation Time	s	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	
Room Absorption	m2	10	10	10	10	10	10	10	10	
Absorption Correction	dB	-10	-10	-10	-10	-10	-10	-10	-10	
Net LAeq, 8 hrs	dB	28	32	25	17	12	-5	-21	-27	21
Net LAmax, night	dB	47	47	40	37	37	28	9	0	41
SRI Cavity Masonry External Wall	dB	38	43	45	43	52	62	65	65	
Area Correction, 2.5m2	dB	4	4	4	4	4	4	4	4	
Absorption Correction	dB	-10	-10	-10	-10	-10	-10	-10	-10	
Net LAeq, 8 hrs	dB	22	17	12	11	-1	-21	-34	-40	10
Net LAmax, night	dB	41	32	27	31	24	12	-4	-13	30
Wall ventilator on North West Elevation										
Proposed, 42 dB Dn,e,w	dB	40	41	42	37	43	46	40	40	
Attenuation to side Elevation	dB	-5	-5	-5	-5	-5	-5	-5	-5	
Absorption Correction ref 10m2	dB	0	0	0	0	0	0	0	0	
Net LAeq, 8 hrs	dB	21	20	16	18	9	-4	-8	-14	17
Net LAmax, night	dB	40	35	31	38	34	29	22	13	39
Tolerance on Calculation	dB	3	3	3	3	3	3	3	3	
Predicted Day Time LAeq, 8hrs	dB	32	35	28	24	17	1	-5	-11	25
Predicted Night Time LAmax	dB	51	50	43	44	42	34	25	16	45

Rear Elevation		Living Room								
	Hz	63	125	250	500	1K	2K	4K	8K	dB(A)
Façade Level Day, LAeq, 16 hrs	dB	55	55	52	49	46	36	26	20	51
SRI Glazing, 4/16/4, 27 Rw + Ctr	dB	21	21	18	26	37	42	33	35	
Area Correction, 5m2	dB	7	7	7	7	7	7	7	7	
Room Volume	m3	50	50	50	50	50	50	50	50	
Typ. Reverberation Time	s	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	
Room Absorption	m2	16	16	16	16	16	16	16	16	
Absorption Correction	dB	-12	-12	-12	-12	-12	-12	-12	-12	
Net SPL	dB	29	29	29	18	4	-11	-12	-20	22
SRI Cavity Masonry External Wall	dB	38	43	45	43	52	62	65	65	
Area Correction, 25m2	dB	14	14	14	14	14	14	14	14	
Absorption Correction	dB	-12	-12	-12	-12	-12	-12	-12	-12	
Net SPL	dB	19	14	9	8	-4	-24	-37	-43	7
<i>Trickle Vents</i>										
Proposed, 32 dB Dn,e,w	dB	40	39	35	35	31	32	35	40	
Absorption Correction ref 10m2	dB	-2	-2	-2	-2	-2	-2	-2	-2	
Net SPL	dB	13	14	15	12	13	2	-11	-22	15
Tolerance on Calculation	dB	3	3	3	3	3	3	3	3	
Predicted LAeq, 16 hrs	dB	32	32	32	22	16	5	-6	-15	25
Rear Elevation		Bedroom								
	Hz	63	125	250	500	1K	2K	4K	8K	dB(A)
Façade Level Day, LAeq, 8 hrs	dB	46	46	43	40	37	27	17	11	42
Façade Level, LAmax	dB	65	61	58	60	62	60	47	38	65
SRI Glazing, 4/16/4, 27 Rw + Ctr	dB	21	21	18	26	37	42	33	35	
Area Correction, 1.5 x 1.5m2	dB	4	4	4	4	4	4	4	4	
Room Volume	m3	30	30	30	30	30	30	30	30	
Typ. Reverberation Time	s	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	
Room Absorption	m2	10	10	10	10	10	10	10	10	
Absorption Correction	dB	-10	-10	-10	-10	-10	-10	-10	-10	
Net LAeq, 8 hrs	dB	19	19	19	8	-6	-21	-22	-30	12
Net LAmax, night	dB	38	34	34	28	19	12	8	-3	29
SRI Cavity Masonry External Wall	dB	38	43	45	43	52	62	65	65	
Area Correction, 2.5m2	dB	4	4	4	4	4	4	4	4	
Absorption Correction	dB	-10	-10	-10	-10	-10	-10	-10	-10	
Net LAeq, 8 hrs	dB	2	-3	-8	-9	-21	-41	-54	-60	-10
Net LAmax, night	dB	21	12	7	11	4	-8	-24	-33	10
<i>Trickle Vents</i>										
Proposed, 32 dB Dn,e,w	dB	40	39	35	35	31	32	35	40	
Absorption Correction ref 10m2	dB	0	0	0	0	0	0	0	0	
Net LAeq, 8 hrs	dB	6	7	8	5	6	-5	-18	-29	9
Net LAmax, night	dB	25	22	23	25	31	28	12	-2	34
Tolerance on Calculation	dB	3	3	3	3	3	3	3	3	
Predicted Day Time LAeq, 8hrs	dB	21	21	22	12	9	-2	-14	-24	16
Predicted Night Time LAmax	dB	40	36	37	32	34	31	16	3	37

APPENDIX II: TERMINOLOGY RELATING TO NOISE

Sound Pressure	Sound, or sound pressure, is a fluctuation in air pressure over the static ambient pressure.
Sound Pressure Level	The sound level is the sound pressure relative to a standard reference pressure of 20µPa (20x10 ⁻⁶ Pascals) on a decibel scale.
Decibel (dB)	A scale for comparing the ratios of two quantities, including sound pressure and sound power. The difference in level between two sounds s_1 and s_2 is given by $20 \log_{10} (s_1 / s_2)$. The decibel can also be used to measure absolute quantities by specifying a reference value that fixes one point on the scale. For sound pressure, the reference value is 20µPa.
A-weighting, dB(A)	The unit of sound level, weighted according to the A scale, which considers the increased sensitivity of the human ear at some frequencies.
Noise Level Indices	Noise levels usually fluctuate over time, so it is often necessary to consider an average or statistical noise level. This can be done in several ways, so a number of different noise indices have been defined, according to how the averaging or statistics are carried out.
Leq,T	A noise level index called the equivalent continuous noise level over the time period T. This is the level of a notional steady sound that would contain the same amount of sound energy as the actual, possibly fluctuating, sound that was recorded.
Lmax,T	A noise level index defined as the maximum noise level during the period T. Lmax is sometimes used for the assessment of occasional loud noises, which may have little effect on the overall Leq noise level but will still affect the noise environment. Unless described otherwise, it is measured using the 'fast' sound level meter response.
L90,T	A noise level index. The noise level exceeded for 90% of the time over the period T. L90 can be considered to be the "average minimum" noise level and is often used to describe the background noise.
L10,T	A noise level index. The noise level exceeded for 10% of the time over the period T. L10 can be considered to be the "average maximum" noise level. Generally used to describe road traffic noise.
Free-Field	Far from the presence of sound reflecting objects (except the ground), usually taken to mean at least 3.5m.
Façade Noise Level	At 1m in front of a large sound reflecting object such as a façade.
Fast/Slow Time Weighting	Averaging times used in sound level meters.
Octave Band	Range of frequencies whose upper limit is twice the lower limit.
DnT,w	The single number quantity that characterises airborne sound insulation between rooms over a range of frequencies.
Rw	Single number quantity that characterises the airborne sound insulating properties of a material or building element over a range of frequencies.