

National Grid
Cable Tunnel Replacement
Project

Environmental Statement
Volume VI
Appendix 11.2 Baseline
Noise And Vibration
Monitoring Report

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BAKER HICKS LTD

**NATIONAL GRID
THAMES TUNNEL
400KV ,
GRAVESEND, KENT
/ TILBURY, ESSEX**

**BASELINE NOISE
AND VIBRATION
MONITORING
REPORT**

JULY 2023

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BAKER HICKS LTD

NATIONAL GRID – GRAVESEND, KENT / TILBURY, ESSEX

THAMES TUNNEL 400KV UPRATING FEED PROJECT

BASELINE NOISE AND VIBRATION MONITORING REPORT

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1. INTRODUCTION

1.1 Overview

- 1.1.1 Southdowns Environmental Consultants Ltd was commissioned in April 2023 by Baker Hicks to undertake a baseline noise and vibration survey. The purpose of the baseline survey was to obtain baseline noise and vibration levels at sensitive receptor locations surrounding proposed working areas associated with the construction of a new National Grid tunnel between sites in Gravesend and Tilbury, within the administrative boundary of Kent and Essex, respectively.
- 1.1.2 Southdowns' noise survey consisted of unattended continuous noise monitoring over a 2-month period within National Grid site locations at Gravesend and Tilbury. Attended noise and vibration measurements were also undertaken over a 1-day period within the vicinity of each Gravesend and Tilbury National Grid site.
- 1.1.3 Noise and vibration level descriptors and criteria are summarised in Section 2 of this report. The sites are described in Section 3. The baseline noise and vibration survey are described in Section 4 and the results of the noise and vibration survey are presented in Section 5. The survey findings are summarised in Section 6. Figures and Tables are presented in Appendices A and B respectively. The sound level meter and vibration meter calibration certificates are presented in Appendix C.



2. SOUND LEVELS, VIBRATION UNITS AND CRITERIA

2.1 Sound Levels

- 2.1.1 Sound is measured on a logarithmic scale in decibels (dB) because of the ears' sensitivity to a wide range of pressure changes. The sound pressure level (SPL) of a signal is denoted by the symbol L_p and defined by the equation $L_p = 10 \log (p/p_0)^2$ where p is the root mean square pressure of the signal and p_0 is the reference sound pressure (2×10^{-5} Pa).
- 2.1.2 The human auditory system is capable of detecting sounds over a frequency range of approximately 20 Hz to 20 kHz. Because the ear is most sensitive to sounds with frequencies between 1 and 5 kHz, an A-weighting network is used to reflect the differential sensitivity of human hearing to sounds of different frequency. The A-weighted sound pressure level, L_{pA} , is measured on a scale denoted by the metric dB(A).
- 2.1.3 The dB(A) level is commonly used for the measurement and assessment of environmental noise due to the relationship between the subjective impression of the auditory strength of a sound, otherwise known as loudness, and the A-weighted sound pressure level of that sound. A change in 3 dB is the minimum perceptible change in event noise levels under normal everyday listening conditions, whilst a 10 dB increase or decrease in the sound pressure level of a steady sound generally corresponds to a perceived doubling or halving of loudness.
- 2.1.4 An indication of the range of sound pressure levels commonly found in the unoccupied environment is given below:

<u>Location</u>	<u>L_p dB(A)</u>
Normal threshold of hearing	-10 to 20
Music halls and theatres	20 to 30
Living rooms and offices	30 to 50
Inside motor vehicles	50 to 70
Industrial premises	70 to 100
Burglar alarms at 1 m	100 to 110
Jet aircraft on take-off	110 to 130
Threshold of pain	130 to 140

- 2.1.5 Community responses to environmental sound sources are dependent on both acoustic and non-acoustic factors. The acoustic factors include absolute sound level, changes to, or exceedances of, background and residual sound levels, as well as the characteristic features, time, duration and intermittency of the sound. Noise is defined as unwanted sound.
- 2.1.6 The equivalent continuous sound pressure level is denoted by the symbol $L_{Aeq,T}$ and is defined as the value of the A-weighted sound pressure level of continuous steady sound that, within a specified time interval, has the same mean-squared sound pressure as a sound that varies with time. This average sound level is used in the UK for the measurement of sound from many sources (including industry, construction, railways and aircraft) and is widely used for the measurement of ambient noise, which comprises sound from all sources in the environment.



- 2.1.7 The $L_{A90,T}$, or background sound level, is defined by the A-weighted sound pressure level that is exceeded by the residual sound at the assessment location for 90% of a given time interval, T. This does not reflect the occurrence of transient and/or higher sound level events and is generally governed by continuous or semi-continuous sounds. Due to the varying acoustical environment, $L_{A90,T}$ is normally defined separately for day and night-time periods.
- 2.1.8 Other percentiles are also sometimes used to describe the levels of ambient sound exceeded for different periods of time. The $L_{A50,T}$ and $L_{A10,T}$ noise levels denote the level of ambient sound exceeded for 50 and 10% of the time, T, respectively.
- 2.1.9 The $L_{Amax,F}$ sound level denotes the maximum instantaneous sound level in any given period of time obtained using the FAST time weighting.

BS 5228-1:2009+A1:2014 – Code of Practice for Noise and Vibration Control on Construction and Open Sites – Part 1: Noise

- 2.1.10 Recommendations are presented in BS 5228 Part 1 for basic methods of noise control relating to construction sites, including sites where demolition, remediation, ground treatment or related civil engineering works are being carried out, and open sites, where work activities/operations generate significant noise levels, including industry-specific guidance.
- 2.1.11 BS 5228 contains a database of the noise emissions from individual items of equipment and activities and methodology to predict noise emissions from demolition and construction methods to identified receptors.
- 2.1.12 There are a number of factors described in BS 5228 which need to be considered when determining the level of noise impact from construction works, which include:
- the location of site equipment in relation to noise-sensitive receptors;
 - existing ambient noise levels;
 - the duration of site operations;
 - hours of working;
 - the character of the construction noise;
 - the type of work being carried out; and
 - the feasibility of noise control measures.
- 2.1.13 BS 5288 provides two main example methods for determining the significance of a construction noise impact based on i) a comparison of the anticipated construction noise level with threshold noise levels that are dependent on pre-existing ambient noise levels; and ii) the potential change in ambient $L_{Aeq,T}$ noise levels with and without construction activity subject to lower cut-off levels of construction noise.

BS 5228 Assessment Method 1 – The ABC Method

- 2.1.14 The BS 5228 (ABC) assessment method 1 allows an assessment of the effects from construction noise using a matrix of established noise threshold levels above which a potential significant effect is identified.



2.1.15 An excerpt of BS 5288, Table E1 setting out the example ABC threshold values is provided below.

Example threshold of >A1 potential significant <A1 effect at dwellings			
Assessment Category and threshold value period	Threshold value, in decibels (dB) A1>(L _{Aeq, T})<A1		
	Category A ^{A)}	Category B ^{B)}	Category C ^{C)}
Night-time (23.00-07.00)	45	50	55
Evenings and weekends ^{D)}	55	60	65
Daytime (07.00-13.00)	65	70	75
>A1 NOTE 1 A potential significant effect is indicated if the L_{Aeq, T} noise level arising from the site exceeds the threshold level for the category appropriate to the ambient noise level. NOTE 2 If the ambient noise level exceeds the Category C threshold values given in the table (i.e. the ambient noise level is higher than the above values), then a potential significant effect is indicated if the total L_{Aeq, T} noise level for the period increases by more than 3 dB due to site noise.<A1 NOTE 3 Applied to residential receptors only.			
^{A)} Category A: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are less than these values			
^{B)} Category B: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are the same			
^{C)} Category C: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are higher than category A values			
D) 19.00–23.00 weekdays, 13.00–23.00 Saturdays and 07.00–23.00 Sundays.			

- Baseline level round up/down to nearest 5 dB;
- Category A, B or C chosen:
 - Category A, if baseline < A values;
 - Category B, if baseline = A values;
 - Category C, if baseline > A values;
- Significant effect if construction noise exceeds category value; and
- If baseline > C values, significant effect if total noise increases by 3 dB or more.

BS 5228 Assessment Method 2 – The 5 dB(A) Change Method

2.1.16 Under the BS 5228 5 dB(A) change method, noise generated by construction activities is deemed to be significant if the total noise (preconstruction ambient plus construction noise) exceeds the preconstruction ambient noise level at a given assessment receptor by 5 dB or more, subject to lower cut-off values of 65, 55 and 45 dB(A) for day, evening and night respectively, and a duration of one month or more, unless works of a shorter duration are likely to result in significant effect. These evaluation criteria are generally applicable to the following resources:

- Residential;



- hotels and hostels;
- buildings in religious use;
- buildings in educational use; and
- buildings in health and/or community use.

2.2 Vibration Units

- 2.2.1 Vibration is the oscillation of particles in an object or surface about a mean stationary position. The number of times a particle oscillates back and forth from its mean position per second defines the frequency of the vibration in Hertz (Hz). The distance a particle moves from its mean position is described as displacement, and is usually measured in m or mm. Vibrations can occur in one or more of three axes with respect to the direction of vibration propagation or the orientation of the receiver: radial, perpendicular and/or vertical, which are referred to as x, y and z respectively.
- 2.2.2 As well as displacement, vibration can also be described and measured in terms of velocity and acceleration. Velocity is a measure of the rate at which the displacement changes with time (mms^{-1}) and can be specified in terms of either Peak Particle Velocity (PPV) or as a root mean square (rms) value.
- 2.2.3 PPV is widely used for the assessment of vibration impacting on structures, utilities and other sensitive equipment (including computers and laboratory equipment), as well as for assessing the effects on humans.

Subjective Response

- 2.2.4 The human body has a complicated frequency response and has different resonances associated with the whole body and individual body parts. The threshold of perceptible vibration of humans is generally very low and is typically around 0.14 to 0.3 mm/s at frequencies between 8 Hz and 80 Hz.
- 2.2.5 Generally, the transfer of building vibration into a human that is of interest is either via a person standing on a vibrating floor or via vibrations transferred from the floor into a seat or bed and then into a person's body.
- 2.2.6 Perceptible vibration inside buildings can give rise to discomfort, disturbance and/or activity interference, as well as giving rise to concerns about building damage. The degree of annoyance someone may experience from the vibration depends on various factors such as: the characteristics of vibration (i.e. frequency (typically between 1 Hz and 80 Hz), duration, magnitude, continuous/transient/intermittent); time of day vibration occurs; audible noise that may accompany the vibration; and the activity someone may be undertaking.

2.3 British Standard BS 4142:2014+A1:2019

- 2.3.1 Guidance on the rating and assessing of sound of an industrial and/or commercial nature is contained in British Standard BS 4142:2014+A1:2019 'Methods for rating and assessing industrial and commercial sound'
- 2.3.2 The standard states that:



2.3.3 *“This standard is applicable to the determination of the following levels at outdoor locations:*

- a) rating levels for sources of sound of an industrial and/or commercial nature; and*
- b) ambient, background and residual sound levels*

2.3.4 *for the purposes of:*

- 1) investigating complaints;*
- 2) assessing sound from proposed, new, modified or additional source(s) of sound of an industrial and/or commercial nature; and*
- 3) assessing sound at proposed new dwellings or premises used for residential purposes.”*

2.3.5 The determination of sound amounting to a nuisance is beyond the scope of BS 4142:2014.

2.3.6 The significance of sound of an industrial and/or commercial nature depends upon 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.

2.3.7 Typically, the greater the difference between rating level and background sound level, the greater the magnitude of the impact. BS 4142+A1:2019 provides the following guidance when assessing the difference in the rating level and background sound assessment level:

- a difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context;
- a difference of around +5 dB is likely to be an indication of an adverse impact, depending on context; and
- the lower the rating level is relative to the measured background sound level, the less likely it is that the specific 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.

2.3.8 Certain acoustic features can increase the significance of the impact over that expected from a basic comparison between specific sound level and the background sound level. These features include tonality and impulsivity, as well as additional characteristics and intermittency of the sound.

2.3.9 Where appropriate, a rating penalty for sound based on a subjective assessment of its characteristics should be established. In other circumstances an objective appraisal of tonal and/or impulsive characteristics may be appropriate.

2.3.10 An individual's response to sound can be subjective and the significance of a sound level impact can depend on such factors as the margin by which a sound exceeds the background sound level, its absolute level, time of day and change in the acoustic environment, as well as local attitudes to the source of the sound and the character of the neighbourhood. BS 4142:2014 therefore recognises the importance of the context in



which a sound occurs and has taken into account the acoustical terms 'sound' and 'noise' in its development. BS 4142 refers to 'sound' as being measured by a sound level meter or other measuring system. The Standard refers to 'noise' as relating to a human response and is routinely described as unwanted sound, or sound that is considered undesirable or disruptive.

2.4 Local Policy

Tilbury

2.4.1 The Tilbury development north of the river Thames falls within the London Borough of Thurrock. The Thurrock Local Development Framework, core strategy and policies for management of development (as amended) was adopted in January 2015.

2.4.2 Policy PMD1 - Minimising Pollution and Impacts on Amenity, Health, Safety, and the Natural Environment states:

"3. The Council will require assessments to accompany planning applications where it has reasonable grounds to believe that a development may suffer from, or cause:

- i. Air pollution;*
- ii. Noise pollution;*
- iii. Contaminated land/soil;*
- iv. Odour;*
- v. Light pollution and shadow flicker;*
- vi. Water pollution;*
- vii. Invasion of privacy;*
- viii. Visual intrusion;*
- ix. Loss of light;*
- x. Ground instability;*
- xi. Vibration"*

Gravesend

2.4.3 The Gravesend development south of the river Thames falls within the London Borough of Gravesham. Policy CS19: Development and Design Principles of the Gravesham Local Plan Core Strategy, adopted in September 2014, states:

"5.15.14 New development will be visually attractive, fit for purpose and locally distinctive. It will conserve and enhance the character of the local built, historic and natural environment, integrate well with the surrounding local area and meet anti-crime standards. The design and construction of new development will incorporate sustainable construction standards and techniques, be adaptable to reflect changing lifestyles, and be resilient to the effects of climate change. This will be achieved through the criteria set out below:"

"• New development will be located, designed and constructed to:



- *safeguard the amenity, including privacy, daylight and sunlight, of its occupants and those of neighbouring properties and land;*
- *avoid adverse environmental impacts from pollution, including noise, air, odour and light pollution, and land contamination; and*
- *not pose an unacceptable risk or harm to the water environment, including the quality and/or quantity of ground waters, surface waters, wetlands and coastal water systems;”*



3. SITE DESCRIPTION

3.1 Site Description and Proposed Development

3.1.1 The proposed tunnel will be constructed between Tilbury and Gravesend as indicated in Figure 3.1 below.

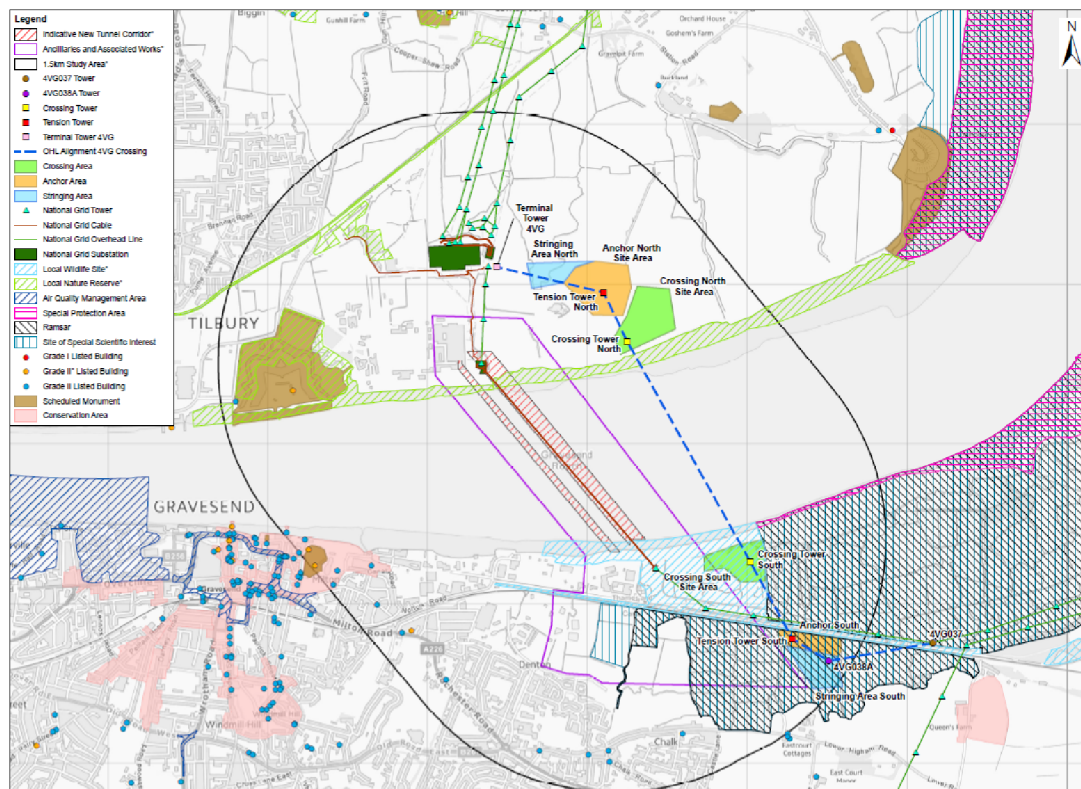


FIGURE 3.1: Location of Tilbury to Gravesend National Grid Tunnel



3.1.2 The monitoring locations are shown on Figure A1 and Figure A2 of Appendix A.

3.2 Crossing South Site Area: Gravesend, Kent

3.2.1 To the south the National Grid tunnel is understood to terminate immediately south of Eastcourt Marshes Electricity Substation.

3.2.2 The surrounding area is predominantly made up industrial and commercial buildings. The closest residential buildings are c. 700 m to the south of the Crossing South Site Area (CSSA).

3.2.3 Immediately to the north of the site area is the Eastcourt Marshes Electricity Substation beyond which lies the river Thames. West of the CSSA is the Thameside Campus National Maritime Training Area. Further to the west is the Metropolitan Police Specialist Training Centre (MPSTC). North of the MPSTC is an area of active development where construction activity was observed through the survey period. To the east of CSSA is Milton Rifle Range.

3.2.4 South of the CSSA is a National Rail railway line and the Thames and Medway Canal.

3.2.5 During the attendance at site the main source of noise was noted to be construction works being undertaken north of the Metropolitan Police Specialist Training Centre. Other noise sources included plant noise from within Metropolitan Police Specialist Training Centre and train passes from the National Rail railway line, located to the southwest and south of the site.

3.3 Crossing North Site Area: Tilbury, Essex

3.3.1 The surrounding area is made up entirely of commercial and industrial sites and buildings.

3.3.2 To the north of the proposed development site is located the existing Tilbury National Grid compound. Northwest of the proposed site are Tarmac and Euromix Concrete industrial sites. Located to the west and south of proposed site is P&O Tilbury port and Hyundai car park.

3.3.3 The main source of noise was noted to come from industrial works being undertaken within the Tarmac and Euromix Concretes sites to the West of the existing National Grid site. Other noise sources included electrical hum from within the National Grid substation, vehicles accessing Hyundai car park and distant operations from P&O port.



4. BASELINE NOISE AND VIBRATION SURVEY

4.1 Noise Survey

- 4.1.1 A baseline noise survey was undertaken at the Gravesend and Tilbury National Grid sites during April and June 2023. The survey comprised unattended continuous noise monitoring over a 2-month period and attended noise and vibration measurements over 1-day periods. Details of the noise and vibration monitoring are presented in the following sub-sections.

4.2 Unattended Noise Monitoring

- 4.2.1 Unattended noise monitoring was undertaken at the Gravesend National Grid site (LT1) location between 16:45 hrs on Tuesday 18th April and 00:00 hrs on Monday 19th June 2023 and at the Tilbury National Grid site (LT2) between 14:30 hrs on Tuesday 18th April and 00:00 hrs on Wednesday 14th June 2023. The unattended noise monitoring locations are labelled as LT1 and LT2 on Figure A1 and Figure A2, respectively, of Appendix A.
- 4.2.2 LT1 was located 4m from the northwest boundary of the Gravesend National Grid substation. The microphone was positioned 1.5 m above local ground, in free-field conditions.
- 4.2.3 LT2 was located 20m from the west boundary of the Tilbury National Grid substation. The microphone was positioned 1.5 m above local ground, in free-field conditions.
- 4.2.4 The noise measurements were obtained using two Rion NL-52 precision integrating Class 1 sound level meters fitted with weatherproof windshields. The sound level meters were powered by H2 + Solar PV generators and stored inside weatherproof security boxes.
- 4.2.5 The sound level meters were calibrated before and after the survey period using a Rion NC-74 Class 1 Acoustic Calibrator to generate a calibration level of 94.0 dB at 1 kHz.
- 4.2.6 Consecutive 15-minute measurements of noise indices which included $L_{Amax,F}$, $L_{Aeq,T}$, $L_{A10,T}$ and $L_{A90,T}$ noise levels were measured over the 2-month monitoring period.

4.3 Attended Noise Monitoring

- 4.3.1 Sample attended noise measurements were obtained at the Gravesend National Grid site on Thursday 18th May 2023 between 12:50 hrs and 15:55 hrs at 3 no. monitoring locations labelled as ST1 to ST3 on Figure A1 of Appendix A.
- 4.3.2 Sample attended noise measurements were obtained at the Tilbury National Grid site on Wednesday 14th June 2023 between 11:50 hrs and 12:25 hrs at 2 no. monitoring locations labelled as ST4 and ST5 on Figure A2 of Appendix A.
- 4.3.3 The attended noise measurements were obtained using a Rion NL-52 Class 1 sound level meter fitted with a windshield. The microphone was positioned approximately 1.5 m above local ground level.
- 4.3.4 The NL-52 sound level meter was configured to measure A-weighted levels which included $L_{Amax,F}$, $L_{Aeq,5min}$, $L_{A10,5min}$ and $L_{A90,5min}$ levels over consecutive 5-minute intervals.



- 4.3.5 The clock on the attended sound level meter was synchronised with the clocks of the unattended sound level meters.
- 4.3.6 The sound level meter was calibrated before and after the survey using a Rion NC-74 Class 1 Acoustic Calibrator to generate a calibration level of 94.0 dB at 1 kHz.

4.4 Attended Vibration Survey

- 4.4.1 Sample 1-minute attended vibration measurements were obtained around the Gravesend National Grid site on Thursday 18th May 2023 between 12:50 hrs and 15:55 hrs at 3 no. monitoring locations labelled as ST1 to ST3 on Figure A1 of Appendix A.
- 4.4.2 Sample 1-minute attended vibration measurements were obtained around the Tilbury National Grid site on Wednesday 14th June 2023 between 11:50 hrs and 12:25 hrs at 2 no. monitoring locations labelled as ST4 and ST5 on Figure A2 of Appendix A.
- 4.4.3 The vibration measurements were made using a Profound Vibra+ unit fitted with a tri-axial geophone to measure vibration in the horizontal x- and y- and vertical z-axes.
- 4.4.4 The geophones located at ST1 to ST5 were fitted to floor mounting plates.

4.5 Receptor Locations

- 4.5.1 Potentially sensitive receptors have been identified around the north and south crossing sites which could be impacted during either the construction or operational phases of the development. A summary of the sensitive receptors is presented below alongside the corresponding measurement Locations. Receptor locations are shown on Figures A1 and A2 of Appendix A.

TABLE 4.1: MEASUREMENT LOCATIONS AND POTENTIALLY SENSITIVE RECEPTORS

4.6 Weather Conditions

- 4.6.1 A log of the weather during the unattended monitoring period from a weather station located in Northfleet, approximately 3.5 km from Gravesend site and 3 km from Tilbury site, has been obtained from an internet source and is summarised in **Error! Reference source not found.** of Appendix B.



5. NOISE AND VIBRATION SURVEY RESULTS

5.1 Unattended Noise Survey Results

5.1.1 The results of the unattended noise survey are presented graphically on Figure A3 to Figure A8 of Appendix A and tabulated in Table B2 and Table B3 of Appendix B.

5.2 Day, Evening and Night Levels

5.2.1 A summary of daytime, evening and night-time noise levels for LT1 and LT2 are presented in 0 and Table 5.2 below.

5.2.2 The day, evening and night-time periods used in 0 and Table 5.2 were defined using recommendations presented in BS 5228 ABC Assessment Method of controlling noise relating to construction sites.



Day/Date	Measured Noise Levels, dB re. 2 x 10 ⁻⁵ Pa.											
	Daytime ^[3]				Evening ^[3]				Night-time ^[3]			
	L _{Amax,F}	L _{A10,15 min}	L _{Aeq,15 min}	L _{A90,15 min}	L _{Amax,F}	L _{A10,15 min}	L _{Aeq,15 min}	L _{A90,15 min}	L _{Amax,F}	L _{A10,15 min}	L _{Aeq,15 min}	L _{A90,15 min}
Tue 18-Apr-23	72 (55-84) ^[2]	54 (48-61) ^[2]	57 (46-54) ^[2]	47 (44-50) ^[2]	58 (50-71)	47 (45-51)	48 (44-46)	44 (43-46)	53 (46-74)	47 (44-59)	55 (43-47)	44 (42-48)
Wed 19-Apr-23	66 (60-83)	52 (49-56)	57 (47-51)	48 (44-51)	62 (53-73)	50 (46-56)	54 (45-50)	46 (44-50)	52 (46-67)	47 (43-53)	52 (43-47)	45 (42-50)
Thu 20-Apr-23	66 (59-81)	53 (47-57)	55 (48-52)	48 (43-51)	60 (49-67)	47 (45-53)	49 (44-47)	43 (42-45)	52 (47-69)	48 (45-55)	54 (45-49)	47 (44-53)
Fri 21-Apr-23	65 (53-78)	52 (46-57)	55 (44-51)	47 (42-53)	59 (49-67)	48 (46-51)	49 (45-47)	44 (43-45)	53 (48-62)	47 (46-50)	49 (45-47)	45 (44-48)
Sat 22-Apr-23	63 (53-82)	48 (43-52)	53 (41-47)	40 (37-46)	58 (50-65)	46 (42-50)	46 (41-44)	39 (37-41)	54 (43-66)	44 (38-52)	48 (37-43)	39 (36-42)
Sun 23-Apr-23	-	-	-	-	58 (46-71)	44 (39-54)	52 (38-45)	38 (36-41)	53 (44-84)	44 (38-53)	59 (37-47)	40 (36-50)
Mon 24-Apr-23	66 (56-85)	53 (45-60)	56 (46-52)	48 (43-51)	59 (49-67)	49 (45-54)	53 (44-48)	45 (42-50)	54 (47-69)	48 (45-54)	52 (45-48)	46 (44-50)
Tue 25-Apr-23	69 (58-88)	52 (47-59)	63 (47-53)	47 (42-50)	62 (48-73)	49 (46-53)	50 (46-48)	45 (44-46)	54 (47-68)	48 (44-54)	52 (44-48)	46 (43-51)
Wed 26-Apr-23	68 (57-87)	54 (51-57)	56 (49-52)	49 (45-51)	61 (48-77)	48 (45-52)	51 (44-48)	44 (43-46)	54 (46-71)	48 (44-54)	53 (44-48)	46 (43-51)
Thu 27-Apr-23	68 (57-81)	54 (48-60)	58 (46-53)	48 (44-52)	63 (52-77)	49 (47-53)	54 (46-50)	45 (44-49)	55 (47-73)	49 (45-54)	53 (44-49)	46 (44-51)
Fri 28-Apr-23	68 (53-84)	53 (44-69)	65 (41-55)	47 (37-52)	56 (43-77)	43 (38-49)	46 (37-43)	37 (35-41)	51 (37-72)	41 (35-55)	51 (33-43)	36 (32-43)
Sat 29-Apr-23	64 (54-73)	48 (45-54)	51 (42-46)	37 (35-43)	55 (49-72)	44 (41-48)	45 (40-42)	38 (36-41)	54 (41-72)	43 (37-50)	52 (36-43)	38 (34-44)
Sun 30-Apr-23	-	-	-	-	57 (50-68)	45 (41-48)	44 (40-42)	38 (37-39)	53 (44-78)	44 (40-52)	52 (39-45)	40 (37-48)
Mon 01-May-23	61 (52-72)	46 (42-53)	49 (40-45)	38 (34-47)	54 (48-65)	44 (41-51)	48 (39-42)	38 (35-41)	51 (44-64)	44 (35-53)	51 (35-45)	39 (32-48)
Tue 02-May-23	67 (56-80)	52 (45-58)	56 (44-50)	45 (42-49)	58 (50-67)	48 (45-53)	50 (44-47)	43 (43-45)	56 (47-78)	48 (45-54)	53 (44-48)	46 (44-51)
Wed 03-May-23	66 (58-78)	52 (49-56)	55 (48-51)	47 (44-50)	57 (47-67)	47 (44-56)	53 (44-47)	44 (42-48)	55 (46-72)	47 (44-54)	51 (44-47)	45 (43-49)
Thu 04-May-23	66 (58-74)	52 (47-57)	54 (46-50)	47 (44-49)	62 (51-87)	49 (47-51)	59 (46-51)	46 (45-47)	61 (54-73)	52 (47-55)	54 (46-51)	50 (45-52)
Fri 05-May-23	70 (56-93)	54 (49-77)	68 (48-56)	47 (46-51)	61 (49-69)	49 (47-53)	52 (46-48)	46 (45-47)	56 (48-73)	48 (46-52)	50 (46-47)	46 (45-46)
Sat 06-May-23	62 (54-70)	50 (47-53)	50 (46-48)	45 (44-46)	58 (51-65)	48 (47-52)	49 (46-47)	46 (46-47)	52 (47-62)	47 (46-50)	48 (45-46)	45 (45-47)
Sun 07-May-23	-	-	-	-	62 (55-74)	50 (48-52)	50 (47-49)	47 (46-48)	58 (49-72)	50 (46-53)	52 (45-49)	47 (45-51)
Mon 08-May-23	65 (55-84)	51 (48-58)	58 (47-51)	47 (45-50)	60 (52-70)	48 (47-51)	49 (46-47)	46 (45-47)	59 (49-77)	49 (47-53)	56 (46-49)	47 (45-51)
Tue 09-May-23	67 (53-92)	53 (48-65)	67 (47-54)	48 (45-51)	56 (50-63)	48 (46-51)	50 (46-47)	45 (44-47)	56 (48-65)	48 (45-53)	51 (44-48)	46 (43-50)
Wed 10-May-23	68 (56-79)	54 (49-59)	57 (48-52)	49 (46-51)	58 (50-71)	49 (46-54)	53 (46-49)	46 (45-49)	55 (48-65)	48 (45-52)	51 (44-48)	46 (43-51)

TABLE 5.1 SUMMARY OF FREE-FIELD UNATTENDED CONTINUOUS NOISE MONITORING RESULTS AT LT1 – DAY/EVENING/NIGHT

Notes: [1] the range of 15 min levels measured during the period are shown in parenthesis;

[2] incomplete dataset on Tuesday 18th April day-time is due to equipment setup; and

[3] daytime defined as 07:00 - 19:00 hrs Mon - Fri and 07:00 - 13:00 hrs Sat. Evening defined as 19:00 - 23:00 hrs Mon - Fri, 13:00 - 23:00 Sat and 07:00 - 23:00 hrs Sun. Night-time defined as 23:00 - 07:00 hrs Mon - Sun.



Day/Date	Measured Noise Levels, dB re. 2 x 10 ⁻⁵ Pa.											
	Daytime ^[3]				Evening ^[3]				Night-time ^[3]			
	L _{Amax,F}	L _{A10,15 min}	L _{Aeq,15 min}	L _{A90,15 min}	L _{Amax,F}	L _{A10,15 min}	L _{Aeq,15 min}	L _{A90,15 min}	L _{Amax,F}	L _{A10,15 min}	L _{Aeq,15 min}	L _{A90,15 min}
Thu 11-May-23	65 (54-75)	52 (48-56)	54 (46-51)	48 (43-52)	59 (51-65)	50 (46-52)	51 (45-48)	46 (43-48)	53 (44-69)	47 (42-55)	52 (41-47)	44 (41-50)
Fri 12-May-23	66 (58-81)	52 (46-61)	56 (45-51)	47 (43-51)	56 (46-66)	46 (44-49)	47 (43-45)	43 (42-45)	51 (45-75)	45 (44-49)	47 (43-44)	43 (42-44)
Sat 13-May-23	59 (50-67)	46 (44-49)	48 (44-46)	43 (42-44)	51 (45-64)	45 (44-53)	49 (43-45)	43 (42-44)	50 (44-63)	45 (43-48)	45 (42-44)	43 (42-44)
Sun 14-May-23	-	-	-	-	56 (48-73)	46 (44-49)	52 (44-46)	44 (42-45)	54 (46-72)	47 (44-52)	51 (43-47)	45 (43-50)
Mon 15-May-23	69 (58-86)	54 (50-57)	65 (49-55)	49 (43-52)	59 (48-67)	49 (44-56)	53 (43-49)	45 (42-49)	57 (48-75)	48 (45-53)	52 (45-48)	46 (44-50)
Tue 16-May-23	68 (53-84)	52 (45-62)	60 (45-53)	48 (42-52)	59 (50-73)	46 (44-48)	48 (44-46)	43 (42-44)	54 (46-66)	48 (44-54)	53 (44-48)	46 (43-51)
Wed 17-May-23	66 (55-88)	52 (49-57)	56 (46-51)	47 (41-50)	59 (50-69)	48 (43-53)	52 (43-48)	45 (42-48)	55 (44-67)	47 (43-54)	52 (42-47)	45 (42-51)
Thu 18-May-23	63 (55-77)	52 (46-58)	55 (44-51)	46 (41-50)	57 (49-64)	48 (45-53)	49 (44-46)	43 (42-44)	56 (47-69)	48 (45-52)	50 (44-47)	45 (43-49)
Fri 19-May-23	66 (54-82)	52 (46-62)	57 (43-51)	46 (41-49)	57 (48-75)	46 (43-50)	48 (42-45)	42 (41-42)	52 (45-68)	45 (42-52)	51 (42-45)	43 (41-49)
Sat 20-May-23	63 (52-85)	49 (43-62)	60 (40-50)	42 (36-49)	54 (45-66)	43 (37-54)	49 (35-43)	37 (33-42)	48 (38-58)	39 (33-45)	42 (32-38)	34 (31-38)
Sun 21-May-23	-	-	-	-	56 (44-66)	43 (38-50)	46 (36-42)	34 (32-36)	51 (43-62)	45 (38-53)	49 (36-44)	40 (33-47)
Mon 22-May-23	69 (58-86)	52 (48-59)	55 (47-51)	48 (45-49)	57 (46-66)	47 (44-55)	51 (44-47)	44 (42-47)	54 (47-67)	47 (44-52)	51 (44-47)	45 (43-50)
Tue 23-May-23	68 (61-84)	53 (48-59)	63 (47-52)	46 (41-49)	58 (52-69)	48 (45-52)	49 (44-47)	43 (42-45)	57 (48-67)	48 (44-53)	52 (43-48)	46 (43-51)
Wed 24-May-23	67 (59-82)	52 (45-59)	65 (44-53)	46 (42-51)	59 (46-71)	48 (43-55)	52 (42-48)	44 (41-48)	54 (45-64)	46 (43-51)	49 (43-46)	44 (42-48)
Thu 25-May-23	69 (59-82)	52 (46-56)	59 (45-51)	45 (42-47)	60 (51-67)	48 (45-52)	49 (43-46)	42 (42-44)	54 (45-66)	48 (43-53)	51 (42-47)	44 (41-49)
Fri 26-May-23	69 (58-79)	51 (48-56)	54 (46-50)	46 (43-49)	62 (51-96)	48 (44-54)	68 (43-57)	44 (42-46)	56 (48-75)	48 (45-52)	53 (44-48)	46 (43-48)
Sat 27-May-23	69 (64-74)	49 (46-53)	53 (45-49)	43 (41-45)	55 (48-66)	47 (45-49)	49 (44-47)	46 (43-48)	57 (49-69)	49 (48-53)	50 (47-49)	48 (45-49)
Sun 28-May-23	-	-	-	-	59 (50-67)	48 (45-52)	50 (44-48)	45 (42-48)	55 (48-67)	48 (45-54)	52 (44-48)	45 (43-49)
Mon 29-May-23	65 (56-80)	51 (47-56)	54 (46-50)	46 (44-49)	57 (51-64)	46 (43-50)	48 (42-45)	43 (41-45)	55 (47-71)	49 (45-53)	52 (44-48)	46 (43-49)
Tue 30-May-23	65 (56-81)	51 (46-58)	57 (45-50)	45 (42-49)	57 (50-69)	49 (47-51)	49 (46-47)	46 (44-47)	57 (51-65)	52 (46-55)	54 (45-52)	50 (44-53)
Wed 31-May-23	68 (55-82)	52 (47-57)	54 (46-51)	46 (43-51)	58 (52-71)	48 (47-52)	49 (46-47)	45 (44-46)	55 (50-66)	49 (46-53)	51 (46-48)	46 (45-49)
Thu 01-Jun-23	66 (55-84)	50 (45-54)	61 (44-50)	44 (41-48)	58 (51-74)	49 (47-54)	52 (46-48)	46 (44-48)	56 (51-69)	49 (44-54)	52 (44-48)	46 (42-49)
Fri 02-Jun-23	66 (56-88)	50 (46-57)	67 (45-53)	44 (42-48)	59 (50-68)	46 (44-49)	49 (43-46)	43 (42-44)	55 (49-87)	50 (46-52)	62 (45-51)	48 (44-50)
Sat 03-Jun-23	63 (59-69)	48 (45-53)	51 (44-48)	45 (41-50)	54 (47-67)	46 (43-53)	49 (43-45)	42 (42-44)	54 (49-64)	47 (44-56)	51 (43-46)	45 (41-47)

TABLE 5.1 CTD.: SUMMARY OF FREE-FIELD UNATTENDED CONTINUOUS NOISE MONITORING RESULTS AT LT1 – DAY / EVENING / NIGHT



Day/Date	Measured Noise Levels, dB re. 2×10^{-5} Pa.											
	Daytime ^[3]				Evening ^[3]				Night-time ^[3]			
	L _{Amax,F}	L _{A10,15 min}	L _{Aeq,15 min}	L _{A90,15 min}	L _{Amax,F}	L _{A10,15 min}	L _{Aeq,15 min}	L _{A90,15 min}	L _{Amax,F}	L _{A10,15 min}	L _{Aeq,15 min}	L _{A90,15 min}
Sun 04-Jun-23	-	-	-	-	59 (51-73)	50 (48-52)	50 (47-49)	47 (42-49)	55 (51-71)	50 (48-55)	53 (47-49)	48 (46-50)
Mon 05-Jun-23	66 (54-79)	52 (44-57)	54 (42-51)	46 (41-49)	59 (50-75)	49 (45-56)	53 (44-49)	45 (43-49)	54 (47-66)	47 (44-52)	50 (43-46)	44 (42-48)
Tue 06-Jun-23	66 (54-80)	51 (46-60)	56 (45-50)	45 (42-49)	57 (50-65)	47 (45-52)	49 (44-46)	44 (43-45)	54 (48-66)	49 (45-53)	52 (44-48)	46 (43-50)
Wed 07-Jun-23	67 (61-80)	52 (48-60)	56 (46-51)	47 (44-50)	59 (51-79)	50 (48-54)	52 (47-50)	48 (46-49)	56 (52-66)	51 (50-54)	52 (49-50)	49 (48-50)
Thu 08-Jun-23	68 (59-89)	52 (47-56)	55 (46-51)	47 (43-50)	59 (51-68)	50 (46-54)	51 (45-49)	46 (44-48)	55 (50-67)	51 (47-52)	52 (46-50)	50 (45-51)
Fri 09-Jun-23	66 (58-94)	51 (47-61)	66 (46-53)	47 (44-51)	61 (54-71)	51 (50-53)	51 (49-50)	48 (46-50)	55 (50-67)	49 (48-51)	52 (47-49)	48 (45-49)
Sat 10-Jun-23	59 (54-64)	48 (45-52)	49 (44-46)	43 (41-46)	59 (46-84)	47 (44-54)	59 (44-50)	43 (42-45)	55 (48-69)	48 (45-55)	52 (45-47)	46 (44-48)
Sun 11-Jun-23	-	-	-	-	64 (51-96)	51 (46-60)	67 (44-56)	44 (43-47)	55 (48-71)	49 (46-53)	51 (45-48)	46 (44-50)
Mon 12-Jun-23	66 (55-83)	51 (45-60)	55 (44-50)	45 (41-48)	59 (52-69)	50 (47-54)	51 (46-48)	45 (44-48)	56 (48-78)	49 (45-59)	56 (44-49)	46 (43-50)
Tue 13-Jun-23	68 (58-90)	53 (47-62)	61 (46-53)	47 (43-52)	60 (49-69)	48 (45-52)	49 (45-47)	43 (42-44)	57 (46-75)	48 (44-53)	52 (43-48)	46 (42-51)
Wed 14-Jun-23	69 (51-90)	54 (45-65)	62 (43-54)	48 (42-54)	59 (50-71)	49 (45-54)	52 (44-48)	44 (42-48)	56 (48-77)	49 (46-52)	53 (45-48)	47 (44-49)
Thu 15-Jun-23	68 (56-89)	52 (46-62)	61 (44-52)	46 (41-51)	57 (49-71)	48 (45-53)	50 (43-47)	44 (42-46)	57 (48-81)	50 (46-58)	53 (46-50)	48 (45-51)
Fri 16-Jun-23	64 (56-81)	50 (43-54)	53 (42-49)	45 (41-50)	61 (51-77)	50 (45-61)	57 (44-50)	45 (41-49)	58 (49-80)	49 (46-56)	54 (45-49)	47 (44-50)
Sat 17-Jun-23	60 (53-75)	48 (46-52)	51 (44-47)	43 (41-46)	56 (49-63)	48 (45-50)	49 (44-47)	45 (42-47)	58 (49-75)	49 (47-55)	54 (45-49)	47 (42-49)
Sun 18-Jun-23	-	-	-	-	64 (52-80)	48 (45-55)	59 (44-50)	44 (43-44)	-	-	-	-
Mean Average	66 (59-72)	51 (46-54)	57 (48-68)	46 (37-49)	58 (51-64)	48 (43-51)	51 (44-68)	44 (34-48)	55 (48-61)	48 (39-52)	52 (42-62)	45 (34-50)

TABLE 5.1 CTD.: SUMMARY OF FREE-FIELD UNATTENDED CONTINUOUS NOISE MONITORING RESULTS AT LT1 – DAY / EVENING / NIGHT



Day/Date	Measured Noise Levels, dB re. 2 x 10 ⁻⁵ Pa.											
	Daytime ^[3]				Evening ^[3]				Night-time ^[3]			
	L _{Amax.F}	L _{A10.15 min}	L _{Aeq.15 min}	L _{A90.15 min}	L _{Amax.F}	L _{A10.15 min}	L _{Aeq.15 min}	L _{A90.15 min}	L _{Amax.F}	L _{A10.15 min}	L _{Aeq.15 min}	L _{A90.15 min}
Tue 18-Apr-23	96 (58-68) ^[2]	52 (49-64) ^[2]	55 (46-64) ^[2]	45 (42-49) ^[2]	57 (49-67)	47 (45-50)	46 (43-49)	42 (41-43)	56 (47-76)	46 (43-53)	45 (42-50)	42 (40-44)
Wed 19-Apr-23	90 (58-66)	53 (48-72)	54 (46-67)	45 (42-48)	58 (52-68)	45 (39-50)	45 (40-47)	40 (36-44)	58 (48-70)	47 (41-56)	45 (41-52)	40 (38-42)
Thu 20-Apr-23	82 (53-63)	50 (47-68)	53 (44-68)	42 (37-49)	59 (53-69)	46 (42-51)	45 (40-49)	38 (37-44)	58 (50-72)	47 (41-54)	46 (42-50)	41 (37-48)
Fri 21-Apr-23	73 (50-61)	48 (42-54)	47 (40-51)	40 (36-46)	58 (53-67)	46 (42-57)	45 (40-52)	36 (35-41)	57 (48-74)	45 (39-54)	47 (39-52)	40 (35-50)
Sat 22-Apr-23	71 (53-60)	47 (42-51)	45 (41-50)	39 (37-41)	57 (54-60)	45 (42-48)	44 (42-46)	41 (39-42)	56 (53-66)	45 (42-47)	44 (42-46)	42 (40-44)
Sun 23-Apr-23	-	-	-	-	62 (55-80)	48 (45-56)	48 (44-56)	43 (42-47)	60 (49-78)	47 (42-60)	48 (42-57)	42 (40-46)
Mon 24-Apr-23	75 (52-62)	50 (42-57)	49 (42-54)	44 (39-48)	59 (53-68)	48 (44-52)	47 (43-51)	43 (39-47)	57 (48-72)	47 (43-53)	46 (43-50)	43 (40-46)
Tue 25-Apr-23	79 (56-66)	51 (45-62)	50 (42-62)	42 (37-47)	60 (54-68)	46 (43-53)	45 (42-48)	40 (39-42)	59 (49-70)	47 (43-52)	46 (42-50)	43 (41-46)
Wed 26-Apr-23	76 (56-64)	51 (45-55)	49 (44-56)	42 (40-45)	58 (52-66)	45 (42-49)	44 (41-49)	40 (39-41)	59 (49-74)	47 (41-54)	46 (41-51)	42 (38-45)
Thu 27-Apr-23	73 (55-63)	52 (47-55)	49 (45-54)	44 (41-46)	58 (54-66)	48 (45-57)	47 (44-54)	44 (42-50)	60 (52-73)	48 (44-56)	48 (44-54)	45 (41-51)
Fri 28-Apr-23	84 (53-66)	52 (47-59)	51 (45-57)	46 (43-50)	58 (54-69)	48 (44-51)	46 (43-50)	42 (40-44)	57 (50-70)	46 (41-55)	45 (40-51)	41 (39-42)
Sat 29-Apr-23	74 (55-60)	47 (43-52)	46 (42-49)	40 (40-42)	57 (52-66)	44 (42-48)	44 (41-47)	40 (39-42)	56 (45-67)	44 (41-47)	43 (40-47)	40 (38-44)
Sun 30-Apr-23	-	-	-	-	57 (54-63)	45 (42-50)	44 (42-47)	40 (40-43)	56 (50-61)	43 (41-46)	44 (41-46)	40 (39-43)
Mon 01-May-23	68 (52-60)	46 (44-51)	45 (43-49)	41 (39-43)	53 (46-66)	43 (41-45)	43 (41-47)	41 (40-43)	54 (43-72)	45 (41-57)	45 (41-54)	41 (40-42)
Tue 02-May-23	79 (53-63)	50 (44-59)	49 (43-57)	43 (41-46)	55 (46-63)	44 (42-48)	44 (40-47)	40 (39-42)	54 (43-74)	44 (40-53)	43 (39-49)	40 (38-43)
Wed 03-May-23	95 (56-67)	52 (45-63)	54 (44-68)	46 (41-48)	55 (47-63)	46 (44-48)	44 (42-47)	42 (41-43)	54 (46-70)	46 (43-49)	44 (42-47)	42 (40-45)
Thu 04-May-23	83 (57-64)	52 (48-57)	52 (47-63)	46 (44-48)	62 (51-71)	47 (45-50)	46 (44-48)	44 (43-47)	61 (49-74)	48 (45-54)	47 (44-50)	45 (43-48)
Fri 05-May-23	83 (56-64)	52 (45-62)	52 (43-60)	46 (41-56)	58 (49-69)	46 (44-47)	44 (43-46)	42 (40-43)	61 (50-69)	51 (45-60)	51 (44-57)	46 (42-54)
Sat 06-May-23	68 (57-62)	52 (48-54)	50 (47-52)	47 (40-51)	61 (56-70)	51 (46-58)	50 (44-54)	47 (43-51)	61 (43-69)	52 (41-65)	57 (41-64)	48 (40-63)
Sun 07-May-23	-	-	-	-	75 (69-81)	67 (64-69)	66 (63-67)	63 (57-66)	72 (65-80)	65 (50-69)	65 (50-68)	62 (44-67)
Mon 08-May-23	77 (55-68)	56 (42-72)	63 (41-70)	50 (38-69)	62 (50-71)	45 (43-48)	44 (42-48)	41 (40-43)	60 (54-71)	49 (44-54)	48 (43-51)	45 (41-48)
Tue 09-May-23	90 (59-71)	53 (48-66)	53 (46-62)	46 (42-51)	57 (52-68)	47 (45-49)	46 (44-48)	44 (43-46)	61 (51-76)	48 (44-56)	48 (43-55)	45 (42-51)

TABLE 5.2: SUMMARY OF FREE-FIELD UNATTENDED CONTINUOUS NOISE MONITORING RESULTS AT LT2 – DAY/EVENING/NIGHT



Day/Date	Measured Noise Levels, dB re. 2 x 10 ⁻⁵ Pa.											
	Daytime ^[3]				Evening ^[3]				Night-time ^[3]			
	L _{Amax,F}	L _{A10,15 min}	L _{Aeq,15 min}	L _{A90,15 min}	L _{Amax,F}	L _{A10,15 min}	L _{Aeq,15 min}	L _{A90,15 min}	L _{Amax,F}	L _{A10,15 min}	L _{Aeq,15 min}	L _{A90,15 min}
Wed 10-May-23	109 (58-76)	58 (46-71)	61 (45-73)	49 (43-62)	63 (55-75)	50 (45-60)	50 (46-55)	45 (43-48)	61 (53-76)	48 (45-54)	47 (45-52)	45 (43-50)
Thu 11-May-23	92 (57-80)	59 (48-68)	64 (46-69)	47 (43-52)	57 (50-66)	48 (45-52)	46 (44-48)	43 (42-44)	59 (51-77)	49 (45-53)	47 (45-51)	44 (41-48)
Fri 12-May-23	90 (58-70)	55 (48-68)	55 (46-63)	48 (43-53)	60 (57-69)	48 (45-50)	47 (45-48)	43 (40-44)	58 (50-72)	48 (45-62)	47 (43-57)	42 (40-47)
Sat 13-May-23	67 (51-58)	49 (44-51)	47 (42-49)	43 (39-47)	59 (49-75)	45 (42-53)	44 (41-50)	40 (39-43)	53 (43-71)	44 (41-46)	44 (41-46)	41 (40-42)
Sun 14-May-23	-	-	-	-	58 (54-65)	46 (44-50)	45 (43-48)	42 (41-43)	59 (50-76)	47 (41-53)	47 (42-51)	43 (39-50)
Mon 15-May-23	100 (59-76)	54 (46-62)	56 (44-67)	48 (41-53)	59 (54-69)	47 (43-53)	46 (42-49)	42 (40-44)	60 (51-74)	47 (41-53)	47 (42-52)	42 (39-50)
Tue 16-May-23	106 (56-74)	54 (47-66)	58 (45-70)	47 (43-56)	60 (53-78)	47 (44-51)	46 (45-49)	43 (42-45)	61 (50-76)	48 (44-56)	47 (43-52)	43 (41-48)
Wed 17-May-23	101 (58-69)	52 (45-65)	55 (44-65)	45 (42-49)	58 (47-66)	46 (42-53)	46 (41-51)	42 (40-43)	55 (44-71)	46 (42-50)	45 (41-47)	43 (40-45)
Thu 18-May-23	89 (60-72)	53 (47-66)	56 (45-65)	45 (43-63)	58 (55-63)	47 (44-50)	46 (44-47)	42 (41-44)	58 (53-74)	47 (43-51)	45 (44-49)	43 (41-45)
Fri 19-May-23	98 (58-71)	53 (46-66)	56 (45-64)	46 (42-62)	59 (52-66)	46 (43-50)	46 (42-48)	41 (40-42)	58 (49-75)	46 (42-53)	46 (42-52)	42 (40-46)
Sat 20-May-23	82 (63-73)	55 (51-65)	54 (50-60)	47 (44-51)	59 (54-79)	46 (45-49)	46 (44-49)	42 (41-44)	55 (48-64)	44 (41-48)	44 (41-45)	41 (40-43)
Sun 21-May-23	-	-	-	-	57 (54-60)	46 (44-49)	46 (44-47)	43 (42-44)	59 (50-73)	47 (43-57)	47 (43-55)	43 (41-52)
Mon 22-May-23	105 (57-77)	60 (47-71)	62 (45-70)	52 (43-63)	55 (50-68)	46 (42-51)	45 (41-50)	42 (40-44)	57 (47-72)	46 (43-53)	46 (42-53)	43 (41-45)
Tue 23-May-23	94 (59-76)	60 (47-75)	62 (46-70)	49 (42-62)	61 (55-74)	48 (43-61)	48 (43-56)	41 (40-42)	58 (47-69)	45 (41-52)	45 (41-51)	42 (40-46)
Wed 24-May-23	91 (58-76)	61 (51-69)	59 (49-65)	49 (44-57)	60 (48-75)	47 (43-58)	47 (42-53)	42 (40-44)	56 (48-69)	45 (42-53)	44 (41-48)	41 (39-43)
Thu 25-May-23	93 (57-75)	58 (46-73)	62 (45-70)	47 (42-52)	60 (53-66)	47 (45-53)	46 (44-49)	42 (41-44)	56 (50-68)	47 (44-53)	45 (44-50)	43 (41-45)
Fri 26-May-23	79 (54-65)	50 (47-54)	49 (45-52)	45 (43-49)	54 (0-70)	43 (0-49)	45 (0-49)	39 (0-43)	53 (45-67)	47 (43-50)	46 (42-49)	44 (40-49)
Sat 27-May-23	71 (48-60)	47 (45-49)	46 (44-48)	42 (42-44)	56 (53-59)	45 (44-48)	45 (44-47)	42 (41-43)	53 (47-69)	45 (42-47)	44 (42-46)	43 (41-45)
Sun 28-May-23	-	-	-	-	62 (55-75)	47 (46-48)	46 (44-49)	42 (41-43)	57 (50-71)	47 (45-54)	46 (43-52)	43 (41-47)

TABLE 5.2 CTD.: SUMMARY OF FREE-FIELD UNATTENDED CONTINUOUS NOISE MONITORING RESULTS AT LT2 – DAY/EVENING/NIGHT



Day/Date	Measured Noise Levels, dB re. 2 x 10 ⁻⁵ Pa.											
	Daytime ^[3]				Evening ^[3]				Night-time ^[3]			
	L _{Amax,F}	L _{A10,15 min}	L _{Aeq,15 min}	L _{A90,15 min}	L _{Amax,F}	L _{A10,15 min}	L _{Aeq,15 min}	L _{A90,15 min}	L _{Amax,F}	L _{A10,15 min}	L _{Aeq,15 min}	L _{A90,15 min}
Mon 29-May-23	73 (51-60)	48 (46-56)	47 (44-52)	43 (42-44)	56 (45-64)	45 (43-48)	44 (42-46)	41 (40-42)	55 (49-69)	47 (45-56)	46 (43-51)	43 (41-44)
Tue 30-May-23	88 (56-66)	52 (46-71)	55 (45-67)	45 (42-50)	54 (48-70)	46 (44-47)	44 (42-48)	42 (41-43)	56 (49-74)	50 (44-55)	49 (43-53)	46 (41-51)
Wed 31-May-23	87 (55-68)	53 (46-67)	56 (45-67)	45 (43-52)	57 (53-65)	47 (46-49)	46 (44-48)	43 (42-45)	56 (49-70)	47 (45-51)	45 (44-49)	43 (41-45)
Thu 01-Jun-23	92 (53-72)	57 (48-71)	58 (46-66)	47 (44-55)	60 (48-82)	47 (44-57)	48 (42-55)	43 (41-46)	55 (47-79)	47 (44-63)	49 (43-59)	43 (41-51)
Fri 02-Jun-23	94 (52-71)	54 (45-72)	59 (44-69)	46 (41-64)	61 (53-71)	47 (45-52)	45 (43-49)	41 (40-42)	56 (51-67)	47 (44-53)	46 (44-51)	44 (41-47)
Sat 03-Jun-23	77 (54-64)	49 (45-52)	47 (44-51)	44 (42-47)	56 (45-63)	44 (43-46)	44 (42-46)	41 (40-43)	54 (46-60)	45 (43-50)	44 (42-46)	42 (40-44)
Sun 04-Jun-23	-	-	-	-	57 (49-75)	47 (45-50)	46 (44-48)	43 (41-45)	56 (48-70)	47 (45-55)	46 (44-50)	44 (42-45)
Mon 05-Jun-23	79 (54-63)	49 (46-65)	49 (44-60)	43 (42-46)	61 (52-73)	47 (45-64)	49 (44-59)	42 (41-43)	60 (49-80)	47 (44-56)	46 (43-52)	42 (41-45)
Tue 06-Jun-23	84 (55-65)	50 (47-61)	51 (45-60)	43 (42-45)	60 (54-68)	45 (43-49)	45 (42-47)	41 (40-42)	58 (50-67)	47 (43-52)	46 (44-50)	43 (41-47)
Wed 07-Jun-23	89 (55-67)	52 (45-66)	53 (44-64)	45 (42-49)	58 (49-67)	48 (46-51)	47 (44-49)	44 (42-46)	60 (50-72)	53 (46-69)	60 (45-67)	48 (44-66)
Thu 08-Jun-23	92 (63-70)	61 (52-68)	60 (49-64)	54 (44-60)	73 (66-82)	65 (60-70)	64 (58-69)	61 (56-67)	73 (68-81)	68 (60-70)	66 (55-69)	63 (48-67)
Fri 09-Jun-23	83 (54-68)	53 (46-71)	59 (45-69)	48 (42-67)	72 (66-78)	51 (48-54)	51 (47-54)	46 (43-49)	72 (54-86)	52 (48-58)	55 (47-61)	47 (44-49)
Sat 10-Jun-23	73 (50-64)	48 (45-53)	47 (43-50)	42 (41-45)	39 (0-55)	33 (0-45)	42 (0-44)	31 (0-43)	54 (48-68)	45 (43-49)	45 (43-46)	43 (41-45)
Sun 11-Jun-23	-	-	-	-	59 (50-81)	47 (43-63)	50 (42-60)	42 (41-45)	60 (53-76)	48 (44-57)	48 (44-53)	44 (42-46)
Mon 12-Jun-23	90 (57-69)	52 (45-70)	53 (43-66)	44 (41-57)	62 (53-78)	47 (44-58)	49 (43-57)	43 (42-44)	64 (53-79)	49 (44-56)	49 (44-56)	44 (42-48)
Tue 13-Jun-23	81 (54-68)	51 (45-71)	52 (44-65)	44 (40-47)	65 (51-84)	47 (44-61)	52 (43-61)	41 (40-43)	60 (53-78)	47 (41-56)	47 (41-53)	42 (39-46)
Mean Average	85 (67-109)	53 (46-61)	53 (45-64)	45 (39-54)	59 (39-75)	47 (33-67)	47 (42-66)	42 (31-63)	58 (53-73)	48 (43-68)	47 (43-66)	44 (40-63)
Mean Average (Excluded data)	85 (67-109) ^[4]	52 (46-61) ^[4]	53 (45-64) ^[4]	45 (39-52) ^[4]	58 (39-72) ^[4]	46 (33-51) ^[4]	46 (42-52) ^[4]	42 (31-47) ^[4]	58 (53-72) ^[4]	47 (43-52) ^[4]	46 (43-55) ^[4]	43 (40-47) ^[4]

TABLE 5.2 CTD.: SUMMARY OF FREE-FIELD UNATTENDED CONTINUOUS NOISE MONITORING RESULTS AT LT2 – DAY/EVENING/NIGHT

Notes: [1] the range of 15 min levels measured during the period are shown in parenthesis;

[2] incomplete dataset on Tuesday 18th April day-time is due to equipment setup;

[3] daytime defined as 07:00 - 19:00 hrs Mon - Fri and 07:00 - 13:00 hrs Sat. Evening defined as 19:00 - 23:00 hrs Mon - Fri, 13:00 - 23:00 Sat and 07:00 - 23:00 hrs Sun. Night-time defined as 23:00 - 07:00 hrs Mon – Sun; and

[4] spurious data measured between 04:30 Sunday 7th to 11:15 Monday 8th May 2023 and 06:00 Thursday 8th to 09:45 Friday 9th June 2023 excluded from mean average.



- 5.2.3 Day, Evening and Night-time ambient noise levels presented in 0 and Table 5.2 have been calculated using logarithmic averaging, whilst mean $L_{Amax,F}$, $L_{A10,T}$ and $L_{A90,T}$ noise levels have been calculated using arithmetic averaging. The range of 15-minute values over which each logarithmic or mean value has been calculated is shown in parenthesis.
- 5.2.4 Mean ambient noise levels measured during daytime periods at LT1 ranged between 48 and 68 dB $L_{Aeq,15min}$, mean ambient noise levels measured during the evening period, ranged between 44 and 68 dB $L_{Aeq, 15min}$. The overall mean ambient noise level measured over the daytime period was 57 dB $L_{Aeq,T}$, this reduced to a measured level of 51 dB $L_{Aeq,T}$ during the evening period.
- 5.2.5 Mean ambient noise levels measured during night-time periods at LT1 ranged between 42 and 62 dB $L_{Aeq,15min}$. The overall mean ambient noise level measured over the night-time period was 52 dB $L_{Aeq,T}$.
- 5.2.6 Mean ambient noise levels measured during daytime periods at LT2 ranged between 45 and 64 dB $L_{Aeq,15min}$, mean ambient noise levels measured during the evening period, ranged between 42 and 52 dB $L_{Aeq, 15min}$. The overall mean ambient noise level measured over the daytime period was 53 dB $L_{Aeq,T}$, this reduced to a measured level of 46 dB $L_{Aeq,T}$ during the evening period.
- 5.2.7 Mean ambient noise levels measured during night-time periods at LT2 ranged between 43 and 55 dB $L_{Aeq,15min}$. The overall mean ambient noise level measured over the night-time period was 46 dB $L_{Aeq,T}$.

5.3 Day and Night Noise Levels

- 5.3.1 Typically operational commercial noise which may impact residential properties is assessed using British Standard BS 4142, which adopts day (07:00 to 23:00 hrs) and night-time (23:00 to 07:00 hrs) periods. A summary of daytime and night-time noise levels is presented in Tables 5.3 and 5.4 respectively.



Day/Date	Measured Noise Levels, dB re. 2 x 10 ⁻⁵ Pa.							
	Daytime ^[3]				Night-time ^[3]			
	L _{Amax,F}	L _{A10.15 min}	L _{Aeq.15 min}	L _{A90.15 min}	L _{Amax,F}	L _{A10.15 min}	L _{Aeq.15 min}	L _{A90.15 min}
Tue 18-Apr-23	63 (50-84) ^[2]	50 (45-61) ^[2]	50 (44-57) ^[2]	45 (43-50) ^[2]	53 (46-74)	47 (44-59)	47 (43-55)	44 (42-48)
Wed 19-Apr-23	65 (53-83)	52 (46-56)	51 (45-57)	47 (44-51)	52 (46-67)	47 (43-53)	47 (43-52)	45 (42-50)
Thu 20-Apr-23	65 (49-81)	52 (45-57)	51 (44-55)	47 (42-51)	52 (47-69)	48 (45-55)	49 (45-54)	47 (44-53)
Fri 21-Apr-23	64 (49-78)	51 (46-57)	50 (44-55)	46 (42-53)	53 (48-62)	47 (46-50)	47 (45-49)	45 (44-48)
Sat 22-Apr-23	61 (50-82)	47 (42-53)	46 (40-53)	39 (36-46)	54 (43-66)	44 (38-52)	43 (37-48)	39 (36-42)
Sun 23-Apr-23	59 (46-83)	47 (39-55)	48 (38-58)	42 (36-52)	53 (44-84)	44 (38-53)	47 (37-59)	40 (36-50)
Mon 24-Apr-23	64 (49-85)	52 (45-60)	51 (44-56)	48 (42-51)	54 (47-69)	48 (45-54)	48 (45-52)	46 (44-50)
Tue 25-Apr-23	67 (48-88)	52 (46-59)	52 (46-63)	46 (42-50)	54 (47-68)	48 (44-54)	48 (44-52)	46 (43-51)
Wed 26-Apr-23	66 (48-87)	52 (45-57)	52 (44-56)	48 (43-51)	54 (46-71)	48 (44-54)	48 (44-53)	46 (43-51)
Thu 27-Apr-23	67 (52-81)	53 (47-60)	52 (46-58)	48 (44-52)	55 (47-73)	49 (45-54)	49 (44-53)	46 (44-51)
Fri 28-Apr-23	65 (43-84)	51 (38-69)	53 (37-65)	44 (35-52)	51 (37-72)	41 (35-55)	43 (33-51)	36 (32-43)
Sat 29-Apr-23	68 (49-94)	50 (41-69)	58 (40-68)	38 (35-45)	54 (41-72)	43 (37-50)	43 (36-52)	38 (34-44)
Sun 30-Apr-23	64 (50-83)	48 (41-64)	50 (40-60)	38 (37-41)	53 (44-78)	44 (40-52)	45 (39-52)	40 (37-48)
Mon 01-May-23	59 (48-72)	46 (41-53)	44 (39-49)	38 (34-47)	51 (44-64)	44 (35-53)	45 (35-51)	39 (32-48)
Tue 02-May-23	65 (50-80)	51 (45-58)	50 (44-56)	44 (42-49)	56 (47-78)	48 (45-54)	48 (44-53)	46 (44-51)
Wed 03-May-23	63 (47-78)	51 (44-56)	50 (44-55)	46 (42-50)	55 (46-72)	47 (44-54)	47 (44-51)	45 (43-49)
Thu 04-May-23	65 (51-87)	51 (47-57)	51 (46-59)	47 (44-49)	61 (54-73)	52 (47-55)	51 (46-54)	50 (45-52)
Fri 05-May-23	68 (49-93)	52 (47-77)	55 (46-68)	47 (45-51)	56 (48-73)	48 (46-52)	47 (46-50)	46 (45-46)
Sat 06-May-23	61 (51-70)	50 (47-53)	48 (46-51)	46 (44-49)	52 (47-62)	47 (46-50)	46 (45-48)	45 (45-47)
Sun 07-May-23	62 (53-86)	49 (46-53)	49 (46-59)	46 (44-48)	58 (49-72)	50 (46-53)	49 (45-52)	47 (45-51)
Mon 08-May-23	64 (52-84)	50 (47-58)	50 (46-58)	46 (45-50)	59 (49-77)	49 (47-53)	49 (46-56)	47 (45-51)
Tue 09-May-23	64 (50-92)	52 (46-65)	53 (46-67)	47 (44-51)	56 (48-65)	48 (45-53)	48 (44-51)	46 (43-50)
Wed 10-May-23	66 (50-79)	52 (46-59)	52 (46-57)	48 (45-51)	55 (48-65)	48 (45-52)	48 (44-51)	46 (43-51)
Thu 11-May-23	63 (51-75)	52 (46-56)	51 (45-54)	48 (43-52)	53 (44-69)	47 (42-55)	47 (41-52)	44 (41-50)

TABLE 5.3: SUMMARY OF FREE-FIELD UNATTENDED CONTINUOUS NOISE MONITORING RESULTS AT LT1 – DAY AND NIGHT

Notes: ^[1] the range of 15 min levels measured during the period are shown in parenthesis;

^[2] incomplete dataset on Tuesday 18th April day-time is due to equipment setup; and

^[3] daytime defined as 07:00 - 23:00 hrs Mon – Sun. Night-time defined as 23:00 - 07:00 hrs Mon - Sun.



Day/Date	Measured Noise Levels, dB re. 2 x 10 ⁻⁵ Pa.							
	Daytime ^[3]				Night-time ^[3]			
	L _{Amax,F}	L _{A10.15 min}	L _{Aeq.15 min}	L _{A90.15 min}	L _{Amax,F}	L _{A10.15 min}	L _{Aeq.15 min}	L _{A90.15 min}
Fri 12-May-23	64 (46-81)	51 (44-61)	50 (43-56)	46 (42-51)	51 (45-75)	45 (44-49)	44 (43-47)	43 (42-44)
Sat 13-May-23	57 (45-83)	46 (44-53)	47 (43-56)	43 (42-44)	50 (44-63)	45 (43-48)	44 (42-45)	43 (42-44)
Sun 14-May-23	61 (48-93)	48 (44-62)	54 (43-66)	43 (42-45)	54 (46-72)	47 (44-52)	47 (43-51)	45 (43-50)
Mon 15-May-23	66 (48-86)	52 (44-57)	54 (43-65)	48 (42-52)	57 (48-75)	48 (45-53)	48 (45-52)	46 (44-50)
Tue 16-May-23	66 (50-84)	51 (44-62)	52 (44-60)	47 (42-52)	54 (46-66)	48 (44-54)	48 (44-53)	46 (43-51)
Wed 17-May-23	64 (50-88)	51 (43-57)	50 (43-56)	47 (41-50)	55 (44-67)	47 (43-54)	47 (42-52)	45 (42-51)
Thu 18-May-23	62 (49-77)	51 (45-58)	50 (44-55)	45 (41-50)	56 (47-69)	48 (45-52)	47 (44-50)	45 (43-49)
Fri 19-May-23	64 (48-82)	51 (43-62)	50 (42-57)	45 (41-49)	52 (45-68)	45 (42-52)	45 (42-51)	43 (41-49)
Sat 20-May-23	64 (45-90)	49 (37-68)	54 (35-66)	40 (33-49)	48 (38-58)	39 (33-45)	38 (32-42)	34 (31-38)
Sun 21-May-23	62 (44-92)	48 (38-64)	51 (36-64)	40 (32-48)	51 (43-62)	45 (38-53)	44 (36-49)	40 (33-47)
Mon 22-May-23	66 (46-86)	51 (44-59)	51 (44-55)	47 (42-49)	54 (47-67)	47 (44-52)	47 (44-51)	45 (43-50)
Tue 23-May-23	66 (52-84)	52 (45-59)	51 (44-63)	45 (41-49)	57 (48-67)	48 (44-53)	48 (43-52)	46 (43-51)
Wed 24-May-23	65 (46-82)	51 (43-59)	52 (42-65)	46 (41-51)	54 (45-64)	46 (43-51)	46 (43-49)	44 (42-48)
Thu 25-May-23	66 (51-82)	51 (45-56)	50 (43-59)	44 (42-47)	54 (45-66)	48 (43-53)	47 (42-51)	44 (41-49)
Fri 26-May-23	67 (51-96)	50 (44-56)	53 (43-68)	45 (42-49)	56 (48-75)	48 (45-52)	48 (44-53)	46 (43-48)
Sat 27-May-23	68 (48-93)	49 (44-60)	54 (43-65)	43 (41-48)	57 (49-69)	49 (48-53)	49 (47-50)	48 (45-49)
Sun 28-May-23	67 (50-89)	50 (44-61)	53 (43-62)	44 (41-49)	55 (48-67)	48 (45-54)	48 (44-52)	45 (43-49)
Mon 29-May-23	63 (51-80)	50 (43-56)	49 (42-54)	45 (41-49)	55 (47-71)	49 (45-53)	48 (44-52)	46 (43-49)
Tue 30-May-23	63 (50-81)	50 (46-58)	49 (45-57)	45 (42-49)	57 (51-65)	52 (46-55)	52 (45-54)	50 (44-53)
Wed 31-May-23	66 (52-82)	51 (47-57)	50 (46-54)	46 (43-51)	55 (50-66)	49 (46-53)	48 (46-51)	46 (45-49)
Thu 01-Jun-23	64 (51-84)	50 (45-54)	50 (44-61)	45 (41-48)	56 (51-69)	49 (44-54)	48 (44-52)	46 (42-49)
Fri 02-Jun-23	64 (50-88)	49 (44-57)	52 (43-67)	44 (42-48)	55 (49-87)	50 (46-52)	51 (45-62)	48 (44-50)
Sat 03-Jun-23	60 (47-75)	48 (43-53)	47 (43-53)	44 (41-50)	54 (49-64)	47 (44-56)	46 (43-51)	45 (41-47)
Sun 04-Jun-23	63 (51-92)	50 (43-65)	52 (42-67)	44 (41-49)	55 (51-71)	50 (48-55)	49 (47-53)	48 (46-50)

TABLE 5.3 CTD.: SUMMARY OF FREE-FIELD UNATTENDED CONTINUOUS NOISE MONITORING RESULTS AT LT1 – DAY AND NIGHT



Day/Date	Measured Noise Levels, dB re. 2 x 10 ⁻⁵ Pa.							
	Daytime ^[3]				Night-time ^[3]			
	L _{Amax,F}	L _{A10.15 min}	L _{Aeq.15 min}	L _{A90.15 min}	L _{Amax,F}	L _{A10.15 min}	L _{Aeq.15 min}	L _{A90.15 min}
Mon 05-Jun-23	64 (50-79)	52 (44-57)	51 (42-54)	46 (41-49)	54 (47-66)	47 (44-52)	46 (43-50)	44 (42-48)
Tue 06-Jun-23	64 (50-80)	50 (45-60)	49 (44-56)	44 (42-49)	54 (48-66)	49 (45-53)	48 (44-52)	46 (43-50)
Wed 07-Jun-23	65 (51-80)	52 (48-60)	51 (46-56)	47 (44-50)	56 (52-66)	51 (50-54)	50 (49-52)	49 (48-50)
Thu 08-Jun-23	66 (51-89)	52 (46-56)	51 (45-55)	46 (43-50)	55 (50-67)	51 (47-52)	50 (46-52)	50 (45-51)
Fri 09-Jun-23	65 (54-94)	51 (47-61)	53 (46-66)	47 (44-51)	55 (50-67)	49 (48-51)	49 (47-52)	48 (45-49)
Sat 10-Jun-23	59 (46-84)	47 (44-54)	48 (43-59)	43 (41-46)	55 (48-69)	48 (45-55)	47 (45-52)	46 (44-48)
Sun 11-Jun-23	66 (51-96)	51 (45-66)	56 (43-67)	43 (41-47)	55 (48-71)	49 (46-53)	48 (45-51)	46 (44-50)
Mon 12-Jun-23	64 (52-83)	51 (45-60)	50 (44-55)	45 (41-48)	56 (48-78)	49 (45-59)	49 (44-56)	46 (43-50)
Tue 13-Jun-23	66 (49-90)	52 (45-62)	52 (45-61)	46 (42-52)	57 (46-75)	48 (44-53)	48 (43-52)	46 (42-51)
Wed 14-Jun-23	67 (50-90)	53 (45-65)	53 (43-62)	47 (42-54)	56 (48-77)	49 (46-52)	48 (45-53)	47 (44-49)
Thu 15-Jun-23	65 (49-89)	51 (45-62)	51 (43-61)	45 (41-51)	57 (48-81)	50 (46-58)	50 (46-53)	48 (45-51)
Fri 16-Jun-23	64 (51-81)	50 (43-61)	49 (42-57)	45 (41-50)	58 (49-80)	49 (46-56)	49 (45-54)	47 (44-50)
Sat 17-Jun-23	59 (49-75)	47 (44-52)	46 (43-51)	43 (41-47)	58 (49-75)	49 (47-55)	49 (45-54)	47 (42-49)
Sun 18-Jun-23	64 (51-81)	49 (45-55)	50 (44-59)	44 (42-50)	56 (54-61)	47 (46-49)	46 (46-47)	45 (45-45)
Mean Average	64 (57-68)	50 (46-53)	51 (44-58)	45 (38-48)	55 (48-61)	48 (39-52)	47 (38-52)	45 (34-50)

TABLE 5.3 CTD.: SUMMARY OF FREE-FIELD UNATTENDED CONTINUOUS NOISE MONITORING RESULTS AT LT1 – DAY AND NIGHT

Notes: [1] the range of 15 min levels measured during the period are shown in parenthesis;

[2] incomplete dataset on Tuesday 18th April day-time is due to equipment setup; and

[3] daytime defined as 07:00 - 23:00 hrs Mon – Sun. Night-time defined as 23:00 - 07:00 hrs Mon - Sun.



Day/Date	Measured Noise Levels, dB re. 2 x 10 ⁻⁵ Pa.							
	Daytime ^[3]				Night-time ^[3]			
	L _{Amax,F}	L _{A10,15 min}	L _{Aeq,15 min}	L _{A90,15 min}	L _{Amax,F}	L _{A10,15 min}	L _{Aeq,15 min}	L _{A90,15 min}
Tue 18-Apr-23	63 (49-96) ^[2]	50 (45-64) ^[2]	53 (43-64) ^[2]	44 (41-49) ^[2]	56 (47-76)	46 (43-53)	45 (42-50)	42 (40-44)
Wed 19-Apr-23	64 (52-90)	51 (39-72)	53 (40-67)	44 (36-48)	58 (48-70)	47 (41-56)	45 (41-52)	40 (38-42)
Thu 20-Apr-23	62 (53-82)	49 (42-68)	52 (40-68)	41 (37-49)	58 (50-72)	47 (41-54)	46 (42-50)	41 (37-48)
Fri 21-Apr-23	60 (50-73)	48 (42-57)	46 (40-52)	39 (35-46)	57 (48-74)	45 (39-54)	47 (39-52)	40 (35-50)
Sat 22-Apr-23	59 (50-71)	46 (42-51)	45 (41-50)	40 (37-42)	56 (53-66)	45 (42-47)	44 (42-46)	42 (40-44)
Sun 23-Apr-23	60 (55-80)	48 (44-57)	47 (43-56)	43 (40-49)	60 (49-78)	47 (42-60)	48 (42-57)	42 (40-46)
Mon 24-Apr-23	61 (52-75)	50 (42-57)	48 (42-54)	44 (39-48)	57 (48-72)	47 (43-53)	46 (43-50)	43 (40-46)
Tue 25-Apr-23	64 (54-79)	50 (43-62)	49 (42-62)	42 (37-47)	59 (49-70)	47 (43-52)	46 (42-50)	43 (41-46)
Wed 26-Apr-23	62 (52-76)	49 (42-55)	48 (41-56)	42 (39-45)	59 (49-74)	47 (41-54)	46 (41-51)	42 (38-45)
Thu 27-Apr-23	62 (54-73)	51 (45-57)	49 (44-54)	44 (41-50)	60 (52-73)	48 (44-56)	48 (44-54)	45 (41-51)
Fri 28-Apr-23	64 (53-84)	51 (44-59)	50 (43-57)	45 (40-50)	57 (50-70)	46 (41-55)	45 (40-51)	41 (39-42)
Sat 29-Apr-23	57 (48-74)	45 (42-52)	45 (41-49)	41 (39-42)	56 (45-67)	44 (41-47)	43 (40-47)	40 (38-44)
Sun 30-Apr-23	58 (50-71)	45 (42-51)	44 (40-49)	40 (38-43)	56 (50-61)	43 (41-46)	44 (41-46)	40 (39-43)
Mon 01-May-23	58 (46-68)	45 (41-51)	44 (41-49)	41 (39-43)	54 (43-72)	45 (41-57)	45 (41-54)	41 (40-42)
Tue 02-May-23	61 (46-79)	48 (42-59)	48 (40-57)	42 (39-46)	54 (43-74)	44 (40-53)	43 (39-49)	40 (38-43)
Wed 03-May-23	64 (47-95)	51 (44-63)	53 (42-68)	45 (41-48)	54 (46-70)	46 (43-49)	44 (42-47)	42 (40-45)
Thu 04-May-23	64 (51-83)	51 (45-57)	51 (44-63)	46 (43-48)	61 (49-74)	48 (45-54)	47 (44-50)	45 (43-48)
Fri 05-May-23	63 (49-83)	50 (44-62)	51 (43-60)	45 (40-56)	61 (50-69)	51 (45-60)	51 (44-57)	46 (42-54)
Sat 06-May-23	62 (55-70)	51 (46-58)	50 (44-54)	46 (40-51)	61 (43-69)	52 (41-65)	57 (41-64)	48 (40-63)
Sun 07-May-23	69 (55-81)	63 (42-69)	64 (41-68)	56 (39-66)	72 (65-80)	65 (50-69)	65 (50-68)	62 (44-67)
Mon 08-May-23	66 (50-77)	53 (42-72)	62 (41-70)	48 (38-69)	60 (54-71)	49 (44-54)	48 (43-51)	45 (41-48)
Tue 09-May-23	68 (52-90)	51 (45-66)	52 (44-62)	46 (42-51)	61 (51-76)	48 (44-56)	48 (43-55)	45 (42-51)
Wed 10-May-23	73 (55-109)	56 (45-71)	60 (45-73)	48 (43-62)	61 (53-76)	48 (45-54)	47 (45-52)	45 (43-50)
Thu 11-May-23	74 (50-92)	56 (45-68)	62 (44-69)	46 (42-52)	59 (51-77)	49 (45-53)	47 (45-51)	44 (41-48)

TABLE 5.4: SUMMARY OF FREE-FIELD UNATTENDED CONTINUOUS NOISE MONITORING RESULTS AT LT2 – DAY AND NIGHT



Day/Date	Measured Noise Levels, dB re. 2 x 10 ⁻⁵ Pa.							
	Daytime ^[3]				Night-time ^[3]			
	L _{Amax,F}	L _{A10,15 min}	L _{Aeq,15 min}	L _{A90,15 min}	L _{Amax,F}	L _{A10,15 min}	L _{Aeq,15 min}	L _{A90,15 min}
Fri 12-May-23	68 (57-90)	53 (45-68)	54 (45-63)	46 (40-53)	58 (50-72)	48 (45-62)	47 (43-57)	42 (40-47)
Sat 13-May-23	59 (49-79)	47 (42-53)	46 (41-56)	41 (39-47)	53 (43-71)	44 (41-46)	44 (41-46)	41 (40-42)
Sun 14-May-23	61 (53-77)	47 (41-57)	47 (41-55)	41 (37-43)	59 (50-76)	47 (41-53)	47 (42-51)	43 (39-50)
Mon 15-May-23	72 (54-100)	53 (43-62)	55 (42-67)	47 (40-53)	60 (51-74)	47 (41-53)	47 (42-52)	42 (39-50)
Tue 16-May-23	70 (53-106)	53 (44-66)	57 (45-70)	46 (42-56)	61 (50-76)	48 (44-56)	47 (43-52)	43 (41-48)
Wed 17-May-23	66 (47-101)	50 (42-65)	54 (41-65)	44 (40-49)	55 (44-71)	46 (42-50)	45 (41-47)	43 (40-45)
Thu 18-May-23	68 (55-89)	51 (44-66)	54 (44-65)	45 (41-63)	58 (53-74)	47 (43-51)	45 (44-49)	43 (41-45)
Fri 19-May-23	68 (52-98)	52 (43-66)	55 (42-64)	45 (40-62)	58 (49-75)	46 (42-53)	46 (42-52)	42 (40-46)
Sat 20-May-23	68 (54-82)	51 (45-65)	52 (44-60)	45 (41-51)	55 (48-64)	44 (41-48)	44 (41-45)	41 (40-43)
Sun 21-May-23	63 (52-84)	50 (44-69)	50 (43-63)	43 (42-47)	59 (50-73)	47 (43-57)	47 (43-55)	43 (41-52)
Mon 22-May-23	71 (50-105)	57 (42-71)	61 (41-70)	50 (40-63)	57 (47-72)	46 (43-53)	46 (42-53)	43 (41-45)
Tue 23-May-23	72 (55-94)	57 (43-75)	61 (43-70)	47 (40-62)	58 (47-69)	45 (41-52)	45 (41-51)	42 (40-46)
Wed 24-May-23	72 (48-91)	57 (43-69)	58 (42-65)	47 (40-57)	56 (48-69)	45 (42-53)	44 (41-48)	41 (39-43)
Thu 25-May-23	71 (53-93)	56 (45-73)	61 (44-70)	46 (41-52)	56 (50-68)	47 (44-53)	45 (44-50)	43 (41-45)
Fri 26-May-23	63 (48-79)	49 (45-54)	48 (44-52)	44 (40-49)	53 (45-67)	47 (43-50)	46 (42-49)	44 (40-49)
Sat 27-May-23	58 (48-71)	46 (44-50)	45 (43-48)	43 (41-44)	53 (47-69)	45 (42-47)	44 (42-46)	43 (41-45)
Sun 28-May-23	60 (49-75)	47 (44-53)	46 (43-51)	42 (41-44)	57 (50-71)	47 (45-54)	46 (43-52)	43 (41-47)
Mon 29-May-23	59 (45-73)	47 (43-56)	46 (42-52)	43 (40-44)	55 (49-69)	47 (45-56)	46 (43-51)	43 (41-44)
Tue 30-May-23	63 (48-88)	51 (44-71)	54 (42-67)	44 (41-50)	56 (49-74)	50 (44-55)	49 (43-53)	46 (41-51)
Wed 31-May-23	65 (53-87)	52 (46-67)	54 (44-67)	45 (42-52)	56 (49-70)	47 (45-51)	45 (44-49)	43 (41-45)
Thu 01-Jun-23	69 (48-92)	54 (44-71)	57 (42-66)	46 (41-55)	55 (47-79)	47 (44-63)	49 (43-59)	43 (41-51)
Fri 02-Jun-23	68 (52-94)	52 (45-72)	58 (43-69)	45 (40-64)	56 (51-67)	47 (44-53)	46 (44-51)	44 (41-47)
Sat 03-Jun-23	61 (45-77)	47 (43-52)	47 (42-54)	43 (40-47)	54 (46-60)	45 (43-50)	44 (42-46)	42 (40-44)
Sun 04-Jun-23	59 (49-75)	47 (43-52)	46 (42-51)	42 (40-45)	56 (48-70)	47 (45-55)	46 (44-50)	44 (42-45)

TABLE 5.4 CTD.: SUMMARY OF FREE-FIELD UNATTENDED CONTINUOUS NOISE MONITORING RESULTS AT LT2 – DAY AND NIGHT



Day/Date	Measured Noise Levels, dB re. 2 x 10 ⁻⁵ Pa.							
	Daytime ^[3]				Night-time ^[3]			
	L _{Amax,F}	L _{A10,15 min}	L _{Aeq,15 min}	L _{A90,15 min}	L _{Amax,F}	L _{A10,15 min}	L _{Aeq,15 min}	L _{A90,15 min}
Mon 05-Jun-23	62 (52-79)	49 (45-65)	49 (44-60)	43 (41-46)	60 (49-80)	47 (44-56)	46 (43-52)	42 (41-45)
Tue 06-Jun-23	64 (54-84)	49 (43-61)	50 (42-60)	43 (40-45)	58 (50-67)	47 (43-52)	46 (44-50)	43 (41-47)
Wed 07-Jun-23	65 (49-89)	51 (45-66)	53 (44-64)	45 (42-49)	60 (50-72)	53 (46-69)	60 (45-67)	48 (44-66)
Thu 08-Jun-23	71 (63-92)	62 (52-70)	61 (49-69)	56 (44-67)	73 (68-81)	68 (60-70)	66 (55-69)	63 (48-67)
Fri 09-Jun-23	69 (54-83)	53 (46-71)	58 (45-69)	47 (42-67)	72 (54-86)	52 (48-58)	55 (47-61)	47 (44-49)
Sat 10-Jun-23	59 (47-83)	46 (43-53)	46 (42-55)	42 (40-44)	54 (48-68)	45 (43-49)	45 (43-46)	43 (41-45)
Sun 11-Jun-23	59 (50-81)	46 (43-63)	47 (41-60)	41 (39-45)	60 (53-76)	48 (44-57)	48 (44-53)	44 (42-46)
Mon 12-Jun-23	67 (53-90)	51 (44-70)	53 (43-66)	43 (41-57)	64 (53-79)	49 (44-56)	49 (44-56)	44 (42-48)
Tue 13-Jun-23	67 (51-84)	50 (44-71)	52 (43-65)	43 (40-47)	60 (53-78)	47 (41-56)	47 (41-53)	42 (39-46)
Mean Average	64 (57-74)	51 (45-63)	52 (44-64)	44 (39-56)	58 (53-73)	48 (43-68)	47 (43-66)	44 (40-63)
Mean Average (Excluded data)	64 (57-74) ^[4]	50 (45-57) ^[4]	51 (44-62) ^[4]	44 (39-50) ^[4]	58 (53-72) ^[4]	47 (43-52) ^[4]	46 (43-55) ^[4]	43 (40-47) ^[4]

TABLE 5.4 CTD.: SUMMARY OF FREE-FIELD UNATTENDED CONTINUOUS NOISE MONITORING RESULTS AT LT2 – DAY AND NIGHT

Notes: [1] the range of 15 min levels measured during the period are shown in parenthesis;

[2] incomplete dataset on Tuesday 18th April day-time is due to equipment setup; and

[3] daytime defined as 07:00 - 23:00 hrs Mon – Sun. Night-time defined as 23:00 - 07:00 hrs Mon - Sun.

[4] spurious data measured between 04:30 Sunday 7th to 11:15 Monday 8th May 2023 and 06:00 Thursday 8th to 09:45 Friday 9th June 2023 excluded from mean average.

- 5.3.2 Daytime and Night-time ambient noise levels presented in Table 5.3 and Table 5.4 have been calculated using logarithmic averaging, whilst mean $L_{Amax,F}$, $L_{A10,T}$ and $L_{A90,T}$ noise levels have been calculated using arithmetic averaging. The range of 15-minute values over which each logarithmic or mean value has been calculated is shown in parenthesis.
- 5.3.3 Mean ambient noise levels measured during daytime periods at LT1 ranged between 44 and 58 dB $L_{Aeq,15min}$. The overall mean ambient noise level measured over the daytime period was 51 dB $L_{Aeq,T}$.
- 5.3.4 Mean ambient noise levels measured during night-time periods at LT1 ranged between 38 and 52 dB $L_{Aeq,15min}$. The overall mean ambient noise level measured over the night-time period was 47 dB $L_{Aeq,T}$.
- 5.3.5 Mean ambient noise levels measured during daytime periods at LT2 ranged between 44 and 62 dB $L_{Aeq,15min}$. The overall mean ambient noise level measured over the daytime period was 51 dB $L_{Aeq,T}$.
- 5.3.6 Mean ambient noise levels measured during night-time periods at LT2 ranged between 43 and 55 dB $L_{Aeq,15min}$. The overall mean ambient noise level measured over the night-time period was 46 dB $L_{Aeq,T}$.

5.4 Attended Noise Survey

Gravesend, Kent

- 5.4.1 The results of the attended noise monitoring undertaken around the Crossing South site Area on Thursday 18th May 2023 are presented in Table B4 of Appendix B and summarised in Table 5.5.

Monitoring Location	Start Time	Dur. (mins)	Measured Noise Levels, dB re. 2×10^{-5} Pa.			
			$L_{Amax,F}$	$L_{A10,T}$	$L_{Aeq,T}$	$L_{A90,T}$
ST1	12:50	15	67.9	51.3	49.6	45.2
	13:35	15	69.4	52.0	56.4	52.8
	15:00	15	71.1	51.1	56.5	53.2
	<i>Cumul.</i>		71.1	51.5	55.1	50.4
ST2	13:10	15	67.1	50.9	50.1	43.8
	14:15	15	73.3	52.0	51.4	46.0
	15:20	15	73.7	51.1	50.5	45.8
	<i>Cumul.</i>		73.7	51.3	50.7	45.2
ST3	13:35	15	70.2	53.4	53.8	46.8
	14:35	15	78.0	57.5	55.5	45.8
	15:40	15	67.9	51.0	49.4	45.9
	<i>Cumul.</i>		78.0	54.0	53.6	46.2

TABLE 5.5: CROSSING SOUTH SITE AREA ATTENDED NOISE SURVEY RESULTS, THURSDAY 18TH MAY 2023

- 5.4.2 Observations made during the attended survey measurements on Thursday 18th May 2023 indicate that the ambient $L_{Aeq,T}$ noise levels were influenced by construction works being undertaken at a development to the west of the National Grid site. Other noise sources included noise from within Metropolitan Police Specialist Training Centre, National Rail railway line, vehicle movements on track access road, small aircraft traffic and wildlife.

Tilbury, Essex

- 5.4.3 The results of the attended noise monitoring undertaken at the Crossing North Site Area on Wednesday 14th June 2023 are presented in 0 of Appendix B and summarised in Table 5.6.

Monitoring Location	Start Time	Dur. (mins)	Measured Noise Levels, dB re. 2×10^{-5} Pa.			
			$L_{Amax,F}$	$L_{A10,T}$	$L_{Aeq,T}$	$L_{A90,T}$
ST4	11:50	15	68.1	52.7	49.4	38.4
	13:00	15	78.3	51.1	53.7	41.3
	13:50	15	83.9	53.4	58.2	41.1
	<i>Cumul.</i>		83.9	52.4	55.2	40.3
ST5	12:15	15	65.5	48.2	47.2	39.7
	13:25	15	69.0	54.1	53.7	47.4
	14:10	15	61.8	47.5	45.9	41.5
	<i>Cumul.</i>		69.0	49.9	50.3	42.9

TABLE 5.6: CROSSING NORTH SITE ATTENDED NOISE SURVEY RESULTS, WEDNESDAY 14TH JUNE 2023

- 5.4.4 Observations made during the attended survey measurements on Wednesday 14th June 2023 indicate that the ambient $L_{Aeq,T}$ noise levels were influenced by industrial works being undertaken within the Tarmac and Euromix Concrete sites to the west of the National Grid site. Other noise sources included an electrical hum from within the National Grid substation, vehicles accessing Hyundai car park and distant operations from P&O port. Other noise sources included vehicle movements on the access road, small aircraft traffic and wildlife.

5.5 Derivation of Ambient Noise Levels

- 5.5.1 Results from the unattended sound measurements obtained at LT1 and LT2 provide an indication of the typical diurnal variation in sound levels whilst the short term attended sound measurements provide an indication of the variation in sound levels in the vicinity of the Gravesend and Tilbury National Grid sites.
- 5.5.2 A comparison of the sample $L_{Aeq,15min}$ sound levels measured at the ST locations with the $L_{Aeq,15min}$ sound levels measured at LT1 and LT2 during coincident measurement periods are presented in Table 5.7 and Table 5.8, respectively. Measurements at ST1, ST2 and ST3 have been compared to LT1, and measurements at ST4 and ST5 have been compared to LT2.

Gravesend, Kent

Time	Ambient Sound Level, dB L _{Aeq,5min}			
	LT1	ST1	ST2	ST3
12:50	45.9	49.7	-	-
12:55	46.2	48.5	-	-
13:00	44.9	50.3	-	-
13:10	45.9	-	47.6	-
13:15	52.1	-	53.1	-
13:20	45.4	-	46.3	-
13:35	45.5	-	-	46.5
13:40	52.5	-	-	55.2
13:45	51	-	-	55.4
13:55	51.5	56.0	-	-
14:00	52.9	57.1	-	-
14:05	53.8	56.1	-	-
14:15	50.5	-	48.0	-
14:20	49.7	-	48.9	-
14:25	51.6	-	54.3	-
14:35	50.4	-	-	53.7
14:40	53.6	-	-	57.0
14:45	50.7	-	-	55.2
15:00	51.9	55.4	-	-
15:05	54.1	56.8	-	-
15:10	52.7	57.2	-	-
15:20	50.4	-	47.9	-
15:25	51.6	-	50.4	-
15:30	53.4	-	52.1	-
15:40	51	-	-	49.1
15:45	50.3	-	-	48.6
15:50	51	-	-	50.3
Average Level Difference	-	+3.7	-0.2	+1.7

TABLE 5.7: COMPARISON OF AMBIENT SOUND LEVELS MEASURED AT LT1 AND THE ATTENDED LOCATIONS (ST1-ST3)

5.5.3 An average difference of 3.7 dB has been calculated at ST1, -0.2 dB at ST2 and 1.7 dB when compared to coincident measurements obtained at LT1.

Tilbury, Essex

Time	Ambient Sound Level, dB L _{Aeq,5min}		
	LT2	ST4	ST5
11:50	47.5	48.7	-
11:55	47.4	48.5	-
12:00	47.4	50.6	-
12:15	44.3	-	44.8
12:20	47.9	-	49.9
12:25	42.5	-	44.9
13:00	45.1	43.9	-
13:05	48.2	48.3	-
13:10	49.7	57.9	-
13:25	49.8	-	48.9
13:30	46.4	-	51.8
13:35	48.8	-	56.7
13:50	63.1	46.3	-
13:55	58.1	62.7	-
14:00	53.5	49.1	-
14:10	46.1	-	45.6
14:15	45.5	-	47.8
14:20	43.3	-	43.2
Average Level Difference	-	-0.4	+2.1

TABLE 5.8: COMPARISON OF AMBIENT SOUND LEVELS MEASURED AT LT2 AND THE ATTENDED LOCATIONS (ST4-ST5)

- 5.5.4 An average difference of -0.4 dB has been calculated at ST4 and 2.1 dB at ST5 when compared to coincident measurements obtained at LT2.
- 5.5.5 The derived day evening and night-time ambient sound levels for each measurement location, based on measurements and derived differences are presented in Table 5.9 and 5.10 below.

Monitoring Location	Receptor Reference	Ambient Sound Level, dB L _{Aeq,T}		
		Daytime (Mon – Fri 07:00 – 19:00, Sat 07:00 – 13:00)	Evening (Mon – Fri 19:00 – 23:00, Sat 13:00 – 23:00)	Night (23:00 – 07:00)
LT1	R1	57	51	52
LT2	R4	53	46	46
ST1	-	61	55	56
ST2	R2	57	51	52
ST3	R3	59	53	54
ST4	R5	57	51	52
ST5	R6	59	53	54

TABLE 5.9: BS-5228 DERRIVED DAY EVENING AND NIGHT AMBIENT SOUND LEVELS AT MEASUREMENT LOCATIONS

Notes: [1] levels presented exclude spurious data identified.

Monitoring Location	Receptor Reference	Ambient Sound Level, dB $L_{Aeq,T}$	
		Daytime (07:00 - 23:00 hrs)	Night (23:00 – 07:00 hrs)
LT1	R1	51	47
LT2	R4	51	46
ST1	-	55	51
ST2	R2	51	47
ST3	R3	53	49
ST4	R5	51	46
ST5	R6	53	48

TABLE 5.10: BS4142 DERRIVED DAY AND NIGHT AMBIENT SOUND LEVELS AT MEASUREMENT LOCATIONS

Notes: [1] levels presented exclude spurious data identified.

5.6 Derivation of Background Sound Assessment Levels

- 5.6.1 The results of the unattended sound monitoring at LT1 and LT2 provide an indication of the diurnal variation in sound levels in the vicinity of the Gravesend and Tilbury sites, whilst the short-term attended sound measurements provide an indication of the variation in sound levels between the unattended monitoring location and the attended monitoring locations ST1, ST2, ST3, ST4 and ST5.

Gravesend, Kent

- 5.6.2 Table 5.11 below presents a comparison of the sample $L_{A90, 5min}$ sound levels measured at the ST attended locations with the $L_{A90,5min}$ sound levels measured at LT1 during coincident measurement periods.

Time	Background Sound Level, dB $L_{A90,5min}$			
	LT1	ST1	ST2	ST3
12:50	42.4	45.2	-	-
12:55	41.9	45.1	-	-
13:00	42.4	45.4	-	-
13:10	42.8	-	43.4	-
13:15	43.8	-	44.0	-
13:20	42.2	-	43.9	-
13:35	41.8	-	-	41.7
13:40	48.1	-	-	45.3
13:45	48.9	-	-	53.3
13:55	49.2	53.0	-	-
14:00	50.2	53.4	-	-
14:05	48.2	51.9	-	-
14:15	48.2	-	45.2	-
14:20	48.1	-	45.8	-
14:25	48.4	-	47.1	-
14:35	48.1	-	-	46.3
14:40	48.8	-	-	45.7
14:45	47.9	-	-	45.4
15:00	48.4	51.9	-	-
15:05	49.6	52.8	-	-
15:10	50.3	55.0	-	-
15:20	48.6	-	45.4	-
15:25	48.6	-	45.9	-
15:30	49.8	-	46.0	-
15:40	49	-	-	45.9
15:45	48.6	-	-	45.7
15:50	48.5	-	-	46.1
Average Level Difference	-	+3.5	-1.5	-1.6

TABLE 5.11: COMPARISON OF BACKGROUND SOUND LEVELS MEASURED AT LT1 AND THE ATTENDED LOCATIONS (ST1-ST3)

- 5.6.3 At ST1 a mean difference of +3.5 dB in the $L_{A90,5min}$ levels was measured. At ST2 a difference of -1.5 dB was measured and at ST3 a difference of -1.6 dB was measured in the $L_{A90,5min}$ levels.
- 5.6.4 The level differences shown in Table 5.11 show that that there was variation between the simultaneous measurements at the attended locations and the unattended monitor. These differences have been applied to the background sound levels measured at LT1.

Tilbury, Essex

- 5.6.5 Table 5.12 below presents a comparison of the sample $L_{A90, 5min}$ sound levels measured at the ST attended locations with the $L_{A90,5min}$ sound levels measured at LT2 during coincident measurement periods.

Time	Background Sound Level, dB $L_{90,5min}$		
	LT2	ST4	ST5
11:50	41.4	37.6	-
11:55	41.2	38.6	-
12:00	41.9	39	-
12:15	41.9	-	40.6
12:20	41.5	-	39.4
12:25	40.6	-	39
13:00	41.7	40.2	-
13:05	41.7	41.3	-
13:10	43.6	42.5	-
13:25	43.8	-	42.8
13:30	42.5	-	43.6
13:35	46.7	-	55.8
13:50	56.4	40.7	-
13:55	56.1	41.1	-
14:00	42.9	41.6	-
14:10	42.3	-	40.8
14:15	42.4	-	42.8
14:20	41.6	-	40.9
Average Level Difference	-	-4.9	+0.3

TABLE 5.12: COMPARISON OF BACKGROUND SOUND LEVELS MEASURED AT LT2 AND THE ATTENDED LOCATIONS (ST4-ST5)

5.6.6 At ST4 a mean difference of -4.9 dB in the $L_{A90,5min}$ levels was measured. At ST2 a difference of +0.3 dB was measured in the $L_{A90,5min}$ levels.

5.6.7 The resulting background sound assessment levels are presented in Table 5.13 and Table 5.14.

Monitoring Location	Background Sound Assessment Level, dB $L_{A90,T}$		
	Receptor Reference	Daytime (07:00 - 23:00 hrs)	Night-time (23:00 - 07:00 hrs)
LT1	R1	45	45
LT2	R4	44	43
ST1	-	49	49
ST2	R2	45	45
ST3	R3	47	47
ST4	R5	44	43
ST5	R6	46	45

TABLE 5.13: BS-5228 DERRIVED DAY AND NIGHT BACKGROUND SOUND LEVELS AT MEASUREMENT LOCATIONS

Notes: [1] levels presented exclude spurious data identified.

Monitoring Location	Background Sound Assessment Level, Db L _{A90,T}			
	Receptor Reference	Daytime (Mon – Fri 07:00 – 19:00, Sat 07:00 – 13:00)	Evening (Mon – Fri 19:00 – 23:00, Sat 13:00 – 23:00)	Night (23:00 – 07:00)
LT1	R1	46	44	45
LT2	R4	45	42	43
ST1	-	50	48	49
ST2	R2	44	42	43
ST3	R3	44	42	43
ST4	R5	41	39	40
ST5	R6	46	44	45

TABLE 5.14: BS4142DERIVED DAY EVENING AND NIGHT BACKGROUND SOUND LEVELS AT MEASUREMENT LOCATIONS

Notes: [1] levels presented exclude spurious data identified.

5.7 Modal Analysis

5.7.1 A histogram of the background L_{A90,T} sound levels measured at LT1 is presented Figure A9 of Appendix A.

5.7.2 Modal analysis of the L_{A90,15min} sound levels measured at LT1 during daytime periods shows a background sound level of 43 dB L_{A90,15min}. Modal analysis of the L_{A90,15min} sound levels measured at LT1 during the night-time periods shows a modal value of 45 dB L_{A90,15min}.

5.7.3 A histogram of the background L_{A90,T} sound levels measured at LT2 is presented Figure A10 of Appendix A.

5.7.4 Modal analysis of the L_{A90,15min} sound levels measured at LT2 during daytime and night-time periods shows background sound levels of 43 dB L_{A90,15min}.

5.8 Attended Vibration Survey Results

Gravesend, Kent

5.8.1 The results of the daytime attended vibration survey at Gravesend are presented with the mean and maximum PPVs presented in Table B5 of Appendix B and summarised in Table 5.15.

Survey Location ID	Start Time	Duration (Minutes)	Measured Vibration Levels, PPV (mms ⁻¹)		
			X-axis	Y-axis	Z-axis
ST1	12:50	5	0.04 (0.07)	0.03 (0.06)	0.07 (0.17)
	13:15	5	0.03 (0.04)	0.03 (0.04)	0.04 (0.05)
ST2	13:35	5	0.04 (0.04)	0.04 (0.04)	0.04 (0.06)
	13:55	5	0.03 (0.03)	0.03 (0.04)	0.04 (0.04)
ST3	14:15	5	0.03 (0.03)	0.03 (0.04)	0.03 (0.04)
	14:35	5	0.04 (0.04)	0.04 (0.04)	0.04 (0.05)

TABLE 5.15: SUMMARY OF GRAVESEND ATTENDED VIBRATION SURVEY RESULTS, THURSDAY 26TH MAY

Notes: - Mean values present the mean maximum PPV values during measurement period; and
- Values in brackets present the Max PPV values during each measurement period.

- 5.8.2 Observations made during the attended vibration surveys identified that vibration measurements at ST1 remained steady with the exception of a passing flatbed lorry.
- 5.8.3 At ST2 and ST3, PPV levels remained steady with no notable vibration events.
- 5.8.4 Average PPV levels during the attended vibration measurements remained below 0.1 mms^{-1} at all survey locations.

Tilbury, Essex

- 5.8.5 The results of the daytime attended vibration survey at Tilbury are presented with the mean and maximum PPVs presented in Table B6 of Appendix B and summarised in Table 5.16.

Survey Location ID	Start Time	Duration (Minutes)	Measured Vibration Levels, PPV (mms^{-1})		
			X-axis	Y-axis	Z-axis
ST4	11:50	5	0.05 (0.09)	0.06 (0.11)	0.11 (0.31)
	12:20	5	0.04 (0.05)	0.03 (0.04)	0.05 (0.07)
ST5	13:00	5	0.09 (0.11)	0.08 (0.11)	0.05 (0.07)
	13:30	5	0.04 (0.04)	0.04 (0.05)	0.05 (0.07)

TABLE 5.16 SUMMARY OF TILBURY ATTENDED VIBRATION SURVEY RESULTS, WEDNESDAY 14TH JUNE

- 5.8.6 Observations made during the attended vibration surveys identified that vibration measurements at ST4 remained steady with the exception of occasional HGV and Hyundai vehicle passes.
- 5.8.7 At ST5, PPV levels remained steady with the occasional Hyundai vehicle pass.
- 5.8.8 Average PPV levels during the attended vibration measurements remained below 0.1 mms^{-1} at all survey locations.

6. SUMMARY

- 6.1.1 A baseline noise and vibration survey has been undertaken on behalf of Baker Hicks to obtain measurements of pre-existing levels at surrounding sensitive receptor locations prior to construction activities associated with the construction of a tunnel between two National Grid sites in Gravesend, Kent and Tilbury, Essex.
- 6.1.2 Unattended and attended noise monitoring has been undertaken to observe the principal sources of noise governing the baseline noise environment and to establish representative baseline background noise levels outside the nearest noise sensitive receptors to the proposed site.
- 6.1.3 The main sources of noise observed in the vicinity of the Gravesend site was construction works from the development next door. Other noise sources noted came from the Metropolitan Police Training Centre and the National Rail railway line located to the southeast and south of the site.
- 6.1.4 The main sources of noise observed in the vicinity of the Tilbury site was operations from the neighbouring Tarmac and Euromix Concrete industrial sites. Other noise sources noted came from within the National Grid substation and the Hyundai Car Park located southwest and west of site.
- 6.1.5 Unattended noise monitoring was undertaken at the Gravesend National Grid site location (LT1) between 16:45 hrs on Tuesday 18th April and 00:00 hrs on Monday 19th June 2023 and at the Tilbury National Grid site (LT2) between 14:30 hrs on Tuesday 18th April and 00:00 hrs on Monday 19th June 2023.
- 6.1.6 Measured noise levels have been processed to derive day, evening and night ambient noise levels for all monitoring locations for use in the assessment of construction noise. Day and night background noise levels have been derived for the use in the assessment of operational noise at residential locations.
- 6.1.7 Construction works were noted to contribute to the noise levels in the vicinity of the Gravesend substation at monitoring location ST3 representing the Metropolitan Police Special Training centre. Daytime observations indicated that level differences due to the construction activity were in the region of 10 dB. Construction noise was not deemed to have unduly impacted noise measurements at ST2 representing the Maritime Training Centre.
- 6.1.8 At LT1 day, evening and night ambient noise levels have been calculated to be 57 dB $L_{Aeq,T}$, 51 dB $L_{Aeq,T}$ and 52 dB $L_{Aeq,T}$ respectively. At LT2 day, evening and night ambient noise levels have been calculated to be 53 dB $L_{Aeq,T}$, 46 dB $L_{Aeq,T}$ and 46 dB $L_{Aeq,T}$ respectively.
- 6.1.9 At LT1 arithmetic mean day and night background noise levels were both calculated to be 45 dB $L_{A90,T}$. Modal analysis of the most frequently occurring measured day and night background noise levels at LT1 indicated levels of 43 dB $L_{A90,T}$ and 45 dB $L_{A90,T}$ respectively. At LT2 day and night arithmetic mean background noise levels were calculated to be 44 dB $L_{A90,T}$ and 43 dB $L_{A90,T}$ respectively. Modal analysis of the most frequently occurring measured day and night background noise levels at LT1 indicated a level of 43 dB $L_{A90,T}$ at both locations.
- 6.1.10 The vibration survey undertaken in the vicinity of the proposed works has found that there are no significant sources of existing vibration prior to the commencement of the construction works. The highest measured vibration magnitude of 0.17 mm s^{-1} measured

within the vicinity of the Gravesend site (ST1) was caused by a flatbed lorry passing. Within the vicinity of the Tilbury site (ST4), the highest measured PPV of 0.31 mms^{-1} was caused by the passing of an HGV.

APPENDIX A: FIGURES

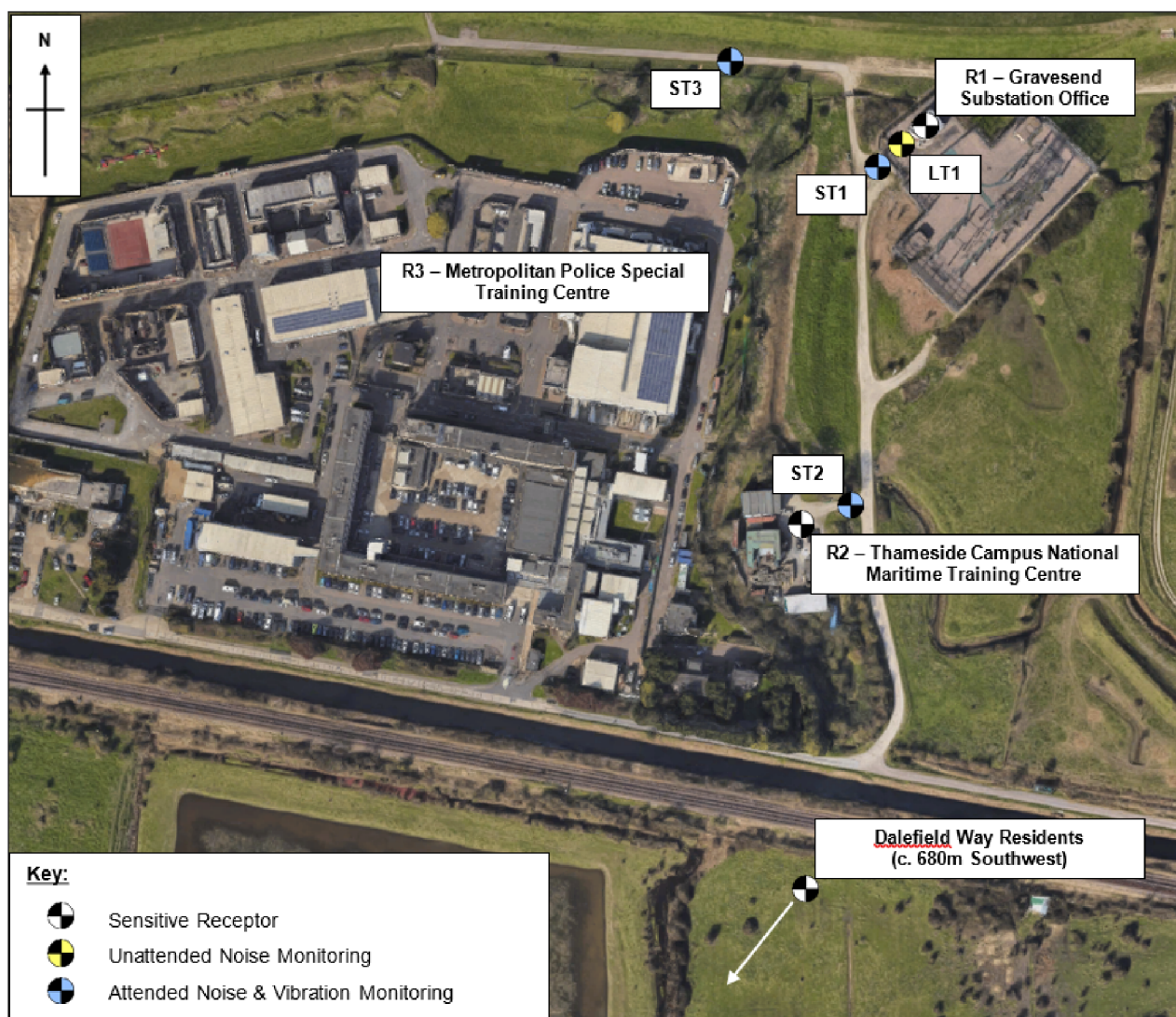


FIGURE A1: GRAVESEND SITE AND BASELINE NOISE AND VIBRATION MONITORING LOCATIONS

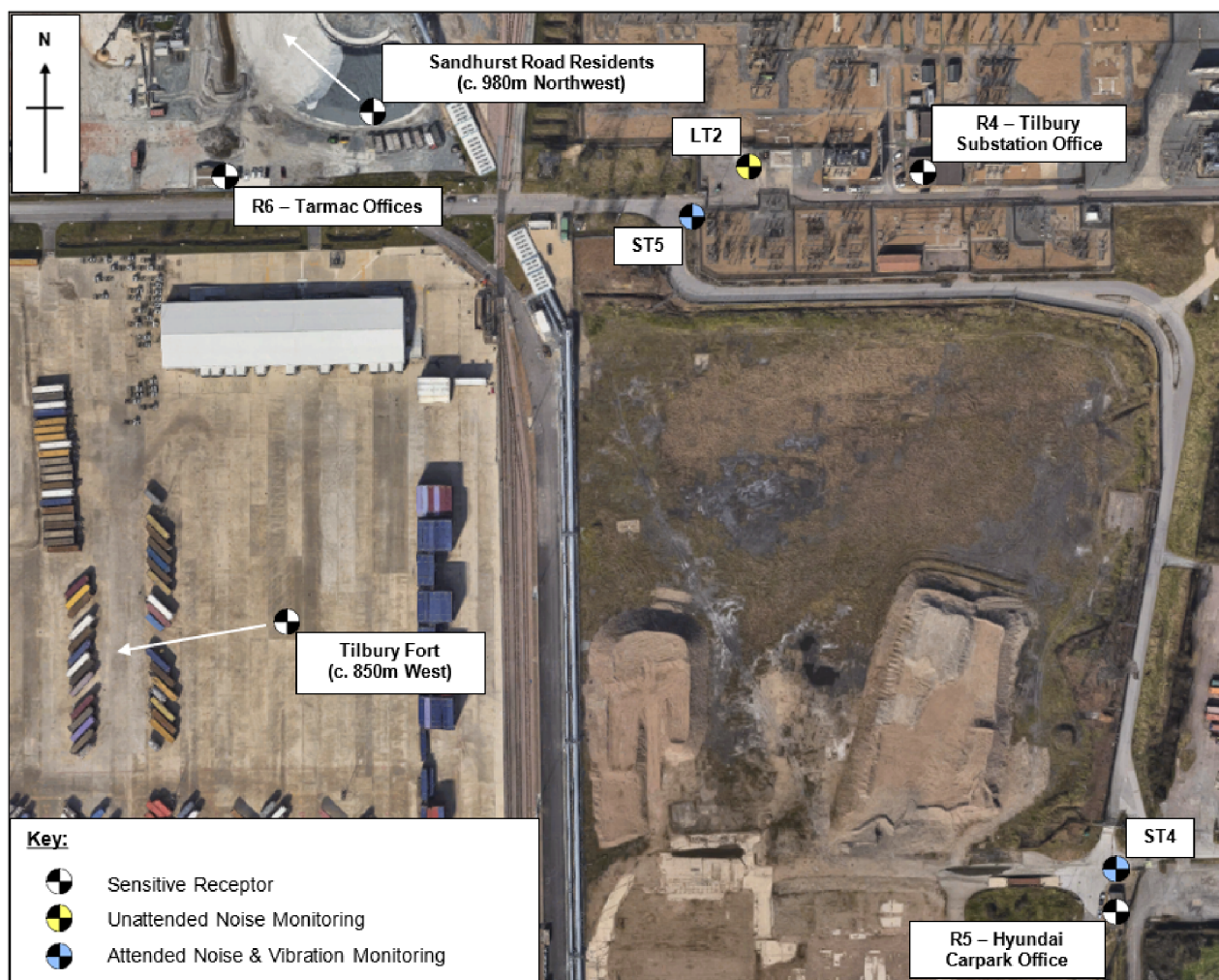


FIGURE A2: GRAVESEND SITE AND BASELINE NOISE AND VIBRATION MONITORING LOCATIONS

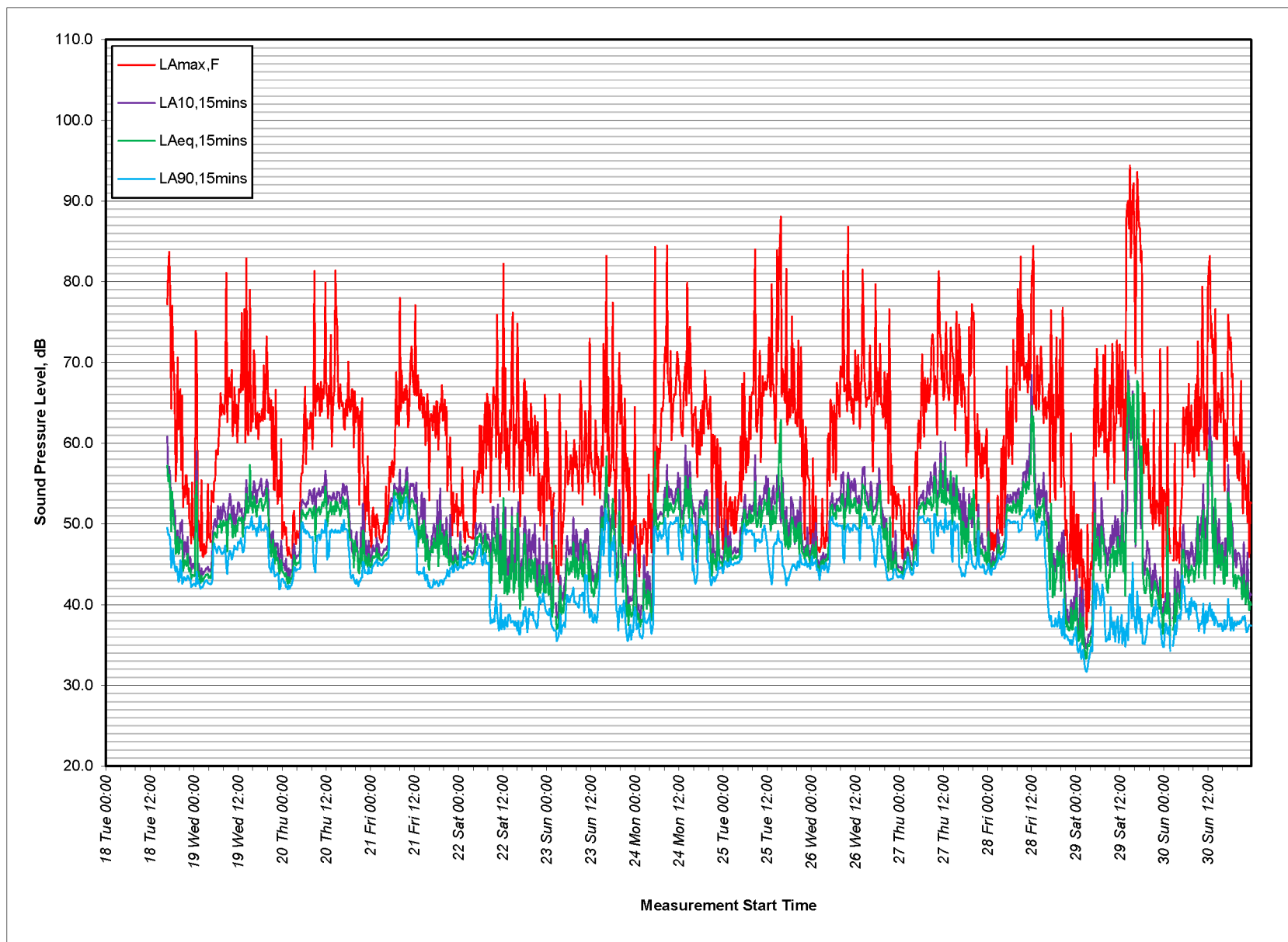


FIGURE A3: UNATTENDED NOISE MONITORING RESULTS AT LT1, APRIL 2023

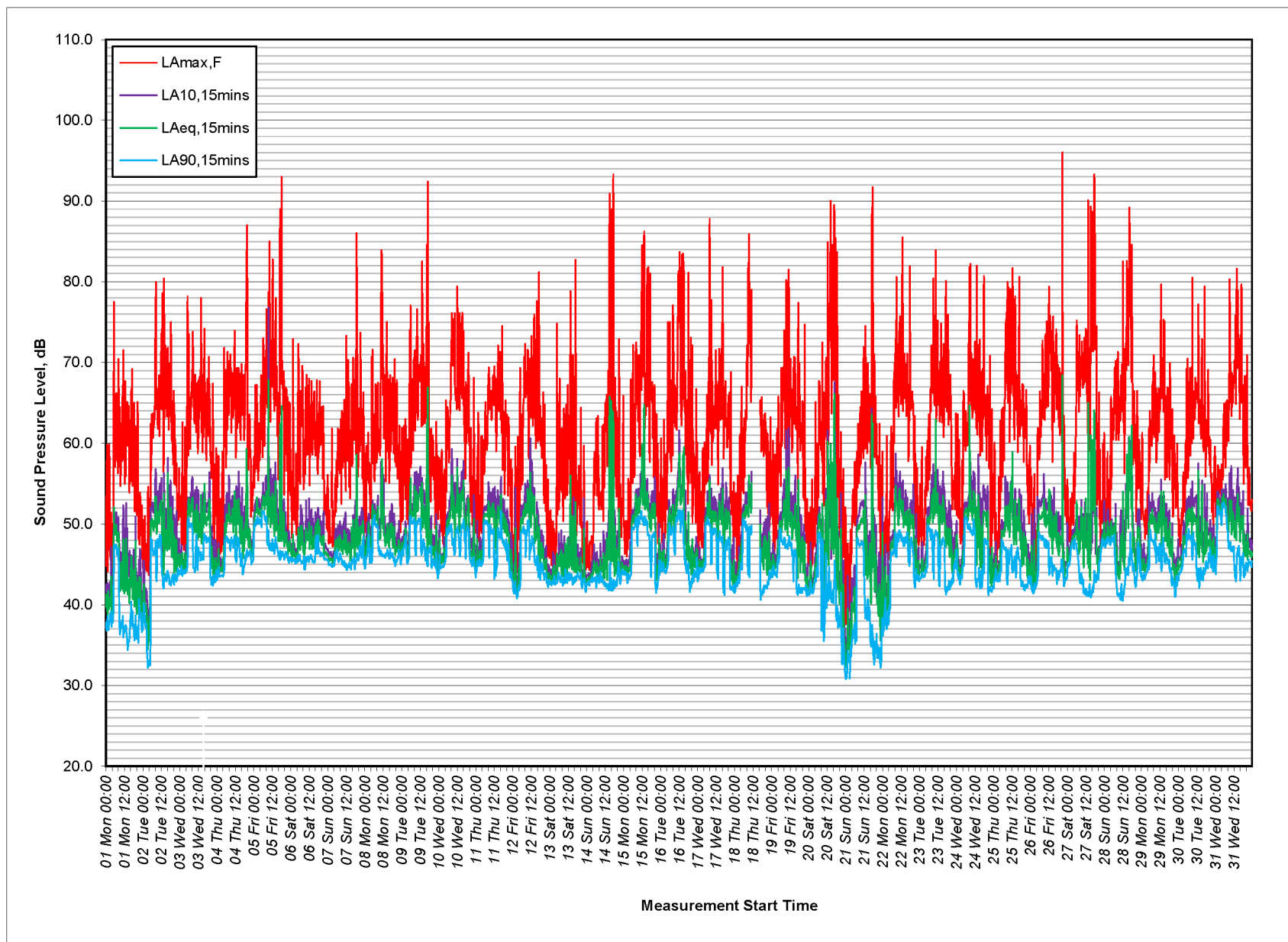


FIGURE A4: UNATTENDED NOISE MONITORING RESULTS AT LT1, MAY 2023

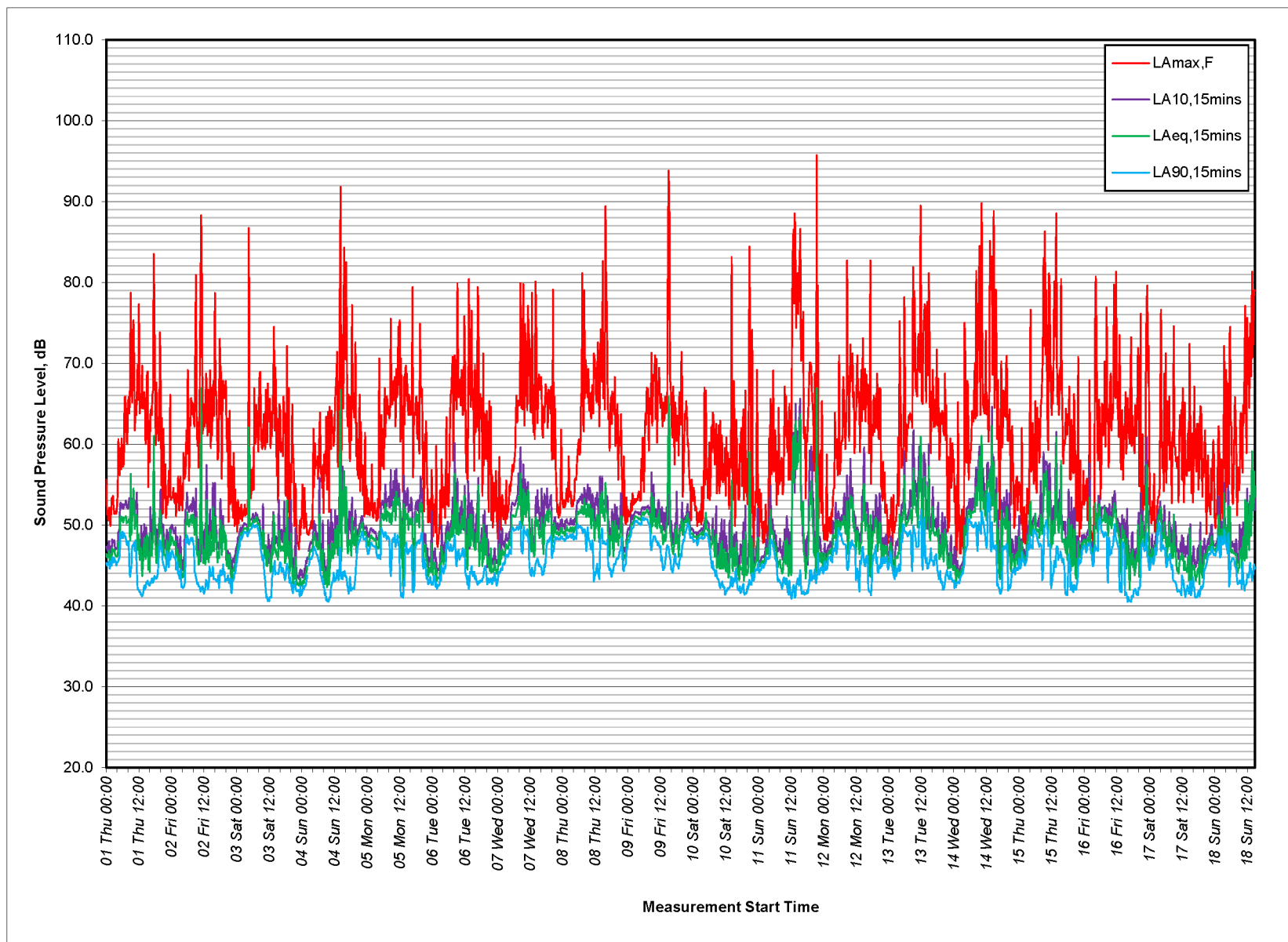


FIGURE A5: UNATTENDED NOISE MONITORING RESULTS AT LT1, JUNE 2023

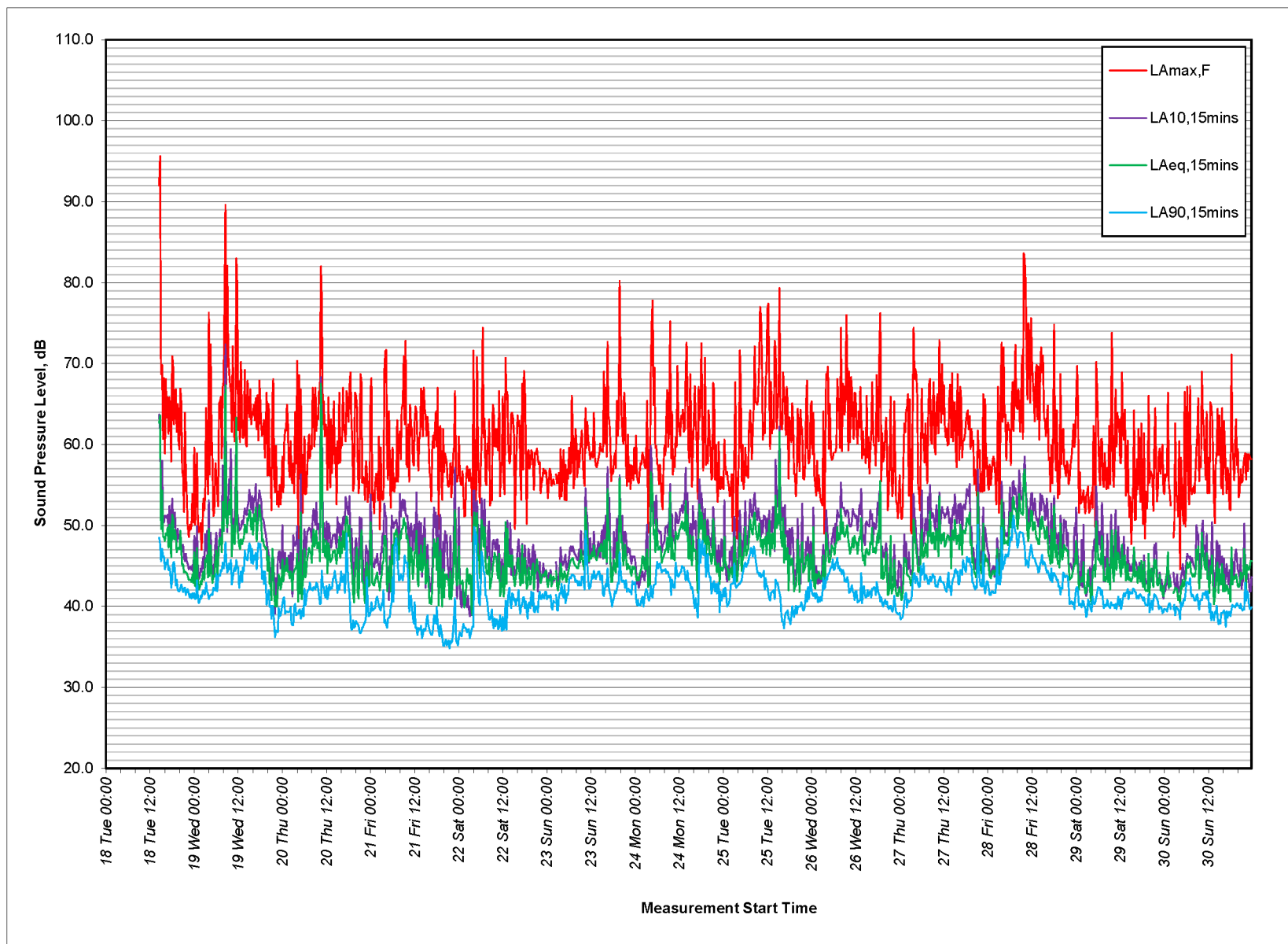


FIGURE A6: UNATTENDED NOISE MONITORING RESULTS AT LT2, APRIL 2023

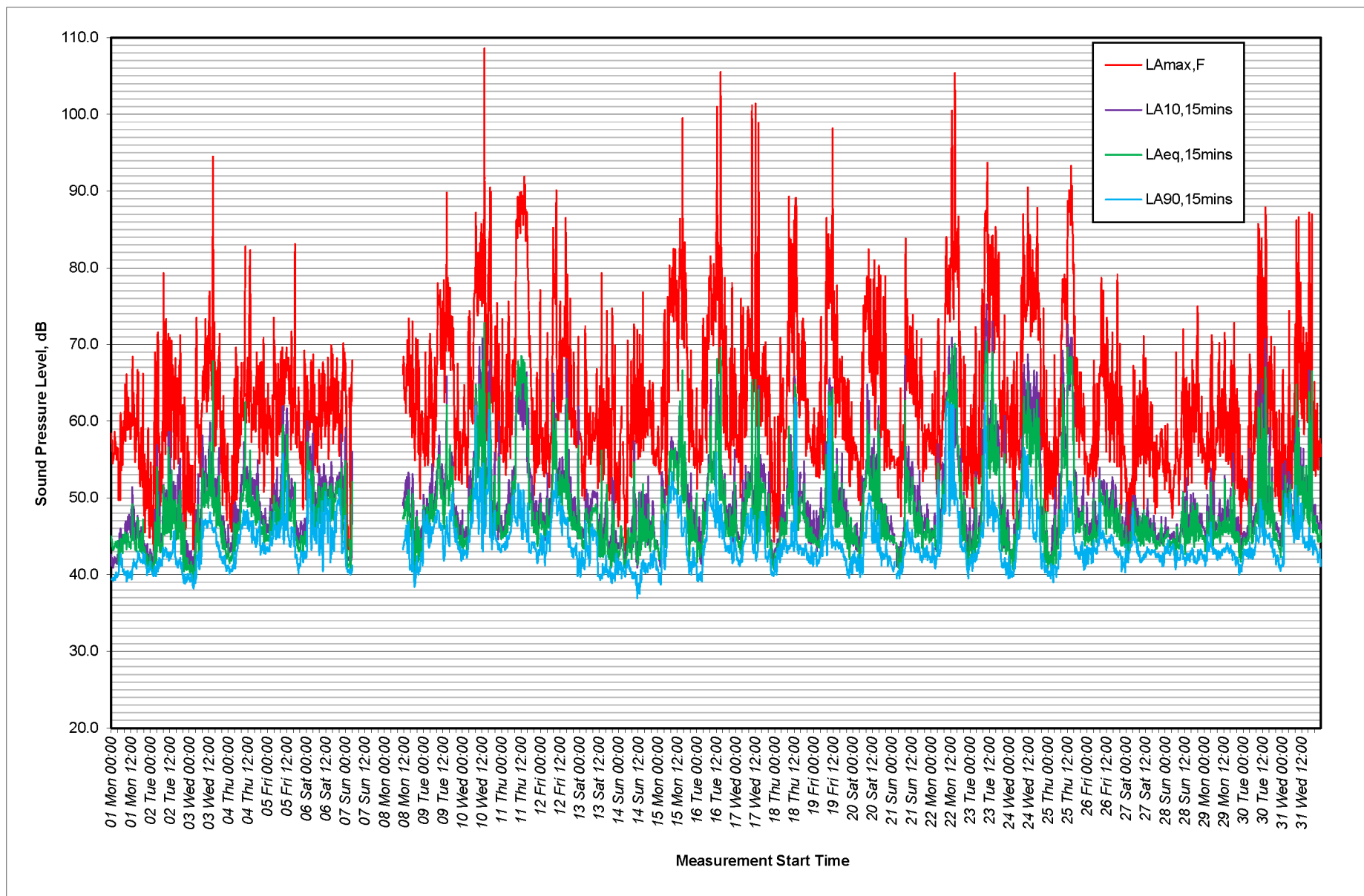


FIGURE A7: UNATTENDED NOISE MONITORING RESULTS AT LT2, MAY 2023

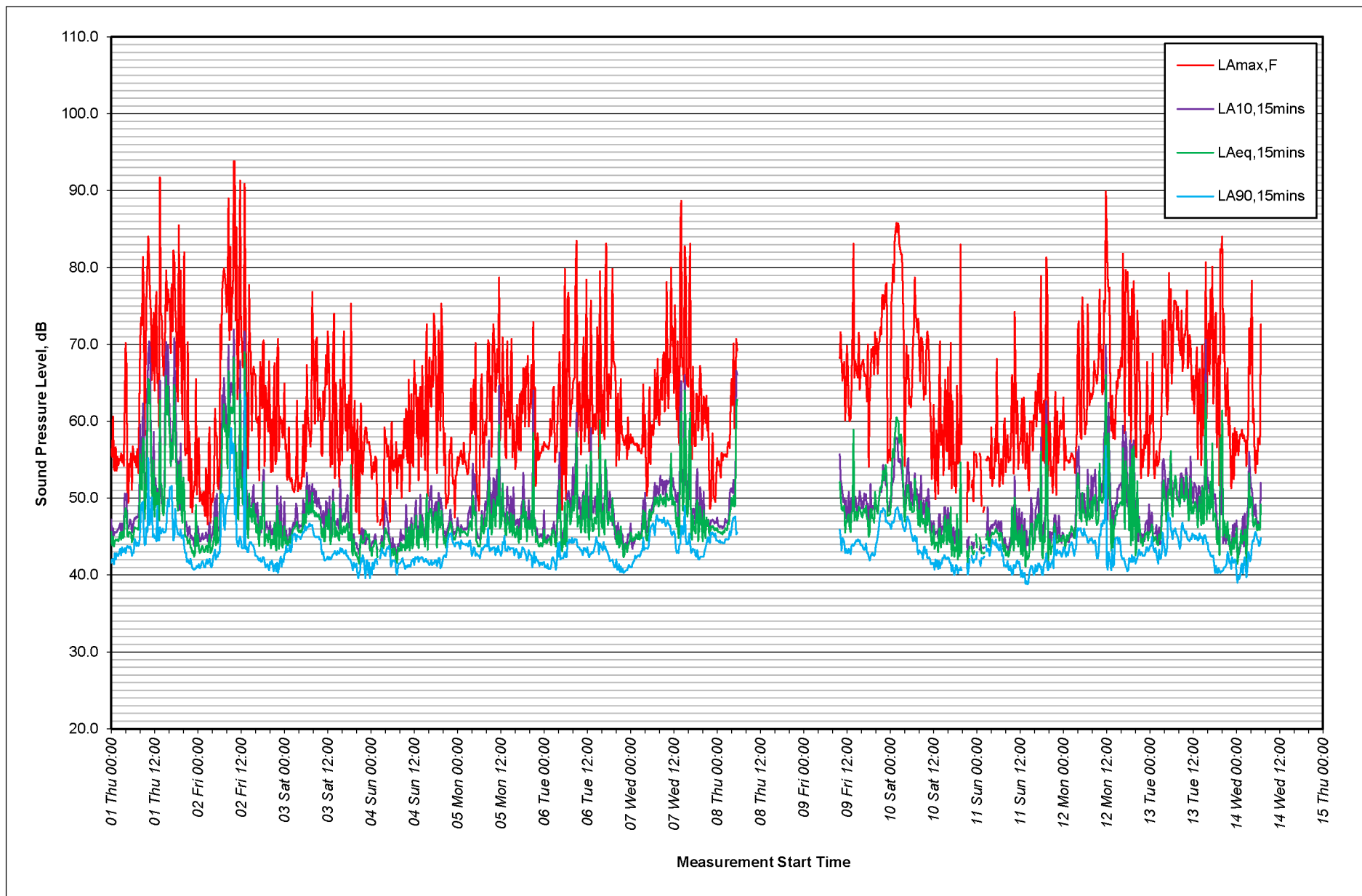


FIGURE A8: UNATTENDED NOISE MONITORING RESULTS AT LT2, JUNE 2023

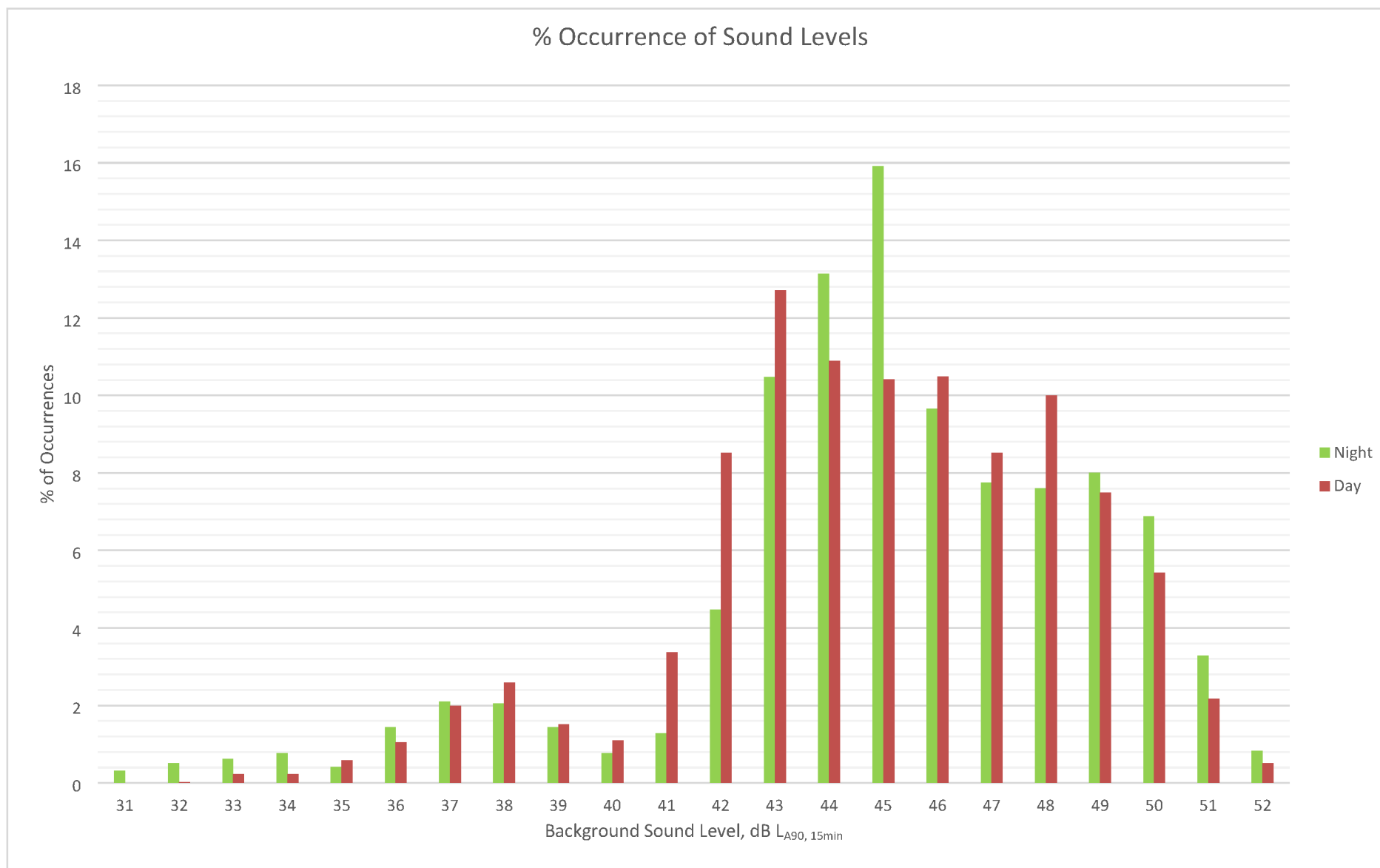


FIGURE A9: STATISTICAL ANALYSIS OF BACKGROUND $L_{A90,15MIN}$ SOUND LEVELS MEASURED AT LT1

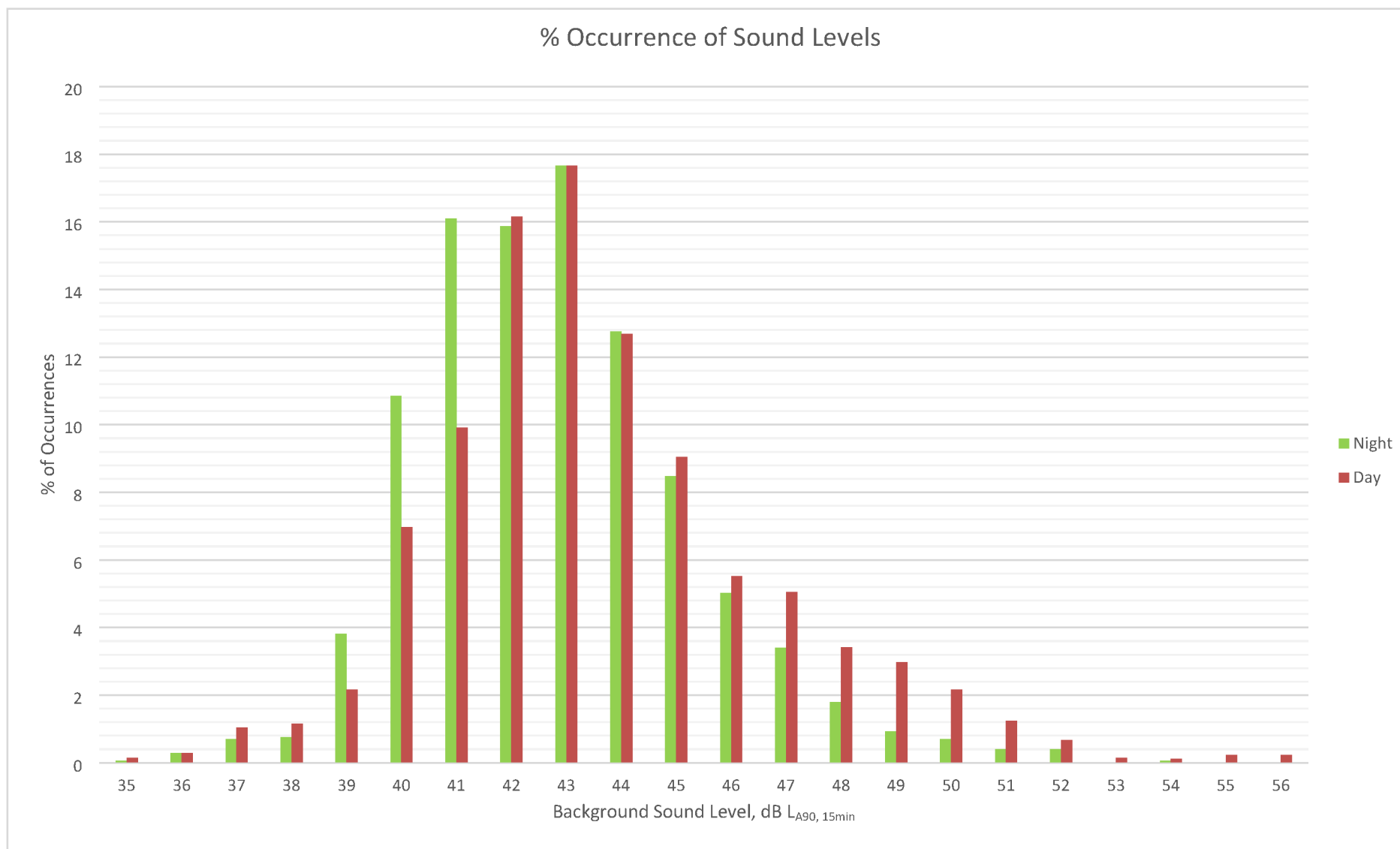


FIGURE A10: STATISTICAL ANALYSIS OF BACKGROUND $L_{A90,15MIN}$ SOUND LEVELS MEASURED AT LT2

APPENDIX B: TABLES

Day	Date	Temperature (°C)			Humidity (%)			Wind Speed (ms ⁻¹)		Precipitation (mm)
		Avg.	Min.	Max.	Avg.	Min.	Max.	Avg.	Max.	Tot.
Tuesday	18-Apr-23	9.1	7.0	10.6	79	65	89	2.1	7.4	0
Wednesday	19-Apr-23	10.0	7.2	13.5	78	56	92	2.3	7.6	0
Thursday	20-Apr-23	9.0	5.3	15.1	71	32	90	1.9	7.3	0.76
Friday	21-Apr-23	8.0	5.9	10.8	87	73	94	0.8	5.1	8.64
Saturday	22-Apr-23	9.9	4.4	16.0	72	40	94	0.5	4.0	0
Sunday	23-Apr-23	10.9	8.7	14.6	86	65	92	0.8	4.7	9.4
Monday	24-Apr-23	9.2	6.3	13.5	77	52	92	0.8	3.8	9.4
Tuesday	25-Apr-23	7.1	2.7	12.1	67	36	87	0.6	4.2	0
Wednesday	26-Apr-23	8.3	4.7	12.1	64	40	81	0.6	4.4	0
Thursday	27-Apr-23	9.7	4.5	15.0	74	39	93	0.8	4.2	5.08
Friday	28-Apr-23	13.7	9.6	18.1	81	58	95	0.8	4.4	0
Saturday	29-Apr-23	11.1	6.0	15.3	77	55	93	1.0	4.9	0
Sunday	30-Apr-23	12.8	6.2	18.8	69	40	94	0.4	3.7	0.25
Monday	01-May-23	13.9	10.2	18.6	71	48	87	0.5	3.3	0
Tuesday	02-May-23	11.1	8.0	13.0	76	57	89	1.6	5.5	0
Wednesday	03-May-23	9.7	6.1	12.3	75	56	88	1.7	6.7	0
Thursday	04-May-23	13.1	9.7	18.2	78	65	88	1.8	6.8	0
Friday	05-May-23	15.3	11.6	20.4	74	48	90	1.2	5.6	0
Saturday	06-May-23	13.6	11.2	15.7	88	79	93	0.5	3.8	2.79
Sunday	07-May-23	16.0	12.5	21.0	77	51	93	0.7	3.3	0
Monday	08-May-23	14.0	10.2	17.7	82	62	94	0.9	4.9	0.25
Tuesday	09-May-23	14.6	11.4	19.4	86	60	94	0.7	3.3	8.64
Wednesday	10-May-23	14.1	10.3	19.8	77	41	95	0.8	4.8	0.25
Thursday	11-May-23	13.3	9.7	18.5	76	47	91	0.5	3.3	0
Friday	12-May-23	11.3	10.0	14.5	88	72	93	1.0	4.4	0.76
Saturday	13-May-23	11.5	9.6	14.3	85	74	91	0.7	3.2	0
Sunday	14-May-23	13.5	8.1	20.9	76	43	94	0.4	2.3	0
Monday	15-May-23	13.2	8.0	15.9	66	45	90	0.8	4.0	0.25
Tuesday	16-May-23	12.5	6.4	19.1	65	35	87	0.5	3.1	0
Wednesday	17-May-23	12.5	7.7	17.9	75	47	89	0.8	4.7	0
Thursday	18-May-23	12.6	8.0	17.0	72	52	91	0.9	5.3	0
Friday	19-May-23	11.7	6.6	16.2	74	54	91	0.9	5.3	0
Saturday	20-May-23	13.9	8.4	19.6	65	39	91	1.4	5.8	0
Sunday	21-May-23	13.6	8.2	17.6	68	51	90	1.1	5.3	0
Monday	22-May-23	14.6	11.0	20.2	67	48	84	0.7	3.6	0
Tuesday	23-May-23	12.9	9.1	17.6	69	47	91	1.0	5.7	0
Wednesday	24-May-23	14.9	8.3	22.0	66	43	89	0.7	4.0	0
Thursday	25-May-23	13.2	10.0	16.0	77	61	92	1.3	6.2	0

Day	Date	Temperature (°C)			Humidity (%)			Wind Speed (ms ⁻¹)		Precipitation (mm)
		Avg.	Min.	Max.	Avg.	Min.	Max.	Avg.	Max.	Tot.
Friday	26-May-23	12.4	9.2	15.9	72	49	88	2.1	7.3	0
Saturday	27-May-23	12.6	8.8	17.0	76	54	92	1.5	5.4	0
Sunday	28-May-23	14.0	7.5	20.0	66	90	93	1.7	6.7	0
Monday	29-May-23	12.3	8.7	15.6	69	55	83	2.3	7.7	0
Tuesday	30-May-23	12.5	9.7	15.1	73	61	81	2.4	6.5	0
Wednesday	31-May-23	13.4	10.3	18.2	79	63	93	2.2	6.5	0
Thursday	01-Jun-23	12.8	10.3	16.7	77	64	85	2.1	5.6	0
Friday	02-Jun-23	12.7	10.4	16.1	68	52	82	2.3	6.7	0
Saturday	03-Jun-23	14.3	8.5	20.1	70	47	90	1.6	6.9	0
Sunday	04-Jun-23	14.4	9.5	19.5	69	40	89	1.6	6.4	0
Monday	05-Jun-23	13.1	10.7	16.8	73	56	83	1.9	5.0	0
Tuesday	06-Jun-23	13.4	11.7	16.2	73	65	78	2.1	6.1	0
Wednesday	07-Jun-23	13.3	10.9	17.2	77	66	84	2.0	6.7	0
Thursday	08-Jun-23	14.1	11.2	18.3	76	64	83	2.1	6.4	0
Friday	09-Jun-23	16.4	11.8	21.0	78	63	89	1.9	6.5	0
Saturday	10-Jun-23	20.0	13.1	25.9	70	48	92	1.6	6.2	0
Sunday	11-Jun-23	20.9	14.1	27.7	68	47	88	1.0	5.0	0
Monday	12-Jun-23	21.0	16.6	26.6	73	53	88	0.9	5.0	0
Tuesday	13-Jun-23	19.4	11.7	25.5	59	34	89	1.4	6.7	0
Wednesday	14-Jun-23	18.4	11.7	24.6	62	35	85	1.3	5.9	0
Thursday	15-Jun-23	18.9	11.3	25.2	64	34	90	1.2	4.9	0
Friday	16-Jun-23	18.8	12.0	25.8	63	33	91	1.1	0.6	0
Saturday	17-Jun-23	17.4	11.1	21.3	73	58	88	1.2	5.3	1.02
Sunday	18-Jun-23	19.8	16.4	26.5	83	52	94	0.6	4.6	6.35

TABLE B1: NORTHFLEET WEATHER RECORD OBTAINED FOR SURVEY PERIOD

TABLE B2: UNATTENDED BASELINE NOISE MONITORING RESULTS AT LT1. *SUPPLEMENTED DOCUMENT*

TABLE B3: UNATTENDED BASELINE NOISE MONITORING RESULTS AT LT2. *SUPPLEMENTED DOCUMENT*

Monitoring Location	Start Time	Dur. (mins)	Measured Noise Levels, dB re. 2 x 10 ⁻⁵ Pa.				Comments
			L _{Amax,F}	L _{A10,T}	L _{Aeq,T}	L _{A90,T}	
ST1	12:50	15	67.9	51.3	49.6	45.2	Main source: construction works next door (50 dB with, 45 dB without). Other sources: light aircraft, police training L90: Birds, wind in trees, police ventilation hum. Lmax: flatbed pass (67.9 dB)
ST2	13:10	15	67.1	50.9	50.1	43.8	Main source: Met police training. L90: Distant construction works audible – crane movements/banging; Other sources: Train pass, light aircraft. L90: Birds, wind in trees, police ventilation hum, light aircraft. Lmax: Police training / plane overhead (67.1 dB)
ST3	13:35	15	70.2	53.4	53.8	46.8	Main source: Construction works next door + compressor (55 dB with, 42 dB without construction works). Other sources: light aircraft. L90: Birds, wind in trees, police ventilation hum, pedestrians. Lmax: plane overhead (70 dB)
ST1	13:55	15	69.4	52.0	56.4	52.8	Main source: construction works next door + angle grinder. Other sources: light aircraft L90: Birds, wind in trees, police ventilation hum. Lmax: plane overhead (69.4 dB)
ST2	14:15	15	73.3	52.0	51.4	46.0	Main source: Police centre ventilation system & police training. No construction works audible. Other sources: Train pass, plane overhead. L90: Birds, wind in trees. Lmax: Car pass (73.3 dB)
ST3	14:35	15	78.0	57.5	55.5	45.8	Main source: Construction works next door (55 dB with works, 45 dB without). Other sources: light aircraft. L90: Birds, wind in trees, police ventilation hum, light aircraft, pedestrians Lmax: Hammering from construction works (78 dB)
ST1	15:00	15	71.1	51.1	56.5	53.2	Main source: Construction works next door. Other sources: light aircraft, vehicle passes L90: Birds, wind in trees, police ventilation hum. Lmax: Plane overhead (71.1 dB)
ST2	15:20	15	73.7	51.1	50.5	45.8	Main source: Police centre ventilation system & police training. L90: Distant construction works, birds, wind in trees. Other sources: wildlife/roosters Lmax: Van pass (73.3 dB)
ST3	15:40	15	67.9	51.0	49.4	45.9	Main source: Construction works next door. Other sources: Distant train pass, light aircraft, helicopter & ship horn in Thames. L90: Birds, wind in trees.

TABLE B4: ATTENDED BASELINE NOISE MONITORING RESULTS AT GRAVESEND, THURSDAY 18TH MAY 2023

Monitoring Location	Start Time	Dur. (mins)	Measured Noise Levels, dB re. 2 x 10 ⁻⁵ Pa.				Comments
			L _{Amax,F}	L _{A10,T}	L _{Aeq,T}	L _{A90,T}	
ST4	11:50	15	68.1	52.7	49.4	38.4	Main source: Birds, cars arriving / leaving Hyundai yard. Other sources: distant industrial operations, aircraft. L90: Wind in trees. Lmax: car pass (68.1 dB)
ST5	12:15	15	65.5	48.2	47.2	39.7	Main source: Electrical Hum/buzz from substation. Other sources: neighbouring industrial operations, Hyundai vehicle passes. L90: Birds, wind in trees. Lmax: substation access gate alarm (68.1 dB)
ST4	13:00	15	78.3	51.1	53.7	41.3	Main source: Birds, radio from Hyundai security hut. Other sources: distant industrial operations, aircraft, digger/grabber movements south of location, occasional cars leaving/arriving Hyundai yard. L90: Wind in trees, creaking metal gate. Lmax: HGV pass (78.3 dB)
ST5	13:25	15	69.0	54.1	53.7	47.4	Main source: Electrical Hum/buzz from substation. Other sources: neighbouring industrial operations, Hyundai vehicle passes. HGV arriving and waiting at substation gate approx. 5mins (56 dB). L90: Birds, wind in trees. Lmax: crashing/banging from neighbouring industrial works (69 dB)
ST4	13:50	15	83.9	53.4	58.2	41.1	Main source: Birds, wind in trees, metal gate. Other sources: aircraft, cars leaving/arriving Hyundai yard. L90: Distant industrial noise from neighbouring sites. Lmax: Digger pass (83.9 dB). Light aircraft overhead (57.4 dB)
ST5	14:10	15	61.8	47.5	45.9	41.5	Main source: Electrical Hum/buzz from substation. Other sources: neighbouring industrial operations, Hyundai vehicle passes. Car pass (60 dB). L90: Birds, wind in trees, distant plant/sirens. Lmax: crashing/banging from neighbouring industrial works (61.8 dB)

TABLE B4 CTD.: ATTENDED BASELINE NOISE MONITORING RESULTS AT TILBURY, WEDNESDAY 14TH JUNE 2023

Location	Time	Dur (mins)	Measured Vibration Levels, PPV (mms ⁻¹)			Comments
			X	Y	Z	
ST1	12:50	5	0.04 (0.07)	0.03 (0.06)	0.07 (0.17)	Flatbed lorry pass - 0.17, Footfall - 0.06.
ST2	13:15	5	0.03 (0.04)	0.03 (0.04)	0.04 (0.05)	PPVs steady throughout.
ST3	13:35	5	0.04 (0.04)	0.04 (0.04)	0.04 (0.06)	PPVs steady throughout, Footfall - 0.06.
ST1	13:55	5	0.03 (0.03)	0.03 (0.04)	0.04 (0.04)	PPVs steady throughout.
ST2	14:15	5	0.03 (0.03)	0.03 (0.04)	0.03 (0.04)	PPVs steady throughout.
ST3	14:35	5	0.04 (0.04)	0.04 (0.04)	0.04 (0.05)	PPVs steady throughout.

TABLE B5: ATTENDED BASELINE VIBRATION MONITORING RESULTS AT GRAVESEND, THURSDAY 18TH MAY 2023

Location	Time	Dur (mins)	Measured Vibration Levels, PPV (mms ⁻¹)			Comments
			X	Y	Z	
ST4	11:50	5	0.05 (0.09)	0.06 (0.11)	0.11 (0.31)	HGV pass - 0.31, Vehicle pass – 0.11.
ST5	12:20	5	0.04 (0.05)	0.03 (0.04)	0.05 (0.07)	Vehicle pass – 0.07
ST4	13:00	5	0.09 (0.11)	0.08 (0.11)	0.05 (0.07)	Vehicle pass – 0.07 and 0.11
ST5	13:30	5	0.04 (0.04)	0.04 (0.05)	0.05 (0.07)	Vehicle pass – 0.07

TABLE B6: ATTENDED BASELINE VIBRATION MONITORING RESULTS AT TILBURY, WEDNESDAY 14TH JUNE 2023

APPENDIX C: CALIBRATION CERTIFICATES



CERTIFICATE OF CALIBRATION



0653

Date of Issue: 04 April 2023

Certificate Number: UCRT23/1471

Calibrated at & Certificate issued by:

ANV Measurement Systems

Beaufort Court

17 Roebuck Way

Milton Keynes MK5 8HL

Telephone 01908 642846 Fax 01908 642814

E-Mail: info@noise-and-vibration.co.uk

Web: www.noise-and-vibration.co.uk

Acoustics Noise and Vibration Ltd trading as ANV Measurement Systems

Page 1 of 2 Pages
Approved Signatory
K. Mistry

Customer Southdowns Environmental Consultants Limited
16 Station Street
Lewes
East Sussex
BN7 2DB

Order No. X_EQUIPMENT/923

Description Sound Level Meter / Pre-amp / Microphone / Associated Calibrator

Identification	Manufacturer	Instrument	Type	Serial No. / Version
	Rion	Sound Level Meter	NL-52	00643062
	Rion	Firmware		2.0
	Rion	Pre Amplifier	NH-25	43090
	Rion	Microphone	UC-59	06989
	Rion	Calibrator	NC-74	34536109
		Calibrator adaptor type if applicable		NC-74-002

Performance Class 1

Test Procedure TP 2.SLM 61672-3 TPS-49

Procedures from IEC 61672-3:2006 were used to perform the periodic tests.

Type Approved to IEC 61672-1:2002 YES **Approval Number** 21.21 / 13.02

If YES above there is public evidence that the SLM has successfully completed the applicable pattern evaluation tests of IEC 61672-2:2003

Date Received

03 April 2023

ANV Job No.

UKAS23/04246

Date Calibrated

04 April 2023

The sound level meter submitted for testing has successfully completed the class 1 periodic tests of IEC 61672-3:2006, for the environmental conditions under which the tests were performed. As public evidence was available, from an independent testing organisation responsible for approving the results of pattern evaluation tests performed in accordance with IEC 61672-2:2003, to demonstrate that the model of sound level meter fully conformed to the requirements in IEC 61672-1:2002, the sound level meter submitted for testing conforms to the class 1 requirements of IEC 61672-1:2002.

Previous Certificate	Dated	Certificate No.	Laboratory
	25 August 2021	UCRT21/2037	0653

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FIGURE C1: LT1 UNATTENDED MONITOR CALIBRATION CERTIFICATE – NL-52 S/N 643062

CERTIFICATE OF CALIBRATION

UKAS Accredited Calibration Laboratory No. 0653

Certificate Number

UCRT23/1471

Page 2 of 2 Pages

Sound Level Meter Instruction manual and data used to adjust the sound levels indicated.

SLM instruction manual title	Sound Level Meter	NL-42 / NL-52
SLM instruction manual ref / issue		11-03
SLM instruction manual source	Manufacturer	
Internet download date if applicable	N/A	
Case corrections available	Yes	
Uncertainties of case corrections	Yes	
Source of case data	Manufacturer	
Wind screen corrections available	Yes	
Uncertainties of wind screen corrections	Yes	
Source of wind screen data	Manufacturer	
Mic pressure to free field corrections	Yes	
Uncertainties of Mic to F.F. corrections	Yes	
Source of Mic to F.F. corrections	Manufacturer	
Total expanded uncertainties within the requirements of IEC 61672-1:2002	Yes	
Specified or equivalent Calibrator	Specified	
Customer or Lab Calibrator	Lab Calibrator	
Calibrator adaptor type if applicable	NC-74-002	
Calibrator cal. date	23 March 2023	
Calibrator cert. number	UCRT23/1384	
Calibrator cal cert issued by	0653	
Calibrator SPL @ STP	94.04	dB Calibration reference sound pressure level
Calibrator frequency	1001.98	Hz Calibration check frequency
Reference level range	25 - 130	dB

Accessories used or corrected for during calibration - Extension Cable & Wind Shield WS-15
Note - if a pre-amp extension cable is listed then it was used between the SLM and the pre-amp.

Environmental conditions during tests	Start	End	
Temperature	22.61	22.70	± 0.30 °C
Humidity	38.6	34.2	± 3.00 %RH
Ambient Pressure	101.78	101.75	± 0.03 kPa

Response to associated Calibrator at the environmental conditions above.

Initial indicated level	94.0	dB	Adjusted indicated level	94.0	dB
The uncertainty of the associated calibrator supplied with the sound level meter ±				0.10	dB

Self Generated Noise This test is currently not performed by this Lab.

Microphone installed (if requested by customer) = Less Than	N/A	dB	A Weighting
Uncertainty of the microphone installed self generated noise ±	N/A	dB	

Microphone replaced with electrical input device - UR = Under Range Indicated

Weighting	A	C	Z
	11.5	15.4	21.2
	dB	dB	dB
	UR	UR	UR

Uncertainty of the electrical self generated noise ± 0.12 dB

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor $k=2$, providing a coverage probability of approximately 95%. The uncertainty evaluation has been carried out in accordance with UKAS requirements.

For the test of the frequency weightings as per paragraph 12. of IEC 61672-3:2006 the actual microphone free field response was used.

The acoustical frequency tests of a frequency weighting as per paragraph 11 of IEC 61672-3:2006 were carried out using an electrostatic actuator.

END

Calibrated by: K. Zablocki

R 1

Additional Comments The results on this certificate only relate to the items calibrated as identified above.

None

FIGURE C1(CTD): LT1 UNATTENDED MONITOR CALIBRATION CERTIFICATE – NL-52 S/N 643062



CERTIFICATE OF CALIBRATION



0653

Date of Issue: 18 November 2021

Certificate Number: UCRT21/2423

Calibrated at & Certificate issued by:

ANV Measurement Systems

Beaufort Court

17 Roebuck Way

Milton Keynes MK5 8HL

Telephone 01908 642846 Fax 01908 642814

E-Mail: info@noise-and-vibration.co.uk

Web: www.noise-and-vibration.co.uk

Acoustics Noise and Vibration Ltd trading as ANV Measurement Systems

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Approved Signatory				
K. Mistry				

Customer Southdowns Environmental Consultants Limited
Suite A3
16 Station Street
Lewes
East Sussex
BN7 2DB

Order No. X_EQUIPMENT/735

Description Sound Level Meter / Pre-amp / Microphone / Associated Calibrator

Identification	Manufacturer	Instrument	Type	Serial No. / Version
	Rion	Sound Level Meter	NL-52	00564786
	Rion	Firmware		2.0
	Rion	Pre Amplifier	NH-25	64911
	Rion	Microphone	UC-59	08848
	Rion	Calibrator	NC-74	34315170
		Calibrator adaptor type if applicable		NC-74-002

Performance Class 1

Test Procedure TP 10. SLM 61672-3:2013

Procedures from IEC 61672-3:2013 were used to perform the periodic tests.

Type Approved to IEC 61672-1:2013 Yes

If YES above there is public evidence that the SLM has successfully completed the applicable pattern evaluation tests of IEC 61672-2:2013

Date Received 15 November 2021

ANV Job No. UKAS21/11750

Date Calibrated 18 November 2021

The sound level meter submitted for testing has successfully completed the periodic tests of IEC 61672-3:2013, for the environmental conditions under which the tests were performed. As evidence was publicly available, from an independent testing organisation responsible for approving the results of pattern-evaluation tests performed in accordance with IEC 61672-2:2013, to demonstrate that the model of sound level meter fully conformed to the class 1 specifications in IEC 61672-1:2013, the sound level meter submitted for testing conforms to the class 1 specifications of IEC 61672-1:2013.

Previous Certificate	Dated	Certificate No.	Laboratory
	27 September 2019	TCRT19/1742	ANV Measurement Systems

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FIGURE C2: LT2 UNATTENDED MONITOR CALIBRATION CERTIFICATE – NL-52 S/N 564786

CERTIFICATE OF CALIBRATION	Certificate Number UCRT21/2423
	Page 2 of 2 Pages

UKAS Accredited Calibration Laboratory No. 0653

Sound Level Meter Instruction manual and data used to adjust the sound levels indicated.

SLM instruction manual title NL-52/NL-42 Description for IEC 61672-1			
SLM instruction manual ref / issue No. 56034 21-03		Source Rion	
Date provided or internet download date 19 March 2021			
	Case Corrections	Wind Shield Corrections	Mic Pressure to Free Field Corrections
Uncertainties provided	Yes	Yes	Yes
Total expanded uncertainties within the requirements of IEC 61672-1:2013			YES
Specified or equivalent Calibrator		Specified	
Customer or Lab Calibrator		Customers Calibrator	
Calibrator adaptor type if applicable		NC-74-002	
Calibrator cal. date		16 November 2021	
Calibrator cert. number		UCRT21/2414	
Calibrator cal cert issued by Lab		0653	
Calibrator SPL @ STP		94.02 dB	Calibration reference sound pressure level
Calibrator frequency		1001.56 Hz	Calibration check frequency
Reference level range		Single	dB

Accessories used or corrected for during calibration - Extension Cable & Wind Shield WS-15

Note - The Extension Cable was used between the SLM and the pre-amp for this calibration.

Environmental conditions during tests	Start	End	
Temperature	24.18	23.97	± 0.30 °C
Humidity	44.5	44.7	± 3.00 %RH
Ambient Pressure	101.74	101.73	± 0.03 kPa

Indication at the Calibration Check Frequency			
Initial indicated level	94.1 dB	Adjusted indicated level	94.0 dB
Uncertainty of calibrator used for Indication at the Calibration Check Frequency ±			0.10 dB

Self Generated Noise	
Microphone installed -	Less Than 18.7 dB A Weighting
Microphone replaced with electrical input device -	
UR = Under Range indicated	
Weighting	A C Z
12.6 dB UR	16.8 dB UR 23.4 dB UR

Self Generated Noise reported for information only and not used to assess conformance to a requirement

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor $k=2$, providing a coverage probability of approximately 95%. The uncertainty evaluation has been carried out in accordance with UKAS requirements.

Additional Comments The results on this certificate only relate to the items calibrated as identified above.

None

..... END
 Calibrated by: C. Hirlav R 3

FIGURE C2 (CTD): LT2 UNATTENDED MONITOR CALIBRATION CERTIFICATE – NL-52 S/N 564786



CERTIFICATE OF CALIBRATION



0653

Date of Issue: 06 January 2022

Certificate Number: UCRT22/1011

Calibrated at & Certificate issued by:

ANV Measurement Systems

Beaufort Court

17 Roebuck Way

Milton Keynes MK5 8HL

Telephone 01908 642846 Fax 01908 642814

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Web: www.noise-and-vibration.co.uk

Acoustics Noise and Vibration Ltd trading as ANV Measurement Systems

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Approved Signatory

K. Mistry

Customer Southdowns Environmental Consultants Limited
Suite A3
16 Station Street
Lewes
East Sussex
BN7 2DB

Order No. X_EQUIPMENT/741

Description Sound Level Meter / Pre-amp / Microphone / Associated Calibrator

Identification	Manufacturer	Instrument	Type	Serial No. / Version
	Rion	Sound Level Meter	NL-52	00553890
	Rion	Firmware		2.0
	Rion	Pre Amplifier	NH-25	43934
	Rion	Microphone	UC-59	08043
	Rion	Calibrator	NC-74	34536109
		Calibrator adaptor type if applicable		NC-74-002

Performance Class 1

Test Procedure TP 2.SLM 61672-3 TPS-49

Procedures from IEC 61672-3:2006 were used to perform the periodic tests.

Type Approved to IEC 61672-1:2002 YES Approval Number 21.21 / 13.02

If YES above there is public evidence that the SLM has successfully completed the applicable pattern evaluation tests of IEC 61672-2:2003

Date Received 13 December 2021

ANV Job No. UKAS21/12808

Date Calibrated 06 January 2022

The sound level meter submitted for testing has successfully completed the class 1 periodic tests of IEC 61672-3:2006, for the environmental conditions under which the tests were performed. As public evidence was available, from an independent testing organisation responsible for approving the results of pattern evaluation tests performed in accordance with IEC 61672-2:2003, to demonstrate that the model of sound level meter fully conformed to the requirements in IEC 61672-1:2002, the sound level meter submitted for testing conforms to the class 1 requirements of IEC 61672-1:2002.

Previous Certificate	Dated	Certificate No.	Laboratory
	14 August 2019	TCRT19/1642	ANV Measurement Systems

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FIGURE C3: ATTENDED NOISE MONITOR CALIBRATION CERTIFICATE – NL-52 S/N 553890

CERTIFICATE OF CALIBRATION	Certificate Number
	UCRT22/1011
UKAS Accredited Calibration Laboratory No. 0653	Page 2 of 2 Pages

Sound Level Meter Instruction manual and data used to adjust the sound levels indicated.

SLM instruction manual title	Sound Level Meter	NL-42 / NL-52
SLM instruction manual ref / issue		11-03
SLM instruction manual source	Manufacturer	
Internet download date if applicable	N/A	
Case corrections available	Yes	
Uncertainties of case corrections	Yes	
Source of case data	Manufacturer	
Wind screen corrections available	Yes	
Uncertainties of wind screen corrections	Yes	
Source of wind screen data	Manufacturer	
Mic pressure to free field corrections	Yes	
Uncertainties of Mic to F.F. corrections	Yes	
Source of Mic to F.F. corrections	Manufacturer	
Total expanded uncertainties within the requirements of IEC 61672-1:2002	Yes	
Specified or equivalent Calibrator	Specified	
Customer or Lab Calibrator	Lab Calibrator	
Calibrator adaptor type if applicable	NC-74-002	
Calibrator cal. date	14 December 2021	
Calibrator cert. number	UCRT21/2515	
Calibrator cal cert issued by	0653	
Calibrator SPL @ STP	94.04	dB Calibration reference sound pressure level
Calibrator frequency	1001.94	Hz Calibration check frequency
Reference level range	25 - 130	dB

Accessories used or corrected for during calibration - Extension Cable & Wind Shield WS-15
 Note - if a pre-amp extension cable is listed then it was used between the SLM and the pre-amp.

Environmental conditions during tests	Start	End	
Temperature	22.98	23.28	± 0.30 °C
Humidity	38.4	38.5	± 3.00 %RH
Ambient Pressure	100.54	100.54	± 0.03 kPa

Response to associated Calibrator at the environmental conditions above.

Initial indicated level	94.8	dB	Adjusted indicated level	94.0	dB
The uncertainty of the associated calibrator supplied with the sound level meter ±				0.10	dB

Self Generated Noise This test is currently not performed by this Lab.

Microphone installed (if requested by customer) = Less Than	N/A	dB	A Weighting
Uncertainty of the microphone installed self generated noise ±	N/A	dB	

Microphone replaced with electrical input device - UR = Under Range indicated

Weighting	A	C	Z
	12.2	15.9	22.3
	dB	dB	dB
	UR	UR	UR

Uncertainty of the electrical self generated noise ± 0.12 dB

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor $k=2$, providing a coverage probability of approximately 95%. The uncertainty evaluation has been carried out in accordance with UKAS requirements.

For the test of the frequency weightings as per paragraph 12. of IEC 61672-3:2006 the actual microphone free field response was used.

The acoustical frequency tests of a frequency weighting as per paragraph 11 of IEC 61672-3:2006 were carried out using an electrostatic actuator.

END

Calibrated by: B. Bogdan R 2

Additional Comments The results on this certificate only relate to the items calibrated as identified above.

None

FIGURE C3 (CTD): ATTENDED NOISE MONITOR CALIBRATION CERTIFICATE – NL-52 S/N 553890



CERTIFICATE OF CALIBRATION



0653

Date of Issue: 14 December 2022

Certificate Number: UCRT22/2355

Calibrated at & Certificate issued by:

ANV Measurement Systems

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17 Roebuck Way

Milton Keynes MK5 8HL

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Acoustics Noise and Vibration Ltd trading as ANV Measurement Systems

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Approved Signatory

K. Mistry

Customer Southdowns Environmental Consultants Ltd

Suite A3

16 Station Street

Lewes

East Sussex

BN7 2DB

Order No. X_EQUIPMENT/878

Test Procedure Procedure TP 1 Calibration of Sound Calibrators

Description Acoustic Calibrator

Identification	Manufacturer	Instrument	Model	Serial No.
	Rion	Calibrator	NC-74	34625615

The calibrator has been tested as specified in Annex B of IEC 60942:2003. As public evidence was available from a testing organisation (PTB) responsible for approving the results of pattern evaluation tests, to demonstrate that the model of sound calibrator fully conformed to the requirements for pattern evaluation described in Annex A of IEC 60942:2003, the sound calibrator tested is considered to conform to all the class 1 requirements of IEC 60942:2003.

ANV Job No. UKAS22/11703

Date Received 10 November 2022

Date Calibrated 14 December 2022

Previous Certificate	Dated	05 October 2021
	Certificate No.	UCRT21/2221
	Laboratory	0653

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FIGURE C4: NOISE CALIBRATOR CALIBRATION CERTIFICATE – NC-74 S/N 34625615

CERTIFICATE OF CALIBRATION

UKAS Accredited Calibration Laboratory No. 0653

Certificate Number

UCRT22/2355

Page 2 of 2 Pages

Measurements

The sound pressure level generated by the calibrator in its WS2 configuration was measured five times by the Insert Voltage Method using a microphone as detailed below. The mean of the results obtained is shown below. It is corrected to the standard atmospheric pressure of 101.3 kPa (1013 mBar) using original manufacturers information.

Test Microphone	Manufacturer	Type
	Brüel & Kjær	4134

Results

The level of the calibrator output under the conditions outlined above was

94.00 ± 0.10 dB rel 20 µPa

Functional Tests and Observations

The frequency of the sound produced was	1001.94 ± 0.12 Hz
The total distortion was	1.57 ± 0.11 % Distortion

During the measurements environmental conditions were

Temperature	23 to 24 °C
Relative Humidity	56 to 62 %
Barometric Pressure	101.4 to 101.5 kPa

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k=2, providing a coverage probability of approximately 95%. The uncertainty evaluation has been carried out in accordance with UKAS requirements.

The uncertainties refer to the measured values only with no account being taken of the ability of the instrument to maintain its calibration.

A small correction factor may need to be applied to the sound pressure level quoted above if the device is used to calibrate a sound level meter which is fitted with a free-field response microphone. See manufacturers handbook for details.

..... END

Note:

Calibrator adjusted prior to calibration?	NO
Initial Level	N/A dB
Initial Frequency	N/A Hz

Additional Comments The results on this certificate only relate to the items calibrated as identified above.

None

Calibrated by: PB/BB

R 1

FIGURE C4: NOISE CALIBRATOR CALIBRATION CERTIFICATE – NC-74 S/N 34625615



CERTIFICATE OF CALIBRATION

Date of Issue: 24 August 2022

Certificate Number: TCRT22/1537

Issued by:

ANV Measurement Systems

Beaufort Court

17 Roebuck Way

Milton Keynes MK5 8HL

Telephone 01908 642846 Fax 01908 642814

E-Mail: info@noise-and-vibration.co.uk

Web: www.noise-and-vibration.co.uk

Page 1 of 3 Pages
Approved Signatory

K. Mistry

Acoustics Noise and Vibration Ltd trading as ANV Measurement Systems

Client	Southdowns Environmental Consultants Ltd 16 Station Street, Lewes East Sussex BN7 2DB
Purchase Order No.	X-Equipment/838
Instrument	Profound Vibra+ Vibration Meter
Serial No.	VIB02624
Sensor Type	Triax Geophone
Geophone Serial No.	TDA01762
Version	3.30
Hardware Revision	2.00
Client Asset No.	N/A
Procedure ID.	Vibra+ Issue 9
Job Number	TRAC22/08302
Date of Calibration	24 Aug 2022
Previous Cert. number	TCRT19/1609
Date of Previous Cert.	29 Jul 2019
Rig Number	5
Kit Number	24

This calibration is traceable to National Standards. ANV Measurement Systems sources used to perform calibrations are calibrated at the National Physical Laboratory or by UKAS laboratories accredited for the purpose.

This certificate contains reported values only, in the absence of any international or British Standard specifically applicable to this instrument, it has been compared with a tolerance of $\pm 10\% \pm 1$ LSD of the amplitude of the test signal.

The instrument has passed calibration.

Comment

This certificate reports recorded values for the instrument 'As Received'.

FIGURE C5: VIBRATION MONITOR CALIBRATION CERTIFICATE – VIBRA+ S/N VIB02624

CERTIFICATE OF CALIBRATION



Certificate Number

TCRT22/1537

Page 2 of 3 Pages

Environment

The ambient environmental conditions at the time of the calibration were;

Temperature: $25.4 \pm 1^\circ\text{C}$, Humidity: $39 \pm 5\%\text{RH}$, Atmospheric pressure $100.5 \pm 1\text{ kPa}$

Test results

Each geophone axis was mounted co-axially with a Rion LS-10 reference servo accelerometer, and tests conducted for dynamic range and frequency response. The tolerances quoted make no allowance for uncertainty of measurement of these tests.

Linearity errors in % measured at 16Hz. Permitted tolerance $\pm 10\% \pm 1\text{ LSD}$ (Least Significant Digit).

RESULTS FOR X-AXIS

Target Velocity Level mm/s	Actual Applied Level mm/s	Vibra Velocity reading mm/s	Error %	Actual Applied Acceleration mm/s ²	Vibra acceleration reading mm/s ²	Error %
1.0	1.02	1.07	5.4	0.10	0.11	7.2
2.5	2.54	2.62	3.2	0.26	0.27	5.4
5.0	5.08	5.23	3.0	0.51	0.53	3.5
10.0	10.08	10.30	2.2	1.02	1.04	2.1
20.0	20.15	20.69	2.7	2.04	2.09	2.2

RESULTS FOR Y-AXIS

Target Velocity Level mm/s	Actual Applied Level mm/s	Vibra Velocity reading mm/s	Error %	Actual Applied Acceleration mm/s ²	Vibra acceleration reading mm/s ²	Error %
1.0	1.02	1.07	5.4	0.10	0.11	7.2
2.5	2.54	2.62	3.2	0.26	0.27	5.4
5.0	5.08	5.23	3.0	0.51	0.53	3.5
10.0	10.08	10.40	3.2	1.02	1.05	2.9
20.0	20.15	20.92	3.8	2.05	2.11	3.1

RESULTS FOR Z-AXIS

Target Velocity Level mm/s	Actual Applied Level mm/s	Vibra Velocity reading mm/s	Error %	Actual Applied Acceleration mm/s ²	Vibra acceleration reading mm/s ²	Error %
1.0	1.02	1.07	5.4	0.10	0.11	7.2
2.5	2.54	2.63	3.6	0.26	0.27	5.4
5.0	5.08	5.21	2.6	0.51	0.53	3.5
10.0	10.08	10.37	2.9	1.02	1.08	5.6
20.0	20.15	20.45	1.5	2.05	2.17	5.8

FIGURE C5 (CTD): VIBRATION MONITOR CALIBRATION CERTIFICATE – VIBRA+ S/N VIB02624

CERTIFICATE OF CALIBRATION



Certificate Number

TCRT22/1537

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Frequency Response of Geophone

Measured at 5.00 mm/s velocity, reference frequency 16Hz.

Results in % difference from 16Hz. No manufacturer's tolerance stated.

Frequency Hz	X-axis %	Y-axis %	Z-axis %
5.0	1.0	-1.7	-4.0
6.3	1.9	-0.4	-2.7
8.0	1.8	0.1	-0.9
10.0	1.4	-0.4	-0.4
12.5	0.7	0.5	0.3
16.0	REF	REF	REF
20.0	-0.4	-0.3	-1.0
25.0	1.5	1.9	1.1
31.5	0.2	1.7	1.9
40.0	0.2	-0.2	0.4
63.0	1.5	4.8	-7.0

Displayed frequency on Vibra, measured at 5.00 mm/s velocity.

No Manufacturer's tolerance stated.

Frequency Hz	X-Axis Hz	Y-Axis Hz	Z-Axis Hz
5.0	5.0	5.0	5.0
6.3	6.5	6.5	6.5
8.0	8.0	8.0	8.0
10.0	10.0	10.0	10.0
12.5	12.5	12.5	12.5
16.0	16.0	16.0	16.0
20.0	20.0	20.0	20.0
25.0	25.0	25.0	25.0
31.5	31.5	31.5	31.5
40.0	40.0	40.0	40.0
63.0	63.0	63.0	63.0

END OF CALIBRATION

CALIBRATED BY :- A. Lloyd

FIGURE C5 (CTD): VIBRATION MONITOR CALIBRATION CERTIFICATE – VIBRA+ S/N VIB02624

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