

Acoustic Assessment at



Grange Travel Limited Canal Road, Gravesend

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Executive Summary

Ned Johnson Acoustic Consultants Limited has been appointed to undertake an acoustic assessment of the portal frame shed for servicing and maintaining coaches at Grange Travel, Canal Road, Gravesend.

The assessment takes account of the existing noise environment, which has been quantified using direct measurement to take account of the effect of the development referred to above.

Noise control recommendations are not required to meet the likely planning requirements of Gravesham Borough Council. The predictions show that the noise from the portal frame shed will be at least 10dB below the typical background noise level at the nearest residential property.



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1. Introduction

- 1.1 Ned Johnson Acoustic Consultants Limited has been appointed to undertake an acoustic assessment of the portal frame shed at Grange Travel, Canal Road, Gravesend.
- 1.2 The development is for the construction of a new building to service and maintain coaches. Environmental Health has recommended that vehicle servicing and maintenance be restricted to Monday – Friday 07:30 to 17:30 and Saturdays 08:00 – 13:00.
- 1.3 The new portal shed is accessed from Canal Basin and is enclosed on all sides, with rollershutter doors on one facade. Various tools are used in the servicing, both hand and power tools.
- 1.4 The noise levels from the system at the nearest noise-affected property has been predicted and compared to the likely requirements of Graversham Borough Council using the methodology set-out in BS4142:2014+A1 2019. Which is that noise from the external equipment shall be at least 5dB below the background noise level at the nearest or most noise affected residential window.

2. Site Description

- 2.1 The development is for a new portal shed at Grange Travel, which will be used for the servicing and maintenance of coaches. The building is enclosed on three facades, with roller shutter doors on one façade to allow vehicles to enter the building.
- 2.2 Figure 1 below shows the location of the development; the measurement locations are shown below.

Figure 1.



2.3 Figure 2 below shows the shed inside and out.

Figure 2.





- 2.4 The nearest receptor to the new shed are the residential flats on the opposite side of Canal Street (marked in Figure 1), which are 100 metres from the portal frame shed. The main source of noise at the receptor point is road traffic, with Canal Road being busy during the working day. Noise will also be audible from the various industrial uses on the industrial estate, such as BOS Trucking, which has lorry movements all day and a scrap metal site.
- 2.5 The context in which the sound emissions occur is that the receptor is a noticeable distance from the shed at Grange Travel and that road noise is the dominant sound source along with some clangs and bangs from other industrial sites, such as Scrap My Car Ltd. Observations during the acoustic survey were that the operations at Grange Travel were not audible near the nearest residential flats.
- 2.6 In terms of sensitivity the residents in the flats, the occupants would not expect the quietness of a suburban location due to the proximity of the road and the industrial estate. The residents are not more sensitive to noise because of the operating hours and location of Grange Travel, and a BS4142 rating below background sound levels will be a low impact.



3. Reference Documents

National Planning Policy Framework

3.1 The Department of Housing, Communities and Local Government published the National Planning Policy Framework (NPPF) in July 2021.

3.2 Paragraphs 174 (e) 185(a), (b) and 187 refer to noise in terms of policy approach:

174. Planning policies and decisions should contribute to and enhance the natural and local environment by:

e) preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution or land instability. Development should, wherever possible, help to improve local environmental conditions such as air and water quality, taking into account relevant information such as river basin management plans; and

185. Planning policies and decisions should also ensure that new development is appropriate for its location taking into account the likely effects (including cumulative effects) of pollution on health, living conditions and the natural environment, as well as the potential sensitivity of the site or the wider area to impacts that could arise from the development. In doing so they should:

a) mitigate and reduce to a minimum potential adverse impacts resulting from noise from new development – and avoid noise giving rise to significant adverse impacts on health and the quality of life.

b) identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason

187. Planning policies and decisions should ensure that new development can be integrated effectively with existing businesses and community facilities (such as places of worship, pubs, music venues and sports clubs). Existing businesses and facilities should not have unreasonable restrictions placed on them as a result of development permitted after they were established. Where the operation of an existing business or community facility could have a significant adverse effect on new development (including changes of use) in its vicinity, the applicant (or 'agent of change') should be required to provide suitable mitigation before the development has been completed.

Noise Policy Statement for England

- 3.3 The Department for Environment, Food and Rural Affairs published the *Noise Policy Statement for England* (NPSE) in March 2010. The explanatory note of NPSE defines the terms used in the NPPF:

"2.20 There are two established concepts from toxicology that are currently being applied to noise impacts, for example, by the World Health Organisation. They are:

NOEL – No Observed Effect Level. This is the level below which no effect can be detected. In simple terms, below this level, there is no detectable effect on health and quality of life due to the noise.

LOAEL – Lowest Observed Adverse Effect Level. This is the level above which adverse effects on health and quality of life can be detected.

2.21 Extending these concepts for the purpose of this NPSE leads to the concept of a significant observed adverse effect level.

SOAEL – Significant Observed Adverse Effect Level. This is the level above which significant adverse effects on health and quality of life occur.”

- 3.4 The NPSE does not define the SOAEL numerically, stating at paragraph 2.22:

“2.22 It is not possible to have a single objective noise-based measure that defines SOAEL that is applicable to all sources of noise in all situations. Consequently, the SOAEL is likely to be different for different noise sources, for different receptors and at different times. It is acknowledged that further research is required to increase our understanding of what may constitute a significant adverse impact on health and quality of life from noise. However, not having specific SOAEL values in the NPSE provides the necessary policy flexibility until further evidence and suitable guidance is available.”

- 3.5 There is no local or national guidance on how the three terms should be defined numerically.
- 3.6 There are three aims in the NPSE, which match, and expand upon, the first two bullet points in paragraph 123 of the NPPF and add a third aim that relates to a wider improvement in health and quality of life (the bold text is in the NPSE):
- 3.7 The first aim of the NPSE states that significant adverse effects on health and quality of life should be avoided while also taking into account the guiding principles of sustainable development.
- 3.8 The second aim of the NPSE refers to the situation where the impact lies somewhere between LOAEL and SOAEL. It requires that all reasonable



steps should be taken to mitigate and minimise adverse effects on health and quality of life while also taking into account the guiding principles of sustainable development. This does not mean that such adverse effects cannot occur.

- 3.9 This aim seeks, where possible, positively to improve health and quality of life through the pro-active management of noise while also taking into account the guiding principles of sustainable development, recognising that there will be opportunities for such measures to be taken and that they will deliver potential benefits to society. The protection of quiet places and quiet times as well as the enhancement of the acoustic environment will assist with delivering this aim.

British Standard 8233

- 3.10 The scope of British Standard 8233: 2014 *Sound insulation and noise reduction for buildings – Code of practice* is the provision of recommendations for the control of noise in and around buildings. It suggests appropriate criteria and limits for different situations, which are primarily intended to guide the design of new or refurbished buildings undergoing a change of use.
- 3.11 The standard suggests suitable internal noise levels for residential dwellings, as shown in Table 1. Below.

Table 1.

Activity	Location	07:00 - 23:00	23:00 - 07:00
		$L_{Aeq, 16 \text{ hour}}$	$L_{Aeq, 8 \text{ hour}}$
Resting	Living Rooms	35	-
Dining	Dining Area	40	-
Sleeping	Bedrooms	35	30

3.12 In terms of this development the internal noise levels have been compared to the internal noise levels in Table 1. It is suggested in this report that by meeting these noise levels the development would be classed as NOAEL.

British Standard 4142:2014+A1 2019

3.13 The scope of British Standard 4142: *Method for rating industrial noise affecting mixed residential and industrial areas* describes methods for determining, at the outside of a building:

a) noise levels from factories, or industrial premises, or fixed installations, or sources of an industrial nature in commercial premises; and

b) background noise level.

3.14 In particular BS4142 describes the “*use outdoor sound levels to assess the likely effects of sound on people who might be inside or outside a dwelling or premises used for residential purposes upon which sound is incident.*” It sets out a methodology for assessing a noise Rating level which is a combination of absolute or ‘specific’ noise level (in terms of L_{Aeq} average noise level over different durations; 1 hour for daytime and

15 minute at night); and then including penalties to account for character of a noise (i.e. tonality, impulsivity, intermittency and 'other').

- 3.15 BS4142 applies to new noise sensitive developments that are proposed near existing industrial sources, the following paragraph relates to such developments:

"Where a new noise-sensitive receptor is introduced and there is extant industrial and/or commercial sound, it ought to be recognized that the industrial and/or commercial sound forms a component of the acoustic environment. In such circumstances other guidance and criteria in addition to or alternative to this standard can also inform the appropriateness of both introducing a new noise-sensitive receptor and the extent of required noise mitigation."

Further to this BS4142:2014 also notes that other standards may be relevant; in this development this would include BS8233:2014.

- 3.16 The rating levels in BS4142 are as follows:

"a) Typically, the greater this difference, the greater the magnitude of the impact.

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

c) A difference of around +5 dB is likely to be an indication of an adverse impact, depending on the context.

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



- 3.17 BS4142:2014 also states *‘where the initial estimate of the impact needs to be modified due to the context, take all pertinent factors into consideration’*. In terms of those factors the document states the following: *‘The sensitivity of the receptor and whether dwellings or other premises used for residential purposes will already incorporate design measures that secure good internal and/or outdoor acoustic conditions, such as, facade insulation ii) ventilation and/or cooling that will reduce the need to have windows open so as to provide rapid or purge ventilation; and acoustic screening.’*
- 3.18 Where there is an adverse impact in terms of the BS4142 rating mitigation can be proposed to reduce the impact or achieve desirable internal noise levels.



4. Survey Methodology

- 4.1 The first survey was conducted over a 6.5-hour period on September 13th 2023 from 11:30 – 18:00.
- 4.2 The instrument used for the survey was a Bruel & Kjaer 2250 2260 precision grade sound level meters.
- 4.3 The sound level meters were calibrated immediately before and after the survey with a Bruel & Kjaer 4231 Acoustic Calibrator producing 94dB_A at 1KHz and no drift was noted in calibration readings. Both calibration results were 93.8dB_A.
- 4.4 During the survey there were no unusual noise events. The sound level meter was set to log every 15 minutes. The metrics measured were L_{Aeq} and L_{A90}.
- 4.5 The measurement procedure in BS4142:2014 was followed. The sound level meter at MP1 was mounted on a tripod at ground floor level with no reflecting surfaces, other than the ground, within 3.5 metres. MP1 was representative of the nearest residential premises to the portal frame shed.
- 4.6 The sound level meter at MP2 was setup inside the shed at Grange Travel from 11:56 – 14:41, to measure the sound levels generated by the servicing and repair of coaches.
- 4.7 During the background survey the temperature was 18°C with a wind speed of 2 metres per second and no precipitation. Cloud cover was approximately 60%.



5. Noise Survey Results

- 5.1 The typical daytime L_{A90} was 50dB and the typical ambient was 56dB L_{Aeq} .
- 5.2 No penalties in the BS4142 assessment have been added as the any intermittent operation or bangs and clangs will not be audible above the residual acoustic environment.
- 5.3 The following tables present the BS4142 assessment for the impact of Grange Travel during the daytime period at the receptor. The premises is not open after 23:00 so no assessment for the plant has been made for the night-time period. The assessment is based upon the highest measured ambient sound level measured inside the portal frame shed.

Table 2. BS4142 assessment for the extraction system during daytime at the Receptor

Results	Measurement	Clause	Commentary
Typical ambient sound level	$L_{Aeq} = 56\text{dB}$	7.3.1	
Typical background sound level	$L_{A90} = 50\text{dB}$	8.3	
Specific sound level at residential facade	26dB_A		
Acoustic feature	0dB	9.2	No penalties as the sound from the shed will not be audible above the residual acoustic environment
Rating level	26dB_A	11	Sound source
Typical background sound level	$L_{A90} = 50\text{dB}_A$	8.3	



Rating level at receptor point	-24dB	11	
The assessment shows that there is likely to be no adverse impact at receptor point			
Uncertainty of the assessment			The rating level is -24dB and in this instance the uncertainty of the measurement does not have any significance to the outcome of the assessment. The measurement conditions were repeatable so overall uncertainty is low.



6 Evaluation of results

- 6.1 The impact of the proposed portal frame shed, has been determined by comparing the measured noise levels with the criteria set out in Section 3 of this report.
- 6.2 The BS4142 assessment shows that the noise from the portal frame shed at the Receptor is predicted to be 24dB below the typical background noise level during daytime hours.
- 6.3 The above results demonstrate that the noise from the development would have a low impact. The predicted sound pressure level of the maintenance and repair work at the nearest noise sensitive receptor meet with the likely requirements of Graversham Borough Council for noise.
- 6.4 The rating for the portal frame shed is based upon the highest measured 15-minute ambient sound level during the acoustic survey inside the portal frame shed. This measured level was 66dB L_{Aeq} and the resulting sound pressure level at the receptor is based upon an attenuation distance of 100 metres giving an attenuation level of 40dB. The calculation is assuming the roller shutter doors are open and no account has been taken of the attenuation of the building frame in this result.
- 6.5 It is noted that the Environmental Health Officer has recommended that no servicing or maintenance works take place with the roller shutter doors or side doors left open. Were this a planning condition the noise from the portal frame shed would be reduced further and be more than 24dB below the background sound level.
- 6.6 Using information from the Insul model, the structure would provide 18dB of sound attenuation, giving a sound level from the portal frame



shed of 8dB at the Receptor, which is 42dB below the typical background sound level.

- 6.7 In terms of penalties, the operations inside the portal frame shed will not be audible above the residual sound level (56dB_A) and no penalties are required, this is in line with Paragraph 9.2 of BS4142:2014+A1 2019.
- 6.8 The noise level due to the portal frame shed at the nearest receptor is a result of the attenuation with distance, and a high background sound level (see Appendix 4 for calculations).



Appendix 1: Glossary of Terms

Daytime Defined in BS8233 and BS4142 as the period 07:00-23:00 hours.

Night-time Defined in BS8233 and BS4142 as the period 23:00-07:00 hours.

Decibel (dB): A unit of level derived from the logarithm of the ratio between the value of a quantity and a reference value. It is used to describe the level of many different quantities. For sound pressure levels the reference quantity is 20 uPa. The threshold of normal hearing is in the region of 0 dB and 140 dB is the threshold of pain. A change of 1 dB is only perceptible under controlled conditions.

dB_A : Decibels measured on a sound level meter incorporating a frequency weighting (A weighting) which differentiates between sounds of different frequency (pitch) in a similar way to the human ear. Measurements in dB_A broadly agree with people's assessment of loudness. A change of 3 dB is the minimum perceptible under normal conditions, and a change of 10 dB corresponds roughly to halving or doubling the loudness of a sound. The background noise in a living room may be about 30 dB_A ; normal conversation about 60 dB_A at 1 metre; heavy road traffic about 80 dB_A at 10 metres; the level near a pneumatic drill about 100 dB_A .

$L_{A10,T}$: The A weighted noise level exceeded for 10% of the measurement period, T. It gives an indication of the upper limit of fluctuating noise such as that from road traffic.

$L_{A90,T}$: The A weighted noise level exceeded for 90% of the measurement period, T. This is defined in BS 4142 as the background noise level.

L_{AE} : The sound exposure level – the level of a sound with a period of 1 second that has the same sound energy as the event considered.



$L_{Aeq,T}$: The equivalent continuous sound level – the sound level of a notionally steady sound having the same energy as a fluctuating sound over a specified measurement period (T).

$L_{A\ Max}$: The highest A weighted noise level recorded during a noise event. The time weighting (slow or fast) should be stated.



Appendix 2: Calibration Certificates

Laboratory Location

Campbell Associates Ltd
5b Chelmsford Road Industrial Estate
GREAT DUNMOW, Essex, GB-CM6 1HD
Phone 01371 871030



Certificate of Calibration

Certificate number: 41049

Test Object: Sound Level Meter, BS EN 60651 and or BS EN 60804 Class 1

Producer: Brüel & Kjær
Type: 2260
Serial number: 2034414
Customer: Ned Johnson Acoustic Consultants Ltd
Address: 378 Church Street,
London. N9 9HS.
Contact Person: Ned Johnson
Order No:

Introduction:

Calibration has been performed as set out in CA Technical Procedures which are based on the procedures for periodic verification of sound level meters as per the **Test Object** listed above. Results and conformance statement are overleaf and detailed results, where appropriate, are provided in the attached Measurement Report.

Tested:	Producer	Type	Serial No	Certificate No
Microphone	Brüel & Kjær	4189	2169417	41048
Calibrator*	Brüel and Kjær	4231	2039392	41047
Preamplifier	Brüel & Kjær	ZC0026	NoCode	Included

* The calibrator was complete with any required coupler for the microphone specified.

Additional items that have also been submitted for verification:

Wind shield	Brüel & Kjær	UA0237 (Large round)
Attenuator	N/A	
Extension cable	N/A	

These items have been taken into account wherever appropriate.

Conditions	Pressure kPa	Temperature °C	Humidity %RH
Reference conditions	101.325	23	50
Measurement conditions	101.07 ±0.03	22.35 ±0.15	42.43 ±1

Calibration Dates:

Received date:	06/05/2022	Reviewed date:	17/05/2022
Calibration date:	17/05/2022	Issued date:	17/05/2022

Technicians: (Electronic certificate)

Calibrated by: *Palanivel Marappan B.Eng (Hons), M.Sc*

Reviewed by: *Darren Batten*

This certificate is issued in accordance with the CA Quality Management system. It provides traceability of measurement to recognized national standards, and to the units of measurement realized at the National Physical Laboratory or other recognized national standards laboratories. This certificate may not be reproduced other than in full, except with the prior written approval of the issuing laboratory.



Laboratory Location

Campbell Associates Ltd

5b Chelmsford Road Industrial Estate
 GREAT DUNMOW, Essex, GB-CM6 1HD
 Phone 01371 871030

**Certificate of Calibration****Certificate number: 41048****Test Object: Measurement Microphone**

Producer: Brüel & Kjær
Type: 4189
Serial number: 2169417
Customer: Ned Johnson Acoustic Consultants Ltd
Address: 378 Church Street,
 London. N9 9HS.
Contact Person: Ned Johnson
Order No:

Measurement Results	Sensitivity (dB re 1V/Pa)	Sensitivity (mV/Pa)	Capacitance (pF)
Measurement 1	-24.87	57.07	14.09
Measurement 2	-24.87	57.10	14.09
Measurement 3	-24.86	57.14	14.10
Result (Average):	-24.87	57.11	14.09
Expanded Uncertainty:	0.10		1.00
Degree of Freedom:	>100		>100
Coverage Factor:	2		2

The stated sensitivity is the pressure sensitivity at 250Hz, S₂₅₀, and is valid at reference conditions. The following correction factors have been applied during the measurement:

Pressure:-0.01 dB/kPa Temperature:-0.006 dB/°C Humidity:0 dB/%RH

Conditions	Pressure kPa	Temperature °C	Humidity %RH
Reference conditions	101.325	23	50
Measurement conditions	101.108 ± 0.043	22.4 ± 0.1	41.9 ± 0.9

The calibration test report shown on the next page gives details of the response at other frequencies relative to this 250 Hz reference sensitivity. Results ≥100 Hz are obtained using an electrostatic actuator as described in BS EN 61094-6 and those below 100 Hz are obtained in a reference pressure chamber. Detailed results are available from the calibration laboratory upon request.

The reported expanded uncertainty of measurements is based on a standard uncertainty multiplied by the coverage factor of k=2, providing a coverage probability of approximately 95%. Where the degrees of freedom are insufficient to maintain this confidence level, the coverage factor is increased to maintain this confidence level.

Calibration Dates:

Received date: 06/05/2022 Reviewed date: 17/05/2022
 Calibration date: 17/05/2022 Issued date: 17/05/2022

Technicians: (Electronic certificate)

Calibrated by: *Palanivel Marappan BEng(Hons), MSc*
 Reviewed by: *Darren Batten*

This certificate is issued in accordance with the CA Quality Management system. It provides traceability of measurement to recognized national standards, and to the units of measurement realized at the National Physical Laboratory or other recognized national standards laboratories. This certificate may not be reproduced other than in full, except with the prior written approval of the issuing laboratory.

Doc ref: Mic-Cert-Master-V3-03



Laboratory Location

Campbell Associates Ltd

5b Chelmsford Road Industrial Estate
 GREAT DUNMOW, Essex, GB-CM6 1HD
 Phone 01371 871030

**Certificate of Calibration****Certificate number: 41047****Test Object: Sound Calibrator**

Producer: Brüel & Kjær
Type: 4231
Serial number: 2039392
Customer: Ned Johnson Acoustic Consultants Ltd
Address: 378 Church Street,
 London. N9 9HS.
Contact Person: Ned Johnson
Order No:

Measurement Results	Level dB	Level Stability dB	Frequency Hz	Distortion %
Measurement 1	94.05	0.02	999.86	0.46
Measurement 2	94.05	0.02	999.86	0.45
Measurement 3	94.05	0.02	999.86	0.46
Result (Average):	94.05	0.02	999.86	0.46
Expanded Uncertainty:	0.1	0.02	1	0.25
Degree of Freedom:	>100	>100	>100	>100
Coverage Factor:	2	2	2	2

The stated level is relative to 20µPa. The level is traceable to National Standards. The stated level is valid at reference conditions. The following correction factors have been applied during the measurement

Pressure: 0.0008 dB/kPa Temperature: 0.0015 dB/°C Humidity: 0.001 dB/%RH Load volume: 0.0003

Conditions	Pressure kPa	Temperature °C	Humidity %RH
Reference conditions	101.325	23	50
Measurement conditions	101.107 ±0.043	22.3 ±0.1	41.6 ±0.8

The reported expanded uncertainty of measurements is based on a standard uncertainty multiplied by the coverage factor of k=2, providing a level of confidence of approximately 95%. Where the degrees of freedom are insufficient to maintain this confidence level, the coverage factor is increased to maintain this confidence level.

Records: K:\C A\Calibration\Nor-1504\Nor-1018 CalCal\2022\BNK4231_2039392_M1.nmf

Preconditioning

The equipment was preconditioned for more than 4 hours in the specified calibration environment.

Method

Calibration has been performed as set out in the current version of CA Technical procedure TP01

Calibration Dates:

Received date:	06/05/2022	Reviewed date:	17/05/2022
Calibration date:	17/05/2022	Issued date:	17/05/2022

Technicians: (Electronic certificate)

Calibrated by: *Palanivel Marappan B.Eng(Hons), M.Sc*
 Reviewed by: *Darren Batten*

This certificate is issued in accordance with the CA Quality Management system. It provides traceability of measurement to recognized national standards, and to the units of measurement realized at the National Physical Laboratory or other recognized national standards laboratories. This certificate may not be reproduced other than in full, except with the prior written approval of the issuing laboratory.



Laboratory Location

Campbell Associates Ltd

5b Chelmsford Road Industrial Estate
 GREAT DUNMOW, Essex, GB-CM6 1HD
 Phone 01371 871030

**Certificate of Calibration and Conformance**Certificate number: **42522**Test Object: **Sound Level Meter, BS EN IEC 61672-1:2003 Class 1**

Producer: **Brüel & Kjær**
 Type: **2250**
 Serial number: **2630254**
 Customer: **Ned Johnson Acoustic Consultants Ltd**
 Address: **378 Church Street,
 London. N9 9HS.**
 Contact Person: **Ned Johnson.**
 Order No: **NJAC1**

Introduction:

Calibration has been performed as set out in CA Technical Procedures which are based on the procedures for periodic verification of sound level meters as per the **Test Object** listed above. Results and conformance statement are overleaf and detailed results, where appropriate, are provided in the attached Measurement Report.

Tested:	<i>Producer</i>	<i>Type</i>	<i>Serial No</i>	<i>Certificate No</i>
Microphone	Brüel & Kjær	4189	2631299	42521
Calibrator*	Brüel and Kjær	4231	1838911	U40769
Preamplifier	Brüel & Kjær	ZC0032	8615	Included

* The calibrator was complete with any required coupler for the microphone specified.

Additional items that have also been submitted for verification:

Wind shield N/A
 Attenuator N/A
 Extension cable N/A

These items have been taken into account wherever appropriate.

Instruction Manual: BE1712-23 Firmware Version: 2.2.1 The test object is a single channel instrument.

Conditions	<i>Pressure kPa</i>	<i>Temperature °C</i>	<i>Humidity %RH</i>
Reference conditions	101.325	23	50
Measurement conditions	98.39 ±0.16	22.75 ±0.25	43.55 ±1.9

Calibration Dates:

Received date: 11/11/2022 Reviewed date: 22/11/2022
 Calibration date: 21/11/2022 Issued date: 22/11/2022

Technicians: (Electronic certificate)

Calibrated by: *Michael Tichner*

Reviewed by: *Jenny Crawford*

This certificate is issued in accordance with the CA Quality Management system. It provides traceability of measurement to recognized national standards, and to the units of measurement realized at the National Physical Laboratory or other recognized national standards laboratories. This certificate may not be reproduced other than in full, except with the prior written approval of the issuing laboratory.



Appendix 3: Uncertainty

As part of the BS4142 assessment the headings from the 2014 standard have been used to consider where uncertainty in the measurements may have occurred.

The complexity of the sound source and the level of variability in sound emission from the source

There will be a variability in sound depending upon the tools being used for maintenance and repair. None of the sounds will be audible at the nearest residential receptor.

The complexity and level of variability of the residual acoustic environment

The ambient residual environment overall provided consistent, reproducible results and therefore uncertainty for this aspect is low.

The level of residual sound in the presence of the specific sound at the measurement location

The specific sound from the portal frame shed is inaudible in comparison to the residual sound level at the receptor.

The location(s) selected for taking the measurements

The location for measurements followed the guidance in BS4142:2014 and was representative of the noise sources in the area.



The distance between sources of sound and the measurement location and intervening ground conditions

The distance between the source and receptor is 100 metres; source measurements were taken inside the portal frame shed.

The number of measurements taken

6.5 hours of data was collected in 15-minute periods. It covers worst-case scenario background levels. Overall there is a reliable dataset from which to derive the typical background noise levels and uncertainty is low.

The measurement time intervals

The time intervals for logged data were 15-minute periods, which is an appropriate period for this type of survey and uncertainty is low.

The range of times when the measurements have been taken

The measurement times were representative of the background and ambient sound levels at both measurement locations.

The range of suitable weather conditions during which measurements have been taken

During the surveys the wind conditions were suitable as they did not exceed 5m/s at any time; there was also some precipitation and the temperature was a 18°C. All conditions were recorded, including cloud cover and all were in line with the requirements of BS4142 and therefore uncertainty due to weather is low.



The measurement method and variability between different practitioners in the way the method is applied

The method for taking measurements followed that required in BS4142. The measurement procedure is reproducible and therefore uncertainty is low.

The level of rounding of each measurement recorded

Where necessary results have been rounded to the nearest whole decibel; any results at 0.5 have been rounded up.

The instrumentation used

The instrument used is a class 1 sound level meter and calibrator and have all been calibrated to a traceable standard at a UKAS accredited laboratory in the last 24 months. Uncertainty due to instrumentation is low.

Uncertainty in the calculation method

Standard calculation for attenuation with distance was used in the calculations and all calculations followed standard acoustic methods for this reason, uncertainty is low.

Simplifying the real situation to 'fit' the model (user influence on modelling)

The calculation of sound impacts was not modelled. All calculations were based on the site characteristics.

Error in the calculation process

All calculations were checked by a colleague in an independent consultancy and uncertainty is low.



Appendix 4: Calculations

Receptor 1

Table 3. Calculation of impact to Receptor 1 due to extraction system

Procedure	Sound Pressure dB _A
SPL in portal frame shed	66
Distance attenuation (100m)	-40
Total	26

Appendix 5: Data

MP1

Table 4

Time	L _{Aeq}	L _{A90}
11:30:00	67.1	54.9
11:45:00	68.4	62.3
12:00:00	68.4	64.3
12:15:00	68.5	65
12:30:00	68.2	64.3
12:45:00	67.5	61.7
13:00:00	65.3	51.4
13:15:00	67.8	53
13:30:00	67.8	53.9
13:45:00	67.2	49.1
14:00:00	68.7	49.4
14:15:00	67.9	50.6
14:30:00	60.4	52.2
14:45:00	60.6	52.6
15:00:00	62.1	52.1
15:15:00	56	50.5
15:30:00	56.8	52.2
15:45:00	59	56
16:00:00	58.8	54.9
16:15:00	57	51.5
16:30:00	55.5	50
16:45:00	56.4	50.6
17:00:00	56.7	50.2
17:15:00	56.5	50.3
17:30:00	57.1	50.3
17:45:00	56.7	49.6
18:00:00	53.8	50



MP2

Table 5

Time	L _{Aeq}
11:56:29	66.3
12:11:29	61.6
12:26:29	60.9
12:41:29	66.6
12:56:29	60.9
13:11:29	58.9
13:26:29	59.2
13:41:29	61.1
13:56:29	60.8
14:11:29	61.3
14:26:29	57.0
14:41:29	56.8

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