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Title:	**Land off Watmore Lane, Winnersh – Phase 1** Noise Impact Assessment
Report No.:	**22681667-04**

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Executive Summary

Bureau Veritas was instructed by Taylor Wimpey West London to conduct an environmental noise assessment for a proposed residential development site at the land off Watmore Lane, Winnersh. The assessment has been conducted based on current guidance and good practice documents following the principles of the NPPF.

Reserved matters in respect of Phase 1 for 111 dwellings and Phase 2 for 118 dwellings pursuant to outline planning permission 230208 including submission of details pursuant to condition 14 (noise).

The outline assessment of the site has been conducted based on measured sound level survey data. The main noise source across the site is road traffic on the M4 Motorway to the south, the A329(M) to the east and the M4 off-slip connecting the M4 with the A329(M), northbound.

The sound level survey has been used to predict the propagation of noise across the site using a CadnaA sound propagation model. The results of the modelling are used to zone the site in accordance with ProPG and local authority guidance.

The results of the sound propagation modelling indicate that, in terms of ProPG guidance, the site is negligible to low noise risk during the day, and low to medium noise risk at night, tending towards the higher risk category towards east and southeast of the site.

With regards to local authority criteria, the area of the site proposed for residential development falls within the No Observed Effect Level (NOEL) criteria during the day, and the Lowest Observed Adverse Effect Level (LOAEL) at night. Therefore, detailed specification of noise mitigation should be provided in an Acoustic Design Statement at the Reserved Matters application stage.

For habitable rooms of the first-row dwellings facing the A329 (M), the ventilation strategy should ensure that the requirements of Part F of the Buildings Regulations are achieved with closed windows. An appropriate ventilation system is one that complies with the performance specification of System 3 to AD-F. An example would be a decentralised constant mechanical extract (dMEV) fan provided to each kitchen, bathroom and wet room, in conjunction with a trickle ventilator to each habitable room that achieves a minimum 25000 mm^2 equivalent free area and with a minimum weighted element normalised sound level difference of 27 dB $D_{ne,w}$ in the 'open' position.

In all cases, purge ventilation would be provided by openable windows.

With regards to glazing, standard glazing units can be used for all the habitable rooms that achieves 27 dB R_w+C_{tr} sound reduction (e.g., glazing 4/12/4).

The noise level across all private gardens within the site should not be above the guideline limits for garden areas of 50-55 dB $L_{Aeq,16hr}$ at daytime. Twenty plots have been identified as potentially requiring additional mechanical cooling to mitigate the overheating condition. This should be assessed using thermos dynamic modelling to demonstrate compliance with Approved Document O.

All adverse impacts are therefore shown to be mitigated and minimised, in line with the current planning policy and guidance. The requirements of Condition 14 in the Outline Planning Application can be all met.

1. Introduction

1.1. Bureau Veritas was instructed by Taylor Wimpey to conduct an environmental noise assessment for the Reserved Matters Application relating to scale, layout, appearance and landscaping in respect of Phase 1 for 111 dwellings pursuant to outline planning permission 230208, including submission of details pursuant to condition 14 (noise).

1.2. The purpose of this assessment is to provide an indication of the impacts of noise on the site and noise mitigation measures based on the current guidance and best practice to discharge Condition 14 in the Outline Planning Application as below:

> *" 14. Prior to commencement of development within each phase and concurrently with the layout of a reserved matters application for that phase, the applicant shall submit to the local planning authority for written approval, details of how the following internal noise levels will be achieved in living rooms, dining rooms and bedrooms with measures to include adequate cooling and ventilation: Living Rooms and bedrooms (daytime) – 35dB $L_{Aeq,16}$ hours (0700-2300), Dining Rooms 40dB $L_{Aeq,16}$ hour (0700 – 2300), Bedrooms: 30dB $L_{Aeq,\ 8\ hour}$ (2300 – 0700).*
>
> *It also notes at Paragraph 93/94 of the appeal decision it notes, "if a scheme along the lines of the illustrative layout is ultimately proposed, then around 50 homes would need additional acoustic measures to provide appropriate internal and external living conditions."….."The mitigation would include fencing to screen road noise in gardens and the use of thermal double glazing and ventilation system to secure internal noise and cooling. Importantly, the double-glazed windows would also provide some noise mitigation when open to the extent that sleep would not be disturbed. As a result, future residents could choose to open a window or rely on an alternative ventilation system."*

1.3. The detailed specification of glazing, ventilation and boundary treatments is presented in an Acoustic Design Statement following the ProPG Stage 2 "Full Assessment" methodology.

1.4. A glossary of acoustic terminology is included in **Appendix One**.

2. Site Details

2.1. The proposed development site is located on open farmland to the east of Watmore Lane, southeast of Winnersh, Berkshire.

2.2. The site is bounded to the south by proposed Phase 2 residential development off Watmore Lane, Winnersh and a SEND school. Beyond these, at approximately 285 m, runs the M4 Motorway.

2.3. Similarly, the east of the site is bounded by farmland, beyond which at a distance of approximately 300m runs the A329(M). The junction of the M4 (J10) and the A329(M) is located to the south-east of the site with a slip road located to the southeast of the site.

2.4. The west of the site is bounded by existing residential dwellings, with the Wheatfield Primary School located beyond the southwest corner of the site. The Blackwater Valley railway line runs northwest/southeast at approximately 250m from the southwest of the site.

2.5. The site is bounded to the north by a permanent static caravan park located off Grovelands Park and the Jade Security, offering security service.

3. Details of Proposed Development

3.1. The proposals are for a residential development comprising 111 units, with associated gardens, car parking, and Public Open Space. Access will be via Maidensfield to the west of the site.

3.2. The development includes 66no. 3- and 4- bedroom market dwellings, and 45no. 1-, 2-, 3- and -4 bedroom affordable dwellings.

3.3. The masterplan showing a development comprising 111 residential units is shown in **Appendix Two**.

4. Criteria for Assessment

Planning Policy

National Planning Policy Framework, 2024

4.1. The Revised NPPF (Dec 2024) sets out the Government's planning policies for England. It states:

> *"187. Planning policies and decisions should contribute to and enhance the natural and local environment by: …*
> *preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution or land instability. Development should, wherever possible, help to improve local environmental conditions such as air and water quality, taking into account relevant information such as river basin management plans; and …"*

4.2. It goes on to state:

> *"198. 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 [NPSE - see below];*
>
> *b) identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason; and…"*

4.3. The terms 'significant adverse impact' and other adverse impacts are defined in the explanatory notes of the 'Noise Policy Statement for England (NPSE), which states:

> *There are two established concepts from toxicology that are currently being applied to noise impacts, for example, by the World Health Organisation. They 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*
>
> *LOAEL - Lowest Observed Adverse Effect Level*
>
> *This is the level above which adverse effects on health and quality of life can be detected.*
>
> *Extending these concepts for the purpose of this NPSE leads to the concept of a significant observed adverse effect level.*
>
> *SOAEL - Significant Observed Adverse Effect Level*

This is the level above which significant adverse effects on health and quality of life occur

4.4. It should be noted that specific noise limits for LOAEL and SOAEL have not yet been specifically defined, and would be specific to different sectors. However, guidance from other acoustic standards may be employed to determine suitable levels within the overall principle of the NPPF.

4.5. The Planning Practice Guidance for Noise (PPGN) provides further detail about how the effects of noise can be categorised. **Table 4.1** summarises the noise exposure hierarchy.

Table 4.1: National Planning Practice Guidance Noise Exposure Hierarchy

Table 4.1: National Planning Practice Guidance Noise Exposure Hierarchy			
Perception	**Examples of Outcomes**	**Increasing Effect Level**	**Action**
Not present	No Effect	No Observed Effect	No specific measures required
Present 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 perceived change in the quality of life	No Observed Adverse Effect	No specific measures required
Lowest Observed Adverse Effect Level			
Present 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 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 the behaviour, attitude or other physiological response, e.g., avoiding certain activities during periods of intrusion; where there is no alternative ventilation, having to keep windows closed most of the time because of the noise. Potential for sleep disturbance resulting in difficulty in getting to sleep, premature awakening and difficulty in getting back to sleep. Quality of life diminished due to change in acoustic character of the area	Significant Observed Adverse Effect	Avoid
Present and very disruptive	Extensive and regular changes in the 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

Wokingham Borough Development Plan (February 2014)

4.6. The Managing Development Delivery Local Plan (MDD) adds extra detail to the policies within the Core Strategy. Together, these two documents set out how the Borough will develop up until 2026. The Development Plan provides additional detailed policies to use when considering development proposals. Policy CC06 of the Plan relates to noise and states the following:

"1. Proposals must demonstrate how they have addressed noise impacts to protect noise sensitive receptors (both existing and proposed) from noise impacts in line with Appendix 1 of the MDD.

2. Noise impact of the development must be assessed. Where there is no adverse impact (No Observed Effect Level) then noise will not be a material consideration.

3. Where there is an adverse effect (Lowest Observed Adverse Effect Level to Significant Observed Adverse Effect Level), then

a) The development layout must be reviewed. Where this results in there being no longer an adverse impact then design and mitigation measures should be incorporated accordingly.

b) Where there is still an adverse impact then internal layout must be reviewed. Where this results in there no longer being an adverse impact then design and [mitigation] measures should be incorporated accordingly.

c) Where there is still an adverse impact then physical mitigation measures such as barriers/mechanical ventilation must be reviewed. Where this results in there no longer being an adverse impact then design and mitigation measures should be incorporated accordingly.

d) Where there is still an adverse impact and the development falls within significant observed adverse impact effect level then planning permission will normally be refused."

4.7. Additional information is provided in Appendix 1 of the Development Plan. The plan defines the NOEL, LOAEL and SOAEL values in terms of absolute sound levels against which the site can be assessed against the above criteria. The values are provided in **Table 4.2**, taken from Annex 1, Table 1 of the Development Plan.

Table 4.2: Impact levels – Amenity Spaces for Dwellings

Noise Source	NOEL	LOAEL	SOAEL
Environmental Noise	$L_{Aeq,T}$	$L_{Aeq,T}$	$L_{Aeq,T}$
07.00 – 23.00	<55	56 – 69*	>70
23.00 – 07.00	<45	46 – 64*	>65

*As written in the Development Plan – for the avoidance of doubt, the LOAEL values assumed in this assessment are taken to be the values between the NOEL and SOAEL values (i.e., 55 – 70 for daytime periods and 45 – 65 for night-time periods) when unrounded to the nearest dB.

4.8. With regards to internal sound levels the guidance values mirror those of BS8233:2014 discussed above.

4.9. Wokingham Borough Council are progressing their Local Plan Update. Between 30th September and 13th November 2024, WBC ran a Regulation 19 consultation on its Proposed Submission Plan. Following this, the Local Plan Update was submitted for independent examination on 28th February 2025. The Inspectors submitted their Initial Questions to the Council on 17th April 2025, and hearings are expected to take place in summer 2025.

Technical Guidance

4.10. The relevant guidance documents are listed below:

- British Standard 8233: 2014, "Guidance on sound insulation and noise reduction for buildings";
- Professional Practice Guidance: Planning and Noise. Professional Practice Guidance on Panning & Noise – New Residential Development, May 2017;
- Acoustics Ventilation and Overheating - Residential Design Guide, January 2020; and
- Approved Document O: Overheating.

British Standard 8233: 2014 Guidance on Sound Insulation and Noise Reduction for Buildings

4.11. BS 8233:2014 provides guidance for the control of noise in and around buildings. It is applicable to the design of new buildings, or refurbished buildings undergoing a change of use.

4.12. With regards to external sound sources affecting habitable residential spaces, Table 4 of BS 8233:2014 provides guideline values that it is desirable to not exceed during daytime and night-time periods. These guideline values are reproduced in **Table 4.3**.

Table 4.3: Indoor ambient sound levels for dwellings

Activity	Location	07:00 to 23:00	23:00 to 07:00
Resting	Living Room	35 dB $L_{Aeq,16hour}$	-
Dining	Dining room/area	40 dB $L_{Aeq,16hour}$	-
Sleeping (daytime resting)	Bedroom	35 dB $L_{Aeq,16hour}$	30 dB $L_{Aeq,8hour}$

4.13. The internal sound requirements are not intended to be met with open windows, although BS 8223:2014 states that the internal sound levels should take account of the proposed ventilation strategy.

4.14. BS 8233:2014 also notes that:

4.15. "Where development is considered necessary or desirable, despite external noise levels above WHO guidelines, the internal target levels may be relaxed by up to 5 dB and reasonable internal conditions sill achieved".

4.16. BS8233:2014 does not provide specific guidance on sound levels for regular individual sound events, such as passing trains, which can cause sleep disturbance. Guidance on suitable sound levels for individual events is provided in the WHO Guidelines for Community Noise.

4.17. The WHO guidelines state that for a reasonable standard in bedrooms to be achieved individual sound events should not normally exceed 45dB L_{Amax} 10 to 15 times during the night-time period.

4.18. For traditional external areas that are used for amenity space, such as gardens and patios, BS8233 states that it is desirable that the external sound 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 sound 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.

ProPG: Planning and Noise

4.19. Professional Practice Guidance on Planning and Noise for new residential development (ProPG) was published June 2017 by the Chartered Institute of Environmental Health (CIEH), the Association of Noise Consultants (ANC) and the Institute of Acoustics (IOA). The guidance has been produced to provide practitioners with guidance on the management of noise within the planning system in England.

4.20. The guidance focusses on proposed new residential development and existing transport noise sources and reflects the Government's overarching Noise Policy Statement for England (NPSE, the National Planning Policy Framework (NPPF) and Planning Practice Guidance (including PPGN), as well as other authoritative sources of guidance.

4.21. The guidance provides advice for Local Planning Authorities (LPAs) and developers, and their respective professional advisers which complements Government planning and noise policy and guidance and, in particular, aims 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.

4.22. ProPG provides guidance for the producing an initial site noise risk assessment, pre-mitigation, based on the prevailing daytime and night-time noise levels across the site, from which the site (or areas thereof) can be zoned. **Figure 4.1** shows the Stage 1 noise risk assessment criteria taken from Figure 1 of ProPG.

4.23. Stage 2 of the ProPG assessment requires consideration of four key elements to be undertaken in parallel. The Stage 2 assessment is intended to be proportionate to the risk, as determined by the initial site risk assessment.

4.24. The four elements of the Stage 2 assessment and implications on acoustic design are discussed below.

Element 1 - Good Acoustic Design Process

- Following a good acoustic design process is a key part of achieving good design, as required by NPPF and NPSE. It is imperative that acoustic design is considered at an early stage of the development process.
- A good acoustic design process takes an overarching and integrated approach in order to achieve optimal acoustic conditions, both in terms of internal noise levels within habitable rooms and external amenity noise (e.g. in gardens, balconies etc.).
- Good acoustic design should avoid 'unreasonable' acoustic conditions and prevent 'unacceptable acoustic conditions. ProPG notes that good acoustic design does not mean over-engineering or 'gold plating' all new developments but instead should aim to provide an optimum acoustic outcome for a particular site.

Element 2 - Internal Noise Level Guidelines

- The second element of Stage 2 is to seek to achieve recommended internal noise levels inside noise sensitive rooms in new residential development. The guideline values proposed are the same as those provided in BS 8233:2014 and WHO, including the recommendation that maximum noise levels should not exceed 45 dB L_{Amax} more than 10 times per night.
- Designers should principally aim, through good acoustic design, to achieve these noise levels in sensitive rooms with windows open. Where noise levels are assessed with windows closed, justification is to be provided.

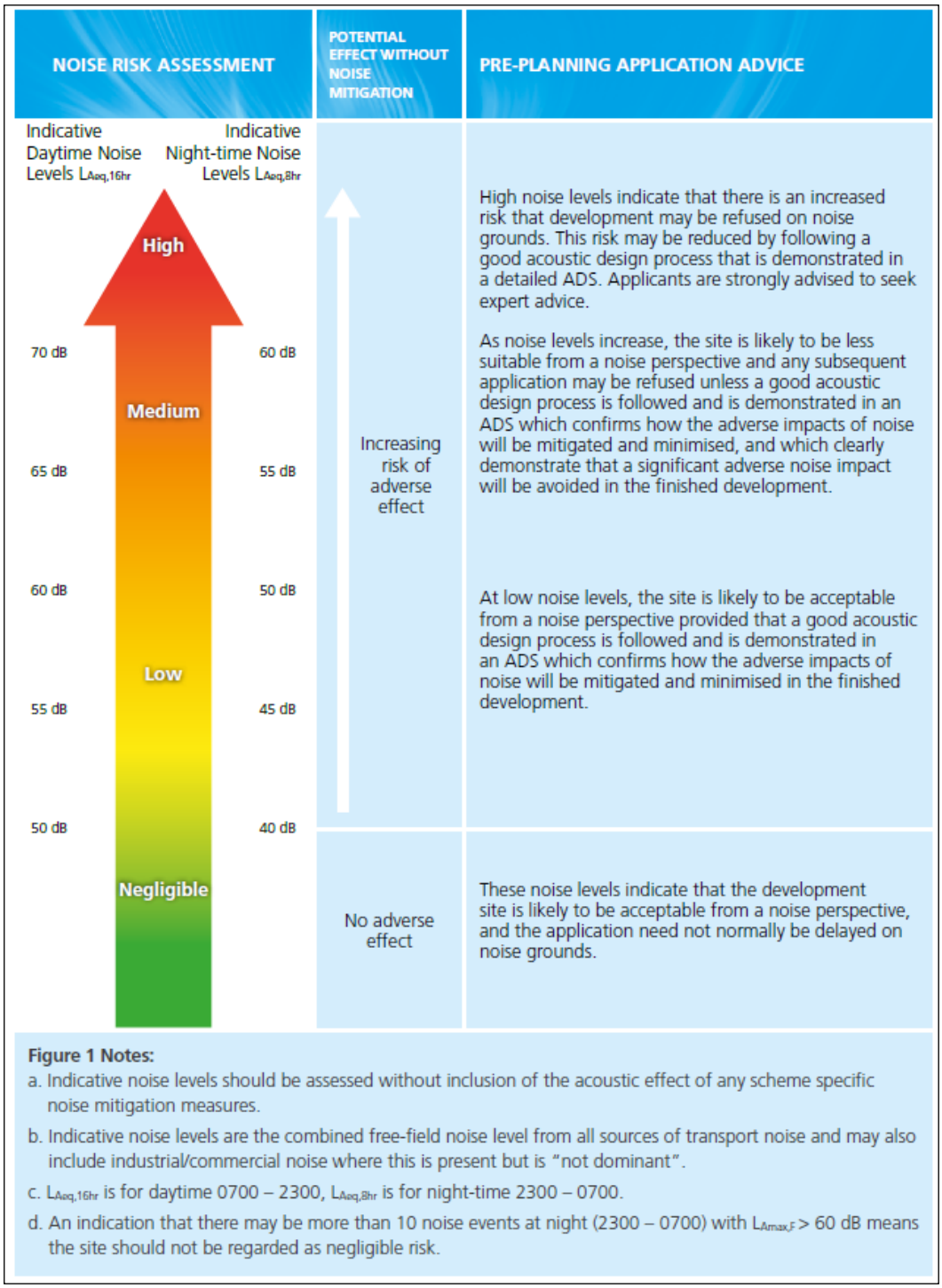
Element 3 - External Amenity Area Noise Assessment

- ProPG recommends the guideline values of 50 – 55 dB $L_{Aeq,16hr}$ in gardens and external amenity areas, where such areas are an intrinsic part of the overall design. If these values cannot be achieved in all areas, the development should be designed to achieve the lowest practicable noise levels. The provision of relatively quiet alternative publically accessible external amenity space may help to offset the noise impact in high noise areas.

Element 4 - Assessment of Other Relevant Issues

- This guidance reflects advice already provided in NPSE and PPG-Noise and includes acoustic factors that determine whether noise could be a concern, e.g., the number, frequency and pattern of noise events; the spectral content of the noise, the character of the noise (i.e., the presence of tones or other features such as impulsiveness), possible cumulative impacts from several sources as well as local topology and topography.
- Other relevant issues to be considered include: magnitude and extent of compliance with ProPG; likely occupants of the development; acoustic design vs. unintended adverse consequences; acoustic design vs. wider planning objectives.

Figure 4.1 Initial Site Risk Assessment (measured/predicted, empty site, pre mitigation)



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	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.
70 dB / 60 dB		
Medium		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.
65 dB / 55 dB		
60 dB / 50 dB		
Low		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.
55 dB / 45 dB		
50 dB / 40 dB		
Negligible	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.

Acoustics Ventilation and Overheating - Residential Design Guide

4.25. Developments will normally (but not always) require additional ventilation (above ADF whole dwelling ventilation provisions) in order to mitigate overheating. Where an overheating assessment is undertaken, it should provide details as to the duration and rate of any additional ventilation required to meet overheating compliance criteria. Where this additional ventilation is provided passively, the overheating assessment should also provide information about the required size of façade openings.

4.26. An overheating assessment might not always be undertaken for a project and without this information it is difficult to identify noise impacts that may occur during the overheating condition.

4.27. When using provisions for purge ventilation (e.g., opening windows) to mitigate overheating, refer to **Tables 4.4** and **Table 4.5** (Table 3-2 and Table 3-3 in the guidance).

Table 4.4 Guidance for Level 1 site risk assessment of noise from transport noise sources relating to overheating condition

Risk category for Level 1 assessment [Note 5]	Potential Effect without Mitigation	Recommendation for Level 2 assessment
$L_{Aeq,T}$ [Note 3] during 07:00 - 23:00 / $L_{Aeq,8hr}$ during 23:00 - 07:00 High: 65 dB / 55 dB Medium: 60 dB / 50 dB Low: 55 dB / 45 dB Negligible: 50 dB	Increasing risk of adverse effect	Recommended Optional
	Use of opening windows as primary means of mitigating overheating is not likely to result in adverse effect	Not required

Table 4.5 Guidance for Level 2 assessment of noise from transport noise sources relating to overheating condition

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

4.28. The use of mechanical systems to control overheating could include systems which provide ambient air at high ventilation rates (ventilative cooling) or systems which provide cooled air, commonly referred to as comfort cooling systems.

4.29. These systems would normally be occupant controlled, but there may be options for automation.

4.30. Recommendations for desirable internal ambient noise levels for overheating conditions are set out in **Table 4.6** (Table 3-5 in the guidance).

Table 4.6: Indoor ambient noise levels from mechanical services - Overheating condition

Possible system or design solution	Desirable upper internal ambient noise levels from mechanical services
Ventilative cooling or Comfort cooling	Bedrooms L_{Aeq} 30 (± 5) dB
	Living / Dining Rooms L_{Aeq} 35 (± 5) dB

Approved Document O: Overheating

4.31. In locations where external noise may be an issue (for example, where the local planning authority considered external noise to be an issue at the planning stage), the overheating mitigation strategy should take account of the likelihood that windows will be closed during sleeping hours (11pm to 7am).

4.32. ADO states that windows are likely to be closed during sleeping hours if noise within bedrooms exceeds the following limits.

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

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

4.33. ADO classifies areas of high risk to overheating being located in central areas of London (and potentially some locations in Manchester city centre). All other areas, including Winnersh, are classed as being of moderate risk. Guidance from the IOA/ANC indicate that the outside to inside level difference via an open window is likely to be around 13 dB if ajar and 9 dB if open for cooling (assuming moderate overheating risk).

4.34. With reference to Approved Document O criteria, where the night-time sound levels at proposed bedroom façade exceed 49 dB $L_{Aeq,8hr}$, the 'simplified' overheating method cannot be relied upon.

4.35. For areas of the Site exposed to noise levels above 49 dB $L_{Aeq,8hr}$, use of openable windows is unlikely to be suitable method to prevent overheating. Dynamic thermal modelling may also be required for these parts of the site.

5. Baseline Sound Level Survey

5.1. A baseline survey was conducted at the site, between 9th and 10th May 2022. The survey location L1 was approximately 200m north of the M4 and L2 was approximately 290 m from A329 as shown on the site location plan in Appendix Three.

5.2. The noise monitoring equipment was calibrated at the beginning and end of the assessment period using an acoustic calibrator, which had itself been calibrated against a reference set traceable to National and International Standards. No shift in calibration level was observed.

5.3. Meteorological conditions during the daytime noise survey period were dry, with temperature of 15°C to 18°C. Throughout the survey, there was a moderate breeze (4 - 6m/s) from the south and southwest, and hence conditions were considered to be conducive to carrying out robust road traffic sound level measurements. During the night-time the conditions were also dry and overcast and the wind was 4-5 m/s from the southwest.

5.4. During the surveys, the dominant sound source at L1 was road traffic on the M4. Other contributory sound sources at the site were the construction activities from adjacent site, which were just audible. At monitoring location L2, the road traffic noise from A329(M) was dominant. It was noticeable that noise from vehicles on the north-bound off-slip road from the M4 connecting to the A329(M) was significant due to tyre-road interaction, as the slip road has not been re-surfaced using low-noise surfacing.

5.5. The results of the survey are summaries in **Table 5.1**. The survey results are detailed in **Appendix Three**.

Table 5.1: Summary of measured sound levels

Location	Period (T)	Sound Pressure Level, dB re: 20µPa			
		$L_{Aeq,T}$	$L_{AFmax,T}$	$L_{A10,T}$*	$L_{A90,T}$*
L1	Day (07:00-23:00)	54	78 L_{AF1} = 55	53	49
	Night (23:00-07:00)	48	70 L_{AF1} = 49	45	39
L2	Day (07:00-23:00)	56	79 L_{AF1} = 57	57	53
	Night (23:00-07:00)	51	80 L_{AF1} = 52	52	43

Note: * Average of the 1-hour interval measurements

6. Noise Propagation Modelling and Assessment

6.1. A sound propagation model of the site was prepared using the CadnaA software package. The sound sources in the model were calibrated based on the measured sound level survey data discussed in **Section 5**, together with road traffic data from the scheme traffic and transport consultant.

6.2. Ground hardness was assumed to be 0.5 (medium hardness) across the site.

6.3. Daytime grids are calculated at 1.5m height. Night-time grids are calculated at 1st floor height (4m).

6.4. The predicted sound levels across the site are then compared to the ProPG initial risk assessment values in order to determine the suitability of the site for residential use.

6.5. **Figures 6.1 and 6.2** show the predicted propagation of sound across the site during daytime and night-time periods based on the measured survey data.

6.6. **Figures 6.3 and 6.4** show the results of the initial risk assessment during daytime and night-time periods, respectively.

Figure 6.1: Predicted daytime noise propagation across the site - L_{Aeq} (Based on measured data)

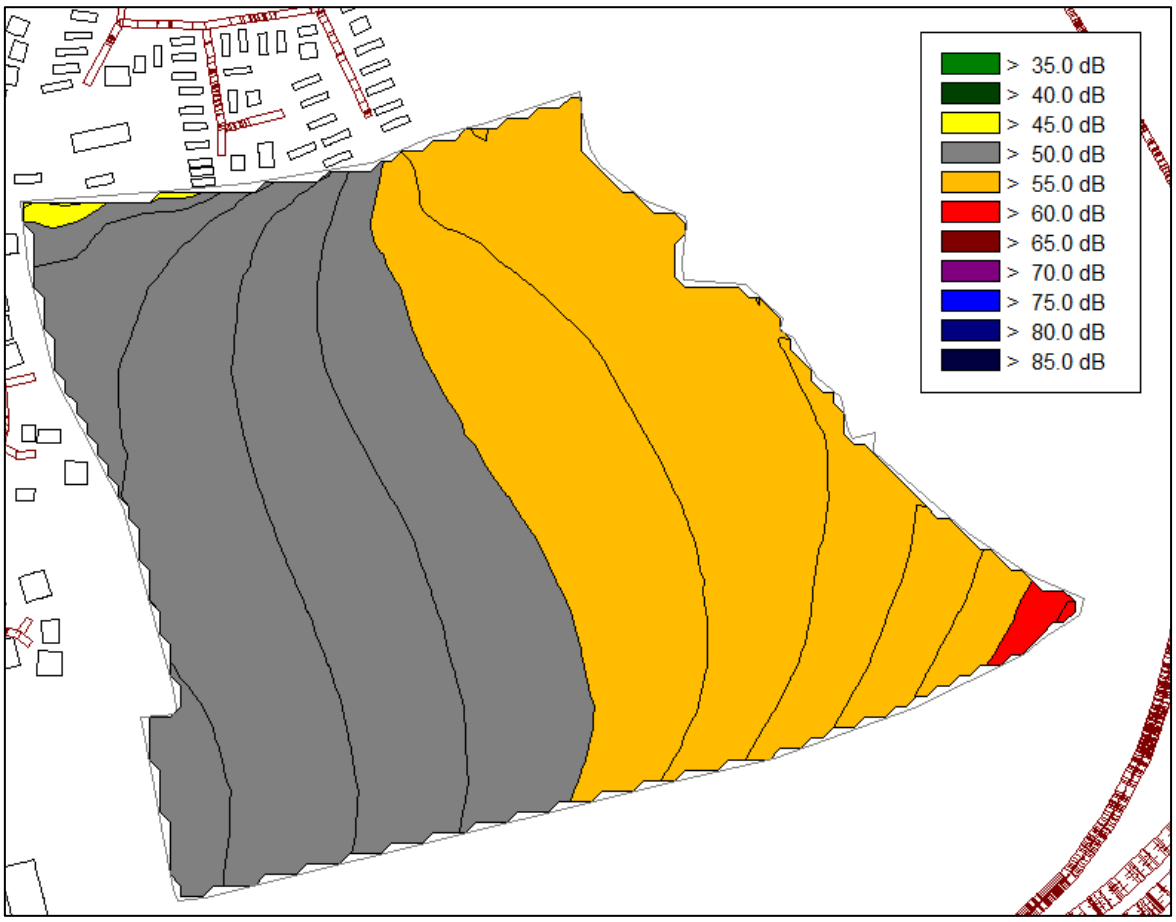


Figure 6.2: Predicted night-time noise propagation across the site - L_{Aeq} (Based on measured data)

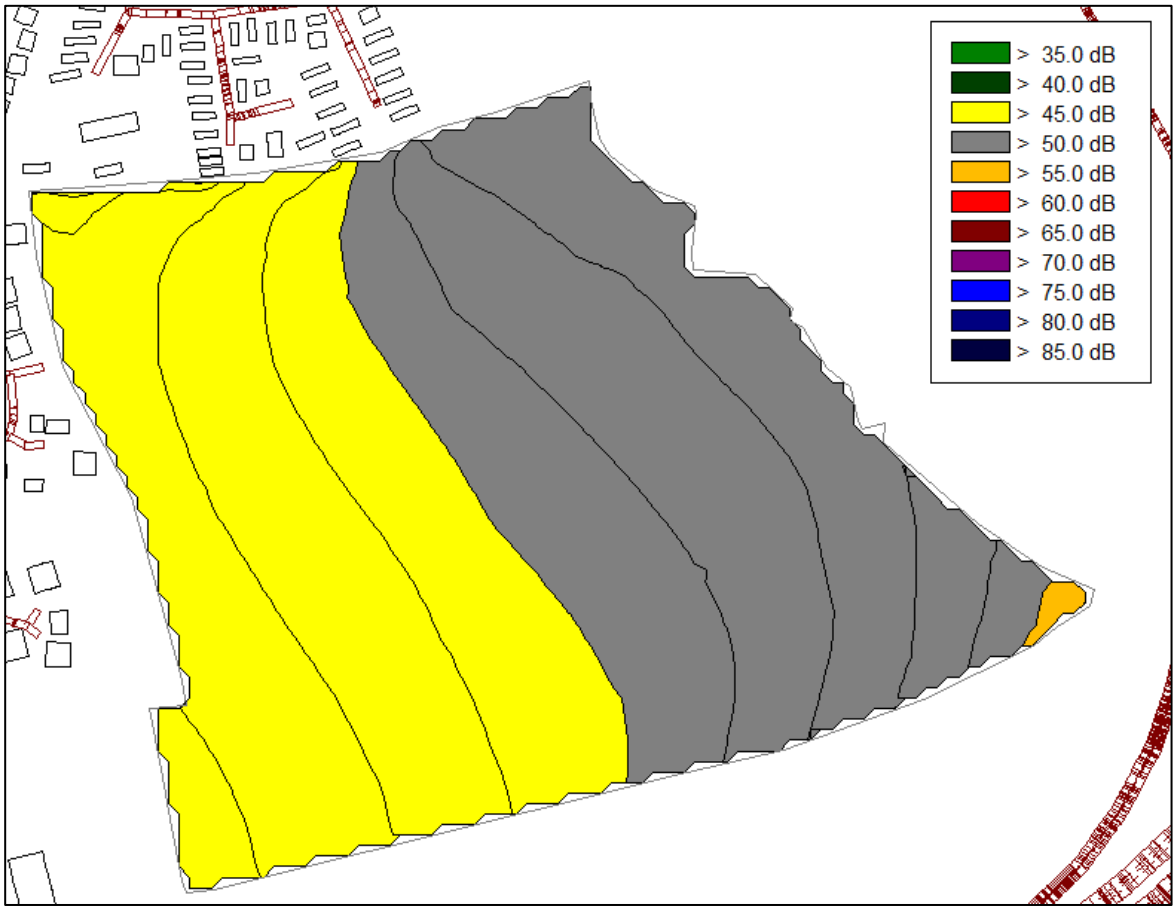


Figure 6.3 Predicted daytime noise propagation across the site – Noise Risk

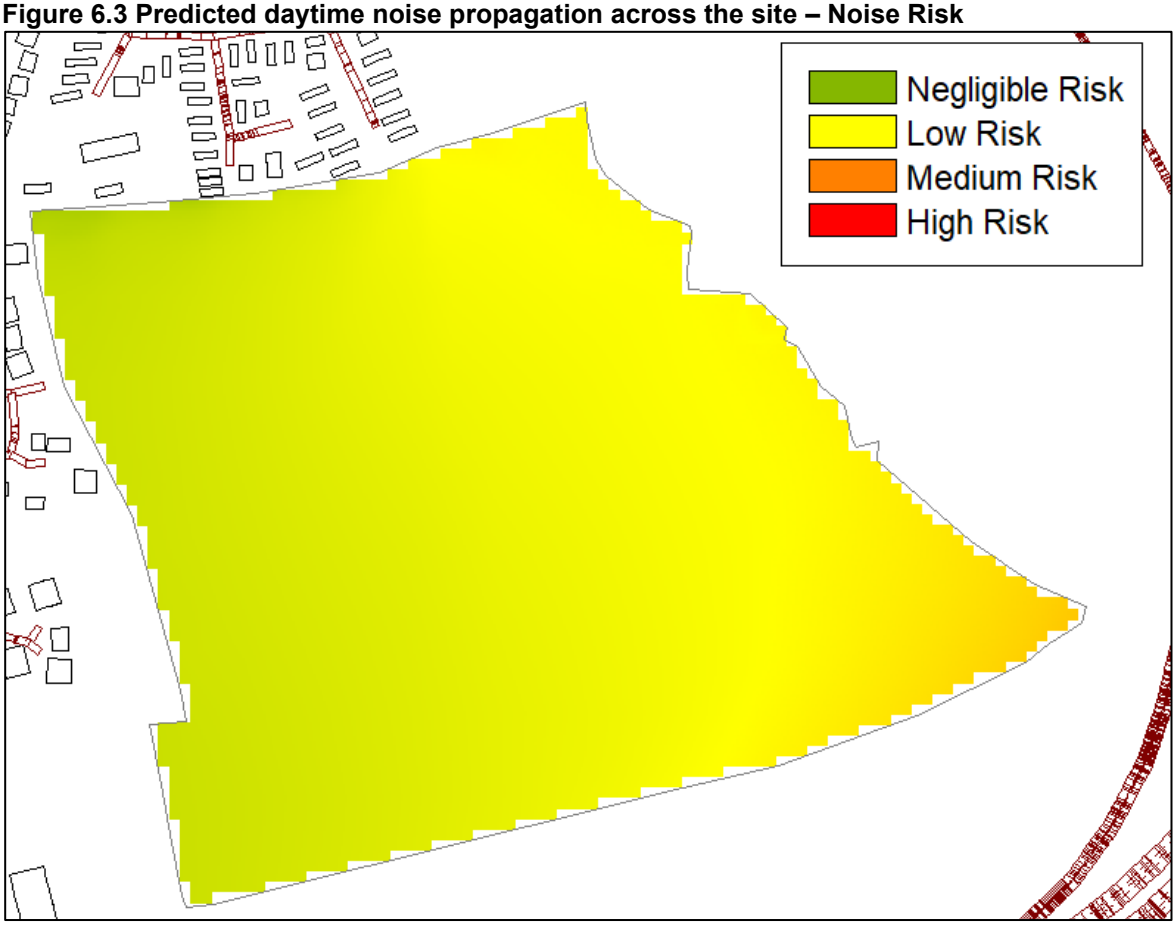
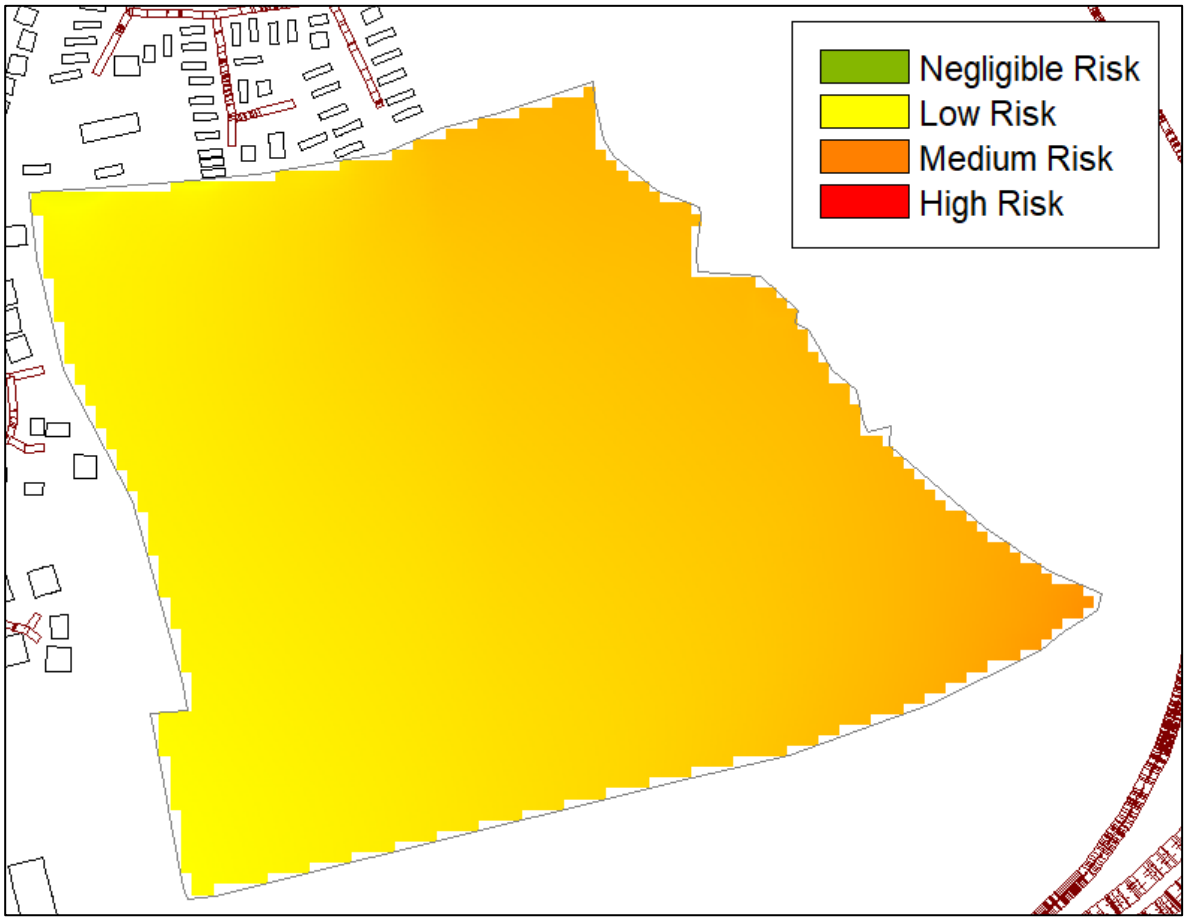


Figure 6.4 Predicted night-time noise propagation across the site – Noise Risk



Stage 1 Initial Noise Risk Assessment

6.7. The results of the sound propagation modelling indicate that, in terms of ProPG guidance, the site is negligible to low risk during the daytime and low to medium risk at night, tending towards the higher risk categories towards the east and southeast of the site.

6.8. It should be noted that the SEND school located between the southern site boundary and the M4 Motorway have not been included within the modelling and initial noise risk assessment above. Buildings within the development will provide additional screening of road traffic noise from the M4 but will likely have only a marginal impact on general road traffic noise levels across the site due to the slip road and A329(M).

6.9. With regards to local authority criteria, the whole site falls within the NOEL criteria during the daytime period (i.e., < 55 dB $L_{Aeq,16hr}$) with the exception of a small area of the site towards the eastern boundary which falls under LOAEL (up to 57 dB $L_{Aeq,16hr}$); however, this area is within the proposed landscape buffer and not residential housing.

6.10. At night, the whole site falls within the LOAEL criteria. As a result, the site therefore requires an Acoustic Design Statement (ADS) to detail how the adverse impacts of noise will be mitigated and minimised. An ADS, in accordance with ProPG Stage 2, should therefore be prepared to support a Reserved Matters application for residential development at the site.

7. Acoustic Design Statement

Element 1 – Good Acoustic Design Process

7.1. This element looks to address how noise can be mitigated at the site in general terms and indicates that noise can be factored into the overall design process for the scheme.

7.2. As the main source of noise is road traffic on the M4 Motorway to the south, the A329(M) to the east and the M4 off-slip connecting the M4 with the A329(M), northbound, which runs along the north of the site boundary. The layout design therefore presents a building frontage to the M4 and the A329 to the east, providing screening to the other residential buildings in the site. Appropriate design of the building envelope to ensure suitable internal amenity is considered below.

Element 2 – Internal Noise Level Guidelines

7.3. The achievement of suitable internal sound levels in habitable spaces is dependent on the façade construction, and in particular the weaker acoustic elements (glazing and ventilation).

7.4. The accepted rule of thumb is that a window left open for ventilation purposes typically provides a reduction in external noise levels of 10 – 15 dB. In order to achieve guideline indoor noise levels with open windows, daytime ambient noise levels should not exceed around 50 dB $L_{Aeq,16hr}$; to achieve night-time guideline levels, external noise levels should not exceed around 45 dB $L_{Aeq,8hr}$ and 60 dB $L_{Amax,f}$ (more than 10 times per night).

7.5. **Figures 7.1 and 7.2** show the road traffic noise propagation across the proposed development site (Illustrative Masterplan).

Figure 7.1: Predicted daytime road traffic noise contours across the development site (ground floor level)

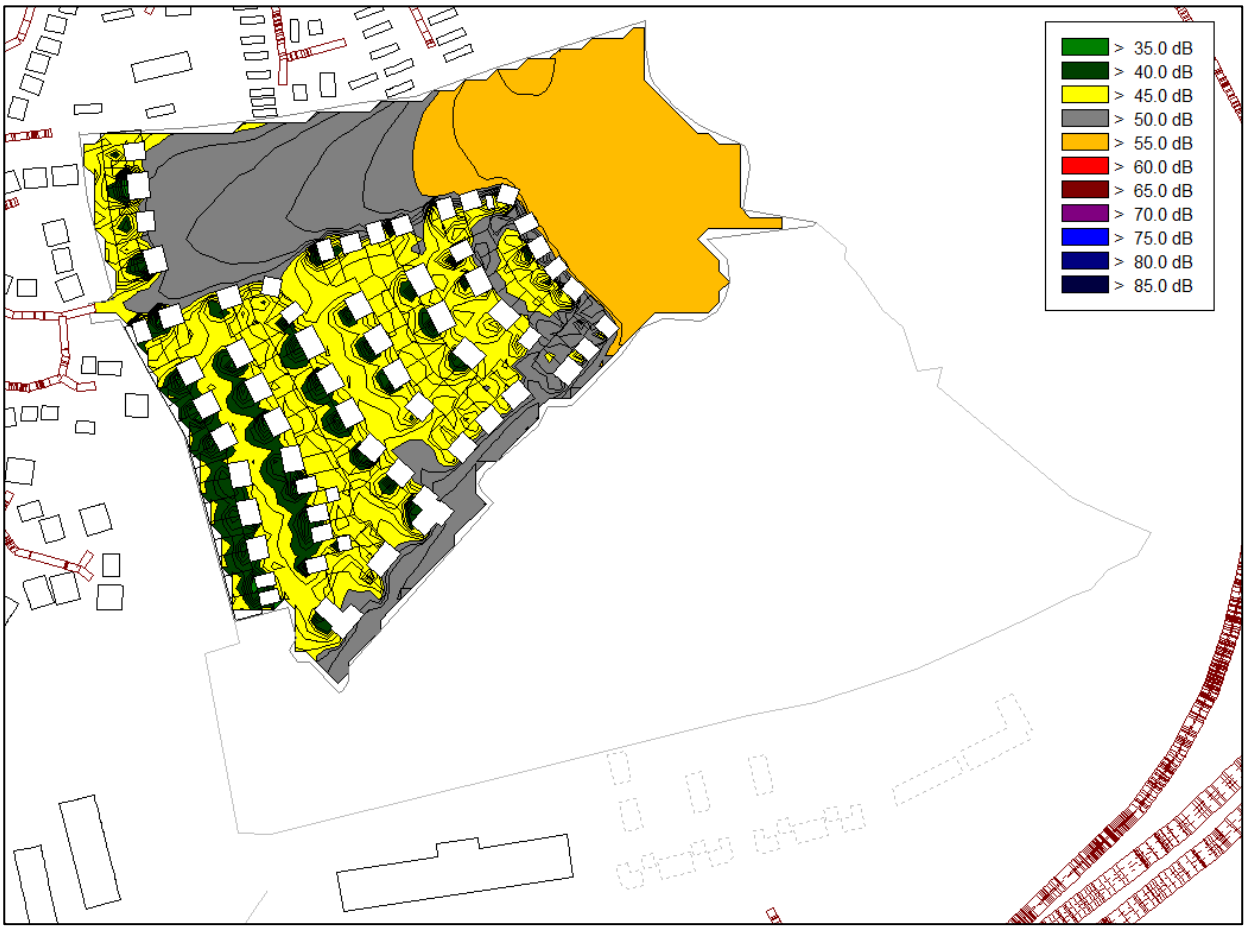
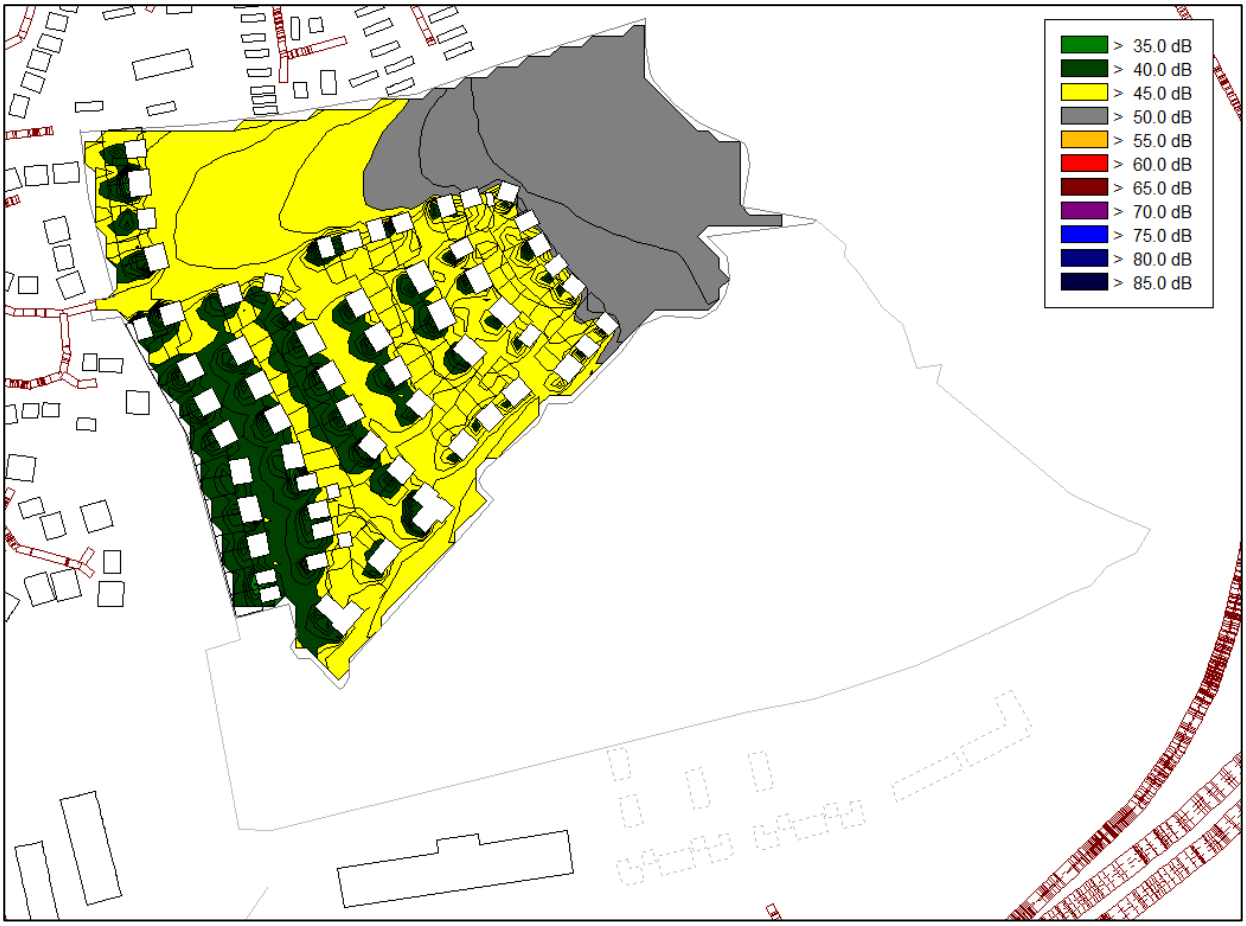


Figure 7.2: Predicted night-time road traffic noise contours across the development site (1st floor level)



7.6. The highest predicted daytime façade level at proposed residential dwellinghouses is 57 dB $L_{Aeq,16h}$ (first floor) at the eastern boundary of the site (Plots 103-108), facing the A329 (M). The highest predicted night-time level on the façade is 52 dB $L_{Aeq,8h}$ (first floor). The highest predicted façade levels at the dwellinghouses at the southern boundary of the site (Plot 50-76 and Plots 109-111) are 55 dB during daytime and 50 dB during night-time. As a result, for the habitable rooms in the proposed dwellings nearest to the M4 and the A329 (M), the ventilation strategy cannot rely on open windows.

7.7. However, the applicant intends to build out the whole site including Phase 1 and Phase 2. The application for Phase 1 and Phase 2 will be submitted concurrently. Once Phase 2 is completed, the noise levels on the façades of the proposed dwellings at the southern site boundary of Phase 1 will be reduced by 5 dB due to the screening of Phase 2 dwellings, as shown in the Figures in **Appendix Four**. As long as the occupants of Phase 1 move in after Phase 2 is built, it is not necessary to provide the noise mitigation measures to the dwellings on the southern boundary of Phase 1.

7.8. Sound levels on other façades reduce away from the M4 and the A329 (M), with the benefit of screening provided by the first row of dwellinghouses.

7.9. Whilst the night-time maximum L_{Amax} sound levels were measured 70 dB at L1 and 78 dB at L2, the typical max levels at the nearest proposed dwellings to the M4 and the A329(M) were much lower. The L_{AF1} (i.e., the level exceeded 1% of the time) levels were only 49 dB and 52 dB $L_{Amax,8hr}$, with the $L_{Amax,1hr}$ typically below 70 dB. As such, as is typical of such sites, the mitigation strategy is driven by the average L_{Aeq} sound levels (as the difference between the target average and maximum sound levels in bedrooms is less than 15dB).

7.10. For habitable rooms of the first-row dwellings facing the A329 (M), the ventilation strategy should ensure that the requirements of Part F of the Buildings Regulations are achieved with closed windows. An appropriate ventilation system is one that complies with the performance specification of System 3 to AD-F. An example would be a decentralised constant mechanical extract (dMEV) fan provided to each kitchen, bathroom and wet room, in conjunction with a trickle ventilator to each habitable room that achieves a minimum 25000 mm^2 equivalent free area and with a minimum weighted element normalised sound level difference of 27 dB $D_{ne,w}$ in the 'open' position.

7.11. In all cases, purge ventilation would be provided by openable windows.

7.12. With regards to glazing, standard glazing units can be used for all the habitable rooms that achieves 27 dB R_w+C_{tr} sound reduction (e.g., glazing 4/12/4).

7.13. There are no restrictions for all the other dwellings in the site in term of noise.

7.14. Example noise break-in calculations (House Type: EMT41), including a dMEV system and passive acoustic trickle ventilator, are provided in **Appendix Five**. The assessment is based on the following assumptions:

- Measured glazing/masonry area of façade;
- 'Normal' internal surface finishes e.g., carpeted with curtains, bed etc. to achieve a reverberation time of 0.3 seconds in each octave band between 63 Hz and 8 kHz (as referenced in BRE Digest 338) within bedrooms and 0.5 seconds within living rooms (as referenced in Approved Document E of the Building Regulations 2010);
- External walls assumed to be clad with masonry (brick or similar) with plasterboard lining;
- Glazing sound insulation performance is typical of the window unit as a whole.

7.15. The highest internal sound levels from road traffic in living room and bedroom spaces during daytime periods are predicted to be 30 dB $L_{Aeq,16h}$ and the highest internal sound level due to road traffic in bedroom spaces during night-time periods are predicted to be 19 dB $L_{Aeq,8h}$ and 28 dB L_{AF1}, which therefore achieve the internal sound levels recommended by BS8233:2014.

Overheating mitigation and acoustic conditions

7.16. The habitable rooms of the first-row dwellings facing the A329 (M) will have Low risk of noise and other plots will have Negligible risk of noise from transport noise sources relating to overheating condition in Level 1 risk assessment in Acoustics Ventilation and Overheating - Residential Design Guide (see Table 4.4).

7.17. As such, the recommendation for Level 2 assessment is optional for the first-row dwellings facing the A329 (M) and not required for other plots.

7.18. In Approved Document O, windows are likely to be closed during sleeping hours if noise within bedrooms exceeds the following limits.

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

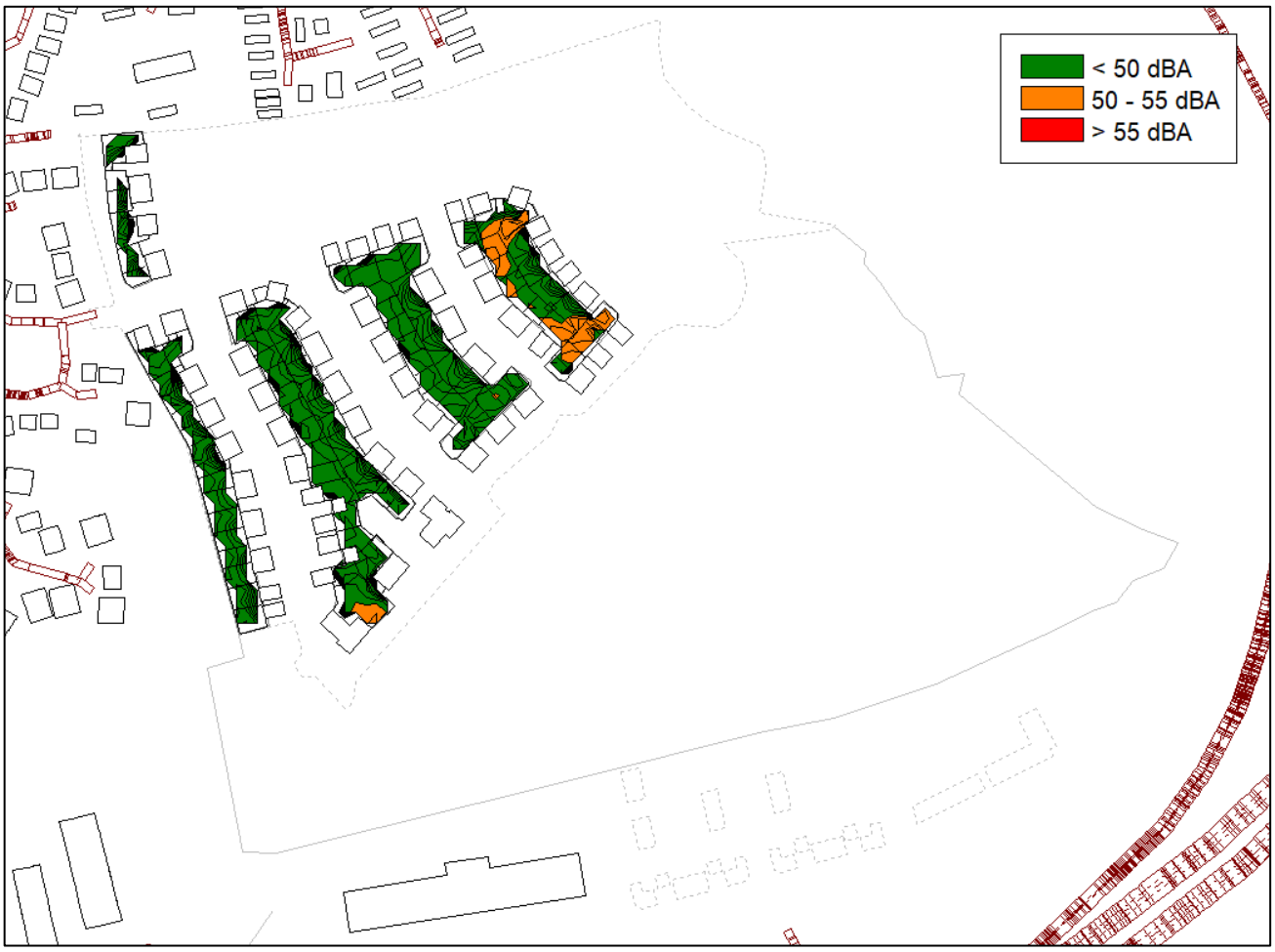
b. 55 dB L_{AFmax}, more than 10 times a night (between 11pm and 7am).

7.19. Plots 101-109, are predicted to be exposed to noise levels above 49 dB $L_{Aeq,8hr}$, and therefore use of openable windows is unlikely to be suitable method to prevent overheating. Dynamic thermal modelling may also be required to determine whether the potential for overheating, and the requirement for mechanical cooling.

Element 3 – External Amenity Noise Assessment

7.20. **Figure 7.3** shows the predicted noise level across all gardens within the site compared to guideline limits for garden areas.

Figure 7.3: Predicted external amenity sound levels



7.21. **Figure 7.3** indicates that the sound level in external amenity spaces would be expected to be below the lower guideline value of 50 dB $L_{Aeq,16h}$, within the majority of garden spaces. This is inclusive of standard 1.8m close-boarded timber garden fences and/or 1.8 m brick walls that are included within the masterplan. There are small areas with sound levels of 50-55 dBA, which is with an upper guideline value of 55 dB $L_{Aeq,T}$ which would be acceptable in noisier environments.

7.22. As such, the external amenity can be achieved without additional noise mitigation measures.

Element 4 – Assessment of Other Relevant Issues

7.23. There are no other relevant issues that require assessment for this site.

8. Conclusions

8.1. The outline assessment of the site has been conducted based on measured sound level survey data. The main noise source across the site is road traffic on the M4 Motorway to the south, the A329(M) to the east and the M4 off-slip connecting the M4 with the A329(M), northbound.

8.2. The sound level survey has been used to predict the propagation of noise across the site using a CadnaA sound propagation model. The results of the modelling are used to zone the site in accordance with ProPG and local authority guidance.

8.3. The results of the sound propagation modelling indicate that, in terms of ProPG guidance, the site is negligible to low noise risk during the day, and low to medium noise risk at night, tending towards the higher risk category towards east and southeast of the site.

8.4. With regards to local authority criteria, the area of the site proposed for residential development falls within the No Observed Effect Level (NOEL) criteria during the day, and the Lowest Observed Adverse Effect Level (LOAEL) at night. Therefore, detailed specification of noise mitigation should be provided in an Acoustic Design Statement at the Reserved Matters application stage.

8.5. The applicant intends to build out the whole site including Phase 1 and Phase 2. The application for Phase 1 and Phase 2 will be submitted concurrently. Once Phase 2 is completed, the noise levels on the façades of the proposed dwellings at the southern site boundary of Phase 1 will be reduced by 5 dB due to the screening of Phase 2 dwellings. As long as the occupants of Phase 1 move in after Phase 2 is built, it is not necessary to provide the noise mitigation measures to the dwellings on the southern boundary of Phase 1.

8.6. For habitable rooms of the first-row dwellings facing the A329 (M), the ventilation strategy should ensure that the requirements of Part F of the Buildings Regulations are achieved with closed windows. An appropriate ventilation system is one that complies with the performance specification of System 3 to AD-F. An example would be a decentralised constant mechanical extract (dMEV) fan provided to each kitchen, bathroom and wet room, in conjunction with a trickle ventilator to each habitable room that achieves a minimum 25000 mm^2 equivalent free area and with a minimum weighted element normalised sound level difference of 27 dB $D_{ne,w}$ in the 'open' position.

8.7. In all cases, purge ventilation would be provided by openable windows.

8.8. With regards to glazing, standard glazing units can be used for all the habitable rooms that achieves 27 dB R_w+C_{tr} sound reduction (e.g., glazing 4/12/4). Use of opening windows as for ventilation purposes is not likely to result in adverse effect for all the plots across the site.

8.9. The noise level across all private gardens within the site should not be above the guideline limits for garden areas of 50-55 dB $L_{Aeq,16hr}$ at daytime.

8.10. Nine plots have been identified as potentially requiring additional mechanical cooling to mitigate the overheating condition. This should be assessed using thermodynamic modelling to demonstrate compliance with Approved Document O.

8.11. All adverse impacts are therefore shown to be mitigated and minimised, in line with the current planning policy and guidance. The requirements of Condition 14 in the Outline Planning Application can be all met.

Appendix One – Glossary of Acoustic Terminology

Sound power level	A logarithmic measure of the power of a sound relative to a reference value.
"A" Weighting (dB(A))	The human ear does not respond uniformly to different frequencies. "A" weighting is commonly used to simulate the frequency response of the ear. It is used in the assessment of the risk of damage to hearing due to noise.
Decibel (dB)	The range of audible sound pressures is approximately 2 x 10^{-5} Pa to 200 Pa. Using decibel notation presents this range in a more manageable form, 0 dB to 140 dB.
Ambient sound level, $L_{Aeq,T}$	equivalent continuous A-weighted sound pressure level of the totally encompassing sound in a given situation at a given time, usually from many sources near and far, at the assessment location over a given time interval, T. NOTE The ambient sound level is a measure of the residual sound and the specific sound when present.
Background sound level, $L_{90,T}$	A-weighted sound pressure level that is exceeded by the residual sound at the assessment location for 90% of a given time interval, T, measured using time weighting F and quoted to the nearest whole number of decibels.
Maximum sound level, $L_{Amax,T}$	The maximum RMS A-weighted sound pressure level occurring within a specified time period.
Noise	Unwanted sound.
Ambient sound	Totally encompassing sound in a given situation at any given time composed of noise from many sources, near and far.
Residual sound	Ambient sound remaining at the assessment location when the specific sound source is suppressed to such a degree that it does not contribute to the ambient sound.
Rating level	Specific sound level plus any adjustment for the characteristic features of the sound.

Appendix Two – Illustrative Site Layout Plan and Monitoring Locations

Monitoring Location L2
Phase 2 Subject to Separate Reserved Matters Planning Application
Monitoring Location L1

Appendix Three – Survey Data

Figure A3.1: Sound level survey data temporal plot at L1 (1-hour intervals)

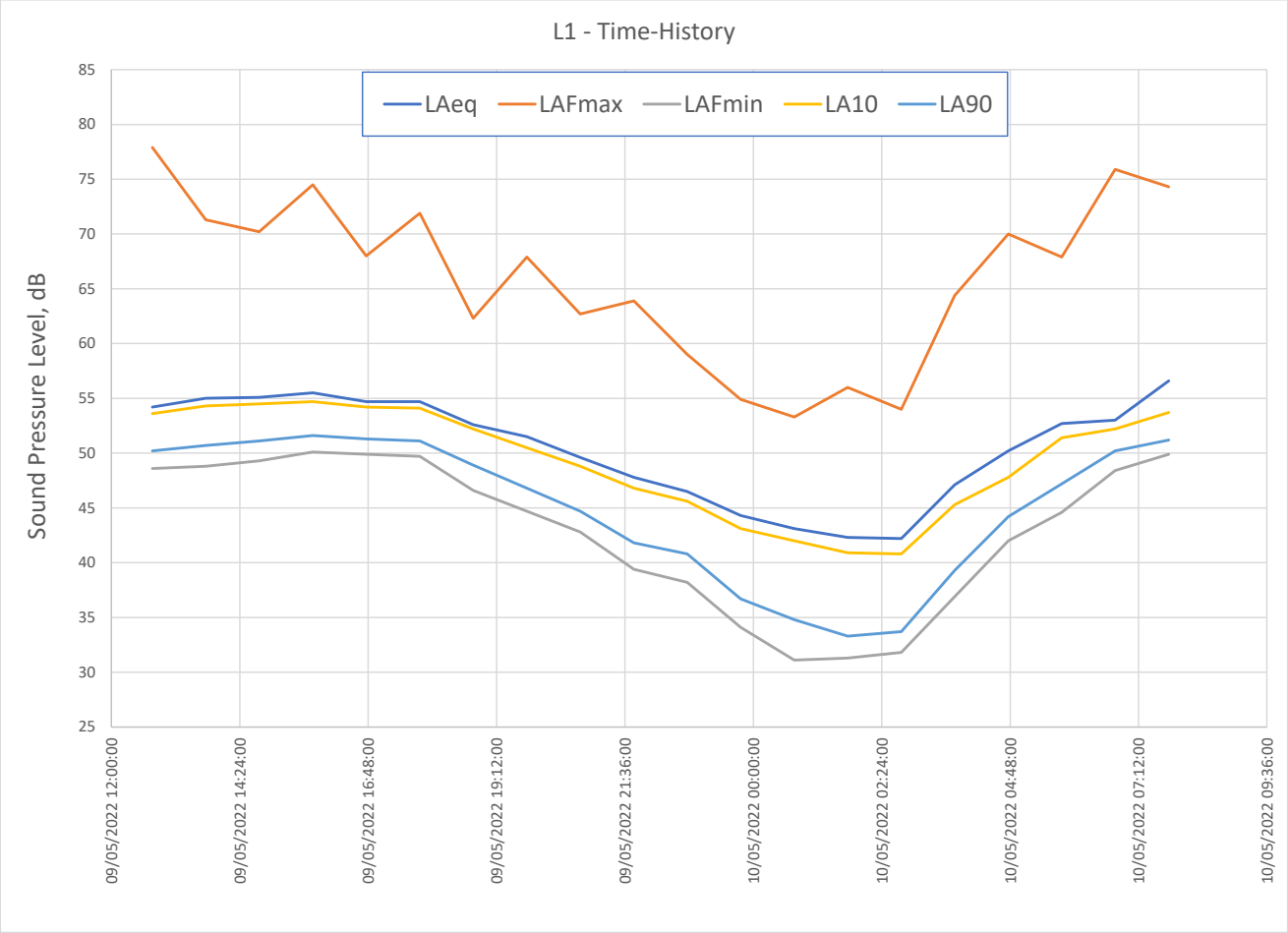
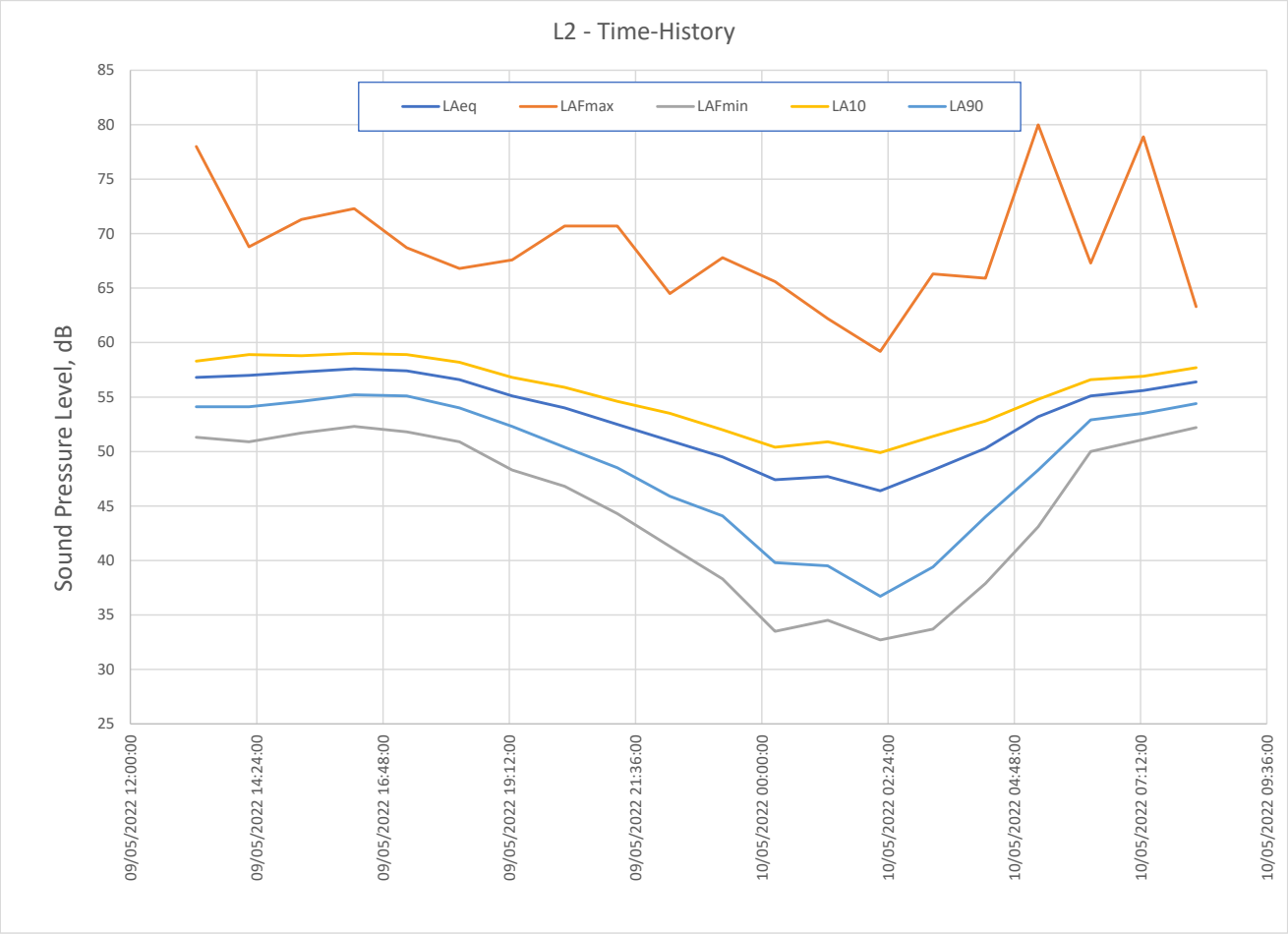


Figure A3.2: Sound level survey data temporal plot at L2 (1-hour intervals)



Appendix four – Noise contours for Phase 1&2

Figure A4.1: Predicted daytime road traffic noise contours across the development site (ground floor level)

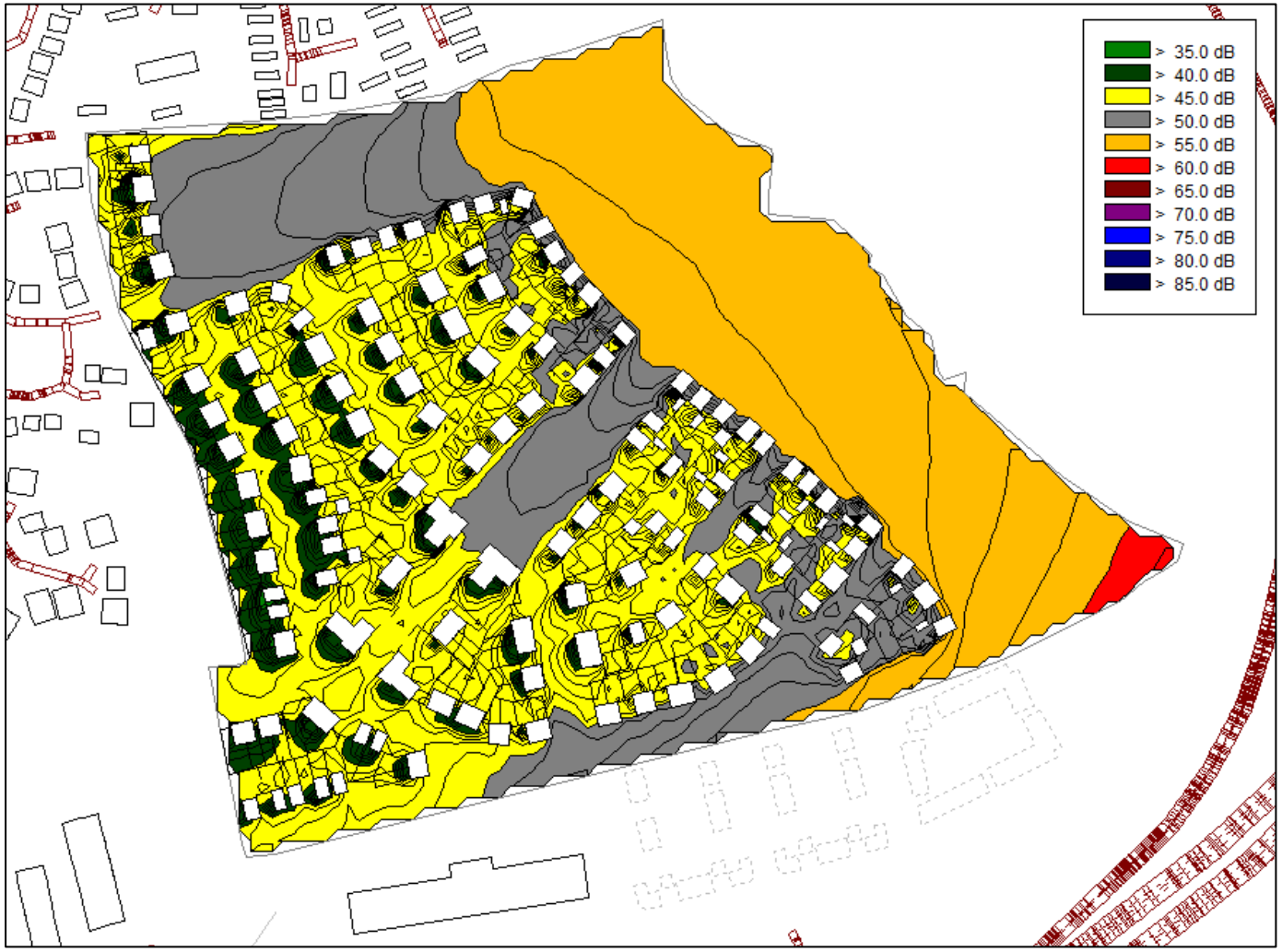
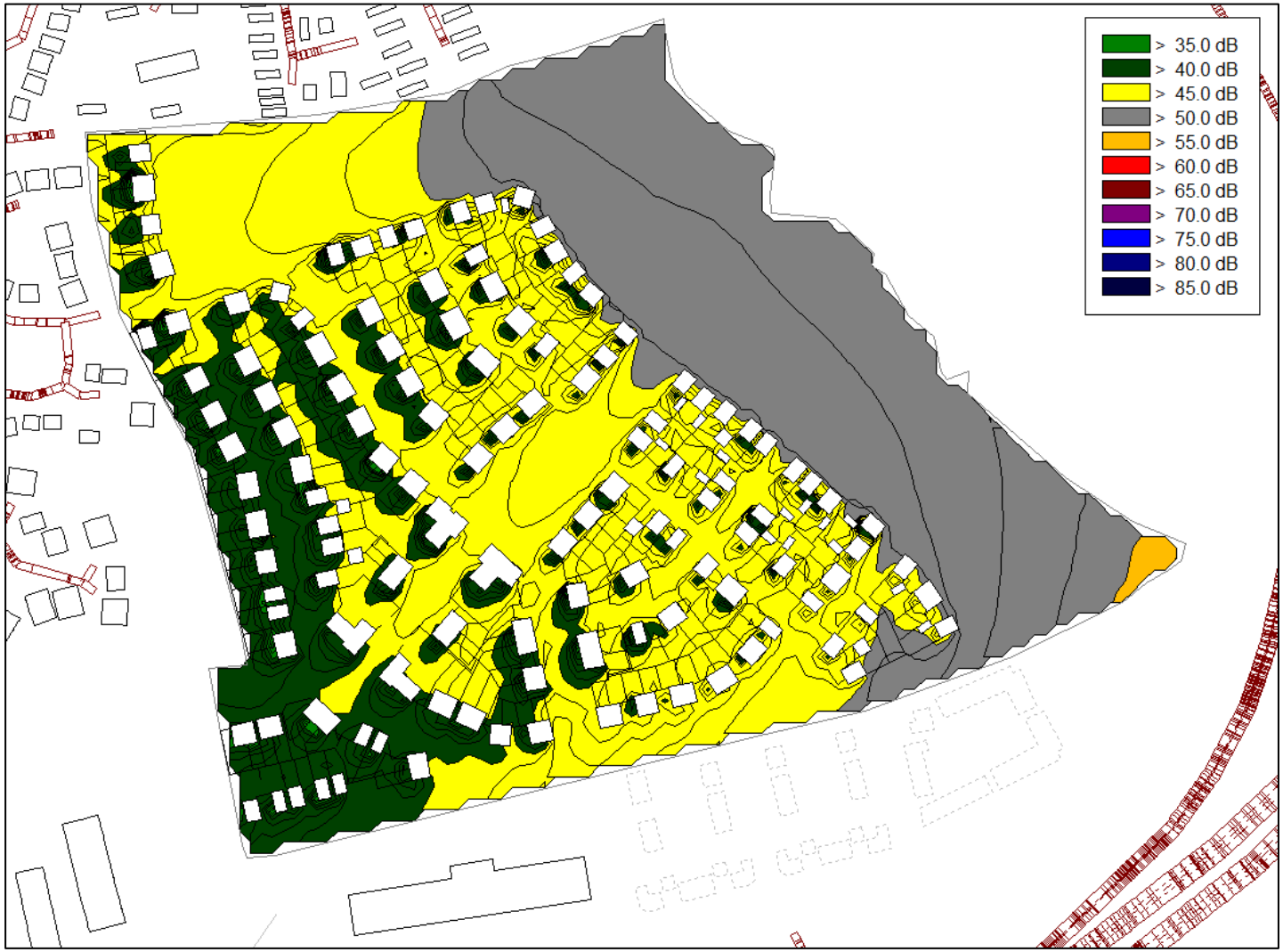


Figure A4.2: Predicted night-time road traffic noise contours across the development site (first floor level)



Appendix Five – Noise Ingress Calculation

Noise Ingress Calculation

Project: Walmore Lane, Winnersh
Description: East façade facing M4
Plot/Flat No: –
Room Name: Bedroom

Calcs By: YH
Date: 20/09/24
Calc ref: 9
Period: NT

Calculation is based on methodology within BS 8233:2014 & BSEN ISO 12354-3. The following equation is utilised:

$$L_{internal} = L_{external} - \Sigma R + 10 \log S/A - DL_{fs} + 3$$

where A = 0.16V/T
and DL_{fs} is a correction to account for the influence of façade shape (e.g. where balconies or terraces are present)

This can be broken down further to:

$$L_{eq,2} = L_{eq,ff} + 10\log((A_0/S \times 10^{(-D_{n,e}/10)}) + (S_{wl}/S \times 10^{(-R_{wl}/10)}) + (S_{ew}/S \times 10^{(-R_{ew}/10)}) + (S_{rr}/S \times 10^{(-R_{rr}/10)})) + 10\log(S/A) - DL_{fs} + 3$$

The above terms are described below.

Description	Term	Value		Room assessed: Bedroom		External wall		Window		Notes
Total facade area (m2)	S_f	16.8		Width (m):	3	Total linear (m):	7	Linear (m):	1.2	0
Window area (m2)	S_{wl}	1.8		Depth (m):	4			Height (m):	1.5	
External wall area (Sf - Swl)	S_{ew}	15.0		Height (m):	2.4					
Area of ceiling (m2)	S_{rr}	0.0	0							
Total area of elements (Sf + Srr)	S	16.8								
Volume of receiving room (m3)	V	28.8								
Reference absorption area (m2)	A_0	10								
Number of ventilators in facade:		1								
Façade shape correction	DL_{fs}	0	See Annex C of BS EN 12354-3							

	Octave band centre frequency, Hz												
	63	125	250	500	1k	2k	4k	8k	dBA	R_w	C_{tr}	$R_w + C_{tr}$	Notes
External Leq, freefield (dB Leq,ff)	35	39	41	41	44	47	47	32	52	-	-	-	Freefield LAeq level
External Lmax, freefield (dB Lmax,ff)	34	48	49	51	52	52	46	40	57	-	-	-	Freefield LAmax level
Dne of each ventilator	16	20	22	27	31	39	49	49		31	-4	27	Passivent Basic Airscoop
Total Dne of all ventilators	16	20	22	27	31	39	49	49		31			
SRI of window (Rwl)	18	24	20	25	35	38	35	35		31	-4	27	4/12/4
SRI of external wall (Rew)	35	37	42	52	60	63	68	68		54	-6	48	Calc 5 - house walls - brick outer
SRI of roof and ceiling (Rrr)													
Rev time of receiving room (T) - secs	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3					
All ventilators [eqn. B]	0.015	0.0061	0.004	0.001	5E-04	7E-05	7E-06	7E-06					A0/S x 10^(-Dne/10)
Glazing [eqn. C]	0.002	0.0004	0.001	3E-04	3E-05	2E-05	3E-05	3E-05					Swl/S x 10^(-Rwl/10)
External wall [eqn. D]	3E-04	0.0002	6E-05	6E-06	9E-07	4E-07	1E-07	1E-07					Sew/S x 10^(-Rew/10)
Ceiling [eqn. E]	#####	#####	#####	#####	#####	#####	#####	#####					Srr/S x 10^(-Rrr/10)
All ventilators [10 x log "B"]	-18.2	-22.2	-24.5	-28.8	-33.0	-41.4	-51.7	-51.7					
Glazing [10 x log "C"]	-27.7	-33.7	-29.7	-34.7	-44.7	-47.7	-44.7	-44.7					
External wall [10 x log "D"]	-35.5	-37.5	-42.5	-52.5	-60.5	-63.5	-68.5	-68.5					
Ceiling [10 x log "E"]	#####	#####	#####	#####	#####	#####	#####	#####					
All elements combined [eqn. F]	-17.6	-21.7	-23.3	-27.8	-32.7	-40.5	-43.9	-43.9					Log sum of equations B,C,D,E
Equiv. absorption area of rec. room (m^2)	15	15	15	15	15	15	15	15					
10 x log(S/A) [eqn. G]	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4					
Façade shape correction, DL_{fs}	0	0	0	0	0	0	0	0					

	63	125	250	500	1k	2k	4k	8k	dBA	Target	Exc.	
Internal Leq,2	20	20	21	17	14	10	6	-9	19	30	-11	Equations (A+F+G) - DLfs +3 dB
Internal Lmax,2	20	29	29	27	22	15	5	0	28	45	-17	Equations (A+F+G) - DLfs +3 dB

A-weighted spectra

A-weightings:	-26	-16	-9	-3	0	1	1	-1	dB Sum	Target	Exc.
Internal LAeq,2	-6	4	12	14	14	11	7	-10	19.4	30	-11
Internal LAmax,2	-6	13	20	24	22	16	6	-1	27.8	45	-17

Noise Ingress Calculation

Project:	Watmore Lane, Winnersh	**Calcs By:**	YH
Description:	East façade facing M4	**Date:**	29/04/25
Plot/Flat No:	–	**Calc ref:**	10
Room Name:	dining kitchen	**Period:**	DT

Calculation is based on methodology within BS 8233:2014 & BSEN ISO 12354-3. The following equation is utilised:

$$L_{internal} = L_{external} - \Sigma R + 10 \log S/A - DL_{ts} + 3$$

where A = 0.16V/T

and DL_{ts} is a correction to account for the influence of façade shape (e.g. where balconies or terraces are present)

This can be broken down further to:

$L_{eq,2} = L_{eq,ff}+10x\log((A_0/Sx10^{(-D_{n,e}/10)})+(S_{wi}/Sx10^{(-R_{wi}/10)})+(S_{ew}/Sx10^{(-R_{ew}/10)})+(S_{rr}/Sx10^{(-R_{rr}/10)}))+10x\log(S/A)-DL_{ts}+3$

The above terms are described below.

Description	Term	Value		Room assessed: dining kitchen External wall			Window		Notes
Total facade area (m2)	S_f	16.8		Width (m):	7	Total linear (m): 7	Linear (m):	1.2	0
Window area (m2)	S_{wi}	1.2		Depth (m):	3		Height (m):	1	
External wall area (Sf - Swi)	S_{ew}	15.6		Height (m):	2.4				
Area of ceiling (m2)	S_{rr}	0.0	0						
Total area of elements (Sf + Srr)	S	16.8							
Volume of receiving room (m3)	V	50.4							
Reference absorption area (m2)	A_0	10							
Number of ventilators in facade:		1							
Façade shape correction	DL_{ts}	0	See Annex C of BS EN 12354-3						

	Octave band centre frequency, Hz												
	63	125	250	500	1k	2k	4k	8k	dBA	R_w	C_{tr}	$R_w + C_{tr}$	Notes
External Leq, freefield (dB Leq,ff)	64	57	54	51	52	50	47	47	57	-	-	-	Freefield LAeq level
External Lmax, freefield (dB Lmax,ff)										-	-	-	Freefield LAmax level
Dne of each ventilator	16	20	22	27	31	39	49	49		31	-4	27	Passivent Basic Airscoop
Total Dne of all ventilators	16	20	22	27	31	39	49	49		31			
SRI of window (Rwi)	18	24	20	25	35	38	35	35		31	-4	27	4/12/4
SRI of external wall (Rew)	35	37	42	52	60	63	68	68		54	-6	48	Calc 5 - house walls - brick outer
SRI of roof and ceiling (Rrr)													
Rev time of receiving room (T) - secs	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5					
All ventilators [eqn. B]	0.015	0.0061	0.004	0.001	5E-04	7E-05	7E-06	7E-06					A0/S x 10^(-Dne/10)
Glazing [eqn. C]	0.001	0.0003	7E-04	2E-04	2E-05	1E-05	2E-05	2E-05					Swi/S x 10^(-Rwi/10)
External wall [eqn. D]	3E-04	0.0002	6E-05	6E-06	9E-07	5E-07	1E-07	1E-07					Sew/S x 10^(-Rew/10)
Ceiling [eqn. E]	#####	######	#####	#####	#####	#####	#####	#####					Srr/S x 10^(-Rrr/10)
All ventilators [10 x log "B"]	-18.2	-22.2	-24.5	-28.8	-33.0	-41.4	-51.7	-51.7					
Glazing [10 x log "C"]	-29.5	-35.5	-31.5	-36.5	-46.5	-49.5	-46.5	-46.5					
External wall [10 x log "D"]	-35.3	-37.3	-42.3	-52.3	-60.3	-63.3	-68.3	-68.3					
Ceiling [10 x log "E"]	#####	######	#####	#####	#####	#####	#####	#####					
All elements combined [eqn. F]	-17.8	-21.8	-23.7	-28.1	-32.8	-40.7	-45.3	-45.3					Log sum of equations B,C,D,E
Equiv. absorption area of rec. room (m^2)	16	16	16	16	16	16	16	16					
10 x log(S/A) [eqn. G]	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2					
Façade shape correction, DL_{ts}	0	0	0	0	0	0	0	0					

	63	125	250	500	1k	2k	4k	8k	dBA	Target	Exc.	
Internal Leq,2	49	39	34	26	23	12	4	5	30	35	-5	Equations (A+F+G) - DLfs +3 dB
Internal Lmax,2										N/a		Equations (A+F+G) - DLfs +3 dB

A-weighted spectra

A-weightings:	-26	-16	-9	-3	0	1	1	-1	dB Sum	Target	Exc.
Internal LAeq,2	23	23	25	23	23	13	5	4	30.3	35	-5
Internal LAmax,2	#####	######	#####	#####	#####	#####	#####	#####	#VALUE!	N/a	#VALUE!