Brick Kiln Road, Raunds

Noise Assessment

13th June 2023

inacoustic | **bristol**
Caswell Park, Caswell Lane, Clapton-in-Gordano, Bristol, BS20 7RT
0117 325 3949 bristol@inacoustic.co.uk

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Authored By	Neil Morgan MSc MIOA	Neil Morgan MSc MIOA	
Checked By	Victor Valeron BEng MSc MIOA	Victor Valeron BEng MSc MIOA	
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1. INTRODUCTION

1.1. Overview

inacoustic has been commissioned to undertake an assessment of noise with regard to the proposed change of use of land at New Barn Farm, Brick Kiln Road, Raunds for commercial and residential purposes.

The following technical noise assessment has been produced to provide supporting information to accompany a planning application to North Northamptonshire Council and is based upon environmental noise measurements undertaken at the site and a subsequent predictive exercise.

This noise assessment is occasionally technical in nature; therefore, a glossary of terms is included in Appendix A to assist the reader.

1.2. Scope and Objectives

The scope of the noise assessment can be summarised as follows:

- A sound monitoring survey was undertaken at discrete locations around the Site;
- A detailed assessment of the suitability of the Site, in accordance with relevant standards in respect of sound from the existing sources; and
- Recommendation of mitigation measures, where necessary, to comply with the requirements of the National Planning Practice Guidance in England: Noise [1], BS8233:2014 [2], and BS4142:2014+A1:2019[3].

[1] Department for Communities and Local Government (DCLG), 2019. National Planning Practice Guidance for England: Noise. DCLG.
[2] British Standard 8233:2014 *Guidance on sound insulation and noise reduction for buildings.* BSI
[3] British Standard 4142:2014+A1:2019 *Method for rating and assessing commercial sound.* BSI

2. LEGISLATION AND POLICY FRAMEWORK

The development proposals for the Site are guided by the following policy directives and guidance:

2.1.1. National Planning Policy Framework, 2021

The *National Planning Policy Framework* (NPPF)[4] sets out the Government's planning policies for England. Planning policy requires that applications for planning permission must be determined in accordance with the development plan, unless material considerations indicate otherwise.

The NPPF is also a material consideration in planning decisions. It sets out the Government's requirements for the planning system and how these are expected to be addressed.

Under Section 15; *Conserving and Enhancing the Natural Environment*, in Paragraph 174, the following is stated:

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

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

Paragraph 185 of the document goes on to state:

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

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

Paragraph 185 refers to the Noise Policy Statement for England, which is considered overleaf.

[4] Ministry of Housing, Communities and Local Government (MHCLG), July 2021. National Planning Policy Framework. HMSO. London.

2.1.2. Noise Policy Statement for England, 2010

The underlying principles and aims of existing noise policy documents, legislation and guidance are clarified in *DEFRA: 2010: Noise Policy Statement for England* (NPSE)[5]. The NPSE sets out the *"Long Term Vision"* of Government noise policy as follows:

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

The NPSE outlines three aims for the effective management and control of environmental, neighbour and neighbourhood noise:

- *"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".*

The guidance states that it is not possible to have a single objective noise-based measure that defines *"Significant Observed Adverse Effect Level (SOAEL)"* that is applicable to all sources of noise in all situations and that not having specific SOAEL values in the NPSE provides the necessary policy flexibility until further evidence and suitable guidance is available.

2.1.3. National Planning Practice Guidance in England: Noise, 2019 (PPGNoise)

Paragraph: 002 of the PPGNoise states the following:

"Can noise override other planning concerns?

It can, where justified, although it is important to look at noise in the context of the wider characteristics of a development proposal, its likely users and its surroundings, as these can have an important effect on whether noise is likely to pose a concern."

As such, Paragraph: 003 of the NPPG states that:

"Plan-making and decision making need to take account of the acoustic environment and in doing so consider:

- *whether or not a significant adverse effect is occurring or likely to occur;*
- *whether or not an adverse effect is occurring or likely to occur; and*
- *whether or not a good standard of amenity can be achieved.*

In line with the Explanatory note of the NPSE, this would include identifying whether the overall effect of the noise exposure … is, or would be, above or below the significant observed adverse effect level and the lowest observed adverse effect level for the given situation."

Consequently, the *National Planning Practice Guidance in England: Noise* (NPPG Noise)[6] summarises the noise exposure hierarchy, based on the likely average response. The following three observed effect levels are identified below, as identified in Paragraph 004:

[5] Department for Environment, Food and Rural Affairs (DEFRA), 2010. Noise Policy Statement for England. DEFRA.
[6] Department for Communities and Local Government (DCLG), 2019. National Planning Practice Guidance for England: Noise. DCLG.

- **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; and
- **No Observed Adverse Effect Level**: This is the level of noise exposure below which no effect at all on health or quality of life can be detected.

Importantly, Paragraph: 004 of the PPGNoise states that:

"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."

Paragraph: 005 of the PPGNoise expands the significant criteria related to each of these levels, which are reproduced in Table 1, below.

TABLE 1: SIGNIFICANCE CRITERIA FROM NPPG IN ENGLAND: NOISE

Perception	Examples of Outcomes	Increasing Effect Level	Action
No Observed Effect Level			
Not Noticeable	No Effect	No Observed Effect	No specific measures required
No Observed Adverse Effect Level			
Noticeable and Not Intrusive	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.	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, 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.	Observed Adverse Effect	Mitigate and reduce to a minimum
Significant Observed Adverse Effect Level			
Present and Disruptive	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	Significant Observed Adverse Effect	Avoid

Perception	Examples of Outcomes	Increasing Effect Level	Action
	of life diminished due to change in acoustic character of the area.		
Present and Very Disruptive	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.	Unacceptable Adverse Effect	Prevent

Paragraph: 006 of the PPGNoise expands on what factors influence whether noise could be a concern; those factors relevant to this Planning Application are reproduced below:

"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;*
- *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.*
- *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."*

Paragraph: 009 of the PPGNoise expands on whether future noise generation could be a concern; with are reproduced below

"Development proposed in the vicinity of existing businesses, community facilities or other activities may need to put suitable mitigation measures in place to avoid those activities having a significant adverse effect on residents or users of the proposed scheme.

In these circumstances the applicant (or 'agent of change') will need to clearly identify the effects of existing businesses that may cause a nuisance (including noise, but also dust, odours, vibration and other sources of pollution) and the likelihood that they could have a significant adverse effect on new residents/users. In doing so, the agent of change will need to take into account not only the current activities that may cause a nuisance, but also those activities that businesses or other

facilities are permitted to carry out, even if they are not occurring at the time of the application being made.

The agent of change will also need to define clearly the mitigation being proposed to address any potential significant adverse effects that are identified. Adopting this approach may not prevent all complaints from the new residents/users about noise or other effects, but can help to achieve a satisfactory living or working environment, and help to mitigate the risk of a statutory nuisance being found if the new development is used as designed (for example, keeping windows closed and using alternative ventilation systems when the noise or other effects are occurring)."

Paragraph: 010 of the PPGNoise outlines various approaches to reducing the adverse effects of noise; the approach considered in this report relates to providing a suitably design building façade.

Further to the comment on the previous page regarding Paragraph: 006 with respect to external amenity spaces, Paragraph: 011 of the PPGNoise goes on to state:

"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)."*

PPGNoise recognises it would, of course, be preferable to have access to a relatively quiet external amenity space that is not subject to a significant adverse effect, but that this may not always be possible, and that it is *"generally desirable"* to have access to some external amenity space even if *"this area is exposed to noise levels that result in significant adverse effects"*.

Finally, Paragraph: 015 of the PPGNoise outlines other information that is available to assist in assessing noise. The paragraph, amongst other standards, recommends the use of:

- BS8233:2014 – Guidance on Sound Insulation and Noise Reduction for Buildings; and
- ProPG: Planning & Noise – Professional Practice Guidance on Planning & Noise – New Residential Development.

Critically, Paragraph: 015 of the PPGNoise states the following:

"Some of these documents contain numerical criteria. These values are not to be regarded as fixed thresholds and as outcomes that have to be achieved in every circumstance."

The ProPG provides a useful narrative as to how external amenity areas should be assessed, when considered in the context of the PPGNoise, which has been reproduced below, for ease of reference:

"BS8233:2014 states that "the acoustic environment of external amenity areas that are an intrinsic part of the overall design should always be assessed and noise levels should ideally not be above the range 50 – 55 dB $L_{Aeq,16hr}$". The standard continues… "These guideline values may not be achievable in all circumstances where development might be desirable. In such a situation, development should be designed to achieve the lowest practicable noise levels in these external amenity spaces but should not be prohibited."

"PPG-Noise states: "If external amenity spaces are an intrinsic part of the overall design, the acoustic environment of those spaces should be considered so that they can be enjoyed as intended".

"It is notable that both documents require a decision to be made regarding whether or not an external amenity area (or amenity space) is intrinsic to the required design for acoustic, or for other, reasons. However, the advice in BS8233:2014 states that the resulting noise levels outside are never a reason for refusal as long as levels are designed to be as low as practicable. Whereas, to comply with policy guidance any amenity space must have an acoustic environment so that it can be enjoyed as intended."

"Developers are particularly encouraged to enter into pre-application discussions with the LPA where noise levels in proposed amenity spaces are likely to be above 55 dB $L_{Aeq,16hr}$ during a reasonably foreseeable typical worst-case day. In particular, a professional judgement should be made on the need to provide access to a quiet or relatively quiet external amenity space as an intrinsic part of a good acoustic design process. This judgement will partly depend on the type of residential development and the intended occupancy, which, in turn, may need to be secured by condition."

"Therefore the ProPG external amenity area noise assessment reflects and extends the advice contained in BS8233:2014 and the current Government guidance in PPGNoise."

The approach therefore taken in this noise assessment, with respect to external amenity spaces, accords exactly with the requirements of the PPGNoise, ProPG and BS8233:2014.

2.2. British Standards

2.2.1. BS8233:2014

BS8233:2014 draws on the results of research and experience to provide information on achieving internal acoustic environments appropriate to their functions. The guideline values provided are in terms of an average (L_{Aeq}) level.

The standard advises that, for steady external noise sources, it is desirable for internal ambient noise levels to not exceed the guidance values, as detailed below in Table 2.

TABLE 2: BS8233:2014 AMBIENT NOISE LEVELS

Activity	Location	07:00 to 23:00	23:00 to 07:00
Resting	Living room	35 dB $L_{Aeq,16hour}$	-
Dining	Dining room	40 dB $L_{Aeq,16hour}$	-
Sleeping	Bedroom	35 dB $L_{Aeq,16hour}$	30 dB $L_{Aeq,8hour}$

BS8233:2014 goes on to suggest that where development is considered necessary or desirable, the internal target levels may be relaxed by up to 5 dB and reasonable internal conditions will still be achieved.

With regard to maximum noise levels, the standard identifies that regular individual noise events (such as passing trains or scheduled aircraft etc) can cause sleep disturbance. The standard does not provide a guideline design target, but simply goes on to suggest that a guideline value may be set in terms of SEL or $L_{Amax,F}$, depending upon the character and number of events per night. It goes on to suggest that more sporadic noise events could require separate values.

2.2.2. BS4142:2014+A1:2019

BS4142:2014+A1:2019 sets out a method to assess the likely effect of sound from factories, industrial premises or fixed installations and sources of an industrial nature in commercial premises, on people who might be inside or outside a dwelling or premises used for residential purposes in the vicinity.

The procedure contained in BS4142:2014+A1:2019 for assessing the effect of sound on residential receptors is to compare the measured or predicted sound level from the source in question, the $L_{Aeq,T}$ 'specific sound level', immediately outside the dwelling with the $L_{A90,T}$ background sound level.

Where the sound contains a tonality, impulsivity, intermittency and other sound characteristics, then a correction depending on the grade of the aforementioned characteristics of the sound is added to the specific sound level to obtain the $L_{Ar,Tr}$ 'rating sound level'. A correction to include the consideration of a level of uncertainty in sound measurements, data and calculations can also be applied when necessary.

BS4142:2014+A1:2019 states: *"The significance of sound of an industrial and/or commercial nature depends upon both the margin by which the rating level of the specific sound source exceeds the background sound level and the context in which the sound occurs"*. An estimation of the impact of the specific sound can be obtained by the difference of the rating sound level and the background sound level and considering the following:

- *"Typically, the greater this difference, the greater the magnitude of the impact."*
- *"A difference of around +10dB or more is likely to be an indication of a significant adverse impact, depending on the context."*
- *"A difference of around +5dB is likely to be an indication of an adverse impact, depending on the context."*
- *"The lower the rating level is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact or a significant adverse impact. Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending on the context."*

During the daytime, the assessment is carried out over a reference time period of 1-hour, with a referencing period of 15 minutes used during the night. The periods associated with day or night, for the purposes of the Standard, are considered to be 07.00 to 23.00 and 23.00 to 07.00, respectively.

2.3. Other Guidance

2.3.1. Relative Change in Ambient Noise Level

The IEMA Guidelines[7] define 'Noise Impact' as the difference in the acoustic environment before and after the implementation of the proposals, also known as the magnitude of change. In circumstances where a noise environment may be altered by addition or removal of a noise source, considered to be largely anonymous or within the prevailing acoustic character of an area, for example, changes to traffic quantum or patterns, it is normal to consider this relative change in ambient noise level. The assessment, therefore, considers this phenomenon to add context.

The impact scale adopted in this assessment is shown in Table 3 below, which relates to established human responses to noise, in line with '*Table 7-12 Effect Descriptors'* of the IEMA Guidelines and set in the context of NPPG.

TABLE 3: IMPACT SCALE FOR COMPARISON OF FUTURE NOISE AGAINST EXISTING NOISE

Noise Level Change dB(A)	Subjective Response	Significance	NPPG Context
Less than 1.0	No perceptible	Negligible	NOEL
1.0 – 2.9	Barely perceptible	Minor impact	NOAEL
3.0 – 4.9	Noticeable	Moderate impact	LOAEL
5.0 – 9.9	Up to a doubling or halving of loudness	Substantial impact	SOAEL
10.0 or more	More than a doubling or halving of loudness	Major impact	UAEL

The criteria above reflect the key benchmarks that relate to human perception of sound. A change of 3 dB(A) is generally considered to be the smallest change in environmental noise that is perceptible to the human ear. A 10 dB(A) change in noise represents a doubling or halving of the perception of loudness. The difference between the minimum perceptible change and the doubling or halving of the noise level is split to provide greater definition to the assessment of changes in noise level.

It is considered that the criteria specified in Table 3 provide a good indication as to the likely significance of changes in noise levels in this case and can be used to inform the context in which the sound occurs in order to assess the impact of noise from the proposed development.

[7] Institute of Environmental Management & Assessment (IEMA), Version 1.2 (November 2014). Guidelines for Environmental Noise Impact Assessment

2.3.2. ProPG Planning and Noise 2017 – New Residential Development

The ProPG advocates a systematic, proportionate, risk-based 2-stage approach. This encourages early consideration of noise issues, facilitates straightforward accelerated decision making for lower risk sites and assists proper consideration of noise issues where the acoustic environment presents more challenges. The key stages of the approach are:

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

The Stage 1: Initial Site Noise Risk Assessment should be undertaken at the earliest opportunity, before any planning application is submitted. It should provide an indication of the likely risk of adverse effects from noise were no subsequent mitigation to be included as part of the development proposal. It should indicate whether the proposed site is considered to pose a negligible, low, medium or high risk from a noise perspective.

The noise risk assessment may be based on measurement or prediction (or a combination) as appropriate, and should aim to describe noise levels over a "typical worst case" 24-hour day either now or in the foreseeable future. Care should be taken so that the risk assessment includes the combined free-field noise level from all relevant sources of transport noise that affect the site. The assessment may also include industrial/commercial noise where this is present but is not dominant.

The Stage 1 procedure is summarised in Figure 1, which has been extracted directly from the document.

FIGURE 1: PROPG STAGE 1 – INITIAL SITE NOISE RISK ASSESSMENT

NOISE RISK ASSESSMENT	POTENTIAL EFFECT WITHOUT NOISE MITIGATION	PRE-PLANNING APPLICATION ADVICE
Indicative Daytime Noise Levels $L_{Aeq,16hr}$ / Indicative Night-time Noise Levels $L_{Aeq,8hr}$		
High: 70 dB / 60 dB	Increasing risk of adverse effect	High noise levels indicate that there is an increased risk that development may be refused on noise grounds. This risk may be reduced by following a good acoustic design process that is demonstrated in a detailed ADS. Applicants are strongly advised to seek expert advice. As noise levels increase, the site is likely to be less suitable from a noise perspective and any subsequent application may be refused unless a good acoustic design process is followed and is demonstrated in an ADS which confirms how the adverse impacts of noise will be mitigated and minimised, and which clearly demonstrate that a significant adverse noise impact will be avoided in the finished development.
Medium: 65 dB / 55 dB		
Low: 60 dB / 50 dB		At low noise levels, the site is likely to be acceptable from a noise perspective provided that a good acoustic design process is followed and is demonstrated in an ADS which confirms how the adverse impacts of noise will be mitigated and minimised in the finished development.
Negligible: 55 dB / 45 dB; 50 dB / 40 dB	No adverse effect	These noise levels indicate that the development site is likely to be acceptable from a noise perspective, and the application need not normally be delayed on noise grounds.

Figure 1 Notes:

a. Indicative noise levels should be assessed without inclusion of the acoustic effect of any scheme specific noise mitigation measures.

b. Indicative noise levels are the combined free-field noise level from all sources of transport noise and may also include industrial/commercial noise where this is present but is "not dominant".

c. $L_{Aeq,16hr}$ is for daytime 0700 – 2300, $L_{Aeq,8hr}$ is for night-time 2300 – 0700.

d. An indication that there may be more than 10 noise events at night (2300 – 0700) with $L_{Amax,F} > 60$ dB means the site should not be regarded as negligible risk.

The four key elements of Stage 2 of the recommended approach are as follows:

- Element 1 – demonstrating a good 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.

Stage 2, Element 2

In summary, this echoes the internal sound level guidance set out within BS8233:2014, as quoted within Table 2 of his report, with supplementary guidance, as follows;

NOTE 5 Designing the site layout and the dwellings so that the internal target levels can be achieved with open windows in as many properties as possible demonstrates good acoustic design. Where it is not possible to meet internal target levels with windows open, internal noise levels can be assessed with windows closed, however any façade openings used to provide whole dwelling ventilation (e.g. trickle ventilators) should be assessed in the "open" position and, in this scenario, the internal L_{Aeq} target levels should not normally be exceeded, subject to the further advice in Note 7

NOTE 6 Attention is drawn to the requirements of the Building Regulations.

NOTE 7 Where development is considered necessary or desirable, despite external noise levels above WHO guidelines, the internal L_{Aeq} target levels may be relaxed by up to 5 dB and reasonable internal conditions still achieved. The more often internal L_{Aeq} levels start to exceed the internal L_{Aeq} target levels by more than 5 dB, the more that most people are likely to regard them as "unreasonable". Where such exceedances are predicted, applicants should be required to show how the relevant number of rooms affected has been kept to a minimum. Once internal L_{Aeq} levels exceed the target levels by more than 10 dB, they are highly likely to be regarded as "unacceptable" by most people, particularly if such levels occur more than occasionally. Every effort should be made to avoid relevant rooms experiencing "unacceptable" noise levels at all and where such levels are likely to occur frequently, the development should be prevented in its proposed form

Paragraphs 2.34 to 2.36 of the ProPG document offer guidance relating to the use of open windows in relation to ventilation and overheating, as follows:

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, special care must be taken to design the accommodation so that it provides good standards of acoustics, ventilation and thermal comfort without unduly compromising other aspects of the living environment. In such circumstances, internal noise levels can be assessed with windows closed but with any façade openings used to provide "whole dwelling ventilation" in accordance with Building Regulations Approved Document F (e.g. trickle ventilators) in the open position. Furthermore, in this scenario the internal L_{Aeq} target noise levels should not generally be exceeded.

It should also be noted that the internal noise level guidelines are generally not applicable under "purge ventilation" conditions as defined by Building Regulations Approved Document F, as this should only occur occasionally (e.g. to remove odour from painting and decorating or from burnt food).

Stage 2, Element 3

In summary, this effectively echoes the external sound level guidance set out within BS8233:2014, as quoted within Section 2.2.1 of his report.

Stage 2, Element 4

The “other relevant issues” to be considered comprise, in summary:

- Compliance with relevant policy;
- Magnitude and extent of compliance with ProPG guidance;
- Likely occupants of the development;
- Acoustic design and unintended adverse consequences; and
- Acoustic design and wider planning issues.

3. Site Description

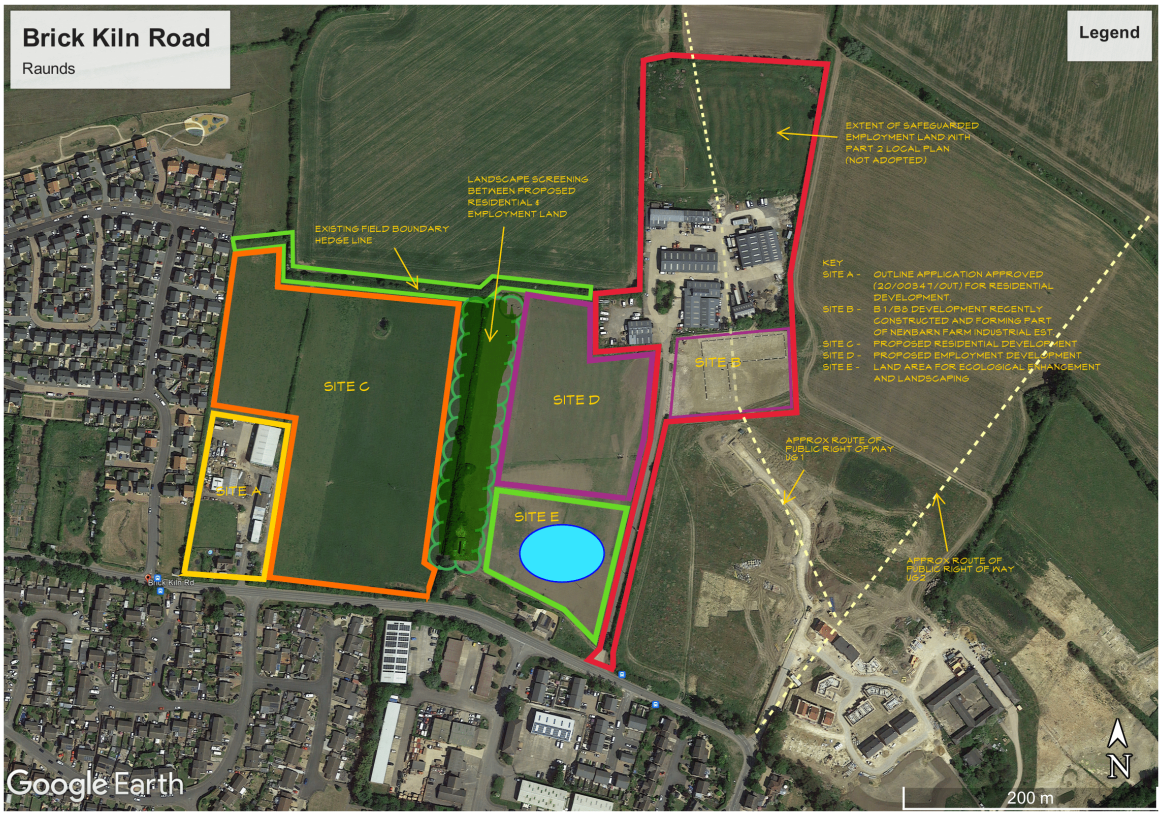
3.1. Site and Surrounding Area

The Proposed Development comprises an area of agricultural land, located to the north of Brick Kiln Road, Raunds and between existing residential development to the south and west and some small scale employment development to the north-east. The area to the north of the site is open farmland.

The Proposed Development area, in the context of its surroundings, can be seen in Figure 2.

The sound environment across the site is primarily influenced by road traffic noise arising from vehicles on Brick Kiln Road. The existing commercial activities located to the north-east of the site, were only barely audible within areas of the site not being proposed for residential development.

Figure 2: Proposed Development Site and Surrounding Area



3.2. Proposed Development Overview

The Proposed Development comprises the construction of 4 N$^{o.}$ blocks of speculative, general commercial/industrial (B1/B2/B8) units and 81 residential units, to the west of the commercial area, as shown in Figure 3 and Figure 4.

The commercial uses are envisaged to be of a light industrial type and operate during the core daytime hours only; 07:00-19:00.

FIGURE 3: PROPOSED COMMERCIAL DEVELOPMENT LAYOUT

FIGURE 4: PROPOSED RESIDENTIAL DEVELOPMENT LAYOUT

3.2.1. Mitigation by Design

The orientation of the commercial units is such that the openings are facing away from the proposed residential development, with solid facades, only, facing to the west.

The assessment of commercial noise also considers the effects of a solid 3-metre high planted bund along the shared section of the boundary of the proposed commercial area, to screen the proposed residential area to the west.

4. Measurement Methodology

4.1. General

The prevailing noise conditions at the site have been determined by an environmental noise survey conducted between Monday 17th and Wednesday 19th April 2023.

4.2. Noise Measurement Details

All noise measurements were undertaken by a consultant certified as competent in environmental noise monitoring, and, in accordance with the principles of BS 7445[8].

All acoustic measurement equipment used during the noise survey conformed to Type 1 specification of British Standard 61672[9]. A full inventory of this equipment is shown in Table 4 below.

Table 4: Inventory of Sound Measurement Equipment

Position	Make, Model & Description	Serial Number	Calibration Certificate Number	Calibration Due Date
MP1	NTI XL2 Sound Level Meter	A2A-14510-EO	1141897	21/03/2025
	MA220 Preamplifier	7614		
	MC230A Microphone	A21028		
MP2	NTI XL2 Sound Level Meter	A2A-14637-E0	1123445	11/02/2024
	MA220 Preamplifier	7615		
	MC230A Microphone	A15851		
All	Rion NC-74 Acoustic Calibrator	34984020	1131148	10/08/2024

The sound measurement equipment used during the survey was field calibrated at the start and end of the measurement period. A calibration laboratory has calibrated the field calibrator used within the twelve months preceding the measurements. A drift of less than 0.1 dB in the field calibration was found to have occurred on the sound level meters.

The weather conditions during the survey were conducive to noise measurement; it being predominantly dry, with low wind speeds, as measured on-site using a rain-tipping gauge and anemometer, respectively. When periods of inclement weather occurred, they have been removed from the dataset used to derive the typical ambient and background sound levels.

The microphones were fitted with protective windshields for the measurements, which are described in Table 5, with an aerial photograph indicating their respective locations shown in Figure 5.

[8] British Standard 7445: 2003: Description and measurement of environmental noise. BSI
[9] British Standard 61672: 2013: Electroacoustics. Sound level meters. Part 1 Specifications. BSI.

Table 5: Measurement Position Descriptions

Measurement Position	Description
MP1	Largely unattended daytime and night-time measurement of sound under free-field conditions, at a height of 1.5 metres above local ground level (approximately 1 metre above road level), located at the southern boundary of the Site. The microphone was located at approximately 5 metres from the closest road's carriageway edge. The sound environment at this location was dominated by road traffic noise from the Brick Kiln Road to the south.
MP2	Largely unattended daytime and night-time measurement of sound under free-field conditions, at a height of 1.5 metres above local ground level (approximately 1 metre above road level), located at the north-eastern boundary of the proposed residential area of the Site. The sound environment at this location was dominated by road traffic noise from the Brick Kiln Road to the south. Daytime commercial noise from the east of the site was just audible during lulls in passing traffic, but not measurable, as was general residential activity-associated noise from the west of the site.

Figure 5: Measurement Positions

4.3. Summary Results

The summarised results of the environmental noise measurements are presented in Table 6, below.

TABLE 6: SUMMARY OF NOISE MEASUREMENT RESULTS

Measurement Position	Period	$L_{Aeq,T}$ (dB)	$L_{AF90,T}$ (dB)	L_{AFmax} (dB)
MP1	Day	65	46	82
	Night	61	36	81
MP2	Day	50	44	67
	Night	48	34	64

5. Noise Assessment – New Commercial Units

5.1. Noise Modelling

5.1.1. General

As precise details of the Proposed Development, *vis-à-vis* end users and operational details have not yet been finalised, beyond the scope of the use category information for the site, the following assessment considers a hypothetical operational scenario, taking account of the type and scale of the development and reasonable, worst-case assumptions on noise generation.

5.1.2. Operational Assumptions

The following input data has been considered within the assessment:

- Internal sound levels of 75 dB(A) within all internal spaces simultaneously during the daytime;
- 50% of the parking bays being utilised within a daytime 1-hour period;
- 10 LGVs arriving and another 10 departing the site during a daytime 1-hour period;
- 4 HGVs arriving and another 4 departing the site during a daytime 1-hour period; and
- Roller shutter doors to the flexible areas maintained in a closed position during noisy operations.

5.1.3. Source Data

The A-weighted sound power levels associated with the Proposed Development, based on archive data, can be seen below in Table 7.

Table 7: Sound Source Data

Source	Distance / Description	Noise Level – dB	
		$L_{Aeq,T}$	SEL
HGV Arriving / Passby	10 metres	-	77.0
HGV Reversing (inc Reverse Alarm)	10 metres	-	82.0
HGV Starting and Departing	10 metres	-	76.0
LGV arriving	10 metres	-	68.0
LGV Starting and Departing	10 metres	-	73.0
Car Passby	10 metres	-	71.0
Car Reversing	10 metres	-	71.0

Internal Level – Flexible Space	Internal Reverberant	75.0	-

5.1.4. Building Envelope

In terms of the acoustic performance of the building envelope, the sound reduction statistics set out in Table 8 have been adopted.

TABLE 8: SOUND REDUCTION INDEX OF BUILDING COMPONENTS

Component	Type / Material	SRI – dB(A)
Walls/Roofs	Profiled Steel / KS1000 or similar	26
Main Doors	Steel Roller Shutter - Closed	18

It has been assumed that any proposed ventilation louvres or access doors will be of a design and fit that does not compromise the overall sound insulation performance of the building envelope.

5.1.5. Calculation Process

Calculations were carried out using Cadna/A, which undertakes its calculations in accordance with guidance given in ISO9613-1:1993 and ISO9613-2:1996.

5.1.6. Sound Data Assumptions

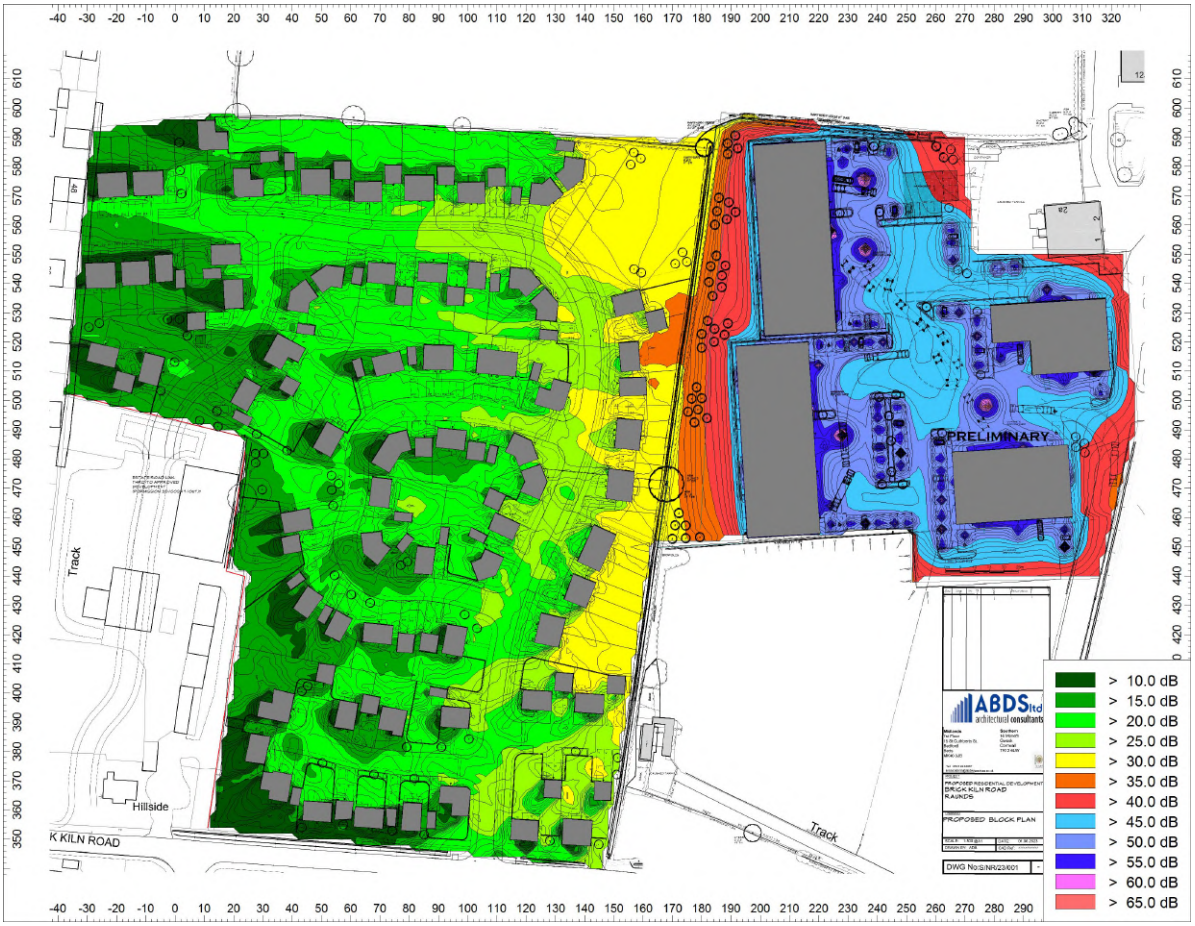
Given that the land between Proposed Development and nearest receptors will be mixed, the ground factor has been set to 0.5 in the calculation software.

It has been assumed that all processes may occur simultaneously, representing a worst-case scenario.

5.1.7. Specific Sound Level Map

A sound map of the predicted daytime specific sound level arising from cumulative typical operations at the closest receptors to the Site can be seen in Figure 6.

FIGURE 6: SPECIFIC SOUND LEVEL MAP OF CUMULATIVE OPERATIONS – DAYTIME



5.2. Commercial Noise Assessment

5.2.1. Rating Penalty Principle

Section 9 of BS4142:2014+A1:2019 describes how the rating sound level should be derived from the specific sound level, by determining a rating penalty.

BS4142:2014+A1:2019 states:

"Certain acoustic features can increase the significance of impact over that expected from a basic comparison between the specific sound level and the background sound level. Where such features are present at the assessment location, add a character correction to the specific sound level to obtain the rating level. This can be approached in three ways:

a) subjective method;
b) objective method for tonality;
c) reference method."

Given that the extraction system was operational, the subjective method has been adopted to derive the rating sound level from the specific sound level. This is discussed in Section 9.2 of BS4142:2014+A1:2019, which states:

"Where appropriate, establish a rating penalty for sound based on a subjective assessment of its characteristics. This would also be appropriate where a new source cannot be measured because it is only proposed at that time, but the characteristics of similar sources can subjectively be assessed.

Correct the specific sound level if a tone, impulse or other characteristics occurs, or is expected to be present, for new or modified sound sources."

BS4142:2014+A1:2019 defines four characteristics that should be considered when deriving a rating penalty, namely; tonality; impulsivity; intermittency; and other sound characteristics, which are defined as:

Tonality

A rating penalty of +2 dB is applicable for a tone which is *"just perceptible"*, +4 dB where a tone is *"clearly perceptible"*, and +6 dB where a tone is *"highly perceptible"*.

Impulsivity

A rating penalty of +3 dB is applicable for impulsivity which is *"just perceptible"*, +6 dB where it is *"clearly perceptible"*, and +9 dB where it is *"highly perceptible"*.

Other Sound Characteristics

BS4142:2014+A1:2019 states that where *"the specific sound features characteristics that are neither tonal nor impulsive, though otherwise are readily distance against the residual acoustic environment, a penalty of +3 dB can be applied."*

5.2.2. Rating Penalty Assessment

Considering the content of Section 5.2.1, an assessment of the noise source associated with the Proposed Development, in terms of whether any rating penalties are applicable, and has been detailed in Table 9.

TABLE 9: RATING PENALTY ASSESSMENT

Source	Tonality	Impulsivity	Intermittency	Other Sound Characteristics	Discussion
Noise Breakout	0 dB	0 dB	0 dB	0 dB	On the basis of the predicted results, which make robust allowances for internally generated noise, it is considered that such activities would be at a level typically regarded as largely inaudible, relative to the background/residual sound environment. Therefore, no acoustic feature corrections would be required for this source.

Source	Tonality	Impulsivity	Intermittency	Other Sound Characteristics	Discussion
Vehicular Activities	0 dB	0 dB	0 dB	+3 dB	On the basis of the predicted results, which make robust allowances for vehicular activity noise, it is considered that such activities would be at a level typically regarded as anonymous relative to the background/residual sound environment, which is already characterised by vehicle movements. Notwithstanding the above, the presence of heavy vehicles and manoeuvring activity may be audible against the residual sound environment, so a correction has been applied for this.

In summary, a +3 dB rating penalty has been included in the assessment.

5.2.3. Uncertainty

BS4142:2014+A1:2019 requires that the level of uncertainty in the measured data and associated calculations is considered in the assessment. The Standard recommends that steps should be taken to reduce the level of uncertainty.

Measurement Uncertainty

BS4142:2014+A1:2019 states that measurement uncertainty depends on a number of factors, including the following, which are applicable to the Proposed Development:

"
...
b) the complexity and level of variability of the residual acoustic environment;
...
d) the location(s) selected for taking the measurements;
...
g) the measurement time intervals;
h) the range of times when the measurements have been taken;
i) the range of suitable weather conditions during which measurements have been taken;
...
k) the level of rounding of each measurement recorded; and
l) the instrumentation used."

Each of the measurement uncertainty factors outlined above have been considered and discussed in Table 10.

TABLE 10: MEASUREMENT UNCERTAINTY FACTORS

Measurement Uncertainty Factor Reference	Level of Uncertainty	Discussion
b)	0 dB	Residual acoustic environment is relatively constant, hence no correction for a complex residual acoustic environment.
d)	0 dB	The measurements were undertaken at a location considered to be robustly representative of the closest noise-sensitive receptors to the site.
g)	0 dB	Measurement time intervals were set in accordance with BS4142:2014+A1:2019, hence no further correction needs to be made.
h)	0 dB	Measurements were undertaken over a continuous 3-day time period.
i)	0 dB	No periods of significant wind or precipitation were noted.
k)	0 dB	Measured values were rounded to 0.1 dB, therefore rounding would not have had a significant impact on the overall typical background sound levels.
l)	0 dB	The acoustic measurement equipment accorded with Type 1 specification of British Standard 61672, and were deployed with appropriate wind shields.

In summary, a correction of 0 dB has been included in the assessment, to account for measurement uncertainty.

Calculation Uncertainty

BS4142:2014 states that calculation uncertainty depends on a number of factors, including the following, which are applicable to the Proposed Development:

" ...

b) uncertainty in the operation or sound emission characteristics of the specific sound source and any assumed sound power levels;
c) uncertainty in the calculation method;
d) simplifying the real situation to "fit" the model (user influence on modelling); and
e) error in the calculation process."

Each of the calculation uncertainty factors outlined above have been considered and discussed in Table 11.

TABLE 11: CALCULATION UNCERTAINTY FACTORS

Calculation Uncertainty Factor Reference	Level of Uncertainty	Discussion
b)	0 dB	Sound levels for all sources/activities have been based on robust archive data and reasonable worst-case assumptions.
c)	0 dB	Calculations were undertaken in accordance with ISO 9613-2, which is considered a *"validated method"* by BS4142:2014+A1:2019.

Calculation Uncertainty Factor Reference	Level of Uncertainty	Discussion
d)	0 dB	The real situation has not been simplified for the purposes of this assessment.
e)	+1 dB	ISO 9613-2 indicates that there is a ±3 dB accuracy to the prediction method, dependent upon input variables and propagation complexities.

In summary, a +1 dB has been considered within the assessment, for calculation uncertainty.

The overall uncertainty is considered to be small enough that it would not affect the conclusions of the assessment.

5.2.4. BS4142:2014+A1:2019 Assessment

The rating sound levels, as calculated from the predicted specific sound level, have been predicted across the proposed residential area and are presented in a graphical format in Figure 7 for the daytime period.

The graphics take account of the acoustic feature corrections set out in Section 5.2.2 and present the results relative to the daytime background sound level measured at MP2 of L_{A90} 46 dB.

FIGURE 7: DAYTIME BS4142 ASSESSMENT OF PROPOSED COMMERCIAL ACTIVITIES

5.2.5. Discussion

Figure 7 identifies that the rating noise level of proposed cumulative commercial activity is predicted to be below the measured background sound level throughout the proposed residential area of the application site, during the proposed operational daytime period. Consequently, no greater than a *Low Impact* is anticipated in BS4142 terms.

This noise effect would be considered a NOAEL in PPG Noise Terms, which means that activities will be *Noticeable and Not Intrusive, where "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.*"

With regard to context'; it should also be borne in mind that future occupiers of the proposed development will be taking up occupancy either after or in the full knowledge of the adjacent commercial operation. Such a line of precedence typically reduces receptor sensitivity, thus further reducing the already-low likelihood of adjacency conflict.

The following noise-limiting planning condition is therefore suggested to cover cumulative commercial activity:

> *Noise arising from non-vehicular activities within the Development shall not exceed the typical background sound level during the day, evening or night at the closest residential receptors to the site, when assessed in accordance with the methodology and principles set out in BS4142:2014+A1:2019 Methods for rating and assessing industrial and commercial sound.*

6. Noise Assessment – New Residential

6.1. Existing Transportation Sources

The baseline noise measurement results presented above have been used to predict noise levels across the site, and to consider the effects of any acoustic screening provided by the structures of the proposed development.

The predictions have been carried out using the noise-modelling suite Cadna/A, in accordance with the CRTN prediction methodology for road traffic noise.

The overall results in Table 6 have been processed to determine appropriate noise emission rates for the roads adjacent to the site. The $L_{Aeq,16hour}$ daytime (0700-2300) and $L_{Aeq,8hour}$ night-time (2300-0700) noise levels at a distance of 10 metres from the roads have been derived, as required to populate the noise model.

In addition to the derived transport source noise levels used in the predictions, the model also considers the effects of the topographical conditions throughout the area, ground absorption, atmospheric absorption, acoustic reflections, acoustic screening as well as applying a light downwind propagation correction to represent worst case.

The model has been used to determine the daytime $L_{Aeq,16\text{-}hour}$ (07:00 to 23:00) and night-time $L_{Aeq,8\text{-}hour}$ (23:00 to 07:00) noise levels across the site.

To assess the effects of noise across the Site, the output from the daytime and night-time baseline noise models has been presented in the form of noise contours overlaid on a plan of the proposed development, as presented below.

6.2. Assessment

Figure 8 and Figure 9 identify the predicted site-wide noise levels for the 16-hour (07:00 to 23:00) daytime, at ground level and 8-hour night-time (23:00 to 07:00) at first floor levels respectively.

Figure 10 and Figure 11 identify the site-wide L_{Aeq} noise levels in the context of key amenity benchmarking criteria, as set out in BS8233 for the daytime and night-time at ground and first floor levels, respectively.

To place the levels in Figure 10 and Figure 11 in context, they accord to the following, typically adopted consideration criteria of planning authorities throughout England:

- **Daytime levels of below 50 dB(A) and night-time of 45 dB(A)** are the threshold for NOAEL (suitable). BS8233-compliant internal noise levels achieved with windows open for ventilation. External amenity criteria comfortably met.
  Low to Negligible Risk in ProPG terms.

- **50 to 55 dB(A) by day and 45 to 50 dB(A) by night** are LOAEL (suitable with mitigation). BS8233 plus 5dB relaxation internal noise levels achieved with windows open for ventilation. External amenity criteria met.
  Low Risk in ProPG terms.

- **55 to 60 dB(A) by day and 50 to 55 dB(A)** by night are SOAEL (mitigation required). BS8233-compliant internal noise levels achieved with standard thermally insulating windows shut and ventilation provided by an alternative means to an open window. External amenity criteria marginally exceeded.
  Low to Medium Risk in ProPG terms.

- **Over 60 dB(A) by day and 55 dB(A)** by night are USOAEL (normally unsuitable). Detailed facade consideration and design may be required in order to achieve BS8233-compliant internal noise levels and Part F (UK Building Regulations).
  Medium Risk in ProPG terms.

FIGURE 8: DAYTIME $L_{AEQ,16\text{-HOUR}}$ NOISE LEVELS

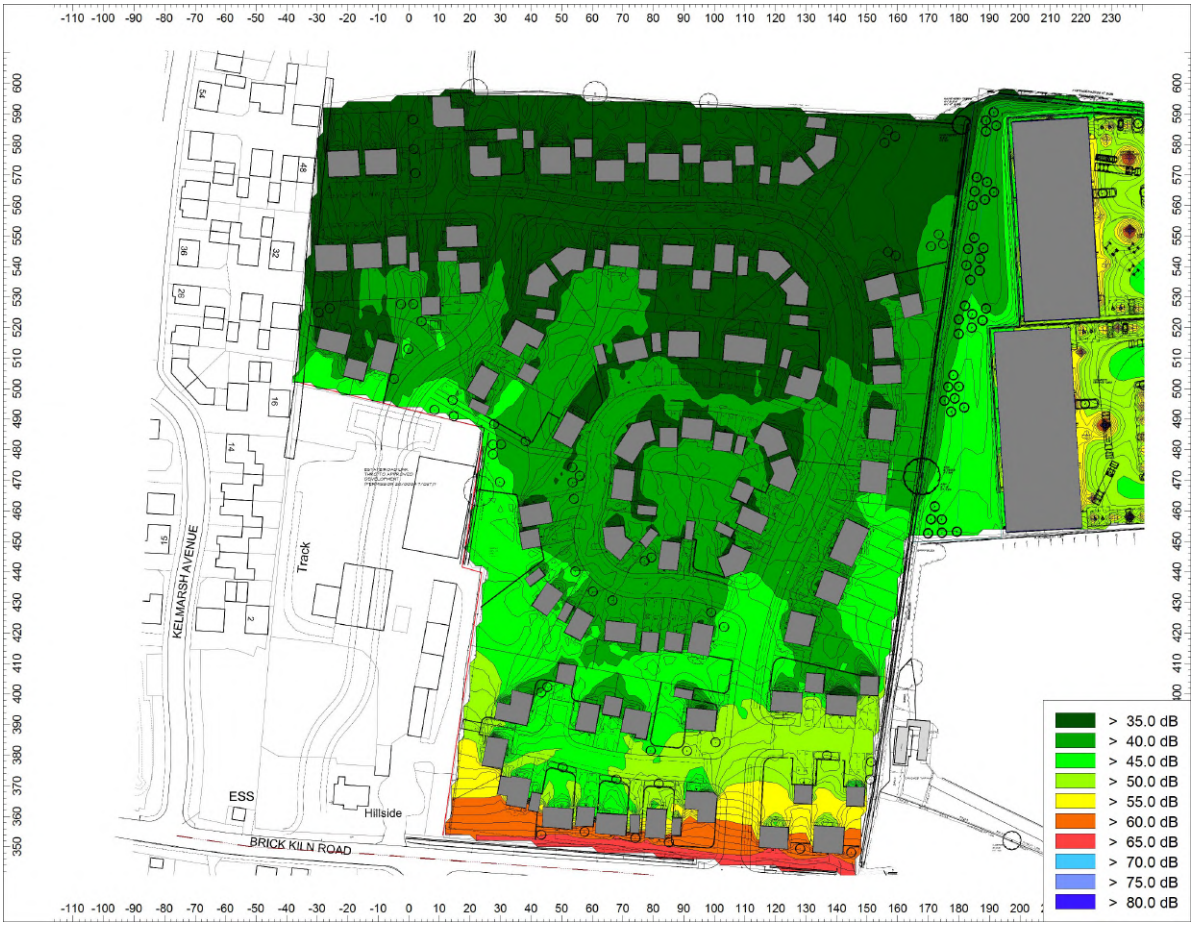


FIGURE 9: NIGHT-TIME $L_{AEQ,8\text{-HOUR}}$ NOISE LEVELS

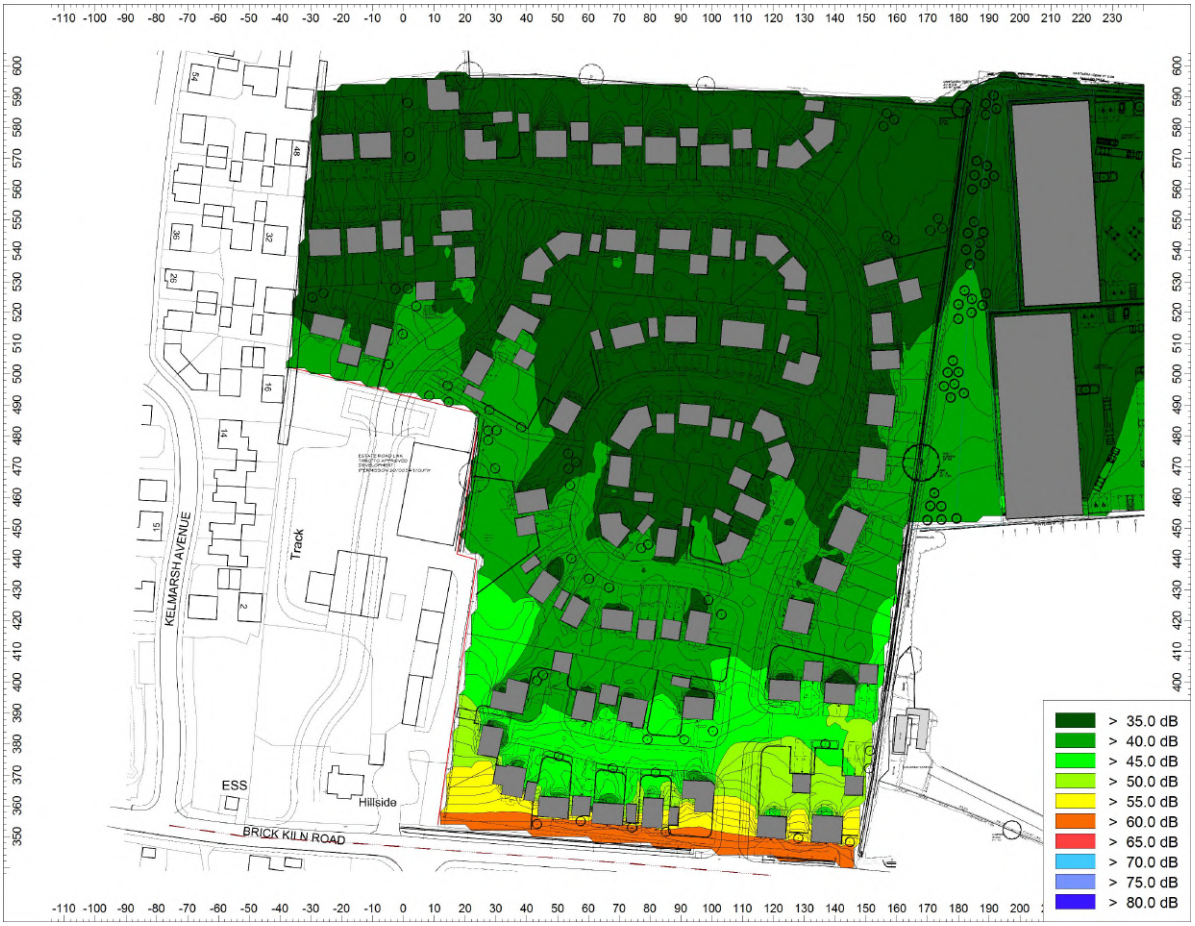


FIGURE 10: DAYTIME $L_{AEQ,16\text{-HOUR}}$ BS8233: 2014 CONTEXT

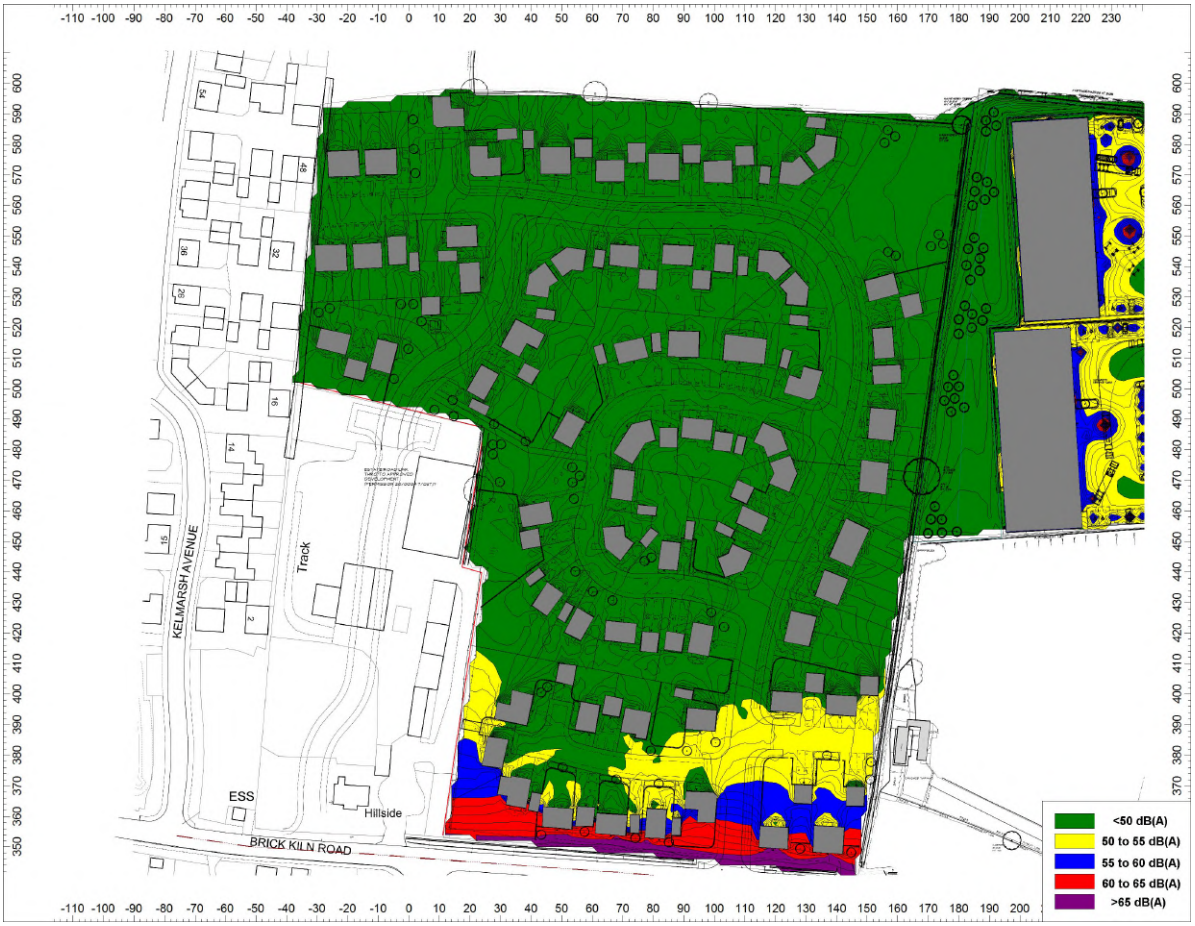


FIGURE 11: NIGHT-TIME $L_{AEQ,8\text{-HOUR}}$ BS8233: 2014 CONTEXT

6.2.1. Results

In summary the data presented in Figure 8 to Figure 11 can be interpreted as follows:

- The sound environment across the site is primarily influenced by road traffic, with very little calculable influence predicted to arise from commercial activities;
- The majority of the Proposed Development will achieve BS8233:2014-compliant internal sound levels with windows open for ventilation, so reliance will not be placed upon the external building fabric to attenuate the passage of environmental sound in those areas;
- The facades closest to and directly overlooking the Brick Kiln Road corridor will require closed windows on the road-facing facades, in order to achieve BS8233:2014-compliant internal sound levels, but will be able to adopt an open window strategy to the rear;
- The vast majority of rear gardens throughout the proposed development will achieve daytime sound levels below the 55 dB(A) external amenity criterion, without the need for additional mitigation; and
- A small number if rear gardens located near to Brick Kiln Road (Plots 5, 6, 7 and 81) will marginally exceed the 55 dB(A) external amenity criterion, however, the introduction of 1.8m high solid boundary structures to these gardens will minimise road traffic noise effects and ensure that broad compliance with the 55 dB(A) external amenity criterion will be achieved; and
- If possible, the reorientation of Plot 5; rotating the dwelling through 90° and locating it closer to Brick Kiln Road, such that the garden is screened by the built form of the dwelling, would add acoustic robustness to the design.

In summary, it is considered that the proposed layout of the residential development represents good acoustic design; almost completely removing the need for acoustically-specific mitigation measures and ensuring that a natural ventilation strategy, using openable windows can be supported.

6.3. Façade Requirements

In order to achieve appropriate noise levels within internal living spaces, the dwellings themselves need to be considered with regard to the level of façade mitigation required in order to achieve internal noise levels of <35 dB(A) in habitable rooms during the day and <30 dB(A) during the night.

The glazing and ventilation elements are typically the weakest acoustic link in the construction of a building façade. Therefore, in order to assess the acoustic performance of the proposed dwellings, it is appropriate in the first instance to explore the level of protection that will be afforded by the performance of the glazing and ventilation elements.

Windows do not reduce noise equally across the entire frequency spectrum, so the frequency content of the sound will influence the overall sound reduction performance of a given window and by extension, the resulting noise levels within the receiving room.

In order to achieve the target daytime and night-time internal noise levels, it is necessary to determine the minimum acoustic performance requirements of each façade component. It is typically assumed that the default choice of glazing for the habitable rooms of the proposed development will be thermal double glazing with ventilation provided by background trickle ventilation and openable windows for purge ventilation.

As already stated; in order to provide a robust assessment and a high-quality living environment for future residents, providing internal noise levels of <35 dB(A) by day and <30 dB(A) by night as defined in BS 8233 has been adopted as the design target for the Proposed Development.

For robustness, the façade noise levels have been predicted at various heights, with the sound reduction specification determined based on the highest predicted level.

To determine the glazing and ventilation requirements in order to provide an adequate level of protection against external noise intrusion, $L_{Aeq,16hour}$ daytime and $L_{Aeq,8hour}$ night-time noise levels have been predicted at the building façade, via the use of a Cadna/A noise modelling exercise.

Accordingly, the required sound level difference from outside to inside for the key building façade locations, to provide appropriate internal noise levels during both daytime and night-time periods, as described, is identified in Table 12.

TABLE 12: REQUIRED SOUND LEVEL DIFFERENCE OUTSIDE TO INSIDE

Facade	Predicted Free-field Noise Level, $L_{Aeq,T}$ dB		Target Internal Noise Level - dB		Required Sound Level Difference, dB
	Day	Night	Day	Night	
Plot 1					
North	61	57	35	30	27
South	44	40	35	30	10
Plot 2 to 4					
East	64	60	35	30	30
West	46	42	35	30	12
Plot 5					
North	61	57	35	30	27
South	44	40	35	30	10
Plot 6					
North	64	60	35	30	30
South	45	41	35	30	11
Plot 7					
North	64	60	35	30	30
South	50	46	35	30	16
Plot 81					
North	57	53	35	30	23
South	43	39	35	30	9

It should be noted that the sound reductions detailed in Table 12 apply to habitable rooms such as living rooms, dining rooms and bedrooms only. For non-habitable rooms such as kitchens, bathrooms, stairways, halls, landings, lower performance standards would be permissible.

It should also be noted that all proposed dwellings are predicted to have a façade that can broadly achieve BS8233:2014-compliant internal sound levels, with windows partially open for ventilation (on the basis of sound attenuating at ~15 dB across a partially open window), meaning that the façade design will be steered by thermal requirements, rather than acoustic factors.

Notwithstanding the above, as some facades will require closed windows to achieve the required internal noise criteria, calculations have been carried out, based upon the latest layout proposals and robust assumptions of up to 30% of a room façade being glazed and a room volume of 30m^3, to determine the likely required acoustic performances for the external façade elements, in order to provide appropriate internal noise levels in rooms during both the daytime and night-time periods.

The outline performance requirements are presented in Table 13.

TABLE 13: RECOMMENDED ACOUSTIC PERFORMANCES FOR GLAZING AND VENTILATION

Example Glazing	Octave Band (Hz) Sound Level (dB)							
	63	125	250	500	1000	2000	4000	R_w
	Sound Reduction Performance, R dB							
All Areas								
4/12/4 Double Glazing	20	24	20	25	35	38	35	31
Example Ventilation	**Octave Band (Hz) Sound Level (dB)**							
	63	125	250	500	1000	2000	4000	$D_{n,e,w}$
	Element Normalised Level Difference (D,n,e) dB							
South Facades of Plots 2, 3 ,4 6 and 7								
Hit and Miss Trickle Vent	30	34	39	34	41	31	31	35
All Other Areas								
Trickle Vent with Direct Air Path	28	32	32	31	33	31	31	32
Example Walls	**Octave Band (Hz) Sound Level (dB)**							
	63	125	250	500	1000	2000	4000	R_w
	Sound Reduction Performance, R dB							
All Areas								
Brick/Block Cavity	36	41	45	45	54	58	58	52

Other units may be suitable and it is the responsibility of the glazing manufacturer to recommend and provide appropriate systems. The above analysis is provided to demonstrate that a design solution is feasible at the site for the purposes of a planning application and not necessarily for the purposes of detailed design or glazing procurement.

The detailed design of the proposed properties may affect both the required sound reduction performance and the appropriate selection of glazing units. The aspects of the detailed design that are important are the room dimensions, room finishes, window dimensions and the sound reduction performance of non-glazing elements.

7. CONCLUSION

inacoustic has been commissioned to undertake an assessment of noise with regard to the proposed change of use of land at New Barn Farm, Brick Kiln Road, Raunds for commercial and residential purposes.

This technical noise assessment has been produced to provide supporting information to accompany a planning application to North Northamptonshire Council and is based upon environmental noise measurements undertaken at the site and a subsequent predictive exercise.

The assessment considers the potential noise emissions arising from robust assumptions on potential activity levels at the Proposed Commercial Development on the eastern area of the Site.

The assessment has identified that noise levels arising as a result of probable commercial operations are predicted to be at a level defined as a *Low Impact* at the closest off-site noise-sensitive receptors; being the proposed residential dwellings to the west, in BS4142:2014+A1:2019 terms.

The suitability of the western area of the Site for residential development has been assessed, based on the measured and predicted sound levels. Where the levels indicate that noise may be a determining factor in the granting of planning permission, mitigation measures have been proposed to ensure satisfactory acoustic conditions are met, in accordance with the steering principles of the ProPG and BS8233.

Specific consideration has been given to the internal noise criteria for the proposed residential properties, as quoted within BS8233:2014.

In light of the above, which demonstrates that the site is predicted to meet the requirements of the relevant British Standard and planning guidance, it is considered that noise can be appropriately managed by the proposed design and an appropriately worded planning condition and therefore does not present a constraint to the development of the Site.

8. APPENDICES

8.1. Appendix A – Definition of Terms

Sound Pressure	Sound, or sound pressure, is a fluctuation in air pressure over the static ambient pressure.
Sound Pressure Level (Sound 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 s1 and s2 is given by 20 log10 (s1 / s2). 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 takes into account 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.
$L_{eq,T}$	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.
$L_{max,T}$	A noise level index defined as the maximum noise level during the period T. L_{max} is sometimes used for the assessment of occasional loud noises, which may have little effect on the overall L_{eq} noise level but will still affect the noise environment. Unless described otherwise, it is measured using the 'fast' sound level meter response.
$L_{90,T}$	A noise level index. The noise level exceeded for 90% of the time over the period T. L_{90} can be considered to be the "average minimum" noise level and is often used to describe the background noise.
$L_{10,T}$	A noise level index. The noise level exceeded for 10% of the time over the period T. L_{10} 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
Facade	At a distance of 1m in front of a large sound reflecting object such as a building façade.
Fast Time Weighting	An averaging time used in sound level meters. Defined in BS 5969.

In order to assist the understanding of acoustic terminology and the relative change in noise, the following background information is provided.

The human ear can detect a very wide range of pressure fluctuations, which are perceived as sound. In order to express these fluctuations in a manageable way, a logarithmic scale called the decibel, or dB scale is used. The decibel scale typically ranges from 0 dB (the threshold of hearing) to over 120 dB. An indication of the range of sound levels commonly found in the environment is given in the following table.

TABLE 14: TYPICAL SOUND LEVELS FOUND IN THE ENVIRONMENT

Sound Level	Location
0dB(A)	Threshold of hearing
20 to 30dB(A)	Quiet bedroom at night
30 to 40dB(A)	Living room during the day
40 to 50dB(A)	Typical office
50 to 60dB(A)	Inside a car
60 to 70dB(A)	Typical high street
70 to 90dB(A)	Inside factory
100 to 110dB(A)	Burglar alarm at 1m away
110 to 130dB(A)	Jet aircraft on take off
140dB(A)	Threshold of Pain

The ear is less sensitive to some frequencies than to others. The A-weighting scale is used to approximate the frequency response of the ear. Levels weighted using this scale are commonly identified by the notation dB(A).

In accordance with logarithmic addition, combining two sources with equal noise levels would result in an increase of 3 dB(A) in the noise level from a single source.

A change of 3 dB(A) is generally regarded as the smallest change in broadband continuous noise which the human ear can detect (although in certain controlled circumstances a change of 1 dB(A) is just perceptible). Therefore, a 2 dB(A) increase would not be normally be perceptible. A 10 dB(A) increase in noise represents a subjective doubling of loudness.

A noise impact on a community is deemed to occur when a new noise is introduced that is out of character with the area, or when a significant increase above the pre-existing ambient noise level occurs.

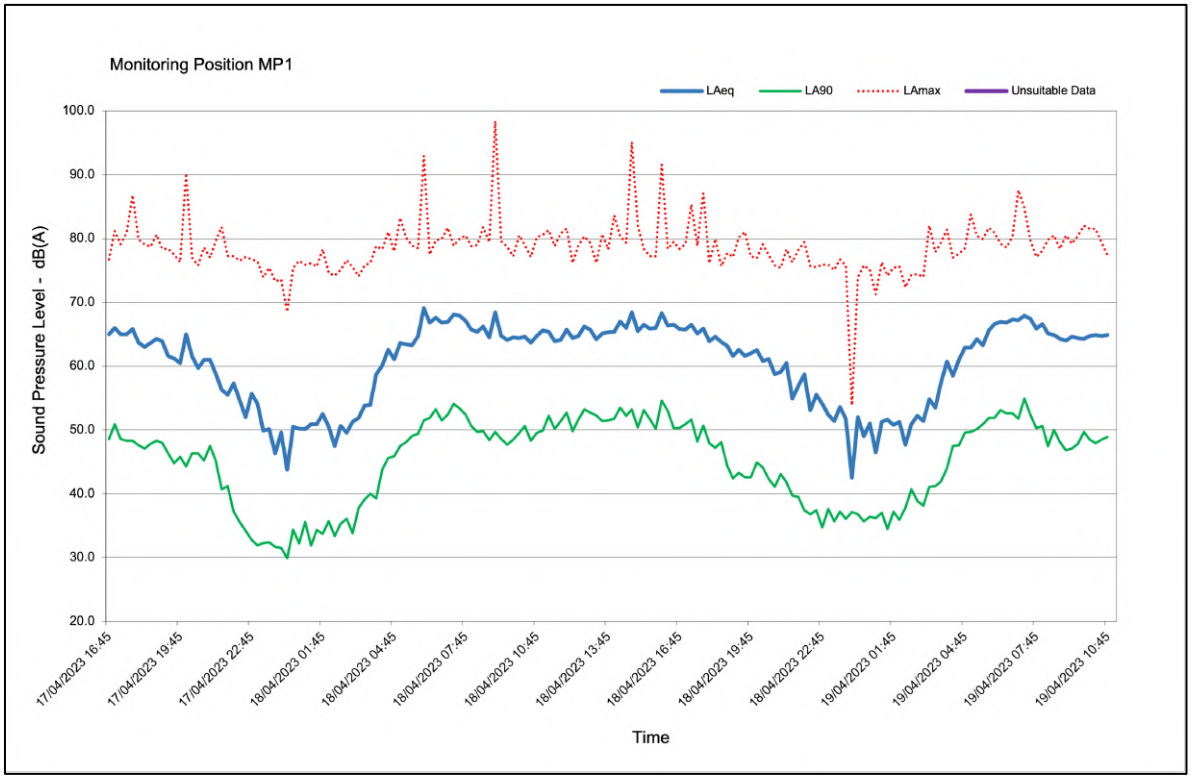
For levels of noise that vary with time, it is necessary to employ a statistical index that allows for this variation. These statistical indices are expressed as the sound level that is exceeded for a percentage of the time period of interest. In the UK, traffic noise is measured as the L_{A10}, the noise level exceeded for 10% of the measurement period. The L_{A90} is the level exceeded for 90% of the time and has been adopted to represent the background noise level in the absence of discrete events. An alternative way of assessing the time varying noise levels is to use the equivalent continuous sound level, L_{Aeq}.

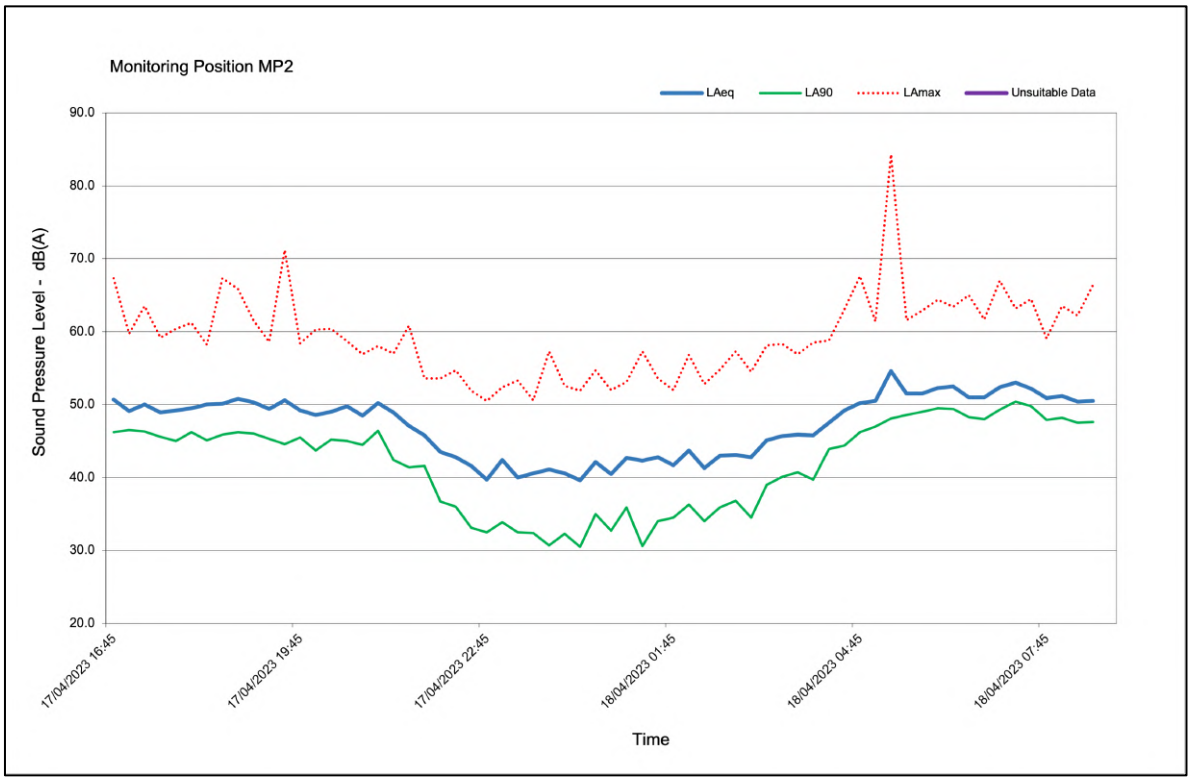
This is a notional steady level that would, over a given period of time, deliver the same sound energy as the actual fluctuating sound.

To put these quantities into context, where a receiver is predominantly affected by continuous flows of road traffic, a doubling or halving of the flows would result in a just perceptible change of 3 dB, while an increase of more than 25%, or a decrease of more than 20%, in traffic flows represent changes of 1 dB in traffic noise levels (assuming no alteration in the mix of traffic or flow speeds).

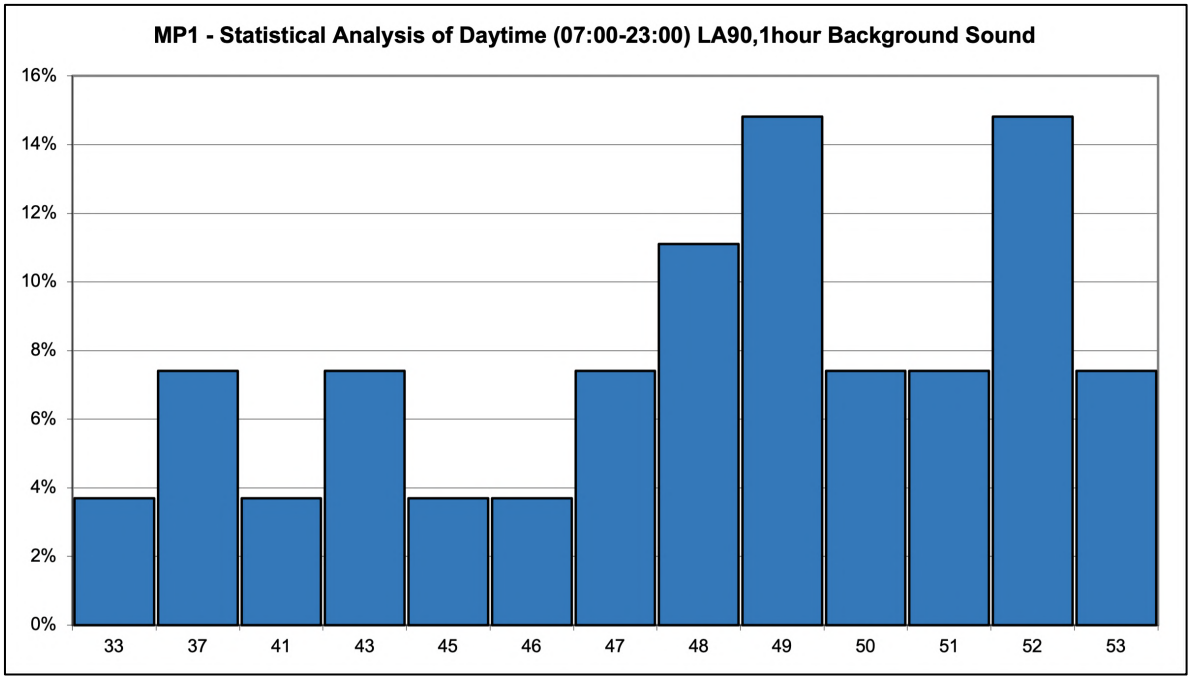
Note that the time constant and the period of the noise measurement should be specified. For example, BS 4142 specifies background noise measurement periods of 1 hour during the day and 15 minutes during the night. The noise levels are commonly symbolised as $L_{A90,1hour}$ dB and $L_{A90,15mins}$ dB. The noise measurement should be recorded using a 'FAST' time response equivalent to 0.125 ms.

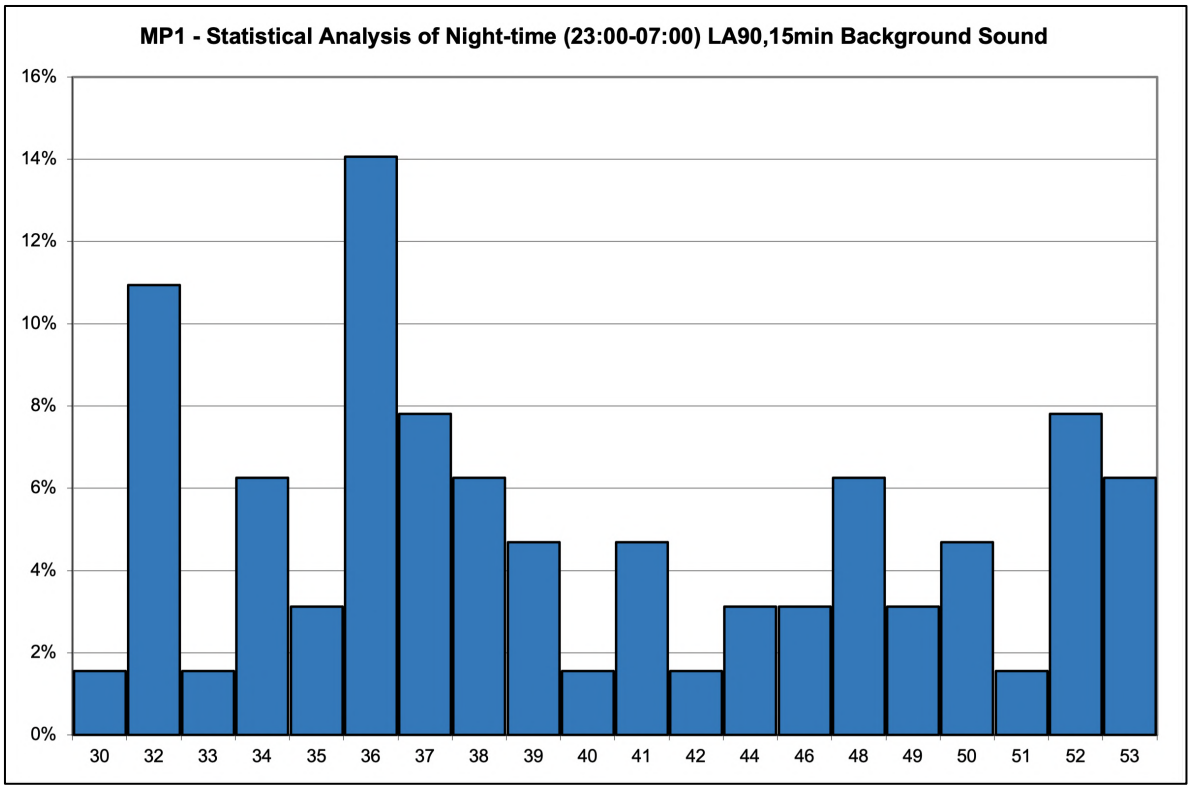
8.2. Appendix B – Sound Measurement Results

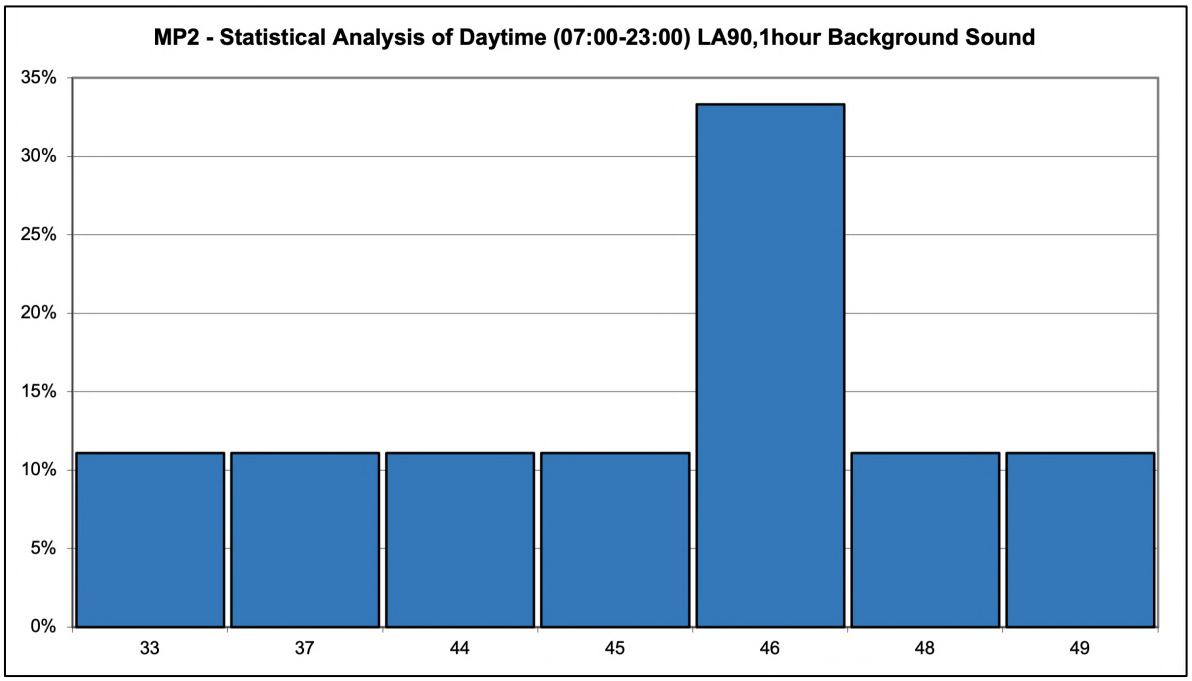


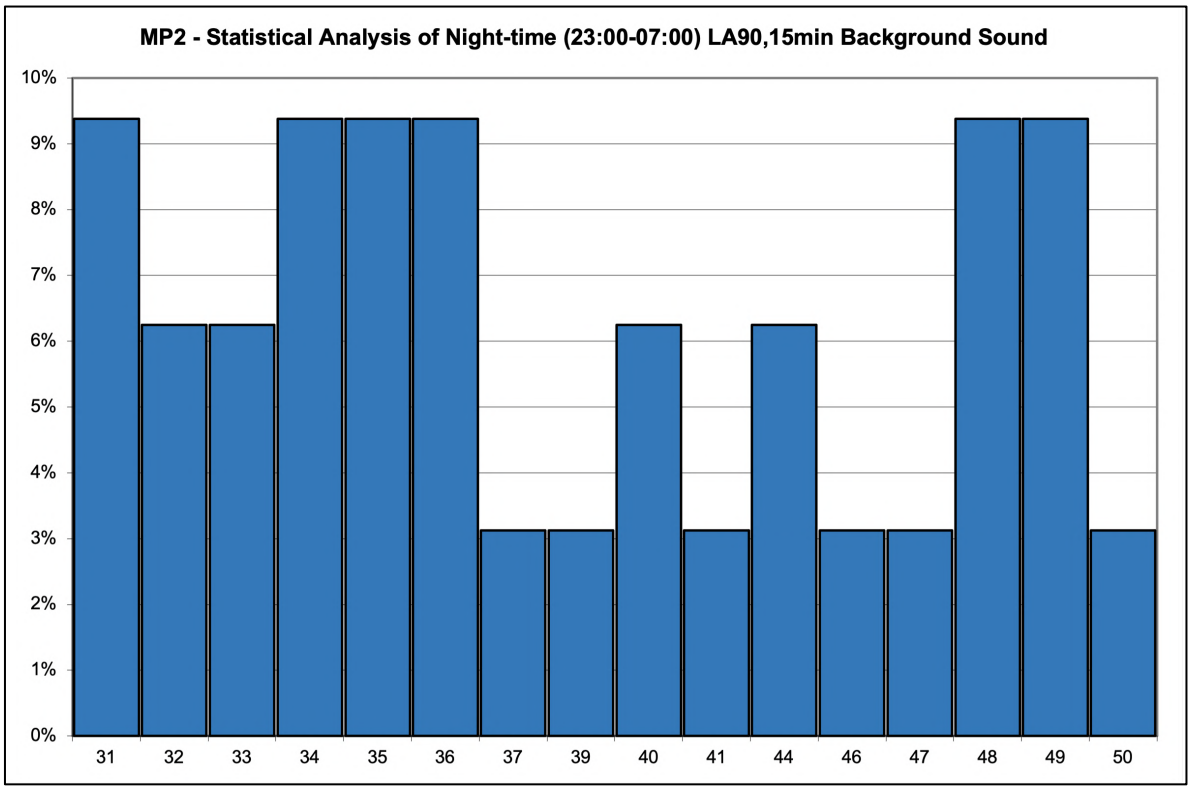


8.3. Appendix C – Statistical Analysis






MP2 - Statistical Analysis of Daytime (07:00-23:00) LA90,1hour Background Sound
35%
30%
25%
20%
15%
10%
5%
0%
33
37
44
45
46
48
49


MP2 - Statistical Analysis of Night-time (23:00-07:00) LA90,15min Background Sound
10%
9%
8%
7%
6%
5%
4%
3%
2%
1%
0%
31
32
33
34
35
36
37
39
40
41
44
46
47
48
49
50

inacoustic | **bristol**
Caswell Park, Caswell Lane, Clapton-in-Gordano, Bristol, BS20 7RT
0117 325 3949 bristol@inacoustic.co.uk