BS 4142 Assessment Report

RSK ACOUSTICS

London Power Tunnels 2 (LPT2)

Eltham

LPT2-HMV-TUN-ELTH-PLN-EN-250014

THE QUEEN'S AWARDS FOR ENTERPRISE: INTERNATIONAL TRADE 2016

QUALITY ASSURANCE

Client:	Hochtief Murphy Joint Venture
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Document history

Rev.	Purpose Description	Author	Reviewer	Date
00	First review	MQO	AS	26/01/2024
01	Final	MQO	AS	30/01/2024

MQO – Morgan Quarless-Oates – Graduate Acoustic Consultant (AMIOA)
AS – Antonio Sanchez – Principal Acoustic Consultant (MIOA)

 Where field investigations have been carried out, these have been restricted to a level of detail required to achieve the stated objectives of the work. This work has been undertaken in accordance with the quality management system of RSK Environment.

GLOSSARY

Noise Terminology

Term	Definition
Ambient sound	The total sound at a given place, usually a composite of sounds from many sources near and far.
Background sound, $L_{A90,T}$	A-weighted sound pressure level that is exceeded by the residual sound at the assessment location for 90% of a given time interval.
dB	Decibel. Scale for expressing sound pressure level. It is defined as 20 times the logarithm of the ratio between the root mean square pressure of the sound field and a reference pressure i.e. $2x10^{-5}$ Pascal.
dB(A)	A-weighted decibel. This provides a measure of the overall level of sound across the audible spectrum with a frequency weighting to compensate for the varying sensitivity of the human ear to sound at different frequencies. Example sound levels include: 140 dB(A) Threshold of pain 120 dB(A) Threshold of feeling 100 dB(A) Loud nightclub 80 dB(A) Traffic at busy roadside 60 dB(A) Normal speech level at 1m 40 dB(A) Quiet office 20 dB(A) Broadcasting studio 0 dB(A) Median hearing threshold (1000 Hz)
Frequency	The repetition rate of a sound wave. The subjective equivalent in music is pitch. The unit of frequency is the Hertz (Hz), which is identical to cycles per second. A thousand hertz is often denoted as kHz, e.g. 2 kHz = 2000 Hz. Human hearing ranges approximately from 20 Hz to 20kHz.
$L_{Aeq,T}$	This is defined as the notional steady sound level over a stated period of time (T), would contain the same amount of acoustical energy as the A-weighted fluctuating sound measured over that period.
Rating level	Specific sound level of a source plus any adjustment for the characteristic features of the sound.
Residual sound	Ambient sound remaining at the assessment location when the specific sound source is suppressed to such a degree that it does not contribute to the ambient sound.
Sound absorption	Process whereby sound energy is converted in to heat. Sound absorption properties is expressed as the sound absorption coefficient α or the sound absorption class (A-E).
Sound insulation	The reduction or attenuation of airborne sound by a solid element between source and receiver.
Specific sound	Sound pressure level produced by the source being assessed at the assessment location.

Term	Definition
L_{Amax}	The maximum A-weighted sound pressure level recorded over the period stated. L_{Amax} is sometimes used in assessing environmental noise where occasional loud noises occur, which may have little effect on the overall L_{eq} noise level but will still affect the noise environment.

CONTENTS

1 INTRODUCTION

1.1 Rationale for Acoustic Works

It is proposed for ventilation plant to been installed at Eltham Headhouse at the London Power Tunnels 2 project site in Eltham. Having previously undertaken baseline noise monitoring at the site, RSK have been commissioned by Hochtief Murphy Joint Venture (HMJV) to undertake an assessment of the proposed installation in line with BS 4142:2014 and Local Authority criteria.

This report details the methodology used to conduct the noise survey and sets plant noise limits. An evaluation of noise emissions from the proposed plant strategy to the nearest noise sensitive receivers has also been undertaken.

1.2 Site Description

The site is located within the Royal Borough of Greenwich with the nearest noise sensitive receptors falling within the London Borough of Bexley.

To the East of the site lies residential properties along Montrose Avenue.

To the South runs the rail line towards Centra London and Dartford with residential properties along Lingfield Crescent beyond the line.

The Eltham Grid Substation is located to the West of the site and Falconwood Field to the North.

2 LEGISLATION AND REGULATORY REQUIREMENTS

This section provides a literature review of legislation and guidance relevant to this assessment.

2.1 BS 4142:2014+A1:2019

British Standard 4142:2014+A1:2019 'Methods for rating and assessing industrial and commercial sound' describes the methods for rating and assessing noise from industrial or commercial sources. The standard is applicable to the assessment of sound affecting residential receptors, through the determination of a specific level of an industrial or commercial noise source.

Where certain acoustic features are present at the assessment location, a character correction should be applied to the specific sound level to give the rating level to be used in the assessment. Acoustic features can include tones, impulsivity, intermittency or a type of noise that is distinct from the existing noise environment.

The assessment of the impact from a commercial or industrial sound can be carried out as follows:

- A difference of around +10 dB or more, between the rating and background noise levels, 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 adverse impact depending on the context.
- 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.

2.2 Local Authority Criteria

Condition 8 of the Royal Borough of Greenwich Planning Decision Notice states:

'a. Prior to operational use of the head house building hereby permitted, an Acoustic Report shall be submitted to the Local Planning Authority for approval. The Acoustic Report shall include details of the following:

• A survey of the existing background/ambient sound level,

• Manufacturers noise specification (Sound power/Sound pressure level, octave band spectral levels) of proposed ventilation equipment,

• The proposed operational hours of the ventilation equipment,

• Proposed mitigation measures to ensure the existing background sound level will not increase when measured at one metre from the façade of the nearest noise sensitive premises. In order to achieve this, the ventilation equipment shall be designed/selected, or the noise should be attenuated, so that it is 10dB below the existing background sound

level (LA9015min). The measurements and assessment shall be made in accordance to the latest British Standard 4142.

b. The approved measures shall be implemented prior to operational use of the head house building and shall be permanently maintained thereafter.'

2.3 BS 7445-1,2 and 3 '*Description and measurement of environmental noise. Guide to quantities and procedures'*

The three-part standard BS 7445 provides the framework within which environmental noise should be quantified.

BS 7445 does not prescribe the meteorological conditions under which noise measurements should or should not be taken, although it recommends that to facilitate the comparison of results, measurements should be undertaken under certain weather conditions (wind speed not exceeding 5 m/s, no strong temperature inversions and no heavy precipitation).

3 ENVIRONMENTAL NOISE SURVEY

3.1 Methodology and Instrumentation

Noise monitoring was undertaken between Thursday 07 December and Monday 11 December and consisted of two positions representative of the nearest or most exposed noise sensitive receptors. NML1 was located on the eastern boundary of the site and representative of receptors on Montrose Avenue, whilst NML2 was located on the southern boundary of the site and representative of receptors on Lingfield Close. The monitoring locations are geographically represented in Appendix 1 – MONITORING LOCATION.

Measurements of the L_{Aeq}, L_{A90} and L_{Amax} indices were recorded over consecutive 15-minute periods (see the glossary of this report for an explanation of the noise units used) for the duration of the survey at both measurement positions using the equipment listed within Table 1 below.

Item	Manufacturer	Type	Serial No.	Calibration Due
Sound Level Analyser	Rion	NL-52	00553877	11/10/2025
Sound Level Analyser	Rion	NL-52	01054197	28/01/2024
Acoustic Calibrator	Rion	NC-75	34625616	13/07/2024
Weatherproof Windshield x2	Rion	WS-15	N/A	N/A

Table 1 Acoustic Survey Equipment

Noise measurements were undertaken to the requirements of BS 7445-1: 2003 'Description and measurement of environmental noise. Guide to quantities and procedures'.

The microphones were fitted within a weatherproof windshield and the sound level meters were calibrated before and after the survey to confirm an acceptable level of accuracy. A calibration drift within the accepted tolerance of ±0.5dB was noted for both positions.

Representative weather conditions were obtained from the online *Wunderground* weather service website. Weather conditions were considered suitable for monitoring purposes in accordance with BS 7445 for all night-time periods. The entire night-time dataset has therefore been included within the analysis. For daytime periods, 07:15 – 12:45 09/12/2023 and 11:00 – 15:45 10/12/2023 have been excluded due to adverse weather conditions.

4 MEASURED NOISE LEVELS

4.1 Noise Measurement Results

A full set of the monitoring results can be found in previously issued report 'LPT2-HMV-TUN-ELTH-PLN-EN-250013 Eltham Baseline Noise Monitoring'.

Section 8.1.3 and 8.1.4 of BS 4142:2014+A1:2019 state the following:

"… the background sound level used for the assessment should be representative of the period being assessed…"

"This level should account for a range of background sound levels and should not automatically be assumed to be either the minimum or modal value."

Representative background noise levels have been derived for NML1 and NML2. These are summarised in Table 2.

Position	Description	Representative Background Noise Level, $L_{A90,15min}$(dB) Daytime Hours (07:00–23:00)	Representative Background Noise Level, $L_{A90,15min}$(dB) Night-time Hours (23:00 – 07:00)
NML1	Located at eastern boundary of LPT2 Eltham site	**53**	**48**
NML2	Located at southern boundary of LPT2 Eltham site	**55**	**50**

Table 2 Representative Background Noise Level

Histograms of these results can be found in Appendix 4 – Background noise level (L_{A90}) Histograms.

5 PLANT NOISE ASSESSMENT

5.1 Plant Noise Emission Limits

Limits for the proposed plant noise emissions at the nearest noise sensitive receptors have been derived from the representative background noise levels at each receptor in line with of BS 4142:2014+A1:2019 and Local Authority planning conditions.

Position	Description	Plant Noise Emission Limit Level, $L_{Ar,Tr}$ (dB) Daytime Hours (07:00–23:00)	Plant Noise Emission Limit Level, $L_{Ar,Tr}$ (dB) Night-time Hours (23:00 – 07:00)
AP1	273-279 Montrose Avenue	**43**	**38**
AP2	35-37 Lingfield Crescent	**45**	**40**

Table 3 Plant Limits at Nearest Noise Sensitive Receptors

Analysis of the available data in octave bands does not indicate the presence of tonal components and therefore no correction for tonality has been applied.

5.2 Proposed Installation

It is proposed for a mechanical ventilation exhaust system to be installed at the Eltham Headhouse. This system will run on a duty of 25%, 50%, 75% or 100% (subject to commissioning). The installation will be installed with some acoustic treatment however no specification has been decided upon at this stage.

Table 4 displays the in-duct sound power level for each fan to be installed when operating at the various speeds. Noise data was provided by manufacturers Systemair.

Fan Speed	In-duct SWL, dB @ Octave Band Centre Frequency, Hz							
	63	125	250	500	1k	2k	4k	8k
100%	120.2	120.1	124.6	124.2	120	118.2	108	100.1
75%	114.2	116.1	117.6	116.2	112	109.2	99	91.1
70%	112.2	114.1	116.6	114.2	110	106.2	97	89.1
60%	109.2	112.1	113.6	110.2	106	102.2	92	84.1
50%	105.2	109.1	108.6	105.2	101	95.2	85	78.1
25%	94.2	94.1	89.6	85.2	78	73.2	63	55.1

Table 4 In-duct Fan Sound Power

5.3 Methodology

Calculations have been made to derive the atmospheric plant noise emissions of the proposed installation from the manufacturer provided in-duct sound power levels. These calculations have been undertaken in relation to drawings provided by HMJV with duct attenuation and other elements calculated accordingly.

Subsequently, a computer noise model of the site has been constructed using SoundPLAN (v9) noise prediction software. A model has been set up to predict plant noise emission levels at the nearest noise sensitive receptors. The model has been set up with the following parameters.

Item	Setting
Algorithm	British Standard 5228:2009+A1:2014 *'Code of practice for noise and vibration control on construction and open sites-Noise'*.
Ground Absorption	Hard, acoustically reflective ground (0.2 coefficient) – roads, pavements and hard standing areas; Acoustically soft (assumed 0.8 coefficient) – grass or vegetated areas.
Met Conditions	10 degrees Celsius 70% humidity Wind from source to receiver
Façade Corrections	Predictions are at 1m from a given facade
Receptor Height	Ground Floor 1.5 m above ground; and First Floor 4 m above ground. Second and higher floors: 1.5 m above relative floor height.
Terrain	The model includes LiDAR terrain data taken from the DEFRA website for the area (2 m resolution elevation points).
Barriers / structures	Other structures, barriers and buildings which are likely to impact on the propagation of noise from construction works have also been included within the model.

5.4 Acoustic Mitigation

It is understood that a louvre will be installed as part of the plant installation at the atmospheric termination of the extract system. Table 5 displays the specifications of the louvre used for modelling.

Item	Minimum Required Insertion Loss dB @ Octave Band Centre Frequency, Hz							
	63	125	250	500	1k	2k	4k	8k
Louvre	-5	-4	-5	-6	-9	-13	-14	-13

Table 5 Louvre Insertion Loss

An in duct atmospheric side attenuator is also understood to be installed within the system. Table 6 displays the insertion loss calculated for the attenuator as per drawings provided by HMJV.

Item	Minimum Required Insertion Loss dB @ Octave Band Centre Frequency, Hz							
	63	125	250	500	1k	2k	4k	8k
In-duct atmospheric attenuator, with 35% free area	-6	-19	-37	-45	-45	-45	-45	-40

Table 6 In-duct Attenuator

5.5 Results

**Daytime limit as per Table 3*

Table **7** and Table 8 display the predicted plant noise emission levels at the nearest noise sensitive receptors with proposed acoustic mitigation in place at the various duties against the noise limits.

Receptor	Rating Noise Level, $L_{Ar,Tr}$ dB at Various Fan Speeds						Daytime Limit (dB)*
	100%	75%	70%	60%	50%	25%	
AP1 (273-279 Montrose Ave.)	24	18	16	14	10	-2	**43**
AP2 (35-37 Lingfield Cres.)	33	28	26	23	19	7	**45**

**Daytime limit as per Table 3*

Table 7 Daytime Predicted Plant Noise Emissions at Receptors

Receptor	Rating Noise Level, $L_{Ar,Tr}$ dB at Various Fan Speeds						Night-time Limit (dB)*
	100%	75%	70%	60%	50%	25%	
AP1 (273-279 Montrose Ave.)	24	18	16	14	10	-2	**38**
AP2 (35-37 Lingfield Cres.)	33	28	26	23	19	7	**40**

Table 8 Night-Time Predicted Plant Noise Emissions at Receptors

**Night-time limit as per Table 3*

6 CONCLUSION

It is proposed for ventilation plant to been installed at Eltham Headhouse at the London Power Tunnels 2 project site in Eltham.

Having previously undertaken baseline noise monitoring works, RSK have undertaken an assessment of the proposed installation in line with BS4142:2014+A1:2019 and Condition 8 of the Royal Borough of Greenwich Planning Decision Notice.

This report has provided details of a noise survey conducted at the site and has set external noise emission limits for the proposed plant items in line with Local Authority requirements.

The results of the acoustic assessment have shown that with the installation of proposed acoustic mitigation, the proposed plant will meet requirements from the Local Authority when running at all duties and at all times of day.

APPENDIX 1 – MONITORING LOCATION

Figure 1 Measurement Locations and Closest Residential Receptors

APPENDIX 2 – SITE PHOTOGRAPHS

Figure 2 NML1

Figure 3 NML2

APPENDIX 3 – MEASURED NOISE LEVELS

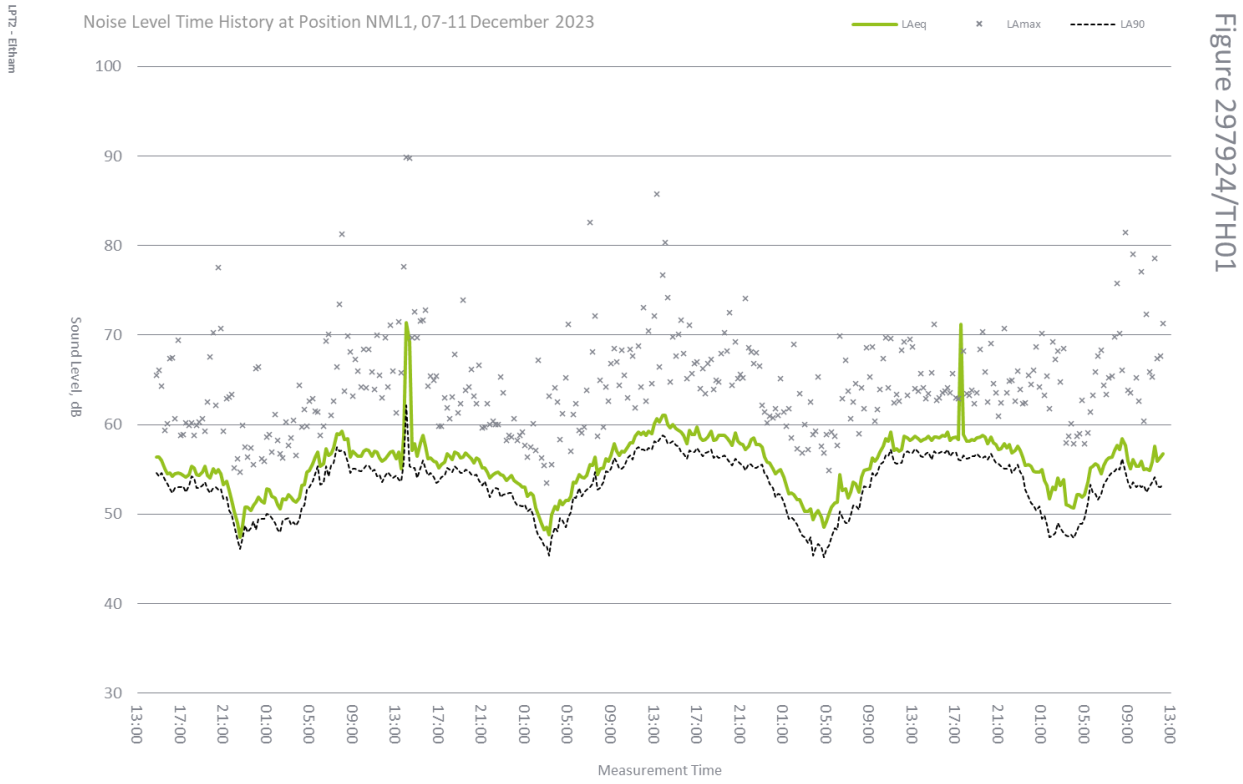

Figure 297924/TH01

Figure 4 NML1 Time History

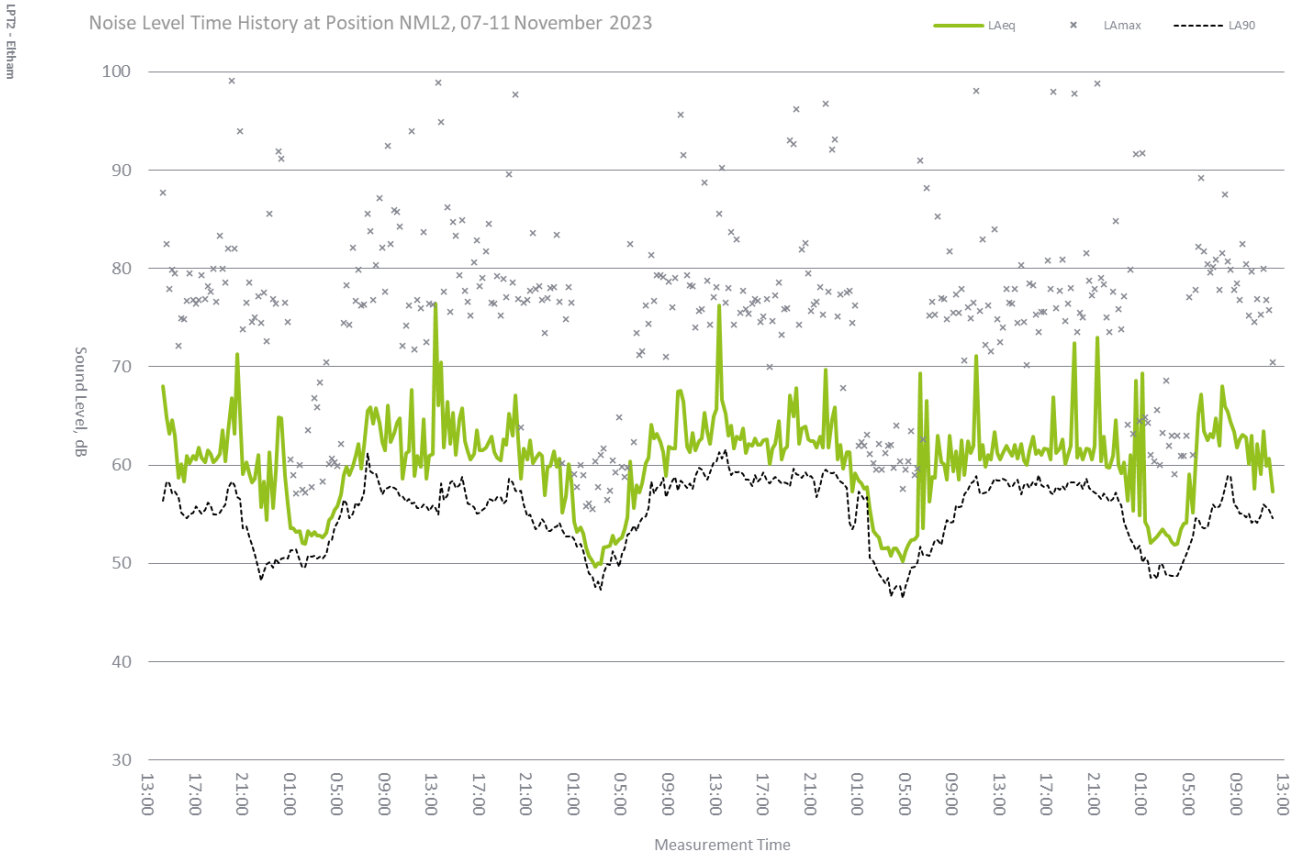

Figure 297924/TH02

Figure 5 NML2 Time History

APPENDIX 4 – BACKGROUND NOISE LEVEL (L_{A90}) HISTOGRAMS

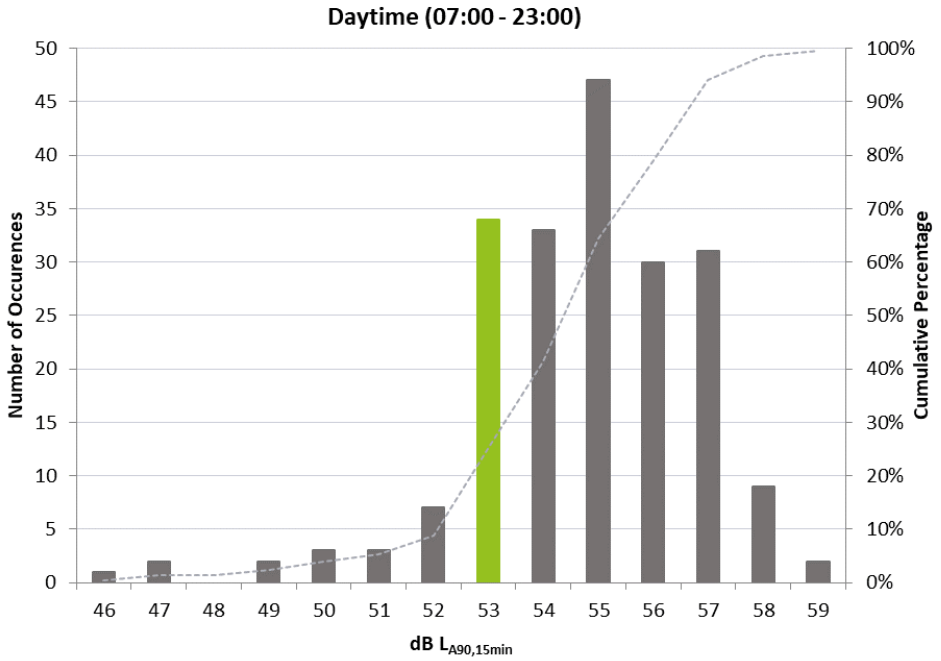

Figure 6 NML1 L_{A90} Daytime Histogram

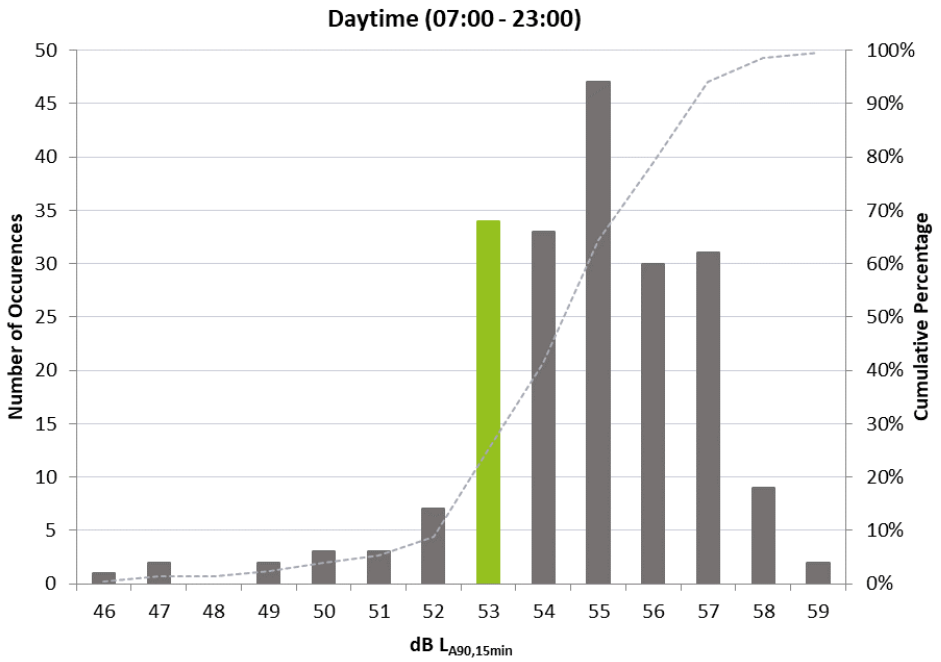

Figure 7 NML2 L_{A90} Daytime Histogram

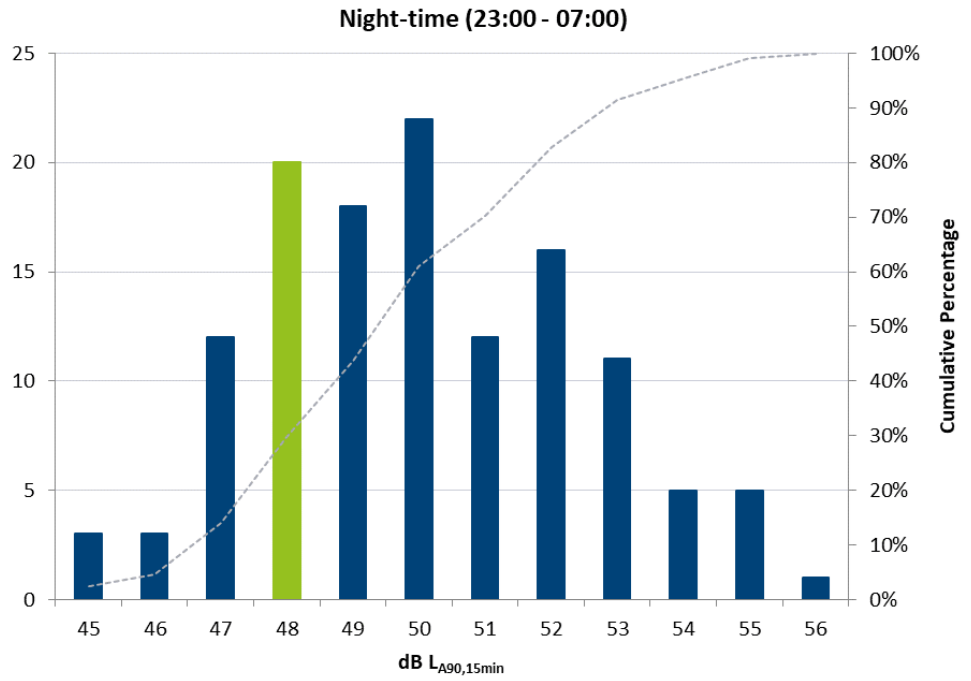

Figure 8 NML1 L_{A90} Night-Time Histogram

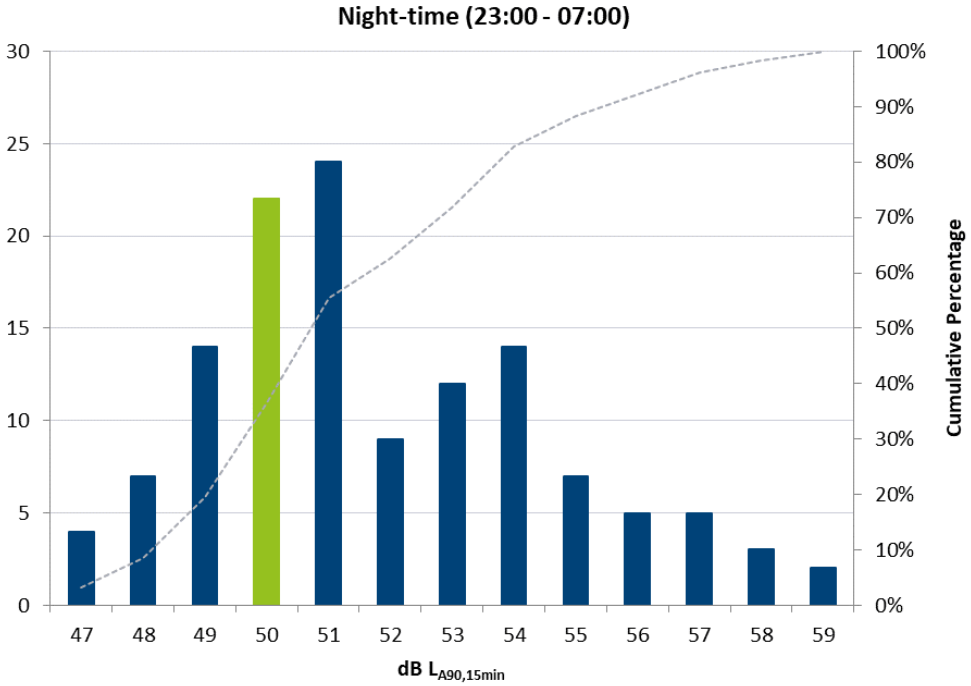

Figure 9 NML2 L_{A90} Night-Time Histogram