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# **Proposed Residential Development Land off Keresforth Road, Dodworth, Barnsley**

## **Noise Impact Assessment**

**For:  
Keepmoat Homes**

07 December 2021

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# 1 Introduction

## 1.1 Overview

Environmental Noise Solutions Ltd (ENS) has been commissioned by Keepmoat Homes to undertake a noise survey and assessment for a proposed residential development at land off Keresforth Road in Dodworth, Barnsley (hereafter referred to as ‘the site’).

The assessment has been requested to inform a planning application for the proposed development.

The report has been prepared for Keepmoat Homes for the sole purpose described above and no extended duty of care to any third party is implied or offered. Third parties referring to the report should consult Keepmoat Homes and ENS as to the extent to which the findings may be appropriate for their use.

A glossary of acoustic terms used in the main body of the text is contained in Appendix A.

## 1.2 Site Description

The site is located to the north-east of Keresforth Road in Dodworth, as shown in Figure 1.1.

**Figure 1.1:** Location of Proposed Development



The site is bound by:

- Vacant grass land / embankment to the east with the M1 motorway further beyond
- Vacant grass land to the north and south
- An existing residential estate to the west

The proposed development is for up to 215 no. new build dwellings, however, for the purposes of the report, an indicative layout of 212 no. new build dwellings has been used to demonstrate how future residential noise amenity can be adequately protected.

## 2 Policy Context and Assessment Guidance

### 2.1 National Planning Policy Framework

The National Planning Policy Framework (NPPF)<sup>1</sup> was updated in 2021 and sets out the Government's planning policies for England and how these are expected to be applied.

Where issues of noise impact are concerned the NPPF provides brief guidance in paragraph 174 where it states that 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.....noise pollution'.*

Paragraph 185 advises 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'.*

The NPPF also refers to the 2010 DEFRA publication, the Noise Policy Statement for England (NPSE) which reinforces and supplements the NPPF.

### 2.2 Noise Policy Statement for England

The Noise Policy Statement for England<sup>2</sup> (NPSE) sets out the long-term vision of promoting good health and a good quality of life through the effective management of noise within the context of Government policy on sustainable development. This long-term vision is supported by the following aims:

- Avoid significant adverse impacts on health and quality of life
- Mitigate and minimise adverse impacts on health and quality of life
- Where possible, contribute to the improvement of health and quality of life

The NPSE describes the following levels at which noise impacts may be identified:

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

According to the explanatory notes in the statement, where a noise level falls between the lowest observable adverse effect level (LOAEL) and a level which represents a significant observable adverse effect level (SOAEL):

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<sup>1</sup> National Planning Policy Framework. Ministry of Housing, Communities and Local Government (2021)

<sup>2</sup> Government Department for Environment, Food and Rural Affairs. Noise Policy Statement for England. March 2010.

*‘...all reasonable steps should be taken to mitigate and minimise adverse effects on health and quality of life whilst also taking into consideration the guiding principles of sustainable development. This does not mean that such effects cannot occur.’*

## **2.3 Planning Practice Guidance on Noise**

Planning Practice Guidance<sup>3</sup> (PPG) is an online resource which provides additional guidance and elaboration on the NPPF. It advises that the Local Planning Authority should consider the acoustic environment in relation to:

- 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
- Whether or not a good standard of amenity can be achieved

In line with the Explanatory Note of the NPSE, the PPG references the LOAEL and SOAEL in relation to noise impact. It also provides examples of outcomes that could be expected for a given perception level of noise, plus actions that may be required to bring about a desired outcome. However, in line with the NPSE, no objective noise levels are provided for LOAEL or SOAEL although the PPG acknowledges that:

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

The PPG also provides general advice on the typical options available for mitigating noise, suggesting that Local Plans may include noise standards applicable to proposed developments within the Local Authority’s administrative boundary, although it states that:

*‘Care should be taken, however, to avoid these being implemented as fixed thresholds as specific circumstances may justify some variation being allowed’.*

With regard to the mitigation of extant environmental noise at a proposed residential development, the guidance states that:

*‘... consideration should also be given to whether adverse internal effects can be completely removed by closing windows and, in the case of new residential development, if the proposed mitigation relies on windows being kept closed most of the time. In both cases a suitable alternative means of ventilation is likely to be necessary. Further information on ventilation can be found in the Building Regulations’.*

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

## **2.4 Assessment Guidance**

### **British Standard 8233:2014**

British Standard 8233:2014 ‘Guidance on Sound Insulation and Noise Reduction for Buildings’ (BS8233)<sup>4</sup> provides recommendations for the control of noise both in and around buildings and suggests criteria and limits appropriate to their function. For dwellings, the main considerations are:

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<sup>3</sup> Planning Practice Guidance on Noise: <http://planningguidance.planningportal.gov.uk/blog/guidance/noise/>

<sup>4</sup> British Standard 8233:2014 Guidance on sound insulation and noise reduction for buildings. BSI

- Bedrooms - the effect of noise upon sleep
- Other habitable rooms - the effect of noise upon resting, listening and communicating

It is desirable that the internal ambient noise level does not exceed the guideline values as replicated in Table 2.1.

**Table 2.1: Indoor Ambient Noise Levels for Dwellings - BS8233:2014**

Activity	Location	07:00 – 23:00	23:00 – 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 $L_{Aeq,8hour}$

BS8233 states:

*'If relying on closed windows to meet the guide values, there needs to be appropriate alternative ventilation that does not compromise the façade insulation or the resulting noise level. If applicable, any room should have adequate ventilation (e.g. trickle ventilators should be open) during assessment.'*

For traditional external areas that are used for amenity space, such as gardens, BS8233 states that:

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

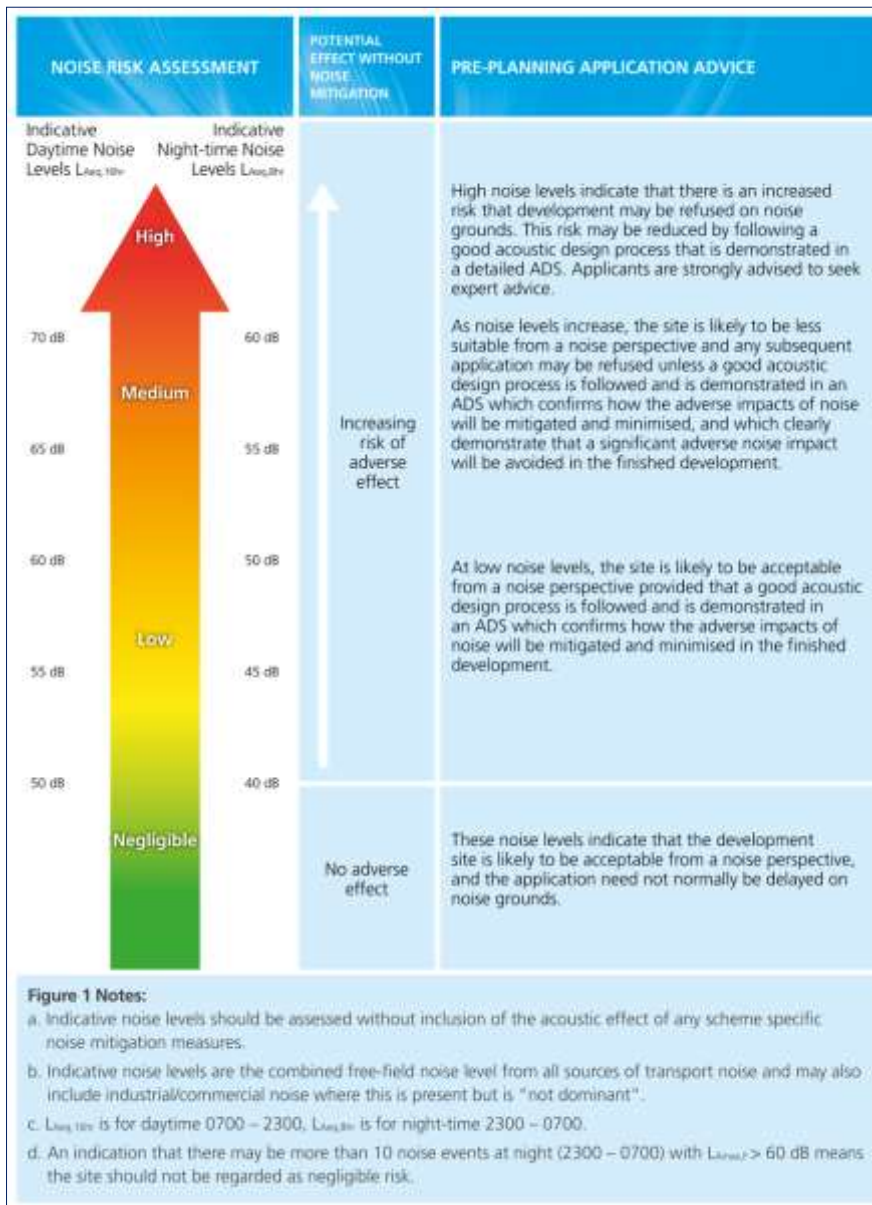
## ProPG Planning and Noise: New Residential Development

ProPG Planning and Noise: New Residential Development (ProPG)<sup>5</sup> promotes a systematic two-stage, risk-based approach to noise assessments that inform planning applications for new residential developments.

The 'Stage 1 Initial Site Noise Risk Assessment' should be conducted, at the proposed development site, at the earliest opportunity, before any planning application is submitted. The noise risk assessment should provide an indication of the likely risk of adverse effects from noise were no subsequent mitigation to be included as part of the development proposal. It should indicate whether the proposed site is considered to pose a negligible, low, medium or high risk from a noise perspective. Figure 2.1 summarises the initial noise risk assessment and demonstrates how measured site noise levels relate to potential adverse effects from noise.

<sup>5</sup> 'ProPG Planning and Noise: New Residential Development (ProPG)', 2017. Association of Noise Consultants (ANC), Institute of Acoustics (IOA) and the Chartered Institute of Environmental Health (CIEH)

**Figure 2.1:** ProPG: Stage 1 – Initial Site Noise Risk Assessment



ProPG recommends compliance with indoor noise level targets in residential dwellings based on the guidance contained in BS8233 (see Table 2.1). However, it is noted that:

*‘Where development is considered necessary or desirable, despite external noise levels above WHO guidelines, the internal target levels may be relaxed by up to 5 dB and reasonable internal conditions still achieved. The more often internal  $L_{Aeq}$  levels start to exceed the internal  $L_{Aeq}$  target levels by more than 5 dB, the more that most people are likely to regard them as “unreasonable”.....Once internal  $L_{Aeq}$  levels exceed the target levels by more than 10 dB, they are highly likely to be regarded as “unacceptable” by most people, particularly if such levels occur more than occasionally’.*

Additionally, with regard to individual noise events, ProPG states:

*Regular individual noise events (for example, scheduled aircraft or passing trains) can cause sleep disturbance. A guideline value may be set in terms of SEL or  $L_{Amax,F}$ , depending on the character and number of events per night. Sporadic noise events could require separate values. In most circumstances in noise sensitive rooms at night (e.g. bedrooms) good acoustic design can be used so that individual noise events do not normally exceed 45dB  $L_{Amax,F}$  more than 10 times a night.'*

ProPG acknowledges that the internal target noise levels may only be practically achieved with windows closed in certain areas (e.g. in urban areas or sites adjacent to transportation noise sources) and states that:

*In such circumstances, internal noise levels can be assessed with windows closed but with any façade openings used to provide 'whole dwelling ventilation' in accordance with Building Regulations Approved Document F (e.g. trickle ventilators in the open position).*

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

ProPG also considers compliance with ambient noise level targets for external amenity areas in line with the recommendation of BS8233. On this issue, ProPG states that:

*Where, despite following a good acoustic design process, significant adverse noise impacts remain on any private external amenity space (e.g. garden or balcony) then that impact may be partially off-set if the residents are provided, through the design of the development or the planning process, with access to:*

- *a relatively quiet facade (containing openable windows to habitable rooms) or a relatively quiet externally ventilated space (i.e. an enclosed balcony) as part of their dwelling; and/or*
- *a relatively quiet alternative or additional external amenity space for sole use by a household, (e.g. a garden, roof garden or large open balcony in a different, protected, location); and/or*
- *a relatively quiet, protected, nearby, external amenity space for sole use by a limited group of residents as part of the amenity of their dwellings; and/or*
- *a relatively quiet, protected, publicly accessible, external amenity space (e.g. a public park or a local green space designated because of its tranquillity) that is nearby (e.g. within a 5 minutes walking distance). The local planning authority could link such provision to the definition and management of Quiet Areas under the Environmental Noise Regulations.'*

## **Building Regulations - Approved Document F**

Building Regulations Approved Document F 'Ventilation' (2010 version incorporating 2013 amendments)<sup>6</sup> states:

*For mainly naturally ventilated buildings, it is common to use a combination of ventilators (e. g. for dwellings it is common to use intermittent extract fans for extract ventilation, trickle ventilators for whole dwelling ventilation and windows for purge ventilation). ... Purge ventilation throughout the building to aid the removal of high concentrations pollutants and water vapour released from occasional activities such as painting and decorating and or accidental releases such as smoke and burnt food or spillage of water. Purge ventilation is intermittent i.e. required only when such activities occur. Purge ventilation provisions may also be used to improve thermal comfort, although this is not controlled under Building Regulations.'*

It is therefore evident that, whilst ventilation may also provide a means to aid thermal comfort, this is not controlled under Building Regulations.

<sup>6</sup> The Building Regulations 2010 Approved Document F 'Ventilation' (amended 2013) (ADF)

Table 2.2 presents the four primary types of ventilation strategy described by ADF.

**Table 2.2: ADF Ventilation Options**

ADF System	Description
1	Background ventilators and intermittent extract fans
2	Passive stack
3	Continuous mechanical extract (MEV) <sup>A</sup>
4	Continuous mechanical supply and extract with heat recovery (MVHR) <sup>B</sup>
<p><sup>A</sup> 1 no. trickle vent at 2500mm<sup>2</sup> effective area required per room with System 3 in dwellings where the designed air permeability is tighter than (&lt;) 5m<sup>3</sup>/(h.m<sup>2</sup>)</p> <p><sup>B</sup> No trickle vents required with System 4</p>	

## 3 Noise Survey and Results

### 3.1 Overview

In order to establish external noise levels affecting the proposed development, noise monitoring was carried out between Tuesday 23<sup>rd</sup> and Wednesday 24<sup>th</sup> November 2021.

The adopted noise monitoring positions (shown in Appendix B) were as follows:

- 1 – north-eastern corner of the site, approximately 9 metres from the slip road (Junction 37, Northbound) of the M1 Motorway, at a height of 1.5m above ground
- 1A – as per Position 1, but at a height of 4m above ground
- 1B – as per Position 1 but at a distance of 18 metres from the slip road
- 1C – as per Position 1B but at a height of 4m above ground
- 1D – as per Position 1 but at a distance of 36m from the slip road
- 1E – as per Position 1D but at a height of 4m above ground
- 2 – eastern boundary of the site, approximately 20 metres from the slip road (Junction 37, Northbound) of the M1 Motorway, at a height of 1.5m above ground
- 2A – as per Position 2, but at a height of 4m above ground
- 2B – as per Position 2 but at a distance of 40 metres from the slip road
- 2C – as per Position 2B but at a height of 4m above ground
- 2D – as per Position 2 but at a distance of 60m from the slip road
- 2E – as per Position 2D but at a height of 4m above ground
- 3 – south-eastern corner of the site, approximately 20 metres from the slip road (Junction 37, Northbound) of the M1 Motorway, at a height of 1.5m above ground
- 3A – as per Position 3, but at a height of 4m above ground
- 3B – as per Position 3 but at a distance of 40 metres from the slip road
- 3C – as per Position 3B but at a height of 4m above ground
- 3D – as per Position 3 but at a distance of 80m from the slip road
- 3E – as per Position 3D but at a height of 4m above ground

Noise measurements were undertaken using Bruel & Kjaer 2250 Type 1 integrating sound level meters. Each meter was connected to a windshield covered microphone positioned in free field conditions (i.e. > 3.5 metres from a vertical reflective surface) at the locations detailed above.

The calibration of each measurement system was verified immediately before and after the survey period using a Bruel & Kjaer Type 4231 calibrator. No drift in calibration levels greater than 0.5 dB was noted.

Measurements consisted of A-weighted broadband parameters including  $L_{Aeq}$ ,  $L_{A10}$  and  $L_{AFmax}$  together with linear octave band data.

Weather conditions during the survey were dry, cool (~ 7°C) and calm (wind speeds ~ 3 – 4 m/s); therefore, appropriate for noise monitoring.

### 3.2 Summary of Results

Table 3.1 presents a summary of the noise data for each measurement session, at each measurement position, rounded to the nearest decibel.

**Table 3.1: Summary of Noise Measurement Data**

Position	Date	Time (hh:mm)	Period	L <sub>Aeq</sub> (dB)	L <sub>AFmax</sub> (dB)	L <sub>A10</sub> (dB)	Noise Source	Notes	
1	23/11/2021	10:01 – 13:01	Day	57	75	59	Road traffic on M1 Motorway and J37 northbound exit slip road	Below surface of slip road	
1A	23/11/2021	10:03 – 10:18	Day	60	71	62		Approx. same height as slip road	
	23/11/2021	23:00 – 23:30	Night	54	67	58			
	24/11/2021	02:06 – 02:36	Night	52	68	53			
1B	23/11/2021	10:25 – 10:40	Day	59	75	61		Below surface of slip road	
1C	23/11/2021	10:45 – 11:00	Day	61	72	63		Slightly above surface of slip road	
1D	23/11/2021	11:04 – 11:19	Day	58	78	60		Approx. same height as slip road	
1E	23/11/2021	11:25 – 11:40	Day	60	67	63	Slightly above surface of slip road		
2	23/11/2021	13:19 – 16:19	Day	61	73	63	Road traffic on M1 Motorway and J37 northbound exit slip road	Below road surface	
2A	23/11/2021	13:22 – 13:37	Day	63	73	65			
	23/11/2021 – 24/11/2021	23:37 – 00:07	Night	54	67	57			
	24/11/2021	01:27 – 01:57	Night	54	68	56			
2B	23/11/2021	13:45 – 14:00	Day	61	68	63			
2C	23/11/2021	14:13 – 14:28	Day	63	70	65			
2D	23/11/2021	14:38 – 14:53	Day	60	65	62			
2E	23/11/2021	14:59 – 15:14	Day	62	72	64			
3	24/11/2021	13:19 – 16:19	Day	65	73	67	Road traffic on M1 Motorway and J37 northbound exit slip road	Above road surface but shielded due to topography	
3A	24/11/2021	00:18 – 01:18	Night	66	74	69		Above and exposed to road surface	
	24/11/2021	14:03 – 14:18	Day	73	78	74			
3B	24/11/2021	14:20 – 14:35	Day	61	65	62		Above road surface but shielded due to topography	
3C	24/11/2021	14:37 – 14:54	Day	65	68	66		Above road, embankment offering some screening	
3D	24/11/2021	14:57 – 15:12	Day	58	64	60		Above road surface but shielded due to topography	
3E	24/11/2021	15:13 – 15:28	Day	59	64	60	Above road surface, embankment offering some screening		

### 3.3 Analysis

#### Road Traffic Noise Levels

For the prediction of daytime road traffic noise, the Department of Transport's Memorandum on the Calculation of Road Traffic Noise (CRTN) explains that the following shortened measurement procedure may be used. Measurements of  $L_{A10,1hr}$  are made over any three consecutive hours between 10:00 - 17:00 hrs.

Using  $L_{A10,3hr}$  as the arithmetic mean of three consecutive hourly  $L_{A10}$  values, the  $L_{A10,18hr}$  and  $L_{Aeq,16hr}$  can be calculated from the following equations:

$$(i) \quad L_{A10,18hr} = L_{A10,3hr} - 1 \text{ dB}$$

$$(ii) \quad L_{Aeq,16hr} \approx L_{A10,18hr} - 2 \text{ dB}$$

Substituting (ii) into (i) gives the following approximation:

$$(iii) \quad L_{Aeq,16hr} \approx L_{A10,3hr} - 3 \text{ dB}$$

Based on the above formula, the daytime ambient noise level is calculated to be:

- 56 dB  $L_{Aeq,16hr}$  at the north-eastern corner (Position 1)
- 60 dB  $L_{Aeq,16hr}$  at the eastern boundary (Position 2)
- 64 dB  $L_{Aeq,16hr}$  at the south-eastern corner (Position 3)

A study prepared by TRL Limited on behalf of the Department for Environment, Food and Rural Affairs (DEFRA) entitled '*Converting the UK Traffic Noise Index  $L_{A10}$  (18 hour) to EU Noise Indices for Noise Mapping*' presents a methodology for calculating night-time road traffic noise levels, based on daytime road traffic noise levels, using the following formula:

$$(iv) \quad L_{Aeq,8hr} \approx 0.87 \times L_{A10,18hr} + 4.24 \quad (\text{for motorway roads})$$

Based on the above formula, the night-time ambient noise level is calculated to be:

- 55 dB  $L_{Aeq,8hr}$  at Position 1
- 58 dB  $L_{Aeq,8hr}$  at Position 2
- 61 dB  $L_{Aeq,8hr}$  at Position 3

However, analysis of simultaneous measured data [at ground floor height (1.5m) and at first floor height (4m)] established an increase in measured noise levels, due to increased exposure to the motorway and slip road, at height (as shown in Table 3.1).

Based on the above, the following night-time ambient noise levels have been determined at first floor height:

- 58 dB  $L_{Aeq,8hr}$  at Position 1A
- 61 dB  $L_{Aeq,8hr}$  at Position 2A
- 68 dB  $L_{Aeq,8hr}$  at Position 3A

Night-time maximum noise levels were attributed to vehicle movements on the M1 Motorway / J37 northbound exit slip road and were measured at

- $\leq 68$  dB  $L_{AFmax}$  at Position 1A
- $\leq 68$  dB  $L_{AFmax}$  at Position 2A
- $\leq 74$  dB  $L_{AFmax}$  at Position 3A

## 4 Noise Assessment

### 4.1 Initial Site Noise Risk Assessment

Assessment of the measured/calculated ambient noise level data, using the ProPG initial site noise risk assessment diagram shown in Section 2, has determined that the site would be categorised as shown in Table 4.1 in terms of adverse effects from noise.

**Table 4.1: Risk of Adverse Effects from Noise**

Position	Distance from Nearest Carriageway	Height (a.g.l.)	Period	External Noise Levels (dB LAeq)	Risk
1	9m	1.5m	Day (07:00–23:00)	56	Low
1A		4m	Day (07:00–23:00)	60	Low
			Night (23:00–07:00)	58	Medium
1B	18m	1.5m	Day (07:00–23:00)	58	Low
1C		4m	Day (07:00–23:00)	60	Low
			Night (23:00–07:00)	58	Medium
1D	36m	1.5m	Day (07:00–23:00)	58	Low
1E		4m	Day (07:00–23:00)	59	Low
			Night (23:00–07:00)	58	Medium
2	20m	1.5m	Day (07:00–23:00)	60	Low
2A		4m	Day (07:00–23:00)	63	Medium
			Night (23:00–07:00)	61	Medium
2B	40m	1.5m	Day (07:00–23:00)	61	Low
2C		4m	Day (07:00–23:00)	62	Low / Medium
			Night (23:00–07:00)	60	Medium
2D	60m	1.5m	Day (07:00–23:00)	60	Low
2E		4m	Day (07:00–23:00)	60	Low
			Night (23:00–07:00)	59	Medium
3	20m	1.5m	Day (07:00–23:00)	64	Medium
3A		4m	Day (07:00–23:00)	71	Medium
			Night (23:00–07:00)	68	High
3B	40m	1.5m	Day (07:00–23:00)	59	Low
3C		4m	Day (07:00–23:00)	63	Medium
			Night (23:00–07:00)	60	Medium
3D	80m	1.5m	Day (07:00–23:00)	57	Low
3E		4m	Day (07:00–23:00)	58	Low
			Night (23:00–07:00)	56	Medium

It can be seen that the risk of adverse noise impacts at the site is:

- Low – medium during the daytime
- Medium – high at night

### 4.2 Noise Propagation

In order to calculate noise propagation across the site to proposed building facades and within private external areas of proposed residential dwellings, a three-dimensional model of the site and the immediate surrounding area has been created using the proprietary noise modelling software CadnaA. This approach enables the beneficial shielding effects, due to topography and the built form of the proposed development, to be accurately accounted for.

The data files and input parameters used to create the model are presented in Table 4.2.

**Table 4.2: CadnaA Model Input Data**

Input Parameter	Data Source / Model Settings
Base landline map	KM-V2020-003 Rev H 'Viability Layout' by Keepmoat Homes
Topography	Environment Agency LIDAR Composite DTM (Digital Terrain Model) 2017
Receptor Positions	<ul style="list-style-type: none"> <li>– Living rooms: 1.5m above ground level (agl)</li> <li>– Bedrooms: 4.5m agl</li> <li>– Gardens: 1.5m agl and <math>\geq 3.5</math>m from buildings where possible</li> </ul>
Building Heights	<ul style="list-style-type: none"> <li>– Residential buildings - 8m agl</li> <li>– Proposed garages – 4m agl</li> </ul>
Barriers	None included in preliminary modelling exercise
Ground Absorption	The default ground absorption setting for the site is 0.5 (mixed ground)
Reflections	<ul style="list-style-type: none"> <li>– Maximum order of reflection is 2</li> <li>– Building facades classified as 'structured' for reflections</li> </ul>
Noise Sources	<ul style="list-style-type: none"> <li>– M1 Motorway and J37 Exit (Northbound) slip road are primary noise sources</li> <li>– Sources verified with noise level monitoring data acquired on site</li> </ul>
Relative Humidity (%)	70
Temperature (°C)	10

Noise propagation across the site is shown in contour plots presented in Appendix C and as façade levels in Appendix D for illustrative purposes.

### 4.3 External Noise Levels

Analysis of the model outputs has determined the following external noise levels at various locations on site.

**Table 4.3: External Façade Noise Levels**

Location	Elevations	External Façade Noise Levels (dB L <sub>Aeq</sub> )	
		Day (07:00–23:00)	Night (23:00–07:00)
Most Exposed Plots on Eastern Boundary of Site (Plots 40, 89 – 90, 152 – 153, 157 – 175, 180)	Facing Motorway / Slip Road	69 – 72	66 – 70
	Shielded from Motorway / Slip Road	51 – 64	46 – 61
Exposed Plots on Eastern Boundary of Site (Plots 1 – 4, 41 – 59, 91 – 92, 95 – 98, 124 – 125, 130 – 136, 154 – 156, 177 – 178, 181 – 192)	Facing Motorway / Slip Road	62 – 68	60 – 65
	Shielded from Motorway / Slip Road	50 – 61	46 – 59
Middle Strip (Plots 5 – 6, 9 – 12, 16 – 18, 35 – 36, 38 – 39, 60 – 64, 87 – 88, 122 – 123, 126 – 129, 137 – 138, 176)	Facing Motorway / Slip Road	57 – 61	54 – 59
	Shielded from Motorway / Slip Road	46 – 57	44 – 55
Remainder of Site	Facing Motorway / Slip Road	$\leq 56$	$\leq 53$
	Shielded from Motorway / Slip Road	$\leq 50$	$\leq 48$

### 4.4 External Amenity

With regard to external noise levels during the day, the noise contour plots shown in Appendix C show that external noise levels are expected to satisfy the upper guideline value of  $\leq 55$  dB L<sub>Aeq,T</sub> for external amenity areas, as recommended by BS8233 / ProPG, in some plots (i.e. those in the northern and western areas of the site); however, it can also be seen that some of the proposed garden areas on the most exposed plots (i.e. those in the southern, central and eastern areas of the site) would exceed the guideline value. On this basis, it is recommended that proposed gardens are protected by 2.4m high imperforate acoustic barrier e.g. solid masonry wall or fencing (close-boarded timber, mass per unit area  $\geq 10$ kg/m<sup>2</sup>) at garden perimeters.

Mitigated noise propagation across the site is shown in contour plots presented in Appendix E. It can be seen that some of the proposed garden areas on the most exposed (i.e. eastern) parts of the site would still exceed the guideline value, even after mitigation; however, BS8233 states that:

*‘..... it is also recognized that these guideline values are not achievable in all circumstances where development might be desirable. In higher noise areas, such as city centres or urban areas adjoining the strategic transport network, a compromise between elevated noise levels and other factors, such as the convenience of living in these locations or making efficient use of land resources to ensure development needs can be met, might be warranted. In such a situation, development should be designed to achieve the lowest practicable levels in these external amenity spaces, but should not be prohibited.’*

## 4.5 Indoor Noise Levels

### Feasibility of Open Windows

It is generally accepted that the noise reduction from outside (free-field level) to inside (reverberant level) with a partially open window open is around 13 dB. On this basis, internal ambient noise levels with windows open have been calculated, as shown in Table 4.4.

**Table 4.4: Internal Ambient Noise Levels (Windows Open)**

Location	Elevations	Internal Levels (dB L <sub>Aeq</sub> ) with Windows Open	
		Day (07:00–23:00)	Night (23:00–07:00)
Most Exposed Plots on Eastern Boundary of Site (Plots 40, 89 – 90, 152 – 153, 157 – 175, 180)	Facing Motorway / Slip Road	≤ 56	≤ 54
	Shielded from Motorway / Slip Road	≤ 48	≤ 45
Exposed Plots on Eastern Boundary of Site (Plots 1 – 4, 41 – 59, 91 – 92, 95 – 98, 124 – 125, 130 – 136, 154 – 156, 177 – 178, 181 – 192)	Facing Motorway / Slip Road	≤ 52	≤ 49
	Shielded from Motorway / Slip Road	≤ 45	≤ 43
Middle Strip (Plots 5 – 6, 9 – 12, 16 – 18, 35 – 36, 38 – 39, 60 – 64, 87 – 88, 122 – 123, 126 – 129, 137 – 138, 176)	Facing Motorway / Slip Road	≤ 45	≤ 43
	Shielded from Motorway / Slip Road	≤ 41	≤ 39
Remainder of Site	Facing Motorway / Slip Road	≤ 40	≤ 37
	Shielded from Motorway / Slip Road	≤ 34	≤ 32

With reference to the indoor noise criteria set out in Section 2, it can be seen that open windows could be used to assist with the mitigation of overheating in some areas of the site (e.g. western plots) without a significant risk of adverse noise impacts. However, if open windows were to be used to assist with the mitigation of overheating in the most exposed areas of the site (i.e. the motorway / slip road facing elevations of plots positioned at the eastern site boundary) there could be a significant risk of adverse noise impacts.

### Closed Windows

Based on the above, minimum sound reduction requirements for glazing and ventilation have been determined on the assumption that the most appropriate ventilation strategy in this instance is:

- ADF System 4 [Mechanical Ventilation with Heat Recovery (MVHR)] in areas with the highest predicted noise levels on site
- ADF System 3 [Mechanical Extract Ventilation (MEV)] on the exposed elevations of plots located at or near to the eastern site boundary
- ADF System 1 (typically the most cost-effective) elsewhere on the site

Where an alternative ventilation strategy is employed, alternative sound reduction performances may be appropriate for glazing.

Calculations have incorporated the measured/calculated external noise level data on site and the noise ingress calculation methodology outlined in BS8233:2014.

It is understood that final plot layout/elevation designs (including room dimensions and façade element surface areas) are yet to be determined. In lieu of such information, the following has been assumed for assessment purposes:

- Typical living room volume of 60m<sup>3</sup> with glazing area of 5m<sup>2</sup>
- Typical bedroom volume of 25m<sup>3</sup> with glazing area of 3m<sup>2</sup>
- Room reverberation time of 0.5 seconds
- Typical masonry external wall construction
- Typical slate / tile roof with double-boarded plasterboard ceiling and insulated ceiling void

In order to satisfy the internal noise criteria, it is necessary to incorporate mitigation measures in the form of appropriate glazing and background ventilation with the minimum specifications presented in Table 4.5.

**Table 4.5: Ventilation / Glazing – Required Sound Reduction Performance**

Location	Elevation	ADF System	Trickle Vents <sup>A</sup>	Glazing
Most Exposed Plots on Eastern Boundary of Site (Plots 40, 89 – 90, 152 – 153, 157 – 175, 180)	Facing Motorway / Slip Road	4	N/A <sup>B</sup>	Acoustic double 37 dB R <sub>w</sub> + C <sub>tr</sub> <sup>C</sup>
	Shielded from Motorway / Slip Road	1	1 no. ≥ 5000mm <sup>2</sup> EA unit rated at ≥ 38 dB D <sub>n,e,w</sub> + C <sub>tr</sub> <sup>D</sup> ; or: 2 no. ≥ 2500mm <sup>2</sup> EA units rated at ≥ 41 dB D <sub>n,e,w</sub> + C <sub>tr</sub> <sup>E</sup>	Enhanced double 29 dB R <sub>w</sub> + C <sub>tr</sub> <sup>F</sup>
Exposed Plots on Eastern Boundary of Site (Plots 1 – 4, 41 – 59, 91 – 92, 95 – 98, 124 – 125, 130 – 136, 154 – 156, 177 – 178, 181 - 192)	Facing Motorway / Slip Road	3	1 no. ≥ 2500mm <sup>2</sup> EA unit rated at ≥ 41 dB D <sub>n,e,w</sub> + C <sub>tr</sub> <sup>E</sup>	Acoustic double 34 dB R <sub>w</sub> + C <sub>tr</sub> <sup>G</sup>
	Shielded from Motorway / Slip Road	1	1 no. ≥ 5000mm <sup>2</sup> EA unit rated at ≥ 38 dB D <sub>n,e,w</sub> + C <sub>tr</sub> <sup>D</sup> ; or: 2 no. ≥ 2500mm <sup>2</sup> EA units rated at ≥ 41 dB D <sub>n,e,w</sub> + C <sub>tr</sub> <sup>E</sup>	Enhanced double 27 dB R <sub>w</sub> + C <sub>tr</sub> <sup>H</sup>
Middle Strip (Plots 5 – 6, 9 – 12, 16 – 18, 35 – 36, 38 – 39, 60 – 64, 87 – 88, 122 – 123, 126 – 129, 137 – 138, 176)	Facing Motorway / Slip Road	1	1 no. ≥ 5000mm <sup>2</sup> EA unit rated at ≥ 38 dB D <sub>n,e,w</sub> + C <sub>tr</sub> <sup>D</sup> ; or: 2 no. ≥ 2500mm <sup>2</sup> EA units rated at ≥ 41 dB D <sub>n,e,w</sub> + C <sub>tr</sub> <sup>E</sup>	Enhanced double 27 dB R <sub>w</sub> + C <sub>tr</sub> <sup>H</sup>
	Shielded from Motorway / Slip Road	1	1 no. ≥ 5000mm <sup>2</sup> EA unit rated at ≥ 30 dB D <sub>n,e,w</sub> + C <sub>tr</sub> <sup>J</sup> ; or: 2 no. ≥ 2500mm <sup>2</sup> EA units rated at ≥ 33 dB D <sub>n,e,w</sub> + C <sub>tr</sub> <sup>J</sup>	Standard double 25 dB R <sub>w</sub> + C <sub>tr</sub> <sup>K</sup>
Remainder of Site	All		1 no. ≥ 5000mm <sup>2</sup> EA unit rated at ≥ 26 dB D <sub>n,e,w</sub> + C <sub>tr</sub> <sup>J</sup> ; or: 2 no. ≥ 2500mm <sup>2</sup> EA units rated at ≥ 29 dB D <sub>n,e,w</sub> + C <sub>tr</sub> <sup>J</sup>	Standard double 25 dB R <sub>w</sub> + C <sub>tr</sub> <sup>K</sup>

**Notes:**

<sup>A</sup> Sound reduction requirement listed in this column apply to a trickle vent in open position

<sup>B</sup> No trickle vents required for MVHR

<sup>C</sup> E.g.: Double glazing: 8mm pane / 16mm gap / 10.8mm acoustic laminate pane

<sup>D</sup> e.g. Greenwood 5000EAW.AC2 or equivalent

<sup>E</sup> e.g. Greenwood 2500EAW.AC2 or equivalent

<sup>F</sup> E.g.: Double glazing: 8mm pane / 12mm gap / 4mm pane

<sup>G</sup> E.g.: Double glazing: 6mm pane / 6 - 20mm gap / 8.8mm acoustic laminate pane

<sup>H</sup> E.g.: Double glazing: 6mm pane / 12mm gap / 6mm pane

<sup>J</sup> Performance typically achieved by standard window trickle vents

<sup>K</sup> E.g.: Double glazing: 4mm pane / 12mm gap / 4mm pane

Please note that the above specifications are indicative at this stage and may require further refinement once detailed information becomes available at a later stage in the planning / design process.

When selecting a glazing system to satisfy the requirements outlined in Table 4.4, it is important to ensure that the  $R_w + C_{tr}$  value is achieved (rather than simply the  $R_w$  value). Published  $R_w$  values tend to be higher than corresponding  $R_w + C_{tr}$  values; therefore, incorrect selection could result in an overestimation of sound reduction performance which in turn could result in higher internal noise levels.

The opening and free area of the ventilation unit should be checked by a mechanical service engineer before designs are finalised. Should the equivalent open area be insufficient to meet the minimum requirements of Part F of the Building Regulations, it may be necessary to increase the number of units per habitable room. Where this applies, the required sound reduction of the ventilation units should be increased accordingly (3 dB per doubling of required no. of vent units).

## 5 Summary and Conclusions

A noise survey and assessment has been performed for a proposed residential development at land off Keresforth Road in Dodworth, Barnsley.

Noise monitoring was carried out between Tuesday 23<sup>rd</sup> and Wednesday 24<sup>th</sup> November 2021 to establish external noise levels affecting the proposed development.

Section 4 provides an assessment using BS8233 / ProPG guidance along with a noise mitigation strategy to minimise potential adverse noise impacts to potential future residents at the site.

# Appendix A – Abbreviations and Definitions

## Sound Pressure Level ( $L_p$ )

The basic unit of sound measurement is the sound pressure level. As the pressures to which the human ear responds can range from 20  $\mu\text{Pa}$  to 200 Pa, a linear measurement of sound levels would involve many orders of magnitude. Consequently, the pressures are converted to a logarithmic scale and expressed in decibels (dB) as follows:

$$L_p = 20 \log_{10}(p/p_0)$$

Where  $L_p$  = sound pressure level in dB;  $p$  = rms sound pressure in Pa; and  $p_0$  = reference sound pressure (20  $\mu\text{Pa}$ ).

## A-weighting

A frequency filtering system in a sound level meter, which approximates under defined conditions the frequency response of the human ear. The A-weighted sound pressure level, expressed in dB(A), has been shown to correlate well with subjective response to noise.

## Equivalent continuous A-weighted sound pressure level, $L_{Aeq, T}$

The value of the A-weighted sound pressure level in decibels of continuous steady sound that within a specified time interval, T, has the same mean-square sound pressure as a sound that varies with time.  $L_{Aeq, 16h}$  (07:00 to 23:00 hours) and  $L_{Aeq, 8h}$  (23:00 to 07:00 hours) are used to qualify daytime and night time noise levels.

## $L_{A10, T}$

The A-weighted sound pressure level in decibels exceeded for 10% of the measurement period, T.  $L_{A10, 18h}$  is the arithmetic mean of the 18 hourly values from 06:00 to 24:00 hours.

## $L_{A90, T}$

The A-weighted sound pressure level of the residual noise in decibels exceeded 90% of a given time interval, T.  $L_{A90}$  is typically taken as representative of background noise.

## $L_{AF \max}$

The maximum A-weighted noise level recorded during the measurement period. The subscript 'F' denotes fast time weighting, slow time weighting 'S' is also used.

## Single Event Level / Sound Exposure Level (SEL or $L_{AE}$ )

The energy produced by a discrete noise event averaged over one second, regardless of the event duration. This allows for comparison between different noise events which occur over different lengths of time.

## Weighted Sound Reduction Index ( $R_w$ )

Single number quantity which characterises the airborne sound insulation properties of a material or building element over a defined range of frequencies ( $R_w$  is used to characterise the insulation of a material or product that has been measured in a laboratory).

# Appendix B – Noise Measurement Positions



# Appendix C – Unmitigated Noise Contour Plots

Figure C1: Day (Northern Part of Site) at 1.5m height



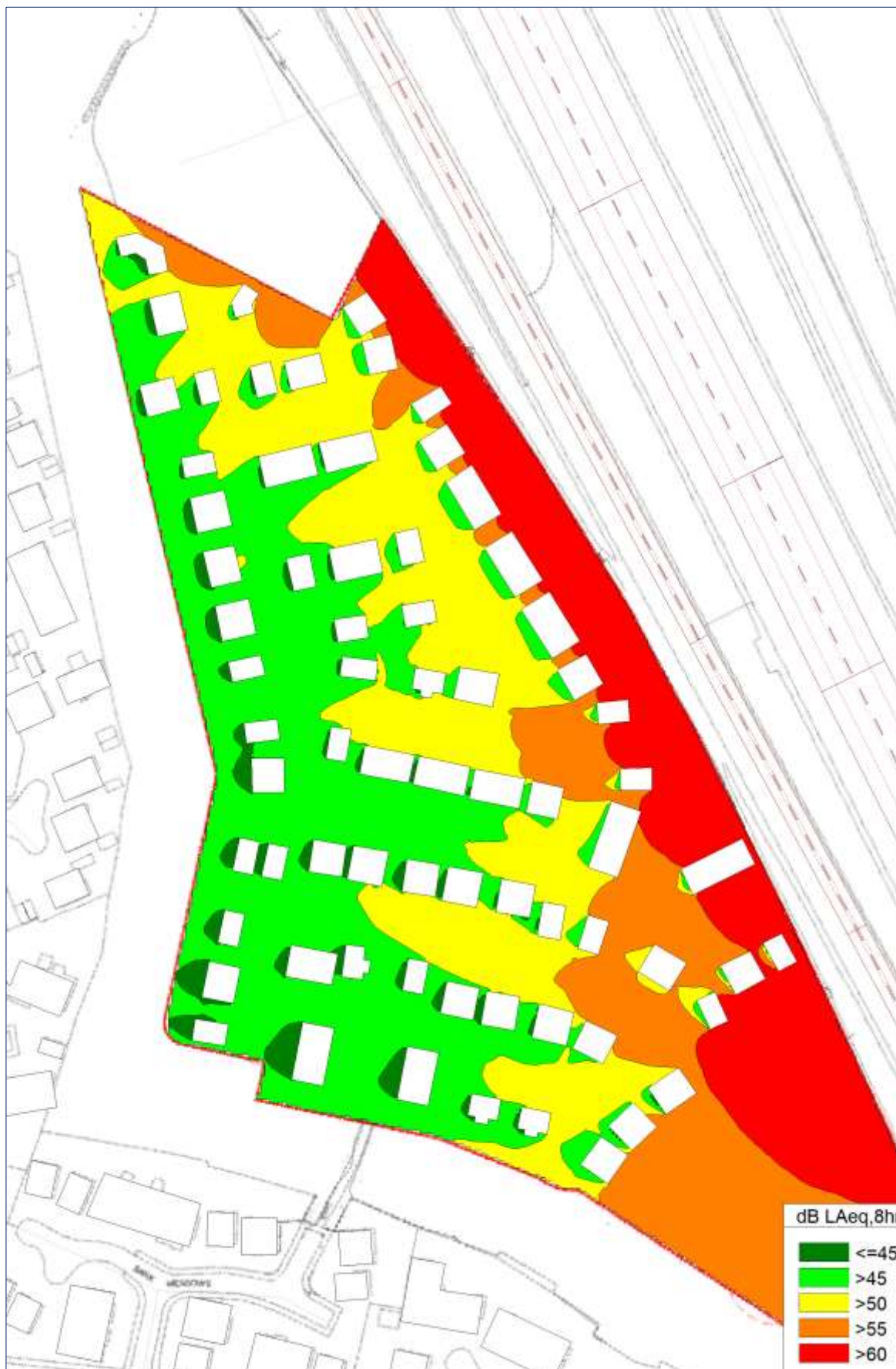
**Figure C2:** Day (Mid Part of Site) at 1.5m height



**Figure C3:** Day (Southern Part of Site) at 1.5m height



Figure C4: Night (Northern Part of Site) at 4m height



**Figure C5:** Night (Mid Part of Site) at 4m height



**Figure C6:** Night (Southern Part of Site) at 4m height



# Appendix D – Façade Noise Levels

Figure D1: Day (Northern Part of Site) at 4.5m height



Figure D2: Day (Mid Part of Site) at 4.5m height



**Figure D3:** Day (Southern Part of Site) at 4.5m height



**Figure D4:** Night (Northern Part of Site) at 4.5m height



**Figure D5:** Night (Mid Part of Site) at 4.5m height



Figure D6: Night (Southern Part of Site) at 4.5m height



# Appendix E – Mitigated Noise Contour Plots

Figure E1: Day (Northern Part of Site) at 1.5m height



Figure E2: Day (Mid Part of Site) at 1.5m height



Figure E3: Day (Southern Part of Site) at 1.5m height

