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GWP ARCHITECTURE

PROPOSED RESIDENTIAL DEVELOPMENT AT GAYWOOD GREEN, KIRKBY

PLANNING STAGE NOISE IMPACT ASSESSMENT

A0176-REP01B

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1. INTRODUCTION

1.1. This report presents details of a noise impact assessment carried out in order to support a planning application for the redevelopment of a residential site at Gaywood Green, Kirkby.

1.2. The following steps have been taken in preparing the assessment and identifying any requirements for noise mitigation to protect the residents:

- Visit the application site in order to inspect the land and surroundings and to carry out a noise survey that determines existing noise levels during daytime and night-time periods;
- Use the noise survey results to determine noise levels impacting upon all of the proposed dwellings and their gardens;
- Assess the noise risk of the proposed development in accordance with ProPG guidance;
- Predict levels of noise ingress to habitable rooms within the proposed houses;
- If predicted noise levels in private gardens or internal noise levels within the proposed dwellings are found exceed the adopted design limits, develop recommendations for a targeted noise mitigation scheme.

1.3. A glossary of the acoustic terminology referred to in this report is presented in Appendix A.

2. SITE AND SURROUNDINGS

- 2.1. The application site is located within a residential area of Kirkby, Merseyside.
- 2.2. The triangular site is bounded to the east by the rear gardens of existing dwellings on Melbourne Crescent. To the south west the site is bounded by Gaywood Avenue, on the opposite side of which lies Southdene Community Centre and a small surface car park. The site is bounded to the north west by Broad Lane, on the opposite side of which are houses.
- 2.3. The site previously contained four 11 storey residential tower blocks.
- 2.4. The location of the application site is indicated in Figure 1.

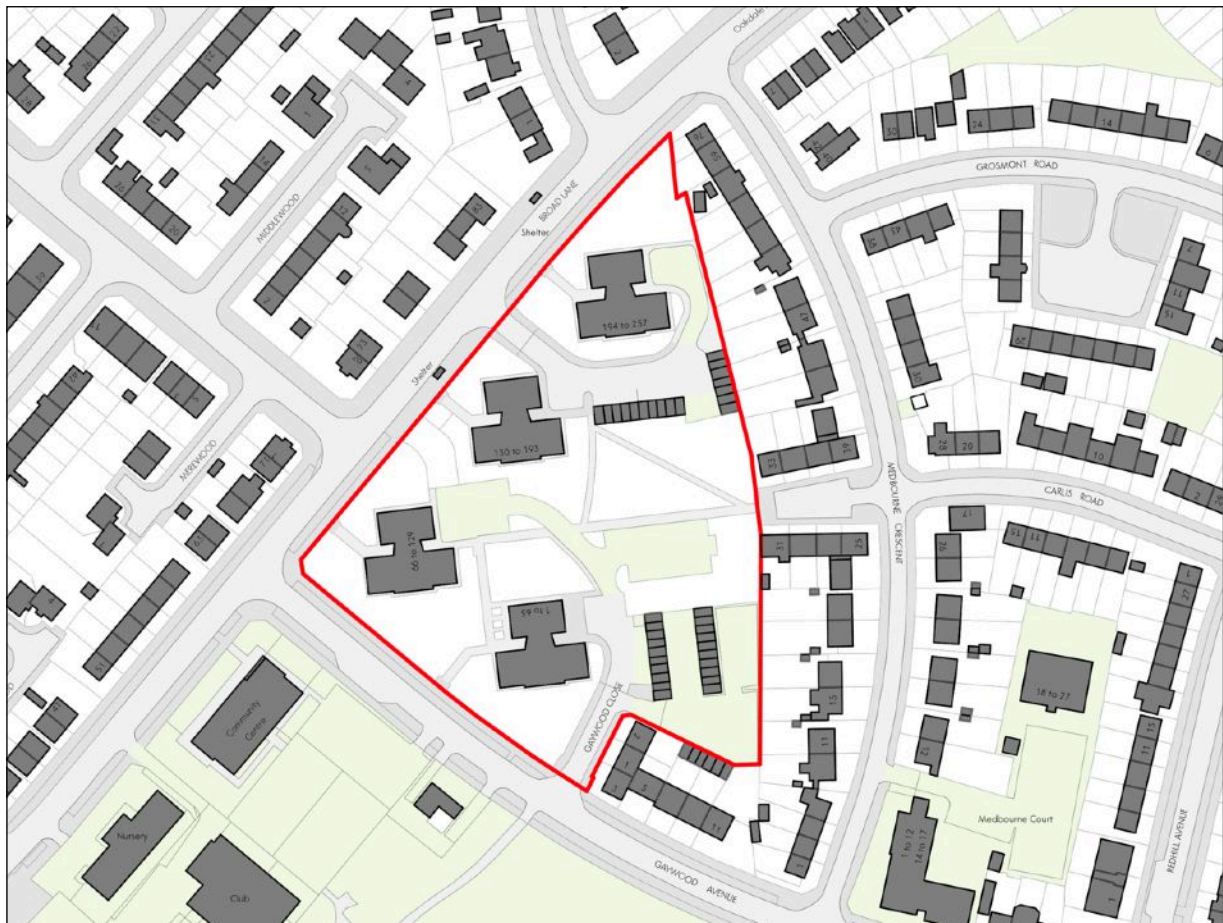


Figure 1 Site Location and Boundary

3. DESCRIPTION OF PROPOSED DEVELOPMENT

- 3.1. The proposed development will include the construction of 79 new-build dwellings comprising 30 two, three and four bedroom houses, 12 inspired living units and 37 apartments with associated car parking and landscaping.
- 3.2. The new dwellings will be of traditional masonry construction.
- 3.3. The background ventilation strategy for the proposed dwellings comprises distributed mechanical extract ventilation (dMEV) involving extract fans continuously operating in wet rooms with make-up air arriving via trickle vents in habitable rooms.
- 3.4. The proposed site layout is shown in Figure 2.



Figure 2 Layout of Proposed Development



4. PLANNING GUIDANCE

National Planning Policy Framework

- 4.1. National Planning Policy is guided by the National Planning Policy Framework (NPPF) which was introduced in 2012 and most recently updated during December 2024. The document sets out the Government's overall planning policies and advises how these are expected to be complied with.
- 4.2. Paragraph 187 of the NPPF states that the planning system 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.'
- 4.3. Paragraph 198 of the NPPF goes on to recommend that '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:
- 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;
 - identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason.'

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 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.

- 4.4. Extension of these concepts 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.

- 4.5. Specific noise limits for LOAEL and SOAEL have yet to be defined, however, guidance from other acoustic standards may be employed to determine suitable levels within the overall principal of the National Planning Policy Framework.

National Planning Policy Guidance

- 4.6. National Planning Practice is guided by the National Planning Policy Framework. With regard to Noise the Framework states the following:

Local planning authorities' plan-making and decision taking should 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.

- 4.7. 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.

- 4.8. Table 1 overleaf summarises the likely average responses to noise based upon the levels of exposure as advised by the government's Planning Practice Guidance.



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

Table 1 Noise Exposure Hierarchy Based on Average Likely Response



5. ACOUSTICS STANDARDS AND GUIDANCE

ProPG: Planning and Noise - Professional Practice Guidance

5.1. ProPG was introduced in 2017 with the aim of delivering sustainable development and promoting good health and well-being through the effective management of noise which may impact on new residential developments. The guidance aims to complement the national planning policy and encourages the use of good acoustic design at the earliest phase of the planning process. It builds upon the recommendations of various other guidance documents including NPPF, NPSE, BS8233 and World Health Organisation guidelines.

5.2. The guidance is applicable to new residential developments which would be exposed predominantly to noise from existing transport sources. The ProPG advocates a risk based approach to noise using a two-stage process:

- Stage 1 – an initial noise risk assessment of the proposed development site; and
- Stage 2 – a systematic consideration of four key elements: –
 - Element 1 – demonstrating a ‘Good Acoustic Design Process’;
 - Element 2 – observing internal ‘Noise Level Guidelines’;
 - Element 3 – undertaking an ‘External Amenity Area Noise Assessment’; and
 - Element 4 – consideration of ‘Other Relevant Issues’.

5.3. The ProPG approach is underpinned by the preparation and delivery of an ‘Acoustic Design Statement’ (ADS), whereby the higher the risk for noise at the site, the more detailed the ADS. The ADS should address the following issues:

- Present the initial site noise risk assessment, including the pre-development acoustic conditions prior to development;
- Describe the external noise levels that occur across the site both before and after any necessary mitigation measures have been incorporated. The external noise assessment with mitigation measures in place should use an informed judgement of typical worst-case conditions;



- Demonstrate how good acoustic design is integrated into the overall design and how the proposed acoustic design responds to specific circumstances of the site;
- Confirm how the internal noise level guidelines will be achieved, including full details of the design measures and building envelope specifications;
- A detailed assessment of the potential impact on occupants should be undertaken where individual noise events are expected to exceed 45 dB L_{AFmax} more than 10 times a night inside bedrooms;
- Priority should be given to enable the use of openable windows where practical across the development. Where this is not practical to achieve the internal noise level guidelines with windows open, then full details of the proposed ventilation and thermal comfort arrangements must be provided;
- Present the findings of the external amenity area noise assessment;
- Present the findings of the assessment of other relevant issues;
- Confirm for a low risk site how adverse impacts of noise will be mitigated and minimised;
- Confirm for a medium or high noise risk site how adverse impacts of noise will be mitigated and minimised and clearly demonstrate that a significant adverse noise impact has been avoided.

5.4. ProPG target noise levels are based on existing guidance from BS8233 and WHO (see below). Table 2 below outlines the guidance noise levels for different room types during day and night periods.

Location	Activity	Daytime (07:00-23:00)	Night-time (23:00-07:00)
Living Rooms	Resting	35dB $L_{Aeq,16hour}$	-
Bedrooms	Sleeping (daytime resting)	35dB $L_{Aeq,16hour}$	30dB $L_{Aeq,8hour}$ 45dB L_{AFmax}
Dining Rooms	Dining	40dB $L_{Aeq,16hour}$	-

Table 2 ProPG Guideline Indoor Ambient Noise Levels for Dwellings

5.5. The footnotes to this table within ProPG suggest that internal noise level limits can be relaxed by up to 5 dB where development is considered necessary or desirable, and still represent “reasonable” internal conditions. They also suggest that in such cases, external levels which



exceed WHO guidance target levels (see WHO section below) may still be acceptable provided that reasonable internal noise levels are achieved. Although, where the acoustic environment of external amenity areas is intrinsic to the overall design, “noise levels should ideally not be above the range 50 to 55 dB $L_{Aeq,16hr}$ ”. The wording of ProPG (and BS 8233:2014) is clear that exceedance of guideline noise levels in external areas should not prohibit the development of desirable developments in any event.

BS8233:2014 Guidance on Sound Insulation and Noise Reduction for Buildings

- 5.6. This standard provides recommended guideline values for internal noise levels within dwellings which are similar in scope to guideline values contained within the World Health Organisation (WHO) document, Guidelines for Community Noise (1999). The guideline average noise levels recommended by BS8233 are the same as those shown in Table 2.
- 5.7. BS8233:2014 adopts guideline external noise values provided in WHO for external amenity areas such as gardens and patios. The standard states that it is “desirable” that the external noise does not exceed 50 dB $L_{Aeq,T}$ with an upper guideline value of 55 dB $L_{Aeq,T}$ whilst recognising that development in higher noise areas such as urban areas or those close to the transport network may require a compromise between elevated noise levels and other factors that determine if development in such areas is warranted. In such circumstances, the development should be designed to achieve the lowest practicable noise levels in external amenity areas.

World Health Organisation (WHO) Guidelines on Community Noise 1999

- 5.8. The WHO Guidelines 1999 recommends that to avoid sleep disturbance, indoor night-time guideline noise values of 30 dB L_{Aeq} for continuous noise and 45 dB L_{AFmax} for individual noise events should be applicable. It is to be noted that the WHO Night Noise Guidelines for Europe 2009 makes reference to research that indicates sleep disturbance from noise events at indoor levels as low as 42 dB L_{AFmax} . The number of individual noise events should also be taken into account and the WHO guidelines suggest that indoor noise levels from such events should not exceed approximately 45 dB L_{AFmax} more than 10 – 15 times per night.



5.9. The WHO document recommends that steady, continuous noise levels should not exceed 55 dB L_{Aeq} on balconies, terraces and outdoor living areas. It goes on to state that to protect the majority of individuals from moderate annoyance, external noise levels should not exceed 50 dB L_{Aeq} .



6. ENVIRONMENTAL NOISE SURVEY

Survey Method

- 6.1. Attended noise measurements were carried out at the application site by Auditive during the afternoons of 9th and 10th October 2023 with continuous unattended measurements taken during the intervening evening and overnight periods.
- 6.2. The measurements were taken at the following positions:
- Position 1 South west site boundary opposite entrance to community centre's carpark
- Position 2 North west site boundary
- 6.3. The demolition of tower blocks 3 and 4 within the northern area of the site was in progress during the daytime survey periods. This involved the top-down removal of building elements using high-reach excavators fitted with claws. The dominant sources of noise associated with these activities included the excavators' engines and intermittent impulsive noise as debris fell to ground from height. The measurement positions were therefore selected in order to assess traffic noise emissions from Broad Lane and Gaywood Avenue whilst maximising the acoustic screening afforded by Tower Blocks 1 and 2 against demolition noise.
- 6.4. A larger excavator with a noticeably louder engine was in use during the second day of measurements (10th October).
- 6.5. The measurement positions are indicated in Figure 3. At both positions the microphone was set on a 3m high pole above the plywood site hoarding. Both positions were subject to free-field¹ conditions.
- 6.6. All significant sources of noise affecting the measurement positions were noted by the survey engineer and audio recordings were made simultaneously during all measurements facilitating the identification specific noise sources during post processing of the results.
- 6.7. Noise measurements were undertaken in general accordance with the guidance presented in British Standard 7445:2003 *Description and measurement of environmental noise*.

¹ Free-field measurements are those taken in the absence of reflections from nearby buildings and other vertical surfaces.

6.8. Calibration checks were carried out immediately before and after the survey periods using an acoustic calibrator; no drift in the instrumentation's sensitivity was detected.

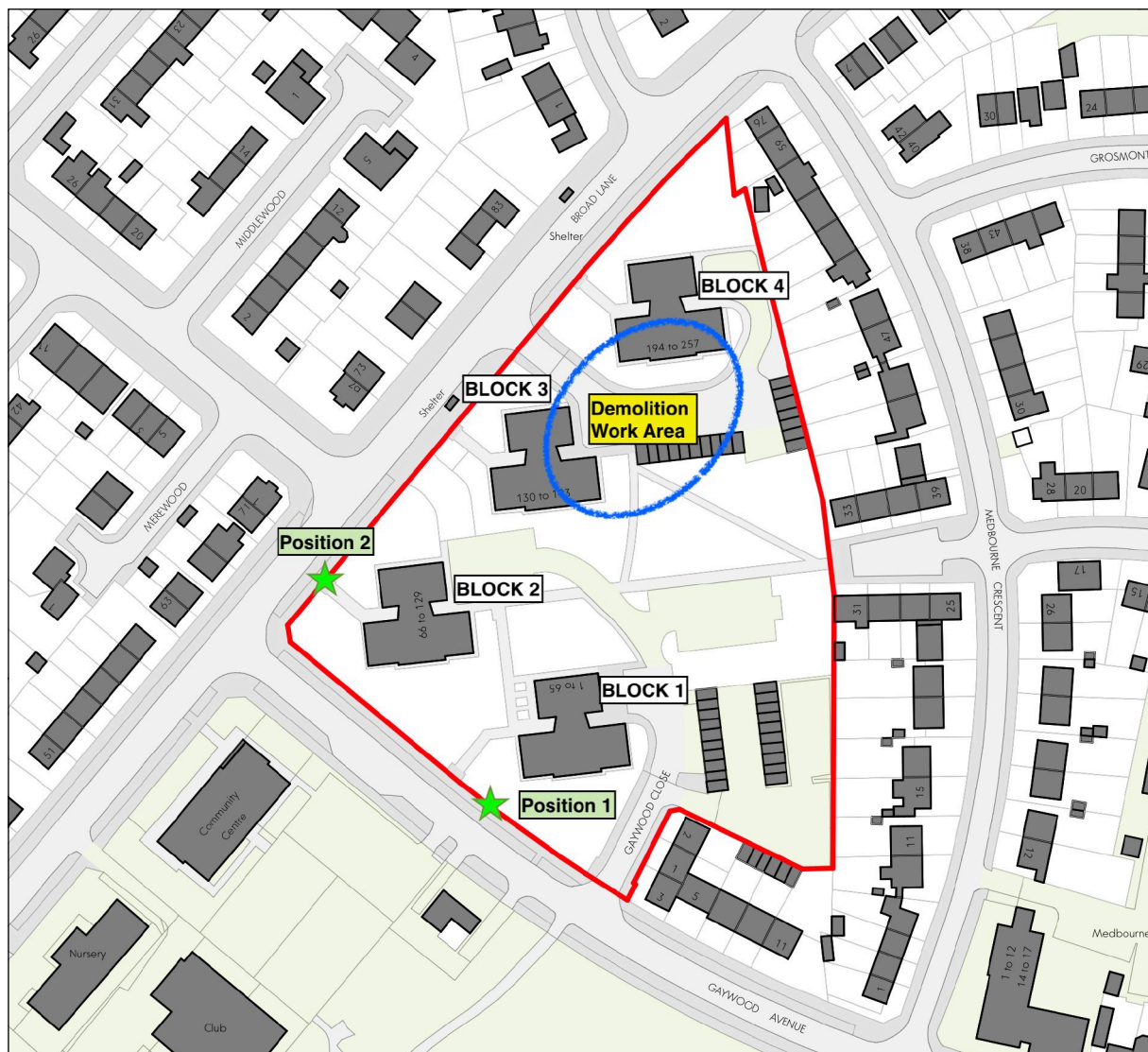


Figure 3 Noise Measurement Positions

6.9. The survey results are presented in terms of the following acoustic parameters:

L_{Aeq} is the equivalent continuous sound level. It is a type of average and is used to describe a fluctuating noise in terms of a single noise level over the measurement period. It is typically used as a descriptor for ambient noise.

L_{AFmax} is the instantaneous maximum noise level measured during the survey period.



L_{AF90} is the sound level that is exceeded for 90% of the survey period. It is typically used as a descriptor for background noise.

The “A” suffix denotes the fact that the sound levels have been “A-weighted” in order to account for the non-linear sensitivity of human hearing at different frequencies. All sound levels in this report are expressed in terms of decibels (dB) relative to 2×10^{-5} Pa.

6.10. Full noise survey details and results are presented in Appendix B.

Survey Results

6.11. The results of the attended daytime noise measurements are summarised in Table 3 and are presented in Appendix B.

Measurement Location	Measured Daytime Noise Levels		
	Ambient Sound Level dB, L_{Aeq}	Range of Maxima dB, L_{AFmax}	Representative Background Sound Level dB, L_{A90}
Position 1	56	66 - 73	45
Position 2	66	79 - 83	54

Table 3 Summary of Attended Noise Survey Results (free-field)

6.12. Figure 4 contains the time history plot of noise levels measured during the unattended survey period at Position 2. Average daytime and night-time noise levels calculated from these extended measurements were 64dB L_{Aeq} and 56dB L_{Aeq} , thereby confirming the average night-time noise level was 8dB lower than the average daytime noise level. The same difference between average daytime and night-time noise levels is likely to have occurred at Position 1.

6.13. The representative² background noise level measured at Position 2 during the overnight survey period was 33dB L_{A90} .

² The representative background noise level was derived by plotting all background noise levels measured between 23:00 and 07:00 on a histogram.

6.14. Maximum noise levels measured at Position 2 during the overnight noise survey are plotted against time in Figure 5 and were predominantly generated by passing vehicles, typically ranging from 75dB L_{Amax} to 80dB L_{Amax} .

6.15. The dominant source of noise in the area during daytime is road traffic. Others sources of noise affecting the daytime measurements were related to the demolition activities including steady underlying noise of excavator engines and intermittent impulsive noise from falling building debris.

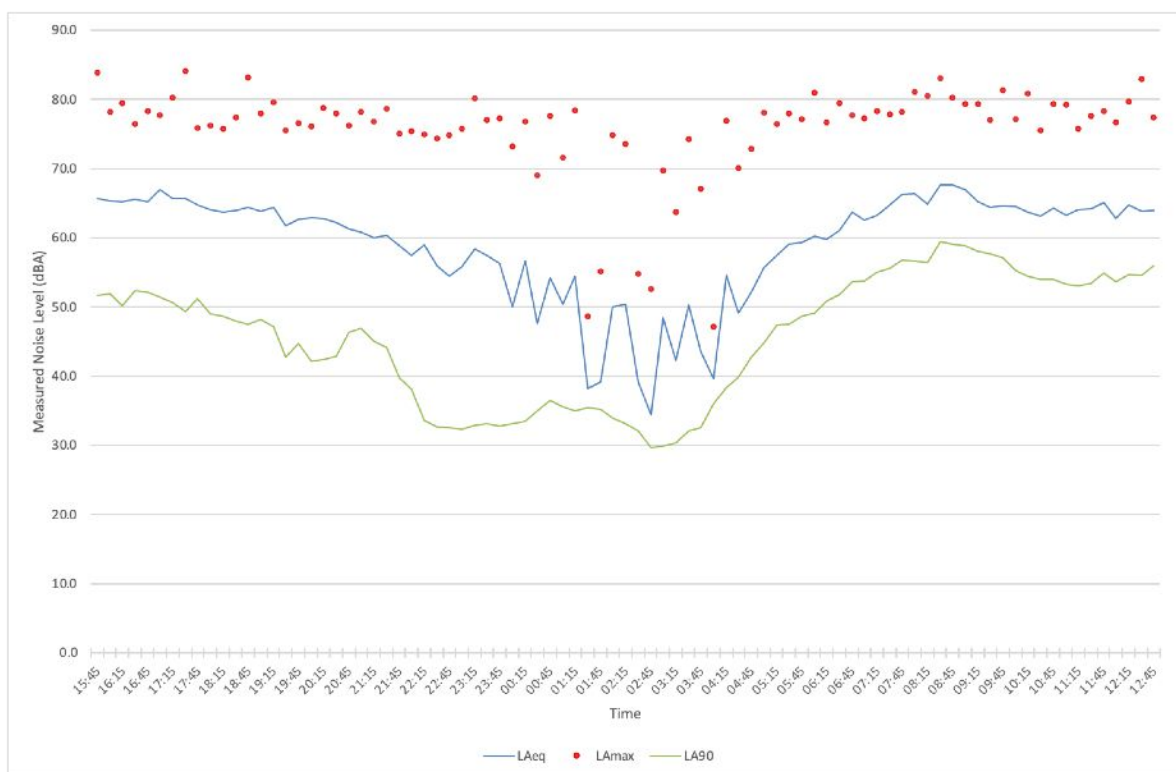


Figure 4 Overnight Maximum Noise Levels at Position 2

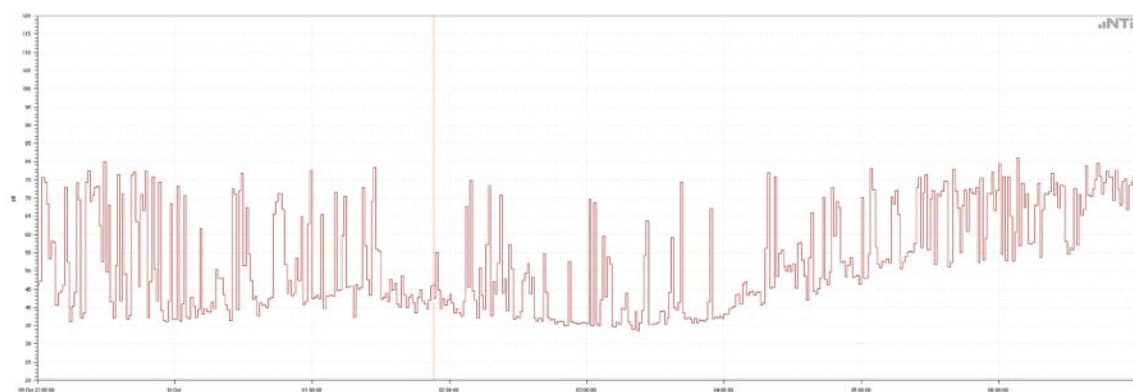


Figure 5 Overnight Maximum Noise Levels at Position 2



6.16. The levels of noise measured at Positions 1 and 2 have been used to calibrate a noise propagation model for the proposed development, thereby allowing the noise risk of the dwellings without mitigation to be assessed using ProPG guidance. This exercise is discussed in the following sections.



7. ACOUSTIC MODELLING AND NOISE RISK

- 7.1. A sound propagation model has been compiled for the proposed development using Cadna-A software in order to allow noise levels impacting upon all elevations of the proposed dwellings to be calculated.
- 7.2. The model incorporates the proposed massing of the buildings, 1.8m high garden fences, ground topology and local roads including Broad Lane and Gaywood Avenue.
- 7.3. Calculations within the model have been carried out in accordance with the method specified within *Calculation of Road Traffic Noise* (DoT, 1988). This method takes into account several factors including the ground absorption, air absorption, screening and attenuation with distance from the source.
- 7.4. The model was calibrated by including receptor points corresponding to the measurement positions used during the noise survey and by adjusting noise emission levels from the roads until the average traffic noise levels calculated at the receptor points matched those measured during the surveys. This exercise was carried out before adding the proposed buildings, thereby representing conditions at the development site during the period when the noise survey was carried out.
- 7.5. The general arrangement of the sound propagation model is shown in Figure 6 and the calculated daytime traffic noise contours across the site are shown in Figure 7.
- 7.6. Figures 8 and 9 show the calculated average traffic noise levels at the facades of each new dwelling during daytime and night-time periods respectively. Daytime facade noise levels have been calculated at ground floor level and night-time facade noise levels at first floor level.
- 7.7. Figure 8 confirms that the nearest dwellings to Broad Lane will be subject traffic noise levels of up to 60dB L_{Aeq} during daytime and traffic noise level outside the nearest dwellings to Gaywood Avenue will reach up to 54dB L_{Aeq} .
- 7.8. Figure 9 confirms that the nearest dwellings to Broad Lane will be subject traffic noise levels of up to 54dB L_{Aeq} during night-time and traffic noise levels outside the nearest dwellings to Gaywood Avenue will reach up to 49dB L_{Aeq} .
- 7.9. Traffic noise levels impacting upon dwellings located further from the local roads are calculated to fall below 45dB L_{Aeq} during daytime and at night.



Figure 6 General Arrangement of Noise Propagation Model

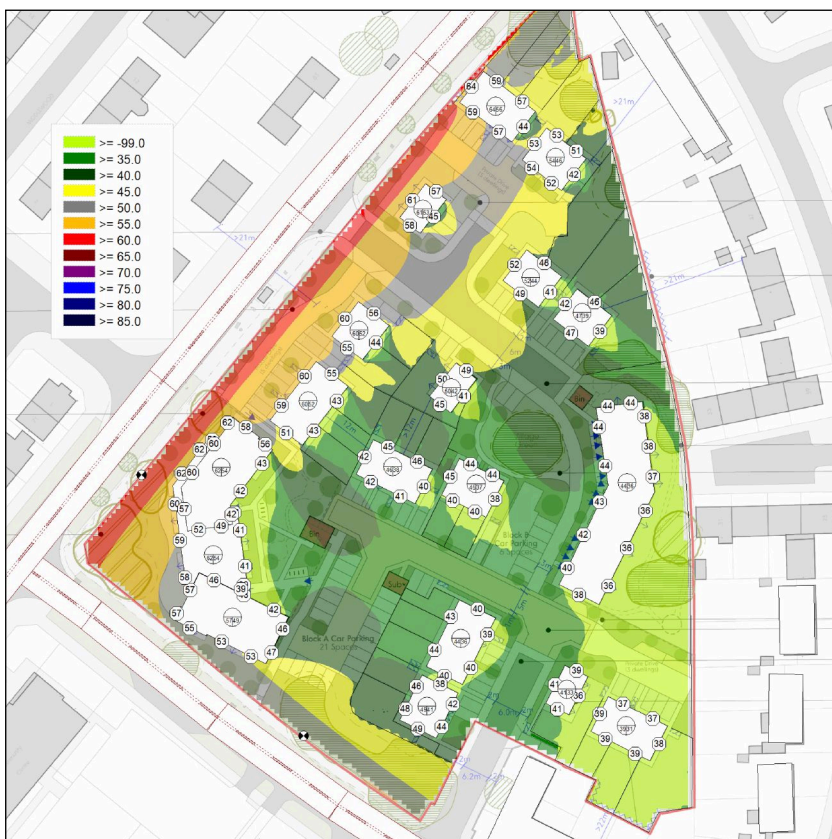


Figure 7 Daytime Traffic Noise Contours (L_{Aeq})

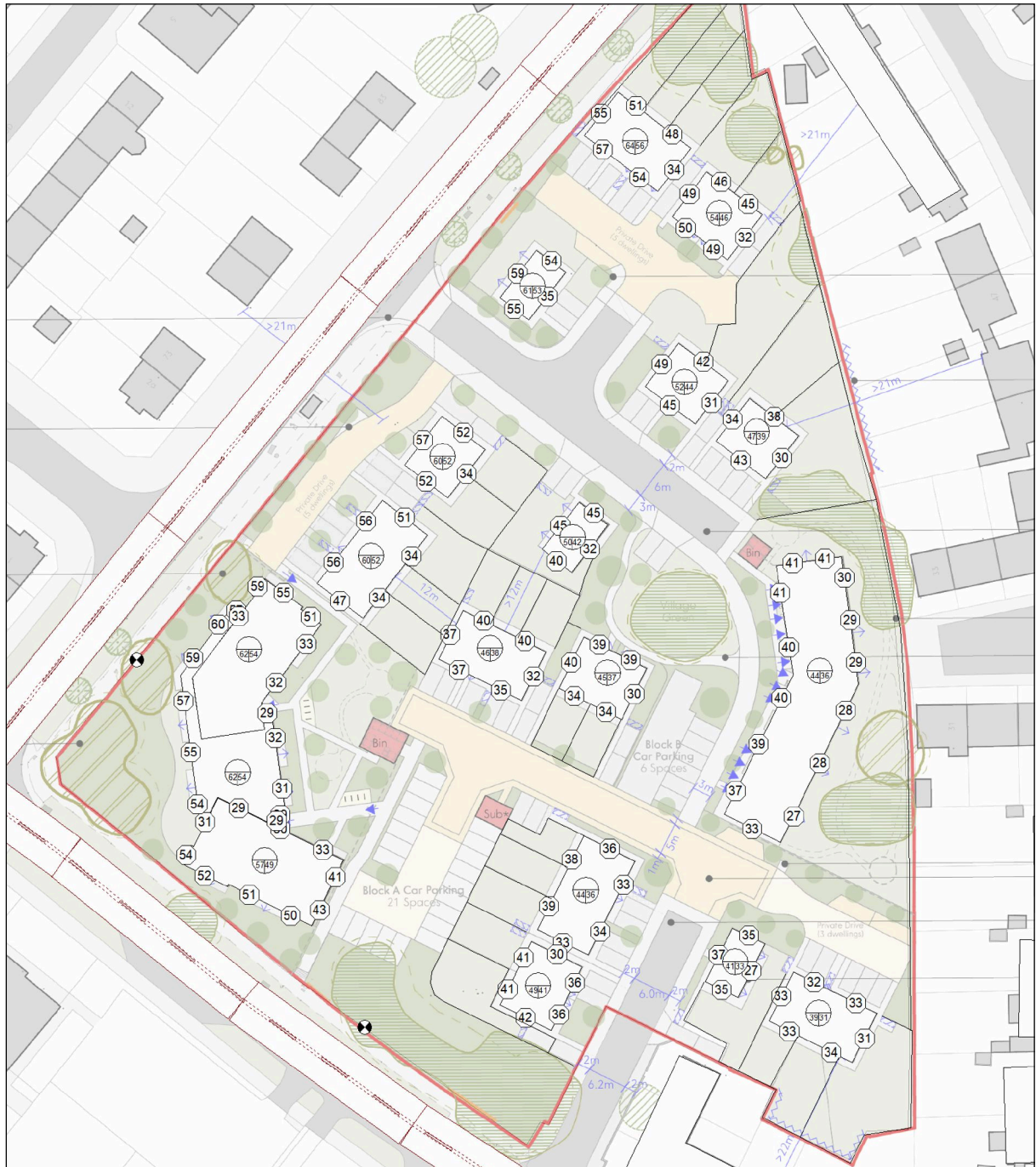


Figure 8 Daytime Facade Noise Levels (L_{Aeq})

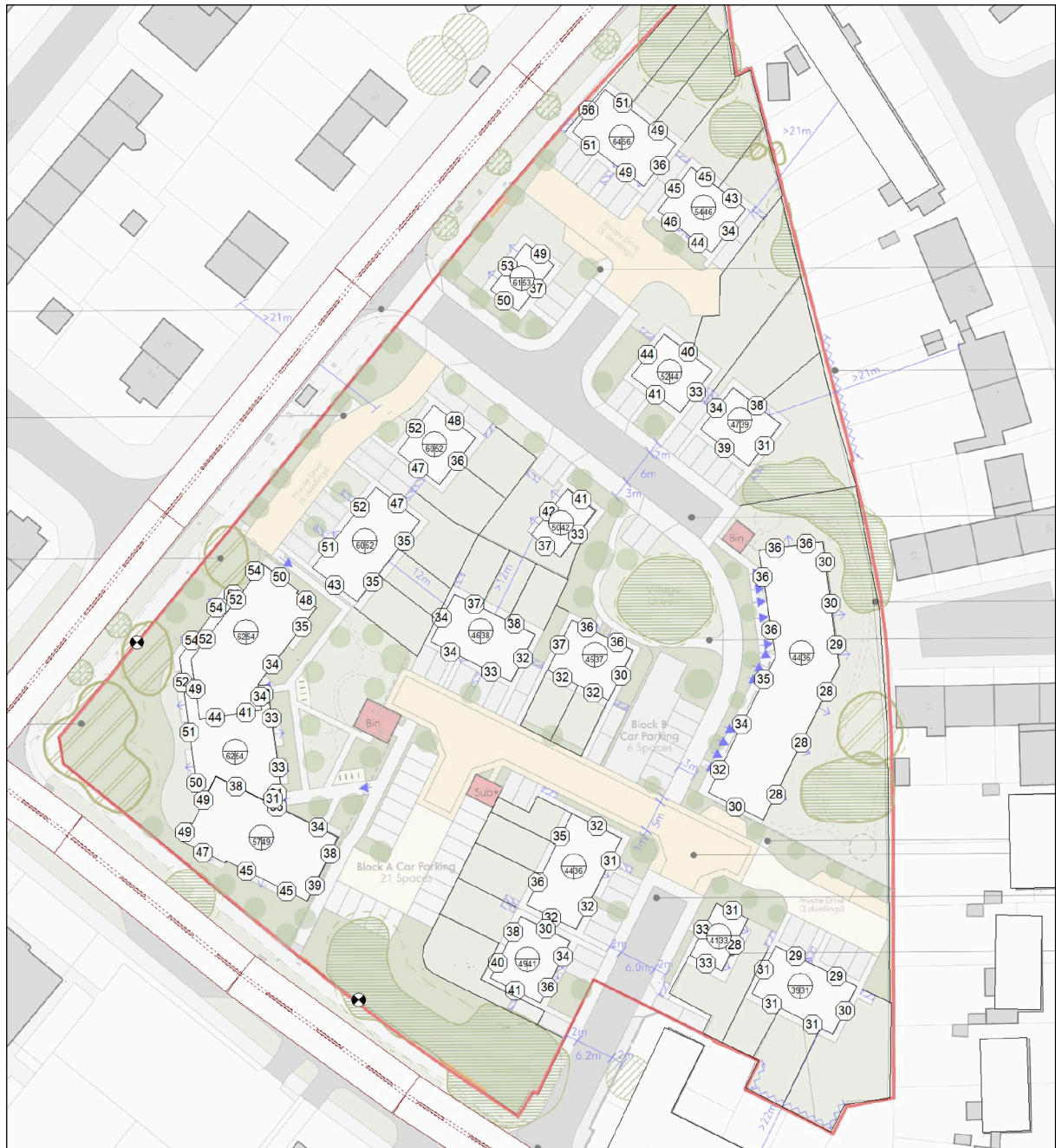


Figure 9 Night-time Facade Noise Levels (L_{Aeq})

7.10. Instantaneous maximum noise levels produced by individual passing vehicles will fall within the range of 70dB L_{Amax} to 75dB L_{Amax} immediately outside the nearest dwellings to Broad Lane and Gaywood Avenue.

7.11. Daytime average noise levels calculated in private garden areas are shown in Figure 10. The figure confirms that traffic noise within all private gardens will lie below 55dB L_{Aeq} and will only exceed 50dB L_{Aeq} in the private gardens of Blocks 1 and 2 which lie close to Broad Lane.



Figure 10 Daytime Traffic Noise Contours (L_{Aeq})

7.12. The surveyed and calculated levels of road traffic noise impacting upon the proposed development have been assessed against the ProPG noise risk levels to determine the potential effect of noise on the proposed development without mitigation measures in place.

7.13. As can be seen in Table 4, the highest average road traffic noise levels impacting upon the most exposed elevations within the development during daytime and night-time will be 60dB L_{Aeq} and 54dB L_{Aeq} respectively. Table 4 confirms these noise levels place the most exposed areas of the development within the medium risk category according to the ProPG guidance, thereby requiring good acoustic design practice in order to reduce impacts on sensitive areas within the



development. The noise risk will reduce to medium/low for dwellings with elevations that are more remote from and/or shielded from road traffic noise.

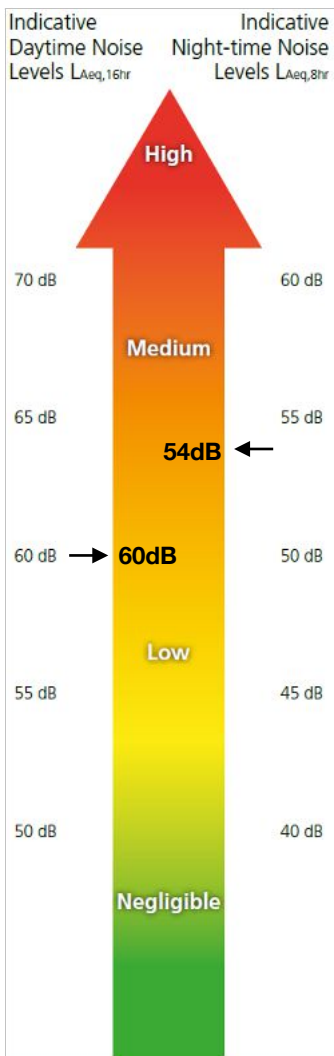
Noise Risk Assessment	Potential Effect Without Mitigation	Pre-Planning Application Advice
 Indicative Daytime Noise Levels $L_{Aeq,15hr}$ Indicative Night-time Noise Levels $L_{Aeq,8hr}$ High 70 dB 65 dB 60 dB 55 dB 50 dB 45 dB 40 dB Medium Low Negligible 54 dB 60 dB	Increasing risk of adverse effect	High noise levels indicate that there is an increased risk that development may be refused on noise grounds. This risk may be reduced by following a good acoustic design process that is demonstrated in a detailed ADS. Applicants are strongly advised to seek expert advice.
		As noise levels increase, the site is likely to be less suitable from a noise perspective and any subsequent application may be refused unless a good acoustic design process is followed and is demonstrated in an ADS which confirms how the adverse impacts of noise will be mitigated and minimised, and which clearly demonstrate that a significant adverse noise impact will be avoided in the finished development.
		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.
Typical Night-time L_{AFmax} (dB)	> 60dB ?	L_{AFmax} Level Comment
75	YES	An indication that that there may be more than 10 noise events at night-time with $L_{AFmax} > 60$ dB means the site should not be regarded as negligible risk.
Notes: a) Indicative noise levels should be assessed without the 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.		

Table 4 ProPG Noise Risk Level Assessment



8. NOISE MITIGATION SCHEME

- 8.1. The design limits for levels of noise ingress to the proposed dwellings recommended by BS8233 (see Table 2) have been adopted when assessing noise mitigation requirements for protecting the proposed development against road traffic noise. Noise mitigation for the proposed development must therefore be targeted to control noise ingress to within these limits in order to achieve acceptable internal levels of acoustic comfort.
- 8.2. The starting point for assessing compliance with the internal noise limits shown in Table 2 is to determine the composite sound reduction performance of the windows, non-glazed areas of the facade and any background ventilation openings. This information together with the levels of external noise impacting upon each residential space are then used to calculate internal noise levels during daytime and at night in accordance with the guidance presented in Annex G of British BS8233. The method takes into account the relative area of each type of element used within the envelope, the volume of the rooms and the estimated reverberation times therein. If predicted internal noise levels are found to exceed the adopted design limits alternative 'upgraded' facade elements or acoustically attenuated background ventilation measures are then reviewed within the calculations until the internal noise levels do not exceed the adopted design limits.
- 8.3. In order to meet the adopted internal design noise limits it has been determined that any trickle ventilators fitted in the closest bedrooms to Broad Lane and Gaywood Avenue should be rated to provide a sound reduction of at least 39dB $D_{n,e,w}$ in the open position. The plots to which this requirement applies are identified in Figure 11. The dMEV background ventilation strategy for these dwellings should will allow adequate background ventilation rates³ to be achieved without the requirement for opening windows. Windows may be openable to provide purge ventilation throughout the development.
- 8.4. 'Standard' double (e.g. 4-16-4) or triple glazing units may be fitted throughout the development. Such units typically provide a sound reduction of at least 30dB R_w .
- 8.5. Given the predicted levels of noise that will impact the development at night, the average internal noise level within the most exposed bedrooms will lie below the 40dB $L_{Aeq,8hour}$ limit recommended by Part O of the Building Regulations if windows are opened to provide relief

³ Whole dwelling ventilation rates as defined within Part F of the Building Regulations

from overheating for up to two hours. However, instantaneous maximum noise levels within the nearest bedrooms to Broad Lane and Gaywood Avenue will exceed the Part O design limit of 55dB L_{Amax} if windows are opened to provide temperature relief at night. Overheating mitigation (e.g. reduced window sizes, increased window reveal depth, provision of overhangs etc) should therefore be considered for any plots fronting onto Broad Lane and Gaywood Avenue that are identified as being subject to an overheating risk at night.

- 8.6. The sound propagation model has confirmed that average daytime noise levels within all private gardens will not exceed 55dB L_{Aeq} and will, in the majority of gardens, lie below 50dB L_{Aeq} assuming standard 1.8m garden fences are installed throughout the development. No additional mitigation measures are therefore necessary to reduce traffic noise in private gardens.



Figure 11 Recommended Noise Mitigation Scheme

9. ACOUSTIC DESIGN STATEMENT

9.1. Table 5 contains an Acoustic Design Statement summarising the issues considered in determining the noise risk of the site and the noise mitigation requirements.

Typical Issues for Low / Medium / High Risk Sites	Statement
Relevant noise sources identified	The assessment has taken into consideration all significant noise sources observed during daytime and night-time monitoring periods. Traffic noise is dominant although low in terms of its absolute level.
Multiple source contributions carefully quantified	Contributions from individual sources have been examined using the survey data.
Assess extent of noise risk for unmitigated site (current and foreseeable future, 15 years ahead)	Unmitigated site will be subject to a medium risk of noise intrusion for the most exposed plots near local roads.
Alternative site layouts considered	Not considered necessary.
Opportunities to mitigate the noise sources within the site	Not required.
Opportunities to mitigate the noise source outside owned land; Physical mitigation; Operational management	Unable to mitigate existing off-site noise sources in the area.
Maximise separation	Not applicable.
Noise barriers – screening opportunities	Not required.
Site layout – protecting residential units	Proposed layout is suitable without mitigation.
Design external amenity spaces (e.g. balconies) to reduce noise entering sensitive rooms	Daytime noise levels in private gardens will be acceptable without mitigation.
Access to quiet open space on or off-site	Private gardens.
Orientation of noise sensitive rooms away from the source of noise exposure i.e. quiet facades	Not required.
Consideration of alternative acoustic options	Not required.
Window location & size on affected facades	Not applicable.
Innovative facade and window designs e.g. plenum windows	Not required.
Facade insulation design	Masonry or lightweight facade elements will provide acceptable attenuation.
Ventilation – natural, from quiet facade	Acoustically rated trickle vents required for bedrooms in most exposed plots near local roads.
Complete Acoustic Design Process throughout	Yes

Table 5 Acoustic Design Statement



10. CONCLUSIONS

- 10.1. The noise environment at the application site has been surveyed and found to be controlled by road traffic on local roads during daytime and at night. The associated noise risk, as assessed in accordance with ProPG guidance, has been determined as medium for the most exposed plots lying close to Broad Lane. Plots lying further from local roads will be subject to a low noise risk.
- 10.2. Levels of traffic noise ingress to all proposed dwellings will meet BS8233 internal design noise limits during day and night if acoustically rated trickle vents (39dB $D_{n,e,w}$ when open) are fitted within the bedrooms of plots that lie close to Broad Lane. These plots are identified in Figure 11 of this report.
- 10.3. Average noise levels during daytime within the majority of private gardens will lie below the BS8233/WHO recommended limit of 50dB L_{Aeq} . Noise within the nearest private gardens to Broad Lane (Blocks 1 and 2) will lie within the range of 50dB L_{Aeq} to 55dB L_{Aeq} . No additional mitigation is therefore considered necessary to reduce daytime noise levels in private gardens.



Appendix A - Glossary of Acoustic Terms

Decibel, dB

This is the unit to measure sound. The human ear has an approximately logarithmic response to acoustic pressure over a very large dynamic range (typically 20 micro-Pascals to 100 Pascals). We therefore use a logarithmic scale to describe sound pressure level, intensities and sound power levels. The logarithms used are to base 10; hence, an increase of 10 dB in sound pressure level is equivalent to an increase by a factor of 10 in acoustic pressure in Pascals. Subjectively, this corresponds to a doubling in the perceived loudness of sound.

Octave and Third Octave Bands

The human ear is sensitive to sound over a range of approximately 20 Hz to 10 kHz, and is generally more sensitive to medium and high frequencies than to low frequencies. In order to define the frequency content of a noise, the spectrum is divided into frequency bands, and the sound pressure level is measured in each band. The most commonly used frequency bands are octave bands, in which the mid frequency of each band is twice that of the band below it. For finer analysis, each octave band may be split into three one-third octave bands or in some cases, fine frequency bands.

A-Weighting

Normal hearing covers the frequency range from about 20Hz to 20KHz but sensitivity is greatest between about 500Hz and 8KHz. The "A-Weighting" is an electronic filters network incorporated in sound level meters which approximately corresponds to the frequency response of the ear. The unit of measurement of A-weighted sound level is dBA.

$L_{Aeq,T}$

The equivalent continuous A-weighted sound pressure level. It is a value of the A-weighted sound pressure level in decibels (dB) of a continuous, steady sound, that within a specified time interval, T, has the same mean squared sound pressure as the sound under consideration that varies with time.

L_{Amax}

The maximum instantaneous A-weighted sound pressure level occurring during the measurement period. L_{Amax} is often referred to when examining noise intrusion to dwellings and sleep disturbance. Acoustic design noise limits for bedrooms are often specified in terms of a permissible L_{Amax} value.



L_{Amin}

The minimum A-weighted sound pressure level occurring during the measurement period.

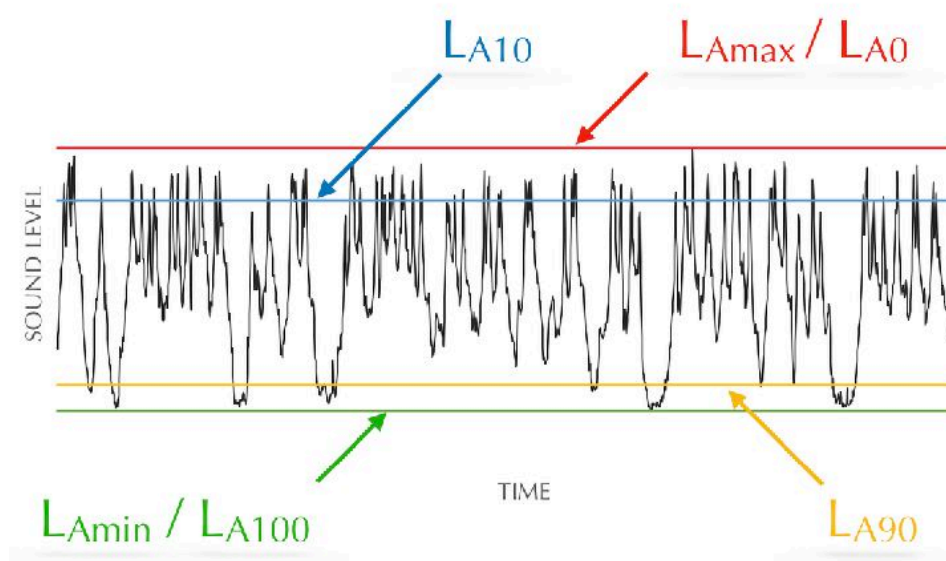
Statistical Level: L_{90}

The sound pressure level exceeded for 90% of the measurement time. Indicative of the general background noise level in the absence of any higher level short duration events that occur during the period.

Statistical Level: L_{10}

This is the sound pressure level exceeded for 10% of the measurement time. It is widely used to measure traffic noise. For a given measurement period, the L_{10} level is by definition greater than or equal to the L_{90} level.

The relationship between the parameters described above is indicated in the attached figure.



Sound Insulation

The use of structures and materials designed to reduce the transmission of sound from one room or area of a building to another, from the exterior to the interior of a building or between the exterior and interior of a building.



Appendix B - Noise Survey Details and Results

Survey Location

Gaywood Green

Kirkby

Liverpool L32

Survey Dates

9th - 10th October 2023

Weather Conditions During Survey

Daytime: Light easterly breeze (<2/ms), dry, 50% RH, overcast, 13°C

Night-time: Light easterly breeze (<2/ms), dry, 7°C

Instrumentation

Equipment Description	Type Number	Manufacturer	Serial Number	Date of Last Laboratory Calibration/Verification
Sound Level Analyser	XL2-TA	NTi Audio	A2A-11085-E0	30 and 31 August 2022
Pre-amp/Microphone	M2230	NTi Audio	6647/A15224	30 and 31 August 2022
Calibrator	CAL200	NTi Audio	12583	13 September 2023
Handheld Weather Station	Kestrel 3000	Kestrel	2673082	-
Tripod	-	-	-	-

**Table B1** - Results of Unattended Noise Survey - Position 2, 9th to 10th October 2023 (free-field)

Start Time	L _{Aeq}	L _{Amax}	L _{A90}	Sound Level (L _{eq} dB) @ Octave Band Centre Frequency (Hz)						
				63	125	250	500	1k	2k	4k
15:45	65.7	83.9	51.7	65.3	60.4	60.0	59.3	64.1	56.0	47.4
16:00	65.3	78.2	51.9	65.6	60.9	59.9	58.9	63.6	55.8	47.6
16:15	65.2	79.5	50.2	65.2	60.1	60.2	58.8	63.5	55.6	47.9
16:30	65.6	76.5	52.4	64.4	60.0	60.5	59.1	64.0	55.9	47.2
16:45	65.2	78.3	52.1	63.8	59.3	59.7	58.7	63.6	55.4	46.8
17:00	66.9	77.7	51.4	67.1	61.5	61.6	60.4	65.2	57.2	48.6
17:15	65.7	80.3	50.6	65.9	60.0	60.3	59.1	64.0	56.1	47.0
17:30	65.7	84.1	49.4	64.9	65.9	60.8	59.8	63.6	56.7	49.5
17:45	64.7	75.9	51.2	65.3	59.6	60.0	58.3	63.1	55.0	46.4
18:00	64.0	76.2	49.0	64.3	59.1	58.9	57.6	62.5	54.2	45.1
18:15	63.7	75.8	48.7	64.1	59.1	58.7	57.5	62.0	54.0	45.6
18:30	63.9	77.4	48.0	64.2	58.4	58.3	57.6	62.2	54.2	47.0
18:45	64.4	83.2	47.5	63.8	59.3	59.2	58.1	62.9	54.6	46.0
19:00	63.8	78.0	48.2	64.2	58.9	58.9	57.4	61.9	54.2	48.2
19:15	64.4	79.6	47.1	63.7	58.1	58.3	57.6	62.9	54.8	45.6
19:30	61.7	75.5	42.8	59.9	57.0	56.7	55.2	60.1	51.9	42.8
19:45	62.7	76.6	44.7	61.6	56.6	57.3	56.3	61.0	53.1	44.2
20:00	62.9	76.1	42.2	60.7	56.2	57.8	56.5	61.4	53.0	43.2
20:15	62.8	78.8	42.4	61.2	56.3	57.1	56.3	61.2	53.1	44.1
20:30	62.2	78.0	42.9	60.9	55.5	56.3	55.5	60.8	52.2	42.8
20:45	61.3	76.2	46.3	59.9	56.1	55.8	54.7	59.5	52.0	44.3
21:00	60.8	78.2	46.9	59.6	56.2	55.3	54.3	59.2	51.3	43.1
21:15	60.0	76.8	45.1	60.1	54.2	54.5	53.5	58.3	50.5	42.1
21:30	60.4	78.7	44.1	57.3	53.9	55.2	53.3	58.7	51.5	41.8
21:45	58.8	75.1	39.7	59.2	52.5	53.3	51.8	56.9	49.7	44.3
22:00	57.4	75.4	38.1	55.7	52.1	52.1	50.5	55.9	47.5	36.7
22:15	59.0	74.9	33.6	56.0	52.5	53.3	52.8	57.1	49.6	42.7
22:30	56.0	74.4	32.7	58.0	51.8	51.5	50.8	54.0	45.6	41.9
22:45	54.4	74.8	32.5	51.4	49.5	49.1	47.8	52.9	44.5	35.2
23:00	55.8	75.7	32.3	52.4	48.7	50.5	48.8	54.4	45.9	34.5



Start Time	L _{Aeq}	L _{Amax}	L _{A90}	Sound Level (L _{eq} dB) @ Octave Band Centre Frequency (Hz)						
				63	125	250	500	1k	2k	4k
23:15	58.4	80.1	32.9	52.0	50.0	51.7	52.3	57.2	47.7	37.8
23:30	57.4	77.0	33.1	59.1	55.8	51.9	51.0	55.8	47.4	38.5
23:45	56.3	77.3	32.8	55.0	51.6	50.2	49.3	55.0	46.3	37.1
00:00	50.1	73.2	33.1	48.6	45.6	44.7	43.4	48.3	41.2	30.8
00:15	56.7	76.8	33.5	52.3	50.0	51.6	49.6	55.3	46.6	36.1
00:30	47.6	69.0	35.0	51.9	45.4	43.7	42.5	46.0	36.6	28.2
00:45	54.2	77.6	36.5	55.9	51.0	48.9	47.8	52.5	44.4	34.5
01:00	50.4	71.6	35.6	53.2	48.4	46.5	44.0	48.7	40.4	31.4
01:15	54.4	78.4	35.0	55.9	48.5	48.1	47.6	53.2	43.5	33.0
01:30	38.2	48.7	35.4	46.2	39.2	36.3	36.9	35.0	22.9	19.9
01:45	39.2	55.1	35.2	47.1	43.2	40.1	38.3	34.9	22.9	18.7
02:00	50.1	74.8	34.0	46.3	43.7	43.9	43.8	48.8	39.0	28.8
02:15	50.4	73.5	33.1	49.4	45.7	46.1	44.7	48.9	39.3	29.9
02:30	39.2	54.8	32.1	48.6	45.8	42.6	35.1	33.8	28.2	22.9
02:45	34.4	52.6	29.7	44.6	38.7	34.5	29.0	31.2	24.5	16.9
03:00	48.4	69.7	29.9	47.7	44.4	43.7	41.8	46.9	38.9	27.9
03:15	42.3	63.7	30.4	45.0	40.7	37.9	37.5	40.5	31.9	22.9
03:30	50.3	74.3	32.1	48.6	44.1	43.0	42.9	48.9	41.0	28.9
03:45	43.5	67.1	32.5	46.2	43.1	41.0	38.1	41.7	32.8	24.0
04:00	39.6	47.1	36.0	47.1	42.9	40.2	37.6	36.4	23.7	16.3
04:15	54.6	76.9	38.3	50.9	45.0	46.2	47.6	53.1	45.5	34.5
04:30	49.1	70.1	39.9	54.3	46.8	45.4	43.5	47.1	39.3	33.1
04:45	52.1	72.9	42.8	53.2	47.5	47.2	46.4	50.1	42.7	35.7
05:00	55.7	78.1	44.8	55.3	50.5	50.2	49.5	53.7	46.7	41.1
05:15	57.4	76.4	47.4	58.3	51.7	51.8	51.2	55.5	48.1	41.9
05:30	59.1	78.0	47.5	58.8	53.3	53.1	53.3	57.4	49.0	41.7
05:45	59.3	77.1	48.6	60.3	53.8	53.8	53.7	57.7	49.3	41.8
06:00	60.2	81.0	49.1	57.4	53.1	53.3	53.7	58.3	51.5	44.9
06:15	59.8	76.7	50.9	58.4	53.5	53.8	53.8	58.1	50.2	43.9
06:30	61.1	79.5	51.8	58.8	54.2	54.8	55.3	59.6	50.5	43.9
06:45	63.7	77.7	53.6	63.4	57.1	57.3	57.1	62.1	54.4	45.9



Start Time	L _{Aeq}	L _{Amax}	L _{A90}	Sound Level (L _{eq} dB) @ Octave Band Centre Frequency (Hz)						
				63	125	250	500	1k	2k	4k
07:00	62.6	77.3	53.7	60.6	55.7	56.8	55.9	61.0	53.2	44.5
07:15	63.2	78.3	55.0	64.9	59.6	59.0	57.8	61.0	53.9	48.2
07:30	64.7	77.8	55.6	63.8	58.3	59.0	58.6	63.0	55.4	46.8
07:45	66.2	78.2	56.8	65.7	61.4	61.1	60.1	64.5	56.6	48.0
08:00	66.4	81.1	56.6	66.7	60.9	61.4	61.0	64.6	56.9	48.9
08:15	64.9	80.5	56.4	65.7	60.0	60.8	58.9	62.9	55.5	48.0
08:30	67.6	83.0	59.4	66.1	61.3	61.8	61.1	65.9	58.0	51.0
08:45	67.7	80.3	59.1	66.5	61.5	61.8	61.3	65.9	58.5	49.9
09:00	67.0	79.4	58.8	67.6	61.1	61.3	60.7	65.3	57.6	49.2
09:15	65.2	79.4	58.0	65.3	59.4	59.6	59.1	63.6	55.3	46.5
09:30	64.4	77.0	57.7	64.1	58.8	59.5	59.0	62.6	54.6	47.5
09:45	64.6	81.3	57.1	64.1	60.0	59.7	58.9	62.7	55.2	47.7
10:00	64.5	77.2	55.3	63.6	58.8	59.3	58.6	62.7	55.3	48.2
10:15	63.7	80.8	54.5	63.3	58.4	58.7	57.7	62.0	53.9	45.2
10:30	63.1	75.5	54.0	64.5	60.8	59.3	57.5	61.0	53.7	46.7
10:45	64.3	79.4	54.0	65.2	61.2	59.8	59.0	62.1	55.1	48.7
11:00	63.3	79.2	53.3	64.1	59.6	59.1	57.8	61.5	53.2	45.7
11:15	64.1	75.8	53.1	64.8	59.8	59.6	58.4	62.2	54.5	47.3
11:30	64.2	77.6	53.4	63.8	62.4	60.0	58.2	62.3	54.3	46.8
11:45	65.1	78.3	54.9	65.4	62.9	60.4	58.9	63.3	55.6	48.7
12:00	62.8	76.7	53.6	64.3	62.8	59.0	57.3	60.6	53.2	46.9
12:15	64.7	79.7	54.7	65.5	62.9	60.1	58.7	62.7	55.0	48.9
12:30	63.8	82.9	54.6	66.2	63.3	60.1	58.2	61.8	54.2	48.2
12:45	63.9	77.4	56.0	63.6	61.9	59.6	58.6	61.9	54.2	47.7

**Table B2** - Results of Attended Noise Survey - Position 1, 9th & 10th October 2023 (free-field)

Date	Start Time	L _{Aeq}	L _{Amax}	L _{A90}	Sound Level (L _{eq} dB) @ Octave Band Centre Frequency (Hz)						
					63	125	250	500	1k	2k	4k
9 th October	13:50	56.7	73.3	45.3	60.7	53.6	52.4	51.7	53.0	49.2	45.4
	14:20	53.6	70.8	45.5	57.5	54.5	50.8	48.7	50.2	45.5	41.0
	14:50	53.3	66.0	45.2	57.5	51.5	48.7	48.1	50.6	45.3	38.7
	15:20	57.4	71.1	51.4	60.6	60.0	53.3	52.7	53.8	49.9	44.8
10 th October	12:49	56.2	69.4	46.9	60.5	54.5	50.9	50.0	53.1	49.1	43.1

Table B3 - Results of Attended Noise Survey - Position 2, 9th & 10th October 2023 (free-field)

Date	Start Time	L _{Aeq}	L _{Amax}	L _{A90}	Sound Level (L _{eq} dB) @ Octave Band Centre Frequency (Hz)						
					63	125	250	500	1k	2k	4k
9 th October	14:04	64.8	78.6	53.7	65.3	65.1	59.9	58.6	62.9	55.2	47.4
	14:35	66.7	82.0	53.9	66.7	61.6	61.4	59.9	64.7	57.6	52.6
	15:04	66.2	80.6	54.1	64.7	60.7	61.1	59.8	64.3	57.1	50.7
10 th October	13:11	65.2	82.9	55.7	68.9	61.8	60.4	59.2	63.2	55.6	50.2