

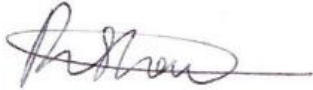
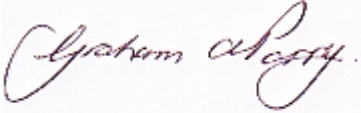
Report for:

Nova Planning

Charters, Oxford Road, Tilehurst
Noise Impact Assessment

Status: Final

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1. INTRODUCTION

1.1. Background

ACCON UK Limited (ACCON) has been commissioned by Nova Planning to undertake a noise impact assessment to support a full planning application for the proposed residential development at Charters, Oxford Road, Tilehurst, RG31 6TQ.

The proposed development is for the construction of four three-storey buildings consisting of a total of 16 residential units (Use Class C3).

1.2. Site Description

The site is situated in an existing residential area and is located immediately to the north-east of Oxford Road and approximately 25 m south-west of the Great Western Railway (GWR) Mainline. Tilehurst Railway Station is located approximately 200 m to the south-east and the River Thames is located to the east.

The proposed development site is located within the administrative boundary of Reading Borough Council (RBC).

Figure 1.1 provides the site location with the site boundary outlined in yellow and the proposed site layout plan is identified in **Figure F.1.1**.

Figure 1.1: Site Location Plan



2. THE NATURE, MEASUREMENT AND EFFECT OF NOISE

Noise is often defined as sound that is undesired by the recipient. Whilst it is impossible to measure nuisance caused by noise directly, it is possible to characterise the loudness of that noise. 'Loudness' is related to both sound pressure and frequency, both of which can be measured. The human ear is sensitive to a wide range of sound levels. The sound pressure level of the threshold of pain is over a million times that of the quietest audible sound. In order to reduce the relative magnitudes of the numbers involved, a logarithmic scale of decibels (dB) is normally used, based on a reference level of the lowest audible sound.

The response of the human ear is not constant over all frequencies. It is therefore usual to weight the measured frequencies to approximate the human response. The resulting 'A' weighted decibel, dB(A), has been shown to correlate closely to the subjective human response.

When related to changes in noise, a change of ten decibels, for example from 60 dB(A) to 70 dB(A), would represent a doubling in 'loudness'. Similarly, a 10 dB(A) decrease in noise, for example from 70 dB(A) to 60 dB(A), would represent a halving in 'loudness'. A change of 3 dB(A) is generally considered to be just perceptible¹. **Table 2.1** provides typical noise levels of common sources.

Table 2.1: Typical Noise Levels

Approximate Noise Level (dB(A))	Example
0	Limit of hearing
30	Rural area at night
40	Library
50	Quiet office
60	Normal conversation at 1 m
70	In car noise without radio
80	Household vacuum cleaner at 1 m
100	Pneumatic drill at 1 m
120	Threshold of pain

¹ Institute of Environmental Management and Assessment (2014). Guidelines for environmental noise impact assessment.

3. NOISE ASSESSMENT CRITERIA

This section of the report identifies relevant National and Local Authority policy and guidance. Additionally, appropriate British Standards and guidance documents are also referenced.

3.1. National Planning Policy Framework

The revised National Planning Policy Framework (NPPF as amended in December 2023) supersedes the 2012, 2018, 2019 and 2021 versions of the NPPF. The purpose of the planning system is to contribute to the achievement of sustainable development. There are three dimensions to sustainable development: economic, social and environmental. The environmental role is to contribute to protecting and enhancing our natural, built and historic environment; and as part of this, make effective use of land, help to improve biodiversity, use natural resources prudently, minimise waste and pollution, and mitigate to adapt to climate change including moving to a low carbon economy.

One of the core planning principles is to contribute to conserving and enhancing the natural environment and reducing pollution. Allocations of land for development should prefer land of lesser value, where consistent with other policies in the Framework. The planning system should contribute to and enhance the natural and local environment by preventing both new and existing development from contributing to or being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution or land instability.

Paragraph 191 of the NPPF states:

“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 (see Explanatory Note to the Noise Policy Statement for England (Department for Environment, Food and Rural Affairs, 2010));*
- 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.”*

Additionally, Paragraph 193 states:

“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.”

3.2. Noise Policy Statement for England

The Noise Policy Statement for England (NPSE) aims to “*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”.*

Based on concepts from toxicology, it introduces three ‘Effect Levels’ relevant to the assessment of noise. These are:

- 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; and
- SOAEL: Significant Observed Adverse Effect Level: This is the level above which significant adverse effects on health and quality of life occur.

3.3. Planning Practice Guidance

The Planning Practice Guidance for Noise (PPG-N) was published in March 2014 and most recently updated in July 2019. The PPG-N suggests that the most appropriate and cost-effective solutions to potential noise issues are best identified when good acoustic design is considered early in the planning process.

The PPG-N provides the following advice on how to determine the noise impact on development:

“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 Noise Policy Statement for England, this would include identifying whether the overall effect of the noise exposure (including the impact during the construction phase wherever applicable) is, or would be, above or below the significant observed adverse effect level and the lowest observed adverse effect level for the given situation. As noise is a complex technical issue, it may be appropriate to seek experienced specialist assistance when applying this policy.” (Paragraph 003 Reference ID 30-003-20190722)

The document goes on to acknowledge the levels of noise exposure at which an effect may occur as provided in the NPSE and introduces a fourth effect level:

- UAE: Unacceptable Adverse Effect: Extensive and regular changes in behaviour and/or an inability to mitigate the effect of noise lead to psychological stress or physical effects.

Where residential development is proposed in the vicinity of existing businesses, community facilities or other activities that produce noise, the PPG-N advises that the applicant (or 'agent of change') need to clearly identify the effects of the existing businesses that may cause a nuisance (including noise) and clearly define the mitigation measures being proposed to address any potential significant adverse effects that are identified. The agent of change needs to not only consider the current activities of the business, but the permitted activities too, even if they are not occurring at the time of the application being made. The PPG-N acknowledges that *"It can be helpful for developers to provide information to prospective purchasers or occupants about mitigation measures that have been put in place, to raise awareness and reduce the risk of post-purchase/occupancy complaints."* (Paragraph 009 Reference ID 30-009-20190722).

It is important to understand that as the PPG-N does not specifically provide any advice with respect to noise levels/limits for different sources of noise, it is appropriate to consider other sources of advice and guidance documents when considering whether new developments would be sensitive to the prevailing acoustic environment and the PPG-N signposts a number of appropriate guidance documents.

3.4. Reading Borough Council

The Reading Borough Council Local Plan (2019) policy on noise states:

CC8: Safeguarding Amenity

"Development will not cause a detrimental impact on the living environment of existing residential properties or unacceptable living conditions for new residential properties, in terms of:

- *Noise and disturbance;*
- *Vibration;"*

EN16: Pollution and Water Resources

"Proposals for development that are sensitive to the effects of noise or light pollution will only be permitted in areas where they will not be subject to high levels of such pollution, unless adequate mitigation measures are provided to minimise the impact of such pollution."

4.2.87 *"In order to improve the quality of life of those living and working within Reading, it is important to avoid any detrimental impact from development in the form of noise and light pollution."*

4.2.90 *"Exposure to high levels of noise can have a significant effect on human health. This policy deals with noise issues in general, whilst policy EN17 deals particularly with noise-generating equipment. It is worth noting that there is a Professional Practice Guide on Planning and Noise available which provides guidance on design of residential developments to take account of noise, and taking account of this from the early design stage will help to reduce noise effects on future residents."*

EN17: Noise Generating Equipment

“Where noise generating equipment is proposed, the noise source specific level (plant noise level) should be at least 10dBA below the existing background level as measured at the nearest noise sensitive receptor.”

4.2.93 “Planning Practice Guidance on noise states that no specific measures are required to manage the acoustic environment in situations where noise can be heard as a result of a development and there is a slight effect on the acoustic character of the area but there is no effect on the behaviour and attitude of people exposed to the noise. However, the guidance also states that:

- The cumulative impacts of more than one source of noise should be considered; and*
- 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.”*

4.2.94 “The Council considers that the above two factors apply due to the town being densely populated and there being a high likelihood of subsequent noise generating plant being installed in a particular location. It is therefore necessary for each planning application for noisy plant to protect the acoustic environment and as far as possible prevent the increase in background noise levels because the cumulative impact of installation of noisy plant which causes an increase in background noise level is likely to lead to an adverse effect.”

4.2.95 “The Planning Practice Guidance on noise also states that local planning authorities may decide to develop specific standards to apply to various forms of proposed development in their area. It cautions against the implementation of fixed thresholds because specific circumstances may justify some variation being allowed. Because this policy sets a noise target in relation to the background noise level, this allows variation of the threshold with the local circumstances because it does not set an absolute noise level that the plant must achieve, it relates it to the local noise level.”

4.2.96 “Where the plant noise rating level does not meet this standard, the background noise will increase. When subsequent new plant is added it will be assessed against this higher background level which results in an increasing benchmark against which subsequent new plant is introduced. This leads to an incremental increase in the noise in an area each time new plant is introduced (‘background creep’). This policy standard has been applied by Reading Borough Council for a number of years and experience has demonstrated it to be achievable in most cases. In addition, noise control technology is improving, therefore further increasing the achievability of this standard.”

3.4.1. Professional Practice Guidance on Planning and Noise: New Residential Development

The Professional Practice Guidance (ProPG) on Planning and Noise for New Residential Development was published in May 2017 and was produced to provide practitioners with guidance on a recommended approach to the management of noise within the planning system in England.

The recommended approach detailed in the ProPG includes a framework to enable situations where noise is not an issue to be clearly determined, and to help identify the extent of risk at noisier sites. The recommended approach provides opportunities to incorporate effective design interventions that will enable residential development to proceed in areas that might otherwise have been considered unsuitable. The ProPG provides advice for Local Planning Authorities and developers, and their respective professional advisers. It aims to complement Government planning and noise policy and guidance. In particular, it strives to:

- Advocate full consideration of the acoustic environment from the earliest possible stage of the development control process;
- Encourage the process of good acoustic design in and around new residential developments;
- Outline what should be taken into account in deciding planning applications for new noise-sensitive developments;
- Improve understanding of how to determine the extent of potential noise impact and effect; and
- Assist the delivery of sustainable development.

The two sequential stages of the recommended approach are:

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

The four key elements to be undertaken in parallel during Stage 2 of the recommended approach are:

- Element 1: demonstrating a “Good Acoustic Design Process”;
- Element 2: observing internal “Noise Level Guidelines”;
- Element 3: undertaking an “External Amenity Noise Assessment”; and

Element 4: consideration of “Other Relevant Issues”.

Figure 3.1 below identifies the guidance given in the ProPG when undertaking the risk assessment stage for a site.

Figure 3.1: Phase 1 – 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 $L_{Aeq, 8hr}$	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 demonstrates that a significant adverse noise impact will be avoided in the finished development. 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.
	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.
Notes: - Indicative noise levels should be assessed without inclusion of the acoustic effect of any scheme specific noise mitigation measures. - Indicative noise levels are the combined free-field noise levels from all sources of transport noise and may also include industrial/commercial noise where this is present but is "not dominant". $L_{Aeq, 16hr}$ is for daytime 0700 - 2300, $L_{Aeq, 8hr}$ is for night-time 2300 - 0700. - An indication that there may be more than 10 noise events at night (2300 - 0700) with $L_{AFmax} > 60$ dB means the site should not be regarded as negligible risk.		

Table 3.1 below identifies the internal noise level criteria provided in the ProPG.

Table 3.1: ProPG Noise Levels

Activity	Location	0700-2300 Hours	2300-0700 Hours
Resting	Living room	35 dB $L_{Aeq,16hr}$	-
Dining	Dining room/area	40 dB $L_{Aeq,16hr}$	-
Sleeping (daytime resting)	Bedroom	35 dB $L_{Aeq,16hr}$	30 dB $L_{Aeq,8hr}$ 45 dB L_{AFmax} ^{Note 4}

Notes:

1. The Table provides recommended internal L_{Aeq} target levels for overall noise in the design of a building. These are the sum total of structure-borne and airborne noise sources. Ground-borne noise is assessed separately and is not included as part of these targets, as human response to ground-borne noise varies with many factors such as level, character, timing, occupant expectation and sensitivity.
2. The internal L_{Aeq} target levels shown in the Table are based on the existing guidelines issued by the WHO and assume normal diurnal fluctuations in external noise. In cases where local conditions do not follow a typical diurnal pattern, for example on a road serving a port with high levels of traffic at certain times of the night, an appropriate alternative period, e.g. 1 hour, may be used, but the level should be selected to ensure consistency with the internal L_{Aeq} target levels recommended in the Table.
3. These internal L_{Aeq} target levels are based on annual average data and do not have to be achieved in all circumstances. For example, it is normal to exclude occasional events, such as fireworks night or New Year's Eve.
4. Regular individual noise events (for example, scheduled aircraft or passing trains) can cause sleep disturbance. A guideline value may be set in terms of SEL or L_{AFmax} , depending on the character and number of events per night. Sporadic noise events could require separate values. In most circumstances in noise sensitive rooms at night (e.g. bedrooms) good acoustic design can be used so that individual noise events do not normally exceed 45dB L_{AFmax} more than 10 times a night. However, where it is not reasonably practicable to achieve this guideline then the judgement of acceptability will depend not only on the maximum noise levels but also on factors such as the source, number, distribution, predictability and regularity of noise events (see Appendix A).
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.
6. Attention is drawn to the requirements of the Building Regulations.
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 (see Section 3.D).

3.4.2. British Standard BS 8233:2014

BS 8233 *Guidance on sound insulation and noise reduction for buildings* has a number of design criteria for intrusive external noise without a specific character. The guidelines are designed to achieve reasonable resting/sleeping conditions in bedrooms and good listening conditions in other rooms. The most appropriate noise levels (Table 4 of the BS) for the residential environment are reproduced in **Table 3.2**.

Table 3.2: Indoor Ambient Noise Levels for Dwellings

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

Although there are no limits set for external noise levels in BS 8233 the following guidance is provided at paragraph 7.7.3.2:

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

3.4.3. World Health Organization Guidelines for Community Noise (1999)

The World Health Organization (WHO) has developed the *Guidelines for Community Noise* (CNG) designed to minimise the adverse effects of noise. The guidelines relevant to residential noise exposure are detailed in **Table 3.3**. For each specific environment, the stated noise levels are the maximum noise levels to avoid the health effect noted.

Table 3.3: WHO Community Noise Guideline Values

Specific Environment	Critical Health Effect(s)	Period Noise Level	Maximum Noise Level
Outdoor Living Area	Serious annoyance, daytime and evening	55 dB $L_{Aeq,16hr}$	-
	Moderate annoyance, daytime and evening	50 dB $L_{Aeq,16hr}$	-
Dwelling, Indoors	Speech intelligibility and moderate annoyance, daytime and evening	35 dB $L_{Aeq,16hr}$	
Inside bedrooms	Sleep disturbance, night-time	30 dB $L_{Aeq,8hr}$	45 dB L_{AFmax}
Outside bedrooms	Sleep disturbance with window open (outside values)	45 dB $L_{Aeq,8hr}$	60 dB L_{AFmax}

The WHO guidelines state, with respect to the L_{Amax} threshold, that “for a good sleep, it is believed that indoor sound pressure levels should not exceed approximately 45 dB L_{Amax} more than 10-15 times per night (Vallet and Vernet 1991)”. Therefore, ACCON consider that it is appropriate to assess against the tenth highest L_{AFmax} level during the night-time period as opposed to the highest level in order to represent typical L_{AFmax} levels and provide a realistic compromise between protection from sleep disturbance and achievable mitigation.

3.4.4. World Health Organization Environmental Noise Guidelines for the European Region

The World Health Organization (WHO) issued the *Environmental Noise Guidelines for the European Region* (ENG) in October 2018. The guidelines state that the main intended purpose is to “provide recommendations for protecting human health from exposure to environmental noise...” As the guidelines, which are source specific and not environment specific, are intended to be suitable for policy-making they focus on the most used noise indicators L_{den} and/or L_{night} for exposure at the most exposed façade outdoors. The ENG recommends that all indoor guideline values within the WHO CNG (see Section 3.1 of the ENG) and “any values not covered by the current guidelines” should remain valid.

3.5. Target Noise Levels

The target internal and external noise levels for new residential dwellings have been derived from the ProPG, BS 8233 and the WHO guidelines and primarily relate to noise without specific character (i.e. road traffic noise).

3.5.1. External Noise Levels

Noise levels within private amenity areas (i.e. communal gardens, private gardens, balconies and terraces) should achieve a noise level within or below the range of 50 dB to 55 dB $L_{Aeq,16hr}$ in respect of traffic noise.

3.5.2. Internal Noise Levels

Noise levels within habitable rooms (i.e. living rooms and bedrooms) should achieve a daytime noise level not exceeding 35 dB $L_{Aeq,16hr}$ and a night-time noise level not exceeding 30 dB $L_{Aeq,8hr}$. Maximum noise levels (L_{AFmax}) should not normally exceed 45 dB internally more than 10 times during the night-time period (2300 hrs to 0700 hrs).

4. NOISE MEASUREMENT SURVEY

A detailed noise measurement survey was carried out at the site in order to determine the extent to which the site is currently affected by noise. An unattended noise measurement survey was carried out in order to characterise the existing noise climate over a 24-hour period and a 3-hour attended noise measurement was carried out in accordance with Paragraph 43 *Shortened Measurement Procedure* identified in the Department of Transport's Technical Memorandum '*Calculation of Road Traffic Noise (CRTN, 1988)*'. The noise measurements were carried out between 1220 hrs on Monday 28th October 2024 and 1220 hrs on Tuesday 29th October 2024.

4.1. Methodology

The noise measurements utilised one Svantek 971 Class 1 Sound Level Meter (SLM) and one Rion NL-52 Class 1 SLM. Both SLMs hold current certificates of calibration, which are available upon request. Before and after the noise measurement period, the equipment was field calibrated in order to ensure that the equipment had remained within reasonable calibration limits (± 0.5 dB).

At the start of the noise measurement period the weather was dry with approximately 100% cloud cover, a daytime temperature of 15°C and a south-westerly wind with speeds of up to 4.0 m/s.

At the end of the noise measurement period the weather was dry with 100% cloud cover, an average temperature of 15°C and an easterly wind with speeds of up to 2 m/s. Weather conditions throughout the noise measurement survey were suitable for noise measurements.

Table 4.1 provides the locations of the noise survey measurements and the observed noise sources during the noise survey. **Figure 4.1** identifies the position of the noise measurements.

Table 4.1: Noise Survey Locations

Location Reference	Location Description	Measurement Duration	Observed Noise Sources
MP1	Located in a freefield position approximately 25 m southwest of the GWR Mainline, at the north-east boundary of the proposed development site, at a height of 2.8m.	24 hours.	Railway noise from the GWR Mainline and road traffic noise from Oxford Road were the dominant noise sources.
ST1	Located in a freefield position approximately 7.5 m northeast of Oxford Road, at the south-west boundary of the proposed development site, at a height of 1.5m.	3 hours.	Road traffic noise from Oxford Road and railway noise from the GWR Mainline were the dominant noise sources.

Figure 4.1: Noise Measurement Positions



4.2. Results

The summary of the unattended noise measurement data is presented in **Table 4.2**. The hourly noise measurement results for **MP1** are provided in **Appendix 2**.

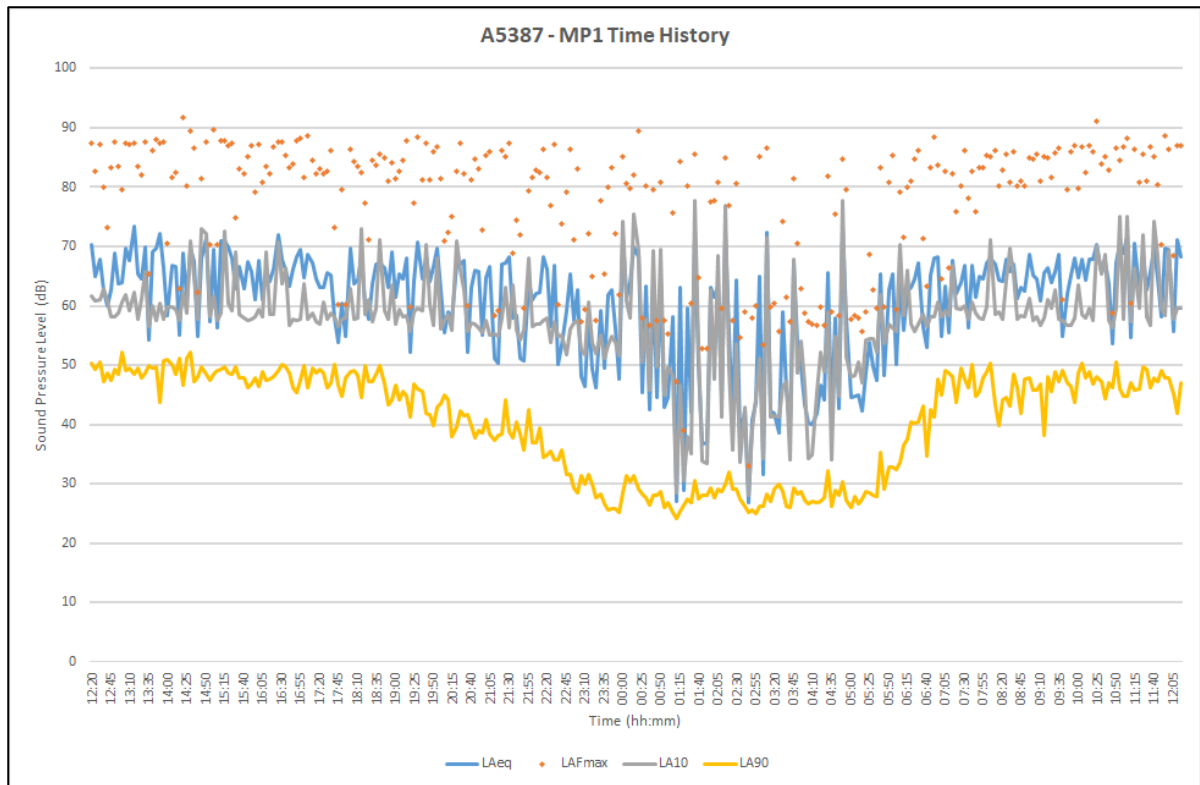
Table 4.2: MP1 Unattended Noise Measurement Summary

Position	Period	$L_{Aeq, T}$ (dB)	L_{AFmax} (dB)	$L_{A10, T}$ (dB)	Mean $L_{A90, T}$ (dB)	Modal $L_{A90, T}$ (dB)
MP1	0700 hrs to 2300 hrs	66	88	60	46	49
	2300 hrs to 0700 hrs	63	86 (85)	52	29	28

Note: The levels stated are logarithmic average for $L_{Aeq, T}$ and arithmetic averages for $L_{A10, T}$ and mean $L_{A90, T}$. The L_{AFmax} is the average of the highest hourly maximum sound levels measured during the measurement period, measured with a fast time-weighting. The L_{AFmax} levels in brackets are the tenth highest L_{AFmax} noise levels measured during the measurement period.

Figure 4.2 identifies the time history for the $L_{Aeq, T}$, L_{AFmax} , $L_{A10, T}$ and $L_{A90, T}$ at **MP1** during the noise measurement survey.

Figure 4.2: Noise Measurement Time History: MP1



The summary of the attended noise measurement data is presented in **Table 4.3**.

Table 4.3: ST1 Attended Noise Measurement Summary

Position	Period	$L_{Aeq,T}$ (dB)	L_{AFmax} (dB)	$L_{A10,T}$ (dB)	$L_{A90,T}$ (dB)
ST1	1220 hrs to 1525 hrs	70	91 (82)	74	56

The calculation of the $L_{Aeq,16hr}$ and $L_{Aeq,8hr}$ noise levels for **ST1** has been carried out utilising the equations developed by TRL and Casella Stanger. A summary of the calculated free-field noise levels are identified in **Table 4.4**. The appropriate equations are provided below;

$$L_{Aeq,1h} = 0.94 \times L_{A10,1h} + 0.77 \text{ dB}$$

$$L_{A10,18h} = L_{A10,3h} - 1 \text{ dB}$$

$$L_{day} = 0.95 \times L_{A10,18h} + 1.44 \text{ dB}$$

$$L_{evening} = 0.97 \times L_{A10,18h} - 2.87 \text{ dB}$$

$$L_{night} = 0.90 \times L_{A10,18h} - 3.77 \text{ dB}$$

$$L_{Aeq,16h} = 10 \log_{10} \left[\frac{1}{16} \right] \left[12 \times 10^{\frac{L_{day}}{10}} + 4 \times 10^{\frac{L_{evening}}{10}} \right] \text{ dB}$$

Table 4.4: Calculated Period Noise Levels at ST1

Monitoring Position	Measured L _{A10,3hr} (dB)	Measured 10 th Highest L _{AFmax,3hr} (dB)	Calculated L _{A10,18hr} (dB)	Calculated L _{Aeq,16hr} (dB)	Calculated L _{Aeq,8hr} (dB)
ST1	74	82	73	70	62

5. NOISE IMPACT ASSESSMENT

5.1. Noise Modelling

The CadnaA noise modelling software has been utilised to calculate the external noise levels from road traffic and rail movements across the proposed development site. CadnaA is a three-dimensional noise model developed by DataKustik and has been extensively used by ACCON and others to develop noise models for a wide variety of situations and noise sources. CadnaA utilises the methodology in the Department of Transport's Technical Memorandum '*Calculation of Road Traffic Noise*' (CRTN) to predict noise from road traffic and the Technical Memorandum '*Calculation of Railway Noise*' (CRN) to predict the noise level from railway lines.

The results of the noise measurement survey detailed in **Section 4** have been utilised to calibrate the noise model predictions of the existing site and its environs.

5.2. ProPG Stage 1: Initial Site Noise Risk Assessment

Figure F.1.2 presents the daytime and night-time ($L_{Aeq,T}$) noise contours for the site at ground floor level (a height of 1.5 m), **Figure F.1.3** presents the daytime and night-time ($L_{Aeq,T}$) noise contours at first floor level (a height of 4.5 m) and **Figure F.1.4** presents the daytime and night-time ($L_{Aeq,T}$) noise contours at second floor level (a height of 7.5 m).

For the purpose of the initial site noise risk assessment, it has been assumed that the site topography will not be significantly altered from the current topography.

The initial site noise risk assessment considers the effects of road traffic noise on the proposed development site from Oxford Road, and railway noise from the GWR Mainline.

Figure F.1.2 indicates that the site at ground floor level and during the daytime period is generally of a medium to high risk of adverse noise effect, with the south-western boundary of the site being at a high risk of adverse noise effect. During the night-time, the proposed development site is generally of medium to high risk of adverse noise effect. At the centre of the site, approximately 18 m north-east of Oxford Road, there is an area of medium risk of adverse noise. The north-east boundary and the south-west boundary of the proposed development site are at a high risk of adverse noise effect.

Figure F.1.3 indicates that at first floor level, the proposed development site is of a medium to high risk of adverse noise effect during the daytime period and of a high risk of adverse noise effect during the night-time period.

Figure F.1.4 indicates that at second floor level, the proposed development site is generally of medium to high risk of adverse noise effect, with an area of high risk of adverse noise effect along the south-western boundary and **Figure F.1.4** also indicates that during the night-time period, the site is at a high risk of adverse noise effect.

5.3. ProPG Stage 2: Noise Impact Assessment

5.3.1. External Noise Levels

The daytime external noise levels ($L_{Aeq, 16hr}$) predicted using the CadnaA noise model are compared against the target external noise level range of 50 dB to 55 dB $L_{Aeq, 16hr}$ or below within amenity areas. Amenity areas could include areas such as private paved gardens and terraces.

Table 5.1 identifies the daytime external noise levels within external amenity spaces. The proposed private amenity areas associated with the development are identified on **Figure F.1.1** and **F.1.9**.

Table 5.1: External Private Amenity Area Noise Levels

Amenity Area Reference	Floor	Type of Amenity Space	External Noise Level $L_{Aeq,16hr}$ (dB)	Within or Below Target Noise Level Range?	Exceedance Over Target Upper Noise Level
Block 1 – Flat 1	Ground	Paved Garden	59	X	+4
Block 1 – Flat 3	Ground	Paved Garden	60	X	+5
Block 1 – Flat 5	Ground	Paved Garden	59	X	+4
Block 1 – Flat 7	Ground	Paved Garden	58	X	+3
Block 2 – Flat 9	Ground	Paved Garden	59	X	+4
Block 2 – Flat 11	Ground	Paved Garden	59	X	+4
Block 2 – Flat 13	Ground	Paved Garden	61	X	+6
Block 2 – Flat 15	Ground	Paved Garden	61	X	+6
Block 3 – Flat 17	Ground	Paved Garden	59	X	+4
Block 3 – Flat 18	First	Terrace	63	X	+8
Block 3 – Flat 19	Ground	Paved Garden	59	X	+4
Block 3 – Flat 20	First	Terrace	63	X	+8
Block 3 – Flat 21	Ground	Paved Garden	59	X	+4
Block 3 – Flat 22	First	Terrace	63	X	+8

Block 3 – Flat 23	Ground	Paved Garden	61	X	+6
Block 3 – Flat 24	First	Terrace	63	X	+8
Block 4 – Flat 25	Ground	Paved Garden	61	X	+6
Block 4 – Flat 27	Ground	Paved Garden	61	X	+6
Block 4 – Flat 29	Ground	Paved Garden	61	X	+6
Block 4 – Flat 31	Ground	Paved Garden	63	X	+8

Table 5.1 indicates that noise levels within the proposed private amenity areas exceed the target external noise level criteria of being within or below 50 - 55 dB $L_{Aeq,16hr}$ by up to 8 dB.

External noise mitigation measures are discussed in **Section 6.1**

5.3.2. Internal Noise Levels

The CadnaA noise model has been utilised to predict the external period ($L_{Aeq,T}$) noise levels at the facades of the proposed dwellings in order to calculate the minimum combined building façade sound reduction required to achieve the internal noise levels identified in **Section 3.5.2**. The night-time L_{AFmax} noise levels have been calculated using point source distance corrections utilising the noise survey measurement results identified in **Section 4**. For the facades of the proposed development facing towards Oxford Road, the measured tenth highest maximum noise level during the 3-hour daytime noise measurement survey has been utilised as a worst-case scenario for the night-time maximum noise levels.

BS 8233 states that “if partially open windows were relied upon for background ventilation, the insulation would be reduced to approximately 15 dB”. The WHO guidelines also state that a slightly open window would result in “a [sound] reduction from outside to inside of 15 dB”.

Table 1 of **Appendix 3** presents the internal noise level assessment assuming open windows for ventilation at the facades of the proposed dwellings. Where the target internal noise levels are exceeded with open windows for ventilation, the minimum combined façade sound reduction which would be required to ensure that the target noise levels would be achieved with windows closed is provided.

Table 1 of **Appendix 3** identifies that, to achieve the target internal noise levels, the highest level of sound reduction required is 39 $R_w + C_{tr}$ dB which is based on the proposed floor plans in **Figures F.1.5 to F1.13**.

Noise mitigation measures to achieve the target internal noise levels are discussed in **Section 6.2**.

6. NOISE MITIGATION MEASURES

6.1. External Noise Levels

Section 5.3.1 indicates that the external noise levels within all proposed amenity areas to the rear of the properties would exceed the target noise level range of 50 dB to 55 dB $L_{Aeq,16hr}$ by up to 8dB.

A noise reduction of 1 – 2 dB may be achievable by providing solid balustrades to the proposed terraces. However, noise levels are likely to remain above the upper target noise level of 55 dB $L_{Aeq,16hr}$. In these circumstances, BS 8233 advises that *“In higher noise areas, such as city centres or urban areas adjoining the strategic transport network, a compromise between elevated noise levels and other factors, such as the convenience of living in these locations or making efficient use of land resources to ensure development needs can be met, might be warranted. In such a situation, development should be designed to achieve the lowest practicable levels in these external amenity spaces but should not be prohibited.”*

Various noise barrier configurations have been investigated to reduce the noise levels in the paved garden areas of the proposed development.

It is recommended that localised 1.6-metre high acoustic fencing should be provided around Flats 1 – 15 and 2-metre high acoustic fencing around Flats 17 -31. The location of the proposed acoustic fencing can be identified in **Figure 6.1**.

Figure 6.1: Proposed Acoustic Barrier Locations

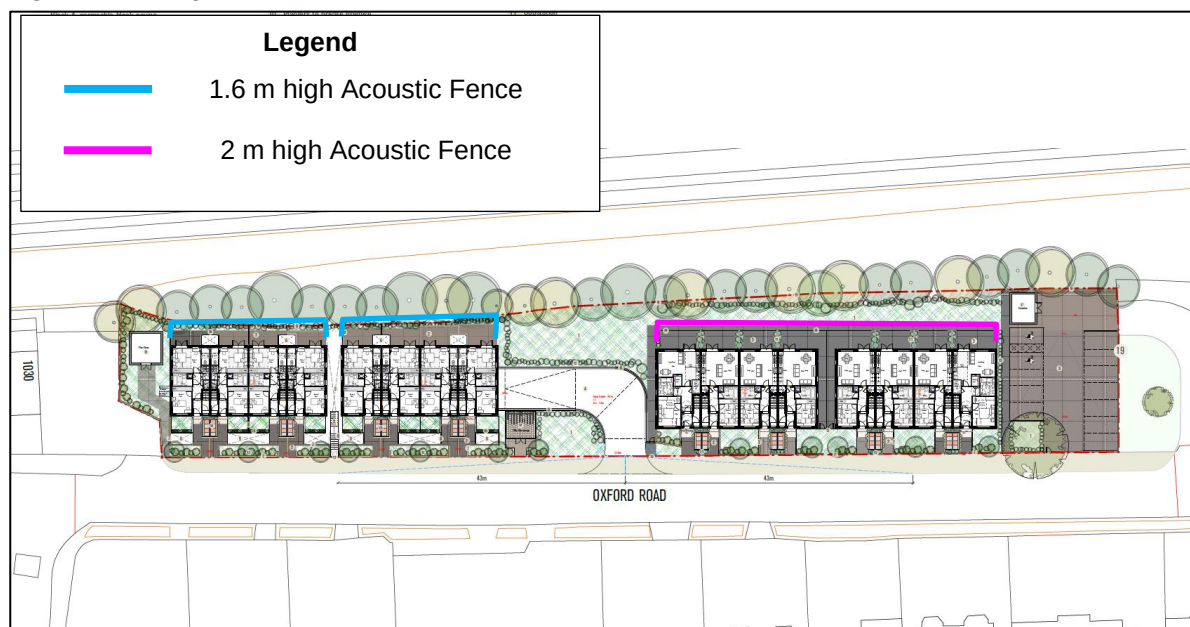


Table 6.1 identifies the predicted external noise levels within the private amenity areas with and without mitigation measures and the overall noise level reduction.

Table 6.1: Predicted External Noise Levels With and Without Mitigation Measures

Amenity Area	External Noise Level (dB)		Reduction in dB
	Without Mitigation	With Mitigation	
Block 1 – Flat 1	59	54.6	-4.4
Block 1 – Flat 3	60	55.5	-4.5
Block 1 – Flat 5	59	55.6	-3.4
Block 1 – Flat 7	58	54.6	-3.4
Block 2 – Flat 9	59	55.1	-3.9
Block 2 – Flat 11	59	55.1	-3.9
Block 2 – Flat 13	61	54.7	-6.3
Block 2 – Flat 15	61	54.4	-6.6
Block 3 – Flat 17	59	52.0	-7.0
Block 3 – Flat 18	63	61.0	-2.0
Block 3 – Flat 19	59	52.7	-6.3
Block 3 – Flat 20	63	61.0	-2.0
Block 3 – Flat 21	59	53.0	-6.0
Block 3 – Flat 22	63	61.0	-2.0
Block 3 – Flat 23	61	53.6	-7.4
Block 3 – Flat 24	63	61.0	-2.0
Block 4 – Flat 25	61	55.0	-6.0
Block 4 – Flat 27	61	55.8	-5.2
Block 4 – Flat 29	61	55.4	-5.6
Block 4 – Flat 31	63	55.3	-7.7

Table 6.1 demonstrates the reduction in noise levels achieved from the proposed noise mitigation measures, this will reduce noise levels by up to 7.7 dB at Flat 31.

It is not possible to achieve 55 dB in all external amenity areas across the development site due to relatively high railway noise levels, however, it should be noted that all residents will have access to a public park nearby, Arthur Newbery Park, which is located within 0.5 km of the proposed development. This is therefore available for amenity use in line with Government planning guidance and policy.

6.2. Internal Noise Levels

Section 5.2.2 has identified the minimum combined building façade sound reductions required for the proposed dwellings. The highest combined façade (glazing, ventilation openings and external wall build-up) sound reduction level required to achieve the target internal noise levels with windows closed is $39 R_w + C_{tr}$ dB.

It is assumed that the external wall construction of the buildings would provide a minimum sound reduction of 50 dB R_w (typically achievable by a standard brick and block cavity wall construction, or similar), and therefore the glazing and any ventilation openings will be the acoustically weakest elements of the building façade. **Table 6.1** indicates the proposed glazing specification in order to achieve the minimum attenuation for the proposed development to attain the internal acoustic standard of BS 8233, based on the room types on the proposed floor plans identified in **Figures F.1.5 to F.1.13**.

Table 6.2: Glazing Specifications

Attenuation	Example of Glazing
Up to $28 R_w + C_{tr}$ dB	Typical double-glazed window systems (i.e. in a 4 mm glass, 6 to 16 mm air gap, 6 mm glass formation)
$29 R_w + C_{tr}$ dB	Glazing in a 8 mm glass, 6 to 16 mm air gap, 6 mm glass formation, or similar
$30 - 32 R_w + C_{tr}$ dB	Glazing in a 10 mm glass, 6 to 16 mm air gap, 6 mm glass formation or similar
$34 - 35 R_w + C_{tr}$ dB	Pilkington Optiphon laminated glazing in a 6 mm glass, 16 mm Argon filled air gap, 8.8 mm glass formation ⁽¹⁾
$36 R_w + C_{tr}$ dB	AGC glazing in a 8 mm glass, 16 mm air gap, 44.2st Thermobel Stratophone glass formation ⁽¹⁾
$37 - 38 R_w + C_{tr}$ dB	AGC glazing in a 8 mm glass, 15 mm air gap, 66.2 st Thermobel Stratophone glass formation ⁽¹⁾
$39 R_w + C_{tr}$ dB	AGC 10 mm glass, 16 mm air gap, 55.2 st Thermobel Stratophone glass formation ⁽¹⁾

Note (1): Other brands of high-performance glazing or other configurations of glazing could also be utilised for the development.

As the internal noise level criteria is exceeded by up to 24 dB with open windows for ventilation, acoustic trickle vents which do not alter the performance of the glazing, or a Mechanical Heat Recovery System (MVHR) is required for habitable rooms in order for windows to remain closed when required. The MVHR system should not exceed the internal noise level criteria of BS 8233 when operating.

7. ACOUSTIC DESIGN STATEMENT

7.1. Initial Site Noise Risk Assessment

The initial site noise risk assessment has identified that the proposed development is of medium to high risk of adverse noise impact during the daytime at ground floor, first floor and second floor level. During the night-time period, the proposed development is generally of medium to high risk of adverse noise impact at ground floor level, and of high risk of adverse noise impact at the first and second floor level.

7.2. External Noise Levels

The assessment of external noise levels identified that noise levels within all private amenity areas are predicted to be above 55 dB $L_{Aeq,16hr}$ for the daytime period. Solid balustrades to all the proposed terraces would assist in reducing the noise level in these amenity areas. It is recommended that localised acoustic fences at ground floor level around flats 1 – 15 at a height of 1.6 m and flats 17- 31 at a height of 2 m should be provided. However, the noise levels within the first-floor terraces are likely to remain above the upper target noise level of 55 dB $L_{Aeq,16hr}$. It should be noted however, that all residents will have access to a public park nearby, Arthur Newbery Park, which is located within 0.5 km of the proposed development. This is therefore available for amenity use in line with Government planning guidance and policy.

7.3. Internal Noise Levels

A noise mitigation scheme has been provided for the proposed development in respect of the proposed floor plans identified in **Figures F.1.5 to F.1.13** in order to achieve the target internal noise levels of BS 8233. The noise mitigation scheme assumes that the external wall construction will provide a sound reduction of at least 50 R_w+C_{tr} dB and that the glazing and any ventilation openings will be the weakest acoustic elements of the building façade.

Recommendations for a glazing specification which achieves the required levels of sound reduction has been provided in **Section 6.2**.

7.4. Recommendations to the Decision Maker

On the basis of the above, it is recommended that there should be no objection to granting planning consent for the proposed development on noise grounds.

ADDITIONAL FIGURES

Figure F.1.1: Proposed Site Layout

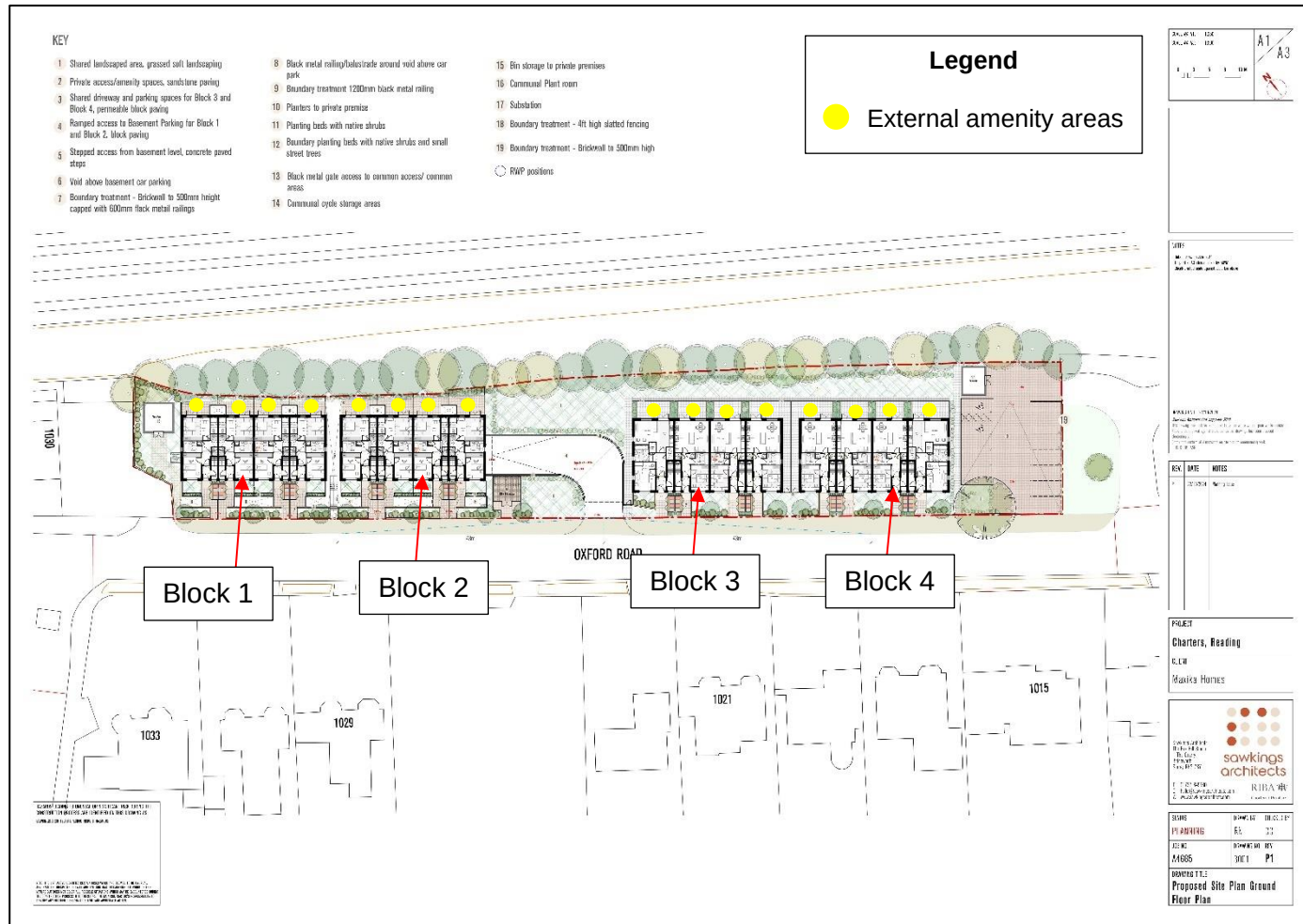


Figure F.1.2: ProPG Initial Site Noise Risk Assessment for Ground Floor (Height 1.5 m)

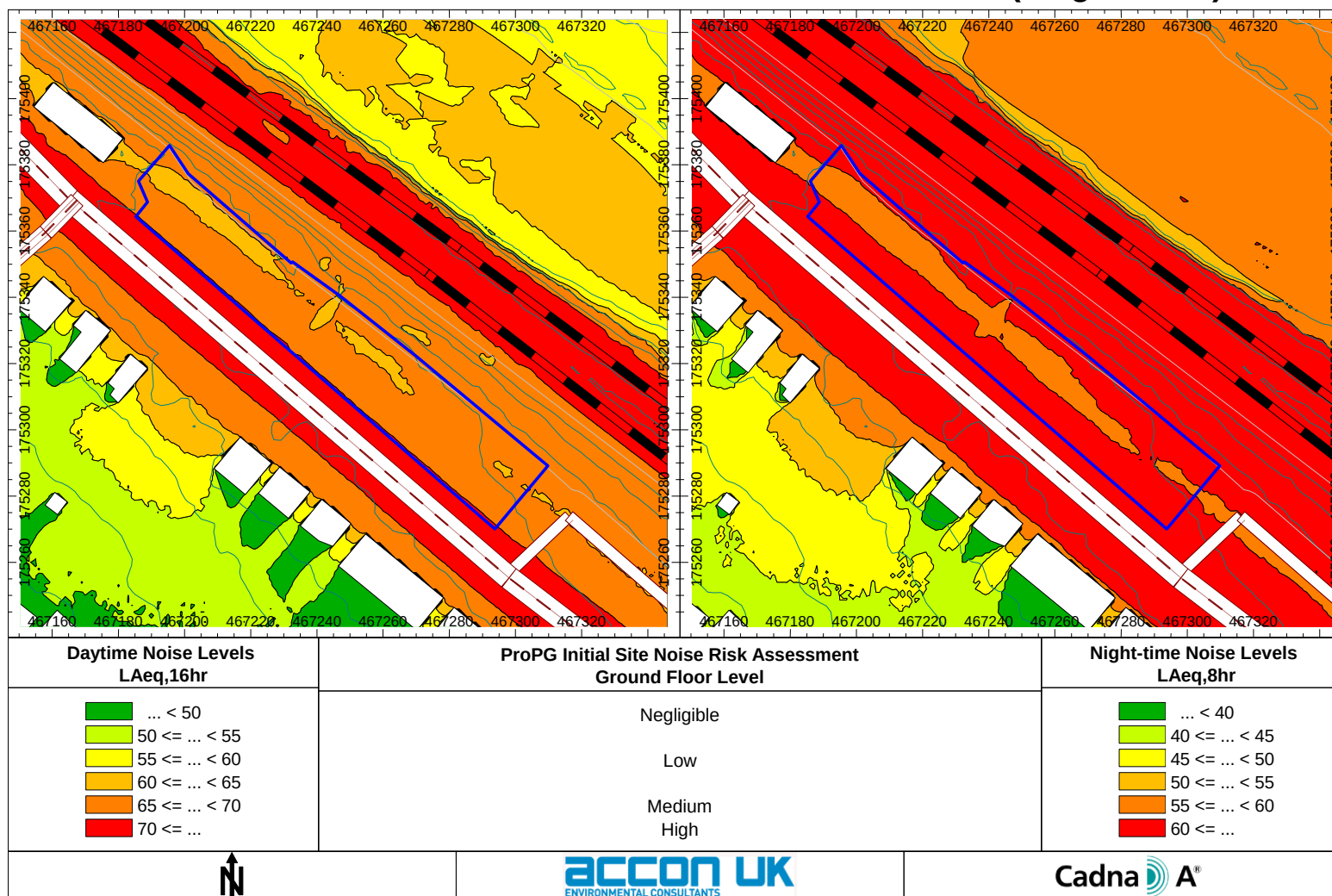


Figure F.1.3: ProPG Initial Site Noise Risk Assessment for First Floor (Height 4.5 m)

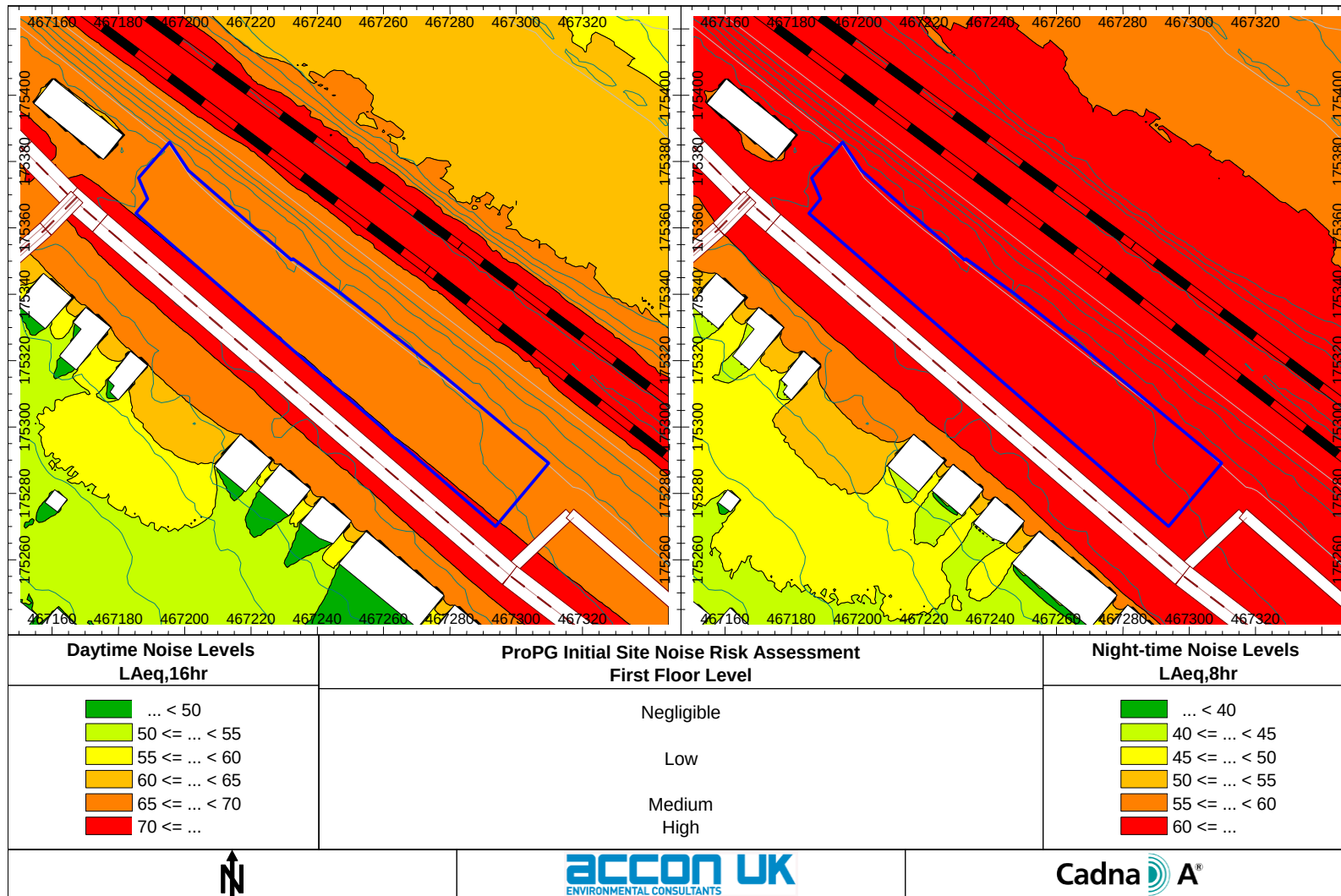


Figure F.1.4: ProPG Initial Site Noise Risk Assessment for Second Floor (Height 7.5 m)

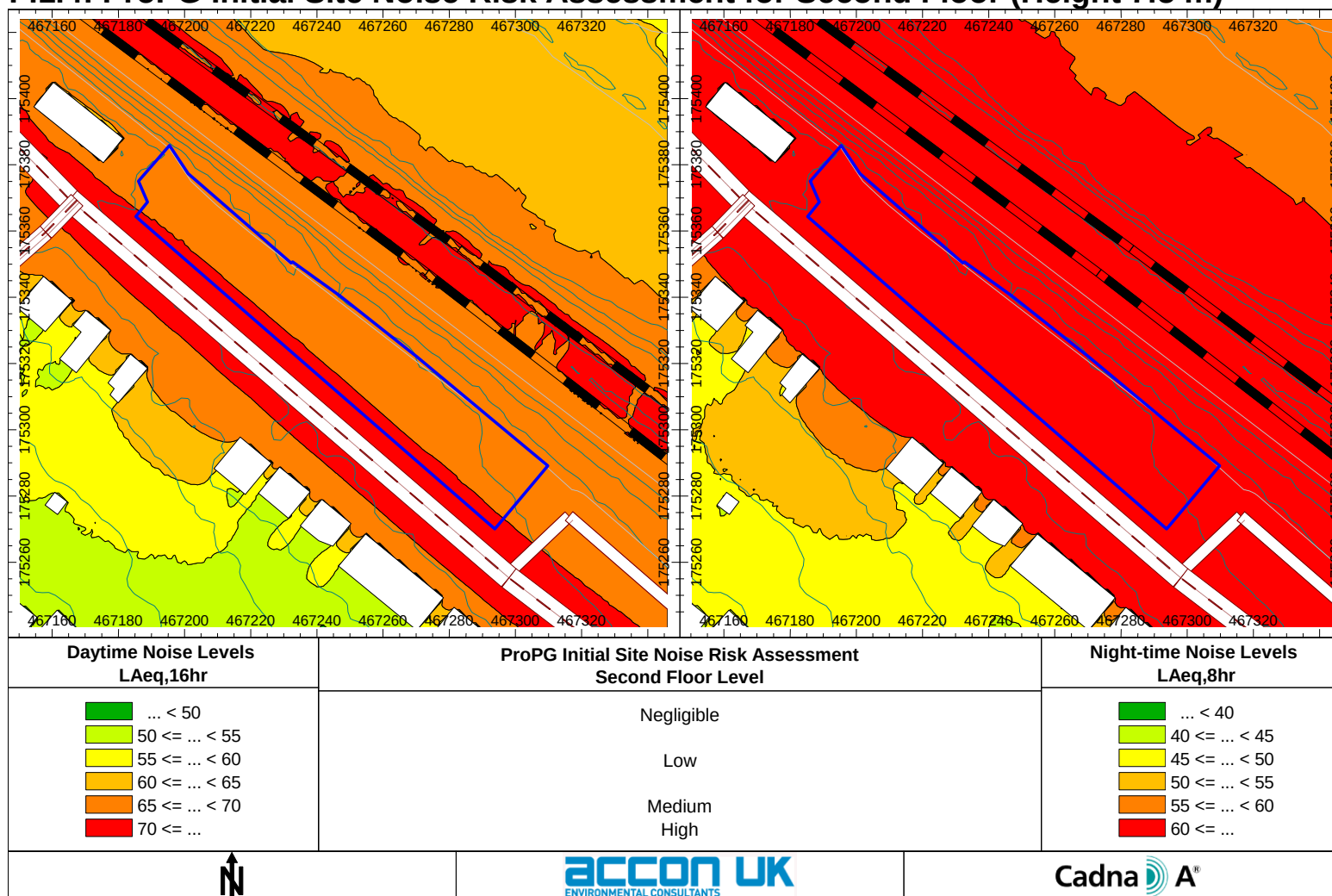


Figure F.1.5: Block 1 and Block 2 Ground Floor Level with Required Mitigation



Figure F.1.6: Block 1 and Block 2 First Floor Level with Required Mitigation



Figure F.1.7: Block 1 and Block 2 Second Floor Level with Required Mitigation

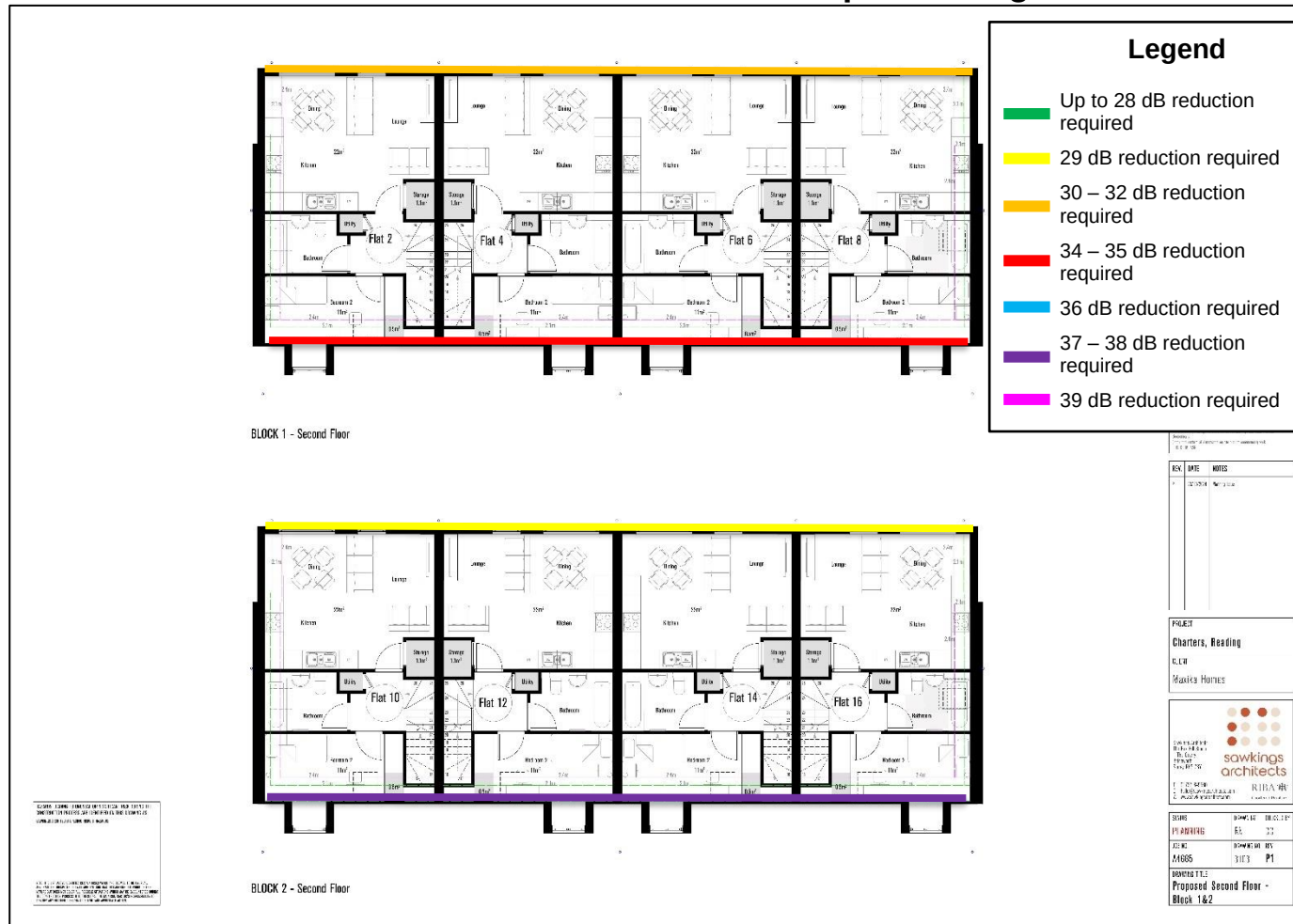


Figure F.1.8: Block 3 Ground Floor Level with Required Mitigation



Figure F.1.9: Block 3 First Floor Level with Required Mitigation

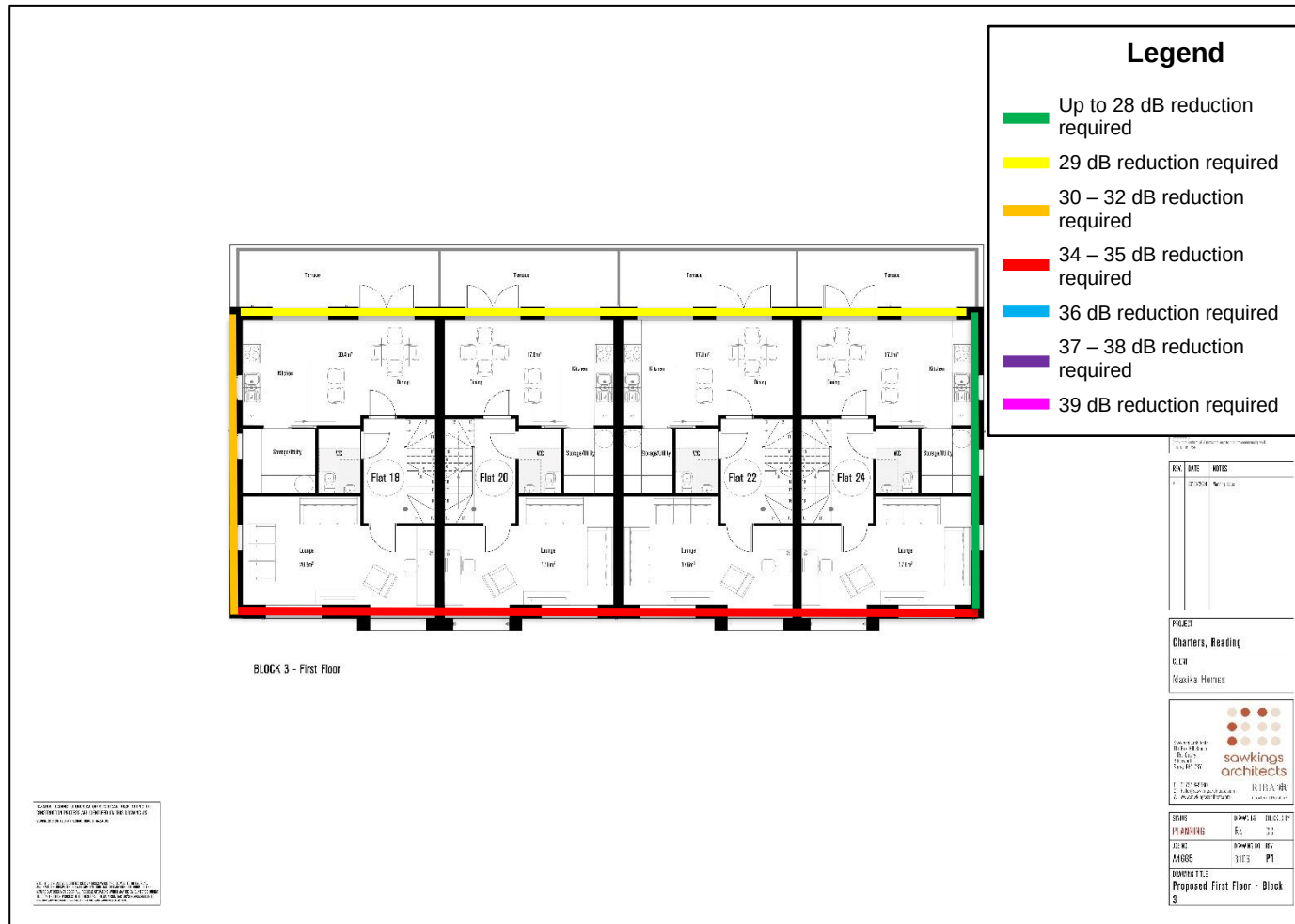


Figure F.1.10: Block 3 Second Floor Level with Required Mitigation

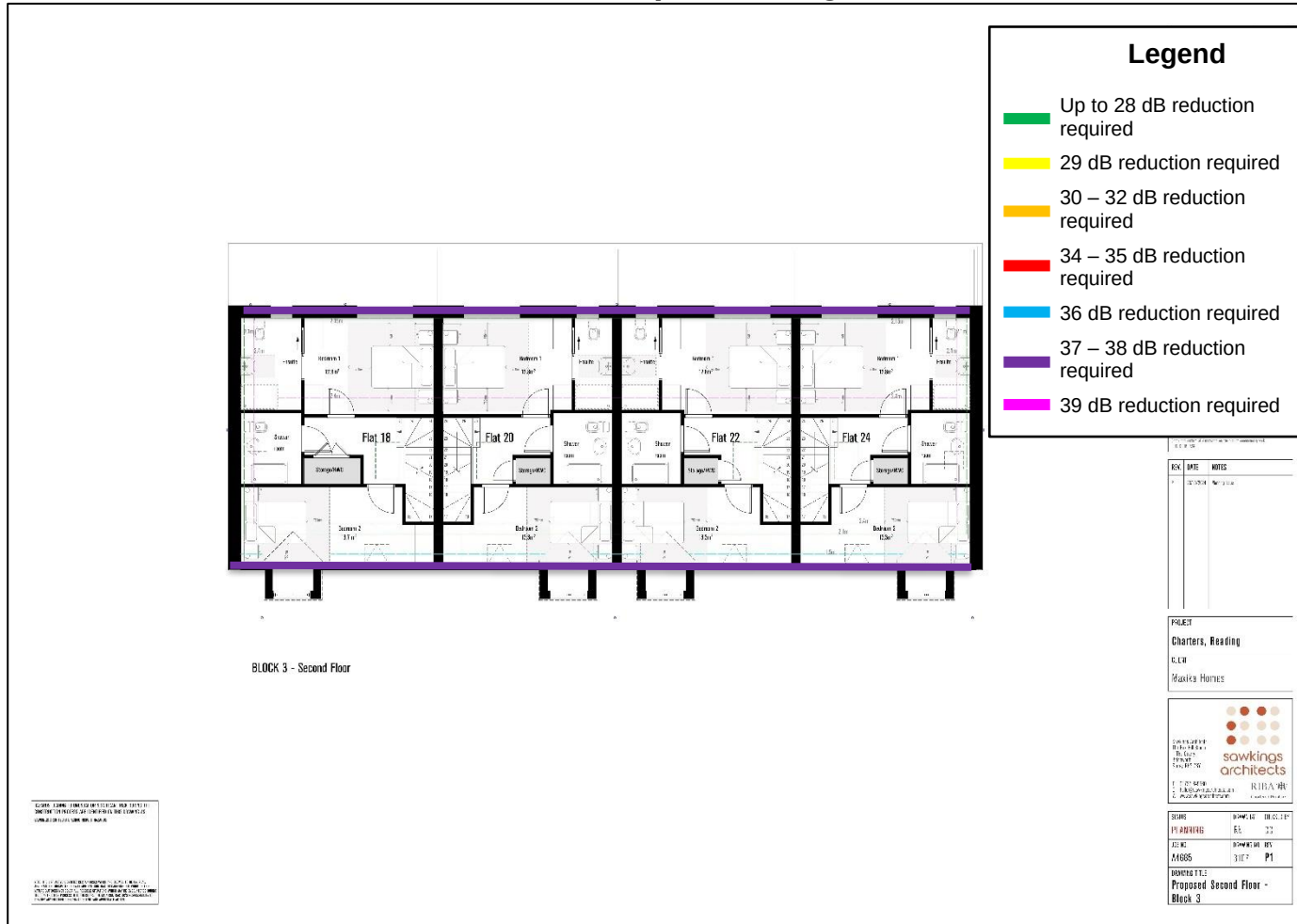
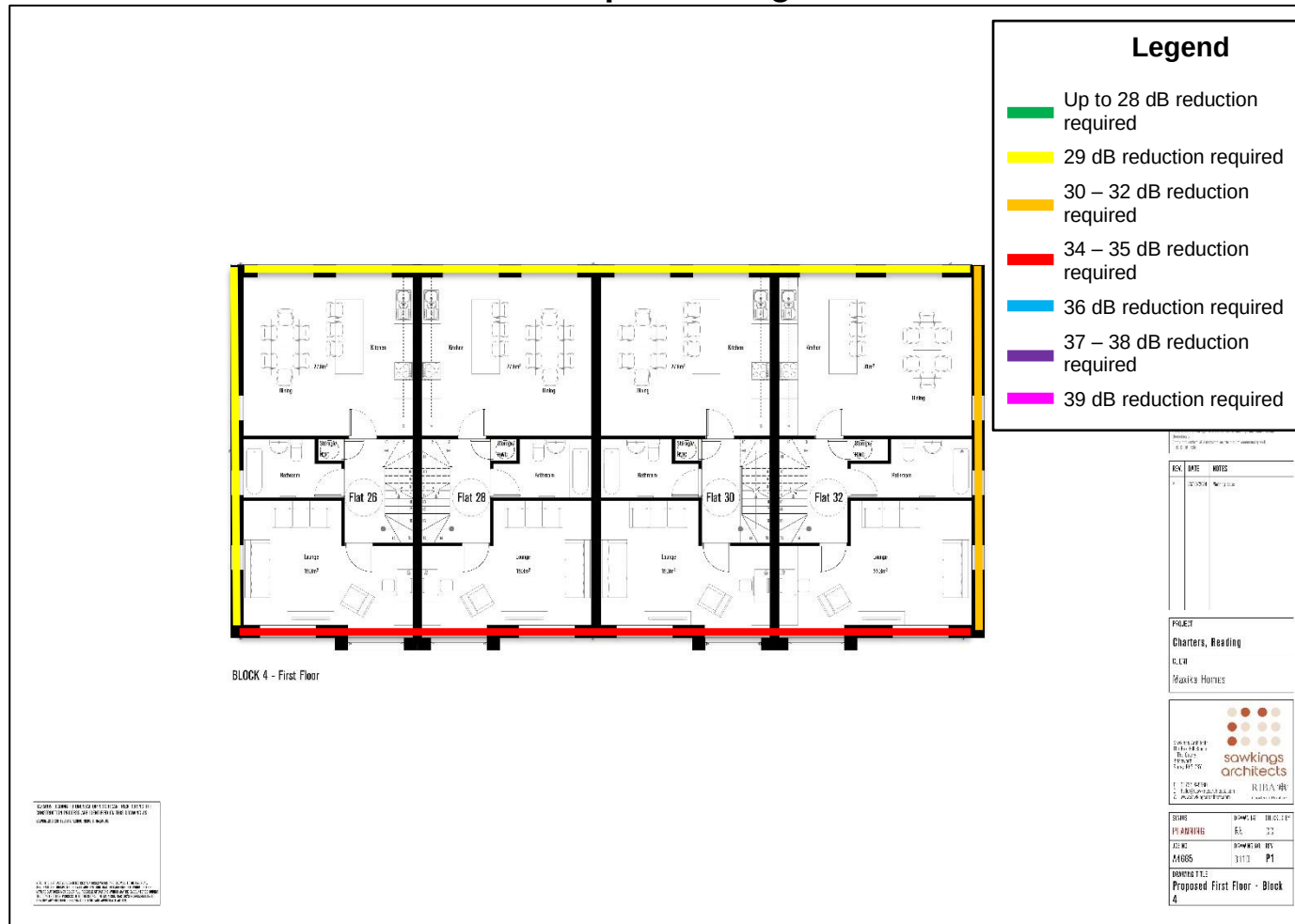


Figure F.1.11: Block 4 Ground Floor Level with Required Mitigation



Figure F.1.12: Block 4 First Floor Level with Required Mitigation



Legend



APPENDICES

Appendix 1

Glossary of Acoustic Terms

Term	Description
'A'-Weighting	<i>This is the main way of adjusting measured sound pressure levels to take into account human hearing, and our uneven frequency response.</i>
Decibel (dB)	<i>This is a tenth (deci) of a bel. Decibel can be a measure of the magnitude of sound, changes in sound level and a measure of sound insulation. Decibels are not an absolute unit of measurement but are an expression of ratio between two quantities expressed in logarithmic form.</i>
$L_{Aeq,T}$ (Ambient/Period Sound Level)	<i>The equivalent steady sound level in dB containing the same acoustic energy as the actual fluctuating sound level over the given period, T. T may be as short as 1 second when used to describe a single event, or as long as 24 hours when used to describe the noise climate at a specified location. $L_{Aeq,T}$ can be measured directly with an integrating sound level meter.</i>
$L_{A90,T}$ (Background Sound Level)	<i>The 'A'-weighted sound pressure level of the residual noise in decibels exceeded for 90 per cent of a given time. The $L_{A90,T}$ is used to describe the background noise levels at a particular location.</i>
L_{Amax}	<i>The 'A'-weighted maximum sound pressure level measured over a measurement period. Typically measured with 'fast' weighting (125 ms) or 'slow' weighting (1 s).</i>
C_{tr}	<i>The correction to a sound insulation quantity (such as $D_{nT,w}$) to take account of a specific sound spectra.</i>
R_w	<i>Weighted sound reduction index, a single number quantity for the airborne sound insulation in buildings and of building elements such as wall, doors and windows. The quantity is intended for rating the airborne sound insulation and for simplifying the formulation of acoustical requirements in building codes, when measured in the presence of flanking sound transmission, denoted R'_w.</i>

Appendix 2

Noise Measurement Results

Table 1: Hourly Noise Measurement Results at MP1

Time	L _{Aeq,T} (dB)	L _{Amax} (dB)	L _{A10,T} (dB)	L _{A90,T} (dB)
07:00-08:00	64	86	60	47
08:00-09:00	66	86	62	46
09:00-10:00	65	87	58	46
10:00-11:00	67	91	62	48
11:00-12:00	68	89	64	47
12:00-13:00	67	88	61	48
13:00-14:00	69	88	60	49
14:00-15:00	67	92	63	49
15:00-16:00	68	90	61	48
16:00-17:00	67	88	61	48
17:00-18:00	64	89	58	48
18:00-19:00	66	86	62	47
19:00-20:00	67	89	60	44
20:00-21:00	64	87	59	41
21:00-22:00	64	87	58	39
22:00-23:00	63	87	56	35
23:00-00:00	58	83	54	28
00:00-01:00	65	90	60	29
01:00-02:00	63	86	45	27
02:00-03:00	63	85	47	28
03:00-04:00	63	87	48	28
04:00-05:00	63	85	49	28
05:00-06:00	59	85	53	29
06:00-07:00	64	88	59	39
Daytime (07:00-23:00)	66	88	60	46
Night-time (23:00-07:00)	63	86	52	29

Appendix 3 **Internal Noise Assessment**

Table 1: Predicted Internal Noise Levels with Open Windows for Ventilation

Block	Floor	Façade	Predicted External Noise Levels (dB)			Predicted Internal Noise Levels (dB) with Open Windows for Ventilation			Minimum Combined Façade Sound Reduction Required dB(A)
			Daytime L _{Aeq,16hr}	Night-time L _{Aeq,8hr}	Night-time L _{AFmax}	Daytime L _{Aeq, 16hr}	Night-time L _{Aeq, 8hr}	Night-time L _{AFmax}	
1	Ground	North–West (Bedrooms)	63	58	77	48	43	62	32
		South–West (Bedrooms)	68	60	80	53	45	65	35
		South–East (Bedrooms)	62	57	79	47	42	64	34
		North–East (Bedrooms)	64	61	84	49	46	69	39
	First	North–West (Bedrooms)	65	61	77	50	46	62	32
		South–West (Bedrooms)	68	60	80	53	45	65	35
		South–East (Bedrooms)	63	58	79	48	43	64	34
		North–East (Living Room)	65	—*	—*	50	—*	—*	30
	Second	South–West (Bedrooms)	68	60	80	53	45	65	35
		North–East (Living Room)	65	—*	—*	50	—*	—*	30
2	Ground	North–West (Bedrooms)	63	56	79	48	41	64	34
		South–West (Bedrooms)	68	60	82	53	45	67	37
		South–East (Bedrooms)	64	59	79	49	44	64	34

Block	Floor	Façade	Predicted External Noise Levels (dB)			Predicted Internal Noise Levels (dB) with Open Windows for Ventilation			Minimum Combined Façade Sound Reduction Required dB(A)
			Daytime L _{Aeq,16hr}	Night-time L _{Aeq,8hr}	Night-time L _{AFmax}	Daytime L _{Aeq, 16hr}	Night-time L _{Aeq, 8hr}	Night-time L _{AFmax}	
		North–East (Bedrooms)	63	60	84	48	45	69	39
	First	North–West (Bedrooms)	63	58	79	48	43	64	34
		South–West (Bedrooms)	68	60	83	53	45	68	38
		South–East (Bedrooms)	66	60	79	51	45	64	34
		North–East (Living Room)	64	—*	—*	49	—*	—*	29
	Second	South–West (Bedrooms)	68	60	83	53	45	68	38
		North–East (Living Room)	64	—*	—*	49	—*	—*	29
3	Ground	North–West (Bedrooms)	65	59	82	50	44	67	37
		South–West (Bedrooms)	69	61	82	54	46	67	37
		South–East (Bedrooms)	62	55	81	47	40	66	36
		North–East (Living Room)	62	—*	—*	47	—*	—*	27
	First	North–West (Living Room)	66	—*	—*	51	—*	—*	31
		South–West (Living Room)	69	—*	—*	54	—*	—*	34
		South–East (Living Room)	63	—*	—*	48	—*	—*	28

Block	Floor	Façade	Predicted External Noise Levels (dB)			Predicted Internal Noise Levels (dB) with Open Windows for Ventilation			Minimum Combined Façade Sound Reduction Required dB(A)
			Daytime L _{Aeq,16hr}	Night-time L _{Aeq,8hr}	Night-time L _{AFmax}	Daytime L _{Aeq, 16hr}	Night-time L _{Aeq, 8hr}	Night-time L _{AFmax}	
	Second	North–East (Dining Room)	64	—*	—*	49	—*	—*	29
		South–West (Bedrooms)	69	61	82	54	46	67	37
		North–East (Bedrooms)	64	61	82	49	46	67	37
4	Ground	North–West (Bedrooms)	63	55	83	48	40	68	38
		South–West (Bedrooms)	69	61	82	54	46	67	37
		South–East (Bedrooms)	66	59	81	51	44	66	36
		North–East (Living Room)	64	—*	—*	49	—*	—*	29
	First	North–West(Living Room)	64	—*	—*	49	—*	—*	29
		South–West (Living Room)	69	—*	—*	54	—*	—*	34
		South–East (Living Room)	66	—*	—*	51	—*	—*	31
		North–East (Dining Room)	64	—*	—*	49	—*	—*	29
	Second	South–West (Bedrooms)	69	61	82	54	46	67	37
		South–East (Bedrooms)	64	61	82	49	46	67	37

*Night-time values have not been applied as living rooms are only assessed against the daytime target noise level criteria in line with BS 8233:2014

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