

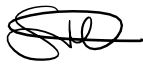


Noise Impact Assessment of External Building Services Equipment

Camden Council 2015/1672/P Condition 7
BREEAM 2014 NC Pol 05

New Main Building
Hampstead School
Westbere Road, London

HRS REF: 119205 AC 13v2

Prepared by	Authorised by		
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Air Tightness Consultancy & Testing	Energy - SAP, EPC, DEC & SBEM	BREEAM & Code for Sustainable Homes
Acoustic Consultancy & Testing	Air Sealing & Fire Stopping	Thermographic Surveys

Executive Summary

HRS Services Ltd. has been appointed by Wates Construction Ltd. to carry out a noise impact assessment relating to mechanical building services plant associated with the scheme currently under development at Hampstead School, Westbere Road, London in order to determine compliance with planning requirements of the London Borough of Camden and Section Pol 05 of BREEAM 2014 New Construction.

This assessment considers mechanical building services equipment serving the new Main Building and Sports Building.

Assessment based on the plant equipment schedule outlined in this report and associated manufacturer quoted noise data predicts that noise levels measured at the boundary of nearby noise sensitive properties is compliant with the requirements of Condition 7 of Planning Application 2015/1672/P and BREEAM 2014 NC Pol 05.

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1. HRS Services Ltd. – Acoustic Credentials

- 1.1 HRS Services Ltd. (HRS) have specialised in providing the UK construction industry with a range of acoustics services since 2006. Specialising in building acoustics, all HRS acousticians hold membership to the Institute of Acoustics.
- 1.2 HRS has been accredited for on-site acoustic testing by United Kingdom Accreditation Service (UKAS) since 2006 (Testing Laboratory Number 2587).
HRS meet the relevant acoustic requirements typically required in the UK, including for sound insulation testing as defined in Approved Document E for the purpose of testing for Part E of Schedule 1 to the Building Regulations 2010
- 1.3 This report has been authorised by Silvio Murgia, HRS Head of Acoustics who meets the BREEAM requirements for a suitably qualified acoustician (SQA) as follows;
 1. Holds an MSc degree in Applied Acoustics, and the IOA Postgraduate Diploma in Acoustics and Noise Control.
 2. Has a minimum of three years relevant experience (within the last five years). This experience includes a practical understanding of factors affecting acoustics in relation to construction and the built environment; including, acting in an advisory capacity to provide recommendations for suitable acoustic performance levels and mitigation measures.
 3. Holds Institute of Acoustics membership (MIOA).

This report has been read and reviewed by Silvio Murgia MIOA and has been found to;

1. Represent sound industry practice
2. Be appropriate given the building being assessed and scope of works proposed
3. Avoid invalid, biased and exaggerated recommendations.

2. Introduction

- 2.1. HRS has been appointed by Wates Construction Ltd. (Wates) to carry out a noise impact assessment relating to mechanical building services plant associated with the scheme currently under development at Hampstead School, Westbere Road, London.
- 2.2. The purpose of this assessment is to use manufacturer supplied noise data to assess the noise impact of building services plant upon the existing noise climate at the nearest noise sensitive receptors in accordance with BS 4142:2014 'Rating Methods for rating and assessing industrial and commercial sound', in order to demonstrate compliance with requirements identified in Condition 7 of the decision notice relating to London Borough of Camden planning application *2015/1672/P* and with those of BREEAM 2014 NC Pol 05.
- 2.3. This document has been prepared for the sole use, benefit and information of Wates for the purposes set out in the document or instructions commissioning the works. The liability of HRS in respect of the information contained herein will not extend to any third party.
- 2.4. This report is limited to addressing the specific acoustic issues contained herein and is based on information and drawings provided by the client.
- 2.5. Whilst every effort has been made to ensure that this report is easy to understand, it is technical in nature; to assist the reader, a glossary of terminology is included in Appendix I.

3. Site Description

- 3.1 The location of the scheme is off Westbere Road, in the London Borough of Camden, and within the grounds of Hampstead School.
- 3.2 The grounds are currently occupied by the existing Hampstead School buildings and associated car parking and recreational areas. The grounds are bounded by Westbere Road to the west, with a railway line situated approximately 120m to the west from the location of the scheme. Residential roads are located to the north and south of the school grounds, and playing fields extend approximately 400m to the north-east and east of the school grounds. A site plan is included in Appendix II of this report.
- 3.3 The closest identified noise-sensitive receptors (NSRs) are identified as residential properties located to the north and south of the site. These are highlighted on the site plan included in Appendix II of this report.

4. Standards and Guidelines

Scheme-Specific Planning Conditions

- 4.1 Condition 7 of the decision notice relating to London Borough of Camden Council planning application 2015/1672/P and dated 17 July 2015 states:

“Prior to use of any new plant equipment, details shall be submitted to and approved in writing by the Council, of the external noise level emitted from plant equipment and mitigation measures as stated in report ref: 119205 AC 7v2 dated 9th March 2015. The measures shall ensure that the external noise level emitted from plant equipment will be lower than the lowest existing background noise level by at least 5dBA, by 10dBA where the source is tonal, as assessed according to BS 4142:1997 at the nearest and/or most affected noise sensitive premises, with all machinery operating together at maximum capacity. Approved details shall be implemented prior to occupation of the development and thereafter be permanently retained.”

- 4.2 Per para 2.2, this assessment has been carried out in accordance with the 2014 issue of BS 4142, rather than the superseded 1997 issue on the basis that this shall be acceptable to all relevant authorities as the latest available British Standard pertaining to the noise impact assessment of building services.

BS 4142:2014 ‘Methods for rating and assessing industrial and commercial sound’

- 4.3 British Standard BS 4142, ‘Methods for rating and assessing industrial and commercial sound’, 2014 (supersedes BS 4142:1997) describes a method for assessing the likelihood of complaints from noise sources that are of an industrial nature (e.g. fans, pumps, chillers, air handling units etc.). The assessment methodology is based upon determining a ‘rating level’ for external noise emissions from equipment being assessed expressed as rating level $L_{Ar,Tr}$.
- 4.4 The rating level is then compared with the underlying background noise level (measured as a L_{A90}) in the absence of noise from the item or items of plant being assessed.
- A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context.
 - A difference of around +5 dB is likely to be an indication of an adverse impact, depending on the context.

- 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.

- 4.5 BS 4142:2014 states that a penalty should be added for any plant which gives rise to noise features that may increase disturbance such as tonal, impulsive or intermittent characteristics. With respect to the acoustic feature correction, BS 4142 states:

‘Certain acoustic features can increase the significance of impact over that expected from a basic comparison between the specific sound level and the background sound level. Where such features are present at the assessment location, add a character correction to the specific sound level to obtain the rating level.’

Generally a rating penalty for a sound should be based on a subjective assessment of its characteristics.

BREEAM 2014 NC Pol 05

- 4.6 For control of mechanical services noise BREEAM 2014 NC Pol 05 states that the credit may be awarded;

Where there are or will be noise-sensitive areas of buildings within 800m radius of the assessed development a noise impact assessment in compliance with BS 7445:1991 has been carried out and the following noise levels measured/determined:

- Existing background noise levels at the nearest or most exposed noise-sensitive development or at a location where background conditions can be argued to be similar.*
- The rating noise level resulting from the new noise source.*

The noise level from the proposed site/building, as measured in the locality of the nearest or most exposed noise-sensitive development, is a difference no greater than +5dB during the day (0700 to 2300) and +3dB at night (2300 to 0700) compared to the background noise level.”

- 4.7 As the Camden Council planning criteria stated in Paragraph 4.1 are more onerous than the BREEAM 2014 NC Pol 05 criteria; meeting the planning requirement will satisfy BREEAM requirements in all cases.

5. Noise Survey

- 5.1 Noise surveys were carried out at the site in order to assess the existing noise climate during the daytime and night time periods. The surveys were undertaken in order to measure the average and maximum noise levels at the proposed building elevations and to measure the lowest background noise levels representative of the nearest NSRs. Measurements were taken on 29th August 2014.
- 5.2 During the daytime survey, it was noted that the noise climate at the location of the NSRs was dominated by distant road traffic, with occasional traffic movement on Westbere Road, Menelik Road and Horton Avenue.
- 5.3 During the night time survey, it was noted that the noise climate at the location of the NSRs was dominated by distant road traffic, and measured noise levels were consistent between positions.
- 5.4 Full details of the noise survey are included in *119205 AC 7v2 HRS Services Environmental Noise Survey Report*; noise measurement results and relevant plant noise limits – calculated with respect to the requirements of Condition 7 – are summarised in below.

Table 1 – Summary of background noise level results, and plant noise limits

Location and nearest noise-sensitive receptor	Daytime (0700-2300)		Night time (2300-0700)	
	$L_{A90,10min}$	BS 4142 Rating Level Limit $L_{Ar,Tr}$	$L_{A90,5min}$	BS 4142 Rating Level Limit $L_{Ar,Tr}$
North (Horton Avenue)	44	39	36 – 37	31
South (Menelik Road)	44 – 45	39	36	31

6. Equipment Schedule

- 6.1. HRS understands that there are 3 main items of noise emitting plant proposed for the Main Building and that they are to be located on the roof. These are identified as being EF01, AHU1 and AHU2.
- 6.2. The Sports Building is understood to have two extract fans located on the roof top and servicing SP.G.16. These are both identified as being EF07.
- 6.3. Main Building G.10 Plant is understood to contain a booster set consisting of two 4kW pumps. Information was available for this equipment and was used to calculate sound pressure levels within the space, from which plant room noise breakout could be determined.
- 6.4. Items for which noise data was not available included a secondary domestic hot water pump, and two calorifiers each in the Main Building plant room and Sports Building plant room. From data available for similar equipment it has been determined that these items would not increase the noise levels significantly over those generated by the booster set, or cause significant breakout (in the case of the Sports Building).
- 6.5. On this basis reverberant noise levels within the Main Building plant room were determined by the noise generated by the booster set.
- 6.6. Main Building fume cupboard extract fans, and Main Building and Sports Building HRUs have been assessed separately; once duct and attenuator losses have been taken into account noise levels at the building envelope terminations have been calculated to not be significant contributors to cumulative noise levels, and as such were omitted from the final calculation.
- 6.7. Noise levels generated within the Sports Hall plant room were determined to not be significant contributors to cumulative noise levels once break-out was calculated, and as such were omitted from the final calculation.
- 6.8. A plan outlining approximate plant locations is included in Appendix II of this report
- 6.9. Manufacturer's noise data for all units used to inform this assessment is outlined in Appendix III of this report.

7. Noise Impact Assessment

- 7.1. HRS understands that the building services plant would not typically operate outside of school opening hours, but assessment has been carried out for the more demanding night time as a worst case, and to account for any potential for idling or set back running.
- 7.2. Based on the type of equipment used HRS does not expect impulsive or tonal characteristics to the noise emitted; however a +2dB correction has been included for all air handling equipment to allow for any tonality present, in line with BS4142:2014 guidance. Additionally, an acoustic feature correction of +3dB has been included in the calculation of the noise rating levels in line with BS4142:2014 guidance, to allow for any intermittent operation of this plant equipment.
- 7.3. Barrier attenuation to account for the presence of parapets was calculated based on rooftop equipment layout drawings, perimeter sections and the site location plan. Barrier attenuation for screening provided by the existing Dame Tamsyn Imison and Technology buildings has not been included in calculations of Main Building equipment and as such the Specific Noise Level at the rear of properties on Horton Avenue could be expected in practice to be lower than that calculated for this assessment.
- 7.4. The noise rating level, $L_{Ar,Tn}$, of the building equipment assessed has been calculated to be below the noise rating level limits applied for both daytime and night time periods. Limits were determined from the requirements for Planning Condition 7 for the scheme. The predicted Rating Level therefore also meets the criteria for BREEAM 2014 NC Pol 05 daytime and night time.
- 7.5. Detailed calculations are included in Appendix IV. Calculations for the compliant night time scenario are included on the basis of being more demanding than the equivalent daytime scenario.

Calculation Uncertainty

- 7.5. Sound Pressure Level data for plant equipment has been taken from manufacturer quoted noise measurements undertaken in an anechoic chamber. In accordance with BS EN ISO 3740:2001 the uncertainty of source measurement is expected to be between 1dB and 2dB in each octave band.
- 7.6. The uncertainty in a distance attenuation calculation over a distance of <100m is quoted by ISO 9613-2 as ± 3 dB for ground level sources and ± 1 dB for rooftop sources.
- 7.7. For a calibrated Class 1 precision integrating sound level meter, the allowable uncertainty is quoted by BS EN61672-1:2003 as ± 1.1 dB at 1kHz.

Appendix I – Glossary of Terms

Sound Pressure Level and the decibel (dB)

A sound wave is a small fluctuation of atmospheric pressure. The human ear responds to these variations in pressure, producing the sensation of hearing. The ear can detect a very wide range of pressure variations. In order to cope with this wide range of pressure variations, a logarithmic scale is used to convert the values into manageable numbers. Although it might seem unusual to use a logarithmic scale to measure a physical phenomenon, it has been found that human hearing also responds to sound in an approximately logarithmic fashion. The dB (decibel) is the logarithmic unit used to describe sound (or noise) levels. The usual range of sound pressure levels is from 0 dB (threshold of hearing) to 120 dB (threshold of pain).

Frequency and hertz (Hz)

As well as the loudness of a sound, the frequency content of a sound is also very important. Frequency is a measure of the rate of fluctuation of a sound wave. The unit used is cycles per second, or hertz (Hz). Sometimes large frequency values are written as kilohertz (kHz), where 1 kHz = 1000 Hz.

Young people with normal hearing can hear frequencies in the range 20 Hz to 20,000 Hz. However, the upper frequency limit gradually reduces as a person gets older.

Noise Indices

When a noise level is constant and does not fluctuate over time, it can be described adequately by measuring the dB(A) level. However, when the noise level varies with time, the measured dB(A) level will vary as well. In this case it is therefore not possible to represent the noise climate with a simple dB(A) value. In order to describe noise where the level is continuously varying, a number of other indices, including statistical parameters, are used. The indices used in this report are described as below.

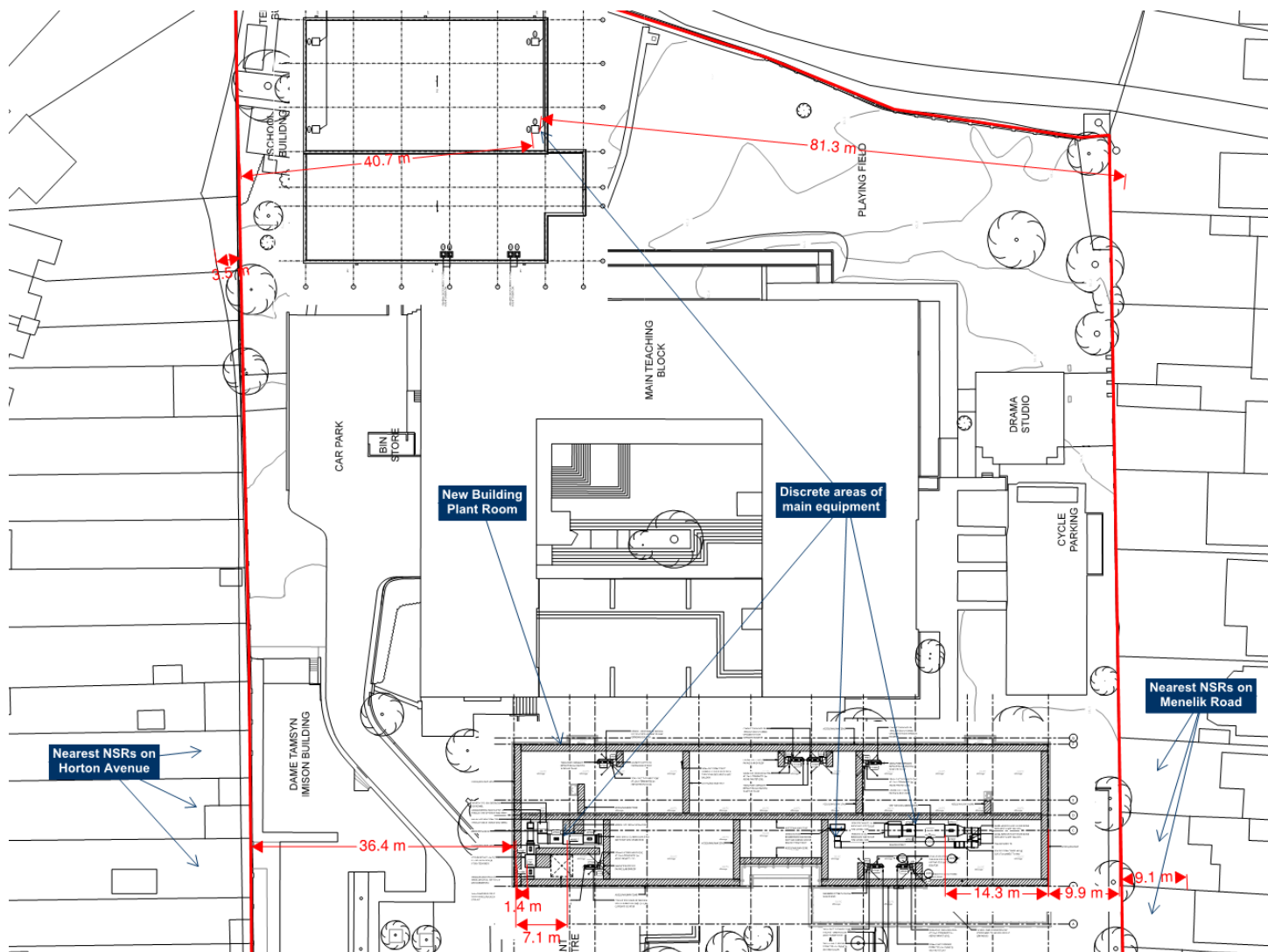
L_{Aeq} This is the A-weighted 'equivalent continuous noise level' which is an average of the total sound energy measured over a specified time period. In other words, L_{Aeq} is the level of a continuous noise which has the same total (A-weighted) energy as the real fluctuating noise, measured over the same time period. It is increasingly being used as the preferred parameter for all forms of environmental noise.

L_{Amax} This is the maximum A-weighted noise level that was recorded during the monitoring period.

L_{A10} This is the A-weighted noise level that was recorded for at least 10% of the monitoring period.

L_{A90} This is the minimum A-weighted noise level that was recorded for at least 90% of the monitoring period. Usually taken as the underlying 'background' noise level.

Appendix II – Indicative equipment and site layout



Appendix III – Equipment Schedule

Table A3-2: Rooftop AHU, manufacturer noise data

		Manufacturer Octave Band Sound Power Level Hz, dB								Total dB(A)
		63	125	250	500	1k	2k	4k	8k	
AHU1	Intake	80	75	79	73	69	66	60	58	50
	Exhaust	76	76	80	75	75	72	70	68	46
	Casing	SPL provided								63 ¹
AHU 2	Intake	76	75	82	79	78	73	68	64	55
	Casing	SPL provided								59 ¹

1 – Including casing attenuation

Table A3-2: Extract fans, manufacturer noise data

		Manufacturer Octave Band Sound Power Level Hz, dB								Total SPL dB(A)
		63	125	250	500	1k	2k	4k	8k	
EF01	Exhaust	82	80	79	75	80	72	69	57	62
	Casing Breakout	SPL provided								54 ¹
EF07	Exhaust	75	75	73	71	72	70	64	57	68

1 – Including casing attenuation

Table A3-3: Attenuator schedule, manufacturer insertion loss data

Unit	Attenuator	Manufacturer Octave Band Insertion Loss Hz, dB							
		63	125	250	500	1k	2k	4k	8k
AHU1	003	6	12	17	28	47	40	33	23
	0015								
AHU2	004								

Table A3-4: Main building G.10 Plant booster set schedule, manufacturer noise data

		Manufacturer Octave Band Sound Power Level Hz, dB								Total SPL dB(A)
		63	125	250	500	1k	2k	4k	8k	
BS01		SPL provided								74

Note: Information contained in Tables A3-1 to -4 taken from Wates Building Services documents WBS-TS-M-011 and WBS-TS-M-005 pertaining to the scheme.

Appendix IV – Noise Impact Assessment

Table A4-1: Night time plant noise assessment at rear of properties to the South on Menelik Road

Plant Item		Sound Pressure Level at 1m dB(A)	Distance to nearest NSR (m)	Distance Attenuation dB(A)	Screening	Sound Pressure Level at Receiver dB(A)
AHU1	Panel Breakout	63.5	24	-27.6	-17.0	18.9
	Intake	50.0	24	-27.6	-17.0	5.4
	Exhaust	46.7	24	-27.6	-17.0	2.1
AHU2	Panel Breakout	59.2	74	-37.4	-19.5	2.3
	Intake	54.7	74	-37.4	-19.5	-2.2
EF01	Breakout	54.0	76	-37.6	-9.8	6.6
	Exhaust	62.0	76	-37.6	-9.8	14.6
G.10 Plant	Breakout	56.7	79	-37.9	-6.1	12.7
EF07	SP.G.16 Exhaust	70.0	81	-38.1	-15.9	16.0
Cumulative Sound Pressure Level at Receiver dB(A)						22.4
BS4142:2014 Acoustic Feature Correction						+5
Total Plant Noise Rating Level (dB $L_{Ar,Tr}$)						27.4
Camden Council Criterion						≤ 31
Difference between Rating Level and Criterion						-3.6

Table A4-2: Night time plant noise assessment at rear of properties to the north on Horton Avenue

Plant Item		Sound Pressure Level at 1m dB(A)	Distance to nearest NSR (m)	Distance Attenuation dB(A)	Screening	Sound Pressure Level at Receiver dB(A)
AHU1	Panel Breakout	63.5	91	-39.2	-13.2	11.1
	Intake	50.0	91	-39.2	-13.2	-2.4
	Exhaust	46.7	91	-39.2	-13.2	-5.7
AHU2	Panel Breakout	59.2	44	-32.9	-9.8	16.5
	Intake	54.7	44	-32.9	-9.8	12.0
EF01	Breakout	54.0	38	-31.6	-9.7	12.7
	Exhaust	62.0	38	-31.6	-9.7	20.7
G.10 Plant	Breakout	56.7	41	-32.3	-6.2	18.3
EF07	SP.G.16 Exhaust	70.0	43.9	-32.8	-18.1	19.0
Cumulative Sound Pressure Level at Receiver dB(A)						25.6
BS4142:2014 Acoustic Feature Correction						+5
Total Plant Noise Rating Level (dB $L_{Ar,Tr}$)						30.6
Camden Council Criterion (dB $L_{Ar,Tr}$)						≤ 31
Difference between Rating Level and Criterion						-0.4

Appendix V – Report Conditions

This document has been prepared for the sole use, benefit and information of the Client. The liability of HRS Services Ltd. in respect of the information contained herein will not extend to any third party unless prior agreement is obtained in writing from HRS Services Ltd.

This report is limited to addressing the specific acoustic issues contained herein. Advice has been provided for acoustic reasons only and it is recommended that appropriate expert advice be sought on all the ramifications, e.g. safety, fire, structural, CDM etc., associated with any proposals contained herein.

The in-situ performance of acoustic measures is influenced to a large extent by the quality of workmanship and compliance with the specifications on-site during construction, as such, HRS Services Ltd. accepts no liability for issues with acoustic performance arising from such factors.

Acoustic survey and testing work carried out for the project is representative of the prevailing conditions at the time of the work. Conditions can vary and no warranty is given as to the possibility of changes in the environment of the site and surrounding area at differing times.

In particular, it should be noted that where calculations are carried out that are based on assumptions regarding certain aspects where information has not been supplied, these are provided for indicative purposes only and should be treated as such.