MACH ACOUSTICS

ST NICHOLAS PRIMARY SCHOOL

Environmental Noise Assessment

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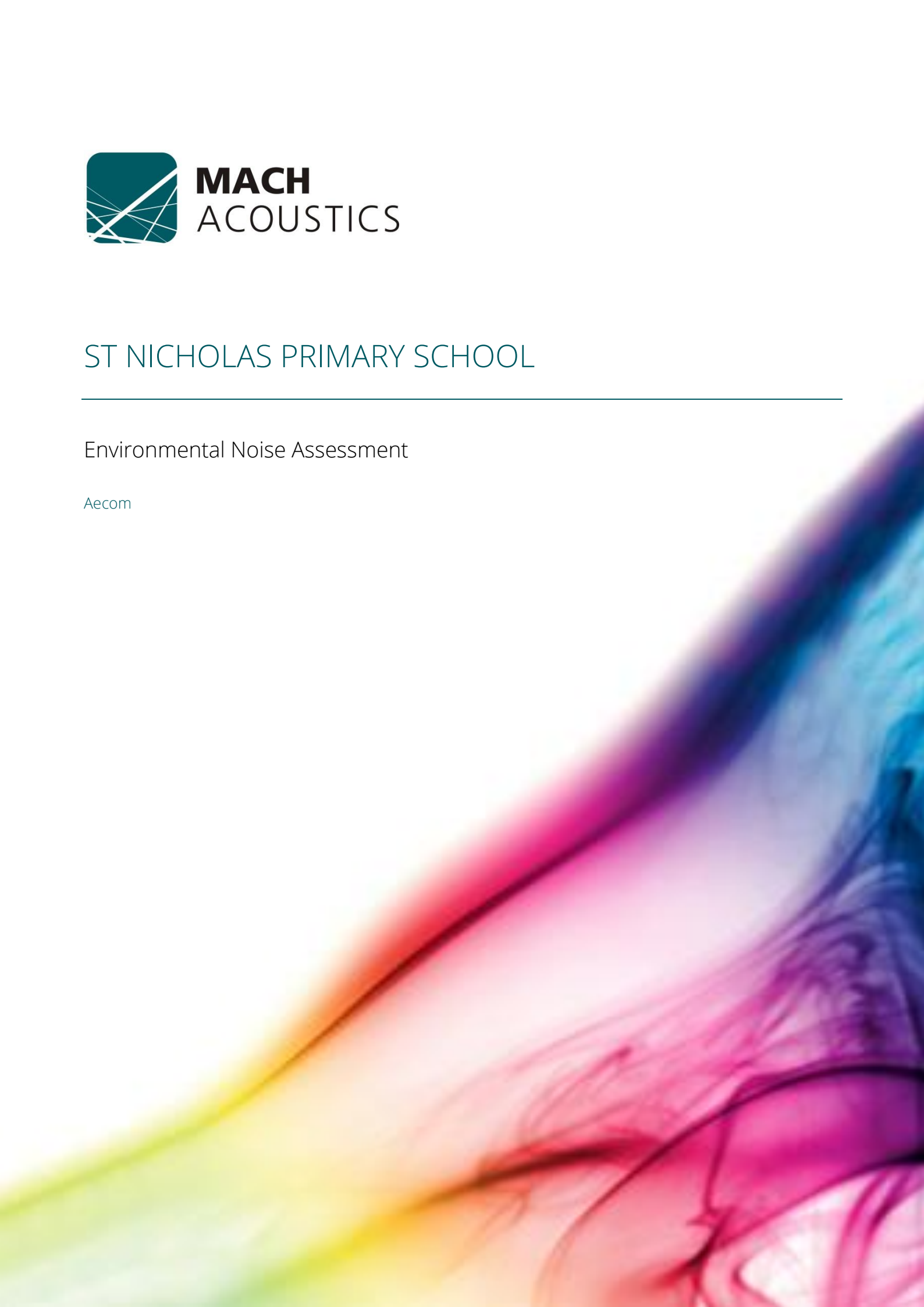

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Environmental Noise Assessment

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1.0 INTRODUCTION

An environmental noise assessment at the existing site of the St Nicholas Primary School in Cardiff has been undertaken. The proposed work consists of a new build teaching block on the existing school site.

Such to establish the existing noise levels across the site, a noise survey has been undertaken. This report describes the noise survey, its results, and the outcomes of subsequent noise break-in and break out assessments.

2.0 ENVIRONMENTAL NOISE SURVEY

To establish the existing environmental noise levels on site, a noise survey was conducted between 25/04/2019 and 26/04/2019. Additional spot measurements were also taken on 05/06/2019.

2.1 Site Description

The proposed extension is to be located on the existing site of St Nicholas Primary School. Residential dwellings surround the site with the A48 to the south. The site in relation to its surroundings is presented below.

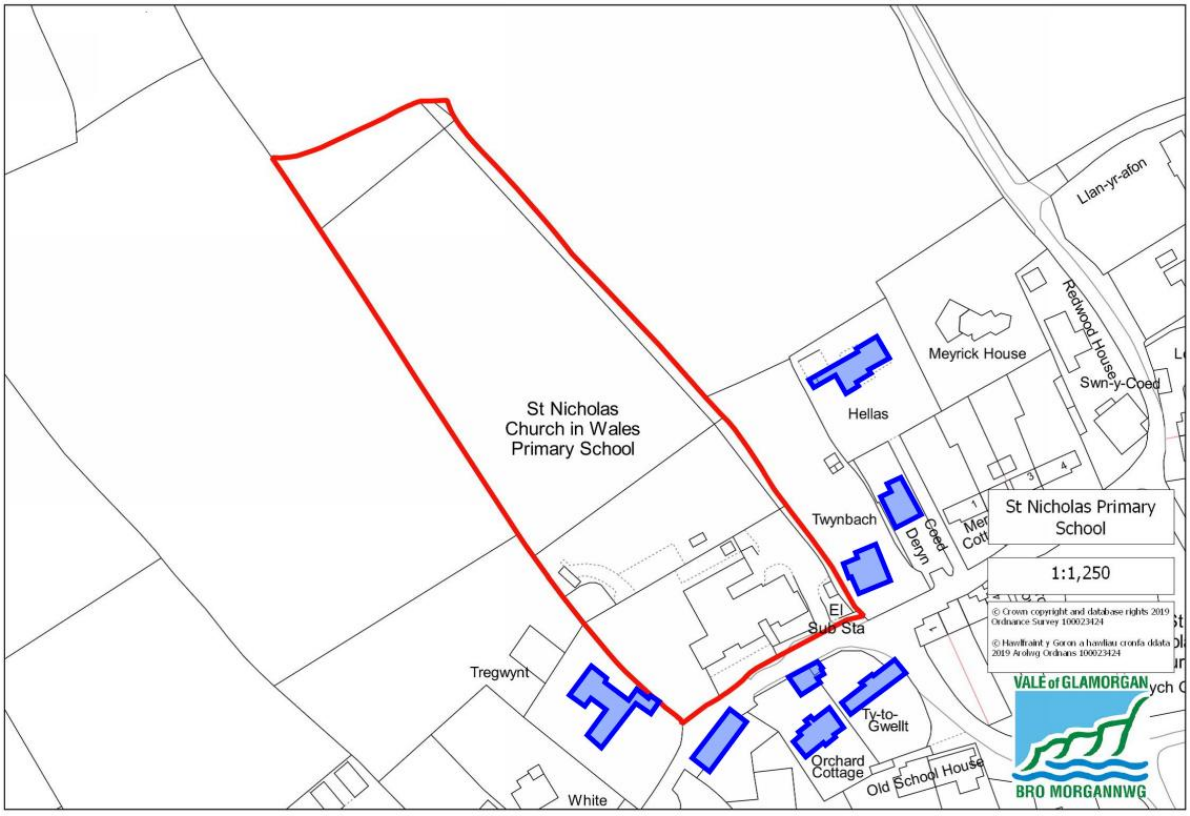

Figure 2.1: Existing School Boundary (red), and Nearest Noise Sensitive Receivers (Blue)

2.2 Noise Sources

Noise levels varied across the site with road traffic noise along the A48 being the most notable contribution to the ambient noise. A summary of the main noise sources is provided below.

Noise Source	Description
A48	Main contributor to ambient noise level with steady flow of traffic.
School Lane	Fairly quiet road, with occasional cars.

Table 2.1: Summary of Main Noise Sources

2.2.1 Non-Representative Noise Sources

During the survey, there were some noise events that were not considered to be representative of normal ambient conditions or are noise activities associated with the development itself. These are noted below.

Noise Source	Description
On-site Work	The survey was carried out during the half-term period, where work was being carried out by contractors surveying the site and was seen to contribute to the noise levels shown in the graph, resulting in the majority of the survey obtaining non representative noise levels.

Table 2.2: Non-Representative Noise Contributions

2.3 Noise Sensitive Receivers

Noise Sensitive Receiver	Distance from Proposed New Building (m)
Residential dwellings on the North-East	16
Residential dwellings on the South	15
Residential dwellings on the South-West	20

Table 2.2: Nearest Noise Sensitive Receivers

2.4 Measurement Positions

Measurement positions used throughout the survey are shown below, with long-term measurement position in blue, and short-term measurement position yellow.

Figure 2.2: Measurement Positions

2.5 Measured Noise Levels

2.5.1 Fixed Position

Noise levels were measured at the fixed position between 09:25 on 25/04/19 and 09:35 on 26/04/19. Measured noise levels are presented in the graph below. A summary of these noise levels is shown in the table below.

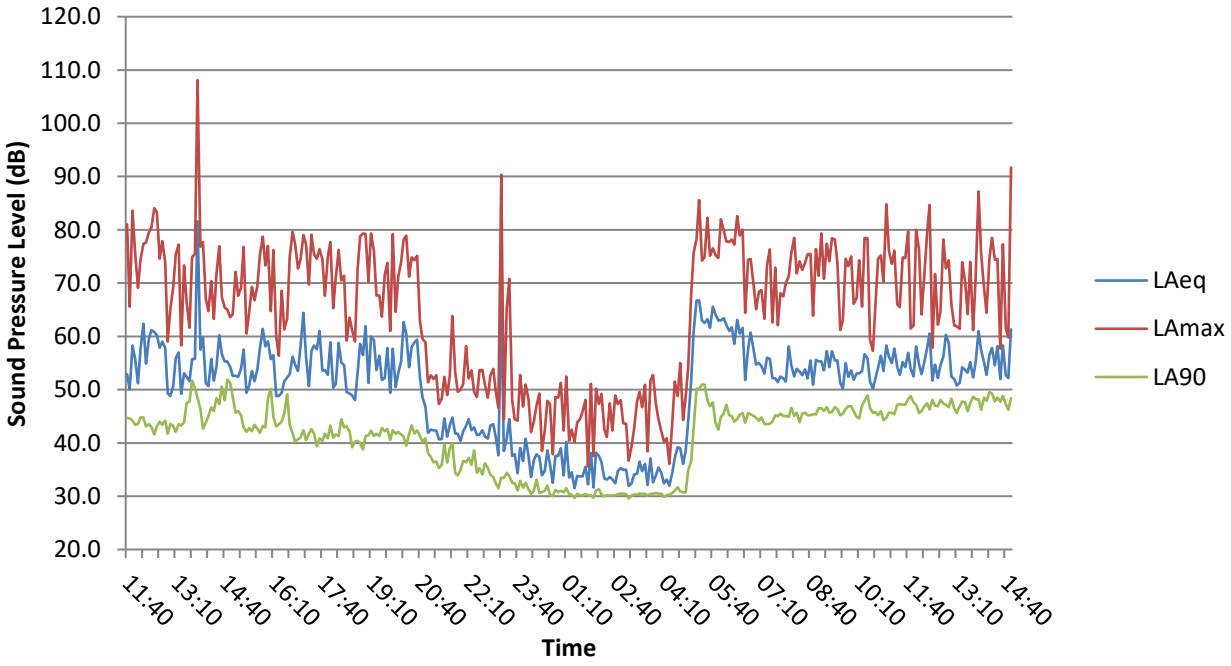

Figure 2.3: Summary of Fixed Position Measurements

		Measured Noise Levels (dB)		
		Maximum	Minimum	Mode
Daytime (07:00-23:00)	L_{A90}	52	34	46
Night time (23:00-07:00)	L_{A90}	51	30	30

Table 2.3: Summary of Fixed Position L_{A90} Measurement Results

2.5.2 Spot Positions

A spot measurement was taken on the 05/06/2019 at position S1.

Date	Spot Position	Measurement Duration	Start Times (hh:mm)	dB L_{Aeq}
05/06/2019	S1	5 minutes	14:50	50

Table 2.4: Spot Measurement Data

3.0 NOISE BREAK-IN ASSESSMENT

3.1 Criteria

BB93 specifies maximum indoor ambient noise levels for all teaching and ancillary spaces. These levels are seen to be the overall noise levels, made up of the sum of building services noise, external noise break-in and any other noise sources present within the unoccupied, fully operational building.

BB93 also sets a maximum "L1" noise level of 60 dB $L_{A1,30min}$ in teaching spaces to assess short transient noise levels associated with aircraft, railways and other similar sources. This is achieved by default for spaces with indoor ambient noise levels up to 40 dB $L_{Aeq,30min}$, but requires assessment in spaces with indoor ambient noise level targets of 45dB $L_{Aeq,30min}$ or above.

3.1.1 BB93 Relaxations

3.1.1.1 Natural/Hybrid Ventilation

Where a natural ventilation strategy is to be employed, the indoor ambient noise limits can be relaxed by 5dB $L_{Aeq,30min}$ where the "normal condition" (outlined in the appendix) is achieved. However, this does not apply to spaces with an indoor ambient noise limit of 45dB $L_{Aeq,30min}$ or higher. For hybrid ventilation systems, the mechanical system noise component must comply with the limits set out in Table 1 of BB93, however the overall noise limit can also be relaxed by 5dB $L_{Aeq,30min}$.

3.1.1.2 Summertime/Intermittent Boost Ventilation

BB93 also permits a further relaxation during the summertime. Summertime is defined as the hottest 200 hours in peak summertime. During summertime, natural and hybrid ventilation systems are permitted to relax indoor ambient noise limits to an upper limit of 55 dB $L_{Aeq,30min}$.

3.2 Design Target

Within the development it is understood that there will be standard teaching spaces. BB93 provides an indoor ambient noise level target of 35 dB $L_{Aeq,30min}$ for these spaces. With the additional natural ventilation relaxation of +5dB, that means the most onerous indoor ambient noise level requirement for this development is 40 dB $L_{Aeq,30min}$.

3.3 BB93 Assessment

As BB93 sets $L_{Aeq,30min}$ targets, the data in the graph needs to be averaged across 30 minute periods. Obtaining these figures from the data above results in a range of figures from 53 – 60 dB $L_{Aeq,30min}$. Based on a subjective review of the site and the spot measurements taken, this data is not considered to be representative of normal conditions and therefore has not been used in the noise break-in assessment.

The spot measurement conducted at a later date confirms that noise levels were low. Therefore a noise level of 50 dB $L_{Aeq,30min}$ has been used in the noise break-in calculations.

3.3.1 Natural Ventilation Feasibility

This section provides a natural ventilation feasibility assessment based on the existing noise climate. An open window typically provides between 10 to 15 dBA of sound attenuation and has been referenced within PPG24 and other documents. For this project, MACH Acoustics has taken 13 dBA as the sound attenuation provided by an open window ventilation strategy.

Subtracting this figure from the measured external noise level at the spot position, S1, gives a predicted internal noise level of 37 dBA.

Description	$L_{Aeq,30min}$ (dB)
Highest Measured	50
Open window attenuation	-13
Predicted Indoor Ambient Noise Level	37

Table 3.1: Predicted BB93 indoor ambient noise level

The predicted internal noise level does not exceed the most onerous internal noise limit of 40dB L_{Aeq}, hence this building can be naturally ventilated through simple openable windows. Please note that any spaces with a lower indoor ambient noise level would require further assessment.

4.0 NOISE BREAK-OUT ASSESSMENT

4.1 Criteria

BS 4142:2014 "Methods for rating and assessing industrial and commercial sound" describes a method of determining the level of noise of an industrial nature, together with the procedures for assessing whether the noise in question is likely to give rise to complaints from persons living in the vicinity. As such, an assessment to BS 4142 is typically called for within planning conditions. The likelihood of complaints in response to a noise depends on various factors. BS 4142 assesses the likelihood of complaints by considering the margin by which the noise in question exceeds the background noise level. Additional information on BS 4142 methodology is provided within Appendix A.

4.2 Design Target

MACH has set plant noise limits at 5dB below existing background noise levels at the nearest noise sensitive receivers

Note, this target is subject to agreement with the local authority.

4.3 Assessment

Noise rating levels are to be assessed against the existing background noise levels, L_{A90}. For the purposes of assessment, MACH Acoustics has used the modal L_{A90} that occurred during the survey.

Plant noise break out should not adversely impact nearby residents but should also ensure that it does not impact the development itself. Therefore, plant noise break-out must meet both of these requirements.

Position	Time Period	Assessed Background Noise Level (dB L_{A90})	Plant Noise Limit dB $L_{Aeq,T}$	
			At Nearest Sensitive Receivers	At Nearest Teaching Window
Fixed	Daytime (07:00 – 23:00)	46	41	48
	Night time (23:00 – 07:00)	30	25	-

Table 4.1: Plant Noise Limits

5.0 CONCLUSION

An environmental noise survey, noise break in assessment and noise break out assessment have been conducted, and the following points can be concluded:

- An environmental noise survey was conducted between the 25/04/19 and the 26/04/19.
- Noise levels on site were found to be varied, with the highest measured noise level at the fixed position with noise levels at the fixed position ranging from 53 – 60 dB $L_{Aeq,30min.}$
- This was adversely affected by non-representative noise source on-site, therefore an assessment was carried out using spot measurement 1 as it was deemed as more representative of the typical noise climate.
- Based on the existing noise climate, the proposed building can be naturally ventilated via openable windows.
- Any spaces with indoor ambient noise levels of 30 dB $L_{Aeq,30min}$ (35dB $L_{Aeq,30min}$ with the +5dB natural ventilation relaxation) will require further assessment.
- Modal background noise levels on site were measured to be 46 dB and 30 dB L_{A90} at daytime and night time respectively.
- Plant noise limits have been set to 5dB below background noise levels, which is subject to agreement with the local authority.
- Additionally, plant noise should not exceed 48 dB $L_{Aeq,T}$ at the nearest openable window to a teaching space to ensure that BB93 indoor ambient noise level targets are not compromised.

APPENDIX A – METHODOLOGY

BS 7445:2003

Environmental noise measurements were conducted in accordance with BS 7445 "Description and measurement of environmental noise".

BS 4142:2014

BS 4142 states that one should *'obtain an initial estimate of the impact of the specific sound by subtracting the measured background sound level from the rating level and consider the following:*

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.*

The aforementioned rating level is based upon the specific noise level of the noise source in question. A correction should be applied to the specific noise level to obtain an increased rating level if *'a tone, impulse or other characteristic occurs, or is expected to be present, for new or modified sound sources.* To summarise, BS4142 section 9.2 advises the following with regards to corrections for acoustic characteristics:

- Tonality – *for sound ranging from not tonal to prominently tonal the Joint Nordic Method gives a correction of between 0 dB and +6 dB for tonality. Subjectively, this can be converted to a penalty of 2 dB for a tone which is just perceptible at the noise receptor, 4 dB where it is clearly perceptible, and 6 dB where it is highly perceptible.*
- Impulsivity – *A correction of up to +9 dB 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 converted to a penalty of 3 dB for impulsivity which is just perceptible at the noise receptor, 6 dB where it is clearly perceptible, and 9 dB where it is highly perceptible.*
- Other sound characteristics – *Where the specific sound features characteristics that are neither tonal nor impulsive, though otherwise are readily distinctive against the residual acoustic environment, a penalty of 3 dB can be applied*
- Intermittency – *When the specific sound has identifiable on/off conditions, if the intermittency is readily distinctive against the residual acoustic environment, a penalty of 3 dB can be applied.*

BB93 – Normal Ventilation

BB93 states that;

> *"The "normal condition" for a natural or hybrid ventilation mode is defined as when the system is operating to limit the daily average carbon dioxide concentration to no more than 1,500ppm with the maximum concentration not exceeding 2,000ppm for more than 20 consecutive minutes on any day. This would normally equate to a minimum ventilation rate of approximately 5l/s per person.*
> *The mid-season design condition can be used in simple ventilation calculations and is defined as an outside temperature of 11 °C and an internal air temperature of 20 °C with no external wind effect….*
>
> *… Where there is a hybrid system, any mechanical system components should meet the IANL limits from table 1. The total noise level including external noise ingress may exceed the IANL limit from table 1 by up to 5 dB."*

APPENDIX B – MEASUREMENT EQUIPMENT

Name	Serial Number	Last Calibrated	Certificate Number	Calibration Due
NTI Precision Sound Analyser XL2 TA	A2A-13174-E0	Nov-17	STD92714	Nov-19
NTI Pre-amplifier MA220	6898	Nov-17	STD92714	Nov-19
NTI Microphone Capsule MC230A	A14429	Nov-17	STD92714	Nov-19
NTI Precision Sound Analyser XL2 TA	A2A-13314-E0	Nov-17	STD92711	Nov-19
NTI Pre-amplifier MA220	6903	Nov-17	STD92711	Nov-19
NTI Microphone Capsule MC230A	A14417	Nov-17	STD92711	Nov-19

The measurement equipment listed above was used during the survey, where all equipment complies with BS EN 60942:2003 i.e. a class 1 device.

APPENDIX C – METEOROLOGICAL CONDITIONS

Date	Time (hh:mm)	Temperature (°C)	Humidity (%)	Pressure (mbar)	Wind Speed (m/s)	Wind Direction	Conditions
25/04/2019	00:00	9-10	93	992	7	E	Passing clouds.
	06:00	10-12	86	993	7	S	Mostly cloudy.
	12:00	8-11	86	997	3	S	Scattered showers. Broken clouds.
	18:00	7-11	86	1002	2	NW	Scattered showers. Scattered clouds.
26/04/2019	00:00	8	92	1005	4	S	Cool.
	06:00	9-11	90	1007	5	S	Light rains. Broken clouds.

Date	Time (hh:mm)	Temperature (°C)	Humidity (%)	Pressure (mbar)	Wind Speed (m/s)	Wind Direction	Conditions
	12:00	9-11	84	1009	7	W	Broken clouds.
	18:00	9-10	84	1006	8	WSW	Light rains. More clouds than sun.

The above data has been taken from timeanddate.com (https://www.timeanddate.com/weather)

APPENDIX D – SITE PHOTOGRAPHS

Location	Image
Fixed Position	

Location	Image
Spot 1