



**Independent Acoustic
Consultancy Practice**

Environmental Noise and Vibration Assessment

**Land at Mon Bank
Newport**

7069/ENS1_Rev2



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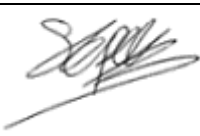
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Environmental Noise and Vibration Assessment

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TABLE OF CONTENTS

1. INTRODUCTION	6
2. CRITERIA.....	7
2.1 Planning Policy Wales	7
2.2 ProPG Supplementary Document 2.....	7
2.3 Technical Advice Note (Wales) 11.....	8
2.4 British Standard 8233:2014	9
2.5 Building Regulations Part O 2022 Edition - For use in Wales	10
2.6 AVO Guide: 2020	12
2.7 British Standard 4142:2014+A1:2019	13
2.8 British Standard 6472-1:2008	14
3. ENVIRONMENTAL NOISE SURVEY	15
3.1 Procedures.....	15
3.2 Meteorological Conditions	16
3.3 Measurement Equipment	17
3.4 Results	18
4. COURTYBELLA RAILWAY LINE	19
4.1 Overview	19
4.2 Survey of Courtybella	20
5. INDUSTRIAL ESTATE NOISE CONTRIBUTIONS.....	20
5.1 BS4242:2014+A1:2019 Assessment	20
5.2 Context.....	21
6. RAIL VIBRATION SURVEY	22
6.1 Procedure.....	22
6.2 Equipment Used.....	22
6.3 Results	23
7. NOISE MAP MODELLING	24
7.1 Undeveloped Site	24
7.2 Developed Site	26
8. EXTERNAL BUILDING FABRIC ASSESSMENT.....	26
8.1 External Walls	27
8.2 Roof	28
8.3 Glazing.....	28
8.4 Ventilation	29

9. OVERHEATING.....	32
10. EXTERNAL NOISE ASSESSMENT (GARDENS)	33
11. CONCLUSION.....	34
APPENDIX A - ACOUSTIC TERMINOLOGY	35
APPENDIX B - DIAGRAMS, GRAPHS AND TABLES	36
APPENDIX C - NOISE MAP MODELS	53
APPENDIX D - DRAWING LISTS.....	56

1. INTRODUCTION

We understand a residential development consisting of 42no dwellings is proposed at the two north-west parcels of land at Mon Bank, Newport, NP20.

The Client has requested a noise and vibration impact assessment is submitted to accompany the planning application.

This report has therefore been commissioned to assess existing ambient and background noise and vibration levels impinging on the site from local sources.

Survey results have been used for comparison with typical Local Authority Planning conditions and current planning guidance.

2. CRITERIA

2.1 Planning Policy Wales

The Welsh Government's Planning Policy Wales (Edition 12) dated February 2024, states the following;

"6.7.20 Where sensitive developments need to be located close to existing transportation infrastructure for sustainable movement and access they should be designed, as far as practicable, to limit harmful substances and noise levels within and around those developments both now and in the future. This may include employing the principles of good acoustic design and the inclusion of active travel or travel management measures as part of development proposals. Such development, however, should preferably be located away from existing sources of significant noise, which may include aircraft noise or roads, particularly new roads or those with programmed route improvements."

The document states *"For more information on the principles of good acoustic design, readers are referred to Professional Planning Guidance (ProPG) Supplementary Document 2, produced by the Association of Noise Consultants, the Institute of Acoustics and the Chartered Institute of Environmental Health (<http://www.association-of-noise-consultants.co.uk/propg/>). ProPG has been written principally to assist with the planning process in England, but the design principles put forward in Supplementary Document 2 may also be adopted in Wales.*

2.2 ProPG Supplementary Document 2

Professional Practice Guidance on Planning & Noise, New Residential Development 'Supplementary Document 2 – Good Acoustic Design' produced by the ANC, IOA and CIEH discusses the general principles of Good Acoustic Design, including the following hierarchy of noise management measures in descending order of preference;

- i) Maximising the spatial separation of noise source(s) and receptor(s).*
- ii) Investigating the necessity and feasibility of reducing existing noise levels and relocating existing noise sources.*
- iii) 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.*
- iv) Incorporating noise barriers as part of the scheme to screen the proposed development site from significant sources of noise.*
- v) Using the layout of the scheme to reduce noise propagation across the site.*
- vi) Using the orientation of the buildings to reduce the noise exposure of noise-sensitive rooms.*
- vii) Using the building envelope to mitigate noise to acceptable levels.*

“It should be remembered that good acoustic design is a process that begins as soon as land is under consideration for development. The timeline for good acoustic design stretches from the conceptual design stage, through quality control during construction, and beyond to post construction performance testing.

Both internal and external spaces should be considered in the acoustic design process. Care should be taken to ensure that acoustic mitigation measures do not result in an otherwise unsatisfactory development. Good acoustic design must be regarded as an integrated part of the overall design process”.

2.3 Technical Advice Note (Wales) 11

Noise bands defining categories A-D of TAN 11 are set in terms of $L_{Aeq,16hr}$ daytime and $L_{Aeq,8hr}$ night time levels for road traffic noise and mixed sources, free field 1.2-1.5m above ground level as follows;

Table 2.1 – TAN11 Noise Exposure Categories

Recommended noise exposure categories for new dwellings near existing noise sources (ref Table 2 of TAN 11 (Wales) October 1997)					
Noise Source	Time	Noise Exposure Categories			
		A	B	C	D
Road Traffic	07:00-23:00	<55	55-63	63-72	>72
	23:00-07:00	<45	45-57	57-66	>66
Rail Traffic	07:00-23:00	<55	55-66	66-74	>74
	23:00-07:00	<45	45-59	59-66	>66
Air Traffic	07:00-23:00	<57	57-66	66-72	>72
	23:00-07:00	<48	48-57	57-66	>66
Mixed Sources ⁽⁴⁾	07:00-23:00	<55	55-63	63-72	>72
	23:00-07:00	<45	45-57	57-66	>66

Note: In addition, sites where individual noise events regularly exceed 82dB(A) $L_{max}(slow)$, several times in any night time hour should be treated as being in NEC C, unless the $L_{eq}(8 \text{ hour})$ already puts the site in NEC D.

(4) Mixed sources: this refers to any combination of road, rail, air and industrial noise sources. The "mixed source" values are based on the lowest numerical values of the single source limits in the table. The "mixed source" NECs should only be used where no individual noise source is dominant.

2.4 British Standard 8233:2014

British Standard 8233:2014 'Guidance on sound insulation and noise reduction for buildings' includes internal noise criteria of habitable rooms in residential dwellings, as shown below;

Table 2.2 – BS 8233:2014 Internal Ambient Noise Criteria for Habitable Rooms

Location	Desired		Reasonable *	
	07:00 to 23:00	23:00 to 07:00	07:00 to 23:00	23:00 to 07:00
Living room	35 dB $L_{Aeq,16hr}$	-	40 dB $L_{Aeq,16hr}$	-
Dining room/area	40 dB $L_{Aeq,16hr}$	-	45 dB $L_{Aeq,16hr}$	-
Bedroom	35 dB $L_{Aeq,16hr}$	30 dB $L_{Aeq,8hr}$	40 dB $L_{Aeq,16hr}$	35 dB $L_{Aeq,8hr}$

* NOTE 7 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 5dB and reasonable internal conditions still achieved.

In addition BS 8233:2014 states: “Regular individual noise events (for example, scheduled aircraft or passing trains) can cause sleep disturbance. A guideline value may be set in terms of SEL or $L_{Amax,F}$, depending on the character and number of events per night. Sporadic noise events could require separate values.”

Reference is therefore made to World Health Organisation (WHO) ‘Guidelines for Community Noise, 1999’ which states “For a good sleep, it is believed that indoor sound pressure levels should not exceed approximately 45dB L_{Amax} more than 10-15 times per night (Vallet & Vernet 1991)”.

Section 7.7.3.2 of BS 8233:2014 entitled ‘Design criteria for external noise’ states;

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

The above criteria in BS 8233:2014 apply for sources without specific character, previously termed “anonymous noise”. BS 8233:2014 7.7.1 advises:

“NOTE: Noise has a specific character if it contains features such as a distinguishable, discrete and continuous tone, is irregular enough to attract attention, or has strong low-frequency content, in which case lower noise limits might be appropriate.”

2.5 Building Regulations Part O 2022 Edition - For use in Wales

Requirement O1 of Part O in Wales applies when a new residential building is erected and states,

“(1) Reasonable provision must be made to –

- a) limit unwanted solar gains in summer;*
- b) provide an adequate means to remove heat from the indoor environment.*

“(2) In meeting the obligations in sub-paragraph(1) –

- a) account must be taken of the safety of any occupant, and their reasonable enjoyment of the building; and*
- b) mechanical cooling may only be used where insufficient heat is capable of being removed from the indoor environment without it.*

Under the heading “*Intention*”, it states that requirement O1(2)(a) is met if the building’s overheating mitigation strategy takes account of all the following:

- a. Noise at night
- b. Pollution
- c. Security
- d. Protection from falling
- e. Protection from entrapment

Noise at night is covered in paragraphs 2.2 to 2.4 as follows:

“2.2 High levels of external noise could limit the use of cross-ventilation to mitigate the risk of summer overheating. External noise is a material consideration considered when applying for Planning permission and mitigating measures may be required in the design in order to obtain Planning permission and controlled through a condition imposed on the consent. In exceptional cases, this could include non-openable windows. More commonly, windows will be openable in order to enable natural ventilation to occur at less sensitive times of day, when there is lower noise, when people are not present in the room, or when they are present but not engaged in noise-sensitive activities. But those windows may need to be kept closed at times to maintain acceptable indoor acoustic conditions, for example when people are using the rooms for sleep or

office work. A noise issue may be identified at the Planning stage but rely on occupants to close windows at noise-sensitive times rather than prevent them from ever opening them, and in those cases overheating strategies should assume windows will be closed during noise-sensitive periods even if they are not fixed closed.

2.3 *When the removing excess heat as part of the overheating strategy, noise levels in bedrooms should be kept to a minimum during the sleeping hours of 23:00 – 07:00. Building control bodies may accept as evidence that this requirement is satisfied:*

- a. documentation to demonstrate that the local planning authority did not consider external noise to be an issue at the site at the planning stage or;*
- b. if the local planning authority did consider external noise to be an issue that should be controlled through a condition at planning stage, then documentation to demonstrate that the proposals for heat removal (during the sleeping hours of 23.00 – 07.00) are accommodated within or do not conflict with documentation provided to the local planning authority to satisfy any related planning permission condition(s). (For example any expectation that windows on one or more façade, or in certain rooms, will need to be kept closed during noise-sensitive periods.)*

2.4 *Where active measures (e.g. mechanical system) are used for removing excess heat within the overheating strategy, the noise generated by these measures, particularly within bedrooms and living rooms should be considered. Noise generated by ventilation/cooling systems (which may travel through ducts) and noise from the fan unit may disturb the occupants of the building and so discourage their use. Therefore, the designer should consider minimising noise by careful design and the specification of quieter products. Further guidance on mechanical ventilation systems can be found in Approved Document F.*

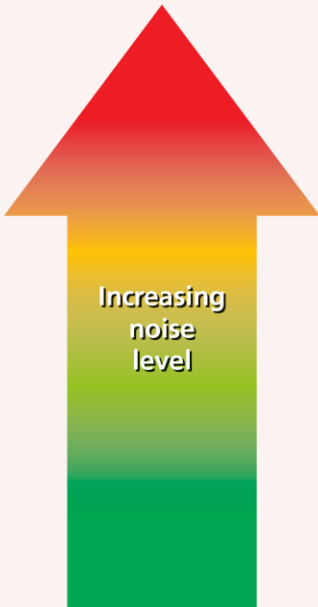
There are no further criteria or guidance on internal noise levels within Building Regulations Part O in Wales and therefore guidance is sought from the Acoustics, Ventilation and Overheating Residential Design Guide (AVO Guide): 2020 prepared by the Association of Noise Consultants (ANC) and the Institute of Acoustics (IOA).

2.6 AVO Guide: 2020

The Acoustics, Ventilation and Overheating – Residential Design Guide (AVO Guide) 2020 aims to assist designers to adopt an integrated approach to the acoustic design of residential dwellings within the context of ventilation and thermal comfort requirements.

The following Internal Ambient Noise Levels are quoted for guidance in AVOG.

Figure 2.1 Guidance for Level 2 assessment of noise from transport noise sources relating to overheating condition

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

2.7 British Standard 4142:2014+A1:2019

British Standard 4142:2014+A1:2019 “Methods for rating and assessing industrial and commercial sound”, provides current guidance for the assessment of industrial noise affecting residential receivers.

This standard describes a rating method comparing L_{Aeq} noise levels from the industrial source with pre-existing background L_{A90} levels at the residential receiver. It advises at a difference (industrial noise - background) of:

- +10dB or higher, likely to be an indication of a significant adverse impact, depending on the context.
- A difference of + 5dB, 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 low impact, depending on the context.

A sliding scale of penalties can be applied to industrial/commercial sound levels which have acoustically distinguishing characteristics, including tonality, impulsivity and intermittency.

Tonality – A penalty of 2dB for a tone which is just perceptible at the noise receptor, 4dB where it is clearly perceptible, and 6dB where it is highly perceptible.

Impulsivity – A penalty of 3dB for impulsivity which is just perceptible at the noise receptor, 6dB where it clearly perceptible, and 9dB where it is highly perceptible.

Other sound characteristics – Where the specific sound features characteristics that are neither tonal nor impulsive, though otherwise are readily distinctive against the residual acoustic environment, a penalty of 3dB can be applied

Intermittency – If intermittency is readily distinctive against the residual acoustic environment, a penalty of 3dB can be applied.

BS 4142:2014 states under section 11;

“Where the initial estimate of the impact needs to be modified due to the context, take all pertinent factors into consideration, including the following.

- 1) *The absolute level of sound. For a given difference between the rating level and the background sound level, the magnitude of the overall impact might be greater for an acoustic environment where the residual sound level is high than for an acoustic environment where the residual sound level is low.*

Where background sound levels and rating levels are low, absolute levels might be as, or more, relevant than the margin by which the rating level exceeds the background. This is especially true at night.

Where residual sound levels are very high, the residual sound might itself result in adverse impacts or significant adverse impacts, and the margin by which the rating level exceeds the background might simply be an indication of the extent to which the specific sound source is likely to make those impacts worse.”

2.8 British Standard 6472-1:2008

British Standard 6472-1:2008 “Guide to Evaluation of Human Exposure to Vibration in Buildings” gives guidance figures for vibration dose value (VDV) ranges which might result in various probabilities of adverse comment within residential buildings, as shown below;

Table 2.3 – BS 6472-1:2008 VDV Guidance Ranges

Place and Time	Low Probability of Adverse Comment $\text{m/s}^{1.75}$	Adverse Comment Possible $\text{m/s}^{1.75}$	Adverse Comment Probable $\text{m/s}^{1.75}$
Residential buildings 16 h day	0.2 to 0.4	0.4 to 0.8	0.8 to 1.6
Residential buildings 8 h day	0.1 to 0.2	0.2 to 0.4	0.4 to 0.8

In our experience, Local Planning Authorities typically request that dwellings are designed and constructed so as to ensure that vibration dose values do not exceed $0.4\text{m/s}^{1.75}$ 0700-2300hrs daytime, and $0.26\text{m/s}^{1.75}$ 2300-0700hrs night-time, as calculated in accordance with BS 6472-1:2008 [1Hz to 80Hz].

3. ENVIRONMENTAL NOISE SURVEY

3.1 Procedures

Continuous noise monitoring was carried out at positions A and B from 1030hrs on Tuesday, 21 November 2023 to 1030hrs on Wednesday, 22 November 2023 and at positions B and C from 1500hrs on Tuesday, 5 December 2023 to 1500hrs on Wednesday, 6 December 2023.

Data including L_{Amax} , L_{Aeq} and background L_{A90} was logged at 1 minute intervals over the monitoring periods, along with continuous audio and 100ms data to allow source identification and further detailed analysis of results if required.

Figure 3.1 – Site Plan Showing Monitoring Locations



Site plan in Figure 3.1 above shows the development site and continuous monitoring positions used, namely:

Table 3.1 – Continuous Monitoring Location Details

Position	Description
A	On west plot of land, approx. 67m from Cardiff Road and 29m from railway line, approx. 1m above local ground level
B	On north plot of land, approx. 41m from Cardiff Road and 23m from railway line, approx. 1.2m above local ground level
C	On north plot of land, approx. 100m from Cardiff Road and 76m from railway line, approx. 1.2m above local ground level <i>Selected to pick up any activity noise from the nearby Whiteheads industrial units</i>

3.2 Meteorological Conditions

Approximate weather conditions are shown in time history graphs in Figure B.1, Figure B.2, Figure B.3 and Figure B.4 of Appendix B.

To summarise, the weather conditions during the monitoring periods were dry with an occasional breeze.

3.3 Measurement Equipment

The following measurement equipment was used during the surveys:

Table 3.2 – Noise Monitoring Equipment List

Make	Description	Model	Serial Number	Last Calibrated	Certificate No.
NTi	Type 1 - Sound Level Meter	XL2-TA	A2A-08723-E0	27 October 2023	UK-23-127
	Preamplifier	MA220	1820	27 October 2023	UK-23-127
	Filters	XL2-TA	A2A-08723-E0	27 October 2023	UK-23-127
	Microphone Capsule	MC230	9381	27 October 2023	UK-23-127
NTi	Type 1 - Sound Level Meter	XL2-TA	A2A-10021-E0	15 August 2023	UK-23-094
	Preamplifier	MA220	5435	15 August 2023	UK-23-094
	Microphone Capsule	MC230	8547	15 August 2023	UK-23-094
NTi	Type 1 - Sound Level Meter	XL2-TA	A2A-13022-E0	21 November 2023	UK-23-093
	Preamplifier	MA220	13634	21 November 2023	UK-23-093
	Microphone Capsule	MC230	A14127	21 November 2023	UK-23-093
NTi	Type 1 - Sound Level Meter	XL2-TA	A2A-19813-E0	27 October 2023	UK-23-128
	Preamplifier	MA220	10302	27 October 2023	UK-23-128
	Microphone Capsule	MC230A	A21824	27 October 2023	UK-23-128
Norsonic AS	Calibrator (114.06dB @ 999.54)	1251	31429	09 March 2023	U43629
Larson Davis	Calibrator (94.00dB / 114.03dB @ 1kHz)	CAL200	19047	15 August 2023	45153-19047-CAL200

Measurement systems were calibrated before and after the surveys and no variation occurred.

Note: Copies of traceable calibration certificates for all equipment are available upon request.

3.4 Results

Time history graphs in Figure B.5, Figure B.6, Figure B.7 and Figure B.8 of Appendix B show L_{Amax} , L_{Aeq} and L_{A90} sound pressure levels measured at positions A, B and C.

The following $L_{Aeq,16hr}$ daytime (0700-2300hrs) and $L_{Aeq,8hr}$ night-time (2300-0700hrs) noise levels were measured;

Table 3.3 – Summary of Daytime $L_{Aeq,16hr}$ and Night-time $L_{Aeq,8hr}$ Results

Date	Period	Position		
		A	B	C
21-22/11/2023	Daytime $L_{Aeq,16hr}$ (dB)	54	56	-
	Night-time $L_{Aeq,8hr}$ (dB)	50	50	-
05-06/12/2023	Daytime $L_{Aeq,16hr}$ (dB)	-	57	52
	Night-time $L_{Aeq,8hr}$ (dB)	-	49	45

There were no $L_{Amax,F}$ events over 82dB measured during the night-time period (2300-0700hrs) at any of the monitoring positions.

Train pass-bys from the main line at positions A and B ranged between 57-65dB $L_{Aeq,40sec}$ and 51-58dB $L_{Aeq,40sec}$ respectively. Spectra of these train pass-bys during the period 21-22/11/2023 are shown in Figure B.13 of Appendix B.

Graphs in Figure B.9, Figure B.10, Figure B.11 and Figure B.12 of Appendix B show statistical analysis of background sound levels measured at positions A, B and C.

The following minimum consistent daytime and night-time background L_{A90} sound levels have been determined;

Table 3.4 – Minimum Consistent Daytime and Night-time Background L_{A90} Results

Period	Position		
	A	B	C
Daytime (0700-2300hrs) L_{A90} (dB)	49	50	48
Night-time (2300-0700hrs) L_{A90} (dB)	38	38	36

The background sound climate was controlled by road traffic noise along Cardiff Road during the daytime and night-time period.

4. COURTYBELLA RAILWAY LINE

4.1 Overview

The Courtybella railway line runs north of the two parcels of land, highlighted in **PURPLE** in Figure 4.1 below. This line is used for freight trains approaching on the mainline from the south so they can turn around and continue on to the docks line. The reverse happens when leaving the docks, so they can continue back on the mainline heading south.

Based on train schedules found online (realtime trains.co.uk), use of the Courtybella line ranges between 3-5 times a day Monday – Sunday. It is also indicated use of the line can occur during the night-time period (2300 – 0700), however most are indicated to occur during daytime hours (0700-2300hrs).

Figure 4.1 – Courtybella Railway Line



4.2 Survey of Courtybella

During the second 24hr monitoring period, 3no events using the Courtybella rail section were detected through audio analysis.

Spectra measurements at Position B of the train events on the Courtybella line are shown in Figure B.14 of Appendix B.

The overall $L_{Aeq, 20min}$ for the full reversing process ranged between 62-66dB and 56-59dB for Positions B and C respectively.

The $L_{Amax,F}$ values for the full reversing process ranged between 80-85dB and 72-76dB for positions B and C respectively. $L_{Amax,F}$ events consisted of train wheel screeches and engine noise.

5. INDUSTRIAL ESTATE NOISE CONTRIBUTIONS

Whitehead Industrial Estate is located to the east of site approx. 63m from the nearest proposed dwelling. The estate consists of large steel frame unit and other smaller buildings including an ancillary store and 2no two-storey office buildings. It is understood the unit is currently occupied by Express Reinforcement Ltd, a steel stockholder and supplier. The industrial site is surrounded by residential properties on all sides. It is understood no night-time operations take place at the industrial estate.

Through audio analysis at Position C, industrial estate activity has been measured. The industrial events captured during the survey contained occasional reversing alarm beeps and occasional bangs and hammering. Only daytime events were detected from the Industrial Estate. Subjectively, these were clearly perceptible however were not frequent.

5.1 BS4242:2014+A1:2019 Assessment

The worst-case period of industrial estate activity was picked out between 0945-1045hrs on 6th December. A sound level of 54dB $L_{Aeq, 8mins}$ has been analysed, isolating the short activity bursts over this hour period.

The following table summarises the results of the detailed BS4142 assessment which can be found in Table B.2 in Appendix B;

Table 5.1 – BS 4142:2014 Assessment of Whitehead Industrial Estate Noise Impact

Period	Industrial Activity Noise Captured at 83m, Pos C	BS 4142:2014 Acoustic Feature Correction	Daytime Background at Pos C
Daytime	42dB $L_{Aeq,1hr}$	+11	48 $L_{A90,1hr}$ (dB)

The BS 4142:2014 assessment results indicate the industrial estate is likely to be an indication of an adverse impact, depending on the context.

5.2 Context

5.2.1 Absolute Sound Levels

Commercial activities are only indicated during daytime hours, and activity is indicated to be infrequent.. Absolute noise levels from short periods of commercial activities are indicated at between below 52dB $L_{Aeq,1min}$.

5.2.2 Receptor Sensitivity

BS4142 advises: “whether dwellings will already incorporate design measures that secure good internal and/or outdoor acoustic conditions, such as:

- i. façade insulation treatment;
- ii. ventilation and/or cooling that will reduce the need to have windows open so as to provide rapid or purge ventilation; and
- iii. acoustic screening.”

BS 4142:2014+A1:2019 therefore indicates sound insulation treatment of new residential façades and screening to external amenity spaces can be used to reduce industrial noise impact. A scheme of noise mitigation measures is proposed in order to secure good internal and outdoor acoustic conditions from road traffic and rail noise, as set out in Sections 8 and 10 of this report which are also indicated suitable to control noise intrusion from industrial estate activities.

Outcome: Based on daytime operations and securing good acoustic conditions, impact can be modified to adverse impact less likely.

6. RAIL VIBRATION SURVEY

6.1 Procedure

Continuous vibration monitoring was carried out from 1030hrs on Tuesday, 21 November 2023 to 1030hrs on Wednesday, 22 November 2023.

Vibration levels were monitored in three orthogonal axes:

- Radial (horizontal, perpendicular to line of tracks)
- Tangential (horizontal, parallel to line of tracks)
- Vertical

Consecutive 1-minute 1/3-octave RMS acceleration spectra (a_{rms}) were recorded as well as hourly VDV_s.

Site plan in Figure 3.1 shows the development site and vibration monitoring positions used, namely:

Table 6.1 – Vibration Monitoring Location Details

Position	Description
V1	On a concrete base, approx. 67m from Cardiff Road and 29m from railway line

6.2 Equipment Used

The following measurement equipment was used during the surveys:

Table 6.2 – Vibration Monitoring Equipment List

Make	Description	Model	Serial Number	Last Calibrated	Certificate No.
Svante	Type 1 - Sound & Vibration Data Logger	SVAN 948	6962	18 August 2023	45151
Dytran	Tri-axial Accelerometer	3233A	158	18 August 2023	45151
Dytran	Cable	6483A09	-	18 August 2023	45151

Note: Copies of traceable calibration certificates for all equipment are available upon request.

6.3 Results

6.3.1 Monitoring Results

Table B.1 of Appendix B show hourly vibration dose value (VDV) results for continuous vibration monitoring at position V1.

Total daytime (0700-2300hrs) and night-time (2300-0700hrs) VDV results are summarised in the table below;

Table 6.3 – Summary of Continuous Vibration Monitoring Results

Axis	V1
Radial Totals	
VDV _d Day: 0700-2300hrs (m/s ^{1.75})	0.020
VDV _d Night: 2300-0700hrs (m/s ^{1.75})	0.006
Tangential Totals	
VDV _d Day: 0700-2300hrs (m/s ^{1.75})	0.021
VDV _d Night: 2300-0700hrs (m/s ^{1.75})	0.007
Vertical Totals	
VDV _b Day: 0700-2300hrs (m/s ^{1.75})	0.009
VDV _b Night: 2300-0700hrs (m/s ^{1.75})	0.005

Vibration dose values do not therefore exceed 0.32m/s^{1.75} 0700-2300hrs daytime, and 0.007m/s^{1.75} 2300-0700hrs night-time, as calculated in accordance with BS 6472-1:2008 [1Hz to 80Hz].

This indicates a low probability of adverse comments, and is below the 0.4 and 0.26 typically quoted by local authorities.

6.3.2 Railway

The graph in Figure B.15 of Appendix B show 1/3-octave band RMS vibration spectra for a number of worst case train pass-bys. These include the old British Standard 6472:1992 curves (for information only).

7. NOISE MAP MODELLING

Three dimensional noise map modelling has been undertaken using environmental noise mapping software package, which in turn uses calculation methods of Calculation of Road Traffic Noise (CRTN) and ISO 9613.

Models have been set up to predict daytime and night-time noise levels across the site from surrounding sources based on measured noise levels discussed in section 3 and 4 of this report.

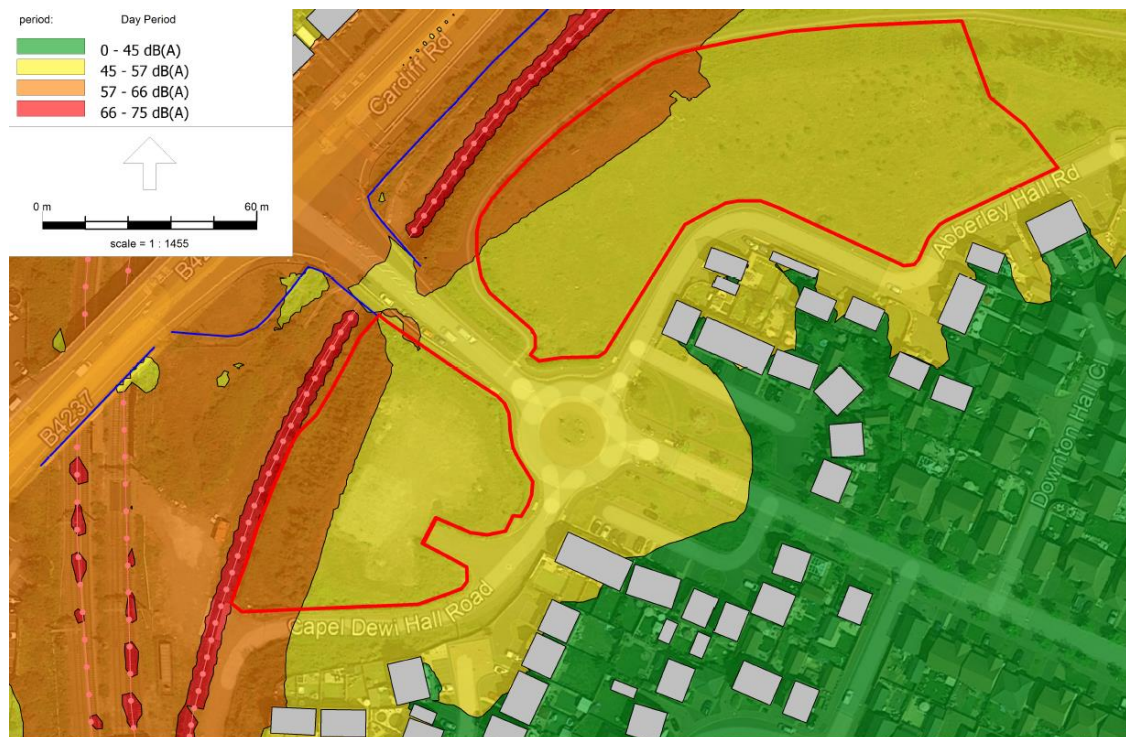
In line with train schedules discussed in 4.1. The model has allowed for up to 5no and 1no train events along the Courtybella line during the daytime and night-time respectively.

The model takes into account distance and screening losses from existing and new structures, allowing garden noise levels to be assessed, as well as predicting noise levels at proposed residential facades. Standard LiDAR DTM 5m data has been used for terrain modelling, along with topographic drawings provided by the client and site observations of specific features such as existing solid barriers between the site and Cardiff Road.

7.1 Undeveloped Site

The model scenarios have included for 5no and 1no 20minute train event(s) occurring along the Courtybella Line during the daytime and night-time period respectively. This is deemed to be the worst case scenario for noise impact across the site.

The noise map model in Figure 7.1 below shows predicted road and rail traffic noise levels during the daytime period (0700-2300hrs) and night-time period (2300-0700hrs) at 1.5m above local ground level across the undeveloped site.

Figure 7.1 - Daytime Model (Undeveloped Site) $L_{Aeq,16hr}$ Contours at 1.5m Height


The site is indicated to fall under a mixture of NEC A (shown in **GREEN**) and NEC B (shown in **YELLOW**) of TAN11 during the daytime period.

Figure 7.2 – Night-time Model (Undeveloped Site) $L_{Aeq,8hr}$ Contours at 1.5m Height


The site is indicated to fall under predominantly NEC B (shown in **YELLOW**) of TAN11 during the night-time period, with only the boundary with the Courtybella Line falling into NEC C (shown in **ORANGE**)

7.2 Developed Site

The proposed housing layout plan referenced in Appendix D has been used for the developed model.

Noise map models in Figure C.3, Figure C.4, Figure C.5 and Figure C.6 of Appendix B show predicted road and rail traffic noise levels during the daytime (0700-2300hrs) and night-time (2300 – 0700hrs) period at 1.5m and 4.5m above local ground level on the developed site.

The model has been modelled with a 2.1m high solid barrier along the northern and western boundaries as highlighted in **PINK** in in Figure C.3; 1.8m high close-boarded timber fences or brick walls have been modelled around gardens shown in **BLUE**.

8. EXTERNAL BUILDING FABRIC ASSESSMENT

Based on survey result, we have carried out an external building fabric assessment with the aim of controlling noise intrusion to habitable rooms to meet 35dB $L_{Aeq,16hr}$ daytime and 30dB $L_{Aeq,8hr}$ night-time, in line with the desirable internal ambient noise values quoted in BS 8233:2014 (see section 2.4 of this report) under whole dwelling ventilation conditions. This includes controlling noise intrusion from train events along the Courtybella railway line, and commercial activities on the industrial estate.

Critical façades are shown on site plan in Figure 8.1 below, marked up with **MAGENTA** and **BLUE** lines.

Figure 8.1 – Façades Requiring Additional Sound Insulation Measures



Note: Habitable rooms include bedrooms, lounges, dining rooms and kitchen/diners but not kitchens or bathrooms.

Habitable rooms on façades highlighted above require up-rated ventilation as specified below. Standard thermal double glazing and trickle ventilation should be sufficient on remaining façades (not highlighted).

This preliminary assessment is intended to provide an initial indication of the sound insulation measures required to control noise intrusion. Final design proposals should be confirmed acceptable with a suitably qualified acoustician at the detailed design stage.

This preliminary assessment has been carried out based on the following assumptions;

- Noise intrusion is calculated to a bedroom with dimensions of 4m (l) x 2.5m (w) x 2.4m (h)
- Façade area, exposed to road traffic of 10m² (l x h)
- Glazing area of 2m²

The analysis is based on the noise spectra quoted in Figure B.13.

8.1 External Walls

The following external wall construction has been used in our analysis;

- Brick / cavity / Block or Brick / cavity / Timber Frame

The following SRI performance figures are taken from BS 8233:2014 for 'Brick and block external wall'. The proposed constructions should be capable of achieving these figures as a minimum;

Table 8.1 – External Wall Sound Reduction Index Figures

Element	Description	Sound Reduction Index dB R (BS EN ISO 10140-2:2010) @ Octave Band Centre Frequency (Hz)				
		125	250	500	1k	2k
External Wall	Brick / Cavity / Block or Brick / Cavity / Timer frame	40	44	45	51	56

8.2 Roof

The following roof constructions have been used in our analysis;

- Roof tiles pitched timber roof joists, 12.5mm plasterboard ceiling + 200mm insulation

The following minimum SRI performance figures are taken from BS 8233:2014: “tiles on felt roof with 100mm mineral wool on plasterboard ceiling”;

Table 8.2 – Roof Sound Reduction Index Figures

Element	Description	Sound Reduction Index dB R (BS EN ISO 10140-2:2010) @ Octave Band Centre Frequency (Hz)				
		125	250	500	1k	2k
Pitched Roof	Tiles on felt, 9mm plasterboard ceiling, 100mm mineral wool insulation	28	34	40	45	49

This is indicated sufficient for unmarked façades and those highlighted **BLUE** and **MAGENTA**.

8.3 Glazing

The housing layout plan in Figure 8.1 shows façades where windows require up-rating. The following minimum sound reduction index figures shall be met for glazing on these critical façades:

Table 8.3 - Glazing Sound Reduction Index Figures

Element	Description	Sound Reduction Index dB R (BS EN ISO 10140-2:2010) @ Octave Band Centre Frequency (Hz)				
		125	250	500	1k	2k
MAGENTA	38dB R_w+C_{tr} Pilkington 10mm / 16mm / 8.8mm <i>Optiphon</i> SGG 8mm / 16mm / 10.8mm <i>Stadip Silence</i>	28	31	42	45	48
BLUE	28dB R_w+C_{tr} Pilkington 6mm / 16mm / 4mm SGG 6mm / 16mm / 6mm	21	20	26	38	35

Standard thermal double-glazing is indicated to be sufficient on all other dwellings.

Typical glazing system that should be capable of achieving the quoted SRI figures (based on Pilkington and Saint Gobain test data) is included in the table for initial budgetary guidance, however;

The successful glazing suppliers shall provide independent laboratory test data to BS EN ISO 10140-5 – 2010, confirming their proposed systems (including frames/seals) meet the quoted octave band sound reduction performance figures above.

For all other façades standard thermal double-glazing is indicated to be sufficient.

8.4 Ventilation

For plots **not** labelled above in **MAGENTA** or **BLUE**, a natural ventilation strategy utilising background ventilators and intermittent extract fans is indicated to be feasible, as specified in Building Regulations Part F, Regulation F1(1) 2010 2022 Edition.

Natural Ventilation with background ventilators and intermittent extract fans (guidance suitable only for less airtight dwellings*). Guidance on minimum provisions for intermittent extract and background ventilators is set out in Para 1.47 & 1.59 of Building Regulations Part F.

The final proposed ventilation strategy should be confirmed acceptable with planners/ EHO and Building Control.

8.4.1 Natural Ventilation

This strategy relies on windows being closed; however, occupiers may still open windows for purge ventilation, or under normal ventilation conditions if they so choose.

Standard background (trickle) ventilators are indicated sufficient. The following minimum ventilator ($D_{n,e}$) performance has been used in our assessment

Table 8.4 – Acoustic Background Ventilator Specifications

Element	Description	Element-Normalised Level Difference dB $D_{n,e}$ (BS EN ISO 10140-2:2010)				
		125	250	500	1k	2k
Ventilator	RW Simon FrameVent (open)	36	33	33	31	29

The calculation has allowed for a maximum of 2no acoustic background ventilators per room, required to meeting the minimum 8000mm² equivalent area requirement of Part F.

The successful trickle ventilator suppliers shall provide independent laboratory test data to BS EN ISO 10140-5 – 2010, confirming their proposed ventilator meet the quoted octave band performance figures above.

Alternatively a mechanical ventilation strategy may be utilised for non-critical plots.

8.4.2 Continuous Mechanical Ventilation

All habitable rooms on critical façades highlighted **MAGENTA** and **BLUE** require a ventilation strategy that does not rely on opening windows to achieve 'extract ventilation' and 'whole building ventilation' rates as required by Building Regulations Part F, Regulation F1(1) 2010 2022 Edition.

Continuous mechanical extract. *Guidance on minimum provisions for extract and whole building ventilation is set out in Para 1.61 & 1.62 of Building Regulations Part F.*

Continuous mechanical supply and extract with heat recovery. *Guidance on minimum provisions for extract and whole building ventilation is set out Para 1.69 of Building Regulations Part F.*

These strategies rely on windows being closed; however, occupiers may still open windows for purge ventilation, or under normal ventilation conditions if they so choose to, and so glazing would not be 'fixed pane'.

The final proposed ventilation strategy should be confirmed acceptable with planners/EHO and Building Control.

8.4.3 Continuous Mechanical Extract with Background Ventilators

Building Regs Part F advises: "**1.64** Where continuous mechanical extract ventilation is used, background ventilators should satisfy all of the following conditions:

- a. not be in wet rooms*
- b. provide minimum equivalent area of 4,000 mm² for each habitable room in the dwelling*
- c. Provide a minimum total number of ventilators that is the same as the number of bedrooms plus two ventilators (i.e. a one-bedroom dwelling should have three background ventilators, a two- bedroom dwelling should have four background ventilators, etc.)."*

The background ventilators shall be acoustically treated to achieve the following ($D_{n,e}$) performance;

Table 8.5 – Acoustic Trickle Ventilator Specifications

Element	Description	Element-Normalised Level Difference dB $D_{n,e}$ (BS EN ISO 10140-2:2010)				
		125	250	500	1k	2k
Ventilator	37dB $D_{n,e,w}+C_{tr}$ based on Greenwood 5000EA with 1 acoustic set (open)	39	38	31	44	43

The calculation has allowed for a maximum of 1no acoustic trickle ventilators per room, meeting the minimum 4000mm² equivalent area requirement of Part F.

For budgetary guidance the above ventilator figures are based on Greenwood 5000EA + 1 acoustic set ventilator. The successful tenderer shall provide independent laboratory test data showing their vent meets the above performance requirements.

The successful trickle ventilator suppliers shall provide independent laboratory test data to BS EN ISO 10140-5 – 2010, confirming their proposed ventilator meet the quoted octave band performance figures above.

8.4.4 Mechanical Ventilation with Heat Recovery

Alternatively, a Mechanical Ventilation with Heat Recovery (MVHR) strategy could be utilised which does not require any background ventilators in the external façade.

8.4.5 Mechanical Ventilation System Noise

All mechanical ventilation systems should be designed to meet the noise criteria set out in Building Regulations Approved Document Part F, 2022 Edition – For use in Wales which states the following:

“Although there is no requirement to undertake noise testing, achieving the levels in the following guidance should ensure good acoustic conditions. The average A-weighted sound pressure level for a ventilator operating under normal conditions and not at boost rates should not exceed both of the following.

- 30dB LAeq,T for noise-sensitive rooms (e.g. bedrooms and living rooms) when a continuous mechanical ventilation system is running on its minimum low rate.*
- 45dB LAeq,T in less noise-sensitive rooms (e.g. kitchens and bathrooms) when a continuous operation system is running at the minimum high rate or an intermittent operation system is running.”*

8.4.6 General

Do not include standard background (trickle) ventilators within window frames on critical facades.

9. OVERHEATING

Our assessment recommends acoustic ventilators on critical facades, to control noise intrusion under whole dwelling ventilation conditions. This is based on windows normally being closed (excluding purge ventilation).

Approved Document O (Wales) advises:

When the removing excess heat as part of the overheating strategy, noise levels in bedrooms should be kept to a minimum during the sleeping hours of 23:00 – 07:00.

There are no further criteria or guidance on internal noise levels within Building Regulations Part O in Wales and therefore guidance is sought from the Acoustics, Ventilation and Overheating Residential Design Guide (AVO Guide): 2020 prepared by the Association of Noise Consultants (ANC) and the Institute of Acoustics (IOA).

It is therefore proposed to refer to the upper 42dB $L_{Aeq,8hr}$ and 65dB $L_{Amax,F}$ quoted in AVO Guide (Figure 2.1) as initial internal ambient noise criteria during overheating conditions.

At this stage and for guidance, we would advise that the “geometric open area” of the **bedroom** windows on critical facades (not the “equivalent area”) should not exceed 3% of the floor area at night, if the upper internal night-time AVO Guide values of 42dB $L_{Aeq,8h}$ and 65dB $L_{Amax,F}$ are to be met (providing approximately 11dB sound reduction).

This should be confirmed acceptable with a suitably qualified thermal modelling engineer. If this is not sufficient, an alternative means of controlling overheating is likely to be required.

Any detailed overheating assessment should be carried out to all plots within the development site.

Note: This assessment has been carried out to bedrooms of the most critical plots within the proposed development site, located closest to the road. It is likely that plots situated further back from the road and rail line, with lower external ambient noise levels, are at a reduced noise risk and open windows could be utilised. This can be reviewed at a later stage, as part of a more detailed overheating assessment if required.

10. EXTERNAL NOISE ASSESSMENT (GARDENS)

The noise map model in Figure C.3 indicates the majority of garden areas meet the desirable guideline value of 50dB $L_{Aeq,16hr}$ quoted in BS8233:2014. Plots 15, 16 & 17 on Site 1 (north east parcel) and all Plots on Site 2 (south west parcel) are indicated to meet the upper guideline value of 55dB $L_{Aeq,16hr}$ with a minimum 2.1m high fence in place along the boundary (marked in in **PINK** in in Figure C.3).

British Standard 8233:2014 advises:

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

The minimum 2.1m high fence along the boundary is also indicated to provide screening to activities on the industrial estate to the closest plots. This is line with good acoustic practice.

11. CONCLUSION

An environmental noise and vibration assessment has been carried out for the proposed residential development at Land at Mon Bank, Newport, NP20. Road traffic is indicated to control the ambient noise climate day and night, train pass- bys are also indicated to influence the ambient noise level.

Noise map models have been generated to show noise propagation across both the undeveloped and developed sites.

An external building fabric assessment has been carried out. Critical facades requiring additional sound insulation measures have been highlighted and specifications for uprated ventilation are included.

An assessment of external noise in gardens has been undertaken and shows that the majority of gardens meet the desirable 50dB $L_{Aeq,16hr}$ garden criterion with the exception of critical plots along the Courtybella line which achieve the upper guideline value of 55 dB $L_{Aeq,T}$ with a minimum 2.1m high fence included.

Rail vibration levels have also been measured for comparison with daytime and night-time criteria quoted in BS 6472 'Guide to evaluation of human exposure to vibration in buildings'. Vibration measured levels are within proposed criteria.

APPENDIX A - ACOUSTIC TERMINOLOGY

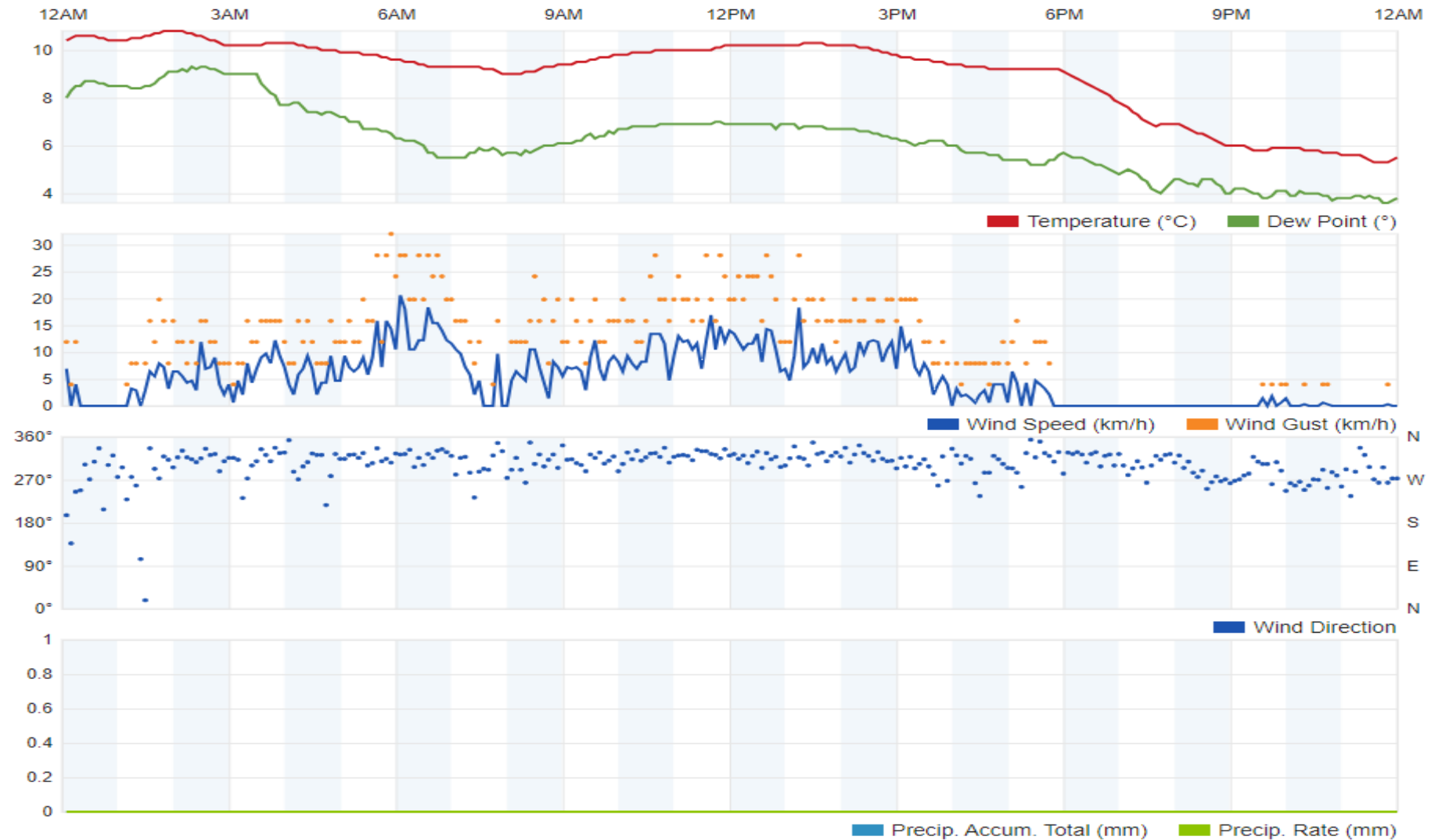
Human response to noise depends on a number of factors including loudness, frequency content and variations in level with time. Various frequency weightings and statistical indices have been developed in order to objectively quantify 'annoyance'.

The following units have been used in this report:

dB(A)	The sound pressure level A-weighted to correspond with the frequency response of the human ear and therefore a persons' subjective response to frequency content.
L_{eq}	The equivalent continuous sound level is a notional steady state level which over a quoted time period would have the same acoustic energy content as the actual fluctuating noise measured over that period.
L_{max}	The highest instantaneous sound level recorded during the measurement period.
L_{10}	The sound level which is exceeded for 10% of the measurement period. i.e. The level exceeded for 6 minutes of a 1 hour measurement - used as a measure of background noise.
L_{90}	The sound level which is exceeded for 90% of the measurement period. i.e. The level exceeded for 54 minutes of a 1 hour measurement - used as a measure of background noise.
$L_{Ar,Tr}$	The 'rating' level, as described in BS 4142:2014 – the specific noise plus any adjustment for the characteristic features of the noise.
SSR	Sound sensitive receiver
$VDV_{b/d,T}$	Vibration Dose Value – the measure of the total vibration experienced over a specified period. It is weighted using W_b and W_d as appropriate, over a given time period, T . The VDV defines a relationship that yields a consistent assessment of continuous, intermittent, occasional and impulsive vibration and correlates well with subjective response.

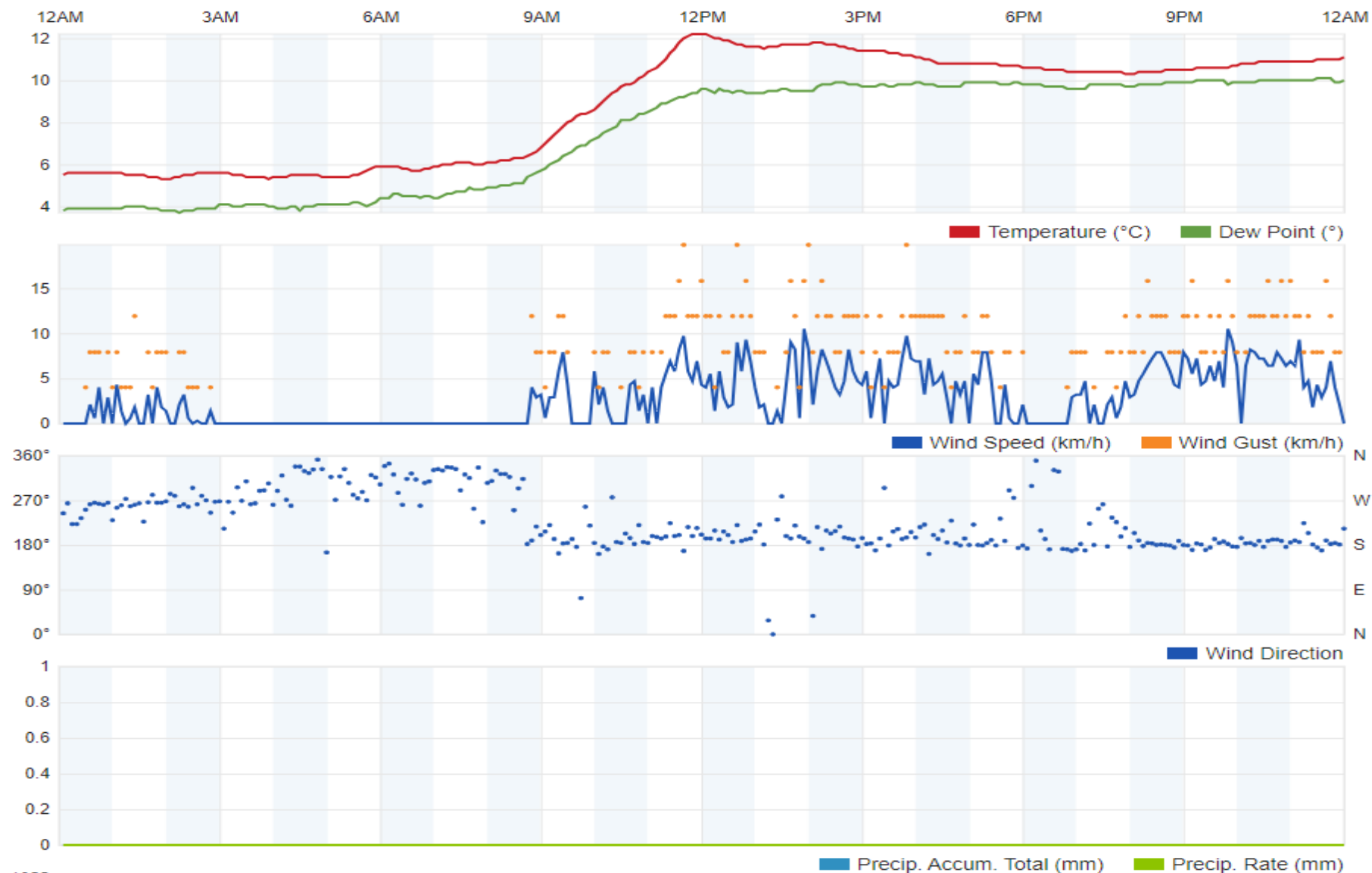
APPENDIX B - DIAGRAMS, GRAPHS AND TABLES

Figure B.1 – Approximate Weather History for Tuesday, 21 November 2023



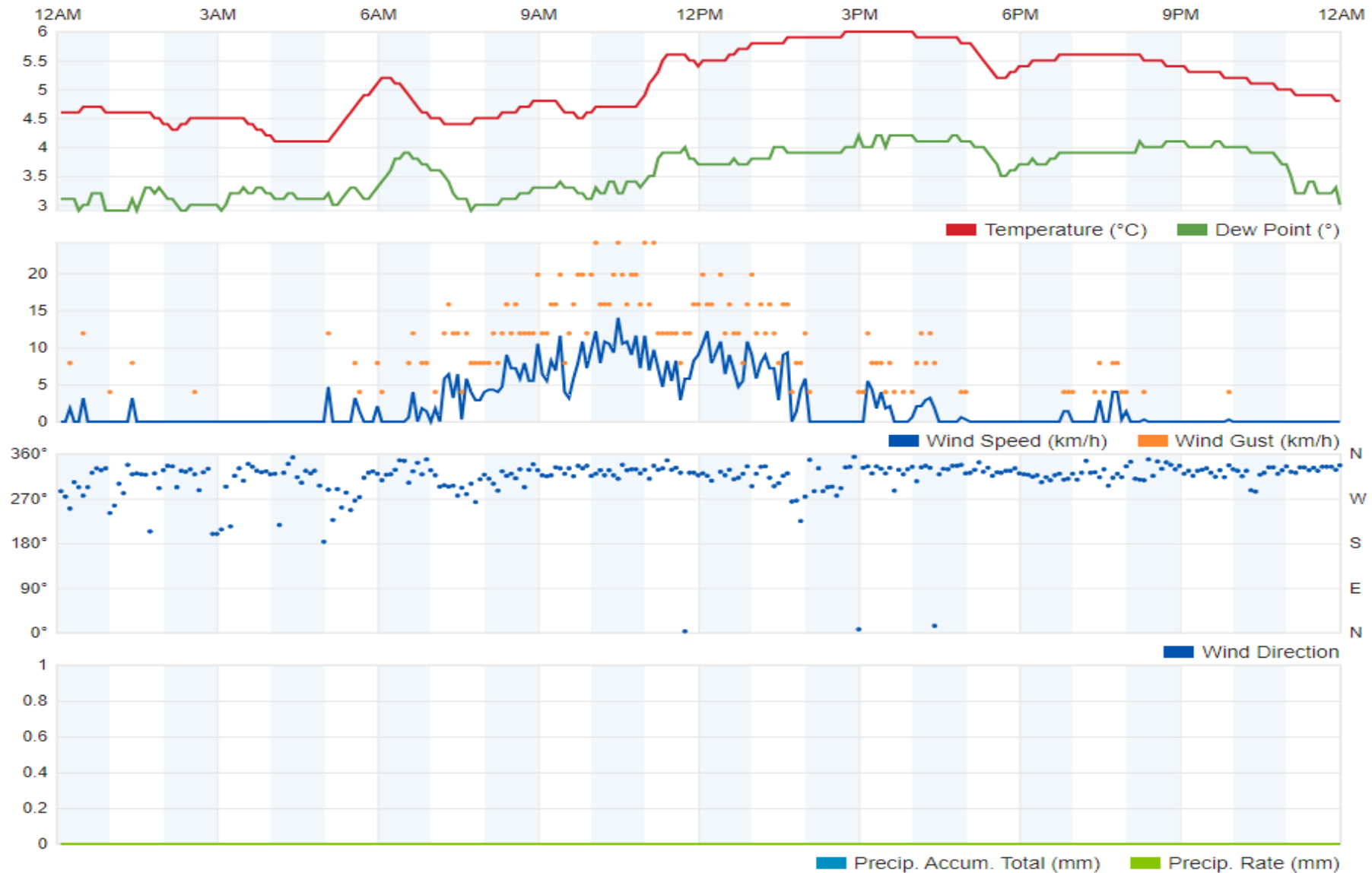
Note: Taken from www.wunderground.com - weather station INEWPO126 located in Newport [Elev 36 m, 51.57 °N, 3.02 °W]

Figure B.2 – Approximate Weather History for Wednesday, 22 November 2023



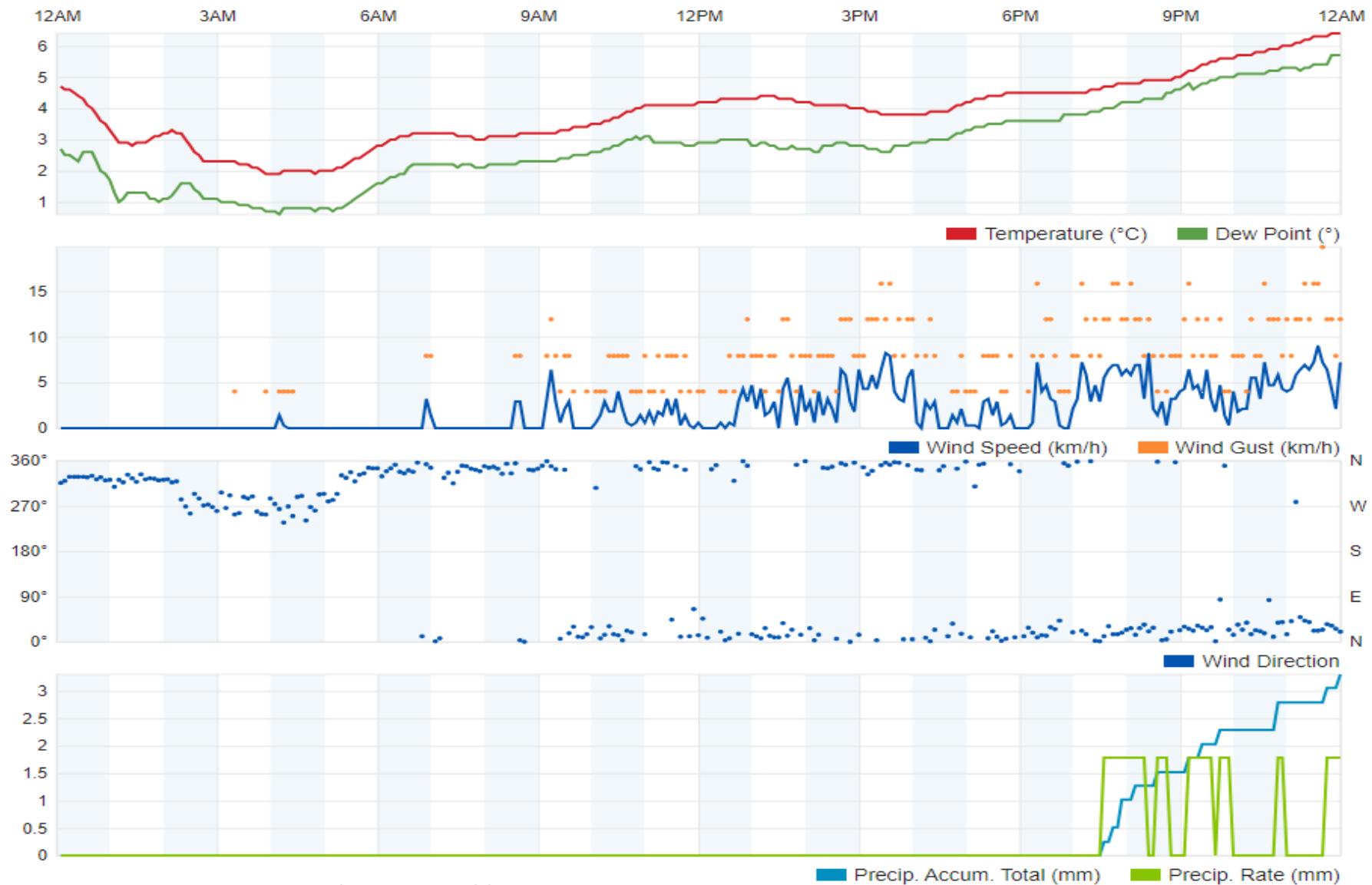
Note: Taken from www.wunderground.com - weather station INEWPO126 located in Newport [Elev 36 m, 51.57 °N, 3.02 °W]

Figure B.3 – Approximate Weather History for Tuesday, 05 December 2023



Note: Taken from www.wunderground.com - weather station INEWPO126 located in Newport [Elev 36 m, 51.57 °N, 3.02 °W]

Figure B.4 – Approximate Weather History for Wednesday, 06 December 2023



Note: Taken from www.wunderground.com - weather station INEWPO126 located in Newport [Elev 36 m, 51.57 °N, 3.02 °W]

Figure B.5 – Time History at Position A (Tuesday, 21 November 2023 to Wednesday, 22 November 2023)

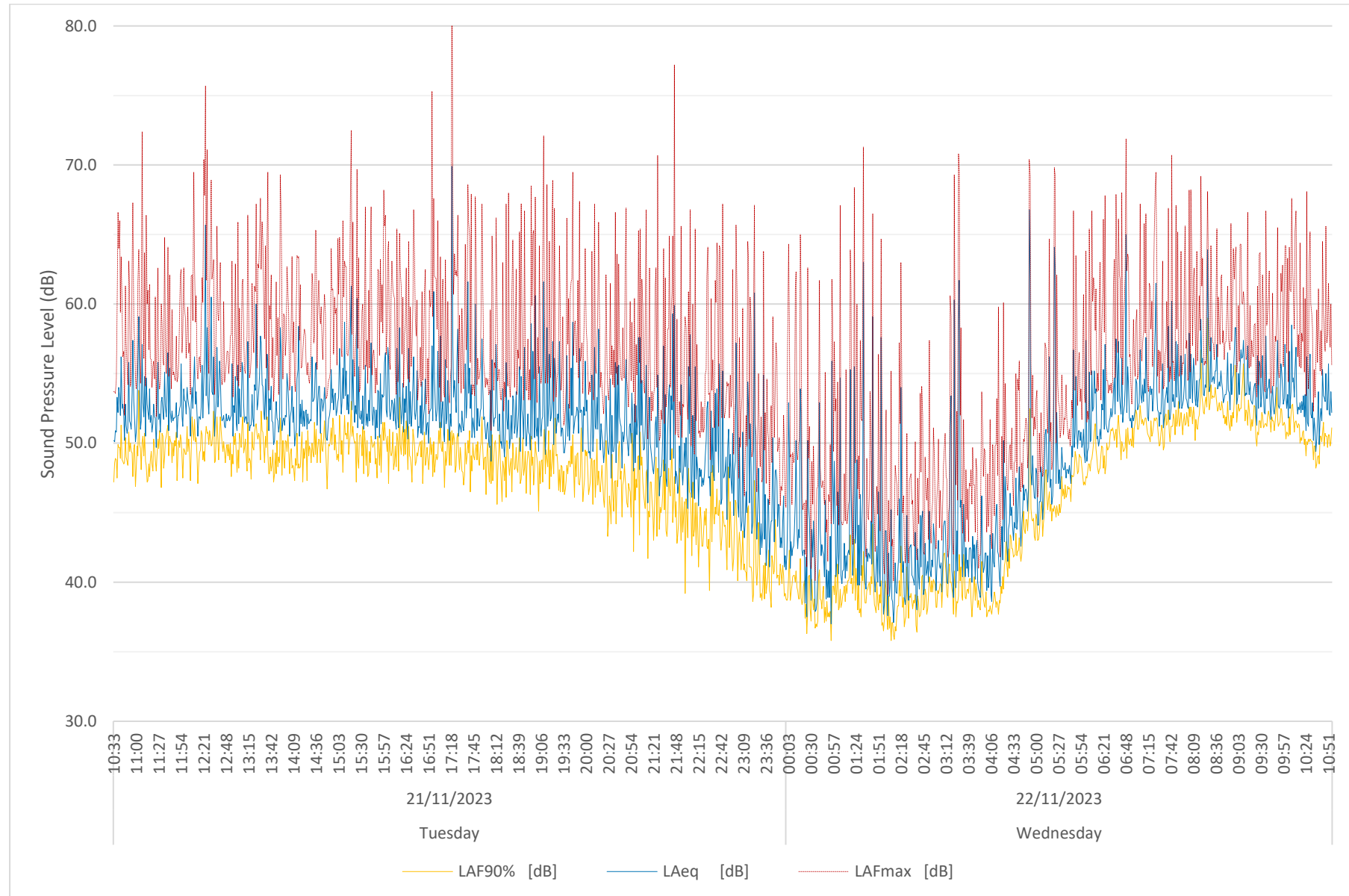


Figure B.6 – Time History at Position B (Tuesday, 21 November 2023 to Wednesday, 22 November 2023)

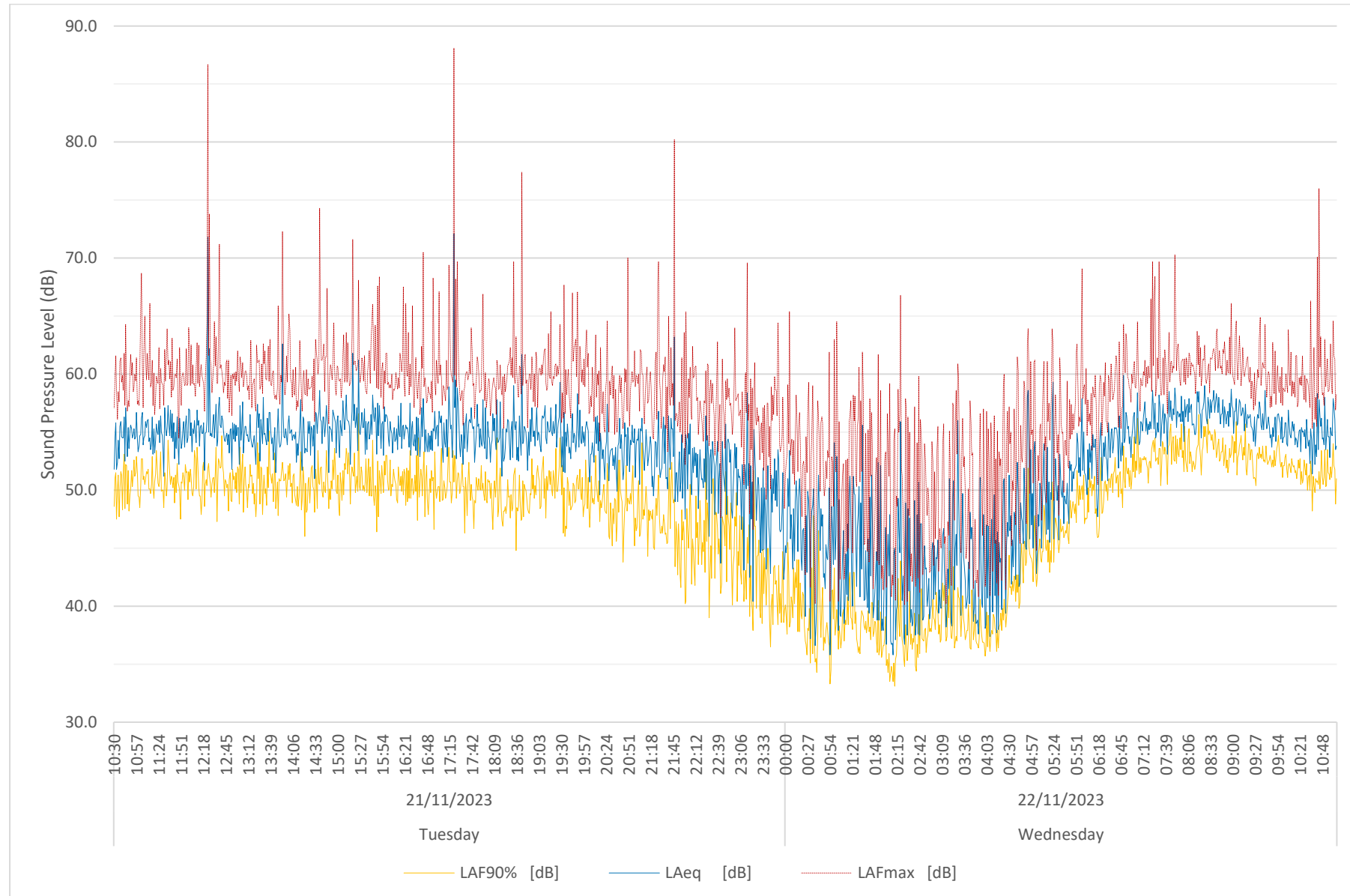


Figure B.7 – Time History at Position B (Tuesday, 05 December 2023 to Wednesday, 06 December 2023)

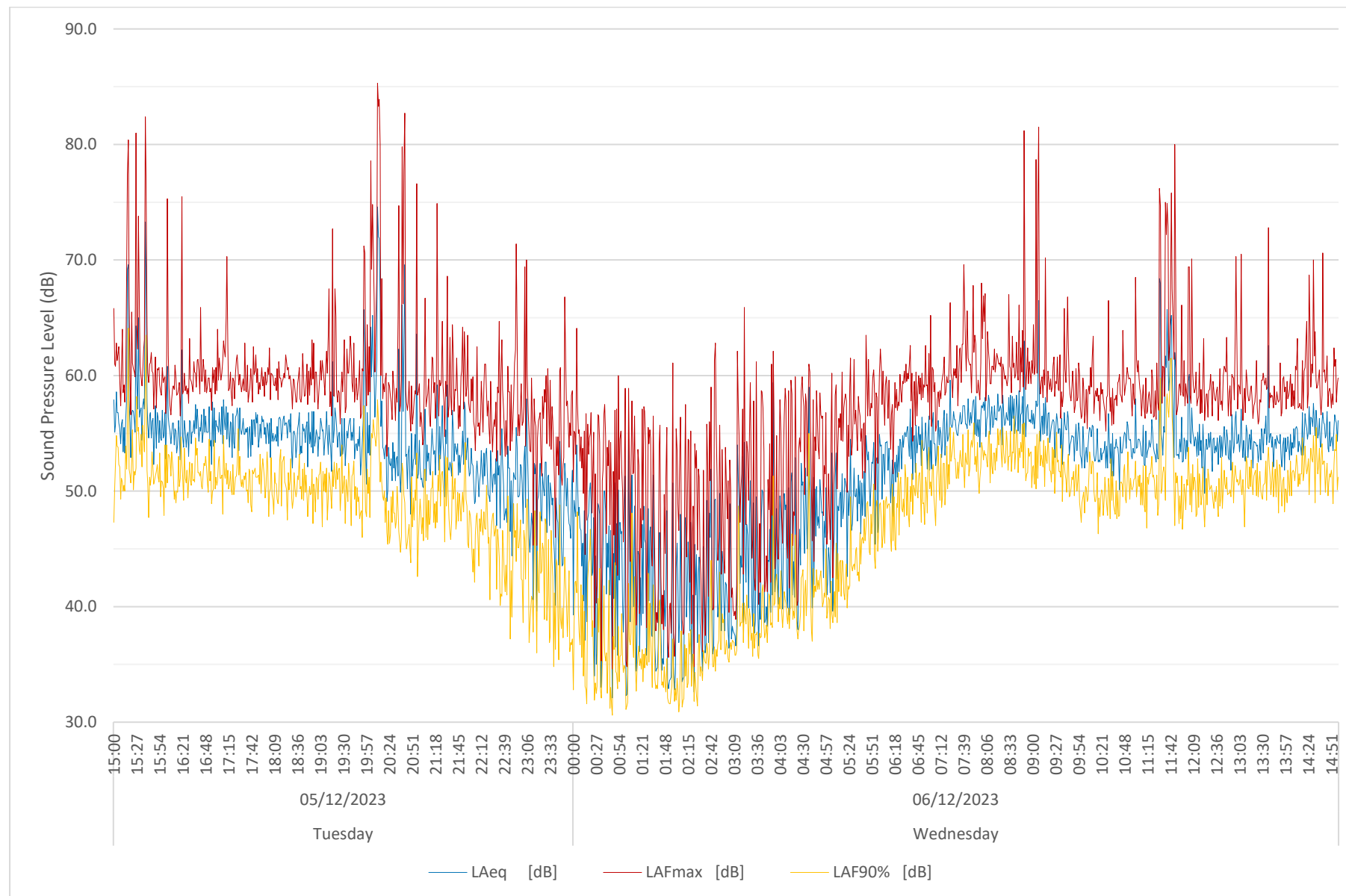


Figure B.8 – Time History at Position C (Tuesday, 05 December 2023 to Wednesday, 06 December 2023)

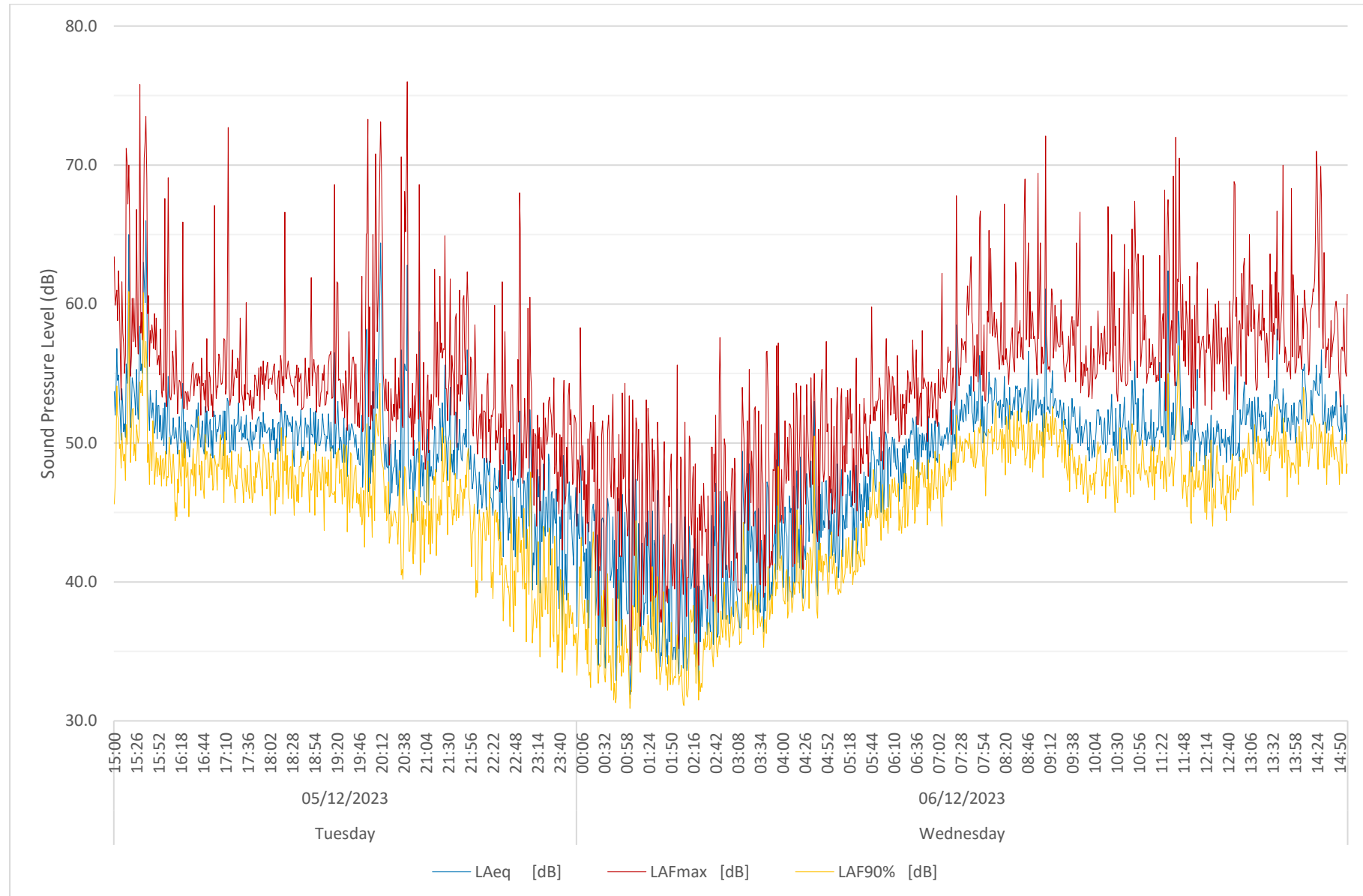


Figure B.9 – Statistical Analysis of Background Sound Levels Measured at Position A (Tuesday, 21 November 2023 to Wednesday, 22 November 2023)

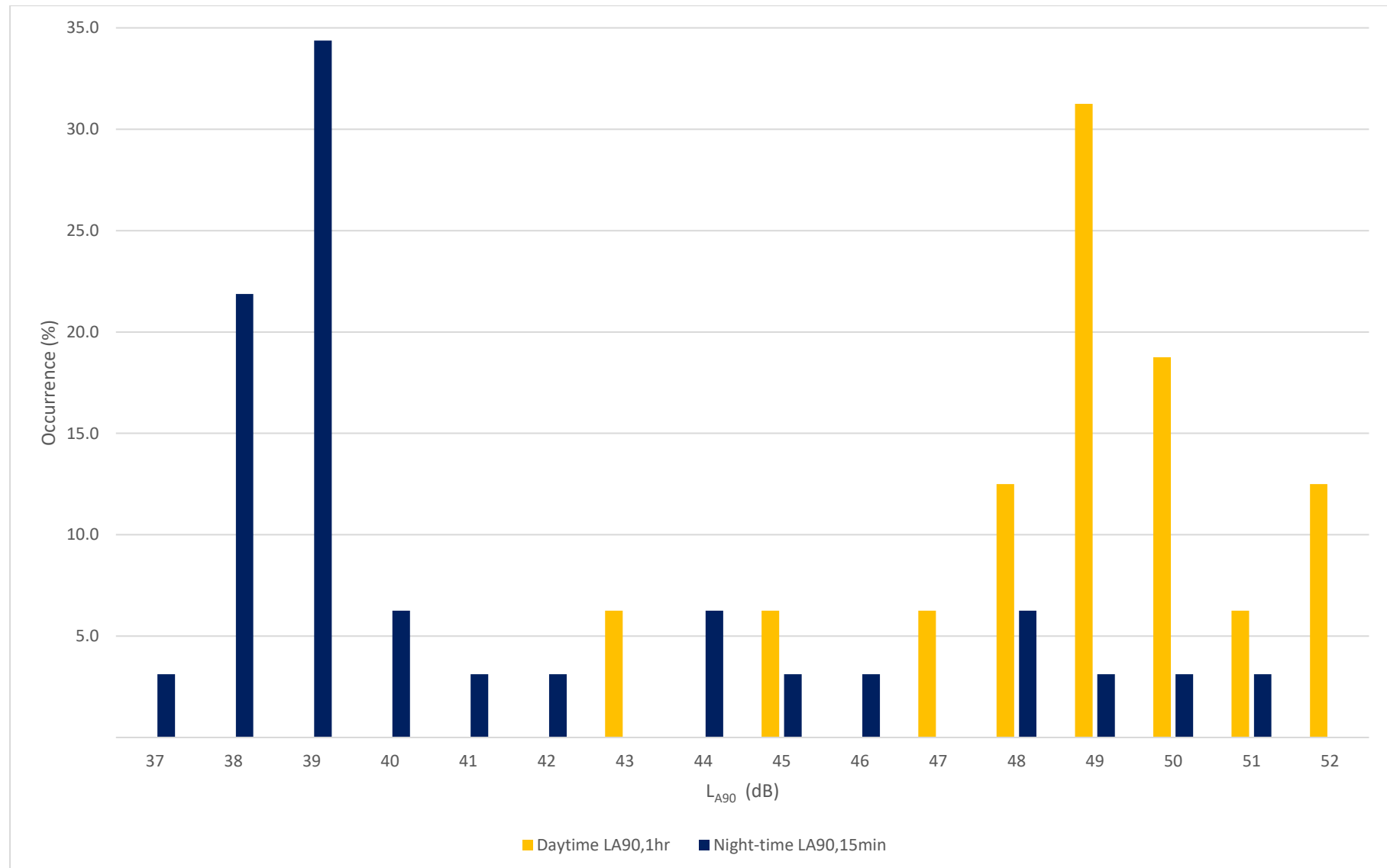


Figure B.10 – Statistical Analysis of Background Sound Levels Measured at Position B (Tuesday, 21 November 2023 to Wednesday, 22 November 2023)

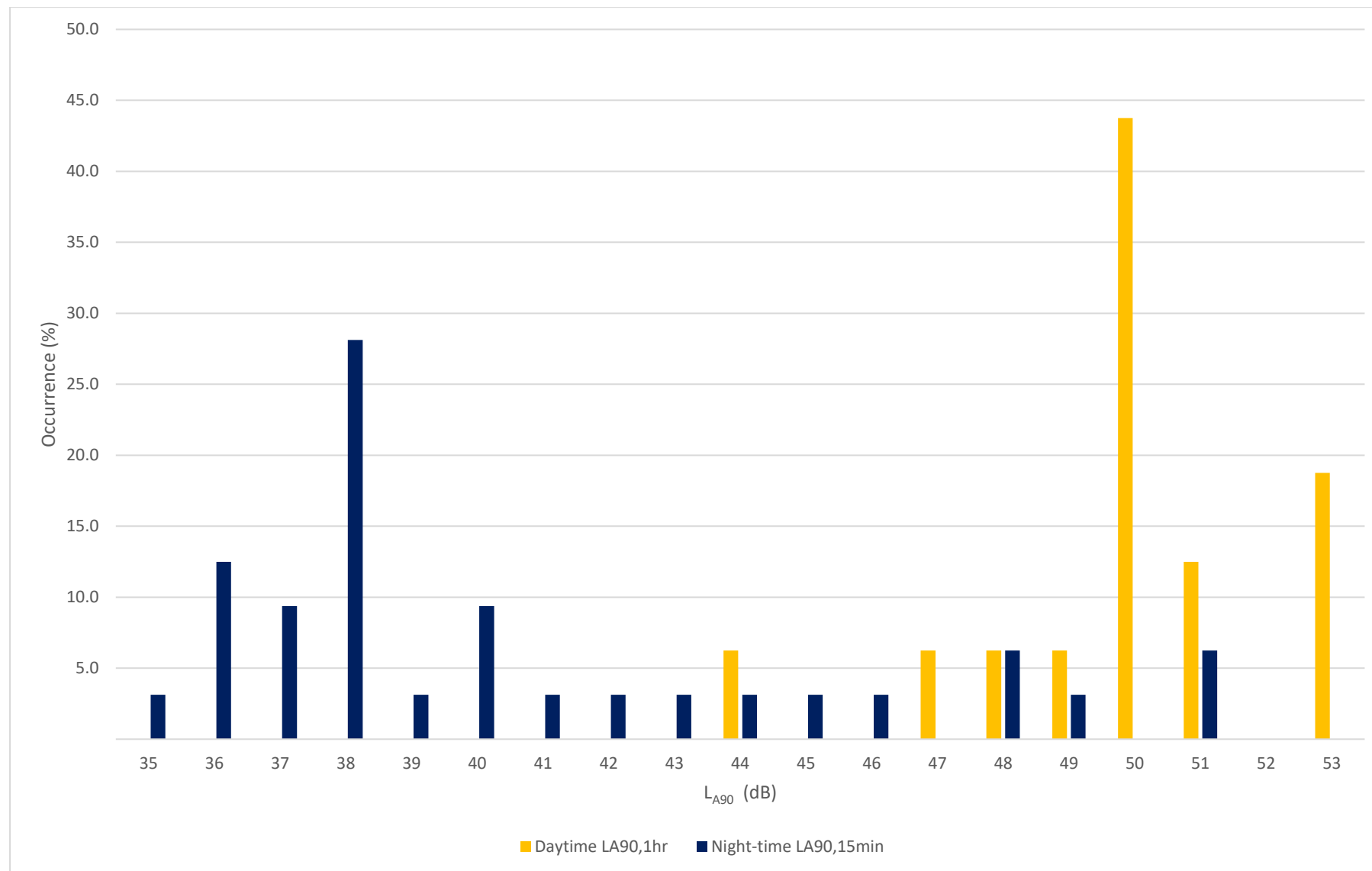


Figure B.11 – Statistical Analysis of Background Sound Levels Measured at Position B (Tuesday, 05 December 2023 to Wednesday, 06 December 2023)

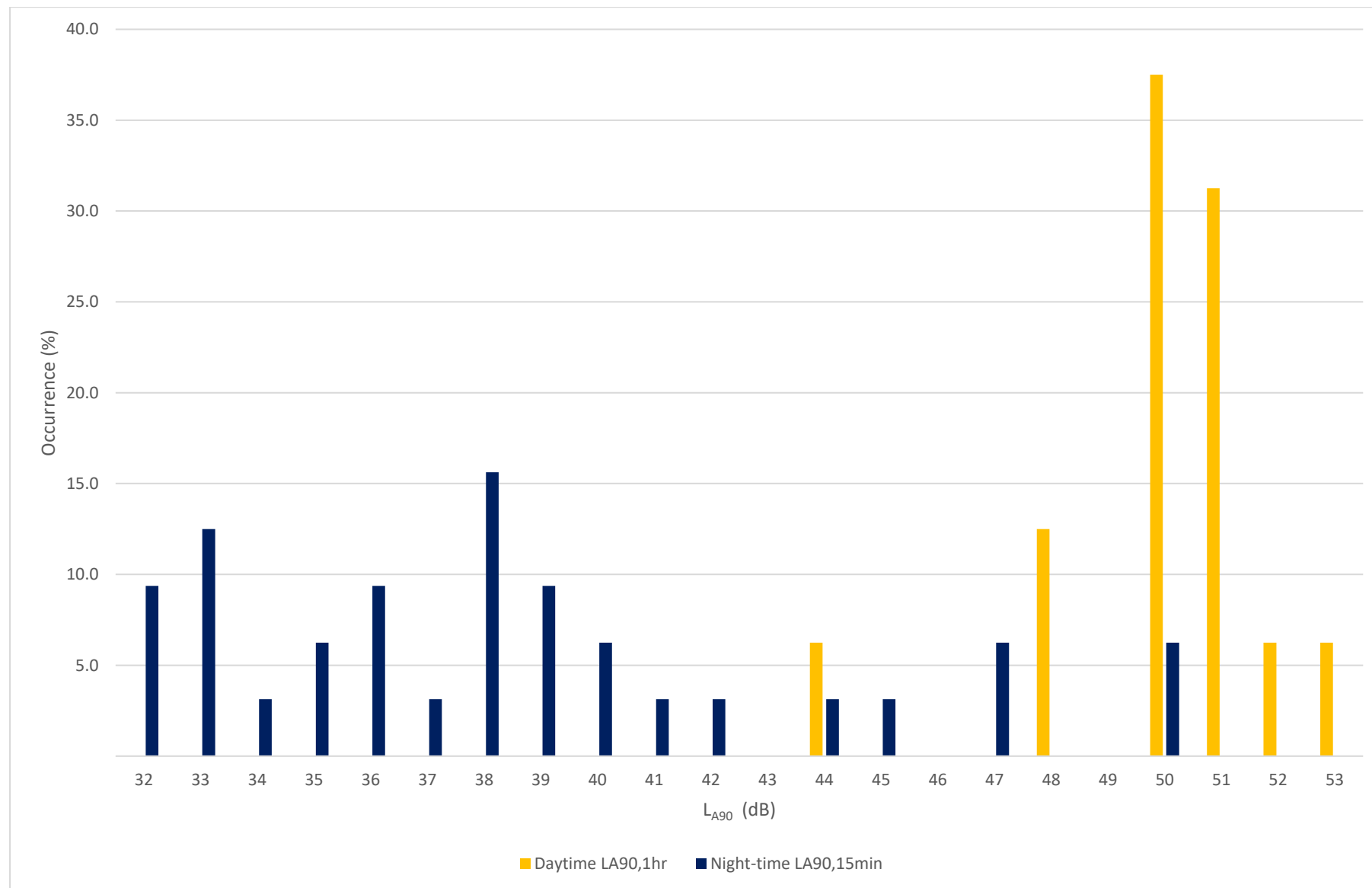


Figure B.12 – Statistical Analysis of Background Sound Levels Measured at Position C (Tuesday, 05 December 2023 to Wednesday, 06 December 2023)

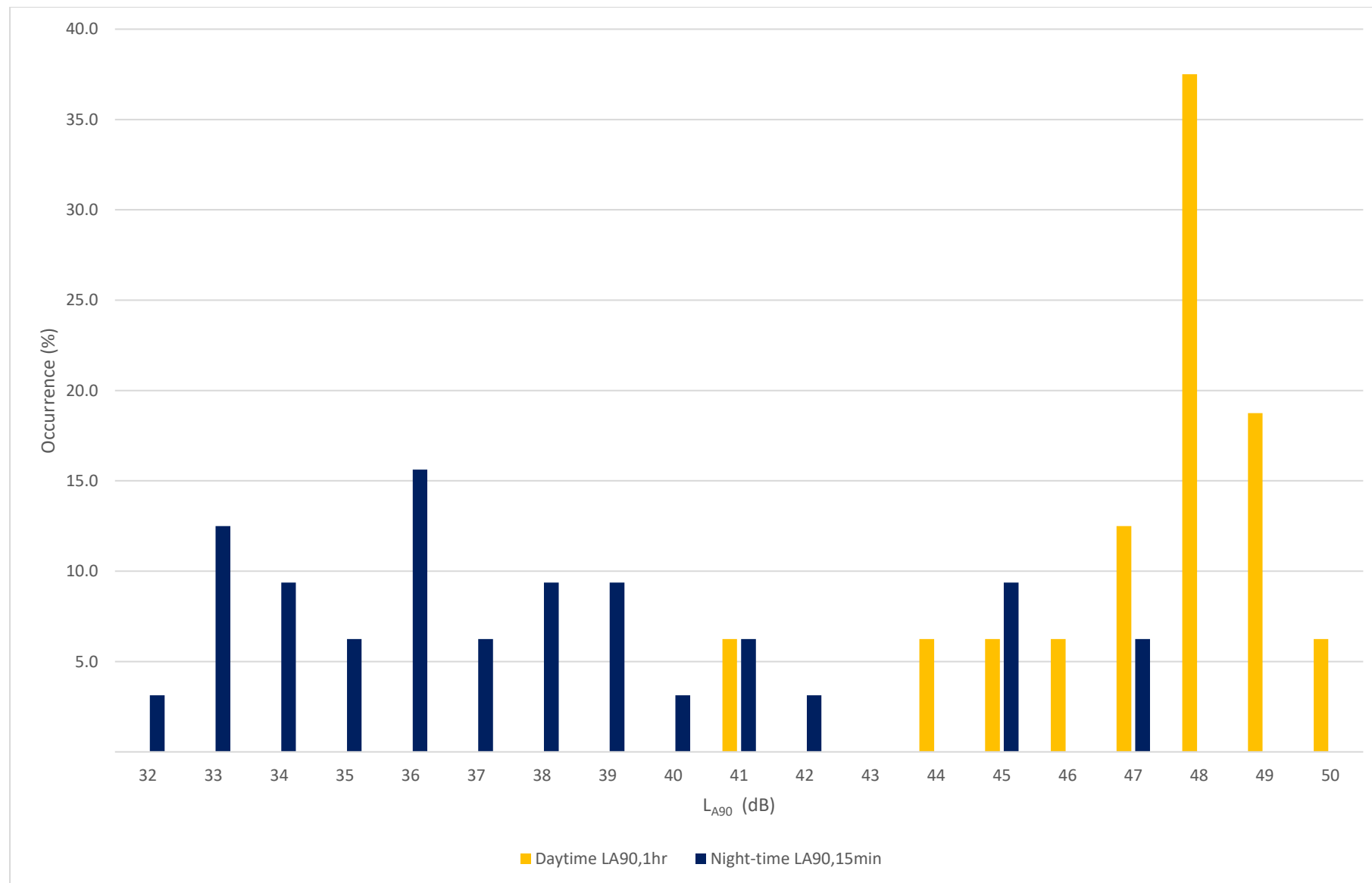


Figure B.13 – L_{eq} and $L_{max,F}$ Octave Band Spectra Measured at Position A & B (Tuesday, 21 November 2023 to Wednesday, 22 November 2023)

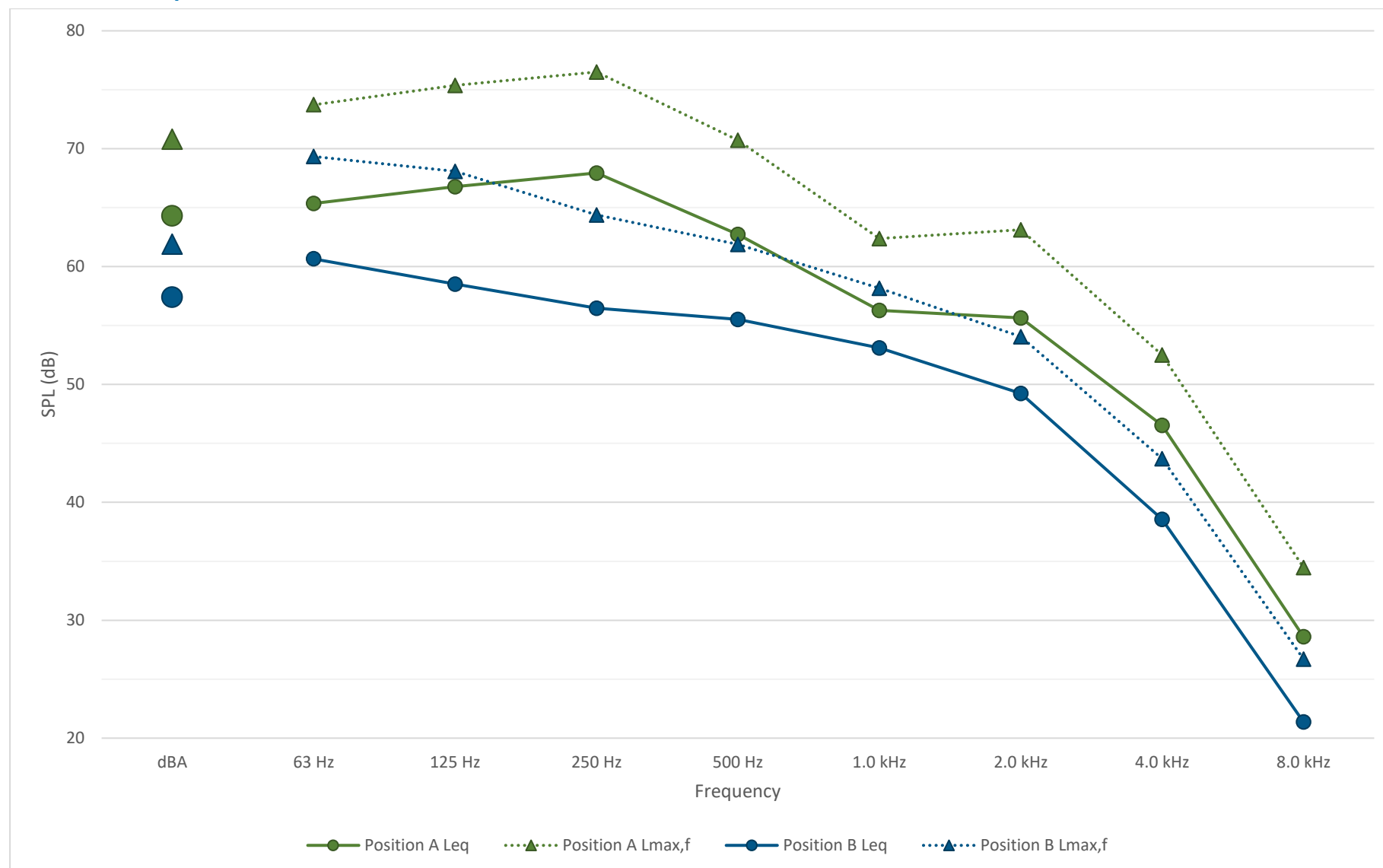


Figure B.14 – L_{eq} and $L_{max,F}$ Octave Band Spectra Measured at Position B for Courtybella Train Events

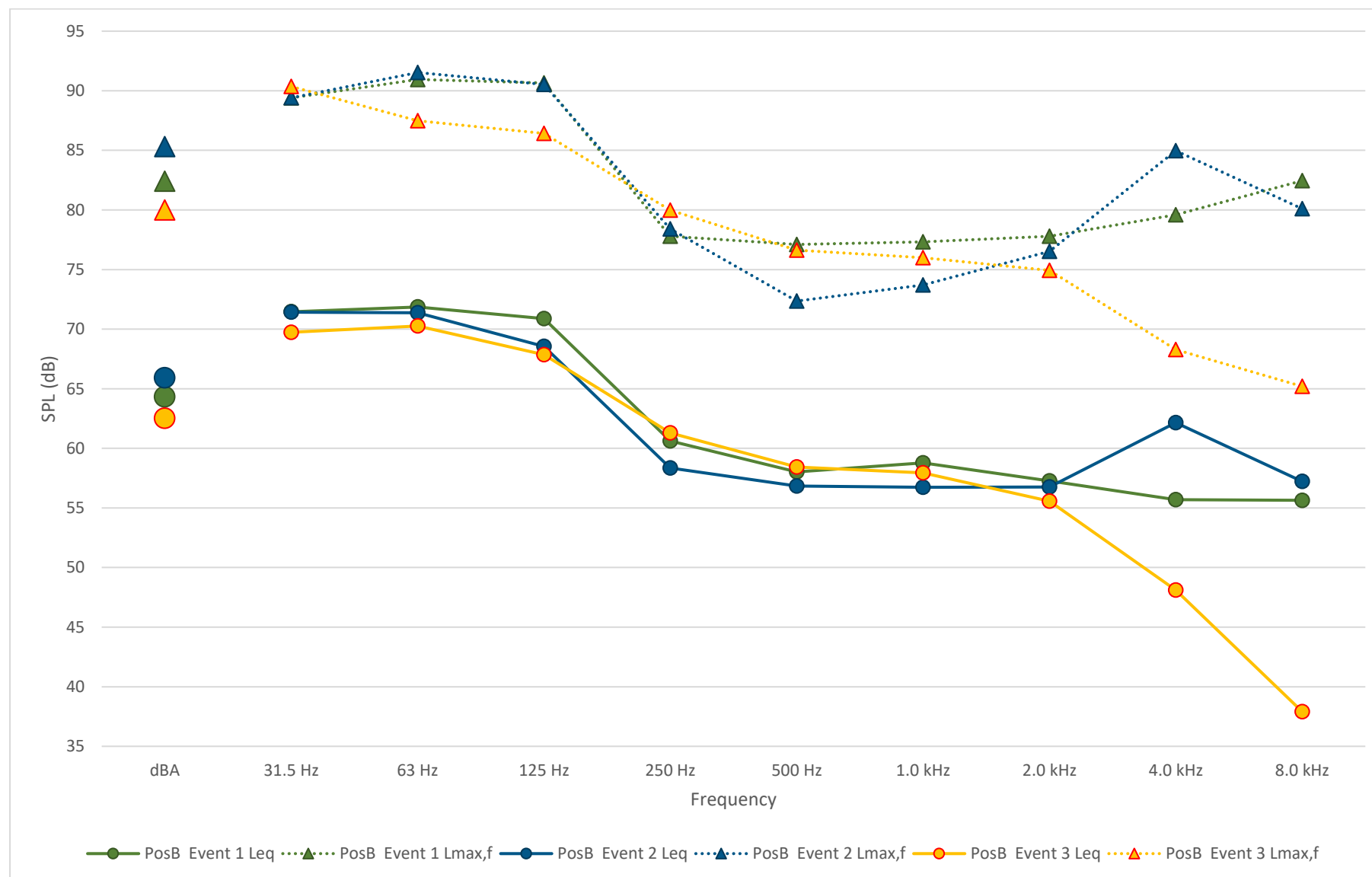


Table B.1 - Vibration Dose Values (VDVs) at Position V1 (Tuesday, 21 November 2023 to Wednesday, 22 November 2023)

Date	Start	Channel	Weighting	VDV, ms ^{-1.75}	Date	Start	Channel	Weighting	VDV, ms ^{-1.75}
21/11/2023	10:30	Radial	W _d	1.36E-02	21/11/2023	22:30	Radial	W _d	3.79E-03
		Tangential	W _d	1.56E-02			Tangential	W _d	3.99E-03
		Vertical	W _b	6.54E-03			Vertical	W _b	3.32E-03
21/11/2023	11:30	Radial	W _d	1.56E-02	21/11/2023	23:30	Radial	W _d	3.75E-03
		Tangential	W _d	1.59E-02			Tangential	W _d	4.22E-03
		Vertical	W _b	6.68E-03			Vertical	W _b	3.70E-03
21/11/2023	12:30	Radial	W _d	1.32E-02	22/11/2023	00:30	Radial	W _d	3.80E-03
		Tangential	W _d	1.40E-02			Tangential	W _d	3.99E-03
		Vertical	W _b	6.16E-03			Vertical	W _b	3.02E-03
21/11/2023	13:30	Radial	W _d	1.05E-02	22/11/2023	01:30	Radial	W _d	3.43E-03
		Tangential	W _d	1.09E-02			Tangential	W _d	3.53E-03
		Vertical	W _b	5.07E-03			Vertical	W _b	2.98E-03
21/11/2023	14:30	Radial	W _d	9.49E-03	22/11/2023	02:30	Radial	W _d	4.05E-03
		Tangential	W _d	9.69E-03			Tangential	W _d	4.37E-03
		Vertical	W _b	4.44E-03			Vertical	W _b	2.87E-03
21/11/2023	15:30	Radial	W _d	6.75E-03	22/11/2023	03:30	Radial	W _d	4.06E-03
		Tangential	W _d	6.84E-03			Tangential	W _d	4.57E-03
		Vertical	W _b	3.61E-03			Vertical	W _b	2.68E-03
21/11/2023	16:30	Radial	W _d	6.35E-03	22/11/2023	04:30	Radial	W _d	3.27E-03
		Tangential	W _d	6.18E-03			Tangential	W _d	3.50E-03
		Vertical	W _b	3.24E-03			Vertical	W _b	2.63E-03
21/11/2023	17:30	Radial	W _d	5.14E-03	22/11/2023	05:30	Radial	W _d	3.70E-03
		Tangential	W _d	4.67E-03			Tangential	W _d	3.86E-03
		Vertical	W _b	2.99E-03			Vertical	W _b	2.90E-03
21/11/2023	18:30	Radial	W _d	5.34E-03	22/11/2023	06:30	Radial	W _d	3.09E-03
		Tangential	W _d	4.65E-03			Tangential	W _d	3.32E-03
		Vertical	W _b	3.74E-03			Vertical	W _b	2.50E-03
21/11/2023	19:30	Radial	W _d	5.73E-03	22/11/2023	07:30	Radial	W _d	2.80E-03
		Tangential	W _d	5.74E-03			Tangential	W _d	2.77E-03
		Vertical	W _b	3.88E-03			Vertical	W _b	2.60E-03
21/11/2023	20:30	Radial	W _d	4.90E-03	22/11/2023	08:30	Radial	W _d	3.20E-03
		Tangential	W _d	4.71E-03			Tangential	W _d	3.49E-03
		Vertical	W _b	3.45E-03			Vertical	W _b	2.64E-03
21/11/2023	21:30	Radial	W _d	4.07E-03	22/11/2023	09:30	Radial	W _d	3.51E-03
		Tangential	W _d	4.04E-03			Tangential	W _d	3.76E-03
		Vertical	W _b	2.72E-03			Vertical	W _b	2.80E-03
Radial Totals					VDV _d (Day : 0700-2300hrs)			0.020	ms ^{-1.75}
					VDV _d (Night : 2300-0700hrs)			0.006	ms ^{-1.75}
Tangential Totals					VDV _d (Day : 0700-2300hrs)			0.021	ms ^{-1.75}
					VDV _d (Night : 2300-0700hrs)			0.007	ms ^{-1.75}
Vertical Totals					VDV _b (Day : 0700-2300hrs)			0.009	ms ^{-1.75}
					VDV _b (Night : 2300-0700hrs)			0.005	ms ^{-1.75}

Figure B.15 – 1/3 Octave Band RMS Vibration Spectra for Train Pass-by at Position V1

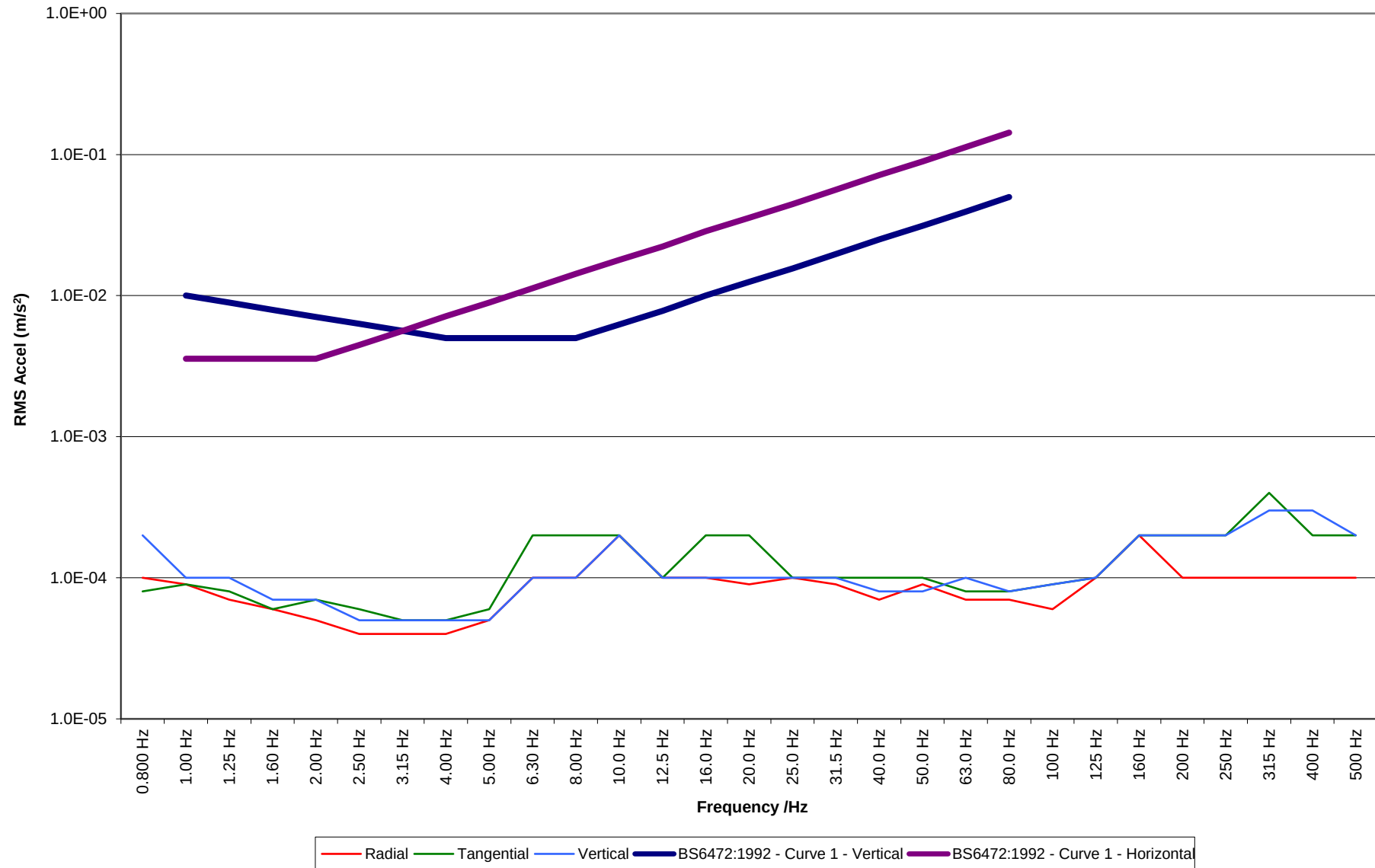


Table B.2 – BS 4142:2014 Daytime Assessment at Position C

Results		Relevant Clause	Commentary
Measured Level of Daytime Industrial Activity at Position C	$L_{Aeq,8min} = 54\text{dB}$	7.3.2	Industrial activity measured level at Position C, 83m away
Residual sound level	$L_{Aeq,T} = 51\text{dB}$	7.3.3	Residual in absence of industrial activity.
Background sound level (daytime)	$L_{A90(0700-2300\text{hrs})} = 48\text{dB}$	8.1.1 8.1.3 8.3	Background sound level measured at Position C
Specific sound level calculated by correcting the ambient sound level to remove the contribution of the residual sound level.	$L_{Aeq,8min} = 51\text{dB}$	7.3.4	
Assessment made during the daytime so the reference time interval is 1hr.	$51 - 9\text{dB} = 42\text{dB}$	7.2	-9dB time correction for industrial activity typically only detectable for 8min over an hour period.
Level at Position C, representative of nearest affected dwelling	$L_{Aeq,1hr} = 42\text{dB}$		No screening loss or distance loss applied,
Acoustic feature correction	+11dB	9.2	At Position C, clear impulsive characteristics displayed, occasional reversing alarms +2dB for tonality, +6dB for impulsiveness and +3dB for intermittency
Rating Level	$(42 + 11) = 53\text{dB}$		
Background sound level (daytime)	$L_{A90(0700-2300\text{hrs})} = 48\text{dB}$	8.3	
Excess of rating over background sound level	$(53 - 48) \text{ dB} = 5\text{dB}$	11	
Assessment indicates likely to be an indication of an adverse impact, depending on the context.		11	At 5dB above background BS 4142:2014 advises: "is likely to be an indication of an adverse impact, depending on the context."
Uncertainty of assessment		10	Uncertainty in background noise measurements is considered low.

APPENDIX C - NOISE MAP MODELS

Figure C.1 – Daytime Noise Map (Undeveloped Site) $L_{Aeq,16hr}$ Contours at 1.5m Height

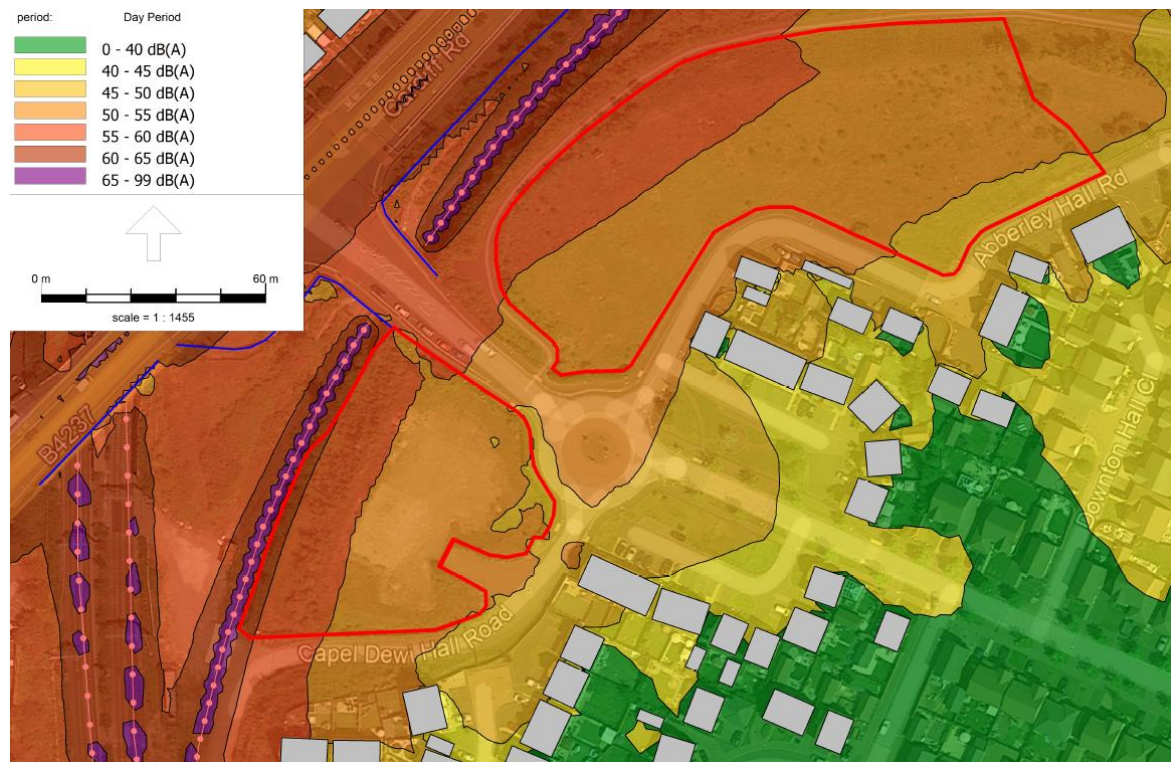


Figure C.2 – Night-time Noise Map (Undeveloped Site) $L_{Aeq,8hr}$ Contours at 1.5m Height

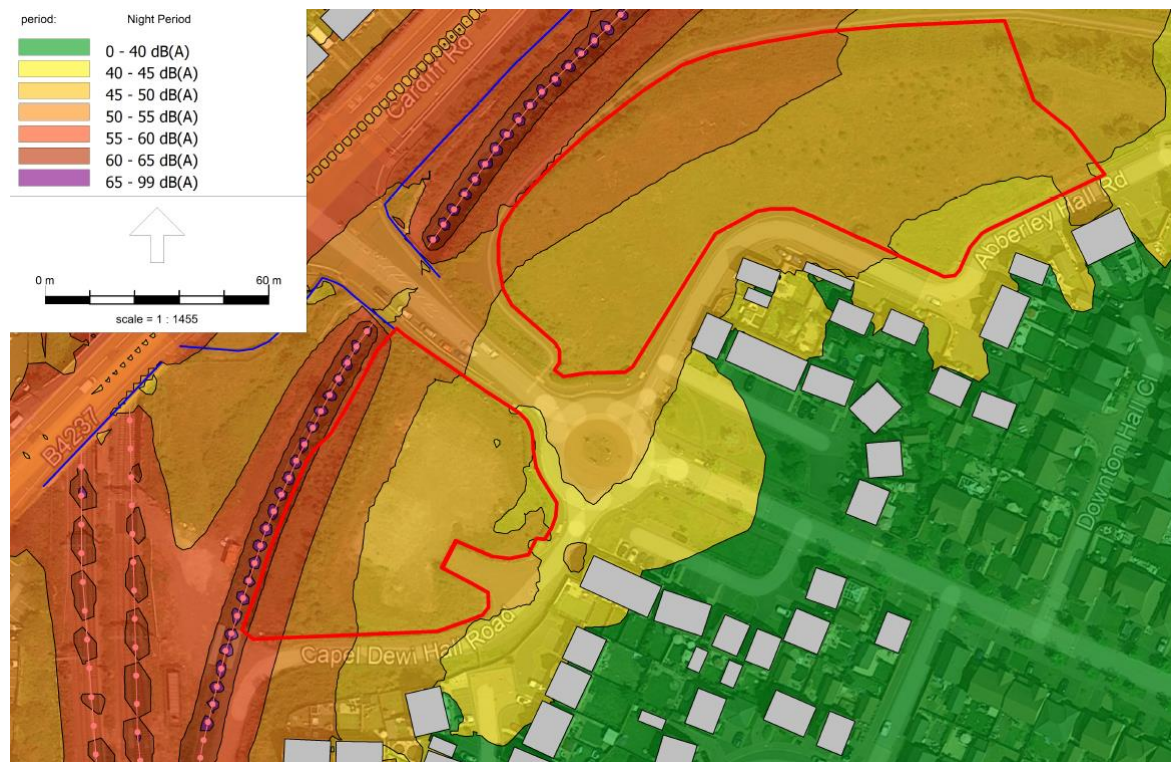


Figure C.3 – Daytime Noise Map (Developed Site) $L_{Aeq,16hr}$ Contours at 1.5m Height

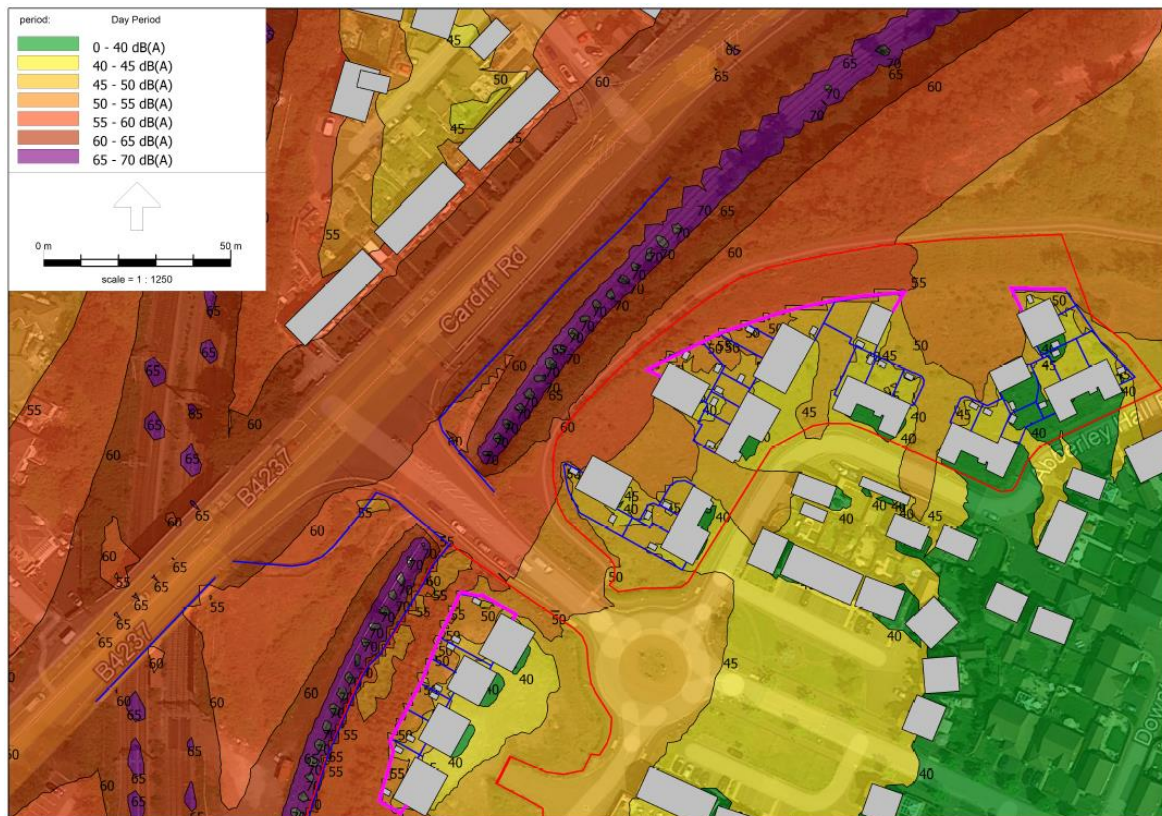


Figure C.4 – Daytime Noise Map (Developed Site) $L_{Aeq,16hr}$ Contours at 4.5m Height

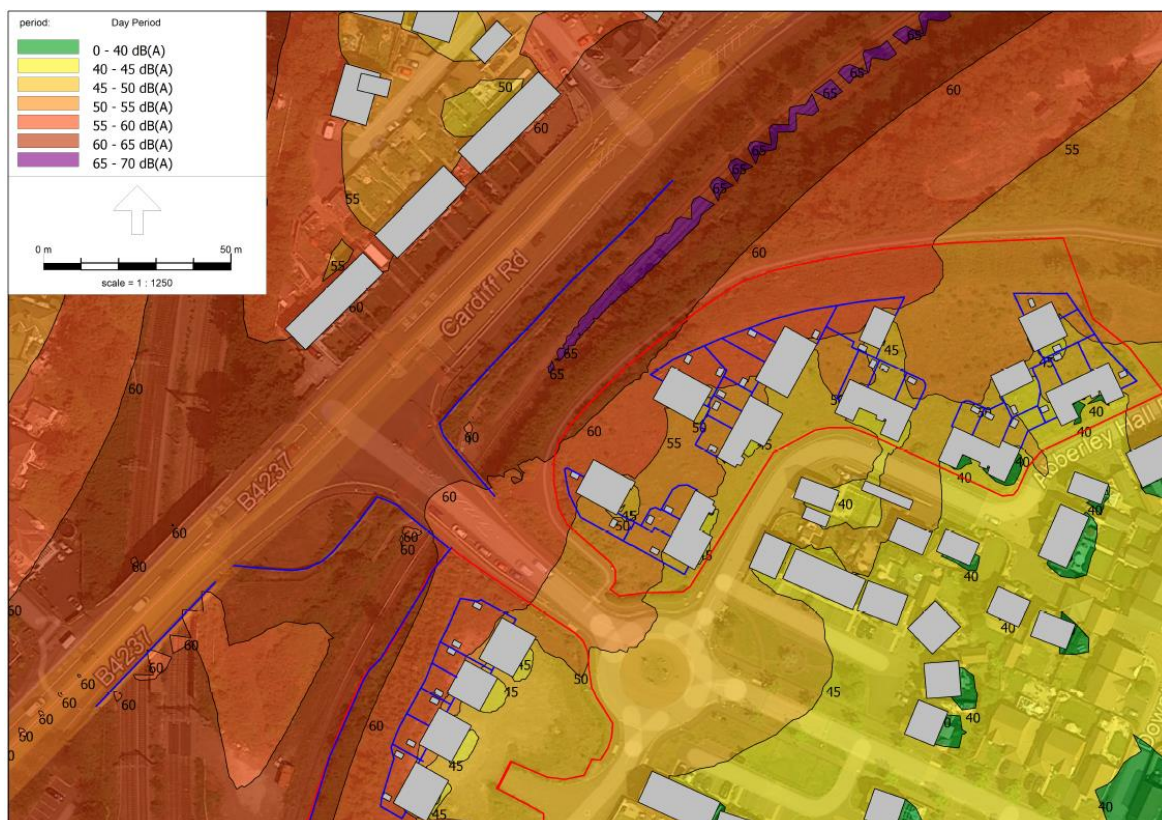


Figure C.5 – Night-time Noise Map (Developed Site) $L_{Aeq,8hr}$ Contours at 1.5m Height

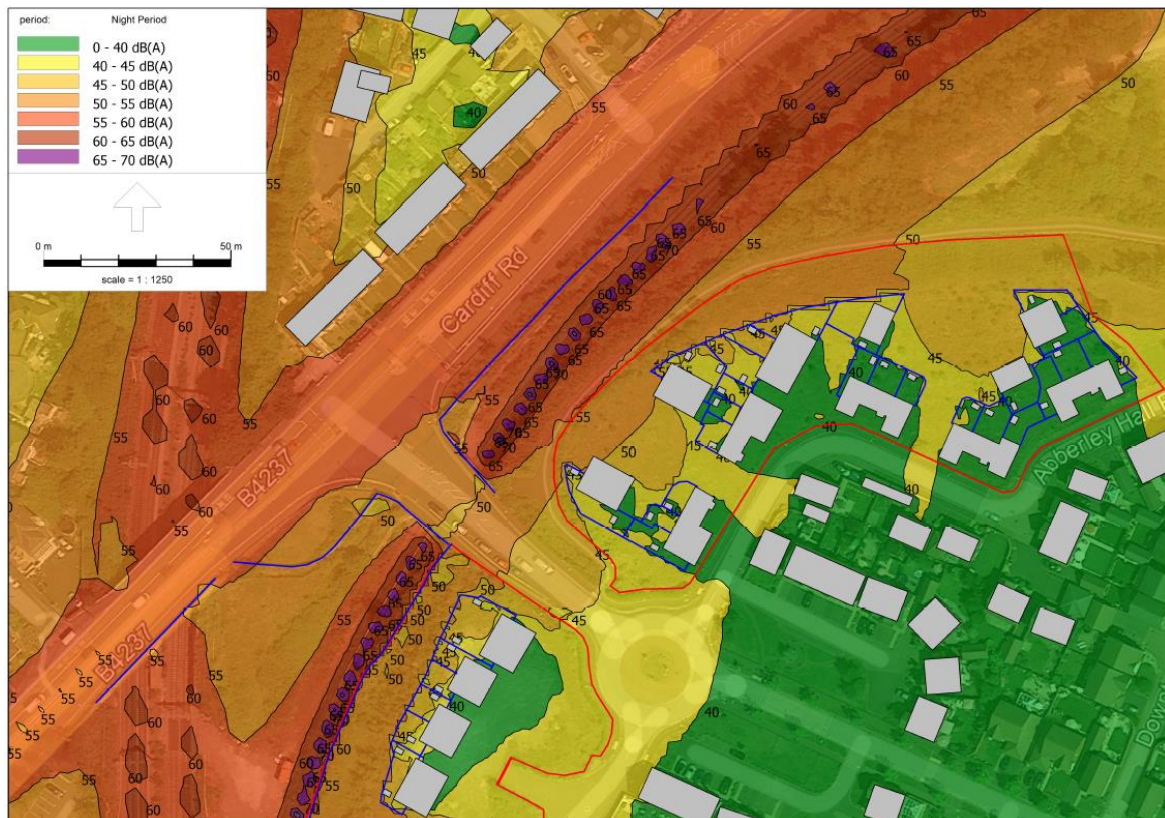
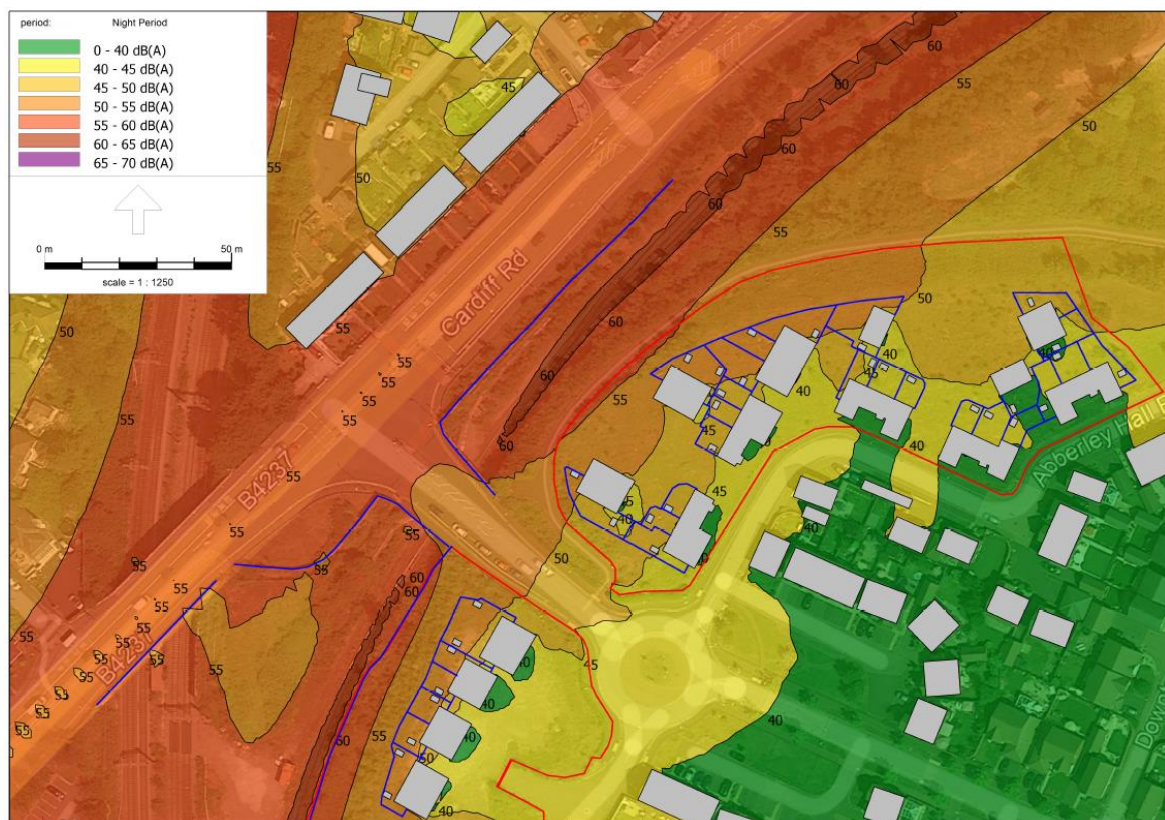


Figure C.6 – Night-time Noise Map (Developed Site) $L_{Aeq,8hr}$ Contours at 4.5m Height



APPENDIX D - DRAWING LISTS

The following LeTrucco Design Architecture drawing have been used in our assessment;

Table D.1 – Drawing List

Drawing Number	Rev	Date	Drawing Title
LT2402.04.01	P1	March 2024	Proposed Site Layouts