



Planning Noise Assessment
Queensmead School
Ruislip
HA4 0LS
Stroma Built Environment Ltd.
SBE Ref: 08-19-79295 – AC - 1v3

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Stroma Built Environment Ltd. The Maltings Burton Road Sheffield S3 8BZ | Tel: 0114 2723004 | Fax: 0114 2723003

www.stroma.com/built-environment | email: BEnfo@stroma.com

Registered Number 04507219 – VAT No. 154 765 781



I. Revision History

Revision	Date	Description		
1v1	30/01/2020	First Issue		
		Compiled By	Authorised By	
		Rob Ashby MIOA Acoustic Consultant	Phil Blakemore MIOA Senior Acoustic Consultant	
1v2	17/02/2020	Second Issue: Updates to Section 4		
		Compiled By	Authorised By	
		Rob Ashby MIOA Acoustic Consultant	Tom Chaffer MIOA Principal Acoustic Consultant	
1v3	17/02/2020	Update to typographical error		
		Compiled By	Authorised By	
		Rob Ashby MIOA Acoustic Consultant	Tom Chaffer MIOA Principal Acoustic Consultant	

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II. Executive Summary

Stroma Built Environment (SBE) has been appointed to undertake a planning noise assessment in support of a proposed new school extension block within the existing Queensmead School, Ruislip. It is understood that planning permission is being sought for the construction of a new self-contained teaching block over two storeys.

The purpose of this report is to consider the existing noise climate around the proposed site in relation to the potential acoustic impact on the development.

A baseline noise survey has been undertaken at key locations around the proposed development site to assess the noise climate, which was found to be controlled primarily by distant and local road traffic noise, with contributions from overhead aircraft and distant rail noise.

Assessment indicates that internal ambient noise level requirements for new teaching spaces required by Building Bulletin 93 (BB93) can be met for the new teaching block by provision of suitable façade sound insulation and ventilation strategy.

Based on the measured noise levels and general arrangement drawings supplied by the client, the indoor ambient noise level requirements of BB93 could be satisfied through a scheme of natural ventilation via partially open windows for ground floor practical spaces. First floor classroom spaces should be provided with a ventilation system which would allow for windows to remain closed whilst providing normal ventilation rates.

Control of overheating for all ground floor practical spaces can be achieved via a scheme of open windows, including outside the hottest 200 hours of the year.

Control of overheating for first floor standard classrooms may be achieved using open windows for the hottest 200 hours of the year, however outside of these hours the ventilation system should be capable of controlling overheating without opening windows.

At this stage in the development, details regarding items of fixed external plant are not available. Therefore noise limits for external noise emission at the location of the nearest identified NSR's have been proposed based on measured background noise levels to achieve a low noise impact.

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1. Introduction

- 1.1 Stroma Built Environment (SBE) has been appointed by Morgan Sindall Construction & Infrastructure to undertake a planning noise assessment in support of a new school extension block within the existing Queensmead School, Ruislip.
- 1.2 It is understood that planning permission is being sought for the construction of a self-contained teaching block over two storeys. Figure 1 presents the approximate location of the new teaching block within the context of the existing school site.

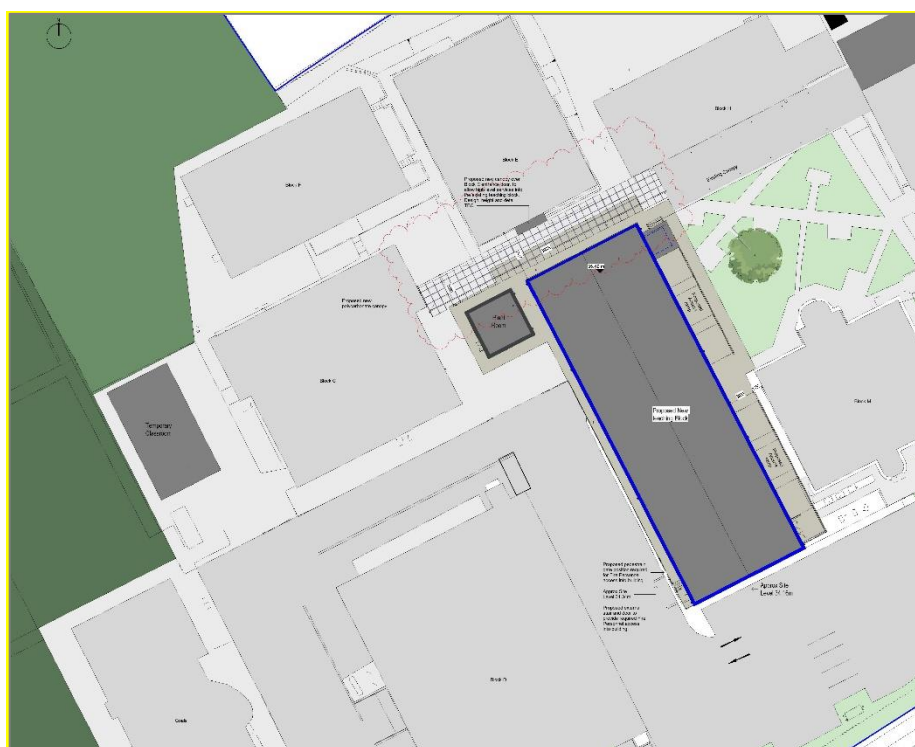


Figure 1: Development location plan

- 1.3 The purpose of this report is to consider the existing noise climate around the proposed site in relation to the potential acoustic impact on the development.
- 1.4 This document has been prepared for the sole use, benefit and information of the client for the purposes set out, or instructions commissioning the works. The liability of SBE in respect of the information contained herein shall not extend to any third party.
- 1.5 This report is limited to addressing the specific issues described and is based on information and drawings provided. Whilst every effort has been made to ensure that this report is easy to understand, it is technical in nature. To provide assistance, a glossary of terminology is included in Appendix III.

2. Relevant Acoustic Standards

Part E Building Regulations – Building Bulletin 93 ‘Acoustic design of schools: performance standards’

- 2.1 Section 8 of Approved Document E states that the normal way of satisfying Requirement E4 of Part E to Schedule 1 of the Building Regulations 2010 for new school buildings is to meet the performance standards set out in Building Bulletin 93 ‘Acoustics design of schools: performance standards’ (BB93).
- 2.2 Section 1.1 of BB93 presents indoor ambient noise levels (IANL) upper limit criteria for various types of teaching, study and ancillary spaces. For example, teaching spaces are required to achieve an IANL $\leq 35 \text{ dB } L_{Aeq, 30\text{min}}$. Any teaching spaces intended specifically for students with special hearing and communication needs are to achieve a maximum IANL of $30 \text{ dB } L_{Aeq, 30\text{min}}$. In addition, BB93 states that the indoor ambient noise level should not regularly exceed $60 \text{ dB } L_{A1, 30\text{min}}$.
- 2.3 Note that the BB93 IANL criteria include contributions from external sources outside the school premises and building services noise, but exclude contributions from teaching activity/equipment, staff and students within the school premises.

School Premises Regulations and Independent School Standards

- 2.4 In addition to the design and construction standards covered by the Building Regulations, the School Premises Regulations and Independent School Standards cover the performance in use of schools including speech intelligibility in the classrooms. In order to comply with the School Premises Regulations and Independent School Standards (but not the building Regulations), operational noise levels (e.g. of equipment) in teaching and learning spaces will need to be suitable for the activities taking place and open plan teaching and learning spaces in new and refurbished schools will need to provide adequate speech intelligibility as measured by the speech transmission index (STI). School client bodies are responsible for ensuring compliance with the School Premises Regulations.

Planning Guidance

National Planning Policy Framework

- 2.5 The current planning guidance for the assessment of the potential environmental noise impact is outlined in the National Planning Policy Framework (NPPF). Whilst the NPPF does not set criteria that must be achieved, the NPPF states the following in relation to the appropriate control of potential noise impacts
- 2.6 *“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..... 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”

- 2.7 Therefore the policy requires that new developments are not affected to an unacceptable degree by environmental noise.

Noise Policy Statement for England

- 2.8 The Noise Policy Statement for England (NPSE) provides further guidance on the Government’s policy with regard to the potential impacts of noise. The NPSE states the aims of Government policy relating to noise are:

“Through the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development:

- *avoid significant adverse impacts on health and quality of life;*
- *mitigate and minimise adverse impacts on health and quality of life; and*
- *where possible, contribute to the improvement of health and quality of life”*

- 2.9 The Explanatory Note to the NPSE provides further guidance on how significant noise effects should be determined. The concepts of No Observed Effect Level (NOEL), Lowest Observed Adverse Effect Level (LOAEL – the lowest noise level at which an adverse effect can be observed) and Significant Observed Adverse Effect Level (SOAEL – the noise level above which significant adverse effects on health and quality of life can be observed) are introduced, however the NPSE also states that:

“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.”

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

- 2.10 BS 4142 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 the equipment being assessed, which is the level of noise from the item or items of plant being assessed (measured as L_{Aeq}).
- 2.11 The rating level is then compared with the underlying background noise level (measured as 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.

2.12 BS 4142 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. Generally a rating penalty for a sound should be based on a subjective assessment of its characteristics.

3. Baseline Noise Survey

Site Description

- 3.1 The proposed development site is located within the grounds of the existing Queensmead School, off Queens Walk, Ruislip, centred on grid reference: 511726,185493.
- 3.2 The site is currently occupied by a number of small teaching spaces in the centre of the existing school site. As such, it is bound on all sides by existing school buildings and/or outdoor facilities. The school as a whole is generally bound to the north by Deanesfield Primary School, which adjoins the northern boundary. To the east the school is bound by Queens Walk, with residential dwellings approximately 16m beyond. To the south, the site is bound by Victoria Road, with a retail park beyond. Adjoining the western site boundary is the Goals sports facility, which includes a number of outdoor all weather pitches.
- 3.3 RAF Northolt lies approximately 1km to the west of the proposed site, parallel with the runway. As a result, aircraft regularly over-fly the existing school site. An elevated railway is located approximately 150m south of the site, with rail traffic audible at the site during the short term measurement periods.

Baseline Conditions

- 3.4 A baseline noise survey has been undertaken at the site, encompassing a mix of short term attended and long term unattended measurements between 11th and 12th December 2019, with additional long term measurements between 8th and 14th January 2020.
- 3.5 The existing site layout and noise monitoring positions are illustrated on Figure 2.

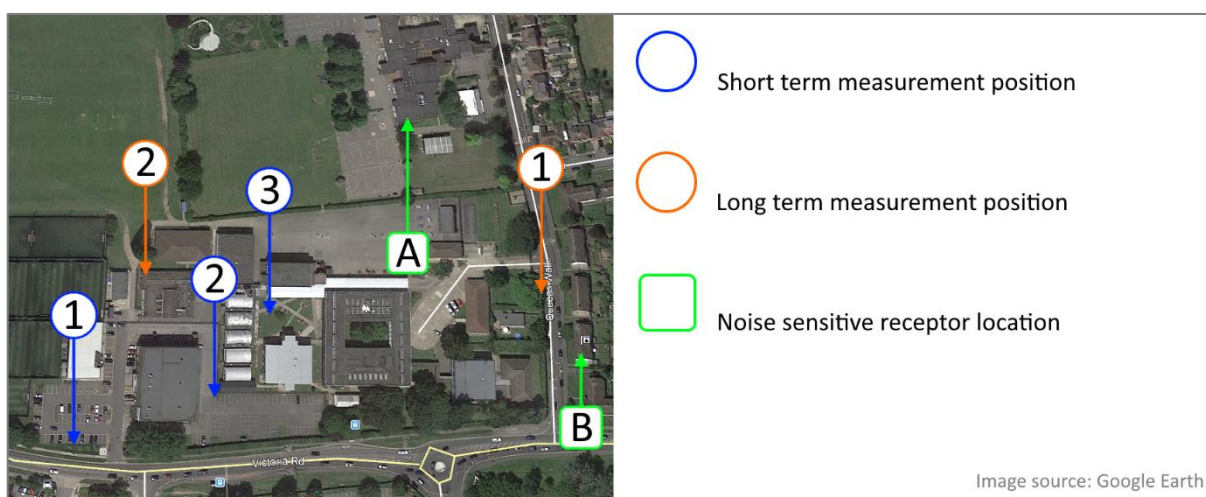


Figure 2: Noise monitoring locations

- 3.6 All measurements were undertaken using Class 1 sound level meters, which were field calibrated prior to and at the end of each monitoring period, with no significant drift detected. All measurements were undertaken with the sound level meter mounted to a tripod at a height of approximately 1.5m above ground level with the exception of long term position 2, which was located at roof level of an existing

single storey teaching block at a height of approximately 4.5m above ground level. All sound level meters were fitted with weather protection kits for the duration of the surveys.

- 3.7 Weather conditions throughout the initial survey period between 11th and 12th December 2019 were generally fine and dry, with average wind speeds < 5ms⁻¹. Analysis of historic weather data for the period between 8th and 12th January 2020 indicates that weather conditions were generally fine and dry with wind speeds < 5ms⁻¹. It is understood that some periods of rainfall occurred during the second unattended survey period (long term 2), and where these have been identified they have been excluded from the presented noise survey summary results.
- 3.8 Table 1 below presents a summary of the measured noise levels, detailed time history plots are presented in Appendix I.

Table 1: Noise survey summary

Monitoring Position	Period	Measured sound pressure level (dB)		
		$L_{Aeq,T}^{[1]}$	$L_{A01,T}^{[2]}$	$L_{A90,T}^{[2]}$
Long term 1	Daytime (07:00-23:00)	61	70	52
	Night (23:00-07:00)	54	64	47
Long term 2	Daytime (07:00-23:00)	59	67	54
	Night (23:00-07:00)	53	63	46
Short term 1	13:00-16:00	68	-	-
Short term 2	16:14-16:34	57	-	-
Short term 3	16:55-17:25	54	-	-

Notes to Table 1: [1] Logarithmic average. [2] Arithmetic average

- 3.9 The noise climate at the site was generally found to be controlled by distant and local road traffic noise, with contributions from rail noise and overhead aircraft, assumed to be associated with the nearby RAF Northolt base. Analysis of audio recordings also indicates that noise from the Goals facility adjoining the western site boundary was audible during the evening, as was noise from existing fixed plant throughout the evening and nighttime.
- 3.10 Aircraft movements associated with RAF Northolt are understood to comprise helicopters, light aircraft and jet aircraft. Due to the nature of the base aircraft do not fly to a schedule. An analysis of maximum

noise events during long term surveys indicates between 4 and 10 identifiable aircraft movements within a typical school day.

Noise Sensitive Receptors

- 3.11 The closest noise sensitive receptors to the proposed new buildings are considered to be Deanesfield Primary School to the north, and residential dwellings along Queens Walk to the east. The identified receptors are presented on Figure 2 and described in Table 2.

Table 2: Identified noise sensitive receptors

NSR	Description	Approximate distance to site boundary (m)
A	Deanesfield Primary School	44
B	Dwellings along Queens Walk	16

4. New Building Envelope

Façade Noise Exposure

- 4.1 There are various indoor ambient noise level criteria defined in BB93 for different spaces. New build standard classrooms and teaching spaces should not ordinarily exceed 35 dB $L_{Aeq, 30min}$. In addition, for rooms requiring internal ambient noise levels of 35 dB $L_{Aeq, 30min}$ or less, then BB93 states that the internal noise level should not regularly exceed 60 dB $L_{A1, 30min}$. Note that these criteria should apply with the ventilation scheme operating under normal conditions.
- 4.2 For the purposes of this assessment, the acoustically sensitive internal room space types have been classified according to the requirements outlined in Section 1.1 of BB93. Classifications are based on current plans provided to SBE and may need to be reviewed as the scheme develops. It is recommended that these are checked as being suitably classified according to Building Control and End Client Requirements. The key BB93 classifications for the purposes of this report are given in Table 3 below.

Table 3: BB93 Room classifications

Room Type	BB93 Classification	Upper limit for indoor ambient noise levels (IANL) (dB $L_{Aeq, 30min}$)
General Classroom	Standard Classroom	≤ 35
Graphics Lab	Electronics/control, textiles, food, graphics, design/resource area, ICT room, art	≤ 40
ICT Hub		
Science Lab	Science Laboratory	≤ 40
Resistant Materials	Design & Technology	≤ 40
Workshop		
Workshop with Heat Bay		
Science Prep	Staff Workroom	≤ 40
Tech Prep		
Staff Base / Staff Office	Office, medical room, staff room ^[1]	≤ 40
Lobby	Corridor, Stairwell, coats and locker area. ^[1]	≤ 45

Notes to Table 3:

- 1) Noise levels in ancillary spaces are recommendations only and are not mandatory.

Building Fabric

- 4.3 The overall sound insulation performance of the external building envelope will be typically dictated by the glazing, being the weakest acoustic element. Based on the measured external noise levels, the assessment assuming typical brick and block façade construction to ground floor, with lightweight facade at first floor (minimum 39 dB $R_w + C_{tr}$) indicates that standard thermal double glazing with a sound insulation of ≥ 28 dB $R_w + C_{tr}$ is suitable throughout.

Roof Build Up

- 4.4 Roof construction must provide adequate sound insulation to prevent external noise break-in from external sources, including road traffic and overhead aircraft. Although at this stage the proposed building envelope construction has not been finalised, it is anticipated that the development would incorporate a lightweight composite roof structure.
- 4.5 Due to the proximity of RAF Northolt, which lies approximately 1km west of the site, careful consideration should be given to the proposed roof build up to prevent noise intrusion from aircraft. Analysis of long term monitoring data indicates that noise levels at the façade of the proposed teaching block are typically < 70 dB $L_{Aeq, 1min}$ whilst aircraft are overhead, and that a typical flyover event would last for between 30 to 60 seconds.
- 4.6 On this basis to mitigate against potential intermittent disturbance from aircraft, it is recommended that the roof construction, including any suspended ceilings etc can achieve a sound insulation performance of ≥ 40 dB R_w .

Ventilation Strategy

- 4.7 Section 1.1.3 of BB93 addresses natural and hybrid (natural/mechanical) ventilation in schools and states that a 5 dB relaxation of BB93 IANL is applicable in teaching spaces when the proposed ventilation systems are operating in their normal condition:
- 4.8 *"The upper limit for the indoor ambient noise level may be increased by 5 dB when natural/hybrid ventilation limits the daily average carbon dioxide concentration to no more than 1,500 ppm with the maximum concentration not exceeding 2,000 ppm for more than 20 consecutive minutes on any day. This would normally equate to a minimum ventilation rate of approximately 5 l/s per person".*
- 4.9 Note 2 to Table 2 in Section 1.1.3 of BB93 states:
- 4.10 *"Where external ambient free field noise levels at the façade expressed as the $L_{Aeq, 30mins}$ do not exceed the IANL given in Table 1 (of BB93) by more than 16 dB for single sided ventilated spaces, and 20 dB for cross ventilated or roof ventilated spaces, the criteria for natural ventilation can usually be achieved."*

- 4.11 Based on the noise measurements summarised in Table 1, and allowing for partial screening of the proposed teaching facades, a scheme of natural ventilation incorporating partially open windows would be appropriate for all ground floor practical spaces with a BB93 IANL requirement of ≤ 40 dB $L_{Aeq,30mins}$.
- 4.12 It is noted that during aircraft movements internal noise levels will be elevated for a short period; however due to the frequency of aircraft movements BB93 $L_{Aeq,30min}$ and $L_{A01,30min}$ internal noise level requirements are calculated to be met. Typically there are noted to be 4 – 10 aircraft movements per school day, with a maximum of two noted within any single half hour time period.
- 4.13 First floor classrooms have a lower IANL requirement of ≤ 35 dB $L_{Aeq,30mins}$ and are not considered suitable to use open windows as part of the normal ventilation strategy. A system of acoustically attenuated natural or mechanical ventilation would be required to provide normal ventilation without opening windows in order to satisfy the IANL requirements of BB93.

Intermittent Boost and Control of Summertime Overheating

- 4.14 BB93 states that when providing intermittent boost ventilation, and when operating to control summertime overheating during the hottest 200 hours of the year (including the summer holidays), total IANL's due to external noise ingress and building services noise should not exceed 55 dB $L_{Aeq, 30min}$.
- 4.15 With reference to BB93 guidance and measured external noise levels all spaces are considered suitable to utilise open windows to provide short term intermittent boost ventilation under the control of the teacher.
- 4.16 Due to the energy efficiencies required from modern buildings including high levels of air tightness and thermal insulation, teaching spaces can be prone to solar gain and/or heat gain from internally located sources. Rapid ventilation rates are therefore often required in order to provide relief from the effects of summer overheating.
- 4.17 Based on the measured noise levels, control of overheating can be achieved for all teaching spaces via partially open windows during the hottest 200 hours of the year.
- 4.18 Outside of the hottest 200 hours, mitigation of overheating for first floor classrooms should be achieved without utilising opening windows.
- 4.19 Control of overheating can be achieved for all ground floor practical spaces with partially open windows, including outside the hottest 200 hours where required.

5. Building Services Noise

Control of Building Services Internal Ambient Noise Levels

- 5.1 BB93 IANL limits include external noise sources such as aircraft or road traffic and also building services noise. Hence, where mechanical / hybrid ventilation is proposed, the services will need to be designed such that the IANL within spaces, including the cumulative total due to both the services noise and external noise intrusion, does not exceed the BB93 IANL criteria for the space in question.
- 5.2 Typically, dependent on façade specification, setting indoor noise levels due to all sources of building services to 5 dB below the identified IANL gives suitable margin for a degree of external noise intrusion. Internal spaces without façades can be designed to meet the relevant BB93 IANL.

Control of Building Services External Noise

- 5.3 It is good practice to control noise from mechanical services to ensure minimal impact on nearby noise sensitive receptors (NSR). It is therefore proposed that noise from new building services plant is limited to 5 dB below the existing representative background sound level when assessed at the nearest noise sensitive receptor.
- 5.4 Noise limits have been proposed for both the day and night-time, on the basis that nearby sensitive receptors would be occupied continuously, and that fixed plant may be required to operate outside of school hours. Daytime background noise levels are based on the period between 19:00-23:00, which is considered an onerous assessment where noise levels would typically be reduced compared to a 16 hour day.
- 5.5 Based on measured background noise survey data and statistical assessment having regard to the guidance in BS 4142, total emission levels for plant noise, including acoustic feature corrections where applicable, should not exceed the rating noise level indicated in Table 4. Provided the noise limits are satisfied at the closest NSR, this is an indication that the noise would represent a 'low impact' according to BS 4142.
- 5.6 The proposed limits are cumulative and applicable to all new items of plant equipment associated with the new teaching blocks.
- 5.7 Building services engineers should be made aware of the proposed plant noise limits in order to inform plant unit specification and selection.
- 5.8 Noise limits for NSR A are proposed for the daytime only, on the basis that a primary school is unlikely to be occupied during the night.

Table 4: Proposed plant noise Rating Limits

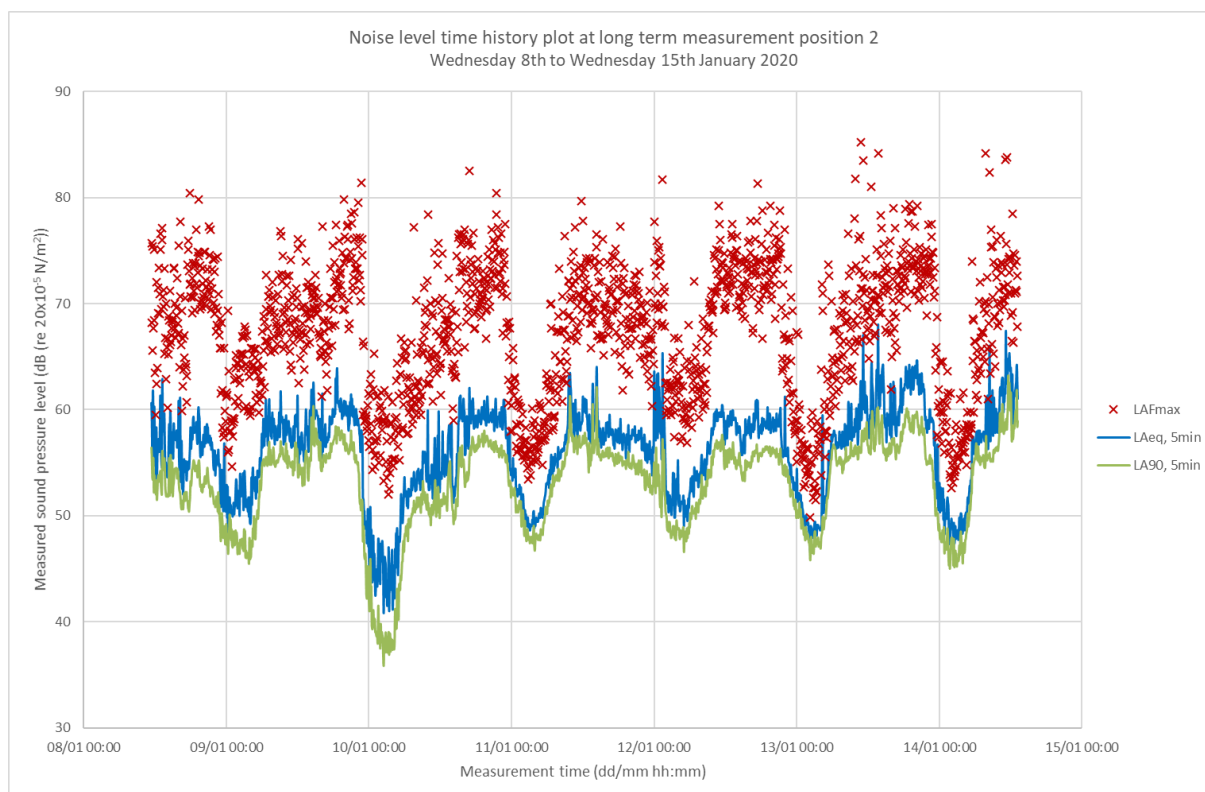
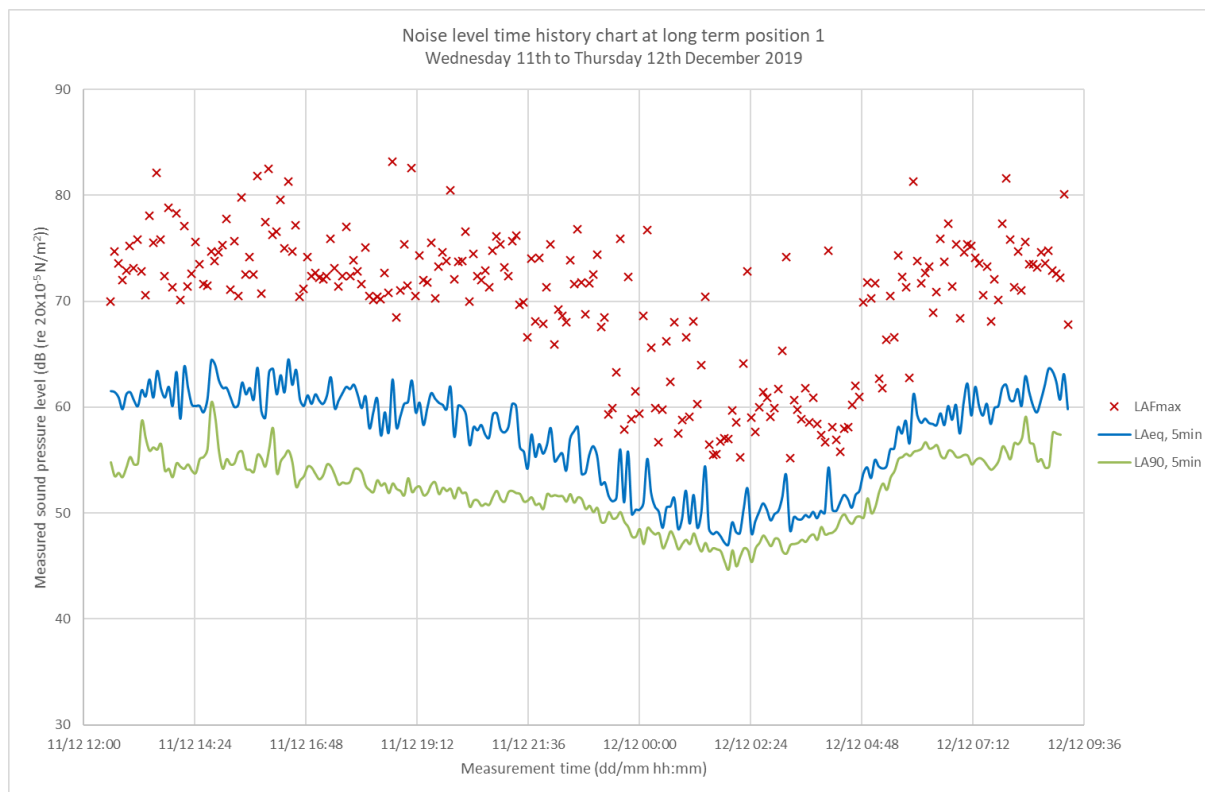
Location	Period	Representative background noise level (dB $L_{A90,T}$)	BS 4142 Rating Level (dB $L_{Ar,Tt}$)
NSR A	Daytime (07:00-23:00)	52	≤ 47
NSR B	Daytime (07:00-23:00)	52	≤ 47
	Night time (23:00-07:00)	47	≤ 42

- 5.9 The rating level in Table 4 should be assessed in accordance with BS 4142, including appropriate consideration of any tonal or impulsive characteristics of the proposed building services plant. It is prudent to ensure that building services noise is designed to be sufficiently below the recommended plant noise limit criteria such that the cumulative noise level from all sources does not exceed the stated target level.
- 5.10 The building services design and unit selection may be informed by the external noise limits and suitable attenuation will be provided where required.
- 5.11 As well as consideration of off-site NSR's, it is recommended that consideration is given to limiting the noise impact from new sources of building services plant upon existing educational buildings associated with Queensmead School. Noise from new sources of building services plant should be attenuated such that noise levels outside any windows within existing Queensmead school buildings required to open for ventilation does not exceed 50 dB $L_{Aeq,T}$.

6. Conclusion

- 6.1 Stroma Built Environment has been appointed to undertake a planning stage noise assessment for a proposed new teaching block within the grounds of the existing Queensmead School, Ruislip.
- 6.2 A baseline noise survey has been undertaken at key locations around the proposed development site to assess the noise climate, which was found to be controlled primarily by distant and local road traffic noise, with contributions from overhead aircraft.
- 6.3 Noise levels measured during the baseline noise survey period have been used to inform the assessment of building fabric sound insulation and ventilation requirements. At this stage in the development, the proposed façade and roof build up are not known, however it is likely that the glazing elements would control the overall sound insulation performance of the façade. Calculations to determine the minimum glazing specification requirements are presented in Section 4 of this report, which indicate that standard thermal double glazing would be suitable across the development.
- 6.4 Based on the measured noise levels and general arrangement drawings supplied by the client, the indoor ambient noise level requirements of BB93 could be satisfied through a scheme of natural ventilation for ground floor practical spaces, in conjunction with a hybrid/mechanical ventilation strategy for first floor classrooms which would allow for windows to remain closed whilst proving normal ventilation rates as defined in BB93.
- 6.5 Control of overheating for all ground floor practical spaces can be achieved via a scheme of open windows, including outside the hottest 200 hours of the year. Control of overheating for first floor standard classrooms may be achieved using open windows for the hottest 200 hours of the year, however outside of these hours the ventilation system should be capable of controlling overheating without opening windows.
- 6.6 At this stage in the development, details regarding items of fixed external plant are not available. Therefore noise limits for external noise emission at the location of the nearest identified NSR's have been proposed based on measured background noise levels to achieve a low noise impact.

Appendix I. Survey Information and Data



Appendix III. Acoustic Glossary

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. The 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

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. The human range of hearing is commonly accepted to be 20 Hz to 20,000 Hz. Additionally, an octave can be used to describe the interval between a frequency in Hz and either half or double that frequency.

Frequency weighting

Different weighting networks can be applied to a given sound level in each stated octave band by a specified amount, in order to better represent the response of the human ear. The most commonly used weighting network is the 'A' weighting, and the letter 'A' will be included within a descriptor to indicate that the value has been 'A' weighted, e.g. $L_{Aeq,T}$ or L_{A90} . An 'A' weighted noise level may also be written as dB(A). Other weightings less commonly used are 'C' and 'D' weighting.

Noise indices

When a noise level varies with time, the measured 'A' weighted dB level will vary as well. In this case it is therefore not possible to represent the noise climate with a simple 'A' weighted dB value. In order to describe noise where the level is continuously varying, a number of other indices, including statistical parameters, are used. The various indices used are described as below:

$L_{Aeq,T}$	The 'A' weighted 'equivalent continuous noise level' which is an average of the total sound energy measured over a specified time period, T
L_{Amax}	The maximum 'A' weighted noise level that was recorded during the monitoring period.
L_{A10}	The 'A' weighted noise level that was recorded for at least 10% of the monitoring period.
L_{A90}	The 'A' weighted noise level that was recorded for at least 90% of the monitoring period, usually taken as the underlying 'background' noise level.

Sound level difference, D

The sound level difference between two internal spaces, or between internal and external spaces. The ' D ' value is used to denote the differences at each third octave or octave band, with a single figure 'weighted' value to

describe an overall performance. Note that the 'D' value will always describe an in-situ or on-site acoustic performance. All values are described using the decibel.

D_w	Single figure weighted sound level difference, simply the measured source noise level minus receiver noise level, not adjusted to reference conditions
$D_{nT,w}$	Weighted normalised sound level difference – a single, weighted sound insulation value, normalised to a reference reverberation time using the measured reverberation time in the receive room
$D_{nT,w} + C_{tr}$	As above, with a spectral adaptation term applied to account for the effects of low frequency noise, and based on urban traffic noise
$D_{nf,w}$	Overall flanking normalised level difference - A parameter that defines the flanking transmission of sound from room to room where a dividing partition or floor construction abuts a flanking building element common to both rooms, such as the building façade or ceiling

Sound reduction index, R

This describes the sound transmitted through a material or building element, such as a wall, door or window. It is measured in a laboratory with suppressed flanking transmission. The 'R' value is used to denote the differences at each third octave or octave band, with a single figure 'weighted' value to describe an overall performance. All values are described using the decibel.

R_w	Weighted single figure sound reduction index
$R_w + C_{tr}$	As above, with a spectral adaptation term applied to account for the effects of low frequency noise, and based on urban traffic noise
R'_w	The 'apparent sound reduction index', a field measurement to obtain the sound reduction index of a material or element, with all effects of site installation accepted.

Appendix IV. SBE Acoustic Credentials

SBE have specialised in providing the UK Construction Industry with a range of acoustics services since 2006. Specialising in Building Acoustics, all SBE acousticians are members of the Institute of Acoustics.

SBE is accredited for on-site acoustic testing by United Kingdom Accreditation Service (UKAS) (Testing Laboratory Number 2731).

SBE meet the relevant acoustic requirements typically required in the UK, including for sound insulation testing as defined in Approved Document E for the purposes of testing for Part E to the Building Regulations 2010.

This report has been authorised by Tom Chaffer, Principal Acoustic Consultant who meets the BREEAM requirements for a suitably qualified acoustician (SQA) as follows;

1. Holds an MSc degree in Audio Acoustics from the University of Salford
2. Has been an Acoustic Consultant for more than three year's (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 Membership of the Institute of Acoustics - MIOA membership.

This report has been read and reviewed by Tom Chaffer 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.

Appendix V. Report Conditions

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