



Residential Noise Assessment

Site Address: Cornerfields, Nutts Lane, Hinckley, Leicestershire, LE10 3EG

Client Name: Sketchley Homes

Project Reference: NP-009577

Authorisation and Version Control

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01	08/10/2025	Previous assessment ref. NP-009577. Report updated to include plant noise assessment and planning application status.

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Contents

1.	INTRODUCTION	5
1.1	Standards, Legislation, Policy & Guidance	5
1.2	Proposal Brief	5
1.3	Local Planning Authority Guidance and Criteria	6
2.	ENVIRONMENTAL NOISE SURVEY	7
2.1	Measurement Methodology	7
2.2	Context & Subjective Impression.....	7
2.3	Environmental Noise Survey Results.....	8
3.	NOISE MODELLING	11
4.	NOISE BREAK-IN ASSESSMENT AND SOUND INSULATION SCHEME.....	13
4.1	Internal Noise Level Criteria	13
4.2	Glazing and Background Ventilation Specification	14
5.	OPEN WINDOW NOISE BREAK-IN ASSESSMENT	16
5.1	Internal Noise Levels with Open Windows Criteria	16
5.2	Open Window Assessment	17
6.	EXTERNAL NOISE LEVEL ASSESSMENT	19
7.	GROUND-BORNE VIBRATION SCREENING ASSESSMENT	20
8.	BS4142 NOISE IMPACT ASSESSMENT	22
8.1	Proposed External Fixed Plant & Specific Sound Levels	22
8.2	BS4142 Noise Impact Assessment	23
9.	CONCLUSION AND ACTION PLAN	24
	APPENDIX A – ACOUSTIC TERMINOLOGY	25
	APPENDIX B – STANDARDS, LEGISLATION, POLICY, AND GUIDANCE	26
	B.1 – National Planning Policy Framework (2021)	26
	B.2 – Noise Policy Statement for England (2010).....	26
	B.3 – BS8233:2014 ‘Guidance on Sound insulation and noise reduction for buildings’	27
	B.5 – BS4142:2014+A1:2019 – ‘Methods for rating and assessing industrial and commercial sound’	28
	B.4 – ProPG: Planning and Noise (2017)	31
	B.5 – Approved Document O: Overheating (2021)	31
	B.6 – Acoustics Ventilation and Overheating – Residential Design Guide 2020.....	32
	APPENDIX C – SITE PLAN	36
	APPENDIX D – ENVIRONMENTAL SURVEY	37
	D.1 – Time History Noise Data	37
	D.2 – Surveying Equipment	38
	D.3 – Meteorological Conditions	38

APPENDIX E – NOISE BREAK-IN CALCULATIONS	39
E.1 – Façades with Background Ventilation	39
APPENDIX F – NOISE MODELLING PARTICULARS	43
APPENDIX G – MANUFACTURER’S DATASHEET	44

Figures

<i>Figure 1 – Proposed Development Layout</i>	<i>6</i>
<i>Figure 2 – Measurement Locations and Site Surroundings</i>	<i>7</i>
<i>Figure 3 – MP1 – Daytime Background Noise Levels</i>	<i>9</i>
<i>Figure 4 – MP1 – Night-time Background Noise Levels</i>	<i>9</i>
<i>Figure 5 – MP2 – Daytime Background Noise Levels</i>	<i>10</i>
<i>Figure 6 – MP2 – Night-time Background Noise Levels</i>	<i>10</i>
<i>Figure 7 – $L_{Aeq,16hr}$ Ambient Sound Map (1.5m Grid Map Height)</i>	<i>11</i>
<i>Figure 8 – $L_{Aeq,8hr}$ Ambient Sound Map (1.5m Grid Map Height)</i>	<i>11</i>
<i>Figure 9 – $L_{AFmax,1min}$ Sound Map (1.5m Grid Map Height)</i>	<i>12</i>
<i>Figure 10 – Development Façade Colours</i>	<i>14</i>
<i>Figure 11 – Specific Sound Level Map</i>	<i>23</i>
<i>Figure 12 – AVO Guide Level 1 Risk Category</i>	<i>33</i>
<i>Figure 13 – AVO Guide Level 2 Internal Ambient Noise Levels</i>	<i>35</i>
<i>Figure 14 – Site Plan</i>	<i>36</i>
<i>Figure 15 – MP1 Noise Survey Time History</i>	<i>37</i>
<i>Figure 16 – MP2 Noise Survey Time History</i>	<i>37</i>
<i>Figure 17 – Noise Break-In Calculations</i>	<i>42</i>

Tables

<i>Table 1 – Measurement Methodology</i>	<i>7</i>
<i>Table 2 – Sound Level Results Summary</i>	<i>8</i>
<i>Table 3 – Short-Term Monitoring Results – MP3</i>	<i>8</i>
<i>Table 4 – Average S.E.L. of Train Pass-Bys</i>	<i>8</i>
<i>Table 5 – CRN Calculation</i>	<i>9</i>
<i>Table 6 – Acoustic Design Criteria</i>	<i>13</i>
<i>Table 7 – Glazing Specification – All Living Rooms and Green Bedrooms</i>	<i>14</i>
<i>Table 8 – Glazing Specification – Red Bedrooms</i>	<i>15</i>
<i>Table 9 – Glazing Specification – Amber Bedrooms</i>	<i>15</i>
<i>Table 10 – AVO Guide Open Window Criteria</i>	<i>16</i>
<i>Table 11 – Open Window Assessment</i>	<i>17</i>
<i>Table 12 – BS8233:2014 External Amenity Area Noise Level Assessment</i>	<i>19</i>
<i>Table 13 – BS6472-1:2008 Ground-Borne Vibration Criteria Inside Dwellings</i>	<i>20</i>
<i>Table 14 – Maximum Measured VDV Levels during Train Pass-bys</i>	<i>20</i>
<i>Table 15 – Number of Trains</i>	<i>20</i>
<i>Table 16 – Summary of Calculated VDV Levels</i>	<i>21</i>

<i>Table 17 – Sound Power Levels of ASHP Units.....</i>	<i>22</i>
<i>Table 18 – Noise Impact Assessment</i>	<i>23</i>
<i>Table 19 – BS8233:2014 Internal Ambient Noise Level Criteria.....</i>	<i>28</i>
<i>Table 20 – Hierarchy of Noise Management Measures</i>	<i>31</i>
<i>Table 21 – AVO Guide (2020) Level 1 Risk Assessment</i>	<i>34</i>
<i>Table 22 – Surveying Equipment.....</i>	<i>38</i>
<i>Table 23 – Weather Conditions</i>	<i>38</i>

1. Introduction

UK Building Compliance has been commissioned to prepare a noise assessment for a new build residential development ('the Proposed Development') at Cornerfields, Nutts Lane, Hinckley, Leicestershire, LE10 3EG ('the Site'). The site is subject to noise from road traffic emissions and trains using the adjacent railway line.

The applicant has received planning permission from the Local Planning Authority (LPA), Hinckley and Bosworth Borough Council for the following applications relating to the site:

"20/01289/OUT: Residential development for up to 9 dwellings (outline – access only)."

"23/00346/REM: Approval of reserved matters (appearance, landscaping, layout and scale) of Outline Planning Permission 20/01289/OUT for residential development of up to 9 dwellings."

A noise survey has been undertaken to establish the prevailing ambient sound levels incident on the Proposed Development Site. The findings have been used to assess the suitability of the site for residential use. Measures required to mitigate noise impacts have been assessed in accordance with the relevant performance standards, legislation, policy, and guidance.

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

1.1 Standards, Legislation, Policy & Guidance

The following performance standards, legislation, policy, and guidance have been considered to ensure good acoustic design in the assessment:

- The LPA's conditional approval; specifically, 'Condition 5'.
- National Planning Policy Framework (2021)
- Noise Policy Statement for England (2010)
- British Standard BS8233:2014 – 'Guidance on sound insulation and noise reduction for buildings'
- ProPG: 'Planning and Noise 2017' (including supplementary documents 1 & 2).
- Approved Document O: Overheating (2021)
- Acoustics Ventilation Overheating: Residential Design Guide 2020' (AVO Guide)

Further information on the legislation can be found in Appendix B.

1.2 Proposal Brief

The proposal is for the erection of 9no. new build residential dwellinghouses. The figure below shows the layout of the Proposed Development.



Drawing Ref. 2025 37 113 Hard Soft Landscaping Site Layout Rev C from 'James Fleming Architectural'

Figure 1 – Proposed Development Layout

1.3 Local Planning Authority Guidance and Criteria

The following planning conditions have been imposed by the LPA in relation to noise:

20/01289/OUT – Residential development for up to 9 dwellings (outline - access only)

“Condition 5:

Development shall not begin until a scheme for protecting the proposed dwellings from noise from the adjacent railway track has been submitted to and approved by the Local Planning Authority and all works which form part of the scheme shall be completed before any of the permitted dwellings are first occupied. Reason: To ensure that the proposed use does not become a source of annoyance to nearby residents in accordance with Policy DM10 of the adopted Site Allocations and Development Management Policies Development Plan Document (2016).

23/00346/REM – Approval of reserved matters (appearance, landscaping, layout and scale) of Outline Planning Permission 20/01289/OUT for residential development of up to 9 dwellings

Condition 9:

Prior to the commencement of development, a further noise report shall be submitted to and approved by the Local Planning Authority in relation to any external fixed plant to be installed. Once the plant units are specified the noise emissions should be calculated by an appropriately qualified person to ensure that the limit levels are achieved.

Reason: To ensure that residents do not experience unacceptable levels of noise and disturbance in accordance with Policy DM10 of the SADMP.”

2. Environmental Noise Survey

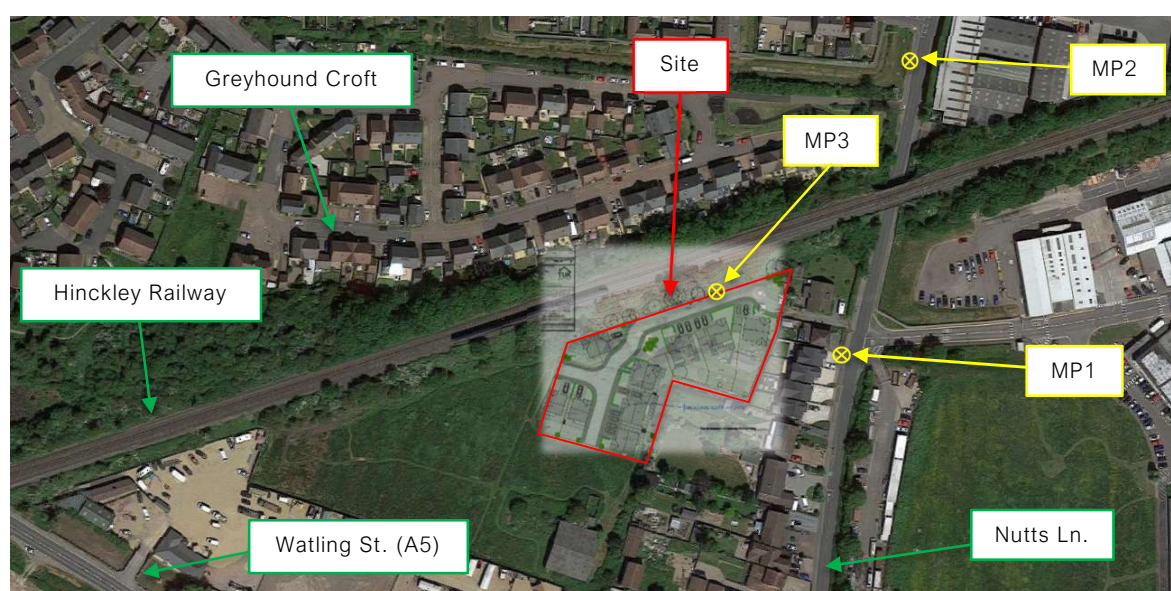
2.1 Measurement Methodology

The measurement dates and particulars are outlined in the following table. Details regarding the equipment used and the weather conditions recorded during the survey can be found in Appendix D.

Location	Survey Dates	Measurement Particulars
MP1	03/07/2023 – 06/07/2023	Equipment mounted on a lamppost at a height of 3.5m on Nutts Lane.
MP2	03/07/2023 – 06/07/2023	Equipment mounted on a lamppost at a height of 3.5m on Nutts Lane close to Sansome Drive.
MP3	06/07/2023	Spot noise and vibration measurements were taken on site, close to the railway line.

Table 1 – Measurement Methodology

The site surroundings and measurement locations are highlighted in the figure below:



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Figure 2 – Measurement Locations and Site Surroundings

2.2 Context & Subjective Impression

The Proposed Development Site is located on vacant land off Nutts Lane in Hinckley, Leicestershire. The area surrounding the Site consists primarily of residential dwellings to the north and east with commercial / light industrial properties further afield. The area to the south of site appears to be a static caravan storage facility with open land in between.

The acoustic environment is deemed to be low to moderate in level and the noise profile is dominated by emissions from Nutts Lane to the east and Hinckley railway line, which bounds the northern perimeter of site. Watling Street (A5) is also audible but to a lesser extent. During the site visits, noise emissions from

the commercial / light industrial properties located on the opposite side of Nutts Lane were not audible above the residual noise level. Due to distance attenuation, acoustic shielding from intervening properties and the nature of the businesses, commercial noise is not considered to be a concern.

2.3 Environmental Noise Survey Results

A summary of the sound levels measured during the long-term survey is presented in the table below. The time history results can be found in Appendix D.

Location	Measurement Period ('T')	Octave Frequency Band (Hz, dB)						L _{Aeq,T} (dB)	L _{AFmax,1min} (dB)
		125	250	500	1k	2k	4k		
MP1	L _{eq,16hr} (Day)	63	62	61	62	58	51	65	--
	L _{eq,8hr} (Night)	59	57	57	58	54	46	61	80
	L _{eq,1hr} (Day)	67	66	64	65	62	57	68	--
	L _{eq,1hr} (Night)	63	60	60	61	59	49	65	80
MP2	L _{eq,16hr} (Day)	63	61	60	63	61	55	67	--
	L _{eq,8hr} (Night)	60	57	56	57	53	44	60	82
	L _{eq,1hr} (Day)	66	66	64	65	65	60	70	--
	L _{eq,1hr} (Night)	63	61	59	62	58	48	65	82

Table 2 – Sound Level Results Summary

Short-Term Noise Survey

A summary of the short-term noise measurement recorded at Measurement Position 3 (MP3) is shown in the table below.

Measurement Position MP3								
Measurement Period ('t')	Octave Band L _{eq,t} (Hz, dB)						L _{Aeq,t} (dB)	L _{AFmax,t} (dB)
	125	250	500	1k	2k	4k		
06/07/2023: 10:14 – 12:17 (Day)	48	48	48	47	43	40	51	85

Table 3 – Short-Term Monitoring Results – MP3

CRN Calculations

The average S.E.L. measurement of the train pass-bys measured at MP3 on 06/07/23 is shown in the following table.

Measurement Position	Description	Average S.E.L. (dBA)
MP3	Passenger Train Pass-By	79
	Freight Train Pass-By	88

Table 4 – Average S.E.L. of Train Pass-Bys

The calculated $L_{Aeq,16hour}$ and $L_{Aeq,8hour}$ values based on the shortened CRN Procedure is presented in the following table. The number of train movements has been predicted using information gathered during attended measurements and the 'Real Time Trains' website.

Description	Day	Night
Passenger Train S.E.L. (dBA)	79	
Predicted Number of Train Movements Per Period	65	5
$L_{Aeq,t}$ at MP3 (dB)	50	42
Description	Day	Night
Freight Train S.E.L. (dBA)	88	
Predicted Number of Train Movements Per Period	45	12
$L_{Aeq,t}$ at MP3 (dB)	57	54
Total		
Cumulative $L_{Aeq,t}$ at MP3 (dB)	58	54

Table 5 – CRN Calculation

Background Noise Levels

The measured daytime and night-time background noise levels are presented in the histogram graphs below.

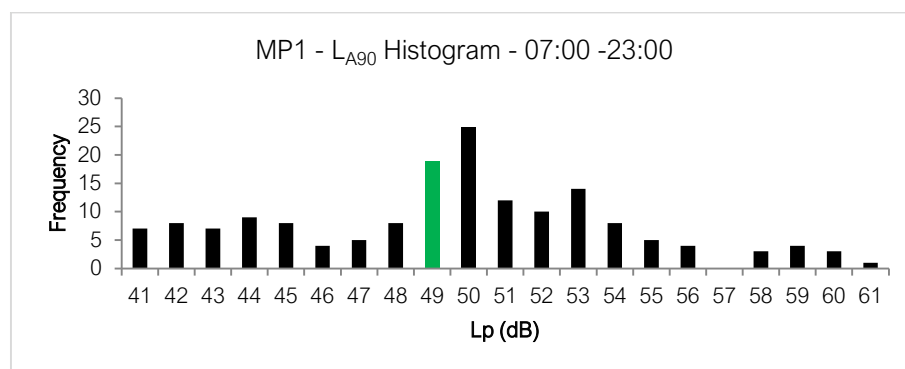


Figure 3 – MP1 – Daytime Background Noise Levels

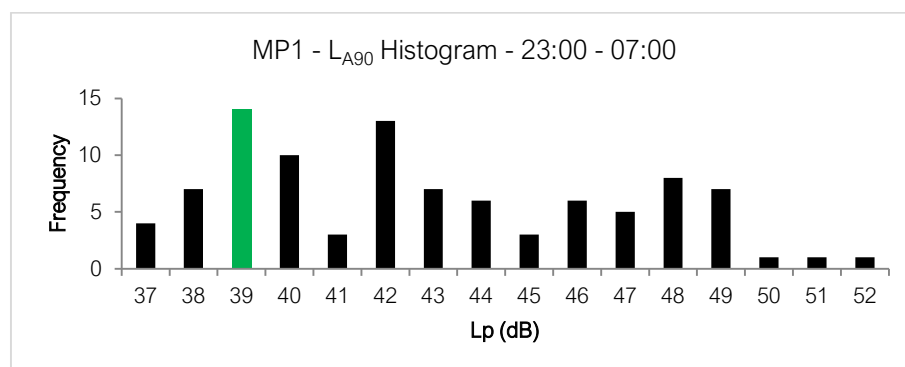


Figure 4 – MP1 – Night-time Background Noise Levels

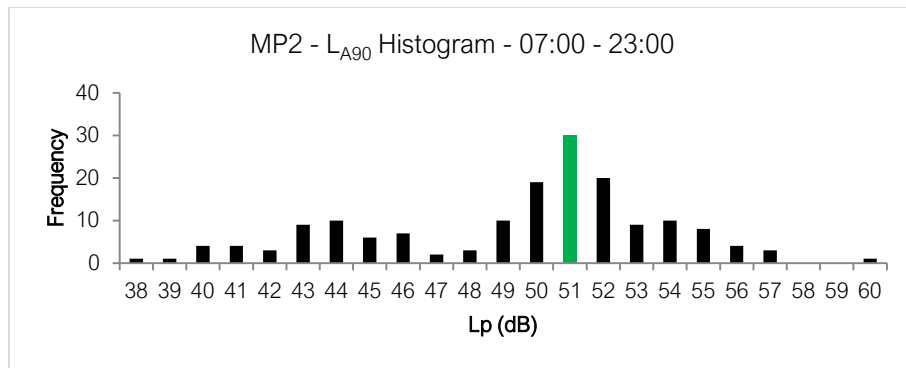


Figure 5 – MP2 – Daytime Background Noise Levels

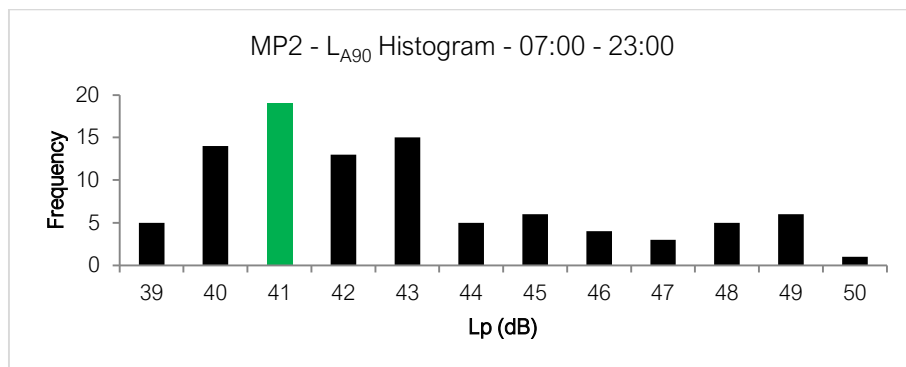


Figure 6 – MP2 – Night-time Background Noise Levels

As can be seen, the lowest modal (statistically most repeated) background noise levels are **49dBA** during the day, and **39dBA** during the night.

3. Noise Modelling

The long-term and short-term environmental noise surveys have allowed the sound levels at the Proposed Development to be modelled within SoundPlan 9.0 software. The modelling particulars are outlined in Appendix F. The sound maps showing the daytime $L_{Aeq,t}$, night-time $L_{Aeq,t}$ and night-time $L_{AFmax,1min}$ sound levels incident upon the Proposed Development can be seen in the figures below.

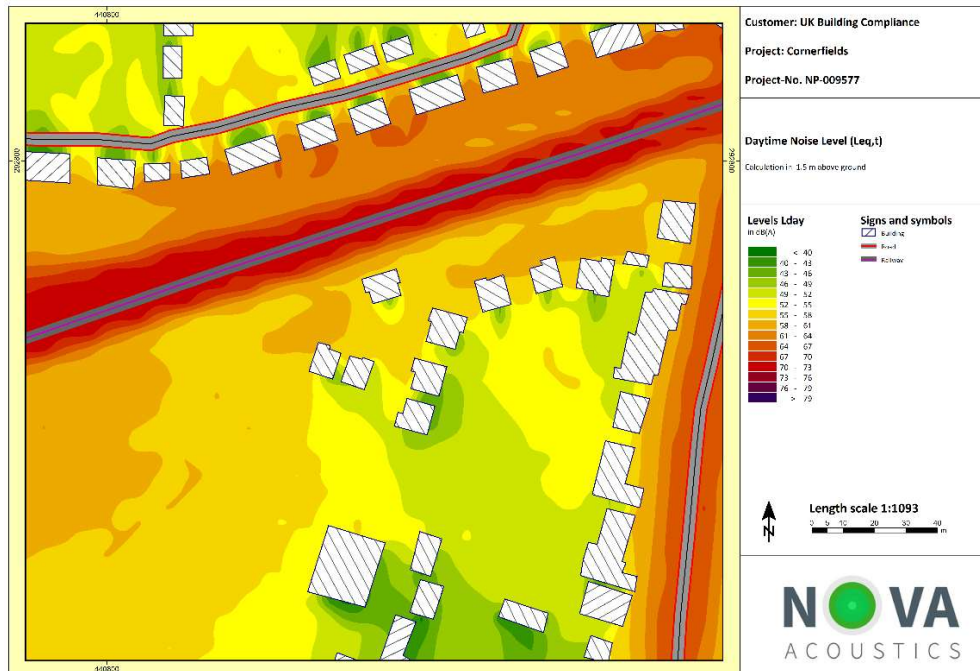


Figure 7 – $L_{Aeq, 16hr}$ Ambient Sound Map (1.5m Grid Map Height)

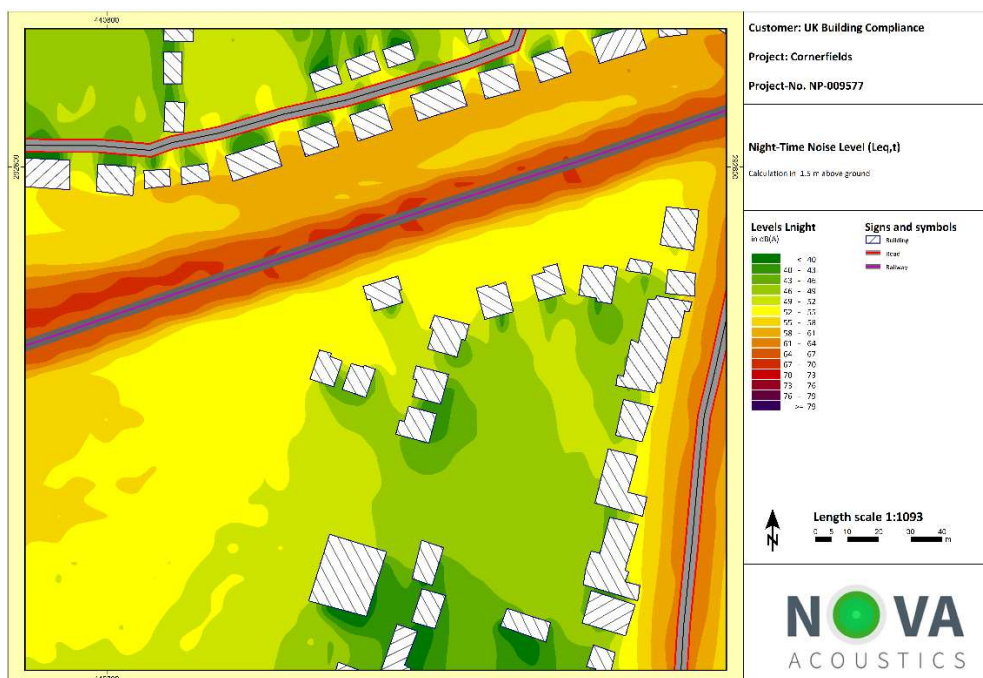


Figure 8 – $L_{Aeq, 8hr}$ Ambient Sound Map (1.5m Grid Map Height)

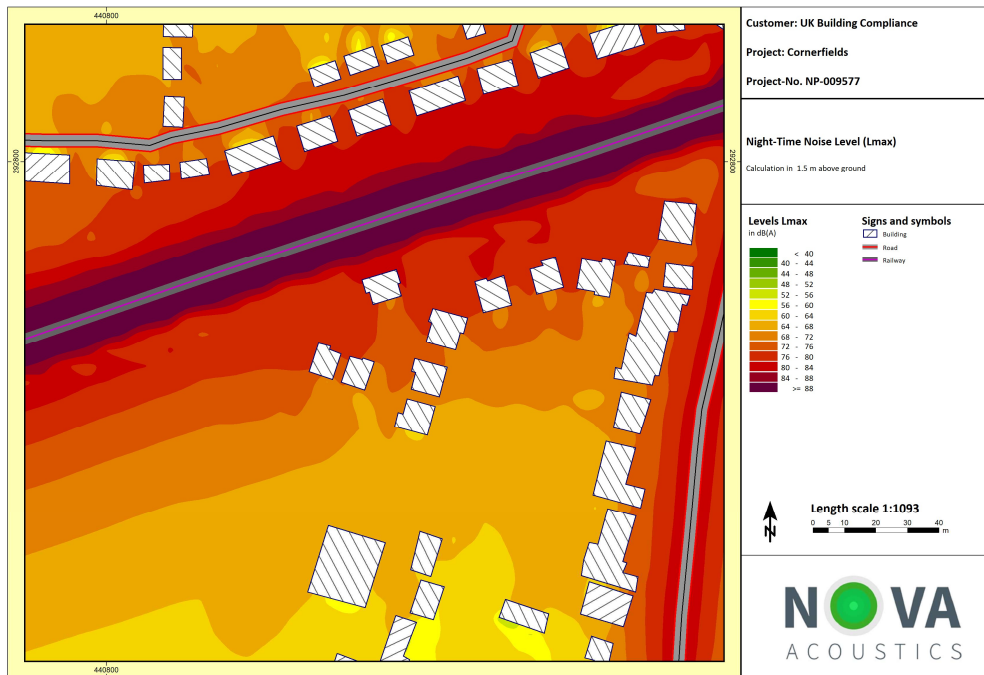


Figure 9 – $L_{AFmax,1min}$ Sound Map (1.5m Grid Map Height)

4. Noise Break-in Assessment and Sound Insulation Scheme

4.1 Internal Noise Level Criteria

As the noise profile of the area is dominated by transport noise sources, which are deemed to be “anonymous” in nature, the following criteria are thought to be applicable to the development.

Activity	Location	Daytime (07:00 – 23:00)	Night-time (23:00 – 07:00)
Resting	Living Room	35 dB $L_{Aeq,16hr}$ / NR30	--
Dining	Dining Room/Area	40 dB $L_{Aeq,16hr}$ / NR35	--
Sleeping (Daytime resting)	Bedroom	35 dB $L_{Aeq,16hr}$ / NR30	30 dB $L_{Aeq,8hr}$ / NR25 45 dB L_{AFmax} *

*NOTE 1: The maximum criteria have been taken from the World Health Organisation (WHO) Guidelines for Community Noise.

*NOTE 2: ProPG:2017 which is relevant to ‘New Residential’ states; “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. However, where it is not reasonably practicable to achieve this guideline then the judgement of acceptability will depend not only on the maximum noise levels but also on factors such as the source, number, distribution, predictability, and regularity of noise events”.

Note 3: BS8233:2014 states: “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”.

Note 4: BS8233:2014 states: “The levels shown in Table 4 (criteria shown above) are based on the existing guidelines issued by the WHO and assume normal diurnal fluctuations in external noise. In cases where local conditions do not follow a typical diurnal pattern, for example on a road serving a port with high levels of traffic at certain times of the night, an appropriate alternative period, e.g., 1 hour, may be used, but the level should be selected to ensure consistency with the levels recommended in Table 4.

Note 5; BS8233:2014 states: “If relying on closed windows to meet the guide values, there needs to be an appropriate alternative ventilation that does not compromise the façade insulation or the resulting noise level.

Table 6 – Acoustic Design Criteria

The measured sound levels at the proposed development are assessed against the relevant criteria and a sound insulation scheme is provided to achieve a good internal acoustic environment.

4.2 Glazing and Background Ventilation Specification

The noise levels incident on the proposed buildings vary significantly dependent on their proximity to the railway line. For this reason, the building façades have been divided into three colours: red, amber, and green, as shown in the figure below.



Drawing Ref. 2025 37 113 Hard Soft Landscaping Site Layout Rev C from 'James Fleming Architectural'

Figure 10 – Development Façade Colours

Glazing and background ventilation specifications that achieve the relevant internal noise criteria are shown in the tables below. Full noise break-in calculations can be found in Appendix E.

Sound Insulation Scheme – All Living Rooms and Green Bedrooms									
Description	Octave Frequency Band (Hz, dB)							Overall (dB)	
	63	125	250	500	1k	2k	4k		
6mm Glass / 16mm Air Cavity / 4mm Glass (SRI)*	20	21	20	26	38	37	39	31 (R _w)	27 (R _w + C _{tr})
Titon Standard Vent + C75 (2 No. Trickle) (D _{ne})*	28	38	36	35	42	39	42	35 (D _{ne})	34 (D _{ne} + C _{tr})

Table 7 – Glazing Specification – All Living Rooms and Green Bedrooms

Sound Insulation Scheme – Red Bedrooms									
Description	Octave Frequency Band (Hz, dB)							Overall (dB)	
	63	125	250	500	1k	2k	4k		
6mm Glass / 16mm Air Cavity / 6.8mm Optiphon Glass (SRI)*	21	21	28	37	48	48	54	39 (R _w)	33 (R _w + C _{tr})
Greenwoods MA3051 (2 No. Through Wall) (D _{n,e})*	30	46	45	50	55	65	67	55 (D _{n,e})	52 (D _{n,e} + C _{tr})

Table 8 – Glazing Specification – Red Bedrooms

Sound Insulation Scheme – Amber Bedrooms									
Description	Octave Frequency Band (Hz, dB)							Overall (dB)	
	63	125	250	500	1k	2k	4k		
8mm Glass / 16mm Air Cavity / 4mm Glass (SRI)*	21	22	21	28	38	40	47	33 (R _w)	28 (R _w + C _{tr})
Titon Standard Vent + C75 (2 No. Trickle) (D _{n,e})*	28	38	36	35	42	39	42	35 (D _{n,e})	34 (D _{n,e} + C _{tr})

Table 9 – Glazing Specification – Amber Bedrooms

*Any other window or ventilation specification capable of providing this attenuation will be suitable provided the glazing suppliers can provide an acoustic test report in accordance with BS EN ISO 10140-2:2010 or an evidence-based calculation.

5. Open Window Noise Break-In Assessment

5.1 Internal Noise Levels with Open Windows Criteria

The AVO Guide advises that if windows are open regularly to provide higher rates of ventilation to mitigate overheating, this will lead to elevated internal noise levels which could lead to undesirable living conditions. If windows are opened rarely the occupants may be able to tolerate elevated noise levels due to the inherent benefits of natural ventilation. This assessment will firstly assess whether the internal noise level criteria can be achieved with open windows. The AVO Guide provides criteria for both daytime and night-time periods which shown below.

Windows	Daytime (07:00 – 23:00)	Night-time (23:00 – 07:00)	AVO Guide Table 3-3 Example Outcomes	AVO Guide Table 3 – 2 Recommendation for Level 2 Assessment
Rarely Open	50 dB $L_{Aeq,16hour}$	42 dB $L_{Aeq,8hour}$ 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	Recommended
Increasing Noise Level			Increasing likelihood of impact on reliable speech communication during the day or sleep disturbance at night	Optional
Often Open	40 dB $L_{Aeq,16hour}$	35 dB $L_{Aeq,8hour}$ Normally Exceeds 45 dB $L_{AF,max}$	Noise can be heard, but does not cause any change in behaviour	Not Required

Table 10 – AVO Guide Open Window Criteria

To advise if openable windows can be used as the ventilation strategy (whilst maintaining reasonable internal noise levels), an open window assessment will be provided. The suitability of the internal noise levels will be based upon the internal noise criteria above and an open window providing 13 dB attenuation. If required, an alternative ventilation strategy compliant with Approved Document F will be proposed.

5.2 Open Window Assessment

This assessment will firstly consider whether the internal noise level criteria from Table 3 – 3 of the AVO Guide can be achieved with open windows.

Red Façades				
External Noise Levels	AVO Guide Windows Open Often	Exceedance	AVO Guide Windows Rarely Open	Exceedance
62 L _{Aeq,16hr} (Day)	53	+9	63	-1
59 L _{Aeq,8hr} (Night)	48	+11	55	+4
83 L _{AFmax} (Night)	58	+25	78	+5
Amber Façades				
External Noise Levels	AVO Guide Windows Open Often	Exceedance	AVO Guide Windows Rarely Open	Exceedance
61 L _{Aeq,16hr} (Day)	53	+8	63	-2
57 L _{Aeq,8hr} (Night)	48	+9	55	+2
76 L _{AFmax} (Night)	58	+18	78	-2
Green Façades				
External Noise Levels	AVO Guide Windows Open Often	Exceedance	AVO Guide Windows Rarely Open	Exceedance
58 L _{Aeq,16hr} (Day)	53	+5	63	-5
54 L _{Aeq,8hr} (Night)	48	+6	55	-1
73 L _{AFmax} (Night)	58	+15	78	-5

Table 11 – Open Window Assessment

The external noise levels incident on the green façades exceed the AVO Guides 'Windows Open Often' criteria which means that windows being used for the primary means of ventilation (whilst maintaining reasonable internal noise levels) could vary dependent on the outcome of a TM59 overheating assessment. To assist in the design of the alternative ventilation strategy a TM59 overheating assessment should be undertaken to ascertain how frequently open windows will be required to mitigate overheating. The TM59 assessor should be provided with this report to base their study.

If a TM59 assessment is not undertaken, then a mechanical extract ventilation system should be installed to provide 'Whole Dwelling Ventilation' in accordance with Approved Document F. It is understood that continuous MEV extract fans installed in accordance with the specified trickle ventilators to allow the ingress of fresh air will be adequate. The ventilation system should be designed by an appropriately qualified person to ascertain compliance with the relevant Building Regulations. Special consideration should be given to 1.5 to 1.7 of Approved Document F to assist in the design of the ventilation system and to ensure the self-generated noise levels from the MEV extract fans to not exceed the specified criteria.

The noise levels incident on the red and amber façades exceed the AVO Guides 'Windows Rarely Open' criteria, which means that mechanical ventilation will be required for rooms with windows on these façades. Again, it is understood that continuous MEV extract fans installed in accordance with the specified trickle ventilators to allow the ingress of fresh air will be adequate

6. External Noise Level Assessment

The following section analyses the external amenity area noise levels across the Proposed Development. The external amenity area sound levels are summarised in the table below.

External Amenity Area Noise Level Assessment			
Plot No.	L _{Aeq,16hr} Noise Level (dB)	BS8233:2014 Criteria (dB)	Exceedance (dB)
1-8	42 – 54	50 – 55 L _{Aeq,16hr}	-1
9	58		+3

Table 12 – BS8233:2014 External Amenity Area Noise Level Assessment

As can be seen in the table above, the noise levels within the external amenity areas of Plots 1 – 8 are within the BS8233 criteria. As such, no further mitigation is deemed necessary in these areas.

The noise levels in the garden area of Plot 9 are expected to exceed the criteria by approximately 3dB. Due to the nature of the site and the fact that the trainline is at a raised level, mitigation in the form of acoustic fencing is likely to be ineffective. As such, if it is deemed that the criteria must be achieved, then it is recommended that the layout of Plot 9 is reorientated so that the garden area is shielded from the trainline by building.

7. Ground-Borne Vibration Screening Assessment

Due to the proximity of the trainline, it is possible that the Site may be affected by ground borne vibration. For this reason, vibration measurements were taken on site, and the results are analysed in the following section.

Ground-Borne Vibration Criteria

BS6472-1:2008 provides criteria for assessing ground-borne vibration in the form of the “likelihood of adverse comment” that might result from given Vibration Dose Values (VDV) within buildings. The following table outlines the criteria presented within BS6472-1:2008.

Description	VDV $\text{m.s}^{-1.75}$		
	Low Probability of Adverse Comment	Adverse Comment Possible	Adverse Comment Probable
Residential 16-hour Day	0.2 – 0.4	0.4 – 0.8	0.8 – 1.6
Residential 8-hour Night	0.1 – 0.2	0.2 – 0.4	0.4 – 0.8

Table 13 – BS6472-1:2008 Ground-Borne Vibration Criteria Inside Dwellings

Ground-Borne Vibration Measured Results

VDV measurements were taken using a Svantek SV958A Vibration Meter and Svantek SV84 accelerometer. The meter was set up at the boundary of site, closest to the trainline and measurements were taken across the relevant low-frequency range (1-80Hz) over a 2-hour period on 06/07/2023. The accelerometer was situated on the floor at the approximate location of the closest proposed residential dwelling.

The table below presents the maximum tri-axial vibration dose during train pass-bys.

Description	Max VDV Event $\text{m.s}^{-1.75}$		
	X Axis (W_d)	Y Axis (W_d)	Z Axis (W_b)
06/07/23 - 13:15 – 15:18	0.07	0.09	0.04

Table 14 – Maximum Measured VDV Levels during Train Pass-bys

The table above shows that vibration levels were typically highest in the Y-axis (Horizontal).

The table below shows the number of trains for both the day and night-time period, taken from the Realtime Trains database.

Day (07:00 – 23:00)	Night (23:00 – 07:00)
106	17

Table 15 – Number of Trains

The calculated day and night-time vibration dose values are detailed in the table below. The calculation method is taken from Example 1 in Appendix B of BS6472-1:2008

Description	Calculated VDV $\text{m.s}^{-1.75}$		
	X Axis (W_d)	Y Axis (W_d)	Z Axis (W_b)
16-hour Day	0.24	0.28	0.13
8-hour Night	0.15	0.17	0.08

Table 16 – Summary of Calculated VDV Levels

Discussion

With reference to the human response criteria in BS6472-1:2008, the calculated VDV's for the daytime and night-time periods correspond with the assessment outcome of "low probability of adverse comment". As such, it is thought that it is unlikely that vibration levels at the site will negatively affect the amenity of future residents.

8. BS4142 Noise Impact Assessment

UK Building Compliance has been informed that air source heat pumps (ASHPs) will be installed for all plots at the development. In the following section of the report, the impact of the noise emissions generated by the ASHPs is assessed.

It is intended that the following ASHP models will be installed:

- Vaillant aeroTHERM plus 10kW for Plots 1, 4, 7, 8 and 9
- Vaillant aeroTHERM plus 12kW for Plots 2, 3, 5 and 6

8.1 Proposed External Fixed Plant & Specific Sound Levels

The calculated octave-band sound power levels for the proposed ASHP units are shown in the table below. As the manufacturer only provides an overall L_{wA} value, the octave-band spectrum has been derived from a comparable unit and adjusted to align with the stated overall sound power level. The manufacturer's datasheets can be found in Appendix G.

Description	1/1 Octave Frequency Band (Hz, L_w , dB)								Overall (L_w , dBA)
	63	125	250	500	1k	2k	4k	8k	
Vaillant aeroTHERM plus 10kW & 12kW	68	63	59	58	55	50	45	37	60

Table 17 – Sound Power Levels of ASHP Units

Noise Modelling

The following assumptions have been made within the SoundPlan 9.0 noise modelling software:

- To accurately model the land surrounding the site, the topographical data has been taken from the Google Maps database.
- For the purpose of the assessment, the ground between the source and receivers is considered a mixture of acoustically 'hard' and 'soft' surfaces that have been modelled according to the ground type.
- Octave band noise data has been used to facilitate noise modelling in accordance with ISO 9613-2. ISO 9613-2 assumes a 'downwind' model to the NSRs.
- The sound map grid height has been set to 1.5m, however, the noise levels used in the assessment have been taken from the most exposed point of each façade.
- The site and all other buildings and any intervening objects have been modelled according to measurements taken on-site and Google Maps data.
- The sound power levels presented in Table 15 have been imputed into the noise model.
- Point source emitters at 1m height (0.8m to the middle of the unit + 0.2m allowance for the base) have been modelled to account for proposed AHSP units.

The sound map showing the specific sound levels emission from the site can be seen in the following figure.

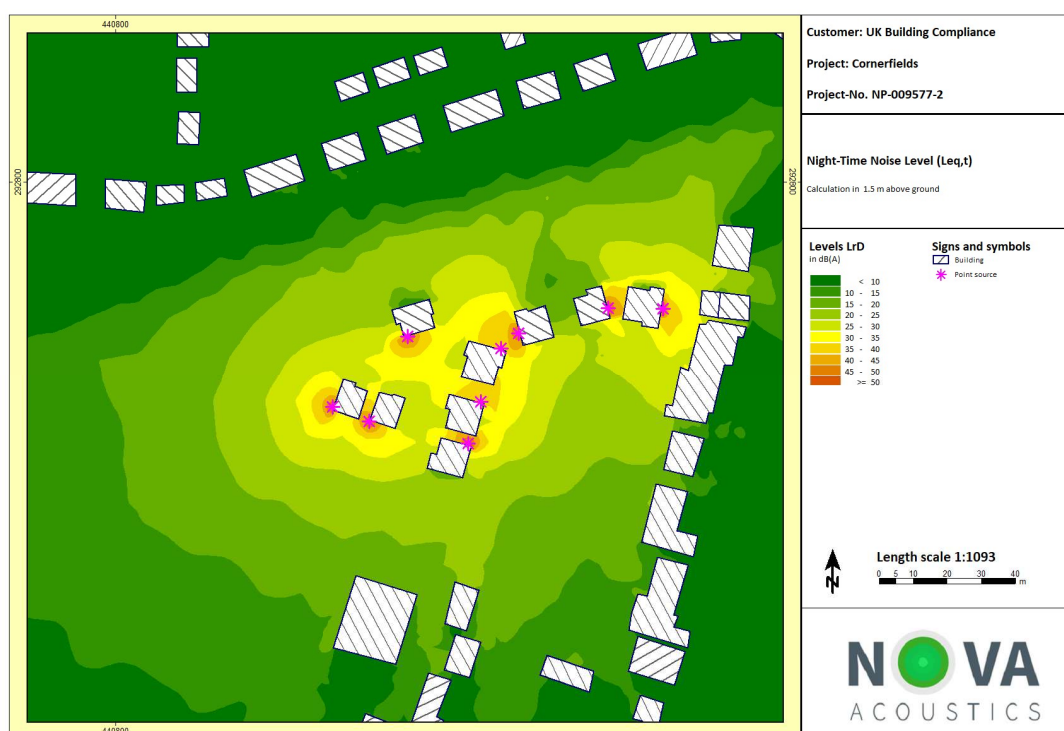


Figure 11 – Specific Sound Level Map

8.2 BS4142 Noise Impact Assessment

The closest and most affected NSRS are considered to be the properties adjacent to the east of the site boundary on Nutts Lane.

The BS4142 noise impact assessment is shown in the table below.

Description	1/1 Octave Frequency Band (Hz, dB)								Overall (dBA)
	63	125	250	500	1k	2k	4k	8k	
Specific Sound Level at NSR1 (L _{eq})	42	34	27	27	25	21	16	7	30
Acoustic Feature Correction	It is not anticipated that any acoustic feature corrections would apply. The predicted specific sound level is 30dB, and when accounting for the 13dB attenuation typically afforded by a partially open window, this results in an internal level of approximately 17dB. Such a value is exceptionally low and would not be expected to give rise to any perceptible acoustic concern.								
Background Sound Level (L _{A90} , dB)	Day: 49					Night: 39			
Exceedance of L _{A90} (dB)	-19					-9			
BS4142 Assessment Outcome	‘Low impact’.								
NPPF & NPSE Outcome	‘No Observed Adverse Effect Level (‘NOAEL’).								

Table 18 – Noise Impact Assessment

9. Conclusion and Action Plan

The proposed development has been assessed against the acoustic design criteria and a sound insulation scheme has been provided to ensure the criteria has been achieved.

The following 'Action Plan' is outlined to ensure the design considerations and specifications from this report are duly implemented:

1. The proposed glazing and background ventilation systems, or suitable alternatives, should be installed as shown in Section 4.
2. To assist in the design of the alternative ventilation strategy a TM59 overheating assessment should be undertaken to ascertain how frequently open windows will be required to mitigate overheating. The TM59 assessor should be provided with this report to base their study. It is highlighted that this report also presents an alternative ventilation strategy in Section 5 should a TM59 assessment not be undertaken.
3. Noise levels in the external amenity area of Plot 9 should be mitigated as described in Section 6.
4. The makes and models of the proposed external plant units assessed in Section 7 should not be altered. If alterations are required, then further assessment should be undertaken.

The findings of this report will require written approval from the Local Authority prior to work commencing.

Appendix A – Acoustic Terminology

A-weighted sound pressure level, L_{pA}	Quantity of A-weighted sound pressure given by the following formula in decibels (dBA). $L_{pA} = 10 \log_{10} (pA/p_0)^2$. Where: pA is the A-weighted sound pressure in pascals (Pa) and p_0 is the reference sound pressure (20 μ Pa)
Background Sound	Underlying level of sound over a period, T , which might in part be an indication of relative quietness at a given location
Equivalent continuous A-weighted sound pressure level, $L_{Aeq,T}$	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
Facade level	Sound pressure level 1 m in front of the facade
Free-field level	Sound pressure level away from reflecting surfaces
Indoor ambient noise	Noise in a given situation at a given time, usually composed of noise from many sources, inside and outside the building, but excluding noise from activities of the occupants
Noise Criteria	Numerical indices used to define design goals in a given space
Noise Rating (NR)	Graphical method for rating a noise by comparing the noise spectrum with a family of noise rating curves
Octave Band	Band of frequencies in which the upper limit of the band is twice the frequency of the lower limit
Percentile Level, $L_{AN,T}$	A-weighted sound pressure level obtained using time-weighting “F”, which is exceeded for $N\%$ of a specified time interval
Rating Level, $L_{Ar,Tr}$	Equivalent continuous A-weighted sound pressure level of the noise, plus any adjustment for the characteristic features of the noise
Reverberation time, T	Time that would be required for the sound pressure level to decrease by 60 dB after the sound source has stopped
Sound Pressure, p	root-mean-square value of the variation in air pressure, measured in pascals (Pa) above and below atmospheric pressure, caused by the sound
Sound Pressure Level, L_p	Quantity of sound pressure, in decibels (dB), given by the formula: $L_p = 10 \log_{10}(p/p_0)^2$. Where: p is the root-mean-square sound pressure in pascals (Pa) and p_0 is the reference sound pressure (20 μ Pa)
Weighted sound reduction index, R_w	Single-number quantity which characterizes the airborne sound insulating properties of a material or building element over a range of frequencies

Appendix B – Standards, Legislation, Policy, and Guidance

This report is to be primarily based on the following standards, legislation, policy, and guidance.

B.1 – National Planning Policy Framework (2021)

Government policy on noise is set out in the National Planning Policy Framework (NPPF), published in 2021. This replaced all earlier guidance on noise and places an emphasis on sustainability. In section 15, Conserving and enhancing the natural and local environment, paragraph 174e, it states:

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.

Paragraph 185 states:

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

- a) Mitigate and reduce to a minimum potential adverse impact resulting from noise from new development – and avoid noise giving rise to significant adverse impacts on health and the quality of life.*
- b) Identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason; and*
- c) Limit the impact of light pollution from artificial light on local amenity, intrinsically dark landscapes, and nature conservation.*

B.2 – Noise Policy Statement for England (2010)

Paragraph 185 of the NPPF also refers to advice on adverse effects of noise given in the Noise Policy Statement for England (NPSE). This document sets out a policy vision to:

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

To achieve this vision the Statement identifies the following three aims:

Through the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development:

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

In achieving these aims the document introduces significance criteria as follows:

SOAEL – Significant Observed Adverse Effect Level

This is the level above which significant adverse effects on health and quality of life occur. It is stated that “significant adverse effects on health and quality of life should be avoided while also considering the guiding principles of sustainable development”.

LOAEL – Lowest Observed Adverse Effect Level

This is the level above which adverse effects on health and quality of life can be detected. It is stated that the second aim above lies somewhere between LOAEL and SOAEL and requires that: “all reasonable steps should be taken to mitigate and minimise adverse effects on health and quality of life while also considering the guiding principles of sustainable development. This does not mean that such adverse effects cannot occur.”

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. This can be related to the third aim above, which seeks: “where possible, positively to improve health and quality of life through the pro-active management of noise while also considering the guiding principles of sustainable development, recognising that there will be opportunities for such measures to be taken and that they will deliver potential benefits to society. The protection of quiet places and quiet times as well as the enhancement of the acoustic environment will assist with delivering this aim.”

The NPSE recognises that it is not possible to have a single objective noise-based measure that is mandatory and applicable to all sources of noise in all situations and provides no guidance as to how these criteria should be interpreted. It is clear, however, that there is no requirement to achieve noise levels where there are no observable adverse impacts but that reasonable and practicable steps to reduce adverse noise impacts should be taken in the context of sustainable development and ensure a balance between noise sensitive and the need for noise generating developments.

Any scheme of noise mitigation outlined in this report will, therefore, aim to abide by the above principles of the NPPF and NPSE whilst recognizing the constraints of the site.

B.3 – BS8233:2014 ‘Guidance on Sound insulation and noise reduction for buildings’

BS8233 provides guidance on noise levels from sources without specific character in the built environment, based on the recommendations of the World Health Organization; specifically, ‘WHO Guidelines on Community Noise, 1999’. The Guidelines on Community Noise (1999) document defines community noise to include noise from “industries” and “construction”. The desirable criteria levels of steady state, “anonymous” noise in unoccupied spaces within dwellings, from sources such as road traffic, mechanical services and other continuously running plant, are tabulated below.

BS8233:2014 Internal Ambient Noise Level Criteria			
Activity	Location	Daytime (07:00 – 23:00)	Night-time (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 $L_{Aeq,8hour}$ 45 dB L_{AFmax}^*

Table 19 – BS8233:2014 Internal Ambient Noise Level Criteria

**ProPG:2017 states that's good acoustic design can be used so that individual noise events do not normally exceed 45 dB L_{AFmax} more than 10 time a night within noise sensitive rooms such as bedrooms. However, where it is not reasonably practicable to achieve the guideline then the judgment of acceptability will depend not only on the maximum noise levels but also on factors such as the source, number distribution, predictability, and regularity of noise events.*

It is noted, however, that where development is considered necessary or desirable, despite external noise level above WHO guidelines, the above target levels may be relaxed by up to 5 dB.

General recommendations for mitigation to enable these targets to be achieved are provided, including the use of bunds and barriers to reduce external noise and space planning and sound insulation for the control of internal noise levels.

For this assessment, the above criteria are considered to be the 'LOAEL' as defined in the NPSE in Appendix B.

B.5 – BS4142:2014+A1:2019 – 'Methods for rating and assessing industrial and commercial sound'

Overview

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

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

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

Rating Penalty

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

BS4142:2014 states:

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

- a) subjective method;*
- b) objective method for tonality;*
- c) reference method.”*

Due to the nature of the development the subjective method has been adopted to derive the rating sound level from the specific sound level. This is discussed in Section 9.2 of BS4142:2014, which states:

“Where appropriate, establish a rating penalty for sound based on a subjective assessment of its characteristics. This would also be appropriate where a new source cannot be measured because it is only proposed at that time, but the characteristics of similar sources can subjectively be assessed. Correct the specific sound level if a tone, impulse or other characteristics occurs, or is expected to be present, for new or modified sound sources.”

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

a) Tonality

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

b) Impulsivity

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

c) Other Sound Characteristics

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

d) Intermittency

BS4142:2014 states that when the “specific sound has identifiable on/off conditions, the specific sound level ought to be representative of the time period of length equal to the reference time interval which contains the greatest total amount of on time ... if the intermittency is readily distinctive against the residual acoustic environment, a penalty of +3 dB can be applied.”

Background Sound Level

The background sound level is the underlying level of sound over a period, T, and is indicative of the relative quietness at a given location. It does not reflect the occurrence of transient and/or higher sound level events and is generally governed by continuous or semi-continuous sounds.

To ensure the background sound level values used within the assessment are reliable and suitably represent both the particular circumstance and periods of interest, efforts have been made to quantify a 'typical' background sound level for a given period. The purpose has not been to simply select the lowest measured value. Diurnal patterns have also been considered as they can have a major influence on background sound levels, for example, the middle of the night can be distinctly different (and potentially of lesser importance) compared to the start or end of the night time period for sleep purposes.

Since the intention is to determine a background sound level in the absence of the specific sound that is under consideration, it is necessary to understand that the background sound level can in some circumstances legitimately include industrial and/or commercial sounds that are present as separate to the specific sound.

Assessment of Impact

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

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

Interpreting the guidance given in BS4142:2014, with consideration of the guidance given in the NPSE and NPPG Noise, an estimation of the impact of the rating sound is summarised in the following text:

- A rating sound level that is +10 dB above the background sound level is likely to be an indication of a Significant Observed Adverse Effect Level;
- A rating sound level that is +5 dB above the background sound level is likely to be an indication of a Lowest Observed Adverse Effect Level;
- The lower the rating sound level is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact or a significant adverse impact. Where the rating sound level does not exceed the background sound level, this is an indication of the specific sound source having a negligible impact and would therefore be classified as No Observed Adverse Effect Level.

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

B.4 – ProPG: Planning and Noise (2017)

ProPG Planning and Noise published May 2017 by the Association of Noise Consultants (ANC) was produced to provide practitioners with guidance on a recommended approach to the management of noise within the planning system in England. ProPG aims to encourage better acoustic design of new residential developments promoting good health and wellbeing through the effective management of noise. It therefore outlines four key elements which should be considered in the assessment of noise:

- 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”.

The ProPG supplementary document 2 provides the following ‘Good Acoustic Design’ hierarchy of noise management measures which LPAs should encourage. These are shown below, In descending order of preference:

Order of Preference	Noise Management Measure
1	Reduction of the noise generated at source by redesign, relocation, or containment. *
2	Maximising the spatial separation of noise source(s) and receptor(s).
3	Using existing topography and existing structures (that are likely to last the expected life of the noise-sensitive scheme) to screen the proposed development site from significant sources of noise.
4	Investigating the necessity and feasibility of reducing existing noise levels and relocating existing noise sources.
5	Incorporating noise barriers as part of the scheme to screen the proposed development site from significant sources of noise.
6	Using the layout of the scheme to reduce noise propagation across the site.
7	Using the orientation of buildings to reduce the noise exposure of noise sensitive rooms.
8	Using the building envelope to mitigate noise to acceptable levels.

Table 20 – Hierarchy of Noise Management Measures

**Not from ProPG*

B.5 – Approved Document O: Overheating (2021)

Approved Document O states the following in relation to noise:

1. 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).
2. Windows are likely to be closed during sleeping hours if noise within bedrooms exceeds the following limits.
 - a. 40dB L_{Aeq,T}, averaged over 8 hours (between 11pm and 7am).

- b. 55dB L_{AFmax} , more than 10 times a night (between 11pm and 7am).
- 3. Where in-situ noise measurements are used as evidence that these limits are not exceeded, measurements should be taken in accordance with the Association of Noise Consultants' Measurement of Sound Levels in Buildings with the overheating mitigation strategy in use.

NOTE: Guidance on reducing the passage of external noise into buildings can be found in the National Model Design Code: Part 2 – Guidance Notes (MHCLG, 2021) and the Association of Noise Consultants' Acoustics, Ventilation and Overheating: Residential Design Guide (2020).B.6 - Acoustics Ventilation and Overheating – Residential Design Guide 2020

B.6 – Acoustics Ventilation and Overheating – Residential Design Guide 2020

It is suggested that the desirable internal noise criteria within BS8233:2014 should be achieved considering adequate ventilation as defined by Building Regulations 'Approved Document F' ('ADF') whole dwelling ventilation. However, for a whole dwelling ventilation system such as MVHR it is considered reasonable to allow higher levels of internal ambient noise from transport sources when higher rates of ventilation are required in relation to the overheating condition.

The 'Institute of Acoustics' ('IOA') and the 'Association of Noise Consultant's' ('ANC') have published 'The AVO Guide: 2020' document 2020. It provides guidance for those acousticians involved in the design of buildings to prevent noise ingress to and achieve reasonable internal levels. This provides valuable guidance on ventilation and overheating in support of the "Good Acoustic Design" principle advocated by ProPG. Along with guidance showing an acoustic assessment during the overheating condition, the AVO Guide (2020) provides a framework that has a two-level assessment procedure to estimate the potential impact on occupants:

Level 1 Risk Assessment

AVO 'Level 1' risk assessment criteria guide based on external free field ambient noise levels for dwellings relying on purge ventilation (e.g., opening windows) to prevent summertime overheating. AVO Guide Table 3-2 detailed in the figure below. To assess the possibility of overheating it is reasonable to relax the BS 8233:2014 internal ambient noise levels from opening a window by 5 decibels (5 dB). Also, it is assumed that a partially open window will provide a sound reduction of 13 dB. Therefore, to achieve internal noise levels in line with BS 8233:2014 the façade external noise levels should fall inside the levels shown in Table 3-2.

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

Table 3-2 of AVO Guide (2020)

Figure 12 – AVO Guide Level 1 Risk Category

The AVO Guide (2020) seeks to determine the level of risk associated with overheating in a new residential development based on the existing noise climate. The AVO risk categories are detailed in the table below with clearer categorisation.

AVO Guide (2020) Level 1 Risk Assessment			
Daytime (07:00 – 23:00)	Night-time (23:00 – 07:00)	Risk Category	Mitigation
≥ 63 dB $L_{Aeq,16hour}$	≥ 55 dB $L_{Aeq,8hour}$	High Risk	Level 2 assessment recommended. Windows which are unopenable on grounds of noise will inevitably create issues for the overheating strategy.
57 – 62 dB $L_{Aeq,16hour}$	52 – 54 dB $L_{Aeq,8hour}$	Medium Risk	Level 2 assessment optional to give more confidence regarding the suitability of internal noise conditions.
54 – 56 dB $L_{Aeq,16hour}$	49 – 51 dB $L_{Aeq,8hour}$	Low Risk	
≤ 53 dB $L_{Aeq,16hour}$	≤ 48 dB $L_{Aeq,8hour}$	Negligible Risk	None required – openable windows suitable for ventilation

Table 21 – AVO Guide (2020) Level 1 Risk Assessment

Level 2 Risk Assessment:

A 'Level 2' assessment of noise is recommended where a dwelling using purge ventilation (e.g., open windows) reaches Level 1 'High Risk' or 'Medium Risk'. The Level 2 assessment guidance comments that where internal ambient noise levels are >50 dB $L_{Aeq,16hr}$ (day) or >42 dB $L_{Aeq,8hr}$ (night) then the outcome might be that the noise causes a material change in behaviour, e.g., having to keep windows closed for the majority of the time, or there is the potential for sleep disturbance.

To conduct a Level 2 assessment, the following minimum information is required:

- Statement of the overheating criteria being applied.
- Description of the provisions for meeting the stated overheating criteria. This should include, where relevant, the area of façade opening.
- Details of the likely internal ambient noise levels whilst using provisions for mitigating overheating, and the method used to predict these.
- Estimation of how frequently and for what duration such provisions are required to mitigate overheating.
- Consideration of the effect of individual noise events.
- Assessment of the adverse effect on occupants.

The figure below outlines the AVO Guide (2020) guidance for a Level 2 assessment of noise from transport sources relating to the 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 $L_{A, Fmax}$	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 $L_{A, Fmax}$ 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.

Note 1 The noise levels suggested in Tables 3-2 and 3-3 assume a steady road traffic noise source but may be adapted for other types of transport.

Table 3-3 of AVO Guide (2020)

Figure 13 – AVO Guide Level 2 Internal Ambient Noise Levels

Appendix D – Environmental Survey

D.1 – Time History Noise Data

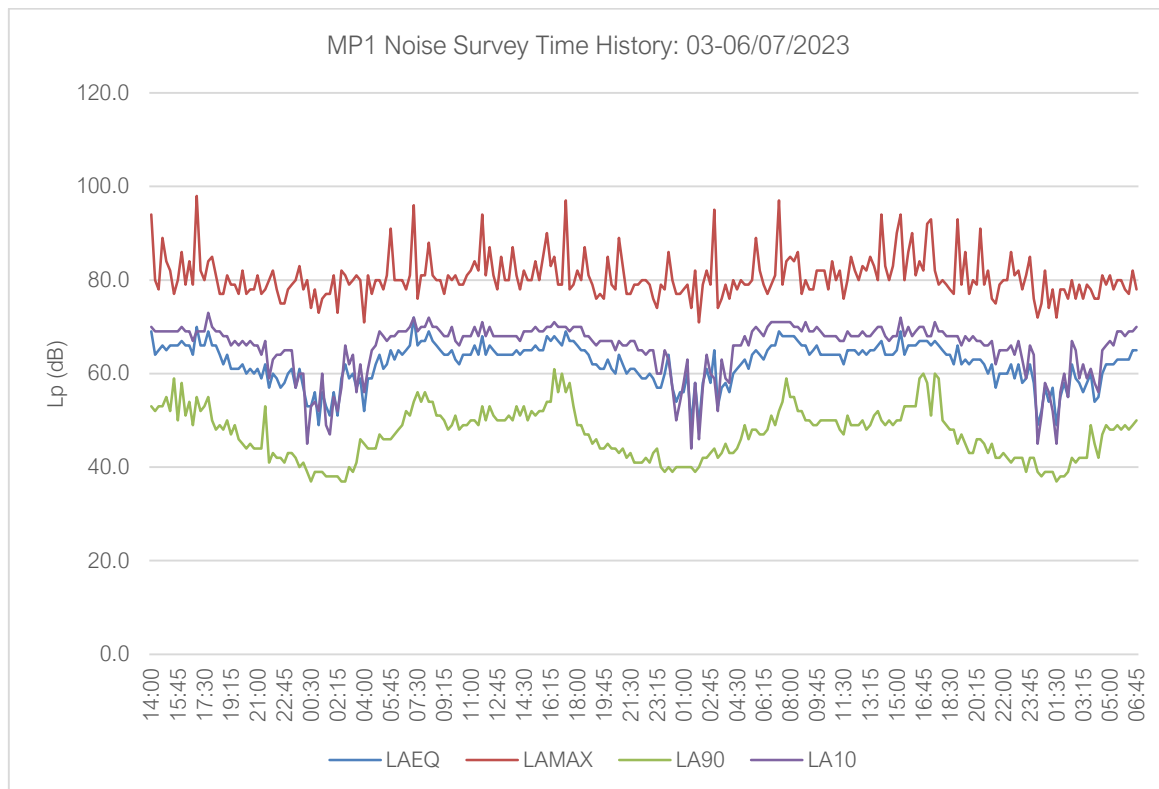


Figure 15 – MP1 Noise Survey Time History

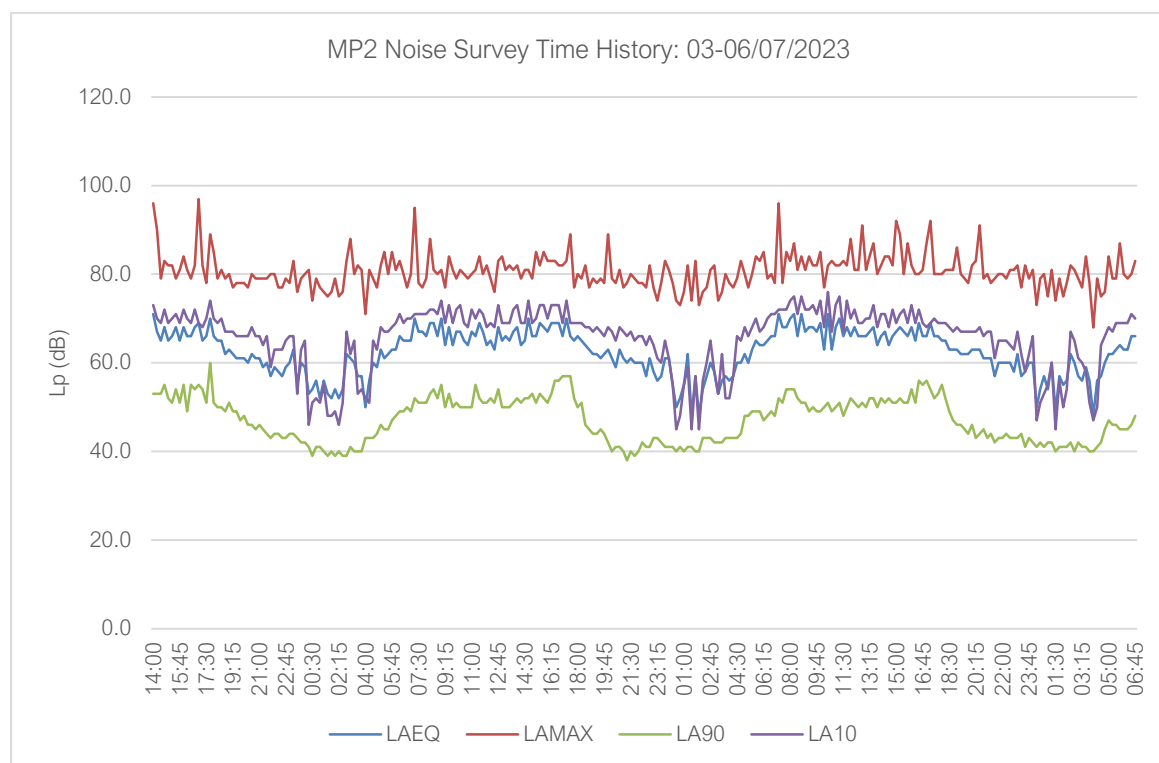


Figure 16 – MP2 Noise Survey Time History

D.2 – Surveying Equipment

Piece of Equipment	Serial No.	Calibration Deviation
Svantek 977 Class 1 Sound Level Meter	34826	≤0.2
Svantek SV33B Class 1 Calibrator	116639	
Svantek 971 Class 1 Sound Level Meter	77796	≤0.2
Svantek SV33B Class 1 Calibrator	116639	

Table 22 – Surveying Equipment

All equipment used during the survey was field calibrated at the start and end of the measurement period with a negligible deviation of ≤0.2dB. All sound level meters are calibrated every 24 months, and all calibrators are calibrated every 12 months, by a third-party calibration laboratory. All microphones were fitted with a protective windshield for the entire measurements period. Calibration certificates can be provided upon request.

D.3 – Meteorological Conditions

As the environmental noise survey was carried out over a long un-manned period no localised records of weather conditions were taken. However, all measurements have been compared with met office weather data of the area, specifically the closest weather station, and the data from the weather station is outlined in the table below. When reviewing the time history of the noise measurements, any scenarios that were considered potentially to be affected by the local weather conditions have been omitted. The analysis of the noise data includes statistical and percentile analysis and review of minimum and maximum values, which aids in the preclusion of any periods of undesirable weather conditions. The weather conditions were deemed suitable for the measurement of environmental noise in accordance with BS7445 Description and Measurement of Environmental Noise. The table below presents the average temperature, wind speed and rainfall range for each 24-hour period during the entire measurement.

Weather Conditions – Stoke Golding (Approx. 4.9km North of Site)				
Time Period	Air Temp (°C)	Rainfall (mm/h)	Prevailing Wind Direction	Wind Speed (m/s)
03/07/23 – 00:00 – 23:59	11.6 – 20.6	0.0	SSW	0.5 – 7.0
04/07/23 – 00:00 – 23:59	11.5 – 17.6	0.0	SW	0.0 – 4.8
05/07/23 – 00:00 – 23:59	9.3 – 20.8	0.0	SSW	0.0 – 3.9
06/07/23 – 00:00 – 23:59	10.2 – 22.3	0.0	SSW	0.0 – 5.7

Table 23 – Weather Conditions

Appendix E – Noise Break-in Calculations

E.1 – Façades with Background Ventilation

The façade sound reduction and predicted internal noise levels are calculated assuming the following:

- The calculation method for façade sound reduction is in accordance with BS8233:2014 and BS EN 12354-3.
- The frequency profile from MP3 has been used for all calculations.
- The second highest L_{AFmax} measurement recorded at MP3 has been used to calibrate the maximum noise emissions from the trainline.
- The reverberation time is typically 0.5 seconds across the relevant frequency range for a furnished living room in the UK. This value is used for both living rooms and bedrooms.
- Based on the technical drawings provided, window areas of 2-5m² and room volumes of 26-38m³ are used in the calculations for bedrooms as a worst-case scenario. For living rooms, the calculations are based on a window area of 2.5-13.5m² and room volume of 27-84m³ as a worst-case scenario.
- The acoustic performance of the façade elements is taken from the relevant manufacturers' technical information, or the sound reduction has been predicted using INSUL 9.0.
- For background trickle ventilation a total Equivalent Area of 5000mm² per habitable room has been used in the calculations, which equates to 2 No. trickle vents (2500mm² each).

Living Room (Red) Day Time Leq

Item / Description	dB(A)	63	125	250	500	1k	2k	4k
Corrected Leq,T Spectrum	62	67	59	59	59	58	54	51
Glazing Noise Ingress	30	43	33	35	28	15	13	7
Ventilation Noise Ingress	28		25	28	28	20	20	13
Wall Noise Ingress	4	23	10	8	-2	-4	-8	-11
Roof Noise Ingress								
Room Absorption Correction		0	0	-1	-1	-1	-2	-3
Total Noise Ingress	34	46	37	38	33	24	22	15
NR30	35	59	48	39	33	30	26	24
Exceedance of Criteria	-1	-13	-11	-1	0	-6	-4	-9

Bedroom (Red) Day Time Leq

Item / Description	dB(A)	63	125	250	500	1k	2k	4k
Corrected Leq,T Spectrum	62	67	59	59	59	58	54	51
Glazing Noise Ingress	24	43	35	28	19	7	3	-6
Ventilation Noise Ingress	17	40	16	17	12	6	-8	-13
Wall Noise Ingress	3	22	8	7	-4	-5	-9	-13
Roof Noise Ingress								
Room Absorption Correction		-2	-2	-3	-3	-3	-4	-5
Total Noise Ingress	25	46	35	29	19	9	3	-6
NR30	35	59	48	39	33	30	26	24
Exceedance of Criteria	-10	-13	-13	-10	-14	-21	-23	-30

Bedroom (Red) Night Time Leq

Item / Description	dB(A)	63	125	250	500	1k	2k	4k
Corrected Leq,T Spectrum	59	64	56	56	56	55	51	48
Glazing Noise Ingress	21	40	32	25	16	4	0	-9
Ventilation Noise Ingress	14	37	13	14	9	3	-11	-16
Wall Noise Ingress	0	19	5	4	-7	-8	-12	-16
Roof Noise Ingress								
Room Absorption Correction		-2	-2	-3	-3	-3	-4	-5
Total Noise Ingress	22	43	32	26	16	6	0	-9
NR25	30	55	43	35	28	25	21	19
Exceedance of Criteria	-8	-12	-11	-9	-12	-19	-21	-28

Bedroom (Red) Night Time Max

Item / Description	dB(A)	63	125	250	500	1k	2k	4k
Corrected Lmax Spectrum	82	87	79	79	79	78	74	71
Glazing Noise Ingress	44	63	55	48	39	27	23	14
Ventilation Noise Ingress	37	60	36	37	32	26	12	7
Wall Noise Ingress	23	42	28	27	16	15	11	7
Roof Noise Ingress								
Room Absorption Correction		-2	-2	-3	-3	-3	-4	-5
Total Noise Ingress	45	66	55	49	39	29	23	14
NR40	45	67	56	49	43	40	37	34
Exceedance of Criteria	0	-1	-1	0	-4	-11	-14	-20

Living Room (Amber) Day Time Leq

Item / Description	dB(A)	63	125	250	500	1k	2k	4k
Corrected Leq,T Spectrum	61	66	58	58	58	57	53	50
Glazing Noise Ingress	31	44	35	36	30	17	14	9
Ventilation Noise Ingress	22		19	22	22	15	14	7
Wall Noise Ingress	1	20	6	5	-6	-8	-11	-15
Roof Noise Ingress								
Room Absorption Correction		0	0	-1	-1	-1	-2	-3
Total Noise Ingress	34	47	37	39	32	21	19	12
NR30	35	59	48	39	33	30	26	24
Exceedance of Criteria	-1	-12	-11	0	-1	-9	-7	-12

Bedroom (Amber) Day Time Leq

Item / Description	dB(A)	63	125	250	500	1k	2k	4k
Corrected Leq,T Spectrum	61	66	58	58	58	57	53	50
Glazing Noise Ingress	26	40	30	32	24	14	8	-2
Ventilation Noise Ingress	28		24	27	27	20	19	13
Wall Noise Ingress	4	23	9	8	-3	-5	-8	-12
Roof Noise Ingress								
Room Absorption Correction		-2	-2	-3	-3	-3	-4	-5
Total Noise Ingress	30	41	32	33	29	20	19	11
NR30	35	59	48	39	33	30	26	24
Exceedance of Criteria	-5	-18	-16	-6	-4	-10	-7	-13

Bedroom (Amber) Night Time Leq

Item / Description	dB(A)	63	125	250	500	1k	2k	4k
Corrected Leq,T Spectrum	57	62	54	54	54	53	49	46
Glazing Noise Ingress	22	36	26	28	20	10	4	-6
Ventilation Noise Ingress	24		20	23	23	16	15	9
Wall Noise Ingress	0	19	5	4	-7	-9	-12	-16
Roof Noise Ingress								
Room Absorption Correction		-2	-2	-3	-3	-3	-4	-5
Total Noise Ingress	26	37	28	29	25	16	15	7
NR25	30	55	43	35	28	25	21	19
Exceedance of Criteria	-4	-18	-15	-6	-3	-9	-6	-12

Bedroom (Amber) Night Time Max

Item / Description	dB(A)	63	125	250	500	1k	2k	4k
Corrected Lmax Spectrum	75	80	72	72	72	71	67	64
Glazing Noise Ingress	40	54	44	46	38	28	22	12
Ventilation Noise Ingress	42		38	41	41	34	33	27
Wall Noise Ingress	18	37	23	22	11	9	6	2
Roof Noise Ingress								
Room Absorption Correction		-2	-2	-3	-3	-3	-4	-5
Total Noise Ingress	44	55	46	47	43	34	33	25
NR40	45	67	56	49	43	40	37	34
Exceedance of Criteria	-1	-12	-10	-2	0	-6	-4	-9

Living Room (Green) Day Time Leq

Item / Description	dB(A)	63	125	250	500	1k	2k	4k
Corrected Leq,T Spectrum	58	63	55	55	55	54	50	47
Glazing Noise Ingress	28	41	32	33	27	14	11	6
Ventilation Noise Ingress	19	16	19	19	12	11	4	
Wall Noise Ingress	-2	17	3	2	-9	-11	-14	-18
Roof Noise Ingress								
Room Absorption Correction		0	0	-1	-1	-1	-2	-3
Total Noise Ingress	31	44	34	36	29	18	16	9
NR30	35	59	48	39	33	30	26	24
Exceedance of Criteria	-4	-15	-14	-3	-4	-12	-10	-15

Bedroom (Green) Day Time Leq

Item / Description	dB(A)	63	125	250	500	1k	2k	4k
Corrected Leq,T Spectrum	58	63	55	55	55	54	50	47
Glazing Noise Ingress	25	38	28	30	23	11	8	3
Ventilation Noise Ingress	25	21	24	24	17	16	10	
Wall Noise Ingress	1	20	6	5	-6	-8	-11	-15
Roof Noise Ingress								
Room Absorption Correction		-2	-2	-3	-3	-3	-4	-5
Total Noise Ingress	28	39	30	31	27	17	16	9
NR30	35	59	48	39	33	30	26	24
Exceedance of Criteria	-7	-20	-18	-8	-6	-13	-10	-15

Bedroom (Green) Night Time Leq

Item / Description	dB(A)	63	125	250	500	1k	2k	4k
Corrected Leq,T Spectrum	54	59	51	51	51	50	46	43
Glazing Noise Ingress	21	34	24	26	19	7	4	-1
Ventilation Noise Ingress	21	17	20	20	13	12	6	
Wall Noise Ingress	-3	16	2	1	-10	-12	-15	-19
Roof Noise Ingress								
Room Absorption Correction		-2	-2	-3	-3	-3	-4	-5
Total Noise Ingress	24	35	26	27	23	13	12	5
NR25	30	55	43	35	28	25	21	19
Exceedance of Criteria	-6	-20	-17	-8	-5	-12	-9	-14

Bedroom (Green) Night Time Max

Item / Description	dB(A)	63	125	250	500	1k	2k	4k
Corrected Lmax Spectrum	73	78	70	70	70	69	65	62
Glazing Noise Ingress	40	53	43	45	38	26	23	18
Ventilation Noise Ingress	40	36	39	39	32	31	25	
Wall Noise Ingress	16	35	21	20	9	7	4	0
Roof Noise Ingress								
Room Absorption Correction		-2	-2	-3	-3	-3	-4	-5
Total Noise Ingress	43	54	45	46	42	32	31	24
NR40	45	67	56	49	43	40	37	34
Exceedance of Criteria	-2	-13	-11	-3	-1	-8	-6	-10

Figure 17 – Noise Break-In Calculations

Appendix F – Noise Modelling Particulars

The SoundPlan 9.0 noise model has been setup with the following inputs and assumptions:

- To accurately model the land surrounding the development the topographical data has been taken from the EAs 'National LIDAR Programme' on the DEFRA Data Services Platform.
- For the purpose of the assessment, the ground between the source and receiver is considered to consist primarily of acoustically 'soft' surfaces.
- The sound map grid height has been set to 1.5m, however, the noise levels used in the assessment will be taken from the most exposed point on each NSR façade.
- All buildings and any intervening objects have been modelled according to the technical drawings provided by the applicant, and those provided by the LIDAR data.
- The noise levels presented in Table 2 have been used to calibrate the noise model.

Appendix G – Manufacturer's Datasheet

Heating
 Hot water
 Renewables

aroTHERM plus

Air source heat pump

Dimensions

Model	Width	Height	Depth
aroTHERM plus 3.5kW aroTHERM plus 5kW	1100mm	765mm	490mm (including back plate and mounting brackets)
aroTHERM plus 7kW		965mm	
aroTHERM plus 10kW aroTHERM plus 12kW		1565mm	





Overview

The aroTHERM plus is our flagship air source heat pump range, available in a wide range of heat output sizes for many types of property with 3.5, 5, 7, 10 and 12kW models available.

This heat pump continues to win awards around the world for its innovative use of the refrigerant R290, which gives it a Global Warming Potential (GWP) of just three. This refrigerant is already used in household appliances all over the world and offers many advantages over refrigerants traditionally used in heat pumps. Coupled with market leading technical features that improve efficiency and deliver higher flow temperatures, the aroTHERM plus is perfect for new and existing heating systems (including hybrid). It's also impressively quiet in operation and has been accredited by Quiet Mark*, making it suitable for use even in densely built-up terraced housing estates.

Features & benefits



High performance ASHP range

With a flow temperature of up to 75°C, the aroTHERM plus can deliver more usable hot water with high hot water comfort levels whilst removing the need for direct electric immersion to sterilise the water, protecting from legionella.



Super quiet operation

From just three metres away, the acoustic pressure level is less than 30 dB(A) for easier planning and siting.



Higher energy-efficiency performance

With a SCOP of up to 5.03, the aroTHERM plus is extremely energy efficient, enabling high energy savings against certain fossil fuels.



R290 natural refrigerant with Low GWP

Already fulfilling the next NZEB requirements, the aroTHERM plus uses monobloc technology with a hermetically sealed refrigerant circuit.



Fully adaptable system approach

The aroTHERM plus can also be combined with photovoltaic systems and integrated into smart power grids (SG-ready), so your customers can enjoy the benefits of variable electricity tariffs.



Quality by design

Suitable for installations less than 150m away from the sea with salt resistant construction C5 class.

* Models 3.5, 5 and 12kW.



Technical data	Unit	3.5kW	5kW	7kW	10kW	12kW
Dimensions						
Product dimensions (H x W x D)	mm	765 x 1100 x 450		965 x 1100 x 450	1565 x 1100 x 450	
Weight, with packaging	kg	132		150	223	
Weight, ready for operation	kg	114		128	194	
Electrical data						
Rated voltage	V	230 V (+10%/- 15%), 50 Hz, 1~N/PE			400 V (+10%/-15%), 50 Hz, 3~N/PE*	
Fuse type		Type C, slow blow, single pole switching				
RCD type**		B				
Inrush current (with inrush current limiter)	A	14.3		15	23.3	15*
Rated current, maximum	A	14.3		15	23.3	15*
IP rating		IP 15B				
eBUS cable minimum size (communication)	mm²	0.75				
eBUS cable maximum length (communication)	m	50				
Fan power consumption	W	40			50	
Fan quantity			1		2	
Fan air flow, maximum	m³/h	2300			5100	
Hydraulic connection						
Heating flow / return	BSP male	G 1 1/4"				
Heating circuit / building circuit						
Water volume in the heat pump	l	1.5		2.0	4.5	
Minimum heating circuit volume for defrost, backup activated/deactivated	l	15 / 40		20 / 55	45 / 150	
Minimum operating pressure	bar	≥0.5				
Maximum operating pressure	bar	≤2.5				
Minimum flow temperature heating	°C	20				
Maximum flow temperature heating	°C	75				
Minimum volume flow	l/h	400		540	995	
Maximum volume flow	l/h	860		1205	2065	
Maximum electrical power heating circuit pump	W	2-50			3-87	
Max. length heating pipework, outside to inside	m	20				
Pump remaining feed pressure	kPa / mbar	56 / 560		44 / 440	55 / 550	
Refrigerant circuit						
Refrigerant type		R 290				
Volume of refrigerant circuit in the heat pump	kg	0.60		0.90	1.30	
Global Warming Potential (GWP) in accordance with EU No. 517/2014		3				
CO ₂ equivalent	t	0.0018		0.0027	0.0039	
Expansion valve type		Electronic				
Oil type	bar	31.5				
Compressor type		Rotary			Scroll	
Oil type		Specific polyalkylene glycol (PAG)				
Compressor control		Electronic				
Noise emissions, heating mode						
Sound power, EN 12102, EN 14511 LWA, A7/W35	dB(A)	51		53	58	
Sound power, EN 12102, EN 14511 LWA, A7/W45	dB(A)	53			58	
Sound power, EN 12102, EN 14511 LWA, A7/W55	dB(A)	54		55	60	
Energy efficiency class						
Energy efficiency class 35°C and 55°C	(A+++ to F)	A+++				

*400v models 10 and 12kW only.

**All Vaillant heat pumps must be installed with a type B RCD rated to 20kHz or greater and with a minimum trigger point of 150mA above 1kHz.

VALTSB2BH1P0424

