PREPARED: 02 December 2024

The Arena, Stockley Park -Travelodge Extension

Plant Noise Impact Assessment

CONTENTS

LIST OF ATTACHMENTS

Project Ref:	AS13316	**Project Name:**	The Arena, Stockley Park – Travelodge Extension
Report Ref:	AS13316.241202.R1	**Report Title:**	Plant Noise Impact Assessment
Client Name:	BBC Pensions Trust		
Project Manager:	Ian MacArthur		
Report Author:	Ian MacArthur		
Clarke Saunders Acoustics Winchester SO22 5BE	This report has been prepared in response to the instructions of our client. It is not intended for and should not be relied upon by any other party or for any other purpose.		

1.0 INTRODUCTION

1.1 Areas of the mixed-use development at The Arena, Stockley Park, Uxbridge are to be refurbished to form an extension to the Travelodge Hotel, linked into the site.

1.2 As part of the proposed development, new mechanical plant will be installed on the roof of the hotel extension building.

1.3 Clarke Saunders Acoustics (CSA) has been instructed to undertake a noise impact assessment of the proposals.

1.4 Noise from the proposed mechanical plant is assessed following the supplementary planning guidance for noise, issued by London Boroughs of Hillingdon; Hounslow and Richmond on Thames using environmental noise survey data collected by CSA.

1.5 Please refer to Appendix A for details of the acoustic terminology used throughout this report.

2.0 DESCRIPTION OF SITE AND PROPOSALS

2.1 The Arena is a mixed-use two storey building complex comprising a range of commercial units (primarily shops and food outlets and currently vacant pub/wine bar) at ground floor level. The northern section of the building is occupied by a leisure centre, linked to a recently constructed (2020) Travelodge Hotel. The first floor of the building is occupied by the leisure centre on the north side, and vacant office units on the south side.

2.2 The Arena complex is located within the Stockley business park, which comprises a number of large office buildings to the south. The Stockley Golf Course is located just to the north of the Arena complex. Please see site plan AS11768/SP1 for details.

2.3 Existing mechanical plant serving the vacant demises is located on the rooftop and will be removed as part of the proposals. The preliminary replacement plant scheme indicates c.12 condenser units for heating/cooling and two air handling units.

2.4 The ambient soundscape is formed by a variety of noise sources: distant road traffic from major road networks; air transport; local traffic accessing the business park and local pedestrian activity within the Arena commercial area. The lake immediately to the south of the Arena contains a fountain and waterfall feature which predominantly determine the ambient noise level at the south of the buildings.

2.5 The closest residential dwellings are identified to be over 550m distant to the north east across Dawley Road. The closest existing Travelodge Hotel bedroom windows are located at first floor level, approximately 60m to the north of the proposed rooftop condenser units.

3.0 LOCAL AUTHORITY REQUIREMENTS

3.1 London Boroughs of Hillingdon, Hounslow and Richmond Upon Thames issued the Supplementary Planning Document [SPD] *'Development Control for Noise Generating and Noise Sensitive Development'* in April 2016. This document summarises the methodology and design criteria required for noise assessments carried out under their areas of jurisdiction.

3.2 With regard to new noise generating industrial and commercial development, the SPD states that, to assess the likely effects of sound on people who might be inside or outside a dwelling or premises used for residential purposes, assessment should be undertaken following BS4142:2014 '*Methods for rating and assessing industrial and commercial sound*'.

3.3 The SPD specifies that, '*... as a general rule, the Boroughs will seek to achieve the external noise standards detailed in Table 2 below (all terms are as defined in BS4142)*'.

Table 2: New Industrial and Commercial Development - External Noise Standards

Noise Impact From Relevant Proposed Industrial Or Commercial Premises Or Plant	Development Outcome
Rating Level (LAr,Tr) is at least 5 dB(A) below the Background Level LA90	Normally acceptable
Rating level (LAr,Tr) is no more than 5 dB(A) above the Background Level LA90	Acceptable only if there are overriding economic or social reasons for development to proceed
Rating level (LAr,Tr) is more than 5 dB(A) above the Background Level LA90	Normally unacceptable

3.4 A summary of the BS4142 assessment procedure is provided in Appendix B.

4.0 ENVIRONMENTAL NOISE SURVEY

4.1 SURVEY PROCEDURE AND EQUIPMENT

4.1.1 As part of longer-term site monitoring, a specific survey of existing background noise levels has been undertaken in free-field conditions at the location shown in site plan AS13316/SP1. The microphone was located above the balcony railings at first floor level. The monitoring location is representative of the ambient and background noise climate at the nearest windows of the existing Travelodge Hotel to the north and east of the site as indicated on the site plan, which are considered to be the nearest noise sensitive receptors.

4.1.2 Measurements of consecutive 5-minute L_{Aeq}, L_{Amax}, L_{A10} and L_{A90} sound pressure levels were taken between 12:00 hours on Monday 1st May and 12:00 hours on Thursday 11th May 2023.

4.1.3 The following equipment was used during the course of the survey:

- Rion sound level meter type NL52;
- Rion sound level meter calibrator type NC-74.

4.1.4 The calibration of the sound level meter was verified before and after use. No significant calibration drift was detected.

4.1.5 The weather during the survey was mixed but mainly dry, with light winds. The extended monitoring period contained sufficient periods of calmer conditions to capture the typical lowest background levels in the locality.

4.1.6 Measurements were made following procedures in BS4142 and BS7445-2:1991 *Description and measurement of environmental noise. Guide to the acquisition of data pertinent to land use.*

4.2 RESULTS

4.2.1 Figures AS13316/TH1-TH10 show the L_{Aeq}, L_{Amax}, L_{A10} and L_{A90} sound pressure levels as time histories at the measurement position.

4.2.2 The ambient and background sound climate at the monitoring location was observed to be primarily determined by distant road traffic from the major road networks; air transport; local traffic accessing the business park; existing plant within the Arena and local pedestrian activity within the Arena commercial area.

4.2.3 The typical lowest free-field background noise levels ($L_{A90,5min}$) are shown in Table 4.1 alongside the average ambient noise levels ($L_{Aeq,T}$) which are shown for context.

Monitoring Period	Typical Lowest $L_{A90,5min}$	Average $L_{Aeq,T}$
Daytime (07:00 – 23:00)	44 dB	57 dB
Night-time (23:00 – 07:00)	41 dB	52 dB

Table 4.1: Measured environmental noise levels {dB ref. 20 µPa}

5.0 PREDICTED NOISE IMPACT

5.1 PROPOSED PLANT

5.1.1 The outline plant scheme indicates 10no. condensing units for heating/cooling bedrooms and 2no. condensing units for hot water, which will be located as shown on site plant AS13316/SP1.

5.1.2 No specific plant selections have been advised at this time. For the purposes of demonstrating that such a scheme can readily achieve the standard requirements of the Local Authority SPD, the following candidate model has been assumed for the condenser units, as an example of the highest noise levels likely to be produced from these type of unit :

- 12.no Mitsubishi CAHV-R450YA [40Kw]

5.1.3 Manufacturer's acoustic data for the example Condensing unit is as follows;

PLANT	SOUND PRESSURE LEVEL @1m (dB)								
	FREQUENCY (Hz)								dBA
	63	125	250	500	1K	2K	4K	8K	
CAHV-R450YA	66	73	70	67	61	59	61	52	69

Table 5.1: Example plant sound pressure levels at 1m {dB ref. 20 µPa}

5.1.4 Two air handling units (AHU) will also be located at rooftop level. These AHU will be fitted with atmospheric side silencers, as required, to achieve the required noise emission target.

5.2 PREDICTED NOISE LEVELS

5.2.1 Significant acoustic screening will be provided in the direction of the nearest existing Travelodge hotel guestroom window by the Arena parapet walling to the north of the proposed plant location, as well as by the southern building geometry of the hotel structure itself.

5.2.2 The resultant Rating Level at the most affected receptors has been assessed using the source sound data as detailed above.

Period	Rating Level ($L_{AR,Tr}$)	Background (L_{A90})	BS4142 Assessment Level	SPD Design Target – *'Normally Acceptable'* ($L_{AR,Tr}$)
Daytime (07:00-23:00)	31 dB	44 dB	-13	≤ -5
Night-time (23:00-07:00)	31 dB	41 dB	-10	

Table 5.2: Noise Emissions Assessment Summary {dB ref. 20 μPa}

5.2.3 The nature of the plant and relative level at the receptor suggests that resultant levels are unlikely to exhibit perceptibly tonal characteristics. Heat pump/condenser operation is not expected to generate impulsive characteristics nor be notably intermittent whilst in operation.

5.2.4 The predicted rating level for the example plant selection is shown to be comfortably compliant with the target criteria which would be normally considered acceptable by the Local Planning Authority.

6.0 CONCLUSION

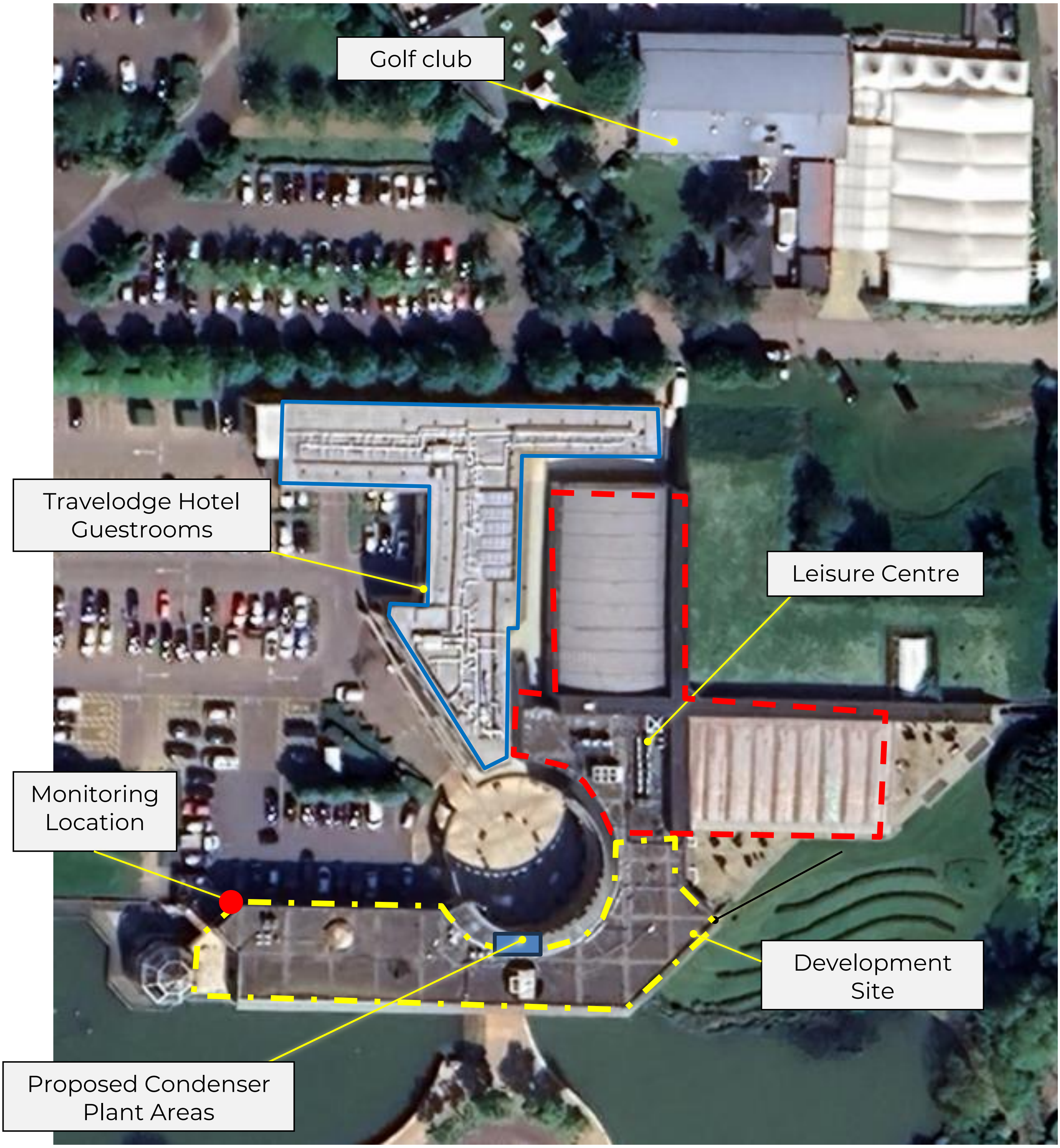
6.1 Clarke Saunders Acoustics has conducted a noise impact assessment of the rooftop plant proposed as part of the redevelopment at The Arena, Stockley Park to form an extension to the existing Travelodge Hotel.

6.2 Target noise emissions criteria which would be normally considered acceptable by Hillingdon Council have been identified, in line with the Borough's Supplementary Planning Document [SPD] *'Development Control for Noise Generating and Noise Sensitive Development' 2016.*

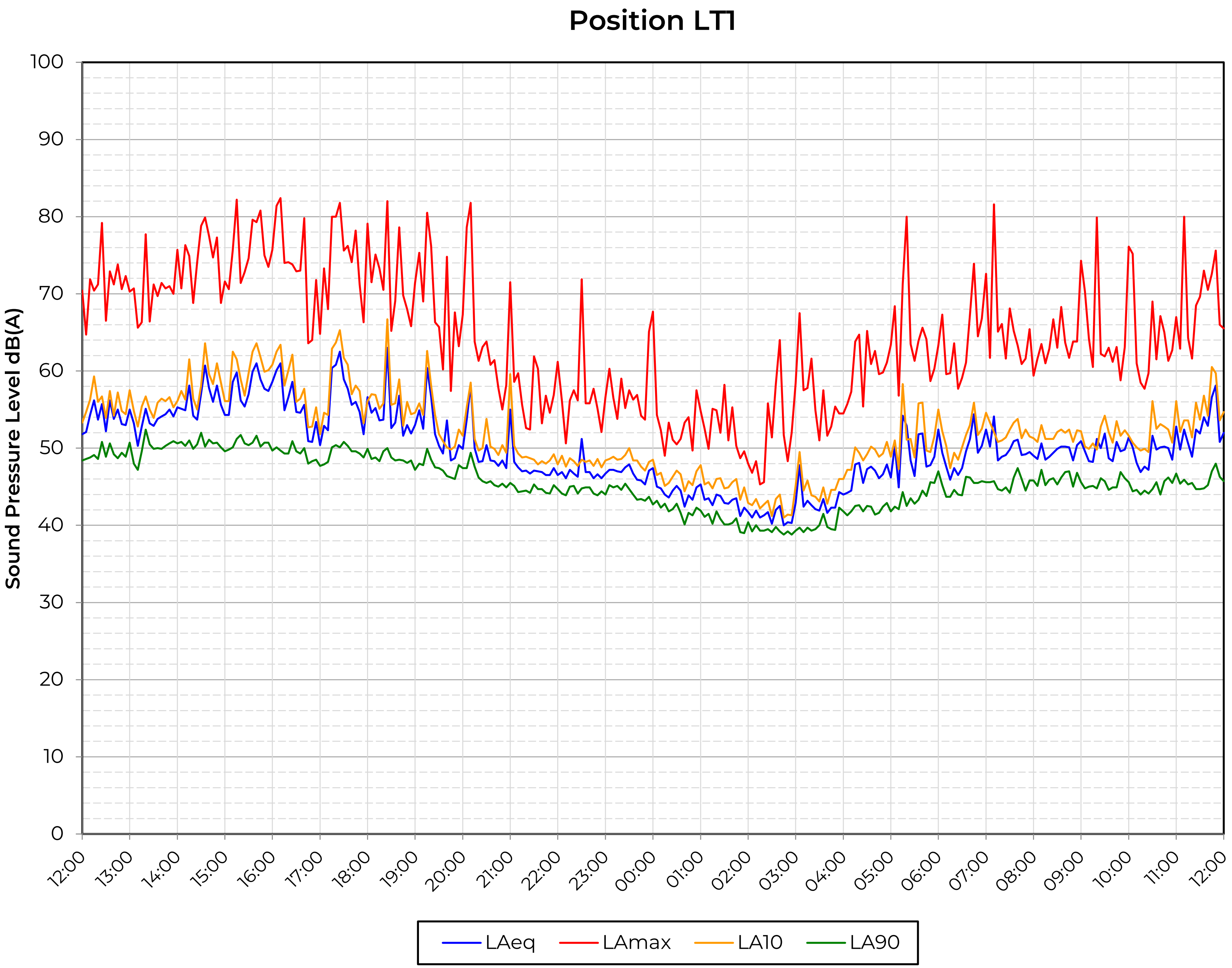
6.3 Environmental noise survey data has been used to determine the background noise level in the locality.

6.4 An assessment has been undertaken of preliminary example plant selections following BS4142:2014, which demonstrates that target noise emissions criteria can be achieved,

Ian MacArthur MIOA
CLARKE SAUNDERS ACOUSTICS


Golf club
Travelodge Hotel Guestrooms
Leisure Centre
Monitoring Location
Development Site
Proposed Condenser Plant Areas

Stockley Park - Travelodge Extension



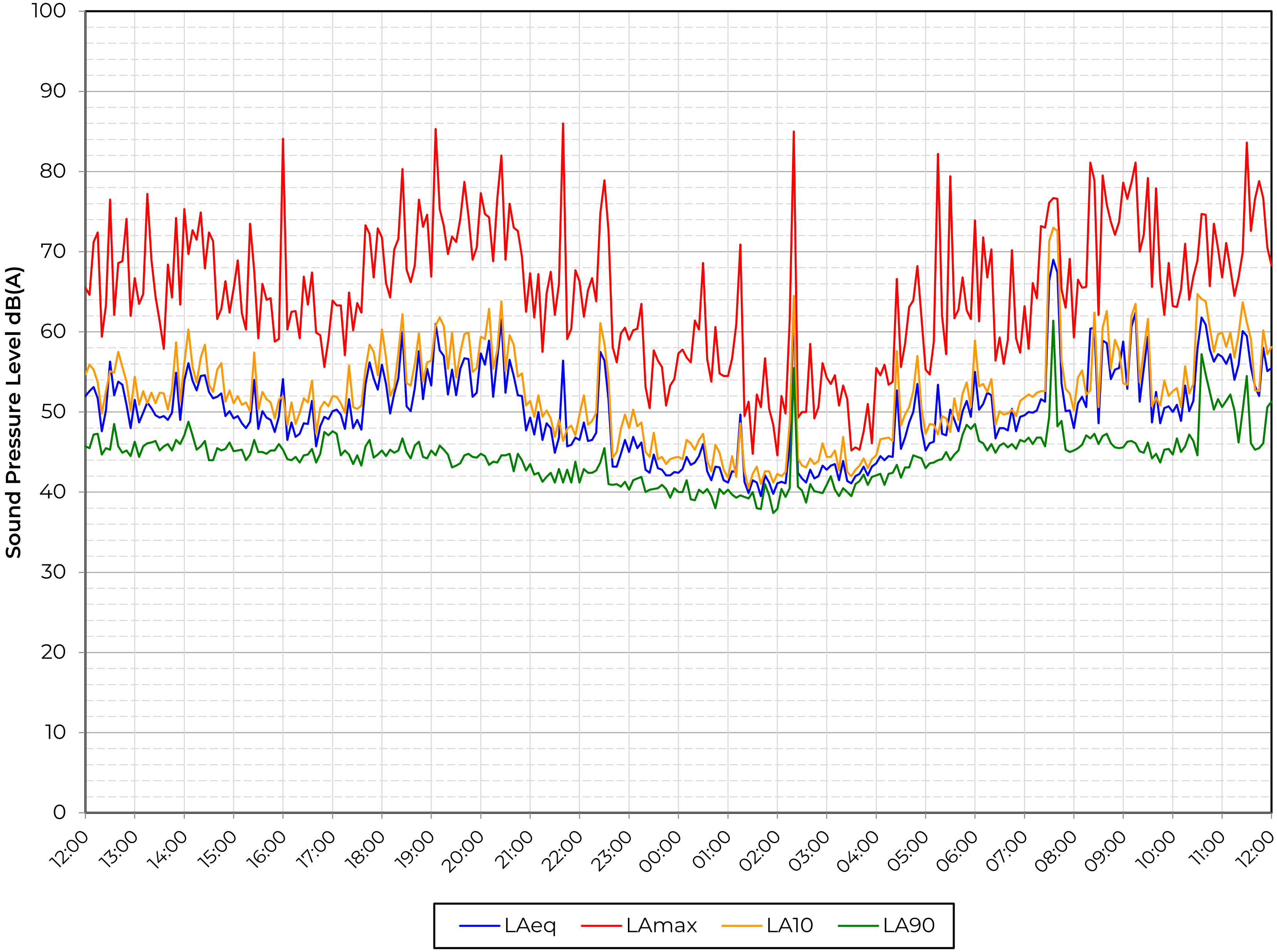
Mon 01 May to Tue 02 May

Figure AS13316/TH1

clarke saunders acoustics

Stockley Park - Travelodge Extension

Position LT1



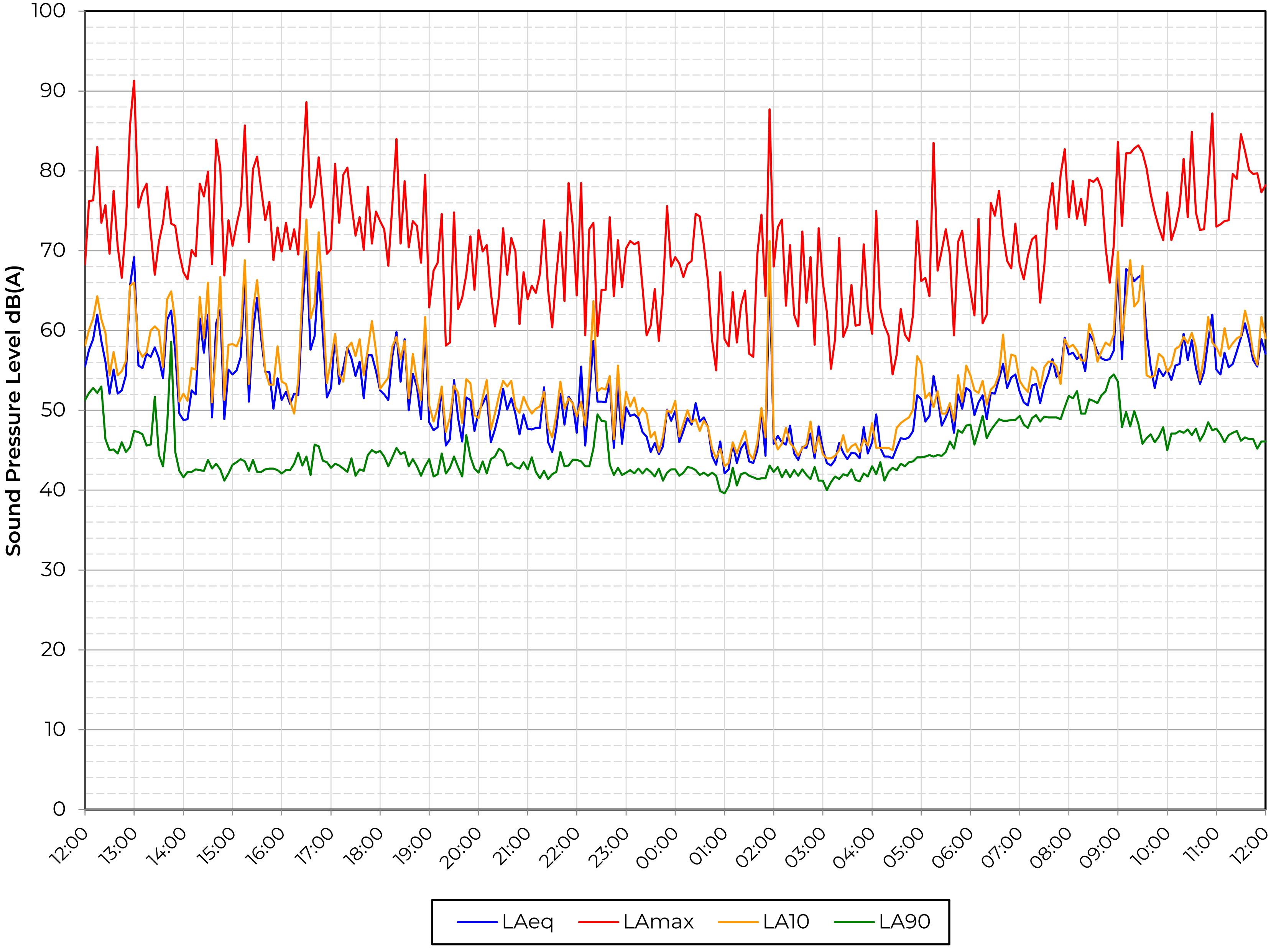
Tue 02 May to Wed 03 May

Figure AS13316/TH2

clarke saunders acoustics

Stockley Park - Travelodge Extension

Position LT1

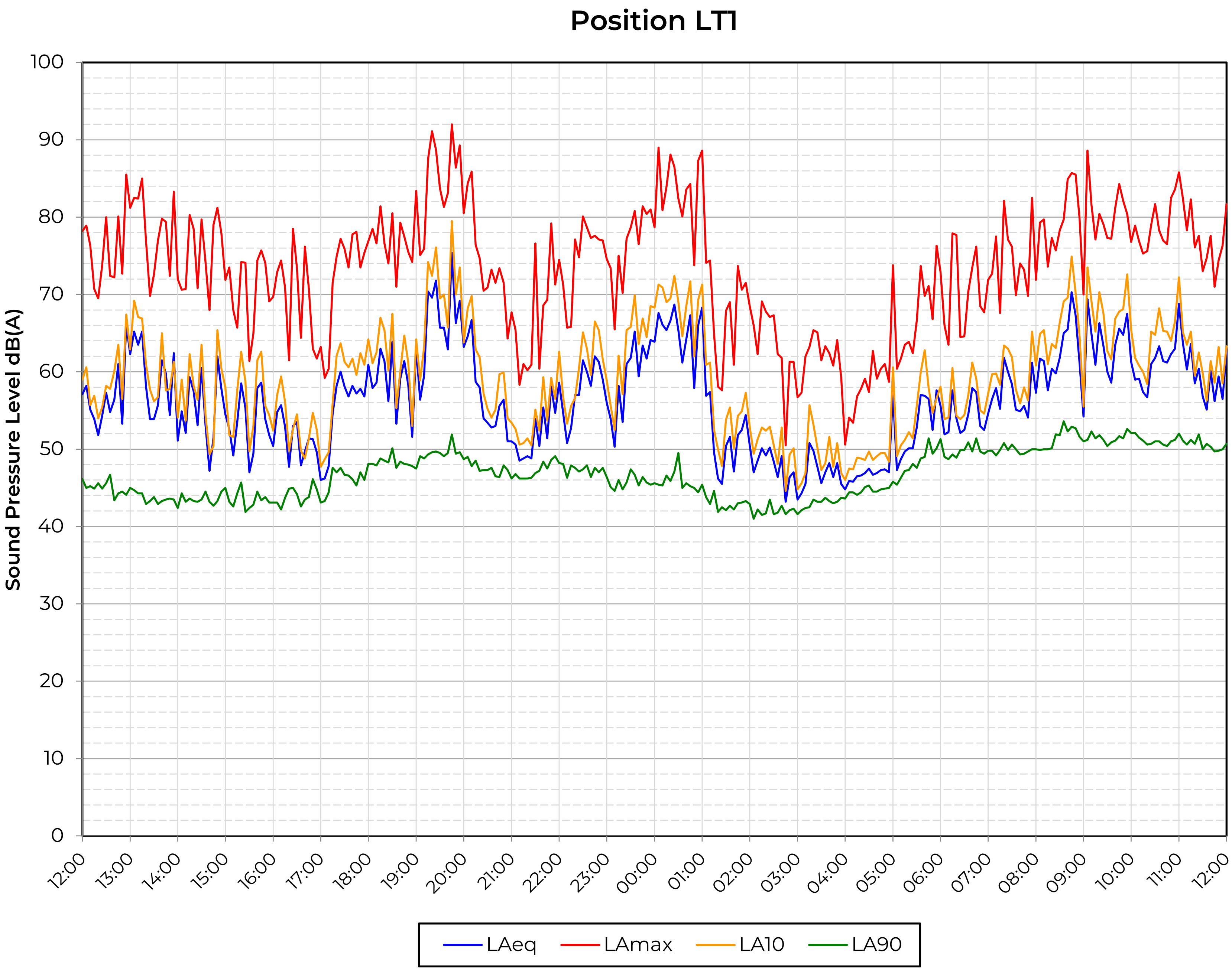


Wed 03 May to Thu 04 May

Figure AS13316/TH3

clarke saunders acoustics

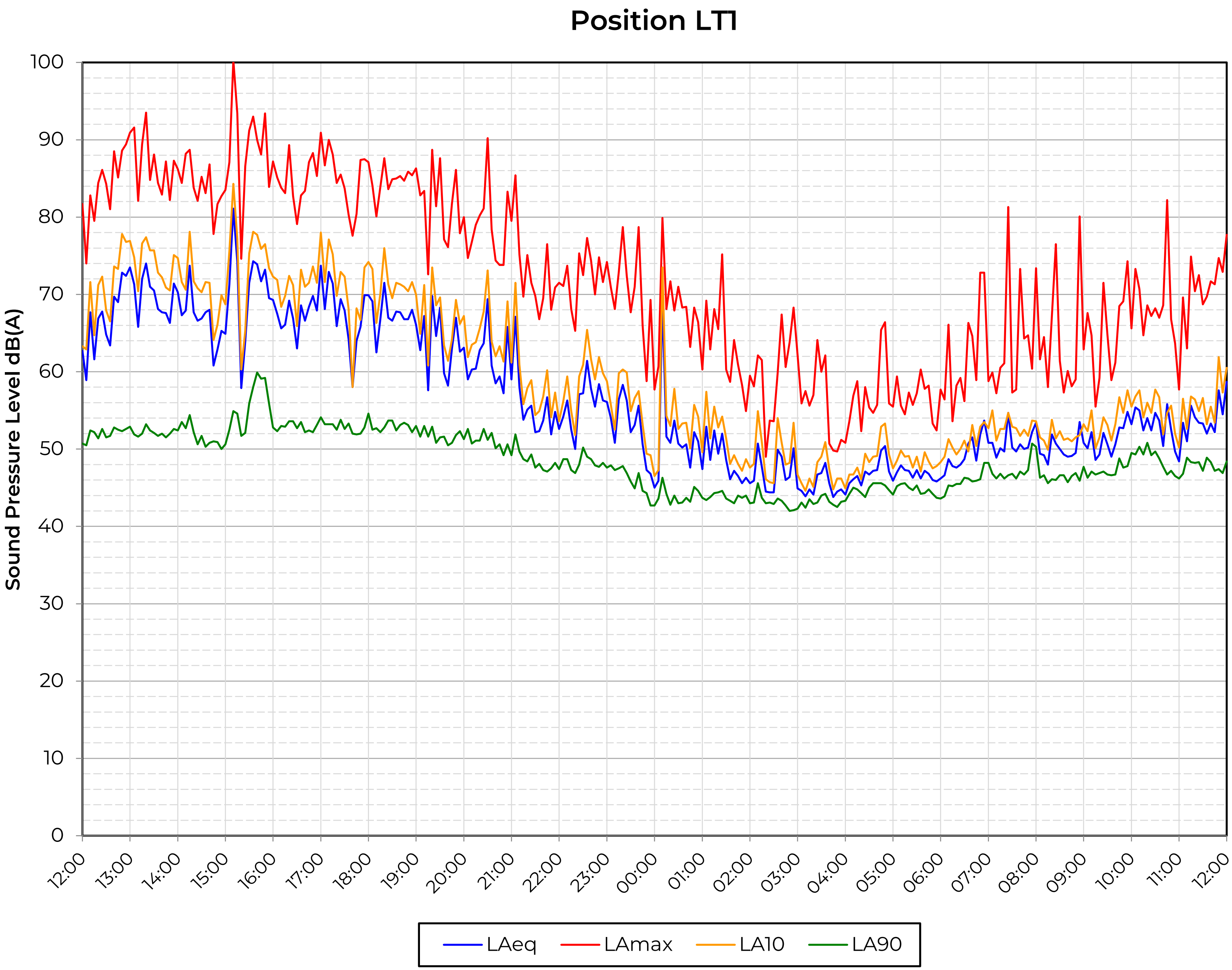
Stockley Park - Travelodge Extension



Thu 04 May to Fri 05 May

Figure AS13316/TH4

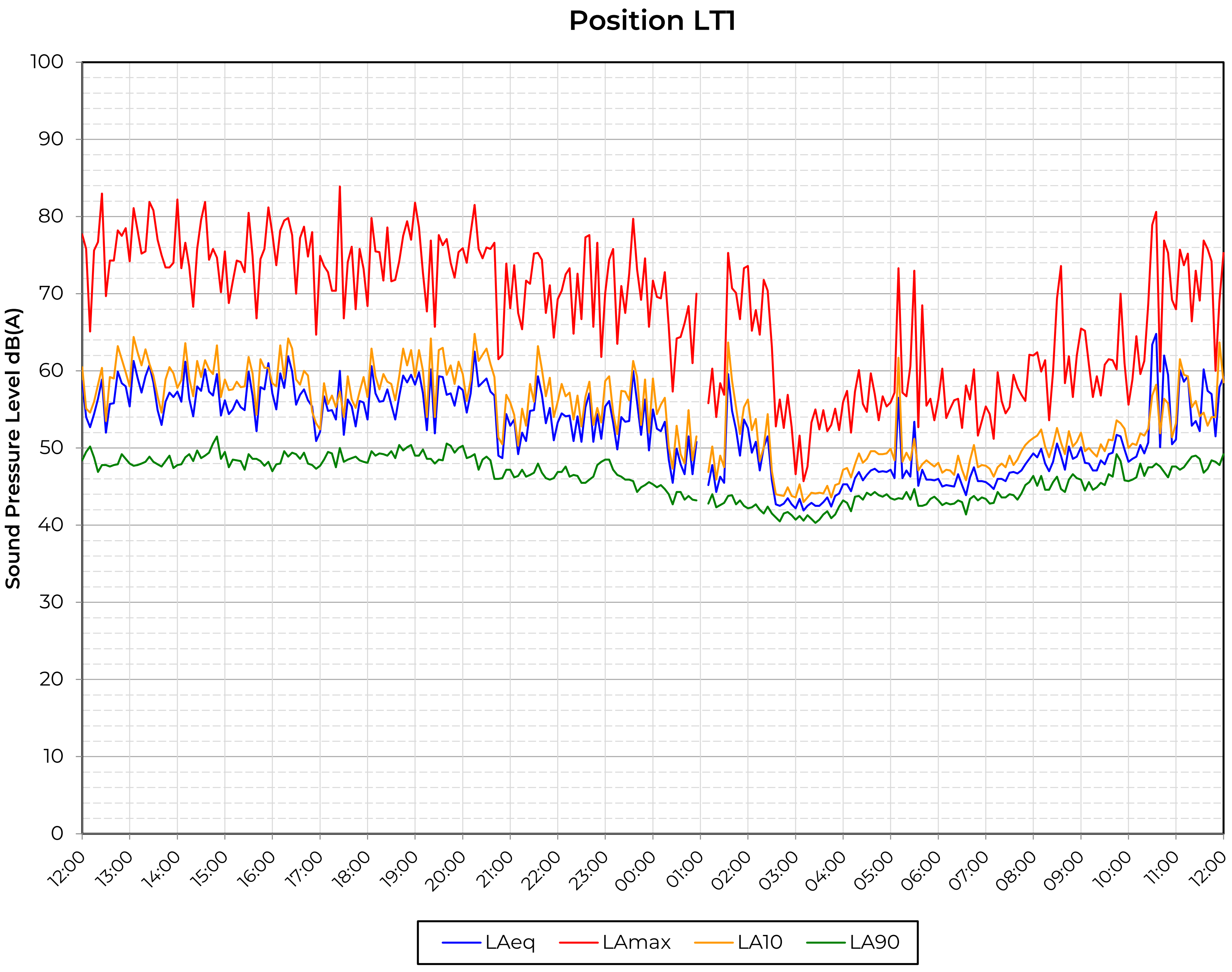
Stockley Park - Travelodge Extension



Fri 05 May to Sat 06 May

Figure AS13316/TH5

Stockley Park - Travelodge Extension



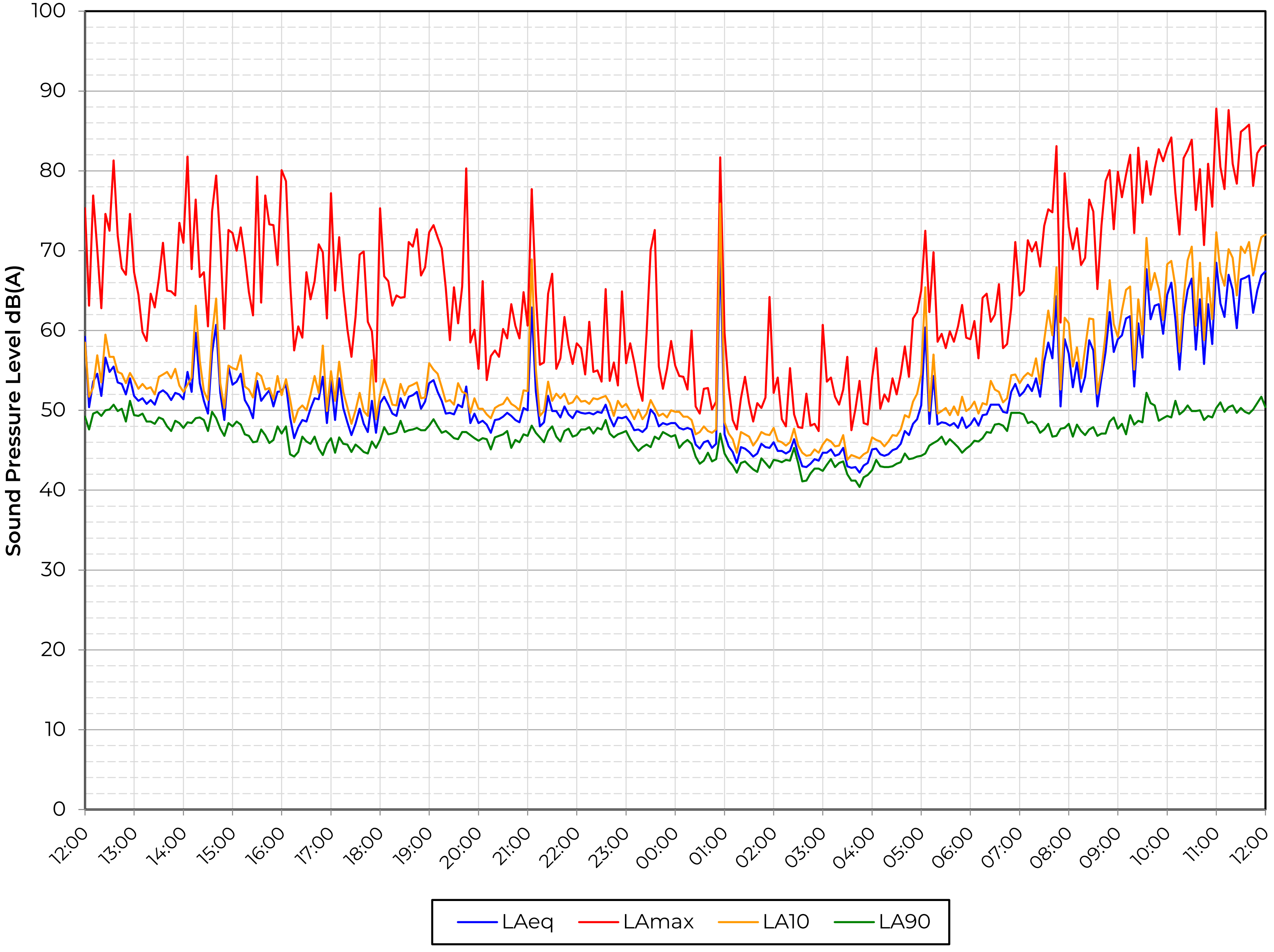
Sat 06 May to Sun 07 May

Figure AS13316/TH6

clarke saunders acoustics

Stockley Park - Travelodge Extension

Position LT1



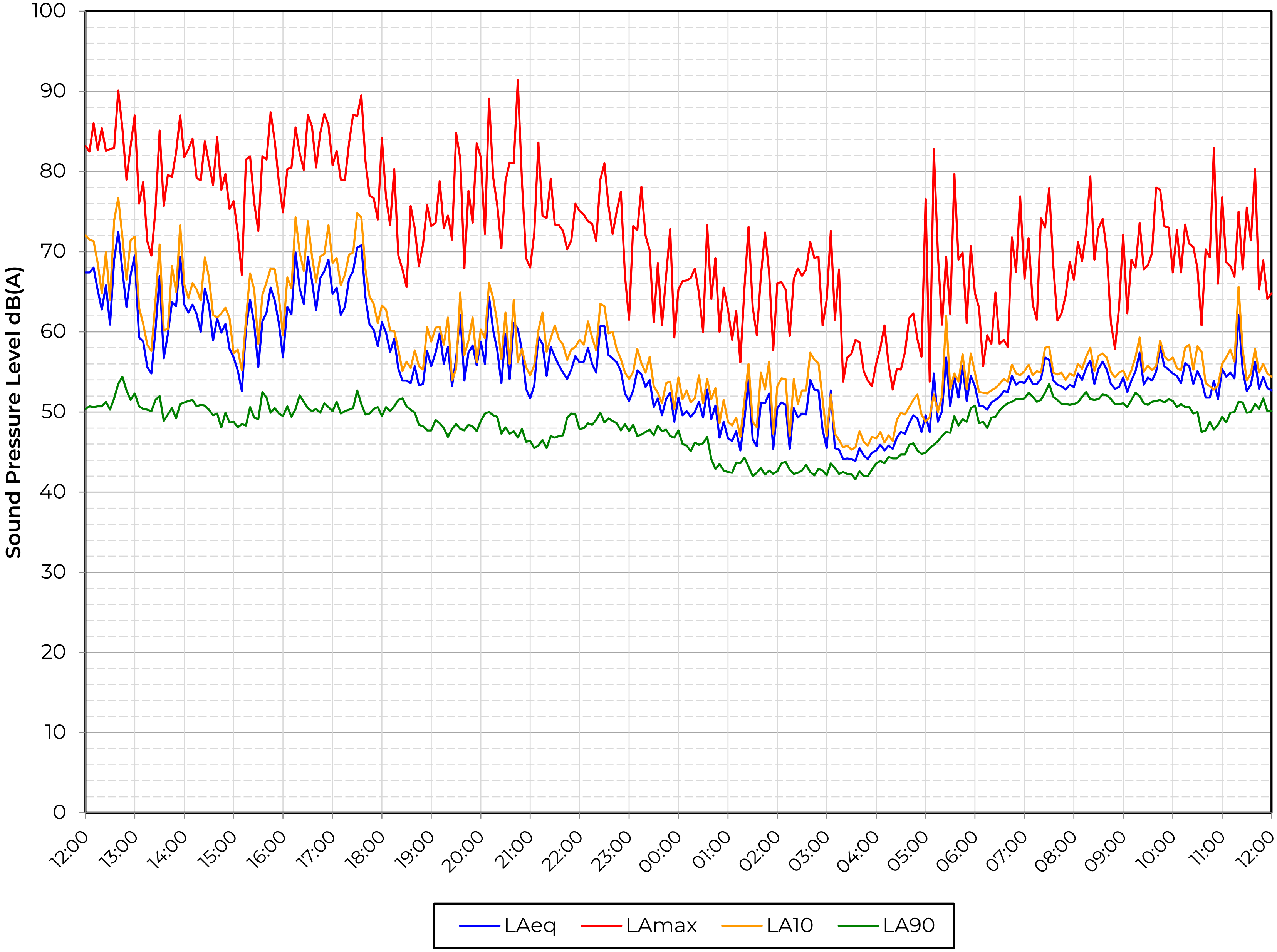
Sun 07 May to Mon 08 May

Figure AS13316/TH7

clarke saunders acoustics

Stockley Park - Travelodge Extension

Position LT1



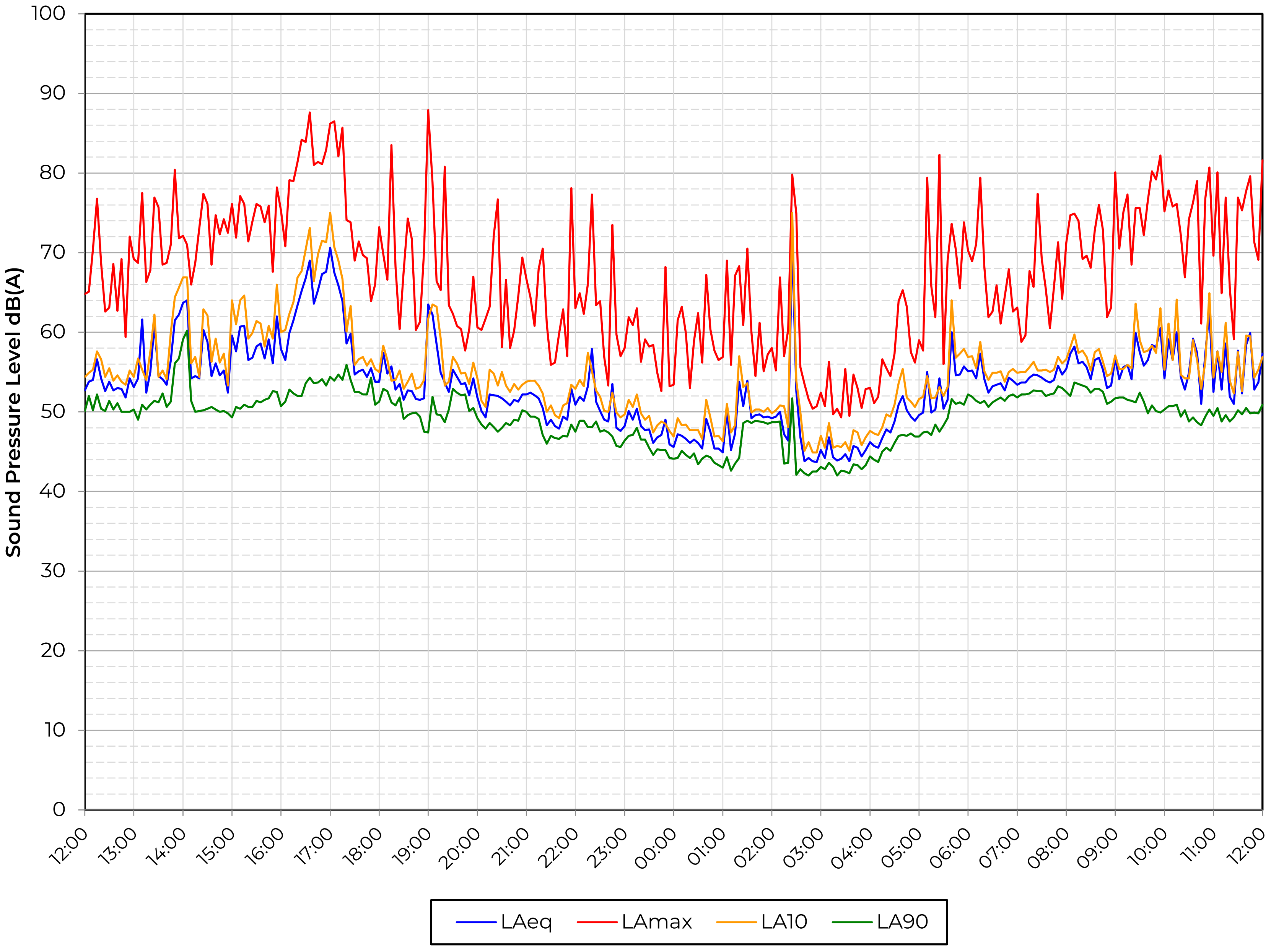
Mon 08 May to Tue 09 May

Figure AS13316/TH8

clarke saunders acoustics

Stockley Park - Travelodge Extension

Position LT1

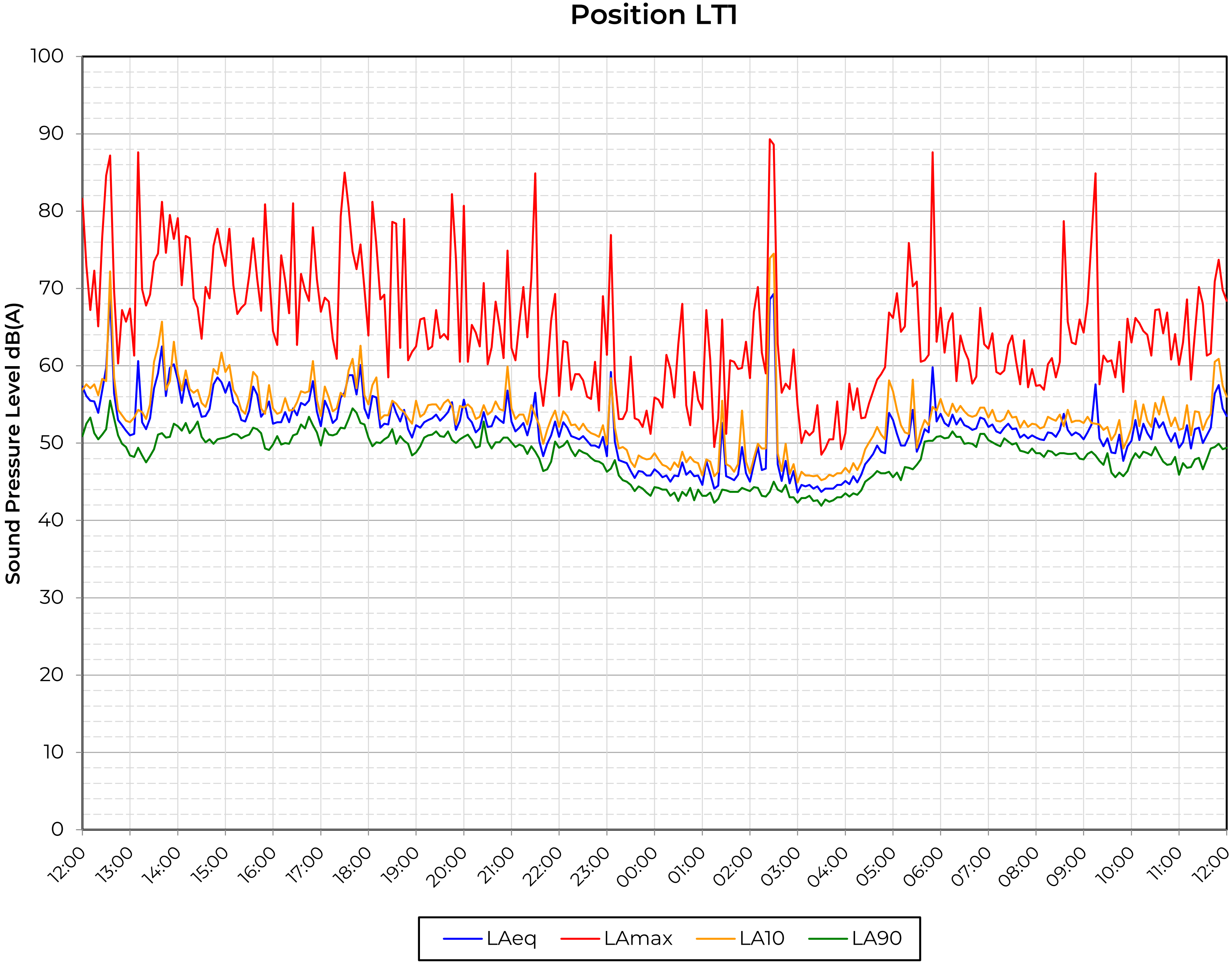


Tue 09 May to Wed 10 May

Figure AS13316/TH9

clarke saunders acoustics

Stockley Park - Travelodge Extension



Wed 10 May to Thu 11 May

Figure AS13316/TH10

Acoustic Terminology

The human impact of sounds is dependent upon many complex interrelated factors such as 'loudness', its frequency (or pitch) and variation in level. In order to have some objective measure of the annoyance, scales have been derived to allow for these subjective factors.

Sound Vibrations propagating through a medium (air, water, etc.) that are detectable by the auditory system.

Noise Sound that is unwanted by or disturbing to the perceiver.

Frequency The rate per second of vibration constituting a wave, measured in Hertz (Hz), where 1Hz = 1 vibration cycle per second. The human hearing can generally detect sound having frequencies in the range 20Hz to 20kHz. Frequency corresponds to the perception of 'pitch', with low frequencies producing low 'notes' and higher frequencies producing high 'notes'.

dB(A): Human hearing is more susceptible to mid-frequency sounds than those at high and low frequencies. To take account of this in measurements and predictions, the 'A' weighting scale is used so that the level of sound corresponds roughly to the level as it is typically discerned by humans. The measured or calculated 'A' weighted sound level is designated as dB(A) or L_A.

L_{eq} : A notional steady sound level which, over a stated period of time, would contain the same amount of acoustical energy as the actual, fluctuating sound measured over that period (e.g. 8 hour, 1 hour, etc).

The concept of L_{eq} (equivalent continuous sound level) has primarily been used in assessing noise from industry, although its use is becoming more widespread in defining many other types of sounds, such as from amplified music and environmental sources such as aircraft and construction.

Because L_{eq} is effectively a summation of a number of events, it does not in itself limit the magnitude of any individual event, and this is frequently used in conjunction with an absolute sound limit.

L_{10} & L_{90} : Statistical L_n indices are used to describe the level and the degree of fluctuation of non-steady sound. The term refers to the level exceeded for n% of the time. Hence, L_{10} is the level exceeded for 10% of the time and as such can be regarded as a typical maximum level. Similarly, L_{90} is the typical minimum level and is often used to describe background noise.

It is common practice to use the L_{10} index to describe noise from traffic as, being a high average, it takes into account the increased annoyance that results from the non-steady nature of traffic flow.

L_{max} : The maximum sound pressure level recorded over a given period. L_{max} is sometimes used in assessing environmental noise, where occasional loud events occur which might not be adequately represented by a time-averaged L_{eq} value.

NR *Noise Rating*. A single figure noise level rating that takes into account the frequency content of an acoustic environment.

R *Sound Reduction Index*. Effectively the Level Difference of a building element when measured in an accredited laboratory test suite in accordance with the procedures laid down in BS EN ISO 10140-2:2010 and corrected for its size and the reverberant characteristics of the receive room.

D The sound insulation performance of a construction is described in terms of the difference in sound level on either side of the construction in the presence of a sound source on one side and the reverberant characteristics of the adjoining 'receive' space. D is the arithmetic Level Difference in decibels between the source and receive sound levels when filtered into frequency bands.

D_{nT}	*Weighted Standardised Level Difference*. As defined in BS EN ISO 717-1, representing the Weighted Level Difference, when standardised for reference receiving room reverberant characteristics.
$D_{n,e}$	Normalised sound insulation of small building elements of fixed dimensions, such as vents, measured in an accredited laboratory test suite in accordance with the procedures laid down in BS EN ISO 10140-2:2010.
$D_{n,f}$	Flanking sound insulation of lightweight elements, such as curtain wall mullions, measured in an accredited laboratory test suite in accordance with the procedures laid down in ISO 10848-2:2006
R_w D_w $D_{nT,w}$ $D_{n,e,w}$ $D_{n,f,w}$	Value of parameter, determined as above, but weighted in accordance with the procedures laid down in BS EN ISO 717-1 to provide a single-figure value.
C, C_{tr}	Spectral adaptation terms to be added to a single number quantity such as DnT,w, to take account of the sound insulation within frequency ranges of particular interest.
$L'_{nT,w}$	*Weighted Standardised Impact Sound Pressure Level* as defined in BS EN ISO 717-2, representing the level of sound pressure when measured within a space where the floor above is under excitation from a calibrated tapping machine, standardised for the receiving room reverberant characteristics.
ΔL_w	Change in impact sound pressure level when a floor is fitted with a 'soft' or resilient covering, as measured in an accredited laboratory test suite in accordance with the procedures laid down in BS EN ISO 10140-3:2010.

Octave Band Frequencies

In order to determine the way in which the energy of sound is distributed across the frequency range, the International Standards Organisation has agreed on "preferred" bands of frequency for sound measurement and analysis. The widest and most commonly used band for frequency measurement and analysis is the Octave Band.

In these bands, the upper frequency limit is twice the lower frequency limit, with the band being described by its "centre frequency" which is the average (geometric mean) of the upper and lower limits, e.g. 250 Hz octave band extends from 176 Hz to 353 Hz. The most commonly used octave bands are:

Octave Band Centre Frequency Hz	63	125	250	500	1000	2000	4000	8000

Human Perception of Broadband Noise

Because of the logarithmic nature of the decibel scale, it should be borne in mind that sound levels in dB(A) do not have a simple linear relationship. For example, 100dB(A) sound level is not twice as loud as 50dB(A). It has been found experimentally that changes in the average level of fluctuating sound, such as from traffic, need to be of the order of 3dB before becoming definitely perceptible to the human ear. Data from other experiments have indicated that a change in sound level of 10dB is perceived by the average listener as a doubling or halving of loudness. Using this information, a guide to the subjective interpretation of changes in environmental sound level can be given.

INTERPRETATION

Change in Sound Level dB	Subjective Impression	Human Response
0 to 2	Imperceptible change in loudness	Marginal
3 to 5	Perceptible change in loudness	Noticeable
6 to 10	Up to a doubling or halving of loudness	Significant
11 to 15	More than a doubling or halving of loudness	Substantial
16 to 20	Up to a quadrupling or quartering of loudness	Substantial
21 or more	More than a quadrupling or quartering of loudness	Very Substantial

Earth Bunds and Barriers - Effective Screen Height

When considering the reduction in sound level of a source provided by a barrier, it is necessary to establish the "effective screen height". For example if a tall barrier exists between a sound source and a listener, with the barrier close to the listener, the listener will perceive the sound as being louder if he climbs up a ladder (and is closer to the top of the barrier) than if he were standing at ground level. Equally if he sat on the ground the sound would seem quieter than if he were standing. This is explained by the fact that the "effective screen height" is changing with the three cases above. In general, the greater the effective screen height, the greater the perceived reduction in sound level.

Similarly, the attenuation provided by a barrier will be greater where it is aligned close to either the source or the listener than where the barrier is midway between the two.

BS4142 is designed to allow contextual assessment of impact from commercial, or industrial sound on sensitive receptors. Examples covered by the Standard include:

- Sound from industrial and manufacturing processes;
- Sound from fixed installations which comprise mechanical and electrical plant and equipment.
- Sound from the loading and unloading of goods and materials at industrial and/or commercial premises, and
- Sound from mobile plant and vehicles that is an intrinsic part of the overall sound emanating from premises or processes.

In brief, the assessment procedure involves establishing sound levels from the items or processes of interest, (the specific sound source(s)), corrected for any acoustic features to derive the Rating Level, ($L_{Ar,Tr}$), at the relevant assessment position(s). The Rating Level is compared against the existing Background Sound Level, ($L_{A90,T}$), to provide an initial estimate of impact. The Standard offers the following guidance with regard to the significance of estimated impact:

a) *Typically, the greater this difference, the greater the magnitude of the impact;*

b) *A difference of around +10dB or more is likely to be an indication of a significant adverse impact, depending on the context;*

c) *A difference of around +5dB could be an indication of an adverse impact, depending on the context;*

d) *Where the rating level does not exceed the background sound level, this is an indication of the specific sound having a low impact, depending on the context. The lower the rating level is relative to the background sound level, the less likely it is that the specific sound source will have an adverse impact.*

Where relevant, the initial estimate should then be modified by accounting for contextual aspects of the operation of the specific sound source and / or the context of the character of the area.

Other Assessment Parameters and Guidance on Character Corrections

The Specific Sound Level (L_s) is expressed in terms of an L_{Aeq} for a reference time interval, (T_r) of one-hour during the daytime (07:00 – 23:00 hours) and a fifteen-minute period during the night-time (23:00 – 07:00 hours). The Rating Level is also expressed in terms of the reference time interval, T_r.

The Specific Sound Level can be determined by various means, which can include prediction based on manufacturer's data and accompanying propagation calculations to the assessment position(s). This method could be used, for instance, where the specific sound source is not yet in-situ, or is in-situ but not yet operational.

Where the specific sound source is already operational and in-situ, measurements of the sound climate resulting from both the specific sound source and all other contributing sources, (knows as the Ambient Sound Level, L_a = $L_{Aeq,T}$) should be measured over a representative time period, ideally at the assessment position(s).

Depending on the relative contribution of other sources not related to the specific sound, (known as the residual sound), the Specific Sound Level can be derived by logarithmically subtracting the Residual Sound Level, $L_r = L_{Aeq,T}$, from the Ambient Sound Level.

With justification, representative proxy locations can be used for the measurement of the ambient and/or residual sound climate. Where these measurement locations are not fully representative of the assessment position(s), measurement can be supplemented with calculation.

The Background Sound Level should ideally also be measured at the assessment position(s) but can be measured at representative proxy locations where suitable reasons can be provided. The Background Sound Level should be measured over a period which is suitable to characterise the background sound climate during the period of interest and should normally be at least 15 minutes.

When deriving the Rating Level from the Specific Sound Level, consideration is given to the character of the sound. The Standard provides several methods for deriving appropriate character corrections, offering the following advice for subjective assessment:

Tonality

For sound ranging from not tonal to prominently tonal, the Joint Nordic Method gives a correction of between 0 dB and +6 dB for tonality. Subjectively, this can be allocated as a penalty of 2 dB for a tone which is just perceptible at the sound receptor, 4 dB where it is clearly perceptible and 6 dB where it is highly perceptible.

Impulsivity

A correction of up to +9dB can be applied for sound that is highly impulsive considering both the rapidity of the change in sound level and the overall change in sound level. Subjectively, this can be allocated as a penalty of 3dB for impulsivity which is just perceptible at the receiver, 6dB where it is clearly perceptible and 9dB where it is highly perceptible.

Other sound characteristics

Where the specific sound contains characteristics that are neither tonal nor impulsive, but are otherwise startling, disturbing or incongruous with the residual acoustic environment, a penalty of +3dB can be applied.

Intermittency

When the specific sound has identifiable on/off conditions, if the intermittency is readily distinctive against the residual acoustic environment, a penalty of +3dB can be applied.

APPENDIX C

PLANT SOUND TO HOTEL WINDOW		63Hz	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	8kHz	dB(A)
Condenser Area										
CAHV-R450YA Normal	Lp @ 1m	66	73	70	67	61	59	61	52	69
Lw to Lp @ 1m	-	0	0	0	0	0	0	0	0	
Attenuation Loss	None	0	0	0	0	0	0	0	0	
Number of	12no	11	11	11	11	11	11	11	11	
Screening Loss	1 Structur	-7	-8	-10	-13	-15	-18	-18	-18	
Distance Loss	60m	-36	-36	-36	-36	-36	-36	-36	-36	
	Subtotal	**34**	**40**	**35**	**30**	**21**	**16**	**18**	**9**	**31**
Specific sound level at receptor	$L_{eq\ 1hr}$	**34**	**40**	**35**	**30**	**21**	**16**	**18**	**9**	**31**