



Armstrong House
3 Bassett Avenue
SO16 7DP

T: 023 8155 5000

LAND AT ST GEORGE'S AVENUE, HAVANT
NOISE AND VIBRATION IMPACT ASSESSMENT

Technical Report: R8905-1 Rev 0

Date: 25th June 2021

For: Barratt David Wilson Southampton
Tollbar House
Tollbar Way
Hedge End
Southampton
SO30 2UH

24 Acoustics Document Control Sheet

Project Title: Land at St George's Avenue, Havant
Noise and Vibration Impact Assessment

Report Ref: R8905-1 Rev 0

Date: 25th June 2021

	Name	Position	Signature	Date
Prepared by	Reuben Peckham BEng MPhil CEng MIOA	Principal Consultant		25/6/201
Reviewed by	Steve Gosling BEng MIOA	Principal Consultant		25/6/201
Approved by	Steve Gosling BEng MIOA	Principal Consultant		25/6/201
For and on behalf of 24 Acoustics Ltd				

Document Status and Approval Schedule

Revision	Description	Prepared By	Reviewed By	Approved By
0	Approved for issue	Reuben Peckham	Steve Gosling	Steve Gosling

DISCLAIMER

This report was completed by 24 Acoustics Ltd on the basis of a defined programme of work and terms and conditions agreed with the Client. The report has been prepared with all reasonable skill, care and diligence within the terms of the Contract with the Client and taking into account the project objectives, the agreed scope of works, prevailing site conditions and the degree of resources allocated to the project.

24 Acoustics Ltd accepts no responsibility whatsoever, following the issue of the report, for any matters arising outside the agreed scope of the works.

This report is issued in confidence to the Client and 24 Acoustics Ltd has no responsibility of whatsoever nature to third parties to whom this report or any part thereof is made known. Any such party relies upon the report at their own risk.

Unless specifically assigned or transferred within the terms of the agreement, 24 Acoustics Ltd retains all copyright and other intellectual property rights, on and over the report and its contents.

© 24 Acoustics Ltd 2021

EXECUTIVE SUMMARY

Barratt David Wilson Southampton (BDW) has commissioned 24 Acoustics Ltd to carry out a noise and vibration impact assessment at a site off St George's Avenue in Havant

Detailed noise and vibration surveys have been undertaken on site. These, together with the associated calculations have shown that noise levels in private external amenity areas during the day will be lower than 55 dB $L_{Aeq,16\text{ hr}}$.

For internal noise, outline recommendations in terms of glazing and alternative means of ventilation have been provided to ensure that noise within habitable rooms, due to road and rail traffic, would comply with maximum internal levels of 35 dB L_{Aeq} during the daytime and 30 dB L_{Aeq} and 45 dB $L_{Amax, f}$ at night.

A worst case vibration assessment has indicated that there is negligible risk of perceptible vibration within the development from the operation of the neighbouring railway line.

On the above basis, it is considered that an appropriate acoustic environment can be provided to the proposed residential properties, both externally and internally and there are considered to be no reasons, on noise or vibration grounds, why planning consent should not be granted.

CONTENTS

1.0	INTRODUCTION	5
2.0	SITE DESCRIPTION AND PROPOSED DEVELOPMENT	5
3.0	STANDARDS AND GUIDANCE	5
4.0	NOISE AND VIBRATION MEASUREMENTS	9
6.0	NOISE IMPACT ASSESSMENT	12
7.0	VIBRATION IMPACT ASSESSMENT	13
8.0	CONCLUSIONS	14
	APPENDIX A: ACOUSTIC TERMINOLOGY	22
	APPENDIX B: NOISE SURVEY RESULTS	24
	APPENDIX C: VIBRATION SURVEY RESULTS	27

1.0 INTRODUCTION

1.1 Barratt David Wilson Southampton (BDW) has commissioned 24 Acoustics Ltd to carry out a noise and vibration impact assessment at a site off St George's Avenue in Havant. The assessment has included:

- Ambient noise and vibration monitoring on the proposed site;
- Assessment of the noise and vibration arising from the nearby railway;
- Assessment of the noise arising from the A27;
- Production of noise contour maps including the illustrative masterplan.

1.2 An explanation of acoustical terms used in this report is provided in Appendix A. All sound pressure levels in this report are given in dB re: 20 μ Pa.

2.0 SITE DESCRIPTION AND PROPOSED DEVELOPMENT

2.1 The site is located between Havant and Emsworth and is accessed off St. George's Avenue in Havant. The site is triangular in shape with the northern boundary formed by the rail line between Warblington to Emsworth. The A27 dual carriageway bounds the south eastern side of the site. To the west are residential properties on Castel Avenue and St. George's Avenue. The site, which can be seen in Figure 1, is currently open unused agricultural land.

2.2 BDW are seeking planning consent to construct 194 private and affordable houses and flats. The proposed development scheme is shown in Figure 2.

2.3 There is potential for the development to be affected from noise from road traffic using the A27 and noise and vibration from the railway.

3.0 STANDARDS AND GUIDANCE

National Planning Policy Framework and Noise Policy Statement for England

3.1 Paragraph 180 of the National Planning Policy Framework (NPPF) [Reference 1] states that planning policies and decisions should:

- a) mitigate and reduce to a minimum potential adverse impacts resulting from noise from new development – and avoid noise giving rise to significant adverse impacts on health and the quality of life;
- 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.

3.2 The NPPF also refers to the Noise Policy Statement for England (NPSE) [Reference 2] which is intended to apply to all forms of noise, including environmental noise, neighbour noise and neighbourhood noise. The NPSE sets out the Government's long-term 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' which 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.

3.3 The NPSE defines the concept of a 'significant observed adverse effect level' (SOAEL) as 'the level above which significant adverse effects on health and quality of life occur'. The following guidance is provided within the NPSE:

"It is not possible to have a single objective noise-based measure that defines SOAEL that is applicable to all sources of noise in all situations. Consequently, the SOAEL is likely to be different for different noise sources, for different receptors and at different times. It is acknowledged that further research is required to increase our understanding of what may constitute a significant adverse impact on health and quality of life from noise. However, not having specific SOAEL values in the NPSE provides the necessary policy flexibility until further evidence and suitable guidance is available."

3.4 The Planning Practice Guidance (PPG) [Reference 3] is written to support the NPPF with more specific planning guidance. The PPG reflects the NPSE and states that noise needs to be considered when new developments may create additional noise and when new developments would be sensitive to the prevailing acoustic environment. It also states that opportunities should be taken, where practicable, to achieve improvements to the acoustic environment. The PPG states that noise can over-ride other planning concerns but should be considered in the context of the wider characteristics of the development proposal, its likely users and its surroundings.

- 3.5 The PPG expands upon the concept of SOAEL (together with Lowest Observable Adverse Effect Level, LOAEL and No Observed Effect Level, NOEL) as introduced in the NPSE and provides a table of noise exposure hierarchy for use in noise impact assessments in the planning system.
- 3.6 The NPPF, NPSE and PPG documents do not refer to specific noise criteria. For residential developments 24 Acoustics considers that the spirit of the requirements of the NPPF and NPSE will be complied with if criteria from British Standard 8233: 2014 and guidance from the World Health Organisation are adopted for internal noise levels within dwellings.

Professional Practice Guidance on Planning & Noise (ProPG)

- 3.7 The Professional Practice Guidance on Planning and Noise (ProPG) [Reference 4] was published jointly by the Association of Noise Consultants, Institute of Acoustics and Chartered Institute of Environmental Health in May 2017. The guidance relates to the consideration of existing sources of transportation noise upon proposed new residential development and strives to:
- Advocate full consideration of the acoustic environment from the earliest possible stage of the development control process;
 - Encourage the process of good acoustic design in and around new residential developments;
 - Outline what should be taken into account in deciding planning applications for new noise-sensitive developments;
 - Improve understanding of how to determine the extent of potential noise impact and effect; and
 - Assist the delivery of sustainable development.
- 3.8 The guidance describes a recommended approach for new residential development, which includes four key elements of the assessment process, identified below:
- i. Good acoustic design process;
 - ii. Internal noise level guidelines;
 - iii. External amenity area noise assessment;
 - iv. Assessment of other relevant issues.
- 3.9 It is important to note that the guidance in ProPG does not constitute an official government code of practice and neither replaces nor provides an authoritative interpretation of the law or government policy.

BS 8233:2014 and WHO Guidelines

- 3.10 BS 8233:2014 [Reference 5] provides design guidance for dwelling houses, flats and rooms in residential use and recommends that internal noise levels in dwellings do not exceed 35 dB $L_{Aeq,16hr}$ in living rooms and bedrooms during the day, 40 dB $L_{Aeq,16hr}$ in dining rooms during the day and 30 dB $L_{Aeq,8hr}$ in bedrooms at night. A relaxation of 5 dBA in the above figures is given in the standard for rooms which are naturally ventilated (by opening windows).
- 3.11 BS 8233:2014 also notes that *"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."*
- 3.12 Although the guidelines have no formal standing, the World Health Organisation (WHO) provides guidance on desirable internal noise levels to minimise the risk of sleep disturbance. The WHO 2000 guidelines [Reference 6] suggest internal night-time noise levels not exceeding 30 dB $L_{Aeq,8hr}$ or regularly (10 – 15 times per night) exceeding 45 dB $L_{Amax,f}$ for 'a good night's sleep'.
- 3.13 BS 8233:2014 suggests an upper guideline value of 55 dB $L_{Aeq,16hr}$ for noise levels in external amenity spaces such as gardens. This is considered an aspirational limit and BS 8233 recognises that the desirable noise levels for external amenity areas are not always achievable in certain locations. BS 8233 also states that development should not be prohibited on the basis of noise levels within external amenity areas.

British Standard BS 6472: 2008

- 3.14 The assessment of human response to vibration within buildings is currently guided by British Standard BS 6472:2008 [Reference 7]. The relevant criteria from the current version of the standard are summarised below.
- 3.15 Where vibration occurs as a series of events, as in the case of train pass-bys, BS 6472 indicates that Vibration Dose Values (VDVs) should be used. Human response to vibration in buildings is assessed in terms of VDVs defined over daytime and night-time periods.
- 3.16 The human body is most sensitive to vibration in the vertical direction (head to foot). The standard defines values of VDV which are likely to cause varying degrees of adverse comment and these are summarised in Table 1.

Place and Time	Vibration Dose Value, $m/s^{1.75}$		
	Low Probability Of Adverse Comment	Adverse Comment Possible	Adverse Comment Probable
Residential 16 hr day (07:00 to 23:00)	0.2 to 0.4	0.4 to 0.8	0.8 to 1.6
Residential 8 hr night (23:00 to 07:00)	0.1 to 0.2	0.2 to 0.4	0.4 to 0.8

Table 1: Vibration Dose Values and Subjective Response

- 3.17 24 Acoustics has utilised the current version of the standard assuming a VDV limit of $0.4 m/s^{1.75}$ during the day and $0.2 m/s^{1.75}$ at night.

Summary

- 3.18 The impact of noise upon the proposed development has been assessed using the following recommended maximum internal noise levels, due to road/ rail traffic:
- 35 dB $L_{Aeq,16hr}$ daytime noise level for living rooms;
 - 30 dB $L_{Aeq,8hr}$ night-time noise level for bedrooms;
 - 45 dB $L_{Amax,f}$ night-time noise levels in bedrooms for regular events;
 - Aspirational target limit of 55 dB $L_{Aeq,16hr}$ in external amenity areas.

4.0 NOISE AND VIBRATION MEASUREMENTS

Instrumentation

- 4.1 Noise and vibration measurements were undertaken on the site between 4th and 12th February 2021 using the following equipment:
- Svantek (Class 1) precision sound level meter Type 958;
 - Svantek tri-axial accelerometer Type SV84;
 - Rion (Class 1) precision sound level meter x 2 Type NL52;
 - Brüel and Kjær acoustic calibrator Type 4231.

Noise Measurement Procedure

- 4.2 The noise measurement locations used (shown in Figure 1 and described below) were chosen to establish how noise from the railway line and A27 affects the proposed site. Three measurement locations were selected and are described below:
- Location 1 – On northern boundary of site;
 - Location 2 – On south-eastern boundary with the A27 (north);
 - Location 3 – On south-eastern boundary with the A27 (south).
- 4.3 In order to assess typical ambient noise levels, the sound level meters were configured to continuously monitor in one minute sample periods. The meters were set up to measure and store overall A-weighted statistical parameters including the L_{Amax} and L_{Aeq} parameters (measured on fast response). Noise measurements were made in accordance with BS 7445: 1991 'Description and measurement of environmental noise Part 2 - Acquisition of data pertinent to land use' [Reference 8].
- 4.4 The instrumentation was powered by an external battery and stored in a weatherproof case. Throughout the course of the survey, an outdoor microphone windshield was used. The microphone height was 1.5m above local grade. The weather was generally dry with wind speeds less than 5 m/s, however, where weather conditions were unsuitable for noise measurement, data has been removed prior to analysis.
- 4.5 Calibration was checked before and on completion of the measurements and no drift was found. The calibration of 24 Acoustics' instrumentation is traceable to National Standards.

Vibration Measurement Procedure

- 4.6 Long-term vibration measurements were obtained at Location 1 to measure levels produced by the rail line. Measurements were undertaken in terms of the Vibration Dose Value (as defined in BS 6472) in $m/s^{1.75}$ in three axes of motion (defined as X (longitudinal), Y (lateral) and Z (vertical), all relative to the surroundings). The axes were orientated as follows:

x-axis - parallel to the railway line;
y-axis - perpendicular to the railway line;
z-axis - vertical.

5.0 NOISE AND VIBRATION SURVEY RESULTS

Noise

- 5.1 The results of the survey are shown graphically in Appendix B and are summarised in Tables 2, 3 & 4 below.

Date and Time	Daytime	Night	
	L _{Aeq} , 16 hour	L _{Aeq} , 8 hour	L _{Amax,f} Typical
Wednesday 10/2/2021	61*	54	79
Thursday 11/2/2021	60	55	79
Friday 12/2/2021	61*	-	-
Representative	61	55	79

Table 2: Noise Survey Results, Location 1

* partial measurement

Date and Time	Daytime	Night	
	L _{Aeq} , 16 hour	L _{Aeq} , 8 hour	L _{Amax,f} Typical
Thursday 4/2/2021	62*	56	71
Friday 5/2/2021	61	53	69
Saturday 6/2/2021	57	53	69
Sunday 7/2/2021	59	56	71
Monday 8/2/2021	60	55	70
Tuesday 9/2/2021	61	55	70
Wednesday 10/2/2021	60	50	67
Thursday 11/2/2021	55	55	70
Friday 12/2/2021	62*	-	-
Representative	61	54	70

Table 3: Noise Survey Results, Location 2

* partial measurement

Date and Time	Daytime	Night	
	L _{Aeq} , 16 hour	L _{Aeq} , 8 hour	L _{Amax,f} Typical
Thursday 4/2/2021	62*	56	70
Friday 5/2/2021	62	54	69
Saturday 6/2/2021	59	52	68
Sunday 7/2/2021	58	56	70
Monday 8/2/2021	60	56	70
Tuesday 9/2/2021	62	56	70
Wednesday 10/2/2021	60	49	69
Thursday 11/2/2021	56	56	69
Friday 12/2/2021	63*	-	-
Representative	62	55	70

Table 4: Noise Survey Results, Location 3

* partial measurement

Vibration

- 5.2 Measured Vibration Dose Values at Location 1 are shown in Appendix C and are summarised in Table 5 for Location 1.

Date	Period	Direction of Motion and Vibration Dose Value, $m.s^{-1.75}$		
		X	Y	Z
10/2/2021	Day	0.0089	0.0089	0.0645
	Night	0.0022	0.0029	0.0189
11/2/2021	Day	0.0052	0.0073	0.0493
	Night	0.0024	0.0031	0.0281
12/2/2021	Day	0.0026	0.0035	0.0276

Table 5: Daytime and Night-time Vibration Survey Results

6.0 NOISE IMPACT ASSESSMENT

Calculated Noise Levels

- 6.1 An acoustic model of the site has been developed to determine the noise levels across the site from the existing railway line. The model has been produced using IMMI 2017 noise mapping software and has used the propagation methodology of ISO 9613 [Reference 9] which takes into account the effects of geometric divergence, acoustic screening and ground and atmospheric absorption. The model has used 50% hard/ soft ground ($G=0.5$), ambient temperature of 10 degrees C and a relative humidity of 70%. Downwind propagation has been assumed to represent a worst case assessment.
- 6.2 Figures 3- 5 show the predicted L_{Aeq} noise contours across the proposed development site for the day and night-time periods. The model of daytime noise levels assumes a receiver height of 1.5 m whereas the night-time model assumes a receiver height of 4 m to represent bedroom height.

Noise Levels in External Amenity Areas

- 6.3 Noise levels in all private external amenity areas during the day are predicted to be no greater than 55 dB $L_{Aeq, 16hr}$. Provision of 1.8 m high good quality garden fences with a minimum surface density of 12 kg/m² is assumed to gardens to the north of the site.

Internal Noise Levels

- 6.4 In order to achieve an acceptable internal noise environment it will be necessary for residents to occupy some rooms in some dwellings with windows closed. Where this is needed there will be a requirement for alternative means of background ventilation in accordance with Part F of the Building Regulations [Reference 10] and potentially to consider measures to prevent overheating.
- 6.5 The requirements are summarised below:
- Lounges/ dining rooms/ kitchen-dining rooms to all plots may be constructed with standard thermal double glazing and standard trickle vents. It will be necessary for residents in these rooms on plots on the south-eastern boundary of the site (with line of sight to the A27) to keep windows closed, however (potentially requiring consideration of measures to prevent overheating);
 - Bedrooms to the plots to the north of the site (facing the railway) and those on the south-eastern boundary (facing the A27) may be built using standard thermal double glazing and trickle vents. Again, however, windows will need to be closed and attention should be drawn to the risk of overheating.
- 6.6 These measures should be reviewed full and in greater detail during the detailed design stage of the project (post-planning).

7.0 VIBRATION IMPACT ASSESSMENT

- 7.1 As a worst case screening tool, 24 Acoustics' experience indicates that the VDV levels measured on the internal floor of a building can be up to twice the measured free field level, in the vertical axis on the ground floor and up to four times on the first floor. This is as a result of the floors within the building amplifying the forcing vibration, although this will depend heavily upon the housing construction type. To provide a worst case scenario, these multiplying factors have been applied to the derived daytime and night-time VDV values recorded at location 1.
- 7.2 The predicted worst case daytime and night-time internal VDV's at Location 1 are summarised in Table 6. The probability of adverse comment is also presented for reference.

Location	Predicted Worst Case Internal VDV ($\text{ms}^{-1.75}$)	
	Daytime (07:00 To 23:00 Hours)	Night-Time (23:00 To 07:00 Hours)
Measured	0.06 <Low Probability of Adverse Comment	0.03 < Low Probability of Adverse Comment
Ground floor	0.12 <Low Probability of Adverse Comment	0.06 <Low Probability of Adverse Comment
First Floor	0.24 Low Probability of Adverse Comment	0.12 Low Probability of Adverse Comment

Table 6: Predicted Worst Case Internal Daytime and Night-Time VDV

- 7.3 Table 6 indicates that the risk of perceptible vibration throughout the development is very low.

8.0 CONCLUSIONS

- 8.1 Barratt David Wilson Southampton (BDW) has commissioned 24 Acoustics Ltd to carry out a noise and vibration impact assessment at a site off St George's Avenue in Havant
- 8.2 Detailed noise and vibration surveys have been undertaken on site. These, together with the associated calculations have shown that noise levels in private external amenity areas during the day will be lower than 55 dB $L_{Aeq,16\text{ hr}}$.
- 8.3 For internal noise, outline recommendations in terms of glazing and alternative means of ventilation have been provided to ensure that noise within habitable rooms, due to road and rail traffic, would comply with maximum internal levels of 35 dB L_{Aeq} during the daytime and 30 dB L_{Aeq} and 45 dB $L_{Amax, f}$ at night.
- 8.4 A worst case vibration assessment has indicated that there is negligible risk of perceptible vibration within the development from the operation of the neighbouring railway line.

- 8.5 On the above basis, it is considered that an appropriate acoustic environment can be provided to the proposed residential properties, both externally and internally and there are considered to be no reasons, on noise and vibration grounds, why planning consent should not be granted.

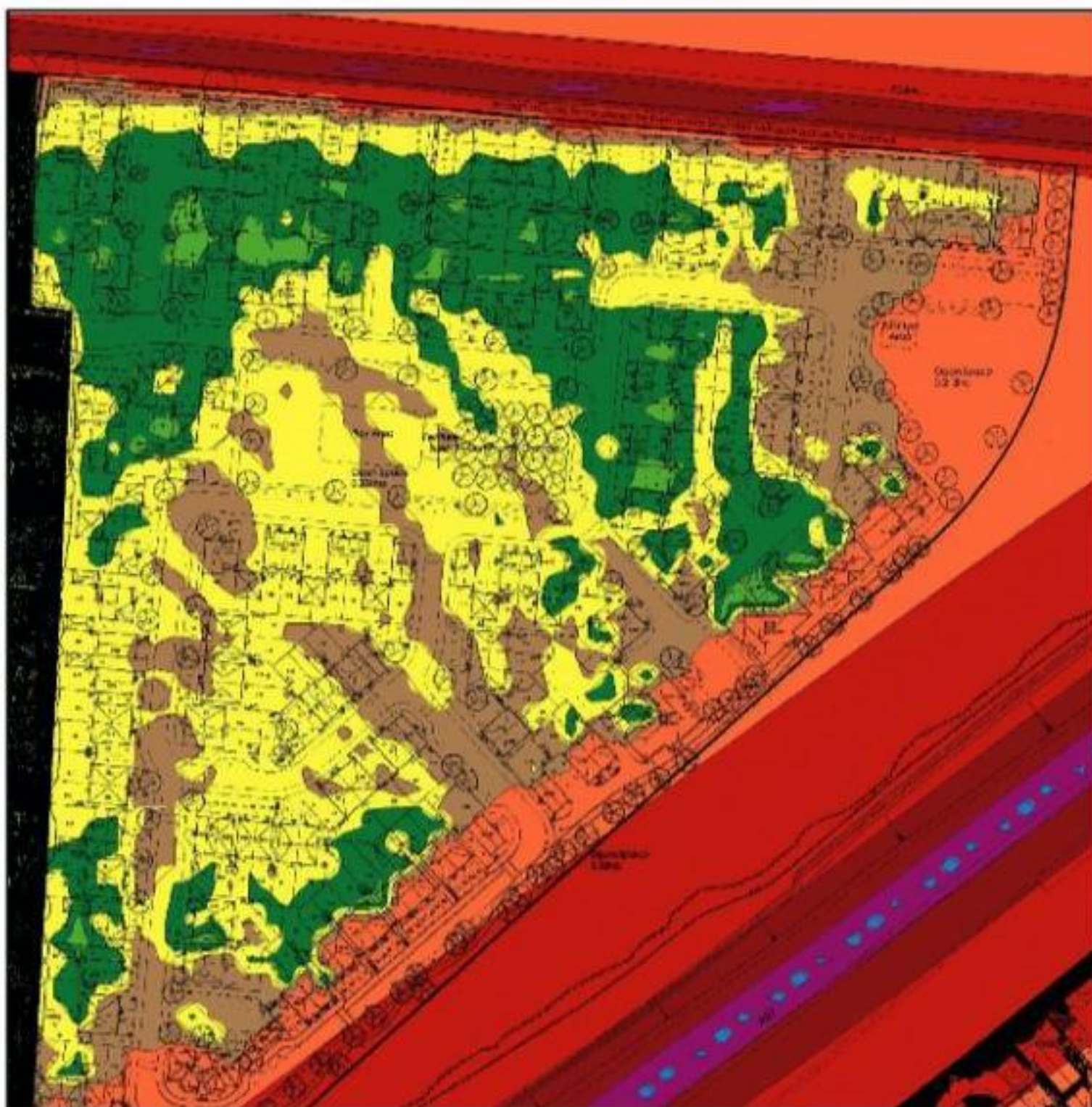
REFERENCES

1. Department for Communities and Local Government. National Planning Policy Framework, 2018.
2. DEFRA. Noise Policy Statement for England, 2010.
3. Department of Communities and Local Government. Planning Practice Guidance, July 2019.
4. Association of Noise Consultants, Institute of Acoustics, Chartered Institute of Environmental Health. Professional Practice Guidance on Planning and Noise, May 2017.
5. British Standards Institution. British Standard 8233:2014 Guidance on sound insulation and noise reduction for buildings, 2014.
6. World Health Organisation. Guidelines for Community Noise, 2000.
7. British Standards Institution. British Standard 6472: Guide to evaluation of human exposure to vibration in buildings, Part 1: Vibration source other than blasting, 2008.
8. British Standards Institution. British Standard 7445: 1991 'Description and measurement of environmental noise Part 2 - Acquisition of data pertinent to land use'
9. International Standards Organisation. ISO 9613. Acoustics - Propagation of Environmental Noise, 1997.
10. Office of the Deputy Prime Minister. Building Regulations 2000 Approved Document F, Ventilation.

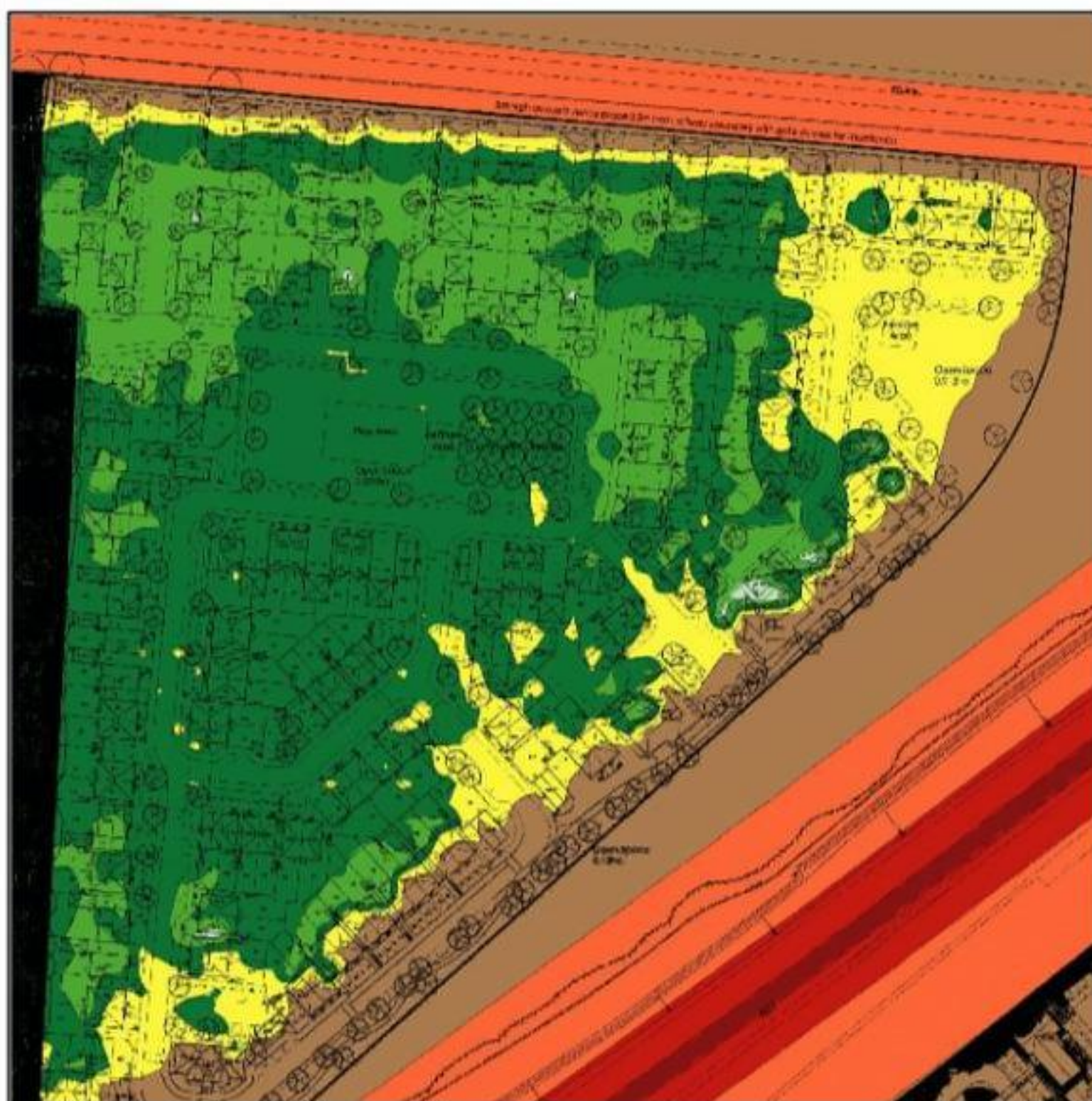


Project: Land off St George's Avenue, Havant	Title: Site Location and Noise Survey Locations		
DWG No: Figure 1	Scale: N.T.S.	Rev: -	
Date: June 2021	Drawn By: RP	Job No: R8905	

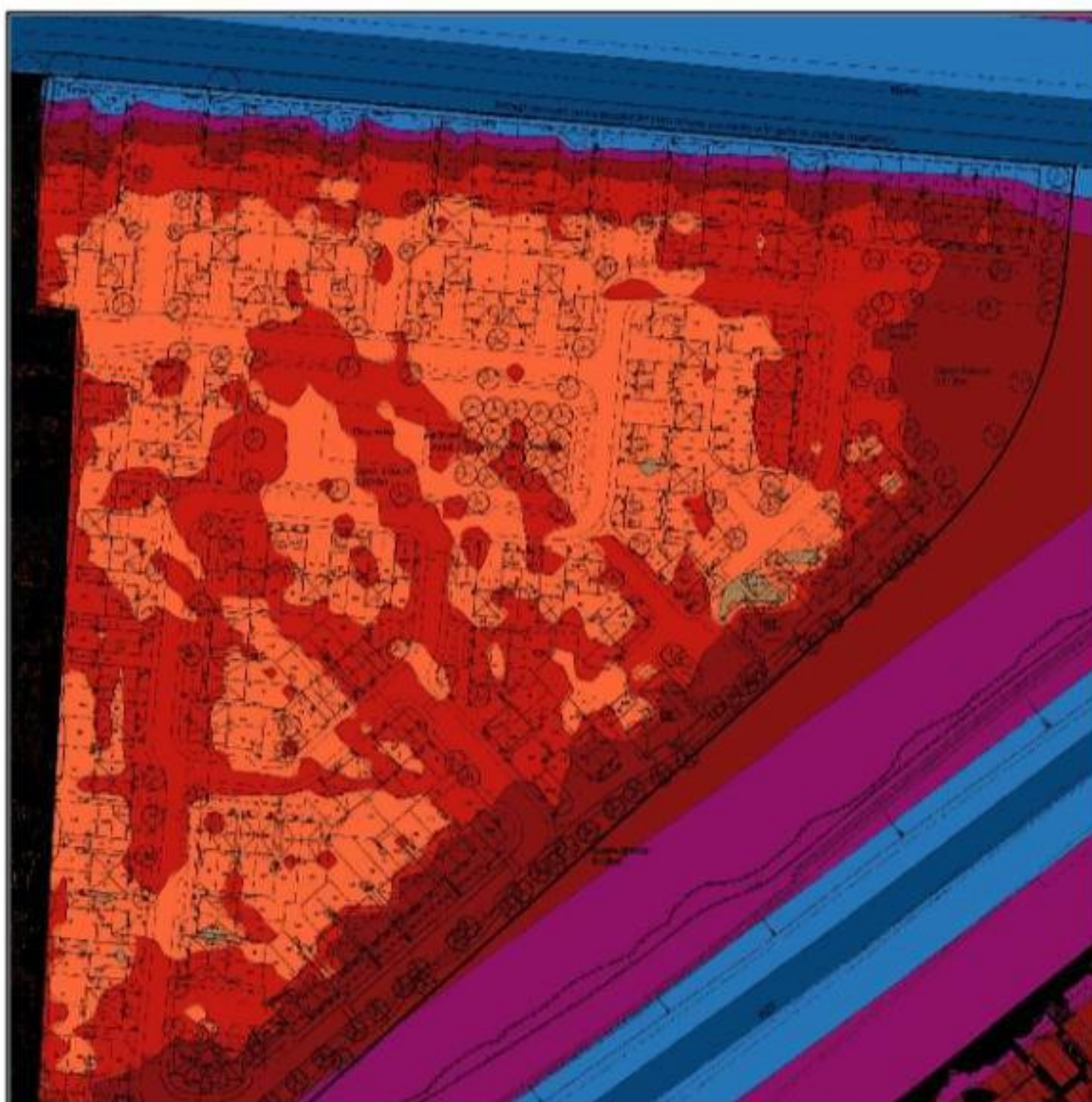




Project: Land off St George's Avenue, Havant	Title: Daytime Noise Contours, 1.5 m height, dB L _{Aeq} , 16 hour		 24Acoustics
DWG No: Figure 3	Scale: N.T.S.	Rev: -	
Date: June 2021	Drawn By: RP	Job No: R8905	



Project: Land off St George's Avenue, Havant	Title: Night time Noise Contours, 4 m height, dB LAeq, 8 hour		 24Acoustics
DWG No: Figure 3	Scale: N.T.S.	Rev: -	
Date: June 2021	Drawn By: RP	Job No: R8905	



Project: Land off St George's Avenue, Havant	Title: Daytime Noise Contours, 4 m height, dB L _{max,f}		 24Acoustics
DWG No: Figure 3	Scale: N.T.S.	Rev: -	
Date: June 2021	Drawn By: RP	Job No: R8905	

APPENDIX A: ACOUSTIC TERMINOLOGY

Noise is defined as unwanted sound. The range of audible sound is from 0 to 140 dB. The frequency response of the ear is usually taken to be around 18 Hz (number of oscillations per second) to 18000 Hz. The ear does not respond equally to different frequencies at the same level. It is more sensitive in the mid-frequency range than the lower and higher frequencies and because of this, the low and high frequency components of a sound are reduced in importance by applying a weighting (filtering) circuit to the noise measuring instrument. The weighting which is most widely used and which correlates best with subjective response to noise is the dB(A) weighting. This is an internationally accepted standard for noise measurements.

For variable sources, such as traffic, a difference of 3 dB(A) is just distinguishable. In addition, a doubling of traffic flow will increase the overall noise by 3 dB(A). The 'loudness' of a noise is a purely subjective parameter, but it is generally accepted that an increase/ decrease of 10 dB(A) corresponds to a doubling/ halving in perceived loudness.

External noise levels are rarely steady, but rise and fall according to activities within an area. In attempt to produce a figure that relates this variable noise level to subjective response, a number of noise indices have been developed. These include:

- i) The L_{Amax} noise level

This is the maximum noise level recorded over the measurement period.

- ii) The L_{Aeq} noise level

This is "equivalent continuous A-weighted sound pressure level, in decibels" and is defined in British Standard BS 7445 [1] as the "value of the A-weighted sound pressure level of a continuous, steady sound that, within a specified time interval, T , has the same mean square sound pressure as a sound under consideration whose level varies with time".

It is a unit commonly used to describe construction noise and noise from industrial premises and is the most suitable unit for the description of other forms of environmental noise. In more straightforward terms, it is a measure of energy within the varying noise.

Vibration

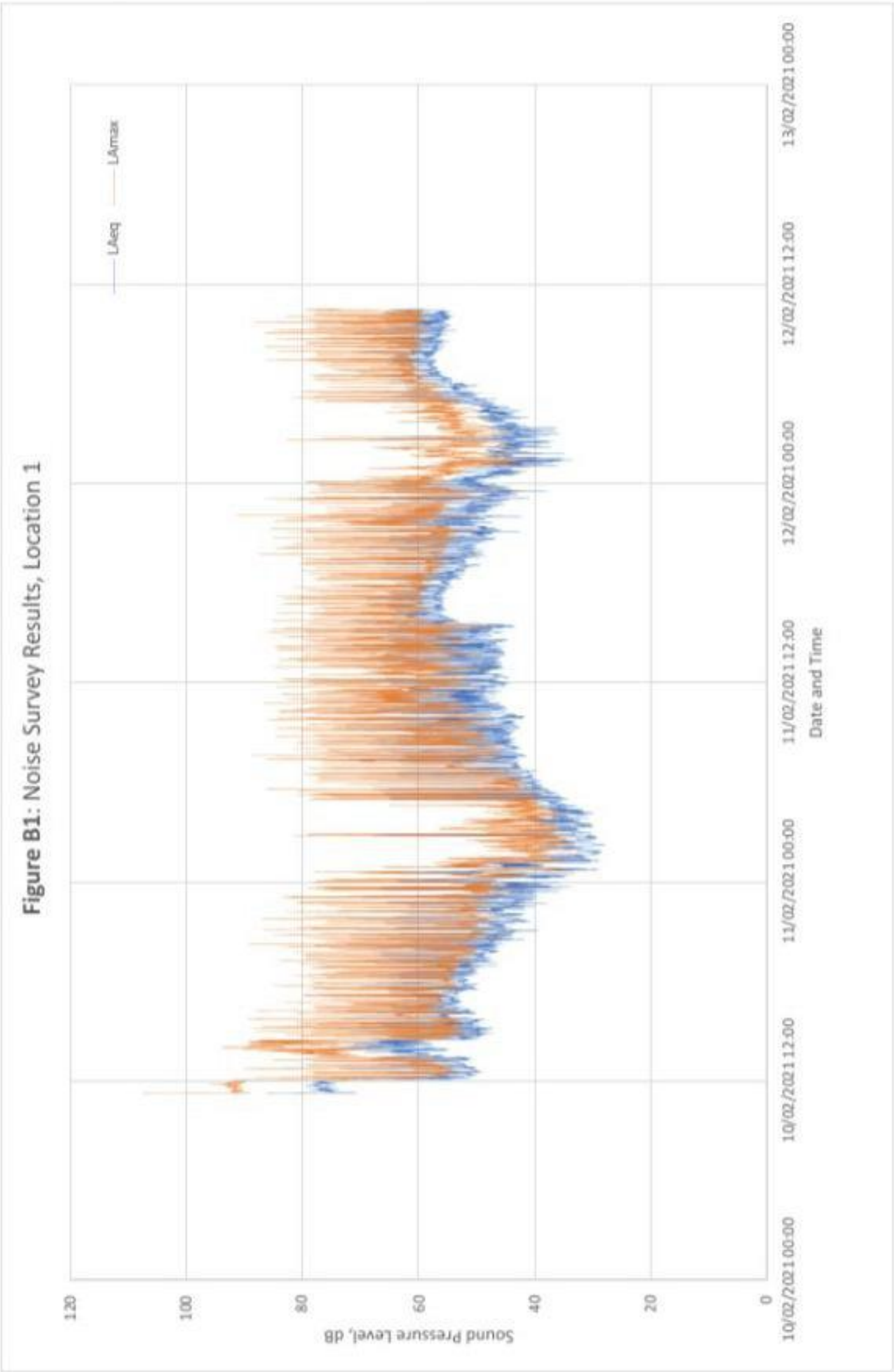
Vibration can be described as a mechanical isolation of a medium about an equilibrium point. Vibration may be periodic, such as the motion of a pendulum or random such as the response of ground to a force input on a construction or demolition site.

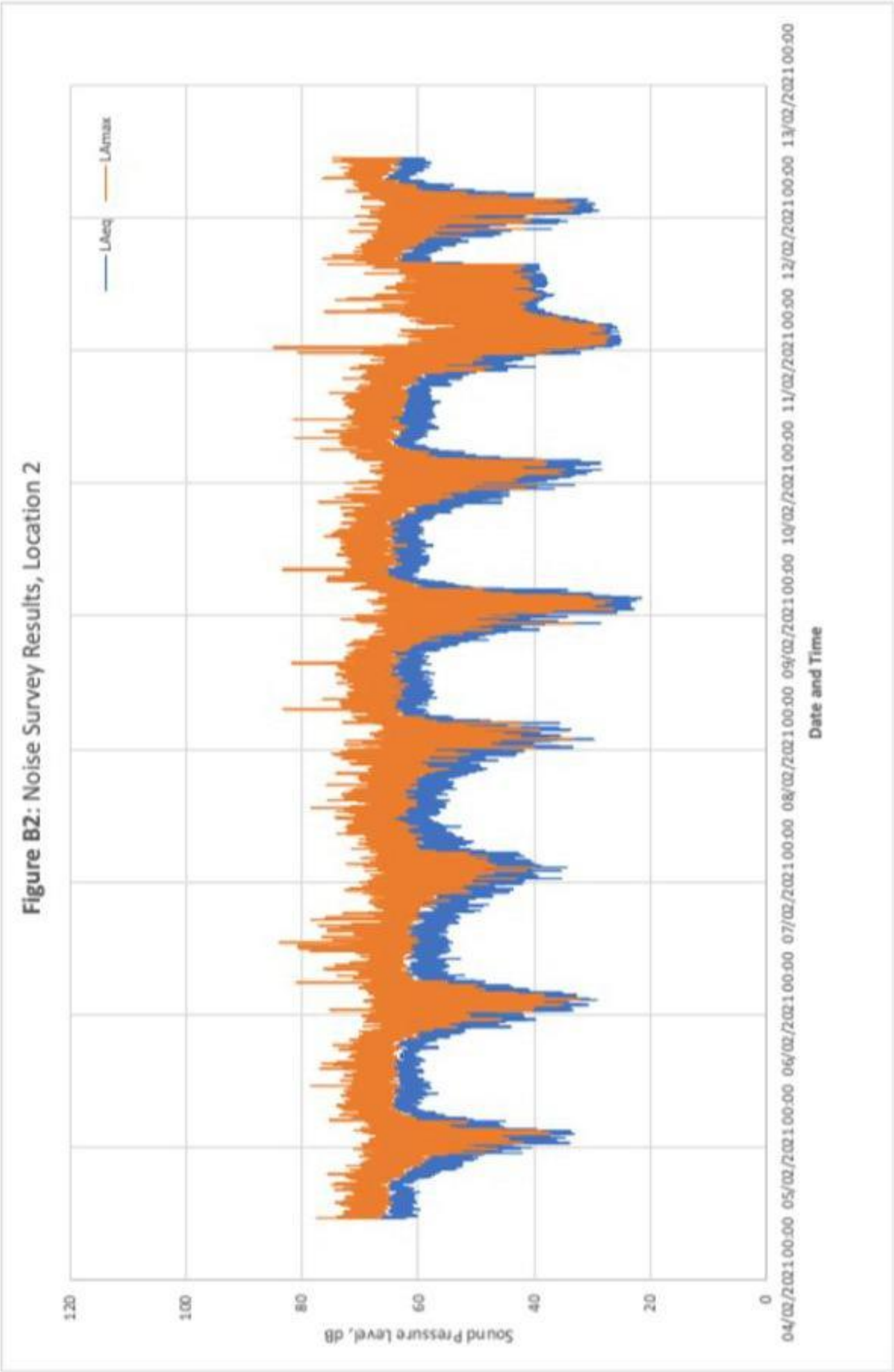
Vibration may be measured in terms of acceleration, velocity or displacement (most commonly acceleration or velocity) using either an accelerometer or a velocity transducer and suitable signal conditioning system.

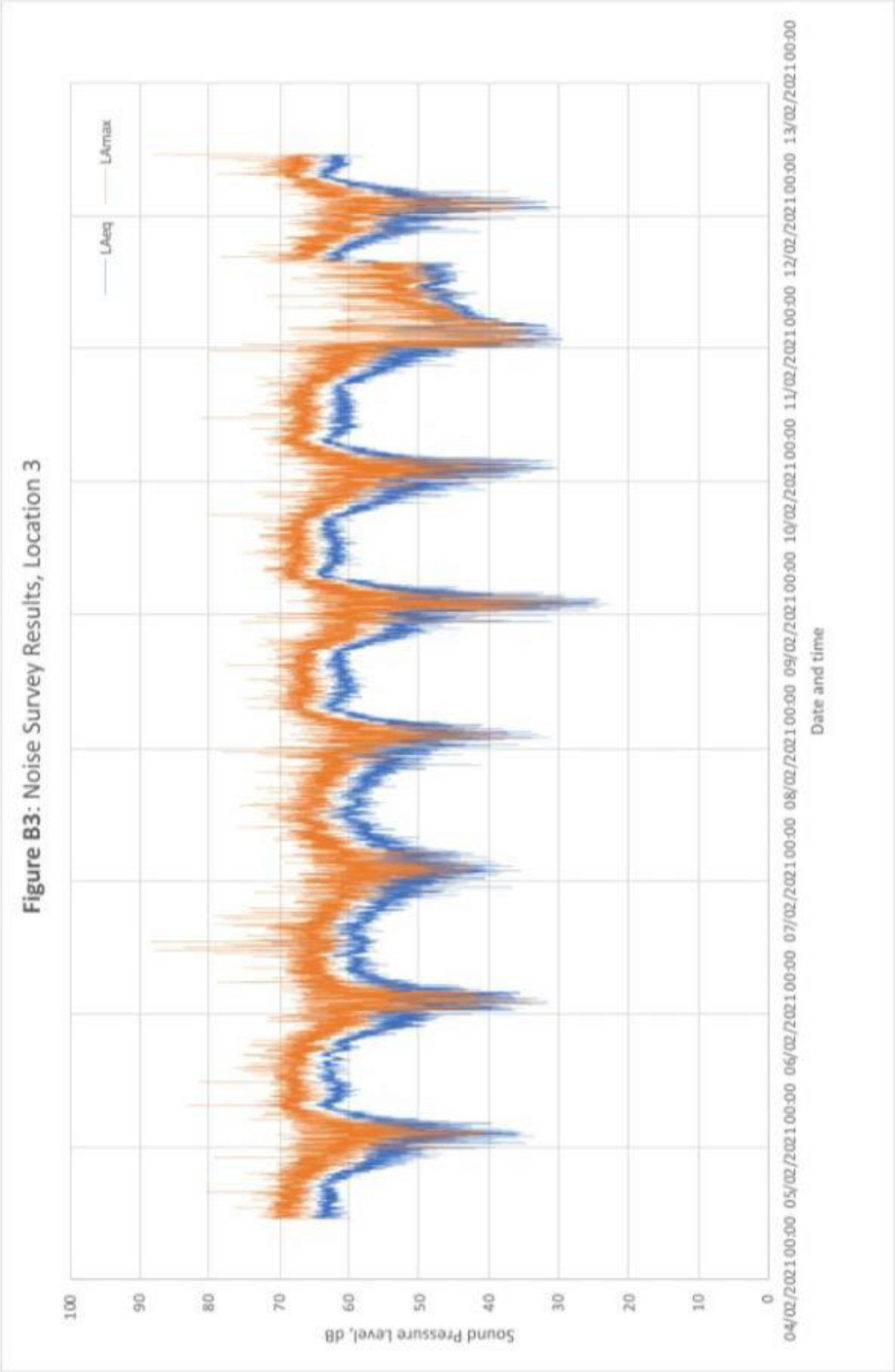
The measured data may be analysed to identify frequency content and considered in terms of a number of different parameters, including the root mean square (rms), maximum or peak.

In the UK British Standard 6472 Parts 1 and 2 provides methodology for measuring and assessing human exposure to vibration in buildings. The standard states that vibration should be measured in the three orthogonal axes of motion, two lateral and one vertical (with respective frequency weighting curves W_d and W_b), in terms of the vibration dose value (VDV) for overall daytime and night-time periods. Guidance is given on the relationship between daytime and night-time VDV exposures levels and the impacts on occupants.

APPENDIX B: NOISE SURVEY RESULTS







APPENDIX C: VIBRATION SURVEY RESULTS

