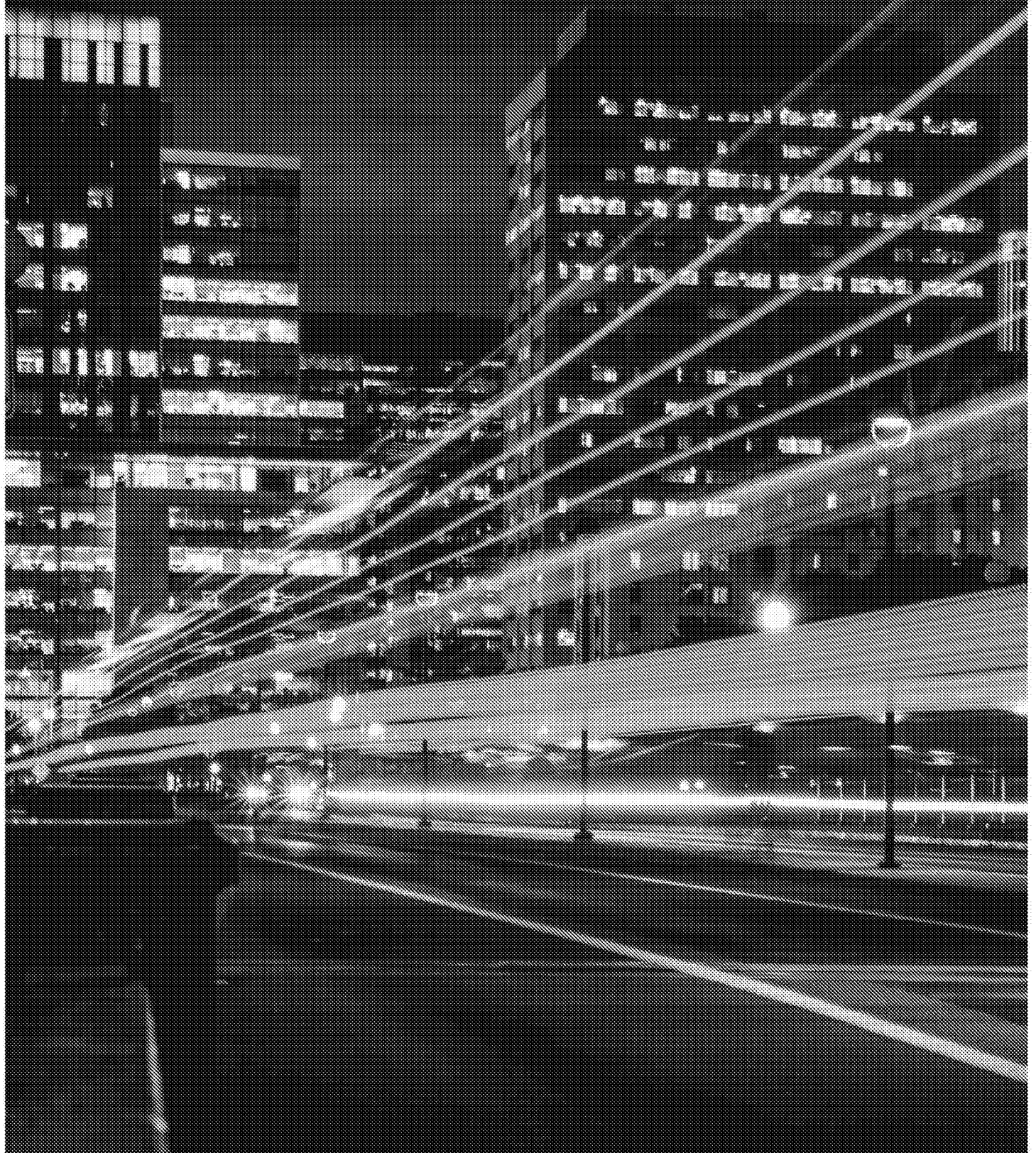




PREPARED: Wednesday, 23 December 2020

NOISE IMPACT ASSESSMENT;
LAND NORTH OF MAYFLOWER WAY, ANGMERING

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APPENDIX A	Acoustic Terminology
APPENDIX B	BS4142 Calculations

Project Ref:	AS11489	Title:	Land North of Mayflower Way, Angmering
Report Ref:	AS11489.201217.NIA	Title:	Noise Impact Assessment
Client Name:	Crayfern Homes Ltd		
Project Manager:	Daniel Saunders		
Report Author:	Daniel Saunders		
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 EXECUTIVE SUMMARY

- 1.1 Clarke Saunders Associates has been commissioned by Crayfern Homes Ltd to undertake an assessment of the land north of Mayflower Way, Angmering, to assess its suitability for residential development.
- 1.2 An environmental noise survey has been undertaken at the site by Clarke Saunders Acoustics between Friday 4th December and Wednesday 9th December 2020. The measured levels have been assessed with reference made to the relevant guidance set out in BS8233:2014 *Guidance on sound insulation and noise reduction for buildings* and BS4142:2014+A1:2019 *Methods for rating and assessing industrial and commercial sound*, to provide the relevant details to discharge planning condition 19 of the Arun District Council Decision Notice (application ref. A/46/19/PL).
- 1.3 The survey has allowed the minimum sound reduction requirements of the external building fabric to be established as an outline performance specification. Mitigation measures include standard thermal double glazing and acoustically specified ventilators.

2.0 INTRODUCTION

- 2.1 The Applicant is proposing to develop 24 dwellings at the land north of Mayflower Way, Angmering. This report provides the relevant details to discharge planning condition 19 of the Arun District Council Decision Notice (application ref. A/46/19/PL), which states:

19. Prior to commencement of development an Acoustic Report which identifies noise sources in the vicinity of the new homes and appropriate mitigation measures shall be submitted to and approved by the Local Planning Authority. The scope and extent of such a report should be agreed with the Planning Authority before its commission. The works shall proceed in accordance with the details so approved and noise mitigation measures shall be provided prior to occupation and retained in perpetuity. Noise measurements shall be carried out and submitted to the Local Planning Authority for approval before occupation of any residential unit in order to demonstrate the effectiveness of such mitigation works.

- 2.2 Clarke Saunders Associates (CSA) has been commissioned by Crayfern Homes Ltd to undertake an assessment of the current environmental noise impact at the site, which will be assessed with reference made to the relevant guidance set out in BS8233:2014 *Guidance on sound insulation and noise reduction for buildings* and, where applicable, BS4142:2014+A1:2019 *Methods for rating and assessing industrial and commercial sound*.
- 2.3 The assessment will also consider the requirement for any outline mitigation measures as appropriate for the proposed residential development in order to provide the information to discharge the planning condition.

3.0 LOCAL AUTHORITY CONSULTATION

- 3.1 CSA discussed the project in detail with Carol Reynolds, Senior Environmental Health Officer for Arun District Council, who confirmed requirements via email on Friday 4th December 2020. This included a background noise survey over a 5-day period, an assessment demonstrating compliance with guideline values specified in BS8233:2014, and a BS4142:2014+A1:2019 assessment relating to the nearby industrial/commercial uses would be sufficient for the planning condition.

- 3.2 Regarding noise arising from the adjacent kennels, BS4142:2014+A1:2019 states "The standard is not intended to be applied to the rating and assessment of sound from: ...domestic animals...". As such, it was agreed, so as not to employ BS4142:2014+A1:2019 beyond its scope, that a contextual assessment of specific sound sources incongruent to the existing soundscape would be provided and additional mitigation measures specified, where necessary, in order to minimise the risk of adverse impact for future occupants.

4.0 SITE DESCRIPTION

- 4.1 The site is located at the land north of Mayflower Way, Angmering, and is bounded by agricultural land to the north, commercial uses and Roundstone Lane to the east, and Mayflower Way to the south and the west.
- 4.2 The commercial uses to the east of the development consist of Roundstone Boarding Kennels and Cattery, Roundstone Van Centre and Car Sales, D & A Motors vehicle repair shop and Angmering Car Sales.

5.0 DESIGN CRITERIA

BS8233:2014 GUIDANCE ON SOUND INSULATION AND NOISE REDUCTION FOR BUILDINGS

The guidance in this document indicates desirable noise levels for various activities within residential dwellings. The relevant section of this standard is shown in the following table:

ACTIVITY	LOCATION	07:00 TO 23:00	23:00 TO 07:00
Resting	Living Room	35 dB $L_{Aeq, 16 \text{ hour}}$	-
Dining	Dining Room	40 dB $L_{Aeq, 16 \text{ hour}}$	-
Sleeping (daytime resting)	Bedroom	35 dB $L_{Aeq, 16 \text{ hour}}$	30 dB $L_{Aeq, 8 \text{ hour}}$

TABLE 5.1 – BS8233:2014 – DESIRABLE INTERNAL NOISE LEVELS

dB ref. 20 μ Pa

For external areas, the standard states the following:

For traditional external areas that are used for amenity space, such as garden patios, it is desirable that the external noise level does not exceed 50 dB $L_{Aeq,T}$, with an upper guideline value of 55 dB $L_{Aeq,T}$ which would be acceptable in noisier environments.

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

6.0 ENVIRONMENTAL SOUND SURVEY

- 6.1 A survey of the existing background sound levels was undertaken at the locations shown in the attached indicative site plan ASI1489/SP. Measurements of consecutive L_{Aeq} , L_{Amax} , L_{A10} and L_{A90} sound pressure levels were taken between 12:40 hours on Friday 4th December and 10:45 hours on Wednesday 9th December 2020.
- 6.2 Direct survey measurements were also made on Wednesday 9th December 2020 in order to assess the sound from the adjacent commercial uses in accordance with BS4142:2014+A1:2019 *Methods for rating and assessing industrial and commercial sound*.
- 6.3 The following equipment was used during the survey:
- 1 no. Rion NA28 sound level meter;
 - 1 no. Rion NL52 sound level meter;
 - 1 no. Rion NL32 sound level meter;
 - 1 no. Norsonic 118 sound level meter;
 - 1 no. Rion NC74 sound level calibrator;
 - 1 no. Norsonic 1251 sound level calibrator.
- 6.4 The calibration of the sound level meters was verified before and after use. No significant calibration drift was detected. All equipment has current laboratory calibration and certification is available upon request.
- 6.5 The weather during the survey was dry with light winds, which made the conditions suitable for the measurement of environmental noise.
- 6.6 Measurements were made following procedures in BS7445:1991 (ISO1996-2:1987) *Description and measurement of environmental noise Part 2 – Acquisition of data pertinent to land use* and BS4142:2014+A1:2019 *Methods for rating and assessing industrial and commercial sound*. Please refer to Appendix A for details of the acoustic terminology used throughout this report.

7.0 RESULTS

- 7.1 Figures ASI1489/TH1-TH15 show the L_{Aeq} , L_{Amax} , L_{A10} and L_{A90} sound pressure levels as time histories at the measurement positions. The ambient noise climate at the site is determined by road traffic on Roundstone Lane and the A259.
- 7.2 The average noise levels at the monitoring position for the daytime and night-time periods are shown in the table below, along with the typical night-time maximum level, derived from the 90th percentile of the measured L_{AFmax} data.

Daytime $L_{Aeq,16hour}$	Night-time $L_{Aeq,8hour}$	Typical Night-time L_{AFmax}
Position 1: 54 dB	Position 1: 43 dB	Position 1: 61 dB
Position 2: 54 dB	Position 2: 45 dB	Position 2: 66 dB
Position 3: 50 dB	Position 3: 43 dB	Position 3: 65 dB

TABLE 7.1 – MEASURED AVERAGE AND TYPICAL MAXIMUM NOISE LEVELS dB ref. 20 μ Pa

- 7.3 The Arun Local Plan recognises that expected development will tend to increase the current level of road traffic on the main roads around the consented site. The first phase of works will include a new dual carriageway to replace the existing single carriageway between the new Fitzalan link road and the Body Shop roundabout and the single carriageway between Station Road, Angmering and the A280 roundabout. The latter part of these works may affect the average ambient noise levels at the development site. The night-time event maxima could not be expected to change, however. It should be noted that a doubling of road traffic would result in a 3dB change in the noise levels. This has been considered in the specification of mitigation measures in Section 9.0 of this assessment.

8.0 CONTEXTUAL ASSESSMENT OF BOARDING KENNELS ACTIVITY

- 8.1 Measurement position 1 was situated such that any noise levels arising from Roundstone Boarding Kennels & Cattery would be captured at the nearest receptor of the proposed development.
- 8.2 Through discussion with Carol Reynolds of Arun District Council, and the owner/operator of Roundstone Boarding Kennels & Cattery, it was confirmed that the kennels would typically contain a minimum of 26 dogs. General playtime/dog exercise throughout the day is undertaken underneath a Perspex covered "run", and dogs are locked inside the kennel housing overnight between 21:30 and 07:30 hours, which is made up of a brick wall construction with Ruberoid type roofing. The open area of the kennel is used for toileting between 07:30 and 08:00 hours, and again between 17:00 and 17:30 hours. The area is also used for playtime between 09:30 and 11:30 hours and again between 14:00 and 16:00 hours.
- 8.3 As shown in the table above, typical night-time L_{AFmax} noise levels at measurement position 1 are lower than those at measurement positions 2 and 3, despite closer proximity to the kennels and commercial uses, indicating typical maxima during the night-time period are generated from road traffic using the A259, to which measurement positions 2 and 3 are more exposed. Furthermore, these measured levels are substantially lower than the typical night-time L_{AFmax} noise levels measured at the boundary of the consented Quiet Waters development to the east (75 dB).
- 8.4 Analysis of the daytime maxima at position 1 indicates a typical daytime L_{AFmax} noise level of 75 dB, which is consistent with measurement position 2, despite closer proximity to the kennels.
- 8.5 It is understood that due to the ongoing COVID-19 pandemic, the kennels are currently operating at a reduced capacity. However, this would not affect the maximum levels generated by a given barking event. CSA library data suggests individual L_{Amax} barking events from a large labradoodle could be ~95 dB(A) at 3m. Given the distances to the nearest receptors (~20m to the nearest enclosed space and ~25m to the nearest open space), these would be substantially mitigated through distance attenuation, screening from boundary fencing, and furthermore building fabric attenuation since the dogs are kept inside throughout the night-time period. As a result, these events are likely to be commensurate with or lower than the existing maximum noise levels from other sources.
- 8.6 The measured average noise levels and night-time maxima, which incorporates any activity at the boarding kennels throughout the survey period, have been considered when specifying the following outline external building fabric performance.

9.0 OUTLINE EXTERNAL BUILDING FABRIC PERFORMANCE

- 9.1 The following design review is based on the Crayfern Homes Ltd drawings for the proposed development available at the time of writing.
- 9.2 The following assessment allows for intensification of road traffic on A259 as result of the proposed widening of the section to the south of the development site.

NON-GLAZED FAÇADE ELEMENT

- 9.3 It has been assumed that all non-glazed elements, i.e. masonry walls/facings and the roof systems, will provide the following minimum sound insulation performances, when tested in accordance with ISO 10140-2:2010. This is likely to be achievable with a standard brick/block cavity masonry external wall construction.

ELEMENT	SINGLE FIGURE WEIGHTED SOUND REDUCTION FIGURE (dB)
Masonry	R_w 51

TABLE 9.1 – MINIMUM SOUND REDUCTION INDEX (NON-GLAZED)

REQUIRED GLAZING PERFORMANCE

- 9.4 The minimum sound insulation specification for the glazed elements of the building façades is provided in the table below. These have been calculated using the site noise survey data to achieve the BS8233 desirable internal levels set out in Section 0.

GLAZING TYPE	SINGLE FIGURE WEIGHTED SOUND REDUCTION FIGURE	VENTILATOR PERFORMANCE
Type A	Standard Thermal Double Glazing	$D_{n,ew}$ 27 dB

TABLE 9.2 – MINIMUM SOUND REDUCTION INDEX FOR GLAZING AND VENTILATORS

- 9.5 The above glazing specification applies to facades of all habitable rooms across the development.
- 9.6 If passive ventilation (wall or trickle vents) is used in order that 'Type A' windows may remain closed to maintain internal noise levels, the performance shown in paragraph 9.4 will be required. These figures stated are for a single vent per room. If multiple vents are required, then the performance requirement will increase by a value equal to $+10\log(N)$, with N being the total number of vents serving the room.
- 9.7 Glazing units on these façades will still be openable and there is no reason why windows could not be opened as a matter of personal preference or for purge ventilation. No internal noise criteria are specified for the purge scenario, during which the expulsion of odours and/or fumes such as burned toast or drying paint is the priority.

10.0 AREAS OF EXTERNAL AMENITY

- 10.1 On the basis of the proposed site layout and measured survey data, it is anticipated that noise levels in all external amenity areas would be commensurate with or lower than the aspirational design range of 50 – 55 dB $L_{Aeq,16hour}$.

11.0 BS4142:2014+A1:2019

- 11.1 British Standard BS4142:2014+A1:2019 describes a method for rating and assessing sound of an industrial and/or commercial nature, which includes:
- 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.
- 11.2 The standard is, therefore, suited to the assessment of sound from Roundstone Van Centre and Car Sales and D & A Motors vehicle repair shop.
- 11.3 This Standard compares the sound levels in terms of a L_{Aeq} for a one-hour period during the daytime (07:00 – 23:00 hours) and a fifteen-minute period during the night-time (23:00 – 07:00 hours) due to the sound source, the "Specific Sound Level", with the existing background sound level in terms of an L_{A90} when the sound source is not operating.
- 11.4 The Specific Sound Level can be determined by various means, depending upon the relative level, of otherwise-occurring sound, i.e. the "Residual Sound Level".
- 11.5 As part of the assessment, consideration is given to the character of the sound. The Standard provides the following advice.

Tonality

- 11.6 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

- 11.7 A correction 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 3 dB for impulsivity which is just perceptible at the receiver, 6 dB where it is clearly perceptible and 9 dB where it is highly perceptible.

Other sound characteristics

- 11.8 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 +3 dB can be applied.

Intermittency

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

Impact Assessment

- 11.10 The resultant background sound level is subtracted from the Rating Level to obtain an initial estimate of the impact.
- Typically, the greater this difference, the greater the magnitude of the impact.
 - 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 could be an indication of an adverse impact, depending on the context.
 - The lower the rating level is relative to the measured background sound level, the less likely it is that there will be an adverse impact. 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.
- 11.11 The initial estimate of the impact may then be modified by taking consideration of the context on which the sound occurs.

SOUND IMPACT

- 11.12 Using the sound levels recorded during the environmental sound survey as described in Section 0, sound emissions arising from typical activity within and around the grounds of Roundstone Van Centre and Car Sales and D & A Motors vehicle repair shop have been assessed following procedures set out in BS4142:2014+A1:2019 *Methods for rating and assessing industrial and commercial sound*. A summary of this assessment is shown in the table below.
- 11.13 Full calculations are shown in attached Appendix B.

BS4142:2014+A1:2019 ASSESSMENT SUMMARY (DAYTIME)		COMMENTS
Specific Sound Level	38 dB	
Total Acoustic Character Correction(S)	+5 dB	A 5 dB penalty as requested by Carol Reynolds of Arun District Council, due to the impulsive nature of noise sources within the commercial uses.
Rating Level	43 dB	
Background Sound Level (L_{A90})	45 dB	Derived from the 10 th percentile of each L_{A90} dataset during the commercial uses' working hours, at monitoring position 1.
Assessment Level	-2 dB	Assessment indicates low impact.

CONTEXT

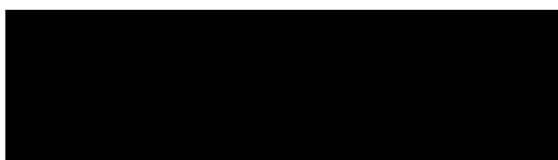
- 11.14 Sound measurements of general workshop activity arising from Roundstone Van Centre and Car Sales and D & A motors vehicle repair shop were taken at the southern corner of the building, where the workshop full height roller-doors were open to outside, and the northern corner of the building, approximately 1m from a member of staff using a compressed air tool, as shown in the indicative site plan ASI1489/SP (measurements ST1 & ST2 respectively).
- 11.15 After discussion with Roundstone Van Centre and Car Sales and D & A Motors, it was confirmed that the workshop doors on the northern side of the building are also often opened, particularly during the summer. Thus, a +3 dB correction has been applied to the general workshop noise measurements, representing a doubling in sound level as a worst-case scenario.
- 11.16 Roundstone Van Centre and Car Sales confirmed their opening hours are 08:00 – 18:00 hours during weekdays, and 08:00 – 13:00 hours on Saturday mornings. D & A Motors confirmed their opening hours are 08:00 – 17:30 hours during weekdays, and 08:30 – 13:00 hours on Saturday mornings. Furthermore, Carol Reynolds of Arun District Council stated the businesses occasionally operate until 22:00 hours during the summer. As such, the background sound level for the assessment is derived from the 10th percentile of each LA90 dataset from 08:00 – 22:00 during the weekdays and 08:00 – 13:00 on Saturday at monitoring position 1.
- 11.17 The most affected receptors have been identified as the rear gardens of plots 17 – 20, approximately 42m and 35m from measurement locations 1 and 2, respectively.
- 11.18 The above assessment summary indicates a low impact from noise arising from general activity at Roundstone Van Centre and Car Sales and D & A Motors vehicle repair shop, as the standard states *“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.”*

UNCERTAINTY

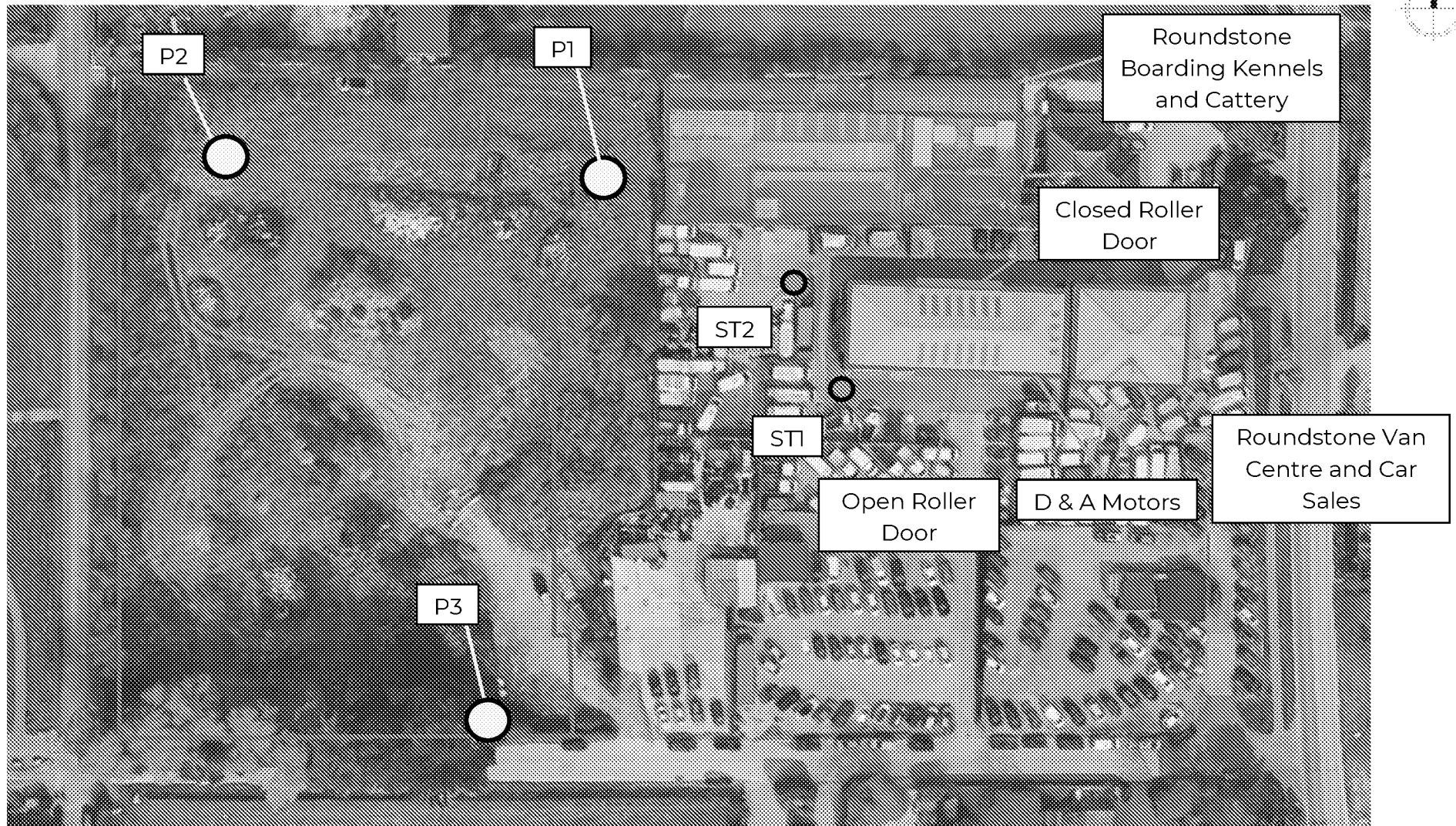
- 11.19 Use of a calibrated type 1 sound level meter is considered to reduce measurement instrument error to insignificant levels as compared with environmental variations.
- 11.20 Background and residual measurements were undertaken at the assessment position; however, measurements of the specific sound source were undertaken surrounding the grounds of the commercial uses in order to gauge the nature of the typical sound sources. A correction for screening provided by the boundary fence has, therefore, been allowed in the calculations.

12.0 CONCLUSION

- 12.1 Clarke Saunders Associates (CSA) has been commissioned by Crayfern Homes Ltd to undertake an assessment of the current environmental noise impact at the consented site for 24 dwellings to discharge the pre-commencement requirements of Condition 19 (application ref. A/46/19/PL).
- 12.2 CSA has consulted with Arun District Council and agreed the survey and assessment methodology using guidance set out in BS8233:2014 *Guidance on sound insulation and noise reduction for buildings* and, where applicable, BS4142:2014+A1:2019 *Methods for rating and assessing industrial and commercial sound*.
- 12.3 The impact of adjacent industrial/commercial activity has been shown to be acceptable using the assessment method in BS4142, where appropriate, and/or in the context of the prevailing ambient sound climate.
- 12.4 Allowance has been made for the potential intensification of road traffic on A259 following the planned widening works.
- 12.5 Mitigation measures have been specified, where necessary, in order to achieve the Arun DC's requirements and protect the internal and external amenity of future occupants. These include thermal double glazing and an alternative means of background ventilation.
- 12.6 A validation exercise will be undertaken prior to occupation, for which a method statement will be agreed with Arun District Council, in order to provide the information to discharge the remaining element of the planning condition.

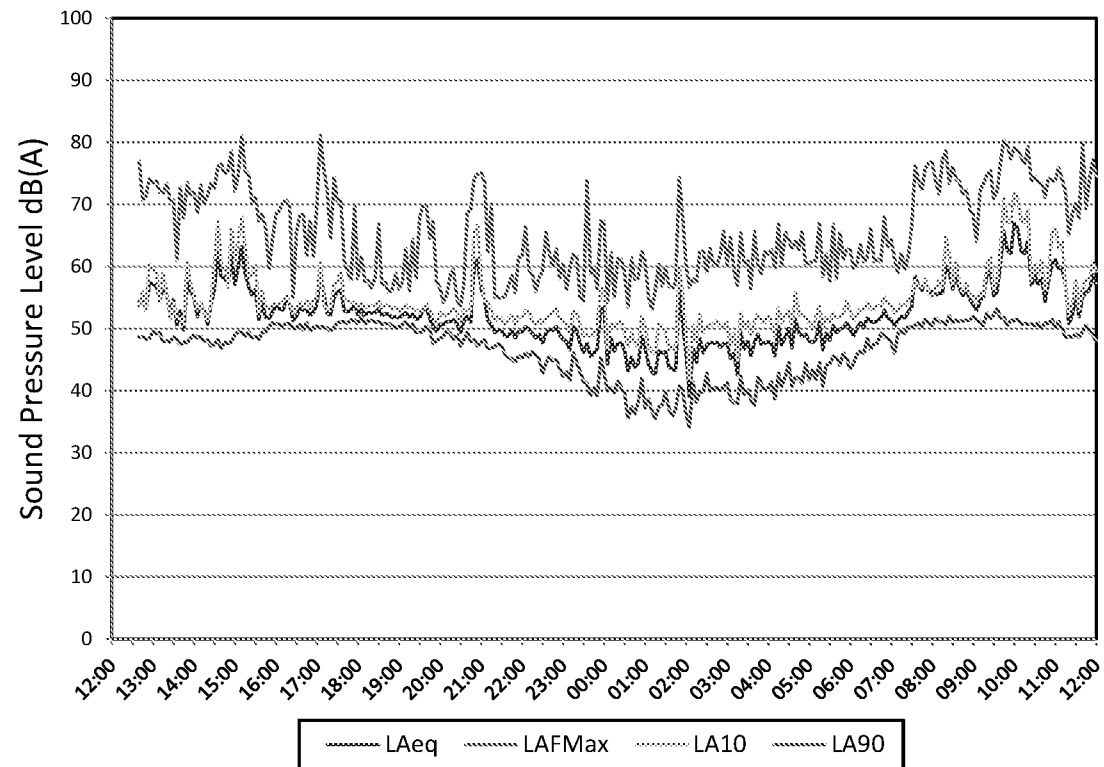


Daniel Saunders MIOA
CLARKE SAUNDERS ACOUSTICS



Land North of Mayflower Way

Environmental Noise Time History - P1

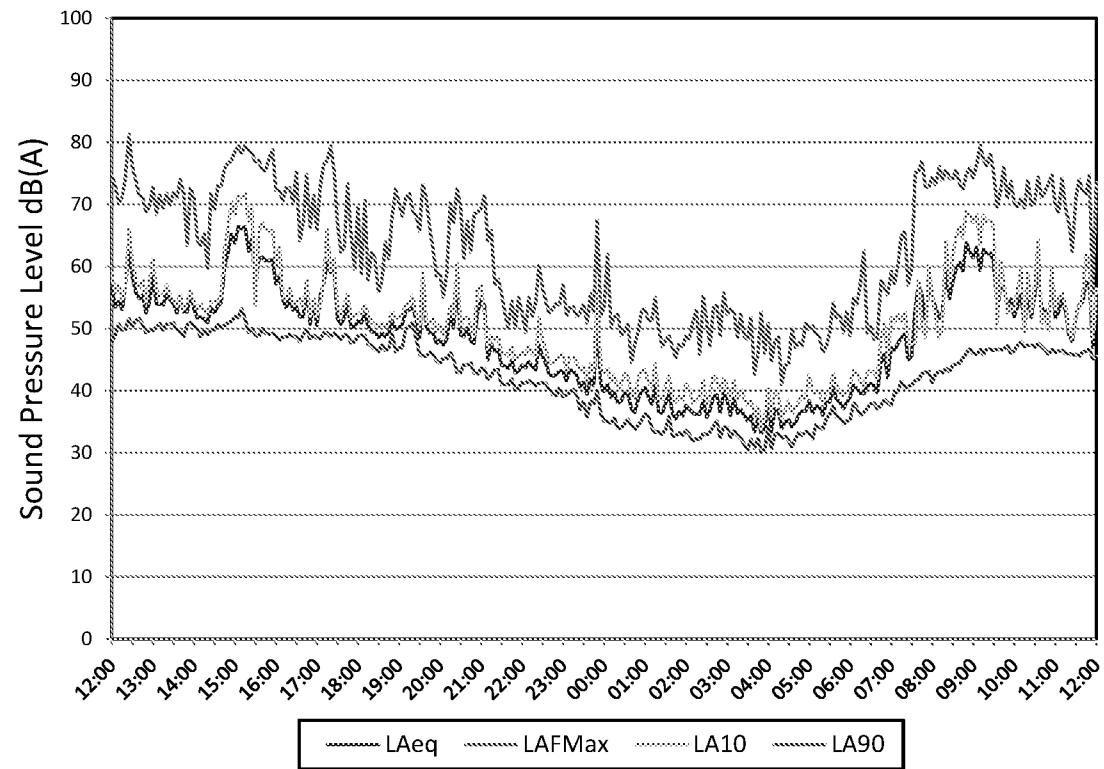


Friday 04 December to Saturday 05 December 2020

Figure AS11489/TH1

Land North of Mayflower Way

Environmental Noise Time History - P1

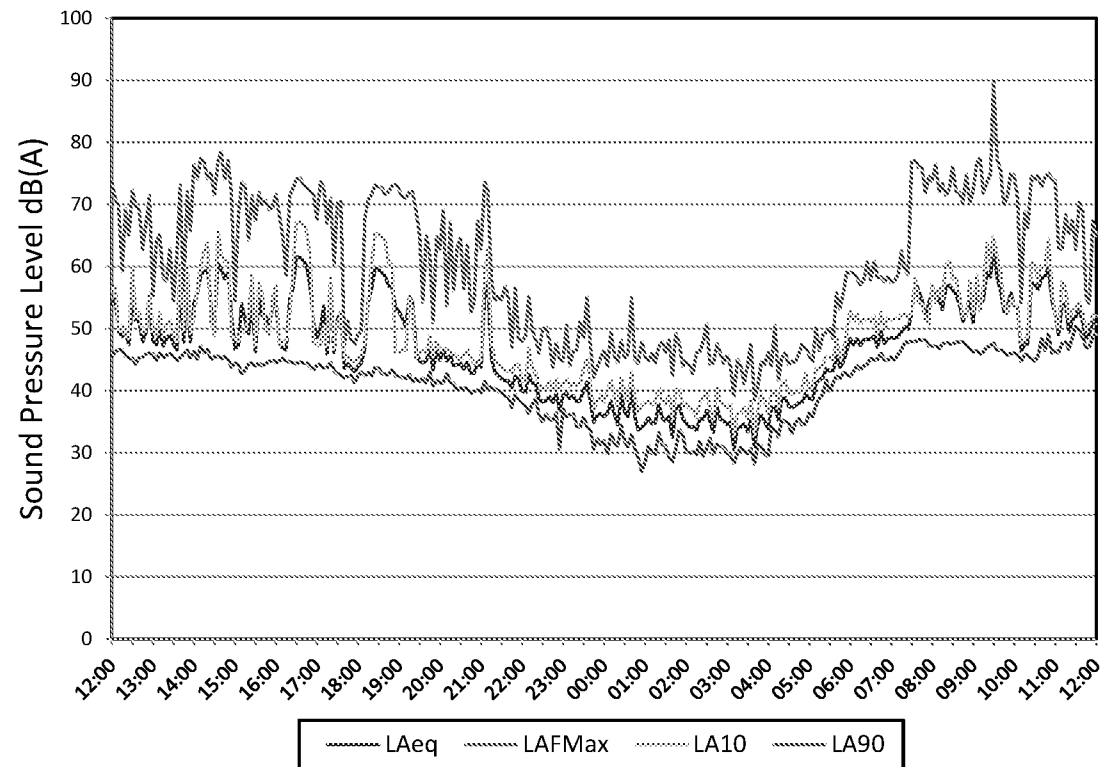


Saturday 05 December to Sunday 06 December 2020

Figure AS11489/TH2

Land North of Mayflower Way

Environmental Noise Time History - P1

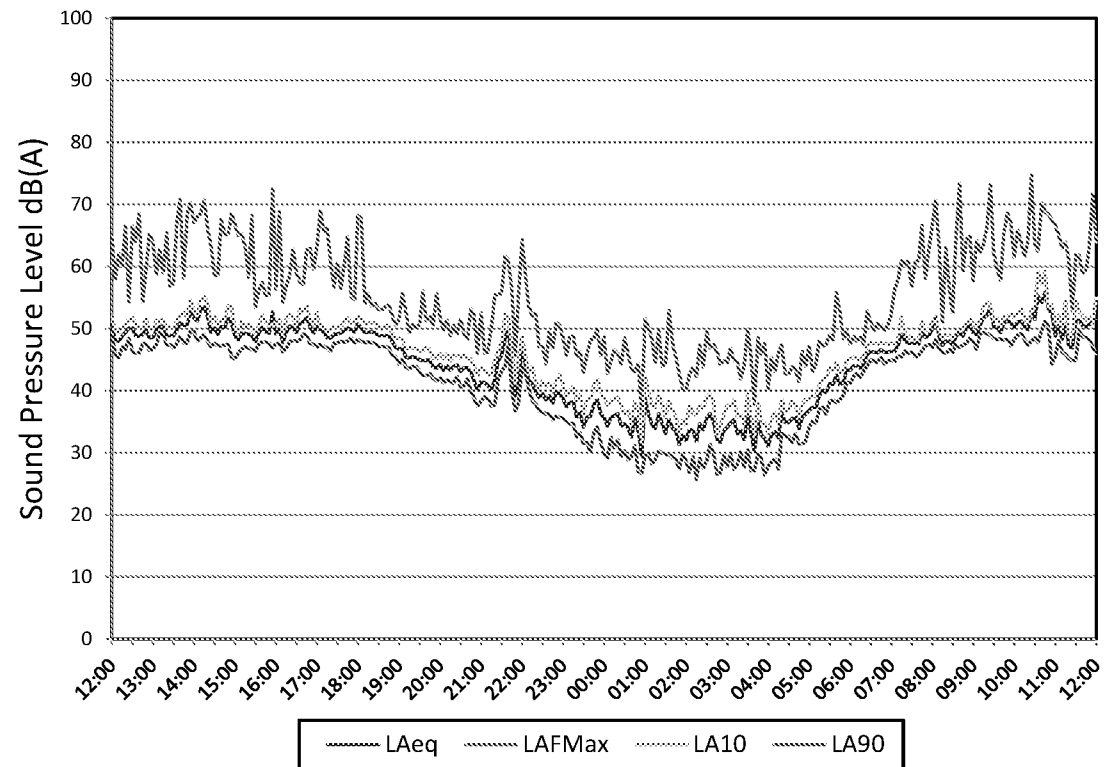


Sunday 06 December to Monday 07 December 2020

Figure AS11489/TH3

Land North of Mayflower Way

Environmental Noise Time History - P1

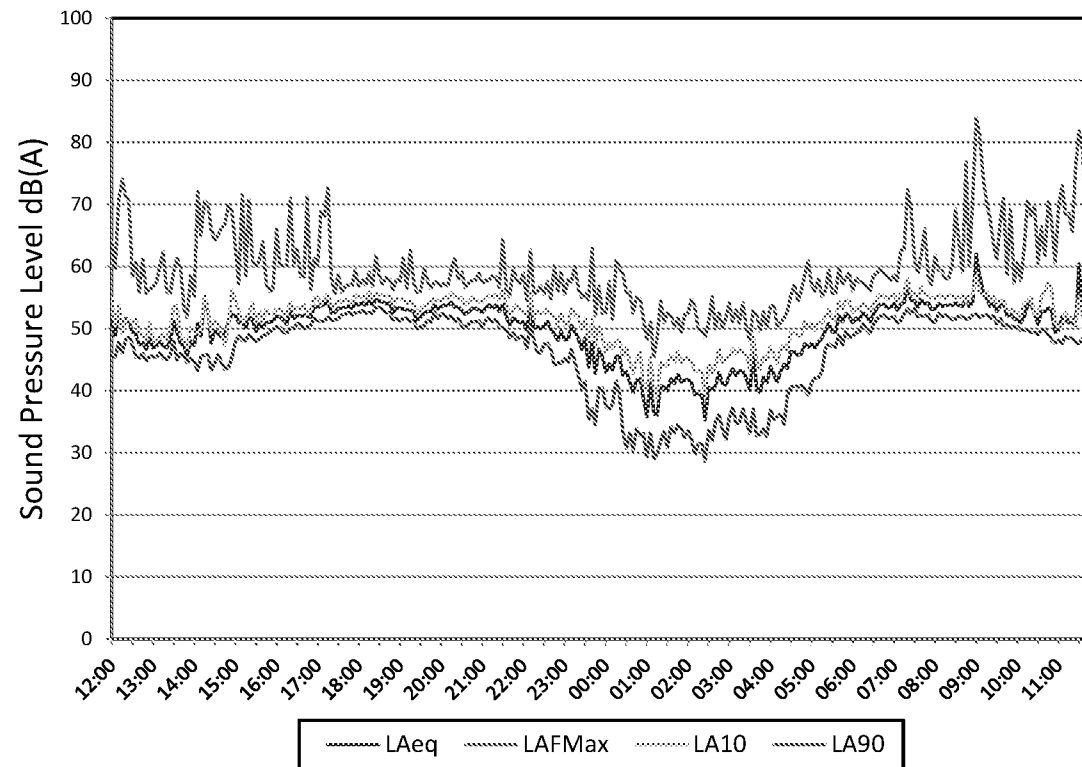


Monday 07 December to Tuesday 08 December 2020

Figure AS11489/TH4

Land North of Mayflower Way

Environmental Noise Time History - P1

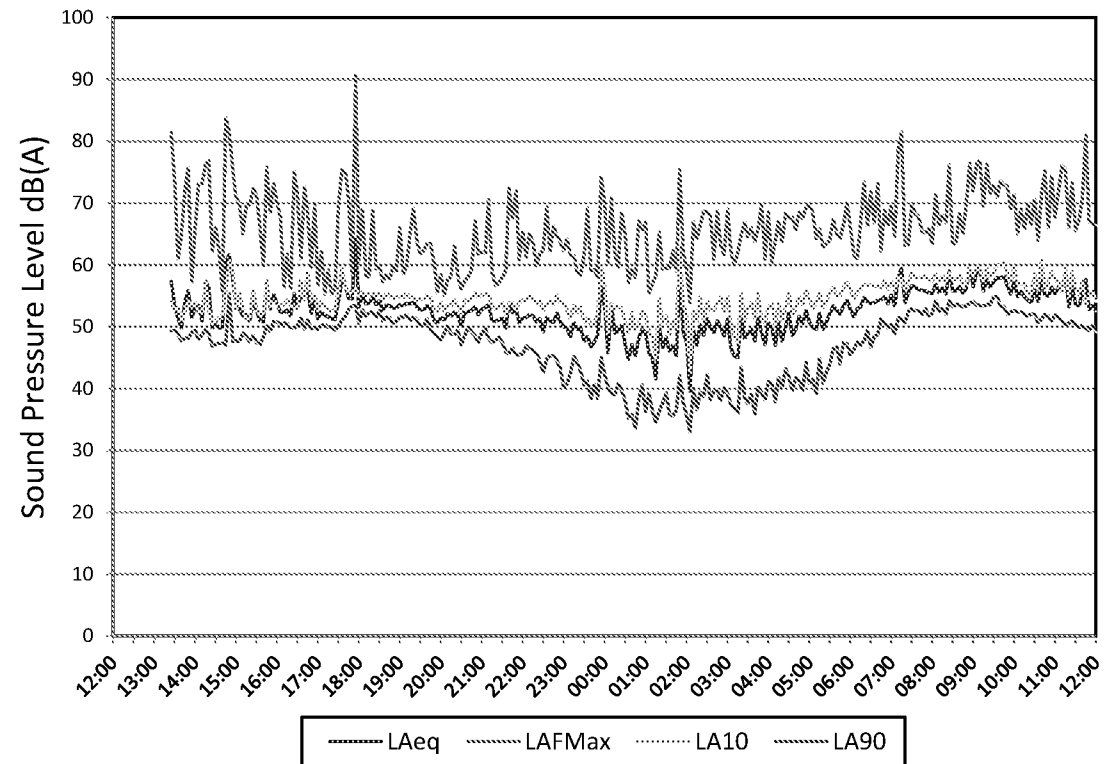


Tuesday 08 December to Wednesday 09 December 2020

Figure AS11489/TH5

Land North of Mayflower Way

Environmental Noise Time History - P2

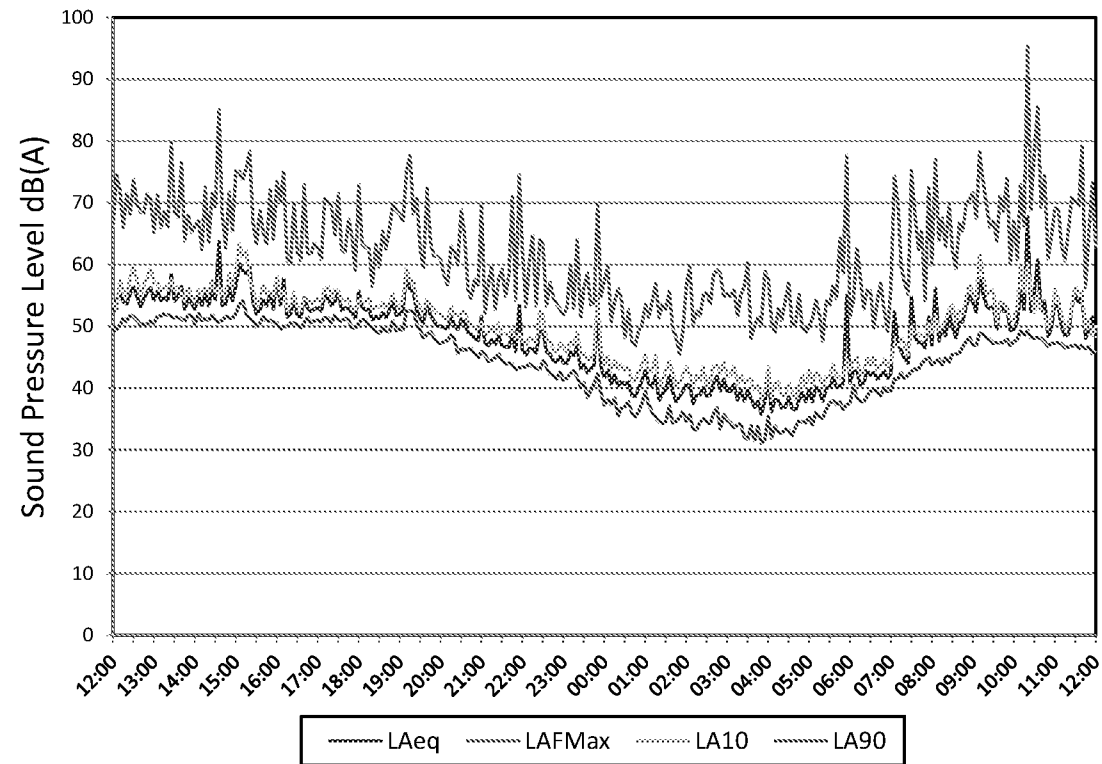


Friday 04 December to Saturday 05 December 2020

Figure AS11489/TH6

Land North of Mayflower Way

Environmental Noise Time History - P2

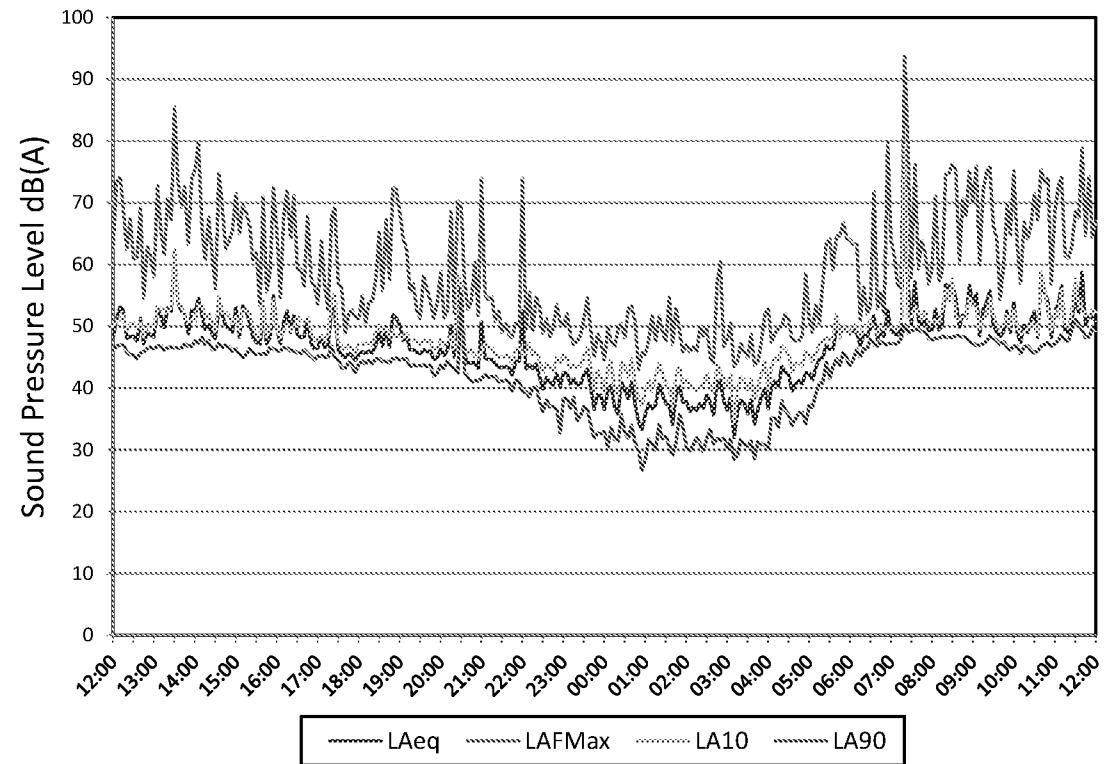


Saturday 05 December to Sunday 06 December 2020

Figure AS11489/TH7

Land North of Mayflower Way

Environmental Noise Time History - P2

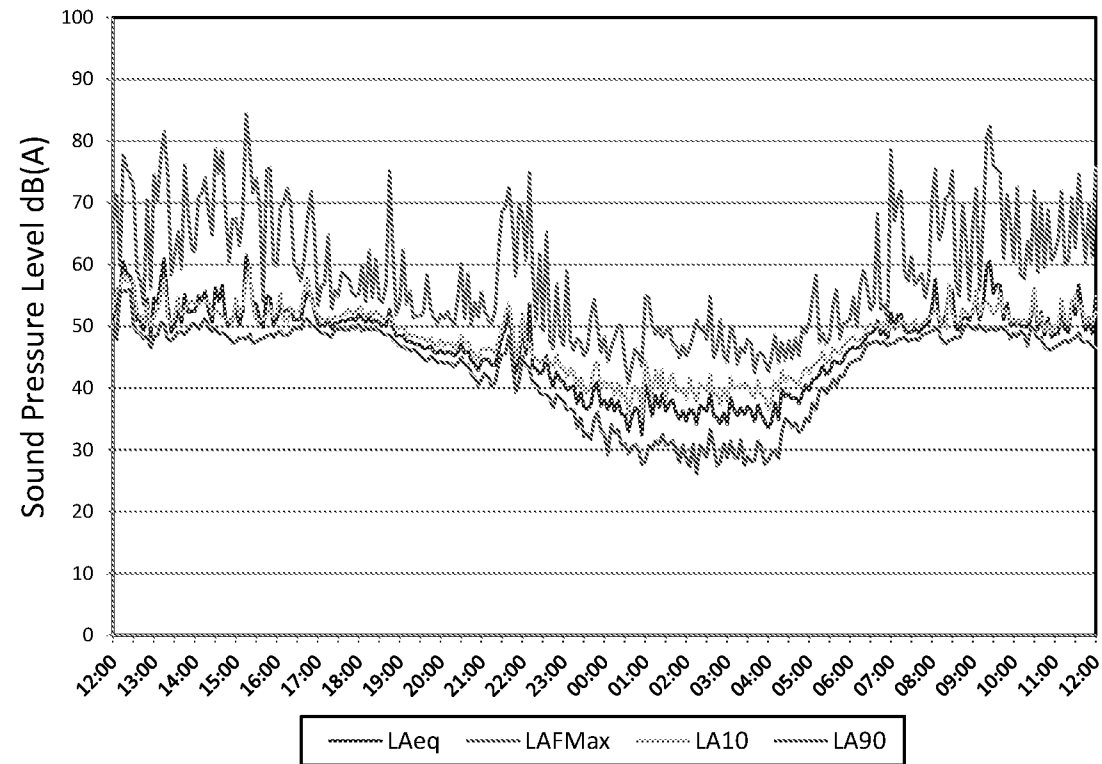


Sunday 06 December to Monday 07 December 2020

Figure AS11489/TH8

Land North of Mayflower Way

Environmental Noise Time History - P2

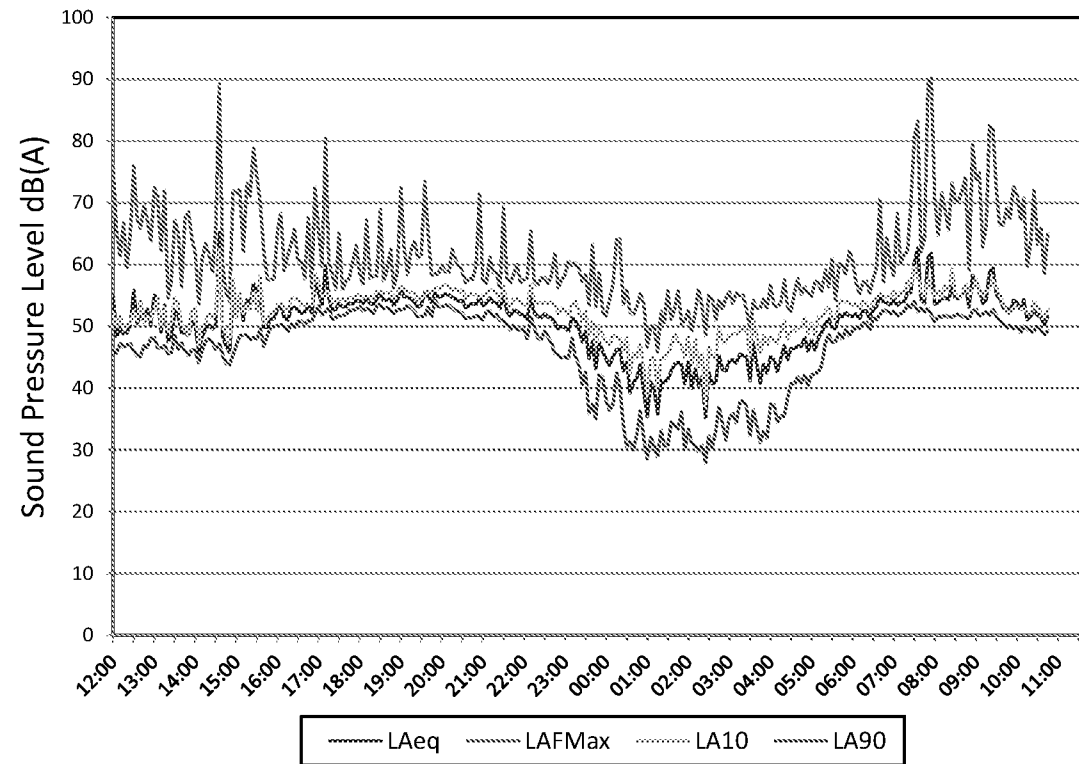


Monday 07 December to Tuesday 08 December 2020

Figure AS11489/TH9

Land North of Mayflower Way

Environmental Noise Time History - P2

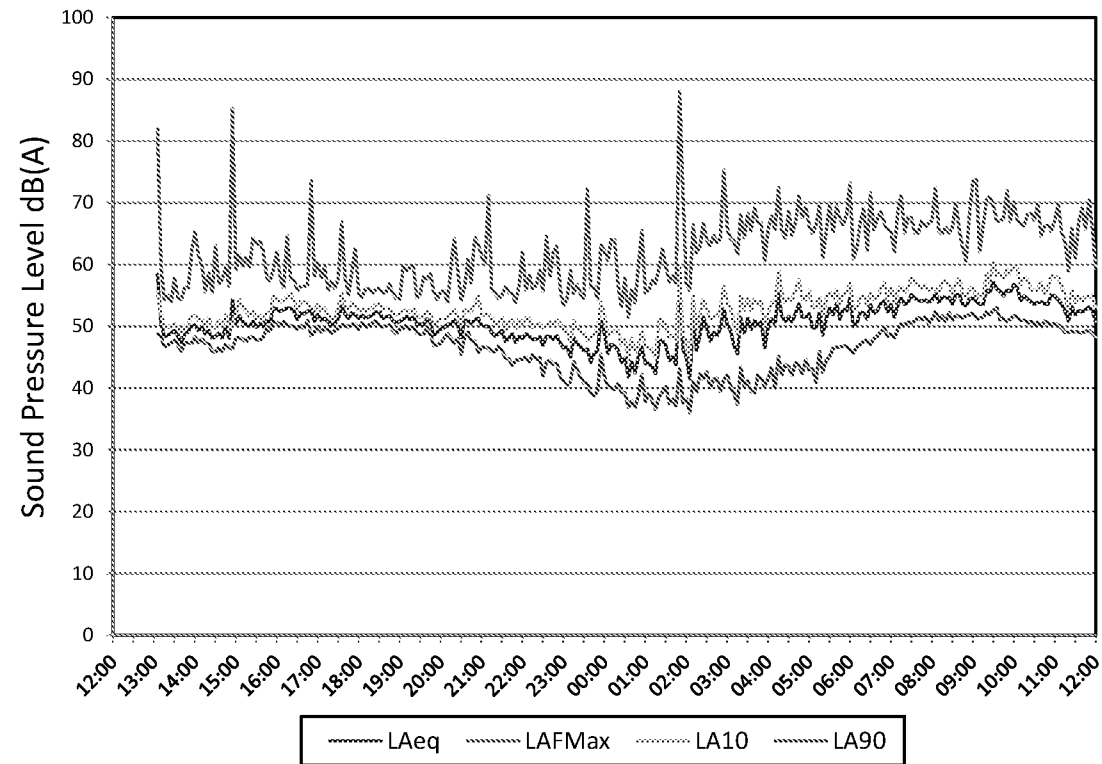


Tuesday 08 December to Wednesday 09 December 2020

Figure AS11489/TH10

Land North of Mayflower Way

Environmental Noise Time History - P3

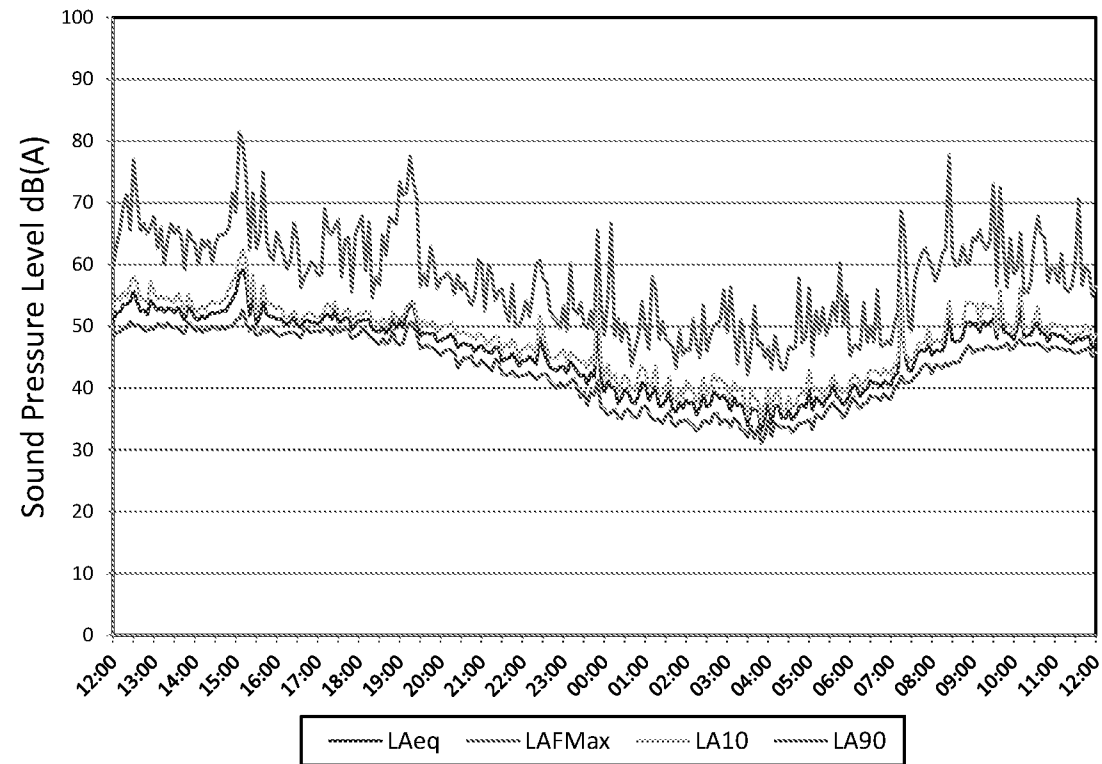


Friday 04 December to Saturday 05 December 2020

Figure AS11489/TH11

Land North of Mayflower Way

Environmental Noise Time History - P3

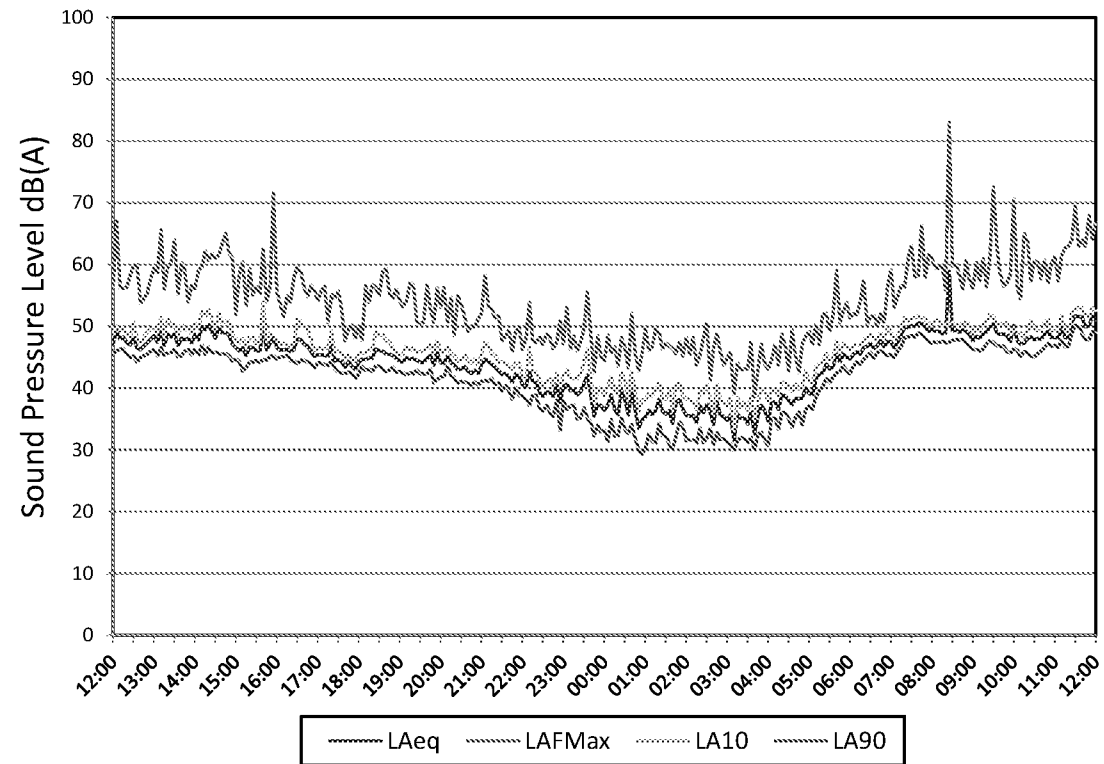


Saturday 05 December to Sunday 06 December 2020

Figure AS11489/TH12

Land North of Mayflower Way

Environmental Noise Time History - P3

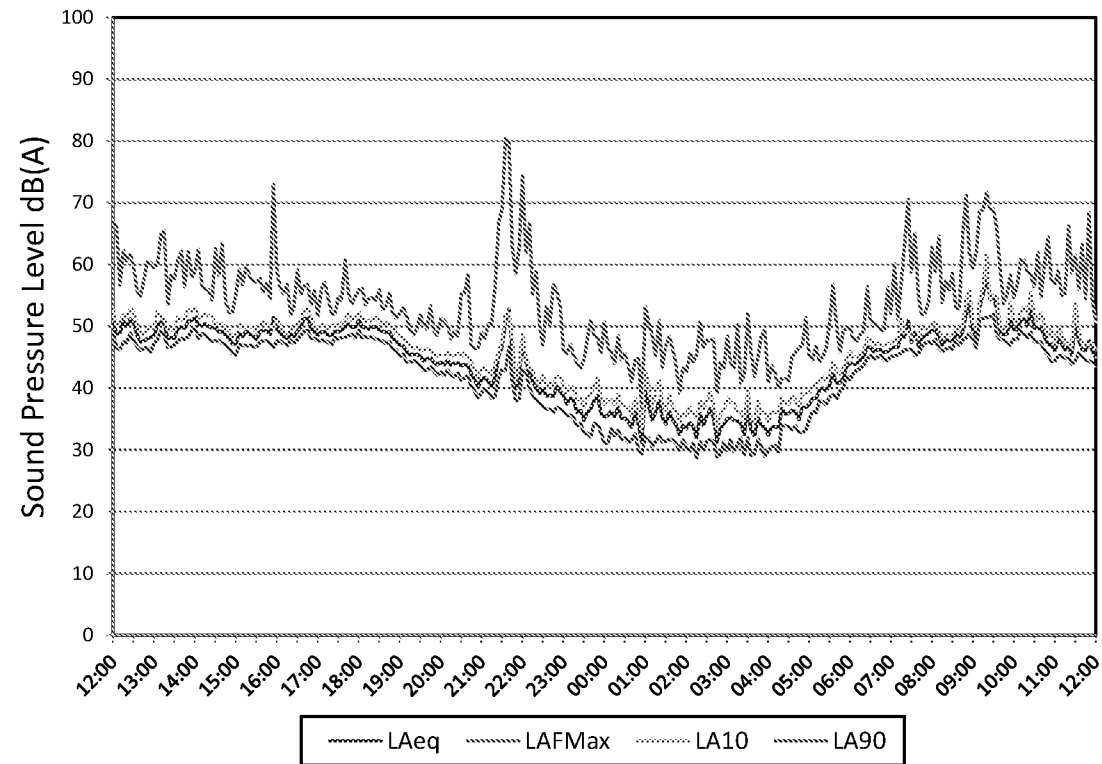


Sunday 06 December to Monday 07 December 2020

Figure AS11489/TH13

Land North of Mayflower Way

Environmental Noise Time History - P3

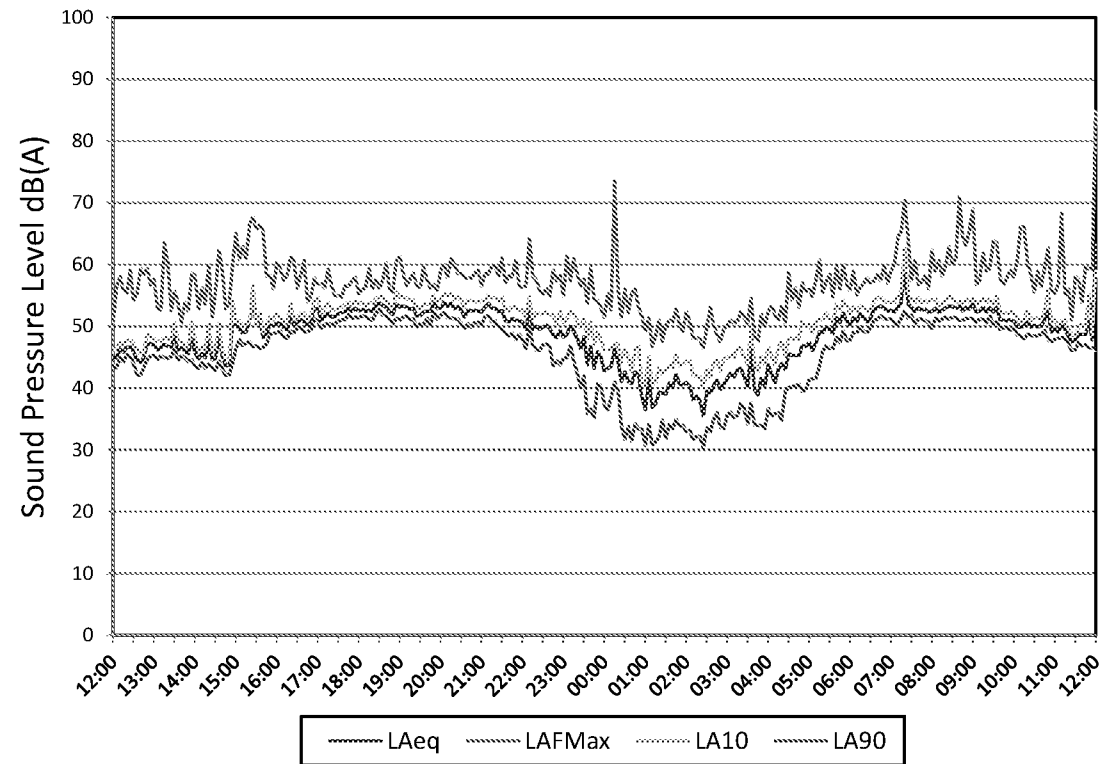


Monday 07 December to Tuesday 08 December 2020

Figure AS11489/TH14

Land North of Mayflower Way

Environmental Noise Time History - P3



Tuesday 08 December to Wednesday 09 December 2020

Figure AS11489/TH15

1.1 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.

1.2 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
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1.3 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

1.4 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.

APPENDIX B
AS11489 - Land North of Mayflower Way
BS4142 Assessment

		Comments
Measured Ambient Sound Level (L_{Aeq}):	53dB(A)	Specific sound source active (General Workshop Noise, South Corner)
Correction	3dB(A)	Doubling in noise levels when north workshop doors are open
Distance propagation loss	42m	to nearest receptor
Measured Ambient Sound Level (L_{Aeq}):	74dB(A)	Specific sound source active (Compressed Air, North Corner)
Distance propagation loss	35m	to nearest receptor
Screening (boundary fence)	-5dB(A)	
Residual Sound Level (L_{Aeq}):	46dB(A)	Specific sound source inactive
Combined Specific Sound Level (L_{Aeq}):	38dB(A)	
Background Sound Level (L_{A90}):	45dB(A)	
Acoustic Feature Correction:	+5dB(A)	5 dB for Impulsivity
Rating Level:	43dB(A)	
Excess of Rating Level over Background Sound Level:	-2dB(A)	